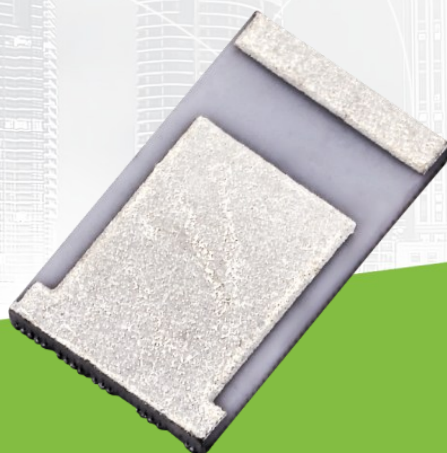




TAOGLAS®



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

| | | |
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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, or 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 Livestock 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.

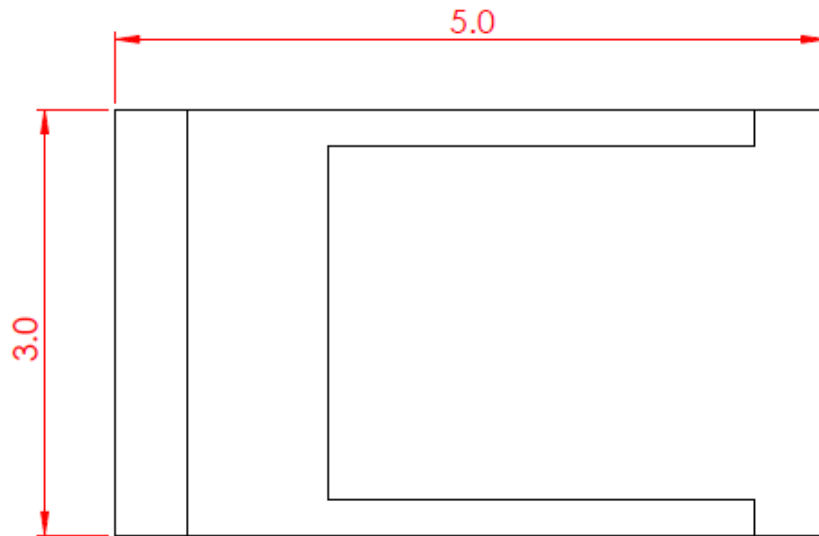
2. Specification

| 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 | | | | |

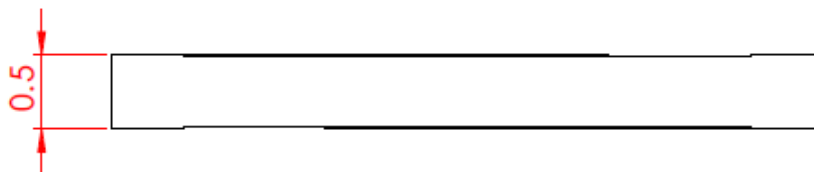
| Mechanical | |
|------------|-------------------|
| Dimensions | 5mm x 3mm x 0.5mm |
| Material | Ceramic |
| Mounting | SMT |

| Environmental | |
|-------------------------------------|--|
| Operation Temperature | -40°C to 85°C |
| Storage Temperature | -40°C to 105°C |
| Temperature Coefficient (τ f) | 0 \pm 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) |

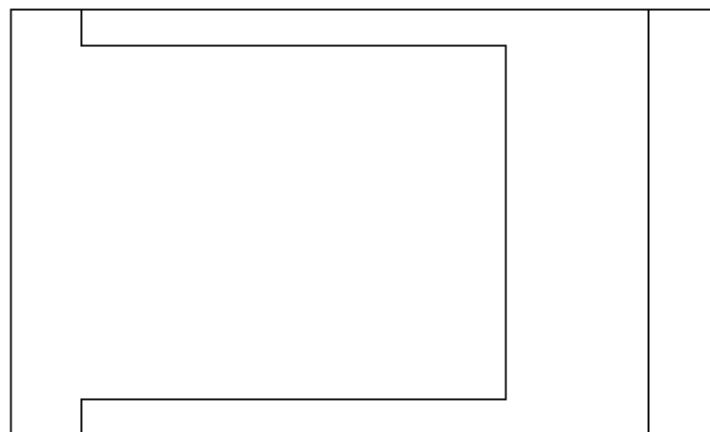
3. Mechanical Drawing



Top View



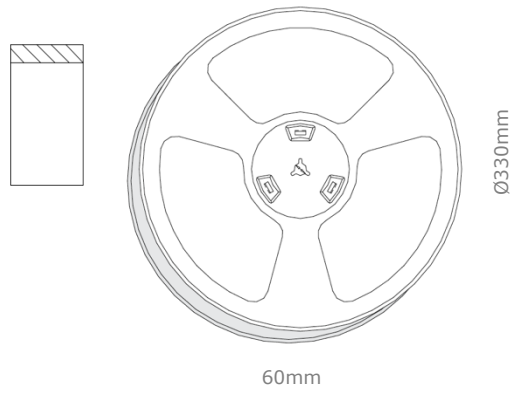
Front View



Bottom View

4. Packaging

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



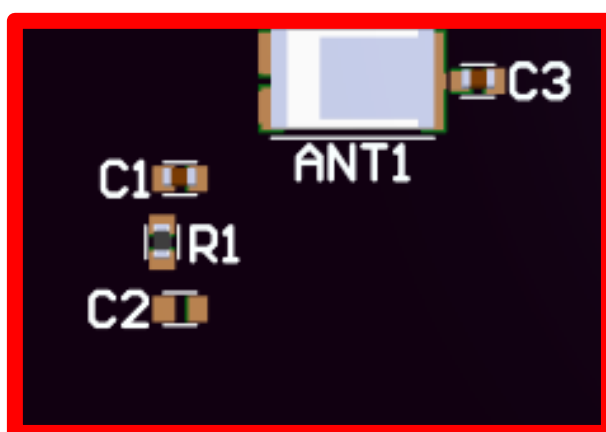
5. Antenna Integration Guide

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.

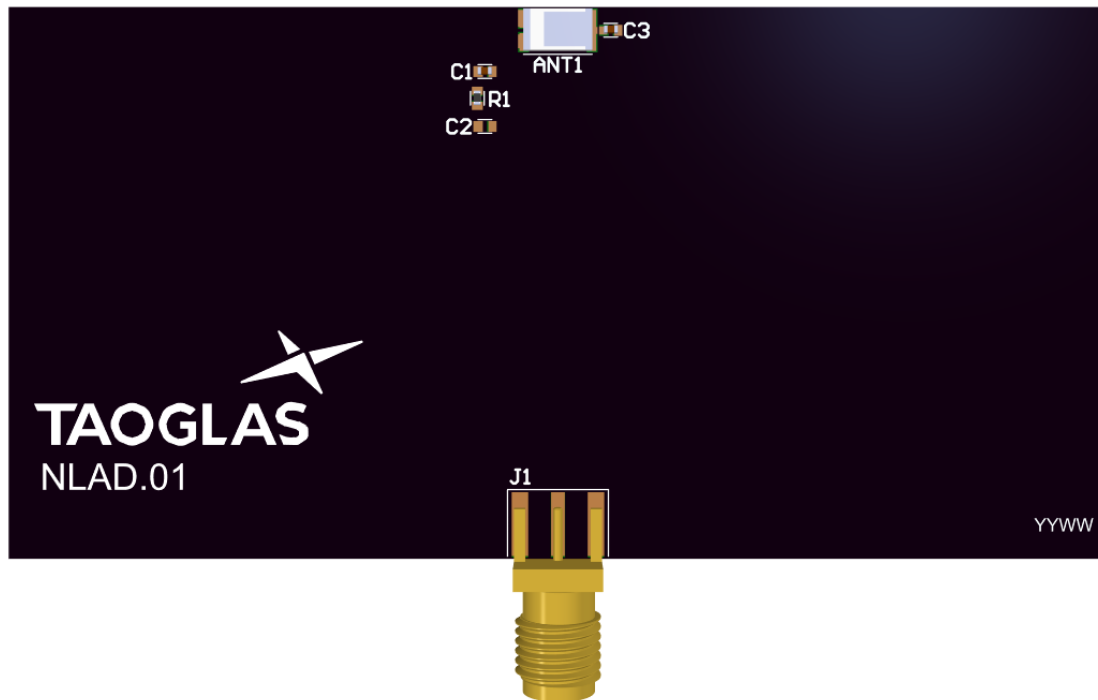


Detail view of antenna and components on board.

Please find the Integration files in Altium, 2D formats and the 3D model for the NLA.01 here:

[Need to insert link when available](#)

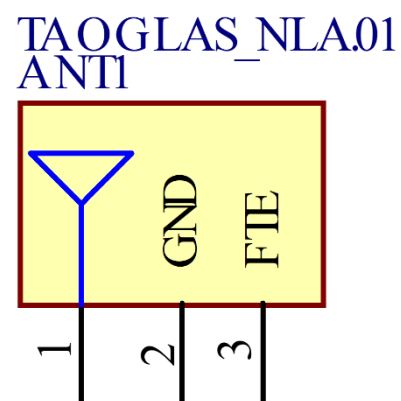
5.1 Schematic and Symbol Definition



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

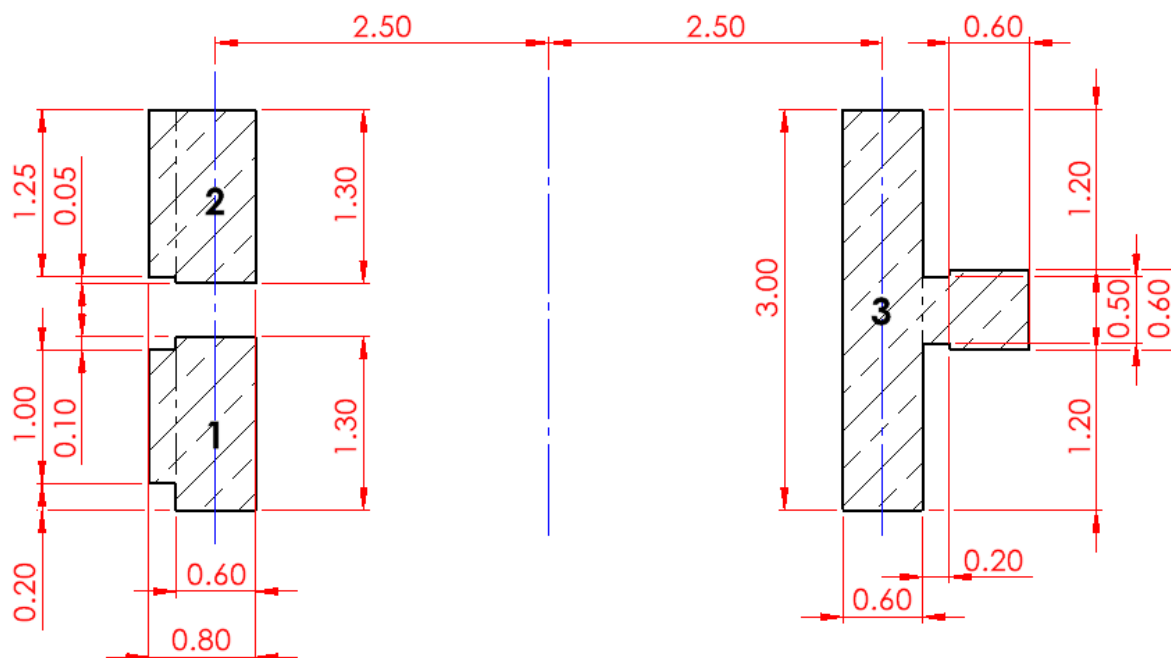
The circuit symbol for the NLA.01 is shown below. The antenna has 3 pins as indicated below.

| Pin | Description |
|-----|---------------------|
| 1 | RF Feed |
| 2 | Ground |
| 3 | Fine Tuning Element |



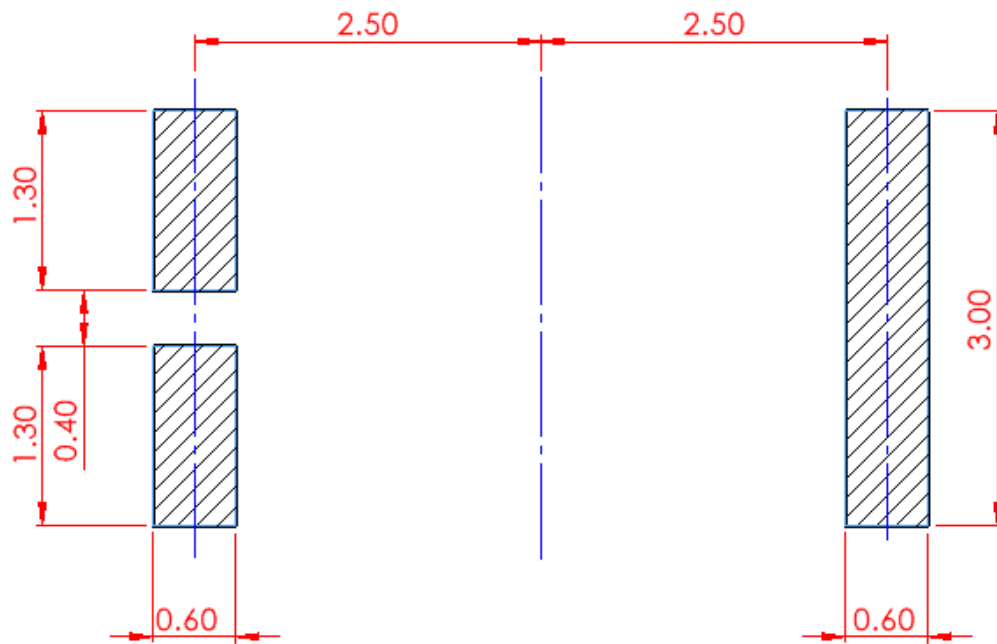
Above is a schematic symbol of NLA.01 and a table of the pin definitions.

5.2 Antenna Footprint

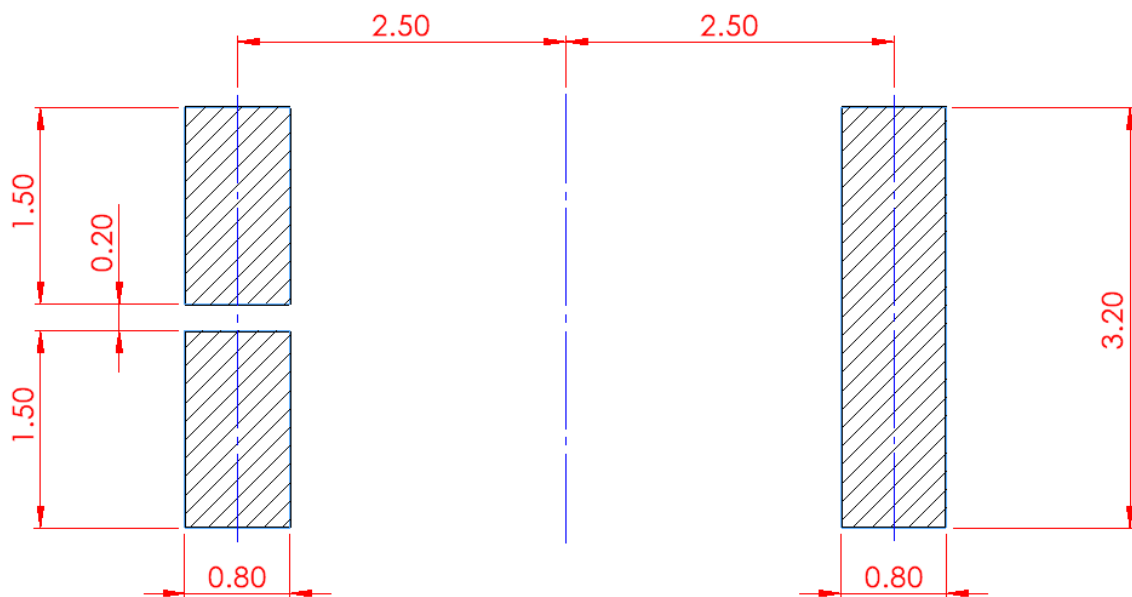


| Pin | Description |
|-----|---------------------|
| 1 | RF Feed |
| 2 | Ground |
| 3 | Fine Tuning Element |

5.3 Top Solder Paste



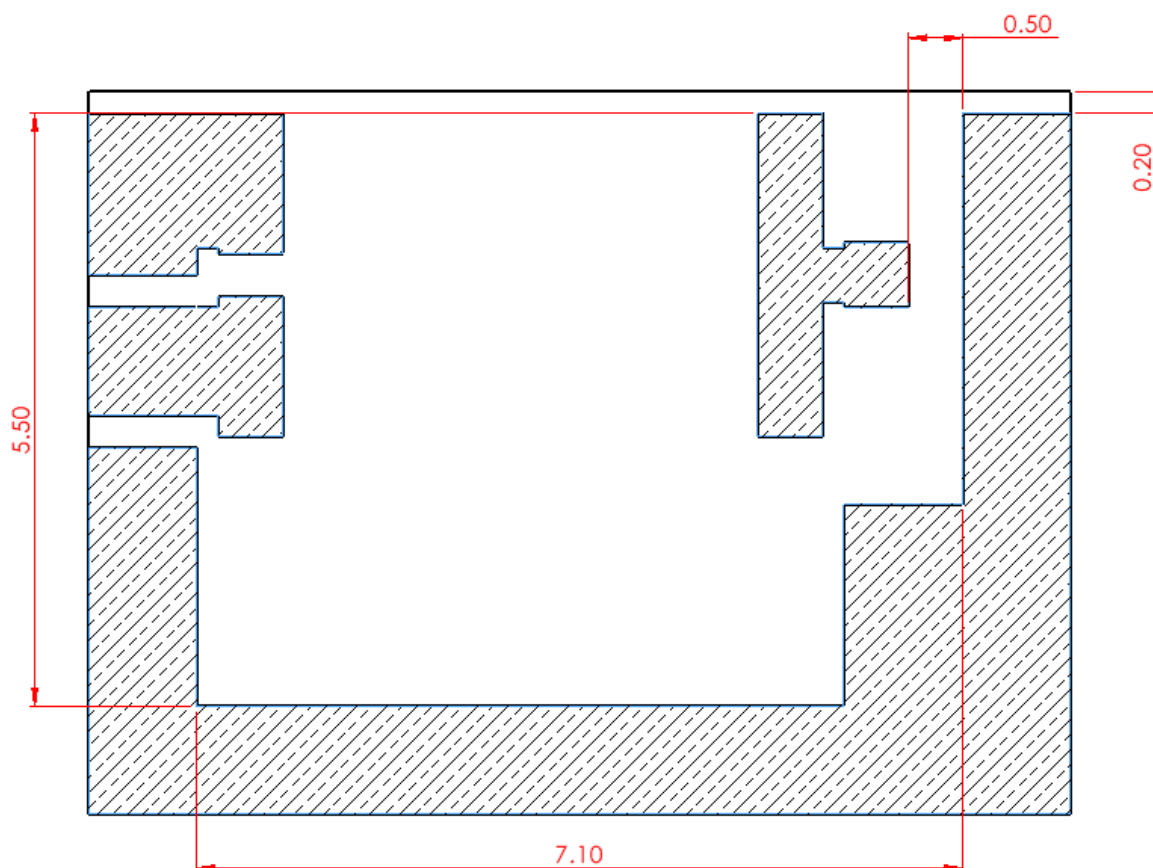
5.4 Top Solder Mask



5.5 Copper Clearance for NLA.01

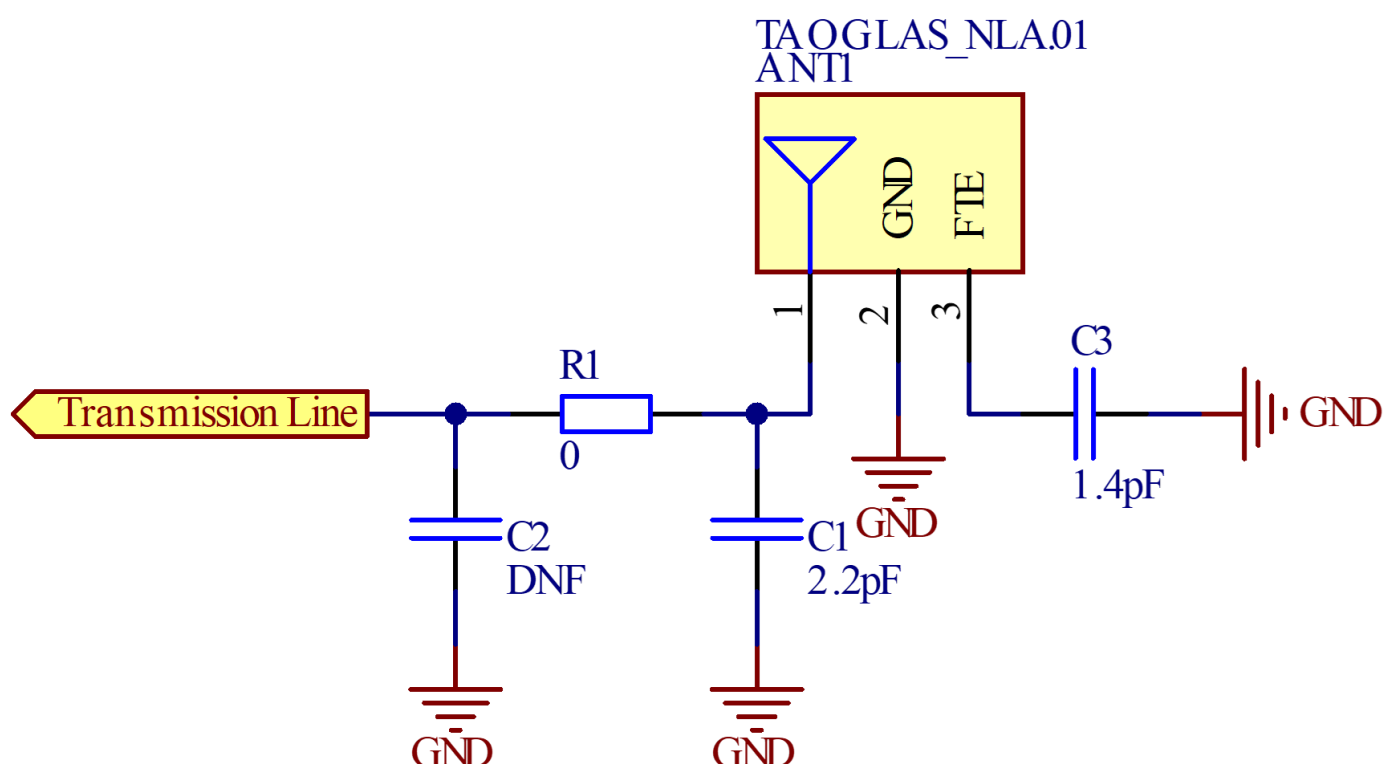
The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the NLA.01 clearance area. The copper keep-out area applies to all layers on the PCB.

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.

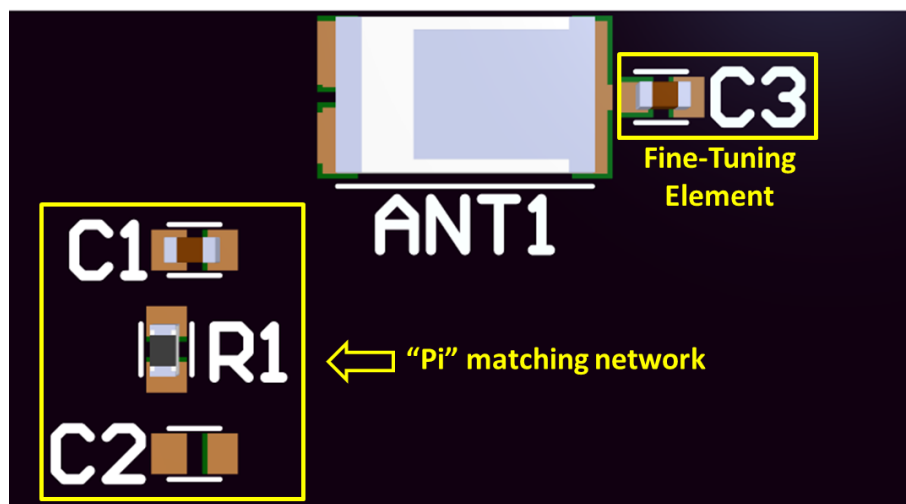


| Designator | Type | Value | Manufacturer | Manufacturer Part Number |
|------------|------------|-------|--------------|--------------------------|
| C1 | Capacitor | 2.2pF | Murata | GRM1555C1H2R2CA01D |
| C2 | Not Fitted | - | - | - |
| C3 | Capacitor | 1.4pF | Murata | GJM1555C1H1R4WB01D |
| R1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

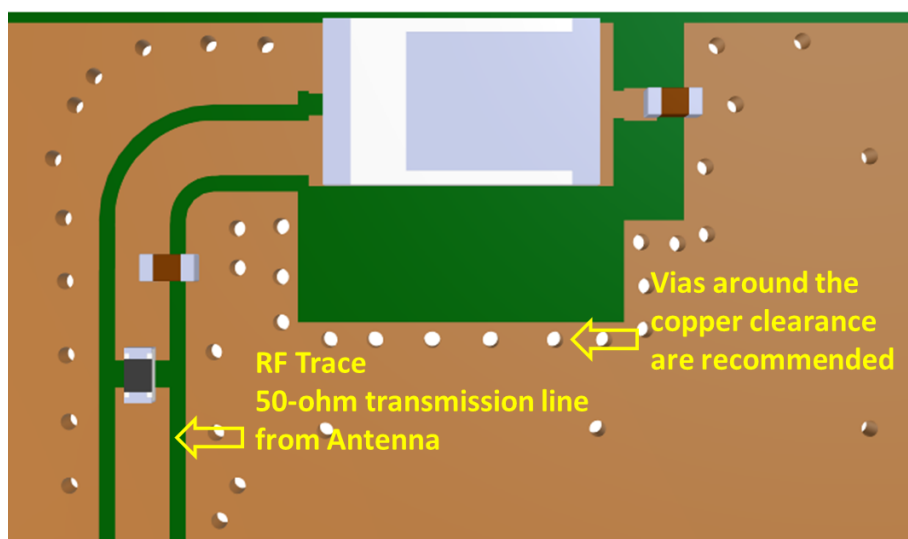
5.7 Antenna Integration

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.



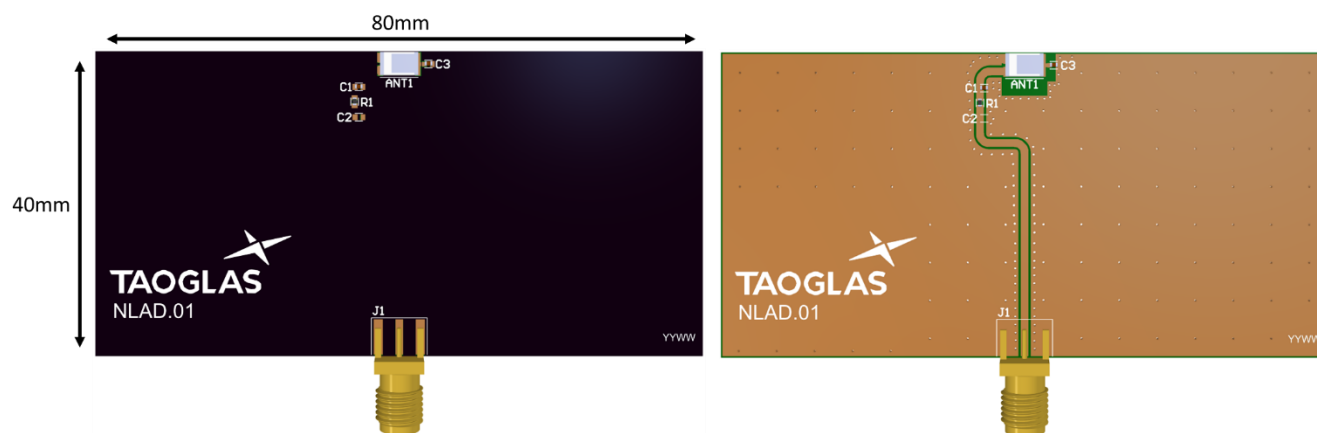
NLA.01 antenna mounted on a PCB, showing “Pi” matching network.



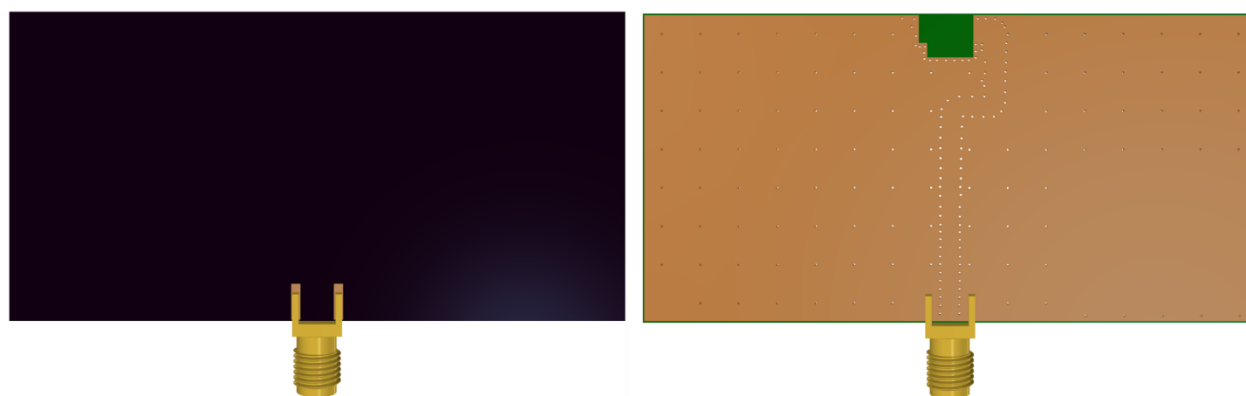
NLA.01 antenna mounted on a PCB, showing transmission line and integration notes.

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.



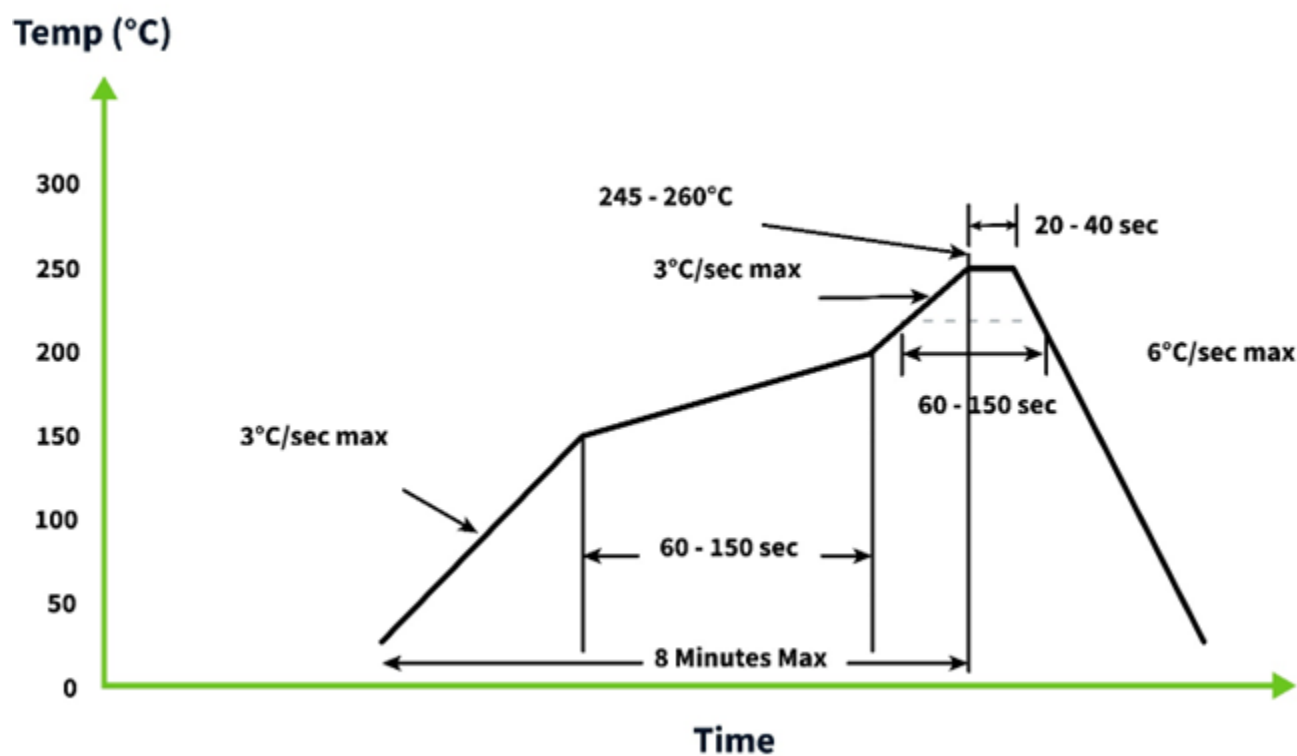
Top Side (NLAD.01 placement on 80x40mm PCB)



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 $\pm 10^{\circ}\text{C}$

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.

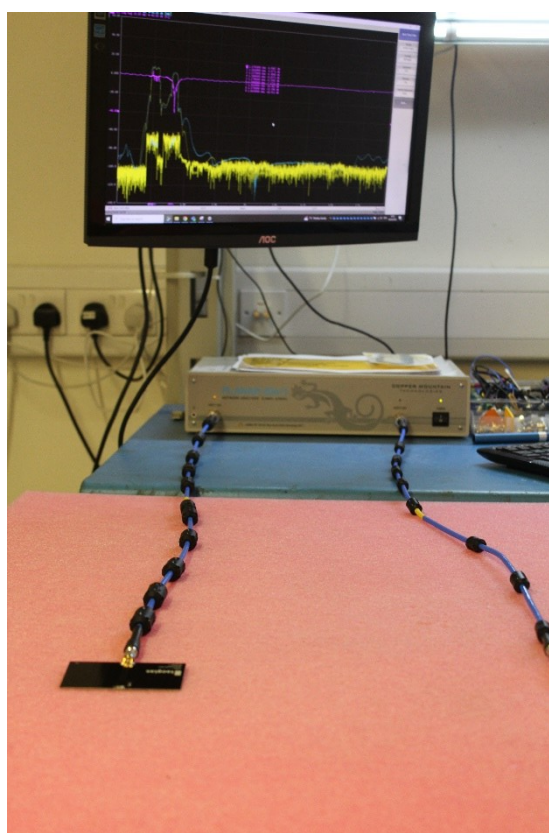
7. Antenna Characteristics

7.1 Test Setup

AUT

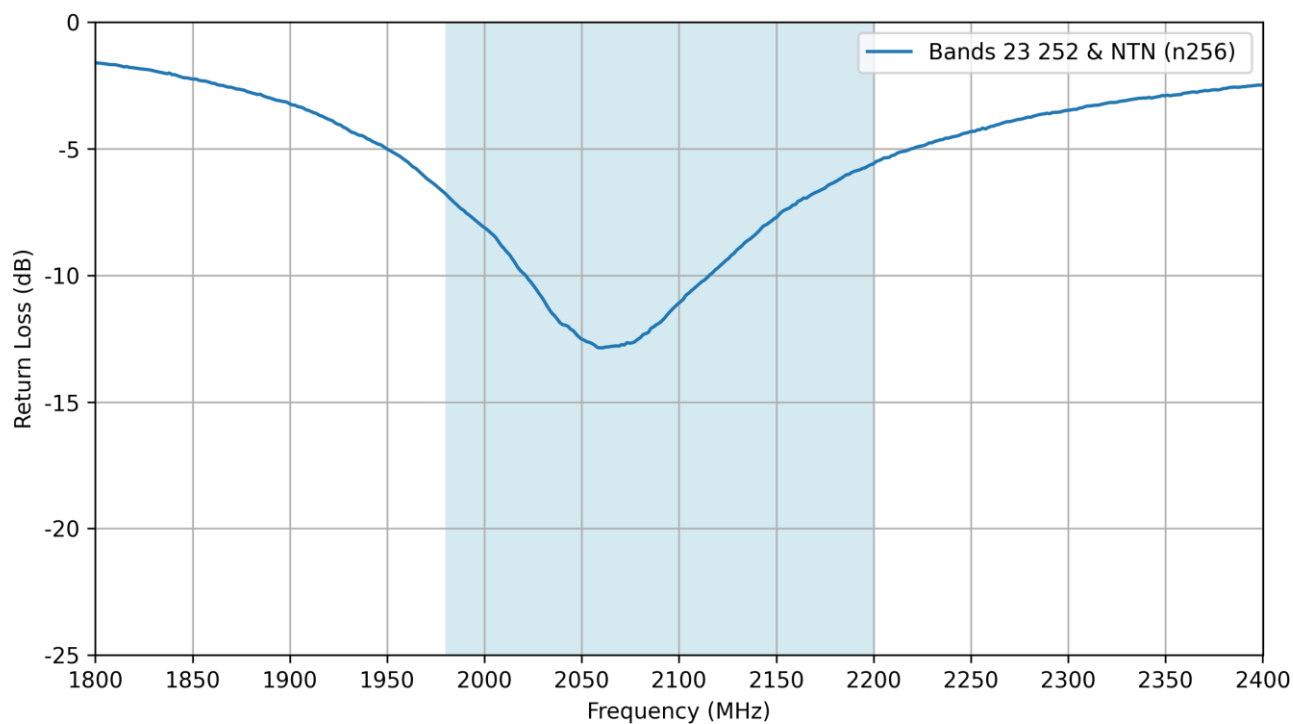


Vector Network Analyzer

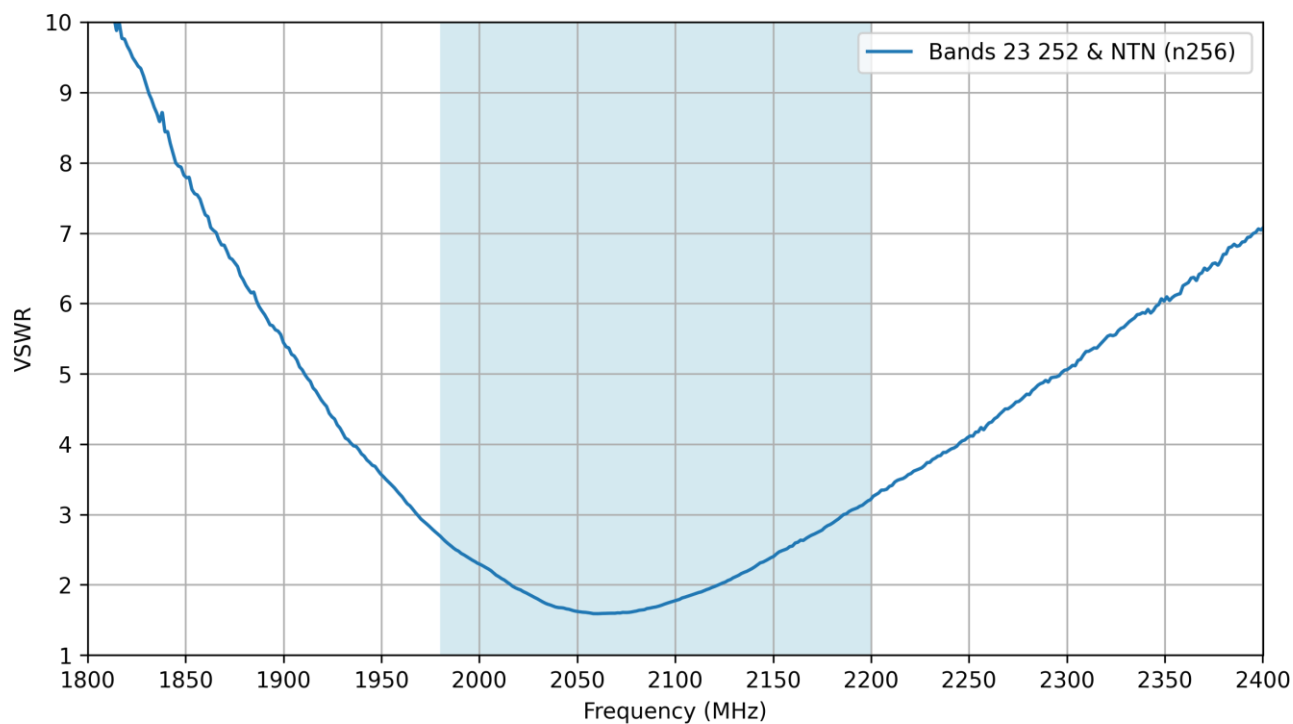


VNA Test Set-up

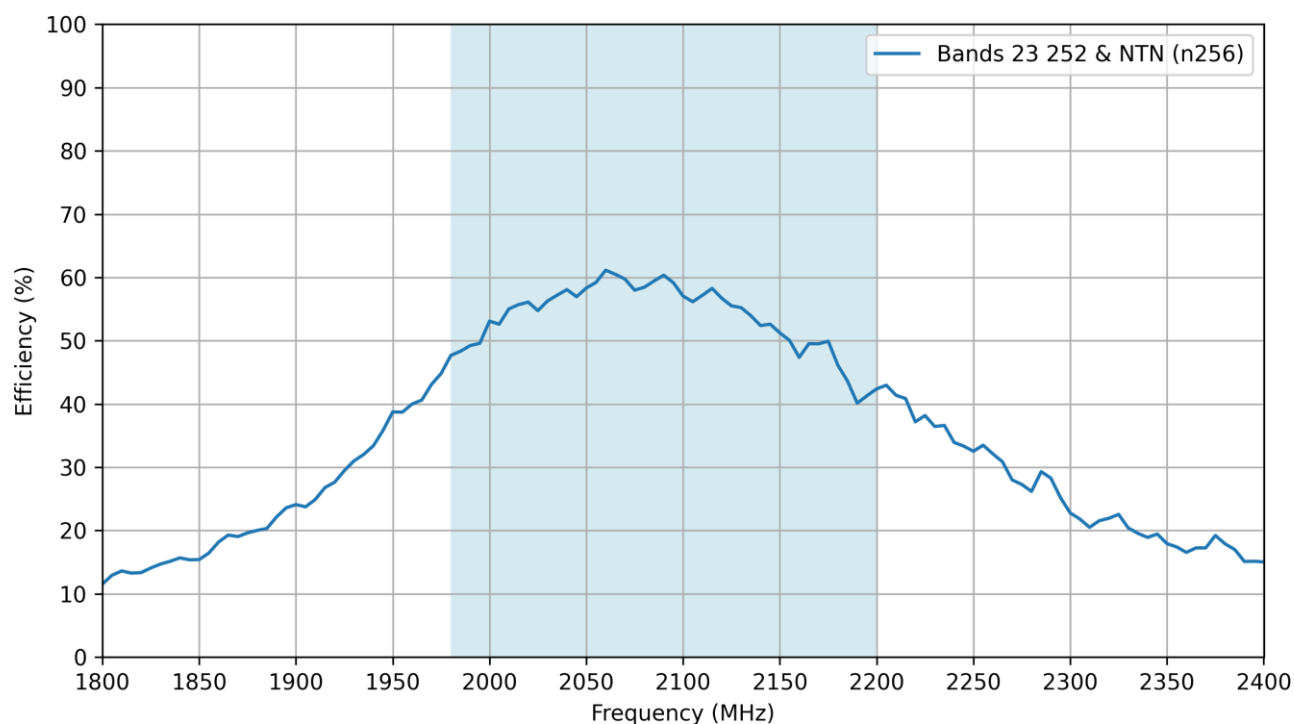
7.2 Return Loss



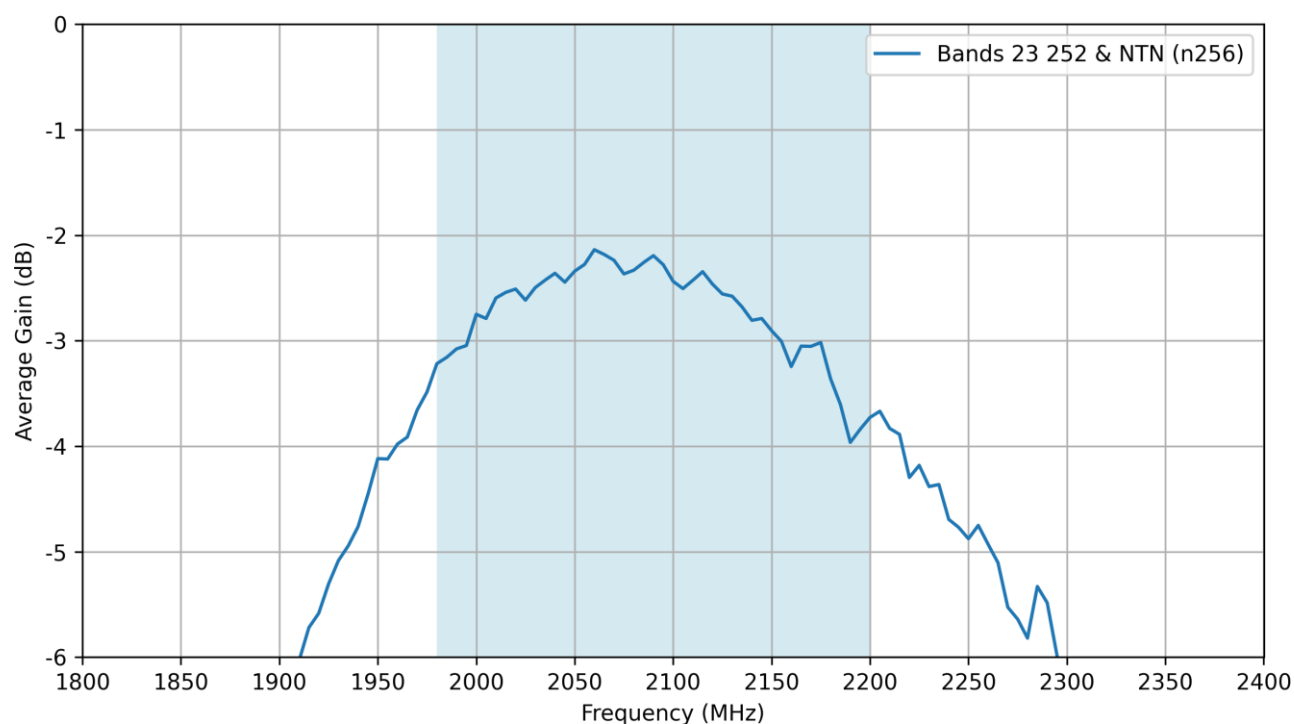
7.3 VSWR



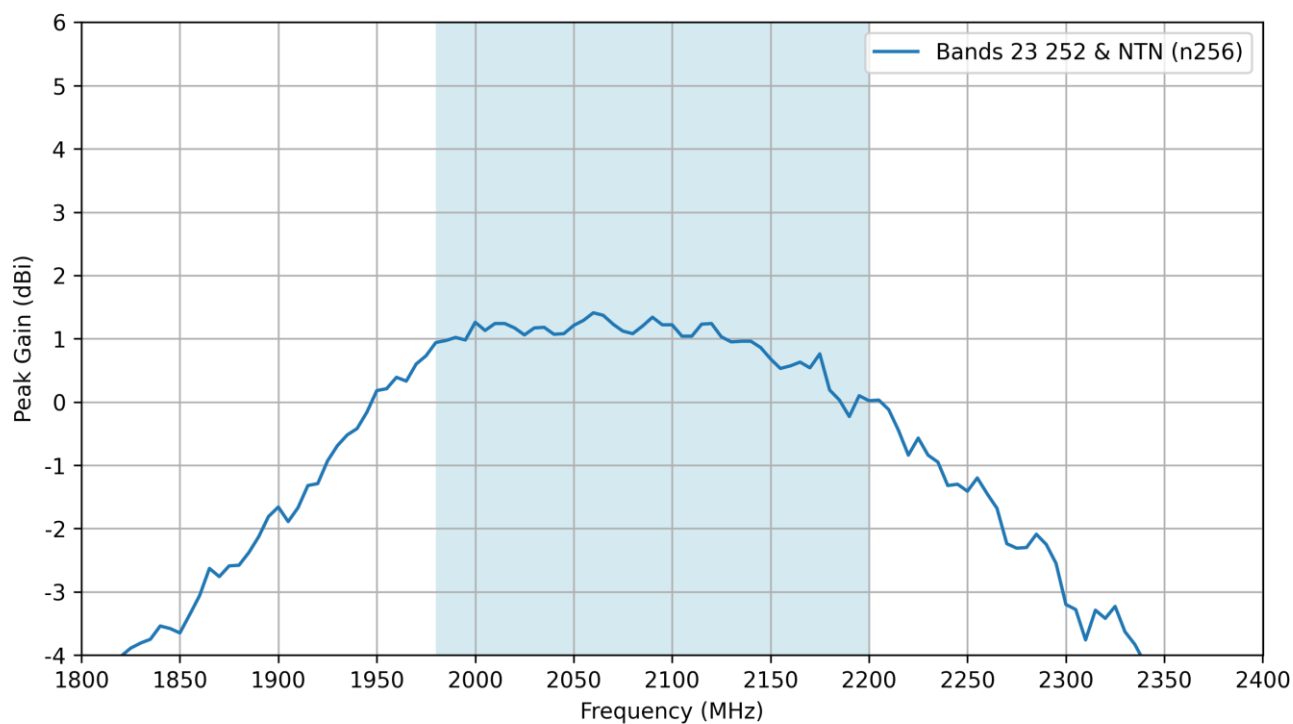
7.4 Efficiency



7.5 Average Gain

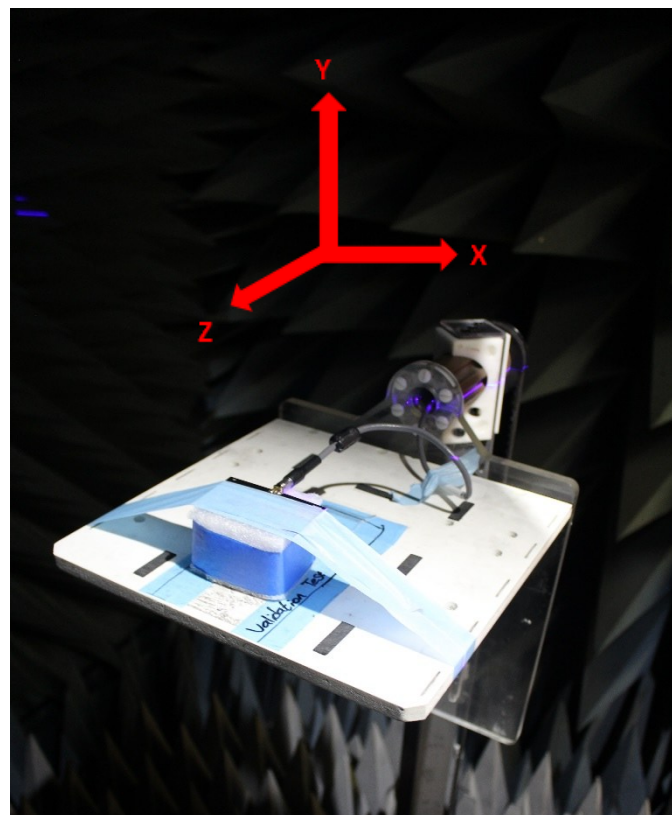
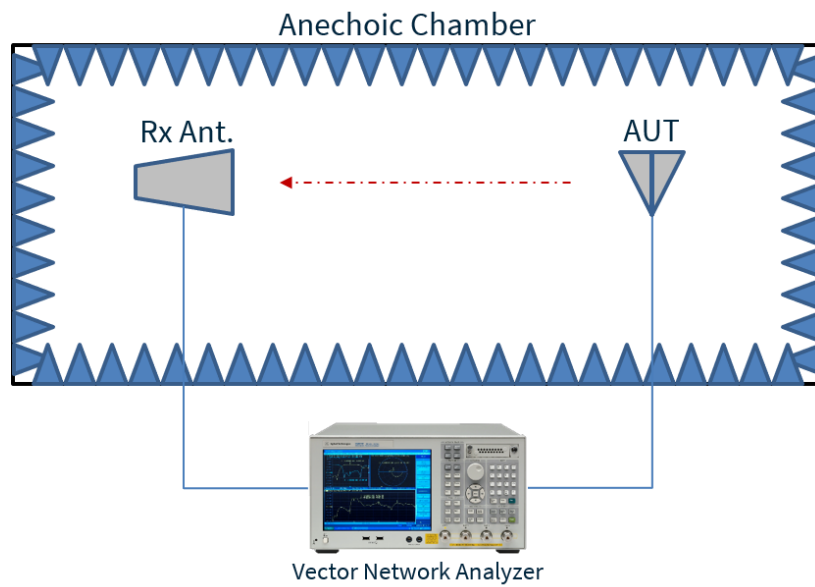


7.6 Peak Gain



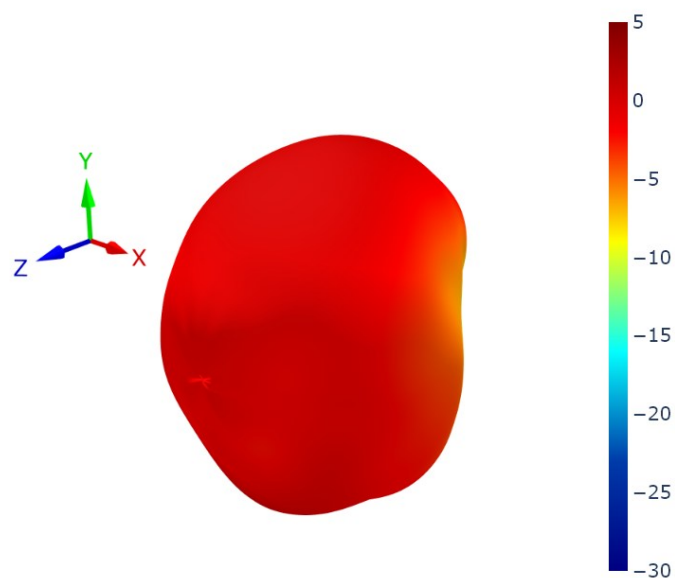
8. Radiation Patterns

8.1 Test Setup

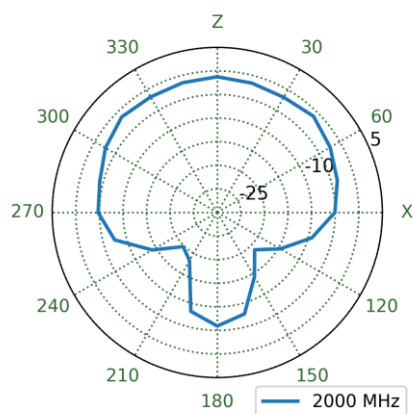


Chamber Test Set-up

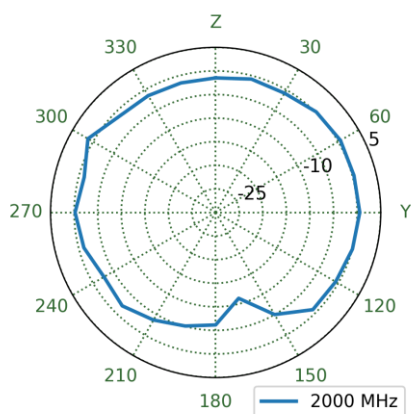
8.2 Patterns at 2000 MHz



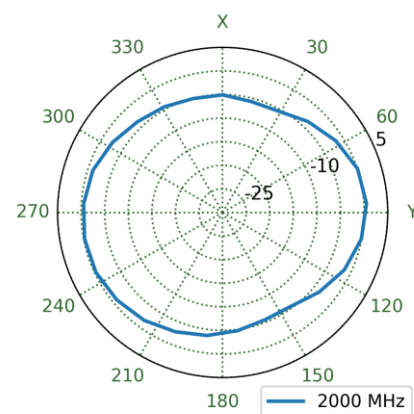
XZ Plane



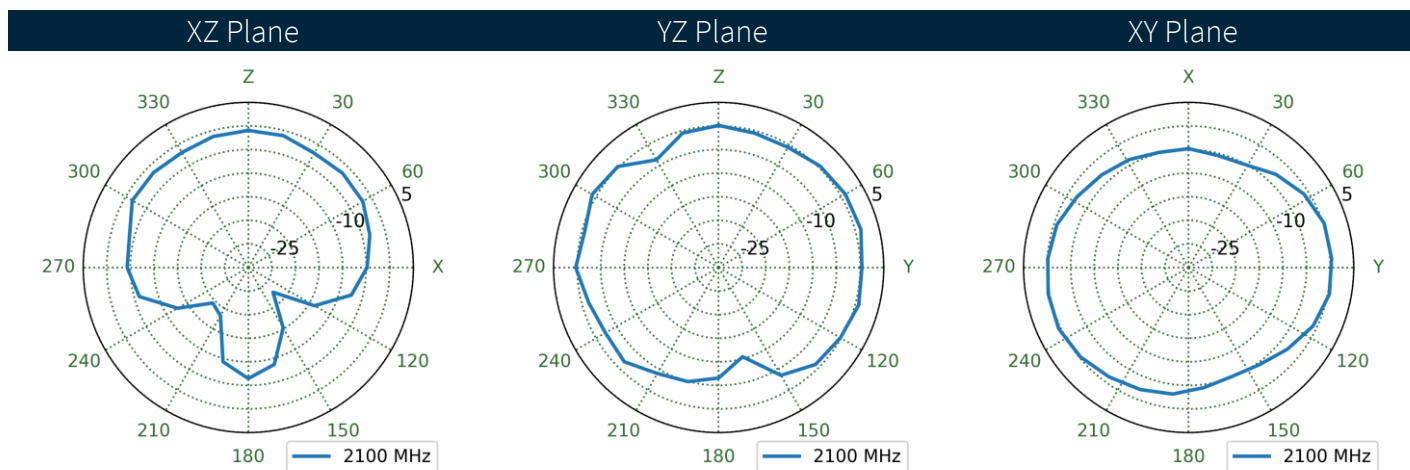
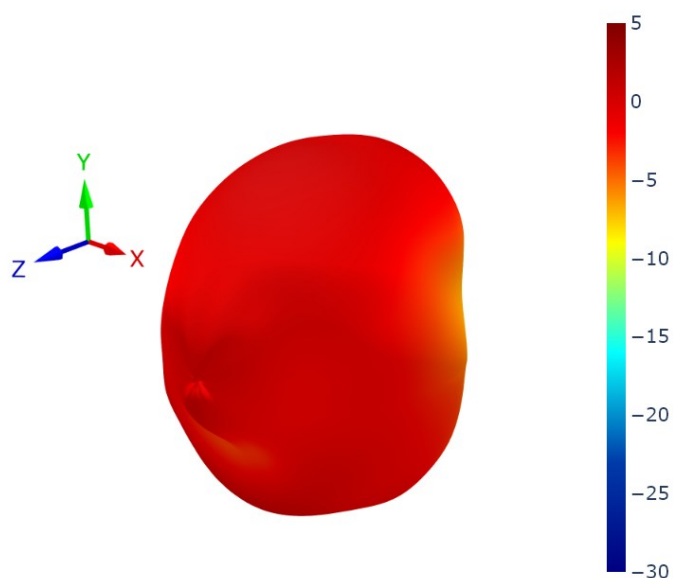
YZ Plane



XY Plane



8.3 Patterns at 2100 MHz



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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