Datasheet


# NCS.5820

**Part No:**
**NCS.5820**

## Description

Extensis NCS Series Embedded NB-IoT SMD Antenna covering Bands 5, 8 & 20

## Features:

Low Profile, Small Footprint SMD Antenna

Global NB-IoT Coverage for:

- Band 5, 824-894MHz
- Band 8, 880-960MHz
- Band 20, 791-862MHz

High Efficiency across each Band

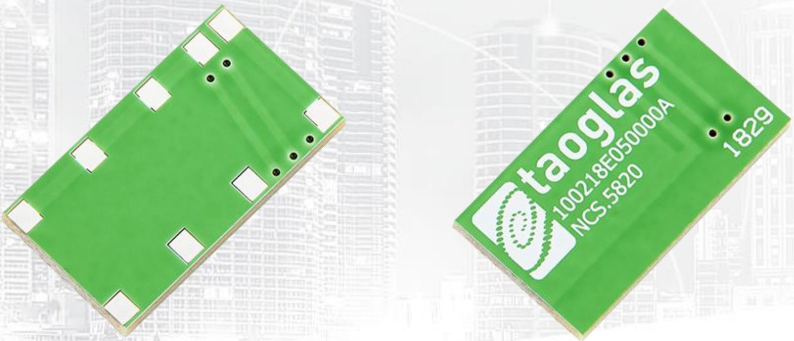
Dimensions: 20 x 11 x 1.6mm

RoHS & Reach Compliant

Ireland ISO 9001: 2015 Certified

Taiwan ISO 9001: 2015 Certified

# 1. Introduction




The evolution of IoT connectivity has seen an urgent need for a low power way to connect thousands of devices. The Extensis NCS series of NB-IoT embedded antennas are the smallest form factor antennas on the market to facilitate this demand.

This part no. the NCS.5820 supports Bands 5 (824-894MHz), 8 (880-960MHz) and 20 (791-862MHz) and demonstrates excellent efficiency in providing global NB-IoT coverage. This antenna will allow the device manufacturer to enjoy mobilization between all bands so that the device can be used in more than one region with more than one carrier. On the contrary, an antenna covering only one band will have less mobility and will not be suitable for international roaming over Low Power Wide Area networks.

With a super low profile height of 1.6 mm and a footprint of just 11 x 20mm, the surface mount antenna can be easily integrated into even the smallest of devices. It allows device designers to take advantage of all of the benefits of NB-IoT technology, including reduced power consumption and increased battery life; increased system capacity and spectrum efficiency; and extended coverage in both rural and deep indoors environments all with a very small form factor. For testing, it can be supplied on the NCSD.5820 evaluation board, see section 5.2.

Typical applications include:

- Remote monitoring / Smart meters
- Smart cities & buildings
- Agriculture
- Network devices
- Manufacturing automation
- Environment and asset tracking

Ease of integration and exceptional performance of this antenna make it the perfect starting point for any NB-IoT device design. It is also an ideal choice for cost-sensitive applications considering also that the material used for this antenna is lower cost than the traditional ceramic NB-IoT antenna.

Overall, this antenna is suitable for applications that need to meet the following requirements:

- Small footprint, low profile design factors
- Long battery life of up to 10 years is required
- Deep indoor penetration with +20dB link budget compared with GSM is required
- Low cost, with an industry target of < $5 per radio module. The material used for this antenna is lower cost than the traditional ceramic NB-IoT antenna
- High security from proven LTE-based security mechanisms
- A worldwide 3GPP industry standard on operator-managed networks in licensed spectrum
- Possibility of up to 100x more devices per cell compared with GSM

For more information or support with integrating this antenna into your device, please contact your regional Taoglas Customer Support Team.

# 2. Specification

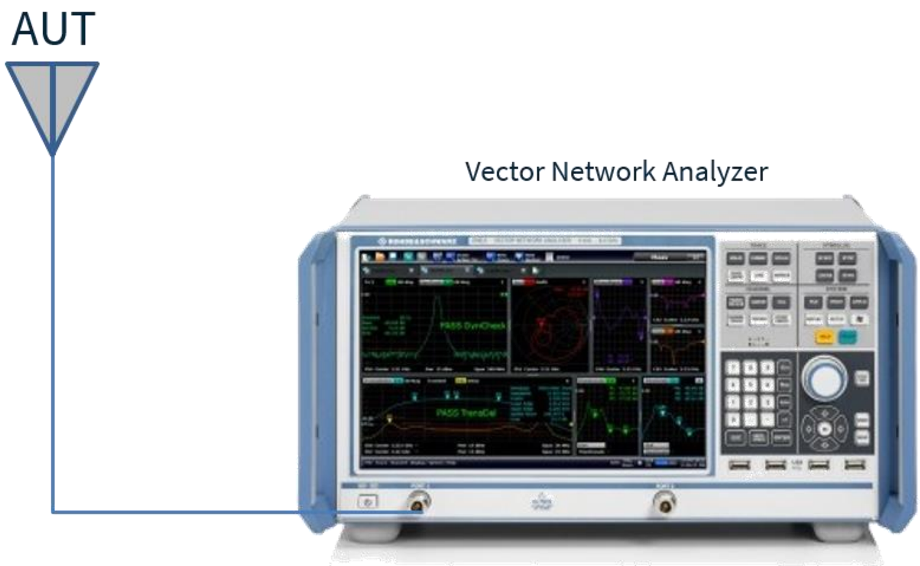
| LTE Electrical | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Band** | Frequency (MHz) | Efficiency (%) | Average Gain (dB) | Peak Gain (dBi) | Impedance | Polarization | Radiation Pattern | Max. input power |
| **915MHz** | 902-928 | 50.3 | -2.99 | 0.50 | 50 Ω | Linear | Omni | 5W |
| **868MHz** | 863-870 | 44.6 | -3.51 | 0.03 | | | | |
| **Band 5** | 824-894 | 44.1 | -3.55 | 0.60 | | | | |
| **Band 8** | 880-960 | 48.8 | -3.12 | 0.60 | | | | |
| **Band 20** | 791-862 | 38.1 | -4.20 | -0.08 | | | | |

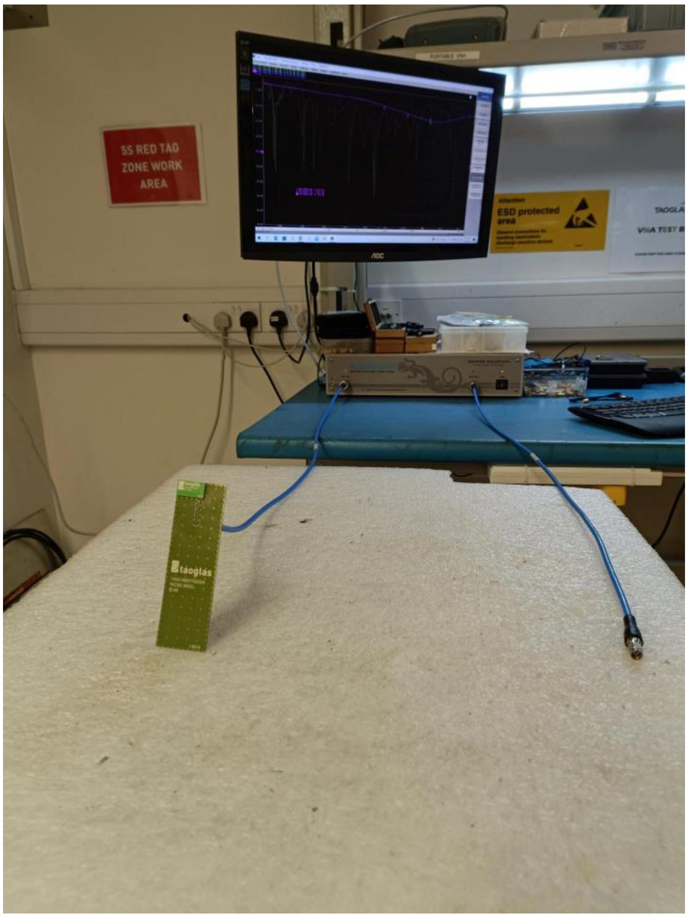
| Mechanical | |
|---|---|
| **Antenna Dimensions** | 20mm x 11mm x 1.6mm |
| **Material** | FR4 |
| **Weight** | 0.74 g |
| **Soldering Type** | SMT through Reflow |

| Environmental | |
|---|---|
| **Operation Temperature** | -40°C ~ +85°C |
| **Storage Temperature** | -40°C ~ +85°C |
| **Moisture Sensitivity Level (MSL)** | 3 (168 Hours) |
| **Humidity** | Non-condensing 65°C 95% RH |

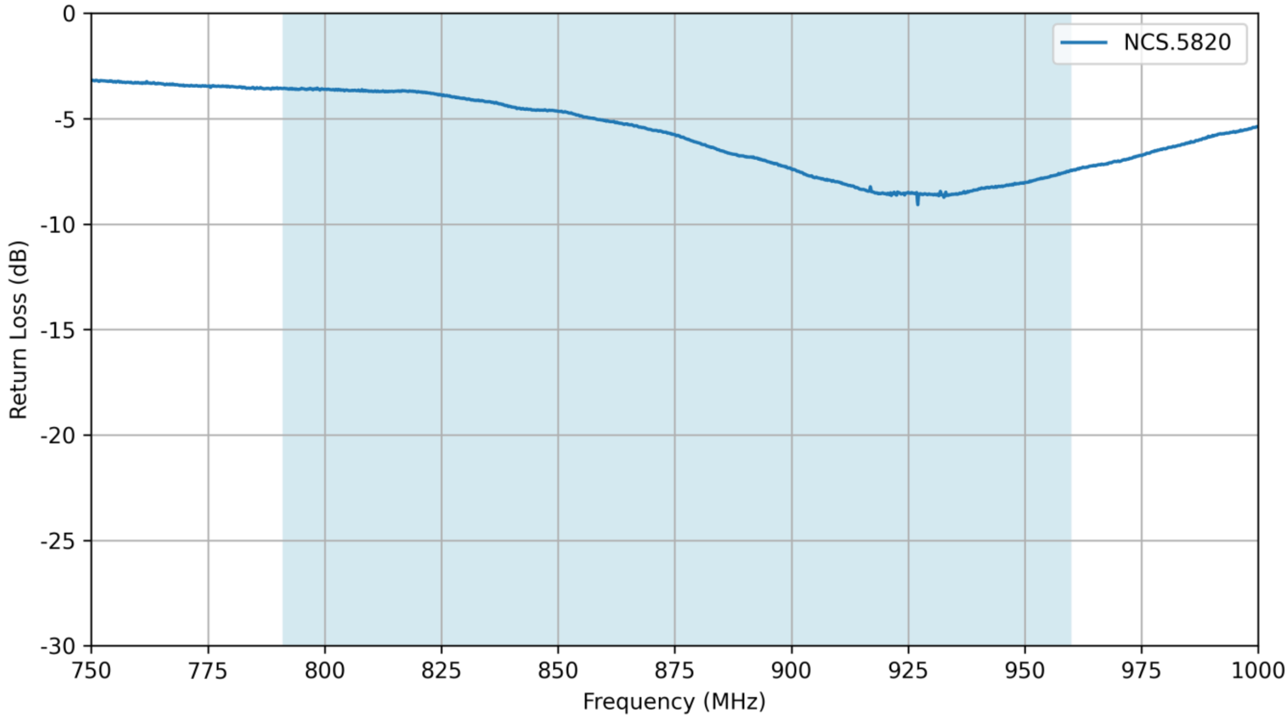
# 3. Antenna Characteristics

## 3.1 Test Setup

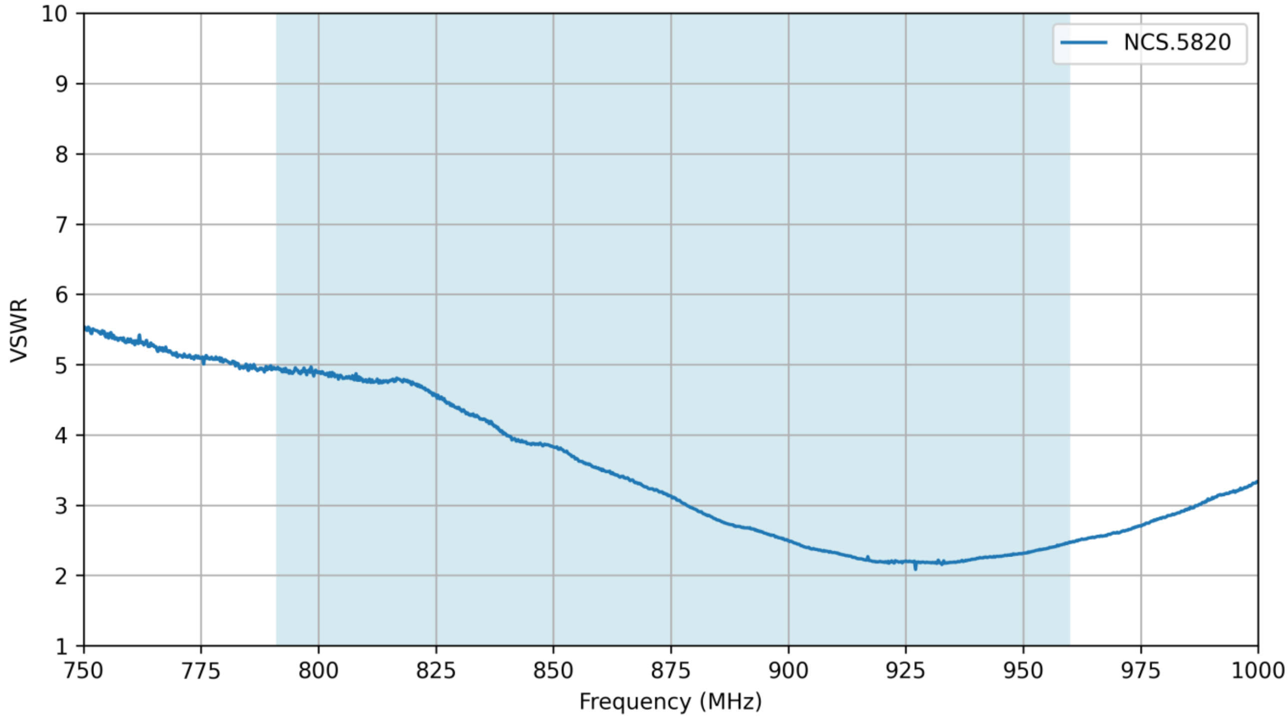


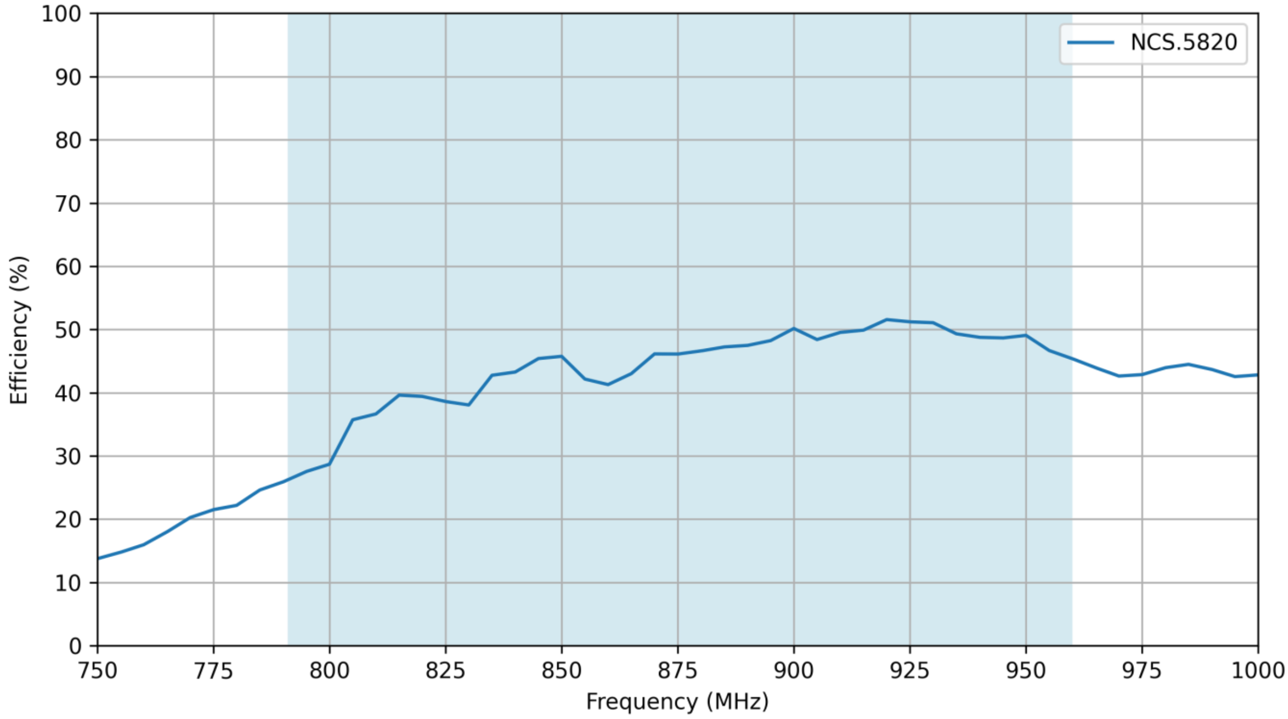
## 3.2 Return Loss



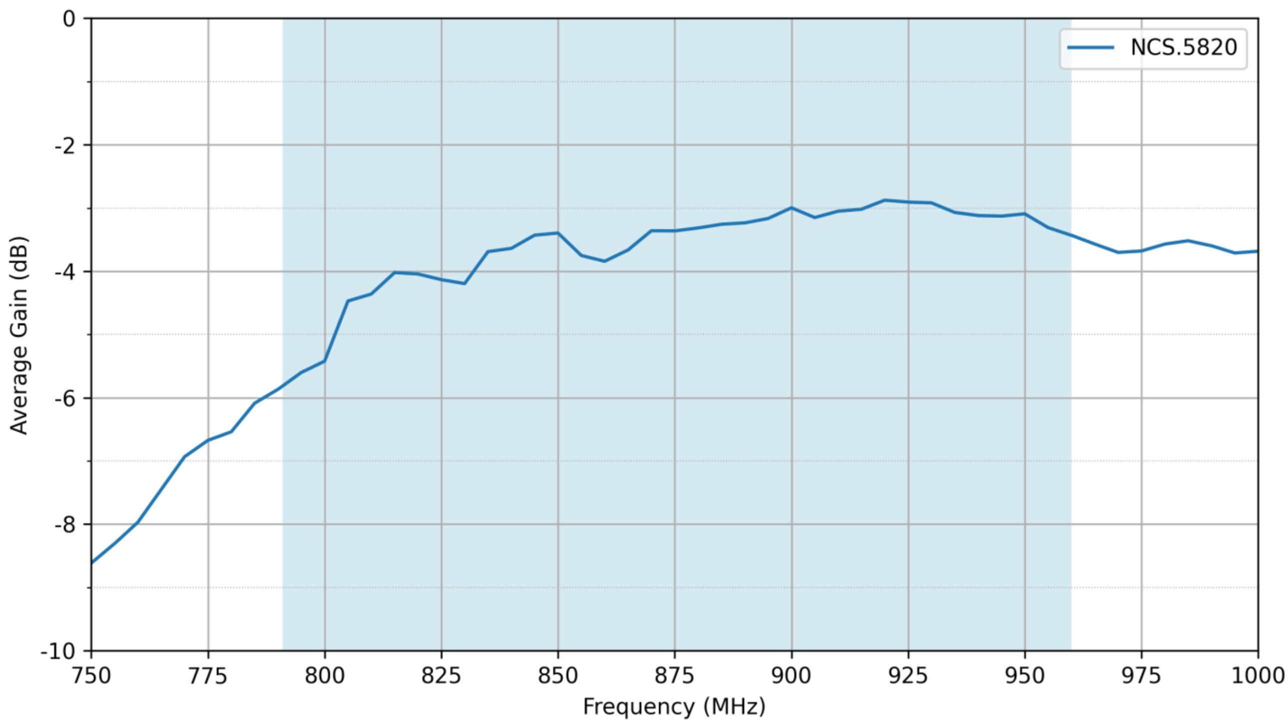

## 3.3 VSWR



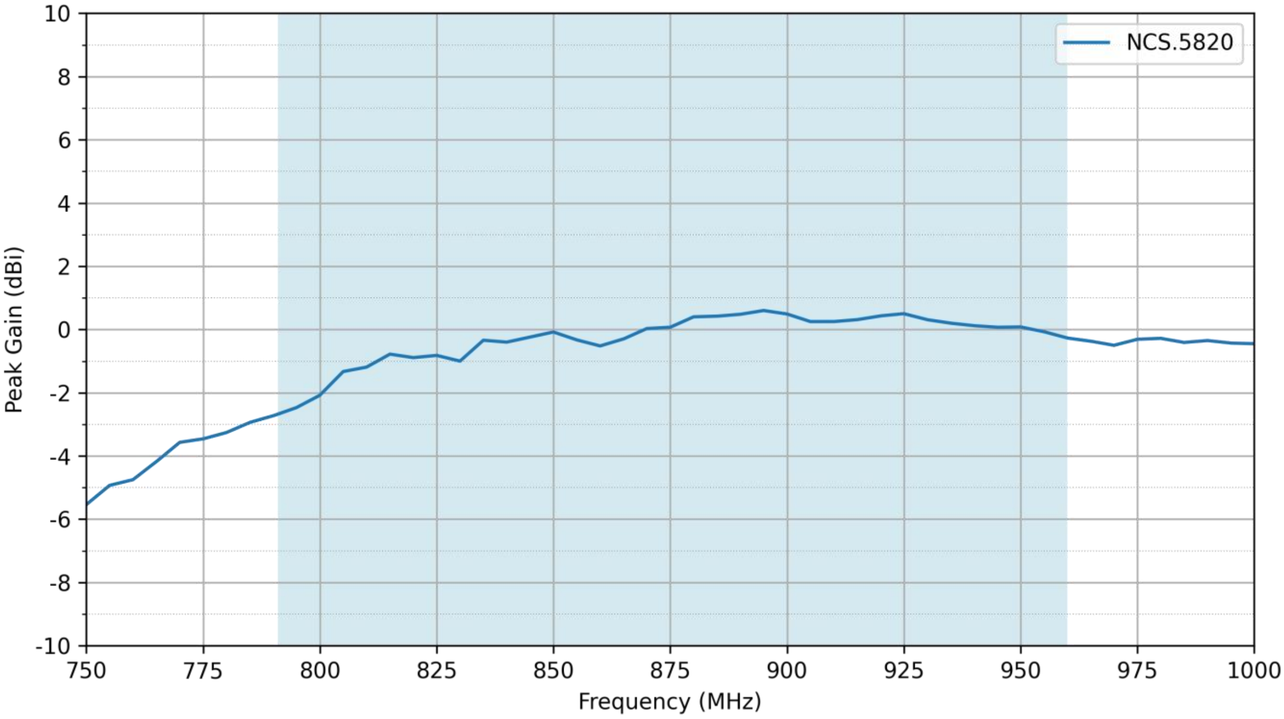
## 3.4 Efficiency




## 3.5 Average Gain

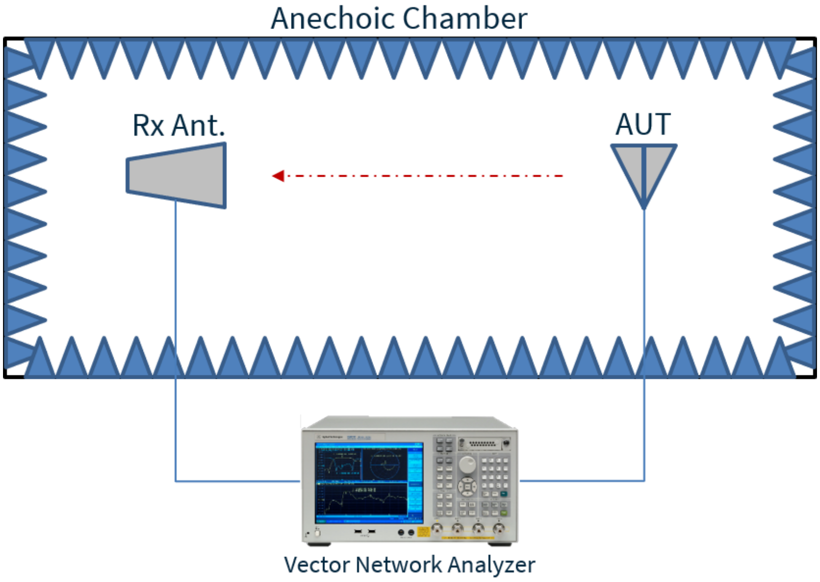


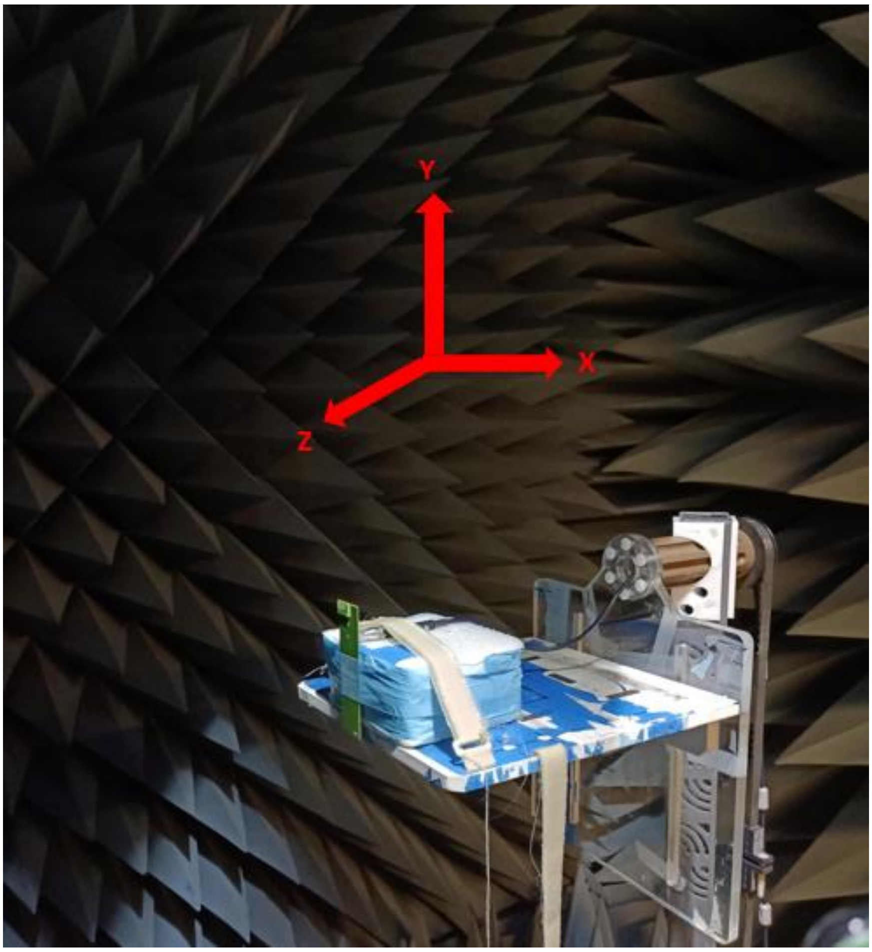
## 3.6 Peak Gain


10
8
6
4
2
0
-2
-4
-6
-8
-10
Peak Gain (dBi)
750
775
800
825
850
875
900
925
950
975
1000
Frequency (MHz)
NCS.5820

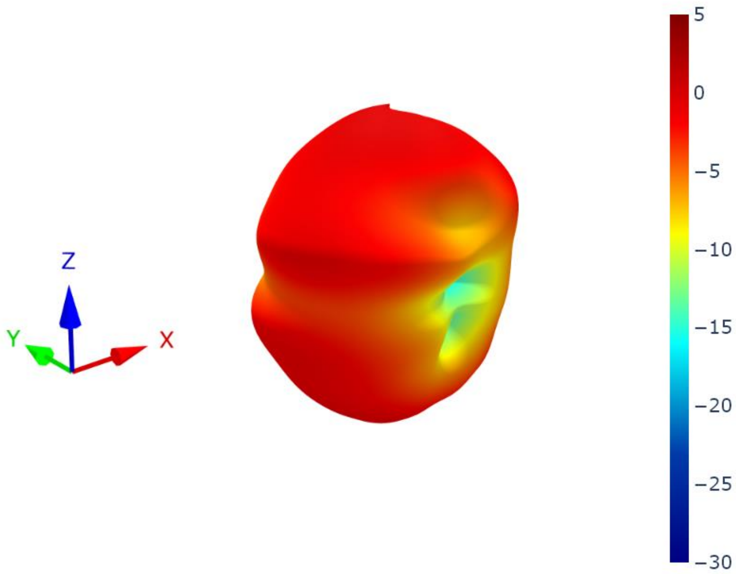
# 4. Radiation Patterns

## 4.1 Test Setup

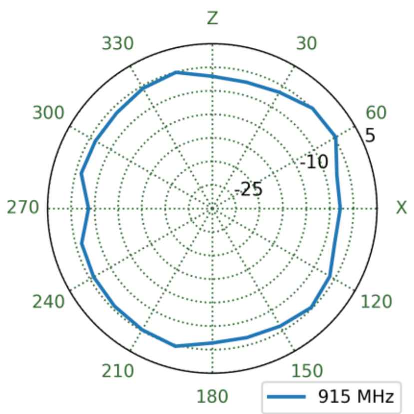


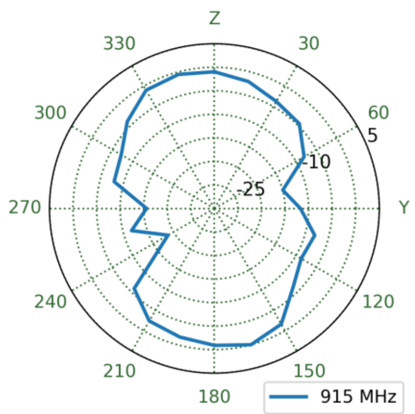



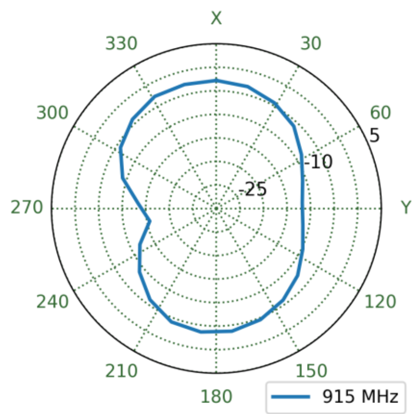
## 4.2 Patterns at 915 MHz



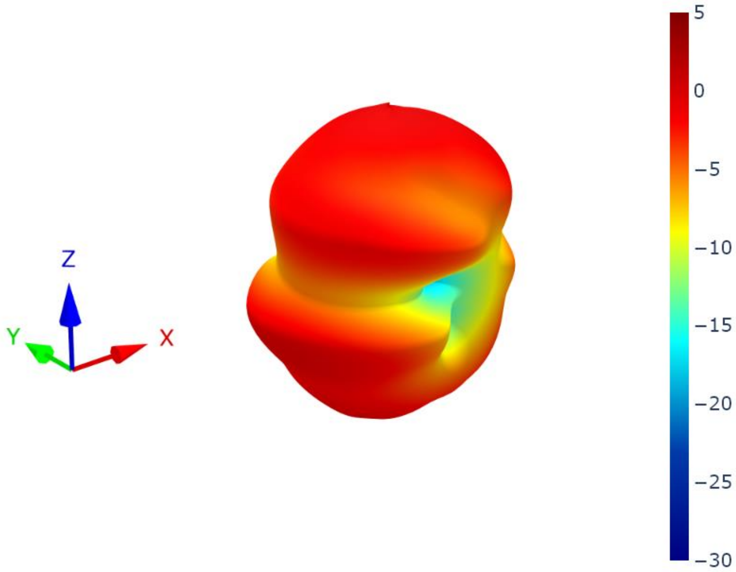

| XZ Plane | YZ Plane | XY Plane |
| --- | --- | --- |



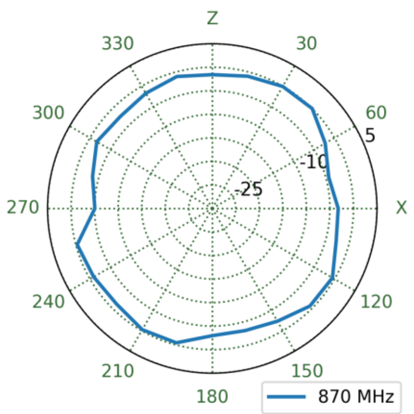



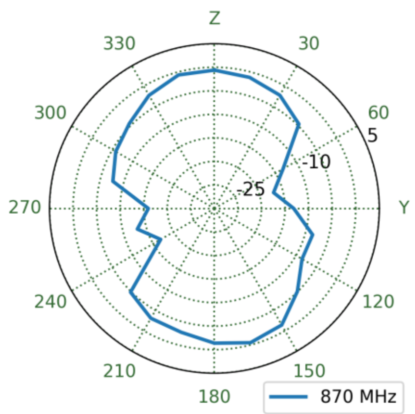



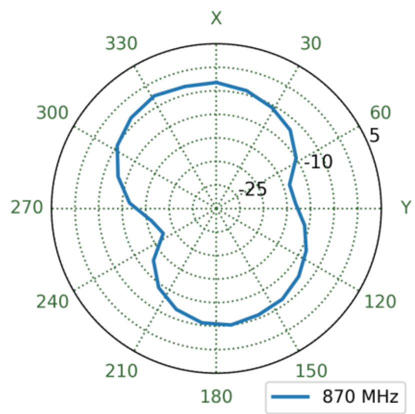
## 4.3 Patterns at 868 MHz



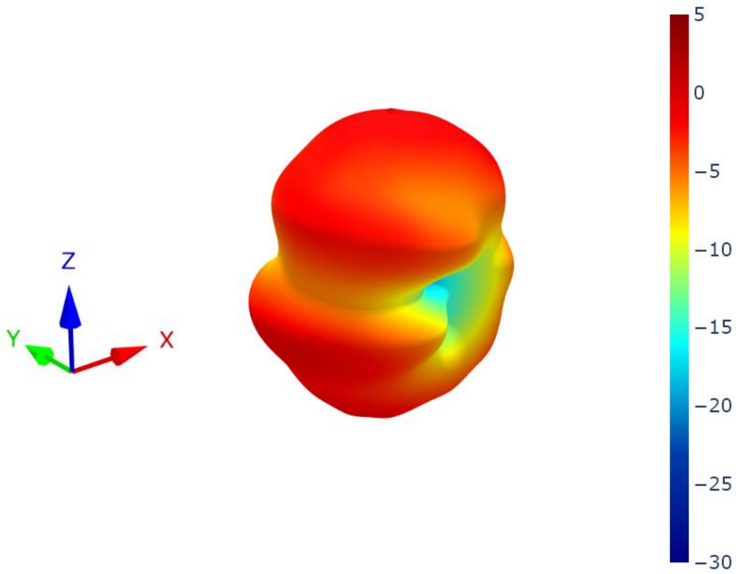

| XZ Plane | YZ Plane | XY Plane |
|---|---|---|



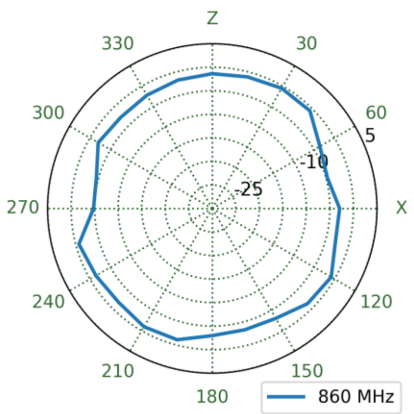



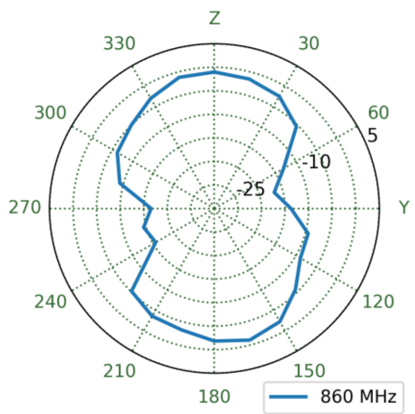



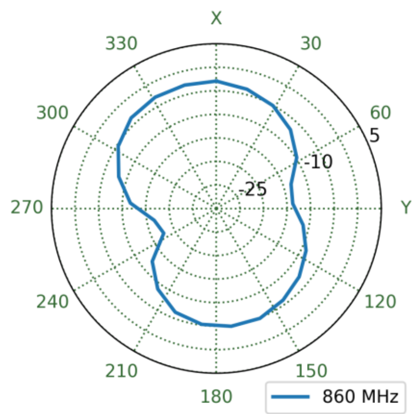
## 4.4 Patterns at 860 MHz



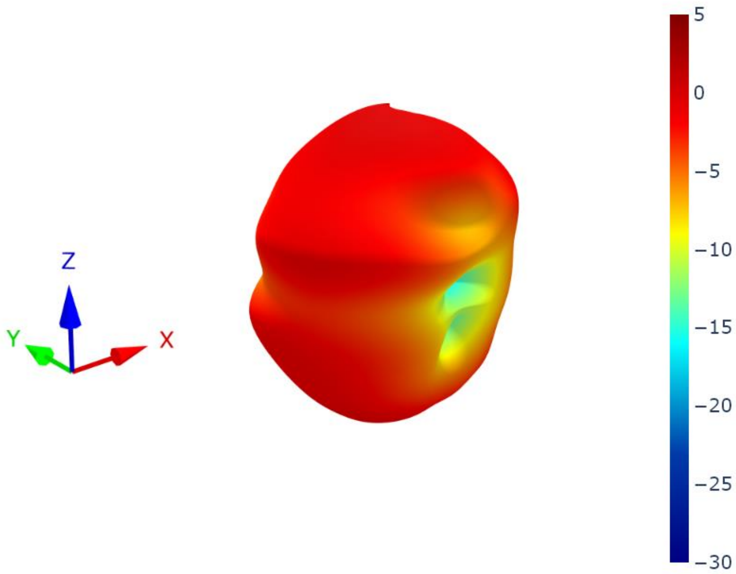

| XZ Plane | YZ Plane | XY Plane |
|---|---|---|



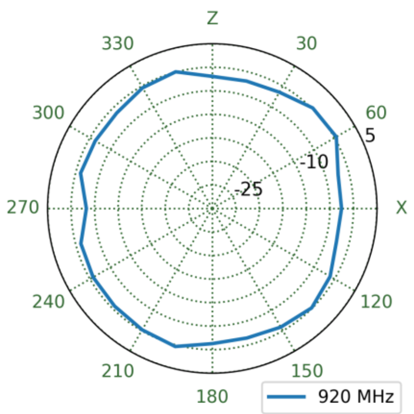



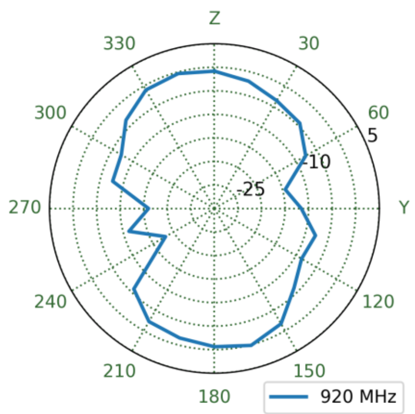



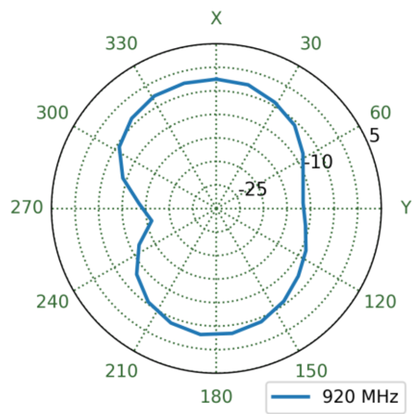
## 4.5 Patterns at 920 MHz



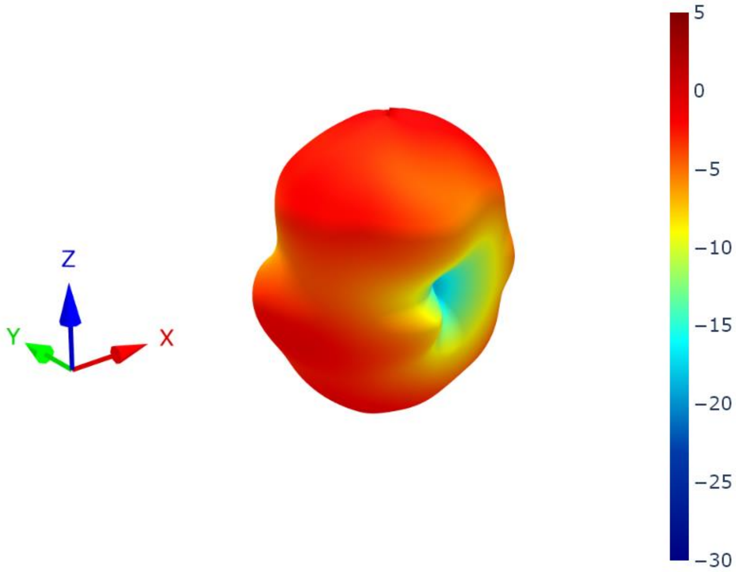

| XZ Plane | YZ Plane | XY Plane |
|---|---|---|



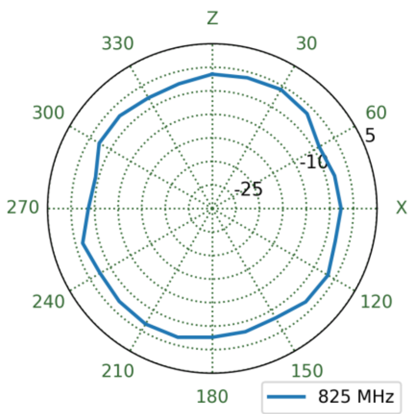



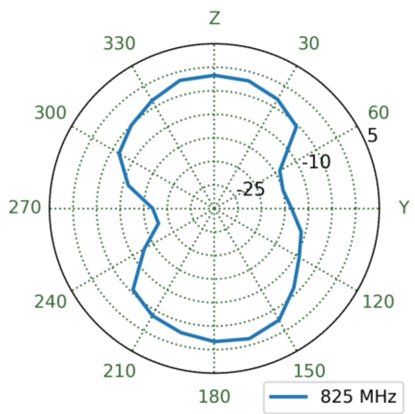



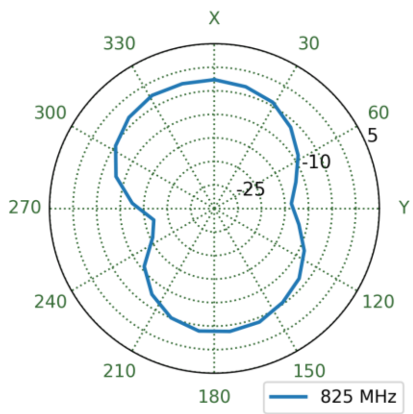
## 4.6 Patterns at 825 MHz



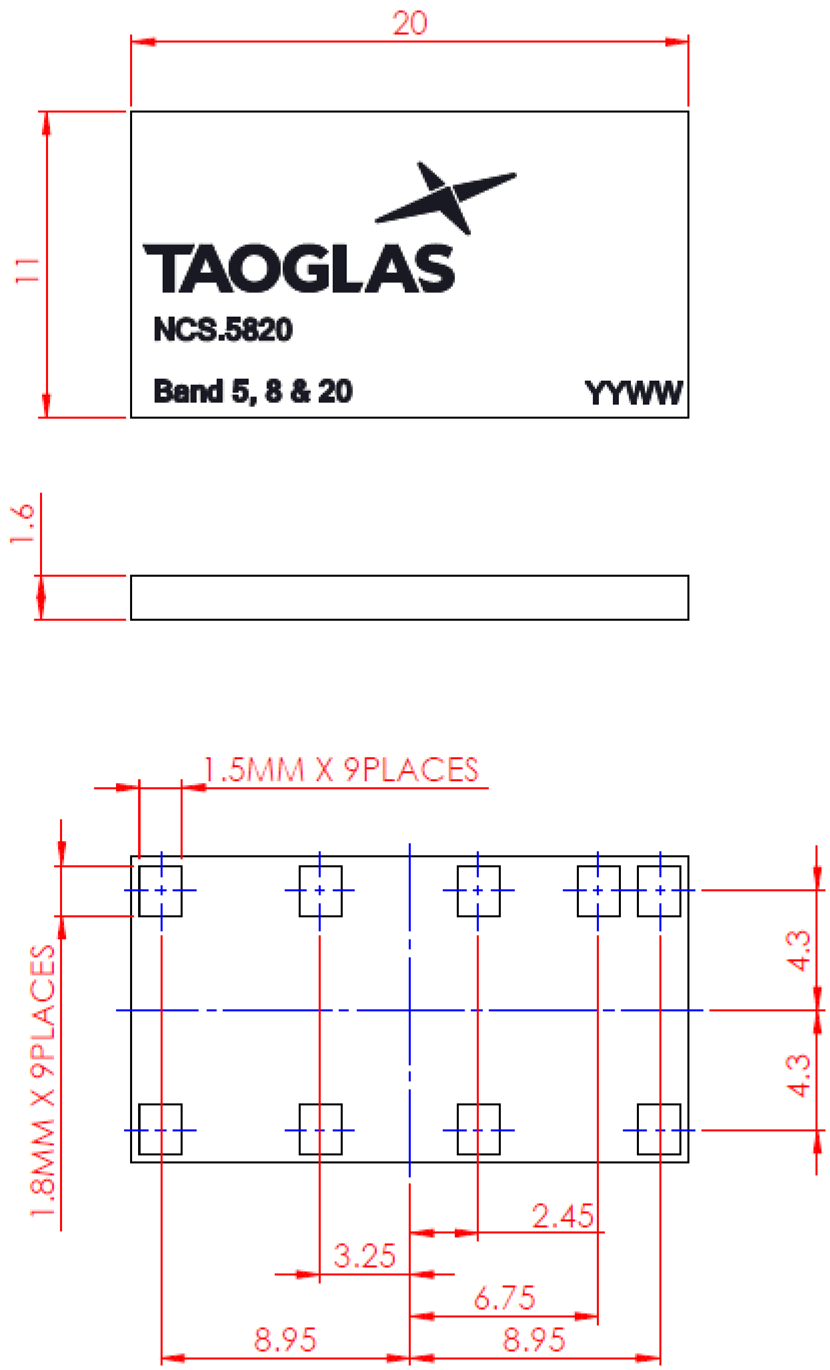

| XZ Plane | YZ Plane | XY Plane |
|---|---|---|



# 5. Mechanical Drawing

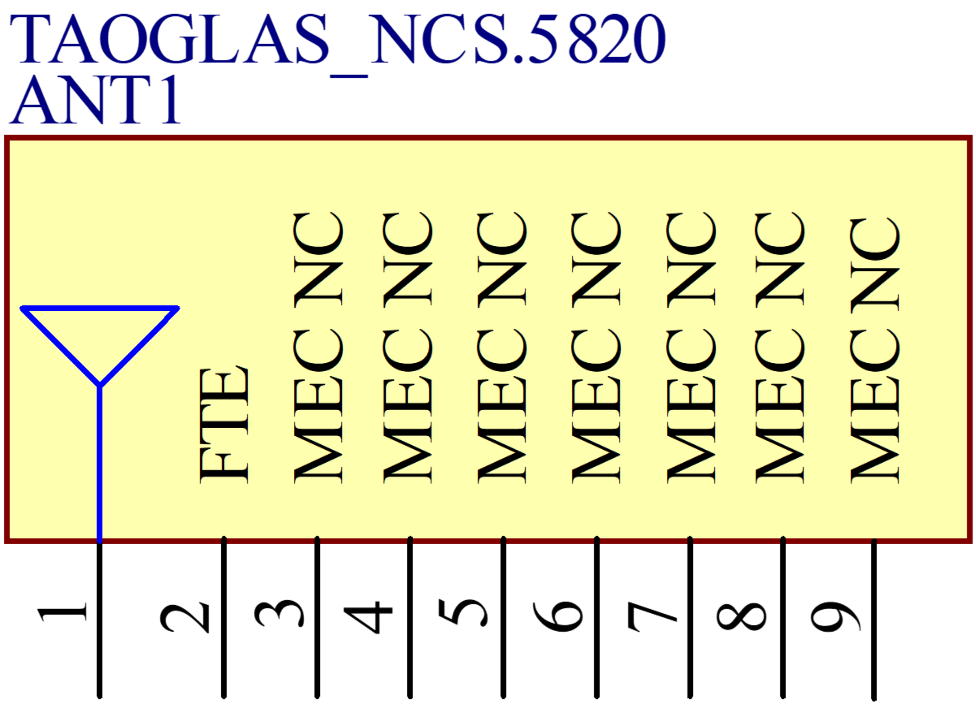


# 6. Antenna Integration Guide


## 6.1 Schematic and Symbol Definition

The circuit symbol for the antenna is shown below. The antenna has 9 pins with only two pins (Pin 1 and Pin 2) as functional. Pins 3, 4, 5, 6, 7, 8 & 9 are for mechanical strength.

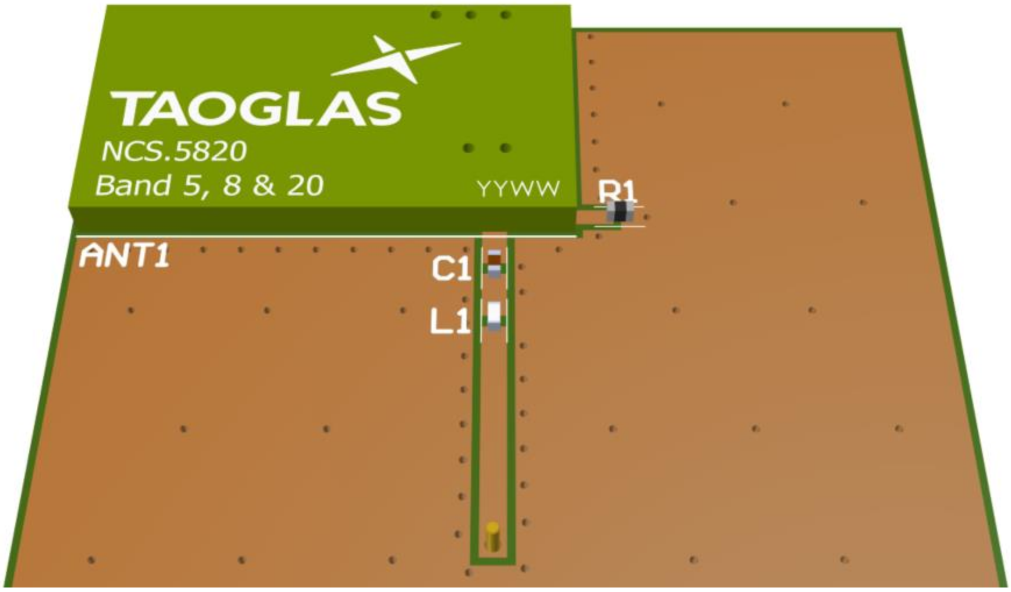
| Pin | Description |
|---|---|
| 1 | RF Feed |
| 2 | Fine Tuning Element |
| 3, 4, 5, 6, 7, 8, 9 | Mechanical, Not Connected |



## 6.2 Antenna Integration

For any given PCB size, the antenna should ideally be placed on the PCB's shortest side, to take advantage of the ground plane. Optimized matching components can be placed as shown.

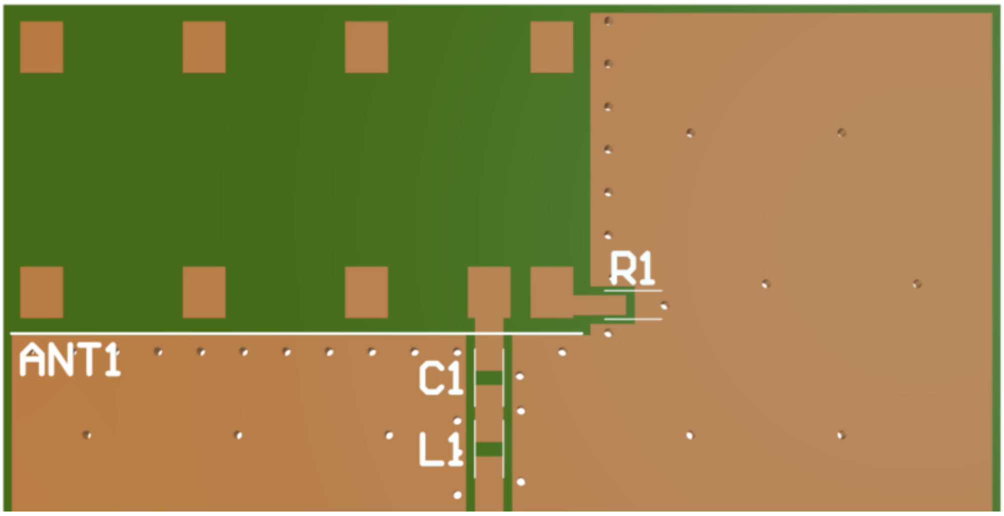

With Solder Mask



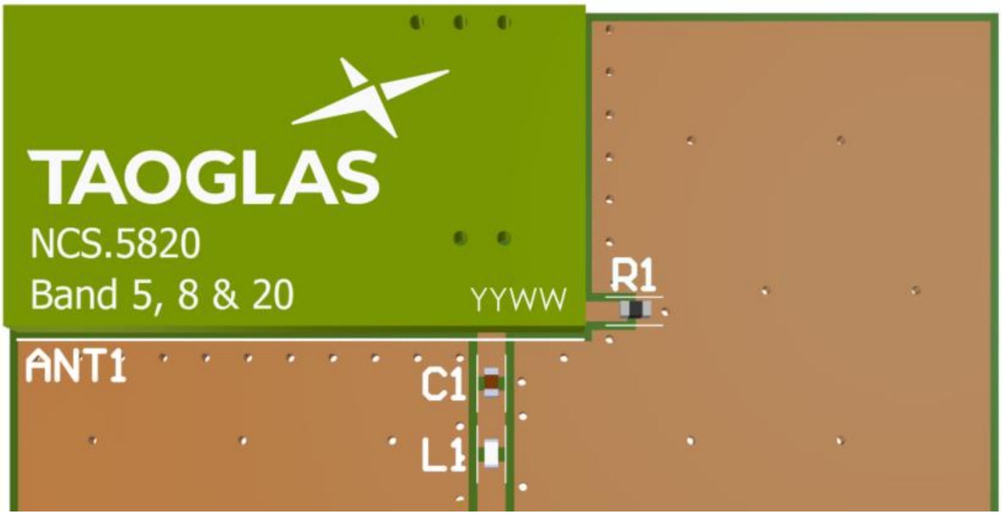

Without Solder Mask

## 6.3 PCB Layout

The footprint and clearance on the PCB must meet the layout drawing in section 6.7. Note the placement of the optimized components. C1 is placed as close as possible to the RF feed (pad 1) within RF Trace. L1 is then placed tightly in series after that. R1 is placed close to the Fine-Tuning Pad (pad 2) outside of the copper keep out area.



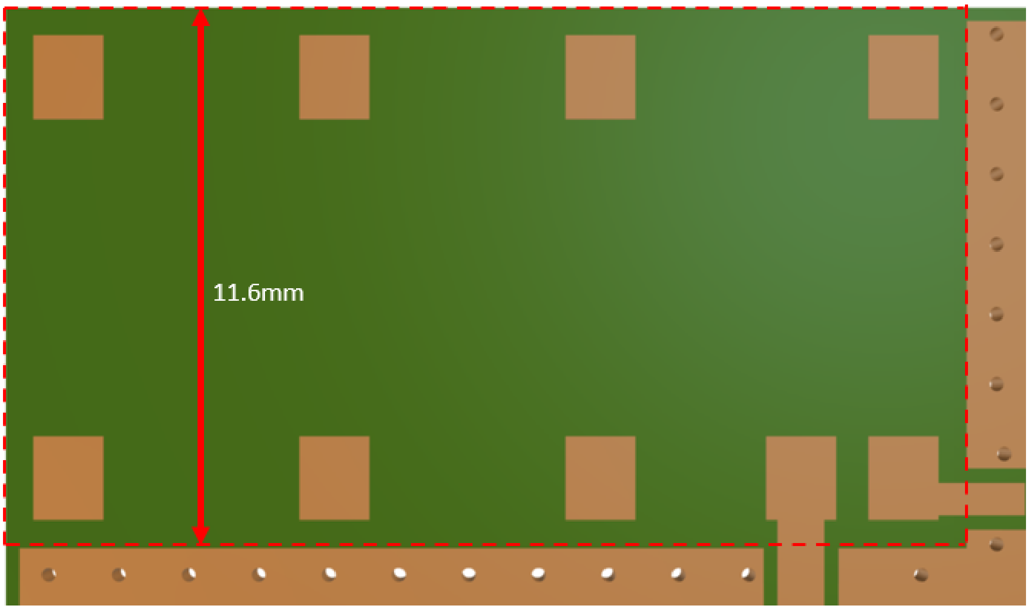

Without Antenna



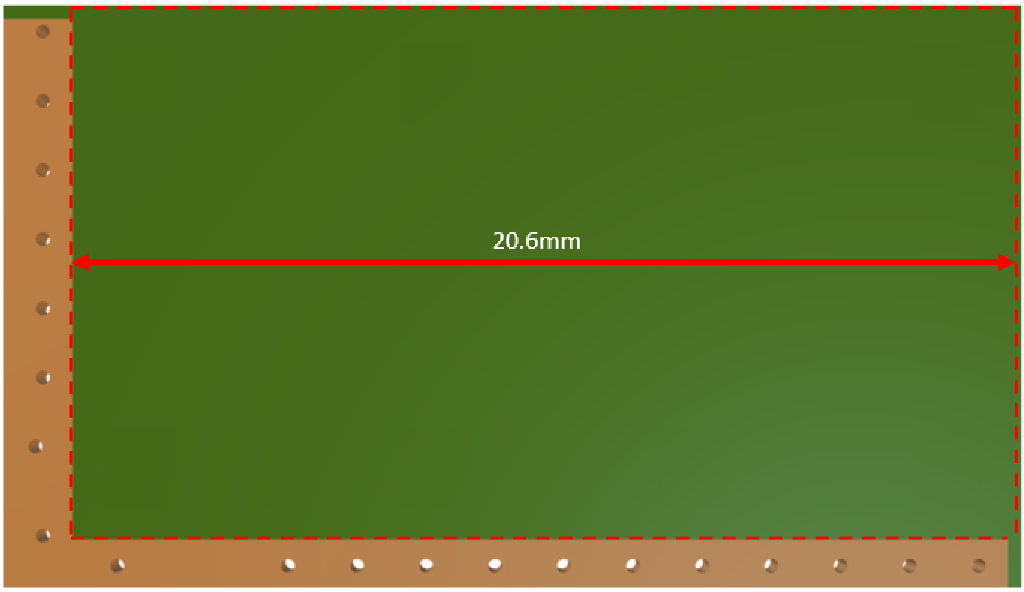

With Antenna

## 6.4 PCB Clearance

Below shows the antenna footprint and clearance through ALL layers on the PCB. Only the antenna pads and connections to feed and GND are present within this clearance area (marked RED). The clearance area extends to 11.6mm in length and 20.6mm in width from the corner of the PCB. This clearance area includes the bottom side and ALL internal layers on the PCB.

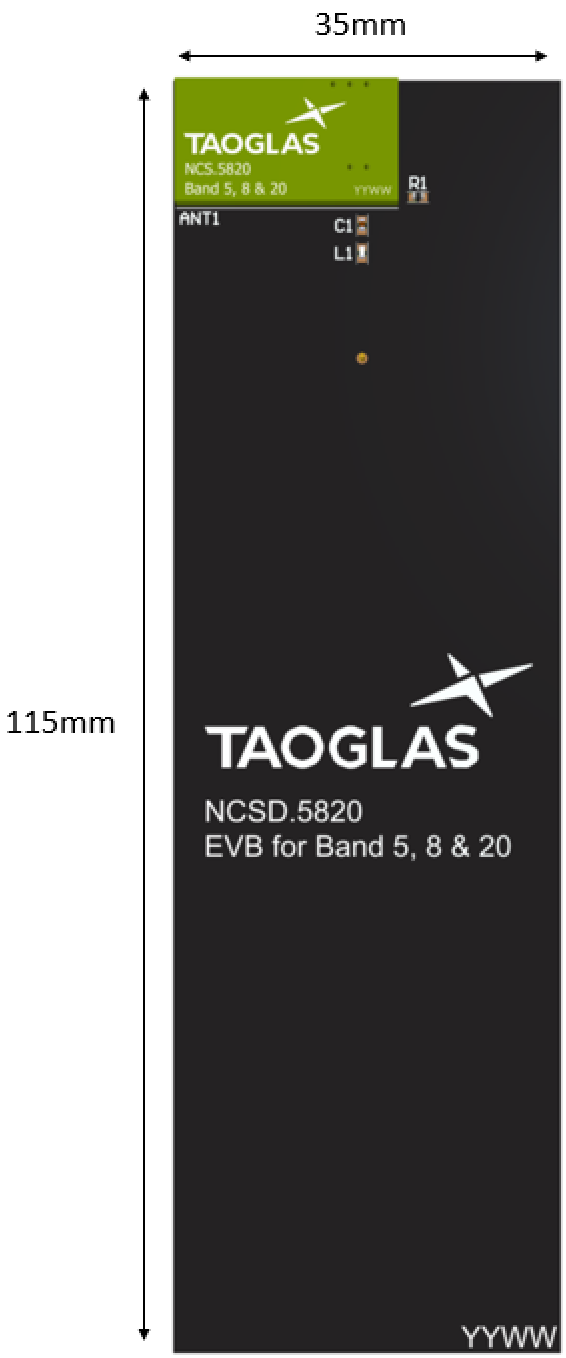



Topside




Bottom side

## 6.5 Evaluation Board



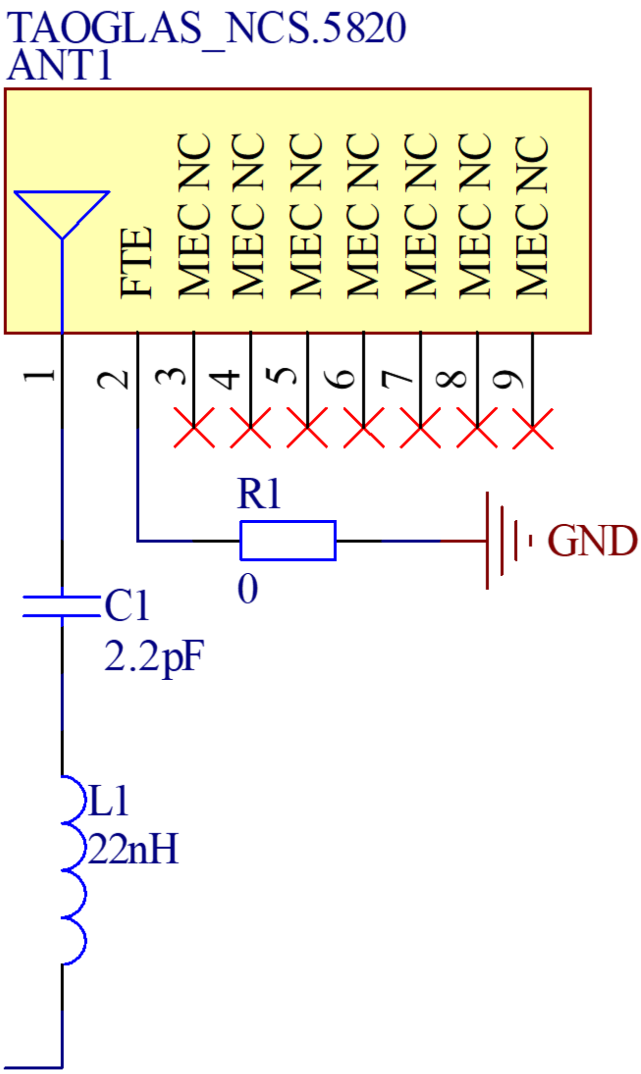

Topside


Bottom side

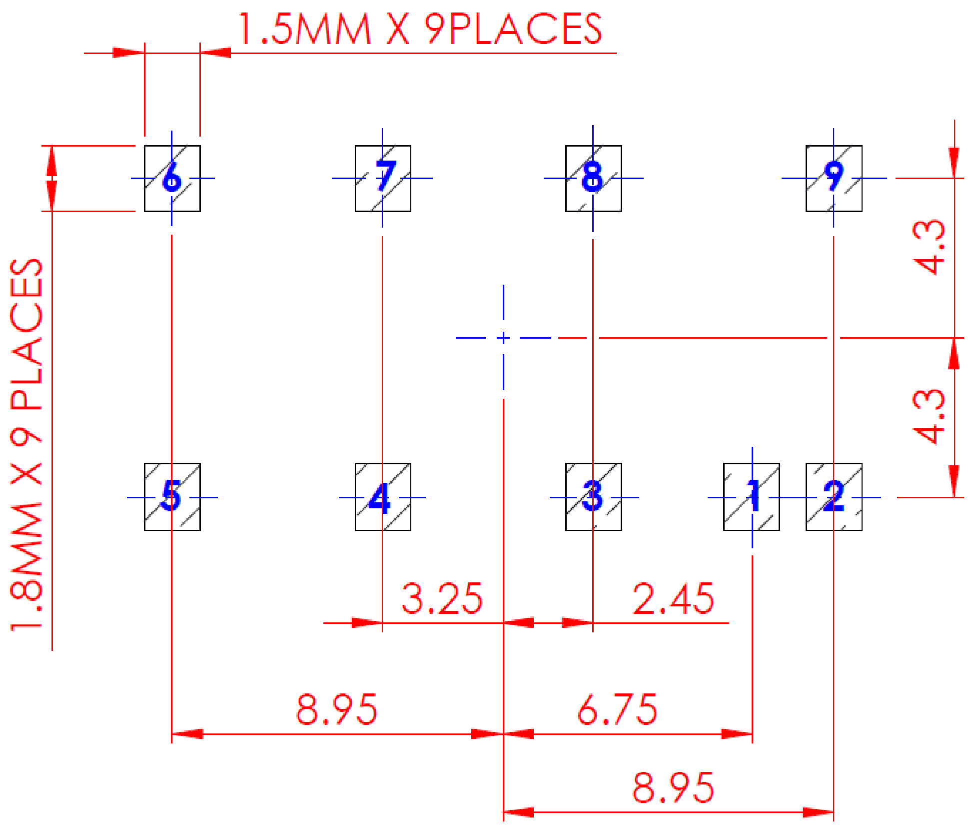
## 6.6 Evaluation Board Matching Circuit

Matching components with the NCS.5820 are required for the antenna to have optimal performance on the evaluation board, located outside of the ground plane in the space specified in the above images. Additional matching components may be necessary for your device, so we recommend incorporating extra component footprints, forming a “pi” network, between the cellular module and the edge of the ground plane.

| Designator | Type | Value | Manufacturer | Manufacturer Part Number |
|---|---|---|---|---|
| C1 | Capacitor | 2.2pF | Murata | GCM1555C1H2R2BA16D |
| L1 | Inductor | 22nH | TDK | MLK1005S22NJT000 |
| R1 | Resistor | 0 Ohms | YAGEO | RC0402JR-070RL |



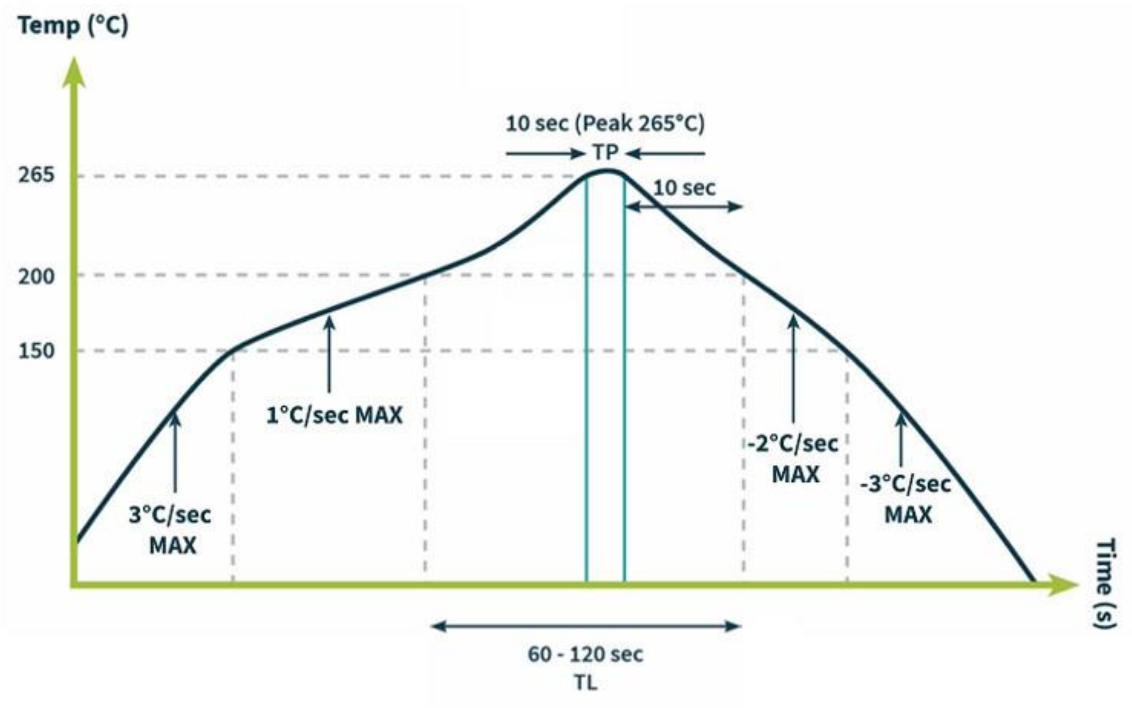
## 6.7 Footprint




| PIN | DESCRIPTION |
|---|---|
| 1 | RF FEED (50 OHM) |
| 2 | GROUND |
| 3 | MECHANICAL, NC |
| 4 | MECHANICAL, NC |
| 5 | MECHANICAL, NC |
| 6 | MECHANICAL, NC |
| 7 | MECHANICAL, NC |
| 8 | MECHANICAL, NC |
| 9 | MECHANICAL, NC |

# 7. Solder Reflow Profile

The NCS.5820 can be assembled by following the recommended soldering temperatures are as follows:



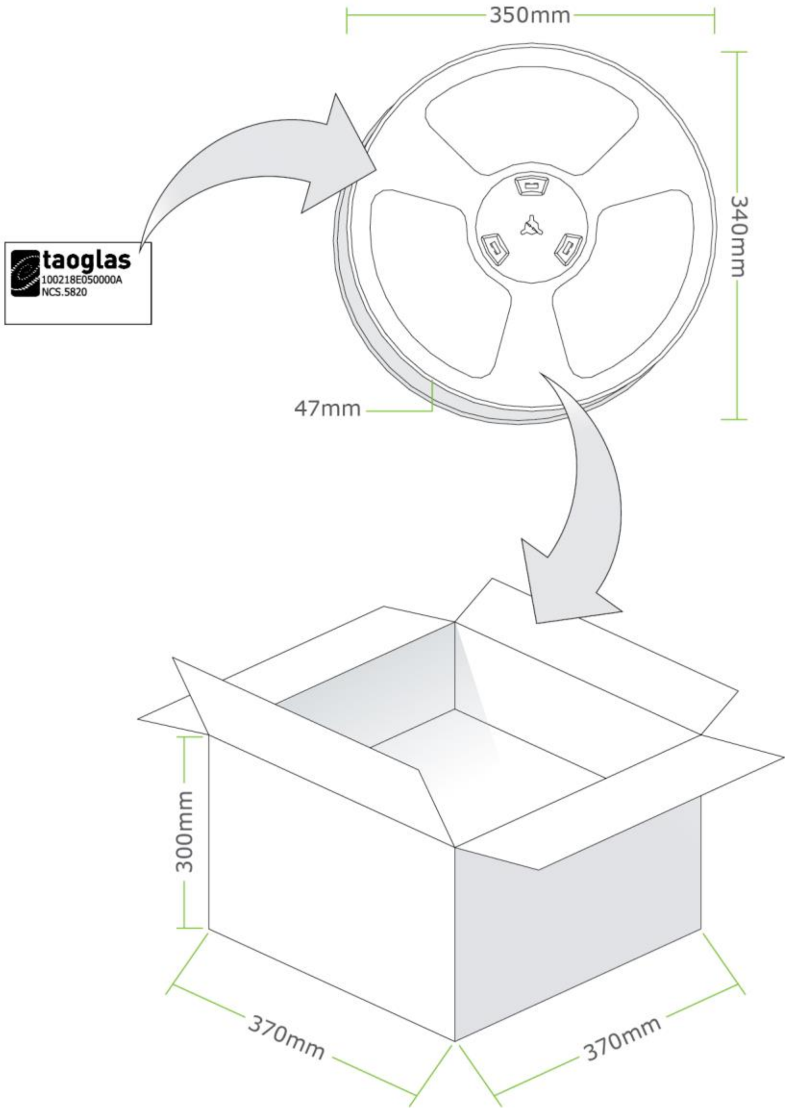

*Temperatures listed within a tolerance of +/- 10º C

Smaller components are typically mounted on the first pass, however, we do advise mounting the NCS.5820 when placing larger components on the board during subsequent reflows.

# 8. Packaging

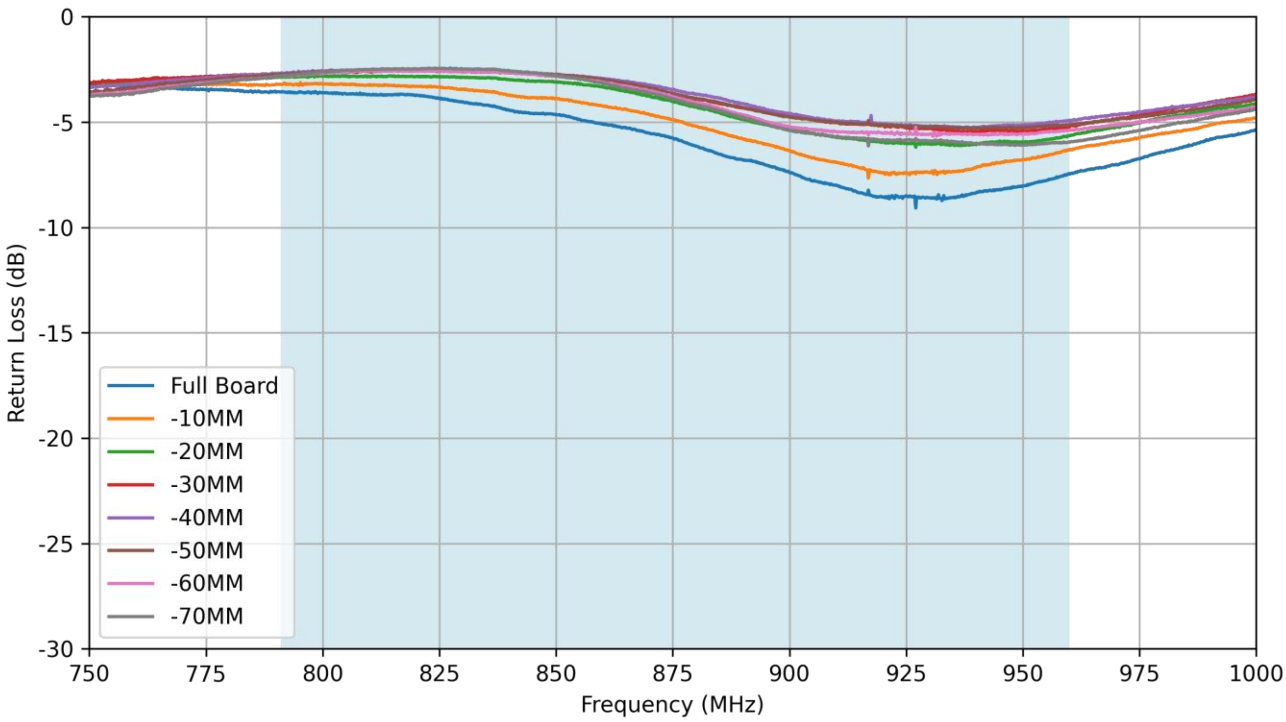
1000pcs NCS.5820 per Tape & Reel
Dimensions - 350*340*47mm
Weight: 1Kg

6000pcs NCS.5820 per carton
Dimensions: 370*370*300mm
Weight: 6Kg

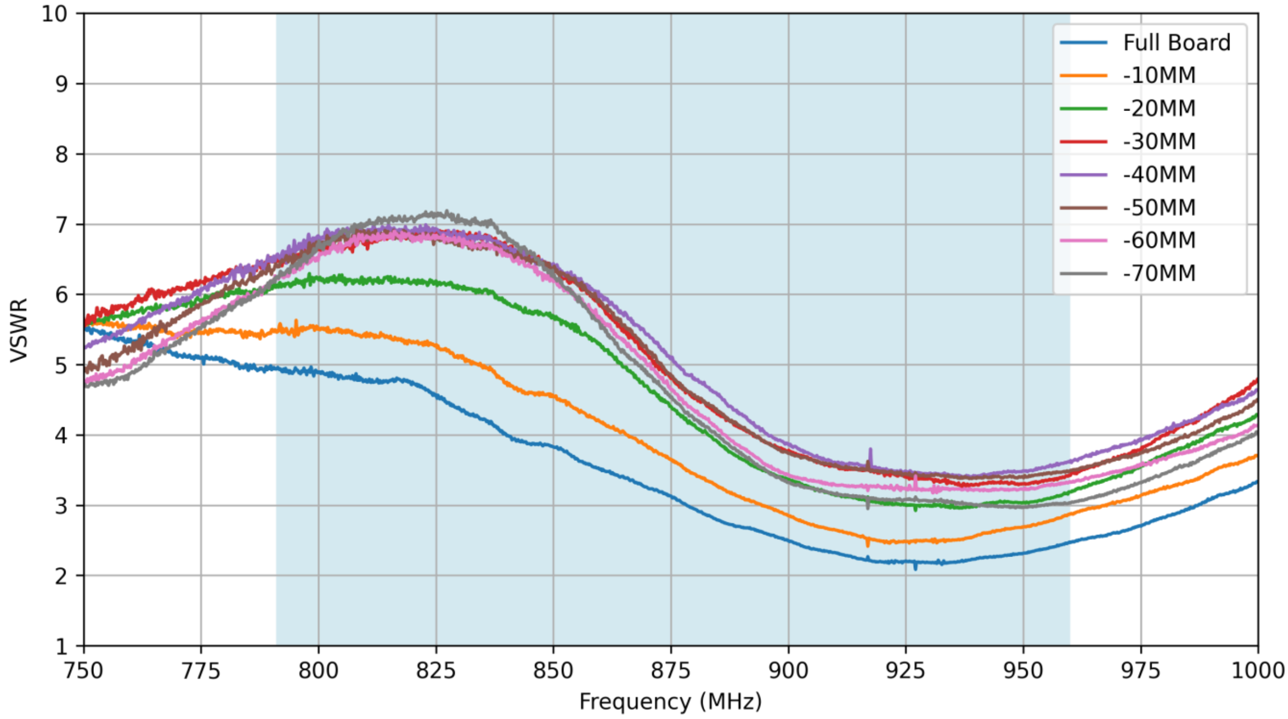


# 9. Application Note

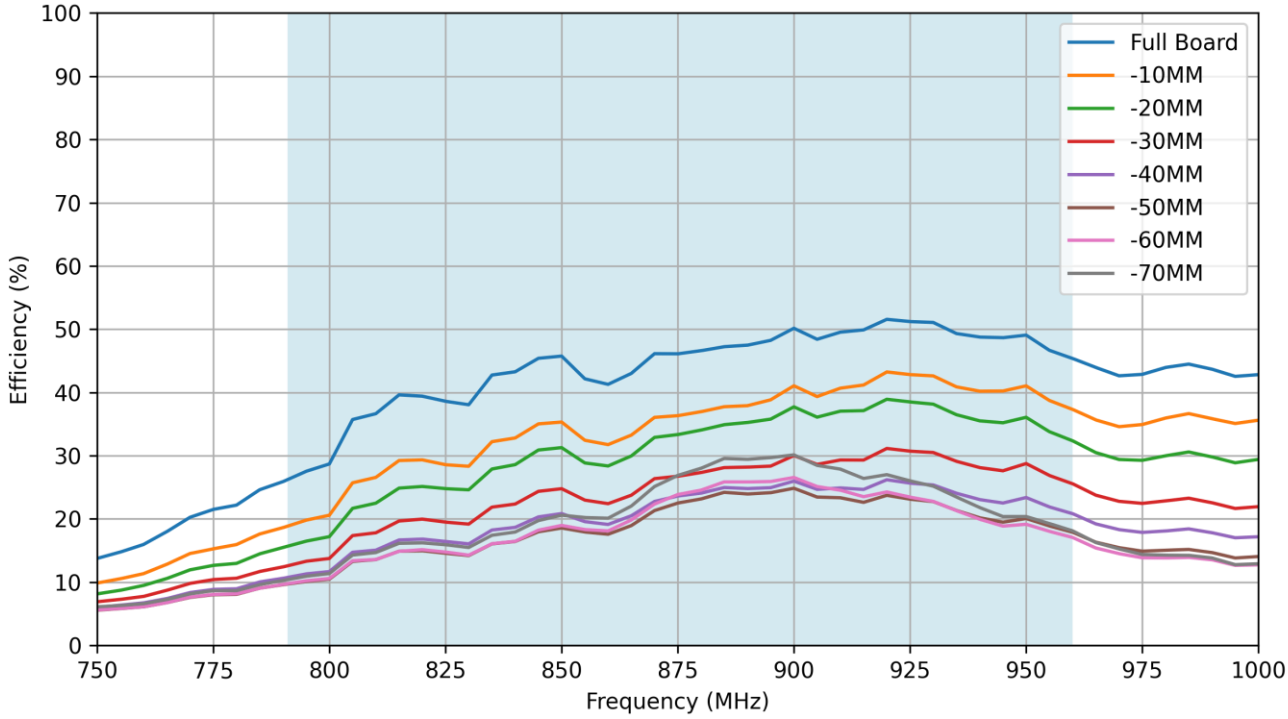

## 9.1 Return Loss



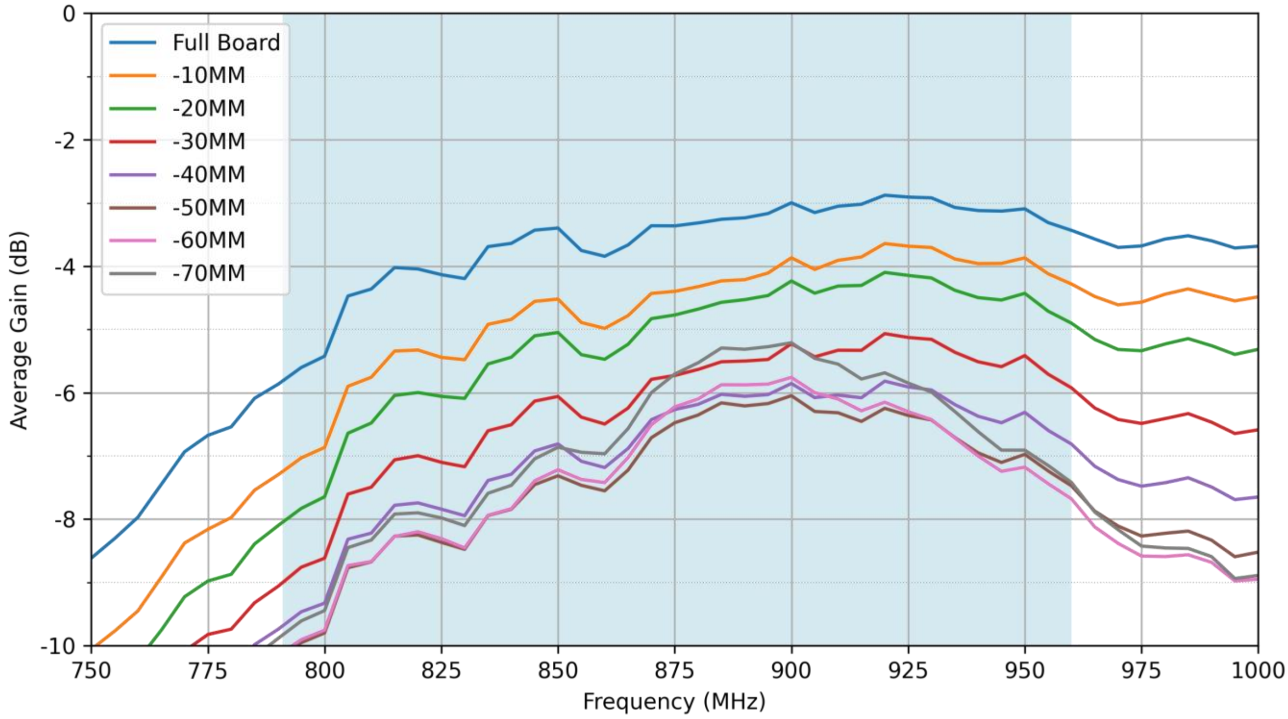
## 9.2 VSWR



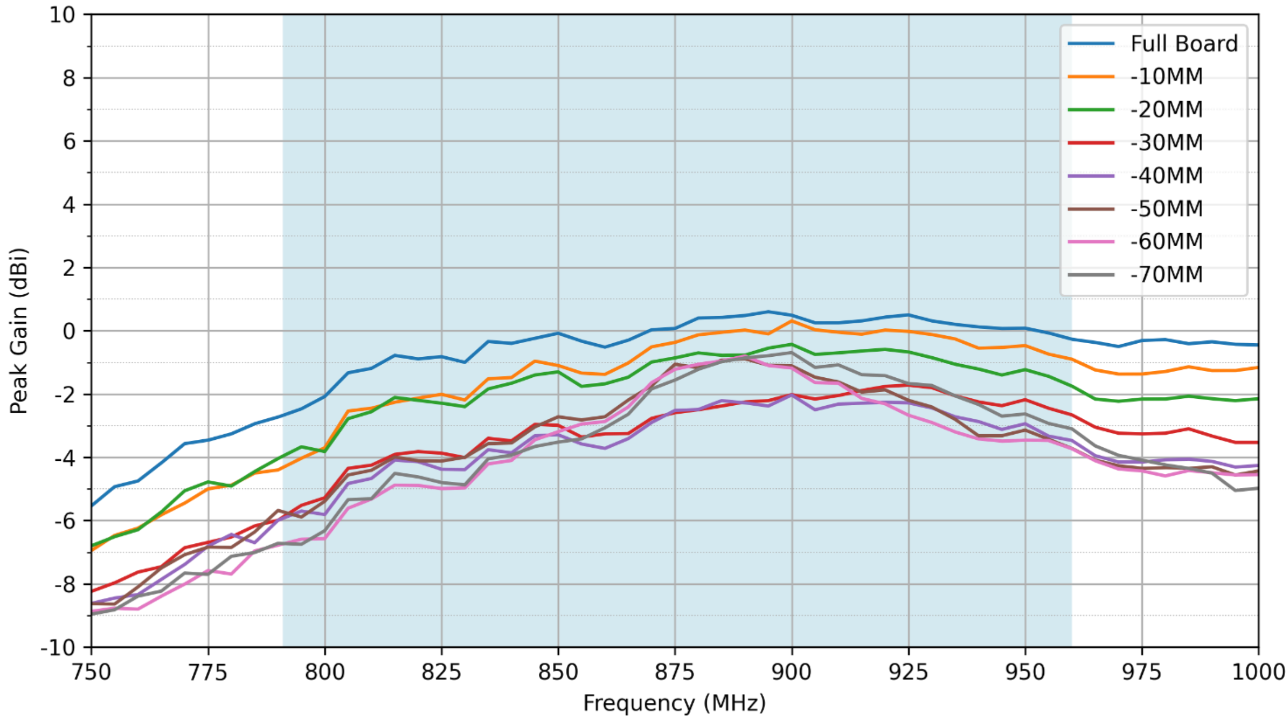

## 9.3 Efficiency



## 9.4 Average Gain




## 9.5 Peak Gain



## Changelog for the datasheet

**SPE-18-8-099 – NCS.5820**

| Revision: G (Current Version) | |
|---|---|
| Date: | 2023-10-11 |
| Changes: | Full datasheet update |
| Changes Made by: | Gary West |

**Previous Revisions**

| Revision: F (Current Version) | |
|---|---|
| Date: | 2020-08-17 |
| Changes: | Updated MSL information. |
| Changes Made by: | Erik Landi |

| Revision: A | |
|---|---|
| Date: | 2018-12-11 |
| Changes: | Initial Release |
| Changes Made by: | Jack Conroy |

| Revision: E | |
|---|---|
| Date: | 2020-08-17 |
| Changes: | Updated Pin Information |
| Changes Made by: | Jack Conroy |

| Revision: D | |
|---|---|
| Date: | 2020-02-27 |
| Changes: | Updated Footprint Data |
| Changes Made by: | Jack Conroy |

| Revision: C | |
|---|---|
| Date: | 2019-09-19 |
| Changes: | Updated Template |
| Changes Made by: | Yu Kai Yeung |

| Revision: B | |
|---|---|
| Date: | 2018-09-17 |
| Changes: | Updated Drawing |
| Changes Made by: | Jack Conroy |

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