TAOGLAS

Datasheet

Part No:
GWLA.15

Description

2-in-1 GPS/GALILEO/BeiDou & Dual-Band Wi-Fi Ceramic Loop Antenna

Features:

Small Footprint Embedded Loop Antenna
Omnidirectional Coverage
High Efficiency
Multi-Band GNSS from 1559-1610MHz
Dual Band Wi-Fi with 2.4 and 5.8GHzi
Low profile SMD Antenna (Surface-Mount)
Dimensions: 3.2 x 1.6 x 0.5mm
RoHS & Reach Compliant

1. Introduction

Super Small, GNSS & Wi-Fi Combination Loop Antenna for the Smallest IoT Devices

The GWLA.15 GPS and 2.4/5.8GHz 2in1 Embedded Ceramic Loop antenna is a high efficiency, miniature SMD, edge-mounted ceramic antenna. Covering GPS/GALILEO/BeiDOu and Wi-Fi, WLAN, ZigBee, Bluetooth, and 802.11ac applications the tiny loop antenna is perfect for application where PCB space is limited, such as hand-held devices. Rather than using two separate chip antennas, one for GPS/GALILEO and one for Wi-Fi, the GWLA.15 has two separate antenna feeds in a single antenna structure, making it the ideal choice. The GWLA.15 uses the main PCB as its ground plane, thereby maintaining good efficiency, despite its small size.

The GWLA.15 can be tuned for different PCB sizes/environments by changing the values of the matching circuit, however, this needs to be carefully calculated, contact a regional Taoglas facility for support. It is important to note that smaller ground-planes will reduce the efficiency of the antenna. At 3.2*1.6*0.5mm, the GWLA.15 is one of the smallest antennas available worldwide. This antenna is delivered on tape and reel and manufactured in a TS16949 first tier automotive approved facility. The GNSS performance is excellent, with high efficiency and an omnidirectional pattern. The Wi-Fi performance is incredibly good and delivers stable efficiency and radiation patterns which allow this antenna to be used in a huge variety of devices.

Typical Applications where GNSS and Dual-Band Wi-Fi are required include:

- Navigation or Position Tracking Systems
- Handheld Devices and Tablets
- POS Systems, Gateways and Routers
- Mobile Wireless Camera Systems
- Smart Home

Many module manufacturers specify peak gain limits for any antennas that are to be connected to that module. Those peak gain limits are based on free-space conditions. In practice, the peak gain of an antenna tested in free-space can degrade by at least 1 or 2 dB when put inside a device. So ideally you should go for a slightly higher peak gain antenna than mentioned on the module specification to compensate for this effect, giving you better performance. Upon testing of any of our antennas with your device and a selection of

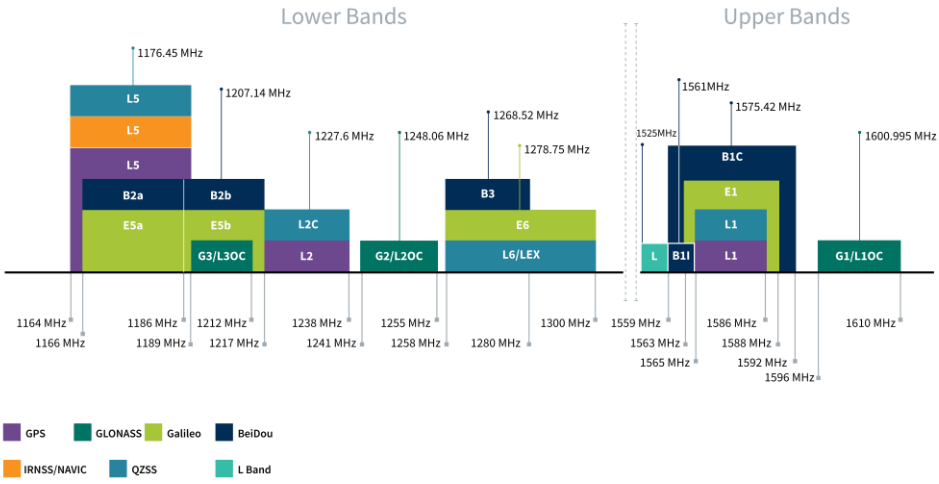
appropriate layout, integration technique, or cable, Taoglas can make sure any of our antennas' peak gain will be below the peak gain limits.

Taoglas can then issue a specification and/or report for the selected antenna in your device that will clearly show it complying with the peak gain limits, so you can be assured you are meeting regulatory requirements for that module. For example, a module manufacturer may state that the antenna must have less than 2 dBi peak gain, but you don't need to select an embedded antenna that has a peak gain of less than 2 dBi in free-space. This will give you a less optimized solution. It is better to go for a slightly higher free-space peak gain of 3 dBi or more if available.

Once that antenna gets integrated into your device, performance will degrade below this 2 dBi peak gain due to the effects of GND plane, surrounding components, and device housing. If you want to be absolutely sure, contact Taoglas and we will test. Choosing a Taoglas antenna with a higher peak gain than specified by the module manufacturer and enlisting our help will ensure you are getting the best performance possible without exceeding the peak gain limits.

2. Specification

GNSS Frequency Bands					
GPS	L1 1575.42 MHz	L2 1227.6 MHz	L5 1176.45 MHz		
	■	□	□		
GLONASS	G1 1602 MHz	G2 1248 MHz	G3 1207 MHz		
	■	□	□		
Galileo	E1 1575.24 MHz	E5a 1176.45 MHz	E5b 1201.5 MHz	E6 1278.75 MHz	
	■	□	□	□	
BeiDou	B1C 1575.42 MHz	B1I 1561 MHz	B2a 1176.45 MHz	B2b 1207.14 MHz	B3 1268.52 MHz
	■	■	□	□	□
L-Band	L-Band 1542 MHz				
	□				
QZSS (Regional)	L1 1575.42 MHz	L2C 1227.6 MHz	L5 1176.45 MHz	L6 1278.75e6	
	■	□	□	□	
IRNSS (Regional)	L5 1176.45 MHz				
	□				
SBAS	L1/E1/B1 1575.42 MHz	L5/B2a/E5a 1176.45 MHz	G1 1602 MHz	G2 1248 MHz	G3 1207 MHz
	■	□	■	□	□



GNSS Bands and Constellations

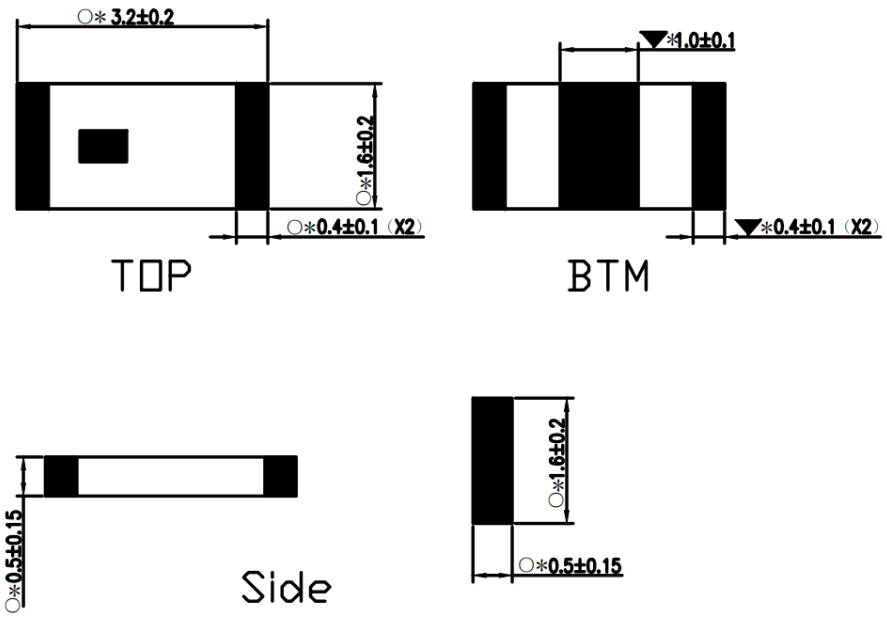
GNSS Electrical			
Frequency (MHz)	**1561**	**1575.42**	**1603**
VSWR (max.)	1:1	1:1	2:1
Antenna Efficiency (%)	47.62	49.48	40.56
Antenna Peak Gain (dBi)	-0.54	-0.16	-0.81
Isolation (dB)	>12		
Polarization	Linear		
Impedance	50 Ω		
Radiation Pattern	Omni		
Max. input power	10W		

Wi-Fi Electrical								
Band	Frequency (MHz)	Efficiency (%)	Average Gain (dB)	Peak Gain (dBi)	Impedance	Polarization	Radiation Pattern	Max. input power
Wi-Fi - 2GHz	2400-2500	40.6	-3.91	-0.34	50 Ω	Linear	Omni	10W
Wi-Fi - 5GHz	5150-5850	58.4	-2.33	2.12				

Mechanical	
Dimensions	3.2 x 1.6 x 0.5mm
Ground Plane	80 *40mm (Standard Evaluation Board)
Weight	0.02g

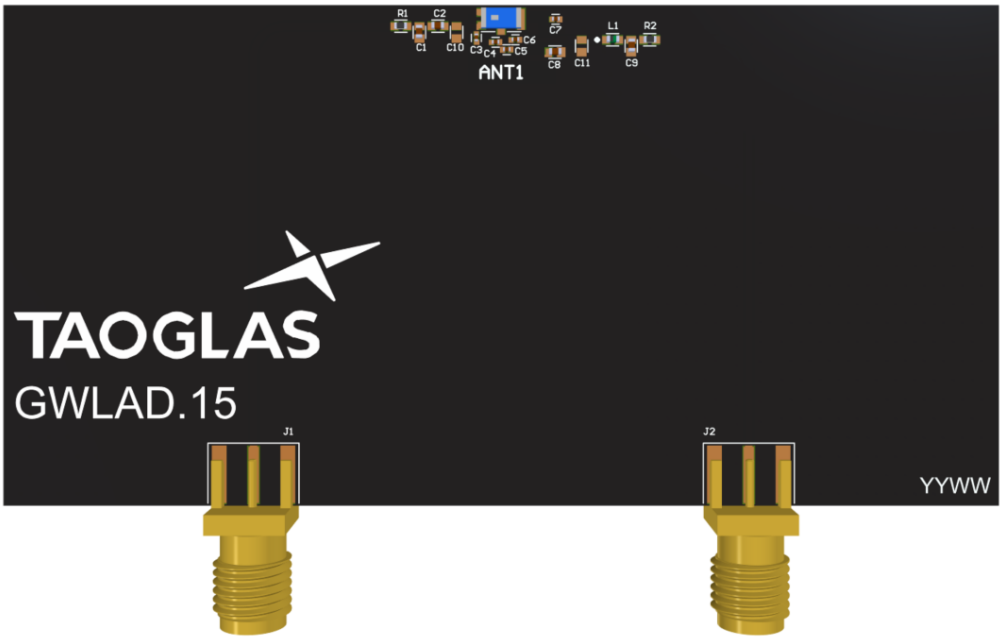
Environmental	
Temperature Range	-40°C to 85°C
Relative Humidity	20% to 70%
Moisture Sensitivity	1

3. Mechanical Drawing



4. Antenna Integration Guide

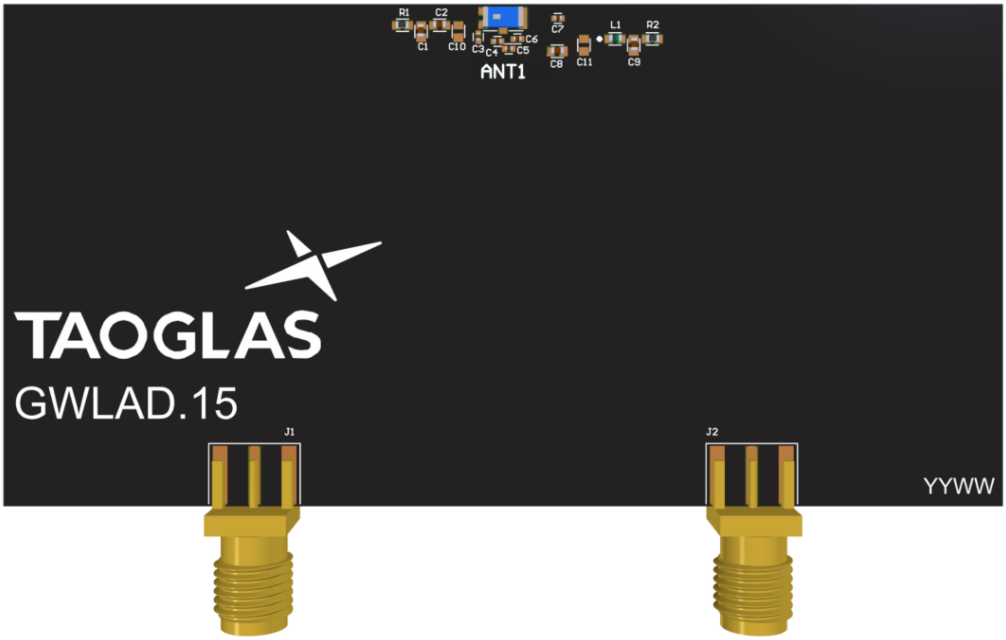
The following is an example on how to integrate the GWLA.15 into a design. This antenna has 3 pins, where one pin is used for the RF Feed. Taoglas recommends using a minimum of 80x40mm ground plane (PCB) to ensure optimal performance.
The antenna should be placed mid-point on the long side of the PCB to take advantage of the ground plane on each side of the antenna.



Top view of PCB.

Please find the Integration files in Altium, 2D formats and the 3D model for the GWLA.15 here:
https://www.taoglas.com/product/gwla-15-gps-galileo-2-4-5-8ghz-dual-band-ceramic-substrate-loop-antenna/

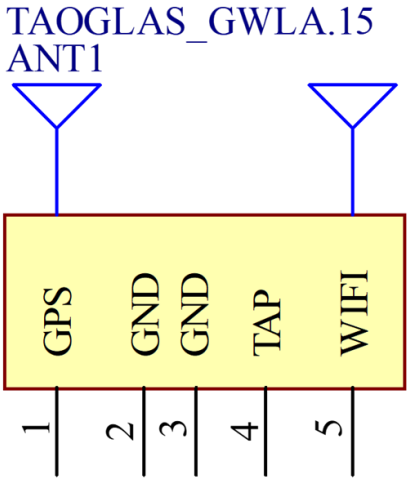
4.1 Schematic Symbol and Pin Definitions



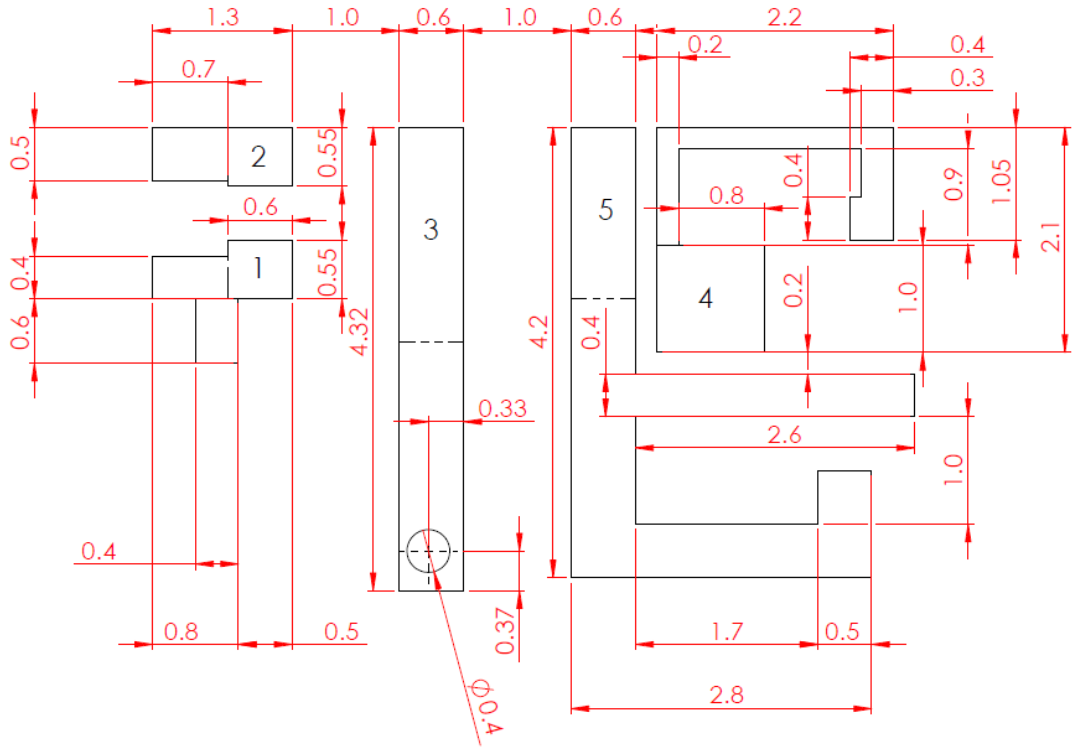
Above is a 3D model of the GWLA.15 on a PCB.

The circuit symbol for the GWLA.15 is shown below. The antenna has 3 pins as indicated below.

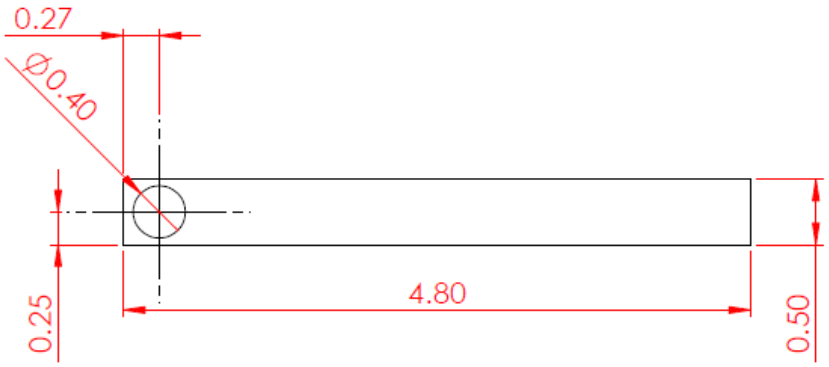
Pin	Description
1	GPS Feed
2-3	Ground
4	TAP
5	Wi-Fi Feed



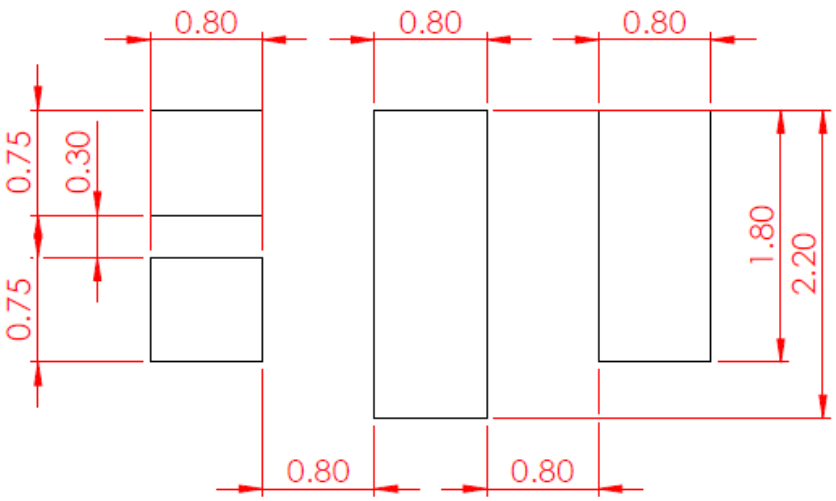
4.2 Footprint (Top-side)



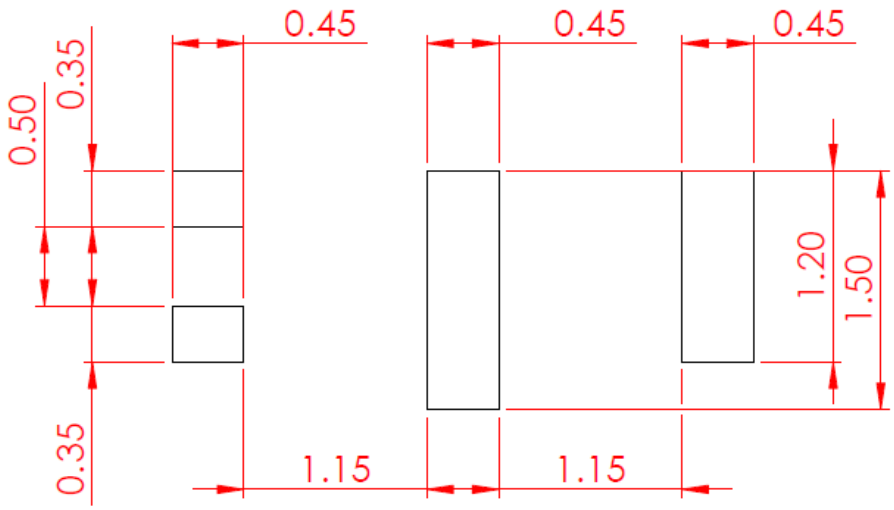
4.3 Footprint (Bottom-side)



4.4 Top Solder Mask



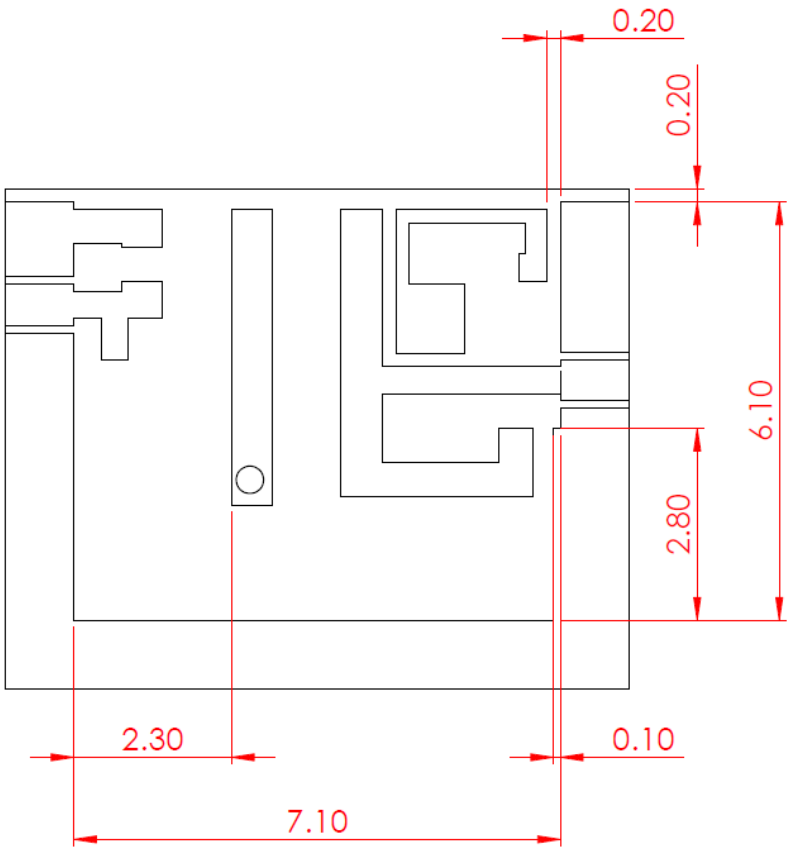
4.5 Top Solder Paste



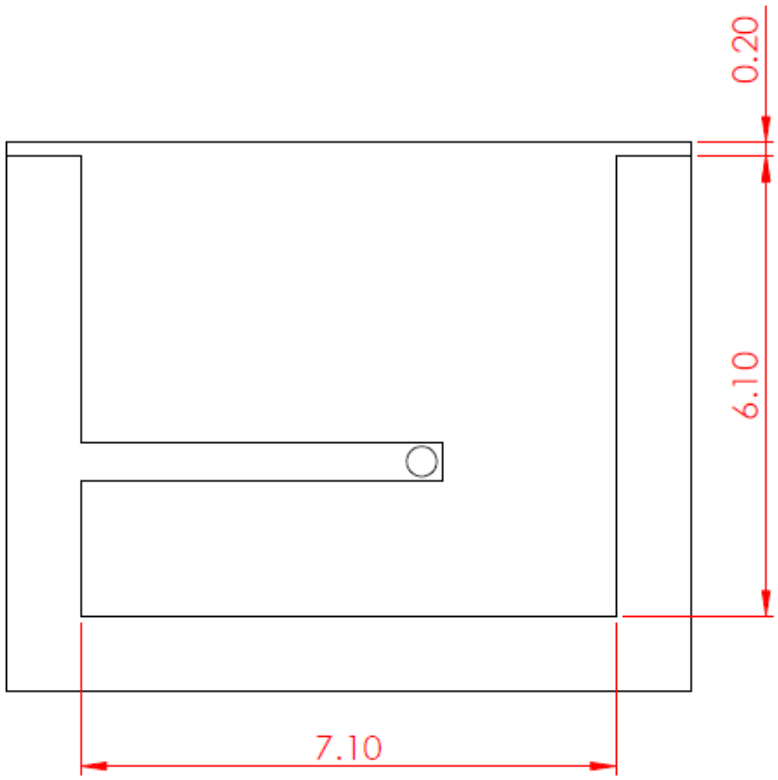
4.6 Copper Clearance for GWLA.15 (Top-side)

The footprint and clearance on the PCB must comply with the antenna's specification. The PCB layout shown in the diagrams below demonstrates the GWLA.15 clearance area. The copper keep out area applies to all layers on the PCB.

The copper clearance area extends to 6.1mm in length and 7.1mm in width around the antenna. The PCB edge clearance should be 0.2mm.

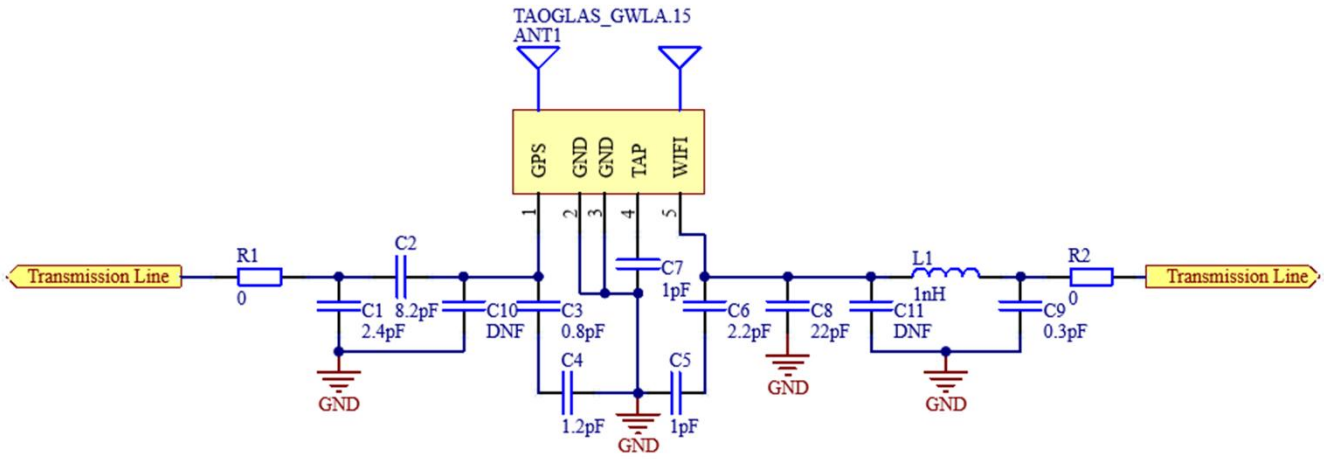


4.7 Copper Clearance for GWLA.15 (Bottom-side)



4.8 Schematic Layout

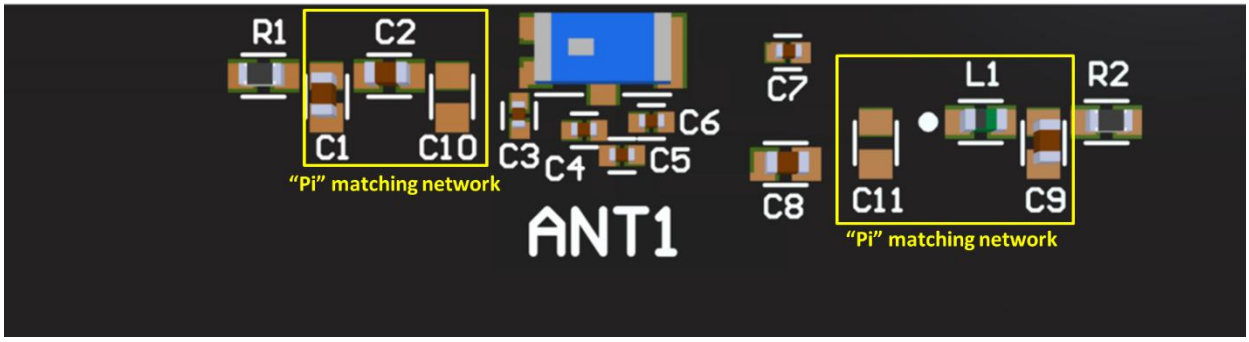
Matching components with the GWLA.15 are required for the antenna to have optimal performance in the spaces specified in the schematic below. Additional matching components may be necessary for your device, Taoglas recommends incorporating extra component footprints, forming a “pi” network, for the GWLA.15.



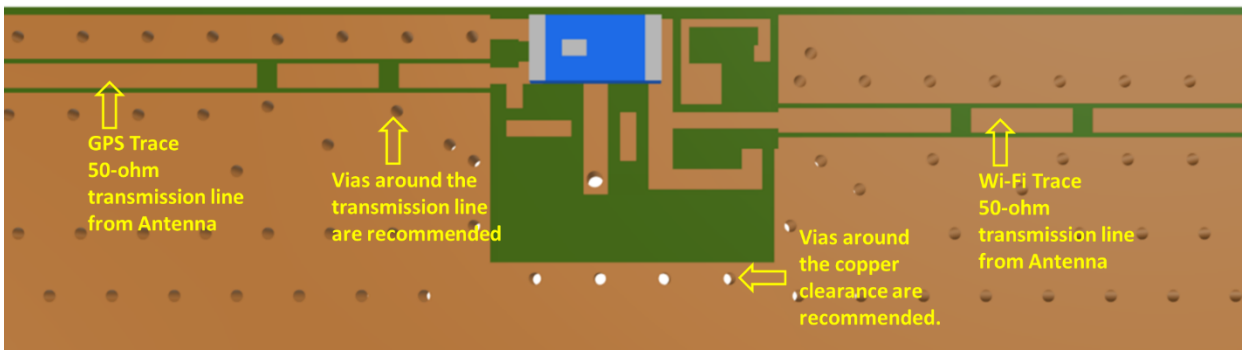
Designator	Type	Value	Manufacturer	Manufacturer Part Number
C1	Capacitor	2.4pF	Murata	GJM1555C1H2R4BB01D
C2	Capacitor	8.2pF	Murata	GRM1555C1H8R2DA01D
C3	Capacitor	0.8pF	Murata	GRM0335C1HR80BA01D
C4	Capacitor	1.2pF	Murata	GRM0335C1H1R2BA01D
C5, C7	Capacitor	1pF	Murata	GRM0335C1H1R0BA01D
C6	Capacitor	2.2pF	Murata	GRM0335C1H2R2BA01D
C8	Capacitor	22pF	Murata	GCM1555C1H220FA16D
C9	Capacitor	0.3pF	Murata	GRM1555C1HR30BA01D
C10, C11	Capacitor	Not Fitted	-	-
L1	Inductor	1nH	Murata	LQG15HN1N0S02D
R1, R2	Resistor	0 Ohm	YAGEO	RC0402JR-070RL

4.9 Antenna Integration

The GWLA.15 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.



GWLA.15 antenna mounted on a PCB, showing “Pi” matching network.

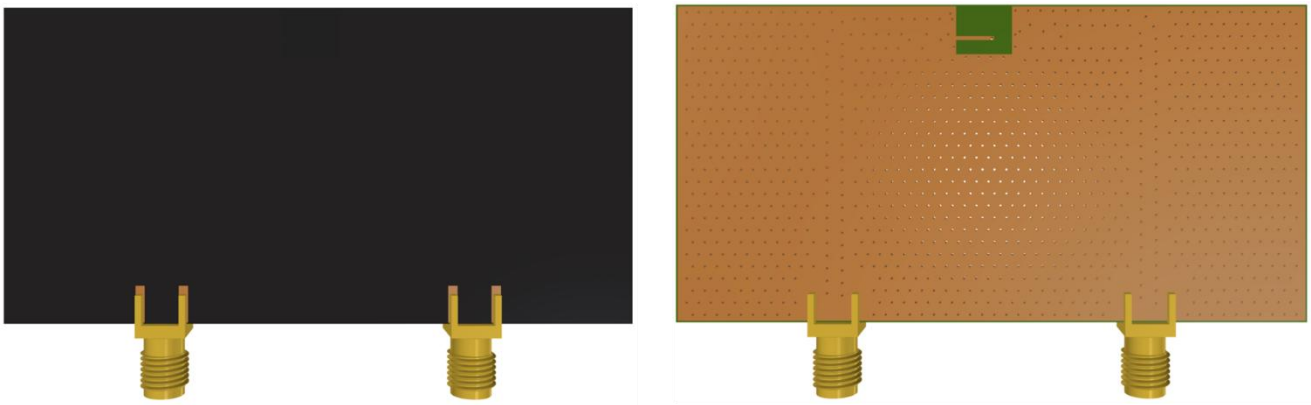


GWLA.15 antenna mounted on a PCB, showing transmission line and integration notes.

4.10 Antenna 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.

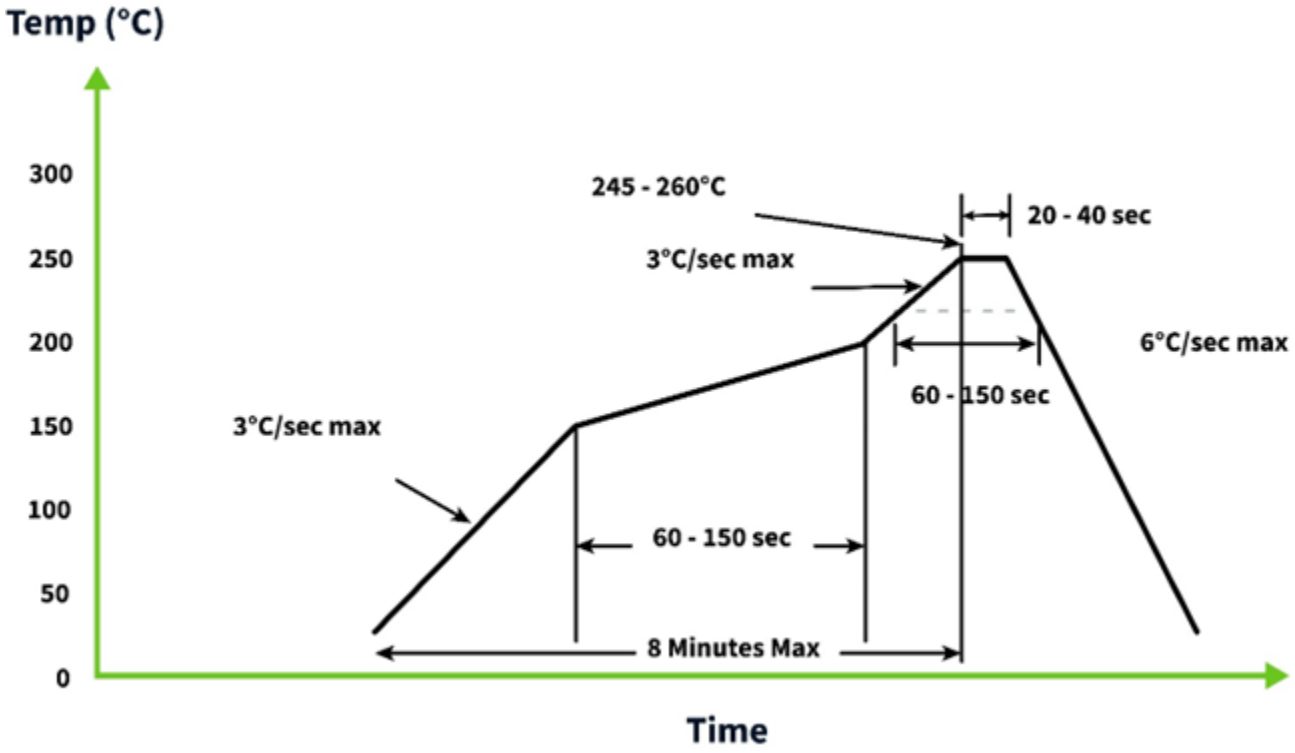
Top Side (GWLA.15 placement on 80x40mm PCB)



Bottom Side (80x40mm PCB)

5. Solder Reflow Profile

The GWLA.15 can be assembled by following the recommended soldering temperatures are as follows:

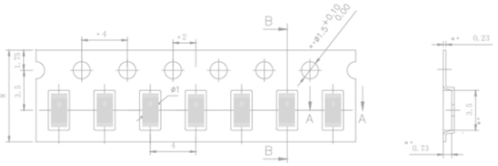


*Temperatures listed within a tolerance of +/- 10º C

Smaller components are typically mounted on the first pass, however, we do advise mounting the GWLA.15 when placing larger components on the board during subsequent reflows.

6. Packaging

3000 PCS / Tape & Reel



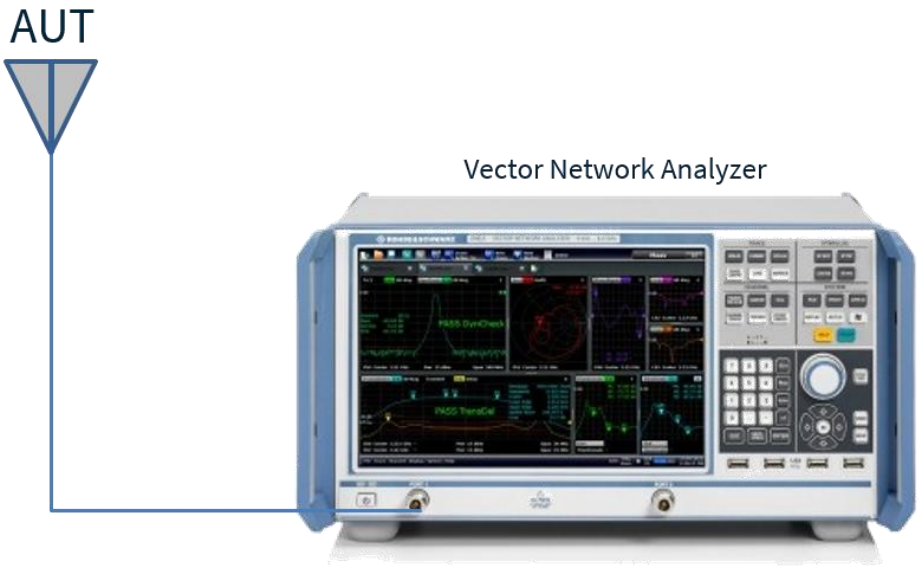
1 PCS / Vacuum bag
Vacuum bag: 225 x 240mm

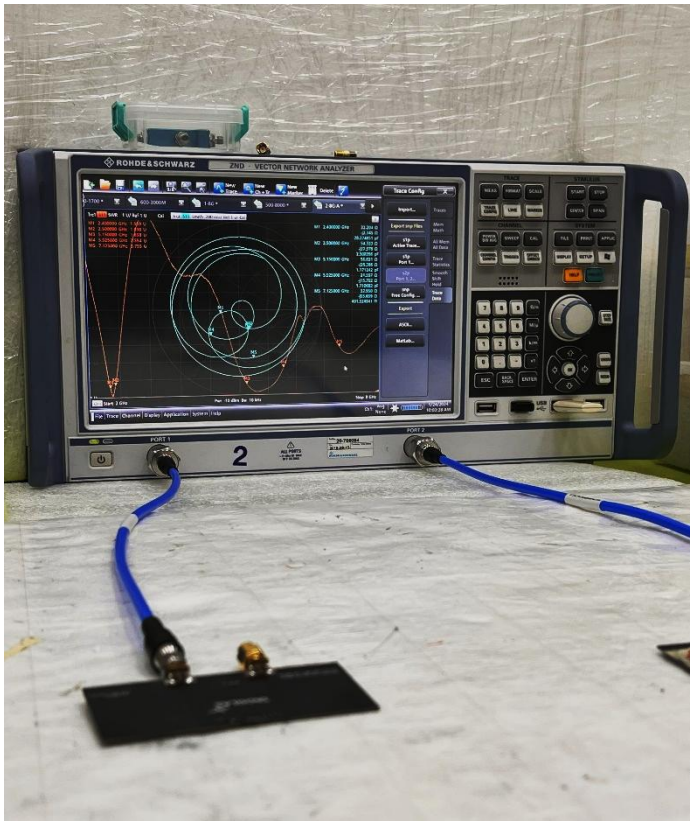
6000 PCS / Box
Box dimensions: 185 x 185 x 30mm
SPQ Label
Weight: 245g

60000 PCS / Carton
Carton: 330 x 210 x 210mm
Carton Label
Weight: 2.79Kg

7. Antenna Characteristics

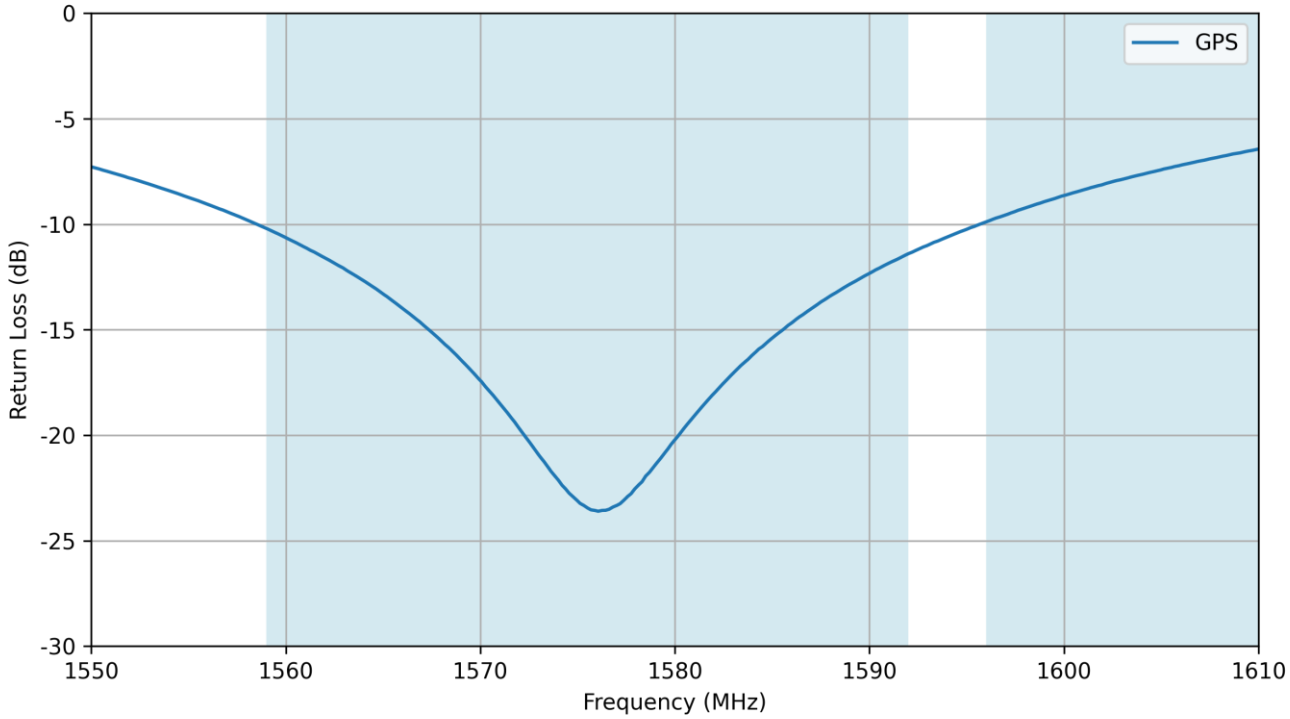
7.1 Test Setup



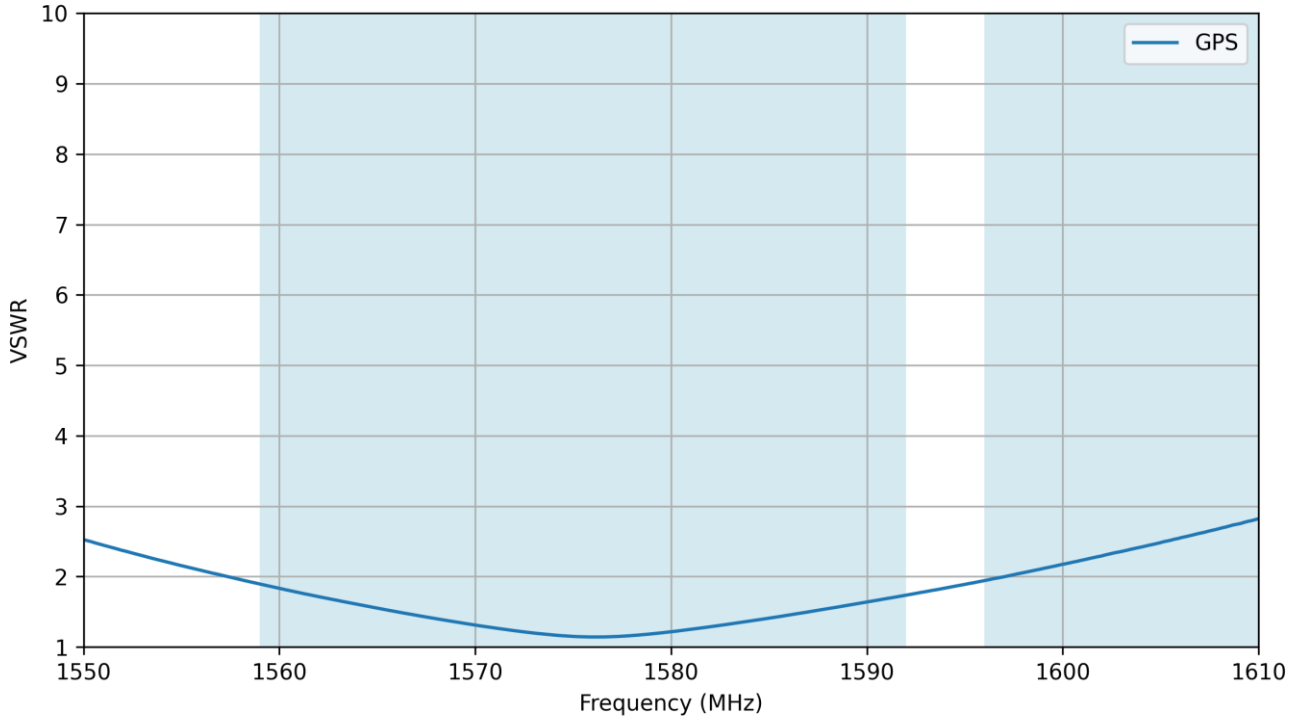


VNA Test Setup

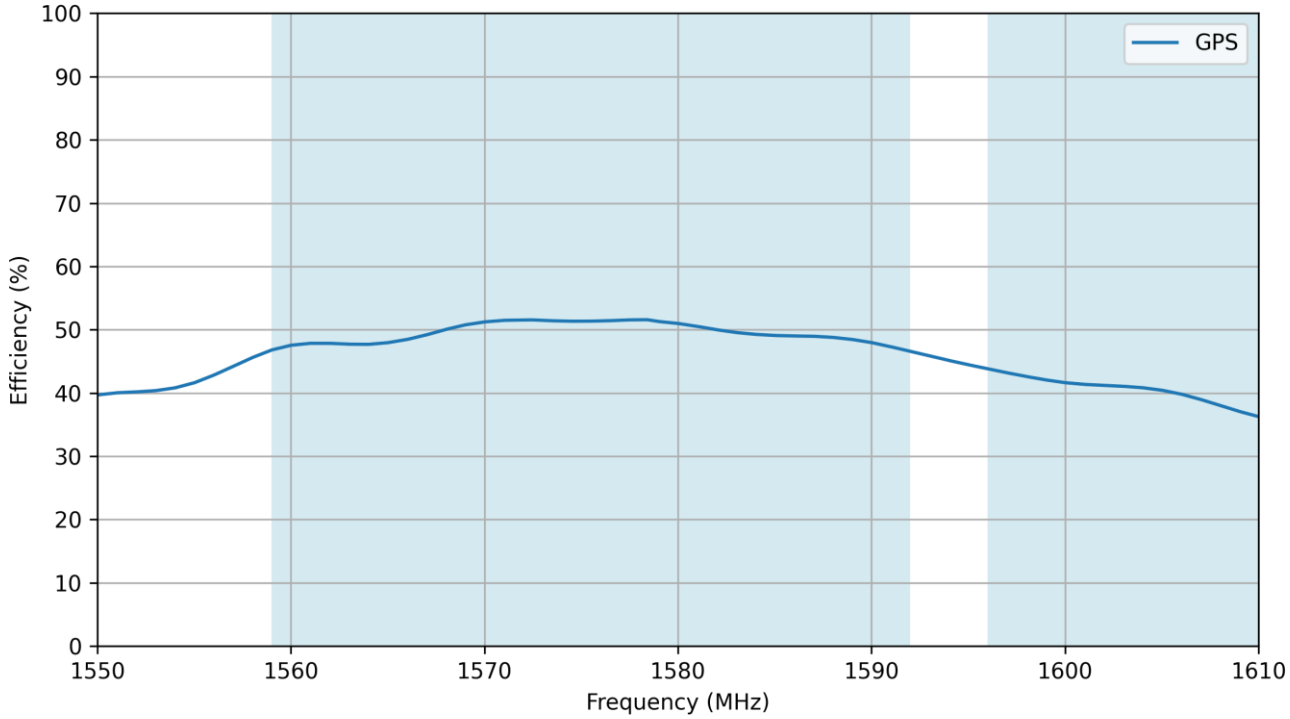
7.2 GNSS - Return Loss



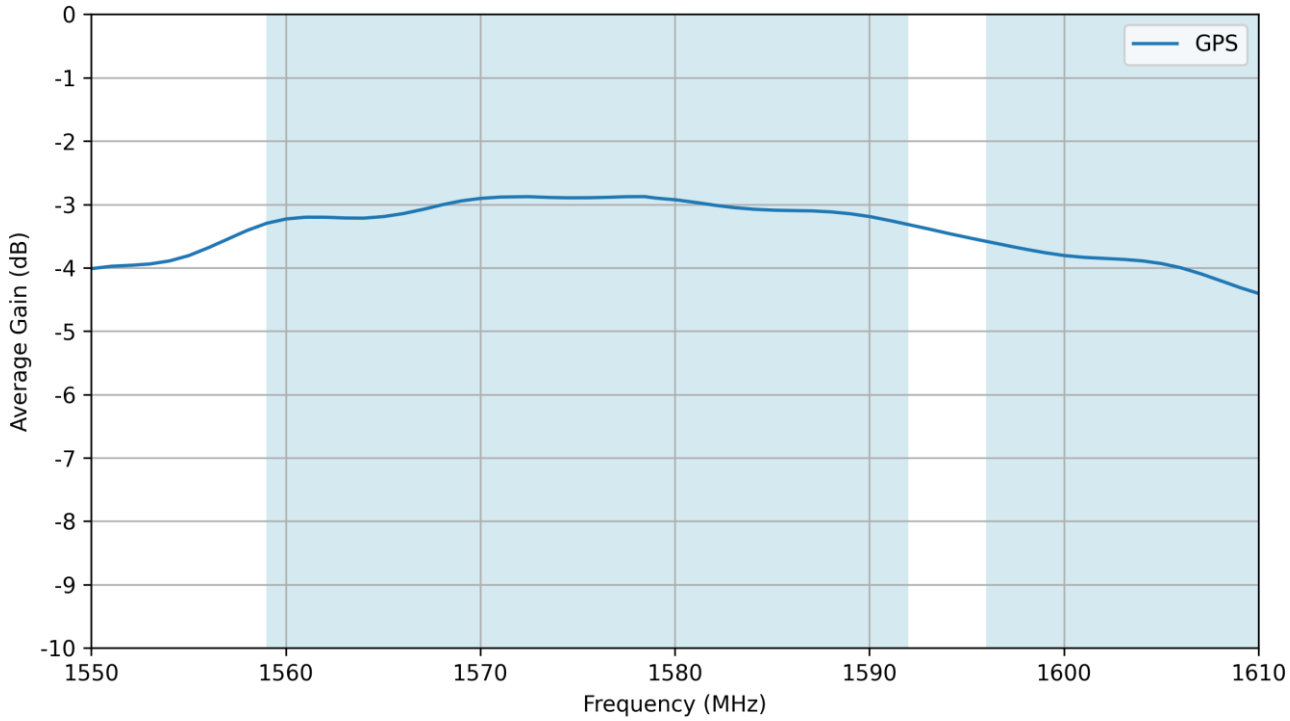
7.3 GNSS - VSWR



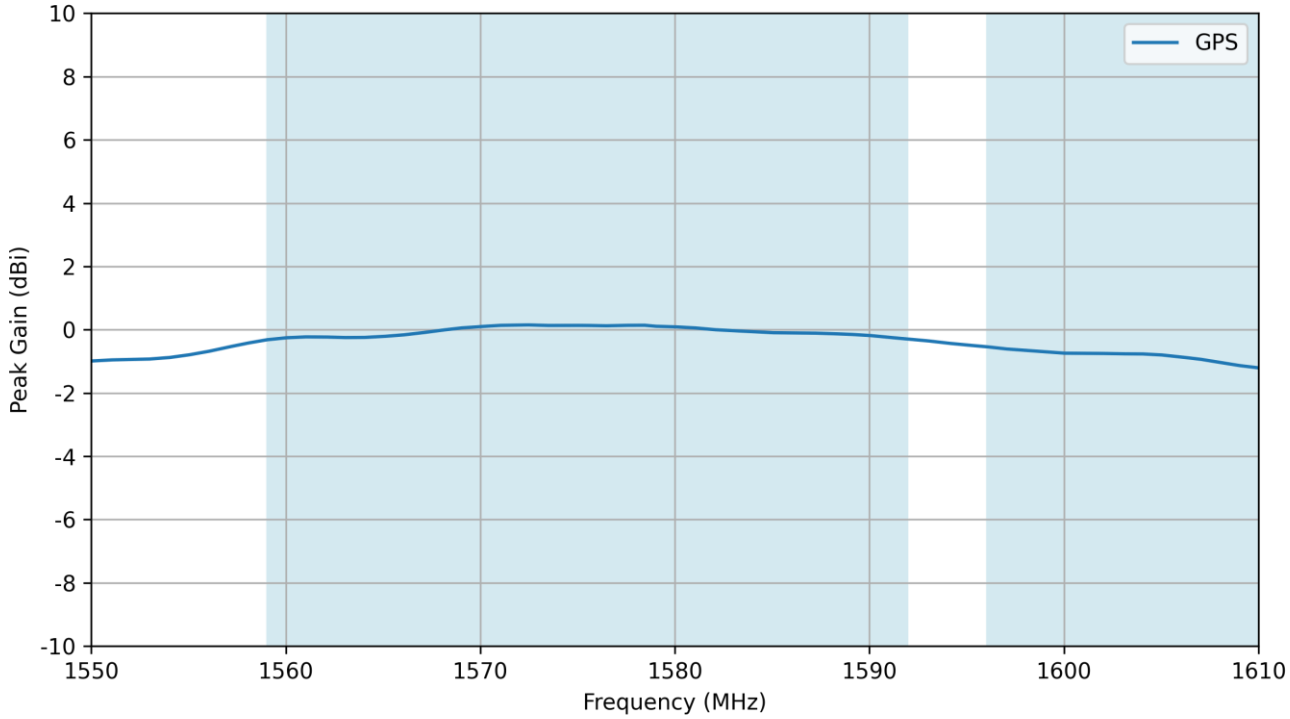
7.4 GNSS - Efficiency



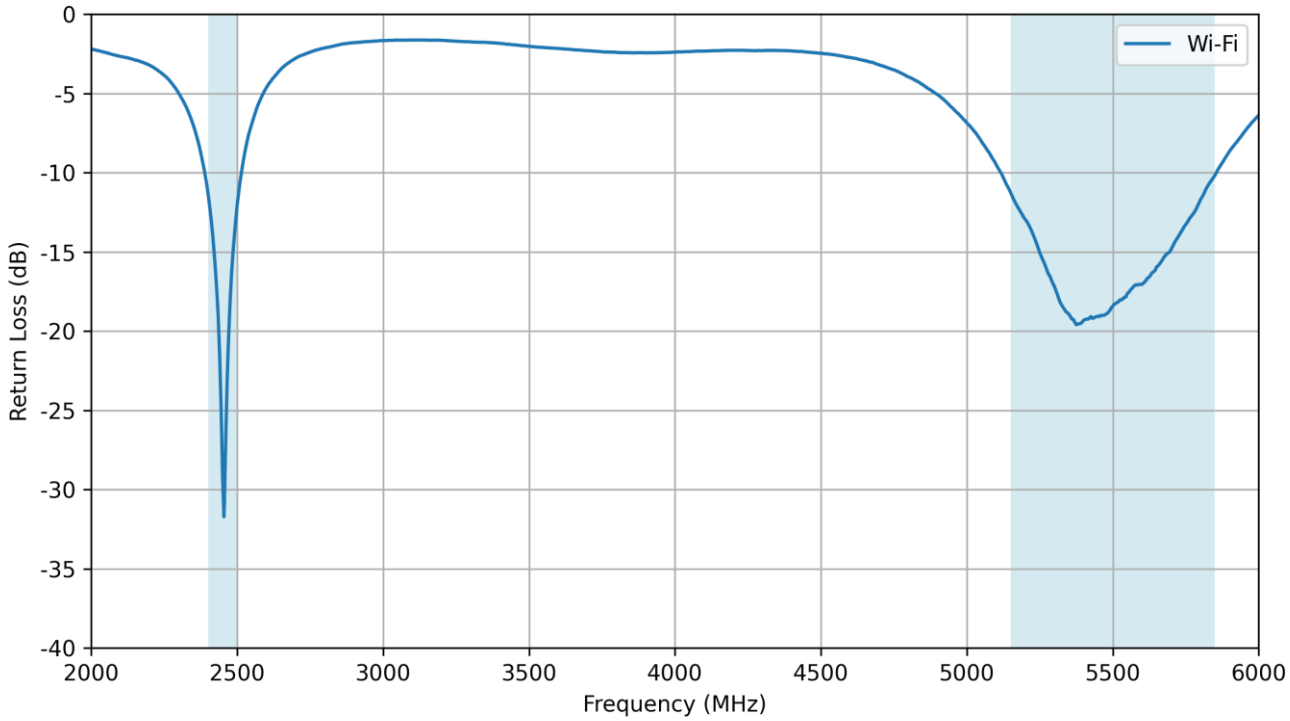
7.5 GNSS - Average Gain



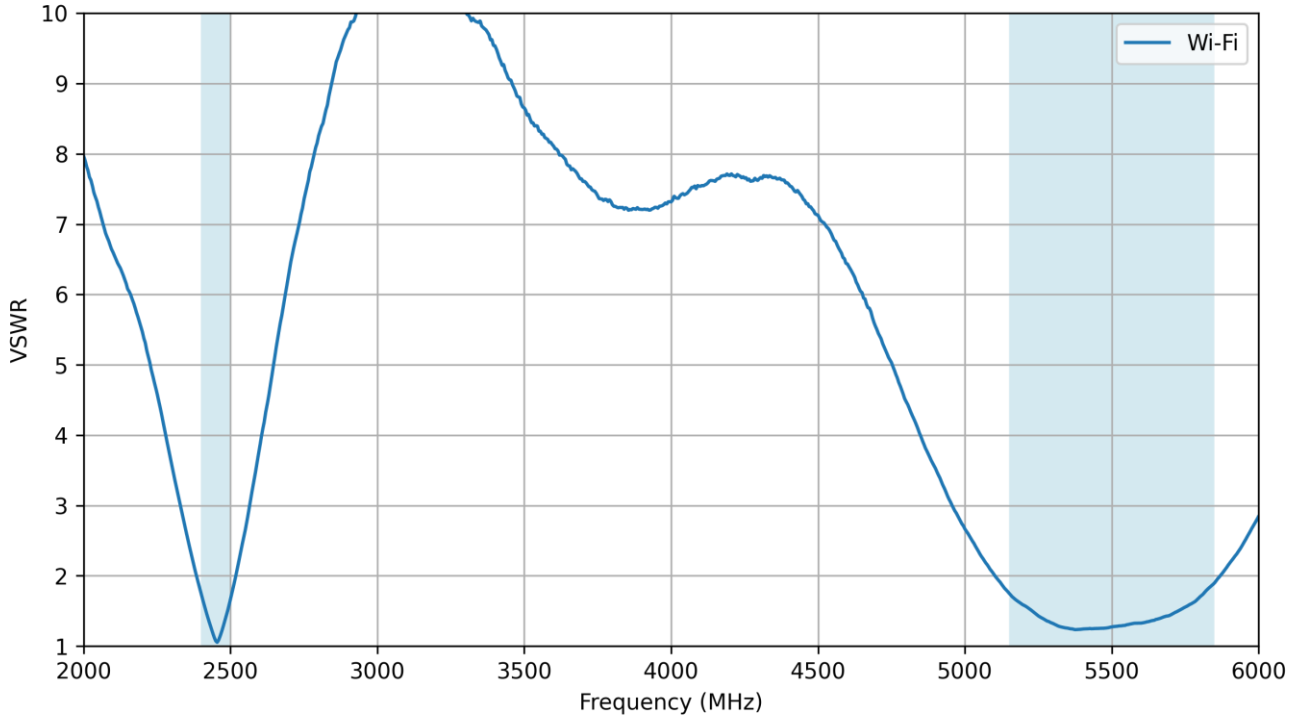
7.6 GNSS - Peak Gain



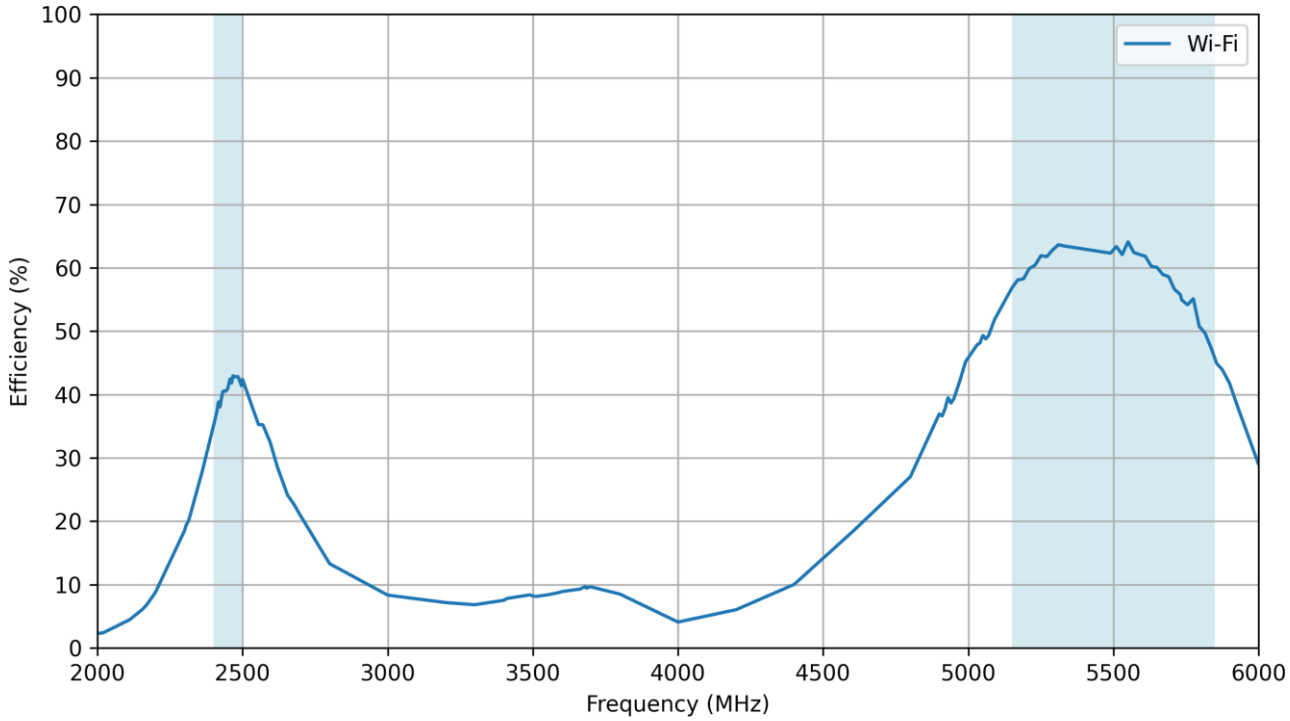
7.7 Wi-Fi - Return Loss



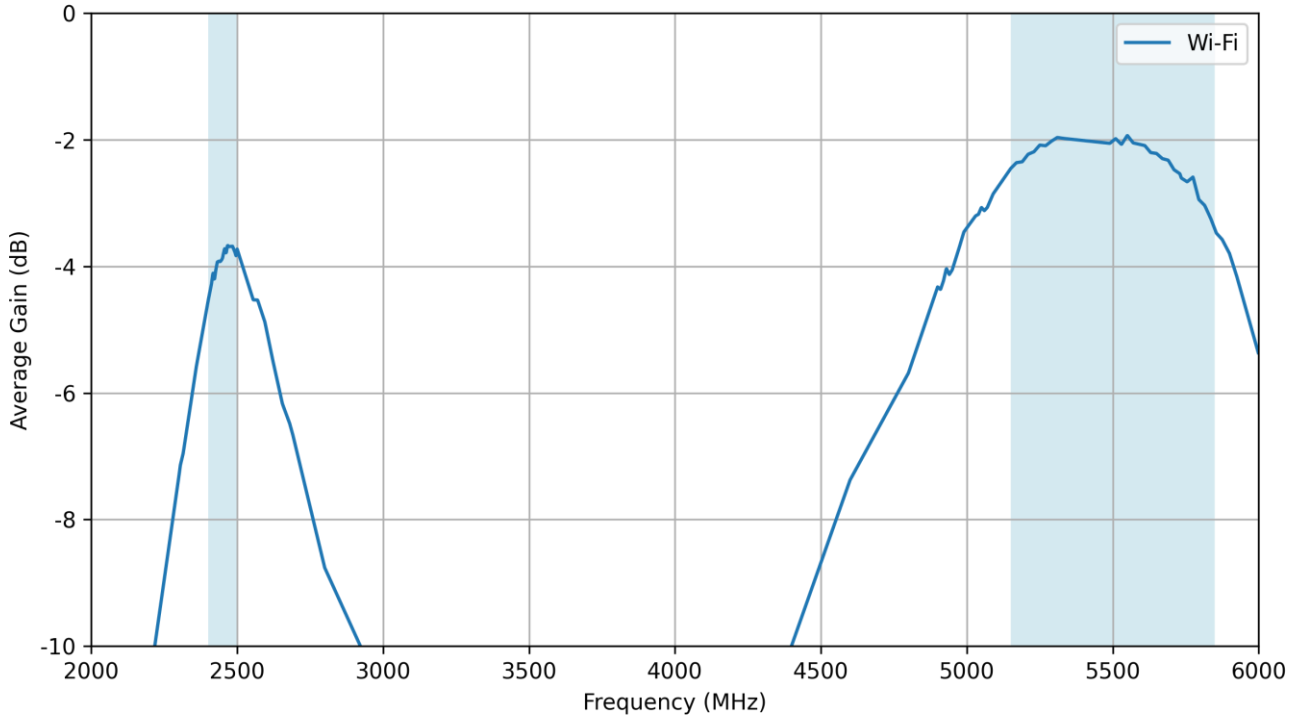
7.8 Wi-Fi - VSWR



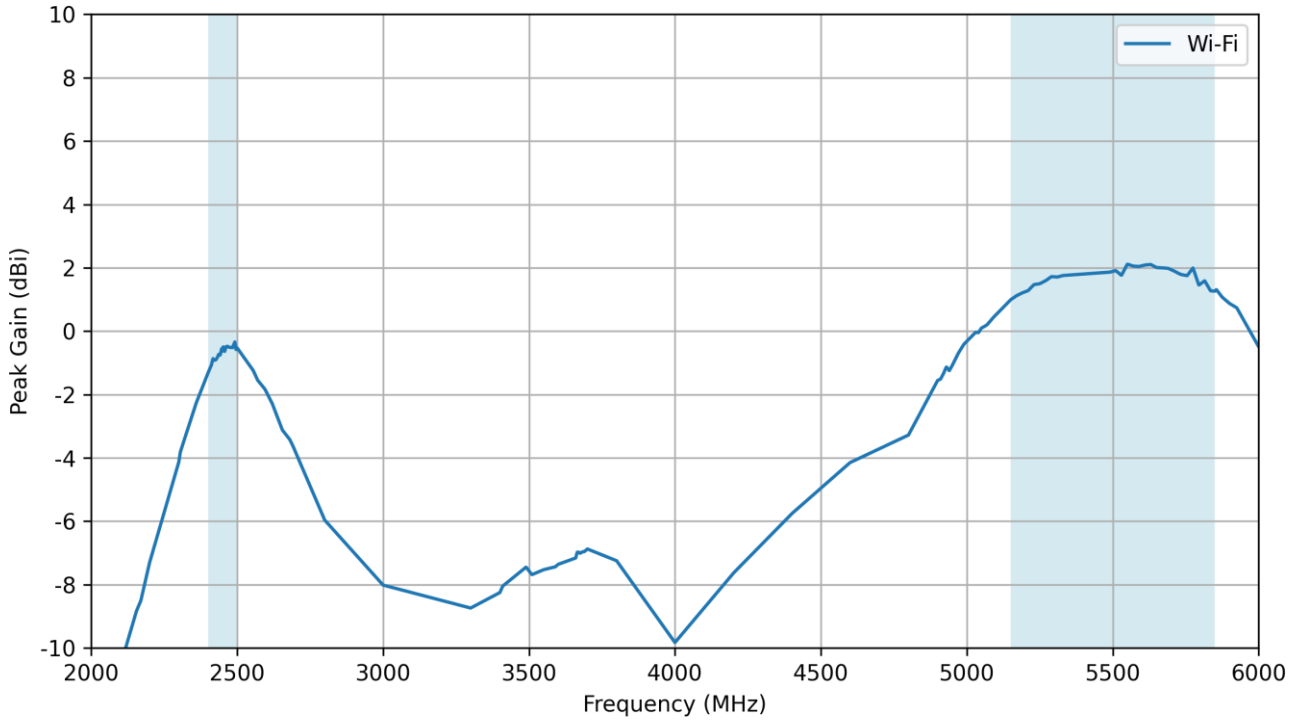
7.9 Wi-Fi - Efficiency



7.10 Wi-Fi - Average Gain

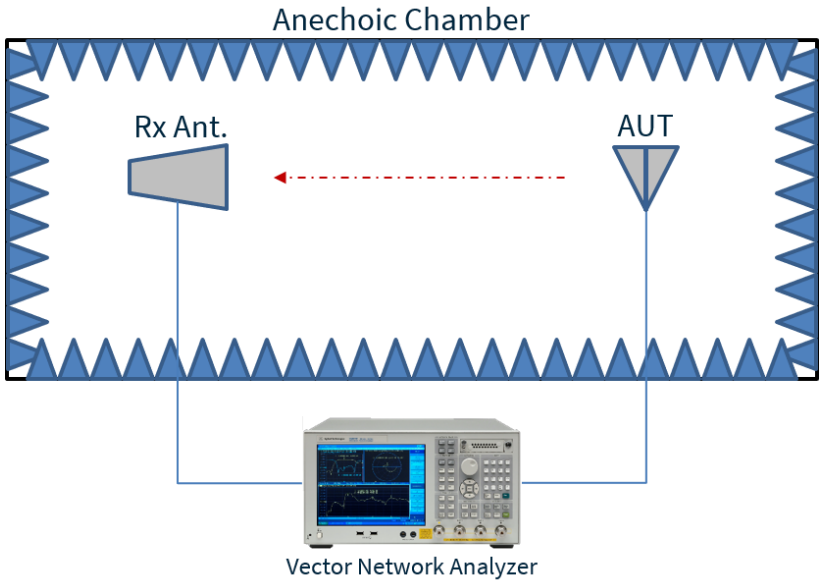


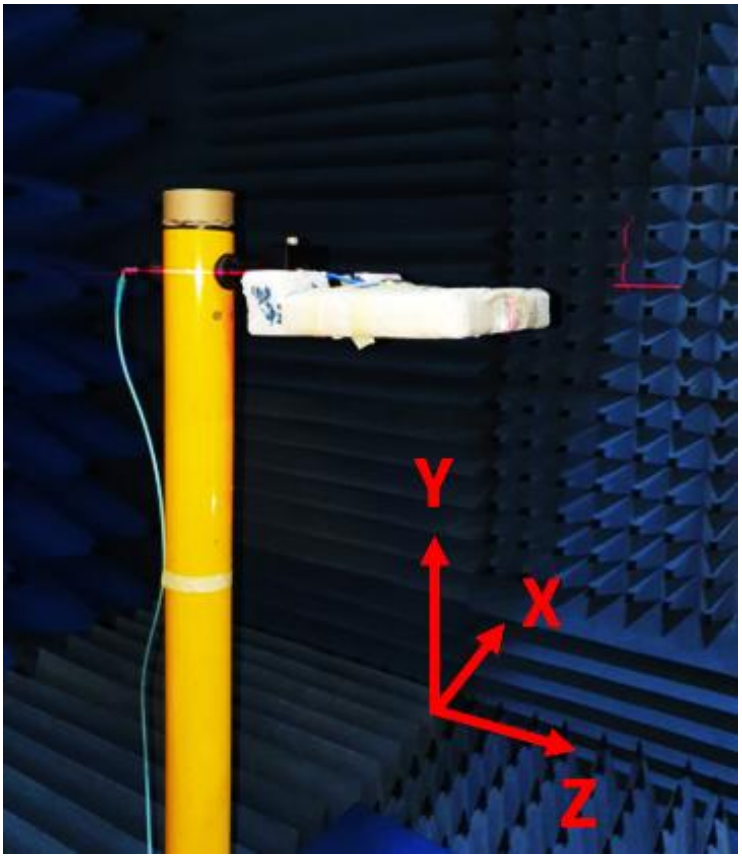
7.11 Wi-Fi - Peak Gain



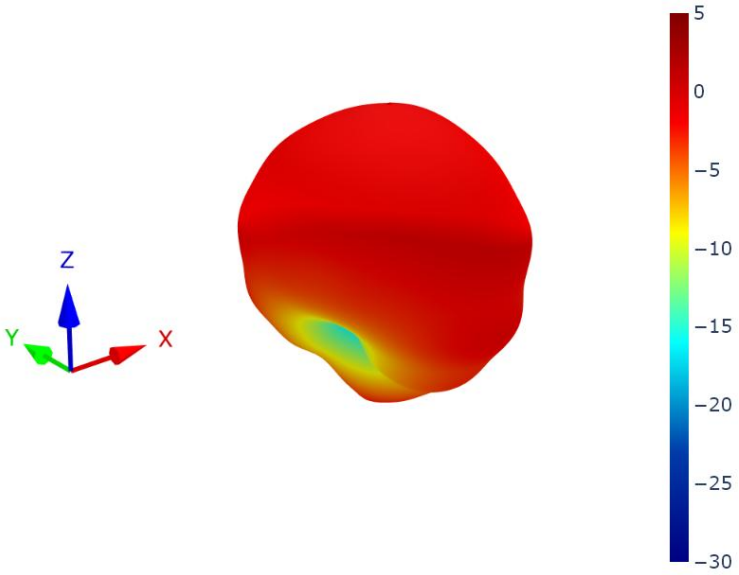
8. Radiation Patterns

8.1 Test Setup

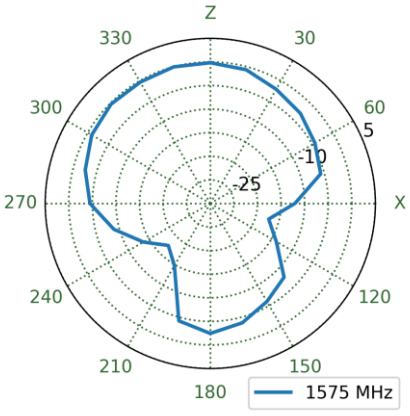


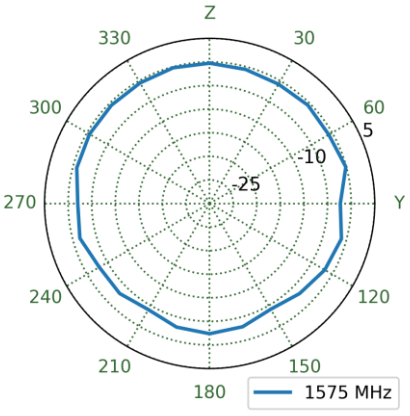


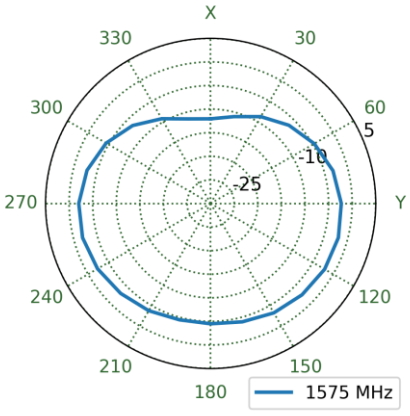
8.2 GNSS - Patterns at 1576 MHz



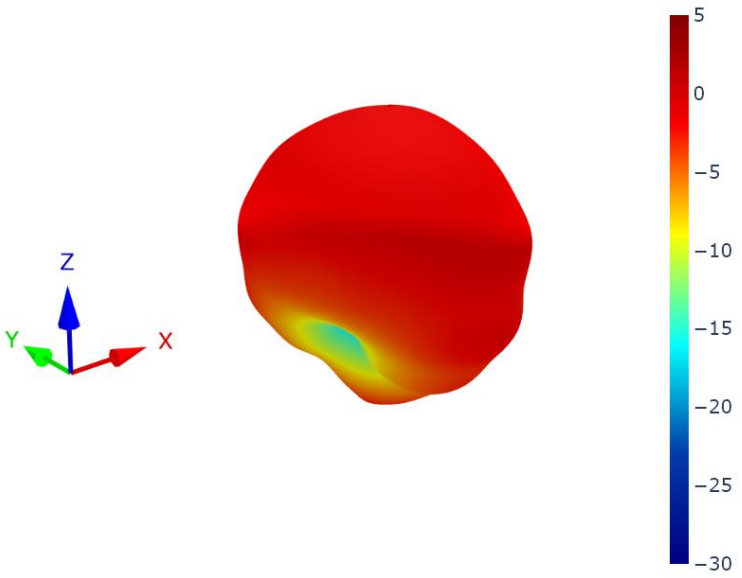
XZ Plane	YZ Plane	XY Plane

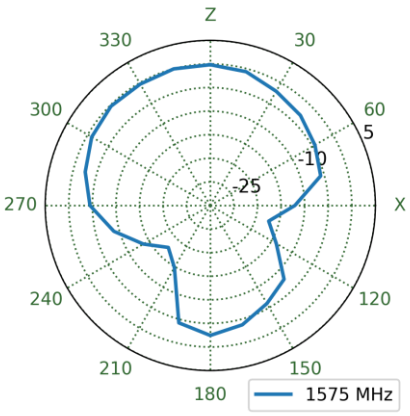
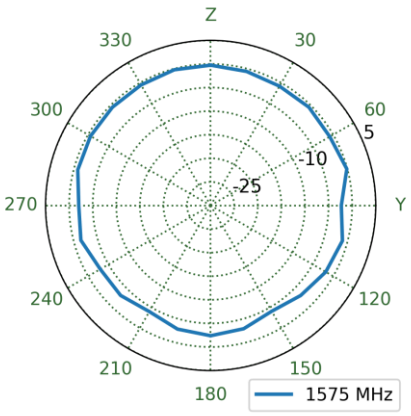
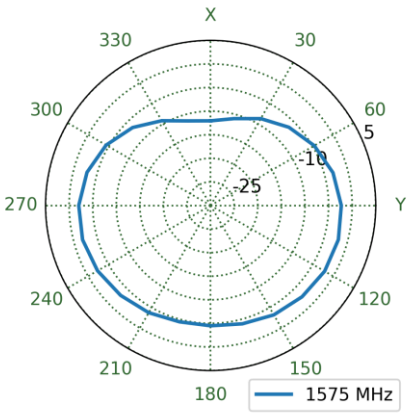




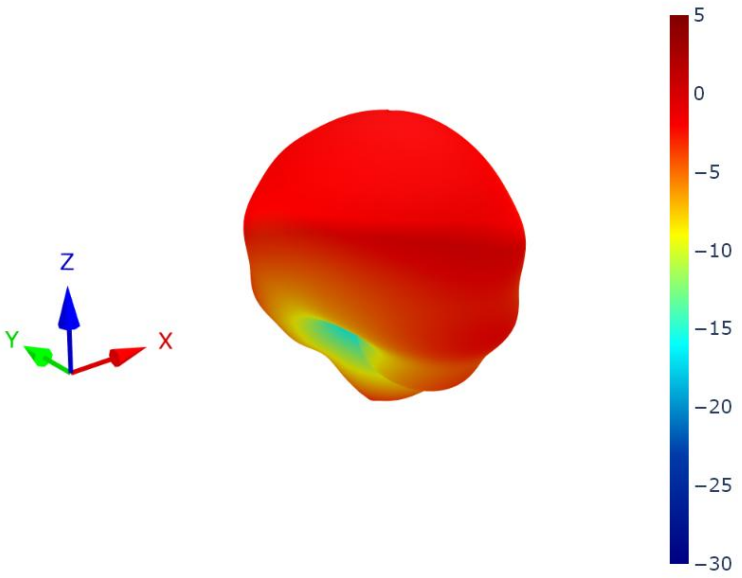


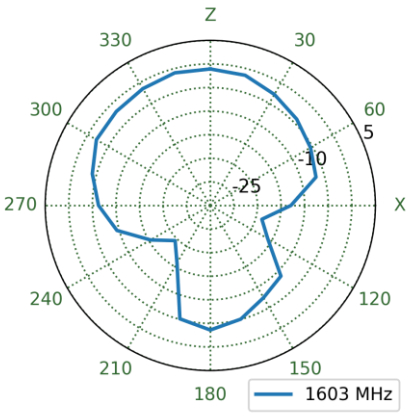
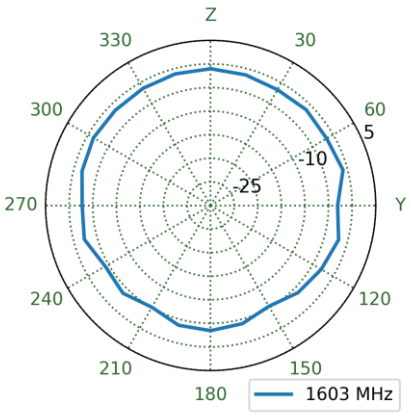
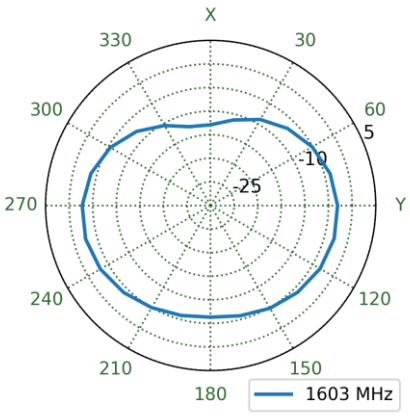
8.3 GNSS - Patterns at 1576 MHz



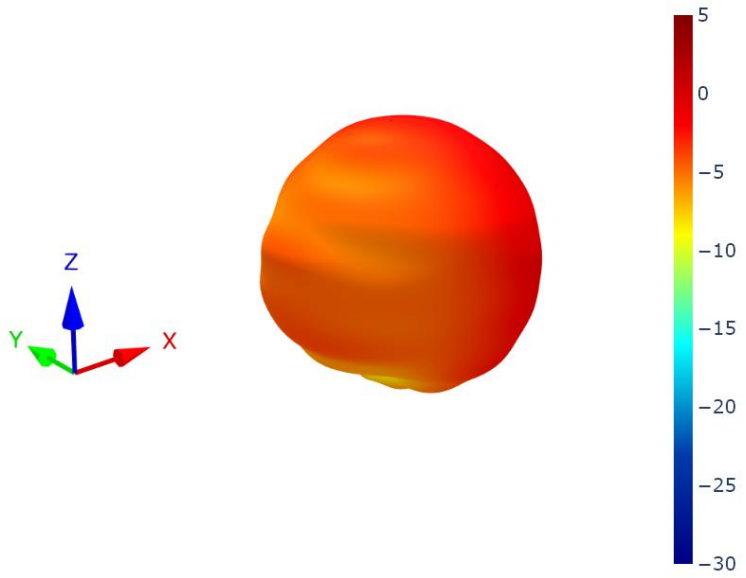
XZ Plane	YZ Plane	XY Plane
		

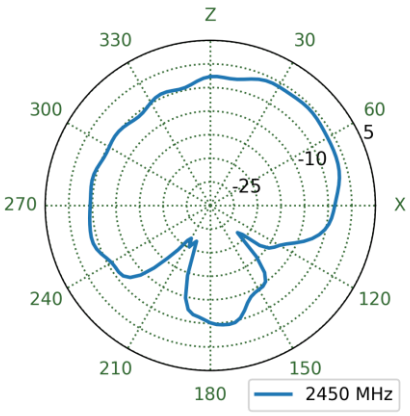
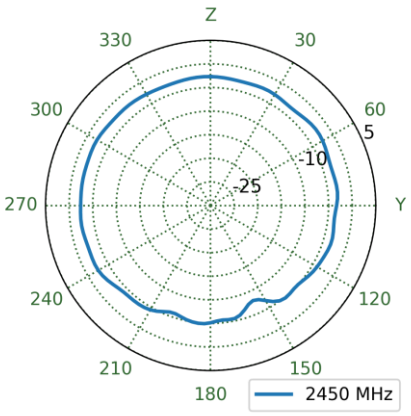
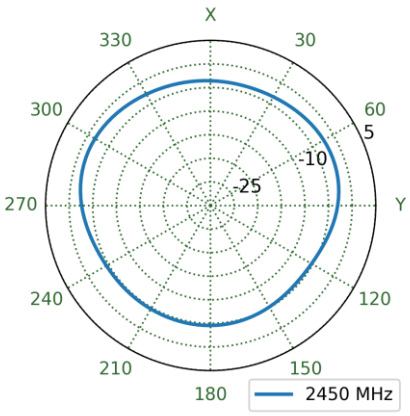
8.4 GNSS - Patterns at 1603 MHz



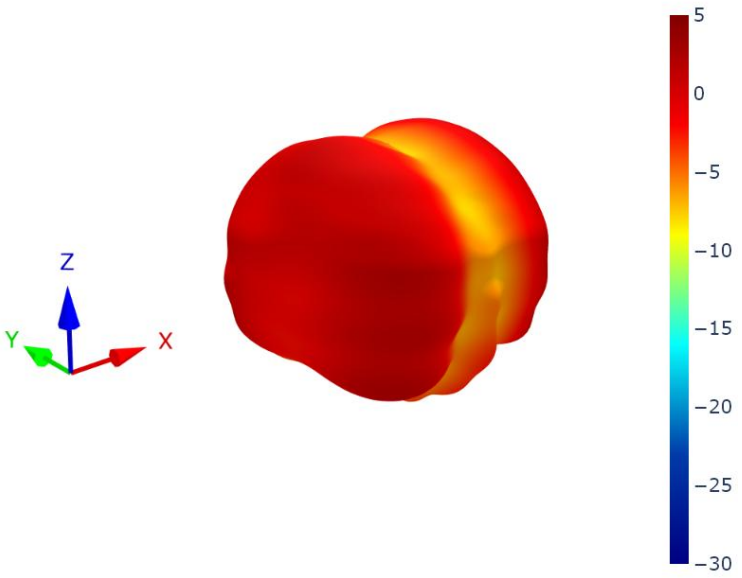
XZ Plane	YZ Plane	XY Plane
		

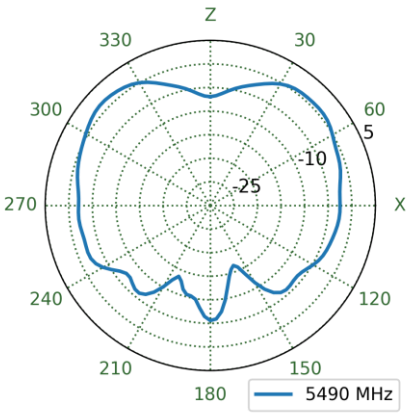
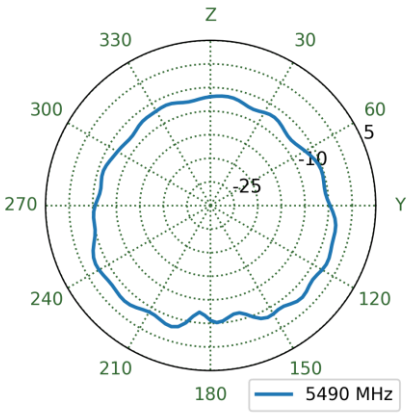
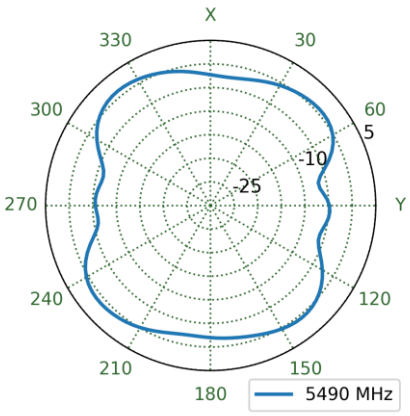
8.5 Wi-Fi - Patterns at 2450 MHz



XZ Plane	YZ Plane	XY Plane
		

8.6 Wi-Fi - Patterns at 5500 MHz



XZ Plane	YZ Plane	XY Plane
		

Changelog for the datasheet

SPE-24-8-128 – GWLA.15

Revision: D (Current Version)	
Date:	2025-04-29
Notes:	Updated schematic symbol.
Author:	Gary West

Previous Revisions

Revision: C	
Date:	2024-12-20
Notes:	Updated Moisture sensitive level
Author:	Paul Liu

Revision: B	
Date:	2024-09-17
Notes:	Integration Instructions Included
Author:	Gary West

Revision: A (Original First Release)	
Date:	2024-06-13
Notes:	Initial Release
Author:	Gary West

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