SPECIFICATION

Part Number: **MAT.03A**

Product Name: MAT.03A Embedded Active GPS and Cellular Antenna Assembly and Reference Board

Features: 2in1 Embedded Antenna Solution
Two SMA(F) connectors for Output

GPS Antenna – ASGP.1575.25B.4.A.01

- SMT Active GPS Patch Antenna
- High performance 28dB LNA
- Ultra low power consumption
- Patch 25x25x4mm

Cellular Antenna- PA.25 Hexa-Band Cellular SMT Antenna

- 2G and 3G Bands
- GSM/GPRS/CDMA/HSPA
- High efficiency Multi-band SMT antenna
- 35x5x6mm

RoHS Compliant ✓

5.

1. Introduction

The MAT.03A Reference GPS and Cellular Embedded Antenna board combines the 2G/3G PA.25 Hexa-Band Cellular SMT Antenna and the ASGP.1575.25B.4.A.0 SMT 28dB Active GPS Patch Antenna from Taoglas. It can be used as a reference board design or actual embedded antenna for telematics applications such as fleet management, asset tracking, road pricing, and security/surveillance. Best placement for this reference board in a device would be over the existing mainboard and away from metal to allow for maximum radiated efficiency, and for the GPS antenna to get a view towards the sky.

The board comes with one SMA(F) connector for each antenna feed on the bottom side for easy connection via a cable assembly to a module or test equipment.

Cellular Antenna PA.25

This compact SMT ceramic high performance antenna achieves high efficiency on almost all worldwide 2G and 3G bands, for applications such as GSM/GPRS/CDMA/HSPA. Transmission losses are kept to absolute minimum resulting in much improved over the air (OTA) device performance compared to similar efficiency cable and connector antenna solutions.

GPS Antenna ASGP.1575.25B.4.A.01

The patent pending revolutionary SMT GPS patch antenna allows for optimal GPS performance by combining the ceramic patch, SAW, LNA, and feed pad in one integral sandwich package, mounted on its own ground-plane. Having the SAW filter and LNA right after the feed reduces the chance of noise entering the transmission line and boosts the GPS signal at the source before noise enters, allowing for better signal to noise ratio.

It also frees up space on your board traditionally used for the filter and LNA.

The SAW is placed in front of the LNA, helping to prevent saturation due to nearby radio transmitters, and the possibility of radiated spurious emissions through other radio systems.

Individual specifications on the antennas are available on the Taoglas website. Contact your regional Taoglas office for support on integration of these antennas in your own device such as gerber and layout review, and matching.

2. Specification

2.1 System Configuration

This antenna specification covers the Hexa-band Cellular Full band and GPS (L1 Band).

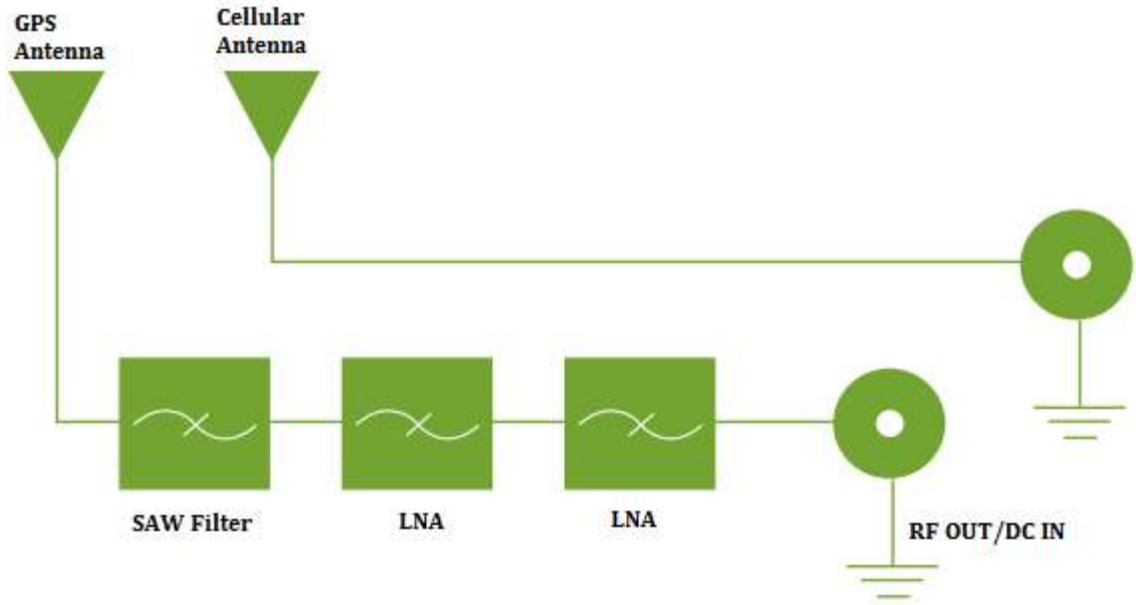


Figure 1. System configuration

2.2 PA.25 Cellular Antenna

Electrical*				
	824–960 MHz	1710-1880MHz	1850-1990MHz	1920-2170MHz
Peak Gain (dBi)	0.48	2.13	2.54	2.25
Efficiency (%)	51.41	57.79	53.27	48.34
Return loss	<-5 dB			
Impedance	50Ω			
Polarization	Linear			
Mechanical				
EVB Connector	SMA(F)			
Dimensions (mm)	35 x 6 x 5			
Termination	Ag (environmental-friendly Pb free)			
Material	Ceramic			
Environmental				
Operation Temperature	-40°C to 85°C			
Storage Temperature	-40°C to 105°C			
Relative Humidity	Non-condensing 65°C 95% RH			
RoHs Compliant	Yes			

*Ground plane size 110x40 mm

2.3 ASGP.1575.25B.4.A.01 GPS Antenna

Electrical Specifications - Antenna*	
Polarization	RHCP
Axial ratio	Max 3.0dB@zenith
Input Voltage	Min:1.8V Typ.: 3.0V Max: 5.5V
Gain	Typ. -1.5dBic @ Zenith
Mechanical Specifications - Antenna	
Dimensions (mm)	25 x 25 x 4
Connection	SMT via solder pads
Environmental Specifications - Antenna	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to + 85°C
Relative Humidity	40% to 95%

Electrical Specifications - LNA*	
Frequency Range	1575.42 ± 1.023 MHz
Output Impedance	50Ω
Outer Band Attenuation	F0=1575.42MHz
	F0±30MHz 5dB min
	F0±50MHz 25dB min
	F0±100MHz 30dB min
Pout at 1dB Gain Compression point	-7 dBm Typ.
Output VSWR	2.0 Max

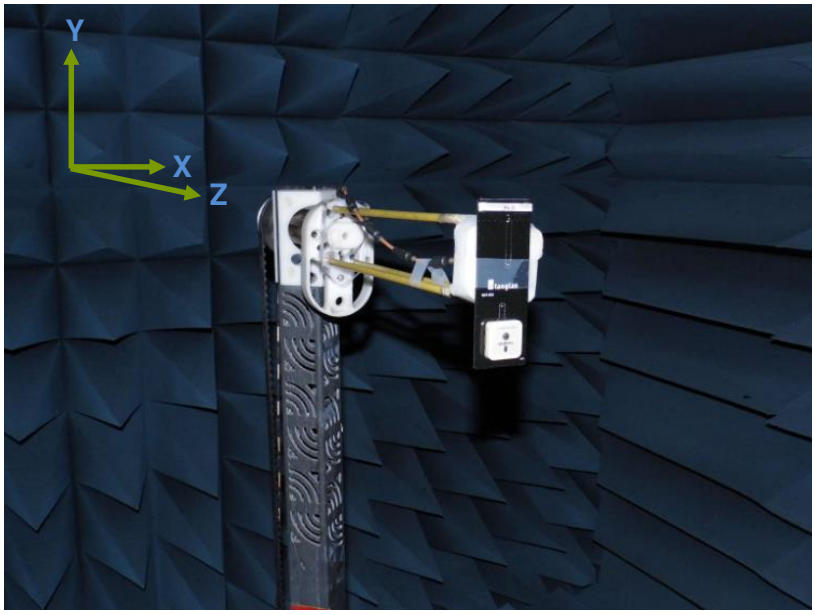
LNA Gain, Power Consumption and Noise Figure*			
Voltage	LNA Gain (Typ)	Power Consumption(mA) Typ	Noise Figure(Typ)
Min 1.8V	20dB	4.5mA	2.8dB
Typ 3.0V	28dB	9mA	2.7dB
Max 5.5V	30dB	18mA	3.0dB

Electrical Specifications – Overall*	
Frequency Range	1575.42MHz +/- 1.023 MHz
Gain	At 90° at 3.0V 26.5±4dBi
Output Impedance	50Ω
VSWR	2.0 Max.

*Ground plane size 110x40 mm

3. Test Setup

(a)



(b)

Figure 2. (a)PA.25 Cellular antenna Return Loss and VSWR test setup; (b) Peak gain, Average gain, Efficiency and Radiation pattern test setup

PA.25 Cellular Antenna

3.1 Return Loss

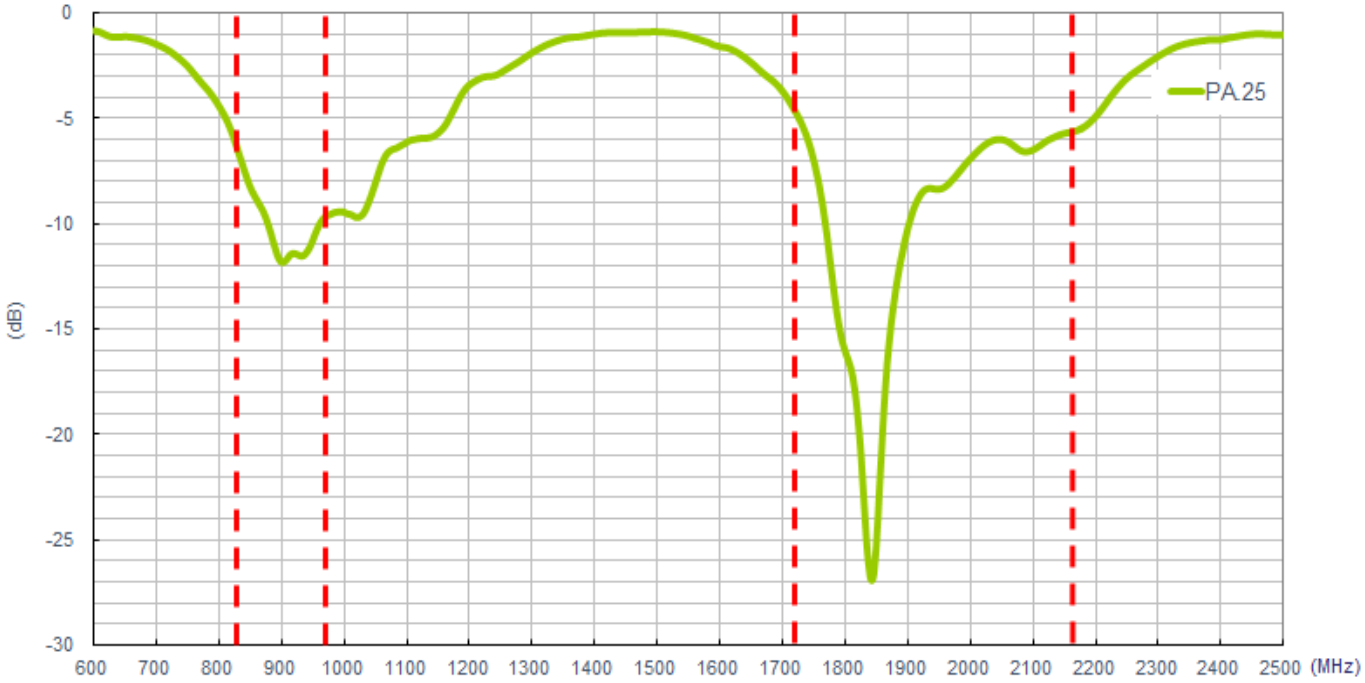


Figure 3. Return Loss of the PA.25 Cellular Antenna

3.2 Efficiency

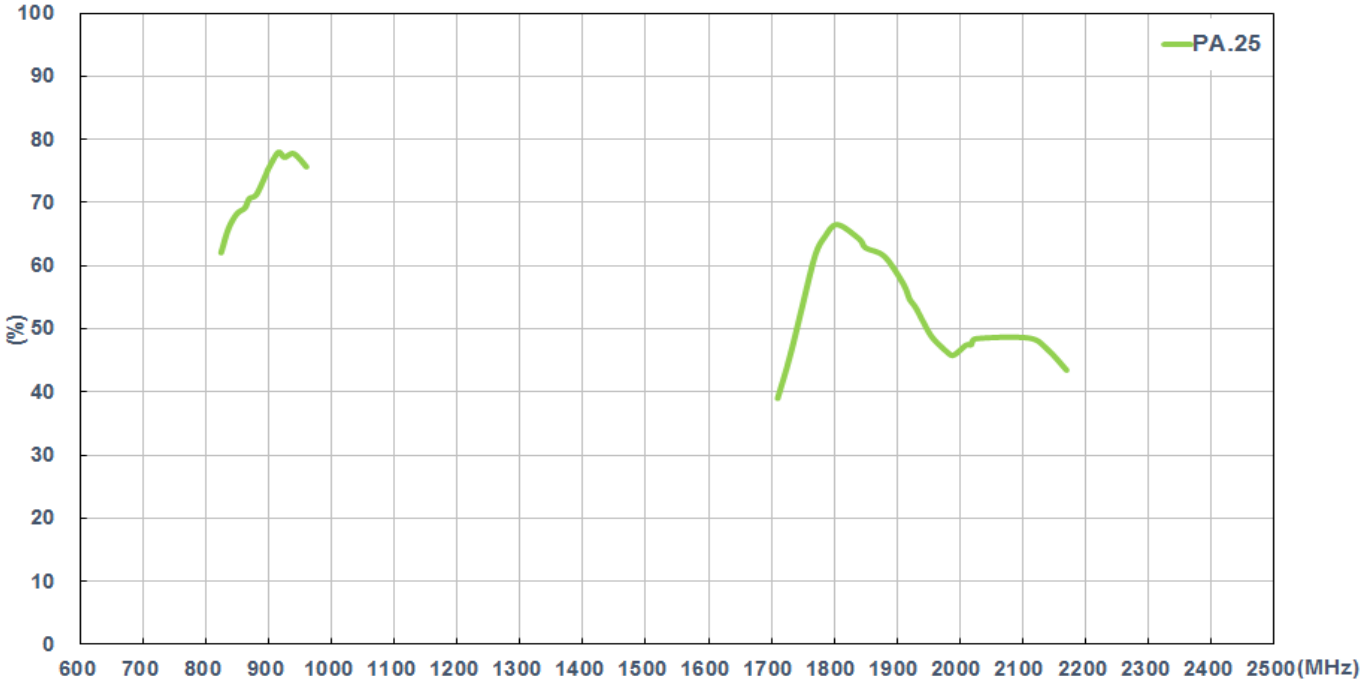


Figure 4. Efficiency of the PA.25 Cellular Antenna

3.3 Peak Gain

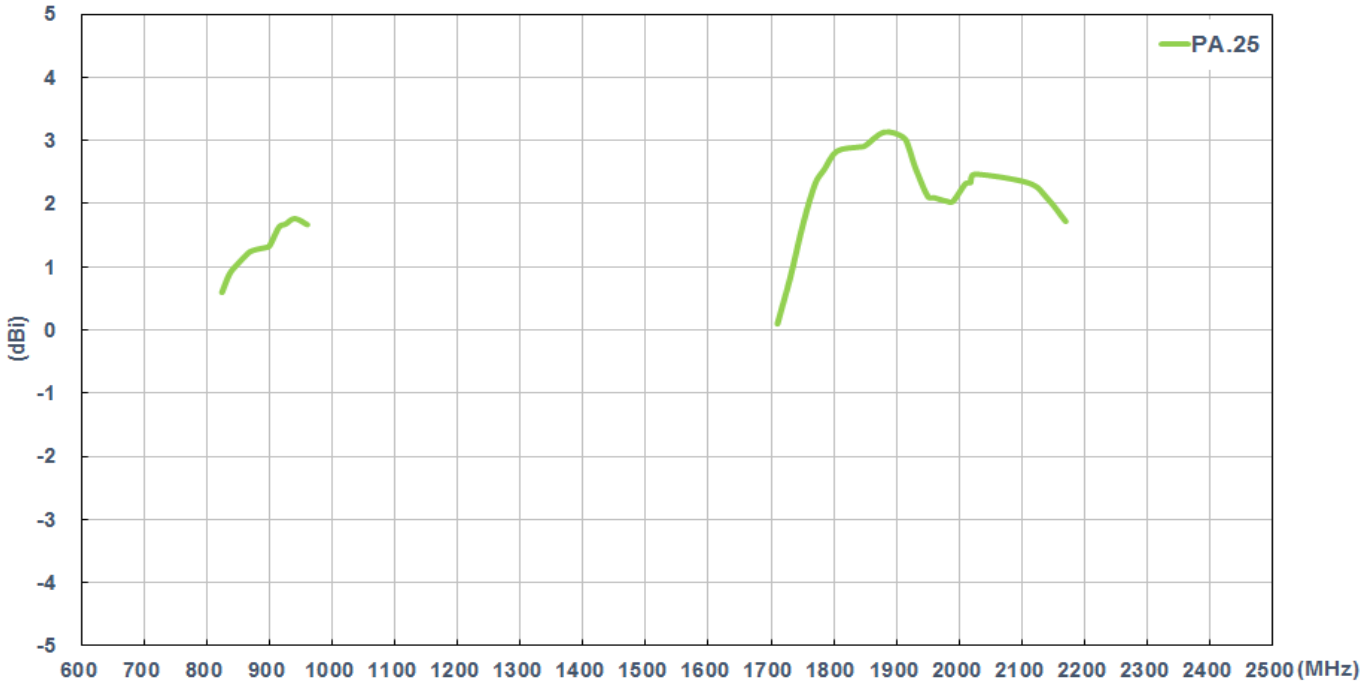


Figure 5. Peak Gain of the PA.25 Cellular Antenna

3.4 Average Gain

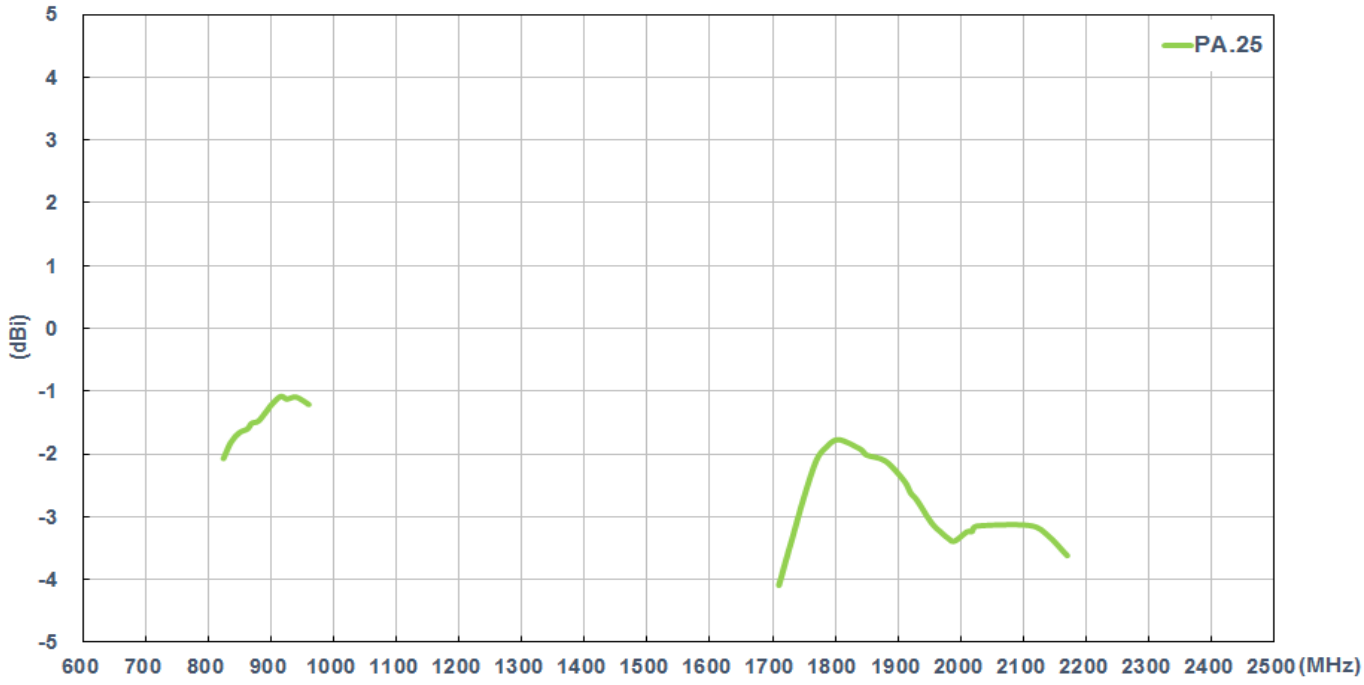
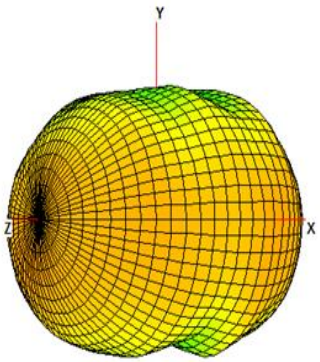


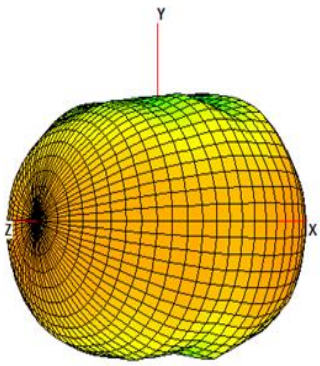
Figure 6. Average Gain of the PA.25 Cellular Antenna

3.5 3D Radiation Pattern

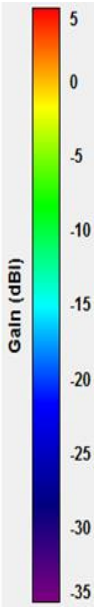
Azimuth=0.0
Elevation=0.0
Roll=-45.0



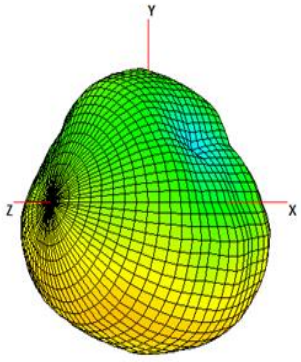
880MHz



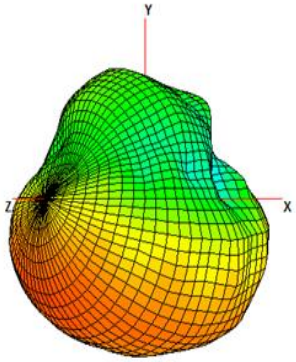
960MHz



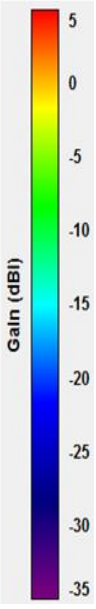
Azimuth=0.0
Elevation=0.0
Roll=-45.0



1710MHz



1880MHz



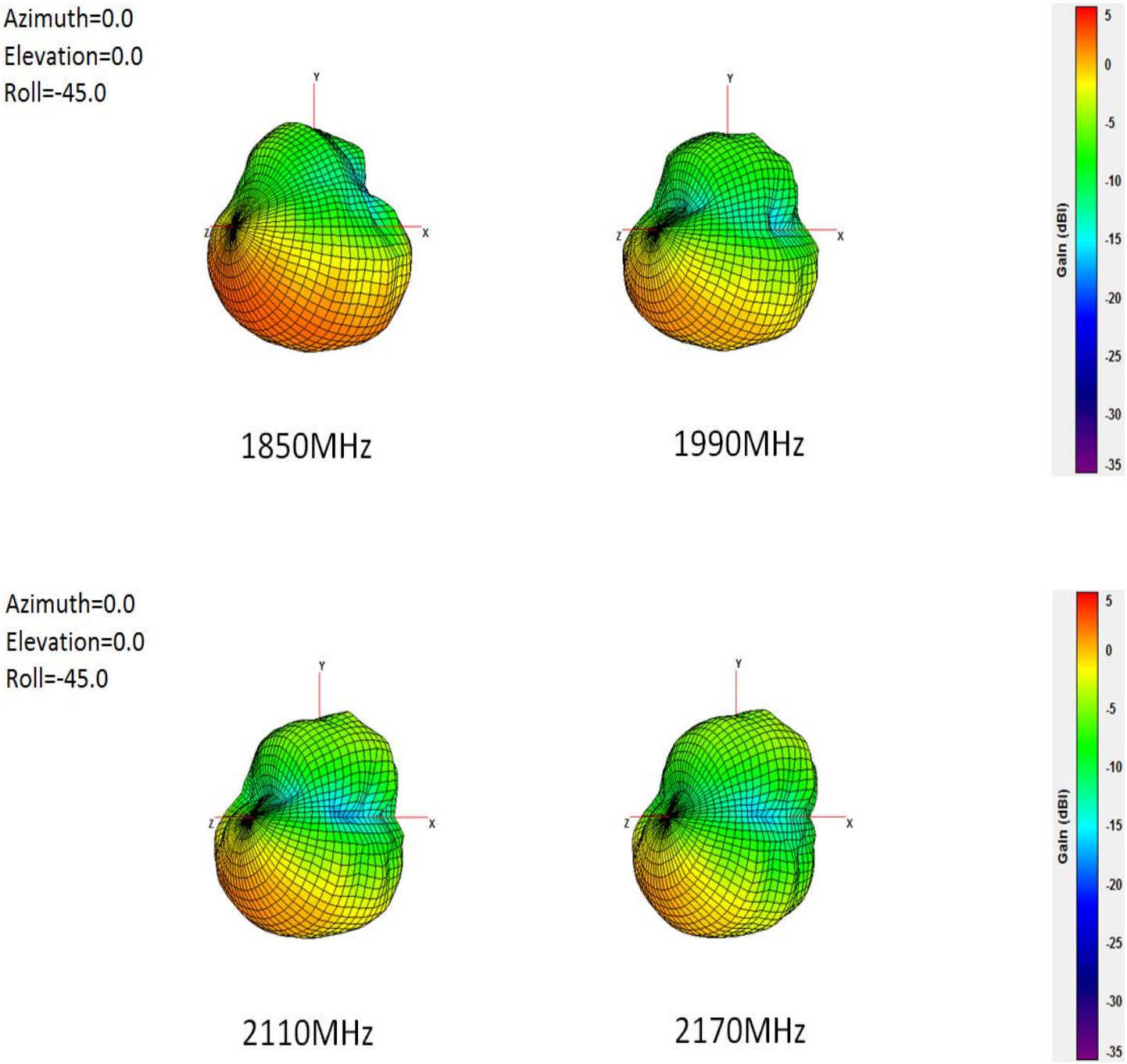
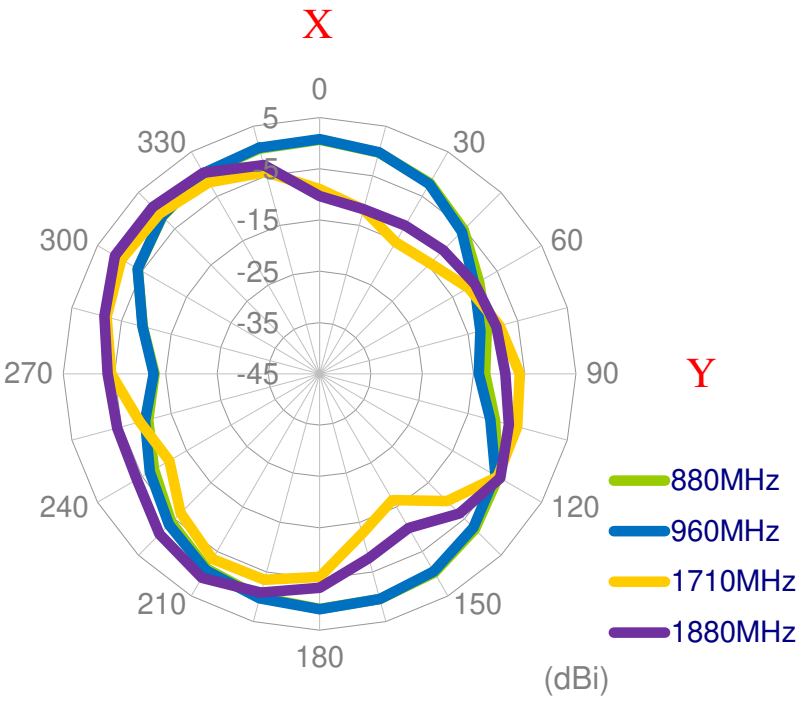
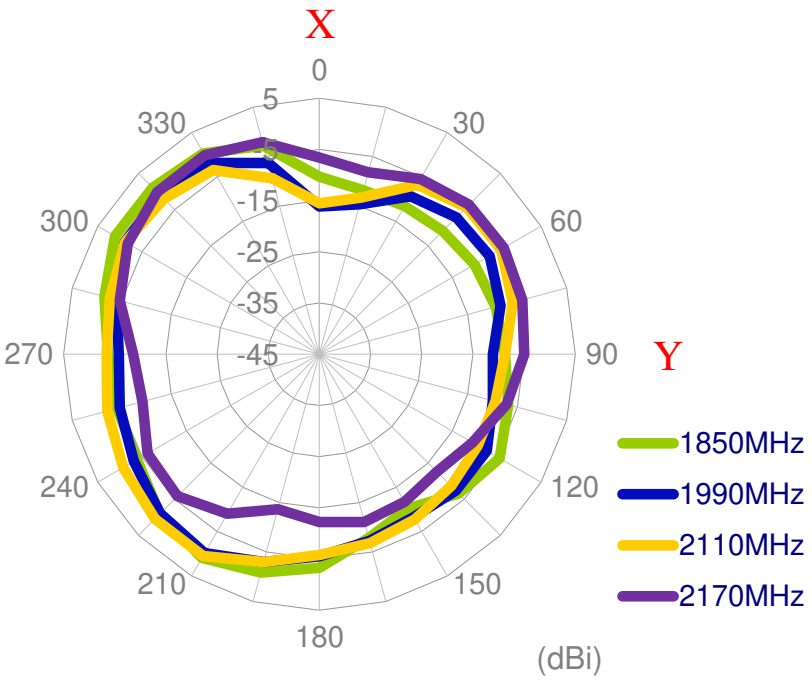


Figure 7. 3D Radiation Pattern of the PA.25 Cellular Antenna

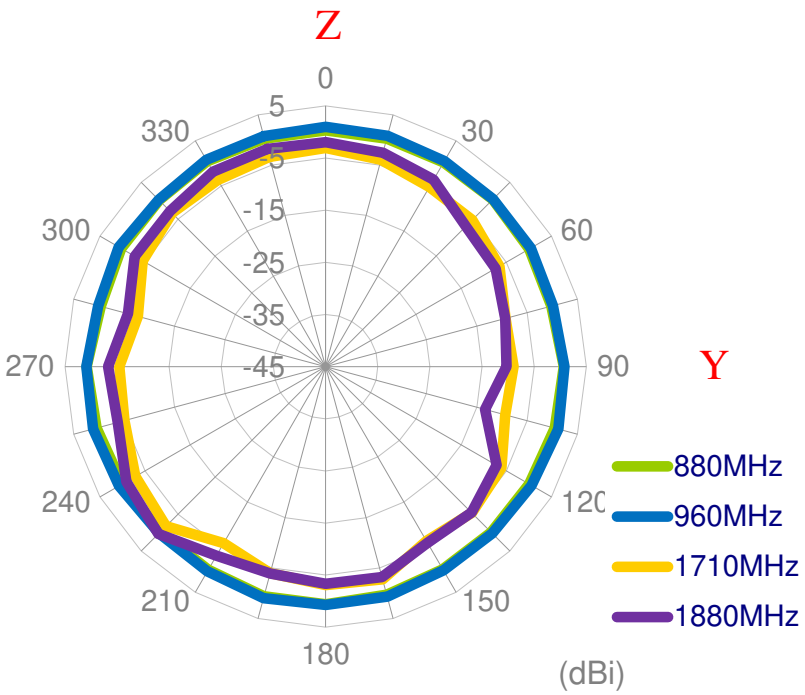
3.6 2D Radiation Pattern

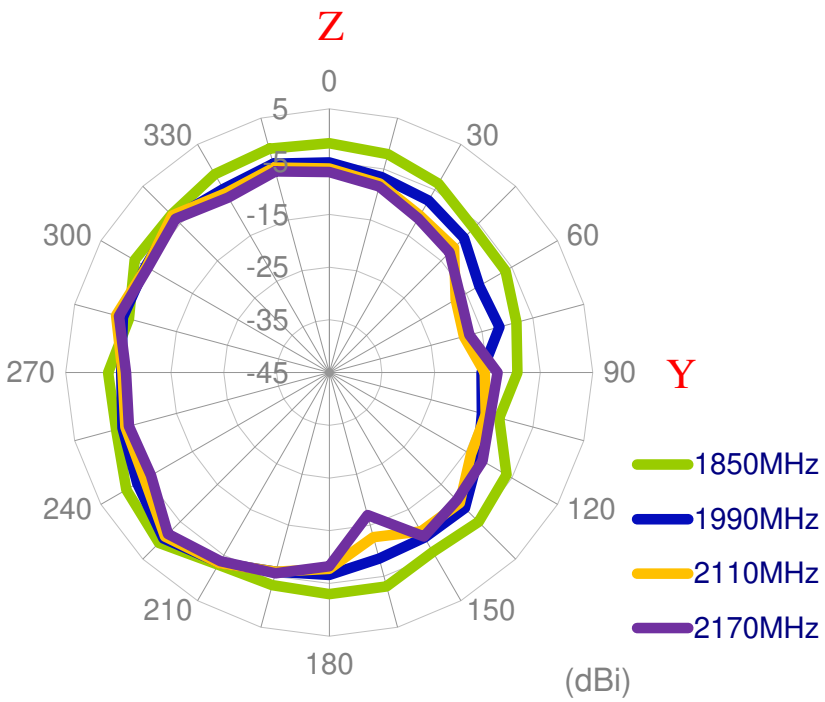
X-Y plane





Y-Z plane


Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
880MHz
960MHz
1710MHz
1880MHz
(dBi)


Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
1850MHz
1990MHz
2110MHz
2170MHz
(dBi)

X-Z plane

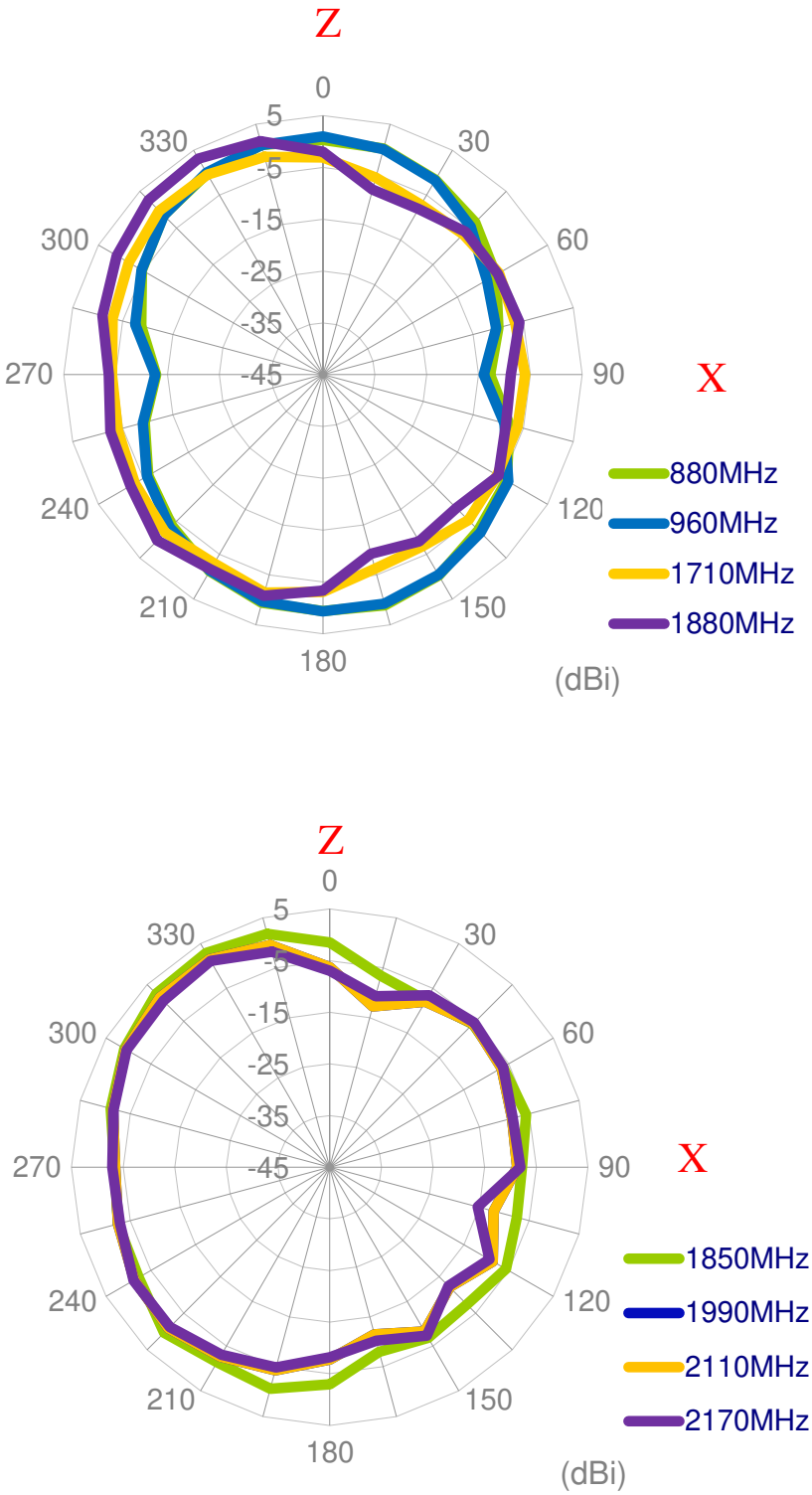


Figure 8. 2D Radiation Pattern of the PA.25 cellular antenna

4. ASGP.1575.25B.4.A.01 Active GPS Antenna

4.1 LNA Gain and Out Band Rejection @3.0V

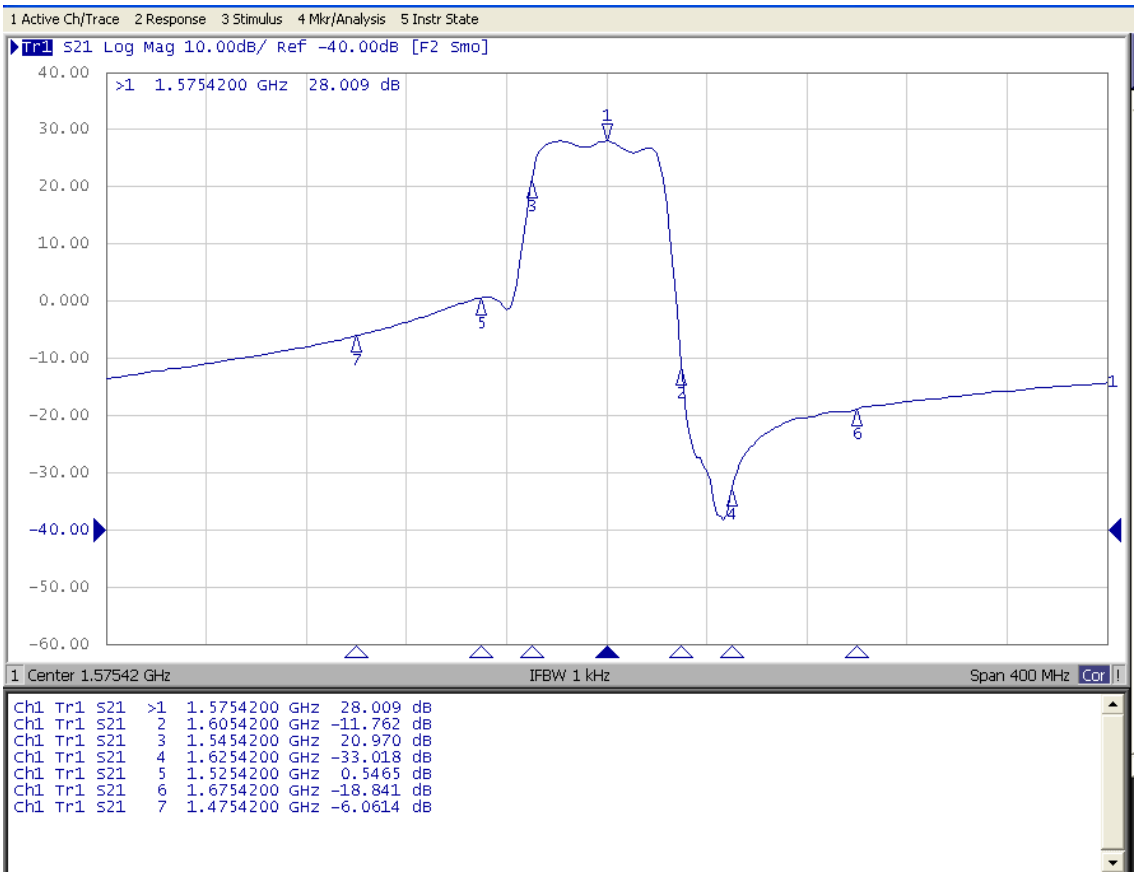


Figure 9. LNA Gain and Out Band Rejection @3.0V

4.2 LNA Noise Figure @3.0V

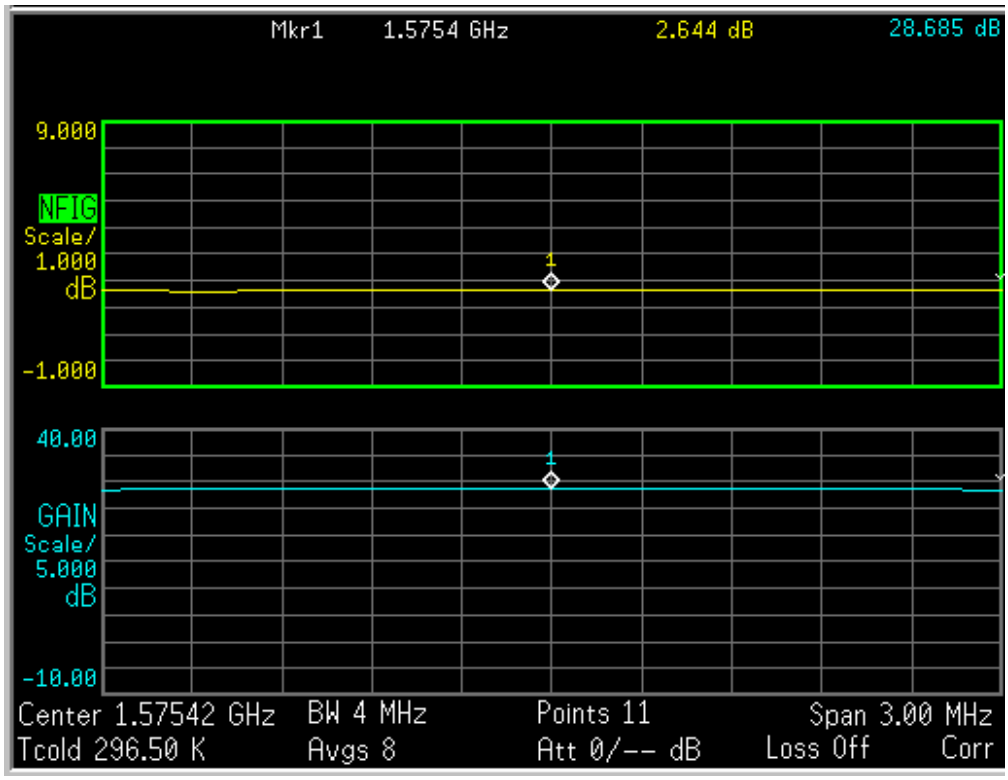
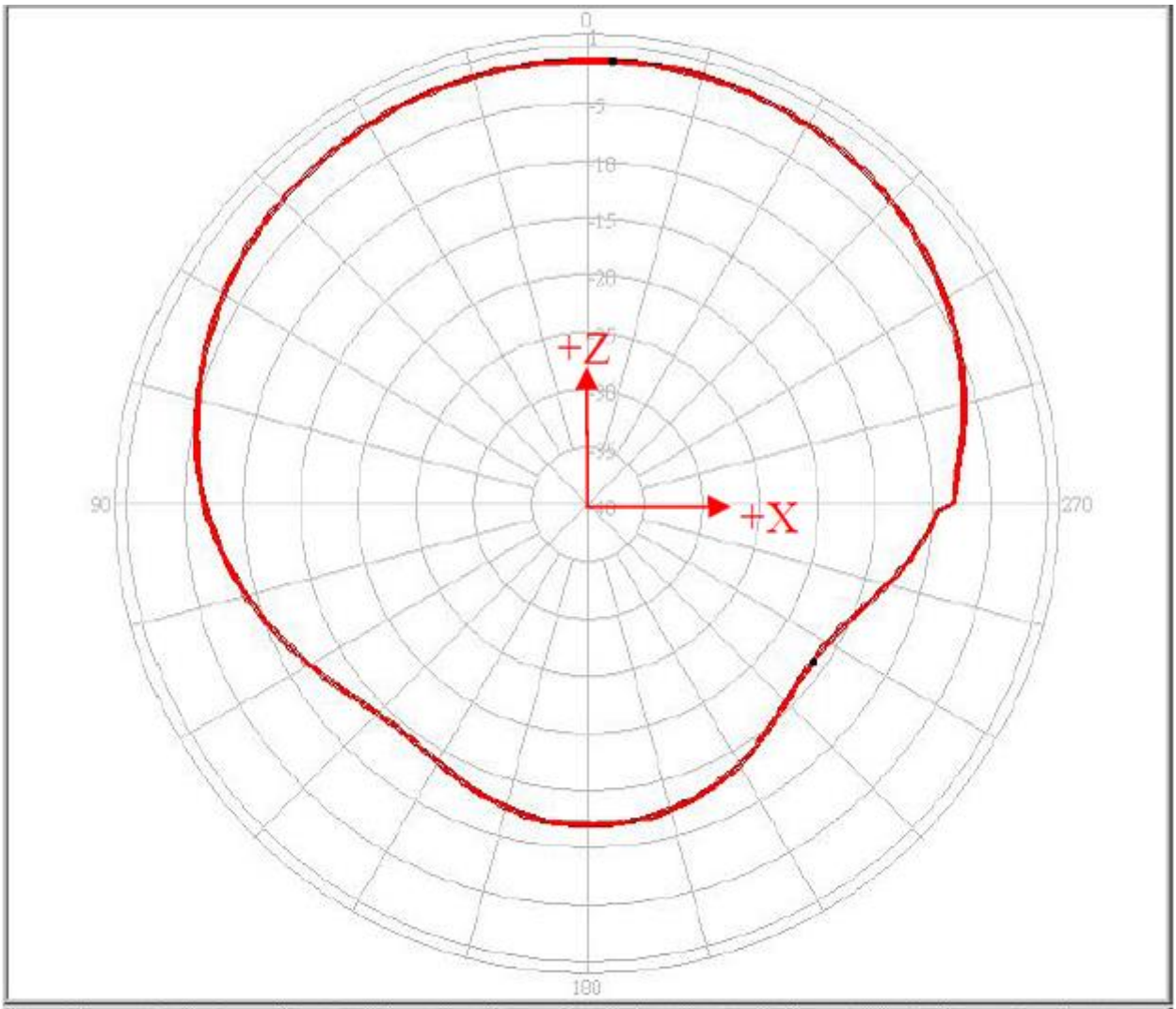


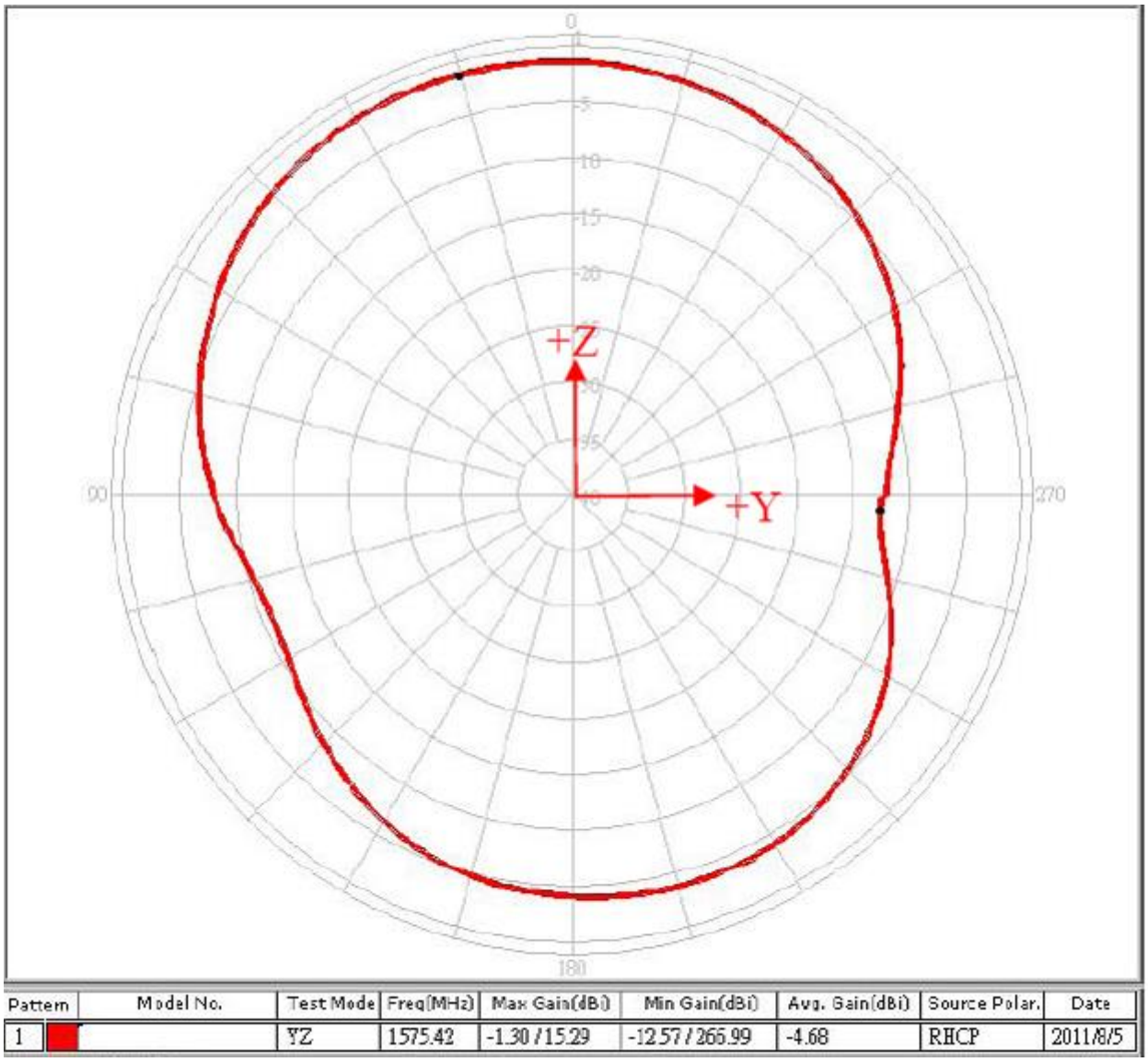
Figure 10. LNA Noise figure @3.0V

4.3 GPS Antenna Radiation Pattern



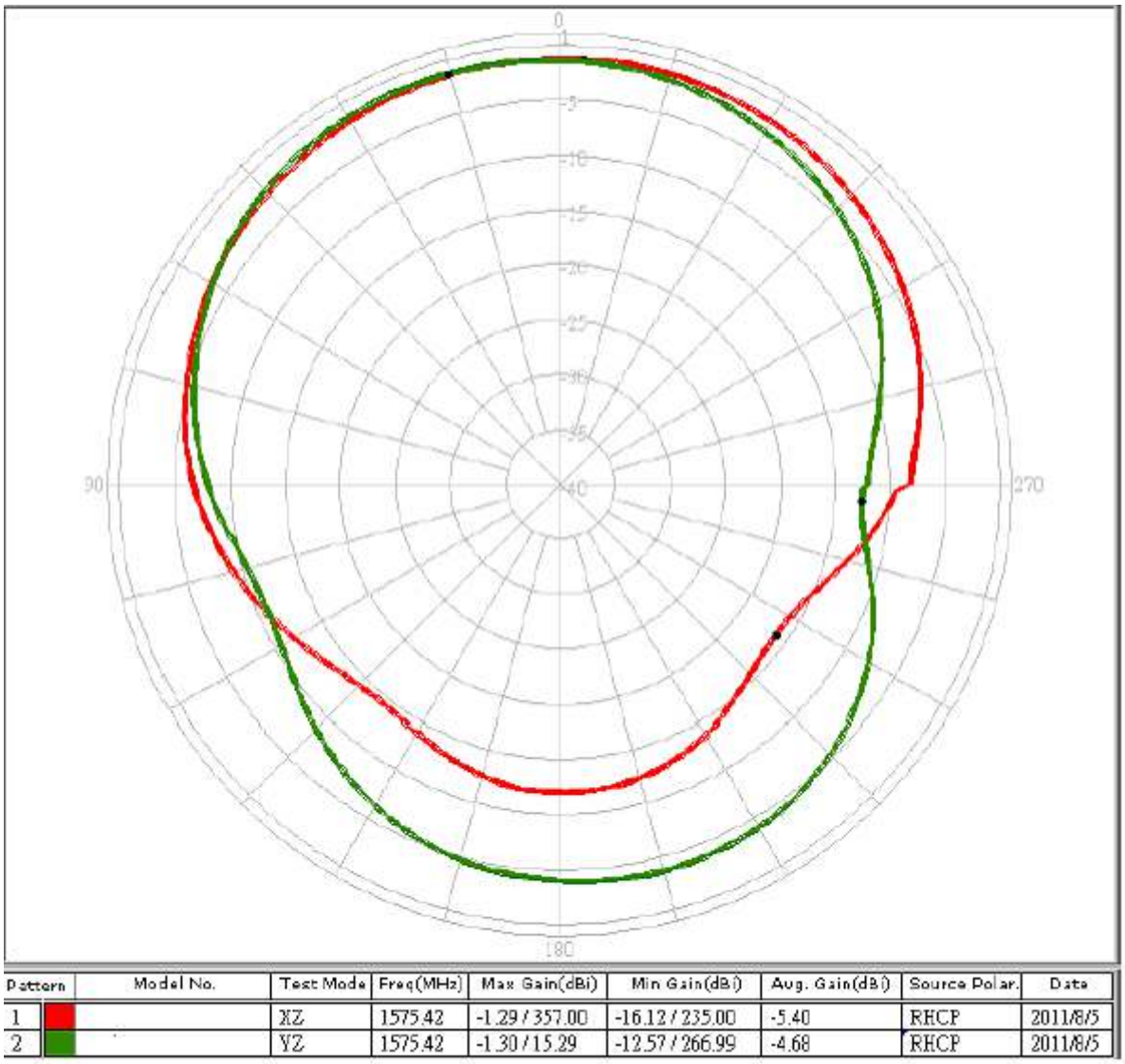
Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.	Date
1		XZ	1575.42	-1.29 / 357.00	-16.12 / 235.00	-5.40	RHCP	2011/8/5

Figure 11. X-Z plane



Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.	Date
1		YZ	1575.42	-1.30 / 15.29	-12.57 / 266.99	-4.68	RHCP	2011/8/5

Figure 12. Y-Z plane



Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.	Date
1		XZ	1575.42	-1.29 / 357.00	-16.12 / 235.00	-5.40	RHCP	2011/8/5
2		YZ	1575.42	-1.30 / 15.29	-12.57 / 266.99	-4.68	RHCP	2011/8/5

Figure 13. X-Y plane

5. Mechanical Drawing

PA.25 Mechanical Drawing

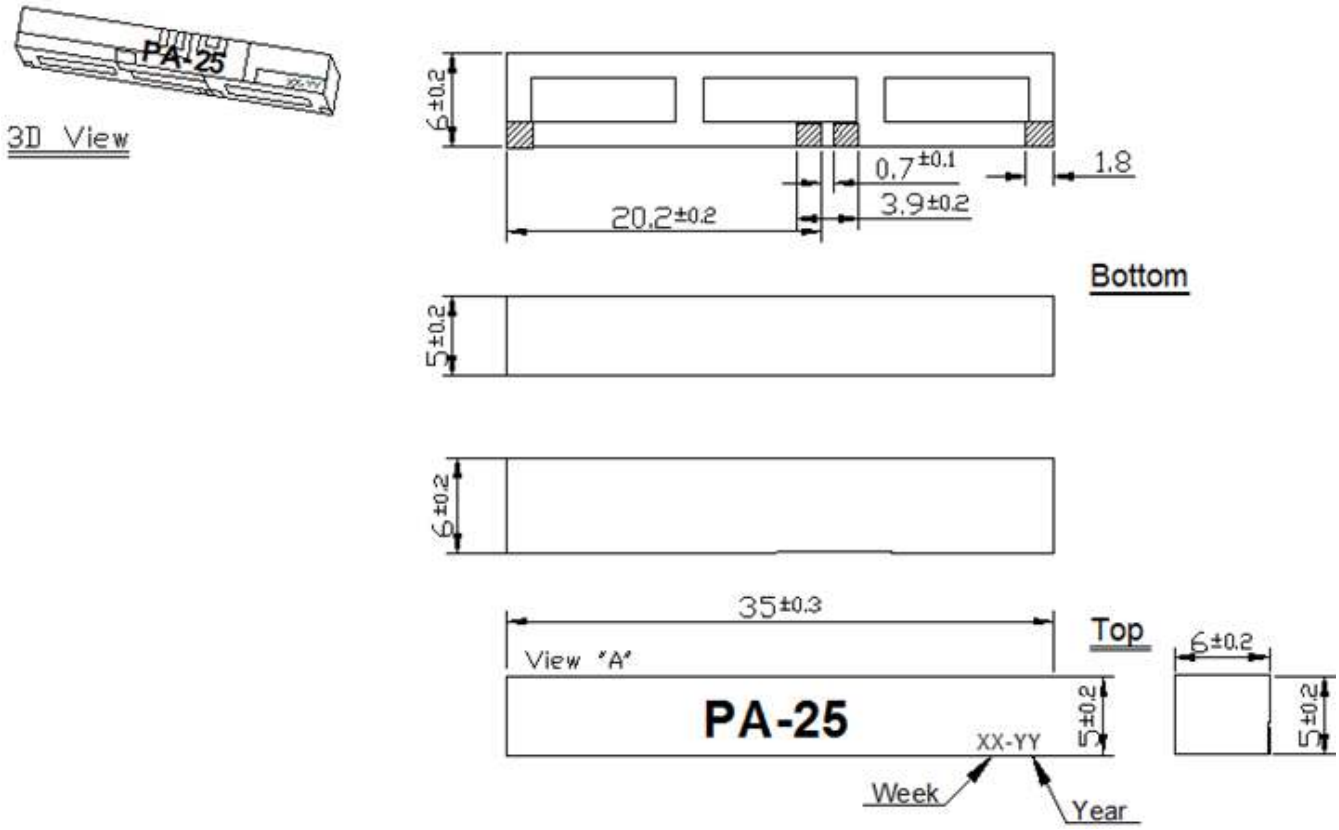


Figure 15. Mechanical Drawing of the PA.25 Antenna.

ASGP.1575.25B.4.A.01 Mechanic Drawing

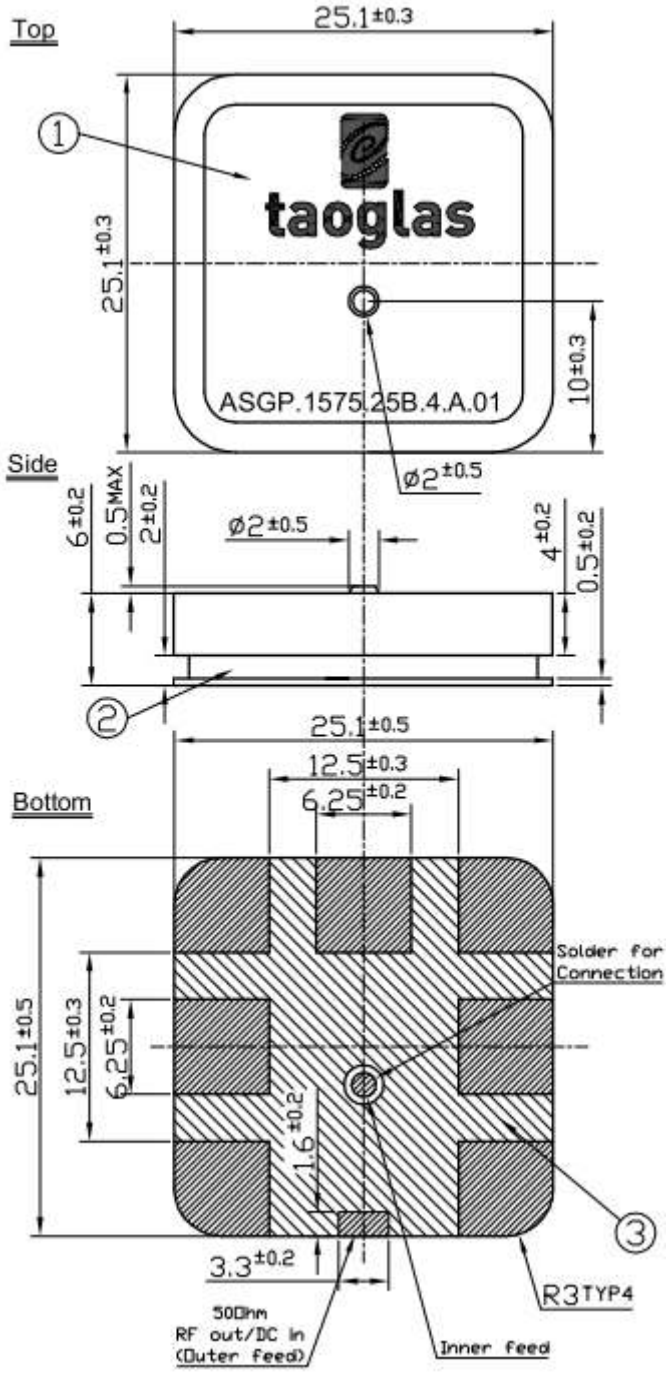


Figure 16. Mechanical Drawing of the ASGP.1575.25B.4.A.01 Active GPS Antenna

6. Layout Dimensions

6.1 PA.25 Layout Dimension

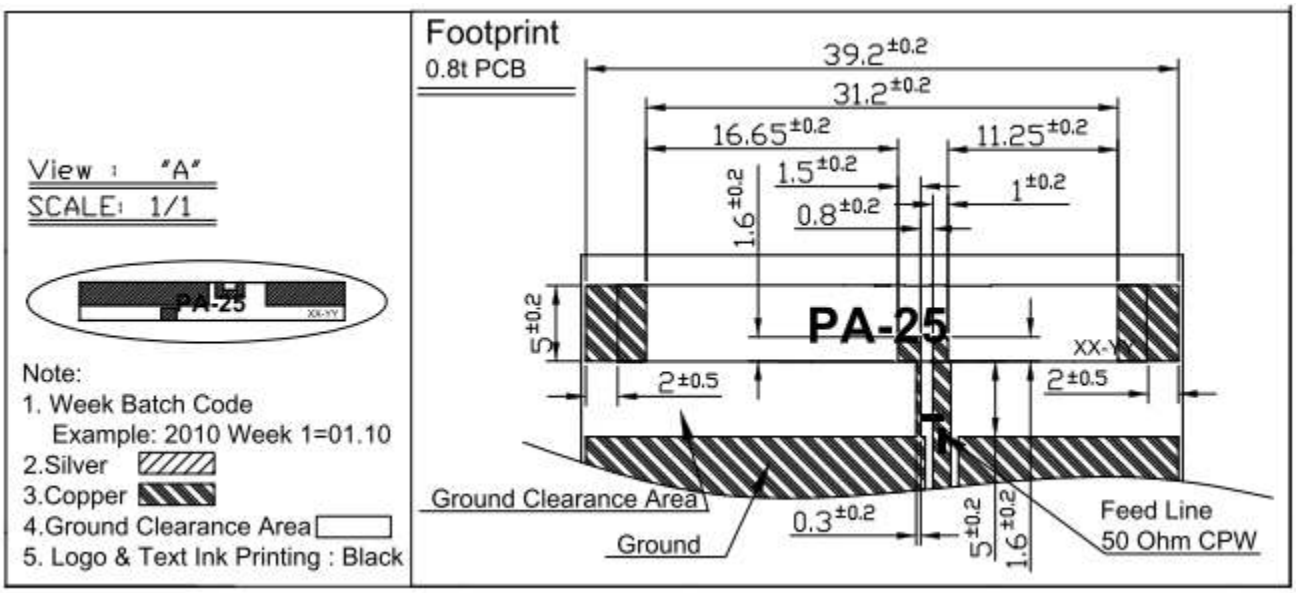
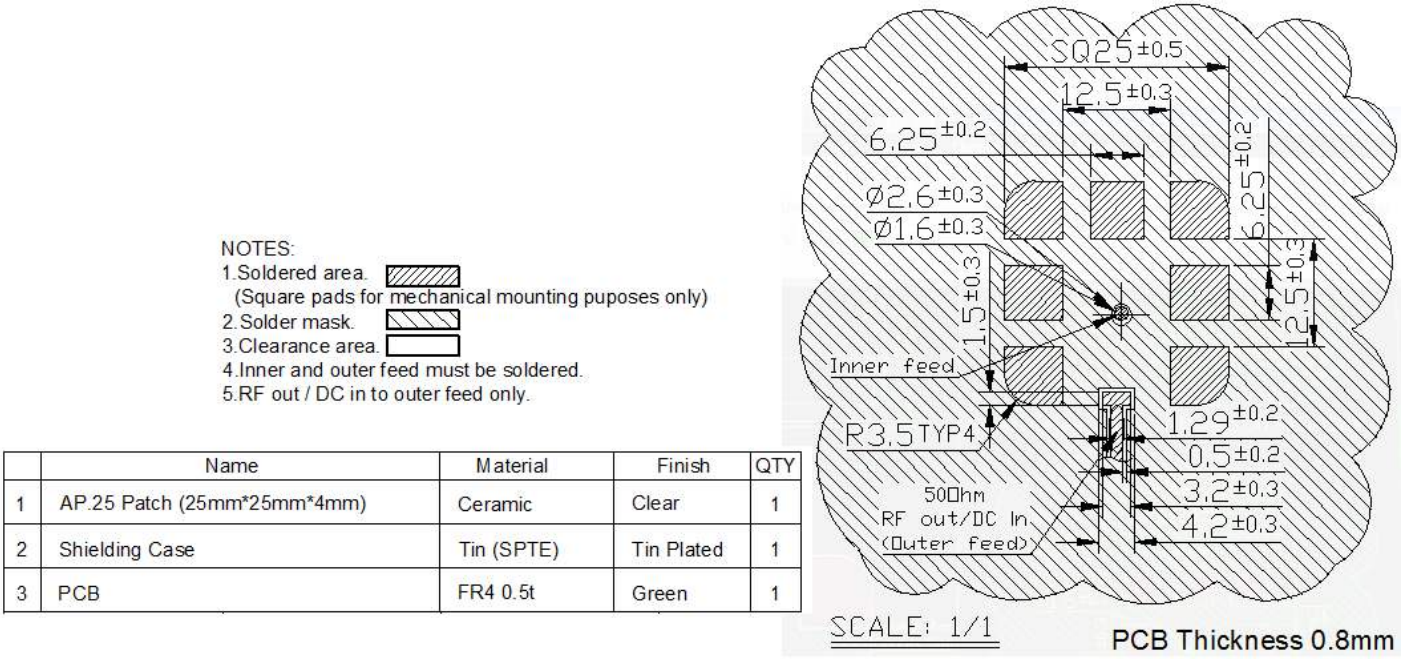


Figure 17. Layout dimensions of the PA.25 Antenna.

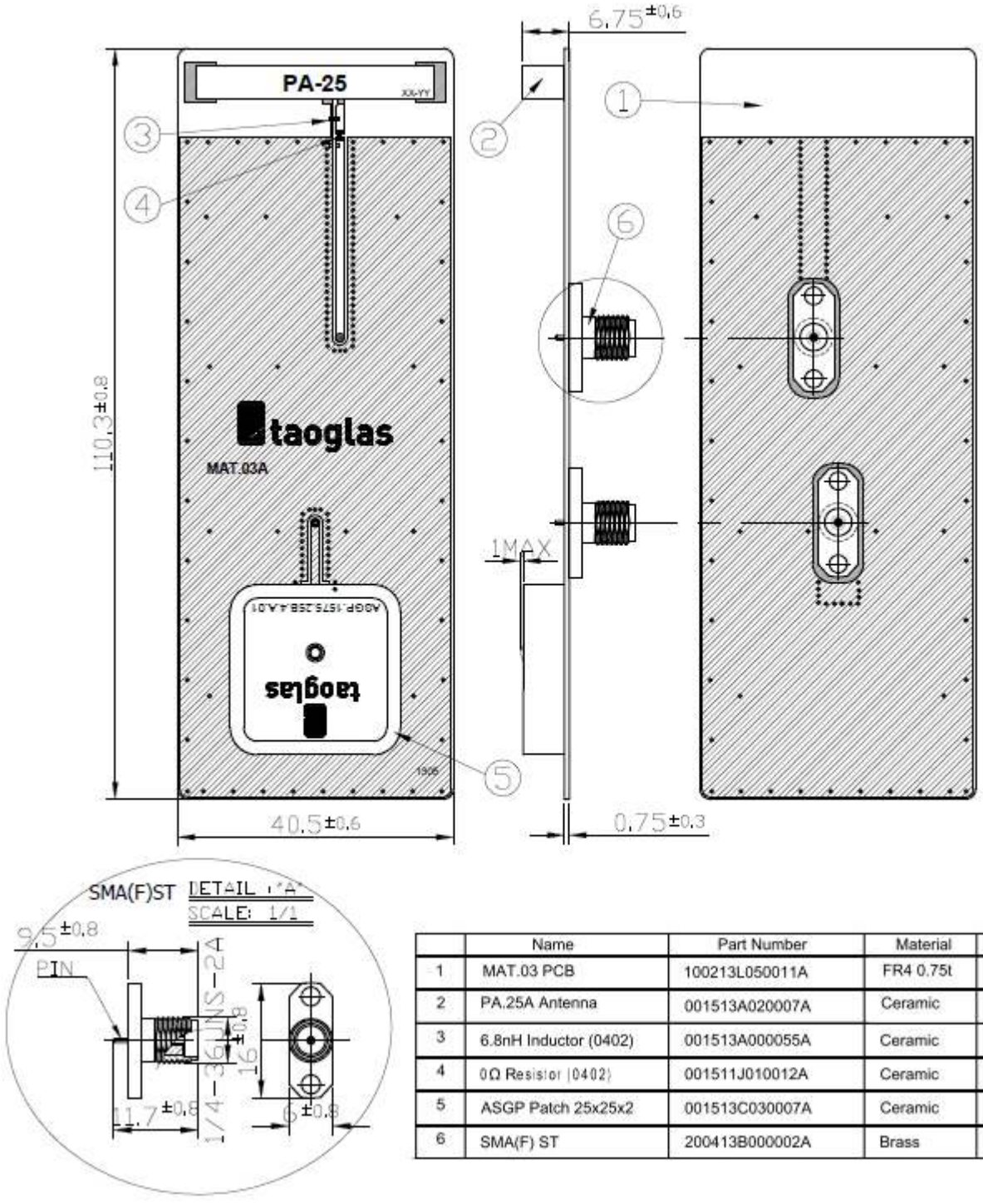
6.2 ASGP.1575.25B.4.A.01 Layout Dimension



	Name	Material	Finish	QTY
1	AP.25 Patch (25mm*25mm*4mm)	Ceramic	Clear	1
2	Shielding Case	Tin (SPTE)	Tin Plated	1
3	PCB	FR4 0.5t	Green	1

Figure 18. Layout dimensions of the ASGP.1575.25B.4.A.01 Antenna

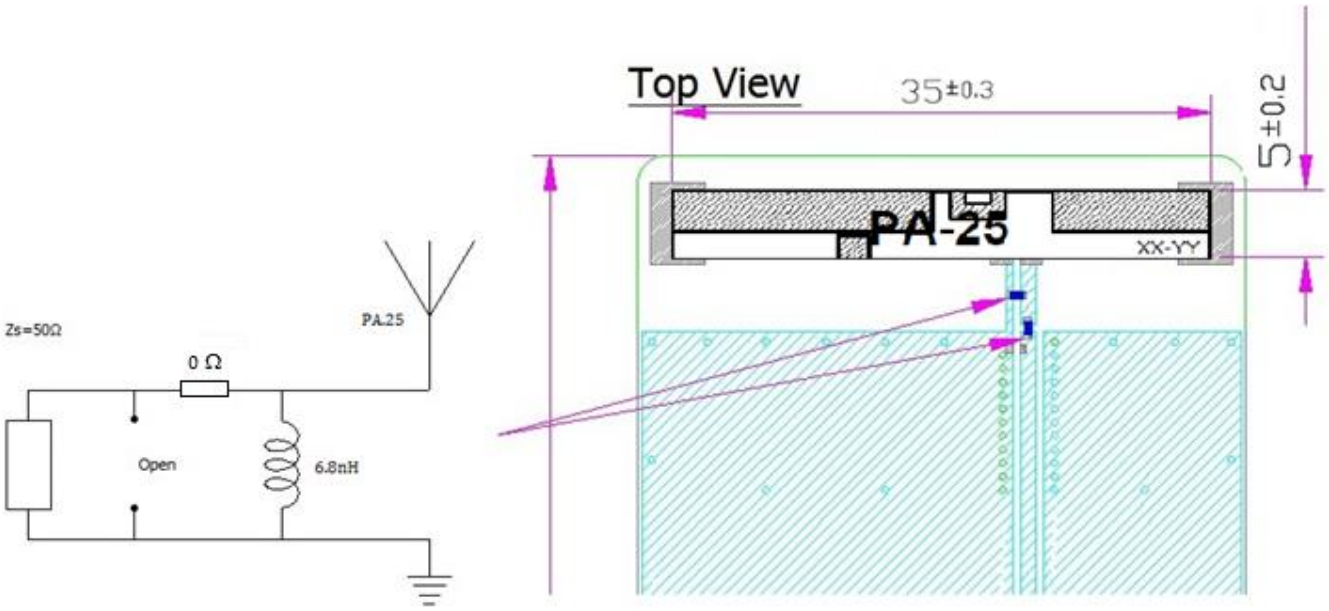
7. EVB Dimension

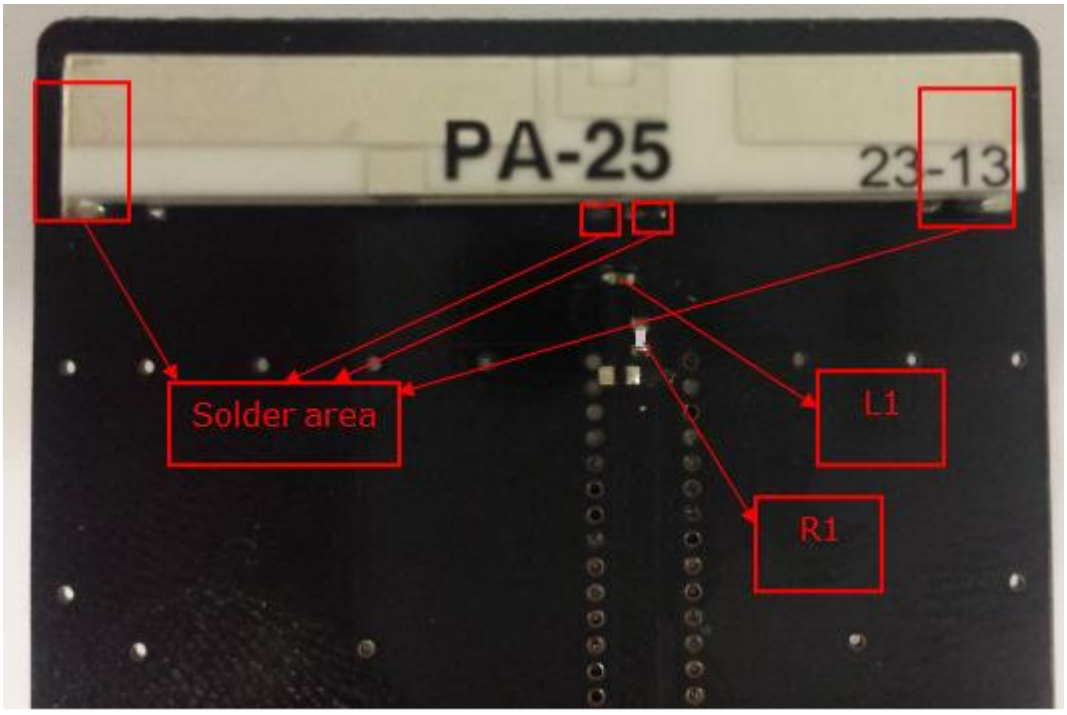


	Name	Part Number	Material	Finish	QTY
1	MAT.03 PCB	100213L050011A	FR4 0.75t	Black	1
2	PA.25A Antenna	001513A020007A	Ceramic	N/A	1
3	6.8nH Inductor (0402)	001513A000055A	Ceramic	N/A	1
4	0Ω Resistor (0402)	001511J010012A	Ceramic	N/A	1
5	ASGP Patch 25x25x2	001513C030007A	Ceramic	N/A	1
6	SMA(F) ST	200413B000002A	Brass	Gold	2

Figure 19. EVB Dimension of MAT.03A Antenna

8. Matching Circuit (PA.25)

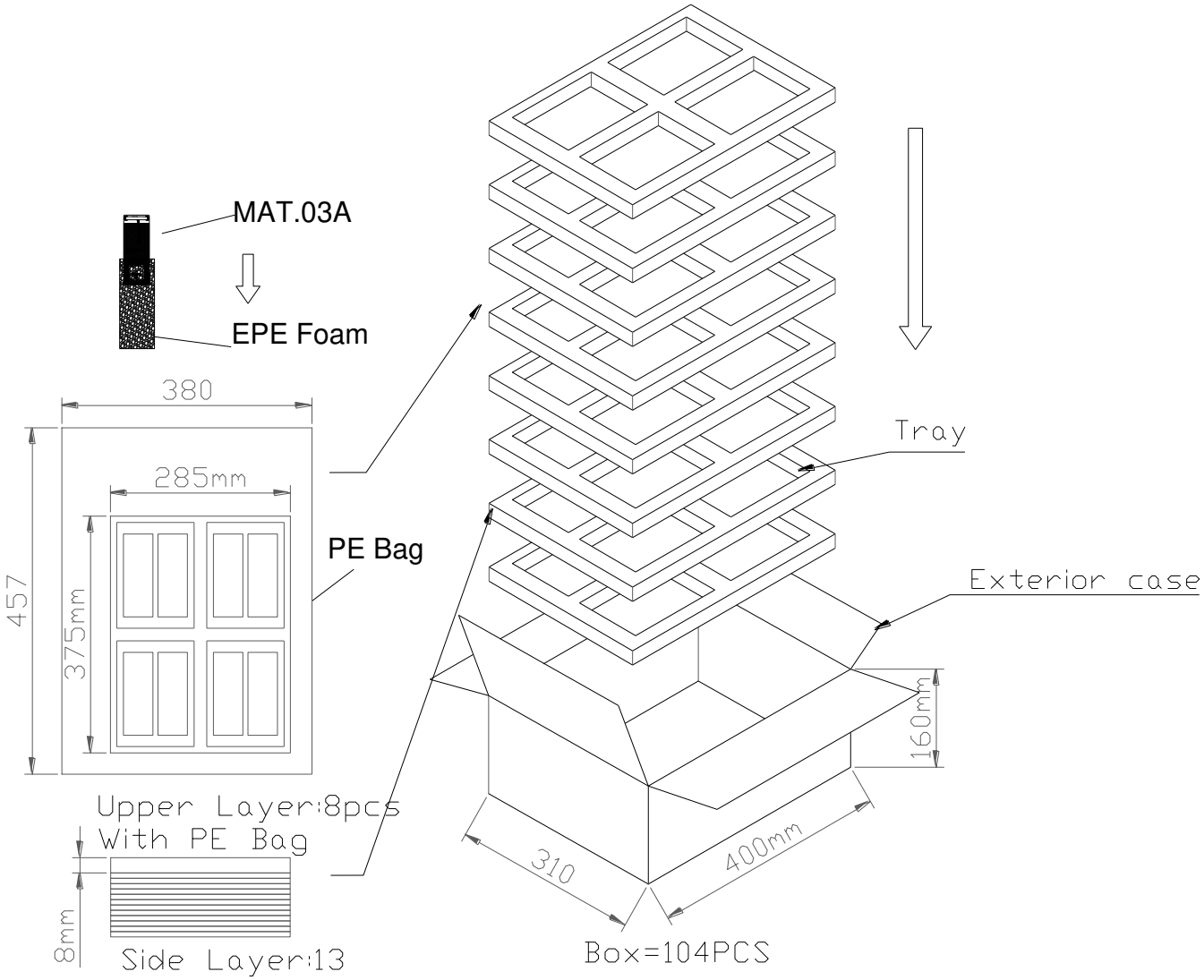




Circuit Symbol	Size	Description
L1	0402	6.8nH inductor (001513A000055A)
R1	0402	0Ω resistor (001511J010012A)

Figure 20. Recommended matching circuit

9. Packaging


MAT.03A
EPE Foam
380
285mm
457
375mm
PE Bag
Upper Layer:8pcs
With PE Bag
8mm
Side Layer:13
Tray
Exterior case
160mm
310
400mm
Box=104PCS

10. Recommended Reflow Temperature Profile

PA.25 and ASGP.1575.25B.4.A.01 can be assembled following either Sn-Pb or Pb-Free assembly processes. The recommended soldering temperatures are as follows:

Phase	Profile Features	Sn-Pb Assembly	Pb-Free Assembly (SnAgCu)
Ramp-Up	Avg. Ramp-Up Rate (T_{smax} to TP)	3°C/second (max)	3°C/second (max)
Preheat	Temperature Min (T_{smin})	100°	100°
	Temperature Max (T_{smax})	150°	150°
	Time (t_{smin} to t_{smax})	60-120 seconds	60-120 seconds
Reflow	Temperature (T_L)	183°C	217°C
	Total Time Above T_L b(t_L)	60-150 seconds	60-150 seconds
Peak	Temperature (T_p)	235°C	260°C
	Time (tp)	10-30 seconds	20-40 seconds
Ramp-Down	Rate	6°C/second (max)	6°C/second (max)
Time from 25°C to peak Temperature		6 minutes max	8 minutes max

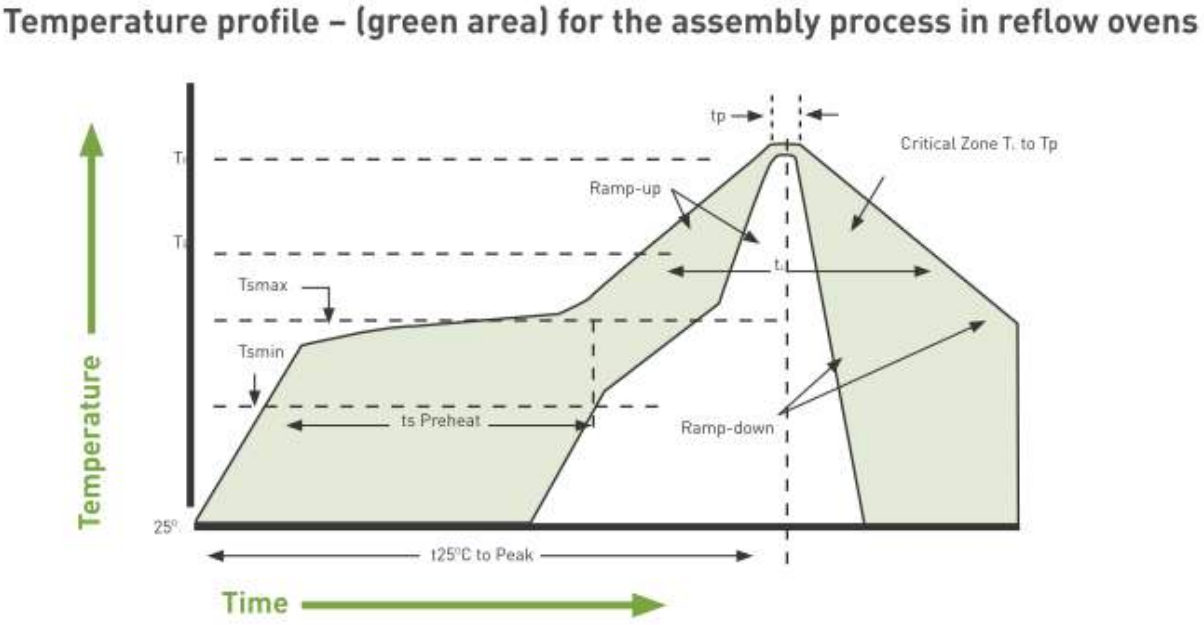


Figure 21. Temperature profile for the assembly process in reflow ovens