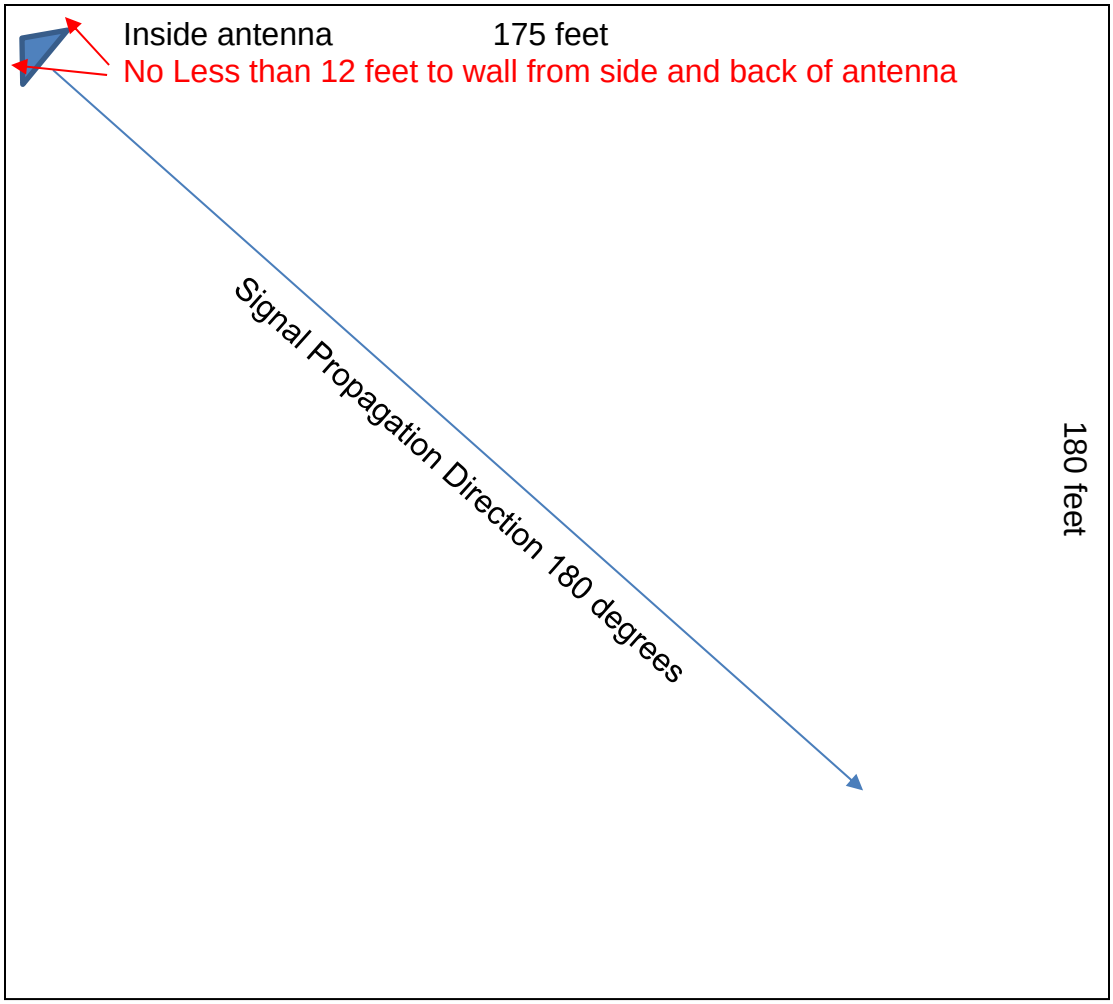
**PSA Airlines Hangar Test System for Airframe GPS Receivers**

ORF Hangar

PSA intends to use a GPS Repeater system, the GPS Networking model GPS-ITS, that receives GPS from an outside antenna and re-transmits the signal **inside the all metal** PSA Hangar. Signal levels will be kept to a minimum and will not exceed -140dBm 100 feet outside of hangar.

PSA intends to use this to test aircraft GPS receivers while aircraft are undergoing repairs and recertification and has determined that this is the safest and best way without having to move a disabled and disassembled aircraft to the outside of the hangar.




Directional antenna transmits signal towards opposite corner. Signal outside hangar at 100 feet: less than -140dBm.

Distances on diagram are based on a directional antenna mounted in a corner and propagating maximum gain to nearest far wall 175 feet away.

The antenna is mounted in a corner and aimed away from this corner but is mounted no closer than 12 feet in from the nearest of the two corner walls behind with a maximum of 2dB of gain directed towards those closest walls. Therefore: Free space loss at operating frequency to the inside wall distance of 12 feet = -47.68 dB. Lowering repeater amp gain to 25dB, calculated radiated power (Avg

receive power L1 North America + Total Sys gain) = -73 dBm Repeated signal power at inside wall 12 feet away from TX antenna = -120.68 dBm

Going beyond the wall and out 100 feet:
=-1*(36.6+(20*LOG10(((12+100)/5280)*1575)))+(-73) = -140.07729 dBm

Per NTIA 8.3.28, 6. The maximum equivalent isotropically radiated power (EIRP) must be such that the calculated emissions are no greater than -140 dBm/24 MHz as received by an isotropic antenna at a distance of 100 feet (30 meters) from the building where the test is being conducted. The calculations showing compliance with this requirement must be provided with the application for frequency assignment and should be based on free space propagation with no allowance for additional attenuation (e.g., building attenuation.)

Use of this Experimental RNSS Test Equipment will be limited to the purpose of testing GPS receivers on aircraft that are undergoing repairs and recertification.

GPS SOURCE

*rce for quality GNSS Networking Solutions and Design Services, Now!*

GPS NETWORKING

# GPS Networking Link Budget Calculator

PSA Airlines ORF Hangar 1

FRN:0004415857

**The following spreadsheet calculates the effective radiated power for a GPS Networking reradiating system as well as the effective signal power at given range in dBm. Enter the components for the strongest repeating path in your system into the section with the red border. NTIA regulations require that the repeated signal be weaker than -140 dBm when measured 100 FT outside of the reradiated structure. Please feel free to reach out to GPS Networking if you need assistance.**

| Receive Ant Gain | Ant Cable Insertion Loss | Repeater Amp Gain | Repeater Ant Gain Best Case | Building Length (Feet) | Repeated Signal Power @ End of Building In dBm | Repeated Signal Power @ 100' Outside of Building In dBm |
|---|---|---|---|---|---|---|
| 33 | -3 | 25 | 2 | 12 | -120.68 | -140.0772932 |

**GPS Carrier Frequency MHz**
1575

**Avg Receive Power L1 dBm North America**
-130

**Free Space loss with Isotropic Antennas**
-47.68

**Total System Gain**
57

**Range in Miles**
0.00

**Range in Meters**
3.74

**Range in Kilometers**
0.00

**Total Signal Power @ Range in Watts**
855.7E-18

**Radiated Power dBm**
-73

**Transmitted Power (W)**
25.1E-12

**Effective Radiated Power (W)**
50.1E-12

**Effective Radiated Power (dBW)**
-103

## System Receive Antenna

| Part Number | Gain/Loss (dB) |
|---|---|
| L1GPSA-N | 33 |

## Passive Components (Cause Loss)

| Part Number | Gain/Loss (dB) |
|---|---|

## Amplified Components (Cause Gain)

| Part Number | Gain/Loss (dB) |
|---|---|
| LA30RPDC | 25 |

## Repeating Antennas

| Part Number | Gain/Loss (dB) |
|---|---|
| L1PRRKA-S | 2 |

## Cable Runs

| Cable Type | Loss Per 100 Feet (LMR400) = -6 | Feet of Cable | Cable Losses |
|---|---|---|---|
| LMR400 | -6 | 50 | -3 |
| | | | 0 |

# GPS-ITS

## GPS Indoor Testing Solution
## Technical Product Data

## Features

- **Amplified Roof Antenna**
  Gain ≥ 35dB

- **Mounting Kit Hardware**
  Roof Antenna Mount & Adjustable Re-Radiating Mount

- **Variable Gain Amplifier with LCD Display**
  Push Button Control in 1dB Increments 0-30dB gain

- **LMR 400 Ultra Flex Cable 50 ft**
  (Custom Lengths available at additional cost)

## Description

The GPS ITS (GPS Indoor Testing Solution) is a complete re-radiating system that allows re-radiation of the GPS L1 signal indoors. The GPS-ITS consists of an active roof antenna, a re-radiating amplifier with a wall mount plug-in transformer that powers the entire system, and a passive re-radiating antenna. The GPS L1 signal from the roof antenna is amplified and radiated indoors. Thus, if a receiver has line of sight with the re-radiating antenna, it can receive the GPS signal indoors up to 100 feet.

## **Roof Antenna** Specifications, $T_A = 25^0C$

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Frequency | L1 | | 1.575 | | GHz |
| Bandwidth | | | 20 | | MHz |
| Out Imped. (1) | | | 50 | | Ω |
| Pre-Amp Gain | | | 35 | 38 | dB |
| Noise Figure | | | 2.75 | | dB |
| Output SWR | | | | 2.0:1 | - |
| Filtering | 1626 MHz | -20 | | | dB |
| | 1500 MHz | -10 | | | dB |
| Req. DC Input V. | | 4.5 | | 5.5 | Vdc |
| Current | | | 22 | | mA |

| **RF Connector Options** | | |
|---|---|---|
| Connector Options | CONNECTOR STYLE | CHARGE |
| | Type N-female | NC |

## Re-Radiating Amplifier Electrical Specifications, $T_A = 25^0C$

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Freq. Range | Ant – J1 | 1.1 | | 1.7 | GHz |
| In/Out Imped. | Ant, J1 | | 50 | | Ω |
| Gain (1) | | 0 | | 30 | dB |
| Input SWR (2) | J1 - 50Ω | | | 1.8:1 | - |
| Output SWR | Ant - 50Ω | | | 1.8:1 | - |
| Noise Figure | Ant – J1 | | 3.3 | 3.5 | dB |
| Current | | | | 20 | mA |
| Gain Flatness | \| L1 – L2 \| ; Ant – J1 | | 0.5 | 1 | dB |
| Reverse Isolation | J1 – Ant | 35 | | | dB |
| Group delay Flatness | $\tau_{d,max} - \tau_{d,min}$ : Ant – J1 | | | 1 | ns |

| **Re-Radiating Amp System Power Supply Options** | | |
|---|---|---|
| Source Voltage Options | VOLTAGE INPUT | STYLE |
| | 110VAC | Transformer (Wall Mount) |
| | 220 VAC | Transformer (Wall Mount) |
| | 240 VAC (United Kingdom) | Transformer (Wall Mount) |
| | Customer Supplied DC 9-32 VDC | Military Style Connector |
| **Re-Radiating Amp Gain Control** | | |
| Variable Gain with LCD Display | 0-30dB gain range with push button control in 1dB increments | |

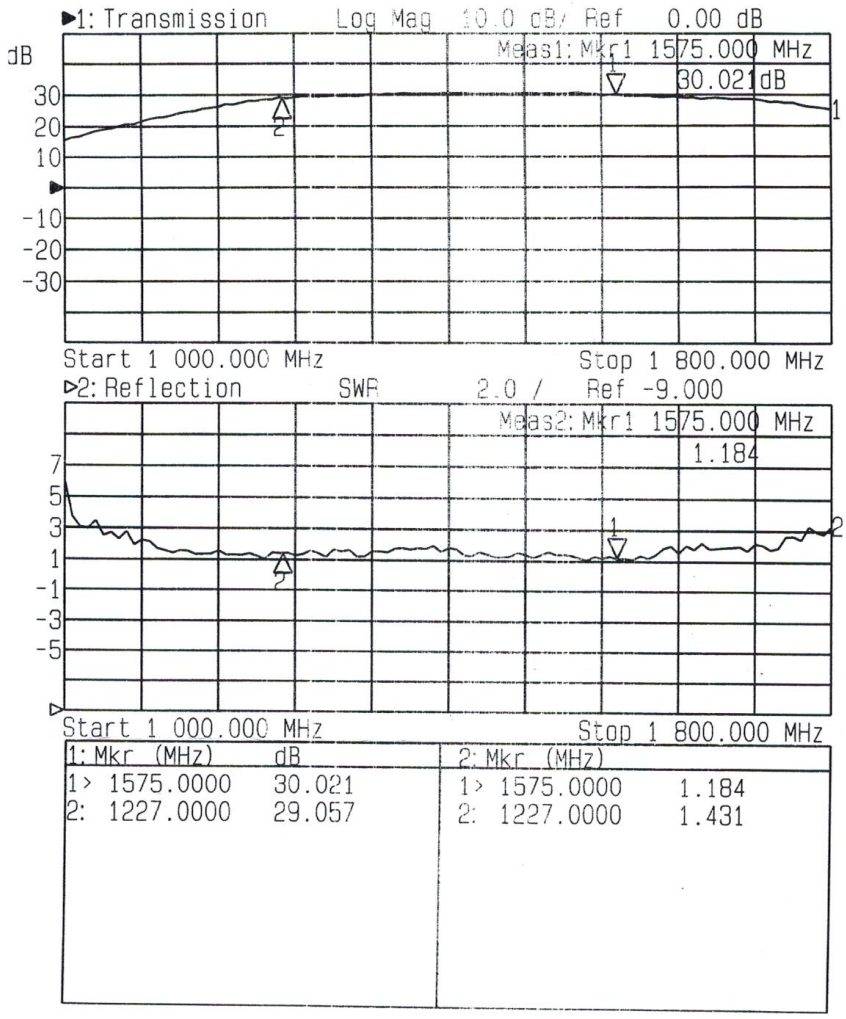
## Re-Radiating A**ntenna** Electrical Specifications, $T_A = 25^0C$

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Frequency | L1 | | 1.575 | | GHz |
| Bandwidth | | | | 20 | MHz |
| Impedance | | | 50 | | Ω |
| Peak Gain | | | 3 | | dBic |
| Output SWR | | | | 1.5:1 | - |
| Polarization | | | RHCP | | - |

## Performance:

**ITS** (Re-Radiating Kit Max Gain)

Input SWR (Ant. Port) and Frequency Response: Ant. To J1) (Typical, type N connectors):



Mechanical

## Re-Radiating Kit Amplifier

Dimensions: Height: 1.3”

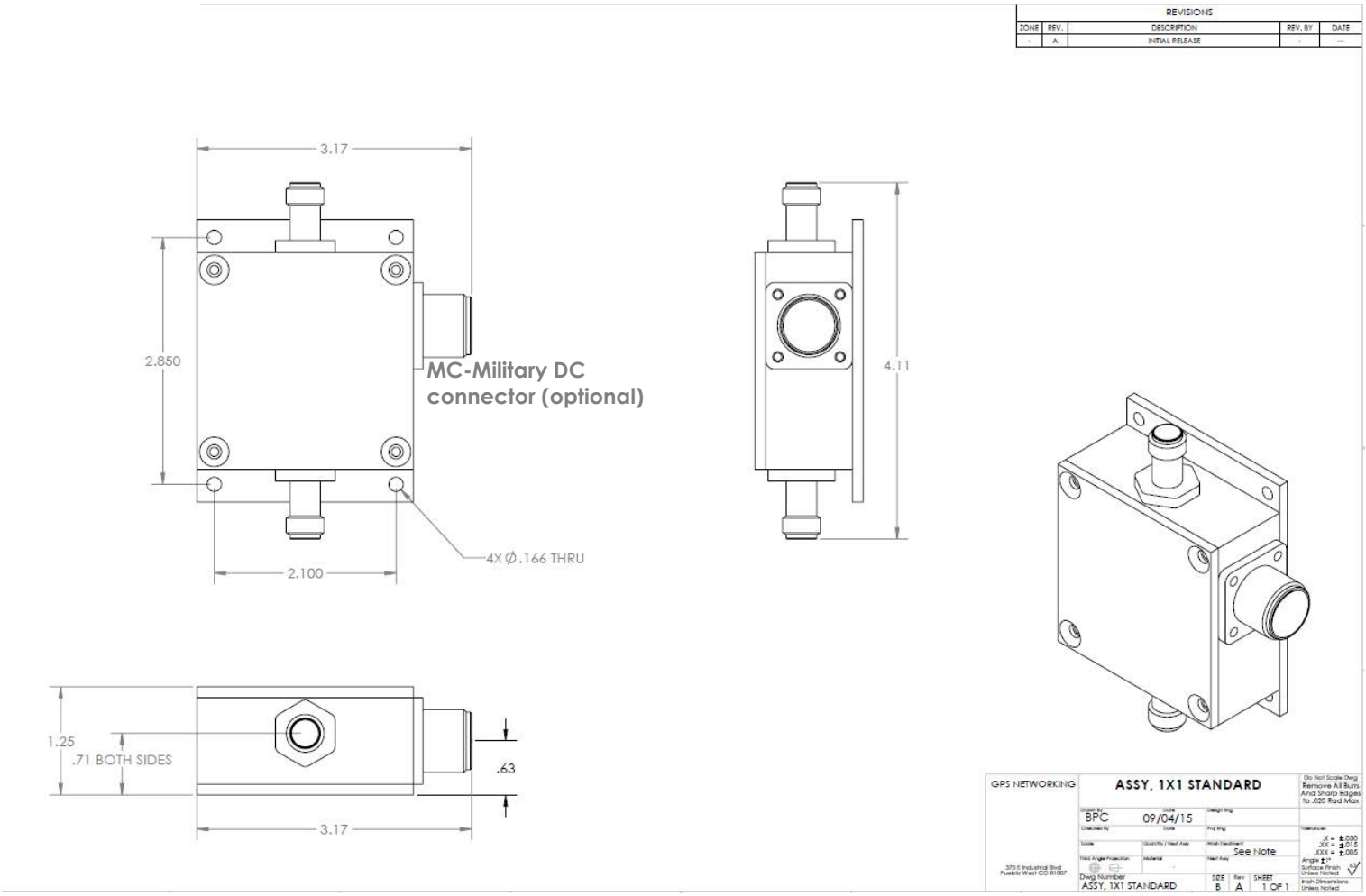
Length (not including connectors) Body: 2.5”
Base Plate: 3.25”

Width (not including connectors): 2.5”

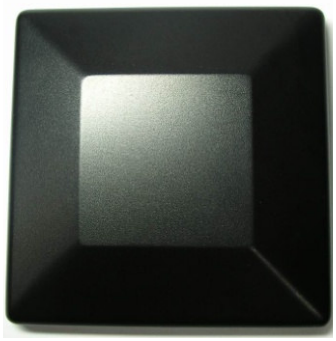
Weight: 11 oz. (316 grams)

Operating Temp. Range: -40$^{o}$ to + 75$^{o}$C

Finish Housing and Base Plate: ELECTROLESS NICKEL PLATED
MIL-C-26074C CLASS 1, .0001-.0003 MAX
Finish Lid: ANODIZE, TYPE II, CLASS 2, BLACK, per MIL-A-8625



# ALLISCOM
# PA175
# GPS ANTENNA
# Data Sheet



**Model No.** **PA175**

**Feature**
- High Efficiency - 90%
- Low Profile Design
- Low Loss - 0.2%

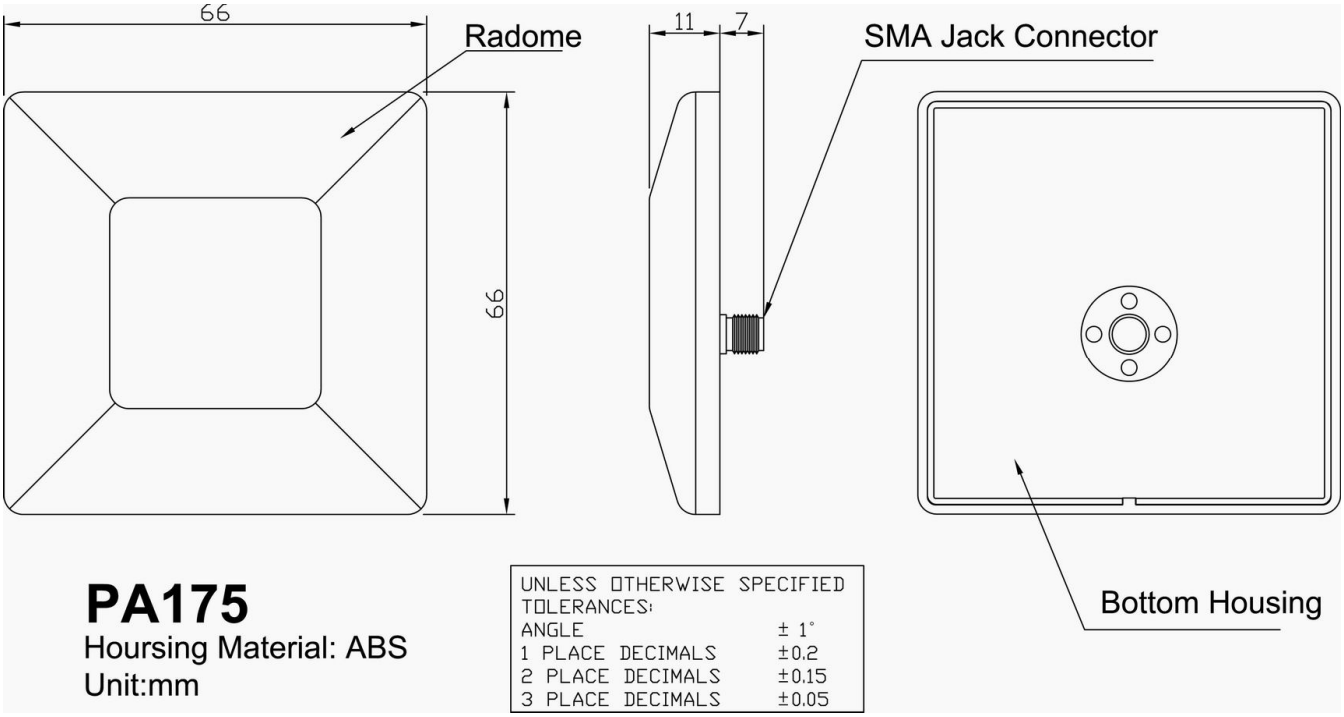
**Description** Allis Communications 1.575 MHz Antenna is an ideal solution for GPS reception. The Antenna is a GPS Passive Antenna for rebroadcasting GPS signal inside a building.

# 1. Specifications

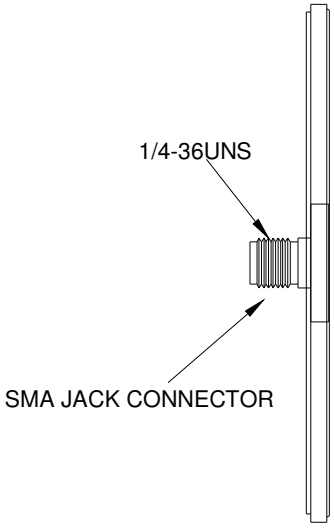
| | |
|---|---|
| Antenna: | |
| Frequency | 1575.42±3 MHz |
| VSWR | 1.5 Max. |
| Bandwidth | 20 MHz Min. @ -10 dB |
| Impedance | 50 Ω |
| Efficiency | 90.1% @1575MHz |
| Axial Ratio | 3 dB Max. θ=0° |
| Peak Gain | 4 dBic Min. |
| Mechanical: | |
| Weight (Without Cable) | 48 grams Max. |
| Size | 66X 66 X18 mm |
| Connector | SMA Jack（Female） |
| Housing Color | Black |
| Housing Material | ABS |
| Environmental: | |
| Working Temperature | -40°C< T< +85°C |
| Storage Temperature | -50°C< T< +95°C |

# 2. Shape and Dimension

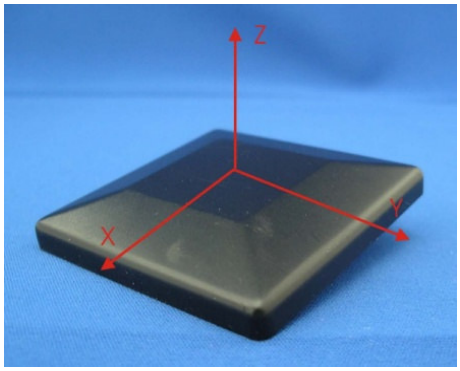
a. Dimension



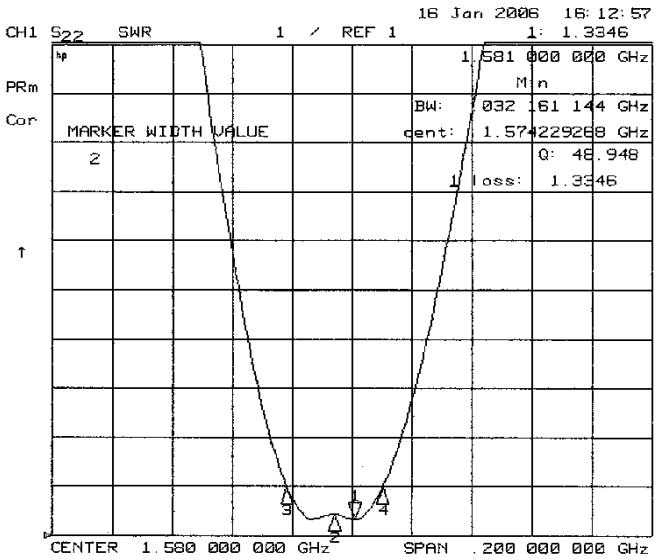
b. SMA Jack (Female) Connector



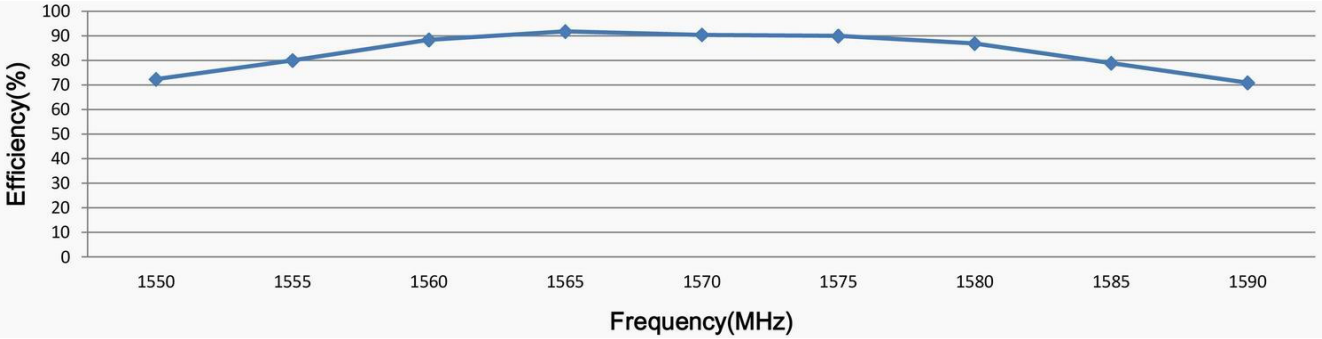

## 3. Antenna Characteristics



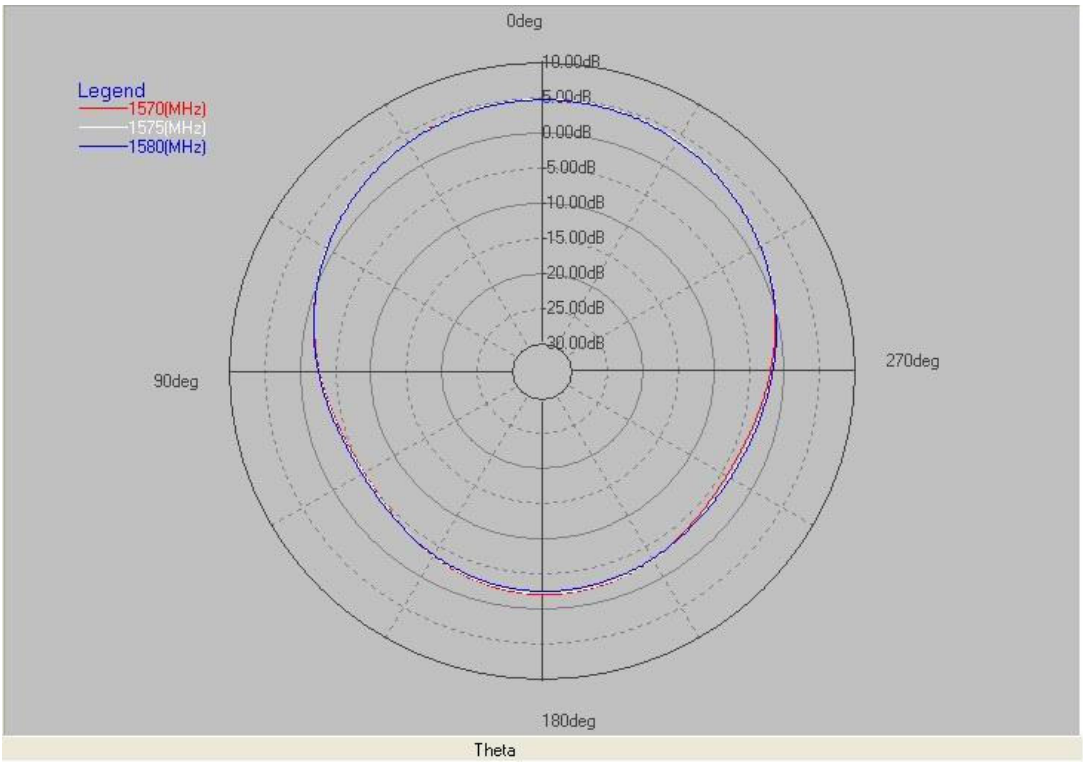

a. VSWR



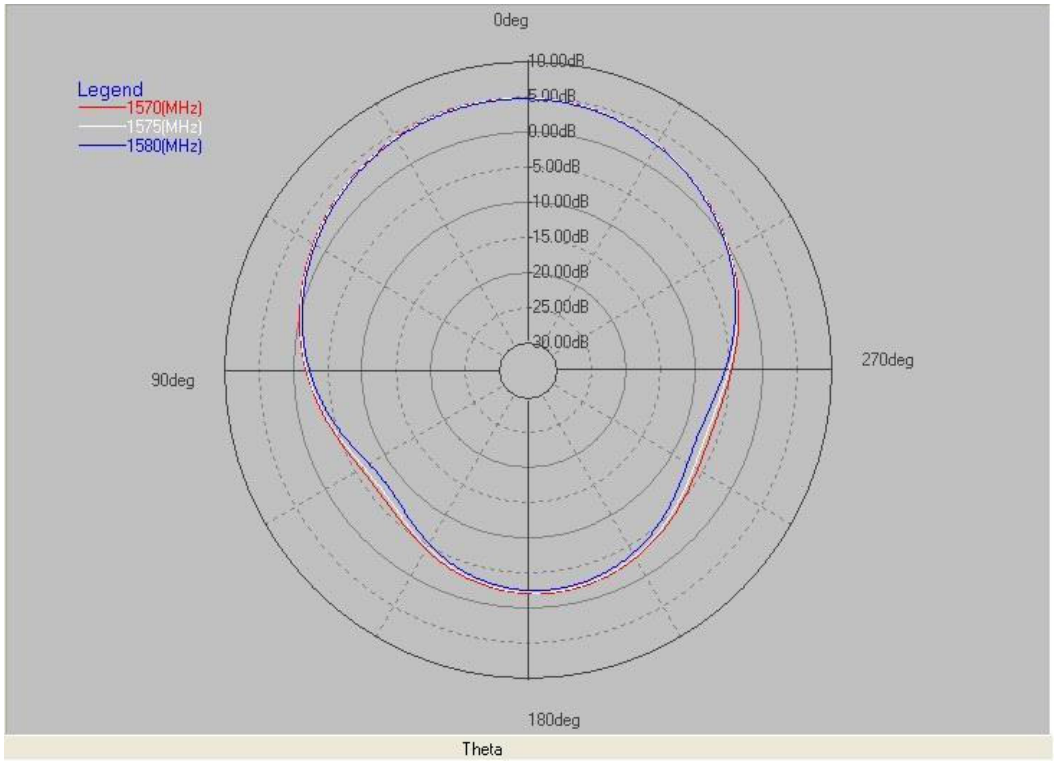
## b.Efficiency




## c.X-Z Plane



d.Y-Z Plane




e. Axial Ratio: 0.8dB