CERAMIC GPS/BEIDOU/GLONASS ANTENNA (25MM*25MM*4MM)

1.0 SCOPE

This specification describes the antenna application and surrounding. The information in this document is for reference and benchmark purposes only. The user is responsible for validating antenna RF performance based on the user's actual implementation.

All measurements are done of the antenna mounted on the recommended PCB with VNA Agilent 5071C and OTA chamber.

Antenna illustrations in this document are generic representations. They are not intended to be an image of any antenna listed in the scope.

2.0 PRODUCT DESCRIPTION

A. DEFINITIONS OF TERMS

The overall antenna size is 25mm*25mm*4mm (Length* Width *Height). There are one feeding pad. See Figure 1.

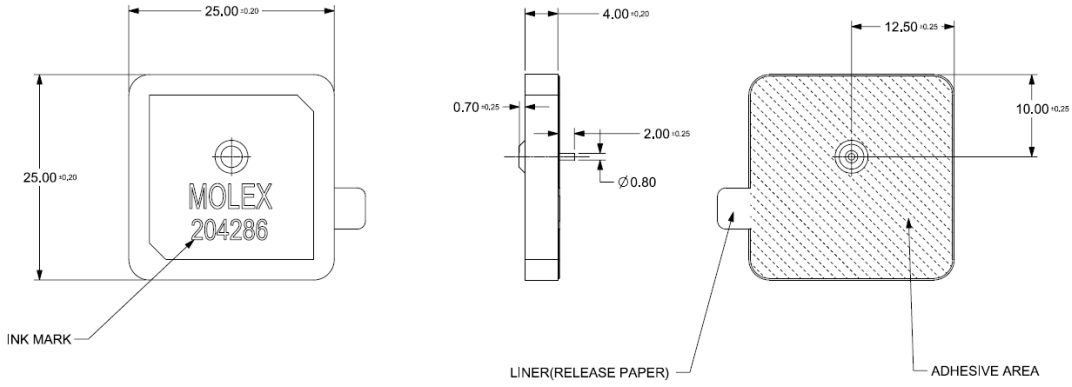


FIGURE 1 DIMENSION OF THE CERAMIC GPS/BEIDOU/GLONASS ANTENNA

PRE-RELEASE REFERENCE USE ONLY

B. RF PERFORMANCE OF ANTENNA MOUNTED ON 70MM*70MM SIZE GROUND PLANE IN FREE SPACE

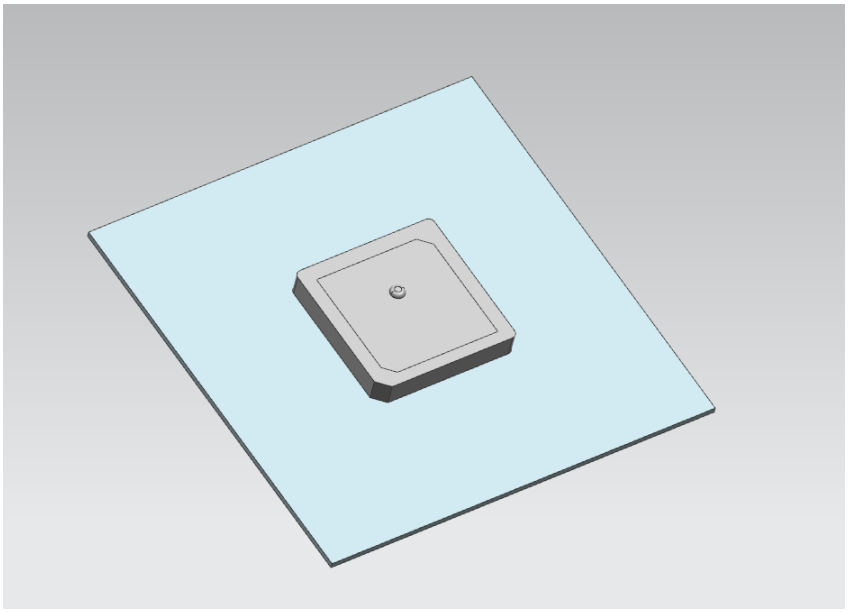


FIGURE 2.1 REFERENCE ANTENNA LOCATION

DESCRIPTION	Test Condition	Requirements		
Frequency Range	Measure antenna on recommended PCB through VNA E5071C	1561MHz +/-5MHz	1575MHz +/-5MHz	1602MHz +/-5MHz
Return Loss	Measure antenna on recommended PCB through VNA E5071C	< -10 dB		
Peak Gain	Measure antenna on recommended PCB through OTA chamber	5.2dBi (Max)	2.1dBi (Max)	4.1dBi (Max)
Avg. Total Efficiency	Measure antenna on recommended PCB through OTA chamber	>70%	>70%	>75%
Polarization	Measure antenna on recommended PCB through OTA chamber	Linear		
Avg. Axial Ratio	Measure antenna on recommended PCB through OTA chamber	<13dB	<7dB	<12dB
Input Impedance	Measure antenna on recommended PCB through VNA E5071C	50Ohms		

PRE-RELEASE REFERENCE USE ONLY

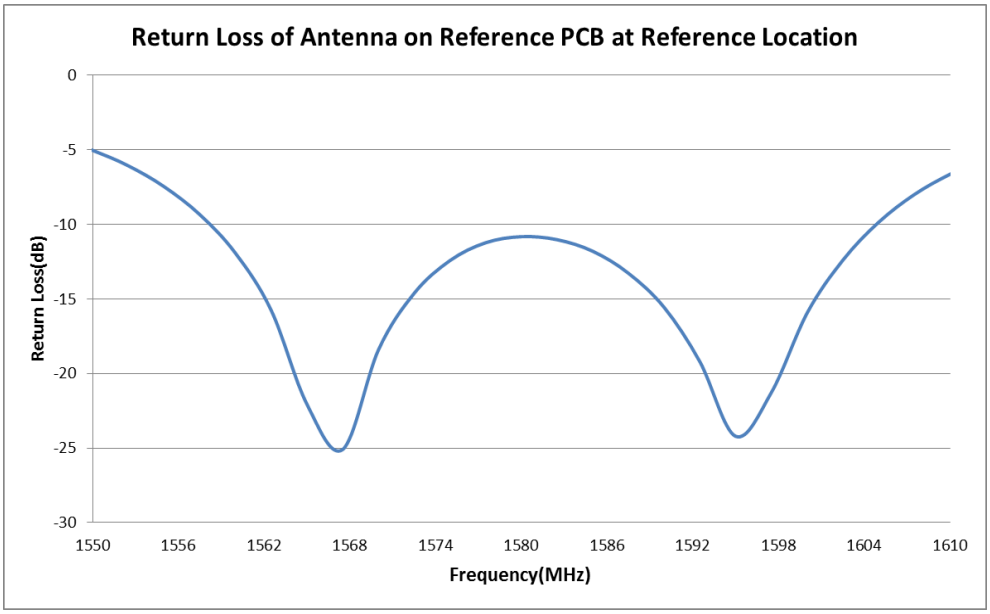


FIGURE 2.2 RETURN LOSS OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT REFERENCY LOCATION

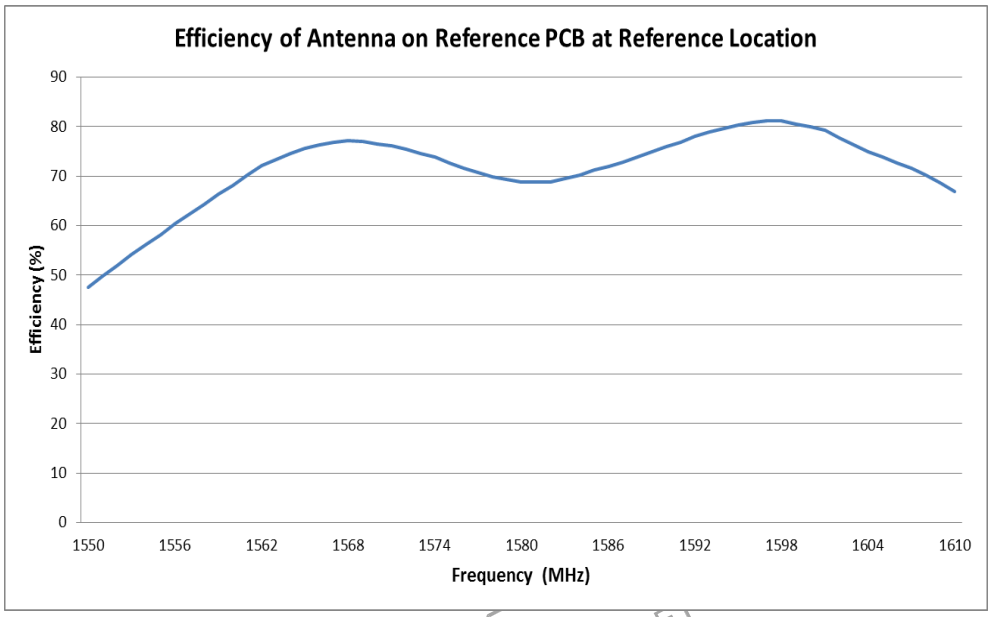


FIGURE 2.3 EFFICIENCY OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT REFERENCY LOCATION

PRE-RELEASE REFERENCE USE ONLY

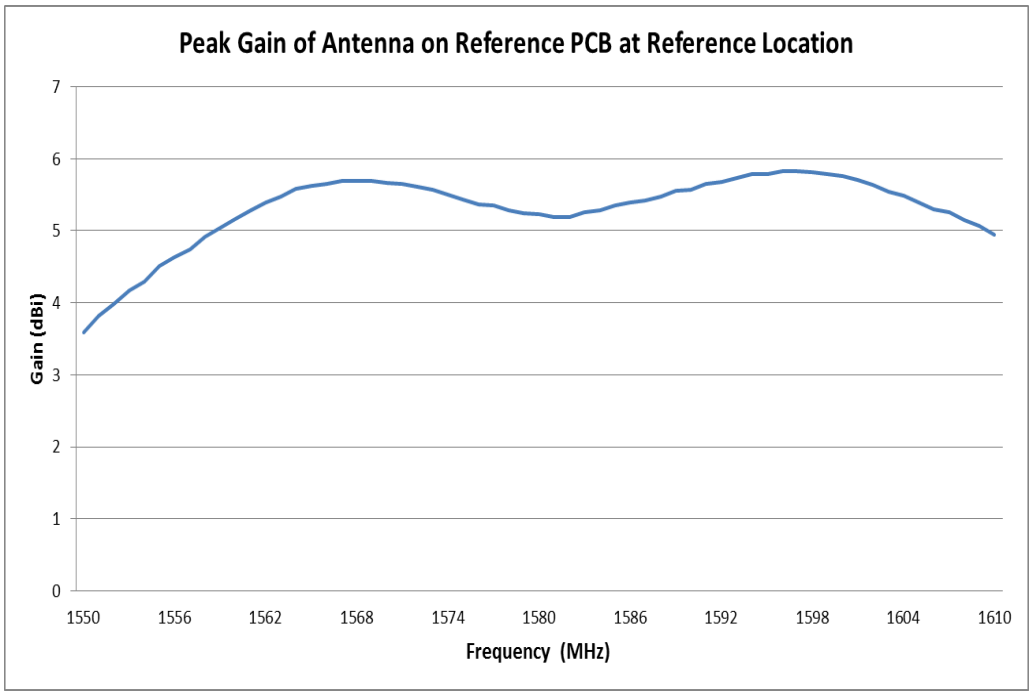


FIGURE 2.4 PEAK GAIN OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT REFERENCE LOCATION

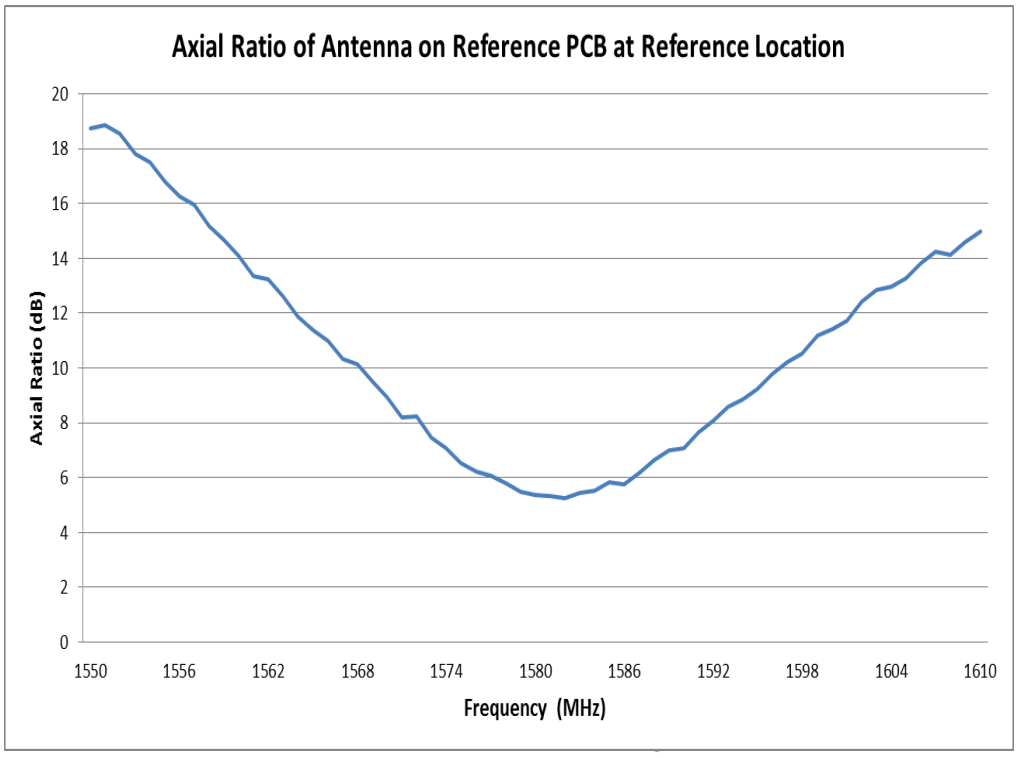


FIGURE 2.5 AXIAL RATIO OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT REFERENCY LOCATION

3.0 REFERENCE DOCUMENTS

- Engineering Drawing : E-204286-001
- Product Specification : PS-204286-001
- Packaging Information – Refer to the Molex related packaging drawings.

4.0 RF Performance as a function of implementation

4.1 ANTENNA RF PERFORMANCES AS A FUNCTION OF DIFFERENT LOCATIONS ON THE GROUND PLANE

Three locations have been evaluated, and these configurations are show in figure 4.1. The figure 4.1.1-4.1.4 are shown the return loss, the efficiency, the peak gain and axial ratio.

The location which gives the best RF performance is location 3. Location 3 (center location) is the recommended location for the antenna.

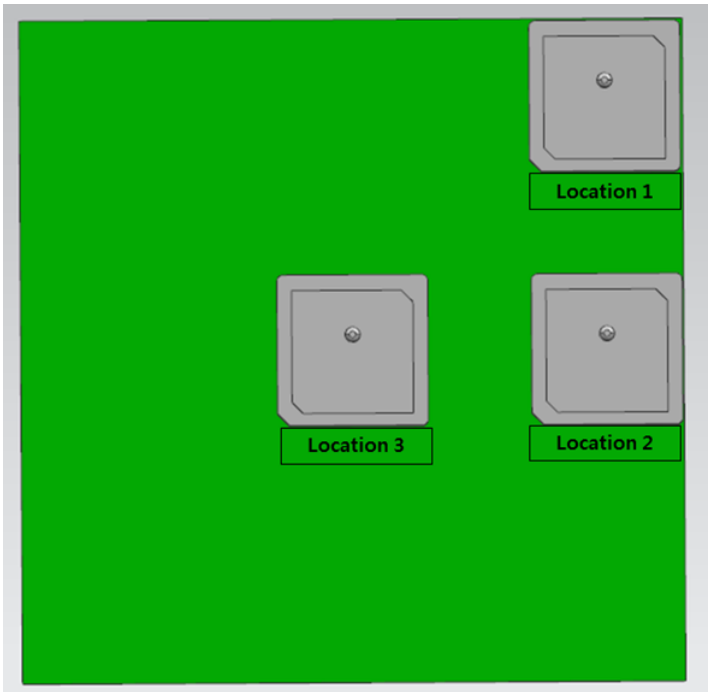


FIGURE 4.1 THREE LOCATIONS ON REFERENCE PCB

PRE-RELEASE REFERENCE USE ONLY

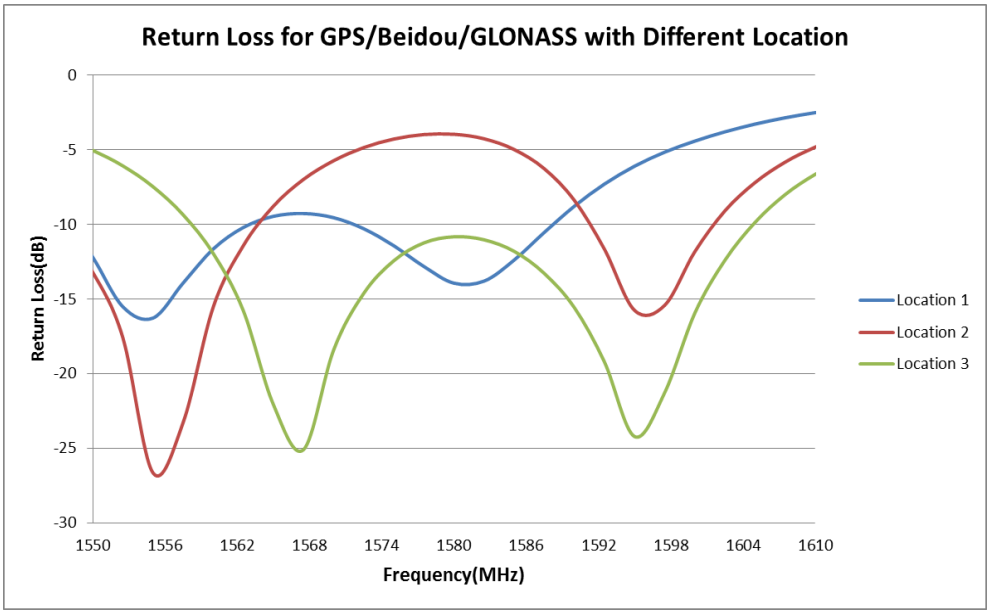


Figure 4.1.1 RETURN LOSS OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT THREE LOCATIONS

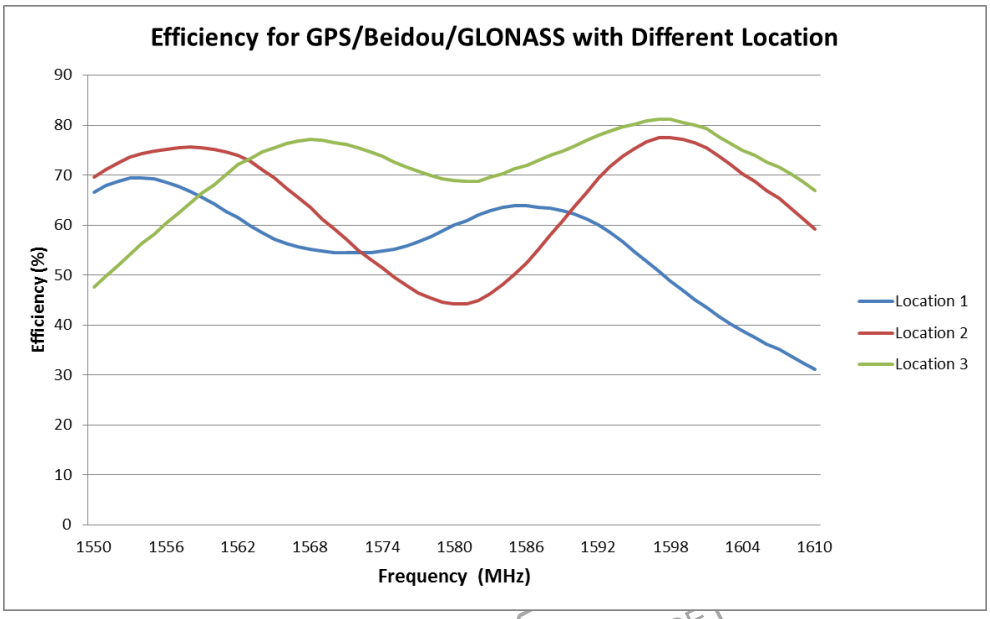


Figure 4.1.2 EFFICIENCY OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT THREE LOCATIONS

PRE-RELEASE REFERENCE USE ONLY

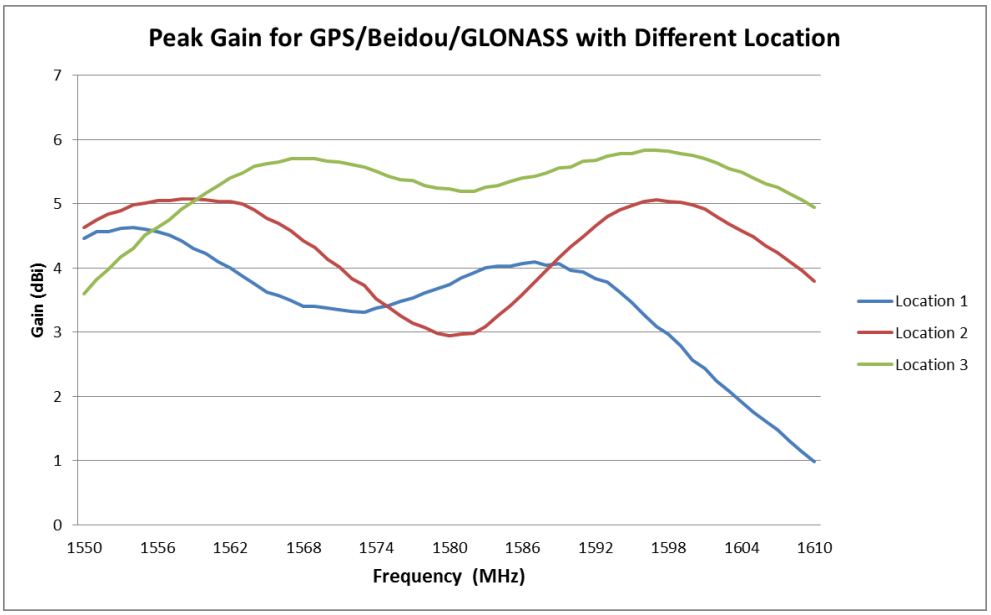


Figure 4.1.3 PEAK GAIN OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT THREE LOCATIONS

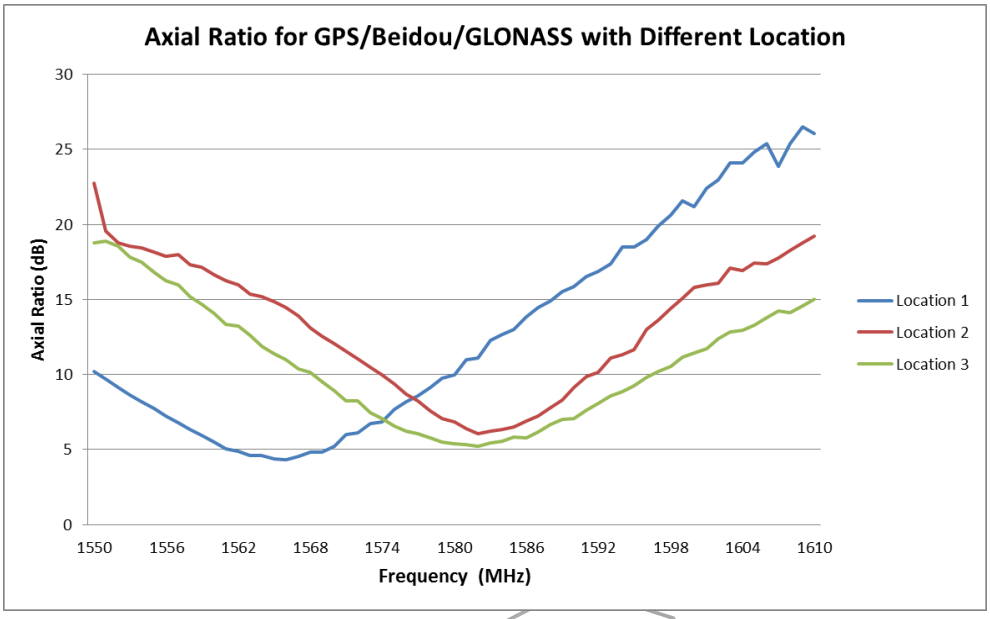


Figure 4.1.4 AXIAL RATIO OF ANTENNA AT GPS/BEIDOU/GLONASS BAND AT THREE LOCATIONS

PRE-RELEASE REFERENCE USE ONLY

4.2 ANTENNA RF PERFORMANCES AS A FUNCTION OF DIFFERENT SIZED GROUNDS

5 kinds of ground plane size have been evaluated, and these configurations are show in figure 4.2. The figure 4.2.1-4.2.4 are shown the return loss, the efficiency, the peak gain and axial ratio.

The ground plane size for this antenna is recommended to be 70mm*70mm.

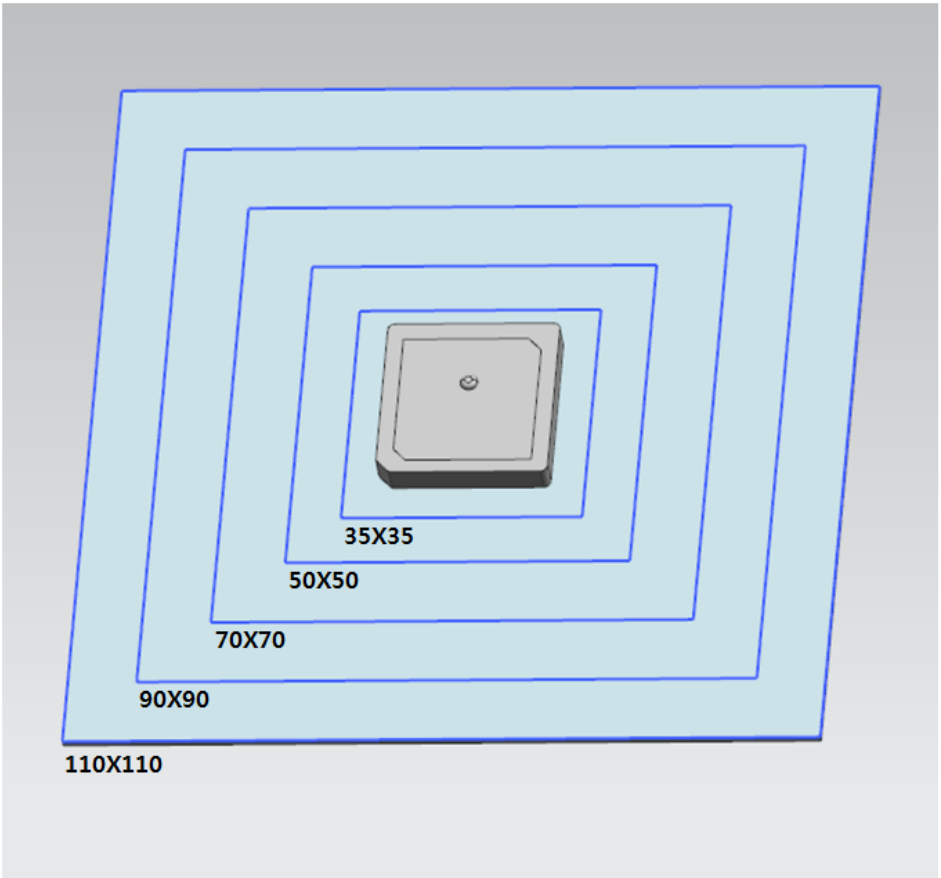


FIGURE 4.2 FIVE KINDS OF GROUND PLANE SIZE

PRE-RELEASE REFERENCE USE ONLY

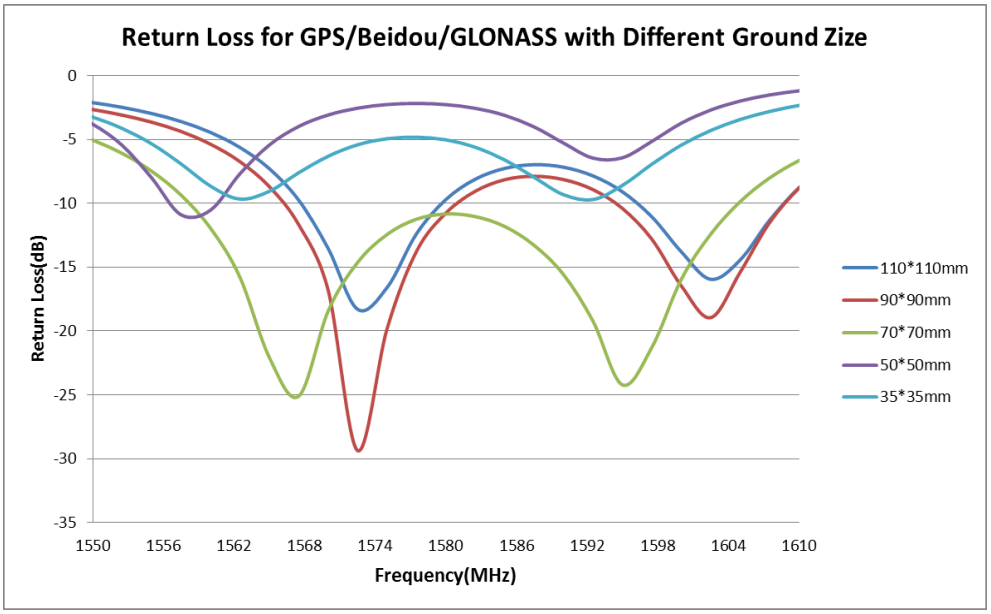


FIGURE 4.2.1 RETURN LOSS COMPARISON AT GPS/BEIDOU/GLONASS BAND OF ANTENNA MOUNTED ON DIFFERENT GROUND SIZE

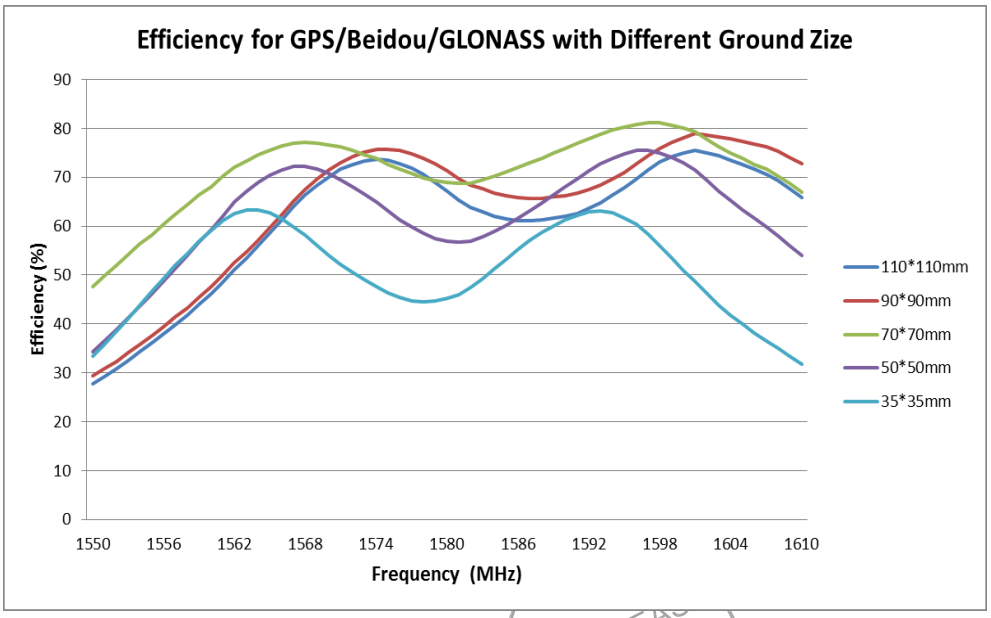


FIGURE 4.2.2 EFFICIENCY COMPARISON AT GPS/BEIDOU/GLONASS BAND OF ANTENNA MOUNTED ON DIFFERENT GROUND SIZE

PRE-RELEASE REFERENCE USE ONLY

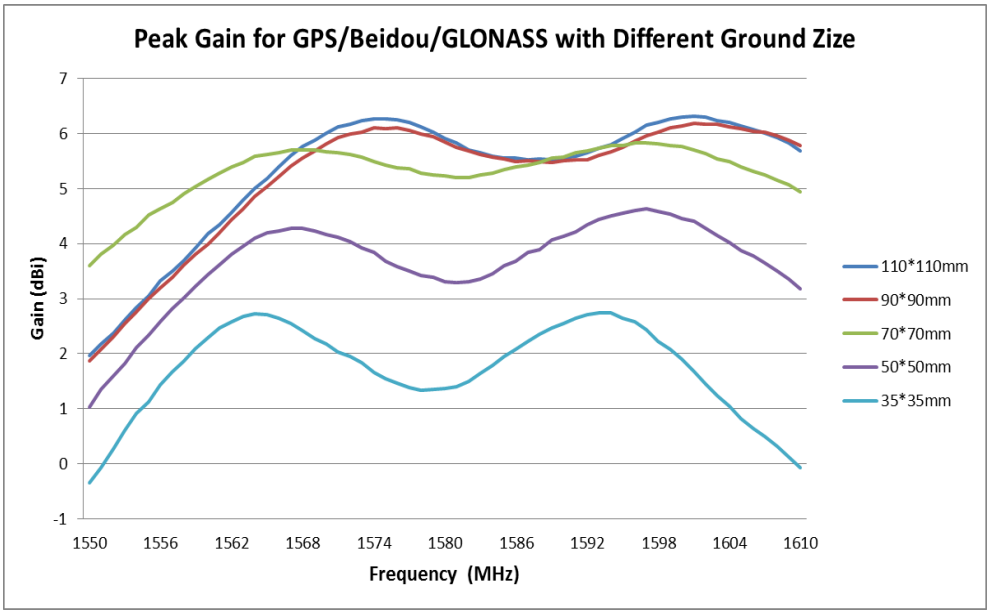


FIGURE 4.2.3 PEAK GAIN COMPARISON AT GPS/BEIDOU/GLONASS BAND OF ANTENNA MOUNTED ON DIFFERENT GROUND SIZE

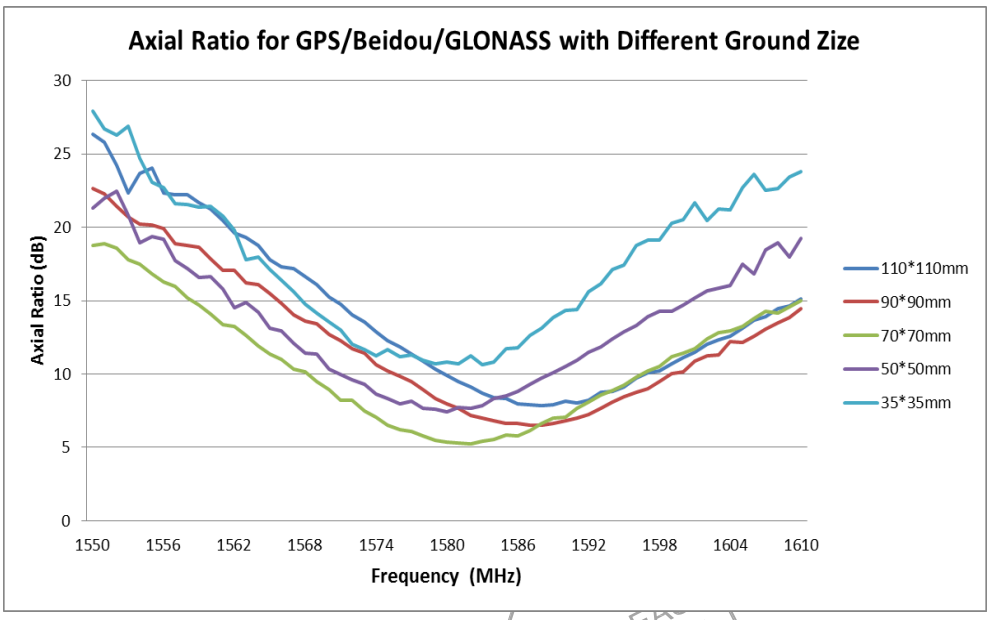


FIGURE 4.2.4 AXIAL RATIO COMPARISON AT GPS/BEIDOU/GLONASS BAND OF ANTENNA MOUNTED ON DIFFERENT GROUND SIZE

FOR RELEASE REFERENCE USE ONLY

4.3 RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCE BETWEEN VERTICAL METAL MATERIAL AND ANTENNA

An evaluation was done with 5 different distances from the antenna which is located at the recommended location to the vertical metal material (50mm x 4mm x 2mm). The 5 distances are as following: 1mm, 3mm, 5mm, 7mm, 10mm.

From the study, we recommend that a metal material (50mm x 4mm x 2mm) should be placed at least 3mm away from the antenna. When the distance is less than 3mm, the antenna performance will be significantly degraded. Refer to figure 4.3.1-4.3.4

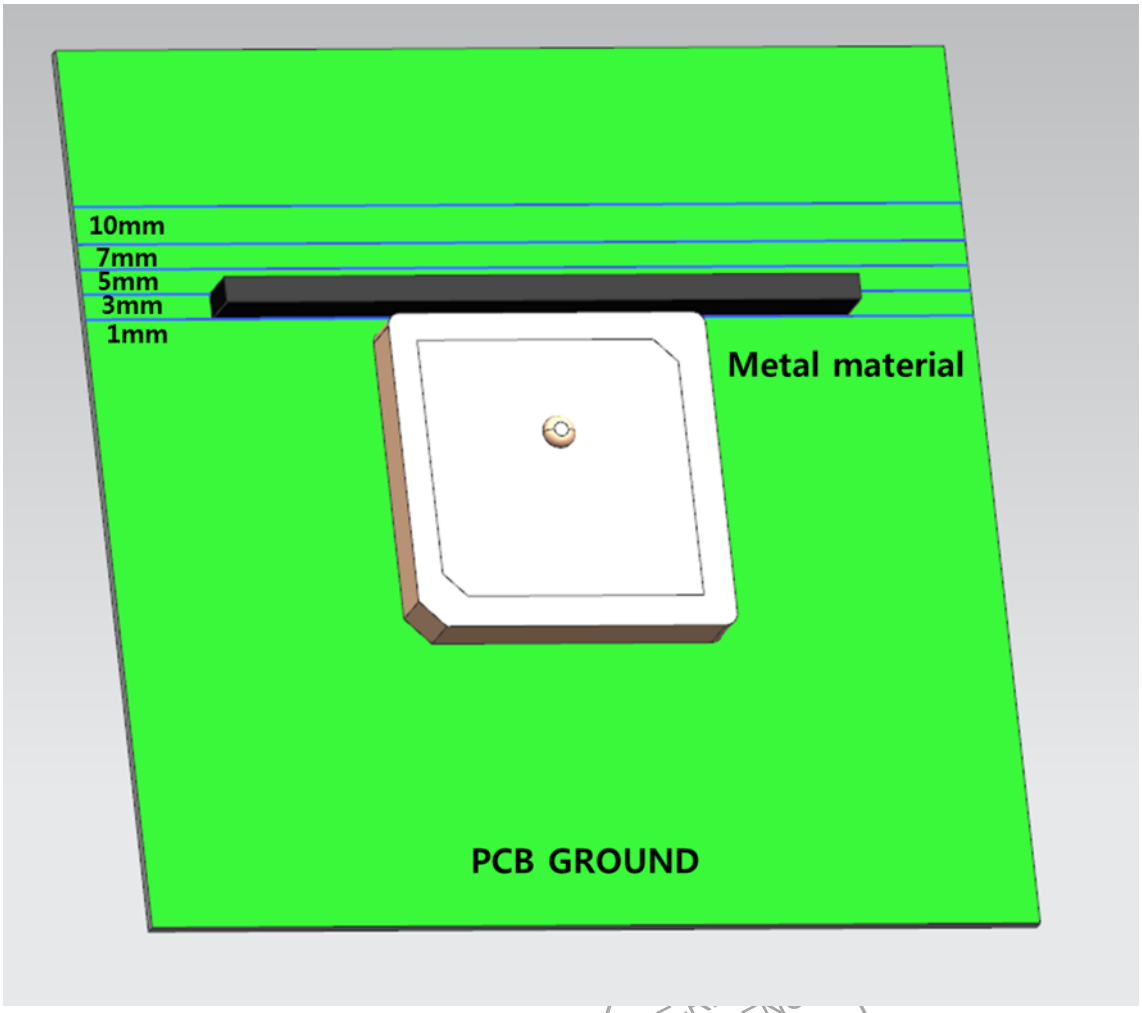


Figure 4.3 METAL MATERIAL FIXED ON REFERENCE PCB

PRE-RELEASE REFERENCE USE ONLY

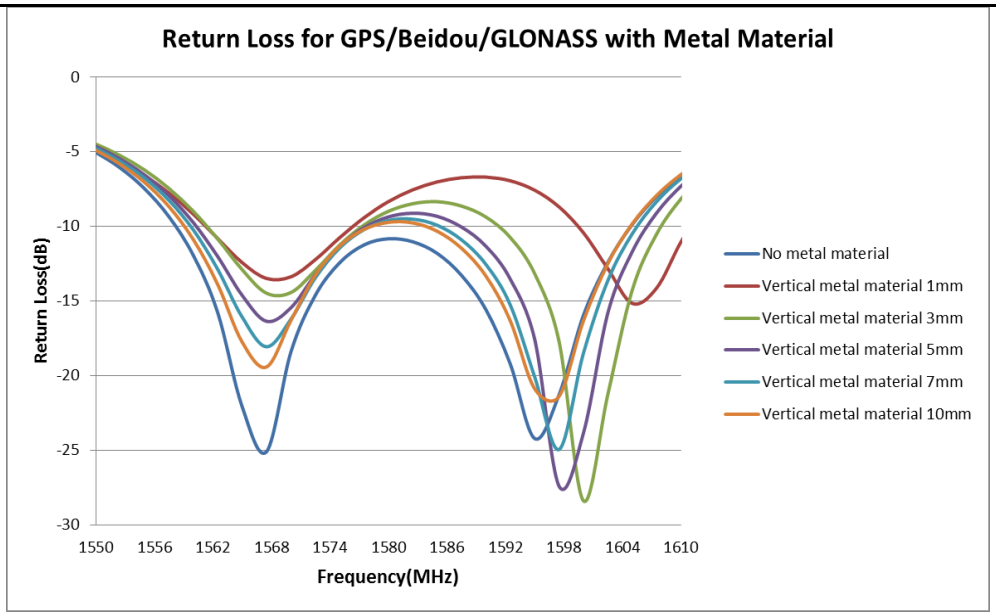


FIGURE 4.3.1 RETURN LOSS OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL METAL MATERIAL

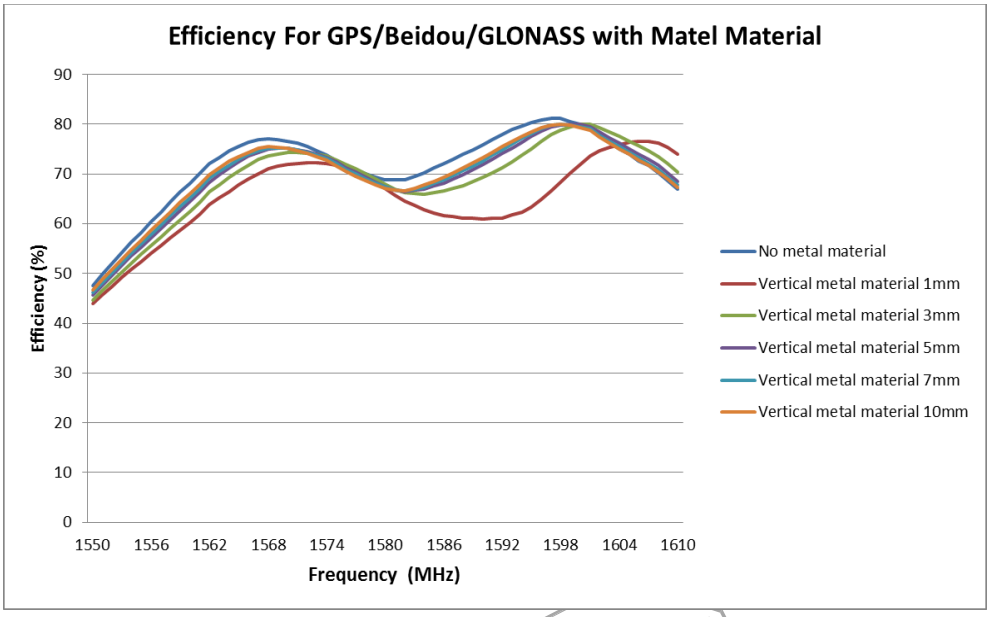


FIGURE 4.3.2 EFFICIENCY OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL METAL MATERIAL

PRE-RELEASE REFERENCE USE ONLY

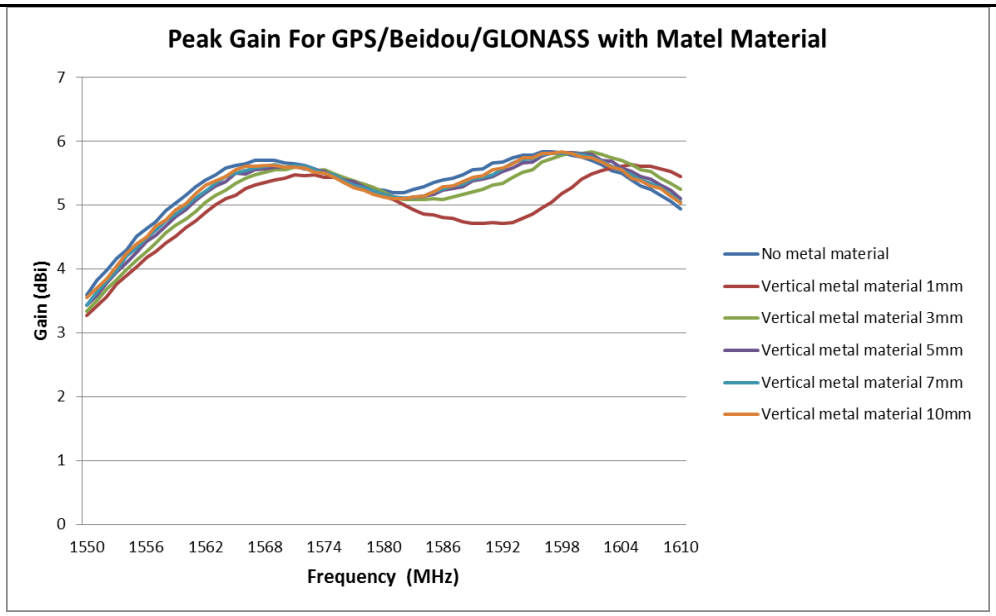


FIGURE 4.3.3 PEAK GAIN OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL METAL MATERIAL

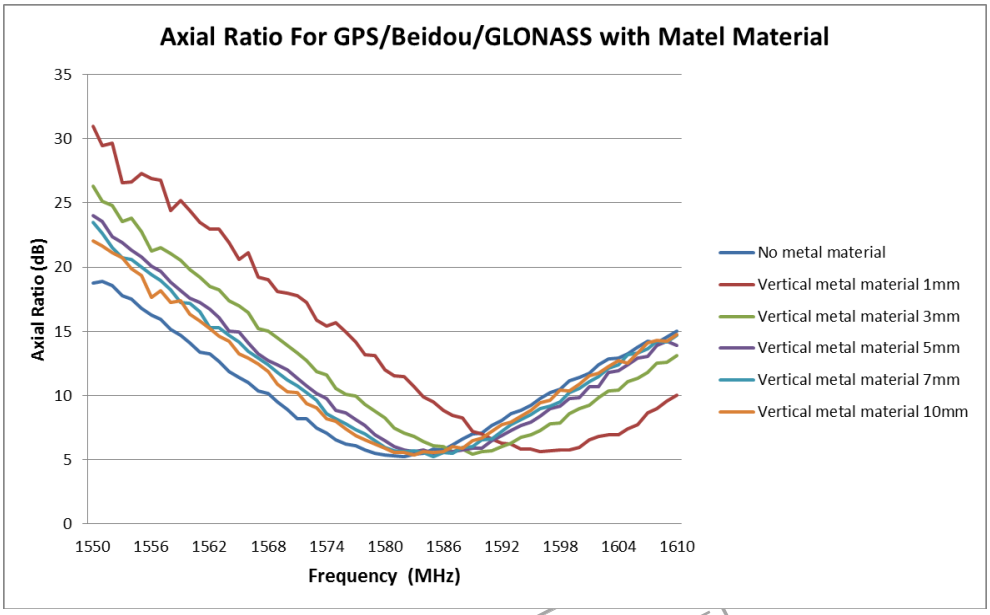


FIGURE 4.3.4 AXIAL RATIO OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL METAL MATERIAL

PRE-RELEASE REFERENCE USE ONLY

4.4 RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCE BETWEEN VERTICAL PLASTIC MATERIAL AND ANTENNA

An evaluation was done with 5 different distances from the antenna which is located at the recommended location to the vertical plastic material (50mm x 4mm x 2mm). The 5 distances are as following: 1mm, 3mm, 5mm, 7mm, 10mm.

Though the vertical plastic material shifts the antenna resonance a bit lower, it has less effect on antenna performance according to the results. The vertical plastic material has less effect on antenna performance, but we also suggest that the vertical plastic material be placed at least 1mm away from the antenna. Refer to figure 4.4.1-4.4.4.

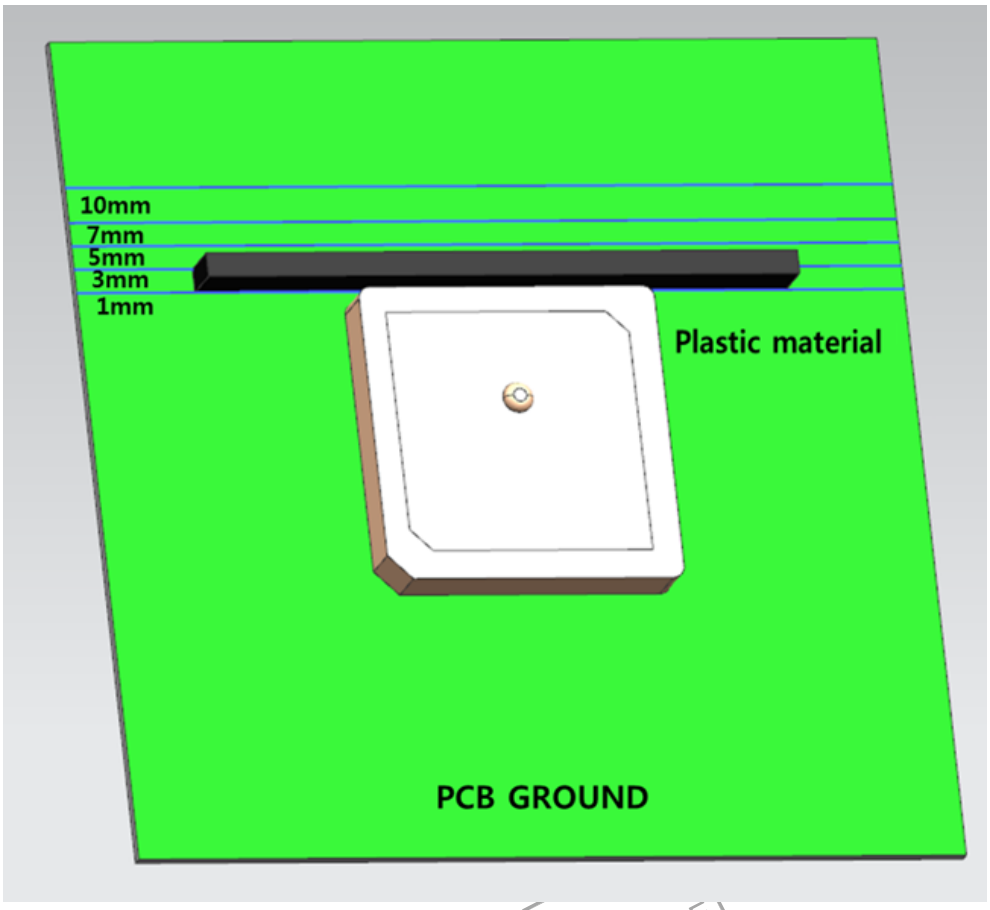


FIGURE 4.4 PLASTIC MATERIAL FIXED ON REFERENCE PCB

PRE-RELEASE REFERENCE USE ONLY

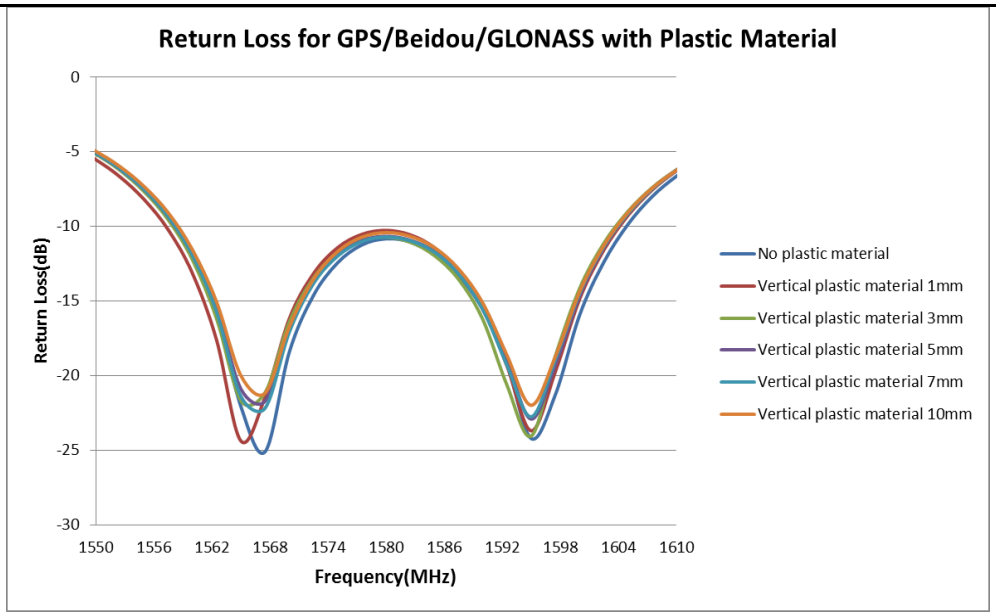


FIGURE 4.4.1 RETURN LOSS OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL PLASTIC MATERIAL

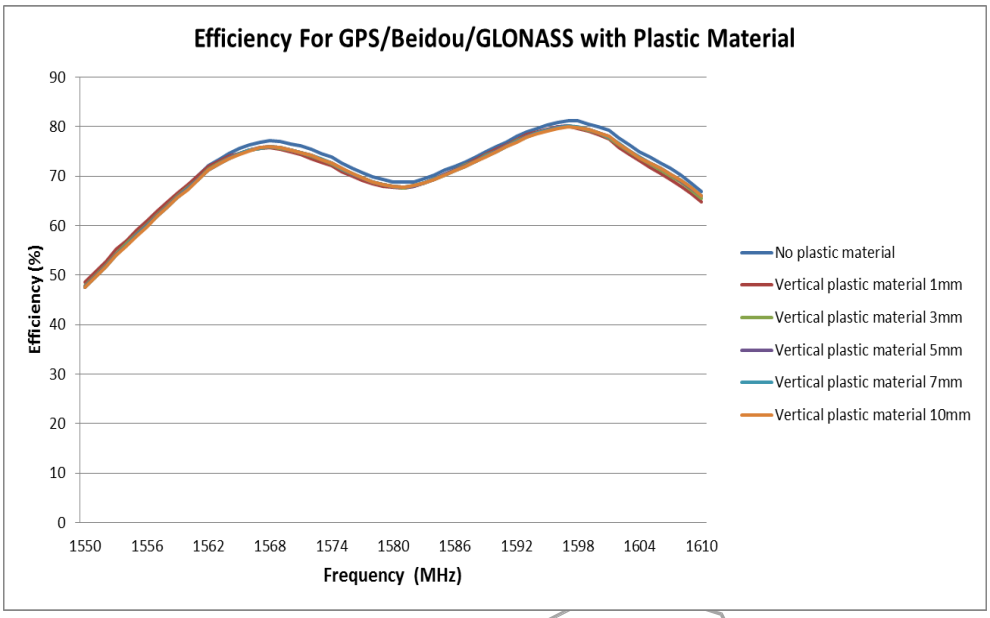


FIGURE 4.4.2 EFFICIENCY OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL PLASTIC MATERIAL

PRE-RELEASE REFERENCE USE ONLY

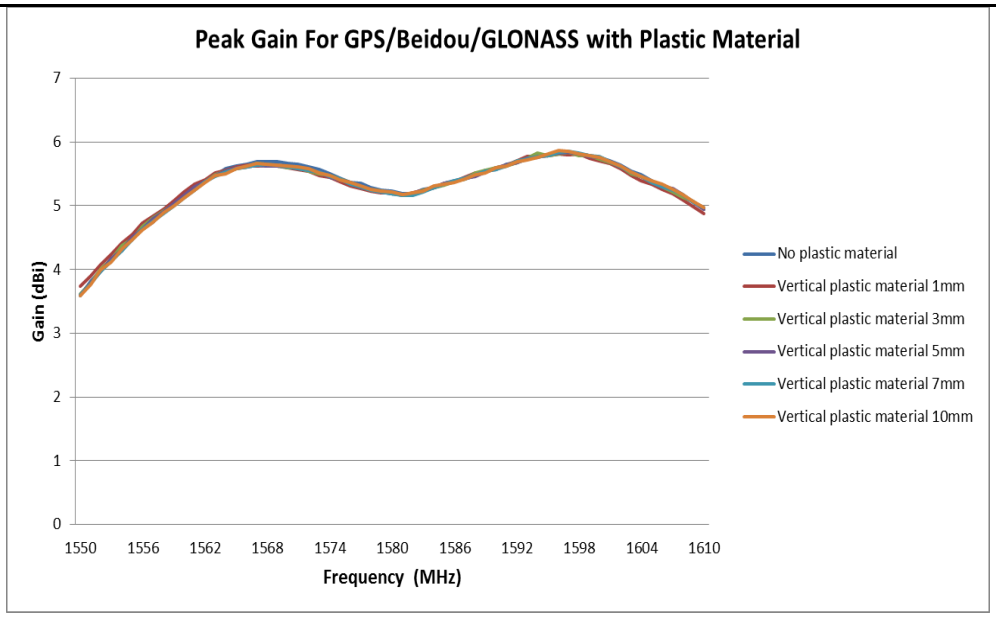


FIGURE 4.4.3 PEAK GAIN OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL PLASTIC MATERIAL

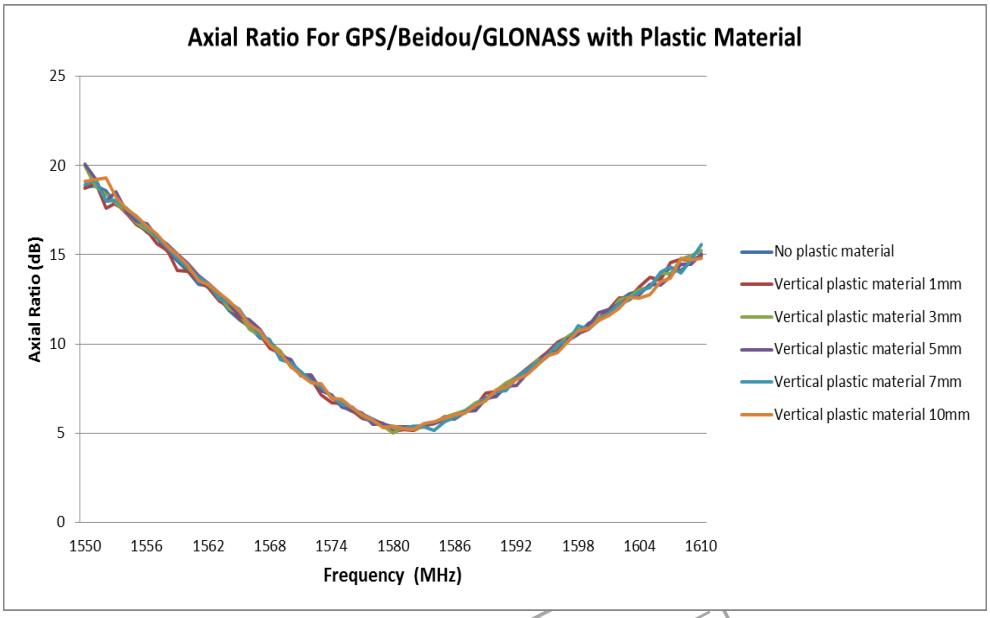


FIGURE 4.4.4 AXIAL RATIO OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN ANTENNA AND VERTICAL PLASTIC MATERIAL

PRE-RELEASE REFERENCE USE ONLY

4.5 RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCE BETWEEN HORIZONTAL PLASTIC COVER AND REDERENCE PCB

An evaluation was done with 4 different distances from reference PCB to the horizontal plastic cover (50mm x 50mm x 2mm). The 4 distances are as following: 4mm, 8mm, 12mm, 16mm.

From the study, we recommend that a plastic cover (50mm x 50mm x 2mm) should be placed at least 8mm away from the antenna. When the distance is less than 8mm, the antenna performance will be significantly degraded. Refer to figure 4.5.1-4.5.4

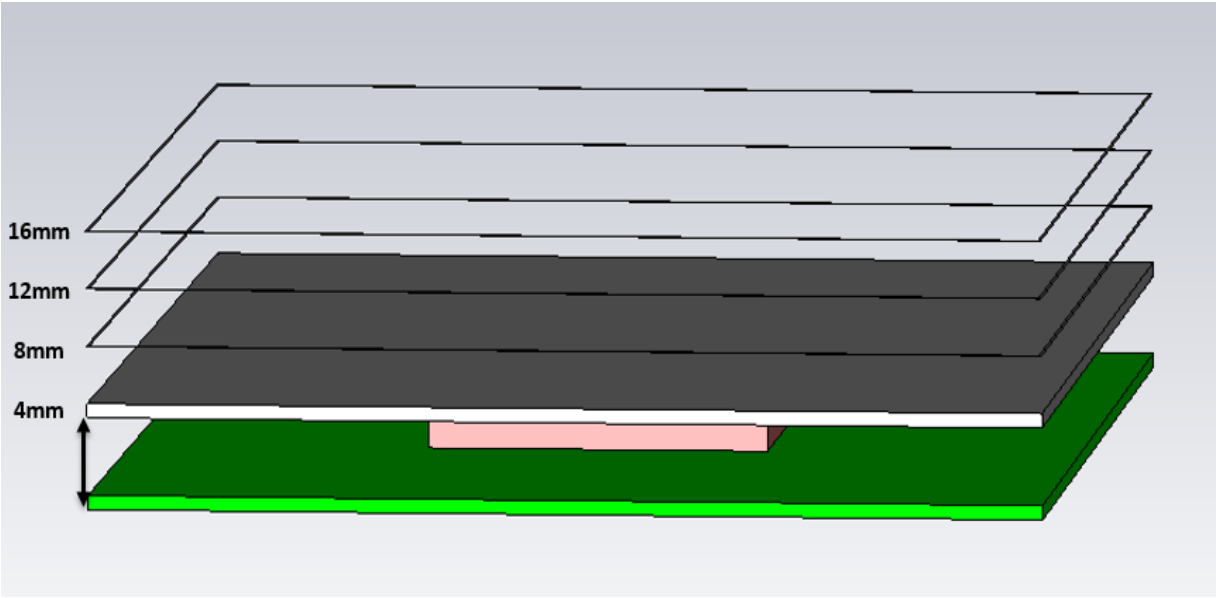


FIGURE 4.5 PLASTIC COVER POSITIONS

PRE-RELEASE REFERENCE USE ONLY

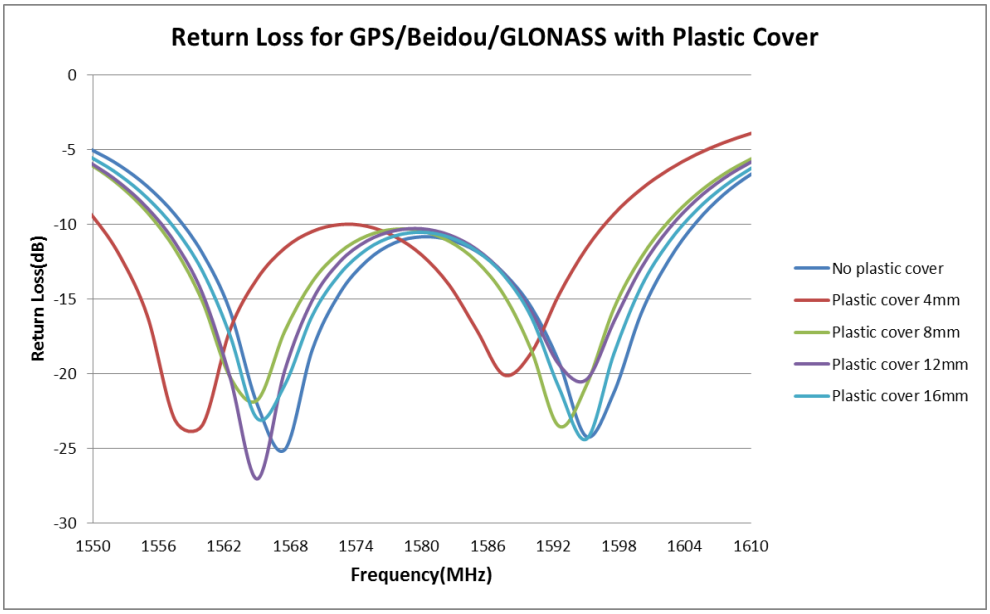


FIGURE 4.5.1 RETURN LOSS OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN REFERENCE PCB AND HORIZONTAL PLASTIC MATERIAL

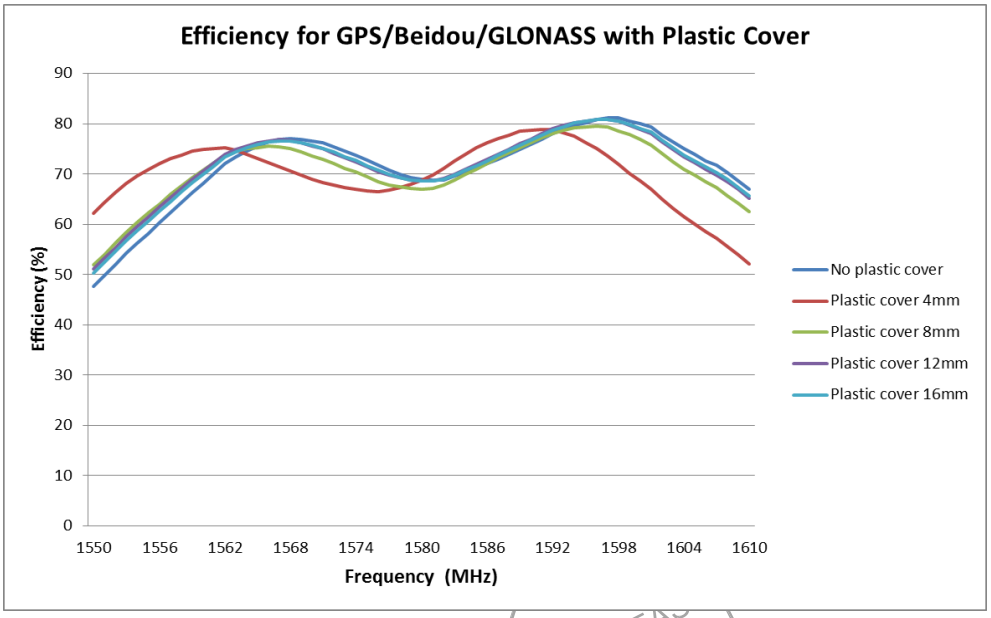


FIGURE 4.5.2 EFFICIENCY OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN REFERENCE PCB AND HORIZONTAL PLASTIC MATERIAL

RELEASE REFERENCE USE ONLY

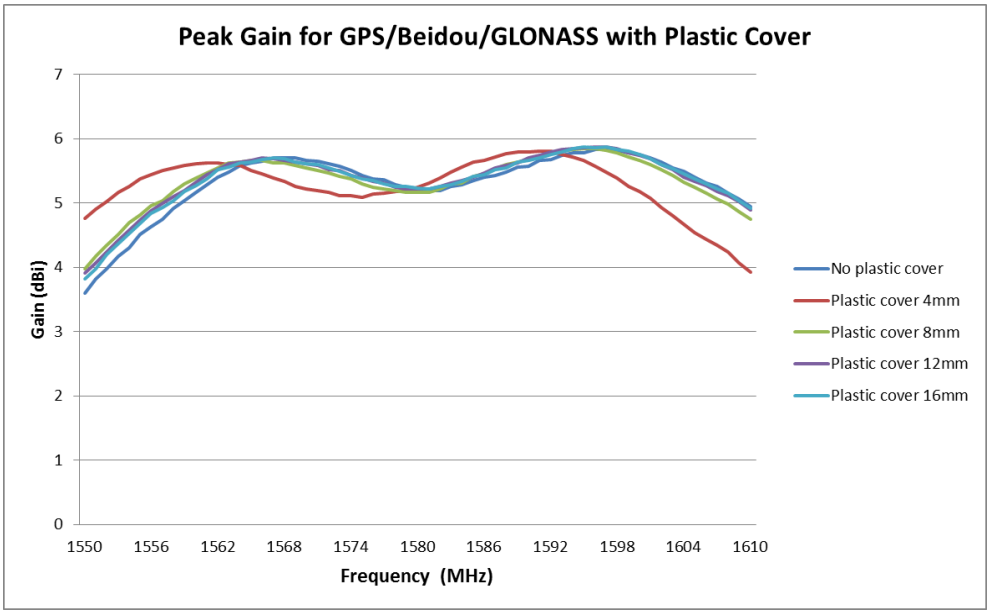


FIGURE 4.5.3 PEAK GAIN OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN REFERENCE PCB AND HORIZONTAL PLASTIC MATERIAL

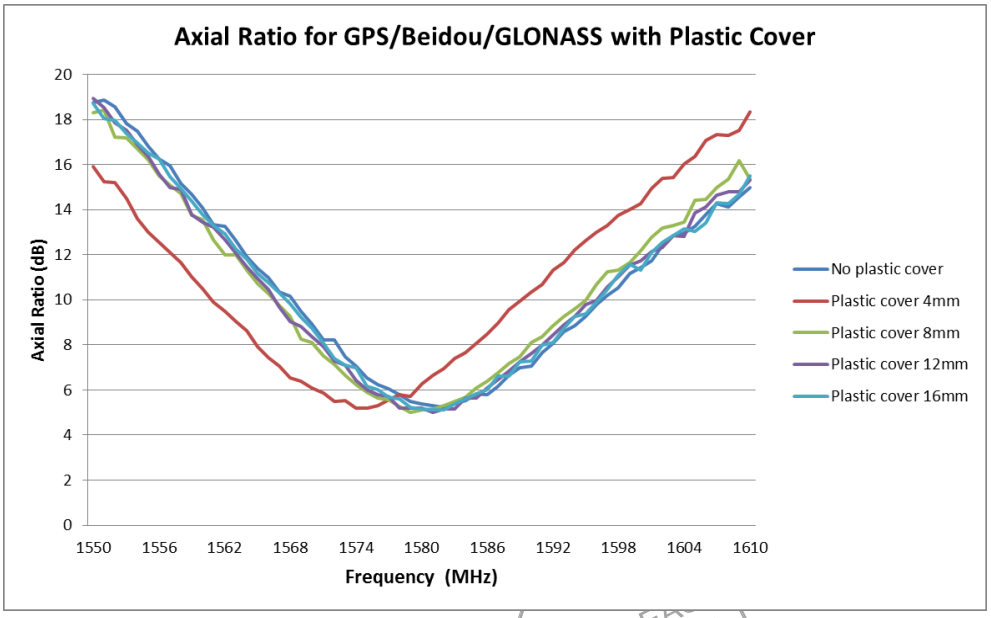
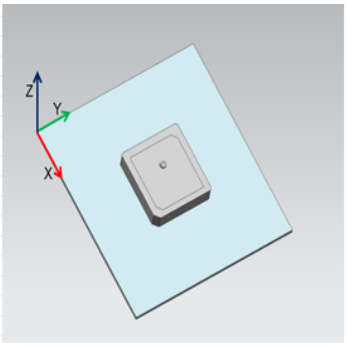
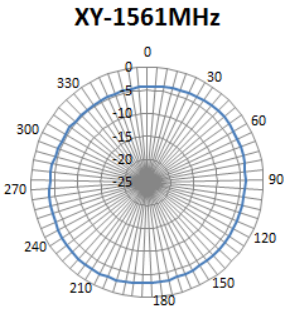


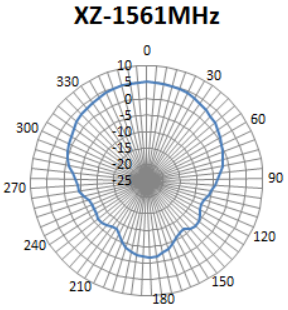
FIGURE 4.5.4 AXIAL RATIO OF ANTENNA FOR GPS/BEIDOU/GLONASS BAND AT DIFFERENT DISTANCES BETWEEN REFERENCE PCB AND HORIZONTAL PLASTIC MATERIAL

RELEASE REFERENCE USE ONLY

4.0 RADIATION PATTERN







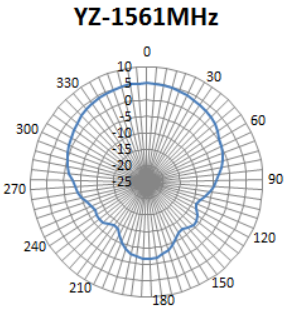
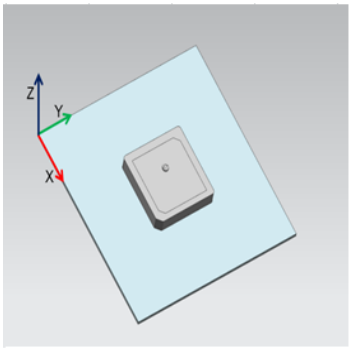
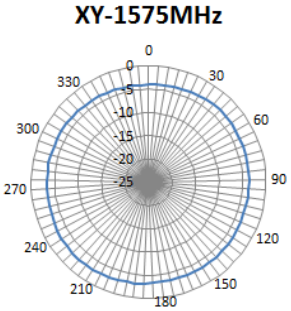
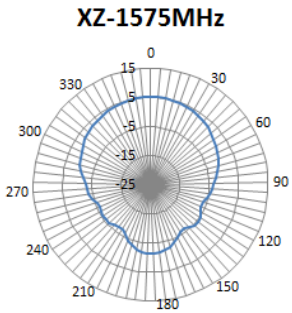


FIGURE 5.1 RADIATION PATTERN OF ANTENNA AT 1561MHZ IN FREE SPACE







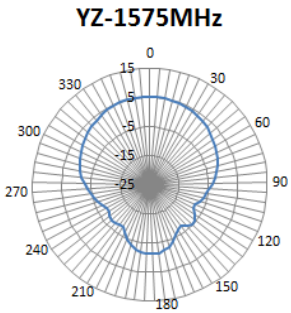
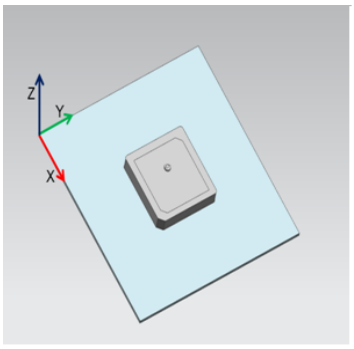
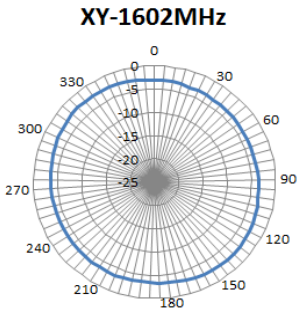
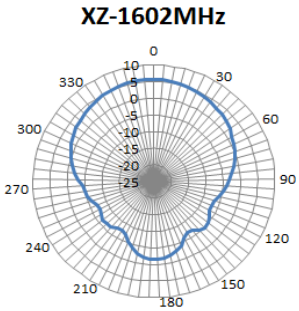


FIGURE 5.1 RADIATION PATTERN OF ANTENNA AT 1575MHZ IN FREE SPACE







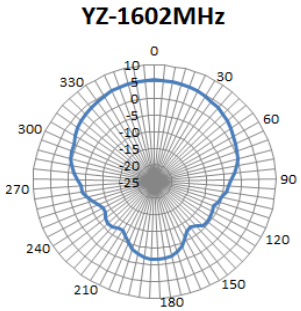


FIGURE 5.1 RADIATION PATTERN OF ANTENNA AT 1602MHZ IN FREE SPACE

PRE-RELEASE REFERENCE USE ONLY