APPLICATION SPECIFICATION

698~2700MHZ CERAMIC ANTENNA LOW PROFILE 3MM

TABLE OF CONTENTS

698~2700MHZ CERAMIC ANTENNA LOW PROFILE 3MM

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.

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

2.1 PRODUCT NAME AND SERIES NUMBER (S)

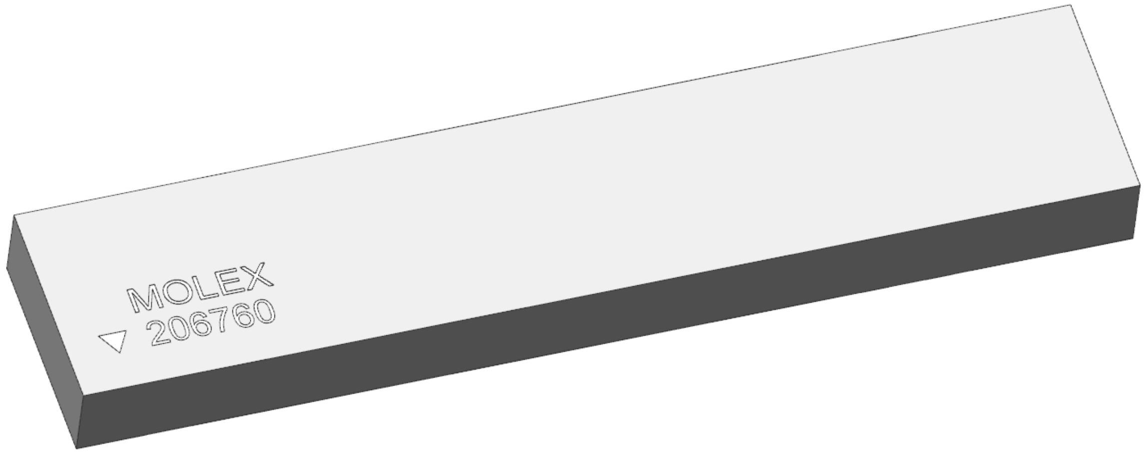
Product name: 698~2700MHz Ceramic Antenna Low Profile 3mm
Series Number: 206760

2.2 DESCRIPTION

206760 is a low profile SMT LTE/Cellular 2G/3G/4G ceramic embedded antenna. It provides high efficiency with small factor 38x8x3mm.

2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-2067600001 for full information.



Molex 2067600001 698~2700MHz Ceramic Antenna Low Profile 3mm 3D View

3.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing(SD)	SD-2067600001	Mechanical Dimension of the product
Product Specification (PS)	PS-2067600001	Product Specification
Packing Drawing(PK)	PK-2067600001	Product packaging specifications

4.0 ANTENNA PERFORMANCE

4.1 RF TEST CONDITIONS

All measurements are done of the antenna mounted on a reference PCB (130*48*0.8mm) with VNA Agilent 5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part No.2067600001.

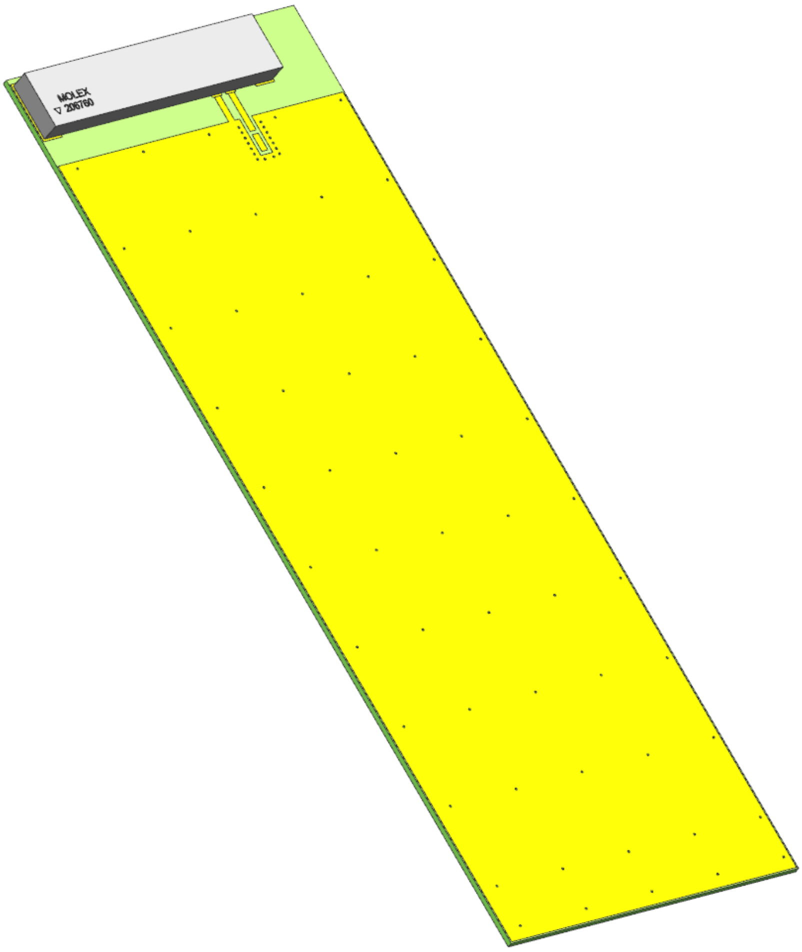


FIGURE4.1.1 ANTENNA LOADED ON REFERENCE PCB (130*48MM)

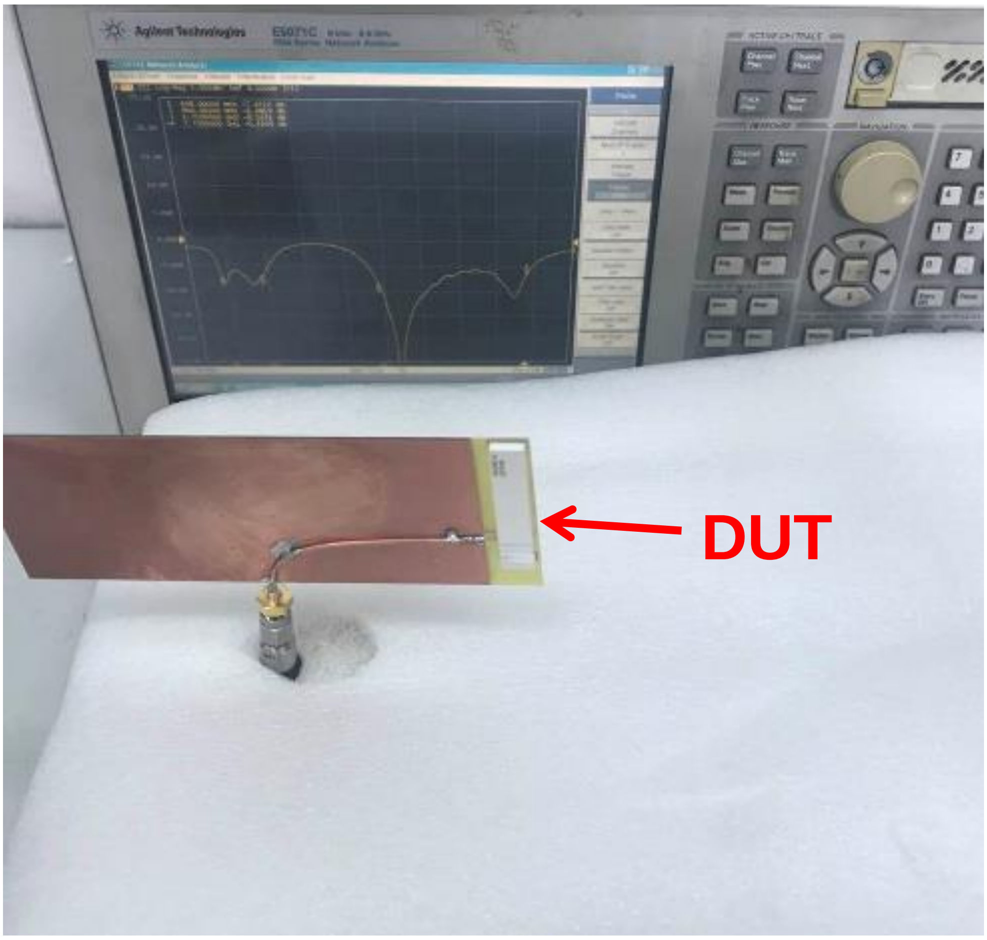


FIGURE4.1.2 ANTENNA LOADED ON REFERENCE PCB (130*48MM) TESTED WITH VNA E5071C

FIGURE4.1.3 ANTENNA LOADED ON REFERENCE PCB (130*48MM) TESTED IN OTA CHAMBER

4.2 ANTENNA PERFORMANCE

DESCRIPTION	EQUIPMENT	PARAMETER	
FREQUENCY RANGE	VNA E5071C	698-960MHz	1710-2700MHz
RETURN LOSS	VNA E5071C	<-5dB	<-5dB
PEAK GAIN (MAX)	OTA Chamber	1.3dBi	4.4dBi
AVERAGE TOTAL EFFICIENCY	OTA Chamber	>60%	>70%
POLARIZATION	OTA Chamber	Linear	
INPUT IMPEDANCE	VNA E5071C	50 ohms	

Note that the above antenna performance is measured with just the antenna mounted on a reference PCB (130*48mm) in free space. When implement into the system, the frequency resonant might be off-tune due to the loading of surrounding components especially metal plane. This off-tune can be compensated through matching. Although module manufacturers specify a peak gain limit, it is based on free-space conditions. The peak gain will be degraded by 1 to 2dBi in the actual implementation as the radiation pattern will change due to the surround components. As such, during selection of antenna, you can select one with high peak gain to compensate for the loss. Molex can offer assistant to choose the best location and best tuning in-order to meet this peak gain requirement.

4.3 RETURN LOSS PLOT

All measurements in this document are done on the reference PCB (130*48mm).

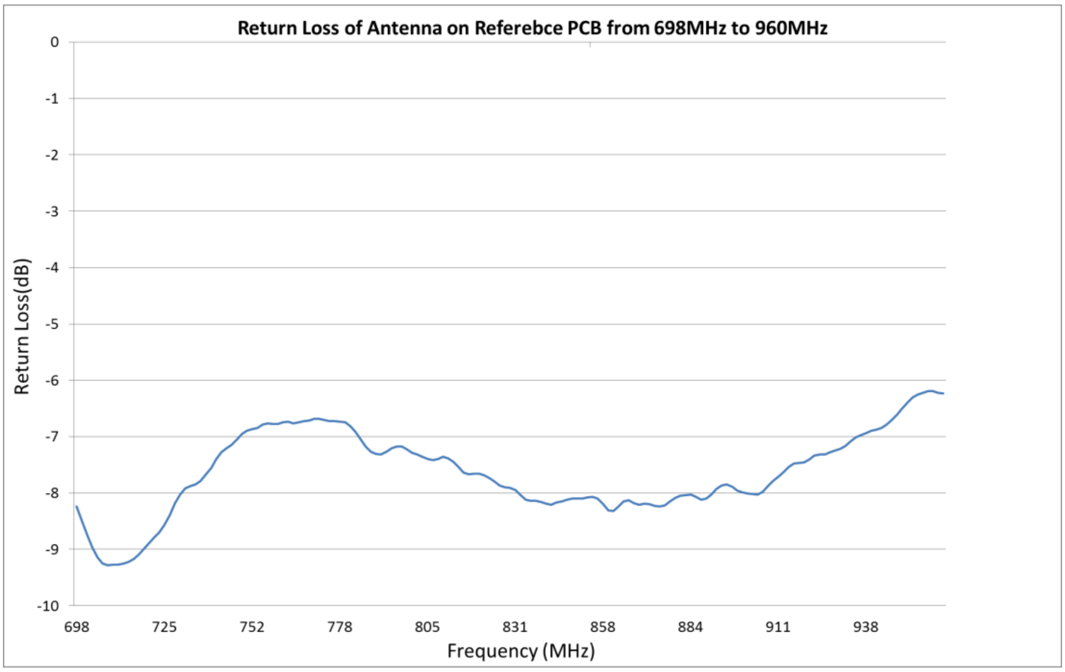


FIGURE 4.3.1 RETURN LOSS OF ANTENNA FROM 698MHZ TO 960MHZ IN FREE SPACE

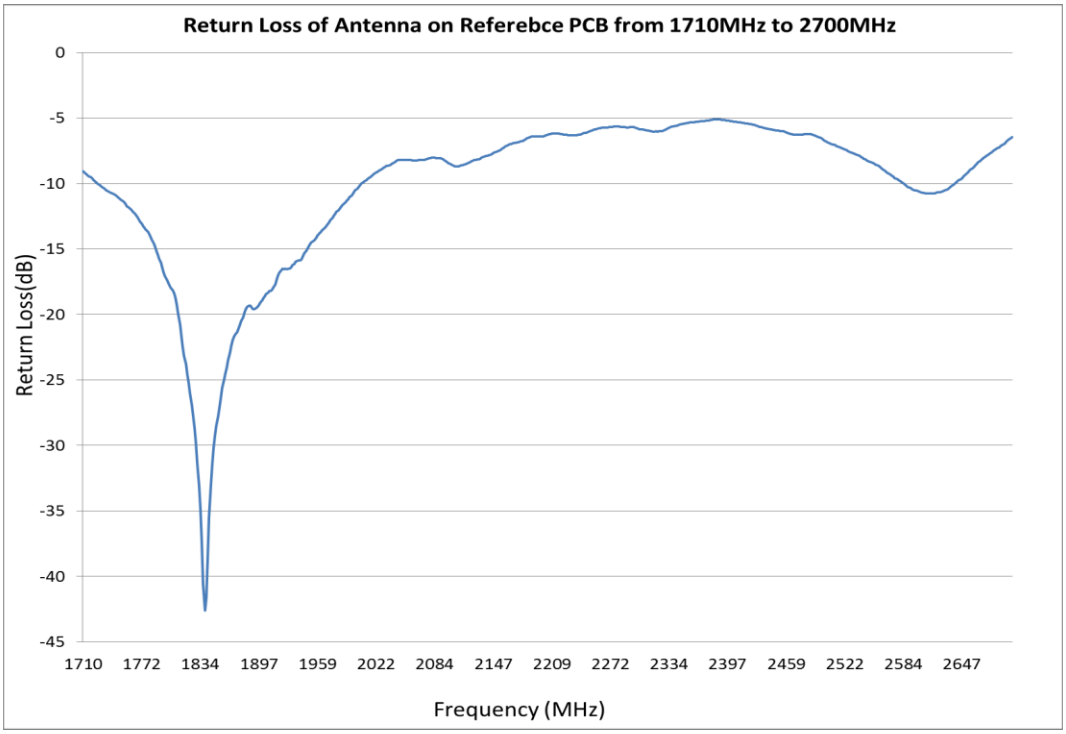


FIGURE 4.3.2 RETURN LOSS OF ANTENNA FROM 1710MHZ TO 2700MHZ IN FREE SPACE

4.4 EFFICIENCY PLOT

All measurements in this document are done on the reference PCB (130*48mm).

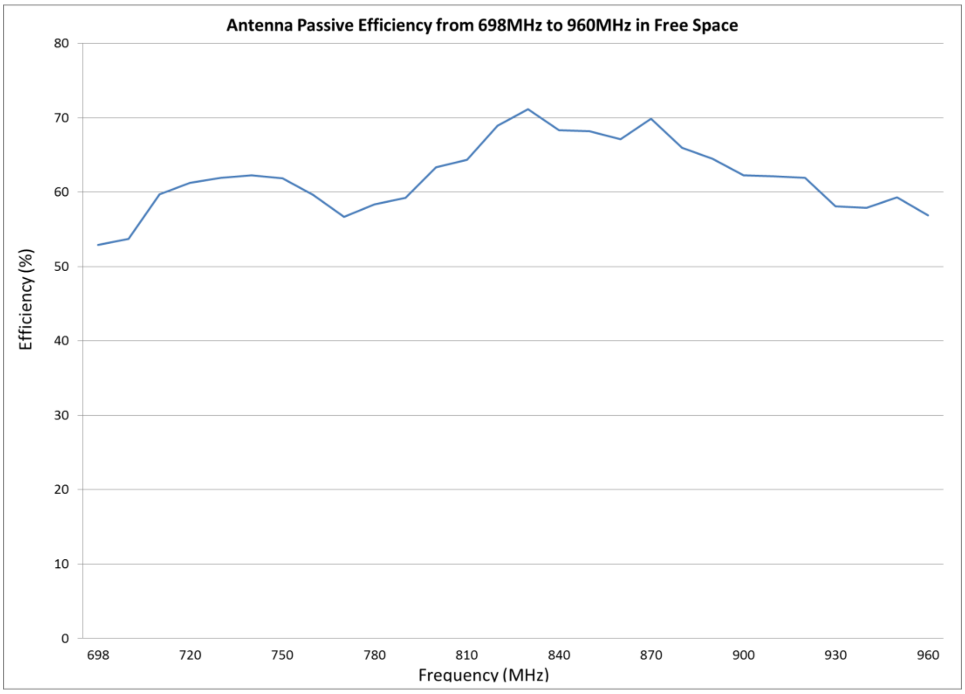


FIGURE 4.4.1 ANTENNA PASSIVE EFFICIENCY FROM 698MHZ TO 960MHZ IN FREE SPACE

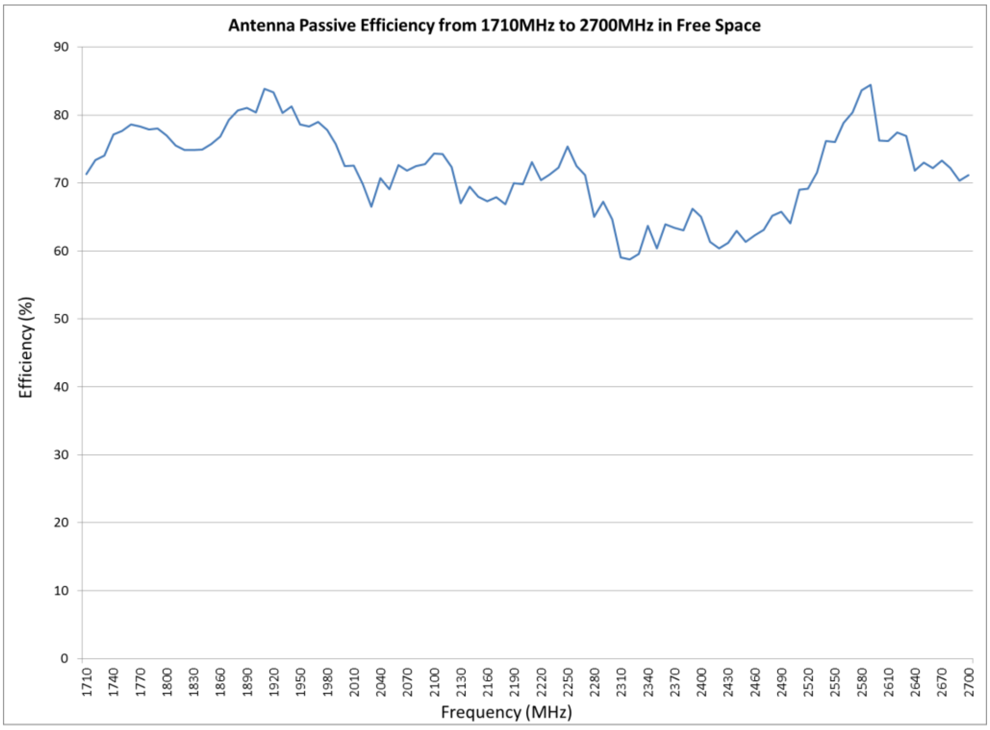


FIGURE 4.4.2 ANTENNA PASSIVE EFFICIENCY FROM 1710MHZ TO 2700MHZ IN FREE SPACE

4.5 RADIATION PATTERN

All measurements in this document are done on the reference PCB (130*48mm).

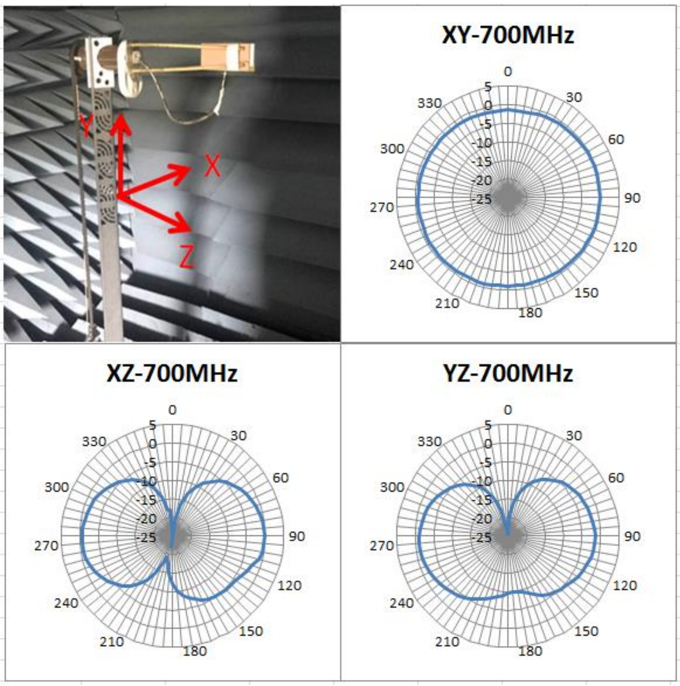


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 700MHZ IN FREE SPACE

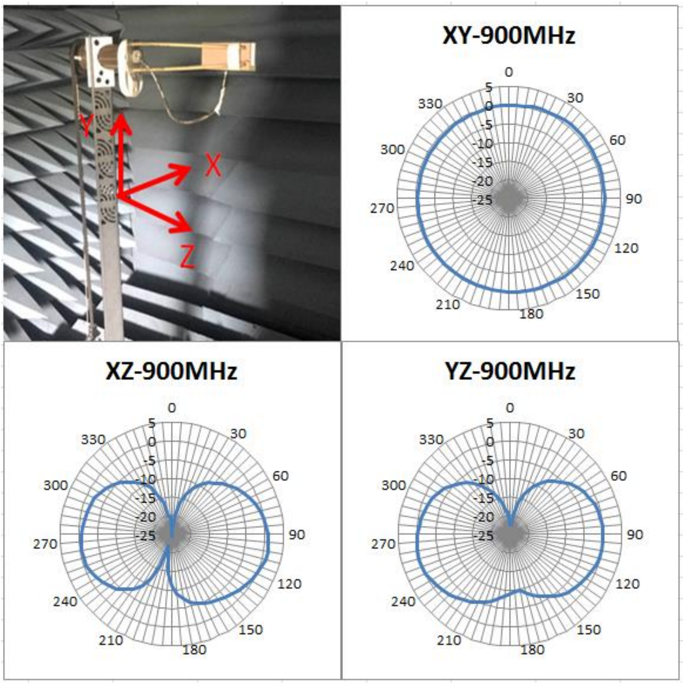


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 900MHZ IN FREE SPACE

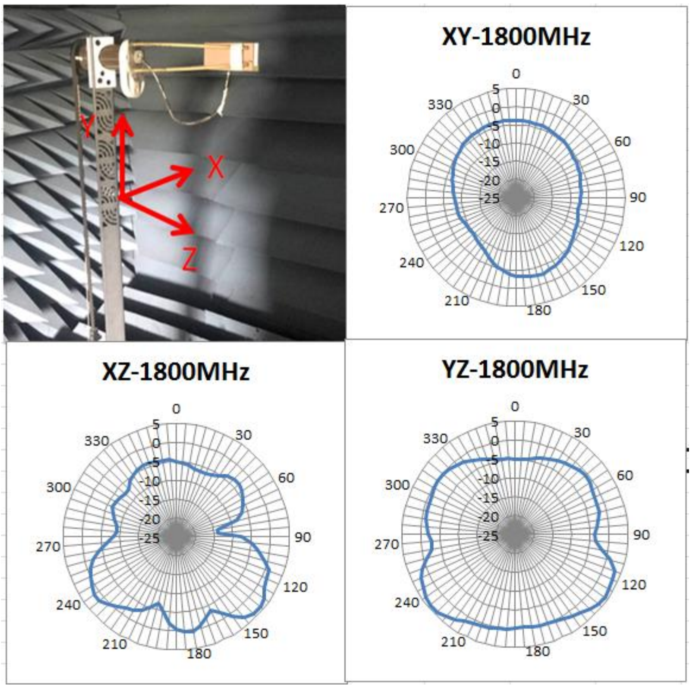


FIGURE 4.5.3 2D RADIATION PATTERN OF ANTENNA AT 1800MHZ IN FREE SPACE

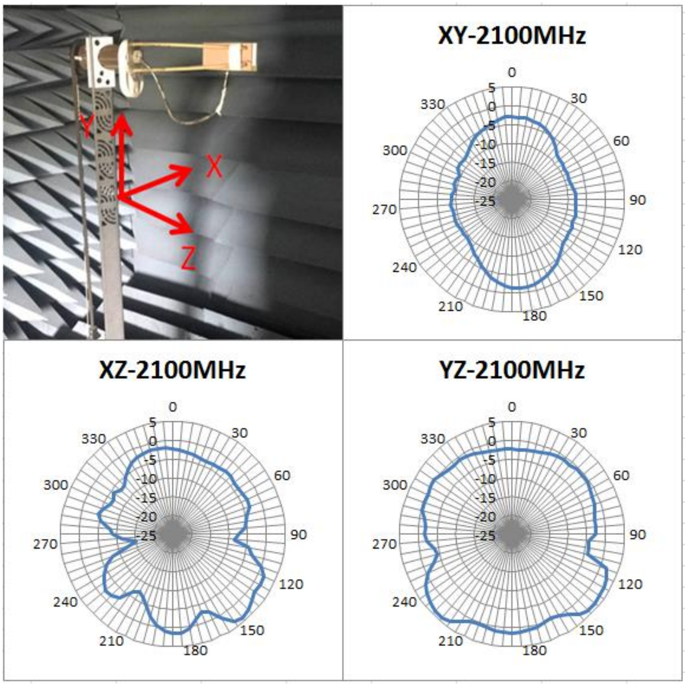


FIGURE 4.5.4 2D RADIATION PATTERN OF ANTENNA AT 2100MHZ IN FREE SPACE

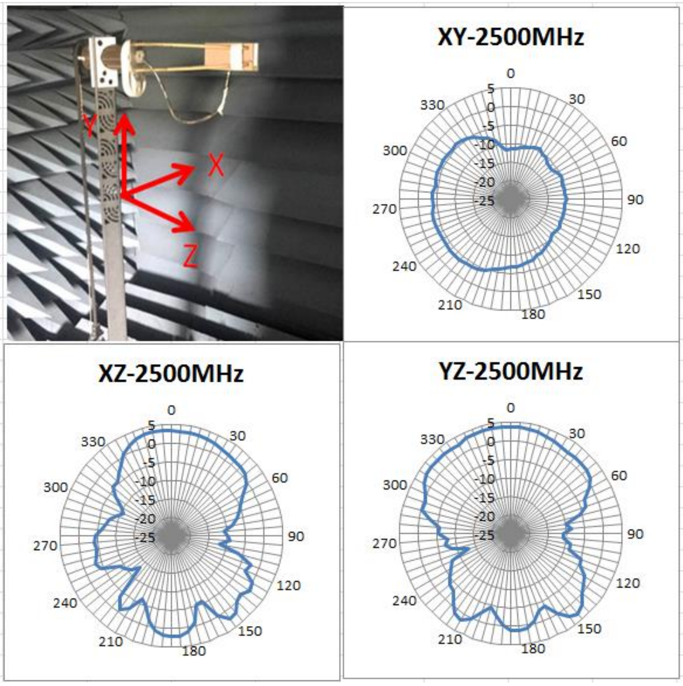


FIGURE 4.5.5 2D RADIATION PATTERN OF ANTENNA AT 2500MHZ IN FREE SPACE

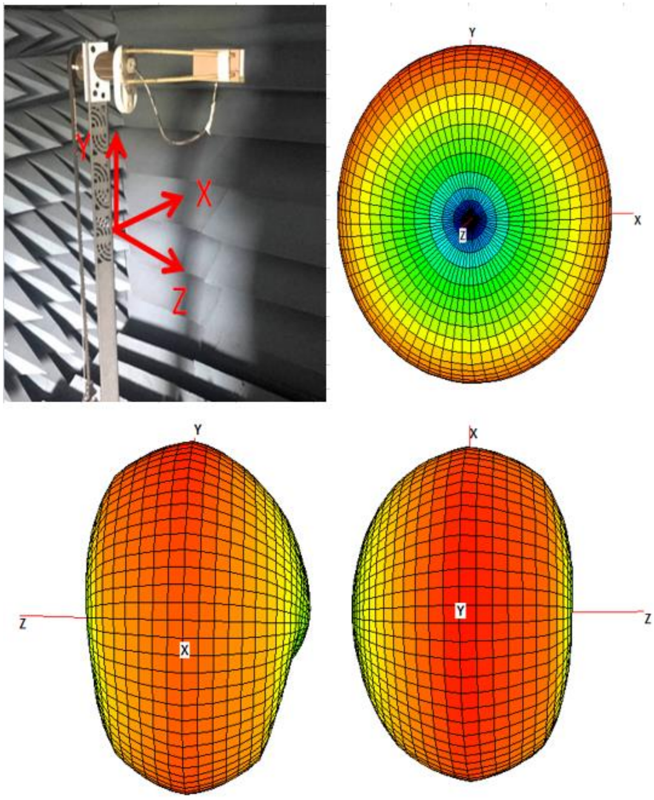


FIGURE 4.5.6 3D RADIATION PATTERN OF ANTENNA AT 700MHZ IN FREE SPACE

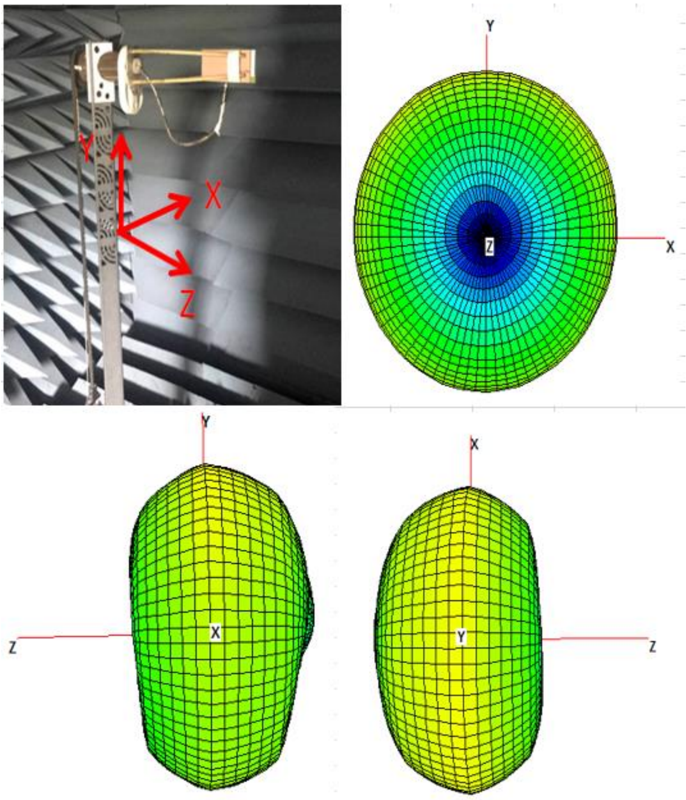


FIGURE 4.5.7 3D RADIATION PATTERN OF ANTENNA AT 900MHZ IN FREE SPACE

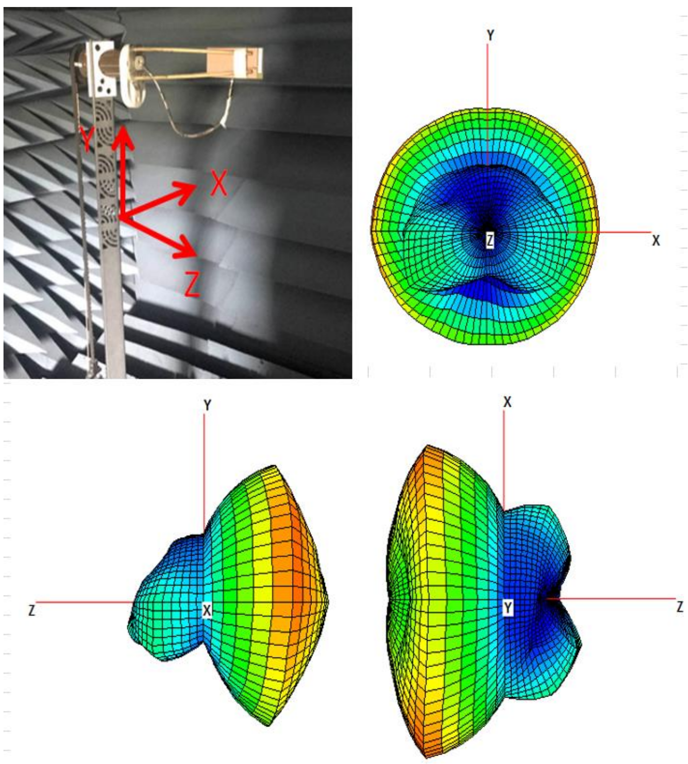


FIGURE 4.5.8 3D RADIATION PATTERN OF ANTENNA AT 1800MHZ IN FREE SPACE

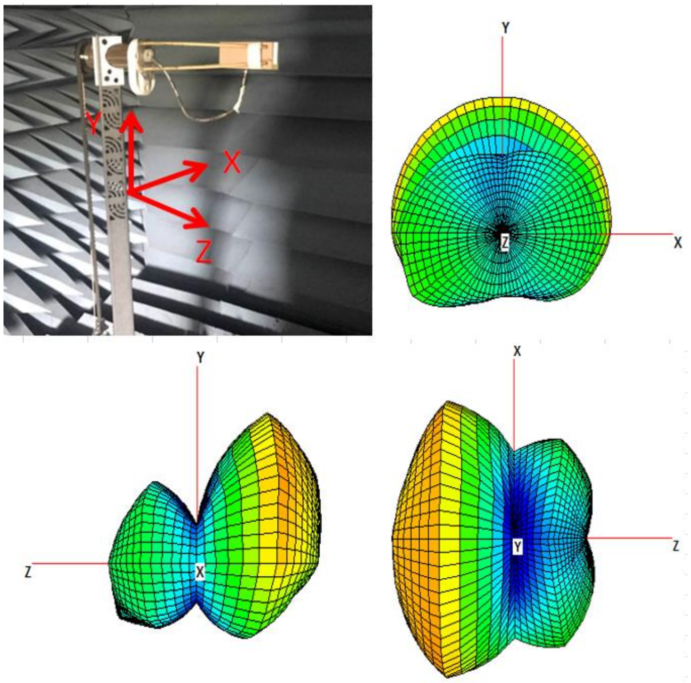


FIGURE 4.5.9 3D RADIATION PATTERN OF ANTENNA AT 2100MHZ IN FREE SPACE

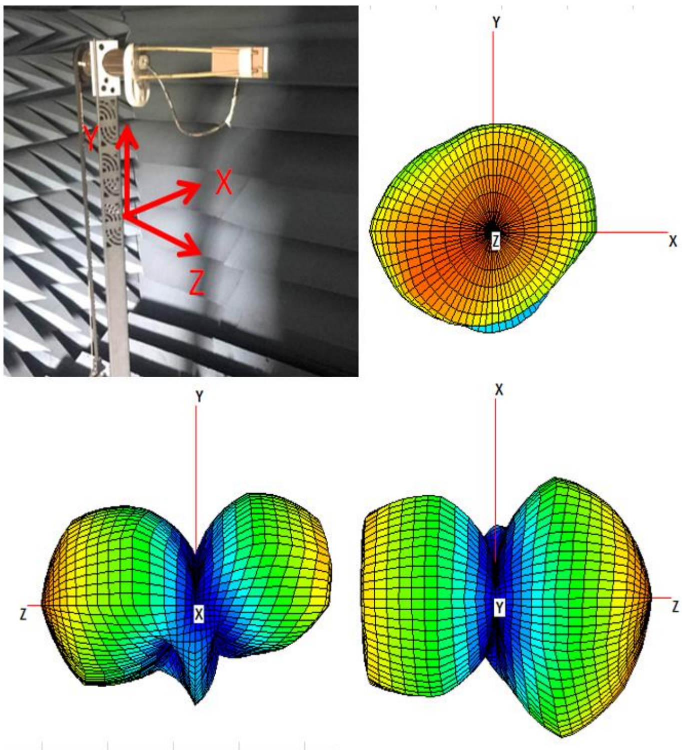


FIGURE 4.5.10 3D RADIATION PATTERN OF ANTENNA AT 2500MHZ IN FREE SPACE

5.0 MATCHING NETWORK

Two Matching configurations as shown in Figure 5.1 and Figure 5.2 are recommended for low band (689MHz~960MHz) and High band (1710MHz~2700MHz),respectively. The combination of these two configurations can be applied for both of the two bands matching at the same time. Take configure 1 for example, the matching network is a parallel inductor following with a series capacitor. The sequence of parallel inductor and series capacitor depends on the resistance of antenna in smith chart. Furthermore, in some case, only one series capacitor or a parallel inductor can achieve matching purpose.

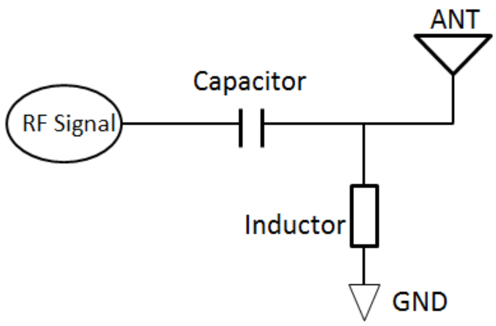


FIGURE 5.1 CONFIG 1 FOR LOW BAND

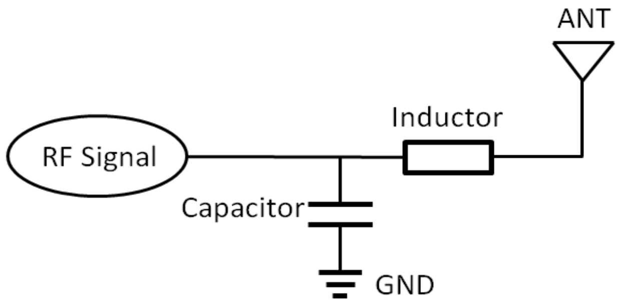


FIGURE 5.2 CONFIG 1 FOR HIGH BAND

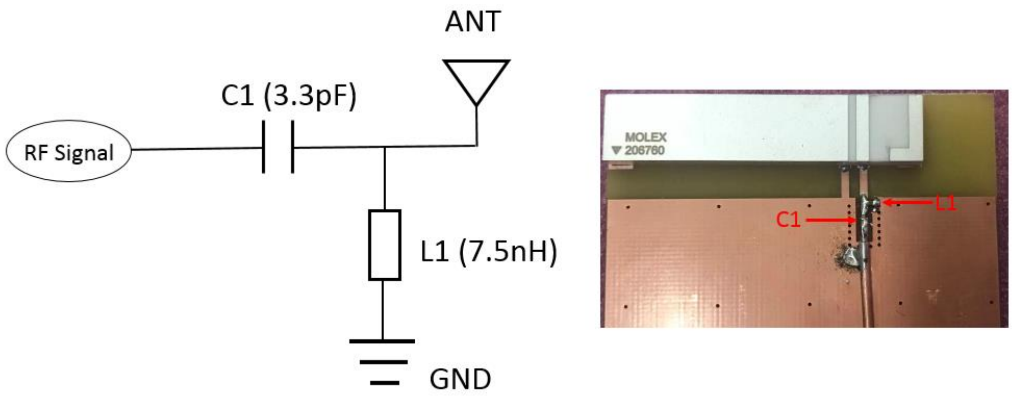


FIGURE 5.3 MATCHING CIRCUIT OF ANTENNA FOR ALL BAND ON REFERENCE PCB (138*48MM)

The following figure 5.4 and figure 5.5 are the return loss and smith chart comparison without and with the matching on reference PCB size (130*48mm).

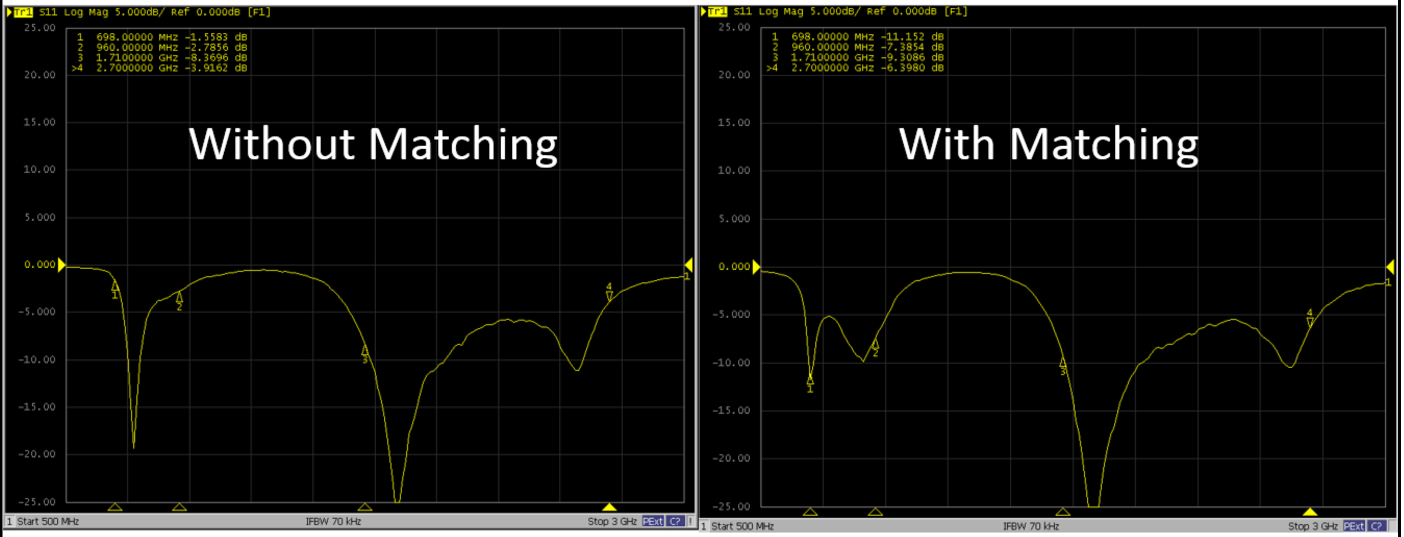


FIGURE 5.4 RETURN LOSS OF ANTENNA WITHOUT AND WITH MATCHING ON REFERENCE PCB (130*48MM)

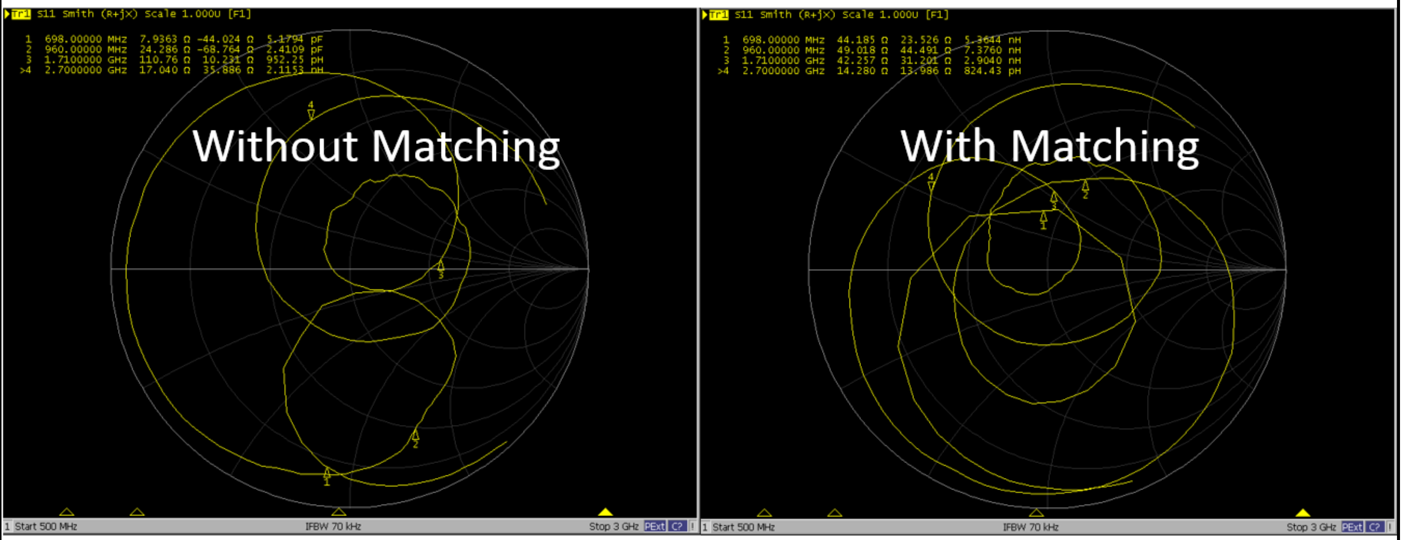


FIGURE 5.5 SMITH CHART OF ANTENNA WITHOUT AND WITH MATCHING ON REFERENCE PCB (130*48MM)

6.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

6.1 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATIONS WITH PARALLEL GROUND

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Five locations from 5mm, 10mm, 20mm, 30mm and 40mm with a parallel ground have been evaluated. The locations are shown in figure 6.1.1. The plane ground size is 90mm*90mm. The antenna performance is better with larger distance between antenna and parallel plane ground. The minimum distance between antenna and ground is recommended to be at least 20mm to achieve acceptable RF performance.

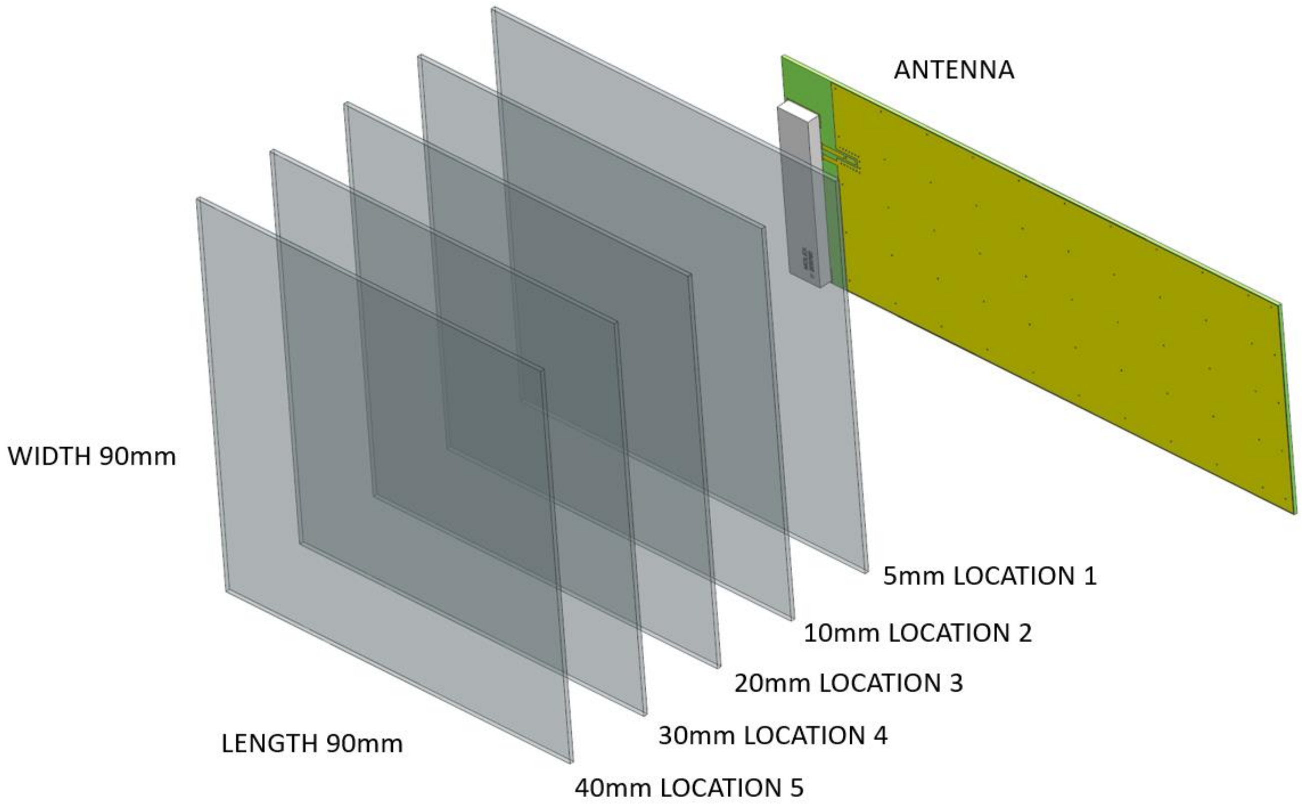


FIGURE 6.1.1 FIVE LOCATIONS WITH PARALLEL PLANE GROUND

.

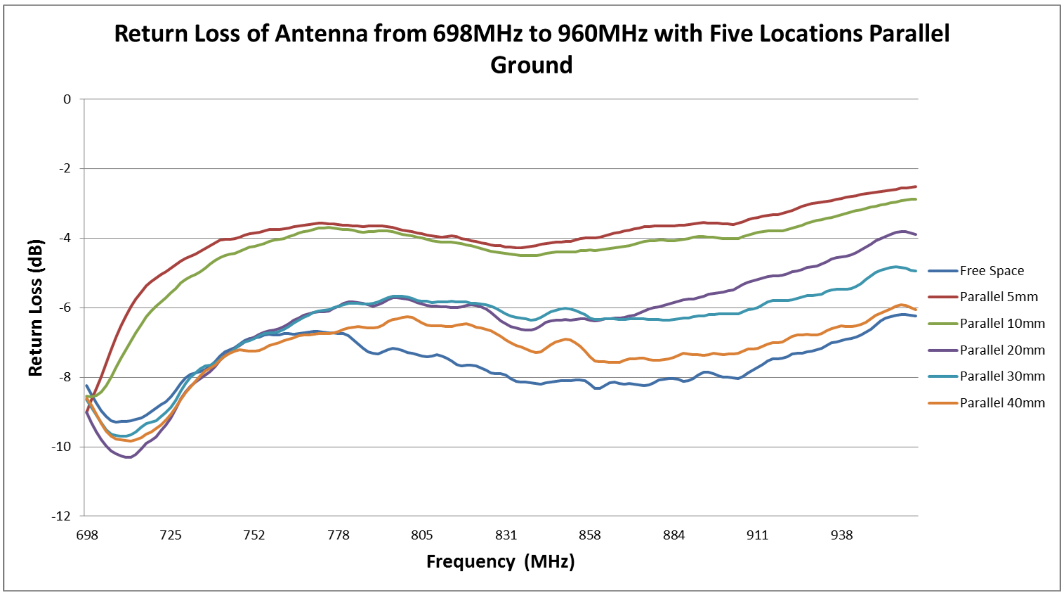


FIGURE 6.1.2 RETURN LOSS OF ANTENNA FROM 698MHZ TO 960MHZ WITH FIVE LOCATIONS PARALLEL GROUND

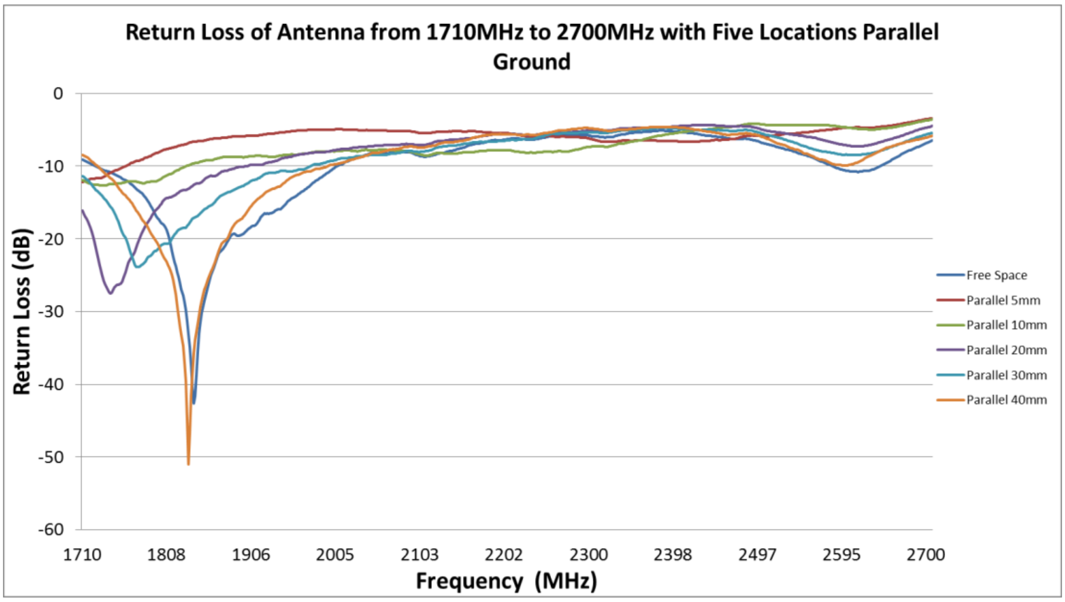


FIGURE 6.1.3 RETURN LOSS OF ANTENNA FROM 1710MHZ TO 2700MHZ WITH FIVE LOCATIONS PARALLEL GROUND

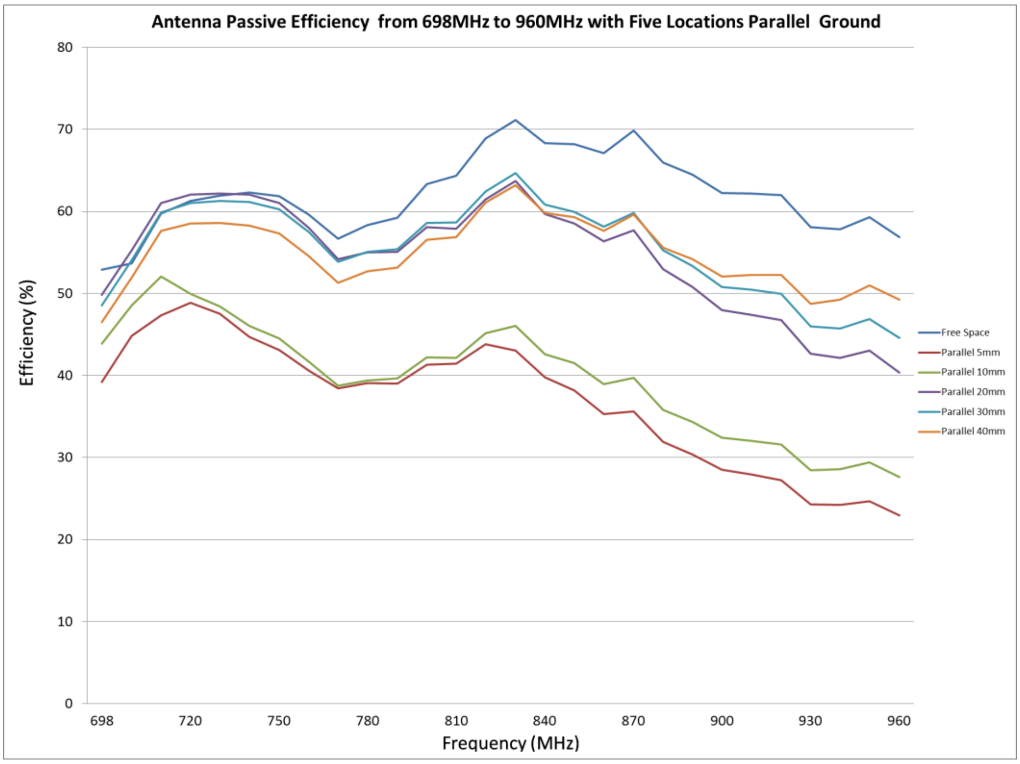


FIGURE 6.1.4 EFFICIENCY OF ANTENNA FROM 698MHZ TO 960MHZ WITH FIVE LOCATIONS PARALLEL GROUND

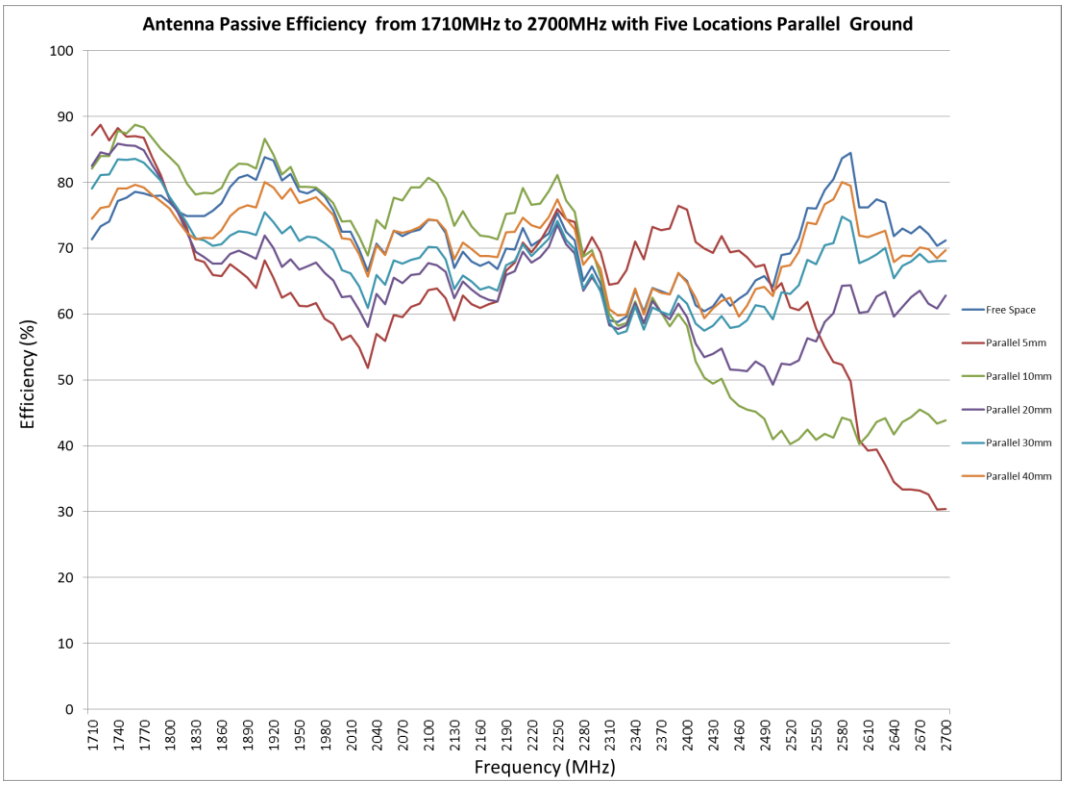


FIGURE 6.1.5 EFFICIENCY OF ANTENNA FROM 1710MHZ TO 2700MHZ WITH FIVE LOCATIONS PARALLEL GROUND

6.2 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATIONS WITH VERTICAL GROUND

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Five locations of 5mm, 10mm, 20mm, 30mm and 40mm away from vertical ground have been evaluated. These locations are shown in figure 6.2.1. The plane ground size is 90mm*90mm. The antenna performance is better with larger distance between antenna and vertical plane ground. The minimum distance between antenna and ground is recommended to be at least 30mm to achieve acceptable RF performance.

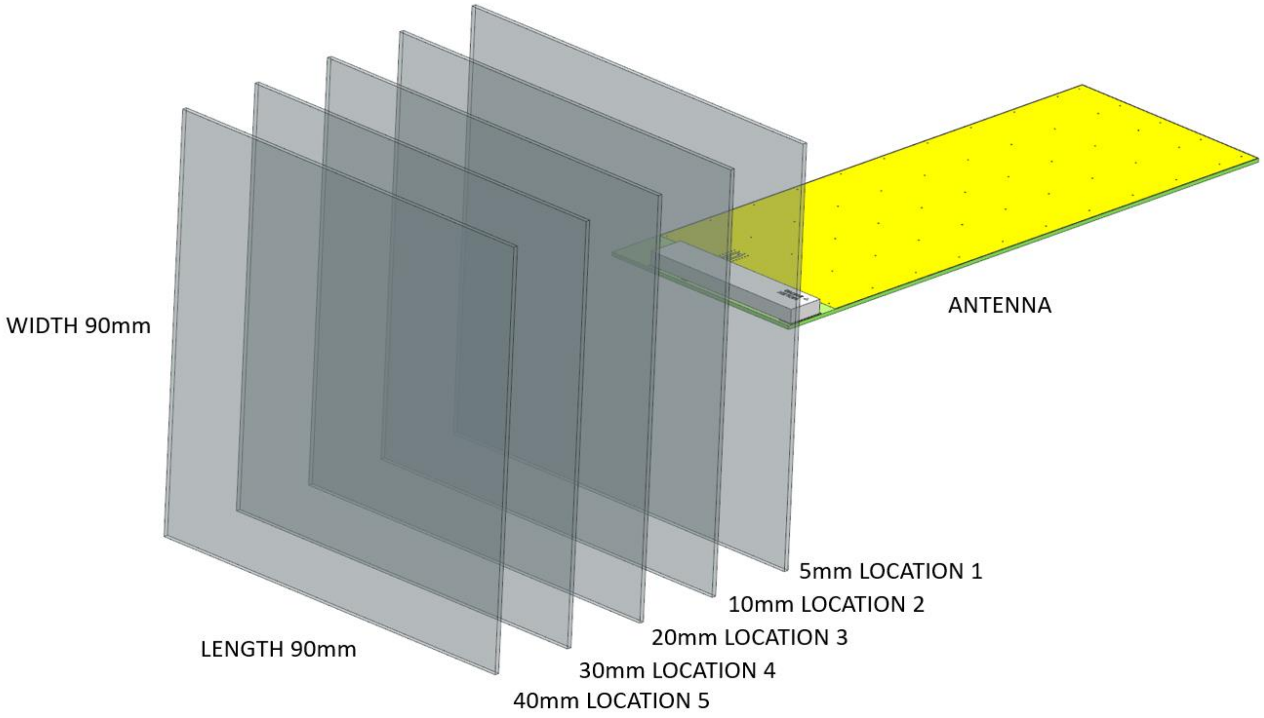


FIGURE 6.2.1 FIVE LOCATIONS WITH VERTICAL PLANE GROUND

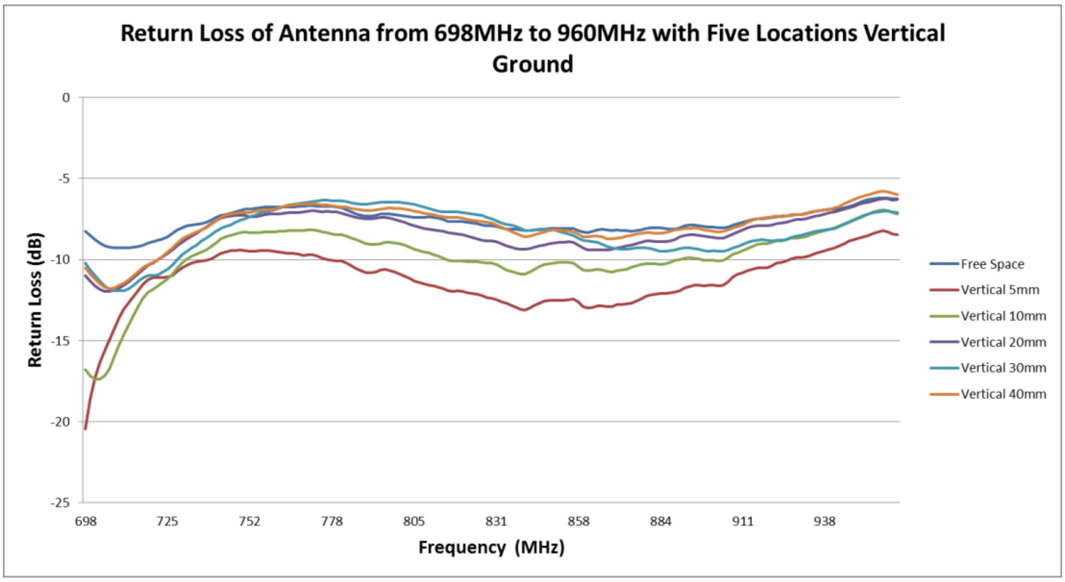


FIGURE 6.2.2 RETURN LOSS OF ANTENNA FROM 698MHZ TO 960MHZ WITH FIVE LOCATIONS VERTICAL GROUND

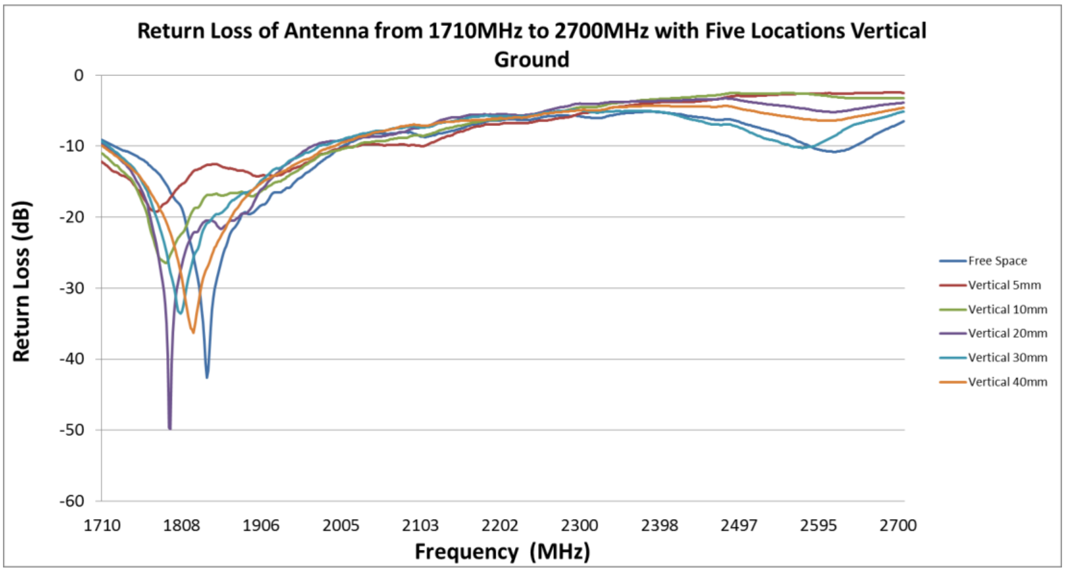


FIGURE 6.2.3 RETURN LOSS OF ANTENNA FROM 1710MHZ TO 2700MHZ WITH FIVE LOCATIONS VERTICAL GROUND

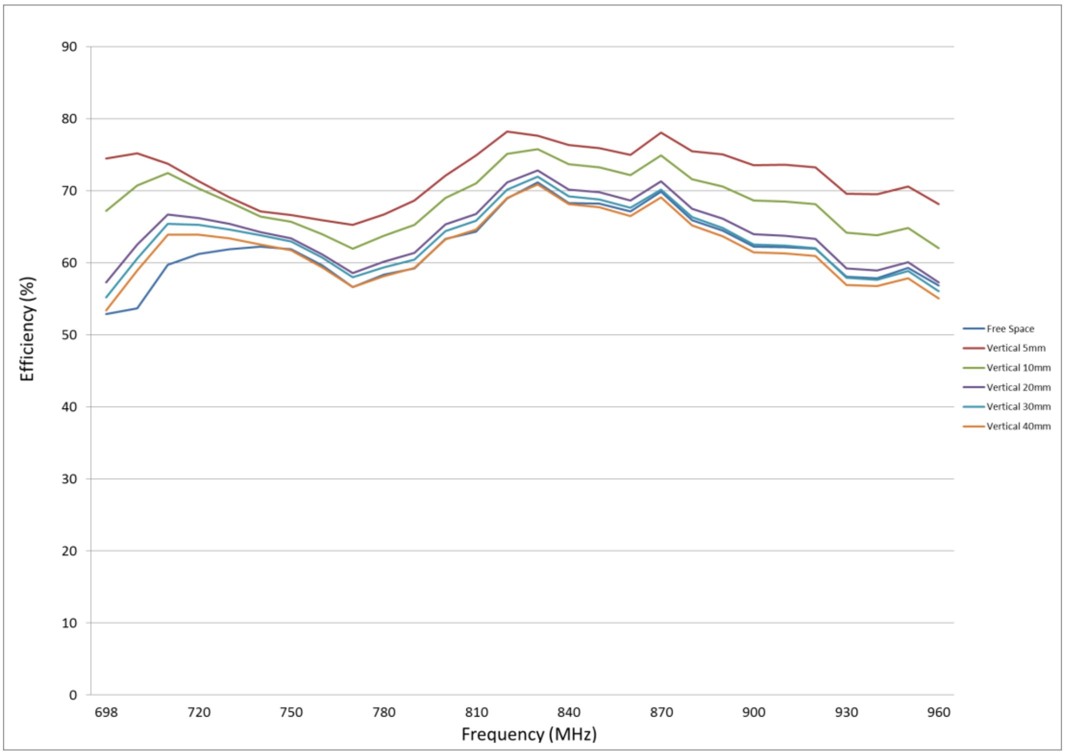


FIGURE 6.2.4 EFFICIENCY OF ANTENNA FROM 698MHZ TO 960MHZ WITH FIVE LOCATIONS VERTICAL GROUND

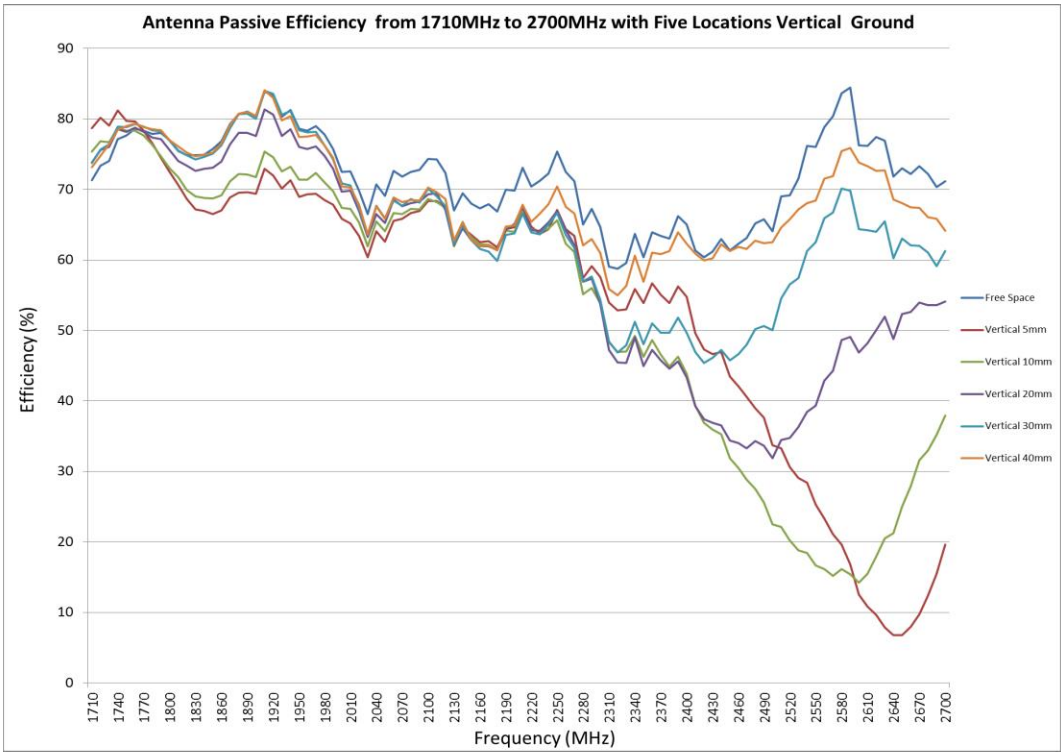


FIGURE 6.2.5 EFFICIENCY OF ANTENNA FROM 1710MHZ TO 2700MHZ WITH FIVE LOCATIONS VERTICAL GROUND

6.3 RF PERFORMANCE AS A FUNCTION ON DIFFERENT PCB SIZE

Four kinds of ground plane size were used for this study, which were 100mm*48mm, 120*48mm, 130mm*48mm (Reference PCB), 150mm*60mm. The PCB configurations are shown in figure 6.3.1. The ground size will affect the efficiency at low band more than high band. The minimum PCB size is recommended to be at least 120mm*48mm to achieve acceptable RF performance.

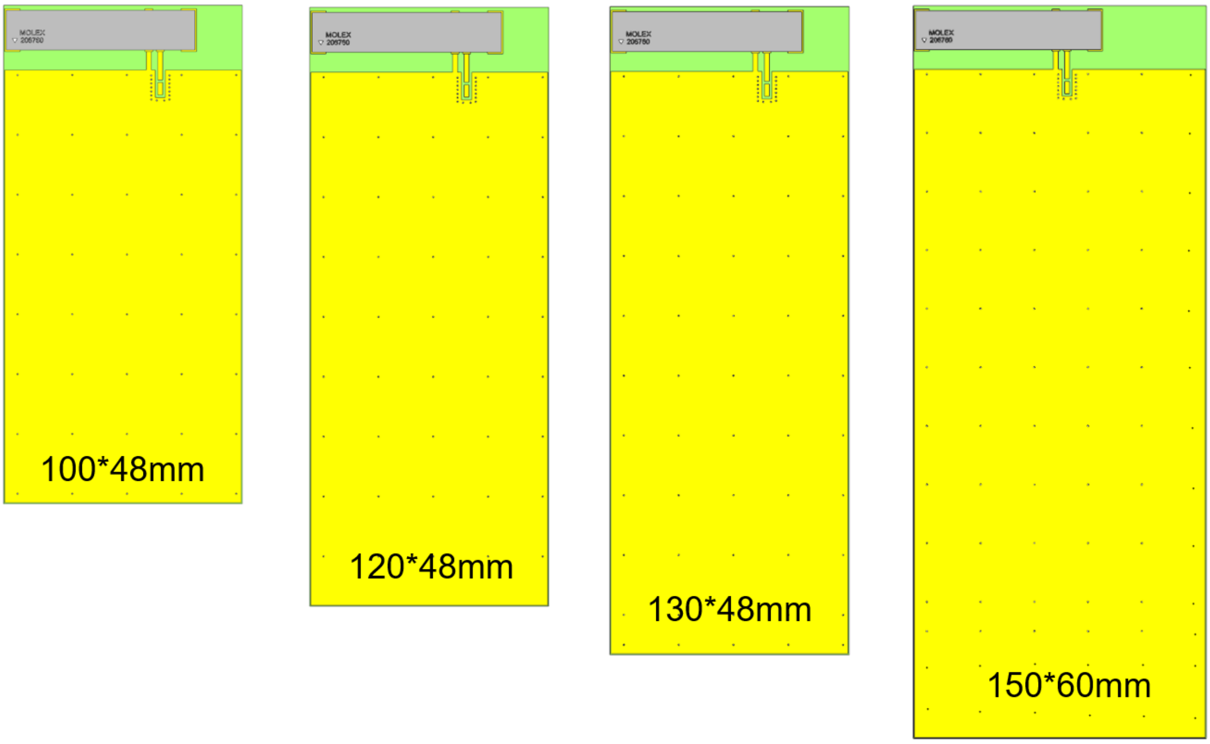


Figure 6.3.1 FOUR KINDS OF GROUND PLANE SIZE

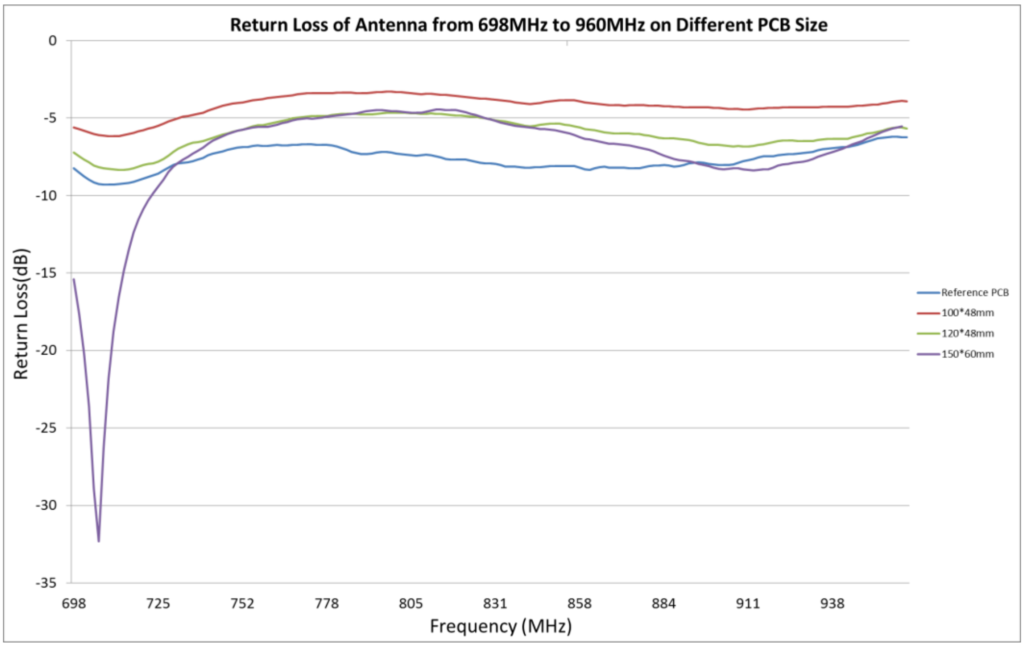


FIGURE 6.3.2 RETURN LOSS OF ANTENNA FROM 698MHZ TO 960MHZ ON DIFFERENT PCB SIZE

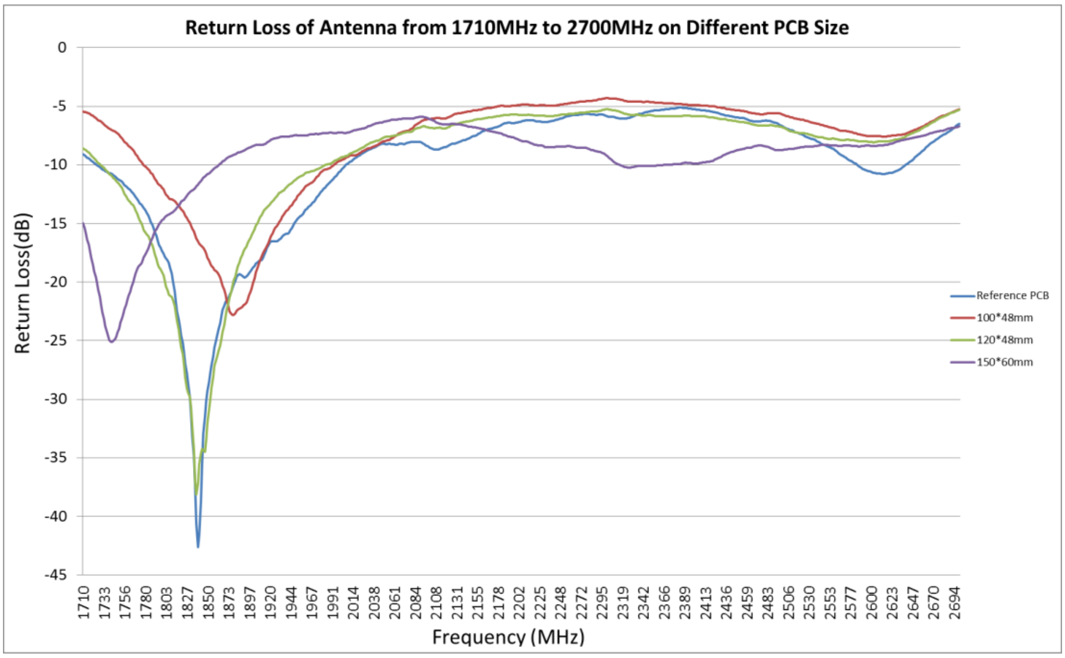


FIGURE 6.3.3 RETURN LOSS OF ANTENNA FROM 1710MHZ TO 2700MHZ ON DIFFERENT PCB SIZE

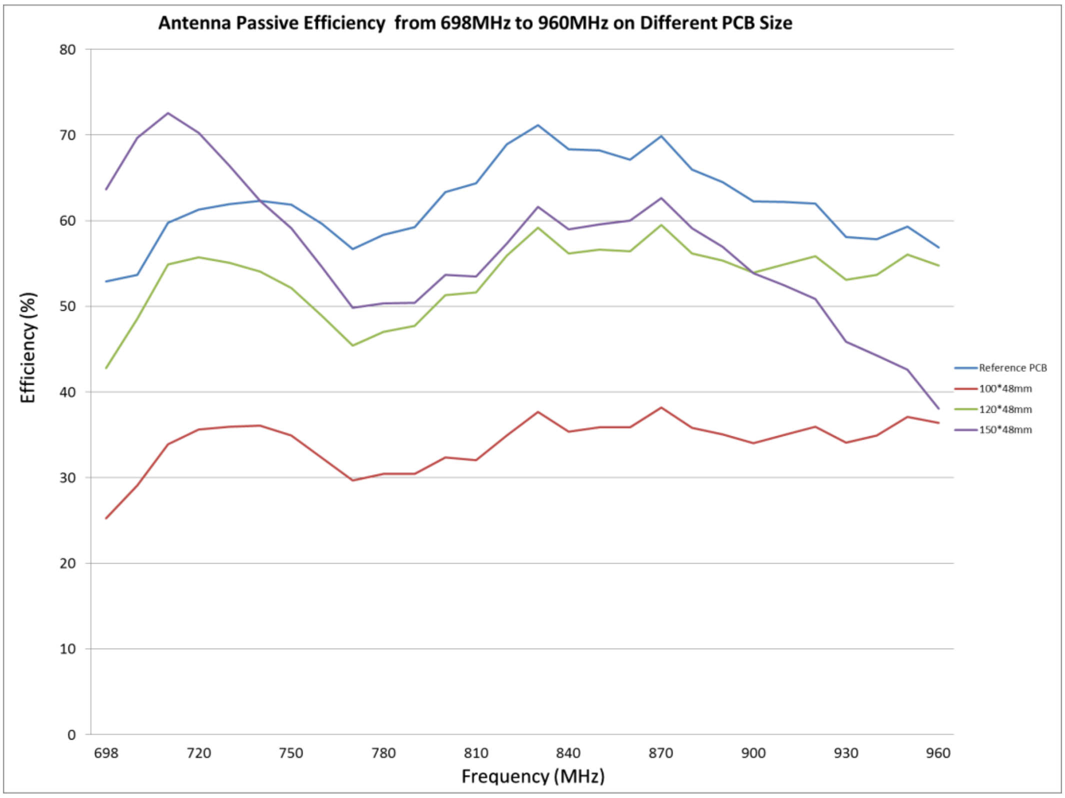


FIGURE 6.3.4 EFFICIENCY OF ANTENNA FROM 698MHZ TO 960MHZ ON DIFFERENT PCB SIZE

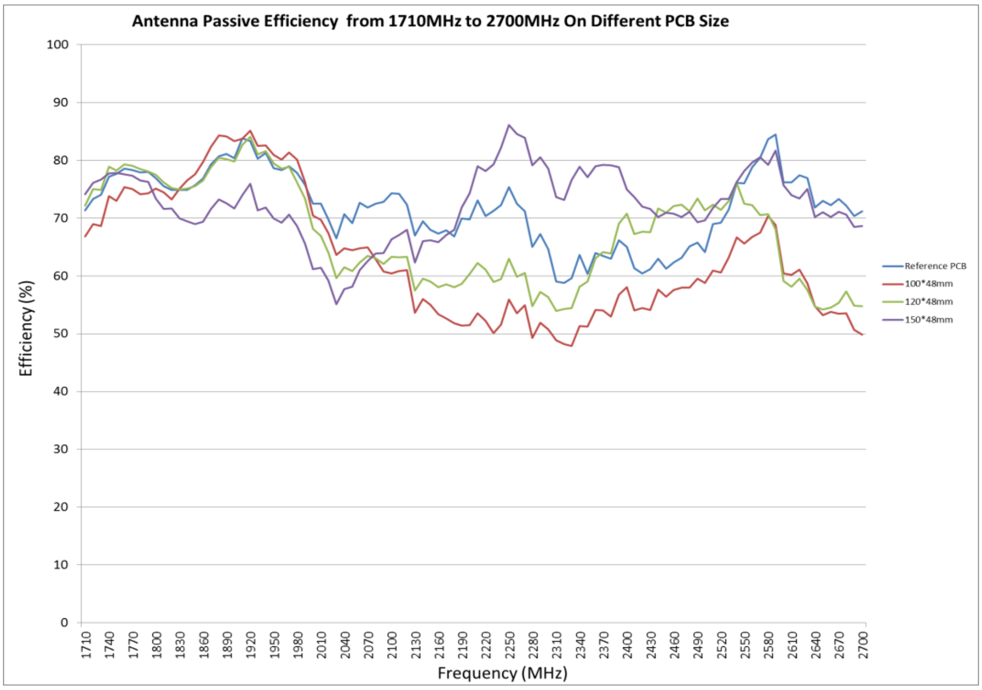


FIGURE 6.3.5 EFFICIENCY OF ANTENNA FROM 1710MHZ TO 2700MHZ ON DIFFERENT PCB SIZE