

APPROVED VENDOR LIST

VENDOR NAME	VENDOR PART NUMBER	ROHS COMPLIANT
1st MOLEX	1461530100	YES
2nd		
3rd		
4TH		
5TH		
SHELF ☒ NO YES ☐ TEMP ☒ NO YES ☐ MSL ☒ NO YES ☐ Rating ☒ NO YES ☐ PARAMETER ☒ NO YES ☐ RoHS COMPLIANT ☐ NO YES ☒ PARTIAL ☐ N/A ☐		
NOTES Revision B adds material information on the coax cable used on this assembly. There is no electrical or mechanical difference between the Rev B and Rev A release. This a documentation change only.		
ORIGINATOR	DESCRIPTION	ZOLL Medical Corporation 269 & 271 Mill Road Chelmsford, MA 01824-4105
R. Salcedo	ANTENNA, 2.4/5GHz, 100mm COAX w/ MHF CONN	
DATE	SHEET	DOCUMENT NO.
2/7/2022	1 of 50	0301-000128-PS
		REV. B

PLEASE CHECK WWW.MOLEX.COM FOR LATEST PART INFORMATION

Part Number: **1461530100**

Status: **Active**

Overview: Internet of Things (IoT) Antennas: Wi-Fi, Bluetooth, Zigbee

Description: Wi-Fi 6E Flex Cabled Balanced Antenna, 9.00mm Width, 100.00mm Cable Length, Compatible with U.FL / I-PEX MHF Connectors

Documents:

3D Model	Application Specification AS-146153-100-001 (PDF)
Drawing (PDF)	Packaging Specification 1461530100-000 (PDF)
3D Model (PDF)	Datasheet (PDF)
Product Specification PS-146153-100-001 (PDF)	RoHS Certificate of Compliance (PDF)

General

Product Family	Antennas
Series	<u>146153</u>
Component Type	Flexible Antenna with Cable
Function	Signal
Mates With	Molex Receptacle <u>734120110</u> and other alternatives
Overview	<u>Internet of Things (IoT) Antennas: Wi-Fi, Bluetooth, Zigbee</u>
Product Name	2.4/5GHz Balanced Flex Antenna
Protocol	BLE, BT, Thread, Wi-Fi, Wireless Hart, Zigbee
Type	Wi-Fi Antenna
UPC	889056310017

Physical

Cable Length	100.00mm
Length	34.90mm
Mounting Style	Adhesive
Net Weight	0.574/g
Packaging Type	PET Film
Polarization	Linear
Radiation Pattern	Omnidirectional
Thickness	0.10mm
Width	9.00mm

Electrical

Band#1 F_End (MHz)	2483.5
Band#1 F_Start (MHz)	2400
Band#2 F_End (MHz)	5930
Band#2 F_Start (MHz)	4900
Electrical Connectivity	Cable
Peak Gain (dBi)	3.0 @ 2.4 GHz, 4.0 @ 5 GHz
Return Loss - S11 (dB)	< -10
Total Efficiency	>75% @ 2.4 GHz, >75% @ 5 GHz

Material Info

Reference - Drawing Numbers

Application Specification	AS-146153-100-001
Packaging Specification	1461530100-000
Product Specification	PS-146153-100-001
Sales Drawing	SD-146153-050-001



Series image - Reference only

EU ELV

Not Relevant

EU RoHS

Compliant

REACH SVHC

Not Contained Per -
D(2021)4569-DC (8
July 2021)

Halogen-Free

Status

Low-Halogen

For more information, please visit [Contact US](#)

China ROHS	Green Image
ELV	Not Relevant
RoHS Phthalates	Not Contained

Search Parts in this Series

146153 Series

2.4/5GHz Wi-Fi[†] Flexible Antenna with Balanced Transmission

146153 RoHS-compliant, Halogen-free

Dual-band transmission-balanced antennas combine ground-plane independence with high-radiation efficiency for better connectivity and faster wireless device processing

Features and Benefits

Balanced antenna with ground-plane independent design	Reduces engineering resources and costs needed to mitigate PCB ground-induced radiation
High radiation efficiency with 34.90 by 9.00 mm strip antenna	Offers total efficiency values of 75% minimum in the 2.4GHz band and 70% minimum in the 5GHz band
Poly-flexible, double-sided adhesive tape on antenna	Enables easy peel-and-stick mounting anywhere within the device casing
Coaxial cable to center-fed antenna attachment with over 18.0N of pull force	Ensures robust antenna reliability and connectivity to radio device
Wide selection of micro-coaxial cable lengths from 50 to 300mm	Extends connectivity for maximum design flexibility

Applications

Telecommunications/Networking

- Wi-Fi devices
- Wireless LAN (WLAN)
- IEEE 802.11b/g/n devices

Industrial applications

- Machine to machine (M2M) communication
- Smartmeters
- 2.4GHz [§]ZigBee IEEE 802.15.4 devices
- 2.4 GHz and 5 GHz Industrial, Scientific and Medical (ISM) band systems and wireless devices

Consumer Electronics (CE) Applications

- Cameras
- Mobile gaming devices
- Personal navigation devices
- Wireless internet TV and audio devices

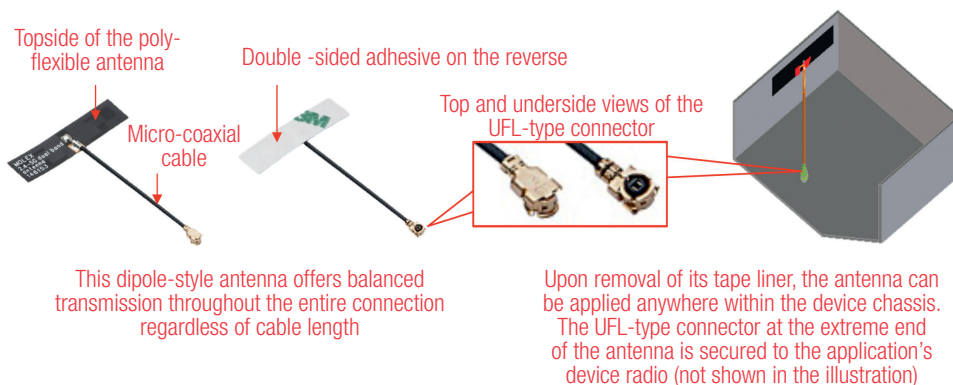
Medical

- Telemedicine and telehealth device

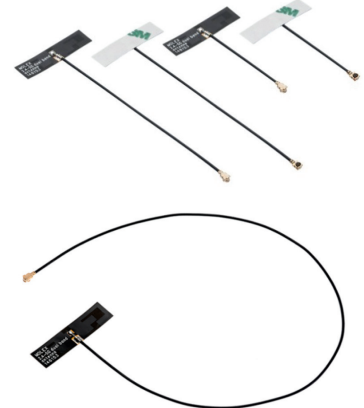
Automotive applications

- [†]Bluetooth devices
- Infotainment devices
- Mobile hotspots

Product Features



molex[®]



Series 146153 [†]Wi-Fi-ready dual-band antennas



Telehealth devices



Smartmeters



Infotainment devices



Wireless Internet TV

[†]Wi-Fi is a registered trademarks of the Wi-Fi Alliance. [†]Bluetooth is a registered trademark of Bluetooth SIG.
[§]ZIGBEE is a registered trademark of trademark of ZigBee Alliance.

2.4/5GHz Wi-Fi Flex Antenna with balanced transmission

146153 RoHS-compliant, Halogen-free

molex[®]

Specifications

Reference Information

Packaging: PE film
Mates With: Surface-mount, micro-coaxial jack
(Part Number: 73412-0110)
Designed In: mm
RoHS: Yes
Halogen Free: Yes
Glow Wire Compliant: No

Electrical specifications (5 GHz) include:

f_start (MHz): 5150
f_end (MHz): 5850
Return Loss S11 (dB): Refer to table
Total Eff. (dB): Refer to table
Peak Gain (dBi): Refer to table
Polarization: Linear
Input Impedance (Ohms): 50

Mechanical

Pull Force: > 18.0N

Physical

Thickness: 0.10mm
Operating Temperature: -30 to +85°C

Electrical specifications (2.4 GHz) include:

f_start (MHz): 2400
f_end (MHz): 2483.5
Return Loss S11 (dB): Refer to table
Total Eff. (dB): Refer to table
Peak Gain (dBi): Refer to table
Polarization: Linear
Input Impedance (Ohms): 50

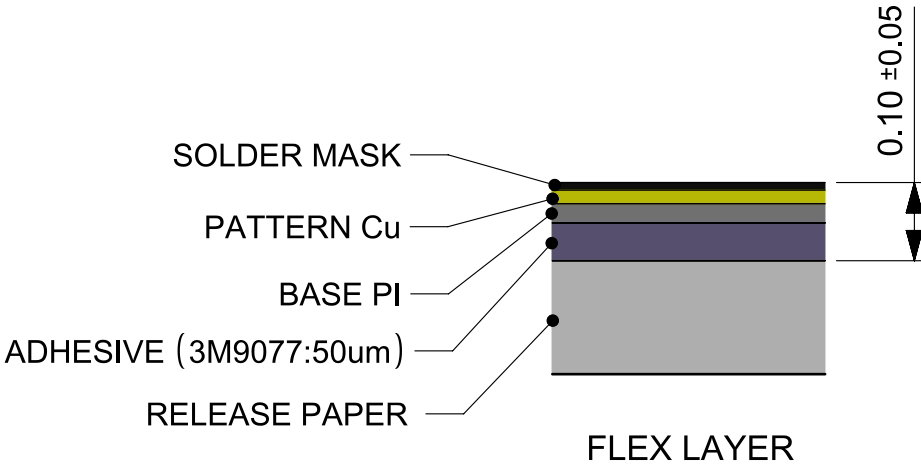
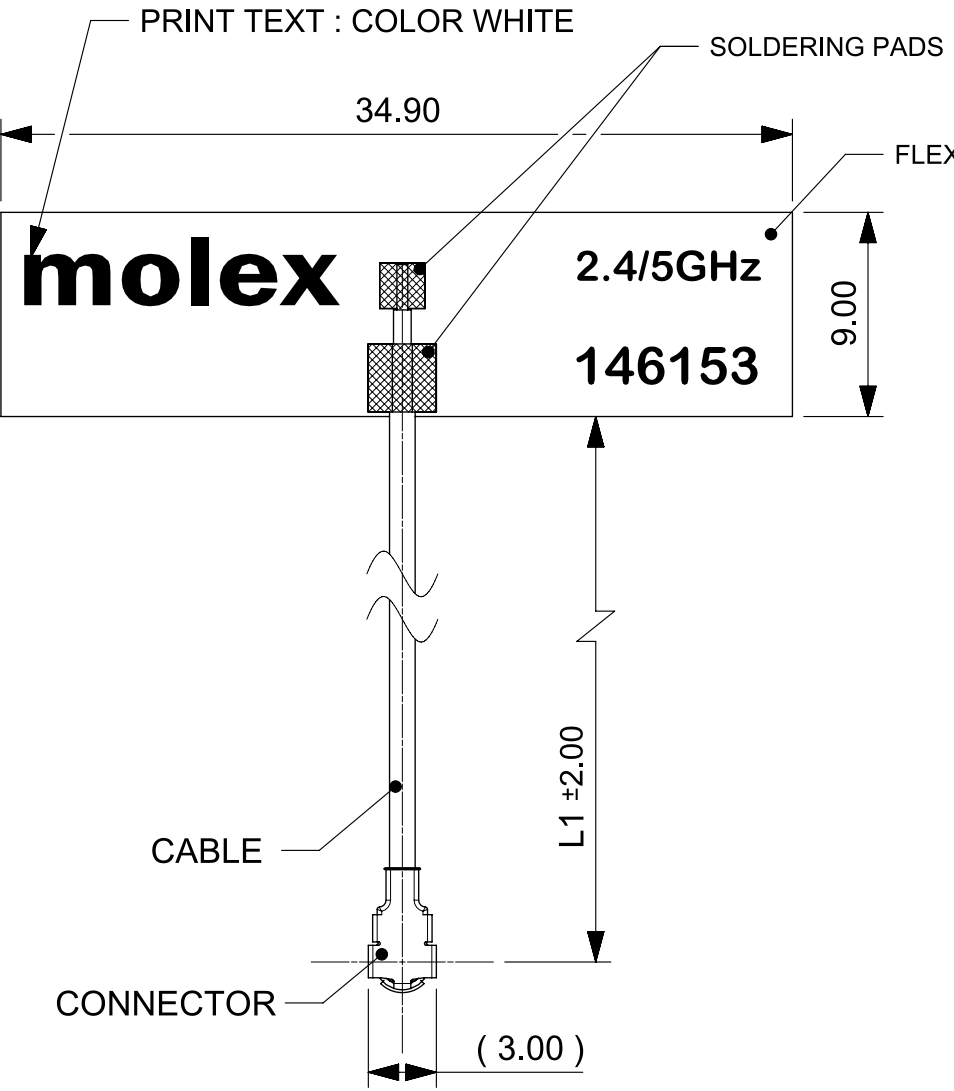
Ordering Information

Order No.	Flexi-Antenna Dimensions	Miniature Coaxial Cable Lengths (mm)	Frequency Range (GHz)	Return Loss S11 (db)	Peak Gain (dBi)	Total Efficiency (%)
146153-0050	34.90 by 9.00mm	50	2.4 - 2.5	< -10	3.2	> 78
			5.15 - 5.85	< -10	4.75	> 75
146153-0100		100	2.4 - 2.5	< -10	3.0	> 75
			5.15 - 5.85	< -10	4.5	> 70
146153-0150		150	2.4 - 2.5	< -10	2.8	> 72
			5.15 - 5.85	< -10	4.2	> 66
146153-0200		200	2.4 - 2.5	< -10	2.6	> 69
			5.15 - 5.85	< -10	4.0	> 62
146153-0250		250	2.4 - 2.5	< -10	2.4	> 66
			5.15 - 5.85	< -10	3.7	> 58
146153-0300		300	2.4 - 2.5	< -10	2.2	> 63
			5.15 - 5.85	< -10	3.3	> 55

Unique And Useful Differentiation vs. Similar Molex Product

Attribute	Product and Technical Differences	
	2.4/5GHz Wi-Fi Flexible Antenna with Balanced Transmission (Series 146153)	2.4/5GHz Standalone Antenna (Series 47950)
Operating Frequencies	2.4/5GHz	2.4/5GHz
Dipole-style, Center-feed design	Yes	Yes
Ground-plane independence	Yes	Yes
Total Radiation Efficiency with 34.9 by 9.00 mm (1.37 by 0.34") version antenna	Total Efficiency values of 75% minimum in the 2.4GHz band and 70% minimum in the 5GHz band [Remark: Signal attenuation along cable affects Total Radiation Efficiency]	Total Efficiency values of 75% minimum in the 2.4GHz band and 60% minimum in the 5GHz band [Remark: Signal attenuation along cable affects Total Radiation Efficiency]
Transmission characteristics	Antenna resonance is not affected by cable length of balanced antenna. Consistent antenna performance	Cable length affects transmission balance. Antenna performance varies greatly with cable length
Wi-Fi-ready	Yes	Yes
Micro coaxial cable lengths	50, 100, 150, 200, 250, 300mm	100, 150, 200mm
Environmentally sustainable	Yes, RoHS-compliant, Halogen-free	Yes, RoHS-compliant, Halogen-free

www.molex.com/link/standard_antennas.html



NOTES:

1. MATERIAL:

FLEX SIZE: 34.9*9mm

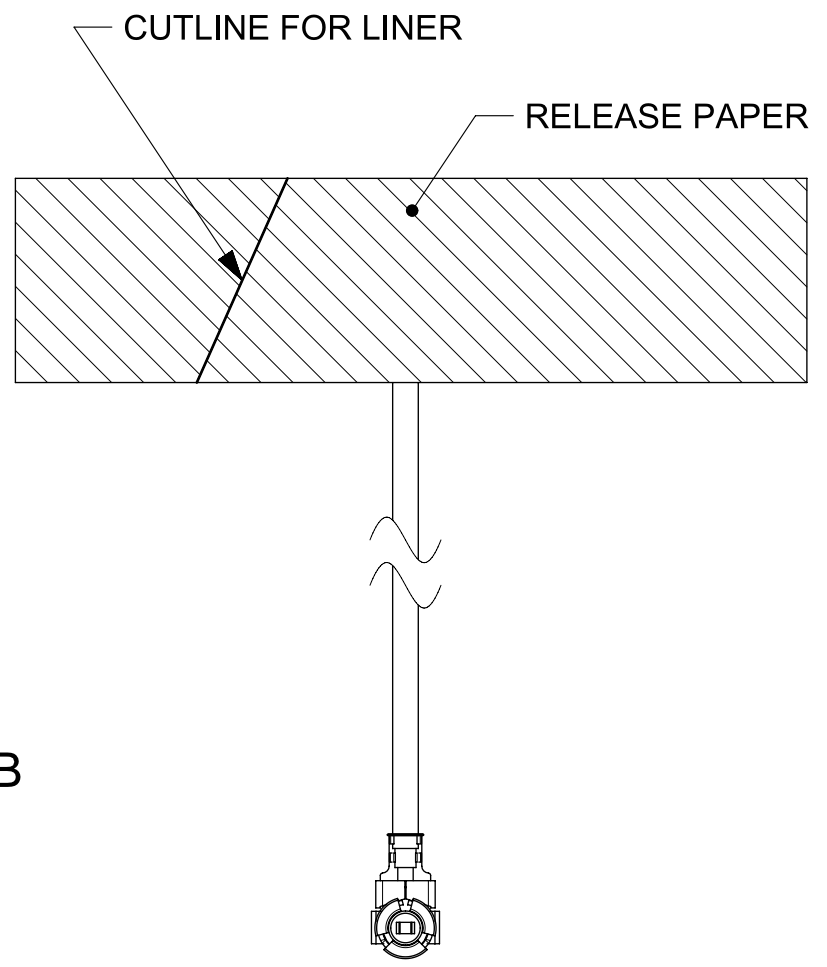
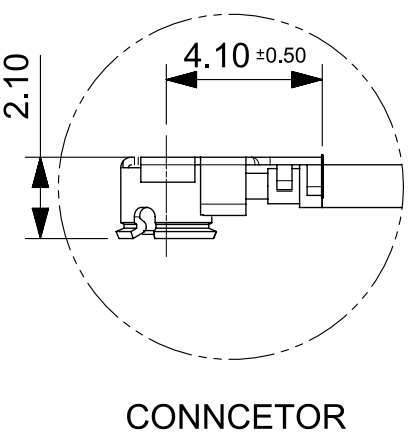
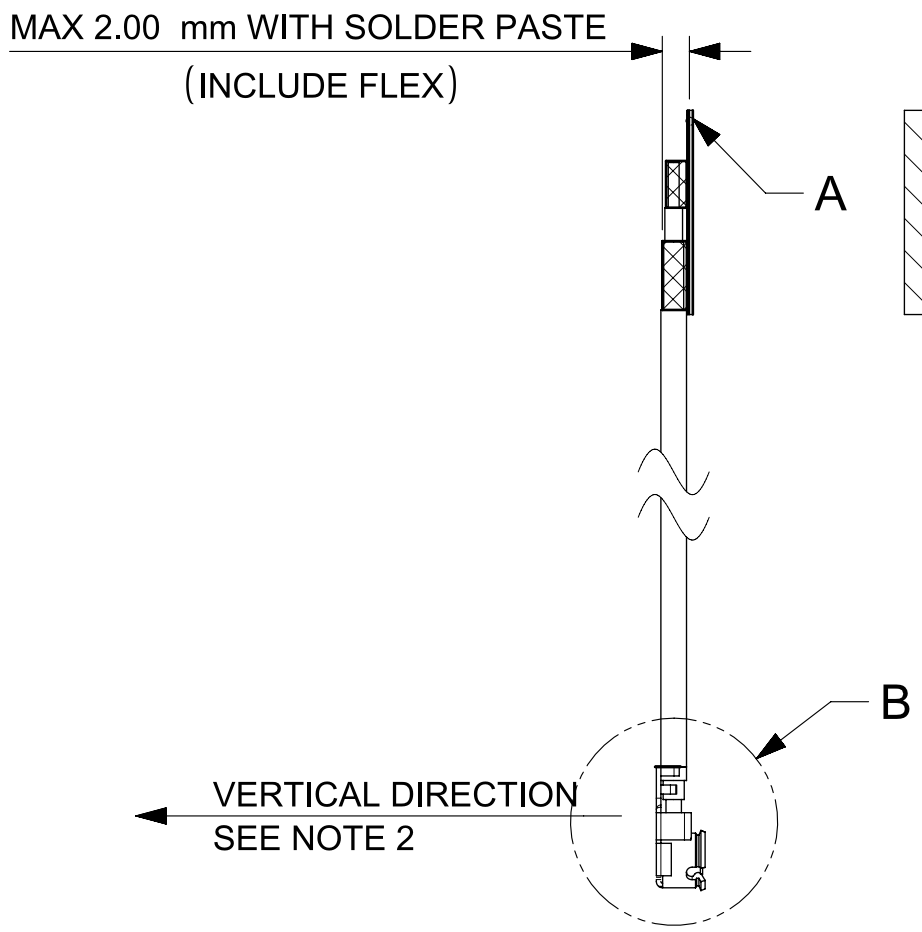
CABLE:Ø1.13 mm

CONNECTOR:OD1.13 RF 2.5H U.FL CONNECTOR-PLUG GOLD PLATED (IPEX MHF-I COMPATIBLE)

2. FOR PULL TEST, CAN NOT LIFT UP IN THE VERTICAL DIRECTION.

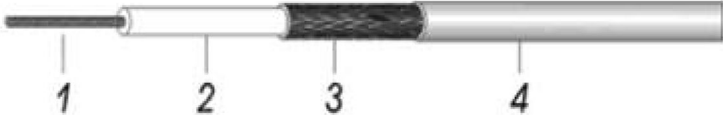
3. SOLDER MASK:BLACK.

4. THE CONNECTOR WILL BE PROTECTED WITH A CAP.



ITEM	MATERIAL NO.	CABLE LENGTH"L1"
1	1461530050	43.3 mm
2	1461530100	93.3 mm
3	1461530150	143.3 mm
4	1461530200	193.3 mm
5	1461530250	243.3 mm
6	1461530300	293.3 mm

SYMBOLS ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0 ▽ = 0	THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO MOLEX ELECTRONIC TECHNOLOGIES, LLC AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION	CURRENT REV DESC: EC DESCRIPTION		molex 2.4/5GHz BALANCE FLEX ANTENNA		
	DIMENSION UNITS mm	SCALE 3:1	EC NO: 615969			
	GENERAL TOLERANCES (UNLESS SPECIFIED)		DRWN: KCHENG 2019/04/22		DOCUMENT NUMBER 1461530050	
	ANGULAR TOL ± 1/2 °		CHK'D: CZHOU 2019/04/22		DOC TYPE PSD	
	4 PLACES ±		APPR: XJSONG 2019/04/22		DOC PART SD	
2 PLACES ± 0.2		INITIAL REVISION:		REVISION D1		
1 PLACE ± 0.3		DRWN: KCHENG 2019/04/22		MATERIAL NUMBER SEE TABLE		
0 PLACES ± 0.5		APPR: XJSONG 2019/04/22		CUSTOMER GENERAL MARKET		
DRAFT WHERE APPLICABLE MUST REMAIN WITHIN DIMENSIONS		THIRD ANGLE PROJECTION	DRAWING A3-SIZE	SERIES 146153	SHEET NUMBER 1 OF 1	

结构图 Structure drawing	
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结构特性 Structure characteristics

结构 Structure	项目 Item	标准值 Standard value
内导体 Inner conductor	材料 Material	镀锡铜线 Tinned copper wire
	组成:总根数/单根外径(mm) Makeup:total / O.D. of every wire(mm)	7/0.08
	(绞合)标称外径(mm) (Intertwist)NOM.O.D.(mm)	0.24±0.02
绝缘层 Insulation	材料 Material	聚全氟乙丙烯 FEP
	颜色 Color	透明 Clarity
	标称外径(mm) NOM.O.D.(mm)	0.7±0.03
外导体 Outer conductor	材料 Material	镀锡铜线 Tinned copper wire
	组成:总根数/单根外径(mm) Makeup:total / O.D. of every wire(mm)	4/0.05
	标称外径(mm) NOM.O.D.(mm)	0.92±0.05
	覆盖率(%) Coverage ratio(%)	90±5
护套层 Jacket	材料 Material	聚全氟乙丙烯 FEP
	颜色 Color	黑 Black
	标称外径(mm) NOM.O.D.(mm)	1.13±0.05



PRODUCT SPECIFICATION

TITLE

WIFI 6E FLEX CABLE BALANCE ANTENNA

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8. ENVIRONMENTAL SPECIFICATION
9. PACKING
10. CHANGE HISTORY

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
F2	EC No: 676655 DATE: 2021/09/06	WIFI 6E CABLE FLEX BALANCE ANTENNA PRODUCT SPECIFICATION	1 of 11
DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
PS-1461530100	Kang Cheng 2020/08/31	Cooper Zhou 2020/08/31	Stary Song 2020/08/31

WIFI 6E FLEX CABLE BALANCE ANTENNA

1.0 SCOPE

This Product Specification covers the mechanical, electrical and environmental performances specification for WiFi 6E flex cable balance antenna.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

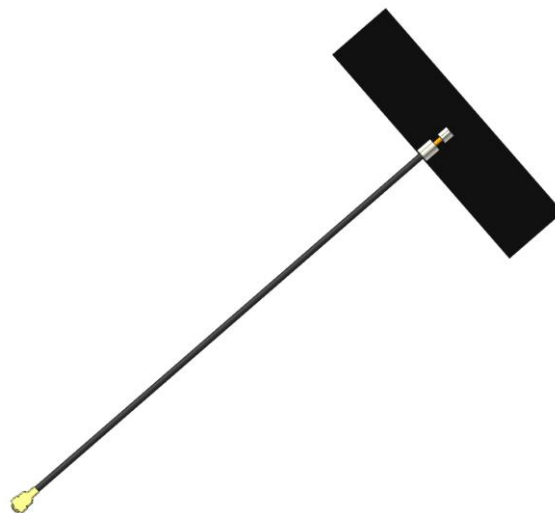
Product name: WiFi 6E flex cable balance antenna
Series Number: 146153 Series

2.2 DESCRIPTION

Series 146153 is a balanced, dipole-type, high efficiency antenna for 2.4/5/6 GHz applications, including WiFi 6E, Bluetooth, Zigbee and others. This antenna is made from poly flexible material with small size 35*9*0.1mm and has double-sided adhesive tape for easy "peel and stick" mounting. This balanced antenna with ground plane independent design offers various cable length options for ease of integration into various devices.

2.3 FEATURES

- 2400~2500MHz,5150~5850MHz,5925~7125MHz, linear polarization
- Ground plane independent, balanced dual band antenna
- Flex size 35 x 9 x 0.1mm (not contain solder area)
- IPEX MHF (U.FL compatible) connector (Such as MHF1/MHF4)
- Cable OD1.13mm, 6 standard length options (50/100/150/200/250/300mm)
- Cable and connector can be customized



Molex 146153 SERIES 3D VIEW

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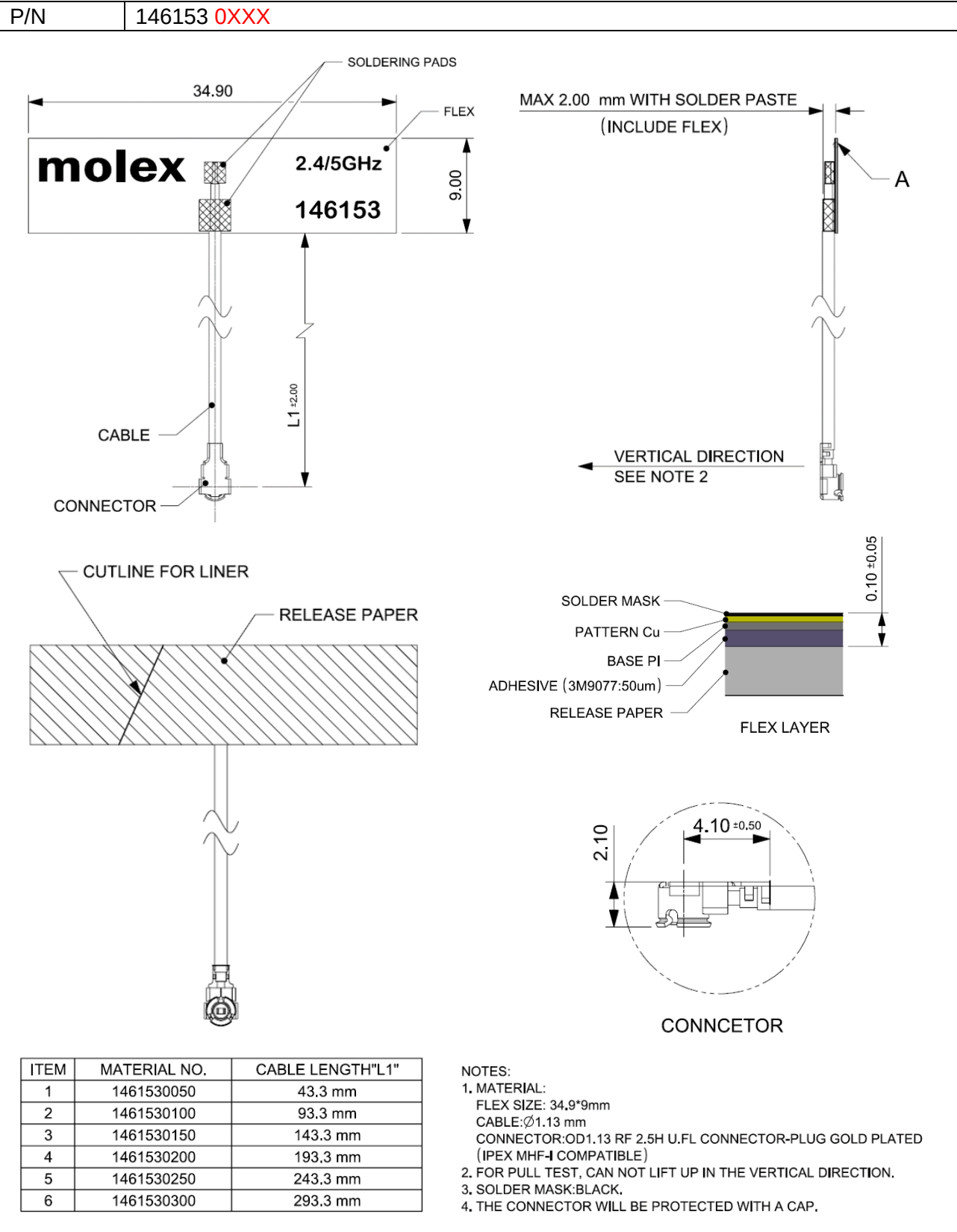
PRODUCT SPECIFICATION

3.0 GENERAL SPECIFICATION

Product name	WIFI 6E FLEX CABLE BALANCE ANTENNA		
Part number	146153		
Frequency	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925GHz-7.125GHz
Polarization	Linear		
Operating with matching	-40°C to 85°C		
Storage with matching	-40°C to 85°C		
RF Power	2 Watts		
Impedance with matching	50 Ohms		
Antenna type	Flex		
Connector type	146153 0XXX	146153 1XXX	
	Compatible MHF1	Compatible MHF4	
User Implementation type	Adhesive 3M9077		
Cable diameter	Ø1.13mm		
Cable length	50 mm (P/N for 1461530050/1461531050)		
	100 mm (P/N for 1461530100/1461531100)		
	150 mm (P/N for 1461530150/1461531150)		
	200 mm (P/N for 1461530200/1461531200)		
	250 mm (P/N for 1461530250/1461531250)		
	300 mm (P/N for 1461530300/1461531300)		

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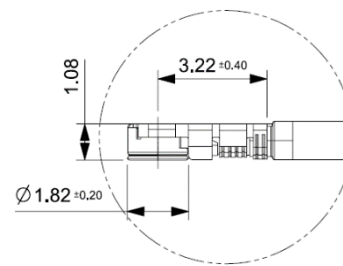
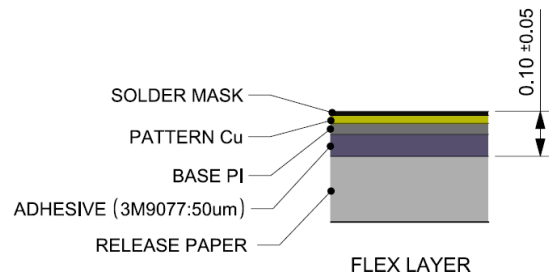
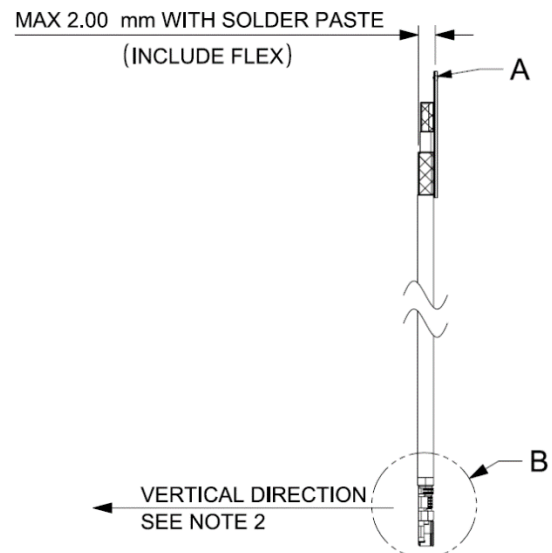
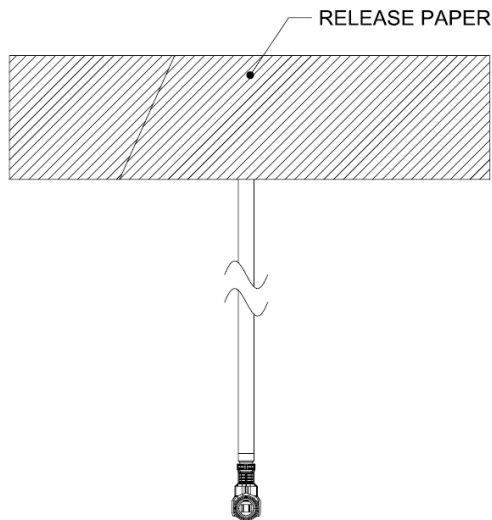
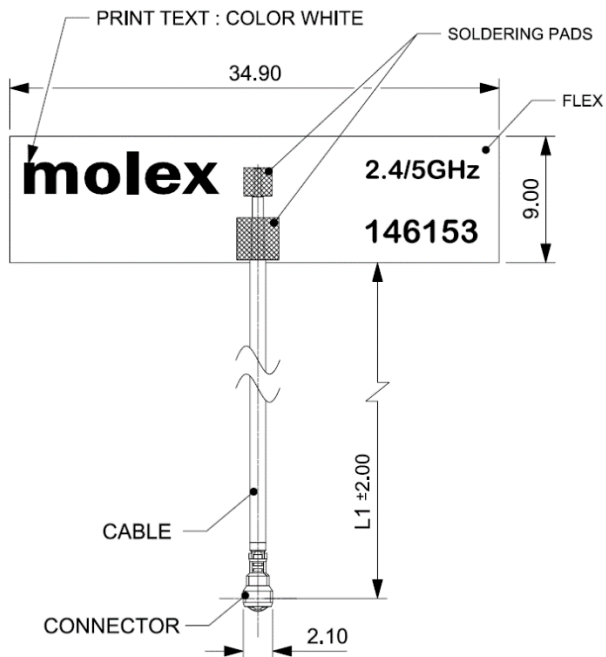
4.0 PRODUCT STRUCTURE INFORMATION



Mechanical Structure Information for 1461530XXX

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
F2	EC No: 676655 DATE: 2021/09/06	WIFI 6E CABLE FLEX BALANCE ANTENNA PRODUCT SPECIFICATION	4 of 11
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P/N 146153 1XXX



DETAIL B SCALE 8:1
CONNECTOR

ITEM	MATERIAL NO.	CABLE LENGTH"L1"
1	1461531050	43.3 mm
2	1461531100	93.3 mm
3	1461531150	143.3 mm
4	1461531200	193.3 mm
5	1461531250	243.3 mm
6	1461531300	293.3 mm

- NOTES:
1. MATERIAL:
FLEX SIZE: 34.9*9mm
CABLE: Ø1.13 mm
CONNECTOR: OD1.13 RF 1.4H I-PEX MHF4L CONNECTOR(GOLD PLATED)
 2. FOR PULL TEST, CAN NOT LIFT UP IN THE VERTICAL DIRECTION.
 3. SOLDER MASK: BLACK.
 4. THE CONNECTOR WILL BE PROTECTED WITH A CAP.

Mechanical Structure Information for 1461531XXX

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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PRODUCT SPECIFICATION

5.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing (SD)	SD-1461530050	Mechanical Dimension of the product
	SD-1461531050	
Application Guide (AS)	AS-1461530100	Antenna Application and surrounding
Packing Drawing (PK)	PK-1461530100	Product packaging specifications

6.0 ANTENNA SPECIFICATION

All measurements are done of the antenna mounted on a PC/ABS material block of 1.5 mm thickness with VNA Agilent E5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.1461530100 for different cable length.

6.1 ELECTRICAL REQUIREMENT

6.1.1 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 50mm			
P/N	1461530050		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	3.2dBi	4.25dBi	5.8dBi
Average Total efficiency	>78%	>79%	>75%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.2 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 100mm			
P/N	1461530100		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	3.0dBi	4.0dBi	5.5dBi
Average Total efficiency	>75%	>75%	>70%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.3 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 150mm			
P/N	1461530150		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.8dBi	3.7dBi	5.2dBi
Average Total efficiency	>72%	>70%	>65%
Return Loss	< -10 dB	< -10 dB	< -10 dB

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PRODUCT SPECIFICATION

6.1.4 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 200mm

P/N	1461530200		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.6dBi	3.5dBi	4.8dBi
Average Total efficiency	>69%	>66%	>60%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.5 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 250mm

P/N	1461530250		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.4dBi	3.2dBi	4.5dBi
Average Total efficiency	>66%	>63%	>56%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.6 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 300mm

P/N	1461530300		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.2dBi	2.8dBi	4.2dBi
Average Total efficiency	>63%	>59%	>51%
Return Loss	< -10 dB	< -10 dB	< -10 dB

Note that the above antenna performance is measured with just the antenna mounted on a PC/ABS block to similar a free-space condition. 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.

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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PRODUCT SPECIFICATION

6.2 CABLE LOSS

DESCRIPTION	TEST CONDITION	REQUIREMENTS		
Frequency Range	2 GHz~7.125GHz	2.0GHz~3.0GHz	5GHz~6GHz	6GHz~7.125G Hz
Attenuation	1m cable measured by VNA5071C	≤3.5dB/m	≤5.5dB/m	≤6.5dB/m

Balance antenna resonance is insensitive to cable's length, but the cable's loss will affect the total efficiency.

7.0 MECHANICAL SPECIFICATION

All measurements in this document are done with the part no.1461530100 for different cable length.

DESCRIPTION	TEST CONDITION	TEST RESULT
Pull Test	1. Test machine: Max intelligent load tester 2. Stick the flex antenna on a plastic board, pull cable in axial direction.	Pull force >8N
Un-mating force (connector)	Solder the receptacle connector to the test board ,then place the board and plug on push-on/pull-off machine, and repeat mating and un-mating 30 cycles at a speed 25±3mm/min. along the mating axis.	Un-mating force : 0.5 kgf min

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
F2	EC No: 676655 DATE: 2021/09/06	WIFI 6E CABLE FLEX BALANCE ANTENNA PRODUCT SPECIFICATION	8 of 11
DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
PS-1461530100	Kang Cheng 2020/08/31	Cooper Zhou 2020/08/31	Stary Song 2020/08/31



PRODUCT SPECIFICATION

8.0 ENVIRONMENTAL SPECIFICATION

DESCRIPTION	SPECIFICATION
Temperature /Humidity cycling	1.The device under test is kept for 30 mins in an environment with a temperature of -40 °C. 2. Kept for 4 Hours in an environment with a temperature of 85 °C. 3. Kept for 2 Hours in an environment with a temperature of 125 °C. 4. The cycle is repeated until a total of 40 cycles have been completed. Hereafter the conditions are stabilized at room temperature. Transfer temperature 8°C per min. 5. Parts should meet RF spec before and after test. 6. No cosmetic problem (No soldering problem; No adhesion problem of glue.)
Temperature Shock	1.The device under test at -40 °C-125 °C by 100 cycles, Dwell of 30 mins, transition time between Dwell 30 secs (~ 61 mins / cycle) and each item should be measured after exposing them in normal temperature and humidity for 24 h. 2. Parts should meet RF spec before and after test. 3. No cosmetic problem (No soldering problem; No adhesion problem of glue) .
High Temperature	1.Temperature:125°C, time:1008 hours 2.There is no substantial obstruction to air flow across and around the samples, and the samples are not touching each other 3. Parts should meet RF spec before and after test. 4. No cosmetic problem (No soldering problem; No adhesion problem of glue) .
Salt mist test	1. The device under test is exposed to a spray of a 5% (by volume) resolution of NACL in water for 2 hours. Thereafter the device under test is left for 1 week in room temperature at a relative humidity of 95%. The cycle is repeated until a total of 2 cycles have been completed. Here after the conditions are stabilized at room temperature. 2. Parts should meet RF spec before and after test. 3. No visible corrosion. Discoloration accept.

REVISION:

ECR/ECN INFORMATION:

TITLE:

SHEET No.

F2

EC No: 676655

DATE: 2021/09/06

**WIFI 6E CABLE FLEX BALANCE ANTENNA
PRODUCT SPECIFICATION**

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DOCUMENT NUMBER:

PS-1461530100

CREATED / REVISED BY:

Kang Cheng 2020/08/31

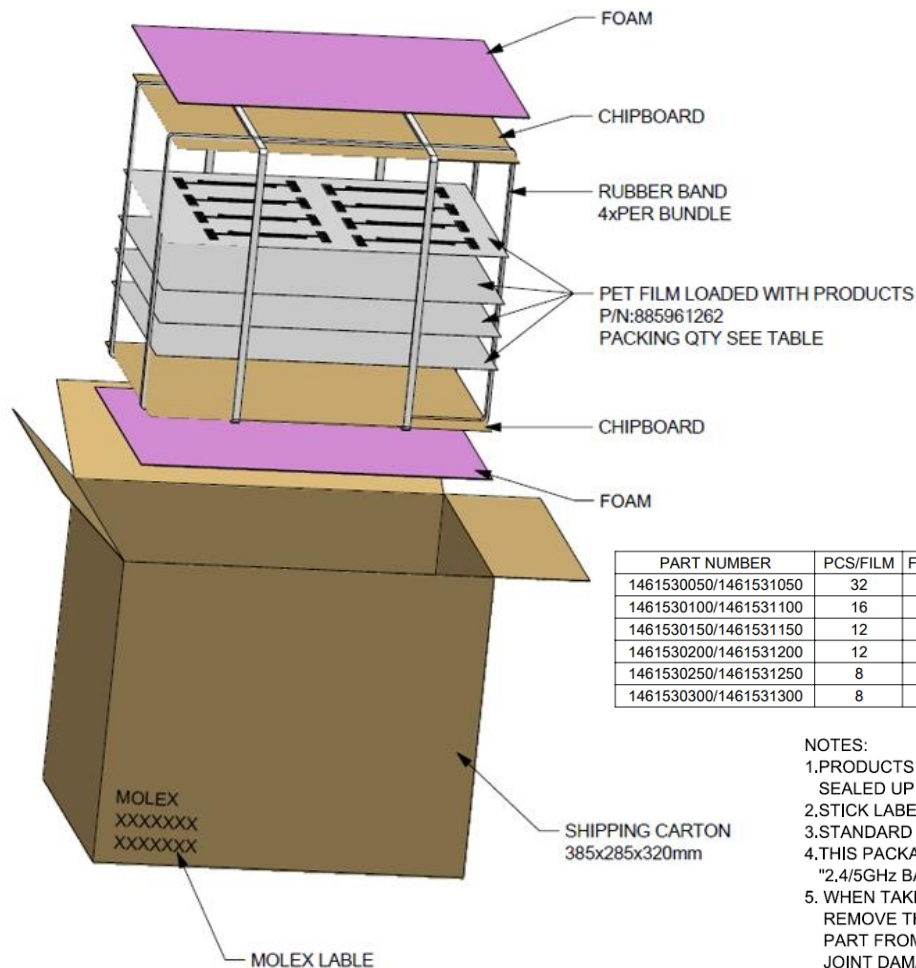
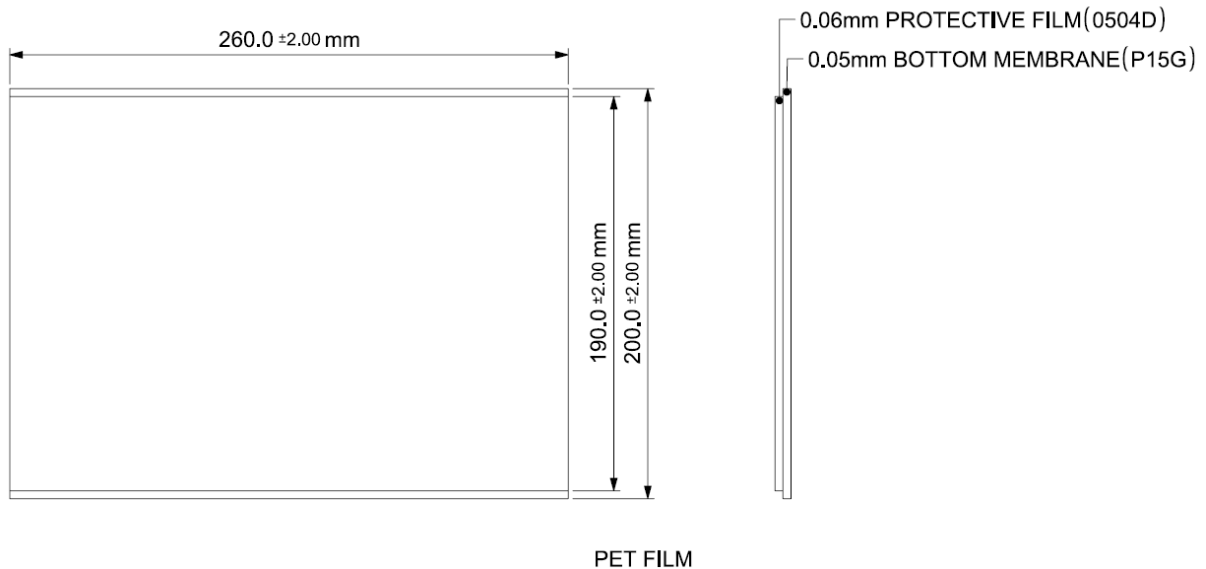
CHECKED BY:

Cooper Zhou 2020/08/31

APPROVED BY:

Stary Song 2020/08/31

9.0 PACKING



PART NUMBER	PCS/FILM	FILM/BUNDLE	BUNDLE/CARTON	QTY/CARTON
1461530050/1461531050	32	40	4	5120PCS
1461530100/1461531100	16	40	5	3200PCS
1461530150/1461531150	12	40	5	2400PCS
1461530200/1461531200	12	40	5	2400PCS
1461530250/1461531250	8	40	5	1600PCS
1461530300/1461531300	8	40	5	1600PCS

NOTES:

1. PRODUCTS MUST BE PACKED IN CARTONS AND SEALED UP WITH TAPE.
2. STICK LABEL WITH PART NUMBER AND DATE CODE
3. STANDARD PACKAGING QUANTITY: SEE TABLE
4. THIS PACKAGING SPECIFICATION TO BE USED FOR "2.4/5GHz BALANCE FLEX ANTENNA".
5. WHEN TAKING PRODUCT FROM PET FILM, PLEASE REMOVE THE COVER TAPE FIRST, THEN PICK UP THE PART FROM FLEX NOT THE CABLE, TO AVOID SOLDER JOINT DAMAGE.

PACKAGING INFORMATION FOR 146153 Series

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PRODUCT SPECIFICATION

10.0 CHANGE HISTORY

CHANGE HISTORY		
REV	DATA	DESCRIPTION
F	2020/07/09	Add 6-7.125GHz Frequency Range
F1	2020/08/31	Optimized Part 6.1 Peak Gain
F2	2021/09/06	Updated General Specification Text

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APPLICATION SPECIFICATION

TITLE

WIFI 6E FLEX CABLE BALANCE ANTENNA

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DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
AS-1461530100	Liu Hai 2021/08/12	Andy Zhang 2021/08/12	Chris Zhong 2021/08/12



APPLICATION SPECIFICATION

WIFI 6E FLEX CABLE BALANCE ANTENNA

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: WIFI 6E flex cable balance antenna

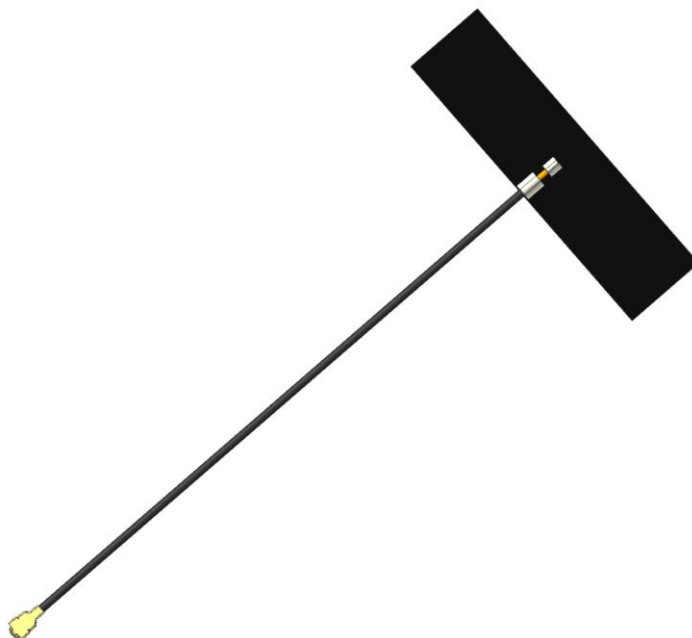
Series Number: 146153

2.2 DESCRIPTION

Series 146153 is a balanced, dipole-type, high efficiency antenna for 2.4/5/6 GHz applications, including WiFi 6E, Bluetooth, Zigbee and others. This antenna is made from poly flexible material with small size 35*9*0.1mm and has double-sided adhesive tape for easy "peel and stick" mounting. This balanced antenna with ground plane independent design offers various cable length options for ease of integration into various devices.

2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-1461530100 for full information.



ANTENNA 3D VIEW

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3.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing (SD)	SD-1461530050	Mechanical Dimension of the product
	SD-1461531050	
Product Specification (PS)	PS-1461530100	Product Specification
Packing Drawing (PK)	PK-1461530100	Product packaging specifications

4.0 ANTENNA PERFORMANCE

4.1 RF TEST CONDITIONS

All measurements are done of the antenna mounted on a PC/ABS material block of 1.5mm thickness with VNA Agilent E5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.1461530100 with a cable length of 100mm.

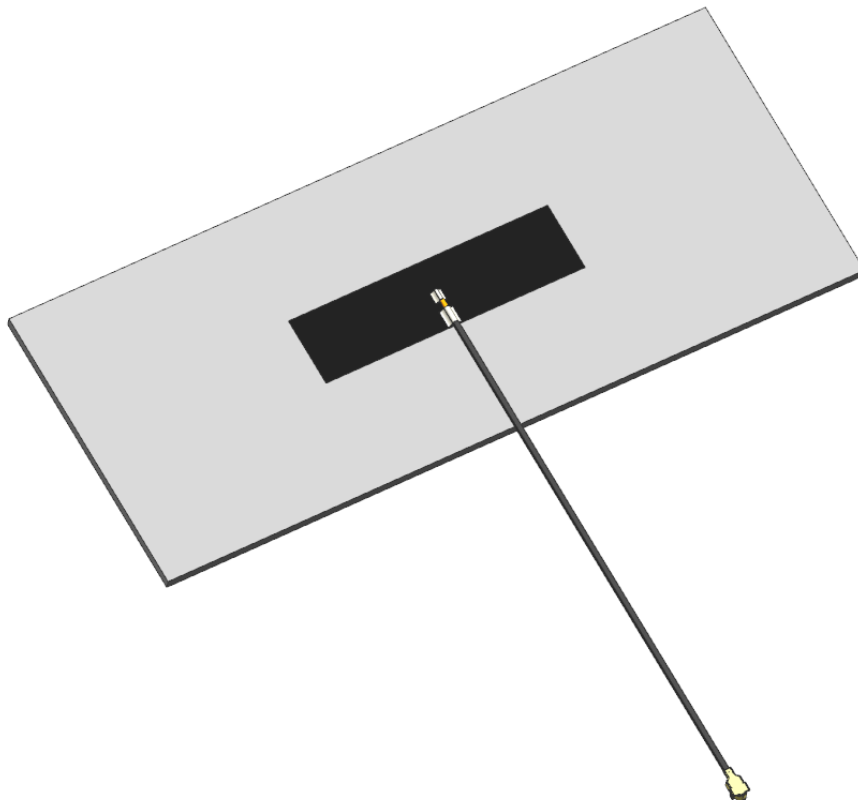


FIGURE4.1.1 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5 MM THICKNESS

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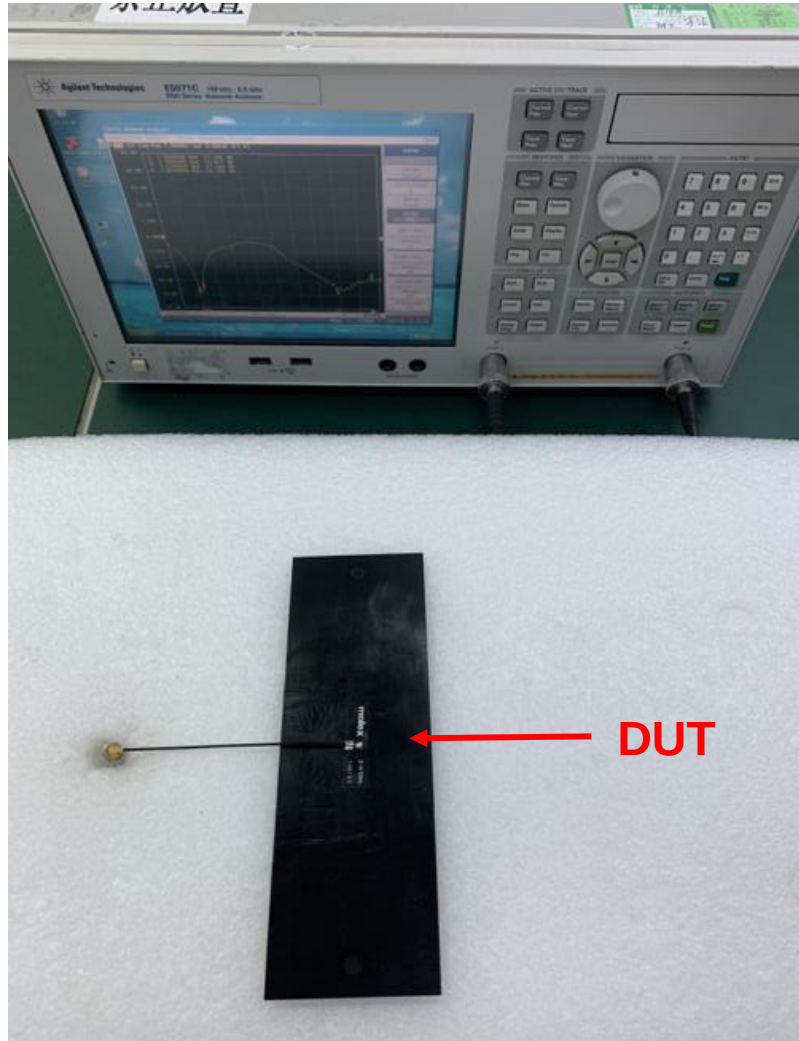


FIGURE4.1.2 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5 MM THICKNESS WITH VNA

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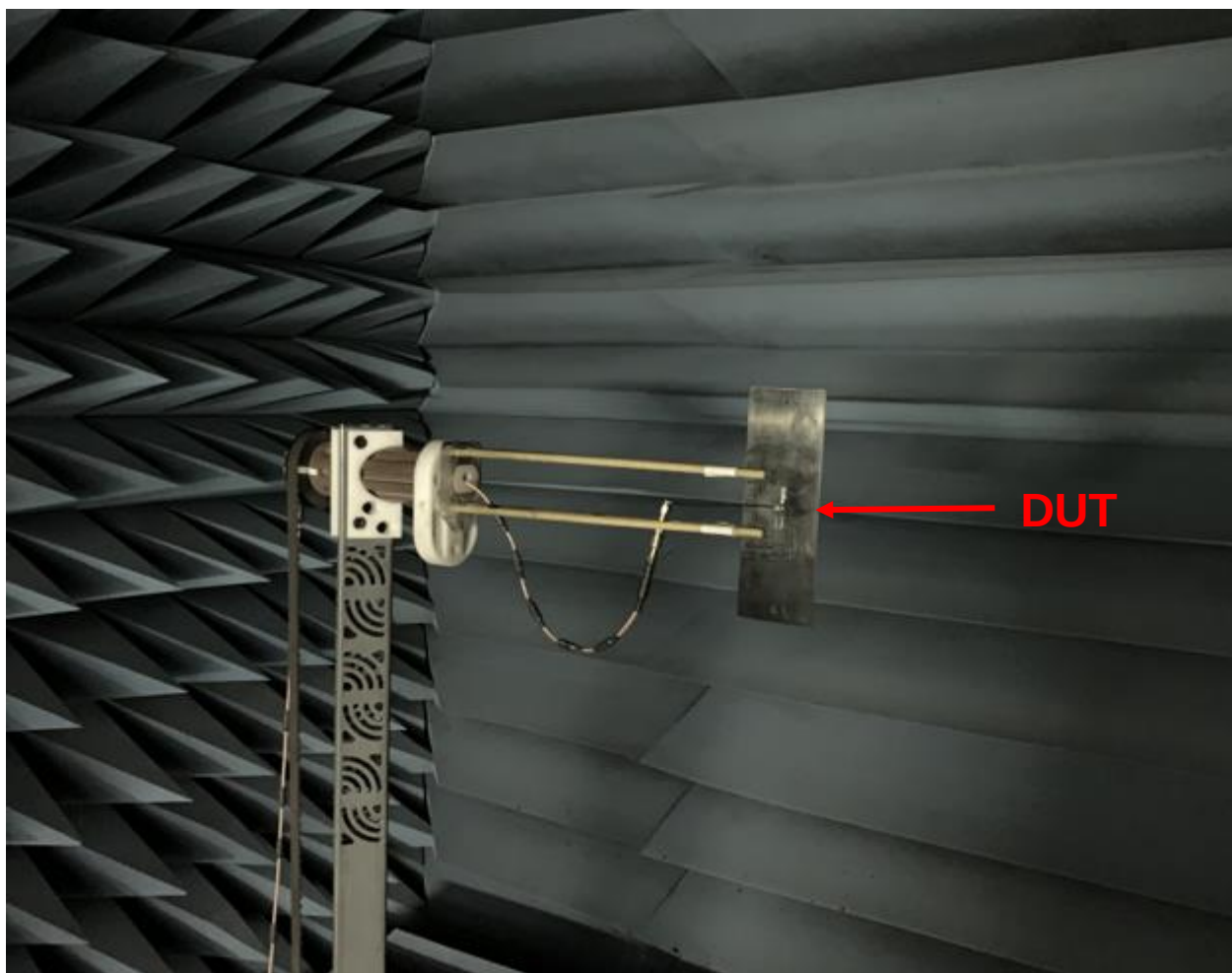


FIGURE4.1.3 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5 MM THICKNESS WITH OTA CHAMBER

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DOCUMENT NUMBER: AS-1461530100	CREATED / REVISED BY: Liu Hai 2021/08/12	CHECKED BY: Andy Zhang 2021/08/12	APPROVED BY: Chris Zhong 2021/08/12



APPLICATION SPECIFICATION

4.2 ANTENNA PERFORMANCE

All measurements in this document are done with the part no.1461530100 with a cable length of 100mm

DESCRIPTION	EQUIPMENT	REQUIREMENT		
Frequency Range	VNA E5071C	2.4-2.5GHz	5.15-5.85GHz	5.925-7.125GHz
Return Loss	VNA E5071C	<- 10dB		
Peak Gain (Max)	OTA Chamber	3.0dBi	4.0dBi	5.5dBi
Average Total Efficiency	OTA Chamber	>75%	>75%	>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 PC/ABS block to similar a free-space condition. 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.

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4.3 RETURN LOSS PLOT

All measurements in this document are done with a cable length of 100mm.

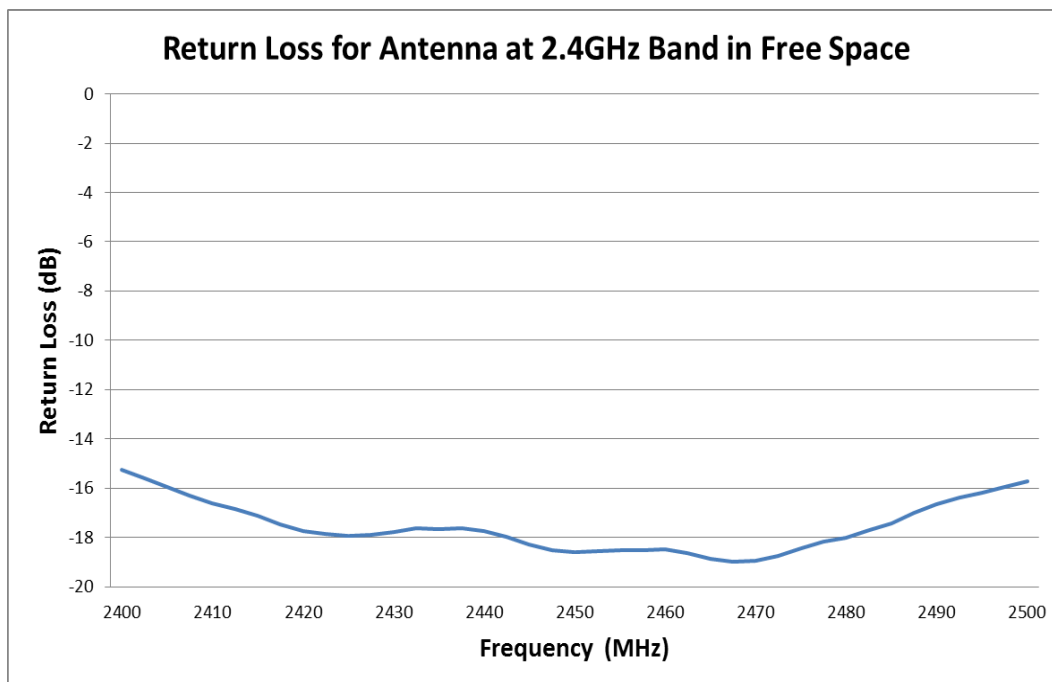


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT 2.4GHZ BAND IN FREE SPACE

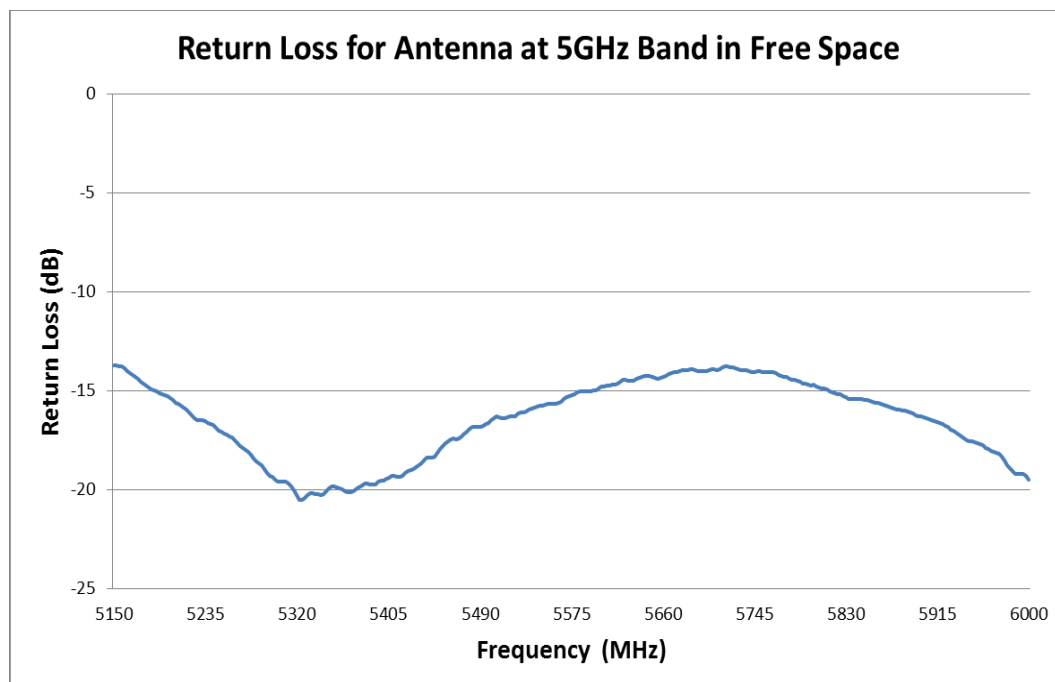


FIGURE 4.3.2 RETURN LOSS OF ANTENNA AT 5GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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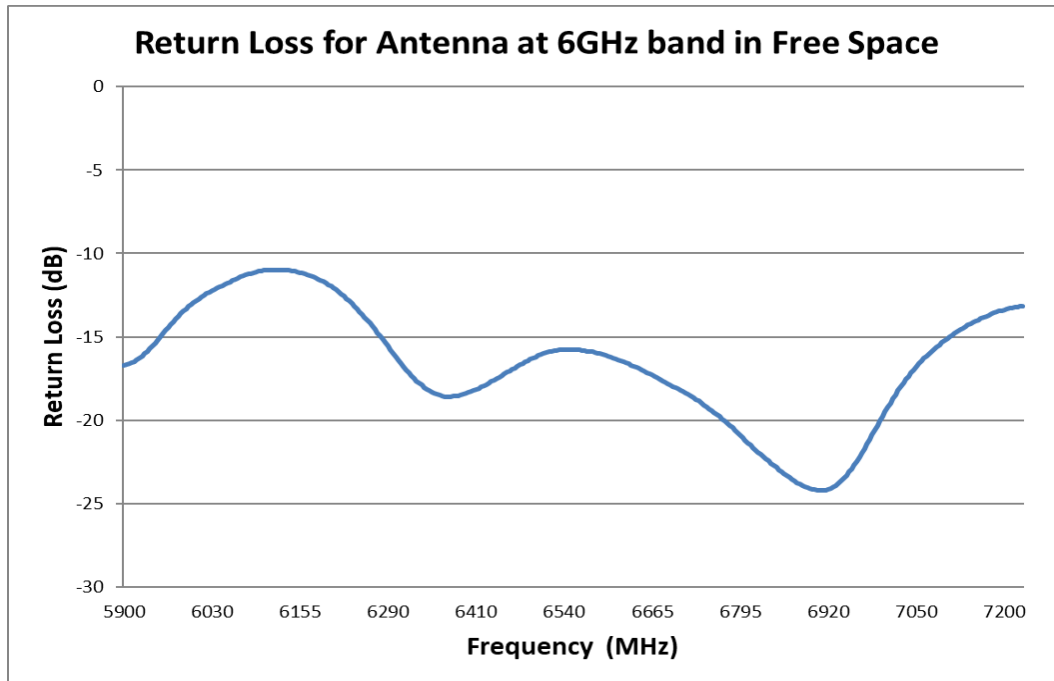


FIGURE 4.3.3 RETURN LOSS OF ANTENNA AT 6GHZ BAND IN FREE SPACE

4.4 EFFICIENCY PLOT

All measurements in this document are done with a cable length of 100mm.

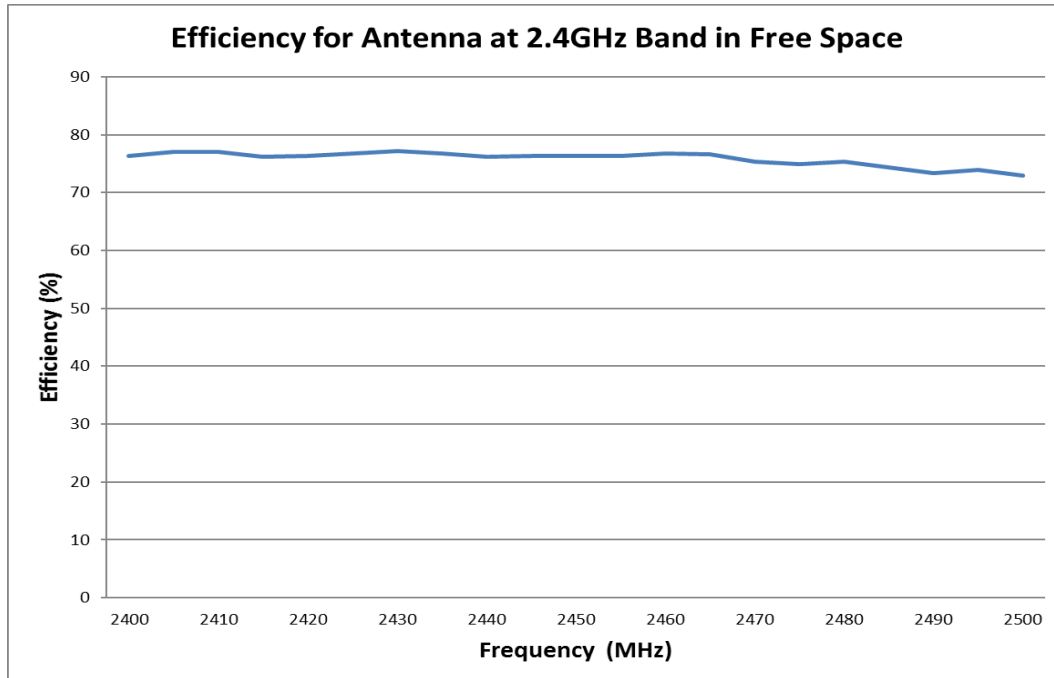


FIGURE 4.4.1 EFFICIENCY OF ANTENNA AT 2.4GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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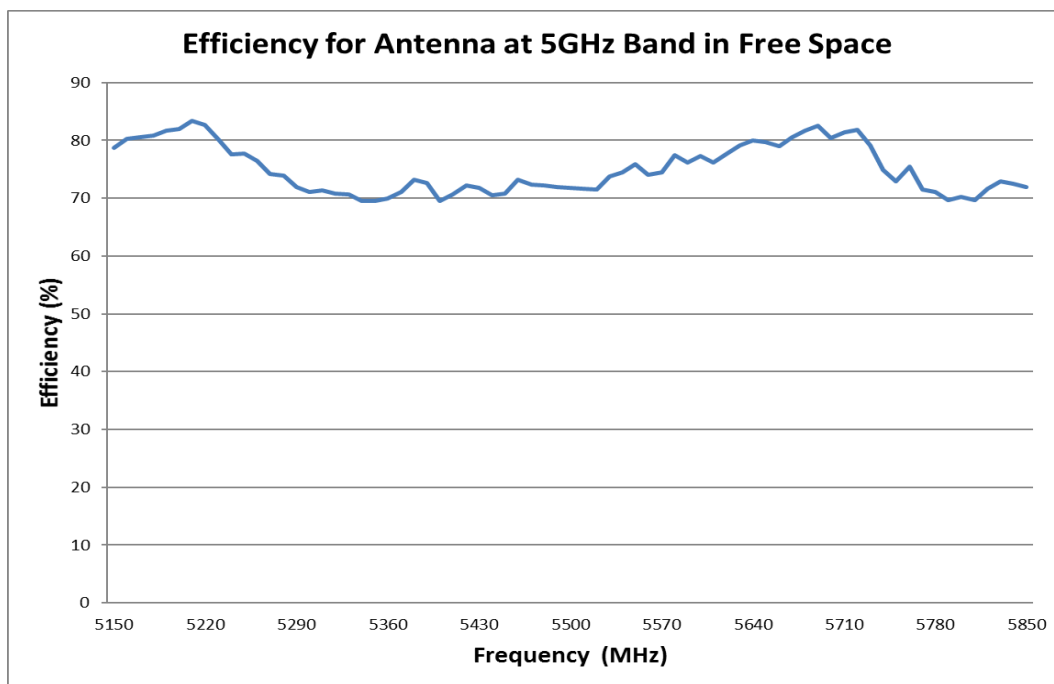


FIGURE 4.4.2 EFFICIENCY OF ANTENNA AT 5GHZ BAND IN FREE SPACE

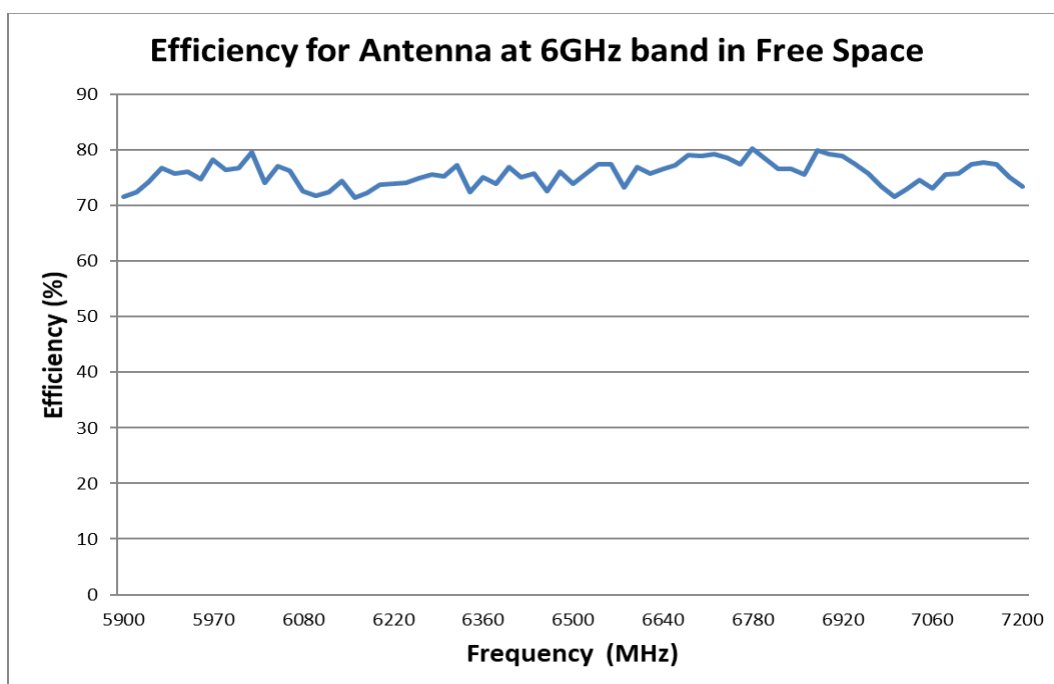


FIGURE 4.4.3 EFFICIENCY OF ANTENNA AT 6GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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4.5 RADIATION PATTERN

All measurements in this document are done with a cable length of 100mm.

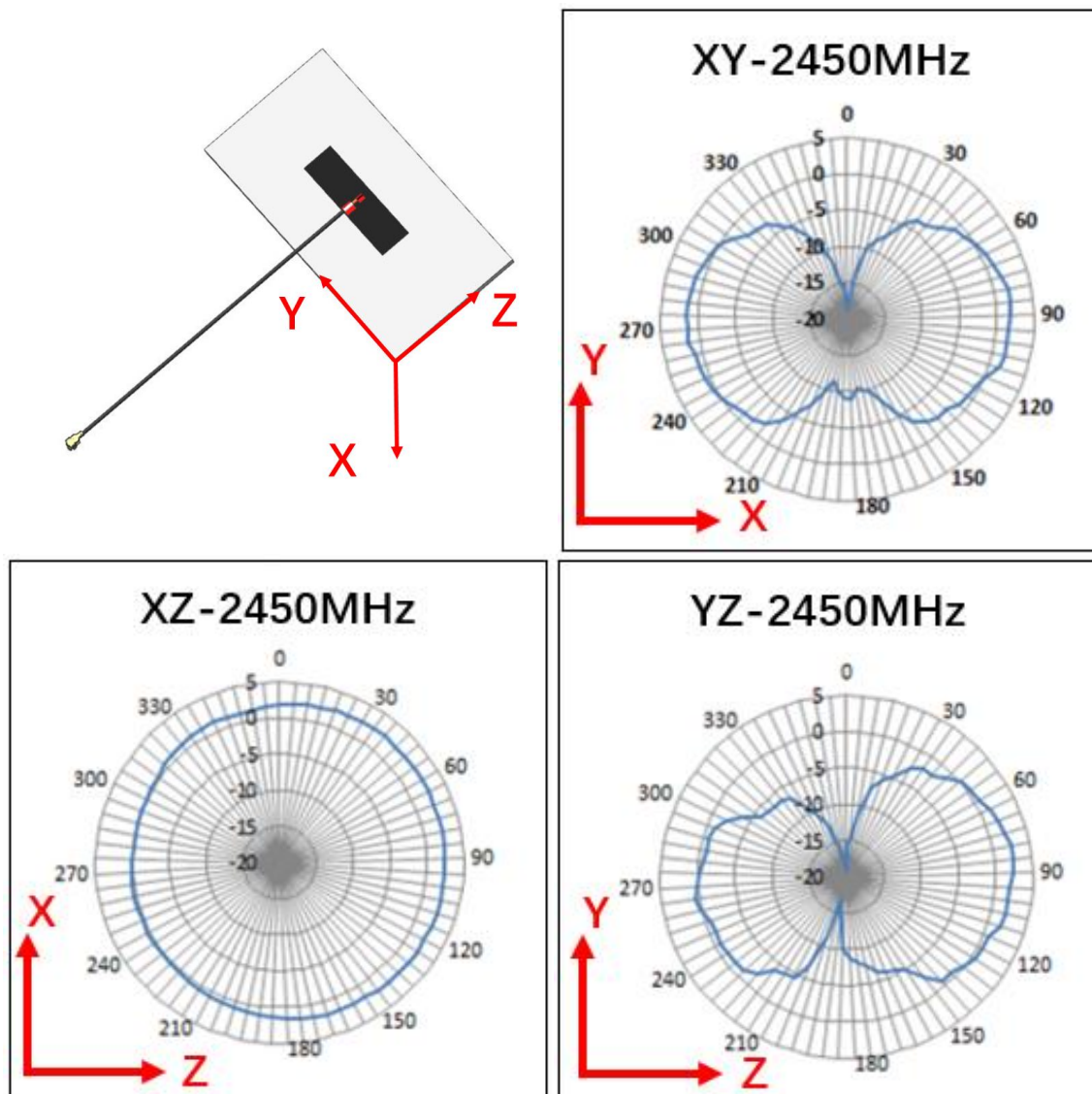


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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AS-1461530100	Liu Hai 2021/08/12	Andy Zhang 2021/08/12	Chris Zhong 2021/08/12

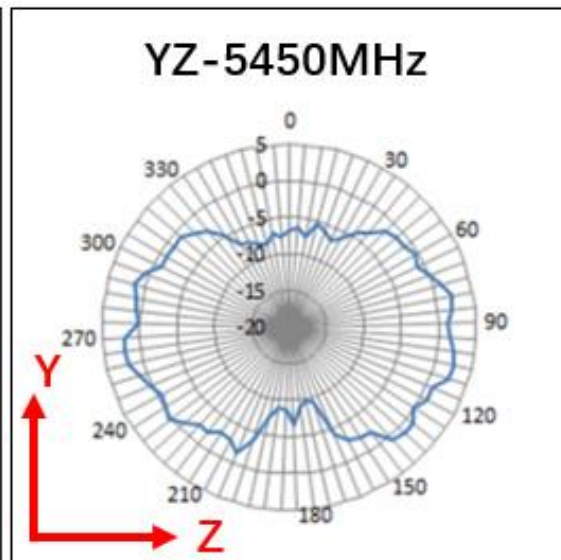
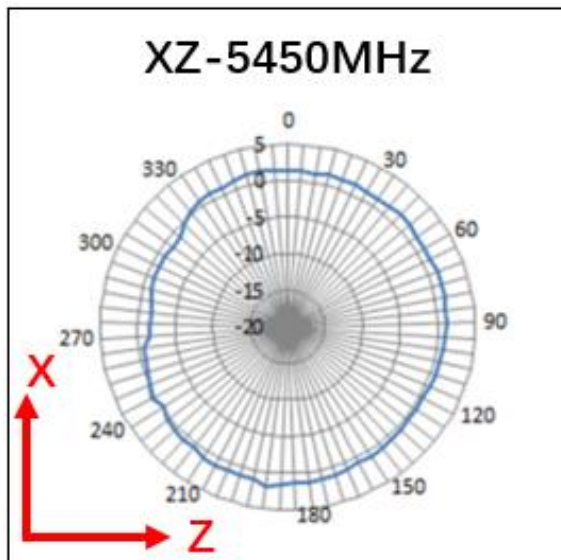
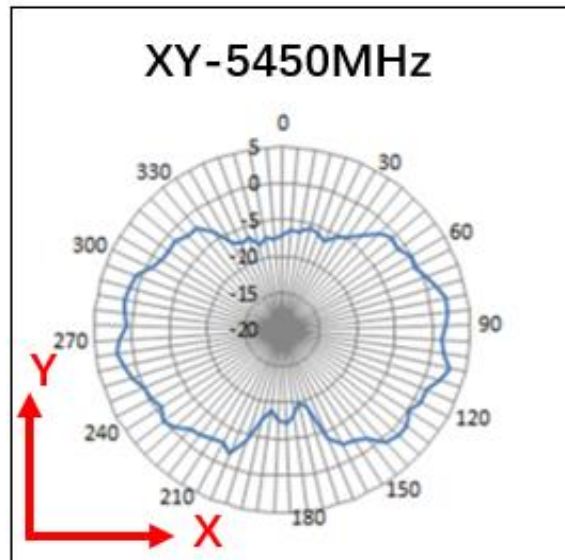
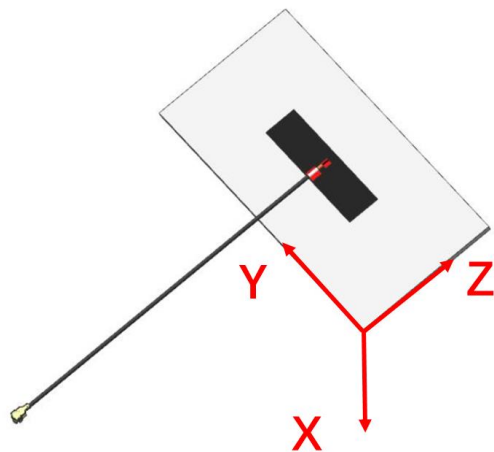


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 5450MHZ IN FREE SPACE

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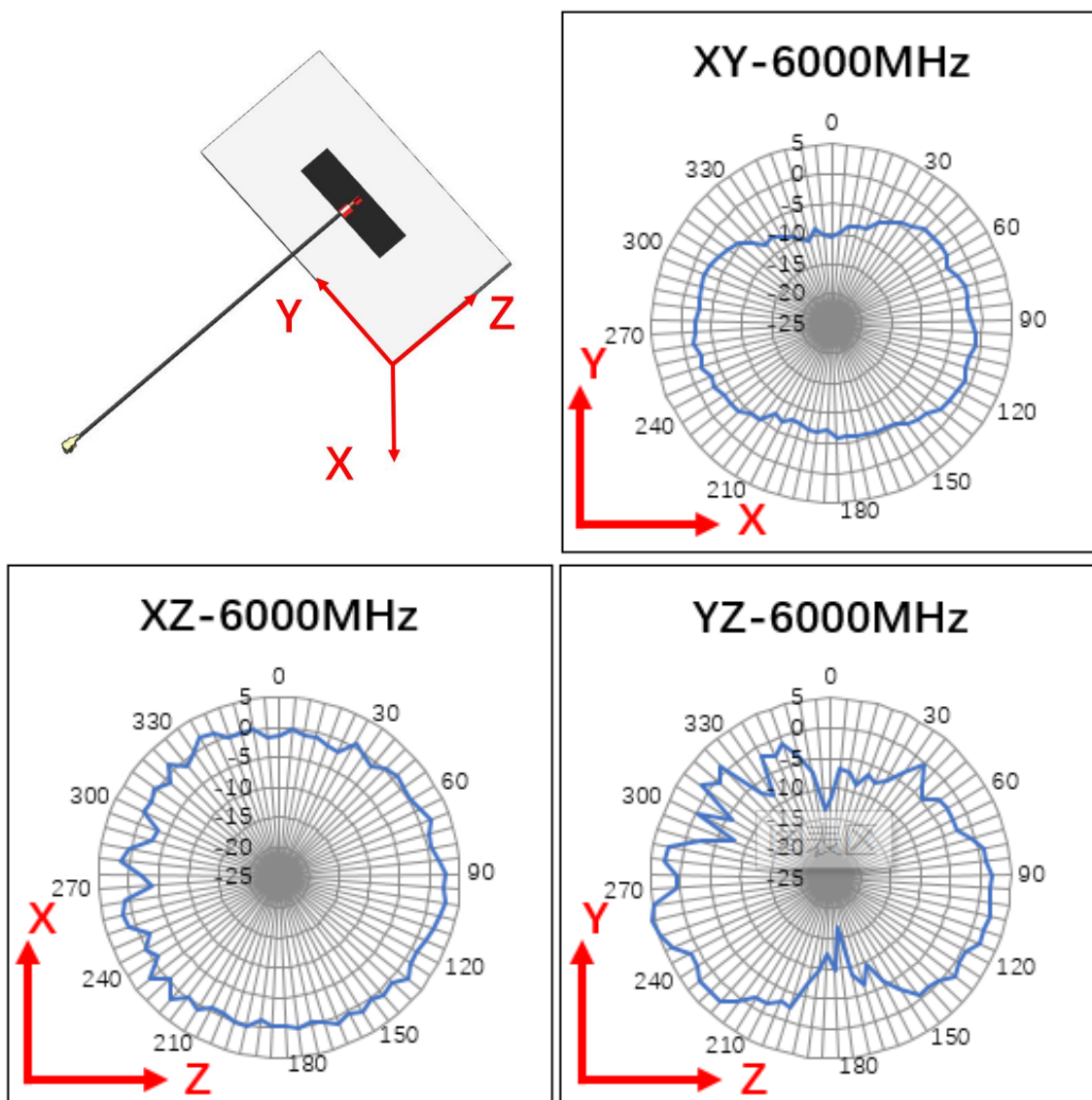


FIGURE 4.5.3 2D RADIATION PATTERN OF ANTENNA AT 6000MHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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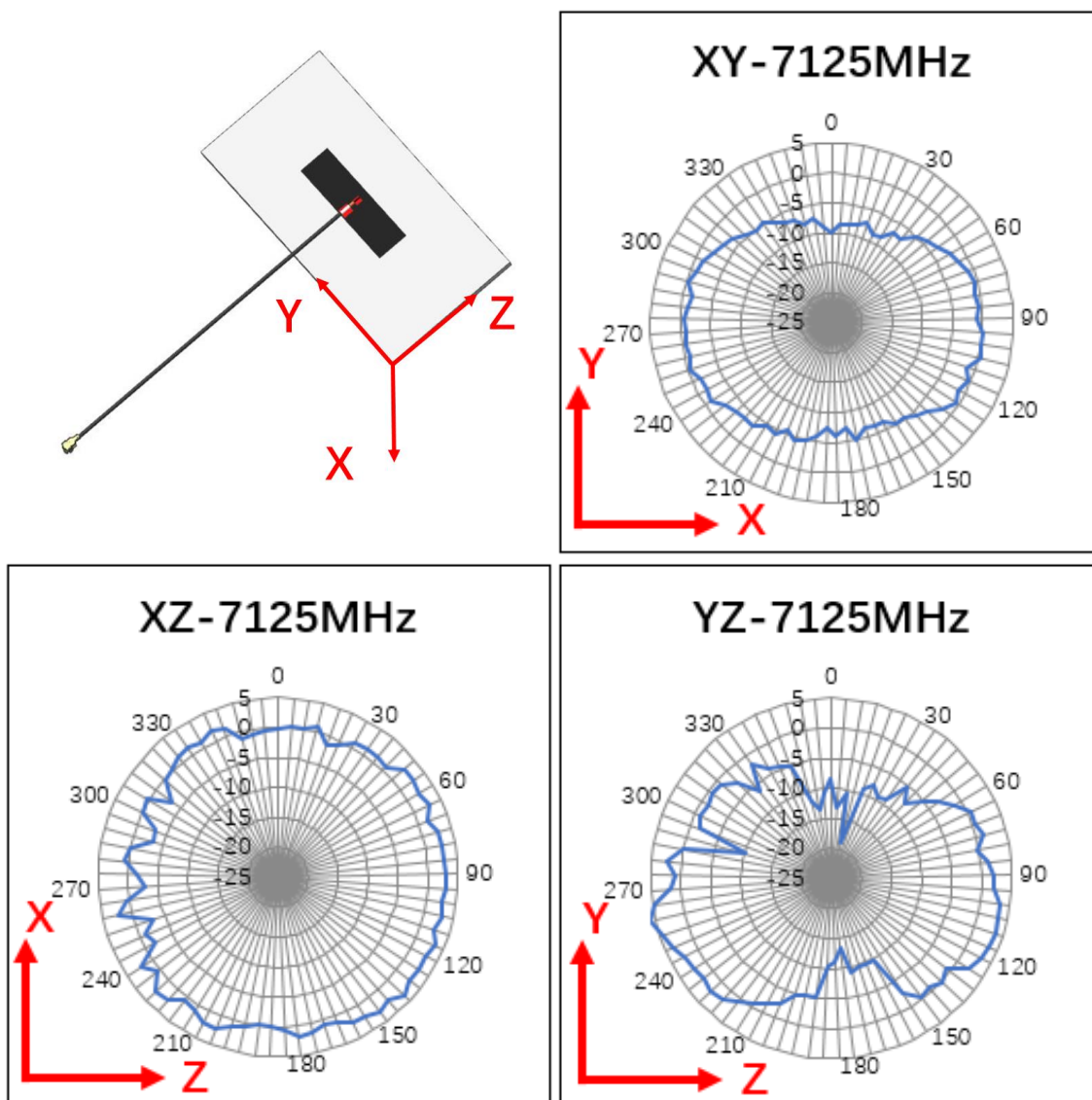


FIGURE 4.5.4 2D RADIATION PATTERN OF ANTENNA AT 7125MHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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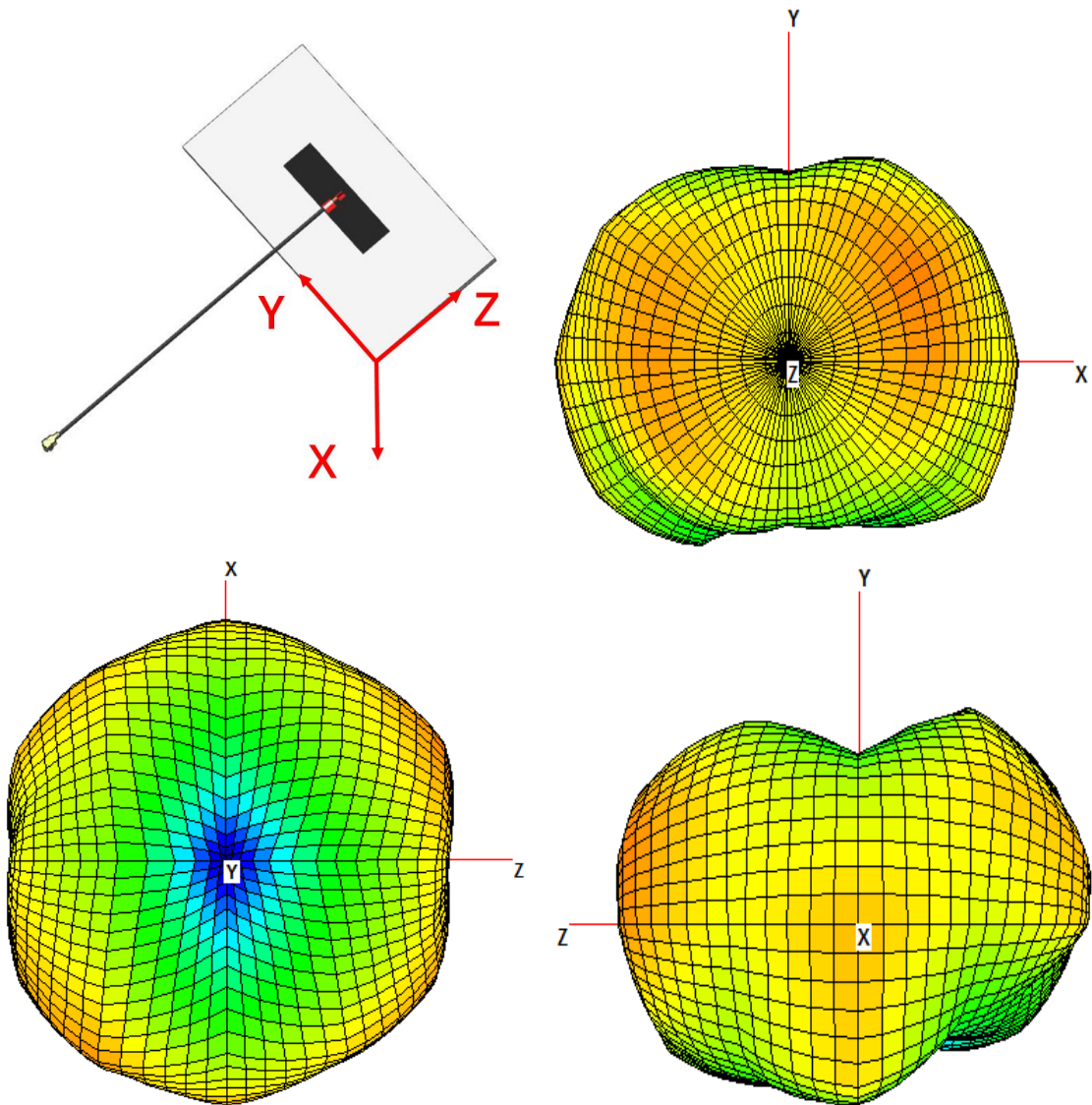


FIGURE 4.5.5 3D RADIATION PATTERN OF ANTENNA AT 2450MHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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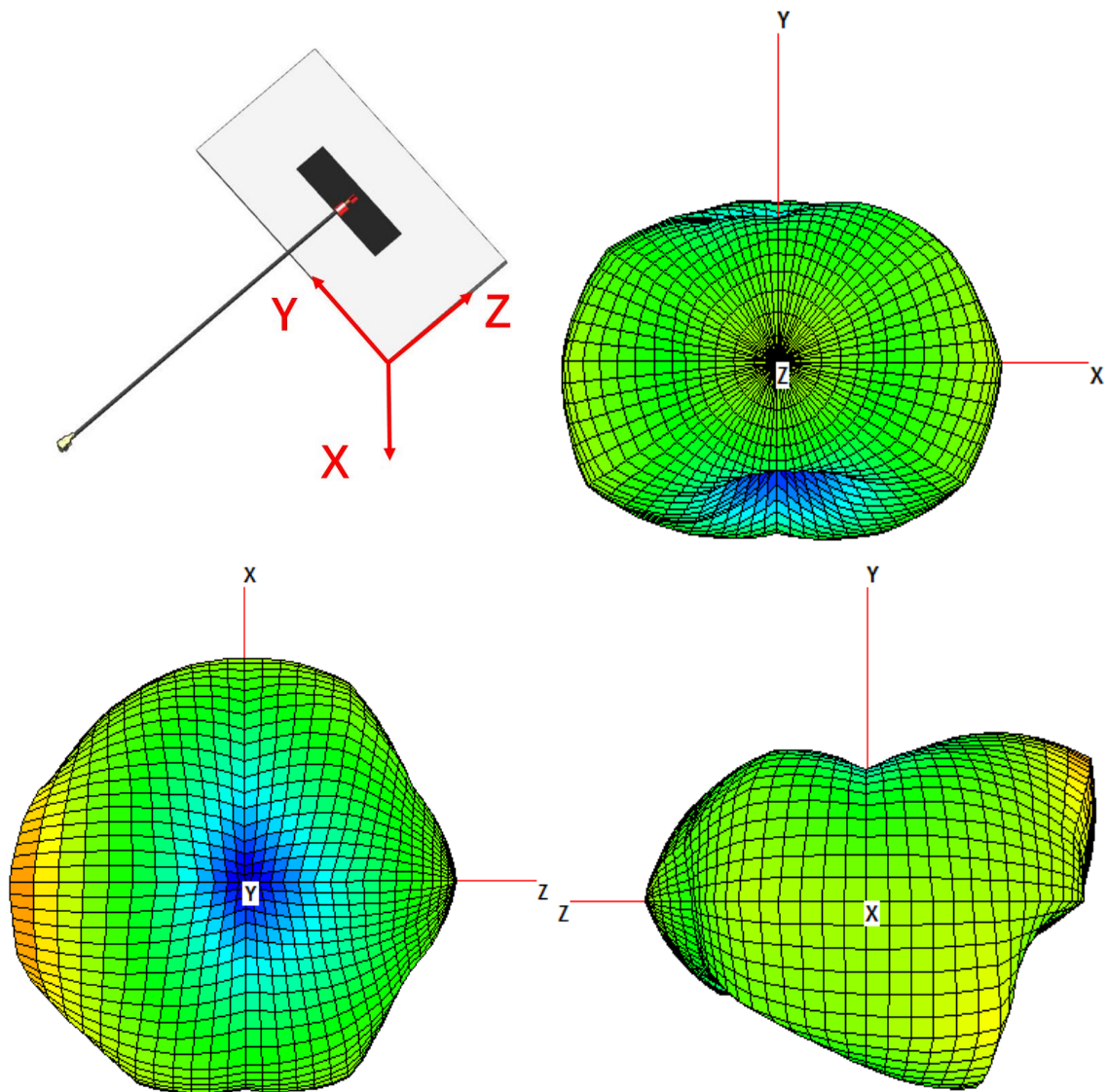


FIGURE 4.5.6 3D RADIATION PATTERN OF ANTENNA AT 5450MHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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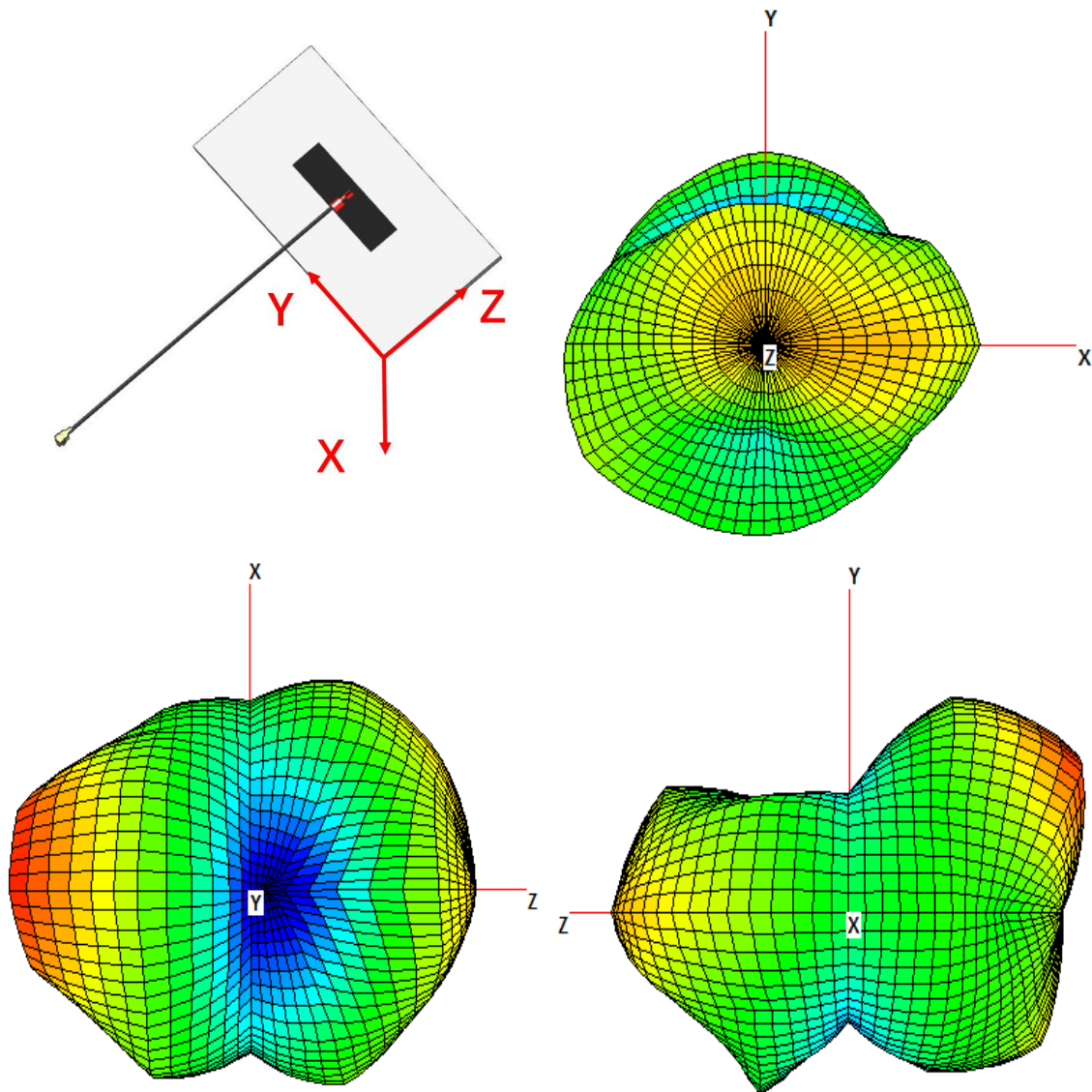


FIGURE 4.5.7 3D RADIATION PATTERN OF ANTENNA AT 6000MHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
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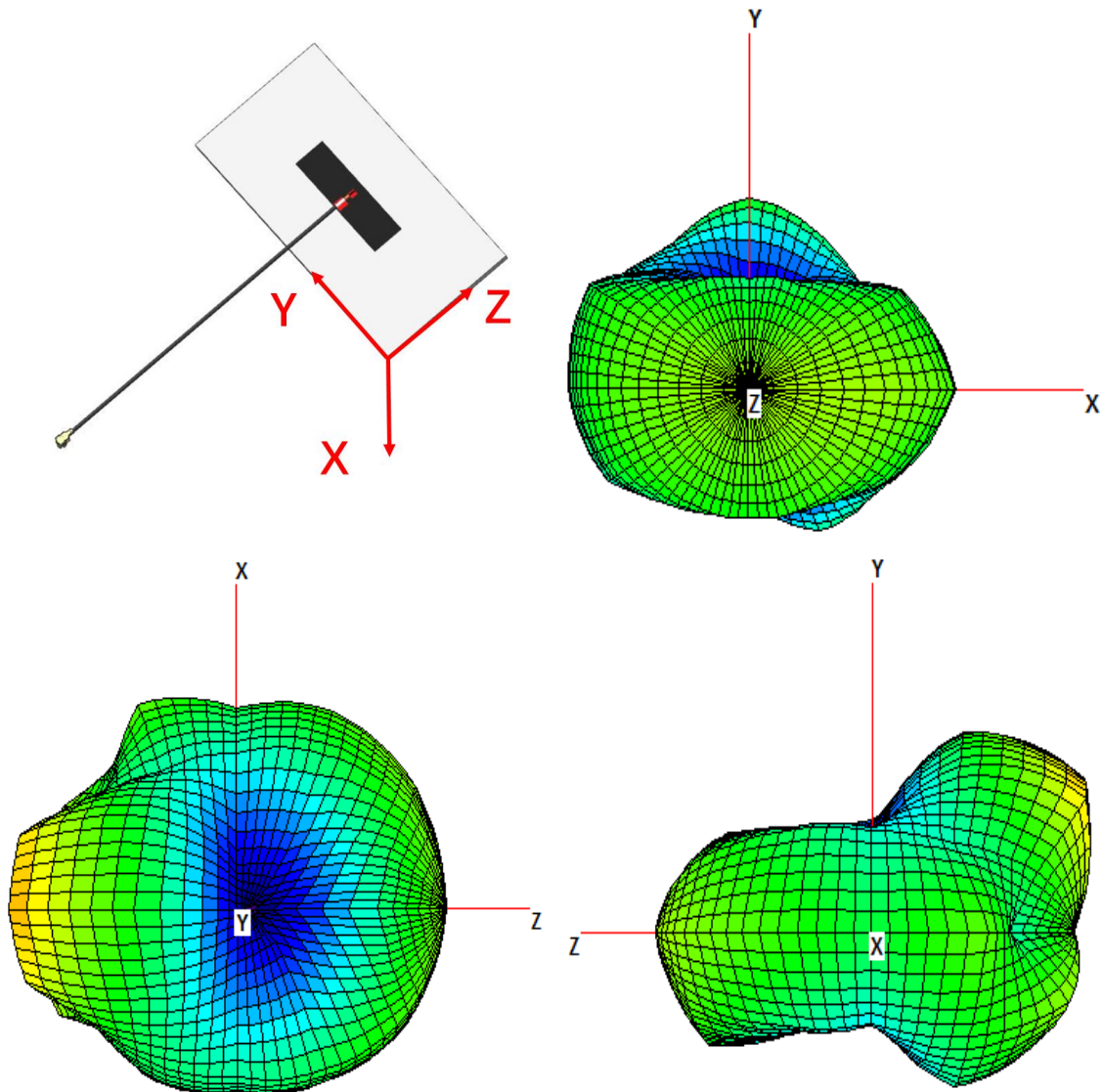


FIGURE 4.5.8 3D RADIATION PATTERN OF ANTENNA AT 7125MHZ BAND IN FREE SPACE

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5.0 ASSEMBLY GUIDELINE

The flex antenna comes with an adhesive 3m9077 for assemble onto the plastic wall of the system. The surface should be smooth with $ra < 1.6\mu m$ and need to clean the surface before sticking this product. The antenna cannot be placed on a metallic surface.

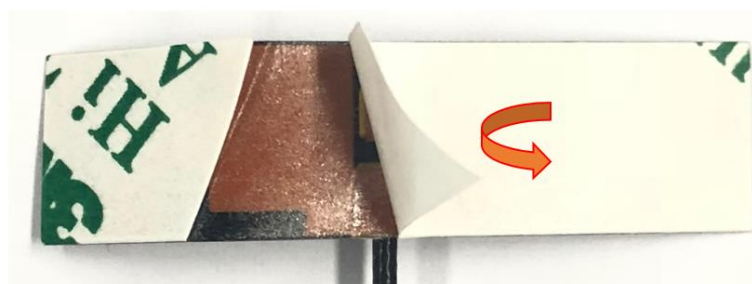
5.1 HOW TO TEAR FLEX RELEASE PAPER



1. Find cut line on flex back side



2. Bend flex slight along cut line



3. Tear release paper

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5.2 CABLE BENDING

During the assembly of the antenna in a device, the cable needs to be positioned away from the antenna flex to achieve best performance. The cable must be away from the Flex edge at least 5mm as shown in figure 5.2.1. If the cable bends into the antenna flex, the antenna performance will be degraded.

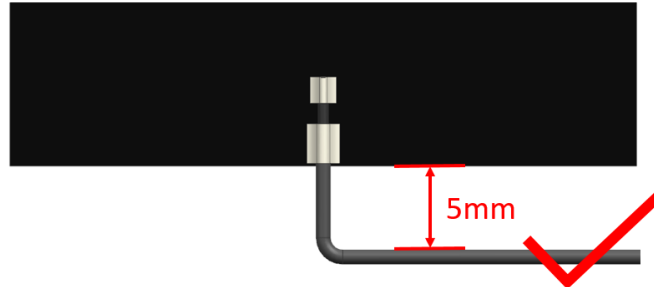


FIGURE 5.2.1 RECOMMENDED CABLE BENDING RANGE

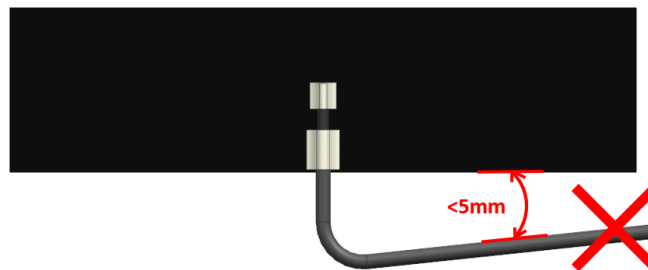


FIGURE 5.2.2 UNRECOMMENDED CABLE BENDING RANGE

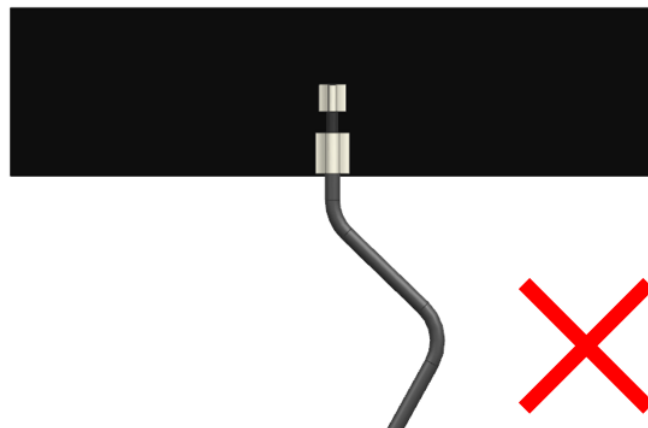


FIGURE 5.2.3 MULTIPLE BENDING OF CABLES IS NOT RECOMMENDED

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6.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

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

Four locations with parallel plane ground have been evaluated and these locations are shown in figure 6.1.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. The antenna performance is better with larger distance between antenna and parallel plane ground. The minimum distance between antenna and plane ground is recommended to be 15mm to achieve acceptable RF performance.

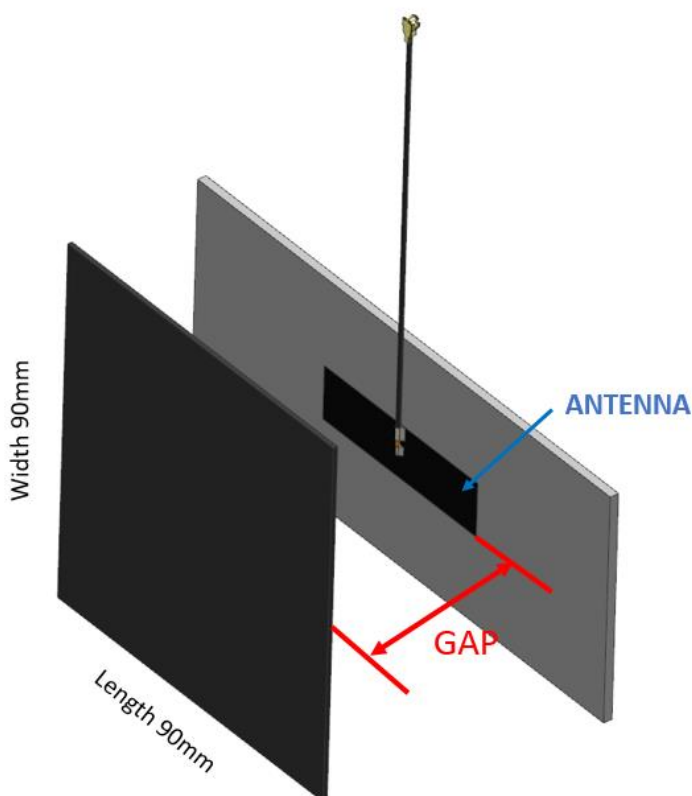


FIGURE 6.1.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

Ground Size: 90mm*90mm;

- Location 1: Distance between antenna and plane (GAP) ground is about 5mm;
- Location 2: Distance between antenna and plane (GAP) ground is about 10mm;
- Location 3: Distance between antenna and plane (GAP) ground is about 15mm;
- Location 4: Distance between antenna and plane (GAP) ground is about 20mm.

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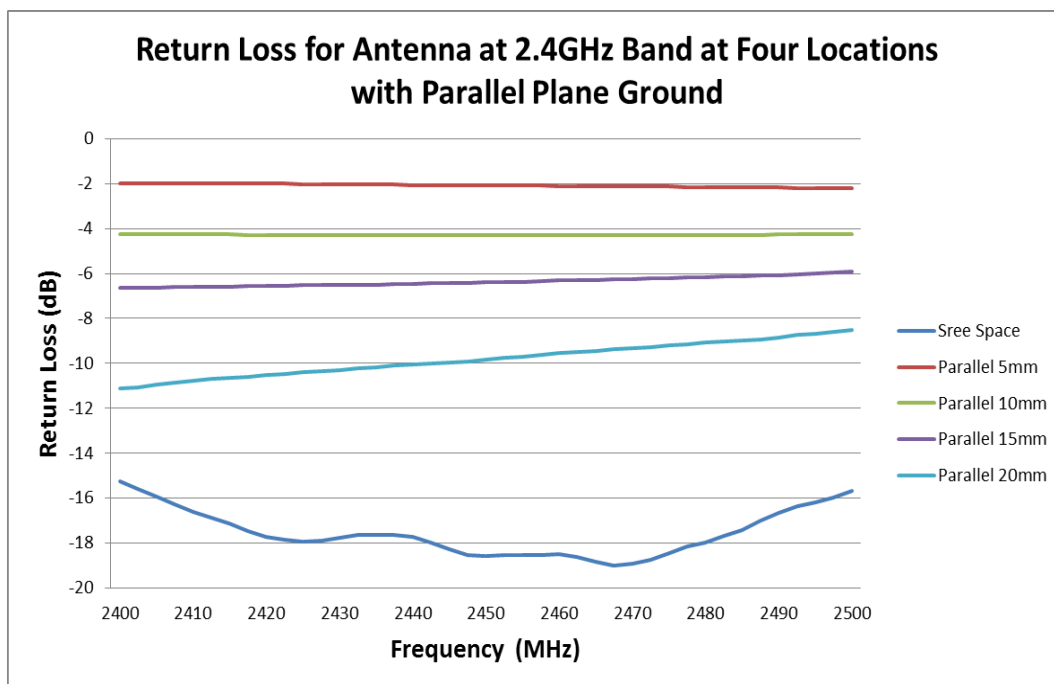


FIGURE 6.1.2 RETURN LOSS OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

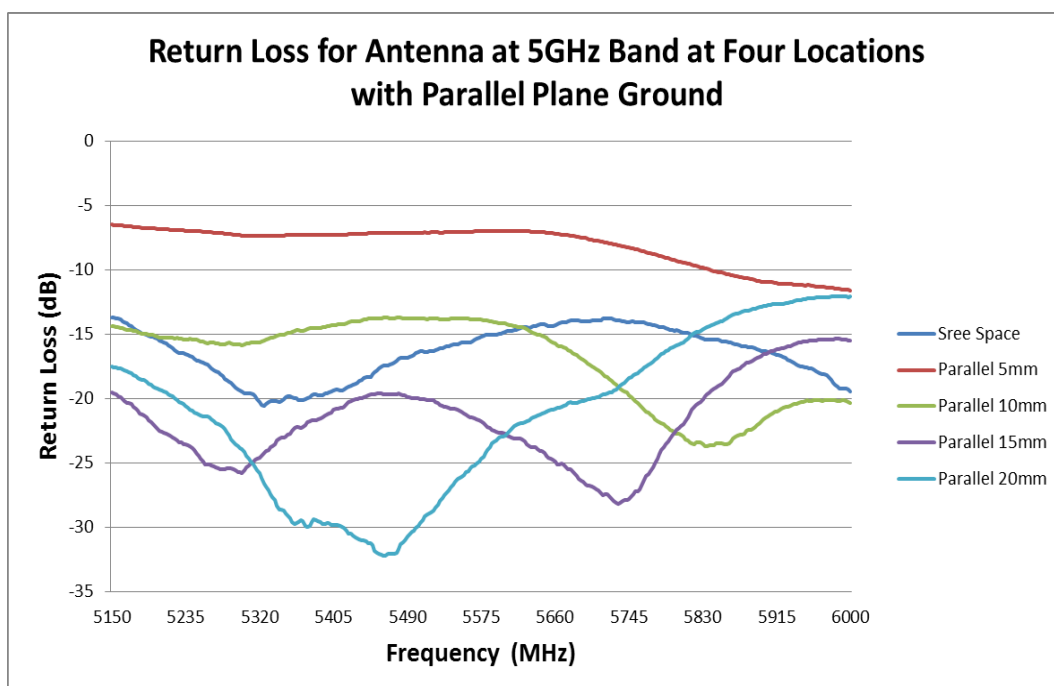


FIGURE 6.1.3 RETURN LOSS OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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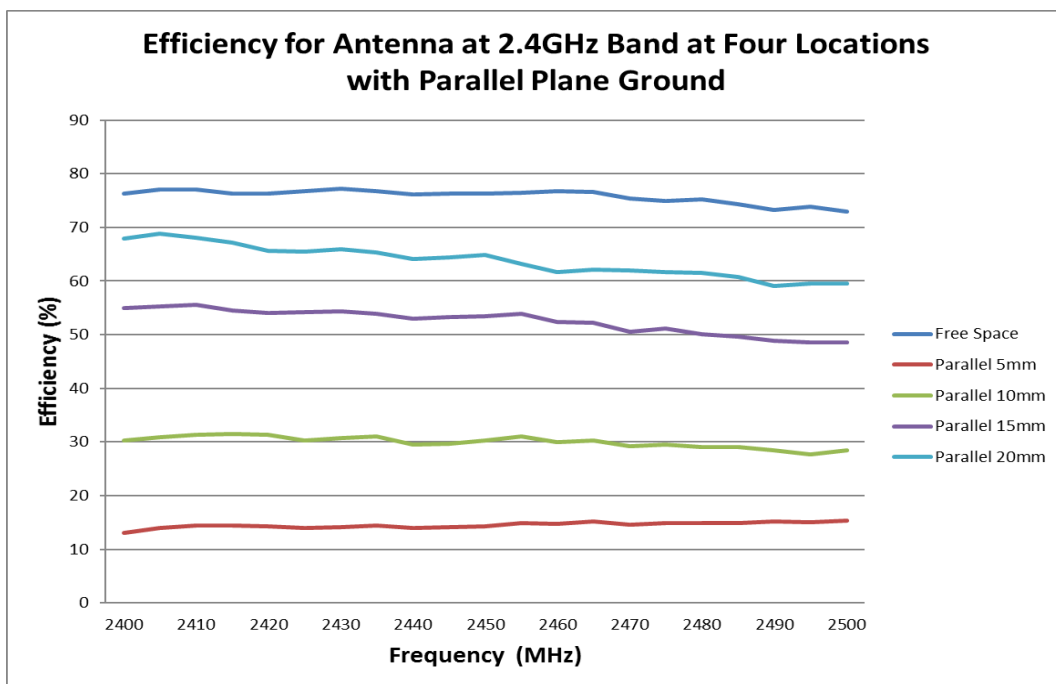


FIGURE 6.1.4 EFFICIENCY OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

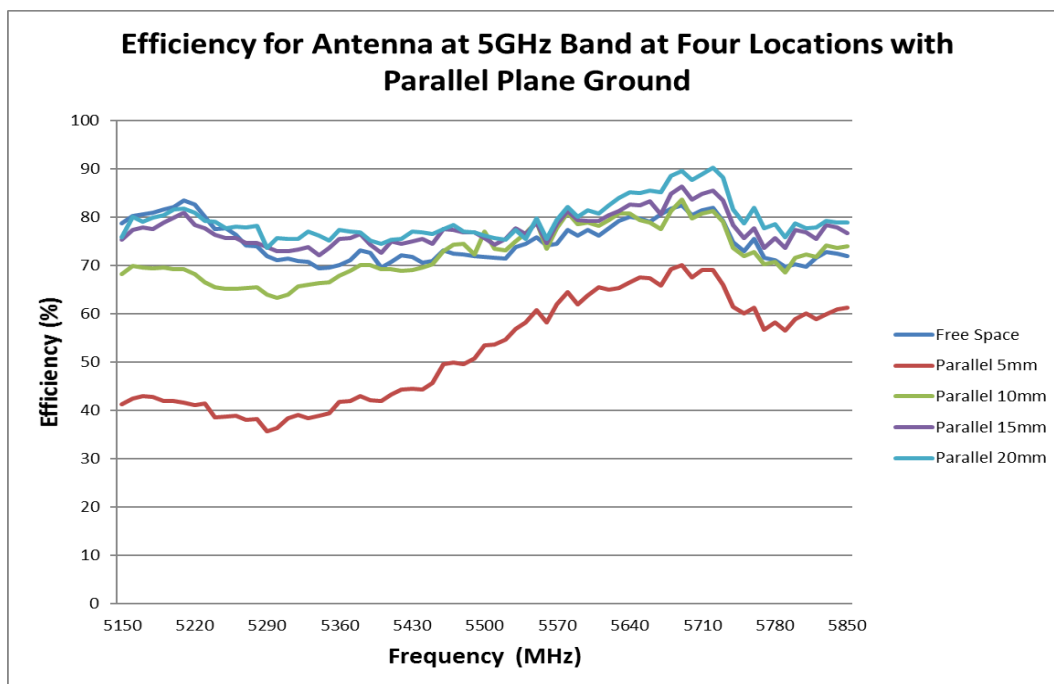


FIGURE 6.1.5 EFFICIENCY OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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

Four locations with vertical plane ground have been evaluated and these locations are shown in figure 6.2.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. The antenna performance is better with larger distance between antenna and vertical plane ground. The minimum distance between antenna and plane ground is recommended to be 5mm to achieve acceptable RF performance.

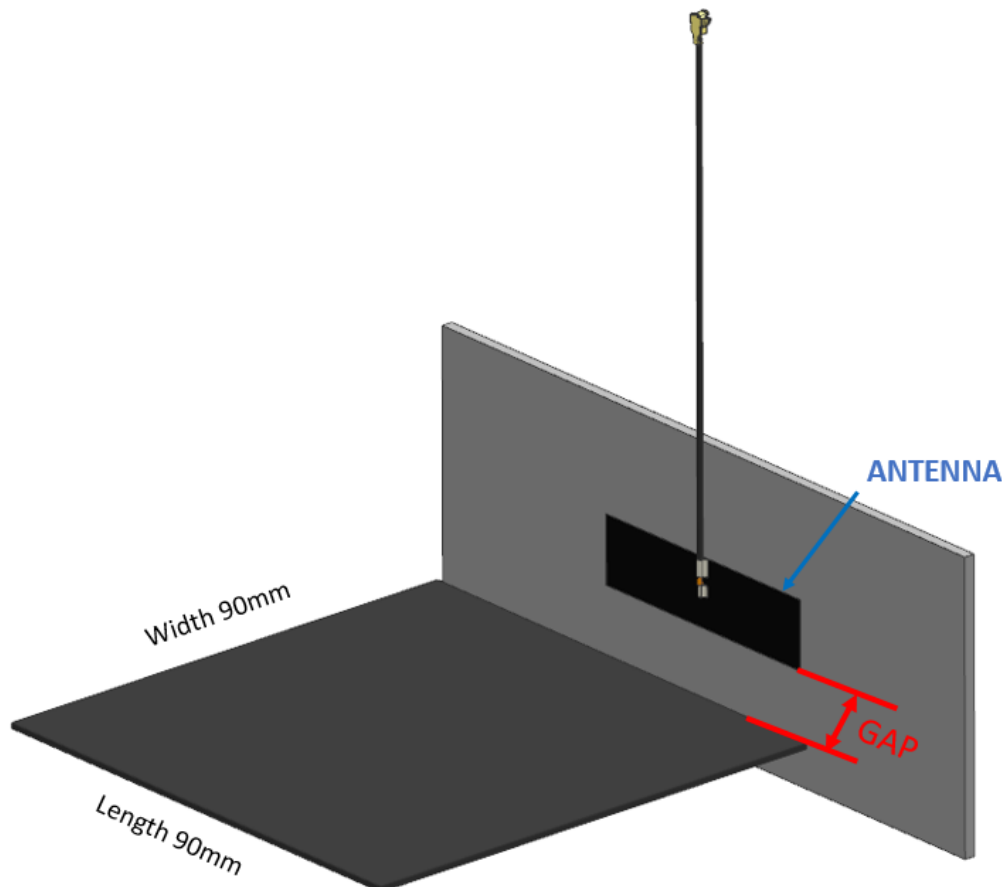


FIGURE 6.2.1 FOUR LOCATIONS WITH VERTICAL PLANE GROUND

Ground Size: 90mm*90mm;

- Location 1: Distance between antenna and plane (GAP) ground is about 5mm;
- Location 2: Distance between antenna and plane (GAP) ground is about 10mm;
- Location 3: Distance between antenna and plane (GAP) ground is about 15mm;
- Location 4: Distance between antenna and plane (GAP) ground is about 20mm.

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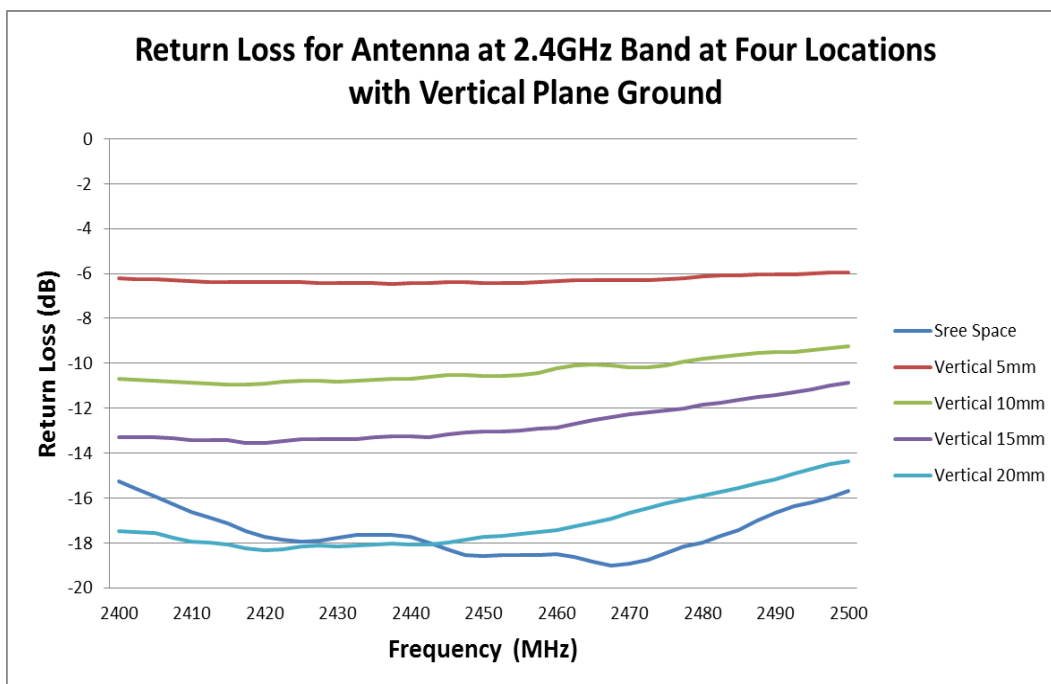


FIGURE 6.2.2 RETURN LOSS OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

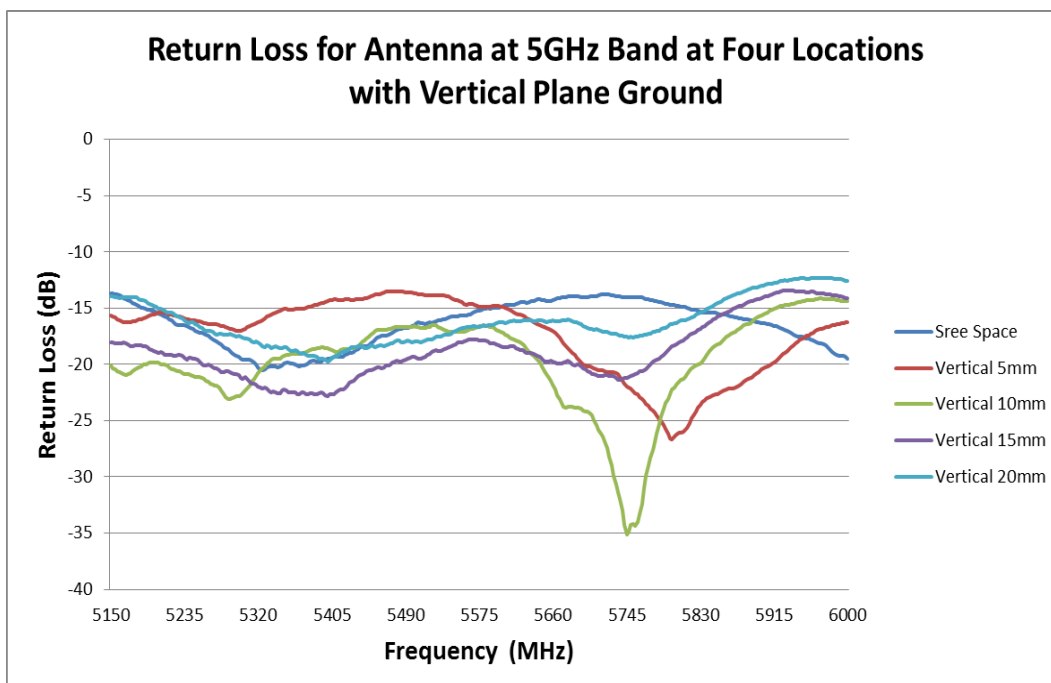


FIGURE 6.2.3 RETURN LOSS OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

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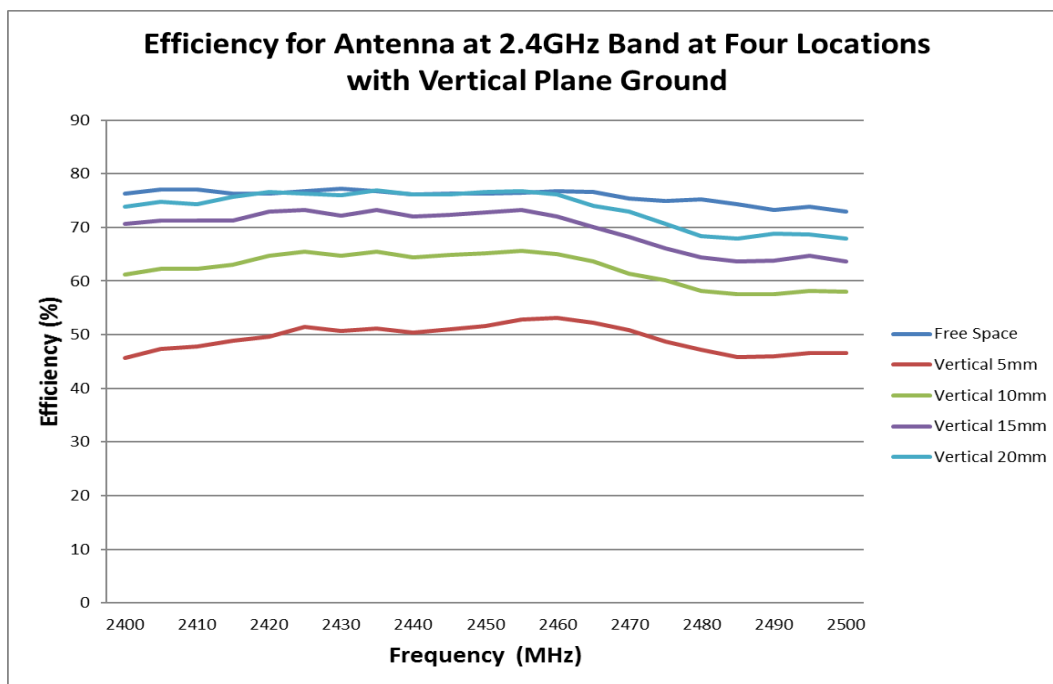


FIGURE 6.2.4 EFFICIENCY OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

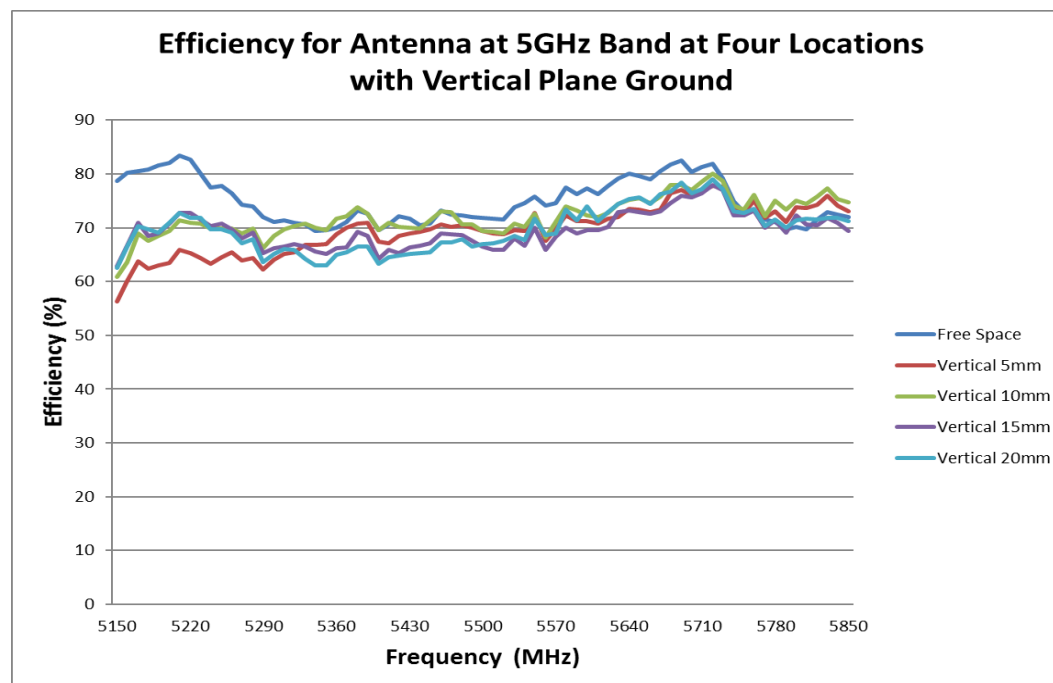


FIGURE 6.2.5 EFFICIENCY OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

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6.3 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCES WITH PARALLEL PLANE GROUND

Four locations with the parallel plane ground have been evaluated and these locations are shown in figure 6.3.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. The antenna performance is better with larger distance between the antenna and the parallel plane ground. The minimum distance between the antenna and the plane ground is recommended to be 5mm to achieve acceptable RF performance.

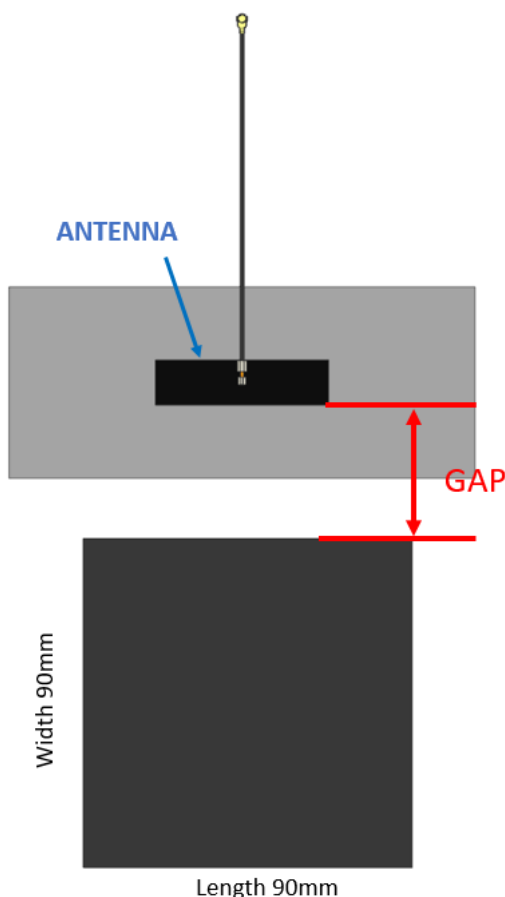


FIGURE 6.3.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

Ground Size: 90mm*90mm;

- Location 1: Distance between antenna and plane (GAP) ground is about 5mm;
- Location 2: Distance between antenna and plane (GAP) ground is about 10mm;
- Location 3: Distance between antenna and plane (GAP) ground is about 15mm;
- Location 4: Distance between antenna and plane (GAP) ground is about 20mm.

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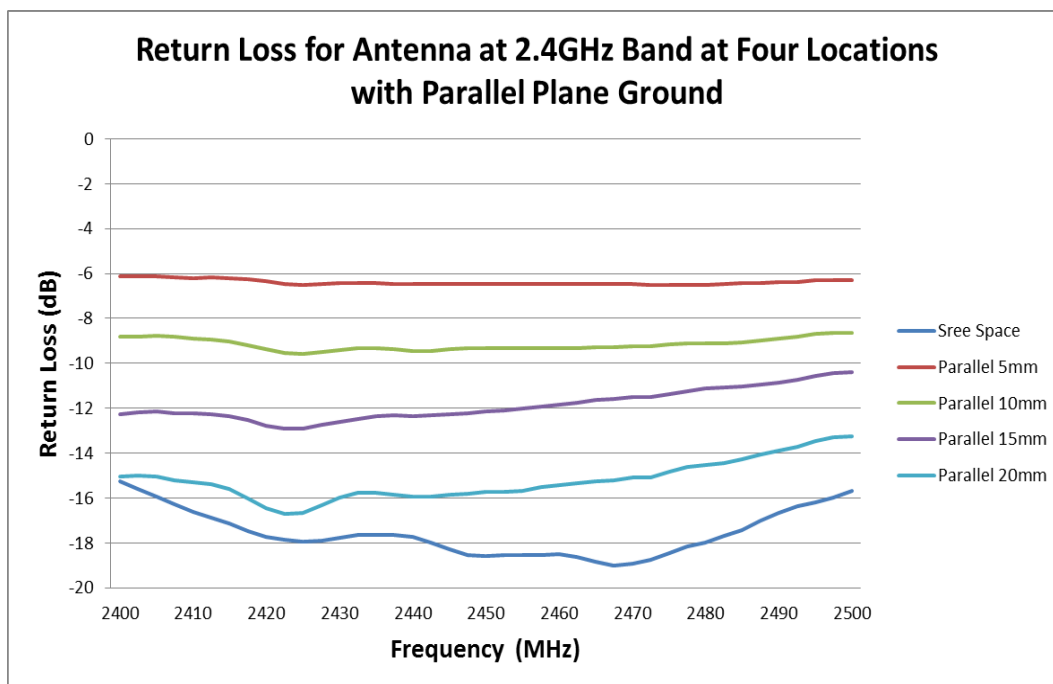


FIGURE 6.3.2 RETURN LOSS OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

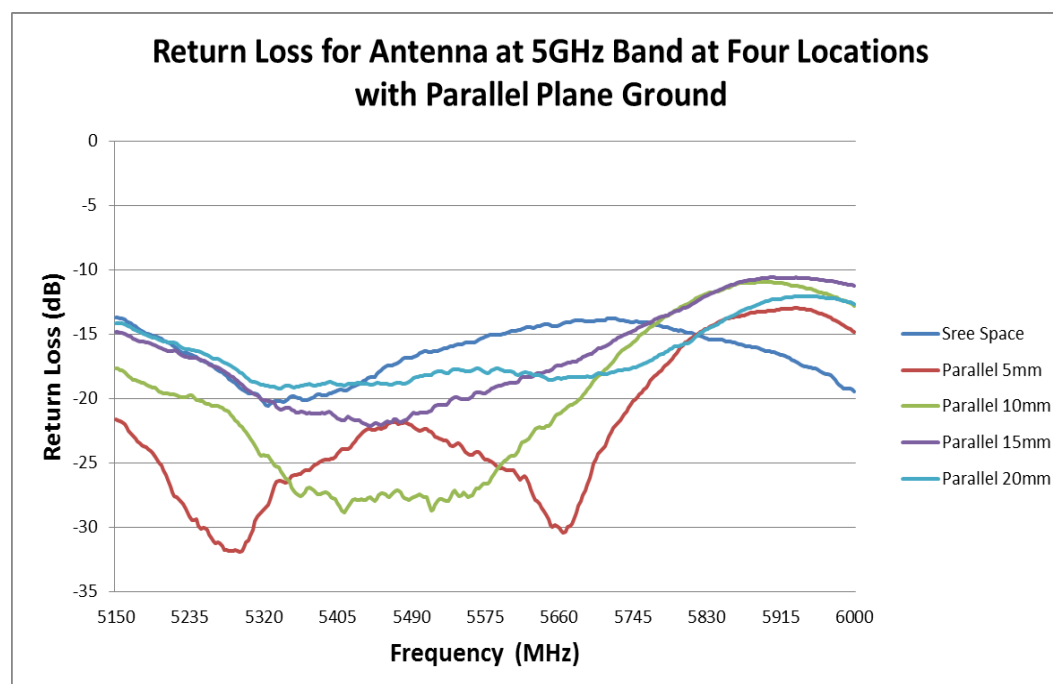


FIGURE 6.3.3 RETURN LOSS OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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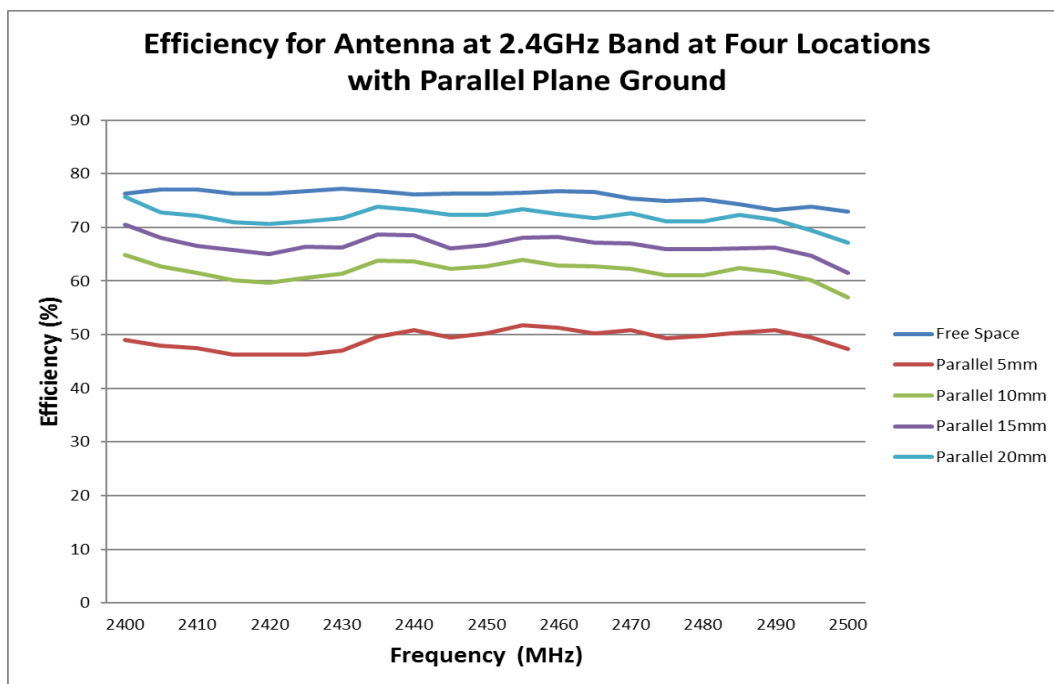


FIGURE 6.3.4 EFFICIENCY OF ANTENNA AT 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

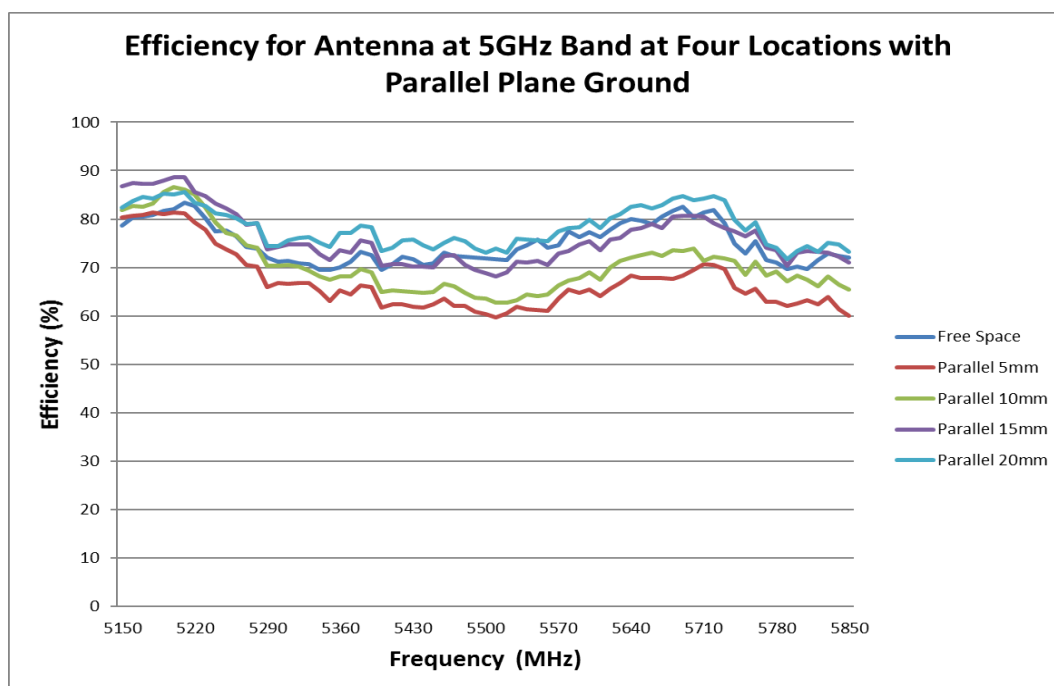


FIGURE 6.3.5 EFFICIENCY OF ANTENNA AT 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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APPLICATION SPECIFICATION

7.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH

7.0.1 CABLE LOSS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT		
7.0.1.1	Frequency Range	2 GHz~7.125GHz	2GHz~3GHz	5GHz~6GHz	6-7.125GHz
7.0.1.2	Attenuation	1m cable measured by VNA5071C	≤3.5dB/m	≤5.5dB/m	≤6.5dB/m

7.0.2 CABLE LENGTH AFFECT THE ANTENNA PERFORMANCE

Balance antenna resonance is insensitive by cable length, but the cable loss will affect the total efficiency. Refer to 7.0.1

7.0.3 FOR EXAMPLE

Base on the 100mm cable performance, we can mostly compute the 300mm cable's.

Frequency (MHz)	100mm cable		cable loss	300mm cable	
	Efficiency (dB)	Efficiency (%)		Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
2400	-1.09	77.77	0.2m*3.5dB/m	-1.79	66.19
2420	-1.05	78.43		-1.75	66.76
2440	-1.15	76.82		-1.85	65.38
2460	-1.17	76.41		-1.87	65.03
2480	-1.19	76.00		-1.89	64.68
2500	-1.23	75.37		-1.93	64.15
5150	-1.10	77.71	0.2*5.5dB/m	-2.20	60.32
5200	-1.13	77.08		-2.23	59.83
5250	-1.13	77.11		-2.23	59.85
5300	-1.20	75.88		-2.30	58.90
5350	-1.33	73.54		-2.43	57.08
5400	-1.23	75.30		-2.33	58.45
5450	-1.16	76.50		-2.26	59.38
5500	-0.92	80.93		-2.02	62.82
5550	-0.92	80.95		-2.02	62.84
5600	-0.95	80.42		-2.05	62.42
5650	-0.97	79.94		-2.07	62.05
5700	-1.00	79.37		-2.10	61.61
5750	-1.06	78.38		-2.16	60.84
5800	-1.20	75.94		-2.30	58.95
5850	-1.11	77.51		-2.21	60.17
5900	-1.27	74.69		-2.37	57.98
5925	-1.30	74.20		-2.40	57.60
5950	-1.19	76.11		-2.29	59.08

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APPLICATION SPECIFICATION

Frequency (MHz)	100mm cable		cable loss	300mm cable	
	Efficiency (dB)	Efficiency (%)		Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
6000	-1.00	79.43	0.2*6.5dB/m	-2.30	58.88
6100	-1.44	71.71		-2.74	53.16
6200	-1.32	73.73		-2.62	54.66
6300	-1.23	75.26		-2.53	55.79
6400	-1.14	76.91		-2.44	57.01
6500	-1.32	73.72		-2.62	54.65
6600	-1.12	77.19		-2.42	57.22
6700	-1.03	78.87		-2.33	58.46
6800	-1.05	78.50		-2.35	58.20
6900	-1.01	79.23		-2.31	58.73
7000	-1.45	71.60		-2.75	53.07
7100	-1.20	75.84		-2.50	56.22
7125	-1.11	77.44		-2.41	57.41

The data is just for your reference, all accurate performance should be according to the test results in the OTA chamber

8.0 CHANGE HISTORY

CHANGE HISTORY		
REV	DATA	DESCRIPTION
H	2020/06/18	Update 2D Figure and add 6-7.125GHz band
H1	2020/08/26	Change 2D 2450MHz 5450MHz pattern
J	2021/08/12	Change 2D of 6000MHz 7125MHz pattern

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Product Compliance Statement

February 07, 2022

Molex is committed to managing the use of chemical substances in accordance with governmental regulations, industry standards, and customer-specific requirements in order to protect the environment. For each part listed, this document provides:

- **EU RoHS Compliance Status.** EU RoHS status is declared per Directive 2011/65/EU and its subsequent amendments, including the Directive EU 2015/863 which additionally prohibited four phthalates. Homogeneous materials of parts that are compliant to this legislation have less than 0.1% by weight each of lead, mercury, hexavalent chromium, PBB, PBDE, DBP, BBP, DIBP, DEHP, and 0.01% by weight of cadmium. In situations where an exemption applies, the preceding limits, corresponding to the exempted substance(s), may be higher.

- **EU REACH SVHC Content.** Substances of Very High Concerns (SVHCs) are declared if above 0.1% of the article per Regulation (EC) No. 1907/2006 and its subsequent amendments. The Candidate List of SVHCs is continually updated at <https://echa.europa.eu/candidate-list-table>.

- **Low-Halogen Status.** Homogeneous materials of parts that are considered Low-Halogen have less than 0.09% by weight each of bromine and chlorine, and less than 0.15% by weight of the sum of bromine and chlorine.

Molex's sole liability for incorrectly certifying a product shall be either replacement of the Molex product or, alternatively and in the sole discretion of Molex, return of the purchase price paid for the relevant Molex product.

For additional information regarding Molex's environmental initiatives and further explanation of this information, please visit www.molex.com



Haim Eliyahu
Director, Global Product Stewardship

Table A

Molex P/N	Part Description	RoHS Compliance Status	REACH SVHC	Low-Halogen Status
1461530100	Wi-Fi 6E Flex Cabled Balanced Antenna, 9.00mm Width, 100.00mm Cable Length, Compatible with U.FL / I-PEX MHF Connectors	Compliant	Not Contained Per - D(2021)4569-DC (8 July 2021)	Low-Halogen

RoHS Certificate of Compliance

12/27/2021

Molex is committed to managing the use of chemical substances in accordance with governmental regulations, industry standards, and customer-specific requirements in order to protect the environment. For each part listed, this document provides:

• **EU RoHS Compliance Status.** EU RoHS status is declared per Directive 2011/65/EU and its subsequent amendments, including the Directive EU 2015/863 which additionally prohibited four phthalates. Homogeneous materials of parts that are compliant to this legislation have less than 0.1% by weight each of lead, mercury, hexavalent chromium, PBB, PBDE, DBP, BBP, DIBP, DEHP, and 0.01% by weight of cadmium. In situations where an exemption applies, the preceding limits, corresponding to the exempted substance(s), may be higher.

Molex's sole liability for incorrectly certifying a product shall be either replacement of the Molex product or, alternatively and in the sole discretion of Molex, return of the purchase price paid for the relevant Molex product.

For additional information regarding Molex's environmental initiatives and further explanation of this information, please visit www.molex.com



Haim Eliyahu
Director, Global Product Stewardship

Table A

Molex Part Number	Part Description	RoHS Compliance Status
1461530100	Wi-Fi 6E Flex Cabled Balanced Antenna, 9.00mm Width, 100.00mm Cable Length, Compatible with U.FL / I-PEX MHF Connectors	Compliant