TITLE

2.4/5GHz BALANCE FLEX ANTENNA

Antenna Brand : Molex Antenna

Antenna PN : 1461530100

Antenna Type : Dipole

TABLE OF CONTENTS

2.4/5GHz BALANCE FLEX ANTENNA

1.0 SCOPE

This Product Specification covers the mechanical, electrical and environmental performances specification for 2.4/5GHz Balance Flex Antenna.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

Product name: 2.4/5GHz Balance Flex Antenna
Series Number: 146153

2.2 DESCRIPTION

Series 146153 is a balanced, dipole-type, high efficiency antenna for 2.4/5 GHz applications, including WiFi, 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

- 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
- RoHS Compliant

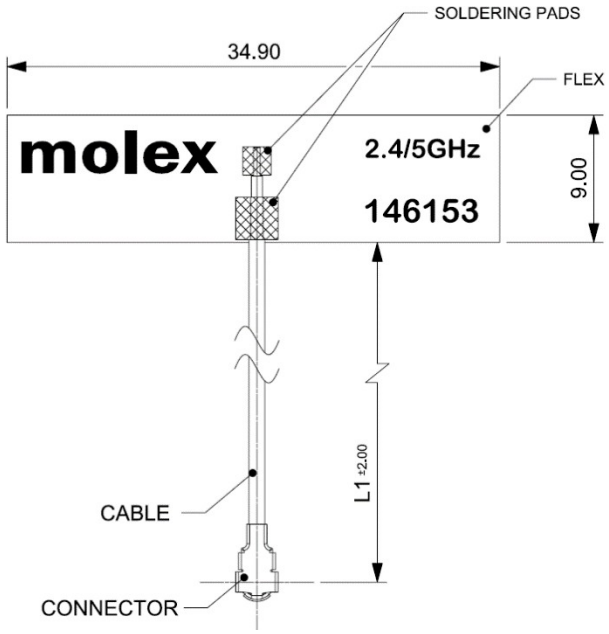
Molex 1461530100 2.4/5GHz BALANCE FLEX ANTENNA MODULE 3D VIEW

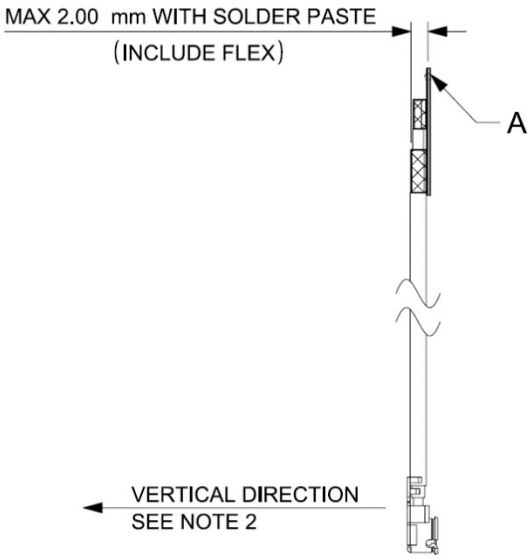
3.0 GENERAL SPECIFICATION

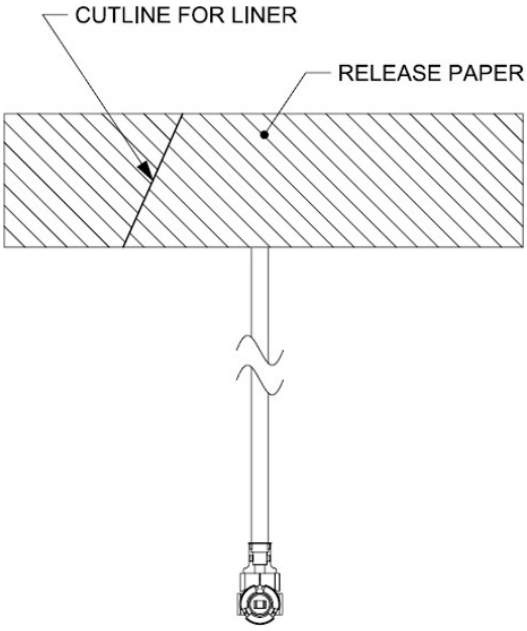
Product name	2.4/5GHz Balance Flex Antenna	
Part number	146153	
Frequency	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Polarization	Linear	
Operating with matching	-40℃ to 85℃	
Storage with matching	-40℃ to 85℃	
RF Power	2 Watts	
Impedance with matching	50 Ohms	
Antenna type	Flex	
Connector type	146153 0XXX	146153 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 1461530050/1461531250)	
	300 mm (P/N for 1461530050/1461531300)	

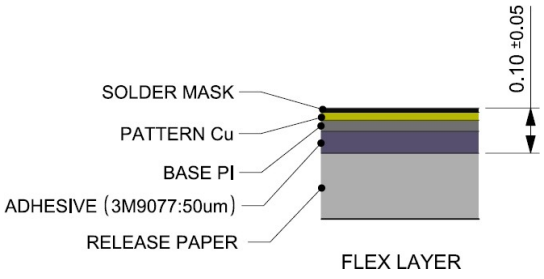
4.0 PRODUCT STRUCTURE INFORMATION

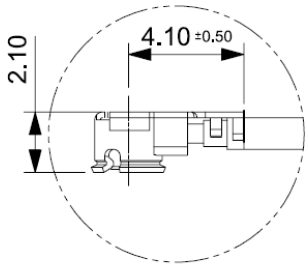
P/N	146153 0XXX











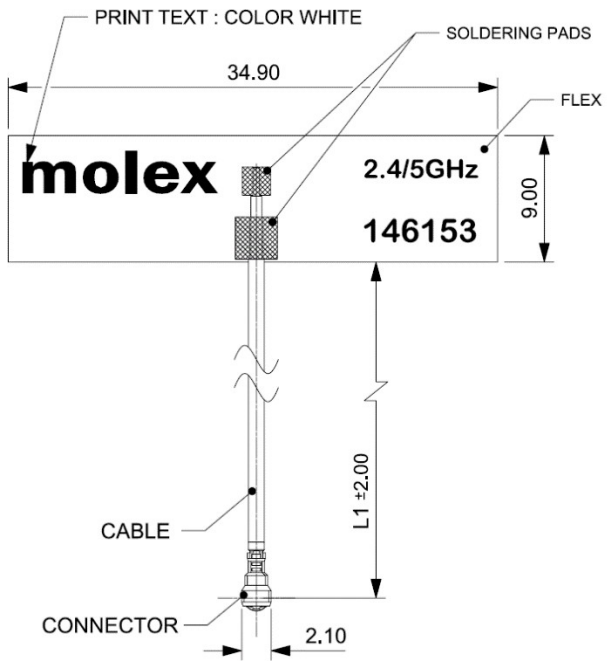
CONNCETOR

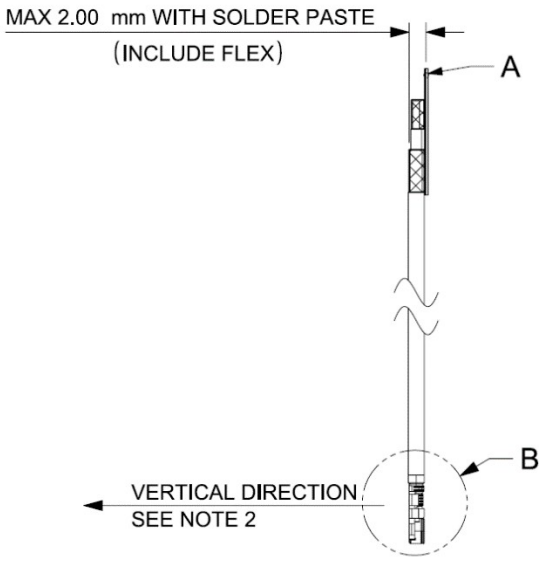
ITEM	MATERIAL NO.	CABLE LENGTH"L1"
1	1461530050	43.3 mm
2	1461530100	93.3 mm
3	1461530150	143.3 mm
4	1461530200	193.3 mm
5	1461530250	243.3 mm
6	1461530300	293.3 mm

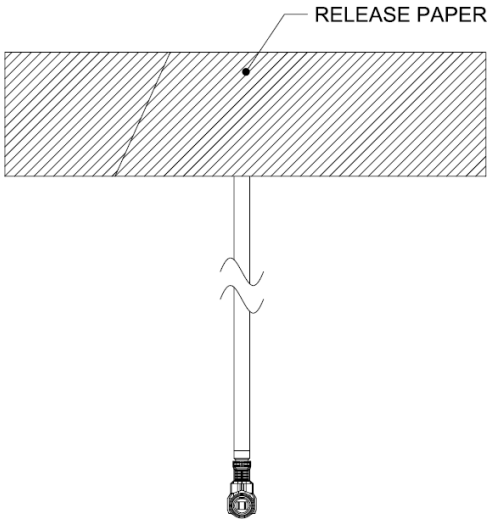
NOTES:
1. MATERIAL:
   FLEX SIZE: 34.9*9mm
   CABLE:∅1.13 mm
   CONNECTOR:OD1.13 RF 2.5H U.FL CONNECTOR-PLUG GOLD PLATED
   (IPEX MHF-I COMPATIBLE)
2. FOR PULL TEST, CAN NOT LIFT UP IN THE VERTICAL DIRECTION.
3. SOLDER MASK:BLACK.
4. THE CONNECTOR WILL BE PROTECTED WITH A CAP.

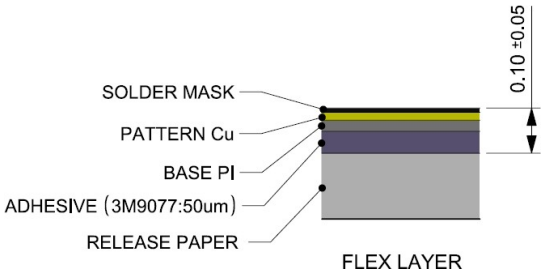
Mechanical Structure Information for 1461530XXX

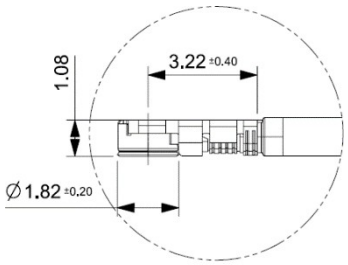
P/N	146153 1XXX











DETAIL B SCALE 8:1
CONNCETOR

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:∅1.13 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

4.5 RADIATION PATTERN

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

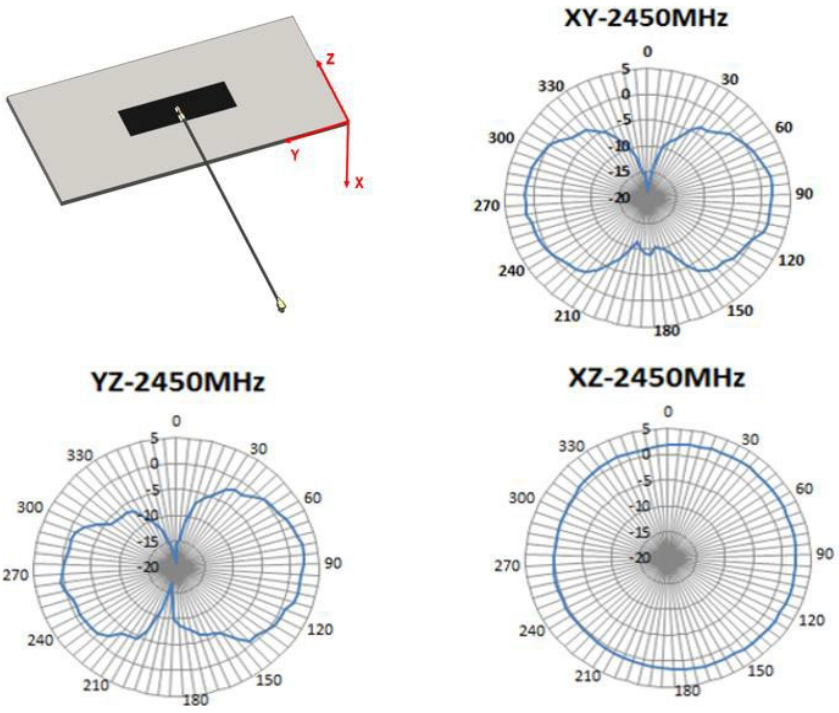


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE

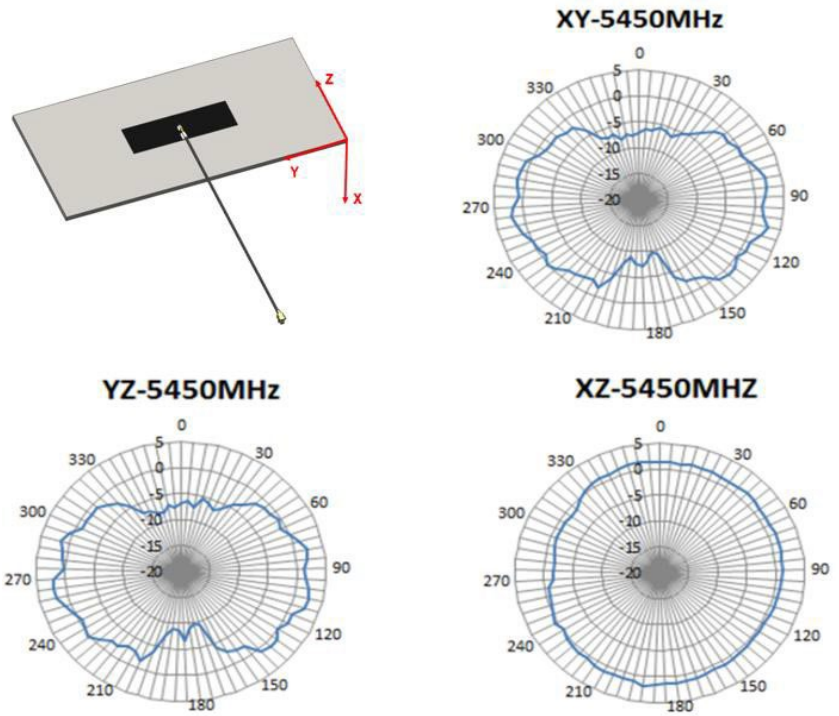


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 5450MHZ IN FREE SPACE

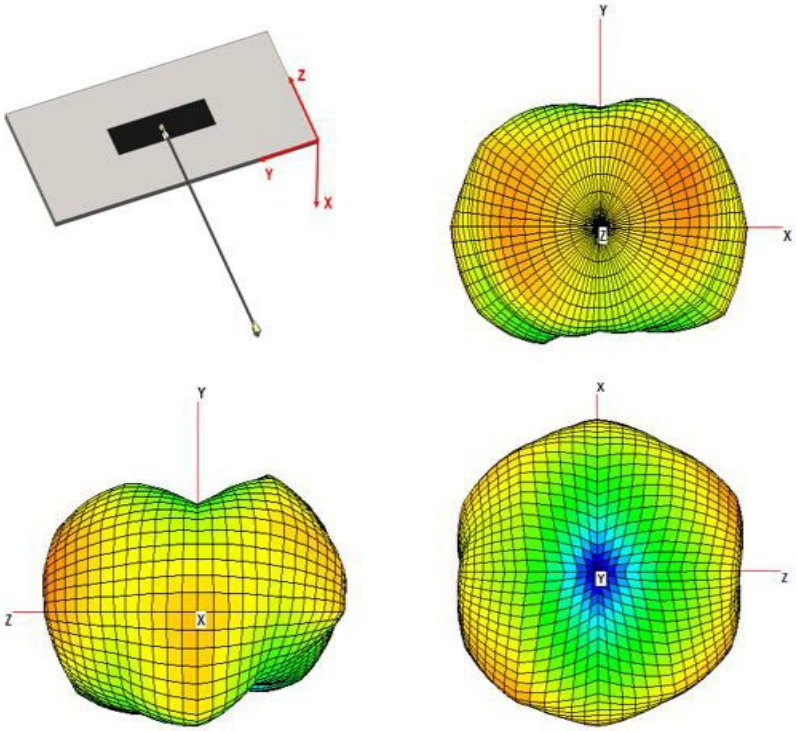


FIGURE 4.5.3 3D RADIATION PATTERN OF ANTENNA AT 2450MHZ BAND IN FREE SPACE

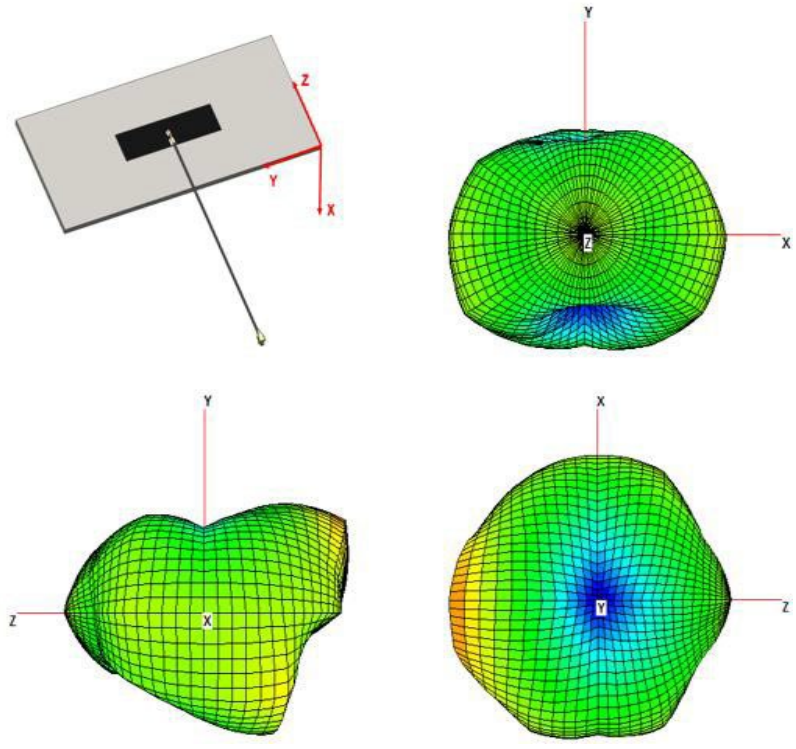


FIGURE 4.5.4 3D RADIATION PATTERN OF ANTENNA AT 5450MHZ BAND IN FREE SPACE

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 LENGHTH 50mm		
P/N	1461530050	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	3.1dBi	3.45dBi
Average Total efficiency	>78%	>79%
Return Loss	< -10 dB	< -10 dB

6.1.2 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 100mm		
P/N	1461530100	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	2.9dBi	3.2dBi
Average Total efficiency	>75%	>75%
Return Loss	< -10 dB	< -10 dB

6.1.3 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 150mm		
P/N	1461530150	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	2.7dBi	3.0dBi
Average Total efficiency	>72%	>70%
Return Loss	< -10 dB	< -10 dB

6.1.4 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 200mm		
P/N	1461530200	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	2.5dBi	2.8dBi
Average Total efficiency	>69%	>66%
Return Loss	< -10 dB	< -10 dB

6.1.5 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 250mm		
P/N	1461530250	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	2.3dBi	3.2dBi
Average Total efficiency	>66%	>63%
Return Loss	< -10 dB	< -10 dB

6.1.6 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 300mm		
P/N	1461530300	
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz
Peak Gain (Max)	2.1dBi	2.6dBi
Average Total efficiency	>63%	>59%
Return Loss	< -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.

6.2 CABLE LOSS

DESCRIPTION	TEST CONDITION	REQUIREMENTS	
Frequency Range	2.4GHz/5GHz	2.0GHz~3.0GHz	5.0GHz~6.0GHz
Attenuation	1m cable measured by VNA5071C	≤3.5dB/m	≤5.5dB/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

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 ℃. 2. Kept for 4 Hours in an environment with a temperature of 85 ℃. 3. Kept for 2 Hours in an environment with a temperature of 125 ℃. 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℃ 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 ℃⇔125 ℃ 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℃, 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.

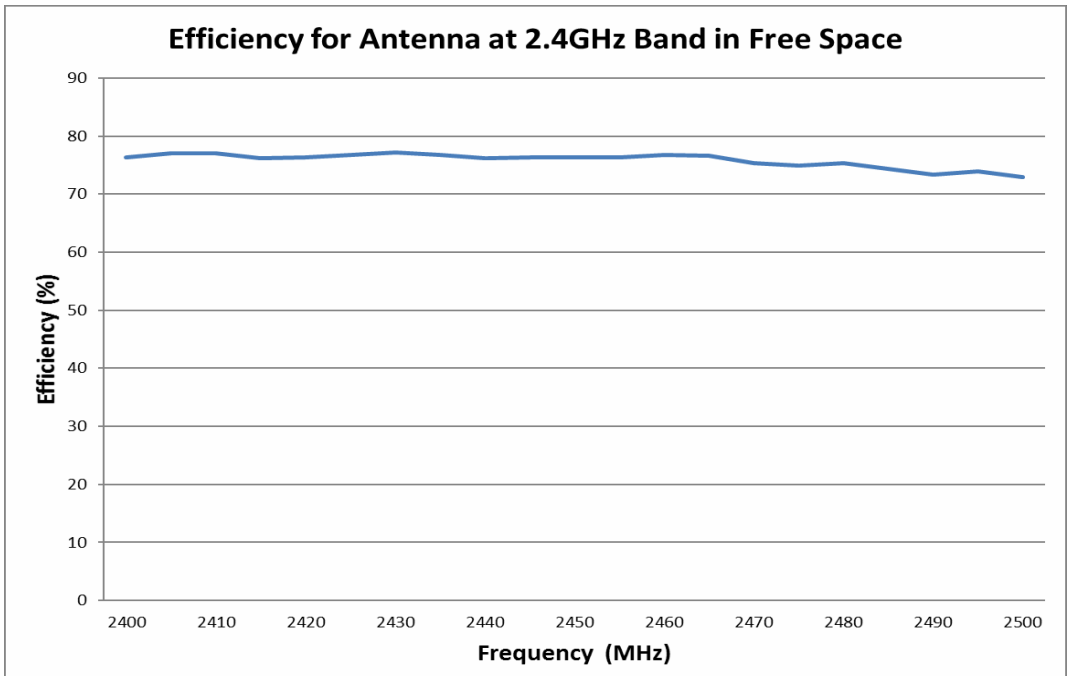
9.0 Antenna Performance 1461530100

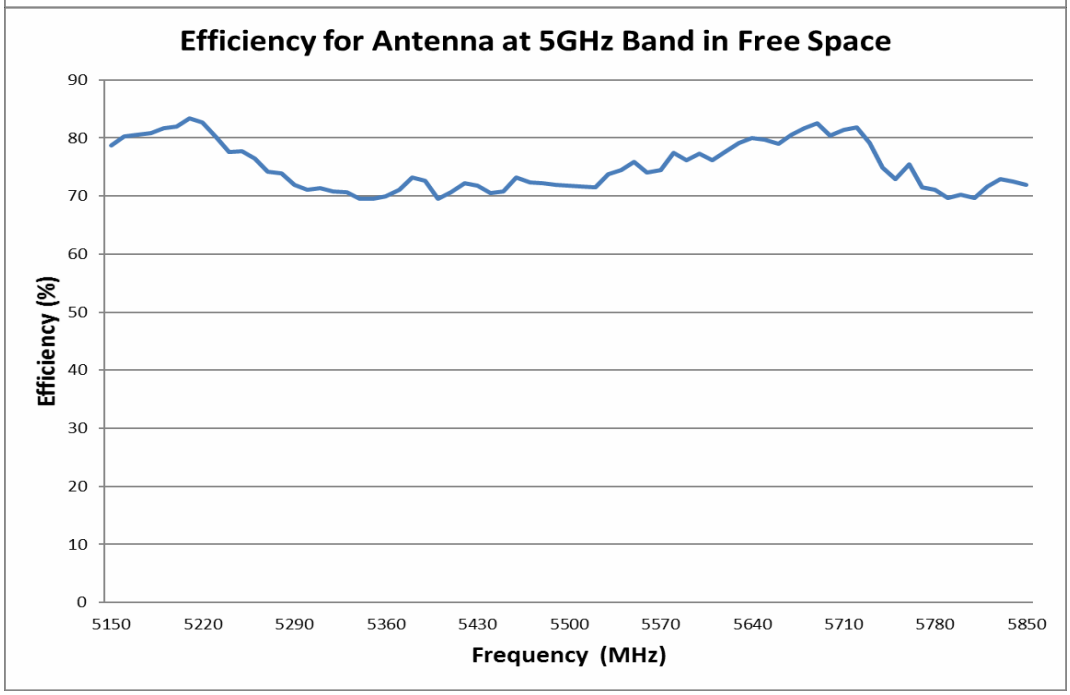
9.1 Antenna Gain

Band	Frequency Range	Peak Gain (dBi)
WIFI 2.4G	2400~2483.5MHz	2.9
WIFI 5.0G	5150~5250MHz	3.1
	5250~5350MHz	3.2
	5470~5725MHz	3.2
	5725~5850MHz	3.1

Gain was measured in anechoic chamber

9.2 Efficiency Plot





Efficiency was measured in anechoic chamber

品名：**RFPCA360908IMLB701**

History List

版本 REV.	修訂者 EDITOR	修訂頁次 PAGE	修訂內容 ITEMS OF CHANGE	申請日期 DATE	生效日期 VALID DATE	ECN 編號 ECN NO.
A0	Huiwenchan	ALL	Temporary Release	2022/10/17	According to the date of PLM Release	N/A

1.Explanation of part number：

RF	PCA	3609	08	I	M	L	B	7	01
Type Code	**Product Code**	**PCB Dimension (Unit: mm)**	**Cable Length (unit: cm)**	**Connector Brand**	**Type of Connector**	**Application**	**Project status**	**Wire Diameter**	**Project**
Walsin RF Device	Antenna	Per 2 digits of length, width e.g.: 3609 Length 36.60mm, Width 9.0mm	2 digits for cable length e.g.08 Cable Length: 8.0cm	A: N C:MCX D:IPEX III E: IPEX IV F: IPEX A13 H: Hirose I: IPEX M: MMCX S: SMA T: TNC U:MURATA N: None	A: Reverse Female **B: Reverse Male** F: Female M: Male N: None	**0: 0GHz** **3: 3GHz** **5: 5GHz** **6: 6GHz** A: 2.4GHz ISM band B: GSM 900/1800 dual band G: GPS band L: 2.4/5.2/5.8 GHz tri-band **N: NFC** **T: LTE band** W: WCDMA band	B: MP **T:During Test** X: Pile Run	0:None 1:⌀ 0.81 2:⌀ 1.32 3:⌀ 1.13 4:Low Loss ⌀ 1.13 5:⌀ 0.5 6:RG316 7：⌀ 1.37 8:RG178 9:Low Loss ⌀ 1.37	01~99 series number

2.Electrical Specification：

Item	Specification
Working Frequency Range	2.4 ~ 2.5 / 5.15 ~ 5.85 GHz
Return Loss	-10 dB
Peak Gain	3.50 dBi(@2.4 ~ 2.5 GHz) 2.99 dBi(@5.15 ~ 5.85 GHz)
VSWR	2 max.
Polarization	Linear Vertical
Radiation Pattern	Directional
Impedance	50Ω
Operation Temperature	－20℃ ～ ＋65℃

UNLESS OTHER SPECIFIED TOLERANCES ON：
X＝N/A X.X＝N/A X.XX＝N/A
ANGLES＝N/A HOLEDIA＝N/A

INPAQ TECHNOLOGY CO., LTD.

SCALE：N/A UNIT：mm
DRAWN BY：詹惠雯 CHECKED BY：詹惠雯
DESIGNED BY：黃瑞郎 APPROVED BY：陳振榮

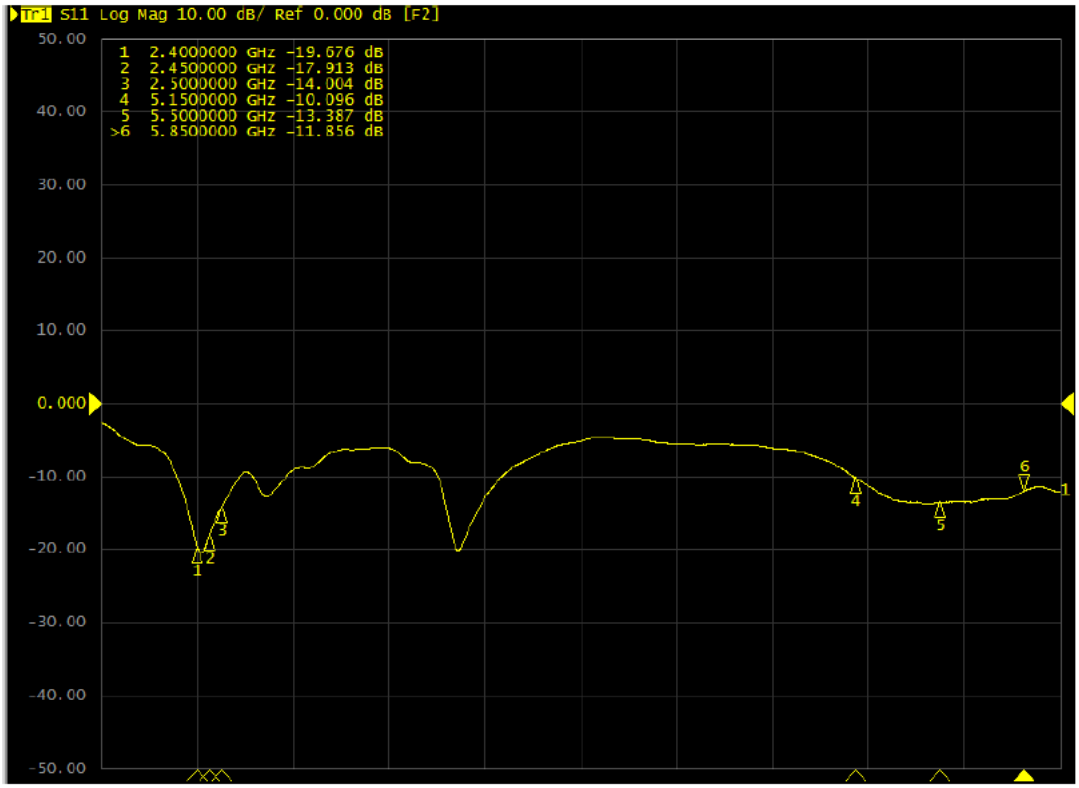
TITLE：RFPCA360908IMLB701

DOCUMENT NO.

SPEC REV. A0

ELECTRICAL CHARACTERISTICS

Return Loss



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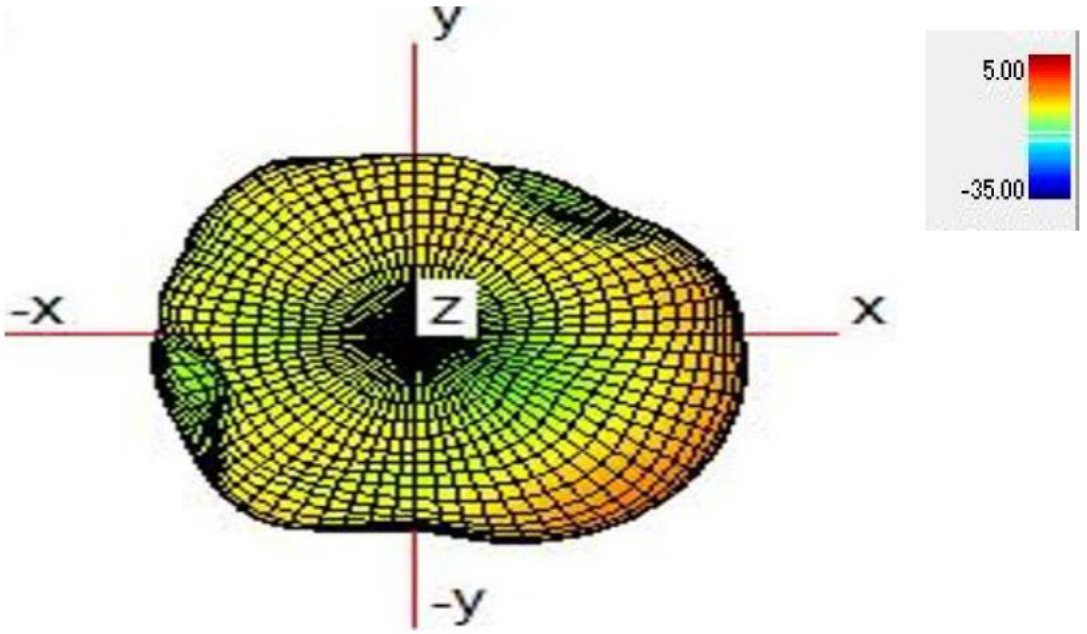
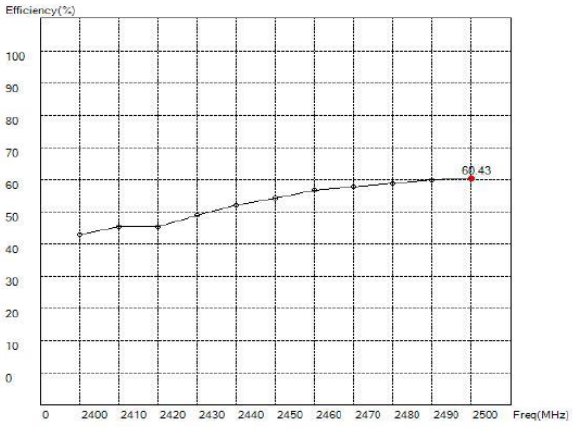
DESIGNED BY：黃瑞郎	APPROVED BY：陳振榮		
TITLE：RFPCA360908IMLB701		DOCUMENT NO.	SPEC REV. A0

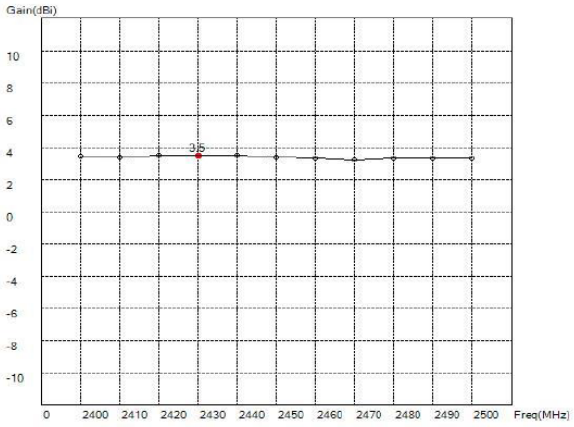
Antenna Efficiency & Peak Gain

WiFi @ 2.4G



2450MHz





Maximum Efficiency at 2500MHz : 60.43%

Maximum Peak Gain at 2430MHz : 3.5dBi

UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
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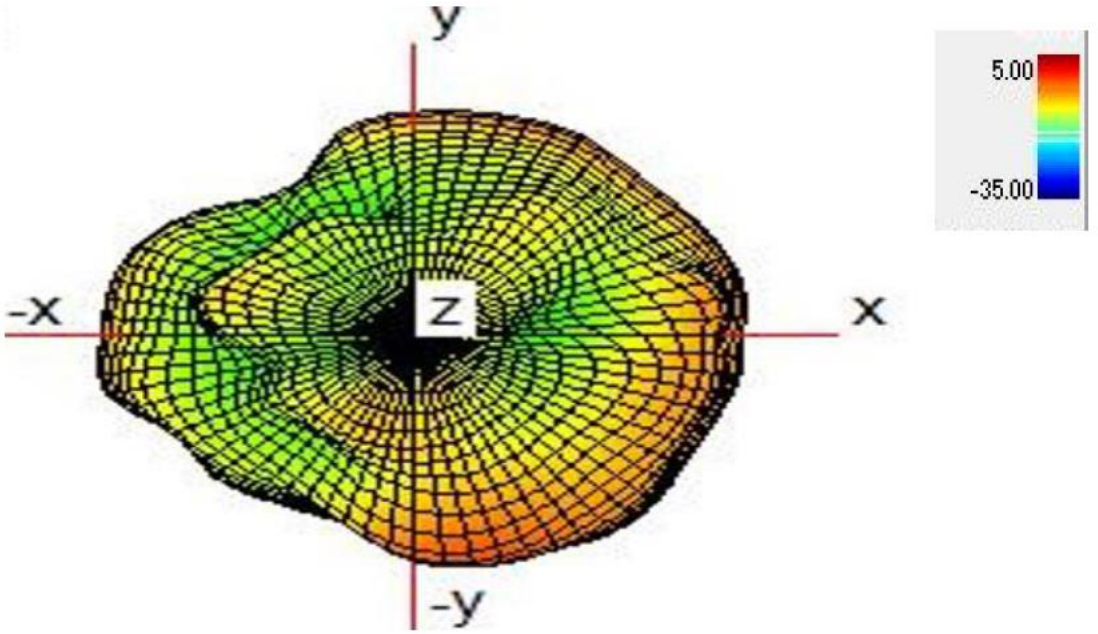
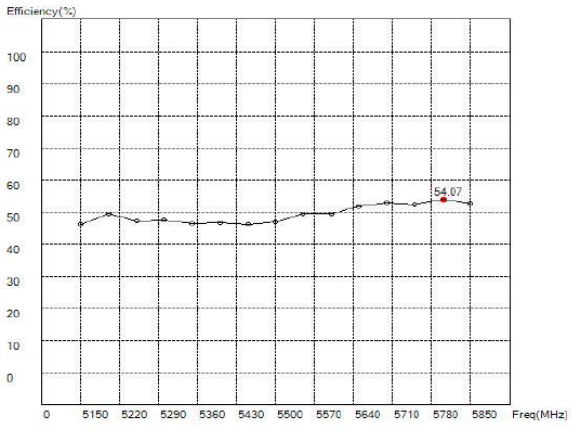
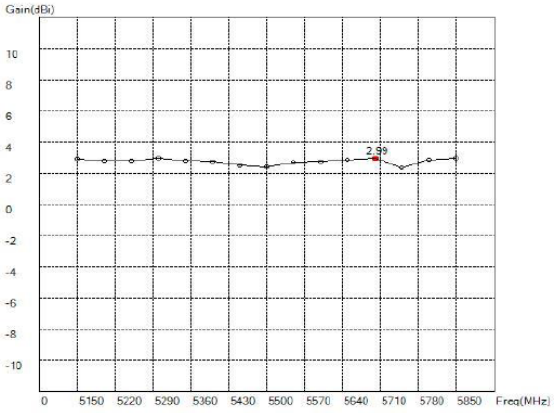
DESIGNED BY：黃瑞郎	APPROVED BY：陳振榮		
TITLE：RFPCA360908IMLB701		DOCUMENT NO.	SPEC REV. A0

WiFi @ 5G



5500MHz





Maximum Efficiency at 5800MHz : 54.07%

Maximum Peak Gain at 5700MHz : 2.99dBi

UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
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DESIGNED BY：黃瑞郎	APPROVED BY：陳振榮		
TITLE：RFPCA360908IMLB701		DOCUMENT NO.	SPEC REV. A0

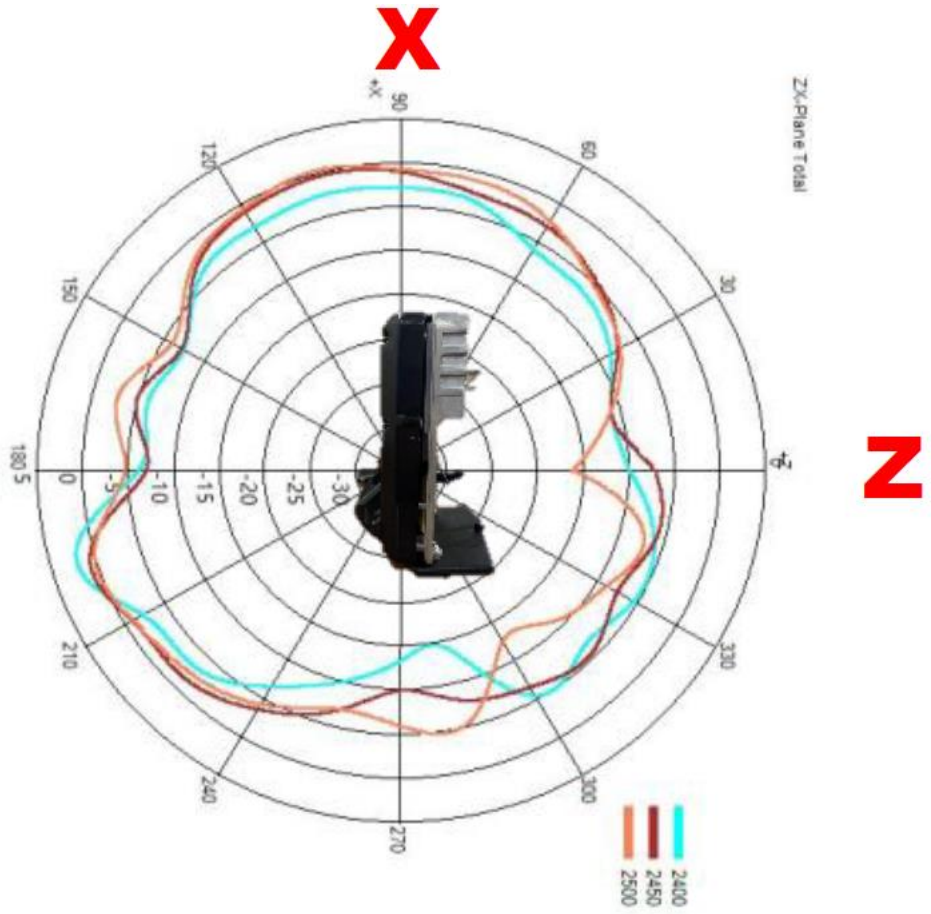
■RADIATION PATTERN

WiFi @ 2.4G

X-Z Plane

Phi=0.00deg

Gain . dB



UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
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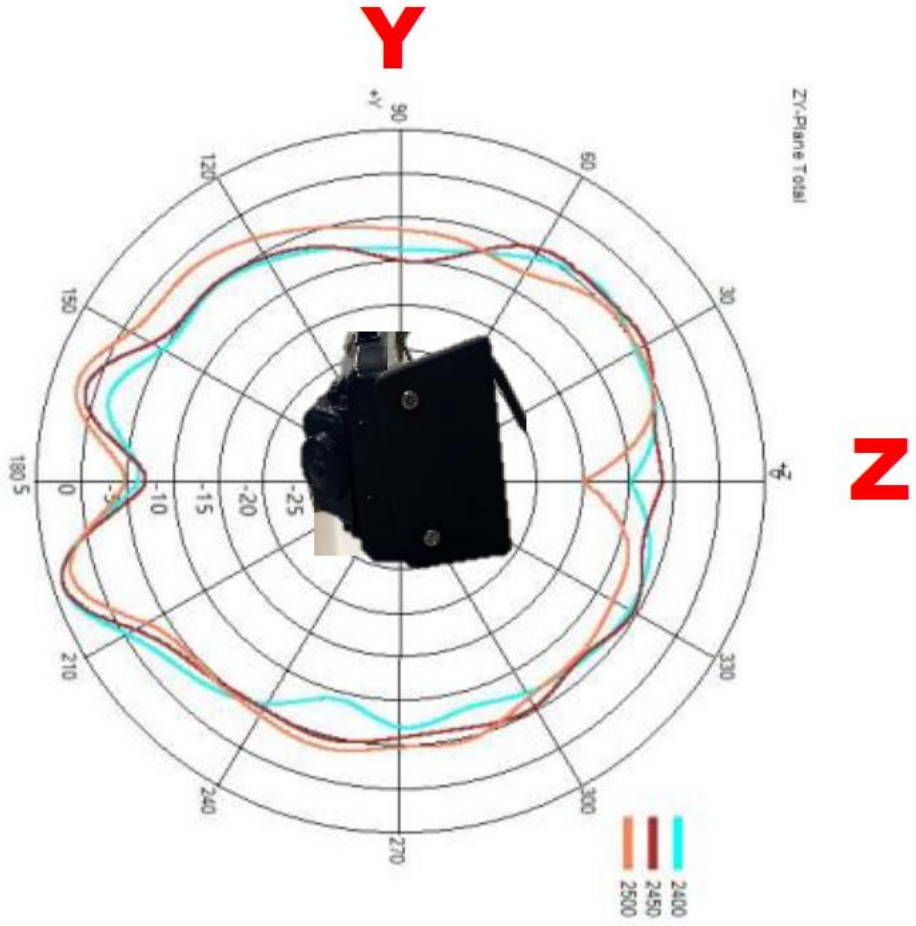
DESIGNED BY：黃瑞郎	APPROVED BY：陳振榮		
TITLE：RFPCA360908IMLB701		DOCUMENT NO.	SPEC REV. A0

Y-Z Plane

Phi=90.00deg

Gain . dB



UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
SCALE：N/A	UNIT：mm	THIS DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF INPAQ TECHNOLOGY CO.,LTD.AND SHALL NOT BE REPRODUCED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS OR DEVICES WITHOUT PERMISSION	
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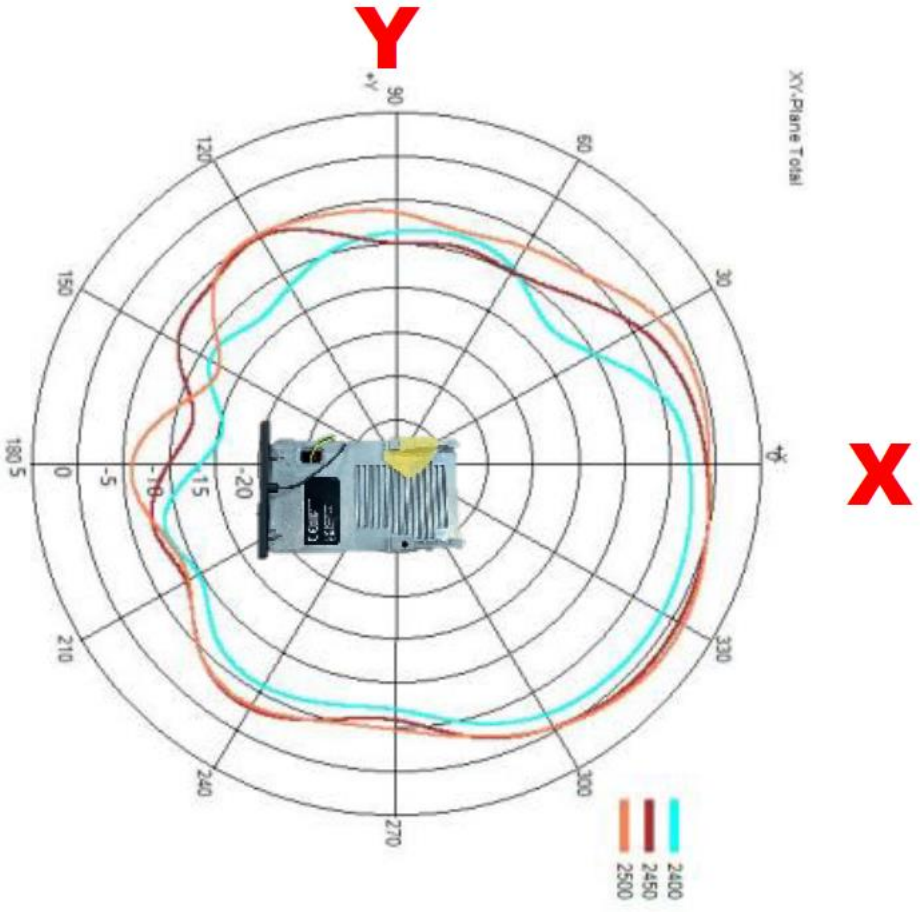
X-Y Plane

Theta=90.00deg

Gain . dB



	ZX plane		ZY plane		XY plane	
Frequency [MHz]	Max Value [dBi]	Average [dBi]	Max Value [dBi]	Average [dBi]	Max Value [dBi]	Average [dBi]
2400	1.98	-4.83	3.43	-4.39	-1.30	-6.00
2450	0.32	-3.77	3.39	-3.80	0.82	-3.79
2500	0.38	-3.75	2.55	-3.72	1.39	-3.17

UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A		INPAQ TECHNOLOGY CO., LTD.	
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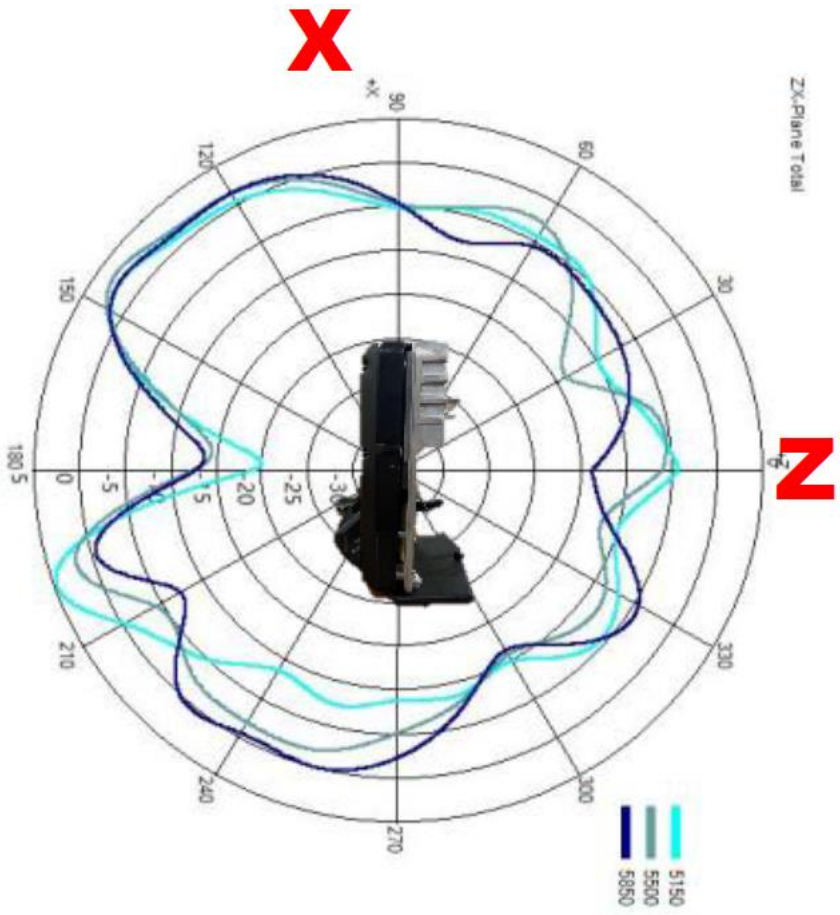
WiFi @ 5G

X-Z Plane

Phi=0.00deg

Gain . dB



UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
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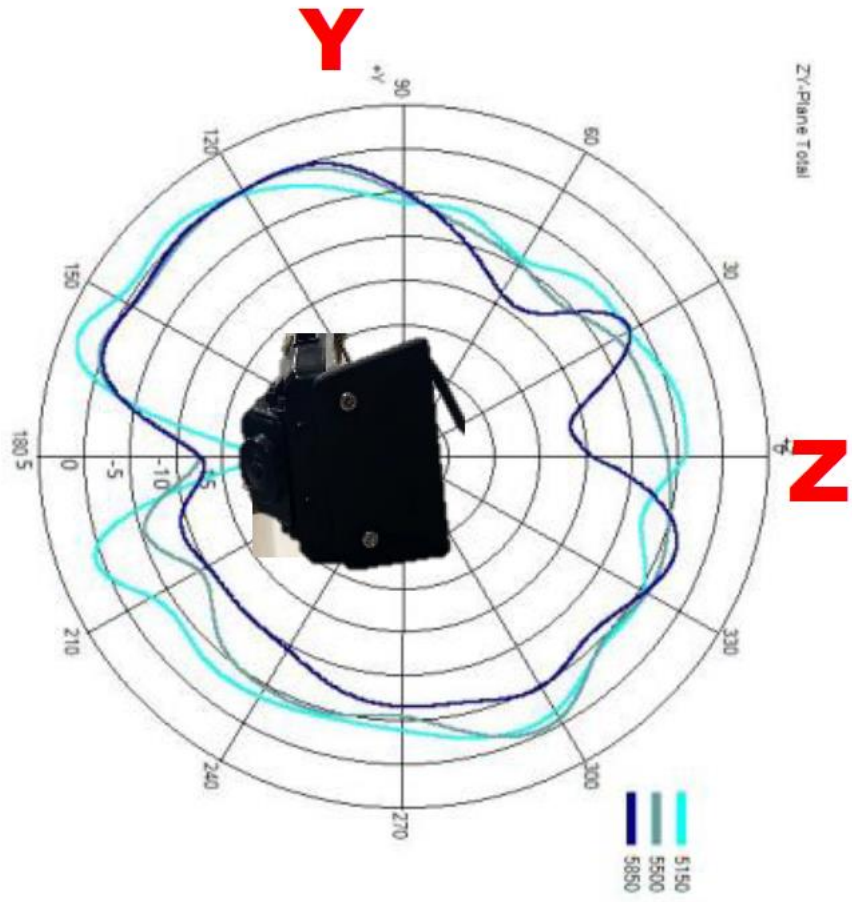
Y-Z Plane

Phi=90.00deg

Gain . dB



UNLESS OTHER SPECIFIED TOLERANCES ON： X＝N/A X.X＝N/A X.XX＝N/A ANGLES＝N/A HOLEDIA＝N/A			INPAQ TECHNOLOGY CO., LTD.
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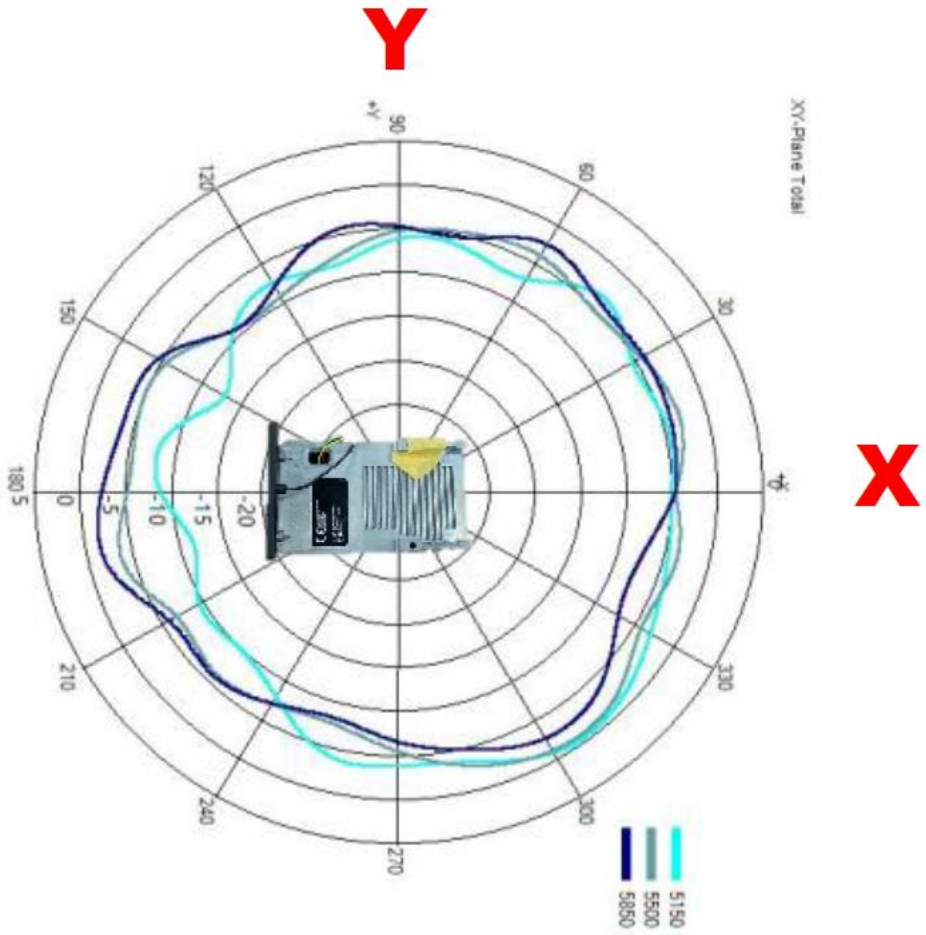
X-Y Plane

Theta=90.00deg

Gain . dB



	ZX plane		ZY plane		XY plane	
Frequency [MHz]	Max Value [dBi]	Average [dBi]	Max Value [dBi]	Average [dBi]	Max Value [dBi]	Average [dBi]
5150	2.90	-3.23	1.27	-2.83	-0.76	-5.32
5500	2.16	-2.92	0.03	-3.82	-1.06	-4.63
5850	1.62	-2.96	-0.01	-4.91	-2.03	-4.67

UNLESS OTHER SPECIFIED TOLERANCES ON：
X＝N/A X.X＝N/A X.XX＝N/A
ANGLES＝N/A HOLEDIA＝N/A

INPAQ TECHNOLOGY CO., LTD.

SCALE：N/A | UNIT：mm

DRAWN BY：詹惠雯 | CHECKED BY：詹惠雯

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