

# 2.4/5GHZ WIFI DUAL BAND ANTENNA WITH SIDE SOLDER CABLE TABLE OF CONTENTS

- 1.0 SCOPE
- 2.0 PRODUCT DESCRIPTION
- 3.0 APPLICABLE DOCUMENTS
- **4.0 ANTENNA PERFORMANCE**
- **5.0 ASSEMBLY GUIDELINE**
- 6.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH
- 7.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

REVISION:	ECR/ECN INFORMATION:			SHEET No.		
С	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		SIDE	1 of 32	
C	DATE: <b>2018/01/24</b>		SOLDER CABLE			
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:	
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24	



### 2.4/5GHZ WIFI DUAL BAND ANTENNA WITH SIDE SOLDER CABLE

#### 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.

Although this document AS-2042810200 is for U.FL compatible connector and 200mm cable, it is applicable to all products under 204281 series. All measurements in this document are done with the part no.2042810200 with a cable length of 200mm, it is used to illustrate the product application. There is no different between the performances for 204810100 and 204811100. The document is applicable to all cable length as well.

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: 2.4/5GHz WIFI Dual Band Antenna with Side Solder Cable

Series Number: 204281

#### 2.2 DESCRIPTION

Series 204281 is a balanced, side-fed, dipole-type, high efficiency antenna for 2.4/5 GHz applications, including WiFi, Bluetooth, Zigbee and others. This antenna is made from polyflexible material with small size 35\*11\*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-2042810200 for full information.



REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WI	FI ANTENNA WITH OLDER CABLE	SIDE	SHEET No.  2 of 32
DOCUMENT NUMBER:		CREATED / REVISED BY:	EATED / REVISED BY: CHECKED BY: APPROVI		<u>ED BY:</u>
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### 3.0 APPLICABLE DOCUMENTS

Document	Number Description	
Solos Drowing(SD)	SD-2042810200	Machanical Dimension of the product
Sales Drawing(SD)	SD-2042811100	Mechanical Dimension of the product
Product Specification (PS)	fication (PS) PS-2042810200 Product Specification	
Packing Drawing(PK)	PK-2042810200	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 1mm thickness with VNA Agilent 5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.2042810200 and 2042811100 with a cable length of 200mm.

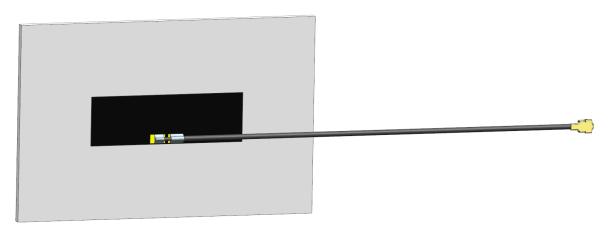


FIGURE4.1.1 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS

REVISION:	ECR/ECN INFORMATION:			SHEET No.			
С	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		SIDE	3 of 32		
C	DATE: <b>2018/01/24</b>		SOLDER CABLE				
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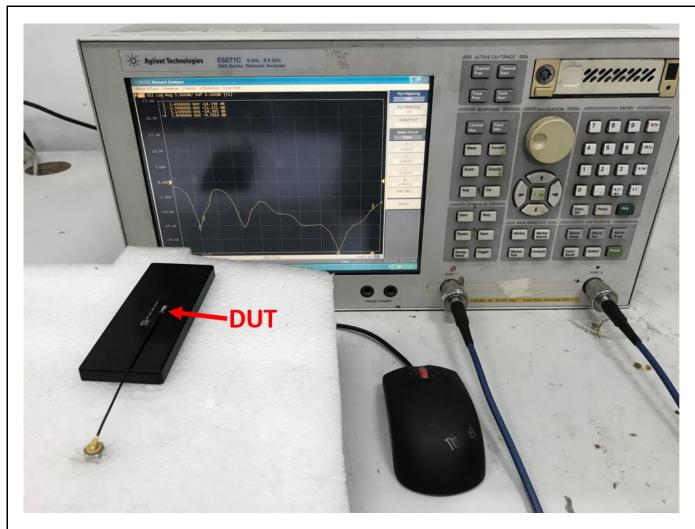


FIGURE4.1.2 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS TESTED WITH VNA E5071C

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WII	FI ANTENNA WITH OLDER CABLE	SIDE	SHEET No. 4 of 32
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	/ED BY:

Benson Liu 2018/01/24

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Kang Cheng 2018/01/24 | Chris Zhong 2018/01/24



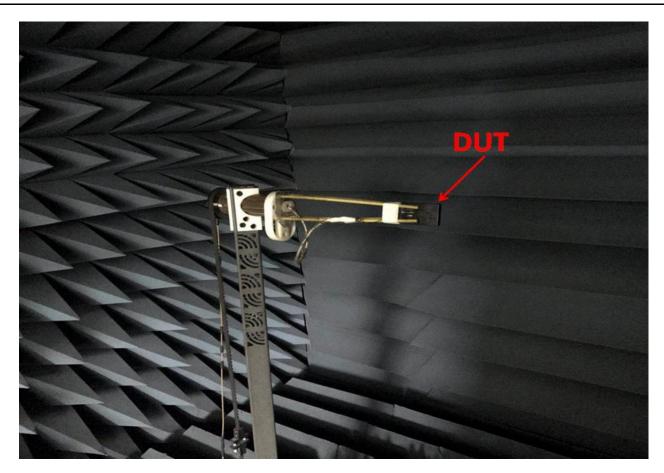


FIGURE4.1.3 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS TESTED IN OTA CHAMBER

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WI	FI ANTENNA WITH OLDER CABLE	SIDE	<u>SHEET No.</u> <b>5</b> of <b>32</b>
DOCUMENT NUMBER:		CREATED / REVISED BV:	CHECKED BV:	ΔPPRO\	/ED BV:

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### 4.2 ANTENNA PERFORMANCE

Description	Equipment	Requirement		
Frequency Range	VNA E5071C	2.4-2.5GHz	5.15-5.85GHz	
Return Loss	VNA E5071C	< -10 dB		
Peak Gain (Max)	OTA Chamber	1.6dBi	2.8dBi	
Average Total Efficiency	OTA Chamber	>59%	>60%	
Polarization	OTA Chamber	Linear		
Input Impedance	nput Impedance VNA E5071C 50 ohms		nms	

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:           EC No:         171309           DATE:         2018/01/24	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		6 of 32	
DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:
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### **4.3 RETURN LOSS PLOT**

All measurements in this document are done with a cable length of 200mm

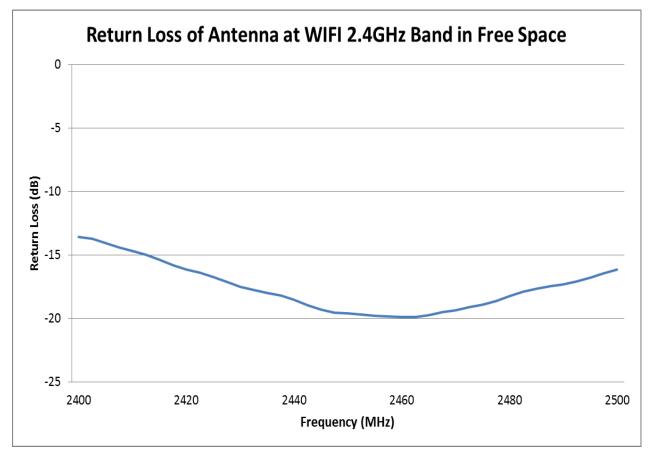


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:		EL ANITENINIA 14//TLI	OIDE	SHEET No.
С	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE		<b>7</b> of <b>32</b>	
C	DATE: 2018/01/24	SOLDER CABLE 7			1 01 32
DOCUMENT NUMBER:		CREATED / REVISED BY: CHECKED BY: APPRO		/ED BY:	
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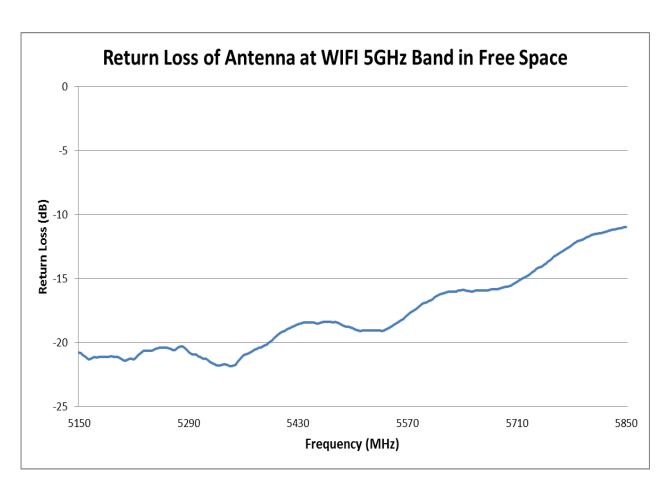


FIGURE 4.3.2 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:		EL ANTENNA WITH	SIDE	SHEET No.
С	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			<b>8</b> of <b>32</b>
C	DATE: <b>2018/01/24</b>		0 01 32		
DOCUMENT NUMBER:		CREATED / REVISED BY: CHECKED BY: APPROV		/ED BY:	
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### **4.4 EFFICIENCY PLOT**

All measurements in this document are done with a cable length of 200mm

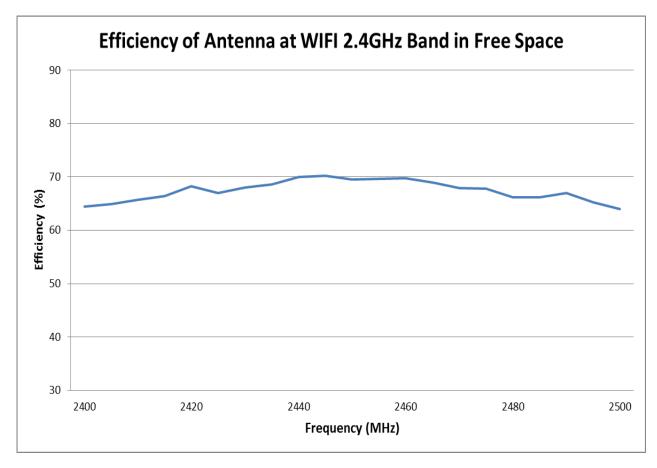


FIGURE 4.4.1 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:		EL ANTENNA WITH	CIDE	SHEET No.
C	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			<b>9</b> of <b>32</b>
	DATE: <b>2018/01/24</b>	SOLDER CABLE			
DOCUMENT NUMBER:		CREATED / REVISED BY: CHECKED BY: APPROV		/ED BY:	
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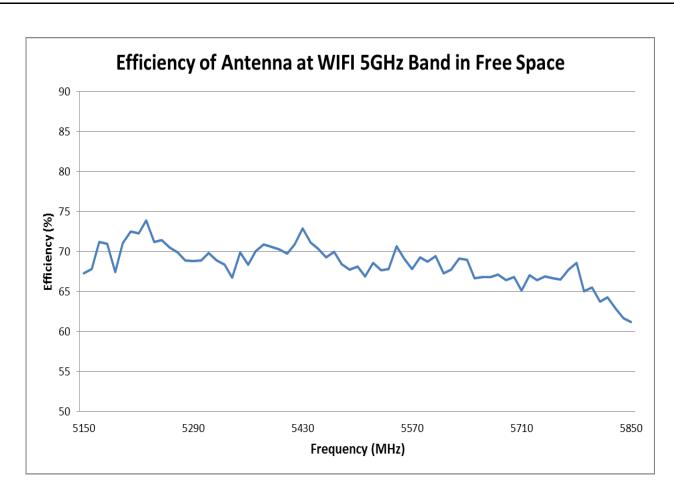
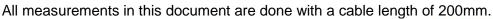


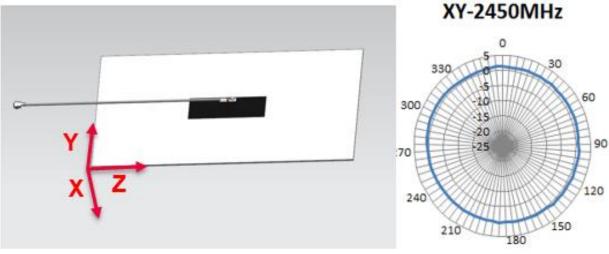
FIGURE 4.4.2 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:				SHEET No.
C	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			<b>10</b> of <b>32</b>
C	DATE: 2018/01/24	3	OLDER CABLE		10 01 32
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROVED BY</u>	
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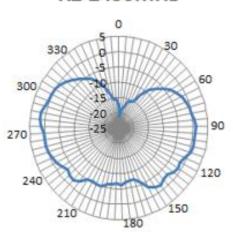


### 4.5 RADIATION PATTERN





XZ-2450MHz



YZ-2450MHz

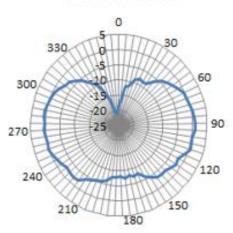


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 2.45GHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WII	FI ANTENNA WITH OLDER CABLE	SIDE	11 of 32
DOCUMEN:	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:

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Chris Zhong 2018/01/24

Kang Cheng 2018/01/24



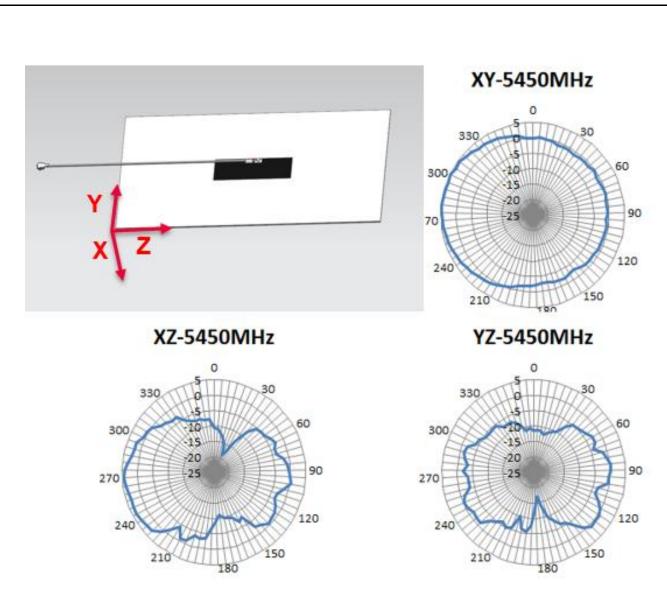


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 5.45GHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			12 of 32
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	EATED / REVISED BY: APPROVED BY		/ED BY:
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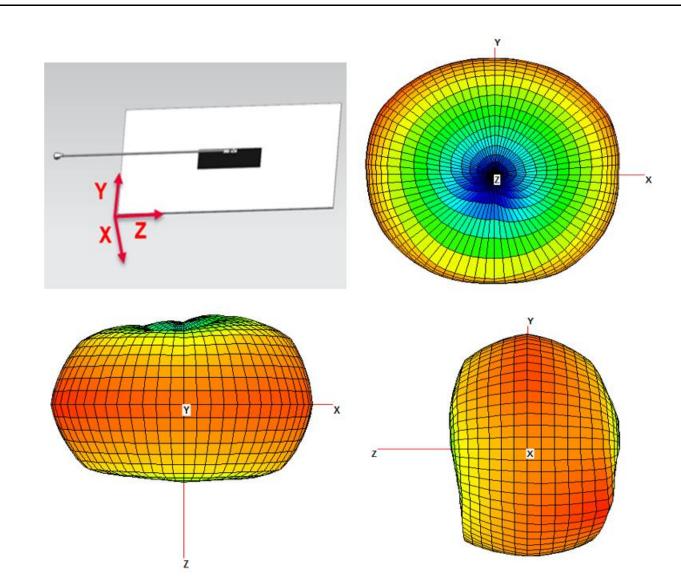


FIGURE 4.5.3 3D RADIATION PATTERN OF ANTENNA AT 2.45GHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:				SHEET No.
^	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE		40 (00	
C	DATE: 2018/01/24	5	OLDER CABLE		<b>13</b> of <b>32</b>
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:	
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24



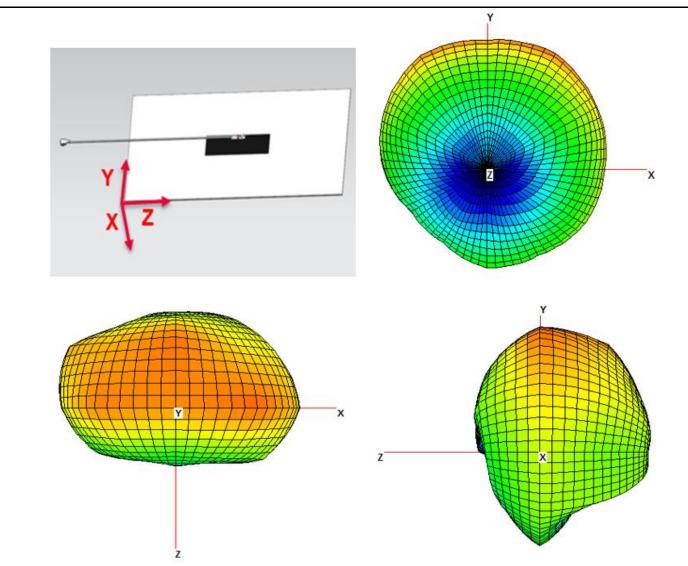


FIGURE 4.5.4 3D RADIATION PATTERN OF ANTENNA AT 5.45GHZ IN FREE SPACE

REVISION:	ECR/ECN INFORMATION:	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			SHEET No.
C	EC No: <b>171309</b>			<b>14</b> of <b>32</b>	
C	DATE: 2018/01/24	3	OLDER CABLE		14 01 32
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:
AS	-2042810200	Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24



### 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<1.6um, and need to clean the surface before sticking this product. The antenna cannot be placed on a metallic surface.

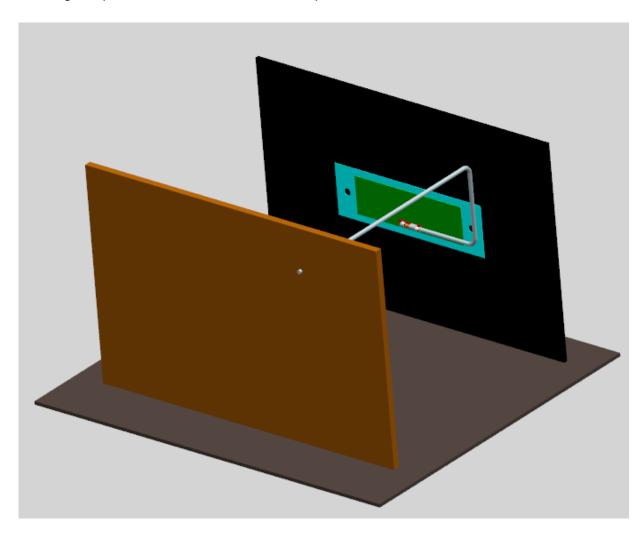


FIGURE 5.1 ASSEMBLY GUIDELINE

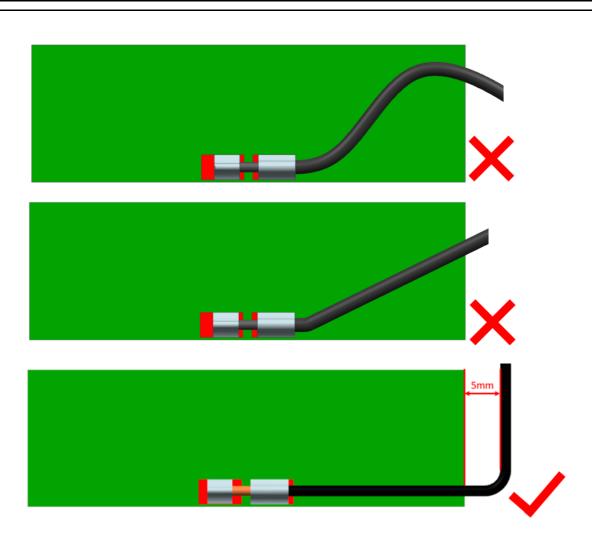
During the assembly of the antenna in a device, the cable needs to be positioned away from the antenna flex to achieve best performance. The cable must be away from the pattern at least 5mm as shown in figure 5.2. If the cable crosses into the antenna flex, the antenna performance will be degraded.

REVISION:	ECR/ECN INFORMATION:	l <del></del>		_	SHEET No.
С	EC No: 171309 DATE: 2018/01/24		FI ANTENNA WITH OLDER CABLE	SIDE	<b>15</b> of <b>32</b>

 DOCUMENT NUMBER:
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**FIGURE 5.2 CABLE BENDING** 

### 6.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH

### **6.1 CABLE LOSS**

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS	
	Frequency Range	2.4GHz/5GHz	2GHz~3GHz	5GHz~6.0GHz
6.1.1	Attenuation	1m cable measured by VNA5071C	≤3.5dB/m	≤5dB/m

REVISION:	ECR/ECN INFORMATION:		SHEET No.		
C	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			<b>16</b> of <b>32</b>
C	DATE: 2018/01/24	3	10 01 32		
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:
AS	-2042810200	Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24



### 6.2 CABLE LENGTH AFFECT THE ANTENNA PERFORMANCE

Balance antenna resonance is insensitive by cable's length, but the cable's loss will affect the total efficiency. Refer to 6.1.1.

### **6.3 FOR EXAMPLE**

	100mm cable			200mm cable	
Frequency (MHz)	Efficiency (dB)	Efficiency (%)	Cable Loss	Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
2400	-1.91	64. 44	0.2m*3.5dB/m	-2.61	54.85
2420	-1.66	68. 21		-2.36	58.06
2440	-1. 55	69. 92		-2. 25	59. 52
2460	-1. 56	69.74		-2. 26	59. 36
2480	-1. 79	66. 18		-2.49	<b>56.</b> 33
2500	-1.94	64.02		-2.64	54. 49
5150	-1.72	67. 25	0.2m*5dB/m	-2.72	53. 42
5200	-1. 49	71.00		-2.49	56. 40
5250	-1. 46	71.40		-2.46	56. 71
5300	-1.62	68.86		-2.62	54.69
5350	-1. 56	69.89		-2.56	<b>55.</b> 52
5400	-1. 53	70.30		-2.53	55.84
5450	-1.53	70. 32		-2 <b>.</b> 53	55. 85
5500	-1. 67	68.08		-2.67	54. 08
5550	-1. 51	70.63		-2.51	56. 10
5600	-1. 59	69. 40		-2.59	<b>55.</b> 13
5650	-1. 76	66.66		-2.76	52. 95
5700	-1. 75	66. 78		<i>−</i> 2. 75	53.04
5750	-1. 76	66. 67		-2. 76	52. 96
5800	-1.84	65. 48		-2.84	52. 01
5850	-2. 13	61.21		-3. 13	48.62

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

<b>REVISION</b> :	ECR/ECN INFORMATION:	TITLE:	SHEET No.					
С	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE		<b>17</b> of <b>32</b>				
C	DATE: <b>2018/01/24</b>	3	SOLDER CABLE					
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:				
AS	-2042810200	Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24			



#### 7.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

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

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations from 5mm, 10mm, 15mm and 20mm with a parallel plane ground have been evaluated. The locations are shown in figure 7.1.1. 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 plane ground is recommended to be at least 15mm to achieve acceptable RF performance.

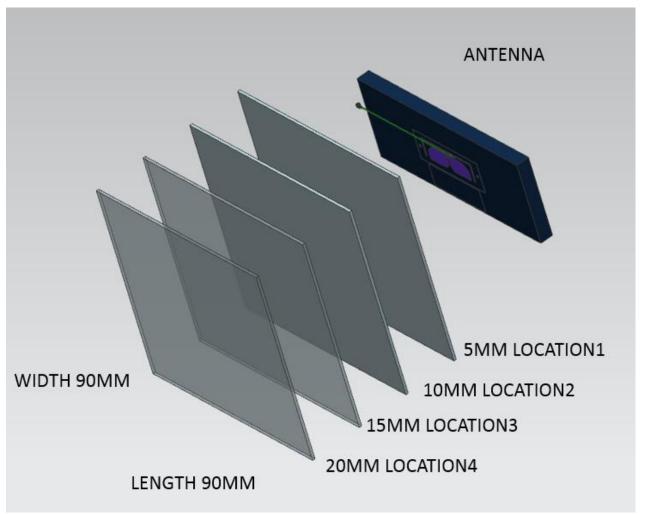


FIGURE 7.1.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WI S	18 of 32		
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:	
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24



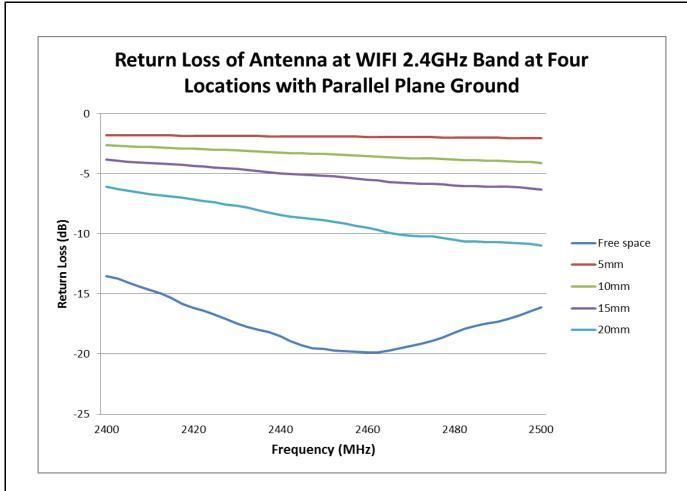


FIGURE 7.1.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WI	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE			
DOCUMEN	T NUMBER:	CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	/ED BY:	
AS	-2042810200	Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24	



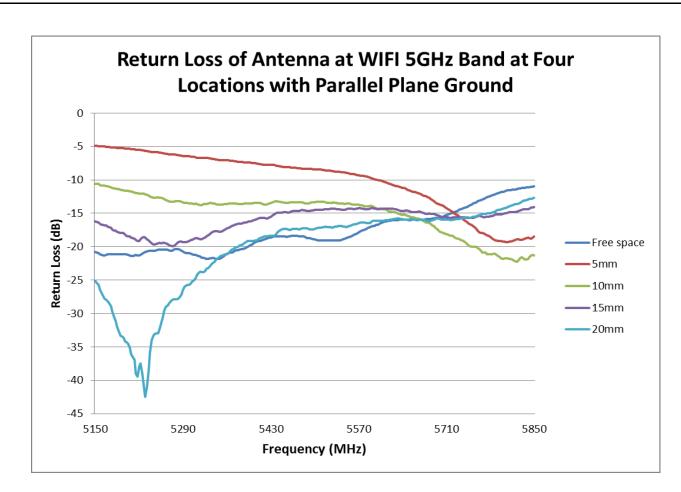


FIGURE 7.1.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WIFI ANTENNA WITH SIDE			20 of 32
-	T NUMBER: -2042810200	CREATED / REVISED BY: Benson Liu 2018/01/24	CHECKED BY: Kang Cheng 2018/01/24	APPROV	



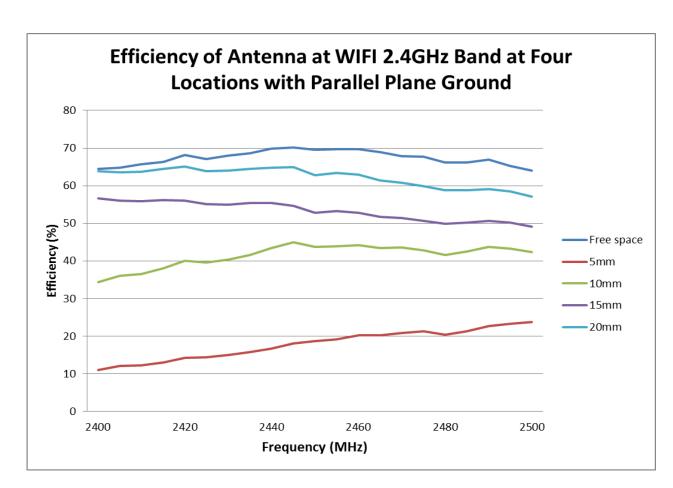


FIGURE 7.1.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:		SHEET No.			
С	EC No: 171309		2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE				
C	DATE: 2018/01/24	3	SOLDER CABLE				
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:		
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24		



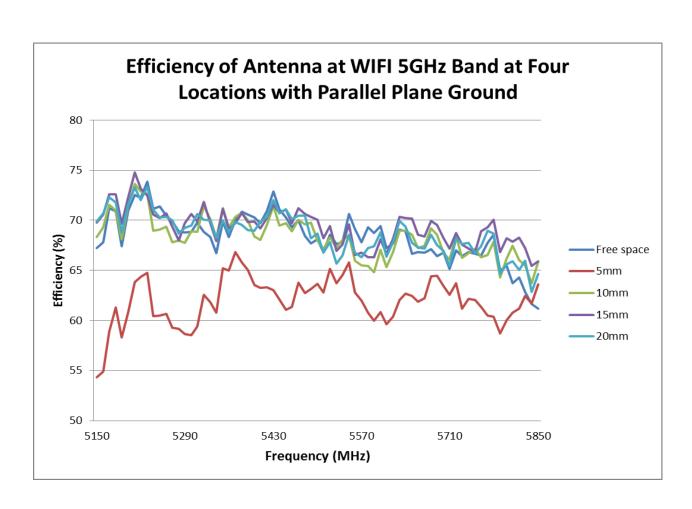


FIGURE 7.1.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:			SHEET No.		
•	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE		<b>22</b> of <b>32</b>			
С	DATE: 2018/01/24	S	SOLDER CABLE				
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	/ED BY:		
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24			



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

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations of 5mm, 10mm, 15mm and 20mm away from the vertical plane ground have been evaluated. These locations are shown in figure 7.2.1. 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 plane ground is recommended to be at least 10mm to achieve acceptable RF performance.

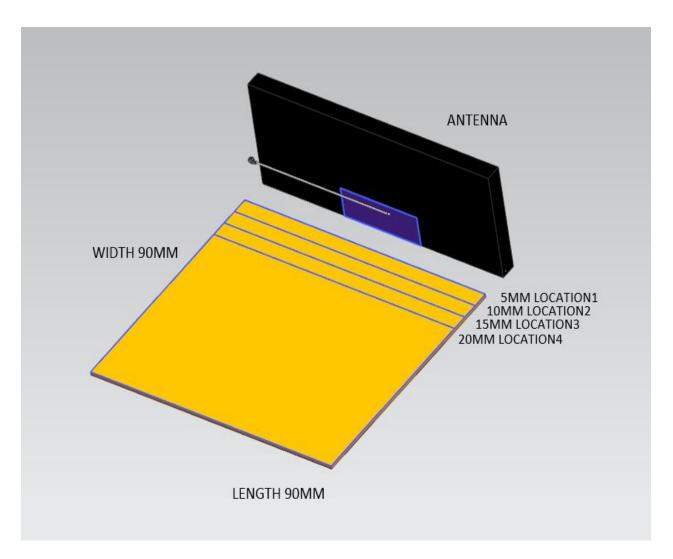


FIGURE 7.2.1 FOUR LOCATIONS WITH VERTICAL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:		SHEET No.			
С	EC No: 171309		2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE				
C	DATE: 2018/01/24	3	SOLDER CABLE				
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:		
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24		



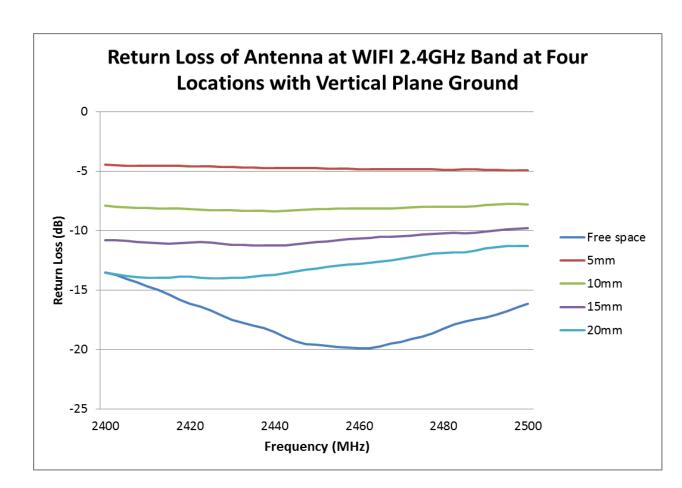


FIGURE 7.2.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		SHEET No.	
С	EC No: 171309			<b>24</b> of <b>32</b>	
C	DATE: 2018/01/24		24 01 <b>3</b> 2		
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24



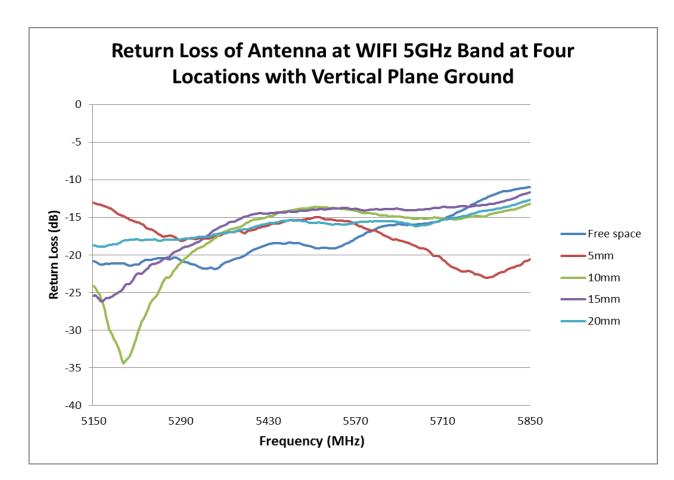


FIGURE 7.2.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:		SHEET No.			
С	EC No: <b>171309</b>		2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE				
C	DATE: 2018/01/24	3	SOLDER CABLE				
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:		
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong	2018/01/24		



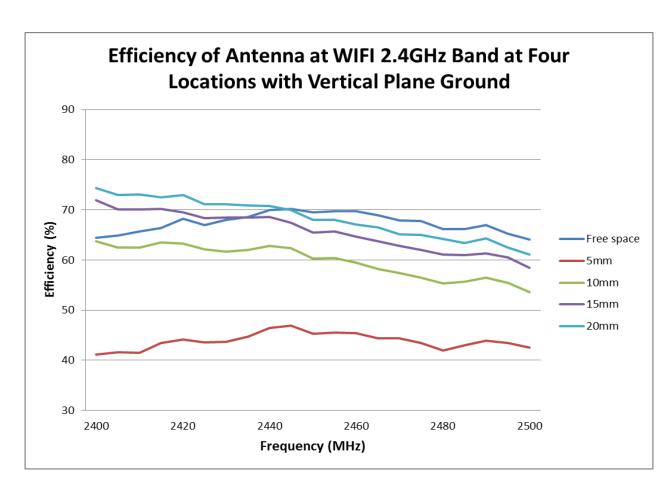


FIGURE 7.2.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.		
С	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		<b>26</b> of <b>32</b>	
C	DATE: 2018/01/24	3	OLDER CABLE		20 01 32
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	ED BY:
AS-2042810200		Benson Liu 2018/01/24 Kang Cheng 2018/01/24 Chris Zhon		2018/01/24	



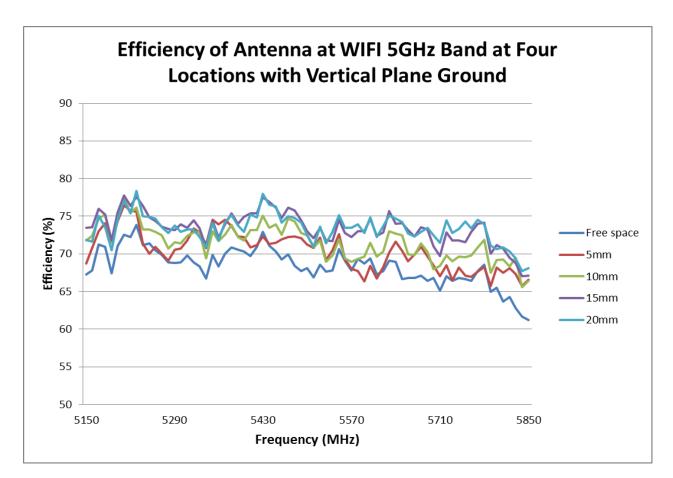


FIGURE 7.2.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:			SHEET No.
•	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE		27 -4 22	
С	DATE: 2018/01/24	3	OLDER CABLE		<b>27</b> of <b>32</b>
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	ED BY:
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24	



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

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations 5mm,10mm,15mm and 20mm from a parallel plane ground have been evaluated. These locations are shown in figure 7.3.1. The plane ground size is 90mm\*90mm. 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 at least 10mm to achieve acceptable RF performance.

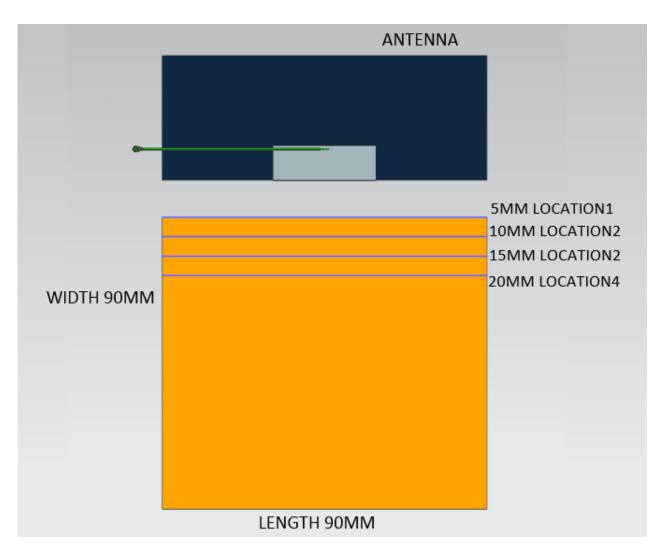


FIGURE 7.3.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	2.4/5G WIFI ANTENNA WITH SIDE		SHEET No.		
•	EC No: <b>171309</b>			<b>28</b> of <b>32</b>		
C	DATE: 2018/01/24	S	SOLDER CABLE			
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	APPRO\	/ED BY:	
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24		



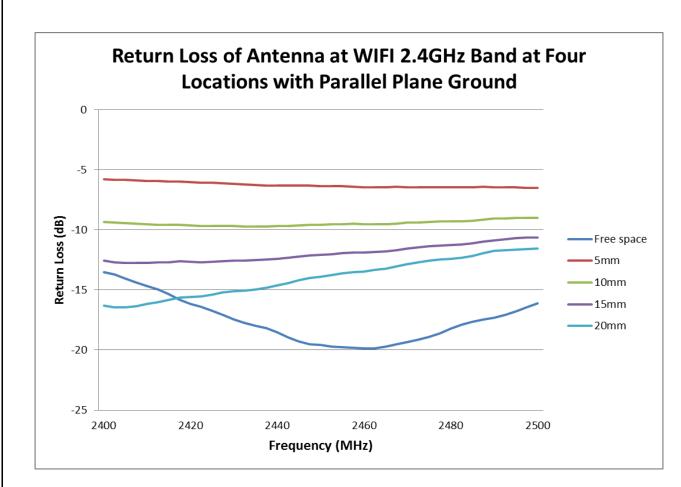


FIGURE 7.3.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION: EC No: 171309  DATE: 2018/01/24	2.4/5G WIFI ANTENNA WITH SIDE SOLDER CABLE		SIDE	29 of 32
	T NUMBER: -2042810200	CREATED / REVISED BY: Benson Liu 2018/01/24	CHECKED BY: Kang Cheng 2018/01/24	APPROV Chris Zhong	



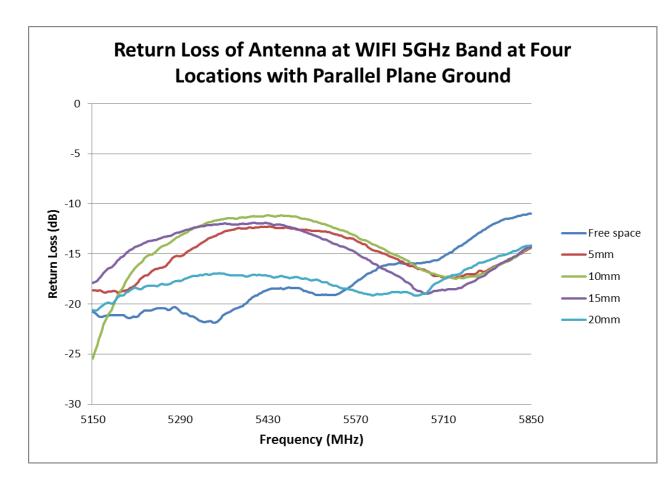


FIGURE 7.3.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:			SHEET No.
•	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE		20 (20	
C	DATE: 2018/01/24	S	OLDER CABLE		<b>30</b> of <b>32</b>
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	/ED BY:
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24	



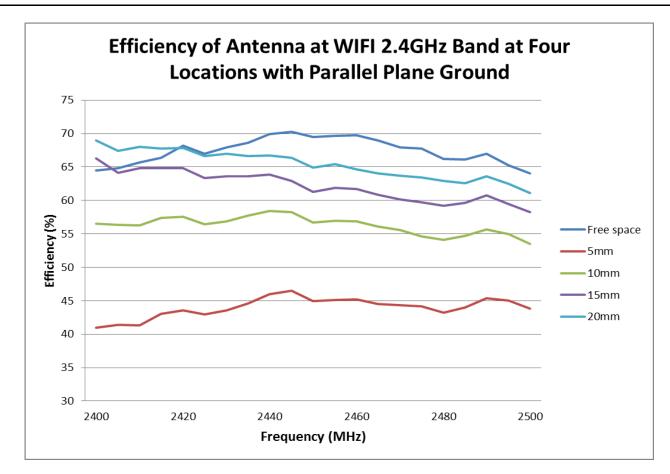


FIGURE 7.3.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:			SHEET No.
•	EC No: <b>171309</b>	2.4/5G WIFI ANTENNA WITH SIDE		24 (22	
C	DATE: 2018/01/24	S	OLDER CABLE		<b>31</b> of <b>32</b>
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	ED BY:
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24	



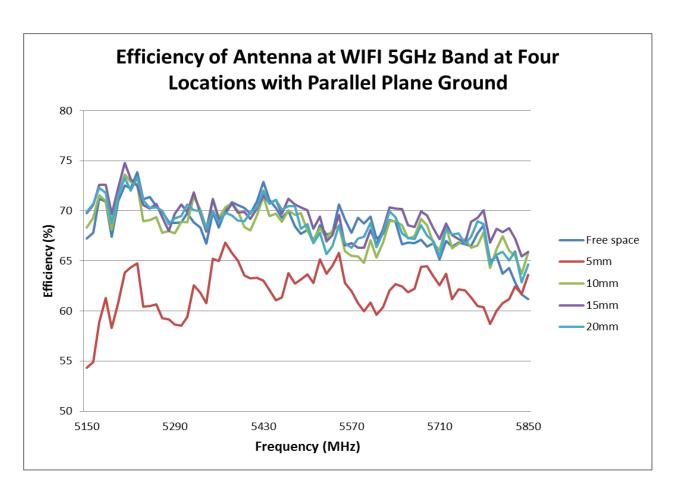


FIGURE 7.3.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

REVISION:	ECR/ECN INFORMATION:	TITLE:			SHEET No.
•	EC No: 171309	2.4/5G WIFI ANTENNA WITH SIDE		22 -4 22	
С	DATE: 2018/01/24	3	OLDER CABLE		<b>32</b> of <b>32</b>
DOCUMENT NUMBER:		CREATED / REVISED BY:	CHECKED BY:	<u>APPROV</u>	ED BY:
AS-2042810200		Benson Liu 2018/01/24	Kang Cheng 2018/01/24	Chris Zhong 2018/01/24	