

# ***APPROVAL SHEET***

**Customer Name:** Whirlpool

**Model Name:** 2167990001

**Frequency:** 2.4GHz

**Whirlpool P/N:** W11409842

**Customer Model:** Rigel

**Date:** \_\_\_\_\_

<b><i>LITE-ON</i></b>		
<i>Approved by</i>	<i>Checked By</i>	<i>Author</i>
<b><i>Customer Approved By</i></b>		
<i>Sign</i>		

**台灣莫仕股份有限公司**

***Molex Taiwan Ltd.***

**新北市淡水區下圭柔山100-3號**

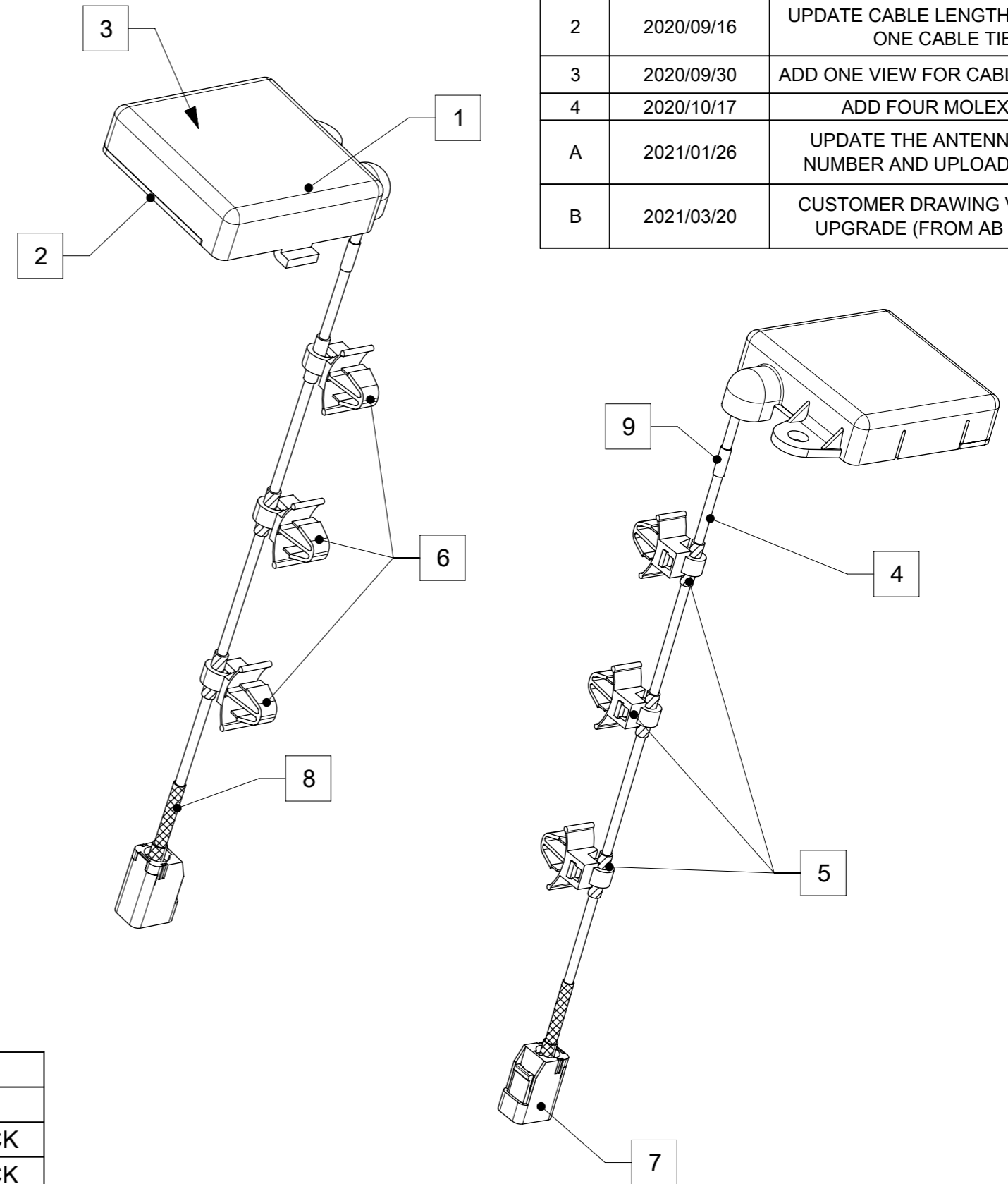
**No. 100-3, Xiaguirou Mt., Tamsui Dist., New Taipei City  
251004, Taiwan**

***TEL: 886-2-26202300***

NOTES:

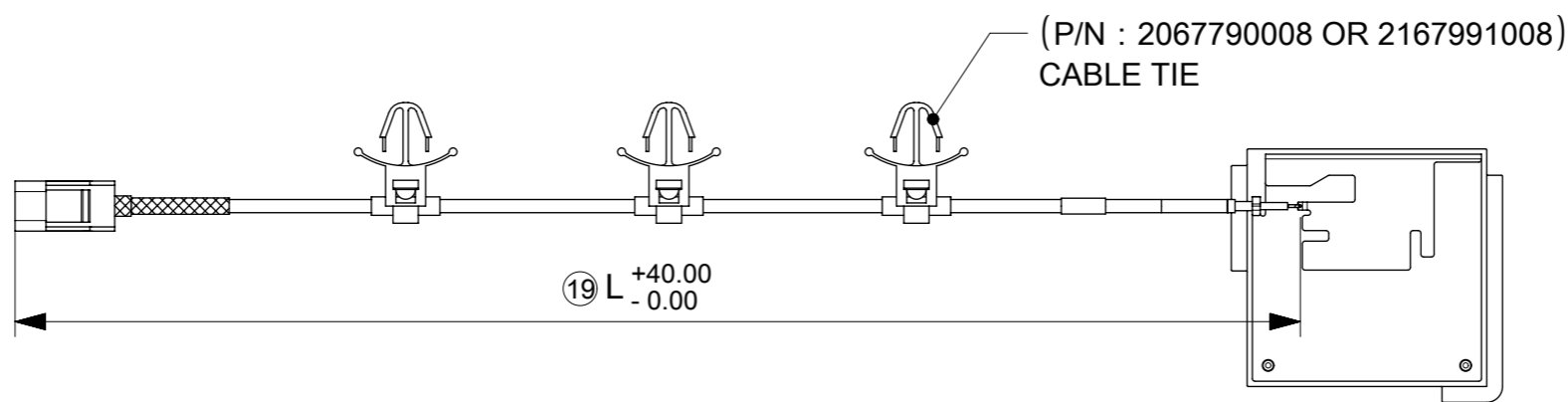
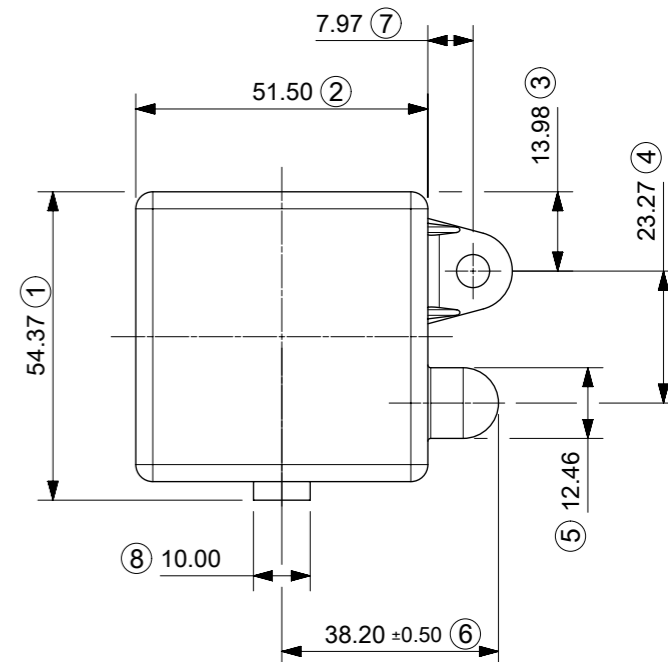
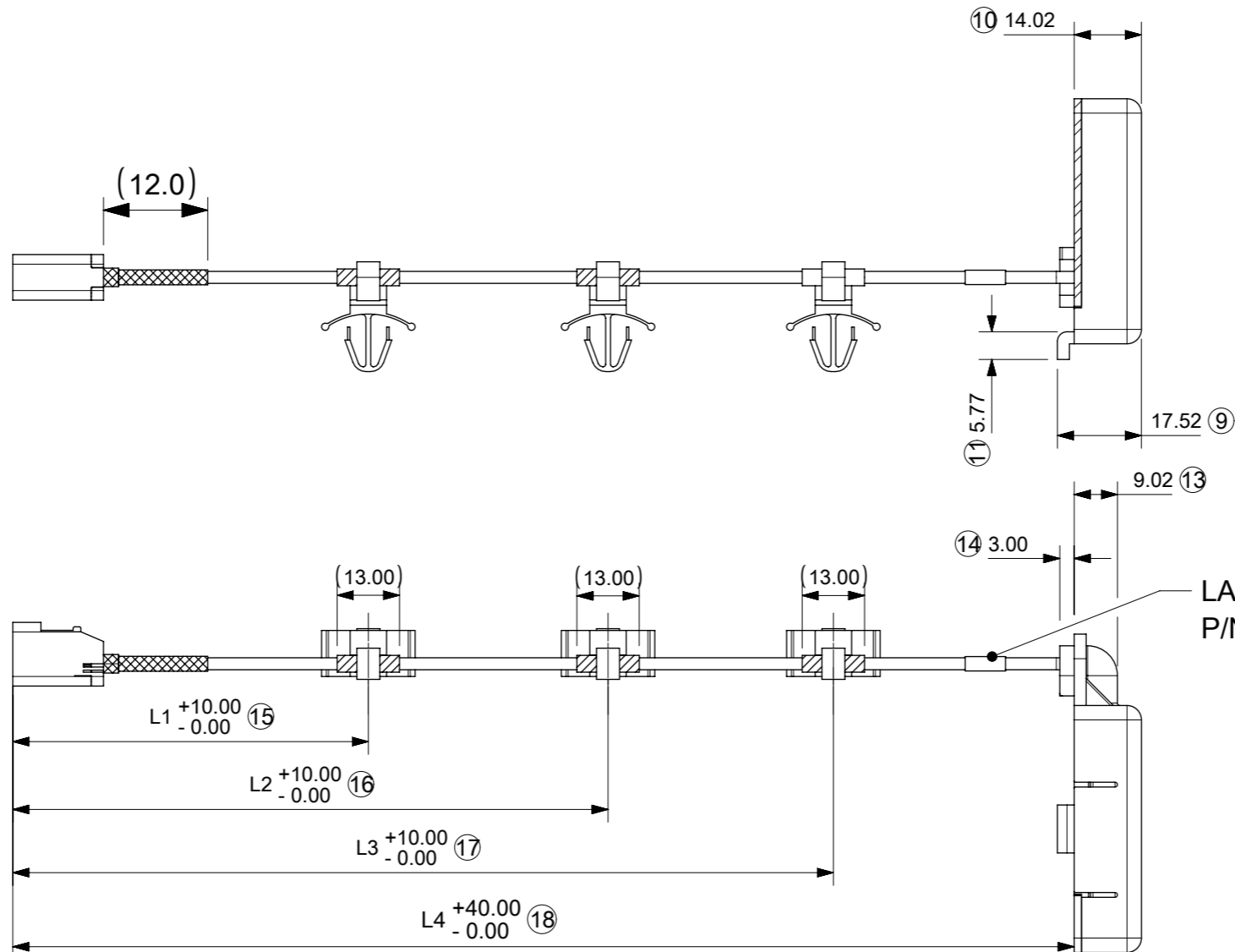
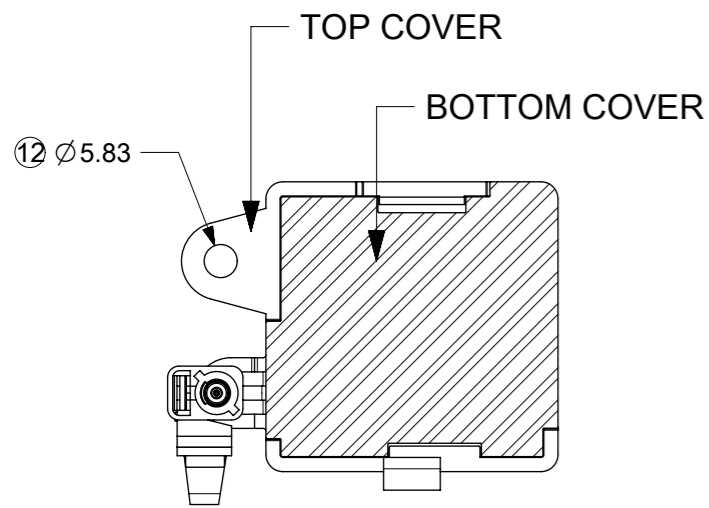
- 1.MATERIAL REFER TO BOM ;
- 2.NO ANY DAMAGE ALLOWED ON COSMETIC;
- 3.NO COLOUR DIFFERENCE AND NO TEXTURE DIFFERENCE ON COSMETIC;
- 4.REFER TO PRODUCT SPECIFICATION FOR RF PARAMETERS.(PS-2167990001)
- 5.PACKAGE REFERENCE TO DRAWING PK-2167990001.

REV	DATE	DESCRIPTION
1	2020/07/16	NEW RELEASE
2	2020/09/16	UPDATE CABLE LENGTH AND ADD ONE CABLE TIE
3	2020/09/30	ADD ONE VIEW FOR CABLE LENGTH
4	2020/10/17	ADD FOUR MOLEX P/N
A	2021/01/26	UPDATE THE ANTENNA PART NUMBER AND UPLOAD TO THE
B	2021/03/20	CUSTOMER DRAWING VERSION UPGRADE (FROM AB TO AC)



MATERIAL BOM			
ITEM	DESCRIPTION	Q'TY	REMARK
1	TOP COVER	1	PC (LEXAN 923) COLOR :BLACK
2	BOTTOM COVER	1	PC (LEXAN 923) COLOR :BLACK
3	INSIDE ANTENNA	1	METAL PLATE
4	CABLE	1	RG316 ( FEP )
5	TAPE	SEE DESCRIPTION	COLOR:WHITE
6	CABLE TIE - PUSH MOUNT	SEE DESCRIPTION	COLOR : NATURAL
7	CONNECTOR	1	FAKRA CODE C;COLOR:BLUE
8	HEAT SHRINK TUBE	1	COLOR:BLACK
9	LABEL	1	MOLEX MARK

FUNCTIONAL SYMBOLS	THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO MOLEX ELECTRONIC TECHNOLOGIES, LLC AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION	CURRENT REV DESC:		<b>molex</b>																										
	<table border="1"> <tr> <th>FUNCTIONAL SYMBOLS</th> <th>DIMENSION UNITS</th> <th>SCALE</th> </tr> <tr> <td><math>\nabla_A = 0</math></td> <td>mm</td> <td>1:1</td> </tr> <tr> <td><math>\nabla_E = 0</math></td> <td colspan="2">GENERAL TOLERANCES (UNLESS SPECIFIED)</td> </tr> <tr> <td><math>\nabla_V = 0</math></td> <td colspan="2">ANGULAR TOL <math>\pm 1.0^\circ</math></td> </tr> <tr> <td></td> <td>4 PLACES</td> <td><math>\pm 0.15</math></td> </tr> <tr> <td></td> <td>3 PLACES</td> <td><math>\pm 0.2</math></td> </tr> <tr> <td></td> <td>2 PLACES</td> <td><math>\pm 0.25</math></td> </tr> <tr> <td></td> <td>1 PLACE</td> <td><math>\pm 0.3</math></td> </tr> <tr> <td></td> <td>0 PLACES</td> <td><math>\pm 0.5</math></td> </tr> </table>	FUNCTIONAL SYMBOLS	DIMENSION UNITS		SCALE	$\nabla_A = 0$	mm	1:1	$\nabla_E = 0$	GENERAL TOLERANCES (UNLESS SPECIFIED)		$\nabla_V = 0$	ANGULAR TOL $\pm 1.0^\circ$			4 PLACES	$\pm 0.15$		3 PLACES	$\pm 0.2$		2 PLACES	$\pm 0.25$		1 PLACE	$\pm 0.3$		0 PLACES	$\pm 0.5$	EC NO: 660350 DRWN: KCHENG06 2021/04/21 CHK'D: HORACM1 2021/05/06 APPR: HORACM1 2021/05/06
FUNCTIONAL SYMBOLS	DIMENSION UNITS	SCALE																												
$\nabla_A = 0$	mm	1:1																												
$\nabla_E = 0$	GENERAL TOLERANCES (UNLESS SPECIFIED)																													
$\nabla_V = 0$	ANGULAR TOL $\pm 1.0^\circ$																													
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DIVISIONAL SYMBOLS	DRAFT WHERE APPLICABLE MUST REMAIN WITHIN DIMENSIONS THIRD ANGLE PROJECTION		INITIAL REVISION: DRWN: KCHENG06 2021/01/26 APPR: HORACM1 2021/02/26	PRODUCT CUSTOMER DRAWING																										
DOCUMENT NUMBER: 2167990001 DOC TYPE: PSD DOC PART: 000 REVISION: B		MATERIAL NUMBER: 216799 SERIES: 216799 CUSTOMER: CUSTOMER RELEASE		SHEET NUMBER: 1 OF 2																										



LABEL SEE MOLEX  
P/N:2167990006

DESCRIPTION											
MOLEX			CABLE TIE		CUSTOMER		CABLE LENGTH				
ITEM	DRAWING P/N	MOLEX P/N	MOLEX P/N	QTY	P/N	DRAWING REV.	L1	L2	L3	L4	L
1	2167990001	2167990001	2167991008	3	W11409842	AC	200	690	880	1159	1185
2	2167990001	2167990031	2167991008	1	W11516201	AC	460	-	-	1114	1140
3	2167990001	2167990041	2167990008	2	W11516200	AC	420	905	-	1134	1160

THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO MOLEX ELECTRONIC TECHNOLOGIES, LLC AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION

FUNCTIONAL SYMBOLS	THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO MOLEX ELECTRONIC TECHNOLOGIES, LLC AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION	SCALE	1:2	CURRENT REV DESC:	<b>molex</b>				
$\nabla_A = 0$	mm	GENERAL TOLERANCES (UNLESS SPECIFIED)				EC NO: 660350	MOLEX WIFI EXTERNAL ANTENNA		
$\nabla_E = 0$		ANGULAR TOL $\pm 1.0^\circ$				DRWN: KCHENG06			
$\nabla_P = 0$		4 PLACES $\pm 0.15$				2021/04/21			
DIVISIONAL SYMBOLS		3 PLACES $\pm 0.2$		CHK'D: HORACM1	2021/05/06				
		2 PLACES $\pm 0.25$		APPR: HORACM1	2021/05/06				
		1 PLACE $\pm 0.3$		INITIAL REVISION:					
		0 PLACES $\pm 0.5$		DRWN: KCHENG06	2021/01/26				
		DRAFT WHERE APPLICABLE MUST REMAIN WITHIN DIMENSIONS		APPR: HORACM1	2021/02/26				
	THIRD ANGLE PROJECTION	DRAWING	SERIES	MATERIAL NUMBER	CUSTOMER	DOCUMENT NUMBER	DOC TYPE	DOC PART	REVISION
		A3-SIZE	216799	2167990001	CUSTOMER RELEASE	2167990001	PSD	000	B
									SHEET NUMBER
									2 OF 2

## Whirlpool PIFA Antenna

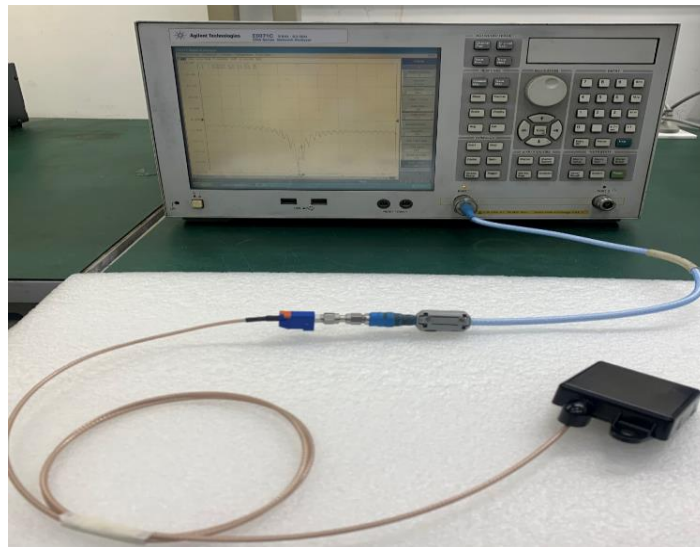
### 1. RF Specification:

Description	Equipment	Whirlpool Part Number		
		W11409842	W11516201	W11516200
Frequency Range(MHz)	VNA E5071C	2400-2500	2400-2500	2400-2500
VSWR	VNA E5071C	< 2	< 2	< 2
Peak Gain (dBi)	OTA Chamber ETS 8500	2.4	2.7	2.5
Average Total Efficiency (%)	OTA Chamber ETS 8500	>60	>60	>60
Input Impedance	VNA E5071C	50 ohms		

### 2. Test Equipment

#### 2.1 Vector Network Analyzer

A vector network analyzer Agilent E5071C (VNA) is used to test VSWR parameter.

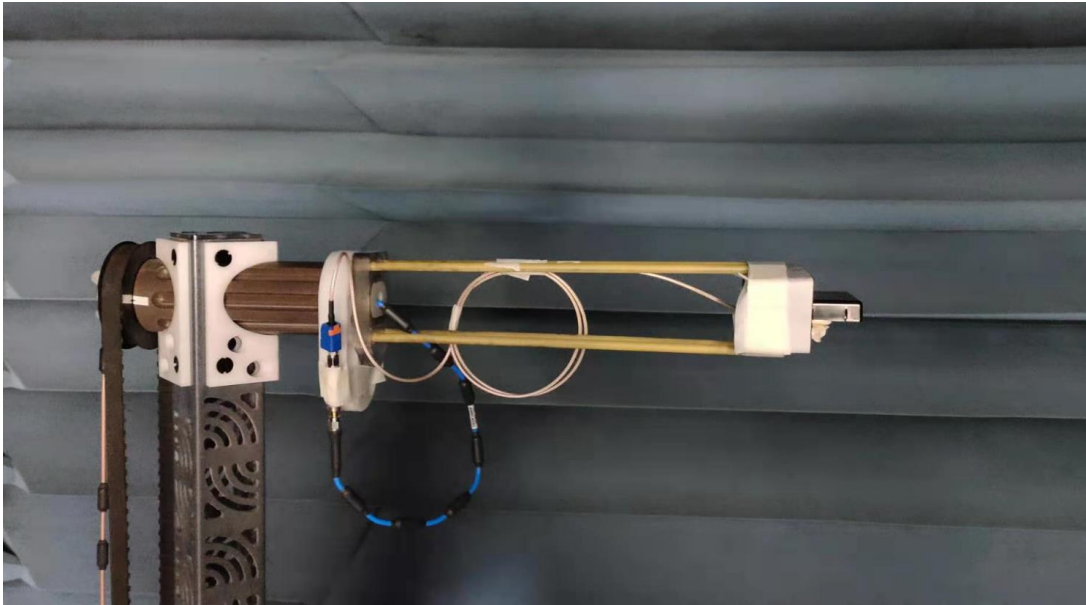


**Antenna under test**

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: 663219 DATE: 2021/1/29	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>1 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>

## 2.2 Anechoic Chamber

The ETS 8500 anechoic chamber is used to test the antenna gain, efficiency and radiation pattern.



Antenna under test

## 3. RF Measurement Results

### 3.1 Antenna Picture



Top View



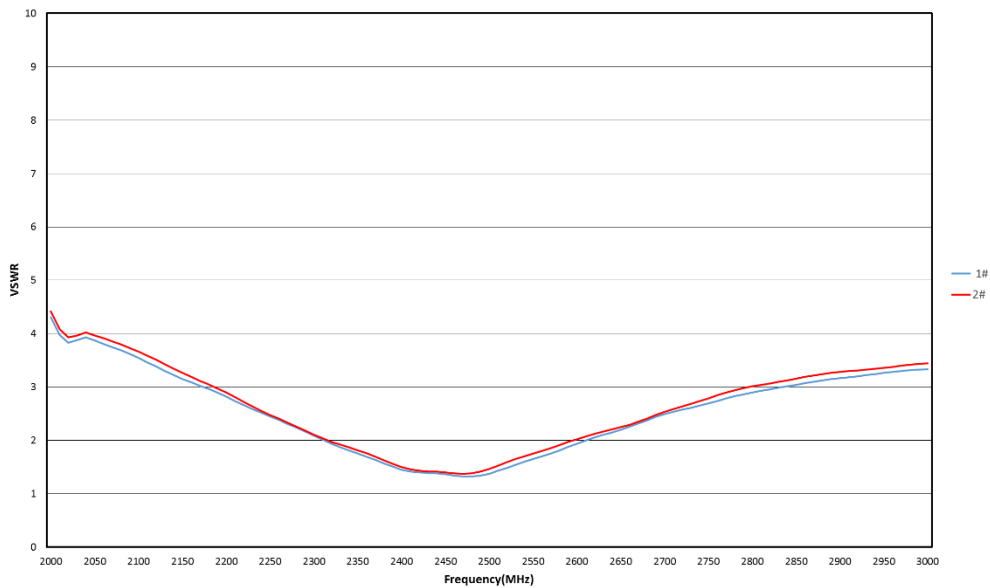
Bottom View

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: 663219 DATE: 2021/1/29	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>2 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>

## 3.2 VSWR Plots

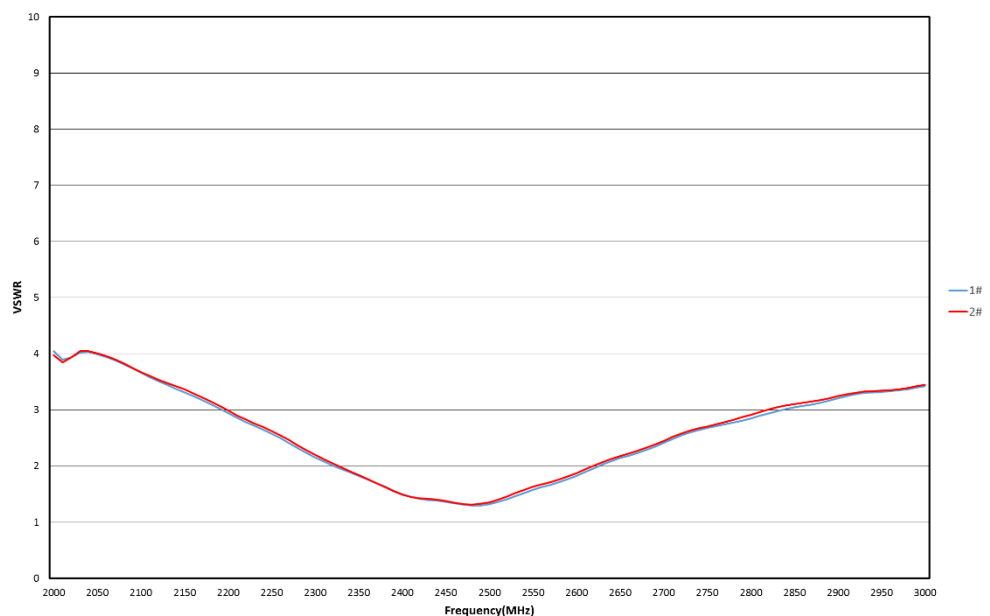
2pcs samples were measured for each part number.

VSWR of 2167990001 Antenna



VSWR of 2167990001 Antenna Measured in Free Space.

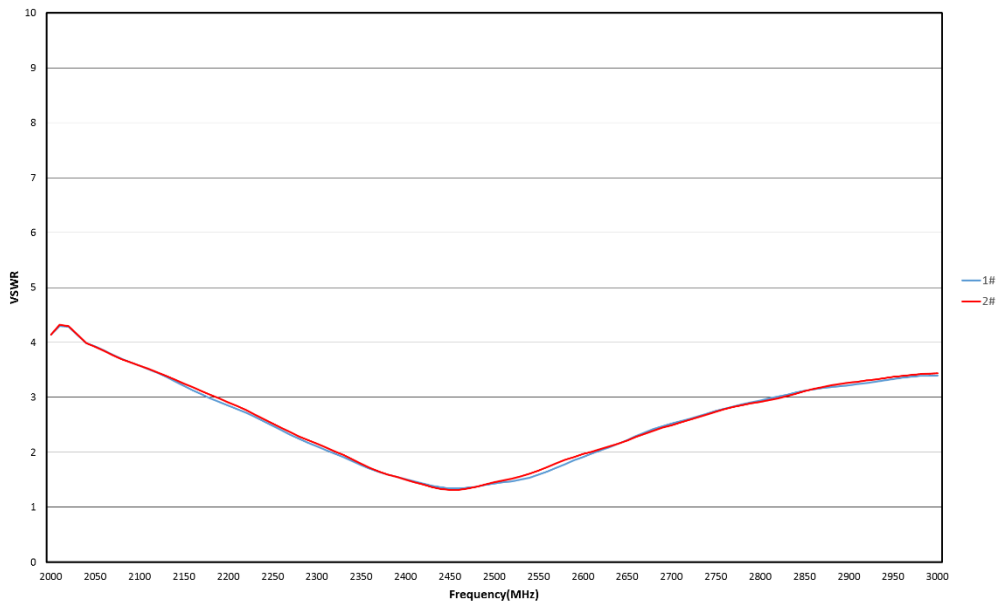
VSWR of 2167990031 Antenna



VSWR of 2167990031 Antenna Measured in Free Space.

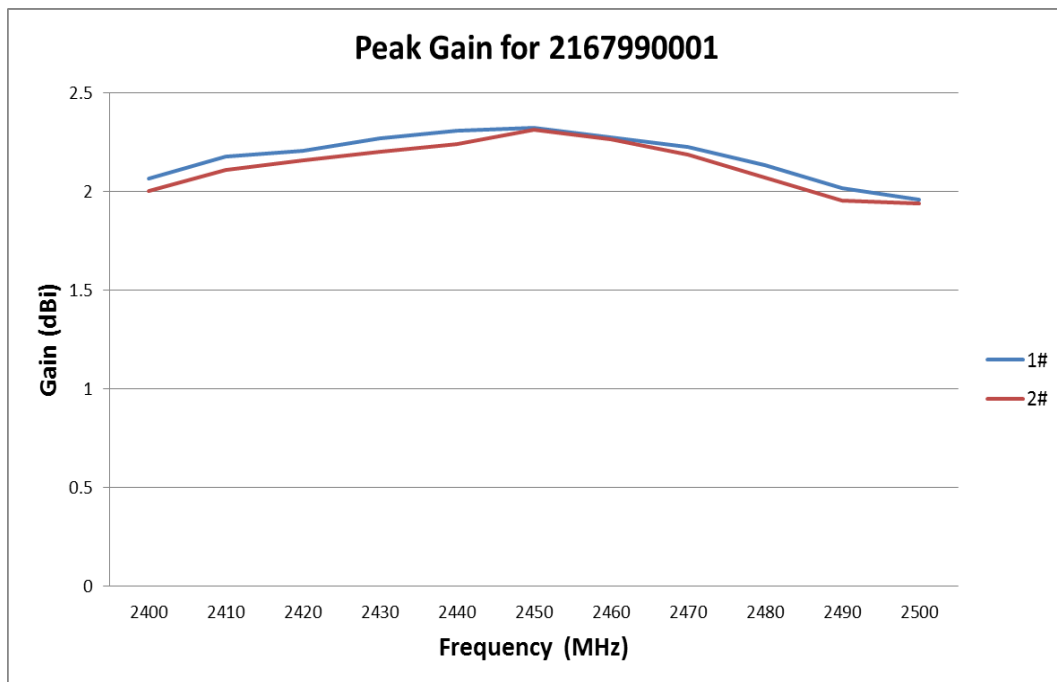
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DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>

VSWR of 2167990041 Antenna



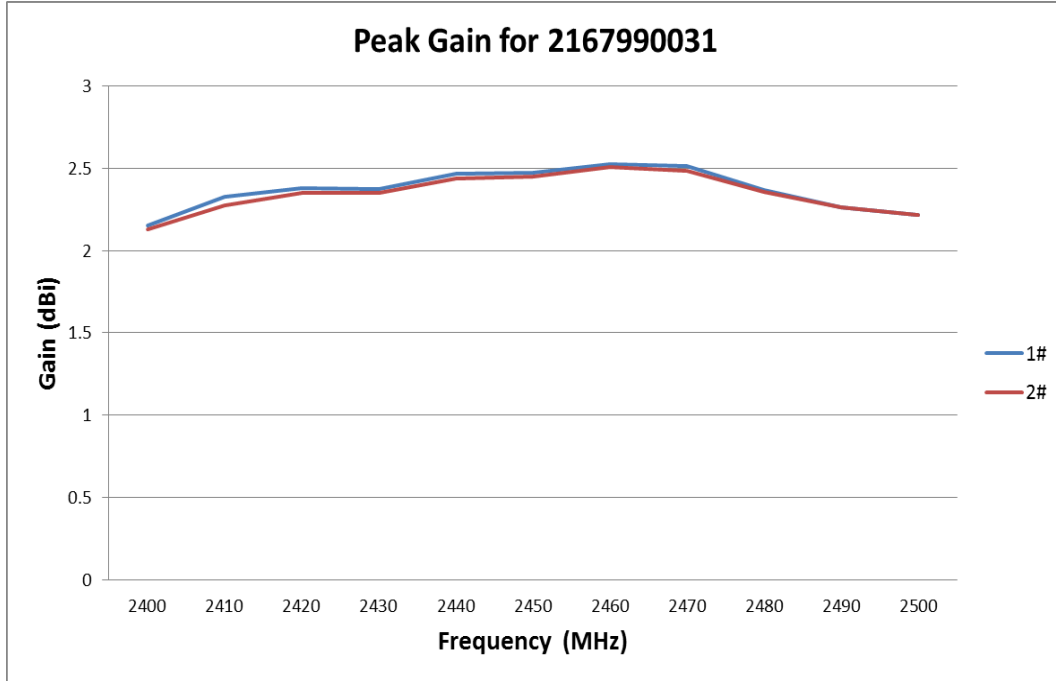
VSWR of 2167990041 Antenna Measured in Free Space.

### 3.3 Peak Gain

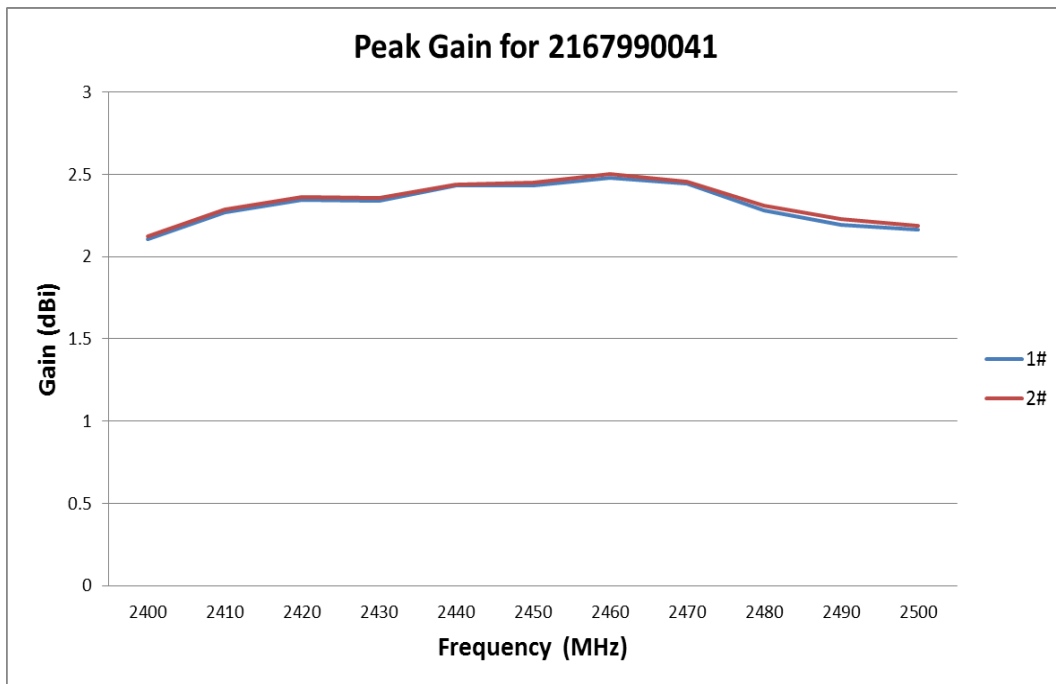


Peak Gain of 2167990001 Antenna Measured in Free Space.

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>663219</b> DATE: <b>2021/1/29</b>	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>4 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



**Peak Gain of 2167990031 Antenna Measured in Free Space.**

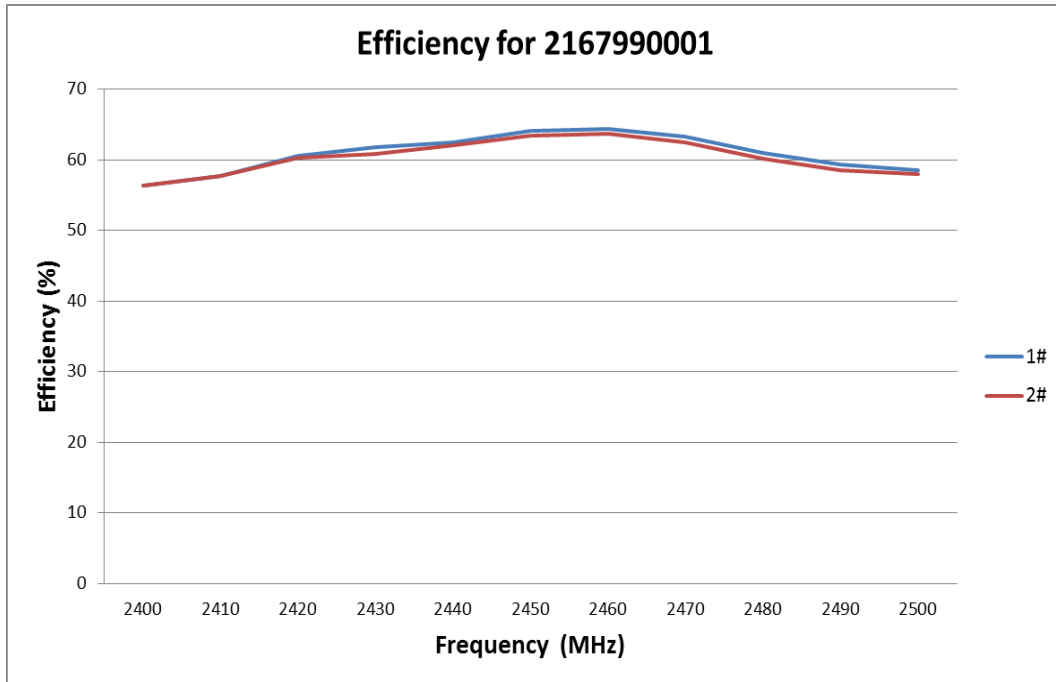


**Peak Gain of 2167990041 Antenna Measured in Free Space.**

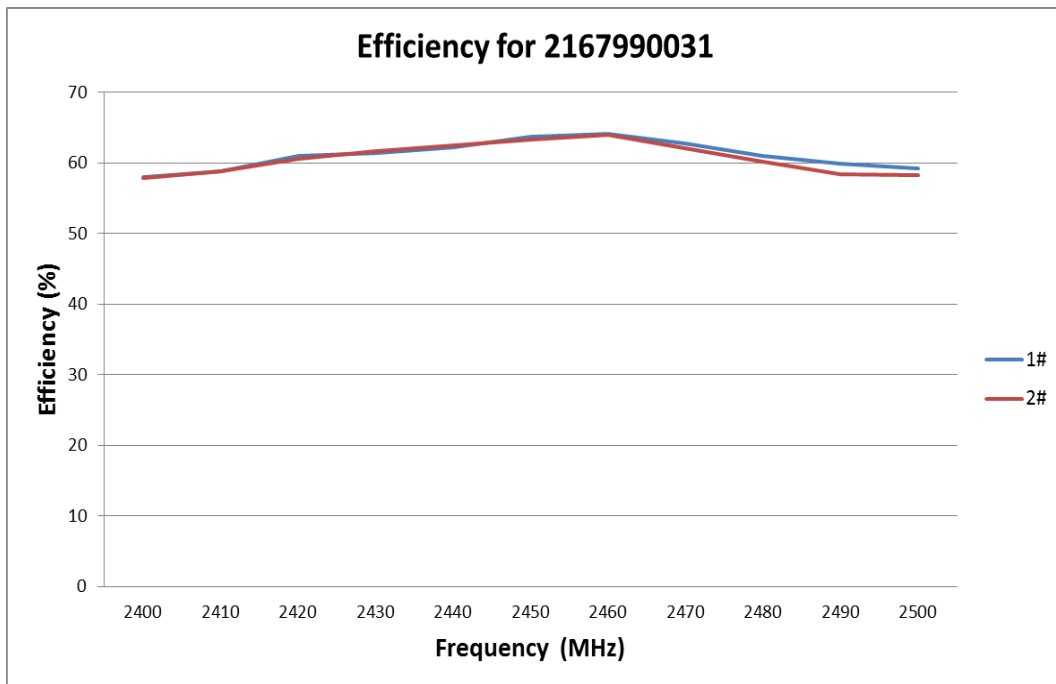
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DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



## 3.4 Efficiency



Efficiency of 2167990001 Antenna Measured in Free Space.

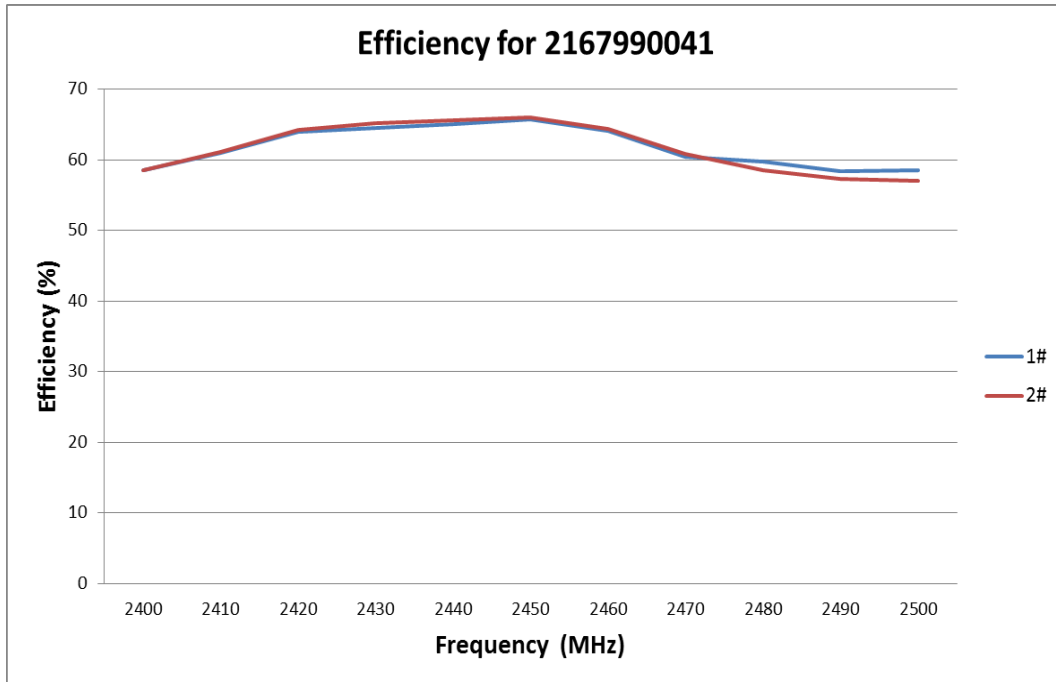


Efficiency of 2167990031 Antenna Measured in Free Space.

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>663219</b> DATE: <b>2021/1/29</b>	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>6 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



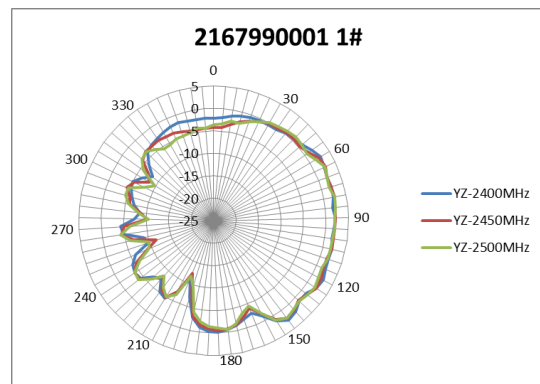
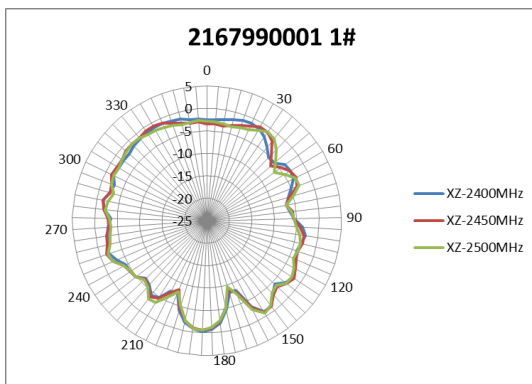
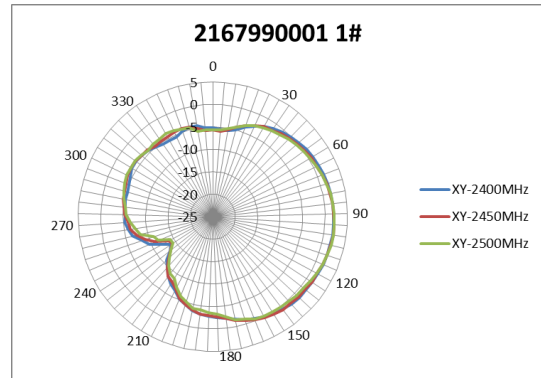
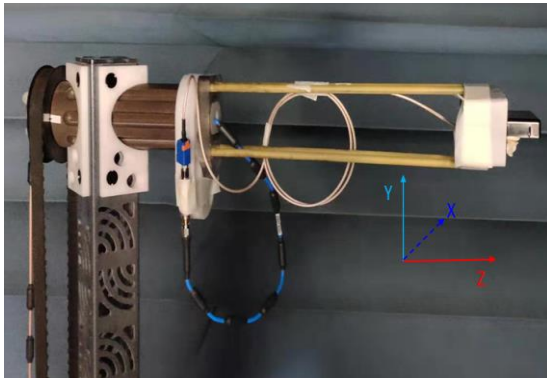
# DATASHEET



Efficiency of 2167990041 Antenna Measured in Free Space.

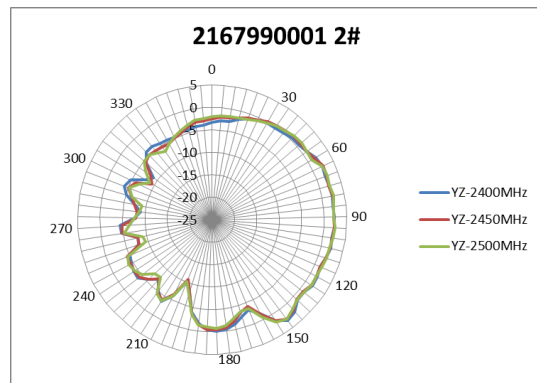
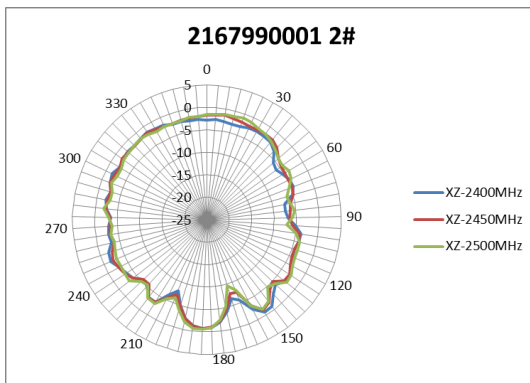
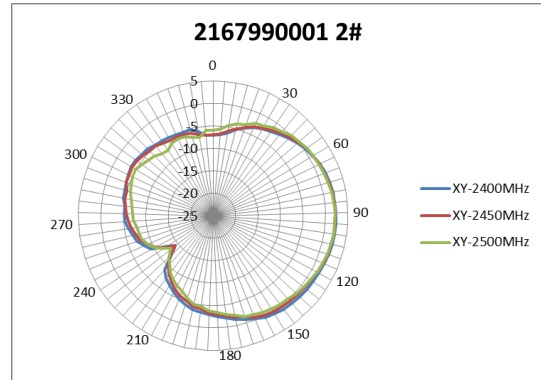
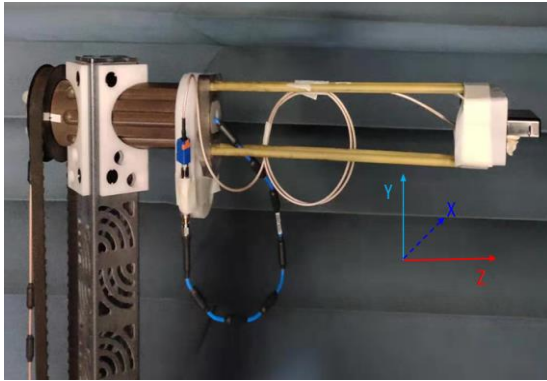
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DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>

## 3.5 2D Radiation Pattern



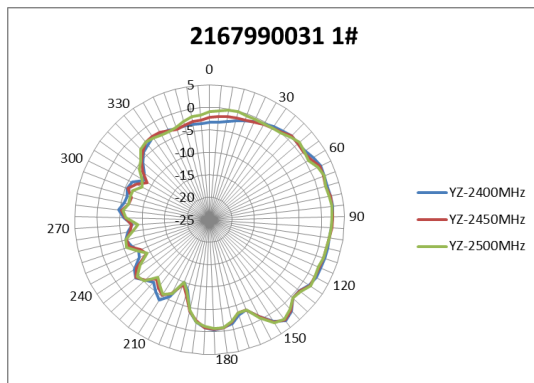
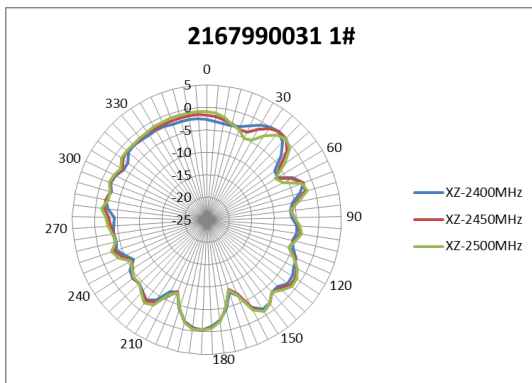
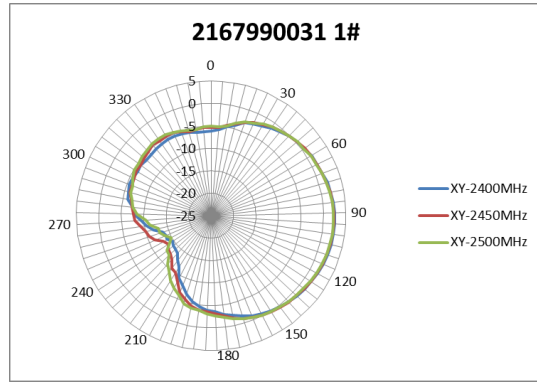
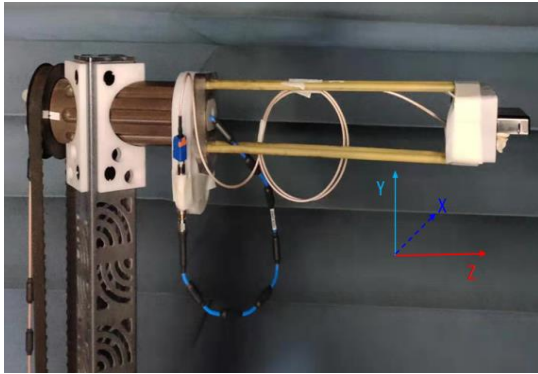
**2D Radiation Pattern of Antenna for 2167990001 sample 1#.**

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>663219</b> DATE: <b>2021/1/29</b>	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>8 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



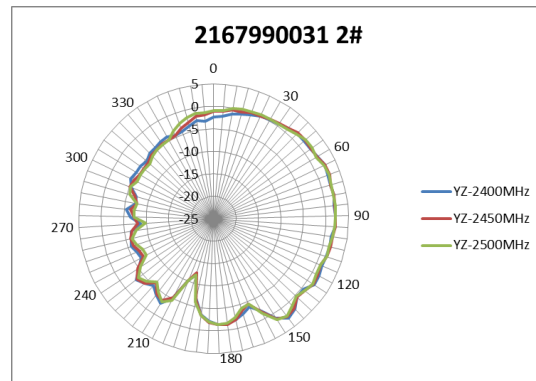
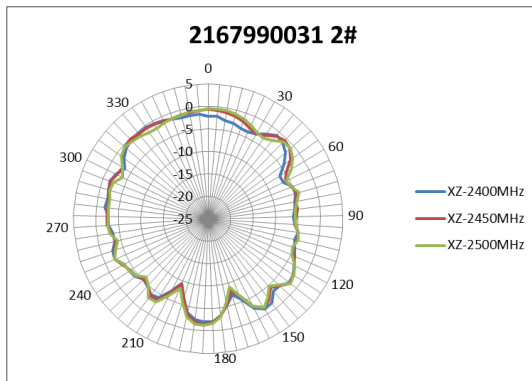
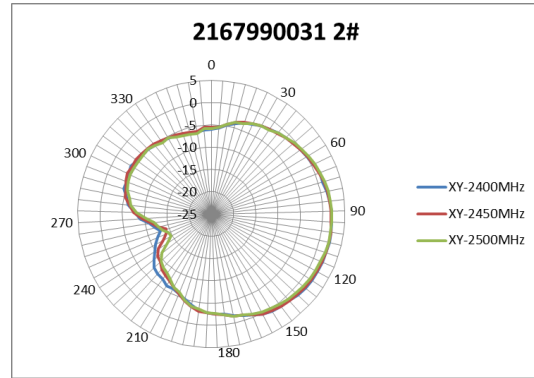
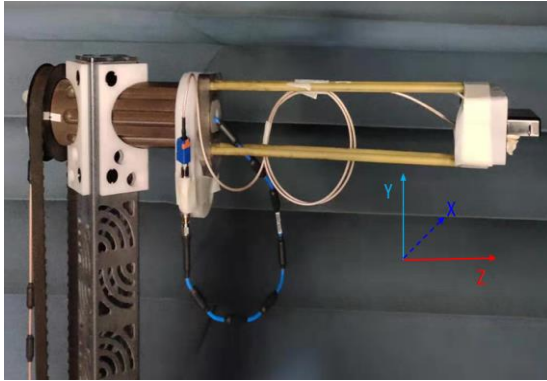
**2D Radiation Pattern of Antenna for 2167990001 sample 2#.**

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>663219</b> DATE: <b>2021/1/29</b>	TITLE: <b>Whirlpool PIFA Antenna Datasheet</b>	SHEET No. <b>9 of 13</b>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



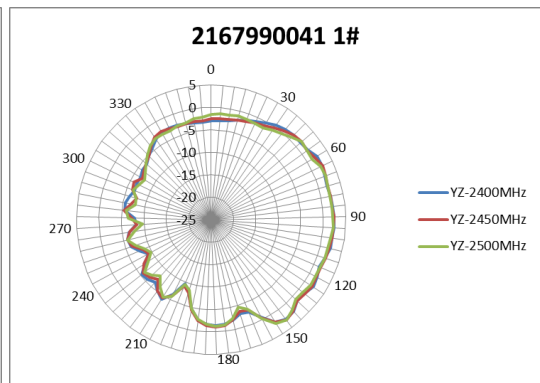
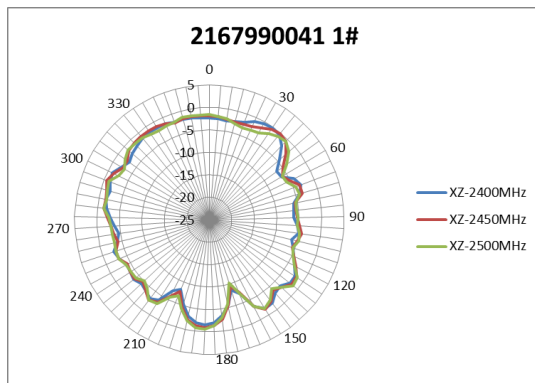
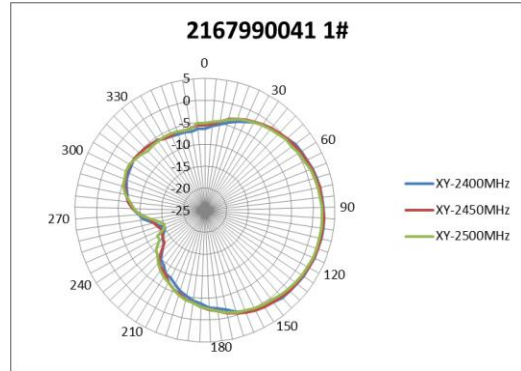
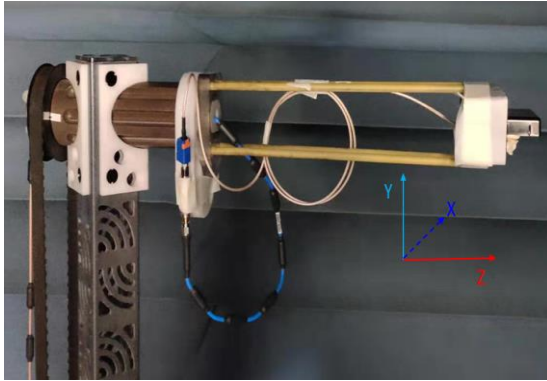
**2D Radiation Pattern of Antenna for 2167990031 sample 1#.**

<b>REVISION:</b> <b>A</b>	<b>ECR/ECN INFORMATION:</b> EC No: <b>663219</b> DATE: <b>2021/1/29</b>	<b>TITLE:</b> <b>Whirlpool PIFA Antenna Datasheet</b>	<b>SHEET No.</b> <b>10 of 13</b>
<b>DOCUMENT NUMBER:</b>		<b>CREATED / REVISED BY:</b> <b>Stern Zhao</b>	<b>CHECKED BY:</b> <b>Chris Zhong</b>
		<b>APPROVED BY:</b> <b>Luo Ning</b>	



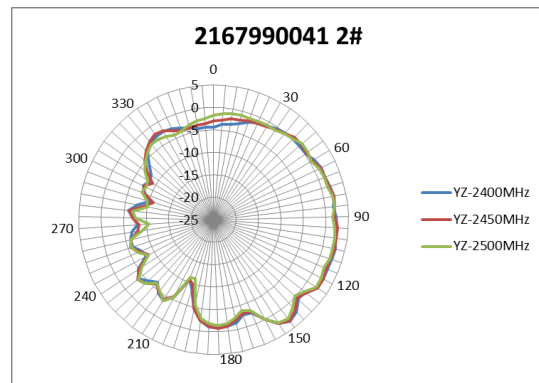
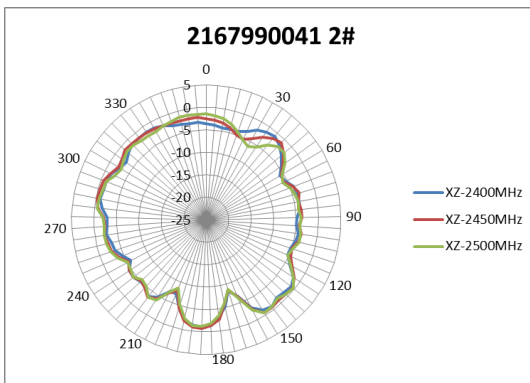
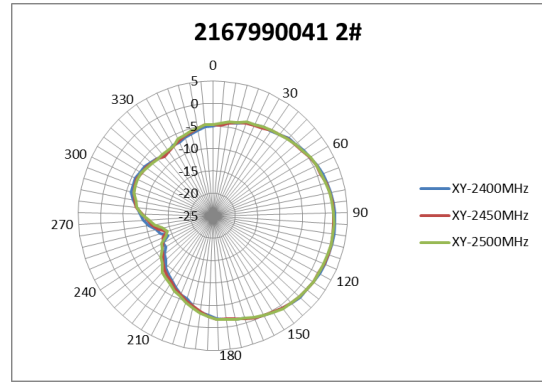
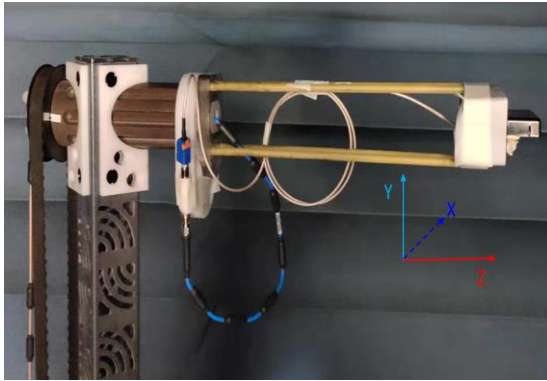
**2D Radiation Pattern of Antenna for 2167990031 sample 2#.**

<b>REVISION:</b> <b>A</b>	<b>ECR/ECN INFORMATION:</b> EC No: <b>663219</b> DATE: <b>2021/1/29</b>	<b>TITLE:</b> <b>Whirlpool PIFA Antenna Datasheet</b>	<b>SHEET No.</b> <b>11 of 13</b>
<b>DOCUMENT NUMBER:</b>		<b>CREATED / REVISED BY:</b> <b>Stern Zhao</b>	<b>CHECKED BY:</b> <b>Chris Zhong</b>
		<b>APPROVED BY:</b> <b>Luo Ning</b>	



**2D Radiation Pattern of Antenna for 2167990041 sample 1#.**

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>663219</b> DATE: <b>2021/1/29</b>	TITLE: <h2 style="text-align: center;">Whirlpool PIFA Antenna Datasheet</h2>	SHEET No. <h2 style="text-align: center;">12 of 13</h2>
DOCUMENT NUMBER:	CREATED / REVISED BY: <b>Stern Zhao</b>	CHECKED BY: <b>Chris Zhong</b>	APPROVED BY: <b>Luo Ning</b>



**2D Radiation Pattern of Antenna for 2167990041 sample 2#.**

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# PRODUCT SPECIFICATION

Brand Name	Model Name	Whirlppl Part Number	Ant. Type	Connector	Support	Max Peak Gain	Does the antenna gain include cable loss?
MOLEX	2167990001	W11409842	PIFA	Fakra	2.4G+BT	2.4dBi	Gain include Cable Loss