

# Antenna Datasheet

**Product OC (Antenna Only):** YMCP002AA

**Product OC (Antenna + Rectangular EVB):** YMCP002AAEVB

**Version:** 1.1

**Date:** 2023-04-10

**Status:** Released

**Product Name:** 4G Metal Shrapnel Antenna

**Key Features:**

High efficiency, excellent performance

Frequency band: 600–960 MHz, 1710–2690 MHz

efficiency: Up to 82%

Dimensions: 40 × 7.23 × 7.6 mm

# Overview

This wideband LTE/cellular/CDMA SMT metal shrapnel antenna is suitable for 4G/3G/2G applications. Operating at 600–960MHz, 1710–2690MHz, it's a high-efficiency antenna which is mounted to the device host PCB using conventional metal shrapnel antenna reflow process. Ideal for all 4G/LTE applications, it also supports worldwide Cat M and NB-IoT frequency bands. Supplied on tape and reel for high-volume applications, it is compatible with all Quectel's 4G/3G/2G including LPWA modules. We provide comprehensive antenna design support such as simulation, testing and manufacturing for custom antenna solutions to meet your specific application needs.

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# 1 Specification

Test Condition: Assembled On EVB

## 1.1. Electrical

Electrical	
Frequency Range	600–960 MHz, 1710–2690 MHz
Impedance	50 Ω
Polarization	Linear
Radiation Pattern	Omni-directional

Electrical - Detail									
SPEC	Band	Band	B71	B12 /B13 /B28	B5 /B8 /B26	B1 /B2 /B3	B40	WIFI 2G	B38 /B41
	Freq. (MHz)		600– 700	700– 810	810– 960	1700– 2170	2300– 2400	2400– 2500	2500– 2690
Max VSWR	On 135 × 43 mm GND		2.5	1.9	1.8	2.5	1.9	1.5	1.8
	On 120 × 43 mm GND		3.1	2.3	2.2	2.6	1.5	1.3	1.8
	On 110 × 43 mm GND		3.4	2.8	2.5	2.9	1.3	1.2	1.8
	On 85 × 43 mm GND		4.0	4.2	3.6	3.1	1.9	1.5	1.9
	On 65 × 43 mm GND		4.2	4.5	3.7	2.6	1.7	1.5	1.9
	On 45 × 43 mm GND		4.0	4.3	3.1	2.8	1.2	1.3	1.7
Max Return Loss (dB)	On 135 × 43 mm GND		-7.3	-10.3	-10.6	-7.3	-10.4	-14.1	-10.9
	On 120 × 43 mm GND		-5.8	-8.2	-8.4	-7.1	-14.3	-17.4	-11.2
	On 110 × 43 mm GND		-5.3	-6.5	-7.2	-6.3	-17.7	-19.9	-10.9
	On 85 × 43 mm GND		-4.5	-4.3	-4.9	-5.9	-9.9	-13.6	-9.9

	On 65 × 43 mm GND	-4.3	-3.9	-4.8	-7.1	-11.5	-14.4	-10.4
	On 45 × 43 mm GND	-4.4	-4.1	-5.7	-6.5	-19.4	-18.1	-11.6
AVG Eff. (%)	On 135 × 43 mm GND	49.3	61.4	57.8	67.5	70.8	67.9	59.8
	On 120 × 43 mm GND	43.0	60.6	56.0	64.3	74.8	71.3	61.3
	On 110 × 43 mm GND	37.1	56.2	54.8	61.3	78.0	73.6	62.3
	On 85 × 43 mm GND	22.4	38.7	46.2	60.1	72.5	68.1	58.3
	On 65 × 43 mm GND	16.6	27.5	33.1	67.6	71.6	69.2	60.9
	On 45 × 43 mm GND	14.2	22.6	25.6	66.6	77.9	72.5	63.3
AVG Gain (dB)	On 135 × 43 mm GND	-3.1	-2.1	-2.4	-1.7	-1.5	-1.7	-2.2
	On 120 × 43 mm GND	-3.7	-2.2	-2.5	-2.0	-1.3	-1.5	-2.1
	On 110 × 43 mm GND	-4.4	-2.5	-2.6	-2.2	-1.1	-1.3	-2.1
	On 85 × 43 mm GND	-6.6	-4.1	-3.4	-2.3	-1.4	-1.7	-2.4
	On 65 × 43 mm GND	-7.9	-5.6	-4.8	-1.7	-1.5	-1.6	-2.2
	On 45 × 43 mm GND	-8.6	-6.5	-5.9	-1.8	-1.1	-1.4	-2.0
Max Peak Gain (dBi)	On 135 × 43 mm GND	0.4	0.7	0.7	3.7	3.9	3.6	2.9
	On 120 × 43 mm GND	0.2	0.6	0.8	3.2	3.6	3.3	3.1
	On 110 × 43 mm GND	-0.3	0.7	0.7	3.0	3.3	3.1	2.9
	On 85 × 43 mm GND	-2.1	-0.8	0.2	2.6	2.6	2.5	2.6
	On 65 × 43 mm GND	-3.6	-2.5	-1.6	2.6	2.6	2.4	2.5
	On 45 × 43 mm GND	-4.1	-3.2	-2.6	2.1	2.3	1.9	2.9
VSWR	On 135 × 43 mm GND	≤ 2.5						
	On 120 × 43 mm GND	≤ 3.1						
	On 110 × 43 mm GND	≤ 3.4						
	On 85 × 43 mm GND	≤ 4.2						
	On 65 × 43 mm GND	≤ 4.5						
	On 45 × 43 mm GND	≤ 4.3						
Return Loss	On 135 × 43 mm GND	≤ -7.3 dB						
	On 120 × 43 mm GND	≤ -5.8 dB						
	On 110 × 43 mm GND	≤ -5.3 dB						

Peak Gain	On 85 × 43 mm GND	≤ -4.3 dB
	On 65 × 43 mm GND	≤ -3.9 dB
	On 45 × 43 mm GND	≤ -4.1 dB
	On 135 × 43 mm GND	≤ 3.9 dBi
	On 120 × 43 mm GND	≤ 3.6 dBi
	On 110 × 43 mm GND	≤ 3.3 dBi
	On 85 × 43 mm GND	≤ 2.6 dBi
	On 65 × 43 mm GND	≤ 2.6 dBi
	On 45 × 43 mm GND	≤ 2.9 dBi

## 1.2. Supported Bands

5G NR / LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / GPRS / GSM / NB-IoT				
Band	Frequency (MHz)	Uplink (MHz)	Downlink (MHz)	Covered
1	2100	1920–1980	2110–2170	√
2	1900	1850–1910	1930–1990	√
3	1800	1710–1785	1805–1880	√
4	1700	1710–1755	2110–2155	√
5	850	824–849	869–894	√
7	2600	2500–2570	2620–2690	√
8	900	880–915	925–960	√
9	1800	1749.9–1784.9	1844.9–1879.9	√
11	1500	1427.9–1447.9	1475.9–1495.9	-
12	700	699–716	729–746	√
13	700	777–787	746–756	√
14	700	788–798	758–768	√
17	700	704–716	734–746	√

18	850	815–830	860–875	√
19	850	830–845	875–890	√
20	800	832–862	791–821	√
21	1500	1447.9–1462.9	1495.9–1510.9	-
22	3500	3410–3490	3510–3590	-
23	2100	2000–2020	2180–2200	√
24	1600	1626.5–1660.5	1525–1559	-
25	1900	1850–1915	1930–1995	√
26	850	814–849	859–894	√
28	700	703–748	758–803	√
31	450	452.5–457.5	462.5–467.5	-
34	2100	2010–2025		√
38	2600	2570–2620		√
39	1900	1880–1920		√
40	2300	2300–2400		√
41	2500	2496–2690		√
42	3500	3400–3600		-
48	3500	3550–3700		-
66	1700	1710–1780	2110–2200	√
71	600	663–698	617–652	√
74	1500	1427–1470	1475–1518	-
77	3500	3300–4200		-
78	3500	3300–3800		-
79	4500	4400–5000		-

**Note:**

- Covered √ means efficiency > 20%.
- Based on 120 × 43 mm GND.

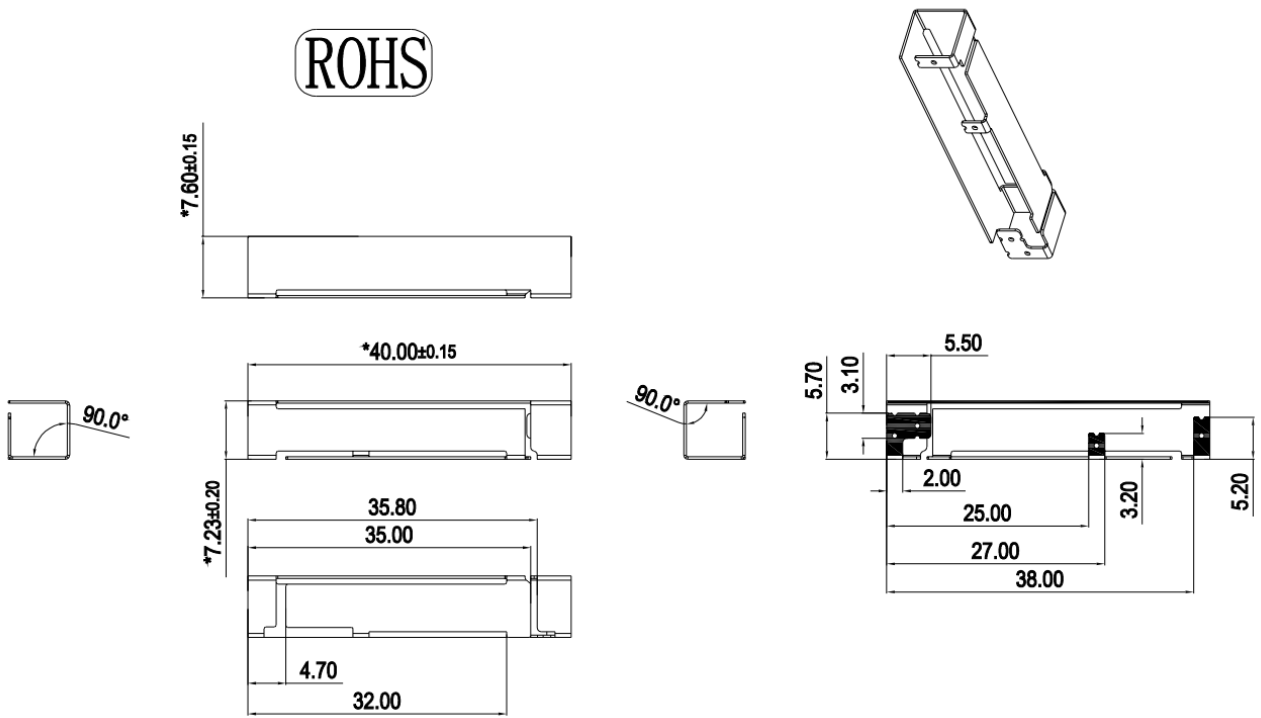
### 1.3. Mechanical & Environmental

Mechanical	
Antenna Size	40 × 7.23 × 7.6 mm
Material & Color	C7701 & Silver
Antenna Weight	Typ. 1.9 g
Mounting Type	SMD
Environmental	
Operation Temperature	-40 °C to +85 °C
RoHS & REACH Compliant	Yes
Storage	
Storage Temperature	18 °C to 27 °C
Humidity	30–80 % RH
Storage Place	Away from corrosive gas and direct sunlight
Packing	Antennas should be stored in unopened sealed manufacturer's plastic packaging



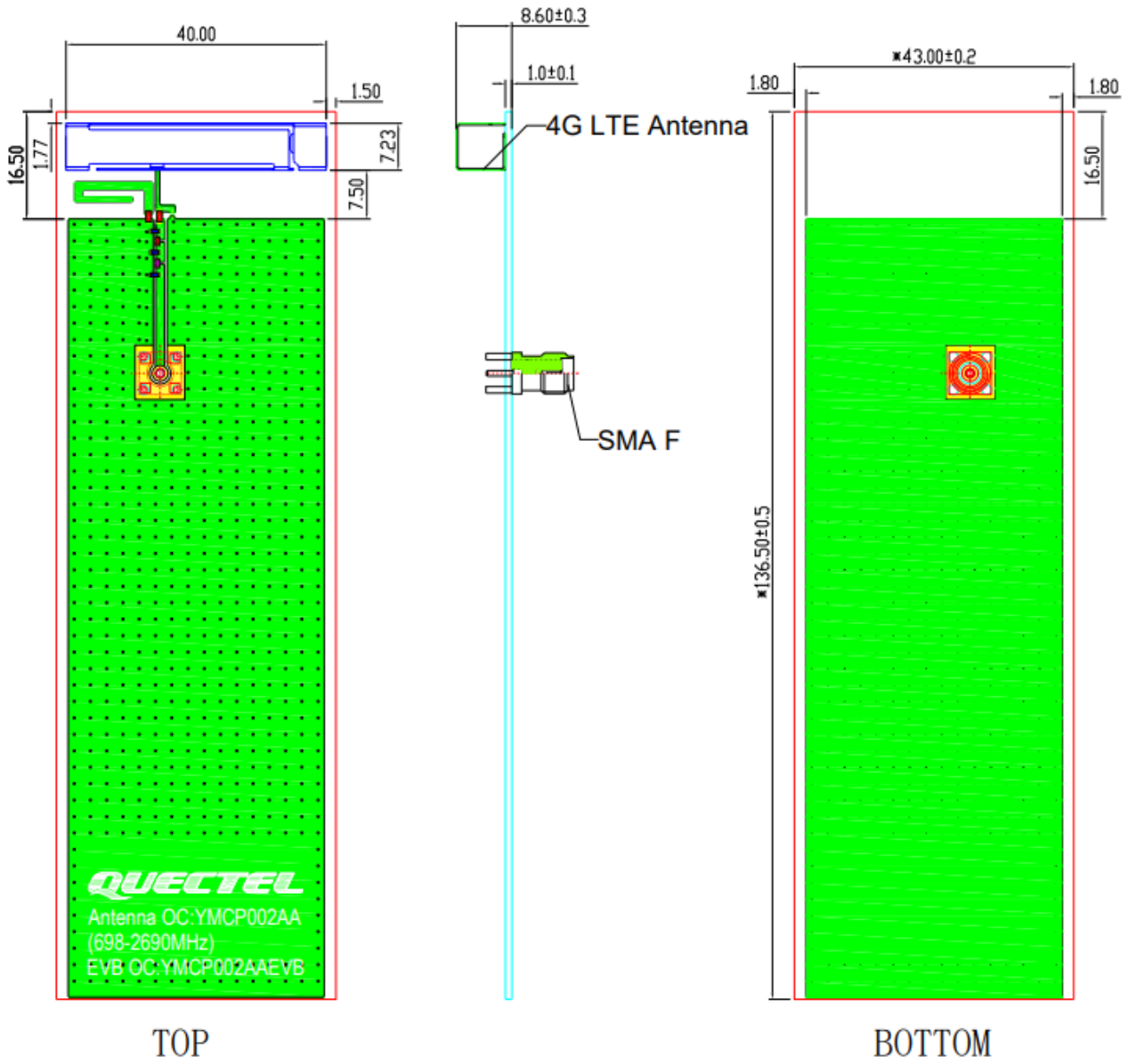
# 2 Drawing

## 2.1. Antenna



All dimensions are in mm

2.2. EVB

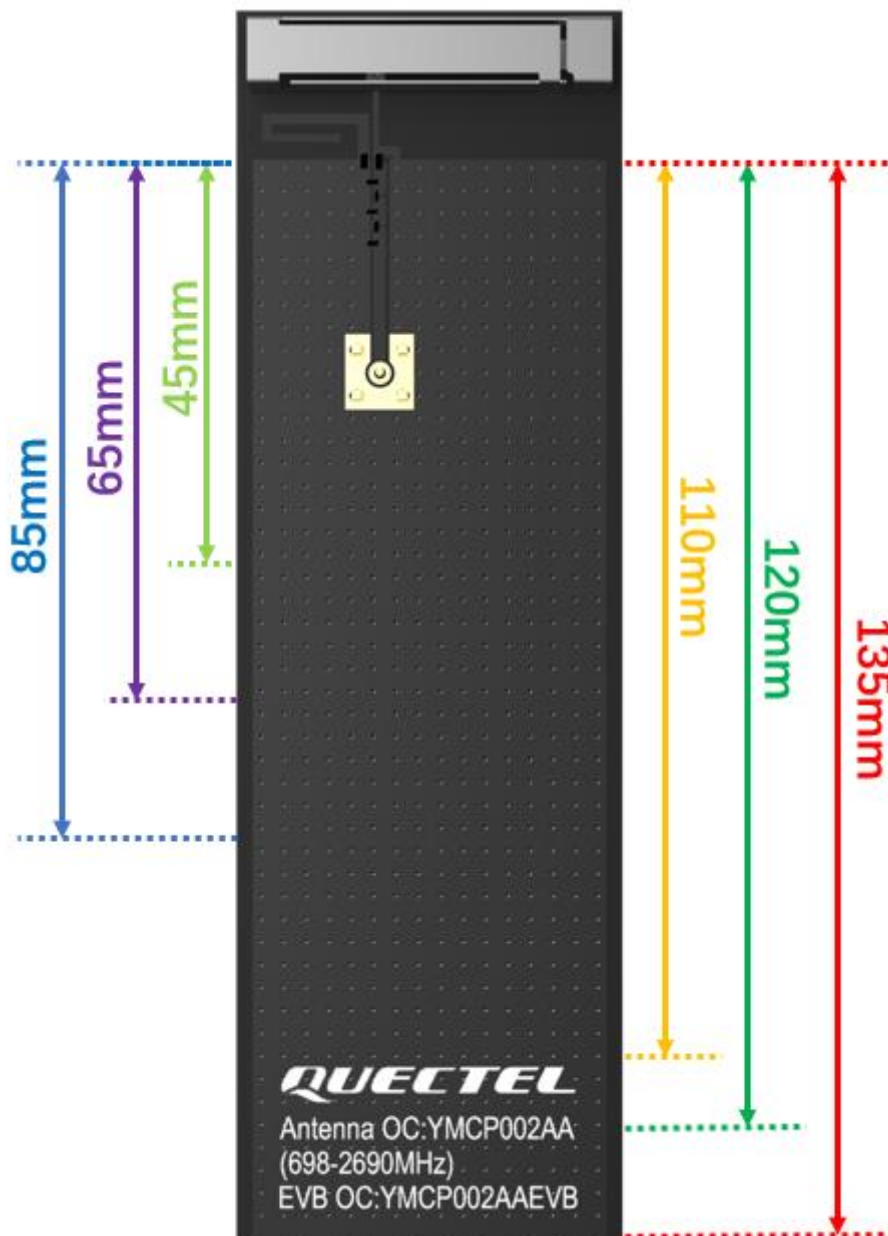


All dimensions are in mm

# 3 Detailed Performance

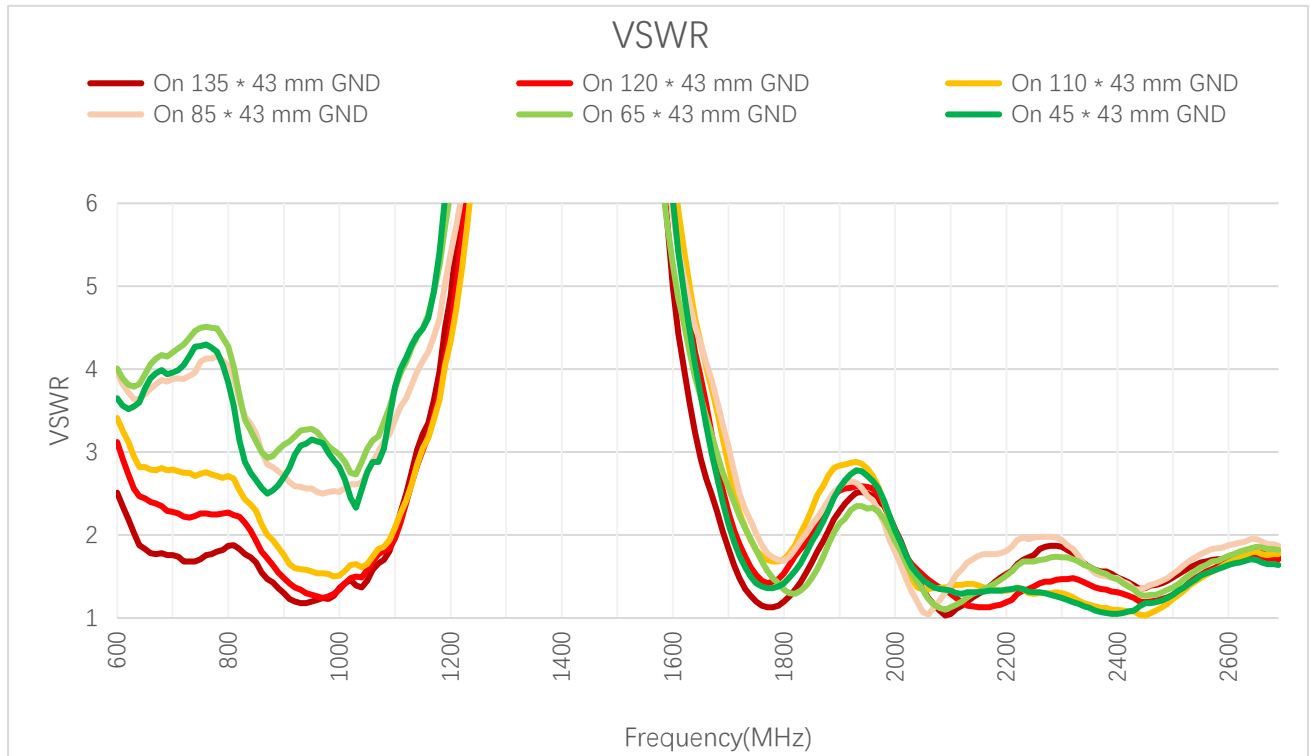
## 3.1. GND Length Dimensions Overview

The performance of the low bands is highly dependent on the ground plane length. The host PCB ground needs to be as long as the device allows. Reducing the GND directly relates to the performance of the low bands. As shown below you can see the effect of the GND plane length vs the efficiency.



### 3.2. S-Parameter Test

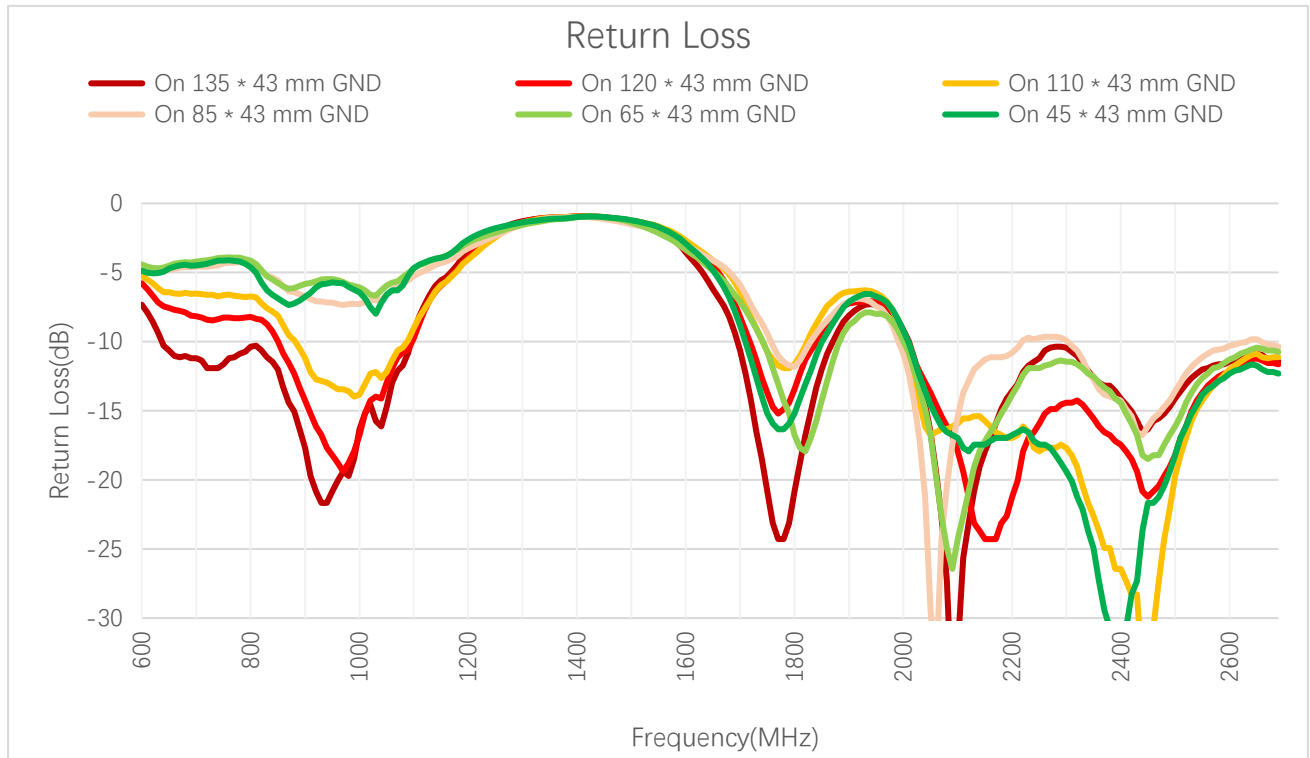
#### 3.2.1. VSWR



**VSWR**

Frequency (MHz)	630	710	830	900	1740	1880	1950	2140	2450	2600
On 135 × 43 mm GND	2.0	1.7	1.8	1.3	1.3	2.1	2.5	1.2	1.4	1.7
On 120 × 43 mm GND	2.6	2.3	2.1	1.5	1.6	2.4	2.6	1.1	1.2	1.7
On 110 × 43 mm GND	2.9	2.8	2.4	1.8	1.9	2.7	2.8	1.4	1.0	1.7
On 85 × 43 mm GND	3.6	3.9	3.4	2.7	2.2	2.4	2.5	1.7	1.4	1.9
On 65 × 43 mm GND	3.8	4.3	3.4	3.1	1.9	1.9	2.3	1.3	1.3	1.8
On 45 × 43 mm GND	3.5	4.0	2.9	2.7	1.5	2.3	2.7	1.3	1.2	1.6

**3.2.2. Return Loss**

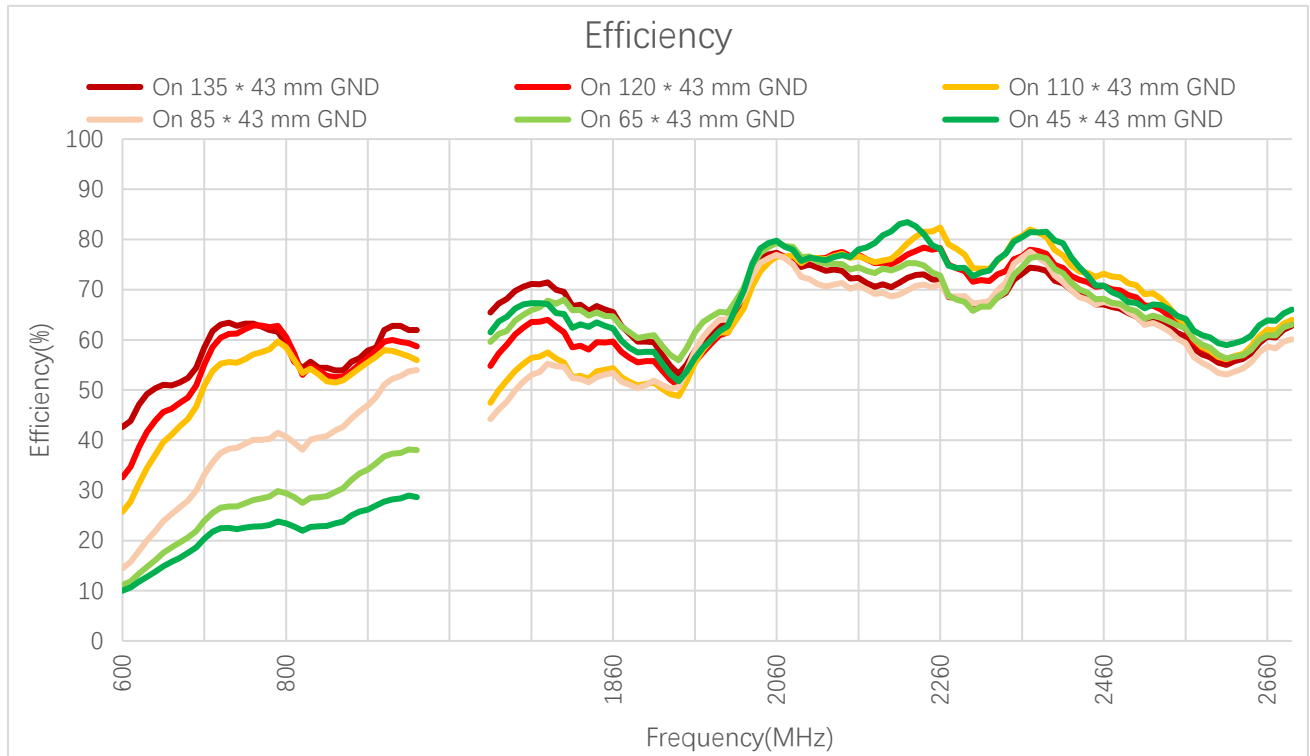


**Return Loss (dB)**

Frequency (MHz)	630	710	830	900	1740	1880	1950	2140	2450	2600
On 135 × 43 mm GND	-9.4	-11.4	-11.1	-17.7	-18.6	-9.3	-7.4	-19.2	-16.3	-11.4
On 120 × 43 mm GND	-7.2	-8.3	-8.8	-14.2	-12.6	-7.7	-7.1	-23.9	-21.3	-12.2
On 110 × 43 mm GND	-6.1	-6.6	-7.6	-11.2	-9.9	-6.7	-6.5	-15.4	-37.1	-12.0
On 85 × 43 mm GND	-4.9	-4.6	-5.2	-6.7	-8.7	-7.6	-7.4	-11.6	-16.1	-10.3
On 65 × 43 mm GND	-4.7	-4.2	-5.3	-5.8	-9.8	-10.2	-8.0	-18.0	-18.6	-11.3
On 45 × 43 mm GND	-5.0	-4.5	-6.3	-6.8	-14.0	-8.1	-6.7	-17.5	-21.9	-12.3

### 3.3. Radiation Performance Test

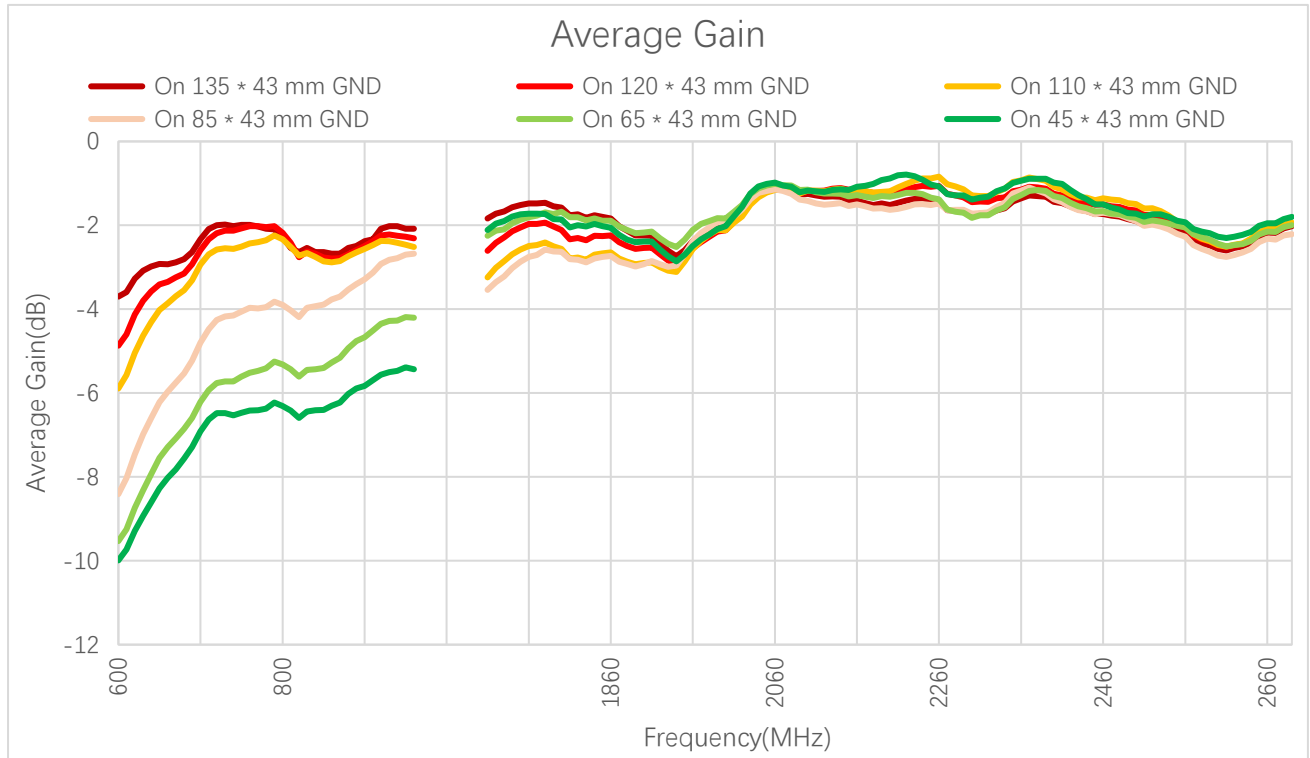
#### 3.3.1. Efficiency



**Efficiency (%)**

Frequency (MHz)	630	710	830	900	1740	1880	1950	2140	2450	2600
On 135 × 43 mm GND	49.2	61.7	55.7	57.9	69.7	61.2	55.0	73.7	67.1	55.4
On 120 × 43 mm GND	41.7	58.6	54.7	56.4	61.1	56.4	52.9	77.5	70.6	56.5
On 110 × 43 mm GND	34.5	53.8	54.3	55.5	53.8	51.6	51.8	77.1	72.5	56.6
On 85 × 43 mm GND	20.0	35.6	40.1	46.9	49.9	51.0	53.8	71.3	67.1	53.4
On 65 × 43 mm GND	14.7	25.6	28.5	34.1	63.8	61.5	58.3	75.1	68.1	57.1
On 45 × 43 mm GND	12.8	21.7	22.7	26.1	66.2	58.4	53.7	76.9	70.8	59.3

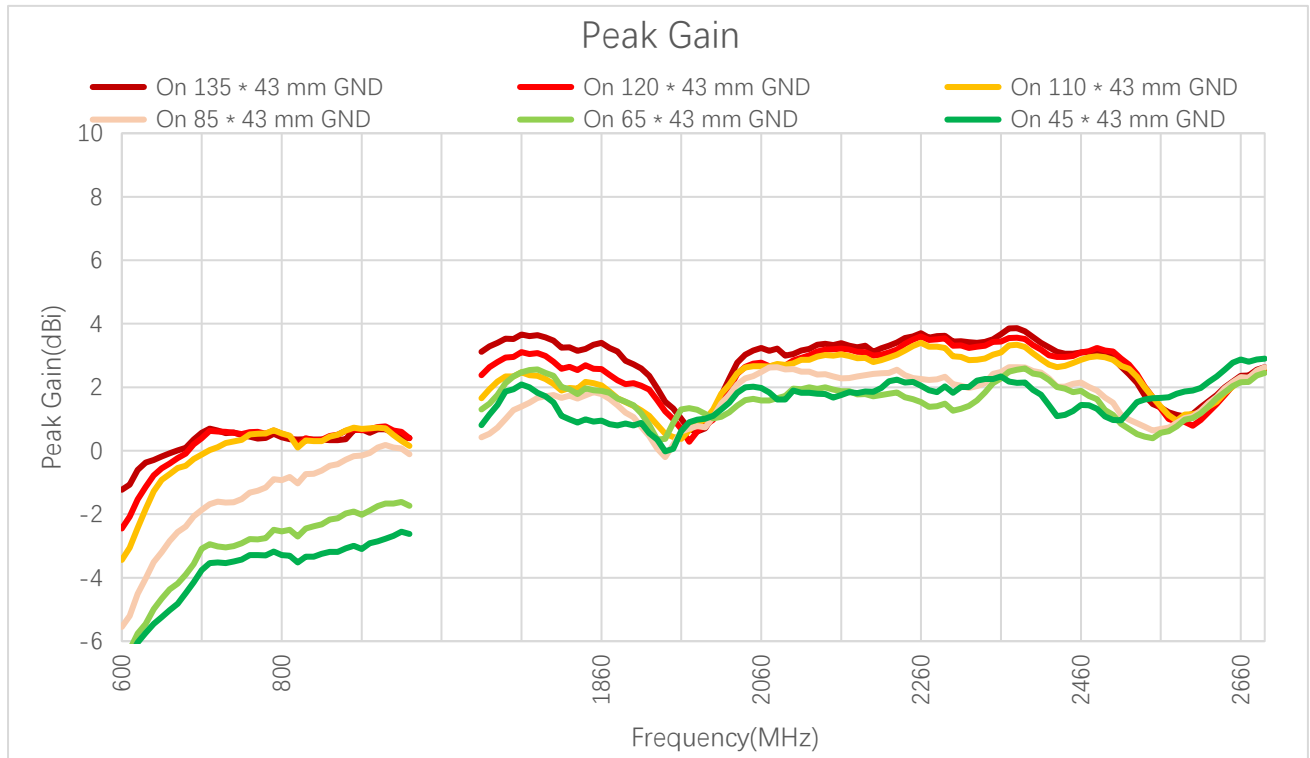
**3.3.2. Average Gain**



**Average Gain (dB)**

Frequency (MHz)	630	710	830	900	1740	1880	1950	2140	2450	2600
On 135 × 43 mm GND	-3.1	-2.1	-2.5	-2.4	-1.6	-2.1	-2.6	-1.3	-1.7	-2.6
On 120 × 43 mm GND	-3.8	-2.3	-2.6	-2.5	-2.1	-2.5	-2.8	-1.1	-1.5	-2.5
On 110 × 43 mm GND	-4.6	-2.7	-2.7	-2.6	-2.7	-2.9	-2.9	-1.1	-1.4	-2.5
On 85 × 43 mm GND	-7.0	-4.5	-4.0	-3.3	-3.0	-2.9	-2.7	-1.5	-1.7	-2.7
On 65 × 43 mm GND	-8.3	-5.9	-5.5	-4.7	-2.0	-2.1	-2.3	-1.3	-1.7	-2.4
On 45 × 43 mm GND	-8.9	-6.6	-6.4	-5.8	-1.8	-2.3	-2.7	-1.1	-1.5	-2.3

**3.3.3. Peak Gain**



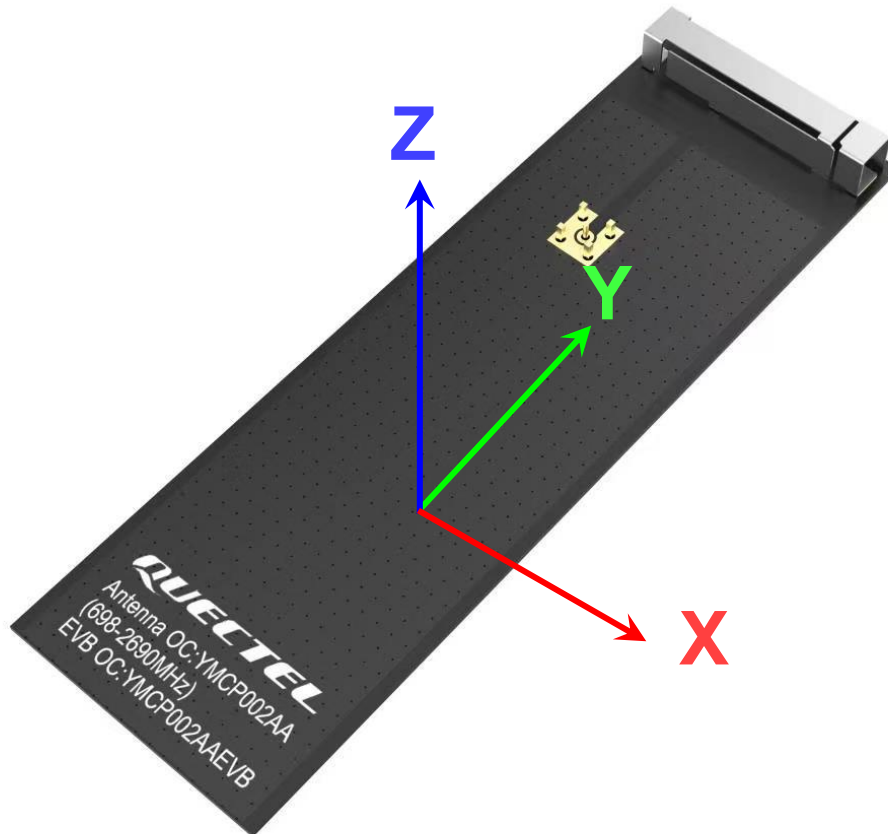
**Peak Gain (dBi)**

Frequency (MHz)	630	710	830	900	1740	1880	1950	2140	2450	2600
On 135 × 43 mm GND	-0.4	0.7	0.4	0.7	3.5	3.1	1.3	3.4	3.1	1.2
On 120 × 43 mm GND	-1.1	0.6	0.4	0.7	2.9	2.2	1.0	3.2	3.0	0.8
On 110 × 43 mm GND	-1.8	0.0	0.3	0.7	2.3	1.7	0.4	3.0	2.8	1.2
On 85 × 43 mm GND	-4.0	-1.7	-0.7	-0.2	1.0	1.4	0.2	2.4	2.1	1.1
On 65 × 43 mm GND	-5.5	-2.9	-2.5	-2.0	2.1	1.6	0.9	2.0	1.9	1.0
On 45 × 43 mm GND	-5.7	-3.5	-3.3	-3.1	1.9	0.8	0.1	1.8	1.3	1.9

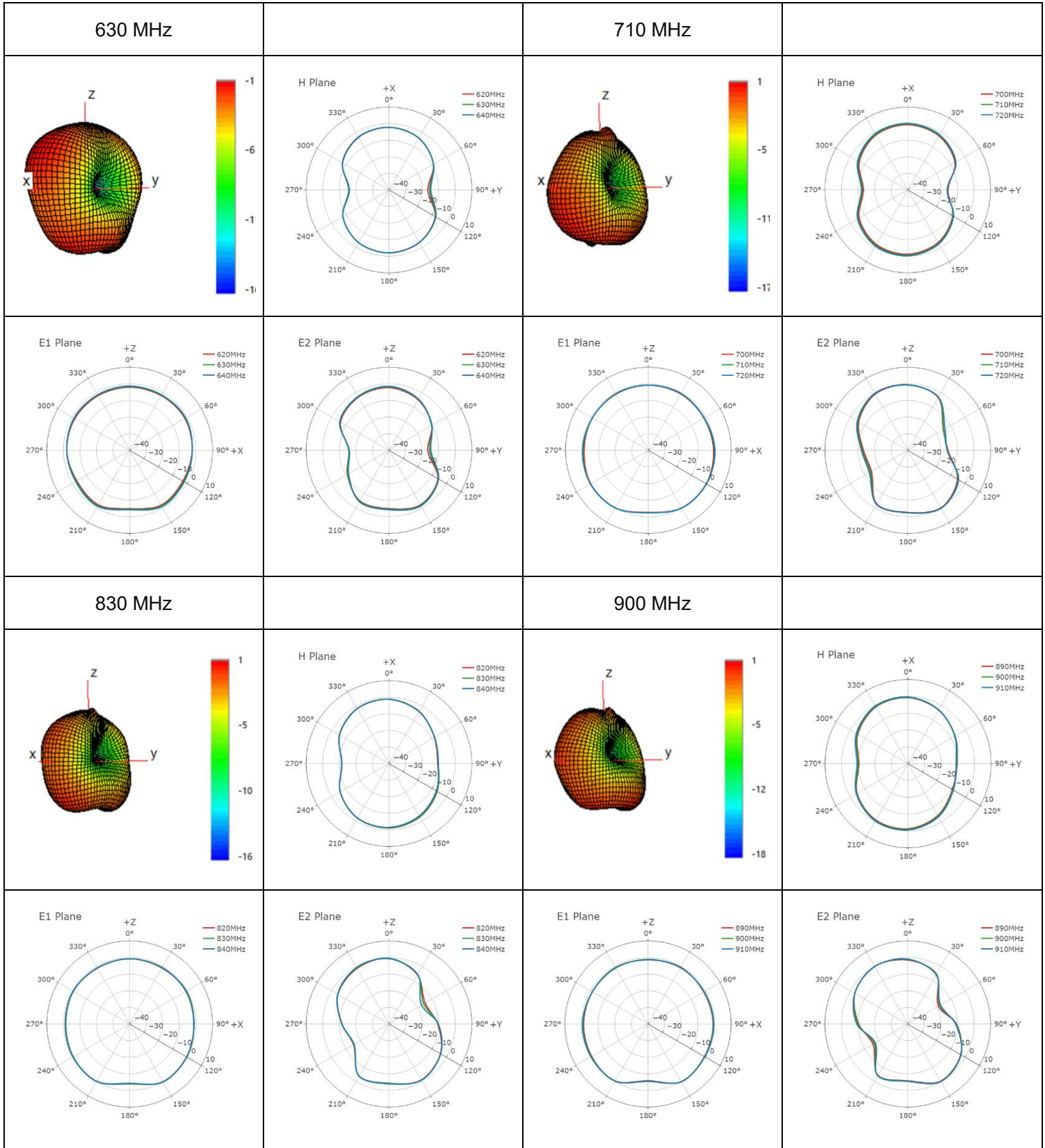


### 3.3.4. 3D & 2D Radiation Pattern

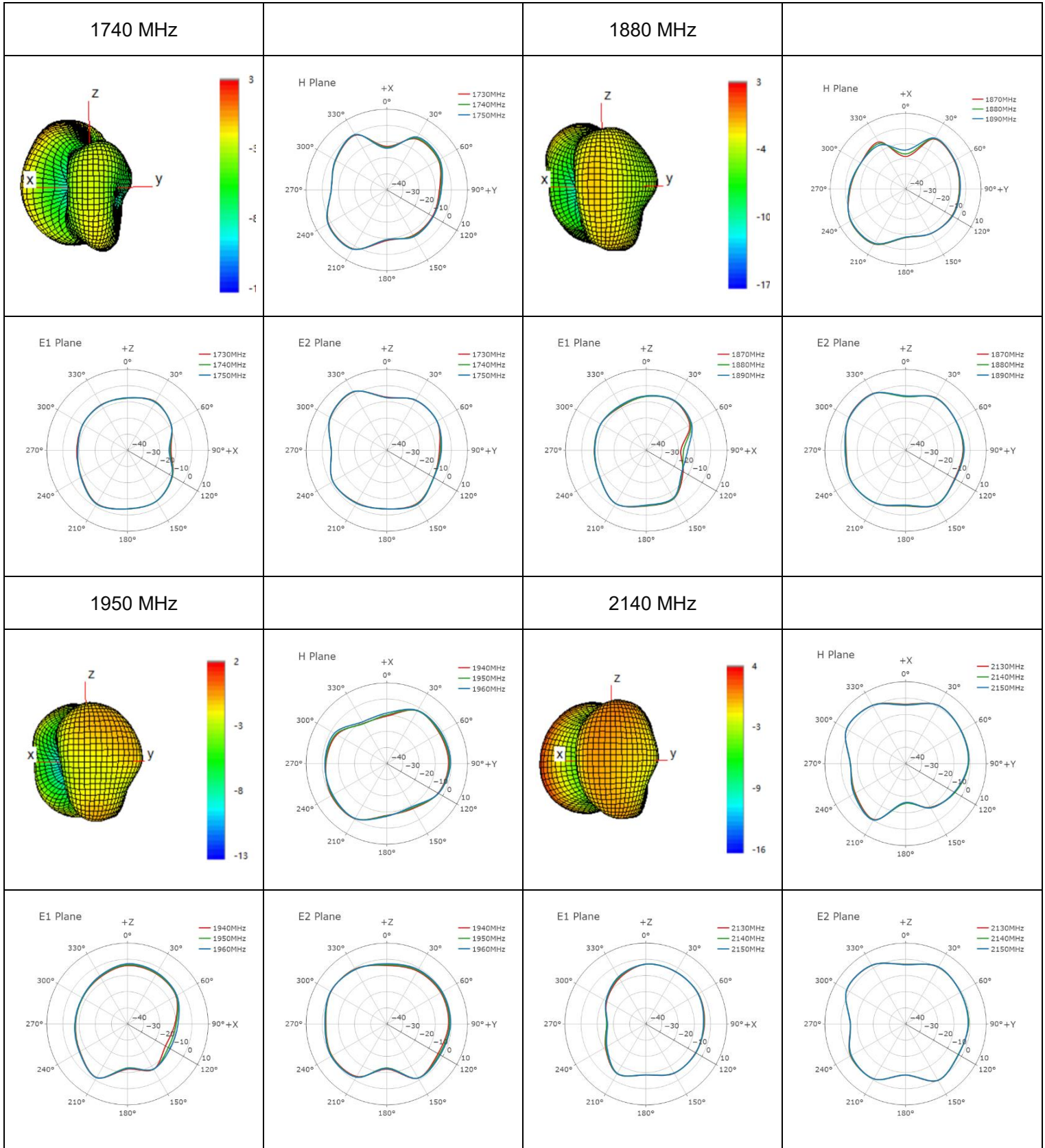
- Test Status: Assembled on 120 × 43 × 1 mm GND EVB



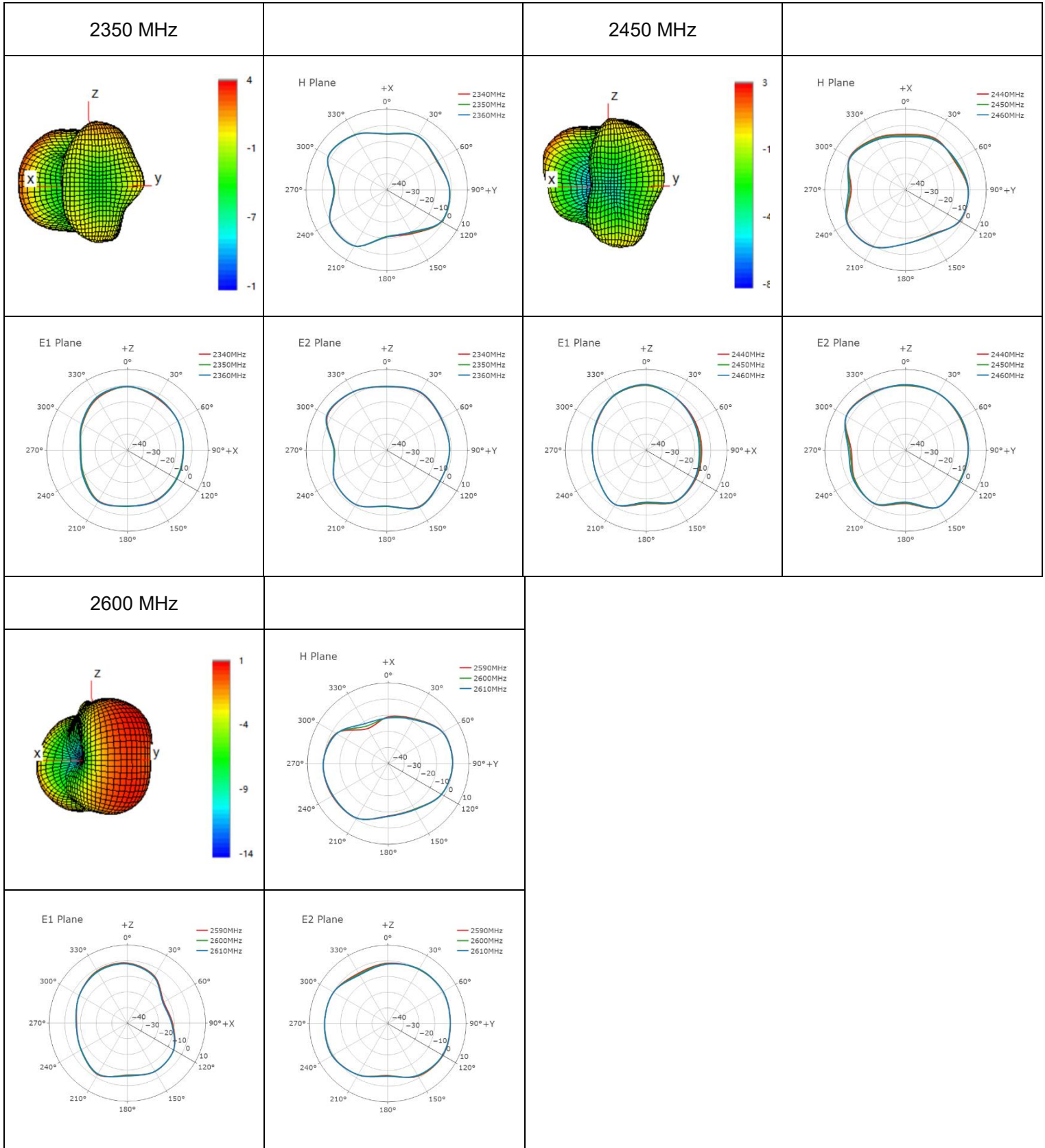
● 4G



● 4G



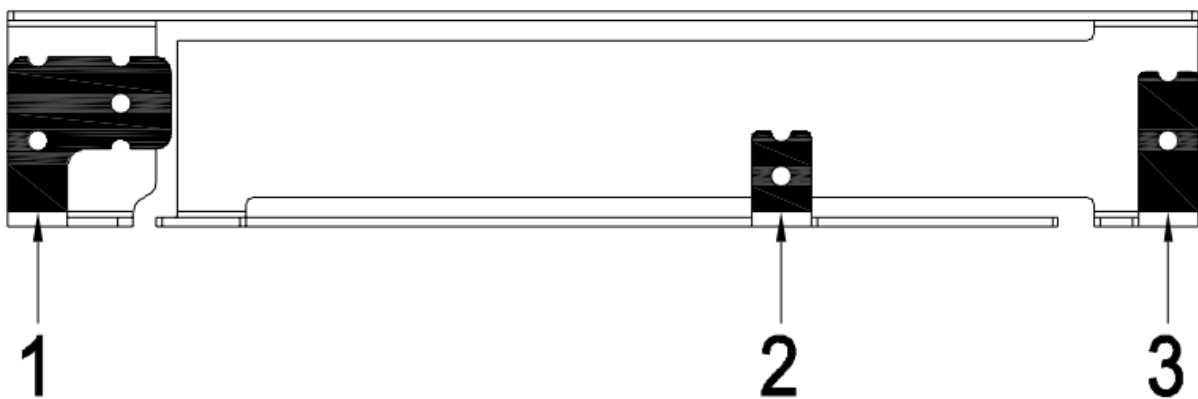
● 4G



# 4 Schematic Symbol and Pin Definition

- The pin assignment for the antenna is as follows.
- The circuit symbol for the antenna is shown below. The antenna has 3 pins, only one of which works. All other pins are for mechanical strength.

Pin #	Description
1	For mechanical use
2	Feed
3	For mechanical use



## 5 Transmission Line

The characteristic impedance of all transmission lines shall be designed as 50  $\Omega$ .

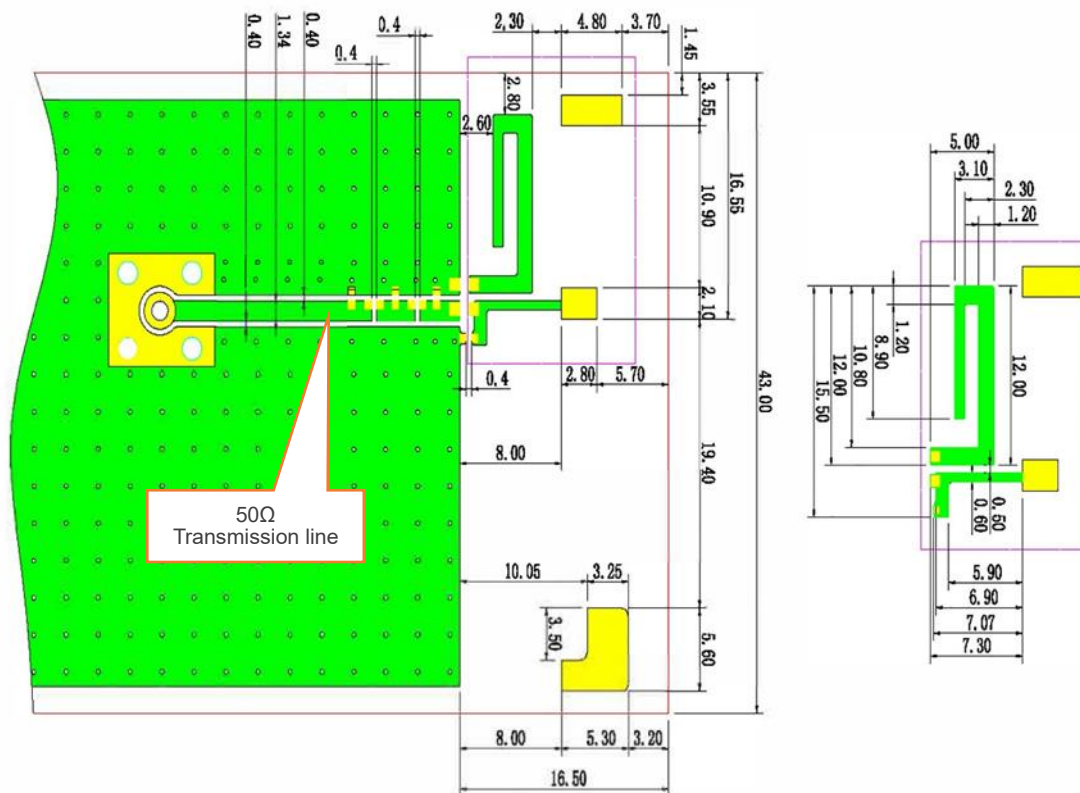
- The length of the transmission lines should be kept as short as possible.
- Any other part of the RF system, such as transceiver, power amplifiers, etc., shall also be designed with an impedance of 50  $\Omega$ .

Once the material for the PCB has been chosen (PCB thickness and dielectric constant), a coplanar transmission line can easily be designed using any of the commercial software packages for transmission line design. For the chosen PCB thickness, copper thickness and substrate dielectric constant, the program will calculate the appropriate transmission line width and gaps on either side of the track so the characteristic impedance of the coplanar transmission is 50  $\Omega$ .



# 6 Recommended PCB Layout

The host PCB must be designed using the PCB footprint shown with the correct clearances. An example of the PCB layout shows the antenna footprint. Please note this clearance area is critical to the performance of the antenna and must be applied through all layers of the PCB.

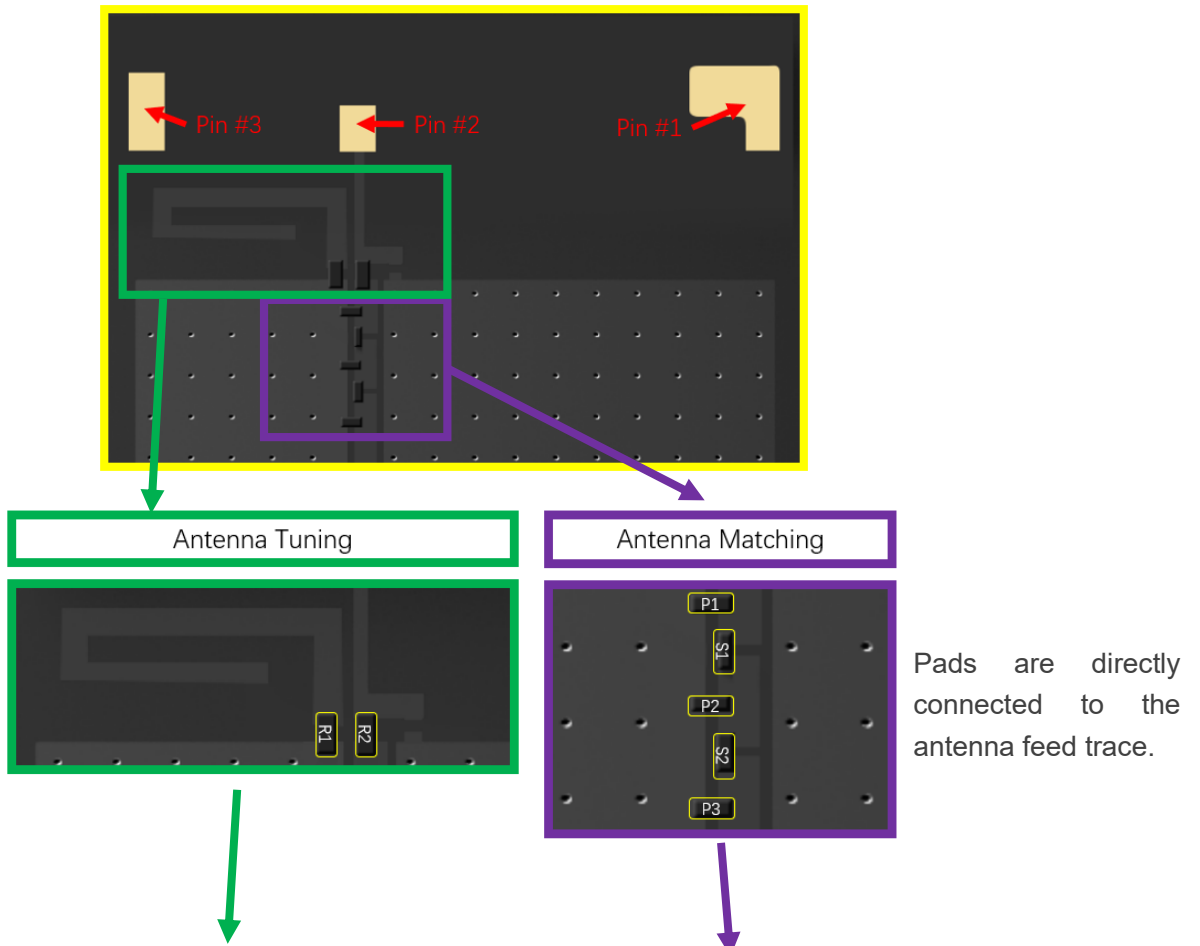


Recommended test board PCB layout for electrical characteristic measurement.  
Substrate material FR4, DK (4.3-4.6).

All dimensions are in mm.

# 7 Matching Circuit

Demo Board Top View



	R1	R2	P1	S1	P2	S2	P3
Default Matching	0 Ohm	0 Ohm	180 nH	0 Ohm	8.2 nH	3.9 pF	18 nH
Tolerance			±5 %		±5 %	±5 %	±5 %

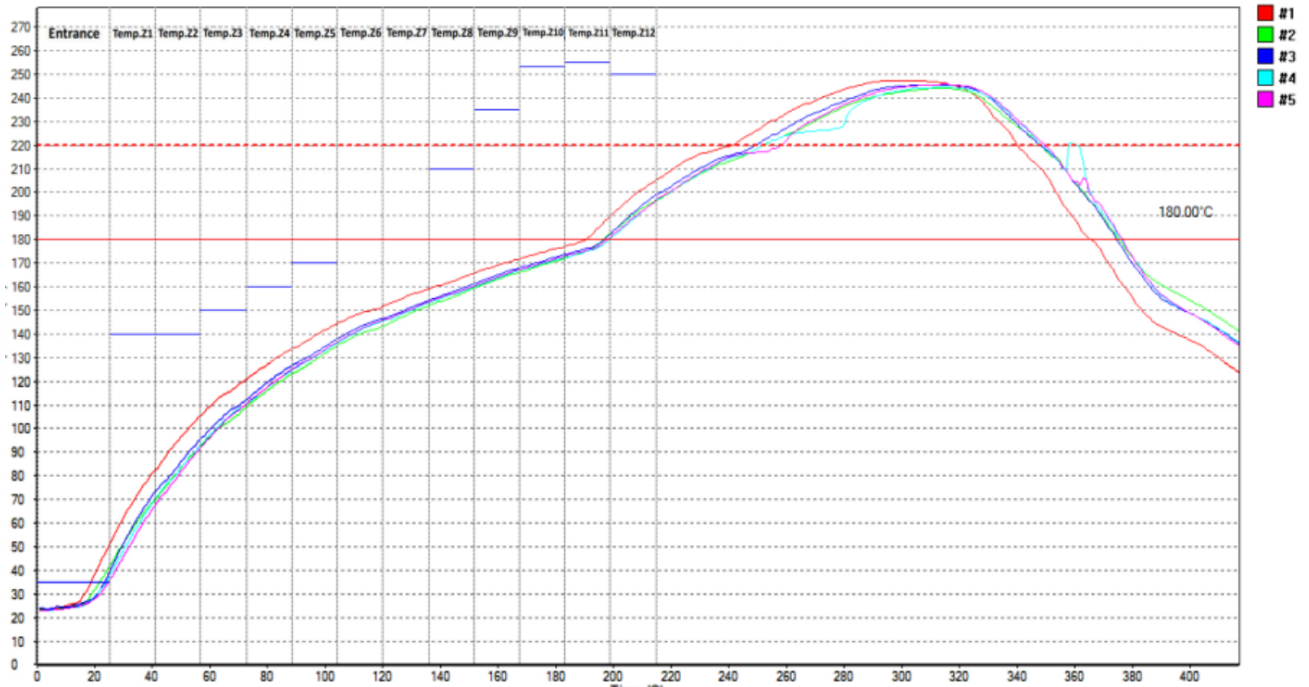
Pin #	Description
1	Dummy Pad
2	Feed
3	Dummy Pad



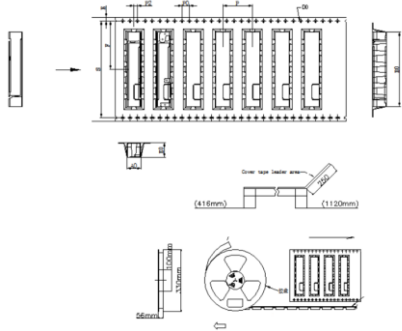
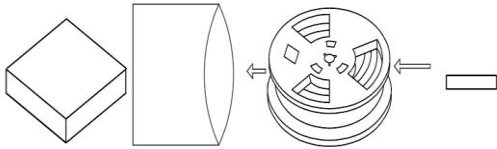
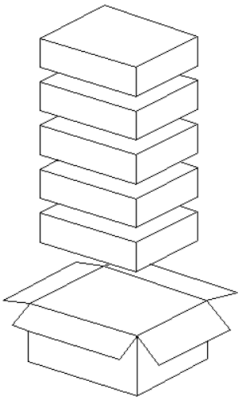
## 8 Soldering Temperature

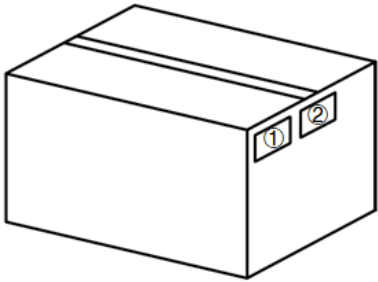
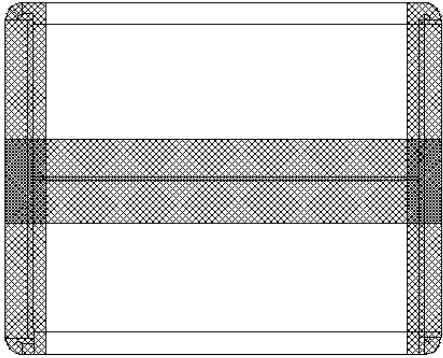
Phase	Profile Features	PB-Free Assembly
RAMP-UP	Avg. Ramp-up Rate (T <sub>max</sub> to T <sub>p</sub> )	3 °C/second (Max.)
PREHEAT	Temperature Min (T <sub>min</sub> ) Temperature Max (T <sub>max</sub> ) Time (t <sub>min</sub> to t <sub>max</sub> )	150 °C 190 °C 110 seconds (Max.)
REFLOW	Temperature (TL) Total Time above TL (tl)	220 °C 90 seconds (Max.)
PEAK	Temperature (T <sub>p</sub> )	230–250 °C
RAMP-DOWN	Rate	-1 °C/second (Max.)

# 9 Reflow Profile



# 10 Packaging

Step	Packaging Picture / 2D Picture	Description
1	 <p>Technical drawing of a reel tape. It includes a top view showing a series of antenna elements on a carrier tape, with dimensions 416mm and 1120mm. A side view shows the thickness of the tape. A circular diagram shows the reel tape being loaded onto a reel.</p>	<p>Reel</p>
2	 <p>Diagram illustrating the process of vacuum-sealing the reel tape into an inner box. It shows a diamond-shaped inner box, a cylindrical vacuum chamber, and the reel tape being placed inside the chamber. A small rectangular object is shown next to the chamber.</p>	<p>456 Antenna Products/Reel Reel tape is vacuumed into the inner box.</p>
3	 <p>Diagram showing five inner boxes stacked on top of a carton box. The text "x 5" is placed to the right of the stack.</p>	<p>5 Inner Boxes Per Carton Box (2280 Antennas / Carton Box)</p> <p><u>Carton Size:</u> <u>L x W x H = 380 x 380 x 320 mm</u></p>

4		<b>Position for Attaching Labels</b> ① Carton Label ② Quality Label
5		<b>Sealing Cartons</b> "I" type sealing cartons

## Contact Us

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## Revision History

Version	Date	Author	Note
-	2023-01-16	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	Creation of the document
1.0	2023-01-16	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	First official release
1.1	2023-04-10	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	Updated the antenna and EVB figures (Chapter 2).





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