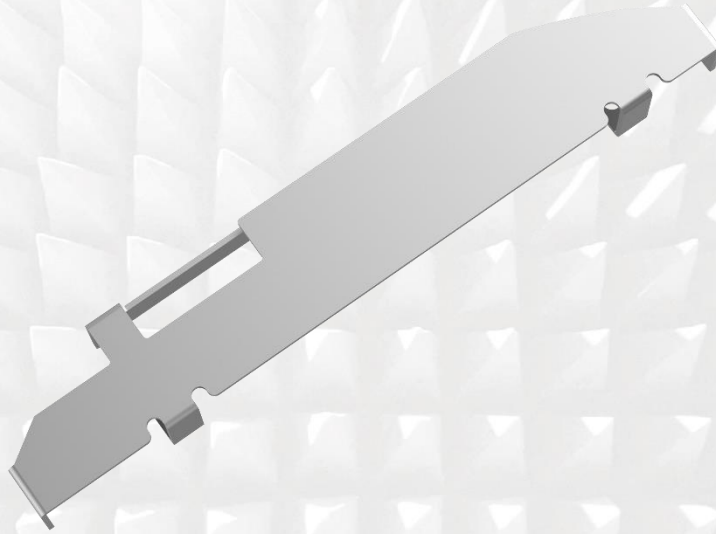




Antenna Datasheet

Product OC (Antenna Only): YMCP003AA

Product OC (Antenna + Rectangular EVB): YMCP003AA EVBAA

Product OC (Antenna + Circular EVB): YMCP003AA EVBBA

Version: 1.2

Date: 2024-06-07

Status: Released

Product Name: IoT Metal Shrapnel Antenna

Key Features:

High efficiency, Excellent performance

Frequency band: 790–960 MHz

Peak efficiency: 72.18 %

Dimensions: 40.99 × 6.68 × 3.99 mm

Overview

This metal shrapnel antenna is suitable for NB-IoT B5/B8/B18/B19/B20/B25 applications. Operating at 790-960MHz, it's a high-efficiency antenna which is mounted to the device host PCB using conventional Metal shrapnel antenna reflow process. Ideal for NB-IoT frequency bands applications. 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	790–960 MHz
Impedance	50 Ω
Polarization	Linear
Radiation Pattern	Omni-directional

Electrical - Detail									
SPEC	Band		B71	B12 /B13 /B28	B5 /B8 /B26	B1 /B2 /B3	B40	Wi-Fi 2G	B38 /B41
	Freq. (MHz)		600– 700	700– 790	790– 960	1700– 2170	2300– 2400	2400– 2500	2500– 2690
Max VSWR	On 120 × 45 mm GND		-	-	1.9	-	-	-	-
	On 110 × 45 mm GND		-	-	2.1	-	-	-	-
	On 100 × 45 mm GND		-	-	2.5	-	-	-	-
	On 90 × 45 mm GND		-	-	3.0	-	-	-	-
	On 80 × 45 mm GND		-	-	3.9	-	-	-	-
	On Φ 80 mm EVB			-	5.8	-	-	-	-
Max Return Loss (dB)	On 120 × 45 mm GND		-	-	-10.2	-	-	-	-
	On 110 × 45 mm GND		-	-	-8.9	-	-	-	-
	On 100 × 45 mm GND		-	-	-7.5	-	-	-	-
	On 90 × 45 mm GND		-	-	-5.9	-	-	-	-

	On 80 × 45 mm GND	-	-	-4.5	-	-	-	-
	On Φ 80 mm EVB		-	-3.0				
AVG Eff. (%)	On 120 × 45 mm GND	-	-	64.8	-	-	-	-
	On 110 × 45 mm GND	-	-	65.1	-	-	-	-
	On 100 × 45 mm GND	-	-	61.4	-	-	-	-
	On 90 × 45 mm GND	-	-	53.0	-	-	-	-
	On 80 × 45 mm GND	-	-	43.3	-	-	-	-
	On Φ 80 mm EVB		-	22.9				
AVG Gain (dB)	On 120 × 45 mm GND	-	-	-2.0	-	-	-	-
	On 110 × 45 mm GND	-	-	-1.9	-	-	-	-
	On 100 × 45 mm GND	-	-	-2.1	-	-	-	-
	On 90 × 45 mm GND	-	-	-2.8	-	-	-	-
	On 80 × 45 mm GND	-	-	-3.7	-	-	-	-
	On Φ 80 mm EVB		-	-6.5				
Max Peak Gain (dBi)	On 120 × 45 mm GND	-	-	1.1	-	-	-	-
	On 110 × 45 mm GND	-	-	1.3	-	-	-	-
	On 100 × 45 mm GND	-	-	1.3	-	-	-	-
	On 90 × 45 mm GND	-	-	0.7	-	-	-	-
	On 80 × 45 mm GND	-	-	-0.1	-	-	-	-
	On Φ 80 mm EVB		-	-3.1				
VSWR	On 120 × 45 mm GND			≤ 1.9				
	On 110 × 45 mm GND			≤ 2.1				
	On 100 × 45 mm GND			≤ 2.5				
	On 90 × 45 mm GND			≤ 3.1				
	On 80 × 45 mm GND			≤ 3.9				
	On Φ 80 mm EVB			≤ 5.8				
Return Loss	On 120 × 45 mm GND			≤ -10.2 dB				
	On 110 × 45 mm GND			≤ -8.9 dB				
	On 100 × 45 mm GND			≤ -7.5 dB				

Peak Gain	On 90 × 45 mm GND	≤ -5.9 dB
	On 80 × 45 mm GND	≤ -4.5 dB
	On Φ 80 mm EVB	≤ -3 dB
	On 120 × 45 mm GND	≤ 1.1 dBi
	On 110 × 45 mm GND	≤ 1.3 dBi
	On 100 × 45 mm GND	≤ 1.3 dBi
	On 90 × 45 mm GND	≤ 0.7 dBi
	On 80 × 45 mm GND	≤ 0.1 dBi
	On Φ 80 mm EVB	≤ -3.1 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:

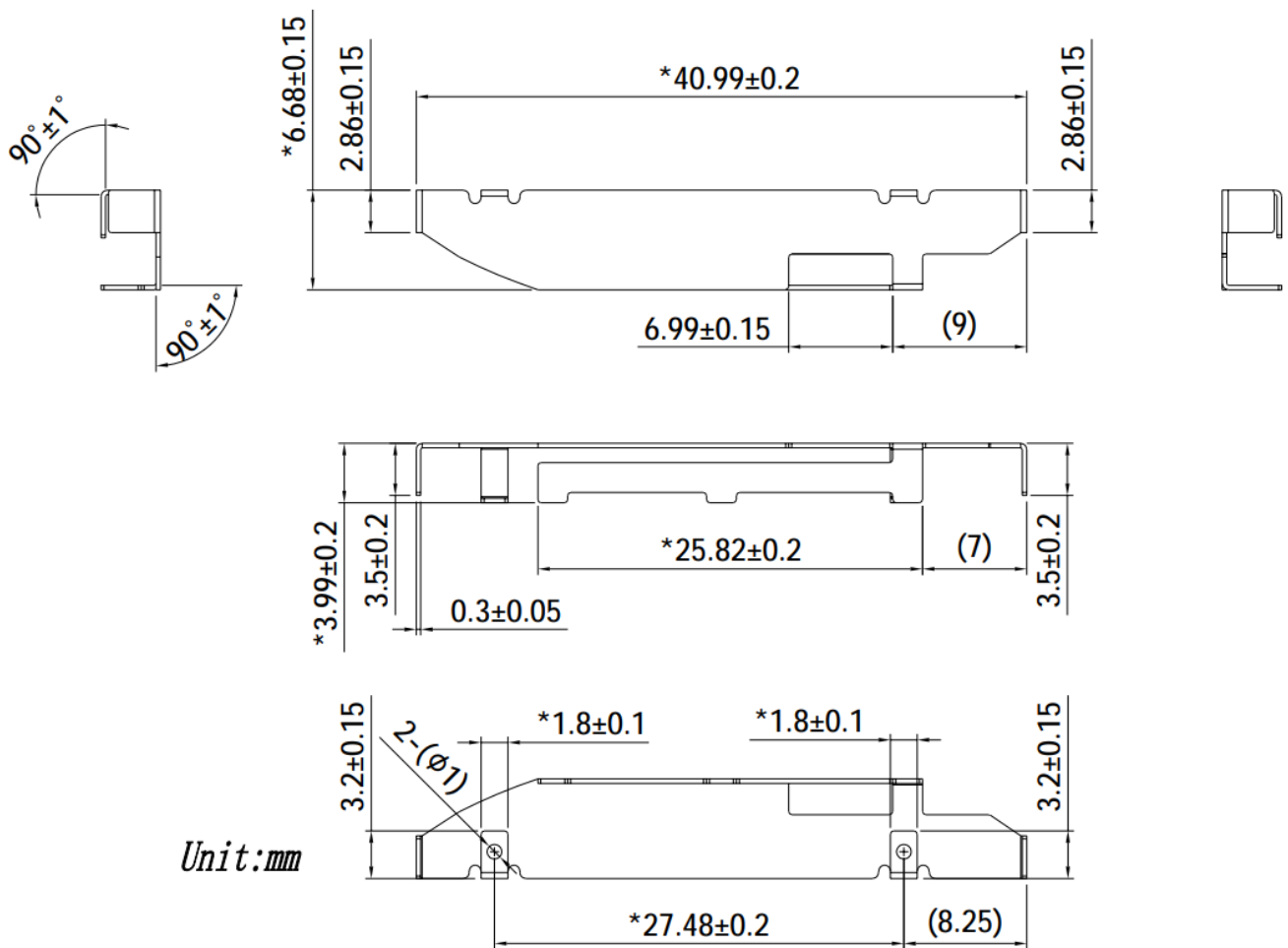
- Covered √ means efficiency > 20%.
- Based on 120 × 45mm GND.

1.3. Mechanical & Environmental

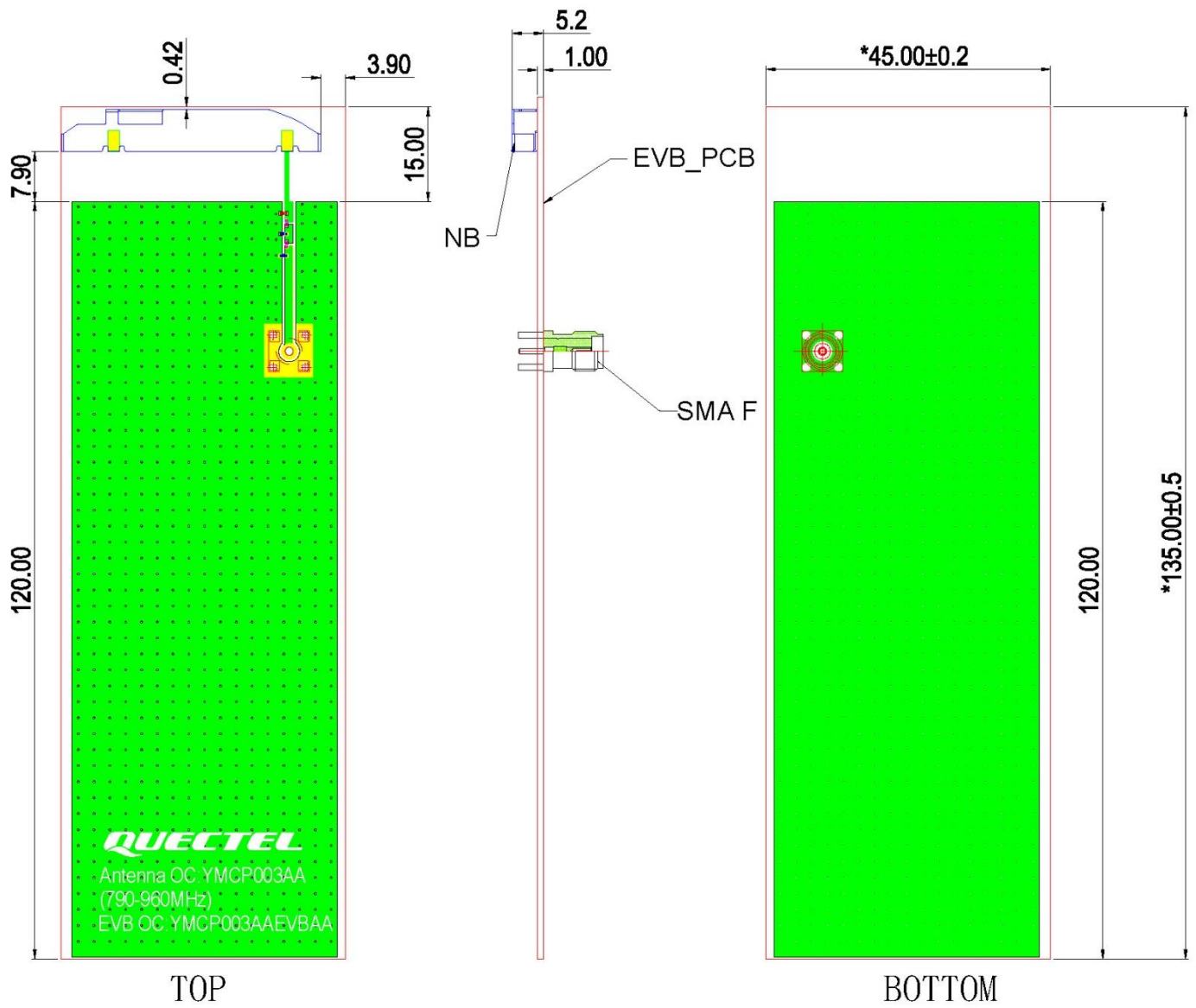
Mechanical	
Antenna Size	40.99 × 6.68 × 3.99 mm
Antenna Material & Color	C7701 & Silver
Antenna Weight	Typ. 0.8 g
Mounting Type	SMD
Recommended EVB Size	135 × 45 mm
Environmental	
Operation Temperature	-40 °C to +85 °C
Storage Temperature	-40 °C to +85 °C
RoHS & REACH Compliant	Yes

2 Drawing

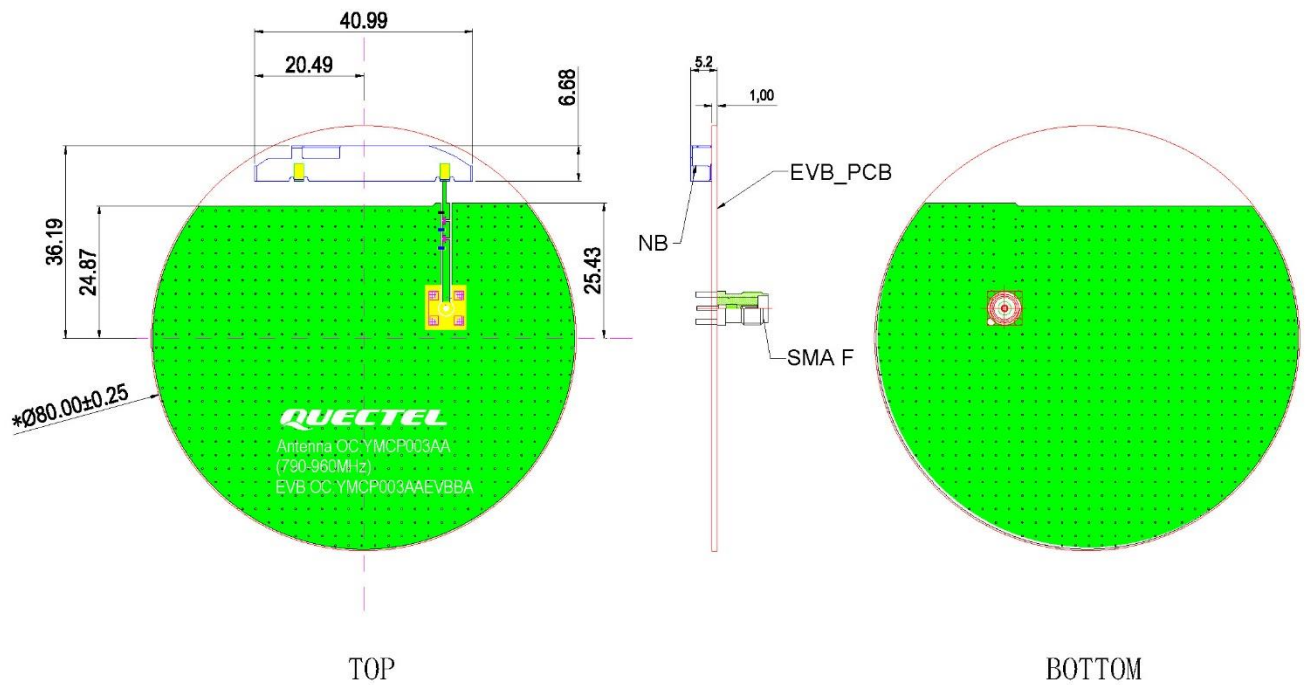
2.1. Antenna



2.2. Rectangular EVB



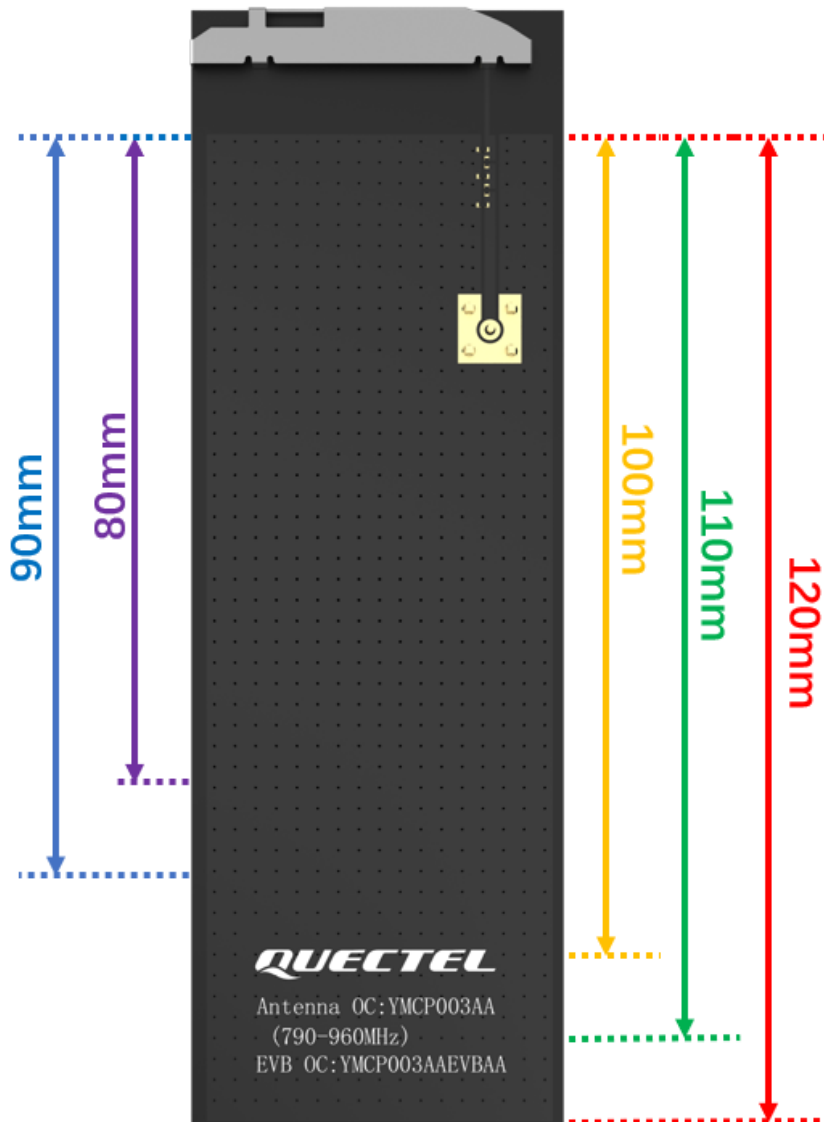
2.3. Circular EVB



3 Detailed Performance

3.1. Overview

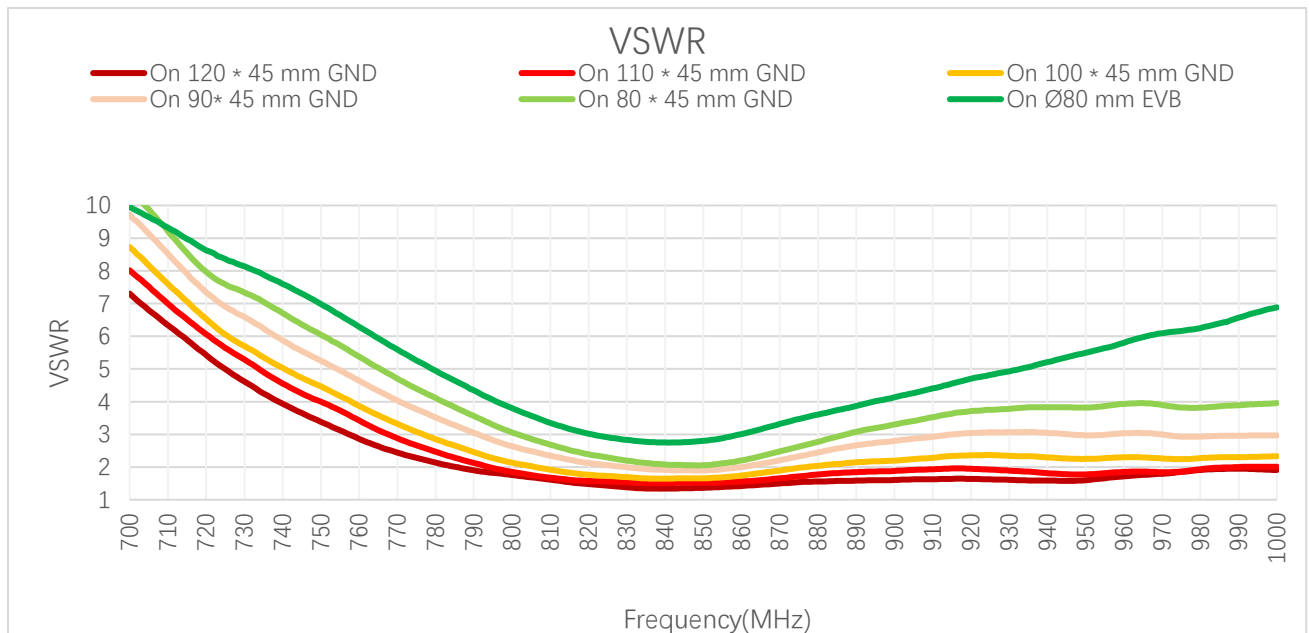
The performance of the low bands is highly dependent on the ground plane length. The host PCB ground needs to be as long as the device allows. Reducing the GND directly relates to the performance of the low bands. As shown below you can see the effect of the GND plane length vs the efficiency.





3.2. S-Parameter Test

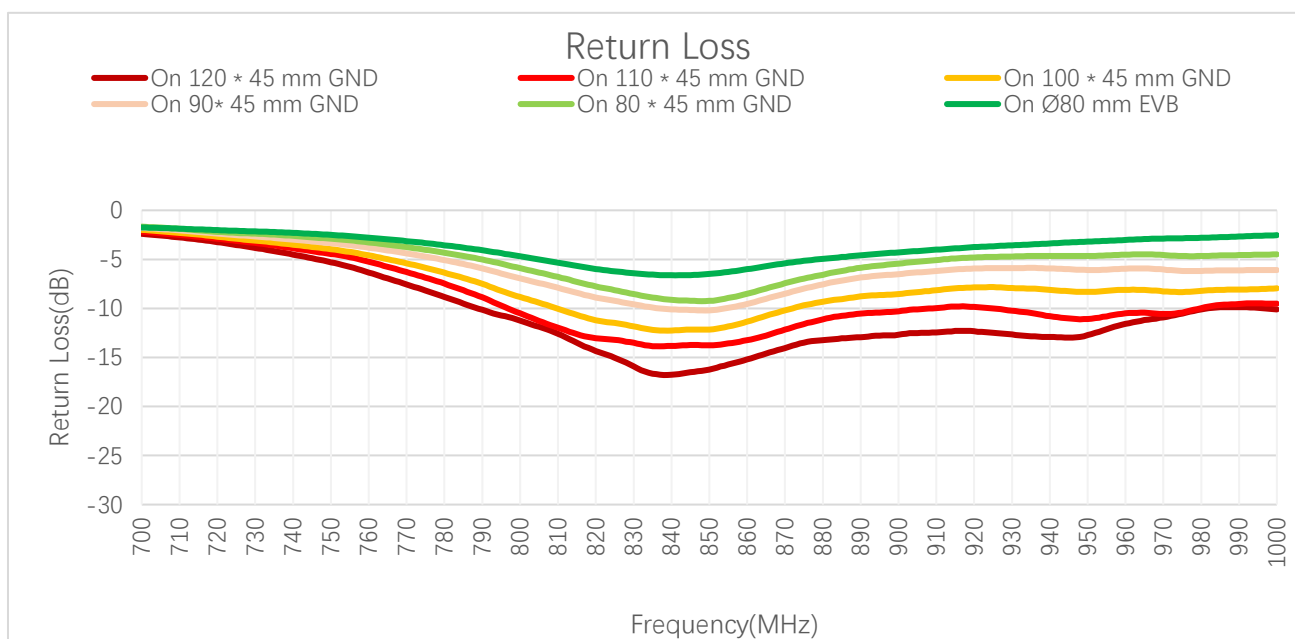
3.2.1. VSWR



VSWR

Frequency (MHz)	600	630	790	830	900	960	1440	1710	1740	1880
On 120 × 45 mm GND	-	-	1.9	1.4	1.6	1.7	-	-	-	-
On 110 × 45 mm GND	-	-	2.1	1.5	1.9	1.9	-	-	-	-
On 100* 45 mm GND	-	-	2.5	1.7	2.2	2.3	-	-	-	-
On 90 × 45 mm GND	-	-	3.0	2.0	2.8	3.0	-	-	-	-
On 80 × 45 mm GND	-	-	3.6	2.2	3.3	3.9	-	-	-	-
On Ø 80 mm EVB	-	-	4.3	2.8	4.1	5.8	-	-	-	-

3.2.2. Return Loss



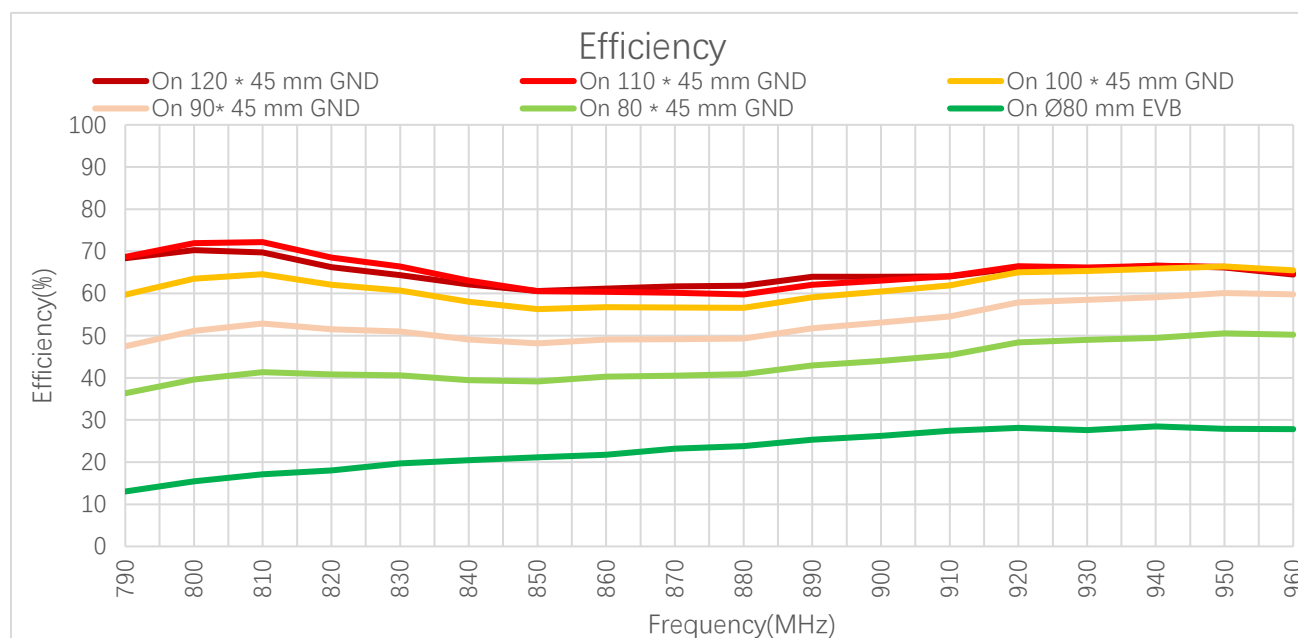
Return Loss (dB)

Frequency (MHz)	600	630	790	830	900	960	1440	1710	1740	1880
On 120 × 45 mm GND	-	-	-10.2	-15.9	-12.7	-11.6	-	-	-	-
On 110 × 45 mm GND	-	-	-8.9	-13.5	-10.3	-10.5	-	-	-	-

On 100 × 45 mm GND	-	-	-7.5	-11.8	-8.5	-8.1	-	-	-	-
On 90 × 45 mm GND	-	-	-5.9	-9.6	-6.5	-5.9	-	-	-	-
On 80 × 45 mm GND	-	-	-5.0	-8.5	-5.4	-4.5	-	-	-	-
On Ø 80 mm EVB	-	-	-4.1	-6.4	-4.3	-3.0	-	-	-	-

3.3. Radiation Performance Test

3.3.1. Efficiency

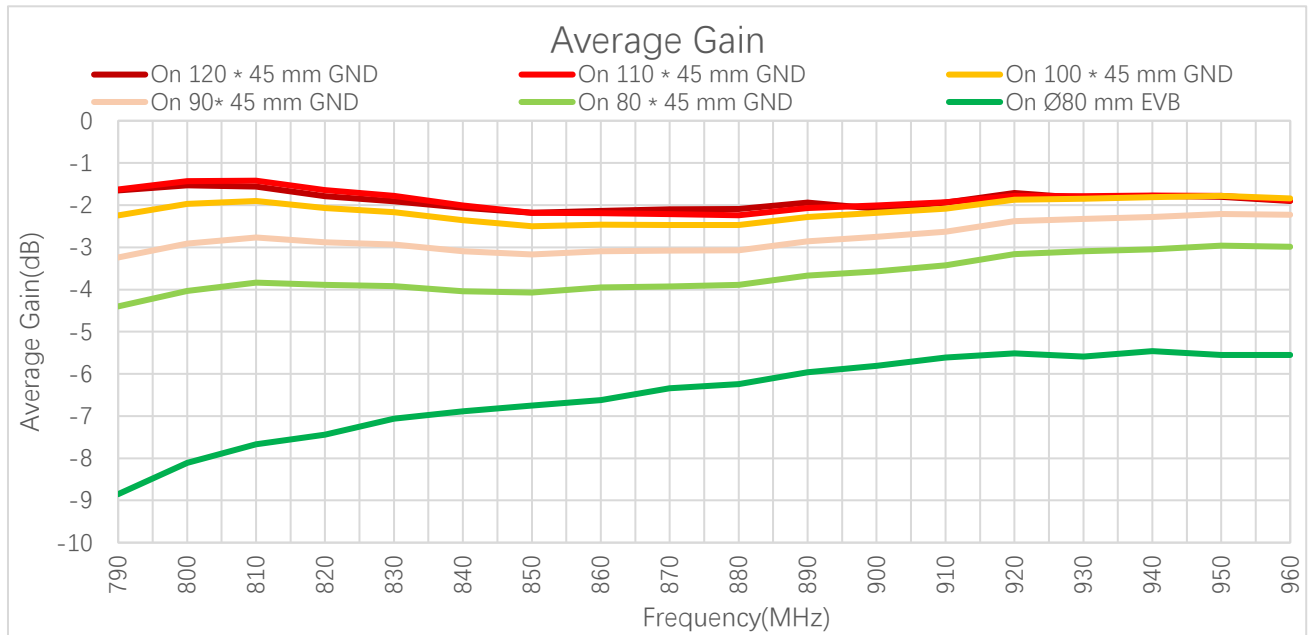


Efficiency (%)

Frequency (MHz)	600	630	790	830	900	960	1440	1710	1740	1880
On 120 × 45 mm GND	-	-	68.3	64.4	64.0	64.5	-	-	-	-
On 110 × 45 mm GND	-	-	68.7	66.4	63.0	64.8	-	-	-	-
On 100 × 45 mm GND	-	-	59.7	60.7	60.5	65.5	-	-	-	-
On 90 × 45 mm GND	-	-	47.5	51.0	53.1	59.8	-	-	-	-
On 80 × 45 mm	-	-	36.3	40.6	44.0	50.2	-	-	-	-

GND										
On Φ 80 mm EVB	-	-	13.0	19.7	26.3	27.8	-	-	-	-

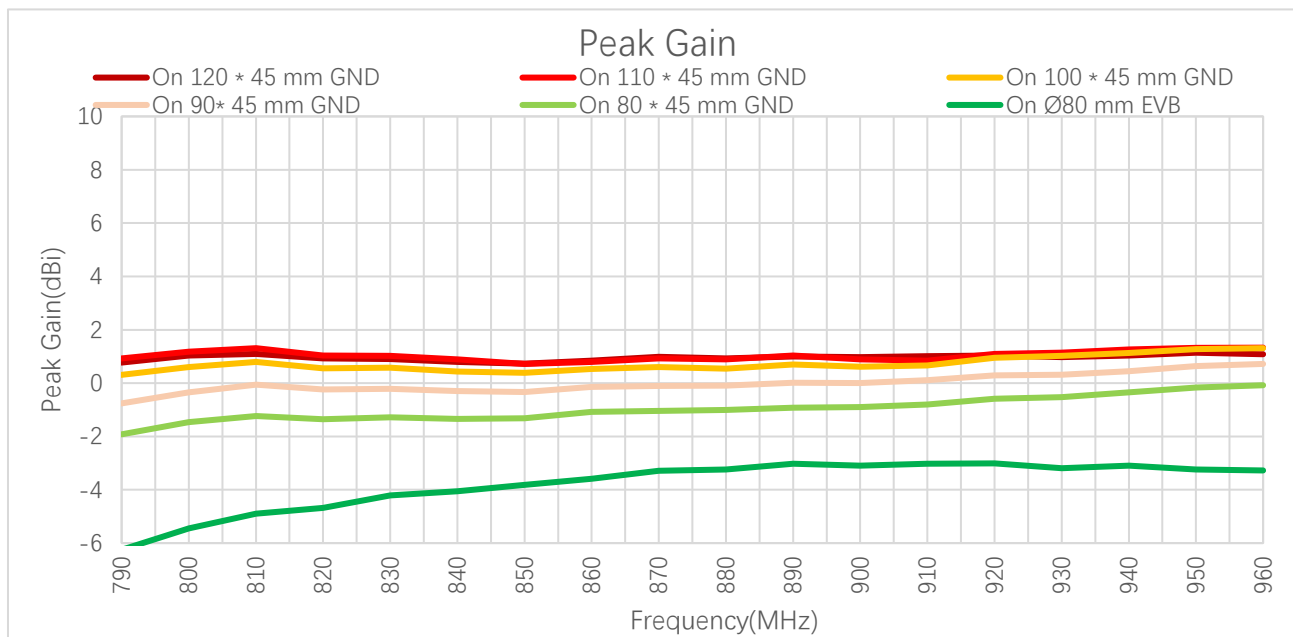
3.3.2. Average Gain



Average Gain (dB)

Frequency (MHz)	600	630	790	830	900	960	1440	1710	1740	1880
On 120 × 45 mm GND	-	-	-1.7	-1.9	-2.1	-1.9	-	-	-	-
On 110 × 45 mm GND	-	-	-1.6	-1.8	-2.0	-1.9	-	-	-	-
On 100 × 45 mm GND	-	-	-2.2	-2.2	-2.2	-1.8	-	-	-	-
On 90 × 45 mm GND	-	-	-3.2	-2.9	-2.8	-2.2	-	-	-	-
On 80 × 45 mm GND	-	-	-4.4	-3.9	-3.6	-3.0	-	-	-	-
On Φ 80 mm EVB	-	-	-8.9	-7.1	-5.8	-5.6	-	-	-	-

3.3.3. Peak Gain

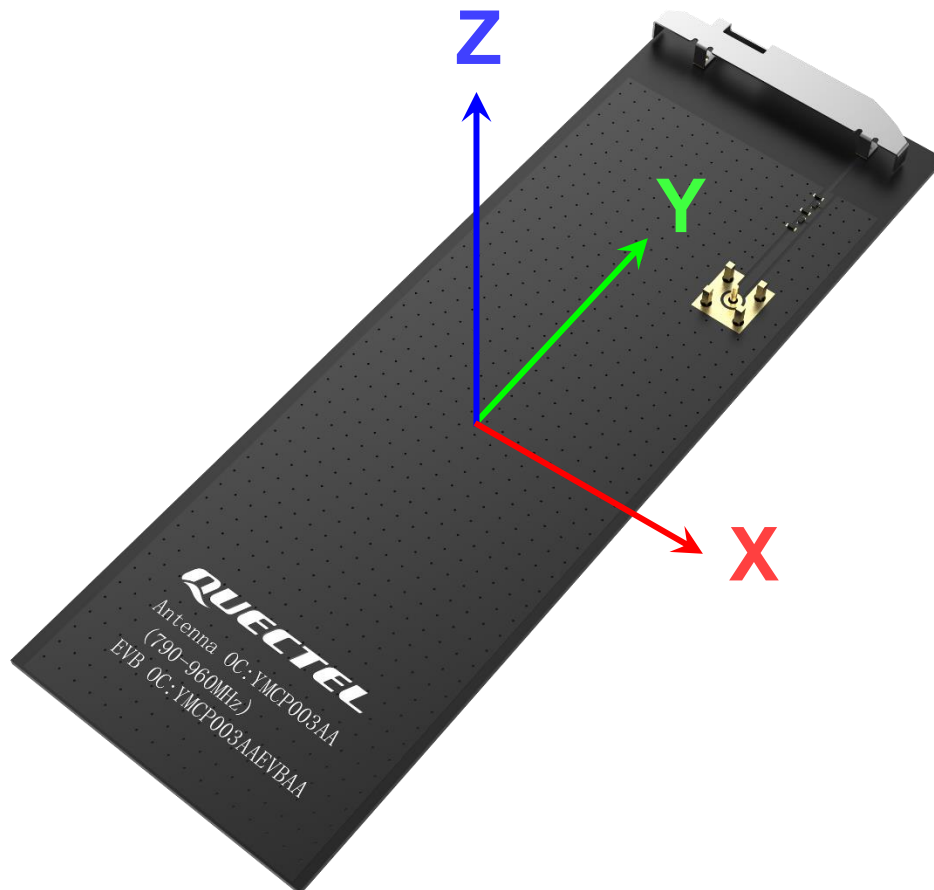


Peak Gain (dBi)

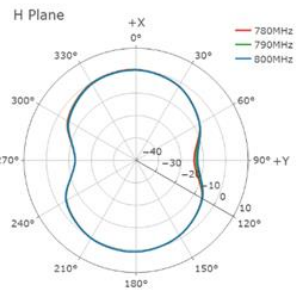
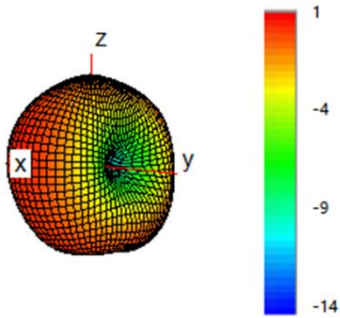
Frequency (MHz)	600	630	790	830	900	960	1440	1710	1740	1880
On 120 × 45 mm GND	-	-	0.8	0.9	1.0	1.1	-	-	-	-
On 110 × 45 mm GND	-	-	0.9	1.0	0.9	1.3	-	-	-	-
On 100 × 45 mm GND	-	-	0.3	0.6	0.6	1.3	-	-	-	-
On 90 × 45 mm GND	-	-	-0.8	-0.2	0.0	0.7	-	-	-	-
On 80 × 45 mm GND	-	-	-1.9	-1.3	-0.9	-0.1	-	-	-	-
On Ø 80 mm EVB	-	-	-6.3	-4.2	-3.1	-3.3	-	-	-	-

3.3.4. 3D & 2D Radiation Pattern

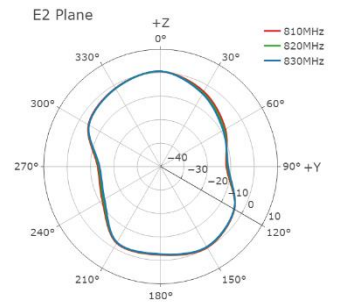
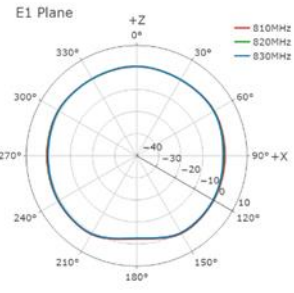
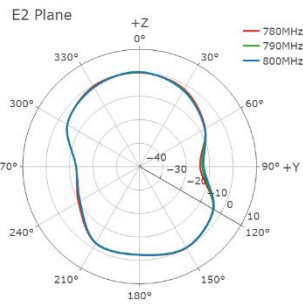
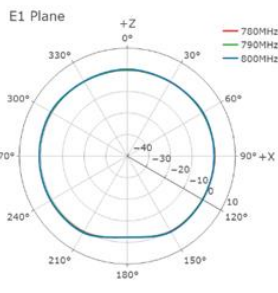
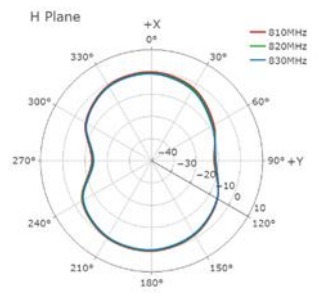
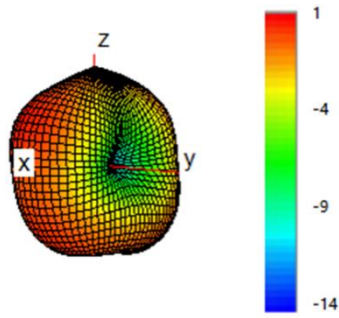
- Test Status: Assembled on a 120 × 45 mm GND.



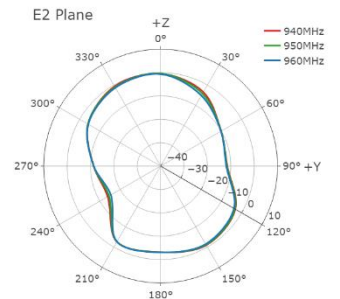
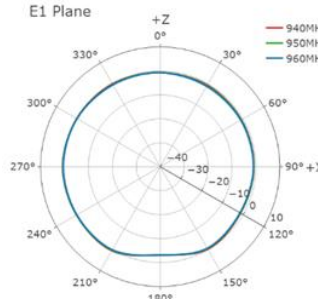
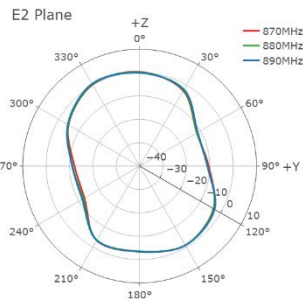
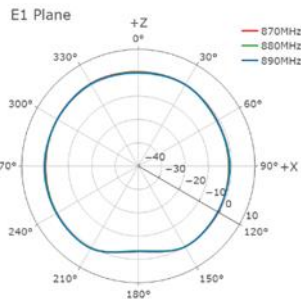
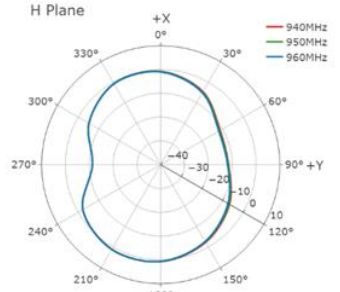
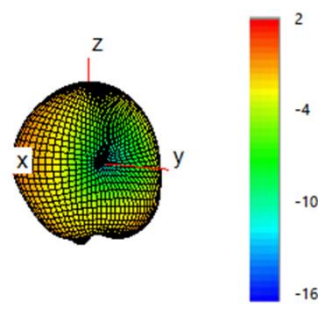
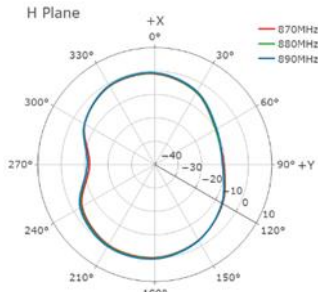
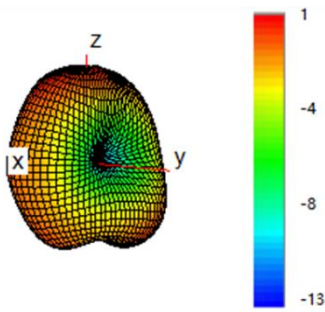
790 MHz



820 MHz



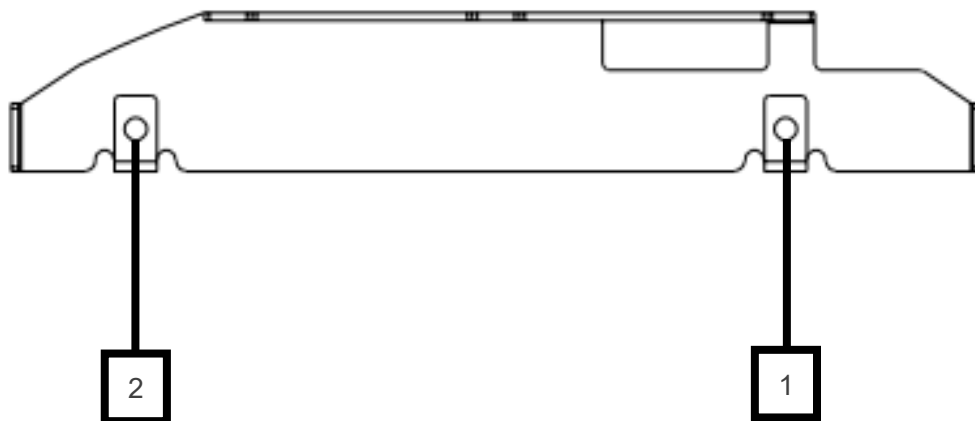
880 MHz



4 Schematic Symbol & Pin Definition

- The pin assignment for the antenna is as follows.
- The circuit symbol for the antenna is shown below. The antenna has 2 pins with only one as functional. All other pins are for mechanical strength.

Pin	Description
1	Not used (Mechanical only)
2	Feed



5 Transmission Line

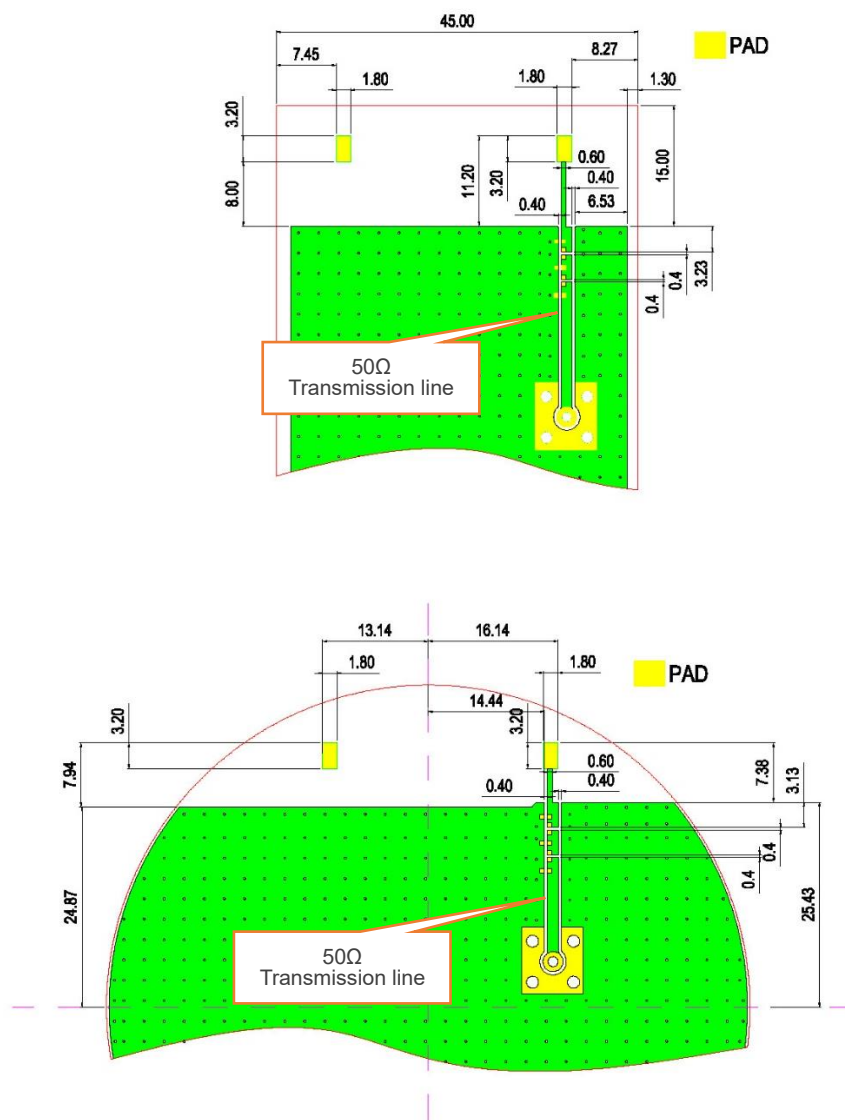
The characteristic impedance of all transmission lines shall be designed as 50 Ω .

- 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 Ω .

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 Ω .

6 Recommended PCB Layout

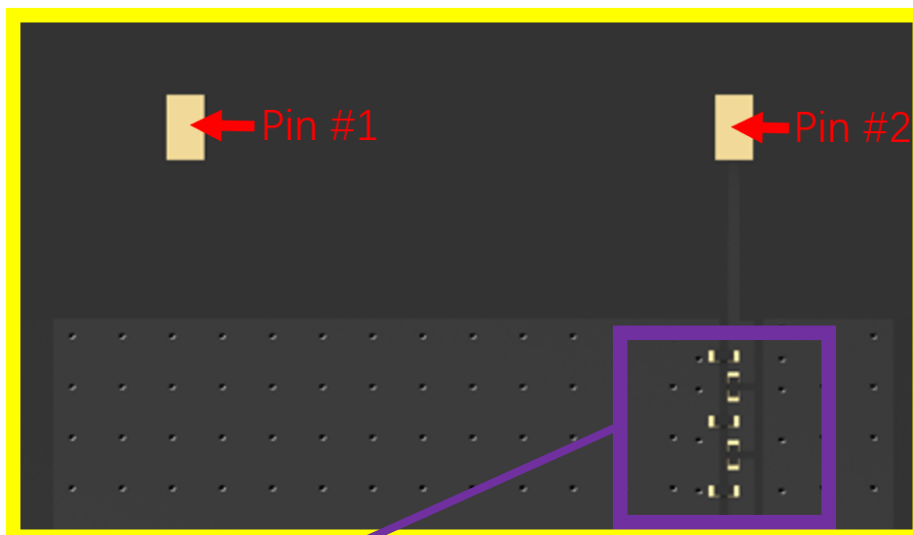
The host PCB must be designed using the PCB footprint shown with the correct clearances. An example of the PCB layout shows the antenna footprint. Please note this clearance area is critical to the performance of the antenna and must be applied through all layers of the PCB.



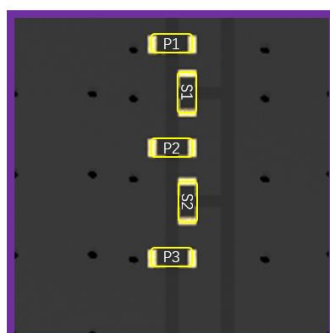
All dimensions in (mm)

7 Matching Circuit

Demo Board Top View



Antenna Matching



Pads are directly connected to the antenna feed trace.

Rectangular GND

	P1	S1	P2	S2	P3
Default Matching	2.7pF	0 Ohm	12 nH	1.2 nH	7.5 nH
Tolerance	±5 %		±5 %	±5 %	±5 %

Circular GND

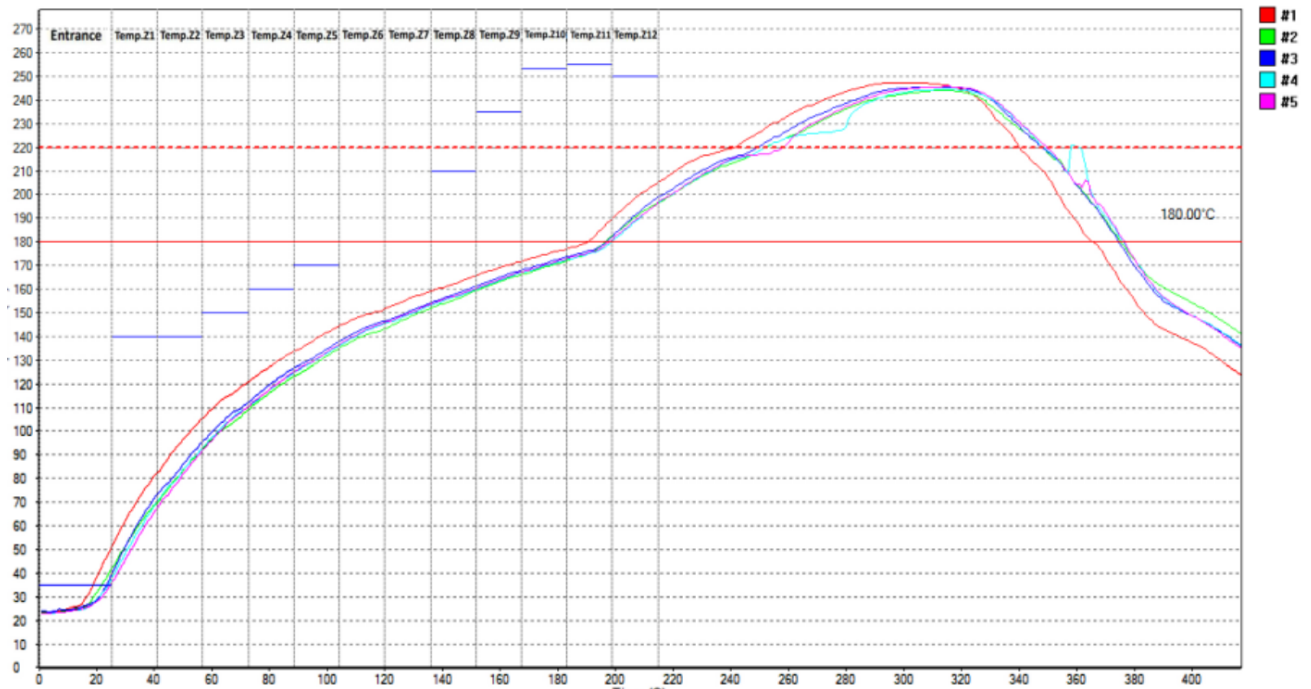
	P1	S1	P2	S2	P3
Default Matching	33 nH	0 Ohm	6.8 nH	2.4 pF	12 nH
Tolerance	±5 %		±5 %	±5 %	±5 %

Pin #	Description
1	Dummy Pad
2	Feed

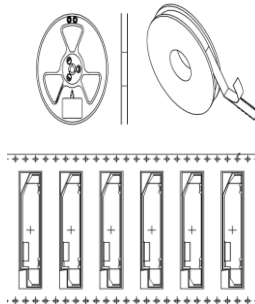
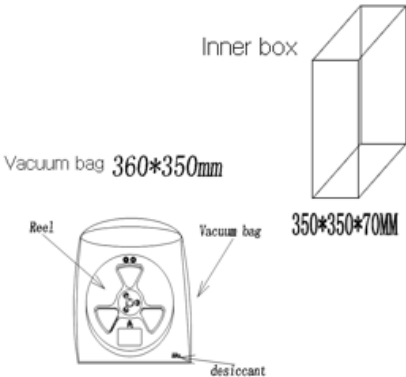
8 Soldering Temperature

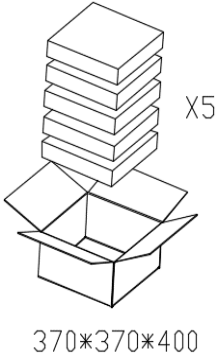
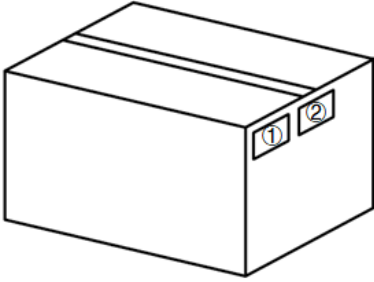
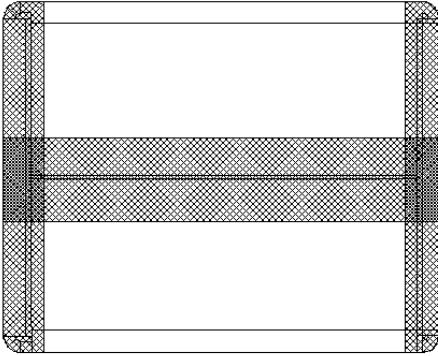
Phase	Profile Features	PB-Free Assembly
RAMP-UP	Avg. Ramp-up Rate (T _{smax} to T _p)	3 °C/second (Max.)
PREHEAT	Temperature Min (T _{smin}) Temperature Max (T _{smax}) Time (t _{smin} to t _{smax})	150 °C 190 °C 110 seconds (Max.)
REFLOW	Temperature (T _L) Total Time above T _L (t _l)	220 °C 90 seconds (Max.)
PEAK	Temperature (T _p)	230–250 °C
RAMP-DOWN	Rate	-1 °C/second (Max.)

9 Reflow Profile



10 Packaging

Step	Packaging Picture / 2D Picture	Description
1	Reel size: 330*60mm 	Quantity/Reel: 800 pcs/Reel
2	 Inner box Vacuum bag 360*350mm Reel Vacuum bag desiccant 350*350*70mm	Put the carrier tape in the vacuum bag to vacuum and put it in the inner box. (800 Antennas / <u>Inner box</u>) <u>Inner Box Size:</u> <u>L × W = 350 × 350 × 70 mm</u>

3	 370*370*400	5 <u>Inner Boxes</u> / Carton Box) (4000 Antennas / Carton Box) <u>Carton Size:</u> <u>L × W × H = 370 × 370 × 400 mm</u>
4		Position for Attaching Labels ① Carton Label ② Quality Label
5		Sealing Cartons “I” type sealing cartons

Contact Us

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Revision History

Version	Date	Author	Note
-	2023-01-05	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	Creation of the document
1.0	2023-01-05	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	First official release
1.1	2023-04-04	Andy YAN/ Lance SUN/ David LIU/ Vinnie LIU	Updated the figure style.
1.2	2023-06-07	Lance SUN	- Updated the storage temperature (Chapter 1.3). - Updated the antenna drawing (Chapter 2.1).



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