3.2 x 1.6 x 0.5 (mm) GPS & WiFi (B.T.) Combo Ceramic Chip Antenna (AA089) Engineering Specification

1. Product Number

H	2	U	9	4	W	1	H	1	G	0	3	0	0

2. Features

*Stable and reliable in performances
*Good isolation between GPS bands and WiFi (Bluetooth) bands
*Low profile, compact size
*RoHS 2.0 compliance
*SMT processes compatible
*Compatible with individual signal input or combined signal input
*AEC-Q200 compliant

3. Applications

*For GPS applications
*For Wi-Fi/ Bluetooth/ BLE/ ZigBee/ 2.4GHz applications
*For wireless devices when both GPS and Wi-Fi(Bluetooth) functions are needed, e.g., Smart phone, Tablet PC, Tracker, Real time video recorder. Smart watch…etc.

4. Description

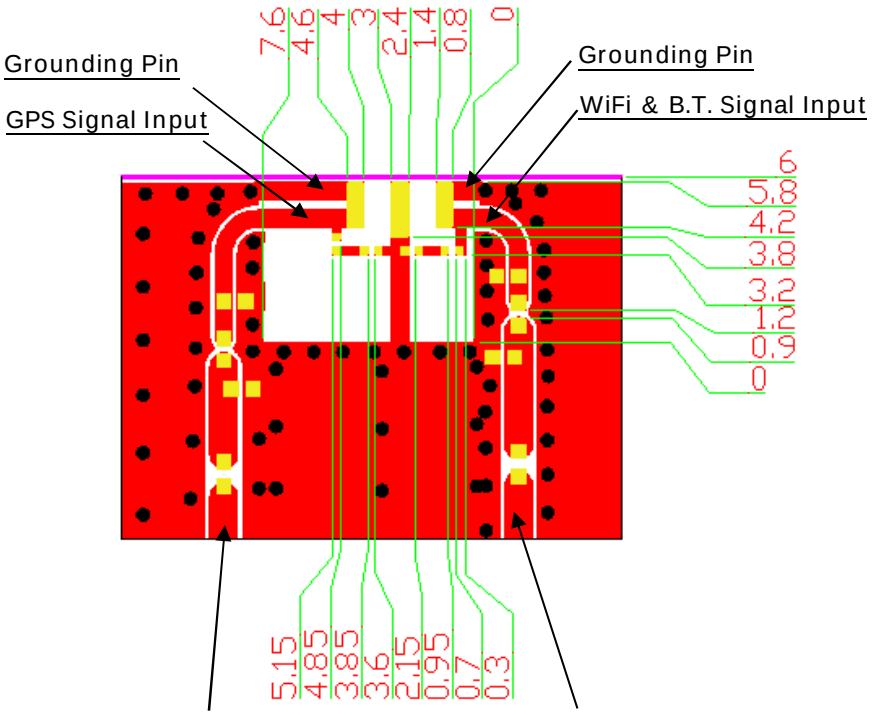
Unictron's AA089 ceramic chip antenna is designed for GPS & Wi-Fi (B.T.) 2.4GHz band applications, covering frequencies 1575.42 MHz & 2400~2500MHz. Fabricated with proprietary design and processes, AA089 shows excellent performance and is fully compatible with SMT processes which can decrease the assembly cost and improve device's quality and consistency.

5. Application for individual signal mode

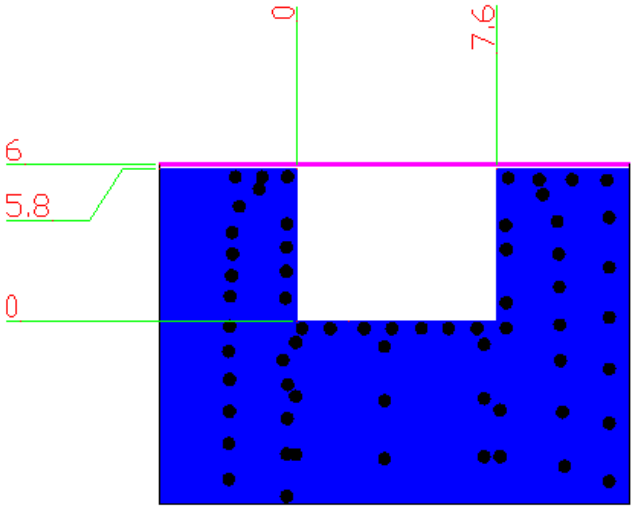
5-1. Layout Guide (Unit：mm)

Solder Land Pattern:

The solder land pattern (gold marking areas) is shown below. Recommendation on matching circuit will be provided according to customer's installation conditions.



Top View



Bottom View

5-2. Electrical Specifications (Evaluation Board Dimensions: 80 x 40 mm^2)

5-2-1. Electrical Table (GPS Band)

Characteristics		Specifications	Unit
Outline Dimensions		3.2 x 1.6 x 0.5	mm
Ground Plane Dimensions		80 x 40	mm
Working Frequency		1575.42	MHz
Isolation(S_{21})		≦-20 (typical)	dB
VSWR (@ center frequency)*		2 Max.	
Characteristic Impedance		50	Ω
Polarization		Linear Polarization	
Peak Gain	(@1575.42 MHz)	1.3 (typical)	dBi
Efficiency		61 (typical)	%

*Center frequency means the frequency with the lowest value in return loss of the chip antenna on the evaluation board.

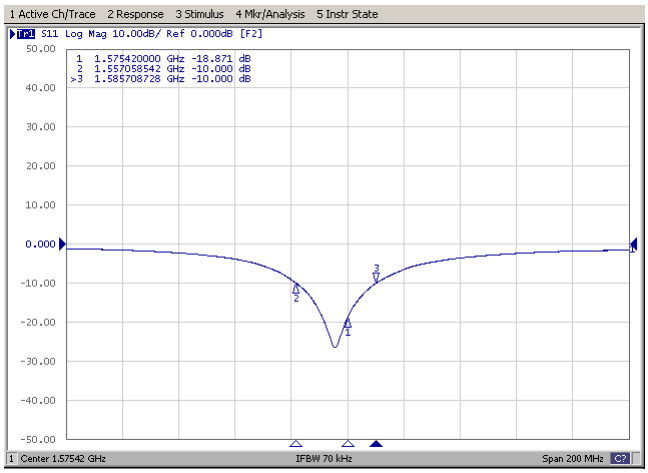
5-2-2. Electrical Table (WiFi & B.T. Band)

Characteristics		Specifications	Unit
Working Frequency		2400~2500	MHz
Isolation(S_{21})		≦-16 (typical)	dB
VSWR (@ center frequency)*		2 Max.	
Characteristic Impedance		50	Ω
Polarization		Linear Polarization	
Peak Gain	(@2442 MHz)	1.8 (typical)	dBi
Efficiency		68 (typical)	%

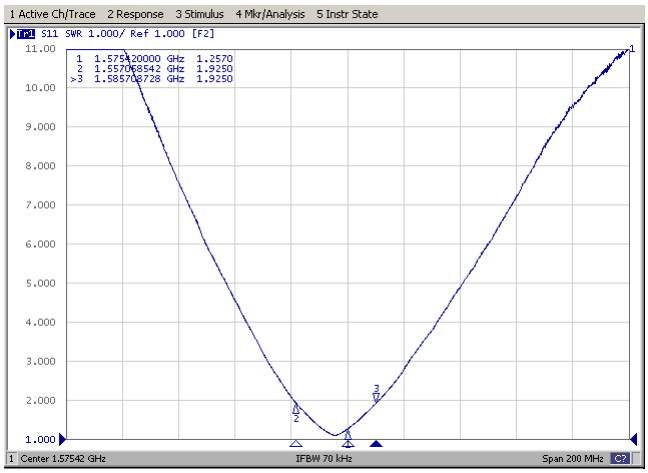
*Center frequency means the frequency with the lowest value in return loss of the chip antenna on the evaluation board.

5-2-3. Return Loss & VSWR of GPS Band

Return Loss (S_{11})

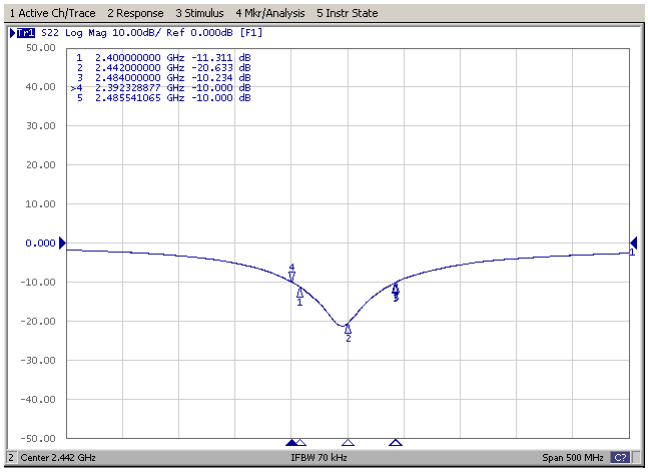


VSWR(S_{11})

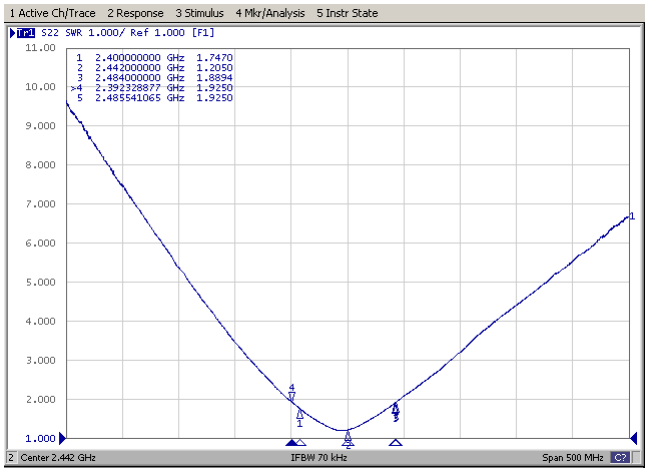


5-2-4. Return Loss & VSWR of WiFi (B.T.) Band

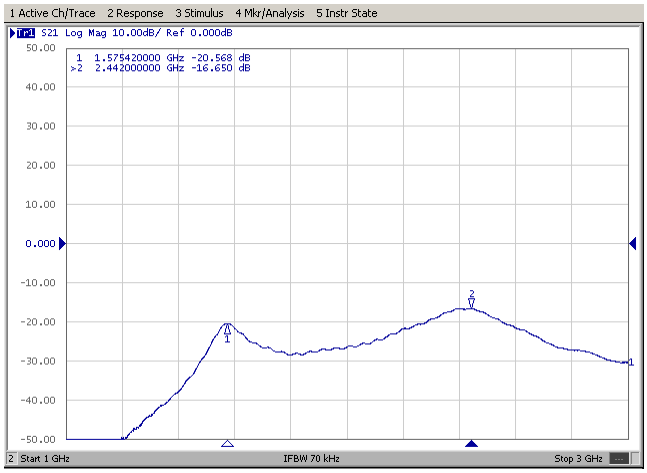
Return Loss (S_{11})



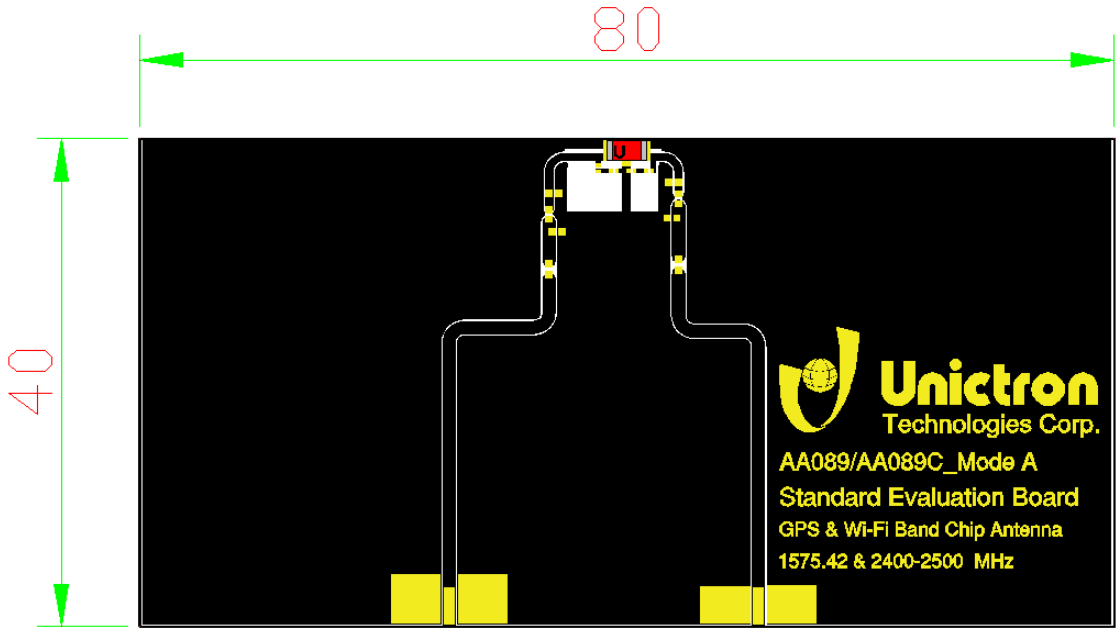
VSWR(S_{11})



5-2-5. Isolation between GPS Band & WiFi (B.T.) Band



5-3. Evaluation Board with Antenna

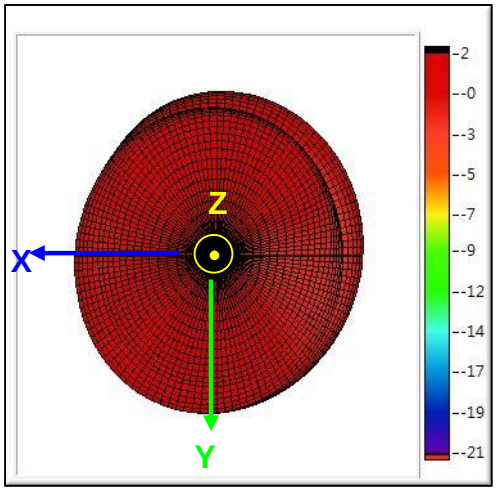


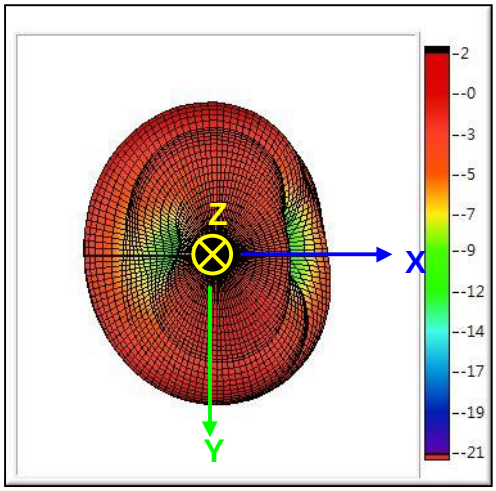
Unit : mm

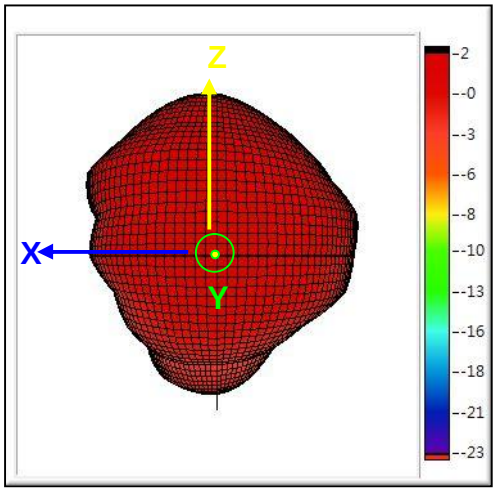
5-4. Radiation Pattern (with 80 x 40 mm^2 Evaluation Board)

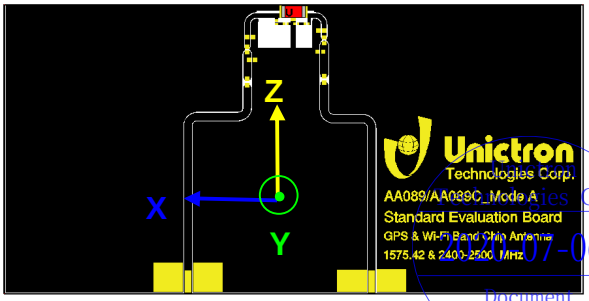
5-4-1 GPS Band

5-4-1-1. 3D Gain Pattern @ 1575.42 MHz (unit: dBi)





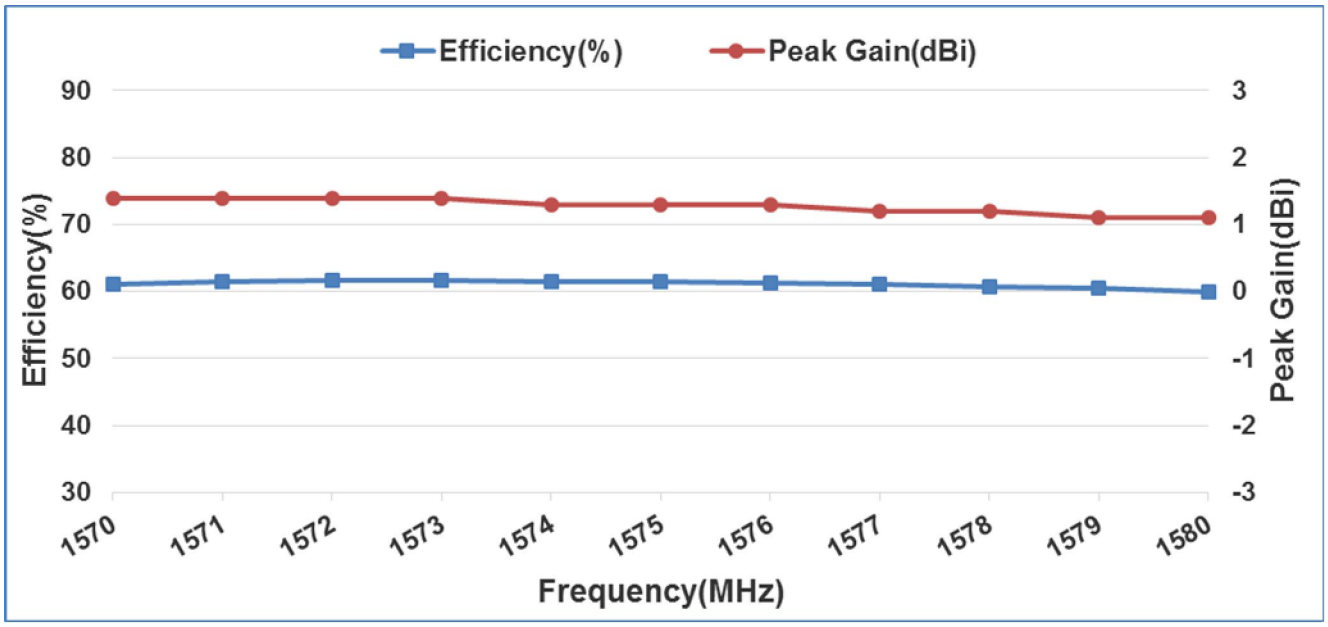




5-4-1-2. 3D Efficiency Table

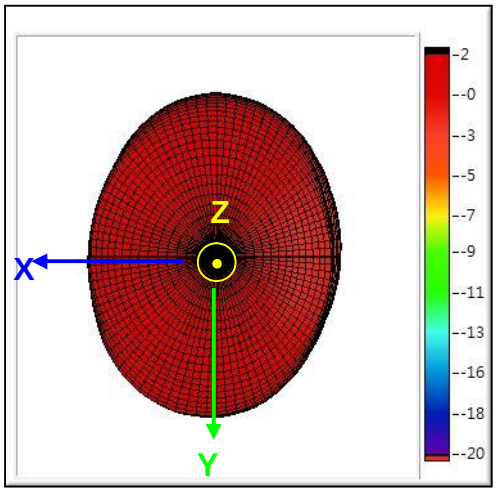
Frequency(MHz)	1570	1571	1572	1573	1574	1575	1576	1577	1578	1579	1580
Efficiency(dB)	-2.1	-2.1	-2.1	-2.1	-2.1	-2.1	-2.1	-2.1	-2.2	-2.2	-2.2
Efficiency(%)	61.0	61.4	61.7	61.6	61.4	61.4	61.3	61.0	60.7	60.6	60.0
Peak Gain(dBi)	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.1	1.1

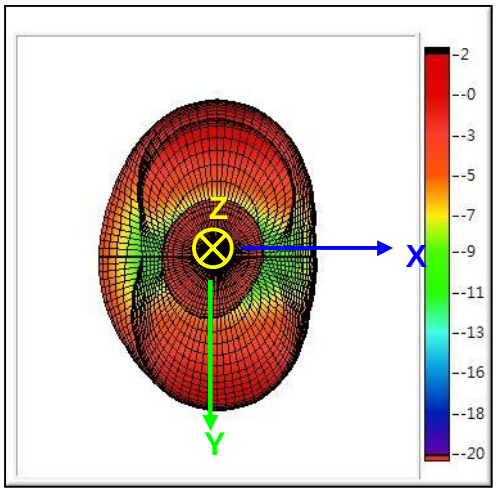
5-4-1-3. 3D Efficiency vs. Frequency

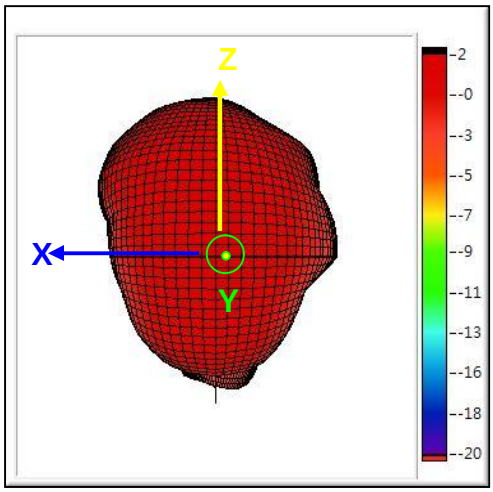


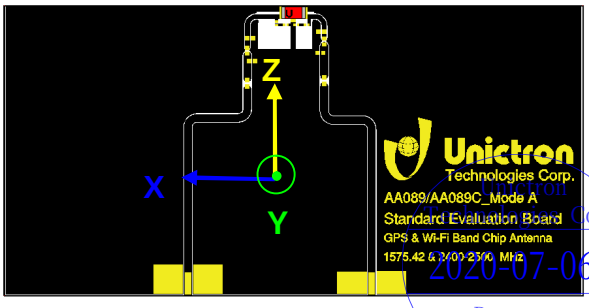
5-4-2. WiFi & B.T. Band

5-4-2-1. 3D Gain Pattern @ 2442 MHz (unit: dBi)





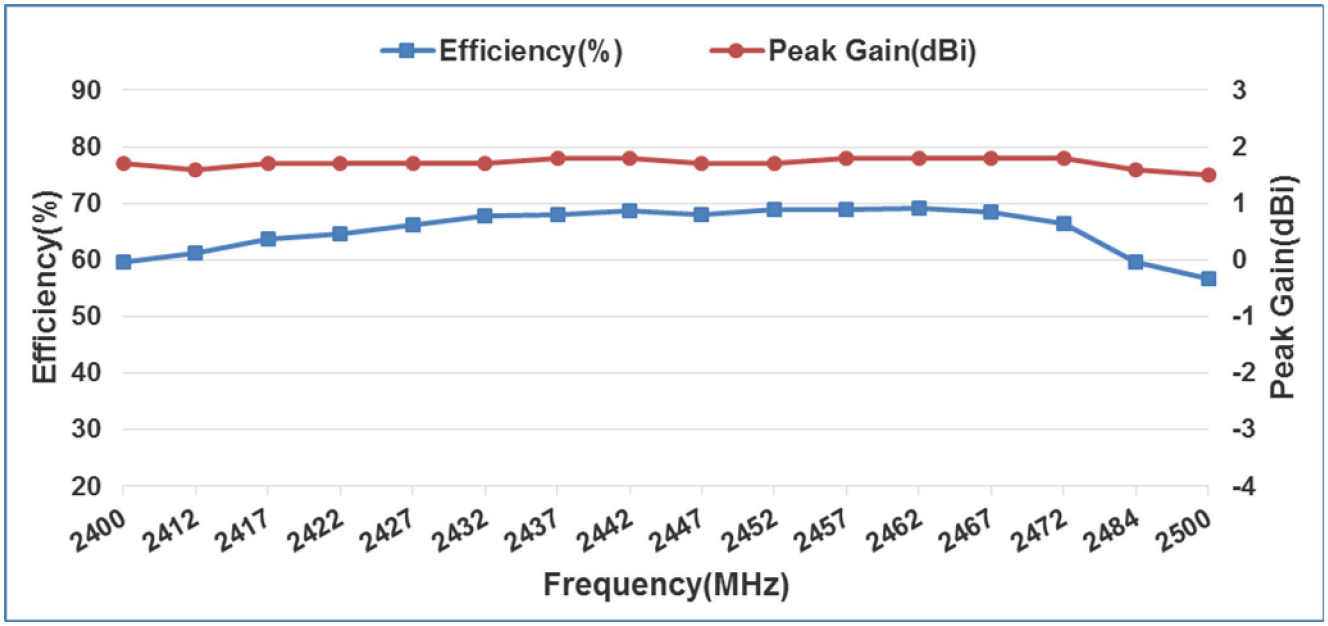




5-4-2-2. 3D Efficiency Table

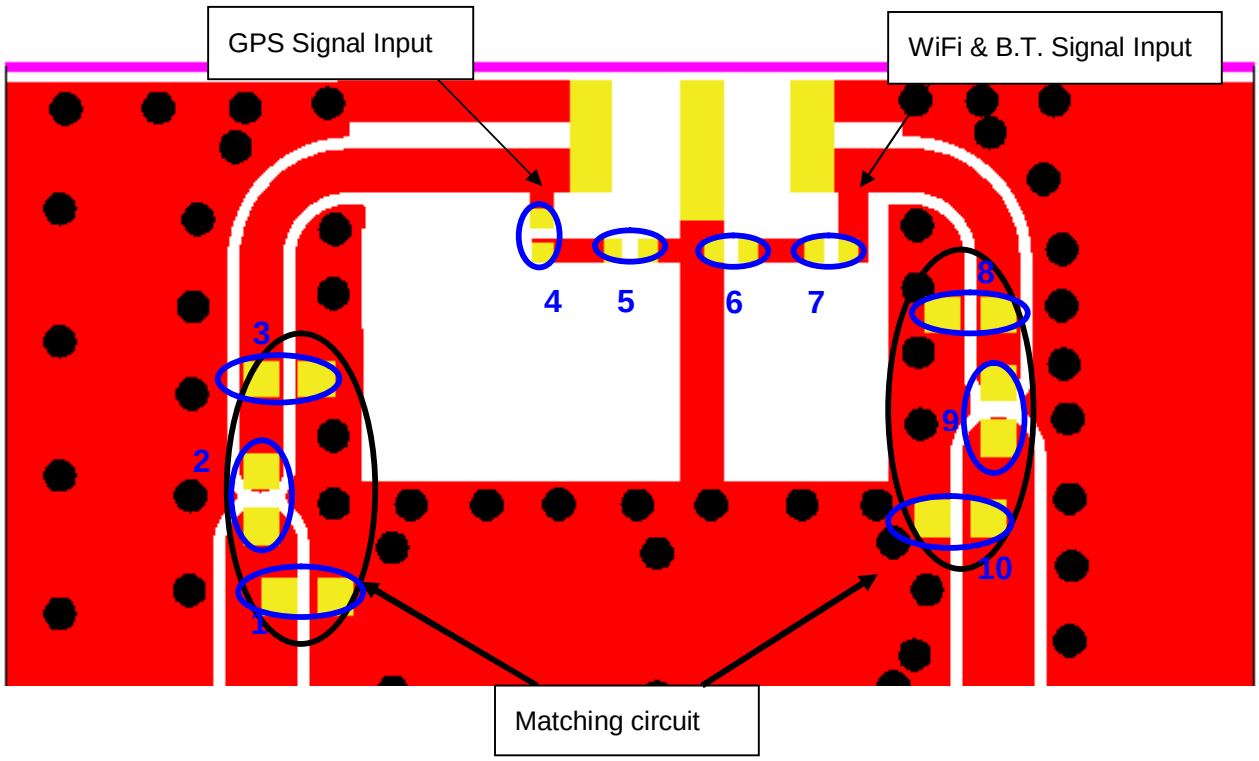
Frequency(MHz)	2400	2412	2417	2422	2427	2432	2437	2442	2447	2452	2457	2462	2467	2472	2484	2500
Efficiency(dB)	-2.2	-2.1	-2.0	-1.9	-1.8	-1.7	-1.7	-1.6	-1.7	-1.6	-1.6	-1.6	-1.6	-1.8	-2.2	-2.5
Efficiency(%)	59.6	61.1	63.8	64.7	66.1	67.7	68.1	68.7	68.1	68.9	69.0	69.2	68.5	66.4	59.7	56.6
Peak Gain(dBi)	1.7	1.6	1.7	1.7	1.7	1.7	1.8	1.8	1.7	1.7	1.8	1.8	1.8	1.8	1.6	1.5

5-4-2-3. 3D Efficiency vs. Frequency



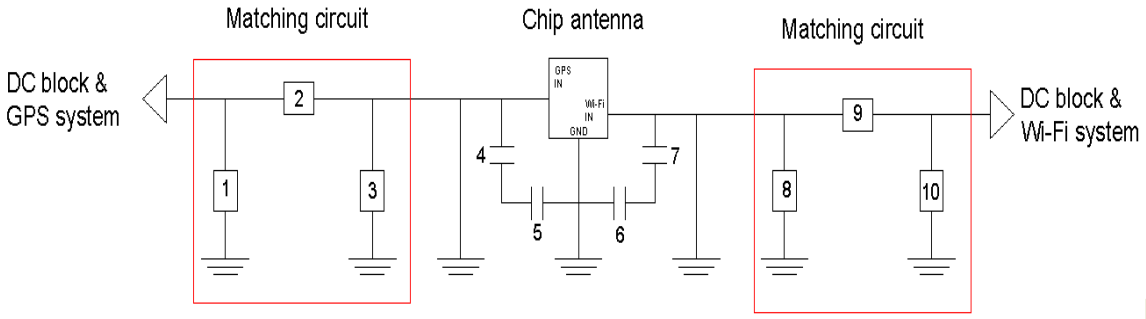
5-5. Frequency tuning and Matching circuit

5-5-1. Chip antenna tuning scenario：



5-5-2. Matching circuit：

With the following recommended values of matching and tuning components, the center frequencies will be about 1575.42 MHz on GPS band and 2442 MHz on WiFi (B.T.) band at our standard 80 x 40 mm^2 evaluation board. However, these are typical reference values which may need to be changed when circuit boards or part vendors are different.



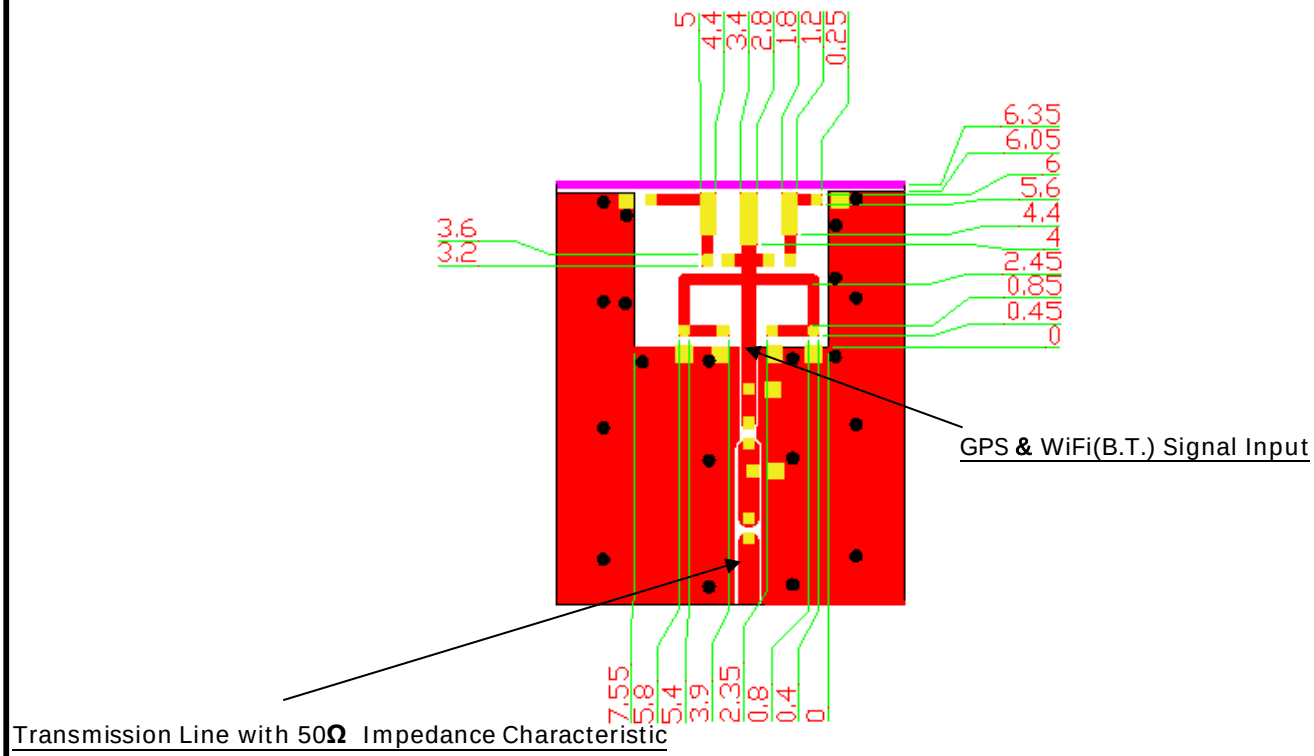
System Matching Circuit Component			
Location	Description	Vendor	Tolerance
1	N/A	-	-
2	4.7nH, (0402)	MURATA	±0.3nH
3	N/A	-	-
4 Fine tuning element	2.7pF, (0201)	MURATA	±0.05pF
5 Fine tuning element	1pF, (0201)	MURATA	±0.05pF
6 Fine tuning element	0.6pF, (0201)	MURATA	±0.05pF
7 Fine tuning element	0.8pF, (0201)	MURATA	±0.05pF
8	N/A		
9	0Ω, (0402)	-	-
10	N/A		
DC Block	22pF, (0402)	MURATA	±5%

6. Application for combined signal mode

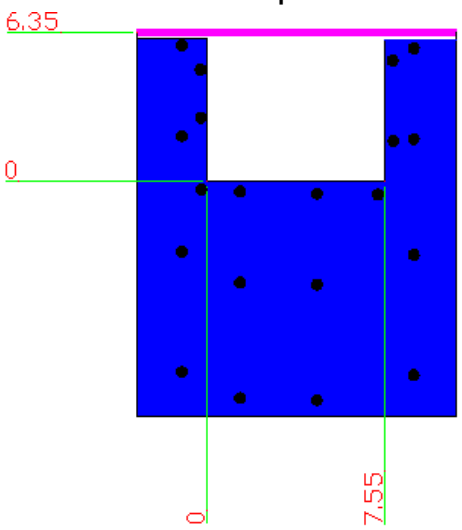
6-1. Layout Guide (Unit：mm)

Solder Land Pattern:

The solder land pattern (gold marking areas) is shown below. Recommendation on matching circuit will be provided according to customer's installation conditions.



Top View



Bottom View

6-2. Electrical Specifications (Evaluation Board Dimensions: 80 x 40 mm^2)

6-2-1. Electrical Table (GPS Band)

Characteristics		Specifications	Unit
Outline Dimensions		3.2 x 1.6 x 0.5	mm
Ground Plane Dimensions		80 x 40	mm
Working Frequency		1575.42	MHz
VSWR(@ center frequency)*		2 Max.	
Characteristic Impedance		50	Ω
Polarization		Linear Polarization	
Peak Gain	(@1575.42 MHz)	2.0 (typical)	dBi
Efficiency		65 (typical)	%

*Center frequency means the resonance frequency of chip antenna on the evaluation board.

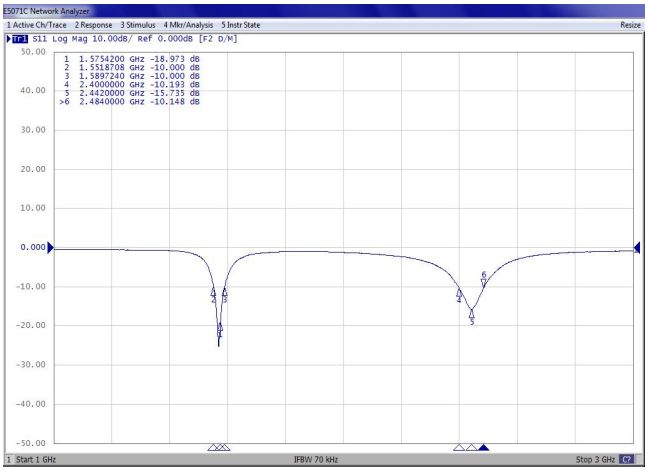
6-2-2. Electrical Table (WiFi & B.T. Band)

Characteristics		Specifications	Unit
Working Frequency		2400~2500	MHz
VSWR(@ center frequency)*		2 Max.	
Characteristic Impedance		50	Ω
Polarization		Linear Polarization	
Peak Gain	(@2442 MHz)	-0.4 (typical)	dBi
Efficiency		54 (typical)	%

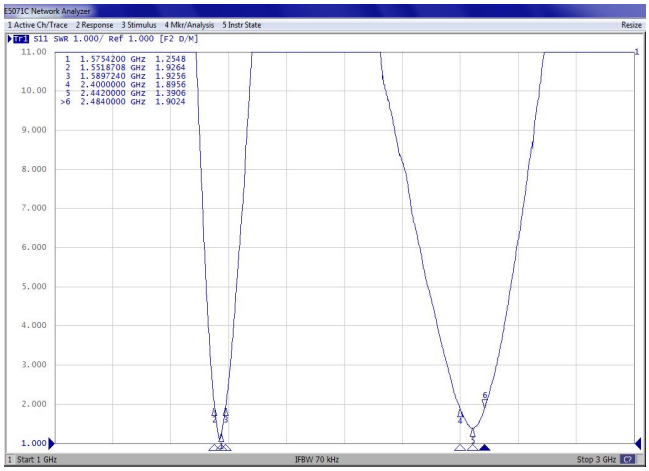
*Center frequency means the resonance frequency of chip antenna on the evaluation board.

6-2-3. Return Loss & VSWR

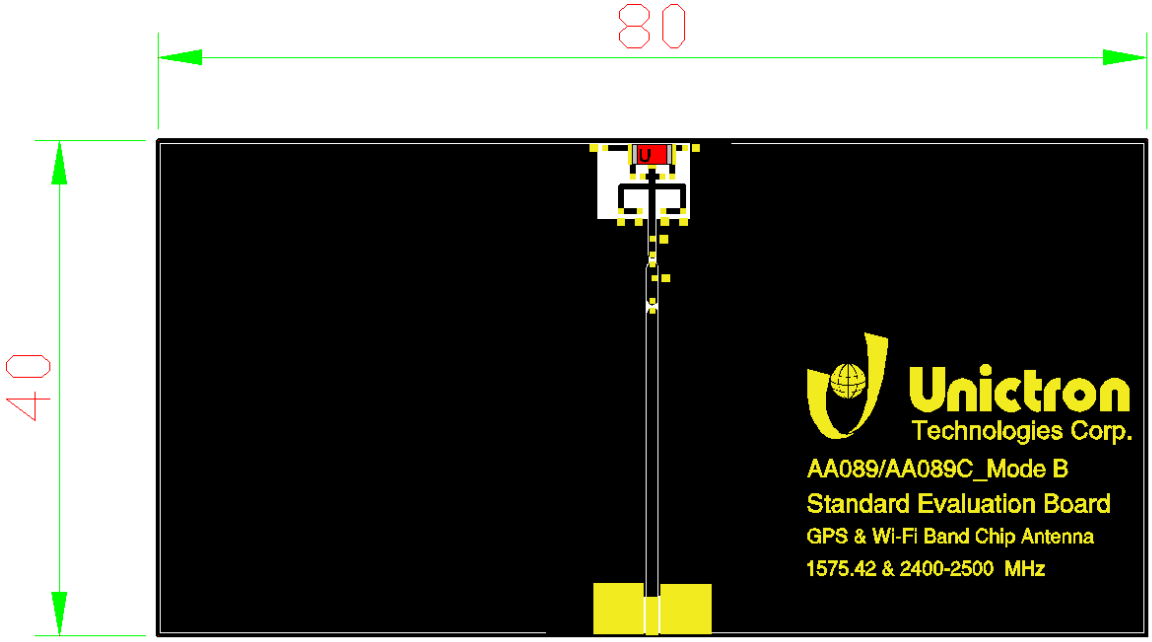
Return Loss (S_{11})



VSWR(S_{11})



6-3. Evaluation Board with Antenna

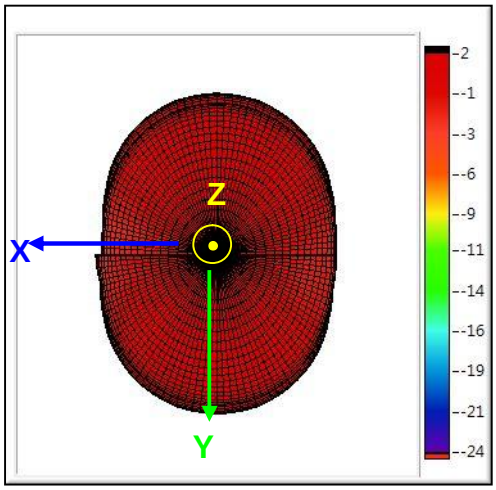


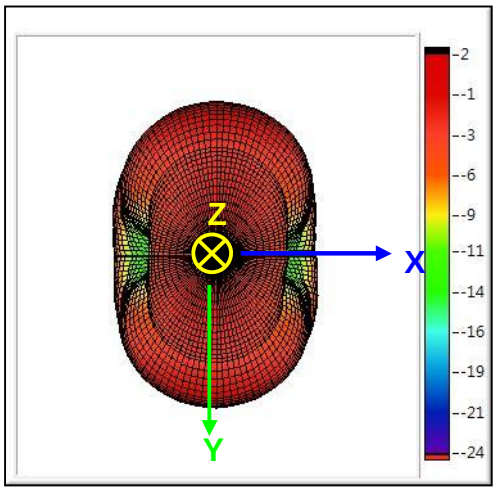
Unit : mm

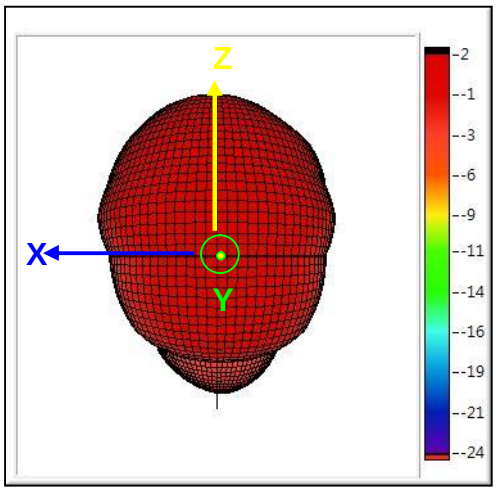
6-4. Radiation Pattern (with 80 x 40 mm^2 Evaluation Board)

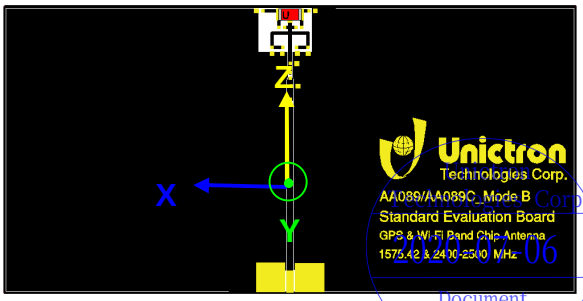
6-4-1 GPS Band

6-4-1-1. 3D Gain Pattern @ 1575.42 MHz (unit: dBi)





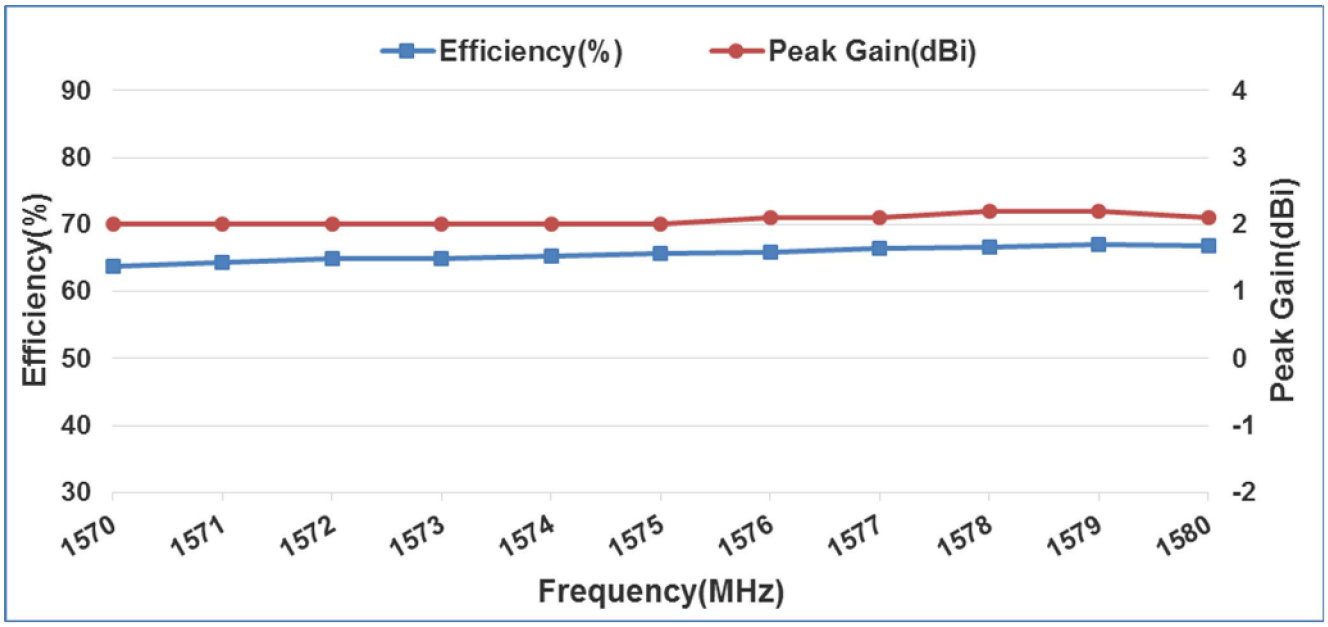




6-4-1-2. 3D Efficiency Table

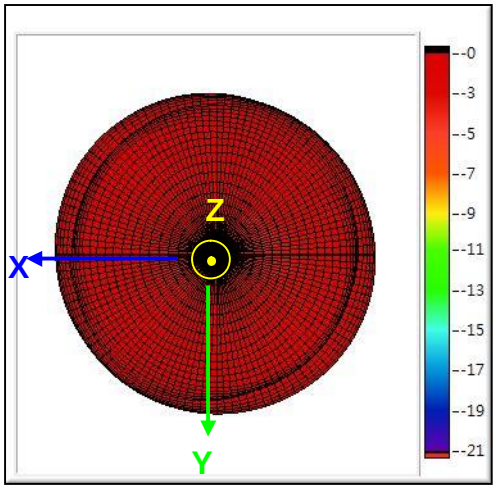
Frequency(MHz)	1570	1571	1572	1573	1574	1575	1576	1577	1578	1579	1580
Efficiency(dB)	-2.0	-1.9	-1.9	-1.9	-1.9	-1.8	-1.8	-1.8	-1.8	-1.7	-1.8
Efficiency(%)	63.7	64.4	65.0	65.0	65.2	65.6	65.9	66.4	66.7	67.0	66.8
Peak Gain(dBi)	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.1	2.2	2.2	2.1

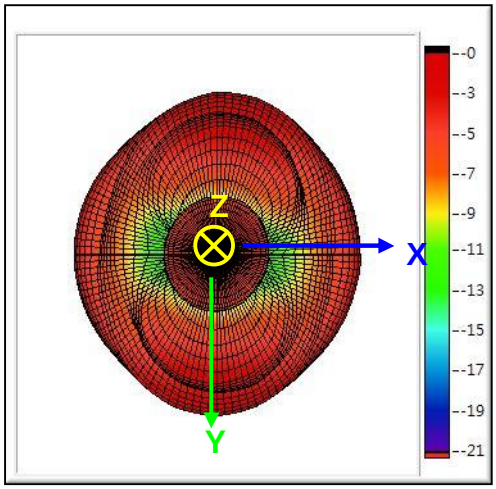
6-4-1-3. 3D Efficiency vs. Frequency

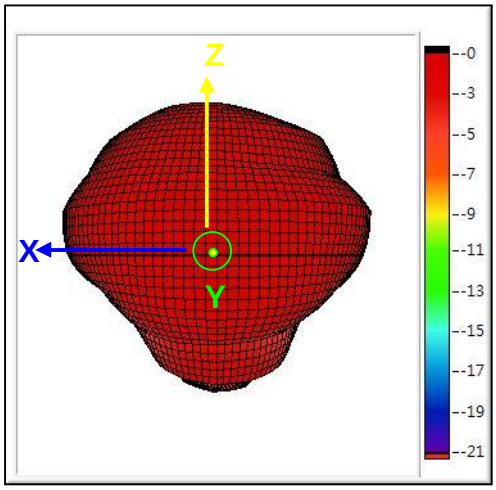


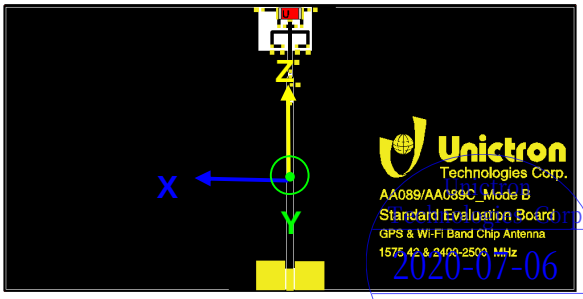
6-4-2. WiFi & B.T. Band

6-4-2-1. 3D Gain Pattern @ 2442 MHz (unit: dBi)





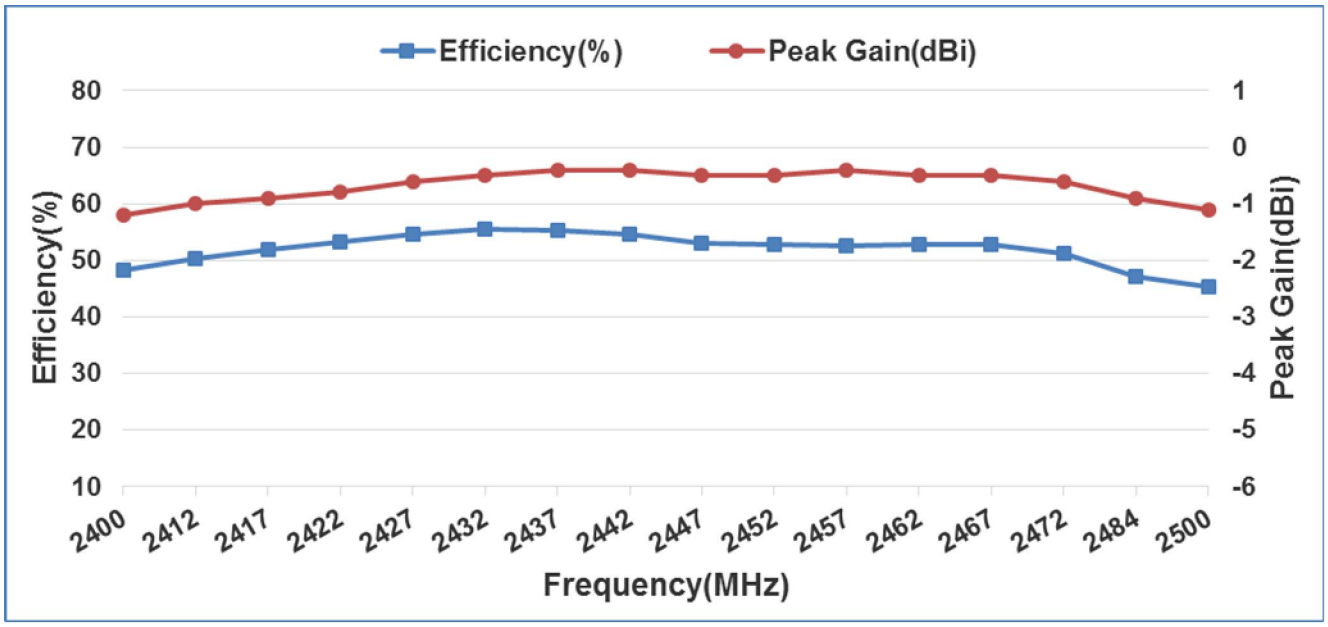




6-4-2-2. 3D Efficiency Table

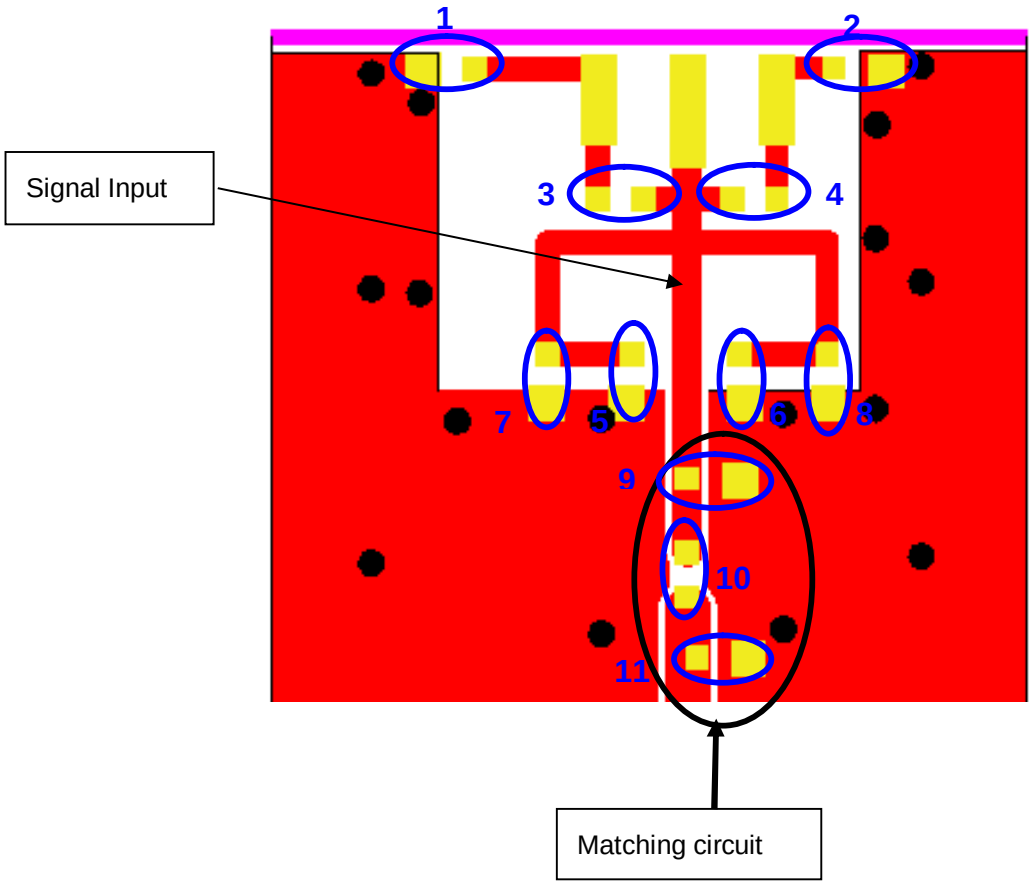
Frequency(MHz)	2400	2412	2417	2422	2427	2432	2437	2442	2447	2452	2457	2462	2467	2472	2484	2500
Efficiency(dB)	-3.2	-3.0	-2.9	-2.7	-2.6	-2.6	-2.6	-2.6	-2.8	-2.8	-2.8	-2.8	-2.8	-2.9	-3.3	-3.4
Efficiency(%)	48.2	50.2	51.8	53.3	54.5	55.5	55.2	54.7	53.0	52.8	52.6	52.8	52.8	51.1	47.1	45.2
Peak Gain(dBi)	-1.2	-1.0	-0.9	-0.8	-0.6	-0.5	-0.4	-0.4	-0.5	-0.5	-0.4	-0.5	-0.5	-0.6	-0.9	-1.1

6-4-2-3. 3D Efficiency vs. Frequency



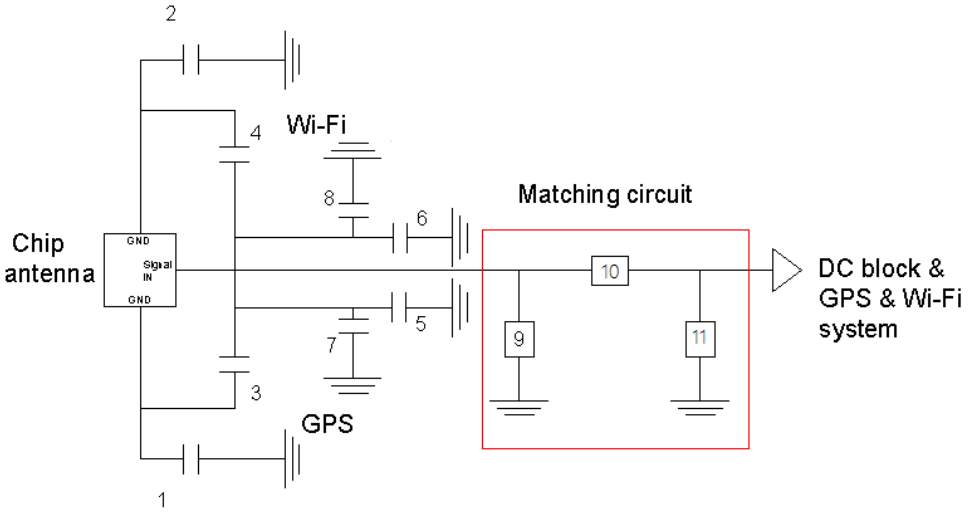
6-5. Frequency tuning and Matching circuit

6-5-1. Chip antenna tuning scenario：



6-5-2. Matching circuit：

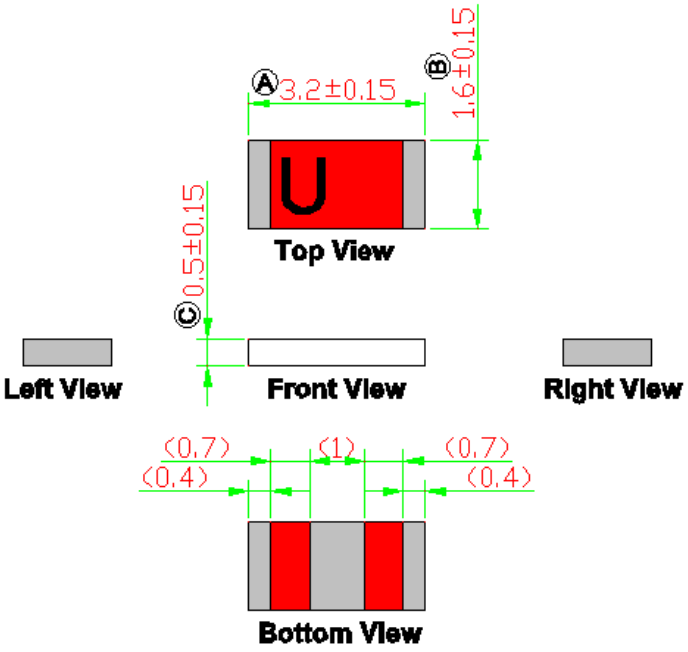
With the following recommended values of matching and tuning components, the center frequencies will be about 1575.42 MHz on GPS band and 2442 MHz on WiFi (B.T.) band at our standard 80x40 mm^2 evaluation board. However, these are typical reference values which may need to be changed when circuit boards or part vendors are different.



System Matching Circuit Component			
Location	Description	Vendor	Tolerance
1 Fine tuning element	4.3pF, (0402)	MURATA	±0.05pF
2 Fine tuning element	2.2pF, (0402)	MURATA	±0.05pF
3 Fine tuning element	1.5pF, (0201)	MURATA	±0.05pF
4 Fine tuning element	0.8pF, (0201)	MURATA	±0.05pF
5 Fine tuning element	39pF, (0402)	MURATA	±5%
6 Fine tuning element	0Ω, (0402)	-	-
7 Fine tuning element	N/A	-	-
8 Fine tuning element	N/A	-	-
9	1.5pF, (0402)	MURATA	±0.05pF
10	0Ω, (0402)	-	-
11	N/A	-	-
DC Block	22pF, (0402)	MURATA	±5%

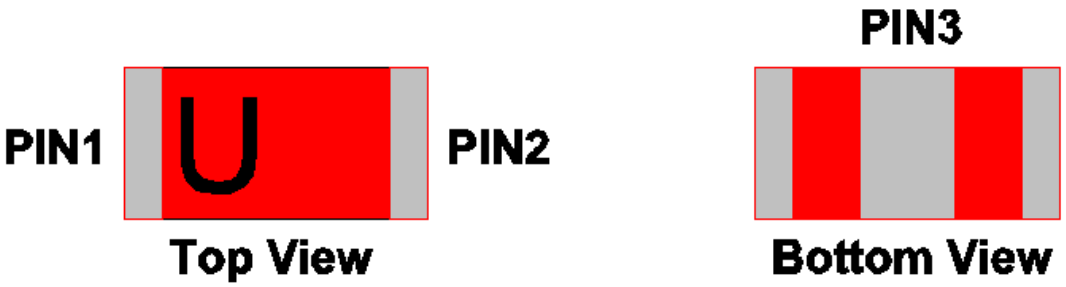
7. Outline Dimensions of Antenna & Evaluation Board (unit: mm)

7-1. Antenna Dimensions



NOTE:
1.All materials are RoHS compliant.
2."Ⓐ~Ⓒ" Critical Dimensions.
3."( )" Reference Dimensions.

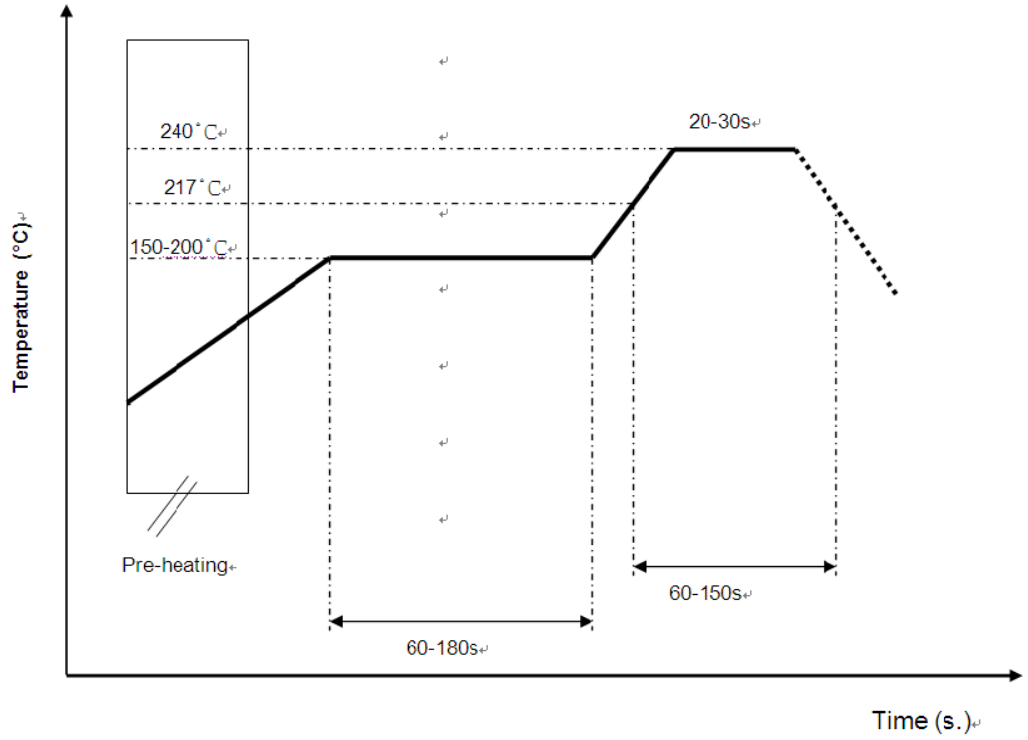
PIN Definitions



PIN	1	2	3
Soldering PAD (Individual signal)	GPS Signal	Wi-Fi & B.T. Signal	Tuning / Ground
Soldering PAD (Combined signal)	Tuning / Ground	Tuning / Ground	GPS & Wi-Fi(B.T.) Signal

8. Soldering Conditions

8-1. Typical Soldering Profile for Lead-free Process



*Recommended solder paste alloy: SAC305 (Sn96.5 /Ag3 /Cu0.5) Lead Free solder paste

9. Reminders for users of Unictron's AA089 ceramic chip antennas

9-1. This chip antenna is made of ceramic materials which is relatively more rigid and brittle compared to circuit board materials. Furthermore, the length of this antenna is quite long. Bending of circuit board at the locations where chip antenna is mounted may cause the cracking of solder joints or antenna itself.

9-2. Punching/cutting of the break-off tab of PCB panel may cause severe bending of the circuit board which may result in cracking of solder joints or chip antenna itself. Therefore break-off tab shall be located away from the installation site of chip antenna.

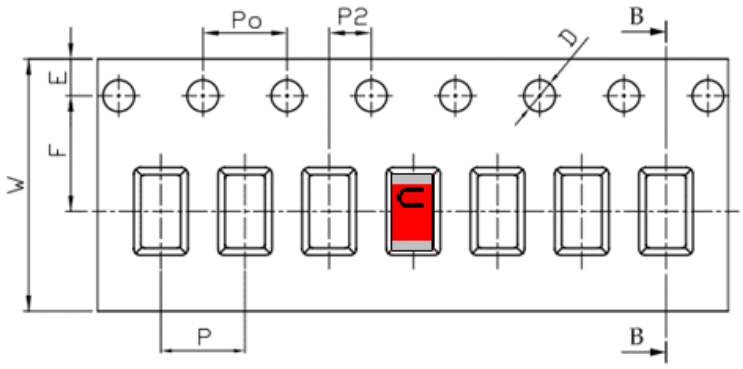
9-3. Be cautious when ultrasonic welding process needs to be used near the locations where chip antennas are installed. Strong ultrasonic vibration may cause the cracking of chip antenna solder joints.

10. Packing

(1) Quantity/Reel: 5000 pcs/Reel

(2) Plastic tape:

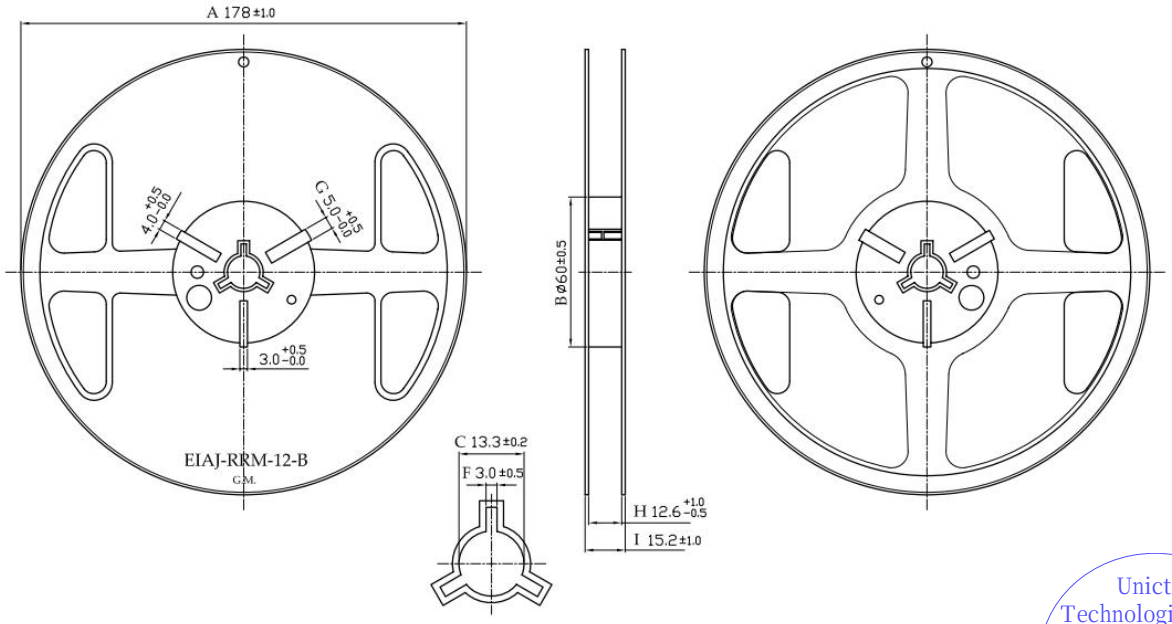
a. Tape Drawing



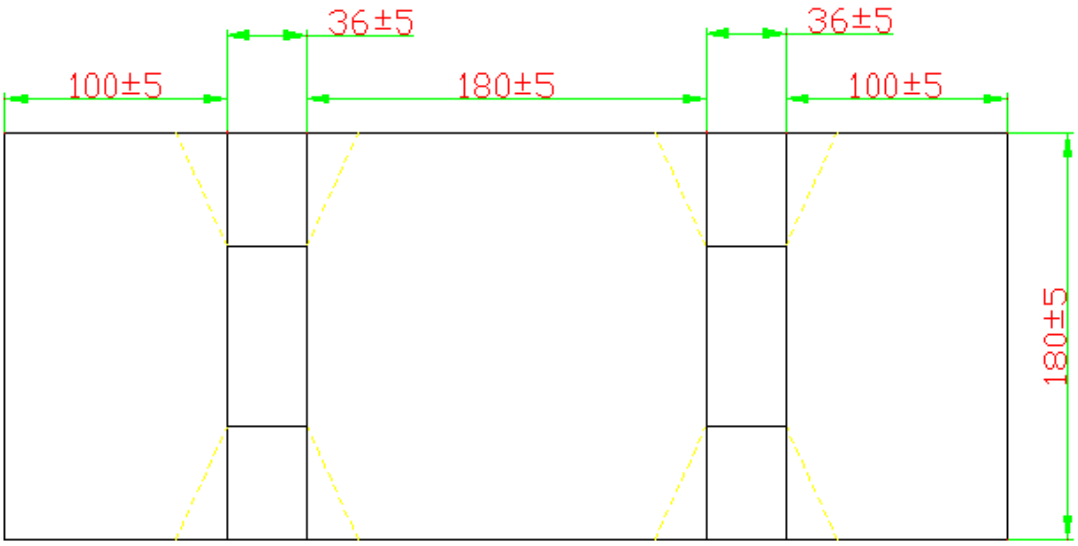
b. Tape Dimensions (unit: mm)

Feature	Specifications	Tolerances
W	12.00	±0.30
P	4.00	±0.10
E	1.75	±0.10
F	5.50	±0.10
P2	2.00	±0.10
D	1.50	+0.10 -0.00
Po	4.00	±0.10
10Po	40.00	±0.20

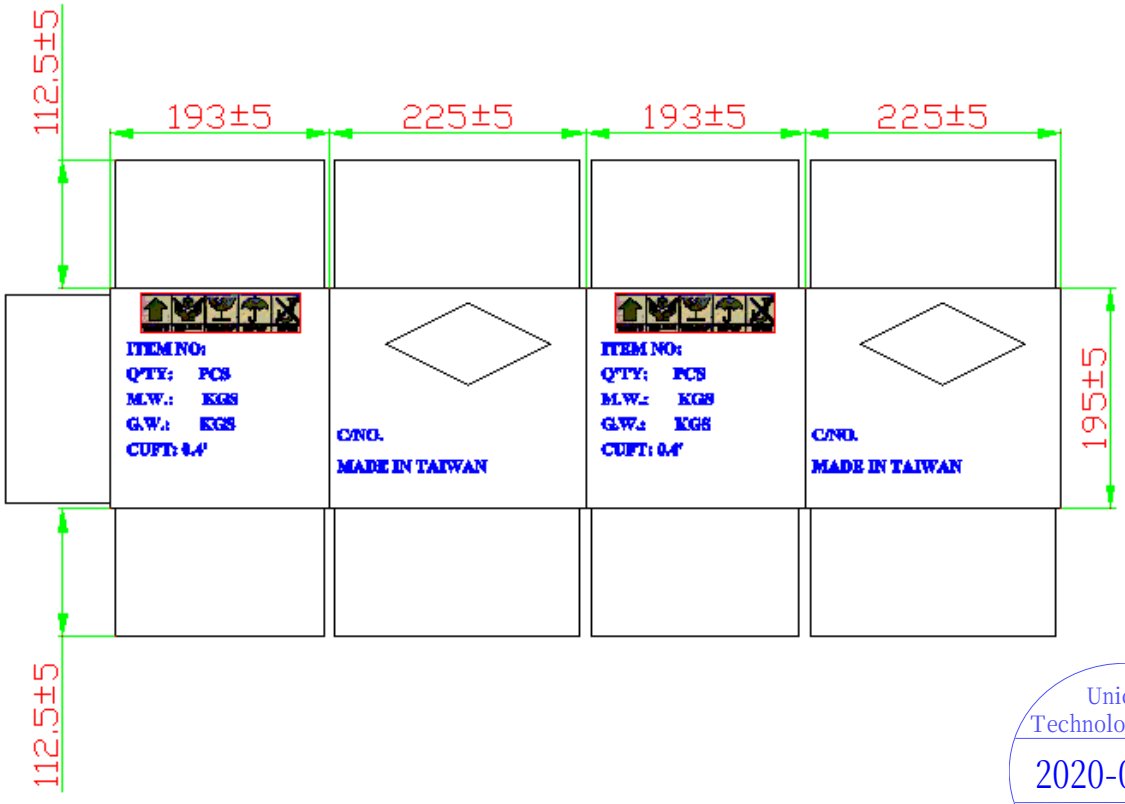
c. Reel Drawing



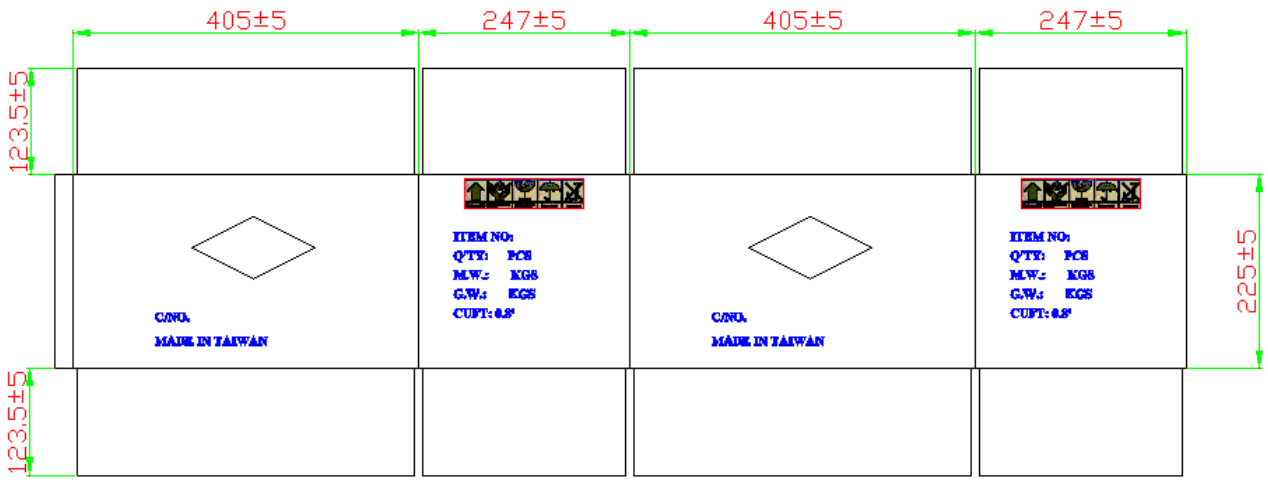
d. Drawing of small size carton in developed view



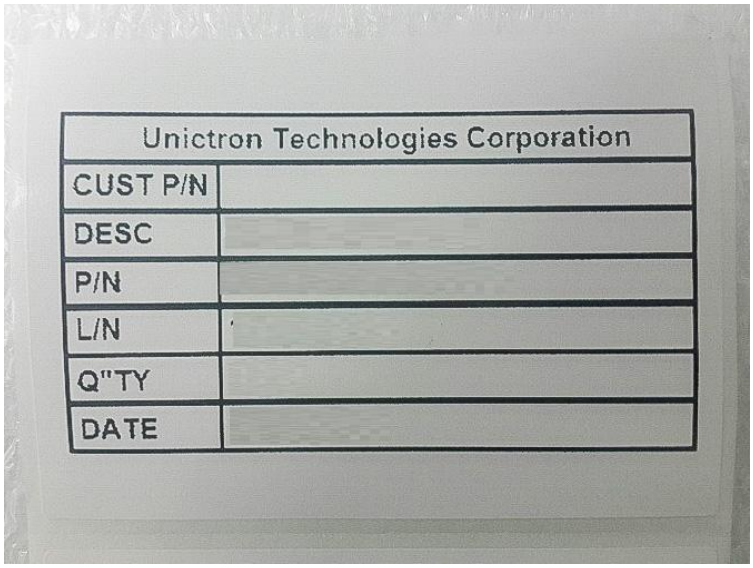
e. Drawing of middle size carton in developed view



e. Drawing of large size carton in developed view

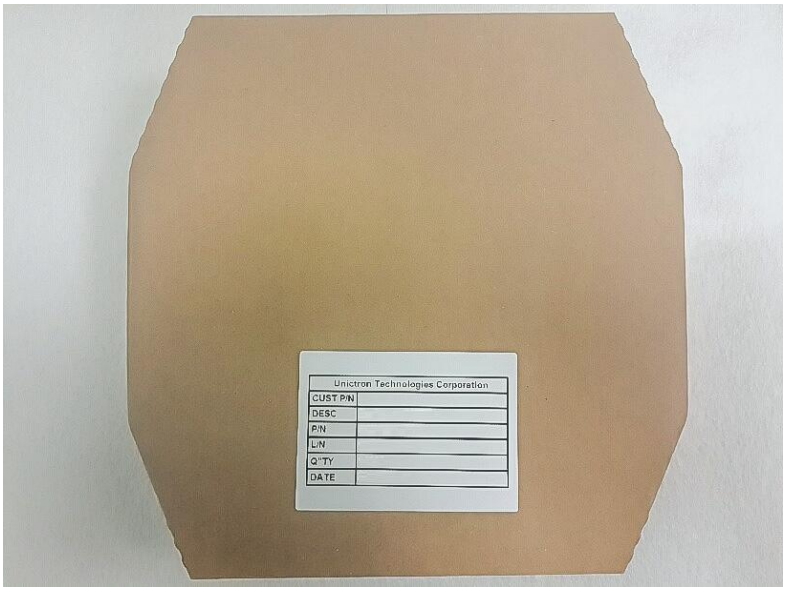


f. Picture of label



g. Reel with label

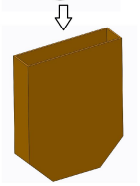
h. Small size carton with label



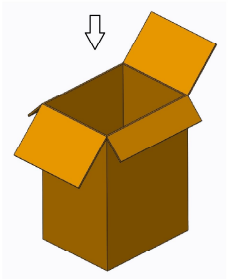
i. Middle size carton with label

10-2. Process of packing

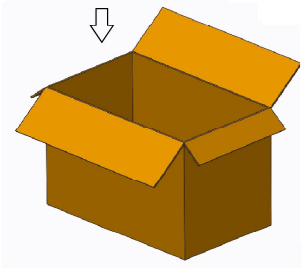
1 reel includes 5,000pcs(max.) chip antennas



1 small size carton includes 2pcs(max.) reels



1 middle size carton includes 5pcs(max.) small catons



1 large size carton includes 2pcs(max.) middle cartons

11. Operating & Storage Conditions

11-1. Operating

(1) Maximum Input Power: 2 W

(2) Operating Temperature: -40℃ to 85℃

11-2. Storage

(1) Storage Temperature: -5℃ to 40℃

(2) Relative Humidity: 20% to 70%

(3) Shelf Life: 1 year

12. Notice

(1) Installation Guide:

Please refer to Unictron's application note "General guidelines for the installation of Unictron's chip antennas" for further information.

(2) All specifications are subject to change without notice.