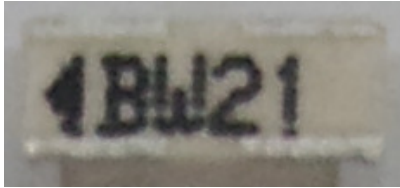


Approval Sheet

Products	Chip Antenna	3D Structure
Supplier CODE	ODBWPTR5020	 Top-Side View  Bottom-Side View
Model	SNH-V6430BN	
SEC CODE		
Revision	Ver1.0 07/08	
Supplier	Partron	

MSL	LEAD FREE	BFRs-Free, Halogen-Free
MSL 1		

By designed	By checked	By approved
김흥기		
Hongki.Kim	Chanik.Jeon	Namsik.Min
07/08	07/08	07/08

– Contents –

※ Cover	1 p
※ Contents	2 p
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1. Revision

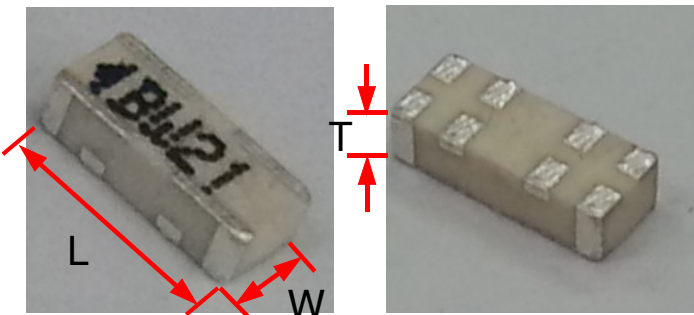
Revision No	Originator	Description of changes	Date of changes
Ver 1.0	Hongki.Kim	Issued	2016.07.08

2. Summary of Parts & Dimension

2.1 Summary of Parts

This product is the internal dielectric chip antenna of radio communication, forms the pattern with Ag paste on the brick of dielectric block and materializes the characteristics.

2.2 Dimension of parts

Type	Only Bulk Ceramic					
Material	Dielectric Block		Mg ₂ SiO ₄ (Magnesium Silicate)			
	Electrode Paste		Ag			
Size [mm]	L = 5.0 ± 0.1 (CPK: 2.14)					
	W = 2.0 ± 0.1 (CPK: 2.43)					
	T = 1.2 ± 0.1 (CPK: 2.26)					
Flatness Level	0.04					
MSL LEVEL	MSL LEVEL 1					
ESD LEVEL	More than 15 KV (HBM CLASS 3B)					
Version	Revision 1.0					
Electrical Characteristics (CTF)	Characteristics	VSWR(CTF)	Cycle of management	Q`ty	CPK	Reference
	2095MHz	1.0 ~ 3.0 :1	all inspection	all	2.36	4,5,8,27 Page
	2125MHz	1.0 ~ 3.0 :1	all inspection	all	3.33	4,5,8,27 Page

3. Critical to Quality()

- The following list is specified as the emphasis management list and managed.

CTQ Item	SPEC	Cycle of management	measurement System
Plasticity Temperature	1350 $\pm$ 15 °C	three times a day	Temperature Sensor
Dry Temperature	200 $\pm$ 15 °C	three times a day	Temperature Sensor
Hot Belt Conveyor Temperature	900 $\pm$ 25 °C	three times a day	Temperature Sensor

CTF Item 	Specification Reason
Single Element Measurement SWR	This item is an important parameter that fixes an electrical characteristic
Single Element Measurement Dimension	Dimension Degree of precision is an important item of characteristic of chip antenna

- require attention for the following list.

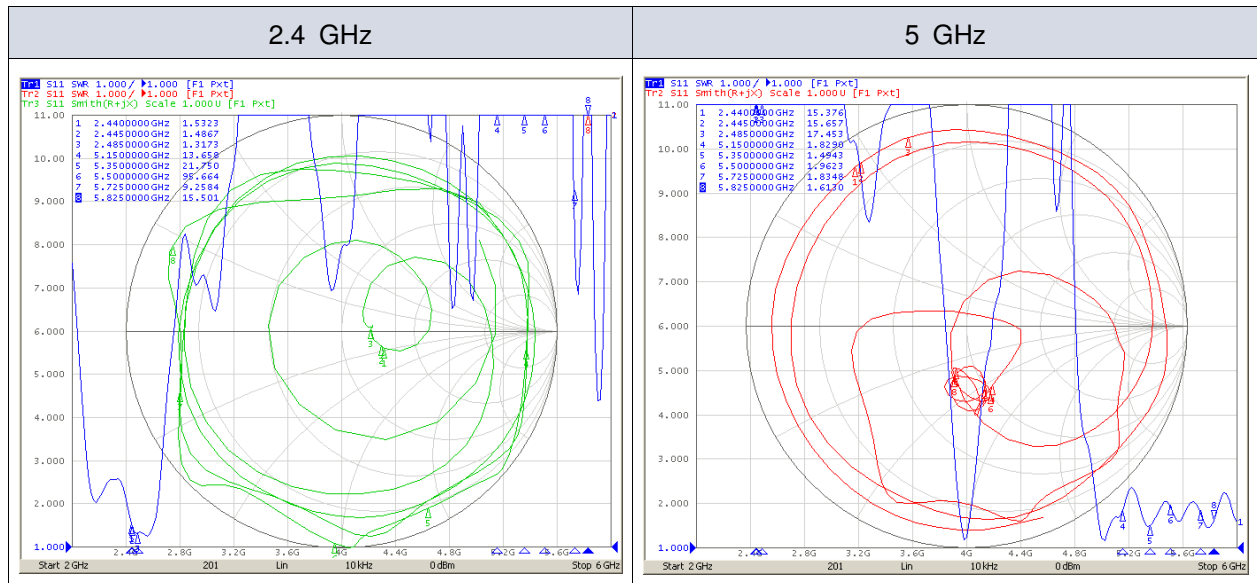
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

4. Electrical Characteristics

4.1 Set Condition

항 목				특 성	
Frequency Range [MHz]				WiFi (2.4GHz) : 2400 ~ 2485 WiFi (5GHz) : 5150 ~ 5825	
SWR [Max]				2.5 : 1 (Typ 2.0 : 1)	
Input Impedance [Ω]				50 Ohm	
Polarization				Linear	
Gain [dBi] WiFi (2.4GHz)	Total Gain (Peak / Avg) [dBi]			-0.3 / -5.3	
	Azimuth	Theta	Peak	-7.99	
			Average	-12.39	
		Phi	Peak	-0.57	
			Average	-4.84	
	Elevation 1	Theta	Peak	-0.82	
			Average	-5.36	
		Phi	Peak	1.77	
			Average	-3.56	
	Elevation 2	Theta	Peak	1.86	
			Average	-2.99	
		Phi	Peak	-1.80	
			Average	-8.48	
Gain [dBi] WiFi (5GHz)	Total Gain (Peak / Avg) [dBi]			-1.8 / -6.7	
	Azimuth	Theta	Peak	-7.99	
			Average	-13.55	
		Phi	Peak	1.88	
			Average	-3.30	
	Elevation 1	Theta	Peak	-1.44	
			Average	-5.27	
		Phi	Peak	-1.83	
			Average	-7.34	
	Elevation 2	Theta	Peak	-2.37	
			Average	-7.58	
		Phi	Peak	-4.99	
			Average	-9.55	

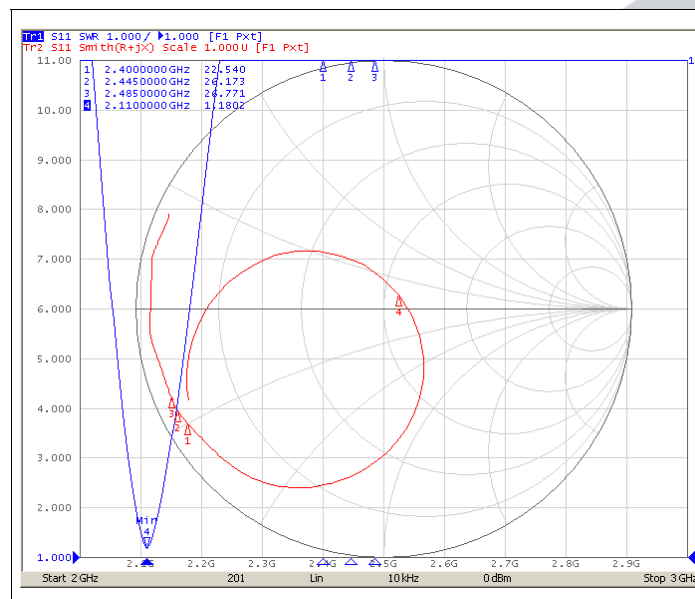
4.2 S11 Graph of Set Condition



4.3 Test Fixture Condition

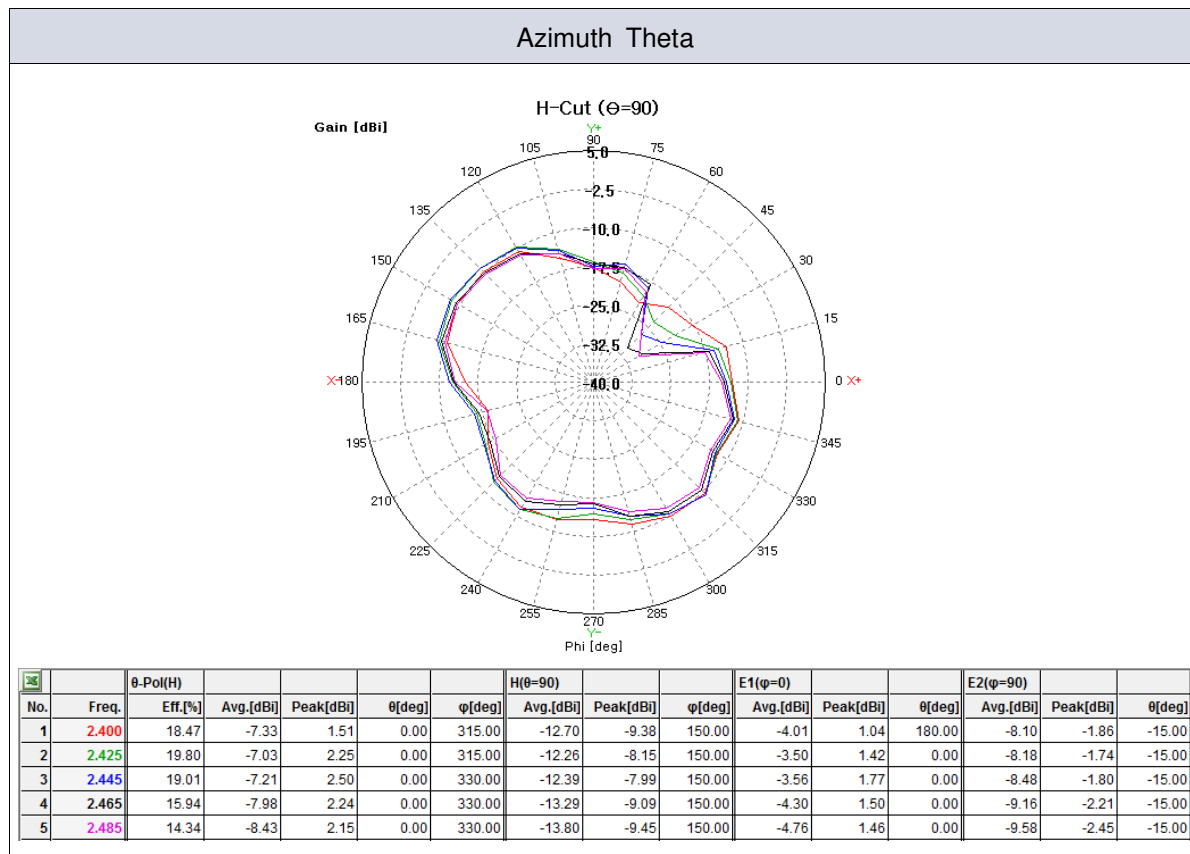
ITEM	SPEC
Frequency Range [MHz]	2095 ~ 2125
Lower frequency(2095 MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (Typ 2.5 : 1)
Upper frequency(2125 MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (Typ 2.5 : 1)

4.4 S11 Graph of Test Fixture Condition

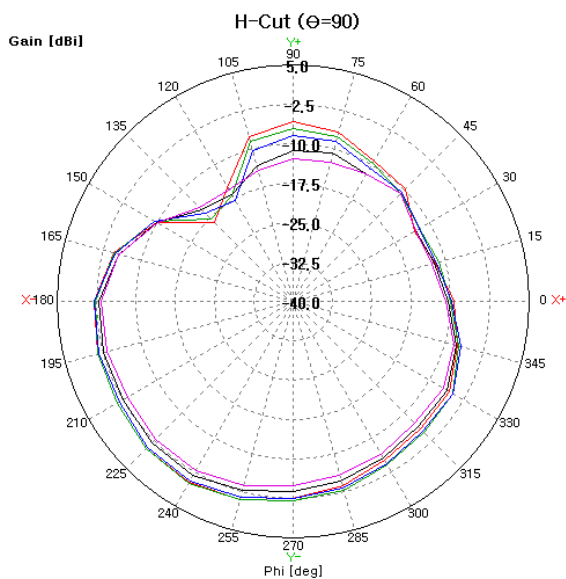


4.5-1 Radiation Pattern (2.4GHz Band)

Azimuth Plane	Elevation1 Plane	Elevation2 Plane
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	

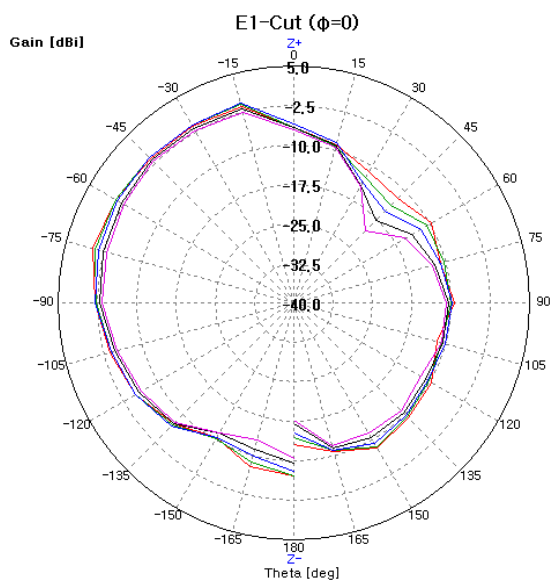


Azimuth Phi



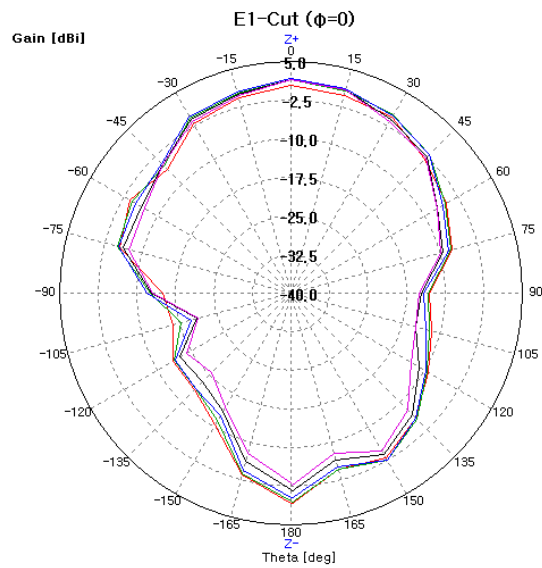
No.	Freq.	Φ -Pol(V)	Eff.[%]	Avg.[dBi]	Peak[dBi]	Θ [deg]	Φ [deg]	H($\Theta=90$) Avg.[dBi]	H($\Theta=90$) Peak[dBi]	Φ [deg]	E1($\Phi=0$) Avg.[dBi]	E1($\Phi=0$) Peak[dBi]	Θ [deg]	Avg.[dBi]	Peak[dBi]	Θ [deg]
1	2.400	31.81	-4.97	2.23	15.00	225.00	225.00	-4.60	-0.15	240.00	-5.16	-0.26	-75.00	-3.34	0.31	-180.00
2	2.425	32.91	-4.83	2.62	15.00	225.00	225.00	-4.49	-0.10	240.00	-5.21	-0.75	-60.00	-2.95	1.19	0.00
3	2.445	31.54	-5.01	2.74	15.00	225.00	225.00	-4.84	-0.57	240.00	-5.36	-0.82	-15.00	-2.99	1.86	0.00
4	2.465	25.63	-5.91	2.26	0.00	240.00	240.00	-5.95	-1.70	240.00	-6.21	-1.54	-45.00	-3.80	1.63	0.00
5	2.485	22.55	-6.47	2.11	0.00	240.00	240.00	-6.72	-2.76	240.00	-6.71	-1.99	-45.00	-4.29	1.59	0.00

Elevation1 Theta



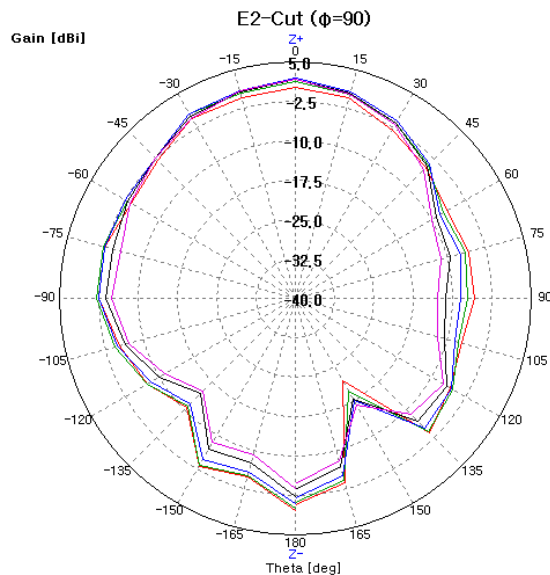
No.	Freq.	Φ -Pol(V)	Eff.[%]	Avg.[dBi]	Peak[dBi]	Θ [deg]	Φ [deg]	H($\Theta=90$) Avg.[dBi]	H($\Theta=90$) Peak[dBi]	Φ [deg]	E1($\Phi=0$) Avg.[dBi]	E1($\Phi=0$) Peak[dBi]	Θ [deg]	Avg.[dBi]	Peak[dBi]	Θ [deg]
1	2.400	31.81	-4.97	2.23	15.00	225.00	225.00	-4.60	-0.15	240.00	-5.16	-0.26	-75.00	-3.34	0.31	-180.00
2	2.425	32.91	-4.83	2.62	15.00	225.00	225.00	-4.49	-0.10	240.00	-5.21	-0.75	-60.00	-2.95	1.19	0.00
3	2.445	31.54	-5.01	2.74	15.00	225.00	225.00	-4.84	-0.57	240.00	-5.36	-0.82	-15.00	-2.99	1.86	0.00
4	2.465	25.63	-5.91	2.26	0.00	240.00	240.00	-5.95	-1.70	240.00	-6.21	-1.54	-45.00	-3.80	1.63	0.00
5	2.485	22.55	-6.47	2.11	0.00	240.00	240.00	-6.72	-2.76	240.00	-6.71	-1.99	-45.00	-4.29	1.59	0.00

Elevation1 Phi



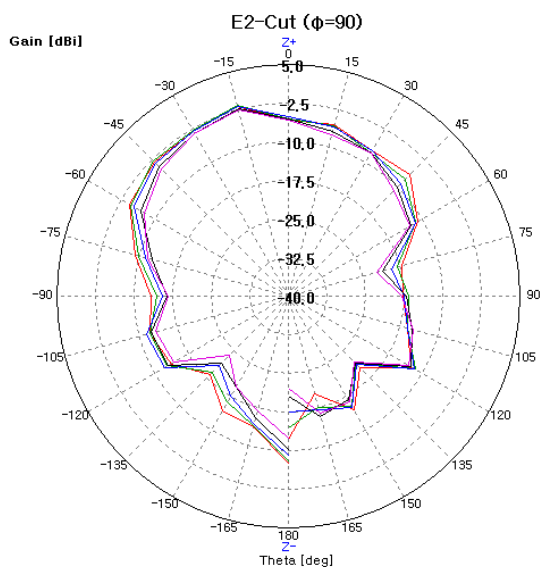
No.	Freq.	θ -Pol(H)	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ [deg]	ϕ [deg]	H($\theta=90$)	Avg.[dBi]	Peak[dBi]	ϕ [deg]	E1($\phi=0$)	Avg.[dBi]	Peak[dBi]	θ [deg]	E2($\phi=90$)	Avg.[dBi]	Peak[dBi]	θ [deg]
1	2.400		18.47	-7.33	1.51	0.00	315.00	-12.70	-9.38	150.00	-4.01	1.04	180.00	-8.10	-1.86	-15.00			
2	2.425		19.80	-7.03	2.25	0.00	315.00	-12.26	-8.15	150.00	-3.50	1.42	0.00	-8.18	-1.74	-15.00			
3	2.445		19.01	-7.21	2.50	0.00	330.00	-12.39	-7.99	150.00	-3.56	1.77	0.00	-8.48	-1.80	-15.00			
4	2.465		15.94	-7.98	2.24	0.00	330.00	-13.29	-9.09	150.00	-4.30	1.50	0.00	-9.16	-2.21	-15.00			
5	2.485		14.34	-8.43	2.15	0.00	330.00	-13.80	-9.45	150.00	-4.76	1.46	0.00	-9.58	-2.45	-15.00			

Elevation2 Theta



No.	Freq.	ϕ -Pol(V)	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ [deg]	ϕ [deg]	H($\theta=90$)	Avg.[dBi]	Peak[dBi]	ϕ [deg]	E1($\phi=0$)	Avg.[dBi]	Peak[dBi]	θ [deg]	E2($\phi=90$)	Avg.[dBi]	Peak[dBi]	θ [deg]
1	2.400		31.81	-4.97	2.23	15.00	225.00	-4.60	-0.15	240.00	-5.16	-0.26	-75.00	-3.34	0.31	-180.00			
2	2.425		32.91	-4.83	2.62	15.00	225.00	-4.49	-0.10	240.00	-5.21	-0.75	-60.00	-2.95	1.19	0.00			
3	2.445		31.54	-5.01	2.74	15.00	225.00	-4.84	-0.57	240.00	-5.36	-0.82	-15.00	-2.99	1.86	0.00			
4	2.465		25.63	-5.91	2.26	0.00	240.00	-5.95	-1.70	240.00	-6.21	-1.54	-45.00	-3.80	1.63	0.00			
5	2.485		22.55	-6.47	2.11	0.00	240.00	-6.72	-2.76	240.00	-6.71	-1.99	-45.00	-4.29	1.59	0.00			

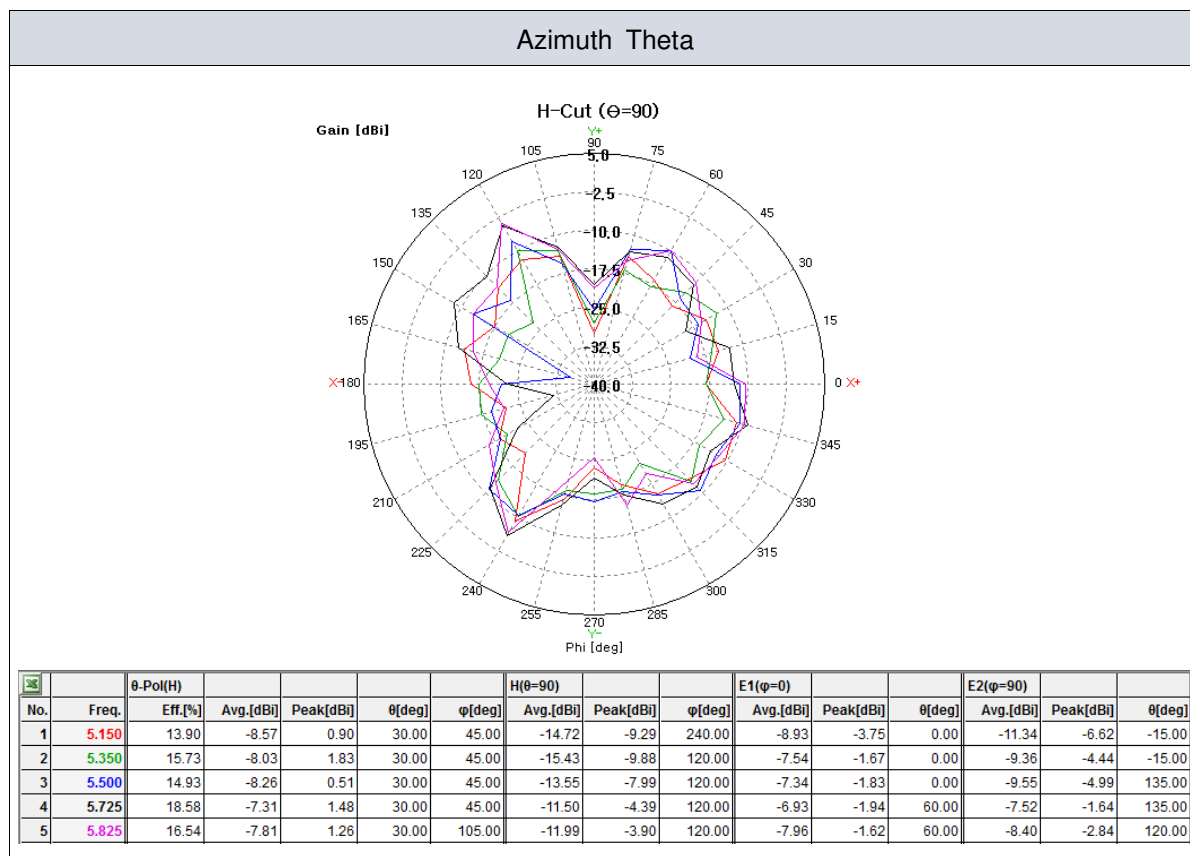
Elevation2 Phi



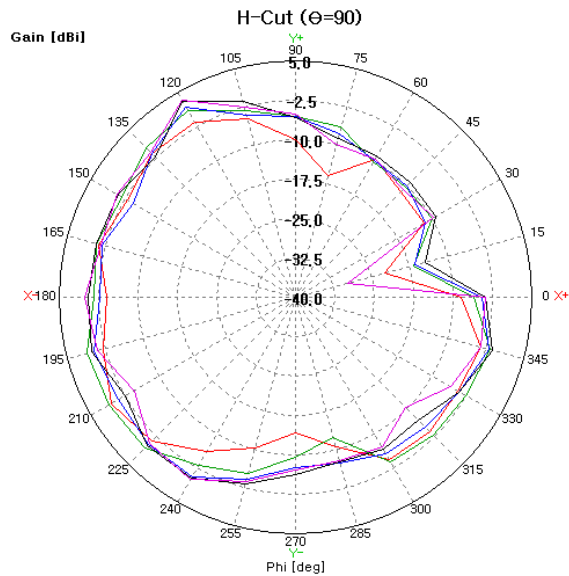
No.	Freq.	θ-Pol(H)					H(θ=90)			E1(φ=0)			E2(φ=90)		
		Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Avg.[dBi]	Peak[dBi]	φ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]
1	2.400	18.47	-7.33	1.51	0.00	315.00	-12.70	-9.38	150.00	-4.01	1.04	180.00	-8.10	-1.86	-15.00
2	2.425	19.80	-7.03	2.25	0.00	315.00	-12.26	-8.15	150.00	-3.50	1.42	0.00	-8.18	-1.74	-15.00
3	2.445	19.01	-7.21	2.50	0.00	330.00	-12.39	-7.99	150.00	-3.56	1.77	0.00	-8.48	-1.80	-15.00
4	2.465	15.94	-7.98	2.24	0.00	330.00	-13.29	-9.09	150.00	-4.30	1.50	0.00	-9.16	-2.21	-15.00
5	2.485	14.34	-8.43	2.15	0.00	330.00	-13.80	-9.45	150.00	-4.76	1.46	0.00	-9.58	-2.45	-15.00

4.5-2 Radiation Pattern (5GHz Band)

Azimuth Plane	Elevation1 Plane	Elevation2 Plane
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	

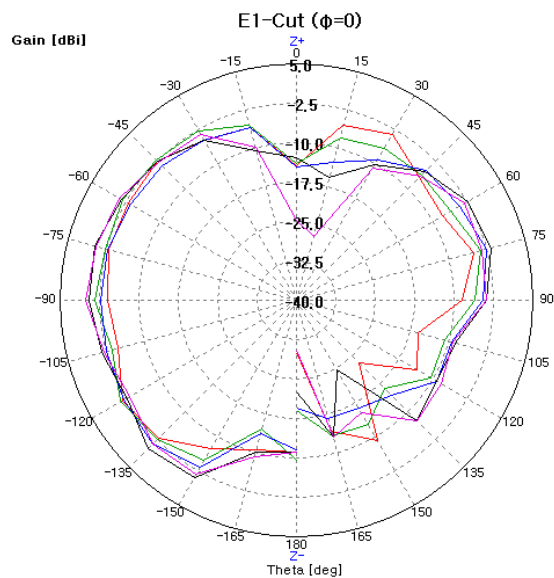


Azimuth Phi



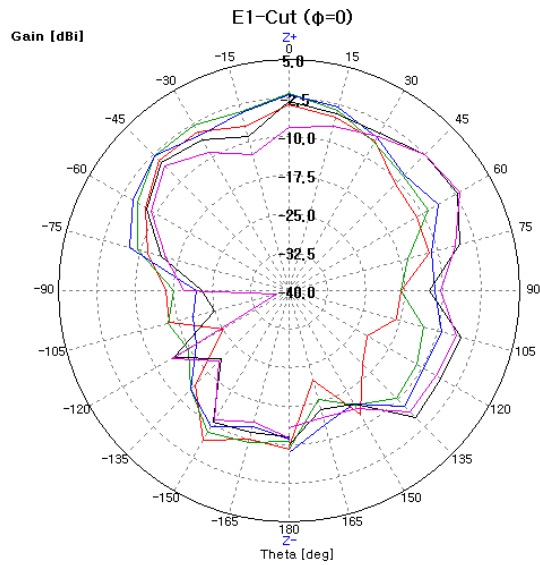
		Φ -Pol(V)					H($\theta=90$)		E1($\Phi=0$)		E2($\Phi=90$)				
No.	Freq.	Eff.(%)	Avg.[dBi]	Peak[dBi]	θ [deg]	Φ [deg]	Avg.[dBi]	Peak[dBi]	Φ [deg]	Avg.[dBi]	Peak[dBi]	θ [deg]	Avg.[dBi]	Peak[dBi]	θ [deg]
1	5.150	31.42	-5.03	1.39	75.00	165.00	-4.53	0.45	210.00	-5.87	-1.72	-120.00	-7.90	-2.51	30.00
2	5.350	39.80	-4.00	1.95	60.00	195.00	-2.68	1.11	120.00	-5.08	-1.40	-120.00	-7.62	-3.25	0.00
3	5.500	36.57	-4.37	2.34	120.00	120.00	-3.30	1.88	120.00	-5.27	-1.44	-135.00	-7.58	-2.37	0.00
4	5.725	43.43	-3.62	3.91	120.00	120.00	-2.62	3.17	120.00	-4.11	-0.02	-135.00	-7.36	-2.43	15.00
5	5.825	37.54	-4.26	3.39	90.00	120.00	-2.98	3.39	120.00	-4.42	0.19	-90.00	-8.24	-3.15	15.00

Elevation1 Theta



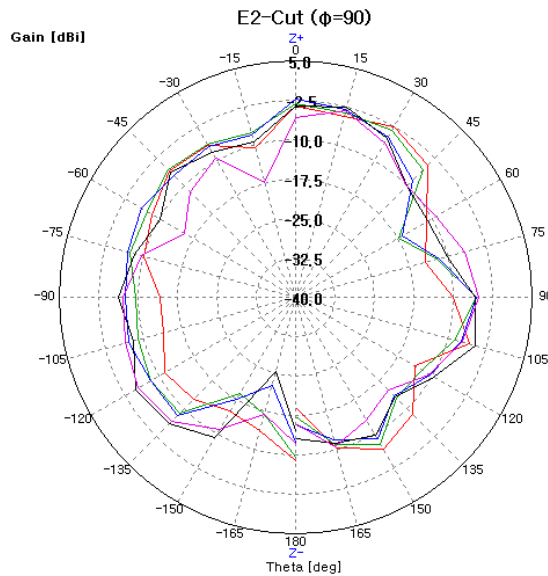
		φ-Pol(V)					H(θ=90)			E1(φ=0)			E2(φ=90)		
No.	Freq.	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Avg.[dBi]	Peak[dBi]	φ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]
1	5.150	31.42	-5.03	1.39	75.00	165.00	-4.53	0.45	210.00	-5.87	-1.72	-120.00	-7.90	-2.51	30.00
2	5.350	39.80	-4.00	1.95	60.00	195.00	-2.68	1.11	120.00	-5.08	-1.40	-120.00	-7.62	-3.25	0.00
3	5.500	36.57	-4.37	2.34	120.00	120.00	-3.30	1.88	120.00	-5.27	-1.44	-135.00	-7.58	-2.37	0.00
4	5.725	43.43	-3.62	3.91	120.00	120.00	-2.62	3.17	120.00	-4.11	-0.02	-135.00	-7.36	-2.43	15.00
5	5.825	37.54	-4.26	3.39	90.00	120.00	-2.98	3.39	120.00	-4.42	0.19	-90.00	-8.24	-3.15	15.00

Elevation1 Phi



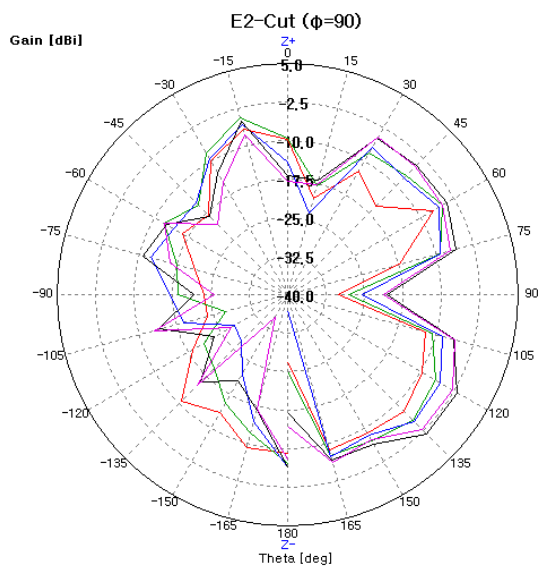
		θ-Pol(H)				H(θ=90)				E1(φ=0)				E2(φ=90)			
No.	Freq.	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Avg.[dBi]	Peak[dBi]	φ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]		
1	5.150	13.90	-8.57	0.90	30.00	45.00	-14.72	-9.29	240.00	-8.93	-3.75	0.00	-11.34	-6.62	-15.00		
2	5.350	15.73	-8.03	1.83	30.00	45.00	-15.43	-9.88	120.00	-7.54	-1.67	0.00	-9.36	-4.44	-15.00		
3	5.500	14.93	-8.26	0.51	30.00	45.00	-13.55	-7.99	120.00	-7.34	-1.83	0.00	-9.55	-4.99	135.00		
4	5.725	18.58	-7.31	1.48	30.00	45.00	-11.50	-4.39	120.00	-6.93	-1.94	60.00	-7.52	-1.64	135.00		
5	5.825	16.54	-7.81	1.26	30.00	105.00	-11.99	-3.90	120.00	-7.96	-1.62	60.00	-8.40	-2.84	120.00		

Elevation2 Theta



№		φ-Pol(V)				H(θ=90)				E1(φ=0)				E2(φ=90)			
No.	Freq.	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Avg.[dBi]	Peak[dBi]	φ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]		
1	5.150	31.42	-5.03	1.39	75.00	165.00	-4.53	0.45	210.00	-5.87	-1.72	-120.00	-7.90	-2.51	30.00		
2	5.350	39.80	-4.00	1.95	60.00	195.00	-2.68	1.11	120.00	-5.08	-1.40	-120.00	-7.62	-3.25	0.00		
3	5.500	36.57	-4.37	2.34	120.00	120.00	-3.30	1.88	120.00	-5.27	-1.44	-135.00	-7.58	-2.37	0.00		
4	5.725	43.43	-3.62	3.91	120.00	120.00	-2.62	3.17	120.00	-4.11	-0.02	-135.00	-7.36	-2.43	15.00		
5	5.825	37.54	-4.26	3.39	90.00	120.00	-2.98	3.39	120.00	-4.42	0.19	-90.00	-8.24	-3.15	15.00		

Elevation2 Phi



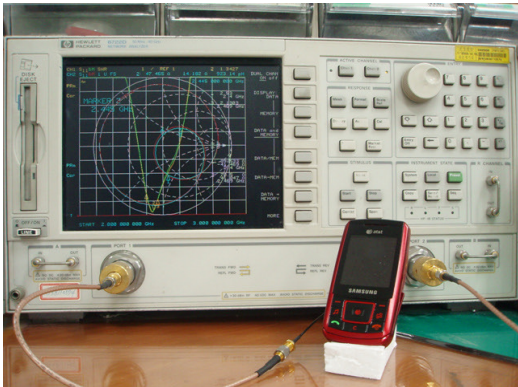
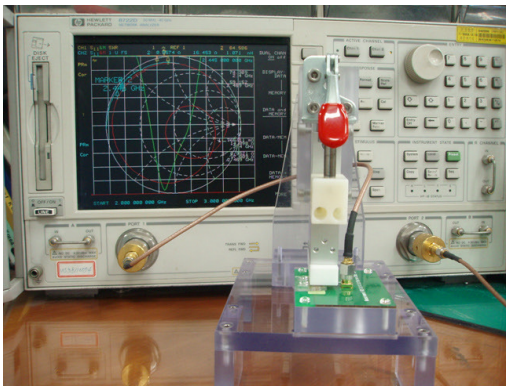
		θ-Pol(H)					H(θ=90)			E1(φ=0)			E2(φ=90)		
No.	Freq.	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Avg.[dBi]	Peak[dBi]	φ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]	Avg.[dBi]	Peak[dBi]	θ[deg]
1	5.150	13.90	-8.57	0.90	30.00	45.00	-14.72	-9.29	240.00	-8.93	-3.75	0.00	-11.34	-6.62	-15.00
2	5.350	15.73	-8.03	1.83	30.00	45.00	-15.43	-9.88	120.00	-7.54	-1.67	0.00	-9.36	-4.44	-15.00
3	5.500	14.93	-8.26	0.51	30.00	45.00	-13.55	-7.99	120.00	-7.34	-1.83	0.00	-9.55	-4.99	135.00
4	5.725	18.58	-7.31	1.48	30.00	45.00	-11.50	-4.39	120.00	-6.93	-1.94	60.00	-7.52	-1.64	135.00
5	5.825	16.54	-7.81	1.26	30.00	105.00	-11.99	-3.90	120.00	-7.96	-1.62	60.00	-8.40	-2.84	120.00

5. Measurement Process

5.1 SWR / Return Loss

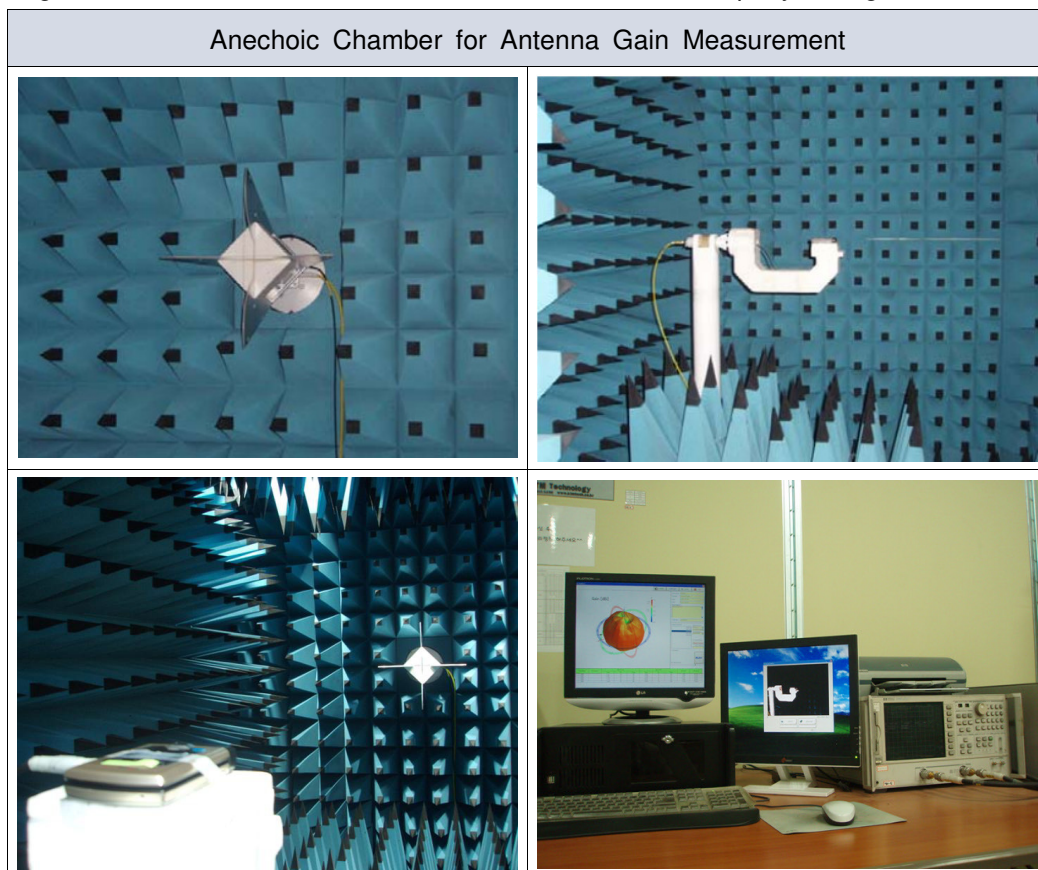
Use Network Analyzer when measuring SWR/Return loss and selecting standard SPL,

Use automatic inspection equipment when selecting superior and inferior goods.

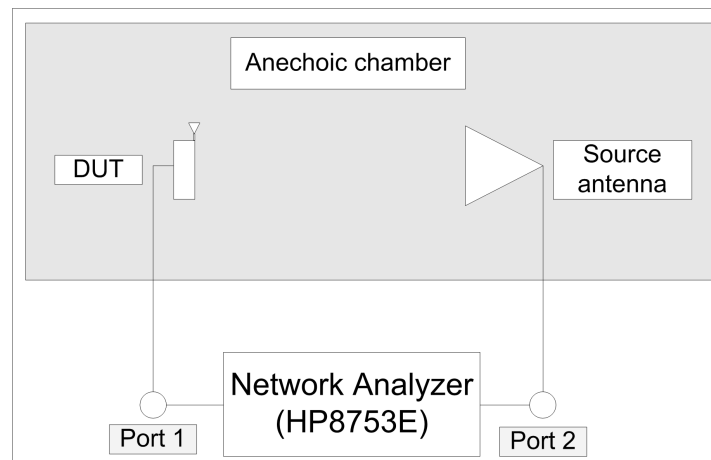
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753E or Advantest R3765CH	Agilent HP8753E or Advantest R3765CH
Cable	RF cable (300 mm)	RF cable (300 mm)
Test condition		

5.2 Gain

Antenna gain is measured in the Anechoic Chamber of this company, using set above of 4.1 list.

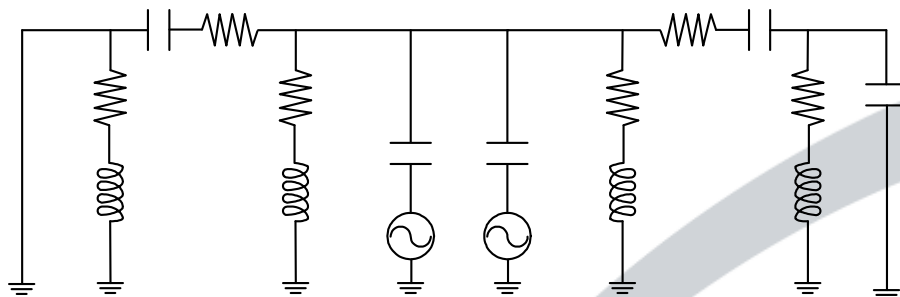


5.3 Gain test block diagram

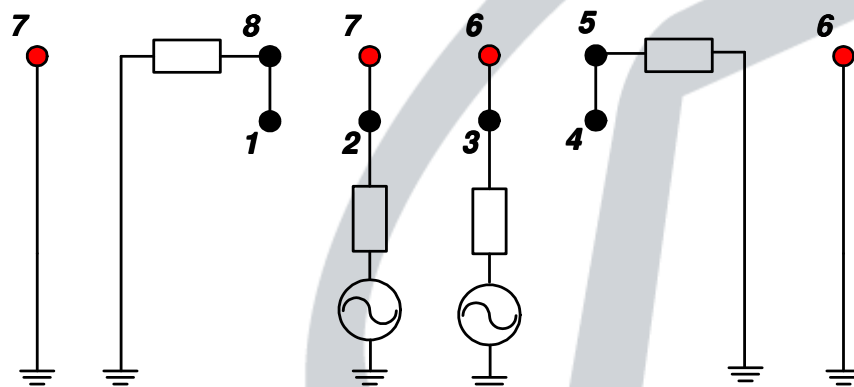


6. Equivalent Circuit

This product is an RF part that realizes the performance of the structure shape of the silver(Ag) pattern on the surface of a rectangular body made of dielectrics by the following structural equivalent circuit configuration.



< Chip Antenna Equivalent Circuit >



< Default Condition Equivalent Circuit >

7. Application Note

This product is an internal dielectric chip antenna that acts to convert guide waves on a transmission structure into free space waves.

This is able to position at anywhere of the PCB that you want. Even if the surround condition of chip antenna alter into the changed electrical characteristic, you can tune the electrical characteristic by designing the another PCB layout. And so far as circumstances permit, using only lumped element, you can adjust the electrical characteristic of antenna without the PCB layout alteration.

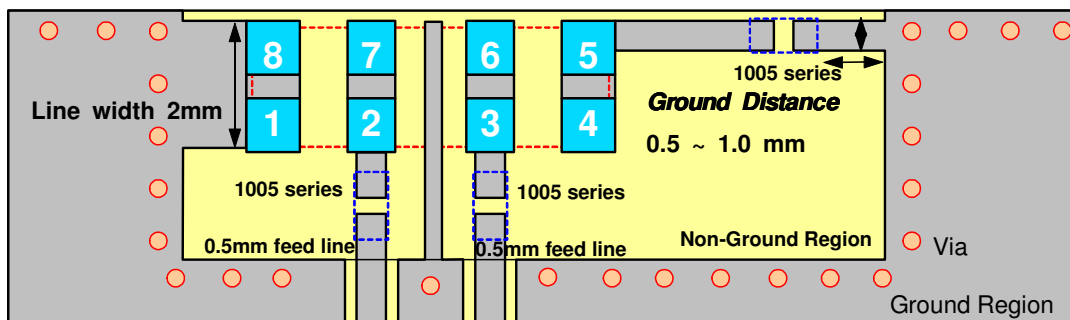
However, You must carefully choose the space for a chip antenna. Because this is only electromagnetic RF device, the electrical characteristic is changed by surrounding condition of antenna.

In case of this product, the four land pads exist and the fixed feeding structure is not, each the No 1, 2, 3 and 4 land pads can become the input pad or the ground short in each another situations. Sometimes, some land pads become just mount pad.

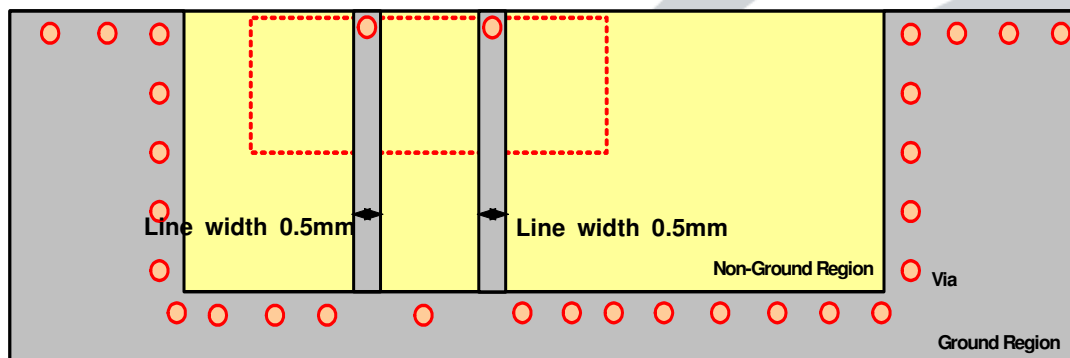
You can obtain the detail informations about the selection of each land pad from PARTRON.

■ PCB Layout Design

- Basic Design



< Chip Antenna The surface to be mounted >



< Chip Antenna The opposite surface to be mounted >

The figure above is a view of the basic PCB drawing for this product as seen from the side opposite to the side on which the chip antenna is mounted.

This structure adds autocad drawing as an appendix for measuring PCB. Please refer to the detailed dimensions of the figure.

A : The No2 Pad is an input pad and Wi-Fi Band. The No3 Pad is an input pad and BlueTooth Band. Pads 1 and 4 are fixed, and pad 5 is connected to the adjacent ground through a lumped element. At this time, the line width connected to each pad is designed as 0.5 mm. Also, pads 6 and 7 are connected via vias to the opposite side of the antenna mount.

B : A non-grounded area extends to an acceptable area to remove all metal surfaces. This product can not operate with the metal surface area. All layers have the same area and the metal surface is removed. As shown in the figure, the vias are used for the outer surface of the area where there is no metal surface. The non-metallic area of the basic design value of this product is 4.2x12 mm². (Non-metal areas may change depending on the frequency used.)

C : Pads 6 and 7 are connected to the ground via the vias and the opposite side of the antenna mount. Pads 2 and 3 are connected to the input line as shown in the figure.

D : Pad No. 5 is connected to the adjacent ground by the width of 0.5mm line. As shown in the figure, pad No. 1 and pad No. 8 are connected to the adjacent ground by the width of 2mm line.

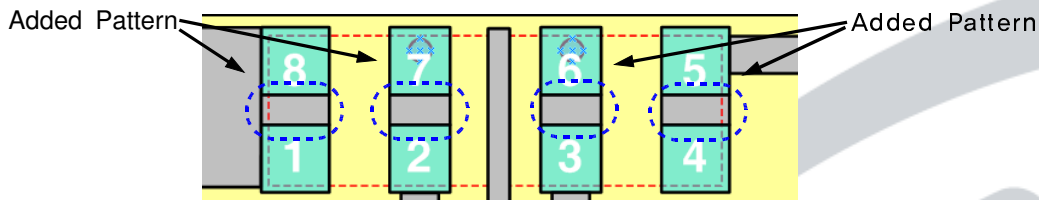
E : Pad No. 5 is connected to the adjacent ground through the 1005 lumped element. At this time, the value of the device used changes according to the frequency band used. (Refer to the Data Sheet for details of the value of lumped element.)

F : As shown in the figure above, insert the vias as many as possible in the corners.

G : Between pad no.2 and pad no.3 there is a Line width of 0.3mm.

- Land Pad Design

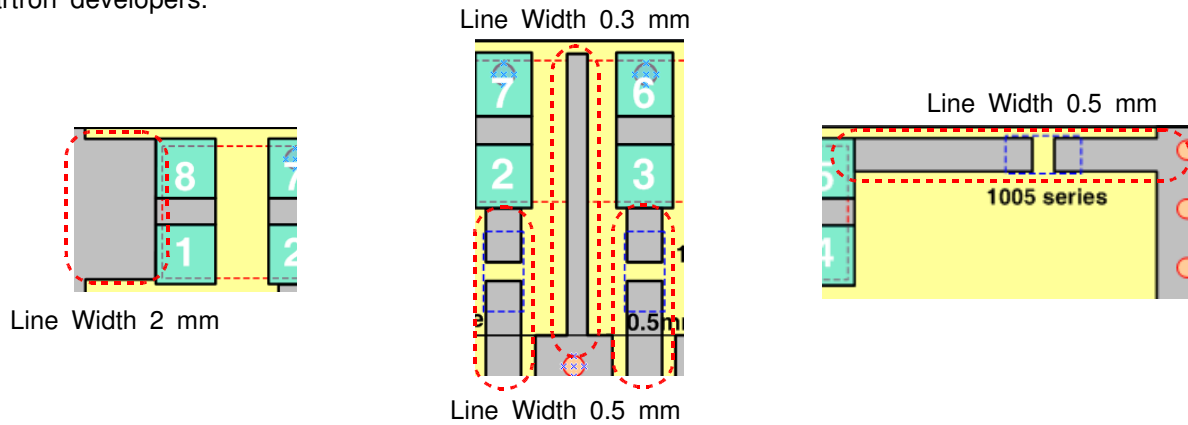
In the case of the first PCB structure, the first and second pads are shorted to the same width, and the second and fourth pads, third and sixth pads and fourth pads The pad 5 is also shorted to the same width, and the actual appearance of the pad is shown as the following four pads only.



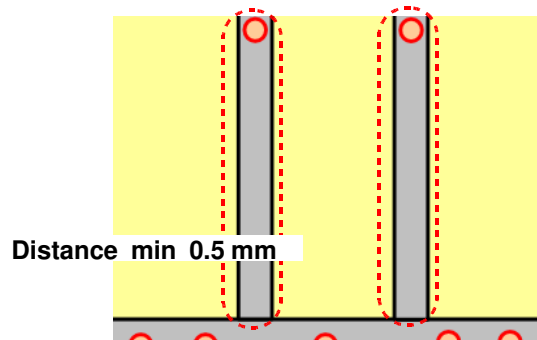
The four pads can be six or eight pads, eliminating the additional connection pads for the short circuit due to changes in the design of the wireless communication system for development applications. This can be changed by the application of Partron developers during the development process. The additional pattern is silk-screened so that lead is not connected and there are eight solder pads as well.

- Line Design

All RF lines configured for this product are designed with a fixed width of 0.5 mm. If you need to change the track width due to unavoidable circumstances, it must be done after consultation with Partron developers.



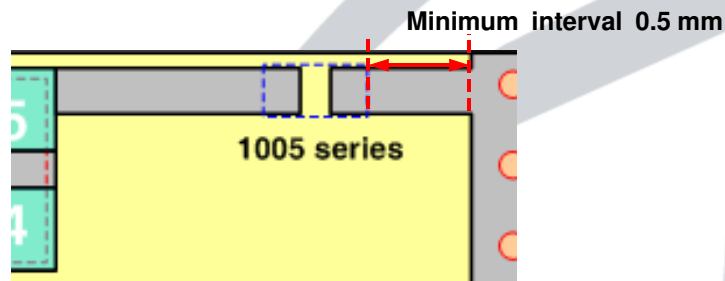
<Figure 1,2,3 Ant track width>



< Figure 4 Line width on the opposite side of the Ant mounting. >

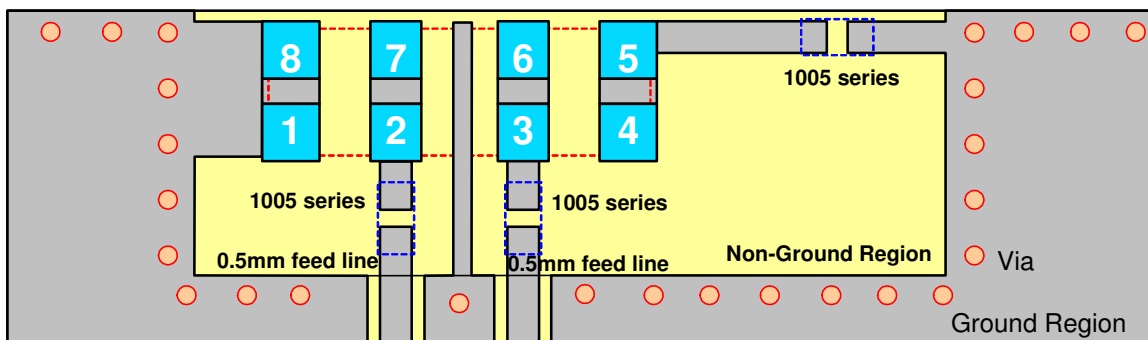
- Inserted Lumped Element

In case of lumped element connected to pad No. 5 for this product, it is based on non-grounded area, and it is located at least 0.5 mm apart from adjacent ground if possible.

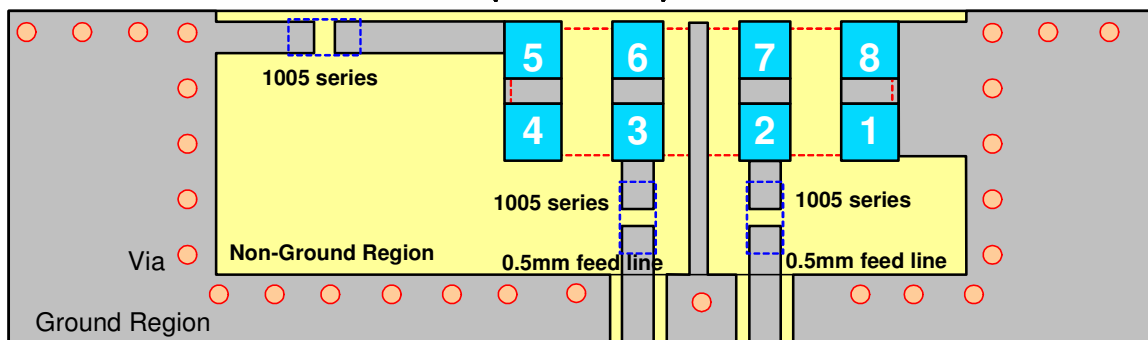


If you don't permit this design, it is possible to change position of lumped element and another design. Have a conference with PARTRON.

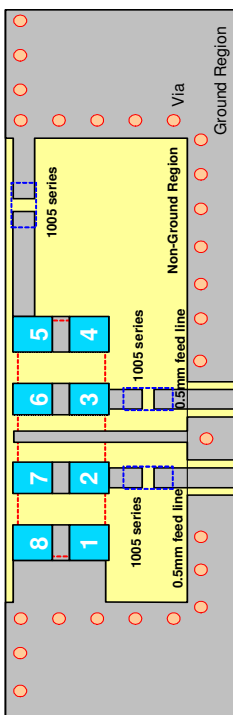
■ Change of Antenna Position



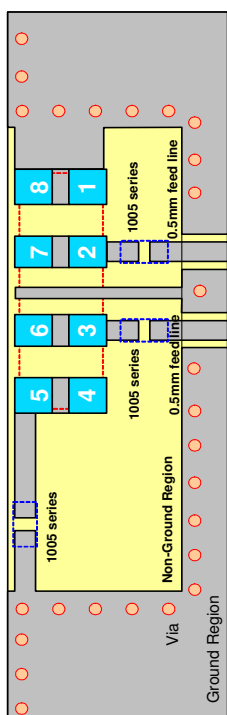
<Left Position>



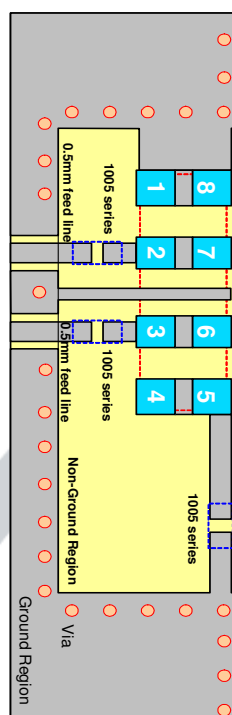
<Right Position>



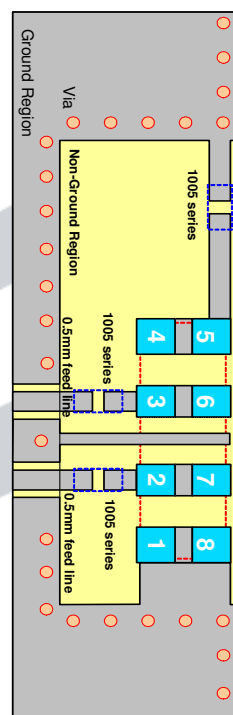
<Right side/up>



<Right Side/Down>



<Left Side/Up>

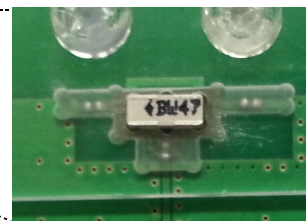
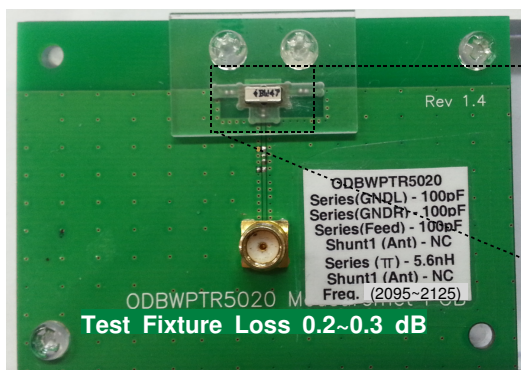
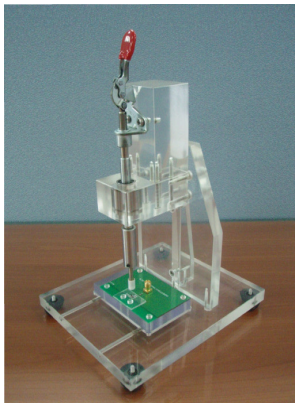


<Left Side/Down>

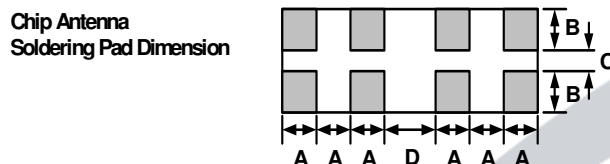
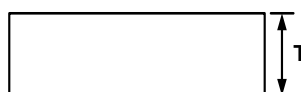
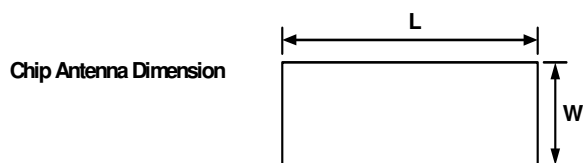
As shown in the above figure, even if the position of the product is changed inside the development application wireless communication system, the position of LMS registration pad is changed to symmetrical or horizontally symmetrical, and then the structure is designed according to PCB design guidelines.

8. Test Fixture Specification

8.1 Test Fixture and Test PCB

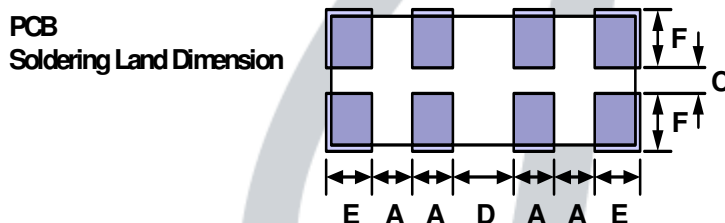


※ Ev B'd is the same as the manual measuring jig (Ev B'd is soldered to the contact type and manual measuring jig is the same for the eastern contact type)



Parameter	L	W	T	A	B	C	D
Value[mm]	5.0 ± 0.1	2.0 ± 0.1	1.2 ± 0.1	0.6	0.8	0.4	1.4

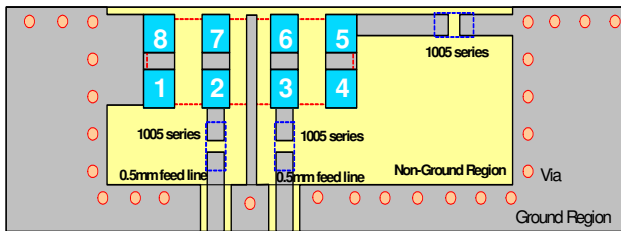
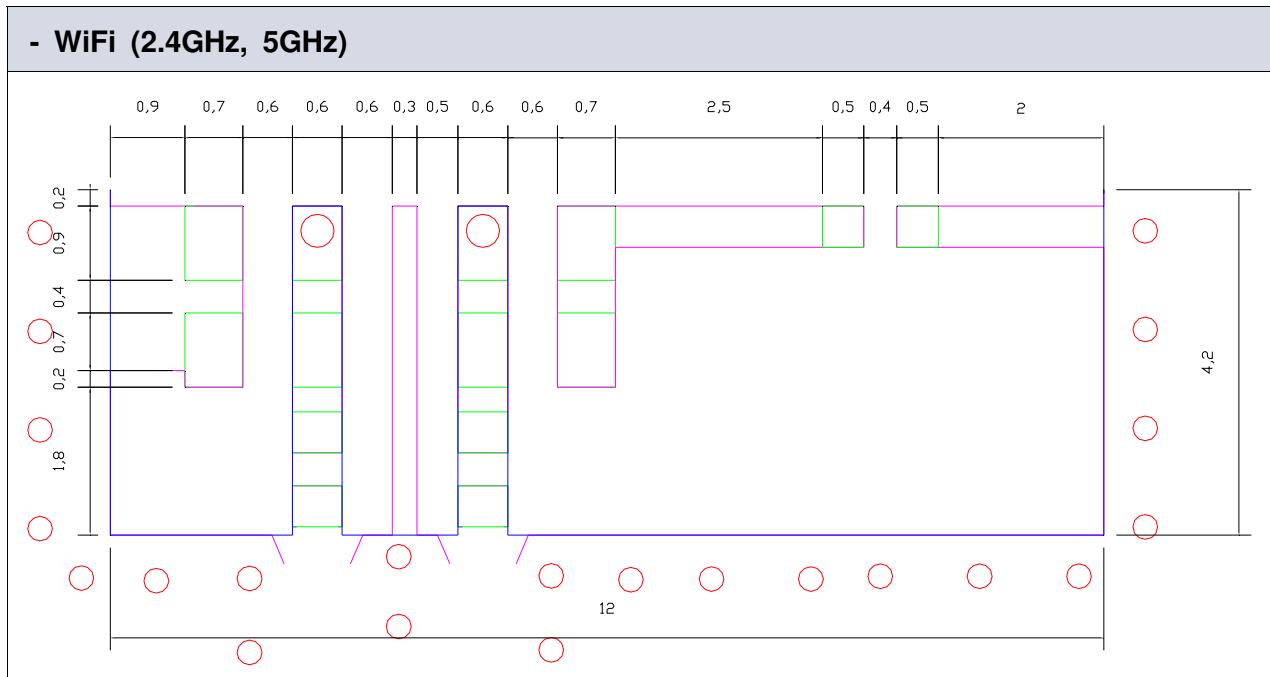
8.2 Soldering Pad Dimension and PCB layout Dimension



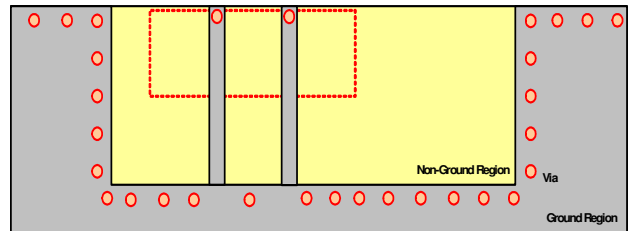
Parameter	A	C	D	E	F
Value[mm]	0.6	0.4	1.4	0.7	0.9

Unless Specified tolerances are ± 0.05 mm

■ PCB Drawing(Auto CAD Design)

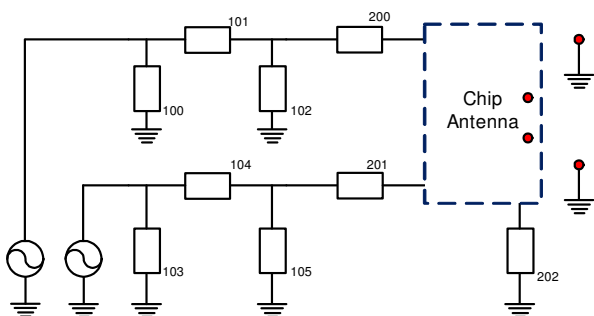


< Top View >

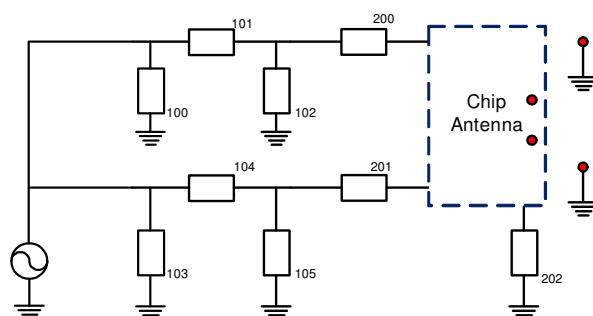


< Bottom View >

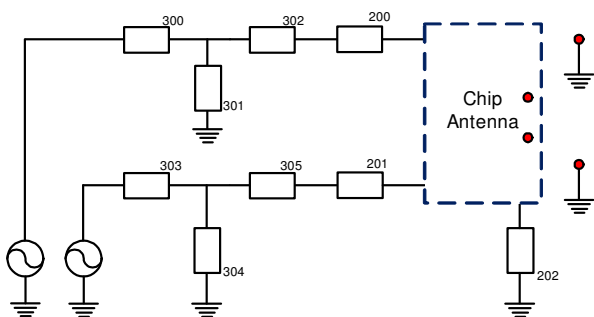
8.3 Matching Circuit and Default



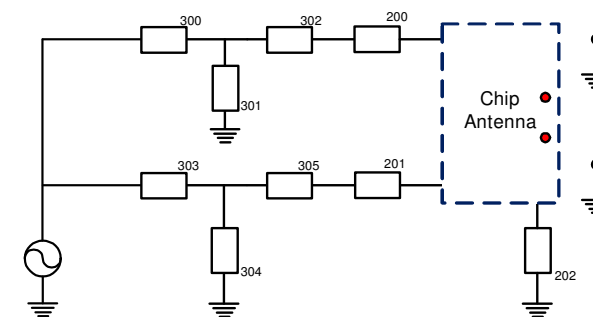
Two Feeding



One Feeding



Two Feeding

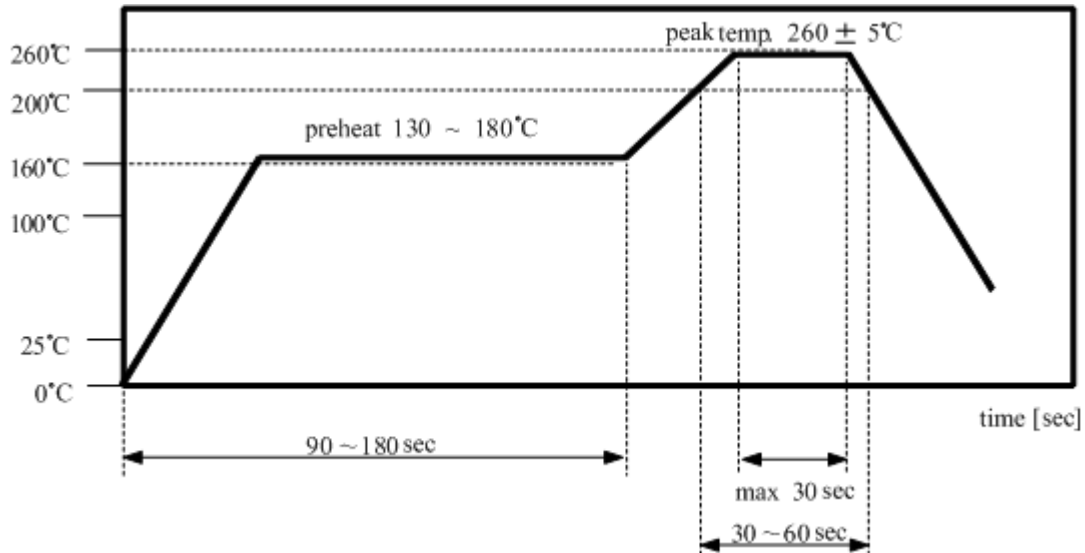


One Feeding

No		100	101	102	103	104	105	200	201	202	300	301	302	303	304	305
Default Value	One Feeding	N/C	4 pF	N/C	N/C	12 pF	1 pF	100 pF	100 pF	1.2 nH	100 pF	N/C	4 pF	100 pF	1 pF	12 pF
	Two Feeding	N/C	4 pF	N/C	N/C	12 pF	1 pF	100 pF	100 pF	1.2 nH	100 pF	N/C	4 pF	100 pF	1 pF	12 pF

9. REFLOW PROFILE

9.1 Reflow Soldering



9.2 Manual Soldering

Pre-heating Temperature : 120°C , 60 ~ 300 sec.

Soldering Temperature : 340°C ± 5°C , 5sec max per each terminal.

9.3 Applied PCB Pattern Design

7. Basic Operation and Application and 8.2 PCB Structure and Solder Pad Dimensions Reference

10. Primary Inspection List

Item	Frequency [MHz]		Size [mm]		
Standard	SWR 3.0 Max		L = 5.0±0.1	W = 2.0±0.1	T = 1.2±0.1
	2095 MHz	2125 MHz			
1	1.81	1.62	5.02	2.01	1.20
2	1.74	1.60	4.99	1.99	1.21
3	1.68	1.69	5.01	2.00	1.22
4	1.70	1.63	4.98	2.02	1.20
5	1.59	1.74	5.02	1.98	1.20
6	1.64	1.69	5.00	2.00	1.19
7	1.76	1.60	4.98	1.99	1.21
8	1.67	1.62	5.00	2.00	1.18
9	1.53	1.58	5.01	2.01	1.20
10	1.52	1.63	5.03	2.00	1.17
11	1.61	1.51	4.99	2.02	1.20
12	1.64	1.50	5.00	1.98	1.19
13	1.83	1.64	4.99	2.01	1.21
14	1.58	1.63	5.01	1.99	1.23
15	1.55	1.62	4.99	2.00	1.20
16	1.68	1.51	5.02	1.98	1.19
17	1.59	1.58	5.00	2.02	1.22
18	1.67	1.62	4.99	1.98	1.18
19	1.68	1.69	5.02	2.00	1.19
20	1.83	1.64	4.98	1.99	1.20
X	1.52	1.51	5.10	2.10	1.30
σ	1.83	1.74	4.90	1.90	1.10
Cpk	1.67	1.62	5	2	1.2
Decision	OK	OK	OK	OK	OK

11. Reliability Condition

11.1 Environment Test

ITEM	TEST CONDITION	LIMIT
PCT	+121±5 °C, RH=100%, 96 hr	After test, Must meet the characteristics spec of 4.3 list
Low Temperature Resistance	-40°C±3°C, 120hr	
Humidity Action	+85±3°C, RH85%	

11.2 Thermal shock test , Reflow test

ITEM	TEST CONDITION	LIMIT
Thermal shock	condition : -40°C±3°C/1min ↔ +85°C±3°C/1min Test Cycle : 20 cycle Temperature change time : within 5 min	After test, Must meet the characteristics spec of 4.3 list
Reflow	Pre Heating : 200±5°C, 30~60 sec Peak Heating : 260°C±5°C, 30sec Max	

11.3 Mechanical Test

ITEM	TEST CONDITION	LIMIT
Vibration	Freq : 10~500Hz , Acceleration : 10 ×9.8m/s ² (G) Sweep time : 15 min , X.Y.Z each 5 times	After test, Must meet the characteristics spec of 4.3 list
Drop	18 times free fall Using the drop jig 152cm high Jig : 120g±20g Plastic Jig Bottom : Concrete or Iron	

11.4 MSL LEVEL Test

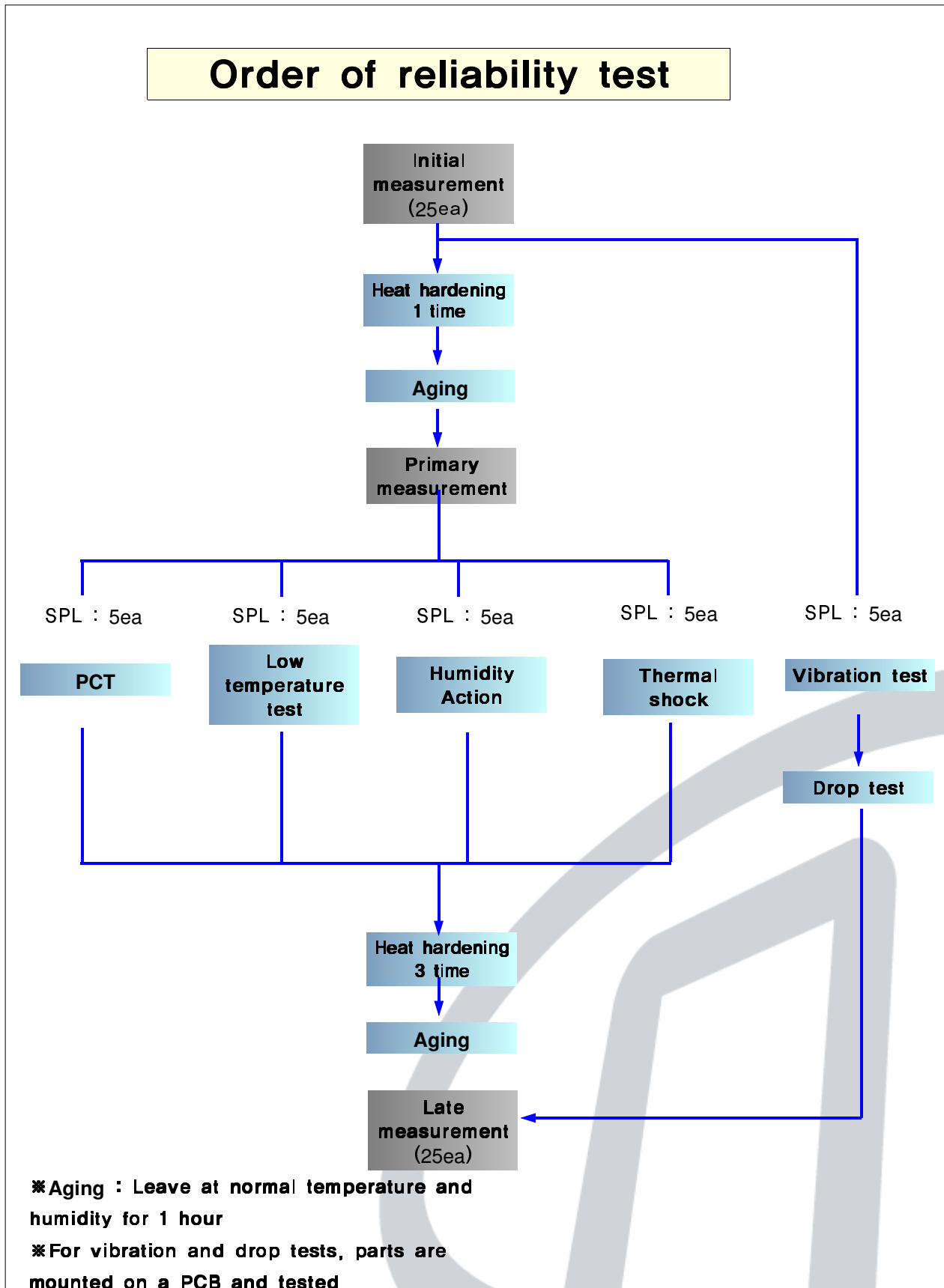
1) JEDEC J-STD-020C Test

	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30°C / RH 85%	168+5 / -0	= < 85°C / RH 85%

2) Test Condition

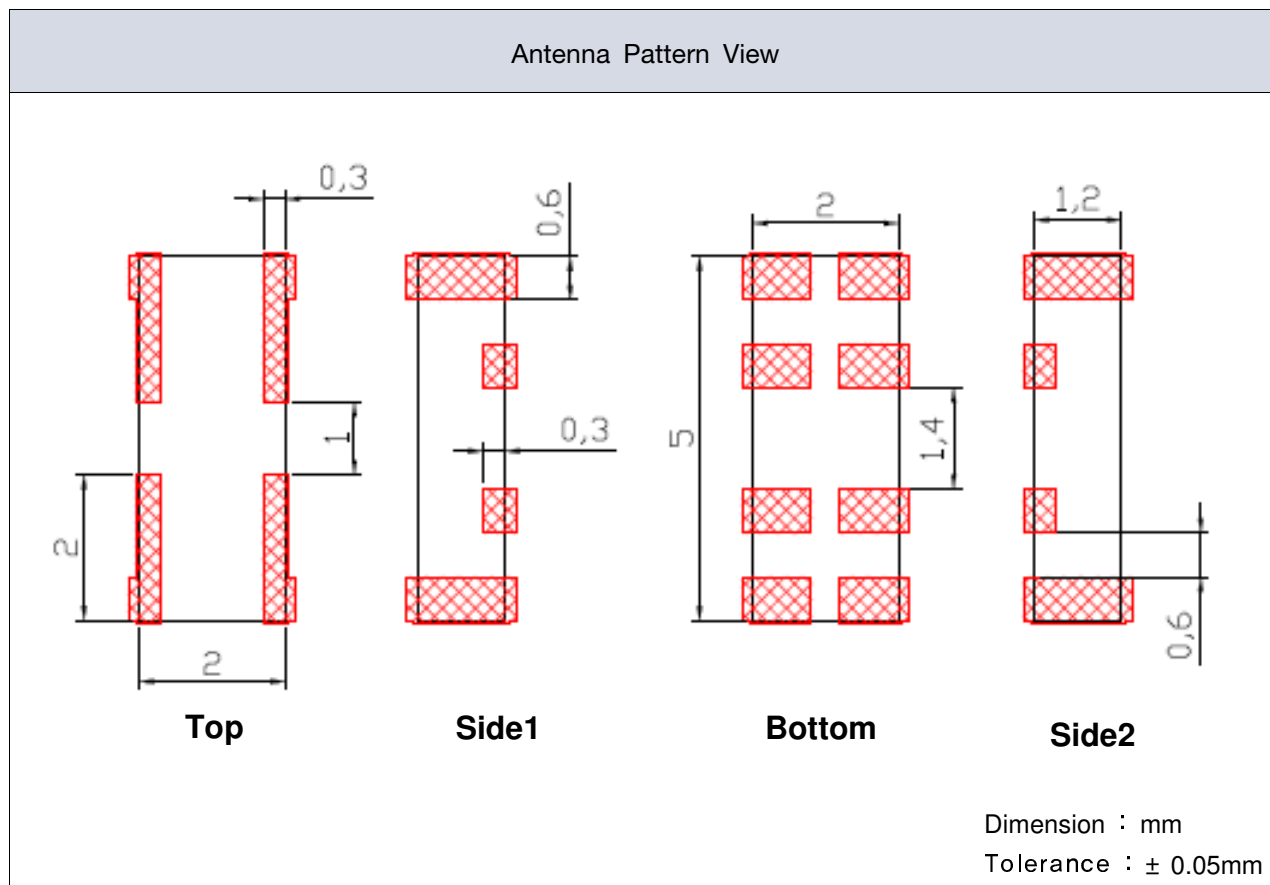
ITEM	Conditon	LIMIT
Soak Requirements	After leaving +85±3°C, RH85% 168hr±2hr 3 times Reflow without aging	After test, Must meet the characteristics spec of 4.3 list

11.5 Order of reliability test

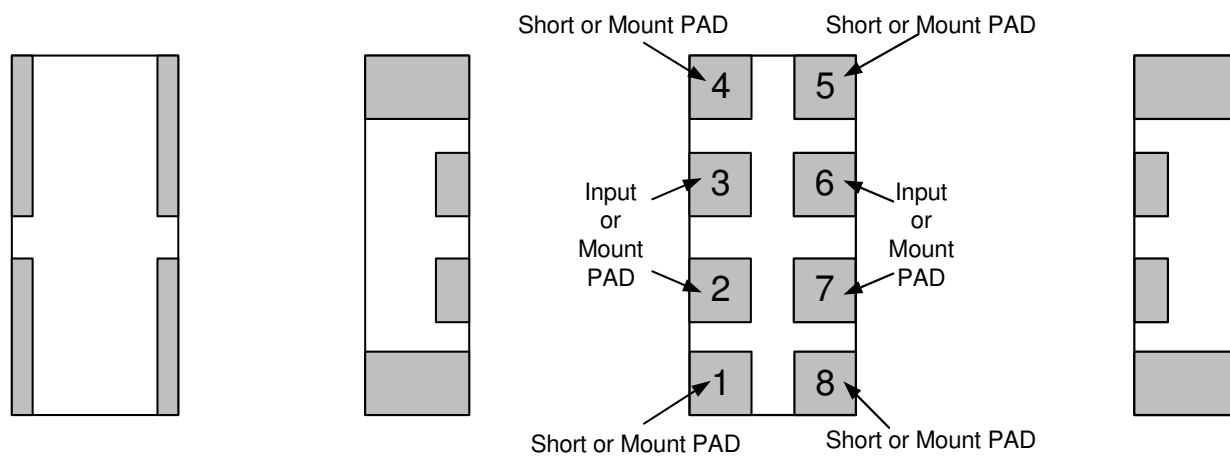


12. Mechanical Characteristics

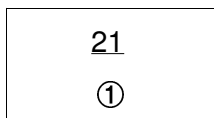
12.1 Antenna Pattern Dimension



12.2 Pin name

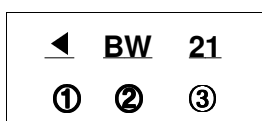
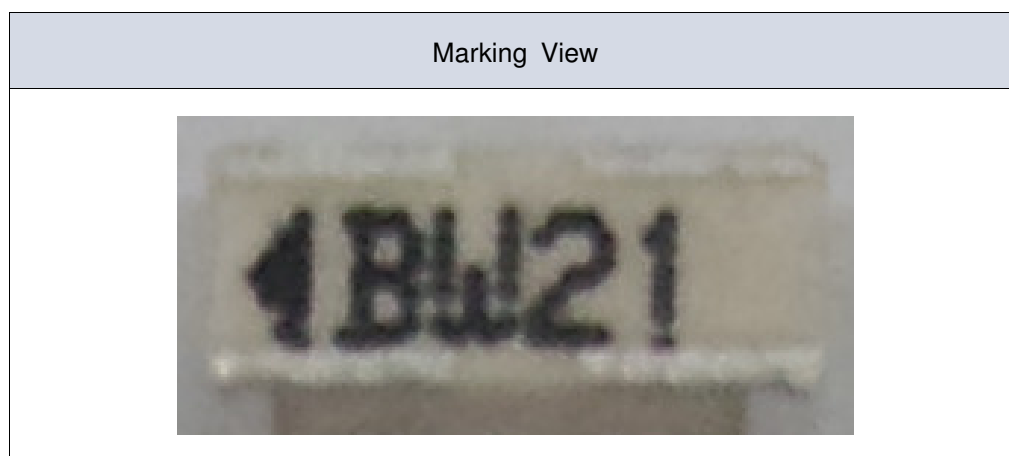


12.3 LOT number notation



① Week : 1 - 1 Week, 2 - 2 Week, 3 - 3 Week, ..., 20 - 20 Week, 21 - 20 Week ...

12.4 Marking



① Input Signal

② Bluetooth, WiFi

③ Week : 1 - 1 Week, 2 - 2 Week, 3 - 3 Week, ..., 20 - 20 Week, 21 - 20 Week ...

12.5 Marking type

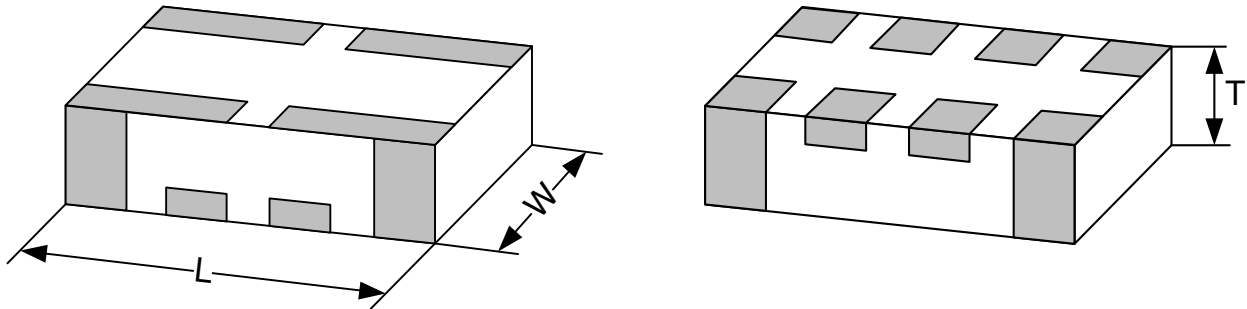
Ink marking - Using Black Ink

13. Structure and Material

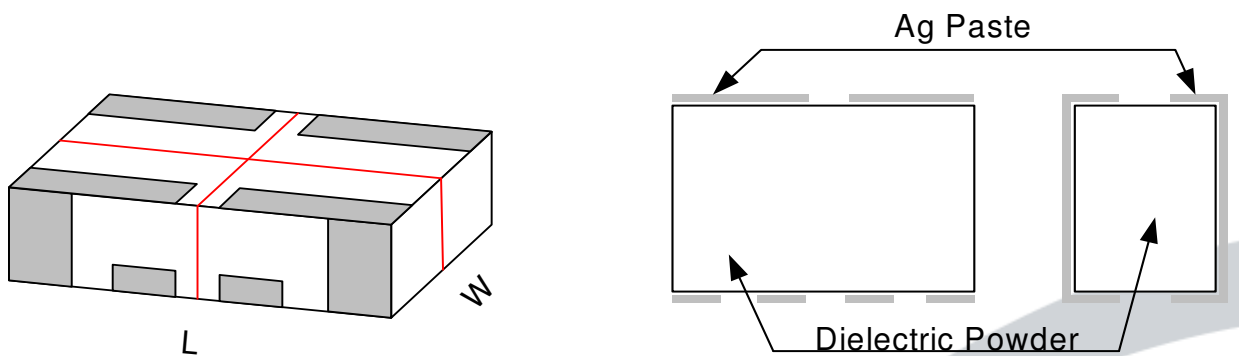
13.1 materialization method

Chip antenna forms the pattern with Ag paste on the brick of dielectric block and materializes the characteristics

13.2 Struture



13.3 Internal cross section



13.4 Material

ITEM	Material	Maker	Printing pattern SPEC
Dielectric Block	Powder	INanoTech	
PATTERN	Ag Paste	DeaJoo	Thickness : Min10 μ m(TYP 16~20 μ m)

14. Attention

14.1 Temperature Condition

	Range of Temperature	Unit
Application Temperature	-40 ~ +100	°C
Keeping Temperature	-40 ~ + 70	°C

14.2 Temperature Test Condition

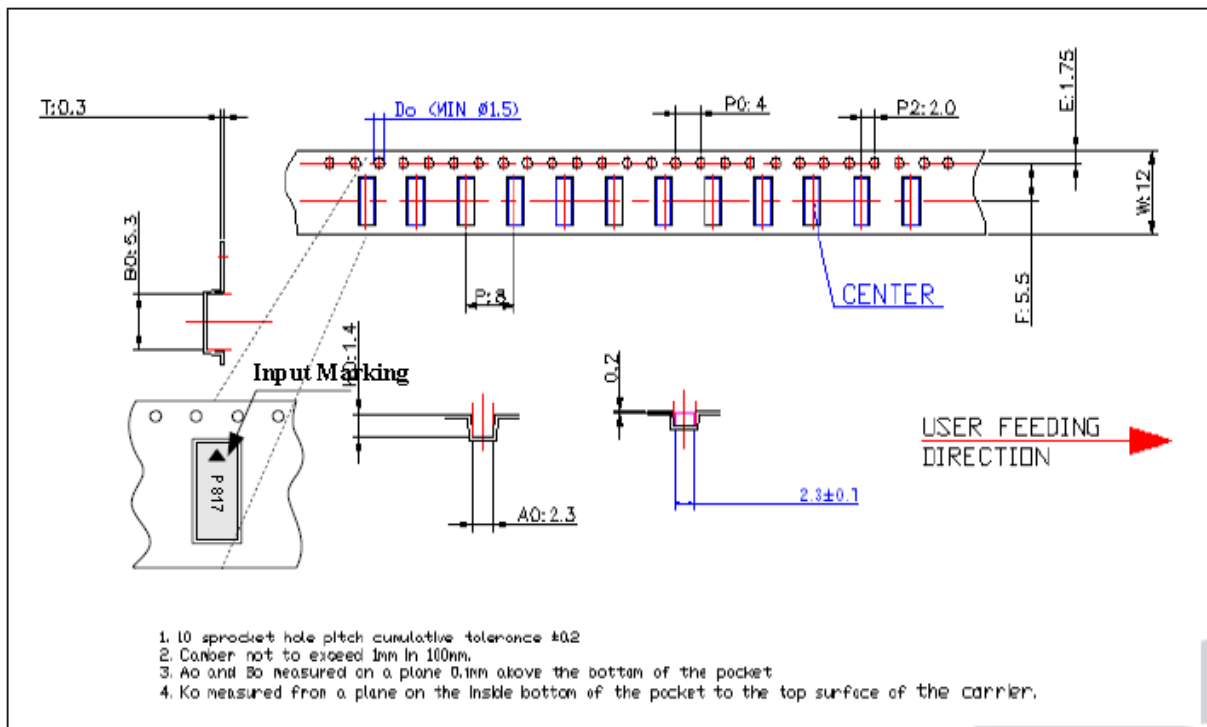
	Condition	Range of Temperature
Application temperature	Low	24hr normal action at -75 °C
	High	24hr normal action at +150 °C
Keeping temperature	Low	normal action when left for 1000hr at -75 °C
	High	normal action when left for 1000hr at +85 °C

* Because of the keeping temperature problem, no admission when left over +85 °C

15. Packing

15.1 Carrier/Reel

Item	Material	Surface Resistance	Electricity	Method
Carrier tape	A-PET	Typical $10^8\Omega$	10V MAX	Heat Press
Cover tape	PET	Typical $10^8\Omega$	30V MAX	
Reel	PS	Typical $10^8\Omega$	30V MAX	-

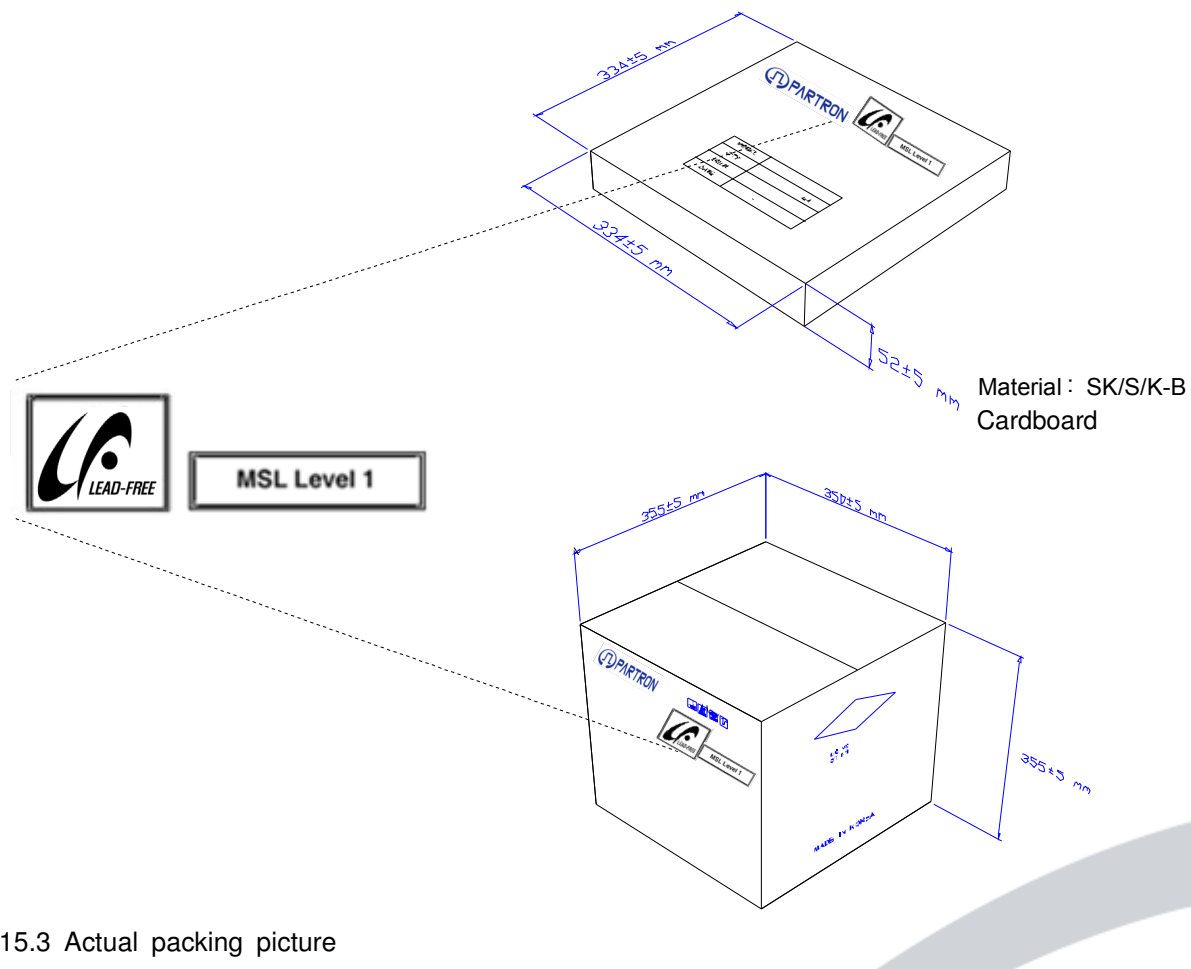


DKC DWG. No.	D-1208-058
DIMENSIONAL UNIT	MM
UNTOLERANCED DIMENSION	± 0.1
CAD FILE NAME	051010
DESIGNED BY	K. M. C
SCALE	1/1
TITLE	CARRIER TAPE 2.0*5.0*1.2P
PART.	CARRIER TAPE
MATERIAL	A-PET
LENGTH	50.4M
COUNT	6300P

NAME	SPEC.
W	12.0 ± 0.2
E	1.75 ± 0.1
F	5.5 ± 0.1
Do	1.5 ± 0.1
P	8.0 ± 0.1
P0	4.0 ± 0.1
P2	2.0 ± 0.1
A0	2.3 ± 0.1
B0	5.3 ± 0.1
K0	1.4 ± 0.1
T	0.3 ± 0.05



15.2 Box



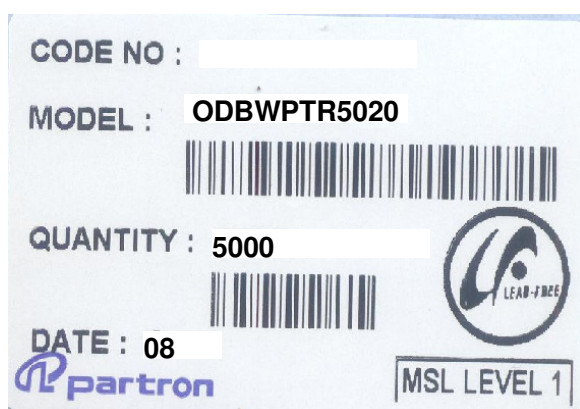
15.3 Actual packing picture



Reel



Internal Box



Reel / Inner Box label



Outer Box label

16. Process Control

Product			Issued/Revision		Process Control				Record	By designed	By checked	By approved		
CHIP ANTENNA			Issued	04.04.06					Revised	05.04.03	PRCP-C001			
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
Ceramic POWDER		◇	Import Inspection						shrinking rate permittivity	refer to Guide Sheet	Micrometer Network	10ea/LOT	C/sheet	Return
POWDER lubricant	○		powder	Mixer					mixing	POWDER lubricant	Scale	PER MIXING	—	Exhaust
		○	Shaping	Press	pressure Mold Condition	refer to Guide Sheet	Per LOT 1/day	parameter C/SHEET	dimension weight density aspect	refer to Guide Sheet	Micrometer scale Calculated Visual	5/100EA 10ea/lot	LOT CARD	Exhaust
		○	Plasticity	Plasticity Hole	SETTER Outside Temperature PROFILE	refer to Guide Sheet	all 2/day 1/month	C/sheet						
		◇	Block						wide length shape	refer to Guide Sheet	Micrometer Calipers Visual Inspection	20ea/LOT 20ea/LOT all	C/sheet	Exhaust
AG PASTE		○	SIDE1 PAD Printing	Printer screen	Squeeze velocity/pressure SNAP	refer to Guide Sheet	1/day	—	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
		○	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework

Product			Issued/Revision		Process Control				Record	By designed	By checked	By approved		
CHIP ANTENNA			Issued	04.04.06					PRCP-C001					
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
AG PASTE			SIDE 2 PAD Printing	Printer screen	Squeeze velocity/pressure SNAP	refer to Guide Sheet	1/day	—	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
			Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
AG PASTE			TOP printing	Printer screen	Squeeze velocity/pressure SNAP	refer to Guide Sheet	1/day	—	PATTERN dimension	refer to Guide Sheet	measure	10ea/3Jig	c/sheet	Rework
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
AG PASTE			BOTTOM PAD Printing CTQ	printer screen	Squeeze velocity/pressure SNAP	refer to Guide Sheet	1/day	—	PATTERN dimension aspect	refer to Guide Sheet	measure Microscope	10ea/3Jig	c/sheet	Rework

Product			Issued/Revision		Process Control				Record	By designed	By checked	By approved		
CHIP ANTENNA			Issued	04.04.06					PRCP-C001					
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
			Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
			aspect inspection						aspect	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
			MARKING	Marking Machine					marking	Reference SPL	Visual Inspection	all	Lot card production diary	Rework Exhaust
			Electrical Characteristic	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/2hour	C/sheet	Electrical Characteristic	refer to Guide Sheet	Network	all	Lot card production diary	Exhaust repair
			aspect inspection						aspect dimension	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
Carrier cover reel			Taping						Quantity Direction aspect	refer to Guide Sheet	Manual	all	Lot card production diary	Rework
			shipper inspection	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/person	C/sheet	Electrical Characteristic aspect packing	refer to Guide Sheet	Network microscope Visual Inspection	refer to Guide Sheet	Result Paper	return Exhaust
packing box label			packing	bar code printer					packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	—	Rework
			packing inspection						packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	—	return

17. RoHS Data

1) Ceramic Powder

Parts Name	iM-K8
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

SGS	
Test Report	No. SHAC/E1519187401 Date: 23 Sep 2015 Page 1 of 5
WUXI INANOTECH CO.,LTD NO.518-3 ZHONGHU ROAD, WUXI, JIANGSU, CHINA (214174)	
The following sample(s) was/were submitted and identified on behalf of the client as : CERAMIC POWDER	
SGS Job No.:	SP15-031877 - SH
Model No.:	IM-KB
Composition :	MgSiO4 59 T103
Date of Sample Received :	21 Sep 2015
Testing Period :	21 Sep 2015 - 23 Sep 2015
Test Requested :	Selected test(s) as requested by client.
Test Method :	Please refer to next page(s).
Test Results :	Please refer to next page(s).
Conclusion :	Based on the performed tests on submitted sample(s), the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBBs), Polychlorinated biphenyl ethers (PCBEs) comply with the limits as set by RoHS Directive 2011/65/EU Annex II, recasting 2002/95/EC.
Signed for and on behalf of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.	
Mary Ma Approved Signatory	
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SGS

Test Report

No. SHA-EC1619187401

Date: 23 Sep 2015

Page 2 of 5

Test Results:

Test Part Description:

Specimen No.	SGS Sample ID	Description
SN1	SHA15-191874-001	Grey powder

Remarks:

- (1) 1 mg/kg < 0.0001%
- (2) MDL = Method Detection Limit
- (3) ND = Not Detected (< MDL)
- (4) "-" = Not Regulated

RoHS Directive 2011/65/EU

Test Method:

- (1) With reference to IEC 6321-6:2013, determination of Cadmium by ICP-OES.
- (2) With reference to IEC 6321-6:2013, determination of Lead by ICP-OES.
- (3) With reference to IEC 6321-4:2013, determination of Mercury by ICP-OES.
- (4) With reference to IEC 6321-2:2008, determination of Hexavalent Chromium by Colorimetric Method Using UV-Vis.
- (5) With reference to IEC 6321-6:2013, determination of PBBs and PBDEs by GC-MS.

Test Results:

Limit	Unit	MDL	ND	
Cadmium (Cd)	1000 mg/kg	2	ND	
Lead (Pb)	1000 mg/kg	2	ND	
Mercury (Hg)	1000 mg/kg	2	ND	
Hexavalent Chromium (Cr(VI))	1000 mg/kg	2	ND	
Sum of PBBs	1000 mg/kg	-	ND	
Monobromobiphenyl	-	mg/kg	6	ND
Dibromobiphenyl	-	mg/kg	6	ND
Tribromobiphenyl	-	mg/kg	6	ND
Tetra bromobiphenyl	-	mg/kg	6	ND
Pentabromobiphenyl	-	mg/kg	6	ND
Hexabromobiphenyl	-	mg/kg	6	ND
Heptabromobiphenyl	-	mg/kg	6	ND
Octabromobiphenyl	-	mg/kg	6	ND
Nonabromobiphenyl	-	mg/kg	6	ND
Decabromobiphenyl	-	mg/kg	6	ND
Sum of PBDEs	1000 mg/kg	-	ND	
Monobromobiphenyl ether	-	mg/kg	6	ND



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File No: SHA-EC1619187401

File No: SHA-EC1619187401

File No: SHA-EC1619187401

File No: SHA-EC1619187401

			
Test Report			
No. SHAC1519187401		Date: 23 Sep 2015	Page 3 of 3
<u>Test Item(s)</u>	<u>Limit</u>	<u>Unit</u>	<u>MDL</u> <u>ODI</u>
Dibromodiphenyl ether	-	mg/kg	5 ND
Tribromodiphenyl ether	-	mg/kg	5 ND
Tetra bromodiphenyl ether	-	mg/kg	5 ND
Pentabromodiphenyl ether	-	mg/kg	5 ND
Hexabromodiphenyl ether	-	mg/kg	5 ND
Heptabromodiphenyl ether	-	mg/kg	5 ND
Octabromodiphenyl ether	-	mg/kg	5 ND
Nonabromodiphenyl ether	-	mg/kg	5 ND
Decabromodiphenyl ether	-	mg/kg	5 ND

SGS

Test Report

No. SHAEC1619187401

Date: 23 Sep 2016

Page 4 of 5

ATTACHMENTS

RoHS Testing Flow Chart

- 1) Name of the person who made testing: Bob Zhang/Gary Xu/Zengchen Zhu/Sunny Qin
- 2) Name of the person in charge of testing: Jin Shi/Summer Jin/Jueyee Huang/Shane Chen
- 3) These samples were dissolved totally by pre-conditioning method according to below flow chart.
(Cu^+ and PBBs/PBDEs test method excluded)

```
graph TD; A[Sample Preparation] --> B[Sample Measurement]; B --> C[Pb/Cd/Hg]; B --> D[PBBs/PBDEs]; B --> E[Cu+]; C --> F["Acid digestion with microwave/hotplate"]; F --> G[Filtration]; G --> H[Solution]; G --> I[Residue]; H --> J["ICP-OES/IAAS"]; J --> K[DATA]; I --> L["1) Alkali Fusion / Dry ashing  
2) Acid to dissolve"]; L --> M[DATA]; D --> N[Sample solvent extraction]; N --> O["Concentration / Dilution of extraction solution"]; O --> P[Filtration]; P --> Q[GCMS]; Q --> R[DATA]; N --> S[Nonmetallic material]; S --> T[Adding digestion reagent]; T --> U["Heating to 30~95°C for extractions"]; U --> V["Filtration and pH adjustment"]; V --> W["Adding 1,5-diphenylcarbazide for color development"]; W --> X[UV-Vis]; X --> Y[DATA]; N --> Z[Metallic material]; Z --> AA[Positive]; AA --> AB[Spot test]; AB --> AC[Boiling water extraction]; AC --> AD["Adding 1,5-diphenylcarbazide for color development"]; AD --> AE["A red color indicates the presence of Cu+. If necessary, confirm with UV-Vis."]; AE --> AF[DATA];
```

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2) Ag Paste

Parts Name	DNF2010C
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table



Test Report No. F86101LF-CTSAIAA15-23789

Issued Date : 2015. 05. 18 Page 1 of 7

DAEJOO ELECTRONICS MATERIALS CO., LTD.
148,Saehwan-ro
Siheung-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : A/AA15-23789

Product Name : Ag Paste

Item No./Part No. : N/A

Client Reference Data : DNF810C(Y150310), DNF851Q(Y150326), DNF851Q(Y150305)

Received Date : 2015. 05. 08

Test Period : 2015. 05. 08 to 2015. 05. 18

Report Comments : By the applicant's request, item No./part No.s & client reference information are stated/added on report.

Test Results : For further details, please refer to following page(s)



SGS Korea Co., Ltd.
Jeff Jang / Chemical Lab Mgr



Test Report No. F86101LF-CTSAIAA15-23789

Issued Date : 2015. 05. 18 Page 2 of 7

Sample No. : A/AA15-23789-001

Sample Description : Ag Paste

Item No./Part No. : N/A

Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Lead (Pb)	mg/kg	With reference to IEC 62321-4:2013 (Determination of Lead by ICP-OES)	5	N.D.
Cadmium (Cd)	mg/kg	With reference to IEC 62321-4:2013 (Determination of Cadmium by ICP-OES)	0.5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013 (Determination of Mercury by ICP-OES)	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321-2:2008 (Determination of Hexavalent Chromium by spot test/Colorimetric Method using MP05)	1	N.D.

Flame Retardants-PBBS/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Dibromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Tribromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Tetrabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Pentabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Hexabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Heptabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Octabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Nonabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Decabromodiphenyl	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321-2:2008 (Determination of PBBS and PBDEs by GC-MS)	5	N.D.

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Test Report No. F890101/LF-CTSAVAA15-23789

Sample No. : A/AA15-23789.001

Sample Description : Ag Paste

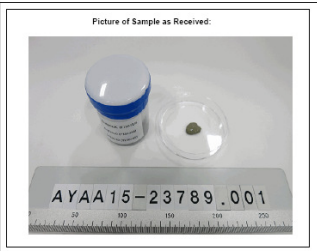
Item No./Part No. : N/A

Material : N/A

Issued Date : 2015. 05. 18

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Picture of Sample as Received:



Test Items	Unit	Test Method	MDL	Result
Pentabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 8231:2008 (Determination of PBBs and PBDEs by GC-MS)	5	N.D.

Test Items	Unit	Test Method	MDL	Result
Chlorine(Cl)	mg/kg	With reference to EN 14562:IC	30	N.D.
Bromine(Br)	mg/kg	With reference to EN 14562:IC	30	N.D.

NOTE:

- (1) N.D. = Not detected (+MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) = Qualitative analysis (No Unit)
- (7) = Boiling-water-extraction

Negative = Absence of CrVI coating
Positive = Presence of CrVI coating
solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area

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Test Report No. F680101LF-CTSAVAIA15-23789 Issued Date : 2015. 05. 19 Page 5 of 7

Flow Chart of Digestion

```

graph TD
    A[Cutting/Preparation] --> B[Sample Measurement]
    B --> C[Cd,Pb]
    B --> D[Hg]
    C --> E[Decomposition under closed(microwave) or open(acid digestion) system by suitable acid for each sample matrix.]
    D --> F[Decomposition under closed(microwave) system by suitable acid for each sample matrix.]
    E --> G[Filtration]
    F --> G
    G --> H[Solution]
    G --> I[Residue]
    H --> J[ICP-AES]
    I --> K[Alkali Fusion]
        
```

Sample material	Digestion Acid
Metal-Fe, Cu, Al, etc.	Aqua regia, HCl, HNO ₃
Plastic	HNO ₃ , HCl, HF, HClO ₄
Silver	HNO ₃ , H ₂ SO ₄
Solder, Au, Pt, Pd, Sb, Sn	Aqua regia
Glass	HNO ₃ , HF
Ti, Zr, W, Mo, Si, Hf, Nb-Ta	HNO ₃ , HCl, HF
Sn(as IEC 82321)	HNO ₃ , HCl, H ₂ SO ₄ , HBr
Others	Any acid

The samples were dissolved totally by pre-conditioning method according to above flow chart.
Section Chief : GBase YI

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F421 V050062

SGS

Test Report No. F680101LF-CTSAVAIA15-23789 Issued Date : 2015. 05. 19 Page 6 of 7

Flow Chart of Cr 6+, PBB/PBDEs Testing

```

graph TD
    subgraph PBBPBDEs
        A1[Mechanic_Sample] --> B1[Sample Measurement]
        B1 --> C1[Solvent Extraction of the Sample]
        C1 --> D1[Screen Analysis]
        D1 --> E1[Concentration/Dilution of Extraction Solution]
        E1 --> F1[GC/MS]
        F1 --> G1[DATA]
    end
    subgraph Cr6_1[Cr 6+]
        A2[Mechanic_Sample] --> B2[Sample Measurement]
        B2 --> C2[Nonmetallic Material]
        C2 --> D2[Adding Extraction Solution]
        D2 --> E2[Heating to 90-95°C for Extraction]
        E2 --> F2[Filtration and pH Adjustment]
        F2 --> G2[Adding 1,5-Diphenylcarbazide for Color Development]
        G2 --> H2[UV-Vis]
        H2 --> I2[DATA]
    end
    subgraph Cr6_2[Cr 6+]
        A3[Mechanic_Sample] --> B3[Sample Measurement]
        B3 --> C3[Spot Test / Boiling Water Extraction]
        C3 --> D3[Adding 1,5-Diphenylcarbazide for Color Development]
        D3 --> E3[Confirm with UV-Vis]
        E3 --> F3[DATA]
    end
        
```

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F421 V050062

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Test Report No. F680101LF-CTSAVAIA15-23789 Issued Date : 2015. 05. 19 Page 7 of 7

Flow Chart for Halogen Test

```

graph TD
    A[Sample screening using XRF.] --> B[Liquid containing water(>80%)]
    B -- Yes --> C[Dilute the solution (EPA300)]
    B -- No --> D[Weigh the samples into the combustion boat.]
    D --> E[Add absorption solution into the bomb or tube.]
    E --> F[Admit O2 gas or O2 +Ar2 gas and start the combustion.]
    F --> G[Allow during absorption of the burnt gas.]
    G --> H[Analyze absorbed solution using Ion Chromatography.]
    H --> I[Data]
    I --> J["** End of Report **"]
        
```

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F421 V050062

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3) Marking Ink

Parts Name	IR/IC-270BK INK
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

测试报告

No. SHAEC1510713104

日期: 2015年06月09日 第1页,共6页

多米诺标识科技有限公司

中国上海市浦东金桥出口加工区云桥路1150号

以下测试之样品是由申请者所提供及确认: IR-299BK/IR-299BK 印刷油墨

SGS工作编号: SP15-018441 - SH

料号: IR-299BK/IR-299BK

批号: AC000132A

样品接收日期: 2015年06月05日

测试周期: 2015年06月05日 - 2015年06月09日

测试要求: 根据客户要求测试

测试方法:

请参见下一页

测试结果:

请参见下一页

结论:
基于所述样品进行的测试, 铜、铅、汞、六价铬、多溴联苯(PBBs)、多溴二苯醚(PBDEs)的测试结果符合欧盟RoHS指令2002/95/EC的重订指令2011/65/EU附带的限值要求。

通标标准技术服务(上海)有限公司
授权签名

刘海鹏

Helen Liu 刘海鹏

批准签名

本报告编号为SHAEC1510713103报告的中文版本

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测试报告

No. SHAEIC1510713104

日期: 2015年06月09日 第2页,共6页

测试结果:

测试样品描述:

样品编号	SGS样品ID	描述
SN1	SHA15-107131.002	黑色液体

备注:

- (1) 1 mg/kg = 0.00001 %
- (2) MDL = 方法检测限
- (3) ND = 未检出 (< MDL)
- (4) "-" = 未规定

RoHS指令2011/65/EU

测试方法:

- (1) 参考IEC 62321-5:2013, 用ICP-OES测定钨的含量
- (2) 参考IEC 62321-5:2013, 用AAS测定钨的含量
- (3) 参考IEC 62321-4:2013, 用ICP-OES测定钨的含量
- (4) 参考IEC 62321-2:2008, 用重量法测定六价铬和总铬的含量
- (5) 参考IEC 62321-2:2008, 用GC-MS测定PBDEs (多溴联苯) 和PBDEs (多溴二苯醚) 的含量

测试项目	测值	单位	MDL	2012
钨(Cd)	100	mg/kg	2	ND
钨(Pb)	1000	mg/kg	2	ND
汞(Hg)	1000	mg/kg	2	ND
六价铬(Cr(VI))	1000	mg/kg	2	ND
多溴联苯之和(PBBs)	-	mg/kg	-	ND
一溴联苯	-	mg/kg	5	ND
二溴联苯	-	mg/kg	5	ND
三溴联苯	-	mg/kg	5	ND
四溴联苯	-	mg/kg	5	ND
五溴联苯	-	mg/kg	5	ND
六溴联苯	-	mg/kg	5	ND
七溴联苯	-	mg/kg	5	ND
八溴联苯	-	mg/kg	5	ND
九溴联苯	-	mg/kg	5	ND
十溴联苯	-	mg/kg	5	ND
多溴二苯醚之和(PBDEs)	1000	mg/kg	-	ND
一溴二苯醚	-	mg/kg	-	ND
二溴二苯醚	-	mg/kg	-	ND



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15-06-2015 15:02:51

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测试报告

No. SH4EC1510713104

日期: 2015年06月09日 第4页,共6页

附件

RoHS 测试流程图

- 1) 分析人员: 张小松/徐倩/李增旭/鲁心童
- 2) 项目负责人: 黄育/金家辉/陈伟/陈高磊
- 3) 样品按照下述流程被完全消解(六价铬和多溴联苯醚/多溴二苯醚测试除外)。

```
graph TD; A[预处理] --> B[置取]; B --> C[盐/熔剂]; B --> D[多溴联苯醚/多溴二苯醚]; B --> E[六价铬]; C --> F[用微波消解仪/电热板进行酸消解]; F --> G[过滤]; G --> H[滤液]; G --> I[残留物]; I --> J["1) 碱溶出/灰化  
2) 酸溶解"]; J --> K[电感耦合等离子体发射光谱/原子吸收光谱]; K --> L[数据]; D --> M[用溶剂萃取]; M --> N[浓缩/稀释萃取液]; N --> O[过滤]; O --> P[气相色谱-质谱联用仪]; P --> Q[数据]; E --> R[非金属]; R --> S[加入消解液]; S --> T["在 90~95℃ 条件下  
萃取"]; T --> U[过滤、调整 pH]; U --> V["加入 1.5~2 亚硫酸二氨基色"]; V --> W[紫外-可见分光光度计]; W --> X[数据]; E --> Y[金属]; Y --> Z[检测到]; Z --> AA{是否测试}; AA -- 是 --> AB[沸水萃取]; AB --> AC["加入 1.5~2 亚硫酸二氨基色"]; AC --> AD["若显示红色，表明检测到六价铬，必要时采用紫外-可见分光光度法验证"]; AD --> AE[数据]; AA -- 否 --> AF[数据];
```

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Serving Society
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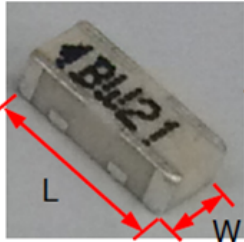
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18. Reliability test report - an annexed paper



19. Shipment Inspection Report

부 분	발 당		확 인		승 인		검 사 성 적 서				검 정																												
협력회사명	주 파 트 론				부품명	CHIP Antenna(ODBWPTR5020)				출고수량																													
적용모델	ODBWPTR5020				CODE NO			LOT - NO			Ver(버전)	1.0																											
검사일	파트론	20		검사원	파트론	안선주		종 합	파트론	합격	재 질																												
	업체				업체			판 정	업체			Powder+Ag paste																											
검 사 항 목	검 사 방 식				검 사 조 건				시 료 수		불량수																												
	파트론		업체						파트론	업체	파트론	업체																											
외 관	KS Q ISO 2869-1 G-2				0.65 (c=0)				n=			Pn= 0																											
치 수	체 크 검 사				c=0				n= 20			Pn= 0																											
전기적특성	KS Q ISO 2869-1 G-2				0.65 (c=0)				n=			Pn= 0																											
유해물질	체 크 검 사				c=0				n=1			Pn= 0																											
측 정 DATA ※ 검사항목별 검사 수중에 일치된 수량을 검사하고 시트가 20개 이상일 경우 측정DATA는 20개만 지정한다.																																							
검 사 항 목	특성검사				치 수(mm)				외관검사		유해물질																												
	2096MHz 1.0 ~ 3.0		2126MHz 1.0 ~ 3.0		L ① 6.00 ±0.10		W ② 2.00 ±0.10		T ③ 1.20 ±0.10		파손,미인쇄 인쇄번질,변색등																												
구 격	파트론	업체	파트론	업체	파트론	업체	파트론	업체	파트론	업체	판정기준에 준함 것																												
구 분	파트론	업체	파트론	업체	파트론	업체	파트론	업체	파트론	업체	파트론	업체																											
1	1.81		1.62		6.02		2.01		1.20		OK																												
2	1.74		1.60		4.99		1.99		1.21		OK																												
3	1.68		1.69		6.01		2.00		1.22		OK																												
4	1.70		1.63		4.98		2.02		1.20		OK																												
5	1.69		1.74		6.02		1.98		1.20		OK																												
6	1.64		1.69		6.00		2.00		1.19		OK																												
7	1.76		1.60		4.98		1.99		1.21		OK																												
8	1.67		1.62		6.00		2.00		1.18		OK																												
9	1.63		1.68		6.01		2.01		1.20		OK																												
10	1.62		1.63		6.03		2.00		1.17		OK																												
11	1.61		1.61		4.99		2.02		1.20		OK																												
12	1.64		1.60		6.00		1.98		1.19		OK																												
13	1.83		1.64		4.99		2.01		1.21		OK																												
14	1.68		1.63		6.01		1.99		1.23		OK																												
15	1.66		1.62		4.99		2.00		1.20		OK																												
16	1.68		1.61		6.02		1.98		1.19		OK																												
17	1.69		1.68		6.00		2.02		1.22		OK																												
18	1.67		1.62		4.99		1.98		1.18		OK																												
19	1.68		1.69		6.02		2.00		1.19		OK																												
20	1.83		1.64		4.98		1.99		1.20		OK																												
X	1.67		1.62		6.00		2.00		1.20																														
σ	0.09		0.06		0.02		0.01		0.01																														
Cpk	2.36		3.33		2.14		2.43		2.26																														
판 정	OK		OK		OK		OK		OK																														
도 면  																																							
RoHS H Sb-F 유기물 (단위 : ppm) <table border="1"> <thead> <tr> <th rowspan="2">물질구분</th> <th colspan="4">RoHS-Free</th> <th colspan="3">Halogen-free</th> <th rowspan="2">유기주석</th> <th rowspan="2">TbOC</th> </tr> <tr> <th>Cd</th> <th>Pb</th> <th>Hg</th> <th>Cr</th> <th>Br</th> <th>Cl</th> <th>Sb</th> </tr> </thead> <tbody> <tr> <td>판정기준</td> <td>50</td> <td>200</td> <td>700</td> <td>700</td> <td>900</td> <td>900</td> <td>700</td> <td>900</td> <td>16</td> </tr> </tbody> </table>													물질구분	RoHS-Free				Halogen-free			유기주석	TbOC	Cd	Pb	Hg	Cr	Br	Cl	Sb	판정기준	50	200	700	700	900	900	700	900	16
물질구분	RoHS-Free				Halogen-free			유기주석	TbOC																														
	Cd	Pb	Hg	Cr	Br	Cl	Sb																																
판정기준	50	200	700	700	900	900	700	900	16																														