

Approval Sheet

Products	Chip Antenna	3D Structure
Supplier CODE	SDBTPTR3015	 Top-Side View  Bottom-Side View
Model	ACT231	
SEC CODE		
Revision	Ver1.0 10/04	
Supplier	Partron	

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

By designed	By checked	By approved
김흥기		
Hongki.Kim	Chanik.Jeon	Namsik.Min
10/04	10/04	10/04

– Contents –

※ Cover	1 p
※ Contents	2 p
1. Revision History	3 p
2. Summary of Parts	4 p
3. Critical to Quality	4 p
4. Electrical Characteristics	5 p
5. Measurement Process	10 p
6. Equivalent Circuit	12 p
7. Application Note	12 p
8. Test Fixture Specification	16 p
9. REFLOW PROFILE	18 p
10. Primary Inspection List	19 p
11. Reliability Condition	21 p
12. Mechanical Characteristics	21 p
13. Structure and Material	23 p
14. Attention	24 p
15. Packing	25 p
16. Process Control	29 p
17. RoHS Data	32 p

1. Revision

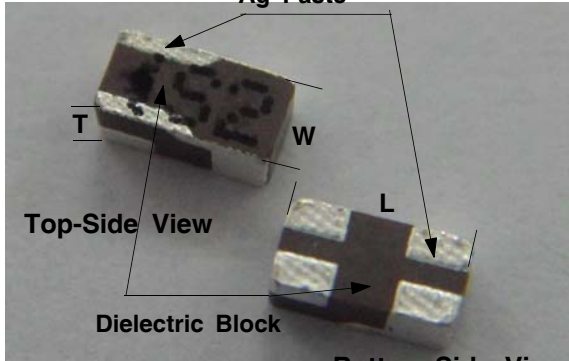
Revision No	Originator	Description of changes	Date of changes
Ver 1.0	Hongki.Kim	Issued	2012.10.04

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 = 3.0 ± 0.1 (CPK: 2.63)					
	W = 1.5 ± 0.1 (CPK: 2.24)					
	T = 1.2 ± 0.1 (CPK: 2.12)					
Flatness Level	0.03					
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
	2400MHz	1.0 ~ 2.5 :1	all inspection	all	4.01	4,6,19 Page
	2485MHz	1.0 ~ 2.5 :1	all inspection	all	5.03	4,6,19 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	$1350 \pm 15^\circ\text{C}$	three times a day	Temperature Sensor
Dry Temperature	$200 \pm 15^\circ\text{C}$	three times a day	Temperature Sensor
Hot Belt Conveyor Temperature	$900 \pm 25^\circ\text{C}$	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.

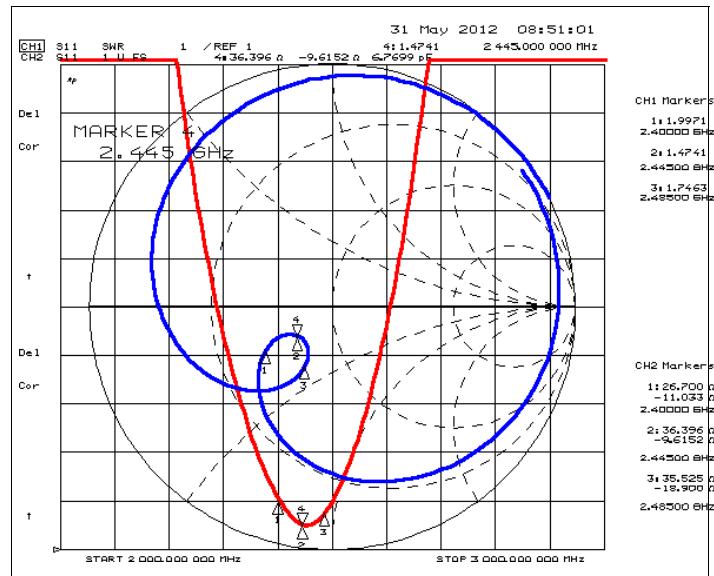
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

4. Electrical Characteristics

4.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3.0 : 1 (Typ 2.5 : 1)
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Matching Value of Antenna Matching Circuit (Direction, from Antenna to Module)	Antenna Matching Circuit	Series (Feeding)		2.2pF
		Series (GND)		3.3pF
	π -Matching Circuit	Shunt1		NC
		Series		100pF
		Shunt2		NC
Gain [dBi]	Total Gain (Peak / Avg) [dBi]			-3.69 / -7.92
	Azimuth	Theta	Peak	-2.20
			Average	-6.16
		Phi	Peak	-5.99
			Average	-10.37
	Elevation 1	Theta	Peak	-3.41
			Average	-8.00
		Phi	Peak	-2.91
			Average	-7.42
	Elevation 2	Theta	Peak	-7.92
			Average	-11.32
		Phi	Peak	-2.37
			Average	-6.53

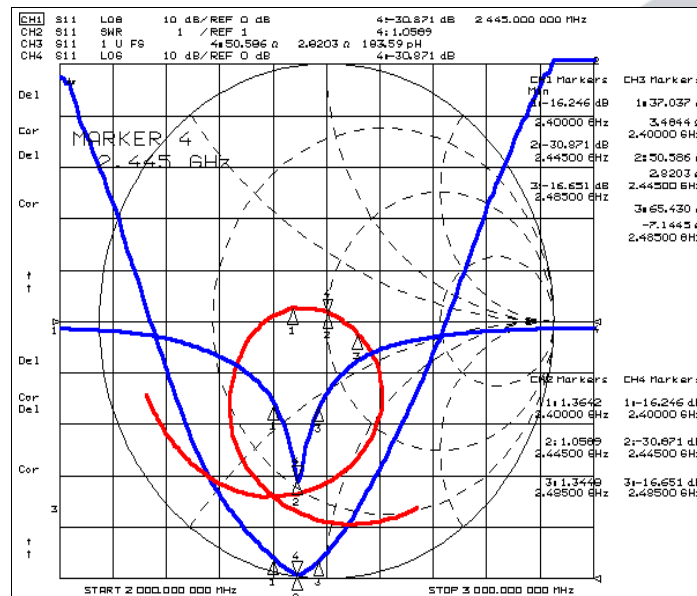
4.2 S11 Graph of Set Condition



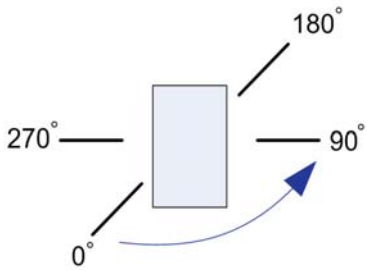
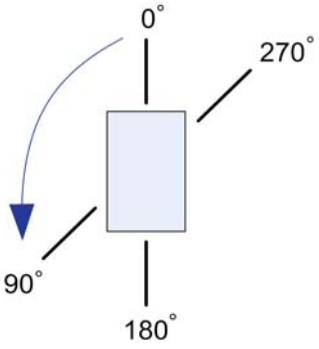
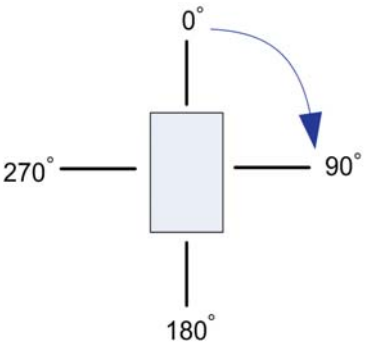
4.3 Test Fixture Condition

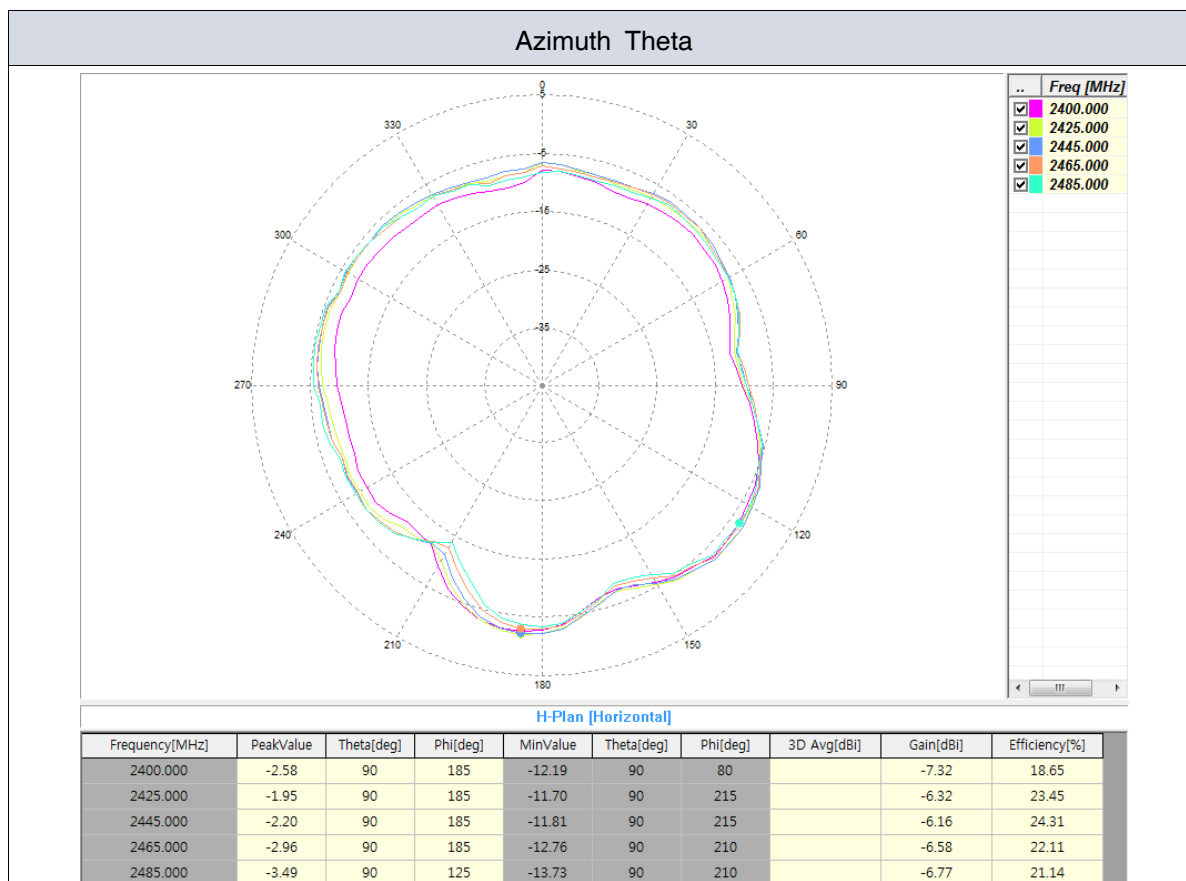
ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
Lower frequency(2400 MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 2.0 : 1)
Upper frequency(2485 MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 2.0 : 1)

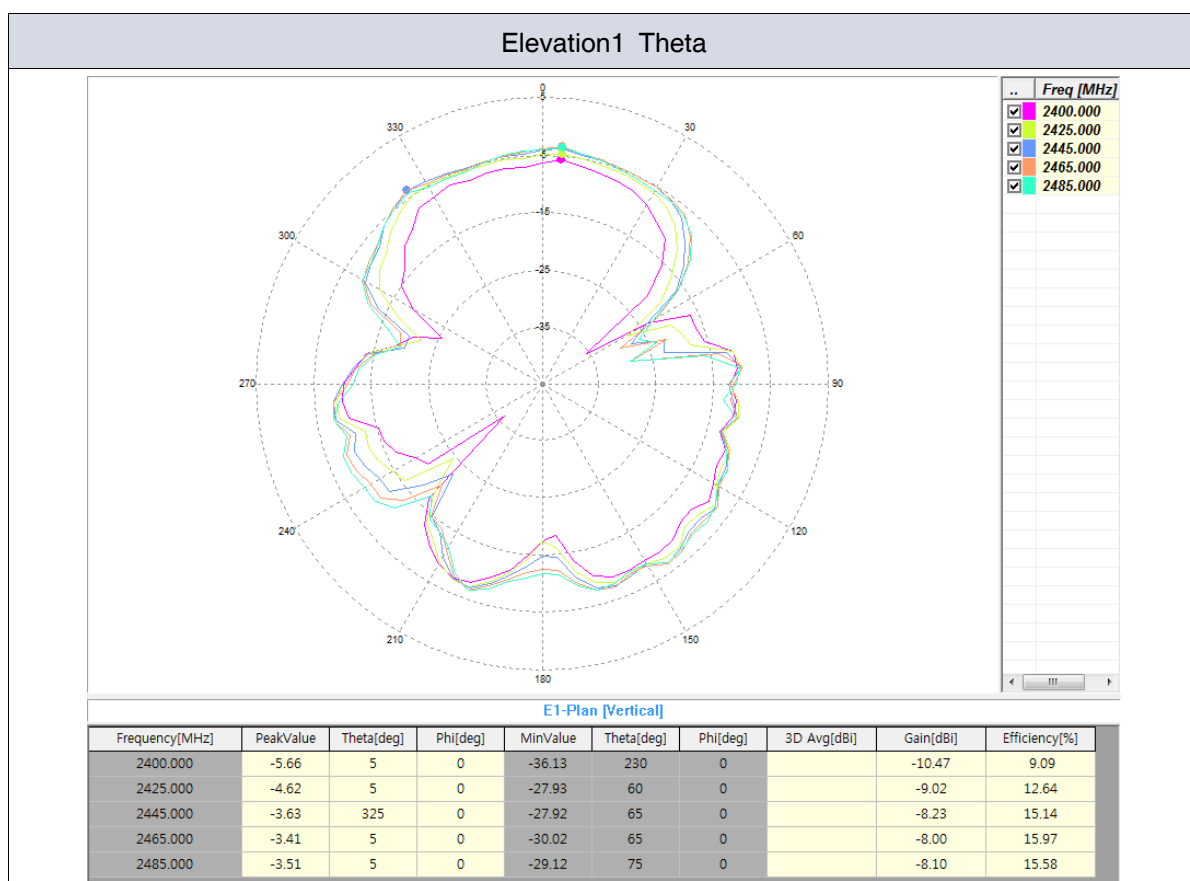
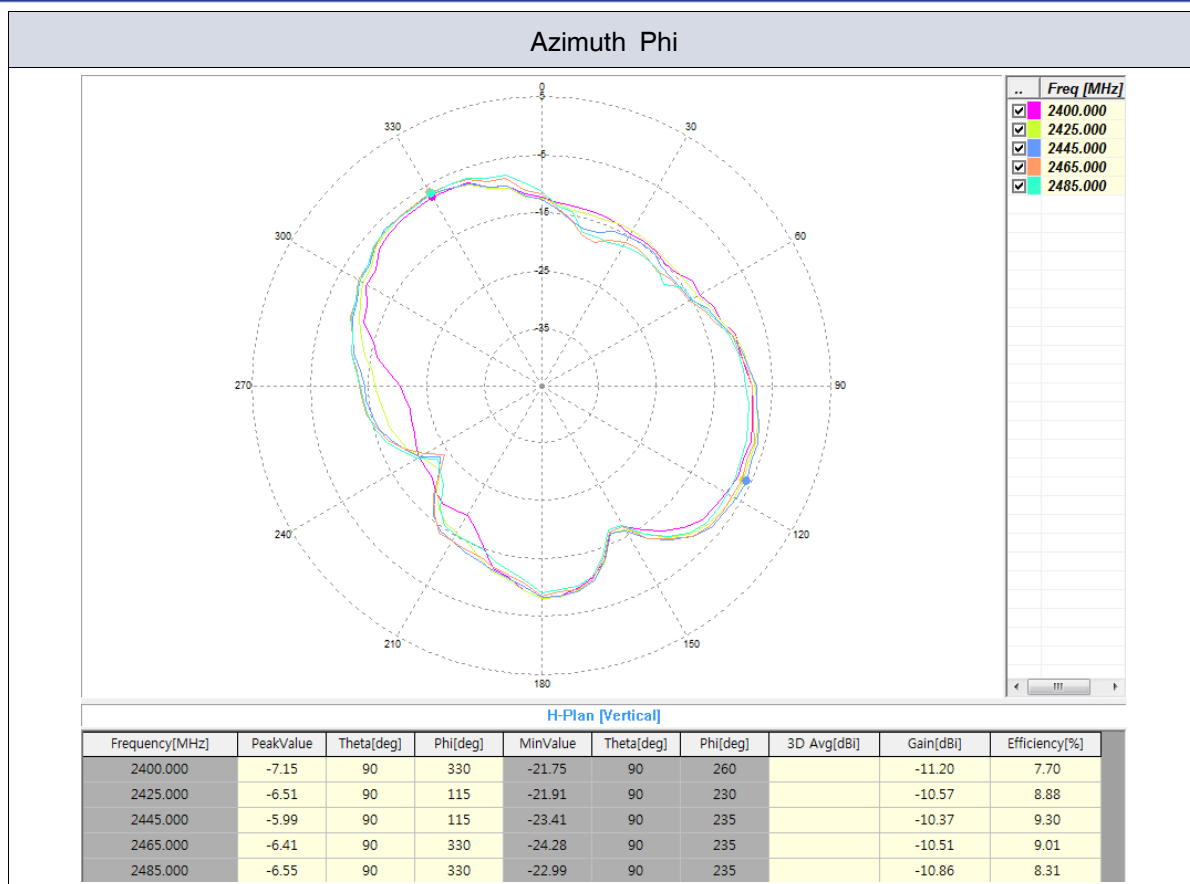
4.4 S11 Graph of Test Fixture Condition



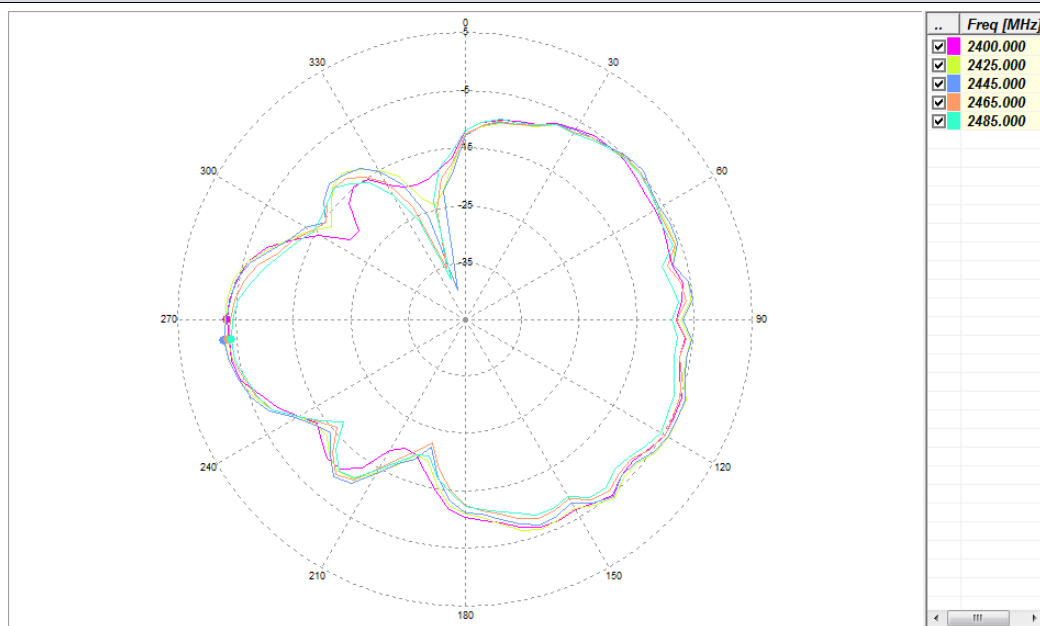
4.5 Radiation Pattern

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





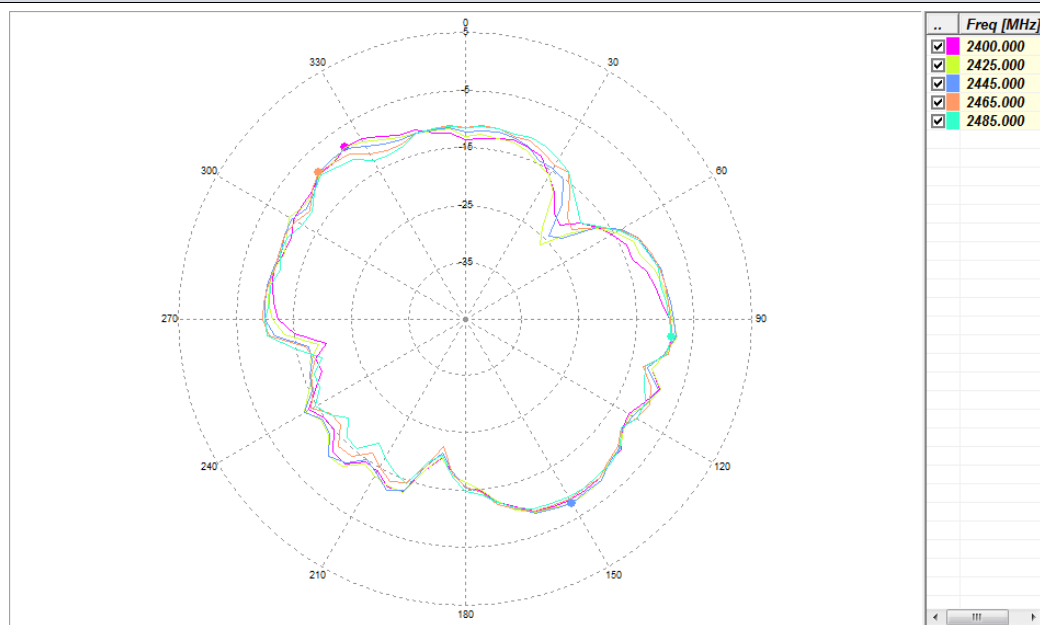
Elevation1 Phi



E1-Plan [Horizontal]

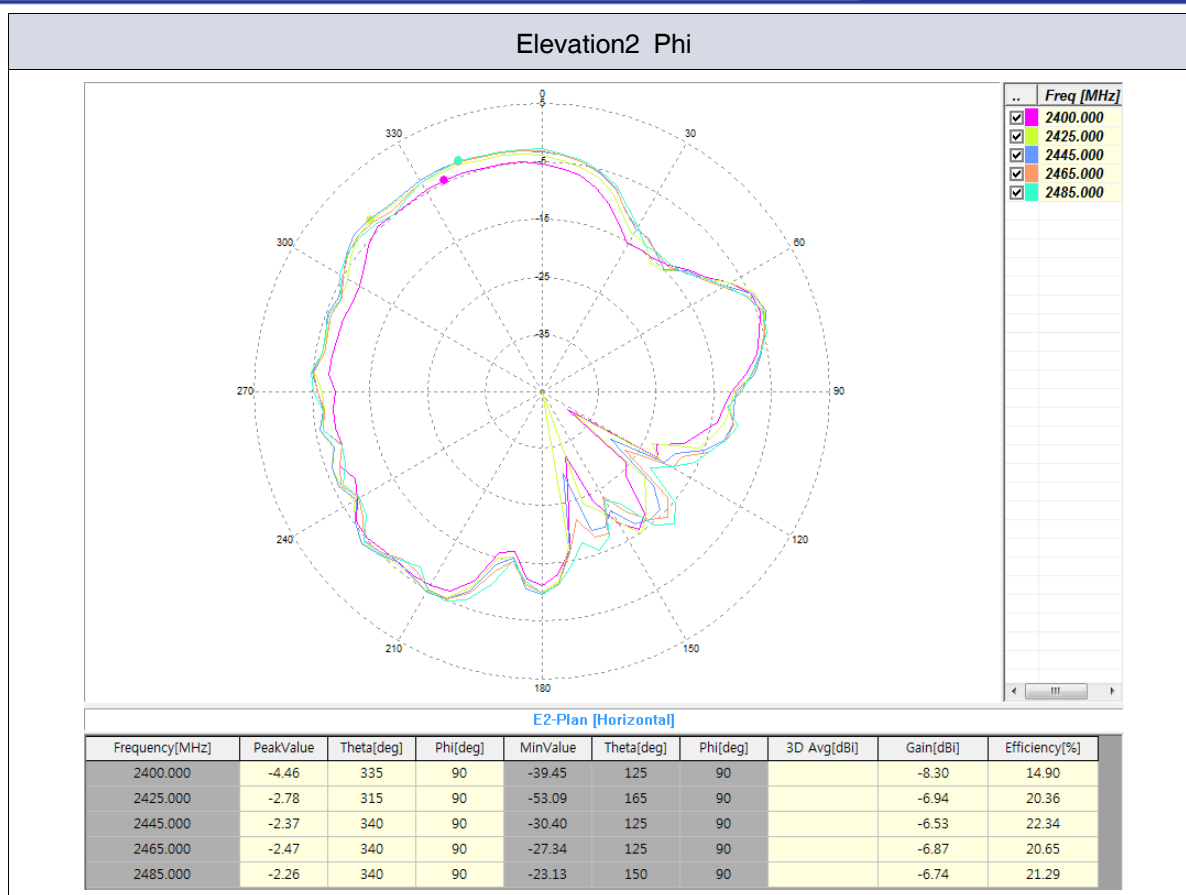
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-3.44	270	0	-20.67	310	0		-7.95	16.15
2425.000	-2.91	265	0	-24.37	345	0		-7.42	18.23
2445.000	-2.75	265	0	-39.52	345	0		-7.46	18.07
2465.000	-3.54	265	0	-35.27	340	0		-8.21	15.20
2485.000	-4.18	265	0	-37.36	340	0		-8.77	13.38

Elevation2 Theta



E2-Plan [Vertical]

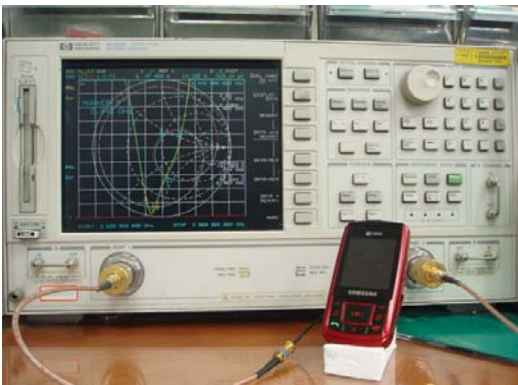
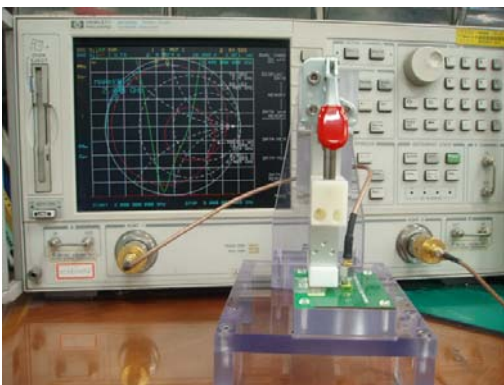
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-8.32	325	90	-21.57	45	90		-11.77	6.76
2425.000	-7.92	150	90	-26.48	45	90		-11.45	7.27
2445.000	-7.92	150	90	-24.31	45	90		-11.32	7.49
2465.000	-8.59	315	90	-22.41	190	90		-11.56	7.09
2485.000	-8.89	95	90	-20.90	190	90		-11.87	6.61



5. Measurement Process

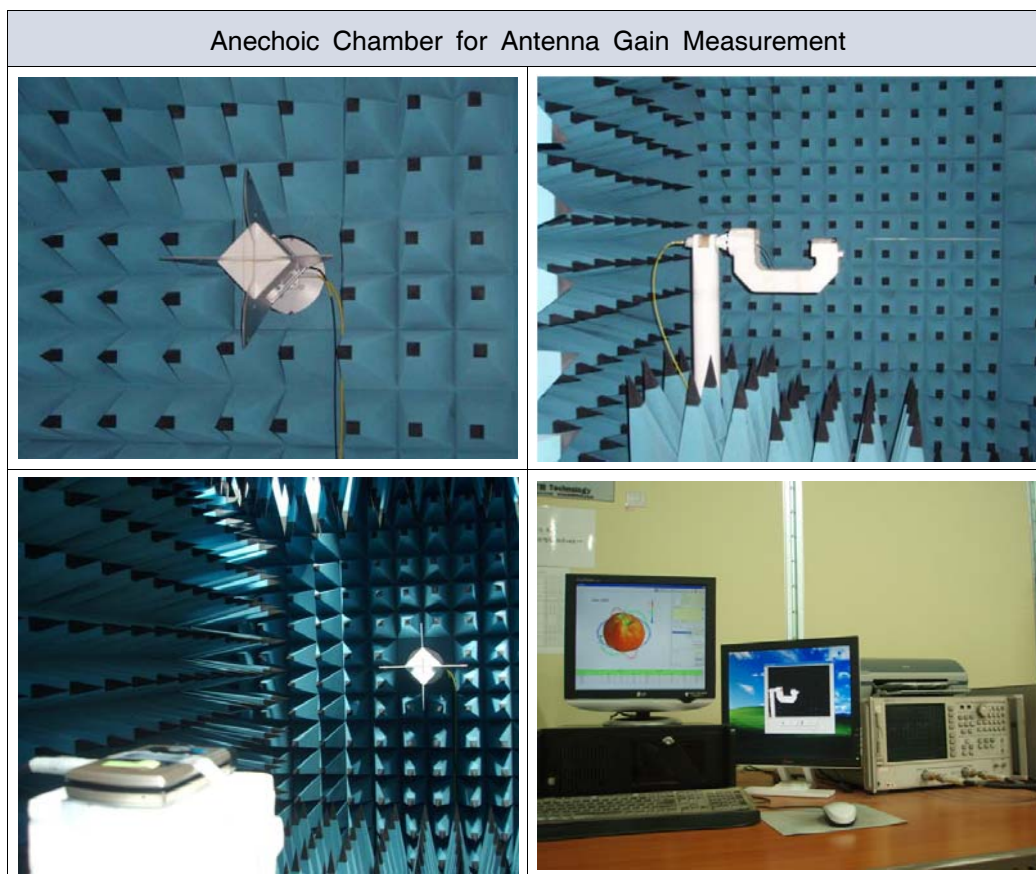
5.1 SWR / Return Loss

Use Network Analyzer when measuring SWR/Return loss and selecting standard SPL,
Use automatic inspection equipment when selecting superior and inferior goods.

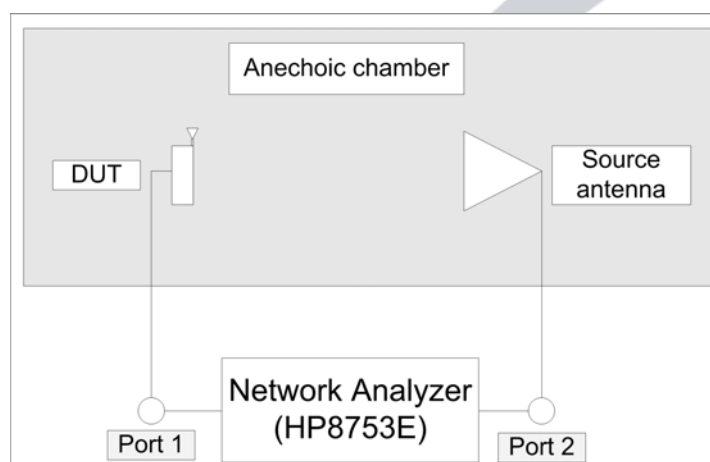
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753E or Advantest R3765CH	Agilent HP8753E or Advantest R3765CH
Cable	RF cable (300 mm)	RF cable (300 mm)
Test condition		

5.2 Gain

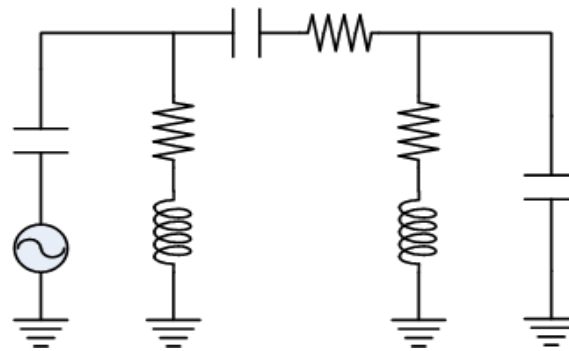
Antenna gain is measured in the Anechoic Chamber of this company, using set above of 4.1 list.



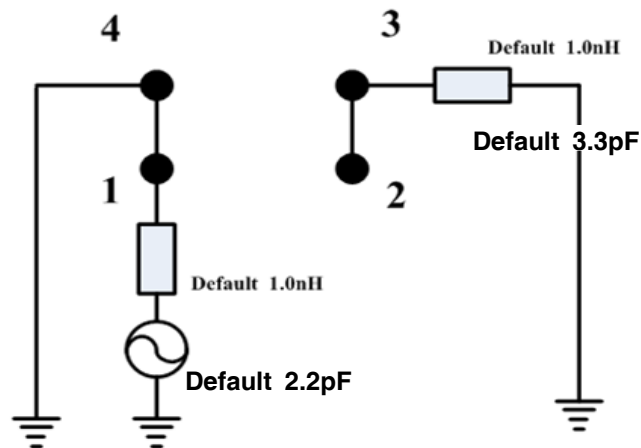
5.3 Gain test block diagram



6. Equivalent Circuit



< 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.

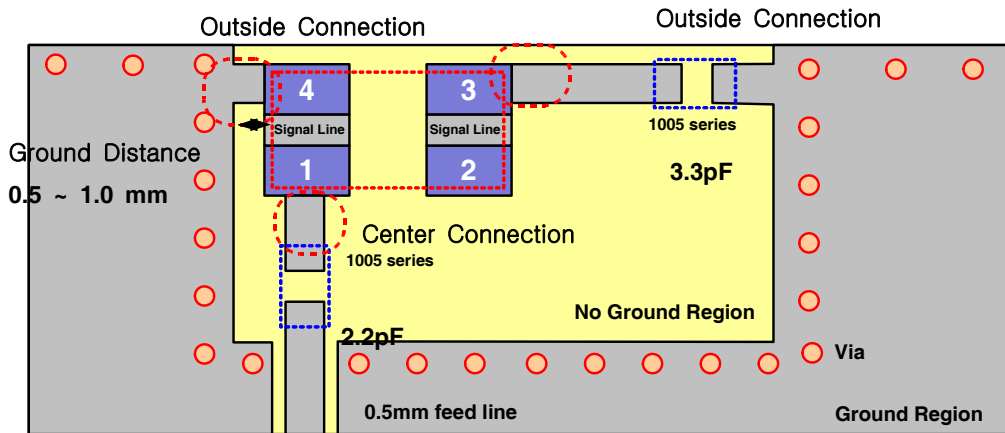
However, You must carefully choose the space for a chip antenna. Because this is only electromagnetic RF device, the electrical characteristic is changed by surrounding condition of antenna.

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



This Figure shows the normal PCB layout design for this product, there are the detail dimension informations at next page.

A : The No1 Pad is an input pad, the No4 and No3 pads are ground short pad. The No1 and No4 pads become electrical short, this region is not soldering region. Alike, the No2 and No3 pads are the same shape like a No1 and No4. Now this look like two land pads. The line width that the No3 and No4 are connecting with ground is over 0.5mm.

B : The area of No Ground Region is $4.0 \times 7.0 \text{ mm}^2$ at normal design condition. This product is not operated without the No Ground Region. At around the No Ground Region, insert the through Via like the figure.

C : The gap of between No1 land pad and ground is not exceeding 1.0mm, over 0.5mm. Like a figure, at between the input pad and input line, the lumped element(1005 size) exists at No Ground Region. The default Value is 1.0nH.

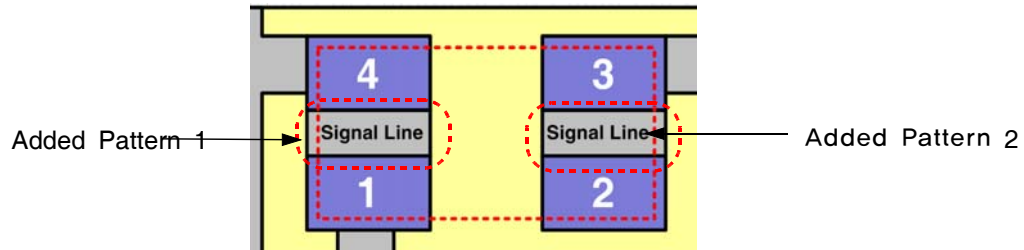
D : The No3 and No4 land pads are connected with the ground at outside of land pads and the No1 land pad is connected at center of land pad.

E : The No3 land pad is connected with the near ground, using the lumped element(1005 size). The value is 1.0nH.

F : If the given condition do permit, insert many through Vias. Especially, have a careful at an edge.

- Land Pad Design

Generally, the land pads of chip antenna are four and the soldering pads of PCB are same. But like a below figure, near land pads are connected each other, then it looks like two land pads on PCB.

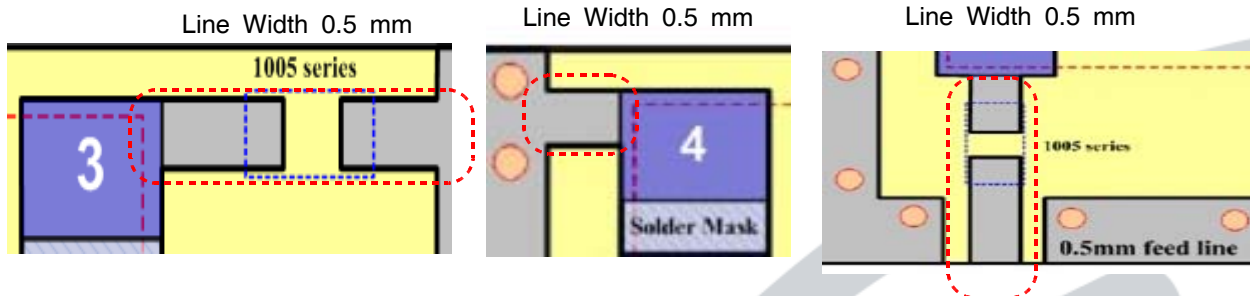


If we have a need to change characteristics, the Added Pattern 1 or 2 is removed, the PCB land pads become three land pads or four land pads.

About this item, detail information is recommended at the process that cooperate with you.

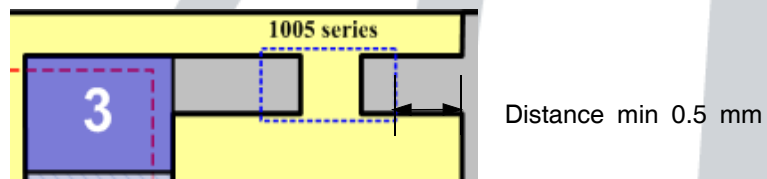
- Line Design

The connect line width is over 0.5mm.



- Inserted Lumped Element

In reference with a position of lumped element, it is necessary to locate inner No Ground Region. The both default values are 1.0pF. It is shown at below figure, the lumped element that existed between No3 land pad and Ground locate at interval of over 0.5mm from ground.

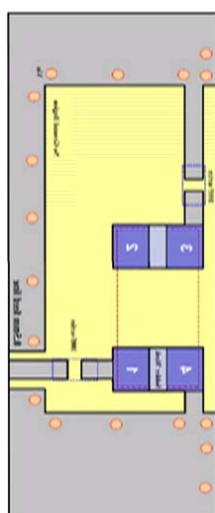


If you don't permit this design, it is possible to change position of lumped element and another design. Have a conference with PARTRON.

■ Change of Antenna Position



<Right side/up>



<Right Side/Down>



<Left Side/Up>



<Left Side/Down>

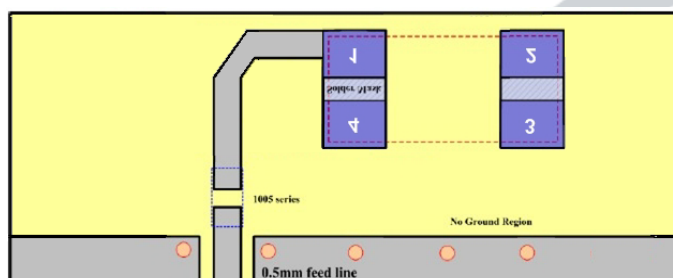
This product is able to position at various spaces of PCB, like above.

■ Example of Another Application

This product has a merit that the antenna is not changed. The electrical characteristic is adjusted by changing lumped element value and designing the another PCB drawing. The information about the another PCB drawing is many other cases, and so we don't explain this paper. If you need a technical report, ask for that in PARTRON

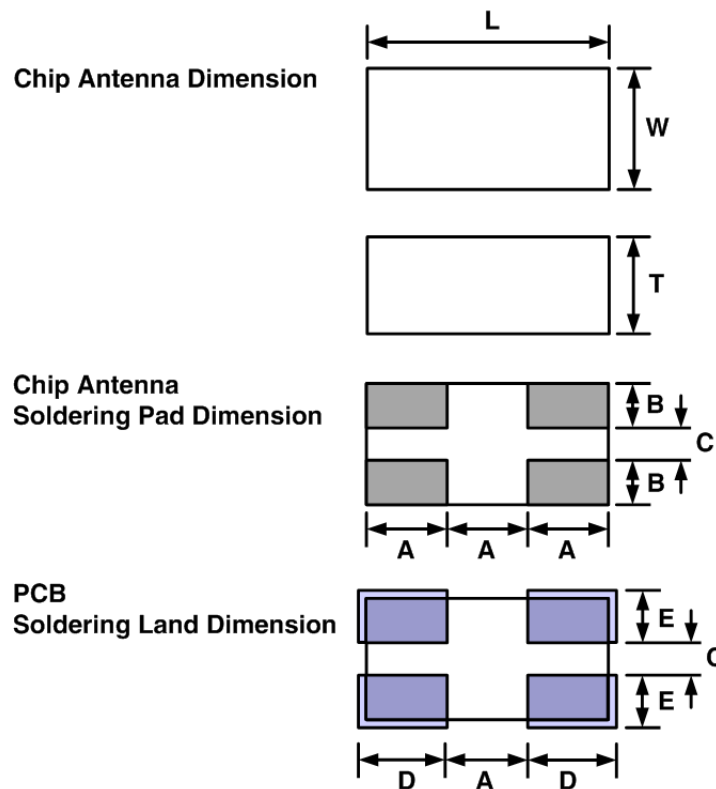
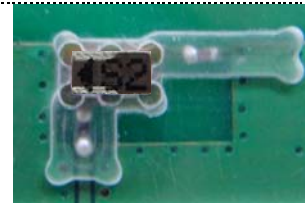
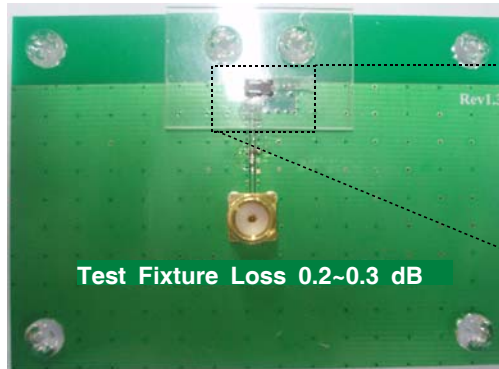
Now, there is an example drawing, this is working like monopole type for avoiding any situations. The Used antenna is sure the same antenna, however it is working differently.

- Monopole Type Layout Example



8. Test Fixture Specification

8.1 Test Fixture and Test PCB

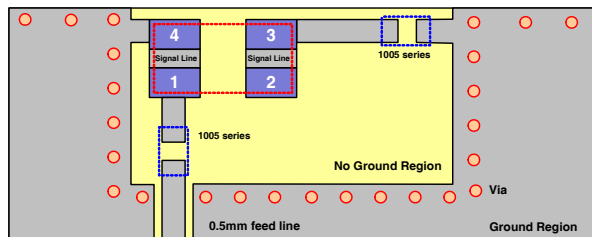
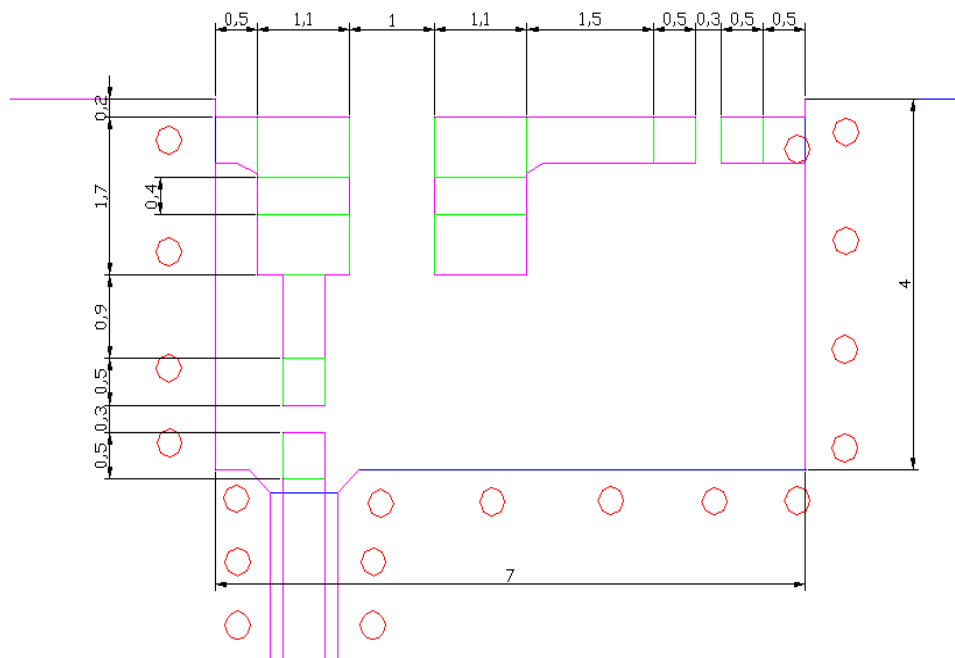


8.2 Soldering Pad Dimension and PCB layout Dimension

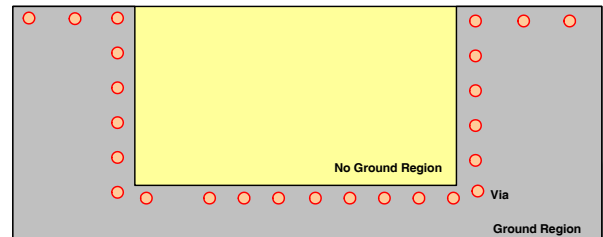
Parameter	L	W	T	A	B	C	D	E
Value[mm]	3.0 ± 0.1	1.5 ± 0.1	1.2 ± 0.1	1.0	0.55	0.4	1.1	0.65

Unless Specified tolerances are ± 0.05 mm

■ PCB Drawing(Auto CAD Design)

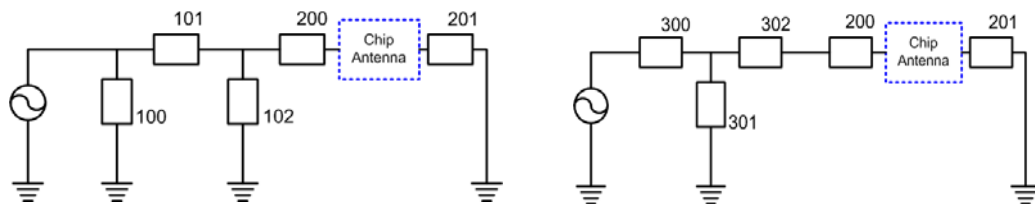


< Top View >



< Bottom View >

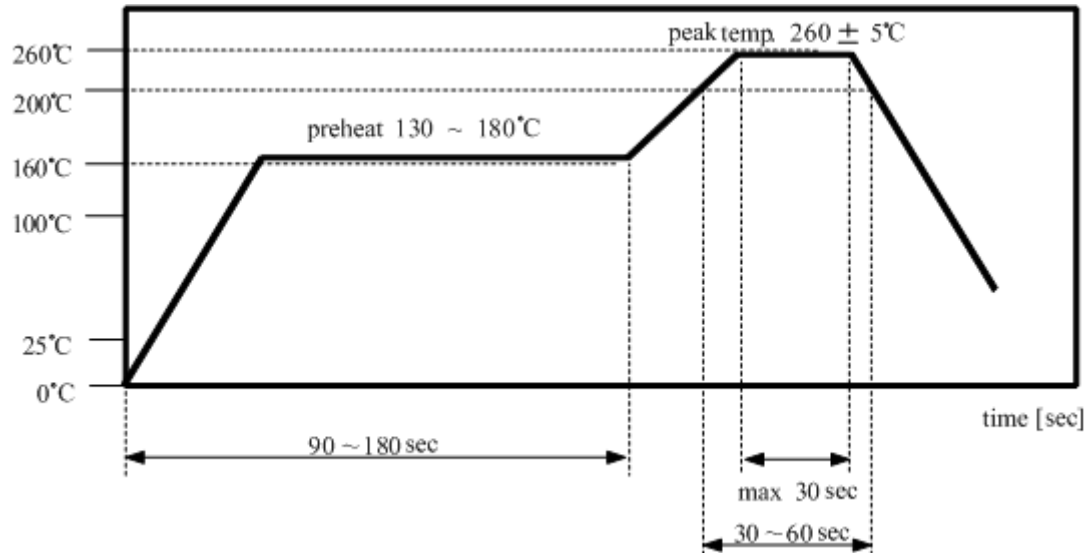
8.3 Matching Circuit and Default



No	100	101	102	200	201	300	301	302
Default Value	N/C	100 pF	N/C	2.2pF	3.3pF	0 Ω	N/C	100 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.

10. Primary Inspection List

Item	Frequency [MHz]		Size [mm]		
Standard	VSWR 2.5 : 1 [MAX]		W=1.5±0.1	L=3.0±0.1	T=1.2±0.1 
	2400	2485			
1	1.48	1.39	1.53	2.98	1.24
2	1.48	1.39	1.52	2.99	1.23
3	1.58	1.28	1.53	2.98	1.24
4	1.40	1.44	1.53	2.98	1.22
5	1.60	1.27	1.51	2.97	1.23
6	1.37	1.49	1.52	2.99	1.23
7	1.59	1.28	1.53	2.98	1.24
8	1.45	1.39	1.51	2.98	1.23
9	1.61	1.26	1.53	2.98	1.24
10	1.54	1.31	1.52	2.99	1.23
11	1.35	1.49	1.50	2.97	1.24
12	1.46	1.39	1.51	2.99	1.23
13	1.48	1.35	1.52	3.00	1.22
14	1.43	1.39	1.52	2.99	1.24
15	1.47	1.35	1.53	2.96	1.23
16	1.40	1.42	1.52	3.01	1.22
17	1.55	1.28	1.51	2.98	1.22
18	1.46	1.37	1.51	2.98	1.23
19	1.56	1.29	1.52	2.98	1.23
20	1.36	1.47	1.55	2.99	1.23
X	1.48	1.37	1.52	2.98	1.23
σ	0.05	0.05	0.01	0.01	0.01
Cpk	4.01	5.03	2.16	2.11	2.81
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 Action	-40°C± 3°C, 1hr	
Low Temperature Resistance	-40°C± 3°C, 120hr	
Humidity Action	+85± 3°C, RH85%	
Humidity Resistance	+85± 3°C, RH85%, 120hr	

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 : 32 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 $\times$ 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

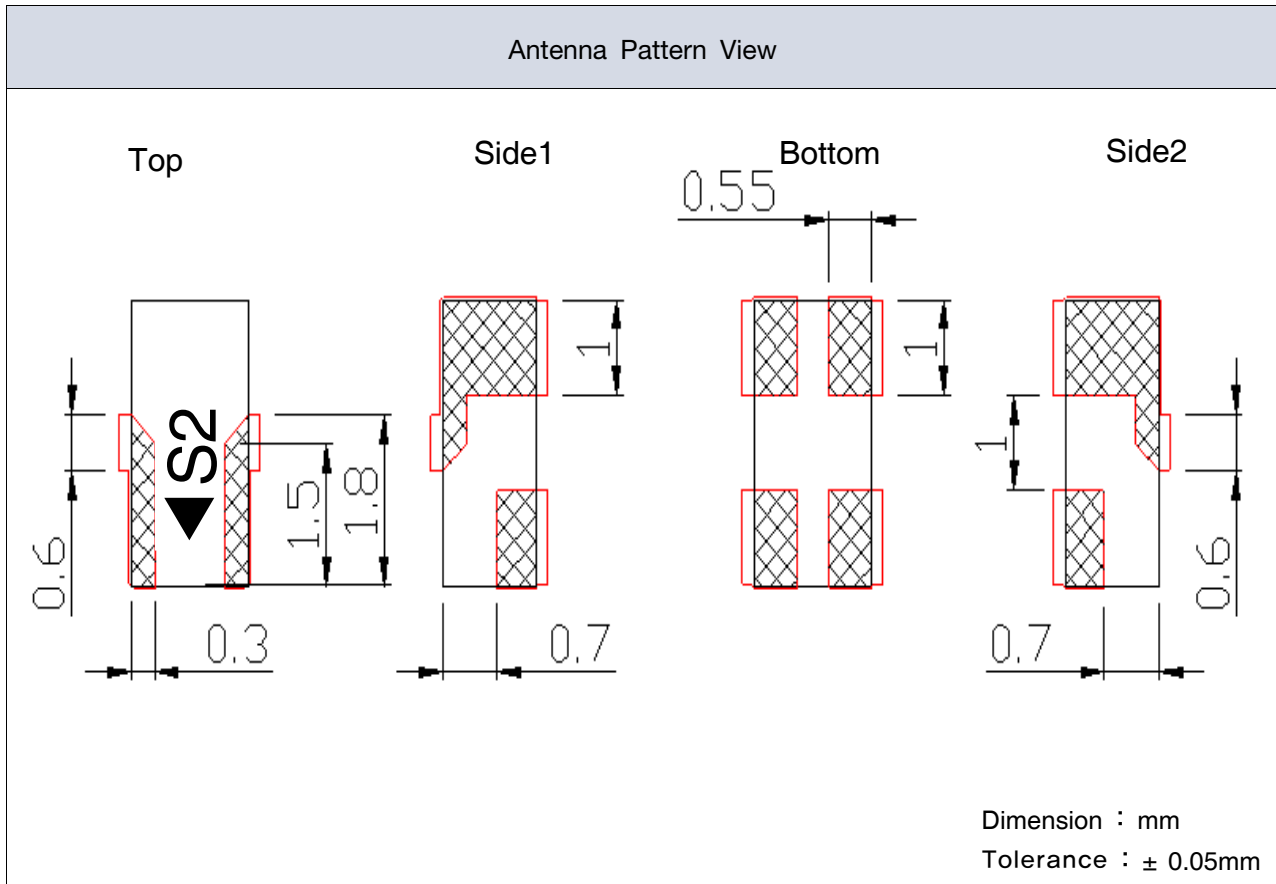
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30°C / RH 85%	168+5 / -0	= < 85°C / RH 85%

2) Test Condition

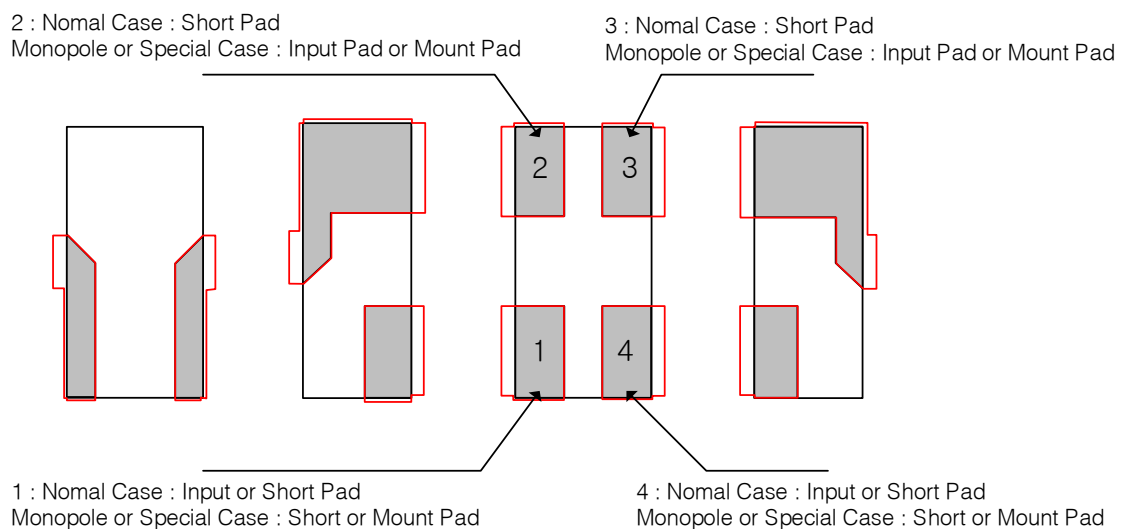
ITEM	Conditon	LIMIT
Soak Requirements	After leaving +85± 3°C, RH85% 168hr± 2hr 3 times Reflow without aging	After test, Must meet the characteristics spec of 4.3 list

12. Mechanical Characteristics

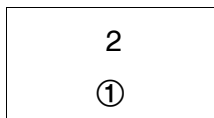
12.1 Antenna Pattern Dimension



12.2 Pin name

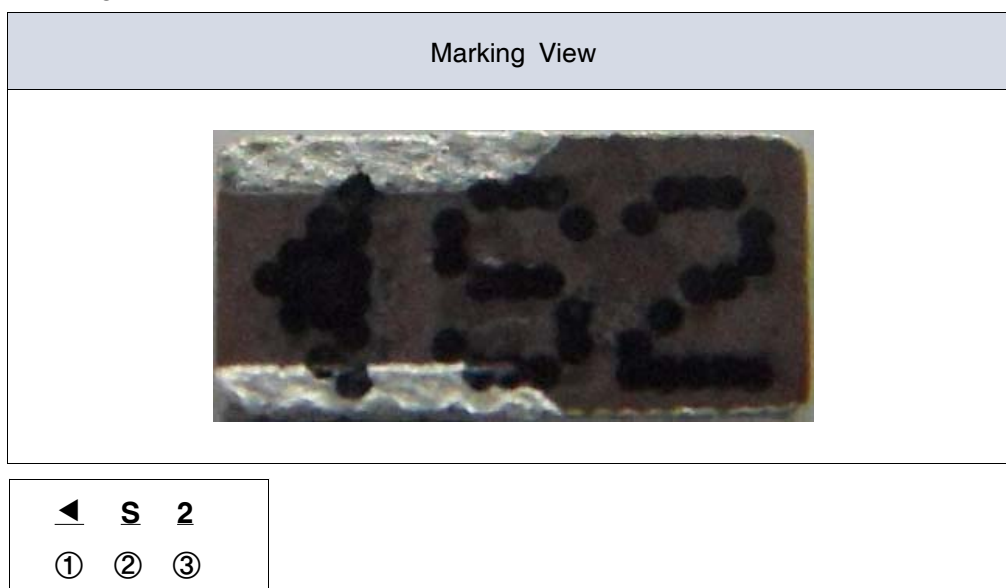


12.3 LOT number notation



- ① Month : 1 - January, 2 -February, 3 - March, 4 - April ····, 9 -September, A - October
 , B - November, C - December

12.4 Marking



- ① Input Signal
 ② Serial
 ③ Month : 1 - January, 2 -February, 3 - March, 4 - April ····, 9 -September, A - October
 , B - November, C - December

12.5 Marking type

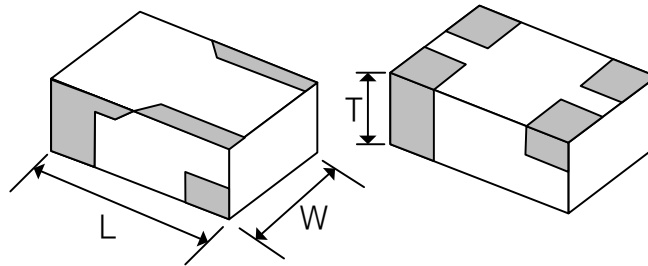
Ink marking - Using Black Ink

13. Structure and Material

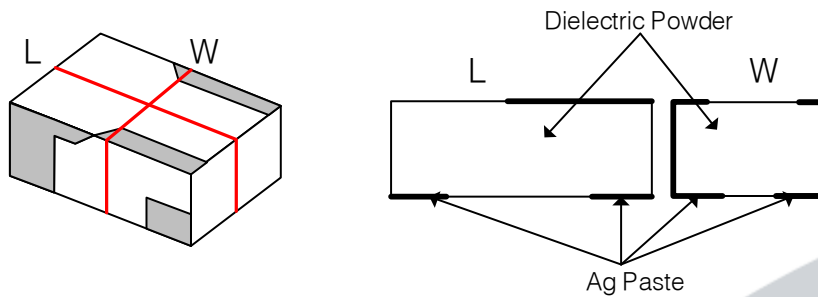
13.1 materialization method

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	Weight
Dielectric Block	Powder	HAYASHI		0.0466 g
PATTERN	Ag Paste	Micro-M	Thickness : TYP 10 μ m	
PAD	Ag paste	Micro-M	Thickness : Min 10 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

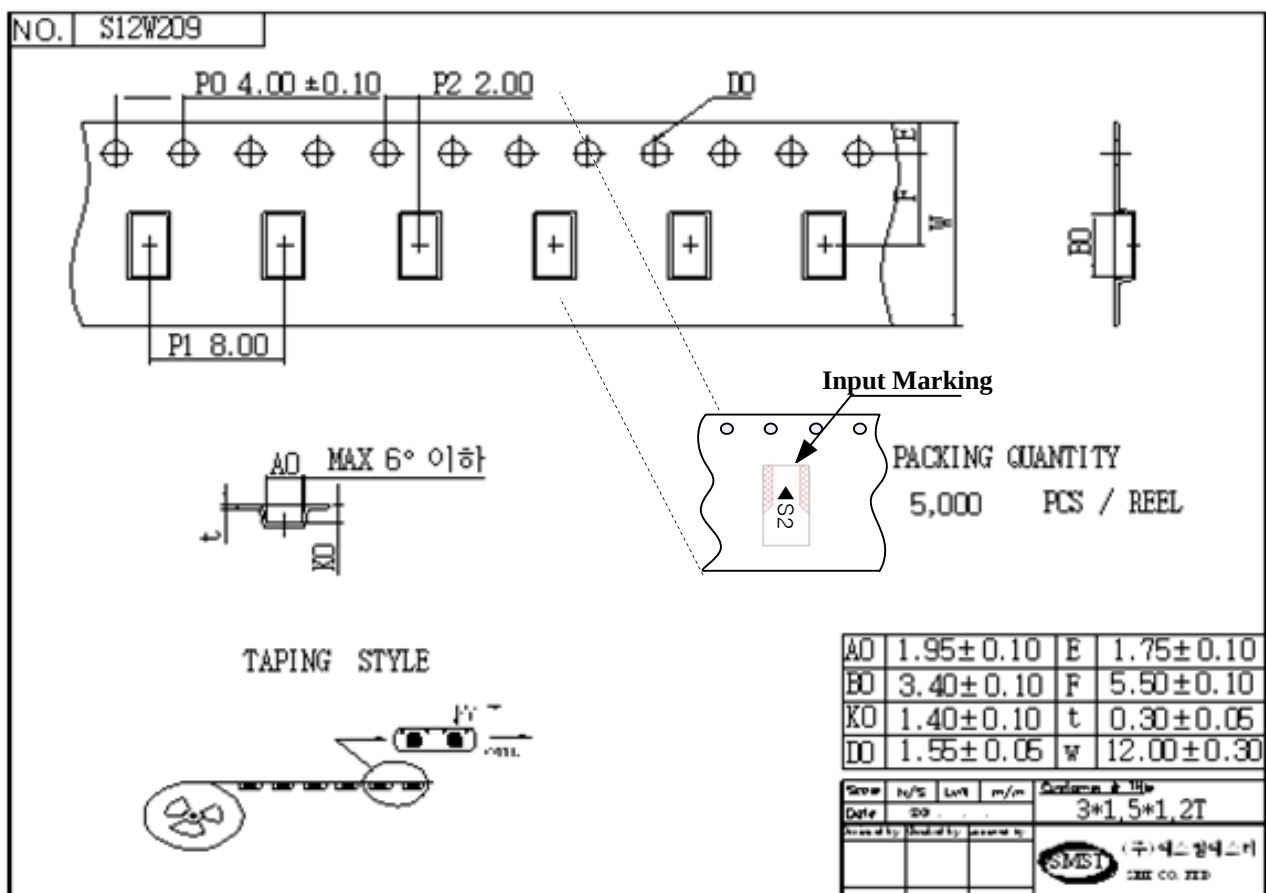
* Because of the keeping temperature problem, no admission when left over +85°C

15. Packing

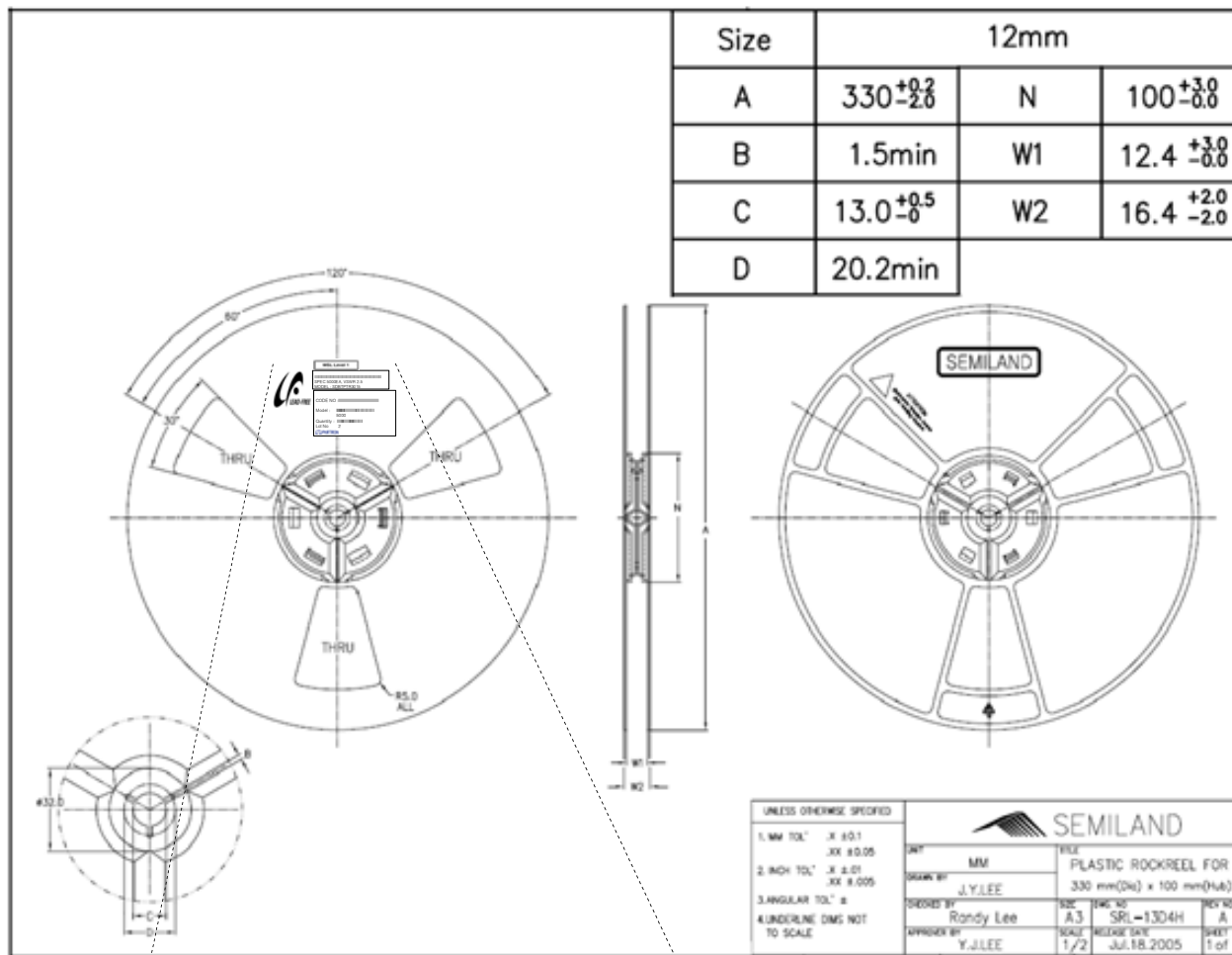
15.1 Carrier/Reel

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	-

15.1.1 Carrier Specification



Size	12mm		
A	$330^{+0.2}_{-2.0}$	N	$100^{+3.0}_{-0.0}$
B	1.5min	W1	$12.4^{+3.0}_{-0.0}$
C	$13.0^{+0.5}_{-0}$	W2	$16.4^{+2.0}_{-2.0}$
D	20.2min		



MSL Level 1



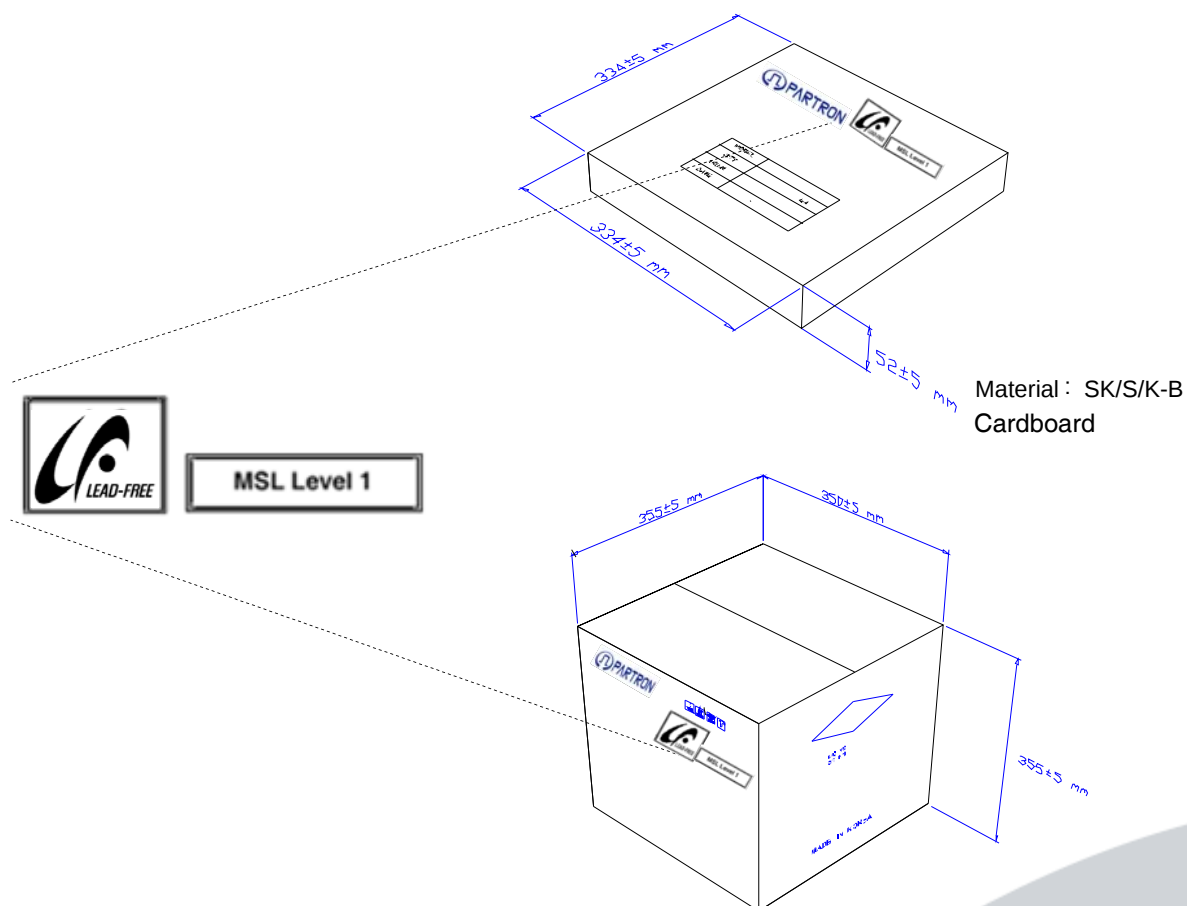
SPEC 5000EA, VSWR 2.5
MODEL : SDBTPTR3015

CODE NO :|||||

Model : 
Quantity : 
Lot No 2



15.2 Box



15.3 Actual packing picture



Reel



Internal Box



Box picture of outside



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 Revised	04.04.06 05.04.03						PRCP-C001				
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	prepar ation	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/presure 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/presure 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/presure 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/presure 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	Powder(MWF-38U)
Tester Organization	Intertek Testing center.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

Intertek

TEST REPORT

Applicant : Dong Bang Enterprise
Address : 105-1102, 1139, Saeang-Song, Daegu-si, Seoul, Korea

Report No. RT10R-S2060-E Page: 1 of 3
Date: May 19, 2010

Sample Description : The following submitted sample(s) said to be:-
Name/Type of Product : HZB-60 MWF-38U
Name of Material : Ceramic
Sample ID No. : RT10R-S2060
Manufacturer/Model : Dong Bang Enterprise

Sample received : May 14, 2010
Testing Date : May 14, 2010 ~ May 19, 2010
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (24 ± 2) °C, Humidity : (60 ± 5) % R.H.

Test Type : RoHS wet chemical analysis
Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

*Note 1: The test results presented in this report relate only to the object tested.
*Note 2: This report shall not be reproduced, except in full, without prior written consent of the Company.

Approved by:  Intertek / Lab. Technical Manager
Authorized by:  Bo-Park / Lab. General Manager

This Test Report is issued by the Company subject to its Terms and Conditions of Business printed overleaf. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. This Test Report shall not be reproduced, except in full, without prior written consent of the Company.

Intertek Testing Services Korea Ltd.
Seoul Office Tel: 02-6290-9000 Fax: 02-6290-9008 Dong Office Tel: 031-820-8947 Fax: 031-820-8945 Web Site: www.intertek.co.kr
Seoul Lab Address: 1/F, A-10 Digital Tower, 438-16, Seongso 2-gil, Songgong-Gu, Seoul, 153-853 Korea
Ulsan Lab Address: #140-2, Yongsan-Ri, Chungang-Myeon, Ulsan-Gu, Ulsan 680-860 Korea

Intertek

TEST REPORT

Report No. RT10R-S2060-E Page: 2 of 3
Sample ID No. : RT10R-S2060
Sample Description : HZB-60 MWF-38U

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	ppm	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	0.5	ND
Lead (Pb)	ppm	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	5	ND
Mercury (Hg)	ppm	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	2	ND
Hexavalent Chromium (Cr ⁶⁺) (for non-metal)	ppm	With reference to IEC 62321 Edition 1.0 : 2008, by alkaline digestion and determined by UV/VIS Spectrophotometer	1	ND

Tested by : Nikkie Lee, Peter Kim

Notes : ppm = parts per million
ND = Not detected
MDL = Method detection limit

*View of sample as received:



This Test Report is issued by the Company subject to its Terms and Conditions of Business printed overleaf. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. This Test Report shall not be reproduced, except in full, without prior written consent of the Company.

Intertek Testing Services Korea Ltd.
Seoul Office Tel: 02-6290-9000 Fax: 02-6290-9008 Dong Office Tel: 031-820-8947 Fax: 031-820-8945 Web Site: www.intertek.co.kr
Seoul Lab Address: 1/F, A-10 Digital Tower, 438-16, Seongso 2-gil, Songgong-Gu, Seoul, 153-853 Korea
Ulsan Lab Address: #140-2, Yongsan-Ri, Chungang-Myeon, Ulsan-Gu, Ulsan 680-860 Korea

Intertek

TEST REPORT

Report No. RT10R-S2060-E Page: 3 of 3
Sample ID No. : RT10R-S2060
Sample Description : HZB-60 MWF-38U

Flow Chart (IEC 62321 Edition 1.0 : 2008)

```

graph TD
    Start([Start]) --> Reagent[Reagent]
    Reagent --> Sampling[Sampling/Grinding or Cutting]
    Sampling --> Split(( ))
    Split --> P1[Pb, Cd, Hg]
    Split --> P2[Cr6+]
    P1 --> P1Note[For a RoHS material, digest the sample with appropriate acid]
    P2 --> P2Note[Weigh sample and add suitable solution]
    P1Note --> P1Filter[Filter the liquid sample(s) and filter the residue]
    P2Note --> P2Filter[Filter the liquid sample(s) and filter the residue]
    P1Filter --> P1Make[Make up with deionized water]
    P2Filter --> P2Make[Make up with deionized water and add diphenylpicrylhydrazine solution]
    P1Make --> P1Analyze[Analyzed by ICP-OES]
    P2Make --> P2Analyze[Analyzed by UV/VIS]
    P1Analyze --> P1Data([Data])
    P2Analyze --> P2Data([Data])
    P1Data --> P1Report([Report])
    P2Data --> P2Report([Report])
  
```

Remarks :

*1 : List of appropriate acid

Element	Appropriate acid
Pb, Cd, Hg	HNO ₃ , HCl, HF, H ₂ SO ₄ , H ₂ O ₂
Cr ⁶⁺	HNO ₃ , H ₂ SO ₄ , HF

***** End of Report *****

This Test Report is issued by the Company subject to its Terms and Conditions of Business printed overleaf. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. This Test Report shall not be reproduced, except in full, without prior written consent of the Company.

Intertek Testing Services Korea Ltd.
Seoul Office Tel: 02-6290-9000 Fax: 02-6290-9008 Dong Office Tel: 031-820-8947 Fax: 031-820-8945 Web Site: www.intertek.co.kr
Seoul Lab Address: 1/F, A-10 Digital Tower, 438-16, Seongso 2-gil, Songgong-Gu, Seoul, 153-853 Korea
Ulsan Lab Address: #140-2, Yongsan-Ri, Chungang-Myeon, Ulsan-Gu, Ulsan 680-860 Korea

2) Ag Paste

Parts Name	Silver Paste
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. F00550-LF CMTA09A-08162		Issued Date: October 27, 2010	
To: MICRO MEDS, L.TD. Pyeonggi-Biotech, Bundang-gu, Seongnam Yang-pyeong Bucheon-si Gyeonggi-DO 455-815 Korea		Page 1 of 8	
The following information was submitted and identified by the client as:			
SGS File No.:	: AFYFA10-08124		
Product Name:	: PCG118304V		
Item No./Part No.:	: N/A		
Received Date:	: Oct. 22, 2010		
Test Period:	: Oct. 25, 2010 ~ Oct. 27, 2010		
Test performed:	: SGS Testing Korea tested the samples submitted by applicant with following results		
Test Results:	: (For further details, please refer to following page(s))		
(Signature)	: SGS-LN2G		
SGS Testing Korea Co., Ltd.			
			
Jeff Jang / Chemical Lab Mgr			
Timothy Jones Andrew Kim Chul Park Jeong Jung Testing Services			

[illegible][illegible]

			
Test Report No. F00004167378YANAH101807		Issued Date: April 23, 2010	
To: MICROM CO., LTD. #00702, Kwang Kunggang-ro, Gwangju 510-740 Korea		Page 1 of 4	
The following merchandise was tested and certified by the client as :			
SGS File No.	: A7047419-10047		
Product Name	: PCT-11027H		
Batch No. Part No.	: N/A		
Received Date	: April 10, 2010		
Test Performance Date	: April 19, 2010		
Test Performed	: (SGS Testing Laboratories tested the samples) selected by applicant with following results		
Test Results	: For further details, please refer to following paper(s)		
Bottle(s)	: 100E		
Photo Kim Cindy Park / Testing Person		SGS Testing Korea Co., Ltd.  Jang Jang / Chemical Lab. Hyg	



Test Report No. F0805HJCTSA10A10-13847 Issued Date: April 23, 2010 Page 2 of 4

Sample No. : AYAA10-13847.001
Sample Description : PCC1 1837H/
Batch/Part No. : N/A
Comments : Moisture is clear

Test Item	Unit	Test Method	MTL	Result
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.
Electricity Phosphate (DOP)	g/kg	With reference to ASTM D5421-71, GC-MS	10	N.D.

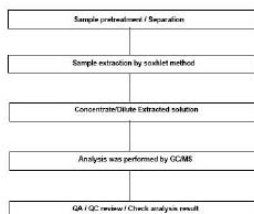
NOTE: (1) N.D. = Not detected (NOL)
(2) N/A = Not Applicable
(3) MTL = Method Detection Limit
(4) = No regulation
(5) = Qualitative analysis (No Unit)
(6) Negative = Unacceptable / Positive = Detectable
(7) (DOP) = calculated from (5) by the equation *

The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide.



Test Report No. F0805HJCTSA10A10-13847 Issued Date: April 23, 2010 Page 4 of 4

Flow Chart for Phthalate Test



*** End ***

NOTE: (1) N.D. = Not detected (NOL)
(2) N/A = Not Applicable
(3) MTL = Method Detection Limit
(4) = No regulation
(5) = Qualitative analysis (No Unit)
(6) Negative = Unacceptable / Positive = Detectable
(7) (DOP) = calculated from (5) by the equation *

The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide.



Test Report No. F0805HJCTSA10A10-13847 Issued Date: April 23, 2010 Page 3 of 4

Pictures of Sample as Received



NOTE: (1) N.D. = Not detected (NOL)
(2) N/A = Not Applicable
(3) MTL = Method Detection Limit
(4) = No regulation
(5) = Qualitative analysis (No Unit)
(6) Negative = Unacceptable / Positive = Detectable
(7) (DOP) = calculated from (5) by the equation *

The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide. The SGS Korea Co., Ltd. is a member of the SGS Group, a leading provider of inspection, testing and certification services worldwide.

3) Marking Ink

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

the way to trust 

시험 성적서

접수번호 : CT10-49187
신청인 : (주)파트론
주소 : 경기 화성시 석우동 22-6
시험명 : 6136E (ink)

접수일자 : 2010. 10. 01
시험완료일 : 2010. 10. 06
용도 : 거래처 제출

시험결과

첨부 시험 성적 결과표와 같음.

비고 1. 이 성적서는 특허자가 제시한 시료 및 시료명으로 시험한 결과로서 전체제품에 대한 품질을 보증하지는 않습니다.
2. 이 성적서는 총알, 소전, 정공 및 수송층으로 사용될 수 있으며, 용도 이외의 사용을 금합니다.

- 이 하 여 백 -

시험원 : 김주환



기술책임자(주) : 이종선



2010년 10월 6일

한국건설생활환경시험연구원장

경기서남지 440-302 경기 수원시 장안구 장지2동 80-17 수원상공회관 1층 (031)245-8641-2
출발관리 : 정달희(02-2102-1676)

총 2 페이지 중 1 페이지

the way to trust 

시험 성적서

접수번호 : CT10-49187

[시험 성적 결과표]

시험 항목	단 위	시험 결과	시험 방법
중금속	mg/kg	불검출(검출한계 25)	ASTM D 7369-2008
중금속		48	
납(Pb)		불검출(검출한계 6)	IEC 62321: 2008 (분석방법 : ICP-OES)
카드뮴(Cd)		불검출(검출한계 1)	
수은(Hg)		불검출(검출한계 1)	
6가 크롬(Cr ⁶⁺)	60	IEC 62321: 2008 (분석방법 : Ion chromatography)	
Poly(brominated Biphenyl)s(PBBs)			
Bromodiphenyl	mg/kg	불검출(검출한계 6)	IEC 62321: 2008 (분석방법 : GC/MS)
Dibromodiphenyl		불검출(검출한계 6)	
Trisbromodiphenyl		불검출(검출한계 6)	
Tetrabromodiphenyl		불검출(검출한계 6)	
Pentabromodiphenyl		불검출(검출한계 6)	
Hexabromodiphenyl		불검출(검출한계 6)	
Heptabromodiphenyl		불검출(검출한계 6)	
Octabromodiphenyl		불검출(검출한계 6)	
Nonabromodiphenyl		불검출(검출한계 6)	
Decabromodiphenyl		불검출(검출한계 6)	
Poly(brominated Diphenyl Ether)s(PBDEs)			
Bromodiphenyl ether	mg/kg	불검출(검출한계 6)	IEC 62321: 2008 (분석방법 : GC/MS)
Dibromodiphenyl ether		불검출(검출한계 6)	
Trisbromodiphenyl ether		불검출(검출한계 6)	
Tetrabromodiphenyl ether		불검출(검출한계 6)	
Pentabromodiphenyl ether		불검출(검출한계 6)	
Hexabromodiphenyl ether		불검출(검출한계 6)	
Heptabromodiphenyl ether		불검출(검출한계 6)	
Octabromodiphenyl ether		불검출(검출한계 6)	
Nonabromodiphenyl ether		불검출(검출한계 6)	
Decabromodiphenyl ether		불검출(검출한계 6)	

- 이 하 여 백 -

*DECLARATION OF COMPLIANCE

Not included any hazardous substance in this product.