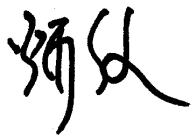
HF | LEAD-FREE | MSL Level 1 | ROHS-Y

Approval Sheet

Products	Dielectric Chip Antenna		
Customer	i-SENS		
Model	GM505		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	SDBTPTR3015		
i-SENS	By designed	By checked	By approved
PARTRON	By designed	By checked	By approved
			
	Research 5P	Quality Assurance	Laboratory
	Chanik.Jeon	Namsik.Min	Byoung-Jun.Yim
	02/24	02/24	02/24

2012. 02. 24

partron
22-6, Seokwoo-dong, Hwaseong-si, Gyeonggi-do
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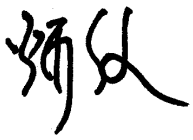
www.partron.co.kr

HF | MSL Level 1 | ROHS-Y

SPECIFICATION

MODEL : SDBTPTR3015

DIELECTRIC CHIP ANTENNA

By designed	By checked	By approved
		
Research 5P	Quality Assurance	Laboratory
Chanik.Jeon	Namsik.Min	Byoung-Jun.Yim
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- Contents -

1. Revision

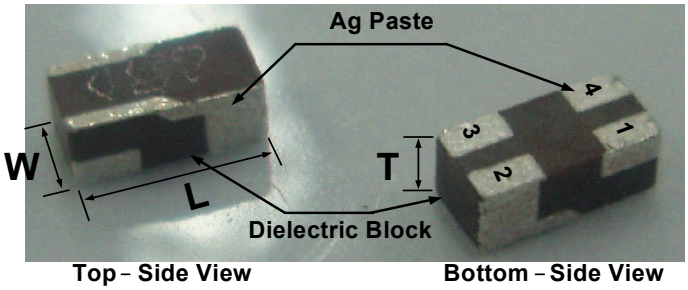
Revision No	Originator	Description of changes	Date of changes
Ver 1.0	Chanik.Jeon	Issued	2012.02.24

2. Introduction

2.1 Introduction of Product

This product is an internal dielectric chip antenna that the Ag paste is printed on the surface of dielectric block.

2.2 Specification and Dimension

Type	Only Bulk Ceramic	
Material	Dielectric Block	Mg_2SiO_4(Magnesium Silicate)
	Paste	Ag
Dimension[mm]	L = 3.0 ± 0.1	 Top - Side View Bottom - Side View
	W = 1.5 ± 0.1	
	T = 1.2 ± 0.1	
Flatness	0.03	
MSL LEVEL	MSL LEVEL 1	
ESD LEVEL	Over 15 kV (HBM CLASS 3B)	
Version	Revision 1.0	

3. Electrical Characteristic

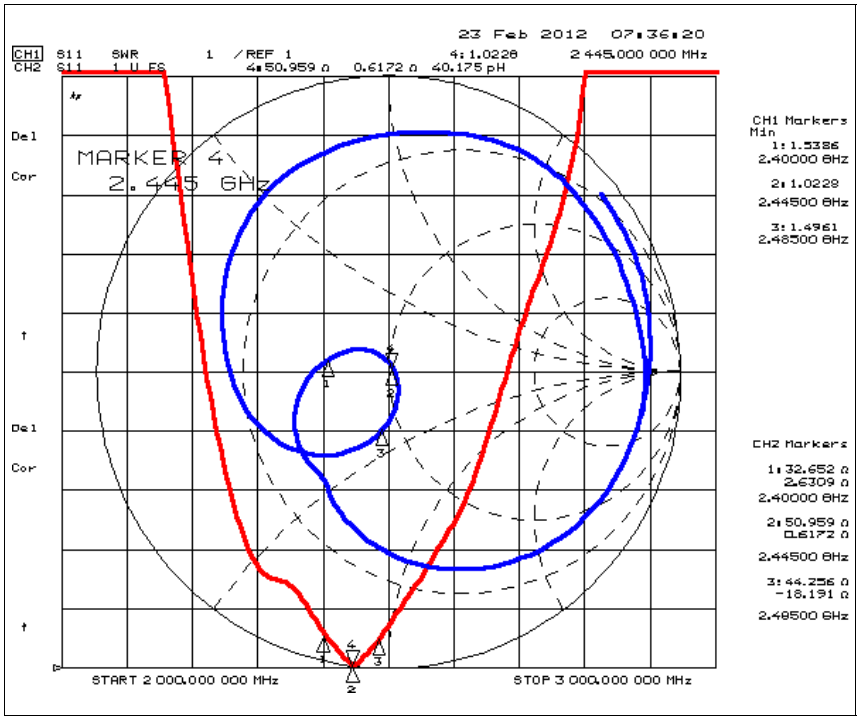
3.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
VSWR [MAX]				3 : 1
Bandwidth [MHz]				85
Polarization				Linear
Matching Value of Antenna Matching Circuit (Direction, from Antenna to Module)		Antenna Matching Circuit	Series (Feeding)	1.8pF
			Series (GND)	1.0pF
		π-Matching Circuit	Shunt1	NC
			Series	9.0pF
			Shunt2	NC
Gain[dBi]	Azimuth Plane	Peak		-0.05
		Average		-4.03
	Elevation1 Plane	Peak		0.00
		Average		-2.46
	Elevation2 Plane	Peak		0.00
		Average		-3.27
	3D	Peak		0.00
		Average		-2.83

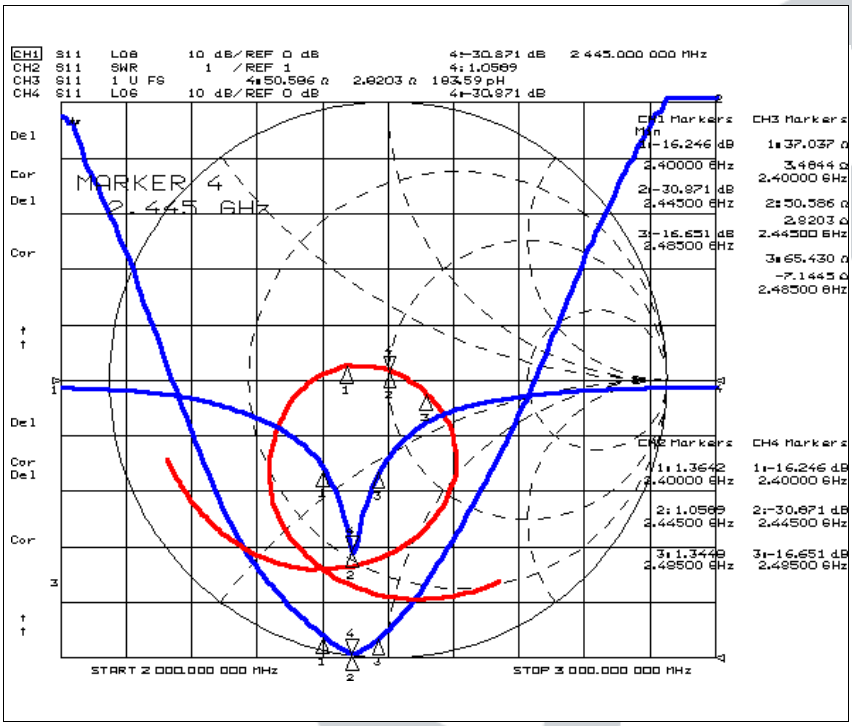
3.2 Test Fixture Condition

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
SWR [Max]	2.5 : 1
Bandwidth [MHz]	85

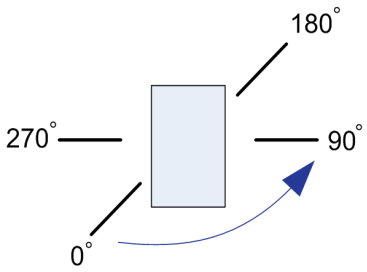
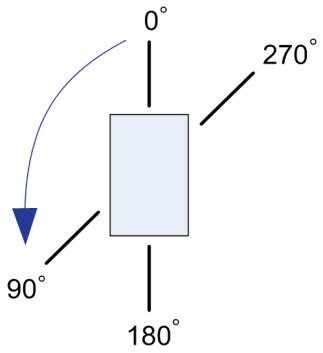
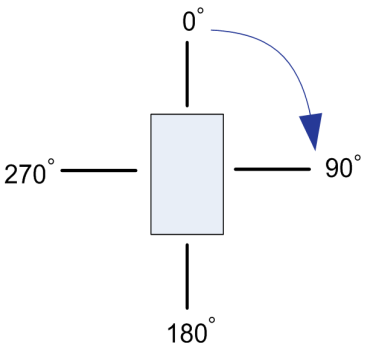
3.3 Graph of Set Condition



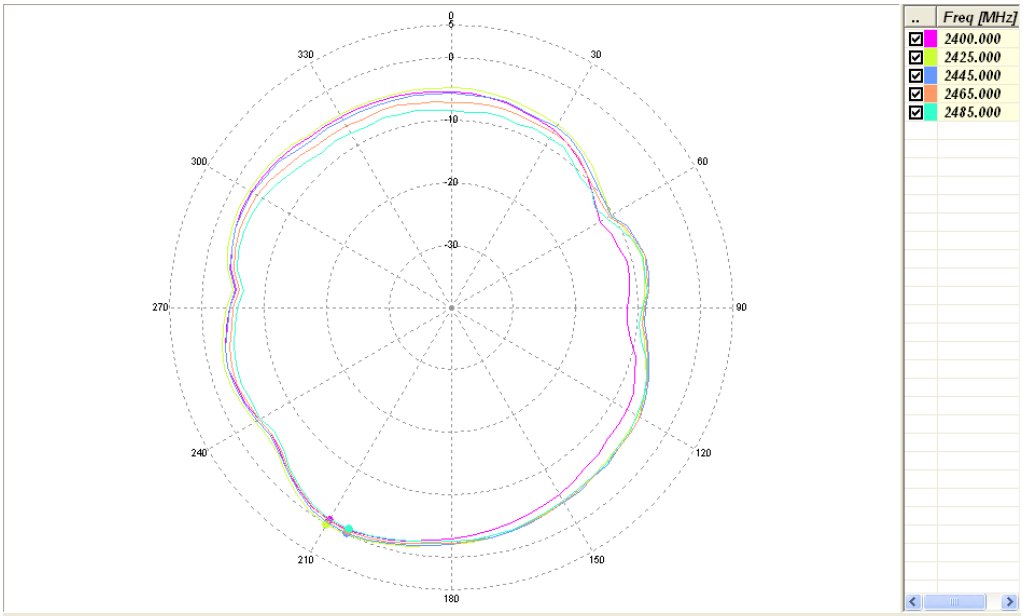
3.4 Graph of Test Fixture Condition



3.5 Radiation Pattern

Azimuth Plane	Elevation1 Plane	Elevation2 Plane
		

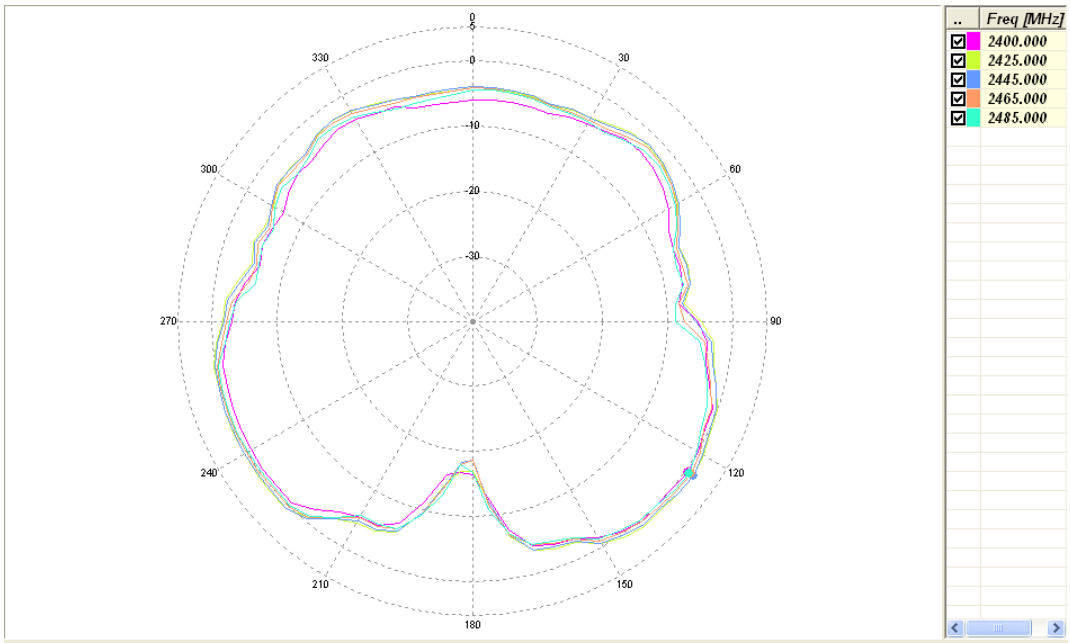
Azimuth Plane



H-Plan [V + H Sum]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-0,90	90	210	-12,63	90	60		-4,91	32,39
2425,000	-0,05	90	210	-10,46	90	60		-4,03	39,61
2445,000	-0,26	90	205	-10,46	90	60		-4,37	36,70
2465,000	-0,68	90	205	-10,83	90	55		-4,87	32,73
2485,000	-1,08	90	205	-11,91	90	55		-5,41	28,90

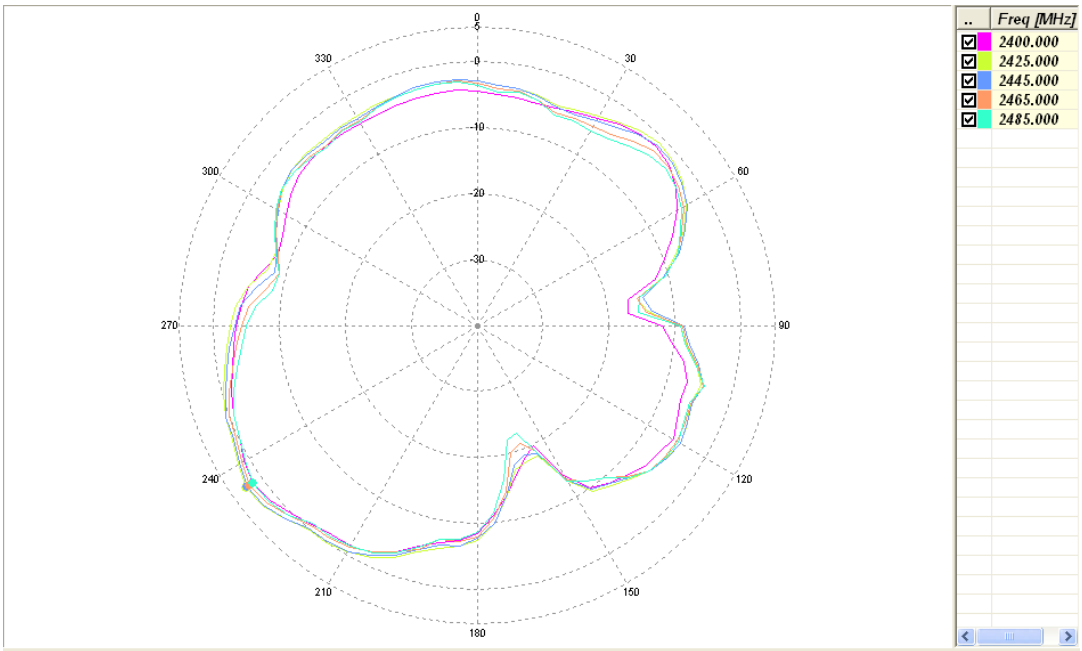
Elevation1 Plane



E1-Plan [V + H Sum]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,00	125	0	-16,80	185	0		-3,69	42,84
2425,000	0,00	125	0	-17,09	180	0		-2,46	56,83
2445,000	0,00	125	0	-18,79	180	0		-2,56	55,63
2465,000	0,00	125	0	-18,87	180	0		-2,99	50,38
2485,000	0,00	125	0	-18,04	185	0		-3,40	45,84

Elevation2 Plane

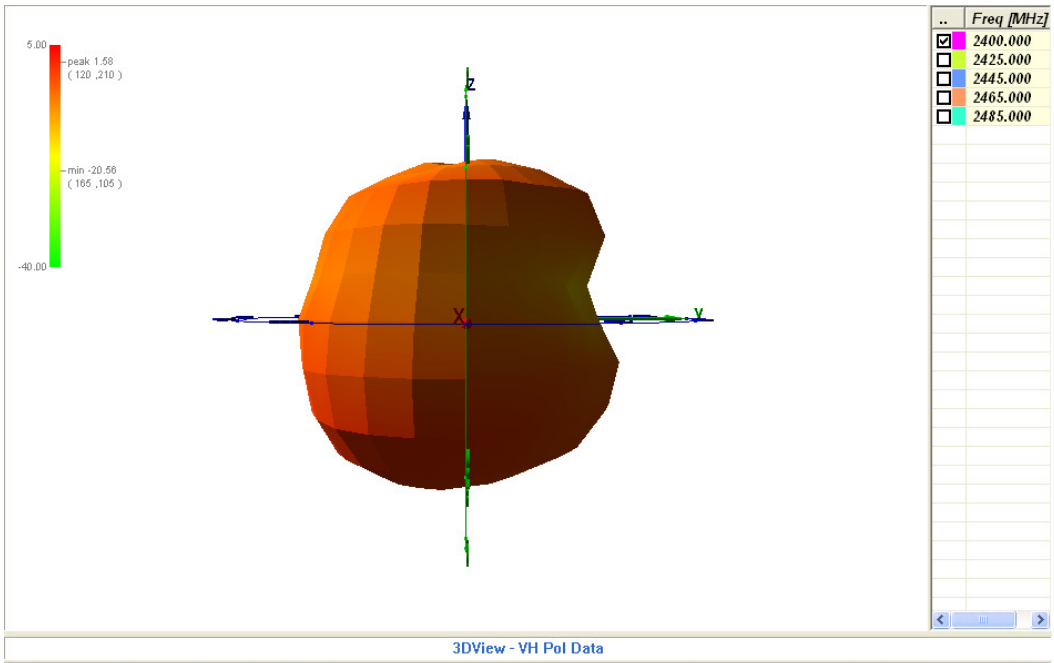


E2-Plan [V + H Sum]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,00	235	90	-19,99	155	90		-4,38	36,57
2425,000	0,00	235	90	-18,38	155	90		-3,27	47,22
2445,000	0,00	235	90	-19,22	160	90		-3,47	45,04
2465,000	0,00	235	90	-21,01	160	90		-4,02	39,71
2485,000	0,00	235	90	-22,67	160	90		-4,34	36,92

3.6 3D Radiation Pattern

3D Radiation Pattern



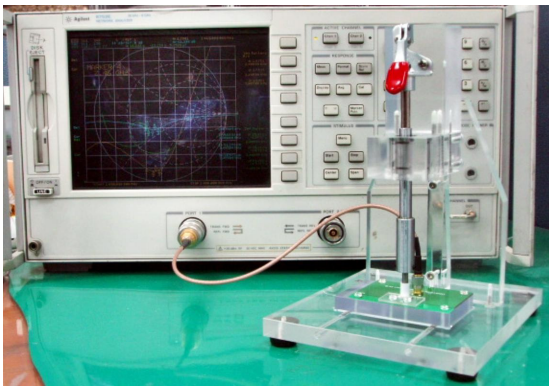
3DView - VH Pol Data

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,00	120	210	-20,56	165	105	-3,82	-3,82	41,64
2425,000	0,00	120	210	-22,80	165	105	-2,83	-2,83	52,24
2445,000	0,00	120	210	-24,06	165	105	-2,96	-2,96	50,68
2465,000	0,00	120	210	-25,91	165	105	-3,35	-3,35	46,30
2485,000	0,00	120	210	-22,92	165	90	-3,69	-3,69	42,89

4. Measurement Process

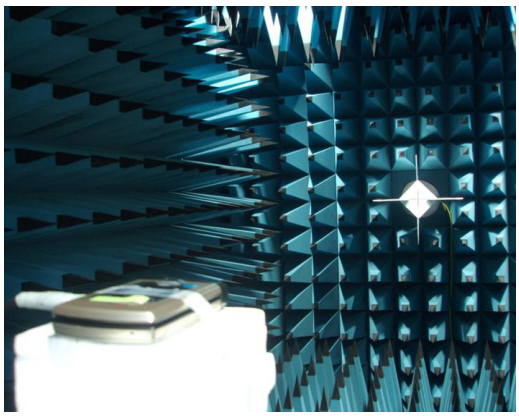
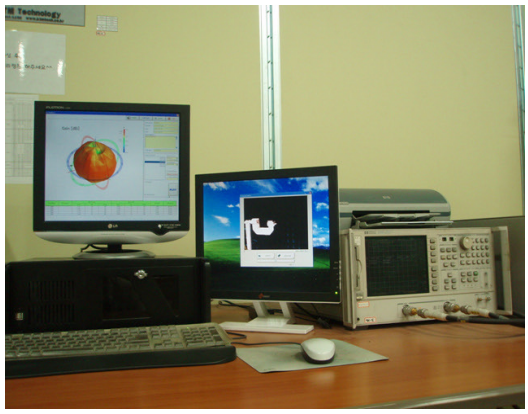
4.1 SWR/Return loss

The SWR/Return loss is measured by Network Analyzer. Using the test fixture, the Selected reference sample is a standard product.

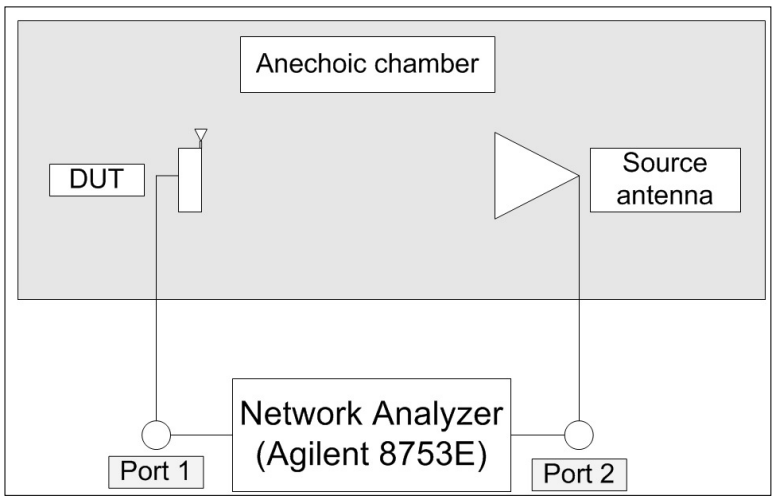
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent 8753E	Agilent 8753E or Advantest R3765CH
Cable	RF cable (300 mm)	RF cable (300 mm)
Test condition		

4.2 Gain

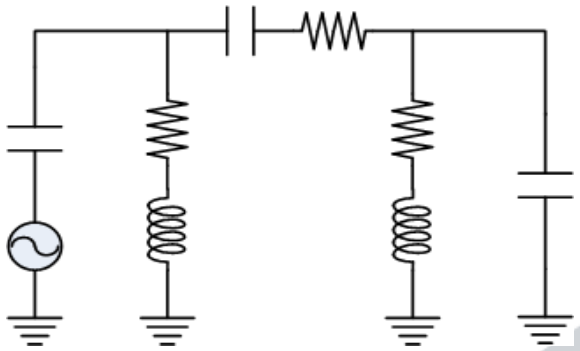
The Antenna Gain is measured by using the Passive DUT at Anechoic Chamber.

Anechoic Chamber for Antenna Gain Measurement	
	

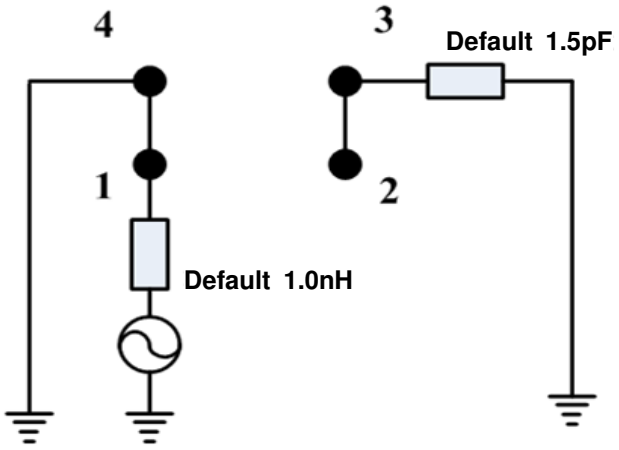
4.3 Gain Measurement block diagram



5. Equivalent Circuit



< Chip Antenna Equivalent Circuit >



< Default Condition Equivalent Circuit >

6. 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.

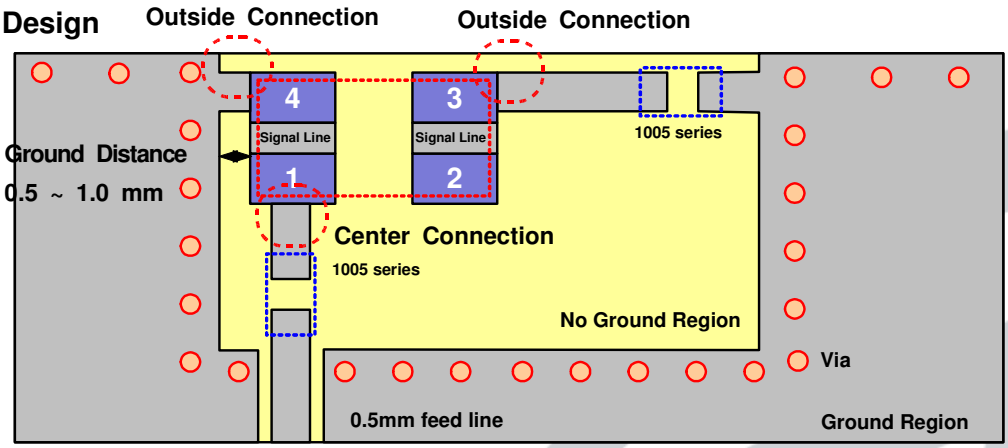
However, You must carefully choose the space for a chip antenna. Because this is only electromagnetic RF device, the electrical characteristic is changed by surrounding condition of antenna.

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 4.0x7.0mm^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.

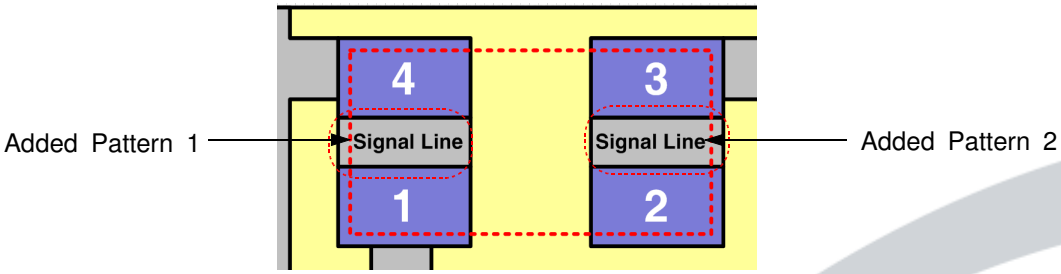
D : The No3 and No4 land pads are connected with the ground at outside of land pads and the No1 land pad is connected at center of land pad.

E : The No3 land pad is connected with the near ground, using the lumped element(1005 size). The value is 1.5pF.

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.

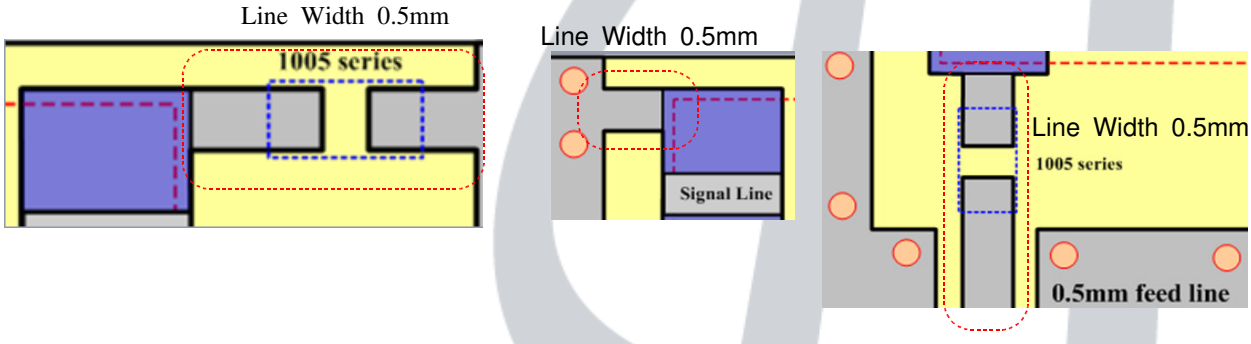


If we have a need to change characteristics, the Added Pattern 1 or 2 is removed, the PCB land pads become three land pads or four land pads.

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

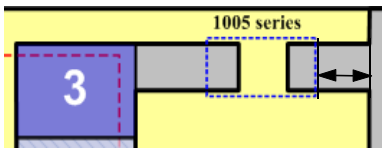
- Line Design

The connect line width is over 0.5mm.



- Inserted Lumped Element

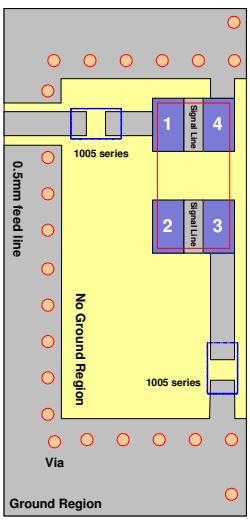
In reference with a position of lumped element, it is necessary to locate inner No Ground Region. The both default values are 4.0pF. It is shown at below figure, the lumped element that existed between No3 land pad and Ground locate at interval of over 0.5mm from ground.



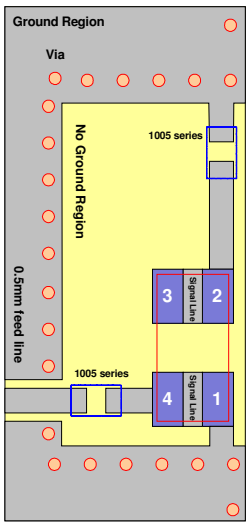
Distance, min 0.5mm

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

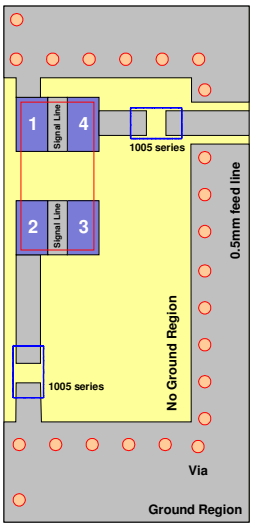
■ Change of Antenna Position



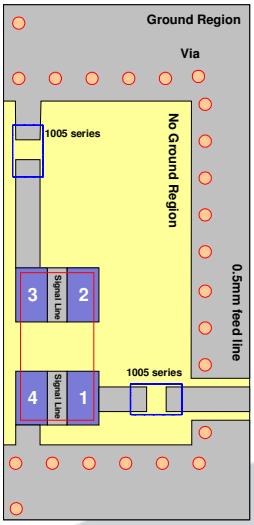
〈Right Side/Up〉



〈Right Side/Down〉



〈Left Side/Up〉



〈Left Side/Down〉

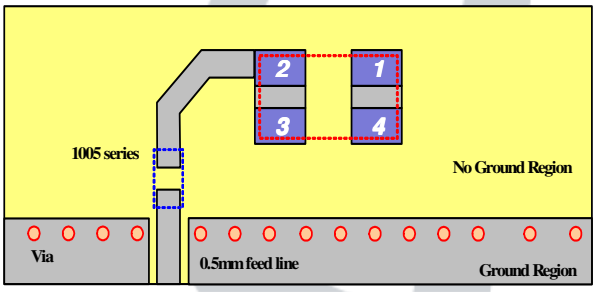
This product is able to position at various spaces of PCB, like above.

■ 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

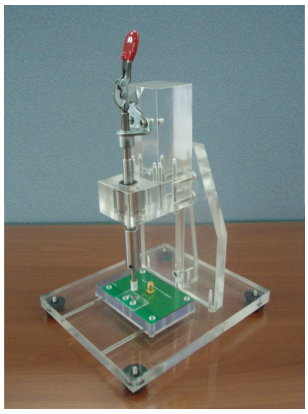
Now, there is an example drawing, this is working like monopole type for avoiding any situations. The Used antenna is sure the same antenna, however it is working differently.

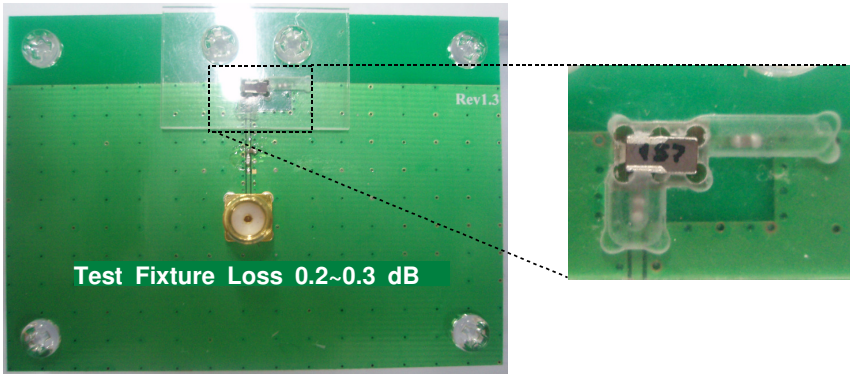
- Monopole Type Layout Example

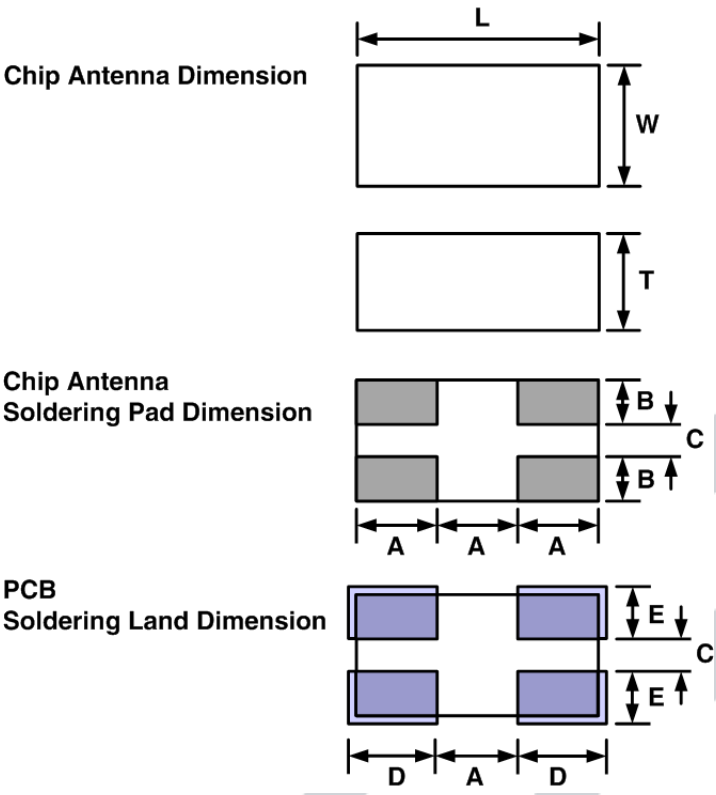


7. Test Fixture Specification

7.1 Test Fixture and Test PCB





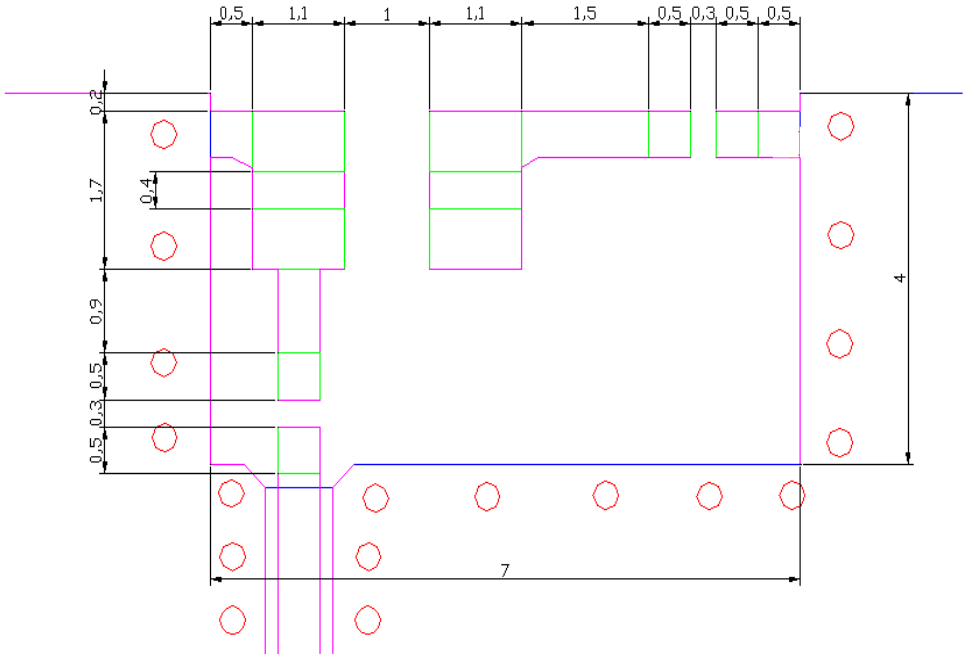


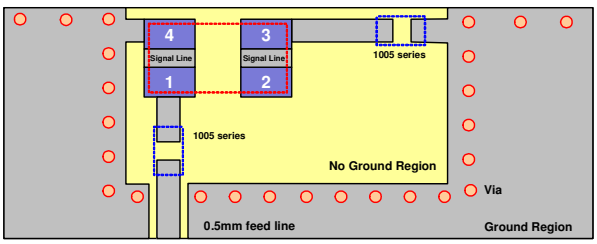
7.2 Soldering Pad Dimension and PCB layout Dimension

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

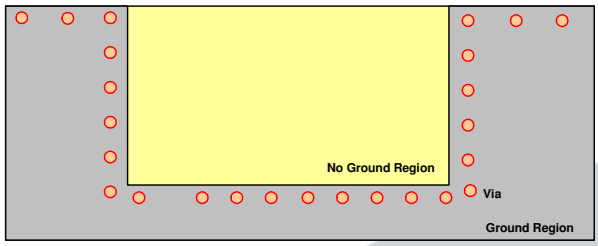
Unless Specified tolerances are ± 0.05 mm

■ PCB Drawing(Auto CAD Design)



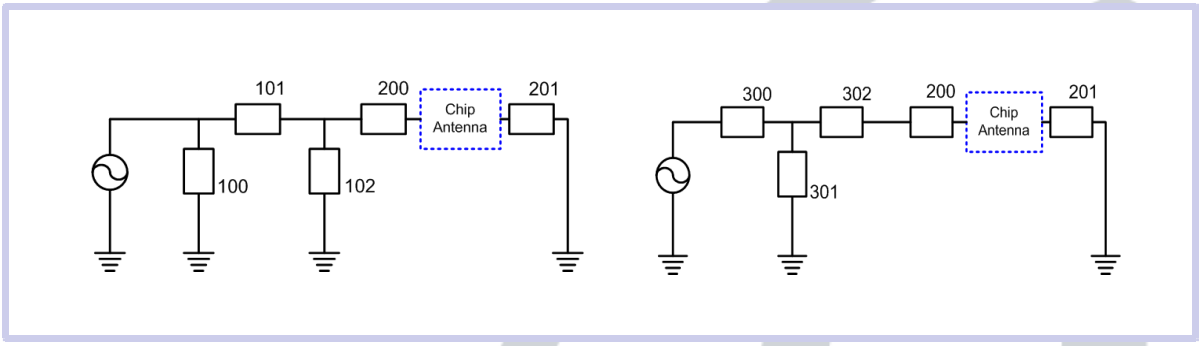


< Top View >



< Bottom View >

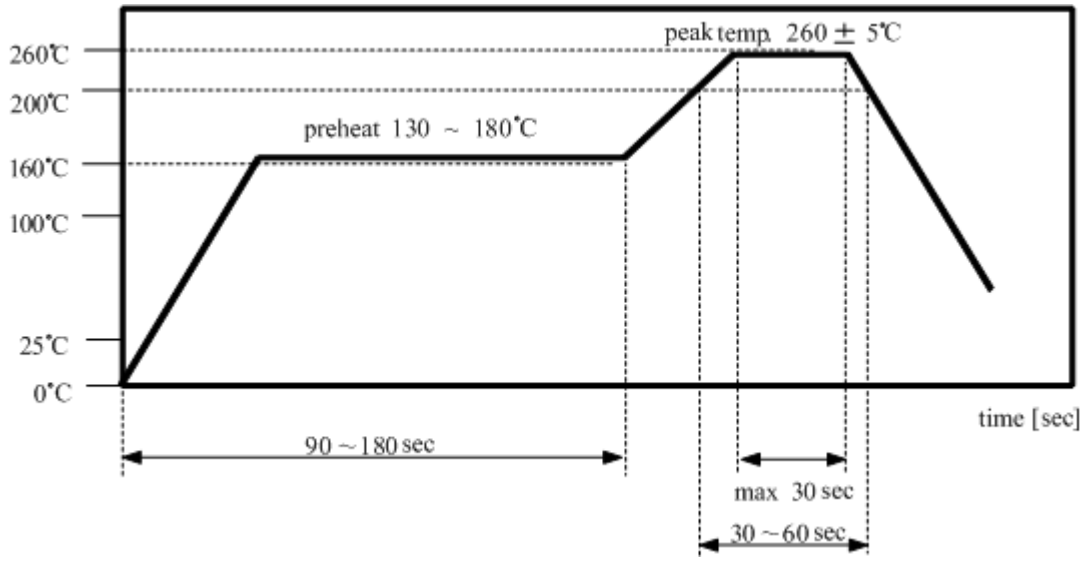
7.3 Matching Circuit and Default Value



No	100	101	102	200	201	300	301	302
Default Value	N/C	100 pF	N/C	1.0nH	1.5 pF	0 Ω	N/C	100 pF

8. Soldering Condition

8.1 Reflow Soldering



8.2 Manual Soldering

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

Soldering Temperature : 340℃±5℃ , 5 sec max per each terminal

8.3 Recommend PCB Pattern Design

Confer to 6 Application Note and 7.2 Soldering Pad Dimension and PCB layout Dimension

9. Primary Inspection List

Contents	Electrical Characteristic		Dimension[mm]		
standard	VSWR 2.5 : 1 [MAX]		W=1.5±0.1	L=3.0±0.1	T=1.2±0.1 CTQ
	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
Result	OK	OK	OK	OK	OK

10. Reliability Condition

10.1 ENVIRONMENT TEST

ITEM	TEST CONDITION	LIMIT
High Temperature Resistance	+85℃±3℃, 120hr	*After the test, specimen would be kept at 25℃±5℃ for 1 hours *specimen sheet meet the electrical specification
Low Temperature Resistance	-40℃±3℃ , 120hr	
Humidity Resistance	+60±3℃, RH90~95% ,120hr	

10.2 Thermal Shock Test , Reflow Test

ITEM	TEST CONDITION	LIMIT
Thermal Shock	-30℃/30min ↔ +70℃/30min cycle : 15 cycle recovery time : with in 5min	SAME as 10.1
Reflow	Pre Heating 200±5℃ , 30~60 sec Peak Heating 260℃±5℃ , 30sec Max	

10.3 Mechanical Test

ITEM	TEST CONDITION	LIMIT
Random Vibration	Frequency 10~500Hz - 10 ×9.8㎨(G) Sweep time 15min , X.Y.Z each 5 times	*After the test, specimen sheet meet the electrical specification
Drop	Height 152㎝ , 5 times (Each Surface)	

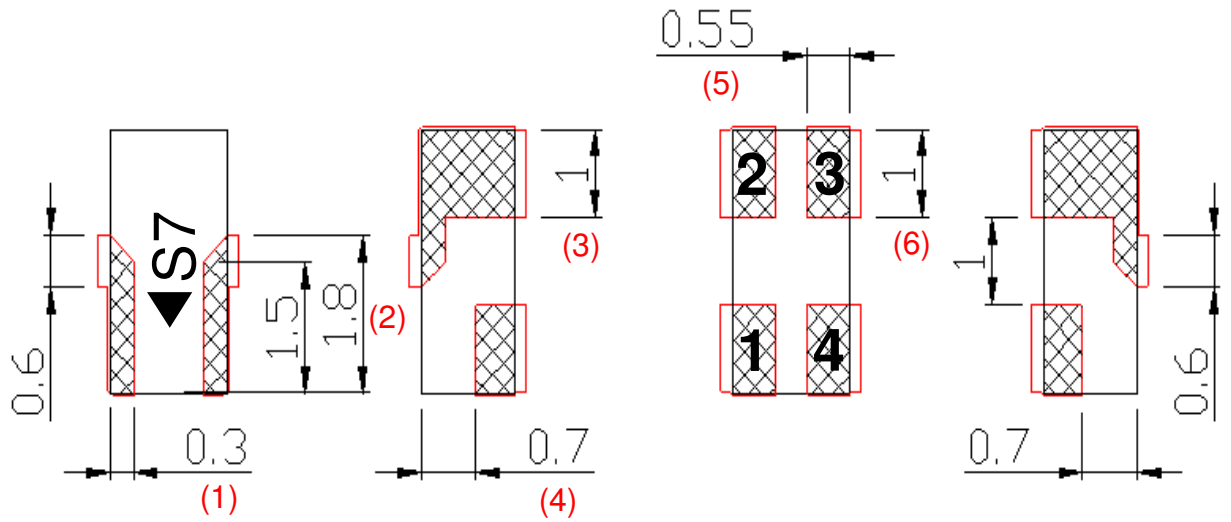
10.4 Reliability Test Result

※ Appendix

11. Mechanical Characteristics

11.1 Antenna Pattern Drawing

Antenna Pattern View



Unit : mm

Unless specified tolerances are ±0.1

11.2 Real Measurement Value

	(1)	(2)	(3)	(4)	(5)	(6)
Drawing Dimension [mm]	0.3±0.1	1.8±0.1	1.0±0.1	0.7±0.1	0.55±0.1	1.0±0.1
1	0.28	1.77	1.01	0.71	0.53	0.99
2	0.29	1.80	0.97	0.72	0.53	1.03
3	0.29	1.77	0.97	0.67	0.52	1.01
4	0.28	1.83	1.01	0.70	0.55	1.00
5	0.28	1.77	1.00	0.67	0.53	0.97
MIN [mm]	0.28	1.77	0.97	0.67	0.52	0.97
MAX [mm]	0.29	1.83	1.01	0.72	0.55	1.03
Average [mm]	0.28	1.79	0.99	0.69	0.53	1.00

11.3 LOT Notation

7
①

① Month : 1 - January, 2 - February, 3 - March, 4 - April, ····, 7 - July, ····, A - October, B - November, C - December

11.4 Marking

Marking View


◀	S	7
①	②	③

① Input Signal

② Serial

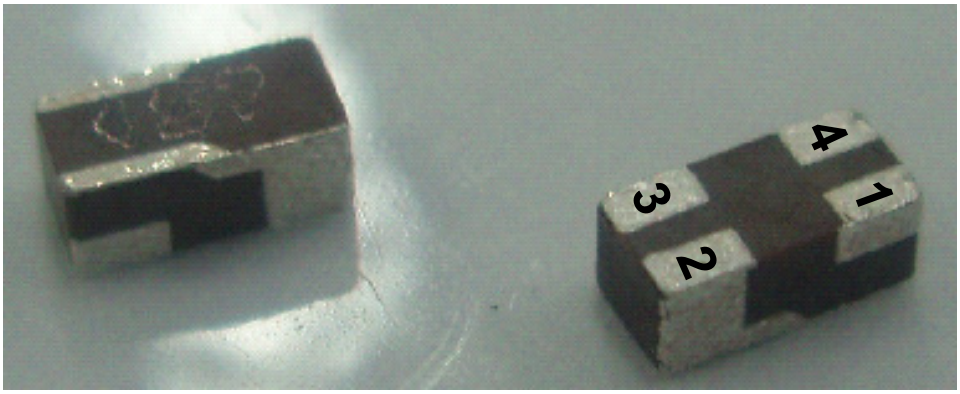
③ Month : 1 - January, 2 - February, 3 - March, 4 - April, ····, 7 - July, ····, A - October, B - November, C - December

12. Structure & Material

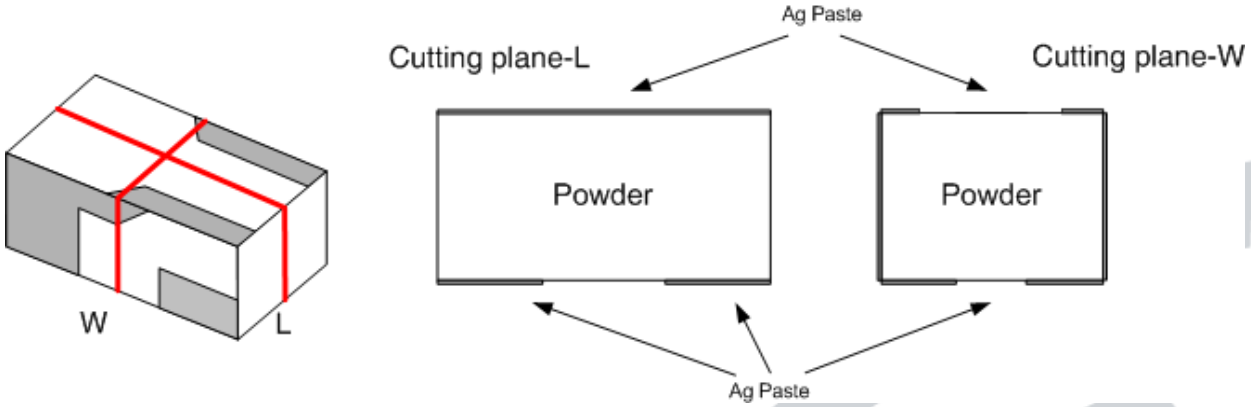
12.1 Fabrication

The structure is materialized printing Ag paste at the dielectric block.

12.2 Structure



12.3 The Cross Section



12.4 Material

Item	Material	Campany	Spec
Dielectric Block	POWDER	HAYASHI	
PATTERN	Ag Paste	METECH	Thickness : TYP 10㎛
PAD	Ag paste	METECH	Thickness : Min10㎛(TYP 16~20㎛)

13. Attention

13.1 Temperature Condition

	Range	unit
Operating Temperature	-40 ~ + 100℃	℃
Keeping Temperature	-40 ~ + 70℃	℃

13.2 Temperature Condition

Item	Condition	Temperature Range
Operating Temperature	Low	at -75℃, for 24hr, Good Operating
	High	at +150℃, for 24hr, Good Operating
Keeping Temperature	Low	at -75℃, after 1000hr, Good Operating
	High	at +85℃, after 1000hr, Good Operating

*In case of "High Temperature Resistance", because the packing material is broken at higher temperature than +85℃, the test is not able.

13.3 MSL LEVEL 1 (JEDEC J-STD-020C)

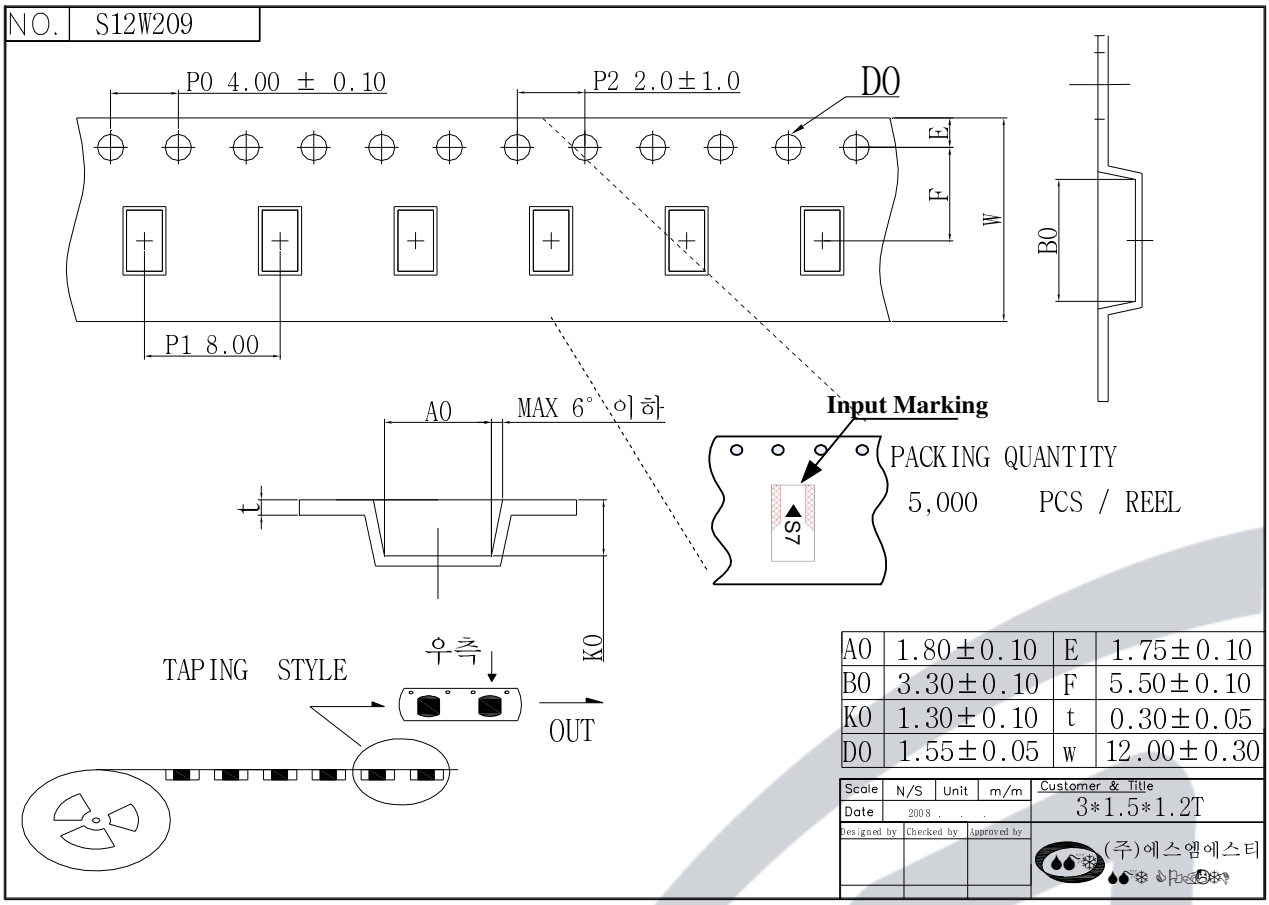
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30℃/85%RH	168+5/-0	= < 85℃/85%RH

14. Packing

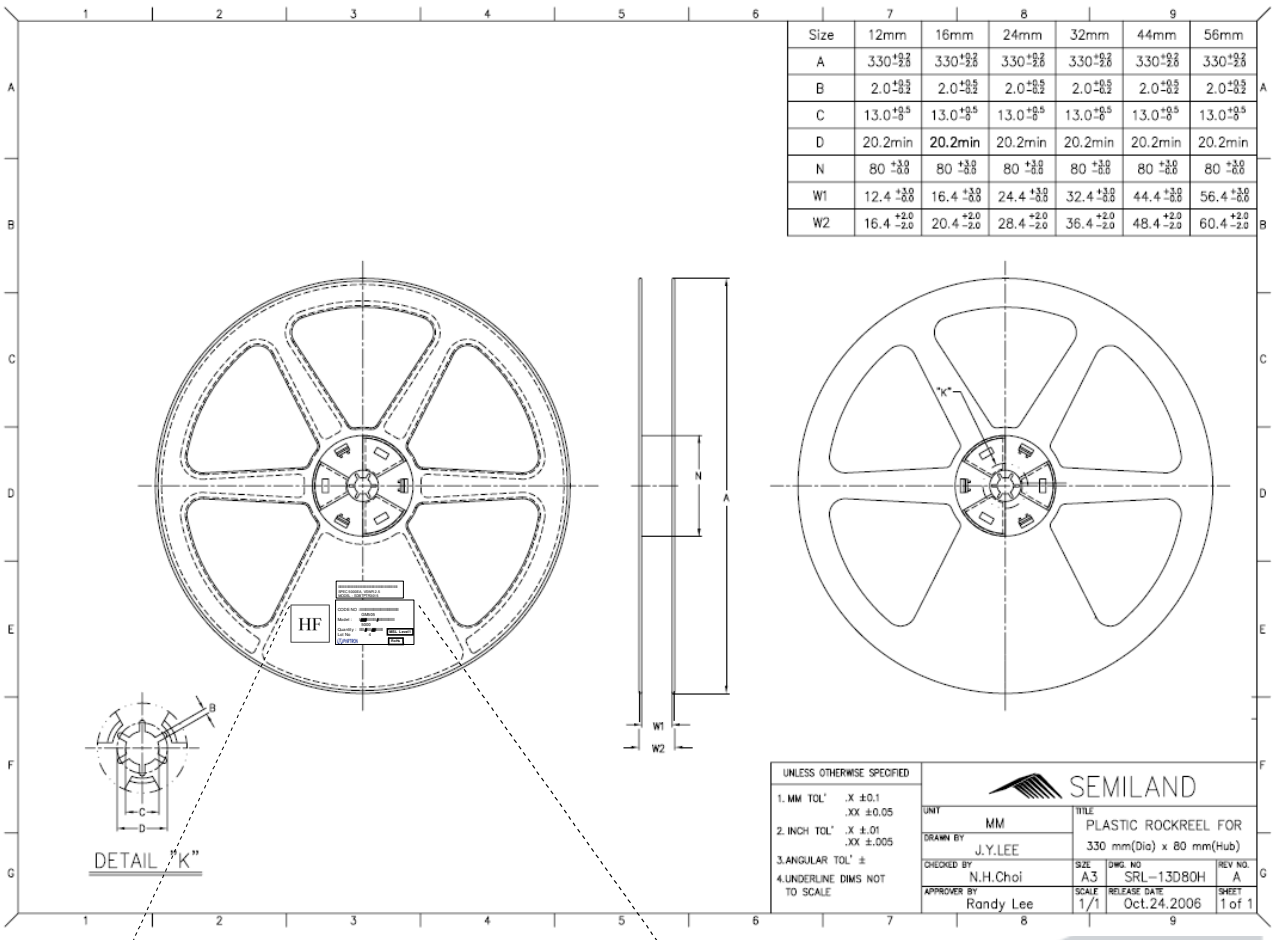
14.1 Carrier/Reel

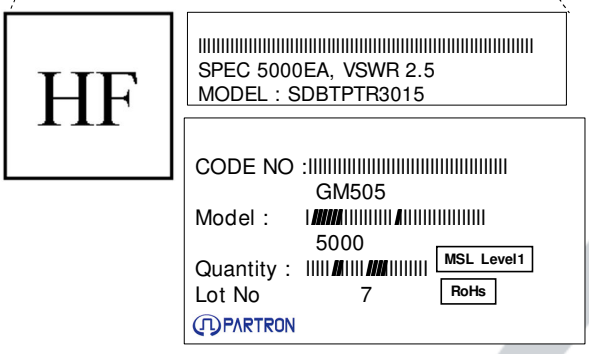
Item	Material	Surface Resistance	Electricity	Method
Carrier tape	A-PET	Typical $10^8\Omega$	10V MAX	Heat Press
Cover tape	PET	Typical $10^8\Omega$	30V MAX	
Reel	PS	Typical $10^8\Omega$	30V MAX	-

14.1.1 Carrier Specification

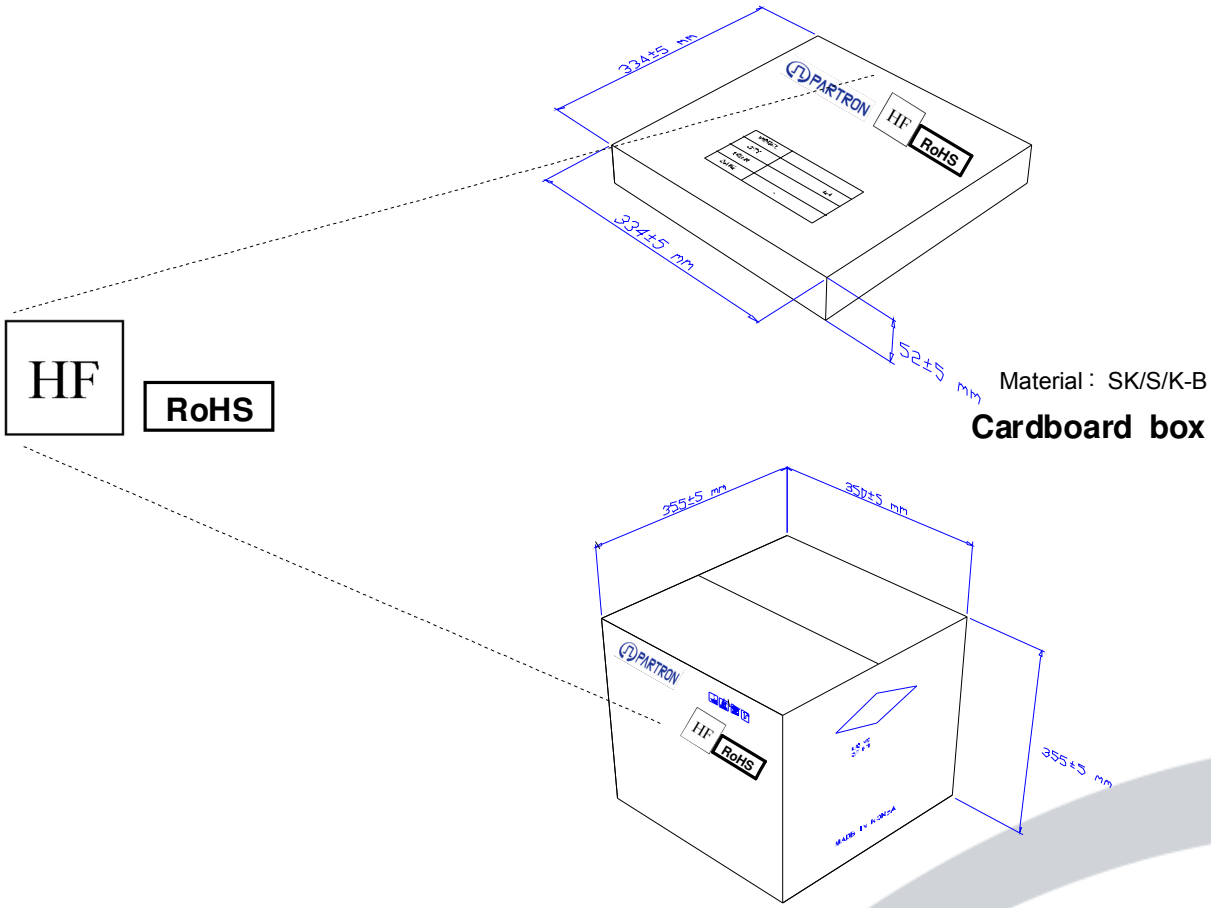


14.1.2 Reel Specification





14.2 Box Specification



Material : SK/S/K-B

Cardboard box

15. Process Control

Product	Issued/Revision		Process Control	Record	By designed	By checked	By approved
CHIP ANTENNA	Issued	04.04.06		PRCP-C001			
	Revised	05.04.03					

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/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			
	Revised	05.04.03					

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			
	Revised	05.04.03					

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	Interket Testing KOREA co. Ltd.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

Intertek

TEST REPORT

Applicant : J-TECH
Address : Rm9-211 Shiheung yutong, 984, Shiheung-3dong, Geumcheon-gu, Seoul, 153-755 Korea

Page: 1 of 4
Report No. RT11R-S2513-E-R Date: Jul. 04, 2011

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : JT-3
Name of Material : HIZIRCO MWF-38U
Sample ID No. : RT11R-S2513
Manufacturer/Vender : Hayashi chemical industry co., ltd.

Sample received : Jun. 28, 2011
Testing Date : Jun. 28, 2011 ~ Jul. 01, 2011
Testing Environment : Temperature : (24 ± 2) ℃, 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 the written approval of the testing laboratory.

Approved by, Authorized by,

Jade Jang / Lab. Technical Manager
Bo Park / Lab. General Manager

Intertek

TEST REPORT

Page: 2 of 4
Report No. RT11R-S2513-E-R Date: Jul. 04, 2011
Sample ID No. : RT11R-S2513
Sample Description : JT-3

Test Item	Unit	Test Method	MDL	Result
Cadmium (Cd)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg		5	N.D.
Mercury (Hg)	mg/kg		2	N.D.
Hexavalent Chromium (Cr^{6+}) (For non-metal)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by alkaline digestion and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	5	N.D.
Dibromobiphenyl	mg/kg		5	N.D.
Tribromobiphenyl	mg/kg		5	N.D.
Tetrabromobiphenyl	mg/kg		5	N.D.
Pentabromobiphenyl	mg/kg		5	N.D.
Hexabromobiphenyl	mg/kg		5	N.D.
Heptabromobiphenyl	mg/kg		5	N.D.
Octabromobiphenyl	mg/kg		5	N.D.
Nonabromobiphenyl	mg/kg		5	N.D.
Decabromobiphenyl	mg/kg		5	N.D.
Polybrominated Diphenyl Ether (PBDEs)				
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	5	N.D.
Dibromodiphenyl ether	mg/kg		5	N.D.
Tribromodiphenyl ether	mg/kg		5	N.D.
Tetrabromodiphenyl ether	mg/kg		5	N.D.
Pentabromodiphenyl ether	mg/kg		5	N.D.
Hexabromodiphenyl ether	mg/kg		5	N.D.
Heptabromodiphenyl ether	mg/kg		5	N.D.
Octabromodiphenyl ether	mg/kg		5	N.D.
Nonabromodiphenyl ether	mg/kg		5	N.D.
Decabromodiphenyl ether	mg/kg		5	N.D.

Tested by : Nikkie Lee, Leo Kim, Ellen Jung, Jessica Kang

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

Intertek

TEST REPORT

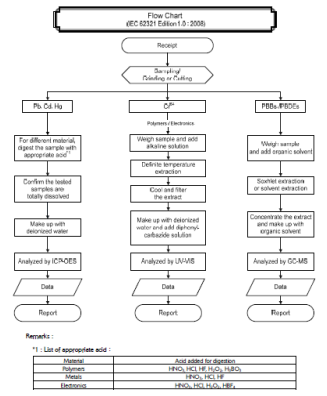
Page: 3 of 4
Report No. RT11R-S2513-E-R Date: Jul. 04, 2011
Sample ID No. : RT11R-S2513
Sample Description : JT-3

* View of sample as received:-

Intertek

TEST REPORT

Page: 4 of 4
Report No. RT11R-S2513-E-R Date: Jul. 04, 2011
Sample ID No. : RT11R-S2513
Sample Description : JT-3



Remarks :
*1 : List of appropriate acid :

Material	Acid added for digestion
Polymers	HNO_3, HCl, HF, H_2O_2, H_3BO_3
Metals	HNO_3, HCl, HF
Electronics	HNO_3, HCl, H_2O_2, HBF_4

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

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

SGS

Test Report No. F690101/LF-CTSAYAA11-26011 Issued Date: 2011. 08. 16 Page 1 of 6

To: DAEJOO ELECTRONICS MATERIALS CO., LTD.
1236-10
Jeongwang-dong
Siheung-si
Gyeonggi-do 429-914
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA11-26011
Product Name	: Ag Paste
Item No./Part No.	: N/A
Client Reference Data	: DNF8010C (Y110714), DNF8510 (Y110727)
Received Date	: 2011. 08. 10
Test Period	: 2011. 08. 11 to 2011. 08. 16
Buyer(s)	: SONY
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.
Report Comments	: The client has confirmed that the described item No.s/part No.s & client reference data are the same with the sample submitted.

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS

Test Report No. F690101/LF-CTSAYAA11-26011 Issued Date: 2011. 08. 16 Page 2 of 6

Sample No. : AYAA11-26011.001
Sample Description : Ag Paste
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS

Test Report No. F690101/LF-CTSAYAA11-26011 Issued Date: 2011. 08. 16 Page 3 of 6

Sample No. : AYAA11-26011.001
Sample Description : Ag Paste
Item No./Part No. : N/A
Materials : N/A

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007 , IC	30	N.D.

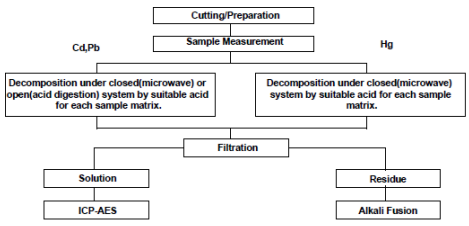
Picture of Sample as Received:

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS

Test Report No. F690101/LF-CTSAYAA11-26011 Issued Date: 2011. 08. 16 Page 4 of 6

Flow Chart of Digestion



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_2SO_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 62321)	HNO_3, HCl, H_2SO_4, HBr
Others	Any acid

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

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS

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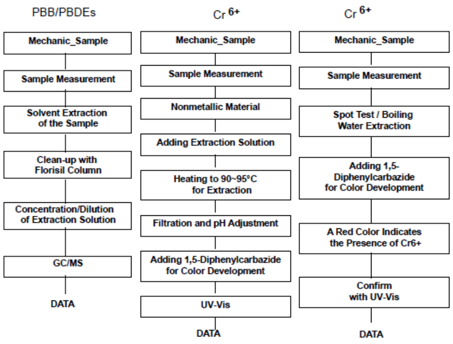
Flow Chart of Cr^{6+},PBB/PBDEs Testing



NOTE:
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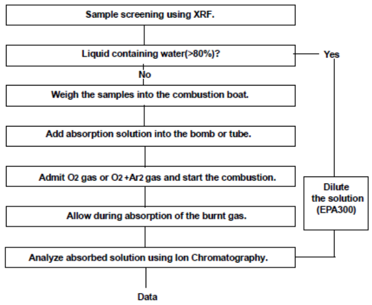
Flow Chart for Halogen Test



*** End ***

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
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SGS Korea Co.,Ltd. 322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080 t +82 (0)31 4608 000 f +82 (0)31 4608 059 http://www.sgslab.co.kr www.kr.sgs.com/greenlab

F052 Version4

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3) Marking Ink

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

CTI

Test Report

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Applicant DOMINO CHINA LIMITED

Address NO. 1150 YUN QIAO ROAD, JIN QIAO EXPORT PROCESSING ZONE PUDONG, SHANGHAI, P.R. CHINA

Report on the submitted sample(s) said to be

Sample Name Ink

Sample Description Black ink

Part No. IR/IC-270BK

Item/Lot No. AC001221A

Material Butanone

Sample Received Date Jan. 11, 2011

Testing Period Jan. 11, 2011 to Jan. 14, 2011

Test Requested To determine the Lead(Pb), Cadmium(Cd), Mercury(Hg), Hexavalent Chromium (Cr(VI)), Polybrominated Biphenyls (PBBs), Polybrominated Diphenyl Ethers (PBDEs), Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I) content in the submitted sample according to the request of client.

Test Method Please refer to the following page(s).

Test Result(s) Please refer to the following page(s).

Tested by

Approved by Technical Manager

Inspected by Zhang Yijun

Date Jan. 14, 2011

No. 94225153

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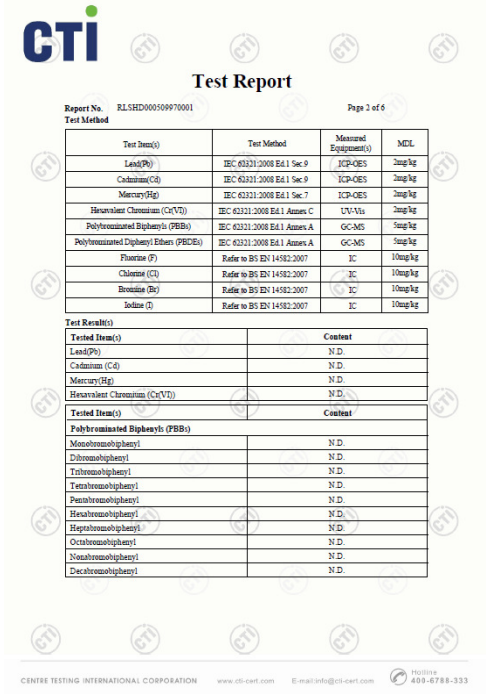

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Test Report

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Test Method

Test Item(s)	Test Method	Measured Equipment(s)	MDL
Lead(Pb)	IEC 62321:2008 Ed.1 Sec.9	ICP-OES	2mg/kg
Cadmium(Cd)	IEC 62321:2008 Ed.1 Sec.9	ICP-OES	2mg/kg
Mercury(Hg)	IEC 62321:2008 Ed.1 Sec.7	ICP-OES	2mg/kg
Hexavalent Chromium (Cr(VI))	IEC 62321:2008 Ed.1 Annex C	UV-Vis	2mg/kg
Polybrominated Biphenyls (PBBs)	IEC 62321:2008 Ed.1 Annex A	GC-MS	5mg/kg
Polybrominated Diphenyl Ethers (PBDEs)	IEC 62321:2008 Ed.1 Annex A	GC-MS	5mg/kg
Fluorine (F)	Refer to BS EN 14582:2007	IC	10mg/kg
Chlorine (Cl)	Refer to BS EN 14582:2007	IC	10mg/kg
Bromine (Br)	Refer to BS EN 14582:2007	IC	10mg/kg
Iodine (I)	Refer to BS EN 14582:2007	IC	10mg/kg

Test Result(s)

Tested Item(s)	Content
Lead(Pb)	N.D.
Cadmium (Cd)	N.D.
Mercury(Hg)	N.D.
Hexavalent Chromium (Cr(VI))	N.D.

Tested Item(s)	Content
Polybrominated Biphenyls (PBBs)	
Monobromobiphenyl	N.D.
Dibromobiphenyl	N.D.
Tribromobiphenyl	N.D.
Tetrabromobiphenyl	N.D.
Pentabromobiphenyl	N.D.
Hexabromobiphenyl	N.D.
Heptabromobiphenyl	N.D.
Octobromobiphenyl	N.D.
Nonabromobiphenyl	N.D.
Decabromobiphenyl	N.D.

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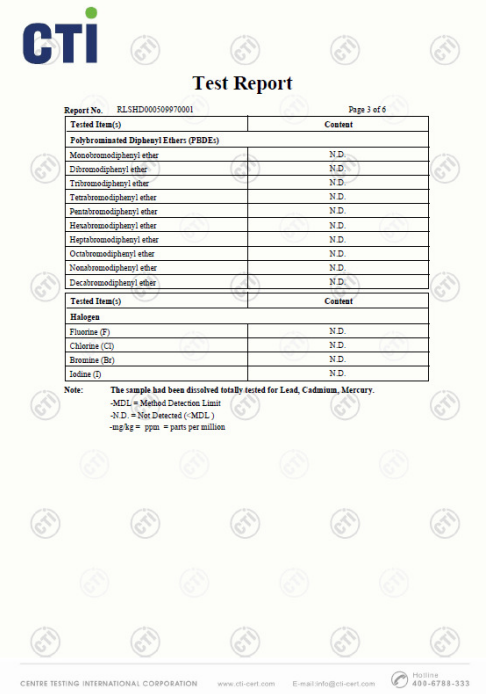

CTI

Test Report

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Tested Item(s)	Content
Polybrominated Diphenyl Ethers (PBDEs)	
Monobromodiphenyl ether	N.D.
Dibromodiphenyl ether	N.D.
Tribromodiphenyl ether	N.D.
Tetrabromodiphenyl ether	N.D.
Pentabromodiphenyl ether	N.D.
Hexabromodiphenyl ether	N.D.
Heptabromodiphenyl ether	N.D.
Octabromodiphenyl ether	N.D.
Nonabromodiphenyl ether	N.D.
Decabromodiphenyl ether	N.D.

Tested Item(s)	Content
Halogen	
Fluorine (F)	N.D.
Chlorine (Cl)	N.D.
Bromine (Br)	N.D.
Iodine (I)	N.D.

Note: The sample had been dissolved totally tested for Lead, Cadmium, Mercury.

-MDL = Method Detection Limit

-N.D. = Not Detected (<MDL)

-mg/kg = ppm = parts per million

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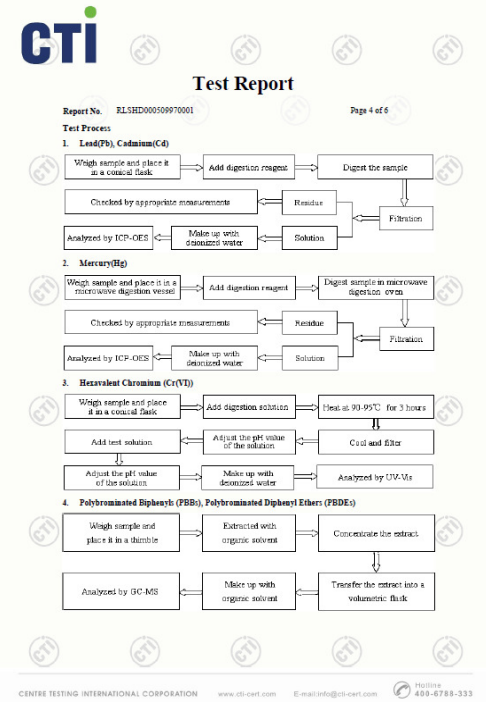

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Test Report

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Test Process

1. Lead(Pb), Cadmium(Cd)

Weigh sample and place it in a conical flask → Add digestion reagent → Digest the sample → Filtration → Residue → Checked by appropriate measurements

Filtration → Solution → Make up with deionized water → Analyzed by ICP-OES

2. Mercury(Hg)

Weigh sample and place it in a microwave digestion vessel → Add digestion reagent → Digest sample in microwave digestion oven → Filtration → Residue → Checked by appropriate measurements

Filtration → Solution → Make up with deionized water → Analyzed by ICP-OES

3. Hexavalent Chromium (Cr(VI))

Weigh sample and place it in a conical flask → Add digestion solution → Heat at 90-95°C for 3 hours → Cool and filter → Adjust the pH value of the solution → Add test solution

Adjust the pH value of the solution → Make up with deionized water → Analyzed by UV-Vis

4. Polybrominated Biphenyls (PBBs), Polybrominated Diphenyl Ethers (PBDEs)

Weigh sample and place it in a thimble → Extracted with organic solvent → Concentrate the extract → Transfer the extract into a volumetric flask → Make up with organic solvent → Analyzed by GC-MS

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Test Report

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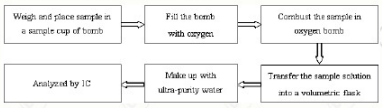
5. **Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I)**



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Test Report

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Photo(s) of the sample(s)

RLSHD000509970001

*** End of report ***