
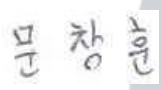
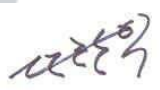
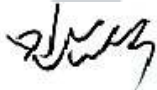


Approval Sheet

Products	Chip Antenna	3D Structure
Supplier CODE	ACS2450JBAUBC	 Top-Side View  Bottom-Side View
Model	UBC-100	
SEC CODE		
Revision	VER.1.0 12/22	
Supplier	PARTRON	

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

By designed	By checked	By approved
		
Chang-hun.Mun	Chanik.Jeon	Nam-Sik.Min
12/22	12/22	12/22

– Contents –

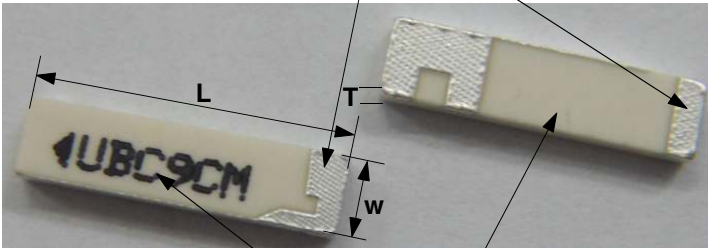
※ Cover	1 p
※ Contents	2 p
1. Revision History	3 p
2. Summary of Parts	4 p
3. Critical to Quality	4 p
4. Electrical Characteristics	5 p
5. Measurement Process	10 p
6. Internal Block Diagram	12 p
7. Basis Action / Application Note	12 p
8. Measurement Jig SPEC	13 p
9. REFLOW PROFILE	14 p
10. Primary Inspection List	15 p
11. Reliability Condition	16 p
12. Mechanical Characteristics	18 p
13. Structure and Material	20 p
14. Attention	21 p
15. Packing	22 p
16. Process Control	26 p
17. RoHS Data	29 p

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 = 10.0 ± 0.1					
	W = 2.5 ± 0.1					
	T = 1.2 ± 0.1					
Flatness Level	0.04					
MSL LEVEL	MSL LEVEL 1					
ESD LEVEL	More than 15 KV (HBM CLASS 3B)					
Version	Revision 1.0		Top-Side View		Bottom-Side View	
Electrical Characteristics (CTF)	Characteristics	VSWR(CTF)	Cycle of management	Q`ty	CPK	Reference
	2730MHz	1.0 ~ 2.5:1	all inspection	all	6.50	4,6,15 Page
	2815MHz	1.0 ~ 2.5:1	all inspection	all	10.59	4,6,15 Page

3. Critical to Quality(CTQ)

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

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

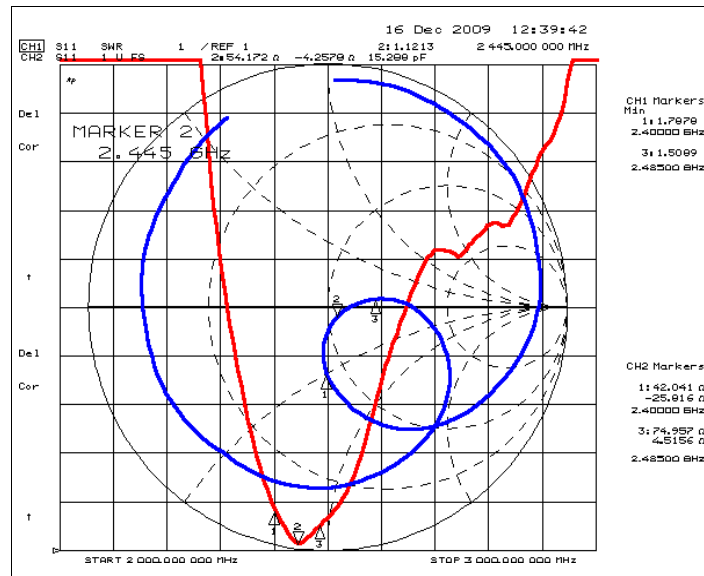
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

4. Electrical Characteristics

4.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3.0 : 1 (Typ 2.5 : 1)
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Gain [dBi]	Total Gain (Peak / Avg) [dBi]			0.39 / -3.71
	Azimuth	Theta	Peak	-0.96
			Average	-4.03
		Phi	Peak	0.39
			Average	-3.57
	Elevation 1	Theta	Peak	0.90
			Average	-2.51
		Phi	Peak	0.25
			Average	-5.07
	Elevation 2	Theta	Peak	-1.38
			Average	-6.07
		Phi	Peak	2.16
			Average	-2.22

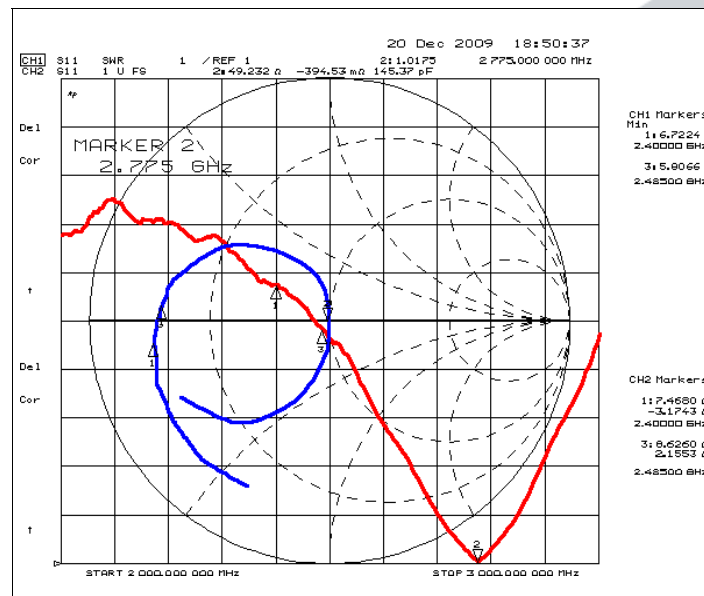
4.2 S11 Graph of Set Condition



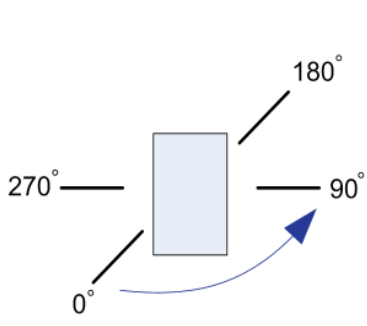
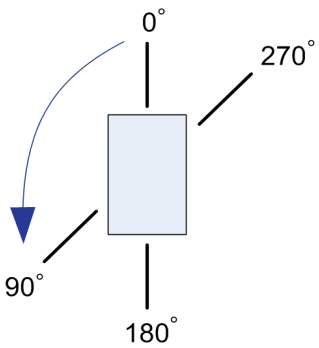
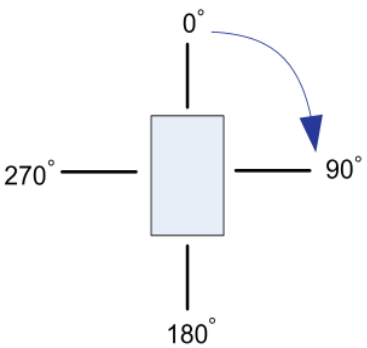
4.3 Test Fixture Condition

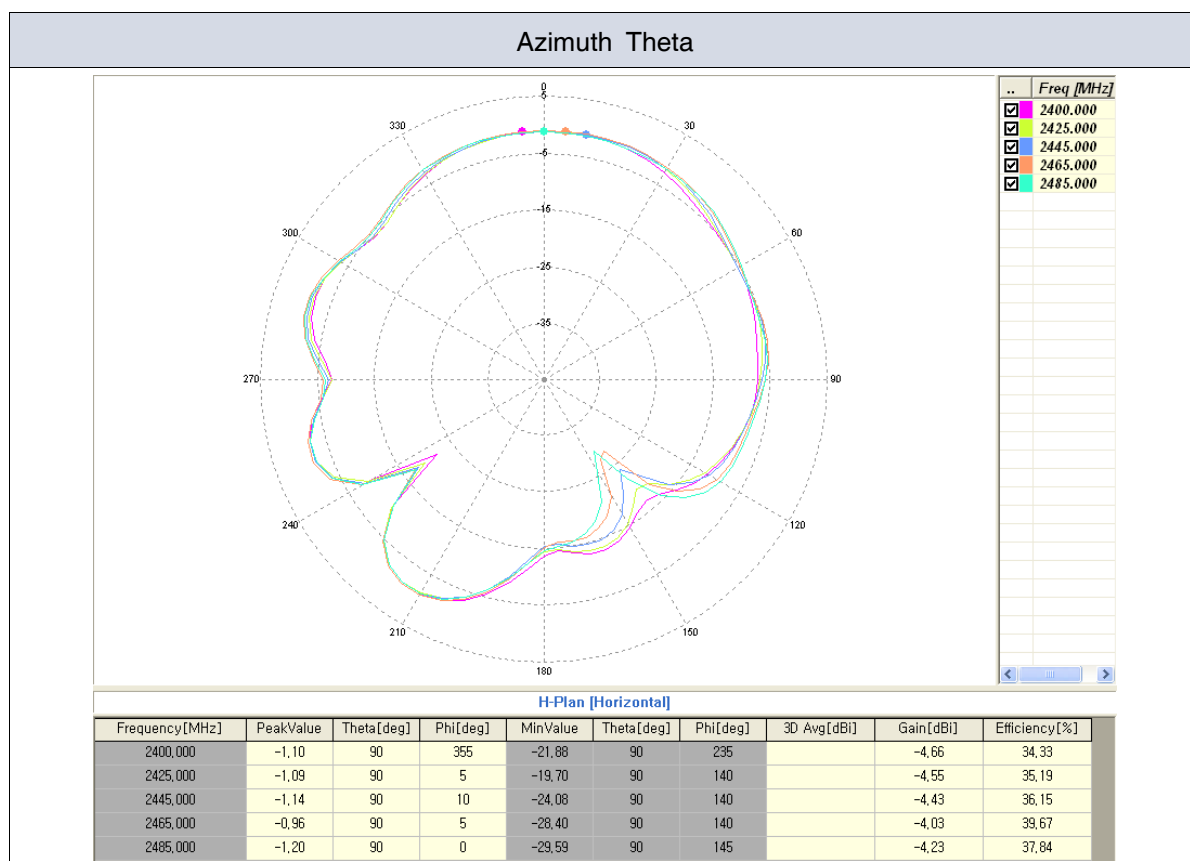
ITEM	SPEC
Frequency Range [MHz]	2730 ~ 2815
Lower frequency(2730 MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 2.0 : 1)
Upper frequency(2815 MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 2.0 : 1)

4.4 S11 Graph of Test Fixture Condition

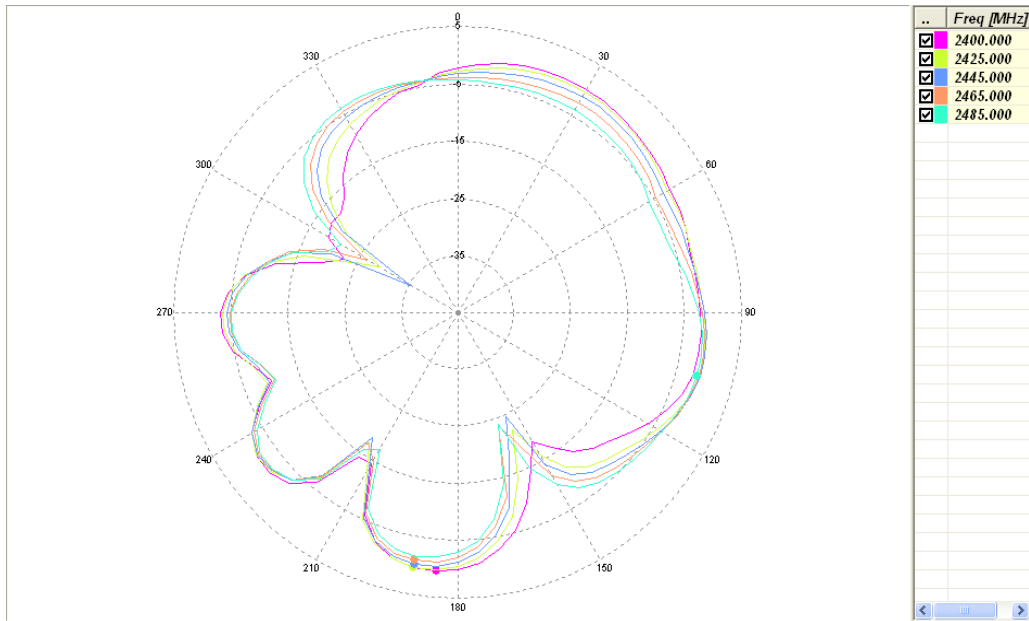


4.5 Radiation Pattern

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



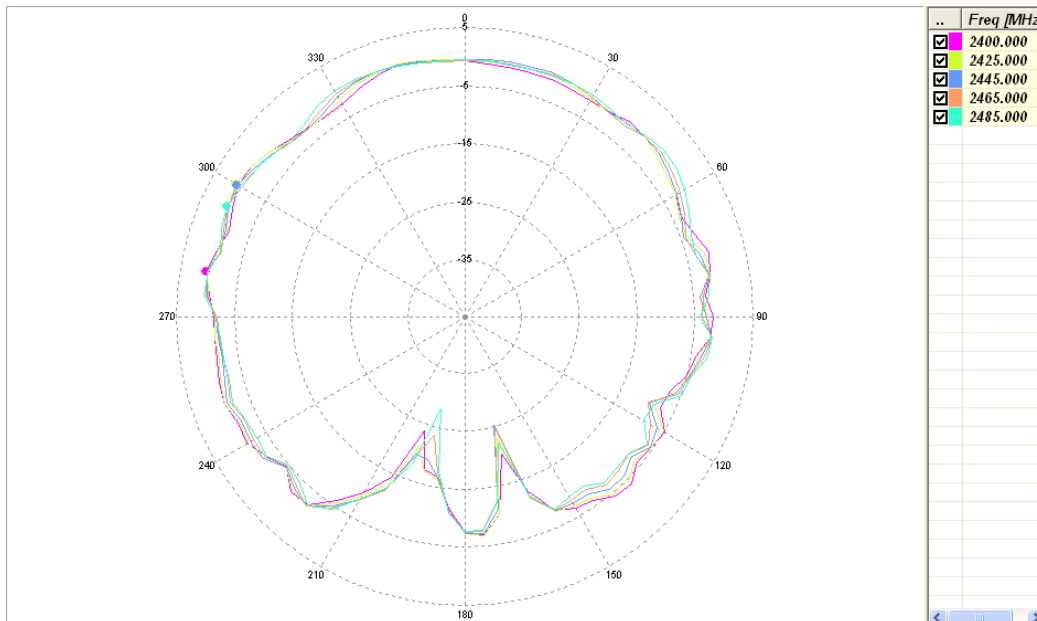
Azimuth Phi



H-Plan [Vertical]

Frequency [MHz]	PeakValue	Theta [deg]	Phi [deg]	MinValue	Theta [deg]	Phi [deg]	3D Avg [dBi]	Gain [dBi]	Efficiency [%]
2400,000	0,39	90	185	-22,86	90	295		-3,57	44,09
2425,000	0,17	90	190	-28,94	90	300		-3,61	43,71
2445,000	-0,33	90	190	-35,10	90	300		-3,94	40,46
2465,000	-1,02	90	190	-26,44	90	300		-4,46	35,91
2485,000	-1,51	90	105	-24,21	90	160		-4,91	32,39

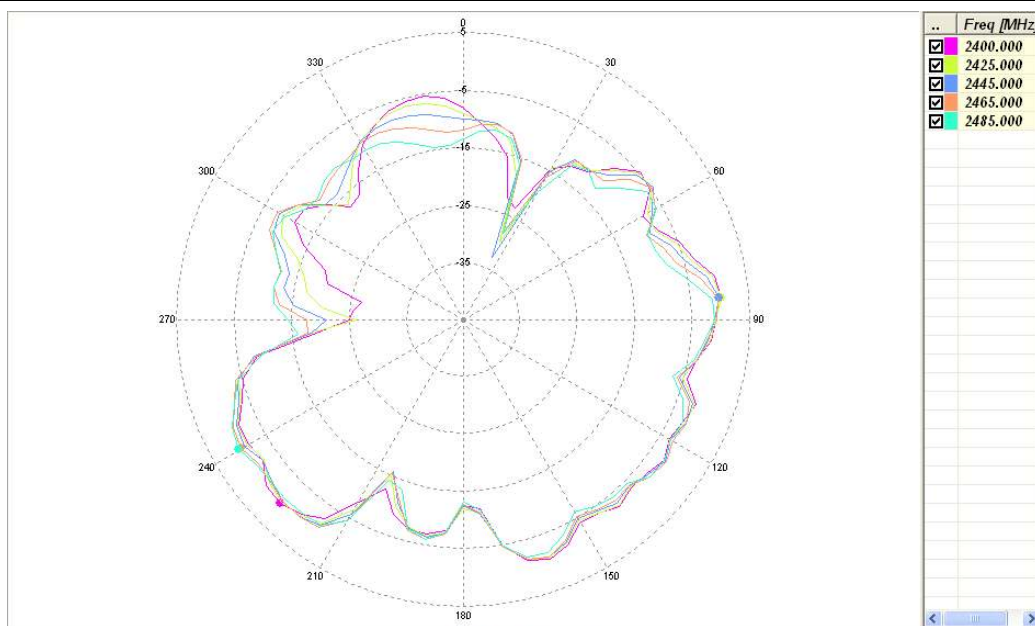
Elevation1 Theta



E1-Plan [Vertical]

Frequency [MHz]	PeakValue	Theta [deg]	Phi [deg]	MinValue	Theta [deg]	Phi [deg]	3D Avg [dBi]	Gain [dBi]	Efficiency [%]
2400,000	0,55	280	0	-23,90	200	0		-2,57	55,42
2425,000	0,90	300	0	-23,24	165	0		-2,51	56,16
2445,000	0,65	300	0	-25,48	165	0		-2,57	55,49
2465,000	0,59	295	0	-24,97	165	0		-2,64	54,61
2485,000	0,51	295	0	-28,40	195	0		-2,51	56,20

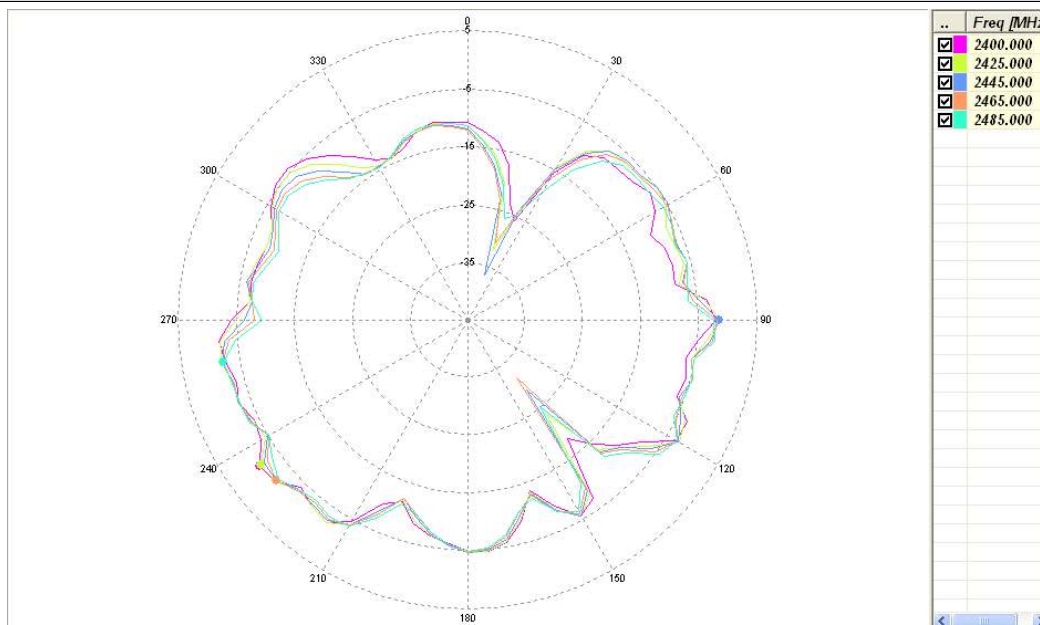
Elevation1 Phi



E1-Plan [Horizontal]

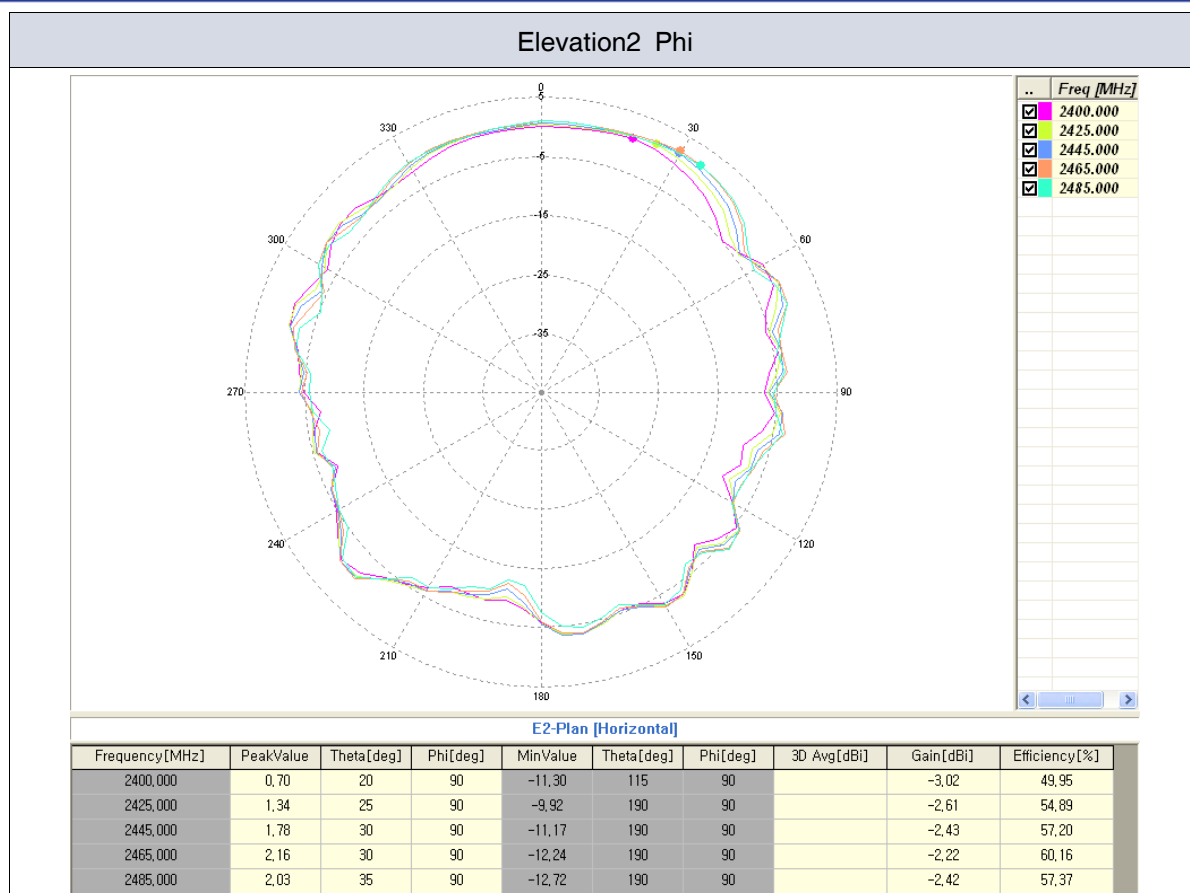
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,25	225	0	-26,85	280	0		-5,07	31,23
2425,000	0,02	85	0	-29,87	25	0		-5,08	31,14
2445,000	-0,19	85	0	-32,96	25	0		-5,18	30,43
2465,000	-0,10	240	0	-27,91	25	0		-5,17	30,54
2485,000	0,28	240	0	-28,34	25	0		-5,65	27,34

Elevation2 Theta



E2-Plan [Vertical]

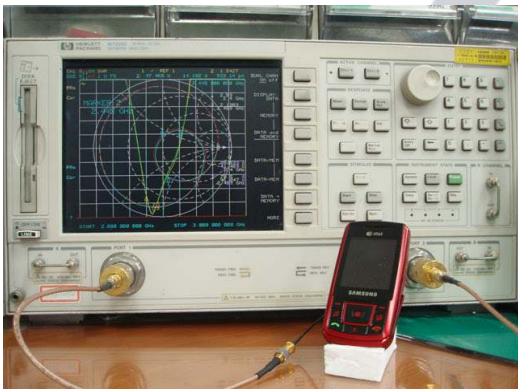
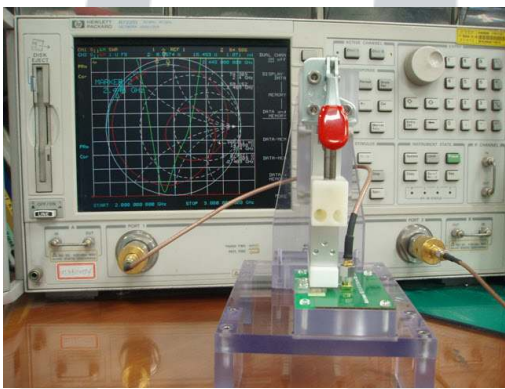
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-0,97	235	90	-25,94	25	90		-6,29	23,62
2425,000	-1,38	235	90	-31,87	20	90		-6,07	24,81
2445,000	-1,54	90	90	-36,57	20	90		-6,26	23,77
2465,000	-1,84	230	90	-31,90	140	90		-6,52	22,41
2485,000	-2,14	260	90	-26,21	20	90		-6,74	21,31



5. Measurement Process

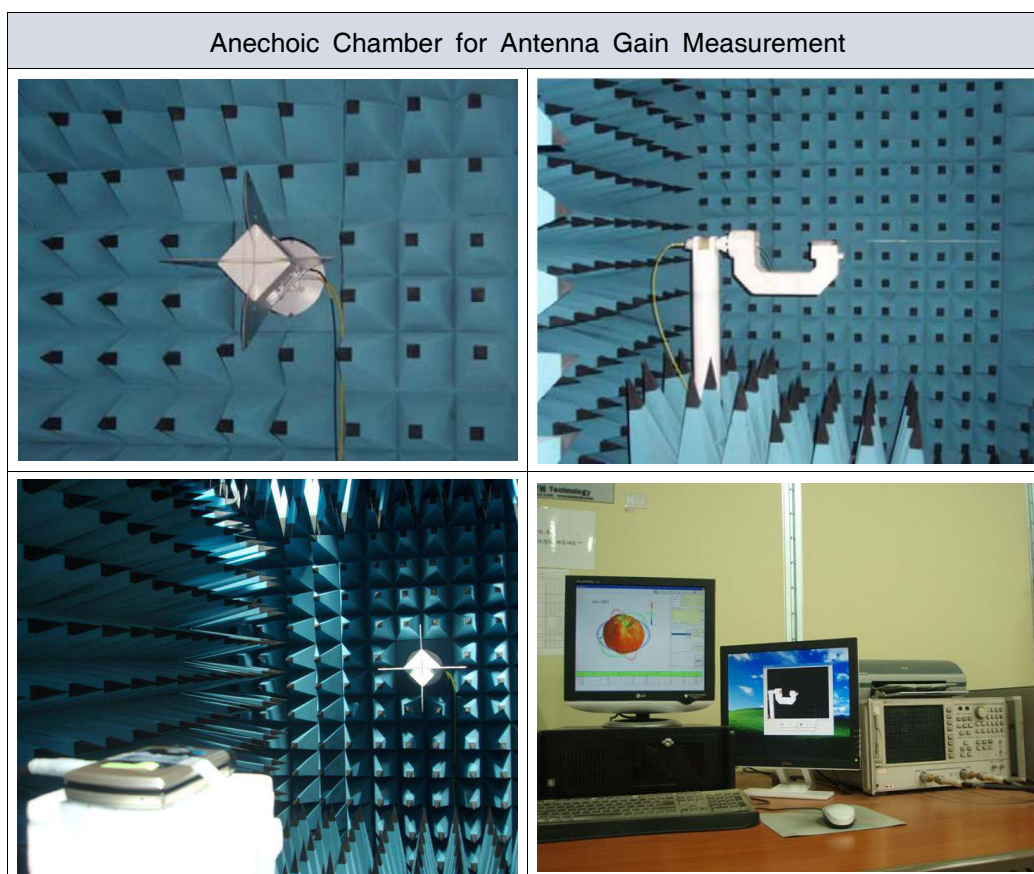
5.1 SWR / Return Loss

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

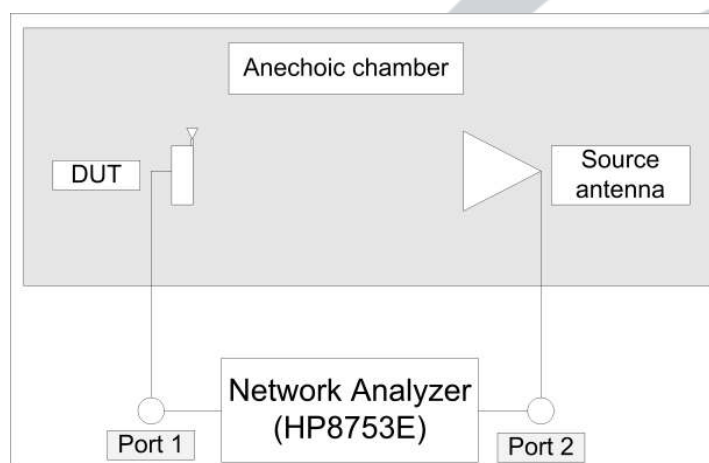
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753E or Advantest R3765CH	Agilent HP8753E or Advantest R3765CH
Cable	RF cable (300 mm)	RF cable (300 mm)
Test condition		

5.2 Gain

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

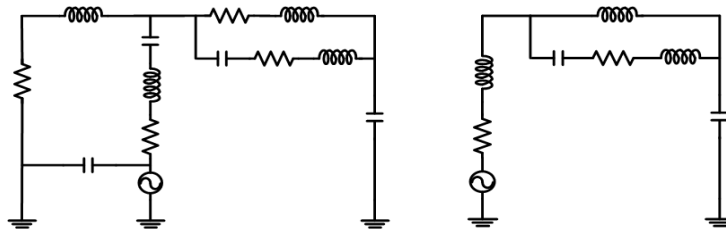


5.3 Gain test block diagram



6. Internal Block Diagram

This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



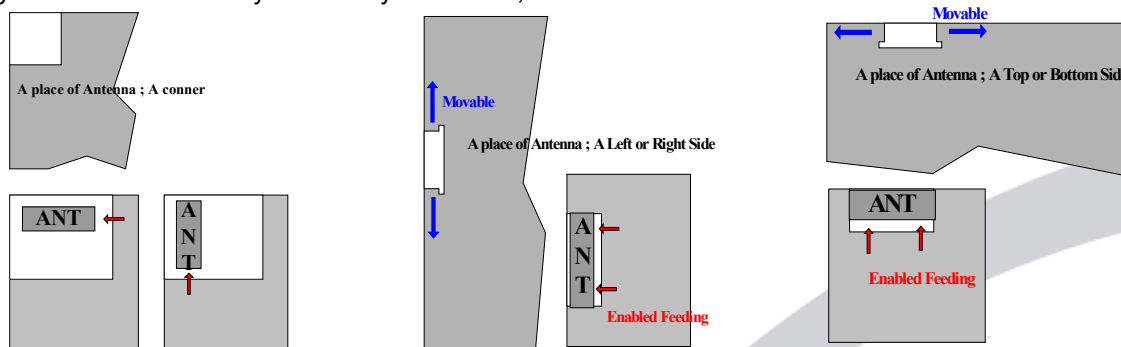
<3Land Type>

<2Land Type>

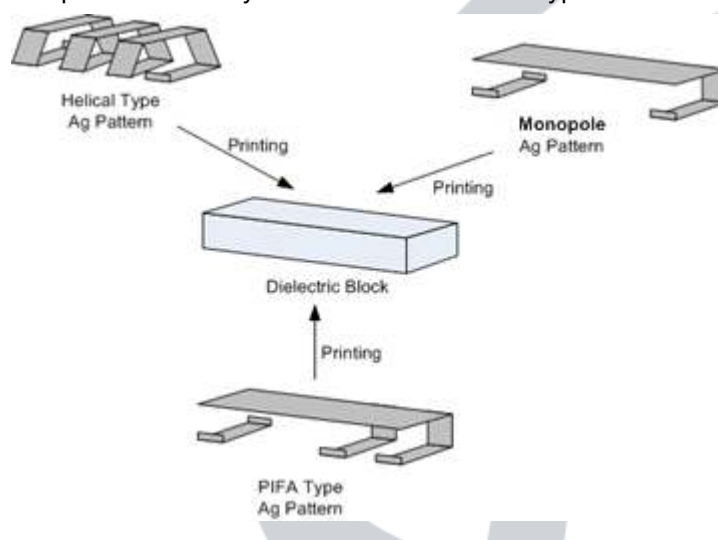
7. Basis Action / Application Note

This product is the internal dielectric chip antenna of radio communication, converts the electric signal advanced along by transmission line into free space wave.

This product will be mounted wherever you want and the design is revised by mount condition. But require attention to select the mount position, because this product is the radiation part and changed characteristics by boundary condition,

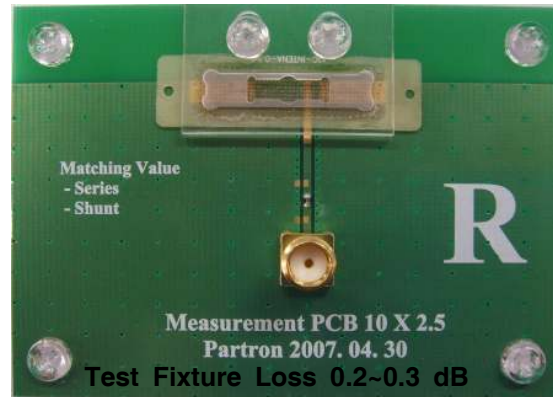


As the following, this product is easy to revise the various types for the boundary condition.



8. Measurement Jig SPEC

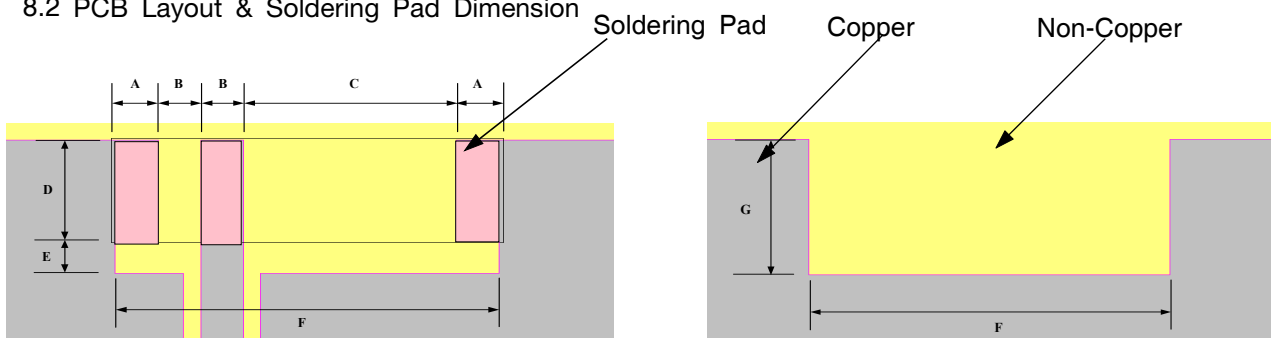
8.1 Test Fixture And Test PCB



※ Ev B'd and Test Fixture Jig is the same

(Contact way of Ev B'd is soldering, Test Fixture is copper contact way)

8.2 PCB Layout & Soldering Pad Dimension



Top Layout

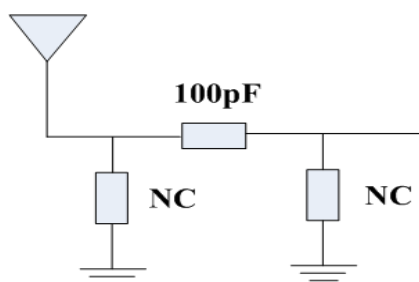
Bottom Pattern

Parameter	A	B	C	D	E	F	G
Value[mm]	1.1	1.0	6.0	2.5	1.0	10	3.5

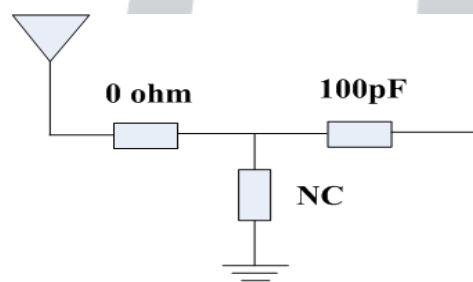
Unit ; mm

Unless specified tolerances are ± 0.05

8.3 Matching Circuit And Reference Value



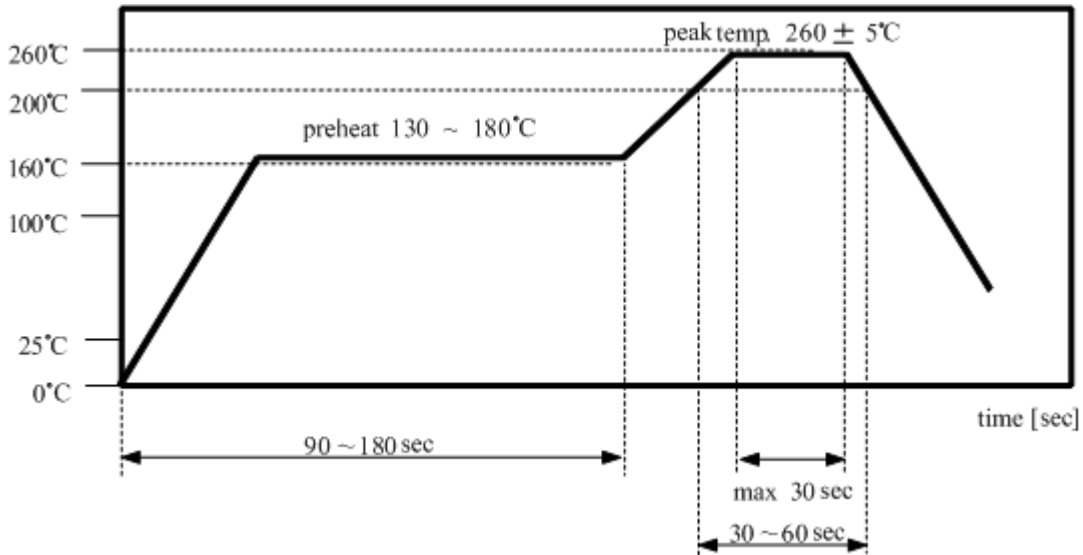
π Matching



T Matching

9. REFLOW PROFILE

9.1 Reflow Soldering



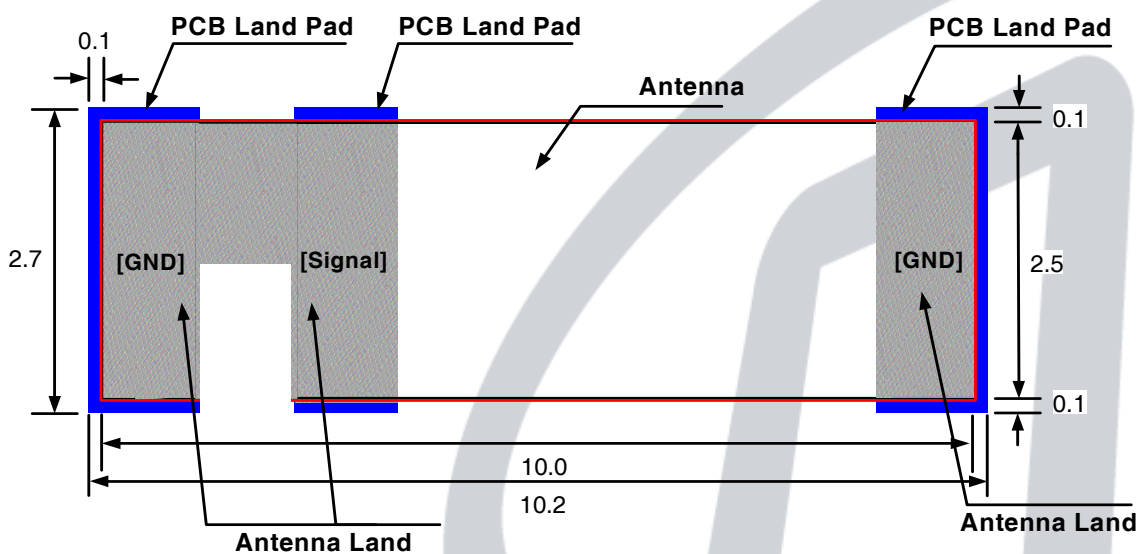
9.2 Manual Soldering

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

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

9.3 PCB Pattern Design

As the following, the PCB land pattern lays out 0.1mm outside land pattern of antenna more than indicated antenna land dimension.



10. Primary Inspection List

Item	Frequency [MHz]		Size [mm]		
Standard	SWR 2.5 Max		W = 2.5±0.1	L = 10.0±0.1	T = 1.2±0.1
	2730 MHz	2815 MHz			
1	1.46	1.55	2.52	10.01	1.22
2	1.50	1.48	2.53	10.02	1.23
3	1.51	1.48	2.53	10.03	1.23
4	1.44	1.50	2.53	10.01	1.23
5	1.43	1.57	2.52	10.01	1.22
6	1.56	1.50	2.54	10.01	1.24
7	1.55	1.50	2.52	10.02	1.22
8	1.49	1.56	2.53	10.02	1.23
9	1.53	1.52	2.52	10.02	1.21
10	1.53	1.51	2.53	10.02	1.23
11	1.55	1.54	2.53	10.03	1.23
12	1.52	1.53	2.52	10.03	1.22
13	1.55	1.50	2.54	10.02	1.24
14	1.53	1.53	2.52	10.01	1.22
15	1.60	1.57	2.53	10.01	1.23
16	1.56	1.53	2.53	10.02	1.21
17	1.59	1.53	2.52	10.03	1.22
18	1.56	1.51	2.54	10.03	1.24
19	1.60	1.47	2.52	10.01	1.22
20	1.59	1.47	2.52	10.02	1.22
Min	1.43	1.47	2.52	10.01	1.21
Max	1.60	1.57	2.54	10.03	1.24
X	0.53	0.52	2.52	10.01	1.22
σ	0.05	0.03	0.01	0.01	0.01
Cpk	6.50	10.59	3.28	3.38	2.76
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 4.4 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 4.4 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 4.4 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

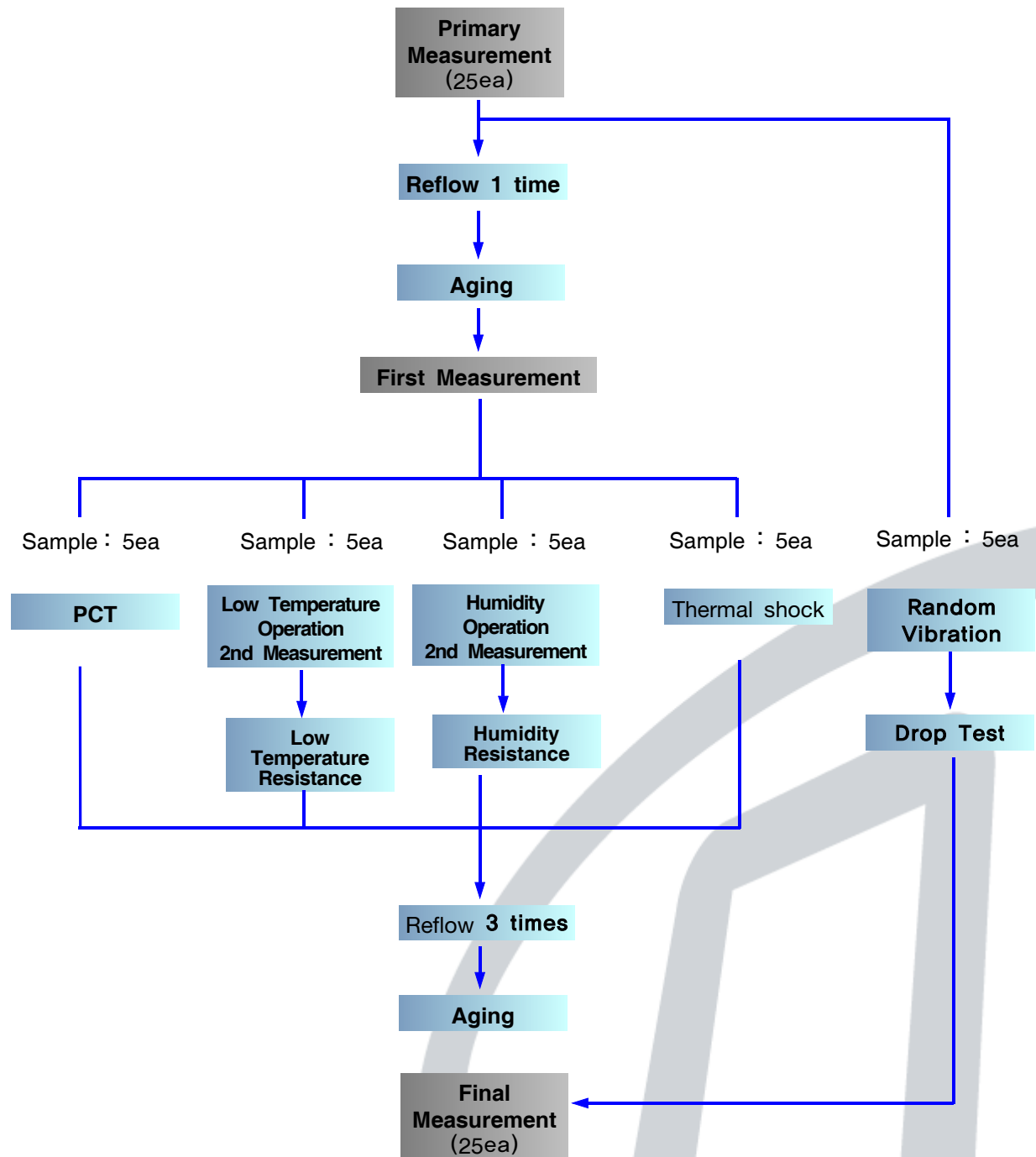
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30°C / RH 85%	168+5 / -0	= < 85°C / RH 85%

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 4.4 list

11.5 Reliability Flow

Reliability Test Flow

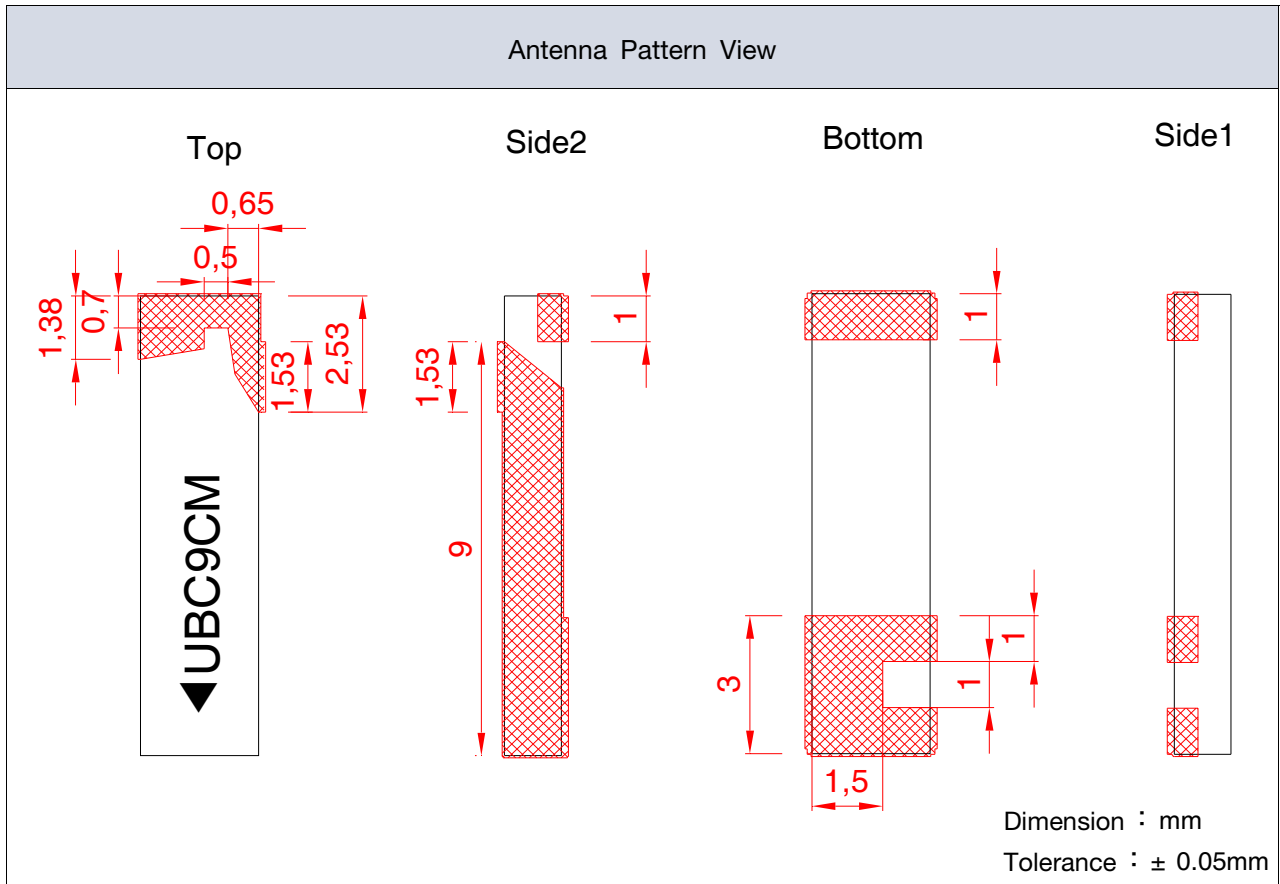


※**Aging** : at Normal Temperature, Humidity, after keeping for 1 hr

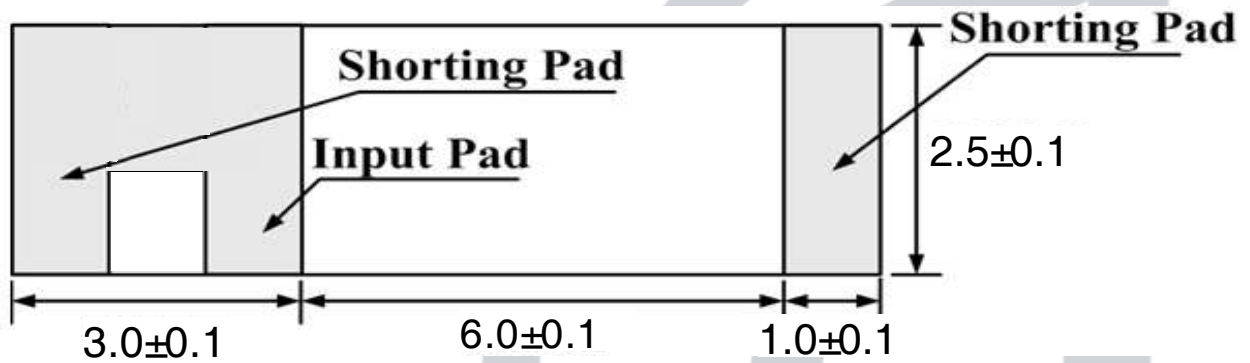
※in case of vibration and drop test, Being to mounted chip antenna on the PCB

12. Mechanical Characteristics

12.1 Antenna Pattern Dimension



12.2 Pin name



12.3 Lot number notation

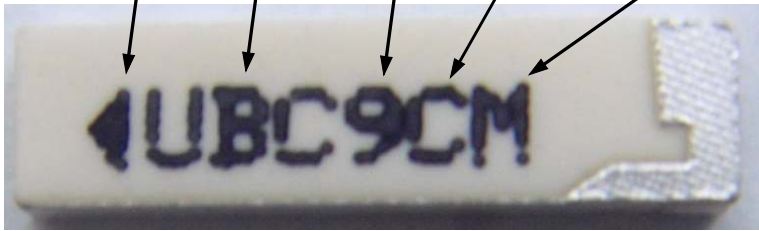
<u>9</u>	<u>C</u>	<u>M</u>
①	②	③

- ① Year : 1 - 2001, 2 - 2002 9 - 2009
 ② Month : 1 - January, 2 - February A - October, B - November, C - December
 ③ Date : 1 - 1st, 2 - 2nd K - 20th, L - 21th, M - 22th

12.4 Marking

Marking View

Input Mark Serial Year Month Date



◀	<u>U</u>	<u>B</u>	<u>C</u>	<u>9</u>	<u>C</u>	<u>M</u>
①	②	③	④	⑤		

- ① Input Signal
 ② Serial
 ③ Year : 1 - 2001, 2 - 2002 9 - 2009
 ④ Month : 1 - January, 2 - February A - October, B - November, C - December
 ⑤ Date : 1 - 1st, 2 - 2nd K - 20th, L - 21th, M - 22th

12.5 Marking type

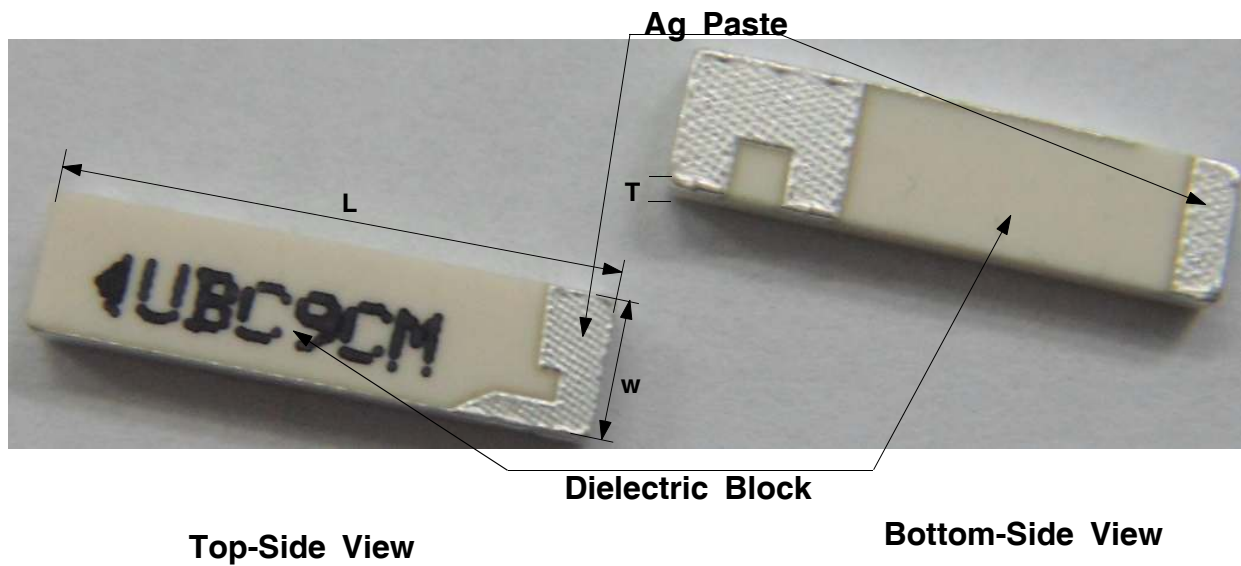
Ink marking - Using Black Ink

13. Structure and Material

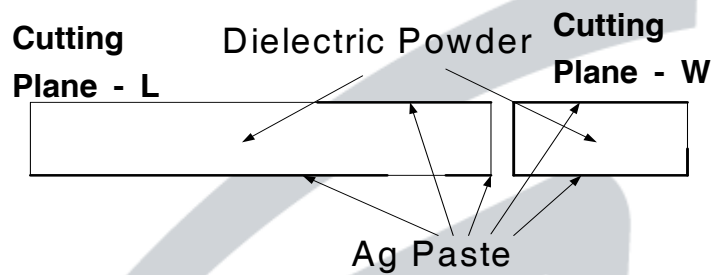
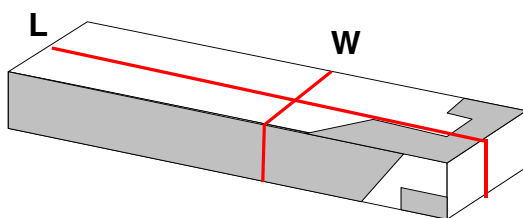
13.1 materialization method

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	Samboo	
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 ~ +85	℃
Keeping temperature	-40 ~ +85	℃

14.2 Temperature Test Condition

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

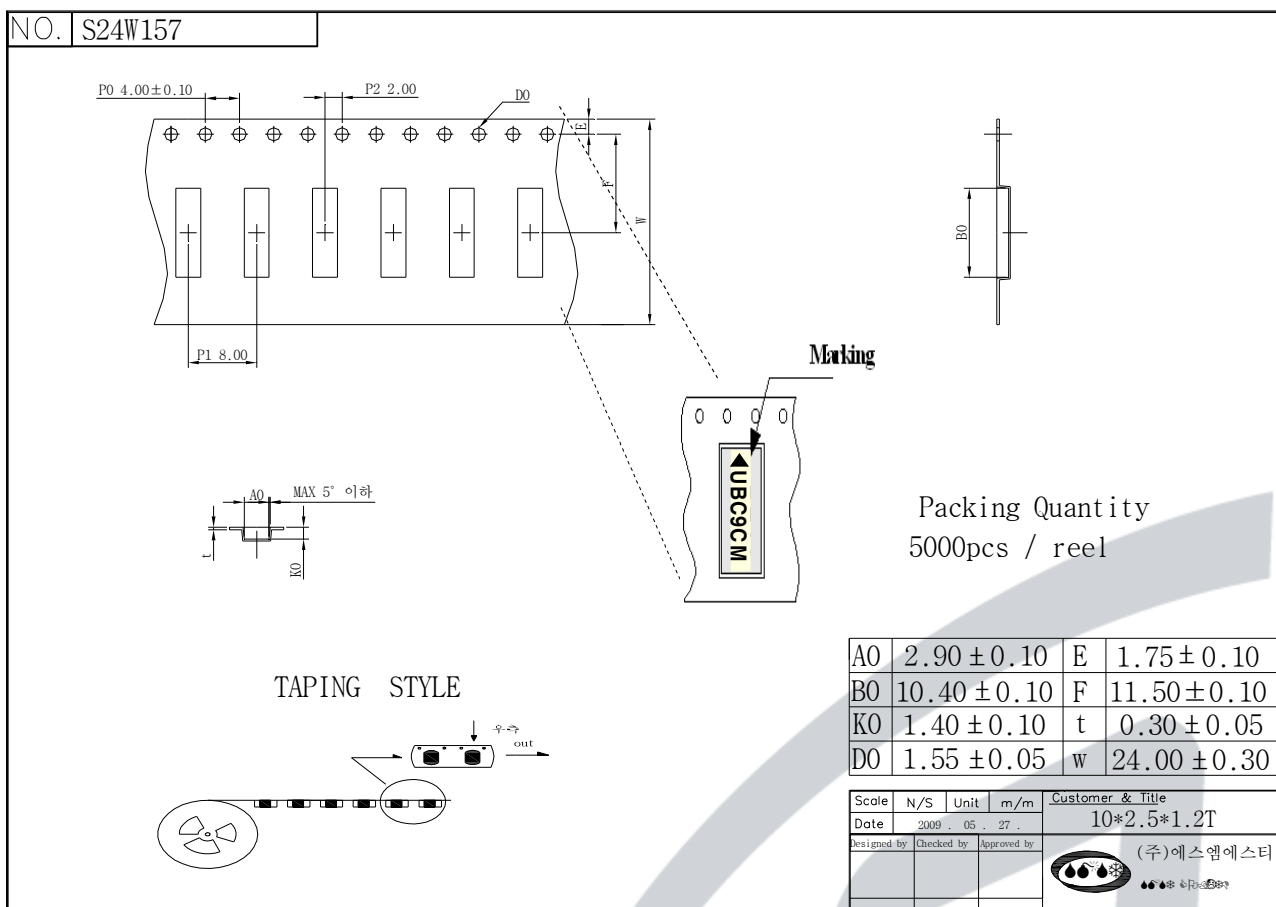
* Because of the keeping temperature problem, no admission when left over +85℃

15. Packing

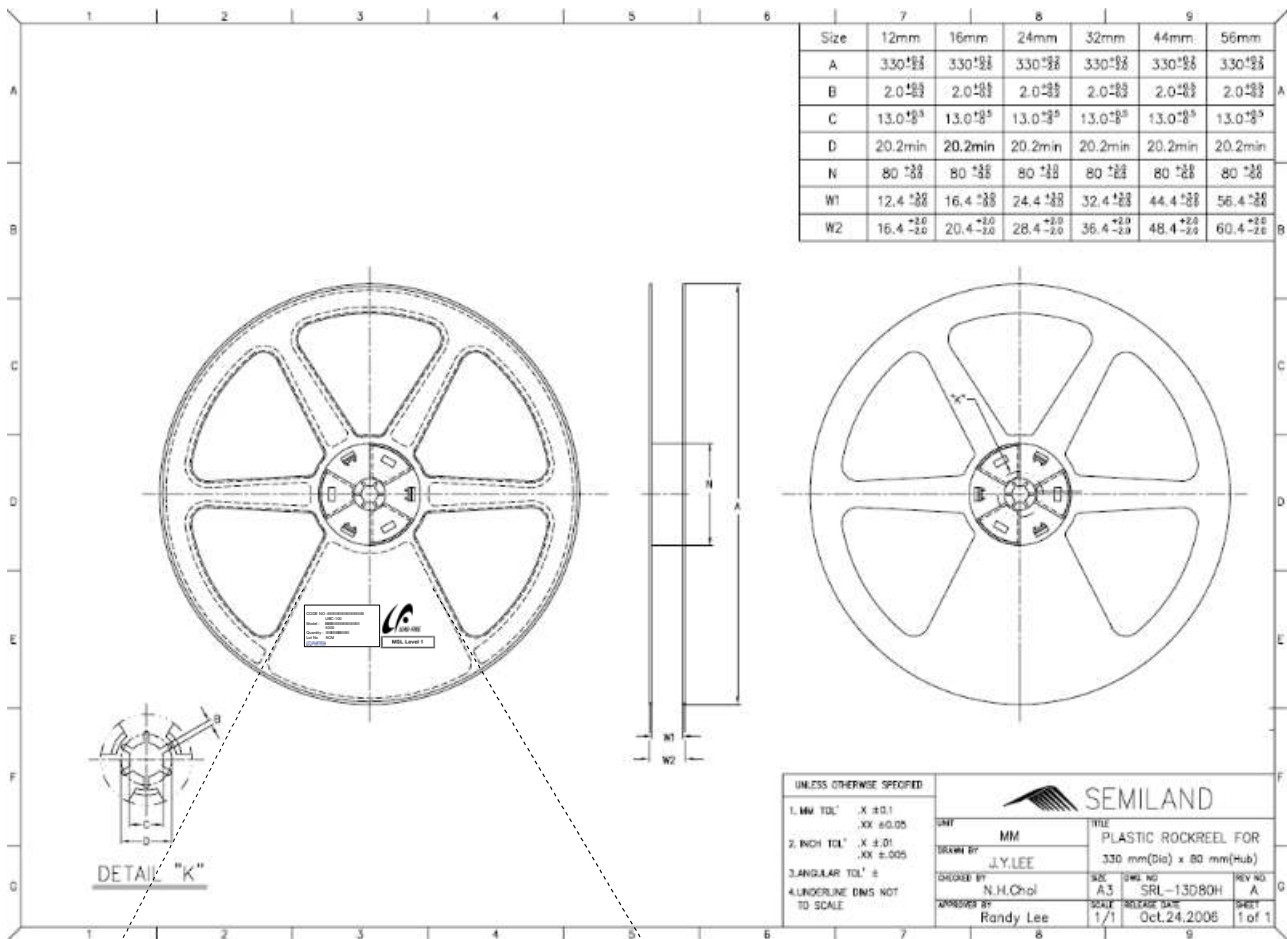
15.1 Carrier/Reel

ITEM	Material	Surface Resistance	electrostatic emission	Packing 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



14.1.2 Reel

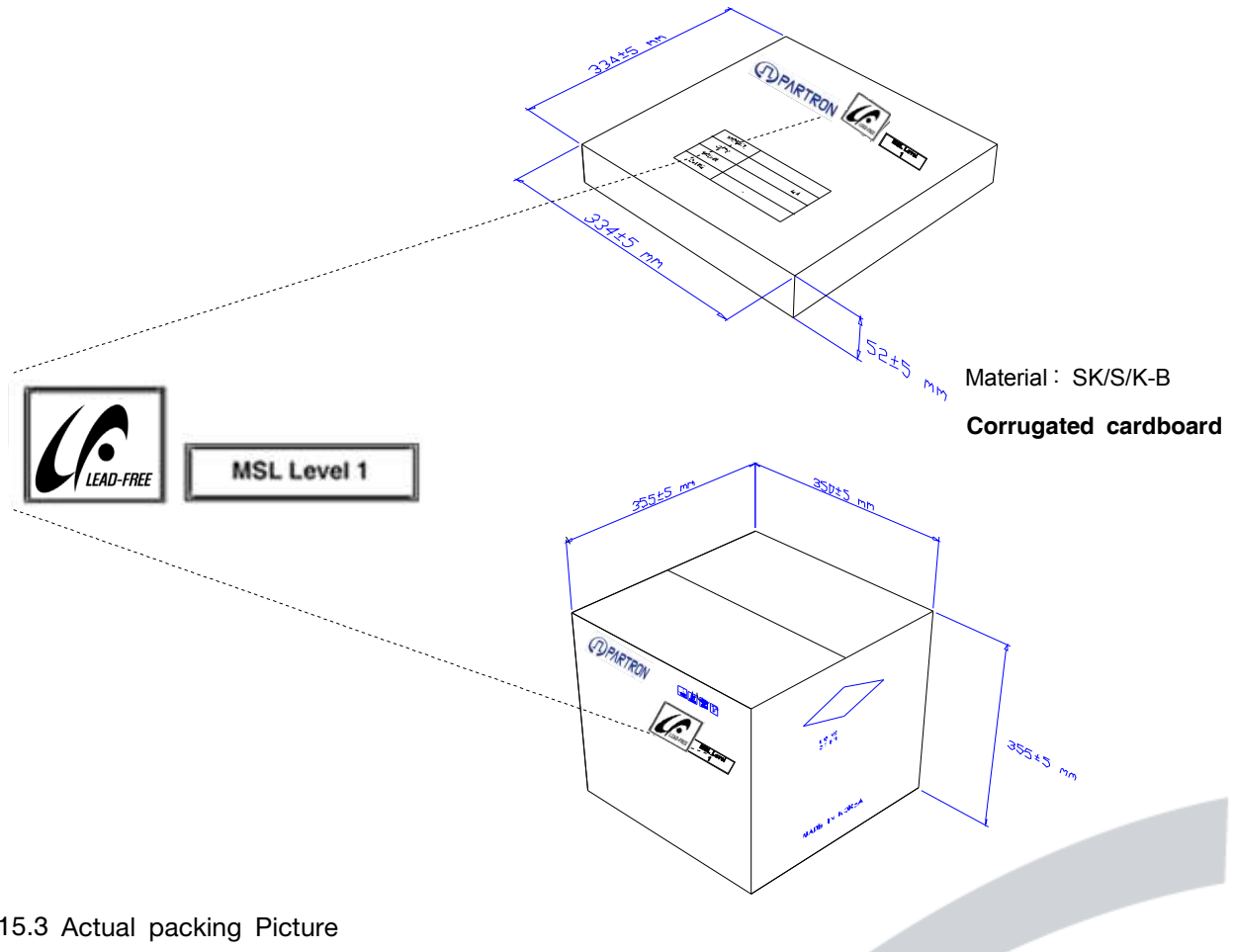


CODE NO :
UBC-100
Model :
5000
Quantity :
Lot No 9CM



MSL Level 1

15.2 Box



15.3 Actual packing Picture



Reel



Internal Box



External Box
















Reel / Internal Box label



External Box label

16. Process Control

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
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

1) Ceramic Powder

Parts Name	Powder(MMS-08)
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. : CE/2008/25164 Date : 2008/02/26 Page : 2 of 4

FUJI TITANIUM INDUSTRY CO., LTD.
12-8, SENGUN-CHO, HIRATSUKA-CITY, KANAGAWA-PREF. JAPAN

Test results by chemical method (Unit: mg/kg)

Test Item (s):	Method (Refer to)	Result	MDL
		No.1	
Cadmium (Cd)	(1)	n.d.	2
Lead (Pb)	(2)	n.d.	2
Mercury (Hg)	(3)	n.d.	2
Hexavalent Chromium Cr(VI) by alkaline extraction	(4)	n.d.	2

TEST PART DESCRIPTION:
NO. 1 WHITE POWDER

Note : 1. mg/kg = ppm; 0.1wt% = 1000ppm
2. n.d. = Not Detected
3. MDL = Method Detection Limit

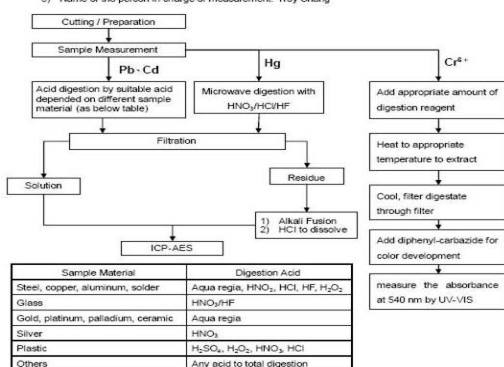
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Test Report No. : CE/2009/25164 Date : 2009/03/25 Page : 4 of 4

Test Report No.: CE/2009/25164 Date: 2009/02/26

FUJI TITANIUM INDUSTRY CO., LTD.
12-8 SENGUNOCHO HIRATSUKA-CITY KANAGAWA-PREF. JAPAN

-
- CE / 2009 / 25164
- GRAN. SCS-0010
- KIT. 6.30a





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 Tel: 3429 3333 電話: 3429 3333 Fax: 3429 3333 傳真: 3429 3333 Email: info@csb.com.hk 電郵: info@csb.com.hk

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

		Issued Date: October 13, 2009		Page 1 of 3	
Test Report No. re209015L/F-CTSAYA09-27959					
To: METECH KOREA CO., LTD. B-401 Dongyang Paragon office1 17-2 Jeongja-dong Bundang-gu Sungnam-city GYEONGGI-DO Korea					
The following merchandise was submitted and identified by the client as :					
Product Name		: Silver Paste			
SGS File No.		: AYA09-27959			
Received Date		: October 08, 2009			
Test Performing Date		: October 09, 2009			
Test Performed		: SGS Testing Korea tested the sample(s) selected by applicant with following results			
Test Results		: For further details, please refer to following page(s)			
<div style="text-align: right;"> SGS Testing Korea Co., Ltd.  Jeff Jang / Chemical Lab Manager </div>					

SGS

Test Report No. F0550167L-CSAYAA09-Z7509

Issued Date: October 13, 2009

Page 2 of 3

Sample No.: AYADA0-2759-001

Sample Description: Silver Paste

Item No./Part No.: POC11-2008

Comments: Material is silver.

Heavy Metals

Lead Item	Unit	Test Method	MCL	Results
Cadmium (Cd)	µg/g	With reference to IEC 62321-2008, ICP	0.5	N.D.
Copper (Cu)	µg/g	With reference to IEC 62321-2008, ICP	5	N.D.
Mercury (Hg)	µg/g	With reference to IEC 62321-2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	µg/g	With reference to IEC 62321-2008, UV-VIS	1	N.D.

Flame Retardance PbDn/PbCl

Test Items	Unit	Test Method	MCL	Results
Monomethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Dimethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Tetramethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Pentamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Hexamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Octadecylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Nonamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Decamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Monomethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Dimethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Tetramethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Pentamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Hexamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Octadecylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Nonamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.
Decamethylphenyl ether	µg/g	With reference to IEC 62321-2008, D-CMS	5	N.D.

NOTE: (1) N.D. = Not detected (<MOL)

(2) µg/L = ppm

(3) MCL = 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 1.0 mg/L with 10 mL sample surface area



Test Report No. F696901/LF-CTS/AA09-27959

Issued Date: October 13, 2009 **Page 3 of 3**

Sample No. : AYAA09-27959.001

Sample Description : Silver Plate


Item No./Part No. : PCC11836HV

Comments : Material is silver.

Relevant Standards

Test Item	Unit	Test Method	MCL	Results
Bismuth (Bi)	mg/kg	With reference to ASTM D 7359-05 , IC	30	N.D.
Cadmium (Cd)	mg/kg	With reference to ASTM D 7359-05 , IC	30	N.D.

Picture of Sample as Received:



*** End ***

NOTE:

- (1) N.D. = Not detected (<MCL)
- (2) mg/kg = ppm
- (3) MCL = Method Detection Limit
- (4) - = No regulation
- (5) - = Qualitative analysis (No Unit)
- (6) = Boiling-water-extraction

Negative = Absence of Cr(VI) coating
 Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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F02010001

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 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1018, 1020, 1022, 1024, 1026, 1028, 1030, 1032, 1034, 1036, 1038, 1040, 1042, 1044, 1046, 1048, 1050, 1052, 1054, 1056, 1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072, 1074, 1076, 1078, 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1138, 1140, 1142, 1144, 1146, 1148, 1150, 1152, 1154, 1156, 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 120

3) Marking Ink

Parts Name	Black Ink
Tester Organization	Intertek 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

Report No. RT09R-S4289-003-E
Sample ID No. : RT09R-S4289-003
Sample Description : 5135E BLACK ink

Applicant : Markem-Inkjet Co., Ltd.
Address : #41301, Daeryung Technopolis 7th, 489-11, Gaeon-dong, Gyeongsang-gi, Seoul, Korea

Page: 1 of 5
Date: Sep. 29, 2009


Sample Description : The following colorized sample(s) used to be:-


Name/Type of Product : 5135E BLACK ink
Sample ID No. : RT09R-S4289-003
Manufacturer/Vender : Markem-Inkjet Co., Ltd.

Sample received : Sep. 24, 2009
Testing Date : Sep. 24, 2009 ~ Sep. 29, 2009
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (24 ± 2) °C, Humidity : (60 ± 5) % R.H.

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: 
Jade Jeng / Lab. Technical Manager

Authorized by: 
Bo Park / Lab. General Manager

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Seoul Lab. #700-70, Anhe Techno Tower 5, 197-22, Guro-2dong, Guro-Gu, Seoul 052-764-0000 Tel: 02-209-1250 Fax: 02-209-1251
Ulsan Lab. #340-2, Yongsan-Ri, Changgyeong-Myeon, Ulsan-Gu, Ulsan 689-885 Korea Tel: 052-257-4754 Fax: 052-256-4792

Intertek

TEST REPORT

Report No. RT09R-S4289-003-E
Sample ID No. : RT09R-S4289-003
Sample Description : 5135E BLACK ink

Page: 2 of 5
Date: Sep. 29, 2009

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	ppm	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	ppm	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	ppm	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr ^{VI})	ppm	With reference to US EPA 3060A and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)	ppm			
Monobromobiphenyl	ppm	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Dibromobiphenyl	ppm		5	N.D.
Tribromobiphenyl	ppm		5	N.D.
Tetrabromobiphenyl	ppm		5	N.D.
Pentabromobiphenyl	ppm		5	N.D.
Hexabromobiphenyl	ppm		5	N.D.
Heptabromobiphenyl	ppm		5	N.D.
Octabromobiphenyl	ppm		5	N.D.
Nonabromobiphenyl	ppm		5	N.D.
Decabromobiphenyl	ppm		5	N.D.
Polybrominated Diphenyl Ether (PBDEs)	ppm			
Monobromodiphenyl ether	ppm	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Dibromodiphenyl ether	ppm		5	N.D.
Tribromodiphenyl ether	ppm		5	N.D.
Tetrabromodiphenyl ether	ppm		5	N.D.
Pentabromodiphenyl ether	ppm		5	N.D.
Hexabromodiphenyl ether	ppm		5	N.D.
Heptabromodiphenyl ether	ppm		5	N.D.
Octabromodiphenyl ether	ppm		5	N.D.
Nonabromodiphenyl ether	ppm		5	N.D.
Decabromodiphenyl ether	ppm		5	N.D.

Notes : 1. ppb = parts per billion
2. ppm = parts per million
N.D. = Not detected (<MDL)
MDL = Method detection limit

Tested by : Nihale Lee, Peter Kim, Ellen Kang, Jessica Kang

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Seoul Lab. #700-70, Anhe Techno Tower 5, 197-22, Guro-2dong, Guro-Gu, Seoul 052-764-0000 Tel: 02-209-1250 Fax: 02-209-1251
Ulsan Lab. #340-2, Yongsan-Ri, Changgyeong-Myeon, Ulsan-Gu, Ulsan 689-885 Korea Tel: 052-257-4754 Fax: 052-256-4792

Intertek

TEST REPORT

Report No. RT09R-S4289-003-E
Sample ID No. : RT09R-S4289-003
Sample Description : 5135E BLACK ink

Page: 3 of 5
Date: Sep. 29, 2009

Test Items	Unit	Test Method	MDL	Results
Bromine (Br)	ppm	With reference to EPA 1631, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	ppm	With reference to EPA 1631, by oxygen combustion with bomb and determined by IC	30	N.D.

Tested by : Nihale Lee

Notes : 1. ppb = parts per billion
2. ppm = parts per million
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received:



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TEST REPORT

Report No. RT09R-S4289-003-E
Sample ID No. : RT09R-S4289-003
Sample Description : 5135E BLACK ink

Page: 4 of 5
Date: Sep. 29, 2009

Flow Chart
(EPA 3052 for Cd, Pb, Hg / EPA 3060A for Cr^{VI} / EPA 3540C for PBBs/PBDEs)

```

graph TD
    Start([Start]) --> SamplePrep[Sample preparation]
    SamplePrep --> SampleMeas[Sample measurement]
    SampleMeas --> CdPbHg[Pb, Cd, Hg]
    SampleMeas --> CrVI[CrVI]
    SampleMeas --> PBBsPBDEs[PBBs/PBDEs]
    CdPbHg --> MicroA[Microwave digestion with HNO3 / H2O2 / HF]
    CrVI --> AddReagent[Add Reagent solution (H2O2/HNO3/H2SO4/H2PO4/H2O2) / H2O2]
    PBBsPBDEs --> SolventEx[Solvent extraction with Toluene more than 12 hrs]
    MicroA --> Heating[Heating at 120°C and stirring for 60 minutes]
    AddReagent --> Heating
    SolventEx --> Concentration[Concentration]
    Heating --> TotalAlig[Total digestion]
    Concentration --> TotalAlig
    TotalAlig --> Digestion[Digestion]
    Digestion --> ICP_OES[Analysed by ICP-OES]
    Digestion --> GCMS[Analysed by GC/MS]
    Digestion --> Titration[Titration]
    Digestion --> DUO[DUO]
    ICP_OES --> Data[Data]
    GCMS --> Data
    Titration --> Data
    DUO --> Data
    Data --> Report([Report])
  
```

* Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart.

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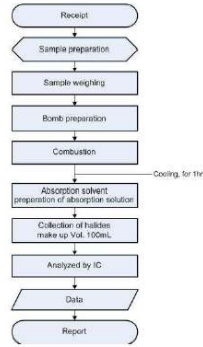
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TEST REPORT

Report No. RT09R-G289-003-E Page: 5 of 5
 Sample ID No. : RT09R-G289-003 Date Sep. 29, 2009
 Sample Description : 5135E BLACK ink

Flow Chart (Halogen)



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

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