

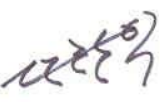

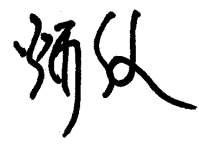


APPENDIX J

: ANTENNA SPECIFICATION


MSL Level 1
ROHS-Y

Approval Sheet

Products	Dielectric Chip Antenna		
Customer	CLIPCOM		
Model	BS-H100		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450KCAH10		
CLIPCOM	By designed	By checked	By approved
PARTRON	By designed	By checked	By approved
			
	Research 5 Team	Quality Assurance	Laboratory
	Chanik.Jeon	Kwang-Gyu.Lee	Byoung-Jun.Yim
	07/31	07/31	07/31

2008. 07. 31


22-6 Seokwoo-dong, Hwaseong-si, Gyeonggi-do, Korea 455-300

Tel : 82-31-201-7870~6

Fax : 82-31-201-7800

www.partron.co.kr



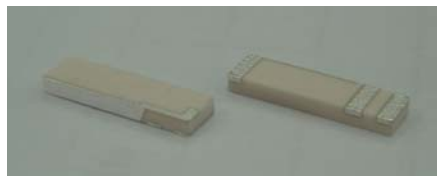
MSL Level 1

ROHS-Y

SPECIFICATION

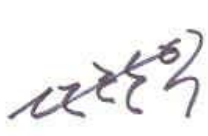

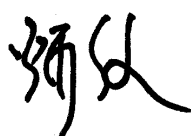
MODEL : ACS2450KCAH10

3D Structure



Top View

Bottom View

By designed	By checked	By approved
		
Research 5 Team	Quality Assurance	Laboratory
Chanik.Jeon	Kwang-Gyu.Lee	Byoung-Jun.Yim
07/31	07/31	07/31

2008. 07. 31

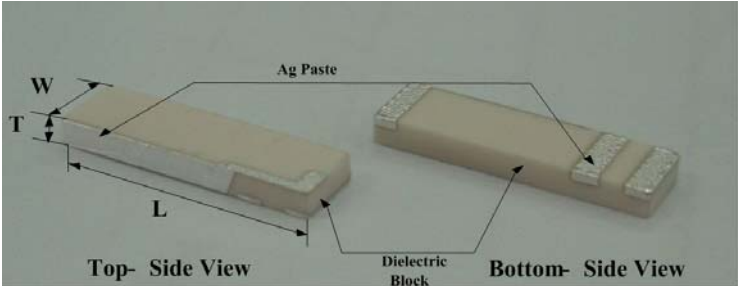
- Contents -

1. Revision History	1 p
2. Summary of Parts	2 p
3. Critical to Quality	2 p
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5. Measurement Process	8 p
6. Internal Block Diagram	10 p
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[illegible]

2. 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

Type	Only Bulk Ceramic	
Material	Dielectric Block	Mg ₂ SiO ₄ (Magnesium Silicate)
	Electrode Paste	Ag
Size[mm]	W = 3.0±0.1	
	L = 11.0±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	

3. Critical to Quality (CTQ)

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

CTQ ITEM	Specification Reason
Shape weight, size	Shape weight and size determines the electric block size after plastic and the dielectric block size effects the level of detail for the printing.
Plastic Size	The size after plastic effects the level of detail for the printing.
Printing Size	The level of detail for printing size is an essential list of the BT antenna.

CTF ITEM 	Specification Reason
Single Element measurement SWR	An important Parameter classifying the electrical characteristics.

- require attention for the following list.

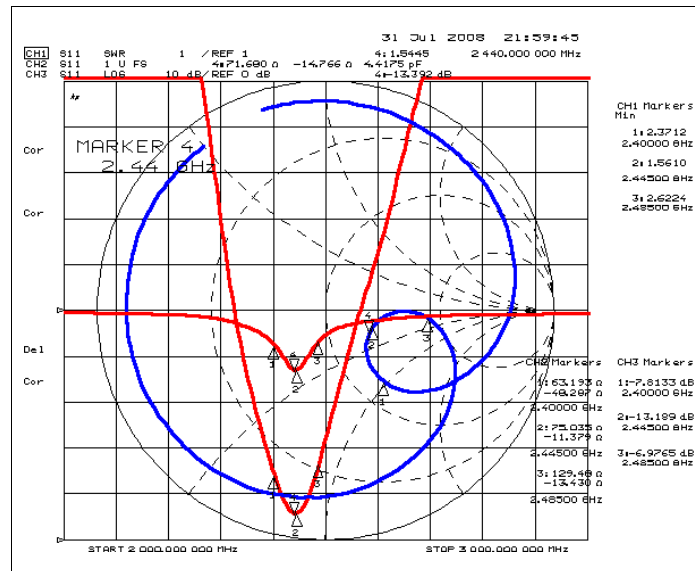
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

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]			0.1 / -4.9
	Azimuth	Theta	Peak	0.18
			Average	-4.86
		Phi	Peak	3.32
			Average	-3.17
	Elevation 1	Theta	Peak	-0.92
			Average	-3.50
		Phi	Peak	-5.13
			Average	-12.54
	Elevation 2	Theta	Peak	-9.22
			Average	-14.29
		Phi	Peak	2.47
			Average	-2.43

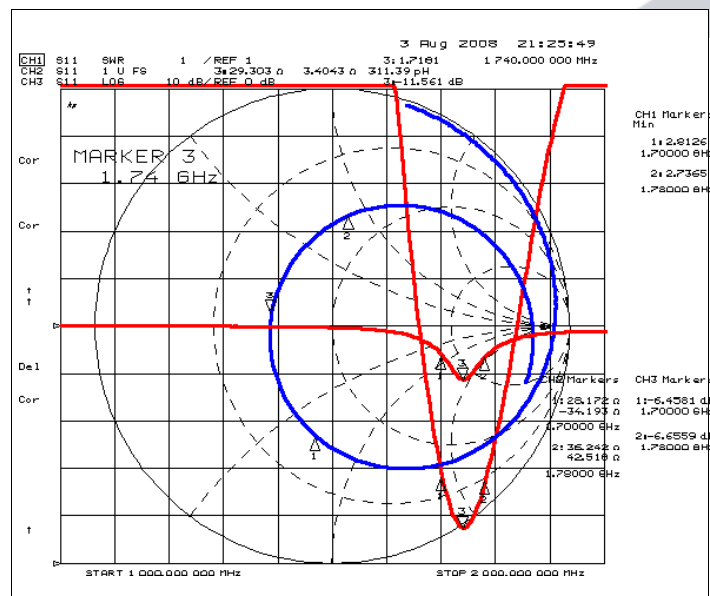
4.2 S11 Graph of Set Condition



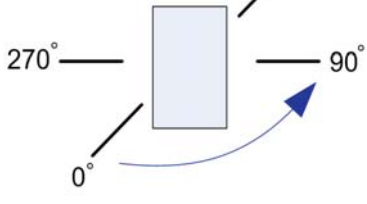
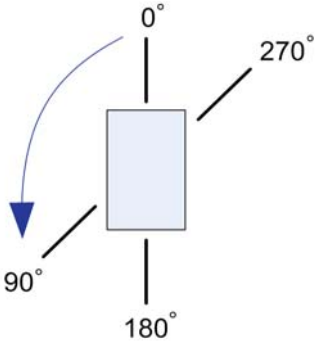
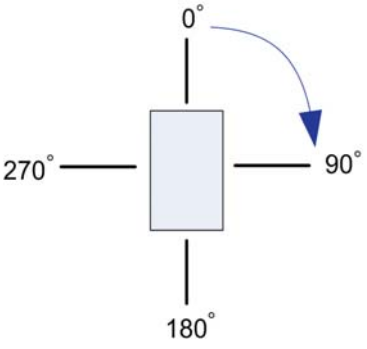
4.3 Test Fixture Condition

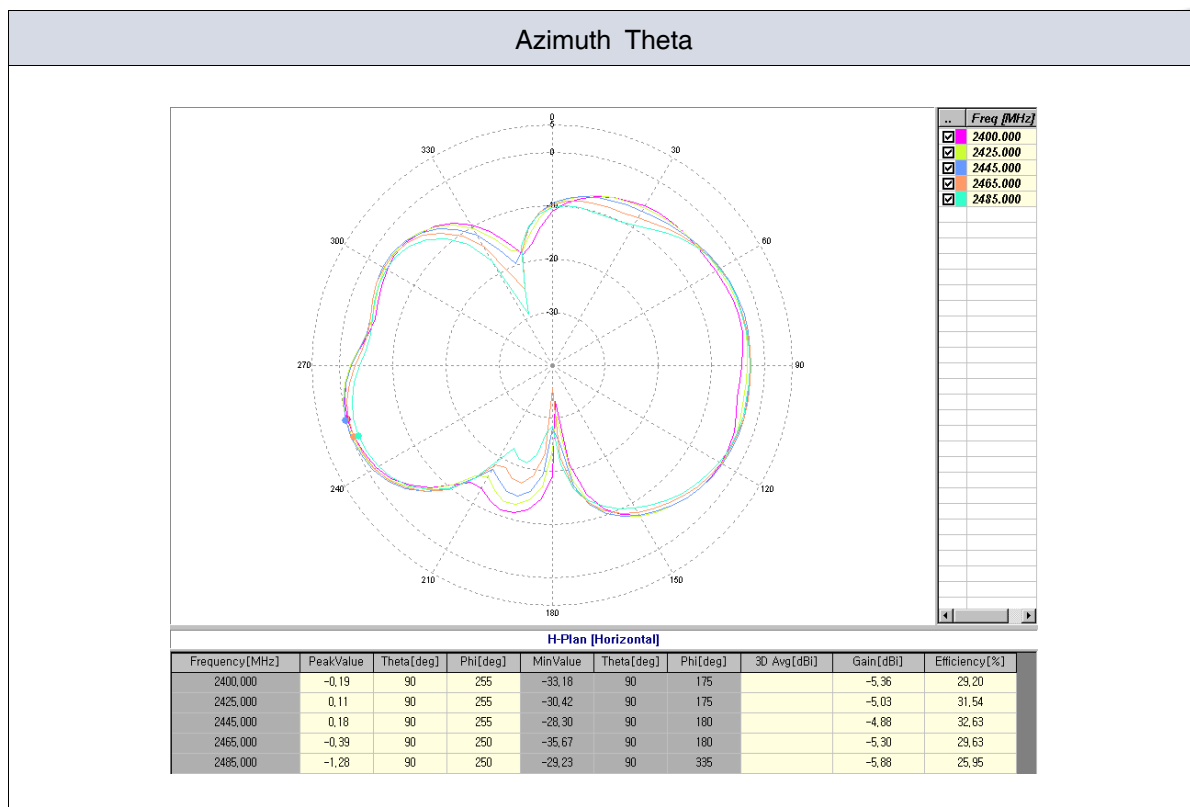
ITEM	SPEC
Frequency Range [MHz]	1700 ~ 1780
Lower frequency(1700MHz) SWR [Min~Max]	1~4.0 : 1[typ3.2 : 1]
Upper frequency(1780MHz) SWR [Min~Max]	1~4.0 : 1[typ3.2 : 1]

4.4 S11 Graph of Test Fixture Condition CTQ

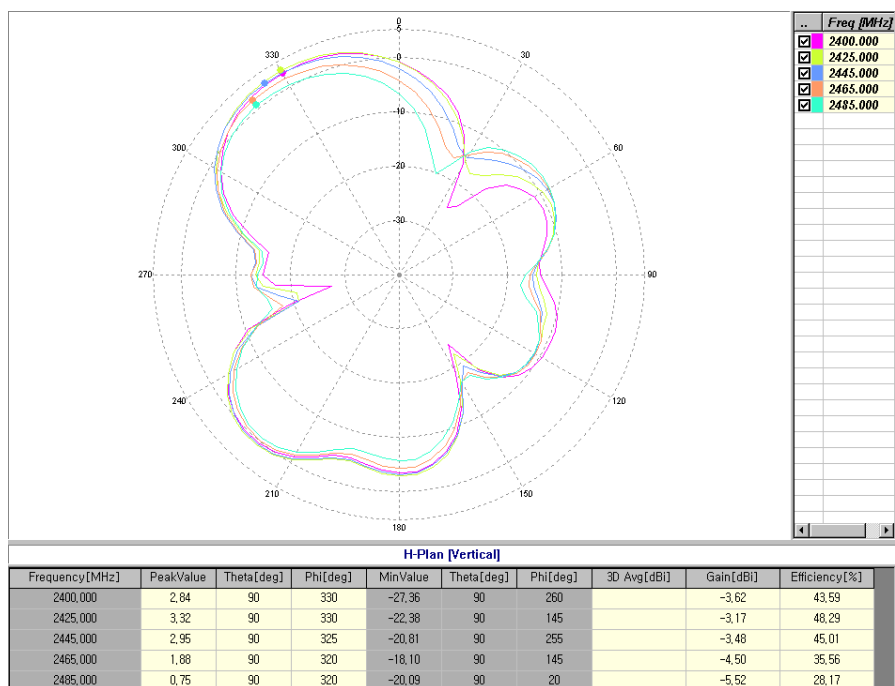


4.5 Radiation Pattern

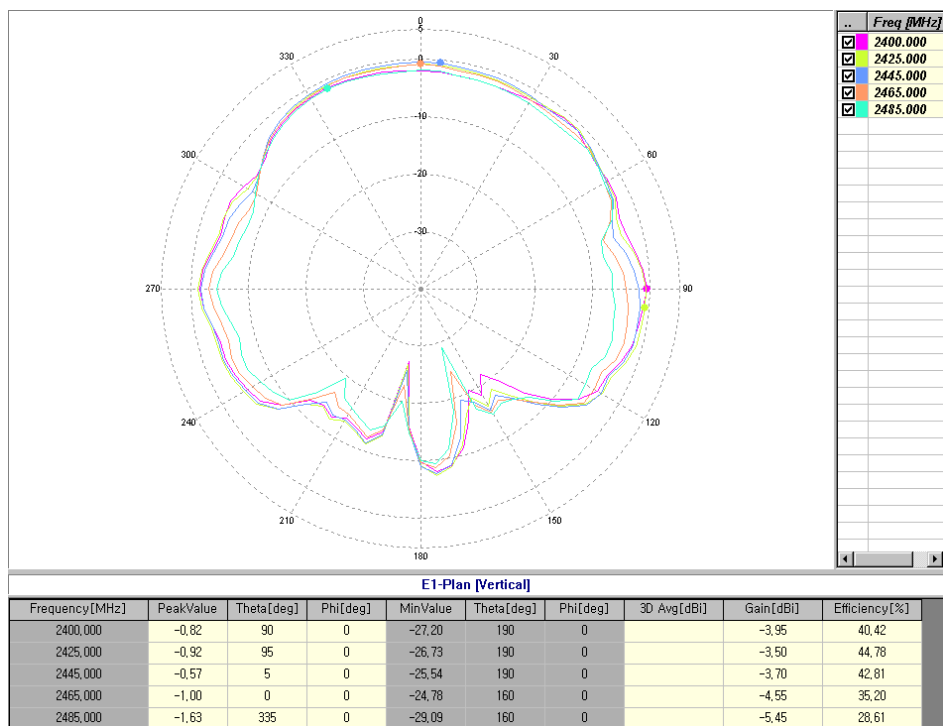
Azimuth Plane	Elevation1 Plane	Elevation2 Plane
		
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	



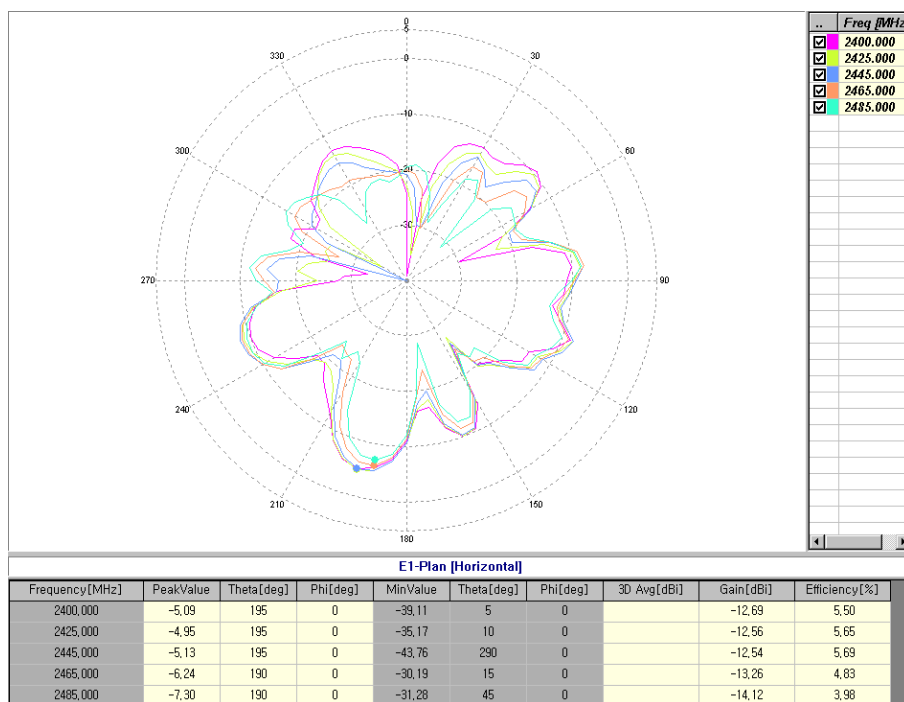
Azimuth Phi



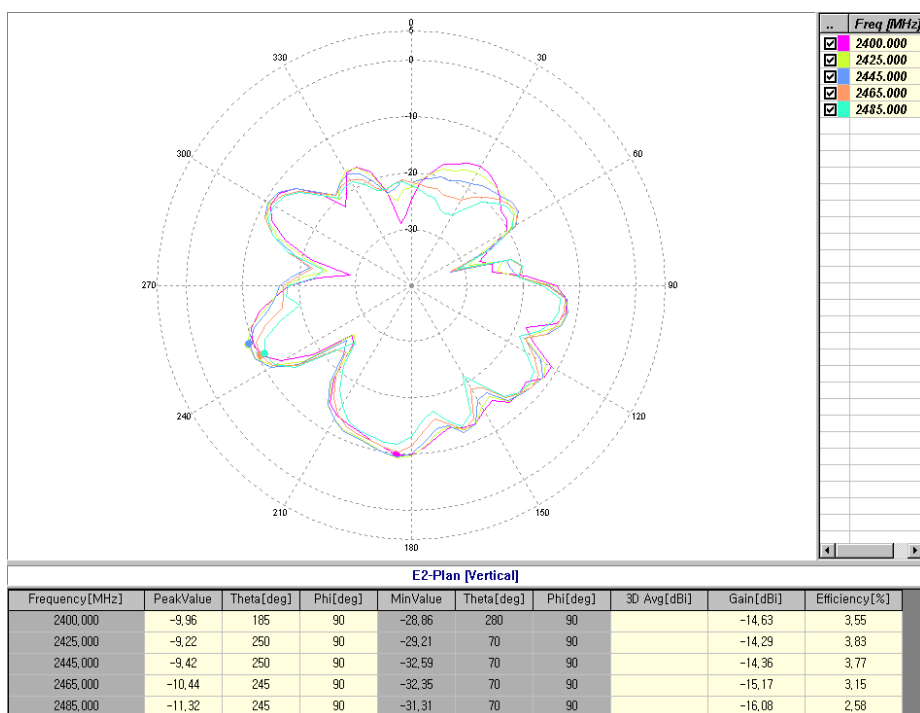
Elevation1 Theta

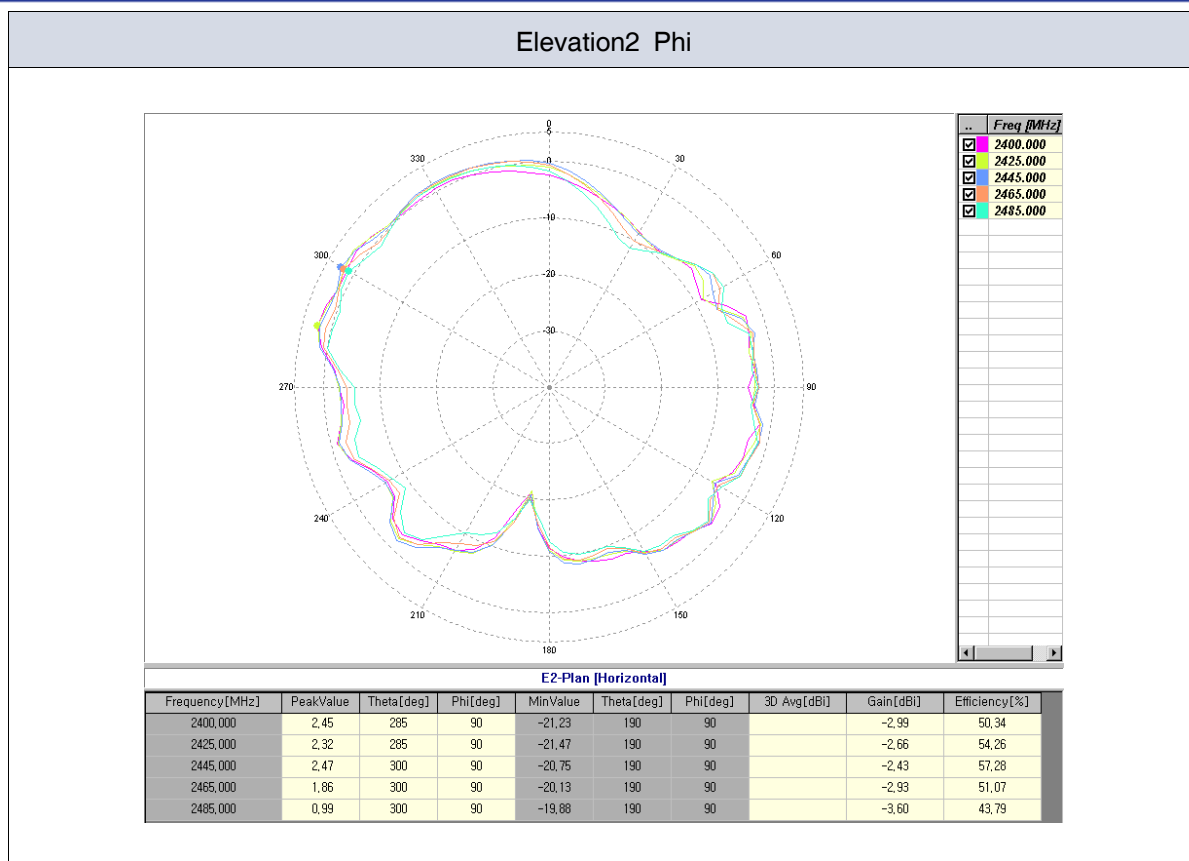


Elevation1 Phi



Elevation2 Theta

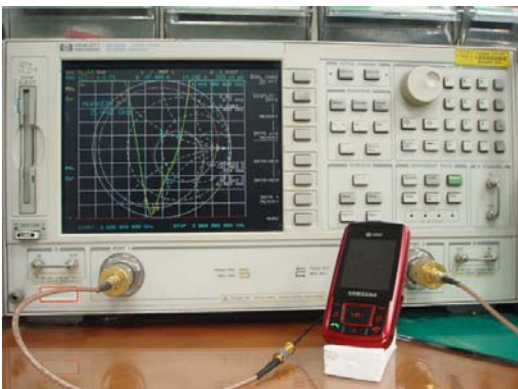
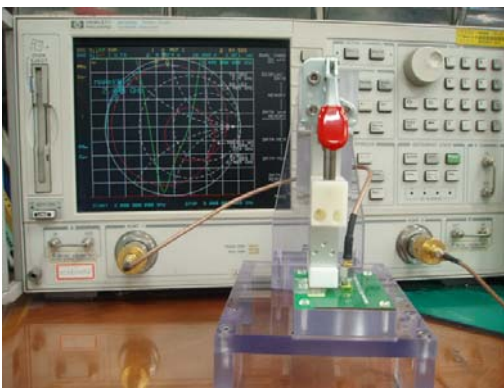




5. Measurement Process

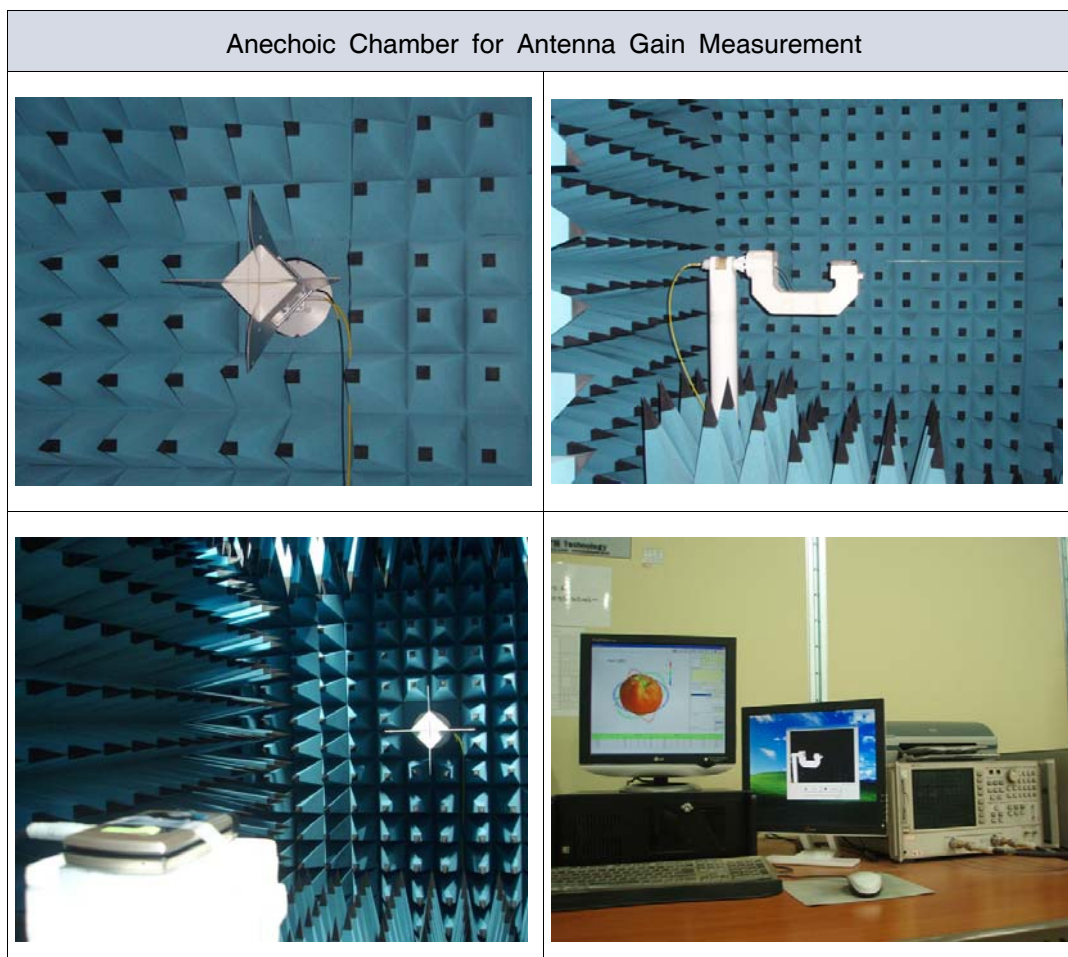
5.1 SWR/Return loss

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

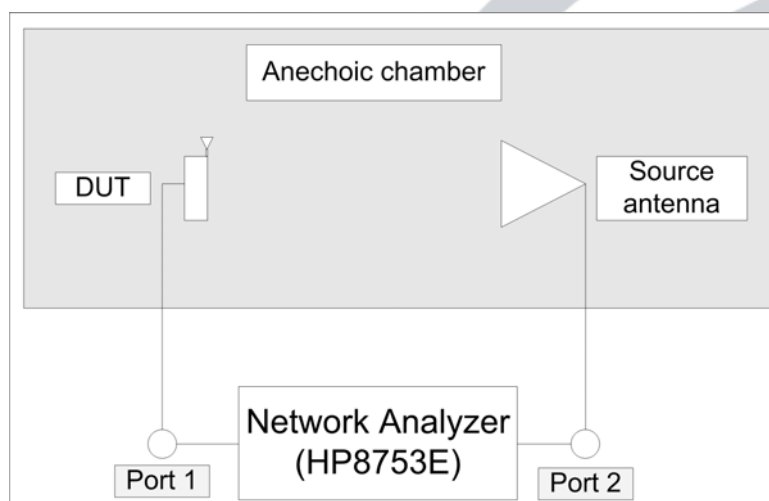
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

5.2 Gain

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

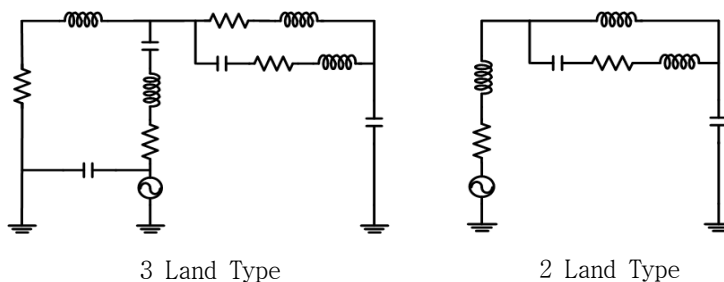


5.3 Gain test block diagram



6. Internal Block Diagram

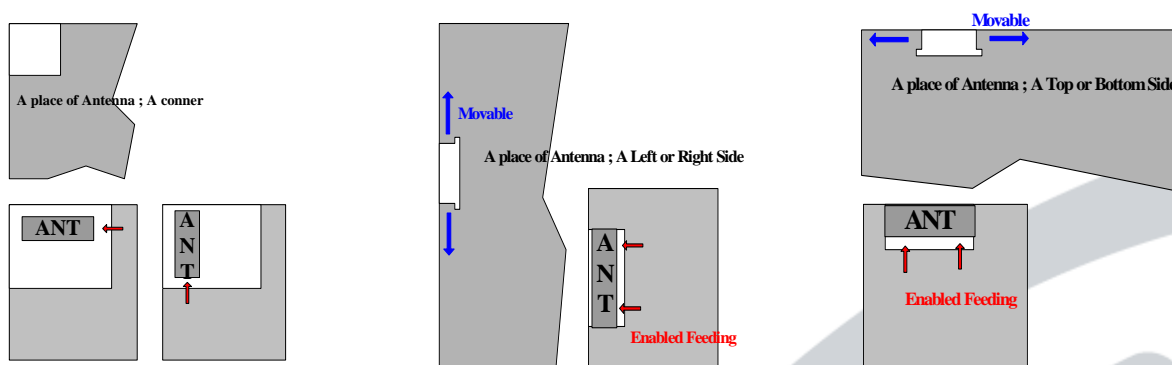
This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



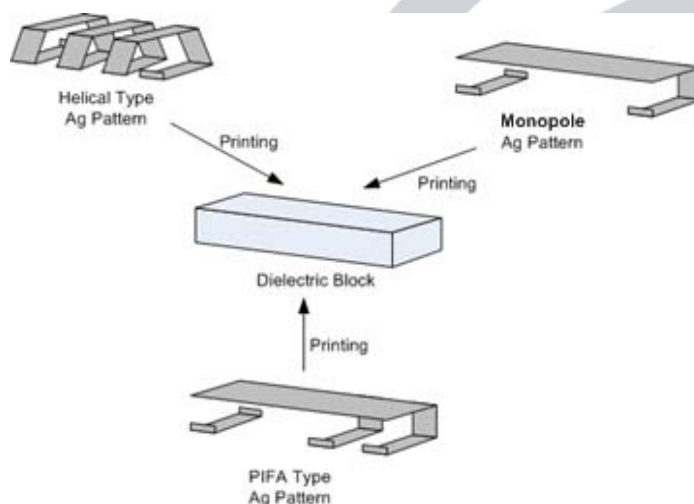
7. Basis Action / Application Note

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,

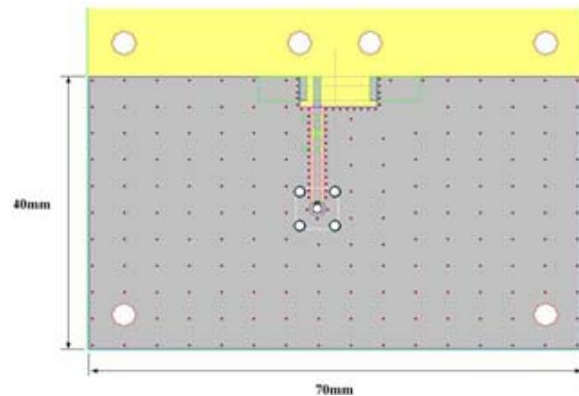


As the following, this product is easy to revise the various types for the boundary condition.



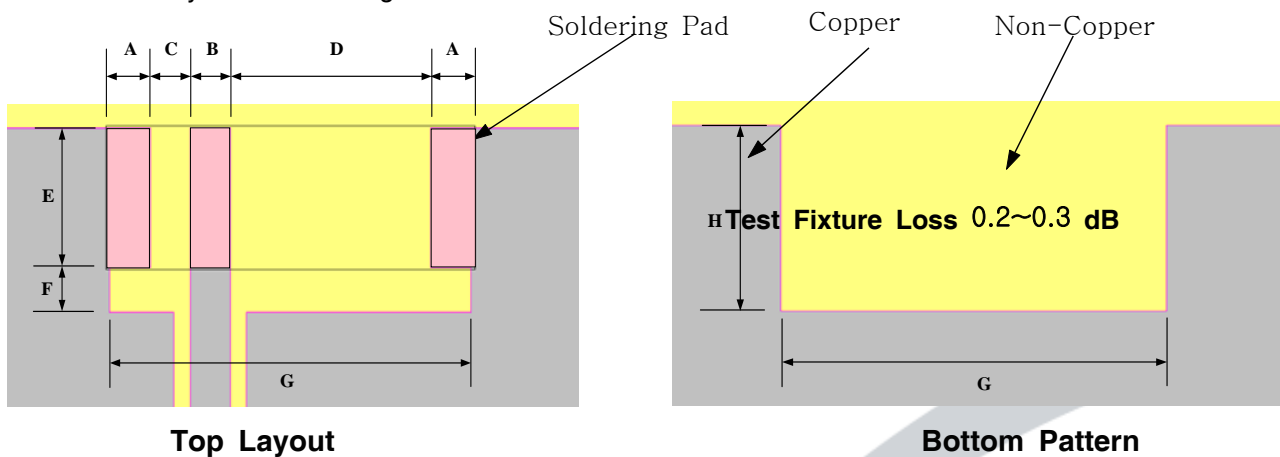
8. Measurement Jig SPEC

8.1 Test Fixture And GROUND Condit



※EvB'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

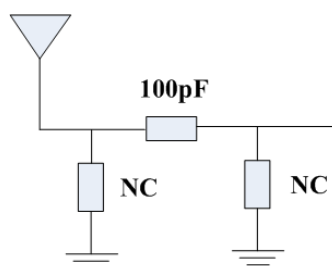
Bottom Pattern

Parameter	A	B	C	D	E	F	G	Parameter
Value[mm]	1.1	1.0	7.0	3.2	1.0	11.2	4.2	Value[mm]

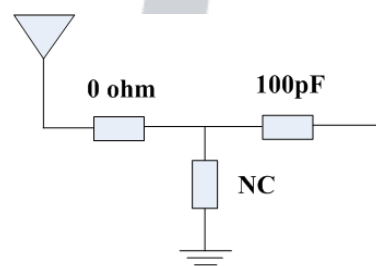
Unit ; mm

Unless specified tolerances are ± 0.1

8.3 Matching Circuit And Reference Value



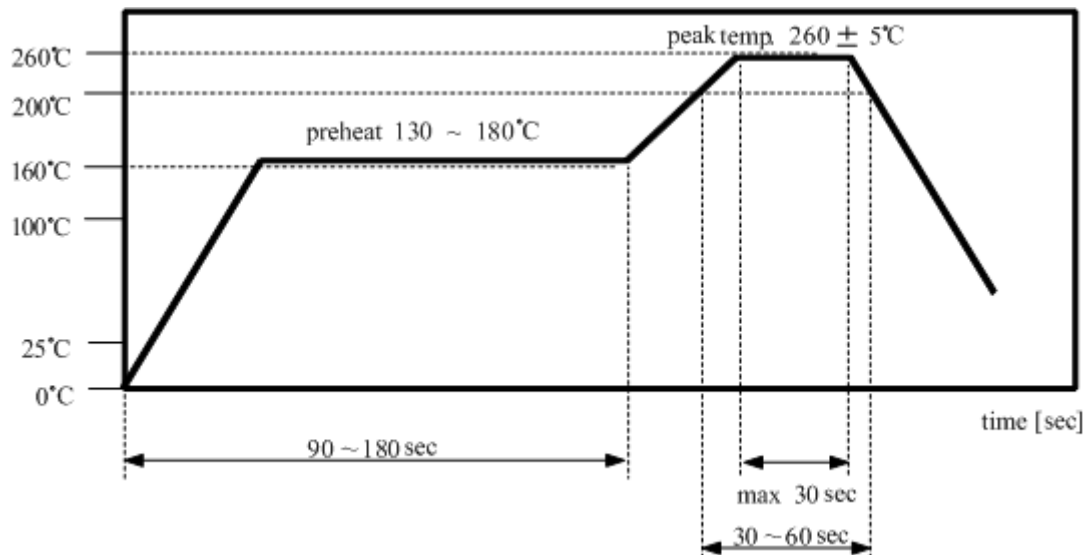
π Matching



T Matching

9. REFLOW PROFILE

9.1 Reflow Soldering



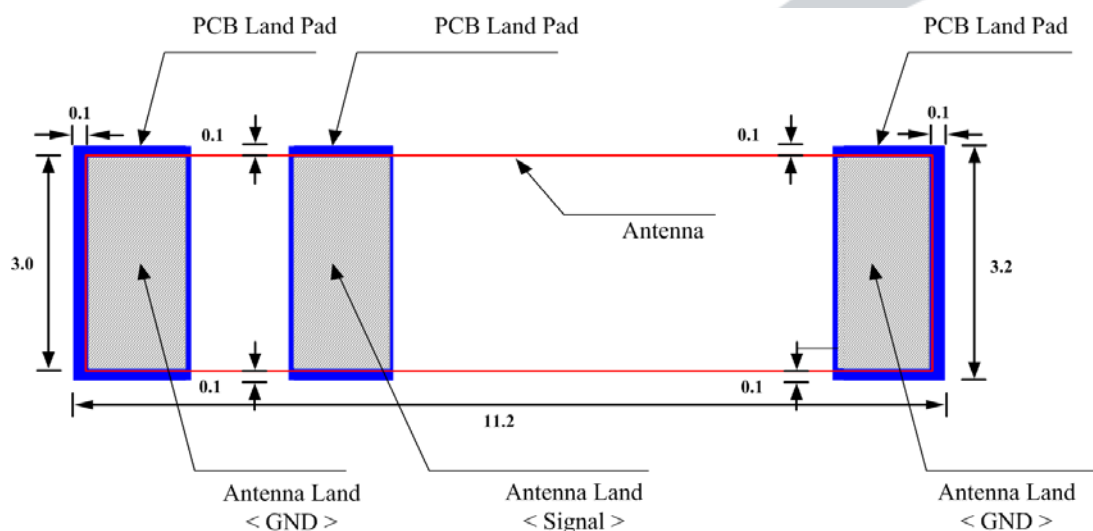
9.2 Manual Soldering

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	Electrical Characteristic[MHz] 		Size [mm]		
Standard	VSWR 3.5 Max		W=3.0±0.1	L=11.0±0.1	T=1.2±0.1
	1700	1780			
1	2.57	2.93	3.03	11.02	1.21
2	2.58	2.64	3.02	11.01	1.22
3	2.64	2.71	3.02	11.02	1.22
4	2.60	2.91	3.01	11.01	1.21
5	3.02	2.58	3.02	11.01	1.24
6	2.63	2.71	3.04	11.00	1.23
7	2.67	2.39	3.01	11.03	1.22
8	2.83	2.65	3.01	11.00	1.23
9	2.49	2.95	3.04	11.02	1.23
10	2.44	3.02	3.03	11.02	1.24
11	2.48	3.03	3.02	11.01	1.21
12	3.00	2.65	3.02	11.00	1.22
13	3.22	2.48	3.04	11.01	1.21
14	2.86	2.73	3.01	11.01	1.23
15	2.63	2.86	3.01	11.01	1.24
16	3.01	2.56	3.02	11.00	1.23
17	2.69	2.77	3.01	11.01	1.22
18	2.69	2.75	3.04	11.00	1.22
19	2.45	2.96	3.03	11.02	1.21
20	2.55	2.92	3.02	11.01	1.21
Min	2.44	2.39	3.01	11.00	1.21
Max	3.22	3.03	3.04	11.03	1.24
X	2.70	2.76	3.02	11.01	1.22
σ	0.21	0.18	0.01	0.01	0.01
Cpk	1.96	2.23	2.28	3.44	2.38
Decision	OK	OK	OK	OK	OK

11. Reliability Condition

11.1 Environment Test

ITEM	TEST CONDITION	LIMIT
High Temperature Action	85℃±3℃, 1hr	After test, Must meet the characteristics spec of 4.4 list
High Temperature Resistance	+85℃±3℃, 120hr±2hr	
Low Temperature Action	-40℃±3℃, 1hr	
Low Temperature Resistance	-40℃±3℃, 120hr±2hr	
Humidity Action	+85±3℃, RH85%	
Humidity Resistance	+85±3℃, RH85%, 120hr±2hr	

11.2 Thermal shock test , Reflow test

ITEM	TEST CONDITION	LIMIT
Thermal shock	condition : -40℃±3℃/1min ↔ +85℃±3℃/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℃, 30~60 sec Peak Heating : 260℃±5℃, 30sec Max	

11.3 Mechanical Test

ITEM	TEST CONDITION	LIMIT
Vibration	Freq : 10~500Hz , Acceleration : 10 ×9.8 ^{m/s²} (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

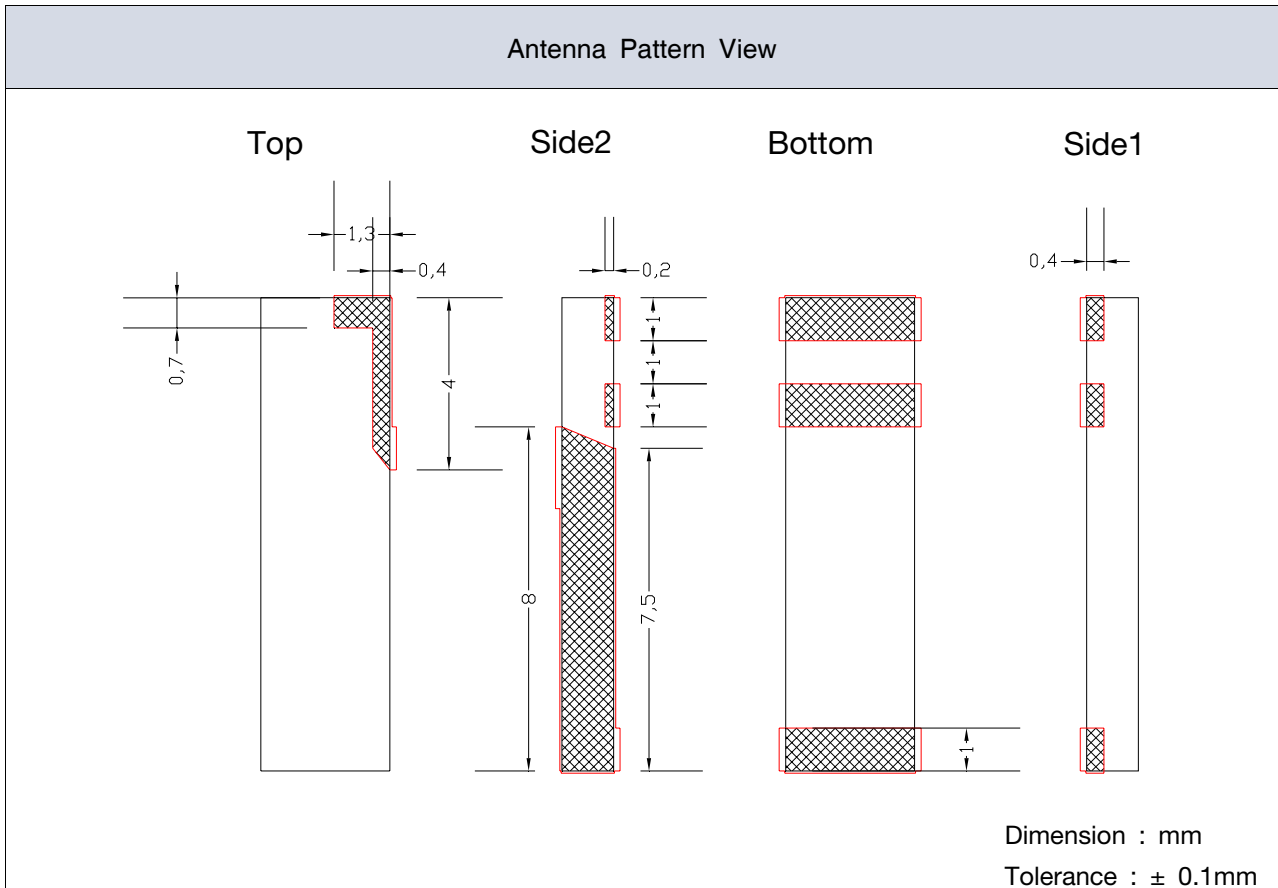
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30℃/85%RH	168+5/-0	= < 85℃/85%RH

2) Test Condition

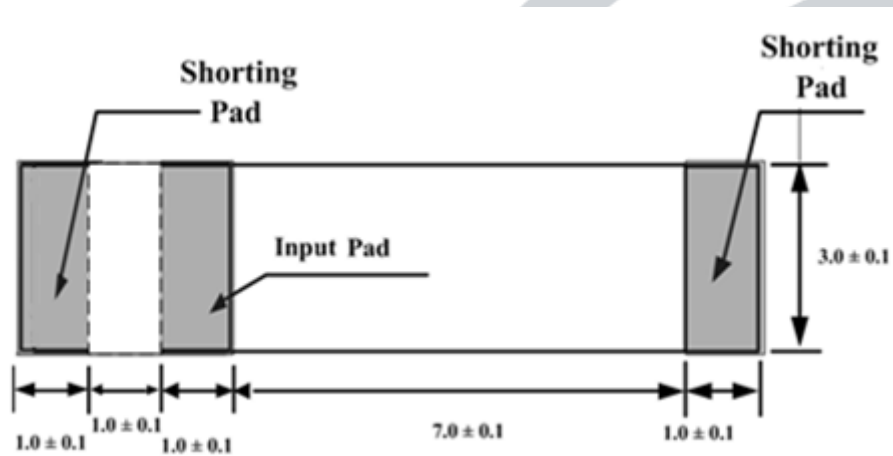
ITEM	Conditon	LIMIT
Soak Requirements	After leaving +85±3℃, RH85% 168hr±2hr 2 times Reflow without aging	After test, Must meet the characteristics spec of 4.4 list

12. Mechanical Characteristics

12.1 Antenna Pattern Dimension



12.2 Pin name

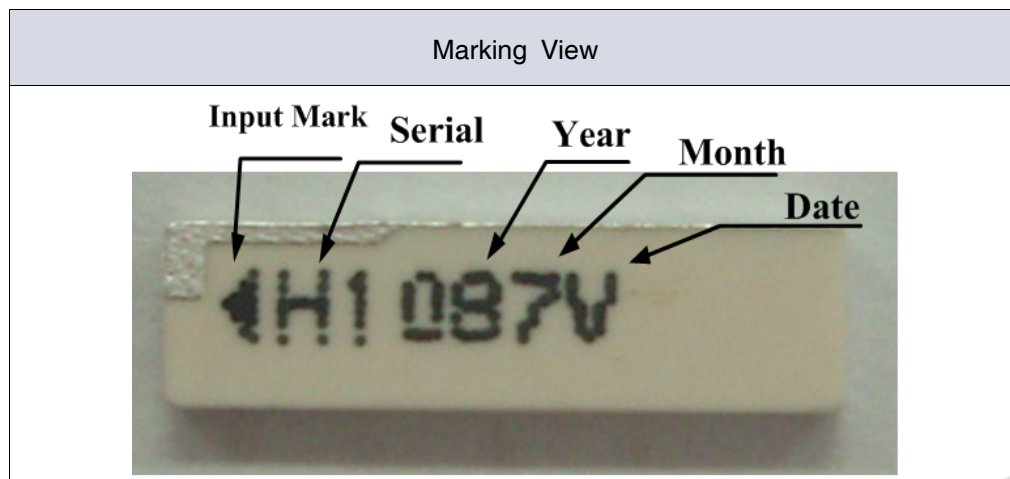


12.3 Lot number notation

8	7	V
①	②	③

- ① Year : 7 - 2007 ····
 ② Month : 1 - January, 2 - February ···· 9 - September, A - October, B - November ··
 ③ Date : 1 - 1st , 2 - 2nd ···· A - 10th, v - 31th ····

12.4 Marking



◀	<u>H 1 0</u>	<u>8</u>	<u>7</u>	<u>V</u>
①	②	③	④	⑤

- ① Input Signal
 ② Serial
 ③ Year; 1 - 2001, 2 - 2002, ···· 7 - 2007 ····
 ④ Month ; 1 - January, 2 - February ···· 9 - September, A - October, B - November ····
 ⑤ Date : 1 - 1st , 2 - 2nd ···· A - 10th, B - 11th ····

12.5 Marking type

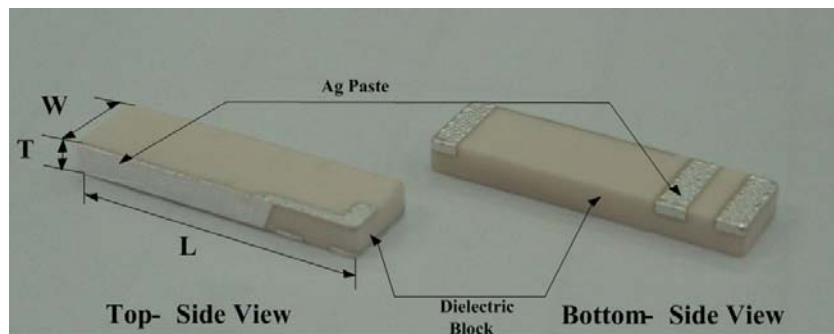
Ink marking - Using Black Ink

13. Structure and Material

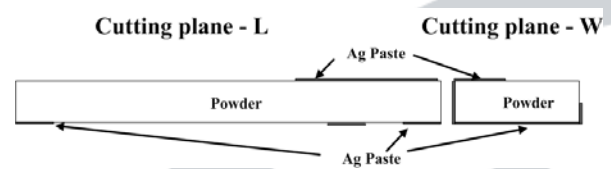
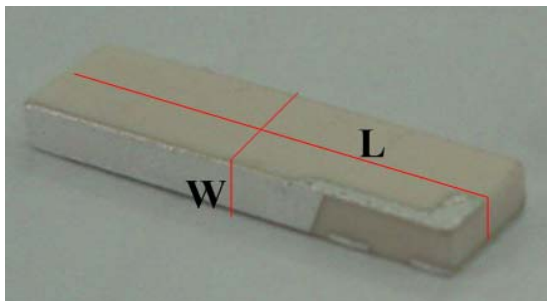
13.1 materialization method

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	Fuji	
PATTERN	Ag Paste	METECH	Thickness : TYP 10 μ m
PAD	Ag paste	METECH	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℃

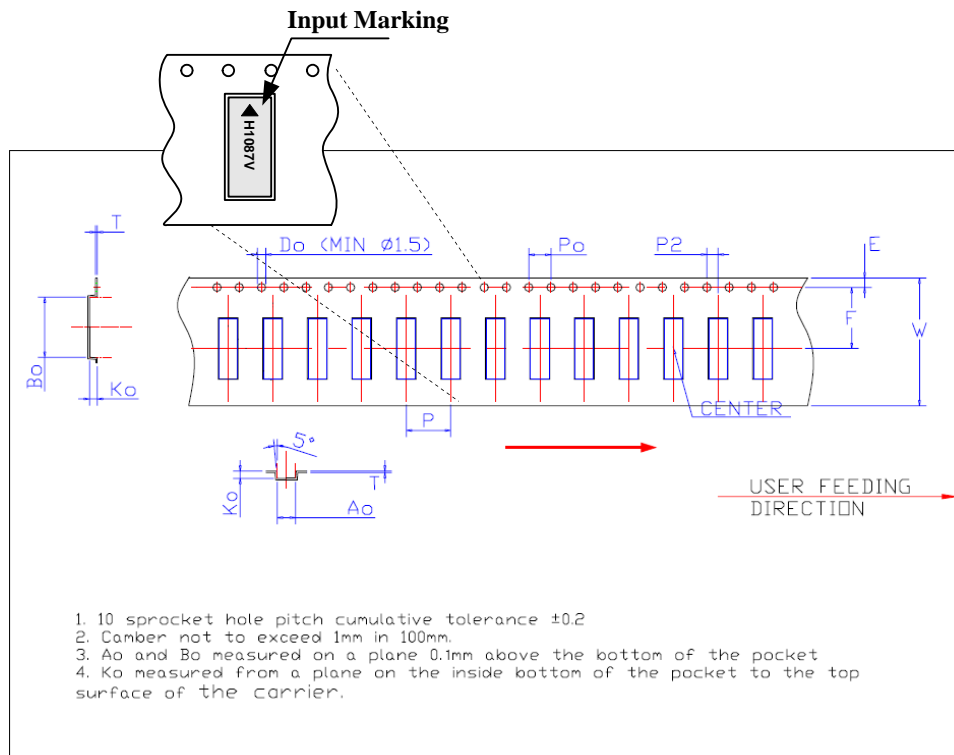
* Because of the keeping temperature problem, no admission when left over +85℃



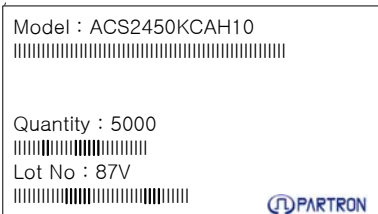
15. Packing

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	-



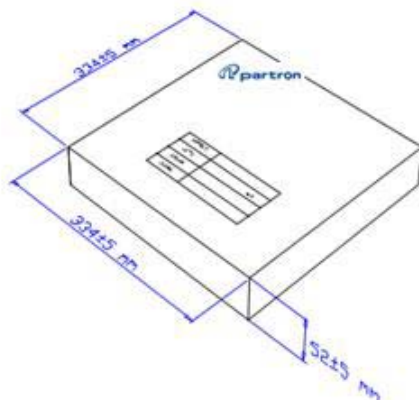
DKC DWG. No.	D-2408-006	TITLE		NAME	SPEC.
DIMENSIONAL UNIT	MM	CARRIER TAPE 3*11*1.2P		W	24 ± 0.2
UNTOLERANCED DIMENSION	± 0.1	PART.	CARRIER TAPE	E	1.75 ± 0.1
CAD FILE NAME	041222	MATERIAL	C-PET	F	11.5 ± 0.1
DESIGNED BY	K. M. J	LENGTH	49.6M	D0	1.5 ± 0.1
SCALE	1/1	COUNT	6200P	P	8.0 ± 0.1
				P0	4.0 ± 0.1
				P2	2.0 ± 0.1
				Ao	3.3 ± 0.1
				Bo	11.3 ± 0.1
				Ko	1.4 ± 0.1
				T	0.3 ± 0.05



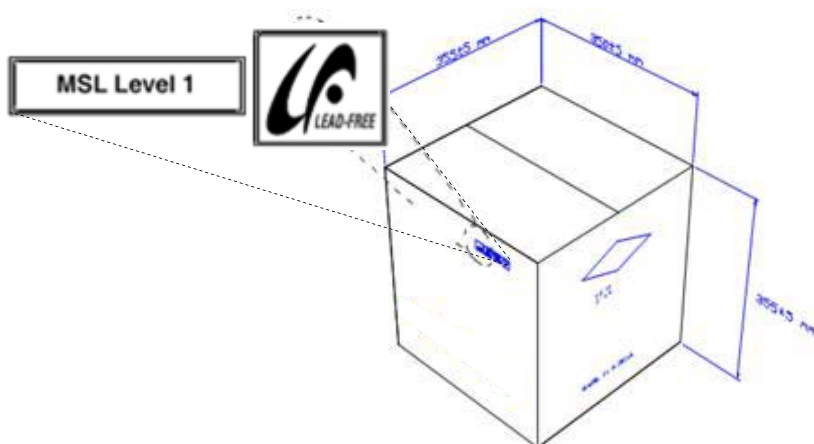
MSL Level 1



15.2 BOX



Material : SK/S/K-B
Corrugated cardboard



15.3 Actual packing Picture



Reel



Internal 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 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

SGS

Test Report No. F695051/LF-CTSAYL07-24813 Issued Date: November 13, 2007 Page 1 of 3

To: FUJI TITANIUM INDUSTRY CO., LTD
12-3
Sengen-cho
Hiratsuka-city
KANAWA-PREF., 254-2041
JAPAN

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

Product Name : MMS-08(B)
SGS File No. : AYL07-24813
Received Date : November 06, 2007
Test Performing Date : November 07, 2007
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)

Pluto Kim
Monet-Jeong
Billy Oh / Testing Person

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

SGS

Test Report No. F695051/LF-CTSAYL07-24813 Issued Date: November 13, 2007 Page 2 of 3

Sample No. : AYL07-24813.001
Sample Description : MMS-08(B)
Item No./Part No. : N/A

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Sb (Sb2O3)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	10	N.D.
Arsenic (As)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	10	N.D.

Phthalates

Test Item	Unit	Test Method	MDL	Results
Diethylhexyl Phthalate (DEHP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Dinoo-decyl Phthalate (DIDP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Dimethyl Phthalate (DMP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Di-n-octyl Phthalate (DNOP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diethyl Phthalate (DEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Bis(2-ethylhexyl) Phthalate (BEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diethyl Phthalate (DEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diisononyl Phthalate (DINP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.

Halogen Contents

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	EN 14582-2007, IC	30	N.D.
Chlorine(Cl)	mg/kg	EN 14582-2007, IC	30	N.D.
Fluorine(F)	mg/kg	EN 14582-2007, IC	30	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) Negative = Undetectable / Positive = Detectable
(7) Sb2O3 : calculated from Sb by the equation = $(121.750 \times 2 + 15.0004 \times 3) \times \text{Sb} \div 1.197 \times \text{Sb}$

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F692 Version2

F692 Version2

SGS

Test Report No. F695051/LF-CTSAYL07-24813 Issued Date: November 13, 2007 Page 3 of 3

Picture of Sample as Received:
Sample Color : Ivory



*** 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)
(6) Negative = Undetectable / Positive = Detectable
(7) Sb2O3 : calculated from Sb by the equation = $(121.750 \times 2 + 15.0004 \times 3) \times \text{Sb} \div 1.197 \times \text{Sb}$

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F692 Version2

2) Ag Paste



Test Report No. F690591LF-CTSAYL07-24812

To: METECH KOREA CO., LTD.
B-801 Dongyang Paragon office17-2 Jeongja-dong
Sungnam-si
Gyeonggi-do
Korea

Received Date : November 07, 2007

Test Performing Date : November 08, 2007

Test Results : SGS Testing Korea tested the sample(s) selected by applicant with following results
: For further details, please refer to following page(s)

Issued Date: November 14, 2007 **Page 1 of 4**

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

Product Name : Silver paste (PCC11837HV)

SGS File No. : AYL07-24812


Photo Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.

Jeff Jang
Jeff Jang / Chemical Lab Mgr

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F002 Ver4.0/2



Test Report No. F690591LF-CTSAYL07-24812

Sample No. : AYL07-24812.001

Sample Description : Silver paste (PCC11837HV)

Item No./Part No. : N/A

Issued Date: November 14, 2007 **Page 2 of 4**

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Sb (Sn203)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	10	N.D.
Arsenic (As)	mg/kg	US EPA 3051(1996), US EPA 6010B(1996), ICP	10	N.D.

Phthalates

Test Item	Unit	Test Method	MDL	Results
Diethylhexyl Phthalate (DEHP)	mg/kg	US EPA 8061A, GC/MS	50	3760
Di-n-octyl Phthalate (DOP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Dimethyl Phthalate (DMP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Di-n-octyl Phthalate (DNOP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diethyl Phthalate (DEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Bis(2-ethylhexyl) Phthalate (BEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Di-isononyl Phthalate (DINP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.

Halogen Contents

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	EN 14592:2007, IC	30	N.D.
Chlorine(Cl)	mg/kg	EN 14592:2007, IC	30	N.D.
Fluorine(F)	mg/kg	EN 14592:2007, IC	30	N.D.

Organotin Compounds

Test Item	Unit	Test Method	MDL	Results
Tributyltin (TBT)	mg/kg	DIN 35407-13, GC/MS	0.03	N.D.
Triphenyltin (TPAT)	mg/kg	DIN 35407-13, GC/MS	0.1	N.D.


Azo Dyes

Test Item	Unit	Test Method	MDL	Results
4-Aminodiphenyl	mg/kg	EN14363-1, GC/MS	5	N.D.
Benidine	mg/kg	EN14363-1, 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) Negative = Undetectable / Positive = Detectable
(7) Sn203 : calculated from Sb by the equation = (121.760 X 2 + 15.9904 X 3) X Sb = 1.197 X Sb

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F002 Ver4.0/2



Test Report No. F690591LF-CTSAYL07-24812

Sample No. : AYL07-24812.001

Sample Description : Silver paste (PCC11837HV)

Item No./Part No. : N/A

Issued Date: November 14, 2007 **Page 3 of 4**

Azo Dyes

Test Item	Unit	Test Method	MDL	Results
4-Chloro-2-Toluidine	mg/kg	EN14362-1, GC/MS	5	N.D.
2-Naphthylamine	mg/kg	EN14362-1, GC/MS	5	N.D.
6-Aminoazobenzene	mg/kg	EN14362-1, GC/MS	5	N.D.
2-Amino-4-Nitrotoluene	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Chloroaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Diaminonitrobenzene	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-diaminodiphenylmethane	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dichlorobenzidine	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dimethoxybenzidine	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dimethylbenzidine	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dimethyl-4,4'-diaminodiphenylmethane	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Chloridine	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Methylen-bis-(2-chloroaniline)	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Crydianiline	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Thiobis	mg/kg	EN14362-1, GC/MS	5	N.D.
2-Toluidine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Toluidinediamine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4,6-Trimethylaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Phenylenediamine	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Aminidine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Xyldine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,6-Xyldine	mg/kg	EN14362-1, GC/MS	5	N.D.

Others

Test Item	Unit	Test Method	MDL	Results
Biophenol A	mg/kg	IN-House, HPLC/DAD	10	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) Negative = Undetectable / Positive = Detectable
(7) Sn203 : calculated from Sb by the equation = (121.760 X 2 + 15.9904 X 3) X Sb = 1.197 X Sb

F002 Ver4.0/2



Test Report No. F690591LF-CTSAYL07-24812

Sample No. : AYL07-24812.001

Sample Description : Silver paste (PCC11837HV)

Item No./Part No. : N/A

Issued Date: November 14, 2007 **Page 4 of 4**

Picture of Sample as Received:

Sample Color : Gray



*** 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)
(6) Negative = Undetectable / Positive = Detectable
(7) Sn203 : calculated from Sb by the equation = (121.760 X 2 + 15.9904 X 3) X Sb = 1.197 X Sb

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F002 Ver4.0/2

3) Marking Ink

SGS

Test Report No. F69501LF-CTSAYL07-24811

To: **IMAJE KOREA CO., LTD**
#1302 7th Daerung Techno Town 420-11
Gasan-dong
Seomchoeong-gu
SEOUL
Korea

Issued Date: November 13, 2007 Page 1 of 4

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

Product Name : 5135E Black Ink

SGS File No. : AYU07-24811

Received Date : November 06, 2007

Test Performing Date : November 07, 2007

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)

SGS Testing Korea Co. Ltd.

Jeff Jang

Photo Kim
Monet Jeong
Billy Oh / Testing Person

Jeff Jang / Chemical Lab Mgr

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F02 Version2

SGS

Test Report No. F69501LF-CTSAYL07-24811

Sample No. : AYU07-24811.001

Sample Description : 5135E Black Ink

Item No./Part No. : 5135E

Issued Date: November 13, 2007 Page 2 of 4

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Sb (Sn2O3)	mg/kg	US EPA 3050B (1996), US EPA 6010B (1996), ICP	10	N.D.
Antimony (As)	mg/kg	US EPA 3050B (1996), US EPA 6010B (1996), ICP	10	N.D.

Phthalates

Test Items	Unit	Test Method	MDL	Results
Diethylhexyl Phthalate (DEHP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Di-n-octyl Phthalate (DOP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Dimethyl Phthalate (DMP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Di-n-octyl Phthalate (DOP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diethyl Phthalate (DEHP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Bis(2-Ethylhexyl) Phthalate (BEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diethyl Phthalate (DEP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.
Diisobutyl Phthalate (DIBP)	mg/kg	US EPA 8061A, GC/MS	50	N.D.

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	EN 14582:2007, IC	30	N.D.
Chlorine(Cl)	mg/kg	EN 14582:2007, IC	30	73
Fluorine(F)	mg/kg	EN 14582:2007, IC	30	N.D.

Organotin Compounds

Test Items	Unit	Test Method	MDL	Results
Tributyltin (TBT)	mg/kg	DIN 35407-13, GC/MS	0.03	N.D.
Triphenyltin (TPHT)	mg/kg	DIN 35407-13, GC/MS	0.1	N.D.

Azo Dyes

Test Items	Unit	Test Method	MDL	Results
4-Aminodiphenyl	mg/kg	EN14362-1, GC/MS	5	N.D.
Benzidine	mg/kg	EN14362-1, 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) Negative = Undetectable / Positive = Detectable
(7) Sb2O3 : calculated from Sb by the equation = (121.760 X 2 + 15.9994 X 3) X Sb = 1.167 X Sb

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F02 Version2

SGS

Test Report No. F69501LF-CTSAYL07-24811

Sample No. : AYU07-24811.001

Sample Description : 5135E Black Ink

Item No./Part No. : 5135E

Issued Date: November 13, 2007 Page 3 of 4

Azo Dyes

Test Items	Unit	Test Method	MDL	Results
4-Chloro-2-Toluidine	mg/kg	EN14362-1, GC/MS	5	N.D.
2-Naphthylamine	mg/kg	EN14362-1, GC/MS	5	N.D.
4-Aminodiphenyl	mg/kg	EN14362-1, GC/MS	5	N.D.
2-Amino-4-Nitrotoluene	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Chloroaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Diaminotoluene	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4-Diaminodiphenylmethane	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dichlorobenzidine	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dimethoxybenzidine	mg/kg	EN14362-1, GC/MS	5	N.D.
3,3'-Dimethyl-4,4'-diaminodiphenylmethane	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Cresidine	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Methylen-bis(2-chloroaniline)	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Cyaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
4,4'-Thioaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
o-Toluidine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Toluidinediamine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4,5-Trinitroaniline	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Phenylenediamine	mg/kg	EN14362-1, GC/MS	5	N.D.
p-Aminodiphenyl	mg/kg	EN14362-1, GC/MS	5	N.D.
2,4-Xyldine	mg/kg	EN14362-1, GC/MS	5	N.D.
2,6-Xyldine	mg/kg	EN14362-1, GC/MS	5	N.D.

Others

Test Items	Unit	Test Method	MDL	Results
Bisphenol A	mg/kg	in-house, HPLC/DAD	10	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) Negative = Undetectable / Positive = Detectable
(7) Sb2O3 : calculated from Sb by the equation = (121.760 X 2 + 15.9994 X 3) X Sb = 1.167 X Sb

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F02 Version2

SGS

Test Report No. F69501LF-CTSAYL07-24811

Sample No. : AYU07-24811.001


Sample Description : 5135E Black Ink

Item No./Part No. : 5135E

Issued Date: November 13, 2007 Page 4 of 4

Picture of Sample as Received:

Sample Color : Black



*** 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)
(6) Negative = Undetectable / Positive = Detectable
(7) Sb2O3 : calculated from Sb by the equation = (121.760 X 2 + 15.9994 X 3) X Sb = 1.167 X Sb

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F02 Version2

Ver 1.0 (2008.07.31)

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