TBBP-A free | MSL Level 1 | ROHS-Y

Approval Sheet

Products	Dielectric Chip Antenna		
Customer	DIOSTECH		
Model	RD-02		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450JBARD2		
CLIPCOM	By designed	By checked	By approved
PARTRON	By designed	By checked	By approved
			
	Research 5 Team	Quality Assurance	Laboratory
	Chanik.Jeon	Nam-Sik.Min	Byoung-Jun.Yim
	4 / 14	4 / 14	4 / 14

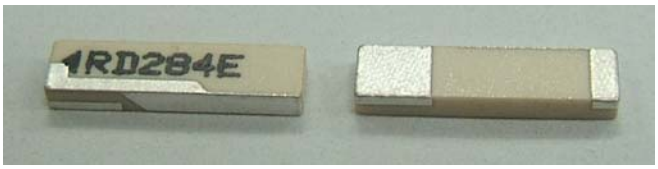
2008. 4. 14

partron
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

TBBP-A free | LEAD-FREE | MSL Level 1 | ROHS-Y

SPECIFICATION

MODEL : ACS2450JBARD2

3D Structure

Top View Bottom View

By designed	By checked	By approved
Research 5 Team	Quality Assurance	Laboratory
Chanik.Jeon	Nam-Sik.Min	Byoung-Jun.Yim
4 / 14	4 / 14	4 / 14

2008. 4. 14

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Tel : 82-31-201-7870~6
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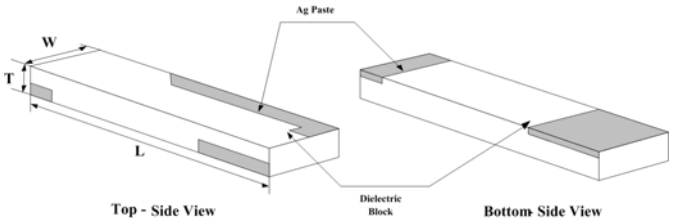
- Contents -

1. Revision

Revision No	Originator	Description of changes	Date of changes
Ver 1.0	Chanik.Jeon	Issued	2008.04.14

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_2SiO_4(Magnesium Silicate)
	Electrode Paste	Ag
Size[mm]	W = 2.5±0.1	
	L = 10.0±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.

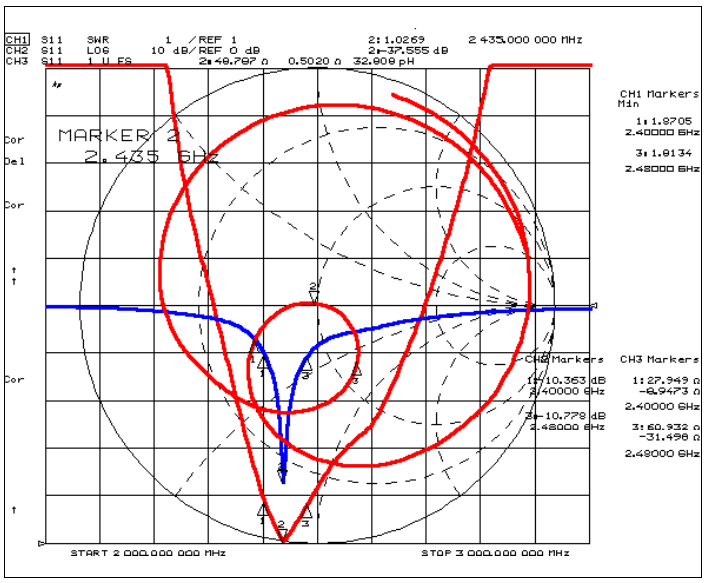
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

4. Electrical Characteristics

4.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				2.5 : 1(Typ 2 : 1)
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Gain[dBi]	Total Gain (Peak / Avg) [dBi]			1.1 / -4.5
	Azimuth	Theta	Peak	-0.55
			Average	-4.85
		Phi	Peak	1.03
			Average	-3.84
	Elevation 1	Theta	Peak	-0.00
			Average	-4.50
		Phi	Peak	0.67
			Average	-3.73
	Elevation 2	Theta	Peak	-1.85
			Average	-5.71
		Phi	Peak	1.07
			Average	-4.87

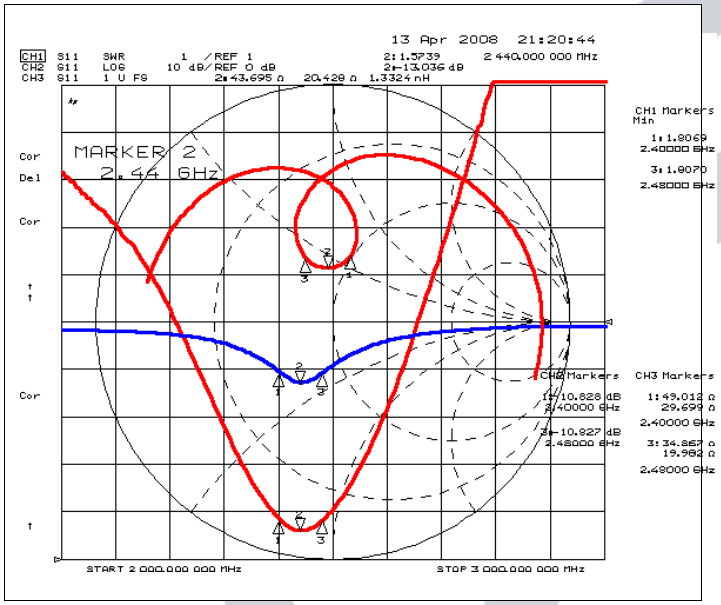
4.2 S11 Graph of Set Condition



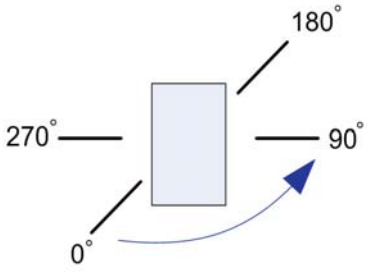
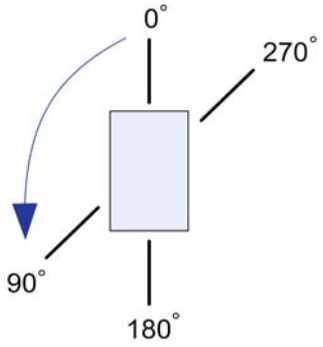
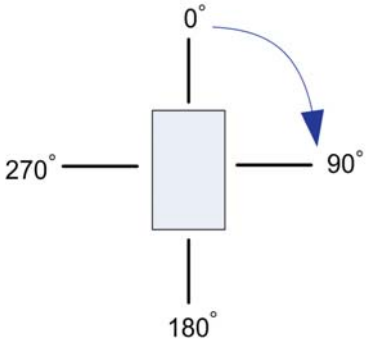
4.3 Test Fixture Condition

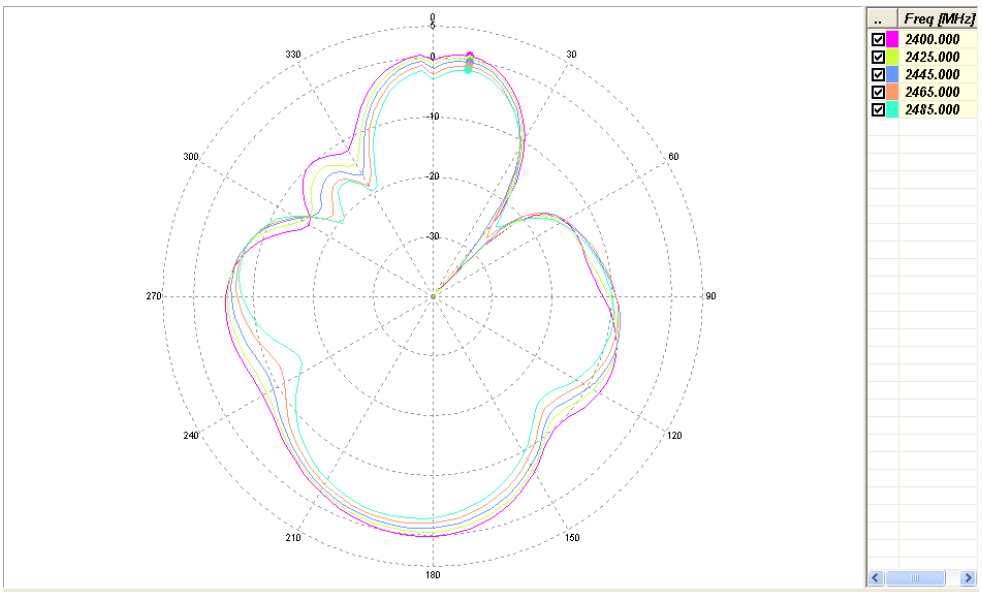
ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2480
Lower frequency(1860MHz) SWR [Min~Max]	1.5~2.5 : 1(Typ 2.1 : 1)
Upper frequency(1940MHz) SWR [Min~Max]	1.5~2.5 : 1(Typ 2.1 : 1)

4.4 S11 Graph of Test Fixture Condition CTQ



4.5 Radiation Pattern

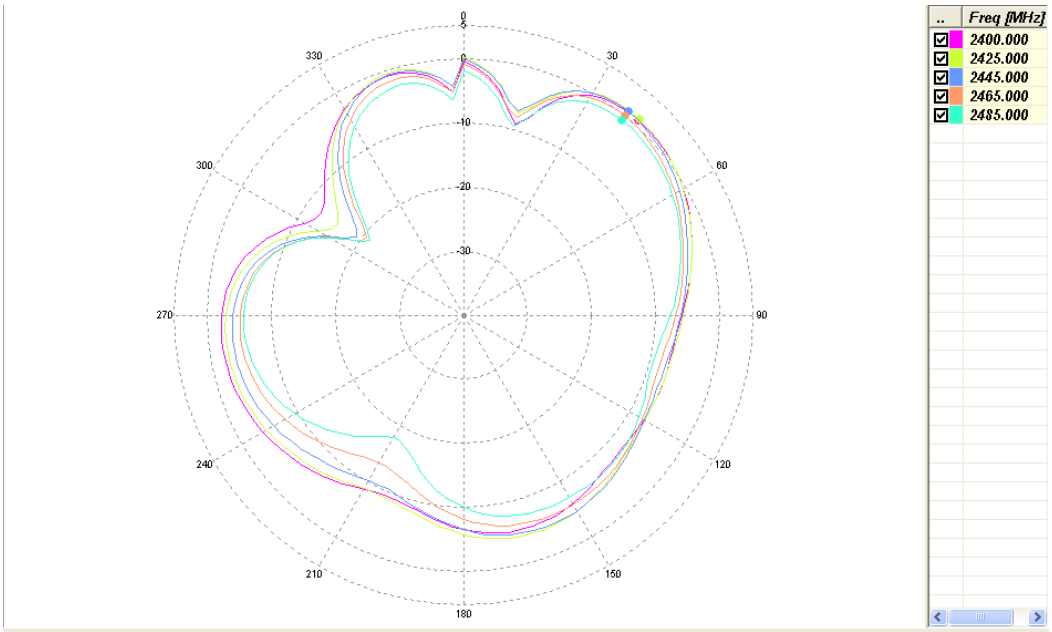
Azimuth Plane	Elevation1 Plane	Elevation2 Plane
		
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	

Azimuth Theta


H-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,55	90	9	-38,83	90	42		-4,85	32,87
2425,000	0,10	90	9	-52,04	90	42		-5,39	29,00
2445,000	-0,44	90	9	-34,00	90	42		-5,96	25,46
2465,000	-1,18	90	9	-26,64	90	42		-6,79	21,07
2485,000	-1,87	90	9	-24,12	90	42		-7,64	17,31

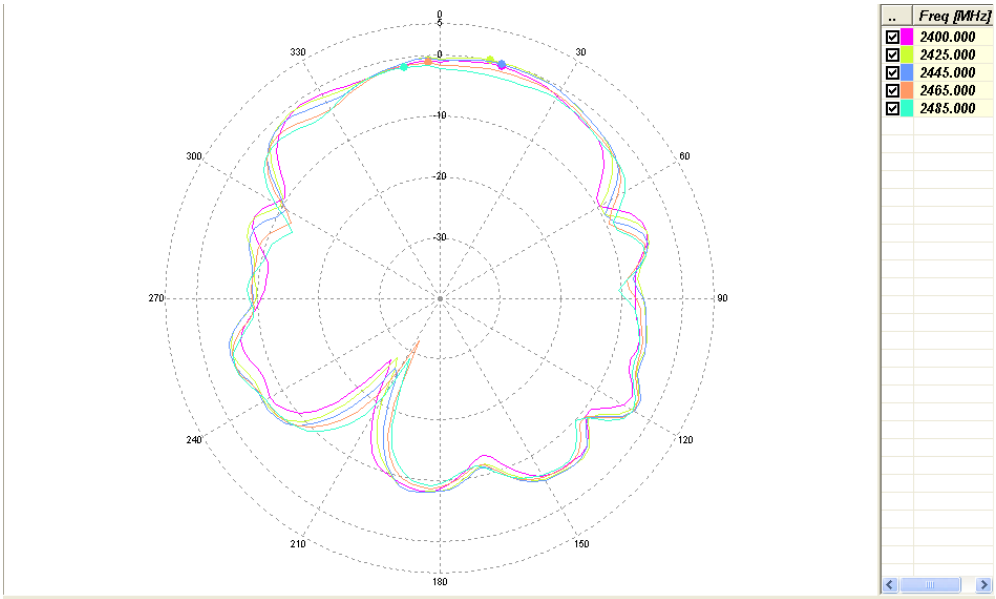
Azimuth Phi



H-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,81	90	42	-12,54	90	306		-3,99	40,05
2425,000	1,03	90	42	-15,66	90	306		-3,84	41,40
2445,000	0,73	90	39	-19,22	90	306		-4,34	36,91
2465,000	-0,09	90	39	-20,48	90	309		-5,37	29,15
2485,000	-0,89	90	39	-21,18	90	309		-6,31	23,52

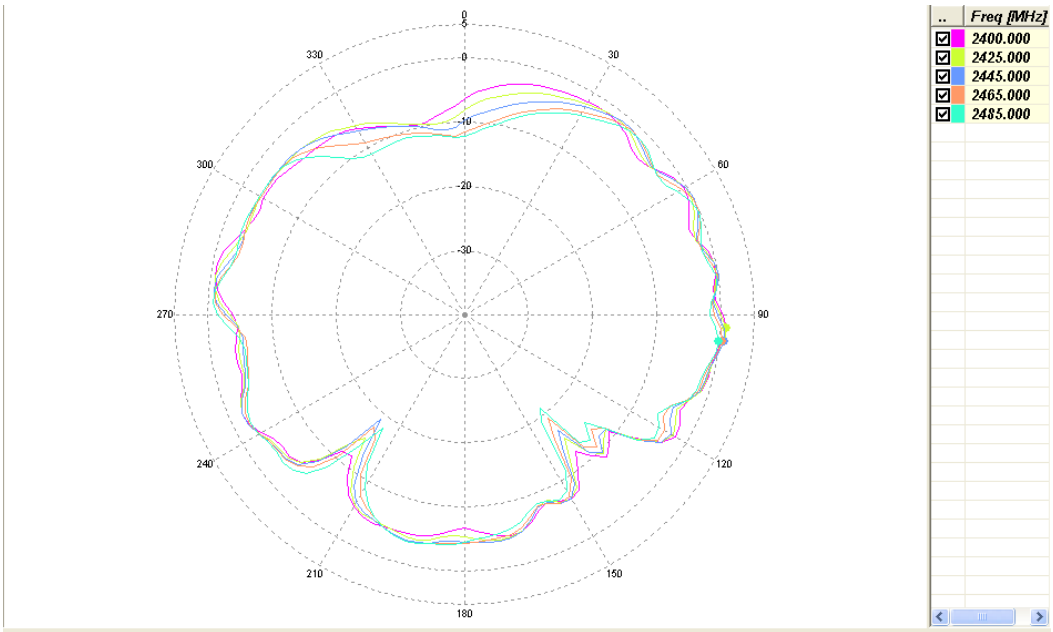
Elevation1 Theta



E1-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-0,59	15	0	-27,12	219	0		-5,15	30,67
2425,000	-0,00	12	0	-27,93	216	0		-4,50	35,57
2445,000	-0,28	15	0	-26,37	213	0		-4,57	35,03
2465,000	-1,27	357	0	-32,16	207	0		-5,23	30,09
2485,000	-1,60	351	0	-28,97	207	0		-5,55	27,98

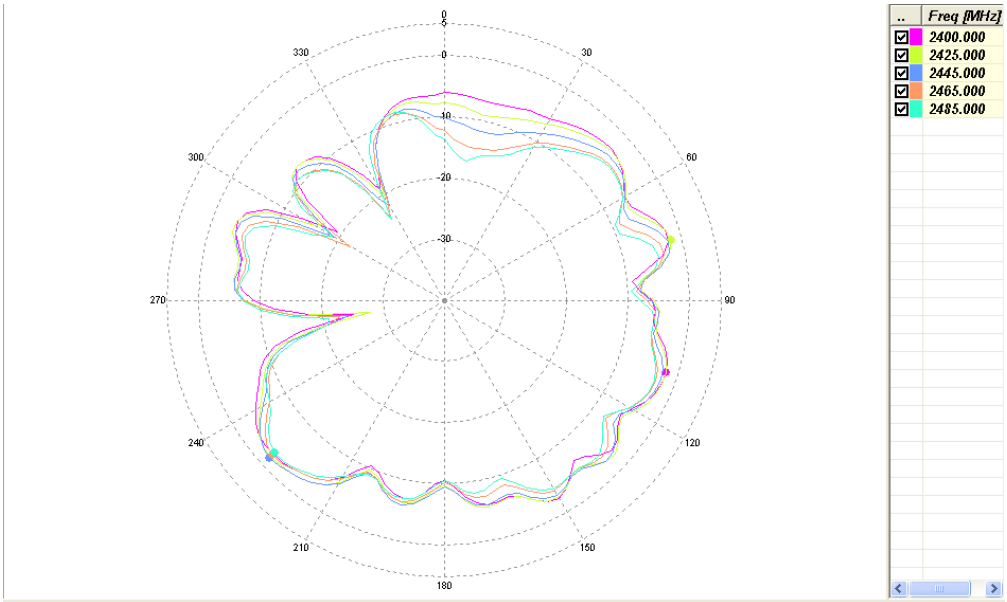
Elevation1 Phi



E1-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,67	93	0	-12,69	141	0		-3,73	42,50
2425,000	0,62	93	0	-15,35	141	0		-3,73	42,44
2445,000	0,53	96	0	-19,01	219	0		-3,81	41,68
2465,000	0,14	96	0	-19,33	141	0		-4,19	38,26
2485,000	-0,29	96	0	-21,28	141	0		-4,35	36,81

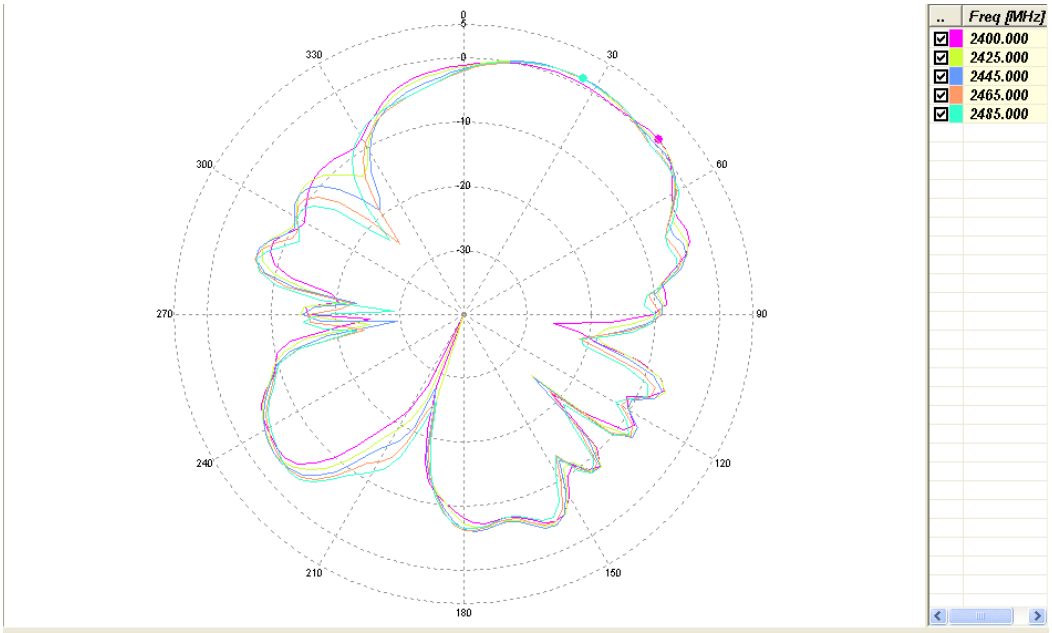
Elevation2 Theta



E2-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-2,14	108	90	-25,00	261	90		-5,78	26,56
2425,000	-1,85	75	90	-27,78	261	90		-5,71	26,97
2445,000	-1,71	228	90	-24,29	261	90		-6,16	24,30
2465,000	-2,42	228	90	-23,79	327	90		-7,07	19,75
2485,000	-2,93	228	90	-24,13	327	90		-7,46	18,04

Elevation2 Phi



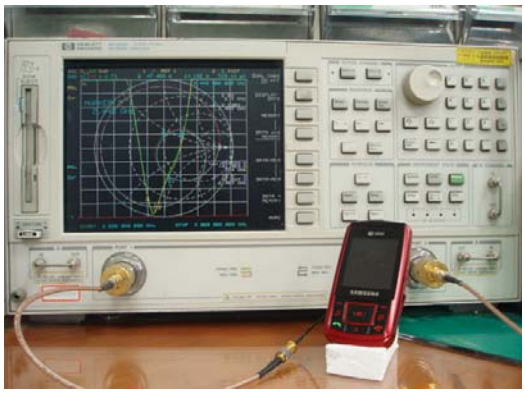
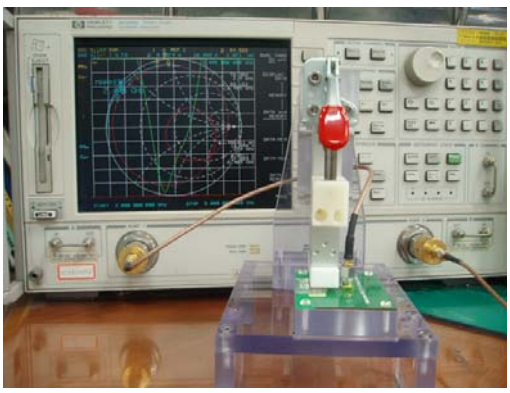
E2-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	0,73	48	90	-42,35	204	90		-5,04	31,47
2425,000	1,07	27	90	-40,14	201	90		-4,87	32,72
2445,000	1,18	27	90	-29,54	264	90		-4,93	32,25
2465,000	1,06	27	90	-25,54	198	90		-5,22	30,20
2485,000	1,09	27	90	-29,03	273	90		-5,19	30,38

5. Measurement Process

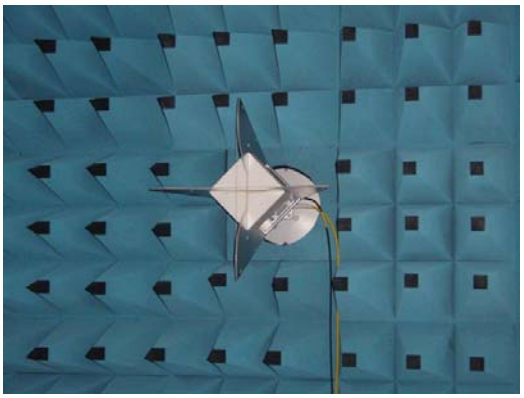
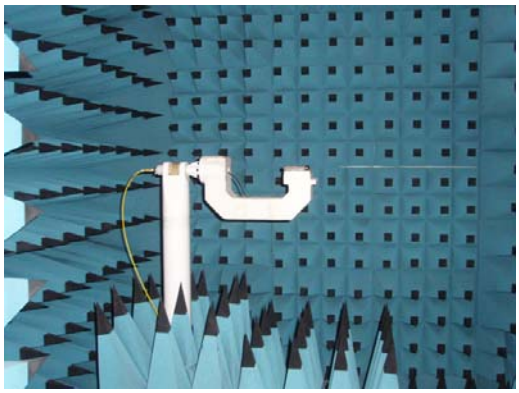
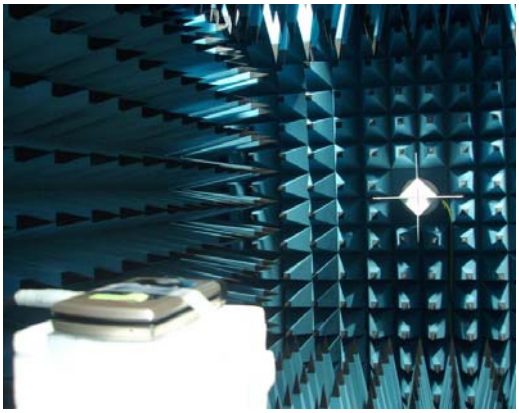
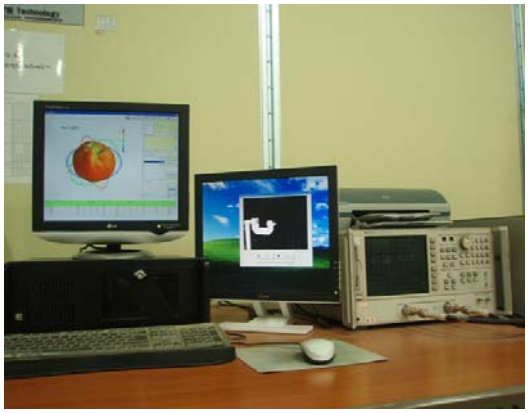
5.1 SWR/Return loss

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

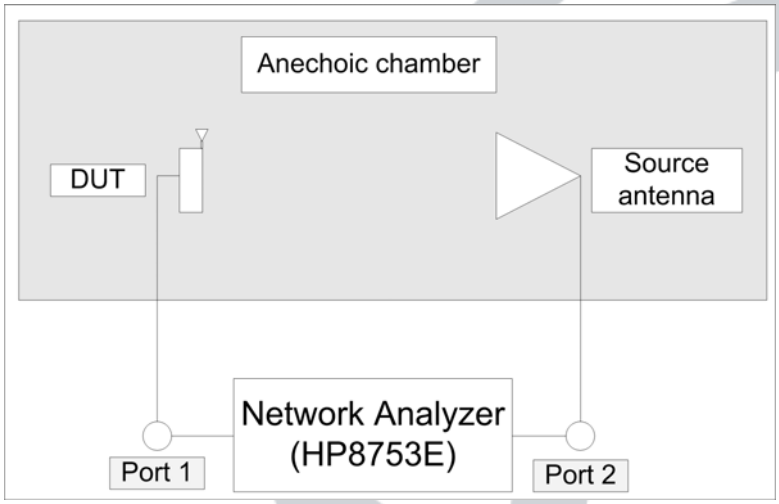
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

5.2 Gain

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

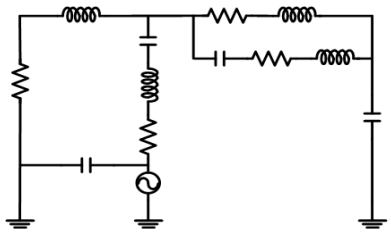
Anechoic Chamber for Antenna Gain Measurement	
	
	

5.3 Gain test block diagram

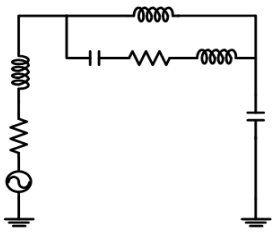


6. Internal Block Diagram

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.



3 Land Type

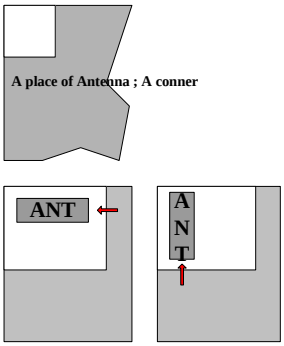


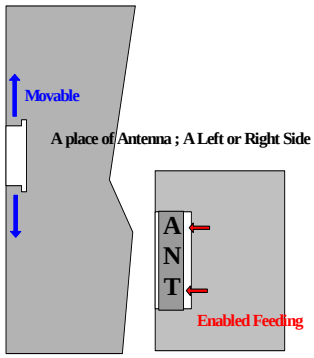
2 Land Type

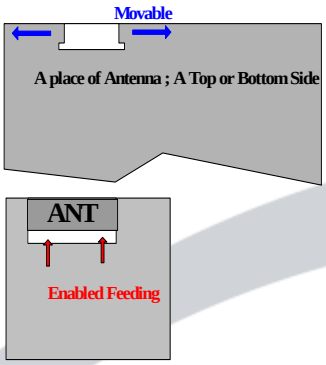
7. Basis Action / Application Note

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

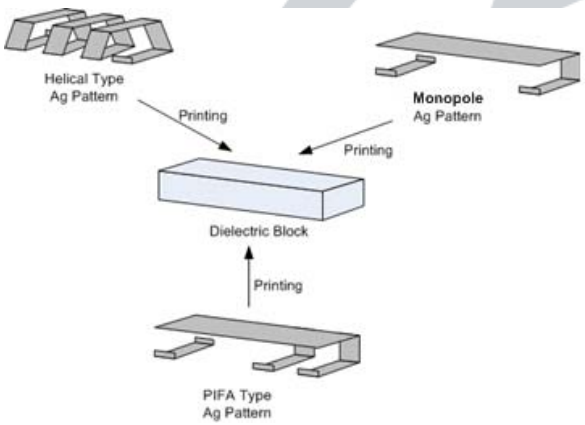
This product will be mounted wherever you want and the design is revised by mount condition. But require attention to select the mount position, because this product is the radiation part and changed characteristics by boundary condition,





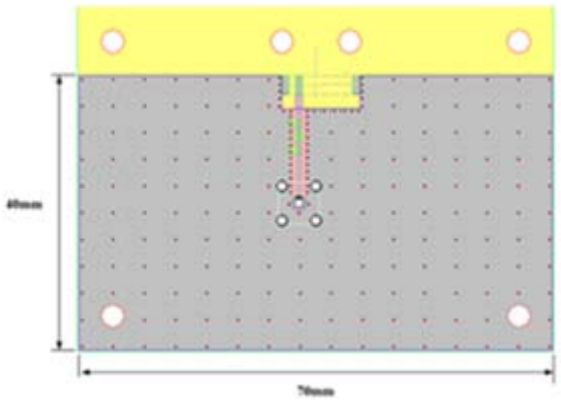


As the following, this product is easy to revise the various types for the boundary condition.



8. Measurement Jig SPEC

8.1 Test Fixture And GROUND Condition

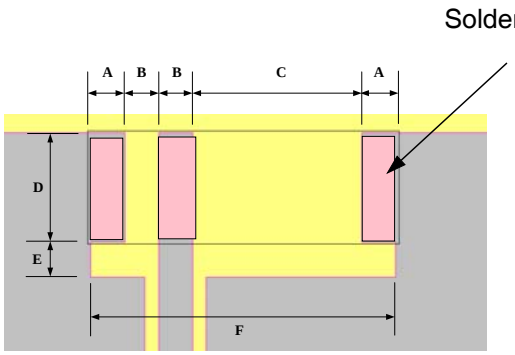


Test Fixture Loss 0.2~0.3 **dB**

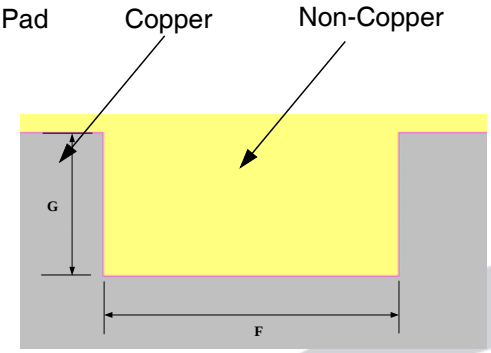
※ Ev B'd and Test Fixture Jig is the same

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

8.2 PCB Layout & Soldering Pad Dimension



Top Pattern



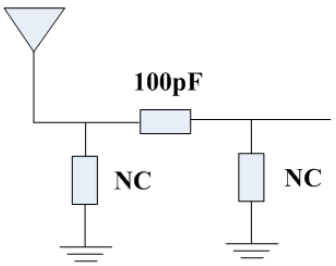
Bottom Pattern

Parameter	A	B	C	D	E	F	G	H
Value[mm]	**1.1**	**1.0**	**1.0**	**6.0**	**2.7**	**1.0**	**10**	**3.7**

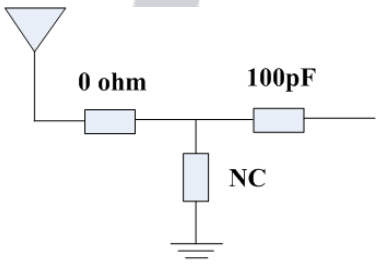
Unit ; mm

Unless specified tolerances are ±0.1

8.3 Matching Circuit And Reference Value



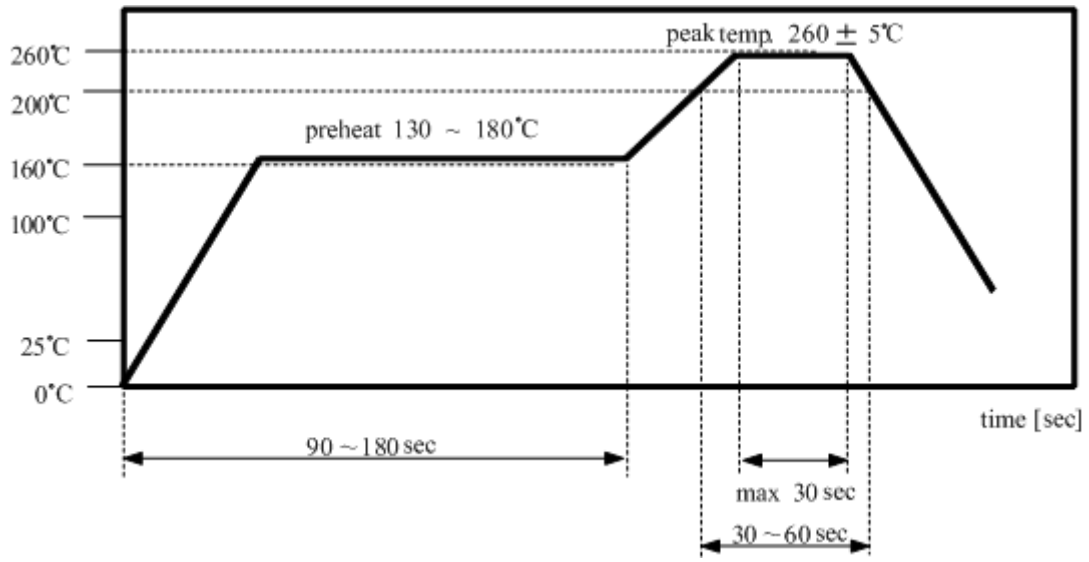
π Matching



T Matching

9. REFLOW PROFILE

9.1 Reflow Soldering



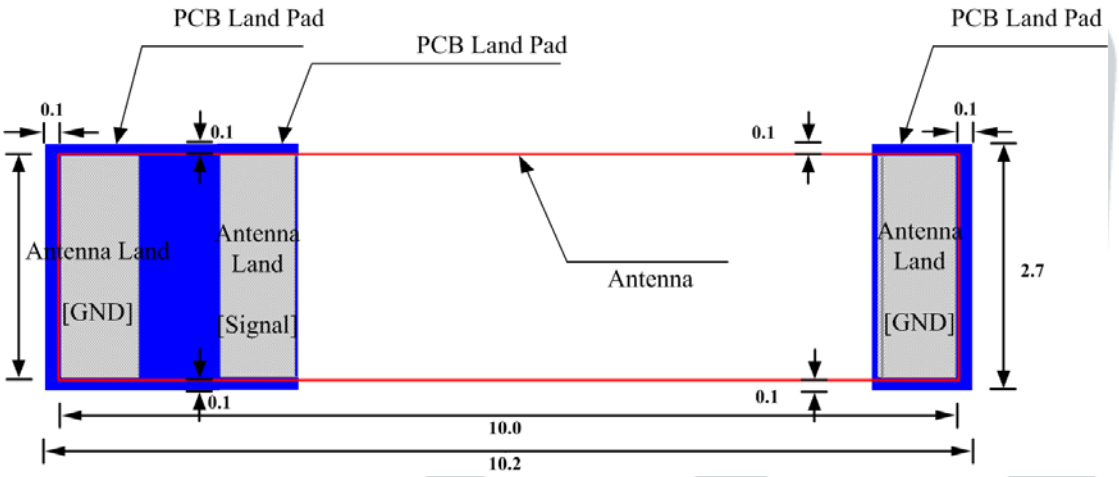
9.2 Manual Soldering

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

Soldering Temperature : 340℃±5℃ , 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] CTF		Size [mm]		
Standard	VSWR MAX		W=3.0±0.1	L=11.0±0.1	T=1.2±0.1
	1860MHz	1940MHz			
1	1.86	1.78	2.52	10.01	1.22
2	1.88	1.79	2.53	10.02	1.23
3	1.87	1.83	2.53	10.03	1.23
4	1.88	1.72	2.53	10.01	1.23
5	1.84	1.82	2.52	10.01	1.22
6	1.72	1.81	2.54	10.01	1.24
7	1.85	1.97	2.52	10.02	1.22
8	1.86	1.88	2.53	10.02	1.23
9	1.83	1.86	2.52	10.02	1.21
10	1.81	1.79	2.53	10.02	1.23
11	1.80	1.77	2.53	10.03	1.23
12	1.81	1.88	2.52	10.03	1.22
13	1.79	1.85	2.54	10.02	1.24
14	1.90	1.92	2.52	10.01	1.22
15	1.86	1.89	2.53	10.01	1.23
16	1.86	1.81	2.53	10.02	1.21
17	1.87	1.78	2.52	10.03	1.22
18	2.07	1.93	2.54	10.03	1.24
19	1.87	1.87	2.52	10.01	1.22
20	1.95	1.83	2.52	10.02	1.22
Min	1.72	1.72	2.52	10.01	1.21
Max	2.07	1.97	2.54	10.03	1.24
X	1.85	1.83	2.52	10.01	1.22
σ	0.06	0.06	0.01	0.01	0.01
Cpk	4.12	4.47	3.28	3.38	2.76
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㎨(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

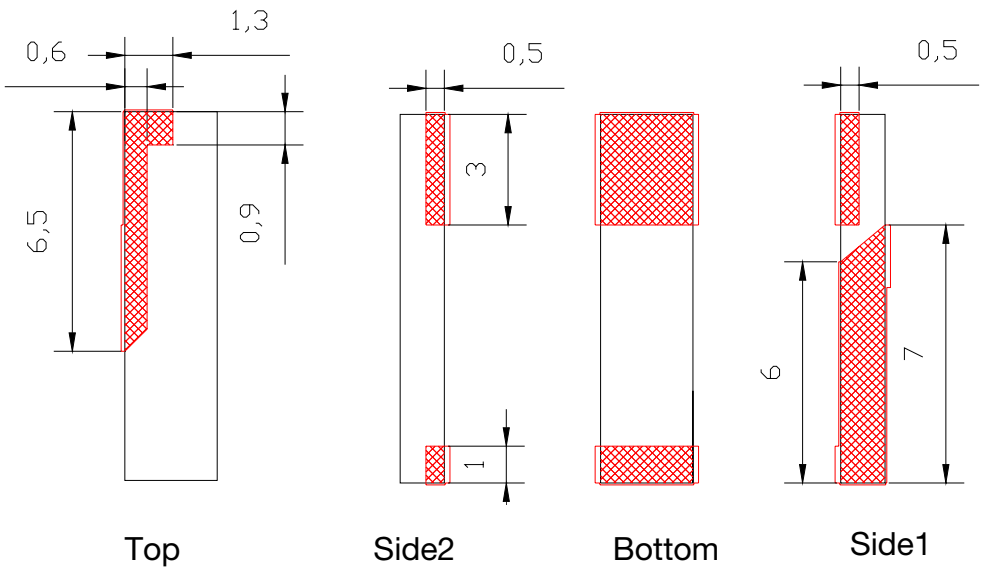
2) Test Condition

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

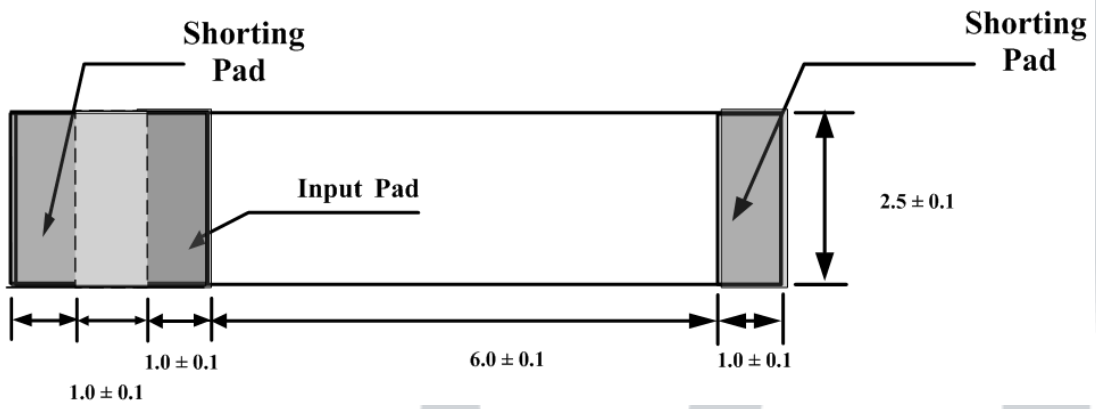
Antenna Pattern View



Dimension : mm

Tolerance : ± 0.1mm

12.2 Pin name



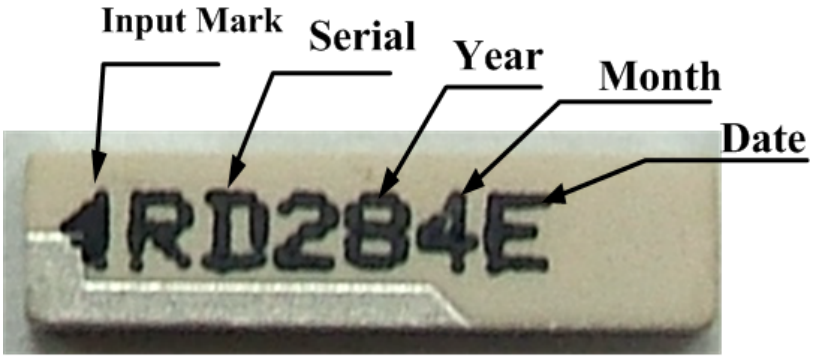
12.3 Lot number notation

8	4	E
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, B - 11th ····

12.4 Marking

Marking View



◀	R D 2	8	4	E
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

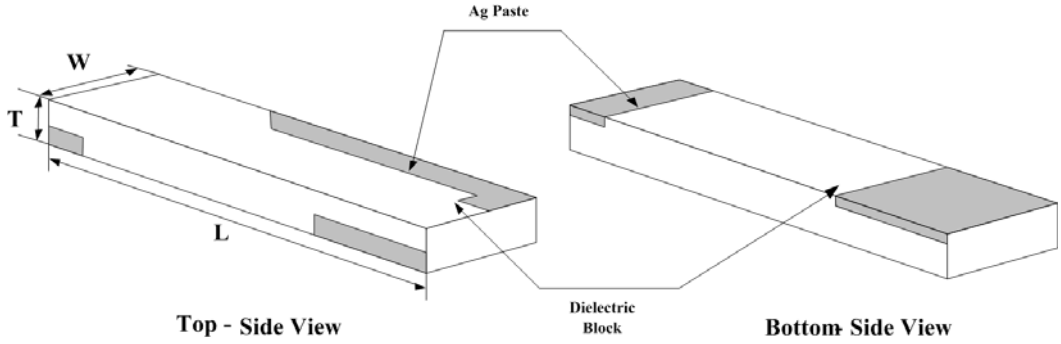
Ink marking - Using Black Ink

13. Structure and Material

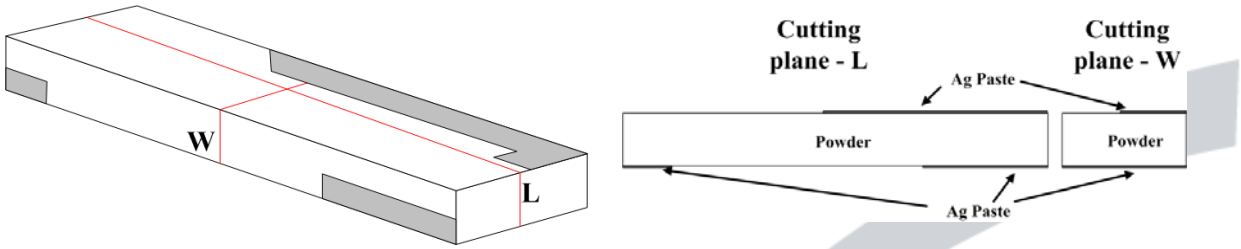
13.1 materialization method

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	DAEJOO	Thickness : TYP 10㎛
PAD	Ag paste	DAEJOO	Thickness : Min 10㎛ (TYP 16~20㎛)

14. Attention

14.1 Temperature Condition

	Range of Temperature	Unit
Application temperature	-40 ~ +85	℃
Keeping temperature	-40 ~ +85	℃

14.2 Temperature Test Condition

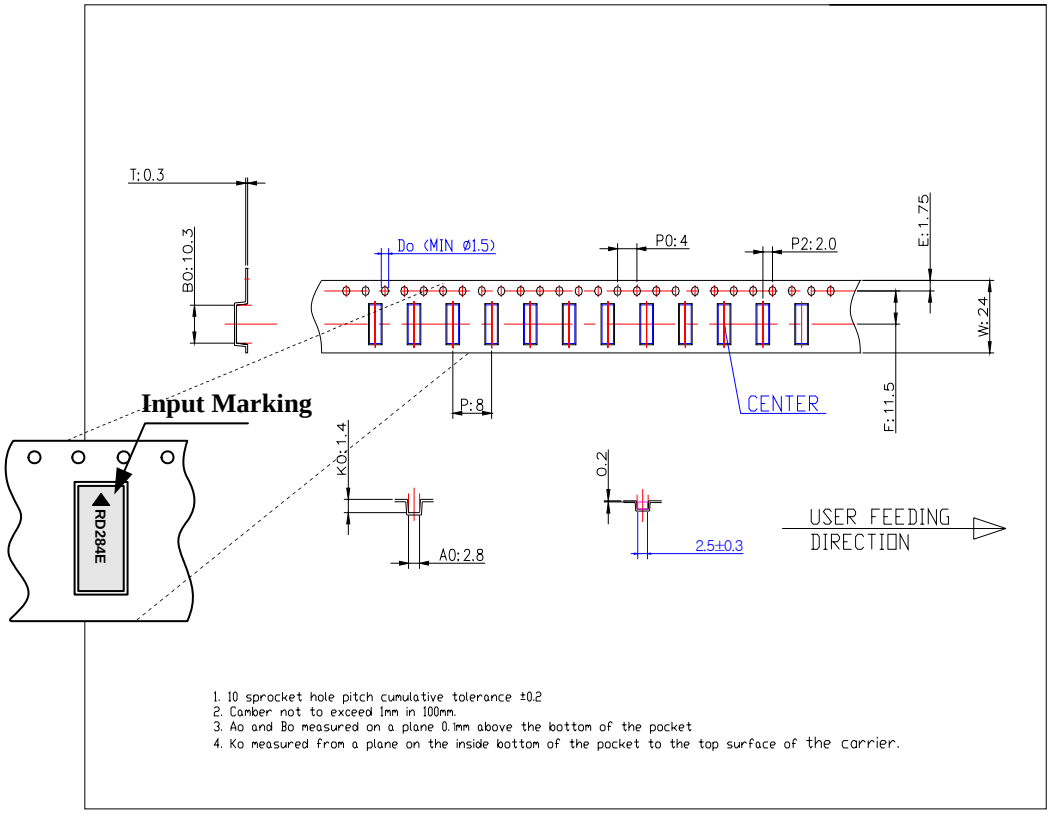
	Condition	Range of Temperature
Application temperature	Low	24hr normal action at -75℃
	High	24hr normal action at +150℃
Keeping temperature	Low	normal action when left for 1000hr at -75℃
	High	normal action when left for 1000hr at +85℃

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

15. Packing

15.1 Carrier/Reel

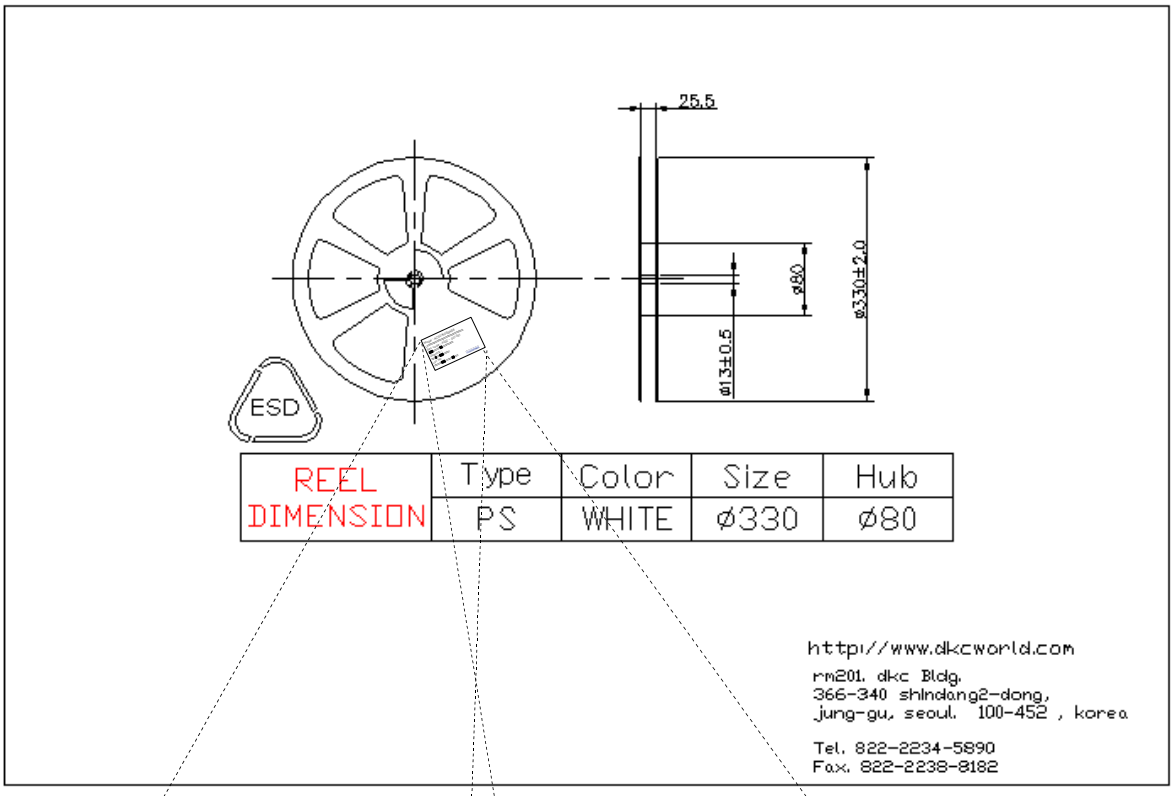
ITEM	Material	Surface Resistance	electrostatic emission	Packing method
Carrier tape	A-PET	Typical $10^8\Omega$	10V MAX	Heat press
Cover tape	PET	Typical $10^8\Omega$	30V MAX	
Reel	PS	Typical $10^8\Omega$	30V MAX	-

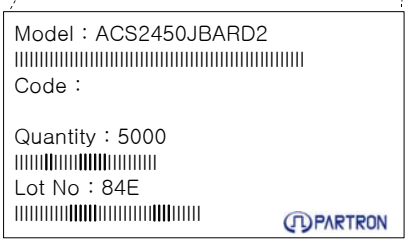


DKC DWG. No.	D-2408-005
DIMENSIONAL UNIT	MM
UNTOLERANCED DIMENSION	±0.1
CAD FILE NAME	041211
DESIGNED BY	K. M. C
SCALE	1/1
TITLE	CARRIER TAPE 2.5*10*1.2P

PART.	CARRIER TAPE
MATERIAL	A-PET
LENGTH	49.2M
COUNT	6150P

NAME	SPEC.
W	24.0±0.2
E	1.75±0.1
F	11.5±0.1
Do	1.5+0.1
P	8.0±0.1
Po	4.0±0.1
P2	2.0±0.1
Ao	2.8±0.1
Bo	10.3±0.1
Ko	1.4±0.1
T	0.3±0.05

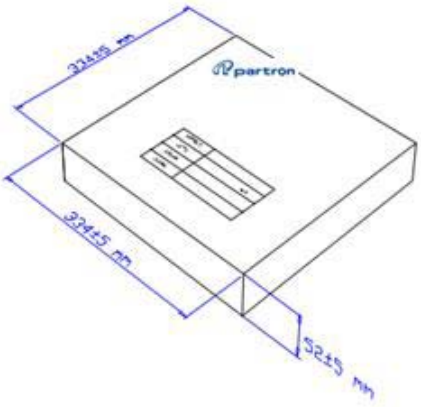

25.5
ø80
ø330±2.0
ø13±0.5
ESD
REEL DIMENSION
Type
Color
Size
Hub
PS
WHITE
ø330
ø80
http://www.dkcworld.com
rm201, dkc Bldg.
366-340 shindang2-dong,
jung-gu, seoul. 100-452 , korea
Tel. 822-2234-5890
Fax. 822-2238-8182


Model : ACS2450JBARD2
Code :
Quantity : 5000
Lot No : 84E
PARTRON

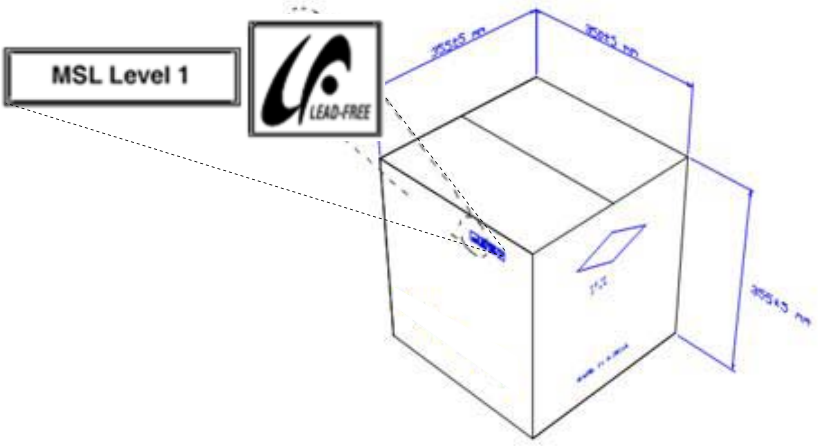

MSL Level 1


LEAD-FREE

15.2 BOX



Material : SK/S/K-B
Corrugated cardboard



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			
	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. 유해물질 성적서

1) Ceramic Powder

SGS

Test Report No. : CE/2007/76776 Date : 2007/08/03 Page : 1 of 3

FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-PREF. JAPAN.

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

Sample Description	:	MIXTURE OF MAGNESIUM SILICATE, STRONTIUM
Style/Item No.	:	MMS-08 (B)
Sample Receiving Date	:	2007/07/27
Testing Period	:	2007/07/27 TO 2007/08/03

Test Requested : In accordance with the RoHS Directive 2002/95/EC, and its amendment directives.

Test Method : With reference to IEC 62321, Ed.1 111/54/CDV Procedures for the Determination of Levels of Regulated Substances in Electrotechnical Products.

(1) Determination of Cadmium by ICP-AES.
(2) Determination of Lead by ICP-AES.
(3) Determination of Mercury by ICP-AES.
(4) Determination of Hexavalent Chromium for non-metallic samples by UV/Vis Spectrometry.
(5) Determination of PBB and PBDE by GC/MS.

Test Result(s) : Please refer to next page(s).

Daniel Yeh, M.P. / Operation Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

SGS

Test Report No. : CE/2007/76776 Date : 2007/08/03 Page : 2 of 3

FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-PREF. JAPAN.

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

Test Item (s):	Method (Refer to)	Result No.1	MDL
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
Sum of PBBs		n.d.	-
Monobromobiphenyl		n.d.	5
Dibromobiphenyl		n.d.	5
Tribromobiphenyl		n.d.	5
Tetrabromobiphenyl		n.d.	5
Pentabromobiphenyl		n.d.	5
Hexabromobiphenyl		n.d.	5
Heptabromobiphenyl		n.d.	5
Octabromobiphenyl		n.d.	5
Nonabromobiphenyl		n.d.	5
Decabromobiphenyl		n.d.	5
Sum of PBDEs (Mono to Nona) (Note 4)	(5)	n.d.	-
Monobromobiphenyl ether		n.d.	5
Dibromobiphenyl ether		n.d.	5
Tribromobiphenyl ether		n.d.	5
Tetrabromobiphenyl ether		n.d.	5
Pentabromobiphenyl ether		n.d.	5
Hexabromobiphenyl ether		n.d.	5
Heptabromobiphenyl ether		n.d.	5
Octabromobiphenyl ether		n.d.	5
Nonabromobiphenyl ether		n.d.	5
Decabromobiphenyl ether		n.d.	5
Sum of PBDEs (Mono to Deca)		n.d.	-

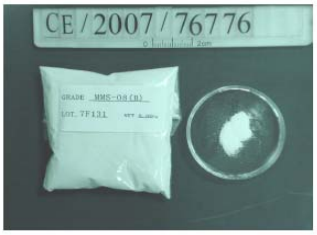
TEST PART DESCRIPTION:
NO.1 : OFF-WHITE POWDER

Note : 1. mg/kg = ppm
2. n.d. = Not Detected
3. MDL = Method Detection Limit
4. According to 2005/717/EC DecaBDE is exempt.
5. "-" = Not Regulated

SGS

Test Report No. : CE/2007/76776 Date : 2007/08/03 Page : 3 of 3

FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-PREF. JAPAN.



** End of Report **

2) Ag Paste

Intertek

TEST REPORT

Applicant : DAEJOO ELECTRONIC MATERIALS CO., LTD.
Address : SIHWA IND ESTATE 1RA 110, 1236-10, JEONGWANG-DONG, SIHEUNG-SI, KYUNGGI-DO, KOREA

Page: 1 of 2
Report No. RT08R-8260-001-R Date: Mar. 25, 2008

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

Name/Type of Product : Ag Paste
Name of Material : Ag Paste
Sample ID No. : RT08R-8260-001
Item No. : DNF8010CY80228
Manufacturer/Vender : DAEJOO ELECTRONIC MATERIALS CO., LTD.

Sample received : Mar. 19, 2008
Testing Date : Mar. 19, 2008 ~ Mar. 24, 2008
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (22 ~ 26) ℃ Relative Humidity: (55 ~ 65) %

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.
* Note 3 : The item no. is assigned by client and indicated according to their requirement and guarantee letter.

Tested by, Authorized by,

E.Y.Lee / Chemist H.W.Yoo / Lab Manager

Intertek Testing Center

Seoul Office : Tel : 02-2109-1250 Fax : 02-2109-1259 Gumi Office : Tel : 054-462-7647 Fax : 054-462-7657 Web Site : www.intertek.co.kr
Seoul Lab. : #709, 7Fl, Ace Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258
Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Intertek

TEST REPORT

Page: 2 of 2
Report No. RT08R-8260-001-R Date: Mar. 25, 2008

Sample ID No. : RT08R-8260-001
Sample Description : Ag Paste

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr^{6+})	mg/kg	US EPA 3060A and determined by UV-VIS	1	N.D.

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

* View of sample as received;-

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

Intertek Testing Center

Seoul Office : Tel : 02-2109-1250 Fax : 02-2109-1259 Gumi Office : Tel : 054-462-7647 Fax : 054-462-7657 Web Site : www.intertek.co.kr
Seoul Lab. : #709, 7Fl, Ace Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258
Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

3) Marking Ink

SGS

Test Report No. FS90501/LF-CTSAYA07-24109R1 Issued Date: November 06, 2007 Page 1 of 3

To: **IMAJE KOREA CO., LTD**
#1302 7th Daerung Techno Town 489-11
Gasan-dong
Geumcheon-gu
SEOUL
Korea

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

Product Name	: 5135E Black Ink
SGS File No.	: AYA07-24109R1
Received Date	: October 31, 2007
Test Performing Date	: November 01, 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)
Buyer(s)	: LG ELECTRONICS
Comments	: This Report cancels and supersedes the Report No.F690501/LF-CTSAYA07-24109 dated November 06, 2007 issued by SGS Testing Korea Co.,Ltd. The Item No/part No. had changed from Garnet to 5135E by customer's request.

SGS Testing Korea Co. Ltd.

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

Jeff Jang / Chemical Lab Mgr

F052 Version2

SGS

Test Report No. FS90501/LF-CTSAYA07-24109R1 Issued Date: November 06, 2007 Page 2 of 3

Sample No.	: AYA07-24109R1.001
Sample Description	: 5135E Black Ink
Item No./Part No.	: 5135E
Comments	: Material is butanone.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	5	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), UV	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Monobromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromodiphenyl ether	mg/kg	US EPA 3540C, 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

F052 Version2

SGS

Test Report No. FS90501/LF-CTSAYA07-24109R1 Issued Date: November 06, 2007 Page 3 of 3

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

F052 Version2