

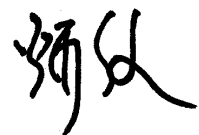



**MSL Level 1**
**ROHS-Y**

# Approval Sheet

Products	Dielectric Chip Antenna		
Customer	UTstarcom		
Model	GTX-75		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450ICAKNB		
UTstarcom	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
	04/23	04/23	04/23

**2008. 04. 23**


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](http://www.partron.co.kr)



MSL Level 1

ROHS-Y

# SPECIFICATION

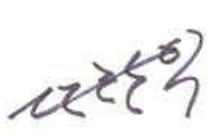

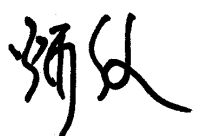
MODEL : ACS2450ICAKNB

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
04/23	04/23	04/23

2008. 04. 23

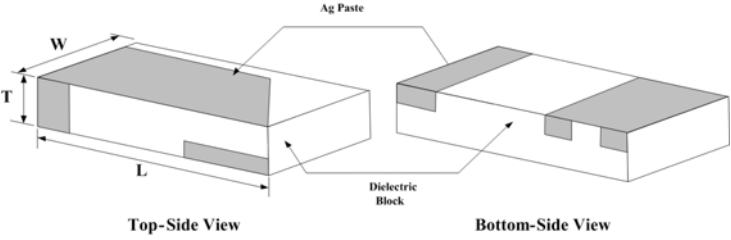
**- Contents -**

1. Revision History .....	4 p
2. Summary of Parts .....	5 p
3. Critical to Quality .....	5p
4. Electrical Characteristics .....	6 p
5. Measurement Process .....	11 p
6. Internal Block Diagram .....	13 p
7. Basis Action / Application Note .....	13 p
8. Measurement Jig SPEC .....	14 p
9. REFLOW PROFILE .....	15 p
10. Primary Inspection List .....	16 p
11. Reliability Condition .....	17 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

- 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 <sub>2</sub> SiO <sub>4</sub> (Magnesium Silicate)
	Electrode Paste	Ag
Size[mm]	W = 3.0±0.1	
	L = 9.0±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.

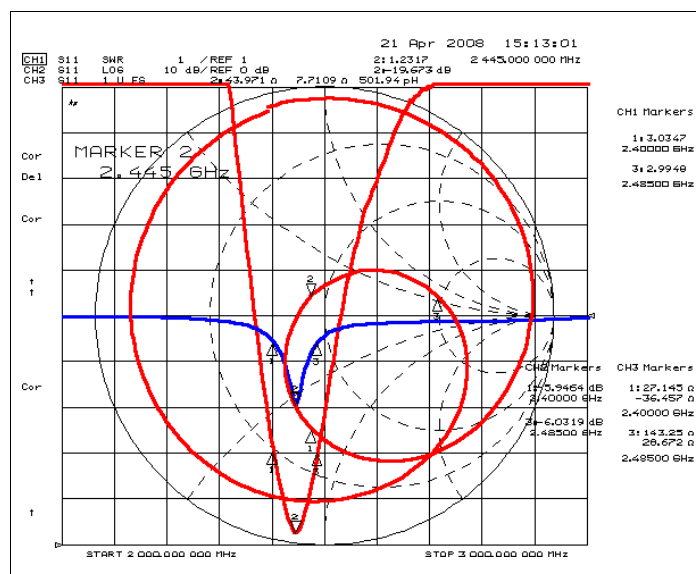
ITEM	Content
Keeping	Sealing tightly when keeping for a long time.
Action	Maybe characteristics changes when changing any design.

## 4. Electrical Characteristics

### 4.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3.5 : 1 (Typ 3.0 : 1)
Input Impedance [ $\Omega$ ]				50 Ohm
Polarization				Linear
Gain[dBi]	Total Gain ( Peak / Avg ) [dBi]			0.5 / -7.1
	Azimuth	Theta	Peak	-4.22
			Average	-9.96
		Phi	Peak	-1.48
			Average	-7.87
	Elevation 1	Theta	Peak	0.50
			Average	-4.18
		Phi	Peak	-2.19
			Average	-8.96
	Elevation 2	Theta	Peak	-4.75
			Average	-9.79
		Phi	Peak	-0.28
			Average	-5.25

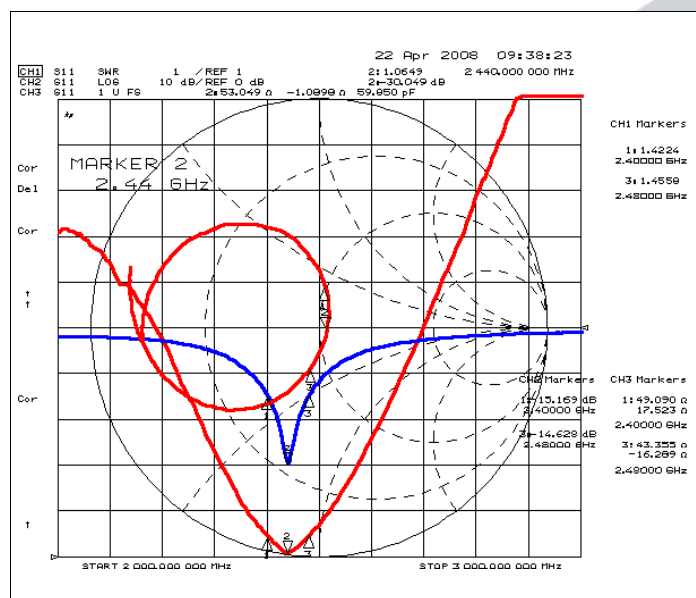
## 4.2 S11 Graph of Set Condition



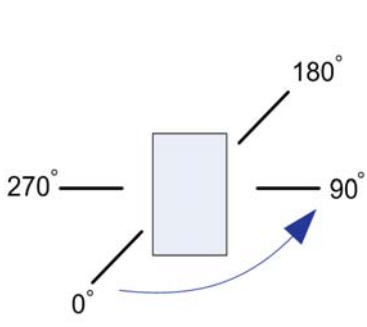
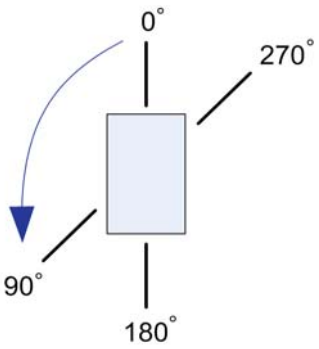
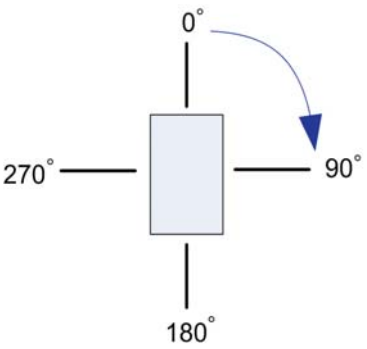
## 4.3 Test Fixture Condition

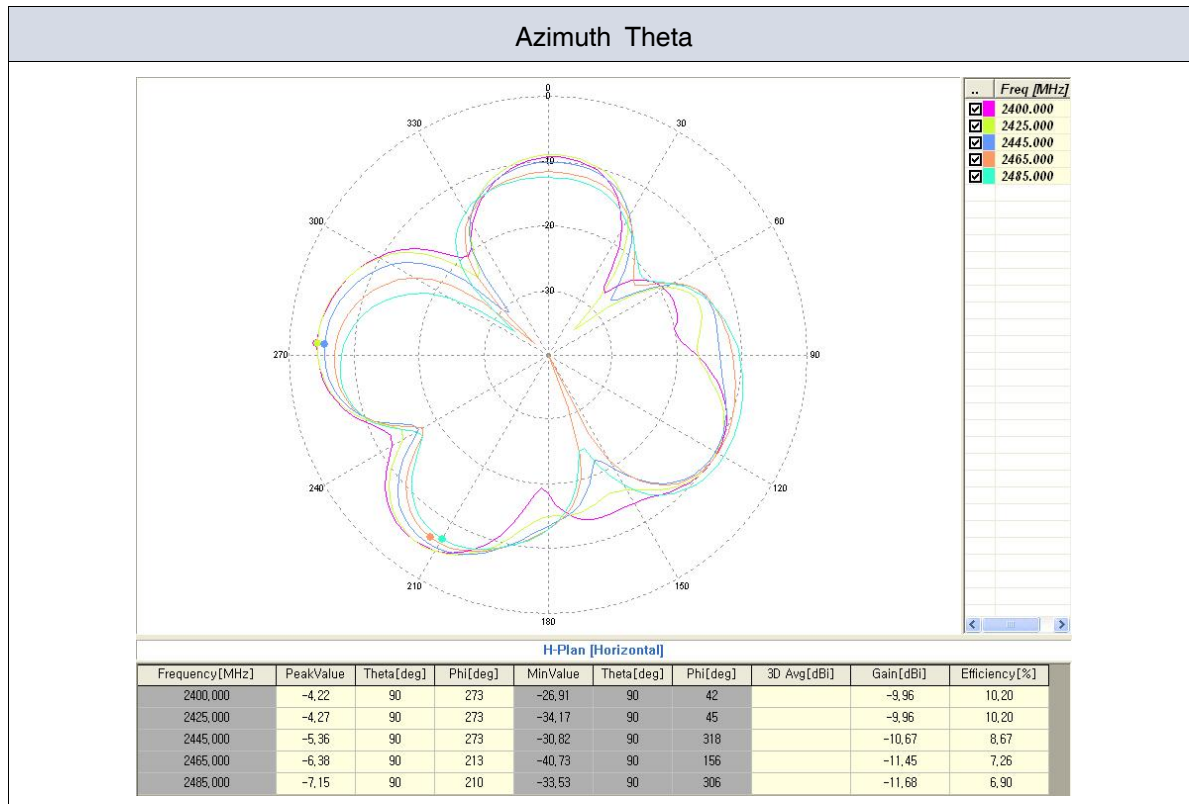
ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2480
Lower frequency(2400MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (Typ 2.5 : 1)
Upper frequency(2480MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (Typ 2.5 : 1)

## 4.4 S11 Graph of Test Fixture Condition CTQ



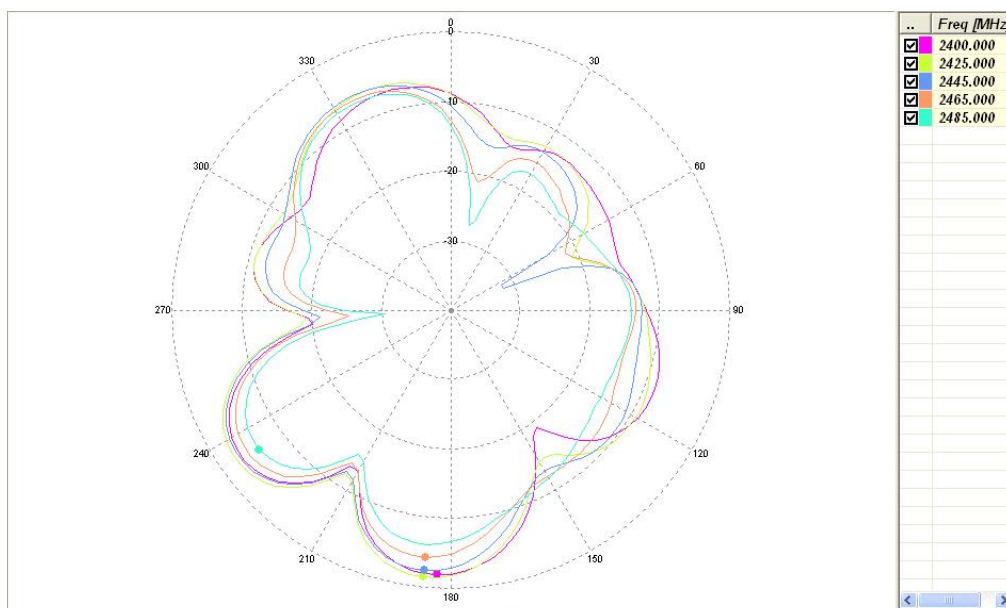
## 4.5 Radiation Pattern

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





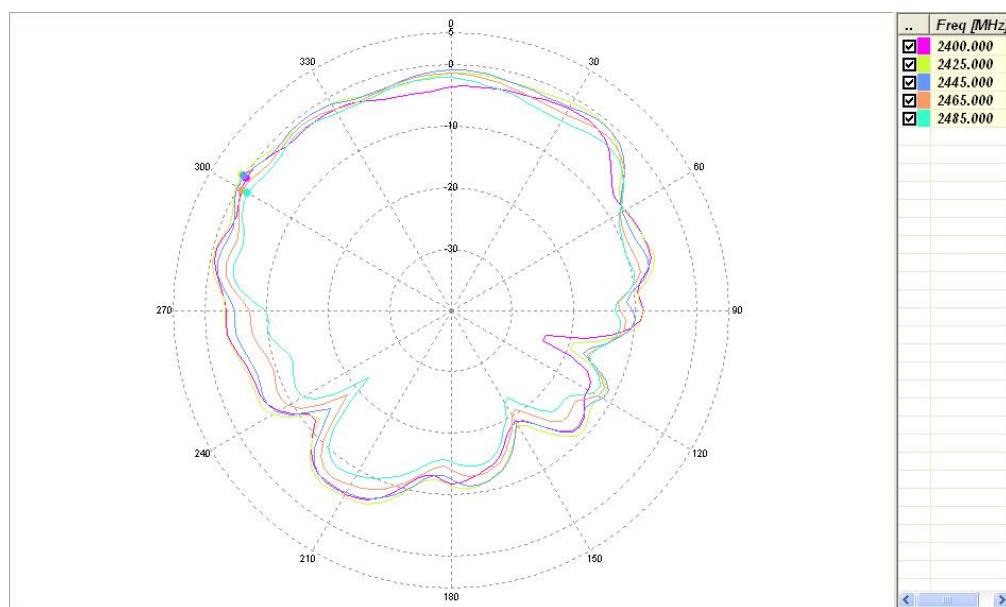
### Azimuth Phi



H-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-1,98	90	183	-19,91	90	264		-8,40	14,55
2425,000	-1,48	90	186	-20,97	90	66		-7,87	16,45
2445,000	-2,42	90	186	-31,84	90	63		-8,56	14,06
2465,000	-4,33	90	186	-25,23	90	267		-9,98	10,15
2485,000	-5,96	90	234	-30,46	90	267		-11,18	7,73

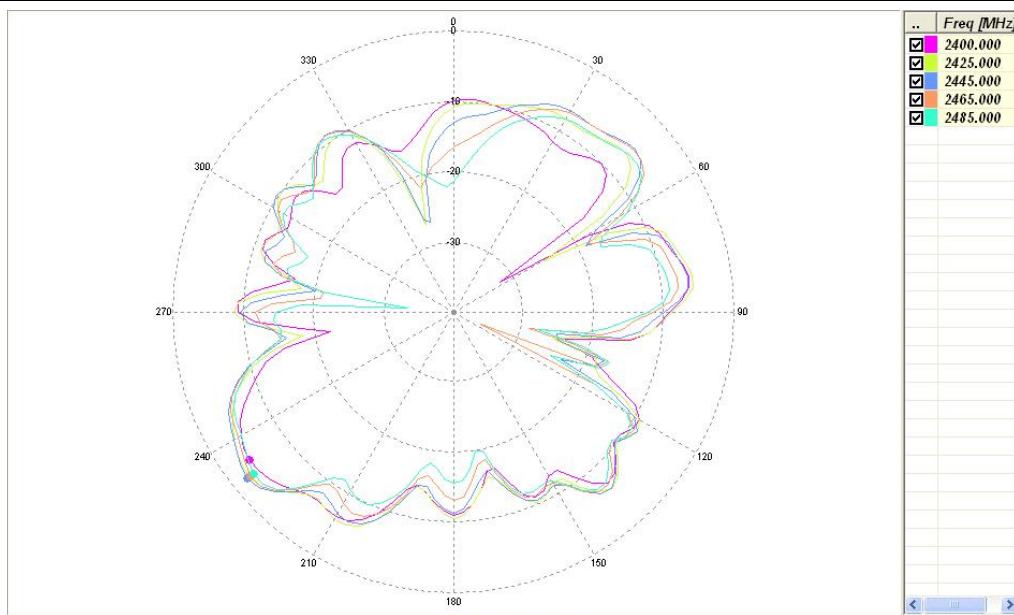
### Elevation1 Theta



E1-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-0,35	303	0	-24,33	108	0		-5,15	30,66
2425,000	0,50	303	0	-19,60	108	0		-4,18	38,32
2445,000	0,11	303	0	-18,96	150	0		-4,48	35,78
2465,000	-0,86	300	0	-20,83	147	0		-5,48	28,43
2485,000	-1,80	300	0	-23,13	147	0		-6,42	22,92

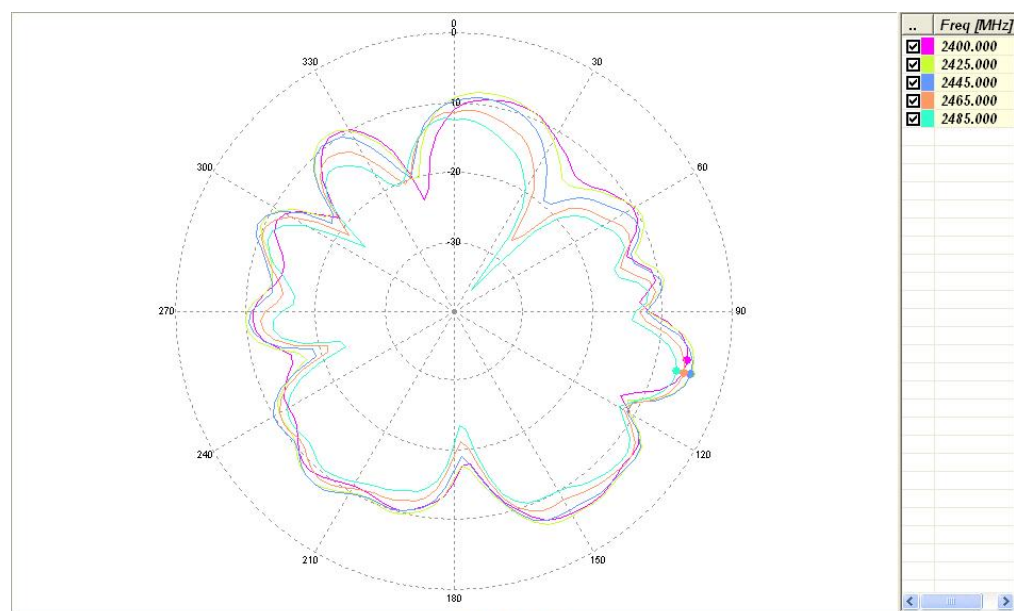
### Elevation1 Phi



E1-Plan [Horizontal]

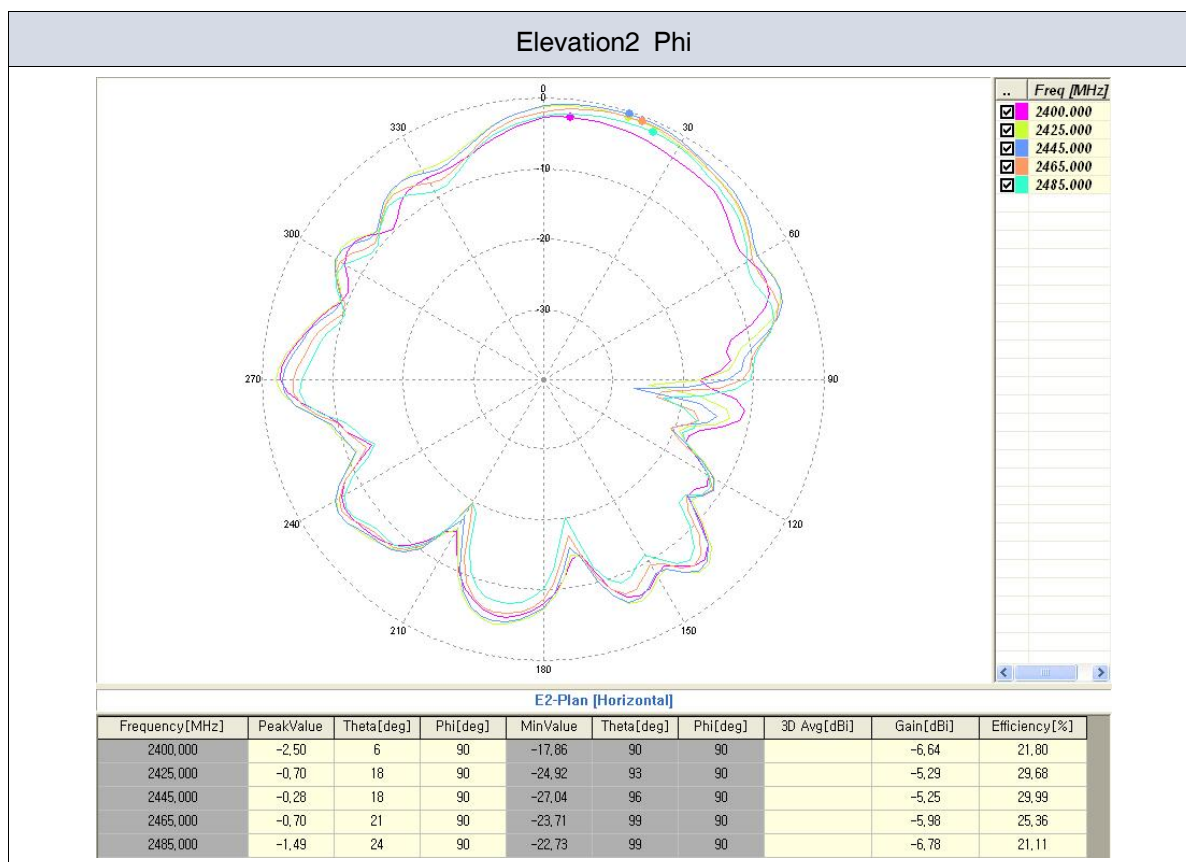
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-4.06	234	0	-32.12	57	0		-10.06	9.97
2425.000	-2.49	231	0	-26.77	342	0		-9.01	12.67
2445.000	-2.19	231	0	-26.68	345	0		-8.96	12.81
2465.000	-2.71	231	0	-35.71	114	0		-9.65	10.95
2485.000	-3.30	231	0	-33.39	276	0		-10.43	9.16

### Elevation2 Theta



E2-Plan [Vertical]

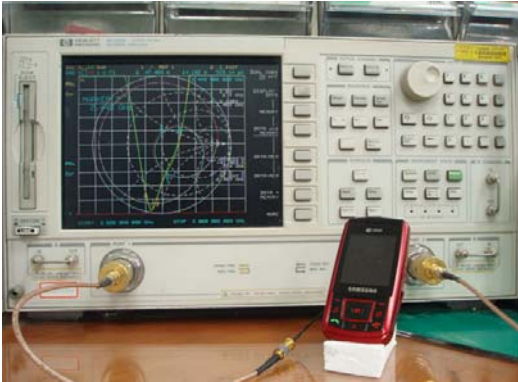
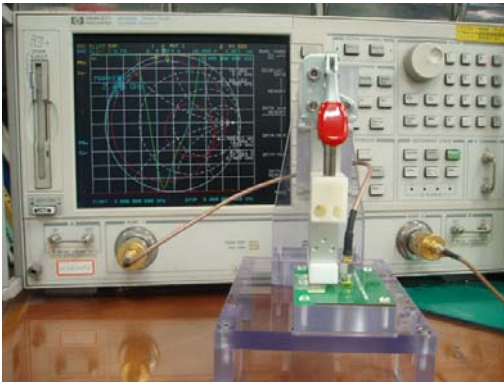
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-5.71	102	90	-23.34	345	90		-10.48	9.06
2425.000	-4.75	105	90	-19.96	345	90		-9.79	10.62
2445.000	-4.80	105	90	-19.73	342	90		-10.21	9.64
2465.000	-5.78	105	90	-26.73	39	90		-11.51	7.18
2485.000	-6.89	105	90	-35.98	39	90		-12.72	5.45



## 5. Measurement Process

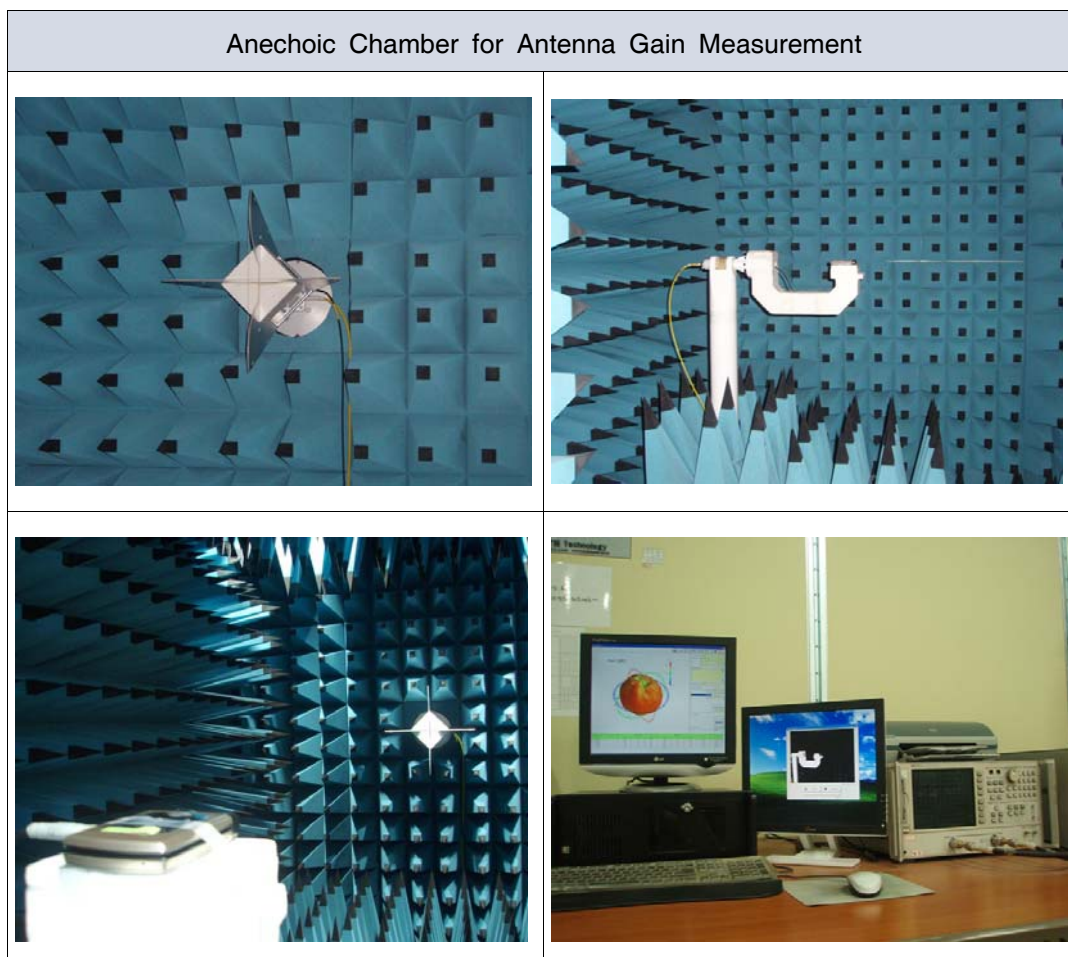
### 5.1 SWR/Return loss

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

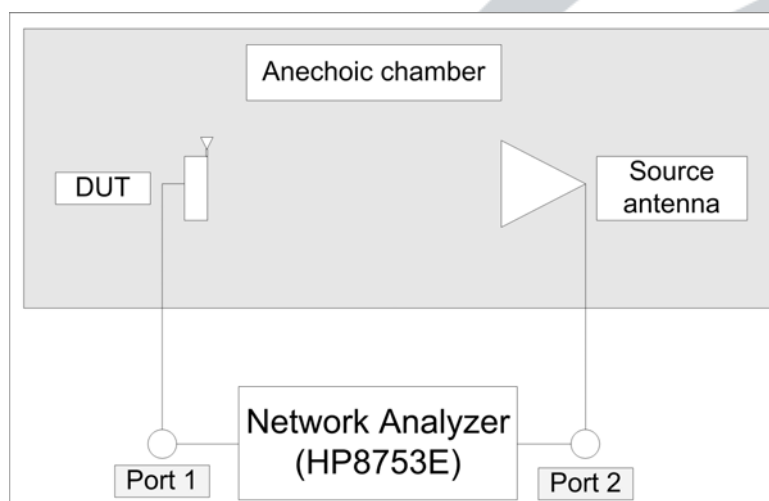
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

## 5.2 Gain

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



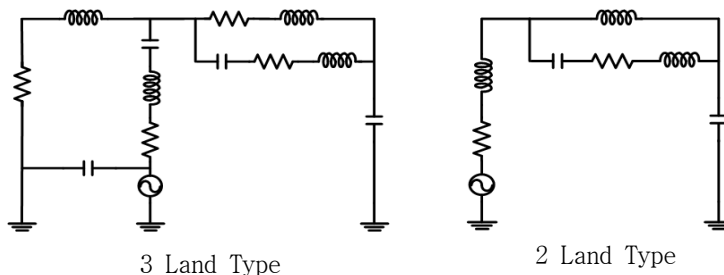
## 5.3 Gain test block diagram





## 6. Internal Block Diagram

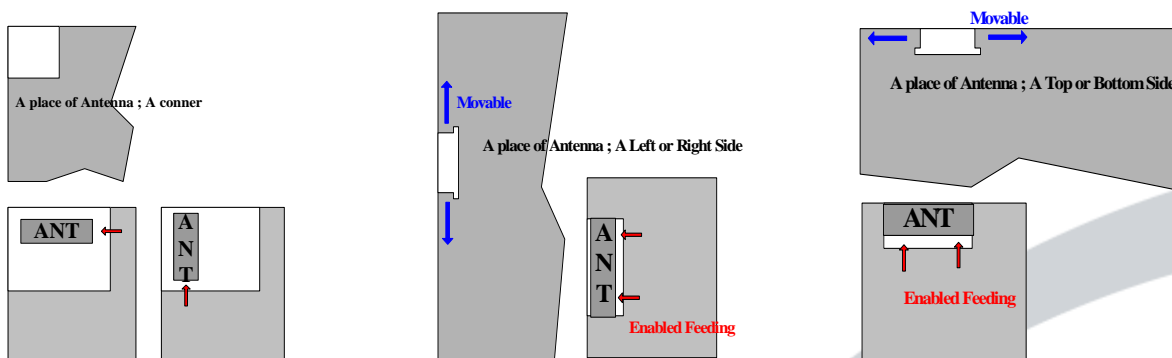
This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



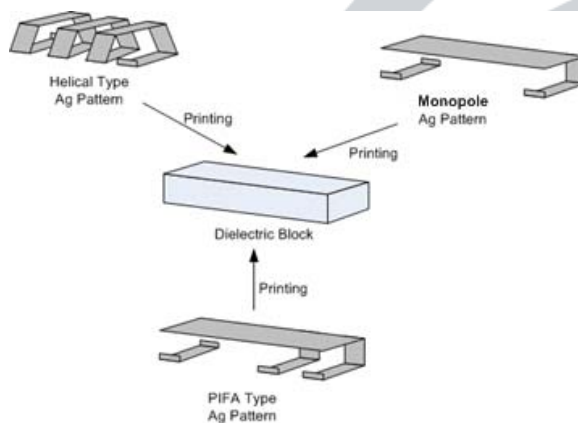
## 7. Basis Action / Application Note

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,

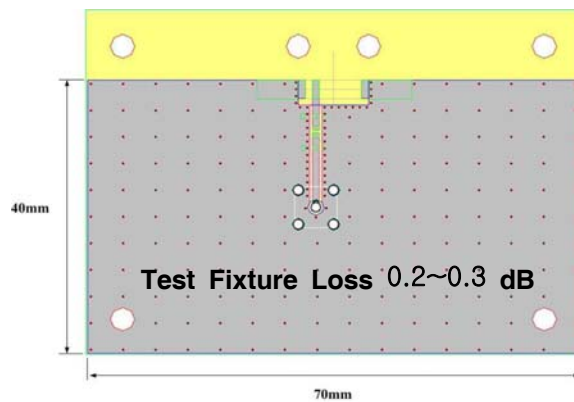


As the following, this product is easy to revise the various types for the boundary condition.



## 8. Measurement Jig SPEC

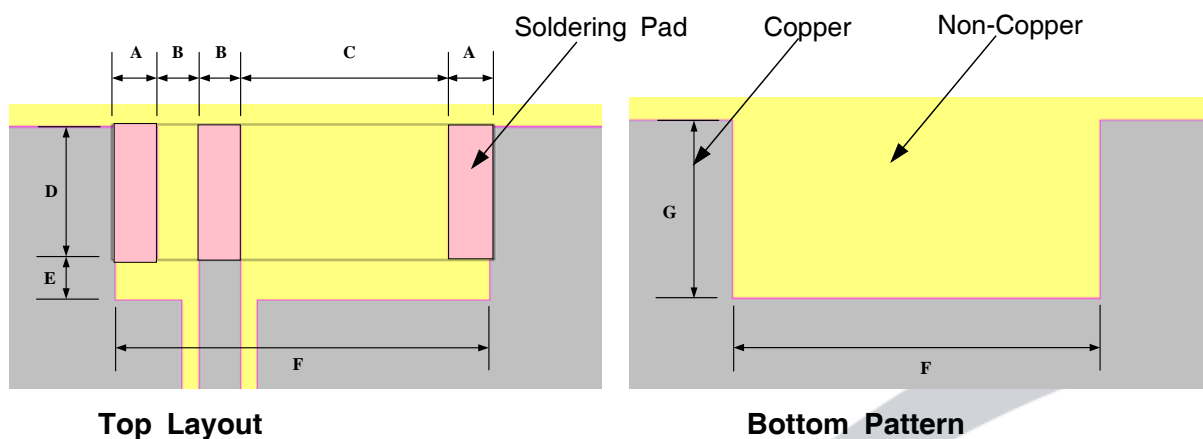
### 8.1 Test Fixture And GROUND Condition



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

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

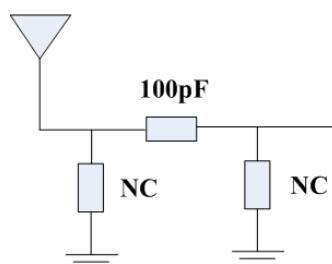
### 8.2 PCB Layout & Soldering Pad Dimension



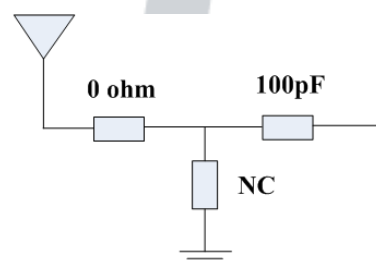
Parameter	A	B	C	D	E	F	G
Value[mm]	1.1	1.0	5.0	3.2	1.0	9.0	4.0

Unit ; mm  
Unless specified tolerances are  $\pm 0.1$

### 8.3 Matching Circuit And Reference Value



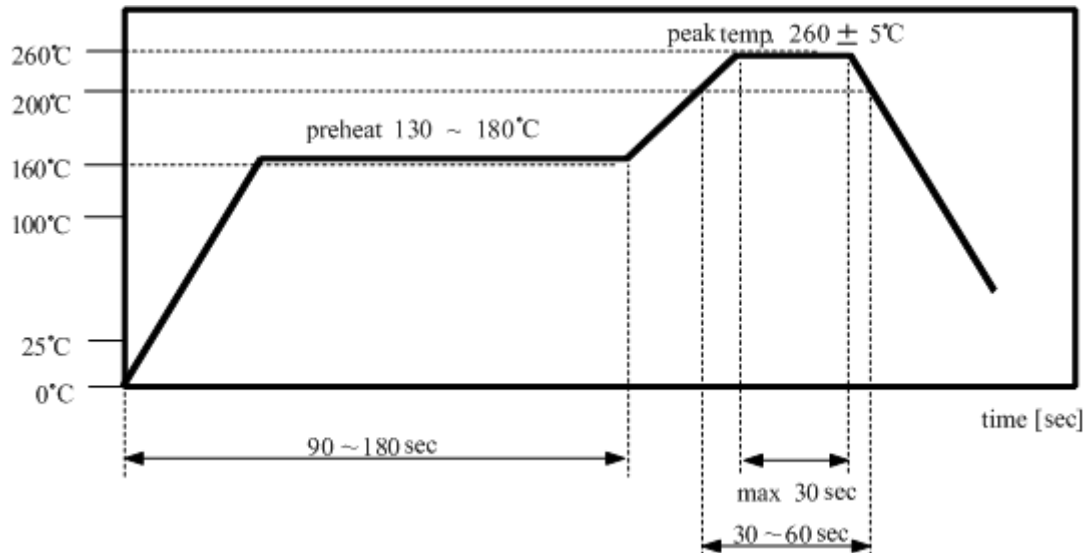
$\pi$  Matching



T Matching

## 9. REFLOW PROFILE

### 9.1 Reflow Soldering



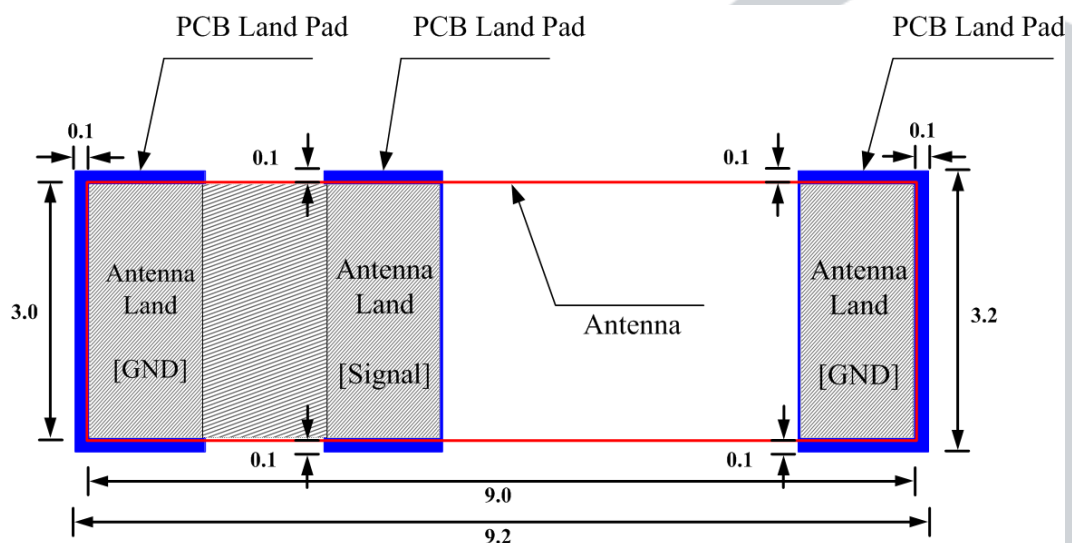
### 9.2 Manual Soldering

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 3.0:1 MAX		W=3.0±0.1	L=9.0±0.1	T=1.2±0.1
	2400MHz	2480MHz			
1	1.39	1.40	3.01	9.00	1.21
2	1.40	1.40	3.01	9.01	1.21
3	1.49	1.32	3.01	9.01	1.21
4	1.42	1.36	3.03	9.00	1.20
5	1.36	1.42	3.01	8.99	1.21
6	1.43	1.33	3.02	8.99	1.20
7	1.32	1.40	3.01	9.01	1.22
8	1.47	1.29	3.01	9.03	1.21
9	1.38	1.34	3.00	9.02	1.23
10	1.41	1.39	3.01	9.01	1.21
11	1.38	1.45	3.02	9.01	1.22
12	1.41	1.40	3.01	9.00	1.21
13	1.34	1.42	3.02	9.01	1.21
14	1.42	1.35	3.02	9.03	1.21
15	1.42	1.37	3.01	9.03	1.20
16	1.32	1.44	3.01	9.01	1.21
17	1.37	1.43	3.01	9.00	1.21
18	1.46	1.36	3.00	8.99	1.20
19	1.37	1.43	3.01	9.02	1.22
20	1.38	1.39	3.01	9.01	1.21
Min	1.32	1.29	3.00	8.99	1.20
Max	1.49	1.45	3.03	9.03	1.23
X	1.39	1.38	3.01	9.01	1.21
σ	0.05	0.04	0.01	0.01	0.01
Cpk	2.85	2.92	4.16	2.39	3.88
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 <sup>m/s²</sup> (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

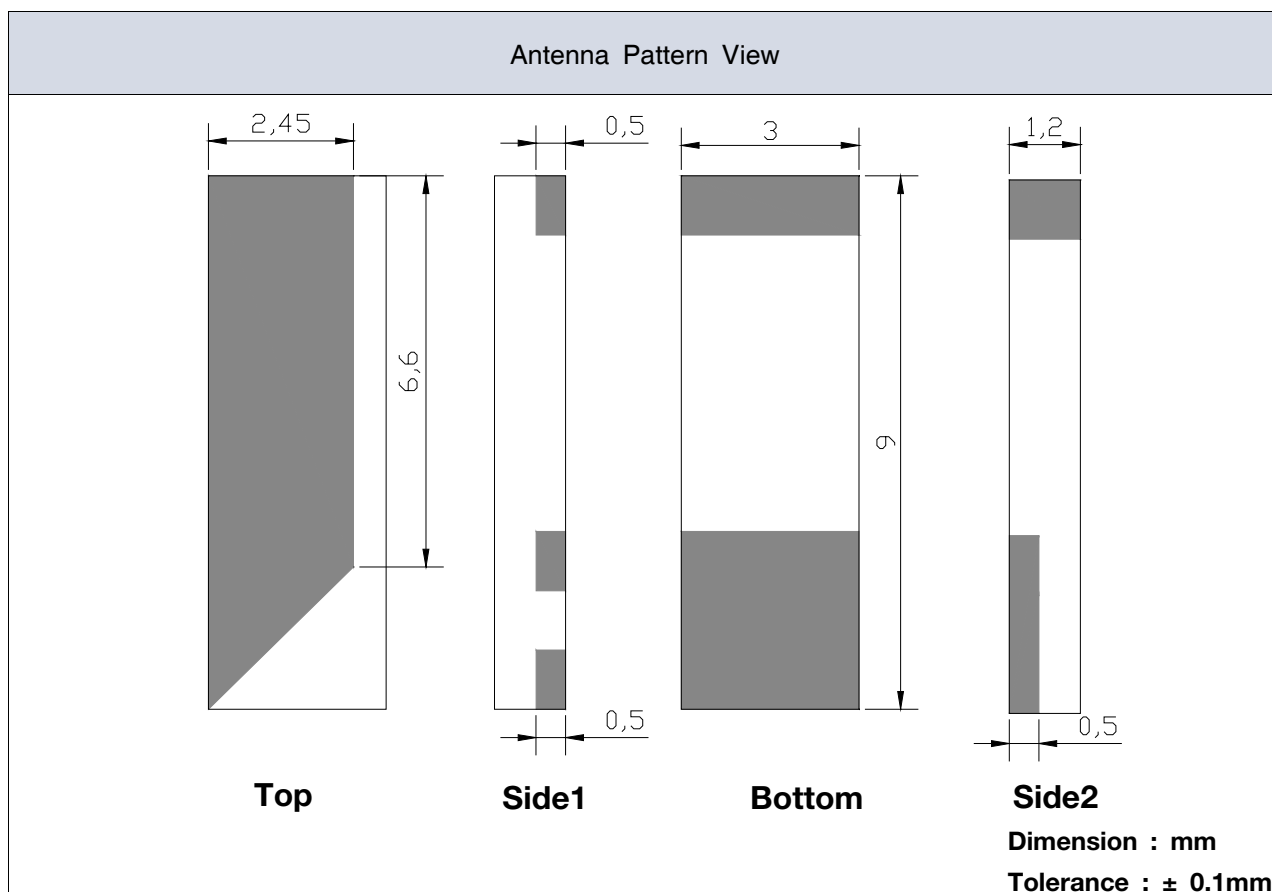
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30℃/85%RH	168+5/-0	= < 85℃/85%RH

#### 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

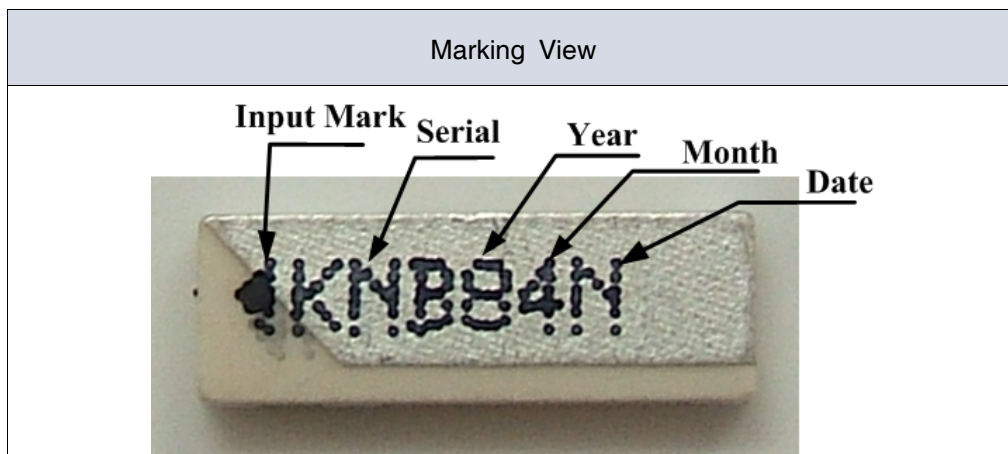


## 12.2 Lot number notation

<b>8</b>	<b>4</b>	<b>N</b>
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 ····

## 12.3 Marking



◀	<u>K</u>	<u>N</u>	<u>B</u>	<u>8</u>	<u>4</u>	<u>N</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 ····

## 12.4 Marking type

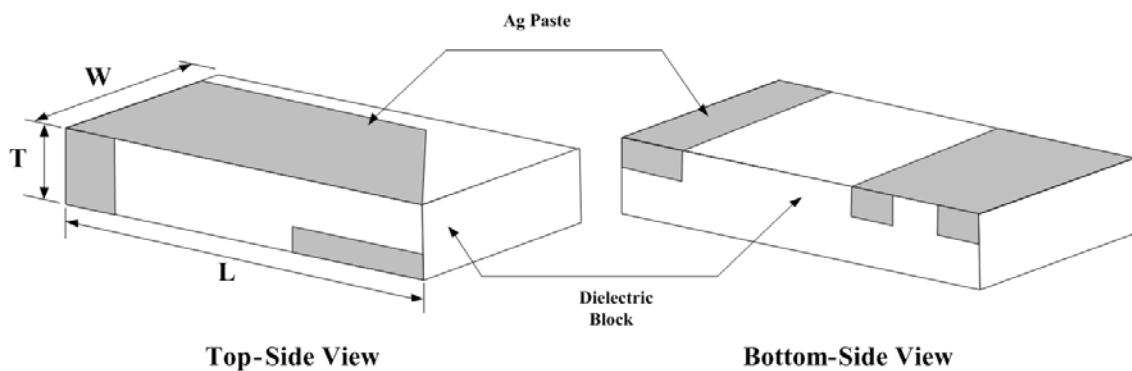
Ink marking - Using Black Ink

## 13. Structure and Material

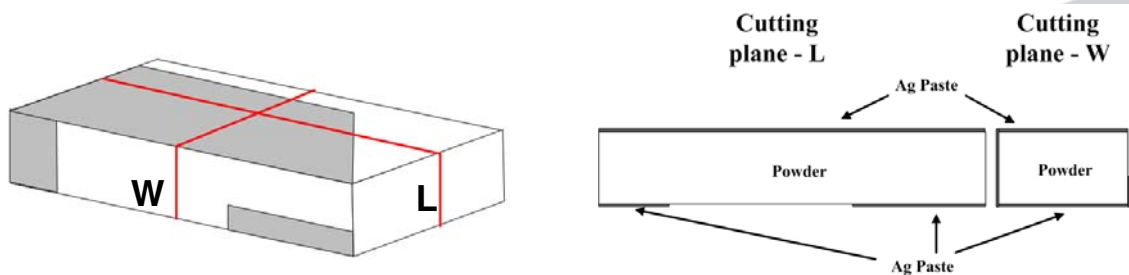
### 13.1 materialization method

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 $\mu$ m
PAD	Ag paste	DAEJOO	Thickness : Min 10 $\mu$ m (TYP 16~20 $\mu$ 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℃

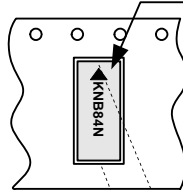
\* Because of the keeping temperature problem, no admission when left over +85℃

## 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	-

Input Marking



NO.	S16W064
-----	---------

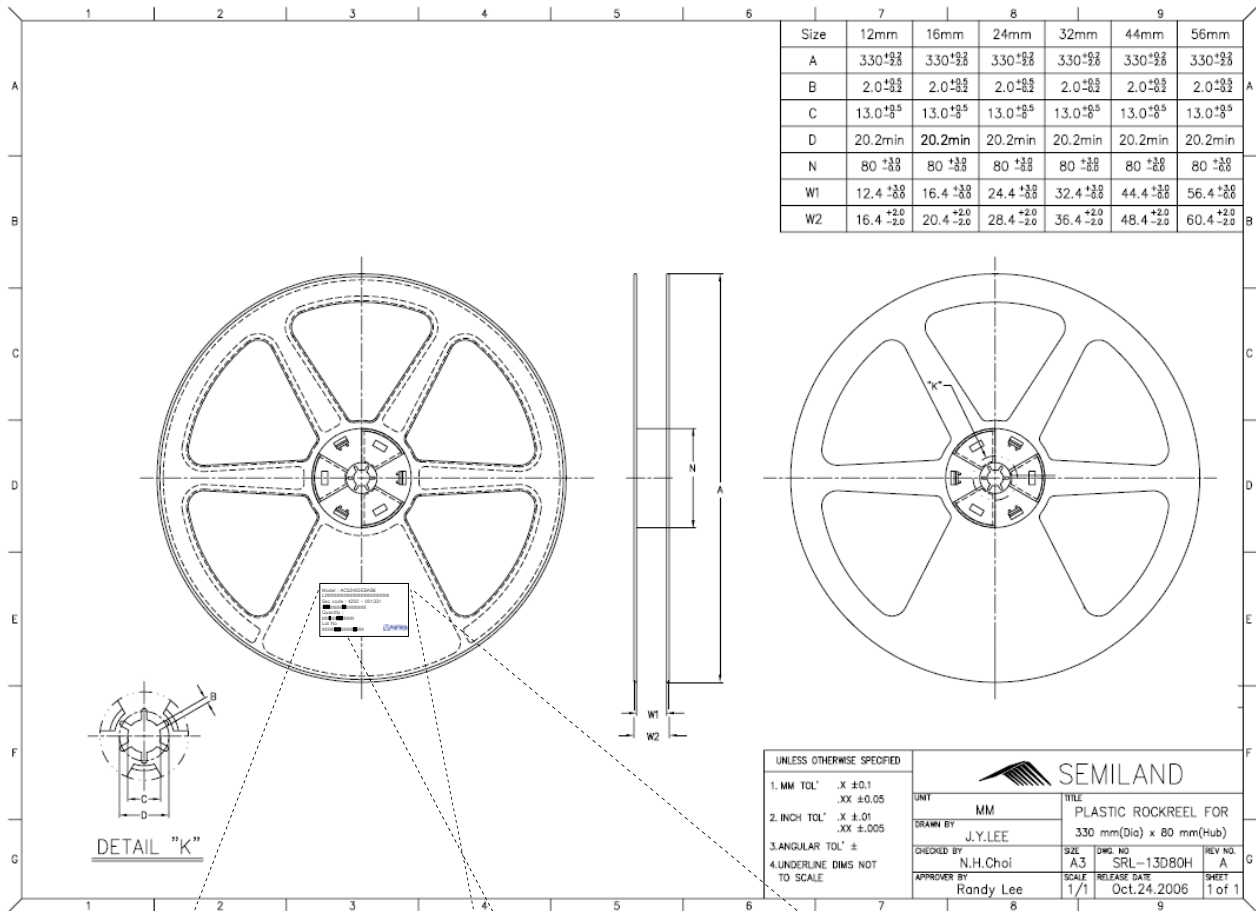
TAPING STYLE

PACKING QUANTITY

6100 PCS / REEL

A0	3.30 ± 0.10	E	1.75 ± 0.10
B0	9.30 ± 0.10	F	7.50
K0	1.30 ± 0.10	t	0.30 ± 0.05
D0	1.55 ± 0.05	w	16.00 ± 0.30

Scale	N/S	Unit	m/m	Customer & Title
Date	2008			동명테크 ( )
Designed by	Checked by	approved by	에스.엠.티 Surface Mount Technology Co.	



Model : ACS2450ICAKNB

Quantity : 5000

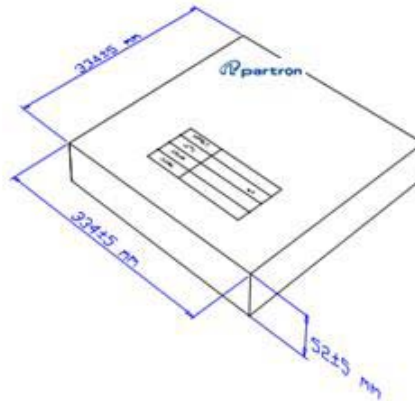
Lot No : 84N

**PARTRON**

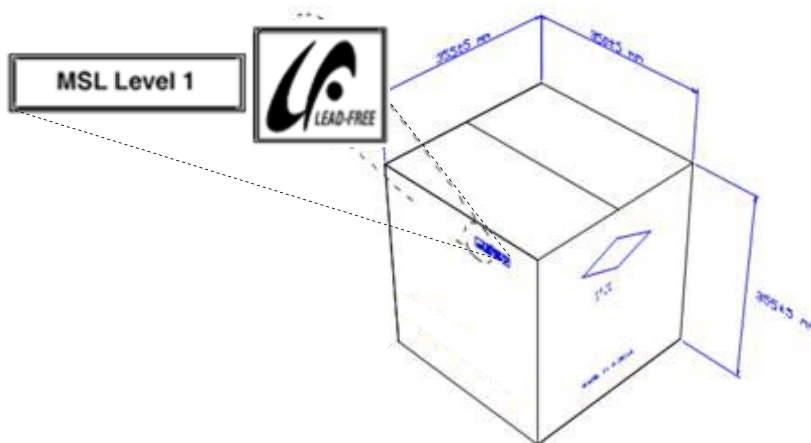
**MSL Level 1**



## 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					
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				
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
	○		Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
		○	Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
		◇	aspect inspection						aspect	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
		○	MARKING	Marking Machine					marking	Reference SPL	Visual Inspection	all	Lot card production diary	Rework Exhaust
		◇	Electrical Characteristic	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/2hour	C/sheet	Electrical Characteristic	refer to Guide Sheet	Network	all	Lot card production diary	Exhaust repair
		◇	aspect inspection						aspect dimension	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
Carrier cover reel		○	Taping						Quantity Direction aspect	refer to Guide Sheet	Manual	all	Lot card production diary	Rework
		◇	shipper inspection	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/person	C/sheet	Electrical Characteristic aspect packing	refer to Guide Sheet	Network microscope Visual Inspection	refer to Guide Sheet	Result Paper	return Exhaust
packing box label		○	packing	bar code printer					packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	Rework
		◇	packing inspection						packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	return

## 17. RoHS Data

### 1) Ceramic Powder

Parts Name	White Powder(MMS-08)
Tester Organization	SGS TAIWAN LTD.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

**SGS**

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

FUJII TITANIUM IND. CO., LTD.  
12-6, 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 (S)  
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).

*David Yen, M.A. Operation Manager*  
Signed for and on behalf of  
SGS TAIWAN LTD.  
Chemical Laboratory - Taipei

The content of this PCF file is in accordance with the original issued reports for reference only. This Test Report cannot be reproduced, except in full, without prior written permission of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.  
SGS Taiwan Ltd. (L08750) NO. 125-1, Wu Tung Road, Wulai Industrial Zone, Taipei county, Taiwan. 0800-228893/08 0800-22 2288-3227 www.sgs.com.tw

**SGS**

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

FUJII TITANIUM IND. CO., LTD.  
12-6, 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
Tri bromobiphenyl		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
Tri bromobiphenyl 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

The content of this PCF file is in accordance with the original issued reports for reference only. This Test Report cannot be reproduced, except in full, without prior written permission of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.  
SGS Taiwan Ltd. (L08750) NO. 125-1, Wu Tung Road, Wulai Industrial Zone, Taipei county, Taiwan. 0800-228893/08 0800-22 2288-3227 www.sgs.com.tw

**SGS**

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

FUJII TITANIUM IND. CO., LTD.  
12-6, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-PREF. JAPAN.

CE/2007/76776

GRADE: MMS-08 (S)  
LOT: 77431

End of Report

The content of this PCF file is in accordance with the original issued reports for reference only. This Test Report cannot be reproduced, except in full, without prior written permission of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.  
SGS Taiwan Ltd. (L08750) NO. 125-1, Wu Tung Road, Wulai Industrial Zone, Taipei county, Taiwan. 0800-228893/08 0800-22 2288-3227 www.sgs.com.tw

2) Ag Paste

Parts Name	Silver Paste
Tester Organization	Intertek
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

**Intertek**

**TEST REPORT**

Applicant : DAEJOO ELECTRONIC MATERIALS CO., LTD.  
Address : SIHWA IND ESTATE 1RA 110, 1236-10, SEONGWANG-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:-

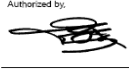
Name/Type of Product : Ag Paste  
Name of Material : Ag Paste  
Sample ID No. : RT08R-8260-001  
Item No. : DNF801OCY80228  
Manufacturer/Vender : DAEJOO ELECTRONIC MATERIALS CO., LTD.

Sample received : Mar. 19, 2008  
Testing Date : Mar. 19, 2008 ~ Mar. 24, 2008  
Testing Laboratory : Intertek Testing Center  
Testing Environment : Temperature : ( 22 ~ 26 ) °C 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:   
E.Y. Lee / Chemist

Authorized by:   
H.W. Yoo / Lab Manager

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

**Intertek Testing 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](http://www.intertek.co.kr)  
Seoul Lab : #906, 7/F, Ase Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258  
Ulsan Lab : #940-2, Yongsan-Rd, Chongryang-Myeon, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

**Intertek**


**TEST REPORT**

Report No. RT08R-8260-001-R Page: 2 of 2  
Sample ID No. : RT08R-8260-001 Date: Mar. 25, 2008  
Sample Description : Ag Paste

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 <sup>6+</sup> )	ppm	US EPA 3060A and determined by UV-VIS	1	N.D.

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

\* View of sample as received:



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

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

**Intertek Testing 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](http://www.intertek.co.kr)  
Seoul Lab : #906, 7/F, Ase Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258  
Ulsan Lab : #940-2, Yongsan-Rd, Chongryang-Myeon, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

### 3) Marking Ink

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

**SGS**  
**Test Report No. F690501LF-CTSA7A07-24109R1** Issued Date: November 05, 2007 Page 1 of 3

To: **MAJE KOREA CO., LTD**  
 #1302 7th Daerang Techno Town 459-11  
 Gajun-dong  
 Guro-gu  
 Seoul  
 Korea

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

Product Name : S135E 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 supercedes the Report No.F690501LF-CTSA7A07-24109 dated November 05, 2007 issued by SGS Testing Korea Co.,Ltd. The Item No/Part No. had changed from Garnet to S135E by customer's request.

SGS Testing Korea Co. Ltd.  
 Pluto Kim  
 Monal Jeong  
 Binny Oh / Testing Person

Jeff Jang / Chemical Lab Mgr

This document is issued by the Company subject to its General Conditions of Service printed on request or available on request and accessible at [www.sgs.com](http://www.sgs.com). Attention is drawn to the limitation of liability, interpretation and jurisdictional issues defined therein. Unless otherwise stated the results shown in this test report shall only be for the sample(s) tested. This document cannot be reproduced except in full, without prior approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

F692 Version2

**SGS**  
**Test Report No. F690501LF-CTSA7A07-24109R1** Issued Date: November 05, 2007 Page 2 of 3

Sample No. : AYA07-24109R1.001  
 Sample Description : S135E Black Ink  
 Item No./Part No. : S135E  
 Comments : Material is butanone.

**Hazardous Metals**

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 8210B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(1996), US EPA 8210B(1996), ICP	2	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 8210B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), UV	1	N.D.

**Phthalates and Bisphenol A**

Test Items	Unit	Test Method	MDL	Results
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.
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

This document is issued by the Company subject to its General Conditions of Service printed on request or available on request and accessible at [www.sgs.com](http://www.sgs.com). Attention is drawn to the limitation of liability, interpretation and jurisdictional issues defined therein. Unless otherwise stated the results shown in this test report shall only be for the sample(s) tested. This document cannot be reproduced except in full, without prior approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

F692 Version2

**SGS**  
**Test Report No. F690501LF-CTSA7A07-24109R1** Issued Date: November 05, 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

This document is issued by the Company subject to its General Conditions of Service printed on request or available on request and accessible at [www.sgs.com](http://www.sgs.com). Attention is drawn to the limitation of liability, interpretation and jurisdictional issues defined therein. Unless otherwise stated the results shown in this test report shall only be for the sample(s) tested. This document cannot be reproduced except in full, without prior approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this report is unlawful and offenders may be prosecuted to the fullest extent of the law.

F692 Version2