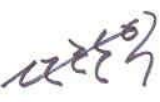

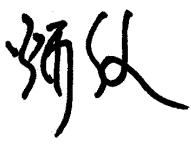



**MSL Level 1**
**ROHS-Y**

# Approval Sheet

Products	Dielectric Chip Antenna		
Customer	Wise & Blue		
Model	WBM-220		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450ICAWB2		
Wise & Blue	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
	06/05	06/05	06/05

**2007. 06. 05**


33 Banwol-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)



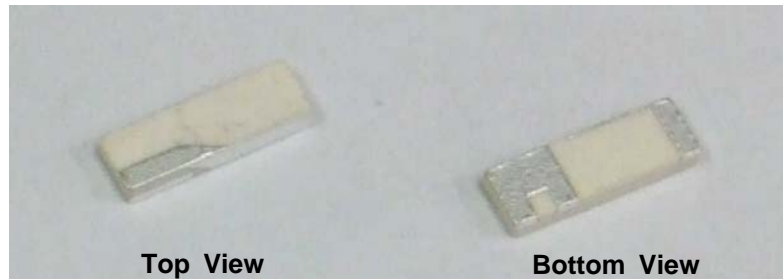
MSL Level 1


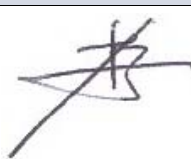
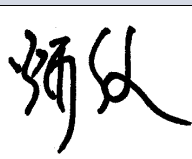
ROHS-Y

# SPECIFICATION

MODEL : ACS2450ICAWB2

3D Structure



By designed	By checked	By approved
		
Research 5 Team	Quality Assurance	Laboratory
Chanik.Jeon	Kwang-Gyu.Lee	Byoung-Jun.Yim
06/05	06/05	06/05

2007. 06. 05

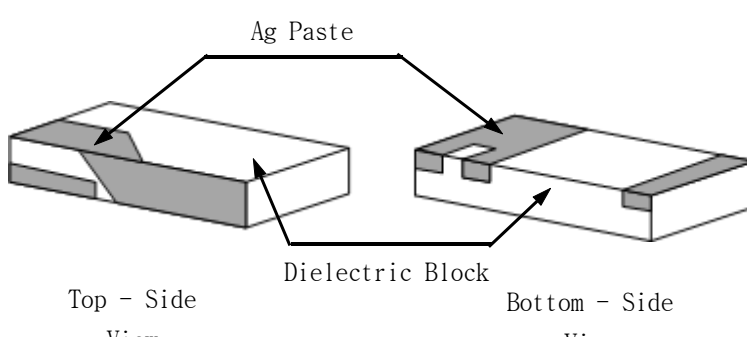
**- Contents -**

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## 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

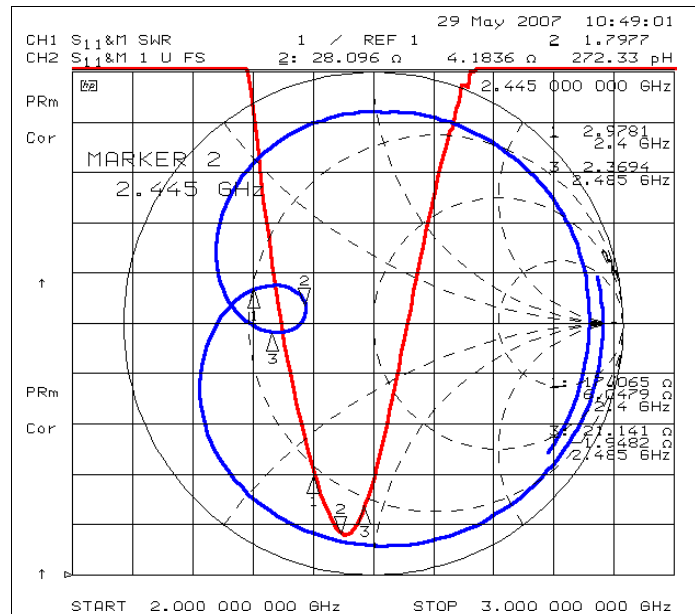
### 4.1 Single Element SPEC

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
SWR [Max]	3 : 1 (Typ 2 : 1)
Input Impedance [ $\Omega$ ]	50
Polarization	Linear
Gain (Peak / Avg) [dBi]	2.5 / 0
Temperature [ $^{\circ}\text{C}$ ]	-40 ~ +80
Humidity [%]	At the normal temperature, RH 100

### 4.2 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3 : 1 (Typ 2.5 : 1)
Input Impedance [ $\Omega$ ]				50 Ohm
Polarization				Linear
Gain[dBi]	Total Gain ( Peak / Avg ) [dBi]			-0.8 / -3.2
	Azimuth	Theta	Peak	1.18
			Average	-1.76
		Phi	Peak	-10.82
			Average	-16.08
	Elevation 1	Theta	Peak	-6.80
			Average	-11.76
		Phi	Peak	2.18
			Average	-1.45
	Elevation 2	Theta	Peak	-7.73
			Average	-12.74
		Phi	Peak	2.70
			Average	-1.52

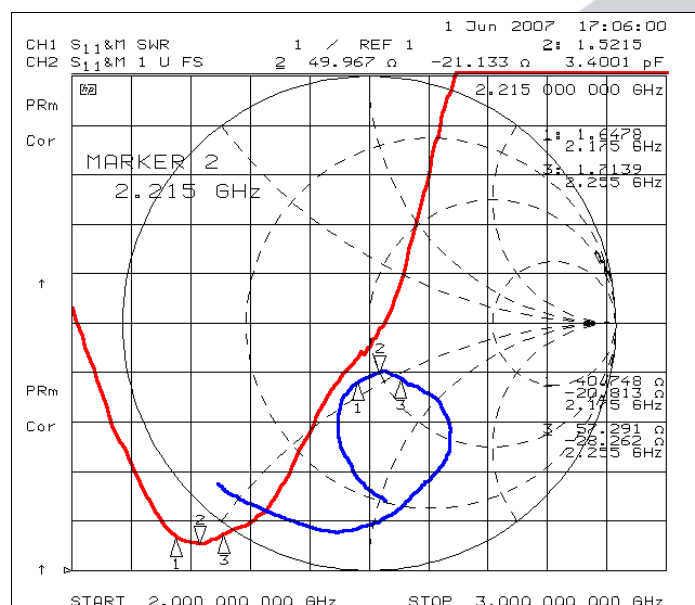
#### 4.3 S11 Graph of Set Condition



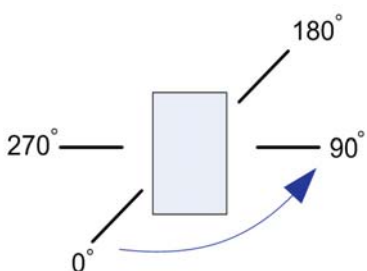
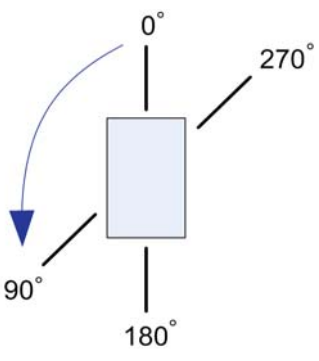
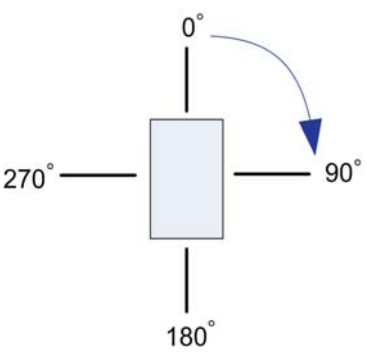
#### 4.4 Test Fixture Condition

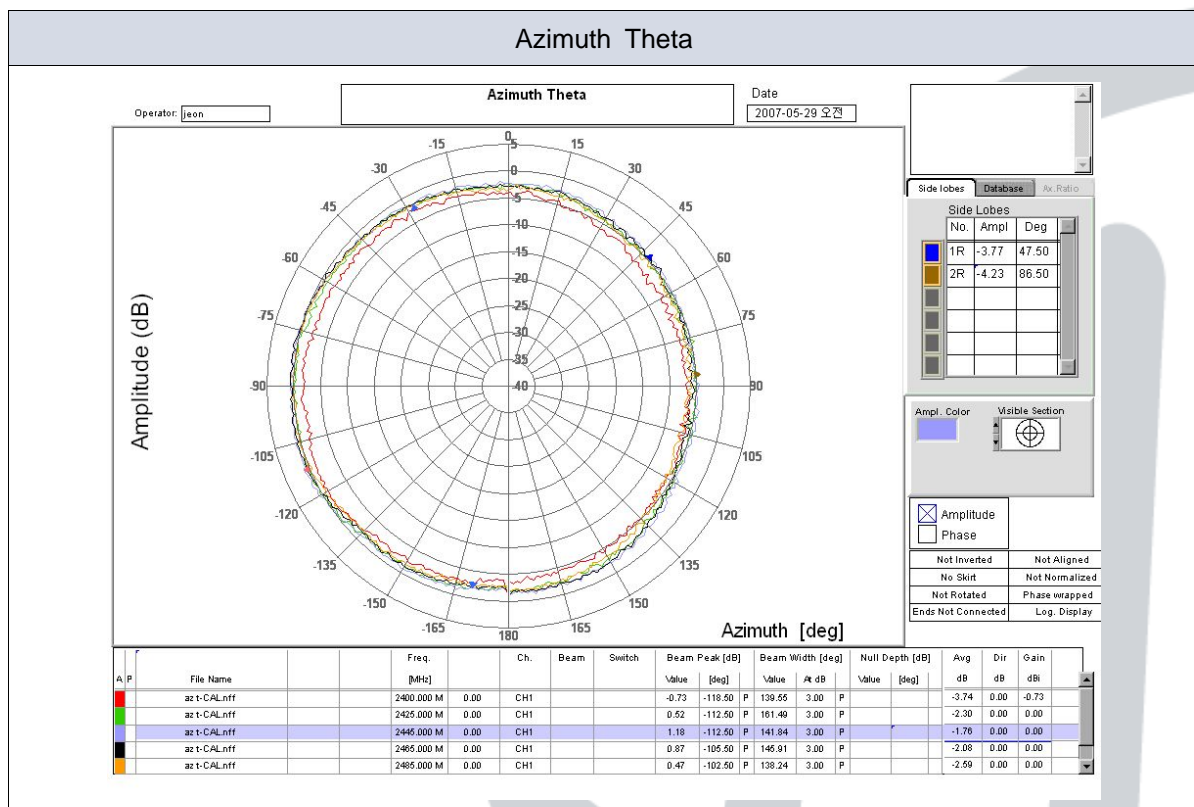
ITEM	SPEC
Frequency Range [MHz]	2175 ~ 2255
Lower frequency(MHz) SWR [Min~Max]	1.5 ~ 3.0 : 1 (Typ 2.0 : 1)
Upper frequency(MHz) SWR [Min~Max]	1.5 ~ 3.0 : 1 (Typ 2.0 : 1)

#### 4.5 S11 Graph of Test Fixture Condition CTQ

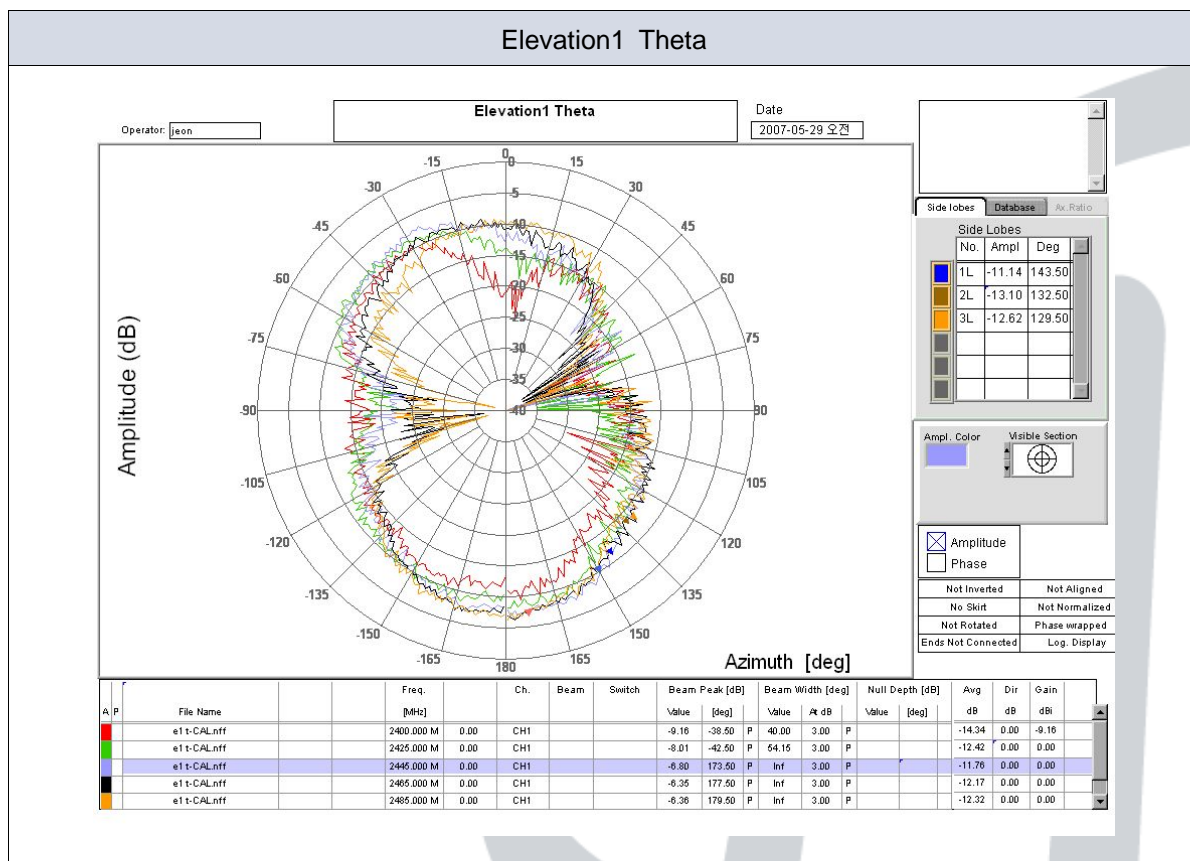
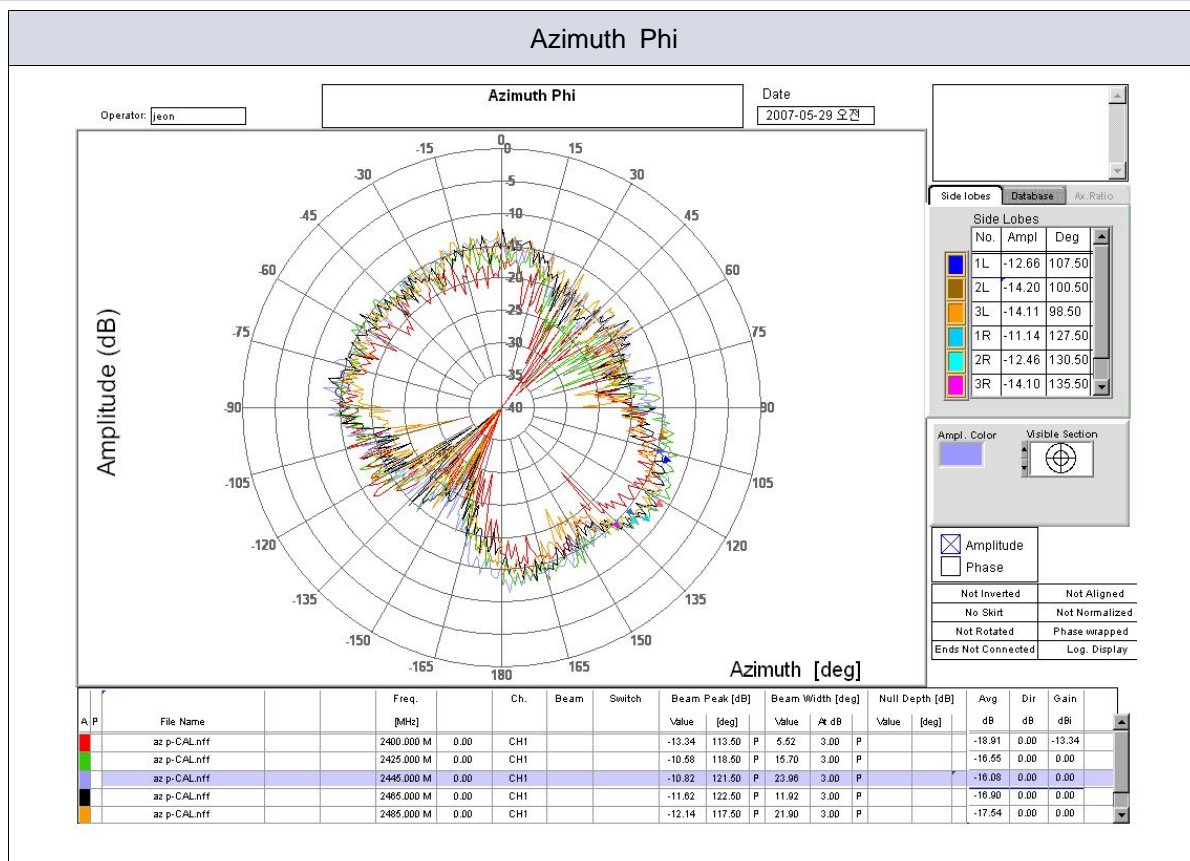


#### 4.6 Radiation Pattern

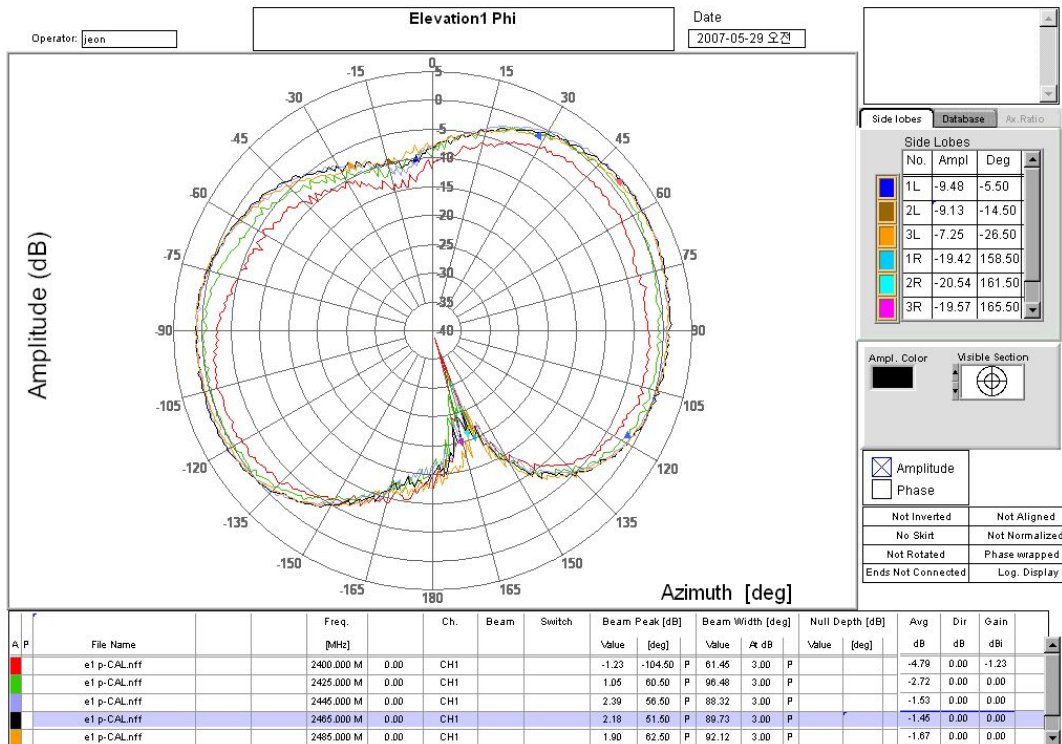
Azimuth Plane	Elevation1 Plane	Elevation2 Plane
		
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	



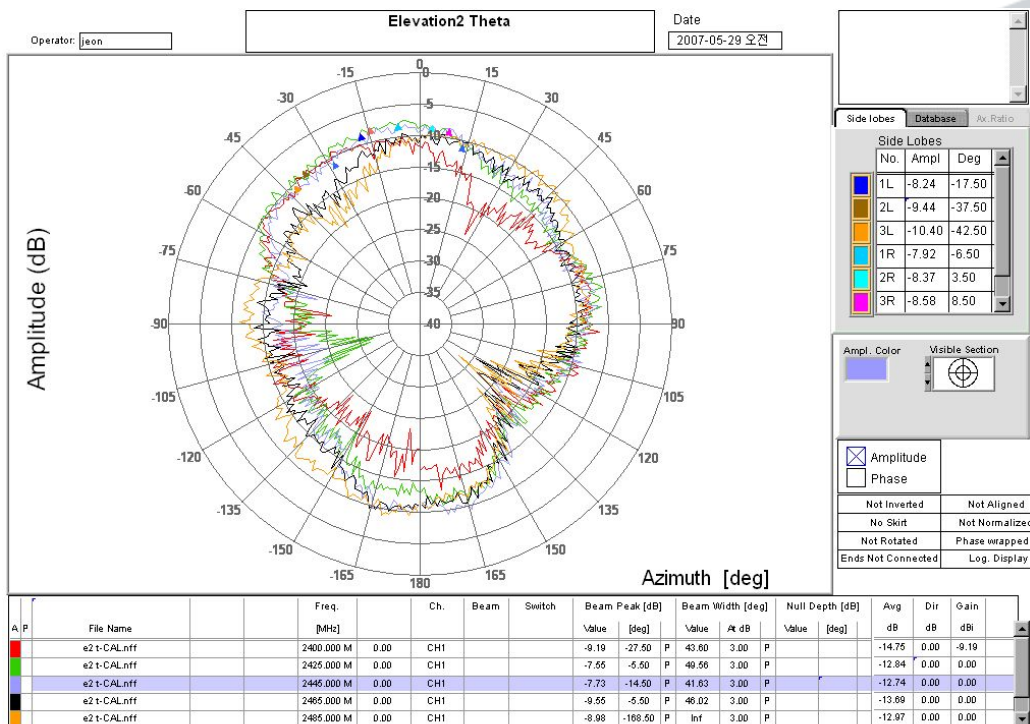


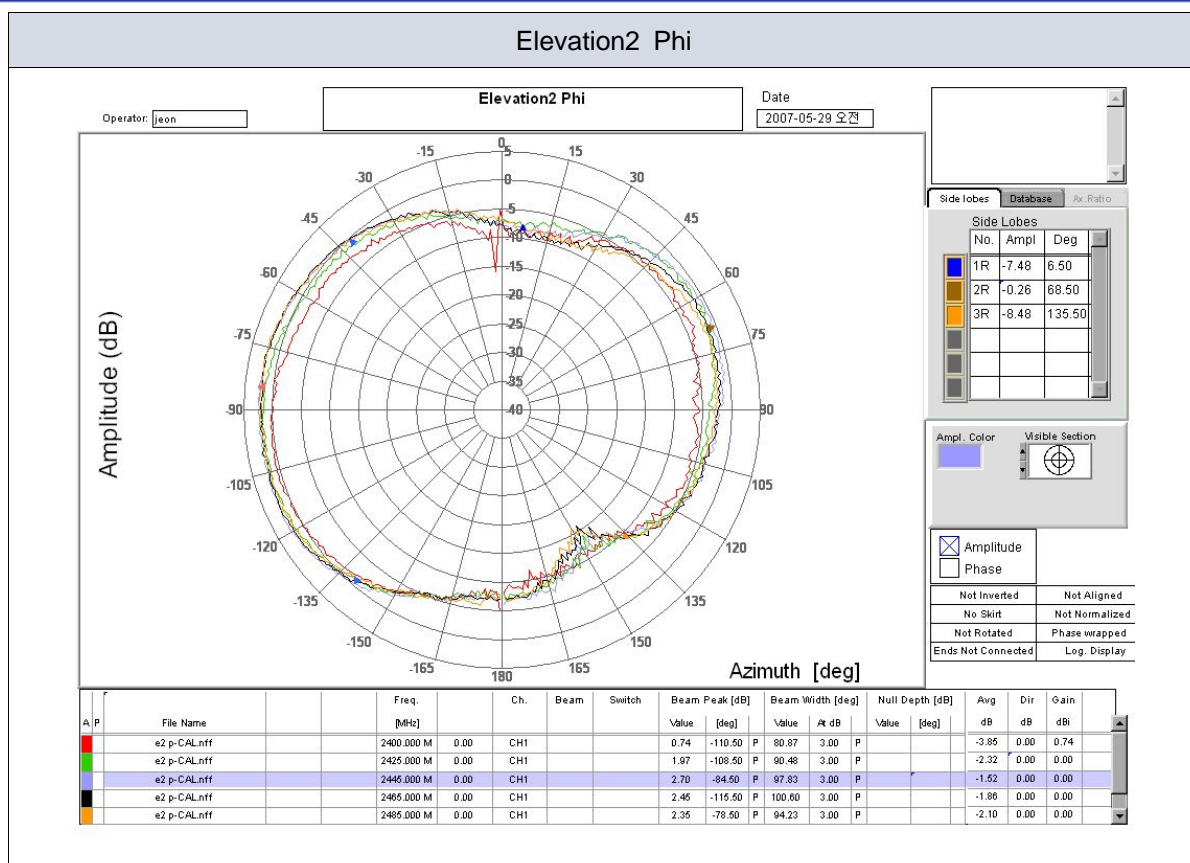


### Elevation1 Phi



### Elevation2 Theta

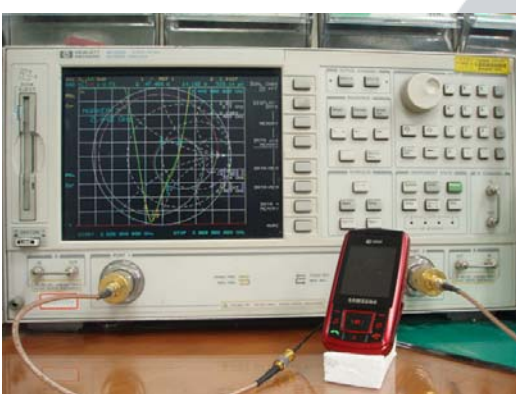
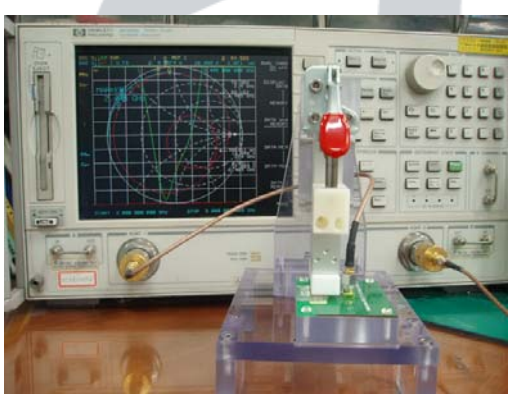




## 5. Measurement Process

### 5.1 SWR/Return loss

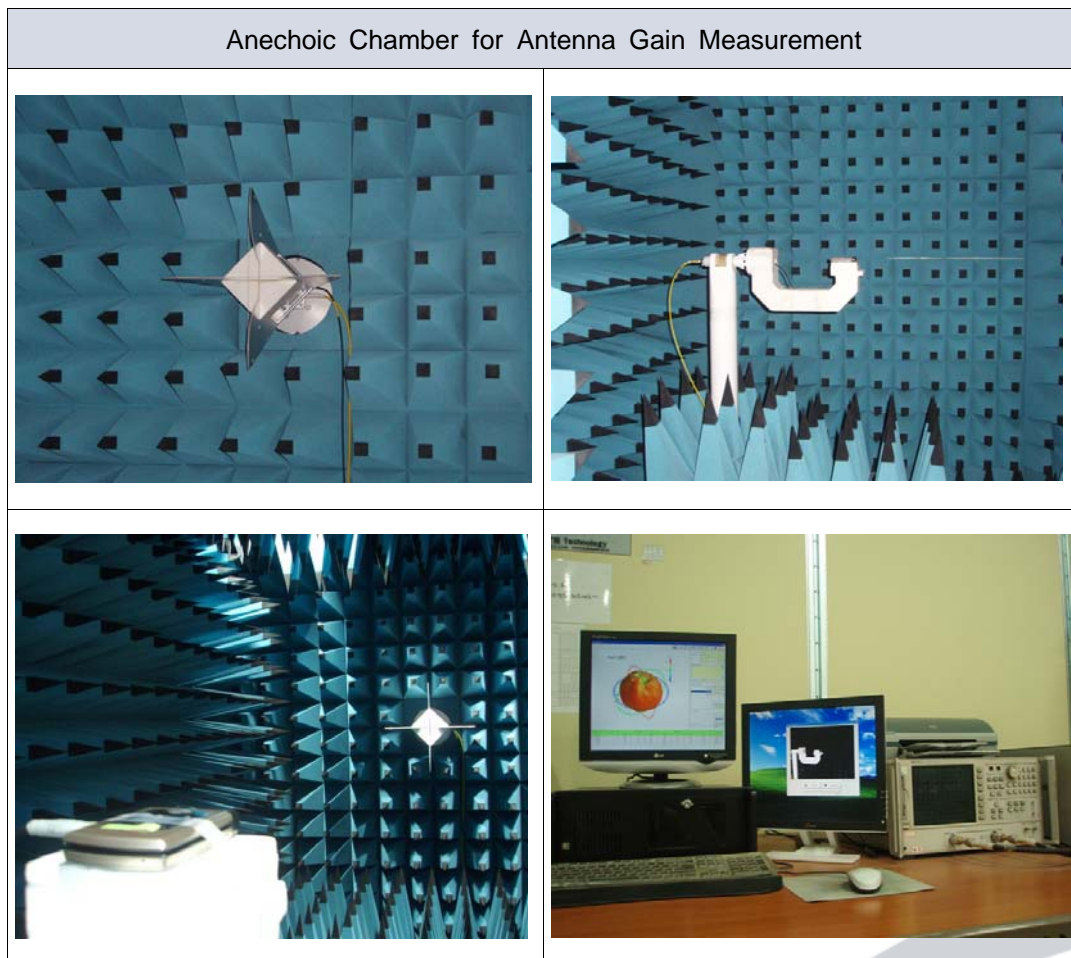
Use Network Analyzer when measuring SWR/Return loss and selecting standard SPL,  
Use automatic inspection equipment when selecting superior and inferior goods.

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

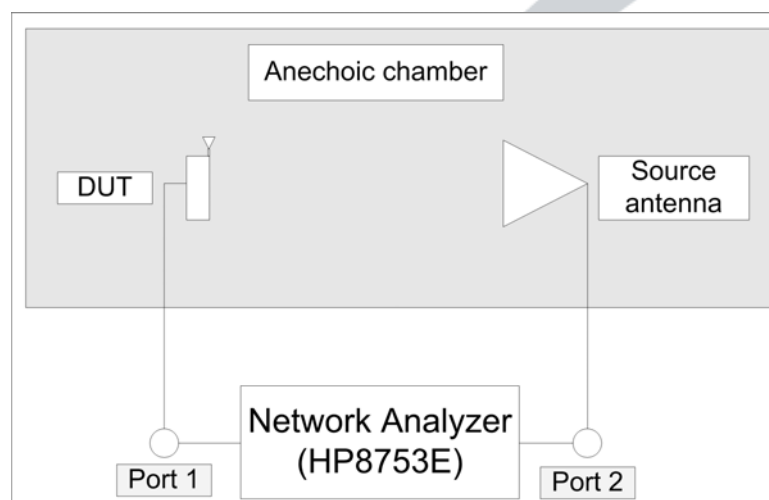


## 5.2 Gain

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

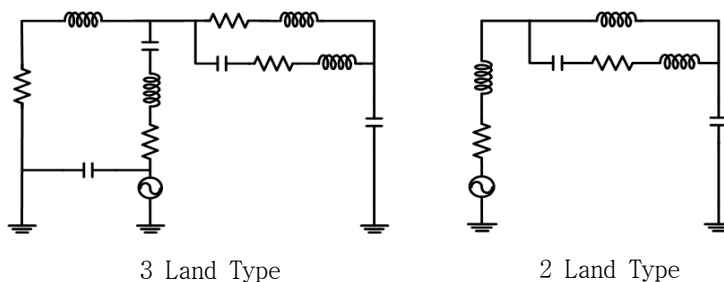


## 5.3 Gain test block diagram



## 6. Internal Block Diagram

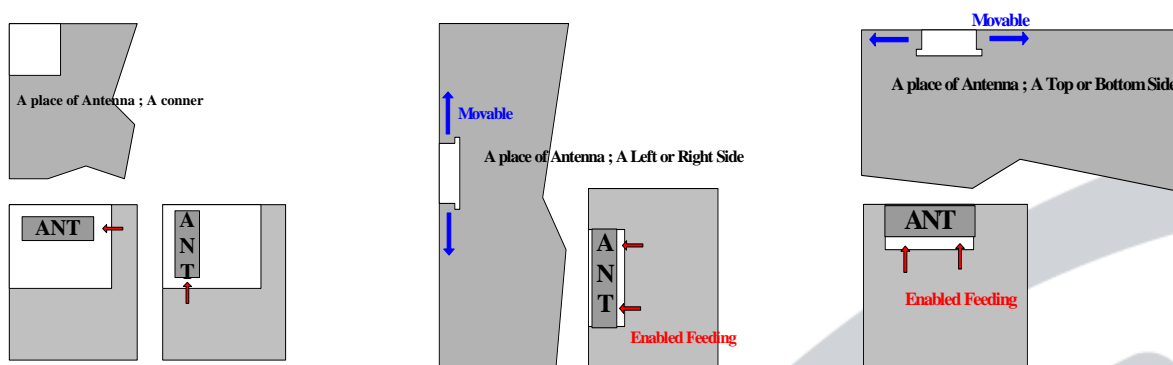
This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



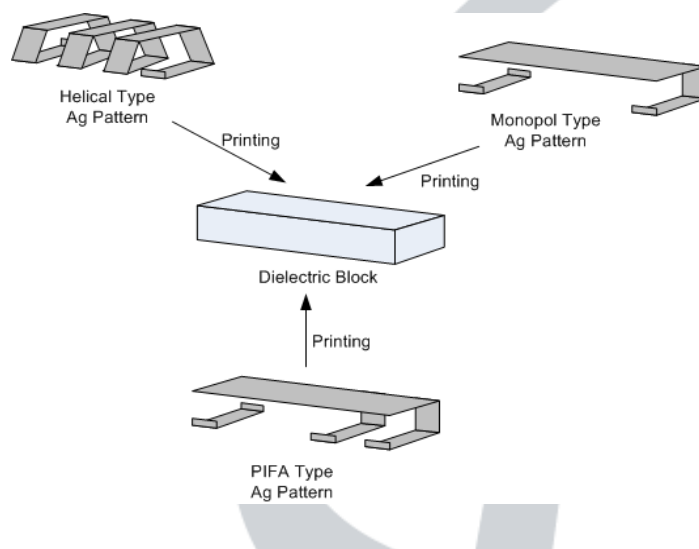
## 7. Basis Action / Application Note

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,

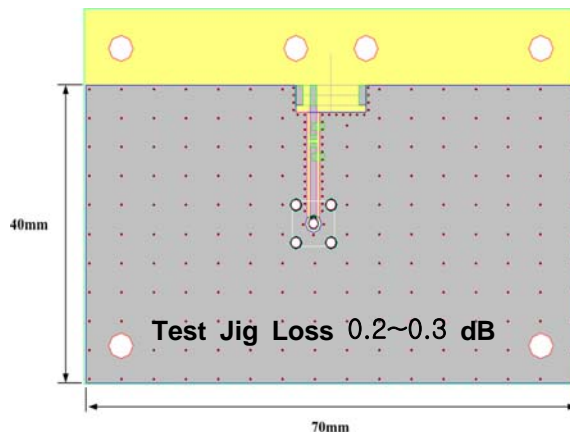


As the following, this product is easy to revise the various types for the boundary condition.



## 8. Measurement Jig SPEC

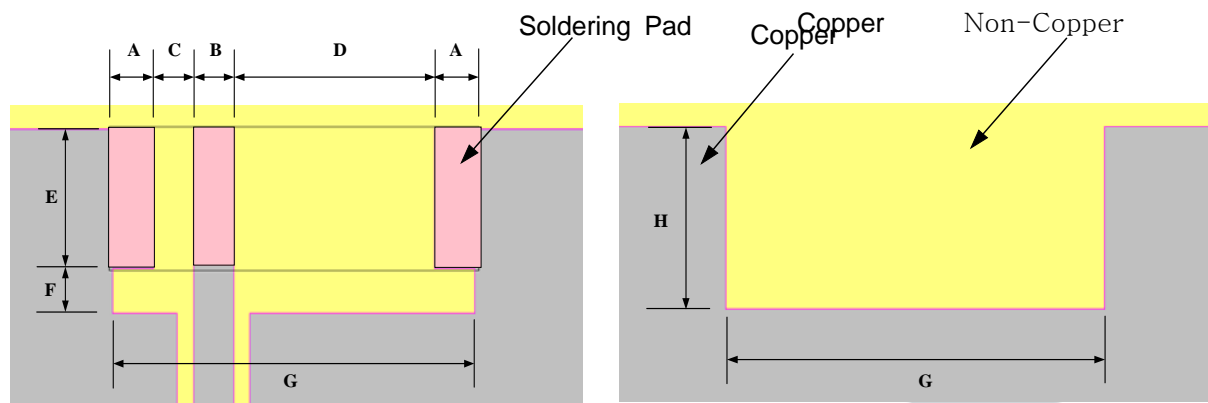
### 8.1 Test Fixture And GROUND Condition



※ 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



**Top Layout**

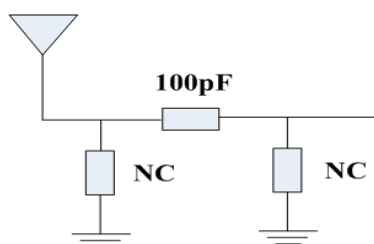
**Bottom Pattern**

Parameter	A	B	C	D	E	F	G	H
Value[mm]	1.1	1.0	1.0	5.0	3.2	1.0	9.0	4.2

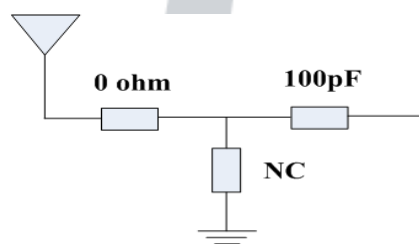
Unit ; mm

Unless specified tolerances are  $\pm 0.1$

### 8.3 Matching Circuit And Reference Value



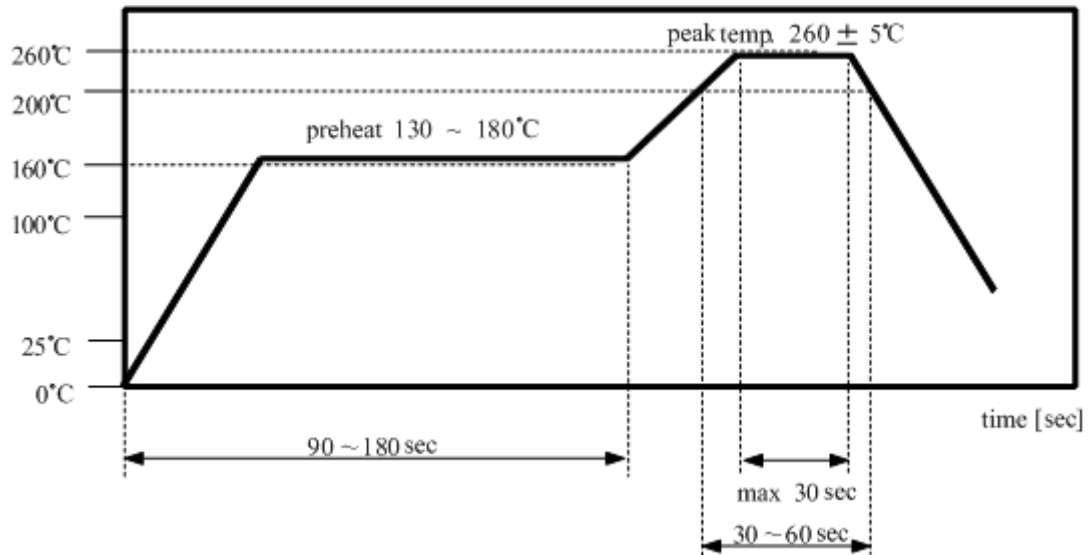
**π Matching**



**T Matching**

## 9. REFLOW PROFILE

### 9.1 Reflow Soldering



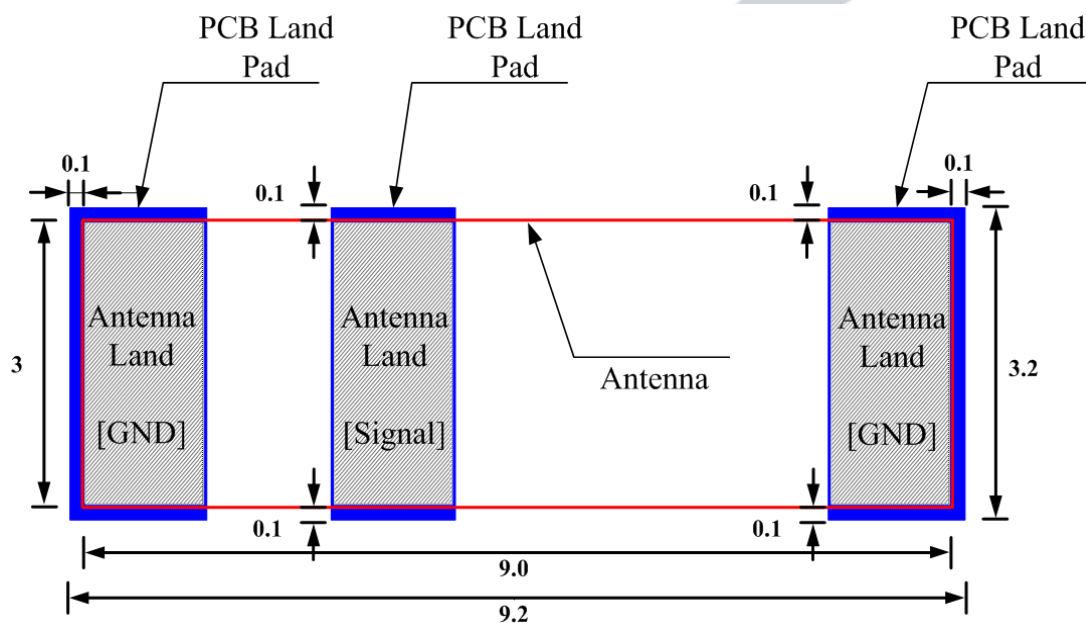
### 9.2 Manual Soldering

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]		Ev B'd Characteristic [MHz]		Size [mm]		
Standard	VSWR 3.0 Max		VSWR 3.0 Max		W=3.0±0.15	L=9.0±0.15	T=1.2±0.15
	2175	2255	2175	2255			
1	2.00	2.06	1.95	2.22	3.04	9.00	1.25
2	1.99	2.12	2.24	1.96	3.05	8.99	1.23
3	1.97	2.06	1.95	2.13	3.01	9.00	1.25
4	1.87	2.18	2.14	2.10	3.02	8.98	1.25
5	1.93	2.11	2.25	2.02	3.02	9.01	1.24
6	2.00	2.01	2.08	2.42	3.03	8.98	1.25
7	2.09	2.00	2.23	2.22	3.01	9.00	1.25
8	1.91	2.18	1.87	2.29	3.05	9.00	1.23
9	2.03	2.18	1.99	2.28	3.04	8.98	1.24
10	1.98	2.07	2.22	1.86	3.04	9.01	1.25
11	1.89	2.10	1.86	1.78	3.03	9.00	1.23
12	1.82	2.17	1.85	1.95	3.06	8.99	1.23
13	1.97	2.05	2.03	2.37	3.01	9.01	1.23
14	1.90	2.12	1.86	2.27	3.03	9.02	1.24
15	1.82	2.04	2.07	1.78	3.04	9.00	1.24
16	2.07	2.00	1.81	1.80	3.02	8.98	1.23
17	2.06	2.07	1.86	1.82	3.05	8.98	1.23
18	2.06	2.05	2.04	1.76	3.03	9.01	1.25
19	1.97	2.12	1.82	1.77	3.01	8.99	1.25
20	1.89	2.11	1.91	1.99	3.02	8.99	1.23
Min	1.82	2	1.81	1.76	3.01	8.98	1.23
Max	2.09	2.18	2.25	2.42	3.06	9.02	1.25
X	1.96	2.09	2.00	2.03	3.03	9.00	1.24
σ	0.08	0.05	0.09	0.09	0.01	0.01	0.01
Cpk	4.25	2.11	2.17	2.10	4.01	4.07	7.08
Decision	OK	OK	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 4.3 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 4.3 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 × 9.8m/s <sup>2</sup> (G) Sweep time : 15 min , X.Y.Z each 5 times	After test, Must meet the characteristics spec of 4.3 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

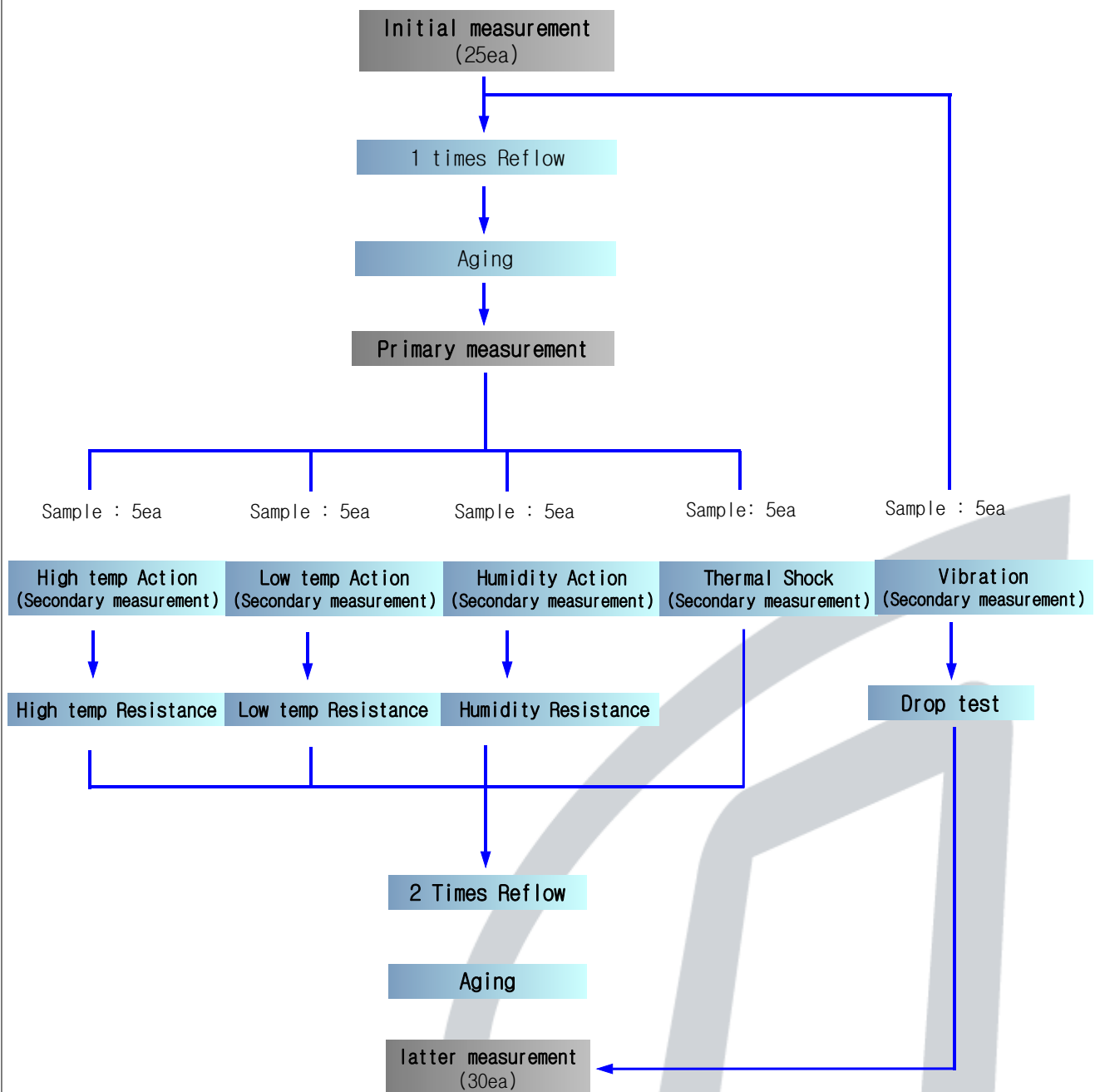
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30℃/85%RH	168+5/-0	= < 85℃/85%RH

#### 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 4.3 list

11.5 Reliability test flow

# Reliability Test Flow

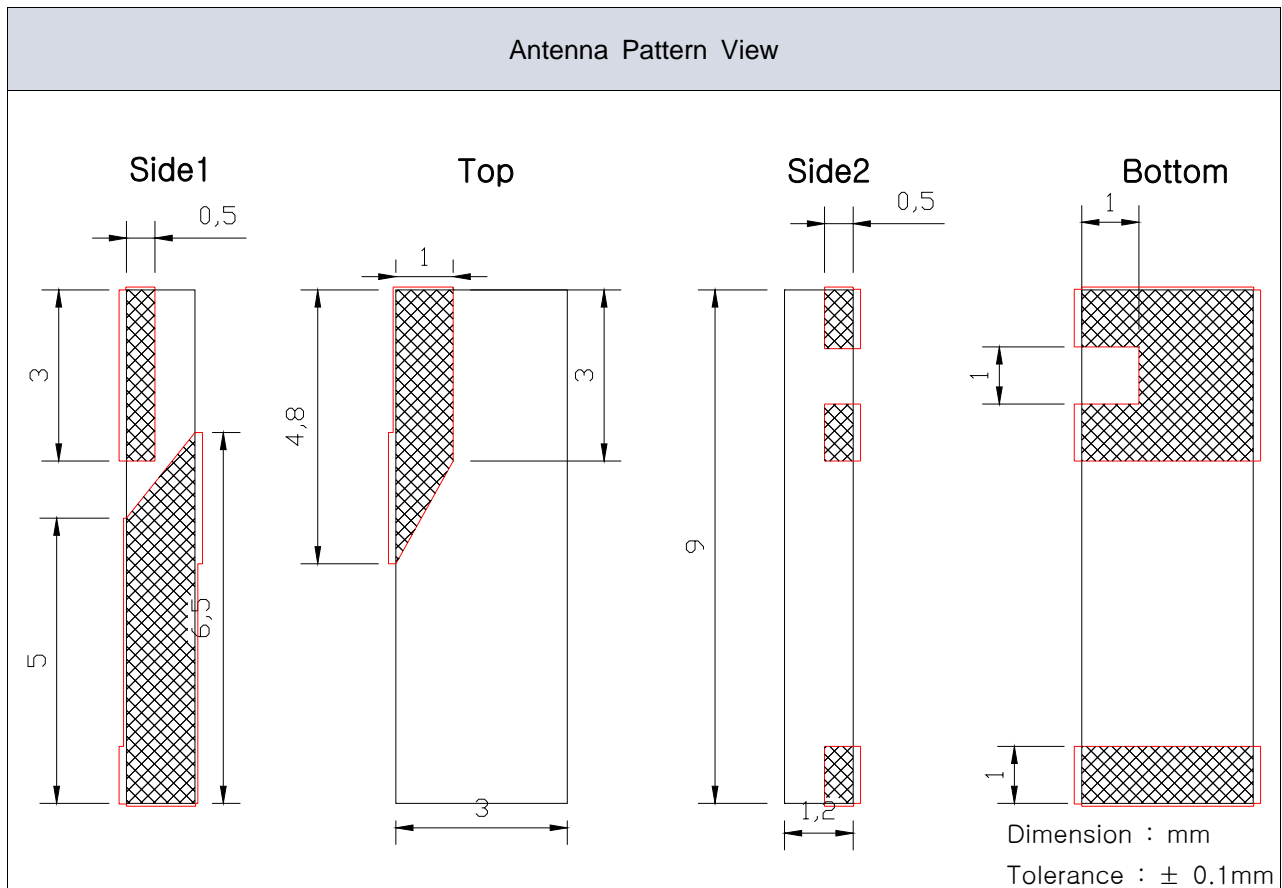


※ Aging : Let stand 1hr at normal temperature and humidity

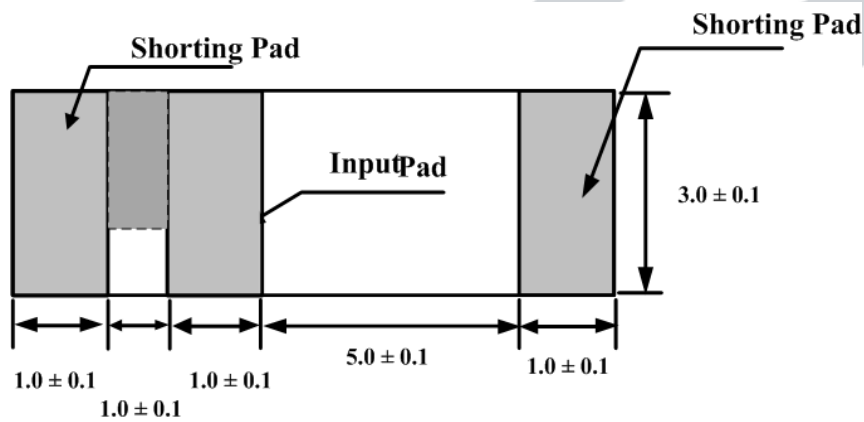
※ The vibration and drop test is executed with PCB loaded the sample.

## 12. Mechanical Characteristics

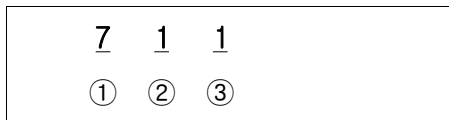
### 12.1 Antenna Pattern Dimension



### 12.2 Pin name

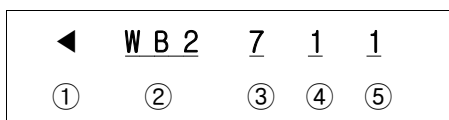
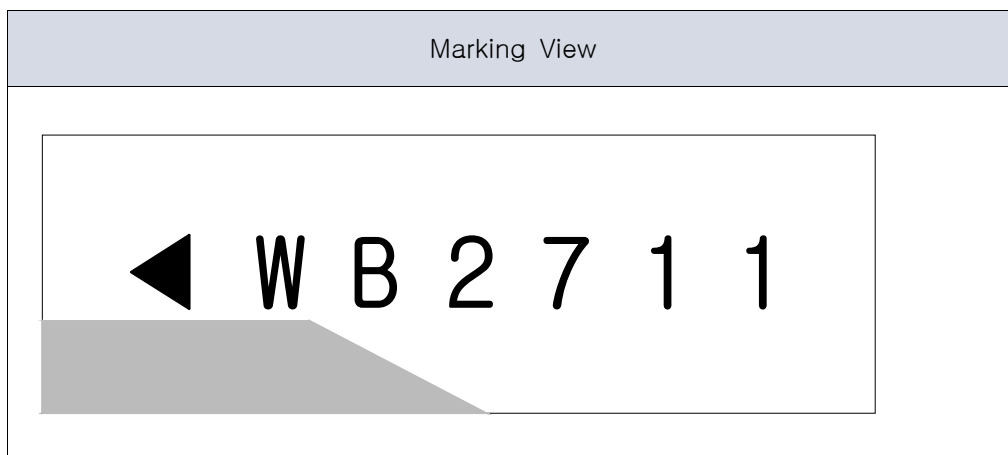


### 12.3 Lot number notation



- 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



- 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

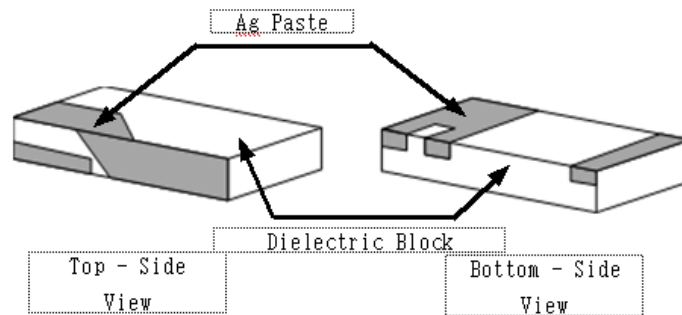
Ink marking - Using Black Ink

## 13. Structure and Material

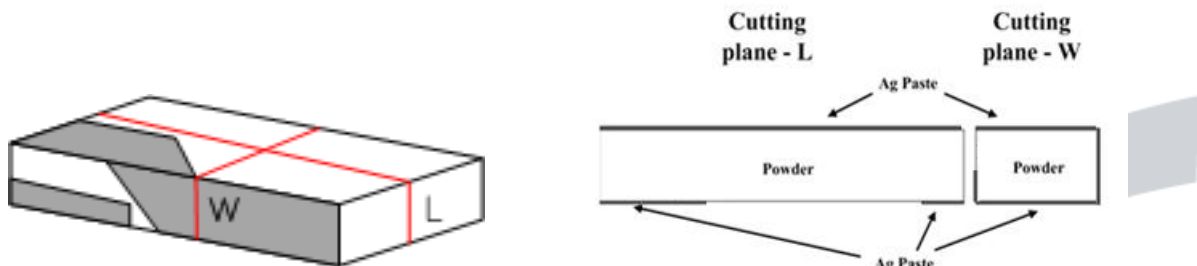
### 13.1 materialization method

Chip antenna forms the pattern with Ag paste on the brick of dielectric block and materializes the characteristics

### 13.2 Structure



### 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 $\mu$ m
PAD	Ag paste	METECH	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℃

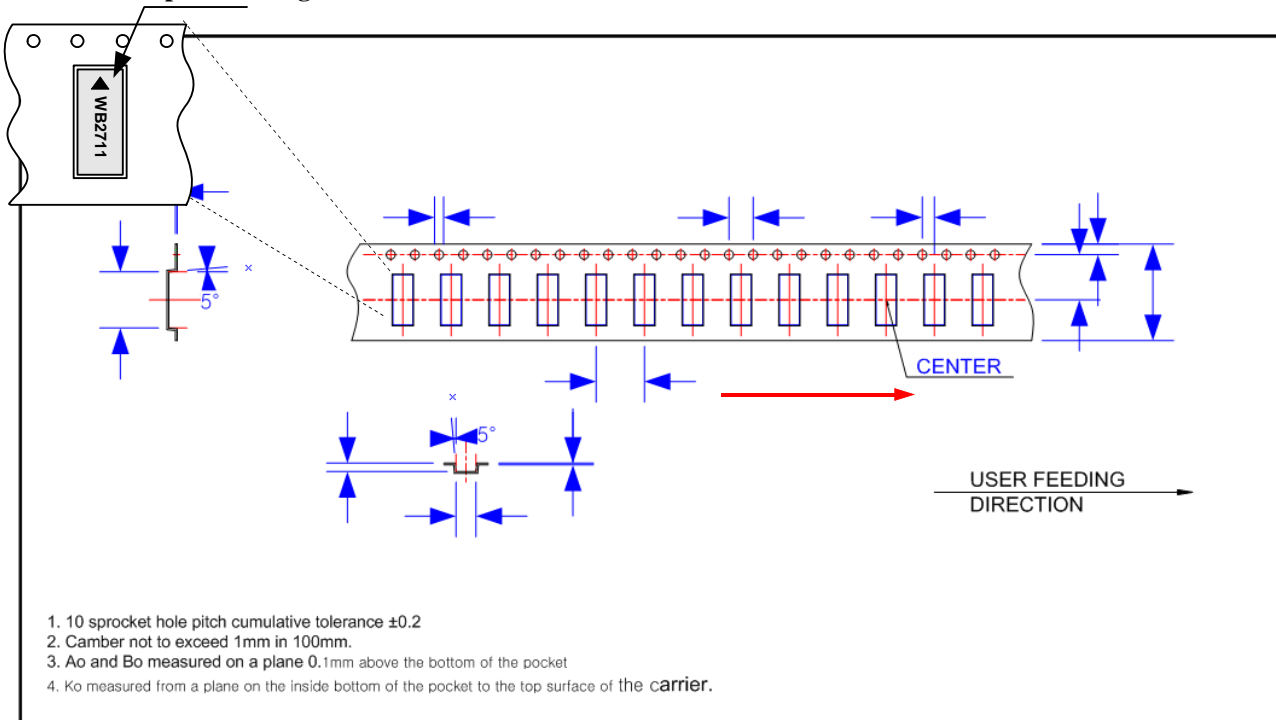


## 15. Packing

### 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	—

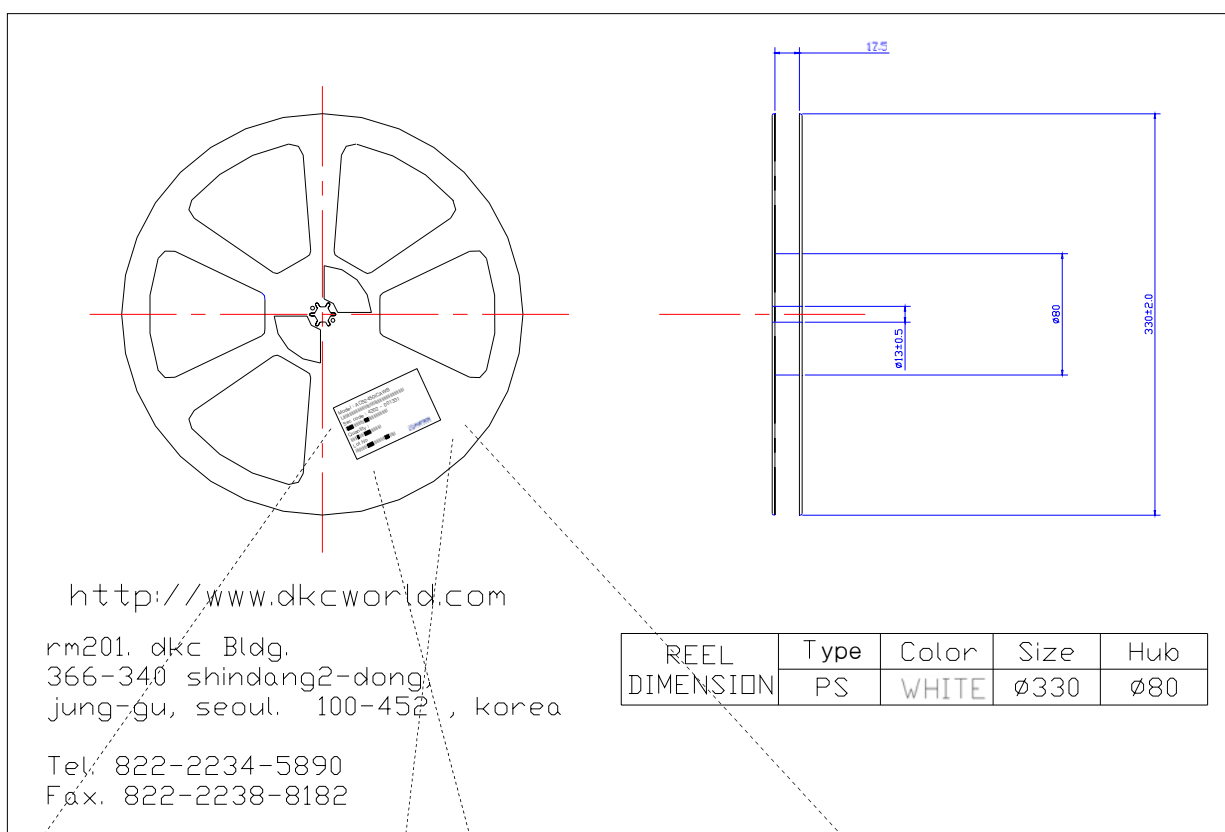
#### Input Marking



TITLE	
CARRIER TAPE 3.0*9.0*1.2P	
PART.	CARRIER TAPE
MATERIAL	C-PET
LENGTH	46.8M
COUNT	5850P

DKC DWG. No.	D-1608-023
DIMENSIONAL UNIT	MM
UNTOLERANCED DIMENSION	$\pm 0.1$
CAD FILE NAME	050423
DESIGNED BY	K. M. J
SCALE	1/1

NAME	SPEC.
W	16.0 $\pm 0.2$
E	1.75 $\pm 0.1$
F	7.5 $\pm 0.1$
Do	1.5 $\pm 0.1$
P	8.0 $\pm 0.1$
Po	4.0 $\pm 0.1$
P2	2.0 $\pm 0.1$
Ao	3.3 $\pm 0.1$
Bo	9.3 $\pm 0.1$
Ko	1.4 $\pm 0.1$
T	0.3 $\pm 0.05$



Model : ACS2450ICAWB2

|||||

Sec code :

|||||

Quantity ;

|||||

Lot No

|||||

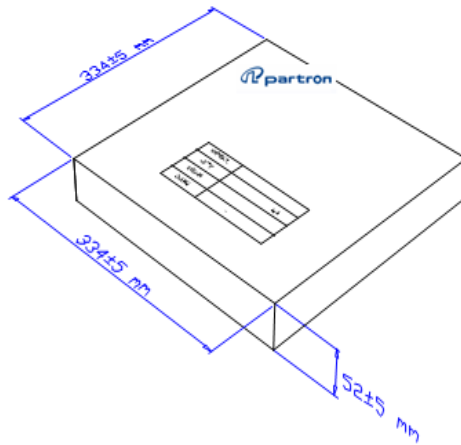


**MSL Level 1**

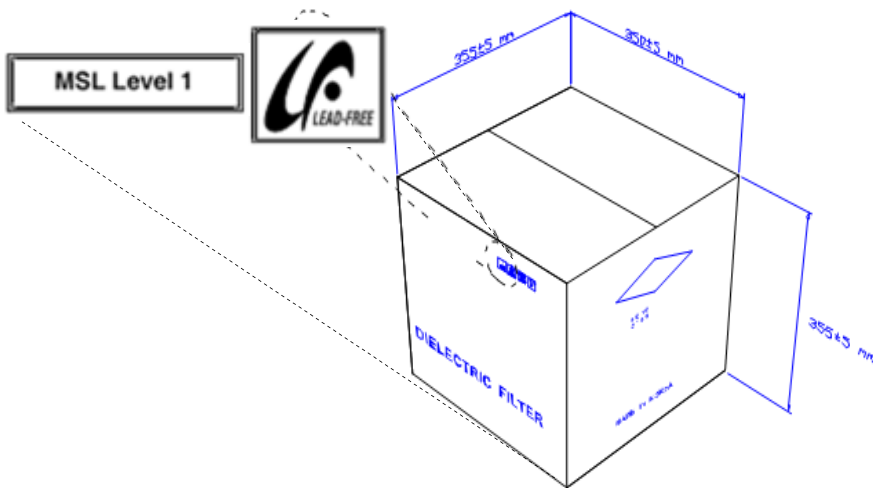




## 15.2 BOX 사양



Material : SK/S/K-B  
골판지



## 15.2 포장 실물 사진



Reel 사진



내상 Box 사진



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						Revised	05.04.03	PRCP-C001			
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
Ceramic POWDER		◇	Import Inspection						shrinking rate permittivity	refer to Guide Sheet	Micrometer Network	10ea/LOT	C/sheet	Return
POWDER lubricant	○		powder	Mixer					mixing	POWDER lubricant	Scale	PER MIXING	-	Exhaust
		○	Shaping	Press	pressure Mold Condition	refer to Guide Sheet	Per LOT 1/day	parameter C/SHEET	dimension weight density aspect	refer to Guide Sheet	Micrometer scale Calculated Visual	5/100EA 10ea/lot	LOT CARD	Exhaust
		○	Plasticity	Plasticity Hole	SETTER Outside Temperature PROFILE	refer to Guide Sheet	all 2/day 1/month	C/sheet						
		◇	Block						wide length shape	refer to Guide Sheet	Micrometer Calipers Visual Inspection	20ea/LOT 20ea/LOT all	C/sheet	Exhaust
AG PASTE		○	SIDE1 PAD Printing	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
		○	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework


Product			Issued/Revision		Process Control				Record	By designed	By checked	By approved		
CHIP ANTENNA			Issued	04.04.06					PRCP-C001					
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
AG PASTE			SIDE 2 PAD Printing	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
			Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
AG PASTE			TOP printing	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN dimension	refer to Guide Sheet	measure	10ea/3Jig	c/sheet	Rework
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
AG PASTE			BOTTOM PAD Printing CTQ	printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN dimension aspect	refer to Guide Sheet	measure Microscope	10ea/3Jig	c/sheet	Rework

Product			Issued/Revision		Process Control					Record	By designed	By checked	By approved	
CHIP ANTENNA			Issued	04.04.06						PRCP-C001				
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
			Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
			Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
			aspect inspection						aspect	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
			MARKING	Marking Machine					marking	Reference SPL	Visual Inspection	all	Lot card production diary	Rework Exhaust
			Electrical Characteristic	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/2hour	C/sheet	Electrical Characteristic	refer to Guide Sheet	Network	all	Lot card production diary	Exhaust repair
			aspect inspection						aspect dimension	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
Carrier cover reel			Taping						Quantity Direction aspect	refer to Guide Sheet	Manual	all	Lot card production diary	Rework
			shipper inspection	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/person	C/sheet	Electrical Characteristic aspect packing	refer to Guide Sheet	Network microscope Visual Inspection	refer to Guide Sheet	Result Paper	return Exhaust
packing box label			packing	bar code printer					packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	Rework
			packing inspection						packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	return

## 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



### Test Report

FUJI TITANIUM IND. CO., LTD.  
 12-8, SENGON-CHO, HIRATSUKA-CITY, KANAKAWA-  
 PREF. JAPAN. (T) 81-463-32-0210

Report No. : CE/2006/75167  
 Date : 2006/07/25  
 Page : 1 of 4


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

Sample Description : MIXTURE OF (1) MAGNESIUM SILICATE  
 (2) STRONTIUM ZIRCONATE (3) BARIUM TITANATE  
 Style/Item No : MMS-08 (B)  
 Sample Received : 2006/07/18  
 Testing Period : 2006/07/18 TO 2006/07/25

Test Result(s) : - Please see the next page(s) -

Daniel Yen, M.R., Operation Manager  
 Signed for and on behalf of  
 SGS TAIWAN LTD.

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 SGS TAIWAN LIMITED NO. 135-1, Wu-Kung Road, Wu-Kung Industrial Zone, Taipei county, Taiwan  
 (886-2) 2299-5311 (886-2) 2299-5327 www.sgs.com.tw



### Test Report

FUJI TITANIUM IND. CO., LTD.  
 12-8, SENGON-CHO, HIRATSUKA-CITY, KANAKAWA-  
 PREF. JAPAN. (T) 81-463-32-0210

Report No. : CE/2006/75167  
 Date : 2006/07/25  
 Page : 2 of 4

Test Result(s)  
 PART NAME NO.1 : WHITE POWDER

Test Item (s):	Unit	Method	MDL	Result No.1
<b>PBBs (Polybrominated biphenyls)</b>				
Mono-bromobiphenyl	%		0.0005	N.D.
Di-bromobiphenyl	%		0.0005	N.D.
Tri-bromobiphenyl	%		0.0005	N.D.
Tetra-bromobiphenyl	%	With reference to	0.0005	N.D.
Penta-bromobiphenyl	%	USEPA3540C. Analysis was	0.0005	N.D.
Hexa-bromobiphenyl	%	performed by HPLC/DAD,	0.0005	N.D.
Hepta-bromobiphenyl	%	LC/MS or GC/MS.	0.0005	N.D.
Octa-bromobiphenyl	%	(prohibited by 2002/95/EC	0.0005	N.D.
Nona-bromobiphenyl	%	(RoHS), 83/264/EEC, and	0.0005	N.D.
Deca-bromobiphenyl	%	76/769/EEC)	0.0005	N.D.
<b>Total PBBs (Polybrominated biphenyls)/Sum of above</b>				
<b>PBDEs(PBDEs) (Polybrominated biphenyl ethers)</b>				
Mono-bromobiphenyl ether	%		0.0005	N.D.
Di-bromobiphenyl ether	%		0.0005	N.D.
Tri-bromobiphenyl ether	%		0.0005	N.D.
Tetra-bromobiphenyl ether	%		0.0005	N.D.
Penta-bromobiphenyl ether	%	With reference to	0.0005	N.D.
Hexa-bromobiphenyl ether	%	USEPA3540C. Analysis was	0.0005	N.D.
Hepta-bromobiphenyl ether	%	performed by HPLC/DAD,	0.0005	N.D.
Octa-bromobiphenyl ether	%	LC/MS or GC/MS.	0.0005	N.D.
Nona-bromobiphenyl ether	%	(prohibited by 2002/95/EC	0.0005	N.D.
Deca-bromobiphenyl ether	%	(RoHS), 83/264/EEC, and	0.0005	N.D.
<b>Total PBDEs(PBDEs) (Polybrominated biphenyl ethers)/Sum of above</b>				
<b>Total of Mono to Nona-brominated biphenyl ether. (Note 4)</b>				N.D.

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 SGS TAIWAN LIMITED NO. 135-1, Wu-Kung Road, Wu-Kung Industrial Zone, Taipei county, Taiwan  
 (886-2) 2299-5311 (886-2) 2299-5327 www.sgs.com.tw

**SGS**

**Test Report**

FUJI TITANIUM IND. CO., LTD.  
12-8, SENGUN-CHO, HIRATSUKA-CITY, KANAKAWA-  
PREF. JAPAN. (T) 81-463-32-0210

Report No. : CE/2006/75167  
Date : 2006/07/25  
Page : 3 of 4

Test Item (s):	Unit	Method	MDL	Result
Chromium VI (Cr+6)	ppm	UV-VIS(US EPA 7196A) after reference to US EPA 3060A.	2	N.D.
Cadmium (Cd)	ppm	ICP-AES after reference to EN 1122, method B-2001 or other acid digestion.	2	N.D.
Mercury (Hg)	ppm	ICP-AES after reference to US EPA 3052 or other acid digestion.	2	N.D.
Lead (Pb)	ppm	ICP-AES after reference to US EPA 3050B or other acid digestion.	2	19.3

NOTE: (1) N.D. - Not Detected (<MDL)  
(2) ppm = mg/kg  
(3) MDL = Method Detection Limit  
(4) Decabromobiphenyl ether (DecaBDE) in polymeric applications is exempted by  
Commission Decision of 13 Oct 2005 amending Directive 2002/95/EC notified  
under document 2005/717/EC.  
(5) PBBEs=PBDEs=Polybrominated Diphenyl Ethers=PBDOs=PBBOs.  
(6) " - " = Not Regulation  
(7) " - - " = Not Applicable

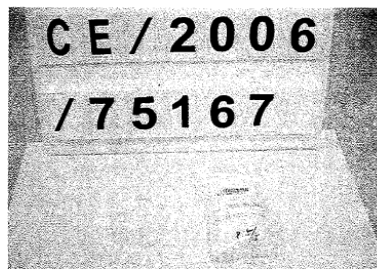
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\*\* End of Report \*\*

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SGS TAIWAN LIMITED NO. 125, WU KUNG ROAD, WU KUNG INDUSTRIAL ZONE, TAYPEI, TAIWAN  
TEL: 886-2-2707-2222 FAX: 886-2-2707-2223 E-MAIL: SGS@SGS.COM

2) Ag Paste

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

**SGS**

**Test Report No.** F690501LF-CTSGP06-26952      **Date:** October 27, 2006      **Page** 1 of 2

**To:** METECH KOREA CO., LTD.  
B-601 Dongyang Paragon officetel 17-2 Jeongja-dong  
Sungnam-si  
Gyeonggi-do  
Korea

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

**Commodity** : PCC11837HV  
**SGS File No.** : GP06-26952  
**Received Date** : October 20, 2006  
**Test Performing Date** : October 23, 2006  
**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  
Patrick An  
Monet Jeong  
Jinhee Song  
Testing Person

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

The above certificate is the accredited test items by Korea Laboratory Accreditation Scheme (KOLAS), which signed the (LAC-MRA).

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**SGS**

**Test Report No.** F690501LF-CTSGP06-26952      **Date:** October 27, 2006      **Page** 2 of 2

**Sample No.** : GP06-26952.001  
**Sample Description** : PCC11837HV  
**Item No./Part No.** : N/A  
**Comments** : Material is silver paste.

**Heavy Metals**

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(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 7195A(1992), UV	1	N.D.

**Picture of Sample as Received:**



\*\*\* End \*\*\*

**NOTE:** (1) N.D. = Not detected (<MDL)  
(2) ppm = mg/kg  
(3) MDL = Method Detection Limit  
(4) Estimated expanded uncertainty U with a coverage factor k = 2, corresponding to a level of confidence of about 95%

The above certificate is the accredited test items by Korea Laboratory Accreditation Scheme (KOLAS), which signed the (LAC-MRA).

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### 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-CTSGP06-27074** Date: October 27, 2006 Page 1 of 3

To: IMAJE KOREA CO., LTD.  
 %1302, Daeryung Techno Town 7th  
 Kasan-dong  
 Keumcheon-ku  
 SEOUL  
 Korea

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

Commodity : Ink-5135E black ink

SGS File No. : GP06-27074

Received Date : October 20, 2006

Test Performing Date : October 23, 2006

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*  
 Jeff Jang / Chemical Lab Mgr

Pluto Kim  
 Monet Jeong  
 Jilly Oh  
 Jerry Jung  
 /Testing Person

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**SGS**  
**Test Report No. F690501LF-CTSGP06-27074** Date: October 27, 2006 Page 2 of 3

Sample No. : GP06-27074.001

Sample Description : Ink-5135E black ink

Style/Item No. : N/A

**Heavy Metals**

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050B(1996), US EPA 8210B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(1996), US EPA 8210B(1996), ICP	5	N.D.
Mercury (mg)	mg/kg	US EPA 3052(1996), US EPA 8010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), LV	1	N.D.

**Flame Retardants-PBBs/PBDEs**

Test Item	Unit	Test Method	MDL	Results
Monobromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromodiphenyl	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) ppm = mg/kg  
 (3) MDL = Method Detection Limit  
 (4) - = No regulation  
 (5) \*\* = Qualitative analysis (No Unit)  
 (6) Negative = Undetectable / Positive = Detectable

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**SGS**  
**Test Report No. F690501LF-CTSGP06-27074** Date: October 27, 2006 Page 3 of 3

Picture of Sample as Received:



\*\*\* End \*\*\*

NOTE: (1) N.D. = Not detected (<MDL)  
 (2) ppm = mg/kg  
 (3) MDL = Method Detection Limit  
 (4) - = No regulation  
 (5) \*\* = Qualitative analysis (No Unit)  
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\* Reliability Test List

