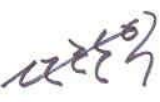

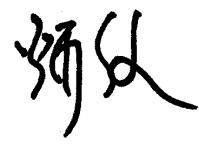



MSL Level 1
ROHS-Y

Approval Sheet

Products	Dielectric Chip Antenna		
Customer	Movon		
Model	MF360		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450GBAMF36		
Movon	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
	06/11	06/11	06/11

2007. 06. 11


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



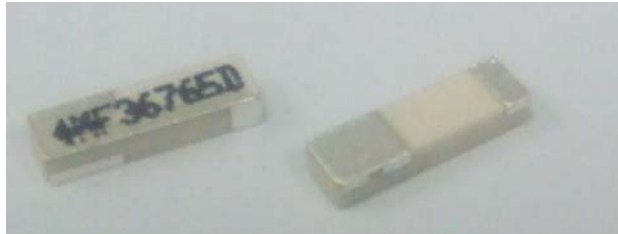
MSL Level 1

ROHS-Y

SPECIFICATION

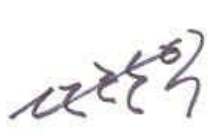

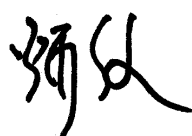
MODEL : ACS2450GBAMF36

3D Structure



Top View

Bottom View

By designed	By checked	By approved
		
Research 5 Team	Quality Assurance	Laboratory
Chanik.Jeon	Kwang-Gyu.Lee	Byoung-Jun.Yim
06/11	06/11	06/11

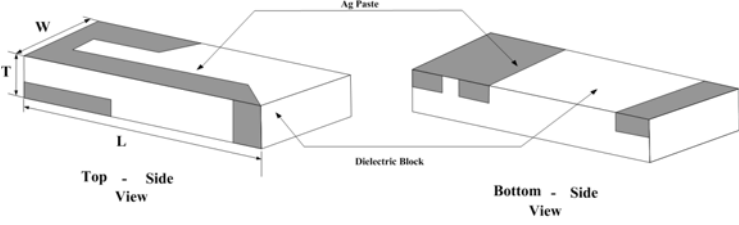
2007. 06. 11

- 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 ₂ SiO ₄ (Magnesium Silicate)
	Electrode Paste	Ag
Size[mm]	W = 2.0±0.1	
	L = 7.0±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 ()

- 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

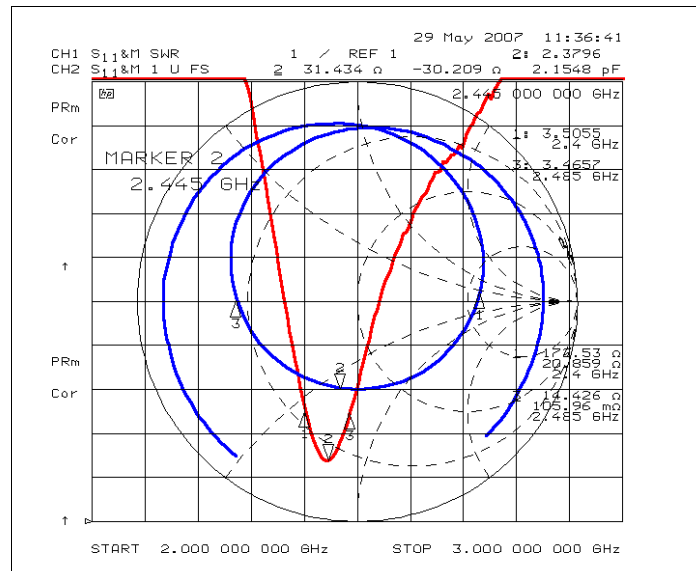
4.1 Single Element SPEC

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
SWR [Max]	3 : 1 (Typ 2 : 1)
Input Impedance [Ω]	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
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Gain[dBi]	Total Gain (Peak / Avg) [dBi]			0.5/-3.5
	Azimuth	Theta	Peak	-1.82
			Average	-3.62
		Phi	Peak	-12.72
			Average	-18.62
	Elevation 1	Theta	Peak	-5.32
			Average	-12.55
		Phi	Peak	1.05
			Average	-3.63
	Elevation 2	Theta	Peak	-7.99
			Average	-13.05
		Phi	Peak	1.21
			Average	-3.48

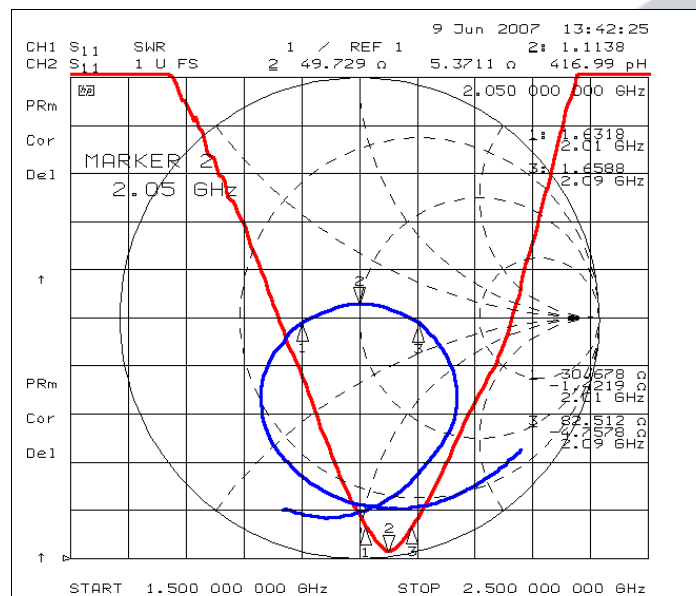
4.3 S11 Graph of Set Condition



4.4 Test Fixture Condition

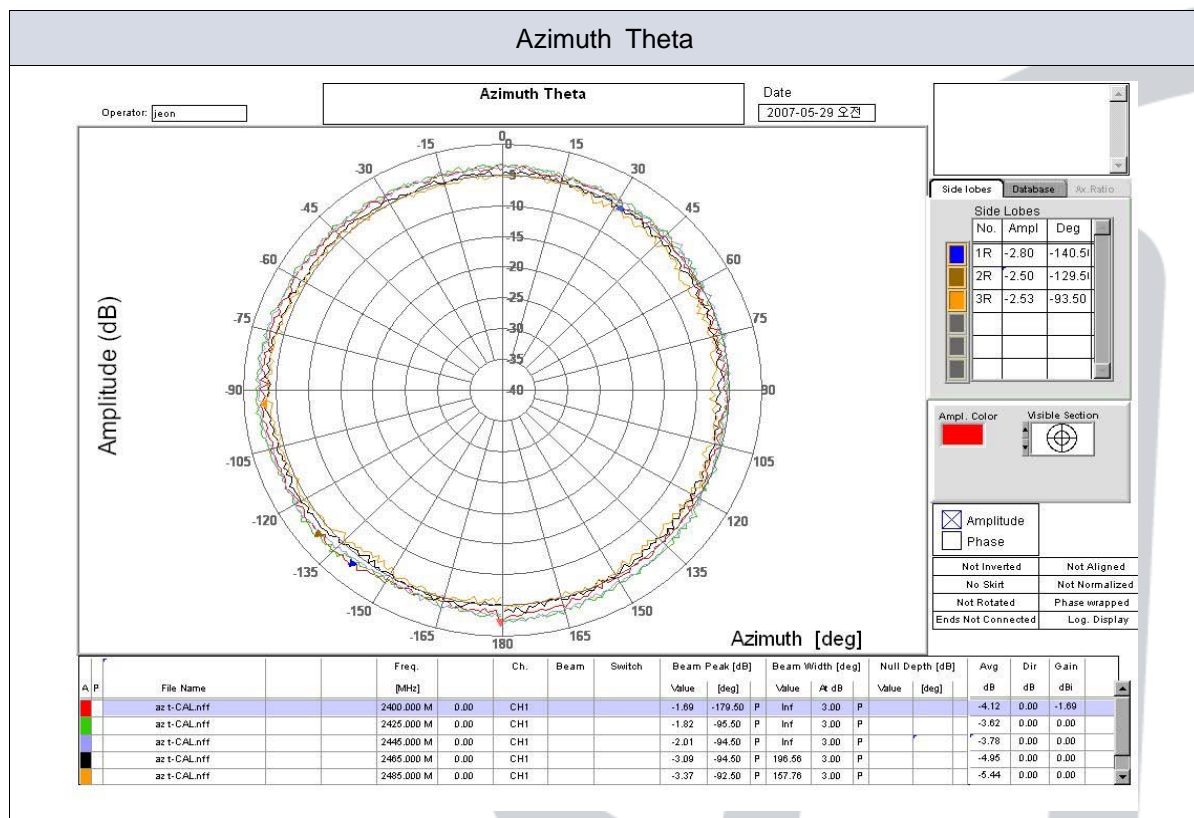
ITEM	SPEC
Frequency Range [MHz]	2010 ~ 2090
Lower frequency(2010MHz) SWR [Min~Max]	1.2 ~ 2.4 : 1 (Typ 2.0 : 1)
Upper frequency(2090MHz) SWR [Min~Max]	1.2 ~ 2.4 : 1 (Typ 2.0 : 1)

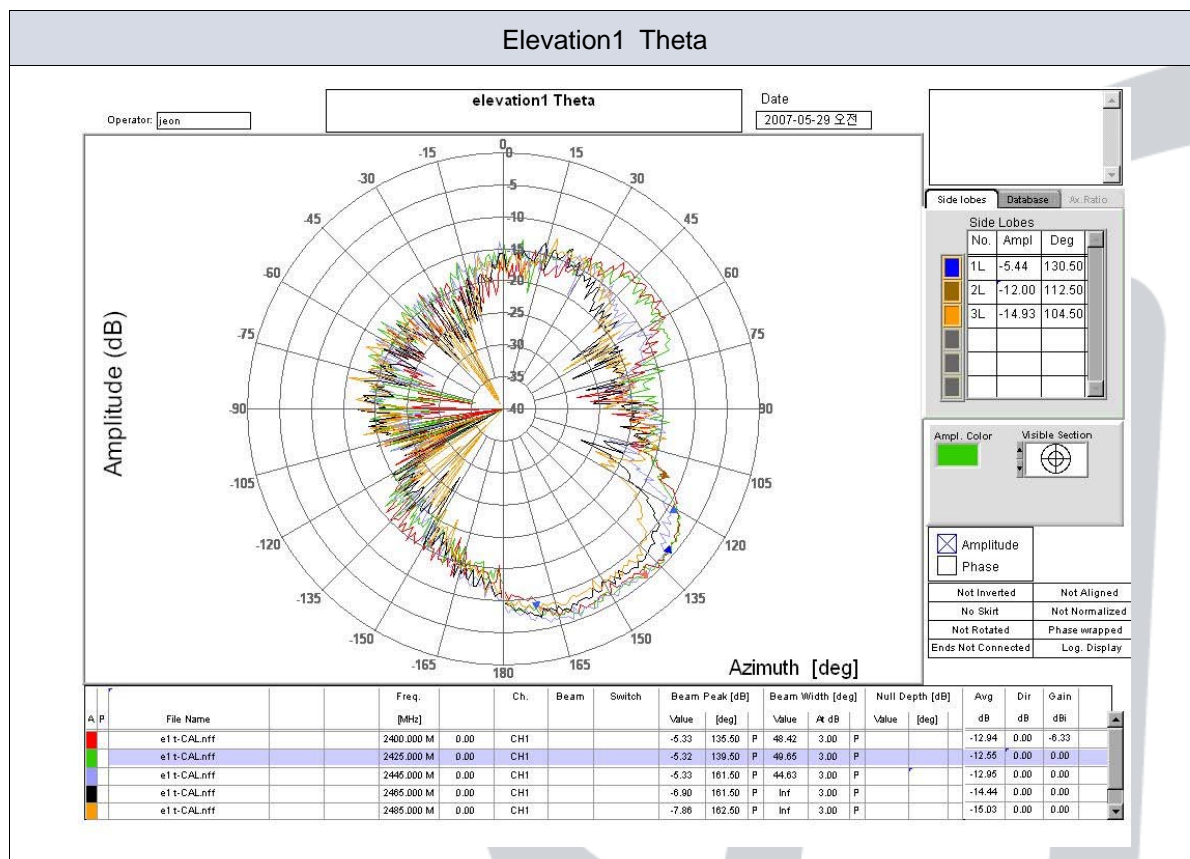
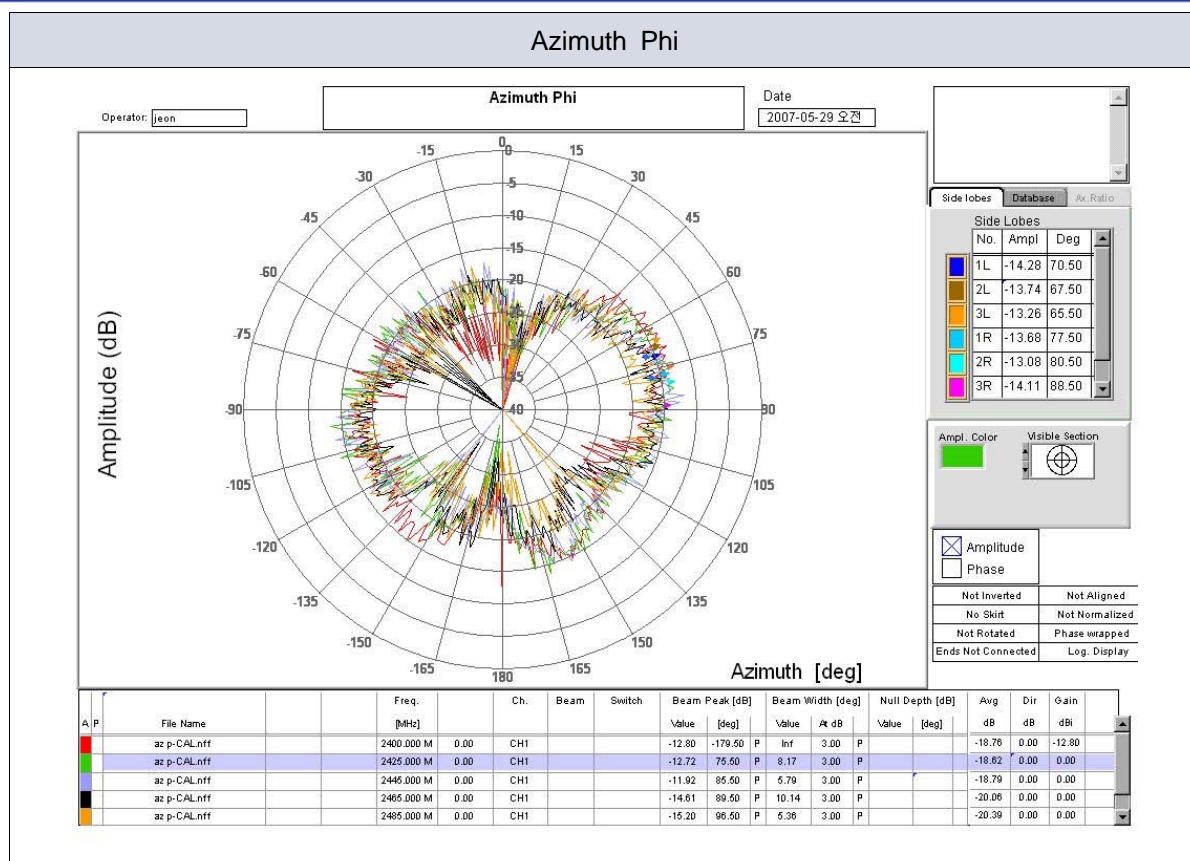
4.5 S11 Graph of Test Fixture Condition CTQ



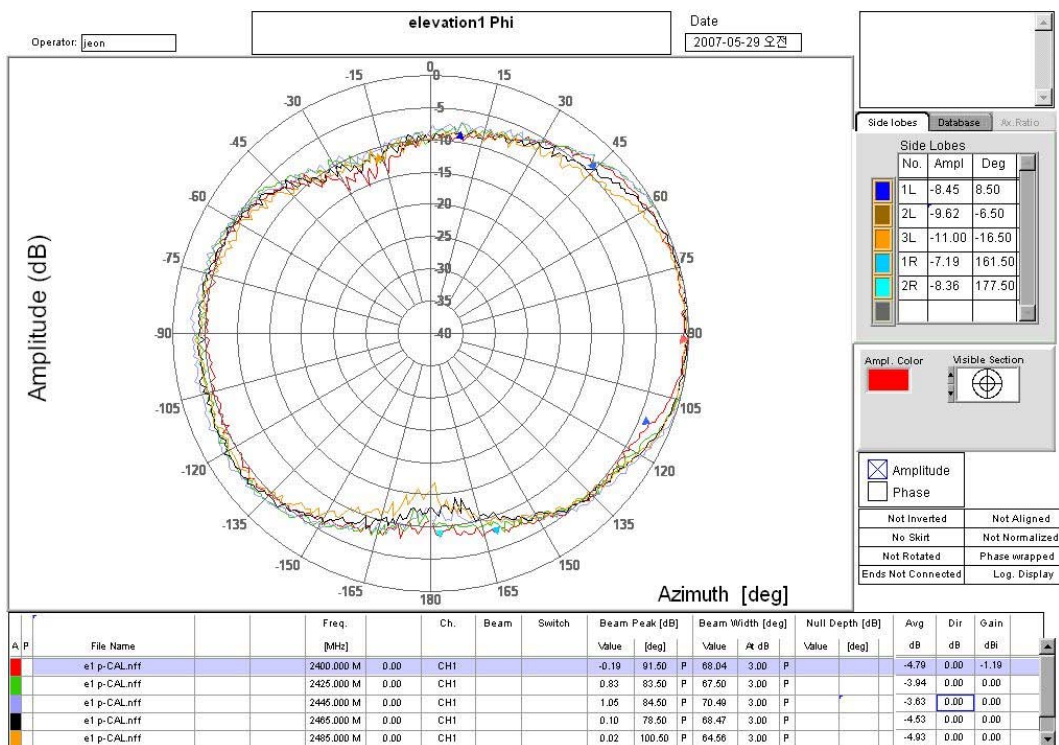
4.6 Radiation Pattern

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

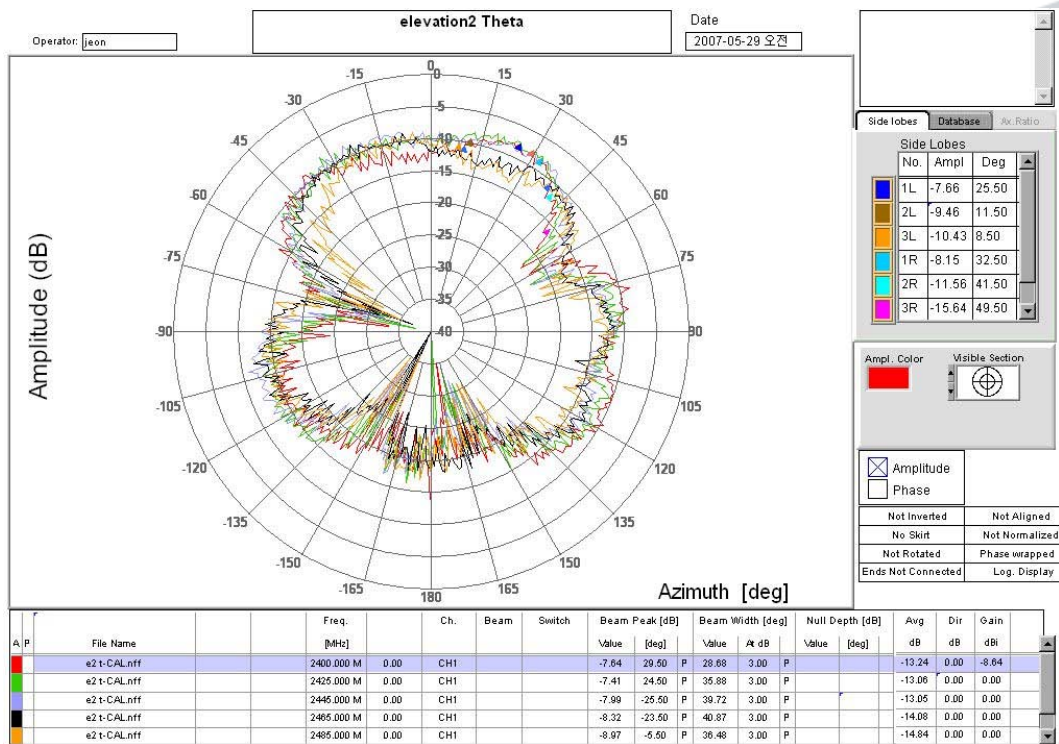


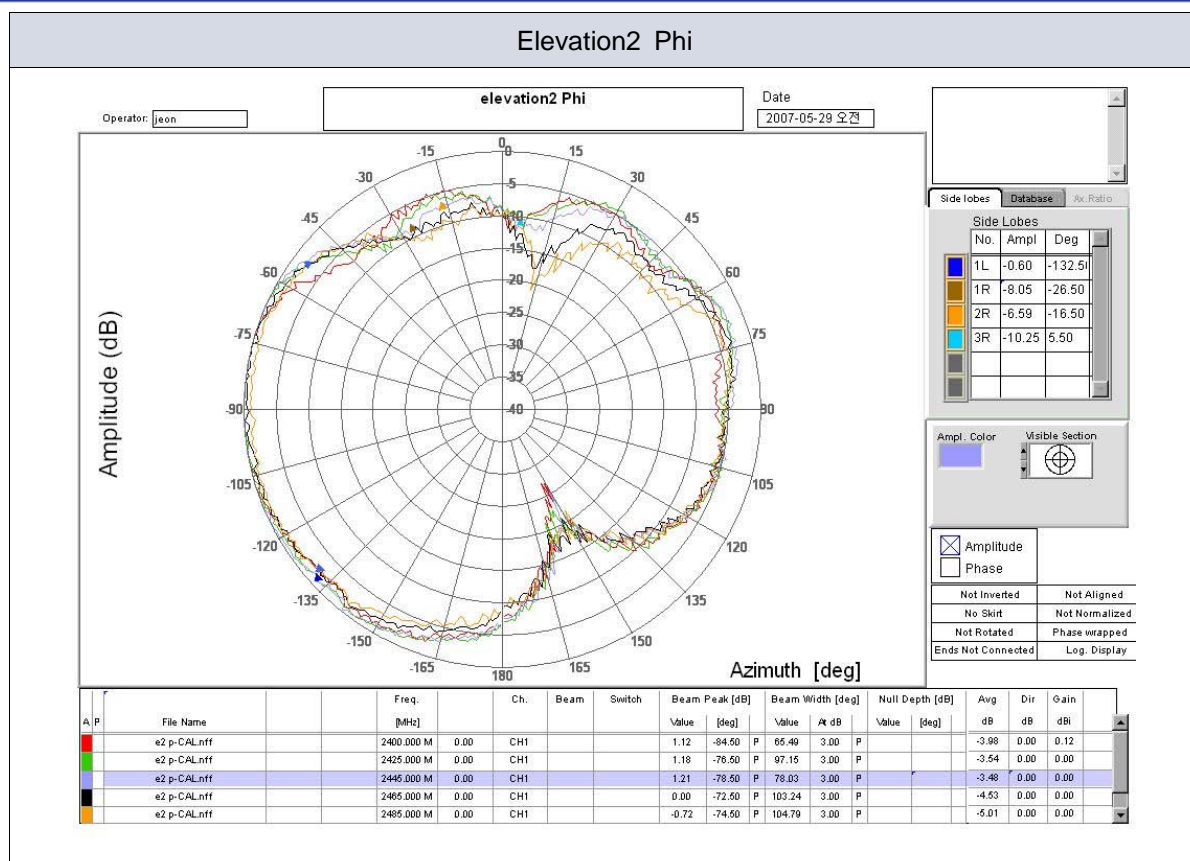


Elevation1 Phi



Elevation2 Theta

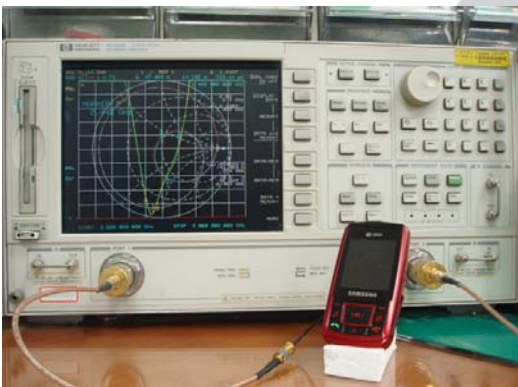
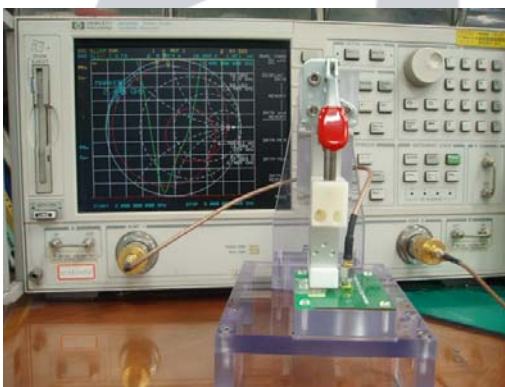




5. Measurement Process

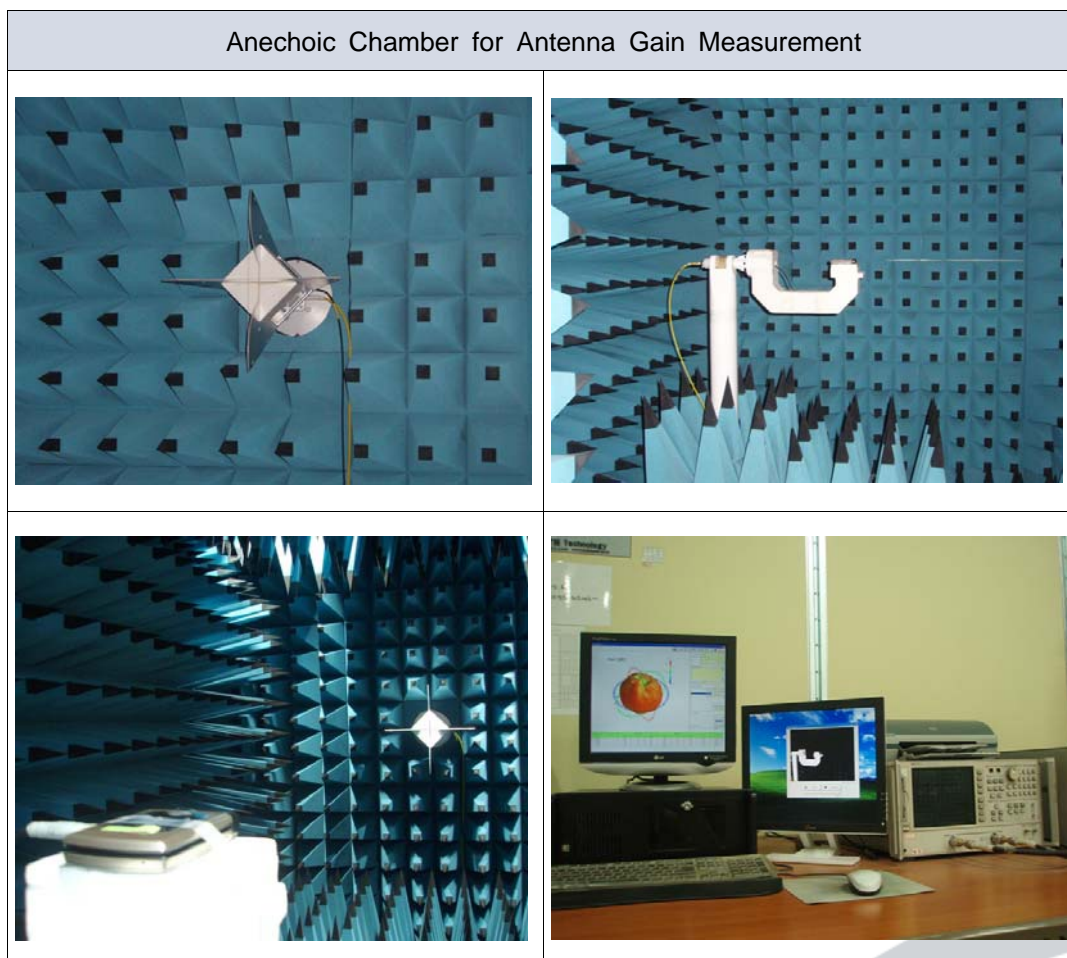
5.1 SWR/Return loss

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

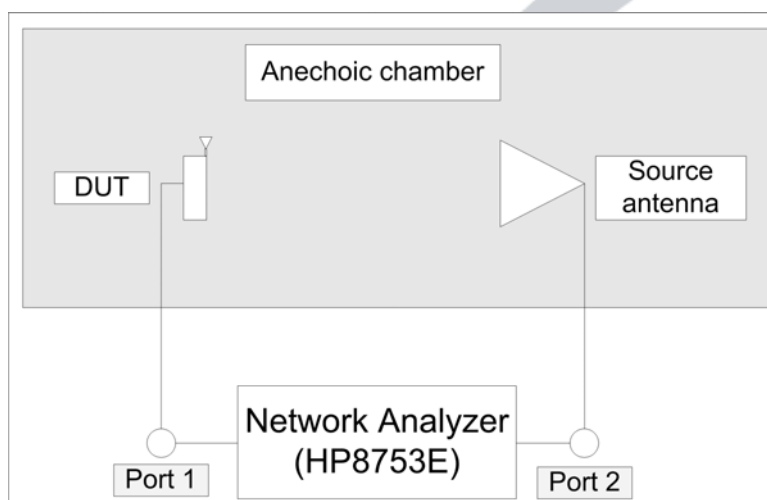
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

5.2 Gain

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

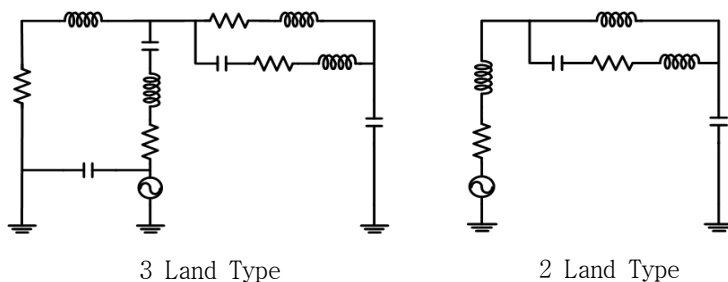


5.3 Gain test block diagram



6. Internal Block Diagram

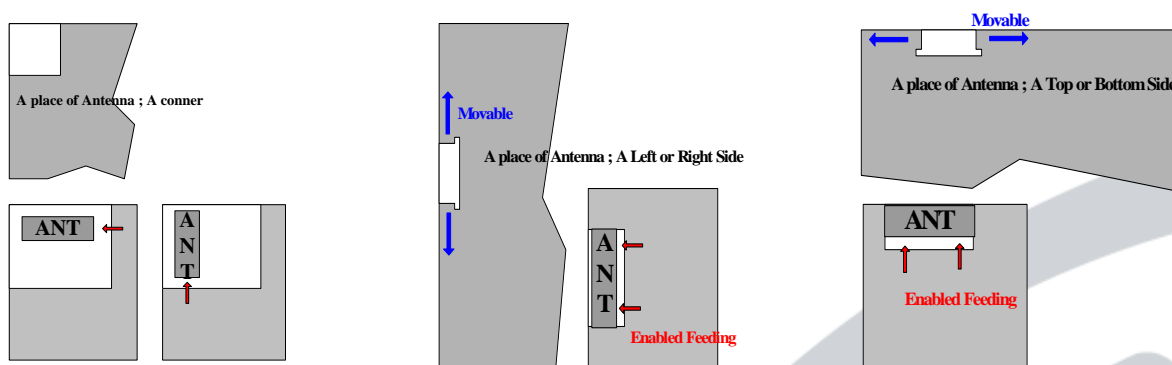
This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



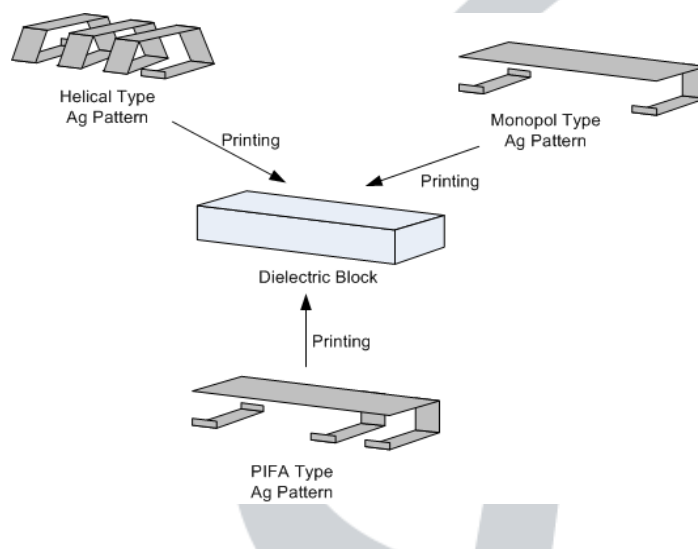
7. Basis Action / Application Note

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,

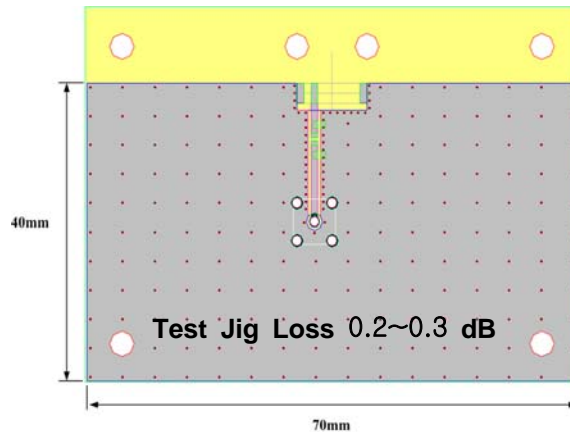


As the following, this product is easy to revise the various types for the boundary condition.



8. Measurement Jig SPEC

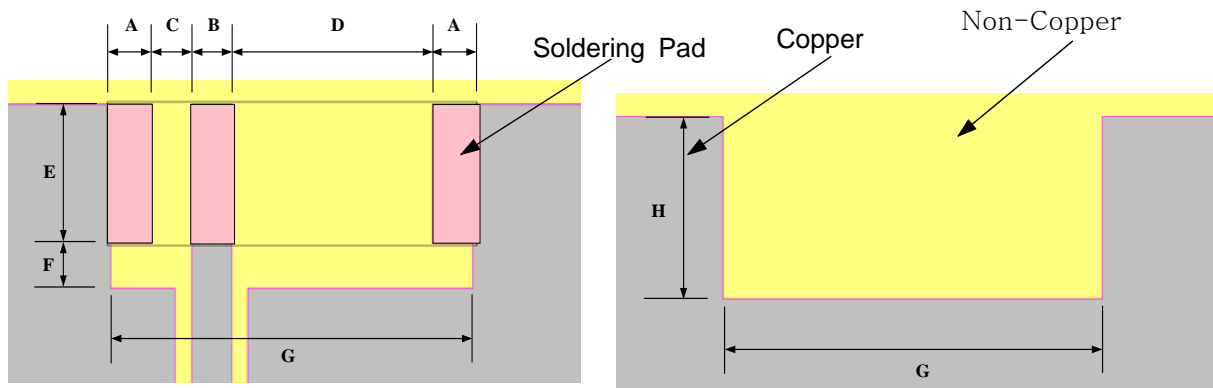
8.1 Test Fixture And GROUND Condition



※ 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

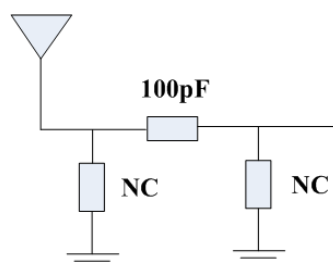
Bottom Pattern

Parameter	A	B	C	D	E	F	G	H
Value[mm]	1.1	1.0	0.5	3.5	2.2	1.0	7.2	3.2

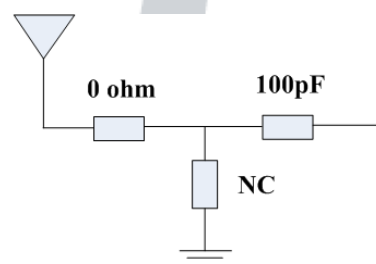
Unit ; mm

Unless specified tolerances are ± 0.1

8.3 Matching Circuit And Reference Value



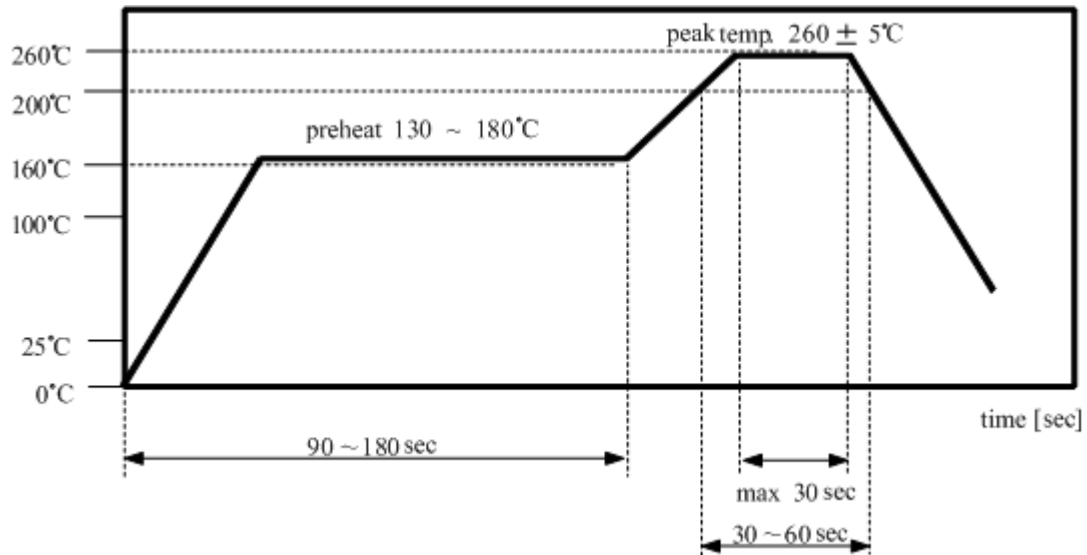
π Matching



T Matching

9. REFLOW PROFILE

9.1 Reflow Soldering



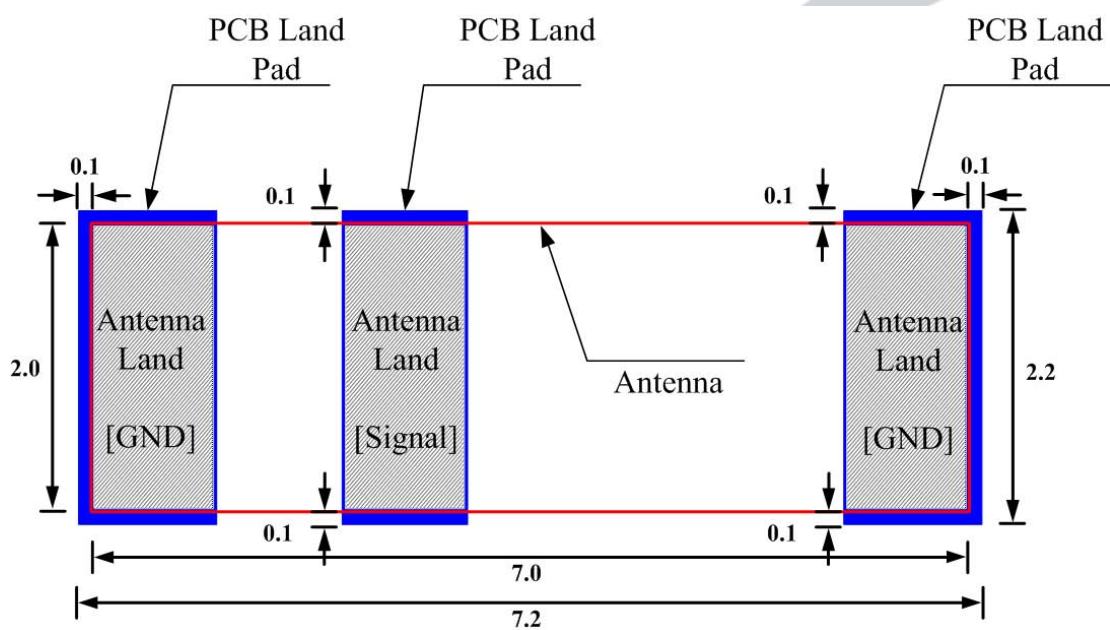
9.2 Manual Soldering

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

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

9.3 PCB Pattern Design

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



10. Primary Inspection List

Item	Electrical Characteristic [MHz]		Ev B'd Characteristic [MHz]		Size [mm]		
Standard	VSWR 3.0 Max		VSWR 3.0 Max		W=2.0±0.1	L=7.0±0.1	T=1.2±0.1
	2010	2090	2010	2090			
1	2.00	2.06	1.95	2.22	2.02	7.01	1.23
2	1.99	2.12	2.24	1.96	2.03	7.02	1.23
3	1.97	2.06	1.95	2.13	2.03	7.03	1.23
4	1.87	2.18	2.14	2.10	2.03	7.01	1.22
5	1.93	2.11	2.25	2.02	2.02	7.01	1.23
6	2.00	2.01	2.08	2.42	2.04	7.01	1.24
7	2.09	2.00	2.23	2.22	2.02	7.02	1.24
8	1.91	2.18	1.87	2.29	2.03	7.02	1.22
9	2.03	2.18	1.99	2.28	2.02	7.02	1.24
10	1.98	2.07	2.22	1.86	2.03	7.02	1.24
11	1.89	2.10	1.86	1.78	2.03	7.03	1.23
12	1.82	2.17	1.85	1.95	2.02	7.03	1.24
13	1.97	2.05	2.03	2.37	2.04	7.02	1.22
14	1.90	2.12	1.86	2.27	2.02	7.01	1.23
15	1.82	2.04	2.07	1.78	2.03	7.01	1.23
16	2.07	2.00	1.81	1.80	2.03	7.02	1.24
17	2.06	2.07	1.86	1.82	2.02	7.03	1.22
18	2.06	2.05	2.04	1.76	2.04	7.03	1.24
19	1.97	2.12	1.82	1.77	2.02	7.01	1.23
20	1.89	2.11	1.91	1.99	2.02	7.02	1.24
Min	1.82	2	1.81	1.76	2.02	7.01	1.22
Max	2.09	2.18	2.25	2.42	2.04	7.03	2.24
X	1.96	2.09	2.00	2.03	2.02	7.01	1.23
σ	0.08	0.05	0.09	0.09	0.01	0.01	0.01
Cpk	4.25	2.11	2.17	2.10	3.28	3.38	2.91
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 4.5 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 4.5 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 × 9.8ms ⁻² (G) Sweep time : 15 min , X.Y.Z each 5 times	After test, Must meet the characteristics spec of 4.5 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

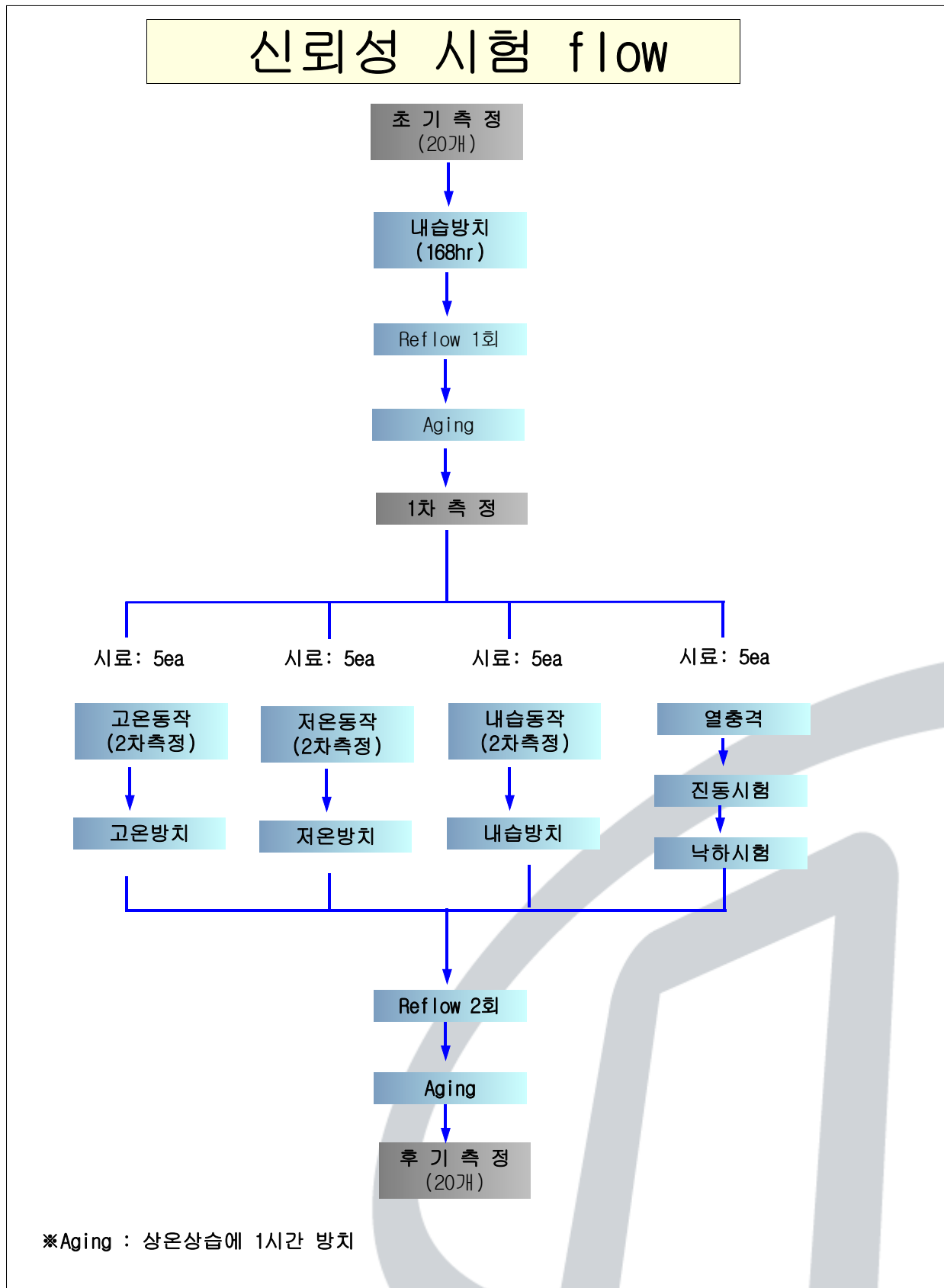
1) JEDEC J-STD-020C Test

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

2) Test Condition

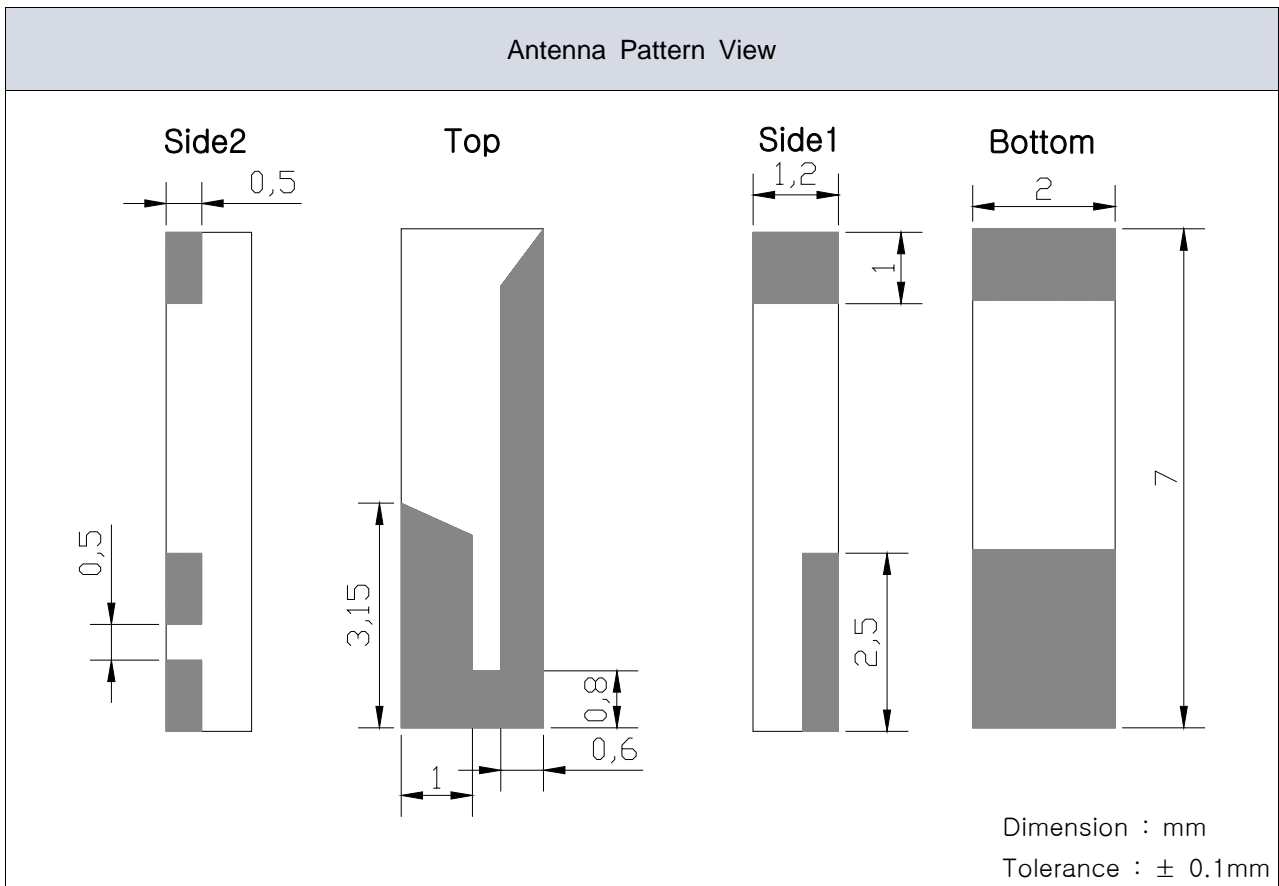
ITEM	Conditon	LIMIT
Soak Requirements	After leaving +85 ± 3℃, RH85% 168hr ± 2hr 2 times Reflow without aging	After test, Must meet the characteristics spec of 4.5 list

11.5 신뢰성 시험 FLOW

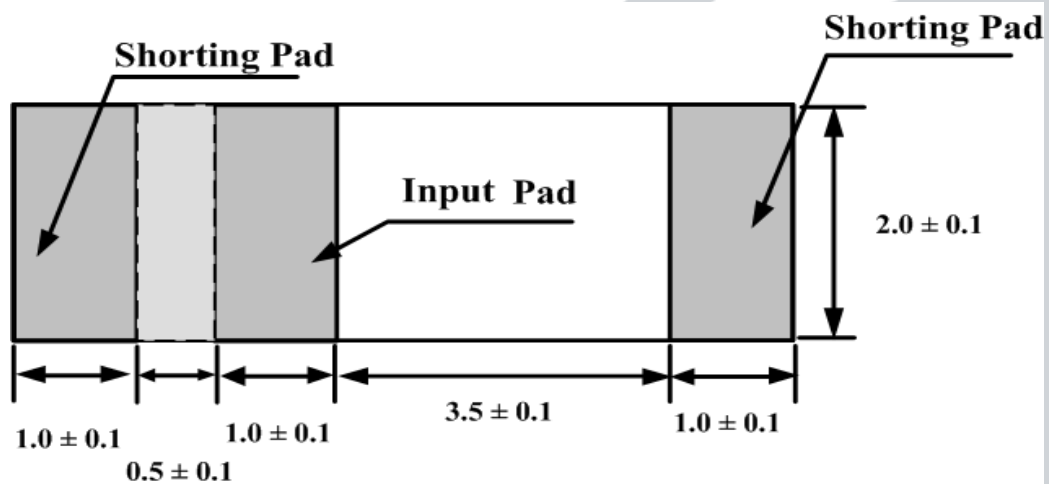


12. Mechanical Characteristics

12.1 Antenna Pattern Dimension



12.2 Pin name

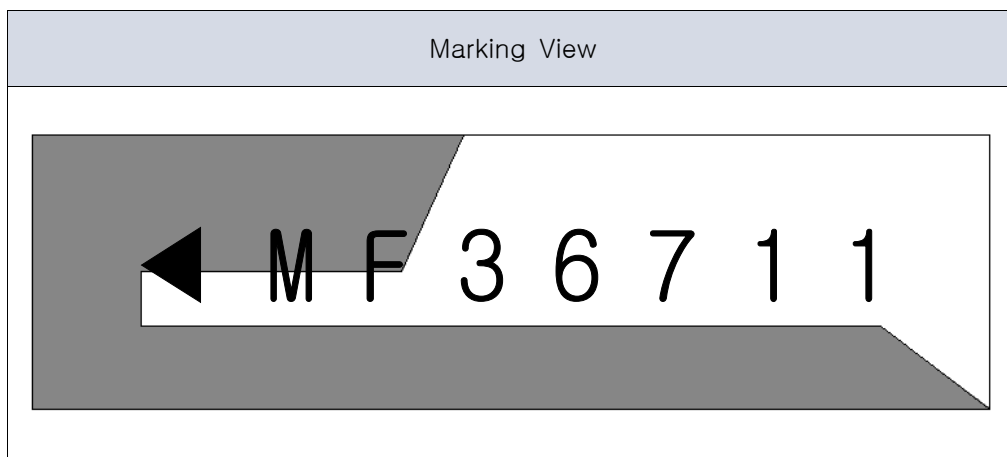


12.3 Lot number notation

<u>7</u>	<u>1</u>	<u>1</u>
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



◀	<u>M</u>	<u>F</u>	<u>3</u>	<u>6</u>	<u>7</u>	<u>1</u>	<u>1</u>
①	②	③	④	⑤			

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

12.5 Marking type

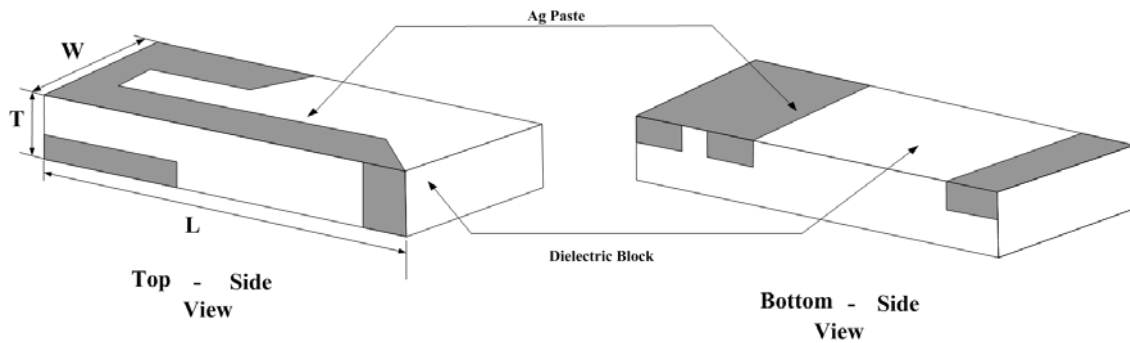
Ink marking - Using Black Ink

13. Structure and Material

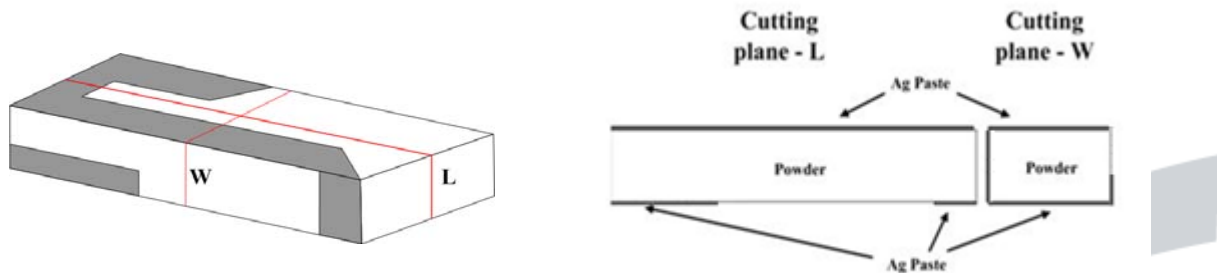
13.1 materialization method

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

13.2 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 μ m
PAD	Ag paste	METECH	Thickness : Min 10 μ m (TYP 16~20 μ m)

14. Attention

14.1 Temperature Condition

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

14.2 Temperature Test Condition

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

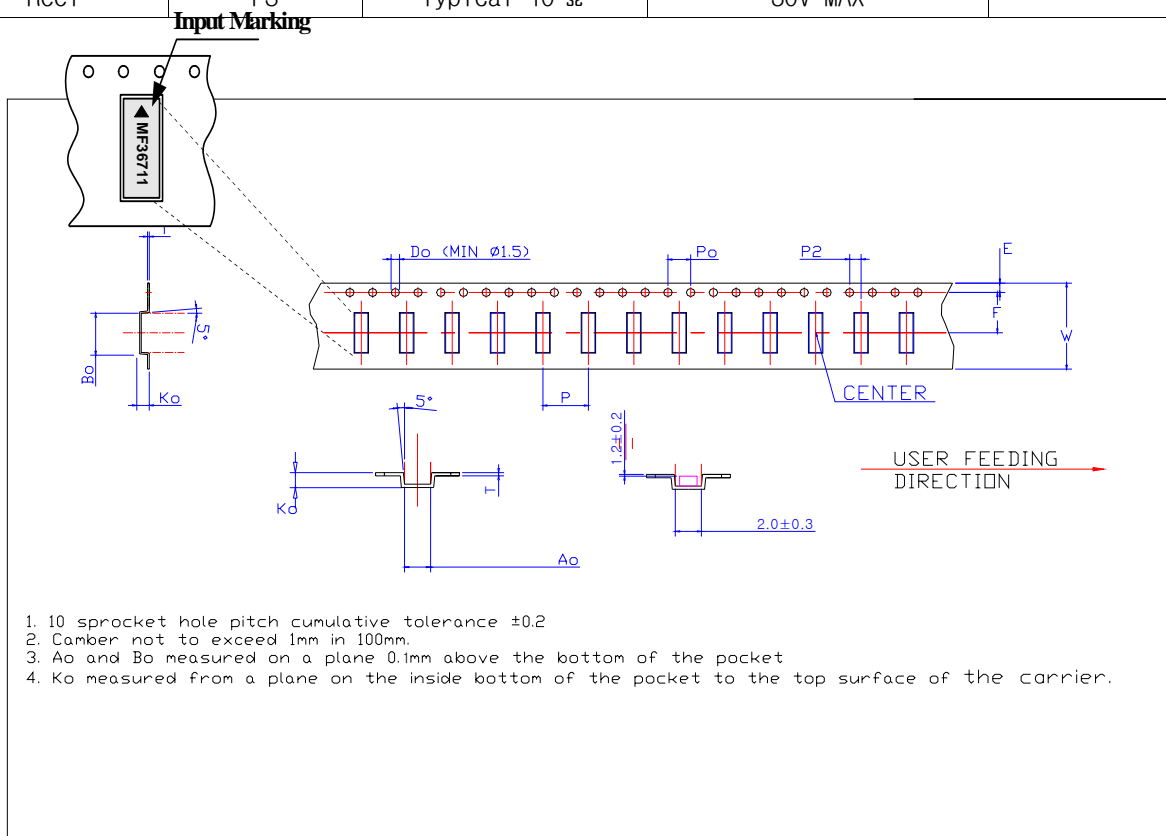
* Because of the keeping temperature problem, no admission when left over +85℃



15. Packing

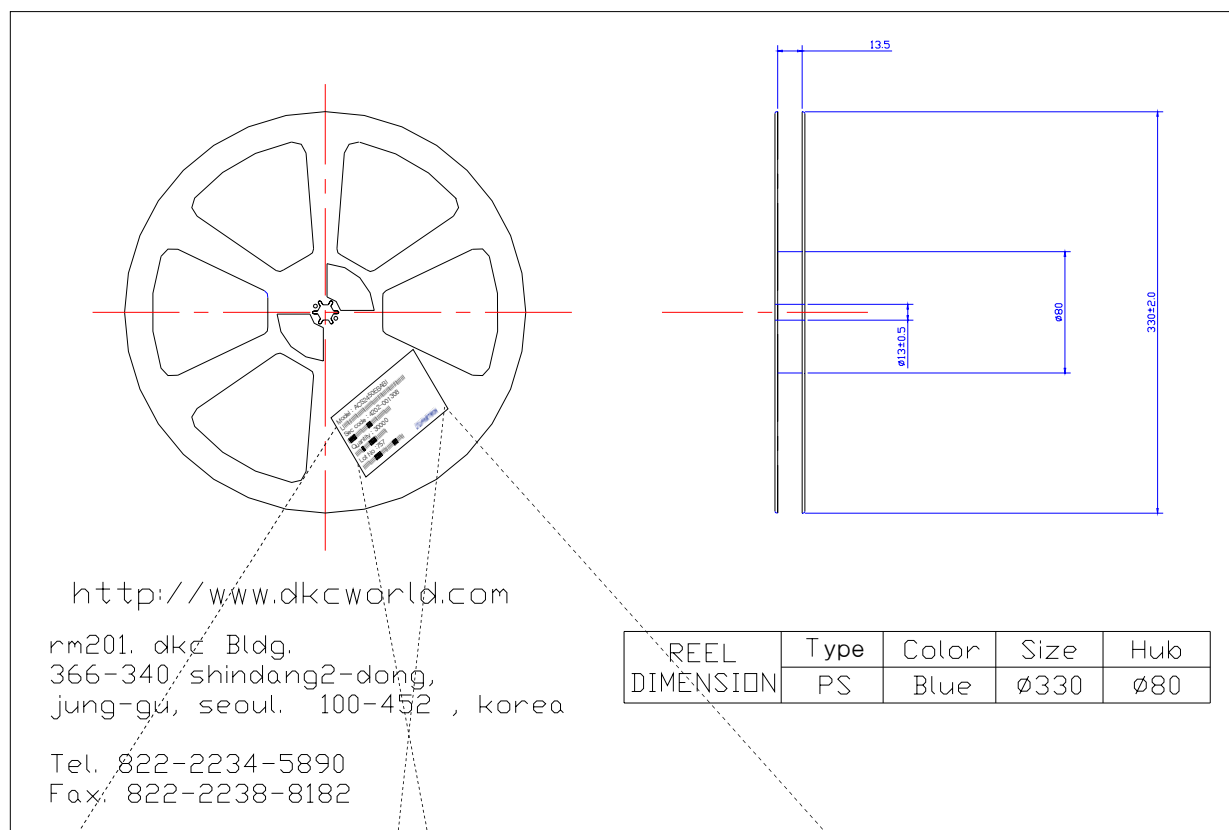
15.1 Carrier/Reel

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



DKC DWG. No.	D-1608-028	TITLE	
DIMENSIONAL UNIT	MM	CARRIER TAPE 2*7*1.2P	
UNTOLERANCED DIMENSION	± 0.1	PART.	CARRIER TAPE
CAD FILE NAME	050617	MATERIAL	A-PET
DESIGNED BY	K. M. J	LENGTH	48.4M
SCALE	1/1	COUNT	6050P

NAME	SPEC.
W	16.0 ± 0.2
E	1.75 ± 0.1
F	7.5 ± 0.1
Do	1.5 ± 0.1
P	8.0 ± 0.1
Po	4.0 ± 0.1
P2	2.0 ± 0.1
Ao	2.3 ± 0.1
Bo	7.3 ± 0.1
Ko	1.4 ± 0.1
T	0.3 ± 0.05



Model : ACS2450GBAMF36

[illegible]

Sec code :



Quantity ;

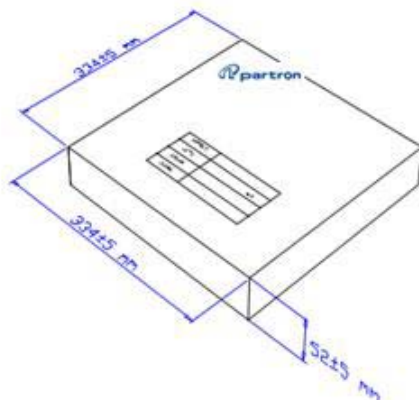
Lot No



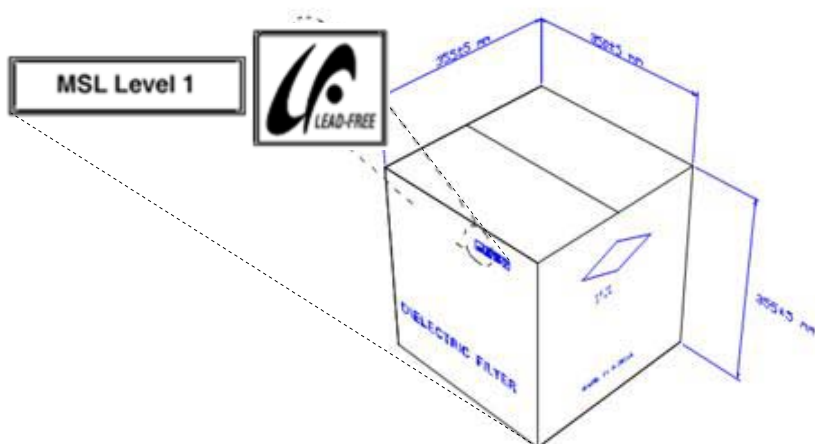
MSL Level 1



15.2 BOX



Material : SK/S/K-B
Corrugated cardboard



15.3 Actual packing Picture



Reel



Internal Box

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					
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, SENGEN-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) -


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

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 SGS TAIWAN LIMITED NO. 136-1, Wu-Kung Road, Wu-Kung Industrial Zone, Taipei county, Taiwan
 (886-2) 2295-5221 (886-2) 2295-5222 www.sgs.com.tw



Test Report

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

Report No. : CE/2006/75167
 Date : 2006/07/25
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Test Result(s)
 PART NAME NO.1 : WHITE POWDER

Test Item (s):	Unit	Method	MDL	Result No.1
PBBs (Polybrominated biphenyls)				
Monobromobiphenyl	%		0.0005	N.D.
Dibromobiphenyl	%		0.0005	N.D.
Tribromobiphenyl	%		0.0005	N.D.
Tetrabromobiphenyl	%	With reference to	0.0005	N.D.
Pentabromobiphenyl	%	USEPA3540C. Analysis was	0.0005	N.D.
Hexabromobiphenyl	%	performed by HPLC/DAD,	0.0005	N.D.
Heptabromobiphenyl	%	LC/MS or GC/MS.	0.0005	N.D.
Octabromobiphenyl	%	(prohibited by 2002/95/EC	0.0005	N.D.
Nonabromobiphenyl	%	(RoHS), 83/264/EEC, and	0.0005	N.D.
Decabromobiphenyl	%	76/769/EEC)	0.0005	N.D.
Total PBBs (Polybrominated biphenyls)/Sum of above				
PBDEs(PBDEs)				
(Polybrominated biphenyl ethers)				
Monobromobiphenyl ether	%		0.0005	N.D.
Dibromobiphenyl ether	%		0.0005	N.D.
Tribromobiphenyl ether	%		0.0005	N.D.
Tetrabromobiphenyl ether	%		0.0005	N.D.
Pentabromobiphenyl ether	%	With reference to	0.0005	N.D.
Hexabromobiphenyl ether	%	USEPA3540C. Analysis was	0.0005	N.D.
Heptabromobiphenyl ether	%	performed by HPLC/DAD,	0.0005	N.D.
Octabromobiphenyl ether	%	LC/MS or GC/MS.	0.0005	N.D.
Nonabromobiphenyl ether	%	(prohibited by 2002/95/EC	0.0005	N.D.
Decabromobiphenyl ether	%	(RoHS), 83/264/EEC, and	0.0005	N.D.
Total PBDEs(PBDEs) (Polybrominated biphenyl ethers)/Sum of above				
Total of Mono to Nona-brominated biphenyl ether. (Note 4)	%			N.D.

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12-8, SENGUN-CHO, HIRATSUKA-CITY, KANAKAWA-
PREF. JAPAN. (T) 81-463-32-0210

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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

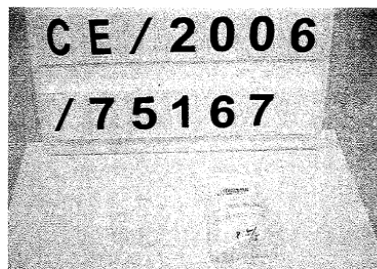
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** End of Report **

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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-801 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 Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050B(1996), US EPA 8010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(1996), US EPA 8010B(1996), ICP	5	N.D.
Mercury (Hg)	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 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. F690501/LF-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
 Jolly Oh
 Jerry Jung
 /Testing Person

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SGS
Test Report No. F690501/LF-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 Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050B(1996), US EPA 8010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(1996), US EPA 8010B(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), UV	1	N.D.

Flame Retardants-PBBS/PBDEs

Test Items	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. F690501/LF-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)
 (6) Negative = Undetectable / Positive = Detectable

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