

자재시방서(승인원)	기안자	최민규 연구원/ND연구팀 (032-650-6259)
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	최민규	곽귀동	유종은
			
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주관부서	사원
	정성엽
	
	11-05 09:33

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문서제목	E606-00017-001-0S		

자 재 코 드	E606000170010S
자 재 명	ANTENNA,MODULE
규 격	ACS2450HFL57 DIELECTRIC CHIP ANT

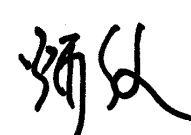
모 델 명	VUDU SPARK		
설계변경 NO	REV NO.	일자	내 용
중점 Check 사항			
환경문서번호			
검 사 방 식	수입검사 규칙(B0-B701-01)에 준하여 검사할 것.		
구 입 방 법	☒ 내수 ☐ LOCAL ☐ 수입		
협력업체명	PARTRON	제조업체명	PARTRON
첨 부 자 료	☒ 협력업체승인원 ☐ 도면 ☐ 검사성적서 ☐ 유해물질 불사용 확인서 ☐ 부품재질별 성적서		
첨부파일경로	ftp://61.73.120.6/approval/E606-00017-001-0S.pdf		

※ 첨부파일 경로 예시 :[네트워크 연결] ftp://61.73.120.6/APPROVAL/자재코드.PDF

IMS-B101-07/01(1)

개발 단가		부품 타입	SMD	LIB	
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Approval Sheet

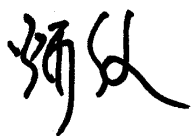
Products	Dielectric Chip Antenna		
Customer	Inkel		
Model			
Customer CODE			
Supplier	PARTRON		
Supplier CODE	ACS2450HFL57		
Inkel	By designed	By checked	By approved
PARTRON	By designed	By checked	By approved
	김 홍 기		
	Antenna 2 Team	Quality Assurance	Laboratory
	Hongki.Kim	Nam-Sik. Min	Byoung-Jun.Yim
	10/24	10/24	10/24

2014 . 10. 24

SPECIFICATION

MODEL : ACS2450HFL57

DIELECTRIC CHIP ANTENNA

By designed	By checked	By approved
김 흥 기		
Antenna 2 Team	Quality Assurance	Laboratory
Hongki.Kim	Nam-Sik. Min	Byoung-Jun.Yim
10/24	10/24	10/24

2014 . 10. 24

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2. Electrical Characteristics

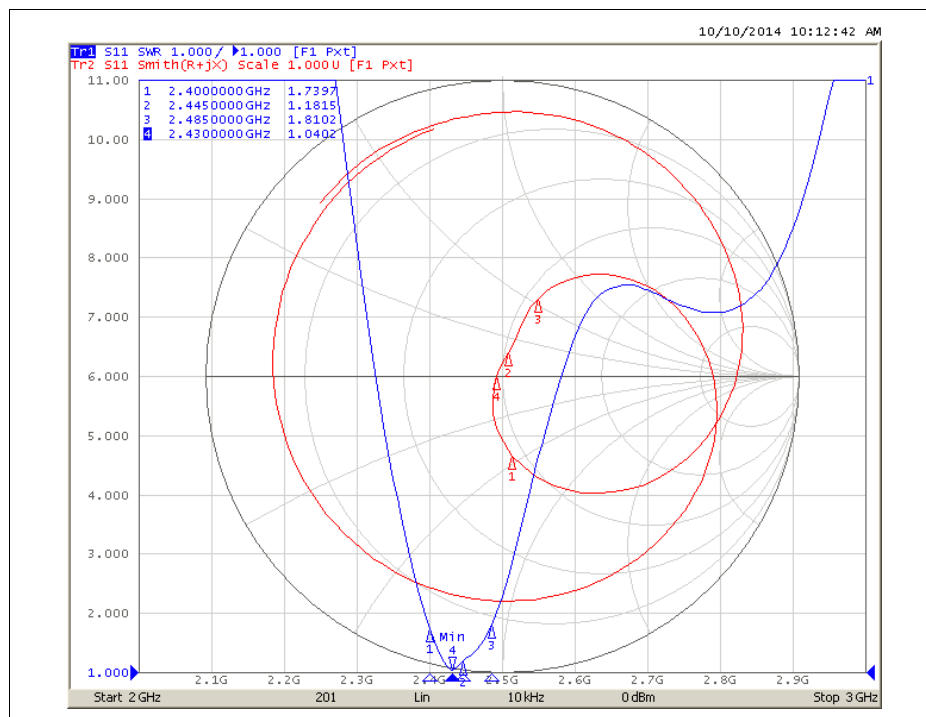
2.1 Set Condition

ITEM			SPEC
Frequency Range [MHz]			2400 ~ 2485
VSWR [Max]			3 : 1
Bandwidth [MHz]			85
Polarization			Linear
Matching Value of ANT Matching Circuit (Direction, from Antenna to Module)	Antenna Matching Circuit	Series1 (Feed)	1.8nH
	T-Matching Circuit (nearby Module)	Series2	100pF
		Series3	100pF
Gain[dBi]	Azimuth Plane	Peak	-1.43
		Average	-4.20
	Elevation1 Plane	Peak	1.93
		Average	-2.81
	Elevation2 Plane	Peak	1.98
		Average	-3.78
	3D	Peak	3.66
		Average	-2.89

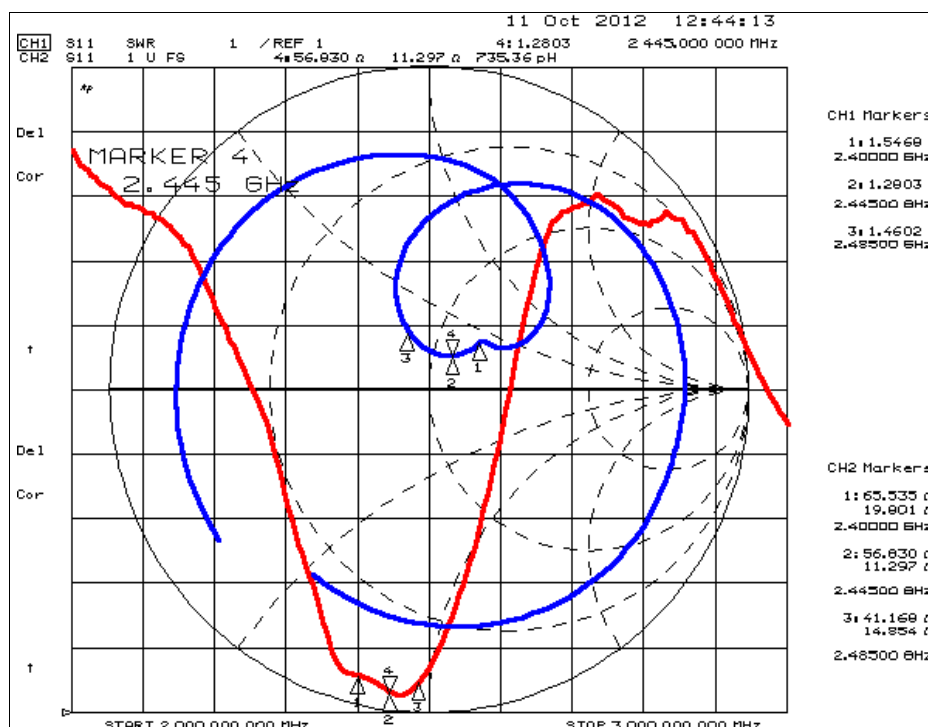
2.2 Test Fixture Condition

ITEM	SPEC
Frequency Range [MHz]	1840 ~ 1920
SWR [Max]	4.0 : 1
Bandwidth [MHz]	80

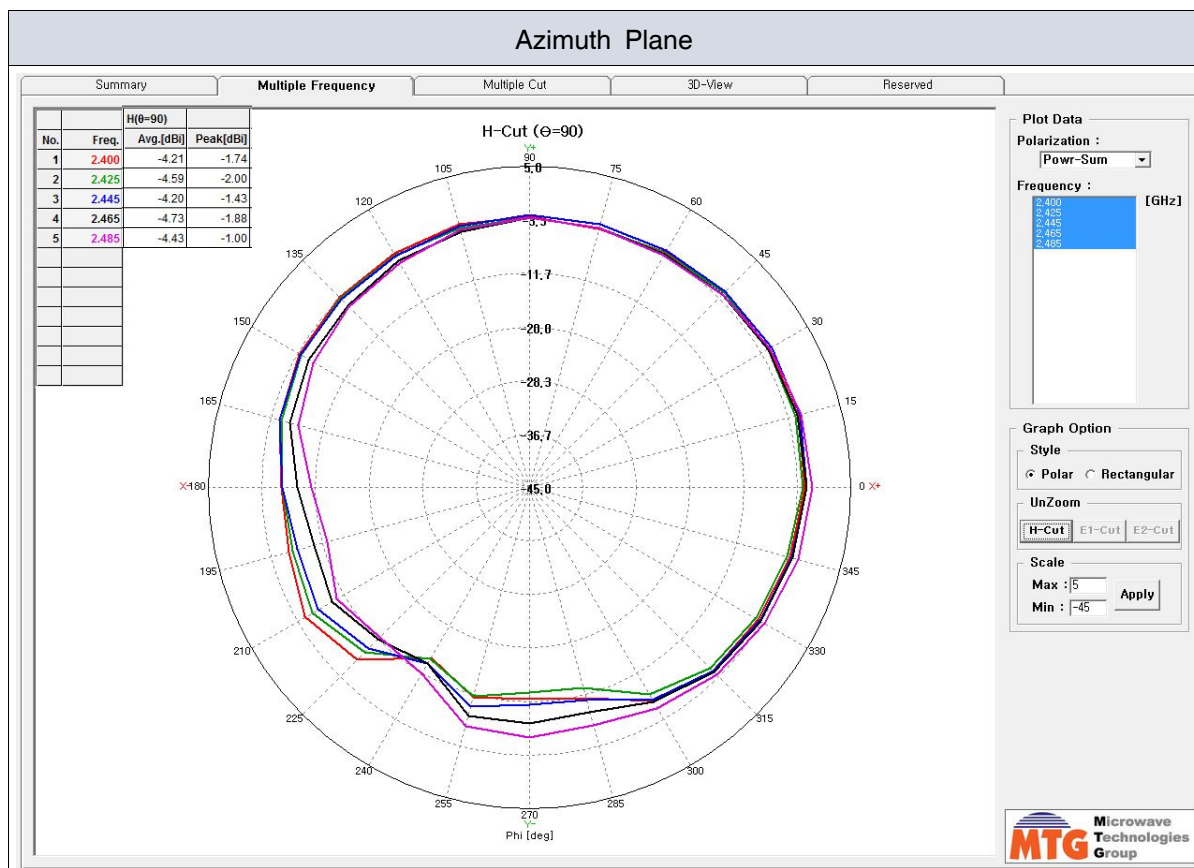
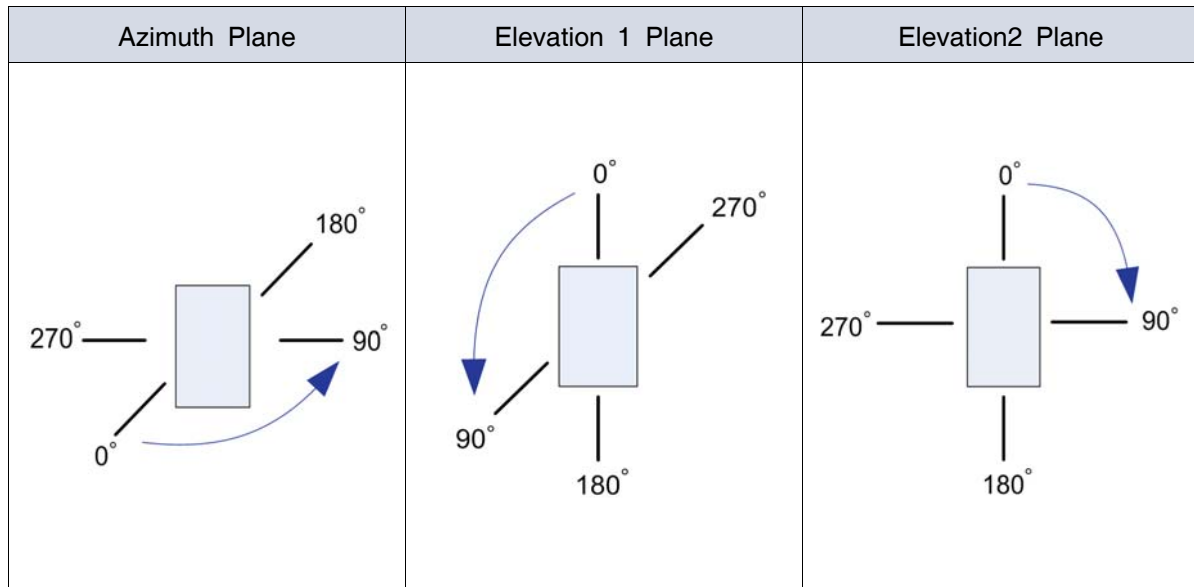
2.3 Graph of Set Condition

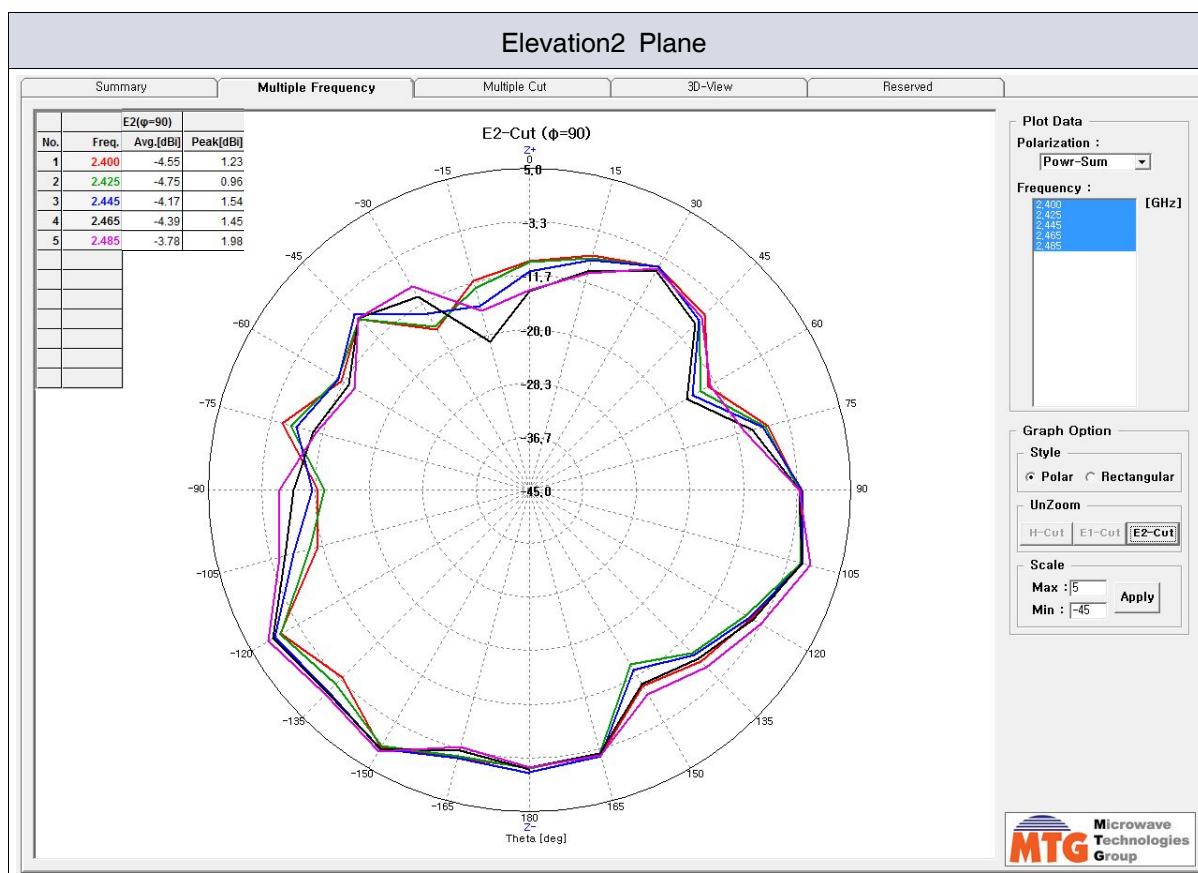
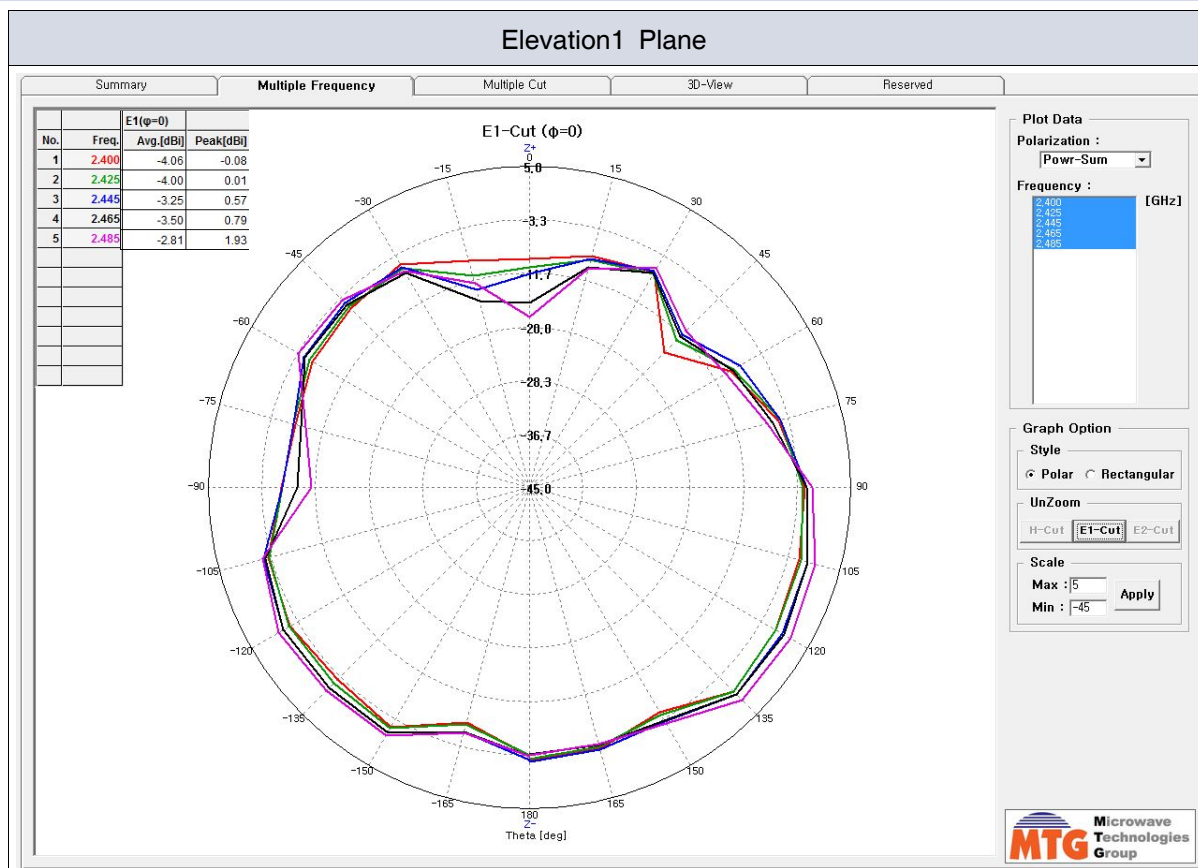


2.4 Graph of Test Fixture Condition

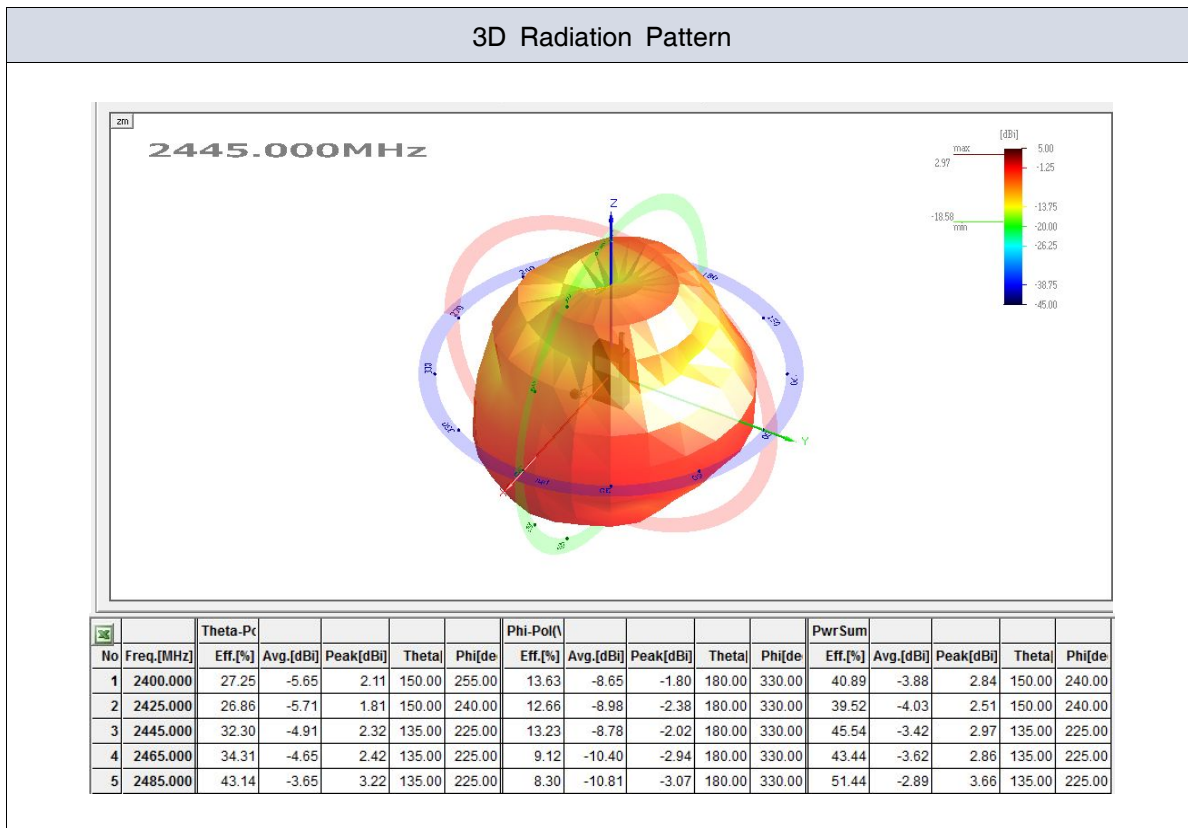


2.5 Radiation Pattern





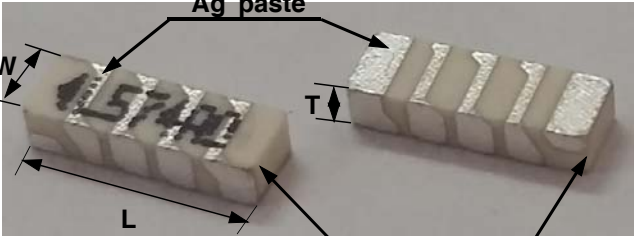
2.6 3D Radiation Pattern



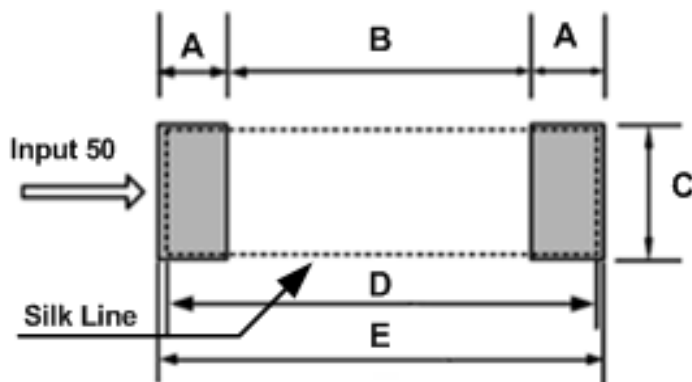
3. Mechanical Characteristics

- The structure is materialized printing Ag paste at the dielectric block

3.1 Structure and Material

Material	Dielectric Block	3D Structure
	Ag Paste	
Size [mm]	W = 2.0±0.1	
	L = 6.0±0.1	
	T = 1.2±0.1	
Temperature [°C]	- 40 ~ +80	
Humidity [%]	At the normal temperature, RH 100	

3.2 PCB Layout & Soldering Pad Dimension



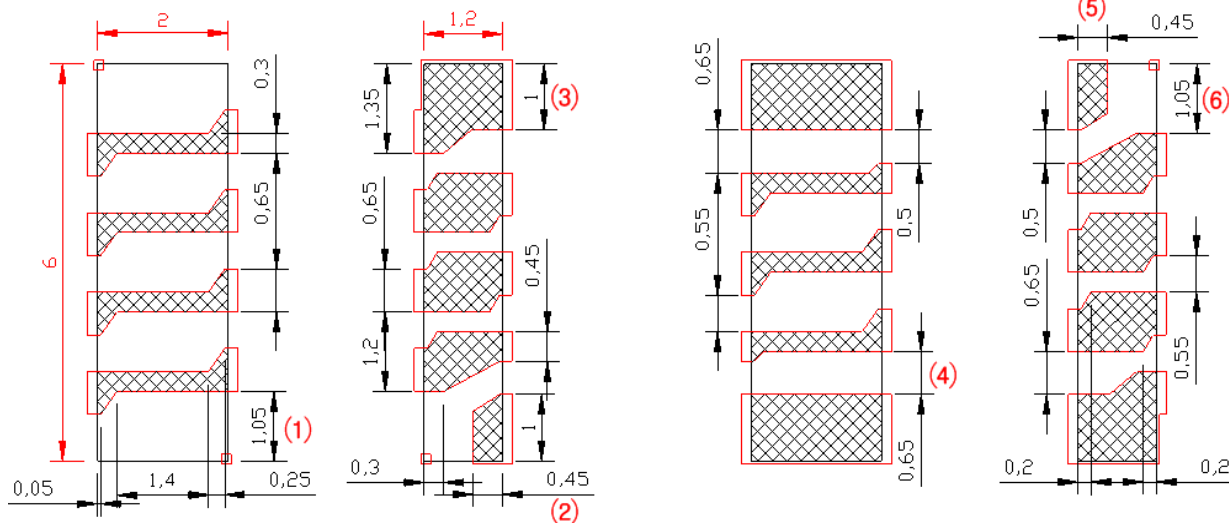
Parameter	A	B	C	D	E
Value[mm]	1.2	4.0	2.4	6.0	6.4

Unit ; mm

Unless specified tolerances are ± 0.1

3.3 Antenna Pattern Dimension

Antenna Pattern View



Top

Side1

Bottom

Side2

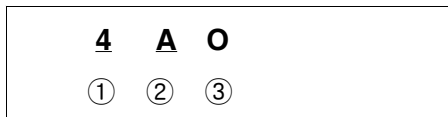
Unit ; mm

Unless specified tolerances are ± 0.1

3.3.1 Real Measurement Value

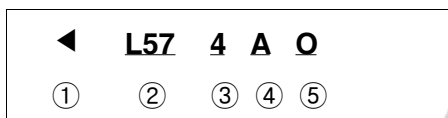
	(1)	(2)	(3)	(4)	(5)	(6)
Drawing Dimension [mm]	1.05±0.1	0.45±0.1	1.0±0.1	0.65±0.1	0.45±0.1	1.05±0.1
1	1.136	0.440	1.033	0.640	0.513	1.099
2	0.962	0.460	0.953	0.634	0.509	1.036
3	1.036	0.507	1.026	0.645	0.470	1.108
4	1.122	0.490	1.022	0.640	0.474	1.080
5	0.982	0.461	0.970	0.669	0.503	1.073
Min [mm]	0.962	0.440	0.953	0.634	0.470	1.036
Max [mm]	1.136	0.507	1.033	0.669	0.513	1.108
Average [mm]	1.048	0.472	1.001	0.646	0.494	1.079

3.4 LOT Notation



- ① Year ; 3 - 2013, 4 - 2014, 9 - 2019, 0 - 2020
- ② Month ; 1 - January, 2 - February, A - October, B - November
- ③ Date ; 1 - 1st, 2 - 2nd, 3 - 3rd O - 24th, P - 25th

3.5 Marking

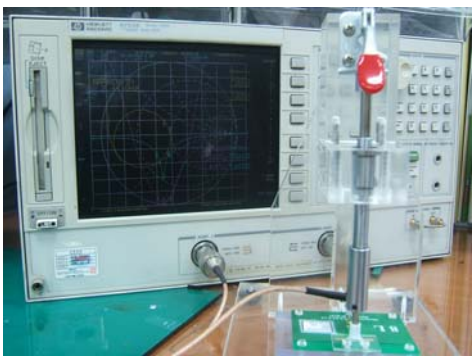


- ① Input Signal
- ② Serial
- ③ Year ; 3 - 2013, 4 - 2014, 9 - 2019, 0 - 2020
- ④ Month ; 1 - January, 2 - February, A - October, B - November
- ⑤ Date ; 1 - 1st, 2 - 2nd, 3 - 3rd O - 24th, P - 25th

4. Measurement Process

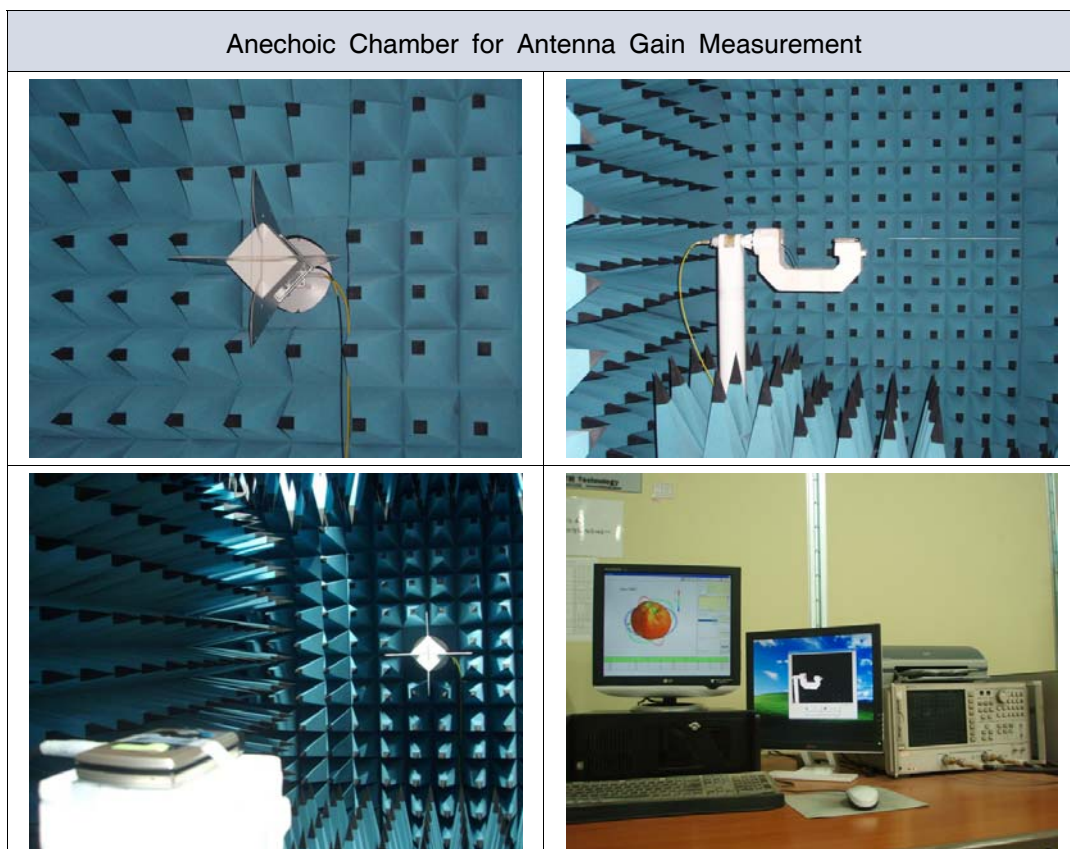
4.1 SWR/Returnloss

-The SWR/Returnloss is measured by Network Analyzer

	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D or Advantest R3765CG	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

4.2 Gain

-The Antenna Gain is measured using the set at Anechoic Chamber



5. Primary Inspection List

Item	Electrical Characteristic [MHz]		Mechanical Dimension [mm]		
	VSWR 4.0 : 1 [Max]		W=2.0±0.1	L=6.0±0.1	T=1.2±0.1 
	1840 MHz	1920 MHz			
1	2.21	1.99	2.03	6.02	1.23
2	2.06	2.13	2.04	6.01	1.24
3	1.96	2.11	2.04	6.00	1.24
4	2.09	2.06	2.05	6.01	1.24
5	1.98	2.23	2.04	6.00	1.24
6	2.10	1.97	2.04	6.01	1.25
7	1.95	2.27	2.04	6.01	1.24
8	1.88	2.38	2.03	6.00	1.23
9	2.04	2.14	2.04	6.01	1.24
10	2.08	2.04	2.03	6.01	1.24
11	1.81	2.38	2.04	6.02	1.24
12	2.03	1.99	2.05	6.01	1.25
13	2.32	1.84	2.04	6.03	1.24
14	1.94	2.16	2.05	6.00	1.25
15	1.83	2.44	2.04	5.99	1.24
16	2.28	1.83	2.06	6.02	1.24
17	2.33	1.79	2.04	6.00	1.25
18	2.17	1.89	2.04	6.01	1.25
19	1.66	2.22	2.03	6.01	1.24
20	1.68	2.33	2.04	6.00	1.23
X	2.02	2.11	2.04	6.01	1.24
σ	0.19	0.19	0.01	0.01	0.01
Cpk	3.42	3.20	2.58	3.23	4.67
Decision	OK	OK	OK	OK	OK

6. Reliability Condition

6.1 ENVIRONMENT TEST

ITEM	TEST CONDITION	LIMIT
High Temperature Resistance	+85℃±3℃, 120hr	*After the test, specimen would be kept at 25℃±5℃ for 1 hours
Low Temperature Resistance	-40℃±3℃, 120hr	
Humidity Resistance	+60±3℃, RH90~95%, 120hr	*specimen sheet meet the electrical specification

6.2 Thermal Shock Test, Reflow Test

ITEM	TEST CONDITION	LIMIT
Thermal Shock	-40℃±3℃/30min ↔ +85℃±3℃/30min cycle : 15 cycle recovery time : with in 5min	SAME as 6-1
Reflow	Pre Heating 200±5℃, 30~60 sec Peak Heating 260℃±5℃, 30sec Max	

6.3 Mechanical Test

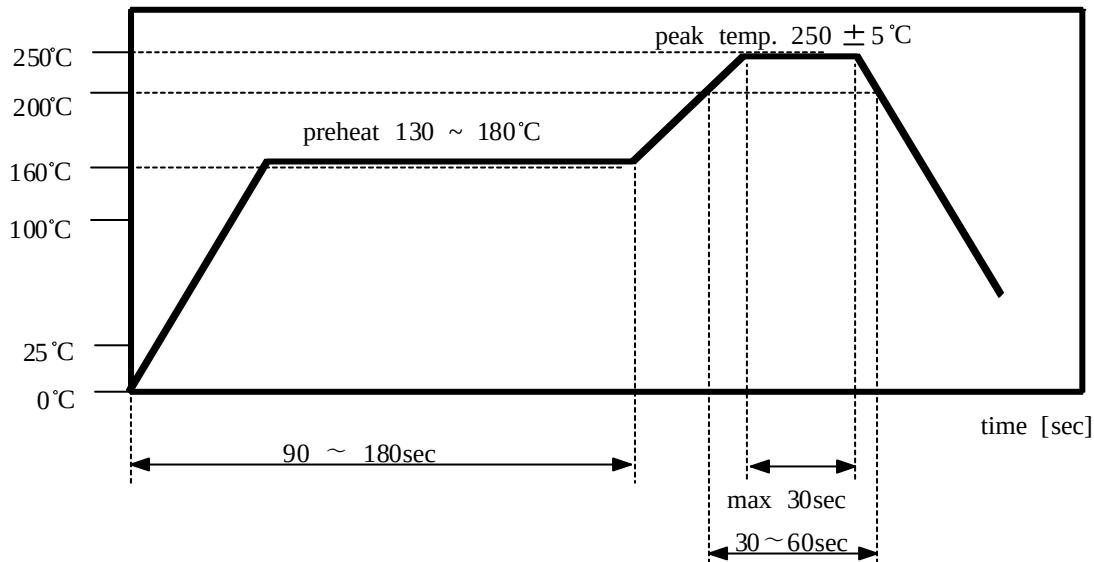
ITEM	TEST CONDITION	LIMIT
Random Vibration	Frequency 10~500Hz - 10 ×9.8m/s ² (G) Sweep time 15min, X.Y.Z each 5 times	*After the test, specimen sheet meet the electrical specification
Drop	Height 152cm, 5 times (Each Surface)	

6.4 Reliability Test Result

※ Appendix

7. Soldering Condon

7.1 Reflow Soldering



7.2 Manual Soldering

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

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

8. Attention

8.1 Temperature Condition

	Range of Temperature	unit
Application	-40 ~ +85	°C
Keeping	-40 ~ +85	°C

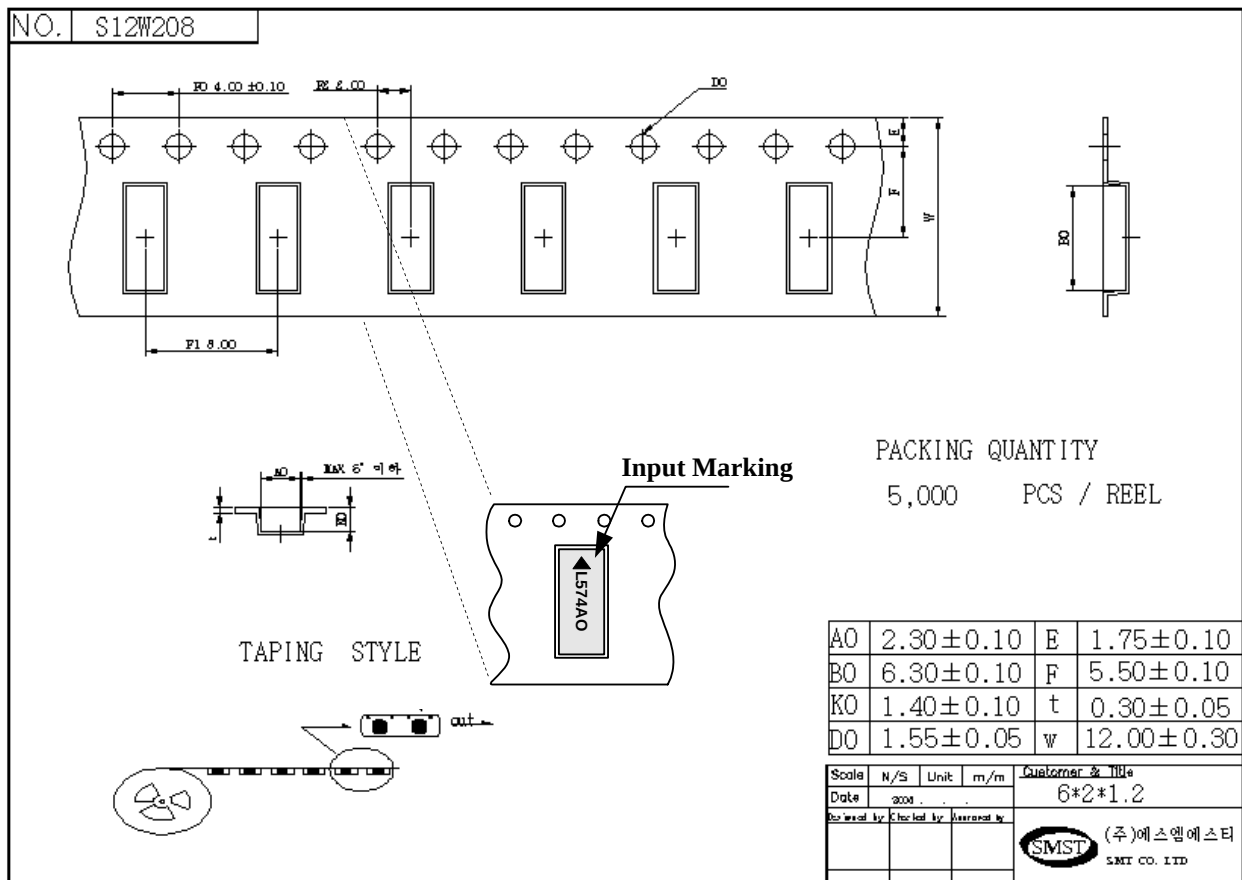
8.2 MSL LEVEL 1 (JEDEC J-STD-020C)

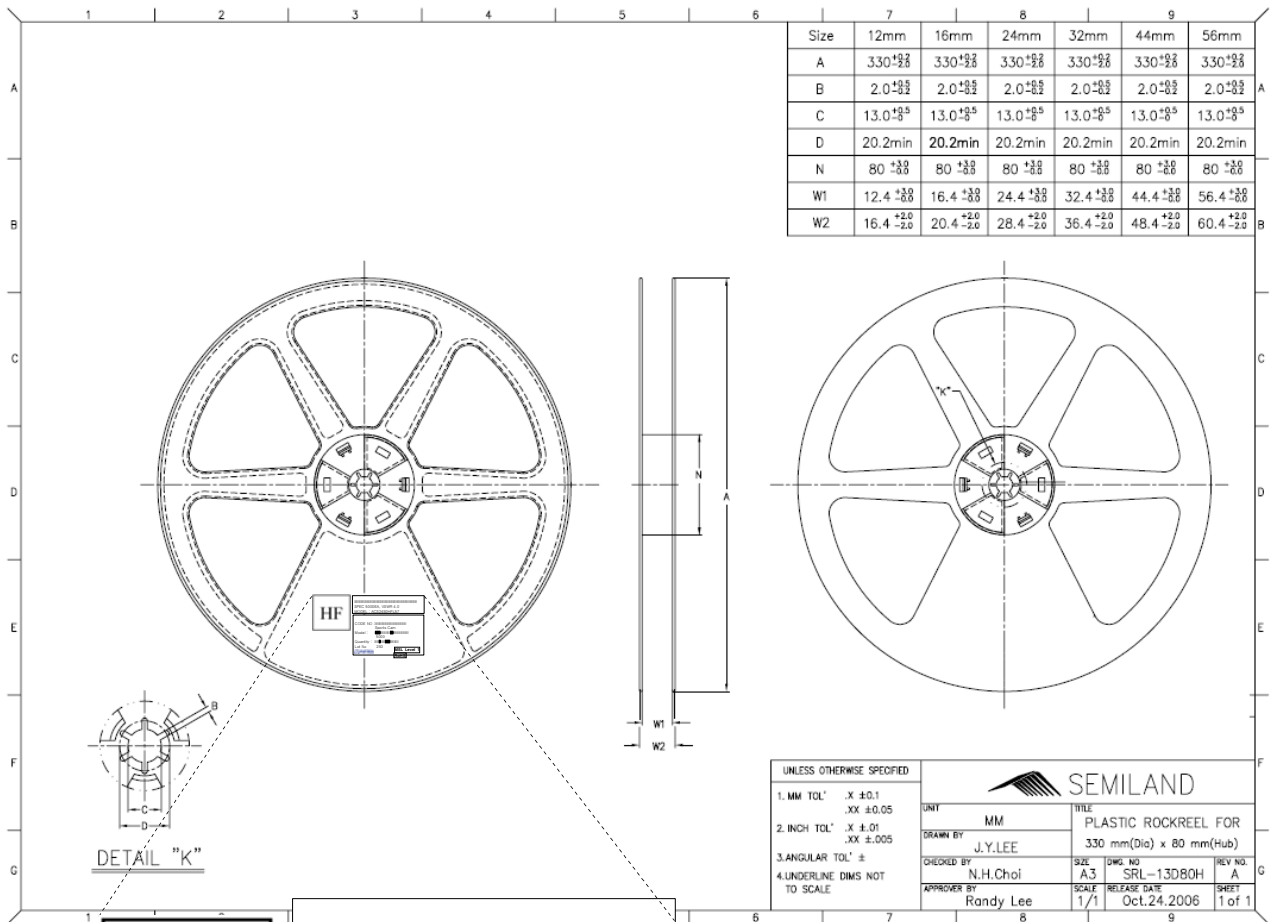
	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30°C/85%RH	168+5/-0	= < 85°C/85%RH

9. Packing

9.1 Carrier/Reel

ITEM	Material	Surface Resistance	Packing Method
Carrier	A-PET	Typical $10^8\Omega$	Heat press
Reel	A-PET		Air press (Using S-460G)





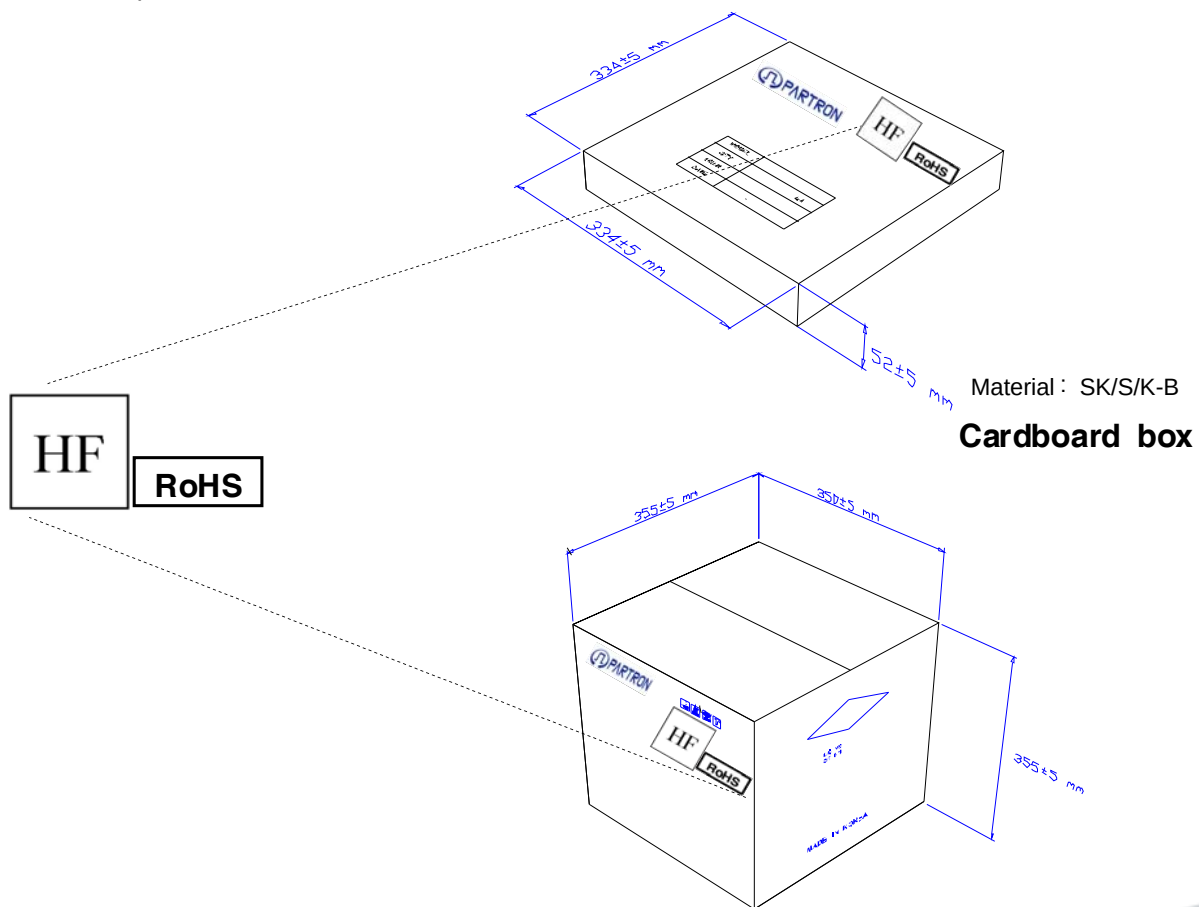
HF

SPEC 5000EA, VSWR 4.0
MODEL : ACS2450HFL57

CODE NO :
ACS2450HFL57
Model :
5000
Quantity :
Lot No 4AO
MSL Level 1
RoHS

UNLESS OTHERWISE SPECIFIED		SEMILAND	
1. MM TOL' .X ±0.1 XX ±0.05	UNIT MM	TITLE PLASTIC ROCKREEL FOR 330 mm(Dia) x 80 mm(Hub)	
2. INCH TOL' .X ±0.01 XX ±0.005	DRAWN BY J.Y.LEE	CHECKED BY N.H.Choi	SIZE A3
3. ANGULAR TOL' ±	APPROVER BY Randy Lee	SCALE 1/1	DATE Oct.24.2006
4. UNDERLINE DIMS NOT TO SCALE			REV NO. A SHEET 1 of 1

9.2 Box Specification



10. 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 CTQ Process (Weight, dimension)	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 CTQ Process (dimension)						wide length shape	refer to Guide Sheet	Micrometer Calipers Visual Inspection	20ea/LOT 20ea/LOT all	C/sheet	Exhaust
AG PASTE		○	SIDE1 PAD Printing CTQ Process (Printing dimension)	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					
	prepara tion	Main Process		Equipment Name	Checked	Condition	Cycle of managem ent	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
AG PASTE			SIDE 2 PAD Printing CTQ	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 CTQ	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	By	By		
CHIP ANTENNA		Issued Revised	04.04.06 05.04.03						PRCP-C001					
Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	prepara tion	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 CTQ	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

11. RoHS Data

1) Ceramic Powder

Parts Name	iM-K8
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



Test Report

No. SHAEIC1417328401 Date: 13 Sep 2014 Page 1 of 7

WUXI INANOTECH CO., LTD.
NO.518-3 ZHONGSHI ROAD, WUXI, JIANGSU, CHINA (214174)

The following sample(s) was/were submitted and identified on behalf of the clients as: CERAMIC POWDER

SGS Job No.: SP14-028034 - SH
Model No.: IM-K8
Composition: MgSiO₃ - SiTiO₃
Date of Sample Received: 10 Sep 2014
Testing Period: 10 Sep 2014 - 13 Sep 2014
Test Requested: Switched test(s) as requested by client.
Test Method: Please refer to next page(s).
Test Results: Please refer to next page(s).
Conclusion: Based on the performed tests on submitted samples, the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by REACH Directive 2011/65/EU Annex II: recycling 2002/95/EC.

Signed for and on behalf of
SGS-CSTC LM.

Serena Wang
Approved Signatory


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Test Report

No. SHAEIC1417328401 Date: 13 Sep 2014 Page 2 of 7

Test Results

Test Result Description

Specimen No. SH14-173284-001
Description Grey powder

Remarks:
(1) 1 mg/kg = 0.0001%
(2) MDL = Method Detection Limit
(3) ND = Not Detected (< MDL)
(4) * = Not Regulated

RoHS Directive 2011/65/EU

Test Method: (1) With reference to IEC 62321-4:2013, determination of Cadmium by ICP-OES.
(2) With reference to IEC 62321-4:2013, determination of Lead by ICP-OES.
(3) With reference to IEC 62321-4:2013, determination of Mercury by ICP-OES.
(4) With reference to IEC 62321-4:2013, determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.
(5) With reference to IEC 62321-4:2013, determination of PBBs and PBDEs by GC-MS.

Test Items

Test Item(s)	Limit	Unit	MDL	Det.
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1000	mg/kg	2	ND
Mercury (Hg)	1000	mg/kg	2	ND
Hexavalent Chromium (Cr(VI))	1000	mg/kg	2	ND
Sum of PBBs	1000	mg/kg	-	ND
Monobromobiphenyl	-	mg/kg	5	ND
Dibromobiphenyl	-	mg/kg	5	ND
Trisbromobiphenyl	-	mg/kg	5	ND
Tetrabromobiphenyl	-	mg/kg	5	ND
Pentabromobiphenyl	-	mg/kg	5	ND
Hexabromobiphenyl	-	mg/kg	5	ND
Heptabromobiphenyl	-	mg/kg	5	ND
Octabromobiphenyl	-	mg/kg	5	ND
Nonabromobiphenyl	-	mg/kg	5	ND
Decabromobiphenyl	-	mg/kg	5	ND
Sum of PBDEs	1000	mg/kg	-	ND
Monobromodiphenyl ether	-	mg/kg	5	ND



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Test Report

No. SHAEIC1417328401 Date: 13 Sep 2014 Page 3 of 7

Test Item(s)	Limit	Unit	MDL	Det.
Dibromodiphenyl ether	-	mg/kg	5	ND
Trisbromodiphenyl ether	-	mg/kg	5	ND
Tetrabromodiphenyl ether	-	mg/kg	5	ND
Pentabromodiphenyl ether	-	mg/kg	5	ND
Hexabromodiphenyl ether	-	mg/kg	5	ND
Heptabromodiphenyl ether	-	mg/kg	5	ND
Octabromodiphenyl ether	-	mg/kg	5	ND
Nonabromodiphenyl ether	-	mg/kg	5	ND
Decabromodiphenyl ether	-	mg/kg	5	ND

Notes: (1) The maximum permissible limit is quoted from directive 2011/65/EU, Annex II

Element(s)

Test Method: With reference to US EPA Method 3052.1996, analysis was performed by ICP-OES.

Test Item(s)	Unit	MDL	Det.
Antimony (Sb)	mg/kg	10	ND

Halogen

Test Method: With reference to EN 14582: 2007, analysis was performed by Ion Chromatograph (IC).

Test Item(s)	Unit	MDL	Det.
Chlorine (Cl)	mg/kg	50	ND
Bromine (Br)	mg/kg	50	ND



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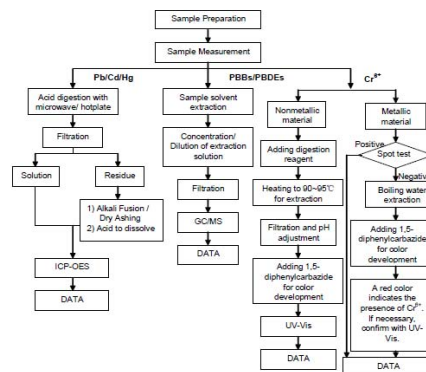


Test Report

No. SHAEIC1417328401 Date: 13 Sep 2014 Page 4 of 7

ATTACHMENTS

1) Name of the person who made testing: Bob Zhang/Star Wang/Shara Wang/Gary Xu
2) Name of the person in charge of testing: Jan Shi/Summer Jin/Jessy Huang
3) These samples were dissolved totally by pre-conditioning method according to below flow chart.
(C²⁺ and PBBs/PBDEs test method excluded)



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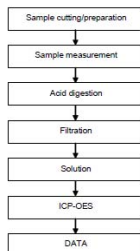
No. SHAEC1417328401

Date: 13 Sep 2014

Page 5 of 7

Elements Testing Flow Chart

- 1) Name of the person who made testing: Star Wang/ Jan Shi
2) Name of the person in charge of testing: Jeff Zhang



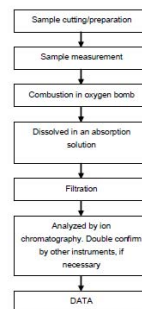
No. SHAEC1417328401

Date: 13 Sep 2014

Page 6 of 7

Halogen Testing (oxygen bomb) Flow Chart

- 1) Name of the person who made testing: Sisily Yin
2) Name of the person in charge of testing: Linda U



No. SHAEC1417328401

Date: 13 Sep 2014

Page 7 of 7

Sample photo:



SGS authenticate the photo on original report only

*** End of Report ***



2) Ag Paste

Parts Name	DNF2010C
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. F800101LF-CTSAIAA14-28567

Issued Date : 2014. 08. 17

Page 1 of 6

DNAJOO ELECTRONICS MATERIALS CO., LTD.
148 Seohyeon-ro
Seungnam-si, Gyeonggi-do
Korea

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

SGS File No. : AYAA14-28567
Product Name : Ag Paste
Item No./Part No. : N/A
Client Reference Data : DNF2010C(Y140409),DNF2010(Y140407),DNF2010(Y140401)
Received Date : 2014. 08. 09
Test Period : 2014. 08. 10 to 2014. 08. 17
Report Comments : (If by the applicant's request, item No. and part No. is a client reference information are stated/added on report.)
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Jeff Jang

Jeff Jang / Chemical Lab Mgr

SGS

Test Report No. F800101LF-CTSAIAA14-28567

Issued Date : 2014. 08. 17

Page 2 of 6

Sample No. : AYAA14-28567-001
Sample Description : Ag Paste
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Lead (Pb)	mg/kg	With reference to IEC 62321:2013, ICP	5	N.D.
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2013, ICP	0.5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2013, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2013, ICP	1	N.D.

Flame Retardancy (mg/kg)

Test Item	Unit	Test Method	MDL	Results
Monobromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Dibromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Trisbromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Pentabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Hexabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Heptabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Octabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Nonabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Decabromophenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Chlorobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Dibromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Trisbromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Tetrabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Pentabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Hexabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Heptabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Octabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Nonabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.
Decabromobiphenyl ether	mg/kg	With reference to IEC 62321:2013, GC-MS	5	N.D.

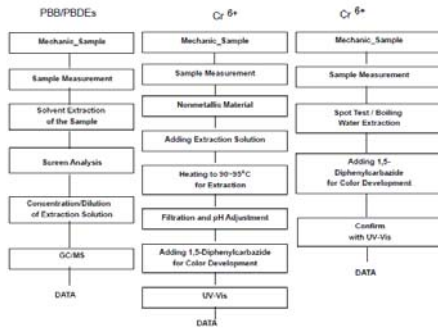
Organic Compounds

Test Item	Unit	Test Method	MDL	Results
Chlorine	mg/kg	BS EN 14883:2007, IC	30	N.D.
Bromine	mg/kg	BS EN 14883:2007, IC	30	N.D.

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SGS Test Report No. F800101LF-CTSAIAA14-28567 Issued Date : 2014. 08. 17 Page 3 of 6 NOTE: (1) N.D. = Not detected (<MDL) (2) mg/kg = ppm (3) MDL = Method Detection Limit (4) - = No regulation (5) Negative = Undetectable / Positive = Detectable (6) "+" = Qualitative analysis (No Unit) (7) "+" = Boiling-water-extraction Negative = Absence of Cr(VI) coating Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area. Picture of Sample as Received:  AYAA14-28567.001	SGS Test Report No. F800101LF-CTSAIAA14-28567 Issued Date : 2014. 08. 17 Page 4 of 6 Flow Chart of Digestion <pre> graph TD A[Cutting/Preparation] --> B[Sample Measurement] B --> C[Cd,Pb] B --> D[Hg] C --> E[Decomposition under closed(microwave) or open(acid digestion) system by suitable acid for each sample matrix.] D --> F[Decomposition under closed(microwave) system by suitable acid for each sample matrix.] E --> G[Filtration] F --> G G --> H[Solution] G --> I[Residue] H --> J[ICP-AES] I --> K[Alkali Fusion] </pre> <table border="1"> <thead> <tr> <th>Sample material</th> <th>Digestion Acid</th> </tr> </thead> <tbody> <tr> <td>Metal:Fe, Cu, Al, etc.</td> <td>Aqua regia, HCl, HNO₃</td> </tr> <tr> <td>Plastic</td> <td>HNO₃, HCl, HF, HClO₄</td> </tr> <tr> <td>Silver</td> <td>HNO₃, H₂SO₄</td> </tr> <tr> <td>Solder, Au, Pt, Pd, Sb, Sn</td> <td>Aqua regia</td> </tr> <tr> <td>Glass</td> <td>HNO₃, HCl, HF</td> </tr> <tr> <td>Ti, Zr, W, Mo, Si, Hf, Nb, Ta</td> <td>HNO₃, HCl, HF</td> </tr> <tr> <td>Sn (as IEC 62321)</td> <td>HNO₃, HCl, H₂SO₄, HBr</td> </tr> <tr> <td>Others</td> <td>Any acid</td> </tr> </tbody> </table> The samples were dissolved totally by pre-conditioning method according to above flow chart. Section Chief : Gisaee Yi	Sample material	Digestion Acid	Metal:Fe, Cu, Al, etc.	Aqua regia, HCl, HNO ₃	Plastic	HNO ₃ , HCl, HF, HClO ₄	Silver	HNO ₃ , H ₂ SO ₄	Solder, Au, Pt, Pd, Sb, Sn	Aqua regia	Glass	HNO ₃ , HCl, HF	Ti, Zr, W, Mo, Si, Hf, Nb, Ta	HNO ₃ , HCl, HF	Sn (as IEC 62321)	HNO ₃ , HCl, H ₂ SO ₄ , HBr	Others	Any acid
Sample material	Digestion Acid																		
Metal:Fe, Cu, Al, etc.	Aqua regia, HCl, HNO ₃																		
Plastic	HNO ₃ , HCl, HF, HClO ₄																		
Silver	HNO ₃ , H ₂ SO ₄																		
Solder, Au, Pt, Pd, Sb, Sn	Aqua regia																		
Glass	HNO ₃ , HCl, HF																		
Ti, Zr, W, Mo, Si, Hf, Nb, Ta	HNO ₃ , HCl, HF																		
Sn (as IEC 62321)	HNO ₃ , HCl, H ₂ SO ₄ , HBr																		
Others	Any acid																		

Flow Chart of Cr⁶⁺, PBB/PBDEs Testing

[illegible]

Fall 2008

3) Marking Ink(Black Ink)

Parts Name	IR/IC-270BK 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

	
Test Report	No. TSNEC1301308602 Date: 26 Dec 2013 Page 1 of 7
YANTAI PARTRON ELECTRONICS CO., LTD 352# MUXIN ROAD ECONOMIC DEVELOPMENT ZONE MUPING YANTAI SHANDONG CHINA	
The following sample(s) was/were submitted and identified on behalf of the clients as : INK	
SGS Job No. :	TP13-006510 - TJ
Model No. :	IR-270BK
Date of Sample Received :	23 Dec 2013
Testing Period :	23 Dec 2013 - 26 Dec 2013
Test Requested :	Selected test(s) as requested by client.
Test Method :	Please refer to next page(s).
Test Results :	Please refer to next page(s).
Conclusion :	Based on the performed tests on submitted samples, the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by RoHS Directive 2011/65/EU Annex II, recasting 2002/95/EC.
Signed for and on behalf of SGS-CSTC Ltd.	
	
Reabeca Zhou Approved Signatory	
I, the undersigned, being the Competent Authority or a Competent Authority of the Client, hereby certify that the information provided in this document is true and correct to the best of my knowledge and belief. I am authorized to sign this document on behalf of the Client. SGS SGS Monitoring, No. 41, The 5th Avenue TEDA, Tianjin, China 300407 1 36-23 023800 1 36-23 023802 www.cn.sgs.com 中国·天津泰达第五大道41号13623023800 邮编: 300407 1 36-23 023801 1 36-23 023802 sgs@sgs.com	

SGS				
Test Report	No. TSNEC1301308502	Date: 26 Dec 2013	Page 2 of 7	
Test Results :				
Test Part Description :				
Specimen No.	SGS Sample ID	Description		
SN1	TSN13-013085.002	black ink		
Remarks :				
(1) 1 mg/kg = 0.0001%				
(2) MDL = Method Detection Limit				
(3) ND = Not Detected (< MDL)				
(4) "x" = Not Regulated				
RoHS Directive 2011/65/EU				
Test Method :				
(1) With reference to IEC 62321-5-2013, determination of Cadmium by ICP-OES.				
(2) With reference to IEC 62321-5-2013, determination of Lead by ICP-OES.				
(3) With reference to IEC 62321-4-2013, determination of Mercury by ICP-OES.				
(4) With reference to IEC 62321-2:2008, determination of Hexavalent Chromium by Colorimetric Method using UV-VIS				
(5) With reference to IEC 62321-2:2008, determination of PBBs and PBDEs by GC-MS.				
Test Item(s)	Limit	Unit	MDL	%²
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1000	mg/kg	2	ND
Mercury (Hg)	1000	mg/kg	2	ND
Hexavalent Chromium (Cr(VI))	1000	mg/kg	2	ND
Sum of PBBs	1000	mg/kg		
Monobromobiphenyl	-	mg/kg	5	ND
Dibromobiphenyl	-	mg/kg	5	ND
Tribromobiphenyl	-	mg/kg	5	ND
Tetrabromobiphenyl	-	mg/kg	5	ND
Pentabromobiphenyl	-	mg/kg	5	ND
Hexabromobiphenyl	-	mg/kg	5	ND
Heptabromobiphenyl	-	mg/kg	5	ND
Octabromobiphenyl	-	mg/kg	5	ND
Nonabromobiphenyl	-	mg/kg	5	ND
Decabromobiphenyl	-	mg/kg	5	ND
Sum of PBDES	1000	mg/kg		
Monobromodiphenyl ether	-	mg/kg	5	ND

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 中国天津经济技术开发区第九大道41号SGS大厦 邮编: 300457 | T 86-(0)22093800 | F 86-(0)22093820 | c_n_sgs@sgs.com

[illegible][illegible]



Test Report

No. TSNEC1301308502

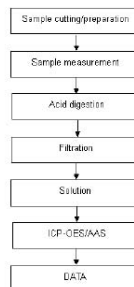
Date: 26 Dec 2013

Page 6 of 7

ATTACHMENTS

Elementary Testing Flow Chart

- 1) Name of the person who made testing: Aaron Wang
2) Name of the person in charge of testing: Cindy Yin

[illegible]

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