

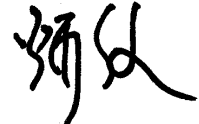
TBBP-A free



MSL Level 1

ROHS-Y

Approval Sheet

Products	FPCB Antenna		
Customer	PANTECH		
Model	ELVIS		
Customer CODE			
Supplier	PARTRON		
Supplier CODE	AFS2450ELV		
PANTECH	By designed	By checked	By approved
PARTRON	By designed	By checked	By approved
			
	Research 5Team	Quality Assurance	Laboratory
	Chanik.Jeon	Nam-Sik.Min	Byoung-Jun.Yim
	03 / 06	03 / 06	03 / 06

2008. 03. 06


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www.partron.co.kr

TBBP-A free



MSL Level 1

ROHS-Y

SPECIFICATION

MODEL : AFS2450ELV

3D Structure



Top View

Bottom View

By designed	By checked	By approved
Research 5Team	Quality Assurance	Laboratory
Chanik.Jeon	Nam-Sik.Min	Byoung-Jun.Yim
03 / 06	03 / 06	03 / 06

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1. Revision History

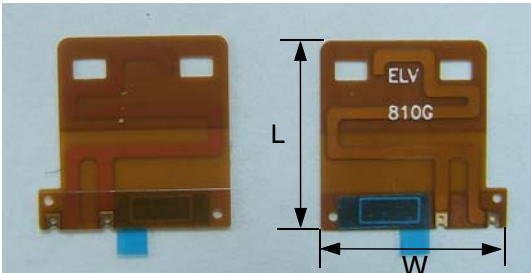
[illegible]

2. Introduction

2.1 Introduction of Product

This product is a FPCB BT antenna that the thin copper is printed inside FPCB.

2.2 Specification and Dimension

Material	FPCB : Copper Foil + Aromatic polyimide	3D Structure
Size [mm]	W = 12.8±0.1	
	L = 12.5±0.1	
	T = 0.20±0.05 (FPCB Thickness)	
Temperature [°C]	-40 ~ +80	
Humidity [%]	At the normal temperature, RH 100	

3. Special Management()

- The below things are special management items.

CTQ	The reason
Dimension & Weight (after forming)	The plasticity dielectric block is influenced at this item
Dimension (after Plasticity)	The accuracy of printed pattern is influenced at this item
Dimension of Printing Pattern	The accuracy of printed pattern is the most special thing at electrical characteristic of dielectric chip antenna

CTF 	The reason
SWR Measurement	This item is an important parameter that fix an electrical characteristic

- Care about the below things.

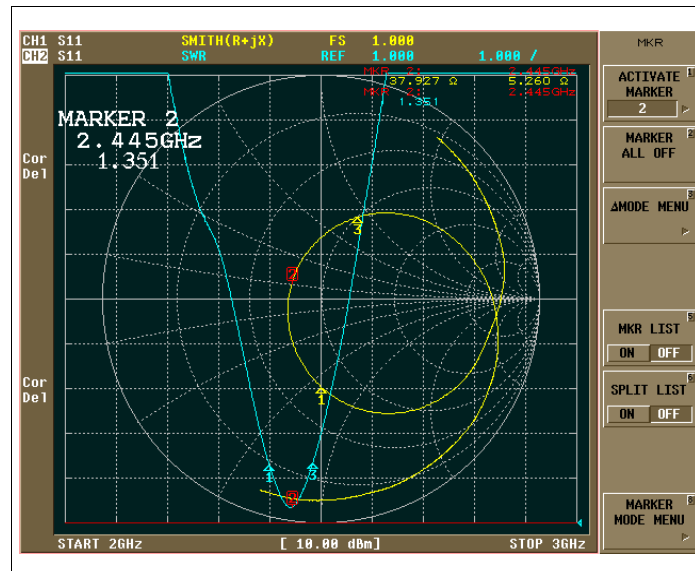
ITEM	Content
Keeping	Sealing tightly when keeping for a long time
Action	Maybe characteristics is changed when changed any design

4. Electrical Characteristics

4.1 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3.0 : 1 (Typ 2.3 : 1)
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Gain[dBi]	Total Gain (Peak / Avg) [dBi]			-1.5 / -9.2
	Azimuth	Theta	Peak	-6.77
			Average	-10.54
		Phi	Peak	-1.49
			Average	-6.59
	Elevation 1	Theta	Peak	-1.97
			Average	-7.21
		Phi	Peak	-6.45
			Average	-11.92
	Elevation 2	Theta	Peak	-7.41
			Average	-11.57
		Phi	Peak	-6.61
			Average	-10.35

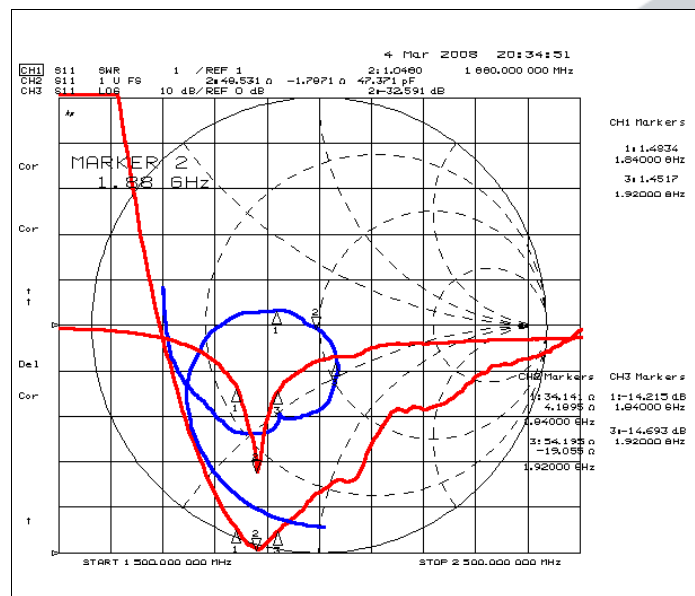
4.2 S11 Graph of Set Condition



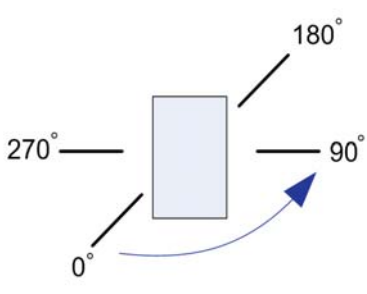
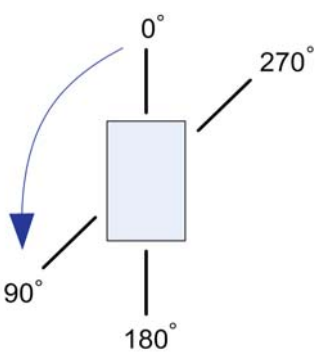
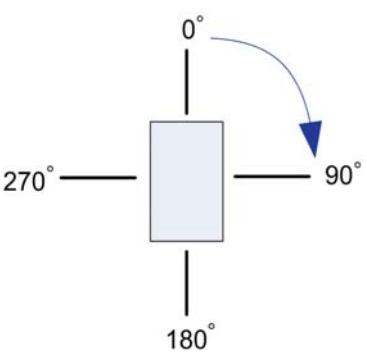
4.3 Test Fixture Condition

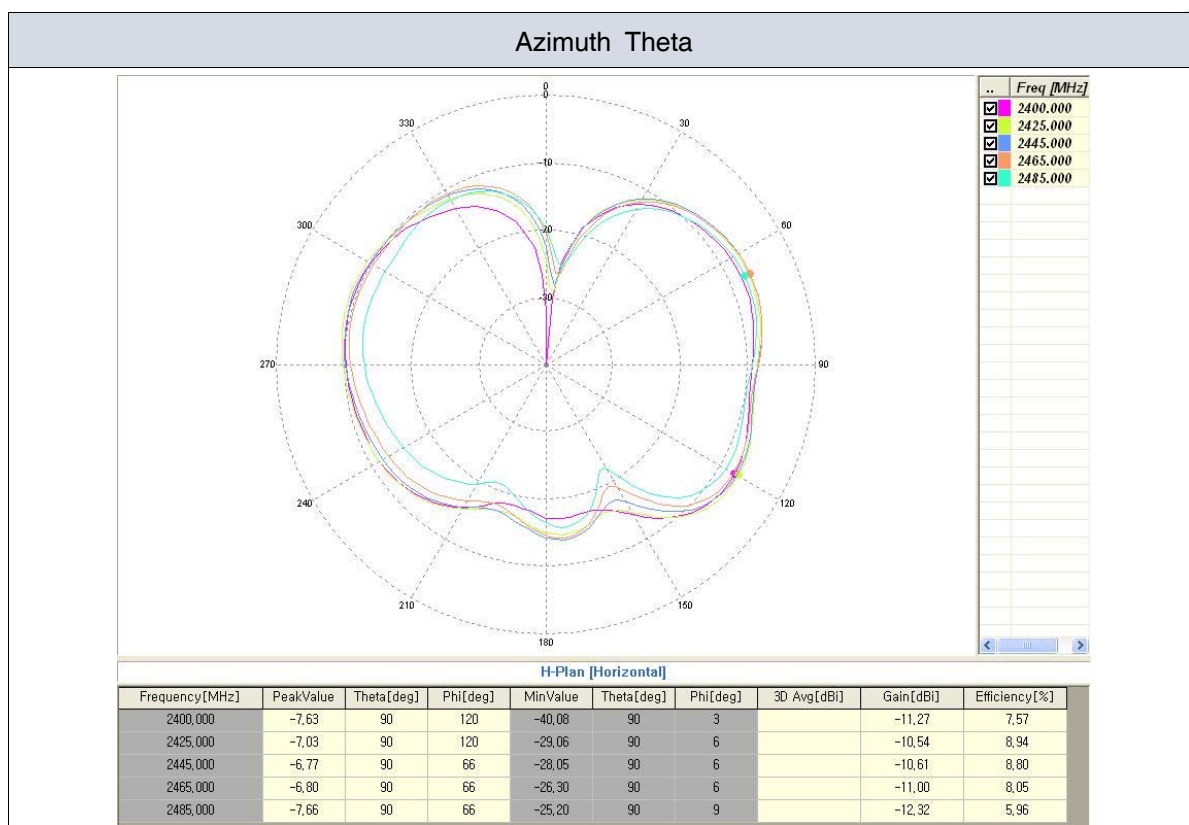
ITEM	SPEC
Frequency Range [MHz]	1840 ~ 1920
Lower frequency(1840MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 1.5 : 1)
Upper frequency(1920MHz) SWR [Min~Max]	1.0 ~ 2.5 : 1 (Typ 1.5 : 1)

4.4 S11 Graph of Test Fixture Condition

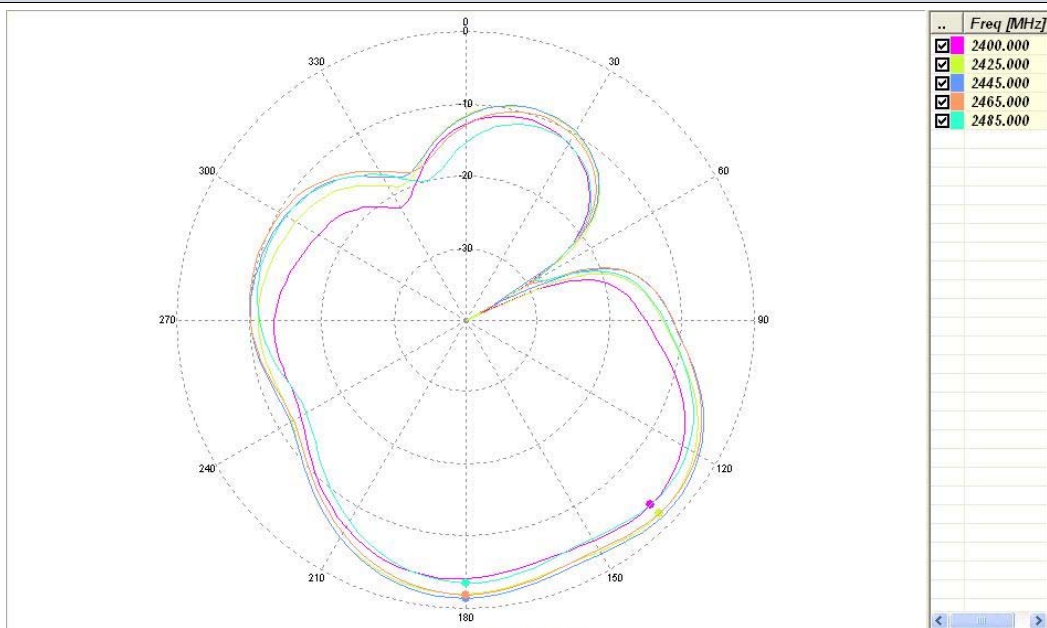


4.5 Radiation Pattern

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



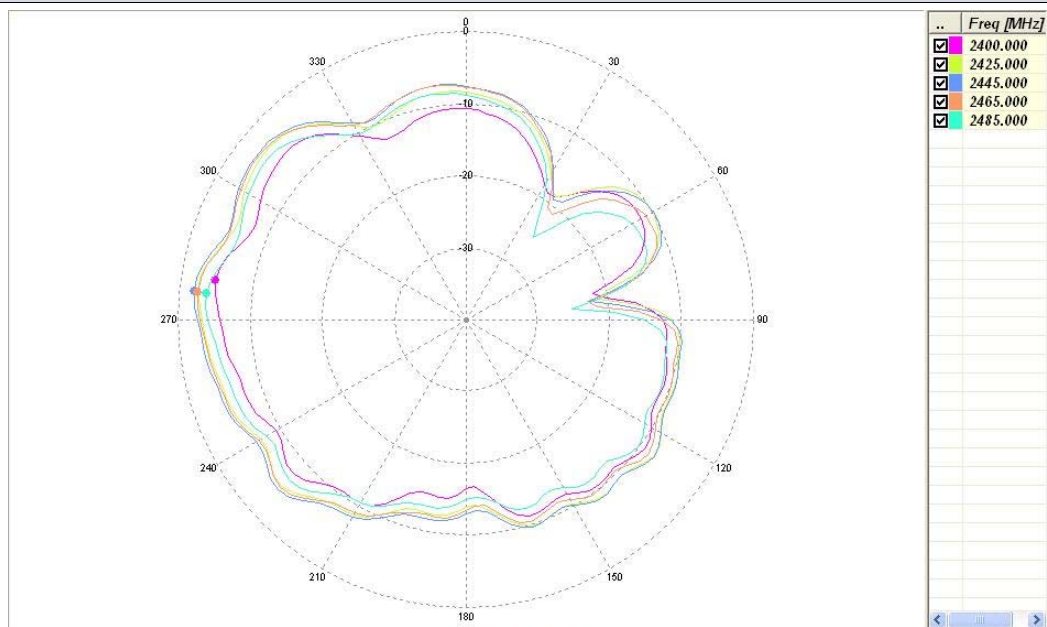
Azimuth Phi



H-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-3.79	90	135	-37.43	90	63		-9.00	12.69
2425.000	-2.00	90	135	-40.42	90	63		-7.12	19.51
2445.000	-1.49	90	180	-35.28	90	60		-6.59	22.03
2465.000	-1.98	90	180	-29.90	90	60		-7.06	19.79
2485.000	-3.56	90	180	-28.98	90	60		-8.62	13.85

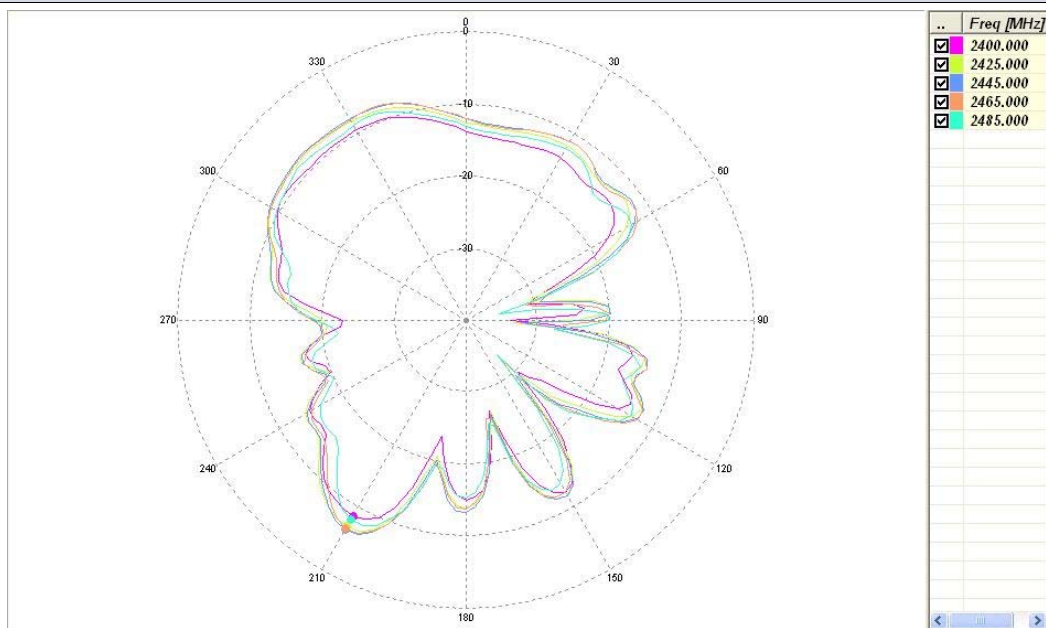
Elevation1 Theta



E1-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400.000	-4.71	279	0	-21.98	78	0		-9.90	10.34
2425.000	-2.45	276	0	-21.42	81	0		-7.77	16.82
2445.000	-1.97	276	0	-22.59	81	0		-7.21	19.12
2465.000	-2.43	276	0	-22.92	81	0		-7.65	17.28
2485.000	-3.69	276	0	-25.16	84	0		-9.06	12.54

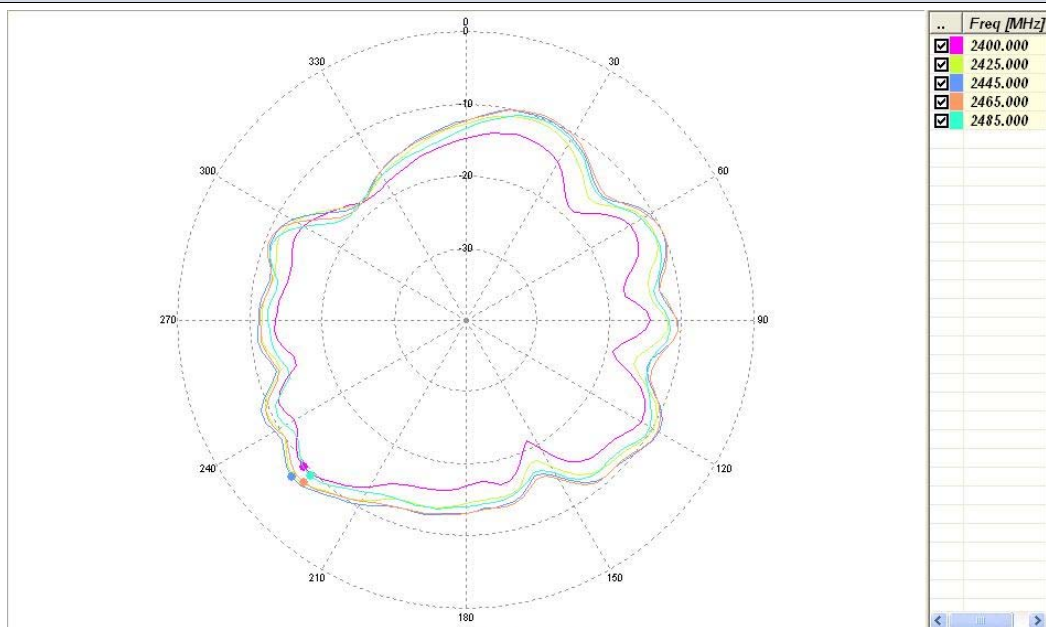
Elevation1 Phi



E1-Plan [Horizontal]

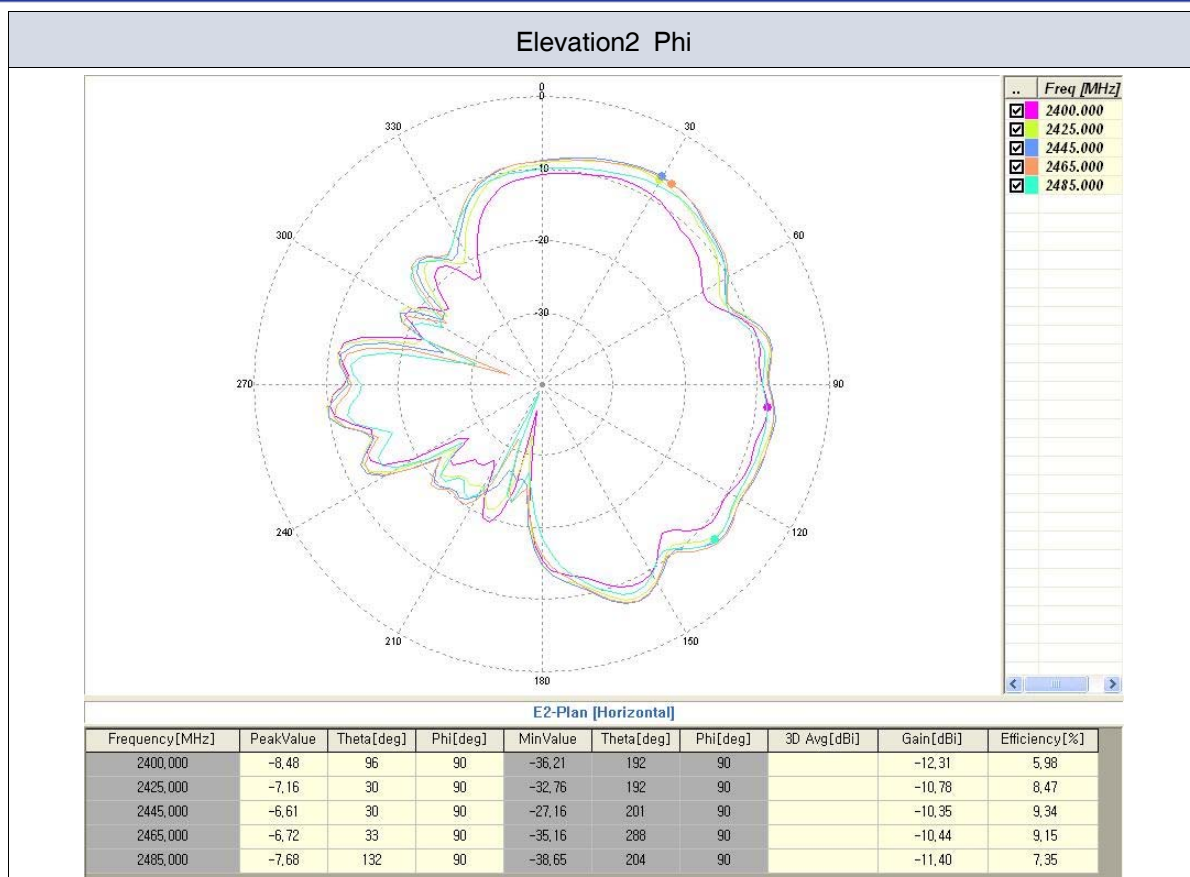
Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-8,60	210	0	-33,76	90	0		-13,69	4,39
2425,000	-6,88	210	0	-33,36	93	0		-12,27	6,03
2445,000	-6,45	210	0	-32,30	93	0		-11,92	6,54
2465,000	-6,61	210	0	-32,72	138	0		-12,11	6,26
2485,000	-7,97	210	0	-35,32	78	0		-13,23	4,86

Elevation2 Theta



E2-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-9,60	228	90	-21,17	153	90		-14,52	3,64
2425,000	-7,71	228	90	-18,15	156	90		-12,40	5,87
2445,000	-7,41	228	90	-18,12	318	90		-11,57	7,08
2465,000	-8,08	225	90	-18,25	315	90		-11,70	6,87
2485,000	-9,41	225	90	-18,27	312	90		-12,72	5,45



5. Measurement Process

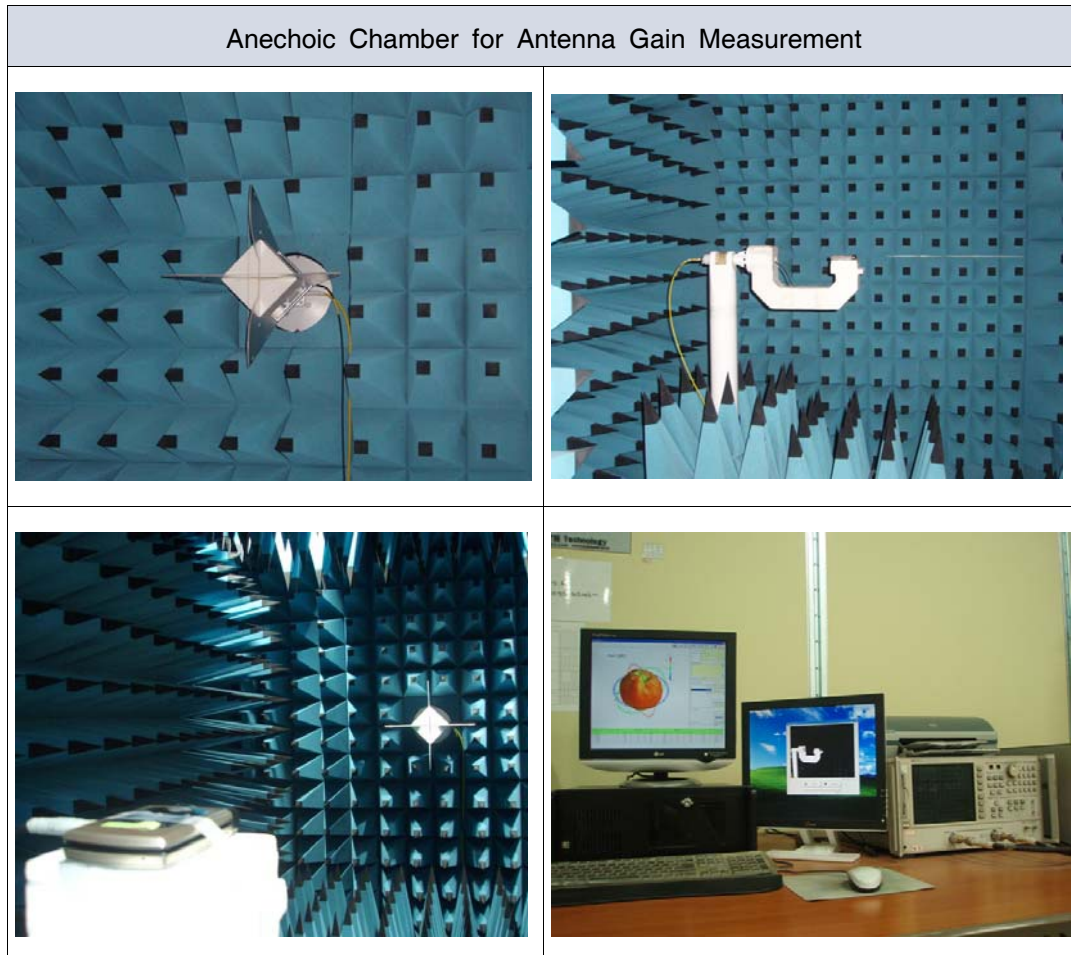
5.1 SWR / Return loss

The SWR / Return loss is measured by Network Analyzer. Using the test fixture, the Selected reference sample is a standard product.

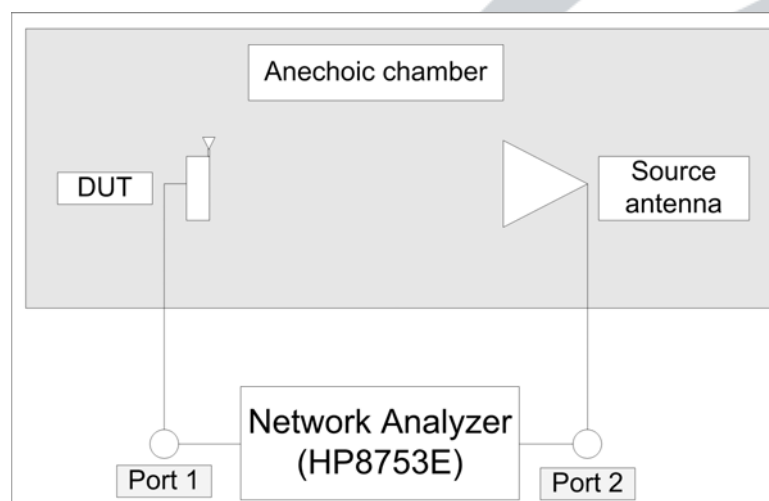
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753E or Advantest R3765CH	Agilent HP8753E or Advantest R3765CH
Cable	RF cable (300 mm)	RF cable (300 mm)
Test condition		

5.2 Gain

The Antenna Gain is measured by using the Passive DUT at Anechoic Chamber.



5.3 Gain Measurement block diagram



6. Primary Inspection List

Item	Frequency [MHz]		Dimension [mm]		
Standard	SWR 2.5 Max		L=12.5±0.1	W=12.8±0.1	T=0.20±0.05
	1840	1920			
1	1.48	1.45	12.50	12.78	0.20
2	1.56	1.43	12.51	12.79	0.20
3	1.41	1.54	12.50	12.79	0.20
4	1.43	1.52	12.50	12.80	0.21
5	1.57	1.40	12.49	12.80	0.20
6	1.52	1.40	12.50	12.78	0.20
7	1.60	1.36	12.49	12.78	0.21
8	1.63	1.30	12.51	12.79	0.21
9	1.58	1.36	12.49	12.80	0.20
10	1.49	1.44	12.48	12.80	0.20
11	1.61	1.33	12.51	12.79	0.20
12	1.51	1.40	12.50	12.80	0.20
13	1.42	1.50	12.50	12.80	0.20
14	1.54	1.36	12.50	12.80	0.20
15	1.44	1.50	12.49	12.79	0.20
16	1.52	1.39	12.51	12.79	0.20
17	1.56	1.42	12.50	12.78	0.21
18	1.47	1.49	12.51	12.80	0.21
19	1.57	1.41	12.49	12.80	0.21
20	1.58	1.39	12.49	12.80	0.20
X	1.52	1.41	12.49	12.79	0.20
σ	0.06	0.06	0.01	0.01	0.004
Cpk	2.60	2.13	3.70	3.82	3.29
Result	OK	OK	OK	OK	OK

7. Reliability Condition

7.1 Environment Test

ITEM	TEST CONDITION	LIMIT
PCT	+121±5 °C, RH=100%, 96 hr	* After the test, specimen would be kept at 25±5 °C for 1 hours * specimen sheet meets the electrical specification
High Temperature Resistance	Leaving that for 120±2 hr at +85±3 °C	
Low Temperature Operation	After leaving that for 1 hr at -40±3 °C Measure that at test temperature	
Low Temperature Resistance	Leaving that for 120±2 hr at -40±3 °C	
Humidity Operation	After leaving that for 1 hr at -40±3 °C, RH 85% Measure that at test temperature	
Humidity Resistance	Leaving that for 120±2 hr at -40±3 °C, RH 85%	

7.2 Thermal shock test, Reflow test

ITEM	TEST CONDITION	LIMIT
Thermal Shock	-40±3 °C/min ↔ +85±3 °C/min cycle : 32 cycle recovery time : within 5 min	* Same as 4.4
Reflow	Pre Heating : 200±5 °C, 30~60 sec Peak Heating : 260±5 °C, 30 sec Max	

7.3 Mechanical Test

ITEM	TEST CONDITION	LIMIT
Vibration	Freq : 10~500 Hz , Acceleration : 10 ×9.8 m/s ² (G) Sweep time : 15 min, X.Y.Z each 5 times	* After the test, specimen sheet meets the electrical specification
Drop	18 times free fall Using the drop jig 152 cm high Jig : 120±20 g Plastic Jig Bottom : Concrete or Iron	

7.4 MSL LEVEL Test

1) JEDEC J-STD-020C Test

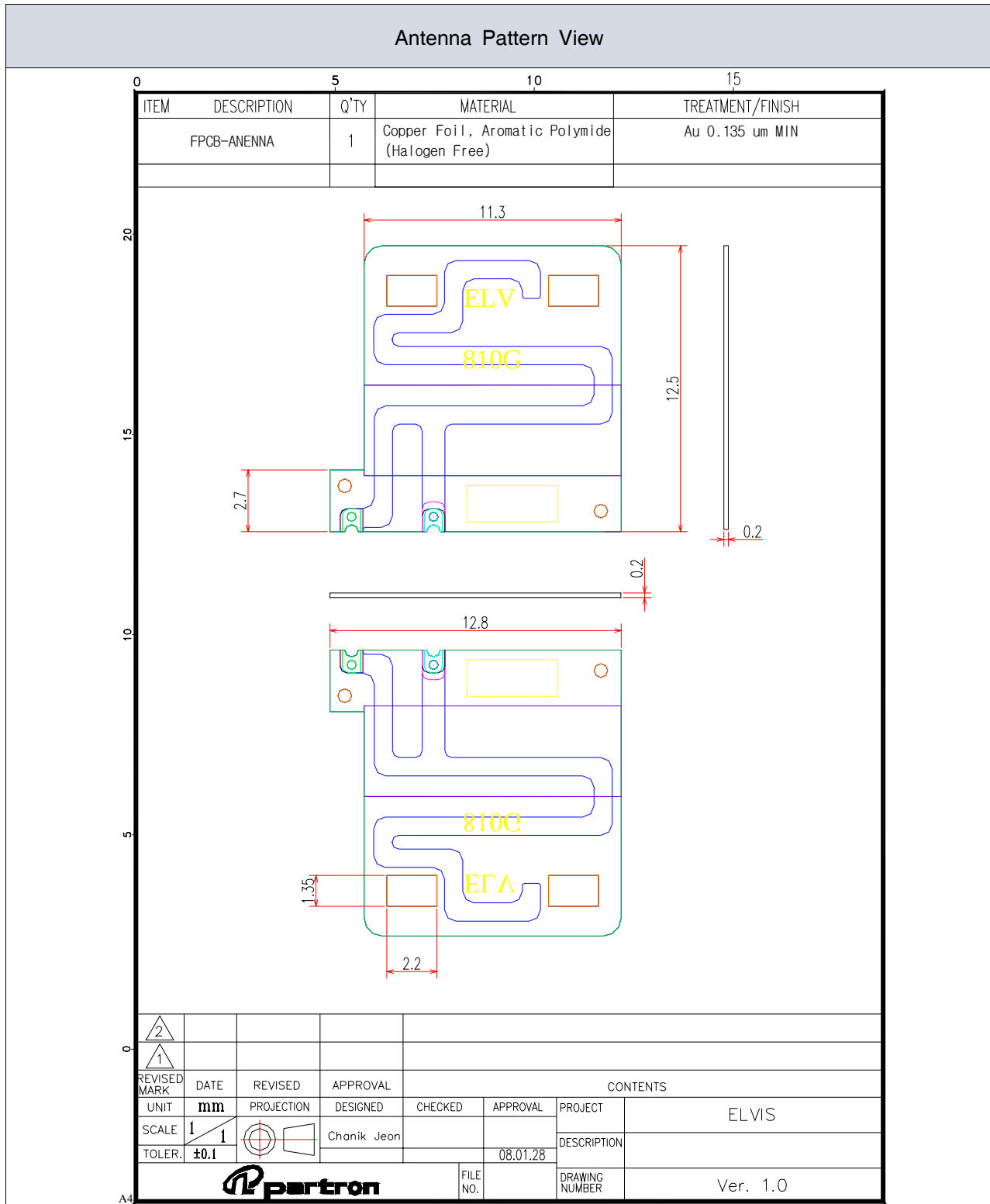
	Floor Life		Soak Requirement	
	Time	Condition	Time	Condition
1	Unlimited	= < 30°C / RH 85%	168+5/-0	= < 85°C / RH 85%

2) Test Condition

ITEM	Conditon	LIMIT
Soak Requirements	After leaving that for 168±2 hr at +85±3 °C, RH 85%, without Aging, Reflow 3 times	* After the test, specimen sheet meets the electrical specification

8. Mechanical Characteristics

8.1 Antenna Pattern Drawing

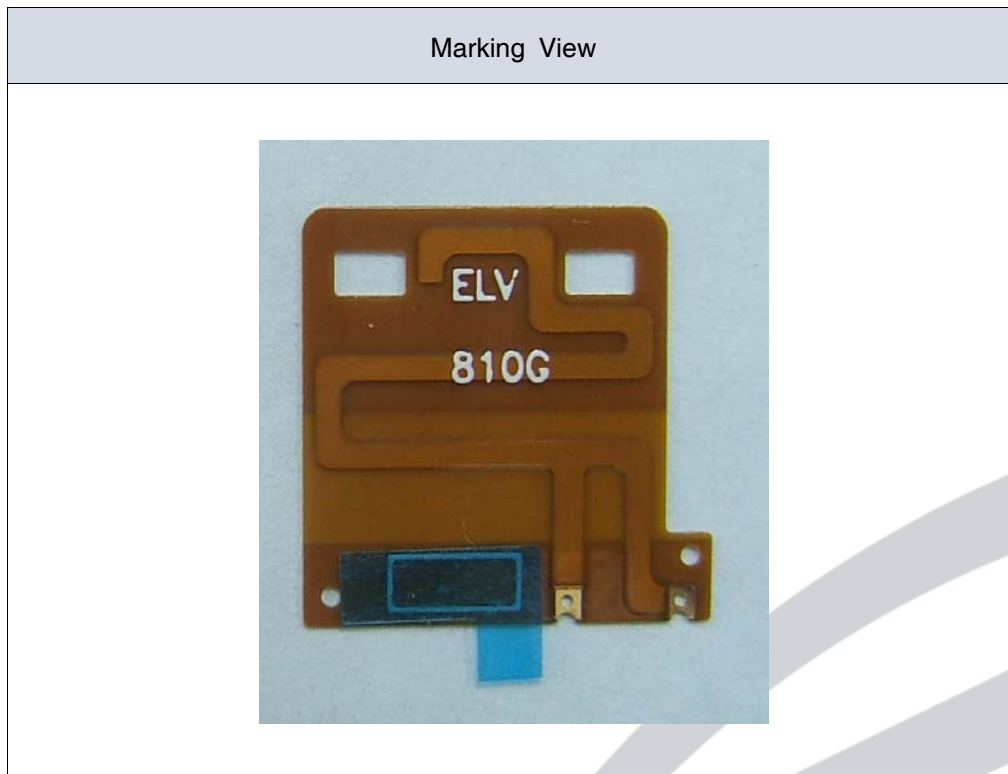


8.2 Lot Notation

8	10	G
①	②	③

- ① Year : 1 - 2001, 2 - 2002, 8 - 2008
- ② Week : 1 - First week, 2 - Second 9 - Ninth, 10 - Tenth,
- ③ Green : Halogen Free

8.3 Marking Specification



E	L	V	8	10	G
①	②	③	④		

- ① Serial
- ② Year : 1 - 2001, 2 - 2002, 8 - 2008
- ③ Week : 1 - First week, 2 - Second 9 - Ninth, 10 - Tenth,
- ③ Green : Halogen Free

9. Attention

9.1 Temperature Condition

	Range	Unit
Operating Temperature	-40 ~ +100℃	℃
Keeping Temperature	-40 ~ +70℃	℃

9.2 Temperature Test Condition

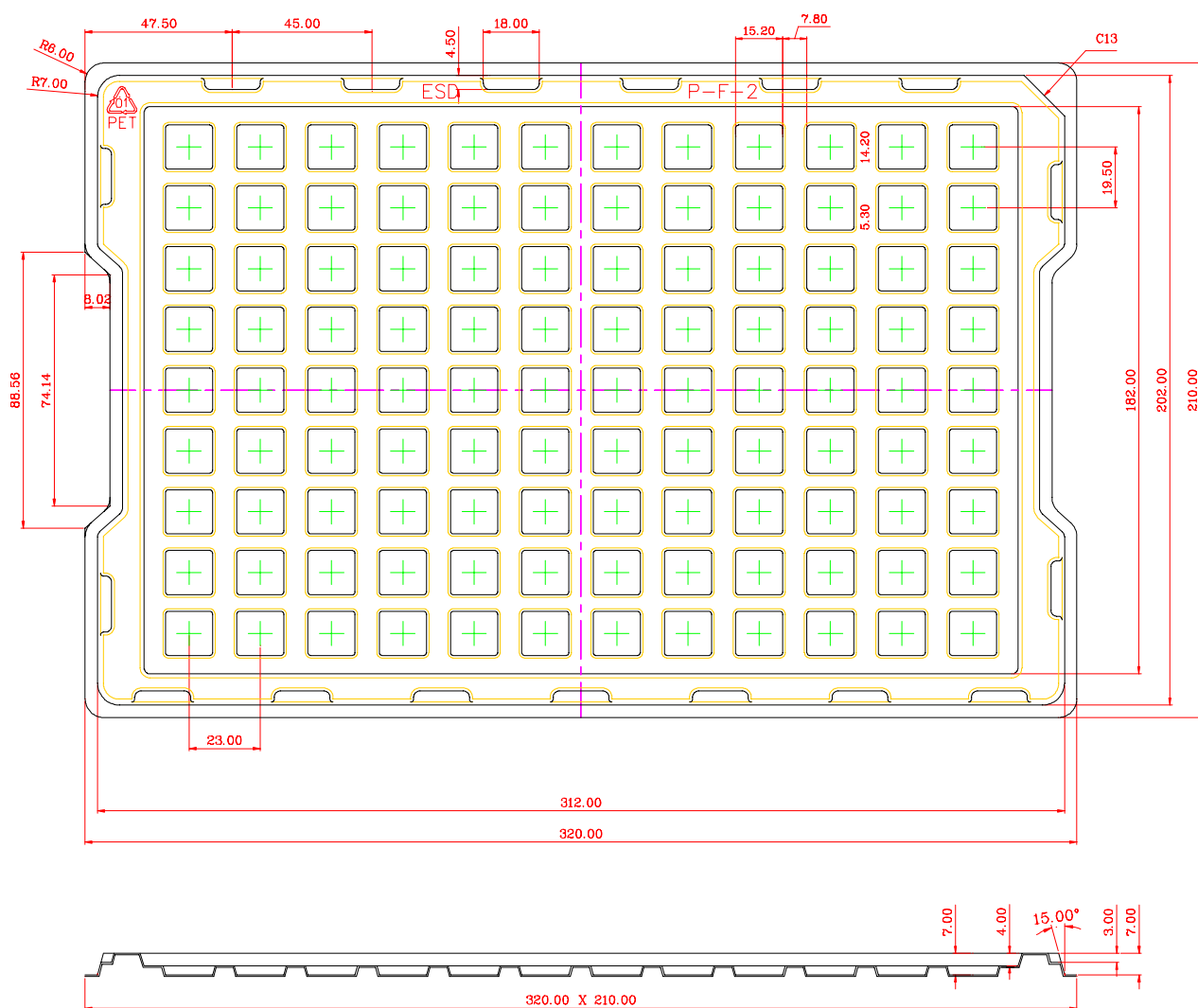
Item	Condition	Temperature Range
Operating Temperature	Low	at -75 ℃, for 24 hr, Good Operating
	High	at +150 ℃, for 24 hr, Good Operating
Keeping Temperature	Low	at -75 ℃, after 1000 hr, Good Operating
	High	at +85 ℃, after 1000 hr, Good Operating

* In case of "High Temperature Resistance", because the packing material is broken at higher temperature than +85 ℃, the test is not able.

10. Packing

10.1 Carrier/Reel

ITEM	Material	Surface Resistance	Electricity	method
Tray	A-PET	Typical $10^8 \Omega$	10V MAX	Heat press



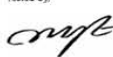
11. Process control

Product	Issued/Revision		Process Control	Record	By designed	By checked	By approved
BT ANTENNA	Issued	07.02.13		PRCP-C001			
	Revised	00.00.00					

Input Materials	FLOW CHART	Process name	Management of Factors					Management of quality					
			Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Method of Inspection	Margin	Cycle of management	Record	Action
FPCB	◇	import inspection	Network	proofreading Condition		Per LOT 1/day	C/sheet	aspect dimension Electrical Characteristic	Network microscope Visual Inspection	refer to Guide Sheet	Per LOT 1/day	Result Paper	return
A'SSY	◇	Characteristic inspection	Network (CTQ)	proofreading Condition	refer to Guide Sheet	Per LOT 1/day	C/sheet	VSWR (CTQ)	Network	refer to Guide Sheet	all	LOT CARD	exhaust
A'SSY	◇	aspect inspection						aspect	visual inspection	refer to Guide Sheet	all	LOT CARD	exhaust
Tray A'ssy 포장재	○	packing						quantity packing Mixing	visual inspection	refer to Guide Sheet	all	LOT CARD	rework
A'SSY	◇	shipper inspection	Network	proofreading Condition	refer to Guide Sheet	Per LOT 1/day	-	Electrical Characteristic aspect packing	Network microscope Visual Inspection	refer to Guide Sheet	Per LOT 1/day	Result Paper	rework

12. RoHS Data

1) FPCB FCCL

Intertek		TEST REPORT	
Applicant : HANWHA L&C Corporation Address : 229, Kumho-Ri, Buyong-Myun, Cheongwon-Kun, Chungbuk, Korea		Page: 1 of 4 Report No. RT07R-1149-006 Date: Sep. 03, 2007	
Sample Description : The following submitted sample(s) said to be:- Name/Type of Product : HANWHALEX HGL series Name of Material : PI film + Epoxy type Adhesive + Copper foil Sample ID No. : RT07R-1149-006 Manufacturer/Vender : HANWHA L&C Corporation			
Sample received : Aug. 29, 2007 Testing Date : Aug. 29, 2007 ~ Sep. 03, 2007 Testing Laboratory : Intertek Testing Center Testing Environment : Temperature : (22 ~ 26) °C Relative Humidity: (55 ~ 65) %			
Test Method(s) : Please see the following page(s). Test Result(s) : Please see the following page(s).			
* Note 1: The test results presented in this report relate only to the object tested. * Note 2: This report shall not be reproduced except in full without the written approval of the testing laboratory.			
Tested by:  E.Y. Lee / Chemist		Authorized by:  H.W. Yoo / Lab Manager	
This Test Report is issued by the Company subject to its Terms and Conditions of Business printed overleaf. Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. This Test Report shall not be reproduced, except in full, without prior written consent of the Company.			
Intertek Testing Center Seoul Office : Tel : 02-2109-1250 Fax : 02-2109-1259 Guro Office : Tel : 054-462-7647 Fax : 054-462-7657 Web Site : www.intertek.co.kr Seoul Lab : #909, 7F, Ase Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-764 Korea Tel : 02-2109-1258 Fax : 02-2109-1258 Ulsan Lab : #340-2, Yungam-Ri, Chongryang-Myun, Ulsan-Gu, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792			

Intertek		TEST REPORT		
Report No. RT07R-1149-006 Sample ID No. : RT07R-1149-006 Sample Description : HANWHALEX HGL series		Page: 2 of 4 Date: Sep. 03, 2007		
Test Items Unit Test Method MDL Results				
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr ⁶⁺)	mg/kg	US EPA 3060A and determined by UV-visible	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS Analysis	5	N.D.
Dibromobiphenyl	mg/kg		5	N.D.
Tribromobiphenyl	mg/kg		5	N.D.
Tetrabromobiphenyl	mg/kg		5	N.D.
Pentabromobiphenyl	mg/kg		5	N.D.
Hexabromobiphenyl	mg/kg		5	N.D.
Heptabromobiphenyl	mg/kg		5	N.D.
Octabromobiphenyl	mg/kg		5	N.D.
Nonabromobiphenyl	mg/kg		5	N.D.
Decabromobiphenyl	mg/kg		5	N.D.
Polybrominated Diphenyl Ether (PBDEs)				
Monobromodiphenyl ether	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS Analysis	5	N.D.
Dibromodiphenyl ether	mg/kg		5	N.D.
Tribromodiphenyl ether	mg/kg		5	N.D.
Tetrabromodiphenyl ether	mg/kg		5	N.D.
Pentabromodiphenyl ether	mg/kg		5	N.D.
Hexabromodiphenyl ether	mg/kg		5	N.D.
Heptabromodiphenyl ether	mg/kg		5	N.D.
Octabromodiphenyl ether	mg/kg		5	N.D.
Nonabromodiphenyl ether	mg/kg		5	N.D.
Decabromodiphenyl ether	mg/kg		5	N.D.

Intertek		TEST REPORT		
Report No. RT07R-1149-006 Sample ID No. : RT07R-1149-006 Sample Description : HANWHALEX HGL series		Page: 3 of 4 Date: Sep. 03, 2007		
Test Items Unit Test Method MDL Results				
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Antimony (Sb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.

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

* View of sample as received:



RT07R-1149-006

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Ulsan Lab : #340-2, Yungam-Ri, Chongryang-Myun, Ulsan-Gu, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

2) FPCB Ink

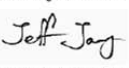


Test Report No. F690501/LF-CTSAYA07-19445 **Issued Date:** September 04, 2007 **Page** 1 of 3

To: SEOUL CHEMICAL RESEARCH LABORATORY CO., LTD
1096-7
Jungwang-dong
Shiheung-city
GYEONGGI-DO
Korea

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

Product Name : SPM-700-2W
SGS File No. : AYA07-19445
Received Date : August 29, 2007
Test Performing Date : August 30, 2007
Test Performed : SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results : For further details, please refer to following page(s)

SGS Testing Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

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F052 Version2



Test Report No. F690501/LF-CTSAYA07-19445 **Issued Date:** September 04, 2007 **Page** 2 of 3

Sample No. : AYA07-19445.001
Sample Description : SPM-700-2W
Item No./Part No. : N/A

Heavy Metals

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

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
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) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

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F052 Version2



Test Report No. F690501/LF-CTSAYA07-19445 **Issued Date:** September 04, 2007 **Page** 3 of 3

Sample No. : AYA07-19445.001
Sample Description : SPM-700-2W
Item No./Part No. : N/A

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	prEN14552 Method A, IC	50	N.D.
Chlorine(Cl)	mg/kg	prEN14552 Method A, IC	50	312

Picture of Sample as Received:

Sample Color : White



*** End ***

NOTE: (1) N.D. = Not detected (<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

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F052 Version2



3) FPCB Coverlay



TEST REPORT

Applicant : HANWHA L&C Corporation
Address : 229, Kumho-Rl, Buyong-Myun, Cheongwon-Kun, Chungbuk, Korea

Page: 1 of 4
Date: Sep. 03, 2007

Report No. RT07R-1149-001
Sample Description : The following submitted sample(s) said to be-
Name/Type of Product : HANWHAFLEX HGC series
Name of Material : PI film + Epoxy type Adhesive
Sample ID No. : RT07R-1149-001
Manufacturer/Vender : HANWHA L&C Corporation

Sample received : Aug. 29, 2007
Testing Date : Aug. 29, 2007 ~ Sep. 03, 2007
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (22 ~ 26) °C Relative Humidity : (55 ~ 65) %

Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.
 * Note 2 : This report shall not be reproduced except in full without prior written approval of the testing laboratory.

Tested by:



E.Y. Lee / Chemist

Authorized by:



H.W. Yoo / Lab Manager

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Intertek Testing Center

Seoul Office : Tel : 02-2109-1250 Fax : 02-2109-1259 Gumi Office : Tel : 054-462-7647 Fax : 054-462-7657 Web Site : www.intertek.co.kr
 Seoul Lab : #909, 7R, Ase Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258
 Ulsan Lab : #340-2, Yongsan-Rl, Chonggyang-Myun, Ulsu-Gu, Ulsan 689-865 Korea Tel : 052-257-6254 Fax : 052-276-6292



TEST REPORT

Page: 2 of 4
Date: Sep. 03, 2007

Report No. RT07R-1149-001
Sample ID No. : RT07R-1149-001
Sample Description : HANWHAFLEX HGC series

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D
Hexavalent Chromium (Cr ^{VI})	mg/kg	US EPA 3060A and determined by UV-visible	1	N.D
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS Analysis	5	N.D
Dibromobiphenyl	mg/kg		5	N.D
Tribromobiphenyl	mg/kg		5	N.D
Tetrabromobiphenyl	mg/kg		5	N.D
Pentabromobiphenyl	mg/kg		5	N.D
Hexabromobiphenyl	mg/kg		5	N.D
Heptabromobiphenyl	mg/kg		5	N.D
Octabromobiphenyl	mg/kg		5	N.D
Nonabromobiphenyl	mg/kg		5	N.D
Decabromobiphenyl	mg/kg		5	N.D
Polybrominated Diphenyl Ether (PBDEs)				
Monobromodiphenyl ether	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS Analysis	5	N.D
Dibromodiphenyl ether	mg/kg		5	N.D
Tribromodiphenyl ether	mg/kg		5	N.D
Tetrabromodiphenyl ether	mg/kg		5	N.D
Pentabromodiphenyl ether	mg/kg		5	N.D
Hexabromodiphenyl ether	mg/kg		5	N.D
Heptabromodiphenyl ether	mg/kg		5	N.D
Octabromodiphenyl ether	mg/kg		5	N.D
Nonabromodiphenyl ether	mg/kg		5	N.D
Decabromodiphenyl ether	mg/kg		5	N.D

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 Ulsan Lab : #340-2, Yongsan-Rl, Chonggyang-Myun, Ulsu-Gu, Ulsan 689-865 Korea Tel : 052-257-6254 Fax : 052-276-6292



TEST REPORT

Report No. RT07R-1149-001
Sample ID No. : RT07R-1149-001
Sample Description : HANWHAFLEX HGC series

Page: 3 of 4
Date: Sep. 03, 2007

Test Items	Unit	Test Method	MDL	Results
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	299
Antimony (Sb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D

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

* View of sample as received -



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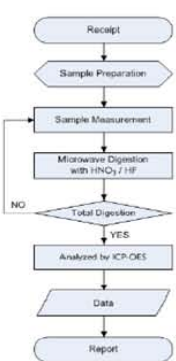


TEST REPORT

Page: 4 of 4
Date: Sep. 03, 2007

Report No. RT07R-1149-001
Sample ID No. : RT07R-1149-001
Sample Description : HANWHAFLEX HGC series

Flow Chart Of Digestion (EPA 3052 For Cd, Pb)



*** Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart

Prepared by : Eung Yong Lee, Chemist
Confirmed by : Seng Chul Park, Senior Researcher

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

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 Ulsan Lab : #340-2, Yongsan-Rl, Chonggyang-Myun, Ulsu-Gu, Ulsan 689-865 Korea Tel : 052-257-6254 Fax : 052-276-6292

4) FPCB Glit

SGS

Test Report No. F690501LF-CTSA07-16553 Issued Date: July 27, 2007 Page 1 of 3

To: INTECH ELECTRONIC CO., LTD.
639-1
Sungbok-dong
Ansan-city
GYEONGGI-DO
Korea

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

Product Name : Gold(Au)
SGS File No. : AYA07-16553
Received Date : July 20, 2007
Test Performing Date : July 23, 2007
Test Performed : SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results : For further details, please refer to following page(s)
Buyer(s) : SAMSUNG

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

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

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PSI2 Version2

SGS

Test Report No. F690501LF-CTSA07-16553 Issued Date: July 27, 2007 Page 2 of 3

Sample No. : AYA07-16553.001
Sample Description : Gold(Au)
Item No./Part No. : Au

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	5	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3090A(1996), US EPA 7195A(1992), UV	1	N.D.

Flame Retardancy: PBBA/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) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

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PSI2 Version2

SGS

Test Report No. F690501LF-CTSA07-16553 Issued Date: July 27, 2007 Page 3 of 3

Sample No. : AYA07-16553.001
Sample Description : Gold(Au)
Item No./Part No. : Au

Halogen Contents

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	prEN14582 Method A, IC	50	N.D.
Chlorine(Cl)	mg/kg	prEN14582 Method A, IC	50	N.D.

Picture of Sample as Received:
Sample Color : White



*** End ***

NOTE: (1) N.D. = Not detected (<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) Negative = Undetectable / Positive = Detectable

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PSI2 Version2



13. Raw Material Features, Manufacturing Certification (FPCB)

1. Material : Polyimide
2. Type of Circuit : Double Side
3. Structure of Layer

	L1	L2	L3	L4
COPPER THICKNESS	1mil	1/2oz		
DIELECTRIC THICKNESS	25um			
NAME of LAYER	Component Side	Solder Side		

4. Finished

- (1) Through Hole : ☒ Cu plating ☐ Fusing ☐ Solder
☐ HASL ☐ Ni
☐ Ni/Au(All, Selective) ☐ NONE

- (2) Solder Resistance: ☒ Solder Side ☒ Comp.Side ☐ NONE
☒ Film [☒ Polyimide ☐ Polyester ☐ LCP]
☐ INK [☐ UV ☐ IR ☐ PSR]

Color:

- (3) MARKING : ☐ Solder Side ☒ Comp.Side ☐ NONE
☒ INK [☐ UV ☒ IR ☐ PSR]

Color: WHITE

(4) Surface Treatment

- ① Plating : Ni/Au
- ② Thickness : [Ni: 2~5um Au:min. 0.03um]
- ③ Instrument : CMI-900
- ④ Plating Company : SurfaceTech
82-31-493-4102
447-5 Moknae-Dong Danwon-Gu Ansan-Si
Kyunggi-DO

(5) Finished by

☒ Stamping ☐ Thomson

5. The Others



14. Certification of Raw Material (FPCB)

1. Manufacturer : 쉐이노플렉스

2. Model : ELVIS

3. NAME : F-PCB

4. Structure of Materials

No.	Structure	Material	Thickness	Model [Mfg.]
1	Base (CCL)	Copper Foil	18 um	MDH-1H-12NE [INNOX]
		Adhesive	12 um	
		Polyimide	25 um	
		Adhesive	12 um	
		Copper Foil	18 um	
2	Solder Resistance	Polyimide	25 um	MAH-1X-30NX [INNOX]
		Adhesive	30um	



INNOX

RoHS

TEL : 82-31-671-0290

FAX : 82-31-671-0225

Certificate of Analysis

Grade : MDH-OH-12NE

Lot No :

Item	Unit	Specification	Test Results	Test Method
Appearance	-	Pass	Pass	INNOX Method
Thickness Total	μm	77±5	77	1/1000 Gauge
Curl	mm	0±5	1	INNOX Method
Dimensional Change MD	%	0±0.15	0.02	IPC-FC-241B
Dimensional Change TD	%	0±0.15	-0.04	IPC-FC-241B
Surface Resistivity	Ωcm	1.0×10 ¹³ min.	1.0×10 ¹³	JIS C 6481
Volume Resistivity	Ωcm	1.0×10 ¹⁵ min.	1.0×10 ¹⁵	JIS C 6471
Dielectric Constant(100KHz)	-	4.0 max.	3.5	IPC TM-650 2.5.5.3
Peel Strength Normal	gf/cm	700min.	1,200	JPCA-BM-02
Peel Strength After Sloder	gf/cm	700min.	1,200	JPCA-BM-02
Solder Resistance	-	300°C/10sec	Pass	JIS C 6471
Flammability	-	94 Vo	Pass	UL94
Chemical Resistance	-	No Change	Pass	JPCA-BM-02
Storage Condition Temp	Temp	25±3°C	-	-
Storage Condition Humidity	Humidith	60%↓	-	-
Storage Condition Shelf Life	Shelf Life	12 month	-	-

INNOFLEX®

Made in Korea

QUALITY ASSURANCE TEAM

Draft	Approval
	

User Approval




INNOX

RoHS

TEL : 82-31-671-0290

FAX : 82-31-671-0225

Certificate of Analysis

Grade : MAH-OX-25NX

Lot No :

Item	Unit	Specification	Test Results	Test Method
Appearance	-	PASS	PASS	INNOX Method
Width	mm	Width±1	Pass	1/1000 Gauge
Thickness Total	μm	39±5	39	1/1000 Gauge
Shrinkage	mm	0±0.5	0.01	INNOX Method
Curl	mm	0±15	5	INNOX Method
Resin Flow	μm	200max.	120	IPC TM-650 2.3.17
Peel Strength	gf/cm	700min.	1,200	JPCA-BM-02
Solder Resistance	-	300℃/10sec	Pass	JIS c 6471
Flammability	-	94 Vo	Pass	UL94
Storage Condition Temp	Temp	5℃	-	-
Storage Condition Humidity	Humidith	60%↓	-	-
Storage Condition Shelf Life	Shelf Life	6 month	-	-

INNOFLEX®
Made in Korea
QUALITY ASSURANCE TEAM

Draft	Approval
	

User Approval


15. Q.C Flow (FPCB)

Q C FLOW

CUSTOMER : PARTRON		DEPARTMENT : QUALITY MANAGEMENT TEAM							
TYPE : CL TYPE DOUBLE SIDE		PREPARATION : KIM MYOUNG HOAN							
MODEL : C-MIC		DATE : FEB 14 2008							
	SYMBOL OF PROCESS	PROCESS	INSPECTION ITEMS & METHOD			CONTENTS OF MANAGEMENT		TERM OF MANAGEMENT	STANDARE OF MANAGEMENT
MATERIAL			CONTENTS	STANDARD OF INSPECTION	METHOD OF INSPECTION	CONTROLLING CONTENTS	STANDADR OF MANAGEMENT		
MAIN&SUB MATERIAL		WAREHOUSING						1 TIME/LOT	
		INSPECTION	1.THICKNESS 2.CONDITON OF SURFACE		1. MICROMETER 2.MAGNIFYING GLASS	1. MEASUREMENT 2. EXTERNAL	1.CERTIFICATION OF MATERIAL	1 TIME / LOT	
		CUTTING	1. SIZE/ STANDARD OF EACH 2. COPPER, C/L ADSSIVE	1. APPLICATE OF PROCESSING SHEET 2. INSPECTION OF SPEC		1. SIZE 2. EXTERNAL		1 TIME / LOT	
		PROCESSING OF SUB MATERIAL	1. SPEC OF CUTTING 2. CONDION OF TOOL 3. MISPRESS		1. YARD STICK 2. MAGNIFIER 3.MICROSCOPE			1 TIME / LOT	
		PROCESSING OF CNC				1. HOLE SIZE(PH) 2. Hole BURR	APPLICATE OF AQL		
DRY FILM		INSPECTION OF WAREHOUSING	1. HOLE SIZE 2. Hole BURR	1. PIN GAGE 2. MICROSCOPE(X5)				1TIME/LOT APPLICATE OF AQL	
		COPPER PLATE	1. CHECK OF LOT DIVISION	1. CHECK OF PLATTING LIQUID				1TIME/LOT APPLICATE OF AQL	
		INSPECTION OF WAREHOUSING	1.PROTUBERANCE, SPOTS 2.THICKNESS, CONDITON OF SURFACE		1. MAGNIFIER 2. MICRO METER				
		Lamination	1.DENT 2.CUTTING, MIXING	1.DISALLOWANCE	1.INSPECTION OF ALL (MAGNIFIER)	1.TEMPREATURE 2.SPEED	1. 100 ± 5 °C 2. 1.5kg /cm², 1m/min		
		EXPOSURE	1. CHECK OF THE SURFACE ON FILM		1.CHECK (MAGNIFIER)	1.FILM SCRATCH	1. 7~8/21STEP 25± 4m/cm²		
		DEVELOPPING	1.MIS-DEVELOPPING 2.OVER ETCHING	1.DISALLOWANCE 2.DISALLOWANCE	1.INSPECTION OF ALL (MAGNIFYING GLASS)	1. TEMPERATURE 2. SPEED 3.PRESSURE	1. 30±3°C 2. 2.7±0.3m/min 3. 1.5±0.5kg f/cm²		
		ETCHING	1.OVER/LACK ETCHING 2.PITCH WIDE	1.DISALLOWANCE (ALLOWANCE OF SPEC IN)	1.CHECK (MAGNIFYING GLASS)	1. TEMPERATURE 2. SPEED 3. PRESSURE	1. 50±3°C 2. 2.7±0.3m/min 3. 2.0±0.5kg f/cm²		
		STRIPPING	1.CONDION OF SURFACE 2.SPOTS, DUST	1.DISALLOWANCE 2.DISALLOWANCE	1.CHECK (MAGNIFYING GLASS)	1. TEMPERATURE 2. SPEED 3. PRESSURE	1. 50±3°C 2. 2.7±0.3m/min 3. 2.5±0.5kg f/cm²		
		CLEANNING OF SURFACE	1.CONDITON OF OXIDIZATION	1.DISALLOWANCE	1.INSPECTION OF MAGNIFYING GLASS	1.SCRATCH, DUST	1.STANDARD SHEET OF MANUFACTURING		
		ATTACHED OF C-LAY FILM	1. CONDITON OF CLOSE ADHESION 2. CONDITON OF DISPOSITION	1.DISALLOWANCE 2.DISALLOWANCE	1.CHECK (MAGNIFYING GLASS)	1. TEMPERATURE	1.STANDARD SHEET OF MANUFACTURING		
NaCo3 Fecl3 NaOH		HOT PRESS(1st)	1. CONDITON OF CLOSE ADHESION 2. CONDITON OF DISPOSITION 2. DISLAMINATION, CONDITON OF RESIN	1.DISALLOWANCE 2.DISALLOWANCE	1.CHECK (MAGNIFYING GLASS)	1. TEMPERATURE 2. SPEED 3. PRESSURE	1. 140 DRGREE 2. 50~60 MIN 3. 40kg		
		ATTACHED OF REINFORCEMENT (STIFFER)	1. CONDITON OF CLOSE ADHESION 2. CONDITON OF DISPOSITION	1.DISALLOWANCE 2.DISALLOWANCE	1.CHECK (MAGNIFYING GLASS)				
		HOT PRESS(End)	1. CONDITON OF CLOSE ADHESION 2. CONDITON OF DISPOSITION	1.DISALLOWANCE 2.DISALLOWANCE	CHECK (MAGNIFYING GLASS)	1. TEMPERATURE 2. SPEED 3. PRESSURE	1. 140 DEGREE 2. 50~60MIN 3. 20kg		
		PLATE (Au/Ni Plating)	1. CONDITON OF SURFACE 2. THICKNESS	1.DISALLOWANCE 2. Sn/Pb(5~20µm) 3. Au(0.08~0.12)Ni(2~3)	1. MICROMETER 2.MAGNIFYING GLASS				
		INSPECTION OF WAREHOUSING	1.THICKNESS OF PLATE 2.CONDITON OF SURFACE	1. Au(0.08~0.12)Ni(2~3)	1. TESTING SHEET OF INSPECTION				
		B.B.T CHECK	1.open/short	1.DISALLOWANCE	1.INSPECTION OF ALL	1. Open/Short 2. CONDITON OF CIRCUIT			
		MEDTERM INSPECTION	1.INSPECTION OF EXTERNAL 2.INSPECTION OF MEASURE 3.INSPECTION OF OPEN&SHORT			1.SPEC IN/OUT CHECK	1.STANDARD SHEET OF INSPECTION		
		EXTERNAL SHAPE	1. DISPOSITION 2. MIS-PRESS	1. CHECK OF DISPOSITION 2. MIS-PRESS	1.MAGNIFYING GLASS		1. STADNARD OF INSPECTION		
		FINAL INSPECTION	1.INSPECTION OF EXTERNAL 2.INSPECTION OF MEASURE(THICKNESS) 3.CONDITON OF PLATE	1.BASIS OF SPEC 2. 0.27 - 0.02, + 0.03 3. GLOSS, DUST, POLLUTION	1. G.II AQL= 0.25 2. MICRO METER 3.MAGNIFYING GLASS	1. POLLUTION , DUST 2. OPEN, DENT ETC.	1.REFERENCE OF DRAWING 2.BASIS TESTING SHEET OF SHIPMENT		
		SHIPPING	1. QUANTITY 2. CONDITON OF PACK		1.INSPECTION OF QUANTITY 2. PACK OF CASE	1. Label 2. Inner PACKING 3. Out Packing	1.BASIS SHEET OF PACK		