

ANTENNA SPECIFICATION		DATE	2008-06-30	REV.	A
MODEL	ECHO	TYPE	Built in	PAGE	1/31

# ANTENNA SPECIFICATION

	Prepared by	Reviewed by	Check by	Approved by
R F				
	08/06/30			
R & D				
	08/06/30			08/06/30

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## 1. Approval Check List

Approval Check List				
No	Date	Change Contents	Change Cause	Rev
1	2008.06.30	ANTENNA SPECIFICATION		A
2				
3				
4				
5				
6				
7				
8				
9				
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13				
14				

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## 2. Material Certification

No	Part material	Raw material	Processing	Finishing	EA	Raw material company	Processing Plant	Etc
1	FRAME	PC(141R-701)	MOLD	-	1	DUPONT	신아정밀	-
2	SLOT	STS301	PRESS	-	1	세인금속	유한프리시젼	-
3								
4								
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8								
9								
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12								
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14								
15								

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### 3. Technical Specifications

#### 3.1 Electrical Specifications.

##### - Folder Close

Electrical Spec.	BAND			
	Cellular		PCS	
Frequency Range (MHz)	824 MHz	894 MHz	1850 MHz	1990 MHz
	5.8:1 below	2.8:1 below	4.0:1 below	2.5:1 below
V.S.W.R (Max.)	Tx	Rx	Tx	Rx
	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
PEAK GAIN (Min., E2-Plane)	-5.8 dBi	-3.6 dBi	-5.8 dBi	-4.6 dBi
	Tx	Rx	Tx	Rx
AVERAGE GAIN (Min., H-Plane)	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
	-6.5 dBi	-4.5 dBi	-7.0 dBi	-5.0 dBi

##### - Folder Open

Electrical Spec.	BAND			
	Cellular		PCS	
Frequency Range (MHz)	824 MHz	894 MHz	1850 MHz	1990 MHz
	3.2:1 below	4.2:1 below	4.7:1 below	2.5:1 below
V.S.W.R (Max.)	Tx	Rx	Tx	Rx
	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
PEAK GAIN (Min., E2-Plane)	-1.0 dBi	-2.8 dBi	-4.8 dBi	-2.7 dBi
	Tx	Rx	Tx	Rx
AVERAGE GAIN (Min., H-Plane)	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
	-1.5 dBi	-3.0 dBi	-6.0 dBi	-4.0 dBi

Impedance(Nominal)	50 ohms
Polarization	VERTICAL
Radiation Pattern	OMNI-DIRECTIONAL
Maximum Power	2 W

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### 3.2 Mechanical Specifications

Mechanical Spec.	
Connector	Board contact pin type
Overall length	See drawing
Operating Temperature	-40°C ~+85 °C
Weight	1.55g (Unit)

### 3.3 Packing Specifications

Packing Spec.		
PRODUCT	QUANTITY (Antenna)	MATERIAL
TRAY	1/80EA	P.S (0.8t)
TRAY INNER PAD	1/800EA	SW 2 type (B corrugated paper)
CARTON BOX	1600EA/1BOX	DW 2 type (AB corrugated paper)

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## 4. Test Equipment

The equipment for antenna test is as follows,

- ◆ Network Analyzer (HP8752C) to measure the V.S.W.R., Standing wave ratio(SWR) and impedance bandwidth of antenna
- ◆ Standard horn antennas adjustable to the CELLULAR bands
- ◆ Standard horn antennas adjustable to the PCS bands
- ◆ Anechoic Chamber installed the cables, connectors and equipments for measurements
- ◆ Digital Caliper to measure the dimensions
- ◆ Torque Driver to measure the torque force of the helix
- ◆ Push/Pull gauge to measure the pulling forces
- ◆ Climatic Chamber for environmental tests

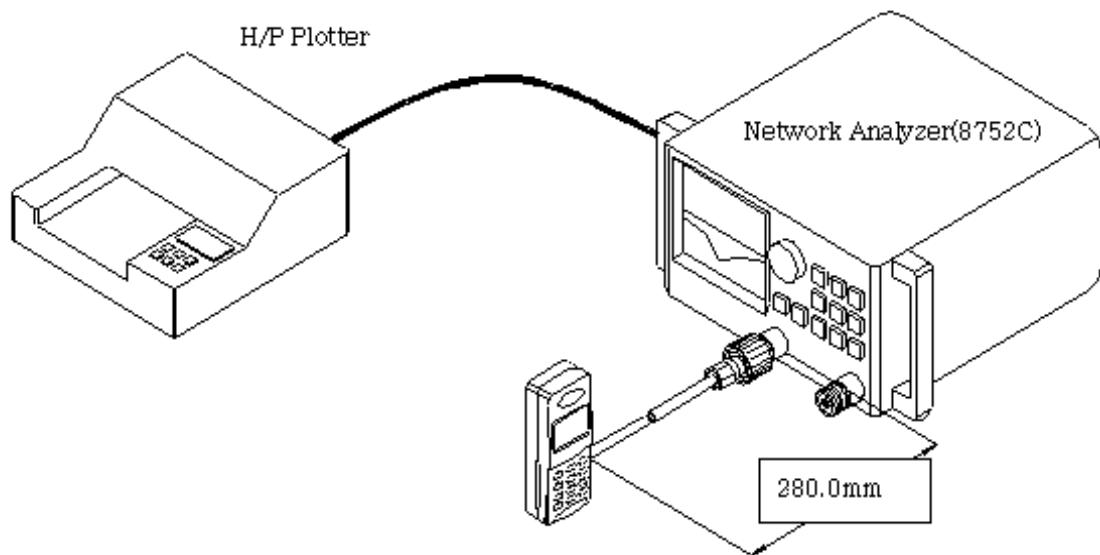
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## 5. Electrical Demands

### 5.1 V.S.W.R

The V.S.W.R characteristics must be satisfied the electrical demands in the below table.

Frequency Range	Cellular:824 ~ 894 MHz		PCS:1850 ~ 1990 MHz	
V.S.W.R (Folder Close)	824MHz	894MHz	1850MHz	1990MHz
	5.8:1 below	2.8:1 below	4.0:1 below	2.5:1 below
V.S.W.R (Folder Open)	824MHz	894MHz	1850MHz	1990MHz
	3.2:1 below	4.2:1 below	4.7:1 below	2.5:1 below



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## 5.2 Radiation Pattern

The radiation pattern must have the omni-directional characteristic in Cellular Band and PCS Band.

## 5.3 Gain

The gain is expressed as dBi. with condition (E2, H-Plane), the minimum Gain of antenna must be satisfied the electrical demands in the below table.

### – Folder Close State

Electrical Spec.	BAND			
	Cellular		PCS	
Frequency Range (MHz)	Tx	Rx	Tx	Rx
	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
PEAK GAIN (Min., E2-Plane)	-5.8 dBi	-3.6 dBi	-5.8 dBi	-4.6 dBi
	Tx	Rx	Tx	Rx
AVERAGE GAIN (Min., H-Plane)	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
	-6.5 dBi	-4.5 dBi	-7.0 dBi	-5.0 dBi

### – Folder Open State

Electrical Spec.	BAND			
	Cellular		PCS	
Frequency Range (MHz)	Tx	Rx	Tx	Rx
	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
PEAK GAIN (Min., E2-Plane)	-1.0 dBi	-2.8 dBi	-4.8 dBi	-2.7 dBi
	Tx	Rx	Tx	Rx
AVERAGE GAIN (Min., H-Plane)	(824MHz)	(894MHz)	(1850MHz)	(1990MHz)
	-1.5 dBi	-3.0 dBi	-6.0 dBi	-4.0 dBi

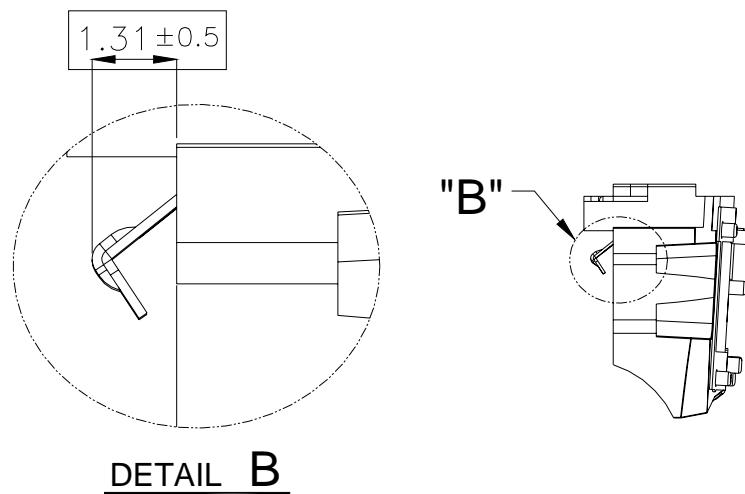
<b>ANTENNA SPECIFICATION</b>		DATE	2008-06-30	REV.	A
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## 6. Mechanical Demands

### 6.1. Contact Pin Force Test

Contact pin of antenna must keep  $200\text{g}/\text{f} \pm 150$  in operation distance.

(Operation distance of antenna is same to under drawing. / PCB overlap : 0mm~1.81mm)



### 6.2. Contact Pin Resistance Test.

After assemble antenna to test equipment, Contact pins are pressed to nominal assembly position 500 times. The antenna contact force must satisfy of (6.1) operation force. (Cycle time: 60 times/min )

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### 6.3 Drop Test

The antenna is attached to the handset. The handset is dropped with the antenna downward onto a concrete surface at 1.5 m height and angle D(45° ). The number of drop is 3 times.

After the test, the original shape shall be possible to restore. The antenna shall satisfy the electrical demands.

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## 7. Environmental Demands

### 7.1 Operation Temperature Test

- Test A: Place the antennas for testing in chamber. The chamber condition should be as follows: 1hours at  $-20^{\circ}\text{C}$ .
- Final measurements: The antenna shall be visually inspected and electrically and also mechanically checked as required by products standard.
- Test B: Place the antennas for testing in chamber. The chamber condition should be as follows: 1hours at  $70^{\circ}\text{C}$ .
- Final measurements: The antenna shall be visually inspected and electrically and also mechanically checked as required by products standard.

### 7.2 Temperature Change Test

The object of temperature test is to evaluate the reliability of antenna component at temperature change.

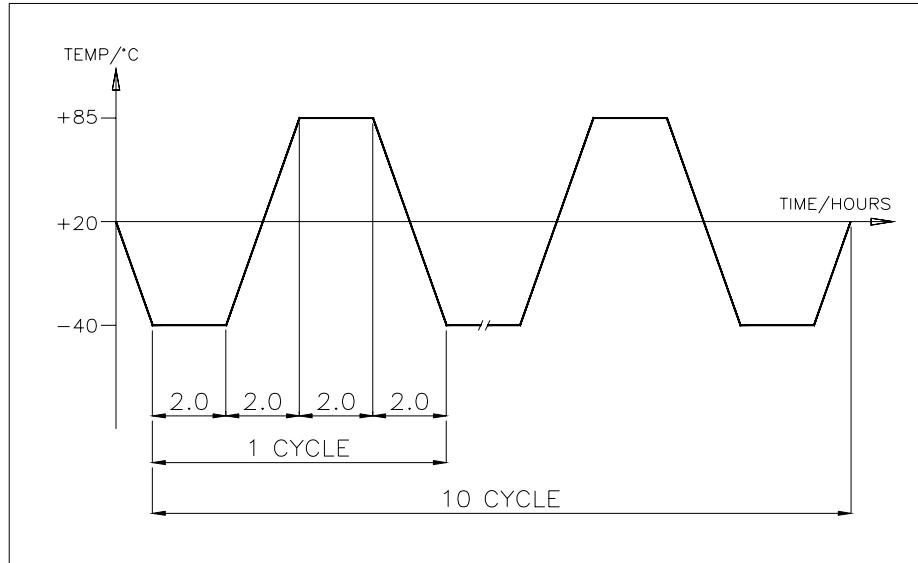
Test: Temperature cycle is as follows. 2 hours at  $-40^{\circ}\text{C}$ .

2 hours at  $+85^{\circ}\text{C}$ .

Temperature increase/decrease time (Temperature change time) is 2 hours. 10 cycles.

Final measurements: The antenna shall be visually inspected and electrically and mechanically checked as required by products standard.

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### 7.3 High Humidity Test

Test: Place the antennas for testing in chamber. The chamber condition should be as follows: 24hours at +55°C, Relative humidity is 95%.

Final measurements: The antenna shall be visually inspected and electrically and also mechanically checked as required by products standard.

### 7.4 Vibration Test

After assemble antenna to test equipment, Do test in X, Z direction per 1hour as a under spec. The antenna shall be visually inspected and electrically and mechanically checked as required by products standard. The test must satisfy to IEC 68-2-6 spec

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Vibration frequency	F=5~55~5Hz(1cycle)
Sweeping Rate	0.5 octave/min
Maximum displacement	1.5mm
Maximum acceleration	2 g
Crossover Frequency	18.0Hz

## 7.5 Salt spray Test

Sprayed with the salt spray solution for a period of 96 hours at a temperature of +35°C.

The antenna shall be visually inspected and electrically and mechanically checked as required by products standard. The test must satisfy to IEC 68-2-11 spec .

## 7.6 Storage temperature Test

After antenna are stored for a period of 96 hours at a temperature of -30 °C and a relative humidity of 95 %. Stored for a period of 96 hours at a temperature of +80 °C and a relative humidity of 95 % (total: 192 hour)

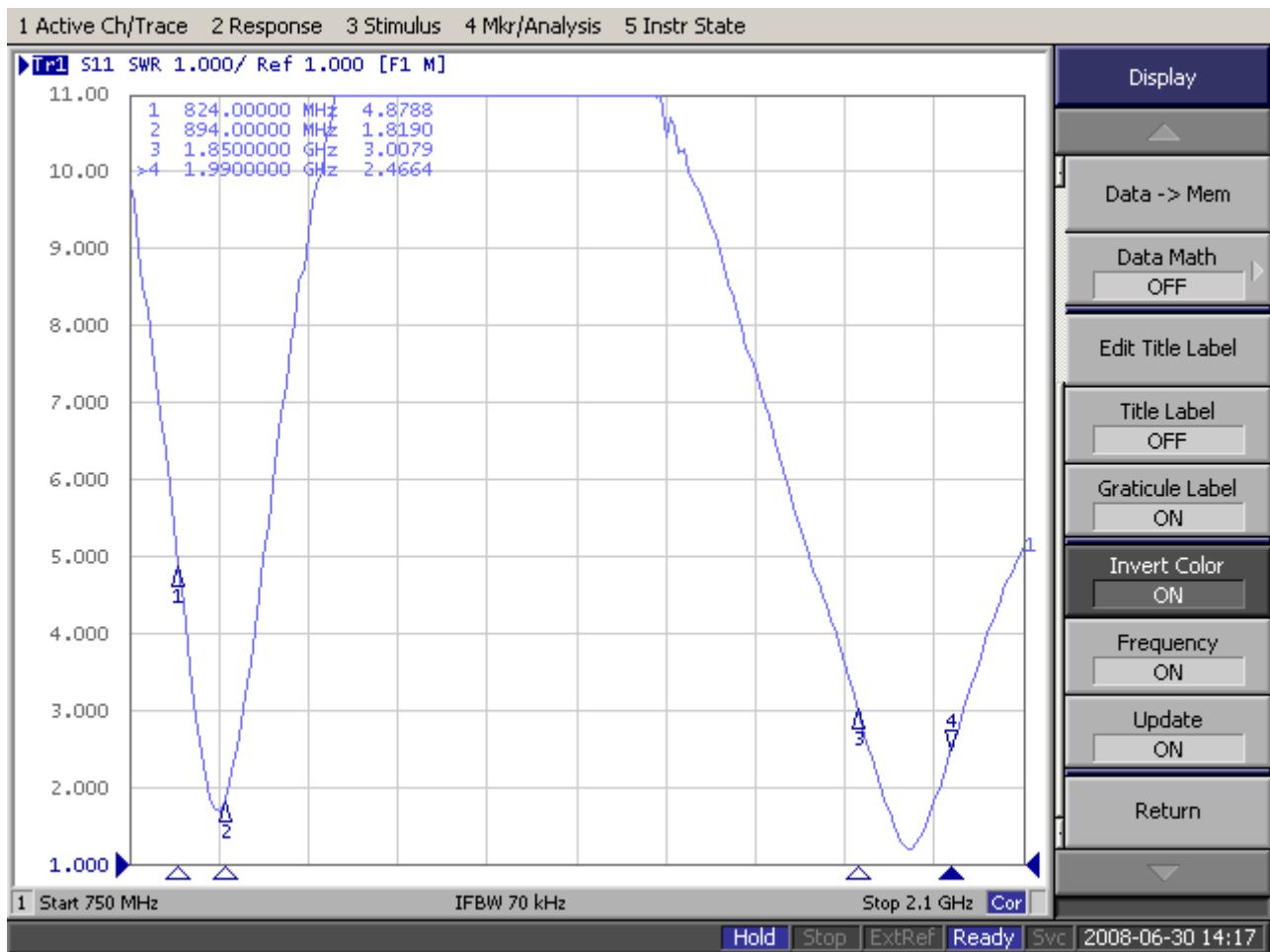
The antenna shall be visually inspected and electrically and mechanically checked as required by products standard.

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## 8. Antenna data

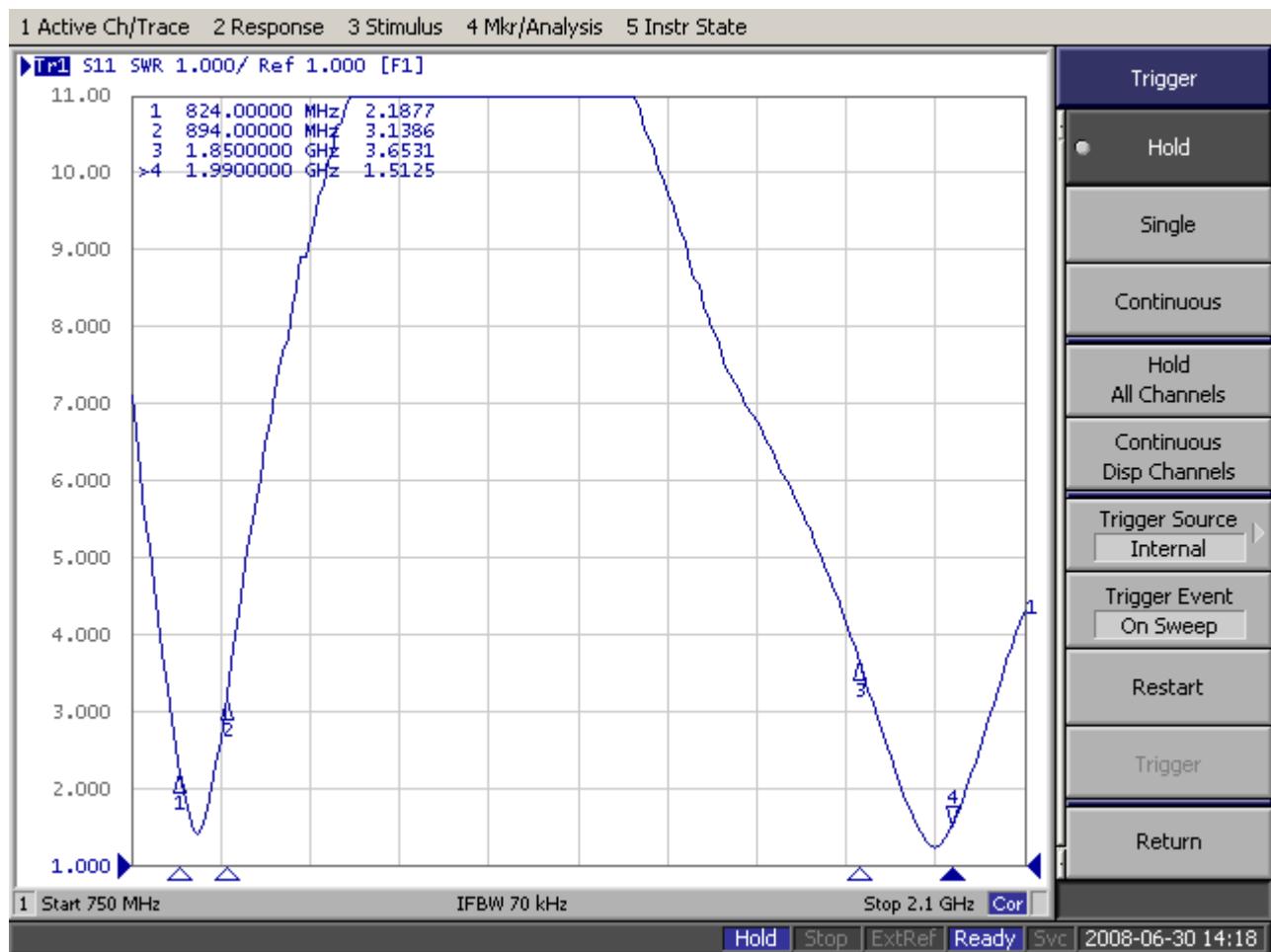
### 8.1. Electrical data(V.S.W.R & GAIN)

→ V.S.W.R (Folder Close)

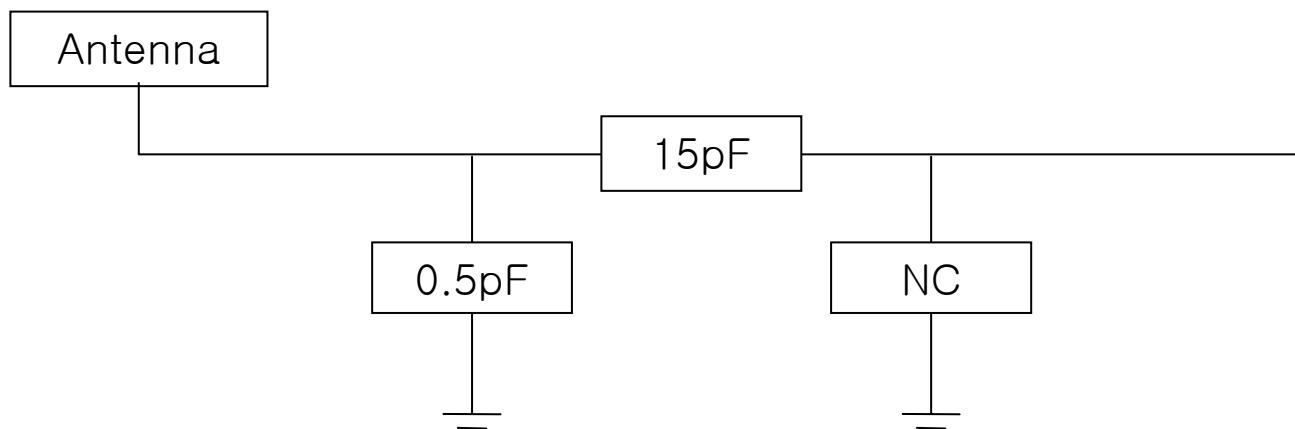


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→ V.S.W.R (Folder Open)



→ Matching Circuit Diagram

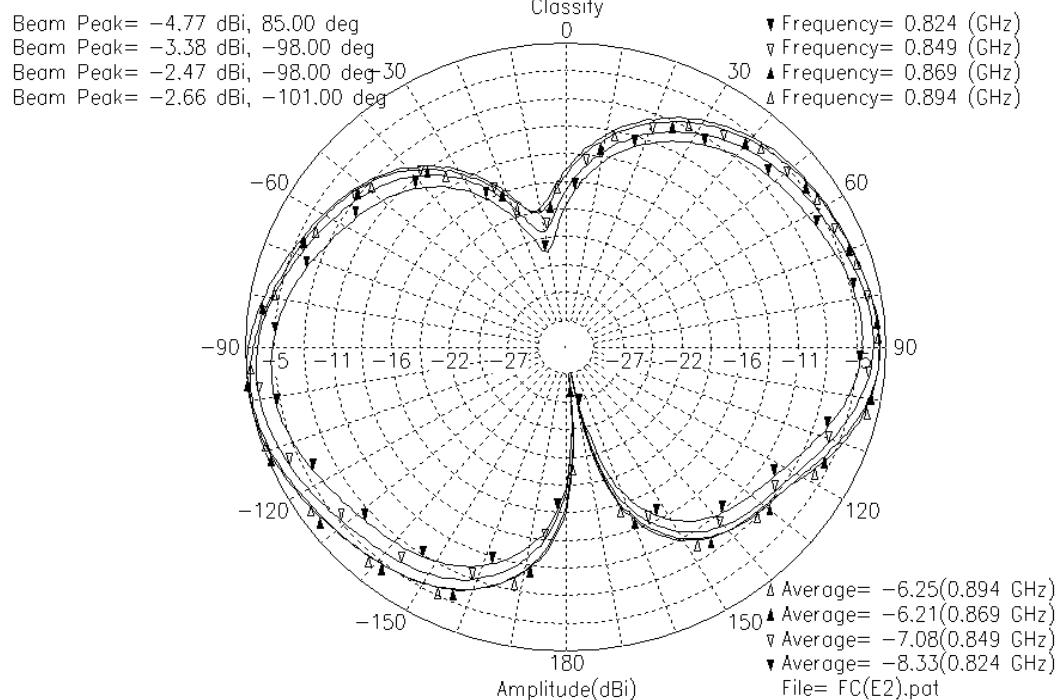


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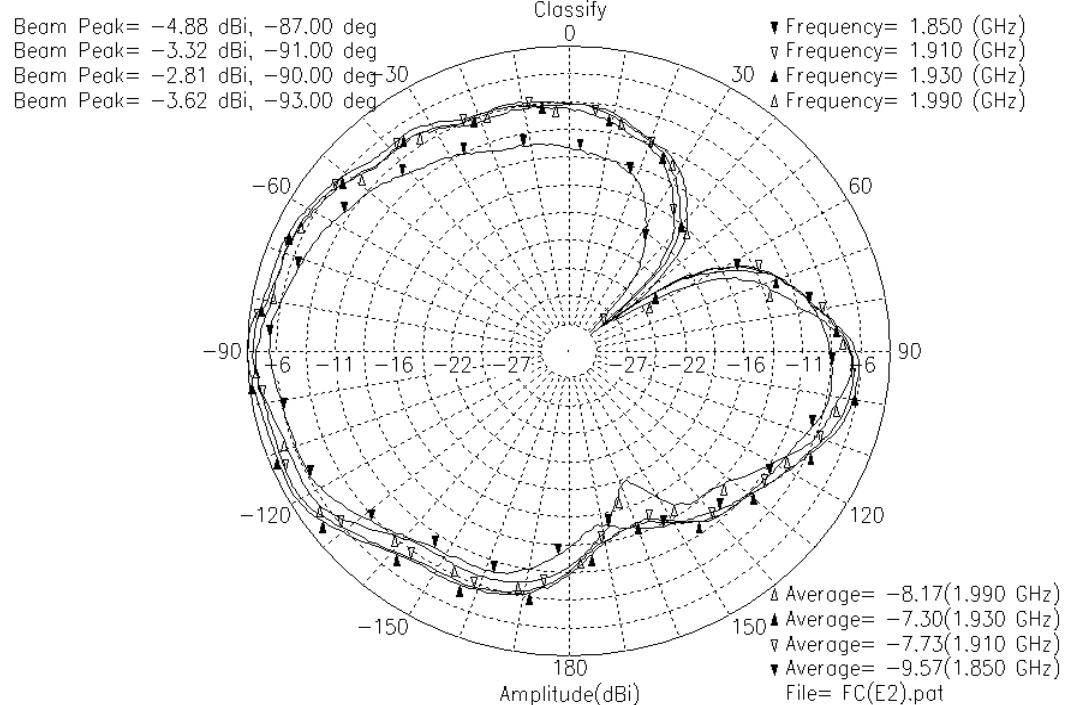
→ GAIN (with Matching Circuit)

- E2-Plane

→ [Cellular Folder Close]

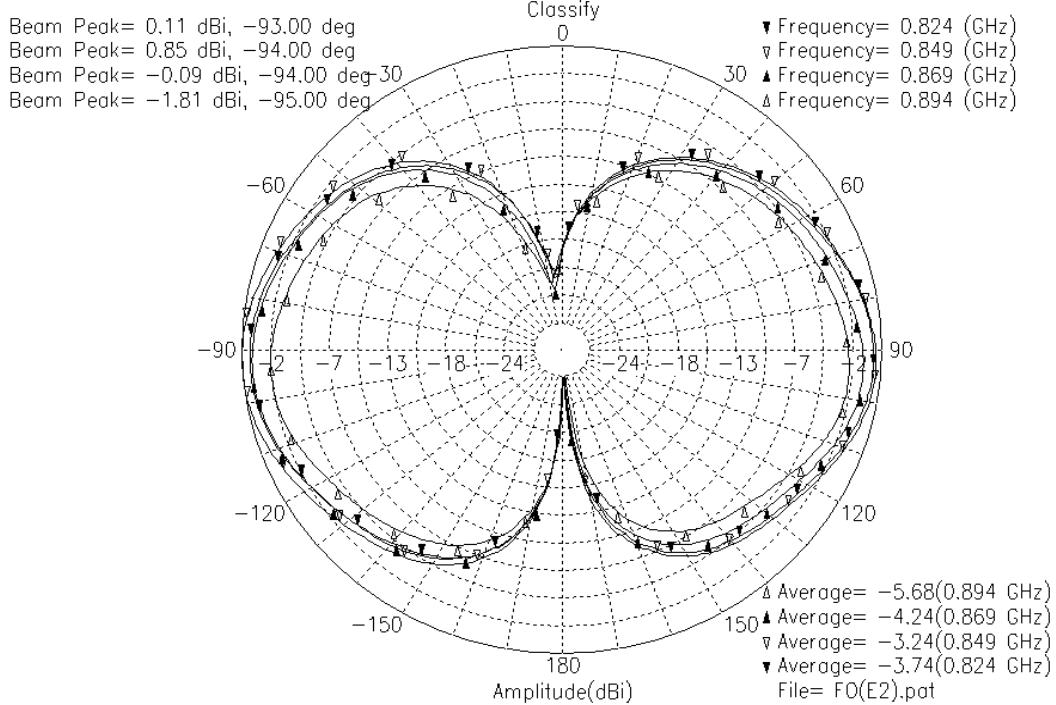


→ [PCS Folder Close]

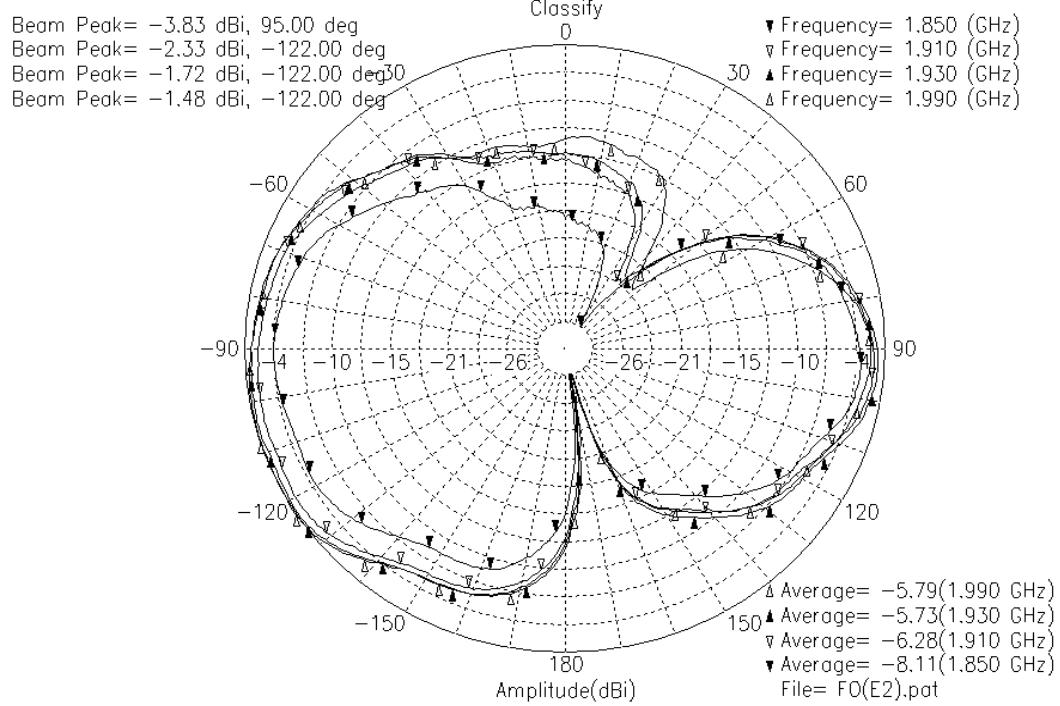


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→ [Cellular Folder Open]



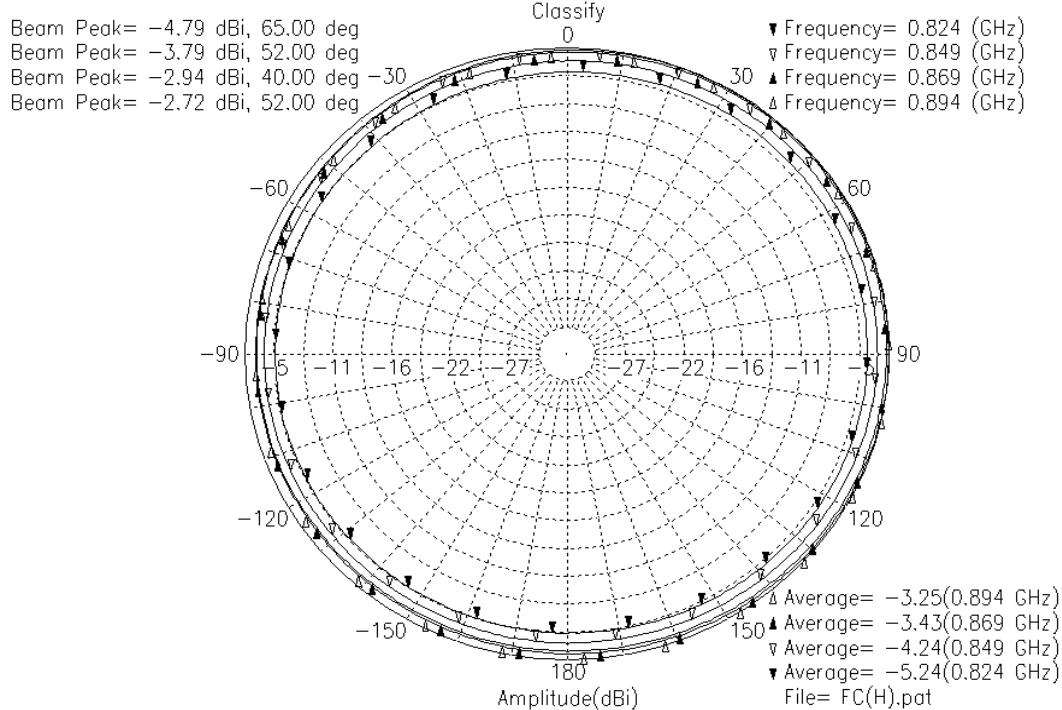
→ [PCS Folder Open]



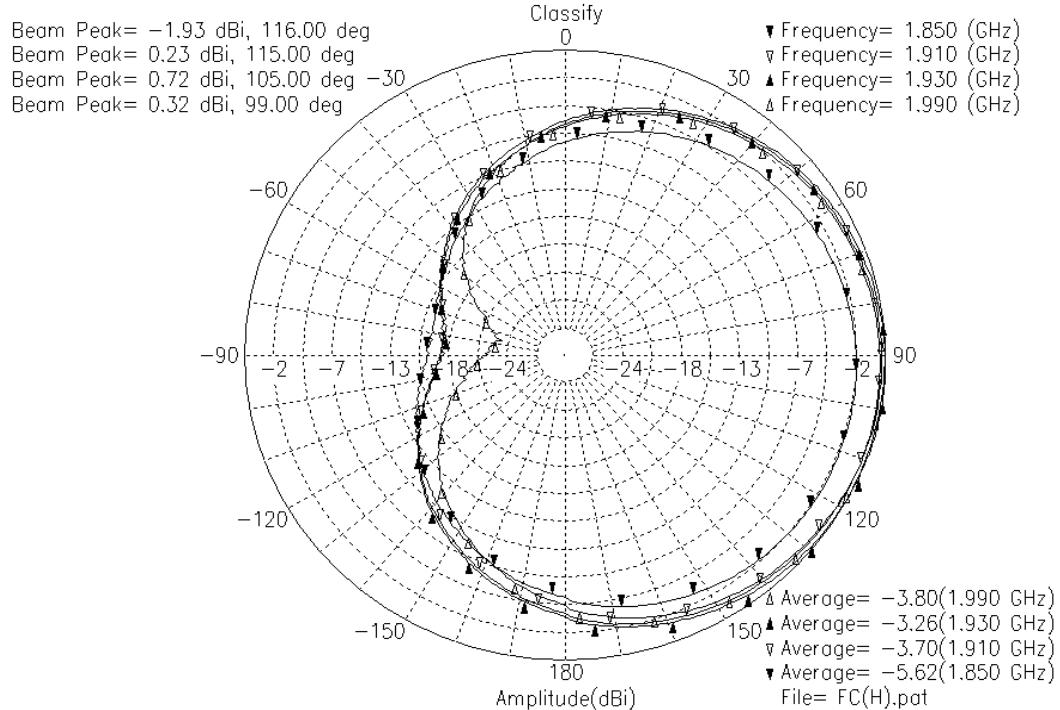
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- H-Plane

→ [Cellular Folder Close]

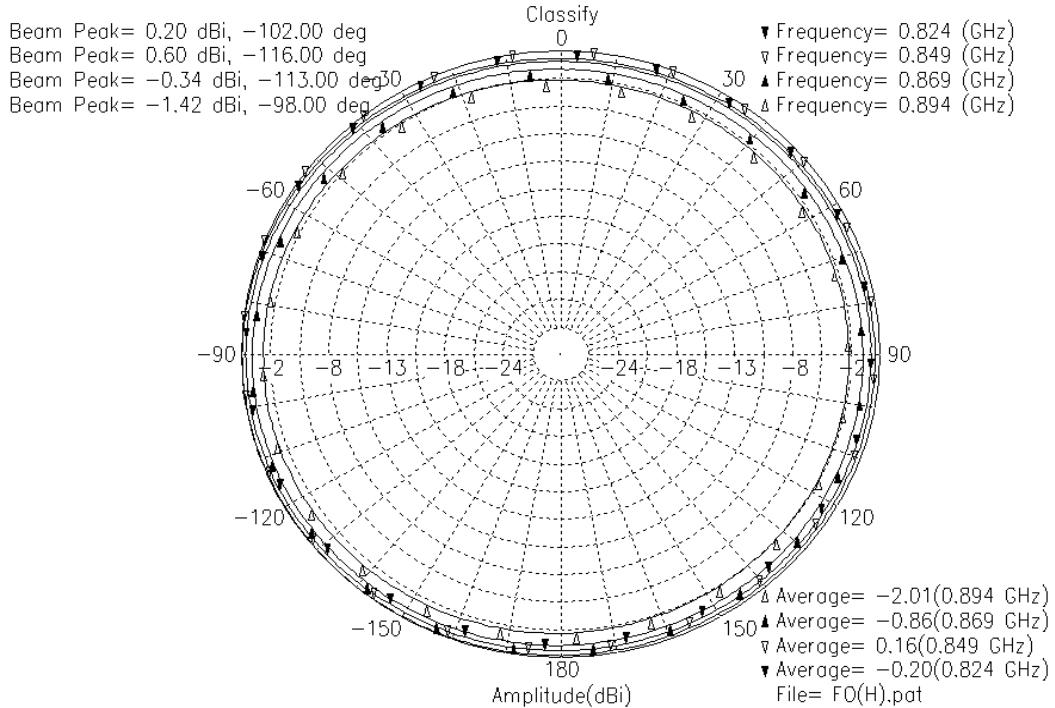


→ [PCS Folder Close]



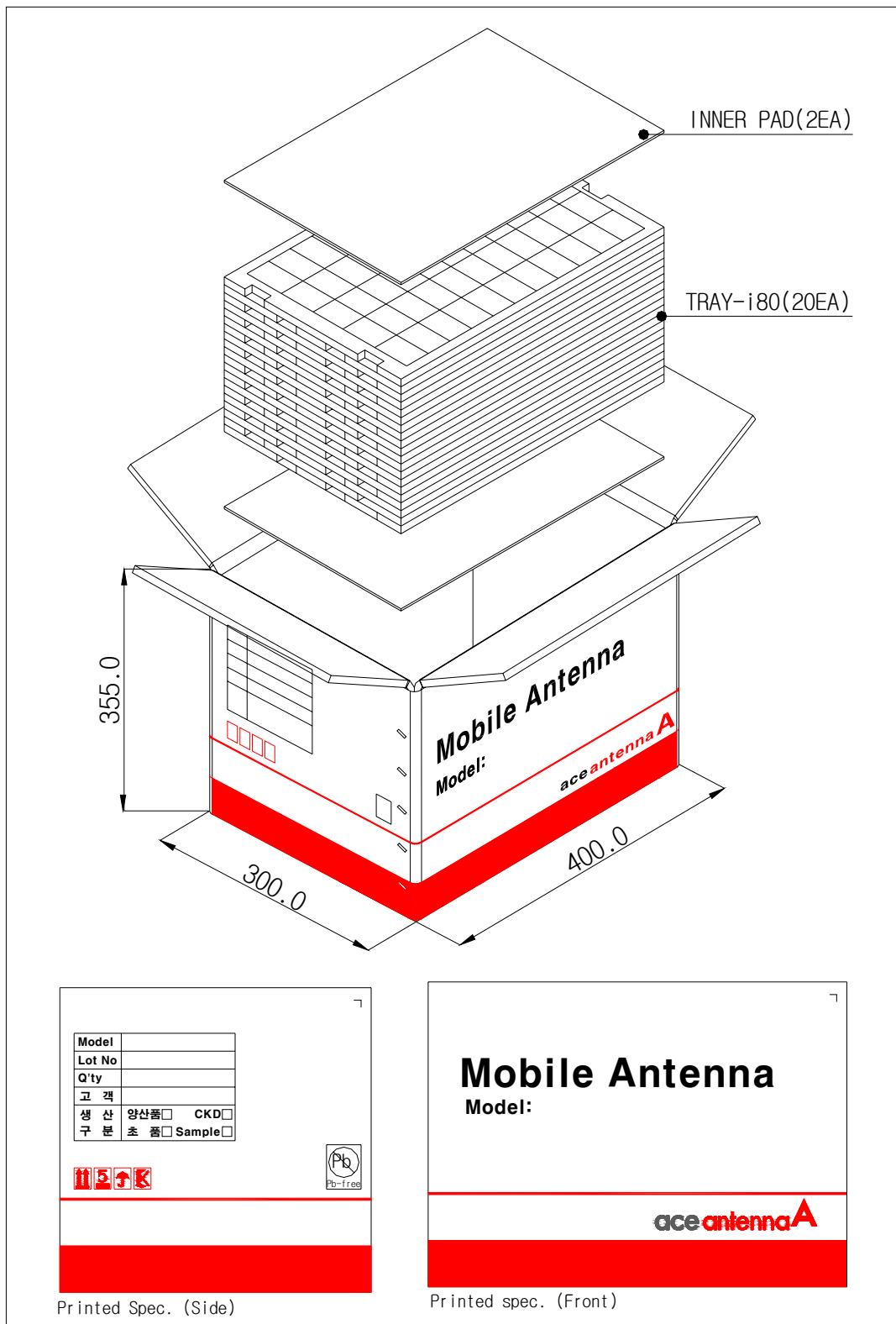
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→ [Cellular Folder Open]



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## 8.2. Packing Spec Drawing.



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## 8.4 Reliability Test.

### 8.4. Environment test report

#### 8.4.1 FRAME [ 141R-701 ]



Intertek Testing Center

340-2, Yongam-ri, Chongryang-myeon,  
Uijeong-ri, Ulsan, 689-865 Korea  
Tel : 052-257-6754, Fax : 052-276-6792

## TEST REPORT

Applicant : GE Plastics Korea  
Address : 240-18, Mokhong-Dong, Chungju-Si,  
Chungcheongbuk-Do, Korea

Page: 1 of 5

Report No. UT07R-0872

Date: Jul. 13, 2007

Sample Description : The following submitted sample(s) said to be:-  
  
 Name/Type of Product : 141R-701  
 Sample ID No. : UT07R-0872  
 Manufacturer/Vender : GE Plastics Korea  
  
 Sample received : Jul. 11, 2007  
 Testing Date : Jul. 11, 2007 ~ Jul. 13, 2007  
 Testing Laboratory : Intertek Testing Center  
 Testing Environment : Temperature : 22°C      Relative Humidity: 51 %  
  
 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

Intertek Testing Center

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Intertek

Intertek Testing Center

340-2, Yongam-ri, Chongryang-myun,  
Uiju-gun, Ulsan, 689-865 Korea  
Tel : 052-257-6754, Fax : 052-276-6792

## TEST REPORT

Report No. UT07R-0872

Page: 2 of 5  
Date: Jul. 13, 2007

Sample ID No. : UT07R-0872

Sample Description : 141R-701

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to BS EN 1122, 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 <sup>6+</sup> )	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

Notes : mg/kg = ppm = parts per million

< = Less than

N.D = Not detected (<MDL)

MDL = Method detection limit

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ace antenna A

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**Intertek**

**Intertek Testing Center**

340-2, Yongam-ri, Chongryang-myeon,  
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Tel : 031-257-6754, Fax : 031-276-6792

## TEST REPORT

Report No. UT07R-0872

Page: 3 of 5  
Date: Jul. 13, 2007

Sample ID No. : UT07R-0872

Sample Description : 141R-701

\* View of sample as received:-



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**ace antenna A**

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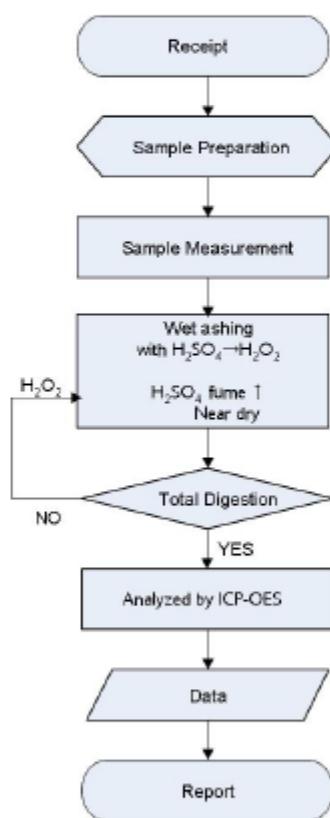
## TEST REPORT

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Page: 4 of 5  
Date: Jul. 13, 2007

Sample ID No. : UT07R-0872  
Sample Description : 141R-701

### Flow Chart Of Digestion ( EN 1122 for Cd )



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

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**Intertek Testing Center**

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Uiju-gun, Ulsan, 689-865 Korea  
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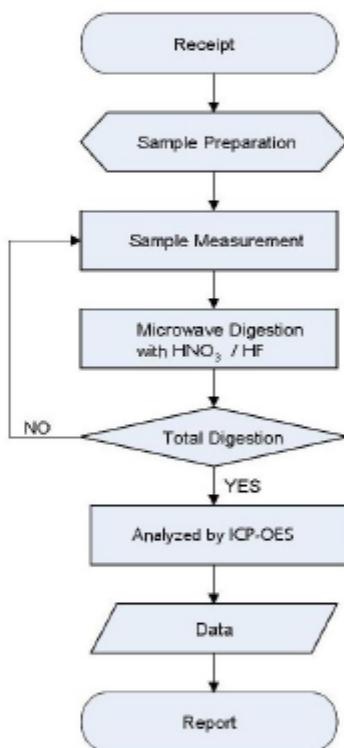
## TEST REPORT

Report No. UT07R-0872

Page: 5 of 5  
Date: Jul. 13, 2007

Sample ID No. : UT07R-0872  
Sample Description : 141R-701

### 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 Sang Chul Park, Senior Researcher

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

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### 8.4.2 SLOT [ STS 301 ]



Test Report No. F690501/LF-CTSAYA07-25043

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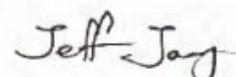
To: TAIHAN STAINLESS STEEL CO., LTD  
603 Seonggok-dong  
Danwon-gu  
Ansan-city  
GYEONGGI-DO  
Korea

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

Product Name : STS301  
 SGS File No. : AYA07-25043  
 Received Date : November 08, 2007  
 Test Performing Date : November 09, 2007  
 Test Performed : SGS Testing Korea tested the sample(s) selected by applicant with following results  
 Test Results : For further details, please refer to following page(s)  
 Buyer(s) : LG, SAMSUNG

SGS Testing Korea Co. Ltd.

Pluto Kim  
 Monet Jeong  
 Billy Oh / Testing Person

  
 Jeff Jang / Chemical Lab Mgr

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F052 Version2

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Sample No. : AYA07-25043.001

Sample Description : STS301

Style/Item No. : N/A

Comments : Material is stainless steel.

#### 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 (Hg)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), UV	1	N.D.

#### Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromobiphenyl	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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F652 Version 2

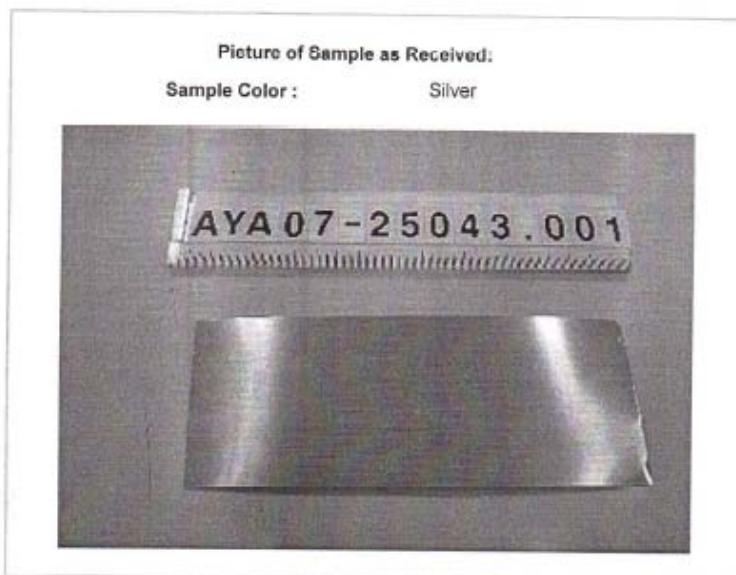
ace antenna A

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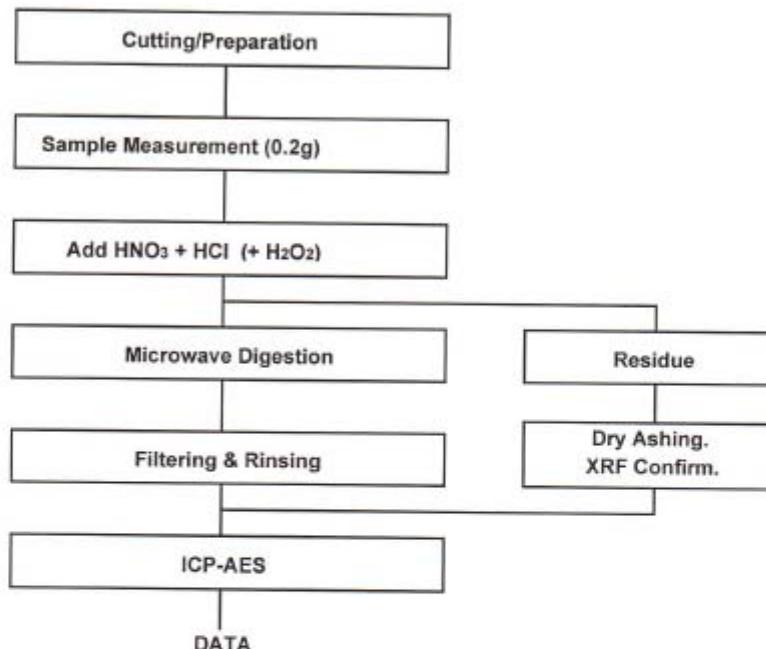


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### Flow Chart of Digestion

(EPA 3052 for Cd, Pb)



The samples were dissolved totally by pre-conditioning method according to above flow chart.

Operator Dami Yeom

Section Chief Jeff Jang

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

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