





# SPECIFICATION

<b>Product Name</b>	<b>WIMAX ANTENNA</b>
<b>Customer</b>	<b>Franklin Technology</b>
<b>Model Name</b>	Dual WIMAX Antenna Port 1 & Port2
<b>Customer Code.</b>	
<b>Provider</b>	<b>RadiAnt</b>
<b>Part Code.</b>	<b>RKC1001-AA</b>

	Submitted	Checked		Approved
<b>Buyer</b>				
<b>RadiAnt</b>	Submitted	Checked	Checked	Approved
				

## – Table of Contents –

<b>1. Product History</b> -----	<b>3</b>
<b>2. Electrical Feature</b> -----	<b>4</b>
2.1 Frequency Band	
2.2 Impedance	
2.3 Matching circuit	
2.4 VSWR	
2.5 Directivity	
2.6 Maximum Power	
<b>3. Environment Test</b> -----	<b>6</b>
<b>4. Electric Performance Data</b> -----	<b>8</b>
<b>5. Drawing</b> -----	<b>11</b>
<b>6. Packing</b> -----	<b>12</b>
<b>7. Certification of RoHS</b> -----	<b>13</b>

## 1. Product History

LIST					
NO	Data	Front	After	Change	REV
1	2010.11.10			Initial Development	0
2	2011..01.19.			Improve for Antenna performance	1
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

## 2. Electrical Feature

### 2.1. Frequency Band

BAND	WIMAX
FREQUENCY	2,495MHz~2,690MHz

### 2.2 Impedance

#### 2.2.1 Input Impedance

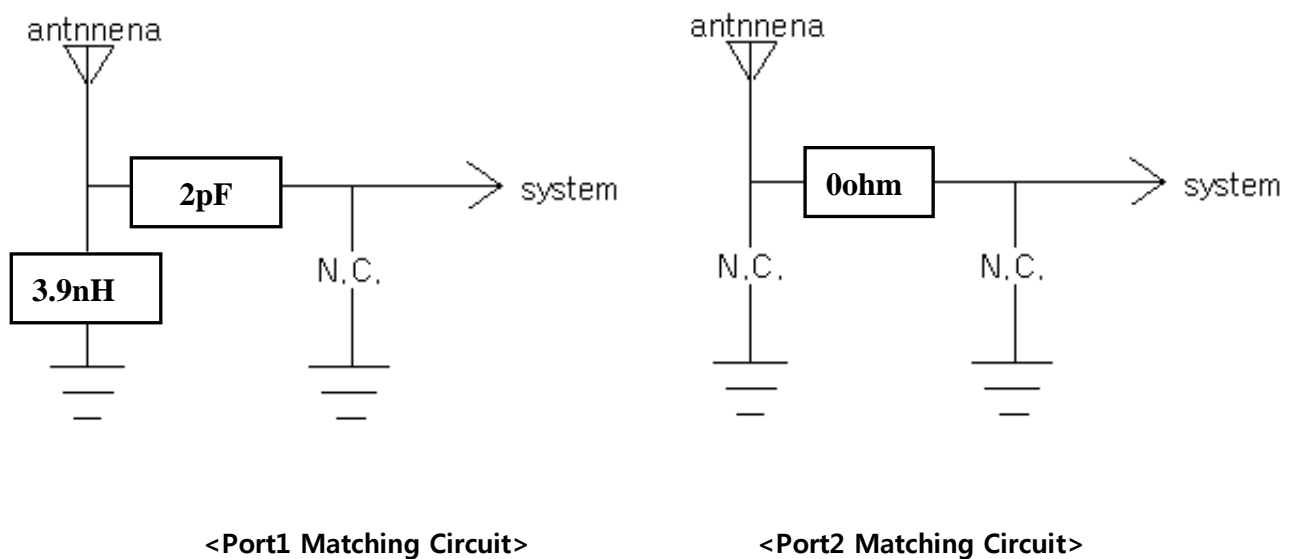
- R = 50Ω

#### 2.2.2 Measuring Method

By using Network Analyzer, connect the antenna installed Set WIMAX terminal to the reflection point of Analyzer and measure the impedance value within the designated frequency band.

### 2.3 Matching circuit

Matching Circuit is composed in free space of 2.1 frequency band while satisfying customer's requirements.



## 2.4 VSWR

Impedance Matching optimization is performed under the below mentioned environment.

### 2.4.1 Free Space Environment

BAND	WIMAX		
FREQ	2,500MHz	2,600MHz	2,700MHz
VSWR	4.0 : 1	4.0 : 1	4.0 : 1

### 2.4.2 Measuring Method

Connect (soldering) 50Ω semi-rigid coaxial cable to the 50Ω spot in Set WIMAX terminal. To minimize the loss of transmission, semi-rigid coaxial cable is used. Including PCB, the Set WIMAX terminal shouldn't be different from the one, which will be used for mass production.

Specification should be the same for all frequency bands. Free Space means that Set Se WIMAX terminal is put on the surface of no conducting plastic.

## 2.5 Directivity

### Omni-directional

BAND	2,500MHz	2,600MHz	2,700MHz
GAIN(Avg.)	-4.0 dBi	-2.0 dBi	-4.0 dBi

## 2.6 Maximum Power

- **P=0.2W Under**

## 3. Environment Test

### 3.1 Operating Temperature Test

#### 3.1.1 Test Condition

Temperature =  $-30^{\circ}\text{C}$ ,  $+80^{\circ}\text{C}$

Duration time = 1 hour

#### 3.1.2 Requirements

After the test, the antenna must not have an outer damage, and also it must pass requirement shown in 2.4.

#### 3.1.3 Measuring Method

Antenna is kept at  $-30^{\circ}\text{C}$  for 1 hour and  $+80^{\circ}\text{C}$  for 1 hour and then passed test of 2.4

### 3.2 Temperature Cycling Test

#### 3.2.1 Test Condition

- Low cycling Temperature TLC =  $-40^{\circ}\text{C}$
- High cycling Temperature THC =  $+80^{\circ}\text{C}$
- 1Cycle = 4 hours
- Test number = 10Cycle

#### 3.2.2 Requirements

After the test, the antenna must not have an outer damage, and also it must pass requirement shown in 2.4.

### 3.2.3 Measuring Method

Antenna is kept at low temperature  $-40^{\circ}\text{C}$  for 2 hours and increase the temperature up to  $+80^{\circ}\text{C}$  within 2 hour and kept for another 2 hours at the same temperature will be 1 cycle. As shown in Figure 3.2.1 repeat 10 cycle and kept for 2 hour in normal temperature.

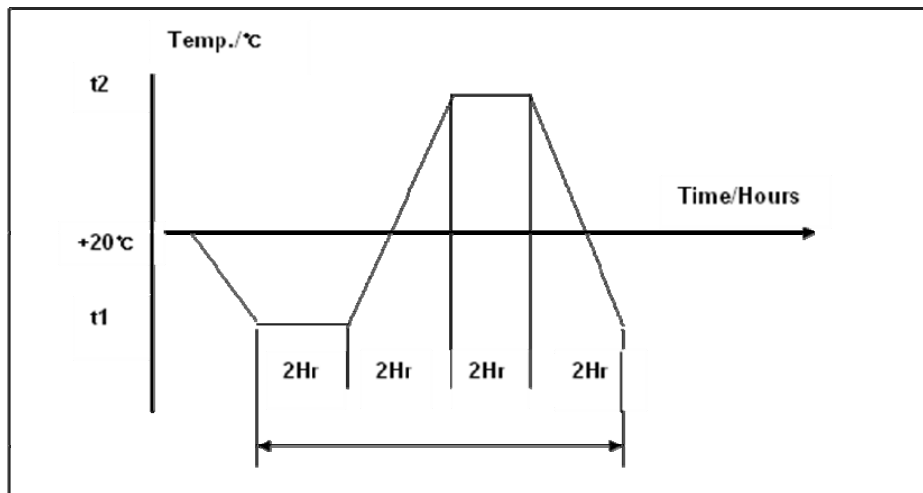


Figure 3.2.1 Temperature Cycling

## 3.3 Corrosion Resistance Test

### 3.3.1 Test Condition

- NaCl = 90%
- Water Temperature =  $60^{\circ}\text{C}$
- Duration Time = 96 hours

### 3.3.2 Requirements

After the test, the antenna must not have an outer damage, and also it must pass requirement shown in 2.4.

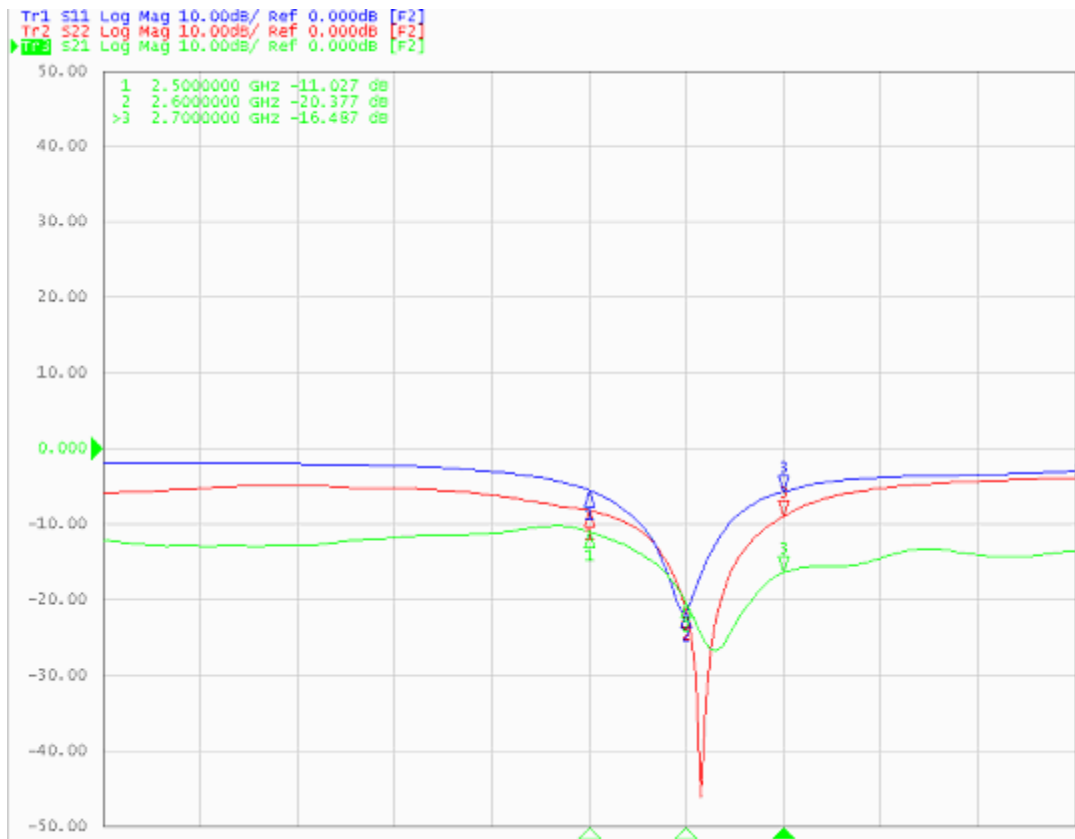
### 3.3.3 Measuring Method

Antenna is soaked in sodium chloride solution at temperature  $+60^{\circ}\text{C}$  and 90%(NaCl) for 96 hours and dry out.

## 4. Electric Performance Data

### 4.1. Return loss

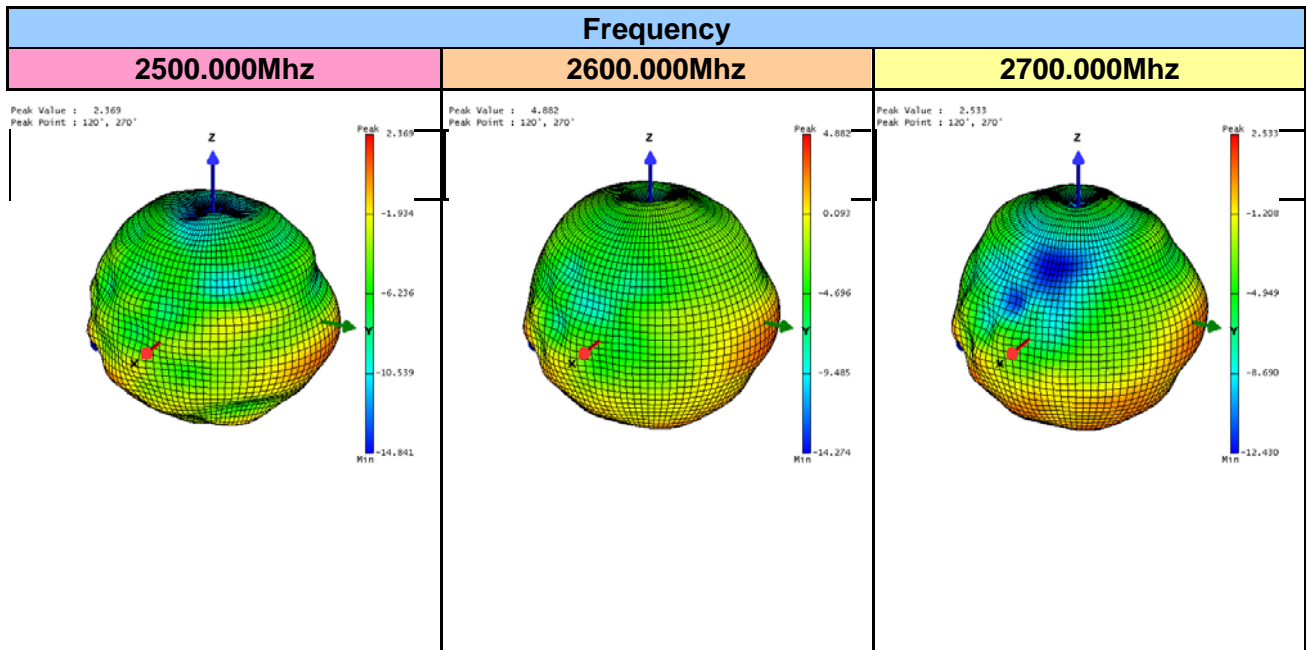
- Port1(S11), Port2(S22)





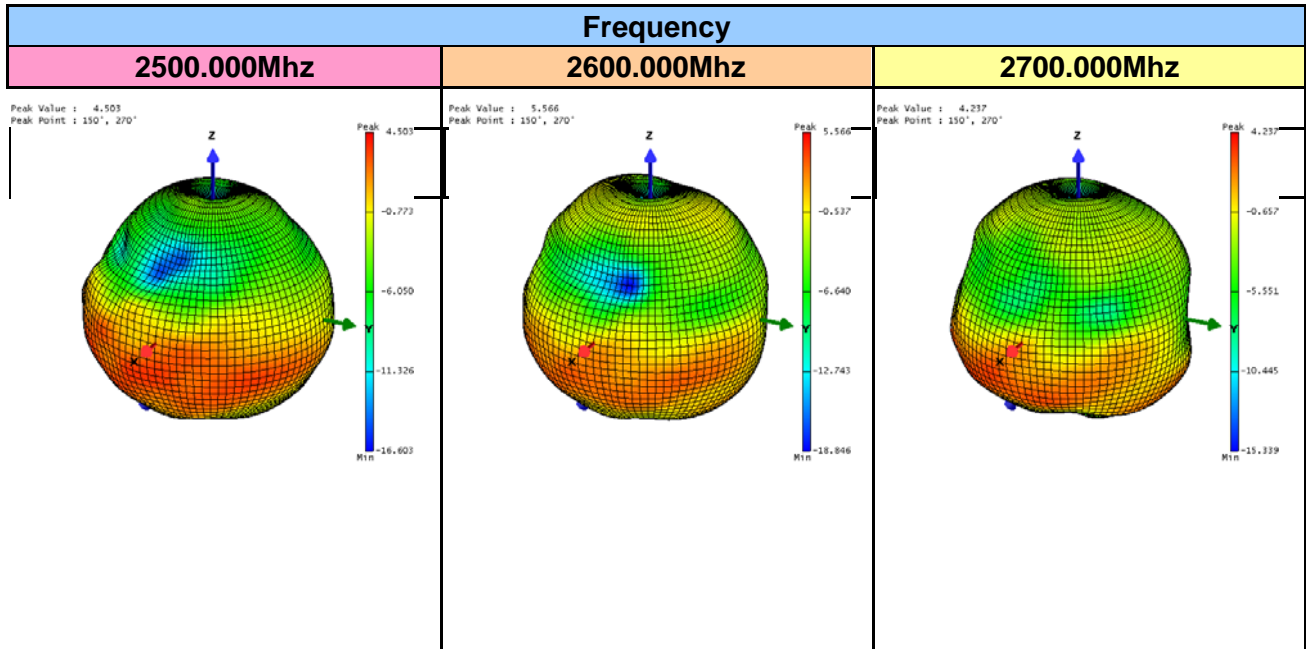
## 4.2. GAIN DATA

### 4.2.1. Dual WIMAX Antenna Port1



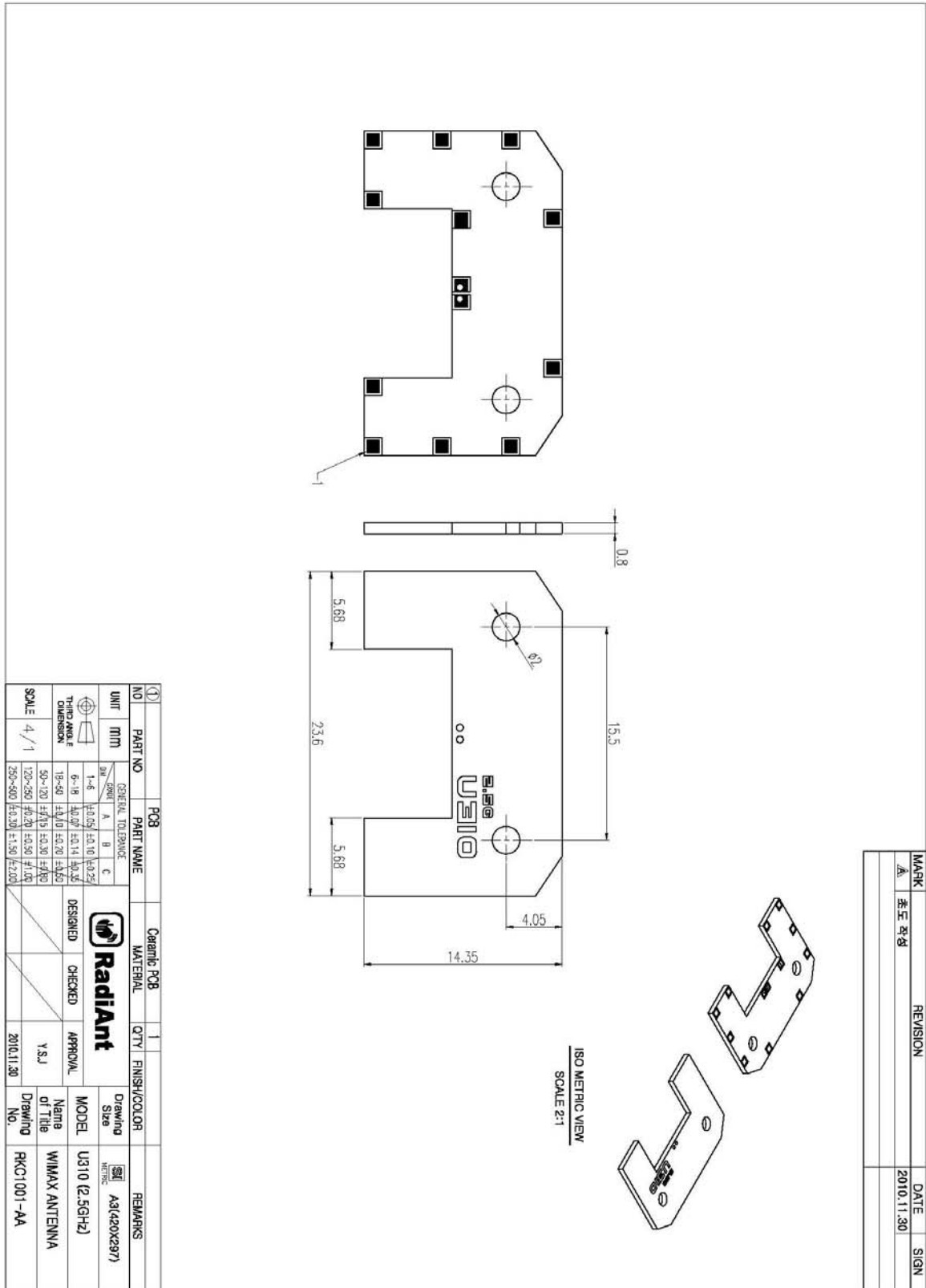
Frequency [MHz]	Peak Value		Minimum Value		Avg. Gain [dBi]	Efficiency [%]
	Value[dBi]	Degree	Value[dBi]	Degree		
2500	2.369	120 / 270	-14.841	075 / 225	-3.682	42.64%
2550	4.274	120 / 270	-11.794	165 / 165	-1.798	65.80%
2600	4.882	120 / 270	-14.274	165 / 150	-0.992	79.22%
2650	4.173	120 / 270	-12.898	165 / 150	-1.285	74.05%
2700	2.533	120 / 270	-12.699	045 / 000	-2.679	53.71%

#### 4.2.2. Dual WIMAX Antenna Port2

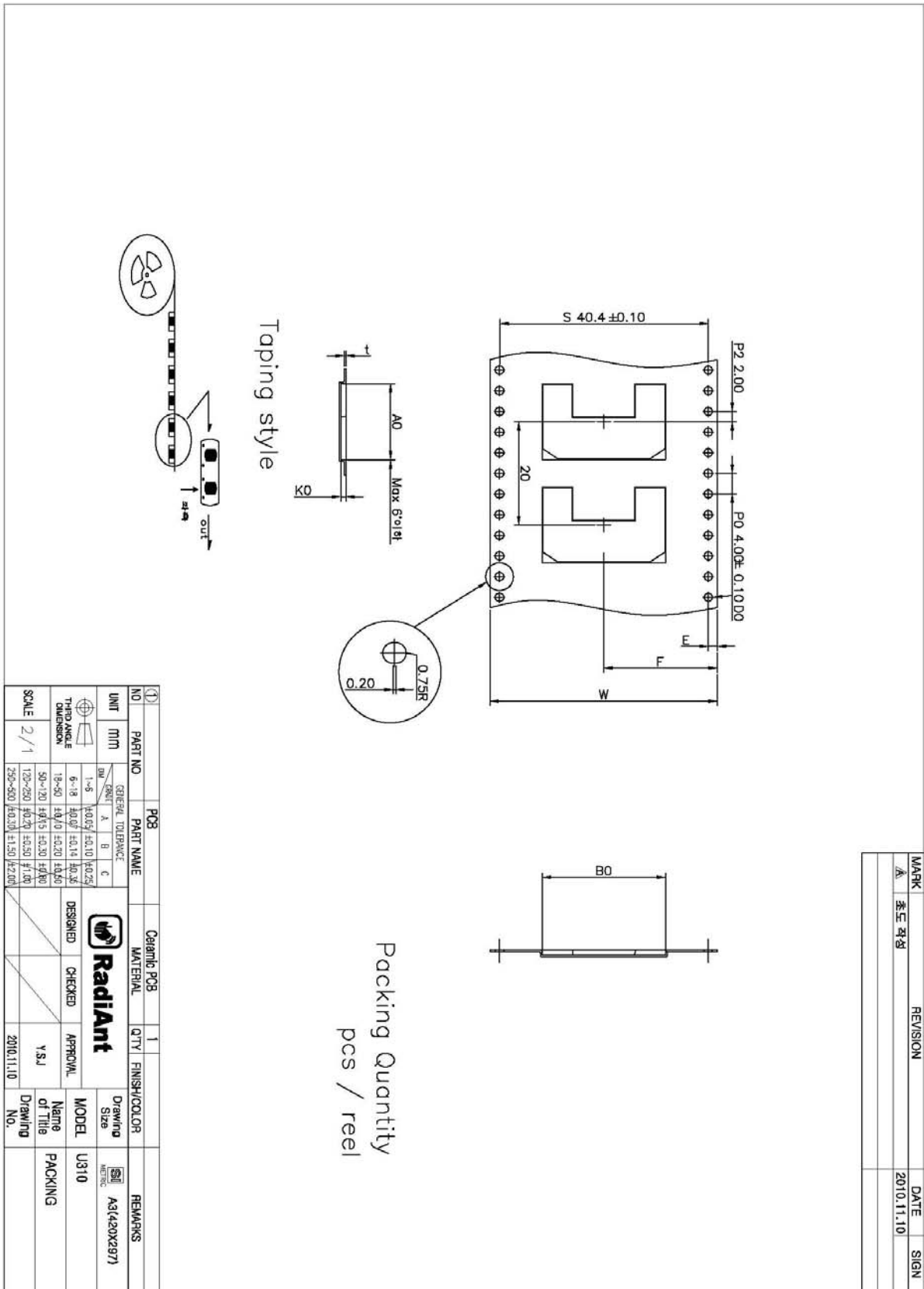


Frequency [MHz]	Peak Value		Minimum Value		Avg. Gain [dBi]	Efficiency [%]
	Value[dBi]	Degree	Value[dBi]	Degree		
2500	4.503	150 / 270	-16.603	075 / 165	-0.958	79.84%
2550	5.297	150 / 270	-21.932	075 / 165	-0.671	85.29%
2600	5.566	150 / 270	-18.846	060 / 015	-0.477	89.18%
2650	5.753	150 / 270	-13.398	090 / 150	0.015	99.89%
2700	4.237	150 / 270	-15.339	090 / 135	-0.967	79.67%

## 5. Drawing



## 6. Packing



## 7.Certification of RoHS



### Test Report

No. : CE/2010/43963 Date : 2010/04/26 Page : 1 of 8


ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE. CHANDLER, ARIZONA 85226-3415 USA



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

Sample Description : RO 4730  
Style/Item No. : RO 4730  
Other Info. : RO 4730 LOT# A986322  
Sample Receiving Date : 2010/4/19  
Testing Period : 2010/4/19 TO 2010/04/26

=====  
Test Result(s) : Please refer to next page(s).  
Conclusion : Based upon the performed tests by submitted samples, the test results of Cadmium, Lead, Mercury, Hexavalent Chromium Cr(VI), PBBs and PBDEs comply with the limits of RoHS Directive 2002/95/EC and its subsequent amendments.

  
**Chenyu Kung / Operation Manager**  
Signed for and on behalf of  
**SGS TAIWAN LTD.**  
Chemical Laboratory – Taipei

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
台灣檢驗科技股份有限公司 Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 1 + 886 (02)2299 3279 f+ 886 (02)2299 3237 [www.sgs.com](http://www.sgs.com)

Member of the SGS Group (SGS SA)

# Test Report

No. : CE/2010/43963    Date : 2010/04/26    Page : 2 of 8

 ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
 100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA


## Test Result(s)

PART NAME NO.1 : CREAM SHEET

Test Item (s):	Unit	Method	MDL	Result	Limit
				No.1	
Cadmium (Cd)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.	100
Lead (Pb)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.	1000
Mercury (Hg)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.	1000
Hexavalent Chromium Cr(VI) by alkaline extraction	mg/kg	With reference to IEC 62321: 2008 and performed by UV-VIS.	2	n.d.	1000
Perfluorooctane sulfonates (PFOS) PFOS – Acid PFOS – Metal Salt PFOS – Amide	mg/kg	With reference to US EPA 3540C: 1996 method for PFOS Content. Analysis was performed by LC/MS.	10	n.d.	-
PFOA (CAS No.: 000335-67-1)	mg/kg	With reference to US EPA 3540C: 1996 method for PFOA Content. Analysis was performed by LC/MS.	10	n.d.	-
<b>Halogen</b>					
Halogen-Fluorine (F) (CAS No.: 014762-94-8)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC.	50	342	-
Halogen-Chlorine (Cl) (CAS No.: 022537-15-1)			50	76	-
Halogen-Bromine (Br) (CAS No.: 010097-32-2)			50	n.d.	-
Halogen-Iodine (I) (CAS No.: 014362-44-8)			50	n.d.	-

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
 除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
 This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
 台灣檢驗科技股份有限公司    Chemical-Taipei    33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號    t + 886 (02)2299 3279 f + 886 (02)2299 3237    www.sgs.com

Member of the SGS Group (SGS SA)

## Test Report

No. : CE/2010/43963 Date : 2010/04/26 Page : 3 of 8

 ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
 100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA


Test Item (s):	Unit	Method	MDL	Result	Limit
				No.1	
<b>Sum of PBBs</b>	mg/kg	With reference to IEC 62321: 2008 and performed by GC/MS.	-	n.d.	1000
Monobromobiphenyl			5	n.d.	-
Dibromobiphenyl			5	n.d.	-
Tribromobiphenyl			5	n.d.	-
Tetrabromobiphenyl			5	n.d.	-
Pentabromobiphenyl			5	n.d.	-
Hexabromobiphenyl			5	n.d.	-
Heptabromobiphenyl			5	n.d.	-
Octabromobiphenyl			5	n.d.	-
Nonabromobiphenyl			5	n.d.	-
Decabromobiphenyl			5	n.d.	-
<b>Sum of PBDEs</b>			-	n.d.	1000
Monobromodiphenyl ether			5	n.d.	-
Dibromodiphenyl ether			5	n.d.	-
Tribromodiphenyl ether			5	n.d.	-
Tetrabromodiphenyl ether			5	n.d.	-
Pentabromodiphenyl ether			5	n.d.	-
Hexabromodiphenyl ether			5	n.d.	-
Heptabromodiphenyl ether			5	n.d.	-
Octabromodiphenyl ether			5	n.d.	-
Nonabromodiphenyl ether			5	n.d.	-
Decabromodiphenyl ether			5	n.d.	-

- Note : 1. mg/kg = ppm; 0.1wt% = 1000ppm  
 2. n.d. = Not Detected  
 3. MDL = Method Detection Limit  
 4. " - " = Not Regulated

### PFOS Reference Information : Directive 2006/122/EC

- (1) May not be placed on the market or used as a substance or constituent of preparations in a concentration equal to or higher than 0.005 % by mass.
- (2) May not be placed on the market in semi-finished products or articles, or parts thereof, if the concentration of PFOS is equal to or higher than 0.1 % by mass calculated with reference to the mass of structurally or microstructurally distinct parts that contain PFOS or, for textiles or other coated materials, if the amount of PFOS is equal to or higher than 1µg/m<sup>2</sup> of the coated material.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
 除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
 This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
 台灣檢驗科技股份有限公司 Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 1 + 886 (02)2299 3279 1 + 886 (02)2299 3237 www.sgs.com

Member of the SGS Group (SGS SA)

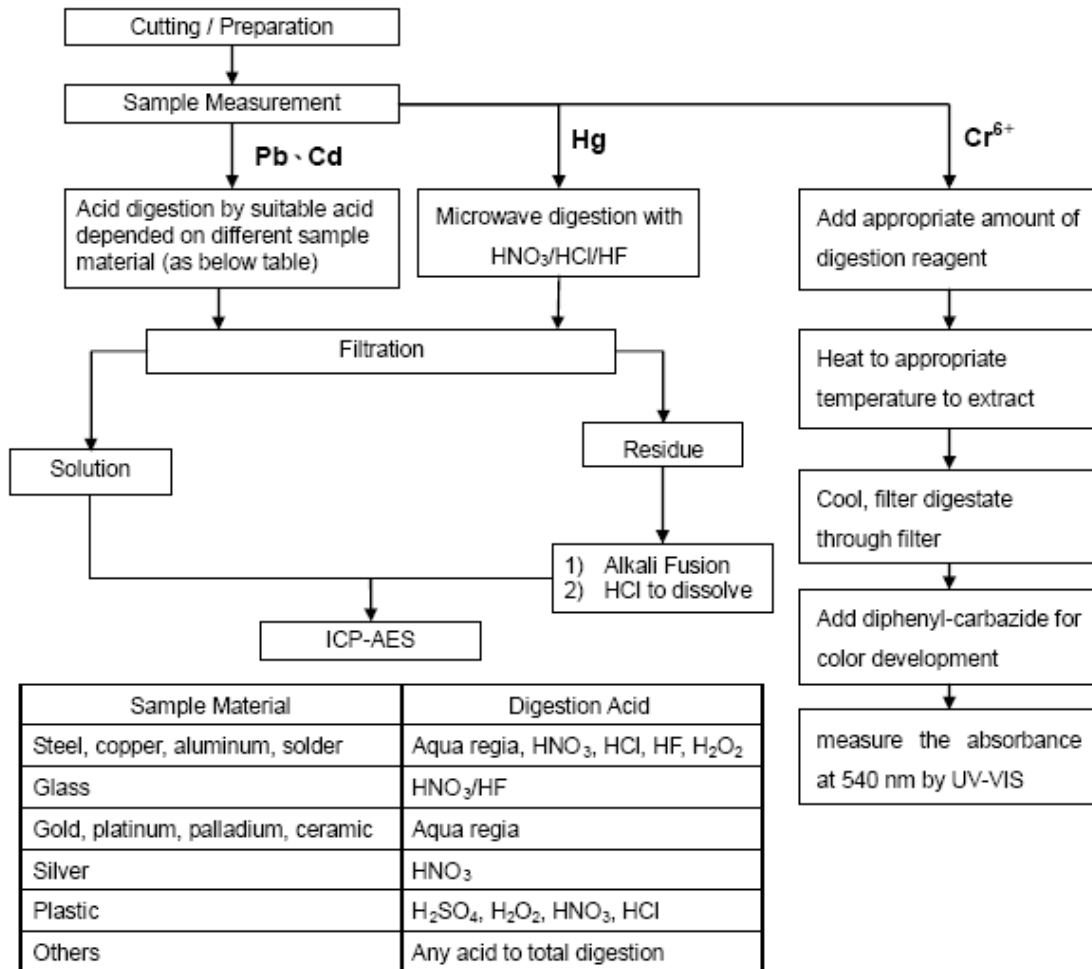
# Test Report

No. : CE/2010/43963 Date : 2010/04/26 Page : 4 of 8

ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA



- 1) These samples were dissolved totally by pre-conditioning method according to below flow chart.  
(Cr<sup>6+</sup> test method excluded)
- 2) Name of the person who made measurement: Climbgreat Yang
- 3) Name of the person in charge of measurement: Troy Chang



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
台灣檢驗科技股份有限公司 Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 1 + 886 (02)2299 3279 1 + 886 (02)2299 3237 www.sgs.com

Member of the SGS Group (SGS SA)



## Test Report

No. : CE/2010/43963 Date : 2010/04/26 Page : 5 of 8

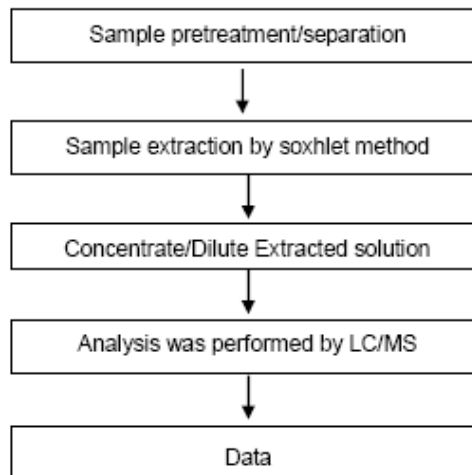
ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA



### Analytical flow chart of Soxhlet extraction (LC/MS) procedure

- 1) Name of the person who made measurement: Lydia Fu
- 2) Name of the person in charge of measurement: Shinjyh Chen

■ Test Items: PFOS/PFOA、Benzotriazole



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
台灣檢驗科技股份有限公司 | Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 t + 886 (02)2299 3279 f + 886 (02)2299 3237 www.sgs.com

Member of the SGS Group (SGS SA)

## Test Report

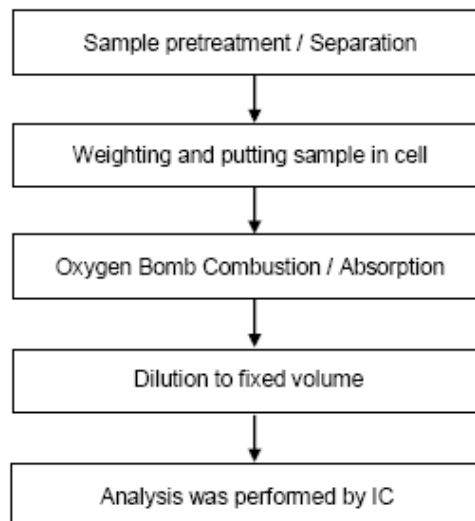
No. : CE/2010/43963 Date : 2010/04/26 Page : 6 of 8

ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA



### Analytical flow chart of halogen content

- 1) Name of the person who made measurement: Rita Chen
- 2) Name of the person in charge of measurement: Troy Chang



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
台灣檢驗科技股份有限公司 Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 t +886 (02)2299 3279 f +886 (02)2299 3237 [www.sgs.com](http://www.sgs.com)

Member of the SGS Group (SGS SA)

# Test Report

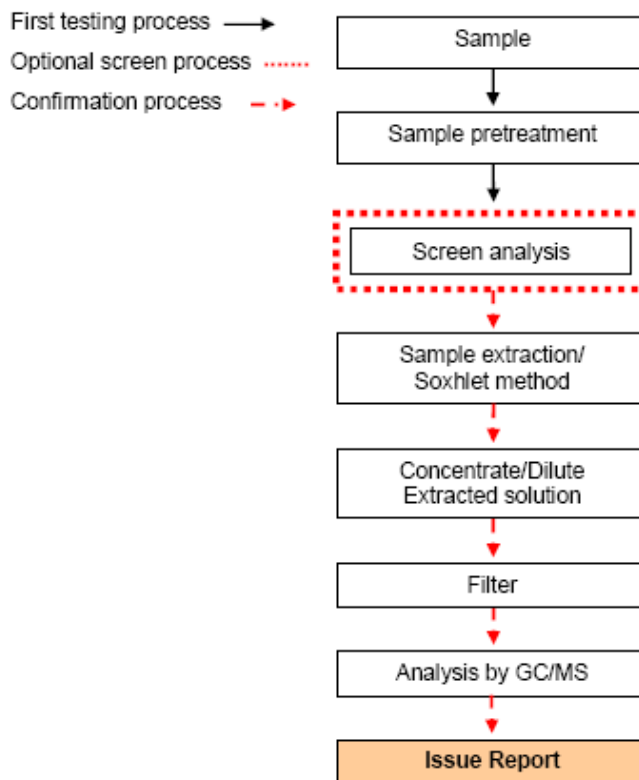
No. : CE/2010/43963 Date : 2010/04/26 Page : 7 of 8

ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA



## PBB/PBDE analytical FLOW CHART

- 1) Name of the person who made measurement: Roman Wong
- 2) Name of the person in charge of measurement: Shinjih Chen



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
 除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
 This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

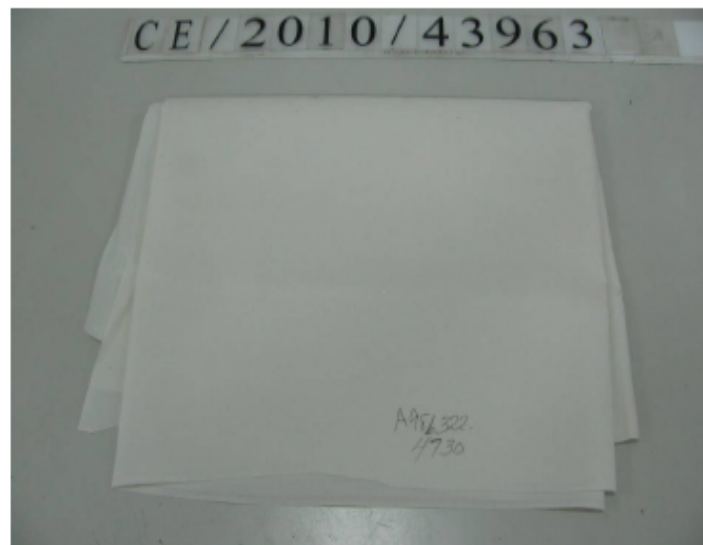
SGS Taiwan Ltd. Chemical-Taipei 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 t + 886 (02)2299 3279 f + 886 (02)2299 3237 www.sgs.com  
 台灣檢驗科技股份有限公司

Member of the SGS Group (SGS SA)

## Test Report

No. : CE/2010/43963 Date : 2010/04/26 Page : 8 of 8

ROGERS CORPORATION-ADVANCED CIRCUIT MATERIALS DIVISION  
100 S. ROOSEVELT AVENUE, CHANDLER, ARIZONA 85226-3415 USA



\*\* End of Report \*\*

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. This test report cannot be reproduced, except in full, without prior written permission of the Company.  
除非另有說明，此報告結果僅對測試之樣品負責。本報告未經本公司書面許可，不可部分複製。  
This Test Report is issued by the Company under its General Conditions of Service printed overleaf or available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this Test Report is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS Taiwan Ltd.  
台灣檢驗科技股份有限公司 | Chemical-Taipei | 33 WuChyuan Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五權路33號 | +886 (02)209 3279 | +886 (02)209 3237 | [www.sgs.com](http://www.sgs.com)

Member of the SGS Group (SGS SA)