

GainForce Technology Co.,Ltd

嘉光科技股份有限公司

承認書

APPROVAL SHEET

品 名： **A n t e n n a**

MODEL NAME AT3216

料 號： **AT3216-B5R5HAAT/LF**

PART NUMBER 11320Y11161A1

客戶名稱： **永 洋**

CUSTOMER _____

供 應 商： **GainForce**

VENDOR _____

使用機種：

MODEL _____

聯 絡 人： 尹 廣 汶

聯絡電話： (02) 2880-1838

附 件：

ACCESSORIES ☒ 規格書

SPECIFICATION

☒ 樣品

SAMPLE

☒ 圖樣

DRAWING

☒ 檢驗報告

TEST REPORT

認可狀況：

(APPROVED STATUS)



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AT3216 Series

Multilayer Chip Antenna

Features

- ❖ Monolithic SMD with small, low-profile and light-weight type.
- ❖ Wide bandwidth

Applications

- ❖ 5~6GHz wireless communication system



Specifications

Part Number	Frequency Range (MHz)	Peak Gain (XZ-V)	Average Gain (XZ-V)	VSWR	Impedance
AT3216-B5R5HAA_	5150~5875	2.0 dBi typ.	-2.5 dBi typ.	2 max.	50 Ω

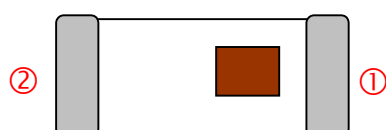
Q'ty/Reel (pcs) : 3,000 pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : -40 ~ +85 °C
 Power Capacity : 500mW max.

Part Number

AT 3216 - B 5R5 HAA □ □
 ① ② ③ ④ ⑤ ⑥ ⑦

① Type	AT : Antenna	② Dimensions (L × W)	3.2× 1.6 mm
③ Material Code	B	④ Frequency Range	5R5=5500MHz
⑤ Specification Code	HAA	⑥ Packaging	T: Tape & Reel B: Bulk
⑦ Soldering	=lead-containing /LF=lead-free		

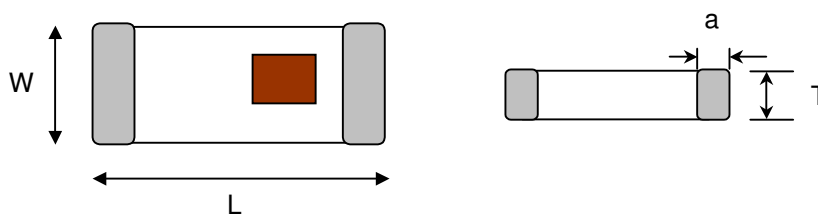
Terminal Configuration



No.	Terminal Name	No.	Terminal Name
①	Feeding Point	②	NC

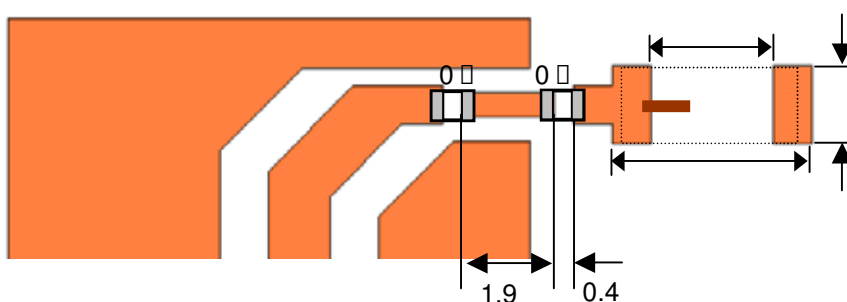
Dimensions and Recommended PC Board Pattern

Unit : mm

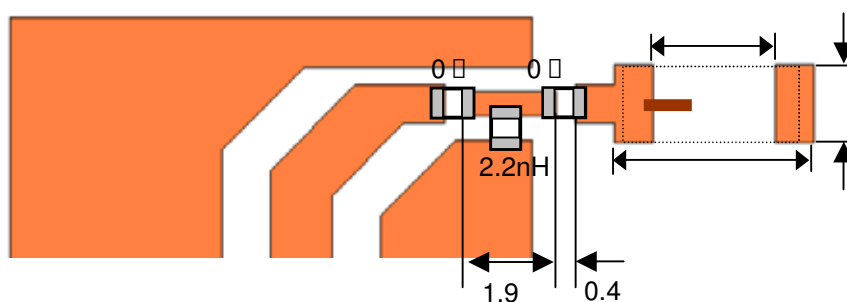


Mark	L	W	T	a
Dimensions	3.2 \pm 0.2	1.6 \pm 0.2	1.3+ 0.1/-0.2	0.5 \pm 0.3

(a) Without Matching Circuits



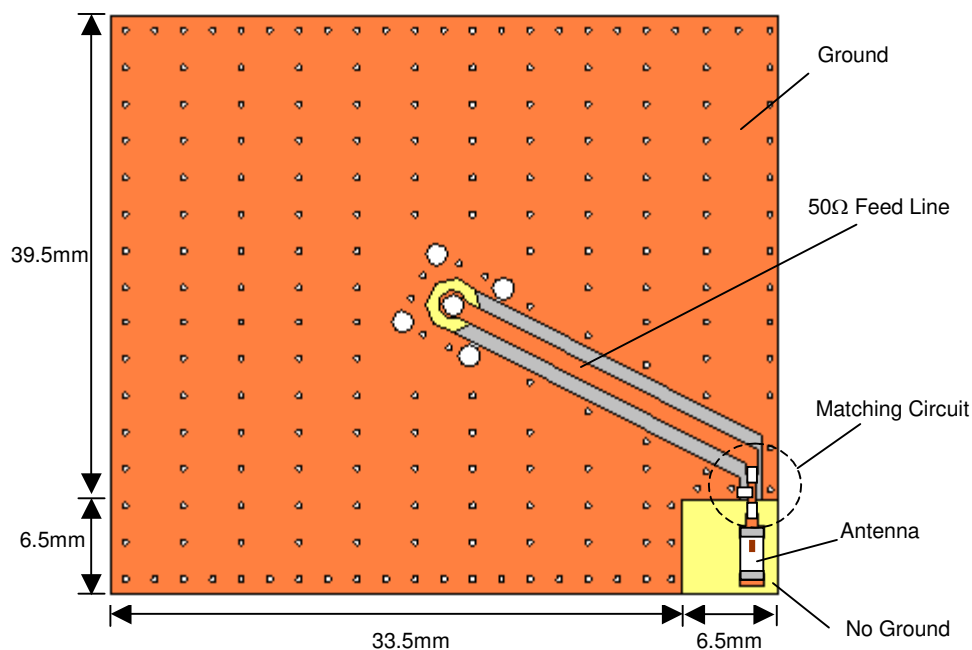
(b) With Matching Circuits



*Line width should be designed to match 50 Ω characteristic impedance, depending on PCB material and thickness.

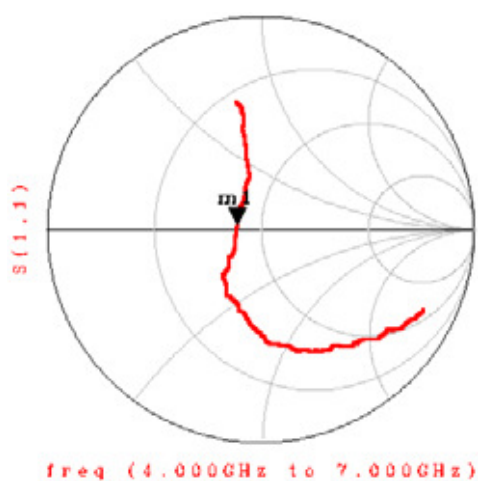
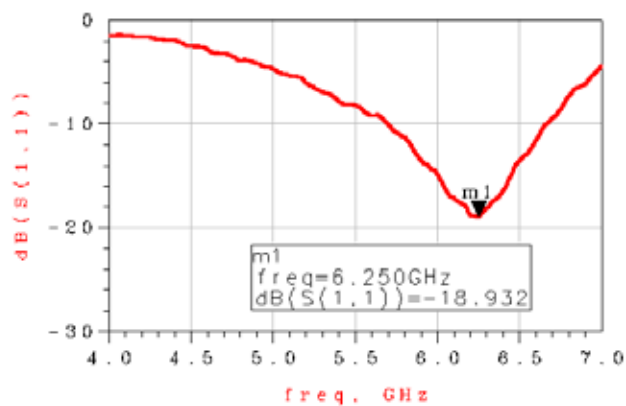
Typical Electrical Characteristics (T=25°C)

❖ Test Board

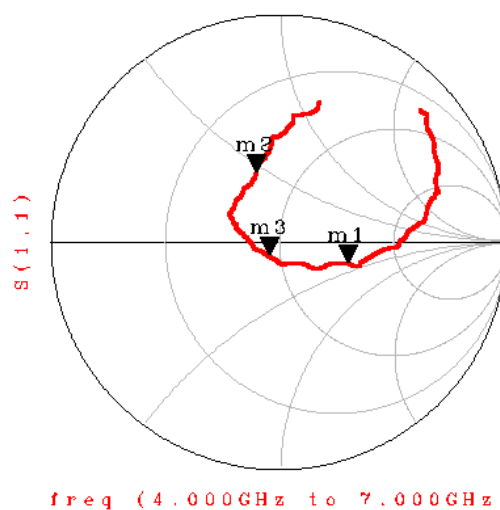
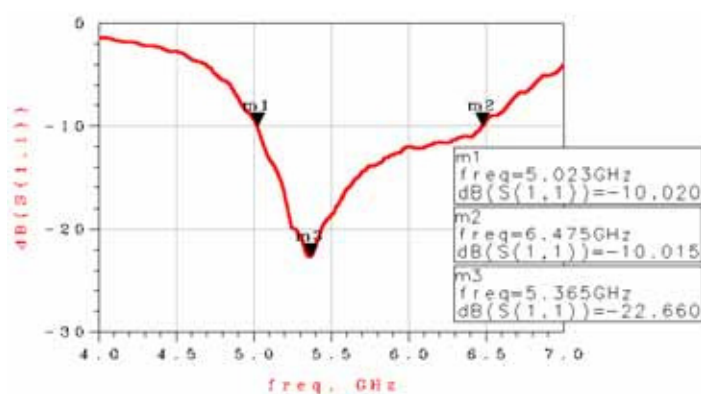


❖ Return Loss

(a) Without Matching Circuits

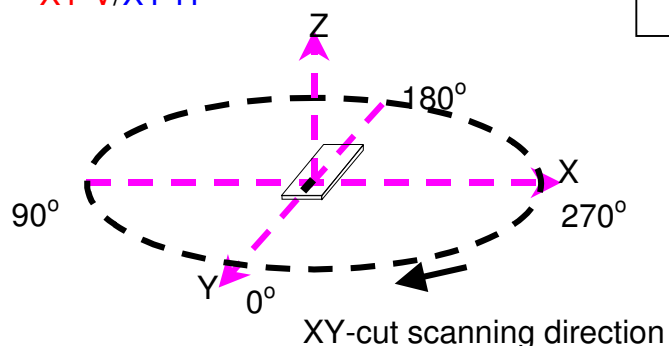


(b) With Matching Circuits

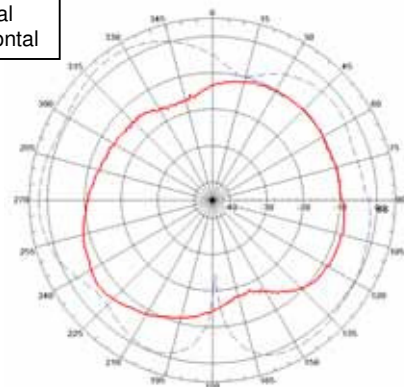


Radiation Patterns

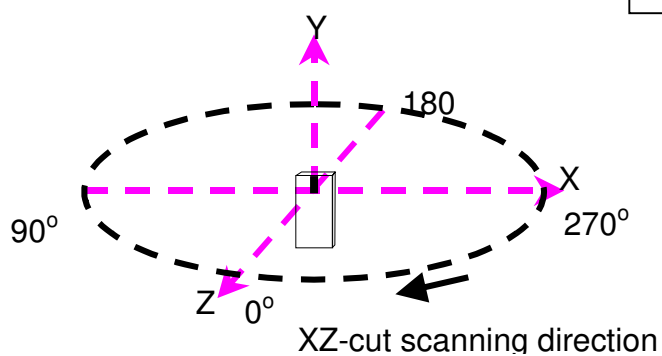
XY-V/XY-H



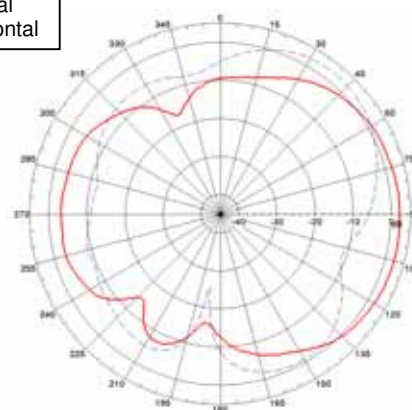
XY cut @5.5GHz
— Vertical
- - Horizontal



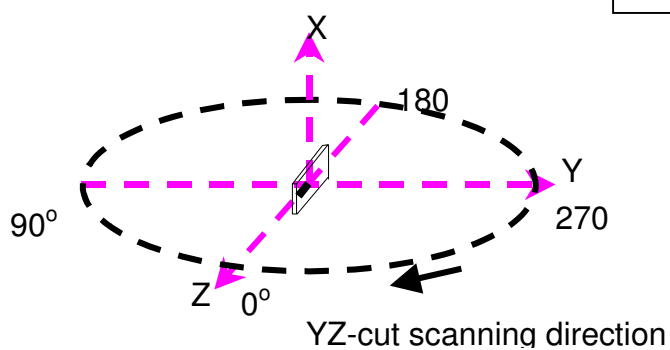
XZ-V/XZ-H



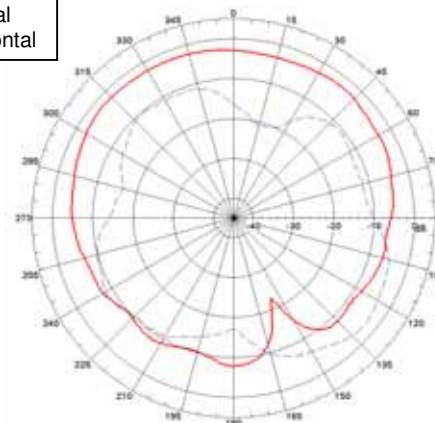
XZ cut @5.5GHz
— Vertical
- - Horizontal



YZ-V/YZ-H



YZ cut @5.5GHz
— Vertical
- - Horizontal



Advanced Ceramic X Corp.

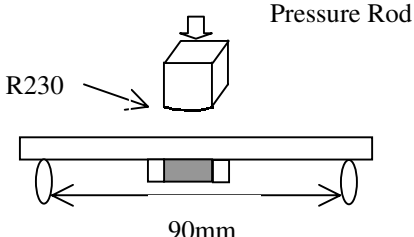
16 Tzu Chiang Road, Hsinchu Industrial District Hsinchu Hsien 303, Taiwan

TEL:886-3-5987008 FAX:886-3-5987001

E-mail: acx@acxc.com.tw

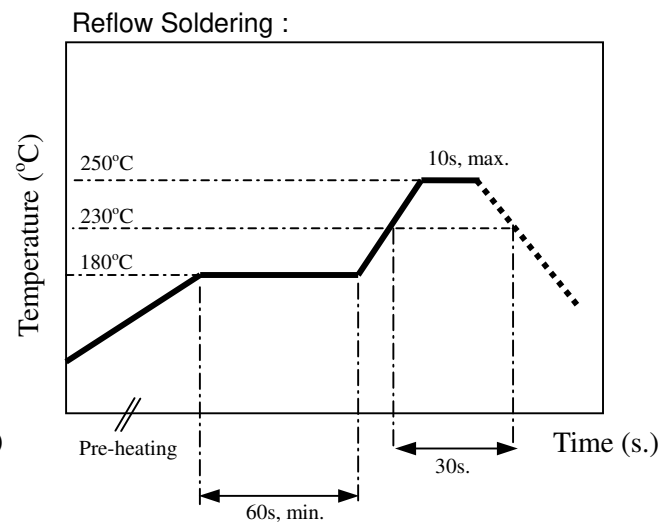
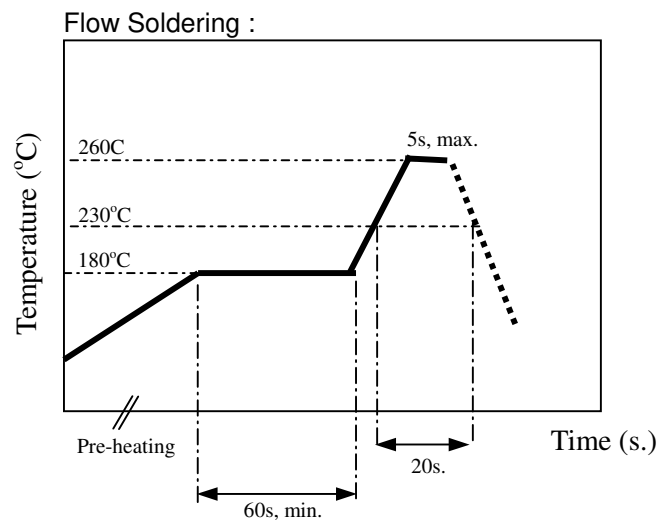
<http://www.acxc.com.tw>

Mechanical & Environmental Characteristics

	Requirements	Procedure
Solderability	<ol style="list-style-type: none"> 1. No apparent damage 2. More than 75% of the terminal electrode shall be covered with new solder 	<ol style="list-style-type: none"> 1. Preheat: $120 \pm 5^{\circ}\text{C}$ 2. Solder: $230 \pm 5^{\circ}\text{C}$ for 5 ± 1 sec
Thermal shock (Temperature Cycle)	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. One cycle/ step 1: $85 \pm 5^{\circ}\text{C}$ for 20sec step 2: $-40 \pm 3^{\circ}\text{C}$ for 20sec 2. Cycle time: 30min 3. No. of cycles: 100 4. Recovery: 1-2hrs
Heat Resistance	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. Temperature: $85 \pm 2^{\circ}\text{C}$ 2. Duration: 24 ± 2hrs 3. Recovery: 1-2hrs
Low Temperature Resistance	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. Temperature: $-40^{\circ} \pm 5^{\circ}\text{C}$ 2. Duration: 24 ± 2hrs 3. Recovery: 1-2hrs
Humidity Resistance	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification after test 	<ol style="list-style-type: none"> 1. Temperature: $85 \pm 2^{\circ}\text{C}$ 2. Humidity: 80% ~ 85% RH 3. Duration: 1000 ± 48hrs 4. Recovery: 1-2hrs
Soldering strength (Push strength)	<ol style="list-style-type: none"> 1. 9.8N minimum 	<ol style="list-style-type: none"> 1. Solder specimen onto test jig. 2. Apply push force at 0.5mm/s until electrode pads are peeled off or ceramic are broken. Pushing force is applied to longitude direction
Deflection (Bending)	<ol style="list-style-type: none"> 1. No apparent damage 2. Fulfill the electrical specification 	<ol style="list-style-type: none"> 1. Solder specimen onto test jig (FR4, 0.8mm) using the recommend soldering profile. 2. Apply a bending force of 2mm deflection 
Drop Shock	<ol style="list-style-type: none"> 1. No apparent damage 	<ol style="list-style-type: none"> 1. Dropped onto hard wood from height of 50 cm for 3 times ; each x,y and z direction except terminal direction

Typical Soldering Profile

❖ Typical Soldering Profile for Lead-free Process



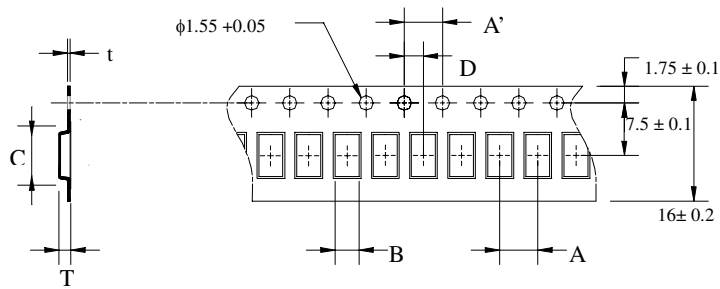
The sample must be pre-heated before soldering .The temperature difference between preheating and soldering must be within 150 °C .

Notes

❖ The contents of this data sheet are subject to change without notice. Please confirm the specifications and delivery conditions when placing your order.

Taping Specifications

❖ Tape Dimensions (Unit: mm)

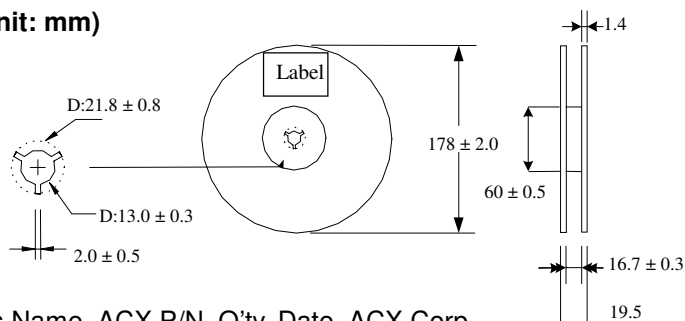


Type	A	A'	B	C	D	t	T
3216	4.0 0.1	4.0 0.1	1.9 0.1	3.5 0.1	2.0 0.1	0.20 0.05	Max. 1.4
5020	4.0 0.1	4.0 0.1	2.4 0.1	5.5 0.1	2.0 0.1	0.20 0.05	Max. 1.4
7020	4.0 0.1	4.0 0.1	2.4 0.1	7.3 0.1	2.0 0.1	0.22 0.05	Max. 1.55
7635	8.0 0.1	4.0 0.1	3.75 0.1	7.85 0.1	2.0 0.1	0.30 0.05	Max. 1.40
8516	4.0 0.1	4.0 0.1	1.85 0.1	8.70 0.1	2.0 0.1	0.25 0.05	Max. 1.40
9520	4.0 0.1	4.0 0.1	2.3 0.1	9.7 0.1	2.0 0.1	0.22 0.05	Max. 1.45
R130	8.0 0.1	4.0 0.1	3.35 0.1	10.35 0.1	2.0 0.1	0.25 0.05	Max. 1.40

❖ Quantity

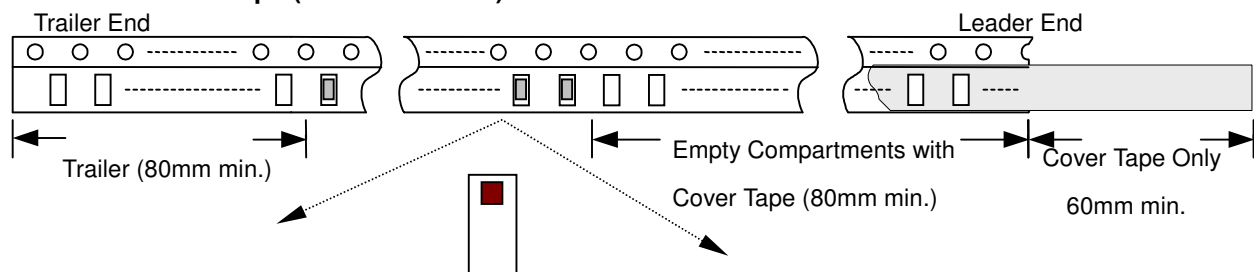
Type	3216	5020	7020	7635	8516	9520	R130
Quantity /per reel	3,000pcs	2,000	1,000 pcs	1,000 pcs	1000pcs	1,000 pcs	1,000 pcs

❖ Reel Dimensions (Unit: mm)

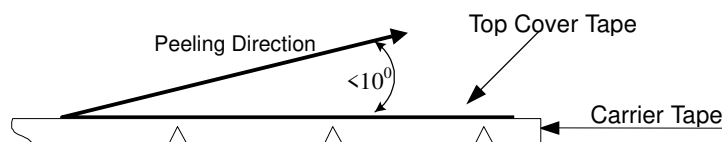


Label: Customer's Name, ACX P/N, Q'ty, Date, ACX Corp.

❖ Leader and Trailer Tape (Plastic material)



❖ Peel-off Force



Peel-off force should be in the range of 0.1 – 0.6 N at a peel-off speed of 300 ± 10 mm/min .

❖Storage Conditions

- (1) Temperature: 15 ~35 ℃ , relative humidity (RH): 45~75%.
- (2) Non-corrosive environment
- (3) Products should be used within six months of receipt.

Notes

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


Product Hazardous Substance Report

Model Name:

Part Number: 11320Y11161A1

Date: 2013.07.12

RoHS Directive 2011/65/EC & PFOS Dire														
Item 項目	Part Number 料號	Description 品名	Component Suppliers 廠商名稱	SUPPLIER PN 原廠/製造商型號	Weight (mg) 零件重量	Sub-Item 分離材質 項目	Sub-parts Homogeneous Material 分離之均勻材質名稱	原材料顏色 (塑膠、油墨及漆料必填) The color of raw material (Required for plastic, ink and paint)	鍍層存在與否/鍍層材質說明 If the plating layer exist or not?(Y/N)/if yes, please describe the material of the plating layer	分離之 均勻材質 單重(mg)	Effective date 報告生效日	1,000	100	1,000
												Pb 鉛	Cd 鎘	Hg 汞
	11320Y11161A1	Chip Antenna AT3216- B5R5HAAT/LF	嘉光科技 (ACX)	AT3216-B5R5HAAT/LF	22.096	1.	Ceramic	NA	N	20.026	2013/6/7 2013/6/3	57,400	N.D	N.D
						2.	Termination Plating	NA	Y(Ni / Sn)	2.070	2013/5/21	N.D	N.D	N.D

Active 2006/122/EC												REACH Regulation (EC) No 1907/2006			Halogen Free IEC 61249-2-21								
Control Substance; mg/kg=ppm Concerned									Analysis report No. 實驗室分析報告號碼	Laboratory Test Report (Hyperlink) 第三公證單位化學分析報告	Material Declaration/ Exception Declaration 物質宣告書或排外宣告證明(Hyperlink)	物質成份元素表		Contained Substance of SVHC	Candidate List Update Date by	SVHC Contained List (Hyperlink)	1500ppm Concerned		Laboratory Test Report (Hyperlink) 第三公證單位化學分析報告	Material Declaration (Hyperlink) 物質宣告書	備註 Remark		
1,000 Cr+6 六價鉻	1,000 PBB	1,000 PBDE	HBCCD	DEHP	BBP	DBP	PFOA	PFOS				元素/化合物名稱	元素/化合物比重 (%)				Cl 氯	Br 溴					
N.D	N.D	N.D	-	-	-	-	N.D	N.D	CE/2013/55890 CE/2013/52137A	 CE_2013_55890.pdf  CE_2013_52137A.pdf		Al2O3	42.82%	No	18/06/2012	--	N.D	N.D	 CE_2013_52137A.pdf				
									Pb compounds	8.56%													
									SiO2	40.54%													
									CaO	4.26%													
									Ag	3.83%													
									Ag	65.14%													
Negative	N.D	N.D	-	-	-	-	N.D	N.D	CE/2013/55138 CE/2013/52137A	 CE_2013_52138.pdf		Ni	11.62%	No	18/06/2012	--	N.D	N.D					
									Sn	23.24%													

物 質 成 份 元 素 表					
組成物	材質	材質比重	元素	元素比重	備註
Ceramic	Powder	90.63%	Al2O3	38.80%	
			Pb compounds	7.76%	
			SiO2	36.74%	
			CaO	3.86%	
			Ag	3.47%	
Termination	Ag paste; plating	9.63%	Ag	6.10%	
			Ni	1.09%	
			Sn	2.18%	

物質成份分析表

料 號	組成物名稱	鉛(Pb)	鎘(Cd)	汞(Hg)	六價鉻 (Cr+6)	多溴聯苯 (PBBs)	多溴化二苯 乙醚 (PBDEs)	ROHS檢測報告編號	檢 測 日 期	排除條例
AT3216-B5R5HAAT/LF 11320Y11161A1	Ceramic	57400	N.D	N.D	N.D	N.D	N.D	CE/2013/55890	2013/6/7	EU RoHS (2002/95/EC) Exemption 7(c)-I Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound.
	Termination	N.D	N.D	N.D	N.D	N.D	N.D	CE/2013/52138	2013/5/21	

註:1.若物質成份含量超出RoHS所限定之含量,但在RoHS的排除條款中,請供應商在檢測報告及表單中清楚註明是在一條文中所規定,以方便查核。

2.若物質超出RoHS限定值,請附上材質證明,以證明所含之成份是RoHS所允許。

永洋 RoHS 值管制標準

Classification	Restricts Substances			AMIT Standard	備註
Heavy metals (重金屬)	Lead (Lead Compounds)	鉛及其化合物	Pb	800ppm	例外(Exception): 1.鉛使用於電子器材中陶製零件不受此限。 2.鋼合金:0.35%(3500ppm) 3.鋁合金:0.40%(4000ppm) 4.銅合金:4%(40000ppm)
	Cadmium (Cadmium Compounds)	鎘及其化合物	Cd	80ppm	
	Mercury (Mercury Compounds)	汞及其化合物	Hg	800ppm	
	Hexavalent Chromium	六價鉻及其化合物	Cr^{+6}	800ppm	
Bromided organic compounds (含溴有機化合物)	PBBs	聚溴聯苯	$C_{12}H_{12}-XBrXO$ (X=1~10)	800ppm	
	PBDEs PBDOs	聚溴二苯醚	$C_{12}H_{12}-XBrXO$ (X=1~10)	800ppm	
Heavy metals (重金屬) (applicable to packaging(包裝材適用))	Pb+Cd+Hg + Cr^{+6} (applicable to packaging)	鉛+鎘+汞+六價鉻(包裝材適用)	Pb+Cd+Hg + Cr^{+6} (包裝材適用)	80ppm(Cd <5 ppm)	含棧板、膠膜、膠帶、膠袋、緩衝材、發泡材、紙箱、label、Tray、束帶、乾燥包、真空袋、溼度指示卡等及上述材料印刷所用油墨。



Advanced Ceramic X Corporation

16 Tzu Chiang Road, Hsinchu Industrial District

Hsinchu Hsien, Taiwan 303 R.O.C.

TEL : 886-3-598-7008 FAX : 886-3-598-7001 e-mail: acxc@acxc.com.tw

Guarantee letter

We, Advanced Ceramic X (ACX) Corporation, are hereby warrants and guarantee that
ACX products fully comply with the international specification set froth herein (i.e.
IEC61249-2-21).Total Br < 900 PPM,Total Cl < 900 PPM , Br+Cl < 1500 PPM.

ACX P/N: AT3216-B5R5HAAT/LF

Company : 環德電子工業股份有限公司 Advanced Ceramic X Corporation

Title : QM Director

Signed by : *Monica Lin*

Date : 2013/7/15



Advanced Ceramic X Corporation

16 Tzu Chiang Road, Hsinchu Industrial District

Hsinchu Hsien, Taiwan 303 R.O.C.

TEL : 886-3-598-7008 FAX : 886-3-598-7001 e-mail: acxc@acxc.com.tw

Guarantee letter regarding substances included in materials

Our company hereby guarantees that we will meet the requirements of EU RoHS to ban all environment-related substances included in the materials (including attachments, packages, and all the matters delivered with the materials).

The observable scope of the environment-related substances would include the following substances.

This guarantee letter covers following product: AT3216-B5R5HAAT/LF

[Environment-related Substance to be Controlled]


The names of the substances	
RoHS	Cadmium and cadmium compounds
	Lead and lead compounds
	Mercury and mercury compounds
	Hexavalent chromium compounds
	Polybrominated biphenyls (PBB)
	Polybrominated biphenyl ethers (PBDE)

※Full fill RoHS requirement. The lead contained in ACX product is exempted from the requirement of ROHS.

7(c)-I Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound

Company : 環德電子工業股份有限公司 Advanced Ceramic X Corporation

Title : QM Director

Signed by : 

Date : 2013/7/15

※ 第一頁為承認書(APPROVAL SHEET)封面,必須註明以下資訊,包括:

- 1、永洋料號(AMIT P/N)
- 2、供應商料號與供應商型號(Part NO, Internal code)
- 3、承認書版次,依承認書初次開始編製(如 A、B、C or 1、2、3),勿以料號版次編製
- 4、產品名稱(如彩盒、說明書、外箱…等)

※ 第二頁必需為承認書的目錄,而且必須符合下列的格式:

※ 目錄(Specification Index)

- 1、規格(specification)
- 2、圖面(mechanical drawing) (須包含本體表面印刷文字(廠牌、型號、date code)說明)
- 3、性能檢測報告(Performance Test Report)
 - a、可靠度測試報告(Reliability Test Report)(shielding case、外露 connector 鹽霧測試報告、電池必須提供)
 - b、各項性能測試報告(performance report)(天線、電池)
- 4、最小之內包裝方式(Packing information) (卷、管、盤狀物料,若 data sheet 已說明則不需另外提供)

☐ 5、製程溫度資訊(Thermal Profile),為獨立一份檔案(針對永洋主、被動元件一定需提供)

(項目 6 為針對 PCB 供應商須提供。)

☐ 6、如下為 **PCB 供應商**必須附上之樣品及文件,請 **PCB 供應商**附於性能檢測報告中:

- ☐ a、文字、孔位、PAD 點及線路等底片
- ☐ b、切片報告(microdection report)及切片樣本
- ☐ c、阻抗報告(impedance report)及阻抗條
- ☐ d、成品出貨檢驗報告
- ☐ e、疊構方式切面圖及連板成型圖
- ☐ f、PCB 耐溫耐熱測試報告
- ☐ g、材質證明及 UL 認證
- ☐ h、GERBER DRAWING
- ☐ i、製作規範

■ 7、永洋 RoHS 調查表(請另外填寫”永洋 RoHS 調查表範本_for 零件供應商(Excel 檔)”並按照內容範例及說明指示提供所需要的資料,並將第三公證單位測試報告檔案附加至 Excel 檔中。)

請注意

- ※ 限用物質承諾保證書須在送樣承認前經 AMIT 稽核審查合格,方可進行承認流程。
- ※ 送樣承認時須同時檢附 AMIT RoHS 調查表,Excel File。
- ※ 請務必依 Check List 所條列之項目,於承認書送出時確認資料是否完整正確 ※

AMIT 申請人員確認: (永洋申請人姓名); 供應商確認: (尹廣汶)

Advance Multimedia Internet Technology Inc.

限用物質承諾保證書

Guarantee of Hazardous Substances

供應商名稱 (Supplier's Name) : 嘉光科技股份有限公司

本公司特此保證：保證供應給永洋科技股份有限公司的產品滿足以下列出的有害物質限值的要求，並於製程中不使用該項物質：

We warrant that all the products supplied to Advance Multimedia Internet Technology Inc. satisfy the following threshold requirements concerning hazardous substances, and the use of these substances used in the production of supplied products are in compliance with such threshold requirements:

有害物質名稱	Name of hazardous substance	永洋針對ROHS規定 限定值 (limit for RoHS) ppm (mg/kg)	SONY SS-00259限 定值 (limit for SONY -00259) ppm (mg/kg)
鎘及其混合物	Cadmium and its compounds (Cd)	80 Solder:75ppm	Plastics/Wire 5ppm Solder:20ppm
鉛及其混合物	Lead and its compounds (Pb)	800 *鋼(steel) 3500 *鋁(aluminum) 4000 *銅(copper) 4%	Plastic/Painting/W ire 100ppm Solder:1000ppm
汞及其混合物	Mercury and its compounds (Hg)	800	0
六價鉻及其混合物	Chromium VI and its compounds (Cr ⁺⁶)	800	0
多溴聯苯(PBB)	Polybrominated Biphenyls (PBB)	800	0
多溴二苯醚	Polybromodiphenyl ether (PBDE)	800	0
鎘+鉛+汞+六價鉻	Cd+ Pb+ Hg+ Cr ⁺⁶	Packaging: 80	Packaging: 100
所有乾電池及蓄電池之產品應符合以下規定：			
汞及其混合物	Mercury and its compounds (Hg)	5PPM 25mg/cell	5PPM 1 PPM (供中國用的 錳電池及碱錳電池)
鎘及其混合物	Cadmium and its compounds (Cd)	250PPM	0
鉛及其混合物	Lead and its compounds (Pb)	4,000PPM	4,000PPM

所有樣品必須依照RoHS Homogenous的定義拆解測試

Entire Specimen shall be follow the destruct testing of RoHS Homogenous.

Advance Multimedia Internet Technology Inc.

※本公司特此保證，自2006年01月01日起，提供給永洋科技股份有限公司產品或零件中，符合RoHS或Sony SS-00259的危害物質限質要求之含量標準。

We also warrant that the products listed hereafter, which will be supplied to Advance Multimedia Internet Technology Inc. (Amit)

from 2006/01/01, satisfy RoHS and/or Sony SS-00259 requirements concerning hazardous substances.

※若本公司違反上述限值標準，因而造成貴公司的一切損失及風險，本公司將承擔一切責任，並承擔補償貴公司因此發生的一切費用。

We shall pay to Amit all damages and costs including, but not limited to, reasonable attorneys' fees, damage awards, payments to settle claims, and the cost of Amit internal resources handling such matters if the parts delivered to Amit failed to meet the abovementioned requirements.

※若本公司設計變更涉及材質改變或製程改變或製造場所改變，必須重新提出「環境管理物質」檢測報告供貴公司存查，若未提出相關之檢測報告，而經貴公司或貴公司之客戶發現者，除需負擔貴公司發生之一切費用（包含但不限於檢測費用、損失）外，另需給付懲罰性違約金新台幣100,000元。

We shall propose again that the examining report supports Amit to be keep for reference on the "Environmental management material", if the product design change involve material or process or manufacture place, if not provide any testing report, but discovered by AMIT or AMIT's customers, shall be share the full expenses cause by the said issue (including but no limited of testing expense lose), but shall addition pay in the amount of NTD 100,000 for penalty.

※本公司對限用物質(RoHS)或(SS-00259)，承諾之料件內/外箱標示。

The following label (please check the appropriate box) will be used for the of shipping RoHS and/or Sony SS-00259 compliant parts on their internal and external packaging:

☐ 按永洋科技股份有限公司之規定標示如下：

☐ Amit's label:



26mmx26mm 綠底白字

☐ 標示不同於永洋科技股份有限公司，說明如下：

☐ Our own label:

※本保證書請蓋公司大小章及騎縫章後正本寄回永洋科技股份有限公司。

Please sign and return this Guarantee Form back to Amit.

公司名稱(Company Name)：嘉光科技股份有限公司

回覆日期(Date)： 2007/06/26

負責人簽名(Authorized Signature):

公司章(Supplier's Company Stamp):



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ADVANCED CERAMIC X (ACX) CORPORATION

16, TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT, HSINCHU HSIEN, TAIWAN 303



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

Sample Submitted By : ADVANCED CERAMIC X (ACX) CORPORATION
 Sample Description : MULTILAYER LTCC-L COMPONENTS (CERAMIC BODY)
 Style/Item No. : AD SERIES, AT SERIES, BD SERIES, BF SERIES, BL SERIES, BM SERIES, BW SERIES, CD SERIES, CF SERIES, CP SERIES, DM SERIES, DP SERIES, DS SERIES, EF SERIES, ES SERIES, FA SERIES, FB SERIES, FD SERIES, FM SERIES, GS SERIES, HI SERIES, HF SERIES, HM SERIES, HS SERIES, LF SERIES, OM SERIES, OS SERIES, PD SERIES, NF SERIES, QS SERIES, SF SERIES, TS SERIES, TP SERIES, LTCC SUBSTRATES
 Sample Receiving Date : 2013/05/31
 Testing Period : 2013/05/31 TO 2013/06/07

Test Requested : (1) As specified by client, with reference to RoHS Directive 2011/65/EU Annex II to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs contents in the submitted sample.
 (2) As specified by client, to test Halogen-Fluorine, Chlorine, Bromine, Iodine contents in the submitted sample.

Test Method : Please refer to next page(s).

Test Result(s) : Please refer to next page(s).


 Troy Chang Manager-Tech
 Signed for and on behalf of
 SGS TAIWAN LTD.
 Chemical Laboratory – Taipei

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ADVANCED CERAMIC X (ACX) CORPORATION

16, TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT, HSINCHU HSIEN, TAIWAN 303



Test Result(s)

PART NAME No.1 : MULTILAYER LTCC-L COMPONENTS (CERAMIC BODY)

Test Item(s)	Unit	Method	MDL	Result No.1
Cadmium (Cd)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.
Lead (Pb)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	9
Mercury (Hg)	mg/kg	With reference to IEC 62321: 2008 and performed by ICP-AES.	2	n.d.
Hexavalent Chromium Cr(VI)	mg/kg	With reference to IEC 62321: 2008 and performed by UV-VIS.	2	n.d.
Sum of PBBs	mg/kg	With reference to IEC 62321: 2008 and performed by GC/MS.	-	n.d.
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.
Sum of PBDEs			-	n.d.
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.

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Test Item(s)	Unit	Method	MDL	Result
				No.1
Halogen				
Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	With reference to BS EN 14582:2007. Analysis was performed by IC.	50	n.d.
Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)			50	n.d.
Halogen-Bromine (Br) (CAS No.: 10097-32-2)			50	n.d.
Halogen-Iodine (I) (CAS No.: 14362-44-8)			50	n.d.

Note :

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

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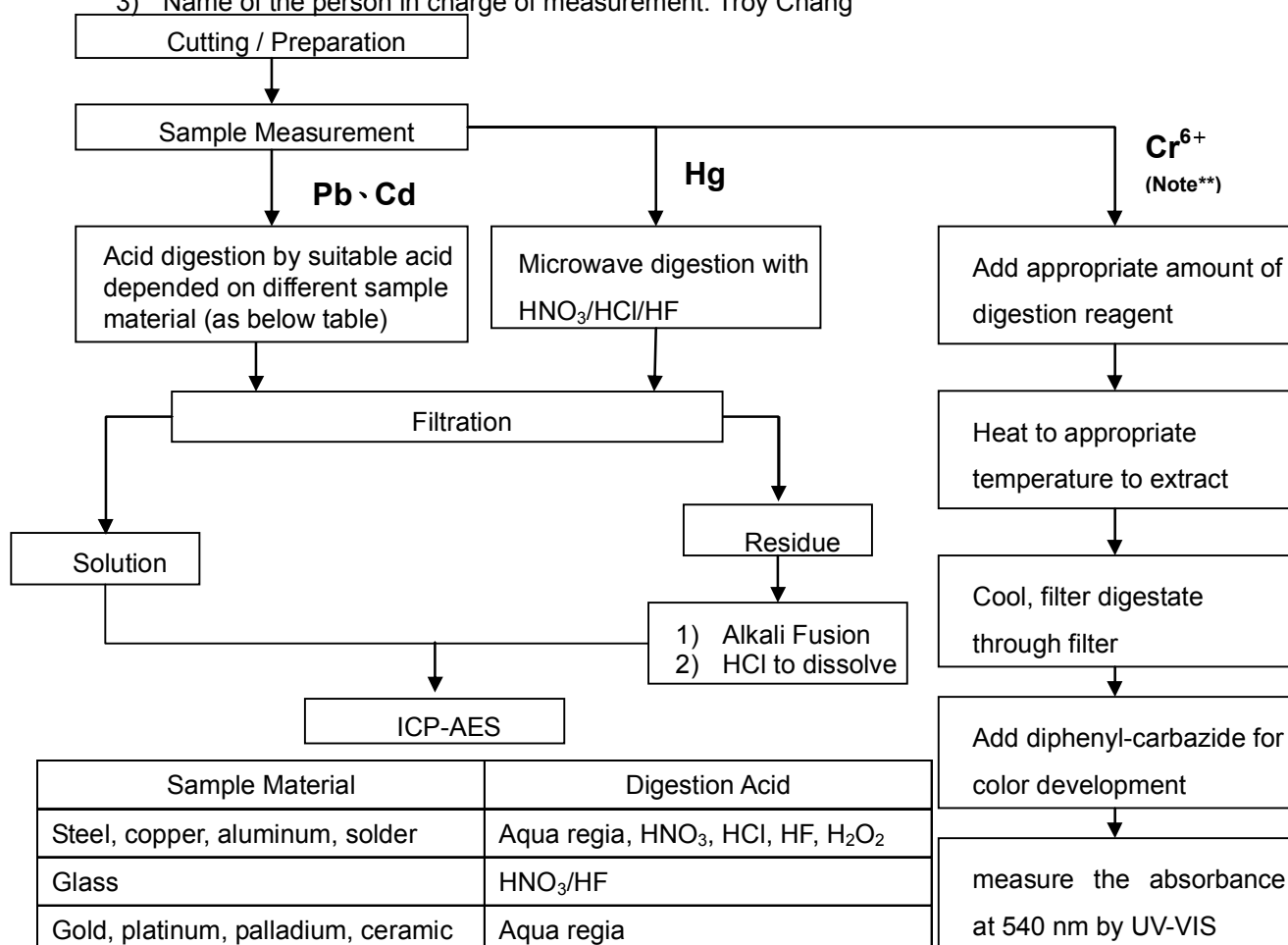
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ADVANCED CERAMIC X (ACX) CORPORATION

16, TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT, HSINCHU HSIEN, TAIWAN 303



- 1) These samples were dissolved totally by pre-conditioning method according to below flow chart.
(Cr⁶⁺ test method excluded)
- 2) Name of the person who made measurement: Climbgreat Yang
- 3) Name of the person in charge of measurement: Troy Chang



Sample Material	Digestion Acid
Steel, copper, aluminum, solder	Aqua regia, HNO ₃ , HCl, HF, H ₂ O ₂
Glass	HNO ₃ /HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO ₃
Plastic	H ₂ SO ₄ , H ₂ O ₂ , HNO ₃ , HCl
Others	Added appropriate reagent to total digestion

Note :** (1) For non-metallic material, add alkaline digestion reagent and heat to 90~95°C.
(2) For metallic material, add pure water and heat to boiling.

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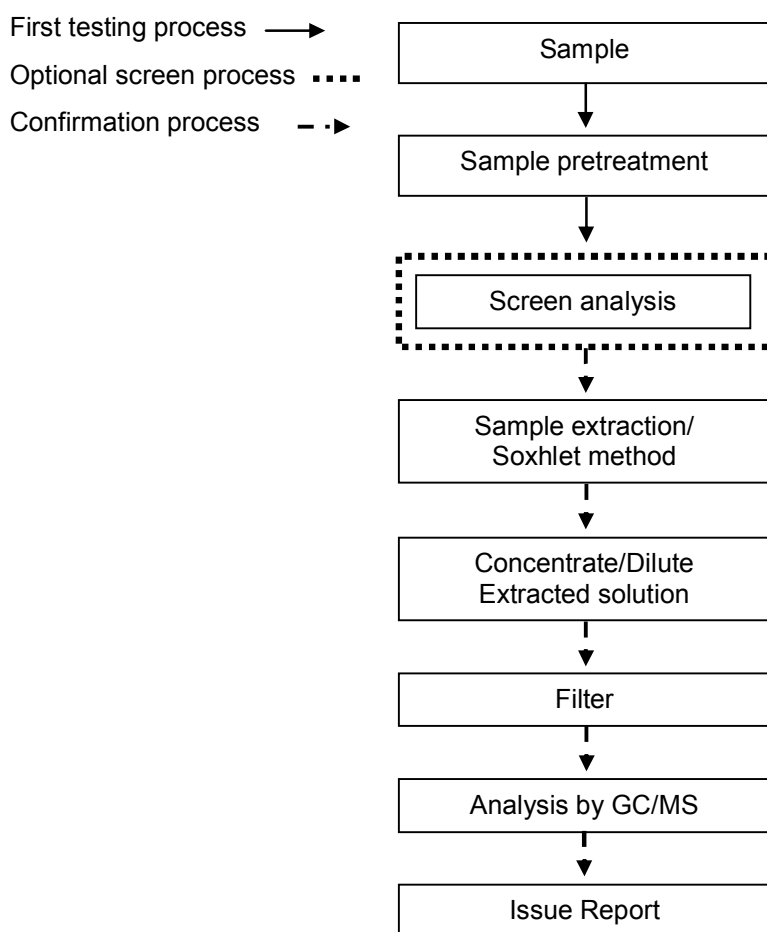
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PBB/PBDE analytical FLOW CHART

- Name of the person who made measurement: Roman Wong
- Name of the person in charge of measurement: Troy Chang



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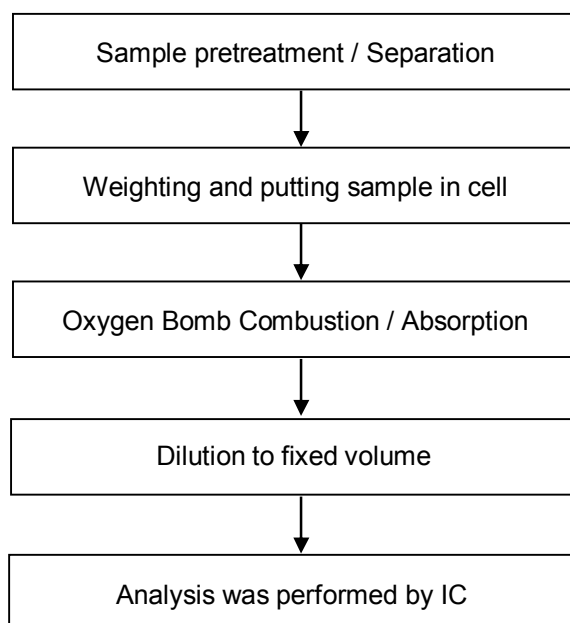
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Analytical flow chart of halogen content

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



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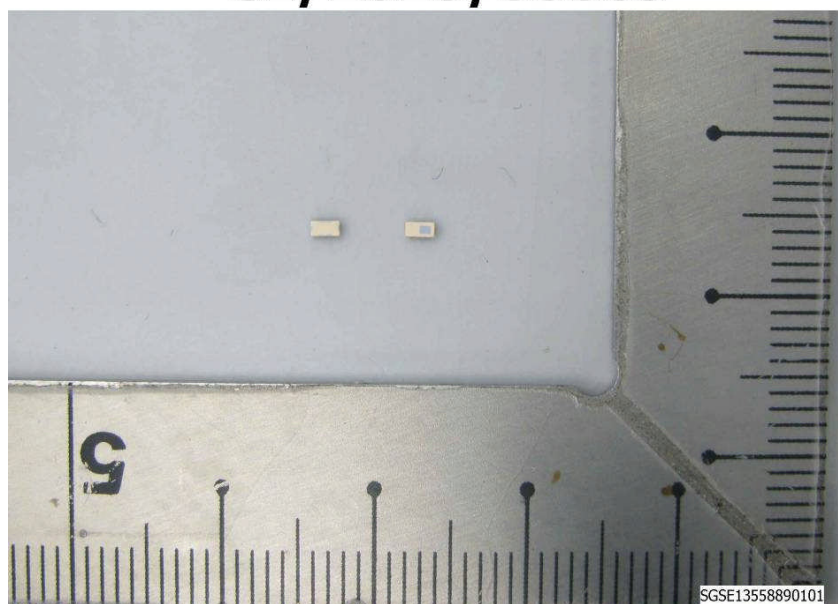
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* The tested sample / part is marked by an arrow if it's shown on the photo. *

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** End of Report **

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