

Appendix 9.

Antenna Specification

(주)에프원미디어 귀중

검 토	심 사	승 인
.

승 인 원

제조 제품명 : CHIP ANTENNA

제 조 자 : Advanced Ceramic X(ACX) Corp.

발행 년월일 : 2009년 04월 17일

PARTS NO.	AT3216 B2R8HAA
품 명	CHIP ANTENNA
규 격	3.2 X 1.6mm
최초적용기종	
사용승인NO.	
인정검사NO.	
승인유효기간	

비 고	
-----	--

신 청 회 사 명 : 휴택 상사

주 소 : 서울시 구로구 신도림동 337번지 푸르지오 104동 701호

전 화 번 호 : 02- 3439-7711/ 3439 -7756

담 당 자 : 과장 임 동빈 / 영업부 (H.P : 019-9229-3845)

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1. Feature/Applications/Specifications/Part Number/
Terminal Configuration
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3. Measuring Diagram/Typical Electrical Characteristics
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AT3216 Series

Multilayer Chip Antenna

Features

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

Applications

- ❖ Bluetooth/Wireless LAN/Home RF
- ❖ ISM band 2.4GHz applications



Specifications

Part Number	Frequency Range (MHz)	Peak Gain (XZ-V)	Average Gain (XZ-V)	VSWR	Impedance
AT3216 -B2R8HAA_	2400 ~ 2500	0.5 dBi typ.	-0.5 dBi typ.	2 max.	50 Ω

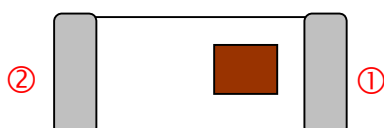
Q'ty/Reel (pcs) : 3,000pcs
 Operating Temperature Range : -40 ~ +85 °C
 Storage Temperature Range : -40 ~ +85 °C
 Power Capacity : 500mW max.

Part Number

AT 3216 - B 2R8 HAA □ /LF
 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	2R8=2800MHz
⑤ Specification Code	HAA	⑥ Packaging	T: Tape & Reel B: Bulk
⑦ Soldering	=lead-containing /LF=lead-free		

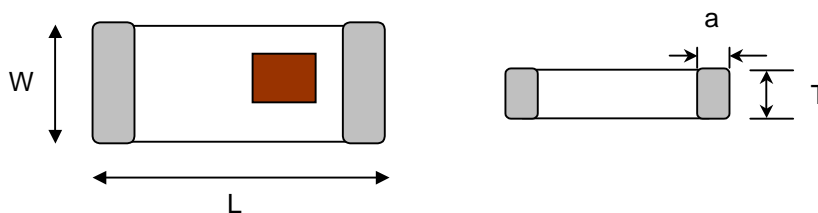
Terminal Configuration



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

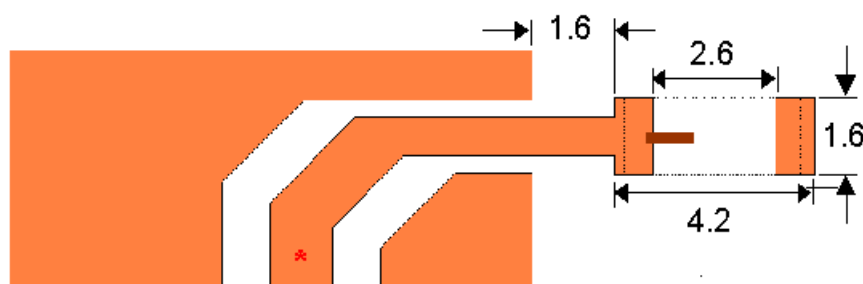
Dimensions and Recommended PC Board Pattern

Unit : mm

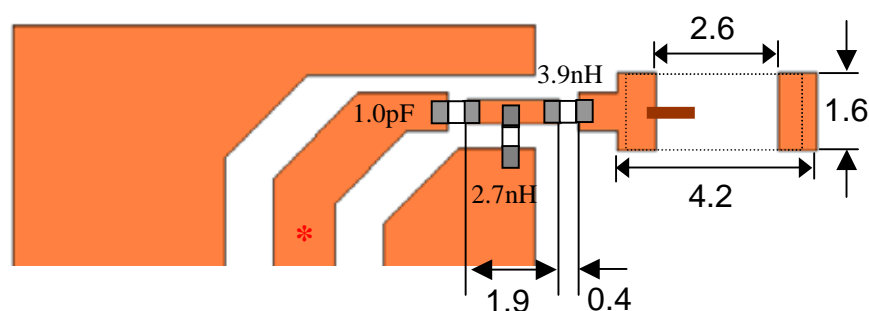


Mark	L	W	T	a
Dimensions	3.2±0.2	1.6±0.2	1.3+ 0.1/-0.2	0.5±0.3

(a) Without Matching Circuits



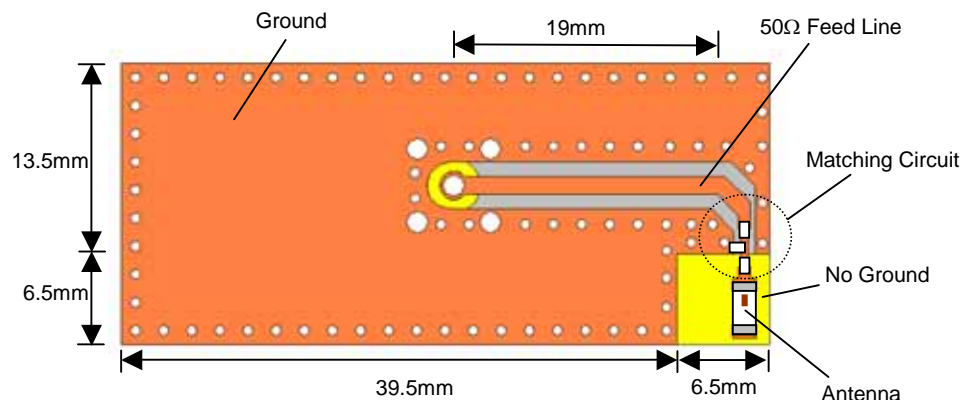
(b) With Matching Circuits



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

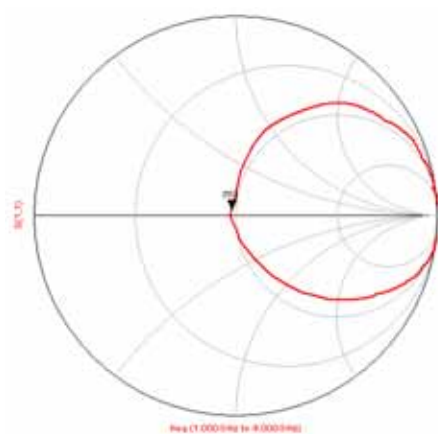
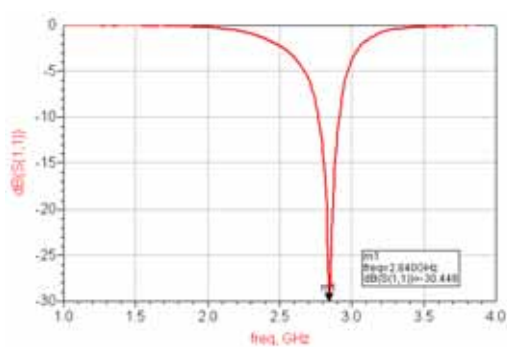
Typical Electrical Characteristics (T=25°C)

❖ Test Board

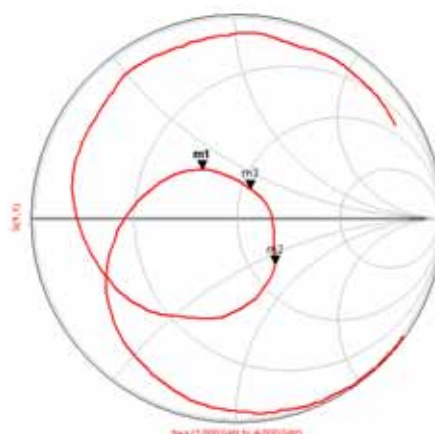
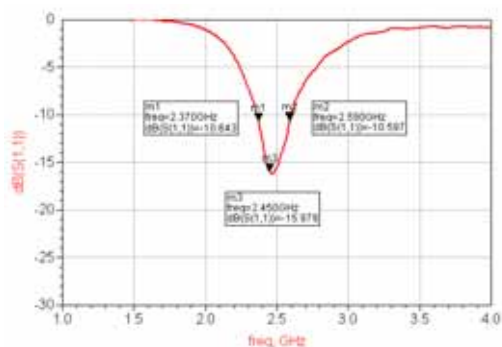


❖ Return Loss

(a) Without Matching Circuits

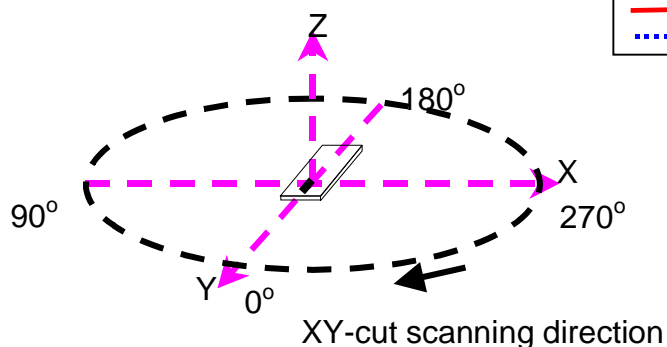


(b) With Matching Circuits

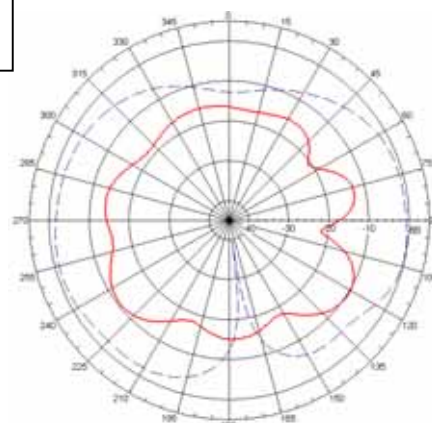


Radiation Patterns

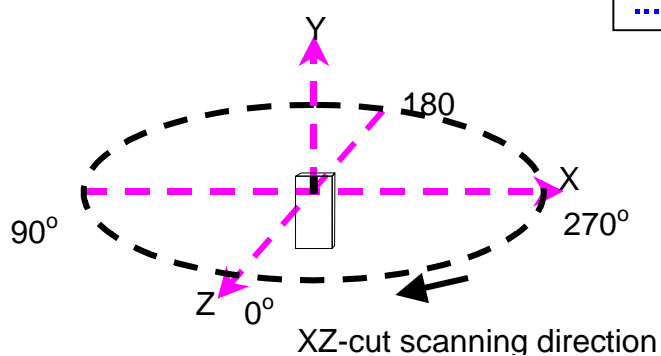
XY-V/XY-H



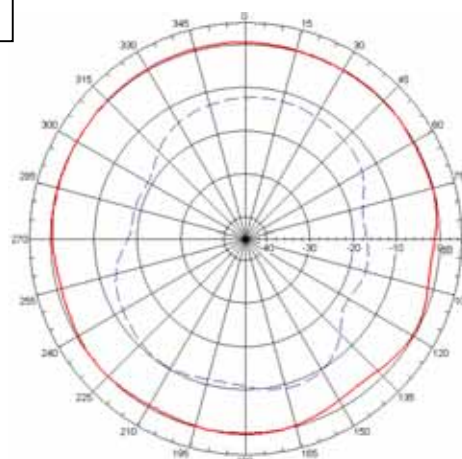
XY cut @2.45GHz
— Vertical
... Horizontal



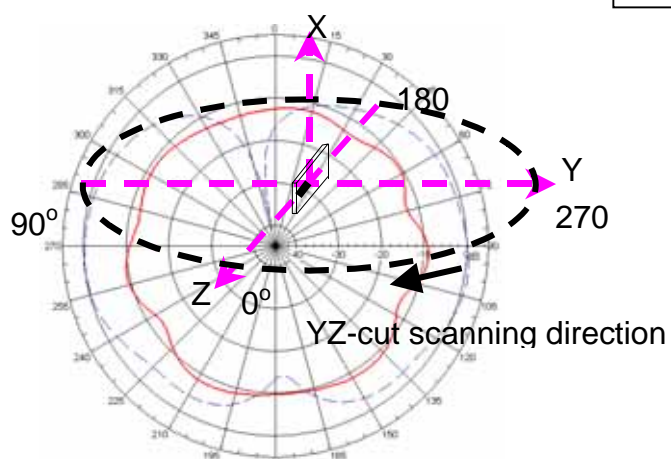
XZ-V/XZ-H



XZ cut @2.45GHz
— Vertical
... Horizontal



YZ-V/YZ-H



YZ cut @2.45GHz
— 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>

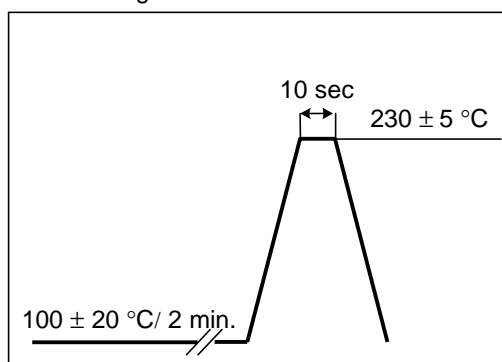
Mechanical & Environmental Characteristics

Item	Requirements	Procedure
Solderability	<ol style="list-style-type: none"> No apparent damage More than 75% of the terminal electrode shall be covered with new solder 	<ol style="list-style-type: none"> Preheat: $120 \pm 5^{\circ}\text{C}$ Solder: $230 \pm 5^{\circ}\text{C}$ for 5 ± 1 sec
Thermal shock (Temperature Cycle)	<ol style="list-style-type: none"> No apparent damage Fulfill the electrical specification after test 	<ol style="list-style-type: none"> One cycle/ step 1: $85 \pm 5^{\circ}\text{C}$ for 20sec step 2: $-40 \pm 3^{\circ}\text{C}$ for 20sec Cycle time: 30min No. of cycles: 100 Recovery: 1-2hrs
Heat Resistance	<ol style="list-style-type: none"> No apparent damage Fulfill the electrical specification after test 	<ol style="list-style-type: none"> Temperature: $85 \pm 2^{\circ}\text{C}$ Duration: 24 ± 2hrs Recovery: 1-2hrs
Low Temperature Resistance	<ol style="list-style-type: none"> No apparent damage Fulfill the electrical specification after test 	<ol style="list-style-type: none"> Temperature: $-40 \pm 5^{\circ}\text{C}$ Duration: 24 ± 2hrs Recovery: 1-2hrs
Humidity Resistance	<ol style="list-style-type: none"> No apparent damage Fulfill the electrical specification after test 	<ol style="list-style-type: none"> Temperature: $85 \pm 2^{\circ}\text{C}$ Humidity: 80% ~ 85% RH Duration: 1000 ± 48hrs Recovery: 1-2hrs
Drop Shock	<ol style="list-style-type: none"> No apparent damage 	<ol style="list-style-type: none"> Dropped onto hard wood from height of 50 cm for 3 times ; each x,y and z direction except terminal direction

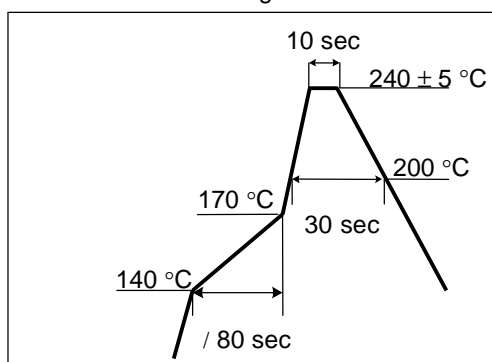
*Operating temperature range: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$

Typical Soldering Profile

Flow Soldering :



Reflow Soldering :



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.

Advanced Ceramic X Corp.

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

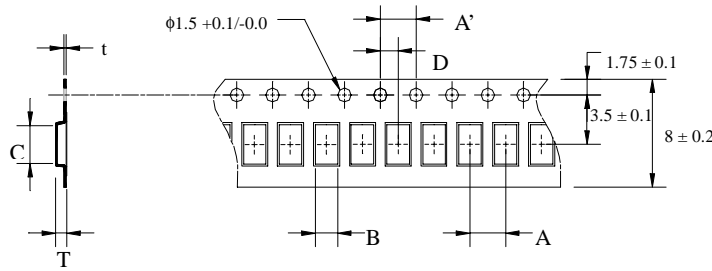
TEL:886-3-5987008 FAX:886-3-5987001

E-mail: acx@acxc.com.tw

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

Taping Specifications

❖Tape Dimensions (Unit: mm)

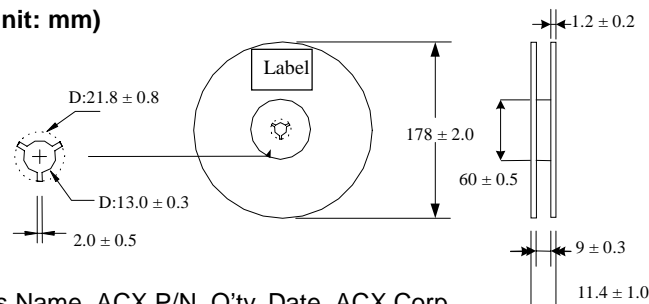


Type	A	A'	B	C	D	t	T
2012	4.0±0.1	4.0±0.1	1.6±0.1	2.4±0.1	2.0±0.1	0.20±0.05	Max. 1.3
2520	4.0±0.1	4.0±0.1	2.35±0.1	2.8±0.1	2.0±0.1	0.22±0.05	Max. 1.45
3216	4.0±0.1	4.0±0.1	1.9±0.1	3.5±0.1	2.0±0.1	0.20±0.05	Max. 1.4
3225	4.0±0.1	4.0±0.1	2.68±0.1	3.46±0.1	2.0±0.1	0.23±0.05	Max. 1.84

❖Quantity

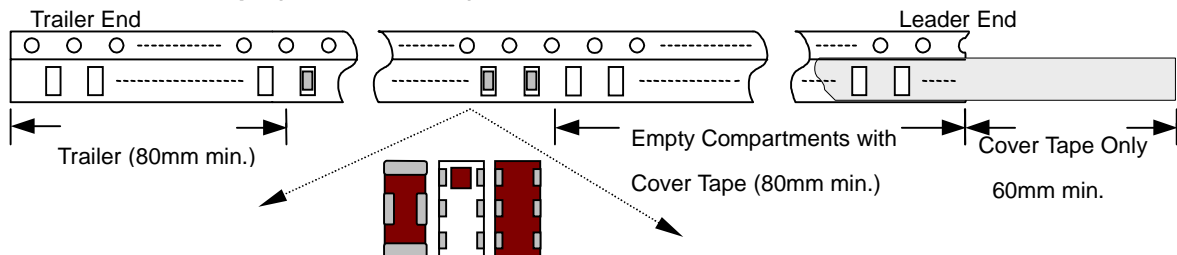
Type	2012	2520	3216	3225
Quantity/per reel	4,000 pcs	3,000 pcs	3,000 pcs	2,000 pcs

❖Reel Dimensions (Unit: mm)

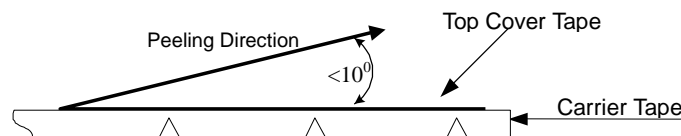


Label: Customer's Name, ACX P/N, Q'ty, Date, ACX Corp.

❖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 °C, relative humidity (RH): 45~75%.
- (2) Non-corrosive environment
- (3) Products should be used within six months of receipt.

Notes

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Test Report

No. : CE/2008/61862

Date : 2008/06/13

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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 client as :

Sample Description : TERMINATION MATERIAL
Style/Item No. : AD SERIES, AM SERIES, AT SERIES, AW SERIES, BD SERIES, BF SERIES, BL SERIES, BM SERIES, CD SERIES, CF SERIES, CP SERIES, DM SERIES, DP SERIES, DS SERIES, FA SERIES, FB SERIES, FD SERIES, HI SERIES, HF SERIES, LF SERIES, NF SERIES, QS SERIES, TS SERIES, LTCC SUBSTRATES, BCM2037
Sample Receiving Date : 2008/06/06
Testing Period : 2008/06/06 TO 2008/06/13

Test Requested : In accordance with the RoHS Directive 2002/95/EC, and its amendment directives.

Test Method : With reference to IEC 62321/2nd CDV (111/95/CDV) Procedures for the Determination of Levels of Regulated Substances in Electrotechnical Products.
(1) Determination of Cadmium by ICP-AES.
(2) Determination of Lead by ICP-AES.
(3) Determination of Mercury by ICP-AES.
(4) Determination of Hexavalent Chromium for non-metallic samples by UV/Vis Spectrometry.
(5) Determination of PBB and PBDE by GC/MS.

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

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

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TW 6970830

Test Report

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Date : 2008/06/13

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ADVANCED CERAMIC X (ACX) CORPORATION

16 TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT, HSINCHU

HSIEN, TAIWAN 303



Test results by chemical method (Unit: mg/kg)

Test Item (s):	Method (Refer to)	Result	MDL
		No.1	
Cadmium (Cd)	(1)	n.d.	2
Lead (Pb)	(2)	n.d.	2
Mercury (Hg)	(3)	n.d.	2
Hexavalent Chromium Cr(VI) by alkaline extraction	(4)	n.d.	2
Sum of PBBs	(5)	n.d.	-
Monobromobiphenyl		n.d.	5
Dibromobiphenyl		n.d.	5
Tribromobiphenyl		n.d.	5
Tetrabromobiphenyl		n.d.	5
Pentabromobiphenyl		n.d.	5
Hexabromobiphenyl		n.d.	5
Heptabromobiphenyl		n.d.	5
Octabromobiphenyl		n.d.	5
Nonabromobiphenyl		n.d.	5
Decabromobiphenyl		n.d.	5
Sum of PBDEs (Mono to Nona)		n.d.	-
Monobromodiphenyl ether		n.d.	5
Dibromodiphenyl ether		n.d.	5
Tribromodiphenyl ether		n.d.	5
Tetrabromodiphenyl ether		n.d.	5
Pentabromodiphenyl ether		n.d.	5
Hexabromodiphenyl ether		n.d.	5
Heptabromodiphenyl ether		n.d.	5
Octabromodiphenyl ether		n.d.	5
Nonabromodiphenyl ether		n.d.	5
Decabromodiphenyl ether		n.d.	5
Sum of PBDEs (Mono to Deca)		n.d.	-

TEST PART DESCRIPTION:

NO.1 : GRAY SHEET

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

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Test Report

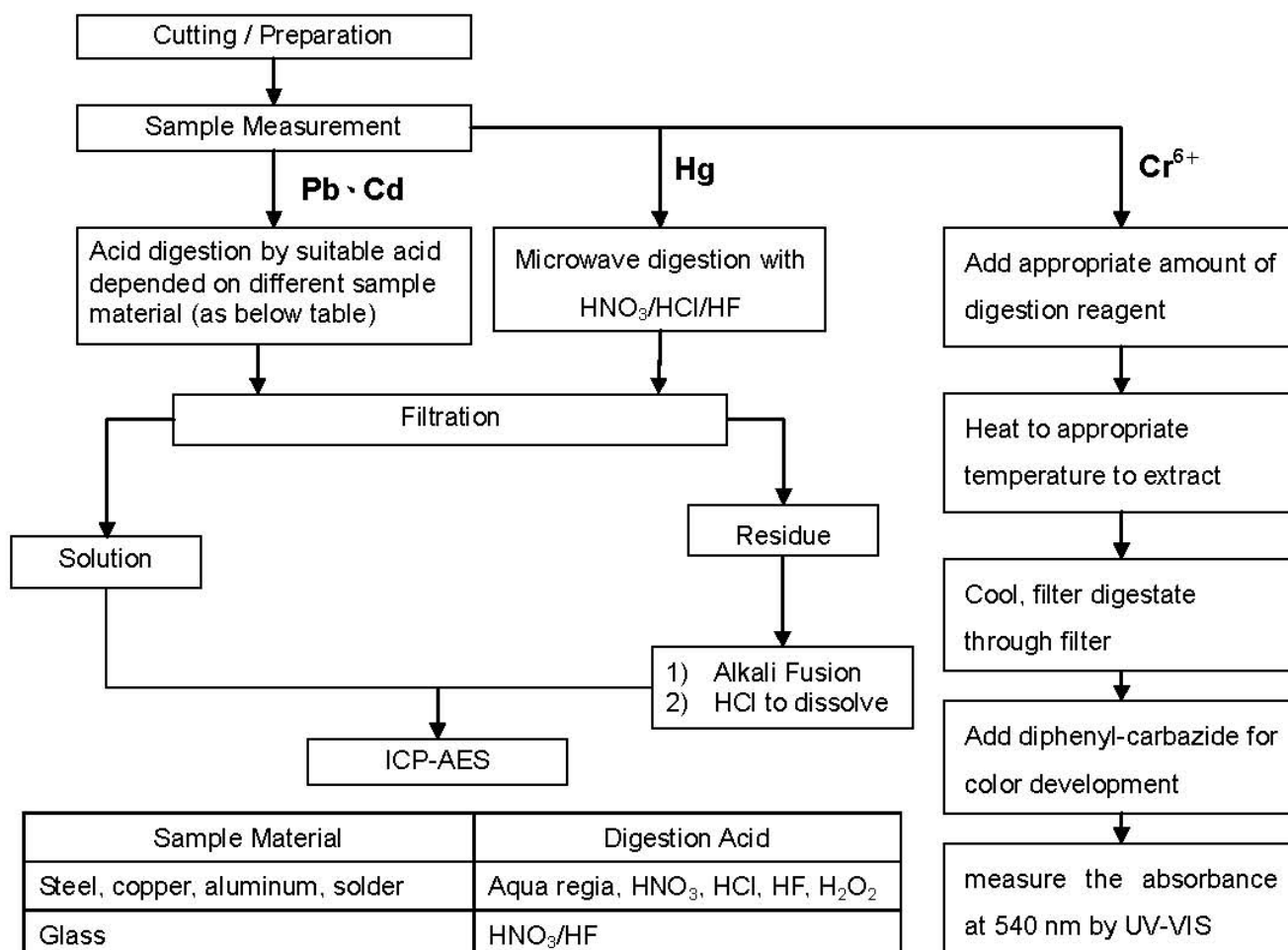
No. : CE/2008/61862 Date : 2008/06/13

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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	Any acid to total digestion

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ADVANCED CERAMIC X (ACX) CORPORATION

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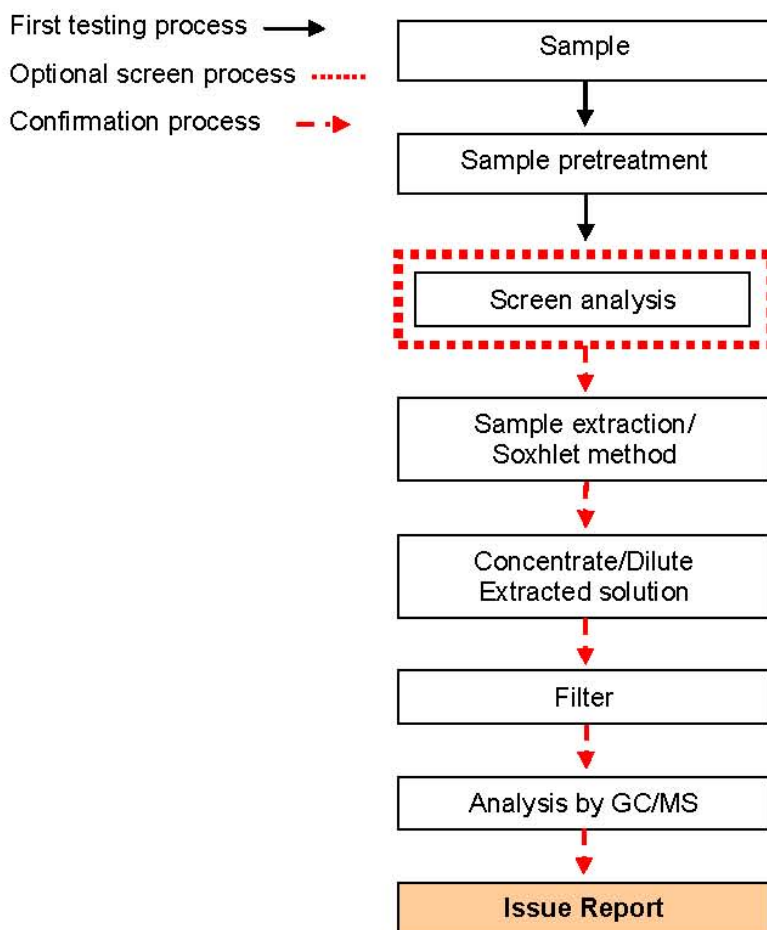
HSIEN, TAIWAN 303



PBB/PBDE analytical FLOW CHART

1) Name of the person who made measurement: Roman Wong

2) Name of the person in charge of measurement: Shinjyh Chen



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ADVANCED CERAMIC X (ACX) CORPORATION

16 TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT, HSINCHU

HSIEN, TAIWAN 303



** End of Report **

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Test Report

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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 client as :

Sample Description : MULTILAYER LTCC-N* COMPONENTS
Style/Item No. : AD SERIES, AM SERIES, AT SERIES, AW SERIES, BD SERIES,
BF SERIES, BL SERIES, BM SERIES, CD SERIES, CF SERIES,
CP SERIES, DM SERIES, DP SERIES, DS SERIES, FA SERIES,
FB SERIES, HI SERIES, HF SERIES, LF SERIES, NF SERIES,
TS SERIES, LTCC SUBSTRATES
Buyer/Order No. : LOCAL COMPANY OR USA COMPANY
Sample Receiving Date : 2008/05/29
Testing Period : 2008/05/29 TO 2008/06/05

=====
Test Requested : In accordance with the RoHS Directive 2002/95/EC, and its
amendment directives.

Test Method : With reference to IEC 62321/2nd CDV (111/95/CDV)
Procedures for the Determination of Levels of Regulated
Substances in Electrotechnical Products.
(1) Determination of Cadmium by ICP-AES.
(2) Determination of Lead by ICP-AES.
(3) Determination of Mercury by ICP-AES.
(4) Determination of Hexavalent Chromium for non-metallic
samples by UV/Vis Spectrometry.
(5) Determination of PBB and PBDE by GC/MS.

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

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



Test Report

No. : CE/2008/57172

Date : 2008/06/05

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ADVANCED CERAMIC X (ACX) CORPORATION
16 TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT,
HSINCHU HSIEN, TAIWAN 303



Test results by chemical method (Unit: mg/kg)

Test Item (s):	Method (Refer to)	Result	MDL
		No.1	
Cadmium (Cd)	(1)	n.d.	2
Lead (Pb)	(2)	273	2
Mercury (Hg)	(3)	n.d.	2
Hexavalent Chromium Cr(VI) by alkaline extraction	(4)	n.d.	2
Sum of PBBs	(5)	n.d.	-
Monobromobiphenyl		n.d.	5
Dibromobiphenyl		n.d.	5
Tribromobiphenyl		n.d.	5
Tetrabromobiphenyl		n.d.	5
Pentabromobiphenyl		n.d.	5
Hexabromobiphenyl		n.d.	5
Heptabromobiphenyl		n.d.	5
Octabromobiphenyl		n.d.	5
Nonabromobiphenyl		n.d.	5
Decabromobiphenyl		n.d.	5
Sum of PBDEs (Mono to Nona)		n.d.	-
Monobromodiphenyl ether		n.d.	5
Dibromodiphenyl ether		n.d.	5
Tribromodiphenyl ether		n.d.	5
Tetrabromodiphenyl ether		n.d.	5
Pentabromodiphenyl ether		n.d.	5
Hexabromodiphenyl ether		n.d.	5
Heptabromodiphenyl ether		n.d.	5
Octabromodiphenyl ether		n.d.	5
Nonabromodiphenyl ether		n.d.	5
Decabromodiphenyl ether		n.d.	5
Sum of PBDEs (Mono to Deca)		n.d.	-

TEST PART DESCRIPTION:

NO.1 : MULTILAYER LTCC-N* COMPONENTS

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

Test Report

No. : CE/2008/57172

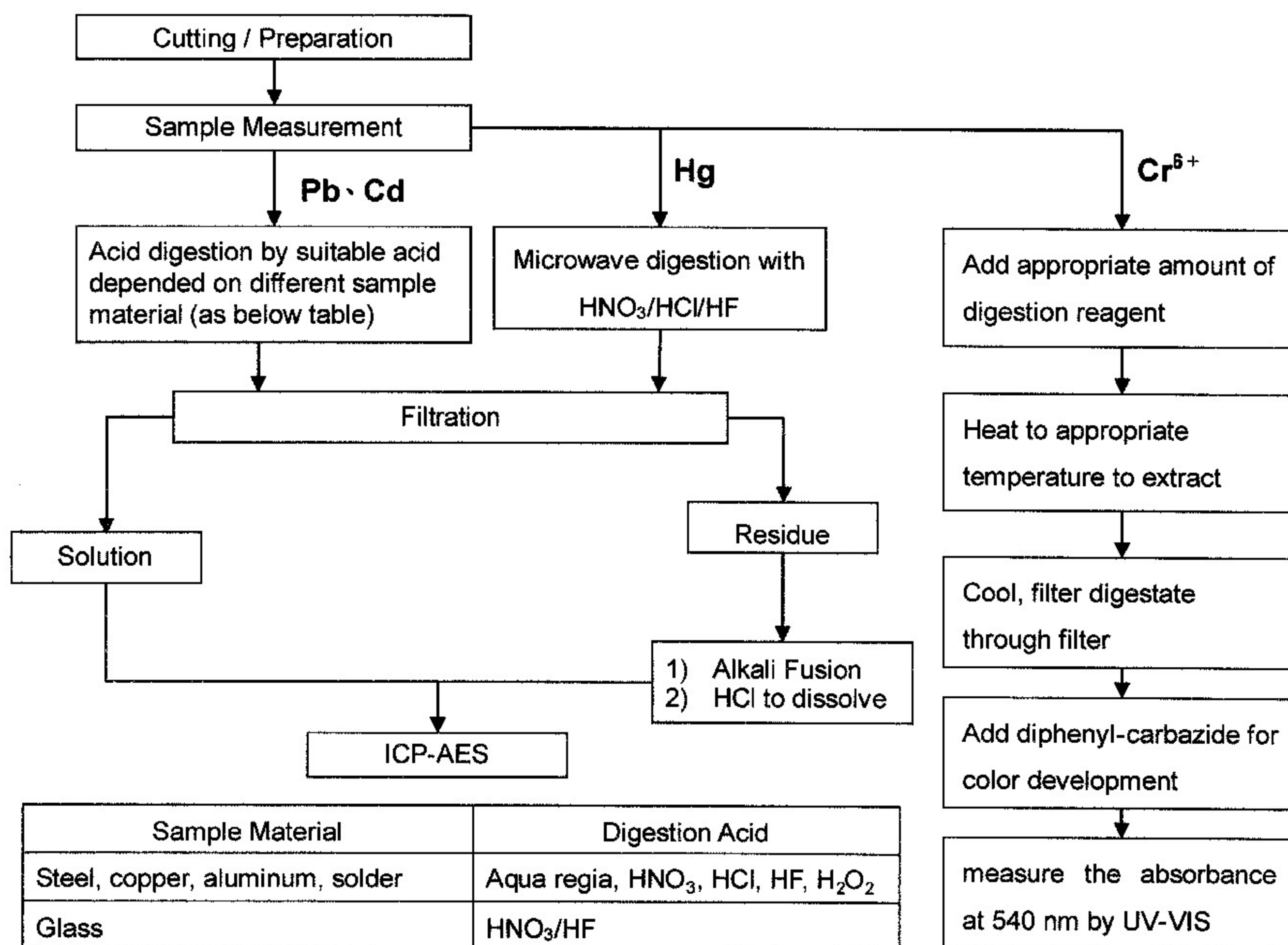
Date : 2008/06/05

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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	Any acid to total digestion

Test Report

No. : CE/2008/57172

Date : 2008/06/05

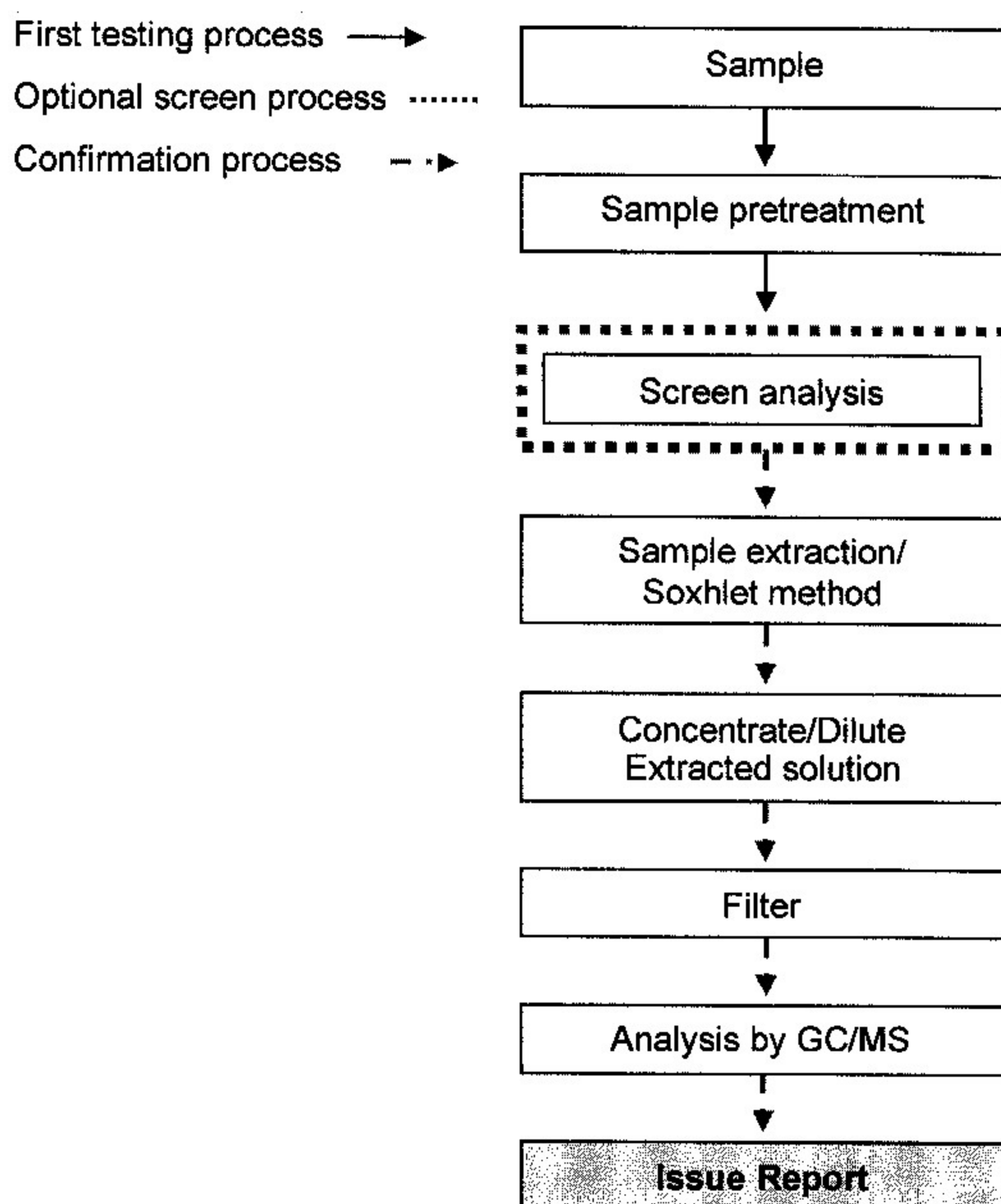
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HSINCHU HSIEN, TAIWAN 303



PBB/PBDE analytical FLOW CHART

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





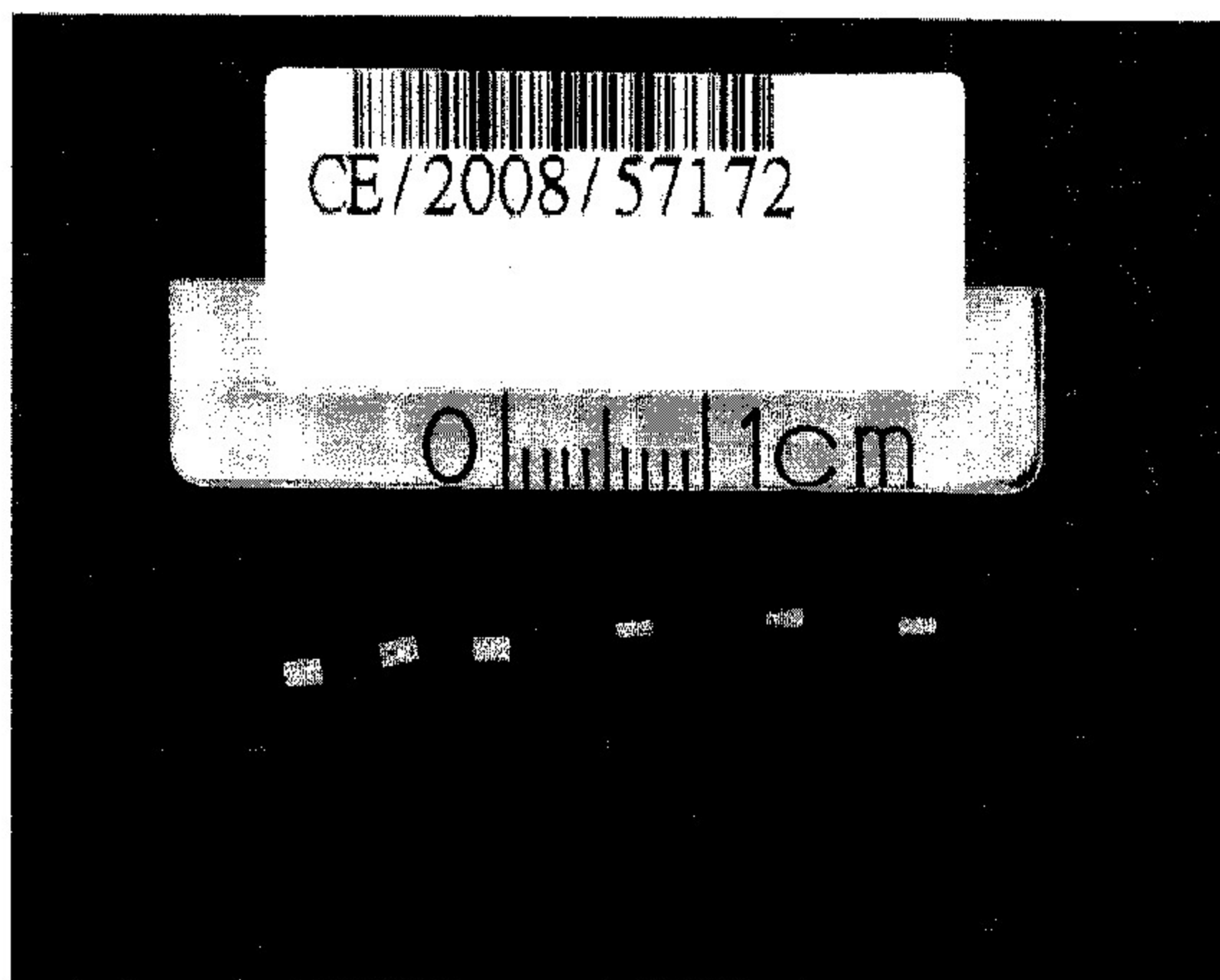
Test Report

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ADVANCED CERAMIC X (ACX) CORPORATION
16 TZU CHIANG ROAD, HSINCHU INDUSTRIAL DISTRICT,
HSINCHU HSIEN, TAIWAN 303



** End of Report **

1 Chemical product and company identification

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

ACX Product Name: AT3216-B2R8HAAT/LF

2 Composition/Information on Ingredients

Components	wt. %
Ceramic	80-95%
Ag	<20%
Ni	<5%
Sn	<5%

3 Hazards Identification

Materials used in this product is fully densified and non-hazardous.

4 First Aid Measure

- 4.1 Eye contact: wash with large amounts of water, obtain first aid or medical assistance if needed.
- 4.2 Skin contact: Flush contact area with soap and water.

5 Fire Fighting Measures

- 5.1 Flammable properties (Flash point): NF
- 5.2 Flammable limits (LFL): NA
- 5.3 Extinguish media: water, foam, clay chemical. Carbon dioxide
- 5.4 Fore and Explosion hazards: No flammable, no flash point, no fire or explosion hazard
- 5.5 Fire fighting instructions: NA
- 5.6 Fire fighting equipment: NA

6 Accidental Release Measures

Spill procedure: Use dustless methods-place into closed container for disposal, or flush with water.

7 Handling and Storage

- 7.1 Vacuum and place into a closable container.
- 7.2 Temperature: 15-35°C
- 7.3 Relative humidity (RH): 45-75%
- 7.4 No-corrosive environment
- 7.5 Product should be used within 30 days after unsealed.



Material Safety Data Sheet
Product: AT3216-B2R8HAAT/LF

Advanced Ceramic X (ACX) Corporation
Tel: 886-3-5987008 Fax: 886-3-5987001
Date printed: APR. 15, 2009 Page: 2/2

8 Exposure Controls/Personal Protection

- 8.1 Eye protection: protection recommended.
- 8.2 Skin protection: Gloves recommended.

9 Physical and Chemical properties

- 9.1 Appearance: white board
- 9.2 Molecular weight: NA
- 9.3 Specific gravity: 3
- 9.4 Odor: Odorless
- 9.5 Vapor density: NA
- 9.6 Freezing point: NA
- 9.7 Physical state: solid boards
- 9.8 Viscosity: NA
- 9.9 Solubility in water: insoluble

10 Stability and Reactivity

- 10.1 Chemical stability: stable
- 10.2 Incompatibility: NF
- 10.3 Hazardous decomposition products: None
- 10.4 Hazardous polymerization: will not occur

11 Toxicological Information

- 11.1 Eye: No data. Believed to be a mild irritant.
- 11.2 Skin: No data. Not expected to be absorbed through intact skin.

12 Ecological Information: No toxic

13 Disposal Consideration: Dispose in accordance with federal, state and local regulation.