製 品 規 格 承 認 願
Qualification of Products Approval

To : 모본 주식회사 귀중

製 品 名 **Product**	**Dielectric Chip Antenna**
型 名 **Type**	AMAN301512ST01
申 請 日 **Date**	2011년 4월 21일

SEJONG TRONICS CO.,LTD

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TEL : 82)2-586-6012 FAX : 82)2-586-6082

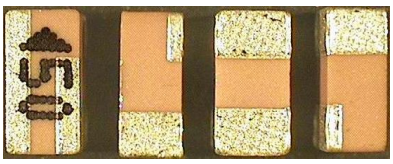
승 인 원

품명 : Dielectric Chip Antenna
Part No. : AMAN301512ST01
모델명 : MF210 (BT)

	입안	심사	결정
모본주식회사			
일자	/	/	/

LEAD-FREE RoHS TBBP-A FREE

HF BFRs/CFRs/PVC-Free



결재	작성	검토		승인
부서	개발	개발	품질	개발
성명	지희민	김종수	김	
일자	4/21	4/21	4/21	4/21

2011. 04. 21

주식회사 아 모 텍

목 차

1. 제/개정 이력

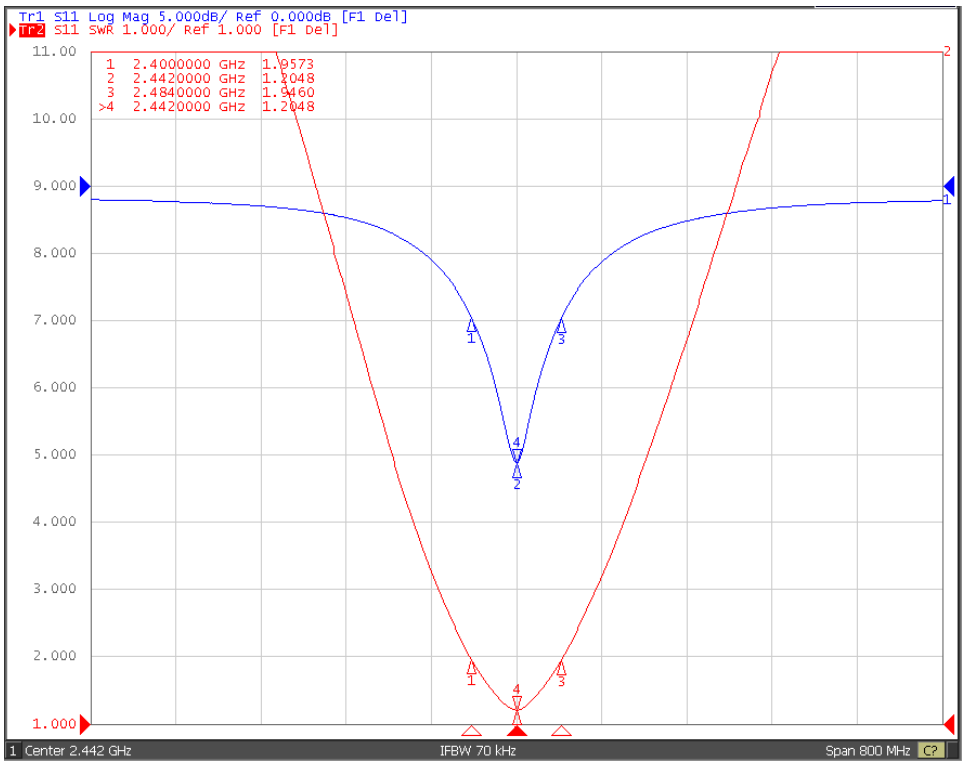
Date	Content	Page
2011.04.21	최초 작성	

2. 제품 규격

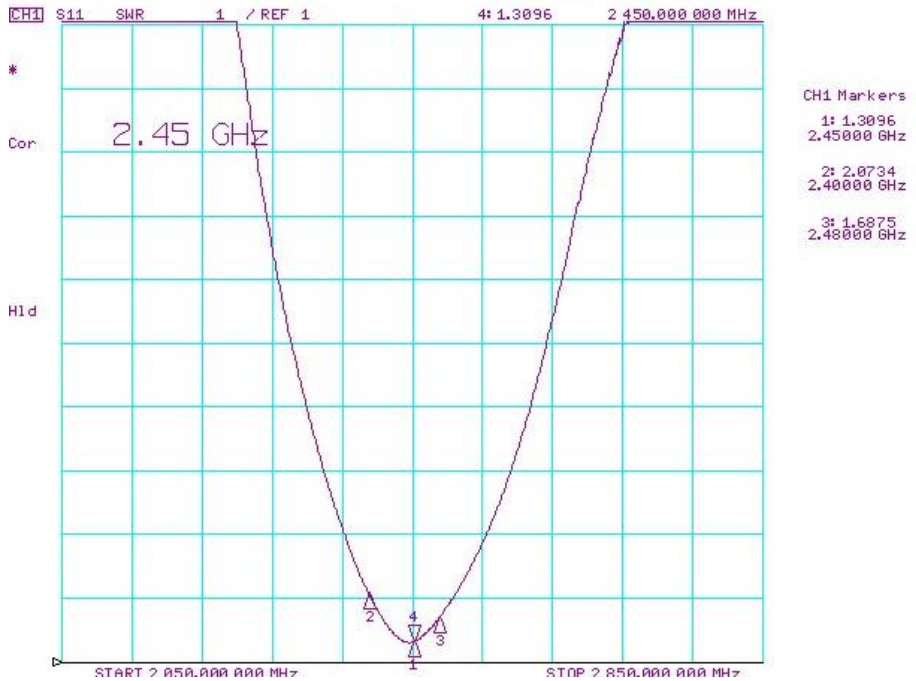
2.1 전기적 특성

구분	항목		규격			비고
1	VSWR	SET 특성	최대 2.5:1 @ 2442 ± 42 MHz			MF210
2		E.V.B 특성	최대 4.0:1 @ 2442 ± 42 MHz			EVB
3		JIG 특성	최대 3.0:1 @ 2442 ± 42 MHz			JIG
4	방사이득 (dBi)		Avg.	H	최소 -5.0	EVB
				E1	최소 -3.5	
				E2	최소 -3.5	
			Peak	H	최소 1.2	
				E1	최소 1.4	
				E2	최소 1.4	
5	방사패턴		Omni-directional			-
6	임피던스		공칭 50			Ω

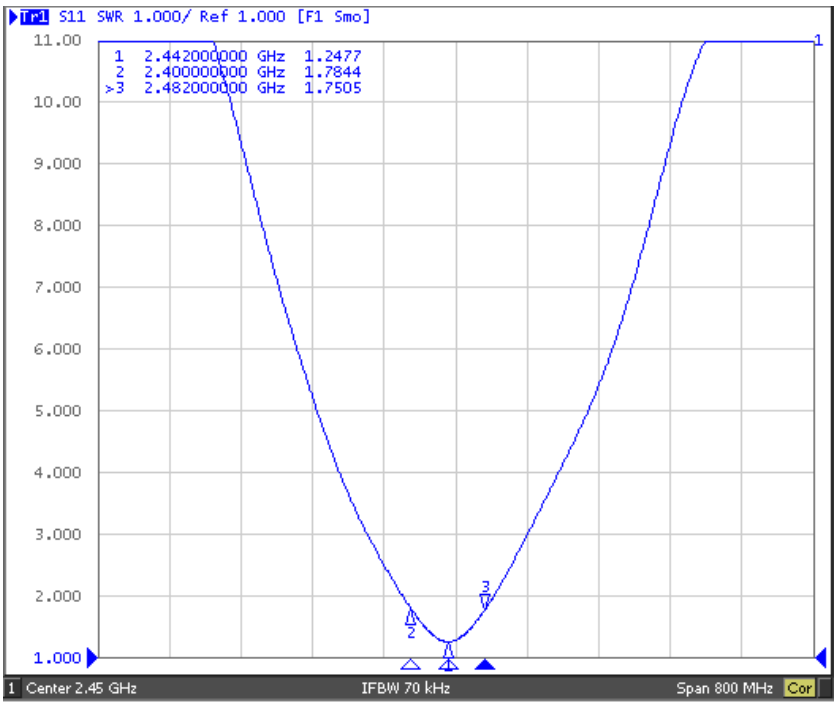
※ 방사이득은 Reference Test Board 에서 2.400~2.490GHz 에 매칭 후 측정.



(SET_ MF210 에서 측정)

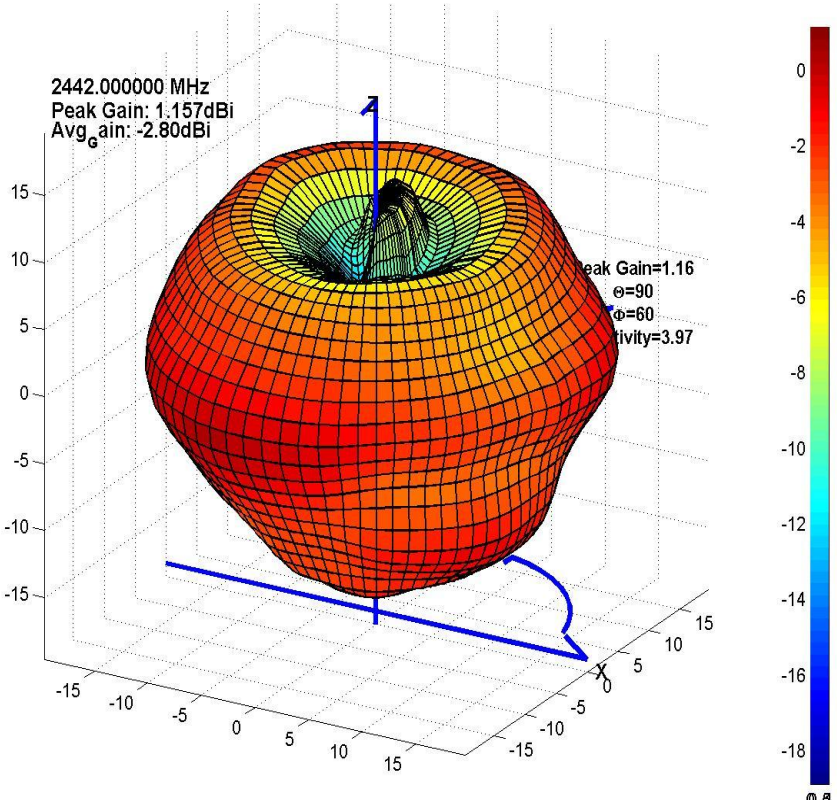


(E.V. board 에서 측정)



(측정 지그에서 측정)

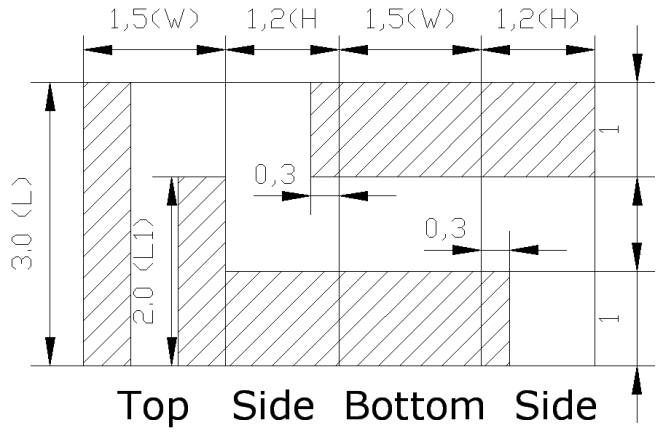
	Passband	VSWR	Passband	VSWR	Passband	VSWR
JIG 특성	2400MHz	1.0~2.5	2442MHz	1.0~2.2	2484MHz	1.0~2.5



(Radiation Pattern : Set 상에서 측정)

Peak Gain	1.16 dBi
Avg.Gain	-2.80 dBi

2.2 기구적 특성 (외형 및 치수)



구 분	항 목	치 수 (mm)
소체	L (가로)	3.0±0.15
	W (세로)	1.5±0.1
	H (높이)	1.2±0.1
Pattern	L1	2.0±0.2

2.3 모델 및 Lot 표기법

Model : **AMAN** (1) **301512** (2) **ST** (3) **01** (4)

(1) : **AM**OTECH **AN**TENNA
(2) : 칩 크기(가로 X 세로 X 높이)
(3) : 공용품, 예) STANDARD Type – ST
(4) : 공용품 번호 (예 : 첫번째-01)

Lot: **XX** (1) **XX** (2) **X** (3) **X** (4) **XX** (5)

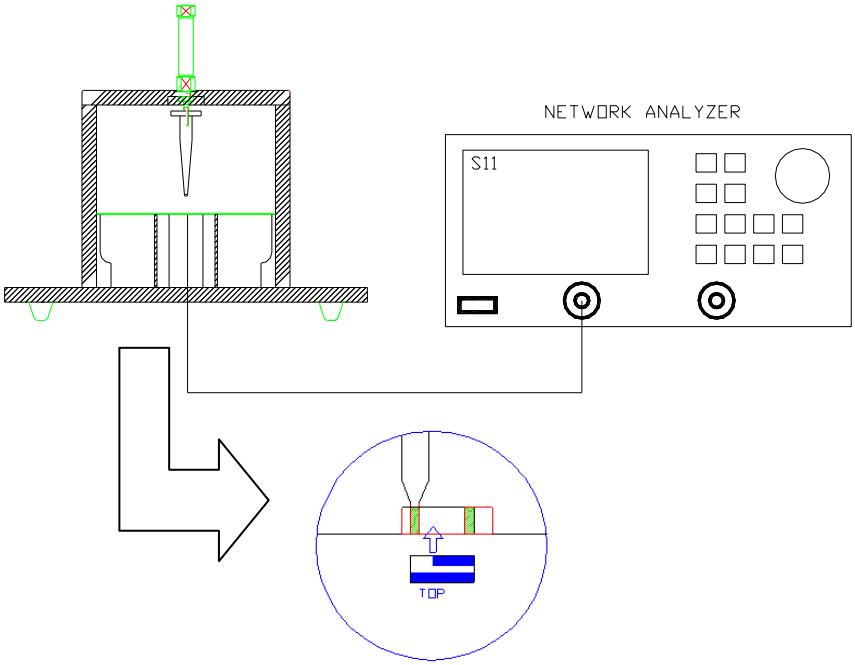
(1) : 소체 성형년도
(2) : 소체 성형월
(3) : 유전율 예)1 : 9.5, 2 : 20.5
(4) : 소체 SIZE 예) A : 542012, B : 542015, C: 903012, D : 903015, E:903040, F: 903045, G:542020
(5) : TYPE 별 소체의 월 생산번호

2.4 마킹 표기법

◀ **5** **0**
(1) (2)

(1) : 방향 식별 표시
(2) : 제조 주차 표시 (예: 1~52 - 1~52 주)

3. 시험 방법 (VSWR 측정)



3.1 VSWR 규격

- 제품규격 참조

3.2 측정방법

A) RF Cable 까지 Calibration 을 한다.

- Center frequency : 제품규격 참조
- Span : 800MHz
- Number of point : 801

B) RF Cable 과 측정지그의 SMA 커넥터를 연결한다.

C) Format 을 VSWR(SWR)로 설정한다.

D) MARKER1, MARKER2, MARKER3 을 설정하여 VSWR 값을 확인한다.

E) MARKER1,2,3 의 VSWR 값이 SPEC 를 만족하는지 확인한다.

4. 초기 검사 성적서

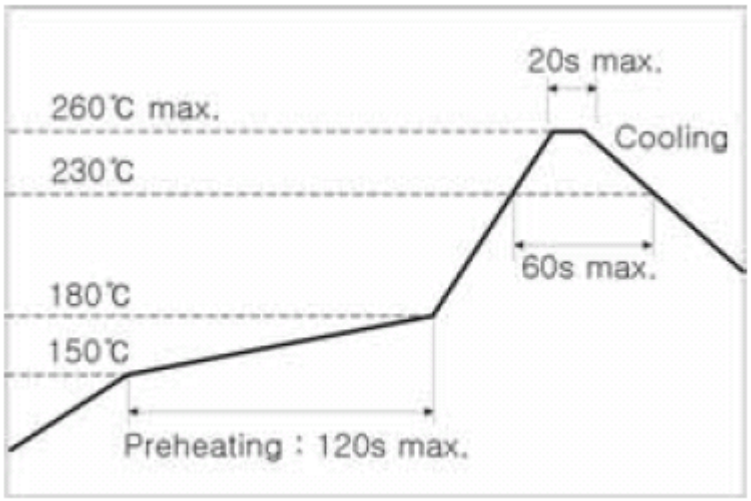
제품명	Dielectric Chip Antenna			시험항목	VSWR, Length, Width, Height		
모델명	AMAN301512ST01 (MF210)			시험조건			
LOT NO.				시험일자	2011. 04 .11		
검사 항목	VSWR @ 2442 – 42MHz (2400MHz)	VSWR @ 2442 +42MHz (2484MHz)	Length (mm)	Width (mm)	Height (mm)	Pattern (mm)	외관검사
SPEC	3.0 : 1	3.0 : 1	3.0 ±0.15	1.5 ±0.10	1.2 ±0.10	2.0 ±0.20	(양호할것)
1	1.93	1.65	2.94	1.53	1.18	2.01	OK
2	1.82	1.63	2.96	1.54	1.20	2.08	OK
3	1.63	1.93	2.94	1.51	1.20	2.06	OK
4	1.85	1.66	2.98	1.53	1.19	2.00	OK
5	1.72	1.68	2.95	1.54	1.22	2.01	OK
6	1.82	1.61	2.97	1.53	1.20	2.03	OK
7	1.65	1.89	2.94	1.54	1.19	2.02	OK
8	1.82	1.62	2.94	1.54	1.19	2.04	OK
9	1.85	1.62	2.98	1.53	1.20	2.05	OK
10	1.85	1.98	2.93	1.53	1.23	2.05	OK
11	1.88	1.65	2.96	1.53	1.20	2.04	OK
12	1.82	1.62	2.96	1.54	1.20	2.05	OK
13	1.84	1.64	3.00	1.53	1.21	2.01	OK
14	1.65	2.00	3.00	1.54	1.20	2.02	OK
15	1.62	1.79	2.98	1.53	1.23	2.01	OK
16	1.61	1.95	2.95	1.53	1.22	2.07	OK
17	1.70	1.63	2.98	1.53	1.20	2.02	OK
18	1.74	1.60	2.95	1.53	1.22	2.01	OK
19	1.78	1.65	2.93	1.55	1.19	2.04	OK
20	1.78	1.65	2.94	1.54	1.20	2.09	OK
21	1.73	1.65	2.94	1.53	1.22	2.01	OK
22	1.66	1.90	2.95	1.55	1.19	2.01	OK
23	1.82	1.62	2.97	1.53	1.22	2.06	OK
24	1.76	1.63	3.00	1.54	1.20	2.01	OK
25	1.79	1.65	3.00	1.53	1.20	2.00	OK
26	1.72	1.67	2.98	1.53	1.22	2.04	OK
27	1.75	1.66	3.00	1.54	1.19	2.02	OK
28	1.76	1.67	2.94	1.54	1.21	2.00	OK
29	1.76	1.66	2.98	1.54	1.20	2.04	OK
30	1.62	1.82	3.00	1.53	1.21	2.00	OK
31	1.89	1.64	2.97	1.55	1.20	2.08	OK

32	1.83	1.63	2.98	1.53	1.22	2.00	OK
33	1.78	1.66	2.94	1.53	1.21	2.03	OK
34	1.74	1.64	2.96	1.54	1.21	2.05	OK
35	1.86	1.60	2.95	1.54	1.20	2.00	OK
36	1.89	1.63	2.94	1.54	1.20	2.01	OK
37	1.82	1.62	2.98	1.54	1.20	2.09	OK
38	1.84	1.64	2.97	1.53	1.24	2.04	OK
39	1.82	1.64	2.95	1.53	1.20	2.05	OK
40	1.89	1.62	2.96	1.54	1.20	2.08	OK
41	1.90	1.62	2.98	1.55	1.19	1.98	OK
42	1.76	1.65	3.00	1.54	1.20	2.09	OK
43	1.73	1.63	2.99	1.55	1.20	2.05	OK
44	1.74	1.67	2.98	1.52	1.21	2.04	OK
45	1.75	1.62	2.94	1.54	1.20	2.00	OK
46	1.85	1.66	2.96	1.53	1.21	2.02	OK
47	1.62	1.96	2.98	1.54	1.23	2.05	OK
48	1.76	1.68	2.98	1.53	1.20	2.06	OK
49	1.72	1.63	2.95	1.54	1.19	2.01	OK
50	1.62	1.89	2.97	1.53	1.23	2.00	OK
AVG	1.78	1.69	2.97	1.54	1.21	2.03	-
STDEV	0.09	0.12	0.02	0.01	0.01	0.03	-
Cpk	4.82	3.79	1.80	2.73	2.40	1.95	-
판정	OK	OK	OK	OK	OK	OK	OK

5. 납땜 조건

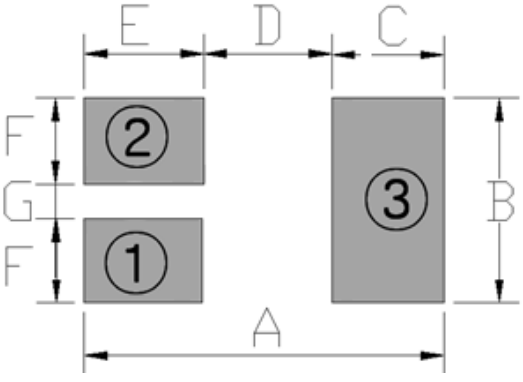
5.1 납땜 온도 조건(Pb-free)

Solder paste : Ag/Sn/Cu:3.0/96.0/0.5



- 안테나의 특성 저하를 막기 위해 다음과 같은 납땜 조건을 지켜야 한다.
- Reflow soldering 조건으로 납땜을 진행하여야 하며, Flow soldering 을 하여서는 안 된다.
- 비활성 Flux 를 사용하여야 한다.(최대 Cl 함량 0.2% 미만)
- Reflow cycle 횟수는 3 회 이내로 해야 한다.

5.2 PCB 패턴 설계 조건 (권고사항)

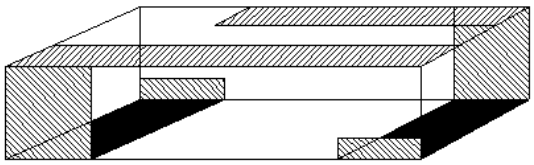


Item	Dimension [mm]
A	3.0
B	1.5
C	1.0
D	1.0
E	1.0
F	0.6
G	0.3

①	feeding
②,③	GND

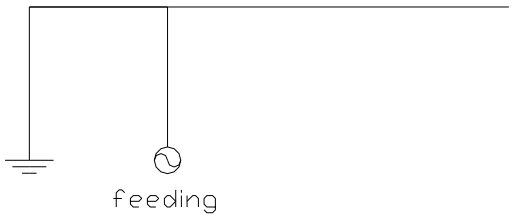
6. 구조 및 재질

6.1 재료 사양



1	소체(Bulk)		산화마그네슘계 세라믹스
2	전극	TOP	Ag
		BOTTOM(일체형)	
		SIDE	

6.2 등가 회로



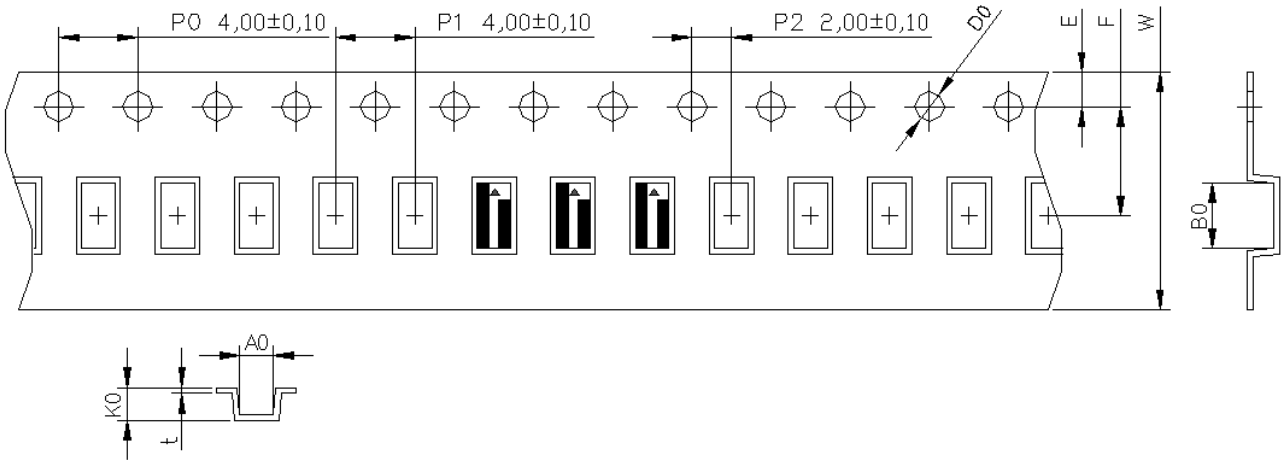
7. 주의 사항

1. 보관환경은 -5~40℃, 상대습도 70 % 이내의 대기에서 보관되어야 한다. (MSL Level 1)
2. Dielectric Chip Antenna 는 고온고습에서 사용하거나 또는 황이나 염소가스에 노출될 경우 전극의 납땜성의 저하를 일으킬 수 있다.
3. Dielectric Chip Antenna 자체 무게에 의한 세라믹의 crack 을 막기 위해 기계적 충격(낙하 등)을 피해야 한다.
4. Dielectric Chip Antenna 는 6 개월 이내에 사용되어져야 하며 6 개월이 경과한 칩은 사용하기 전에 반드시 납땜성을 확인하여야 한다.
5. SMT 전/후 대기 중에 방치된 제품 외부패턴(Ag)의 변색은 자연적인 현상이며 제품의 기능 혹은 특성상에 영향을 미치지 아니하므로 정상품으로 간주한다.

8. 포장 사양

8.1 Carrier tape 사양

8.1.1 크기



A0	1.70±0.10	E	1.75±0.10
B0	3.30±0.10	F	5.50±0.10
K0	1.35±0.10	t	0.30±0.10
D0	1.50-0.00,+0.10	W	12.00±0.10

8.1.2 재질 및 표면저항

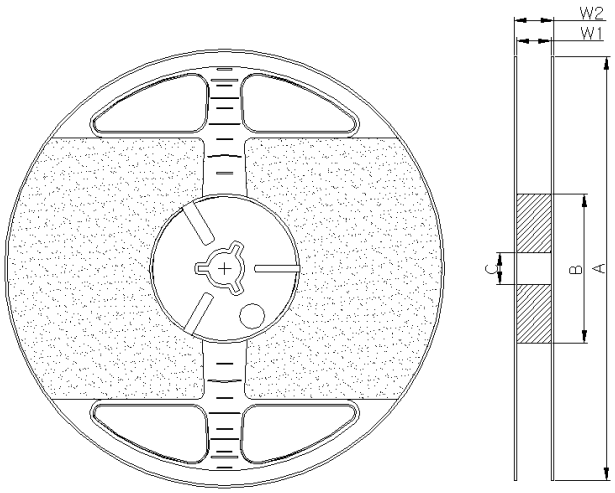
1) Carrier tape : 최대 $10^{11}\Omega$

2) Cover tape : 최대 $10^{11}\Omega$

3) Reel : 최대 $10^{11}\Omega$

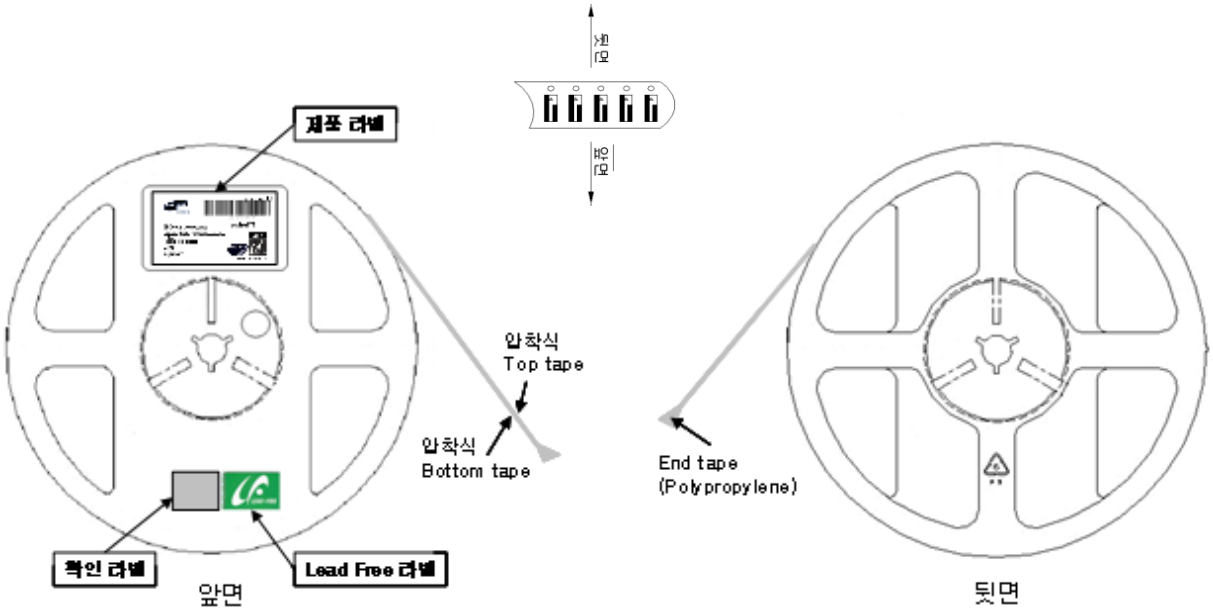
8.2 릴(Reel) 사양

8.2.1 크기



Item	Spec (mm)	Item	Spec (mm)
A	180.00 +0.00/-3.00	W1	13.00±0.50
B	60.00 +1.00/-0.00	W2	15.40±1.00
C	13.20±0.20	-	-

8.2.2 라벨 부착 및 Winding 방법



8.2.3 재질

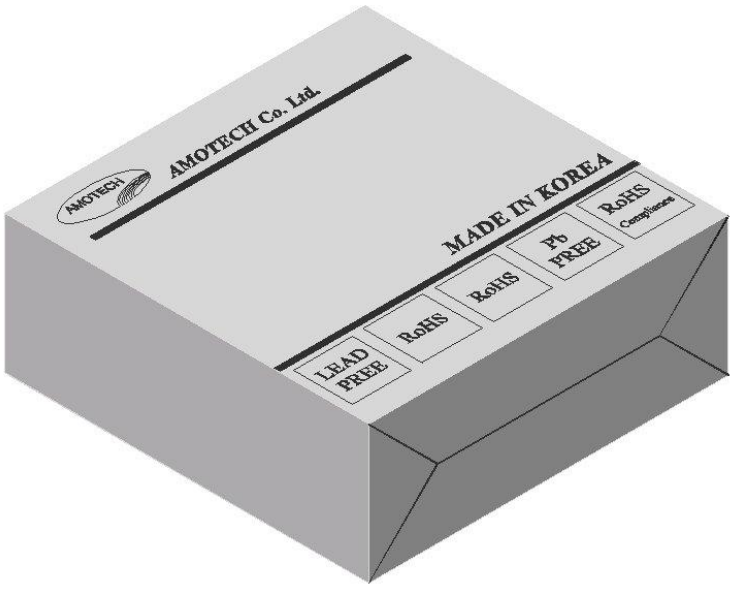
1) Plastic reel : GPPS (General Purpose Poly Styrene) resin

8.3 박스 포장 사양

8.3.1 소형 박스

크기 : 183 (W) x 70 (D) x 185 (H) (mm)

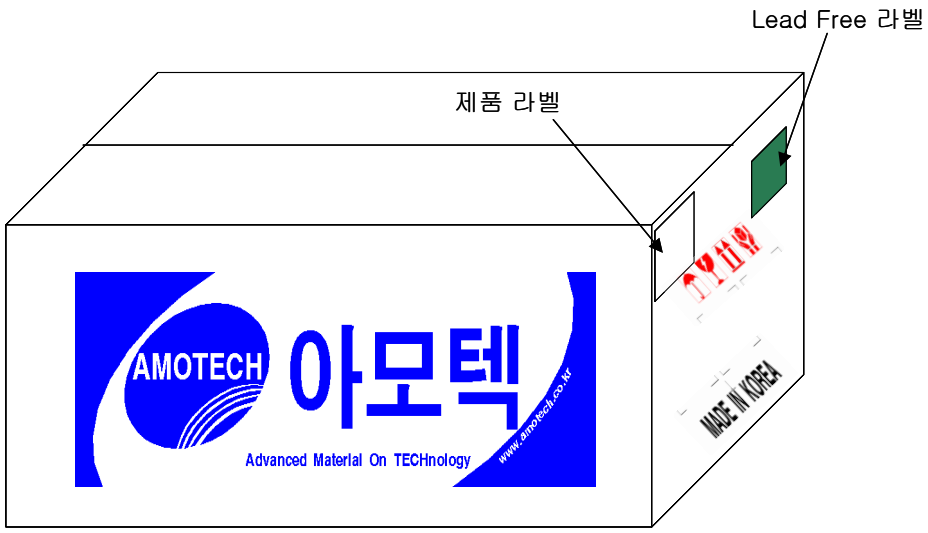
수량 : 3 reel (2,500 ea/reel × 3 reel = 7,500 ea)



8.3.2 중형 박스

크기 : 365 (W) x 200 (D) x 200 (H) (mm)

수량 : 5 소형 박스(7,500 ea/소형 박스× 5 소형 박스 = 37,500 ea)

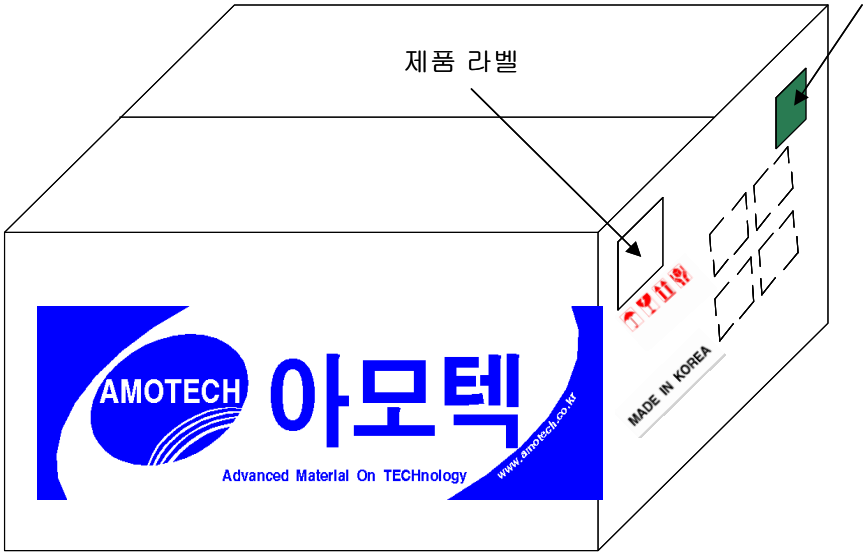


8.3.3 대형 박스

크기 : 390 (W) x 390 (D) x 280 (H) (mm)

수량 : 14 소형 박스 (7,500 ea/ 소형 박스 ×14 소형 박스 = 105,000 ea)

Lead Free 라벨



9. 관리 공정도

구분	부품명	공정 기호	공정명	공정 설명	소요설비/치공구	관리 포인트	T/T	비 고
1	Powder, Ag Paste, Carrier tape, Cover Tape, Screen, Reel, Ink	▽	자재입고	-	-	-	-	-
2	Powder	◇	수입검사	입하된 원/부자재가 설정된 규격에 일치하는가를 확인	-	유전율	-	-
	Ag Paste				점도계(HBDV Ⅱ+),미세저울, Belt 소성로	점도, 무기물 함량		
	Carrier tape				3차원 측정기	Dimension		
	Screen				3차원 측정기, 30cm 자	Dimension, Tension		
3	* Powder	○	성형 CTQ	성형기로 Powder에 압력을 가하여 성형 하고 세타에 적재	성형기, Mold, 버니어 켈리퍼스, 전자 저울, 세타	CTQ : 두께 Size 중량	-	-
4	성형체	○	소결 CTQ	성형체를 치밀화 하기 위해 열처리	연속로 2호기, 엘리베이터로, 메저링, 버리어 켈리퍼스, Setter	CTQ : 가로 Size 메저링 온도, Setting 온도, 투입 속도	-	-
5	소결체	○	연마	소결체 모서리 부분의 Burr를 제거	날젠통, 회전 연마기 (Ball Mill기) 금강사, 지르코니아 볼, 건조기	연마 시간, 연마 속도, 연마볼 비율	-	-
6	* Ag Paste * Screen	○	인쇄	소체 표면에 Ag 전극 인쇄	인쇄 M/C, 인쇄 Screen 인쇄 지그, Lupe, 건조로	인쇄 속도, 인쇄 Gap 인쇄 스크린, 건조 온도, 건조 속도	-	-
7	인쇄 건조 제품	◇	선행	양산 진행 판단을 위해 Sampling 방법으로 특성 확인	온소부로, 세타 Network Analyzer	가소부 온도, 가소부 속도	-	-
8	인쇄 건조 제품	○	온소부	Ag 전극을 치밀화 하기 위해 열처리	온소부로, 세타	소부 온도, 소부 속도	-	-
9	소부 제품	◇	외관검사	외관 상태를 검사, 선별	외관 선별 M/C 확대경, 핀셋	외관한도견본	-	-
10	* Carrier tape * Cover Tape * Reel, * Ink	◇	특성 선별	전기적 특성을 검사, 제품 마킹, 포장	Sorting M/C (Network Analyzer)	Frequency, Marking, Taping 온도	-	-
11	Ant. 완제품	◇	Reel 검사	포장 상태를 검사	확대경	제품 오삽, Carrier tape 외관	-	-
12	Ant. 완제품	◇	출하 검사	전기적 특성, 기계적 신뢰성 검사	Network Analyzer, 납조, Reflow M/C, Push Pull Gage, 버니어 켈리퍼스	VSWR, 기계적 신뢰성	-	-

* : 투입 자재

10. 유해물질 성적서

10.1 제품 성분 분석

Intertek

TEST REPORT

Applicant : Amotech Co., Ltd.
Address : 5BL-1 Lot, 617, Namchon-dong, Namdong-gu,
Incheon, 405-100 Korea

Page: 1 of 5

Report No. RT09R-S4525-002-E Date: Oct. 19, 2009

Sample Description	: The following submitted sample(s) said to be:-
Name/Type of Product	: Dielectric Chip Antenna
Name of Material	: Ceramic(MMT-20)
Sample ID No.	: RT09R-S4525-002
Manufacturer/Vender	: Amotech Co., Ltd.
Sample received	: Oct. 14, 2009
Testing Date	: Oct. 14, 2009 ~ Oct. 19, 2009
Testing Laboratory	: Intertek Testing Center
Testing Environment	: Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.
Test Type	: RoHS wet chemical analysis
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.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

Intertek Testing Center

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Seoul Lab. : #709, 7Fl, Ace Techno TowerV, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258
Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

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TEST REPORT

Report No. RT09R-S4525-002-E

Date: Oct. 19, 2009

Sample ID No. : RT09R-S4525-002
Sample Description : Dielectric Chip Antenna

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg		5	N.D.
Mercury (Hg)	mg/kg		2	N.D.
Hexavalent Chromium (Cr^{6+}) (For non-metal)	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by alkaline digestion and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	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 IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS	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.

Tested by : Nikkie Lee, Peter Kim, Ellen Jung, Jessica Kang

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

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

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TEST REPORT

Page: 3 of 5
Report No. RT09R-S4525-002-E Date: Oct. 19, 2009

Sample ID No. : RT09R-S4525-002
Sample Description : Dielectric Chip Antenna

Test Items	Unit	Test Method	MDL	Results
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.

Tested by : Nikkie Lee

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

* View of sample as received;-

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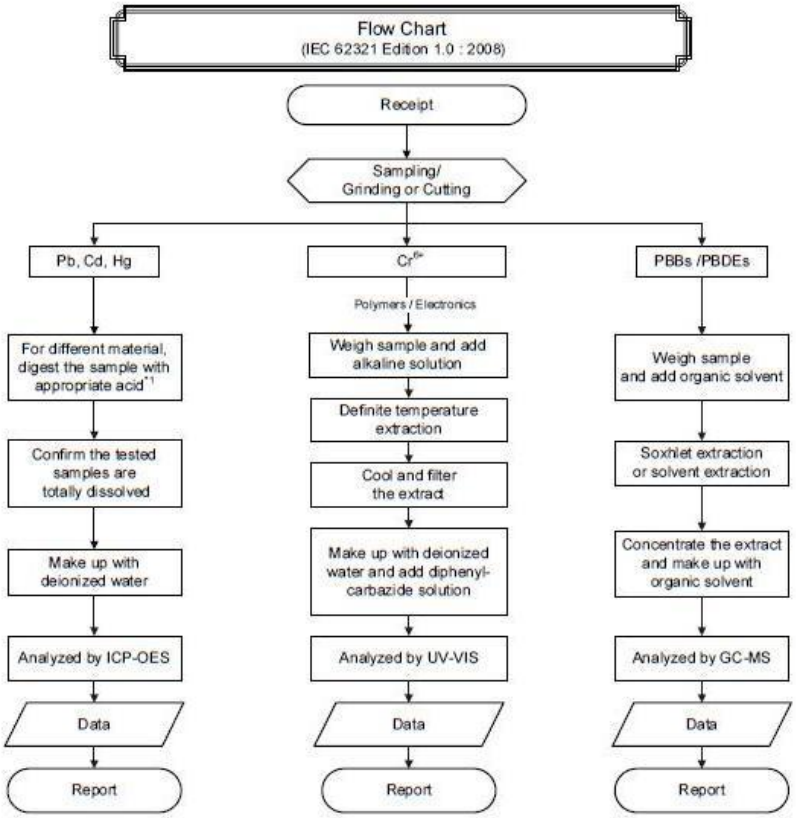
TEST REPORT

Page: 4 of 5
Report No. RT09R-S4525-002-E Date: Oct. 19, 2009

Sample ID No. : RT09R-S4525-002
Sample Description : Dielectric Chip Antenna



Remarks :

*1 : List of appropriate acid :

Material	Acid added for digestion
Polymers	HNO_3, HCl, HF, H_2O_2, H_3BO_3
Metals	HNO_3, HCl, HF
Electronics	HNO_3, HCl, H_2O_2, HBF_4

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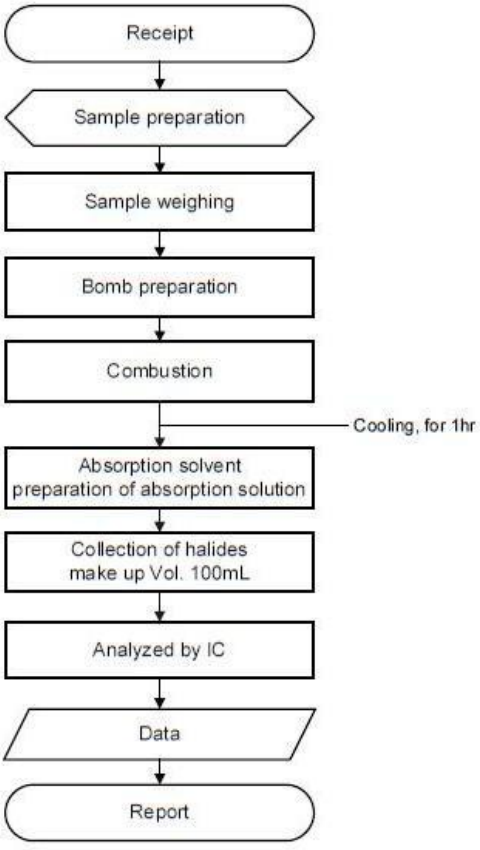
TEST REPORT

Report No. RT09R-S4525-002-E

Page: 5 of 5
Date: Oct. 19, 2009

Sample ID No. : RT09R-S4525-002
Sample Description : Dielectric Chip Antenna

Flow Chart (Halogen)



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

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10.2 유전체 원료(powder)

SGS

Test Report No. F690501/LF-CTSAYAA10-40920 Issued Date: December 13, 2010 Page 1 of 3

To: AMOTECH CO., LTD.
5BL-1L, 617
Namchon-dong
Namdong-gu
INCHEON 405-100
Korea

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

SGS File No.	: AYAA10-40920
Product Name	: MMT-20
Item No./Part No.	: N/A
Received Date	: Dec. 08, 2010
Test Period	: Dec. 09, 2010 to Dec. 13, 2010
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)

SGS Testing Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
322, The O valley, 565-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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SGS

Test Report No. F690501/LF-CTSAYAA10-40920 Issued Date: December 13, 2010 Page 2 of 3

Sample No. : AYAA10-40920.001

Sample Description : MMT-20

Item No./Part No. : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Picture of Sample as Received:

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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-8, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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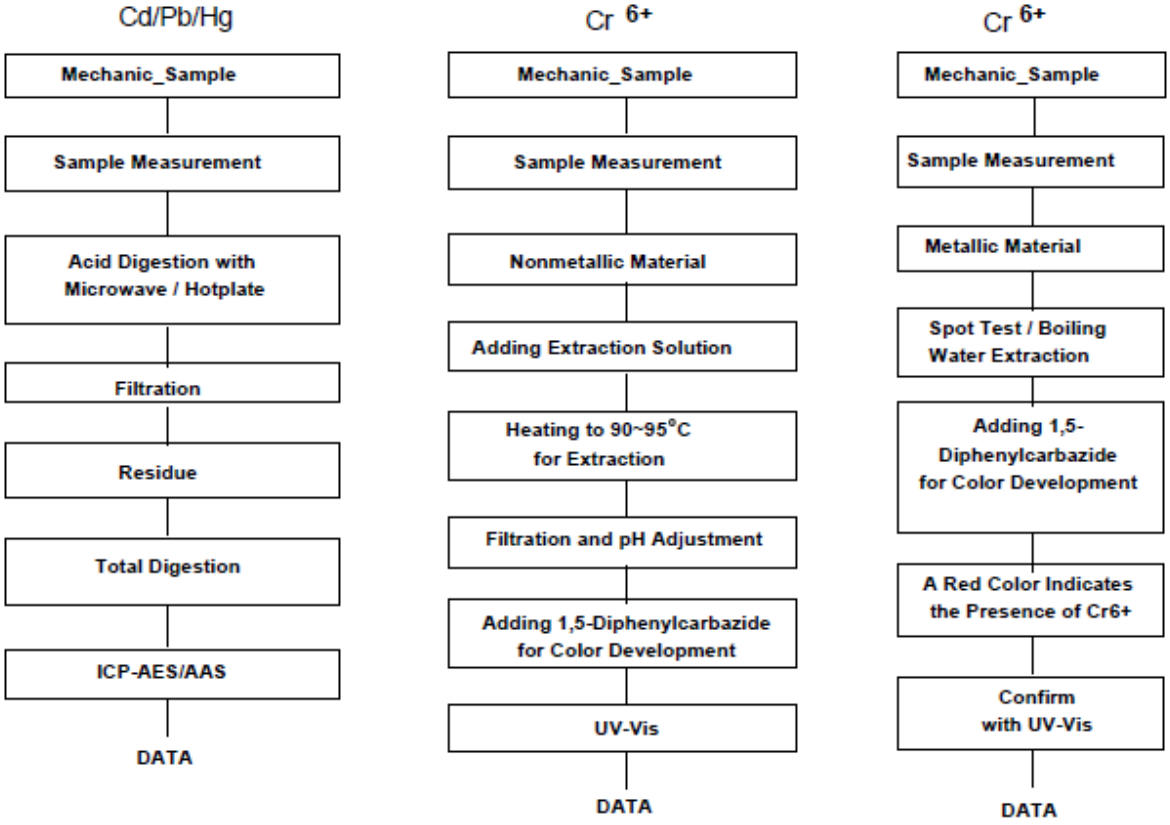
Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+} Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Gilsae Yi

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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10.3 Ag paste

SGS

Test Report No. F690501/LF-CTSAYAA10-36123 Issued Date: October 27, 2010 Page 1 of 3

To: **MICRO M CO., LTD.**
Rm#503, B-dong, Bundangtechnopark
Yatap-dong
Bundang-gu
GYEONGGI-DO 463-816
Korea

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

SGS File No.	: AYAA10-36123
Product Name	: PCC11837HV
Item No./Part No.	: N/A
Received Date	: Oct. 22, 2010
Test Period	: Oct. 25, 2010 to Oct. 27, 2010
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)
Buyer(s)	: SAMSUNG

SGS Testing Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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SGS

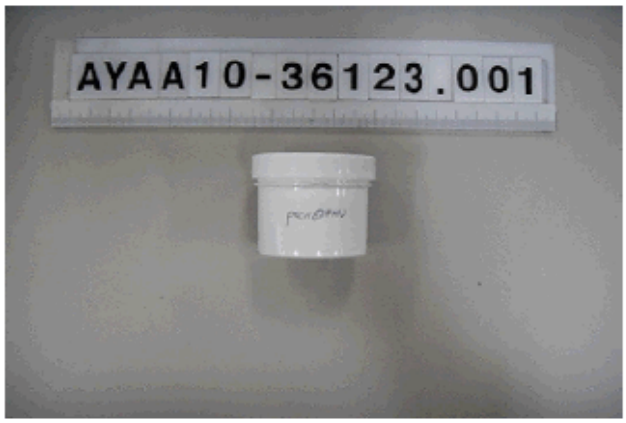
Test Report No. F690501/LF-CTSAYAA10-36123 Issued Date: October 27, 2010 Page 2 of 3

Sample No. : AYAA10-36123.001
Sample Description : PCC11837HV
Item No./Part No. : N/A
Comments : Material is Silver.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Picture of Sample as Received:



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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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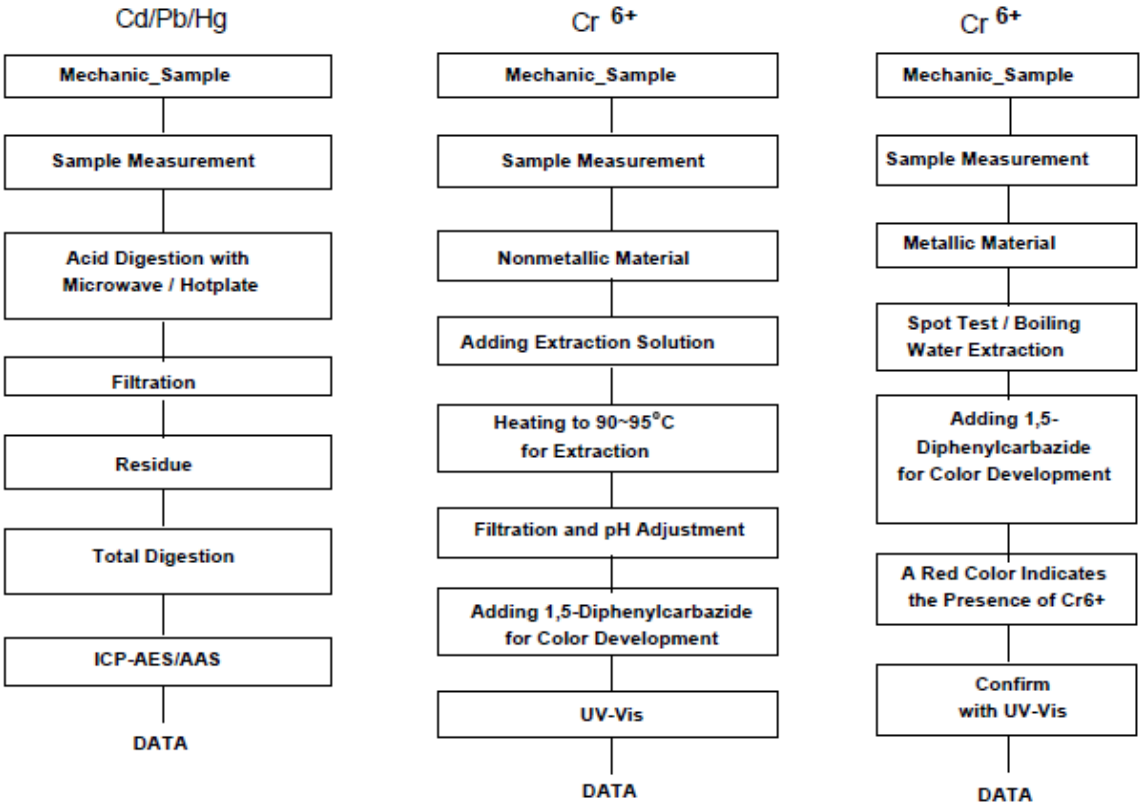
Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+} Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Gilsae Yi

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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10.4 ink

Intertek

TEST REPORT

Applicant : Markem-Imaje Co., LTD.
Address : R#1301, Daeryung Technotown 7th, 489-11, Gasan-dong, Gumcheon-gu, Seoul, Korea

Page: 1 of 7

Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : 5157E black ink
Sample ID No. : RT10R-S1957-002
Manufacturer/Vender : Markem-Imaje Co., LTD.

Sample received : May 10, 2010
Testing Date : May 10, 2010 ~ May 19, 2010
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.

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.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

Intertek Testing Services Korea Ltd.

Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0026 Daegu Office : Tel : 053-600-8647 Fax : 053-600-8645 Web Site : www.Intertek.co.kr
Seoul Lab. Address : 1/F, A-ju Digital Tower, #284-56, Seongsu 2-ga, Seongdong-Gu, Seoul, 133-833 Korea
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

Intertek

TEST REPORT

Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr^{6+})	mg/kg	With reference to US EPA 3060A and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	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	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.

Tested by : Nikkie Lee, Peter Kim, Ellen Jung, Jessica Kang

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

Intertek Testing Services Korea Ltd.

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TEST REPORT

Page: 3 of 7
Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

Test Items	Unit	Test Method	MDL	Results
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Phthalates				
Dibutyl phthalate (DBP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di(2-ethylhexyl) phthalate (DEHP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Di-n-octyl phthalate (DNOP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.
Diisononyl phthalate (DINP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	100	N.D.
Diisodecyl phthalate (DIDP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	100	N.D.
Benzyl butyl phthalate (BBP)	mg/kg	With reference to US EPA 8061A, by solvent extraction and determined by GC/MS	50	N.D.

Tested by : Nikkie Lee, Ellen Jung, David Kwon

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

Intertek Testing Services Korea Ltd.

Seoul Office: Tel : 02-6090-9500 Fax : 02-3409-0026 Daegu Office : Tel : 053-600-8647 Fax : 053-600-8645 Web Site : www.Intertek.co.kr
Seoul Lab. Address : 1/F, A-ju Digital Tower, #284-56, Seongsu 2-ga, Seongdong-Gu, Seoul, 133-833 Korea
Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

Intertek

TEST REPORT

Page: 4 of 7
Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

* View of sample as received;-

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

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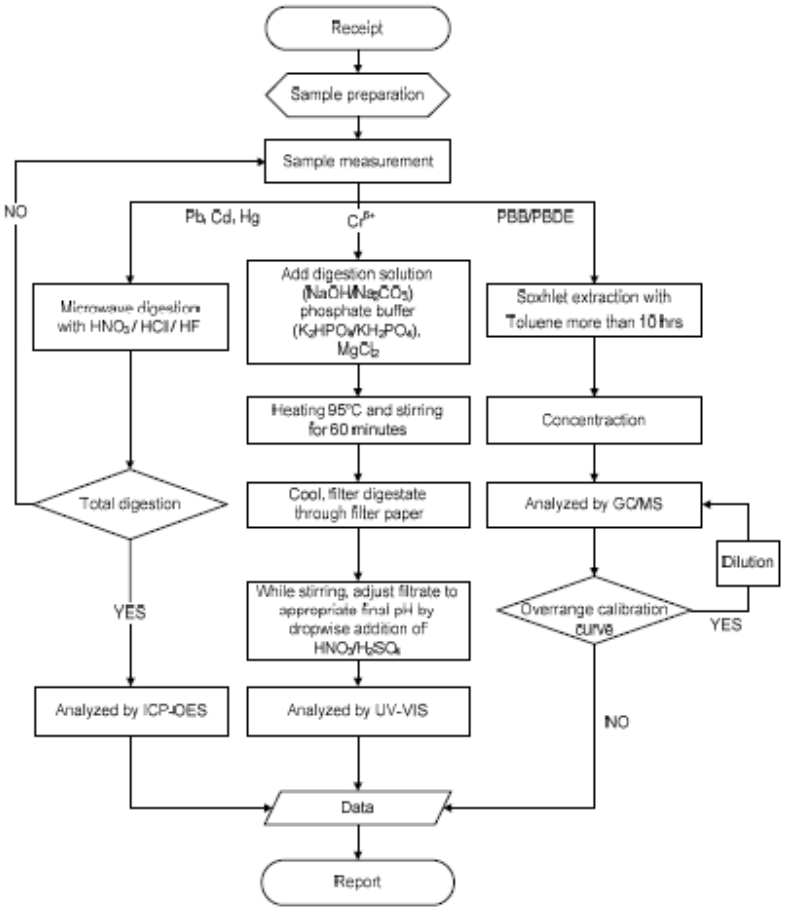
TEST REPORT

Report No. RT10R-S1957-002-E-RA

Page: 5 of 7
Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

Flow Chart
(EPA 3052 for Cd, Pb, Hg / EPA 3060A for Cr^{6+} / EPA 3540C for PBB/PBDE)



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

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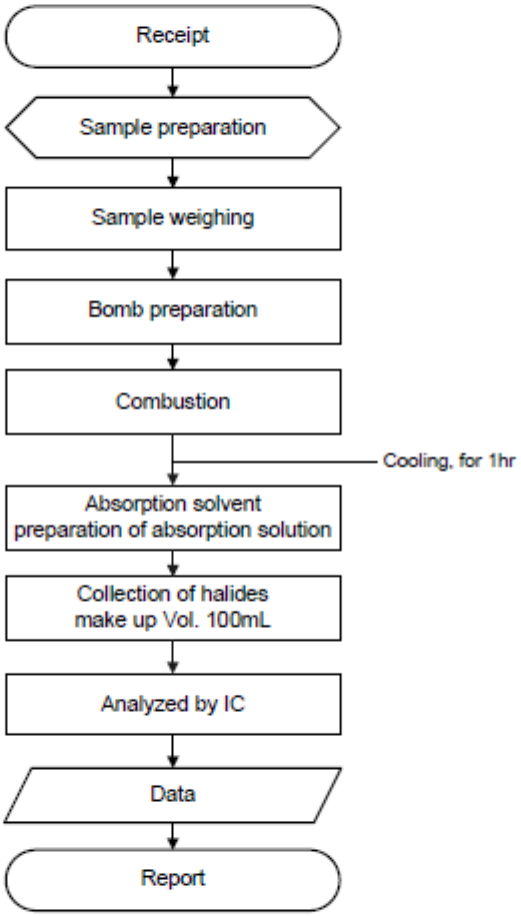
TEST REPORT

Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

Flow Chart (Halogen)



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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

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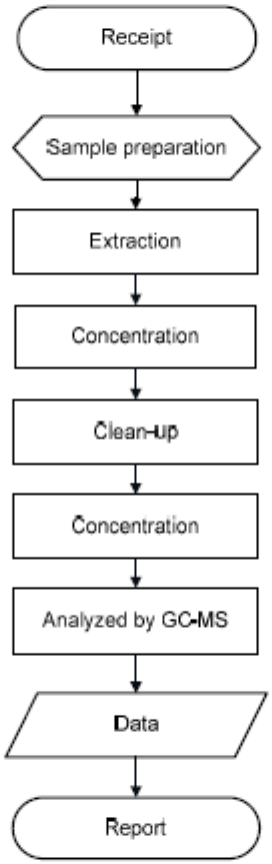
TEST REPORT

Report No. RT10R-S1957-002-E-RA Date: May 19, 2010

Sample ID No. : RT10R-S1957-002
Sample Description : 5157E black ink

Flow Chart (Phthalates)



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

Intertek Testing Services Korea Ltd.

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10.5 캐리어 테잎

SGS

Test Report No. F690501/LF-CTSAYAA10-00826 Issued Date: January 14, 2010 Page 1 of 4

To: **WOONGJIN CHEMICAL CO., LTD**
58
Sinjeonji-dong
Anseong-city
GYEONGGI-DO
Korea

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

SGS File No.	: AYAA10-00826
Product Name	: APET Product
Item No./Part No.	: N/A
Received Date	: January 11, 2010
Test Performing Date	: January 12, 2010
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)
Buyer(s)	:SAMSUNG ELECTRONICS

SGS Testing Korea Co. Ltd.

Pluto Kim
Cindy Park/ Testing Person

Jeff Jang / Chemical Lab Mgr

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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Test Report No. F690501/LF-CTSAYAA10-00826 Issued Date: January 14, 2010 Page 2 of 4

Sample No. : AYAA10-00826.001

Sample Description : APET Product

Item No./Part No. : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, 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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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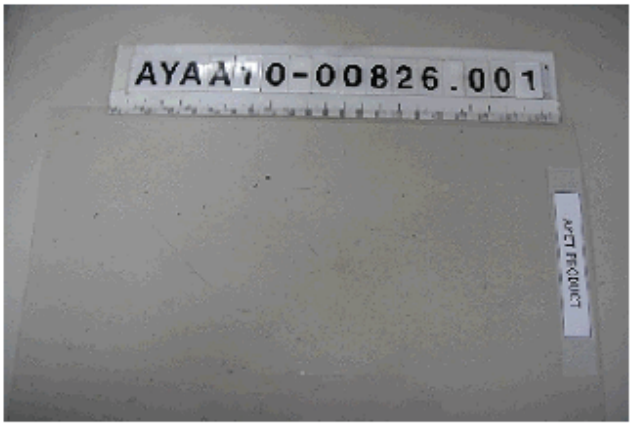
Test Report No. F690501/LF-CTSAYAA10-00826 Issued Date: January 14, 2010 Page 3 of 4

Picture of Sample as Received:



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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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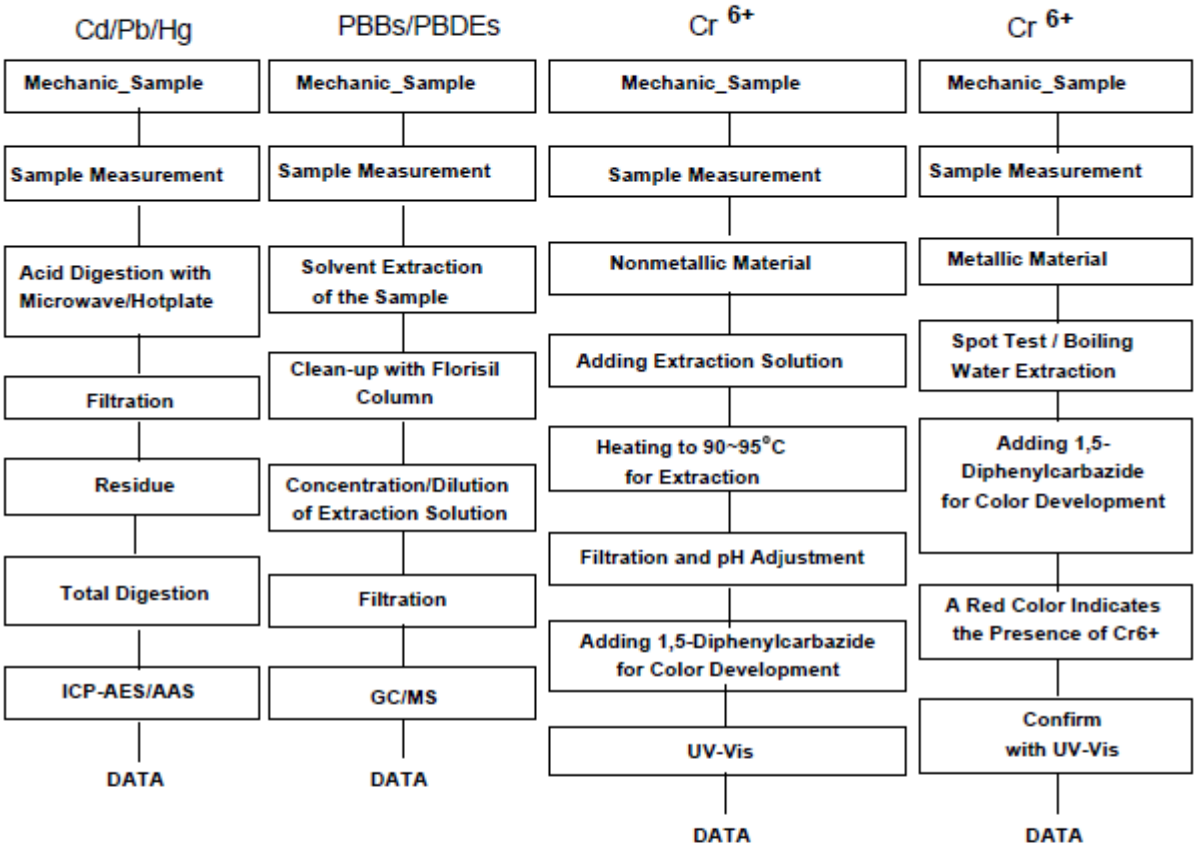
Test Report No. F690501/LF-CTSAYAA10-00826 Issued Date: January 14, 2010 Page 4 of 4

Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+}/PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Operator Dami Yeom

Section Chief Jeff Jang

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
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Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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10.6 커버 테잎

SGS

Test Report No. F690501/LF-CTSAYAA09-21421 Issued Date: July 28, 2009 Page 1 of 5

To: **CHEMTECH SOLUTION CO., LTD**
#540-13,Goryum-ri
Chungbuk-myun
Pyungtaek-city
GYEONGGI-DO
Korea

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

Product Name	: CTS COVER TAPE(antistatic)
SGS File No.	: AYAA09-21421
Received Date	: July 23, 2009
Test Performing Date	: July 24, 2009
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)
Buyer(s)	: SAMSUNG, LG

SGS Testing Korea Co. Ltd.

Jeff Jang

Jeff Jang / Chemical Lab Mgr

Pluto Kim
Cindy Park
Jinee Song/ Testing Person

SGS Testing Korea Co.,Ltd.
322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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SGS

Test Report No. F690501/LF-CTSAYAA09-21421 Issued Date: July 28, 2009 Page 2 of 5

Sample No. : AYAA09-21421.001

Sample Description : CTS COVER TAPE(antistatic)

Item No./Part No. : CTS COVER TAPE(antistatic)

Comments : Materials are multilayer film+adhesive.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, 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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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Test Report No. F690501/LF-CTSAYAA09-21421 Issued Date: July 28, 2009 Page 3 of 5

Sample No. : AYAA09-21421.001
Sample Description : CTS COVER TAPE(antistatic)
Item No./Part No. : CTS COVER TAPE(antistatic)
Comments : Materials are multilayer film+adhesive.

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	With reference to ASTM D 7359-08 , IC	30	N.D.
Chlorine(Cl)	mg/kg	With reference to ASTM D 7359-08 , IC	30	61

Picture of Sample as Received:

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) * = Boiling-water-extraction:
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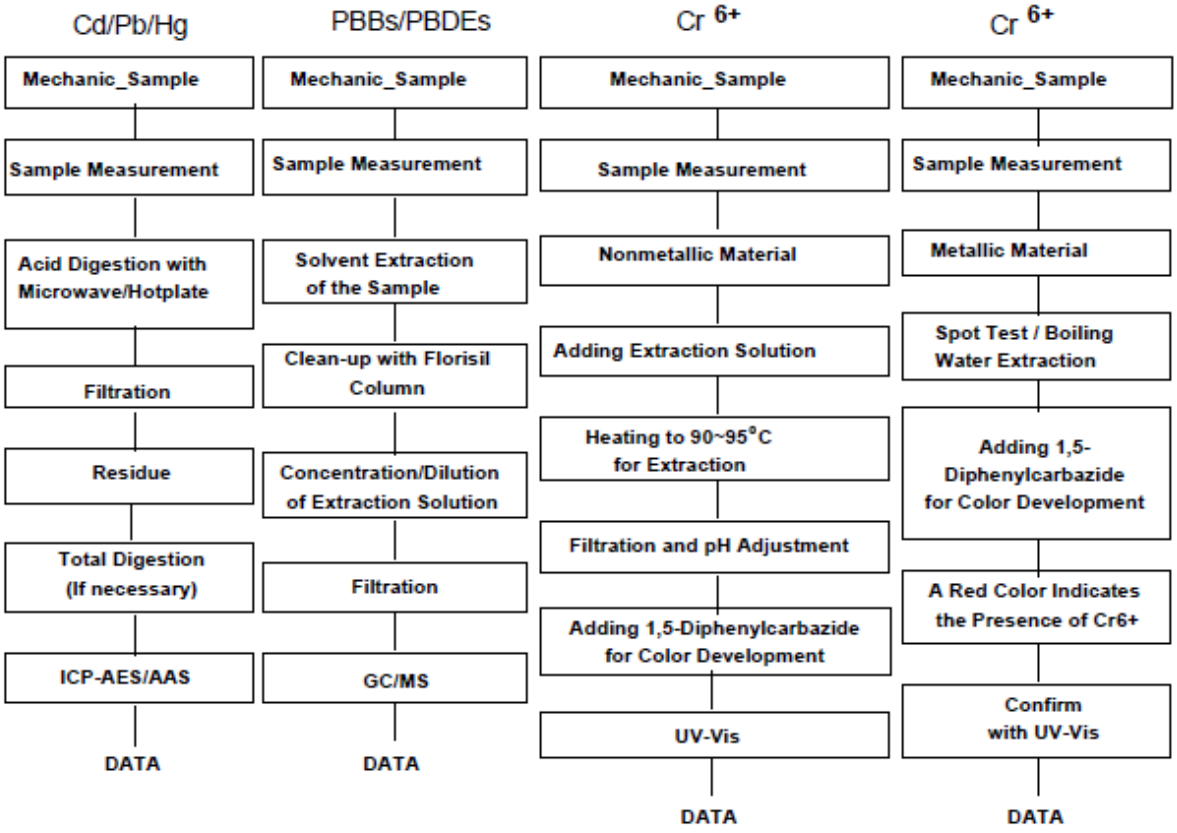
Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr^{6+}/PBBs&PBDEs Testing



Operator Dami Yeom

Section Chief Jeff Jang

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) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
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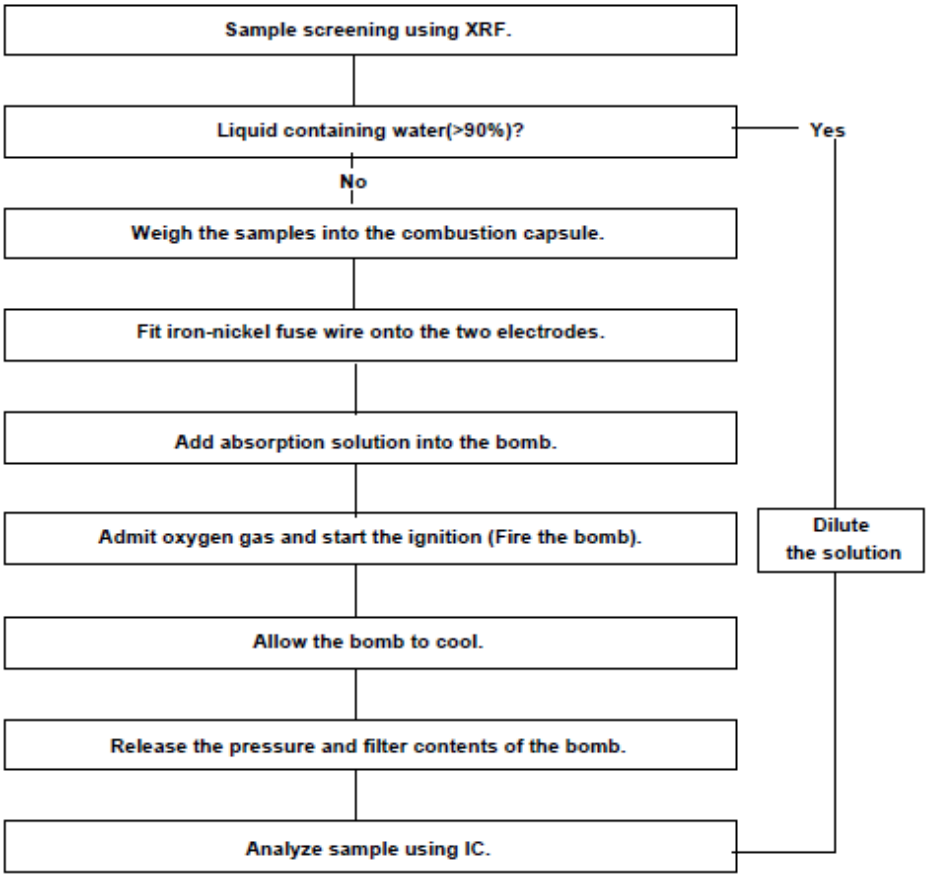
Flow Chart for Halogen Test



*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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