

# **ICP Test Report Certification Packet**

Company name:	Littelfuse, Inc.	
Product Series:	5x20 Cartridge	
Product #:	213xxxP Series	
Issue Date:	March 3, 2014	
2011/65/EU)-restricted packing/packaging mate In addition, it is hereby in	substance nor such userials, and for additives a reported to you that the grackaging materials, a	ere is neither RoHS (EU Directive 2002/95/EC, se, for materials to be used for unit parts, for and the like in the manufacturing processes. parts and sub-materials, the materials to be used and the additives and the like in the manufacturing mponents.
	Issued by:	JORDANUFF H. CABILAN  [Global EHS Engineer]
(1) Parts, sub-materials This document co by Littelfuse, Inc.  < Raw Materials	overs the 5x20 Cartridge	e RoHS-Compliant series products manufactured
Please see Ta	able 1	
,	I measurable substance opropriate pages as ider	
Remarks :		



Table 1: List of Raw Materials covered by this report

Total Parts	Raw Material Part Number	Raw Material Description	Page(s)
1	C910541	Cap – Base & plating	3-6
2	C909543	Soda Lime Glass Tubes	7-11
3	C909542	Borosilicate Glass Body	12-16
4	082xxx-001	Element - 99% Sn Plated Cu	17-20
5	687xxx-001	Element – Ag-Cu Sn Plated	21-26
6	YTW102 (692535-001 )	Solder	27-32
7	934-077 (C030208)	Overcap - Cap Base & plating	33-36
8	934-077 (C030208)	Overcap – Wire Base & plating	33-36
9	648115	Yarn	37-42
10	648150	Yarn	43-48
11	425907	Ink- Green	49-59
12	425902	Ink - Black	60-70
13	425901	Ink - Red	71-81
14	425903	Ink- Yellow	82-92
15	425904	Ink- Blue	93-103
16	425906	Ink- Brown	104-114



NO.: A002R131010052-1R02 Date: Oct. 12, 2013 Page 1 of 4

Customer: Suzhou Fuhong Electronic Industrial Co., Ltd.

Address: NO.89 WEI DU ROAD, WANGTING TOWN XIANGCHENG DISTRICT SUZHOU, CHINA

Report on the submitted sample said to be

Sample name: Copper shell

Model: /

Item/Lot No.: /

Material: /

Buyer: /

Supplier: /
Manufacturer: /

76.2

Sample received date: Oct. 10, 2013

Testing period: From Oct. 10, 2013 to Oct. 12, 2013

### **Testing Requested**

As specified by client, to determine the Lead, Cadmium, Mercury, Hexavalent Chromium content in the submitted sample in accordance with Directive 2011/65/EU (RoHS).

### **Testing method:**

Testing Item	Pretreatment method	Measuring instrument	MQL
Lead (Pb)	IEC 62321: 2008, section 9	ICP-OES	2mg/kg
Cadmium (Cd)	IEC 62321: 2008, section 9	ICP-OES	2 mg/kg
Mercury (Hg)	IEC 62321: 2008, section 7	ICP-OES	2 mg/kg
Chromium (Cr VI)	IEC 62321: 2008, Annex B	UV-VIS	0.02mg/kg*

### Note:

### **Conclusion:**

When tested as specified, the submitted sample complied with the requirements of Directive 2011/65/EU (RoHS).

\*\*\*\*\*\*FOR FURTHER DETAILS, PLEASE REFER TO THE FOLLOWING PAGE(S)\*\*\*\*\*\*

Signed for and on behalf of

Shenzhen AOV Testing Technology Co., Ltd, Kunshan Branch

Project Leader:

Li Tingting, Maggie

**Chemical Test Director** 

Reviewed by: Weikin

Wang Wexin, Weikin

Technical Director

Approved by:

Yuan Qi, Mickey

Lab Manager



<sup>-\* 0.02</sup> mg/kg refers to the MQL of sample extraction liquid.



NO.: A002R131010052-1R02 Date: Oct. 12, 2013 Page 2 of 4

### **Test Flow:**

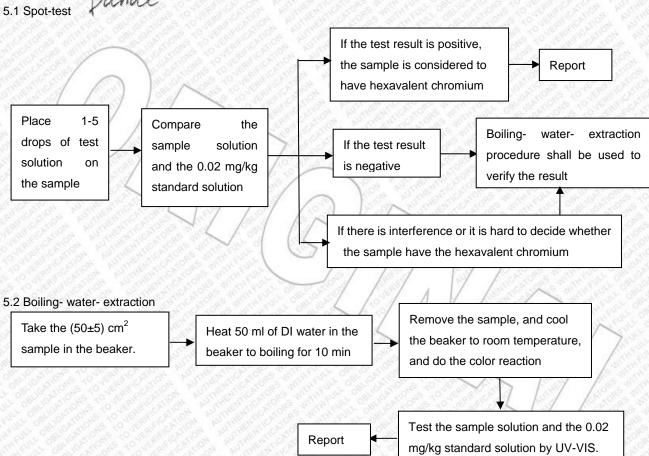
1. To Determine Lead, Cadmium Content: (Metal parent metal) Tested by: ondu Add the digestion solution; the Weigh the sample into Add H<sub>2</sub>O<sub>2</sub> until the sample is clear vessel is heated until the sample a vessel. has been dissolved Cooling the vessel, filter; washed and Tested by ICP-OES Report filled to the mark with distilled water. 2. To Determine Mercury Content: (Metal parent metal) onall Tested by: The sample is digested in the Weigh the sample Add the digestion solution, close microwave oven following a specific into a vessel. the microwave vessel. decomposition program. Cooling the vessel, filter; washed and Tested by ICP-OES Report filled to the mark with distilled water. 3. To Determine Hexavalent Chromium Content (boiling- water- extraction): (Metal parent metal ) Tested by: Remove the sample, and cool Take the (50±5) cm<sup>2</sup> Heat 50 mL of DI water in the the beaker to room temperature, sample in the beaker. beaker to boiling for 10 min and do the color reaction Test the sample solution and the 0.02 Report mg/kg standard solution by UV-VIS. 4. To Determine Lead, Cadmium and Mercury Content: (Plating) Tested by: Cooling, filter; washed and filled Weigh the plating-out Tested by Report to the mark with DI water. sample Instrument





NO.: A002R131010052-1R02 Date: Oct. 12, 2013 Page 3 of 4

5. To Determine Hexavalent Chromium Content in colorless and colored chromate coating on metals: (Plating)
Tested by:



### **Test Results:**

Item	Unit	RoHS Limit	Results	
		A Chie Confedition	substrate	Plating**
Lead (Pb)	mg/kg	1000	N.D.	N.D.
Cadmium (Cd)	mg/kg	100	N.D.	N.D.
Mercury (Hg)	mg/kg	1000	N.D.	N.D.
Chromium (CrVI)	mg/kg	1000	Negative	Negative





NO.: A002R131010052-1R02 Date: Oct. 12, 2013 Page 4 of 4

### Note:

- -N.D.=not detected(<MQL)
- -MQL=Method Quantitation Limit
- -Negative=Absence of Cr (VI) coating;
- Positive=Presence of Cr (VI) coating;

Uncertain= can not verify whether the sample have Hexavalent Chromium by spot-test.

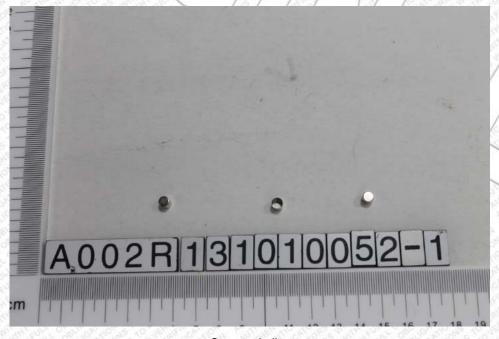
(The tested sample should be further verified by boiling-water-extraction method if the spot test result is uncertain or negative.)

-\*\*Testing part-- Plating

The test is based on the following assumption: The sample plating is a single layer and each part is uniform. The test result maybe cannot stand for the physical truth of sample plating.

-Photo is included

**Photograph of Sample** 



Copper shell

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





**Test Report** No. CANEC1309150301 Date: 24 Jun 2013 Page 1 of 5

XIAMEN LICHUN ELECTRONIC ELEMENT CO.,LTD
42-2 XINGLIN WEST RD,361022,JIMEI DISTRICT,XIAMEN,FUJIAN,P.R.C

The following sample(s) was/were submitted and identified on behalf of the clients as: Soda lime glass tube

SGS Job No. : XM14644726EC - XM

Date of Sample Received: 18 Jun 2013

Testing Period: 18 Jun 2013 - 24 Jun 2013

Test Requested : Selected test(s) as requested by client.

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

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

Conclusion: Based on the performed tests on submitted samples, the results of Lead,

Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by RoHS

Directive 2011/65/EU Annex II; recasting 2002/95/EC.

Signed for and on behalf of SGS-CSTC Ltd.

Almay Gao

Approved Signatory

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### **Test Report**

No. CANEC1309150301

Date: 24 Jun 2013

Page 2 of 5

Test Results:

### Test Part Description:

Specimen No. SGS Sample ID Description

1 CAN13-091503.001 Transparent glass tube

### Remarks:

(1) 1 mg/kg = 1 ppm = 0.0001%

(2) MDL = Method Detection Limit

(3) ND = Not Detected ( < MDL )

(4) "-" = Not Regulated

### RoHS Directive 2011/65/EU

Test Method: With reference to IEC 62321:2008

(1) Determination of Cadmium by ICP-OES.

(2) Determination of Lead by ICP-OES.

(3) Determination of Mercury by ICP-OES.

(4) Determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.

(5) Determination of PBBs / PBDEs content by GC-MS.

Limit	Unit	MDL	001
7.00			ND
			142
	77.007		ND
			ND
1100		4	ND
		5	ND
11.0	mg/kg	5	ND
4	mg/kg	5	ND
-	mg/kg	5	ND
	mg/kg	5	ND
100	mg/kg	5	ND
62	mg/kg	5	ND
-	mg/kg	5	ND
1.2	mg/kg	5	ND
-	mg/kg	5	ND
1,000	mg/kg	1.5	ND
-	mg/kg	5	ND
		100 mg/kg 1,000 mg/kg 1,000 mg/kg 1,000 mg/kg 1,000 mg/kg 1,000 mg/kg - mg/kg	100 mg/kg 2 1,000 mg/kg mg/kg 5 - mg/kg 5

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Test Report	No. CANEC13091503	No. CANEC1309150301		Jun 2013	Page 3 of 5
Test Item(s)	<u>Limit</u>	<u>Unit</u>	MDL	<u>001</u>	
Dibromodiphenyl ether	2	mg/kg	5	ND	
Tribromodiphenyl ether		mg/kg	5	ND	
Tetrabromodiphenyl ether		mg/kg	5	ND	
Pentabromodiphenyl ether		mg/kg	5	ND	
Hexabromodiphenyl ether	-	mg/kg	5	ND	
Heptabromodiphenyl ether	-	mg/kg	5	ND	
Octabromodiphenyl ether	1.2	mg/kg	5	ND	
Nonabromodiphenyl ether	-	mg/kg	5	ND	
Decabromodiphenyl ether	-	mg/kg	5	ND	

### Notes:

(1) The maximum permissible limit is quoted from the directive 2011/65/EU, Annex II

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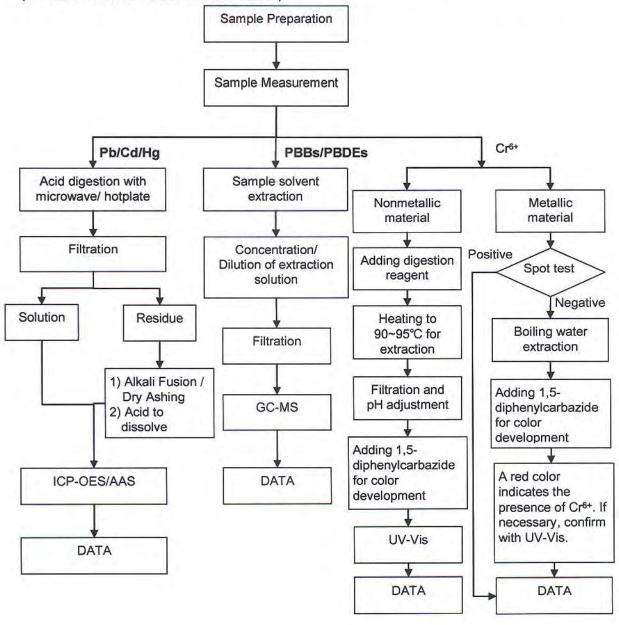
Date: 24 Jun 2013

Page 4 of 5

### **ATTACHMENTS**

### **RoHS Testing Flow Chart**

- 1) Name of the person who made testing: Michael Tso / Cutey Yu
- 2) Name of the person in charge of testing: Adams Yu / Yolanda Wei
- 3) These samples were dissolved totally by pre-conditioning method according to below flow chart (Cr6+ and PBBs/PBDEs test method excluded).



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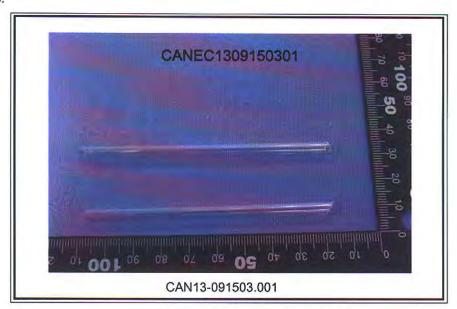
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Date: 24 Jun 2013

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Sample photo:



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**Test Report** No. CANEC1309150303 Date: 24 Jun 2013 Page 1 of 5

XIAMEN LICHUN ELECTRONIC ELEMENT CO.,LTD 42-2 XINGLIN WEST RD,361022,JIMEI DISTRICT,XIAMEN,FUJIAN,P.R.C

The following sample(s) was/were submitted and identified on behalf of the clients as: Bosi glass tube

SGS Job No. : XM14644726EC - XM

Date of Sample Received: 18 Jun 2013

Testing Period: 18 Jun 2013 - 24 Jun 2013

Test Requested: Selected test(s) as requested by client.

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

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

Conclusion: Based on the performed tests on submitted samples, the results of Lead,

Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by RoHS

Directive 2011/65/EU Annex II; recasting 2002/95/EC.

Signed for and on behalf of SGS-CSTC Ltd.

Almay Gao

Approved Signatory

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**Test Report** 

No. CANEC1309150303

Date: 24 Jun 2013

Page 2 of 5

Test Results:

### Test Part Description:

Specimen No. SGS Sample ID Description

CAN13-091503.002 Transparent glass tube

Remarks:

(1) 1 mg/kg = 1 ppm = 0.0001%

(2) MDL = Method Detection Limit

(3) ND = Not Detected ( < MDL)

(4) "-" = Not Regulated

### RoHS Directive 2011/65/EU

Test Method: With reference to IEC 62321:2008

(1) Determination of Cadmium by ICP-OES.

(2) Determination of Lead by ICP-OES.

(3) Determination of Mercury by ICP-OES.

(4) Determination of Hexavalent Chromium by Colorimetric Method using UV-Vis.

(5) Determination of PBBs / PBDEs content by GC-MS.

Test Item(s)	<u>Limit</u>	<u>Unit</u>	MDL	002
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1,000	mg/kg	2	ND
Mercury (Hg)	1,000	mg/kg	2	ND
Hexavalent Chromium (CrVI)	1,000	mg/kg	2	ND
Sum of PBBs	1,000	mg/kg	-	ND
Monobromobiphenyl	-	mg/kg	5	ND
Dibromobiphenyl	-	mg/kg	5	ND
Tribromobiphenyl		mg/kg	5	ND
Tetrabromobiphenyl	-	mg/kg	5	ND
Pentabromobiphenyl		mg/kg	5	ND
Hexabromobiphenyl	1 · 2	mg/kg	5	ND
Heptabromobiphenyl	1, 9	mg/kg	5	ND
Octabromobiphenyl	+	mg/kg	5	ND
Nonabromobiphenyl		mg/kg	5	ND
Decabromobiphenyl	-	mg/kg	5	ND
Sum of PBDEs	1,000	mg/kg	1,6	ND
Monobromodiphenyl ether	1	mg/kg	5	ND

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Test Report	No. CANEC13091503	03	Date: 24 .	Jun 2013	Page 3 of 5
Test Item(s)	<u>Limit</u>	<u>Unit</u>	MDL	002	
Dibromodiphenyl ether	-	mg/kg	5	ND	
Tribromodiphenyl ether	<del>-</del>	mg/kg	5	ND	
Tetrabromodiphenyl ether		mg/kg	5	ND	
Pentabromodiphenyl ether	4.	mg/kg	5	ND	
Hexabromodiphenyl ether	4.	mg/kg	5	ND	
Heptabromodiphenyl ether	-	mg/kg	5	ND	
Octabromodiphenyl ether	44	mg/kg	5	ND	
Nonabromodiphenyl ether		mg/kg	5	ND	
Decabromodiphenyl ether	9	mg/kg	5	ND	

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(1) The maximum permissible limit is quoted from the directive 2011/65/EU, Annex II

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### **Test Report**

No. CANEC1309150303

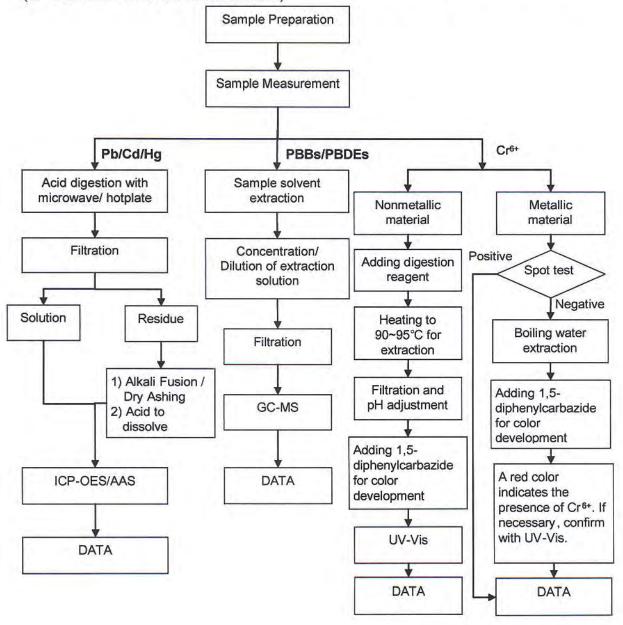
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Page 4 of 5

### **ATTACHMENTS**

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- 3) These samples were dissolved totally by pre -conditioning method according to below flow chart (Cr6+ and PBBs/PBDEs test method excluded).



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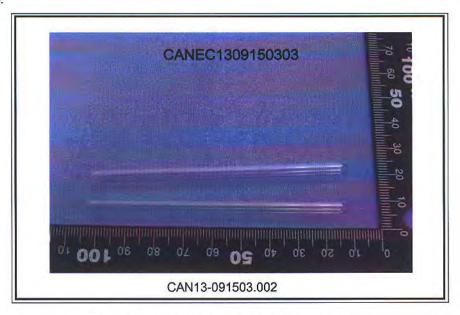
### **Test Report**

No. CANEC1309150303

Date: 24 Jun 2013

Page 5 of 5

Sample photo:



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Intertek Consumer Goods GmbH · Würzburger Straße 152 · 90766 Fürth · Germany

Littelfuse Philippines Inc. LIMA Technology Center, Lipa City, Malvar, Batangas

Fürth, 2013-12-17

### Test report No. FUHLP2013-3898

### Testing of a material sample according to the RoHS directive 2011/65/EC

### Sample description: Cu99.9MSn

Arrival in lab: 2013-12-02; Period of analysis: 2013-12-04 - 2013-12-13 Head of Inorganic Lab: Claudia List

Copying this test report is permitted only in agreement with the contracted lab. The test results refer only to the tested item. This report consists of 6 page(s).

The test methods signed with \* are not listed in the attachment of the accreditation certificate.

### Conclusion based on tested item

Test order	Status
testing according to the RoHS directive 2011/65/EC	pass <sup>°</sup>

Please see overview of test results

- Test results see next pages -





Page 2 of 4 page(s) of our test report No. FUHLP2013-3898 dated 17.12.2013

### Sample description: Cu99.9MSn

nM = non Metal M = Metal cM = composite Material

### **List of component parts:**

Sample No.	Part No.	Material	Description
334031	1	М	Tinned copper wire

### Photo:



Sample No. 334031 Part No. 1

### Analysis of metals by ICP-MS, results in mg/kg

Method: Pb, Cd, Cr: DIN EN ISO 17294-2\*\*

Digestion: with conc. HNO<sub>3</sub> + HCI\*\*

Detection limit: Pb 5.0 mg/kg, Cd 1.0 mg/kg, Cr 10 mg/kg, Hg: 0.5 mg/kg

Sample No.	Part No.	Pb	Hg	Cd	Cr <sub>total</sub>
334031	1	50	<0.5	<1.0	<10

Status	
pass	

### **Comment:**

Elements	RoHS-limit value			
Lead (Pb)	1000 mg/kg			
Mercury (Hg)	1000 mg/kg			
Cadmium (Cd)	100 mg/kg			
Chromium VI (Cr VI)	1000 mg/kg			
Polybrominated Biphenyle (PBBs)	1000 mg/kg			
Polybrominated Diphenyl ether (PBDEs)	1000 mg/kg			

Intertek Consumer Goods GmbH

Prüfleitung / Lab Manager

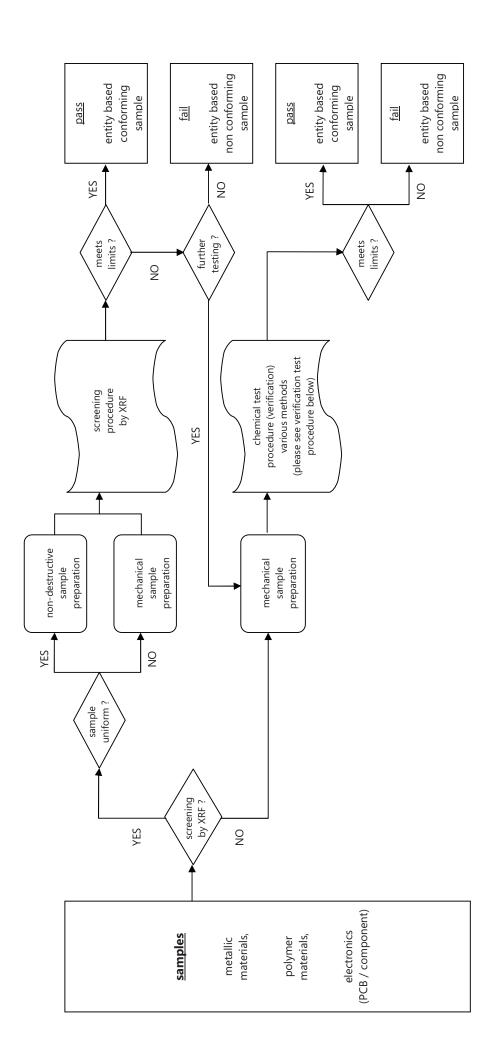
□ A. Breunig, □ K. Grönhardt, □ Dr. K. Laue-Schuler,
□ R. Micolay, □ M. Neumeister, □ Dr. R. Rätze, □ K. Scharrer, □ M. Tutsch

- Flow charts see next page(s) -



Page 3 of 4 page(s)

# Test procedure



Intertek Consumer Goods GmbH Würzburger Straße 152 90766 Fürth, Germany

Tel.: +49 911 74075 0 Fax: +49 911 74075 30 cg.germany@intertek.com

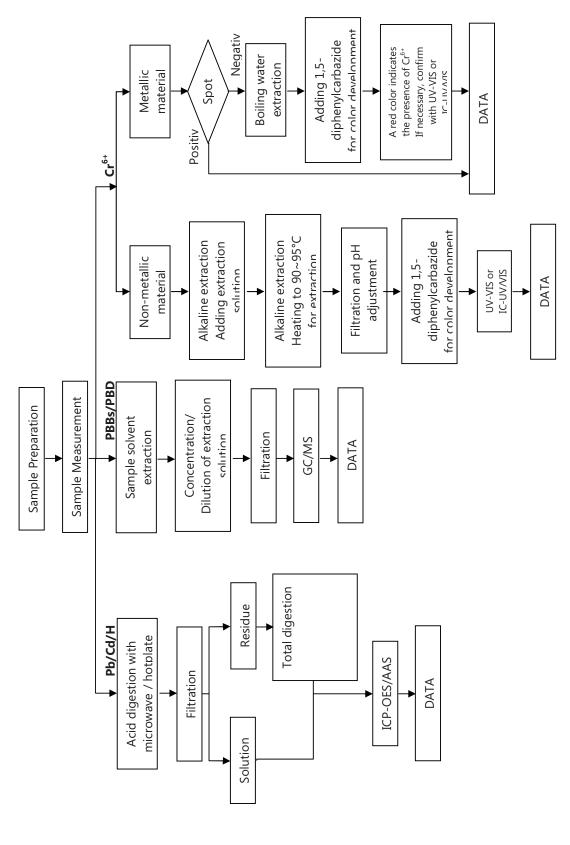
Sitz Fürth Amtsgericht Fürth, HRB 5756 Ust-IdNr. DE169317871

Geschäftsführer Kay Grönhardt Jan-Jörg Müller-Seiler



Page 4 of 4 page(s)

# Verification test procedure



Intertek Consumer Goods GmbH Würzburger Straße 152 90766 Fürth, Germany

Tel.: +49 911 74075 0 Fax: +49 911 74075 30 cg.germany@intertek.com

Sitz Fürth Amtsgericht Fürth, HRB 5756 Ust-IdNr. DE169317871

Kay Grönhardt Jan-Jörg Müller-Seiler Geschäftsführer



Applicant: Littelfuse Philippines Inc.

LIMA Technology Center, Lipa City,

Malvar, Batangas

Sample Description:

One (1) submitted sample said to be:

Item Name : Wires with plating

Item No. : 101--23-.---tin plated silver copper alloy wire – AgCu, Sn--%

Country of Origin : GERMANY

- Octobries of Origin - Octobries - Octobr

Tests conducted:

As requested by the applicant, for details refer to attached page(s).

Conclusion:

 Tested sample
 Standard
 Result

 Tested components of submitted sample
 Restriction of the use of certain hazardous substance in electrical and electronic equipment (RoHS Directive 2011/65/EU)
 See Test Conducted

To be continued

Date: Jan. 21, 2014

Prepared and check by: For Intertek Testing Services Ltd., Shanghai

Joy Zhou

Authorized by: For Intertek testing services Ltd., Shanghai

Jonny Jing Manager





### **Tests Conducted**

### (A) Test result of RoHS Directive:

Tooling item	Result
Testing item	(1)
Cadmium (Cd) content (mg/kg) /plating	ND
Lead (Pb) content (mg/kg) /plating	17
Mercury (Hg) content (mg/kg) /plating	ND
Chromium (VI)(Cr <sup>6+</sup> ) result (by boiling water extraction on metal) (mg/kg with 50cm <sup>2</sup> ) /plating	ND

Testing item	<u>Result</u>		
resung tem	(2)		
Cadmium (Cd) content (mg/kg)	ND		
Lead (Pb) content (mg/kg)	ND		
Mercury (Hg) content (mg/kg)	ND		
Chromium (VI)(Cr <sup>6+</sup> ) result (by boiling water extraction on metal) (mg/kg with 50cm <sup>2</sup> )	ND		

Remark: mg/kg with 50cm<sup>2</sup> = milligram per kilogram with 50 square centimeter

ND = not detected

### Tested components:

- (1) Silver color metal wire plating
- (2) Silver color metal wire substrate

### (B) RoHS Requirement:

Restricted substances	Limits
Cadmium (Cd)	0.01% (100 mg/kg)
Lead (Pb)	0.1% (1000 mg/kg)
Mercury (Hg)	0.1% (1000 mg/kg)
Chromium (VI) (Cr <sup>6+</sup> )	0.1% (1000 mg/kg)
Polybrominated biphenyls (PBBs)	0.1% (1000 mg/kg)
Polybrominated diphenyl ethers (PBDEs)	0.1% (1000 mg/kg)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

To be continued



Number: 140100488SHA-002 **Test Report** 

### **Tests Conducted**

### (C) Test method:

Testing item	Testing method	Reporting limit
Cadmium (Cd) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 mg/kg
Lead (Pb) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 mg/kg
Mercury (Hg) content	With reference to IEC 62321-4 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 mg/kg
Chromium (VI) (Cr <sup>6+</sup> ) content (for metal)	With reference to IEC 62321 Edition 1.0: 2008, by boiling water extraction and determined by UV-VIS Spectrophotometer.	Positive/Negative (Threshold of 0.02mg/kg with 50cm <sup>2</sup> )

Date sample received: Jan. 13, 2014

Testing period: Jan. 13, 2014 To Jan. 16, 2014

To be continued

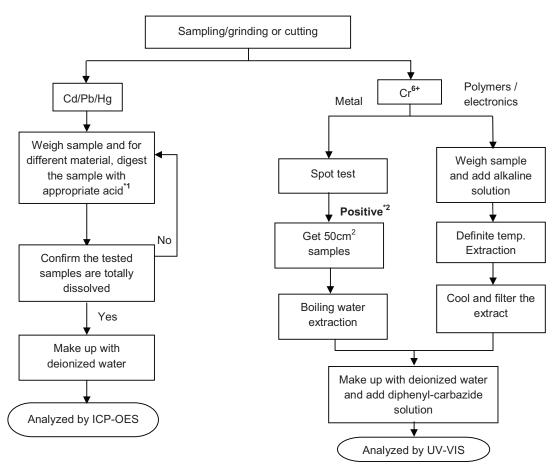


### **Tests Conducted**

### (D) Measurement flowchart:

Test for Cd/Pb/Hg/Cr (VI) contents

Reference standard: IEC 62321 Edition 1.0: 2008&2013



### Remarks:

\*1: list of appropriate acid:

<u>Material</u>	Acid added for digestion	
Polymers	HNO <sub>3</sub> ,HCI,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>	
Metals	HNO <sub>3,</sub> HCI,HF	
Electronics	HNO <sub>3</sub> ,HCI,H <sub>2</sub> O <sub>2</sub> ,HBF <sub>4</sub>	

\*2: If the result of spot test is positive, Chromium VI would be determined as detected.

To be continued

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**Tests Conducted** 



To be continued



**Tests Conducted** 



### End of report

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**Test Report** No. SHAEC1317518845 Date: 06 Sep 2013 Page 1 of 6

LITTELFUSE PHILIPPINES INC. LIMA TECHNOLOGY CENTER, LIPA CITY, MALVAR, BATANGAS

The following sample(s) was/were submitted and identified on behalf of the clients as: LEAD-FREE SOLDER WIRE

SGS Job No. : SP13-026309 - SH

Model No.: YTW108 (692535-001、692535-003、693535-004)

Composition : Sn3.0CuRE

Date of Sample Received : 03 Sep 2013

Testing Period: 03 Sep 2013 - 06 Sep 2013

Test Requested : Selected test(s) as requested by client.

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

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

Conclusion: Based on the performed tests on submitted samples, the results of Lead,

Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) comply with the limits as set by RoHS

Directive 2011/65/EU Annex II; recasting 2002/95/EC.

Signed for and on behalf of SGS-CSTC Ltd.

JJ Fan

Approved Signatory

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**Test Report** No. SHAEC1317518845 Date: 06 Sep 2013 Page 2 of 6

Test Results:

### **Test Part Description:**

Specimen No. SGS Sample ID Description

1 SHA13-175188.038 Silvery metal wire

### Remarks:

(1) 1 mg/kg = 1 ppm = 0.0001%

(2) MDL = Method Detection Limit

(3) ND = Not Detected ( < MDL)

(4) "-" = Not Regulated

### RoHS Directive 2011/65/EU

Test Method: (1) With reference to IEC 62321-5:2013, determination of Cadmium by ICP-OES.

(2) With reference to IEC 62321-5:2013, determination of Lead by ICP-OES.

(3) With reference to IEC 62321-4:2013, determination of Mercury by ICP-OES.

(4) With reference to IEC 62321:2008, determination of Hexavalent Chromium by spot test / Colorimetric Method using UV-Vis.

(5) With reference to IEC 62321:2008, determination of PBBs and PBDEs by GC-MS.

Test Item(s)	<u>Limit</u>	<u>Unit</u>	<u>MDL</u>	<u>038</u>
Cadmium (Cd)	100	mg/kg	2	ND
Lead (Pb)	1000	mg/kg	2	129
Mercury (Hg)	1000	mg/kg	2	ND
Hexavalent Chromium (Cr(VI))	-	-	$\Diamond$	Negative
Sum of PBBs	1000	mg/kg	-	ND
Monobromobiphenyl	-	mg/kg	5	ND
Dibromobiphenyl	-	mg/kg	5	ND
Tribromobiphenyl	-	mg/kg	5	ND
Tetrabromobiphenyl	-	mg/kg	5	ND
Pentabromobiphenyl	-	mg/kg	5	ND
Hexabromobiphenyl	-	mg/kg	5	ND
Heptabromobiphenyl	-	mg/kg	5	ND
Octabromobiphenyl	-	mg/kg	5	ND
Nonabromobiphenyl	-	mg/kg	5	ND
Decabromobiphenyl	-	mg/kg	5	ND
Sum of PBDEs	1000	mg/kg	-	ND
Monobromodiphenyl ether	-	mg/kg	5	ND

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Test Report	No. SHAEC1317518845		Date: 06	Sep 2013	Page 3 of 6
Test Item(s)	<u>Limit</u>	<u>Unit</u>	<u>MDL</u>	<u>038</u>	
Dibromodiphenyl ether	-	mg/kg	5	ND	
Tribromodiphenyl ether	-	mg/kg	5	ND	
Tetrabromodiphenyl ether	-	mg/kg	5	ND	
Pentabromodiphenyl ether	-	mg/kg	5	ND	
Hexabromodiphenyl ether	-	mg/kg	5	ND	
Heptabromodiphenyl ether	-	mg/kg	5	ND	
Octabromodiphenyl ether	-	mg/kg	5	ND	
Nonabromodiphenyl ether	-	mg/kg	5	ND	
Decabromodiphenyl ether	-	mg/kg	5	ND	

### Notes:

- (1) The maximum permissible limit is quoted from directive 2011/65/EU, Annex II
- (2) \$Spot-test:

Negative = Absence of Cr(VI) coating, Positive = Presence of Cr(VI) coating;

(The tested sample should be further verified by boiling-water-extraction method if the spot test result is Negative or cannot be confirmed.)

♦Boiling-water-extraction:

Negative = Absence of Cr(VI) coating

Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

Information on storage conditions and production date of the tested sample is unavailable and thus Cr(VI) results represent status of the sample at the time of testing.

### **Halogen**

Test Method: With reference to EN 14582: 2007, analysis was performed by Ion Chromatograph (IC).

Test Item(s)	<u>Unit</u>	<u>MDL</u>	<u>038</u>
Fluorine (F)	mg/kg	50	ND
Chlorine (CI)	mg/kg	50	392
Bromine (Br)	mg/kg	50	ND
lodine (I)	mg/kg	50	ND

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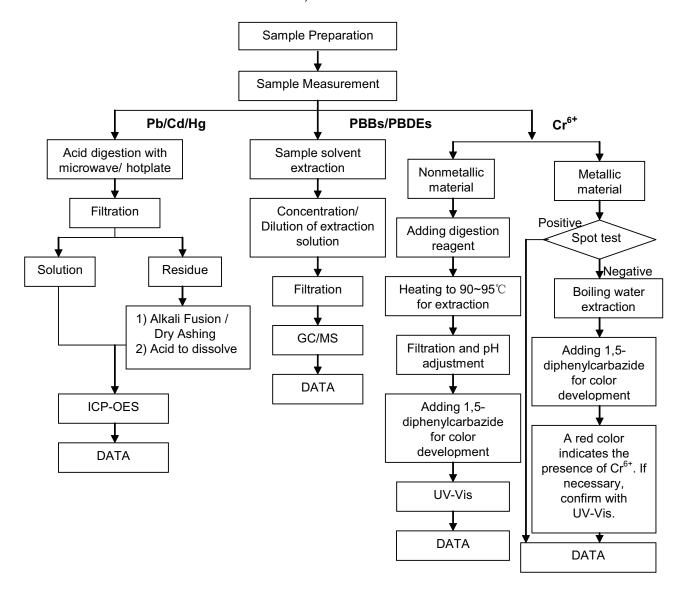


**Test Report** No. SHAEC1317518845 Date: 06 Sep 2013 Page 4 of 6

### **ATTACHMENTS**

### **RoHS Testing Flow Chart**

- 1) Name of the person who made testing: Jan Shi/Star Wang/Shara Wang/Gary Xu
- 2) Name of the person in charge of testing: Jeff Zhang/George Xu/ Jessy Huang
- 3) These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr<sup>6+</sup> and PBBs/PBDEs test method excluded)



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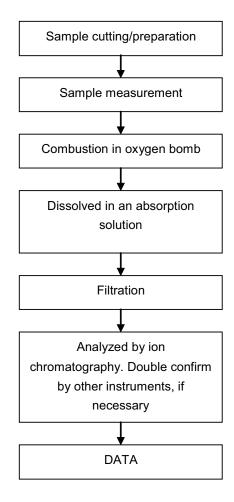


**Test Report** No. SHAEC1317518845 Date: 06 Sep 2013 Page 5 of 6

### Halogen Testing (oxygen bomb) Flow Chart

1) Name of the person who made testing: Sisily Yin

2) Name of the person in charge of testing: Linda Li



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### **Test Report**

No. SHAEC1317518845

Date: 06 Sep 2013

Page 6 of 6

Sample photo:



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NO.: A002R130403070-2R02

Date: Apr.08, 2013 Page 1 of 4

Customer: SuZhou FuHong Electronic Industrial Co., Ltd.

Address: NO. 89 WEI DU ROAD, WANGTING TOWN, XIANGCHENG DISTRICT, SUZHOU, CHINA

Report on the submitted sample said to be

Sample name: Lead wire copper shell

Model: /

Item/Lot No.: / Material:

Buyer: / Supplier:

Manufacturer: /

Sample received date: Apr.03, 2013

Testing period: From Apr.03, 2013 to Apr.08, 2013

### **Testing Requested**

As specified by client, to determine the Lead, Cadmium, Mercury & Hexavalent Chromium content in the submitted sample in accordance with Directive 2011/65/EU (RoHS).

### Testing method:

Testing Item	Pretreatment method	Measuring instrument	MQL
Lead (Pb)	IEC 62321: 2008, section 9	ICP-OES	2mg/kg
Cadmium (Cd)	IEC 62321: 2008, section 9	ICP-OES	2 mg/kg
Mercury (Hg)	IEC 62321: 2008, section 7	ICP-OES	2 mg/kg
Chromium (Cr VI)	IEC 62321: 2008, Annex B	UV-VIS	0.02mg/kg*

### Note:

### Conclusion:

When tested as specified, the submitted sample complied with the requirements of Directive 2011/65/EU (RoHS).

\*\*\*\*\*\*FOR FURTHER DETAILS, PLEASE REFER TO THE FOLLOWING PAGE(S)\*\*\*\*\*\*

Signed for and on behalf of Shenzhen AOV Testing Technology Co., Ltd, Kunshan Branch

Project Leader:

Li Tingting, Maggie

**Chemical Test Director** 

Reviewed by: Weikin

Wang Wexin, Weikin

**Technical Director** 

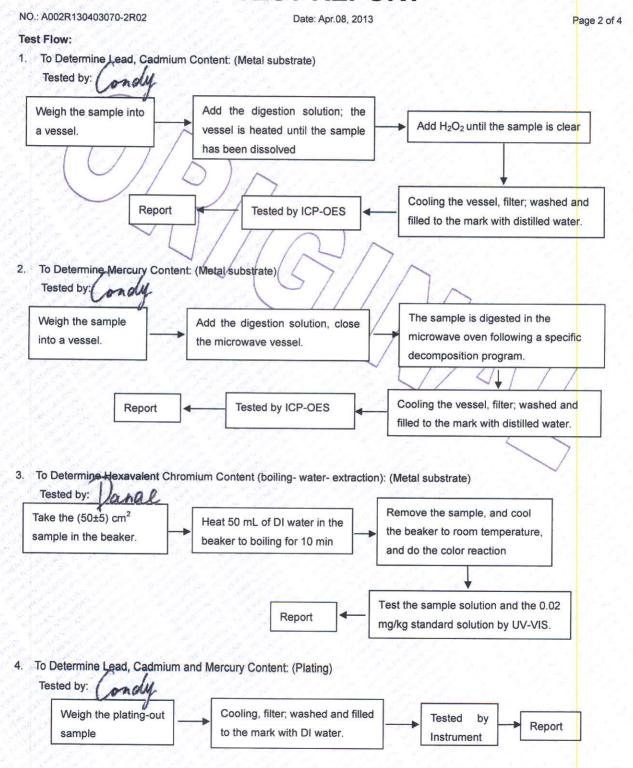
Approved by

Yuan Qi, Mickey

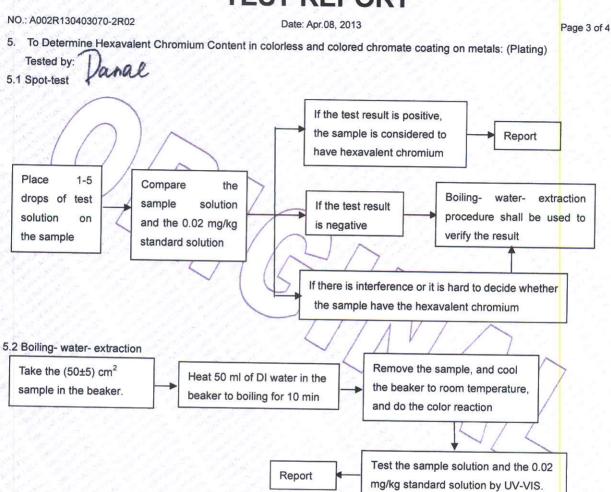
Lab Manager

<sup>-\* 0.02</sup> mg/kg refers to the MQL of sample extraction liquid.









### Sample Description:

Code	Sample Description	Code	Sample Description
2-1	Lead wire substrate	2-3	Copper shell substrate
2-2	Lead wire Plating	2-4	Copper shell Plating

### Test Results:

Item	Unit	RoHS Limit	Tall .	R	esult	sult	
The state of the s	a Server	The state of the s		2-2**	2-3	2-4**	
Lead (Pb)	mg/kg	1000	N.D.	N.D.	N.D.	N.D.	
Cadmium (Cd)	mg/kg	100	N.D.	N.D.	N.D.	N.D.	
Mercury (Hg)	mg/kg	1000	N.D.	N.D.	N.D.	N.D.	
Chromium (CrVI)	mg/kg	1000	Negative	Negative	Negative	Negative	





NO.: A002R130403070-2R02

Date: Apr.08, 2013

Page 4 of 4

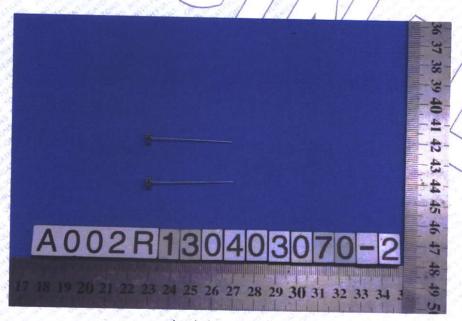
#### Note:

- -Specimens, which requested to determine Lead, Cadmium and Mercury Content, have been dissolved completely.
- -N.D.=not detected(<MQL)
- -MQL=Method Quantitation Limit
- -Negative=Absence of Cr (VI);
- -Positive=Presence of Cr (VI);

Uncertain = can not verify whether the sample have Hexavalent Chromium by spot-test.

- (The tested sample should be further verified by boiling-water-extraction method if the spot test result is uncertain or
- -\*\*The test is based on the following assumption: The sample plating is a single layer and each part is uniform. The test result maybe cannot stand for the physical truth of sample plating:
- -Photo is included

Photograph of Sample



Lead wire copper shell

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





Number: 140100201SHA-004 **Test Report** 

Applicant: LITTELFUSE, INC.

> 800 E. NORTHWEST HWY DES PLAINES, IL 60016

ATTN: J. CABILAN / A. CESISTA JR

Sample Description:

One (1) submitted sample said to be: White yarn Part Description Part Number 648115

Tests conducted:

As requested by the applicant, for details refer to attached page(s).

Conclusion:

Tested sample Result

Submitted sample Restriction of the use of certain hazardous substance in electrical Pass

and electronic equipment (RoHS Directive 2011/65/EU)

To be continued

Date: Jan. 15, 2014

Prepared and check by: For Intertek Testing Services Ltd., Shanghai

Authorized by: For Intertek testing services Ltd., Shanghai

Jonny Jing





## **Tests Conducted**

(I) Test Result Summary:

Testing Item	Result (ppm)
Heavy Metal	***
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (CI)	ND
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: John Zeng / Leaf Liu

Date sample received: Jan. 07, 2014

Testing period: Jan. 07, 2014 To Jan. 09, 2014



#### **Tests Conducted**

## (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321-4 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

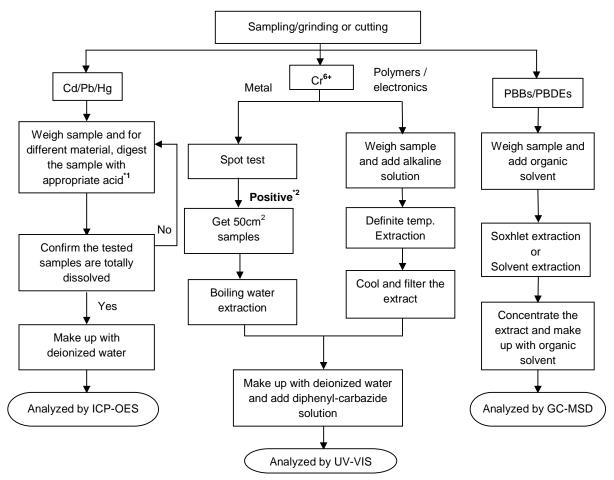
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008 & 2013



#### Remarks:

\*1: List of appropriate acid:

'''		
MATERIAL	ACID ADDED FOR DIGESTION	
Polymers	HNO <sub>3</sub> ,HCl,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>	
Metals	HNO <sub>3</sub> ,HCL,HF	
Electronics	HNO <sub>3</sub> ,HCL,H <sub>2</sub> O <sub>2</sub> ,HBF <sub>4</sub>	

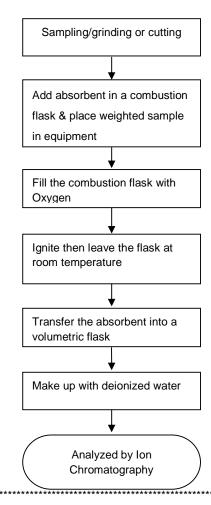
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 



End of report

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Number: 140100201SHA-002 **Test Report** 

Applicant: LITTELFUSE, INC. Date: Jan. 15, 2014

800 E. NORTHWEST HWY DES PLAINES, IL 60016

ATTN: J. CABILAN / A. CESISTA JR

Sample Description:

One (1) submitted sample said to be: White yarn

Part Description **GLASS YARN** Part Number 648150

Tests conducted:

As requested by the applicant, for details refer to attached page(s).

Conclusion:

Tested sample

Submitted sample Restriction of the use of certain hazardous substance in electrical Pass

and electronic equipment (RoHS Directive 2011/65/EU)

To be continued

Prepared and check by: For Intertek Testing Services Ltd., Shanghai

Authorized by: For Intertek testing services Ltd., Shanghai

Jonny Jing



## **Tests Conducted**

(I) Test Result Summary:

Testing Item	Result (ppm)
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	1100
Chlorine (CI)	ND
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: John Zeng / Leaf Liu

Date sample received: Jan. 07, 2014

Testing period: Jan. 07, 2014 To Jan. 09, 2014



#### **Tests Conducted**

## (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321-5 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321-4 Edition 1.0: 2013, by acid digestion until the tested sample was totally dissolved, and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

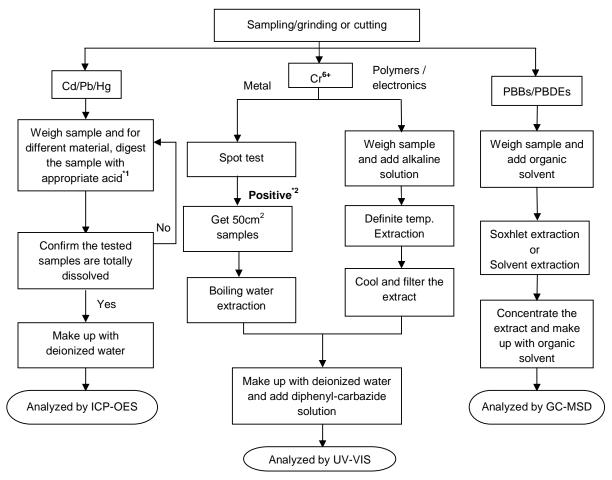
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008 & 2013



#### Remarks:

\*1: List of appropriate acid:

'''		
MATERIAL	ACID ADDED FOR DIGESTION	
Polymers	HNO <sub>3</sub> ,HCl,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>	
Metals	HNO <sub>3</sub> ,HCL,HF	
Electronics	HNO <sub>3</sub> ,HCL,H <sub>2</sub> O <sub>2</sub> ,HBF <sub>4</sub>	

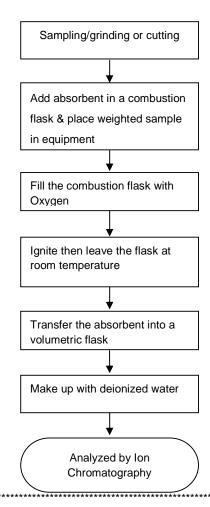
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 



End of report

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Joy Zhou

**Test Report** Number: 131000457SHA-004

Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST I DES PLAINES, IL 600 ATTN: J. CABILAN / A	16		Date	Oct. 29, 2013
Sample Descriptio One (1) s Part Desc Part Num	submitted sample said to be cription	: INK	( - GREEN 1907	***********	******
Tests conducted: As reque	sted by the applicant, for	details refer to	attached page(s).	*******	*******
Conclusion: <u>Tested sample</u> Submitted sampl		and maximur 2011/65/EU	ee to test method of IEC 62 n concentration limits quote	ed from RoHS Directive	Result Pass
***********	*********	******	***********	**********	To be continued
Prepared and che For Intertek Testi	eck by: ing Services Ltd., Shangh	ai	Authorized by: For Intertek testing service	ces Ltd., Shanghai	

Jonny Jing Manager



**Tests Conducted** 

## RoHS testing and Halogen content

(I) Test Result Summary:

Testing Item	Result (ppm)
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	·
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (CI)	700
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



## **Tests Conducted**

## (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

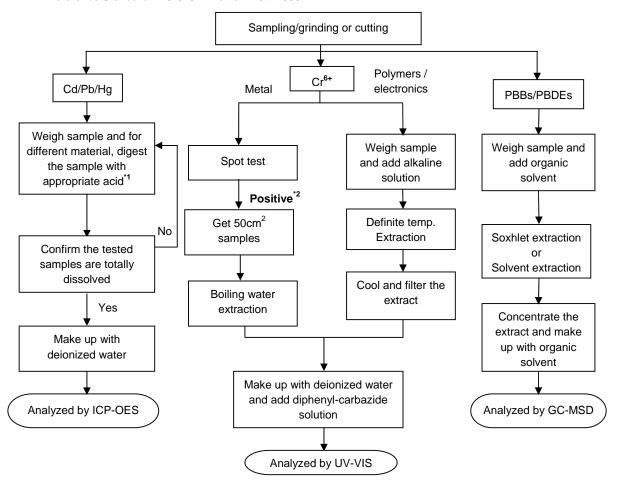
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCl,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3</sub> ,HCL,HF
Electronics	HNO <sub>3</sub> ,HCL,H <sub>2</sub> O <sub>2</sub> ,HBF <sub>4</sub>

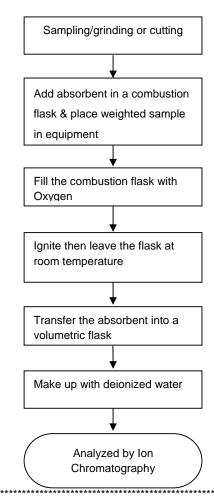
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

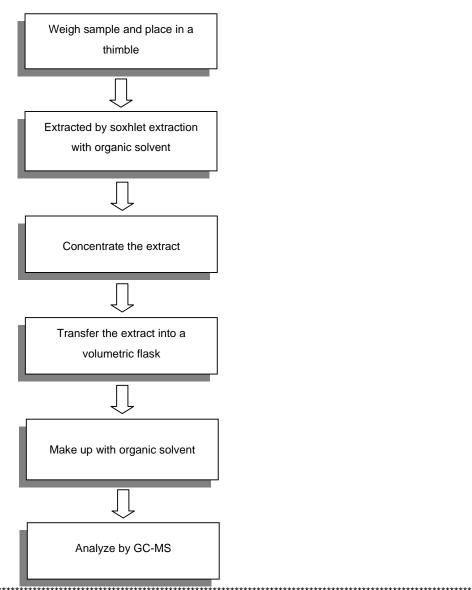
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

## 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

# ( ${\rm II}$ ) Test method:

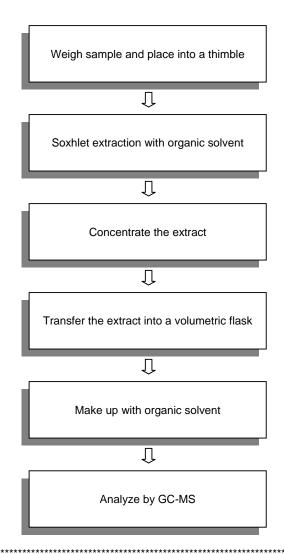
	Testing item	Testing method	Reporting limit
	HBCDD (hexabromocyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
·×××××××××××××××××××××××××××××××××××××			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

## 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013



**Tests Conducted** 



Picture was provided by applicant

End of report

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Joy Zhou

**Test Report** Number: 131000457SHA-001

Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST I DES PLAINES, IL 600 ATTN: J. CABILAN / A	16		Date:	Oct. 29, 2013
Sample Description One (1) s Part Desc Part Num	ubmitted sample said to be cription	: INK	- BLACK 902	*******	*******
Tests conducted: As reques	sted by the applicant, for	details refer to	attached page(s).	******	*******
Conclusion: Tested sample Submitted sample	Э	and maximum 2011/65/EU	e to test method of IEC 62321 n concentration limits quoted fro	om RoHS Directive	Result Pass
*******	**********	******	*************************	**********	To be continued
Prepared and che For Intertek Testi	eck by: ng Services Ltd., Shangh	ai	Authorized by: For Intertek testing services l	_td., Shanghai	

Jonny Jing Manager



**Tests Conducted** 

## RoHS testing and Halogen content

(I) Test Result Summary:

Testing Item	Result (ppm)		
Heavy Metal			
Cadmium (Cd) content	ND		
Lead (Pb) content	ND		
Mercury (Hg) content	ND		
Chromium VI (Cr <sup>6+</sup> ) content	ND		
Polybrominated Biphenyls (PBBs)			
Monobrominated Biphenyls (MonoBB)	ND		
Dibrominated Biphenyls (DiBB)	ND		
Tribrominated Biphenyls (TriBB)	ND		
Tetrabrominated Biphenyls (TetraBB)	ND		
Pentabrominated Biphenyls (PentaBB)	ND		
Hexabrominated Biphenyls (HexaBB)	ND		
Heptabrominated Biphenyls (HeptaBB)	ND		
Octabrominated Biphenyls (OctaBB)	ND		
Nonabrominated Biphenyls (NonaBB)	ND		
Decabrominated Biphenyl (DecaBB)	ND		
Polybrominated Diphenyl Ethers (PBDEs)			
Monobrominated Diphenyl Ethers (MonoBDE)	ND		
Dibrominated Diphenyl Ethers (DiBDE)	ND		
Tribrominated Diphenyl Ethers (TriBDE)	ND		
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND		
Pentabrominated Diphenyl Ethers (PentaBDE)	ND		
Hexabrominated Diphenyl Ethers (HexaBDE)	ND		
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND		
Octabrominated Diphenyl Ethers (OctaBDE)	ND		
Nonabrominated Diphenyl Ethers (NonaBDE)	ND		
Decabrominated Diphenyl Ether (DecaBDE)	ND		
Halogen Content			
Fluorine (F)	ND		
Chlorine (CI)	100		
Bromine (Br)	ND		
lodine (I)	ND		

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



## **Tests Conducted**

## (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

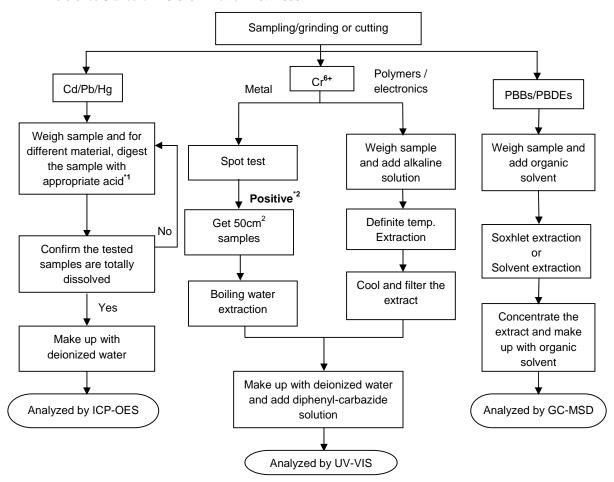
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCI,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCL,HF
Electronics	HNO <sub>3,</sub> HCL,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

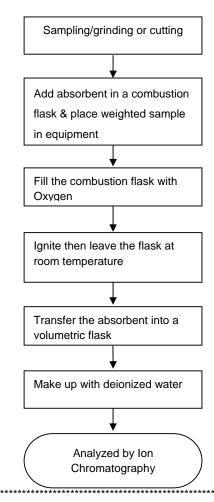
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

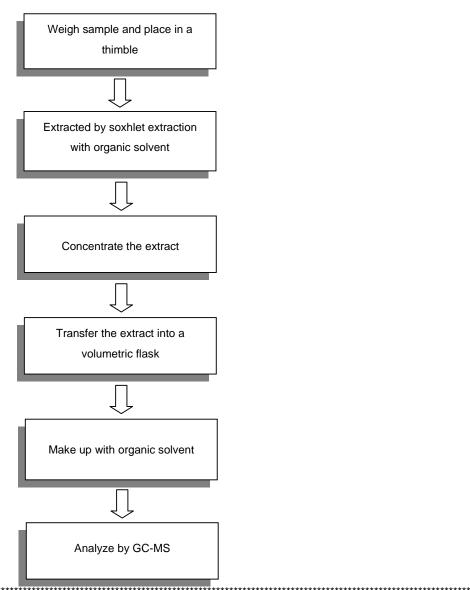
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

## 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

## (II) Test method:

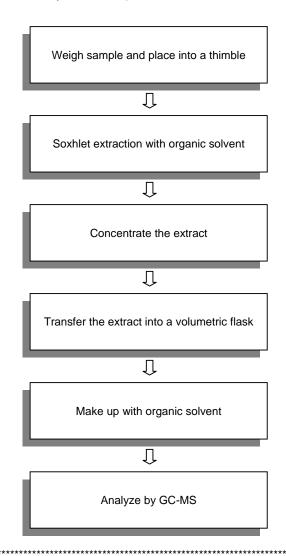
Testing item		Testing method	Reporting limit
HBCDD (hexabrom	locyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
***************************************			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

## 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013

resting period. Oct. 10, 2010 10 Oct. 23, 2010



**Tests Conducted** 



Picture was provided by applicant

End of report

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Joy Zhou

**Test Report** Number: 131000457SHA-007

Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST I DES PLAINES, IL 600 ATTN: J. CABILAN / A	16		Date:	Oct. 29, 2013	
Sample Description One (1) s Part Description Part Num	ubmitted sample said to be cription	: INK	( - RED 901	******	*****	
Tests conducted:  As requested by the applicant, for details refer to attached page(s).						
Conclusion: Tested sample Submitted sampl	e *********			C 62321 Edition 1.0: 2008 uoted from RoHS Directive	<u>Result</u> Pass	
					To be continued	
Prepared and che For Intertek Testi	eck by: ng Services Ltd., Shangh	ai	Authorized by: For Intertek testing s	ervices Ltd., Shanghai		

Jonny Jing Manager



**Tests Conducted** 

## RoHS testing and Halogen content

(I) Test Result Summary:

Testing Item	Result (ppm)		
Heavy Metal			
Cadmium (Cd) content	ND		
Lead (Pb) content	ND		
Mercury (Hg) content	ND		
Chromium VI (Cr <sup>6+</sup> ) content	ND		
Polybrominated Biphenyls (PBBs)			
Monobrominated Biphenyls (MonoBB)	ND		
Dibrominated Biphenyls (DiBB)	ND		
Tribrominated Biphenyls (TriBB)	ND		
Tetrabrominated Biphenyls (TetraBB)	ND		
Pentabrominated Biphenyls (PentaBB)	ND		
Hexabrominated Biphenyls (HexaBB)	ND		
Heptabrominated Biphenyls (HeptaBB)	ND		
Octabrominated Biphenyls (OctaBB)	ND		
Nonabrominated Biphenyls (NonaBB)	ND		
Decabrominated Biphenyl (DecaBB)	ND		
Polybrominated Diphenyl Ethers (PBDEs)			
Monobrominated Diphenyl Ethers (MonoBDE)	ND		
Dibrominated Diphenyl Ethers (DiBDE)	ND		
Tribrominated Diphenyl Ethers (TriBDE)	ND		
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND		
Pentabrominated Diphenyl Ethers (PentaBDE)	ND		
Hexabrominated Diphenyl Ethers (HexaBDE)	ND		
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND		
Octabrominated Diphenyl Ethers (OctaBDE)	ND		
Nonabrominated Diphenyl Ethers (NonaBDE)	ND		
Decabrominated Diphenyl Ether (DecaBDE)	ND		
Halogen Content			
Fluorine (F)	ND		
Chlorine (CI)	850		
Bromine (Br)	ND		
lodine (I)	ND		

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



#### **Tests Conducted**

### (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

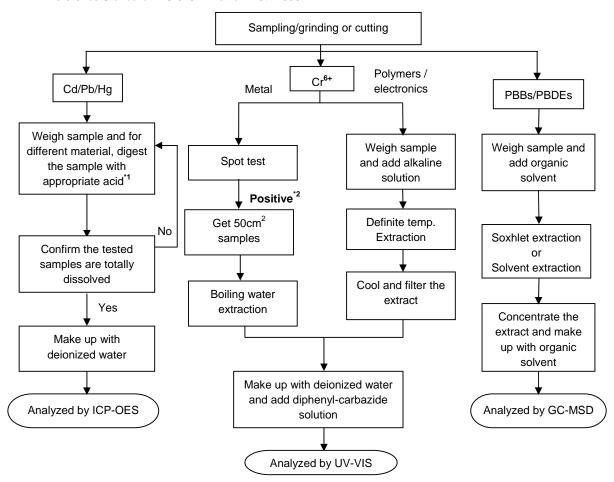
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCI,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCL,HF
Electronics	HNO <sub>3,</sub> HCL,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

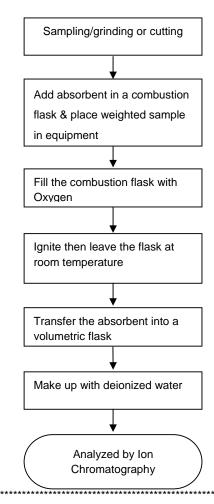
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

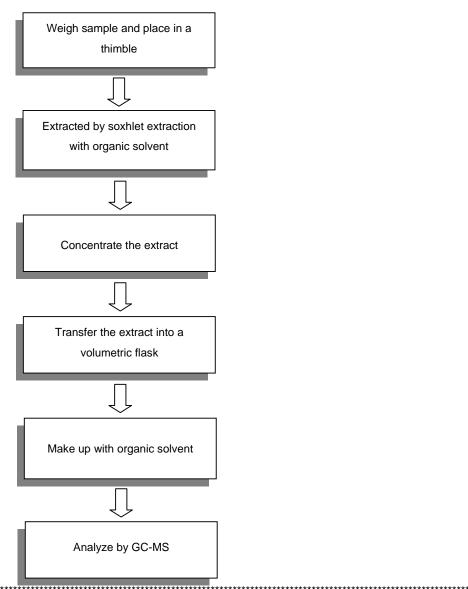
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

### 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

### (II) Test method:

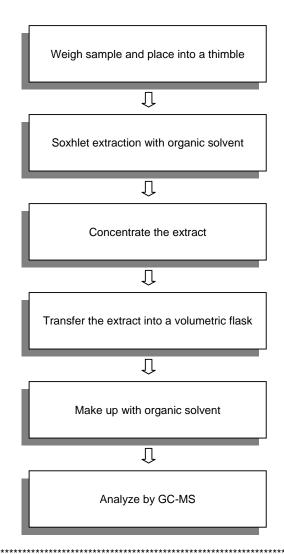
Testing item		Testing method	Reporting limit
HBCDD (hexabrom	locyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
***************************************			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

### 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013



**Tests Conducted** 



Picture was provided by applicant

End of report

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Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST H DES PLAINES, IL 600 ATTN: J. CABILAN / A	16	ΓA JR	Date:	Oct. 29, 2013
Sample Description One (1) so Part Description Part Num	ubmitted sample said to b cription ber	:	w ink INK - YELLOW 425903	******	*******
Tests conducted:		-1-4-11	for to all other description		
As reques	sted by the applicant, for o	details re	erer to attached page(s).	******	******
Conclusion: Tested sample Submitted sample	)		 ference to test method of IEC 62321 Edition ximum concentration limits quoted from Rol		Result Pass
***********	******************	******	*****************	*******	To be continued

Prepared and check by: For Intertek Testing Services Ltd., Shanghai Authorized by: For Intertek testing services Ltd., Shanghai Joy Zhou Jonny Jing Manager



**Tests Conducted** 

### RoHS testing and Halogen content

(I) Test Result Summary:

Testing Item	Result (ppm)
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (CI)	7050
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



#### **Tests Conducted**

### (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

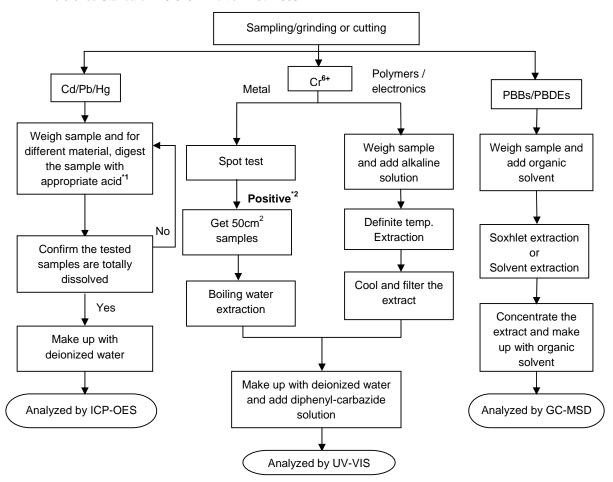
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

-11	
MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCl,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3</sub> ,HCL,HF
Electronics	HNO <sub>3</sub> ,HCL,H <sub>2</sub> O <sub>2</sub> ,HBF <sub>4</sub>

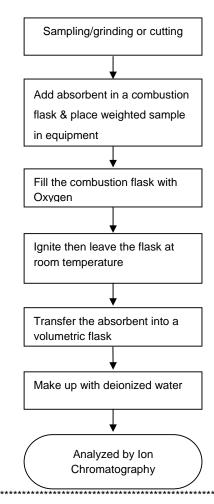
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

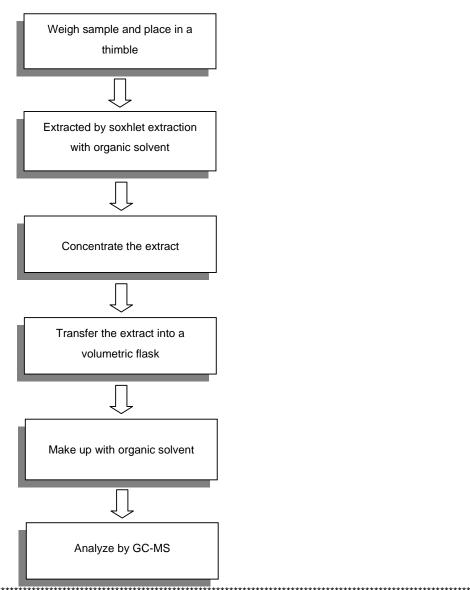
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

### 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

### (II) Test method:

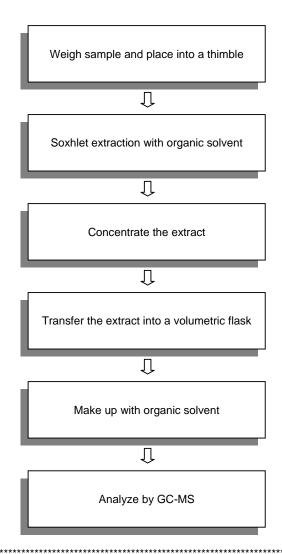
Testing item		Testing method	Reporting limit
HBCDD (hexabrom	locyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
*************************************			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

### 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013



**Tests Conducted** 



Picture was provided by applicant

End of report

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**Test Report** Number: 131000457SHA-002

Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST I DES PLAINES, IL 600 ATTN: J. CABILAN / A	16		Date:	Oct. 29, 2013
Sample Descriptio One (1) s Part Desc Part Num	ubmitted sample said to cription	: INK	BLUE 1904	*******	********
Tests conducted: As reques	sted by the applicant, for	details refer to	attached page(s).	********	******
Conclusion: <u>Tested sample</u> Submitted sample	Э		e to test method of IEC 62 n concentration limits quote		Result Pass
*******	*******	*******	*****	*********	To be continued
Prepared and che For Intertek Testi	eck by: ng Services Ltd., Shangh	nai	Authorized by: For Intertek testing service	ees Ltd., Shanghai	
Joy Zhou			Jonny Jing Manager		



**Tests Conducted** 

### RoHS testing and Halogen content

(I) Test Result Summary:

<u>Testing Item</u>	Result (ppm)
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (CI)	300
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



#### **Tests Conducted**

### (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	1 ppm
Polybrominated Biphenyls (PBBs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

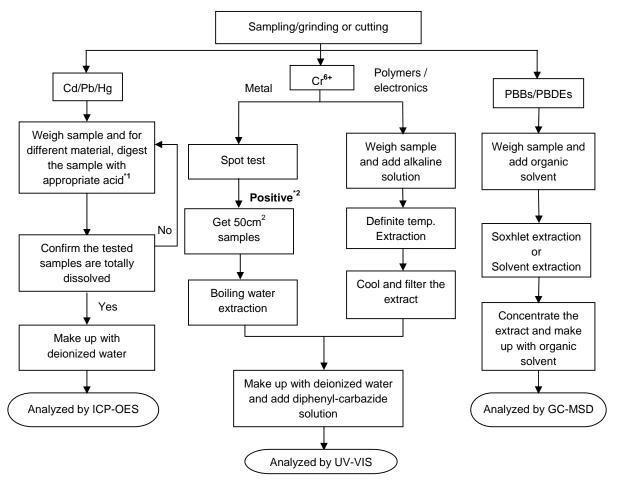
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCI,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCL,HF
Electronics	HNO <sub>3,</sub> HCL,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

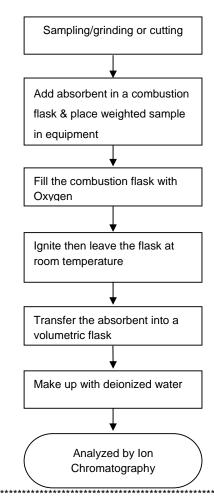
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

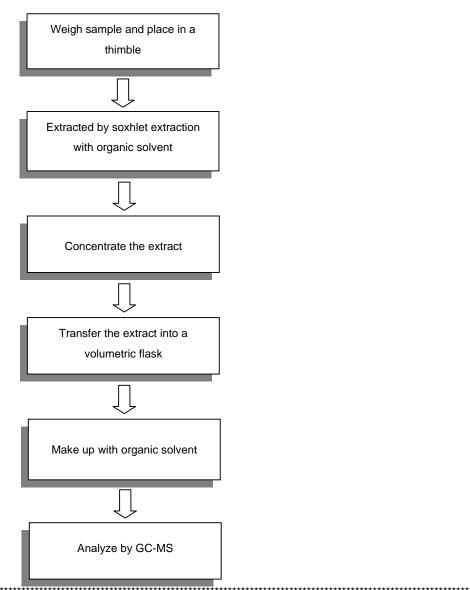
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

### 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

### (II) Test method:

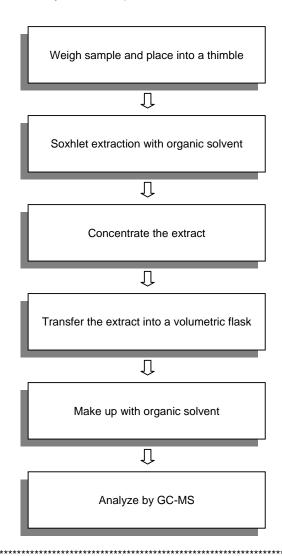
Testing item		Testing method	Reporting limit
HBCDD (hexabrom	locyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
*************************************			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

### 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013



**Tests Conducted** 



Picture was provided by applicant

End of report

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Prepared and check by: For Intertek Testing Services Ltd., Shanghai

Joy Zhou

**Test Report** Number: 131000457SHA-003

Applicant:	LITTELFUSE, INC. 800 E. NORTHWEST I DES PLAINES, IL 600 ATTN: J. CABILAN / A	HWY 16	: Oct. 29, 2013
Part Desc Part Num ************************************	ubmitted sample said to loription uber uber	be: <b>Brown ink</b> : INK - BROWN : 425906  details refer to attached page(s).	******
Conclusion: Tested sample Submitted sample	***********	Standard With reference to test method of IEC 62321 Edition 1.0: 2008 and maximum concentration limits quoted from RoHS Directive 2011/65/EU	**************************************
*******	***************************************	***************************************	To be continued

Authorized by:

Jonny Jing Manager

For Intertek testing services Ltd., Shanghai



**Tests Conducted** 

### RoHS testing and Halogen content

(I) Test Result Summary:

Testing Item	Result (ppm)
Heavy Metal	
Cadmium (Cd) content	ND
Lead (Pb) content	ND
Mercury (Hg) content	ND
Chromium VI (Cr <sup>6+</sup> ) content	ND
Polybrominated Biphenyls (PBBs)	
Monobrominated Biphenyls (MonoBB)	ND
Dibrominated Biphenyls (DiBB)	ND
Tribrominated Biphenyls (TriBB)	ND
Tetrabrominated Biphenyls (TetraBB)	ND
Pentabrominated Biphenyls (PentaBB)	ND
Hexabrominated Biphenyls (HexaBB)	ND
Heptabrominated Biphenyls (HeptaBB)	ND
Octabrominated Biphenyls (OctaBB)	ND
Nonabrominated Biphenyls (NonaBB)	ND
Decabrominated Biphenyl (DecaBB)	ND
Polybrominated Diphenyl Ethers (PBDEs)	·
Monobrominated Diphenyl Ethers (MonoBDE)	ND
Dibrominated Diphenyl Ethers (DiBDE)	ND
Tribrominated Diphenyl Ethers (TriBDE)	ND
Tetrabrominated Diphenyl Ethers (TetraBDE)	ND
Pentabrominated Diphenyl Ethers (PentaBDE)	ND
Hexabrominated Diphenyl Ethers (HexaBDE)	ND
Heptabrominated Diphenyl Ethers (HeptaBDE)	ND
Octabrominated Diphenyl Ethers (OctaBDE)	ND
Nonabrominated Diphenyl Ethers (NonaBDE)	ND
Decabrominated Diphenyl Ether (DecaBDE)	ND
Halogen Content	
Fluorine (F)	ND
Chlorine (CI)	9800
Bromine (Br)	ND
lodine (I)	ND

Remarks: ppm = parts per million = mg/kg

ND = not detected

Responsibility of Chemist: Dent Fang / Leaf Liu



### **Tests Conducted**

### (II) RoHS Requirement:

Restricted Substances	<u>Limits</u>
Cadmium (Cd) Content	0.01% (100ppm)
Lead (Pb) Content	0.1% (1000ppm)
Mercury (Hg) Content	0.1% (1000ppm)
Chromium VI (Cr <sup>6+</sup> ) Content	0.1% (1000ppm)
Polybrominated Biphenyls (PBBs)	0.1% (1000ppm)
Polybrominated Diphenyl Ethers (PBDEs)	0.1% (1000ppm)

The above limits were quoted from RoHS Directive 2011/65/EU for homogeneous material.

# (III) Test Method:

Testing Item	Testing Method	Reporting Limit
Cadmium (Cd) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Lead (Pb) content	With reference to IEC 62321 edition 1.0:2008 in clause 8/9/10, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Mercury (Hg) content	With reference to IEC 62321 edition 1.0:2008 in clause 7, by microwave digestion until the tested samples are totally dissolved and determined by ICP-OES.	2 ppm
Chromium VI (Cr <sup>6+</sup> ) content	With reference to IEC 62321 edition 1.0:2008 in annex C, by alkaline digestion and determined by UV-VIS Spectrophotometer.	
Polybrominated Biphenyls (PBBs)  With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.		5 ppm
Polybrominated Diphenyl Ethers (PBDEs)	With reference to IEC 62321 edition 1.0:2008 in Annex A, by solvent extraction and determined by GC-MSD and further HPLC confirmation when necessary.	5 ppm
Halogen Content	With reference to EN 14582:2007 by combustion flask with oxygen and determined by Ion Chromatography	50 ppm

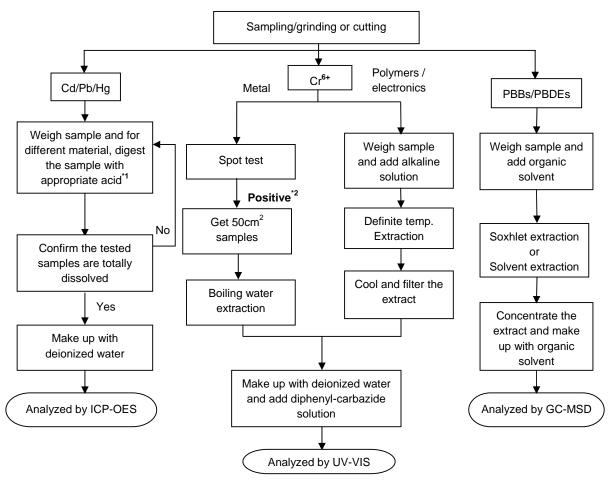
Remark: Reporting limit = Quantitation Limit of Analyze in Sample



**Tests Conducted** 

#### (IV) Measurement Flowchart:

Test for Cd/ Pb/ Hg/Cr (VI)/ PBBs/PBDEs Contents Reference Standard: IEC 62321 Edition 1.0: 2008



## Remarks:

\*1: List of appropriate acid:

MATERIAL	ACID ADDED FOR DIGESTION
Polymers	HNO <sub>3</sub> ,HCI,HF,H <sub>2</sub> O <sub>2</sub> ,H <sub>3</sub> BO <sub>3</sub>
Metals	HNO <sub>3,</sub> HCL,HF
Electronics	HNO <sub>3,</sub> HCL,H <sub>2</sub> O <sub>2,</sub> HBF <sub>4</sub>

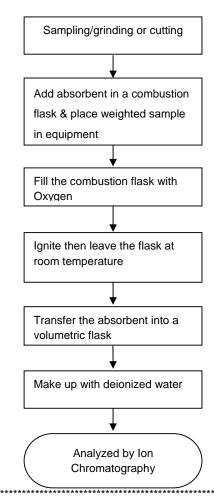
\*2: If the result of spot test is positive, Chromium (VI) would be determined as detected.



**Tests Conducted** 

(V) Measurement flowchart:

Test or Halogen content Reference standard: EN 14582





**Tests Conducted** 

#### 2. Phthalate content test

With reference to EN 14372 by Gas Chromatography-Mass Spectrometry (GC-MS) analysis.

Tested Compound	Result (%,w/w)	Client' requirement (%, w/w)
Di-butyl phthalate (DBP)	ND	-
Di(2-ethyl hexyl) phthalate(DEHP)	ND	-
Benzyl butyl phthalate (BBP)	ND	-
Sum of three phthalates	ND	0.1
Di-iso-butyl phthalate (DIBP)	ND	0.1

Remark : Detection Limit = 0.01%(w/w)

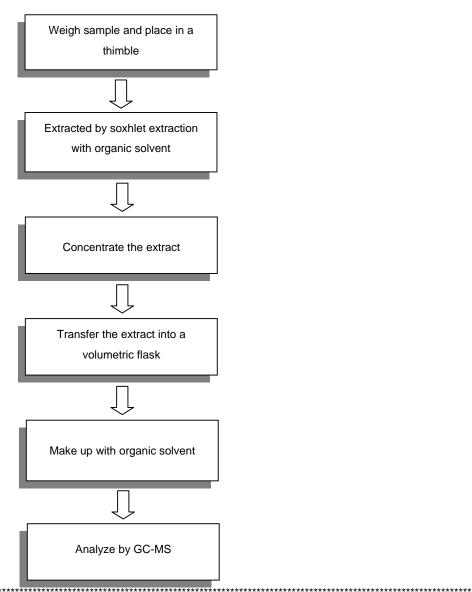
ND = Not Detected



**Tests Conducted** 

Measurement flowchart:

Test for **phthalate** content





**Tests Conducted** 

### 3. HBCDD content

# ( I )Test result summary:

Testing item	Result (ppm)
HBCDD (hexabromocyclododecane)	ND

Remarks: ppm = parts per million = mg/kg

ND = Not detected

# ( ${\rm II}$ ) Test method:

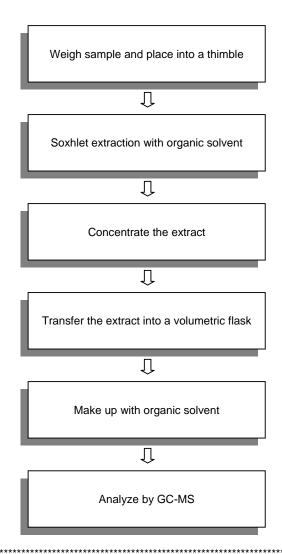
Testing item		Testing method	Reporting limit
HBCDD (hexabron	nocyclododecane)	With reference to US EPA 3540C, by solvent extraction and determined by GC-MS	10 ppm
***************************************			



**Tests Conducted** 

Measurement flowchart:

Test for HBCDD (hexabromocyclododecane) content





**Tests Conducted** 

### 4. Total Antimony (Sb) Content

As per client's request, acid digestion method was used and total Antimony content was determined by Inductively Coupled Argon Plasma Spectrometry.

Result: <10ppm

Remark: ppm = parts per million = mg/kg

Date sample received: Oct. 16, 2013

Testing period: Oct. 16, 2013 To Oct. 29, 2013



**Tests Conducted** 



Picture was provided by applicant

End of report

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