

Test Report

Report No.: A001E20161121002

Date: Dec.09,2016

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Applicant: Ruuvi Innovations Ltd.
Address: c/o Solventia Rauhankatu 20B20, 06100 Porvoo, Finland

Report on the submitted sample(s) said to be:

Sample Name: Open-Source Sensor Beacon
Sample Model: RuuviTag
Brand: Ruuvi
Manufacturer: Ruuvi Innovations Ltd.
Address: c/o Solventia Rauhankatu 20B20, 06100 Porvoo, Finland
Sample Received Date: Nov.21,2016
Testing Period: Nov.21,2016 to Nov.25,2016

Test Requested: Please refer to following page(s).

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

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

Tested by: Felix.Li

Liwenlong, Felix.Li

Test Engineer

Reviewed by: Jason

Jiangyuncheng, Jason

Laboratory Manager

Approved by: Lewis

Liulinwen, Lewis

Technical Director



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Test Requested:

As specified by client, to determine the Pb, Cd, Hg, Cr⁶⁺, PBBs, PBDEs content in the submitted sample in accordance with EU RoHS Directive 2011/65/EU(RoHS) and its amendment directives on XRF and Chemical Method.

Conclusion
Pass
Test Methods:

A: Screening by X-ray Fluorescence Spectrometry (XRF) :With reference to IEC 62321-3-1:2013 Ed 1.0 Screening – Lead, mercury, cadmium, total chromium and total bromine by X-ray fluorescence spectrometry

B: Chemical test:

Test Item	Test Method	Measuring Instrument	MDL
Cadmium (Cd)	IEC 62321-5:2013 Ed 1.0 Section 7	AAS/ICP-OES	2 mg/kg
Lead (Pb)	IEC 62321-5:2013 Ed 1.0 Section 7	AAS/ICP-OES	2 mg/kg
Mercury (Hg)	IEC 62321-4:2013 Ed 1.0 Section 7	ICP-OES	2 mg/kg
Non-metal Hexavalent Chromium (Cr ⁶⁺)	IEC 62321:2008 Ed 1.0 Annex C	UV-Vis	1 mg/kg
Metal Hexavalent Chromium (Cr ⁶⁺)	IEC 62321:2008 Ed 1.0 Annex B	UV-Vis	/
PBBs/PBDEs	IEC 62321:2008 Ed 1.0 Annex A	GC-MS	5 mg/kg

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Test Results:
A、EU RoHS Directive 2011/65/EU and its amendment directives on XRF

Seq. No.	Tested Part(s)	Results(mg/kg)				
		Cd	Pb	Hg	Cr	Br
Bluetooth sensor						
1	White plastic cover（shell）	BL	BL	BL	BL	BL
2	Black seal ring（shell）	BL	BL	BL	BL	BL
3	White dust sheet（shell）	BL	BL	BL	BL	BL
4	Chip Transistor	BL	BL	BL	BL	BL
5	Chip capacitor	BL	BL	BL	BL	BL
6	Chip IC	BL	X*	BL	BL	BL
7	Chip crystal (A636C)	BL	OL*	BL	BL	BL
8	Microphone	BL	BL	BL	BL	BL
9	Chip diode	BL	BL	BL	BL	BL
10	Chip IC (1610A)	BL	BL	BL	BL	BL
11	Chip crystal	BL	BL	BL	BL	BL
12	Chip LED	BL	BL	BL	BL	BL
13	Chip resistor	BL	BL	BL	BL	BL
14	Metal sheet	BL	BL	BL	X*	-
15	Solder resist (PCB board)	BL	BL	BL	BL	X*
16	Substrate (PCB board)	BL	BL	BL	BL	X*
17	Copper foil (PCB board)	BL	BL	BL	BL	-
18	Tin solder (PCB board)	BL	BL	BL	BL	-
19	Black plastic button (touch switch)	BL	BL	BL	BL	BL
20	Metal shell (touch switch)	BL	BL	BL	X*	-
21	Shrapnel (touch switch)	BL	BL	BL	X*	-
22	Scotch tape (touch switch)	BL	BL	BL	BL	BL
23	White plastic base (touch switch)	BL	BL	BL	BL	BL

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Element	Unit	Non-metal	Metal	Composite Material
Cd	mg/kg	$BL \leq 70 - 3\sigma < X$ $< 130 + 3\sigma \leq OL$	$BL \leq 70 - 3\sigma < X$ $< 130 + 3\sigma \leq OL$	$BL \leq 50 - 3\sigma < X$ $< 150 + 3\sigma \leq OL$
Pb	mg/kg	$BL \leq 700 - 3\sigma < X$ $< 1300 + 3\sigma \leq OL$	$BL \leq 700 - 3\sigma < X$ $< 1300 + 3\sigma \leq OL$	$BL \leq 500 - 3\sigma < X$ $< 1500 + 3\sigma \leq OL$
Hg	mg/kg	$BL \leq 700 - 3\sigma < X$ $< 1300 + 3\sigma \leq OL$	$BL \leq 700 - 3\sigma < X$ $< 1300 + 3\sigma \leq OL$	$BL \leq 500 - 3\sigma < X$ $< 1500 + 3\sigma \leq OL$
Cr	mg/kg	$BL \leq 700 - 3\sigma < X$	$BL \leq 700 - 3\sigma < X$	$BL \leq 500 - 3\sigma < X$
Br	mg/kg	$BL \leq 300 - 3\sigma < X$	-	$BL \leq 250 - 3\sigma < X$

Note: BL= Below Limit

OL= Over limited

X= Inconclusive

“-“= Not regulated

*= Scanning by XRF and detected by chemical method. The test results of chemical method please refer to next pages.

Remark:

- Results were obtained by XRF for primary scanning, and further chemical testing by ICP (for Cd, Pb, Hg), UV-Vis (for Cr(VI)) and GC-MS (for PBBs, PBDEs) are recommended to be performed, if the concentration exceeds the above warning value according to IEC 62321-3-1:2013 Ed 1.0.
- The XRF scanning test for RoHS elements – The reading may be different to the actual content in the sample be of non-uniformity composition.
- The maximum permissible limit is quoted from the document 2005/618/EC amending RoHS directive 2011/65/EU:

RoHS Restricted Substances	Maximum Concentration Value (mg/kg) (by weight in homogenous materials)
Cadmium (Cd)	100
Lead (Pb)	1000
Mercury (Hg)	1000
Hexavalent Chromium (Cr(VI))	1000
Polybrominated biphenyls (PBBs)	1000
Polybrominated diphenylethers (PBDEs)	1000

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Disclaimers:

This XRF Scanning report is for reference purposes only. The applicant shall make its/his/her own judgment as to whether the information provided in this XRF screening report is sufficient for its/his/her purposes.

The result shown in this XRF scanning report will differ based on various factors, including but not limited to, the sample size, thickness, area, surface flatness, equipment parameters and matrix effect (e.g. plastic, rubber, metal, glass, ceramic etc.). Further wet chemical pre-treatment with relevant chemical equipment analysis are required to obtain quantitative data.

B、The Test Results of Chemical Method:

1) The Test Results of Pb

Test Item(s)	Unit	Result(s)	
		6	7
Lead(Pb)	mg/kg	3574*	46417*

Note: N.D. = Not Detected or less than MDL

mg/kg = ppm= parts per million

MDL = Method Detection Limit

* As claimed by the material declaration submitted by the client, the materials of the sample No.6 and No.7 are ceramic, according to the RoHS 2011/65 / EU, lead in the ceramic electronic components is exempted.

 2)The Test Results of metal Cr⁶⁺

Test Item(s)	MDL	Result(s)			Limit
		14	20	21	
Hexavalent Chromium (Cr ⁶⁺)	**	Negative	Negative	Negative	#

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Note:

- Negative = Absence of Cr(VI) on the tested areas
- MDL = Method Detection Limit

- ** = Spot-test:

Negative = Absence of Cr(VI) coating/ surface layer

Positive = Presence of Cr(VI) coating/ surface layer

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

Boiling-water-extraction:

Negative = Absence of Cr(VI) coating/ surface layer

The detected concentration in boiling- water-extraction solution is less than 0.02 mg/kg with 50cm² sample surface areas.

Positive = Presence of Cr(VI) coating/ surface layer

The detected concentration in boiling- water-extraction solution is equal or greater than 0.02 mg/kg with 50cm² sample surface areas.

- # =

Negative indicates the absence of Cr(VI) on the tested areas and result be regarded as no conflict with RoHS requirement.

Positive indicates the presence of Cr(VI) on the tested areas.

Storage conditions and production date of the tested sample are unavailable and thus result of Cr(VI) represent status of the sample at the time of testing.

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4) The Test Results of PBBs & PBDEs

Unit:mg/kg

Item(s)	MDL	Result(s)		Limit
		15	16	
Polybrominated Biphenyls (PBBs)				
Monobromobiphenyl	5	N.D.	N.D.	Total PBBs Content <1000
Dibromobiphenyl	5	N.D.	N.D.	
Tribromobiphenyl	5	N.D.	N.D.	
Tetrabromobiphenyl	5	N.D.	N.D.	
Pentabromobiphenyl	5	N.D.	N.D.	
Hexabromobiphenyl	5	N.D.	N.D.	
Heptabromobiphenyl	5	N.D.	N.D.	
Octabromobiphenyl	5	N.D.	N.D.	
Nonabromodiphenyl	5	N.D.	N.D.	
Decabromodiphenyl	5	N.D.	N.D.	
Total content	/	N.D.	N.D.	
Polybrominated Diphenylethers (PBDEs)				
Monobromodiphenyl ether	5	N.D.	N.D.	Total PBDEs Content <1000
Dibromodiphenyl ether	5	N.D.	N.D.	
Tribromodiphenyl ether	5	N.D.	N.D.	
Tetrabromodiphenyl ether	5	N.D.	N.D.	
Pentabromodiphenyl ether	5	N.D.	N.D.	
Hexabromodiphenyl ether	5	N.D.	N.D.	
Heptabromodiphenyl ether	5	N.D.	N.D.	
Octabromodiphenyl ether	5	N.D.	N.D.	
Nonabromodiphenyl ether	5	N.D.	N.D.	
Decabromodiphenyl ether	5	N.D.	N.D.	
Total content	/	N.D.	N.D.	
Conclusion	/	Pass	Pass	/

Note: N.D. = Not Detected or less than MDL
 mg/kg = ppm= parts per million
 MDL = Method Detection Limit

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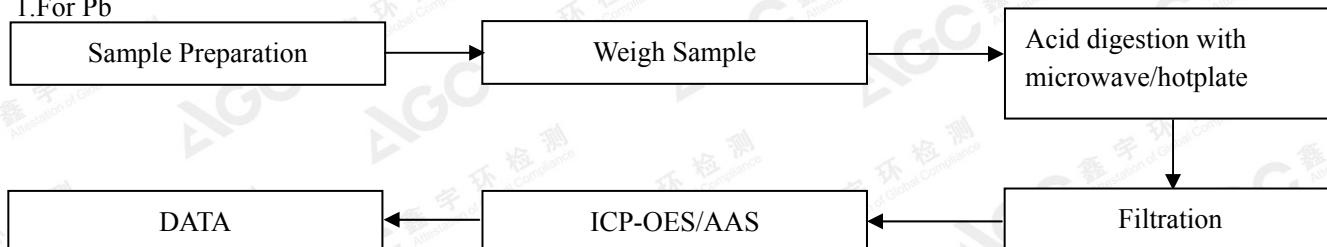
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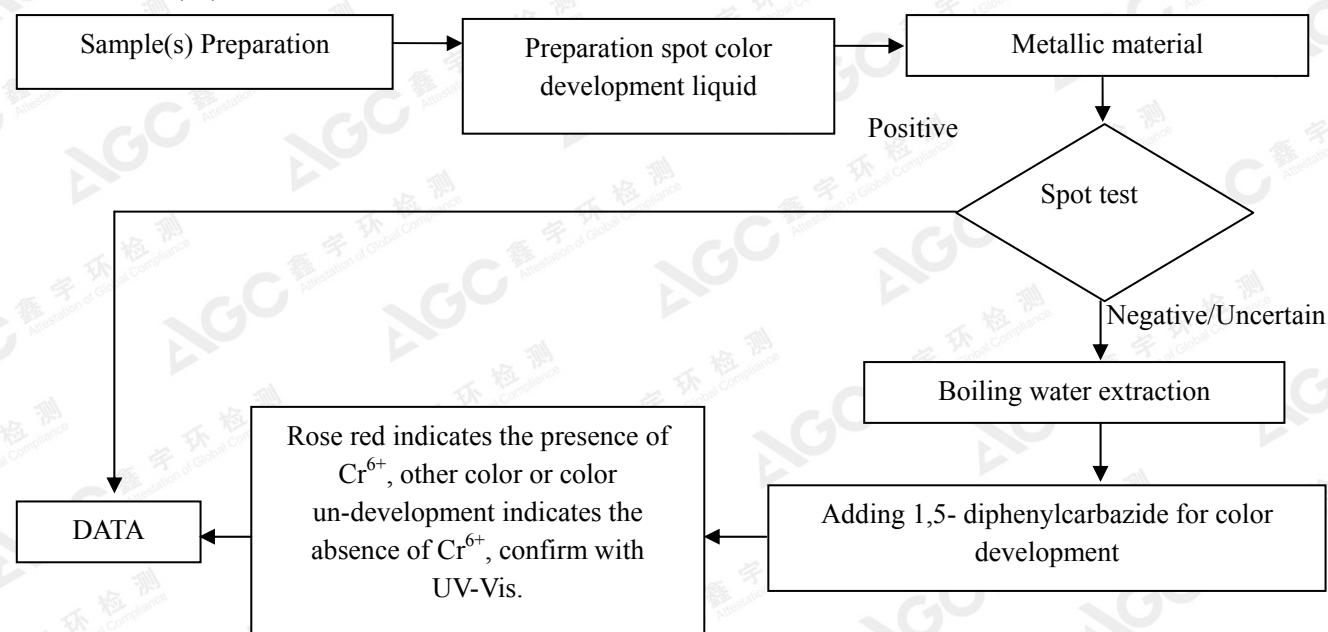
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Test Flow Chart

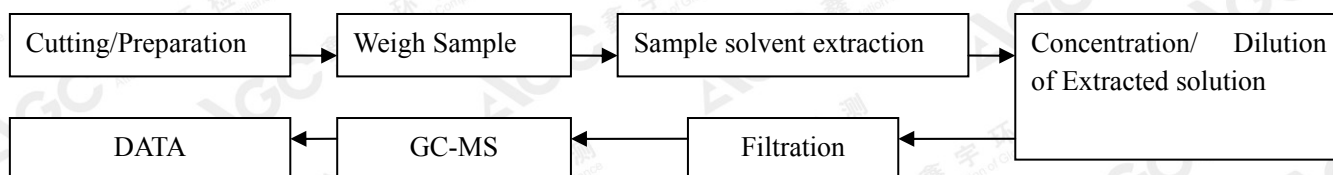
1.For Pb



2.For metal Cr(VI)



3.For PBBs & PBDEs



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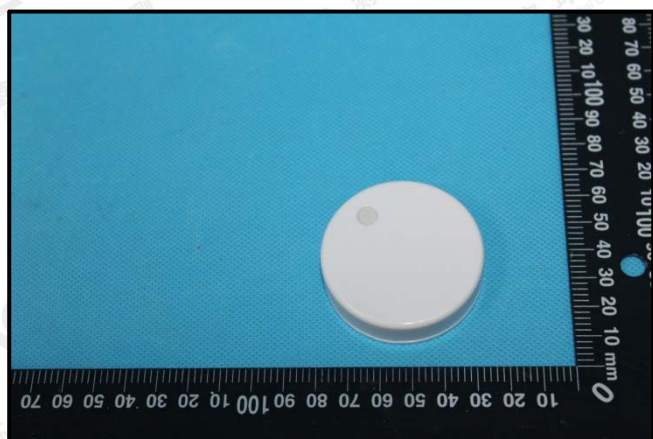
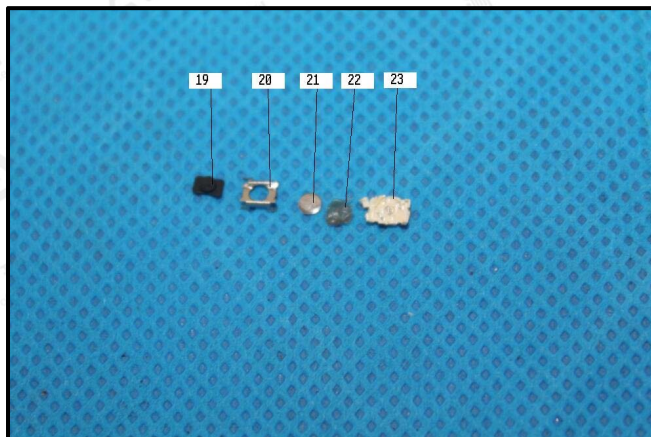
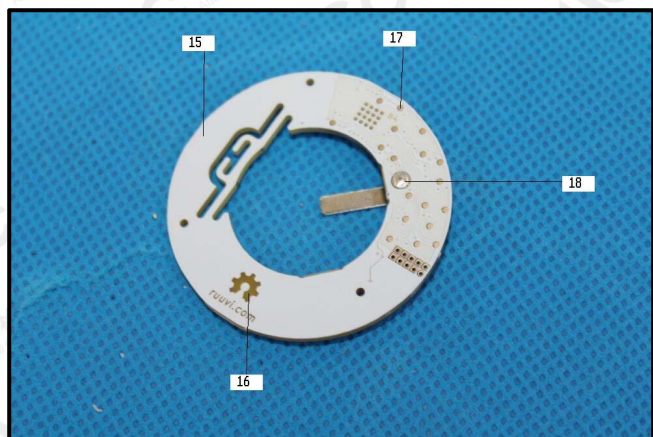
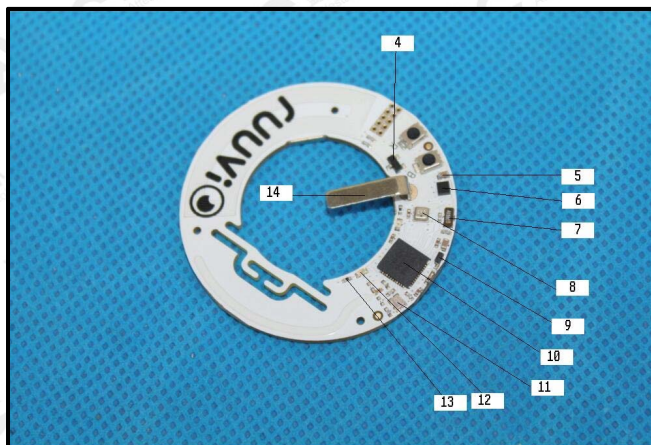
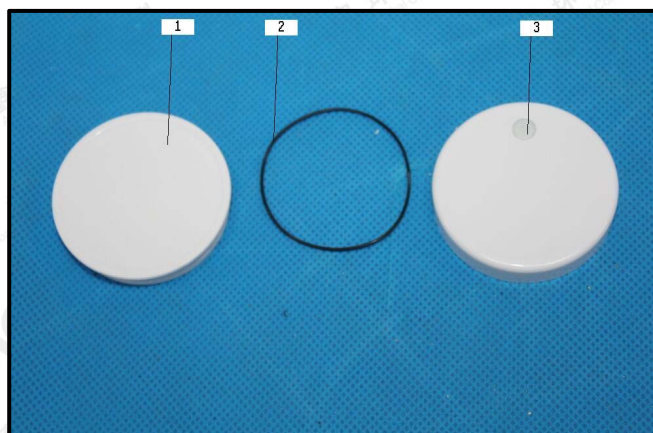
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The photo of the sample



AGC authenticate the photo only on original report

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