

Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 1 of 13

Applicant: Ruuvi Innovations Ltd.
Address: C/O KT, PL22, 11101 Riihimäki, Finland.
Test site: 1,6/F, Building 2, No. 1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Baoan District, Shenzhen, Guangdong, China

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 KT, PL22, 11101 Riihimäki, Finland.
Sample Received Date: Sep.23, 2019
Testing Period: Sep.23, 2019 to Sep.30, 2019
Test Requested: Please refer to following page(s).
Test Method: Please refer to following page(s).
Test Result: Please refer to following page(s).

Approved by: 

Liulinwen, Lewis

Technical Director



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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page2 of 13

Test Requested:

1. As specified by client, to determine Lead(Pb), Cadmium(Cd), Mercury(Hg) content in the submitted sample in accordance with European Directive 2006/66/EC and its amendments 2013/56/EU on batteries and accumulators.
- 2.As specified by client, to determine the Pb, Cd, Hg, Cr⁶⁺, PBBs, PBDEs, DBP, BBP, DEHP, DIBP content in the submitted sample in accordance with Directive 2011/65/EU (RoHS) and its amendment directive (EU) 2015/863 on XRF and Chemical Method.

Conclusion

Pass

Pass

1. Test result of Lead(Pb), Cadmium(Cd), Mercury(Hg)

Unit: %,w/w

Test item(s)	Test Method/ Equipment	MDL	Result(s)	Limit
			21	
Lead (Pb)	IEC 62321-5:2013 ICP-OES	0.0005	0.0016	—
Cadmium (Cd)		0.0005	N.D.	0.002
Mercury (Hg)	IEC 62321-4: 2013+A1:2017 ICP-OES	0.0001	N.D.	0.0005
Conclusion	/	/	Pass	/

Note:

- N.D.=Not Detected(less than method detection limit)
- MDL = Method Detection Limit
- “—” =Not regulated
- As specified by client, only test the designated sample.

Sample Description:

21	Button battery
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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 3 of 13

2. Test Methods:

A: Screening by X-ray Fluorescence Spectrometry (XRF) : With reference to IEC 62321-3-1:2013 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	ICP-OES	2 mg/kg
Lead (Pb)	IEC 62321-5:2013	ICP-OES	2 mg/kg
Mercury (Hg)	IEC 62321-4: 2013+A1:2017	ICP-OES	2 mg/kg
Non-metal Hexavalent Chromium (Cr ⁶⁺)	IEC 62321-7-2:2017	UV-Vis	1 mg/kg
Metal Hexavalent Chromium (Cr ⁶⁺)	IEC 62321-7-1:2015	UV-Vis	/
PBBs/PBDEs	IEC 62321-6:2015	GC-MS	5 mg/kg
Di-iso-butyl phthalate (DIBP)	IEC 62321-8:2017	GC-MS	50 mg/kg
Dibutyl phthalate (DBP)		GC-MS	50 mg/kg
Butylbenzyl phthalate (BBP)		GC-MS	50 mg/kg
Di-(2-ethylhexyl) Phthalate (DEHP)		GC-MS	50 mg/kg

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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 4 of 13

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
1	White plastic shell(Outer shell)	BL	BL	BL	BL	BL
2	White dustproof net(Outer shell)	BL	BL	BL	BL	BL
3	Black seal ring(Outer shell)	BL	BL	BL	BL	BL
4	Transparent label(Outer shell)	BL	BL	BL	BL	BL
5	Black foam (Outer shell)	BL	BL	BL	BL	BL
6	High-frequency crystal oscillator(Main board)	BL	BL	BL	BL	BL
7	Chip LED(Main board)	BL	BL	BL	BL	BL
8	Chip capacitor(Main board)	BL	BL	BL	BL	BL
9	Chip resistor(Main board)	BL	BL	BL	BL	BL
10	Chip IC(Main board)	BL	BL	BL	BL	BL
11	Environmental sensor (Main board)	BL	BL	BL	X*	BL
12	Low frequency oscillator (Main board)	BL	OL	BL	BL	BL
13	Chip triode(Main board)	BL	BL	BL	BL	BL
14	Battery connector (Main board)	BL	BL	BL	X*	N/A
15	PCB(Main board)	BL	BL	BL	BL	X*
16	Tin solder(Main board)	BL	BL	BL	BL	N/A
17	Black plastic switch button(Switch)	BL	BL	BL	BL	BL
18	Silver metal shell(Switch)	BL	BL	BL	X*	N/A
19	Metal shrapnel(Switch)	BL	BL	BL	X*	N/A
20	White plastic seat(Switch)	BL	BL	BL	BL	X*

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Date: Oct.09, 2019

Page 5 of 13

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	$BL \leq 300 - 3\sigma < X$	N/A	$BL \leq 250 - 3\sigma < X$

Note: BL= Below Limit

OL= Over limited

X= Inconclusive

“N/A”= Not applicable

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

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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 6 of 13

Remark:

- i 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.
- ii The XRF scanning test for RoHS elements – The reading may be different to the actual content in the sample be of non-uniformity composition.
- iii The maximum permissible limit is quoted from RoHS directive 2011/65/EU and its amendment directive (EU) 2015/863:

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
Di-iso-butyl phthalate (DIBP)	1000
Dibutyl phthalate (DBP)	1000
Butylbenzyl phthalate (BBP)	1000
Di-(2-ethylhexyl) Phthalate (DEHP)	1000

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.

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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 7 of 13

B、The Test Results of Chemical Method:

1) The Test Results of non-metal Cr⁶⁺

Test Item(s)	Unit	Result(s)	Limit
		11	
Hexavalent Chromium(Cr ⁶⁺)	mg/kg	N.D.	1000

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

2) The Test Results of metal Cr⁶⁺

Test Item(s)	MDL	Result(s)			Limit
		14	18	19	
Hexavalent Chromium (Cr ⁶⁺)	See note	Negative	Negative	Negative	#

Note:

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

Number	Colorimetric result (Cr(VI) concentration)	Qualitative result
1	The sample solution is < the 0,10 µg/cm ² equivalent comparison standard solution	The sample is negative for Cr(VI) – The Cr(VI) concentration is below the limit of quantification. The coating is considered a non-Cr(VI) based coating.
2	The sample solution is ≥ the 0,10 µg/cm ² and ≤ the 0,13 µg/cm ² equivalent comparison standard solutions	The result is considered to be inconclusive – Unavoidable coating variations may influence the determination.
3	The sample solution is > the 0,13 µg/cm ² equivalent comparison standard solution	The sample is positive for Cr(VI) – The Cr(VI) concentration is above the limit of quantification and the statistical margin of error. The sample coating is considered to contain Cr(VI).

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No.18 C

Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 8 of 13

- # = Negative indicates the absence of Cr(VI) on the tested areas concentration is below the limit of quantification.
The coating is considered a non-Cr(VI) based coating.
Uncertainty indicates the absence of Cr(VI) on the tested areas unavoidable coating variations may influence the determination.
Positive indicates the presence of Cr(VI) on the tested areas concentration is above the limit of quantification and the statistical margin of error. The sample coating is considered to contain Cr(VI).
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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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 9 of 13

3) The Test Results of PBBs & PBDEs

Unit:mg/kg

Item(s)	MDL	Result(s)		Limit
		15	20	
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.	
PolybrominatedDiphenylethers (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 = parts per million
MDL = Method Detection Limit

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Test Report

Report No.: AGC-00941-19-09-01-001

Date: Oct.09, 2019

Page 10 of 13

4) Test result of DBP, BBP, DEHP, DIBP content

Unit: mg/kg

Seq. No.	Limit Test item	DIBP	DBP	BBP	DEHP	Conclusion
		1000	1000	1000	1000	
1		N.D.	N.D.	N.D.	N.D.	Pass
2		N.D.	N.D.	N.D.	N.D.	Pass
3		N.D.	N.D.	N.D.	N.D.	Pass
4		N.D.	N.D.	N.D.	N.D.	Pass
5		N.D.	N.D.	N.D.	N.D.	Pass
6		N.D.	N.D.	N.D.	N.D.	Pass
7		N.D.	N.D.	N.D.	N.D.	Pass
8		N.D.	N.D.	N.D.	N.D.	Pass
9		N.D.	N.D.	N.D.	N.D.	Pass
10		N.D.	N.D.	N.D.	N.D.	Pass
11		N.D.	N.D.	N.D.	N.D.	Pass
12		N.D.	N.D.	N.D.	N.D.	Pass
13		N.D.	N.D.	N.D.	N.D.	Pass
15		N.D.	N.D.	N.D.	N.D.	Pass
17		N.D.	N.D.	N.D.	N.D.	Pass
20		N.D.	N.D.	N.D.	N.D.	Pass

Note: 1. MDL = Method Detection Limit
2. N.D. = Not Detected (less than method detection limit)

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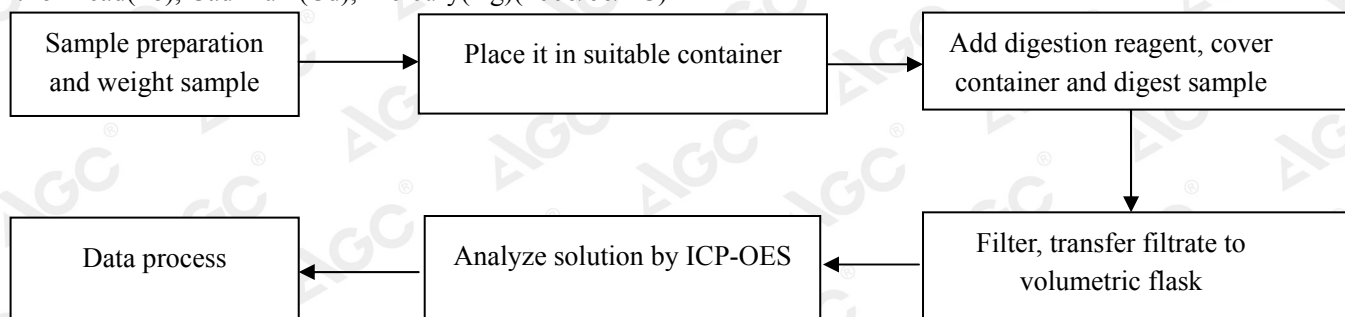
Page 11 of 13

Remark:
Exemption

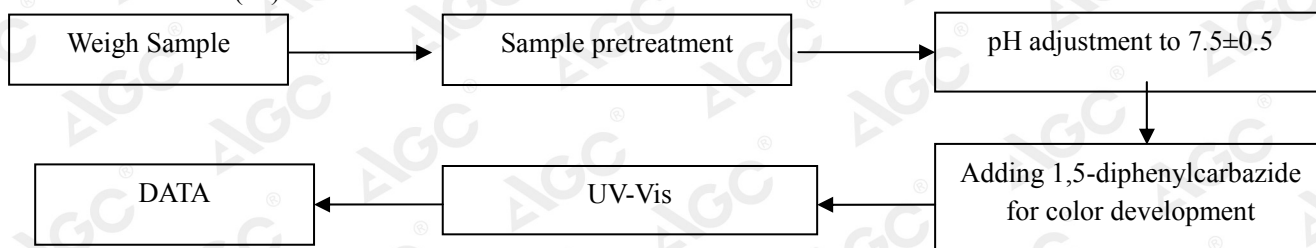
Seq. No	Exemption clause	Content
12	7(c)-I	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound

Test Flow Chart

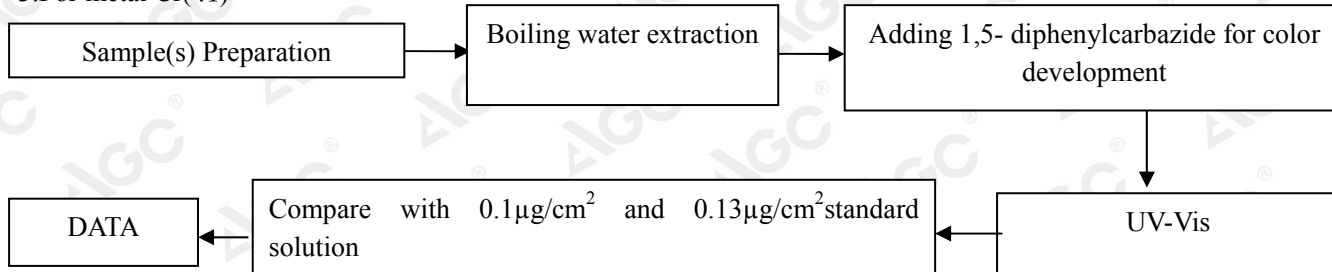
1. For Lead(Pb), Cadmium(Cd), Mercury(Hg)(2006/66/EC)



2. For non-metal Cr(VI)



3. For metal Cr(VI)



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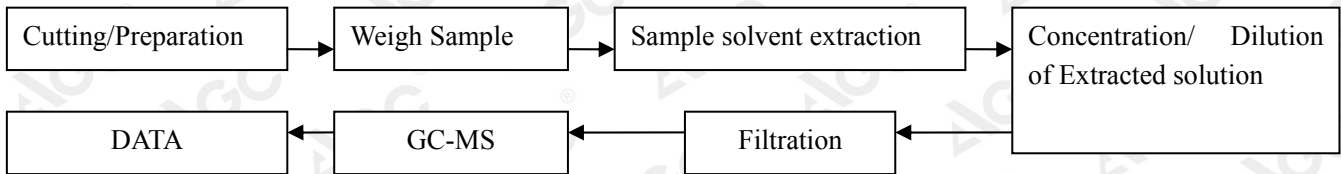
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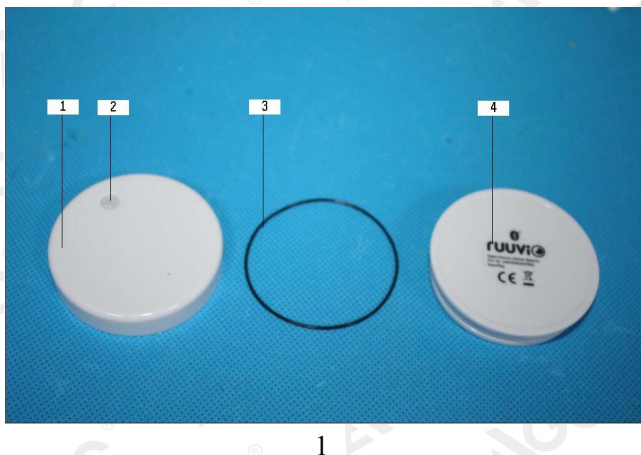
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Page 12 of 13

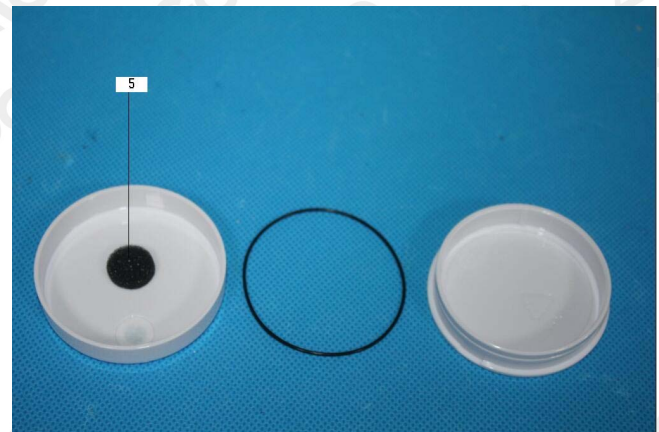
4. For PBBs, PBDEs, DBP, BBP, DEHP, DIBP



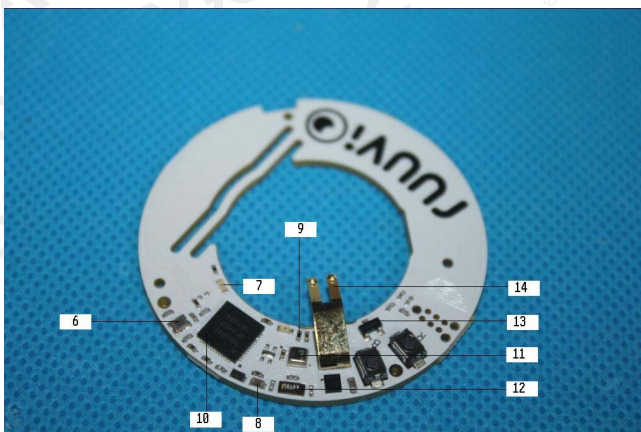
The photo of the sample



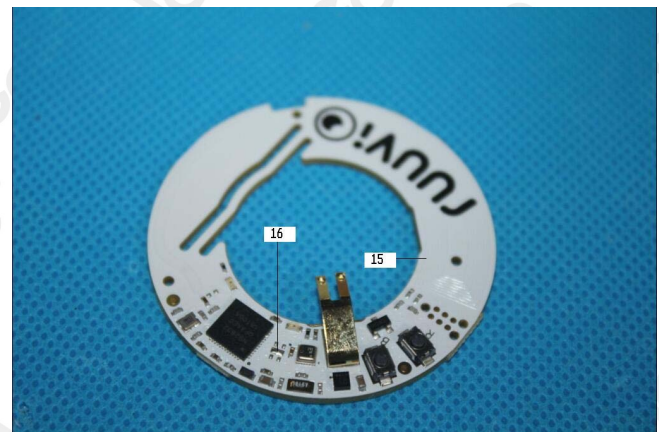
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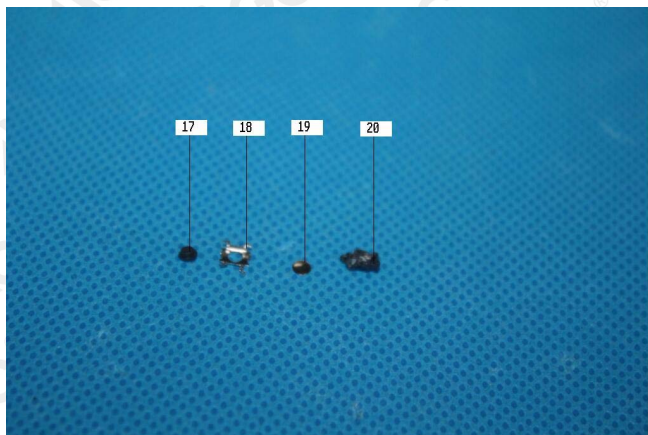
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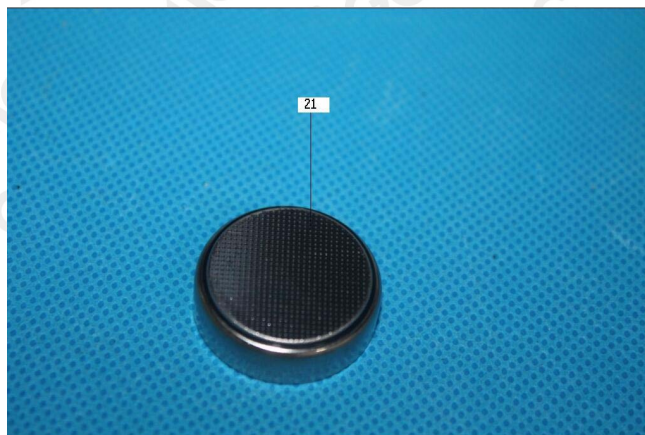
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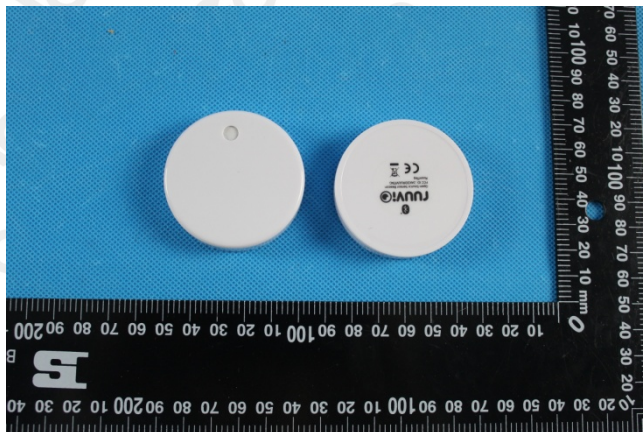
Page13 of 13



5



6



AGC-00941-19-09-01-001

AGC authenticate the photo only on original report

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