



Test Report

Applicant : Arduino S.r.l.
Address : Via Andrea Appiani, 25, 20900 MONZA(Italy)

Manufacturer : Arduino S.r.l.
Address : Via Andrea Appiani, 25, 20900 MONZA(Italy)

Sample Name : Arduino Nano ESP32, Arduino Nano ESP32 with headers
Sample Model : ABX00092, ABX00083
Sample Brand : Arduino

Received Date : October 8, 2023
Testing Period : October 8, 2023 ~ October 12, 2023

Test Requested : As specified by client, with reference to RoHS Directive 2011/65/EU and (EU) 2015/863 to determine the Lead (Pb), Cadmium (Cd), Mercury (Hg), Hexavalent Chromium (Cr(VI)), Polybrominated biphenyls (PBBs), Polybrominated diphenyl ethers (PBDEs), Dibutyl phthalate (DBP), Benzyl butyl phthalate (BBP), Bis(2-ethylhexyl) phthalate (DEHP) and Diisobutyl phthalate (DIBP) content in the submitted sample.

Test Method : Please refer to next page.
Test Results : Please refer to next page(s).
Conclusion : Based on the performed tests on submitted sample(s), the results Comply with the RoHS Directive 2011/65/EU and (EU) 2015/863.

CCIC (Shenzhen) Environmental Service Co., Ltd.

Completed by:

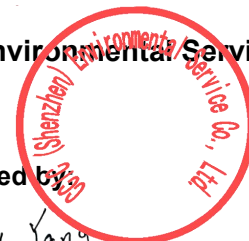
Liu fangzi
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Reviewed by:

Zhu meijuan
Zhu meijuan

Approved by:

Renyou.Yang
Renyou.Yang





1. Test Method(s):

As requested by the client, Reference to IEC 62321-3-1:2013 (Ed1.0) Procedures for the screening analysis of Lead (Pb), Cadmium (Cd), Mercury (Hg), total Chromium (Cr), and Bromine (Br) by XRF. If the screening analysis results exceed the screening limits of IEC 62321-3-1:2013 (Ed1.0) Annex A, use the chemical methods for testing.

Table1 IEC 62321-3-1:2013 (Ed1.0) Annex A screening limits of XRF (mg/kg)

Element	Polymer	Metal	Composite Materials
Cd	$BL \leq (70-3\sigma) < X < (130+3\sigma) \leq OL$	$BL \leq (70-3\sigma) < X < (130+3\sigma) \leq OL$	$LOD < X < (150+3\sigma) \leq OL$
Pb	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (500-3\sigma) < X < (1500+3\sigma) \leq OL$
Hg	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (700-3\sigma) < X < (1300+3\sigma) \leq OL$	$BL \leq (500-3\sigma) < X < (1500+3\sigma) \leq OL$
Br	$BL \leq (300-3\sigma) < X$	Not applicable	$BL \leq (250-3\sigma) < X$
Cr	$BL \leq (700-3\sigma) < X$	$BL \leq (700-3\sigma) < X$	$BL \leq (500-3\sigma) < X$

BL = Less than screening limits of XRF

OL = More than screening limits of XRF

X = The results of screening analysis by XRF are within this range, requiring further chemical testing.

LOD = Limit of Detection

Table2 testing methods & Equipments

Testing Item	Testing Method	Equipment
Screening analysis by XRF		
Lead (Pb) Cadmium (Cd) Mercury (Hg) Chromium (Cr) Bromine (Br)	IEC 62321-3-1:2013 (Ed1.0)	ED-XRF
Chemical testing		
Lead (Pb)	IEC 62321-5:2013 (Ed1.0)	ICP-OES
Hexavalent chromium (Cr(VI)) for coating on metals	IEC 62321-7-1:2015 (Ed1.0)	UV-VIS
PBBs	IEC 62321-6:2015 (Ed1.0)	GC-MS
PBDEs	IEC 62321-6:2015 (Ed1.0)	GC-MS
DBP	IEC 62321-8:2017 (Ed1.0)	GC-MS
BBP	IEC 62321-8:2017 (Ed1.0)	GC-MS
DEHP	IEC 62321-8:2017 (Ed1.0)	GC-MS
DIBP	IEC 62321-8:2017 (Ed1.0)	GC-MS



2. Test Result(s):

Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A1	Black plastic	Cd	P	\	PBBs: ND PBDEs: ND	P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	P			P	
		PBBs	D			P	
PBDEs	D	P					
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A2	Golden metal	Cd	P	\	\	P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	P			P	
		PBBs	\			\	
PBDEs	\	\					
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A3	Silvery metal	Cd	P	\	Cr(VI): Negative ($< 0.10 \mu\text{g}/\text{cm}^2$)	P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	D			P	
		PBBs	\			\	
PBDEs	\	\					
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A4	Silvery metal	Cd	P		Cr(VI): Negative (< 0.10 µg/cm ²)	P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	D	\		P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A5	Golden metal	Cd	P			P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A6	Black plastic	Cd	P			P	\
		Pb	P			P	
		Hg	P			P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A7	White sticker	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A8	Silvery metal	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A9	Black IC	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A10	Silvery metal	Cd	P		Cr(VI): Negative (< 0.10 µg/cm ²)	P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	D	\		P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A11	Beige plastic	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A12	Black plastic	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A13	Silvery metal	Cd	P		Cr(VI): Negative (< 0.10 µg/cm ²)	P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	D	\		P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A14	Transparent brown plastic film	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A15	Coppery metal	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PTH Screening	Chemical testing		
A16	Brown capacitor	Cd	P			P	\
		Pb	D			P	
		Hg	P	\	Pb: 40	P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A17	Brown capacitor	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A18	Black triode	Cd	P			P	\
		Pb	D			P	
		Hg	P	\	Pb: 63	P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A19	Black diode	Cd	P		Pb: 1.04×10 ⁴ See remark (5)	P	\
		Pb	D			P	
		Hg	P	\		P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P		P		
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A20	Black IC	Cd	P		Pb: 257	P	\
		Pb	D			P	
		Hg	P	\		P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P		P		
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A21	Gray inductance	Cd	P		\	P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	P			P	
		PBBs	P			P	
		PBDEs	P		P		
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A22	Black IC	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A23	Silvery metal crystal oscillator	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A24	Silvery metal crystal oscillator	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A25	Black IC	Cd	P			P	\
		Pb	D			P	
		Hg	P	\		P	
		Cr(VI)	P		Pb: 28	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A26	Black triode	Cd	P			P	\
		Pb	D			P	
		Hg	P	\		P	
		Cr(VI)	P		Pb: ND	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A27	Translucent LED	Cd	P			P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	P		\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
A28	Solder	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\	\	
A29	Green PCB	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	P			P	
		PBDEs	P			P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	
A30	Blue PCB	Cd	P			P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	P	\		P	
		PBBs	D		PBBs: ND	P	
		PBDEs	D		PBDEs: ND	P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	P	\	P	



Part No.	Part Description	Restricted Substances	Results (mg/kg)			Conclusion (P/F)	Resubmitted Date/ Source of Data
			EDXRF (P/F/D)	PHTH Screening	Chemical testing		
B1	Solder	Cd	P			P	\
		Pb	P			P	
		Hg	P	\	\	P	
		Cr(VI)	P	\	\	P	
		PBBs	\			\	
		PBDEs	\			\	
		DEHP	\	\	\	\	
		DBP	\	\	\	\	
		BBP	\	\	\	\	
		DIBP	\	\	\		
B2	Blue PCB	Cd	P			P	\
		Pb	P			P	
		Hg	P	\		P	
		Cr(VI)	P	\		P	
		PBBs	D		PBBs: ND	P	
		PBDEs	D		PBDEs: ND	P	
		DEHP	\	P	\	P	
		DBP	\	P	\	P	
		BBP	\	P	\	P	
		DIBP	\	\	P		

Note:

- mg/kg = milligram per kilogram = ppm
- ND = Not detected (<MDL)
- P = PASS = Less than screening limits of XRF
- F = FAIL = More than screening limits of XRF
- D = DETECTED = Inconclusive
- NA = Not applicable
- \ = Not available

Remark:

- (1) The results of XRF are only for reference;
- (2) For hexavalent chromium (Cr(VI)), XRF testing result is the content of Chromium (Cr) elements; for polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs), XRF testing result is the content of Bromine (Br) elements;
- (3) Screening results of PHTH are for primary screening, and further chemical testing by GC-MS (for DBP, BBP,



DEHP and DIBP) are recommended to be performed if the concentration (based on weight of a single sample) exceeds the below warning value.

TEST ITEM	Screening Limit (Unit: mg/kg)
Bis(2-ethylhexyl) phthalate (DEHP)	P≤600<D
Dibutyl phthalate (DBP)	P≤600<D
Benzylbutyl phthalate (BBP)	P≤600<D
Diisobutyl phthalate (DIBP)	P≤600<D

- (4) According to IEC 62321-7-1:2015, three types of Cr(VI) results for coating on metals is as follows:
 Sample Cr(VI) concentration is < 0.10 µg/cm², The coating is considered a non-Cr(VI) based coating, the sample is negative for Cr(VI);
 Sample Cr(VI) concentration is between 0.10 µg/cm² and 0.13 µg/cm², The result is considered to be inconclusive, if addition samples are available, perform a total of 3 trials to increase sampling surface area, use the averaged result of the 3 trials for the final determination;
 Sample Cr(VI) concentration is > 0.13 µg/cm², The sample coating is considered to contain Cr(VI), The sample is positive for Cr(VI).
- (5) According to the declaration from client, the source of Lead in No. A19 could be from the high melting temperature type solder, while Lead in high melting temperature type solder above 85% by weight in electronic component is exempted by RoHS Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011.

3. Method Detection Limit (MDL):

For XRF screening analysis (mg/kg)

Item	Pb	Cd	Hg	Br	Cr
Polymer	20	20	20	20	20
Other materials	50	50	50	50	50

For chemical testing (mg/kg)

Item	Pb	Cd	Hg	PBBs	PBDEs	DEHP	BBP	DBP	DIBP	Cr(VI)
General materials	2	2	2	5	5	50	50	50	50	See remark (2)

Remark:

- (1) PBBs and PBDEs method detection limit only for one substance;
 (2) MDL for polymer and Composites is 8 mg/kg, MDL for coating on metals is 0.02 µg/cm².

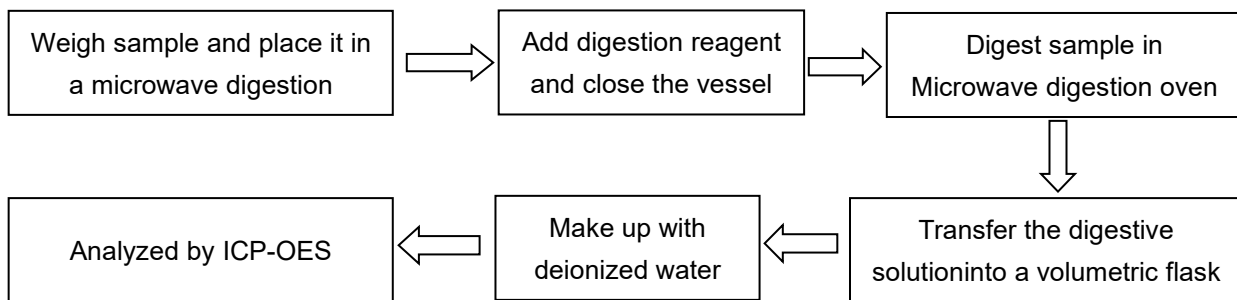


4. RoHS Requirement (mg/kg):

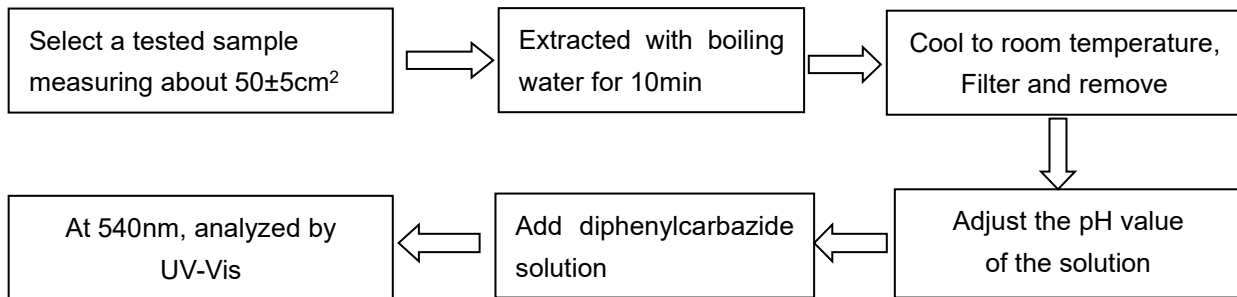
Restricted substances	Cd	Pb	Hg	Cr(VI)	PBBs	PBDEs	DEHP	BBP	DBP	DIBP
RoHS limit	100	1000	1000	1000	1000	1000	1000	1000	1000	1000

5. Chemical Test Process:

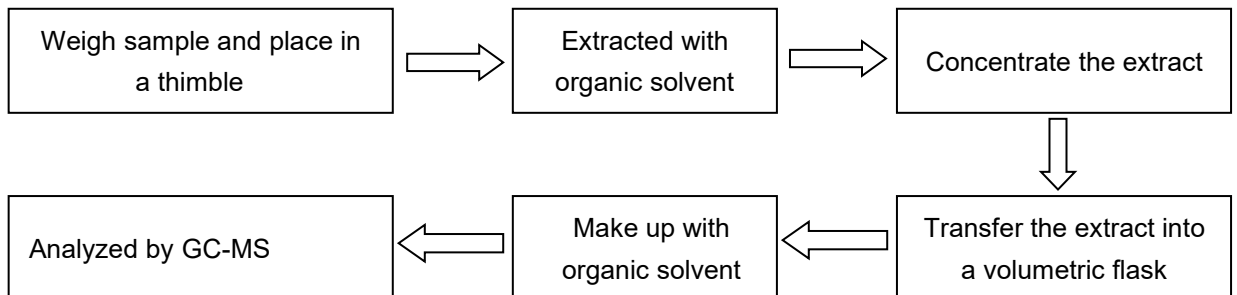
(1) Lead (Pb)



(2) Hexavalent Chromium (Cr(VI)) (Boiling water extraction)

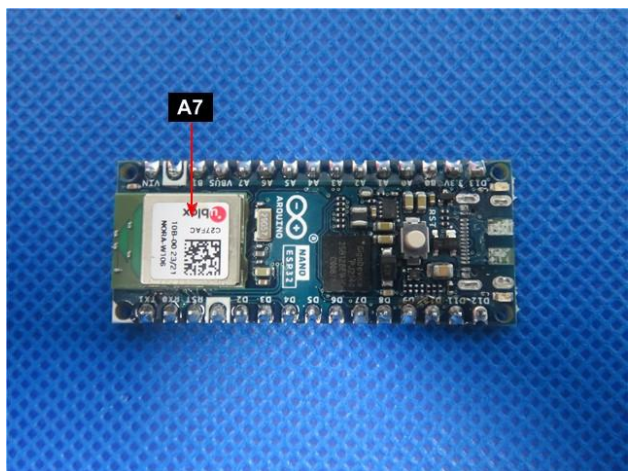
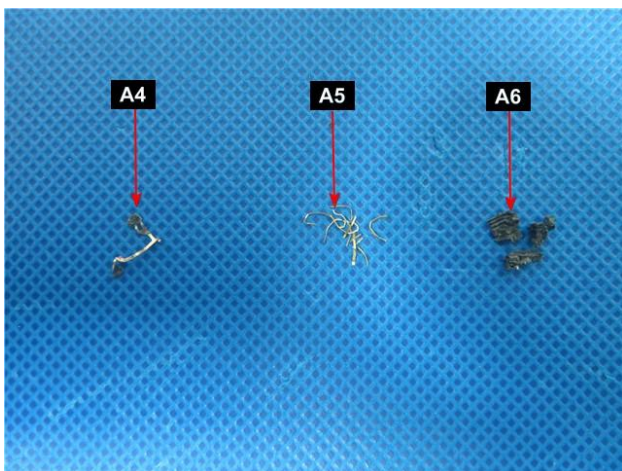
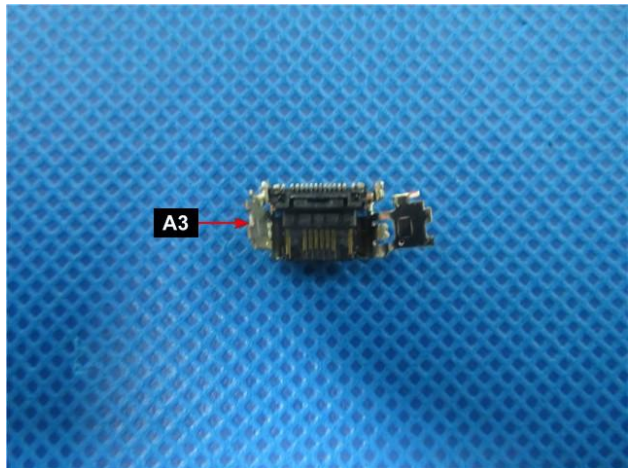
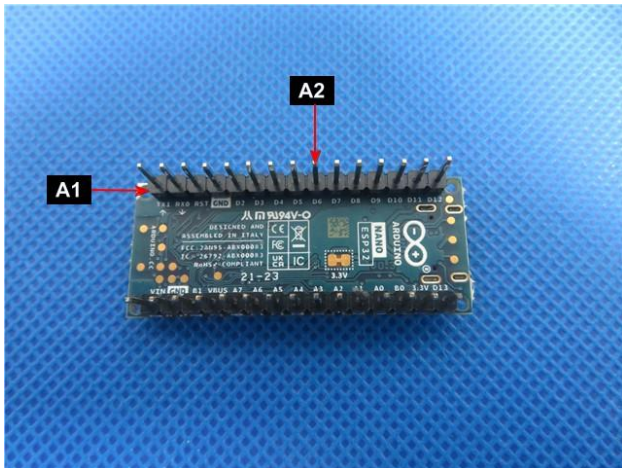
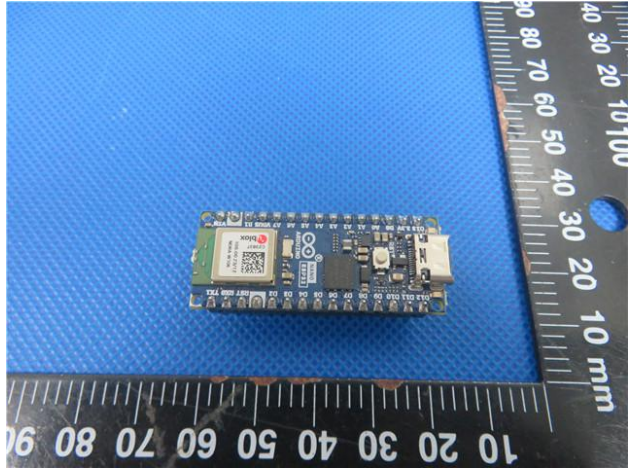
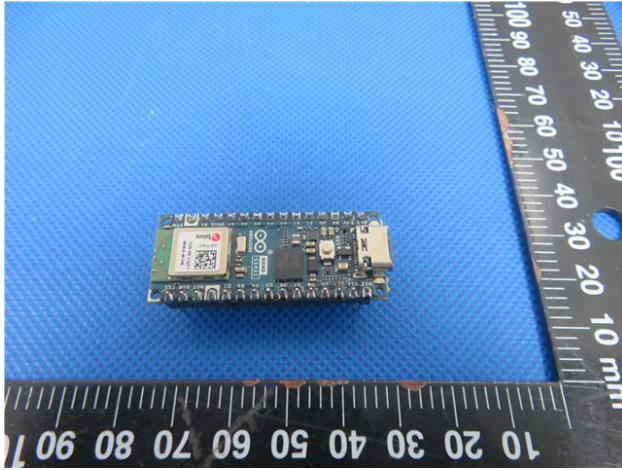


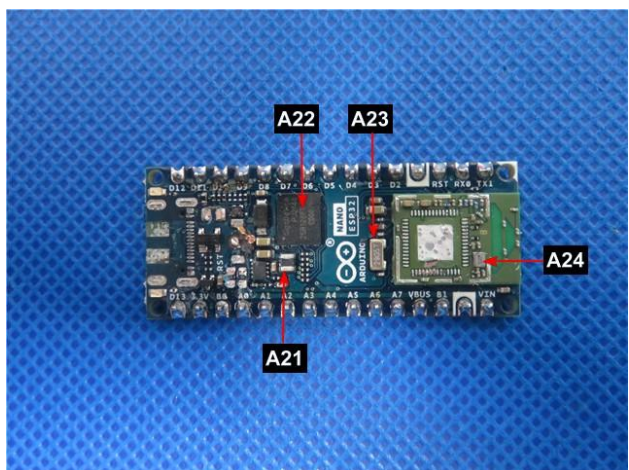
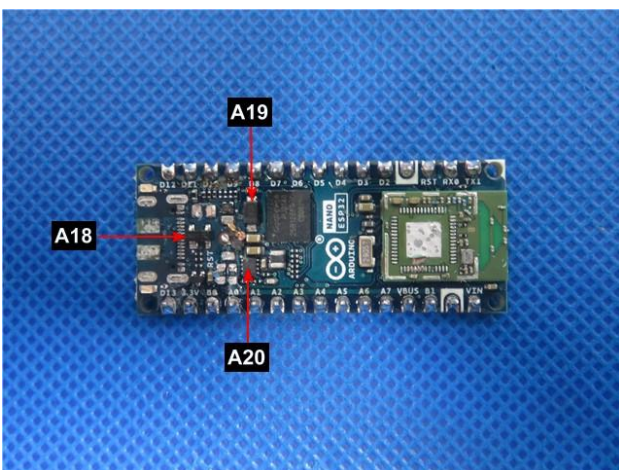
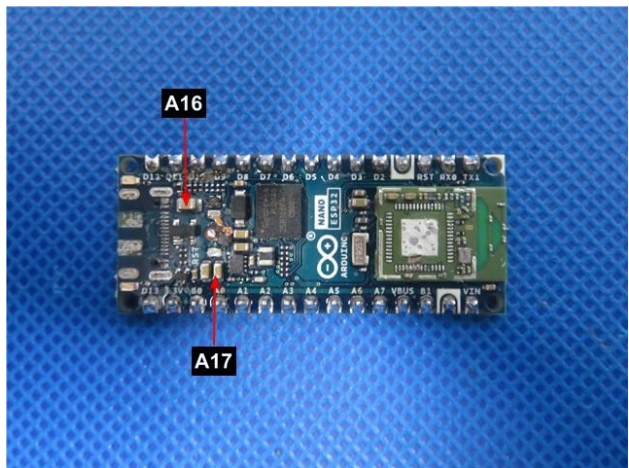
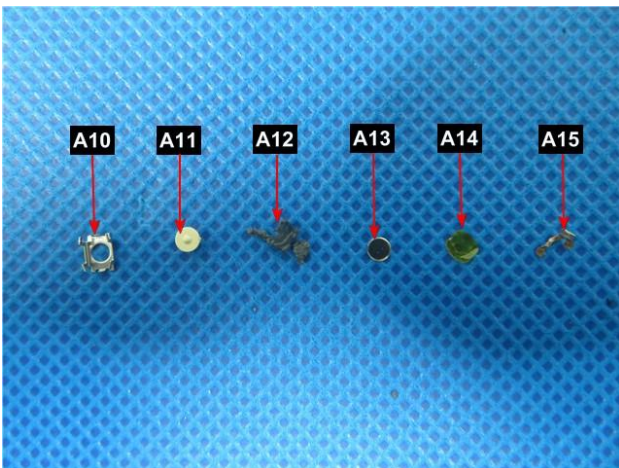
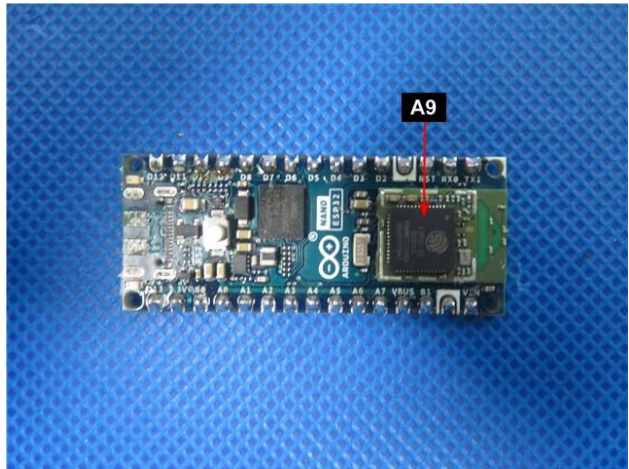
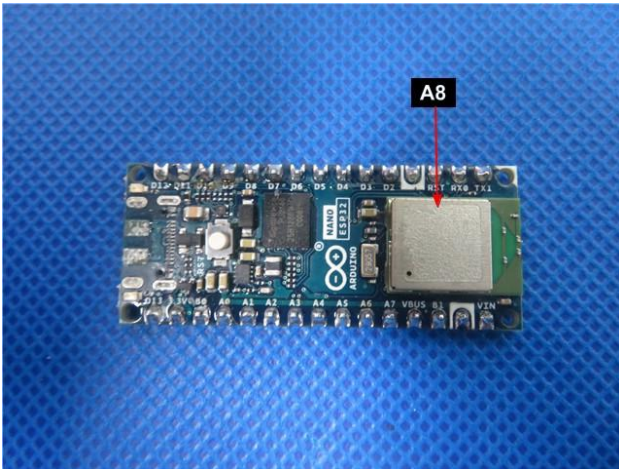
(3) PBBs /PBDEs, DEHP, BBP, DBP, DIBP

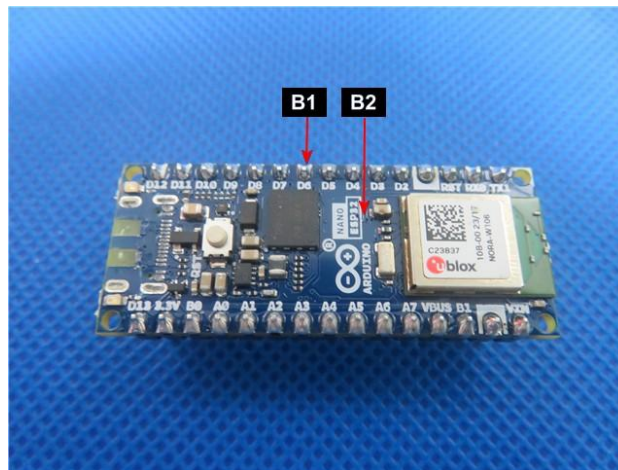
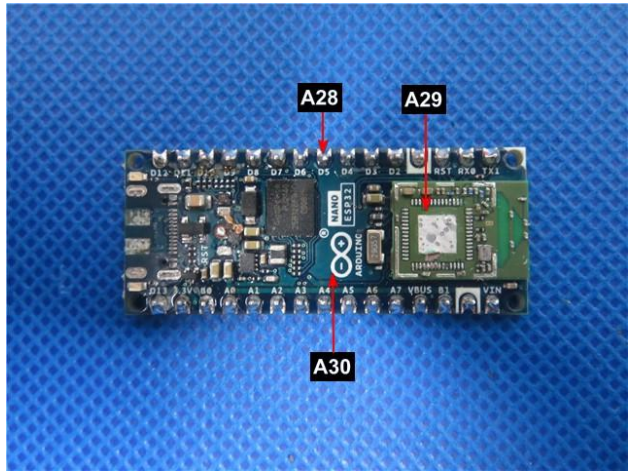
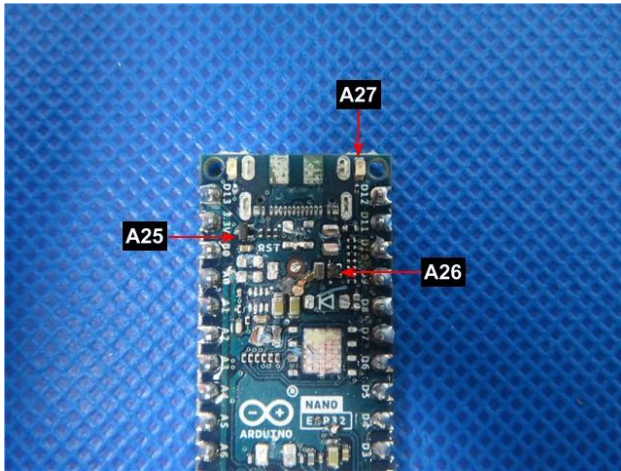




6. Appendix:







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