



# TEST REPORT

Report No.....: CHTEW20120052

Report Verification:



Project No.....: SHT2009048107EW

Applicant's name.....: Arduino S.r.l.

Address.....: Via Andrea Appiani, 25  
20900 MONZA (Italy)

Test item description.....: MKR WAN 1310

Trade Mark.....: Arduino

Model/Type reference.....: ABX00029

Listed Model(s).....: -

Standard.....: Article 2 paragraph 1 item 8 (Y)

Date of receipt of test sample.....: Sept.30, 2020

Date of testing.....: Sept.30, 2020- Feb.07, 2021

Date of issue.....: Feb.07, 2021

Result.....: PASS

Compiled by

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Echo Wei

Supervised by

(position+printedname+signature) ...: Project Engineer Kiki Kong

Kiki Kong

Approved by

(position+printedname+signature) ...: RF Manager Hans Hu

Hans Hu

Testing Laboratory Name.....: Shenzhen Huatongwei International Inspection Co., Ltd.

Address.....: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road,  
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*The test report merely correspond to the test sample.*

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## 1. Test standards and Report version

### 1.1. Test Standards

The tests were performed according to following standards:

[Article 2 paragraph 1 item 8](#): Specified Low Power Radio Equipment

### 1.2. Report version

Revision No.	Date of issue	Description
N/A	2021-02-07	Original

## 2. Test description

Report clause	Test Item	Result
5.1	RF shielding method	PASS
5.2	Frequency Error	PASS
5.3	Antenna Output Power and Tolerance	PASS
5.4	Occupy Bandwidth (99%)	PASS
5.5	Adjacent channel leakage power	PASS
5.6	Transmitter Spurious Emission and Unwanted Emission Intensity	PASS
5.7	Receiver Spurious Emission and Unwanted Emission Intensity	PASS
5.8	Transmitting Time Restrictions	PASS
5.9	Carrier Sense Capability	PASS

### 3. Summary

#### 3.1. Client Information

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)

#### 3.2. Product Description

Name of EUT:	MKR WAN 1310
Trade Mark:	Arduino
Model/Type reference:	ABX00029
Listed Model(s):	-
Power supply:	DC 5V
Software version	1.1.9
Hardware version	3.0

#### 3.3. Radio Specification Description

RF Specification	
Operation frequency:	920.8MHz~927.8MHz
Channel number:	36
Channel separation:	200KHz
Modulation type:	LORA
Antenna Type:	external omnidirectional dipole antenna
Antenna Gain:	2.1dBi
RF Rated output power:	2.00mW



### 3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Qualifications	Type	Accreditation Number
	CNAS	L1225
	A2LA	3902.01
	FCC	762235
	Canada	5377A

## 4. Test CONFIGURATION

### 4.1. Test Frequency

Test Channel	Channel No.	Frequency (MHz)
CH <sub>L</sub>	00	920.8
-	:	:
CH <sub>M</sub>	18	924.4
-	:	:
CH <sub>H</sub>	35	927.8

### 4.2. EUT operation mode

For RF test items

The EUT has been tested under typical operating condition. The Applicant provides software to control the EUT for staying in continuous transmitting and receiving mode for testing.

### 4.3. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

1	Laptop	Manufacturer :	DELL
		Model No. :	Inspiron 13-5378

### 4.4. Modifications

No modifications were implemented to meet testing criteria.

#### 4.5. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Battery Voltage	Normal Voltage / $N_V$	-
	Low Voltage / $L_V$	-
	High Voltage / $H_V$	-
DC Voltage	Normal Voltage / $N_V$	DC 5.00V
	Low Voltage / $L_V$	DC 4.50V
	High Voltage / $H_V$	DC 5.50V
Other	Normal Temperature/ $T_{nor}$ :	25°C
	lative Humidity	55 %
	Air Pressure	989 hPa

The RF unit is supplied DC3.3V. The fluctuation of input voltage to the circuit of RF unit of test equipment is under  $\pm 1\%$ , when input voltage DC5.0V is fluctuated  $\pm 10\%$ . So all measurement has been conducted by only rated voltage.

DC Input	RF_IC Input	Rate of fluctuation(%)
5.00V	3.3V	0.0
4.50V	3.3V	0.0
5.50V	3.3V	0.0



#### 4.6. Statement of the measurement uncertainty

Parameter	Uncertainty
Frequency Error	69 Hz
Total RF power, conducted	0.63 dB
Spurious emissions, conducted	0.63 dB
DC and low frequency voltages	3%
Humidity	5%
Temperature	1°C

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR100028-1 [2] and shall correspond to an expansion factor (coverage factor)  $K=1.96$  or  $K=2$  (which provide confidence levels of respectively 95% and 95.5% in the case where the distributions characterizing the actual measurement uncertainties are normal).

#### 4.7. Equipments Used during the Test

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. (mm-dd-yy)	Next Cal. (mm-dd-yy)
1	Spectrum Analyzer	R&S	FSV40	100048	2020/10/19	2021/10/18
2	EXA Signal Analyzer	Agilent	N9020A	MY5050187	2020/10/19	2021/10/18
3	DC Power Supply	Gwinstek	SPS-2415	GER835793	10/28/2020	10/27/2022

The Calibration Bodies is confirm to the article 24-2, 4, 2(c) paragraph (1).

Calibration Body: CCIC(Shenzhen) Metrology&Testing Service Co.,Ltd.

(a) Calibration conducted by the National Institute of Information and Communications Technology (NICT) in Japan (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1) in JRL.

(b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Act (Act No. 51 of 1992).

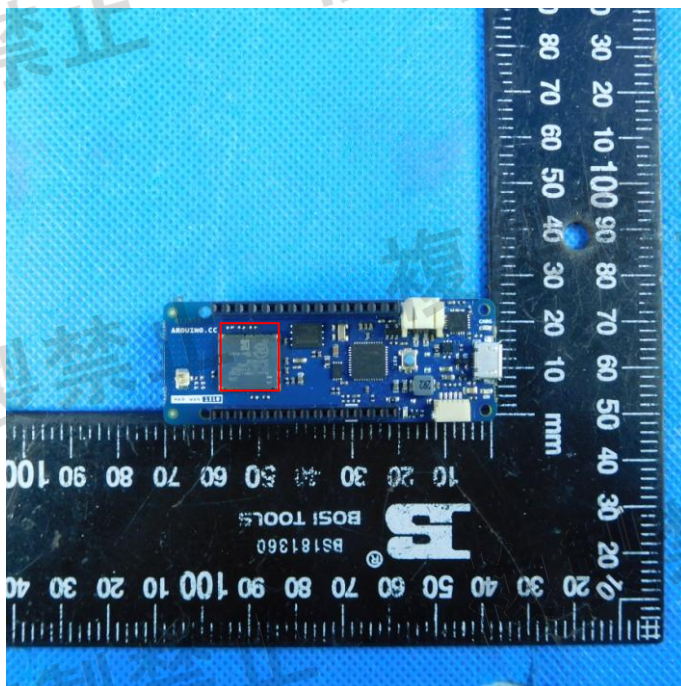
(c) Calibration conducted in countries except Japan, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).

(d) Calibration, etc. conducted by using measuring instruments and other equipment listed in the right column of appended table No. 3, which shall have been given any type of calibration, etc. listed above from (a) to (c).

## 5. Test conditions and Results

### 5.1. RF shielding method

We apply the product for Japan RF certification, the product structure is stuck by shield, See below the structure:

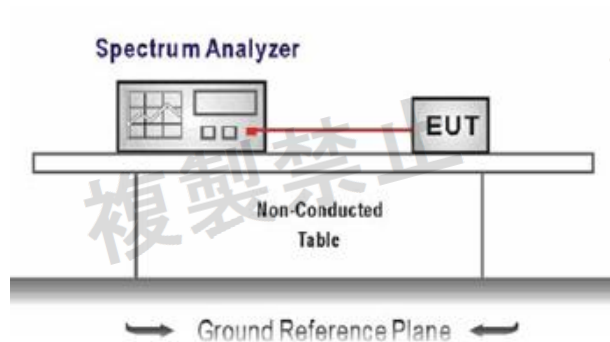


## 5.2. Frequency Error

### LIMIT

±20ppm

### TEST CONFIGURATION



### TEST CONDITION

Without modulation, continuously transmitting

### SPECTRUM SET:

Test Frequency= test channel,  
RBW=1KHz, VBW=30KHz, Span=1MHz, Sweep time=Auto, Detector mode=Positive peak

### TEST RESULTS

☒ Passed ☐ Not Applicable

Please refer to appendix A on the appendix report

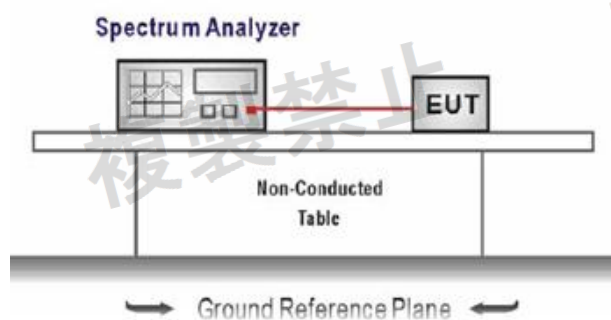
### 5.3. Antenna Output Power and Tolerance

#### LIMIT

Output power shall be less than 20 mw;

Output Power Tolerance must be within +20%, -80%

#### TEST CONFIGURATION



#### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

#### SPECTRUM SET:

- 1) Search Frequency of Peak Power  
Test Frequency: test channel,  
RBW=1MHz, VBW=3MHz, Span=4MHz, Sweep time=Auto, Detector mode =Positive peak

#### TEST RESULTS

☒ Passed ☐ Not Applicable

Please refer to appendix B on the appendix report.

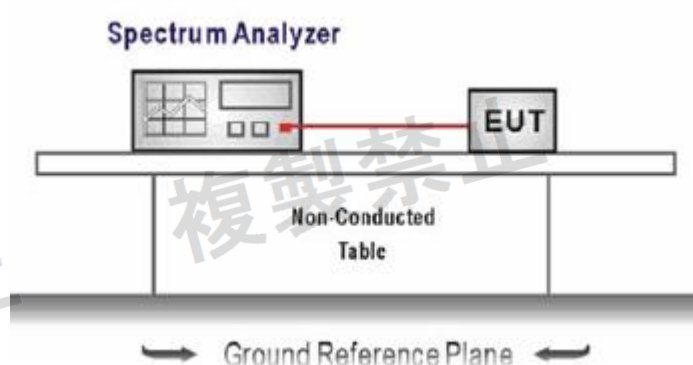


#### 5.4. Occupy Bandwidth (99%)

##### LIMIT

Frequency Band	Limit
920.6-928.0MHz	$\leq 200\text{kHz}$
920.7-927.9MHz	$\leq 400\text{kHz}$
920.8-927.8MHz	$\leq 600\text{kHz}$
920.9-927.7MHz	$\leq 800\text{kHz}$
921.0-927.6MHz	$\leq 1000\text{kHz}$

##### TEST CONFIGURATION



##### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

##### SPECTRUM SET:

Test Frequency: test channel,  
RBW=VBW=10KHz, Span=2MHz, Sweep time=Auto, Detector mode=Positive peak

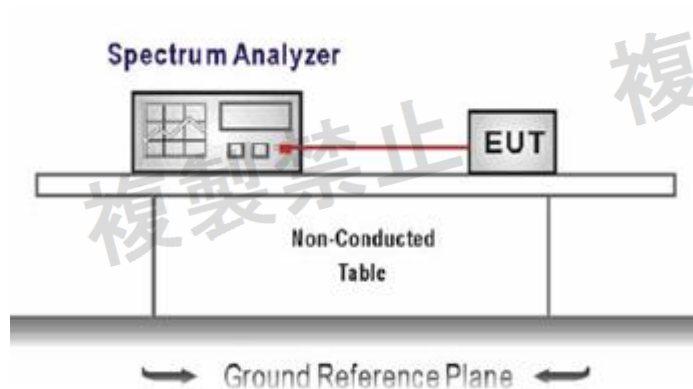
##### TEST RESULTS

☒ Passed ☐ Not Applicable

Please refer to appendix C on the appendix report.



### 5.5. Adjacent channel leakage power

**LIMIT** $\leq -15\text{dBm}$ **TEST CONFIGURATION****TEST CONDITION**

Test diffusion code and modulate with standard coding test signal

**SPECTRUM SET:**

Test Frequency: test channel,

RBW=30KHz, VBW=30KHz, Span=3MHz, Sweep time=Auto, Detector mode=RMS

**TEST RESULTS**☒ Passed☐ Not Applicable

Please refer to appendix D on the appendix report.

## 5.6. Transmitter Spurious Emission and Unwanted Emission Intensity

### LIMIT

30 - 710MHz;  $\leq -36\text{dBm}/100\text{kHz}$

710 - 900MHz;  $\leq -55\text{dBm}/1\text{MHz}$

900 - 915MHz;  $\leq -55\text{dBm}/100\text{kHz}$

915 - 920.3MHz;  $\leq -36\text{dBm}/100\text{kHz}$

920.3 - 924.3MHz (Except  $200 + 100 \times n$  kHz from the center frequency of radio channel);  $\leq -36\text{dBm}/100\text{kHz}$

924.3 - 930MHz (Unit channel = 200kHz; Except  $200 + 100 \times n$  kHz from the center frequency of radio channel. Unit

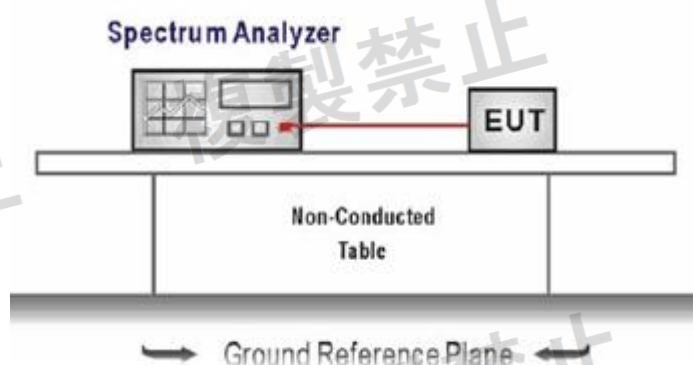
Channel = 100kHz; Except  $100 + 50 \times n$  kHz from the center frequency of radio channel);  $\leq -36\text{dBm}/100\text{kHz}$

930 - 1000MHz;  $\leq -55\text{dBm}/100\text{kHz}$

1000 - 1215MHz;  $\leq -45\text{dBm}/1\text{MHz}$

1215 - 5000MHz;  $\leq -30\text{dBm}/1\text{MHz}$

### TEST CONFIGURATION



### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

### SPECTRUM SET:

Test Frequency: test channel,

Frequency range: 30MHz-710MHz, RBW/VBW=100/100kHz

Frequency range: 710MHz-900MHz, RBW/VBW=1/1MHz

Frequency range: 900MHz-915MHz, RBW/VBW=100/100kHz

Frequency range: 915MHz-920.3MHz, RBW/VBW=100/100KHZ

Frequency range: 920.3MHz-924.3MHz, RB W/VBW=100/100kHz

Frequency range: 924.3MHz-930MHz, RBW/VBW=100/100kHz

Frequency range: 930MHz-1000MHz, RBW/VBW=100/100KHZ

Frequency range: 1000MHz-1215MHz, RBW/VBW=1/1MHz

Frequency range: 1215MHz-5000MHz, RBW/VBW=1/1MHz

Sweep time=Auto, Detector mode=RMS

### TEST RESULTS

☒ Passed ☐ Not Applicable

Please refer to appendix E on the appendix report.

## 5.7. Receiver Spurious Emission and Unwanted Emission Intensity

### LIMIT

30 - 710MHz;  $\leq -54\text{dBm}/100\text{kHz}$

710 - 900MHz;  $\leq -55\text{dBm}/1\text{MHz}$

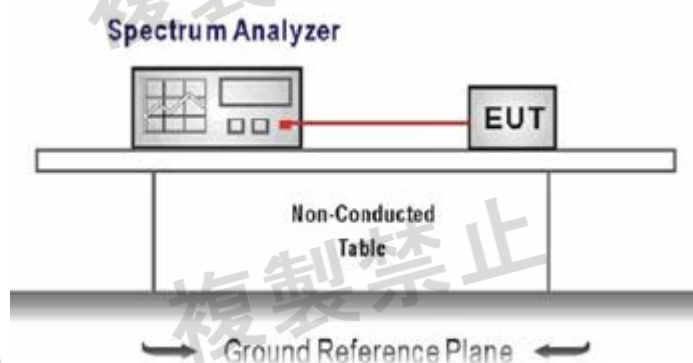
900 - 915MHz;  $\leq -55\text{dBm}/100\text{kHz}$

915 - 930MHz;  $\leq -54\text{dBm}/100\text{kHz}$

930 - 1000MHz;  $\leq -55\text{dBm}/100\text{kHz}$

1000 - 5000MHz;  $\leq -47\text{dBm}/1\text{MHz}$

### TEST CONFIGURATION



### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

### SPECTRUM SET:

Test Frequency: test channel,

Frequency range: 30MHz-710MHz. RBW/VBW=100/100kHz

Frequency range: 710MHz-900MHz, RBW/VBW=1/1MHz

Frequency range: 900MHz-915MHz, RBW/VBW=100/100kHz

Frequency range: 915MHz-930MHz, RBW/VBW=100/100kHz

Frequency range: 930MHz-1000MHz, RBW/VBW=100/100kHz

Frequency range: 1000MHz-5000MHz, RBW/VBW=1/1MHz

Sweep time=Auto, Detector mode= RMS

### TEST RESULTS

☒ Passed

☐ Not Applicable

Please refer to appendix F on the appendix report.

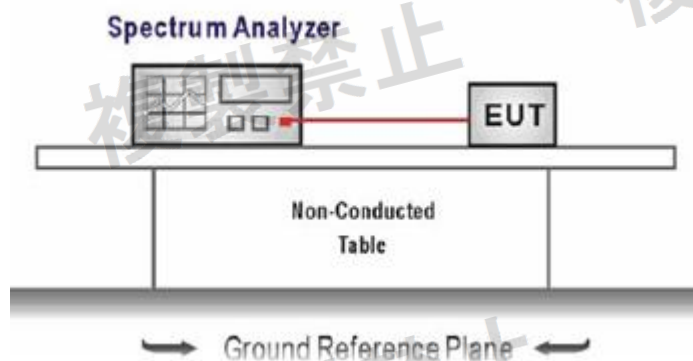
## 5.8. Transmitting Time Restrictions

### LIMIT

Transmission time: 0.4S or less

Suspend time: 2ms or more

### TEST CONFIGURATION



### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

### TEST PROCEDURE

Test Frequency: test channel,

RBW=1MHz, VBW=1MHz, Span=0, Sweep time=10S, Detector mode=Positive peak

### TEST RESULTS

☒ Passed

☐ Not Applicable

Please refer to appendix G on the appendix report.

## 5.9. Carrier Sense Capability

### LIMIT

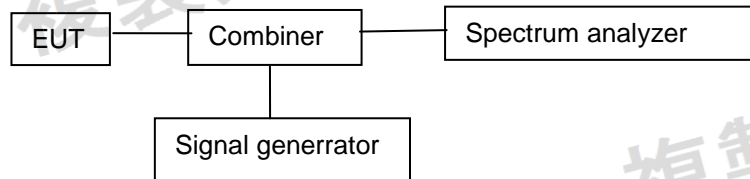
Feeder input point; ①②-80dbm

Receive bandwidth: ①② 200 x n KHZ

Judgment time; ①5ms or more, ② 128us or more \*1

\*1 Total transmission time =360s/hour or less

### TEST CONFIGURATION



### TEST CONDITION

Test diffusion code and modulate with standard coding test signal

### TEST PROCEDURE

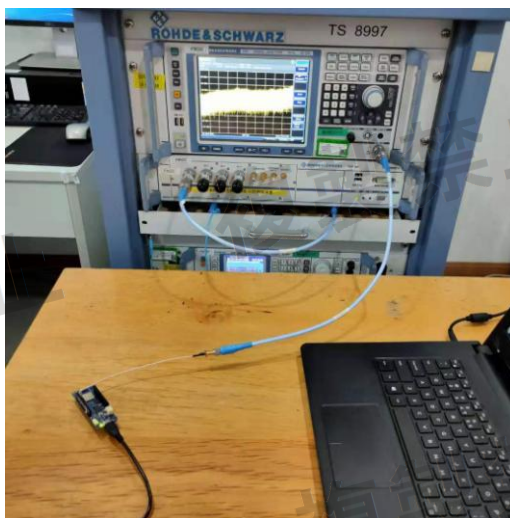
1. SG adjusted the frequency as same as the EUT receiving channel and emitted the absence of modulation from SG and power level is above 7uV.
2. Turn off the RF signal of the SG.
3. EUT have transmitted the maximum modulation signal and fixed channelize.
4. Setting of SA: RB W/VB W=100/100kHz, Span=300kHz, trig=free run, Detect mode=positive peak.
5. SG RF signal on.
6. EUT shall be stop the transmitted any signal and SG RF signal off. the EUT will be continuous transmitted signal.

### TEST RESULTS

☒ Passed ☐ Not Applicable

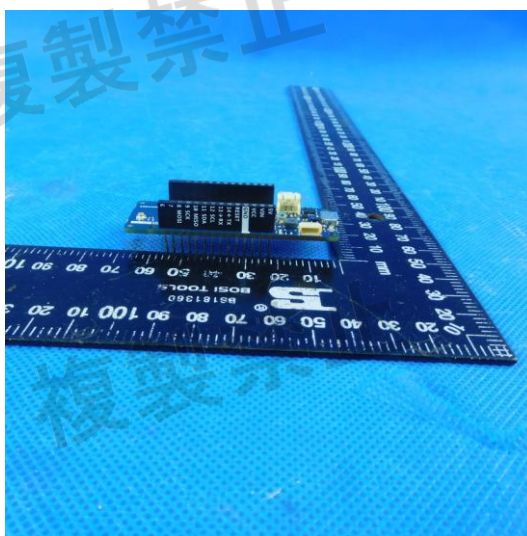
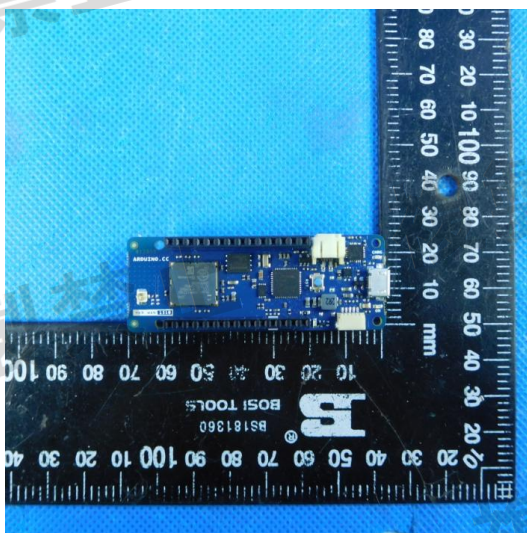
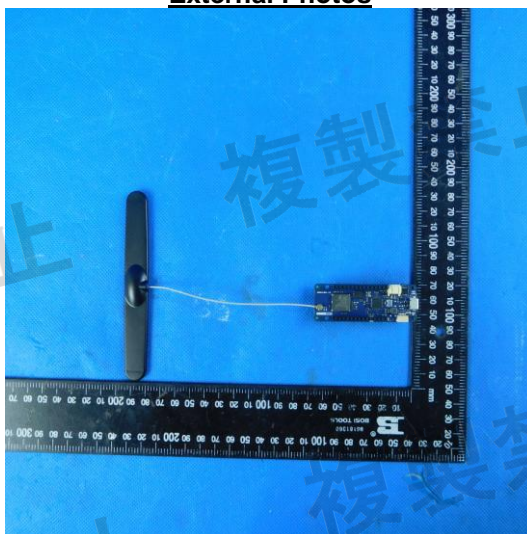


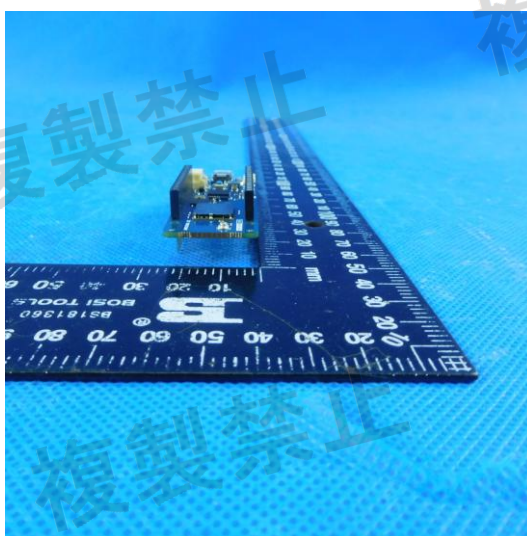
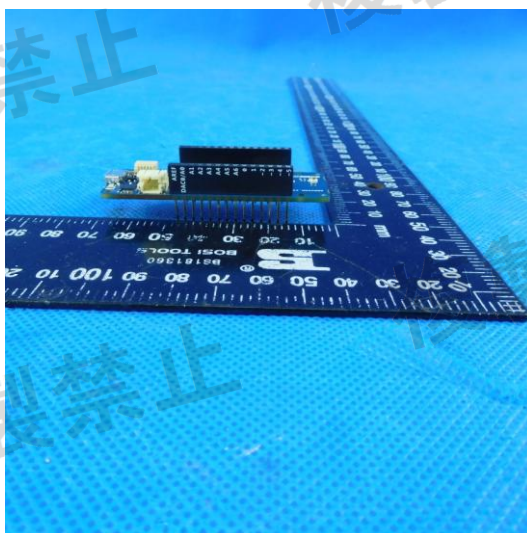
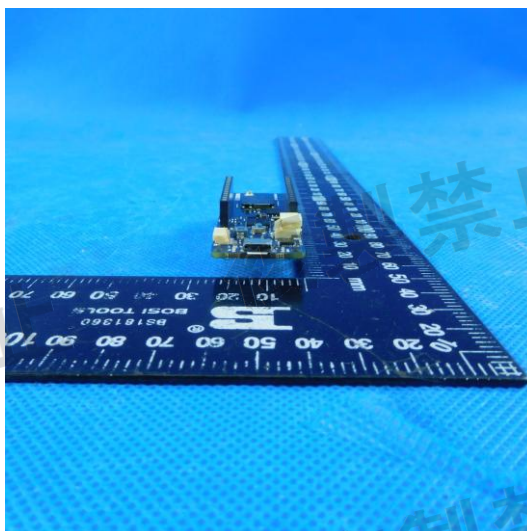
## 6. Test Setup Photos of the EUT



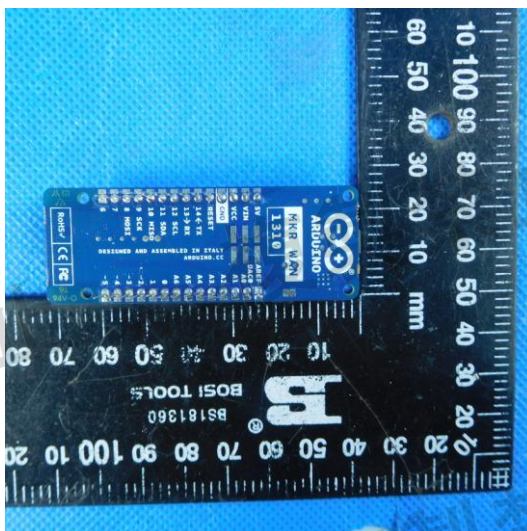
## 7. External and Internal Photos of the EUT

### External Photos

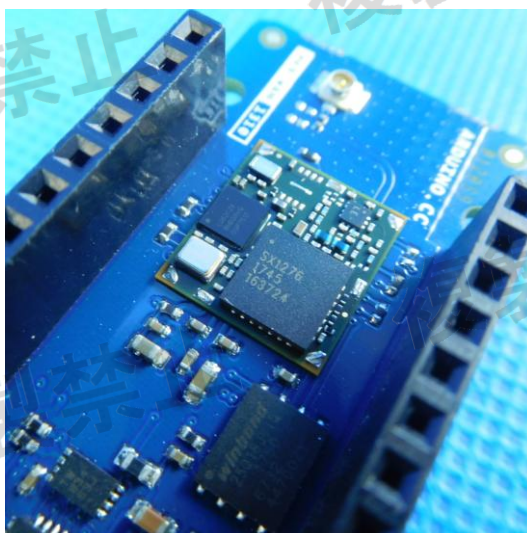
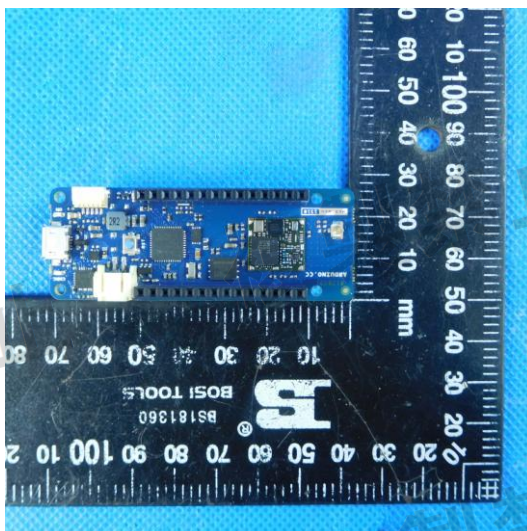








Internal Photos



**8. APPENDIX REPORT**