TEST REPORT

Applicant Name :	Seeed Technology Co., Ltd
Address :	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Report Number :	SZNS1220114-02177E-EM

Test Standard (s)

FCC Rules and Regulations Part 15 Subpart B Class B
ANSI C63.4: 2014

Sample Description

Product:	XIAO nRF52840 Sense
Trademark:	Seeed Studio
Tested Model:	XIAO-nRF52840 Sense
Multiple Product:	XIAO nRF52840
Multiple Model:	XIAO-nRF52840
Date Received:	2022-01-14
Date of Test:	2022-01-17 to 2022-01-21
Report Date:	2022-03-14

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Icey Huang
Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
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Test Report Declaration

Applicant	:	Seeed Technology Co., Ltd
Manufacturer	:	Seeed Technology Co., Ltd
Product	:	XIAO nRF52840 Sense
Tested Model	:	XIAO-nRF52840 Sense
Multiple Product	:	XIAO nRF52840
Multiple Model	:	XIAO-nRF52840
Trademark	:	Seeed Studio

Measurement Procedure Used:

FCC Rules and Regulations Part 15 Subpart B Class B
ANSI C63.4: 2014

The device described above is tested by Shenzhen Accurate Technology Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart B Class B limits both radiated and conducted emissions. The measurement results are contained in this test report and Shenzhen Accurate Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Shenzhen Accurate Technology Co., Ltd.

1. TEST RESULTS SUMMARY

Test Items	Test Standard	Test Results
Power Line Conducted Emission (0.15-30MHz)	FCC Part 15 Subpart B Class B	Pass
Radiated Emission (30 MHz -1000MHz)	FCC Part 15 Subpart B Class B	Pass
Radiated Emission (1G GHz -13 GHz)	FCC Part 15 Subpart B Class B	Pass

2. GENERAL INFORMATION

2.1.Description of Device (EUT)

Product	:	XIAO nRF52840 Sense
Test Model	:	XIAO-nRF52840 Sense
Multiple Product	:	XIAO nRF52840
Multiple Model	:	XIAO-nRF52840
Trademark	:	Seeed Studio
Model difference	:	There are two kinds of samples, the difference between them is that: XIAO nRF52840 Sense has attached microphone, but XIAO nRF52840 has not.
Ratting	:	DC 5 V from type C port
Remark(s)	:	The EUT's highest operating frequency is 2480 MHz, the radiated emission measurement shall be made up to 12.4 GHz.
Applicant	:	Seeed Technology Co., Ltd
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Manufacturer	:	Seeed Technology Co., Ltd
Address	:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Sample Number	:	SZNS1220114-02176E-EM-S1

2.2.Test Mode

Test Mode: Running;
Note: The EUT will run RE program automatically after power it

.

2.3.Accessory and Auxiliary Equipment

Laptop : Manufacturer: Lenovo
Model: ThinkPad X240

2.4.Description of Test Facility

Name of Firm : Shenzhen Accurate Technology Co., Ltd.
Site Location : 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

2.5.Measurement Uncertainty

Conduction Emission Expanded Uncertainty (0.15kHz-30MHz) : *U=2.72dB, k=2*
Radiated emission expanded uncertainty (30MHz-1000MHz) : U=4.28dB, k=2
Radiated emission expanded uncertainty (1GHz-13GHz) : *U=4.98dB, k=2*

3. MEASURING DEVICE AND TEST EQUIPMENT

3.1.For Conducted Emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	1 Year
2.	Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	1 Year
3.	Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	1 Year
4.	Conducted Emission Test Software: e3 19821b (V9)					

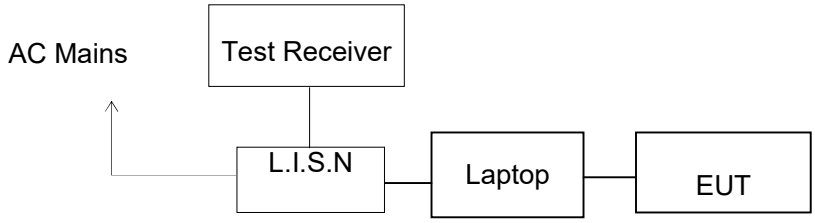
3.2.For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	1 Year
2.	Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	1 Year
3.	SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	1 Year
4.	A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	1 Year
5.	Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	3 Year
6.	Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	3 Year
7.	Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	1 Year
8.	Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	1 Year
9.	Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	1 Year
10.	Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	1 Year
11.	Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	1 Year
12.	Radiated Emission Test Software: e3 19821b (V9)					

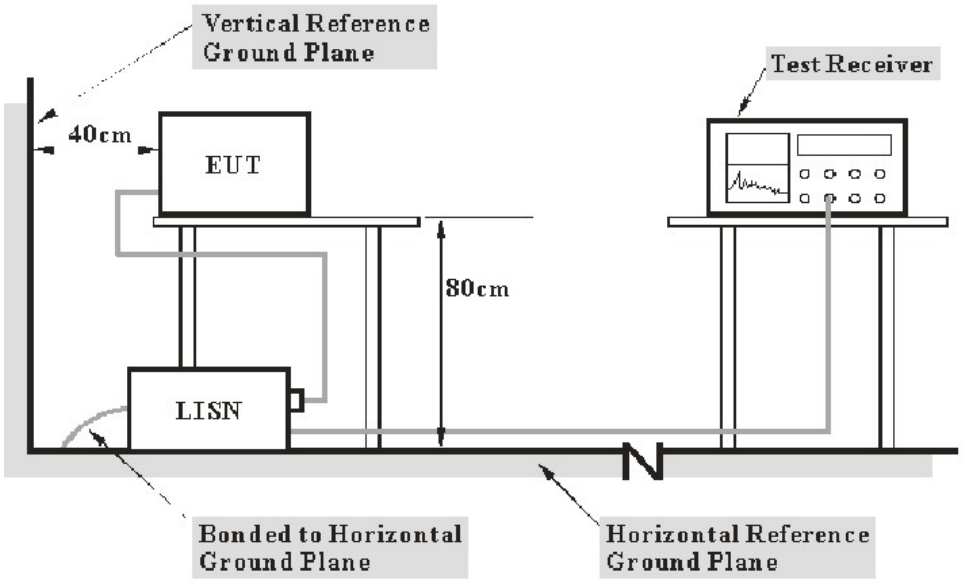
4. POWER LINE CONDUCTED MEASUREMENT

4.1.Block Diagram of Test Setup

4.1.1.Block diagram of connection between the EUT and simulators



4.1.2.Test System Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

4.2.Power Line Conducted Emission Measurement Limits (Class B)

Frequency (MHz)	Limit dB(μV)	
	Quasi-peak Level	Average Level
0.15 - 0.50	66.0 – 56.0 *	56.0 – 46.0 *
0.50 - 5.00	56.0	46.0
5.00 - 30.00	60.0	50.0
NOTE1: The lower limit shall apply at the transition frequencies. NOTE2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.		

4.3.Manufacturer

The equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

4.4.Operating Condition of EUT

4.4.1.Setup the EUT and simulator as shown as Section 4.1.

4.4.2.Turn on the power of all equipment.

4.4.3.Let the EUT work in test mode and measure it.

4.5.Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.4: 2014 on Conducted Emission Measurement.

The bandwidth of test receiver is set at 9kHz.
The frequency range from 150kHz to 30MHz is checked.

Over Limit = Limit (dBμV) - Level (dBμV)

4.6.Power Line Conducted Emission Measurement Results

PASS.

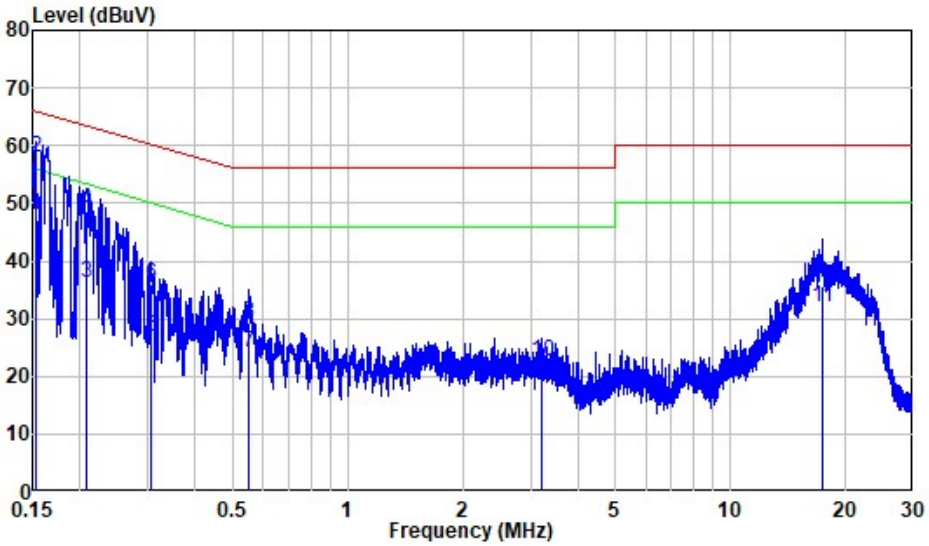
The frequency range from 150kHz to 30MHz is checked.

Maximizing procedure was performed on the six (6) highest emissions of the EUT. Emissions attenuated more than 20 dB below the permissible value are not reported.

All data was recorded in the Quasi-peak and average detection mode.

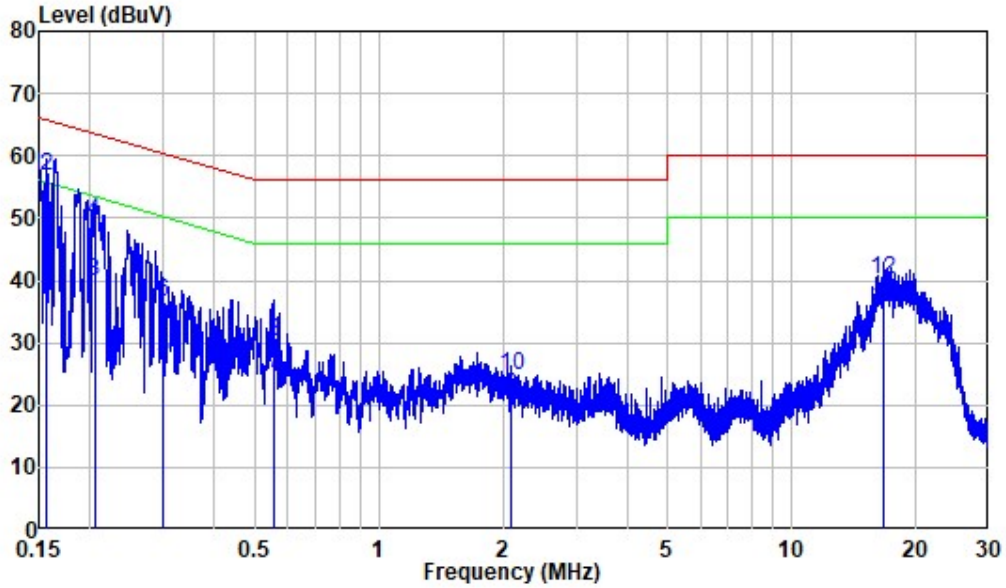
The spectral diagrams are attached as below.

Job No.:	**SZNS12220114-02176E-EM**	**Power:**	**AC 120V 60Hz**
Limit:	**FCC PART 15B**	**Test By:**	**Bin Duan**
Eut:	**XIAO nRF52840 Sense**	**Test item:**	**Conduction Test**
Model No.	**XIAO-nRF52840 Sense**	**Test Mode**	**Running**
Climatic:	**22° C 52%RH**	**Date:**	**2022.1.20**
Applicant:	**Seeed Technology Co., Ltd**		



Site : Shielding Room
Condition: Line
Mode : Running
Model : XIAO-nRF52840 Sense
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.153	9.89	38.20	48.09	55.83	-7.74	Average
2	0.153	9.89	48.05	57.94	65.83	-7.89	QP
3	0.209	9.80	26.51	36.31	53.26	-16.95	Average
4	0.209	9.80	38.67	48.47	63.26	-14.79	QP
5	0.305	9.80	17.17	26.97	50.11	-23.14	Average
6	0.305	9.80	26.15	35.95	60.11	-24.16	QP
7	0.550	9.81	14.31	24.12	46.00	-21.88	Average
8	0.550	9.81	19.61	29.42	56.00	-26.58	QP
9	3.226	9.93	9.74	19.67	46.00	-26.33	Average
10	3.226	9.93	12.86	22.79	56.00	-33.21	QP
11	17.383	10.12	21.82	31.94	50.00	-18.06	Average
12	17.383	10.12	25.64	35.76	60.00	-24.24	QP



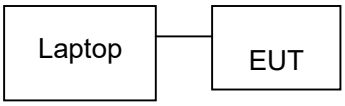
Site : Shielding Room
Condition: Neutral
Mode : Running
Model : XIAO-nRF52840 Sense
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.156	9.80	35.79	45.59	55.66	-10.07	Average
2	0.156	9.80	46.86	56.66	65.66	-9.00	QP
3	0.205	9.80	29.98	39.78	53.43	-13.65	Average
4	0.205	9.80	39.59	49.39	63.43	-14.04	QP
5	0.300	9.80	17.61	27.41	50.25	-22.84	Average
6	0.300	9.80	26.80	36.60	60.25	-23.65	QP
7	0.557	9.81	15.39	25.20	46.00	-20.80	Average
8	0.557	9.81	20.25	30.06	56.00	-25.94	QP
9	2.089	9.82	11.62	21.44	46.00	-24.56	Average
10	2.089	9.82	15.04	24.86	56.00	-31.14	QP
11	16.595	10.07	25.53	35.60	50.00	-14.40	Average
12	16.595	10.07	30.22	40.29	60.00	-19.71	QP

5. RADIATED EMISSION MEASUREMENT

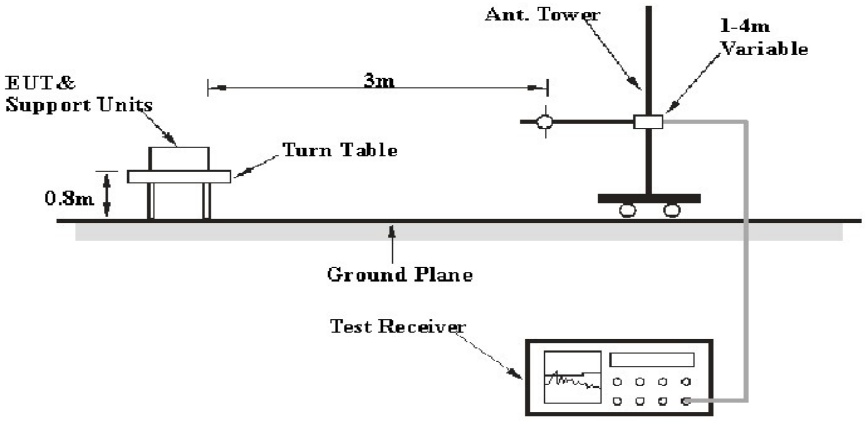
5.1.Block Diagram of Test Setup

5.1.1.Block diagram of connection between the EUT and simulators

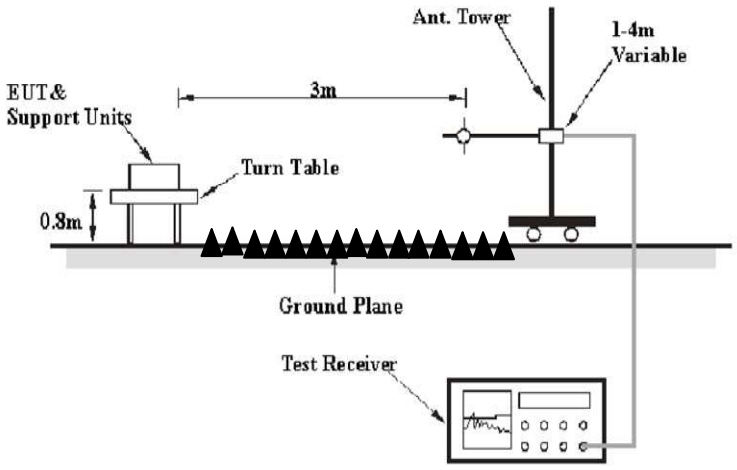


5.1.2.Test System Setup

Below 1GHz:



Above 1GHz:



5.2.Radiated Emission Limit (Class B)

All emanations from a class B device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified below:

Frequency MHz	Distance Meters	Field Strengths QP Limit	
		μV/m	dB(μV/m)
30-88	3	100	40.0
88-216	3	150	43.5
216-960	3	200	46.0
Above 960	3	500	54.0
Remark: (1) Emission level dB(μV) = 20 log Emission level μV/m. (2) The smaller limit shall apply at the cross point between two frequency bands. (3) Distance is the distance in meters between the measuring instrument antenna and the closest point of any part of the device or system.			

Frequency MHz	Distance Meters	Field Strengths Limit	
		Peak dB(μV/m)	AVG dB(μV/m)
Above 1GHz	3	74	54

5.3.Manufacturer

The following equipments are installed on Radiated Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

5.4.Operating Condition of EUT

5.4.1.Setup the EUT and simulator as shown as Section 5.1.

5.4.2.Turn on the power of all equipment.

5.4.3.Let the EUT work in test mode and measure it.

5.5.Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2014 on radiated emission measurement.

The bandwidth of the Receiver (ESR) is set at 9kHz in 9kHz-30MHz, 120 kHz in 30-1000MHz, and 1MHz in above 1000MHz.

The frequency range from 30MHz to 1000MHz is investigated.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705–108	1000.
108–500	2000.
500–1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Over Limit (dB) = Level(dBμv/m) - Limit (dBμv/m)
QP = Quasi-peak Reading

The “Over Limit” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit.

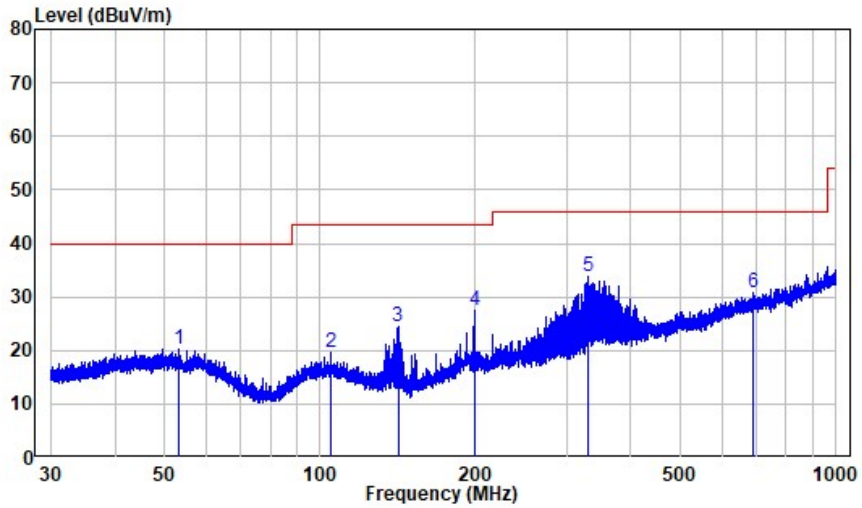
5.6.Radiated Emission Measurement Result

PASS.

The frequency range from 30MHz to 1GHz is investigated.
The spectral diagrams are attached as below.

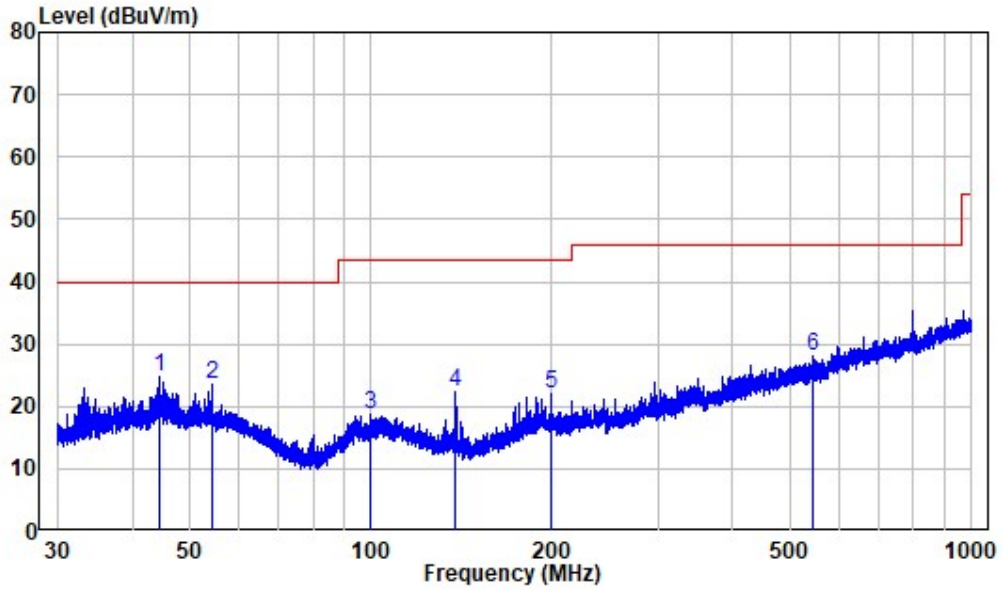
Job No.:	**SZNS1220114-02177E-EM**	**Power:**	**DC 5V**
Test standard:	**FCC PART 15B**	**Test By:**	**Bin.D**
EUT:	**XIAO nRF52840 Sense**	**Test item:**	**Radiation Emission**
Model No.:	**XIAO-nRF52840 Sense**	**Test Mode**	**Running**
Temp.(℃)/Hum.(%):	**22° C 60%RH**	**Date:**	**2022.1.18**
Applicant:	**Seeed Technology Co., Ltd**		

Below 1G



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220114-02177E-EM
Test Mode: Running

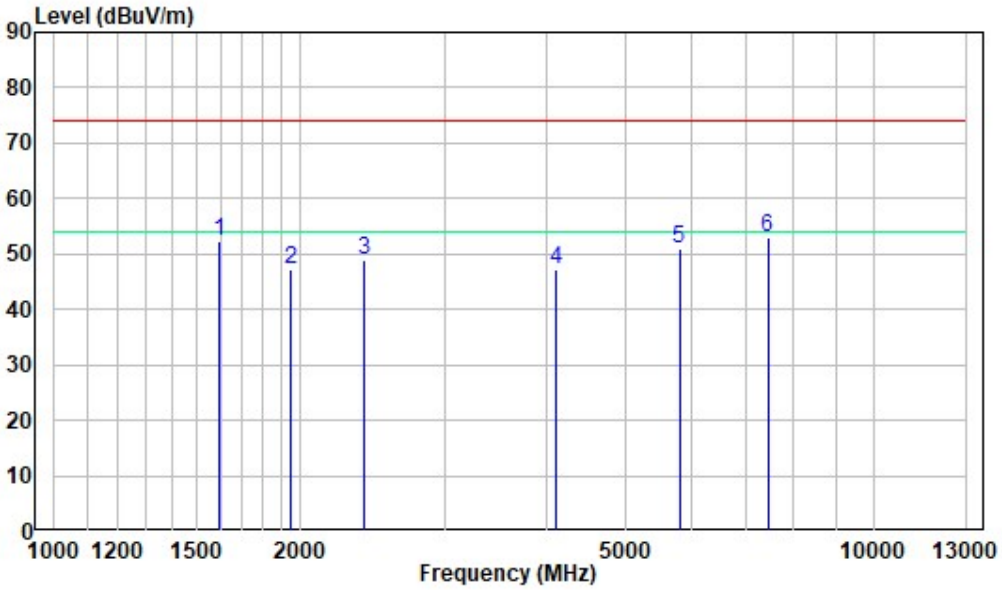
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	53.038	-10.18	30.45	20.27	40.00	-19.73	Peak
2	105.087	-11.85	31.50	19.65	43.50	-23.85	Peak
3	141.516	-15.52	39.99	24.47	43.50	-19.03	Peak
4	199.460	-11.44	38.97	27.53	43.50	-15.97	Peak
5	329.906	-7.99	41.65	33.66	46.00	-12.34	Peak
6	688.658	-1.51	32.18	30.67	46.00	-15.33	Peak



Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220114-02177E-EM
Test Mode: Running

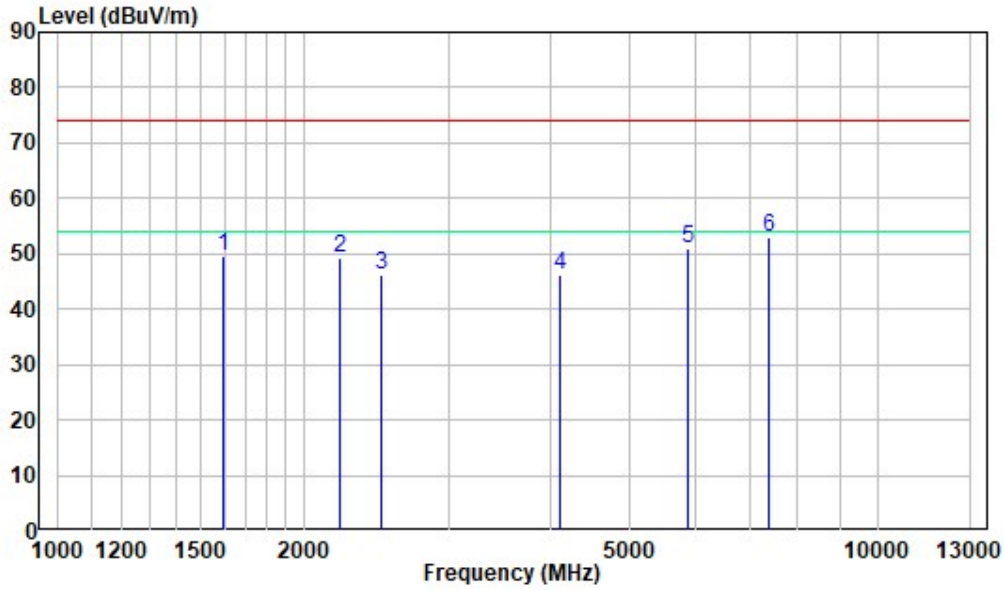
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	44.470	-9.91	34.70	24.79	40.00	-15.21	Peak
2	54.309	-10.32	33.79	23.47	40.00	-16.53	Peak
3	100.009	-11.80	30.40	18.60	43.50	-24.90	Peak
4	138.266	-15.36	37.79	22.43	43.50	-21.07	Peak
5	199.723	-11.41	33.40	21.99	43.50	-21.51	Peak
6	542.560	-3.96	31.99	28.03	46.00	-17.97	Peak

Above 1G



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS1220114-02177E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	1596.000	-9.04	61.21	52.17	74.00	-21.83	Peak
2	1948.000	-7.62	54.94	47.32	74.00	-26.68	Peak
3	2396.667	-7.22	55.99	48.77	74.00	-25.23	Peak
4	4097.333	-5.24	52.54	47.30	74.00	-26.70	Peak
5	5800.667	-1.82	52.63	50.81	74.00	-23.19	Peak
6	7435.333	3.51	49.51	53.02	74.00	-20.98	Peak



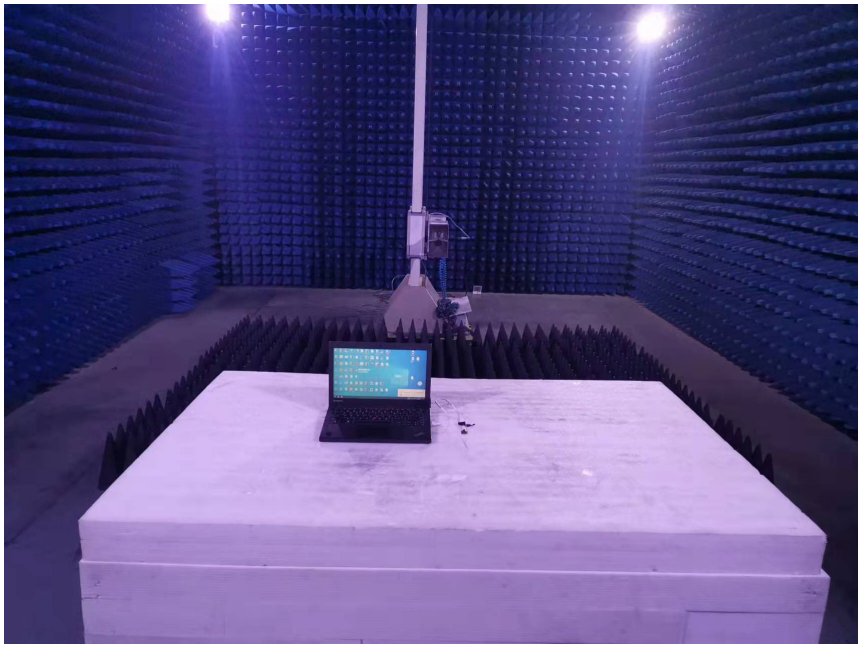
Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS1220114-02177E-EM
Test Mode: Running

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	1595.333	-9.04	58.55	49.51	74.00	-24.49	Peak
2	2212.000	-7.22	56.58	49.36	74.00	-24.64	Peak
3	2480.000	-7.21	53.51	46.30	74.00	-27.70	Peak
4	4102.667	-5.24	51.49	46.25	74.00	-27.75	Peak
5	5884.667	-1.85	52.80	50.95	74.00	-23.05	Peak
6	7361.333	3.32	49.72	53.04	74.00	-20.96	Peak

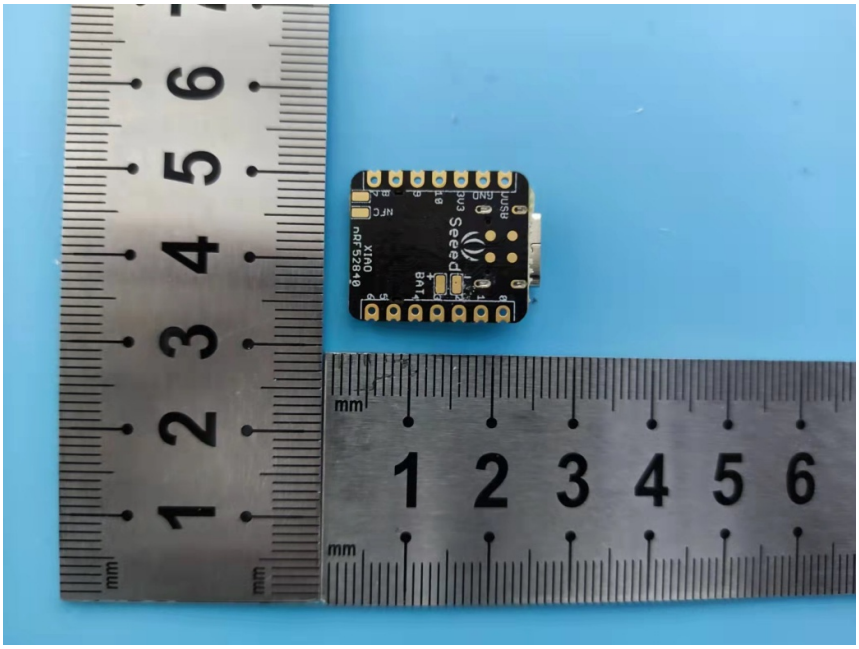
6. PHOTOGRAPHS

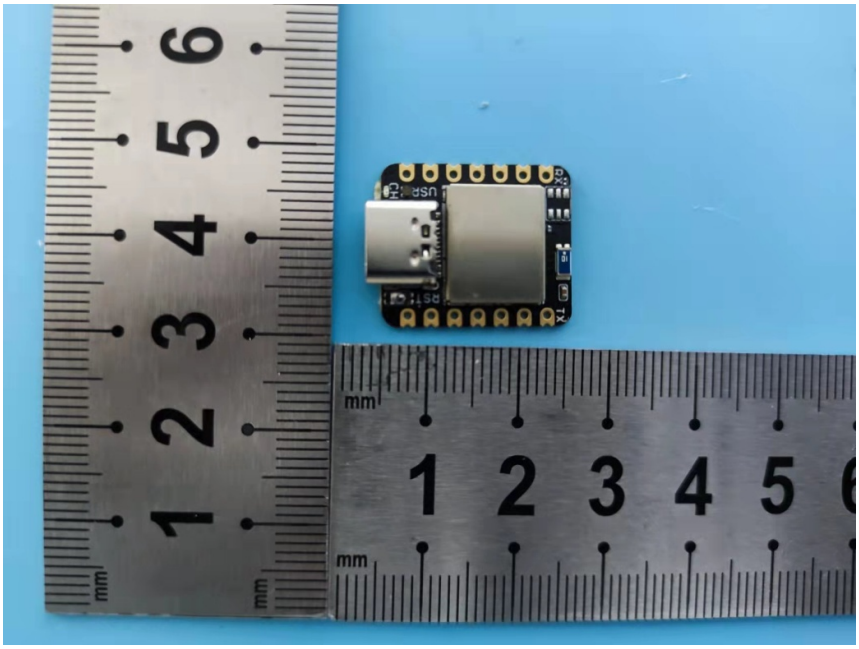
6.1.Photo of Conducted Emission Measurement

6.2.Photo of Radiation Emission Measurement



6.3.Photo of EUT





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