

RF MEASUREMENT REPORT

FCC ID: 2AEDR-SPLUSCP-1
Applicant: Accuride International Inc.
Product: Senseon Plus Wireless Card Programmer
Model No.: SPLUSCP-1
Brand Name: Senseon
FCC Classification: Part 15 Low Power Communication Device Transmitter (DXX)
FCC Rule Part(s): Part 15 Subpart C (Section 15.225)
Result: Complies
Test Date: 2022-03-23 ~ 2022-03-29

Reviewed By:

Jame Yuan

Approved By:

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2203RSU011-U1	Rev. 01	Initial Report	2022-05-27	Valid

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1.4. Product Information

Product Name	Senseon Plus Wireless Card Programmer
Model No.	SPLUSCP-1
Brand Name	Senseon
EUT Identification No.	20220304Sample#08
Integrated modular Information	Product Type: Wi-Fi & Bluetooth Internet of Things Module Model No.: ESP32-WROOM-32E Radio Specification:802.11b/g/n (Support Wi-Fi only)
SRD Specification	13.56MHz
Power Supply	5 Vdc
Remark: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification

Frequency Range	13.56MHz
Channel Number	1
Type of modulation	ASK
Antenna Type	PCB Antenna

Note: For other features of this EUT, test report will be issued separately.

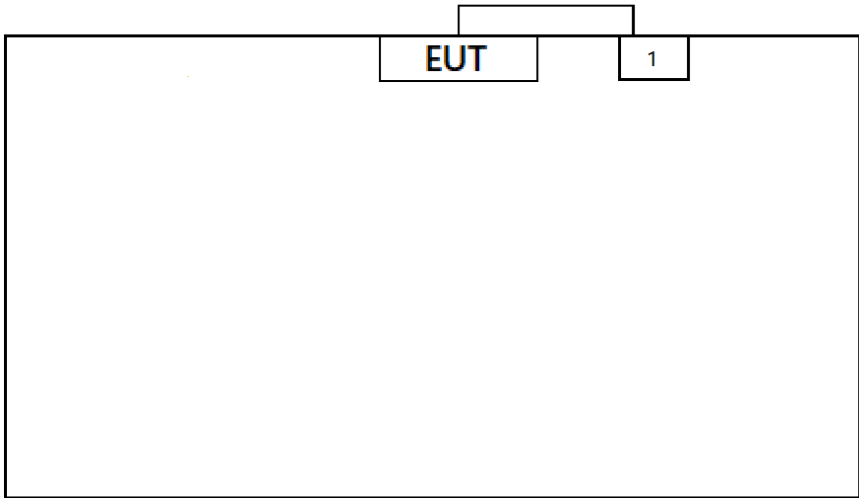
2. Test Configuration

2.1. Test Mode

Test Mode
Mode 1: Transmit by NFC

2.2. Test Configuration and Software

The device was tested per the guidance ANSI C63.10-2013 that was used to reference the appropriate EUT setup for radiated spurious emissions and AC line conducted emission testing.

		
Product	Manufacturer	Model No.
1 Adapter	Huizhou Guoatong Technology Co., Ltd	GAT-0502000
Note: The adapter was from Lab.		

2.3. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.225
- ANSI C63.10-2013

2.4. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~75 %RH

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna of the this device is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument Name	Manufacturer	Model No.	Asset No.	Cali. Interval	Cal. Due Date	Test Site
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2022-12-29	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2022-06-24	WZ-AC2
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2022-10-28	WZ-AC2/AC1
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2022-05-24	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2022-12-01	WZ-AC2
Thermohygrometer	testo	Testo 608-H1	MRTSUE11038	1 year	2022-11-11	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2022-04-29	WZ-AC2
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2022-12-29	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2022-08-05	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2022-04-29	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2022-06-28	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2022-12-29	WZ-AC1
Thermohygrometer	testo	Testo 608-H1	MRTSUE11039	1 year	2022-11-11	WZ-AC1

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software

5. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 9kHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 9kHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB

6. Test Result

6.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Test Result	Reference
15.225 (a), (b), (c)	In-Band Emission	Radiated	Pass	Section 5.2
15.225(d)	Out-Band Emission		Pass	Section 5.3
15.215(c)	20dB Bandwidth		Pass	Section 5.4
15.225(e)	Frequency Stability Tolerance		Pass	Section 5.5
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass	Section 5.6

Notes: For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.

6.2. In-band Emission Measurement

6.2.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.225		
Frequency (MHz)	Distance (m)	Level ($\mu\text{V/m}$)
13.553 ~13.567	30	15848
13.410 ~13.553, 13.567 ~13.710	30	334
13.110 ~13.410, 13.710 ~14.010	30	106

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: $E \text{ field strength (dB}\mu\text{V/m)} = 20 \log E \text{ field strength (}\mu\text{V/m)}$

6.2.2. Test Procedure

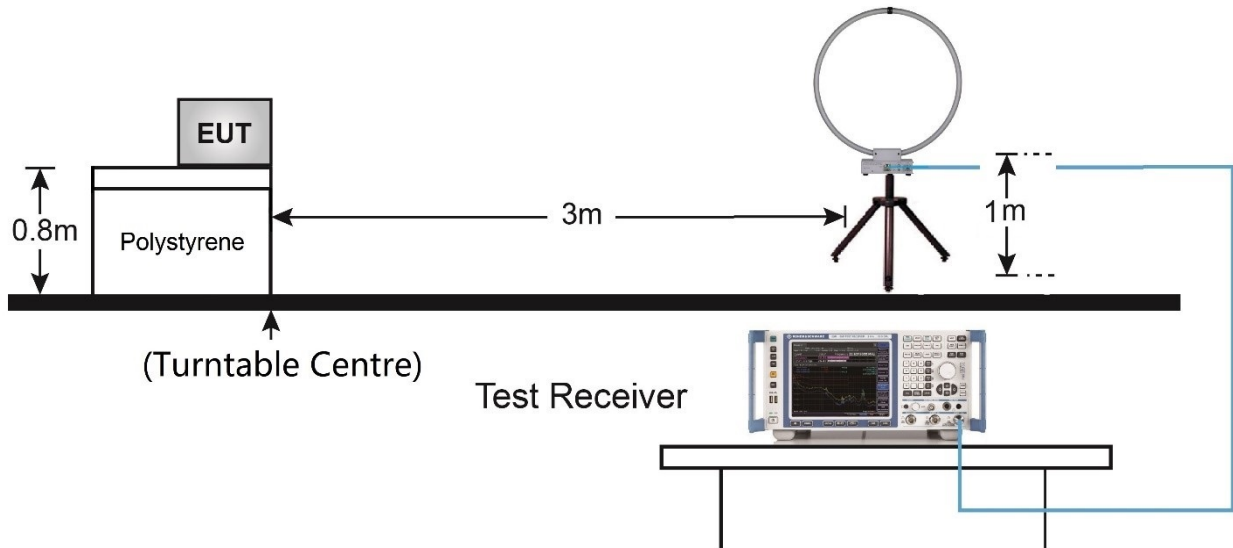
ANSI C63.10-2013 - Section 6.4.7

6.2.3. Test Setting

1. RBW = 9kHz
2. VBW = 3 * RBW
3. Detector = Peak
4. Trace mode = Max hold
5. Sweep = Auto couple
6. Allow the trace to stabilize

6.2.4. Test Setup

9kHz ~ 30MHz Test Setup:



6.2.5. Test Result

Refer to Appendix A.1.

6.3. Out-band Emission Measurement

6.3.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level ($\mu\text{V}/\text{m}$)
0.009 - 0.490	300	2400/F (kHz)
0.490 - 1.705	30	24000/F (kHz)
1.705 - 30	30	30
30 - 88	3	100
88 - 216	3	150
216 - 960	3	200
Above 960	3	500

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dB $\mu\text{V}/\text{m}$) = 20 log E field strength ($\mu\text{V}/\text{m}$)

6.3.2. Test Procedure

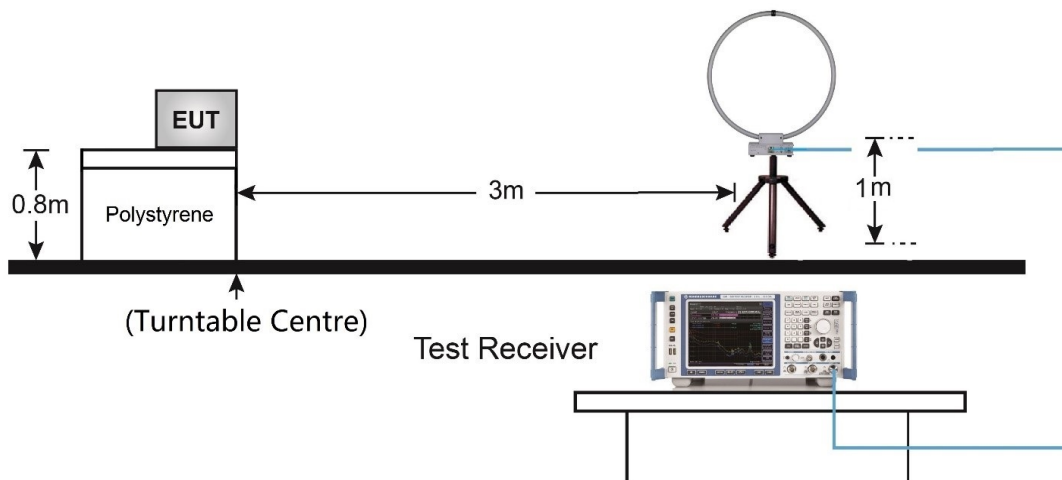
ANSI C63.10-2013 - Section 6.5.4

6.3.3. Test Setting

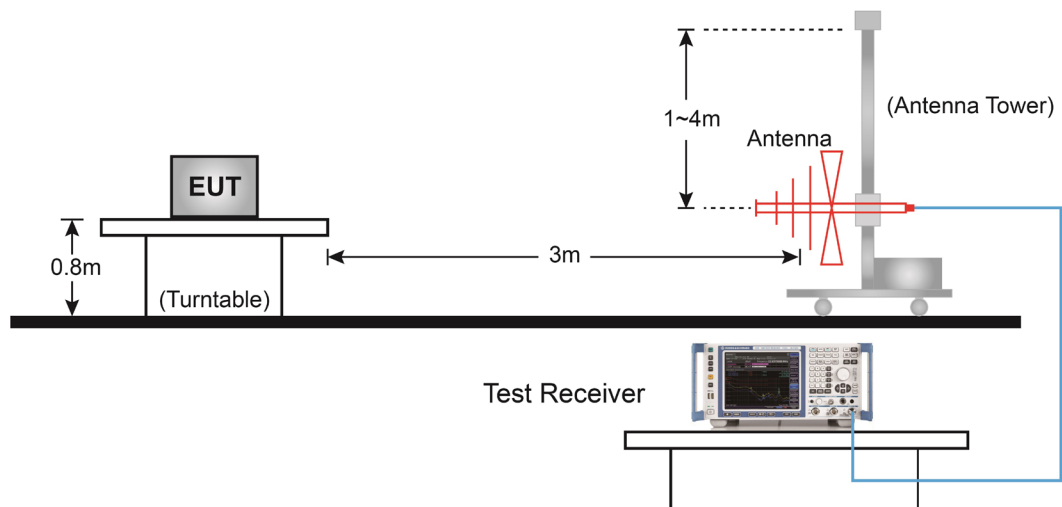
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 9kHz for emission below 30MHz and 100kHz for emission between 30MHz and 1GHz
3. VBW = 3 * RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

6.3.4. Test Setup

9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



6.3.5. Test Result

Refer to Appendix A.2.

6.4. Occupied Bandwidth Measurement

6.4.1. Test Limit

The occupied bandwidth is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequency.

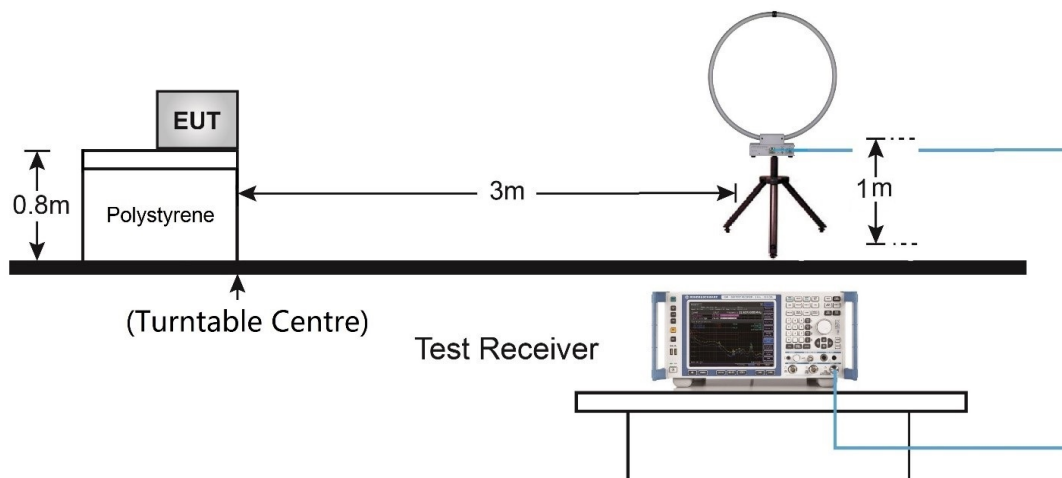
6.4.2. Test Procedure

ANSI C63.10-2013 - Section 6.9.2

6.4.3. Test Setting

1. Set RBW \geq 1% to 5% of the 20dB bandwidth
2. VBW = approximately three times RBW
3. Span = approximately 2 to 5 times the 20dB bandwidth
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.3.

6.5. Frequency Tolerance Measurement

6.5.1. Test Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency.

6.5.2. Test Procedure

ANSI C63.10-2013 - Section 6.8

6.5.3. Test Setting

Frequency Stability Under Temperature Variations:

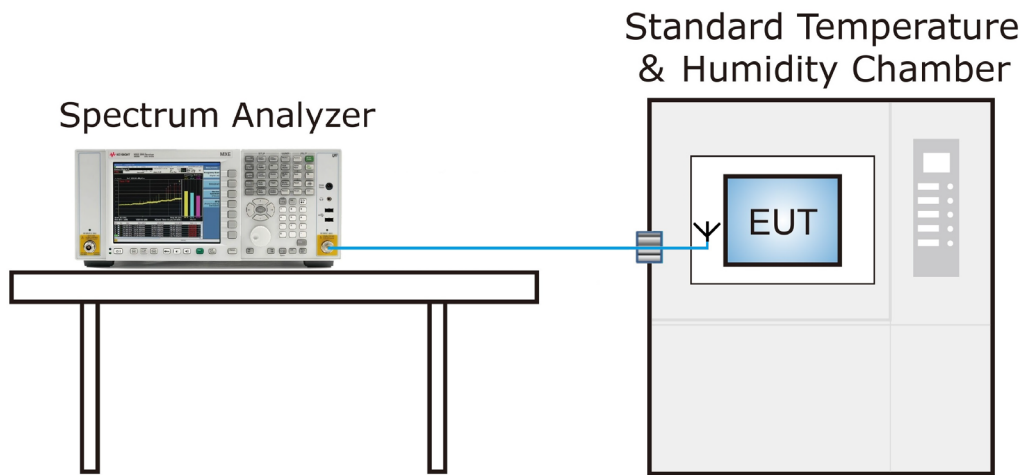
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change. For hand-carried battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

6.5.4. Test Setup



6.5.5. Test Result

Refer to Appendix A.4.

6.6. AC Conducted Emissions Measurement

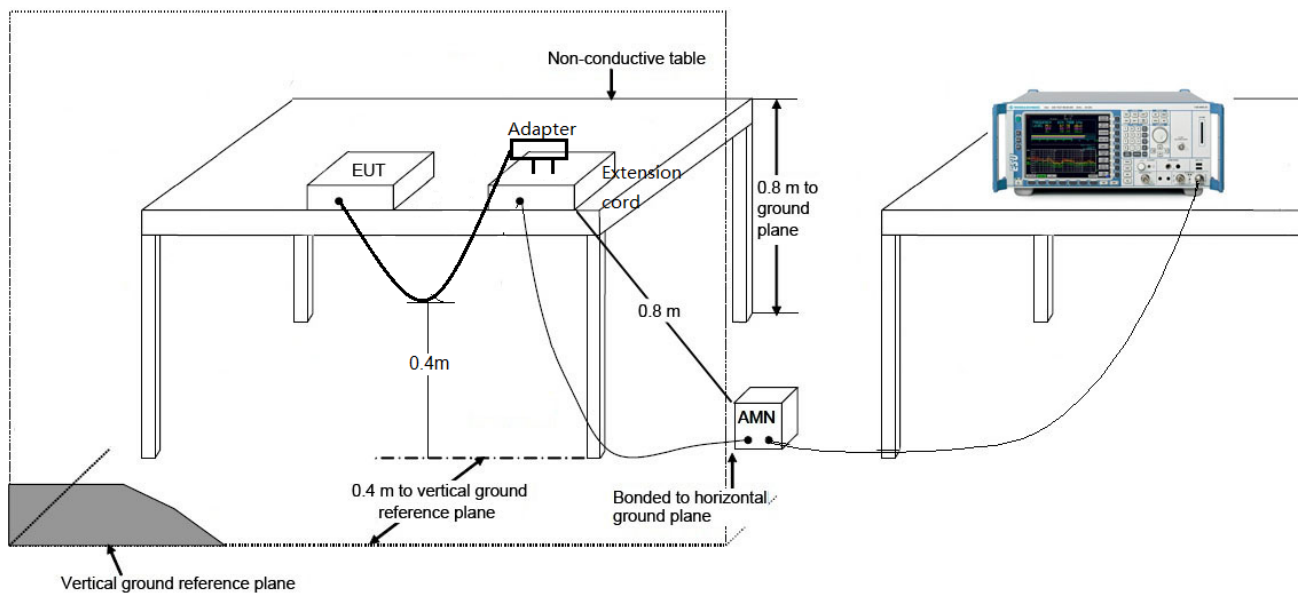
6.6.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.6.2. Test Setup



6.6.3. Test Result

Refer to Appendix A.5.

Appendix A - Test Result

A.1 In-band Emission Test Result

Test Engineer	Charles Zhang	Test Date	2022-03-25
Test Mode	Mode1	Test Site	WZ-AC1

Frequency (MHz)	Reading Level (dB μ V/m)	Factor (dB)	Measure Level (dB μ V/m)	Limit (@3m) (dB μ V/m)	Margin [dB]
Face On					
13.35	9.46	17.05	26.51	80.51	-54.00
13.42	11.04	17.05	28.09	90.47	-62.38
13.56	29.71	17.05	46.76	124.00	-77.24
13.64	12.63	17.05	29.68	90.47	-60.79
13.82	10.77	17.04	27.81	80.51	-52.70
Face Off					
13.26	10.99	17.05	28.04	80.51	-52.47
13.48	8.63	17.05	25.68	90.47	-64.79
13.56	25.33	17.05	42.38	124.00	-81.62
13.68	9.44	17.05	26.49	90.47	-63.98
13.84	9.88	17.04	26.92	80.51	-53.59

Note

- All measurements were performed using a loop antenna. The antenna was positioned in two orthogonal (face on and face off) and the position with the highest emission level was recorded.
- Measurements were tested at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear extrapolation factor (40 dB/decade) as specified in &15.31(f)(2).
 Extrapolation Factor = $20 \cdot \log(30/3)^2 = 40$ dB
 For example, Limit (@3m) = $20 \cdot \log(106) + 40 = 80.51$ dB μ V/m
- All measurements were recorded using an EMI test receiver employing a peak detector.

A.2 Out-Band Emission Test Result

Test Engineer	Hyde Yu	Test Date	2022-03-23
Test Mode	Mode1	Test Site	WZ-AC2

Out-Band Emission Below 30MHz						
Frequency (MHz)	Reading Level (dBμV/m)	Factor (dB)	Measure Level (dBμV/m)	Limit(@3m) (dBμV/m)	Margin (dB)	Detector
Face On						
2.42	23.91	17.55	41.46	69.54	-28.08	Peak
Face Off						
2.43	22.38	17.55	39.93	69.54	-29.61	Peak

Out-Band Emission Above 30MHz							
Polarization	Frequency (MHz)	Reading Level (dBμV/m)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
H	46.98	6.22	20.47	26.69	40.00	-13.31	Peak
H	148.83	12.83	15.08	27.91	43.50	-15.59	Peak
H	338.95	5.69	22.25	27.94	46.00	-18.06	Peak
H	691.54	4.74	28.74	33.48	46.00	-12.52	Peak
H	800.18	10.13	30.04	40.17	46.00	-5.83	Peak
H	908.82	8.74	31.42	40.16	46.00	-5.84	Peak
V	40.19	14.67	19.34	34.01	40.00	-5.99	Peak
V	47.95	14.92	20.52	35.44	40.00	-4.56	Peak
V	148.83	18.40	15.08	33.48	43.50	-10.02	Peak
V	664.38	5.27	28.13	33.40	46.00	-12.60	Peak
V	800.18	5.51	30.04	35.55	46.00	-10.45	Peak
V	963.14	3.43	31.55	34.98	54.00	-19.02	Peak

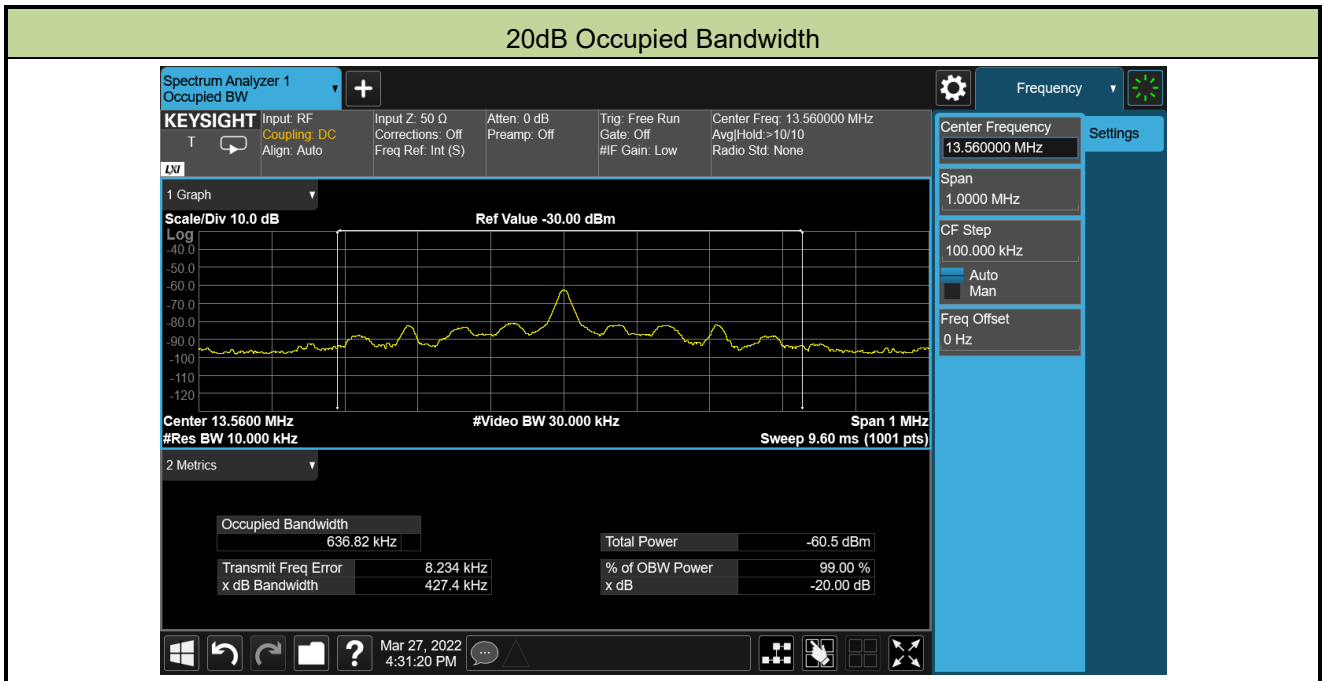
Note

- Below 30MHz measurement was performed using a loop antenna. The antenna was positioned in two orthogonal (face on and face off) and the position with the highest emission level was recorded.
- Measurements were tested at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear extrapolation factor (40 dB/decade) as specified in &15.31(f)(2).
 Extrapolation Factor = $40 * \log(30/3)^2 = 40$ dB
 For example, Limit (@3m) = $20 * \log(30) + 40 = 69.54$ dBμV/m
- All measurements were recorded using an EMI test receiver employing a peak detector.

A.3 Occupied Bandwidth Test Result

Test Engineer	Charles Zhang	Test Date	2022-03-27
Test Mode	Mode1	Test Site	WZ-AC1

Frequency (MHz)	20dB Occupied Bandwidth (kHz)
13.56	427.40



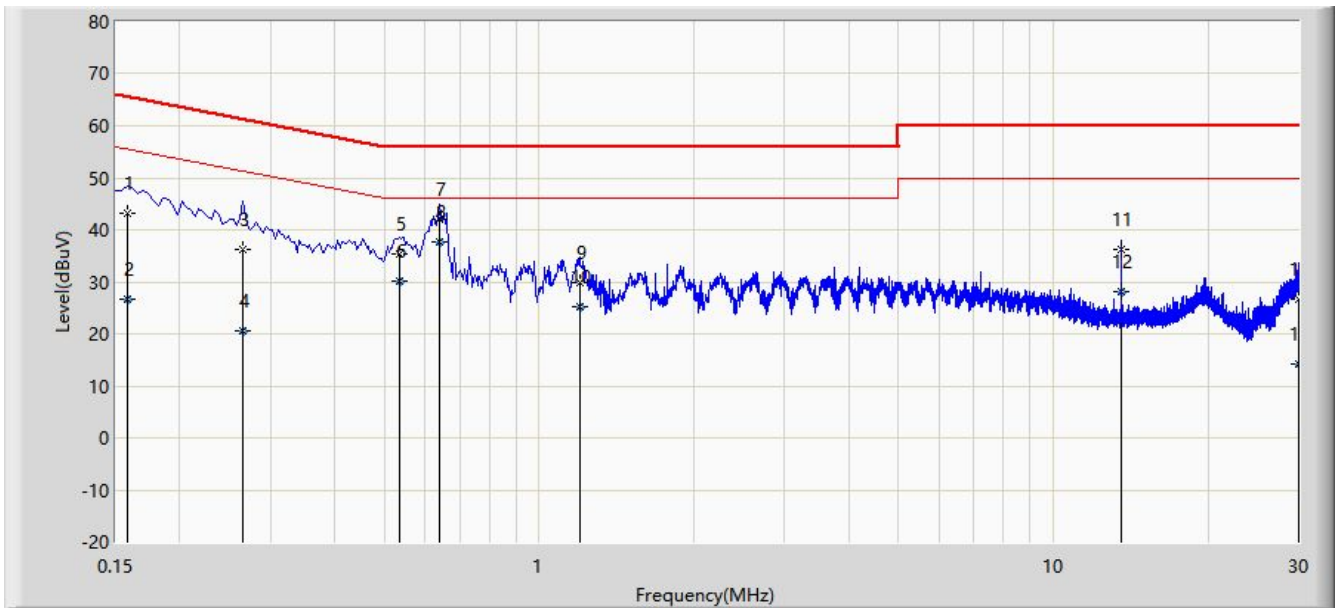
A.4 Frequency Stability Tolerance Test Result

Test Engineer	Charles Zhang	Test Date	2022-03-26
Test Mode	Mode1	Test Site	WZ-AC1

Reference Voltage: 120V			
Deviation Limit: +/- 0.01% = +/- 1356Hz			
Voltage (%)	Power Battery	Temp (°C)	Frequency Deviation (Hz)
100%	120V	-20	450
		-10	-925
		0	-275
		+10	-625
		+20	-425
		+30	350
		+40	375
		+50	400
85%	102V	+ 20	925
115%	138V	+ 20	-500

A.5 AC Conducted Emissions Test Result

Site: WZ-SR2	Test Date: 2022-03-29
Limit: FCC_Part15.207_CE_AC Power	Engineer: Helen Han
Probe: ENV216_101683_Filter Off_E	Polarity: Line
EUT: Senseon Plus Wireless Card Programmer	Power: AC 120V/60Hz
Test Mode 1	

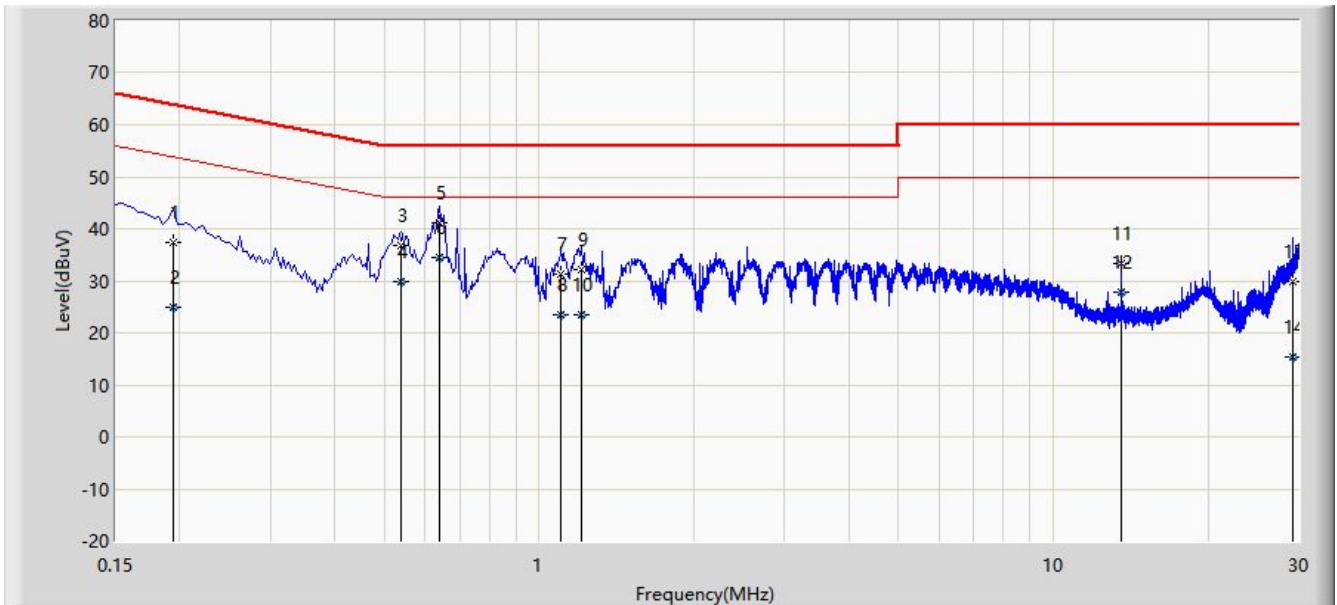


No	Flag	Mark	Frequency (MHz)	Measure Level (dBμV)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV)	Factor (dB)	Type
1			0.158	43.278	33.378	-22.291	65.568	9.900	QP
2			0.158	26.575	16.675	-28.994	55.568	9.900	AV
3			0.266	36.156	26.252	-25.085	61.242	9.904	QP
4			0.266	20.634	10.730	-30.608	51.242	9.904	AV
5			0.534	35.245	25.323	-20.755	56.000	9.922	QP
6			0.534	30.222	20.300	-15.778	46.000	9.922	AV
7			0.638	41.992	32.066	-14.008	56.000	9.926	QP
8		*	0.638	37.793	27.867	-8.207	46.000	9.926	AV
9			1.198	29.831	19.877	-26.169	56.000	9.954	QP
10			1.198	25.107	15.153	-20.893	46.000	9.954	AV
11			13.558	36.141	25.187	-23.859	60.000	10.955	QP
12			13.558	28.063	17.108	-21.937	50.000	10.955	AV
13			29.930	26.564	14.458	-33.436	60.000	12.107	QP
14			29.930	14.133	2.027	-35.867	50.000	12.107	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Site: WZ-SR2	Test Date: 2022-03-29
Limit: FCC_Part15.207_CE_AC Power	Engineer: Helen Han
Probe: ENV216_101683_Filter Off_E	Polarity: Neutral
EUT: Senseon Plus Wireless Card Programmer	Power: AC 120V/60Hz
Test Mode 1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V)	Factor (dB)	Type
1			0.194	37.518	27.606	-26.345	63.864	9.912	QP
2			0.194	24.827	14.915	-29.036	53.864	9.912	AV
3			0.538	36.845	26.912	-19.155	56.000	9.934	QP
4			0.538	29.787	19.854	-16.213	46.000	9.934	AV
5			0.638	41.236	31.293	-14.764	56.000	9.943	QP
6		*	0.638	34.469	24.526	-11.531	46.000	9.943	AV
7			1.102	31.283	21.319	-24.717	56.000	9.963	QP
8			1.102	23.440	13.476	-22.560	46.000	9.963	AV
9			1.210	32.052	22.086	-23.948	56.000	9.966	QP
10			1.210	23.384	13.418	-22.616	46.000	9.966	AV
11			13.562	33.439	22.474	-26.561	60.000	10.965	QP
12			13.562	27.877	16.912	-22.123	50.000	10.965	AV
13			29.230	29.853	17.683	-30.147	60.000	12.171	QP
14			29.230	15.326	3.156	-34.674	50.000	12.171	AV

Note: Measure Level (dB μ V) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Appendix A - Test Setup Photograph

Refer to "2203RSU011-UT" file.

Appendix B - EUT Photograph

Refer to "2203RSU011-UE" file.

The End