

# TEST REPORT

**Product Name** : Mini Carbon Monoxide Smart Sensor  
**Brand Mark** : hwiote  
**Model No.** : Mini600-CO-TB  
**FCC ID** : 2BFDL-MINI600  
**Report Number** : BLA-EMC-202404-A1702  
**Date of Sample Receipt** : 2024/4/8  
**Date of Test** : 2024/4/8 to 2024/4/18  
**Date of Issue** : 2024/4/18  
**Test Standard** : 47 CFR Part 15, Subpart C 15.247  
**Test Result** : Pass

Prepared for:

**Shenzhen Hanwei IoT Co., Ltd.**

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Prepared by:

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Date:

2024/4/18



**Report Revise Record**

<b>Version No.</b>	<b>Date</b>	<b>Description</b>
00	2024/4/18	Original

BlueAsia

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## 1 Test summary

Test item	Test Requirement	Test Method	Class/Severity	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	N/A
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass

N/A: Not Applicable

## 2 General information

<b>Applicant</b>	Shenzhen Hanwei IoT Co., Ltd.
<b>Address</b>	Unit 801, University Town Venture Park, No.10 Lishan Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong Province
<b>Manufacturer</b>	Shenzhen Hanwei IoT Co., Ltd.
<b>Address</b>	Unit 801, University Town Venture Park, No.10 Lishan Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong Province
<b>Factory</b>	Shenzhen Hanwei IoT Co., Ltd.
<b>Address</b>	Unit 801, University Town Venture Park, No.10 Lishan Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong Province
<b>Product Name</b>	Mini Carbon Monoxide Smart Sensor
<b>Test Model No.</b>	Mini600-CO-TB

## 3 General description of EUT

<b>Hardware Version</b>	V1.0.0
<b>Software Version</b>	V1.0.0
<b>Engineer sample no</b>	DC5V
<b>Operation Frequency</b>	2402MHz-2480MHz
<b>Modulation Type</b>	GFSK
<b>Channel Spacing</b>	2MHz
<b>Number of Channels</b>	40
<b>Antenna Type</b>	Ceramic Chip Antenna
<b>Antenna Gain</b>	0.8dBi(Provided by the customer)

#### 4 Operation frequency each of channel

BLE:

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	11	2422MHz	21	2442MHz	31	2462MHz
2	2404MHz	12	2424MHz	22	2444MHz	32	2464MHz
....	....	....	....	....	....	....	....
9	2418MHz	19	2438MHz	29	2458MHz	39	2478MHz
10	2420MHz	20	2440MHz	30	2460MHz	40	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2442MHz
The Highest channel	2480MHz

## 5 Test environment

Environment	Temperature	Voltage
Normal	25°C	DC 5V

## 6 Test mode

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in transmitting mode with modulation

Remark: Only the data of the worst mode would be recorded in this report.

## 7 Measurement uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %
Radiated Emission(9kHz-30MHz)	±4.34dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB
Unwanted Radiated Emission (30MHz ~ 1000MHz)	±4.35 dB
Unwanted Radiated Emission (1GHz ~ 18GHz)	±4.44 dB

## 8 Description of support unit

Device Type	Manufacturer	Model Name	Serial No.	Remark
PC	Lenovo	E460C	N/A	From lab (No.BLA-ZC-BS-2022005)

## 9 Laboratory Location

All tests were performed at:  
 BlueAsia of Technical Services(Shenzhen) Co., Ltd.  
 Building C, No. 107, Shihuan Road, Shiyuan Sub-District, Baoan District, Shenzhen, Guangdong Province, China  
 Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673  
 No tests were sub-contracted.



## 10 Test instruments list

Test equipment of radiated spurious emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber 1	SKET	966	N/A	2023/11/16	2026/11/15
Chamber 2	SKET	966	N/A	2021/07/20	2024/7/19
Spectrum	R&S	FSP40	100817	2023/08/30	2024/08/29
Receiver	R&S	ESR7	101199	2023/08/30	2024/08/29
Receiver	R&S	ESPI7	101477	2023/07/07	2024/07/06
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2022/10/12	2025/10/11
Horn Antenna	Schwarzbeck	BBHA9120D	01892 P:00331	2022/09/13	2025/09/12
Horn Antenna	Schwarzbeck	BBHA 9170	1106	2022/04/24	2024/04/23
Amplifier	SKET	LNPA_30M01 G-30	SK2021060801	2023/07/07	2024/07/06
Amplifier	SKET	PA-000318G-4 5	N/A	2023/08/30	2024/08/29
Amplifier	SKET	LNPA_18G40 G-50	SK2022071301	2023/07/14	2024/07/13
Filter group	SKET	2.4G/5G Filter group r	N/A	2023/07/07	2024/07/06
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBE CK	FMZB1519B	00102	2022/09/14	2025/09/13
1kHz calibration audio source	SKET	MCS-ABT-C35	N/A	2023/09/04	2024/09/03
Free Field Microphone	SKET	MGS MP 663	0414	2023/09/04	2024/09/03
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A
Signal Generator DTV	ECREDIX	DSG-1000	N/A	N/A	N/A

<b>Test equipment of RF conducted test</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>S/N</b>	<b>Cal.Date</b>	<b>Cal.Due</b>
Spectrum	R&S	FSP40	100817	2023/08/30	2024/08/29
Spectrum	Agilent	N9020A	MY49100060	2023/08/30	2024/08/29
Spectrum	Agilent	N9020A	MY54420161	2023/08/30	2024/08/29
Signal Generator	Agilent	N5182A	MY47420955	2023/08/30	2024/08/29
Signal Generator	Agilent	N5181A	MY46240904	2023/07/07	2024/07/06
Signal Generator	R&S	CMW500	132429	2023/08/30	2024/08/29
BluetoothTester	Anritsu	MT8852B	06262047872	2023/08/30	2024/08/29
Power probe	DARE	RPR3006W	14I00889SN042	2023/09/01	2024/08/31
Power detection box	CDKMV	MW100-PSB	MW201020JYT	2023/07/07	2024/07/06
DC Power supply	zhaoxin	KXN-305D	20K305D1221363	2023/08/30	2024/08/29
DC Power supply	zhaoxin	RXN-1505D	19R1505D050168	2023/08/30	2024/08/29
2.4GHz/5GHz RF Test software	MTS	MTS 8310	Version 2.0.0.0	N/A	N/A
Audio Analyzer	Audio Precision	ATS-1	ATS141094	2023/07/07	2024/07/06

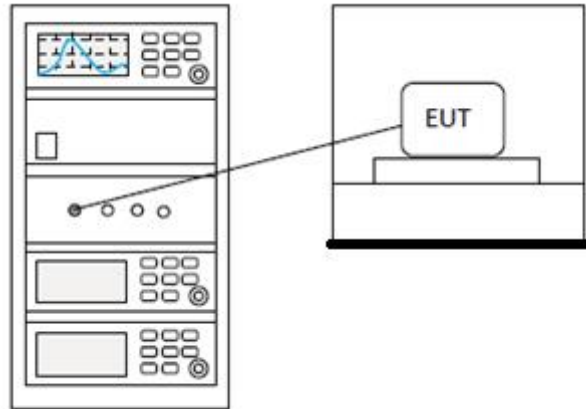
## 11 Conducted band edges measurement

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 11.1 Limits

<b>Limit:</b>	<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</p>
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### 11.2 Test setup



### 11.3 Test data

**Pass: Please Refer To Appendix: Appendix1 For Details**

## 12 Radiated spurious emissions

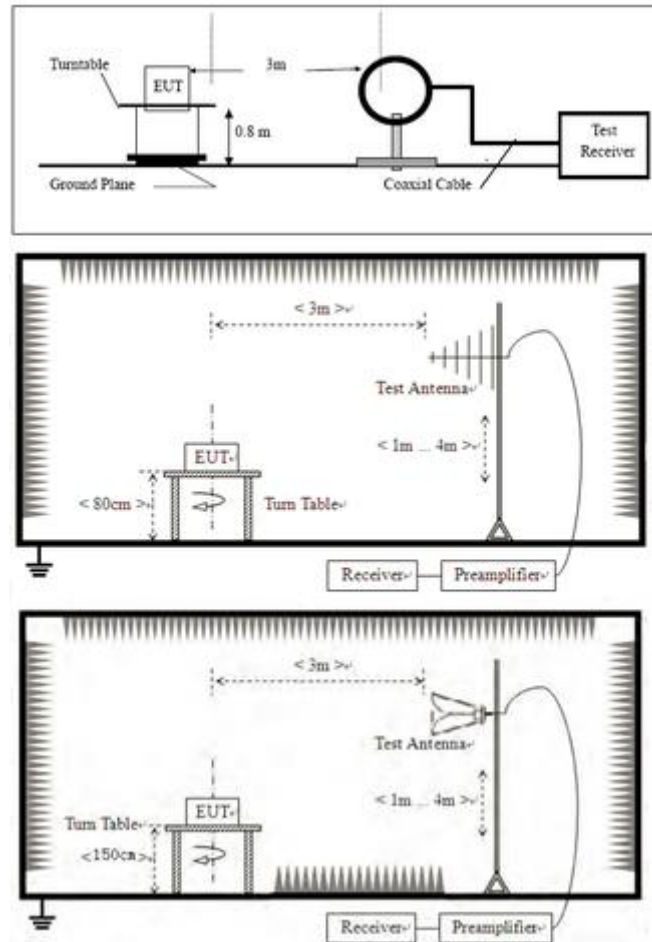
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.4,6.5,6.6
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 12.1 Limits

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 12.2 Test setup



## 12.3 Procedure

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

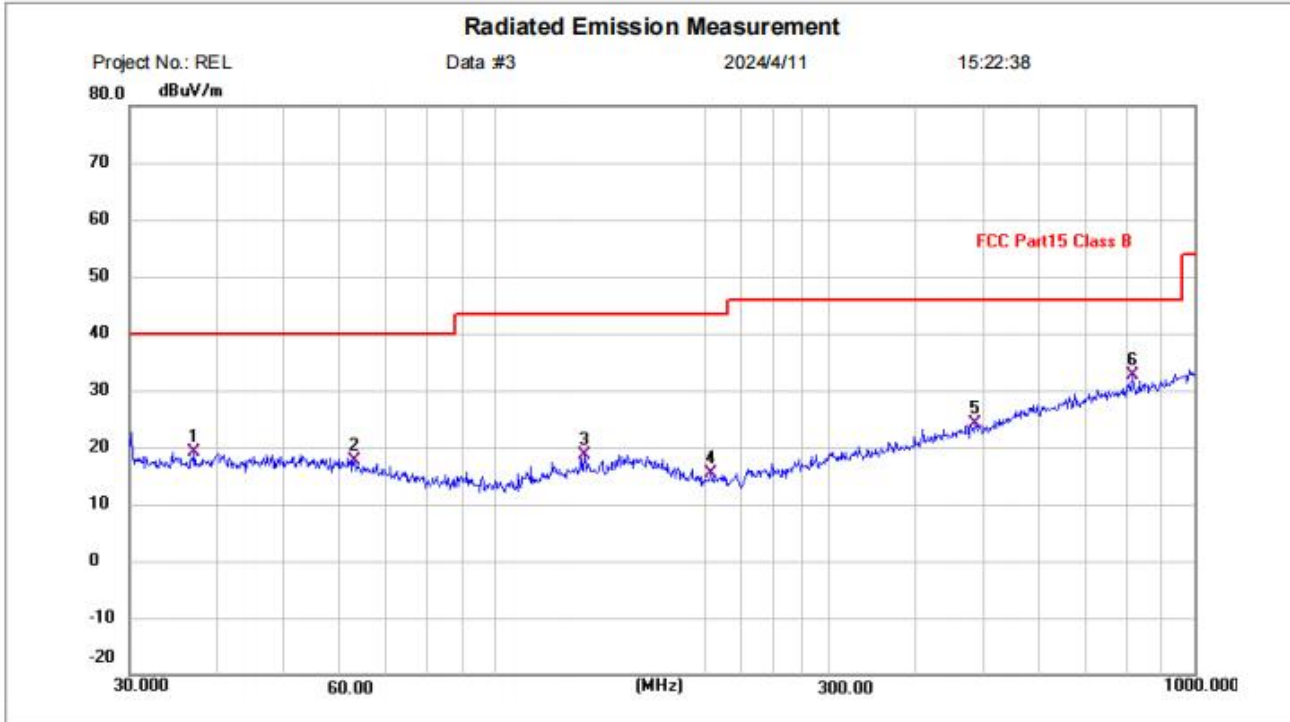
Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
- 3) Scan from 9 kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

### 12.4 Test data

Below 1GHz

[TestMode: TX]; [Polarity: Horizontal]



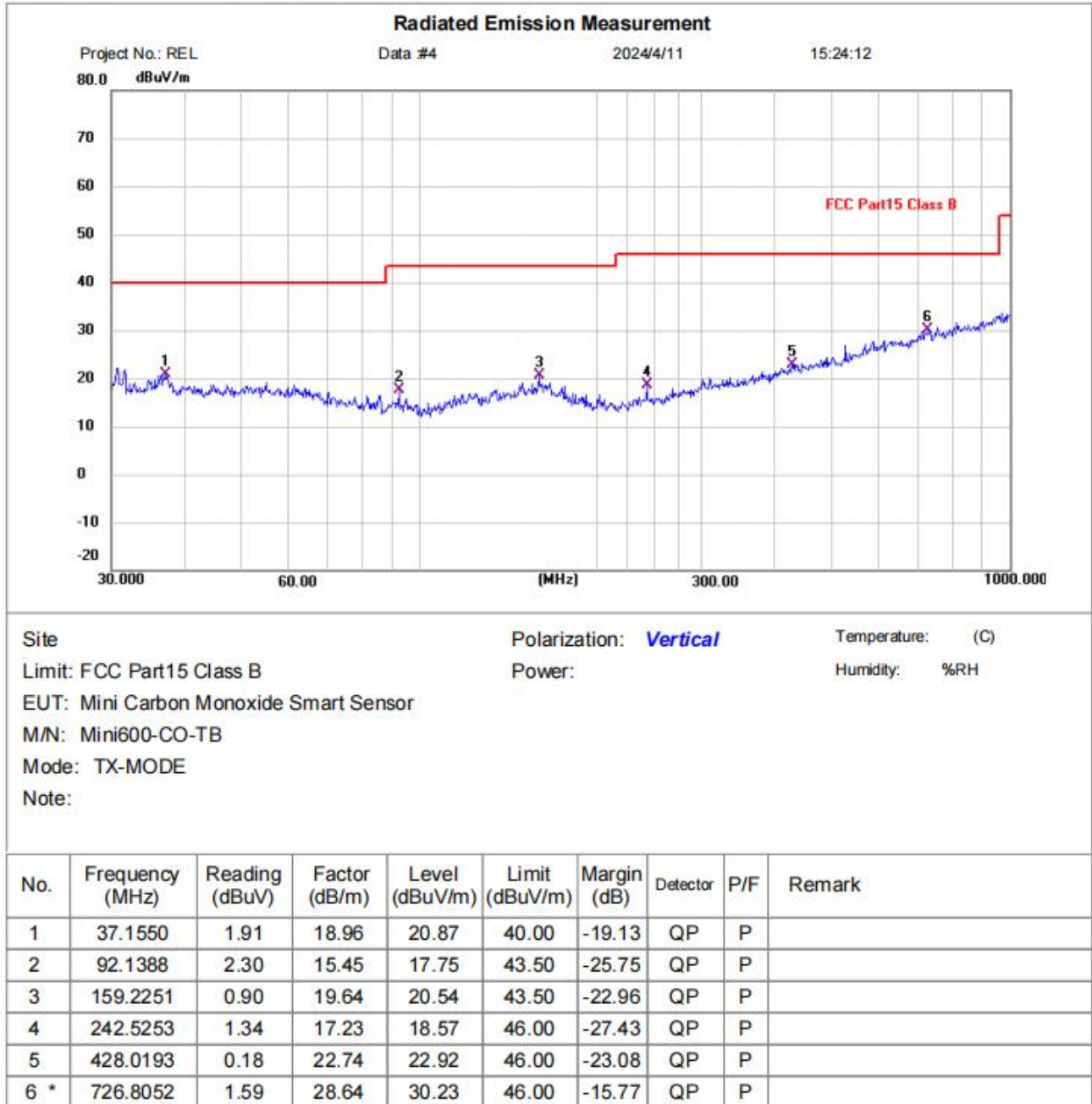
Site:      Polarization: **Horizontal**      Temperature: (C)  
 Limit: FCC Part15 Class B      Power:      Humidity: %RH  
 EUT: Mini Carbon Monoxide Smart Sensor  
 M/N: Mini600-CO-TB  
 Mode: TX-MODE  
 Note:

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	37.1549	0.28	18.96	19.24	40.00	-20.76	QP	P	
2	62.8707	-0.60	18.16	17.56	40.00	-22.44	QP	P	
3	134.0881	-0.08	18.64	18.56	43.50	-24.94	QP	P	
4	203.5227	-0.38	15.88	15.50	43.50	-28.00	QP	P	
5	485.6092	0.48	23.61	24.09	46.00	-21.91	QP	P	
6 *	815.9678	2.29	30.27	32.56	46.00	-13.44	QP	P	

**Test Result: Pass**



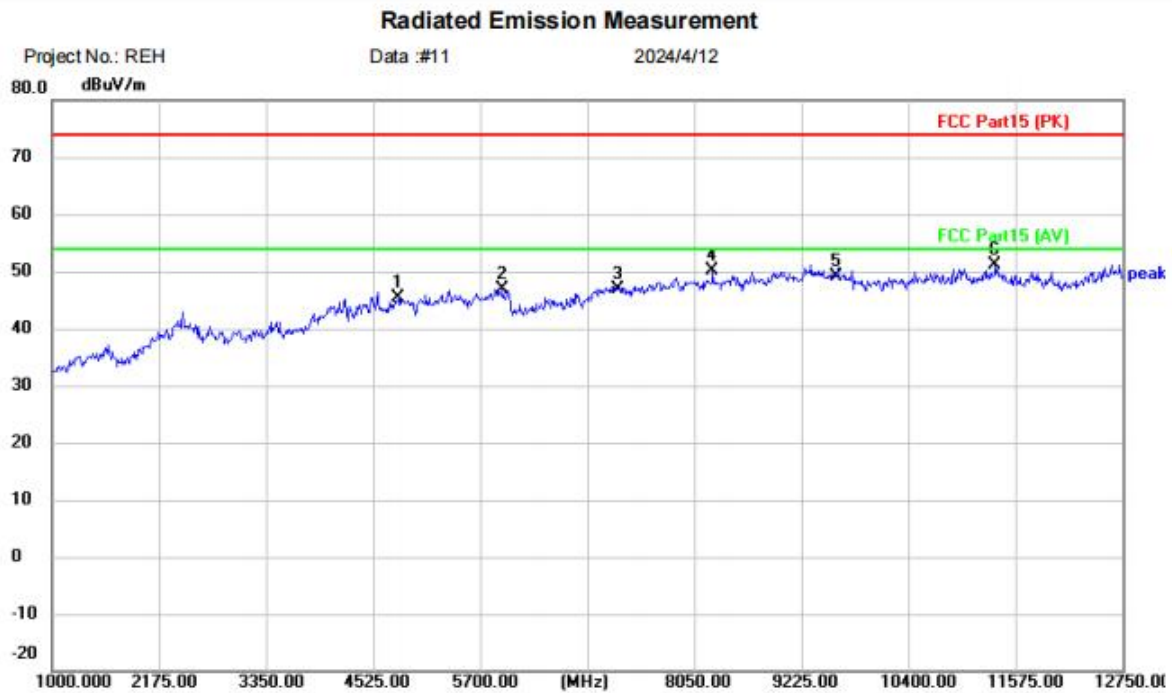
[TestMode: TX]; [Polarity: Vertical]



**Test Result: Pass**

Above 1GHz:

[TestMode: TX low channel]; [Polarity: Horizontal]

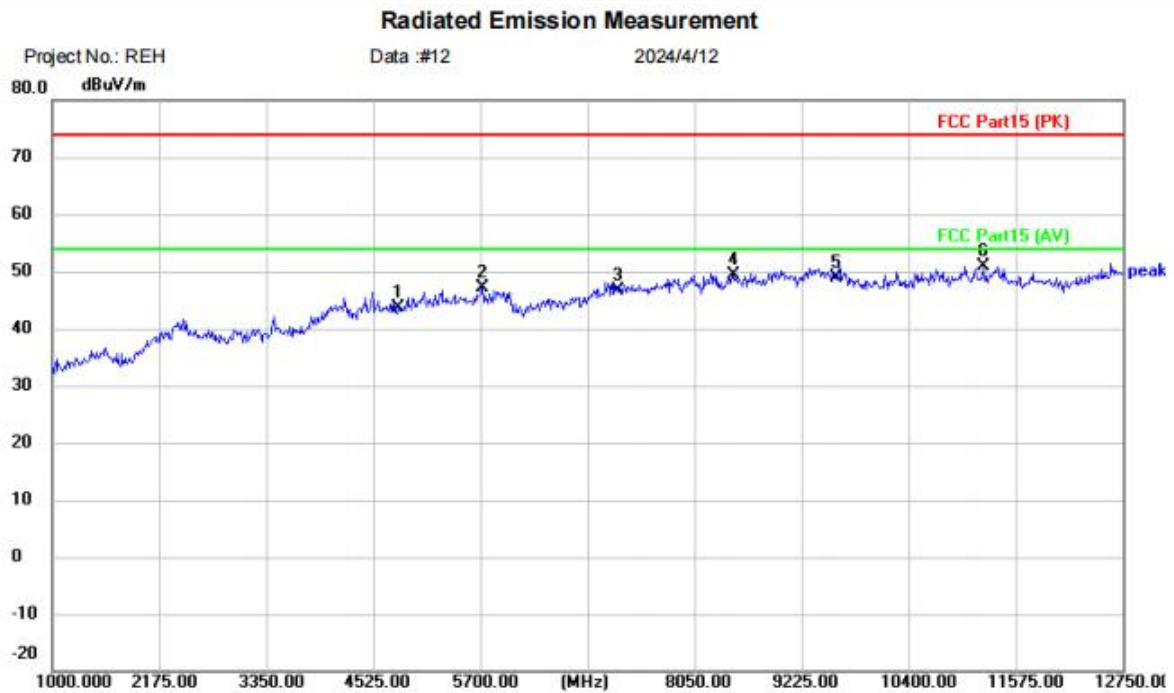


Site: Polarization: *Horizontal* Temperature: (C)  
 Limit: FCC Part15 (PK) Power: Humidity: %RH  
 EUT: Mini Carbon Monoxide Smart Sensor  
 M/N: Mini600-CO-TB  
 Mode: TX-2402  
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		4804.000	39.86	5.64	45.50	74.00	-28.50	peak	
2		5946.750	38.22	8.71	46.93	74.00	-27.07	peak	
3		7206.000	37.65	9.24	46.89	74.00	-27.11	peak	
4		8249.750	40.34	9.86	50.20	74.00	-23.80	peak	
5		9608.000	36.84	12.31	49.15	74.00	-24.85	peak	
6	*	11351.75	38.48	12.65	51.13	74.00	-22.87	peak	

**Test Result: Pass**

[TestMode: TX low channel]; [Polarity: Vertical]

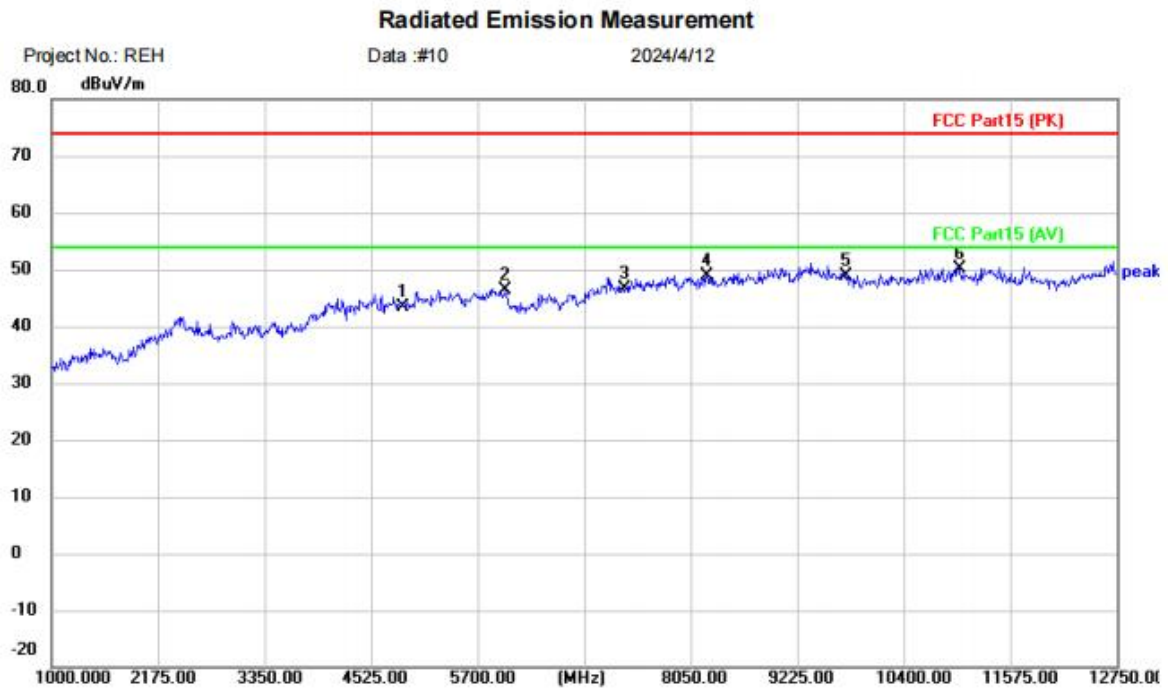


Site	Polarization: <b>Vertical</b>	Temperature: (C)
Limit: FCC Part15 (PK)	Power:	Humidity: %RH
EUT: Mini Carbon Monoxide Smart Sensor		
M/N: Mini600-CO-TB		
Mode: TX-240z		
Note:		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4804.000	38.01	5.64	43.65	74.00	-30.35	peak	
2		5723.500	39.17	8.08	47.25	74.00	-26.75	peak	
3		7206.000	37.48	9.24	46.72	74.00	-27.28	peak	
4		8473.000	38.63	10.77	49.40	74.00	-24.60	peak	
5		9608.000	36.60	12.31	48.91	74.00	-25.09	peak	
6	*	11222.50	38.11	12.70	50.81	74.00	-23.19	peak	

**Test Result: Pass**

[TestMode: TX middle channel]; [Polarity: Horizontal]

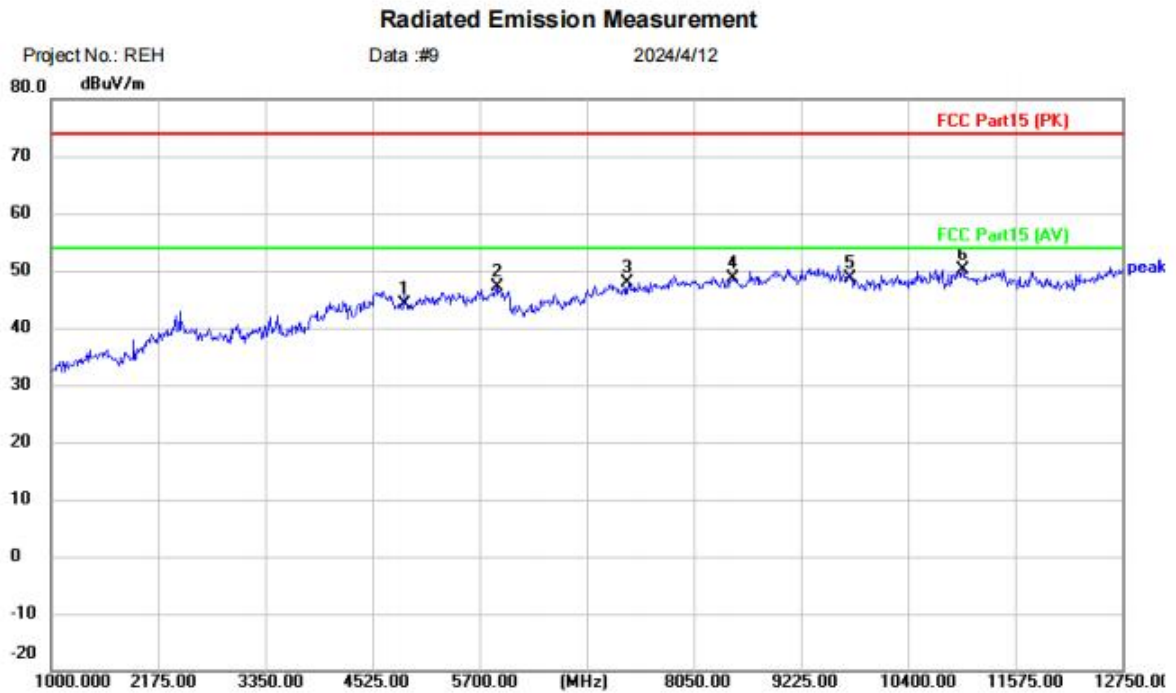


Site: Polarization: **Horizontal**      Temperature: (C)  
 Limit: FCC Part15 (PK)      Power:      Humidity: %RH  
 EUT: Mini Carbon Monoxide Smart Sensor  
 M/N: Mini600-CO-TB  
 Mode: TX-2442  
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4884.000	37.68	5.75	43.43	74.00	-30.57	peak	
2		6005.500	40.79	5.61	46.40	74.00	-27.60	peak	
3		7326.000	37.29	9.43	46.72	74.00	-27.28	peak	
4		8226.250	38.89	9.87	48.76	74.00	-25.24	peak	
5		9768.000	36.70	12.22	48.92	74.00	-25.08	peak	
6	*	11011.00	36.79	13.40	50.19	74.00	-23.81	peak	

**Test Result: Pass**

[TestMode: TX middle channel]; [Polarity: Vertical]



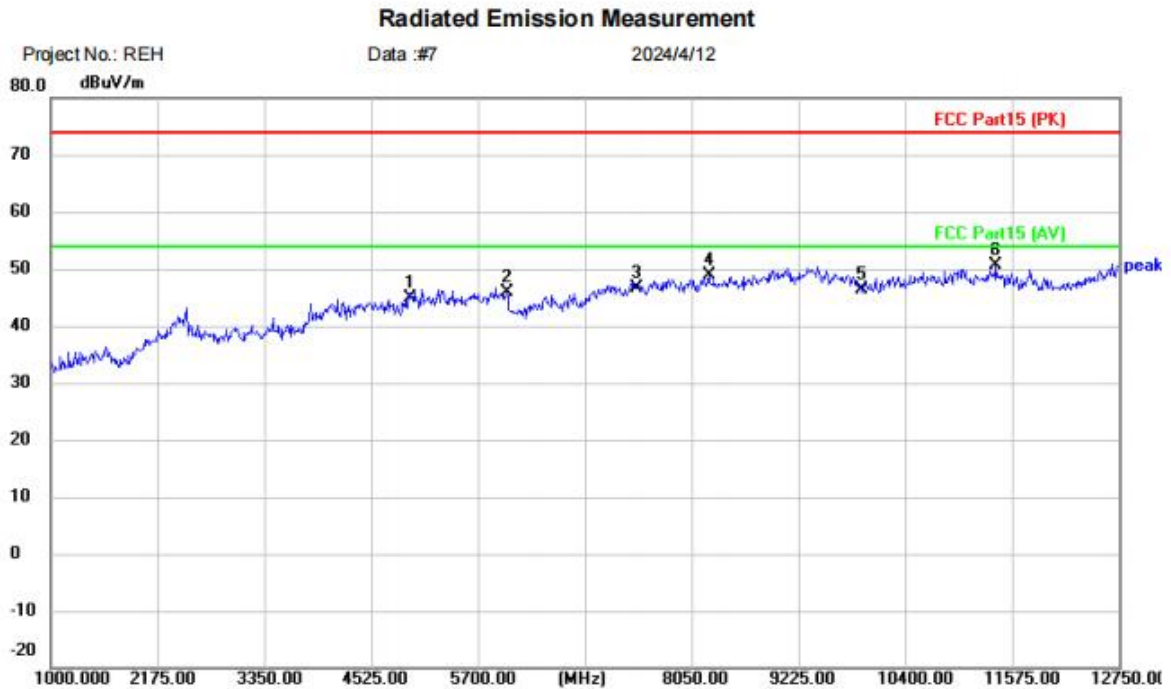
Site	Polarization: <b>Vertical</b>	Temperature: (C)
Limit: FCC Part15 (PK)	Power:	Humidity: %RH
EUT: Mini Carbon Monoxide Smart Sensor		
M/N: Mini600-CO-TB		
Mode: TX-2442		
Note:		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		4884.000	38.47	5.75	44.22	74.00	-29.78	peak	
2		5888.000	38.56	8.60	47.16	74.00	-26.84	peak	
3		7326.000	38.34	9.43	47.77	74.00	-26.23	peak	
4		8473.000	37.87	10.77	48.64	74.00	-25.36	peak	
5		9768.000	36.41	12.22	48.63	74.00	-25.37	peak	
6	*	10999.25	36.62	13.48	50.10	74.00	-23.90	peak	

**Test Result: Pass**



[TestMode: TX High channel]; [Polarity: Horizontal]

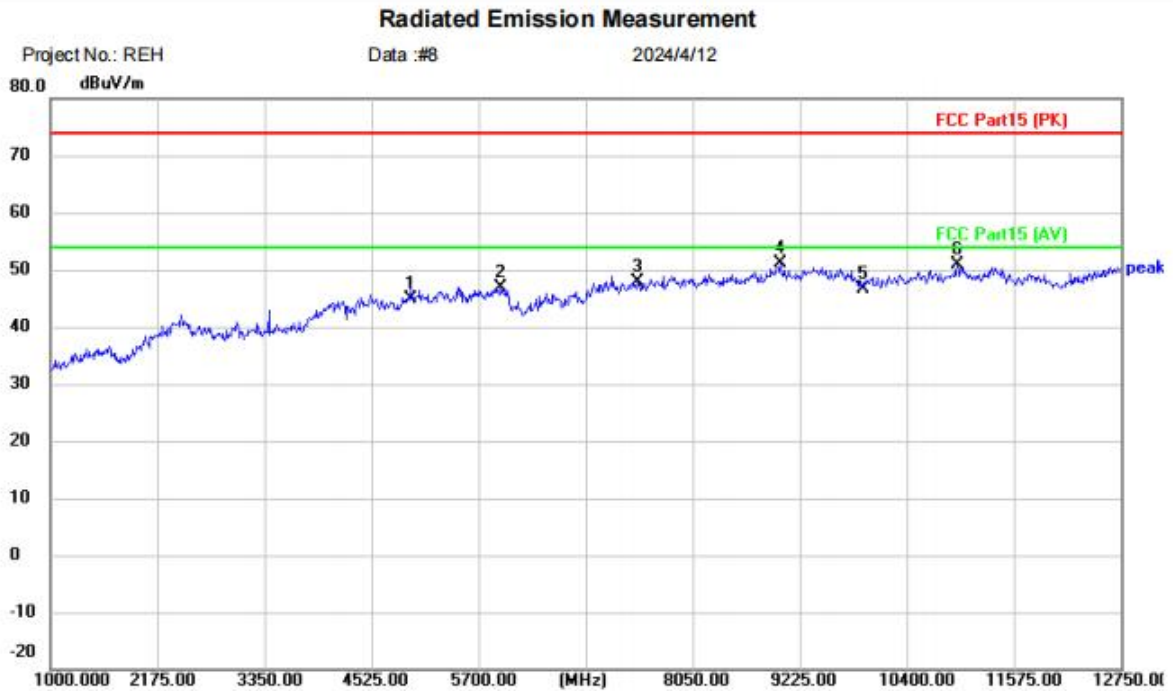


Site	Polarization: <b>Horizontal</b>	Temperature: (C)
Limit: FCC Part15 (PK)	Power:	Humidity: %RH
EUT: Mini Carbon Monoxide Smart Sensor		
M/N: Mini600-CO-TB		
Mode: TX-2480		
Note:		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4960.000	38.28	6.60	44.88	74.00	-29.12	peak	
2		6017.250	40.28	5.63	45.91	74.00	-28.09	peak	
3		7440.000	36.90	9.64	46.54	74.00	-27.46	peak	
4		8238.000	39.03	9.86	48.89	74.00	-25.11	peak	
5		9920.000	34.17	12.14	46.31	74.00	-27.69	peak	
6	*	11398.75	38.10	12.61	50.71	74.00	-23.29	peak	

**Test Result: Pass**

[TestMode: TX High channel]; [Polarity: Vertical]



Site:      Polarization: *Vertical*      Temperature: (C)

Limit: FCC Part15 (PK)      Power:      Humidity: %RH

EUT: Mini Carbon Monoxide Smart Sensor

M/N: Mini600-CO-TB

Mode: TX-2480

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	38.39	6.60	44.99	74.00	-29.01	peak	
2		5946.750	38.13	8.71	46.84	74.00	-27.16	peak	
3		7440.000	38.28	9.64	47.92	74.00	-26.08	peak	
4	*	9013.500	38.82	12.35	51.17	74.00	-22.83	peak	
5		9920.000	34.58	12.14	46.72	74.00	-27.28	peak	
6		10952.25	37.70	13.30	51.00	74.00	-23.00	peak	

**Test Result: Pass**

### 13 Antenna requirement

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	N/A

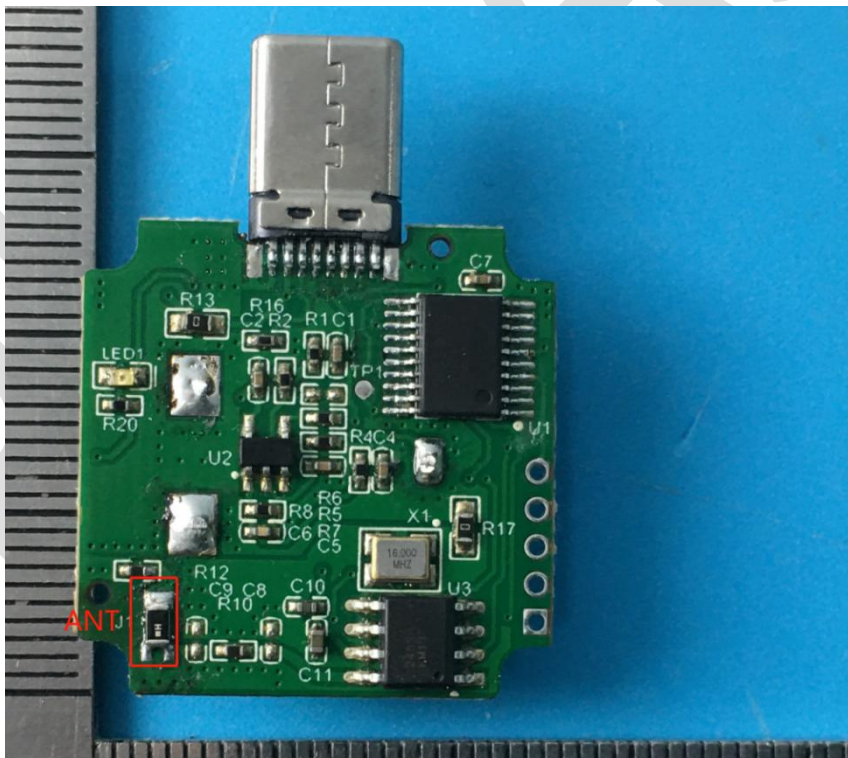
#### 13.1 Conclusion

Standard Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of a so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0.8dBi.





## 14 Radiated emissions which fall in the restricted bands

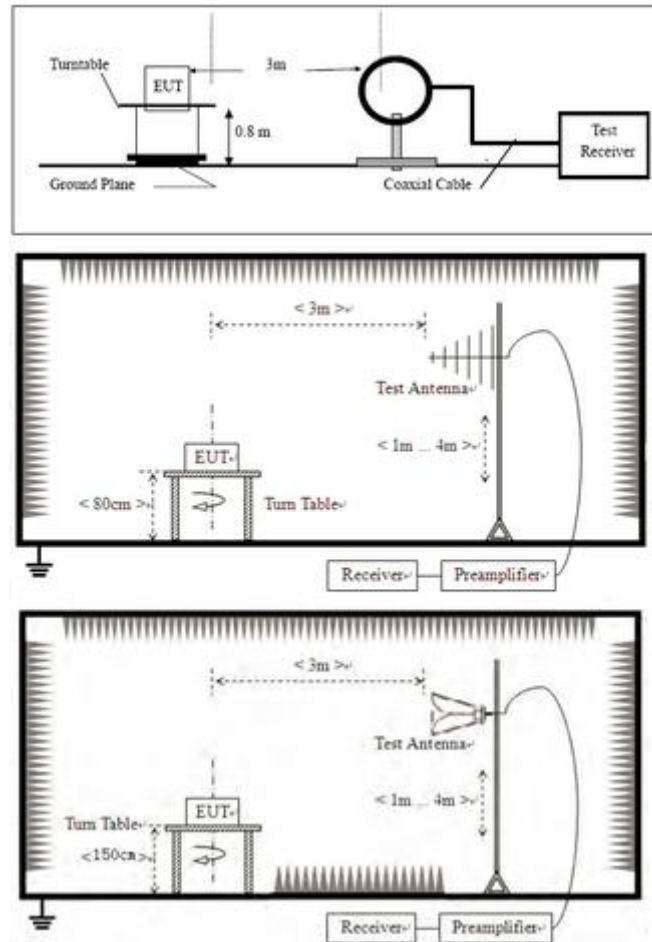
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.10.5
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 14.1 Limits

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 14.2 Test setup



## 14.3 PROCEDURE

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

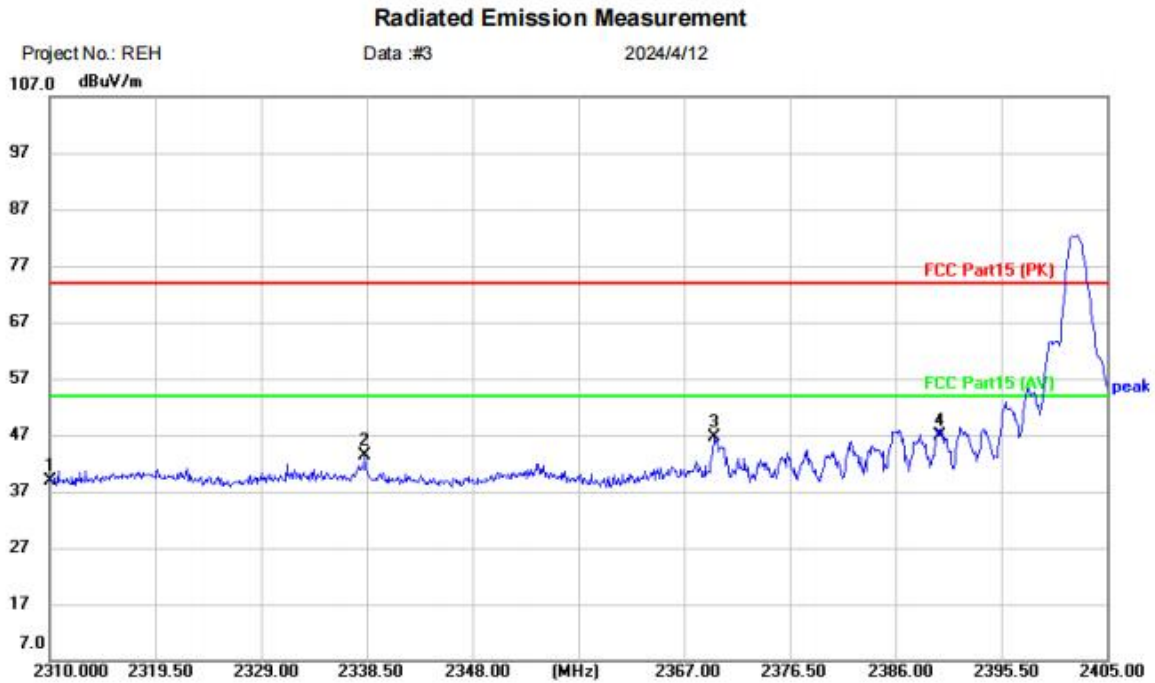
Remark 1:  $Level = Read\ Level + Cable\ Loss + Antenna\ Factor - Preamp\ Factor$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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### 14.4 Test data

[TestMode: TX low channel]; [Polarity: Horizontal]

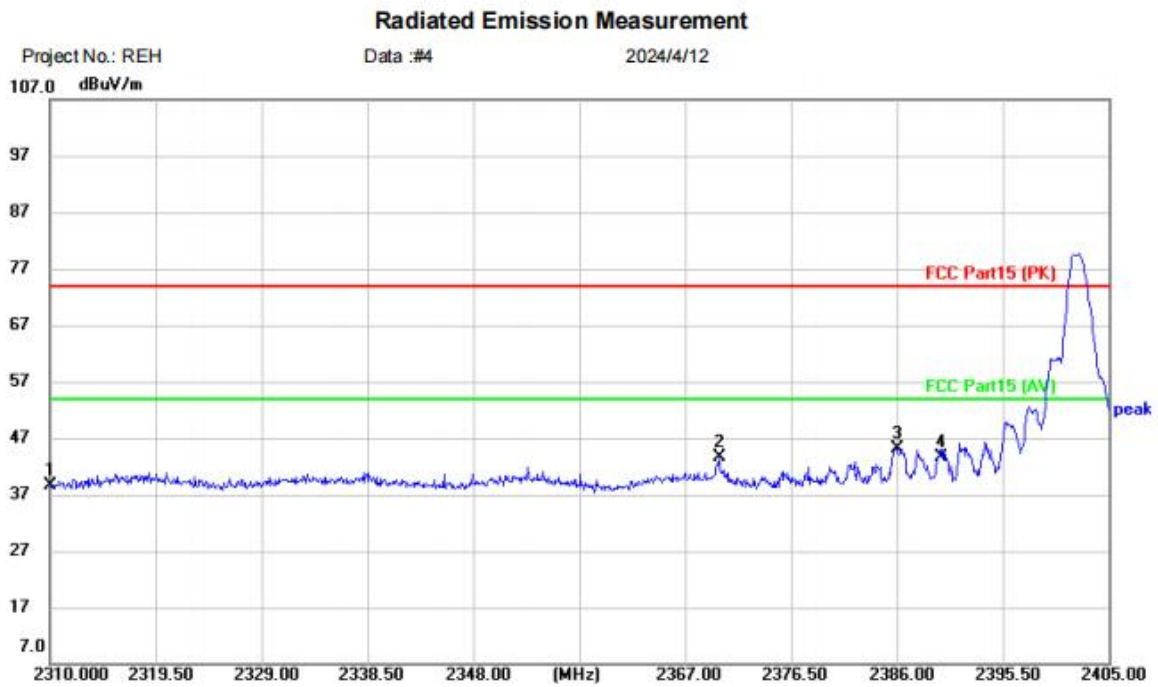


Site	Polarization: <b>Horizontal</b>	Temperature: (C)
Limit: FCC Part15 (PK)	Power:	Humidity: %RH
EUT: Mini Carbon Monoxide Smart Sensor		
M/N: Mini600-CO-TB		
Mode: TX-2402		
Note:		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		2310.000	41.86	-2.89	38.97	74.00	-35.03	peak	
2		2338.310	46.20	-2.83	43.37	74.00	-30.63	peak	
3		2369.660	49.30	-2.74	46.56	74.00	-27.44	peak	
4	*	2390.000	49.63	-2.70	46.93	74.00	-27.07	peak	

**Test Result: Pass**

[TestMode:TX low channel]; [Polarity: Vertical]



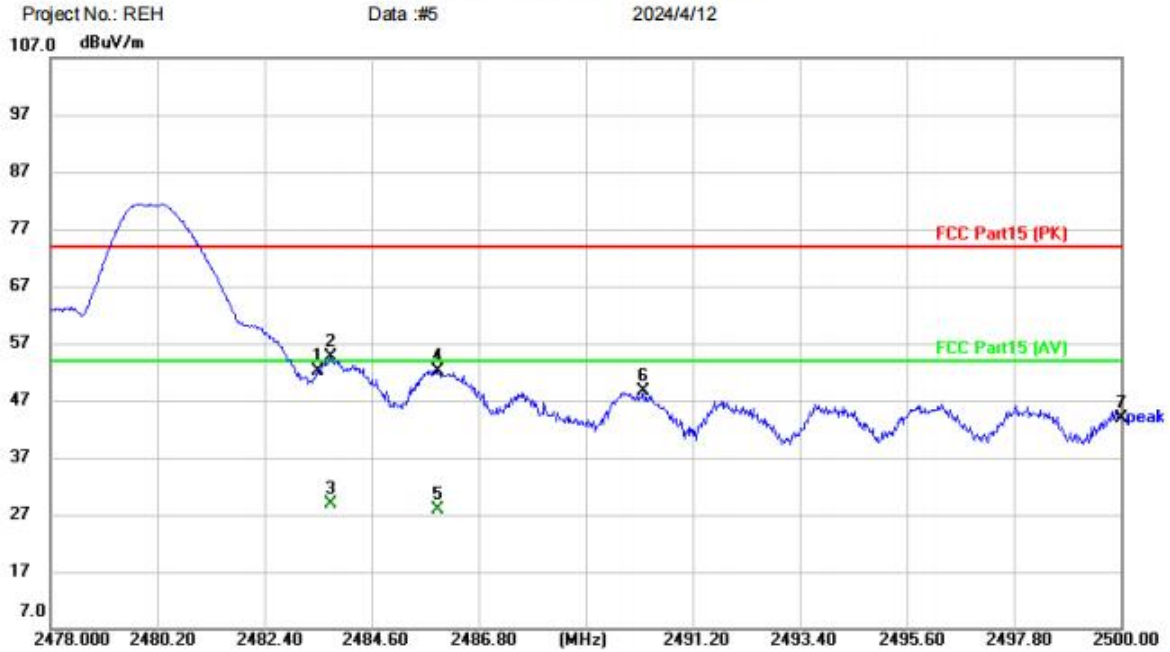
Site	Polarization: <b>Vertical</b>	Temperature: (C)
Limit: FCC Part15 (PK)	Power:	Humidity: %RH
EUT: Mini Carbon Monoxide Smart Sensor		
M/N: Mini600-CO-TB		
Mode: TX-2402		
Note:		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2310.000	41.54	-2.89	38.65	74.00	-35.35	peak	
2		2370.040	46.28	-2.73	43.55	74.00	-30.45	peak	
3	*	2386.000	47.84	-2.70	45.14	74.00	-28.86	peak	
4		2390.000	46.42	-2.70	43.72	74.00	-30.28	peak	

**Test Result: Pass**

[TestMode: TX High channel]; [Polarity: Horizontal]

### Radiated Emission Measurement



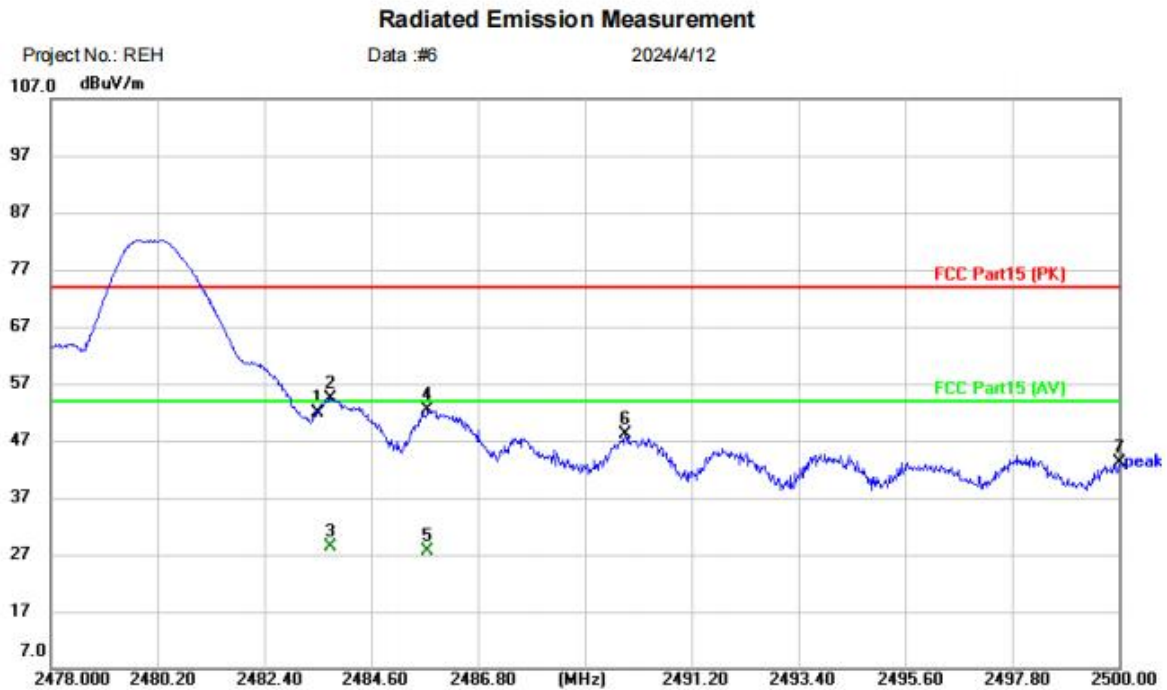
Site:      Polarization: **Horizontal**      Temperature: (C)  
 Limit: FCC Part15 (PK)      Power:      Humidity: %RH  
 EUT: Mini Carbon Monoxide Smart Sensor  
 M/N: Mini600-CO-TB  
 Mode: TX-2480  
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2483.500	54.98	-2.91	52.07	74.00	-21.93	peak	
2	*	2483.764	57.47	-2.91	54.56	74.00	-19.44	peak	
3		2483.764	31.77	-2.91	28.86	54.00	-25.14	AVG	
4		2485.964	55.15	-2.92	52.23	74.00	-21.77	peak	
5		2485.964	30.75	-2.92	27.83	54.00	-26.17	AVG	
6		2490.188	51.65	-2.95	48.70	74.00	-25.30	peak	
7		2500.000	46.78	-3.00	43.78	74.00	-30.22	peak	

**Test Result: Pass**



[TestMode:TX High channel]; [Polarity: Vertical]



Site:      Polarization: **Vertical**      Temperature: (C)  
 Limit: FCC Part15 (PK)      Power:      Humidity: %RH  
 EUT: Mini Carbon Monoxide Smart Sensor  
 M/N: Mini600-CO-TB  
 Mode: TX-2480  
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2483.500	54.89	-2.91	51.98	74.00	-22.02	peak	
2	*	2483.764	57.37	-2.91	54.46	74.00	-19.54	peak	
3		2483.764	31.33	-2.91	28.42	54.00	-25.58	AVG	
4		2485.766	55.39	-2.92	52.47	74.00	-21.53	peak	
5		2485.766	30.66	-2.92	27.74	54.00	-26.26	AVG	
6		2489.836	51.03	-2.95	48.08	74.00	-25.92	peak	
7		2500.000	46.18	-3.00	43.18	74.00	-30.82	peak	

**Test Result: Pass**

## 15 Conducted spurious emissions

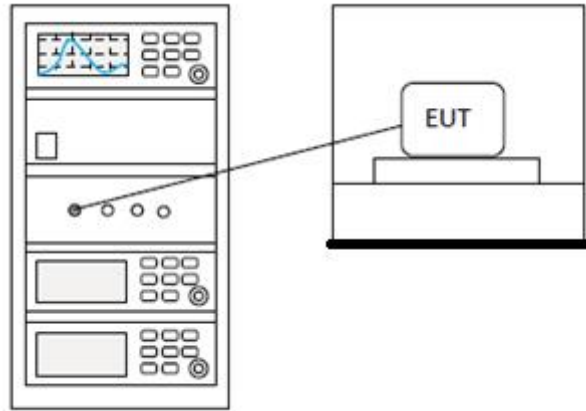
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 15.1 Limits

<b>Limit:</b>	<p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).</p>
---------------	--



### 15.2 Test setup



### 15.3 Test data

**Pass: Please Refer To Appendix: Appendix1 For Details**

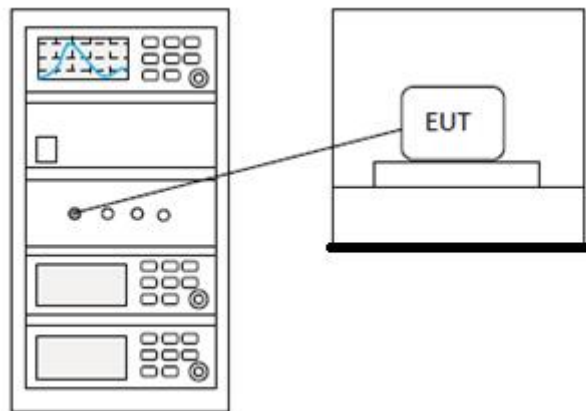
## 16 Power spectrum density

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.10.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

### 16.1 Limits

<b>Limit:</b>	≤8dBm in any 3 kHz band during any time interval of continuous transmission
---------------	---

### 16.2 Test setup



### 16.3 Test data

**Pass: Please Refer To Appendix: Appendix1 For Details**

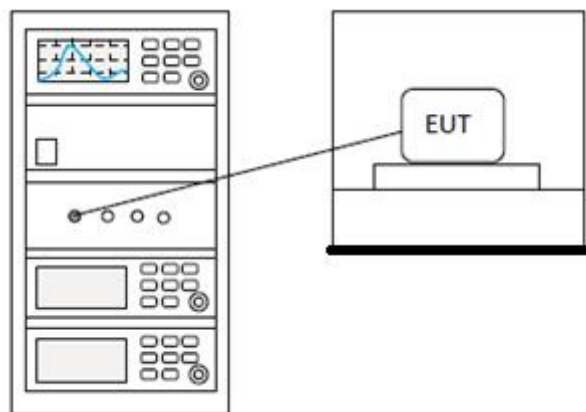
## 17 Conducted peak output power

<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 7.8.5
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Charlie
<b>Temperature</b>	25°C
<b>Humidity</b>	60%

### 17.1 Limits

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for $\geq 50$ hopping channels
	0.25 for $25 \leq$ hopping channels $< 50$
	1 for digital modulation
2400-2483.5	1 for $\geq 75$ non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

### 17.2 Test setup



### 17.3 Test data

**Pass: Please Refer To Appendix: Appendix1 For Details**

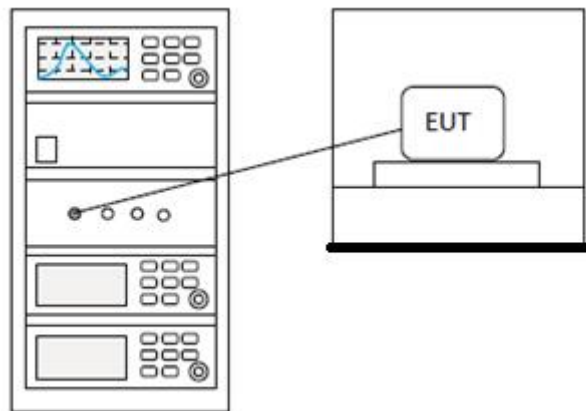
## 18 Minimum 6dB bandwidth

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.8.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Charlie
Temperature	25°C
Humidity	60%

### 18.1 Limits

Limit:	≥500 kHz
--------	----------

### 18.2 Test setup



### 18.3 Test data

**Pass: Please Refer To Appendix: Appendix1 For Details**

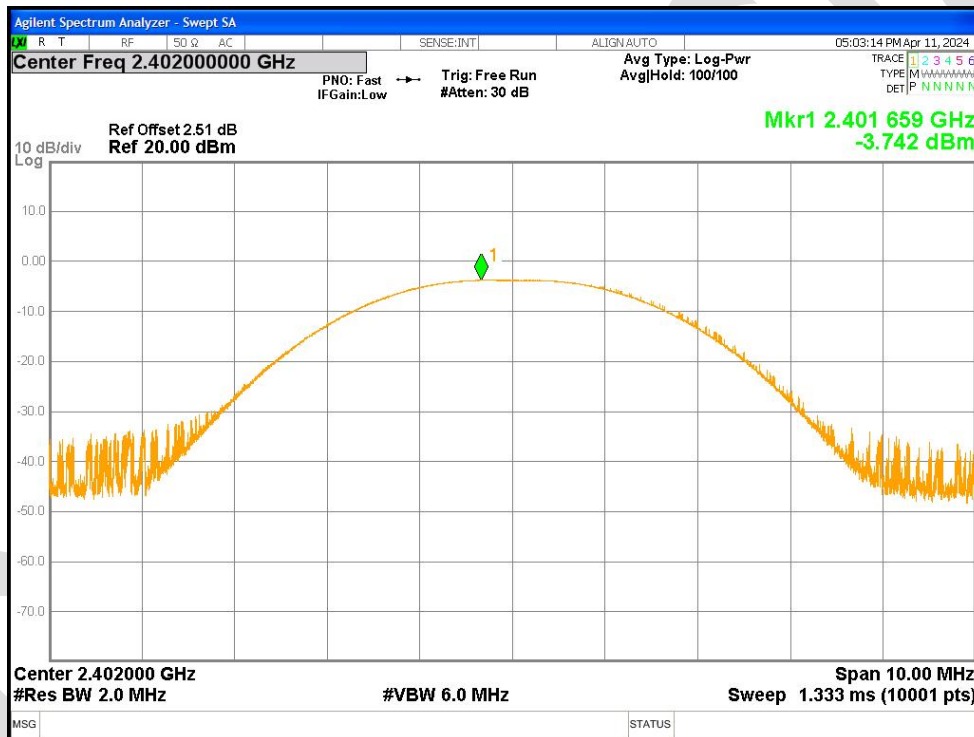
## 19 Appendix

### Appendix1

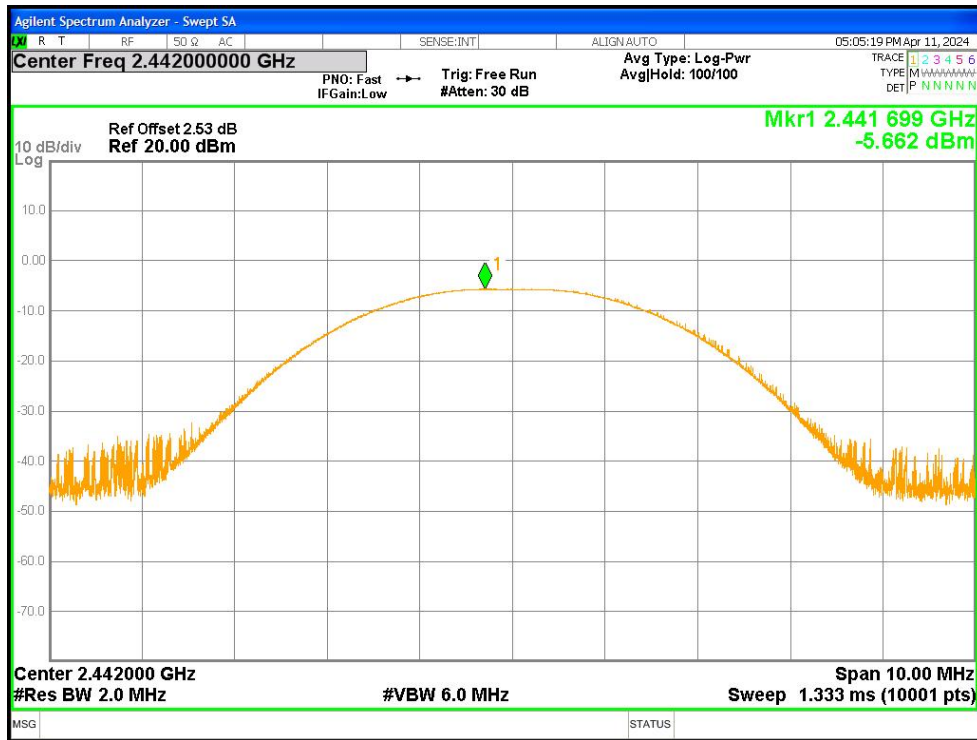
#### 19.1 Maximum Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	-3.742	30	Pass
NVNT	BLE 1M	2442	Ant1	-5.662	30	Pass
NVNT	BLE 1M	2480	Ant1	-5.902	30	Pass

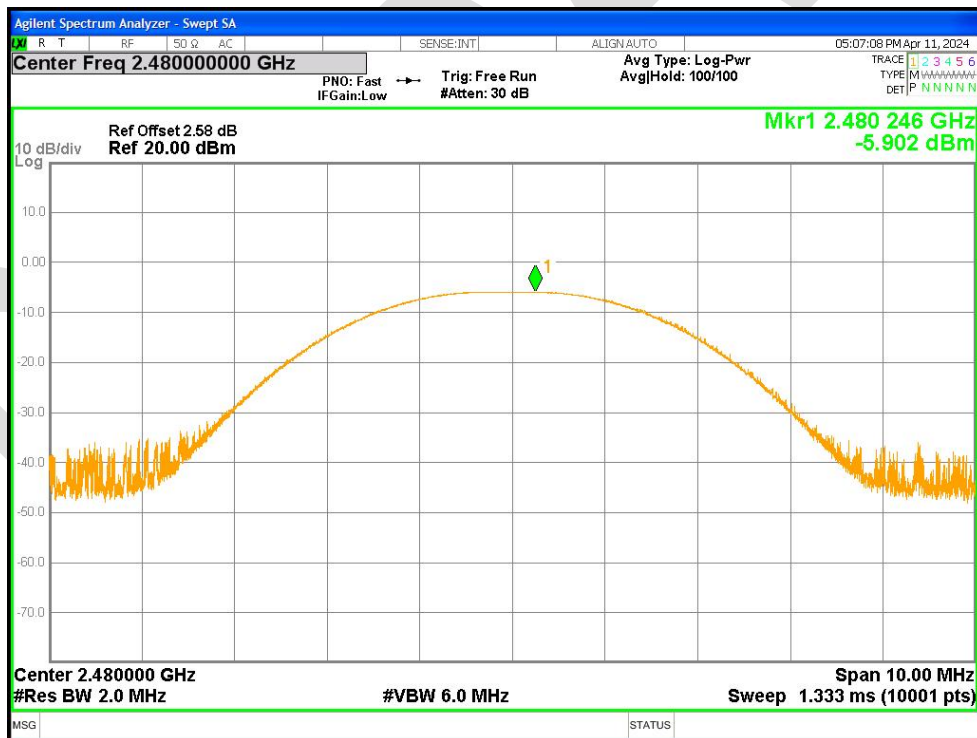
Power NVNT BLE 1M 2402MHz Ant1



Power NVNT BLE 1M 2442MHz Ant1



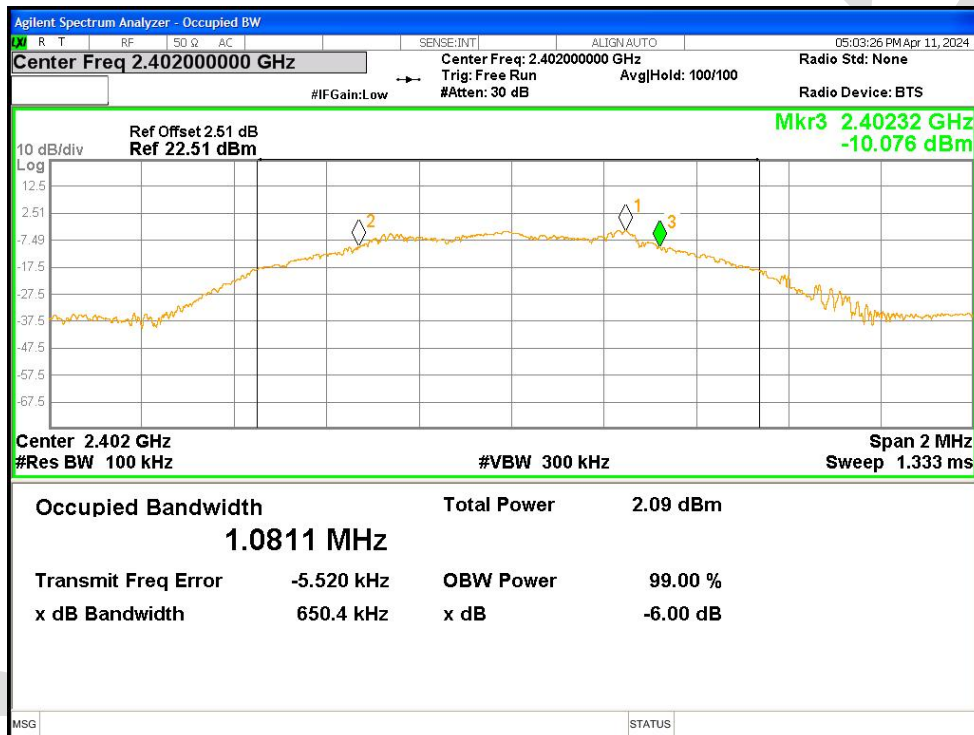
Power NVNT BLE 1M 2480MHz Ant1



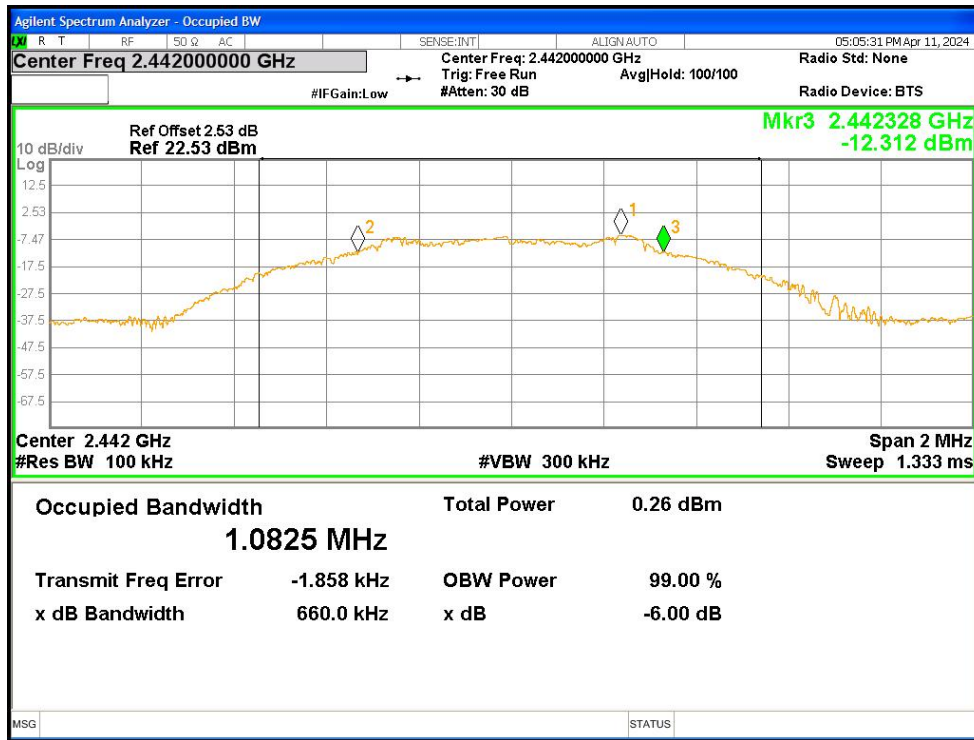
### 19.2 -6dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 1M	2402	Ant1	0.65	0.5	Pass
NVNT	BLE 1M	2442	Ant1	0.66	0.5	Pass
NVNT	BLE 1M	2480	Ant1	0.687	0.5	Pass

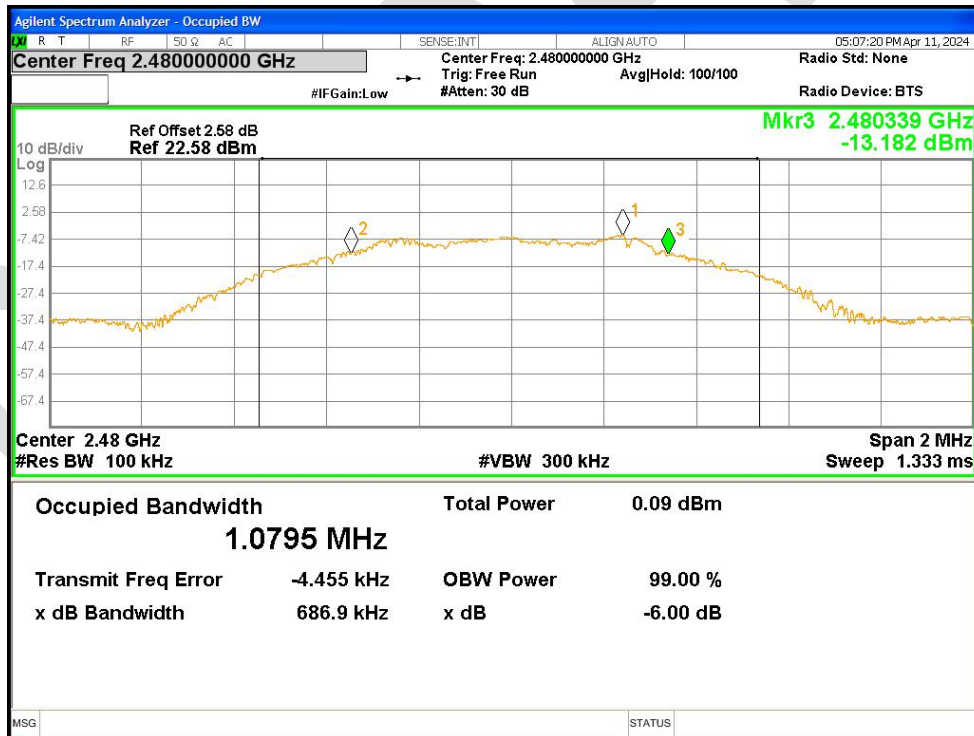
-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 1M 2442MHz Ant1



-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1

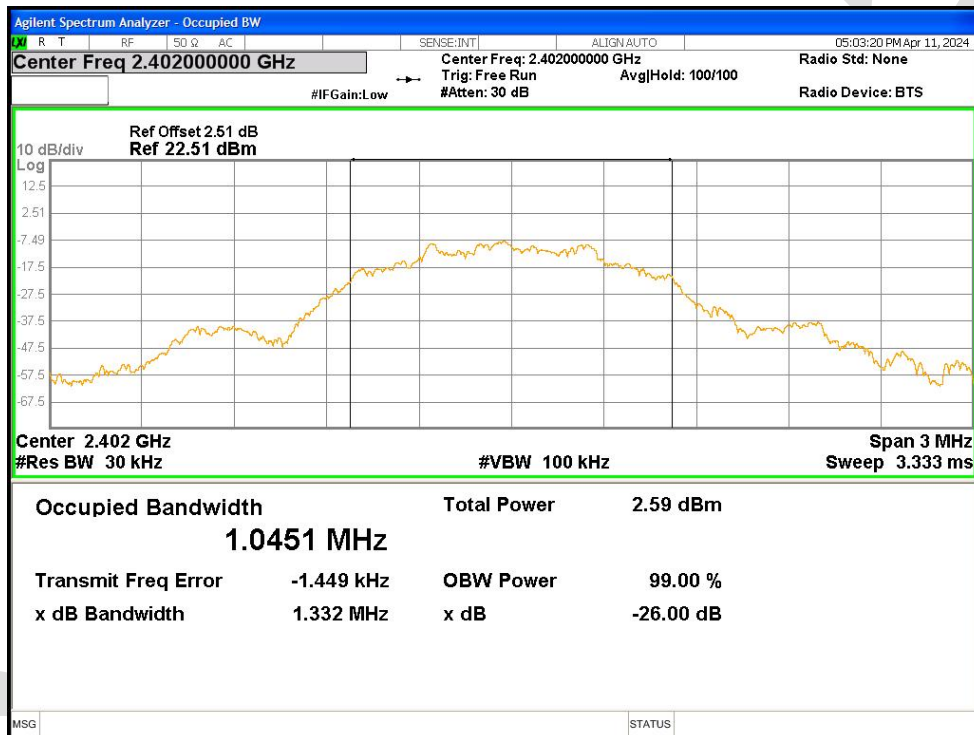




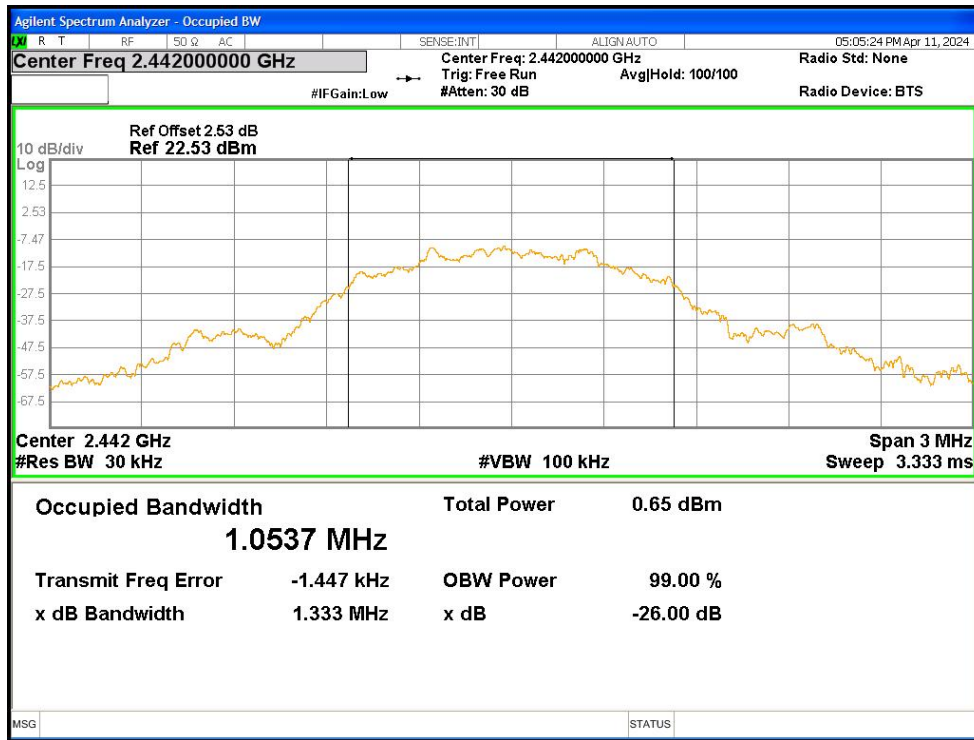
### 19.3 Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	BLE 1M	2402	Ant1	1.0451
NVNT	BLE 1M	2442	Ant1	1.0537
NVNT	BLE 1M	2480	Ant1	1.0536

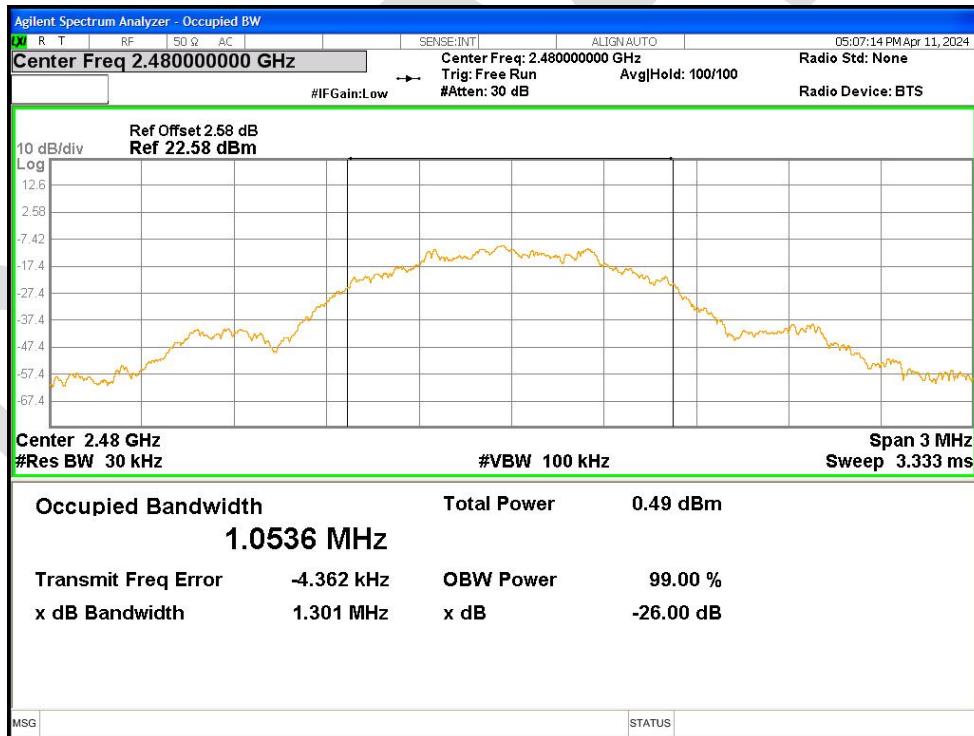
OBW NVNT BLE 1M 2402MHz Ant1



OBW NVNT BLE 1M 2442MHz Ant1



OBW NVNT BLE 1M 2480MHz Ant1



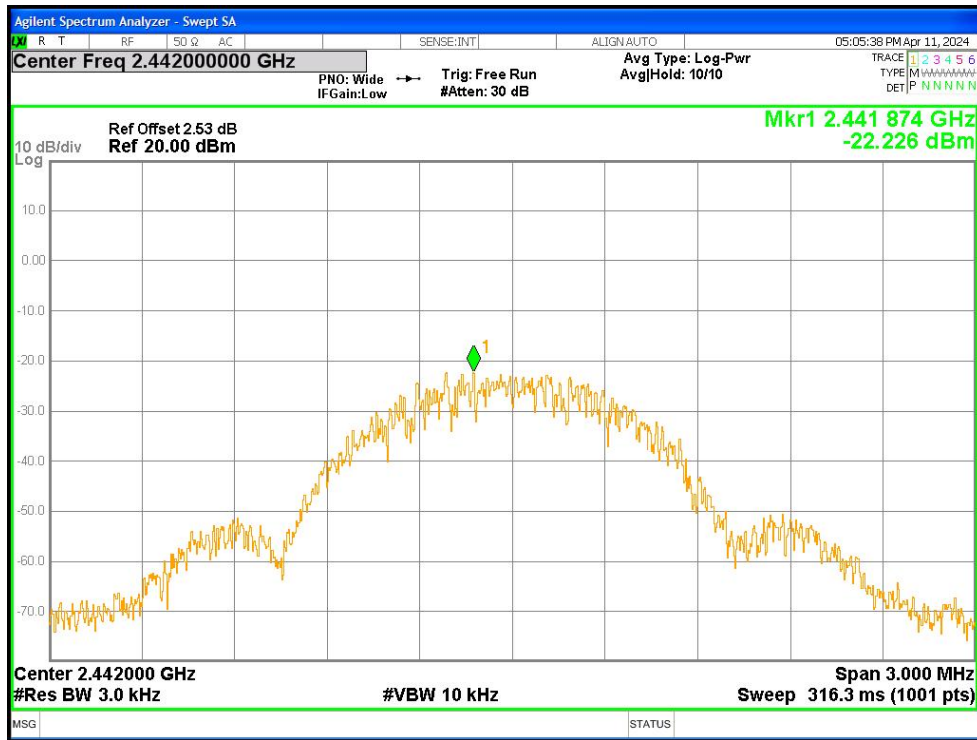
### 19.4 Maximum Power Spectral Density Level

Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	-20.03	8	Pass
NVNT	BLE 1M	2442	Ant1	-22.226	8	Pass
NVNT	BLE 1M	2480	Ant1	-22.198	8	Pass

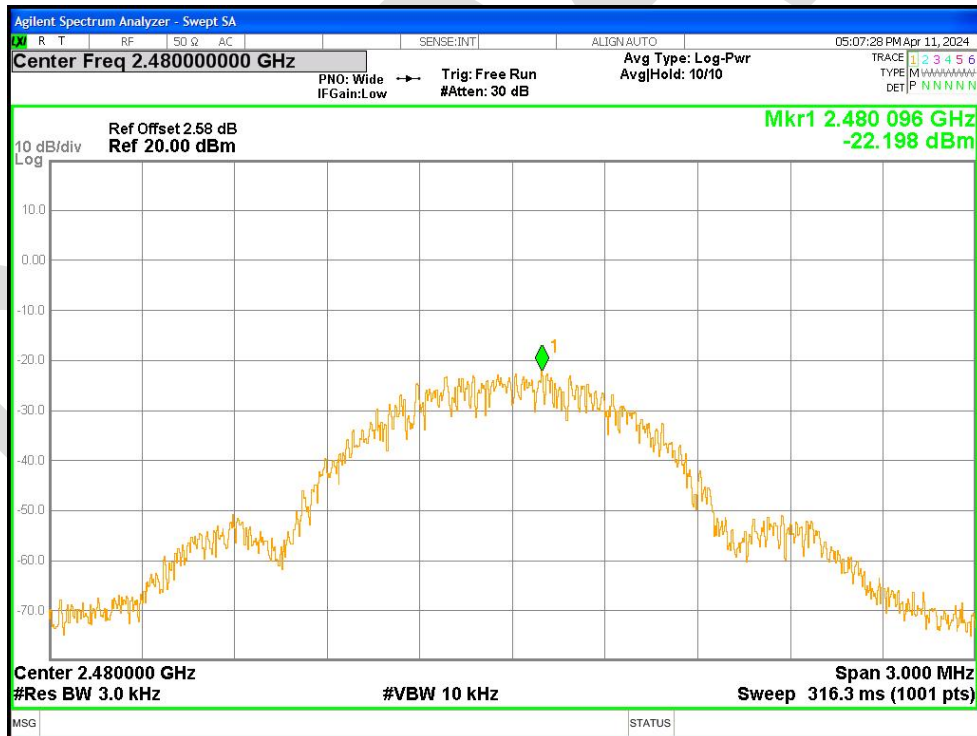
PSD NVNT BLE 1M 2402MHz Ant1



PSD NVNT BLE 1M 2442MHz Ant1



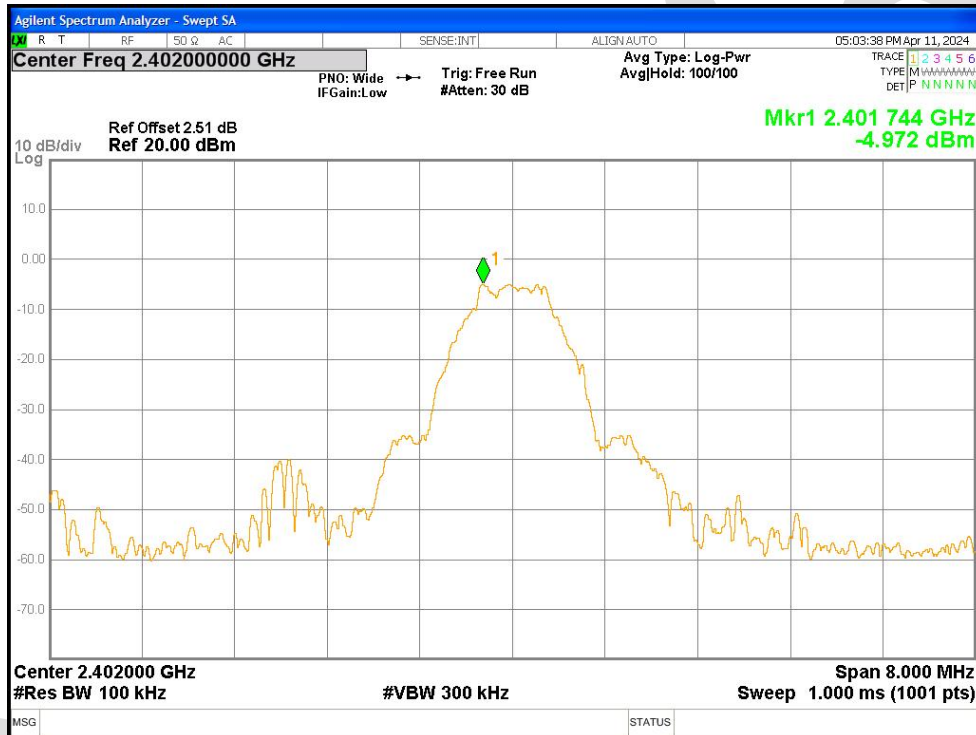
PSD NVNT BLE 1M 2480MHz Ant1



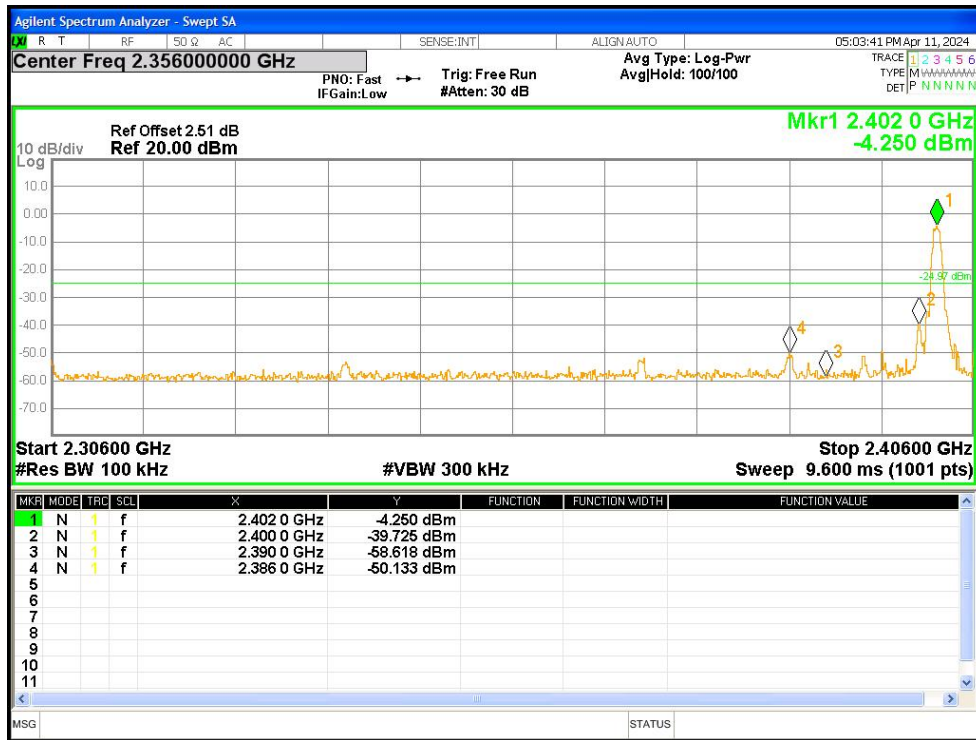
### 19.5 Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-45.16	-20	Pass
NVNT	BLE 1M	2480	Ant1	-43.75	-20	Pass

Band Edge NVNT BLE 1M 2402MHz Ant1 Ref



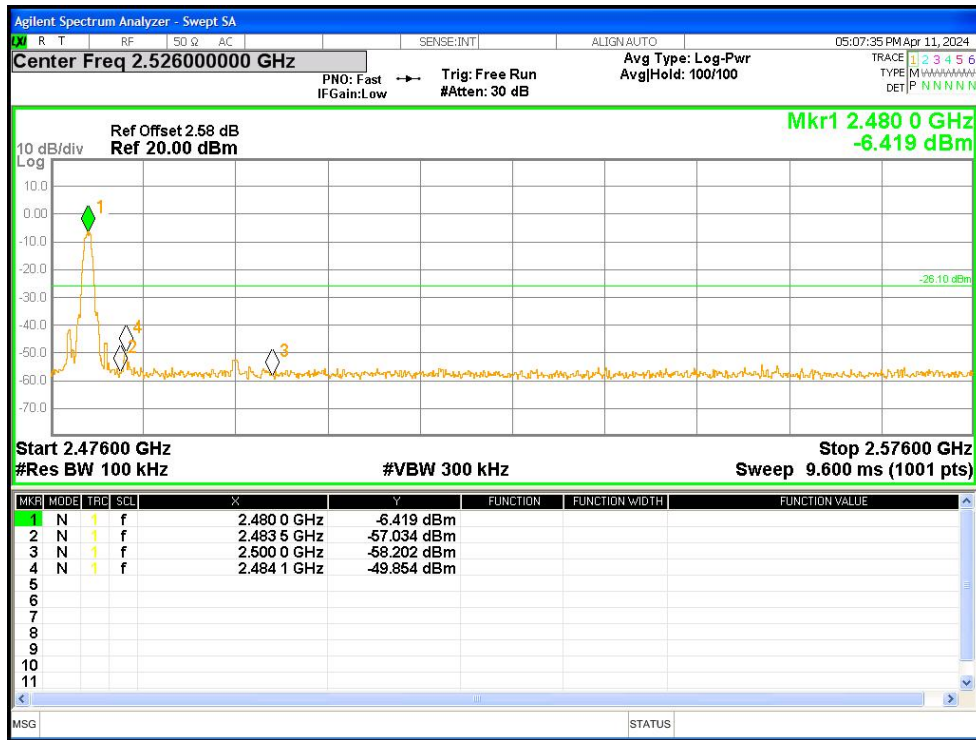
Band Edge NVNT BLE 1M 2402MHz Ant1 Emission



Band Edge NVNT BLE 1M 2480MHz Ant1 Ref



Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



### 19.6 Conducted RF Spurious Emission

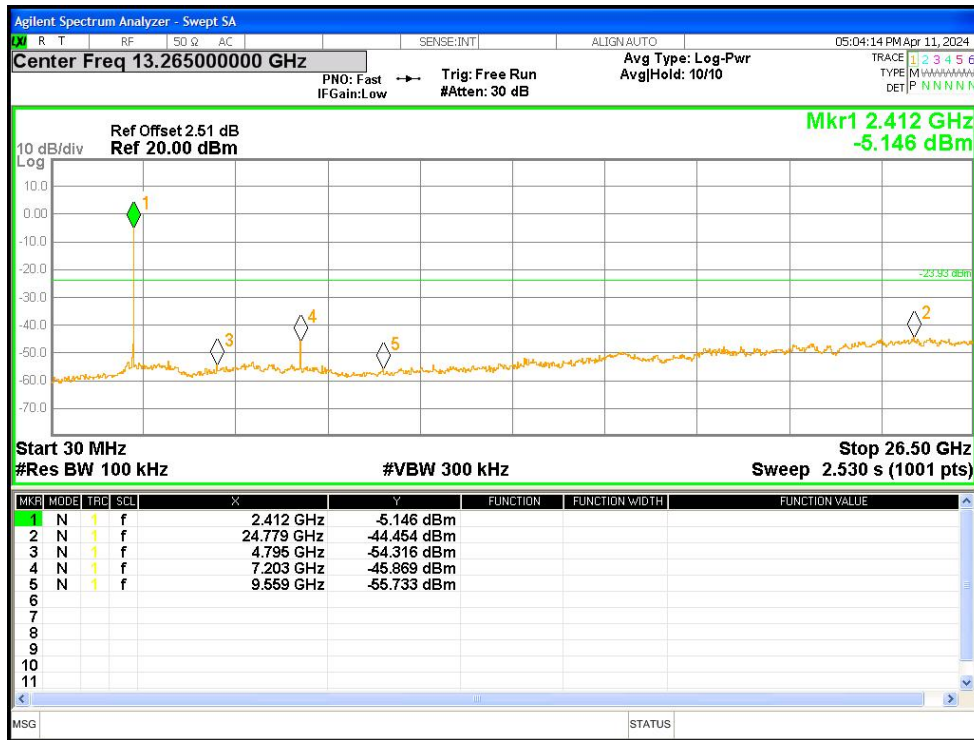
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-40.52	-20	Pass
NVNT	BLE 1M	2442	Ant1	-35.59	-20	Pass
NVNT	BLE 1M	2480	Ant1	-38.79	-20	Pass

Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Ref

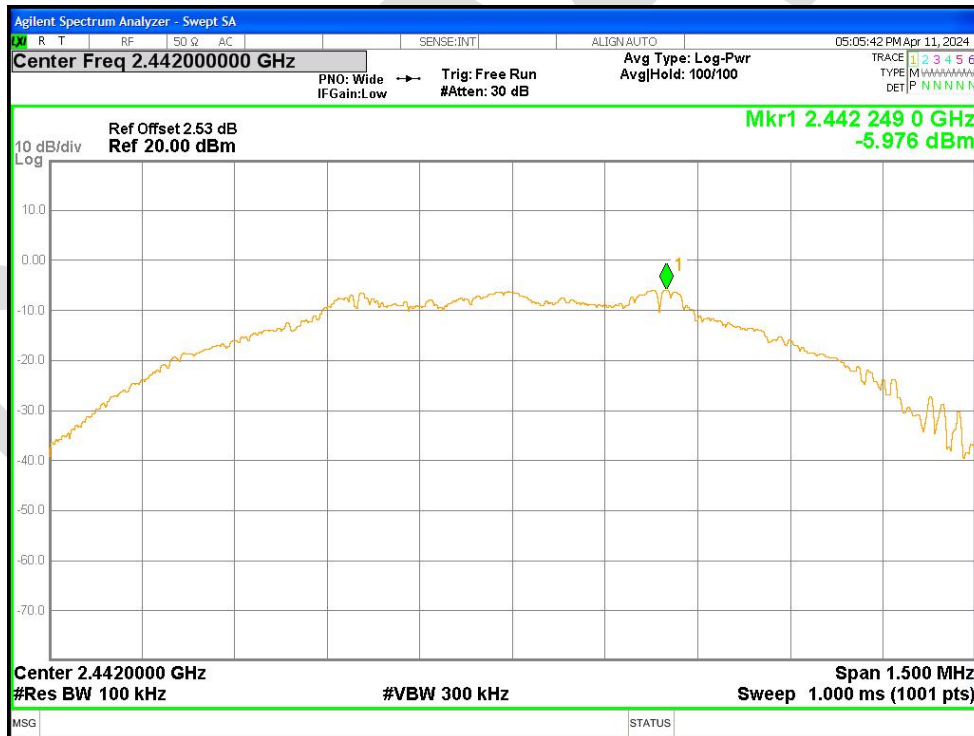


Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission

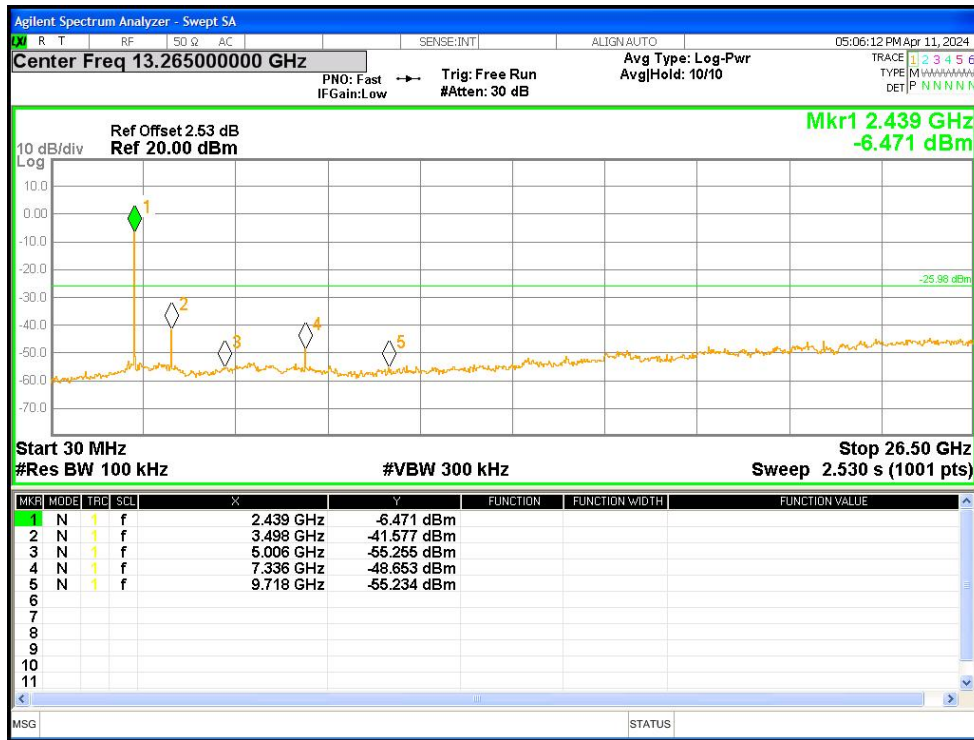




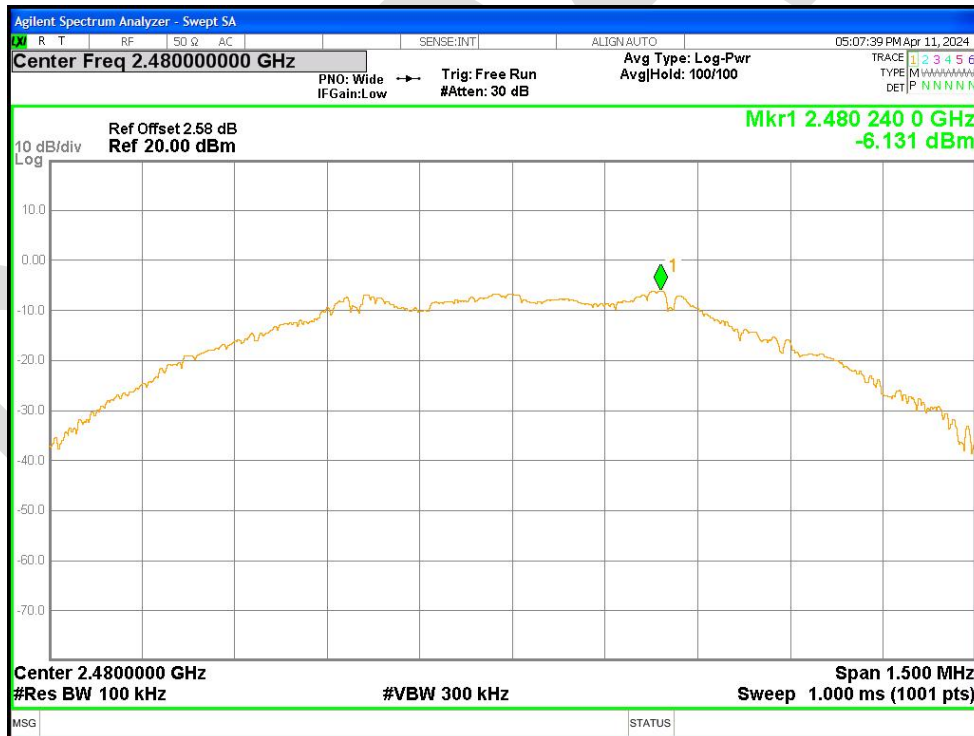
Tx. Spurious NVNT BLE 1M 2442MHz Ant1 Ref



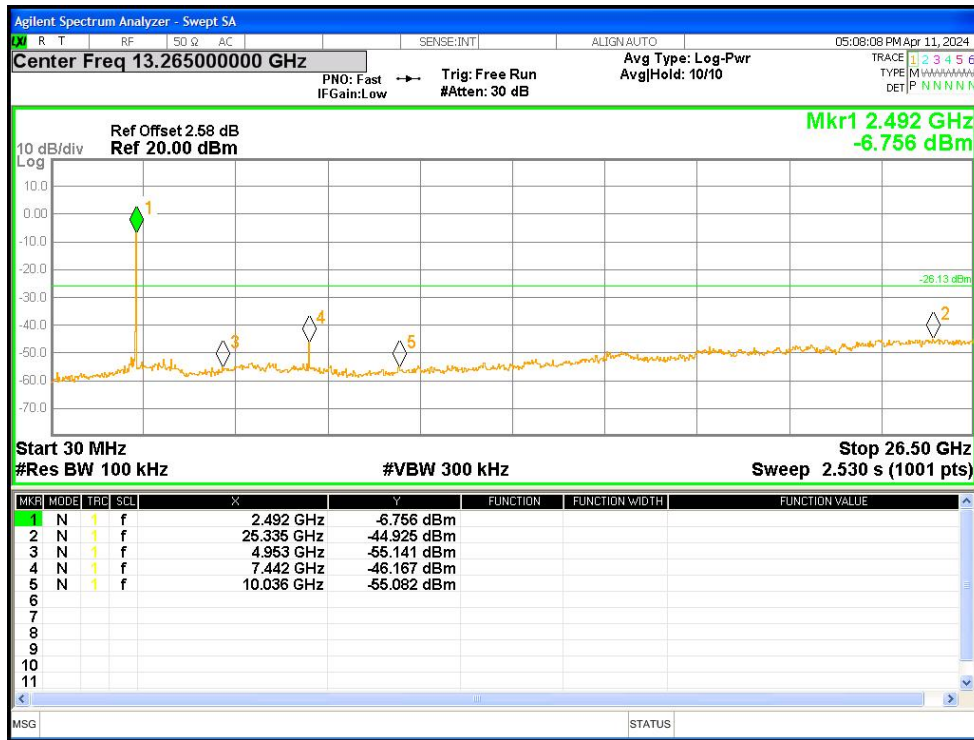
Tx. Spurious NVNT BLE 1M 2442MHz Ant1 Emission



Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Ref



Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission



## APPENDIX A: PHOTOGRAPHS OF TEST SETUP



**APPENDIX B: PHOTOGRAPHS OF EUT**

Reference to the test report No. BLA-EMC-202404-A1701

**----END OF REPORT----**

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