TEST REPORT
On behalf of

Signify (China) Investment Co., Ltd.

Product Name: LED Lamp

Model No.: 9290032676,9290032675

FCC ID: 2AGBW9290032675X

Prepared For: Signify (China) Investment Co., Ltd.
Building no.9, Lane 888, Tianlin Road, Minhang District,
Shanghai 200233, China.

Prepared By: Audix Technology (Shanghai) Co., Ltd.
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TESTING
NVLAP LAB CODE 200371-0

File No. : C1D2301014
Report No. : ACI-F23028
Date of Test : 2023.02.15-22
Date of Report : 2023.02.24

The statement is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

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TEST REPORT

Applicant	:	Signify (China) Investment Co., Ltd.
EUT Description	:	LED Lamp
	(A) Model No.	: Refer to Sec.2.1
	(B) Power Supply	: 120V AC 60Hz
	(C) Test Voltage	: 120V/60Hz

Test Procedure Used:

FCC RULES AND REGULATIONS PART 15 SUBPART C
AND ANSI C63.10-2013

The device described above is tested by Audix Technology (Shanghai) Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits.

The test results are contained in this test report and Audix Technology (Shanghai) Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. This report also shows that the EUT (M/N: Refer to Sec2.1), which was tested is technically compliance with the FCC limits.

This report applies to above tested Sample only. This report shall not be reproduced in part without written approval of Audix Technology (Shanghai) Co., Ltd.

The test results for EUT's WIFI function are contained in No.ACI-F23029 report.

Date of Test : 2023.02.15-22 Date of Report : 2023.02.24

Producer : Huimin Yan
HUIMIN YAN / Assistant

Review : Byron Wu
BYRON WU / Deputy Assistant Manager

AUDIX®
For and on behalf of
Audix Technology (Shanghai) Co., Ltd.

Signatory : Kamp. Chen.
Authorized Signature(s)
KAMP CHEN / Manager

1 SUMMARY OF STANDARDS AND RESULTS

1.1 Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Description / Test Item	Test Standard	Results	Meets Limit
EMISSION			
Conducted Emission	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.207
Radiated Emission	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.209(a) 15.205(a)(c)
6 dB Bandwidth Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(a)(2)
Maximum Peak Output Power Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(b)(3)
Emission Limitations Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(d)
Band Edge Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(d)
Power Spectral Density Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(e)
Antenna Requirement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.203
N/A is an abbreviation for Not Applicable.			

2 GENERAL INFORMATION

2.1 Description of Equipment Under Test

Description	:	LED Lamp
Type of EUT	:	☑ Production ☐ Pre-product ☐ Pro-type
Model Number	:	9290032676, 9290032675
Note	:	The difference between the above models is only the bulb
Test Model	:	9290032676
Note	:	Models 9290032676 and 9290032675 were pre-test, the results of worst Model 9290032676 was selected for report.
Radio Tech	:	BLE 4.2; IEEE 802.11 b/g/n.
Channel Freq.	:	BLE: 2402MHz-2480MHz; 802.11b/g/n20: 2412MHz-2462MHz; 802.11n40: 2422MHz-2452MHz.
Modulation	:	BLE: GFSK; 802.11b: DSSS (CCK, DQPSK, DBPSK); 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK).
Antenna Info.	:	Antenna Type: Monopole Antenna Antenna Gain: -4 dBi
Applicant	:	Signify (China) Investment Co., Ltd. Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai 200233, China.

2.2 EUT Specifications Assessed in Current Report

Mode	Modulation	Data Rate(Mbps)
BLE	GFSK	1

Channel List			
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
…	…	…	…
…	…	…	…
…	…	…	…
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

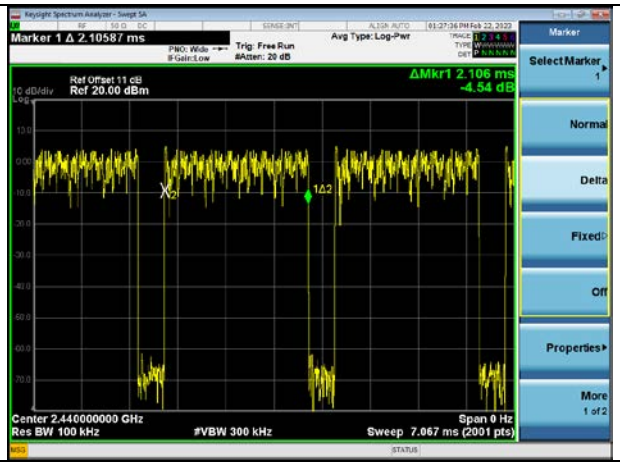
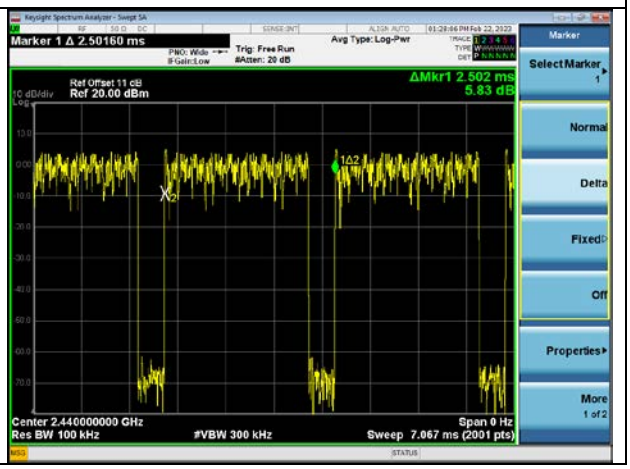
2.3 Test Information

The test software " EspRFTestTool_v2.8_Manual.exe" was used to control EUT work in TX mode, Power Setting and select test channel.

Mode	data rate (Mbps)	Power Setting	Test Channel		Frequency (MHz)
BLE	1	10	Low:	00	2402
		10	Middle:	19	2440
		10	High:	39	2480

2.4 Duty Cycle Check

Mode	Transmission Duration (ms)	Transmission Period (ms)	Duty Cycle (%)	DCCF
BLE	2.106	2.502	84.17	0.75

Mode	Ton	Toff
BLE		

2.5 Sample Description

Test Item	Model Number	Sample Number	Date of receipted
Conducted Emission	9290032676	E2301041-01/02	2023.01.11
	9290032675	E2301042-01/02	2023.01.11
Radiated Emission	9290032676	E2302120-01/01	2023.02.10
	9290032675	E2302121-01/01	2023.02.10
Conducted RF Test	9290032676	E2302120a-01/01	2023.02.10
	9290032675	E2302121a-01/01	2023.02.10

2.6 Supported equipment

Brand	:	Acer
Product Name:	:	Notebook PC
Model Name	:	TravelMate P238 series
Model Number	:	N15W8
Product Name	:	Test Fixture
Product Function	:	USB to TTL

2.7 Description of Test Facility

Name of Firm	:	Audix Technology (Shanghai) Co., Ltd.
Site Location	:	3F and 4F, 34Bldg, 680 Guiping Rd., Caohejing Hi-Tech Park, Shanghai 200233, China.
Accredited by NVLAP, Lab Code	:	200371-0
FCC Designation Number	:	CN5027
Test Firm Registration Number	:	954668

3 CONDUCTED EMISSION TEST

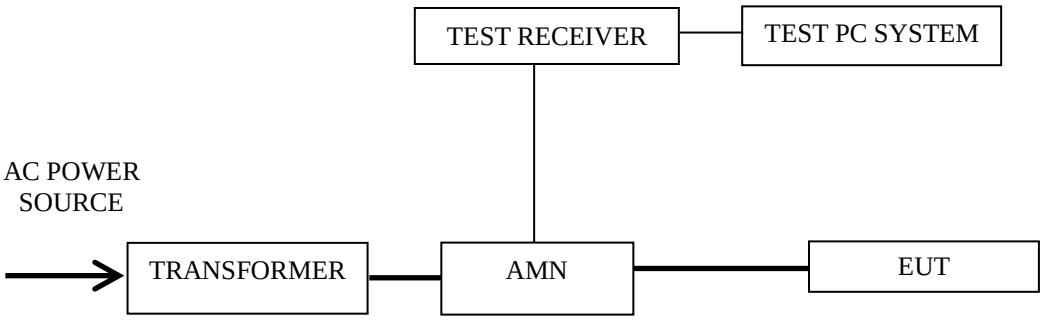
3.1 Test Equipment

The following test equipments are used during the conducted emission test in a shielded room:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESCI	101302	2022.06.07	1 Year
2.	Artificial Mains Network (AMN)	R&S	ENV4200	100125	2022.07.13	1 Year
3.	Software	Audix	e3	6.2009-1-15	--	--

3.2 Block Diagram of Test Setup

3.2.1 Conducted Disturbance Test Setup



—— : Signal Line
—— : Power Line

3.3 Conducted Emission Limits (§15.207)

Frequency Range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ~ 0.5	66~56	56~46
0.5 ~ 5	56	46
5 ~ 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 0.15 MHz~0.50 MHz

3.4 Test Configuration

The EUT (listed in Sec.2.1) was installed as shown on Sec.3.2 to meet FCC requirement and operating in a manner which tends to maximize its emission level in a normal application.

3.5 Operating Condition of EUT

3.5.1 Setup the EUT as shown in Sec. 3.2.

3.5.2 Turn on the power of all equipment.

3.5.3 Turn the EUT on the test mode, and then test.

3.6 Test Procedures

The EUT was placed upon a non-metallic table, which is 0.8 m above the horizontal conducting ground plane and 0.4 m from a vertical reference plane. The EUT was connected to the power mains through an Artificial Mains Network (AMN) to provide a 50 Ω coupling impedance for the measuring equipment. Both sides of AC line (Line & Neutral) were checked to find out the maximum conducted emission according to FCC Part 15 Subpart C and ANSI C63.10: 2013 requirements during conducted disturbance test.

The I.F. bandwidth of Test Receiver ESCI was set at 9 kHz.

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

Test with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. (According to KDB 174176 D01 Line Conducted FAQ)

The test modes were done on conducted disturbance test and all the test results are listed in Sec. 3.7

3.7 Test Results

< PASS >

The frequency and amplitude of the highest conducted emission relative the limit is reported. All the emissions not reported below are too low against the FCC limit.

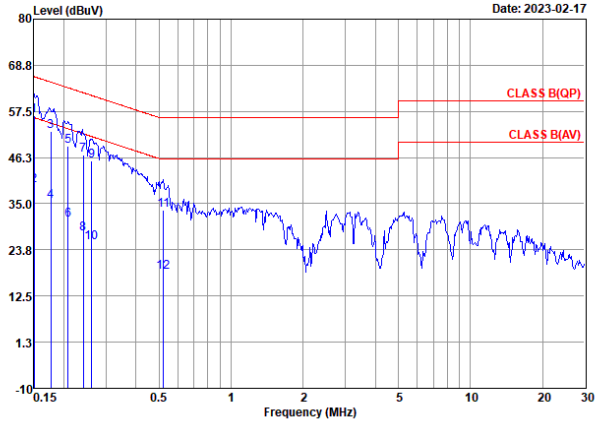
Worst case emission:

No.	Operation	Mode	Channel	Frequency (MHz)	Data Page
1.	Transmitting	BLE	00	2402	P12

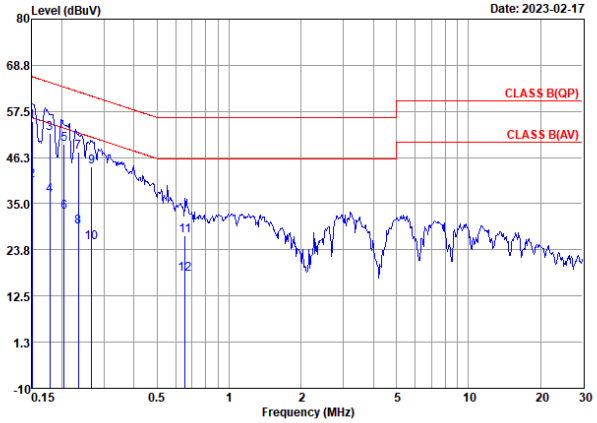
NOTE 1 – Emission Level = Read Level + AMN Factor + Cable Loss,
Margin = Limits - Emission Level
NOTE 2 – "QP" means "Quasi-Peak" values
NOTE 3 – The emission levels which not reported are too low against the official limit.

Worst case emission

EUT	:	LED Lamp	Temperature	:	22℃
Model No.	:	9290032676	Humidity	:	51%RH
Test Mode	:	Transmitting	Date of Test	:	2023.02.17



Line



Neutral

Polarization	Frequency (MHz)	Meter Reading dB (μV)	AMN Factor (dB)	Cable Loss (dB)	Emission Level dB (μV)	Limits dB (μV)	Margin (dB)	Remark
Line	0.15	46.94	9.7	0.03	56.67	66	9.33	QP
	0.15	29.6	9.7	0.03	39.33	56	16.67	Average
	0.1767	43.02	9.7	0.03	52.75	64.64	11.89	QP
	0.1767	25.8	9.7	0.03	35.53	54.64	19.11	Average
	0.2082	39.43	9.7	0.03	49.16	63.28	14.12	QP
	0.2082	21.4	9.7	0.03	31.13	53.28	22.15	Average
	0.2409	37.13	9.7	0.03	46.86	62.07	15.21	QP
	0.2409	17.9	9.7	0.03	27.63	52.07	24.44	Average
	0.2616	35.68	9.7	0.03	45.41	61.38	15.97	QP
	0.2616	15.9	9.7	0.03	25.63	51.38	25.75	Average
	0.521	23.74	9.72	0.04	33.5	56	22.5	QP
	0.521	8.5	9.72	0.04	18.26	46	27.74	Average
Neutral	0.15	45.43	9.7	0.03	55.16	66	10.84	QP
	0.15	30.9	9.7	0.03	40.63	56	15.37	Average
	0.1781	42.34	9.7	0.03	52.07	64.57	12.5	QP
	0.1781	27.3	9.7	0.03	37.03	54.57	17.54	Average
	0.204	39.83	9.7	0.03	49.56	63.45	13.89	QP
	0.204	23.2	9.7	0.03	32.93	53.45	20.52	Average
	0.2345	37.77	9.7	0.03	47.5	62.29	14.79	QP
	0.2345	19.7	9.7	0.03	29.43	52.29	22.86	Average
	0.2658	34.26	9.7	0.03	43.99	61.25	17.26	QP
	0.2658	15.9	9.7	0.03	25.63	51.25	25.62	Average
	0.6543	17.48	9.75	0.05	27.28	56	28.72	QP
	0.6543	8.1	9.75	0.05	17.9	46	28.1	Average

TEST ENGINEER: Jarey

4 RADIATED EMISSION TEST

4.1 Test Equipment

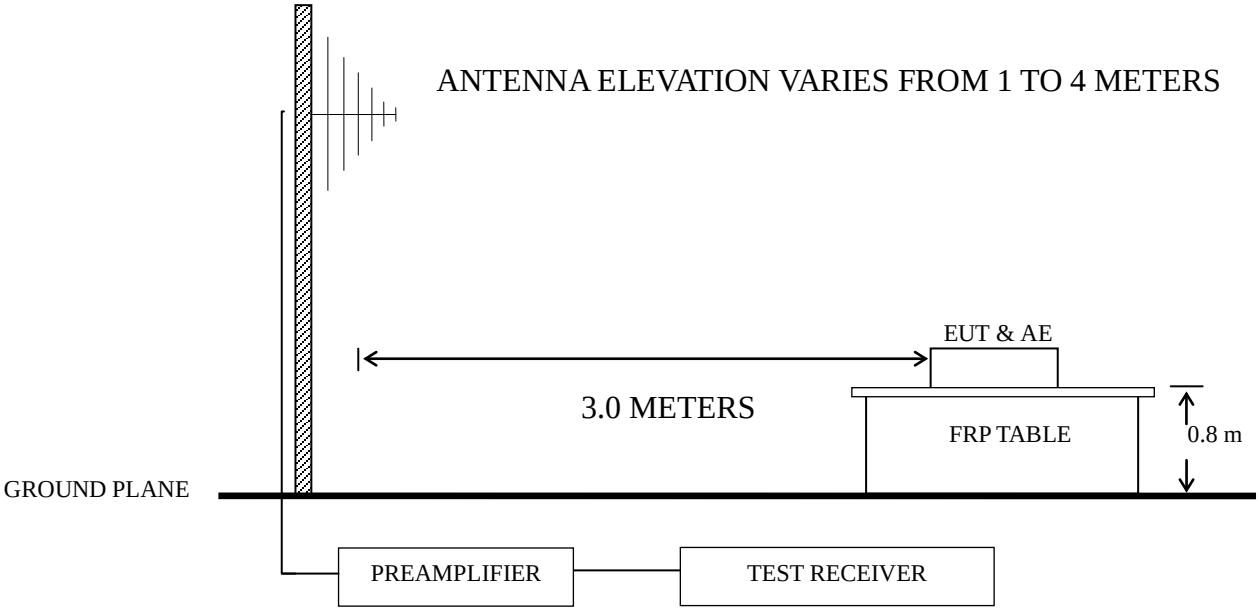
The following test equipment are used during the radiated emission test in a semi-anechoic chamber:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Preamplifier	Agilent	8447D	2944A10548	2022.06.06	1 Year
2.	Preamplifier	HP	8449B	3008A00864	2022.06.06	1 Year
3.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2022.09.15	1 Year
4.	Test Receiver	R&S	ESCI	101303	2022.06.07	1 Year
5.	Bilog Antenna+6dB Attenuator	Schwarz beck	VULB 9168+EMCI-N-6-06	707+AT-N0637	2022.07.25	1 Year
6.	Horn Antenna	EMCO	3115	9607-4878	2022.07.21	1 Year
7.	Horn Antenna	EMCO	3116	00062643	2022.12.12	1 Year
8.	Cavity Band Rejection Filter	Microwave	WT-A3882-R 10	WT200312-1-1	2022.06.06	1 Year
9.	Software	Audix	e3	6.111206	--	--

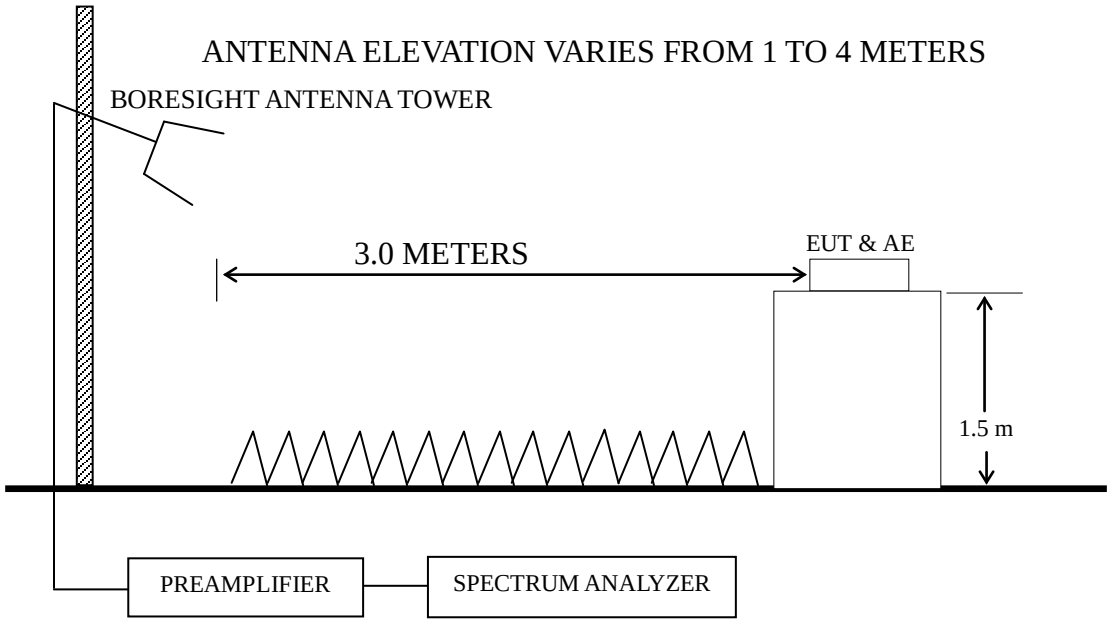
4.2 Block Diagram of Test Setup

4.2.1 EUT & Peripherals

4.2.2 Below 1GHz



4.2.3 Above 1GHz



4.3 Radiated Emission Limit (§15.209)

Frequency (MHz)	Distance (m)	Field strength limits (μV/m)	
		(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

NOTE 1 - Emission Level dB (μV/m) = 20 log Emission Level (μV/m)
NOTE 2 - The tighter limit applies at the band edges.
NOTE 3 - 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 4 - The limits shown are based on Quasi-peak value detector below or equal to 1GHz and Average value detector above 1GHz.
NOTE 5 - Above 1 GHz, the limit on peak emission is 20 dB above the maximum permitted average emission limit applicable to the EUT

4.4 Test Configuration

The EUT (listed in Sec.2.1) and the simulators (listed in Sec.2.2) were installed as shown on Sec.4.2 to meet FCC requirements and operating in a manner that tends to maximize its emission level in a normal application.

4.5 Operating Condition of EUT

4.5.1 Setup the EUT as shown in Sec. 4.2.

4.5.2 Turn the EUT on.

4.5.3 Connect the EUT and the TTL terminal of Test Fixture through three HCI cables of EUT, as follows (TX to RXD, RX to TXD, GND to GND). Plug the USB terminal of Test Fixture to the USB port of Notebook PC.

4.5.4 Use the software as section 2.3 to select the test mode, then disconnect the Test Fixture from EUT, remove the Test Fixture and Notebook PC, then test.

4.5.5 Repeat step 4.5.3 and 4.5.4, until the test of all modes finished.

4.6 Test Procedures

Radiated emission test applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A pre-amp is necessary for this measurement. For measurement above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

The EUT was placed on a turntable. Below 1 GHz, the table height is 80 cm above the reference ground plane. Above 1 GHz, the table height is 1.5 m. The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna, which was mounted on an antenna tower. The antenna moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (Calibrated Bilog Antenna) or Horn antenna was used as receiving antenna. Both horizontal and vertical polarizations of the antenna were set on measurement. In order to find the maximum emission, all of the interference cables were manipulated according to ANSI C63.10: 2013 requirements during radiated emission test.

The bandwidth of Test Receiver R&S ESCI was set at 120 kHz from 30MHz to 1000MHz.

The bandwidth of Agilent N9010A was set at 1MHz for above 1GHz.

The frequency range from 30 MHz to 25 GHz (Up to 10^{th} harmonics from fundamental frequency) was checked.

All the test results are listed in Sec.4.7.

4.7 Test Results

<PASS>

The frequency and amplitude of the highest radiated emission relative the limit is reported. All the emissions not reported below are too low against the FCC limit.

Frequency range: below 1GHz (Worst case emission)

No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	BLE	39	2480 MHz	P17

Frequency range: above 1GHz

No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	BLE	00	2402 MHz	P18
2.			19	2440 MHz	P19
3.			39	2480 MHz	P20

Band-Edge:

No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	BLE	00	2402 MHz	P21
2.			39	2480 MHz	P22

Restricted bands:

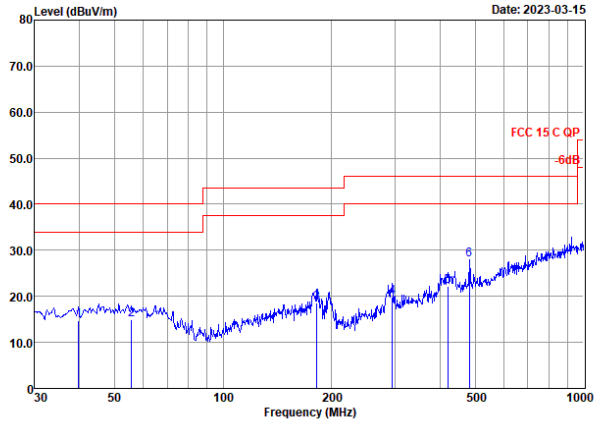
No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	BLE	00	2402 MHz	P23
2.			39	2480 MHz	P24

NOTE 1 – Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin = Limits - Emission Level.
NOTE 2 – "QP" means "Quasi-Peak" values.
NOTE 3 – 0°was the table front facing the antenna. Degree is calculated from 0°clockwise facing the antenna.
NOTE 4 – The emission levels which not reported are too low against the official limit.
NOTE 5 – The emission levels recorded below is data of EUT configured in Standing direction, for this direction was the maximum emission direction during the test. The data of Side & Lying direction are too low against the official limit to be reported.
NOTE 6 – All reading are Quasi-Peak values below or equal to 1GHz, Peak and Average values above 1GHz.
For above 1GHz test, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
NOTE 7 – The frequency range 2310-2390MHz & 2483.5-2500MHz were tested for Restricted bands.

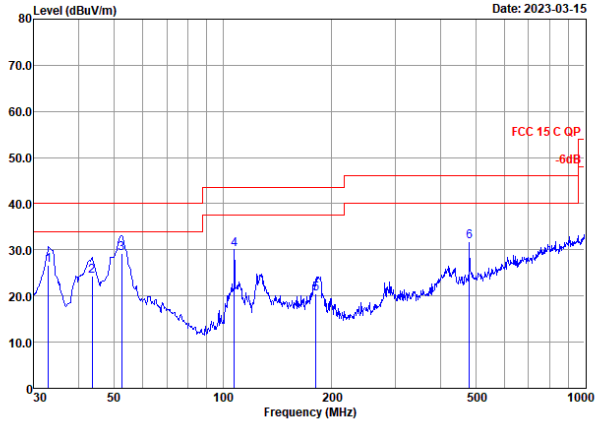
Worst case emission < 1GHz

EUT	:	LED Lamp	Temperature	:	22℃
Model No.	:	9290032676	Humidity	:	51%RH
Test Mode	:	Transmitting	Date of Test	:	2023.02.15

BLE CH2480MHz



Horizontal



Vertical

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	39.715	23.42	18.8	0.66	28.24	14.64	40	25.36	QP
	55.609	22.87	19.5	0.8	28.2	14.97	40	25.03	QP
	181.92	26.83	17.7	1.44	27.49	18.48	43.5	25.02	QP
	294.11	25.6	19.18	1.88	26.93	19.73	46	26.27	QP
	419.11	25.8	21.92	2.22	27.7	22.24	46	23.76	QP
	482.22	30.08	23.17	2.43	27.84	27.84	46	18.16	QP
Vertical	32.864	35.55	18.8	0.59	28.28	26.66	40	13.34	QP
	43.506	32.82	19.1	0.7	28.23	24.39	40	15.61	QP
	52.391	36.99	19.6	0.78	28.2	29.17	40	10.83	QP
	107.51	40.77	16.2	1.13	28.06	30.04	43.5	13.46	QP
	180.65	28.76	17.85	1.44	27.49	20.56	43.5	22.94	QP
	480.53	34.22	23.1	2.4	27.84	31.88	46	14.12	QP

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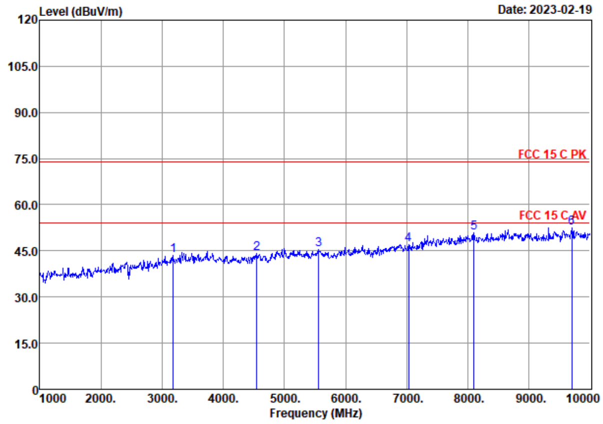
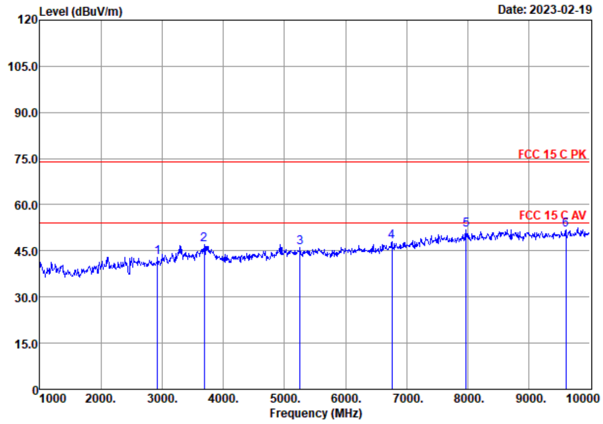
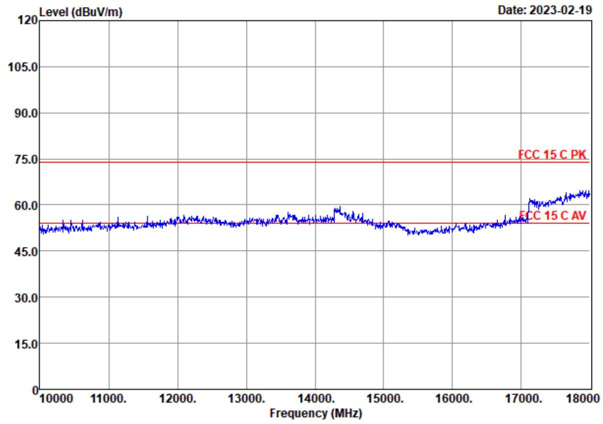
Radiated Emission > 1GHz

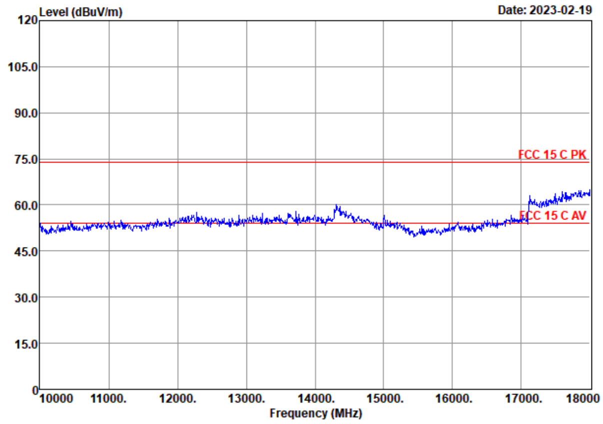
EUT	:	LED Lamp	Temperature	:	22℃
Model No.	:	9290032676	Humidity	:	51%RH
Test Mode	:	Transmitting	Date of Test	:	2022.02.19

BLE CH2402MHz





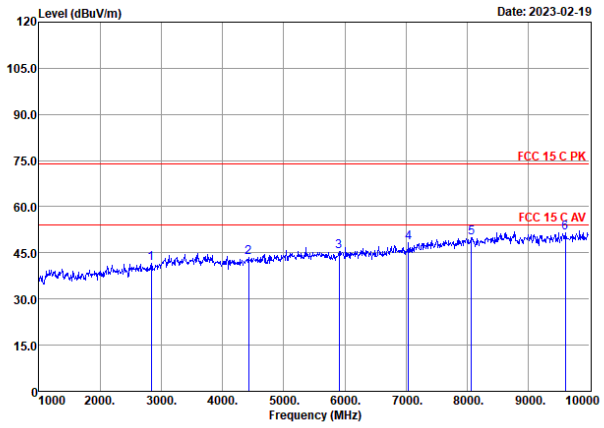


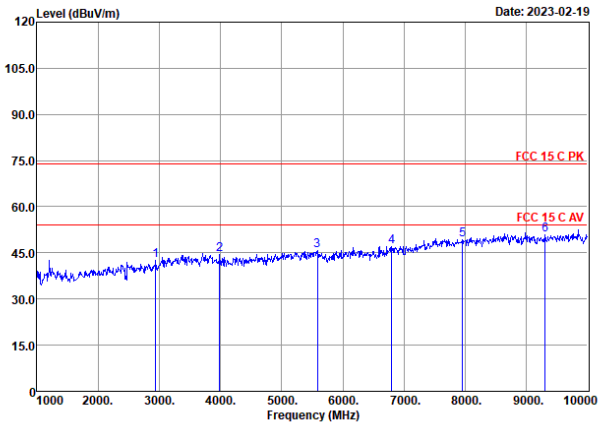


Horizontal Vertical

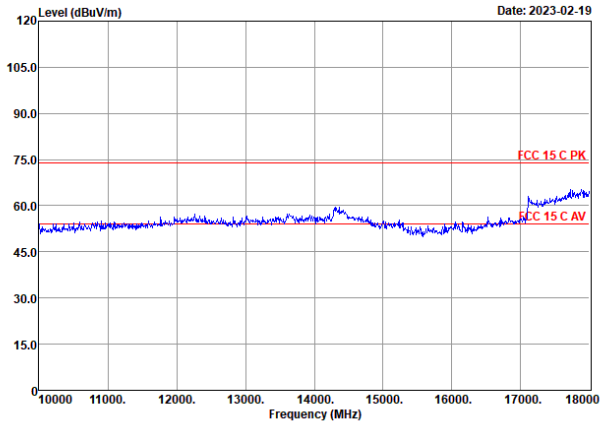
Polarization	Frequency (MHz)	Meter Reading dB (µV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (µV/m)	Limits dB (µV/m)	Margin (dB)	Remark
Horizontal	3178	42.01	30.82	6.05	35.34	43.54	74	30.46	Peak
	4546	39.09	32.6	7.3	34.87	44.12	74	29.88	Peak
	5563	37.97	34.17	8.09	34.76	45.47	74	28.53	Peak
	7030	37.12	35.47	9.26	34.7	47.15	74	26.85	Peak
	8101	37.67	37.5	10.28	34.7	50.75	74	23.25	Peak
	9703	37.65	38.3	11.15	34.63	52.47	74	21.53	Peak
Vertical	2926	42.89	29.45	5.85	35.45	42.74	74	31.26	Peak
	3691	43.52	32.12	6.53	35.19	46.98	74	27.02	Peak
	5257	39.21	33.7	7.89	34.73	46.07	74	27.93	Peak
	6760	38.47	35.3	9.01	34.72	48.06	74	25.94	Peak
	7975	38.69	37.7	10.22	34.7	51.91	74	22.09	Peak
	9604	36.92	38.4	11.15	34.64	51.83	74	22.17	Peak

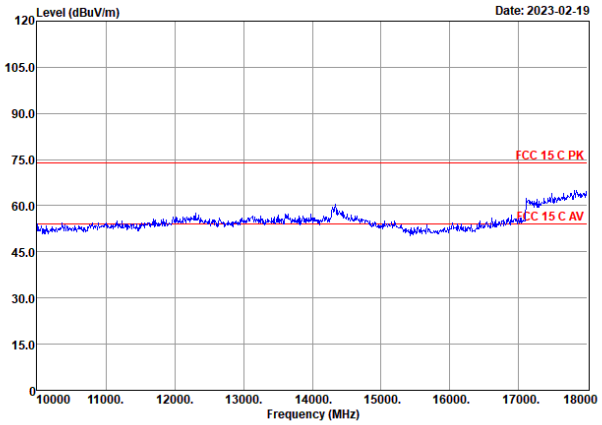
BLE CH2440MHz





Horizontal

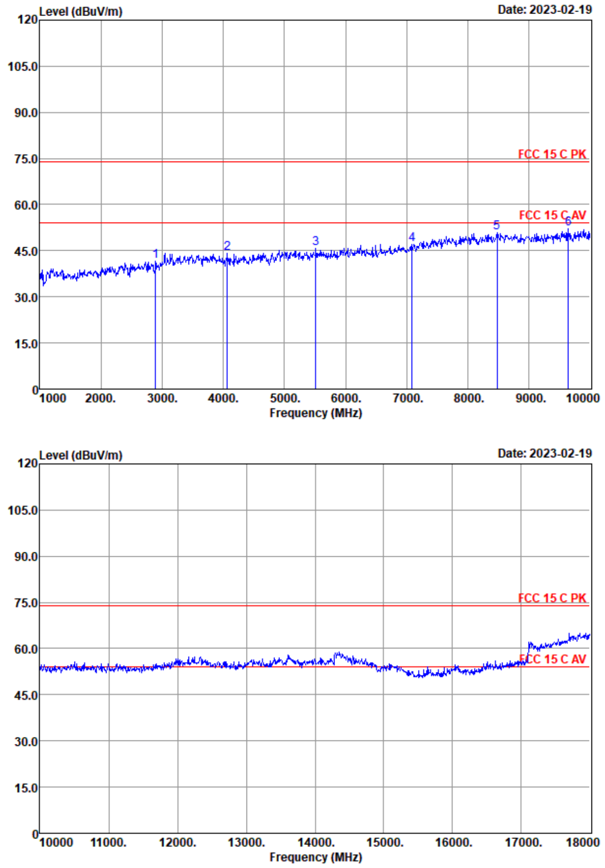




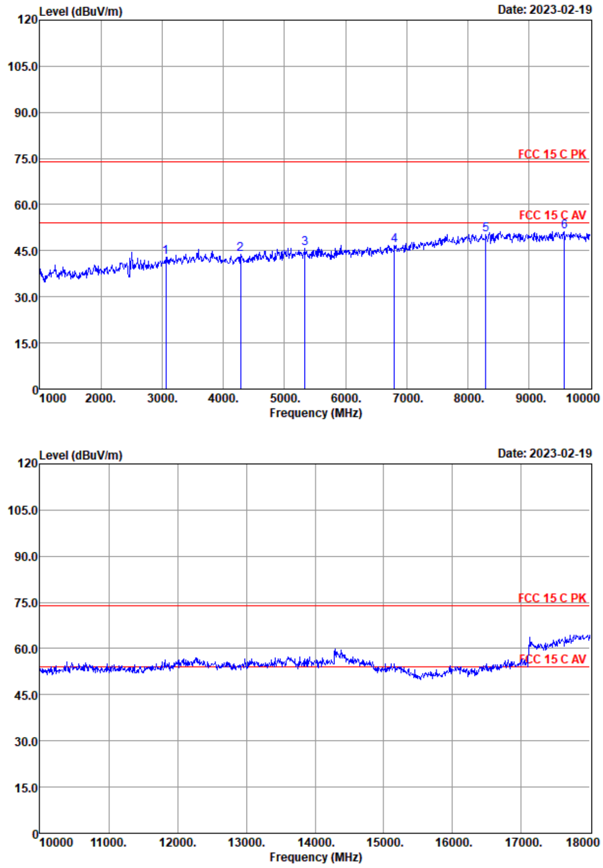
Vertical

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2836	42.21	29.17	5.78	35.52	41.64	74	32.36	Peak
	4429	38.9	32.45	7.18	34.92	43.61	74	30.39	Peak
	5905	38.19	33.9	8.3	34.79	45.6	74	28.4	Peak
	7039	38.22	35.47	9.26	34.7	48.25	74	25.75	Peak
	8065	36.9	37.6	10.28	34.7	50.08	74	23.92	Peak
	9604	36.66	38.4	11.15	34.64	51.57	74	22.43	Peak
Vertical	2944	42.44	29.6	5.85	35.44	42.45	74	31.55	Peak
	3988	40.34	32.42	6.75	35.1	44.41	74	29.59	Peak
	5581	38.16	34.13	8.09	34.76	45.62	74	28.38	Peak
	6796	37.11	35.5	9.09	34.72	46.98	74	27.02	Peak
	7957	36.17	37.7	10.22	34.7	49.39	74	24.61	Peak
	9307	36.47	38	10.97	34.67	50.77	74	23.23	Peak

BLE CH2480MHz



Horizontal



Vertical

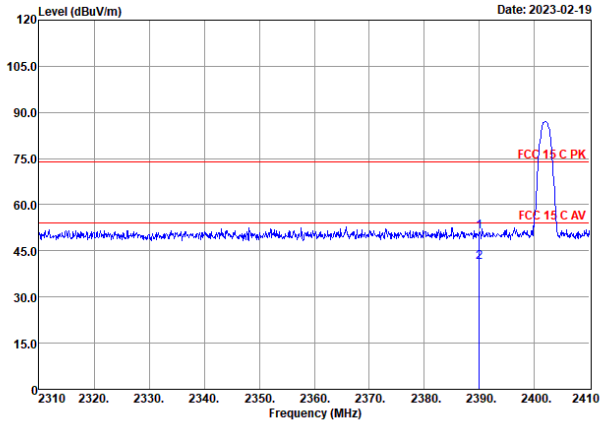
Polarization	Frequency (MHz)	Meter Reading dB (µV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (µV/m)	Limits dB (µV/m)	Margin (dB)	Remark
Horizontal	2890	42.1	29.28	5.82	35.48	41.72	74	32.28	Peak
	4069	40.01	32.3	6.87	35.07	44.11	74	29.89	Peak
	5509	38.24	34.3	8.04	34.75	45.83	74	28.17	Peak
	7084	36.89	35.55	9.37	34.7	47.11	74	26.89	Peak
	8479	36.69	38.4	10.46	34.7	50.85	74	23.15	Peak
	9640	37.41	38.3	11.15	34.64	52.22	74	21.78	Peak
Vertical	3061	41.8	30.44	5.96	35.38	42.82	74	31.18	Peak
	4285	39.4	32.3	7.06	34.98	43.78	74	30.22	Peak
	5338	38.8	33.77	7.94	34.74	45.77	74	28.23	Peak
	6796	36.78	35.5	9.09	34.72	46.65	74	27.35	Peak
	8290	36.49	38.1	10.4	34.7	50.29	74	23.71	Peak
	9577	36.3	38.4	11.15	34.64	51.21	74	22.79	Peak

TEST ENGINEER: Jarey

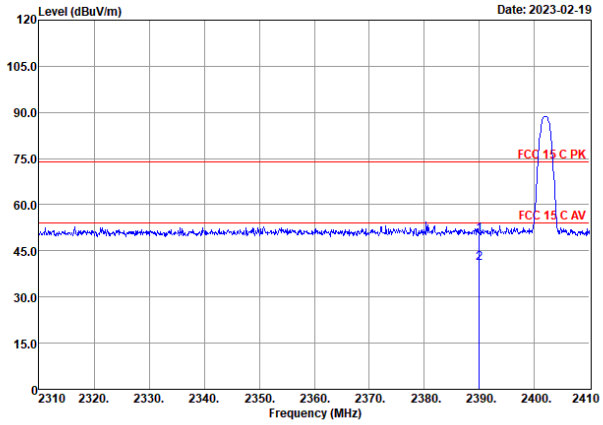
Band-Edge:

EUT	:	LED Lamp	Temperature	:	22℃
Model No.	:	9290032676	Humidity	:	51%RH
Test Mode	:	Transmitting	Date of Test	:	2023.02.19

BLE CH2402MHz



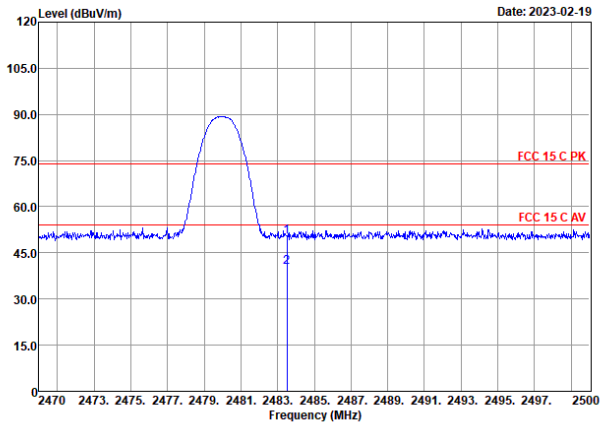
Horizontal



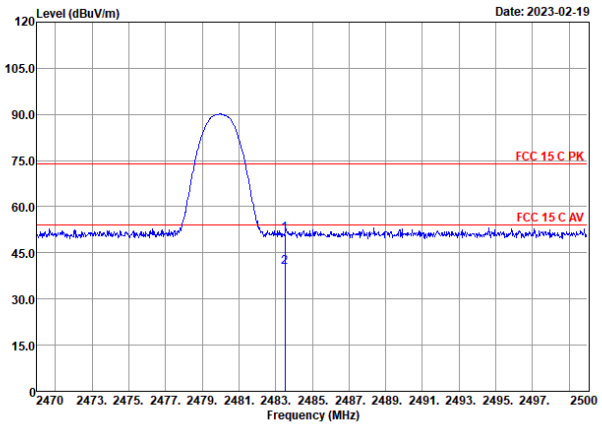
Vertical

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2390	53.26	28.4	5.36	35.9	51.12	74	22.88	Peak
	2390	43.42	28.4	5.36	35.9	41.28	54	12.72	Average
Vertical	2390	52.46	28.4	5.36	35.9	50.32	74	23.68	Peak
	2390	43.24	28.4	5.36	35.9	41.1	54	12.9	Average

BLE CH2480MHz



Horizontal



Vertical

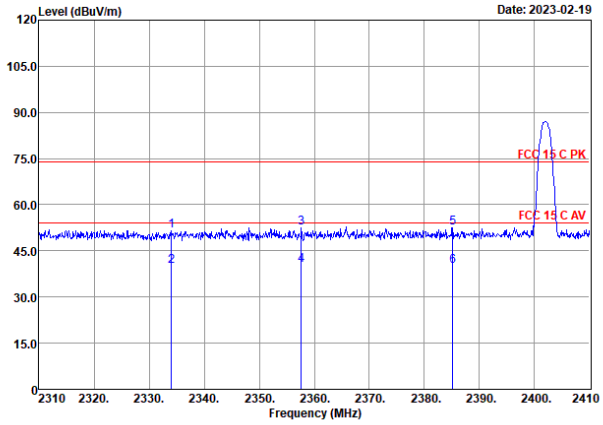
Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2483.5	52.22	28.44	5.43	35.82	50.27	74	23.73	Peak
	2483.5	42.43	28.44	5.43	35.82	40.48	54	13.52	Average
Vertical	2483.5	53.06	28.44	5.43	35.82	51.11	74	22.89	Peak
	2483.5	42.41	28.44	5.43	35.82	40.46	54	13.54	Average

TEST ENGINEER: Jarey

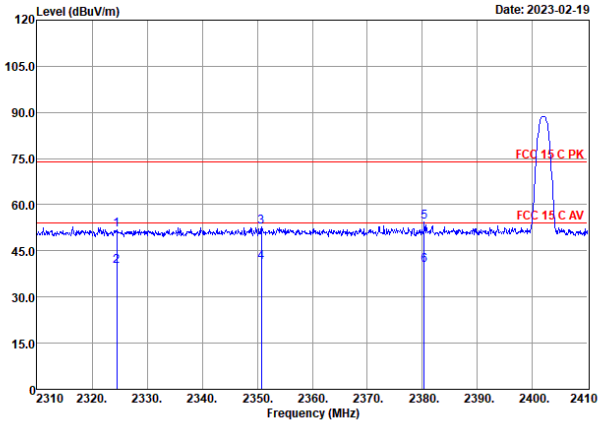
Emissions in restricted frequency bands:

EUT	:	LED Lamp	Temperature	:	22℃
Model No.	:	9290032676	Humidity	:	51%RH
Test Mode	:	Transmitting	Date of Test	:	2023.02.19

BLE CH2402MHz



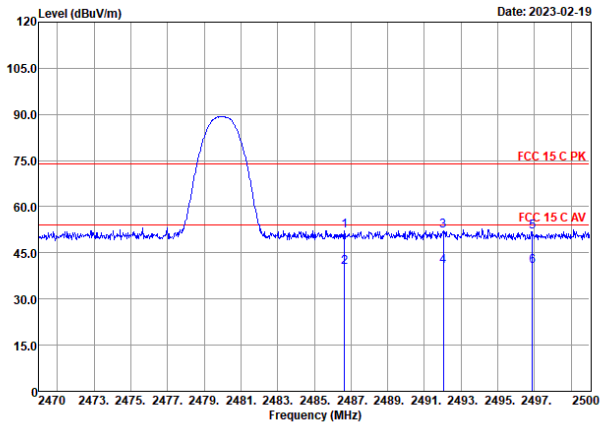
Horizontal



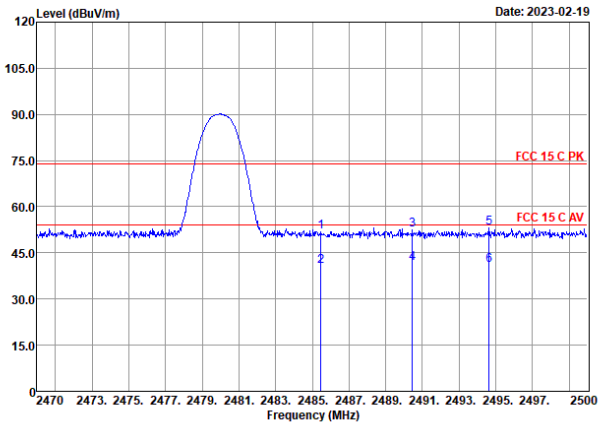
Vertical

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2334.1	53.92	28.29	5.29	35.96	51.54	74	22.46	Peak
	2334.1	42.49	28.29	5.29	35.96	40.11	54	13.89	Average
	2357.6	54.76	28.4	5.32	35.93	52.55	74	21.45	Peak
	2357.6	42.58	28.4	5.32	35.93	40.37	54	13.63	Average
	2385.1	54.67	28.4	5.36	35.91	52.52	74	21.48	Peak
	2385.1	42.27	28.4	5.36	35.91	40.12	54	13.88	Average
Vertical	2324.5	54.33	28.25	5.29	35.97	51.9	74	22.1	Peak
	2324.5	42.43	28.25	5.29	35.97	40	54	14	Average
	2350.8	54.97	28.4	5.32	35.94	52.75	74	21.25	Peak
	2350.8	43.4	28.4	5.32	35.94	41.18	54	12.82	Average
	2380.3	56.64	28.4	5.36	35.91	54.49	74	19.51	Peak
	2380.3	42.46	28.4	5.36	35.91	40.31	54	13.69	Average

BLE CH2480MHz



Horizontal



Vertical

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2486.65	54.08	28.44	5.47	35.82	52.17	74	21.83	Peak
	2486.65	42.31	28.44	5.47	35.82	40.4	54	13.6	Average
	2492.02	53.94	28.47	5.47	35.81	52.07	74	21.93	Peak
	2492.02	42.59	28.47	5.47	35.81	40.72	54	13.28	Average
	2496.88	53.78	28.5	5.47	35.81	51.94	74	22.06	Peak
	2496.88	42.47	28.5	5.47	35.81	40.63	54	13.37	Average
Vertical	2485.48	53.88	28.44	5.47	35.82	51.97	74	22.03	Peak
	2485.48	42.69	28.44	5.47	35.82	40.78	54	13.22	Average
	2490.46	54.22	28.47	5.47	35.82	52.34	74	21.66	Peak
	2490.46	43.32	28.47	5.47	35.82	41.44	54	12.56	Average
	2494.63	54.92	28.47	5.47	35.81	53.05	74	20.95	Peak
	2494.63	42.69	28.47	5.47	35.81	40.82	54	13.18	Average

TEST ENGINEER: Jarey

5 6 dB BANDWIDTH MEASUREMENT

5.1 Test Equipment

The following test equipment was used during the Emission Bandwidth measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2022.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2023.02.22	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2022.08.06	1 Year

5.2 Block Diagram of Test Setup

5.3 Specification Limits (§15.247(a)(2))

The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4 Operating Condition of EUT

The software as section 2.3 was used to enable the EUT to change the test mode one by one.

5.5 Test Procedure

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with settings: RBW = 100kHz, VBW ≥ 3 × RBW.

The 6 dB bandwidth is defined as the total spectrum the power of which is lower than peak power minus 6 dB .

The test procedure is defined in ANSI C63.10-2013 (the 11.8.2 Measurement Procedure “Option 2” was used).

5.6 Test Results

PASSED.

All the test results are attached in next pages.

(Test Date: 2023.02.22 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**6dB Bandwidth (kHz)**	Limit
BLE	00	2402	**641.4**	500 kHz
	19	2440	**640.6**	500 kHz
	39	2480	**640.1**	500 kHz

BLE CH2402MHz

BLE CH2440MHz

BLE CH2480MHz

6 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

6.1 Test Equipment

The following test equipment was used during the maximum peak output power measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2022.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2023.02.22	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2022.08.06	1 Year

6.2 Block Diagram of Test Setup

The Same as Section. 5.2.

6.3 Specification Limits ((§15.247(b)(3))

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5 MHz is: 1 Watt. (30 dBm)

6.4 Operating Condition of EUT

The software as section 2.3 was used to enable the EUT to change the test mode one by one.

6.5 Test Procedure

The transmitter output was connected to the spectrum analyzer.

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) RBW ≥ DTS Bandwidth.
b) VBW ≥ [3 × RBW].
c) Span ≥ [3 × RBW].
d) Sweep time = auto.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

The test procedure is defined in ANSI C63.10-2013 (11.9.1.1 Measurement Procedure " RBW ≥ DTS bandwidth" was used).

6.6 Test Results

PASSED.

All the test results are listed below.

(Test Date: 2023.02.22 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**Peak Output Power (dBm)**	Limit
BLE	00	2402	**5.953**	30 dBm
	19	2440	**6.334**	30 dBm
	39	2480	**6.422**	30 dBm

BLE CH2402MHz

BLE CH2440MHz

BLE CH2480MHz

7 EMISSION LIMITATIONS MEASUREMENT

7.1 Test Equipment

The following test equipment was used during the emission limitations test:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2022.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2023.02.22	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2022.08.06	1 Year

7.2 Block Diagram of Test Setup

The Same as Section. 5.2.

7.3 Specification Limits (§15.247(d))

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)). (※This test result attaching to Section. 3.7)

7.4 Operating Condition of EUT

The software as section 2.3 was used to enable the EUT to change the test mode one by one.

7.5 Test Procedure

The transmitter output was connected to the spectrum analyzer.

Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum PSD level.
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Establish an emission level by using the following procedure:
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

Scan up through 10^{th} harmonic.

The test procedure is defined in ANSI C63.10-2013 (11.11.2 Reference level measurement and 11.11.3 Emission level measurement was used).

7.6 Test Results

PASSED.

The test data was attached in the next pages.

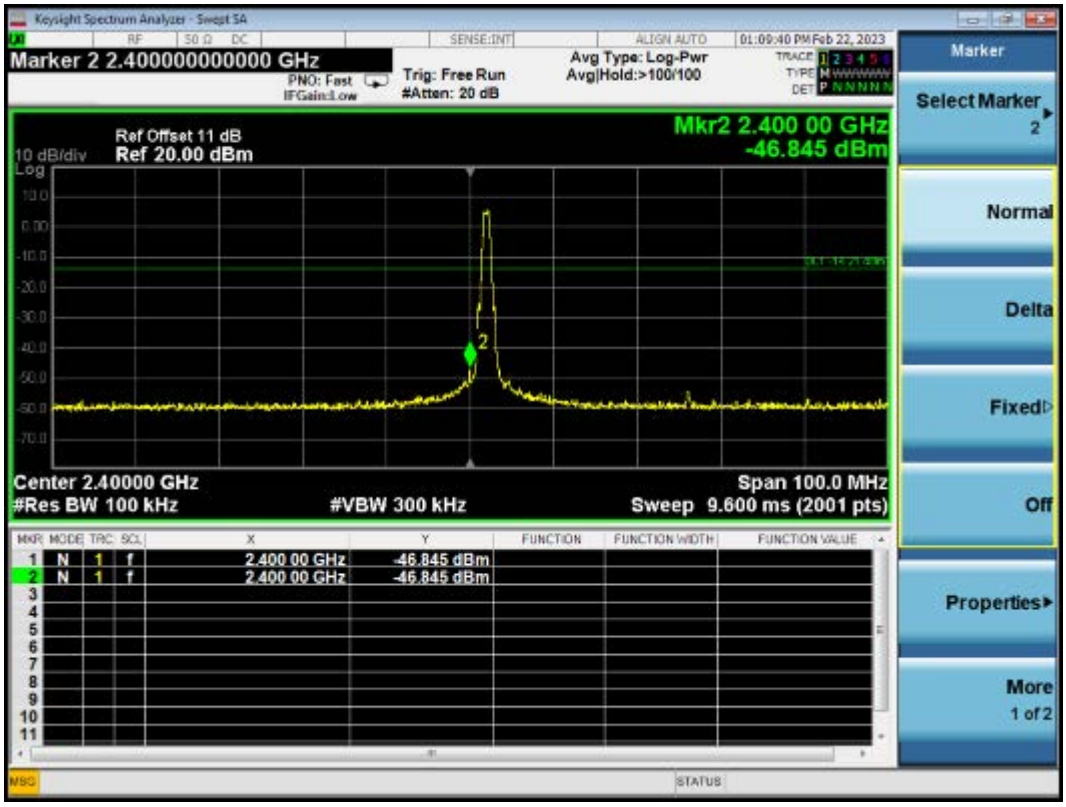
(Test Date: 2023.02.22 Temperature: 23℃ Humidity: 51 %)

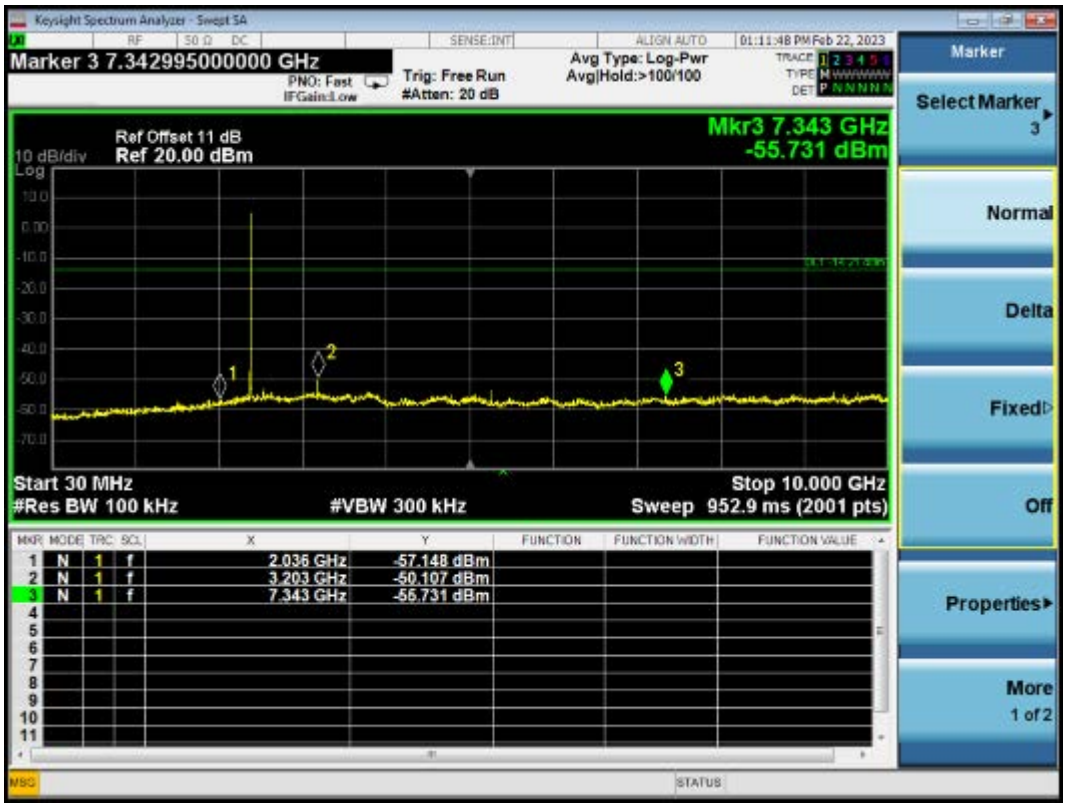
Mode	Channel	Frequency (MHz)	Data Page
BLE	00	2402	P36-37
	19	2440	P38-39
	39	2480	P40-41

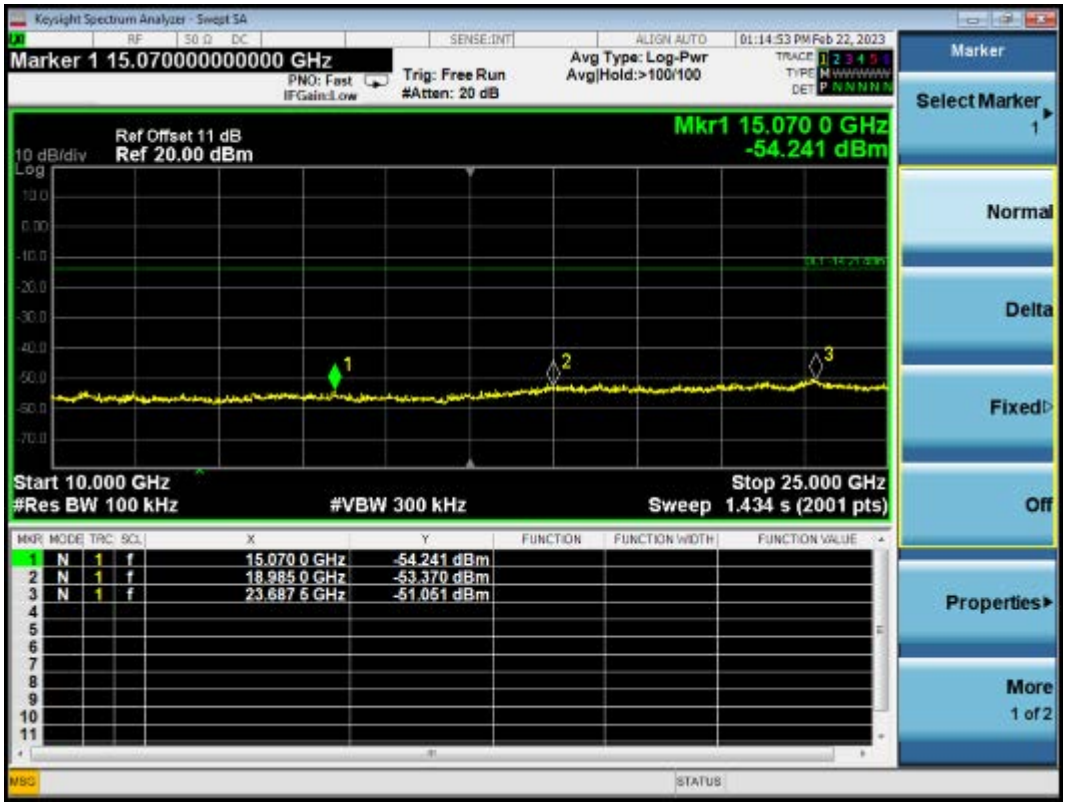
BLE CH2402MHz

Reference level

Emission level



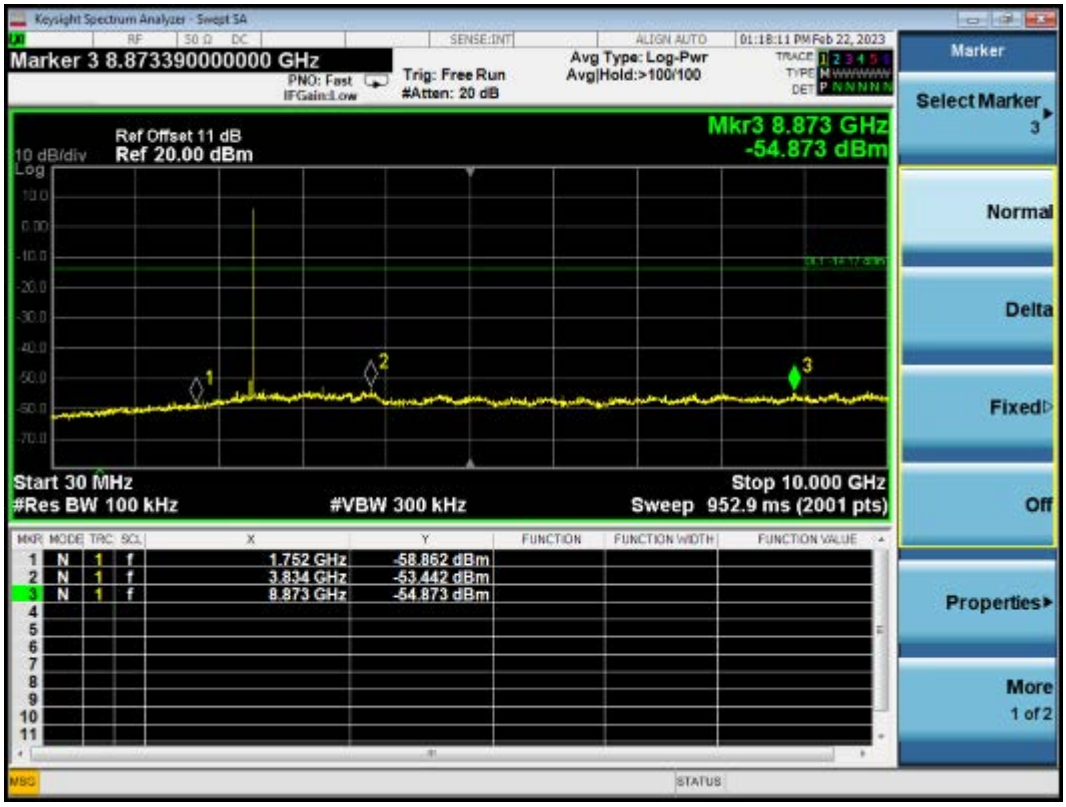

Keysight Spectrum Analyzer - Swept SA
Marker 3 7.342995000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
01:11:48 PM Feb 22, 2023
Ref Offset 11 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr3 7.343 GHz
-55.731 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 952.9 ms (2001 pts)
1 N 1 f 2.036 GHz -57.148 dBm
2 N 1 f 3.203 GHz -50.107 dBm
3 N 1 f 7.343 GHz -55.731 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

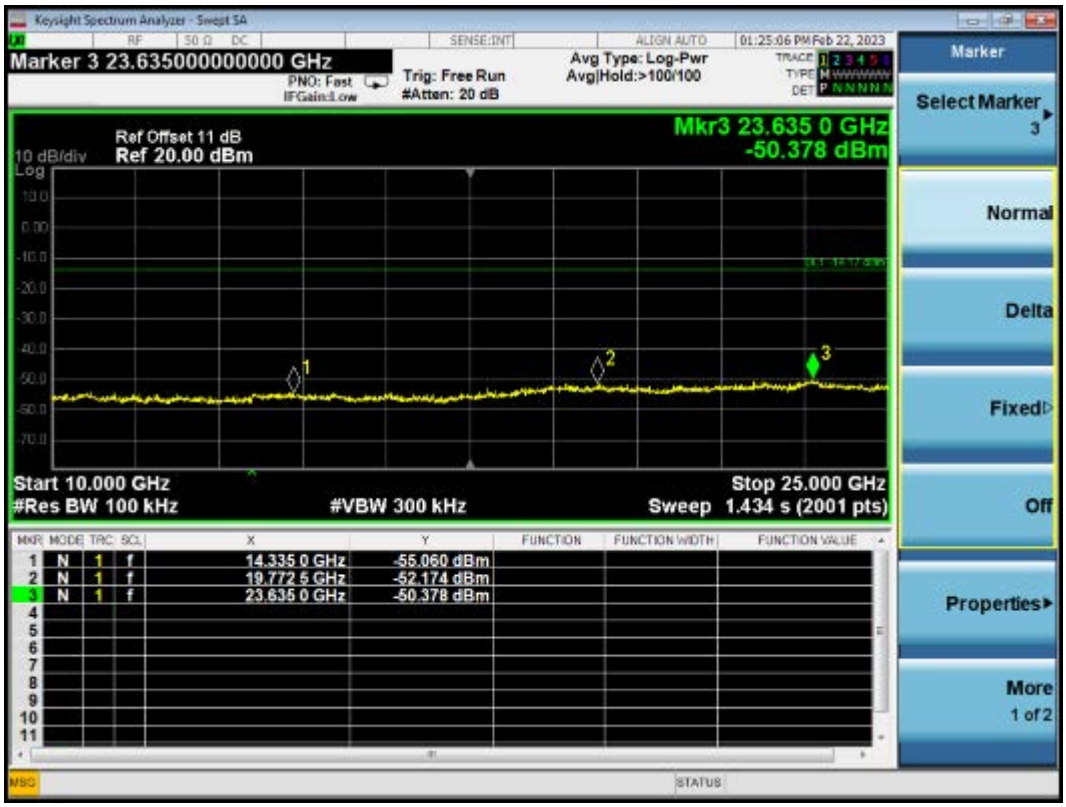

Keysight Spectrum Analyzer - Swept SA
Marker 1 15.070000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
01:14:53 PM Feb 22, 2023
Ref Offset 11 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 15.070 0 GHz
-54.241 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 1.434 s (2001 pts)
1 N 1 f 15.070 0 GHz -54.241 dBm
2 N 1 f 18.985 0 GHz -53.370 dBm
3 N 1 f 23.687 5 GHz -51.051 dBm
Marker
Select Marker 1
Normal
Delta
Fixed
Off
Properties
More 1 of 2
MSG
STATUS

BLE CH2440MHz

Reference level

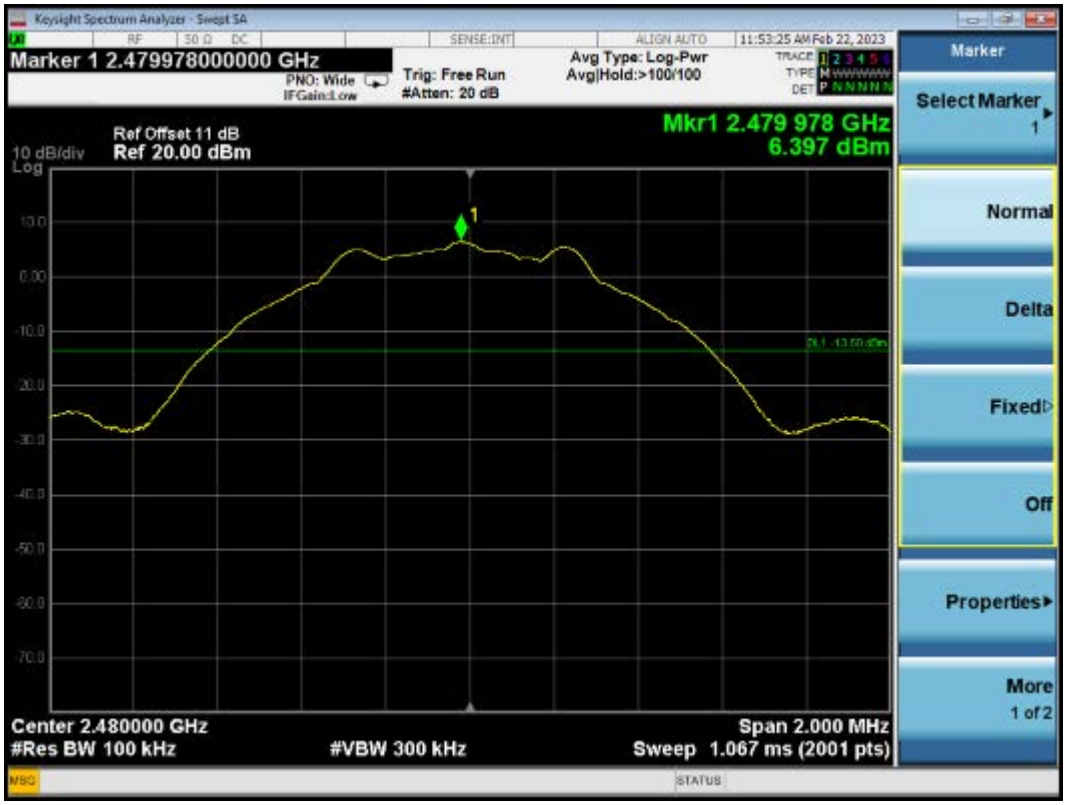
Emission level



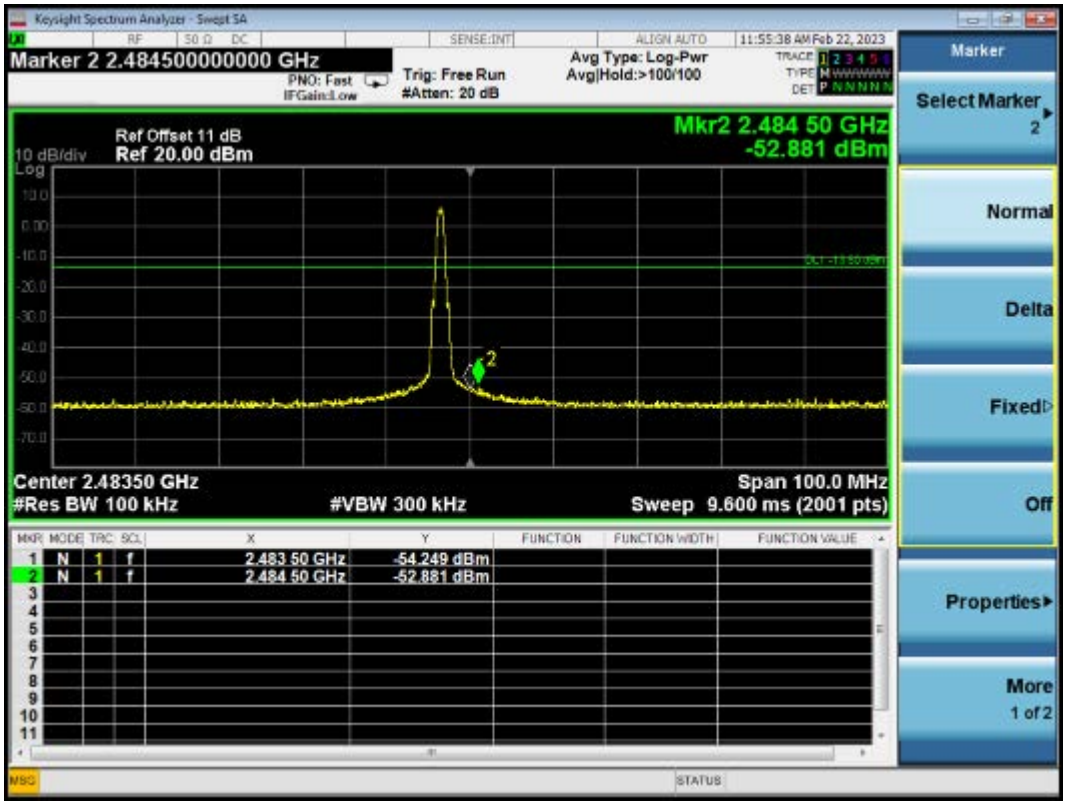

Keysight Spectrum Analyzer - Swept SA
Marker 3 23.635000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
01:25:06 PM Feb 22, 2023
Ref Offset 11 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr3 23.635 0 GHz
-50.378 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 1.434 s (2001 pts)
1 N 1 f 14.335 0 GHz -55.060 dBm
2 N 1 f 19.772 5 GHz -52.174 dBm
3 N 1 f 23.635 0 GHz -50.378 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

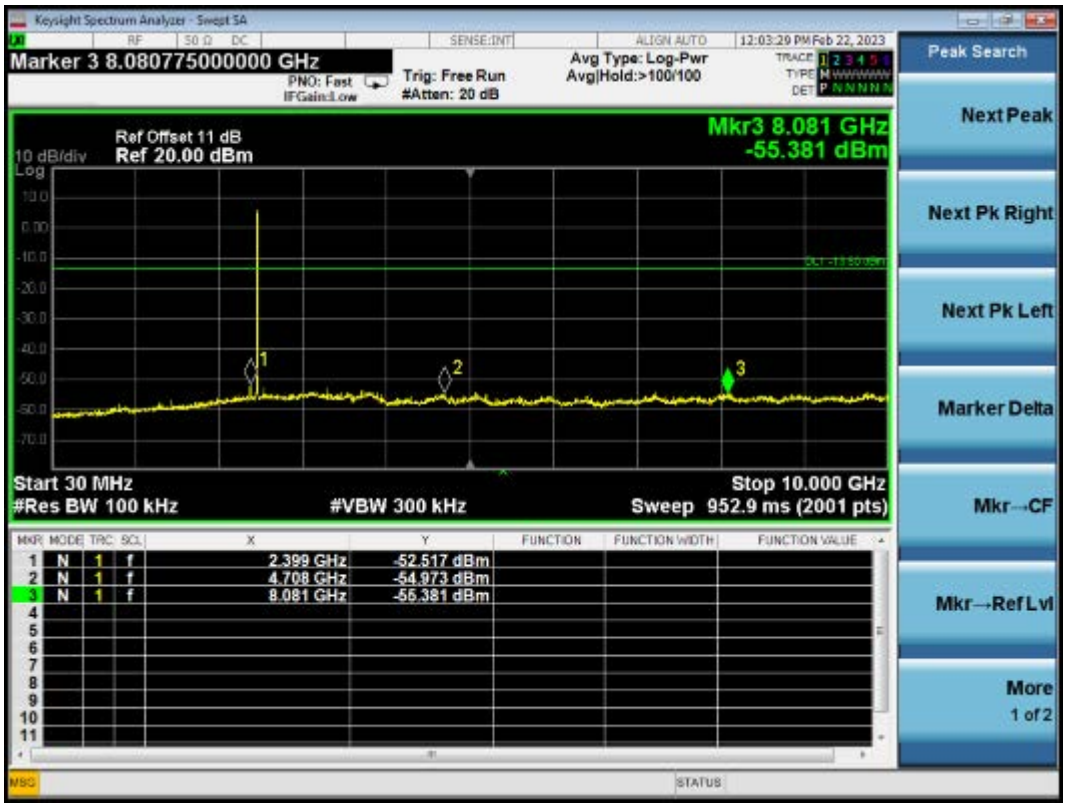
BLE CH2480MHz

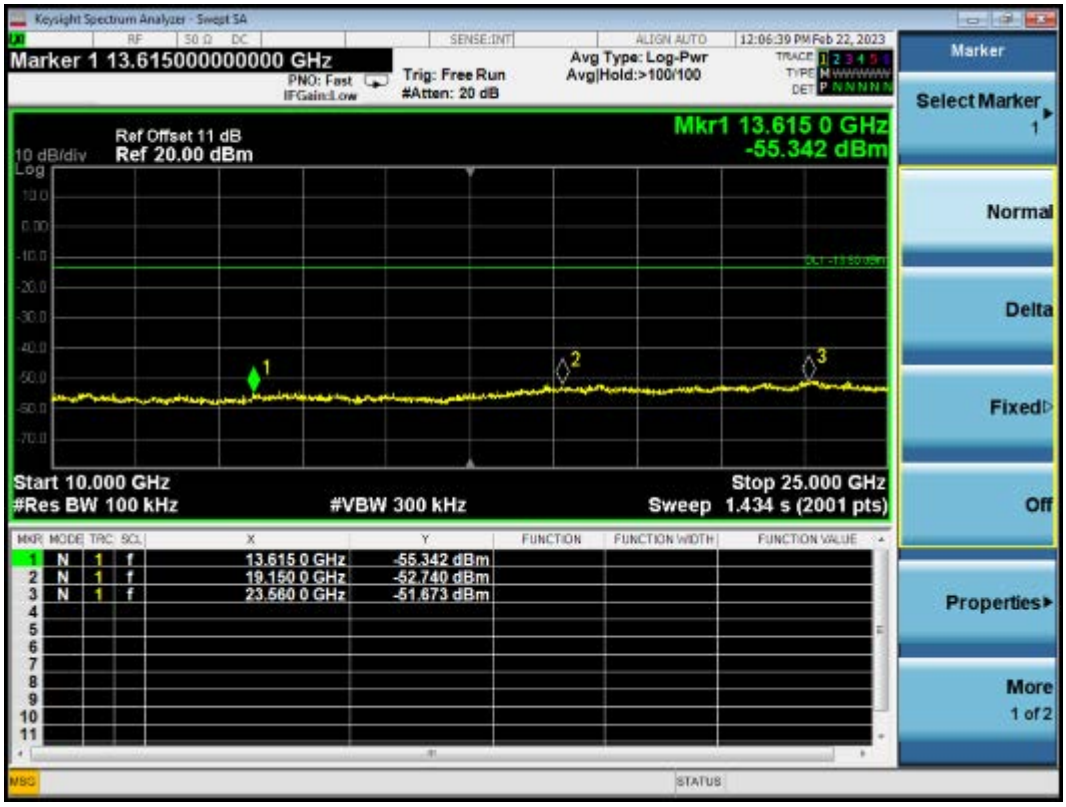
Reference level



Emission level




Keysight Spectrum Analyzer - Swept SA
Marker 3 8.080775000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:03:29 PM Feb 22, 2023
Ref Offset 11 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr3 8.081 GHz
-55.381 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 952.9 ms (2001 pts)
1 N 1 f 2.399 GHz -52.517 dBm
2 N 1 f 4.708 GHz -54.973 dBm
3 N 1 f 8.081 GHz -55.381 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 1 13.615000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:06:39 PM Feb 22, 2023
Ref Offset 11 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 13.615 0 GHz
-55.342 dBm
Start 10.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 1.434 s (2001 pts)
1 N 1 f 13.615 0 GHz -55.342 dBm
2 N 1 f 19.150 0 GHz -52.740 dBm
3 N 1 f 23.560 0 GHz -51.673 dBm
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2

8 POWER SPECTRAL DENSITY MEASUREMENT

8.1 Test Equipment

The following test equipment was used during the power spectral density measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	2022.09.15	1 Year
2.	Coaxial Cable	WOKEN	SFL402-105F LEX	F02-150819-045	2023.02.22	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2022.08.06	1 Year

8.2 Block Diagram of Test Setup

The Same as section 5.2.

8.3 Specification Limits (§15.247(e))

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band.

8.4 Operating Condition of EUT

The software as section 2.3 was used to enable the EUT to change the test mode one by one.

8.5 Test Procedure

The transmitter output was connected to the spectrum analyzer.

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × RBW].
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

The test procedure is defined in ANSI C63.10-2013 (11.10.2 Measurement Procedure “Method PKPSD (peak PSD)” was used).

8.6 Test Results

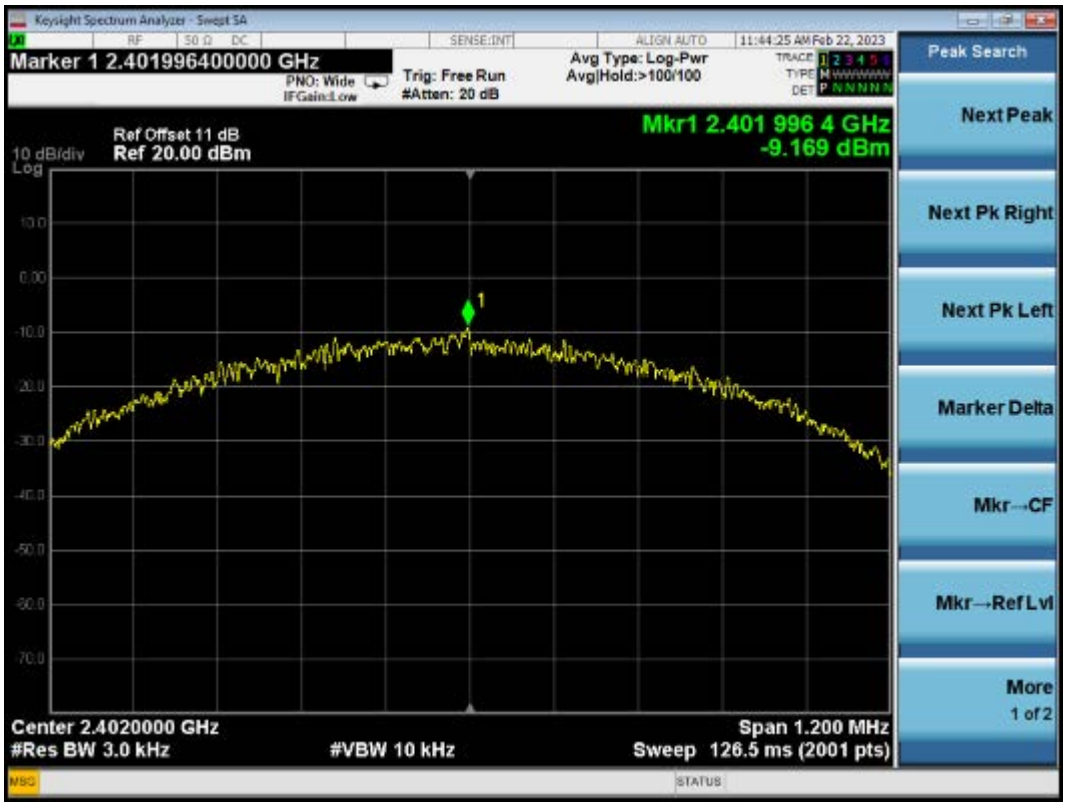
PASSED.

All the test results are attached in next pages.

(Test Date: 2023.02.22 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**Power Spectral Density (dBm)**	Limit
BLE	00	2402	**-9.169**	8 dBm
	19	2440	**-8.774**	8 dBm
	39	2480	**-8.543**	8 dBm

BLE CH2402 MHz



BLE CH2440 MHz

BLE CH2480 MHz

9 ANTENNA REQUIREMENT

9.1 Specification Limits (§15.203)

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.

9.2 Result

According to KDB 353028 D1, the following describes the three ways that can be used to demonstrate compliance to Section 15.203: a) Antenna permanently attached. b) Unique (non-standard) antenna connector. c) Professional installation.
For this product, the antenna is: ☑ Antenna permanently attached ☐ Unique (non-standard) antenna connector ☐ Professional installation ☐ not meet any of ways list above that ☑ compliant ☐ not compliant with the requirement of Section 15.203.

10 DEVIATION TO TEST SPECIFICATIONS

None.

11 MEASUREMENT UNCERTAINTY LIST

The measurement uncertainty was estimated for test on the EUT according to CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage of K=2.
The uncertainties value is not used in determining the PASS/FAIL results.

Test Items/Facilities	Frequency/Equipment/Unit	Uncertainty
Conducted Emission No.1 Shielded Room	9kHz~150kHz	±3.1 dB
	150kHz~30MHz	±2.6 dB
Conducted Emission No.3 Shielded Room	9kHz~150kHz	±3.1 dB
	150kHz~30MHz	±2.6 dB
Radiated Emission	30MHz~200MHz, Horizontal	±3.8 dB
	30MHz~200MHz, Vertical	±4.1 dB
	200MHz~1000MHz, Horizontal	±3.6 dB
	200MHz~1000MHz, Vertical	±5.1 dB
	1GHz~6GHz	±5.3 dB
	6GHz~18GHz	±5.3 dB
	18GHz~40GHz	±3.5 dB
Output Power Test	50MHz~18GHz	0.77 dB
Power Density Test	9kHz~6GHz	1.08 dB
RF Frequency Test	9kHz~40GHz	$6*10^{-4}$
Bandwidth Test	9kHz~6GHz	$1.5*10^{-3}$
RF Radiated Power Test	30MHz~1000MHz	3.06 dB
Conducted Output Power Test	50MHz~18GHz	0.83 dB
AC Voltage(<10kHz) Test	120V~230V	0.04 %
DC Power Test	0V~30V	0.4 %
Temperature	-40℃~+100℃	0.52 ℃
Humidity	30%~95%	2.6 %