TEST REPORT
On behalf of

Signify (China) Investment Co., Ltd.

Product Name: Sensor

Model No.: SC200B/02 SR Sensor WH, SC200B/02 SR Sensor BL

FCC ID: 2AGBWSC200B

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.	:	C1D2401018
Report No.	:	ACI-F24028
Date of Test	:	2024.01.17-02.01
Date of Report	:	2024.02.07

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 U.S. Government.

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TEST REPORT

Applicant	:	Signify (China) Investment Co. Ltd
EUT Description	:	Sensor
		(A) Model No. : Refer to Sec.2.1
		(B) Power Supply : 12 to 22Vdc
		(C) Test Voltage : DC 16V (From DALI Extender)

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 BLE function are contained in No.ACI-F24027 report.

Date of Test : 2024.01.17-02.01 Date of Report : 2024.02.07

Producer : HUIMIN YAN / Assistant

Review : JAREY LU / Deputy Assistant Manager

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

Signatory : KAMP CHEN / Manager

Authorized Signature(s)

1 SUMMARY OF STANDARDS AND RESULTS

1.1 Description of Standards and Results

The result is determined according to the decision rules of customer selection in the ASC-403 application service form.
1. According to IEC GUIDE 115 Procedure 2 and ILAC-G8, the uncertainties value is not used in determining the PASS/FAIL results.
2. If the required specification or standard already contains the decision rules, it will be carried out in accordance with the regulations or standard documents or the requirements of the competent units. If the required specification or standard does not contain a decision rule, the same paragraph 1.
3. If your company has a required decision rule, it will be implemented in accordance with the requirements and ISO/IEC Guide 98-4 specifications.

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	N/A	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	:	Sensor
Type of EUT	:	☑ Production ☐ Pre-product ☐ Pro-type
Model Number	:	SC200B/02 SR Sensor WH, SC200B/02 SR Sensor BL
Note	:	The models are all the same, only the color is different.
Test Model	:	SC200B/02 SR Sensor WH
R Radio Tech	:	BLE 5.0; Zigbee.
Channel Freq.	:	BLE: 2402MHz-2480MHz; Zigbee: 2405MHz-2480MHz;
Modulation	:	BLE: GFSK; Zigbee: OQPSK;
Antenna Info.	:	Antenna Type: PCB Antenna Antenna Gain: 0.99 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(kbps)
ZigBee	OQPSK	250

Channel List			
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

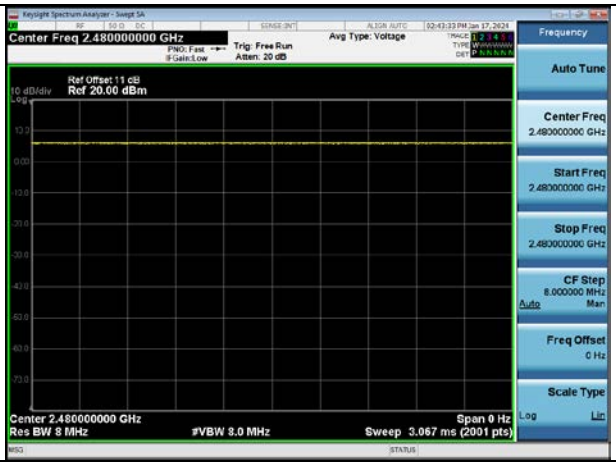
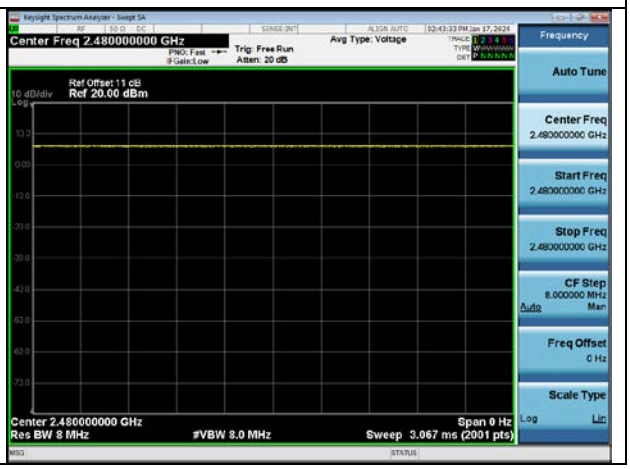
2.3 Test Information

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

Mode	data rate (kbps)	Power Setting	Test Channel		Frequency (MHz)
ZigBee	250	4	Low:	11	2405
		4	Middle:	19	2445
		4	High:	26	2480

2.4 Duty Cycle Check

Mode	Transmission Duration (ms)	Transmission Period (ms)	Duty Cycle (%)
ZigBee	3	3	100

Mode	Ton	Ton+off
ZigBee		

2.5 Sample Description

Test Item	Model Number	Sample Number	Date of receipted
Radiated Emission	SC200B/02 SR Sensor WH	E20240109038-01/02	2024.01.09
Conducted RF Test	SC200B/02 SR Sensor WH	E20240109038a-01/02	2024.01.09

2.6 Supported equipment

Brand : Acer
Product Name: : Notebook PC
Model Name : TravelMate P238 series
Model Number : N15W8

Product Name : Test Fixture
Mode Number : WSTK JLINK
Product Function : USB to TTL

Brand : PHILIPS
Product Name: : DALI Extender
Model Name : 9137010662

2.7 Description of Test Facility

Name of Firm : Audix Technology (Shanghai) Co., Ltd.

Site Location : 3F, Building 34, No. 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 RADIATED EMISSION TEST

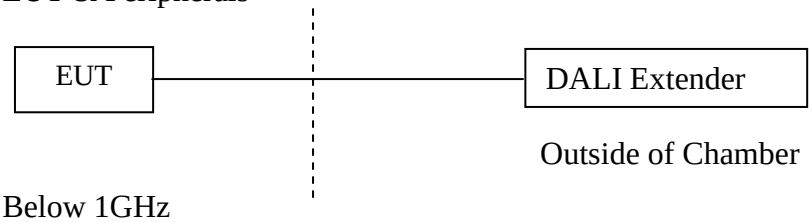
3.1 Test Equipment

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

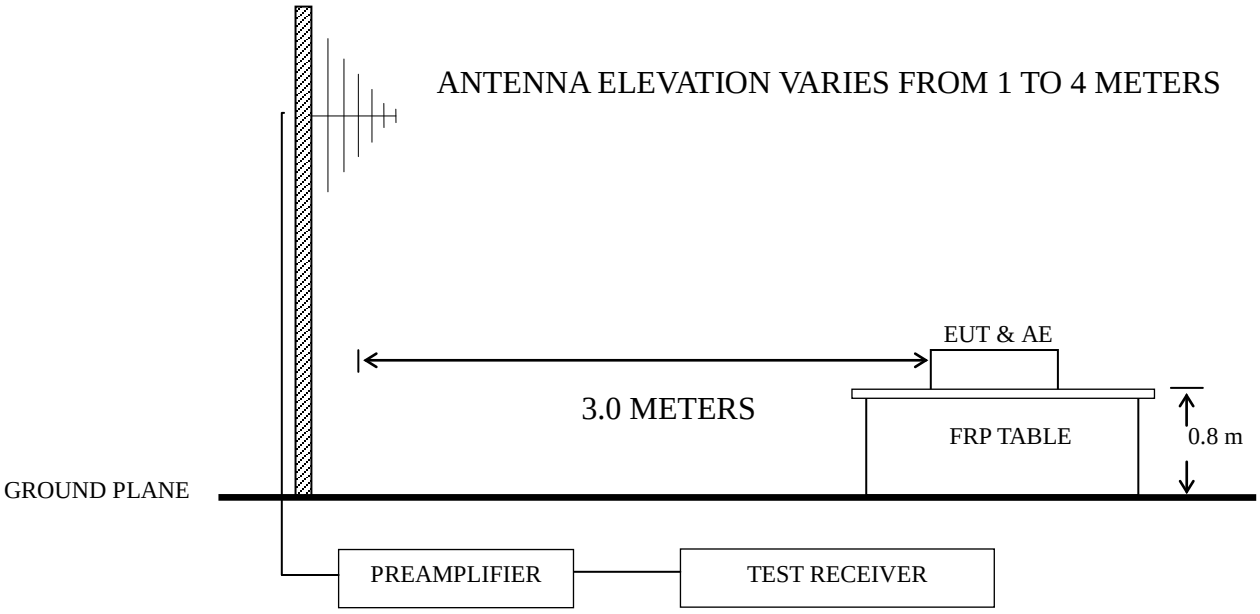
Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Preamplifier	Agilent	8447D	2944A10548	2023.02.22	1 Year
2.	Preamplifier	HP	8449B	3008A00864	2023.02.22	1 Year
3.	EXA Signal Analyzer	Agilent	N9010A	MY52221182	2023.08.09	1 Year
4.	Test Receiver	R&S	ESCI	101303	2023.02.22	1 Year
5.	Bilog Antenna+6dB Attenuator	Schwarzbeck	VULB 9168+EMCI-N-6-06	708+AT-N0638	2023.02.07	1 Year
6.	Horn Antenna	EMCO	3115	96074878	2023.08.02	1 Year
7.	Horn Antenna	EMCO	3116	00062643	2023.01.30	2 Year
8.	Cavity Band Rejection Filter	Microwave	WT-A3882-R10	WT200312-1-1	2023.02.22	1 Year
9.	Coaxial Switch	Anritsu	MP59B	6200655086	2023.02.22	1 Year
10.	Coaxial Cable	SCHAFFNER	RG 212U-MIL C 17+N1K50-EW0630 -N1K50-15m-1	RE-10m-001/ RE-15m-002	2023.02.22	1 Year
11.	Software	Audix	e3	v9.210616	--	--

3.2 Block Diagram of Test Setup

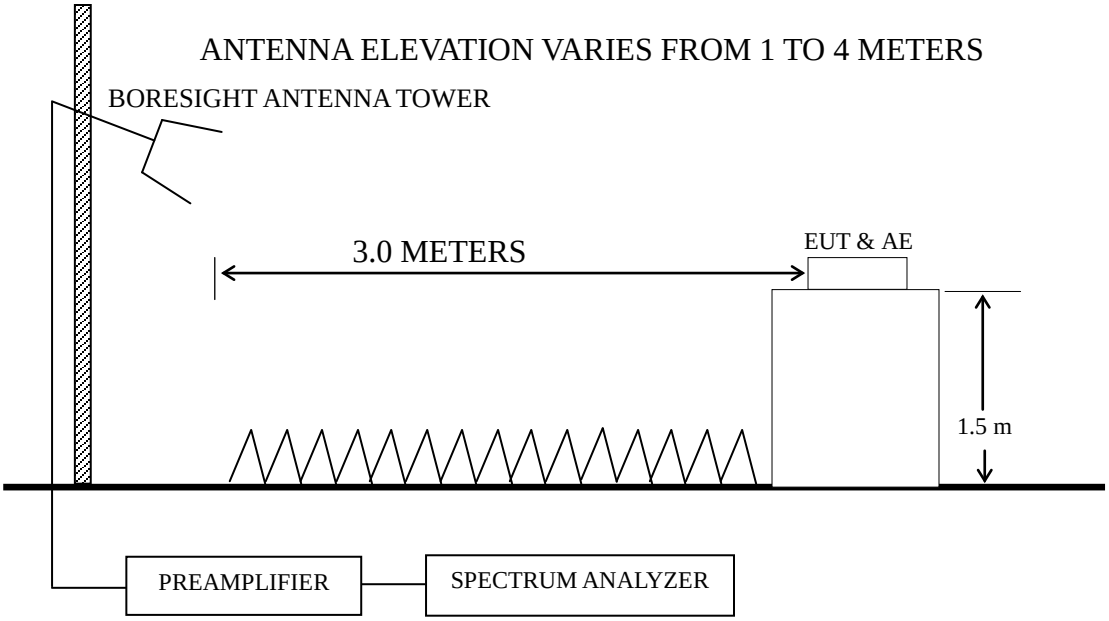
3.2.1 EUT & Peripherals



3.2.2 Below 1GHz



3.2.3 Above 1GHz



3.3 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

3.4 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.

3.5 Operating Condition of EUT

3.5.1 Setup the EUT as shown in Sec. 3.2.

3.5.2 Disconnect the wire between DALI Extender and EUT.

3.5.3 Plug Test Fixture to EUT through HCI cable.

3.5.4 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.

3.5.5 Then connect the wire between DALI Extender and EUT, turn EUT on, then test.

3.5.6 Repeat step 3.5.2 and 3.5.5, until the test of all modes finished.

3.6 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 10th harmonics from fundamental frequency) was checked.

All the test results are listed in Sec.3.7.

3.7 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	ZigBee	11	2405 MHz	P14-15

Frequency range: above 1GHz

No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	ZigBee	11	2405 MHz	P16-17
2.			19	2445 MHz	P18-19
3.			26	2480 MHz	P20-21

Band-Edge and Restricted bands:

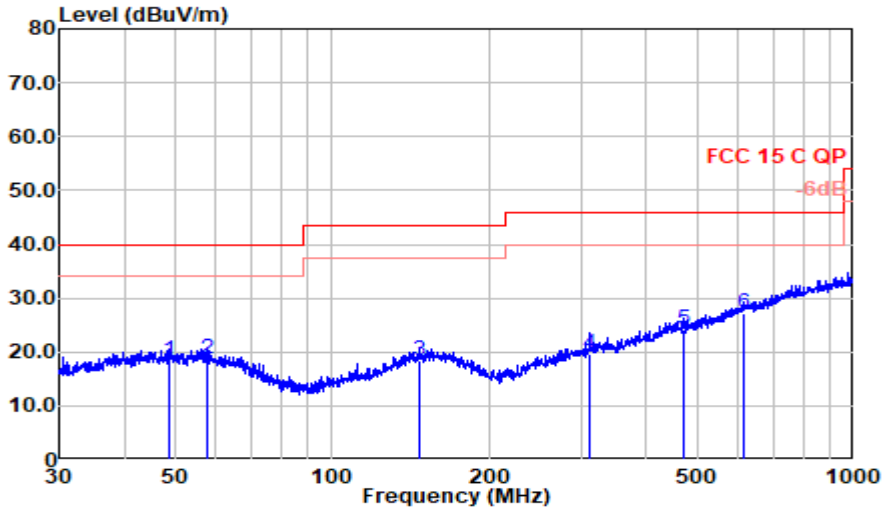
No.	Operation	Mode	Channel	Frequency	Data Page
1.	Transmitting	ZigBee	11	2405 MHz	P22-23
2.			26	2480 MHz	P24-25

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 Lying direction, for this direction was the maximum emission direction during the test. The data of Side & Standing 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.

Radiated emission < 1GHz

Test Date:	2024.01.28	Temp./Hum.:	22℃/51%RH	Test By:	Jarey

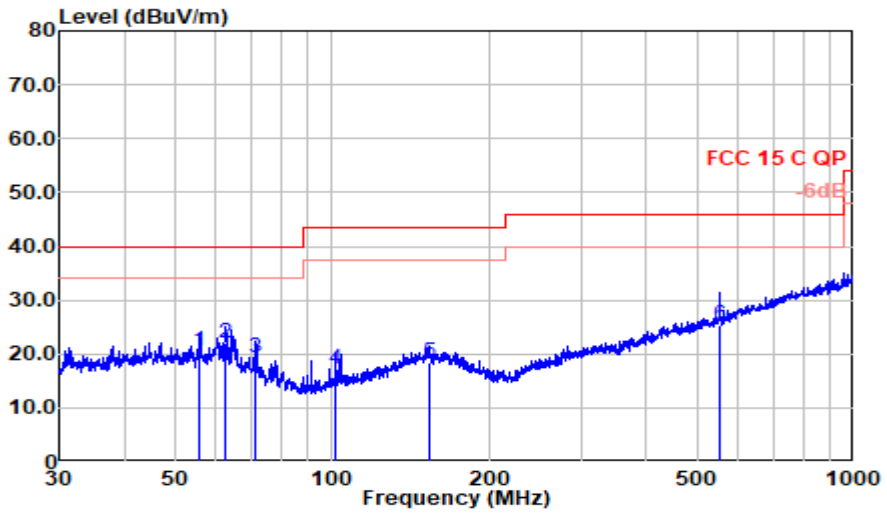
Mode: Zigbee CH2405MHz



Polarization at Horizontal

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
48.587	27.86	19.80	0.76	29.90	18.52	40.00	21.48	QP
57.493	28.34	19.35	0.83	29.87	18.65	40.00	21.35	QP
147.145	27.48	19.11	1.33	29.42	18.51	43.50	24.99	QP
311.633	26.70	19.60	1.95	28.75	19.50	46.00	26.50	QP
473.005	28.27	22.96	2.42	29.39	24.25	46.00	21.75	QP
615.292	27.40	25.91	2.84	28.94	27.21	46.00	18.79	QP

Mode: Zigbee CH2405MHz



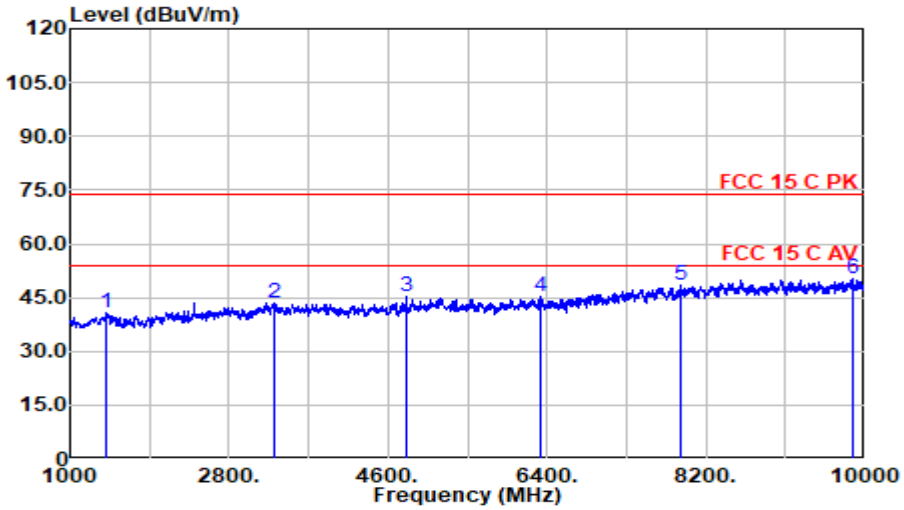
Polarization at Vertical

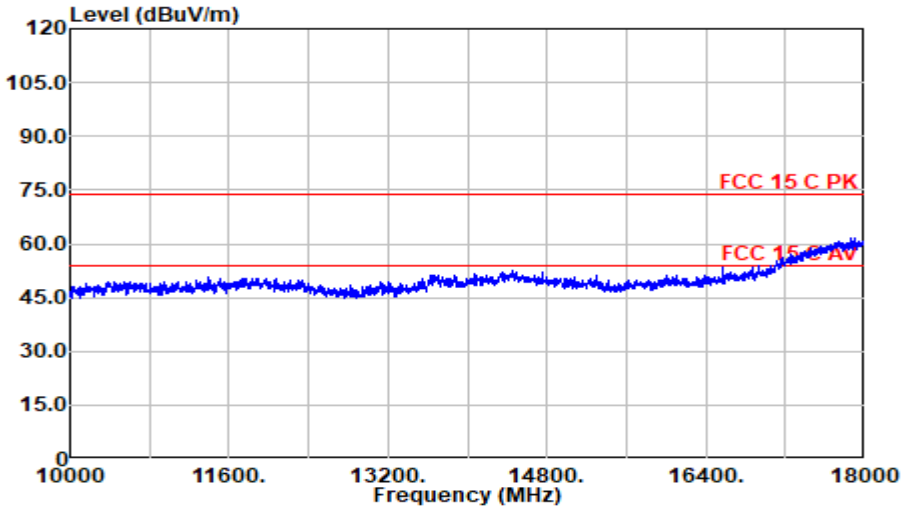
Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
55.805	30.06	19.62	0.81	29.88	20.61	40.00	19.39	QP
62.541	32.18	18.74	0.86	29.85	21.93	40.00	18.07	QP
71.205	31.29	17.04	0.91	29.82	19.42	40.00	20.58	QP
101.644	30.88	14.86	1.17	29.69	17.23	43.50	26.27	QP
154.279	27.01	19.30	1.36	29.38	18.29	43.50	25.21	QP
552.883	27.71	24.32	2.61	29.19	25.45	46.00	20.55	QP

Radiated Emission > 1GHz

Test Date:	2024.01.31	Temp./Hum.:	22℃/51%RH	Test By:	Jarey

Mode: Zigbee CH2405MHz

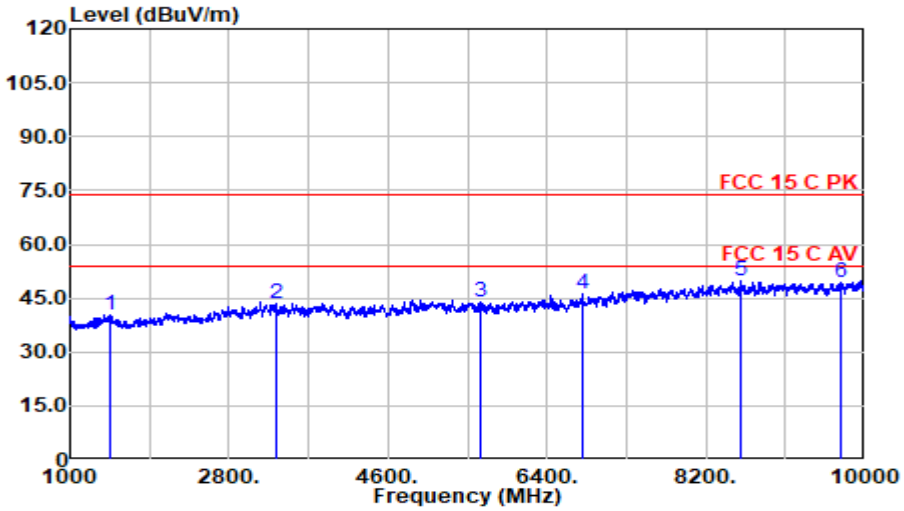


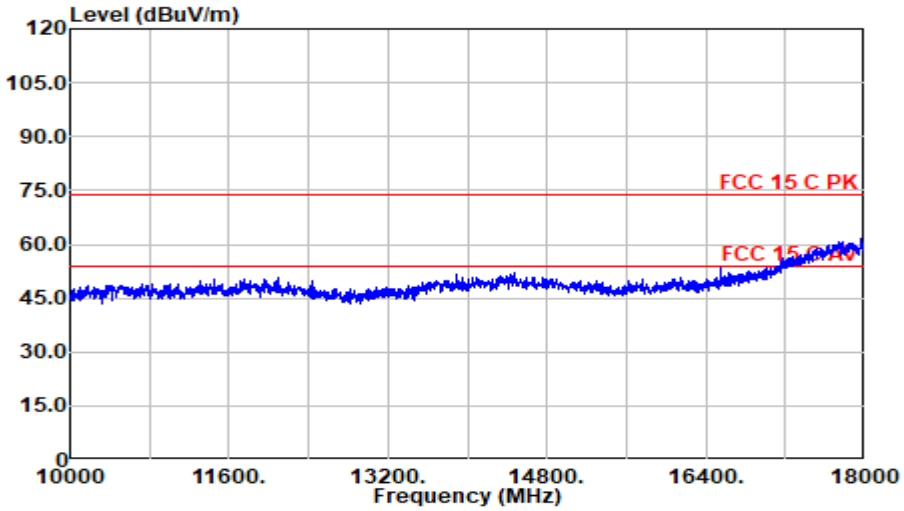


Polarization at Horizontal

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
1400.500	47.12	26.00	4.23	36.50	40.85	74.00	33.15	Peak
3317.500	41.28	31.40	6.18	35.26	43.60	74.00	30.40	Peak
4811.500	39.38	32.97	7.63	34.67	45.31	74.00	28.69	Peak
6332.500	36.30	34.70	8.71	34.60	45.11	74.00	28.89	Peak
7912.000	35.57	37.38	10.22	34.88	48.30	74.00	25.70	Peak
9865.000	35.14	38.26	11.34	34.61	50.13	74.00	23.87	Peak

Mode: Zigbee CH2405MHz

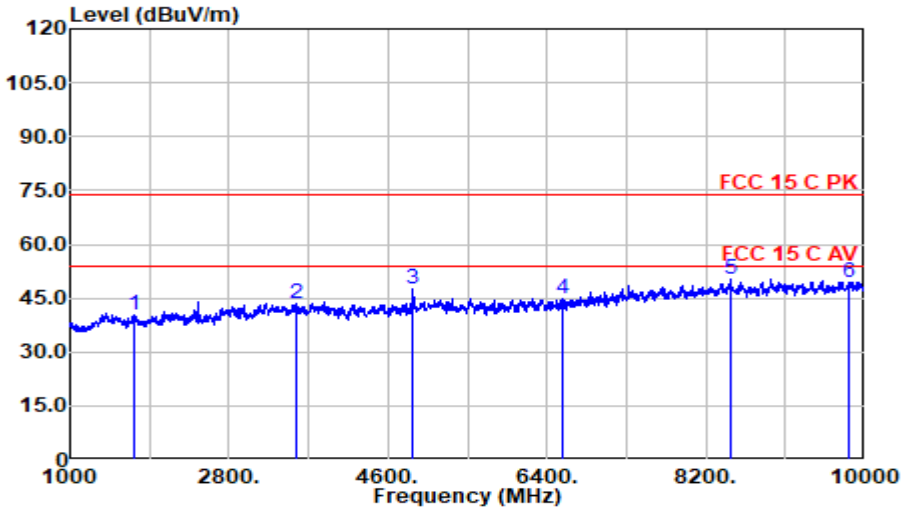


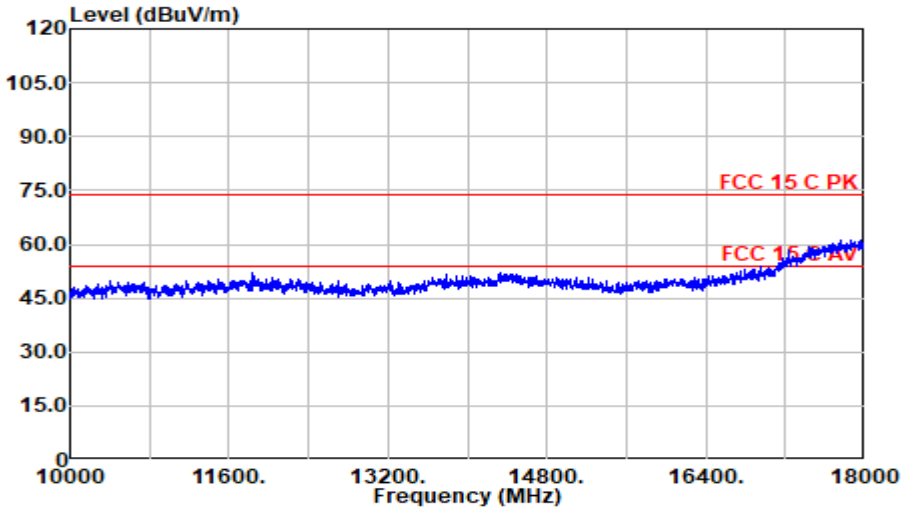


Polarization at Vertical

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
1463.500	46.39	26.03	4.33	36.50	40.25	74.00	33.75	Peak
3340.000	41.22	31.40	6.20	35.25	43.57	74.00	30.43	Peak
5639.500	36.59	33.92	8.21	34.60	44.13	74.00	29.87	Peak
6809.500	36.17	35.32	9.10	34.60	45.99	74.00	28.01	Peak
8600.500	35.95	38.10	10.51	34.78	49.78	74.00	24.22	Peak
9730.000	34.87	38.10	11.24	34.63	49.58	74.00	24.42	Peak

Mode: Zigbee CH2440MHz

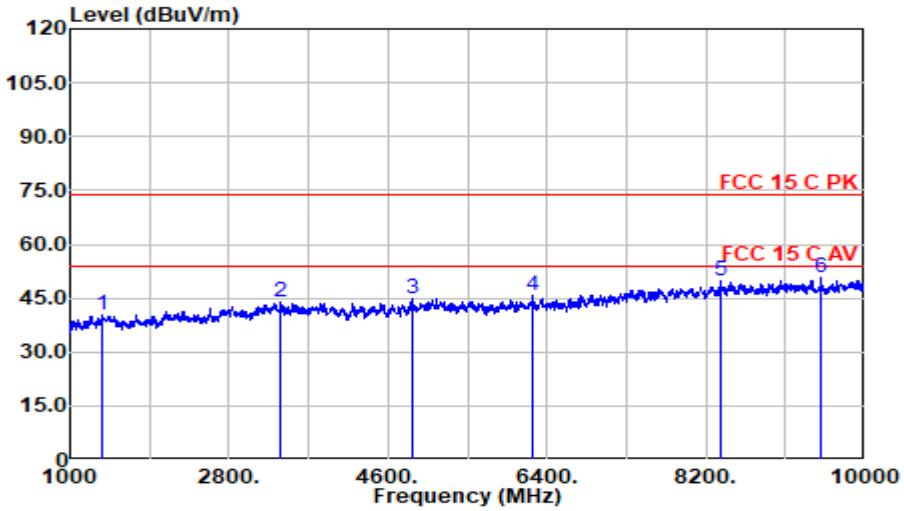


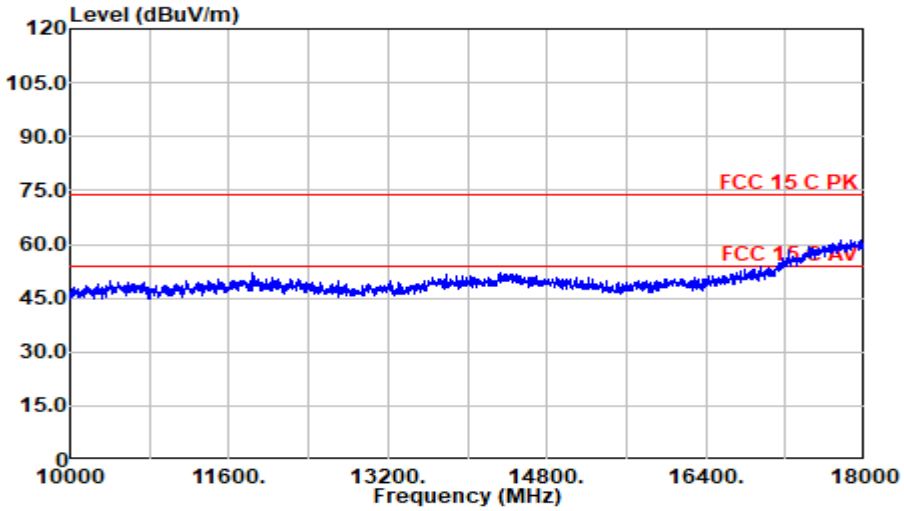


Polarization at Horizontal

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
1724.500	45.80	26.49	4.69	36.50	40.48	74.00	33.52	Peak
3569.500	40.67	31.50	6.40	35.16	43.41	74.00	30.59	Peak
4883.500	40.90	33.40	7.70	34.64	47.35	74.00	26.65	Peak
6571.000	35.82	34.74	8.91	34.60	44.87	74.00	29.13	Peak
8483.500	36.19	38.20	10.47	34.80	50.06	74.00	23.94	Peak
9815.500	34.68	38.13	11.31	34.62	49.50	74.00	24.50	Peak

Mode: Zigbee CH2440MHz

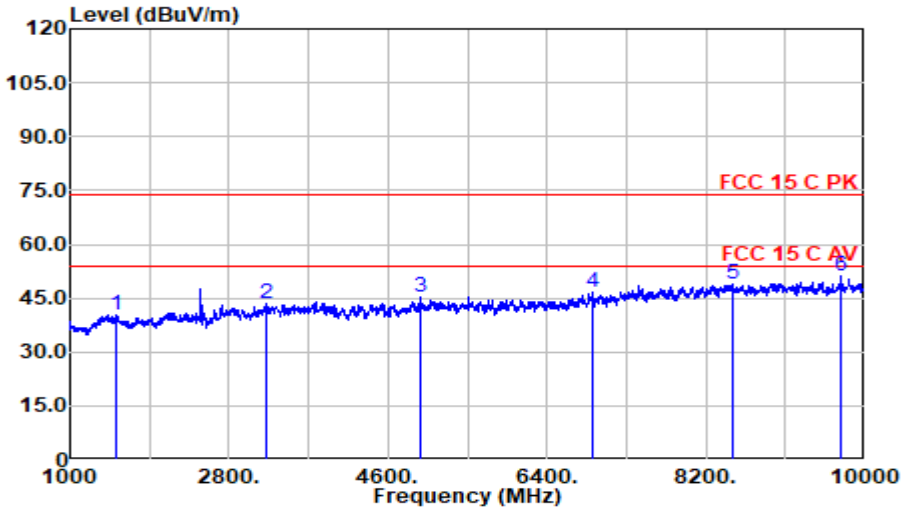


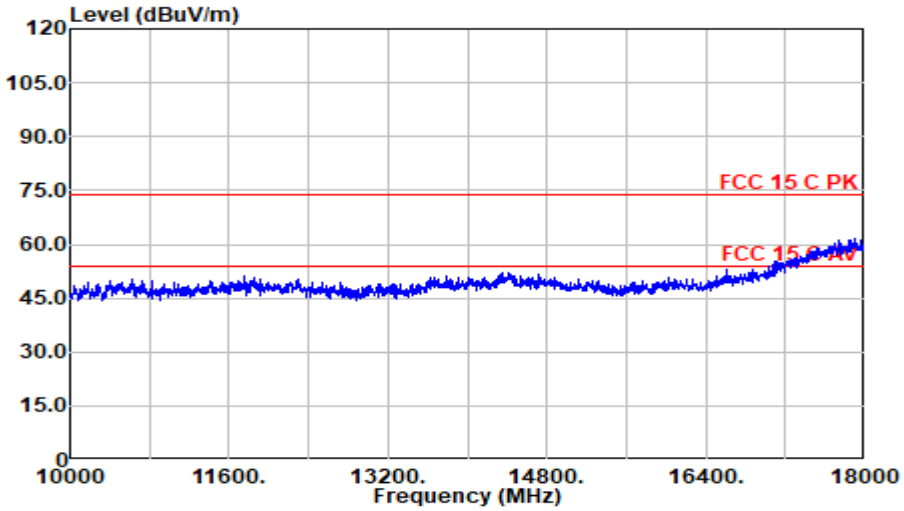


Polarization at Vertical

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
1373.500	46.72	26.05	4.19	36.50	40.46	74.00	33.54	Peak
3389.500	41.41	31.40	6.24	35.23	43.83	74.00	30.17	Peak
4879.000	38.55	33.37	7.69	34.64	44.97	74.00	29.03	Peak
6233.500	37.27	34.67	8.63	34.60	45.96	74.00	28.04	Peak
8371.000	35.99	38.10	10.43	34.82	49.70	74.00	24.30	Peak
9496.000	36.08	38.38	11.05	34.65	50.86	74.00	23.14	Peak

Mode: Zigbee CH2480MHz

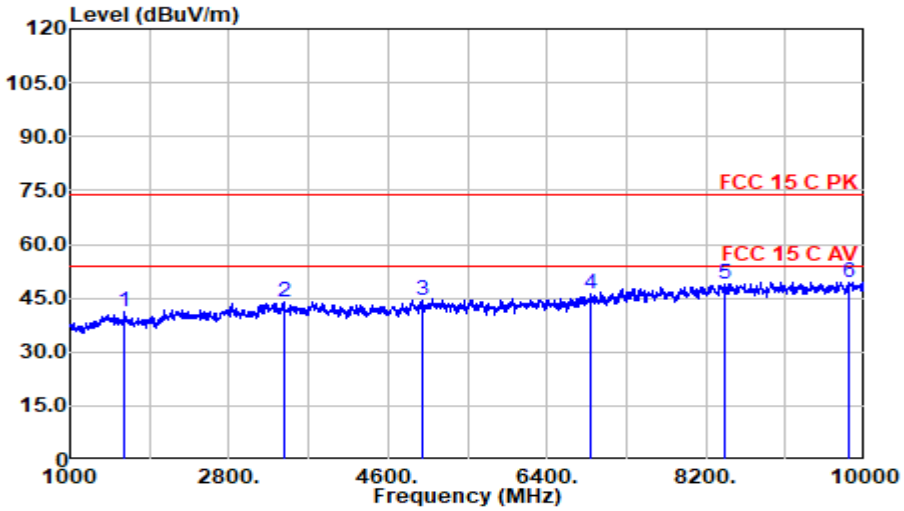


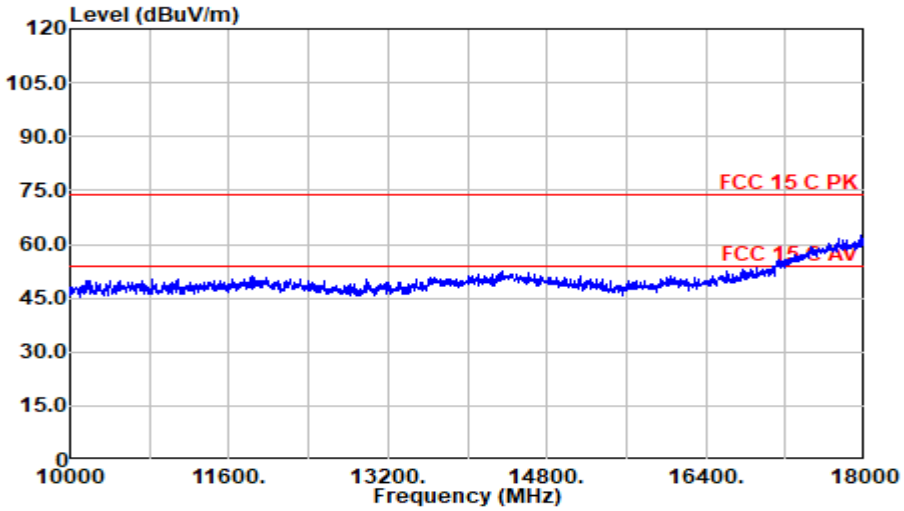


Polarization at Horizontal

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
1513.000	46.15	26.10	4.40	36.50	40.15	74.00	33.85	Peak
3227.500	41.52	31.10	6.09	35.30	43.41	74.00	30.59	Peak
4960.000	38.96	33.24	7.77	34.61	45.36	74.00	28.64	Peak
6913.000	36.33	35.53	9.18	34.60	46.43	74.00	27.57	Peak
8506.000	34.93	38.20	10.48	34.80	48.81	74.00	25.19	Peak
9730.000	36.48	38.10	11.24	34.63	51.19	74.00	22.81	Peak

Mode: Zigbee CH2480MHz





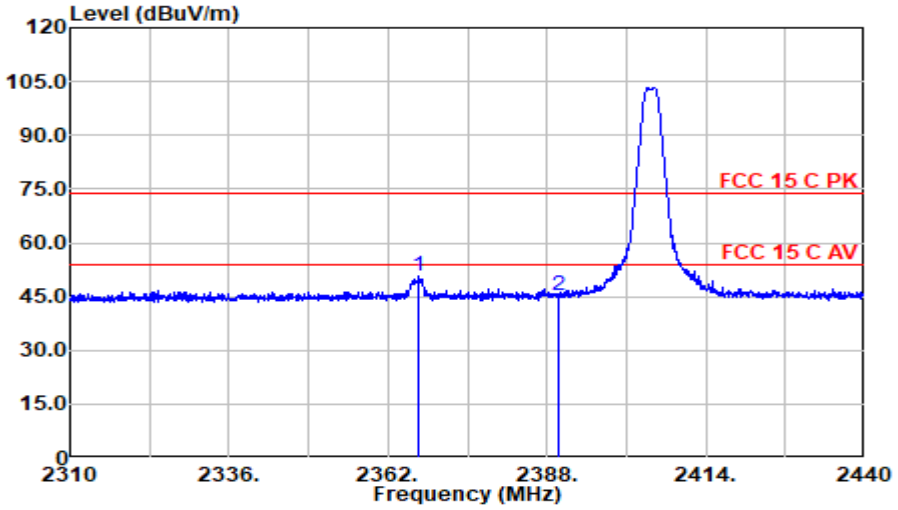
Polarization at Vertical

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
1616.500	47.26	25.97	4.55	36.50	41.28	74.00	32.72	Peak
3416.500	41.49	31.43	6.27	35.22	43.97	74.00	30.03	Peak
4987.000	37.89	33.35	7.80	34.60	44.43	74.00	29.57	Peak
6904.000	36.26	35.51	9.18	34.60	46.34	74.00	27.66	Peak
8416.000	35.30	38.13	10.45	34.81	49.07	74.00	24.93	Peak
9811.000	34.51	38.12	11.30	34.62	49.32	74.00	24.68	Peak

Band-Edge and Restricted bands:

Test Date:	2024.01.31	Temp./Hum.:	22°C/51%RH	Test By:	Jarey

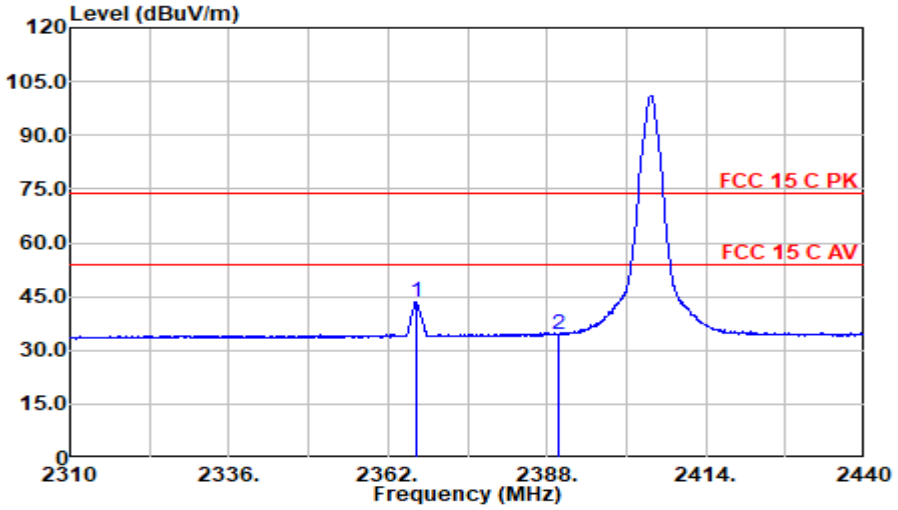
Mode: Zigbee CH2405MHz



Polarization at Horizontal

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
2367.070	52.78	28.47	5.37	36.04	50.57	74.00	23.43	Peak
2390.000	47.40	28.56	5.39	36.02	45.33	74.00	28.67	Peak

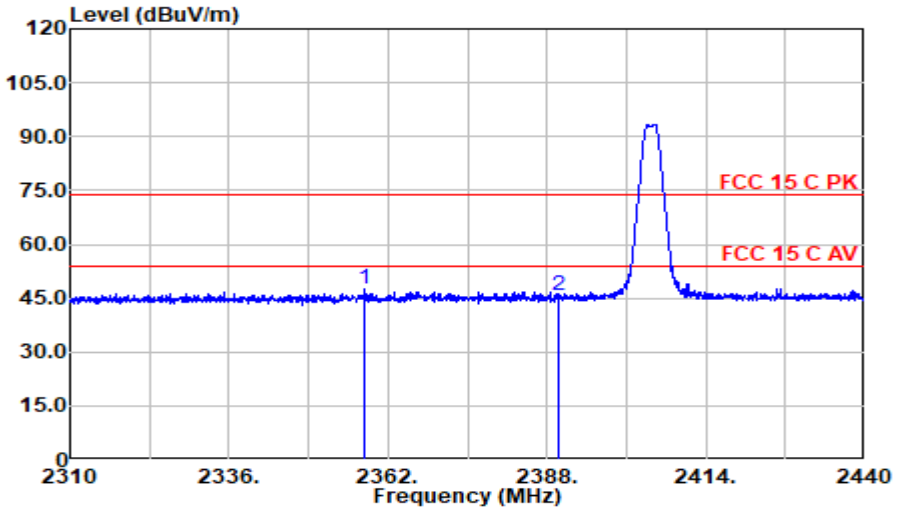
Mode: Zigbee CH2405MHz



Polarization at Horizontal

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
2366.680	45.87	28.47	5.37	36.04	43.67	54.00	10.33	Average
2390.000	36.62	28.56	5.39	36.02	34.55	54.00	19.45	Average

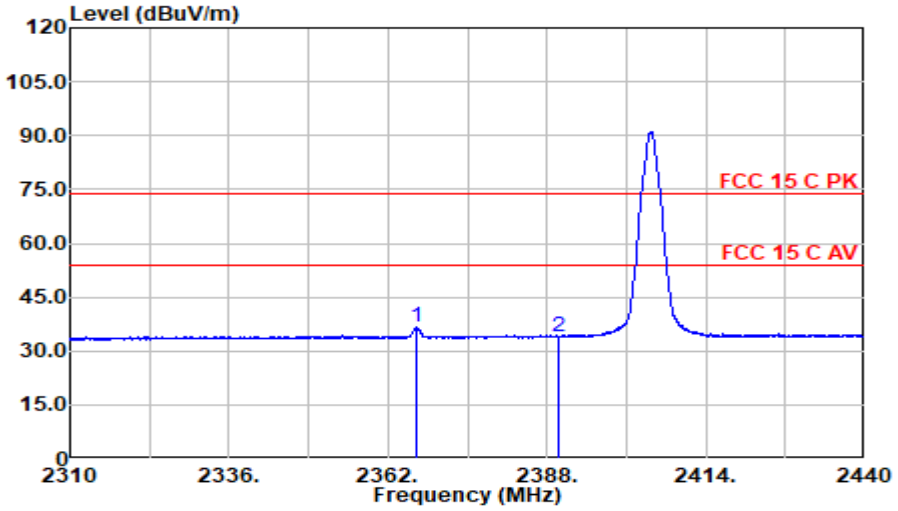
Mode: Zigbee CH2405MHz



Polarization at Vertical

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
2358.230	49.66	28.43	5.36	36.05	47.40	74.00	26.60	Peak
2390.000	47.76	28.56	5.39	36.02	45.69	74.00	28.31	Peak

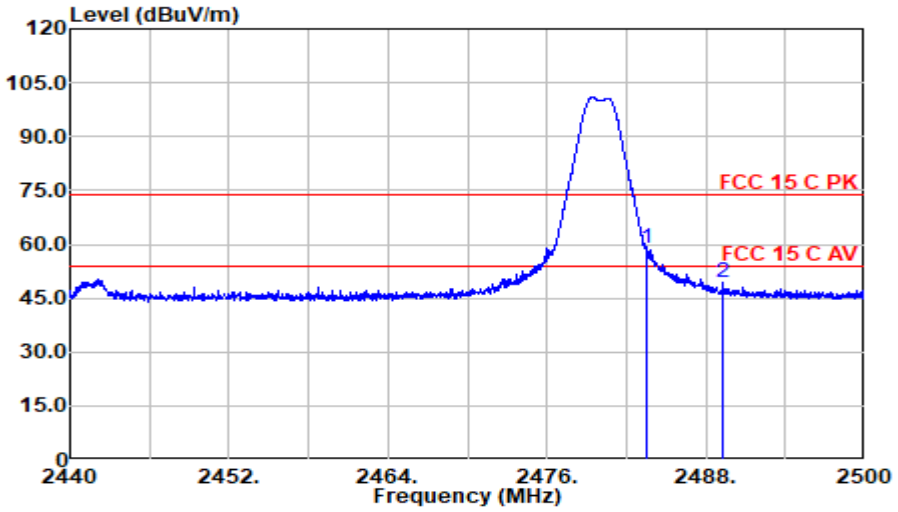
Mode: Zigbee CH2405MHz



Polarization at Vertical

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
2366.680	38.83	28.47	5.37	36.04	36.62	54.00	17.38	Average
2390.000	36.06	28.56	5.39	36.02	34.00	54.00	20.00	Average

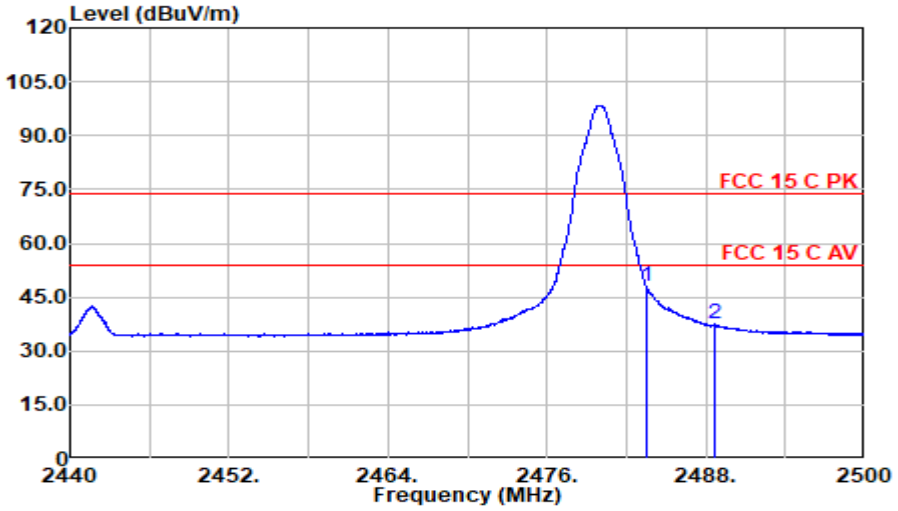
Mode: Zigbee CH2480MHz



Polarization at Horizontal

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
2483.500	60.58	28.63	5.47	35.91	58.77	74.00	15.23	Peak
2489.290	51.02	28.66	5.47	35.91	49.24	74.00	24.76	Peak

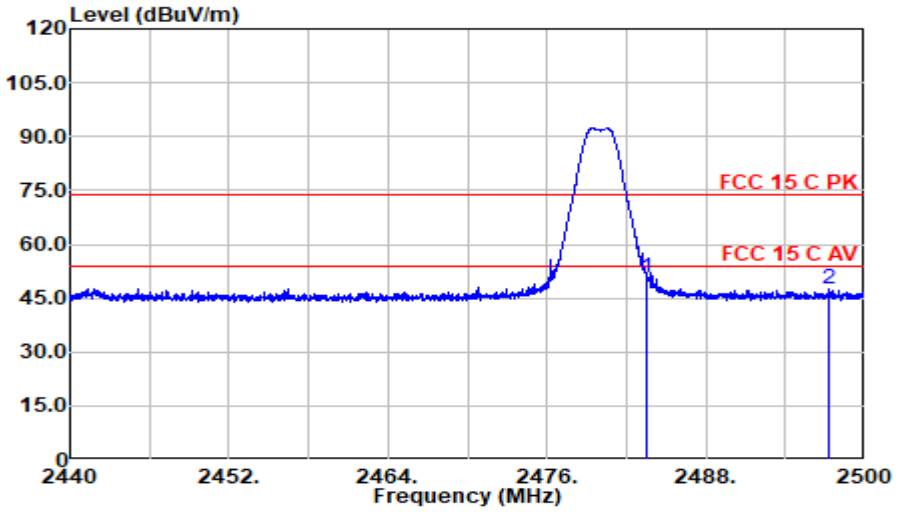
Mode: Zigbee CH2480MHz



Polarization at Horizontal

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
2483.500	49.96	28.63	5.47	35.91	48.15	54.00	5.85	Average
2488.720	39.17	28.66	5.47	35.91	37.39	54.00	16.61	Average

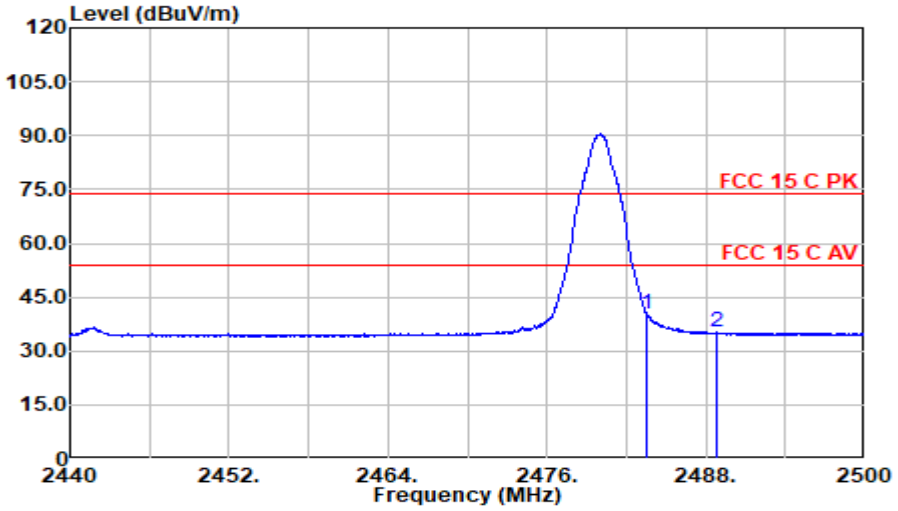
Mode: Zigbee CH2480MHz



Polarization at Vertical

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
2483.500	52.65	28.63	5.47	35.91	50.84	74.00	23.16	Peak
2497.330	49.07	28.69	5.48	35.90	47.34	74.00	26.66	Peak

Mode: Zigbee CH2480MHz



Polarization at Vertical

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
2483.500	42.22	28.63	5.47	35.91	40.41	54.00	13.59	Average
2488.810	37.02	28.66	5.47	35.91	35.24	54.00	18.76	Average

4 6 dB BANDWIDTH MEASUREMENT

4.1 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	2023.08.09	1 Year
2.	RF Cable	Mini-Circuits	FLC-3FT-SM SM+	22022838	2023.08.09	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2023.08.09	1 Year

4.2 Block Diagram of Test Setup

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

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

4.4 Operating Condition of EUT

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

4.5 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).

4.6 Test Results

PASSED.

All the test results are attached in next pages.

(Test Date: 2024.01.17 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**6dB Bandwidth (kHz)**	Limit
ZigBee	11	2405	**1642**	500 kHz
	19	2445	**1643**	500 kHz
	26	2480	**1643**	500 kHz

ZigBee

CH2405

CH2445

CH2480

5 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

5.1 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	2023.08.09	1 Year
2.	RF Cable	Mini-Circuits	FLC-3FT-SM SM+	22022838	2023.08.09	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2023.08.09	1 Year

5.2 Block Diagram of Test Setup

The Same as Section. 5.2.

5.3 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)

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 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).

5.6 Test Results

PASSED.

All the test results are listed below.

(Test Date: 2024.01.17 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**Peak Output Power (dBm)**	Limit
ZigBee	11	2405	**5.914**	30 dBm
	19	2445	**5.977**	30 dBm
	26	2480	**5.857**	30 dBm

ZigBee

CH2405

CH2445

CH2480

6 EMISSION LIMITATIONS MEASUREMENT

6.1 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	2023.08.09	1 Year
2.	RF Cable	Mini-Circuits	FLC-3FT-SM SM+	22022838	2023.08.09	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2023.08.09	1 Year

6.2 Block Diagram of Test Setup

The Same as Section. 5.2.

6.3 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)

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.

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 10th 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).

6.6 Test Results

PASSED.

The test data was attached in the next pages.

(Test Date: 2024.01.17 Temperature: 23℃ Humidity: 51 %)

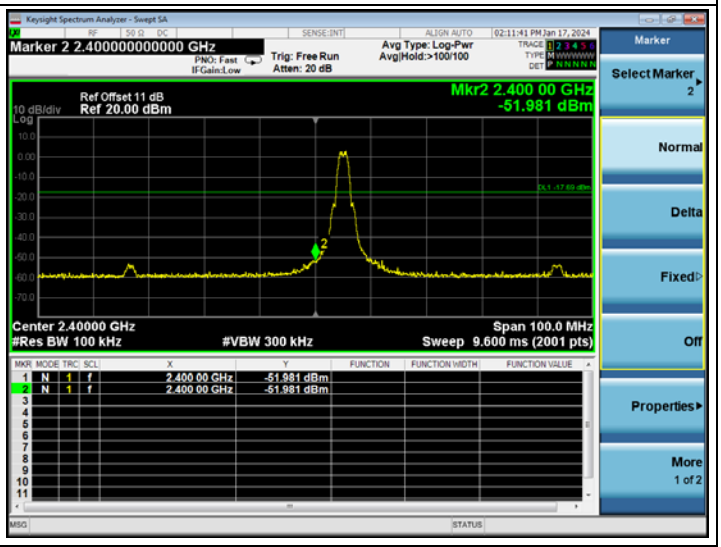
Mode	Channel	Frequency (MHz)	Data Page
ZigBee	11	2405	P35
	19	2445	P36
	26	2480	P37

ZigBee

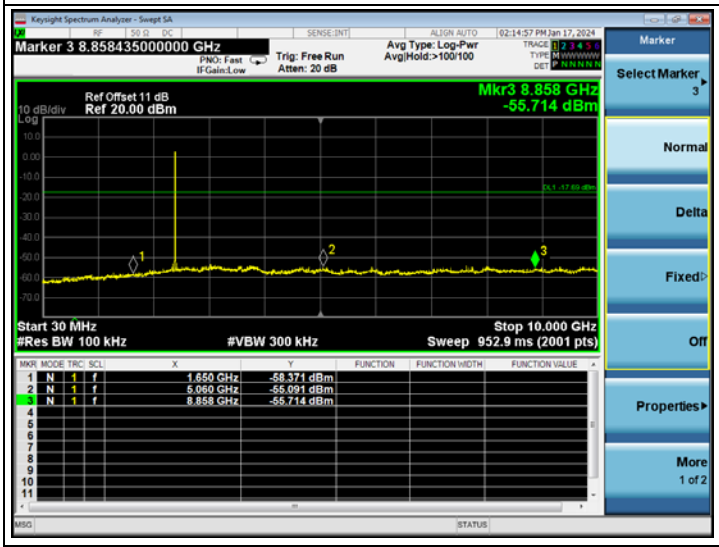
CH2405

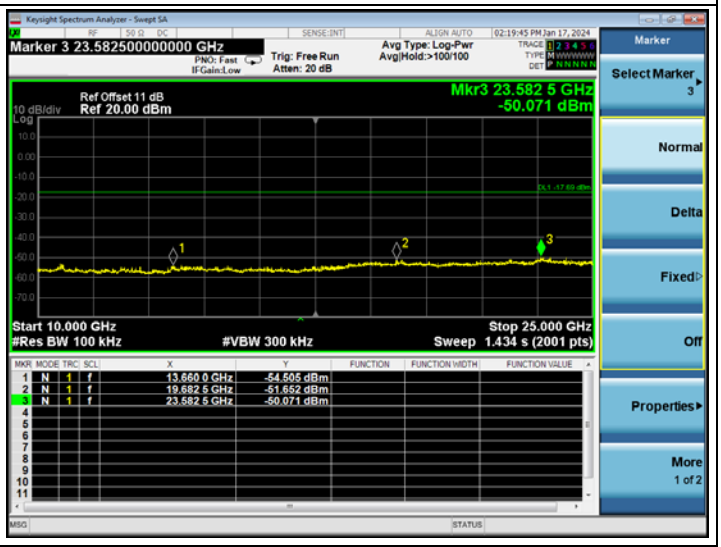
Reference Level

Lower Edge



Emission Level



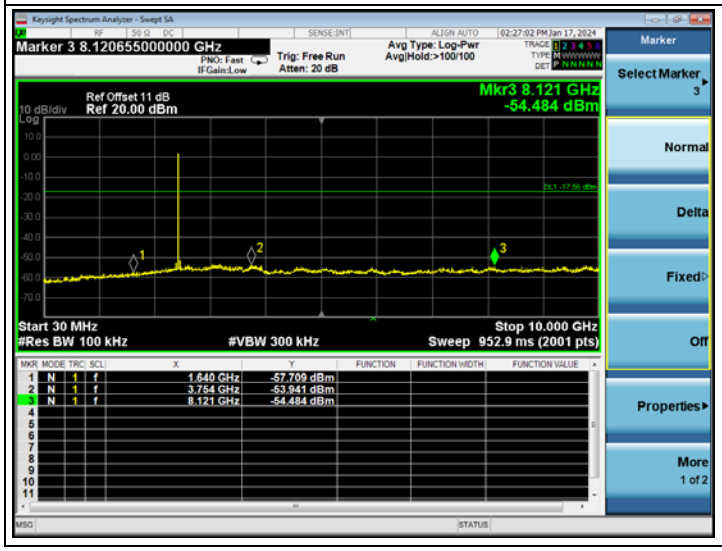


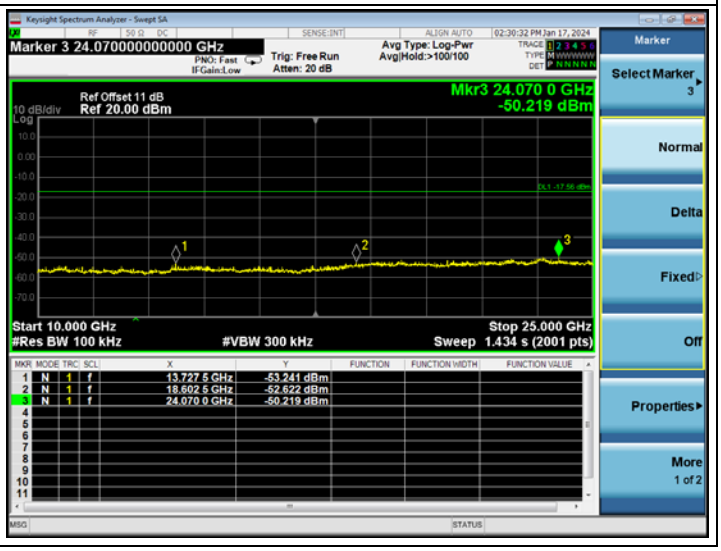
ZigBee

CH2445

Reference Level

Emission Level



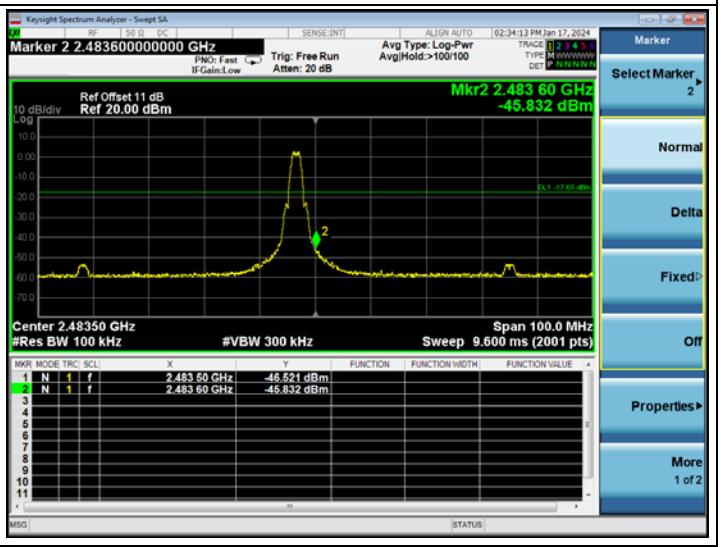


ZigBee

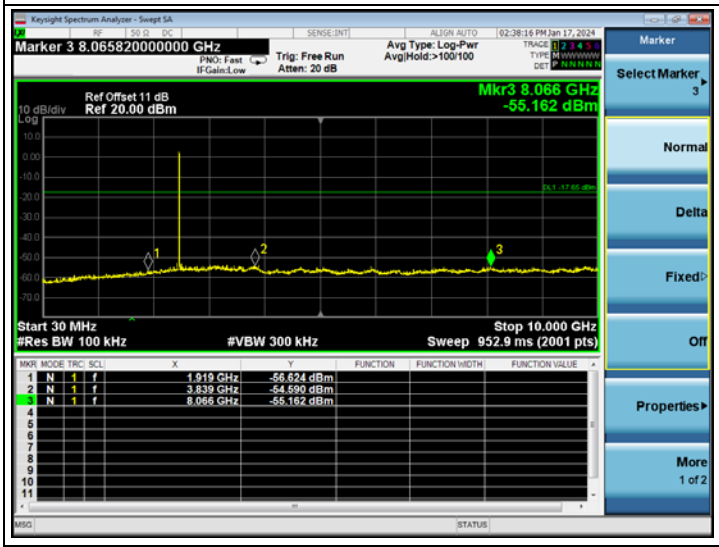
CH2480

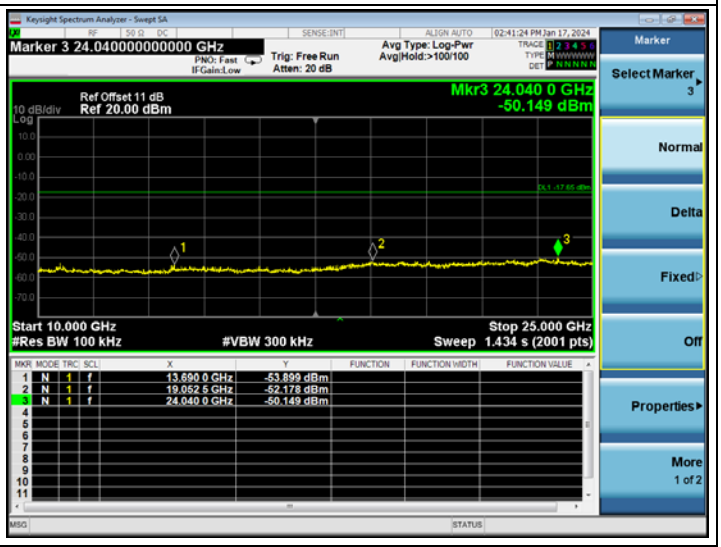
Reference Level

Higher Edge



Emission Level





7 POWER SPECTRAL DENSITY MEASUREMENT

7.1 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	2023.08.09	1 Year
2.	RF Cable	Mini-Circuits	FLC-3FT-SM SM+	22022838	2023.08.09	1 Year
3.	10 dB Attenuator	Mini-Circuits	BW-S10W2+	001	2023.08.09	1 Year

7.2 Block Diagram of Test Setup

The Same as section 5.2.

7.3 Specification Limits (§15.247(e))

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

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.

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).

7.6 Test Results

PASSED.

All the test results are attached in next pages.

(Test Date: 2024.01.17 Temperature: 23℃ Humidity: 51 %)

Mode	Channel	Frequency (MHz)	**Power Spectral Density (dBm)**	Limit
ZigBee	11	2405	**-9.182**	8 dBm
	19	2445	**-9.036**	8 dBm
	26	2480	**-9.273**	8 dBm

ZigBee

CH2405

CH2445

CH2480

8 ANTENNA REQUIREMENT

8.1 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.

8.2 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.

9 DEVIATION TO TEST SPECIFICATIONS

None.

10 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
Estimation of Uncertainty for Conduction Emission (Shielded Room-1)	9kHz~150kHz(50Ω/50μH -AMN)	3.74 dB
	150kHz~30MHz(50Ω/50μH -AMN)	3.34 dB
	150kHz~30MHz(50Ω/50μH –AMN-CAT 3)	3.46 dB
	150kHz~30MHz(50Ω/50μH –AMN-CAT 5)	3.48 dB
	150kHz~30MHz(50Ω/50μH –AMN-CAT 6)	3.60 dB
	9kHz~30MHz(VP, considering the effect of mains impedance when compared with AMN)	24.64 dB
	9kHz~30MHz(VP)	2.76 dB
	9kHz~30MHz(CP, considering the effect of AE impedance when compared with AMN)	24.64 dB
	9kHz~30MHz(CP)	2.82 dB
Estimation of Uncertainty for Conduction Emission (Shielded Room-3)	9kHz~150kHz(50Ω/50μH -AMN)	3.74 dB
	150kHz~30MHz(50Ω/50μH -AMN)	3.34 dB
Estimation of Uncertainty for Power Clamp	30MHz~300MHz (Absorbing Clamp)	3.68 dB
Estimation of Uncertainty for CDNE	30MHz~300MHz (CDNE-M210)	3.68 dB
	30MHz~300MHz (CDNE-M310)	3.68 dB
Estimation of Uncertainty for EMF	20kHz~10MHz	1.54 dB
Estimation of Uncertainty for Radiated Emission	30M~200MHz (Vertical)	4.56dB
	30M~200MHz (Horizontal)	4.44dB
	200M~1000MHz (Vertical)	5.28dB
	200M~1000MHz (Horizontal)	3.88dB
	1G~6GHz	4.34dB
	6G~18G Hz	4.40dB
	18G~40G Hz	4.04dB