TESTING LABORATORY
CERTIFICATE#4323.01

FCC PART 15.247

TEST REPORT

For

Sengled Co.,Ltd.

Room 201/15, Building 1, No. 498, Guoshoujing Road, Pilot Free Trade Zone, Shanghai, China

FCC ID: 2AGN8-BT003

Report Type:	**Product Type:**
Original Report	Sengled Bluetooth module

Project Engineer:	Miller Xie
Report Number:	RSHD210330001-00A
Report Date:	2021-04-07
Reviewed By:	Oscar Ye EMC Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road,Kunshan,Jiangsu province,China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Sengled Co.,Ltd.
Tested Model:	BT003
Product Type:	Sengled Bluetooth module
Power Supply:	DC 3.3V
RF Function:	BLE (1Mbps)
Operating Band/Frequency:	2402-2480MHz
Channel Number:	40
Channel Separation:	2 MHz
Modulation Type	GFSK
Antenna Type:	PCB Antenna
*Maximum Antenna Gain:	1.0 dBi
Maximum Output Power:	9.55 dBm

Note: The maximum antenna gain is provided by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: RSHD210330001-1(Assigned by BACL, Kunshan.) The EUT was received on 2021-03-30.*

Objective

This report is prepared on behalf of *Sengled Co.,Ltd.*in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communications Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No related submittal/grant.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emissions	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel List for BLE mode:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	…	…
…	…	…	…
…	…	…	…
18	2438	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

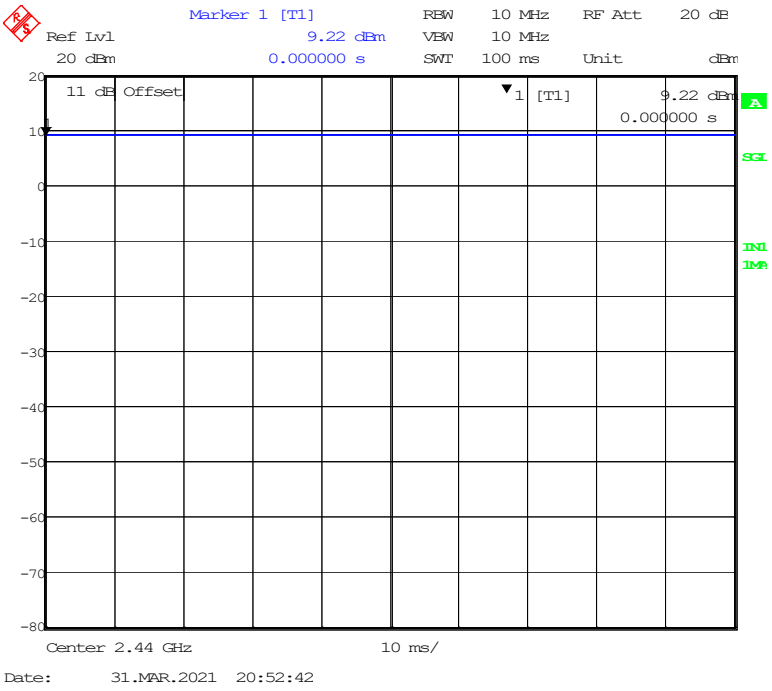
RF test software: EMI_Tool

*Power Level Setting: 10

Note: The power level setting was declared by the applicant.

Duty Cycle:

BLE (1Mbps): Middle Channel



Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	10log(1/x)
BLE (1Mbps)	100	/	/	0

Note: "x" means the Duty Cycle.

Support Equipment List and Details

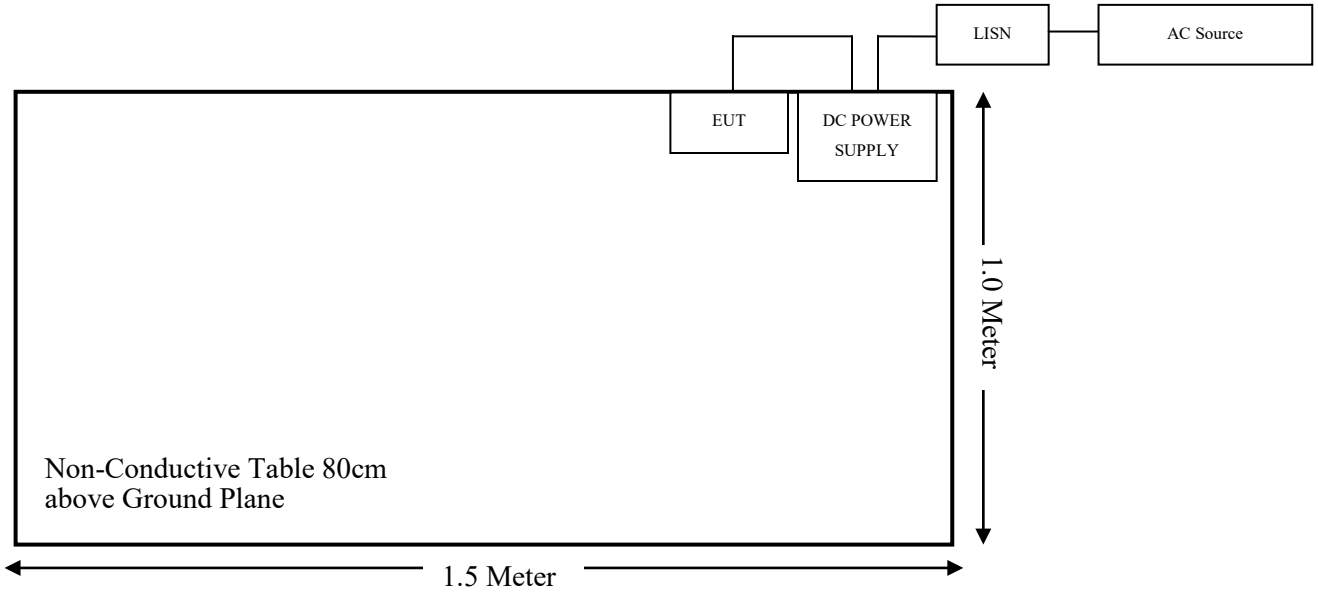
Manufacturer	Description	Model	Serial Number
ZHAOXIN	DC POWER SUPPLY	RXN-605D	18R605D060264

External I/O Cable

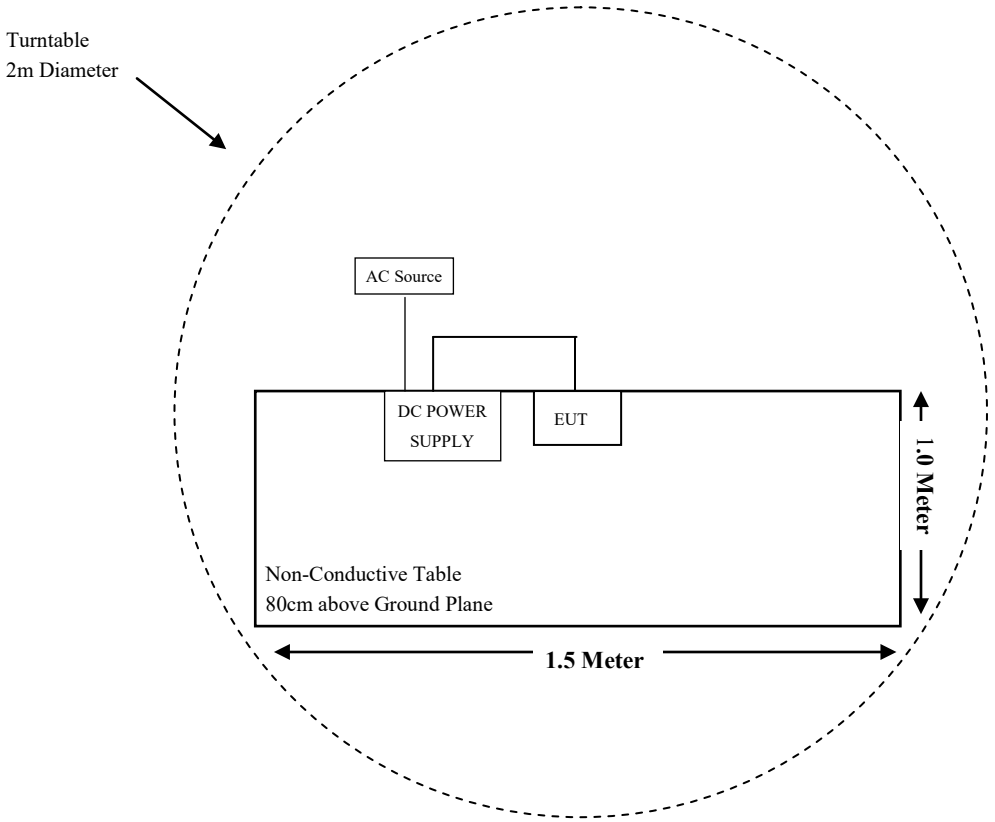
Cable Description	Length (m)	From	To
Power Cable 1	0.8	EUT	DC POWER SUPPLY
Power Cable 2	2.0	DC POWER SUPPLY	LISN/AC Source

Block Diagram of Test Setup

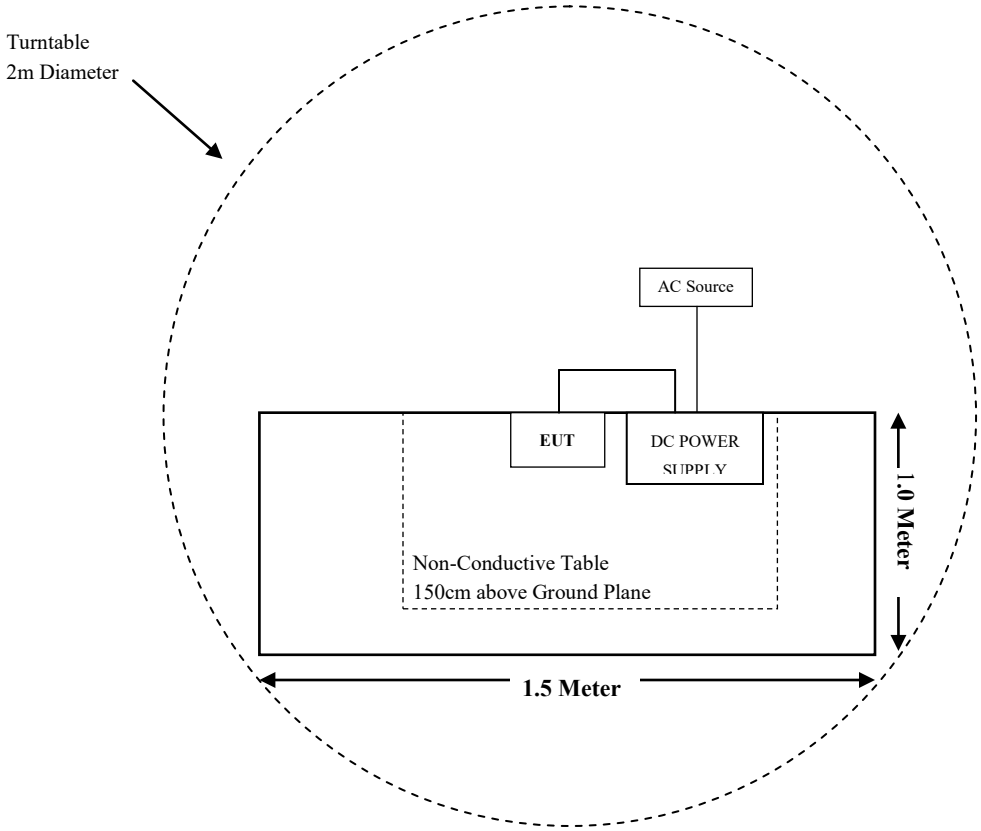
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2020-11-27	2021-11-26
Sunol Sciences	Hybrid Antenna	JB3	A090314-1	2020-08-05	2023-08-04
Sonoma Instrument	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
Radiated Emission Test（Chamber 2#）					
Rohde & Schwarz	EMI Receiver	ESU40	100207	2021-03-16	2022-03-15
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2020-07-15	2023-07-14
ETS-LINDGREN	Horn Antenna	3116	00084159	2020-01-17	2023-01-16
A.H.Systems, inc	Amplifier	PAM-0118P	512	2020-08-14	2021-08-13
SELECTOR	Amplifier	EM18G40G	060726	2020-08-22	2021-08-21
MICRO-TRONICS	Band Reject Filter	BRM50702	G024	2020-08-05	2021-08-04
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-6	006	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2020-08-15	2021-08-14
RF Conducted Test					
Rohde & Schwarz	EMI Test Receiver	ESIB26	100146	2020-12-14	2021-12-13
Narda	Attenuator	10dB	010	2020-08-15	2021-08-14
Sengled Co., Ltd.	RF Cable	Sengled Co., Ltd. C01	N/A	Each Time	N/A
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	1316.3003K03-101746-zn	2020-07-28	2021-07-27
Rohde & Schwarz	LISN	ENV216	101115	2020-11-27	2021-11-26
Audix	Test Software	e3	V9	N/A	N/A
Rohde & Schwarz	Pulse limiter	ESH3-Z2	0357.8810.54	2020-08-10	2021-08-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2020-08-15	2021-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE(1Mbps)	2402~2480	1.00	1.26	10.00	10.00	20	0.0025	1.0

Note: The tune-up Conducted Power was declared by the manufacturer.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has a PCB antenna for BLE and the antenna gain is 1.0 dBi, the antenna permanently attached to the EUT, fulfill the requirement of this section. Please refer to the EUT photos.

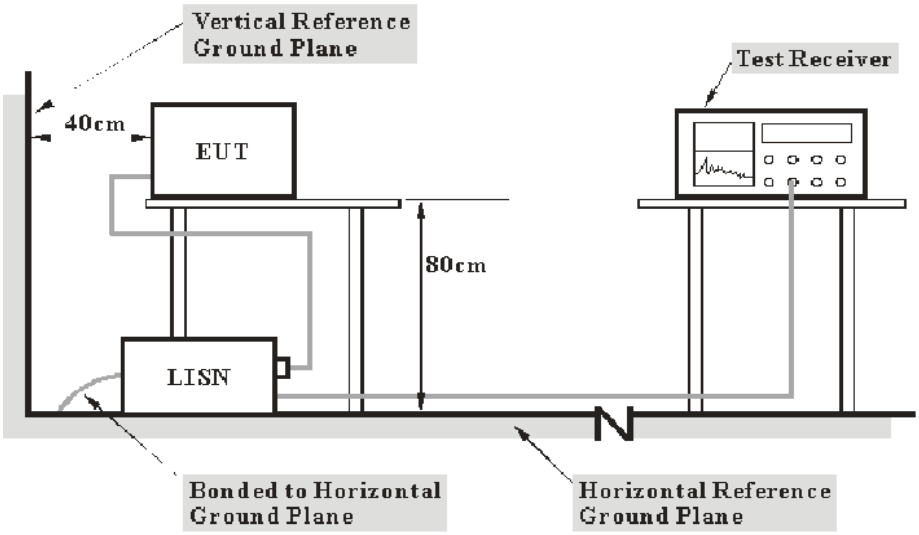
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



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

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

ANSI C63.10-2013 clause 6.2

During the conducted emission test, the DC source was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

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

Corrected Factor & Over Limit Calculation

The Corrected Factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of 7 dB means the emission is 7 dB above the limit. The equation for over limit calculation is as follows:

Over Limit (dB) = Read level (dBµV) + Factor (dB) - Limit (dBµV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

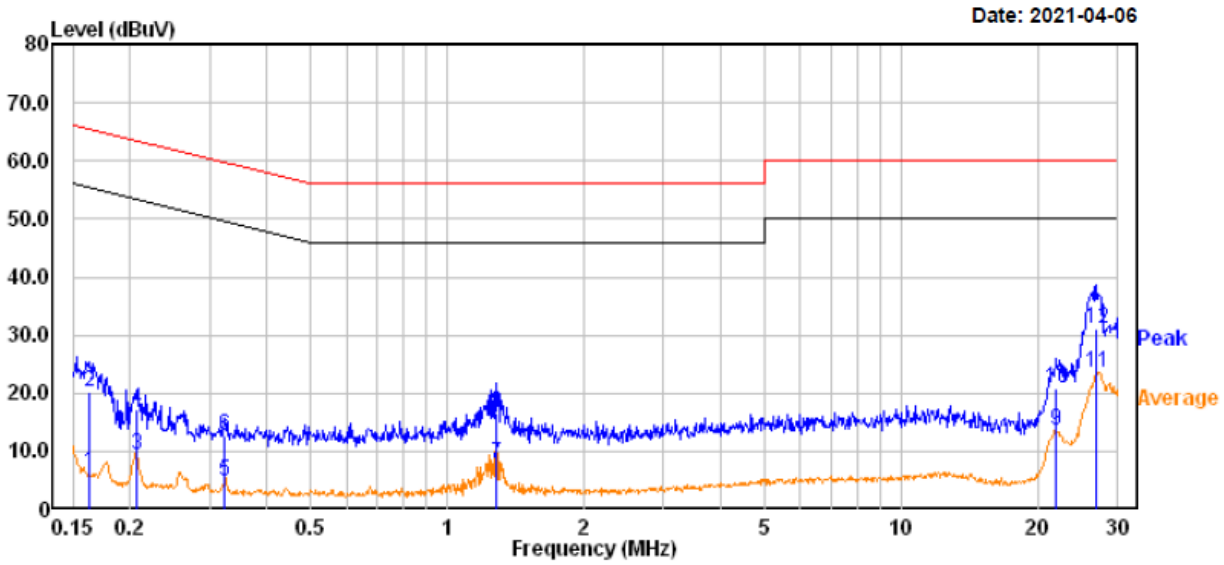
Temperature:	24.2 ℃
Relative Humidity:	51 %
ATM Pressure:	101.7 kPa

The testing was performed by Miller Xie on 2021-04-06.

EUT operation mode: Transmitting in middle channel (worst case)

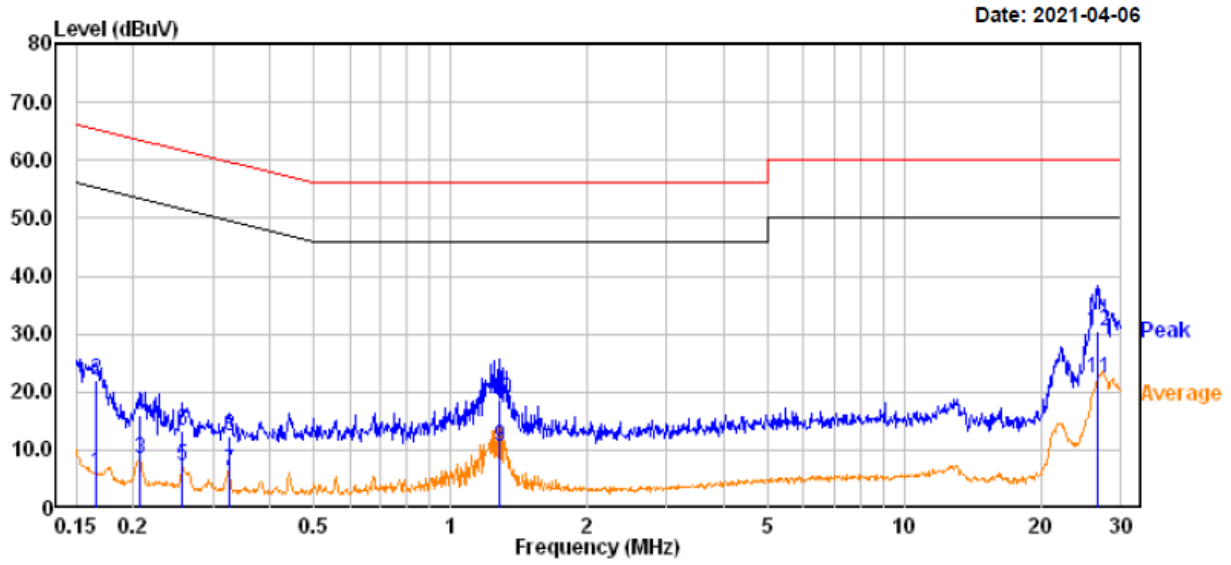
BLE (1Mbps)

AC 120V/60 Hz, Line



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.163	-13.64	19.83	6.19	55.30	-49.11	Average
2	0.163	0.53	19.83	20.36	65.30	-44.94	QP
3	0.206	-10.32	19.82	9.50	53.35	-43.85	Average
4	0.206	-2.74	19.82	17.08	63.35	-46.27	QP
5	0.322	-15.11	19.82	4.71	49.67	-44.96	Average
6	0.322	-7.03	19.82	12.79	59.67	-46.88	QP
7	1.279	-12.03	19.82	7.79	46.00	-38.21	Average
8	1.279	-3.10	19.82	16.72	56.00	-39.28	QP
9	22.025	-6.34	19.85	13.51	50.00	-36.49	Average
10	22.025	1.10	19.85	20.95	60.00	-39.05	QP
11	26.884	3.90	19.73	23.63	50.00	-26.37	Average
12	26.884	11.50	19.73	31.23	60.00	-28.77	QP

AC 120V/60 Hz, Neutral



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.166	-13.80	19.83	6.03	55.17	-49.14	Average
2	0.166	2.13	19.83	21.96	65.17	-43.21	QP
3	0.206	-11.31	19.82	8.51	53.35	-44.84	Average
4	0.206	-3.82	19.82	16.00	63.35	-47.35	QP
5	0.257	-12.72	19.82	7.10	51.53	-44.43	Average
6	0.257	-6.46	19.82	13.36	61.53	-48.17	QP
7	0.325	-13.55	19.82	6.27	49.58	-43.31	Average
8	0.325	-7.35	19.82	12.47	59.58	-47.11	QP
9	1.279	-9.14	19.82	10.68	46.00	-35.32	Average
10	1.279	-1.07	19.82	18.75	56.00	-37.25	QP
11	26.751	2.60	19.72	22.32	50.00	-27.68	Average
12	26.751	10.70	19.72	30.42	60.00	-29.58	QP

Note:

1) Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
2) Over Limit (dB) = Read level (dBµV) + Factor (dB) - Limit (dBµV)

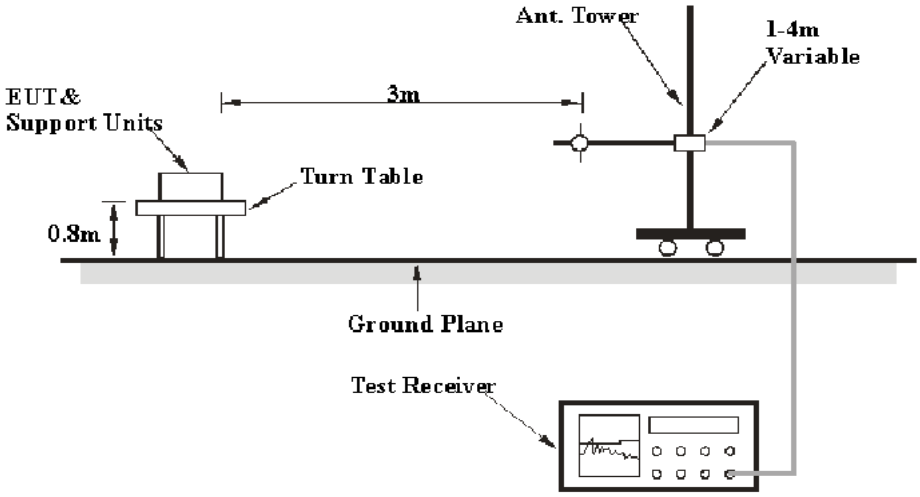
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

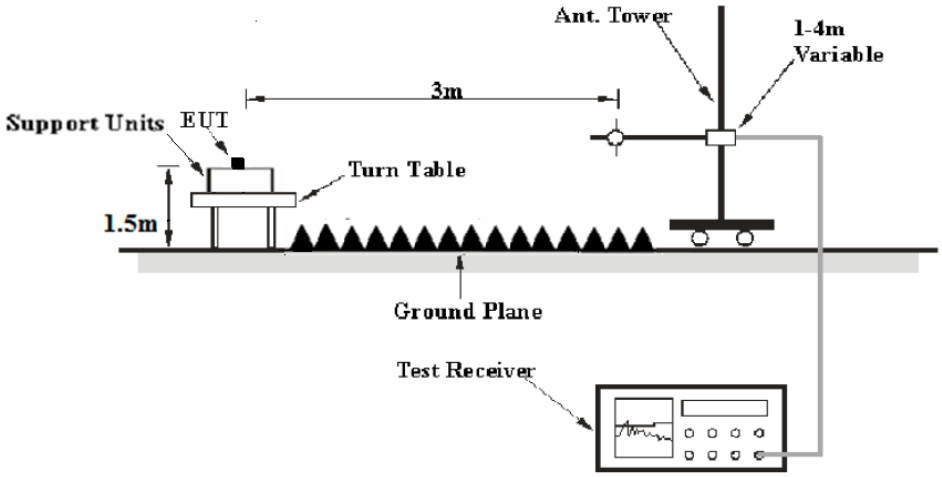
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	120 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Peak
	1MHz	3 MHz	1MHz	AVG

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dBμV/m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

Temperature:	24.1-24.5 ℃
Relative Humidity:	50-52 %
ATM Pressure:	101.6-102.3 kPa

The testing was performed by Miller Xie from 2021-03-21 to 2021-04-02.

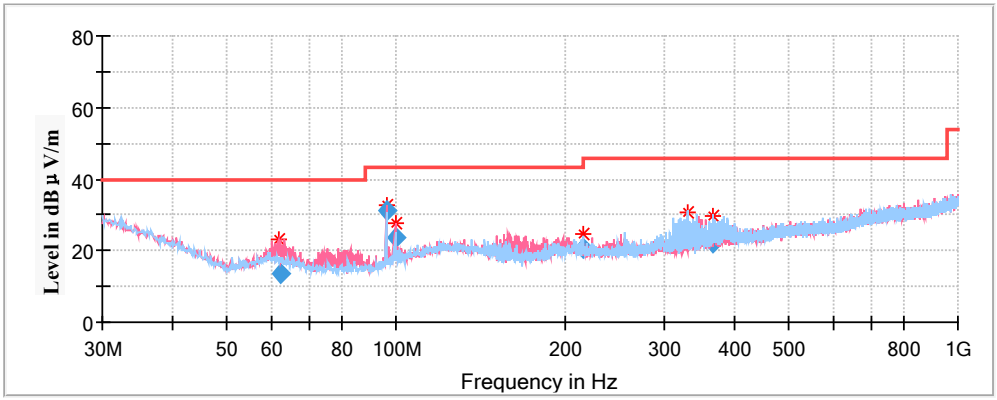
Test Result: Compliant.

EUT operation mode: Transmitting

BLE(1Mbps):

Spurious Emission Test:

30MHz-1GHz:
(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case ***midddle channel of operation in the Y axis of orientation*** *was recorded)*



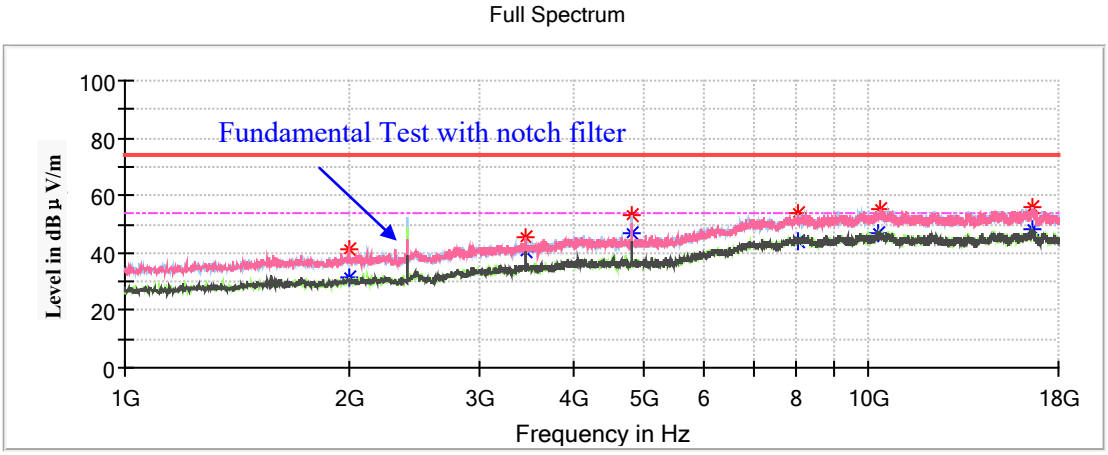
Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	Quasi-peak (dBµV/m)	Height (cm)	Polar (H/V)				
62.163650	13.68	200.0	V	163.0	-15.0	40.00	26.32
95.999000	31.21	100.0	V	0.0	-15.5	43.50	12.29
99.643400	23.83	100.0	V	287.0	-14.6	43.50	19.67
216.007700	20.58	100.0	H	28.0	-12.0	46.00	25.42
330.252250	25.52	100.0	H	259.0	-10.0	46.00	20.48
365.807450	21.94	100.0	H	40.0	-9.0	46.00	24.06

1GHz-18GHz:

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded)*

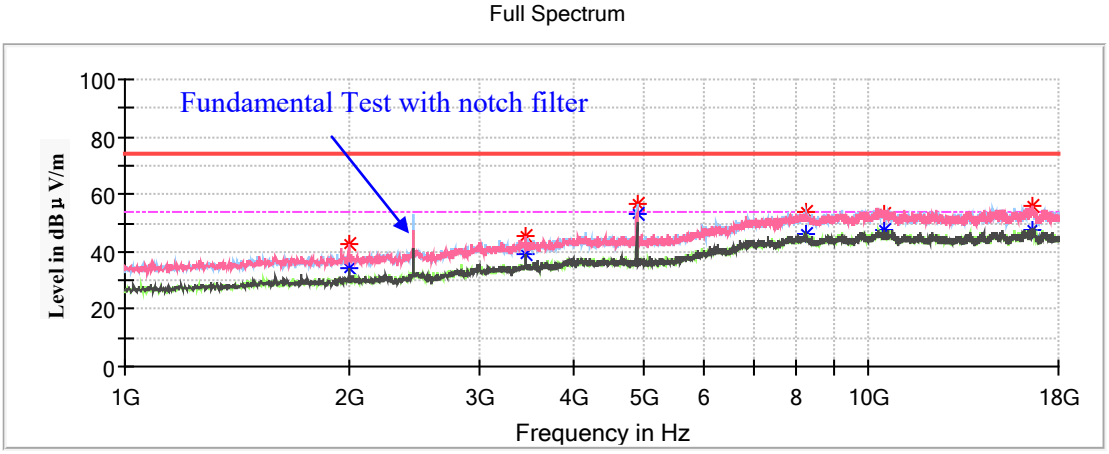
Note:
1. This test was performed with the 2.4-2.5GHz notch filter.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Low Channel: 2402MHz



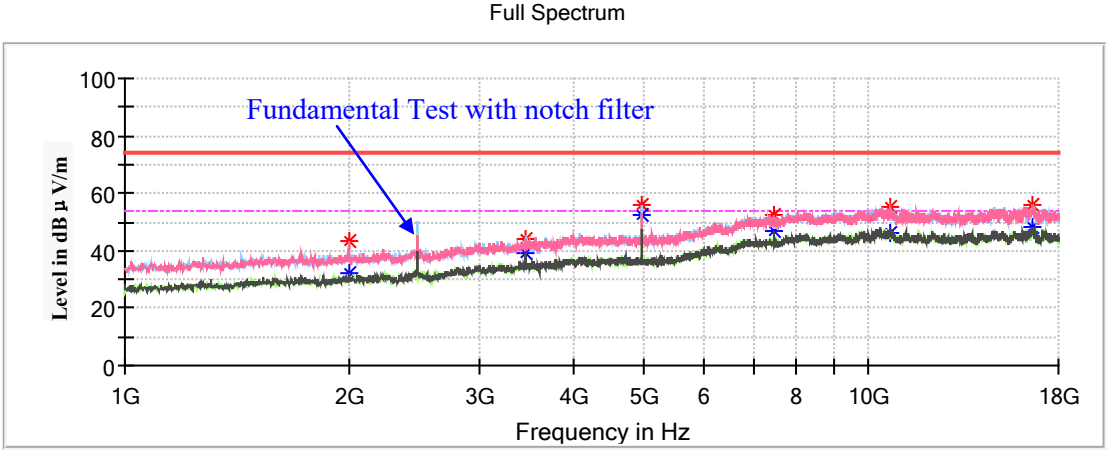
Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
1999.600000	41.61	---	150.0	V	34.0	-7.7	74.00	32.39
1999.600000	---	31.12	150.0	V	34.0	-7.7	54.00	22.88
3454.800000	---	40.24	200.0	V	304.0	-1.9	54.00	13.76
3454.800000	45.48	---	200.0	V	304.0	-1.9	74.00	28.52
4804.000000	52.83	---	200.0	H	324.0	1.0	74.00	21.17
4804.000000	---	46.72	200.0	H	324.0	1.0	54.00	7.28
8041.400000	---	44.12	150.0	H	357.0	10.8	54.00	9.88
8041.400000	53.53	---	150.0	H	357.0	10.8	74.00	20.47
10336.400000	---	46.86	200.0	V	68.0	12.6	54.00	7.14
10336.400000	55.10	---	200.0	V	68.0	12.6	74.00	18.90
16606.000000	55.66	---	150.0	H	330.0	11.9	74.00	18.34
16606.000000	---	48.55	150.0	H	330.0	11.9	54.00	5.45

Middle Channel: 2440MHz



Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)				
1997.900000	42.73	---	150.0	V	224.0	-7.7	74.00	31.27
1999.600000	---	33.98	150.0	V	224.0	-7.7	54.00	20.02
3454.800000	---	39.40	150.0	V	309.0	-1.9	54.00	14.60
3454.800000	45.19	---	150.0	V	309.0	-1.9	74.00	28.81
4880.000000	---	53.05	150.0	H	73.0	1.1	54.00	0.95
4880.000000	56.31	---	150.0	H	73.0	1.1	74.00	17.69
8264.100000	---	45.89	150.0	V	234.0	10.8	54.00	8.11
8264.100000	53.82	---	150.0	V	234.0	10.8	74.00	20.18
10474.100000	---	47.69	200.0	V	131.0	12.9	54.00	6.31
10474.100000	53.19	---	200.0	V	131.0	12.9	74.00	20.81
16595.800000	---	47.90	200.0	H	168.0	11.9	54.00	6.10
16595.800000	55.78	---	200.0	H	168.0	11.9	74.00	18.22

High Channel: 2480MHz

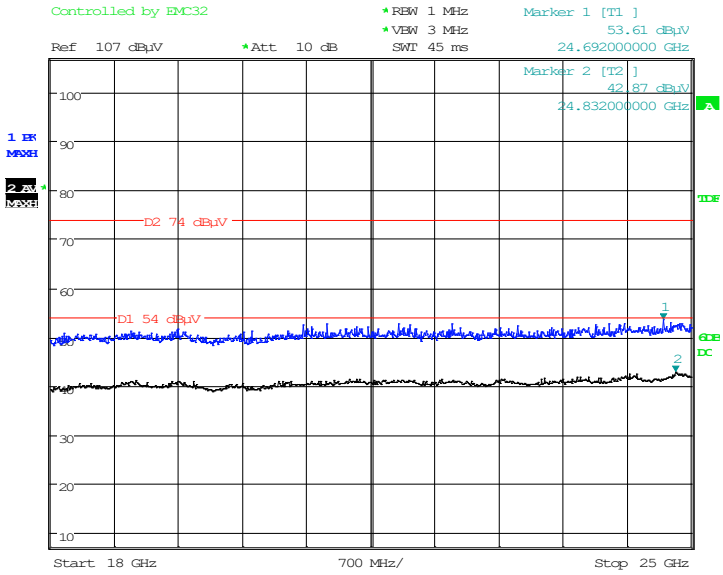


Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
	MaxPeak (dBµV/m)	Average (dBµV/m)	Height (cm)	Polar (H/V)				
1999.600000	43.69	---	200.0	V	318.0	-7.7	74.00	30.31
1999.600000	---	31.83	200.0	V	318.0	-7.7	54.00	22.17
3454.800000	---	39.16	150.0	V	302.0	-1.9	54.00	14.84
3454.800000	43.93	---	150.0	V	302.0	-1.9	74.00	30.07
4960.000000	---	52.43	150.0	H	67.0	1.1	54.00	1.57
4960.000000	55.90	---	150.0	H	67.0	1.1	74.00	18.10
7440.000000	---	47.05	200.0	V	277.0	9.2	54.00	6.95
7440.000000	52.41	---	200.0	V	277.0	9.2	74.00	21.59
10722.300000	55.05	---	150.0	V	96.0	12.3	74.00	18.95
10722.300000	---	45.95	150.0	V	96.0	12.3	54.00	8.05
16617.900000	---	48.27	150.0	V	157.0	11.9	54.00	5.73
16617.900000	55.93	---	150.0	V	157.0	11.9	74.00	18.07

18GHz-25GHz:

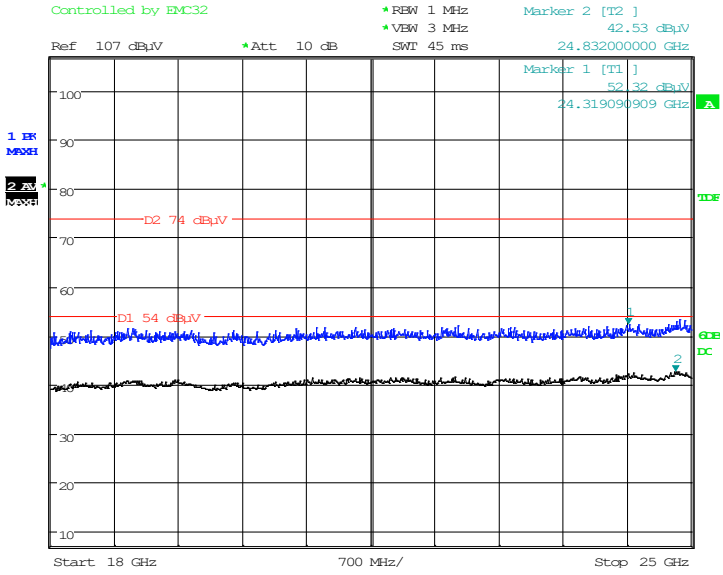
*(Pre-scan with low, middle and high channels of operation in the X,Y and Z axes of orientation, the worst case **middle channel of operation in Y-axis of orientation** was recorded)*

Horizontal



Date: 2.APR.2021 17:15:58

Vertical



Date: 2.APR.2021 17:17:33

Restricted Bands Emissions Test:

*(Pre-scan in the X,Y and Z axes of orientation, the worst case **Y-axis of orientation** was recorded.)*

Note:
1. The test is performed with a 10dB Attenuator.
2. Corrected Factor (dB/m) = Antenna factor (RX) (dB/m) + Cable Loss (dB) – Amplifier Factor (dB)
   Corrected Amplitude (dBμV/m) = Corrected Factor (dB/m) + Reading (dBμV)
   Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

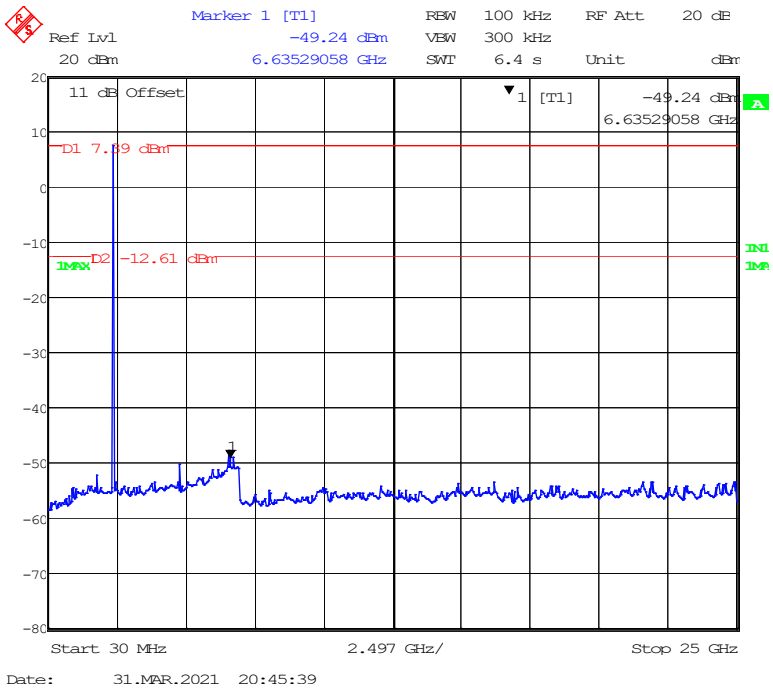
BLE (1Mbps)

Frequency (MHz)	Corrected Amplitude		Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	MaxPeak (dBμV/m)	Average (dBμV/m)	Height (cm)	Polar (H/V)				
Low Channel: 2402MHz								
2390.00	---	45.80	200.0	V	279.0	3.8	54.00	8.20
2390.00	52.28	---	200.0	V	279.0	3.8	74.00	21.72
High Channel: 2480MHz								
2483.50	---	46.35	150.0	V	0.0	4.1	54.00	7.65
2483.50	52.56	---	150.0	V	0.0	4.1	74.00	21.44

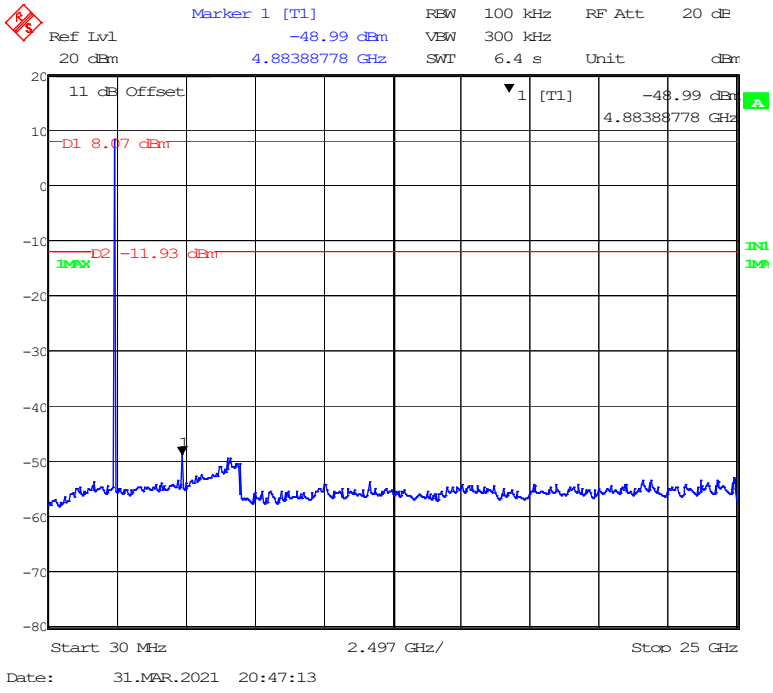
Conducted Spurious Emissions at Antenna Port:

BLE (1Mbps)

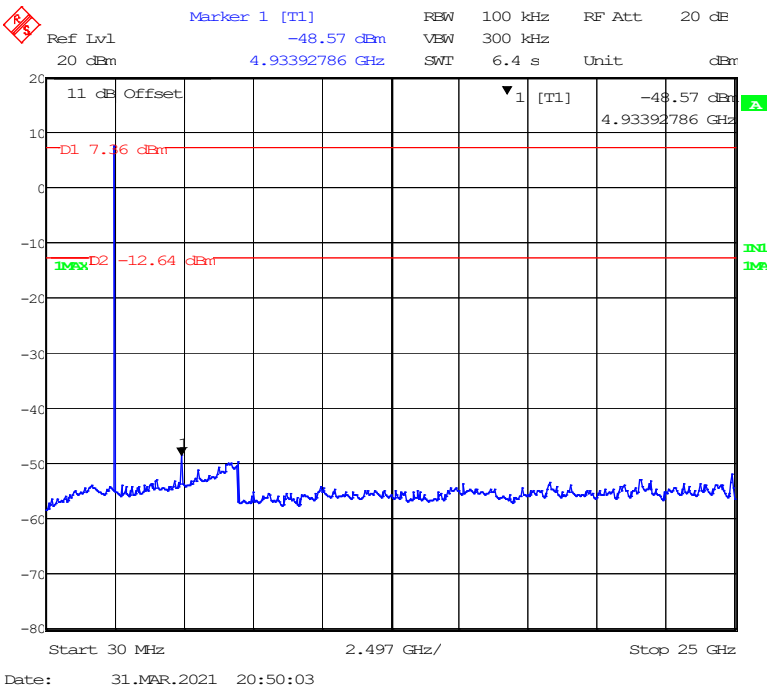
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

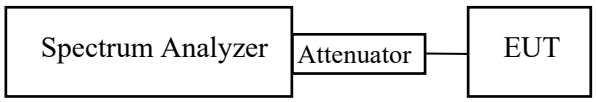
Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 * RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	52 %
ATM Pressure:	101.6 kPa

The testing was performed by Miller Xie on 2021-03-31.

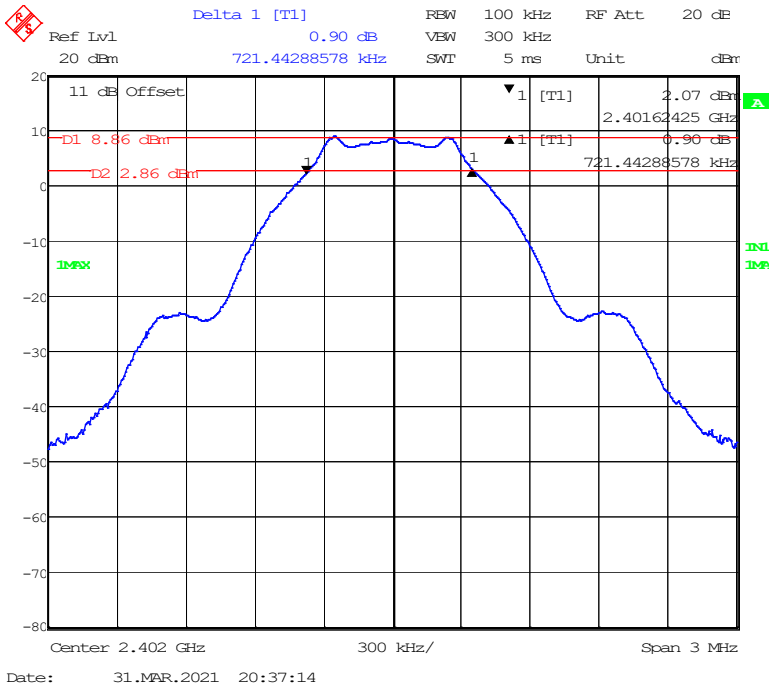
Test Result: Compliant.

EUT operation mode: Transmitting

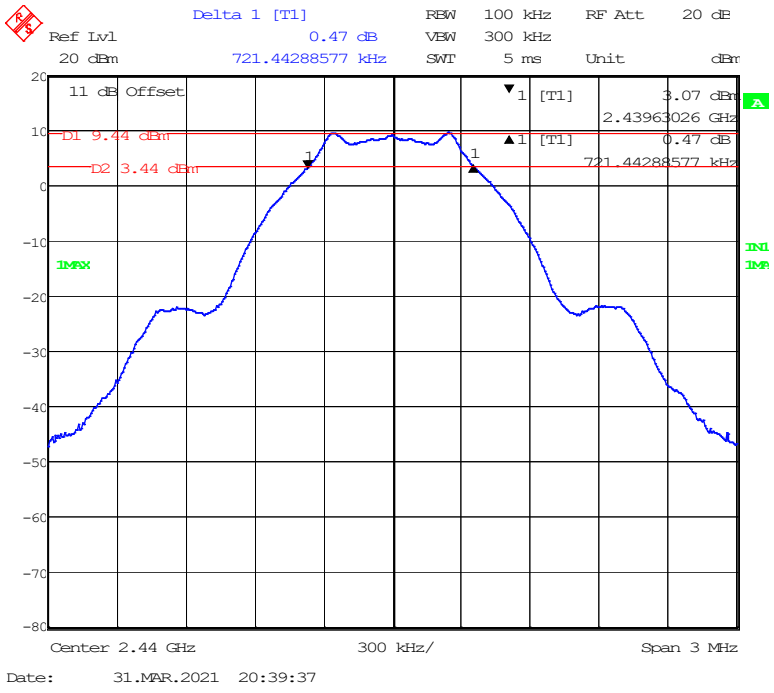
BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (MHz)
Low	2402	0.721	≥0.5
Middle	2440	0.721	≥0.5
High	2480	0.721	≥0.5

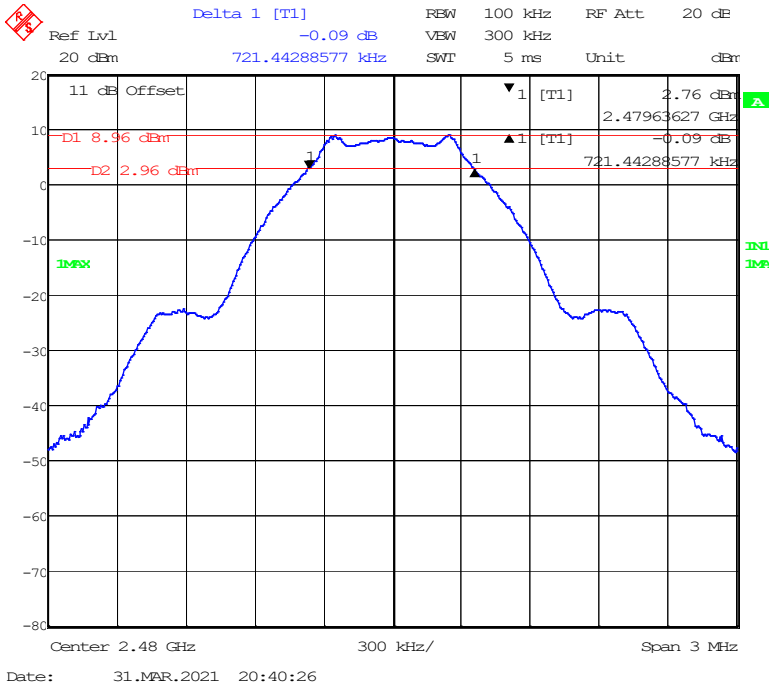
Low Channel



Middle Channel



High Channel



FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

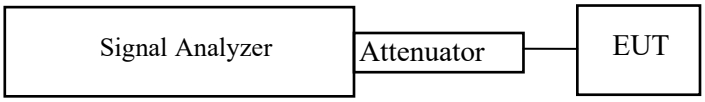
Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.9.1.1

1. Set the RBW ≥ DTS bandwidth.
2. Set VBW ≥ 3 * RBW.
3. Set span ≥ 3 * RBW
4. Sweep time = auto couple.
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use peak marker function to determine the peak amplitude level.



Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	50 %
ATM Pressure:	102.3 kPa

The testing was performed by Miller Xie on 2021-03-31.

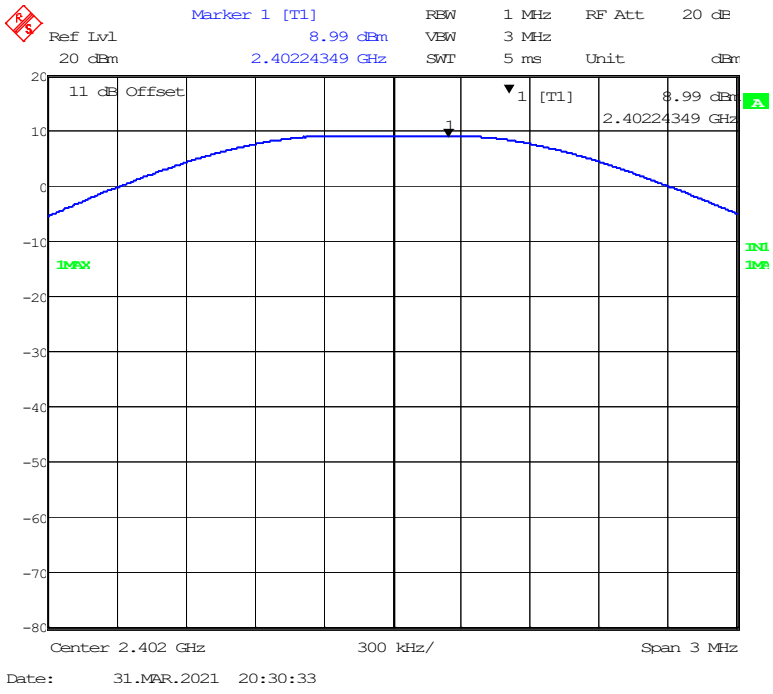
Test Result: Compliant.

EUT operation mode: Transmitting

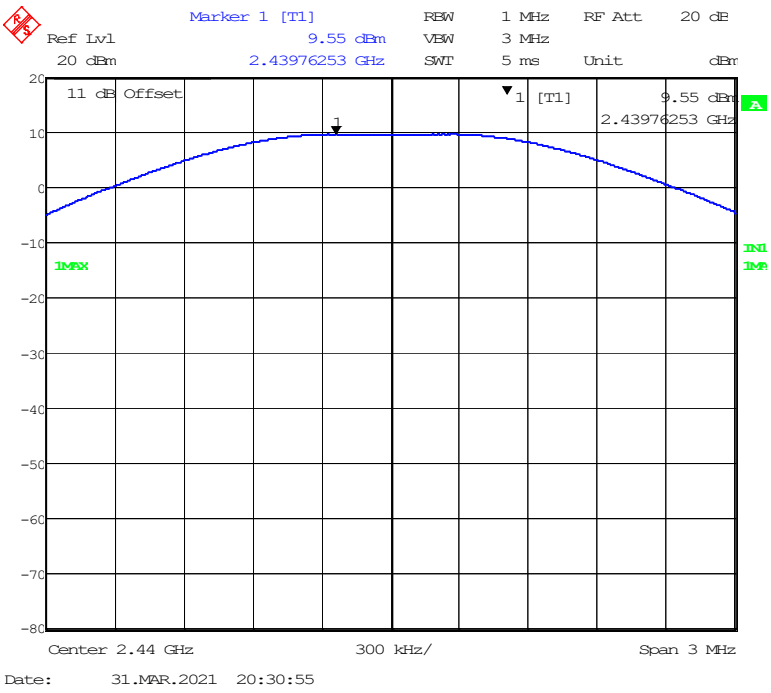
BLE (1Mbps)

Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)	Result
Low	2402	8.99	30	Pass
Middle	2440	9.55	30	Pass
High	2480	9.04	30	Pass

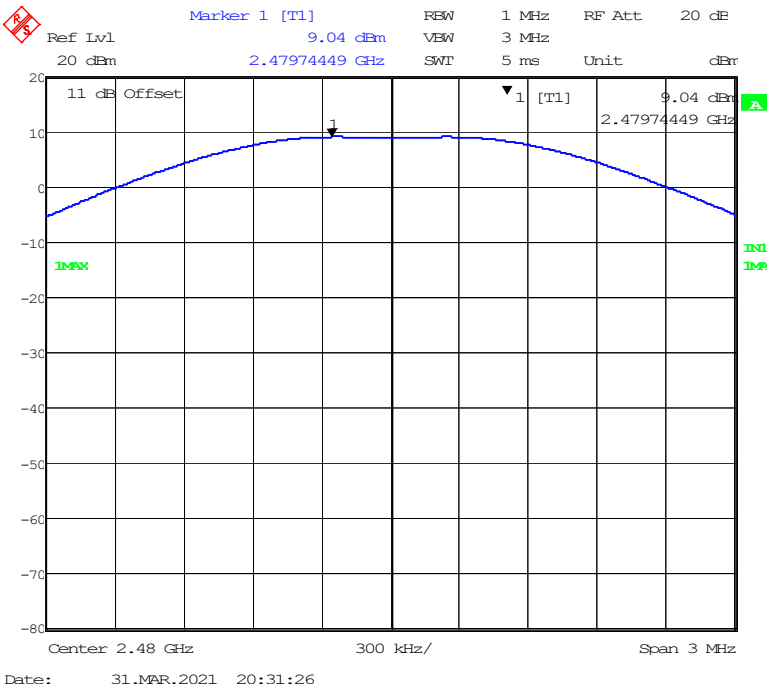
Low Channel



Middle Channel



High Channel



FCC §15.247(d) – BAND EDGE

Applicable Standard

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)).

Test Procedure

According to ANSI C63.10-2013 sub-clause 6.10.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	52 %
ATM Pressure:	101.6 kPa

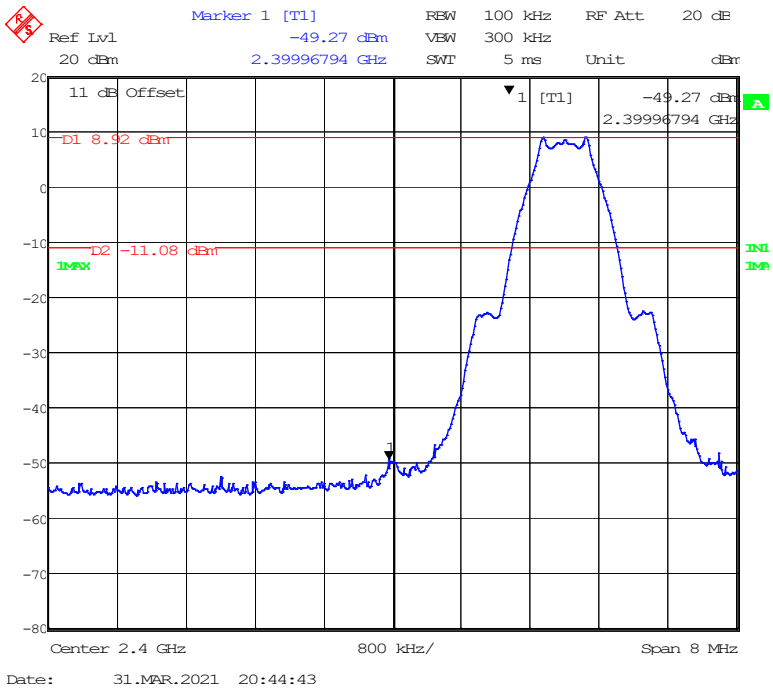
The testing was performed by Miller Xie on 2021-03-31.

Test Result: Compliant.

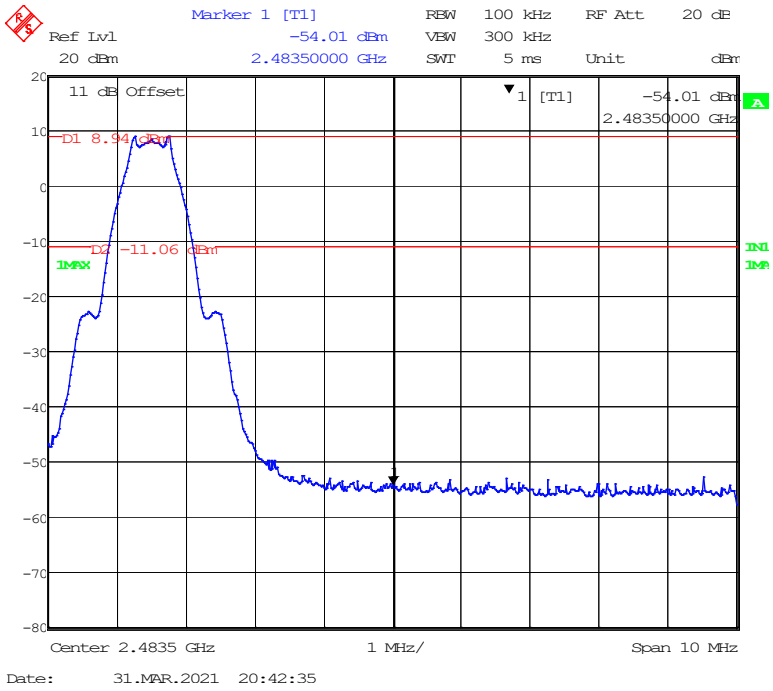
EUT operation mode: Transmitting

BLE (1Mbps):

Left Side



Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to ANSI C63.10-2013 sub-clause 11.10.2

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1. Set the RBW to: 3kHz≤ RBW≤100 kHz.
2. Set the VBW ≥ 3*RBW.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.
9. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Data

Environmental Conditions

Temperature:	24.1 ℃
Relative Humidity:	52 %
ATM Pressure:	101.6 kPa

The testing was performed by Miller Xie on 2021-03-31.

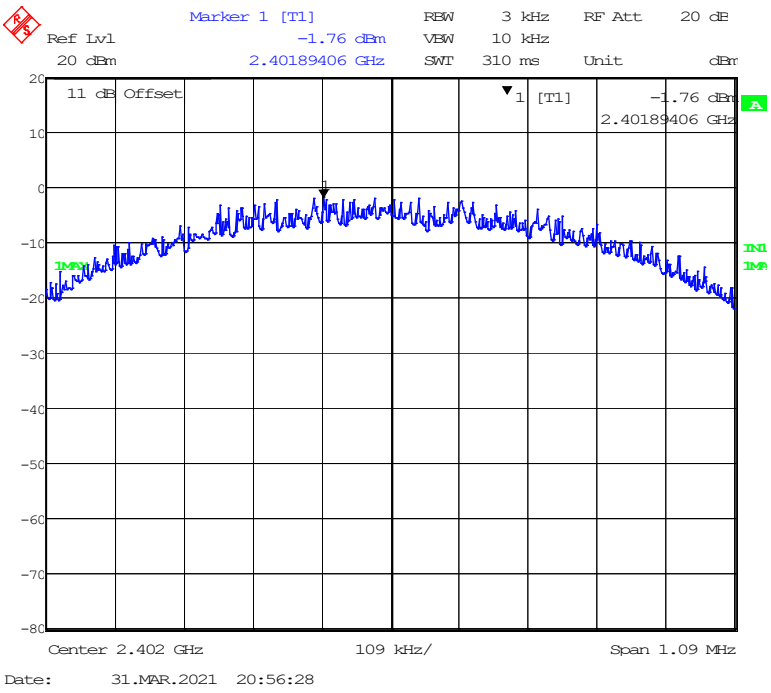
Test Result: Compliant.

EUT operation mode: Transmitting

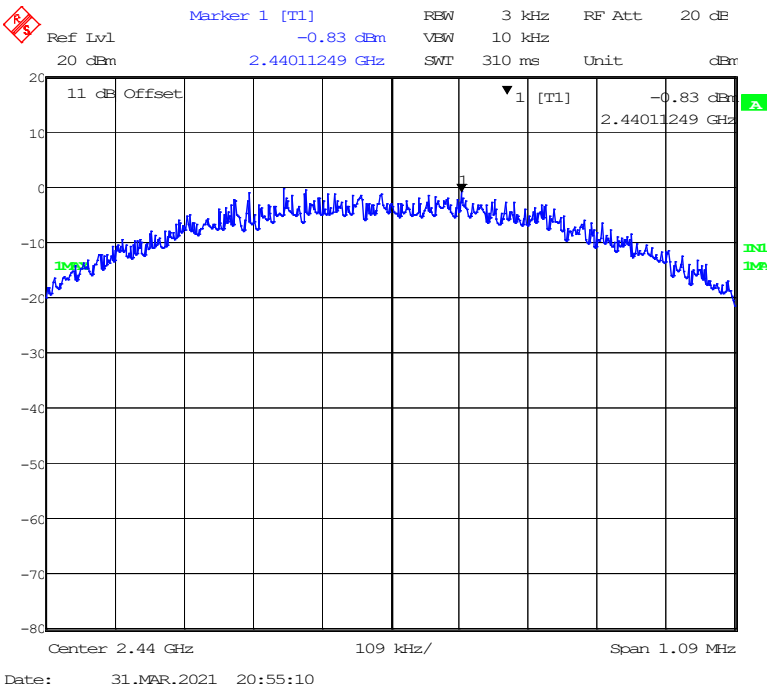
BLE (1Mbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-1.76	≤8
Middle	2440	-0.83	≤8
High	2480	-1.05	≤8

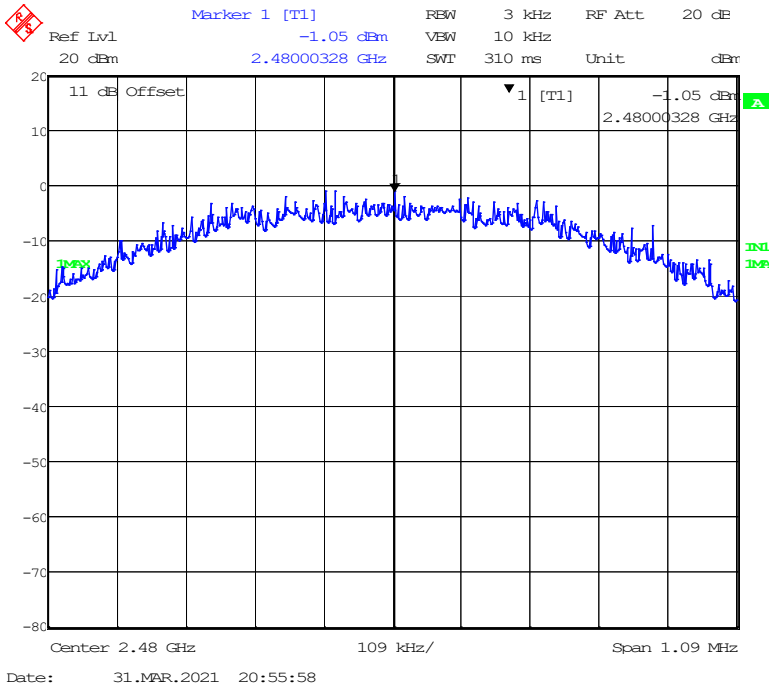
Low Channel



Middle Channel



High Channel



Declarations

1: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

2: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

5: This report cannot be reproduced except in full, without prior written approval of the Company.

6: This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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