TEST REPORT

Applicant Name:	Konexial, Inc.
Address:	415 Locust St Suite 200 Knoxville, TN 37902 United States
Report Number:	SZ1240327-15983E-RF-00
FCC ID:	2BG7E-PINGIT

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	GPS Tracker
Model No.:	PingIT
Multiple Model(s) No.:	N/A
Trade Mark:	Konexial
Date Received:	2024/03/27
Issue Date:	2024/07/12

Test Result:	Pass▲

▲ In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Jojo Guo
RF Engineer

Approved By:

Nancy Wang
RF Supervisor

Note: The information marked# is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.

This report may contain data that are not covered by the NVLAP accreditation and are marked with an asterisk "▼".

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	SZ1240327-15983E-RF-00	Original Report	2024/07/12

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	GPS Tracker
Tested Model	PingIT
Multiple Model(s)	N/A
Frequency Range	BLE: 2402-2480MHz
Maximum Conducted Peak Output Power	BLE: 0.21dBm
Modulation Technique	BLE: GFSK
Antenna Specification#	3.14dBi (provided by the applicant)
Voltage Range	DC 3.7V from battery
Sample serial number	2J8M-1 for Conducted and Radiated Emissions Test 2J8M-2 for RF Conducted Test (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Adapter Information	N/A

Objective

This report is in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209, 15.247 rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance ANSI C63.10-2013.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

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

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF output power, conducted		0.72 dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz~150 kHz	3.94dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.84dB(k=2, 95% level of confidence)
Radiated Emissions	9kHz - 30MHz	3.30dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	4.48dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	4.55dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	4.85dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.05dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.35dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.44dB(k=2, 95% level of confidence)
	18GHz - 40GHz	5.16dB(k=2, 95% level of confidence)
Temperature		±1℃
Humidity		±1%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 715558, the FCC Designation No. : CN5045.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
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.

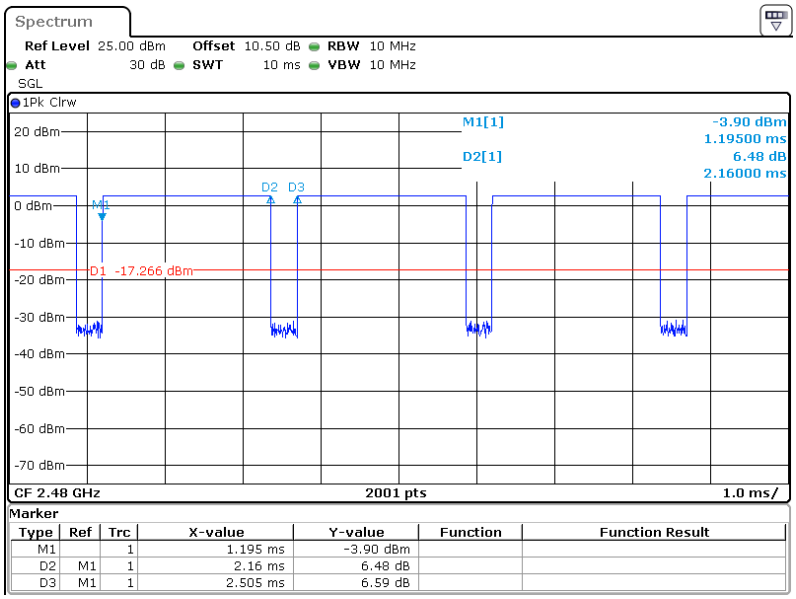
EUT Exercise Software

"STM32CUBEMONITOR-RF"# exercise software was used and the power level is 28#. The software and power level was provided by the applicant.

Duty cycle

Test Modes	Ton (ms)	Ton+off (ms)	Duty Cycle (%)	1/Ton (Hz)	VBW Setting (Hz)
BLE 1Mbps	2.16	2.505	86.23	463	500

BLE 1M



Support Equipment List and Details

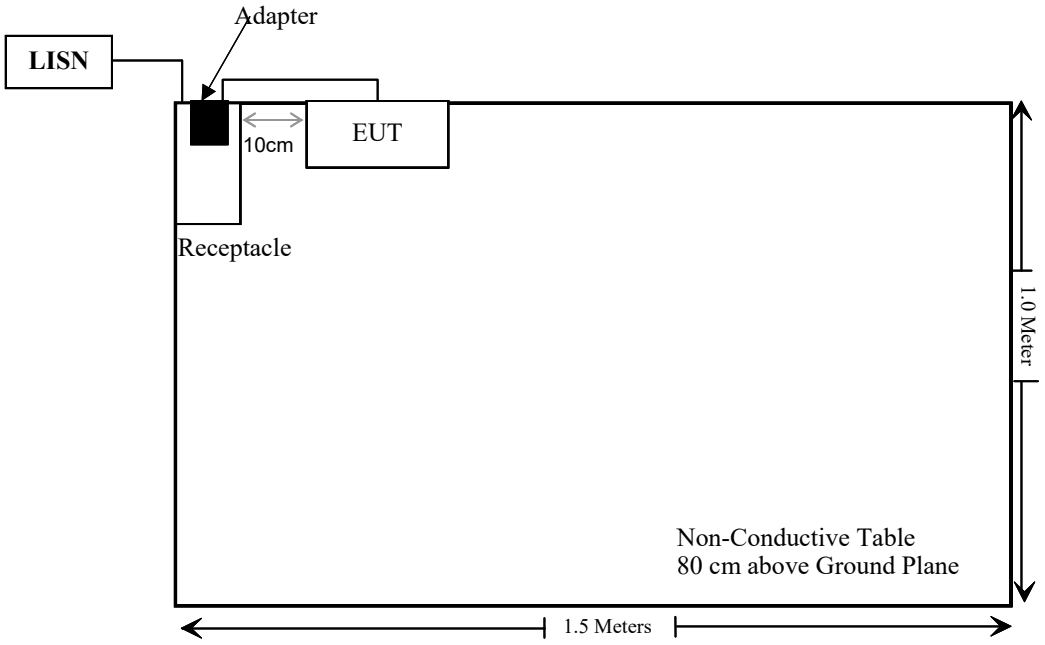
Manufacturer	Description	Model	Serial Number
Huawei	Adapter	HW-100400C01	Unknown
Bull	Receptacle	Unknown	Unknown

External I/O Cable

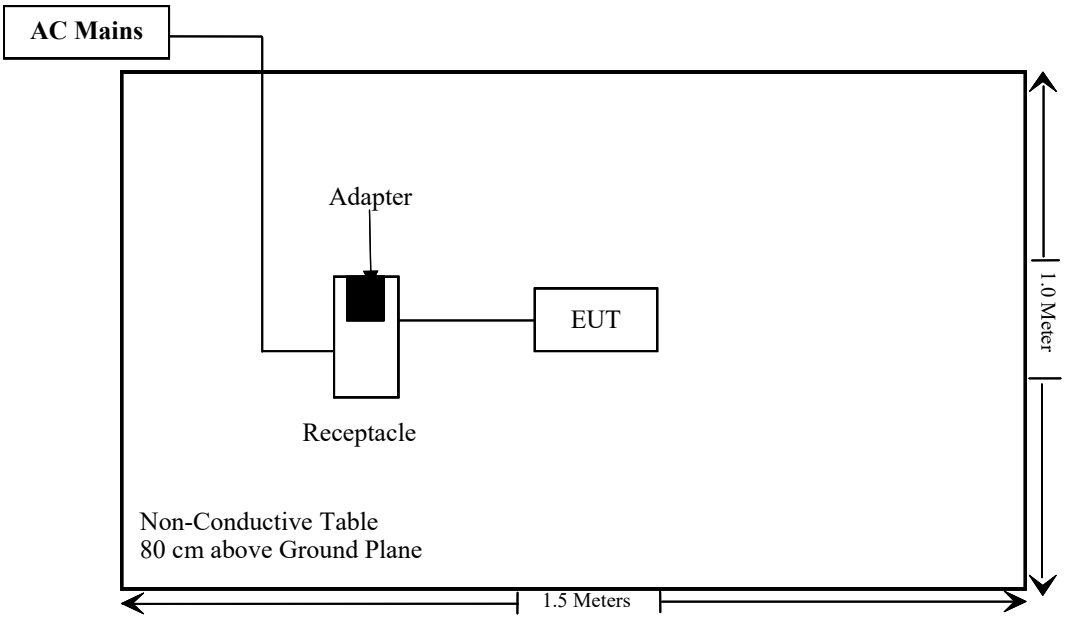
Cable Description	Length (m)	From Port	To
Un-shielding Detachable DC Cable	1.0	EUT	Adapter
Un-shielding Detachable AC Cable	1.5	Receptacle	LISN/AC Mains

Block Diagram of Test Setup

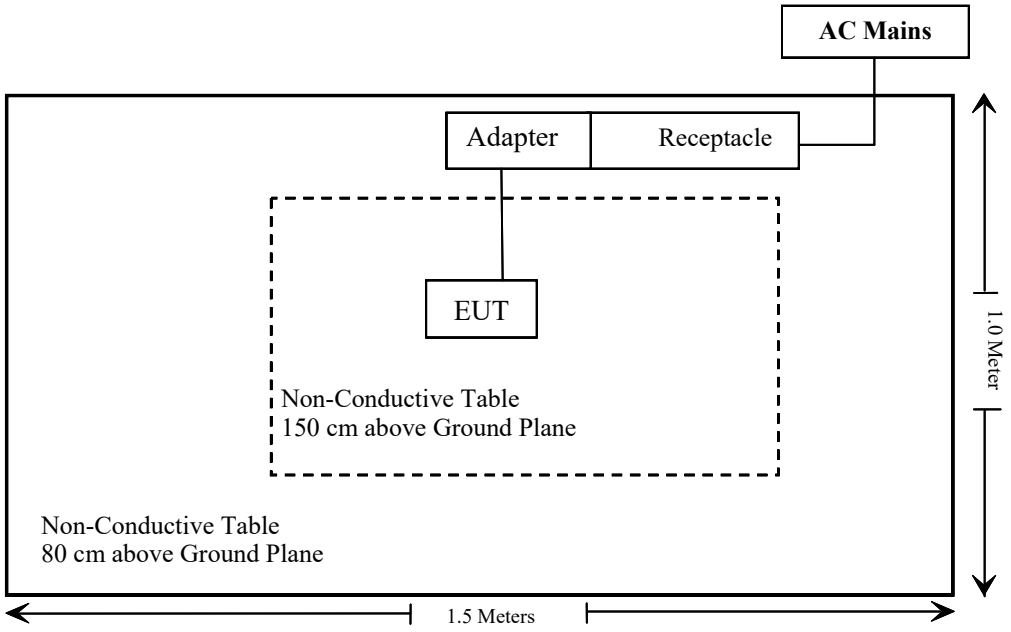
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (3) & §2.1091	Maximum Permissible Exposure(MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	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(e)	Power Spectral Density	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2024/01/16	2025/01/15
Rohde & Schwarz	LISN	ENV216	101613	2024/01/16	2025/01/15
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2023/08/03	2024/08/02
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2023/06/08	2024/06/07
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2024/07/19
BACL	Active Loop Antenna	1313-1A	4031911	2024/03/21	2025/03/20
Unknown	Cable	Chamber Cable 1	F-03-EM236	2023/08/03	2024/08/02
Unknown	Cable	Chamber Cable 4	EC-007	2023/08/03	2024/08/02
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2023/04/18	2024/04/17
COM-POWER	Pre-amplifier	PA-122	181919	2023/06/29	2024/06/28
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2024/07/25
Unknown	RF Cable	KMSE	0735	2023/10/08	2024/10/07
Unknown	RF Cable	UFA147	219661	2023/10/08	2024/10/07
SNSD	2.4G Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2023/08/03	2024/08/02
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2023/04/18	2024/04/17
A.H.System	Pre-amplifier	PAM-1840VH	190	2023/08/03	2024/08/02
Electro-Mechanics Co	Horn Antenna	3116	2026	2023/09/18	2026/09/17
UTIFLEX	RF Cable	NO. 13	232308-001	2023/08/03	2024/08/02
Audix	EMI Test software	E3	191218(V9)	NCR	NCR
RF Conducted Test					
R&S	Spectrum Analyzer	FSU26	200120	2024/01/08	2025/01/07
Unknown	10dB Attenuator	Unknown	F-03-EM190	2023/07/04	2024/07/03
Micro-Tronics	RF Cable	8082135	W1113	2023/07/04	2024/07/03

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

FCC §15.247 (i) & §1.1307 (b) (3) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

Ris the minimum separation distance in meters
f = frequency in MHz

Result

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
BLE	2402-2480	1.00	3.14	0.99	1.99	0.002	0.2	0.768
GSM 850	824 ~ 849	35.00	-7.11	-9.26	25.74	0.375	0.2	0.422
PCS 1900	1850 ~ 1910	32.00	-5.84	-7.99	24.01	0.252	0.2	0.768
NB-IoT Band 2	1850 ~ 1910	25.70	-5.84	-7.99	17.71	0.059	0.2	0.768
NB-IoT Band 5	824 ~ 849	25.70	-7.11	-9.26	16.44	0.044	0.2	0.422
NB-IoT Band 12	699 ~ 746	25.70	-10.28	-12.43	13.27	0.021	0.2	0.358
NB-IoT Band 13	746 ~ 787	25.70	-9.97	-12.12	13.58	0.023	0.2	0.382
NB-IoT Band 17	704 ~ 746	25.70	-10.28	-12.43	13.27	0.021	0.2	0.360
NB-IoT Band 26	814 ~ 894	25.70	-7.11	-9.26	16.44	0.044	0.2	0.417
CAT-M1 Band 2	1850 ~ 1910	25.70	-5.84	-7.99	17.71	0.059	0.2	0.768
CAT-M1 Band 4	1710 ~ 1755	25.70	-18.20	-20.35	5.35	0.003	0.2	0.768
CAT-M1 Band 5	824 ~ 849	25.70	-7.11	-9.26	16.44	0.044	0.2	0.422
CAT-M1 Band 12	699 ~ 746	25.70	-10.28	-12.43	13.27	0.021	0.2	0.358
CAT-M1 Band 13	746 ~ 787	25.70	-9.97	-12.12	13.58	0.023	0.2	0.382
CAT-M1 Band 26	814 ~ 894	25.70	-7.11	-9.26	16.44	0.044	0.2	0.417

Note 1: The tune up conducted power and antenna gain was declared by the applicant.
Note 2: The target power of WWAN radio is from the contain ID of module with report number B18W50279-MPE

Simultaneous transmitting consideration (worst case):

The ratio= ERP BLE /limit+ GSM 850/limit= 0.002/0.768+0.375/0.422=0.891<1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

According to FCC § 15.203, the applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Antenna Connector Construction

The EUT has an internal antenna arrangement which was permanently attached and the maximum antenna gain[#] is 3.14dBi, fulfill the requirement of this section. Please refer to the EUT photos.

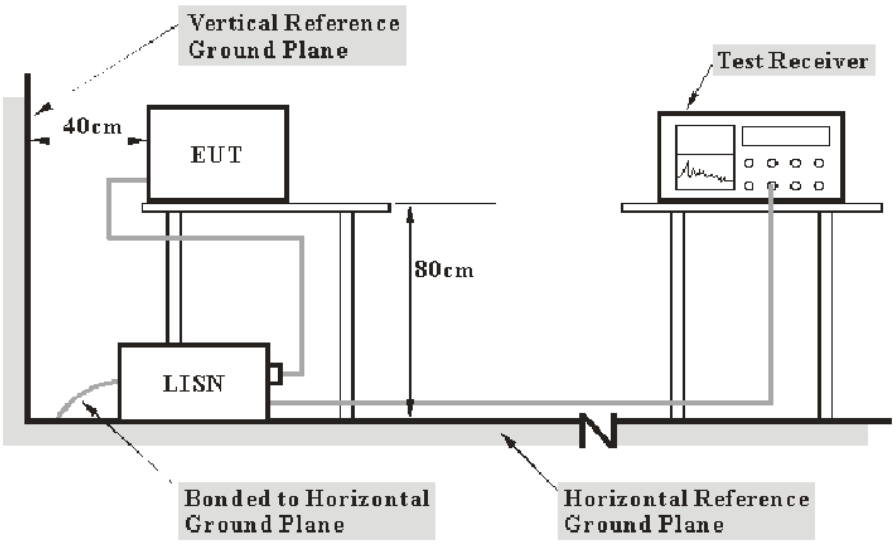
Result: Compliant

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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 setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

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

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.

Factor & Over Limit Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Factor = LISN VDF + Cable Loss

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 below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Note: The term "cable loss" refers to the combination of a cable and a 10dB transient limiter (attenuator).

Test Data

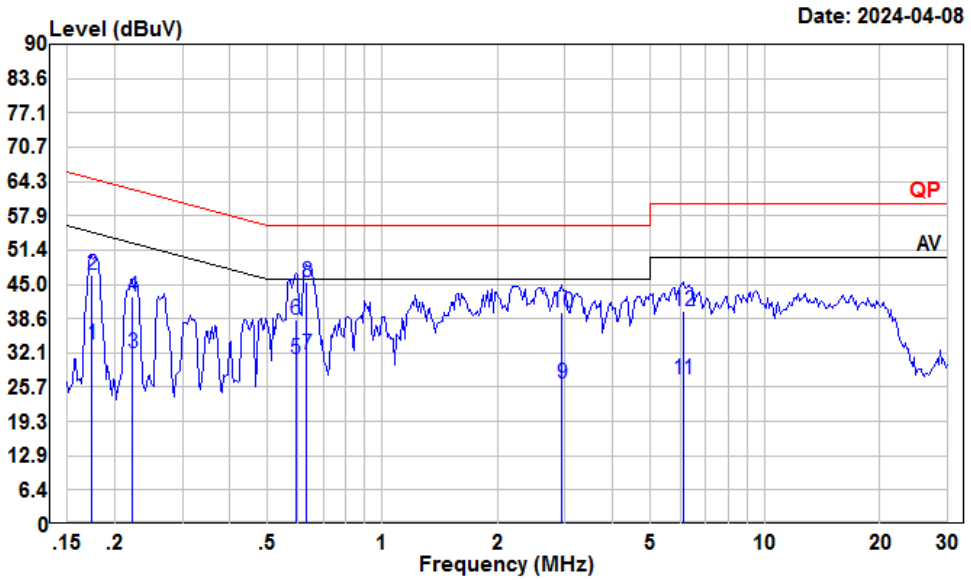
Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	70 %
ATM Pressure:	101 kPa

The testing was performed by Macy Shi on 2024-04-08.

EUT operation mode: Transmitting (Maximum output power mode BLE 1M, High Channel)

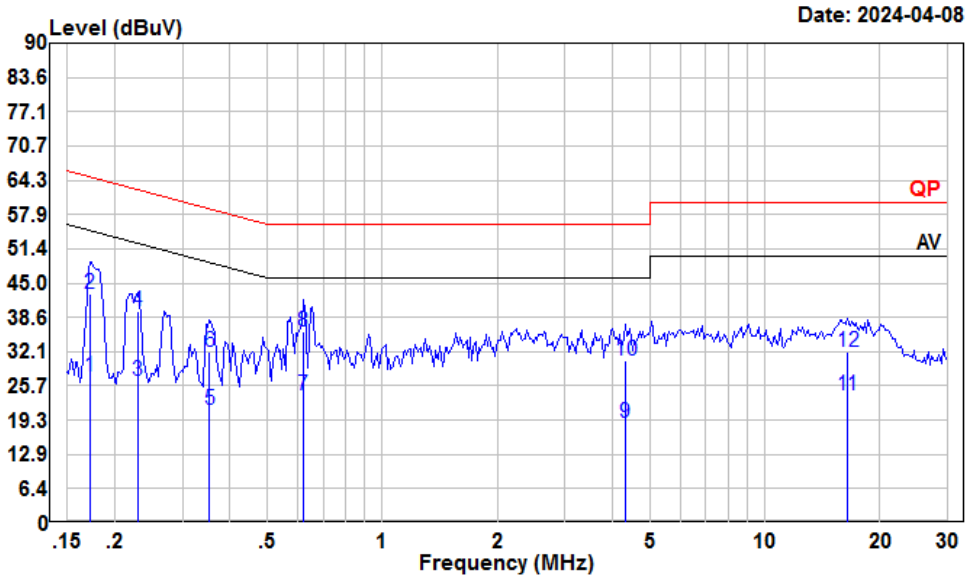
AC 120V/60 Hz, Line



Condition: Line
Project : SZ1240327-15983E-RF
Tester : Macy shi
Note : BLE

	Freq	Read Level	Level	LISN Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.17	12.61	33.60	10.85	10.14	54.77	-21.17	Average
2	0.17	25.80	46.79	10.85	10.14	64.77	-17.98	QP
3	0.22	11.29	32.20	10.77	10.14	52.74	-20.54	Average
4	0.22	21.76	42.67	10.77	10.14	62.74	-20.07	QP
5	0.59	10.20	30.92	10.50	10.22	46.00	-15.08	Average
6	0.59	17.60	38.32	10.50	10.22	56.00	-17.68	QP
7	0.63	11.02	31.74	10.50	10.22	46.00	-14.26	Average
8	0.63	24.62	45.34	10.50	10.22	56.00	-10.66	QP
9	2.95	5.72	26.41	10.43	10.26	46.00	-19.59	Average
10	2.95	19.05	39.74	10.43	10.26	56.00	-16.26	QP
11	6.12	6.45	27.12	10.45	10.22	50.00	-22.88	Average
12	6.12	19.29	39.96	10.45	10.22	60.00	-20.04	QP

AC 120V/60 Hz, Neutral



Condition: Neutral
Project : SZ1240327-15983E-RF
Tester : Macy shi
Note : BLE

	Freq	Read Level	LISN Level	Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dBuV	dB	
1	0.17	6.86	27.51	10.50	10.15	54.86	-27.35	Average
2	0.17	22.35	43.00	10.50	10.15	64.86	-21.86	QP
3	0.23	6.12	26.72	10.44	10.16	52.48	-25.76	Average
4	0.23	19.15	39.75	10.44	10.16	62.48	-22.73	QP
5	0.35	0.48	21.23	10.59	10.16	48.87	-27.64	Average
6	0.35	11.28	32.03	10.59	10.16	58.87	-26.84	QP
7	0.62	3.07	23.99	10.70	10.22	46.00	-22.01	Average
8	0.62	15.01	35.93	10.70	10.22	56.00	-20.07	QP
9	4.31	-1.86	18.83	10.44	10.25	46.00	-27.17	Average
10	4.31	9.79	30.48	10.44	10.25	56.00	-25.52	QP
11	16.40	3.13	24.00	10.77	10.10	50.00	-26.00	Average
12	16.40	11.23	32.10	10.77	10.10	60.00	-27.90	QP

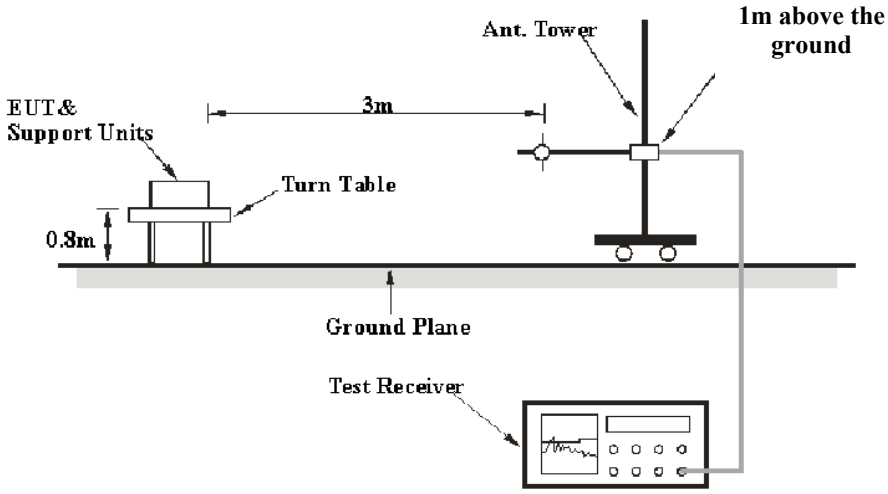
FCC §15.209, §15.205 & §15.247(D) – UNWANTED EMISSION FREQUENCIES AND RESTRICTED BANDS

Applicable Standard

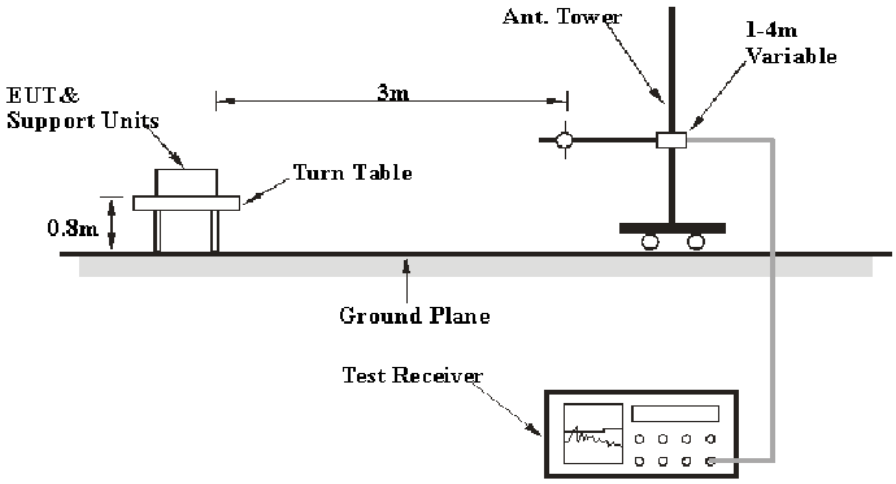
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

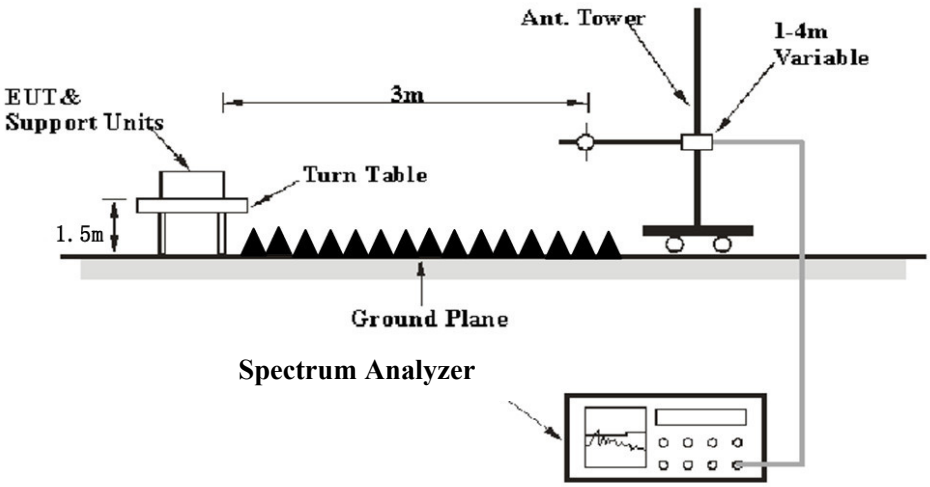
9 kHz-30MHz:



30MHz-1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.205, FCC 15.209, FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 9 kHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

9 kHz-1GHz:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	/	/	200 Hz	QP
	300 Hz	1 kHz	/	PK
150 kHz – 30 MHz	/	/	9 kHz	QP
	10 kHz	30 kHz	/	PK
30 MHz – 1000 MHz	/	/	120 kHz	QP
	100 kHz	300 kHz	/	PK

1-25 GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	≥1/Ton

Note: Ton is minimum transmission duration

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

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

All final data was recorded in Quasi-peak detection mode except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz, average detection modes for frequency bands 9–90 kHz and 110–490 kHz, peak and average detection modes for frequencies above 1 GHz.

For 9 kHz-30MHz, the report shall list the six emissions with the smallest margin relative to the limit, for each of the three antenna orientations (parallel, perpendicular, and ground-parallel) unless the margin is greater than 20 dB.

All emissions under the average limit and under the noise floor have not recorded in the report.

Factor & Over Limit/Margin Calculation

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

Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Over Limit/Margin = Level / Absolute Level – Limit
Level / Absolute = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	22~25.6 ℃
Relative Humidity:	50~54 %
ATM Pressure:	101 kPa

The testing was performed by Anson Su from 2024-04-09 for below 1GHz and Dylan Yang from 2024-04-12 to 2024-04-16 for above 1GHz.

EUT operation mode: Transmitting

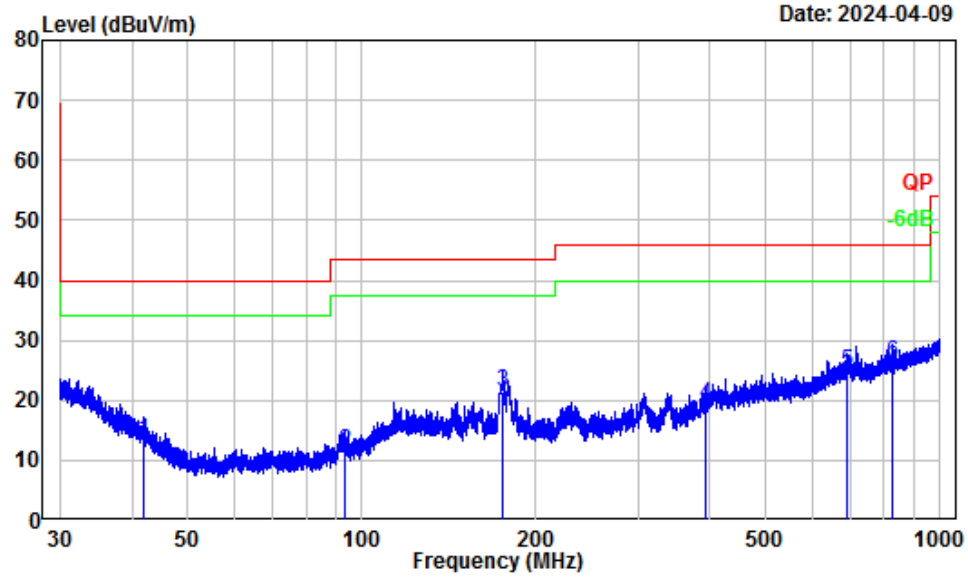
Pre-scan in the X, Y and Z axes of orientation, the worst case Z-axis of orientation was recorded.

9 kHz-30MHz (Maximum output power mode BLE 1M, High Channel):

The emissions are 20dB below the limit or the noise floor which are not recorded.

30MHz-1GHz: *(Maximum output power mode BLE 1M, High Channel)*

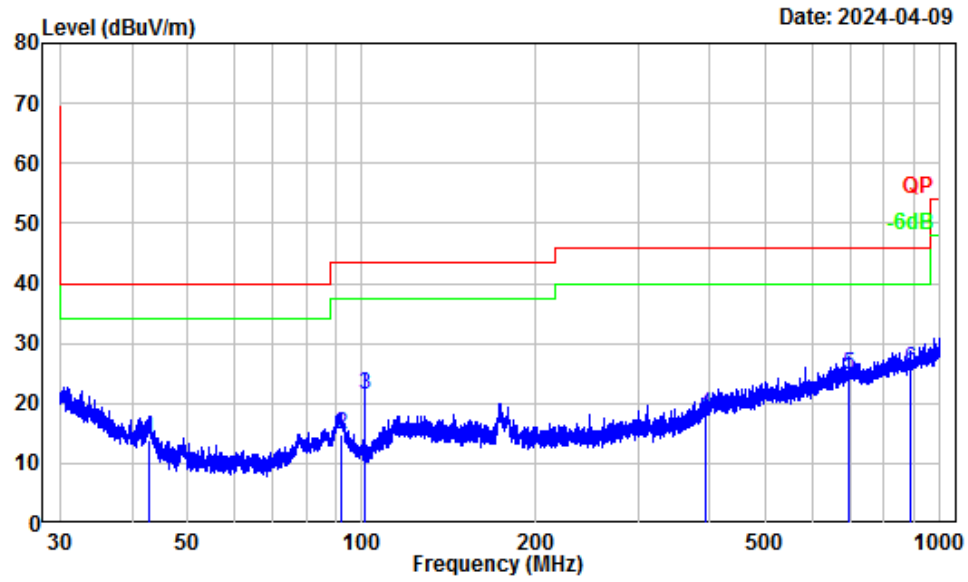
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: SZ1240327-15983E-RF
Note : BLE 1M
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	41.88	-11.59	24.79	13.20	40.00	-26.80	QP
2	93.44	-15.59	27.03	11.44	43.50	-32.06	QP
3	175.42	-12.14	33.63	21.49	43.50	-22.01	QP
4	394.16	-7.65	26.82	19.17	46.00	-26.83	QP
5	692.29	-1.65	26.55	24.90	46.00	-21.10	QP
6	826.77	-0.16	26.47	26.31	46.00	-19.69	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: SZ1240327-15983E-RF
Note : BLE 1M
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	42.88	-13.52	27.26	13.74	40.00	-26.26	QP
2	91.82	-16.98	31.75	14.77	43.50	-28.73	QP
3	101.02	-14.93	36.49	21.56	43.50	-21.94	QP
4	393.47	-7.90	25.99	18.09	46.00	-27.91	QP
5	695.64	-1.99	26.83	24.84	46.00	-21.16	QP
6	891.12	0.48	25.10	25.58	46.00	-20.42	QP

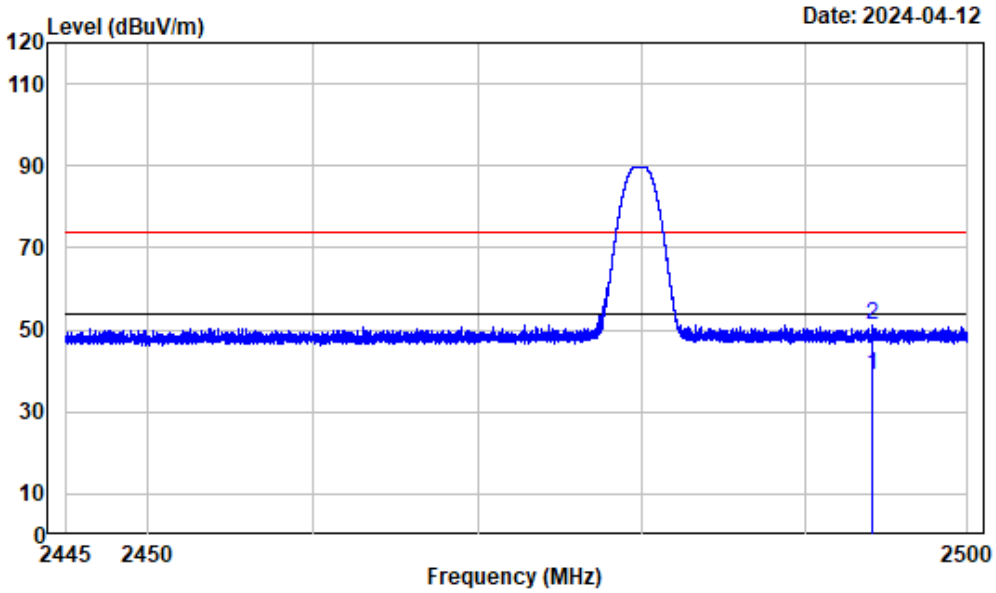
1-25 GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave					
BLE 1M							
Low Channel 2402MHz							
2388.27	54.65	PK	H	-2.93	51.72	74	-22.28
2388.27	41.89	AV	H	-2.93	38.96	54	-15.04
2384.76	54.56	PK	V	-2.93	51.63	74	-22.37
2384.76	41.38	AV	V	-2.93	38.45	54	-15.55
4804.00	53.04	PK	H	2.42	55.46	74	-18.54
4804.00	47.32	AV	H	2.42	49.74	54	-4.26
4804.00	52.78	PK	V	2.42	55.20	74	-18.80
4804.00	48.42	AV	V	2.42	50.84	54	-3.16
Middle Channel 2440MHz							
4880.00	53.18	PK	H	2.58	55.76	74	-18.24
4880.00	46.59	AV	H	2.58	49.17	54	-4.83
4880.00	52.89	PK	V	2.58	55.47	74	-18.53
4880.00	47.81	AV	V	2.58	50.39	54	-3.61
High Channel 2480MHz							
4960.00	48.41	PK	H	2.68	51.09	74	-22.91
4960.00	42.67	AV	H	2.68	45.35	54	-8.65
4960.00	48.83	PK	V	2.68	51.51	74	-22.49
4960.00	43.29	AV	V	2.68	45.97	54	-8.03

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Absolute Level/Level = Factor + Reading/Read Level
Margin = Absolute Level - Limit
The other spurious emission which is in the noise floor level was not recorded.

Test plots for Band Edge Measurements (Radiated):

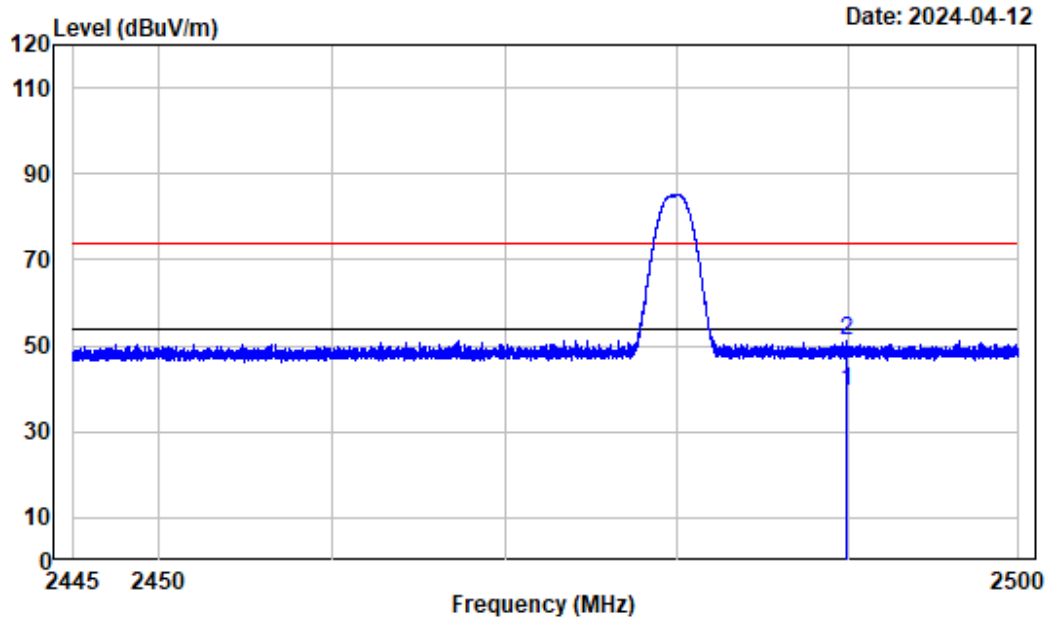
BLE 1M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Horizontal**



Condition : Horizontal
Project No.: SZ1240327-15983E
Tester : Dylan
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2494.184	-3.19	42.24	39.05	54.00	-14.95	Average
2	2494.184	-3.19	54.17	50.98	74.00	-23.02	peak

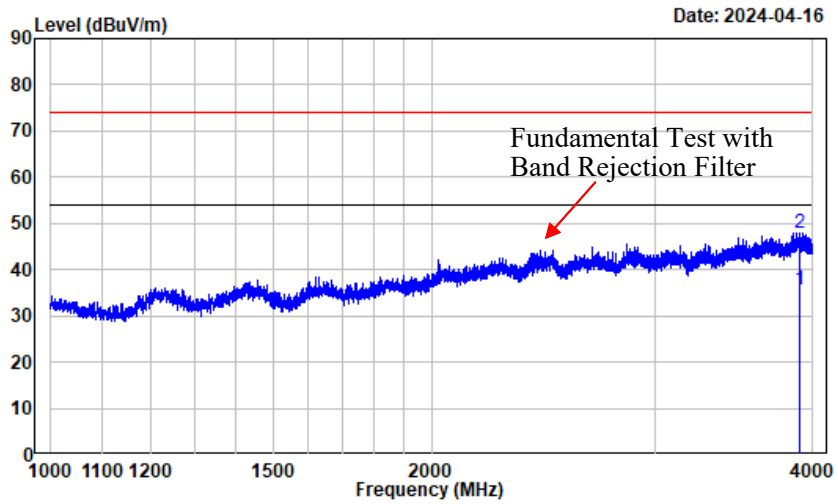
BLE 1M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Vertical**



Condition : Vertical
Project No.: SZ1240327-15983E
Tester : Dylan
Note : BLE1M_2480

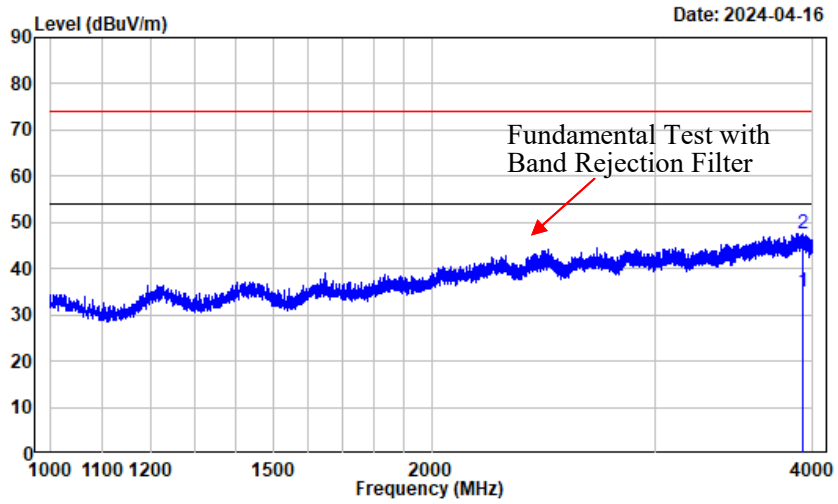
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2489.942	-3.18	42.39	39.21	54.00	-14.79	Average
2	2489.942	-3.18	54.44	51.26	74.00	-22.74	peak

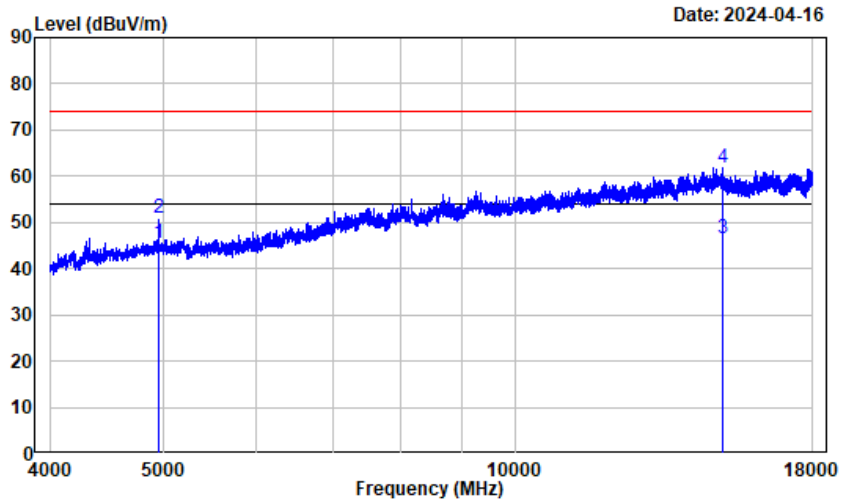
Listed with harmonic margin test plot (BLE1M Mode High channel):

Horizontal	
1-4GHz	

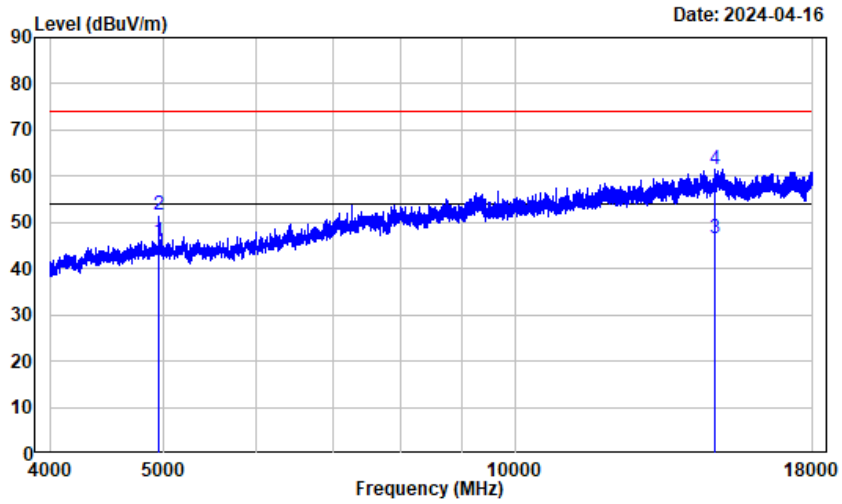
Condition : Horizontal
Project No.: SZ1240327-15983E
Tester : Dylan
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3906.625	-0.48	36.28	35.80	54.00	-18.20	average
2	3906.625	-0.48	48.39	47.91	74.00	-26.09	peak

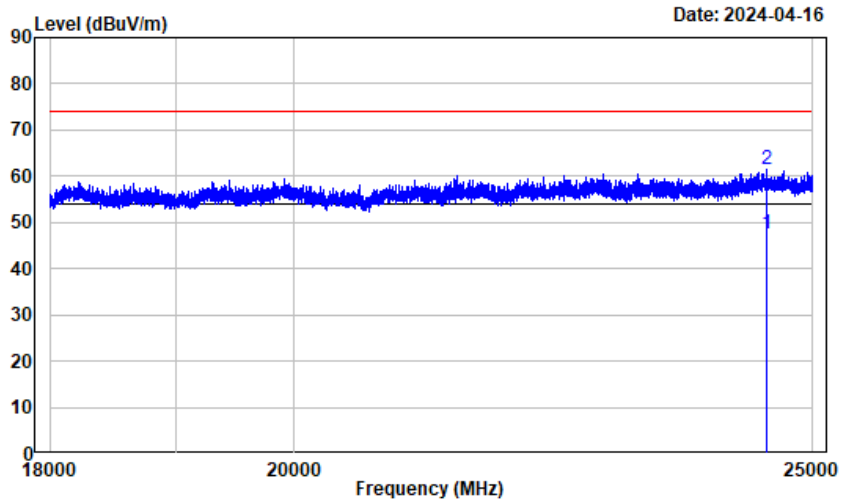
Vertical	
1-4GHz	 Condition : Vertical Project No.: SZ1240327-15983E Tester : Dylan Note : BLE1M_2480 | | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark | | | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | | | 1 | 3929.500 | -0.31 | 35.42 | 35.11 | 54.00 | -18.89 | average | | 2 | 3929.500 | -0.31 | 47.98 | 47.67 | 74.00 | -26.33 | peak |

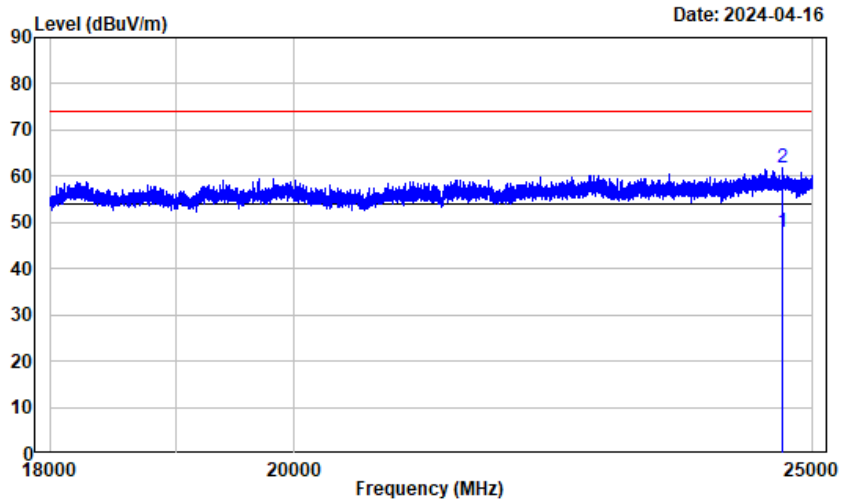
Horizontal	
4-18GHz	 Condition : Horizontal Project No.: SZ1240327-15983E Tester : Dylan Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.68	42.67	45.35	54.00	-8.65	Average
2	4960.000	2.68	48.41	51.09	74.00	-22.91	Peak
3	15091.500	15.89	30.77	46.66	54.00	-7.34	average
4	15091.500	15.89	45.96	61.85	74.00	-12.15	peak

Vertical	
4-18GHz	 Condition : Vertical Project No.: SZ1240327-15983E Tester : Dylan Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4960.000	2.68	43.29	45.97	54.00	-8.03	Average
2	4960.000	2.68	48.83	51.51	74.00	-22.49	Peak
3	14832.500	16.82	29.55	46.37	54.00	-7.63	average
4	14832.500	16.82	44.68	61.50	74.00	-12.50	peak

Horizontal	
18-25GHz	 Condition : Horizontal Project No.: SZ1240327-15983E Tester : Dylan Note : BLE1M_2480 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 24507.380 18.99 28.41 47.40 54.00 -6.60 Average 2 24507.380 18.99 42.36 61.35 74.00 -12.65 peak

Vertical	
18-25GHz	

Condition : Vertical
Project No.: SZ1240327-15983E
Tester : Dylan
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	24680.630	18.77	28.96	47.73	54.00	-6.27	Average
2	24680.630	18.77	43.07	61.84	74.00	-12.16	peak

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

Standard Applicable

According to FCC §15.247(a) (2)
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.

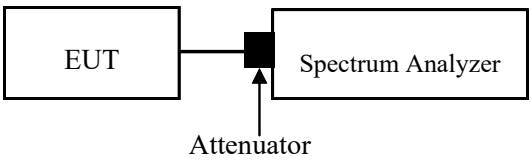
Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 6.9.3

a. Set RBW = 100 kHz.
b. Set the VBW ≥ [3×RBW].
c. Detector = peak.
d. Trace mode = max hold.
e. Sweep = auto couple.
f. Allow the trace to stabilize.
g. 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.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Procedure as below

a. The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
b. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
c. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
d. Step a) through step c) might require iteration to adjust within the specified range.
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f. Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
g. If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
h. The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).



Test Data

Environmental Conditions

Temperature:	24℃
Relative Humidity:	51 %
ATM Pressure:	101 kPa

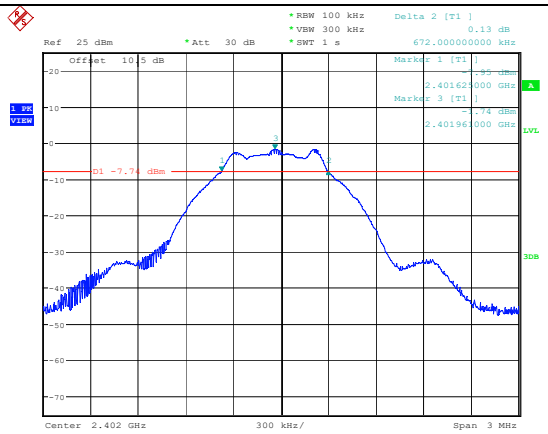
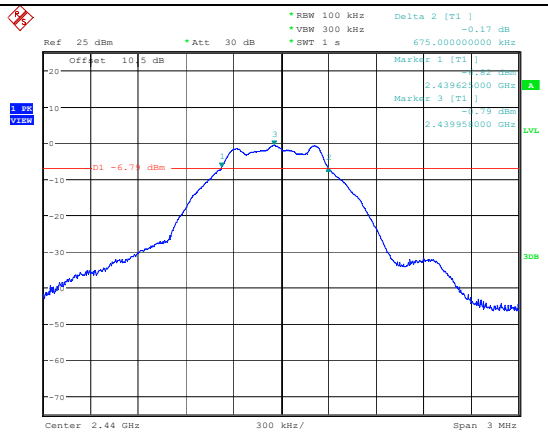
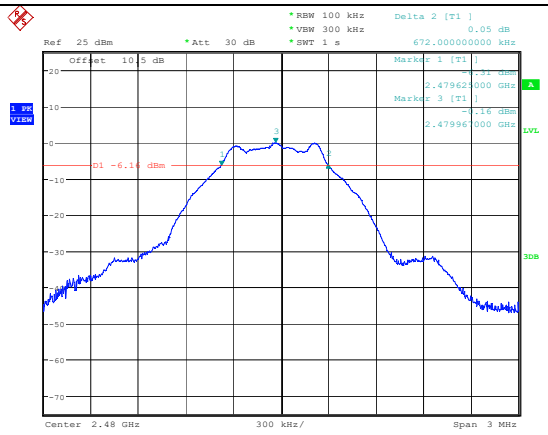
The testing was performed by Bamboo Zhan on 2024-04-24.

EUT operation mode: Transmitting

Test Result: Compliant.

Test Modes	Test Channel	Test Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
BLE 1M	Lowest	2402	0.672	≥0.5
	Middle	2440	0.675	≥0.5
	Highest	2480	0.672	≥0.5

6 dB Bandwidth

BLE 1M	
Low Channel	 ProjectNo.:SZ1240327-15983E-RF Tester:Bamboo Zhan Date: 24.APR.2024 09:12:37
Middle Channel	 ProjectNo.:SZ1240327-15983E-RF Tester:Bamboo Zhan Date: 24.APR.2024 09:15:05
High Channel	 ProjectNo.:SZ1240327-15983E-RF Tester:Bamboo Zhan Date: 24.APR.2024 09:27:39

FCC §15.247(b) (3)- PEAK OUTPUT POWER MEASUREMENT

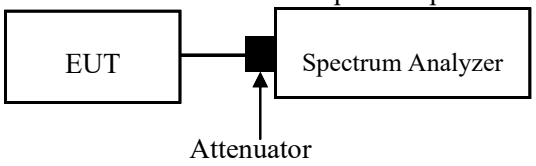
Applicable Standard

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

Test Method: ANSI C63.10-2013 Clause 11.9.1.1

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.
4. Set the RBW ⩾ DTS bandwidth.
5. Set the VBW ≥ [3 × RBW].
6. Set span ⩾ [3 × RBW].
7. Sweep time = auto couple.
8. Detector = peak.
9. Trace mode = max hold.
10. Allow the trace to stabilize.
11. Use peak marker function to determine the peak amplitude level.



Test Data

Environmental Conditions

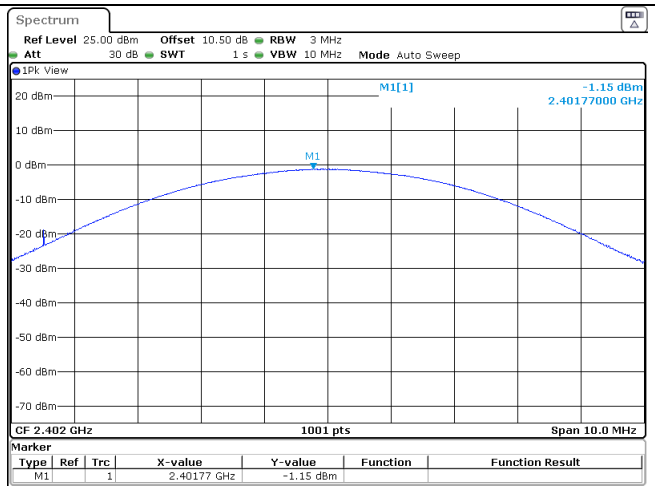
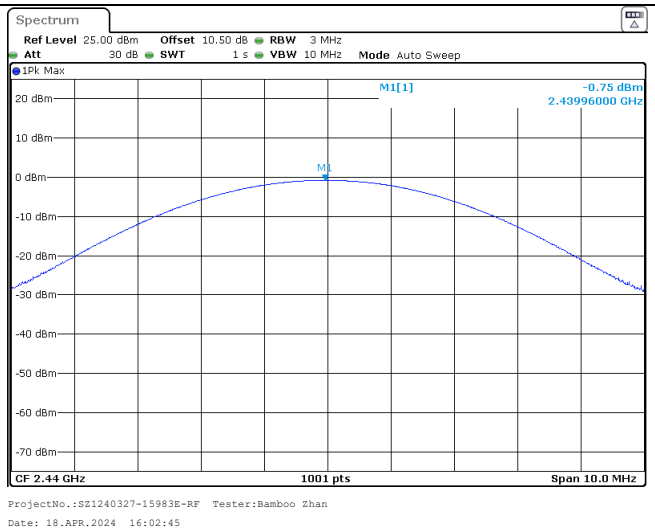
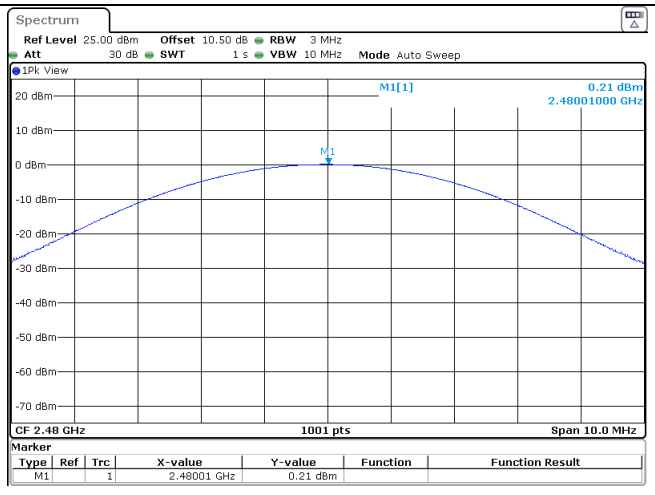
Temperature:	26 ℃
Relative Humidity:	51 %
ATM Pressure:	101 kPa

The testing was performed by Bamboo Zhan on 2024-04-18.

EUT operation mode: Transmitting

Test Result: Compliant.

Test Modes	Test Frequency (MHz)	Peak Conducted Output Power (dBm)	Limits (dBm)
BLE 1M	2402	-1.15	≤30
	2440	-0.75	≤30
	2480	0.21	≤30

BLE 1M	
Low Channel	
Middle Channel	
High Channel	

FCC §15.247(e) – POWER SPECTRAL DENSITY

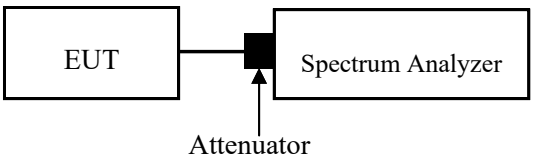
Applicable Standard

According to FCC §15.247(e):
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

Test Method: ANSI C63.10-2013 Clause 11.10.2

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set analyzer center frequency to DTS channel center frequency
3. Set the span to 1.5 times the DTS bandwidth.
4. Set the RBW to: 3kHz≤ RBW≤100 kHz.
5. Set the VBW ≥ 3×RBW.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level within the RBW.
11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

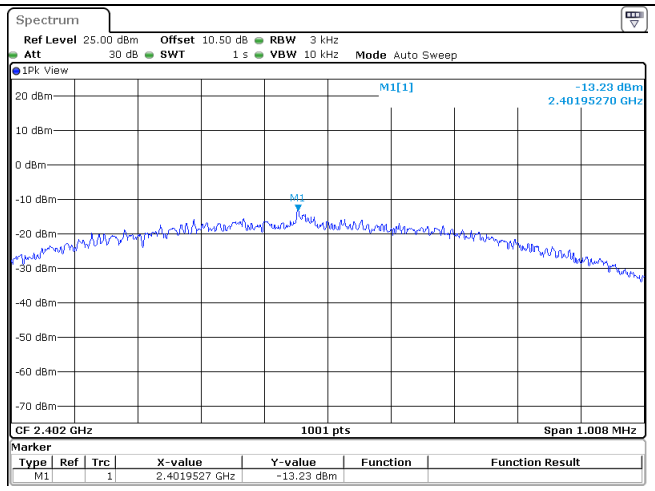
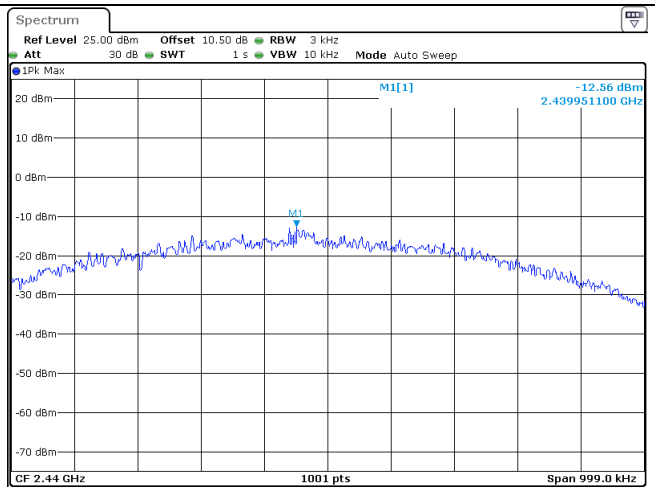
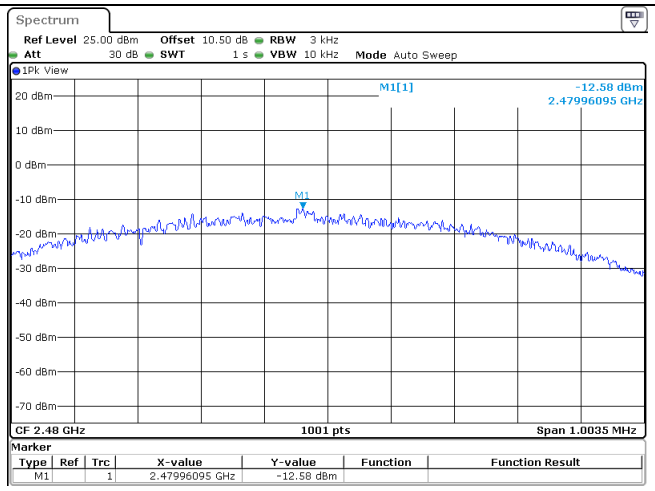
Temperature:	25.8 ℃
Relative Humidity:	50 %
ATM Pressure:	101 kPa

The testing was performed by Bamboo Zhan on 2024-04-07.

Test Mode: Transmitting

Test Result: Compliant.

Test Modes	Test Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
BLE 1M	2402	-13.23	≤8.00
	2440	-12.56	≤8.00
	2480	-12.58	≤8.00

BLE 1M	
Low Channel	
Middle Channel	
High Channel	

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

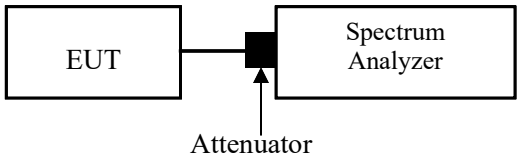
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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)).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required

Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.11

1. Set the RBW =100 kHz.
2. Set the VBW ≥ 3×RBW.
3. Detector = peak
4. Sweep time = auto couple.
5. Trace mode=max hold
6. All trace to fully stabilize
7. Use the peak marker function to determine the maximum amplitude level.
   Ensure that amplitude of all unwanted emissions outside of the authorized frequency band(excluding restricted frequency bands) is attenuated by at least the minimum requirement specified in 11.11.
   Report the three highest emissions relative to the limit.



Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	51 %
ATM Pressure:	101 kPa

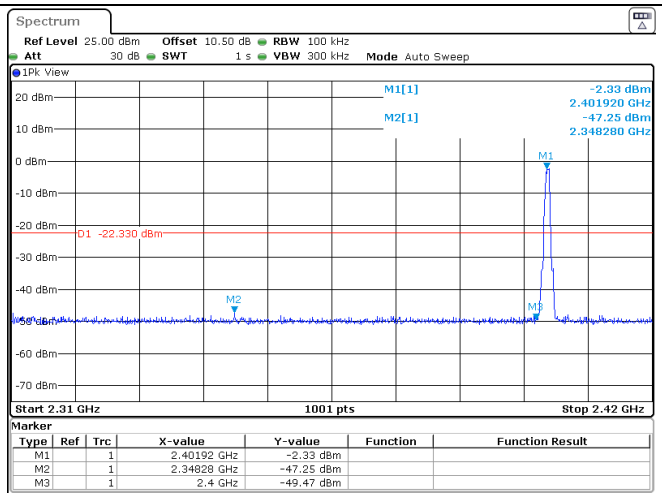
The testing was performed by Bamboo Zhan on 2024-04-18.

EUT operation mode: Transmitting

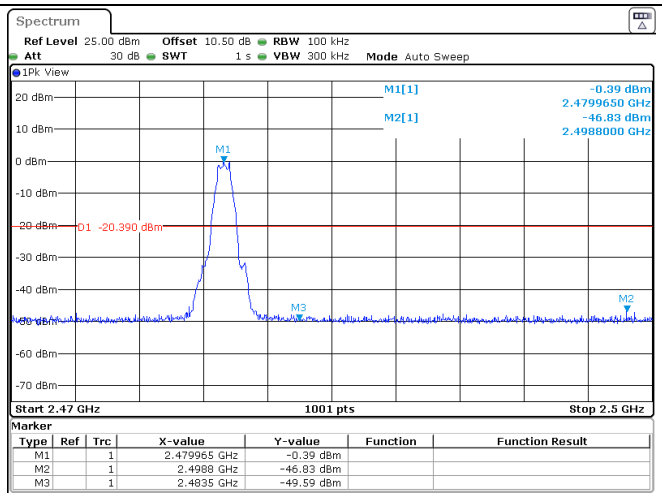
Test Result: Compliant.

Band Edge, Single Channel

BLE 1M, Left Side



BLE 1M, Right Side



EUT PHOTOGRAPHS

Please refer to the attachment SZ1240327-15983E-RF External photo and SZ1240327-15983E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment SZ1240327-15983E-RF Test Setup photo.

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