TEST REPORT

Applicant Name:	FCC: Fanvil Technology Co., LTD. IC: Fanvil Technology Co., Ltd
Address:	FCC: 10/F Block A, Dualshine Global Science Innovation Honglang North 2nd Road, Bao'an District, Shenzhen, 518101, China IC: 10/F Block A, Dualshine Global Science Innovation Center, Honglang North 2nd Road, Bao'an District, Shenzhen, 518101, China
Report Number:	2401Y98830E-RFA
FCC ID:	2APPZ-BTH60
IC:	27176-BTH60

Test Standard (s)

FCC PART 15.247;

RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247 ISSUE 3, AUGUST 2023

Sample Description

Product Type:	Wireless handset
Model No.:	BTH60
Multiple Model(s) No.:	N/A
Trade Mark:	Fanvil
Date Received:	2024/10/17
Issue Date:	2024/12/09

Test Result:	Pass▲

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

Prepared and Checked By:

Bruce Lin

Bruce Lin
RF Engineer

Approved By:

Jimmy Xiao

Jimmy Xiao
EMC Manager

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.

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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY **4**

GENERAL INFORMATION **5**

PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 5
OBJECTIVE 5
TEST METHODOLOGY 5
MEASUREMENT UNCERTAINTY 6
TEST FACILITY 6

SYSTEM TEST CONFIGURATION **7**

DESCRIPTION OF TEST CONFIGURATION 7
EQUIPMENT MODIFICATIONS 7
EUT EXERCISE SOFTWARE 7
SUPPORT EQUIPMENT LIST AND DETAILS 8
EXTERNAL I/O CABLE 8
BLOCK DIAGRAM OF TEST SETUP 8

SUMMARY OF TEST RESULTS **10**

TEST EQUIPMENT LIST **11**

FCC§15.247 (I), §1.1307(B)(3)(I)(B)& §2.1093 - SAR-BASED EXEMPTION **13**

APPLICABLE STANDARD 13
MEASUREMENT RESULT 15

RSS-102 § 6.3 -SAR EXEMPTION LIMITS **16**

APPLICABLE STANDARD 16
TEST RESULT: 17

FCC §15.203 & RSS-GEN §6.8 - ANTENNA REQUIREMENT **18**

APPLICABLE STANDARD 18
ANTENNA CONNECTOR CONSTRUCTION 19

FCC §15.209, §15.205 & §15.247(D), RSS-GEN § 8.10 & RSS-247 § 5.5 - UNWANTED EMISSION FREQUENCIES AND RESTRICTED BANDS **20**

APPLICABLE STANDARD 20
EUT SETUP 20
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 21
TEST PROCEDURE 22
FACTOR & OVER LIMIT/ MARGIN CALCULATION 22
TEST DATA 22

FCC §15.247(A) (2), RSS-GEN § 6.7 & RSS-247 § 5.2 (A) - 99% OCCUPIED BANDWIDTH & 6 DB EMISSON BANDWIDTH **52**

STANDARD APPLICABLE 52
TEST PROCEDURE 53
TEST DATA 54

FCC §15.247(B) (3), RSS-247 §5.4 (D) - PEAK OUTPUT POWER MEASUREMENT **55**

APPLICABLE STANDARD 55
TEST PROCEDURE 55
TEST DATA 56

FCC §15.247(E), RSS-247 §5.2 (B) – POWER SPECTRAL DENSITY 57
APPLICABLE STANDARD 57
TEST PROCEDURE 57
TEST DATA 58
FCC §15.247(D) & RSS-247 §5.5 - 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE 59
APPLICABLE STANDARD 59
TEST PROCEDURE 59
TEST DATA 60
DUTY CYCLE 61
DUTY CYCLE 61
TEST DATA 61
EUT PHOTOGRAPHS 62
TEST SETUP PHOTOGRAPHS 63
APPENDIX 64
APPENDIX A: DTS BANDWIDTH 64
APPENDIX B: OCCUPIED CHANNEL BANDWIDTH 68
APPENDIX C: MAXIMUM CONDUCTED OUTPUT POWER 71
APPENDIX D: MAXIMUM POWER SPECTRAL DENSITY 74
APPENDIX E: BAND EDGE MEASUREMENTS 77
APPENDIX F: DUTY CYCLE 79

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	2401Y98830E-RFA	Original Report	2024/12/09

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	BTH60
FVIN	V1.4
Product	Wireless handset
Tested Model	BTH60
Multiple Model(s)	N/A
Frequency Range	BLE: 2402-2480MHz
Maximum Conducted Peak Output Power	BLE: 1.79 dBm
Modulation Technique	BLE: GFSK
Antenna Specification#	1.62dBi (provided by the applicant)
Voltage Range	DC 3.7V from battery or indirect charging by IP phone through 5V adapter
Sample serial number	2SPO-5 for Radiated Emissions Test 2SPO-6 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, 15.209, 15.247 rules and RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247 Issue 3, August 2023 of the Innovation, Science and Economic Development Canada rules.

Test Methodology

All tests and measurements indicated in this document were performed in accordance ANSI C63.10-2013, RSS-GEN Issue 5, February 2021 Amendment 2 and RSS-247 Issue 3, August 2023.

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		109.2kHz(k=2, 95% level of confidence)
RF output power, conducted		0.86dB(k=2, 95% level of confidence)
AC Power Lines Conducted Emissions	9kHz~150 kHz	3.63dB(k=2, 95% level of confidence)
	150 kHz ~30MHz	3.66dB(k=2, 95% level of confidence)
Radiated Emissions	9kHz - 30MHz	3.60dB(k=2, 95% level of confidence)
	30MHz~200MHz (Horizontal)	5.32dB(k=2, 95% level of confidence)
	30MHz~200MHz (Vertical)	5.43dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Horizontal)	5.77dB(k=2, 95% level of confidence)
	200MHz~1000MHz (Vertical)	5.73dB(k=2, 95% level of confidence)
	1GHz - 6GHz	5.34dB(k=2, 95% level of confidence)
	6GHz - 18GHz	5.40dB(k=2, 95% level of confidence)
	18GHz - 40GHz	5.64dB(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.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

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

"BT-tool-v.1.1.2"[#] software was used to test and power level is 5[#]. The software and power level was provided by the applicant.

Support Equipment List and Details

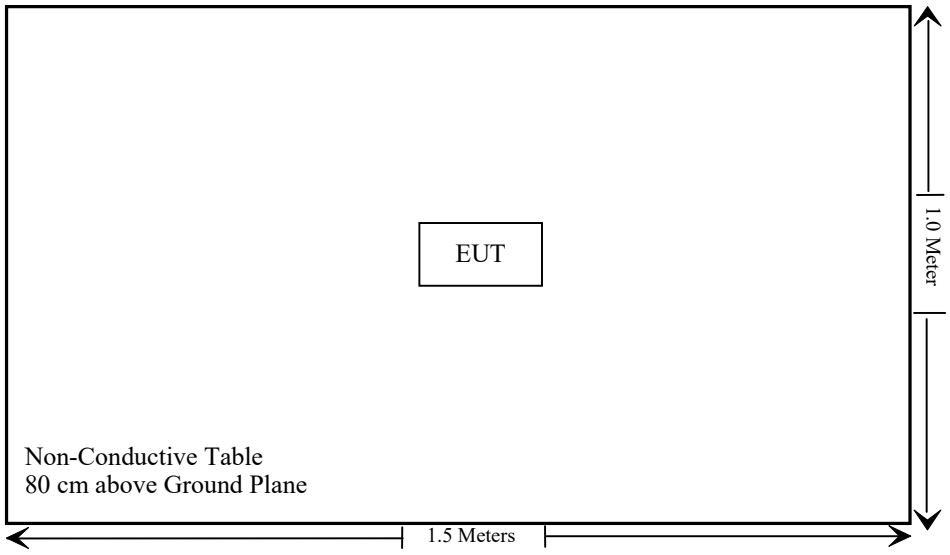
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

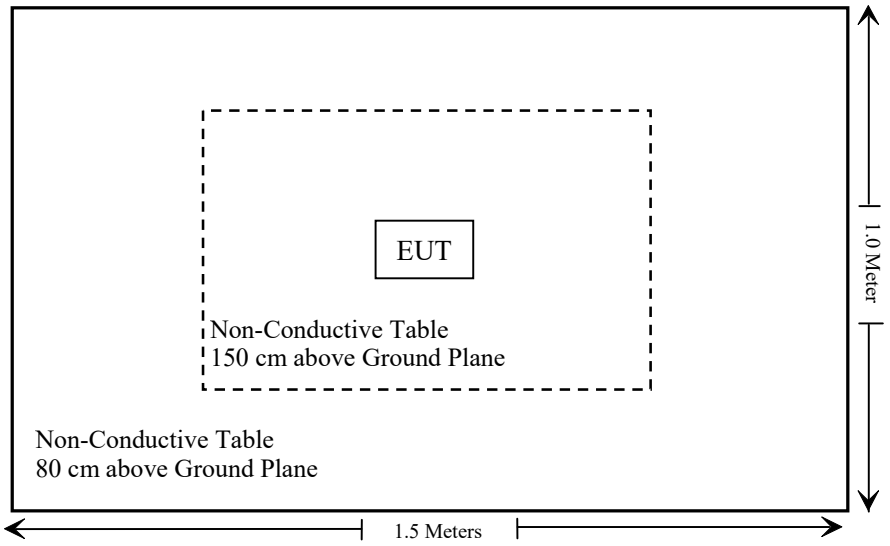
Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	RSS Rules	Description of Test	Result
§15.247 (i), §1.1307(b)(3)(i)(B) §2.1093	RSS-102 §6.3	SAR-Based Exemption & SAR Exemption Limits▾	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207 (a)	RSS-Gen §8.8	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	RSS-GEN § 8.10 & RSS-247 § 5.5	Spurious Emissions	Compliant
§15.247 (a)(2)	RSS- Gen§6.7 RSS-247 § 5.2 (a)	99% Occupied Bandwidth & 6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	RSS-247 § 5.4(d)	Maximum Conducted Output Power	Compliant
§15.247(e)	RSS-247 § 5.2 (b)	Power Spectral Density	Compliant
§15.247(d)	RSS-247 § 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
/	/	Duty Cycle	/

Not Applicable: The EUT is powered by battery directly and the EUT is placed on the IP phone for the indirect charging by the way that the IP phone is charged by 5V adapter, for the indirect charging, the bluetooth will not work.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR3	102455	2024/01/16	2025/01/15
Sonoma instrument	Pre-amplifier	310 N	186238	2024/05/21	2025/05/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2023/07/20	2026/07/19
Unknown	Cable	Chamber A Cable 1	N/A	2024/06/18	2025/06/17
Unknown	Cable	XH500C	J-10M-A	2024/06/18	2025/06/17
BACL	Active Loop Antenna	1313-1A	4031911	2024/05/14	2027/05/13
Unknown	Cable	2Y194	0735	2024/05/21	2025/05/20
Unknown	Cable	PNG214	1354	2024/05/21	2025/05/20
Audix	EMI Test software	E3	19821b(V9)	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2024/03/27	2025/03/26
COM-POWER	Pre-amplifier	PA-122	181919	2024/06/18	2025/06/17
Schwarzbeck	Horn Antenna	BBHA9120D(1201)	1143	2023/07/26	2026/07/25
Unknown	RF Cable	KMSE	735	2024/06/18	2025/06/17
Unknown	RF Cable	UFA147	219661	2024/06/18	2025/06/17
Unknown	RF Cable	XH750A-N	J-10M	2024/06/18	2025/06/17
JD	Multiplex Switch Test Control Set	DT7220FSU	DQ77926	2024/06/18	2025/06/17
A.H.System	Pre-amplifier	PAM-1840VH	190	2024/06/18	2025/06/17
Electro-Mechanics Co	Horn Antenna	3116	9510-2270	2023/09/18	2026/09/17
UTIFLEX	RF Cable	NO. 13	232308-001	2024/06/18	2025/06/17
Audix	EMI Test software	E3	191218(V9)	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Tonscend	RF control Unit	JS0806-2	19D8060154	2024/08/06	2025/08/05
Rohde & Schwarz	Spectrum Analyzer	FSV40	101473	2024/01/16	2025/01/15
Unknown	RF Cable	65475	01670515	2024/06/27	2025/06/26
Narda	20dB Attenuator	99899	0106	2024/06/27	2025/06/26

*** 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)(i)(B)& §2.1093 - SAR-BASED EXEMPTION

Applicable Standard

According to FCC §2.1093 and §1.1307(b)(3)(i)(B)

According to KDB 447498 D04 Interim General RF Exposure Guidance v01

This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold Pth (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by Formula (B.2).

$$P_{\text{th}}\ (\text{mW}) = \begin{cases} ERP_{20\ \text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ \text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \quad \text{(B. 2)}$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ \text{cm}}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1).
The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

$$P_{\text{th}}\ (\text{mW}) = ERP_{20\ \text{cm}}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \quad \text{(B. 1)}$$

$$\sum_{i=1}^{a}\frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b}\frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k} \le 1 \quad \text{(C. 1)}$$

a number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for P_{th}, including existing exempt transmitters and those being added.

b number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.

c number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.

P_i the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

$P_{\text{th},i}$ the exemption threshold power (Pth) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source i.

ERP_j the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j.

$ERP_{\text{th},j}$ exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

$Evaluated_k$ the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation.

$Exposure\ Limit_k$ either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources, as applicable

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance.

Measurement Result

For worst case:

Radio	Frequency (MHz)	Distance (mm)	P_{th} (mW)	Maximum Conducted Power including Tune-up Tolerance (dBm)	Antenna Gain (dBi)	The Greater of Conducted Power	
						dBm	mW
BLE	2402-2480	5	2.72	2	1.62	2	1.58

Note: Max tune-up conducted power# and antenna gain# was declared and provided by the applicant

Result: Compliant

RSS-102 § 6.3 -SAR EXEMPTION LIMITS

Applicable Standard

According to RSS-102 Issue 6§ 6.3-SAR exemption limits. Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in table 11, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

The exemption limits in table 11 Table 11 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a flat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

For limb-worn devices where the 10 gram of tissue applies, the exemption limits for routine evaluation in table 11 are multiplied by a factor of 2.5.

For controlled-use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in table 11 Table 11 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in table 11, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in table 11, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.

For implanted medical devices, the exemption limit for routine SAR evaluation is set at an output power of 1 mW, regardless of frequency.

The SAR levels from exempted transmitters shall be included in the compliance assessment and the determination of the TER. Detailed guidance is included in sections 7.1.8 and 8.2.2.1.

Test Result:

For worst case:

Mode	Frequency (MHz)	Gain# (dBi)	Max tune-up conducted power# (dBm)	Max tune-up EIRP# (dBm)	Max tune-up EIRP# (mW)	Distance (mm)	Exemption Limit (mW)	SAR Evaluation Exemption
BLE	2402-2480	1.62	2.00	3.62	2.30	5	2.97	Yes

Note 1: (2480-2450)/(3500-2450)= (3-P)/(3-2), the exemption limit of 2480MHz is P= 2.97 mW
Note 2: The max tune-up conducted power# and antenna gain# were declared by the applicant

Result: Compliant

FCC §15.203 & RSS-GEN §6.8 - 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.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be res ponsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.
c. 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.

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.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device. Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached; fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Gain# (dBi)	Impedance (Ω)	Frequency Range (GHz)
PCB	1.62	50	2.4~2.5

Result: Compliant

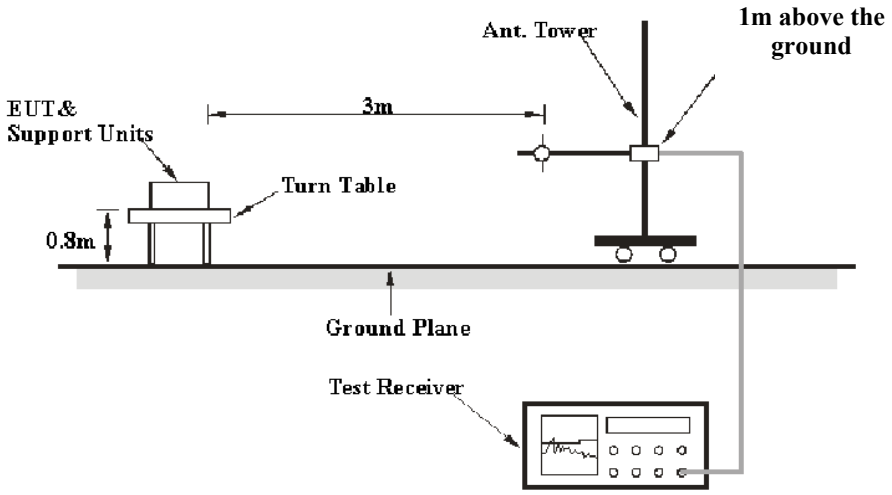
FCC §15.209, §15.205 & §15.247(D), RSS-GEN § 8.10 & RSS-247 § 5.5 - UNWANTED EMISSION FREQUENCIES AND RESTRICTED BANDS

Applicable Standard

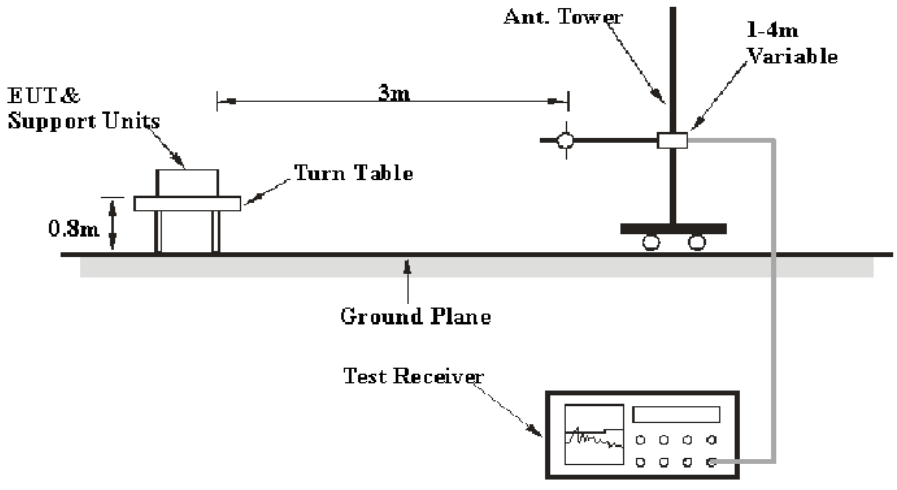
FCC §15.247 (d); §15.209; §15.205; RSS-247 §5.5, RSS-GEN §8.10.

EUT Setup

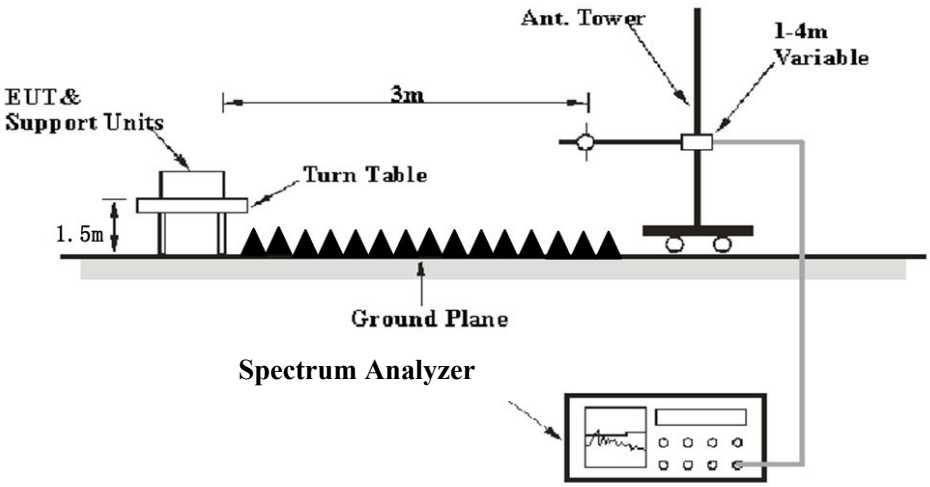
9 kHz-30MHz:



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, RSS-Gen and RSS-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

1-25GHz:
Pre-scan

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	5 kHz
	<98%	1MHz	≥1/Ton, not less than 5 kHz

Final measurement for emission identified during pre-scan

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 / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	22~24.4 °C
Relative Humidity:	51.2~54 %
ATM Pressure:	101 kPa

The testing was performed by Anson Su on 2024-11-13 for below 1GHz and Dylan Yang on 2024-11-15 to 2024-11-17 for above 1GHz.

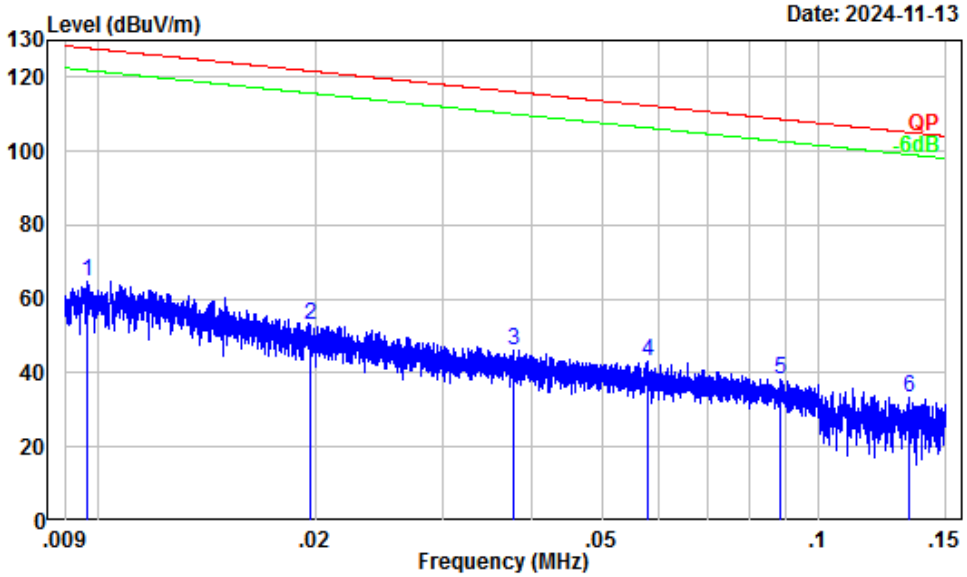
EUT operation mode: Transmitting

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

The spurious emission from 9 kHz-30MHz of IC RSS-GEN standard, the unit of final result on the test plots are dBµV/m, so the limit should be added by 51,5 dB from dBµA/m to dBµV/m.

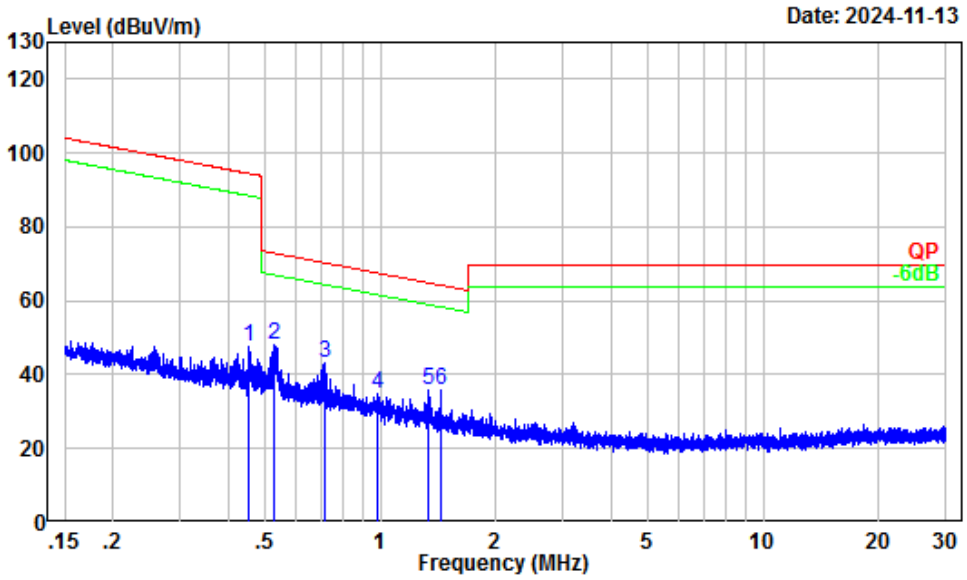
9 kHz-30MHz: *(Maximum output power mode, BLE 2M, Low Channel)*

Parallel (worst case)



Site : Chamber A
Condition : 3m
Project Number: 2401Y98830E-RF
Test Mode : Transmitting
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.01	37.96	26.91	64.87	127.91	-63.04	Peak
2	0.02	32.71	20.47	53.18	121.69	-68.51	Peak
3	0.04	25.77	20.48	46.25	116.06	-69.81	Peak
4	0.06	22.02	21.30	43.32	112.37	-69.05	Peak
5	0.09	18.22	19.83	38.05	108.70	-70.65	Peak
6	0.13	15.49	18.05	33.54	105.10	-71.56	Peak

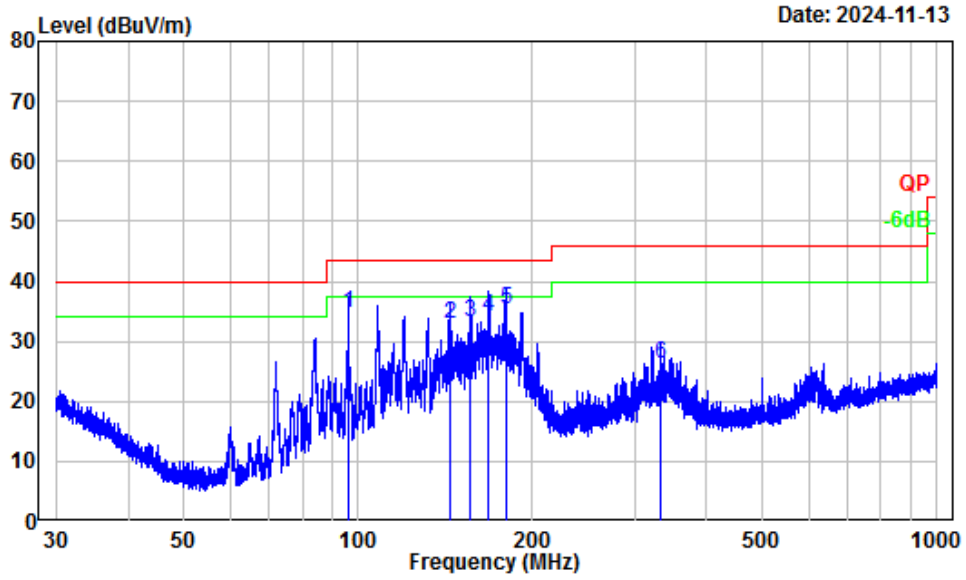


Site : Chamber A
Condition : 3m
Project Number: 2401Y98830E-RF
Test Mode : Transmitting
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	0.45	4.48	43.25	47.73	94.48	-46.75	Peak
2	0.53	3.14	44.89	48.03	73.13	-25.10	Peak
3	0.71	0.92	42.10	43.02	70.47	-27.45	Peak
4	0.99	-1.49	36.48	34.99	67.59	-32.60	Peak
5	1.34	-2.77	38.36	35.59	64.88	-29.29	Peak
6	1.43	-3.10	39.04	35.94	64.27	-28.33	Peak

30MHz-1GHz: *(Maximum output power mode BLE 2M, Low Channel)*

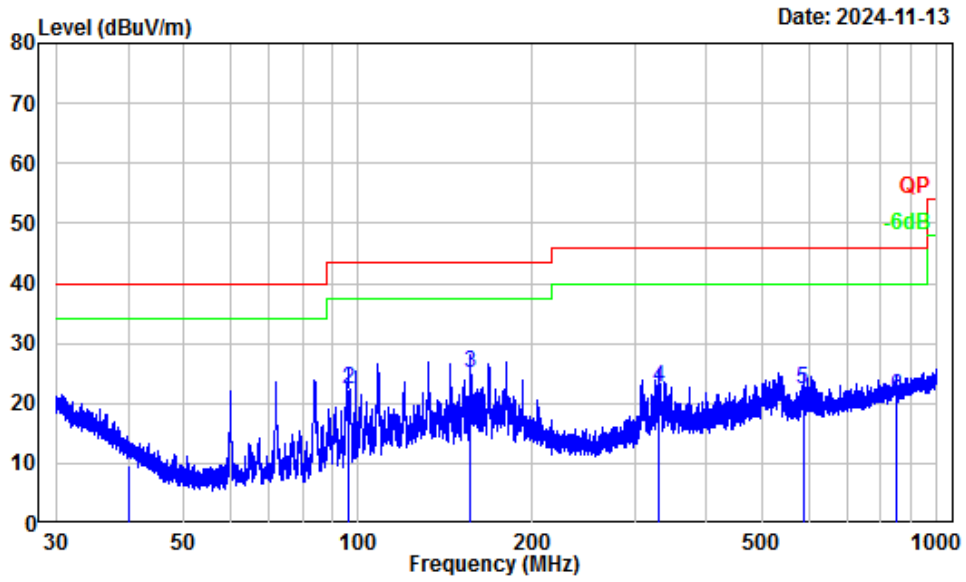
Horizontal



Site : Chamber A
Condition : 3m Horizontal
Project Number: 2401Y98830E-RF
Test Mode : Transmitting
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	96.14	-17.73	52.30	34.57	43.50	-8.93	QP
2	144.21	-13.33	46.25	32.92	43.50	-10.58	QP
3	156.12	-13.85	47.14	33.29	43.50	-10.21	QP
4	167.75	-14.29	48.32	34.03	43.50	-9.47	QP
5	179.94	-12.89	48.29	35.40	43.50	-8.10	QP
6	333.10	-12.48	38.86	26.38	46.00	-19.62	QP

Vertical



Site : Chamber A
Condition : 3m Vertical
Project Number: 2401Y98830E-RF
Test Mode : Transmitting
Tester : Anson Su

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	40.01	-13.21	22.88	9.67	40.00	-30.33	QP
2	96.23	-17.71	39.99	22.28	43.50	-21.22	QP
3	156.12	-13.85	38.87	25.02	43.50	-18.48	QP
4	330.48	-12.53	35.16	22.63	46.00	-23.37	QP
5	587.10	-8.41	30.66	22.25	46.00	-23.75	QP
6	854.02	-4.11	25.36	21.25	46.00	-24.75	QP

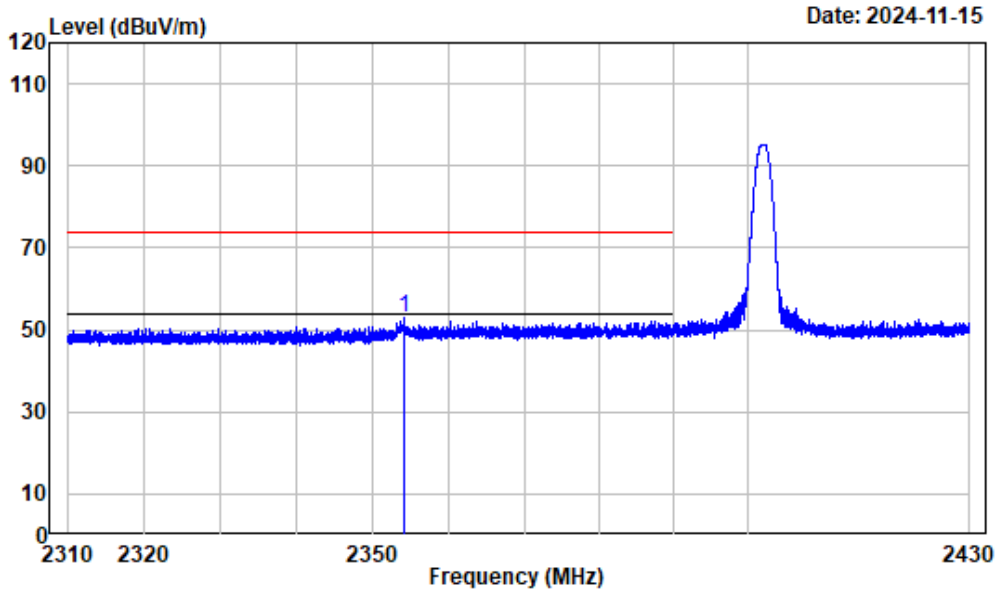
1-25 GHz:

Frequency (MHz)	Receiver		Polar (H/V)	Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	PK/AV					
BLE 1M							
Low Channel 2402MHz							
4804.00	50.31	PK	H	2.42	52.73	74	-21.27
4804.00	43.28	AV	H	2.42	45.70	54	-8.30
4804.00	45.78	PK	V	2.42	48.20	74	-25.80
4804.00	33.68	AV	V	2.42	36.10	54	-17.90
Middle Channel 2440MHz							
4880.00	49.63	PK	H	2.58	52.21	74	-21.79
4880.00	42.11	AV	H	2.58	44.69	54	-9.31
4880.00	46.84	PK	V	2.58	49.42	74	-24.58
4880.00	34.57	AV	V	2.58	37.15	54	-16.85
High Channel 2480MHz							
4960.00	48.71	PK	H	2.69	51.40	74	-22.60
4960.00	41.29	AV	H	2.69	43.98	54	-10.02
4960.00	47.02	PK	V	2.69	49.71	74	-24.29
4960.00	35.72	AV	V	2.69	38.41	54	-15.59
BLE 2M							
Low Channel 2402MHz							
4804.00	49.17	PK	H	2.42	51.59	74	-22.41
4804.00	40.96	AV	H	2.42	43.38	54	-10.62
4804.00	47.23	PK	V	2.42	49.65	74	-24.35
4804.00	35.88	AV	V	2.42	38.30	54	-15.70
Middle Channel 2440MHz							
4880.00	49.84	PK	H	2.58	52.42	74	-21.58
4880.00	39.80	AV	H	2.58	42.38	54	-11.62
4880.00	46.60	PK	V	2.58	49.18	74	-24.82
4880.00	35.82	AV	V	2.58	38.40	54	-15.60
High Channel 2480MHz							
4960.00	48.85	PK	H	2.69	51.54	74	-22.46
4960.00	39.24	AV	H	2.69	41.93	54	-12.07
4960.00	46.39	PK	V	2.69	49.08	74	-24.92
4960.00	35.35	AV	V	2.69	38.04	54	-15.96

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

Test plots for Band Edge Measurements (Radiated):

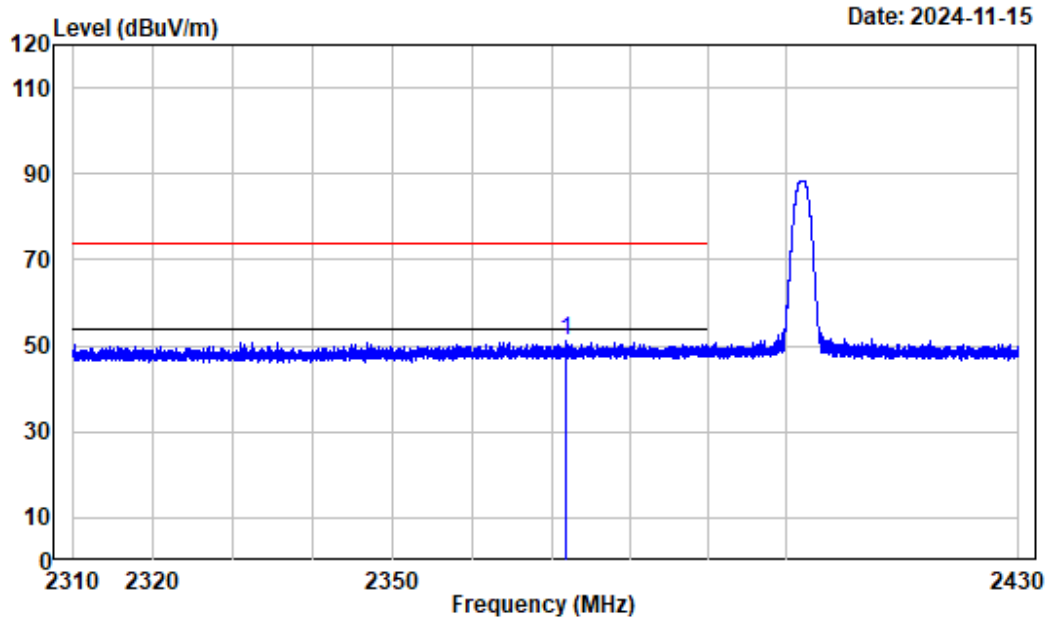
BLE 1M			
Test Channel:	**2402MHz**	**Ant. Polar. :**	**Horizontal**



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2354.121	-3.16	55.94	52.78	74.00	-21.22	peak

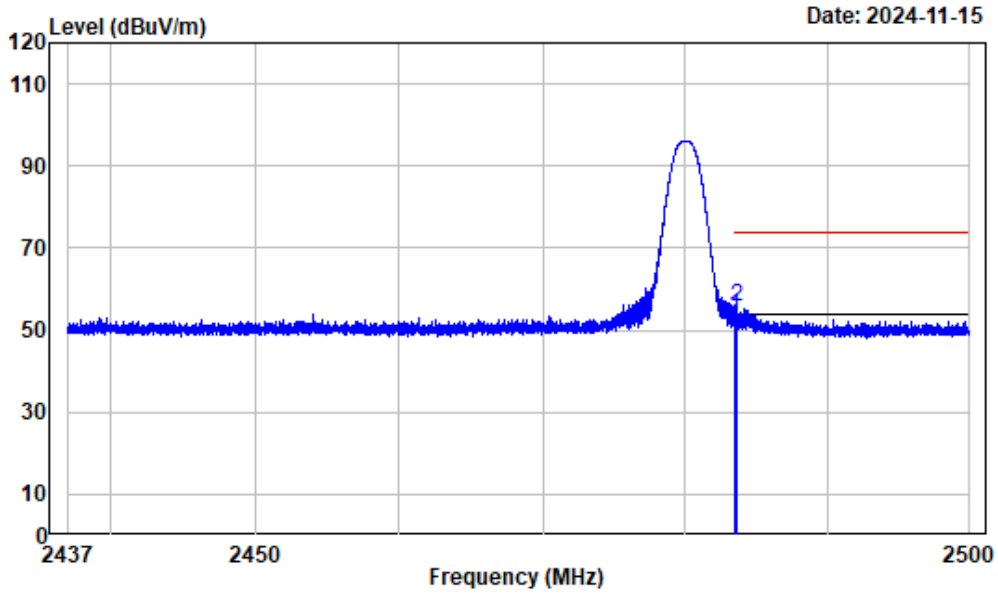
BLE 1M			
Test Channel:	**2402MHz**	**Ant. Polar. :**	**Vertical**



Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2371.958	-3.17	54.21	51.04	74.00	-22.96	peak

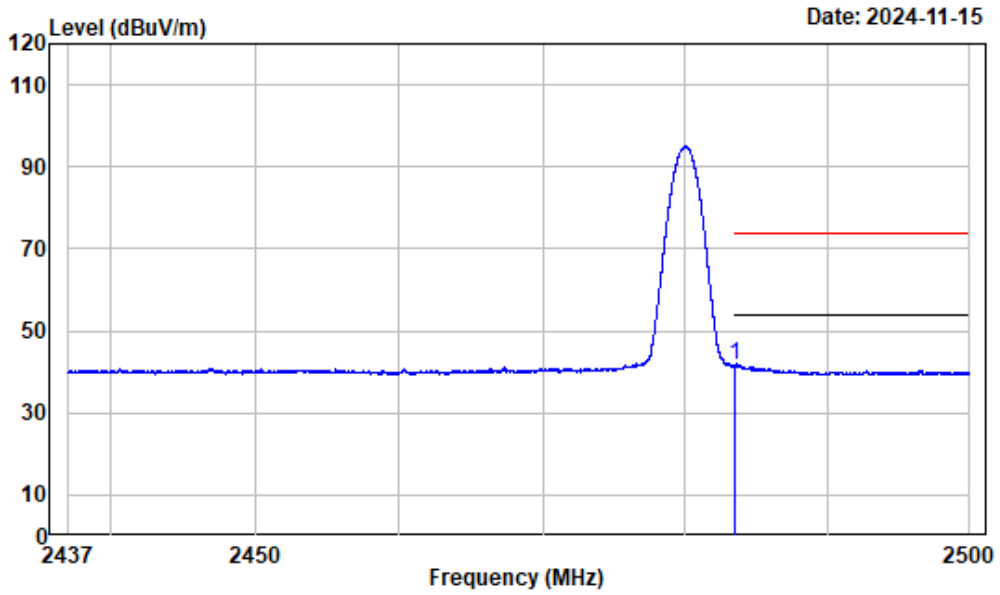
BLE 1M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Horizontal-Peak**



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	56.48	53.31	74.00	-20.69	Peak
2	2483.634	-3.17	58.78	55.61	74.00	-18.39	peak

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

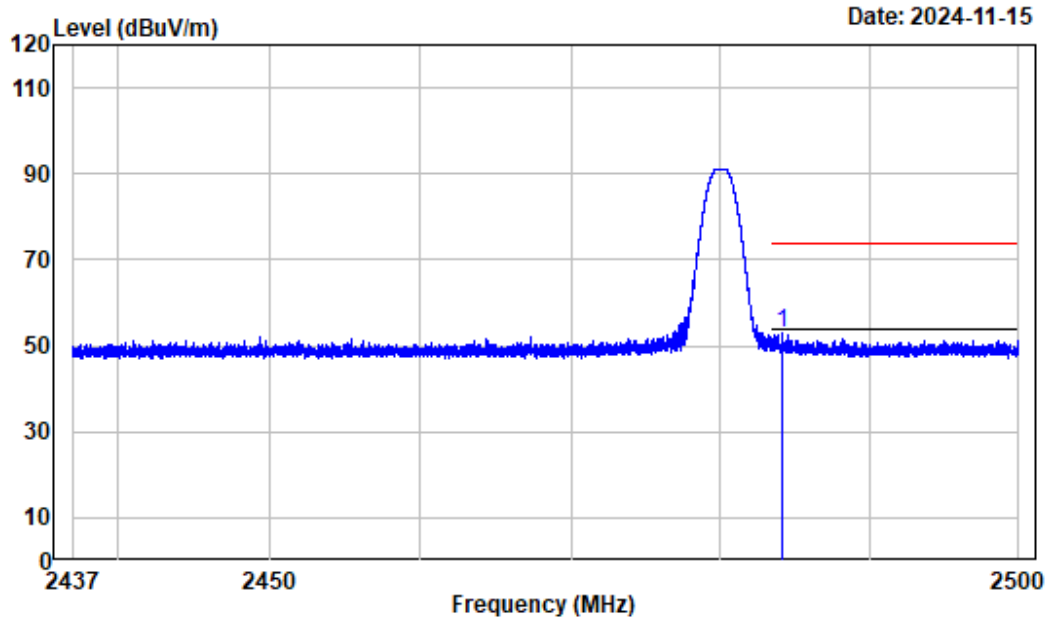


Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	44.66	41.49	54.00	-12.51	Average

Note: Spectrum analyzer setting: RBW=1 MHz, VBW=5 kHz

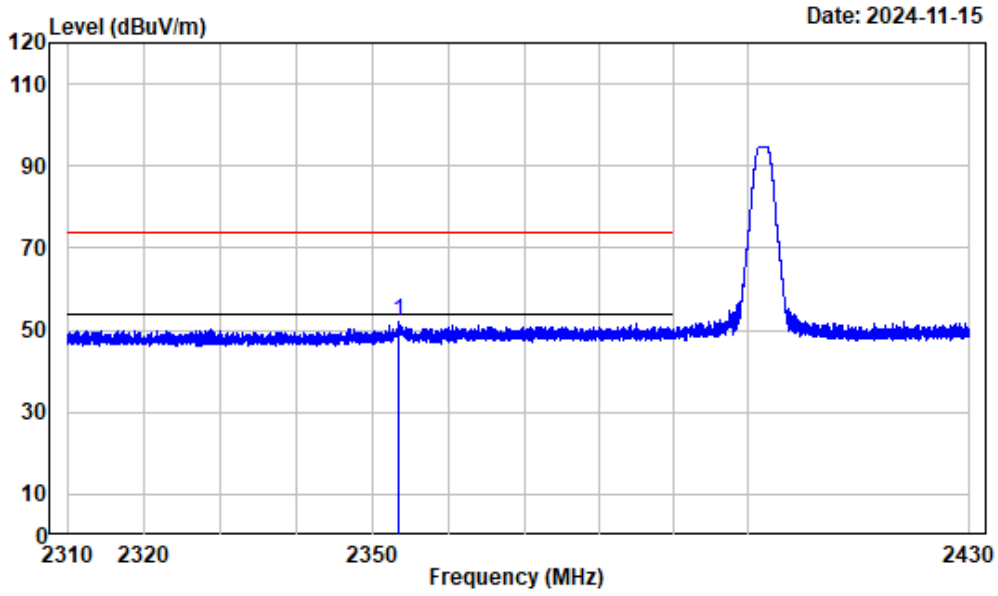
BLE 1M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Vertical**



Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2484.091	-3.17	56.12	52.95	74.00	-21.05	peak

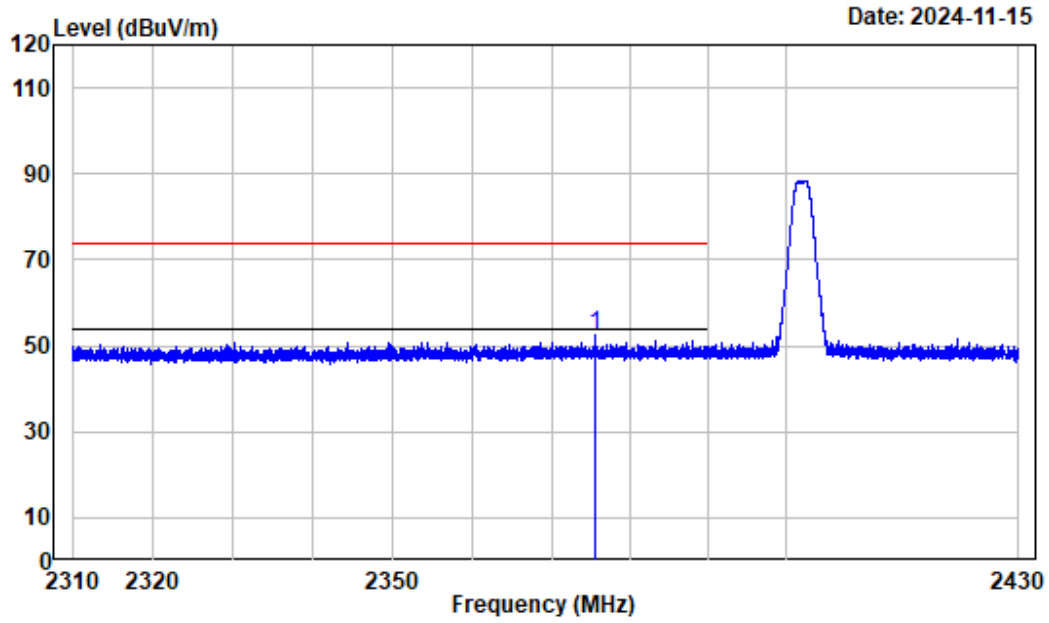
BLE 2M			
Test Channel:	**2402MHz**	**Ant. Polar. :**	**Horizontal**



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2353.281	-3.16	55.11	51.95	74.00	-22.05	peak

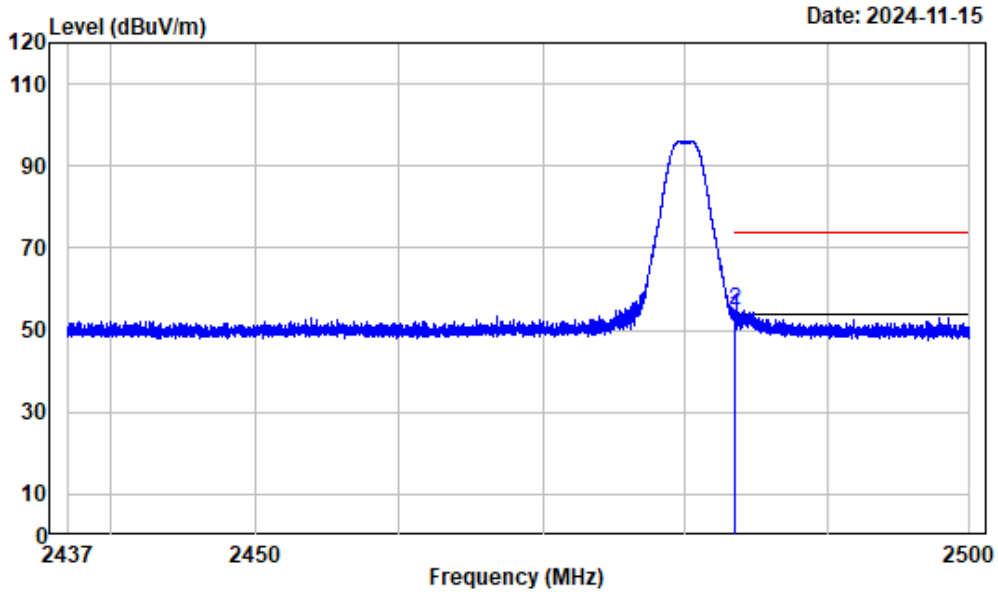
BLE2M			
Test Channel:	**2402MHz**	**Ant. Polar. :**	**Vertical**



Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2375.588	-3.18	55.55	52.37	74.00	-21.63	peak

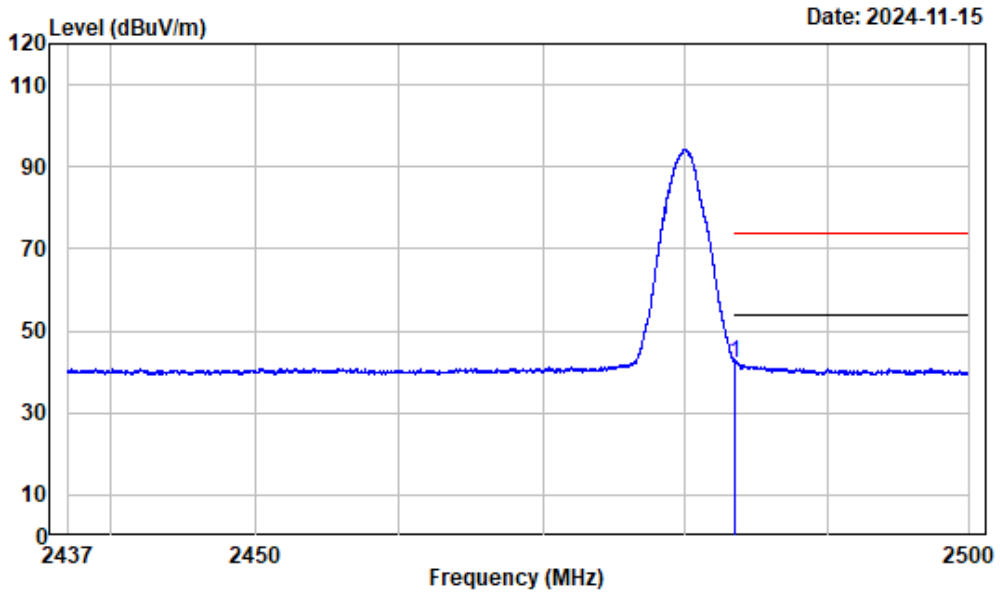
BLE 2M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Horizontal-Peak**



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	56.40	53.23	74.00	-20.77	Peak
2	2483.523	-3.17	58.02	54.85	74.00	-19.15	peak

BLE2M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Horizontal-Average**

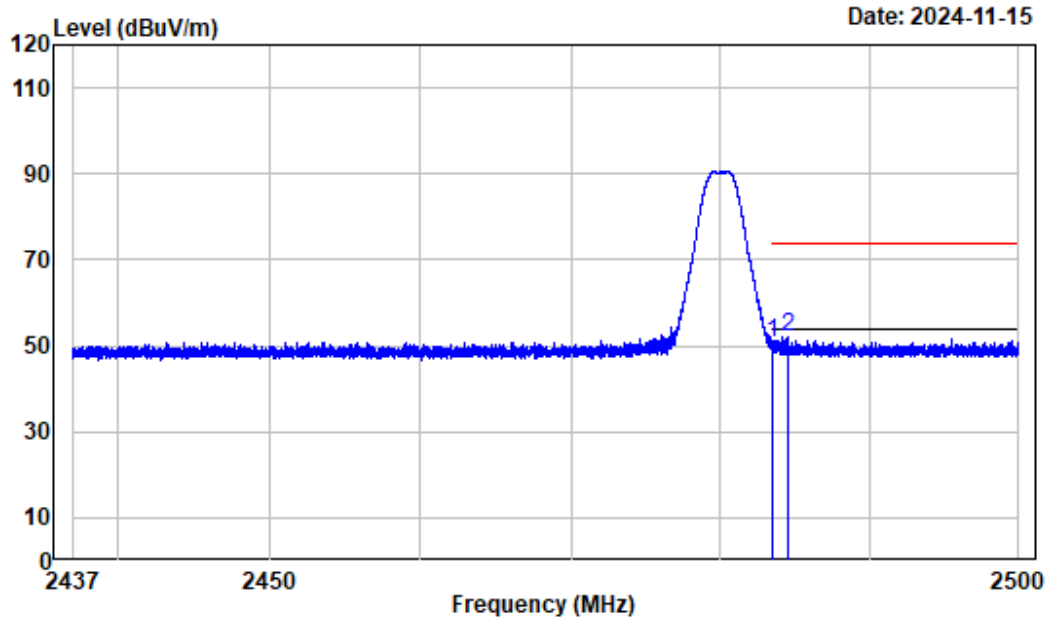


Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	45.48	42.31	54.00	-11.69	Average

Note: Spectrum analyzer setting: RBW=1 MHz, VBW=5 kHz

BLE2M			
Test Channel:	**2480MHz**	**Ant. Polar. :**	**Vertical**

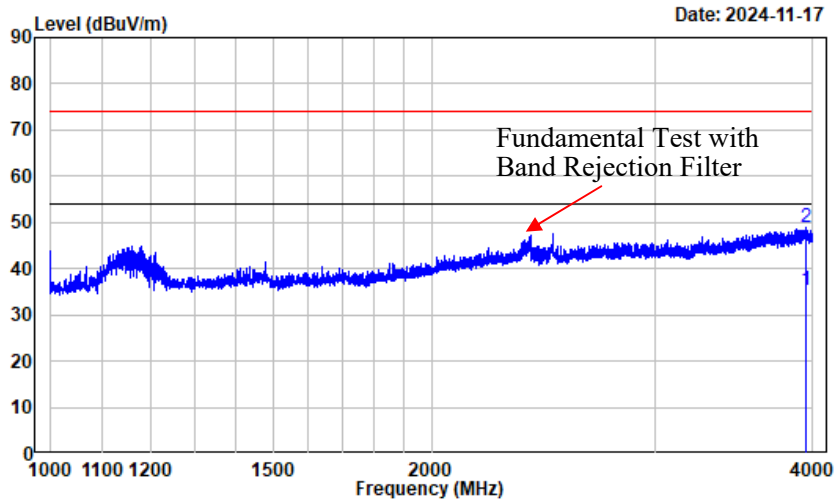


Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2480

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	2483.500	-3.17	54.02	50.85	74.00	-23.15	Peak
2	2484.469	-3.17	55.13	51.96	74.00	-22.04	peak

Listed with the worst harmonic margin test plot for each mode:

BLE 1M

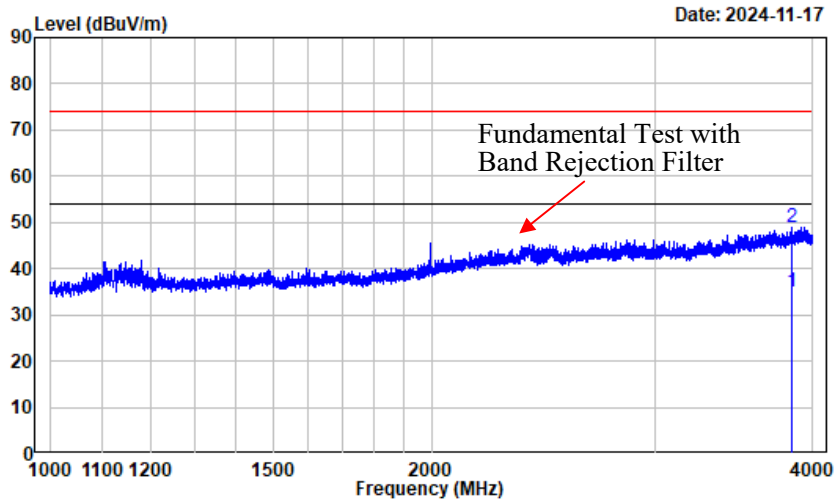
Horizontal	
1-4GHz	


```
Condition   : Horizontal
Project No.: 2401Y98830E-RF
Tester      : Dylan.Yang
Note        : BLE1M_2402
```

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3951.244	-0.16	35.62	35.46	54.00	-18.54	Average
2	3951.244	-0.16	48.95	48.79	74.00	-25.21	Peak

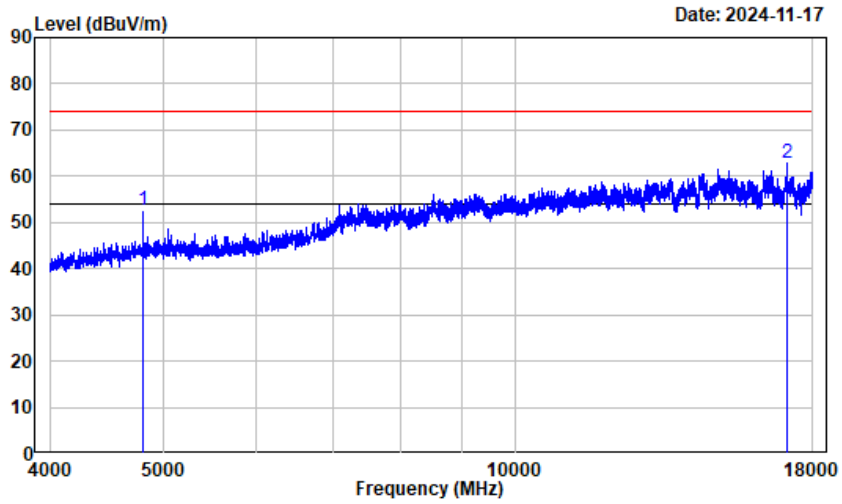
Vertical

1-4GHz



Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

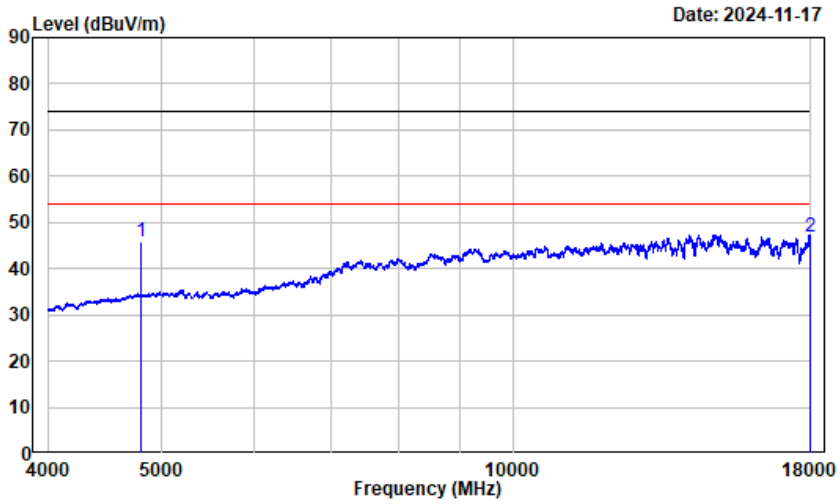
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3850.731	-0.78	35.69	34.91	54.00	-19.09	Average
2	3850.731	-0.78	49.82	49.04	74.00	-24.96	Peak

Horizontal-Peak	
4-18GHz	 Condition : Horizontal Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE1M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	50.31	52.73	74.00	-21.27	Peak
2	17102.140	18.03	44.73	62.76	74.00	-11.24	Peak

Horizontal-Average

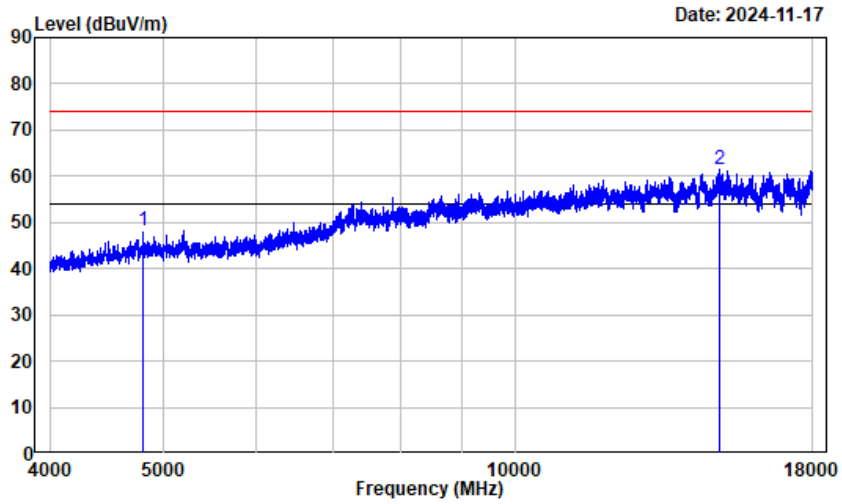
4-18GHz



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

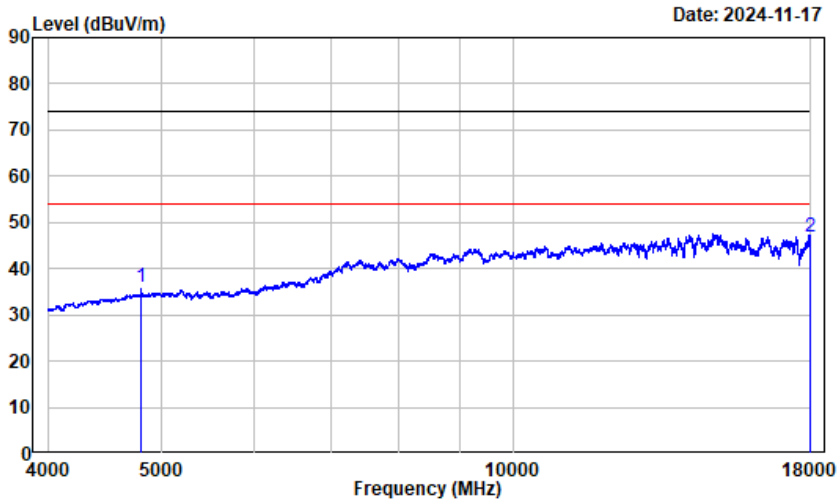
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	43.28	45.70	54.00	-8.30	Average
2	18000.000	24.62	22.25	46.87	54.00	-7.13	Average

Note: Spectrum Analyzer Setting: RBW=1MHz, VBW=5kHz

Vertical-Peak	
4-18GHz	 Condition : Vertical Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE1M_2402 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 4804.000 2.42 45.78 48.20 74.00 -25.80 Peak 2 14961.620 16.41 45.05 61.46 74.00 -12.54 Peak

Vertical-Average

4-18GHz

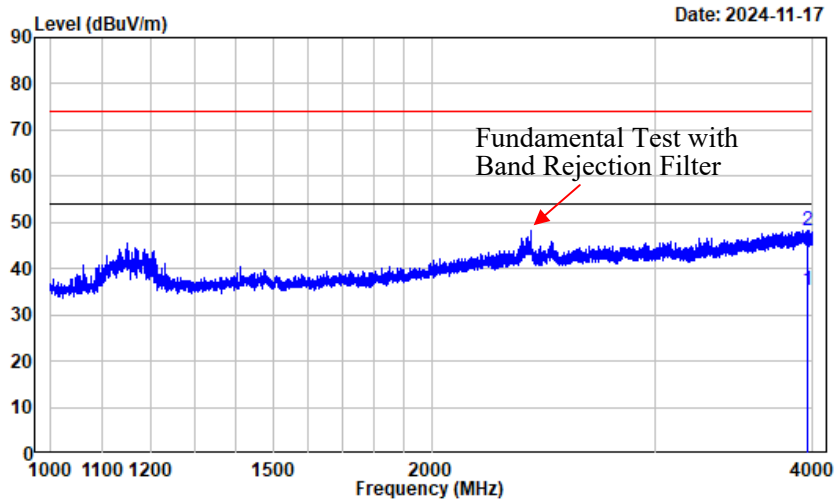


Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	33.68	36.10	54.00	-17.90	Average
2	17996.500	24.60	22.28	46.88	54.00	-7.12	Average

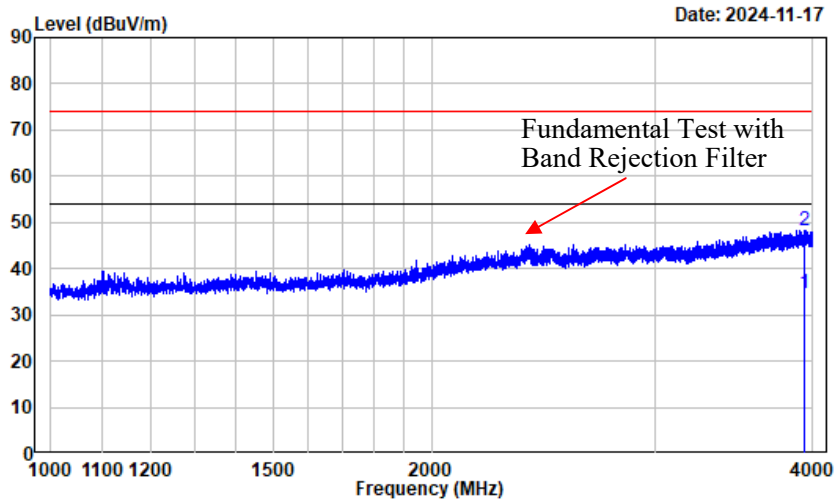
Note: Spectrum Analyzer Setting: RBW=1MHz, VBW=5kHz

BLE 2M

Horizontal	
1-4GHz	 Condition : Horizontal Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE2M_2402 | | Freq | Factor | Read Level | Level | Limit Line | Over Limit | Remark | | | MHz | dB/m | dBuV | dBuV/m | dBuV/m | dB | | | 1 | 3961.370 | -0.17 | 35.58 | 35.41 | 54.00 | -18.59 | Average | | 2 | 3961.370 | -0.17 | 48.37 | 48.20 | 74.00 | -25.80 | Peak |

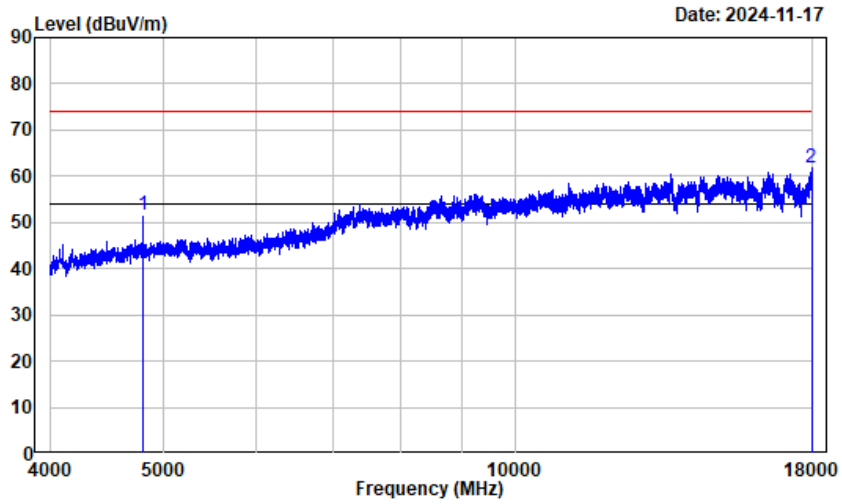
Vertical

1-4GHz



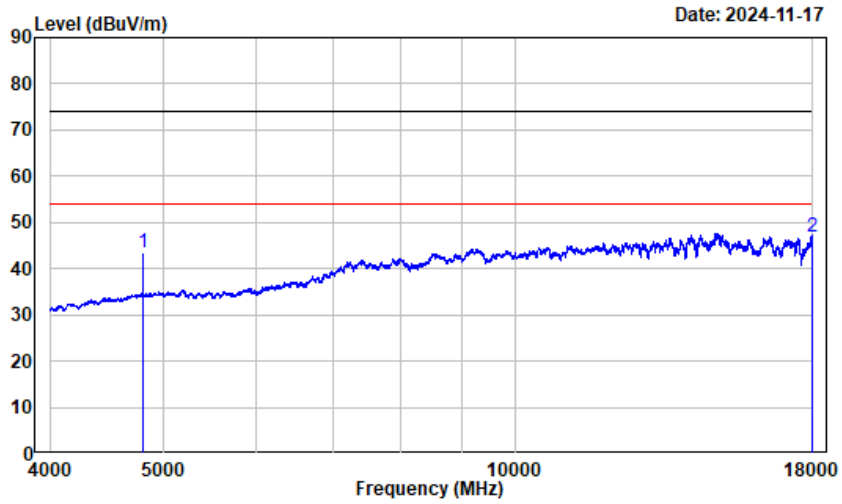
Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	3935.117	-0.28	34.84	34.56	54.00	-19.44	Average
2	3935.117	-0.28	48.42	48.14	74.00	-25.86	Peak

Horizontal-Peak	
4-18GHz	 Condition : Horizontal Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE2M_2402 Freq / Factor / Read Level / Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 4804.000 2.42 49.17 51.59 74.00 -22.41 Peak 2 17956.240 24.31 37.62 61.93 74.00 -12.07 Peak

Horizontal-Average

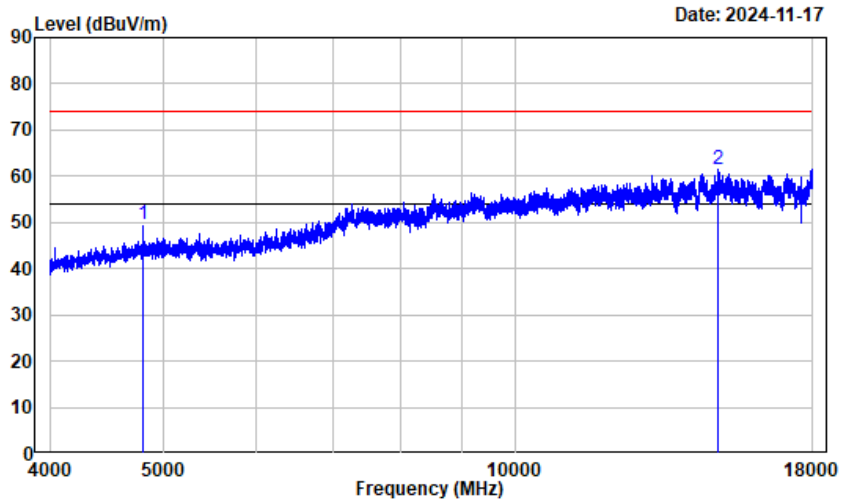
4-18GHz



Condition : Horizontal
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	40.96	43.38	54.00	-10.62	Average
2	17998.250	24.61	22.41	47.02	54.00	-6.98	Average

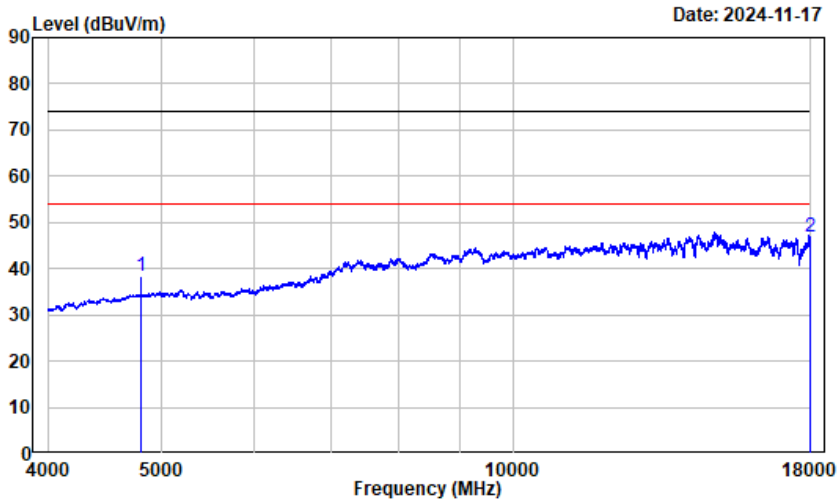
Note: Spectrum Analyzer Setting: RBW=1MHz, VBW=5kHz

Vertical-Peak	
4-18GHz	 Condition : Vertical Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	47.23	49.65	74.00	-24.35	Peak
2	14940.620	16.47	45.02	61.49	74.00	-12.51	Peak

Vertical-Average

4-18GHz

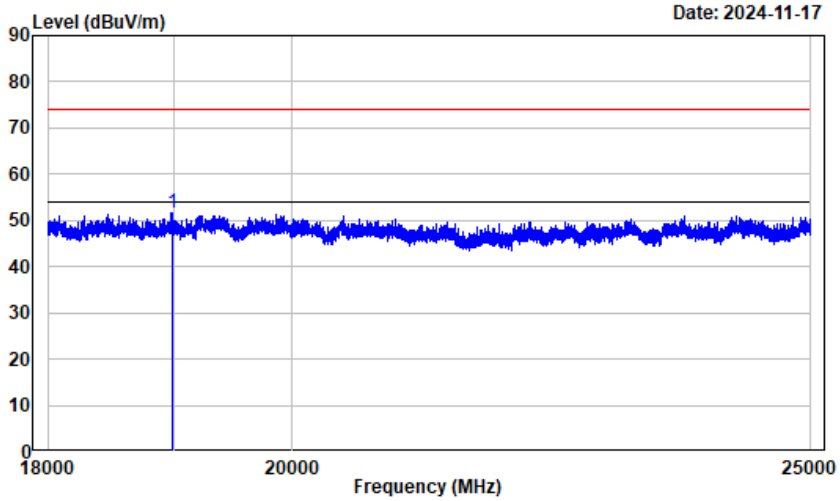


Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE2M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	4804.000	2.42	35.88	38.30	54.00	-15.70	Average
2	17998.250	24.61	22.39	47.00	54.00	-7.00	Average

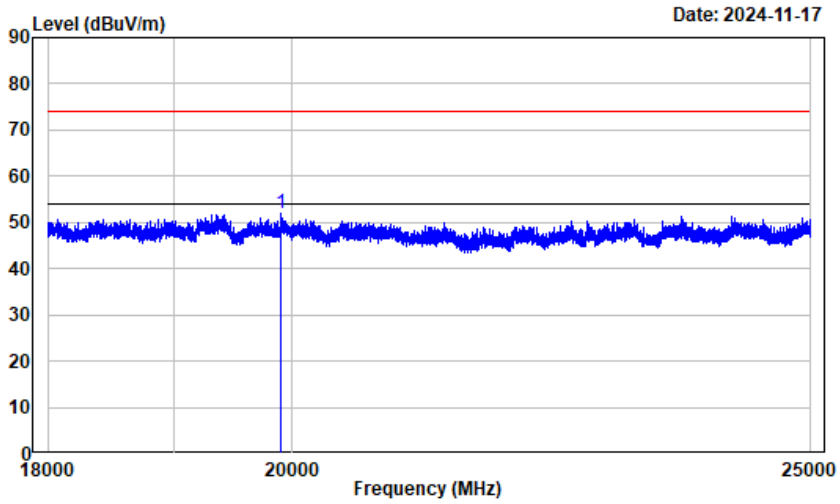
Note: Spectrum Analyzer Setting: RBW=1MHz, VBW=5kHz

For 18-25 GHz, just show the worst case mode (BLE 1M)

Horizontal	
18-25GHz	 Condition : Horizontal Project No.: 2401Y98830E-RF Tester : Dylan.Yang Note : BLE1M_2402 Freq / Factor / Read Level / Limit Level / Limit Line / Over Limit / Remark MHz / dB/m / dBuV / dBuV/m / dBuV/m / dB 1 18989.750 15.22 36.57 51.79 74.00 -22.21 Peak

Vertical

18-25GHz



Condition : Vertical
Project No.: 2401Y98830E-RF
Tester : Dylan.Yang
Note : BLE1M_2402

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	19899.860	15.42	36.51	51.93	74.00	-22.07	Peak

FCC §15.247(a) (2), RSS-GEN § 6.7 & RSS-247 § 5.2 (a) - 99% OCCUPIED BANDWIDTH & 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.

According to RSS-247 §5.2 a)
The minimum 6 dB bandwidth shall be 500 kHz.

According to RSS-Gen §6.7
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.
In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level 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, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

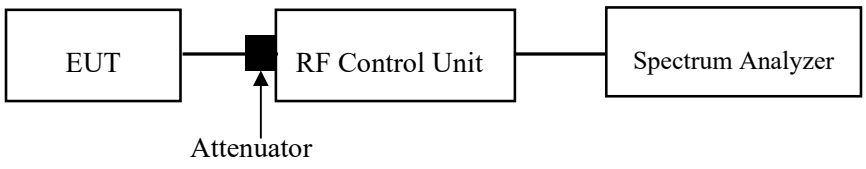
Test Procedure

Test Method: ANSI C63.10-2013 Clause 11.8.1 & Clause 6.9.3& RSS-Gen §6.7

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 associatedwith the two outermost amplitude points (upper and lower frequencies) that are attenuated by6 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 (for RSS rules, VBW shall not be smaller than 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 maybe reported in addition to the plot(s).



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Navilite Cai on 2024-11-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

FCC §15.247(b) (3), RSS-247 §5.4 (d) - 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.

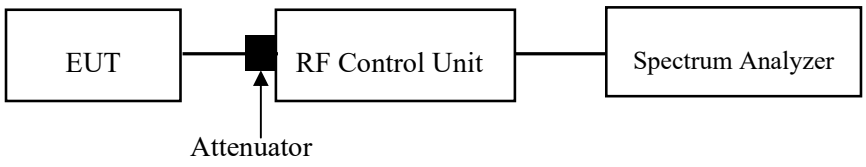
According to RSS-247§5.4 d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling 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 transmitting at a reduced power level. If multiple modes of operation are implemented, 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.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the cable loss was add with offset into test equipment, the total offset consists of attenuator and/or RF cable loss.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Navilite Cai on 2024-11-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

FCC §15.247(e), RSS-247 §5.2 (b) – 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.

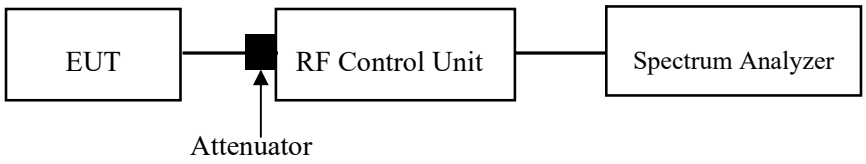
According to RSS-247 §5.2 b):

The transmitter power spectral density conducted from the transmitter 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 section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power)

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.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by client or lab, the cable loss was add with offset into test equipment, the total offset consists of attenuator and/or RF cable loss.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Navilite Cai on 2024-11-04.

Test Mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

FCC §15.247(d) & RSS-247 §5.5 - 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

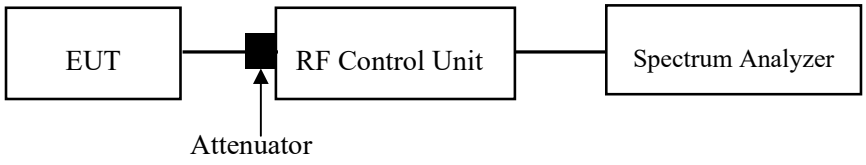
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Navilite Cai on 2024-11-04.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

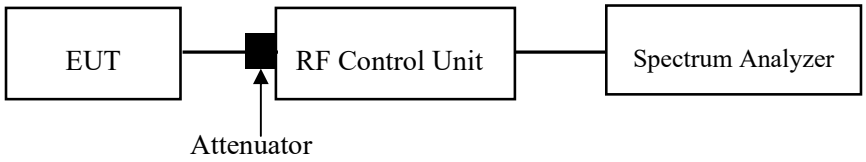
DUTY CYCLE

Duty Cycle

Test Procedure

According to ANSI C63.10-2013 Section 11.6

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:
1) Set the center frequency of the instrument to the center frequency of the transmission.
2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
3) Set VBW ≥ RBW. Set detector = peak or average.
4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if T ≤ 16.7 μs.)



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	101 kPa

The testing was performed by Navilite Cai on 2024-11-04.

EUT operation mode: Transmitting

Test Result: Please refer to the Appendix.

EUT PHOTOGRAPHS

Please refer to the attachment 2401Y98830E-RF External photo and 2401Y98830E-RF Internal photo.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2401Y98830E-RF Test Setup photo.

APPENDIX

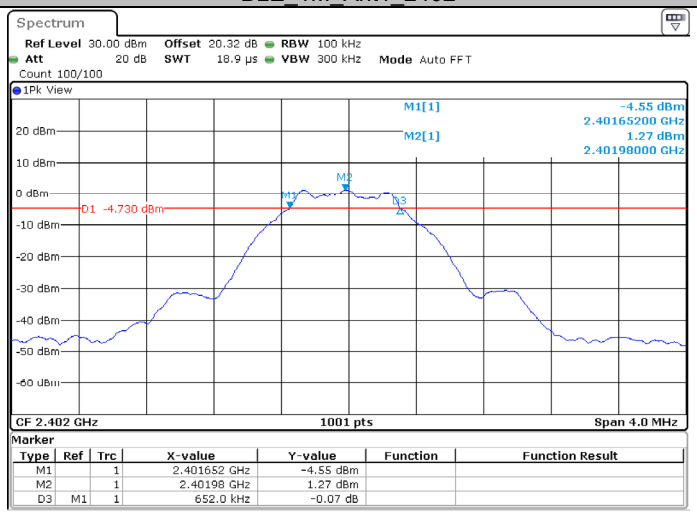
Appendix A: DTS Bandwidth

Test Result

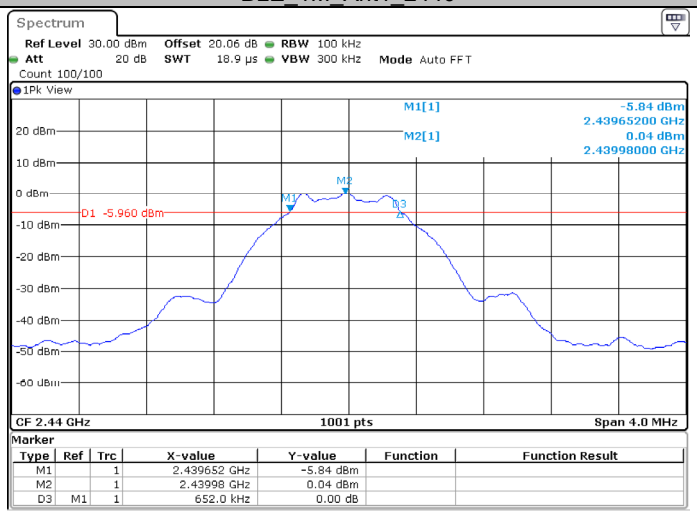
Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.65	0.5	PASS
		2440	0.65	0.5	PASS
		2480	0.65	0.5	PASS
BLE_2M	Ant1	2402	1.14	0.5	PASS
		2440	1.13	0.5	PASS
		2480	1.14	0.5	PASS

Test Graphs

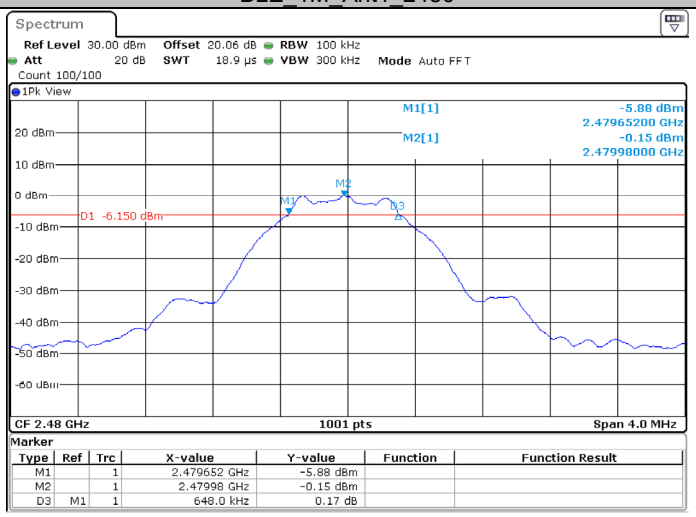
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



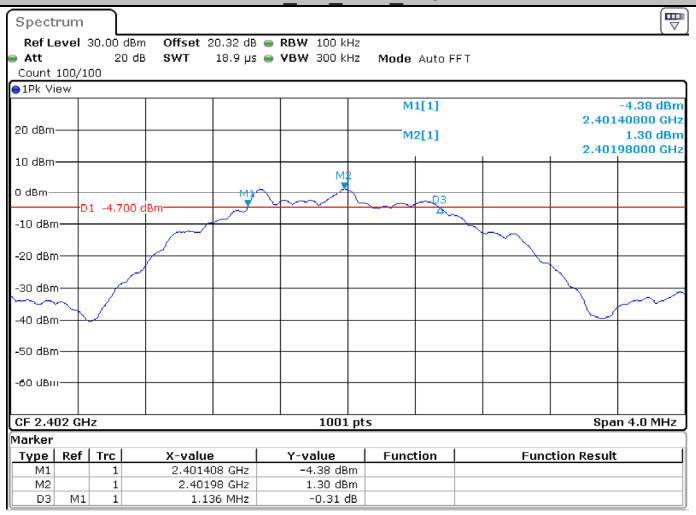
BLE_1M_Ant1_2480



ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai

Date: 4.NOV.2024 15:02:44

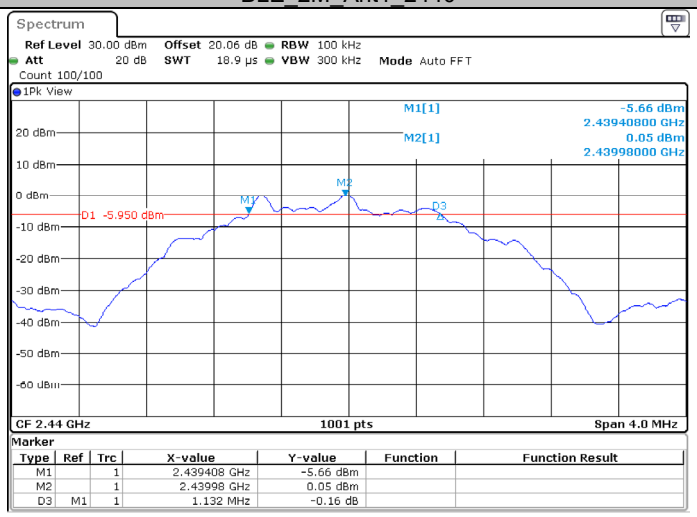
BLE_2M_Ant1_2402



ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai

Date: 4.NOV.2024 15:03:47

BLE_2M_Ant1_2440

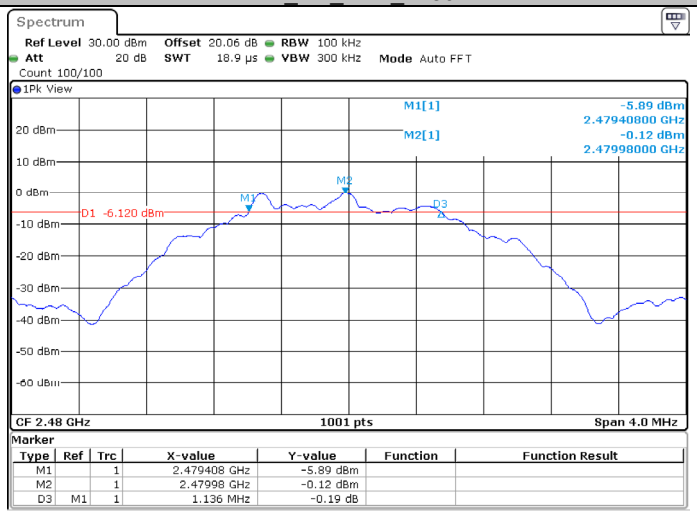


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.439408 GHz	-5.66 dBm		
M2		1	2.43998 GHz	0.05 dBm		
D3	M1	1	1.132 MHz	-0.16 dB		

ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:04:57

BLE_2M_Ant1_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479408 GHz	-5.89 dBm		
M2		1	2.47998 GHz	-0.12 dBm		
D3	M1	1	1.136 MHz	-0.19 dB		

ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:05:53

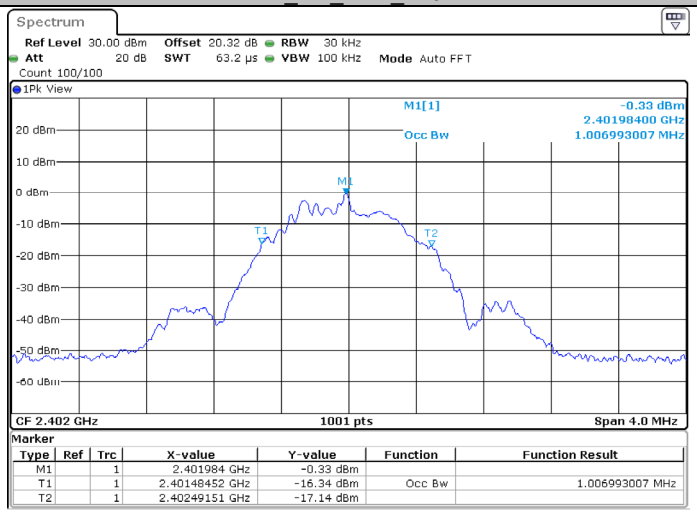
Appendix B: Occupied Channel Bandwidth

Test Result

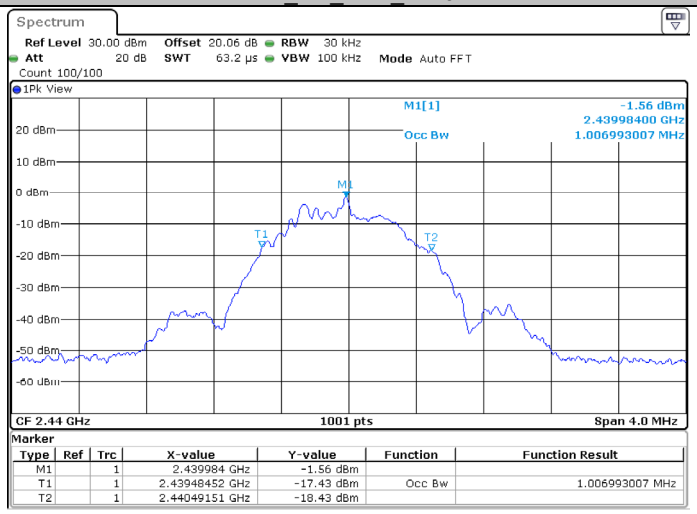
Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.007	---	---
		2440	1.007	---	---
		2480	1.007	---	---
BLE_2M	Ant1	2402	1.986	---	---
		2440	1.994	---	---
		2480	1.994	---	---

Test Graphs

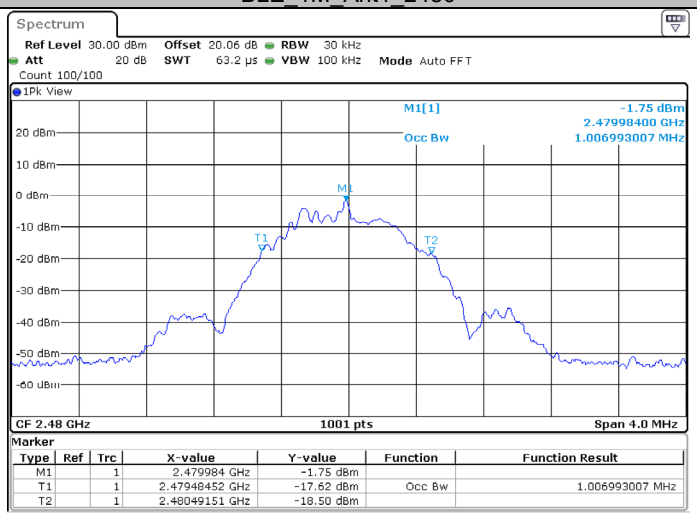
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

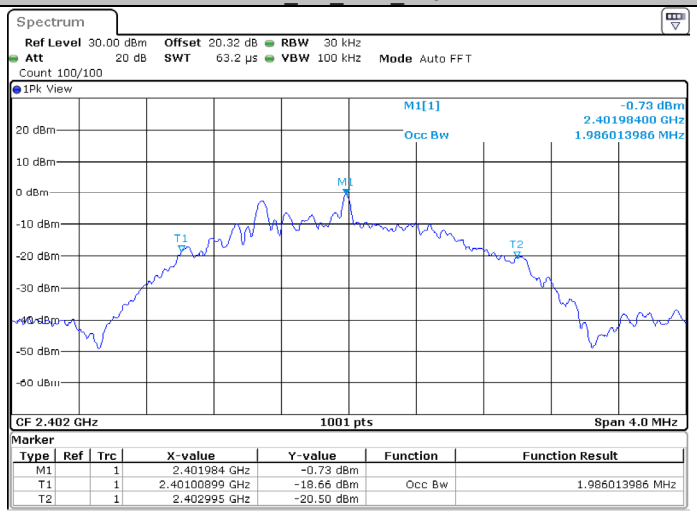


BLE_1M_Ant1_2480



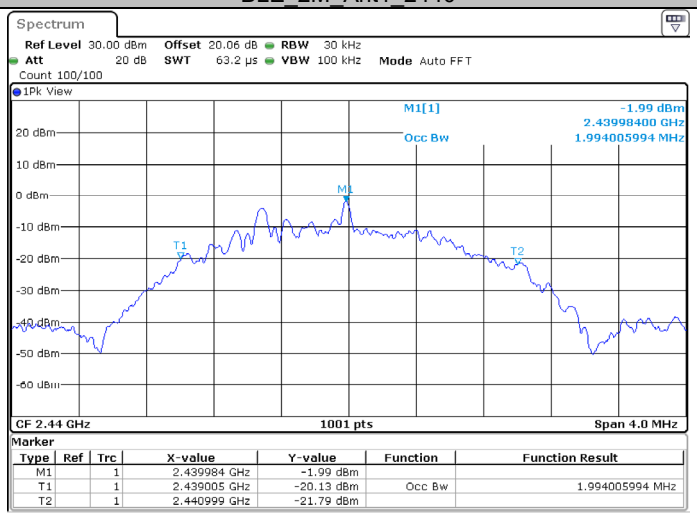
ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:02:50

BLE_2M_Ant1_2402



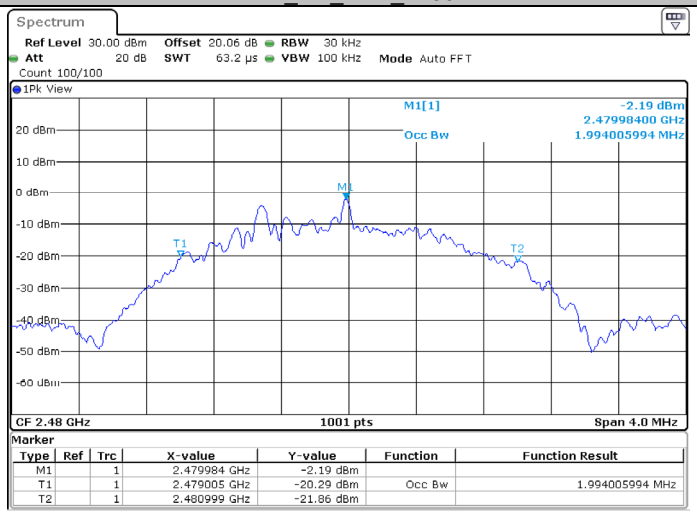
ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:03:53

BLE_2M_Ant1_2440



ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:05:03

BLE_2M_Ant1_2480



ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:05:58

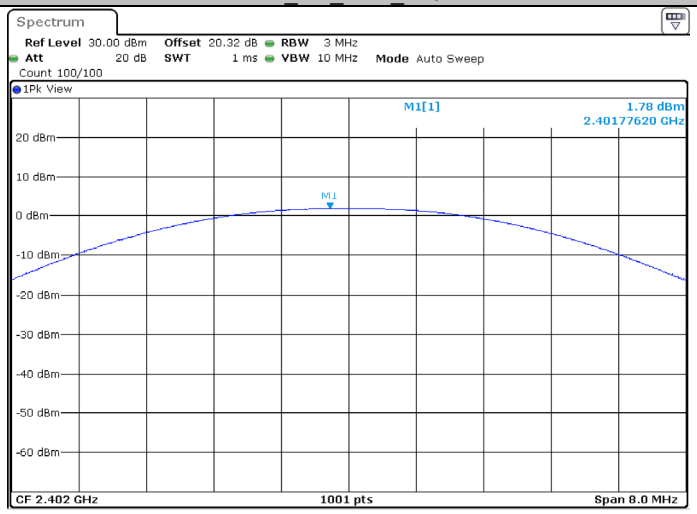
Appendix C: Maximum conducted output power

Test Result Peak

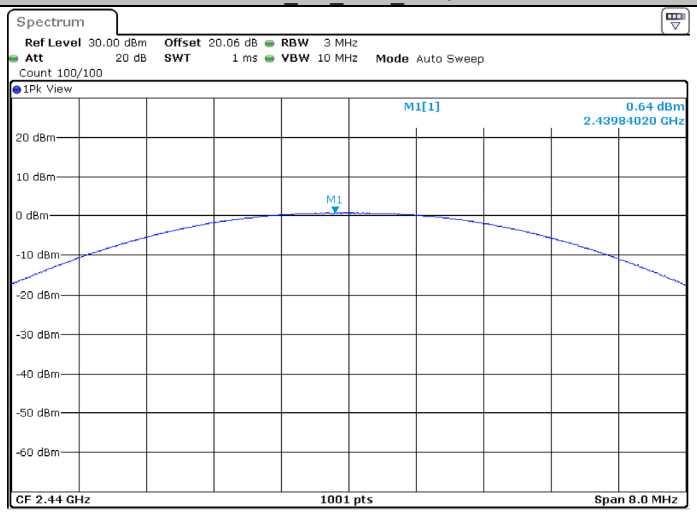
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
BLE_1M	Ant1	2402	1.78	≤30	3.40	≤36	PASS
		2440	0.64	≤30	2.26	≤36	PASS
		2480	0.43	≤30	2.05	≤36	PASS
BLE_2M	Ant1	2402	1.79	≤30	3.41	≤36	PASS
		2440	0.62	≤30	2.24	≤36	PASS
		2480	0.40	≤30	2.02	≤36	PASS

Test Graphs Peak

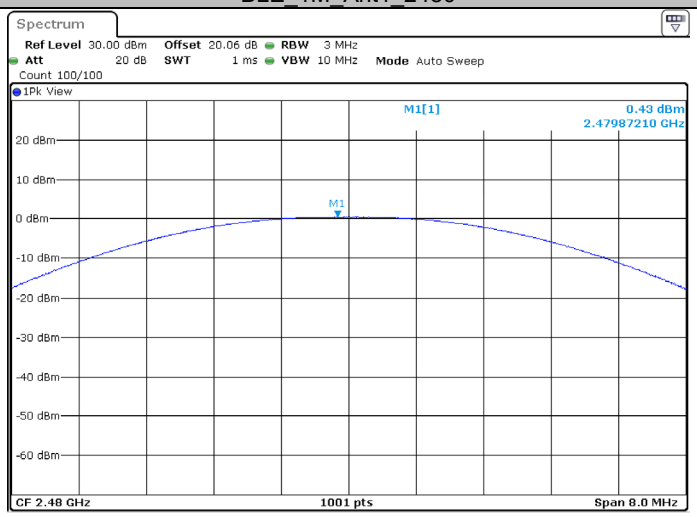
BLE_1M_Ant1_2402



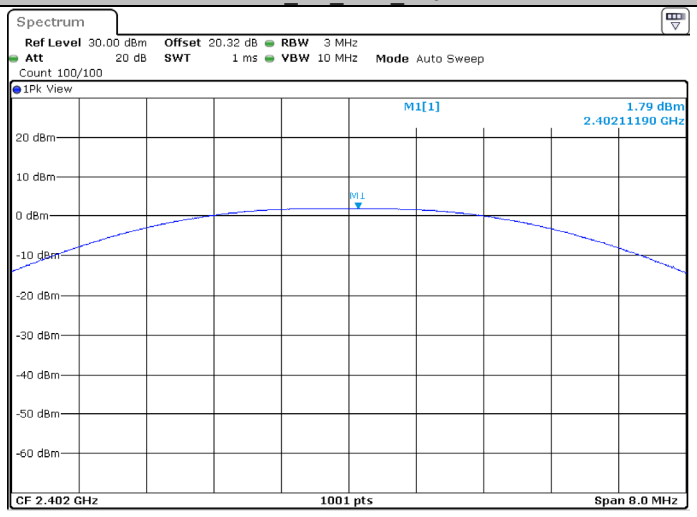
BLE_1M_Ant1_2440



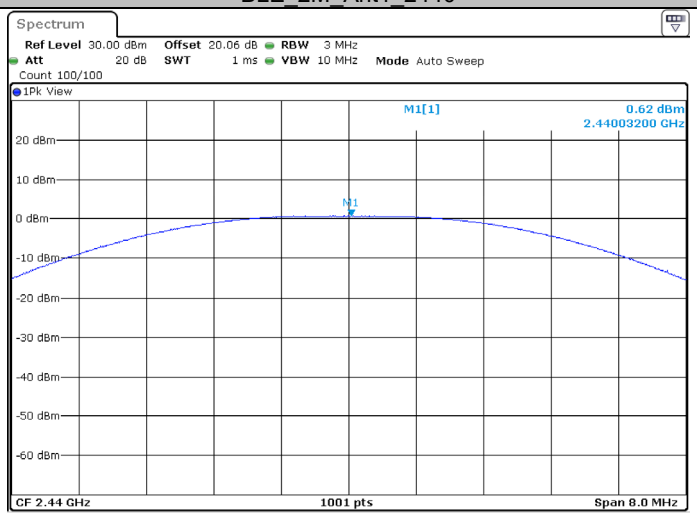
BLE_1M_Ant1_2480



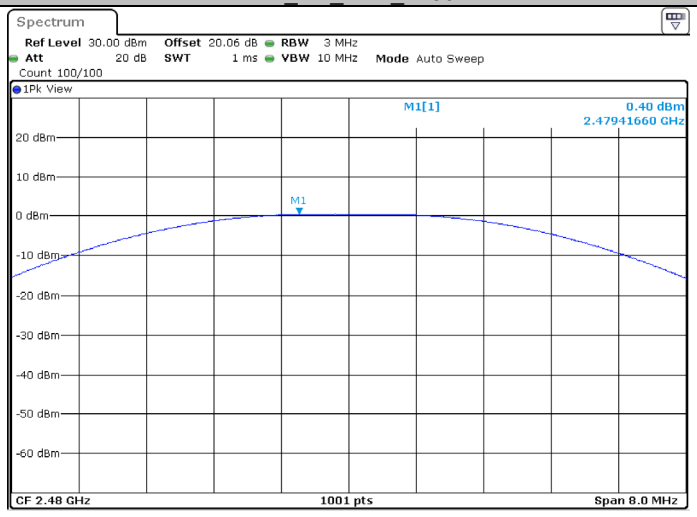
BLE_2M_Ant1_2402



BLE_2M_Ant1_2440



BLE_2M_Ant1_2480



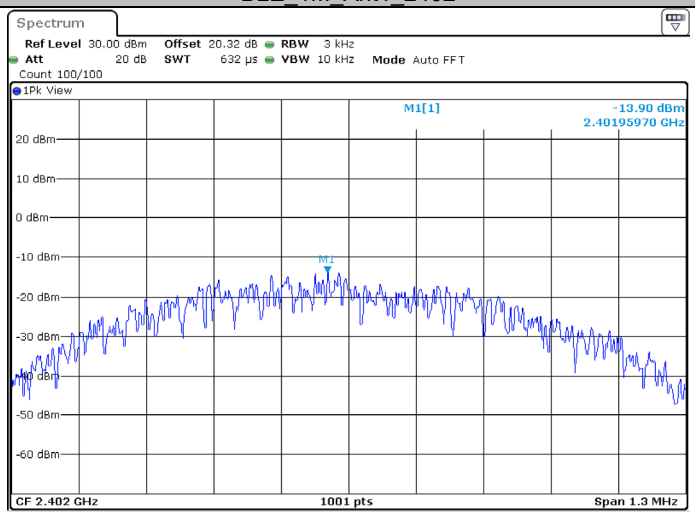
Appendix D: Maximum power spectral density

Test Result

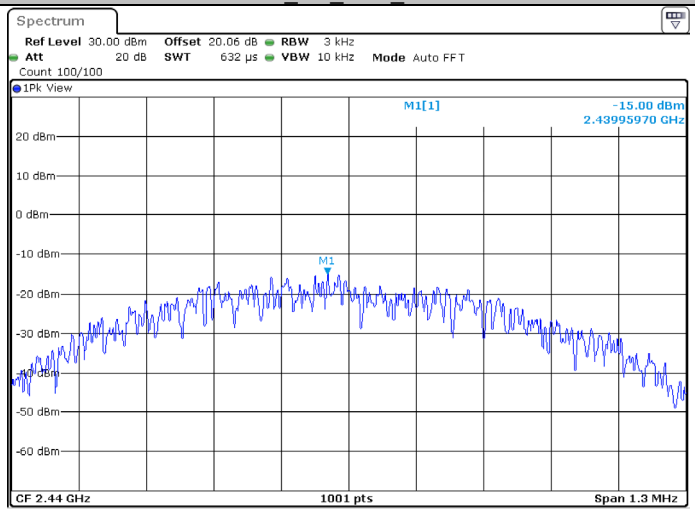
Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-13.90	≤8.00	PASS
		2440	-15.00	≤8.00	PASS
		2480	-15.25	≤8.00	PASS
BLE_2M	Ant1	2402	-15.28	≤8.00	PASS
		2440	-16.52	≤8.00	PASS
		2480	-16.75	≤8.00	PASS

Test Graphs

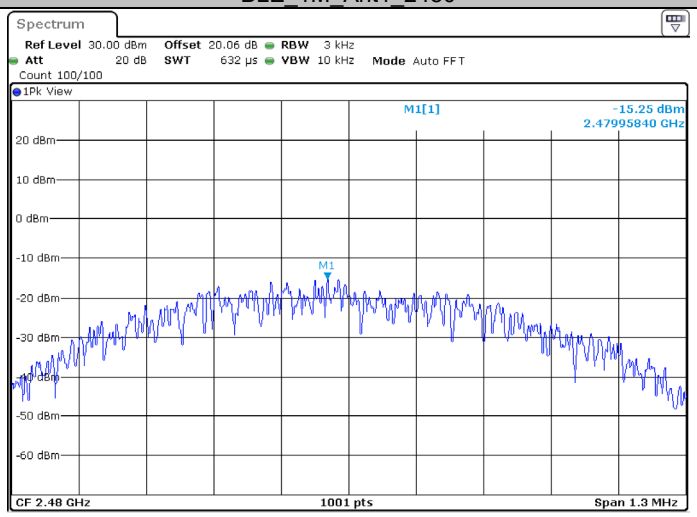
BLE_1M_Ant1_2402



BLE_1M_Ant1_2440

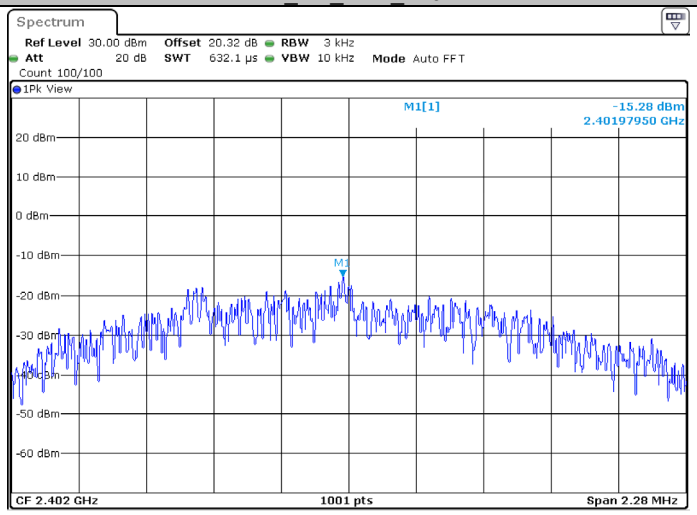


BLE_1M_Ant1_2480



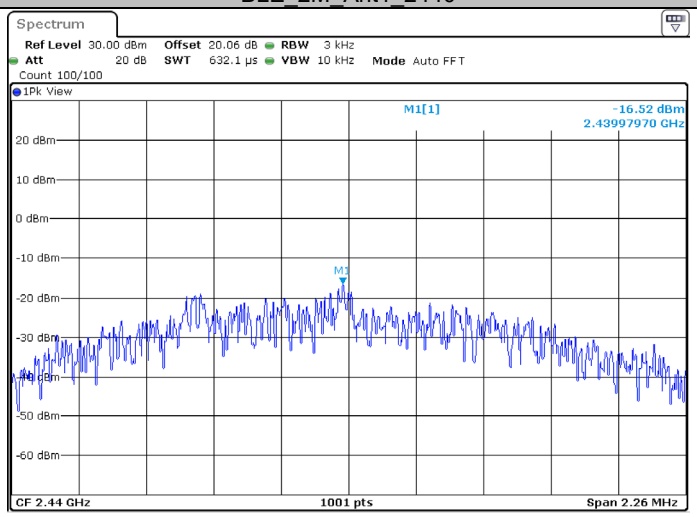
ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:03:02

BLE_2M_Ant1_2402

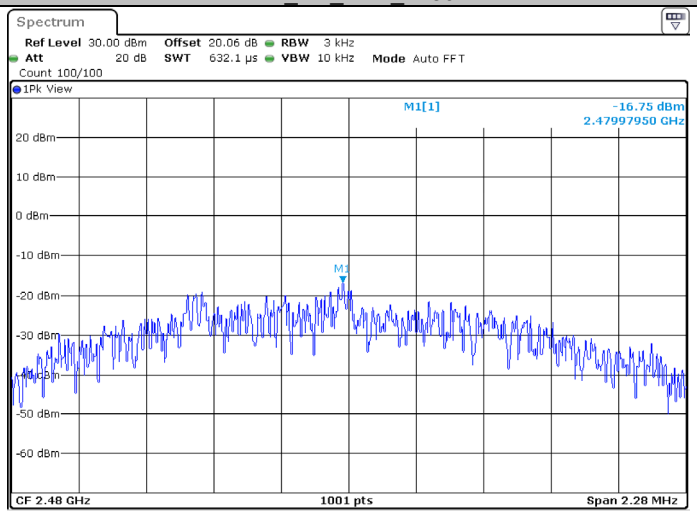


ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:04:05

BLE_2M_Ant1_2440



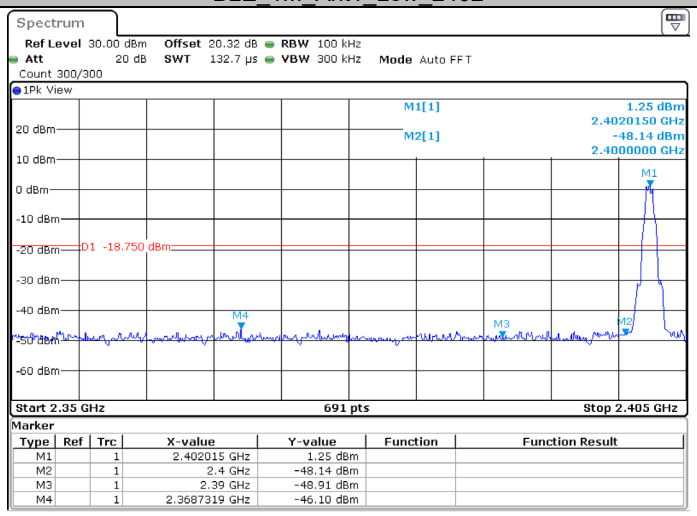
BLE_2M_Ant1_2480



Appendix E: Band edge measurements

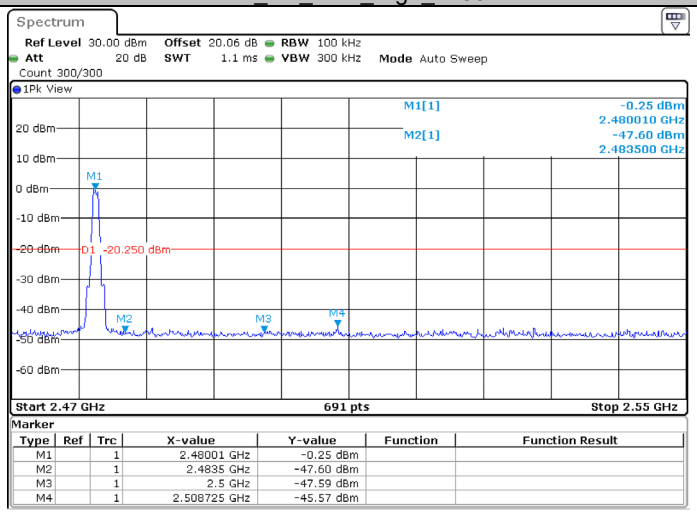
Test Graphs

BLE_1M_Ant1_Low_2402



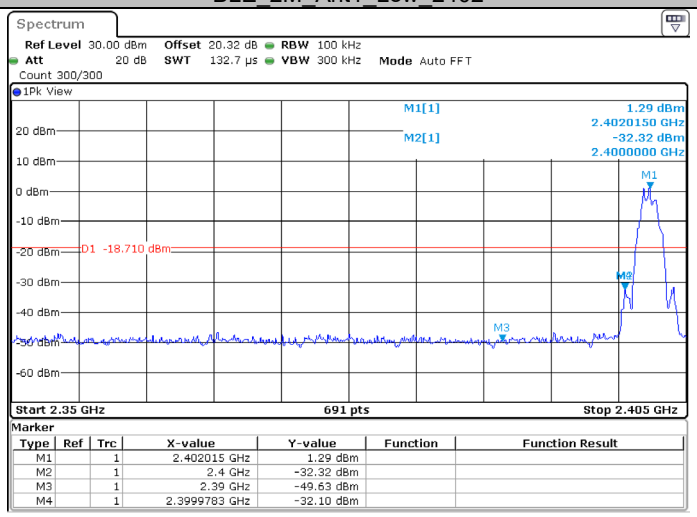
ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:01:18

BLE_1M_Ant1_High_2480



ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:03:11

BLE_2M_Ant1_Low_2402

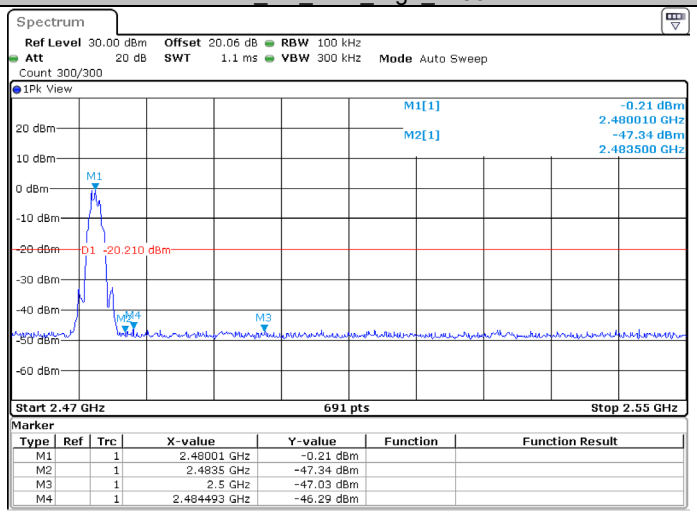


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402015 GHz	1.29 dBm		
M2		1	2.4 GHz	-32.32 dBm		
M3		1	2.39 GHz	-49.63 dBm		
M4		1	2.3999783 GHz	-32.10 dBm		

ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:04:14

BLE_2M_Ant1_High_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48001 GHz	-0.21 dBm		
M2		1	2.4835 GHz	-47.34 dBm		
M3		1	2.5 GHz	-47.03 dBm		
M4		1	2.484493 GHz	-46.29 dBm		

ProjectNo.:2401Y98830E-RF Tester:Navilite.Cai
Date: 4.NOV.2024 15:06:19

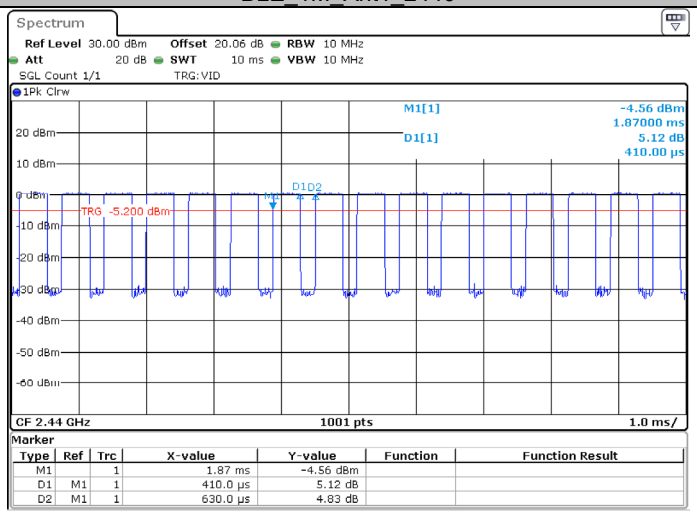
Appendix F: Duty Cycle

Test Result

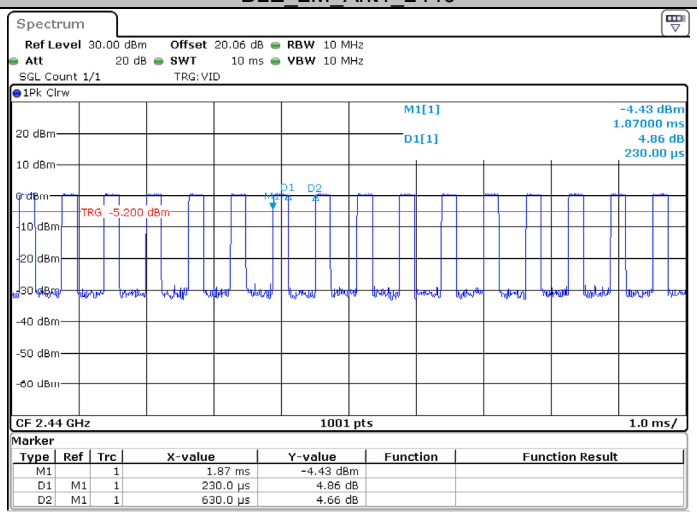
Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T (Hz)	VBW Setting (Hz)
BLE_1M	Ant1	2440	0.41	0.63	65.08	2439	3000
BLE_2M	Ant1	2440	0.23	0.63	36.51	4348	5000

Test Graphs

BLE_1M_Ant1_2440



BLE_2M_Ant1_2440



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