FCC RF Test Report

APPLICANT	:	**Amazon.com Services LLC**
EQUIPMENT	:	**Electronic Display Device**
MODEL NAME	:	**SA569P**
FCC ID	:	**2A4DH-5698**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**
TEST DATE(S)	:	**Jan. 03, 2024 ~ Mar. 06, 2024**

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

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Approved by: Jason Jia

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR391903-01B	Rev. 01	Initial issue of report	Mar. 08, 2024
FR391903-01B	Rev. 02	Updated the equipment list.	May 18, 2024
FR391903-01B	Rev. 03	Updated section 3.3.3 PSD Test Procedures to RMS detector test method.	Jun. 18, 2024
FR391903-01B	Rev. 04	Updated model name	Jul. 03, 2024

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Report only	-
3.2	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 30dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 9.22 dB at 2369.02 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 19.46 dB at 0.532 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:
1.   The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2.   The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"
Disclaimer:
The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

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1   General Description

1.1 Applicant

Amazon.com Services LLC

410 Terry Avenue N Seattle, WA 98109-5210 United States

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Electronic Display Device
Model Name	SA569P
FCC ID	2A4DH-5698
SN Code	Conducted: PN43LB0134850405 Conduction: GN433W0435050018 Radiation: GN433W0435050037

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.3 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	BLE 1Mbps: -1.54 dBm (0.0007 W) BLE 2Mbps: -1.24 dBm (0.0008 W)
99% Occupied Bandwidth	BLE 1Mbps:1.043MHz BLE 2Mbps:2.070MHz
Antenna Type / Gain	PCB IFA Antenna Type with gain 4 dBi
Type of Modulation	Bluetooth LE : GFSK

1.4 Modification of EUT

No modifications are made to the EUT during all test items.

1.5 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH08-KS TH01-KS	CN1257	314309

1.6 Test Software

Item	Site	Manufacturer	Name	Version
1.	TH01-KS	Tonscend	JS1120-3 test system China_210602	3.3.10
2.	03CH08-KS	AUDIX	E3	210616
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.

2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2   Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
	Bluetooth – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_BLE 2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps
	Mode 6: Bluetooth Tx CH39_2480 MHz_BLE 2Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_BLE 1Mbps
	Mode 2: Bluetooth Tx CH19_2440 MHz_BLE 1Mbps
	Mode 3: Bluetooth Tx CH39_2480 MHz_BLE 1Mbps
	Mode 4: Bluetooth Tx CH00_2402 MHz_BLE 2Mbps
	Mode 5: Bluetooth Tx CH19_2440 MHz_BLE 2Mbps
	Mode 6: Bluetooth Tx CH39_2480 MHz_BLE 2Mbps
AC Conducted Emission	Mode 1: Bluetooth Link + USB Cable(Charging from Adapter)
Remark: For Radiated Test Cases, the tests were performance with Adapter and USB Cable.	

2.3 Connection Diagram of Test System

AC Conducted Emission:

```
                        ┌──────────────┐
                        │  BT Earphone │
                        └──────────────┘



   ┌──────────┐                    ┌──────────┐
   │  Power   │                    │          │
   │          │────────────────────│   EUT    │
   │  Source  │                    │          │
   └──────────┘                    └──────────┘




        This example is connection diagram of EUT test configurations.

     . For detail, please refer to test mode configuration and setup photographs for each test item.
```

Radiated Emission:

```
   ┌──────────┐                    ┌──────────┐
   │  Power   │                    │          │
   │          │────────────────────│   EUT    │
   │  Source  │                    │          │
   └──────────┘                    └──────────┘




        This example is connection diagram of EUT test configurations.

     . For detail, please refer to test mode configuration and setup photographs for each test item.
```
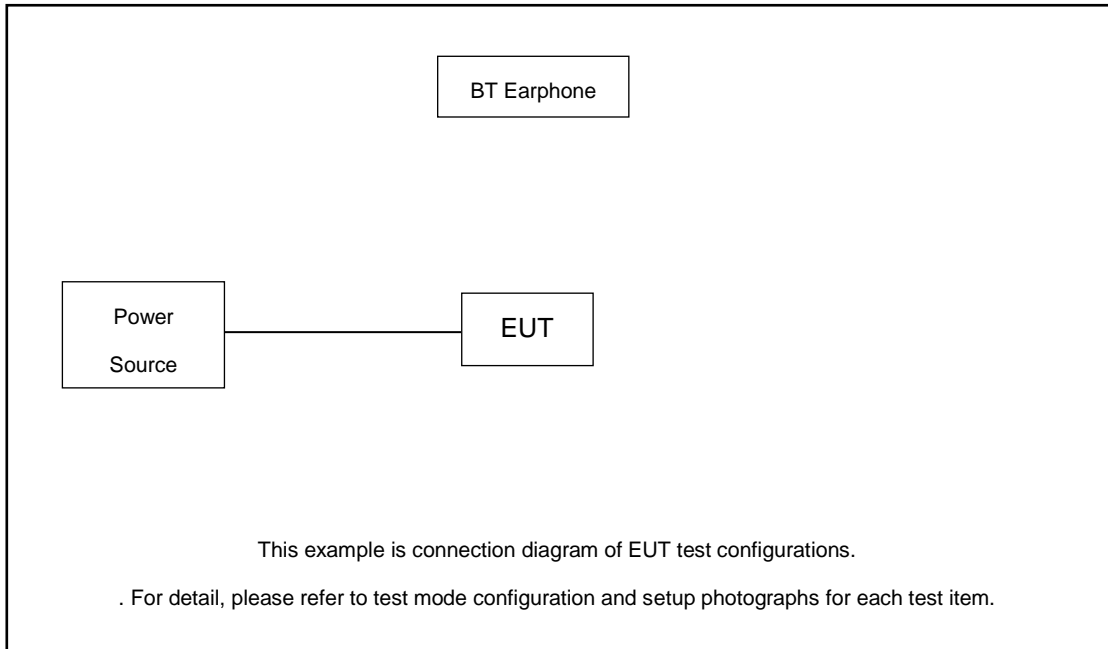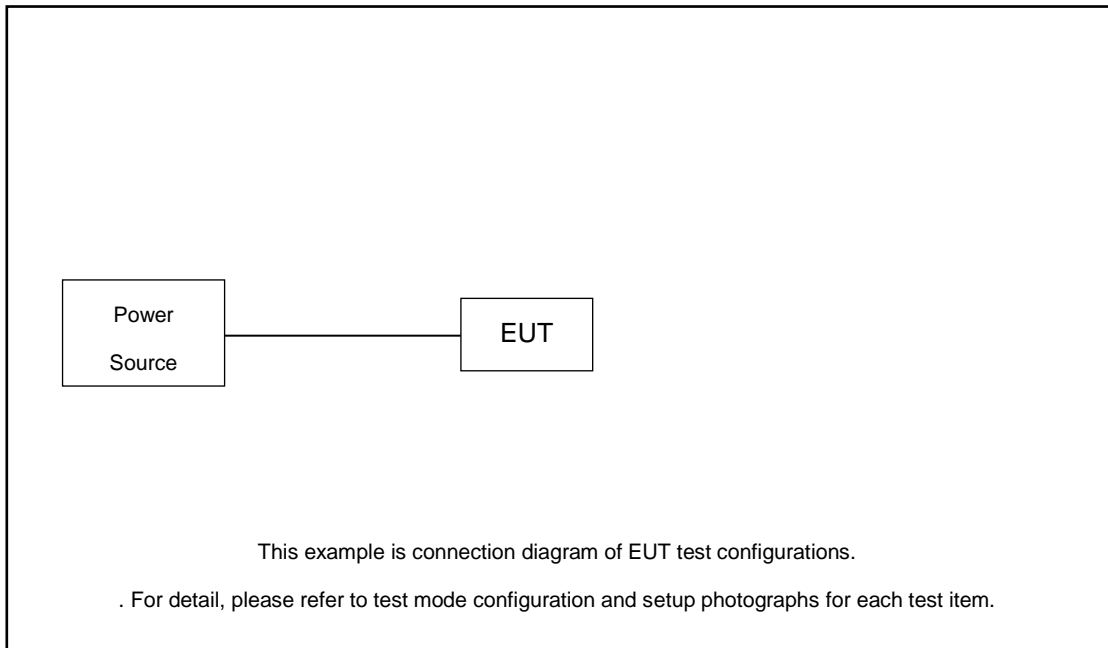
2.4 Support Unit used in test configuration and system

Item	Equipment	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	thinkplus-BH3	N/A	N/A	N/A

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2.5 EUT Operation Test Setup

For BLE function, the engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT makes BT link with the Bluetooth earphone.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 2.19 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

$$= 2.19 + 10 = 12.19 \text{ (dB)}$$

3   Test Result

3.1   6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

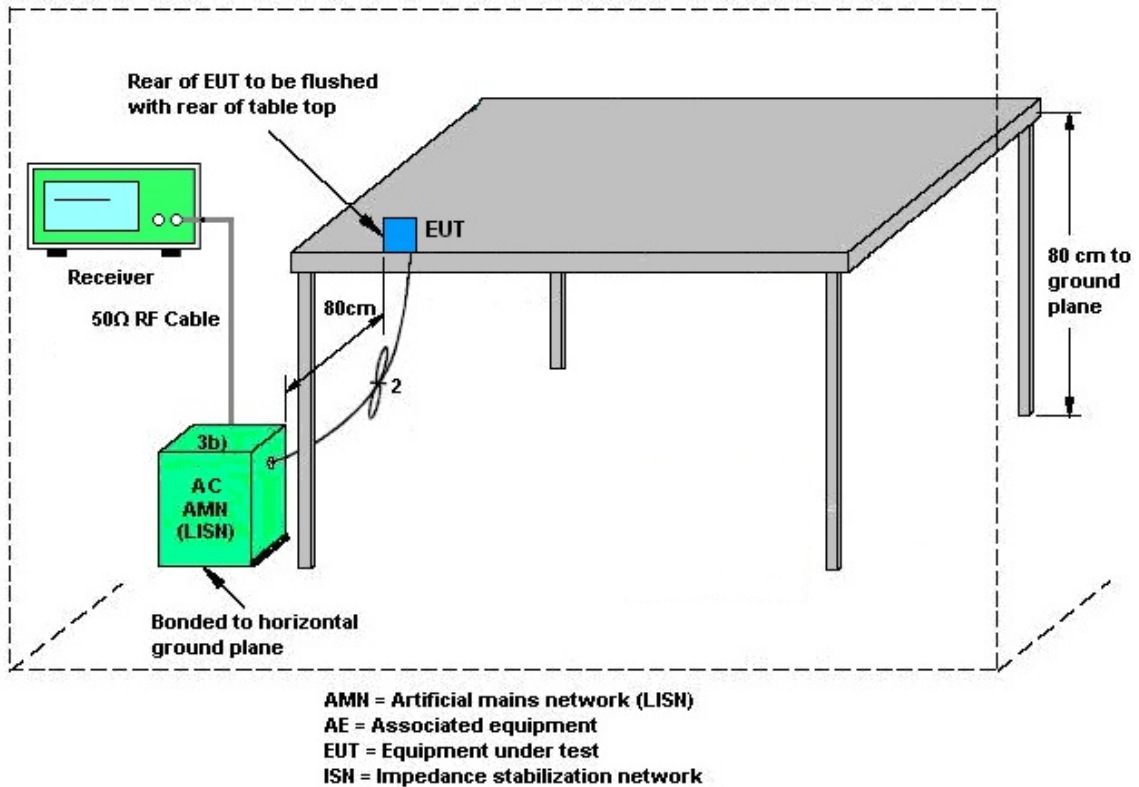The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup

Spectrum Analyzer   EUT
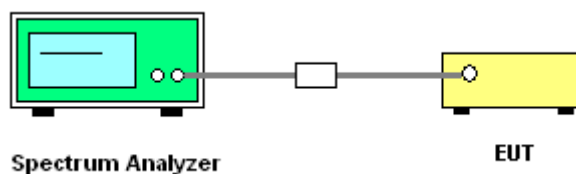
3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

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3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup
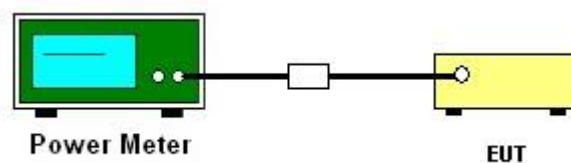
3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

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3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.3 Method AVGPSD-1.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = rms, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 30dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup
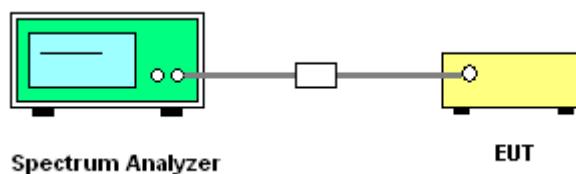
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 30 dB down from the highest emission level within the authorized band.

3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.4.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 11.13
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

Spectrum Analyzer   EUT

3.4.5 Test Result of Conducted Band Edges Plots

Please refer to Appendix A.

3.4.6 Test Result of Conducted Spurious Emission Plots

Please refer to Appendix A.

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.

3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.

7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

8. Use the following spectrum analyzer settings:

   (1) Span shall wide enough to fully capture the emission being measured;

   (2) Set RBW=100 kHz for f < 1 GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;

   (3) Set RBW = 1 MHz, VBW= 3MHz for f $\geq$ 1 GHz for peak measurement.
   For average measurement:

   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

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3.5.4 Test Setup

For radiated emissions below 30MHz
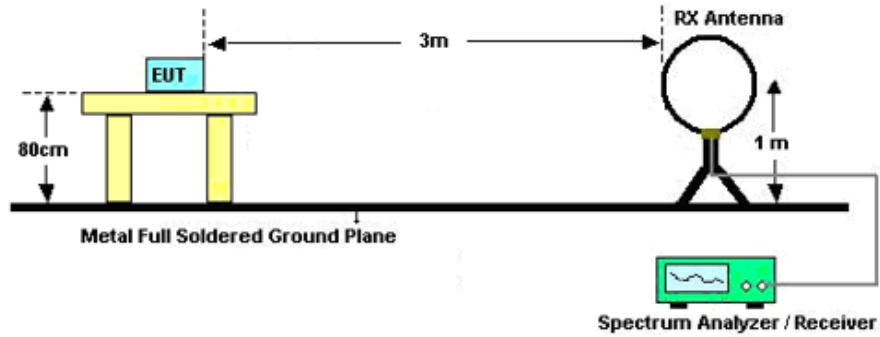
For radiated emissions from 30MHz to 1GHz
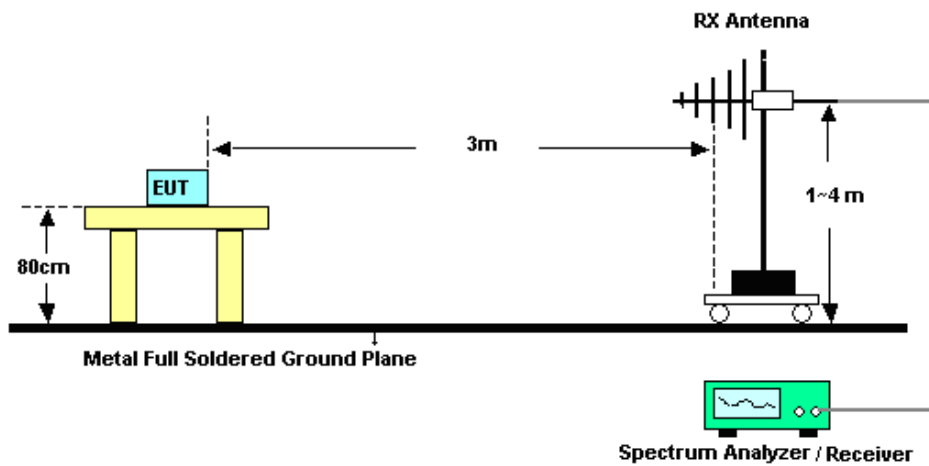
For radiated emissions above 1GHz
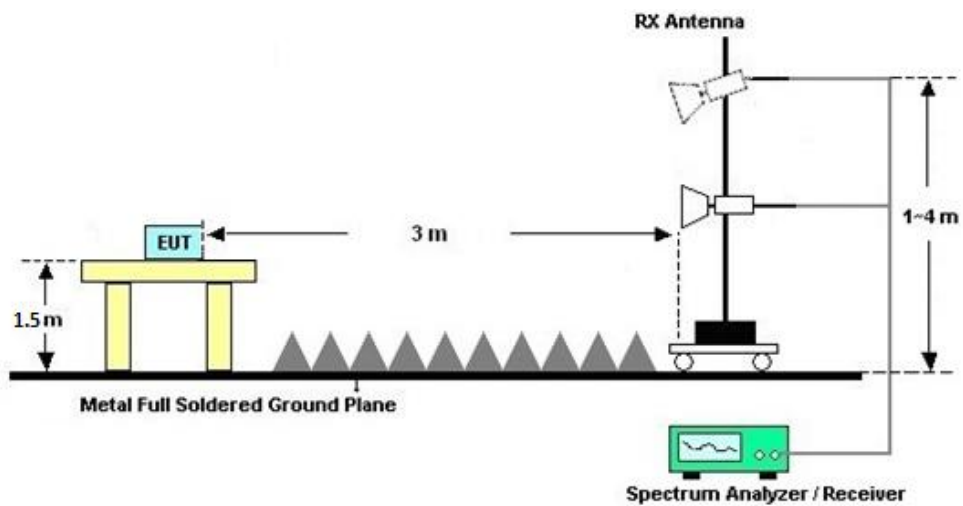
3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.6.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup

AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

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3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Keysight	N9038A	MY56400023	3Hz~8.5GHz;Max 30dBm	Jan. 05, 2023	Jan. 02, 2024	Jan. 04, 2024	Radiation (03CH08-KS)
Spectrum Analyzer	R&S	FSV40	101932	10kHz~40GHz; Max 30dBm	Oct. 10, 2023	Jan. 02, 2024	Oct. 09, 2024	Radiation (03CH08-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Oct. 10, 2023	Jan. 02, 2024	Oct. 09, 2024	Radiation (03CH08-KS)
Bilog Antenna	TESEQ& VGT	CBL 61110	59915	30MHz-1GHz	Aug. 12, 2023	Jan. 02, 2024	Aug. 11, 2024	Radiation (03CH08-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Mar. 18, 2023	Jan. 02, 2024	Mar. 17, 2024	Radiation (03CH08-KS)
high gain Amplifier	EM	EM01G18GA	060845	1Ghz-18Ghz	Jan. 05, 2023	Jan. 02, 2024	Jan. 04, 2024	Radiation (03CH08-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 08, 2023	Jan. 02, 2024	Jan. 07, 2024	Radiation (03CH08-KS)
Amplifier	SONOMA	310N	413741	9KHz-1GHz	Jan. 05, 2023	Jan. 02, 2024	Jan. 04, 2024	Radiation (03CH08-KS)
Amplifier	EM	EM01G18GA	060834	1Ghz-18Ghz	Oct. 10, 2023	Jan. 02, 2024	Oct. 09, 2024	Radiation (03CH08-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2023	Jan. 02, 2024	Jan. 04, 2024	Radiation (03CH08-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Jan. 02, 2024	NCR	Radiation (03CH08-KS)
Turn Table	EM	EM 1000-T	N/A	0~360 degree	NCR	Jan. 02, 2024	NCR	Radiation (03CH08-KS)
Antenna Mast	EM	EM 1000-A	N/A	1 m~4 m	NCR	Jan. 02, 2024	NCR	Radiation (03CH08-KS)
6db attenuator	TOJOIN	SMA(JK)	EMC01	2W/DC-18G	Jan. 10, 2023	Jan. 02, 2024	Jan. 09, 2024	Radiation (03CH08-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Jan. 17, 2024	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Jan. 17, 2024	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Jan. 17, 2024	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Jan. 17, 2024	Oct. 10, 2024	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 11, 2023	Mar. 06, 2024	Oct. 10, 2024	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 02, 2024	Mar. 06, 2024	Jan. 01, 2025	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 02, 2024	Mar. 06, 2024	Jan. 01, 2025	Conducted (TH01-KS)
RF Test System	Tonscend	TS1120-3	N/A	N/A	NCR	Mar. 06, 2024	NCR	Conducted (TH01-KS)
automation control unit	Tonscend	JS0806-2	21H8060473	N/A	NCR	Mar. 06, 2024	NCR	Conducted (TH01-KS)
power control unit	Tonscend	JS0806-4ADC	21J8060495	N/A	NCR	Mar. 06, 2024	NCR	Conducted (TH01-KS)

NCR: No Calibration Required

Sporton International Inc.(Kunshan)
TEL : +86-512-57900158
FCC ID: 2A4DH-5698

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Report Version   : Rev. 04
Report Template No.: BU5-FR15CBT4.0 Version 2.0

5   Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Conducted Spurious Emission & Bandedge	**±2.26 dB**
Occupied Channel Bandwidth	**±0.1%**
Conducted Power	**±0.46 dB**
Conducted Power Spectral Density	**±0.88 dB**
Frequency	**±0.4 Hz**

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.84 dB**

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.32 dB**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.28 dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.90 dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.26 dB**

----------- THE END -----------

Appendix A. Conducted Test Results

Ambient Condition: 25 ℃, 45 %RH	
Test Date: 2024.3.6	**Test Engineer:** Gene Wang

DTS Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.68	2401.66	2402.34	0.5	PASS
		2440	0.68	2439.66	2440.34	0.5	PASS
		2480	0.68	2479.66	2480.34	0.5	PASS
BLE_2M	Ant1	2402	1.17	2401.42	2402.59	0.5	PASS
		2440	1.17	2439.42	2440.59	0.5	PASS
		2480	1.17	2479.42	2480.59	0.5	PASS

Test Graphs

BLE_1M_Ant1_2402
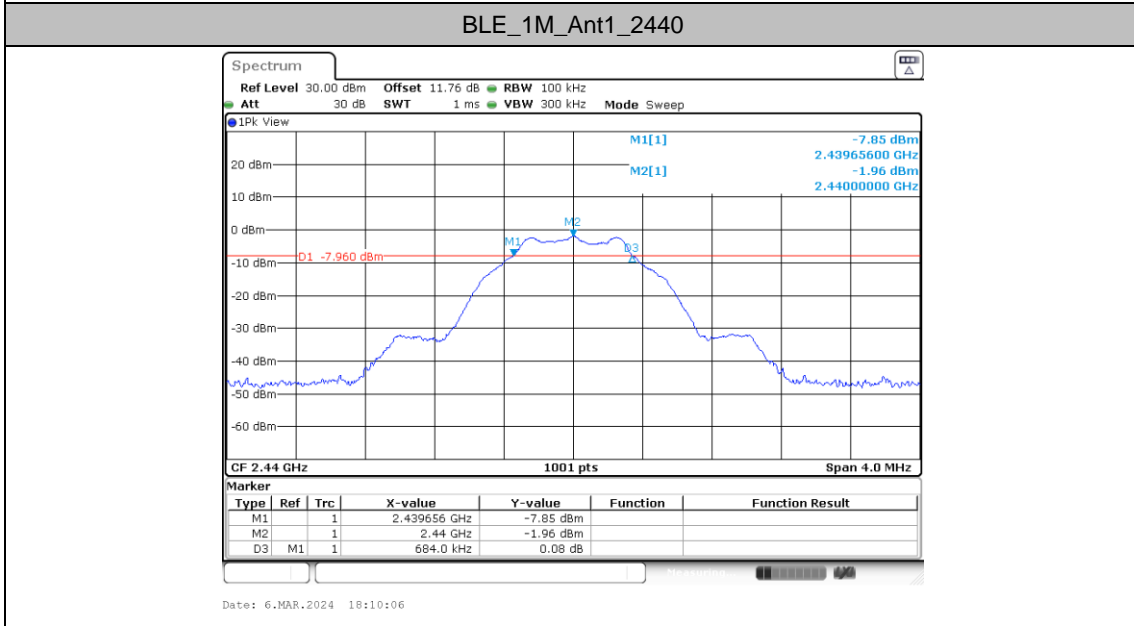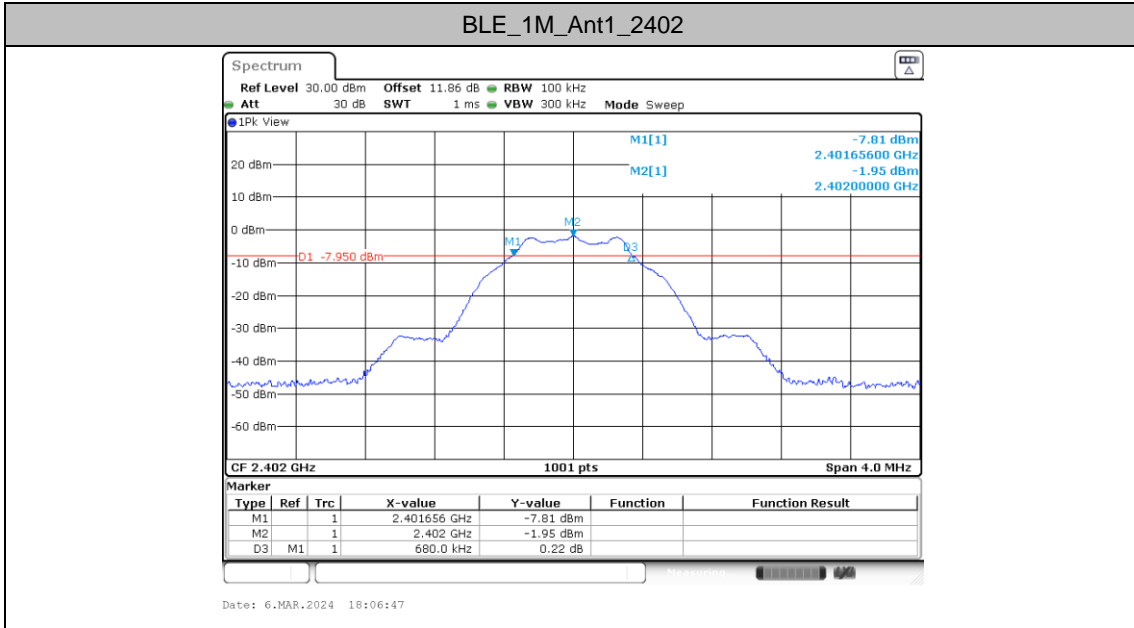
BLE_1M_Ant1_2440
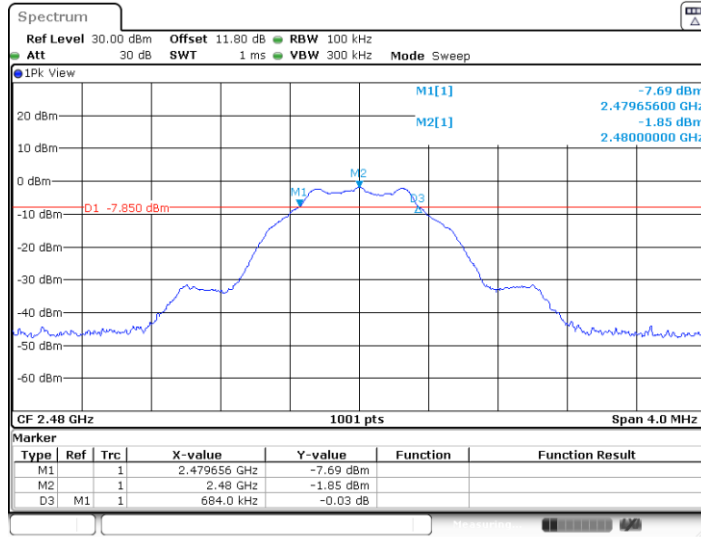
BLE_1M_Ant1_2480

Date: 6.MAR.2024 18:13:22

BLE_2M_Ant1_2402
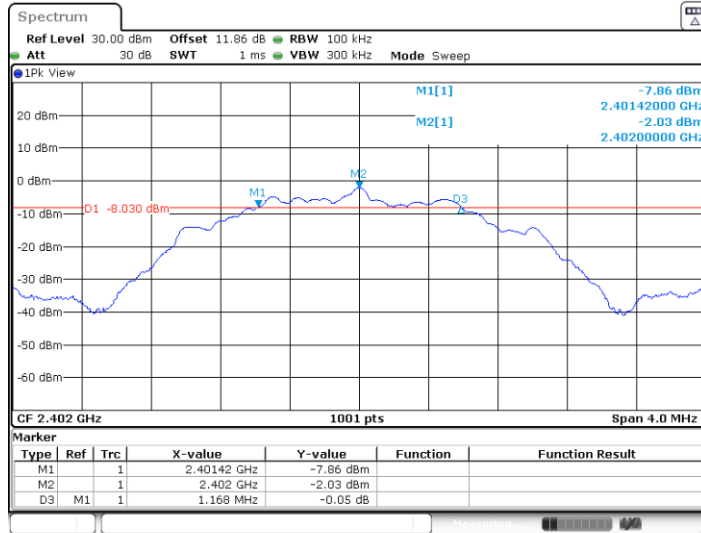
Date: 6.MAR.2024 18:15:47

BLE_2M_Ant1_2440

Spectrum

Ref Level 30.00 dBm Offset 11.76 dB RBW 100 kHz
Att   30 dB   SWT   1 ms   VBW 300 kHz   Mode Sweep
1Pk View

M1[1]   -7.93 dBm
                    2.43942000 GHz
M2[1]   -2.05 dBm
                    2.44000400 GHz

D1 -8.050 dBm

CF 2.44 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.43942 GHz	-7.93 dBm		
M2		1	2.440004 GHz	-2.05 dBm		
D3	M1	1	1.168 MHz	0.01 dB		
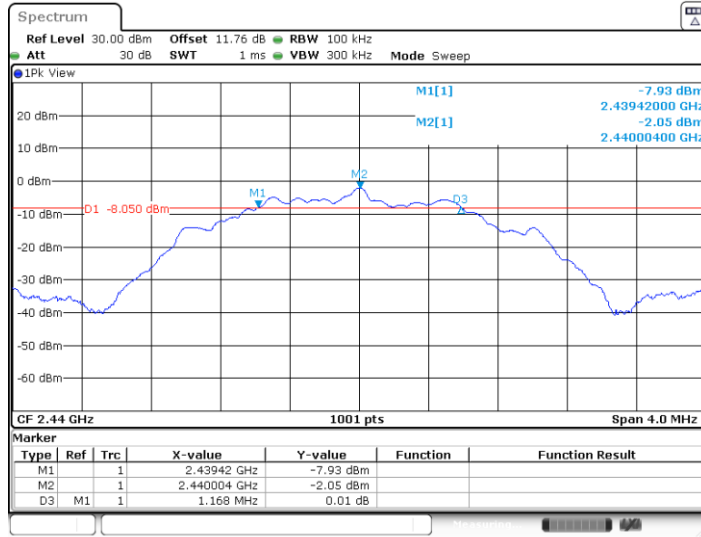
Date: 6.MAR.2024 18:18:50

BLE_2M_Ant1_2480

Spectrum

Ref Level 30.00 dBm Offset 11.80 dB RBW 100 kHz
Att   30 dB   SWT   1 ms   VBW 300 kHz   Mode Sweep
1Pk View

M1[1]   -7.83 dBm
                    2.47942000 GHz
M2[1]   -1.91 dBm
                    2.48000000 GHz

D1 -7.910 dBm

CF 2.48 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47942 GHz	-7.83 dBm		
M2		1	2.48 GHz	-1.91 dBm		
D3	M1	1	1.168 MHz	-0.02 dB		
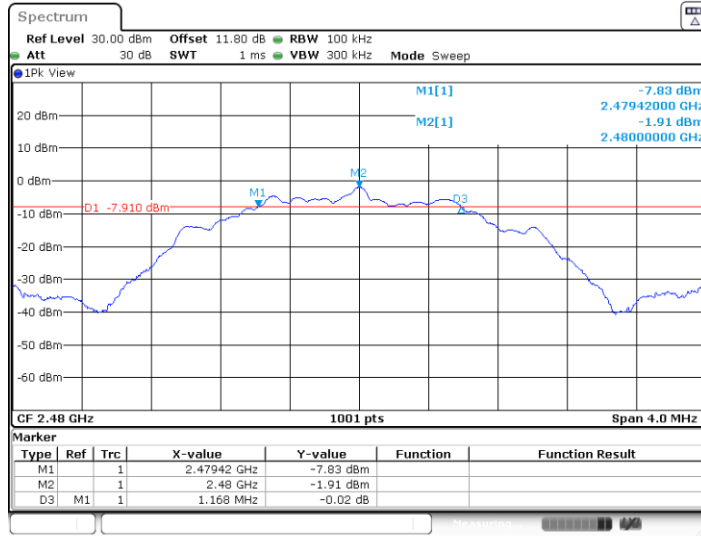
Date: 6.MAR.2024 18:24:44

Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.039	2401.4845	2402.5235	---	---
		2440	1.043	2439.4845	2440.5275	---	---
		2480	1.043	2479.4845	2480.5275	---	---
BLE_2M	Ant1	2402	2.07	2400.9770	2403.0470	---	---
		2440	2.07	2438.9770	2441.0470	---	---
		2480	2.07	2478.9770	2481.0470	---	---

Test Graphs

BLE_1M_Ant1_2402

Spectrum

Ref Level 30.00 dBm Offset 11.86 dB ● RBW 50 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 200 kHz   Mode Sweep
●1Sa View

M1[1]   -3.14 dBm
                               2.40198800 GHz
Occ Bw   1.038961039 MHz

CF 2.402 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401988 GHz	-3.14 dBm		
T1		1	2.40148452 GHz	-16.85 dBm	Occ Bw	1.038961039 MHz
T2		1	2.40252348 GHz	-16.96 dBm		

Date: 6.MAR.2024 18:06:52

BLE_1M_Ant1_2440

Spectrum

Ref Level 30.00 dBm Offset 11.76 dB ● RBW 50 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 200 kHz   Mode Sweep
●1Sa View

M1[1]   -3.14 dBm
                               2.43998400 GHz
Occ Bw   1.042957043 MHz

CF 2.44 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.439984 GHz	-3.14 dBm		
T1		1	2.43948452 GHz	-16.98 dBm	Occ Bw	1.042957043 MHz
T2		1	2.44052747 GHz	-17.17 dBm		

Date: 6.MAR.2024 18:10:12

BLE_1M_Ant1_2480

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479988 GHz	-3.03 dBm		
T1		1	2.47948452 GHz	-16.76 dBm	Occ Bw	1.042957043 MHz
T2		1	2.48052747 GHz	-17.13 dBm		

Date: 6.MAR.2024 18:13:27

BLE_2M_Ant1_2402

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.401988 GHz	-3.94 dBm		
T1		1	2.40097702 GHz	-18.20 dBm	Occ Bw	2.06993007 MHz
T2		1	2.40304695 GHz	-19.39 dBm		
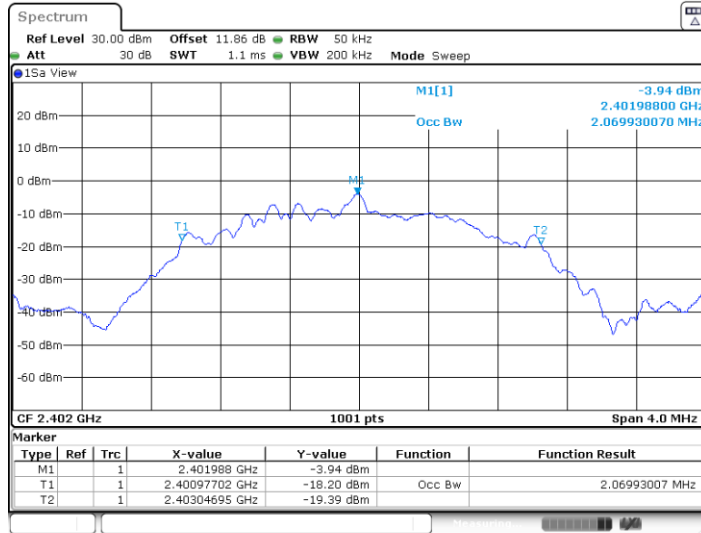
Date: 6.MAR.2024 18:15:53

BLE_2M_Ant1_2440

Spectrum

Ref Level 30.00 dBm   Offset 11.76 dB ● RBW   50 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 200 kHz   Mode Sweep
● 1Sa View

M1[1]   -3.97 dBm
                         2.43998400 GHz
Occ Bw   2.069930070 MHz

CF 2.44 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.439984 GHz	-3.97 dBm		
T1		1	2.43897702 GHz	-18.10 dBm	Occ Bw	2.06993007 MHz
T2		1	2.44104695 GHz	-19.33 dBm		
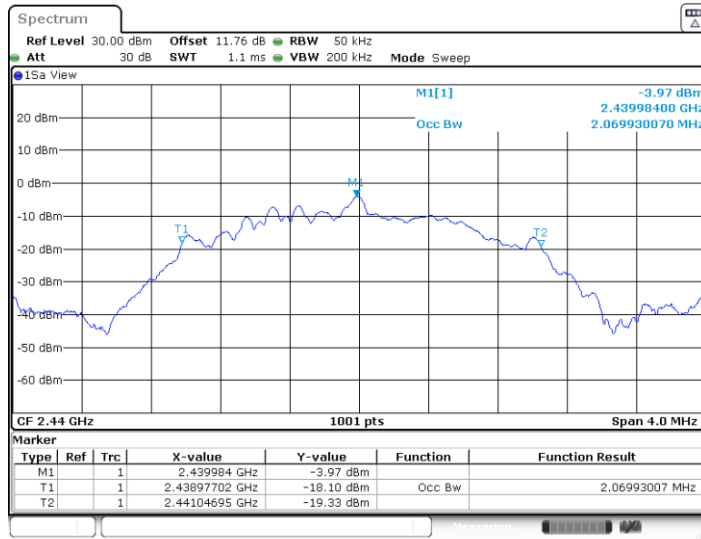
Date: 6.MAR.2024 18:18:56

BLE_2M_Ant1_2480

Spectrum

Ref Level 30.00 dBm   Offset 11.80 dB ● RBW   50 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 200 kHz   Mode Sweep
● 1Sa View

M1[1]   -3.86 dBm
                         2.47998400 GHz
Occ Bw   2.069930070 MHz

CF 2.48 GHz   1001 pts   Span 4.0 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479984 GHz	-3.86 dBm		
T1		1	2.47897702 GHz	-18.02 dBm	Occ Bw	2.06993007 MHz
T2		1	2.48104695 GHz	-19.37 dBm		
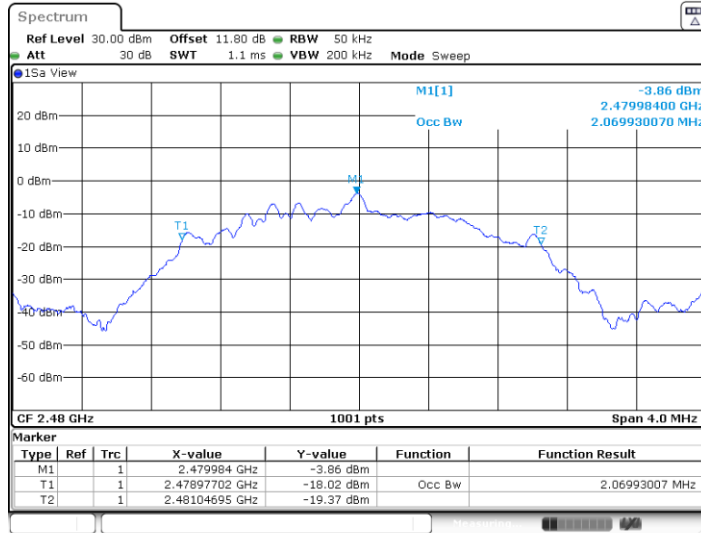
Date: 6.MAR.2024 18:24:49

Maximum conducted output power

Test Result Average

TestMode	Antenna	CH.	Duty Factor (dB)	Average Conducted Power (dBm)	Conducted Power Limit	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit	Pass/Fail
BLE1M	Ant1	0	2.14	-1.91	30.00	4	2.09	36.00	Pass
		19	2.14	**-1.54**	30.00	4	**2.46**	36.00	Pass
		39	2.14	-1.67	30.00	4	2.33	36.00	Pass
BLE2M	Ant1	0	5.02	-1.72	30.00	4	2.28	36.00	Pass
		19	5.02	**-1.24**	30.00	4	**2.76**	36.00	Pass
		39	5.02	-1.49	30.00	4	2.51	36.00	Pass

Remark：Power setting is the AUTO(AUTO is the default)

Maximum power spectral density

Test Result

TestMode	Antenna	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-18.22	≤8.00	PASS
		2440	-17.91	≤8.00	PASS
		2480	-18.68	≤8.00	PASS
BLE_2M	Ant1	2402	-19.34	≤8.00	PASS
		2440	-19.08	≤8.00	PASS
		2480	-18.95	≤8.00	PASS

Test Graphs

BLE_1M_Ant1_2402

BLE_1M_Ant1_2440

BLE_1M_Ant1_2480

Spectrum

Ref Level 10.00 dBm Offset 14.00 dB ● RBW 3 kHz
● Att   20 dB SWT   23.2 ms ● VBW 10 kHz Mode Sweep
● 1Rm View

M1[1]   -18.68 dBm
2.47997920 GHz

CF 2.48 GHz   1001 pts   Span 2.086 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799792 GHz	-18.68 dBm		
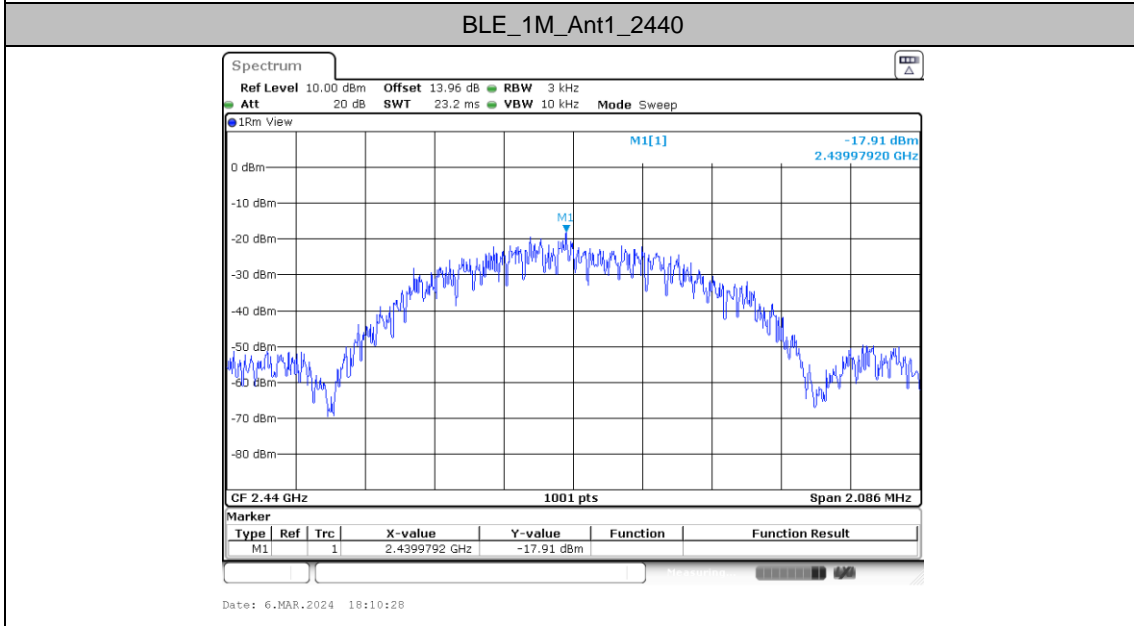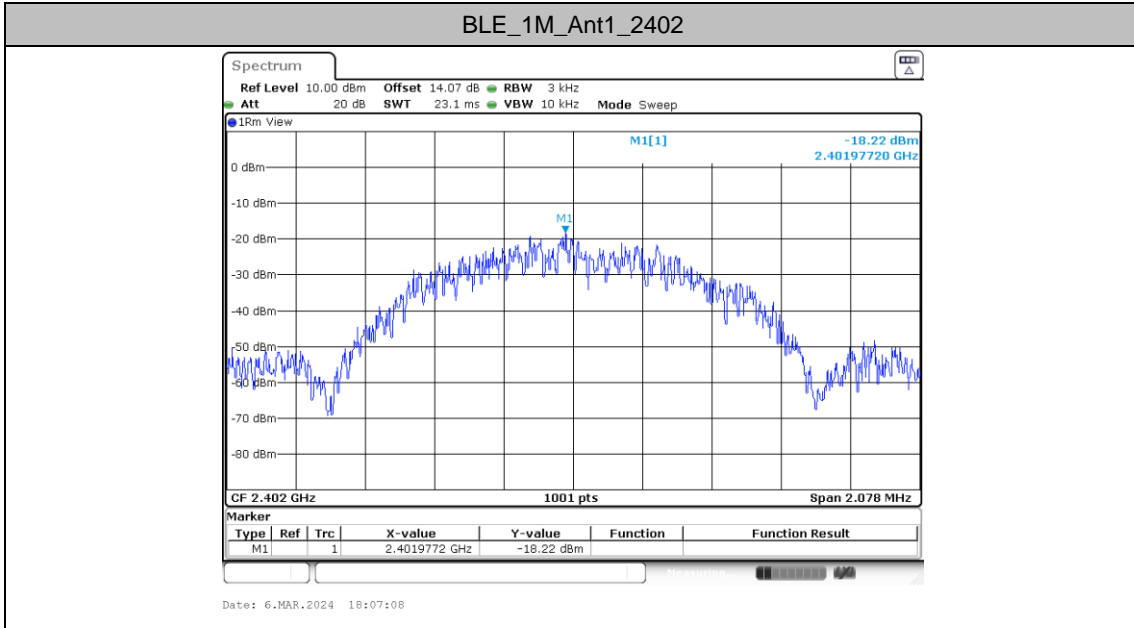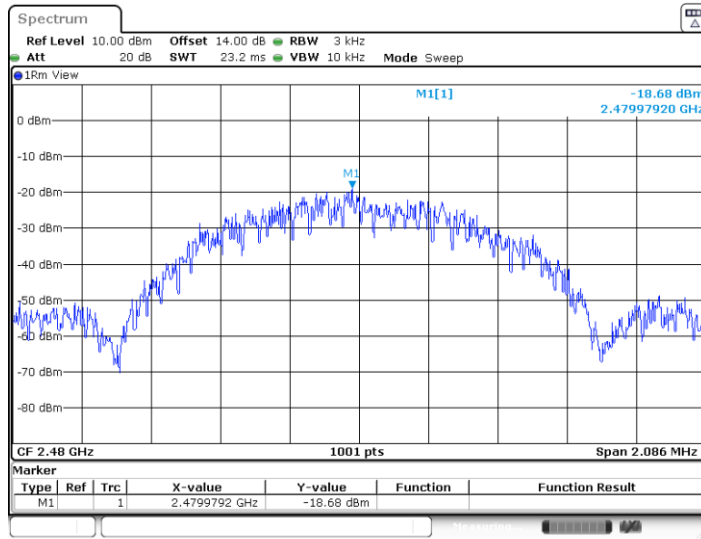
Date: 6.MAR.2024 18:13:43

BLE_2M_Ant1_2402

Spectrum

Ref Level 10.00 dBm Offset 17.00 dB ● RBW 3 kHz
● Att   20 dB SWT   46 ms ● VBW 10 kHz Mode Sweep
● 1Rm View

M1[1]   -19.34 dBm
2.40195860 GHz

CF 2.402 GHz   1001 pts   Span 4.14 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4019586 GHz	-19.34 dBm		
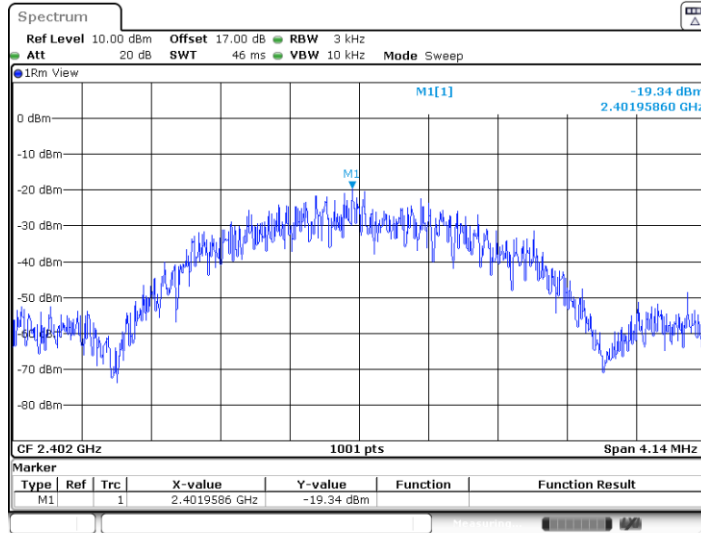
Date: 6.MAR.2024 18:16:09

BLE_2M_Ant1_2440

Spectrum

Ref Level 10.00 dBm   Offset 16.88 dB ● RBW   3 kHz
● Att   20 dB   SWT   46 ms ● VBW 10 kHz   Mode Sweep
● 1Rm View

M1[1]   -19.08 dBm
                                    2.43995860 GHz

CF 2.44 GHz   1001 pts   Span 4.14 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4399586 GHz	-19.08 dBm		
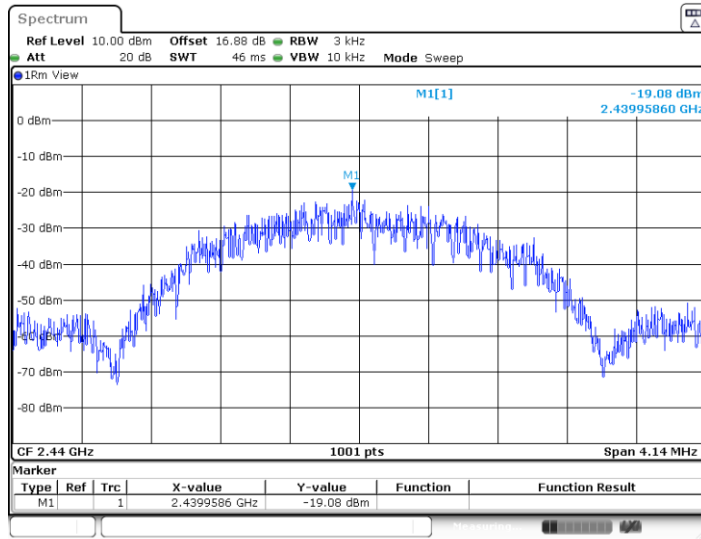
Date: 6.MAR.2024 18:20:21

BLE_2M_Ant1_2480

Spectrum

Ref Level 10.00 dBm   Offset 16.92 dB ● RBW   3 kHz
● Att   20 dB   SWT   46 ms ● VBW 10 kHz   Mode Sweep
● 1Rm View

M1[1]   -18.95 dBm
                                    2.47995860 GHz

CF 2.48 GHz   1001 pts   Span 4.14 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799586 GHz	-18.95 dBm		
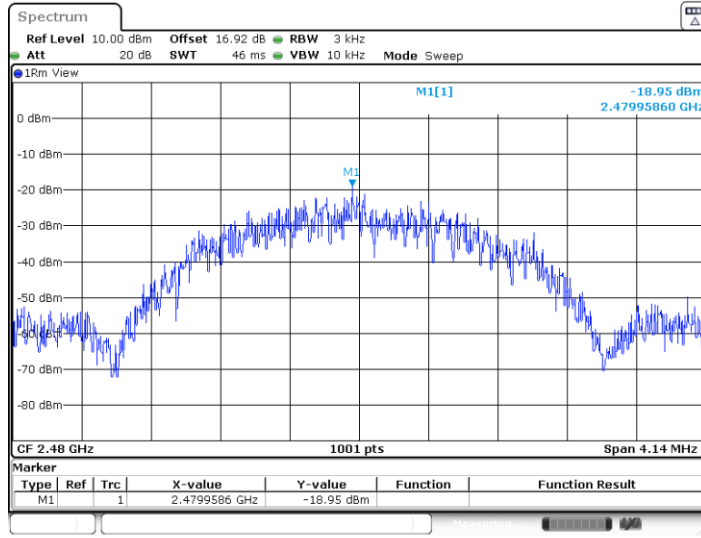
Date: 6.MAR.2024 18:25:05

Reference level measurement

Test Result

TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
BLE_1M	Ant1	2402	2402.00	-1.96
		2440	2440.00	-1.96
		2480	2480.00	-1.85
BLE_2M	Ant1	2402	2402.00	-2.03
		2440	2440.00	-2.05
		2480	2480.00	-1.91

Test Graphs

BLE_1M_Ant1_2402

BLE_1M_Ant1_2440

BLE_1M_Ant1_2480

Spectrum

Ref Level 30.00 dBm Offset 11.80 dB ● RBW 100 kHz
● Att   30 dB   SWT   1 ms ● VBW 300 kHz   Mode Sweep
● 1Pk View

M1[1]   -1.85 dBm
                                                2.47999700 GHz

CF 2.48 GHz   691 pts   Span 1.02 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479997 GHz	-1.85 dBm		
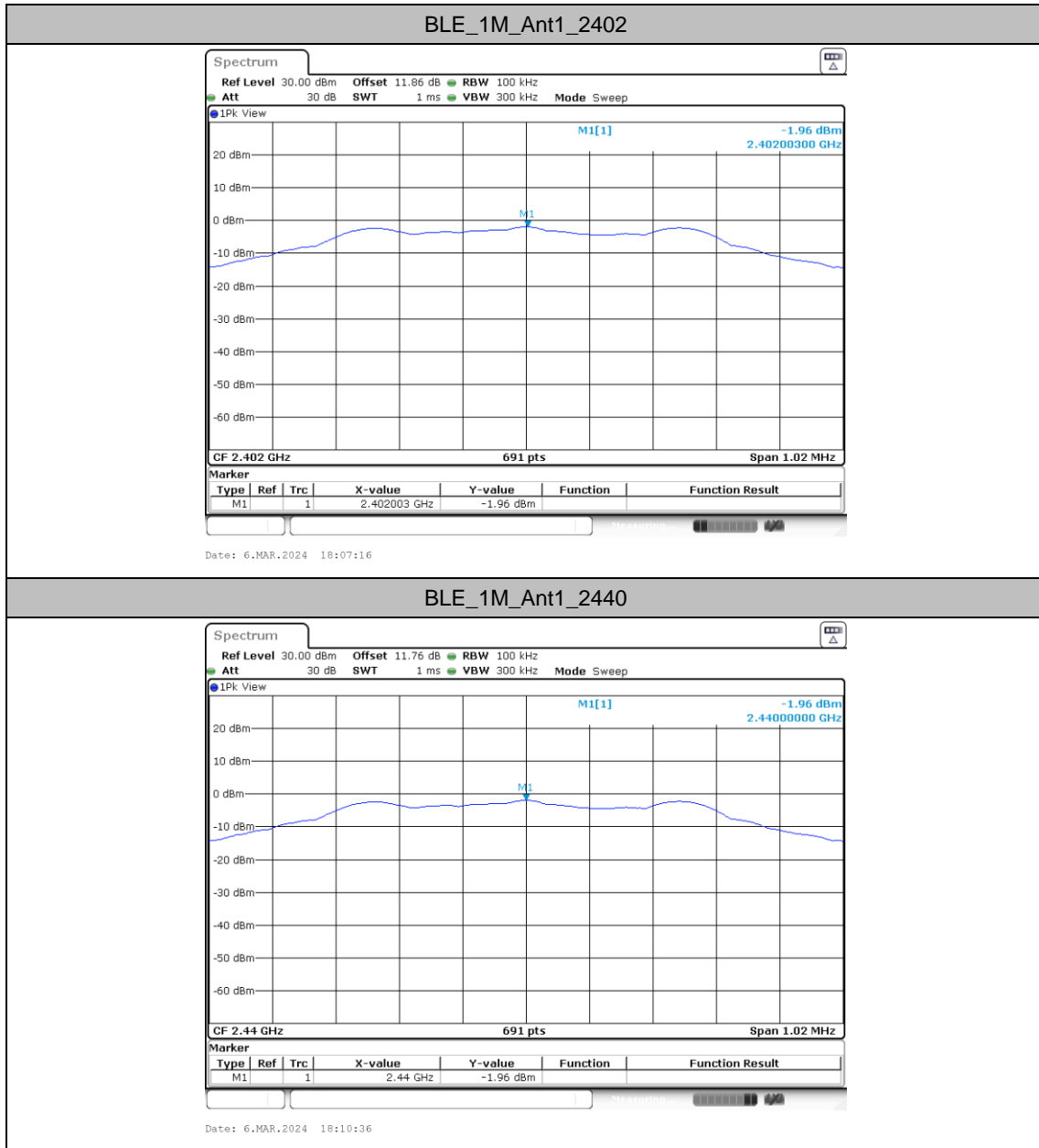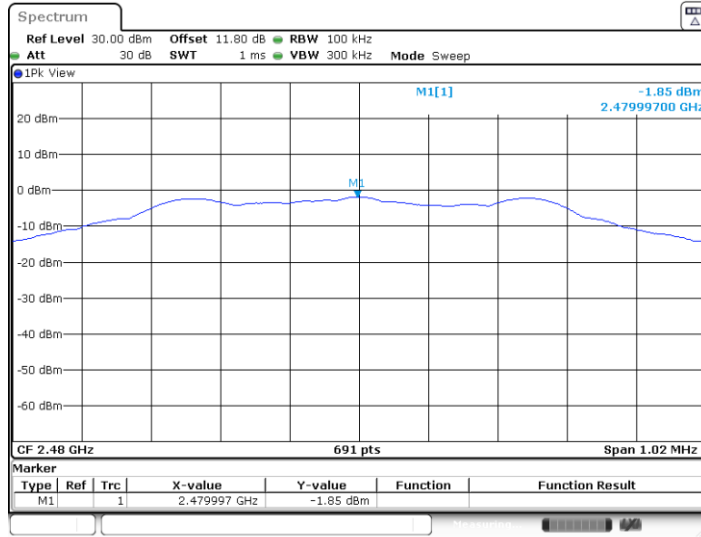
Date: 6.MAR.2024 18:13:51

BLE_2M_Ant1_2402

Spectrum

Ref Level 30.00 dBm Offset 11.86 dB ● RBW 100 kHz
● Att   30 dB   SWT   1 ms ● VBW 300 kHz   Mode Sweep
● 1Pk View

M1[1]   -2.03 dBm
                                                2.40200000 GHz

CF 2.402 GHz   691 pts   Span 1.755 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402 GHz	-2.03 dBm		
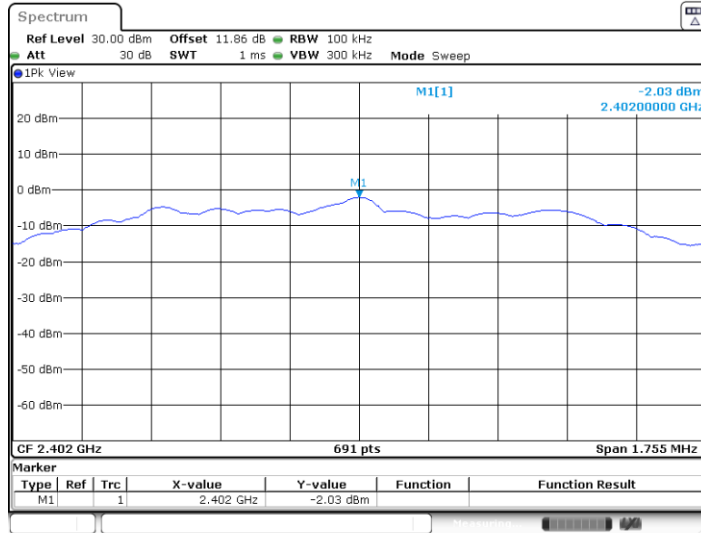
Date: 6.MAR.2024 18:16:16

BLE_2M_Ant1_2440

Spectrum

Ref Level 30.00 dBm   Offset 11.76 dB   ● RBW 100 kHz
● Att   30 dB   SWT   1 ms   ● VBW 300 kHz   Mode Sweep
● 1Pk View

M1[1]   -2.05 dBm
                                          2.44000000 GHz

M1

CF 2.44 GHz   691 pts   Span 1.755 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.44 GHz	-2.05 dBm		
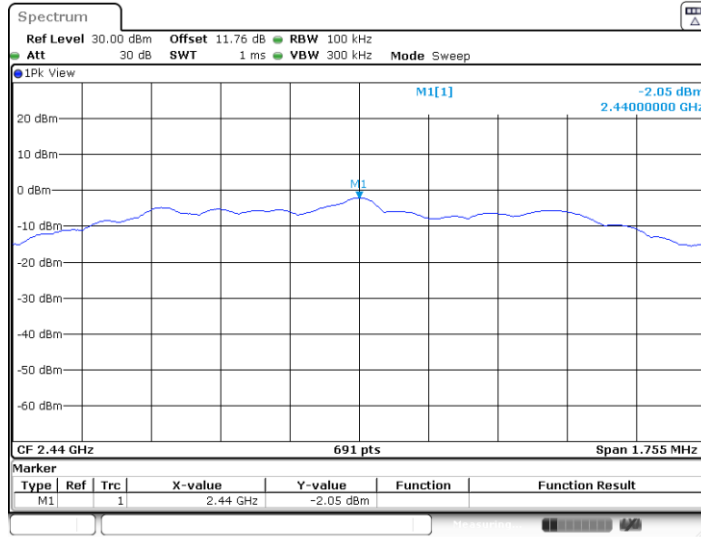
Date: 6.MAR.2024 18:20:28

BLE_2M_Ant1_2480

Spectrum

Ref Level 30.00 dBm   Offset 11.80 dB   ● RBW 100 kHz
● Att   30 dB   SWT   1 ms   ● VBW 300 kHz   Mode Sweep
● 1Pk View

M1[1]   -1.91 dBm
                                          2.47999750 GHz

M1

CF 2.48 GHz   691 pts   Span 1.755 MHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799975 GHz	-1.91 dBm		
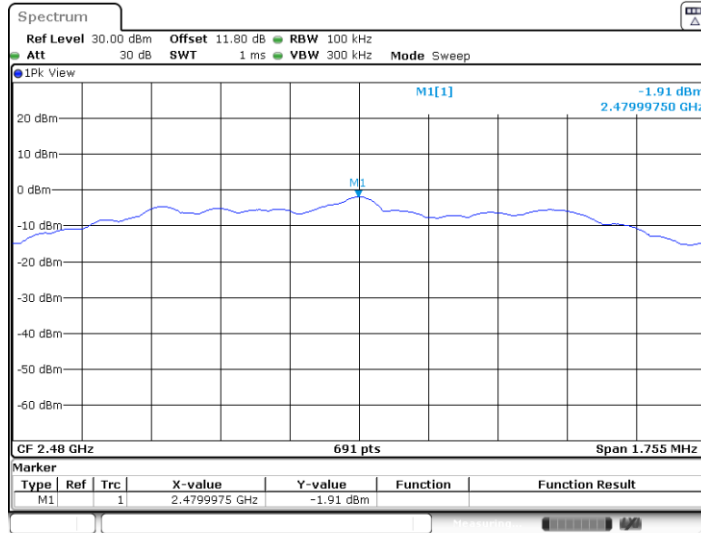
Date: 6.MAR.2024 18:25:13

Band edge measurements

Test Result

TestMode	Antenna	ChName	Freq(MHz)	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
BLE_1M	Ant1	Low	2402	-1.96	-43.96	≤-31.96	PASS
		High	2480	-1.85	-42.63	≤-31.85	PASS
BLE_2M	Ant1	Low	2402	-2.03	-33.3	≤-32.03	PASS
		High	2480	-1.91	-43.06	≤-31.91	PASS

Test Graphs
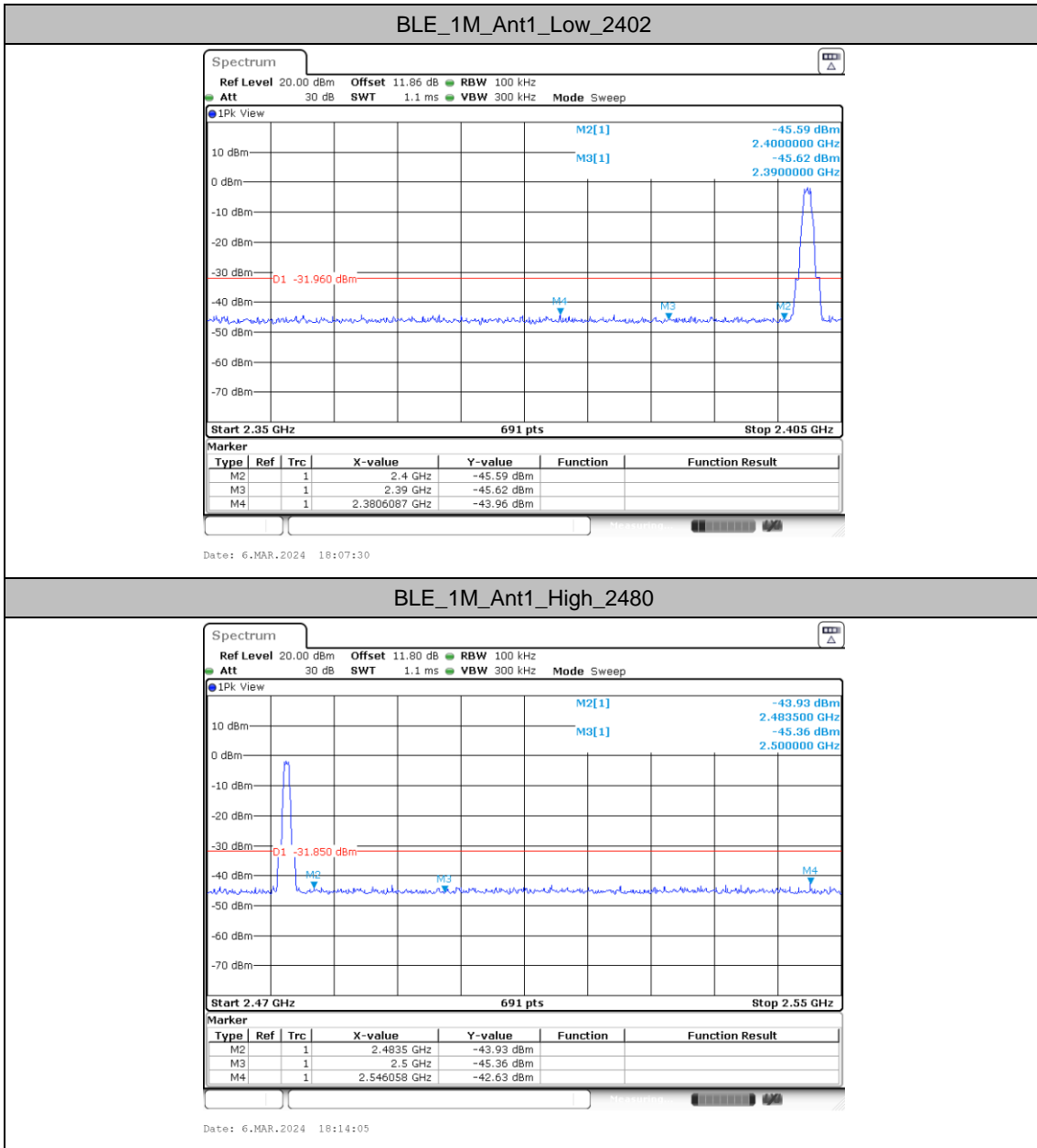
BLE_1M_Ant1_Low_2402

Date: 6.MAR.2024 18:07:30

BLE_1M_Ant1_High_2480

Date: 6.MAR.2024 18:14:05

BLE_2M_Ant1_Low_2402

Spectrum

Ref Level 20.00 dBm   Offset 11.86 dB ● RBW 100 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 300 kHz   Mode Sweep
● 1Pk View

M2[1]   -31.90 dBm
                      2.4000000 GHz
M3[1]   -45.73 dBm
                      2.3900000 GHz

D1 -32.030 dBm

Start 2.35 GHz   691 pts   Stop 2.405 GHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M2		1	2.4 GHz	-31.90 dBm		
M3		1	2.39 GHz	-45.73 dBm		
M4		1	2.3999783 GHz	-33.30 dBm		

Date: 6.MAR.2024 18:16:30

BLE_2M_Ant1_High_2480

Spectrum

Ref Level 20.00 dBm   Offset 11.80 dB ● RBW 100 kHz
● Att   30 dB   SWT   1.1 ms ● VBW 300 kHz   Mode Sweep
● 1Pk View

M2[1]   -45.48 dBm
                      2.483500 GHz
M3[1]   -45.26 dBm
                      2.500000 GHz

D1 -31.910 dBm

Start 2.47 GHz   691 pts   Stop 2.55 GHz

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M2		1	2.4835 GHz	-45.48 dBm		
M3		1	2.5 GHz	-45.26 dBm		
M4		1	2.492261 GHz	-43.06 dBm		
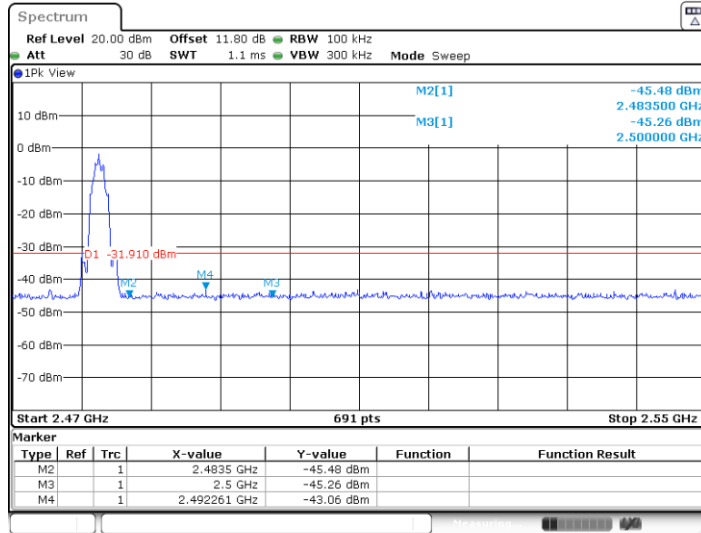
Date: 6.MAR.2024 18:25:28

Conducted Spurious Emission

Test Result

TestMode	Antenna	Freq(MHz)	FreqRange [MHz]	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
BLE_1M	Ant1	2402	30~1000	-1.96	-54.72	≤-31.96	PASS
			1000~26500	-1.96	-45.22	≤-31.96	PASS
		2440	30~1000	-1.96	-55.04	≤-31.96	PASS
			1000~26500	-1.96	-44.87	≤-31.96	PASS
		2480	30~1000	-1.85	-54.89	≤-31.85	PASS
			1000~26500	-1.85	-44.95	≤-31.85	PASS
BLE_2M	Ant1	2402	30~1000	-2.03	-54.61	≤-32.03	PASS
			1000~26500	-2.03	-44.15	≤-32.03	PASS
		2440	30~1000	-2.05	-55.29	≤-32.05	PASS
			1000~26500	-2.05	-44	≤-32.05	PASS
		2480	30~1000	-1.91	-54.88	≤-31.91	PASS
			1000~26500	-1.91	-44.86	≤-31.91	PASS

Test Graphs

BLE_1M_Ant1_2402_30~1000

BLE_1M_Ant1_2402_1000~26500
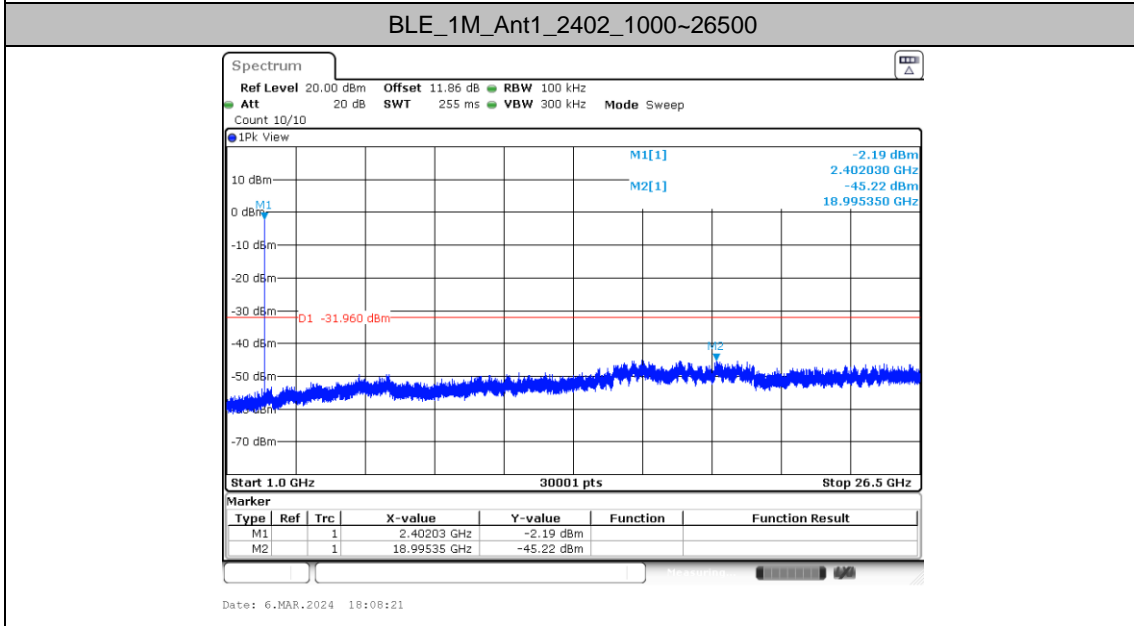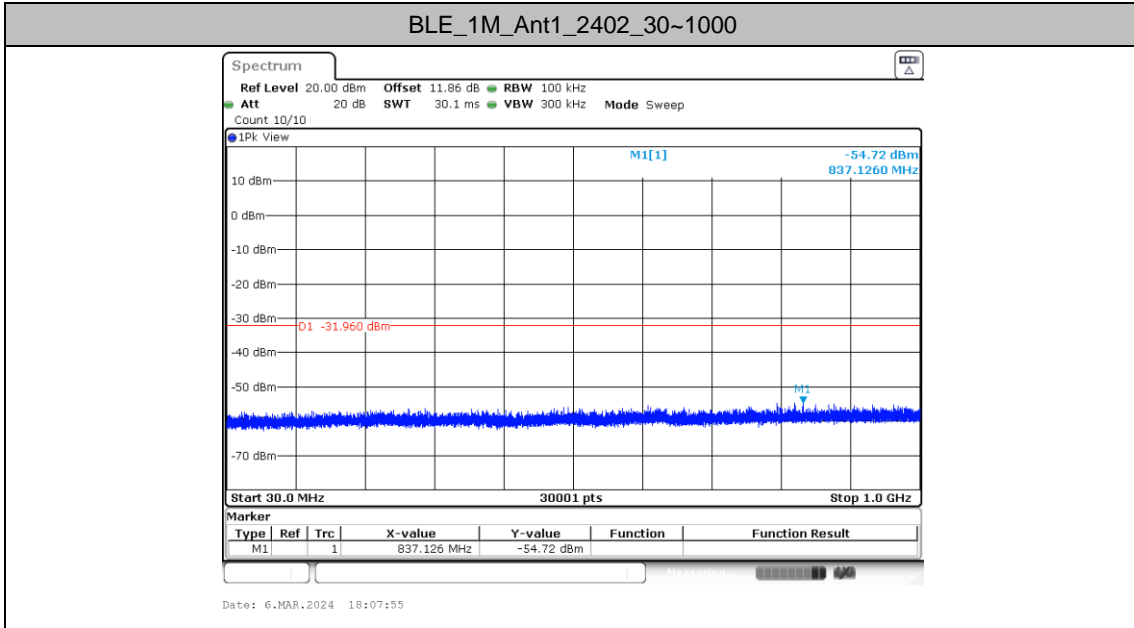
BLE_1M_Ant1_2440_30~1000
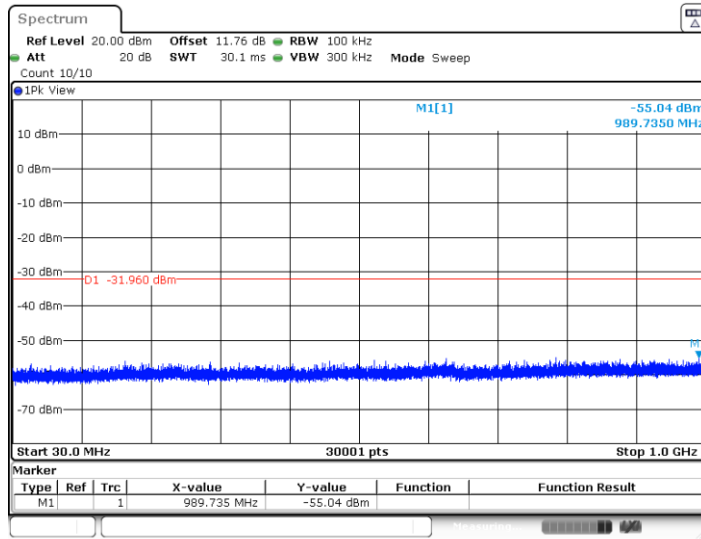
Date: 6.MAR.2024 18:11:14

BLE_1M_Ant1_2440_1000~26500
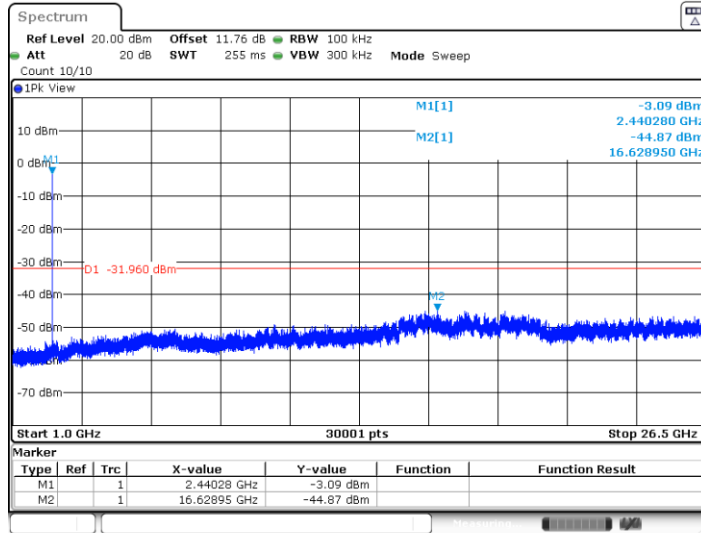
Date: 6.MAR.2024 18:11:38

BLE_1M_Ant1_2480_30~1000
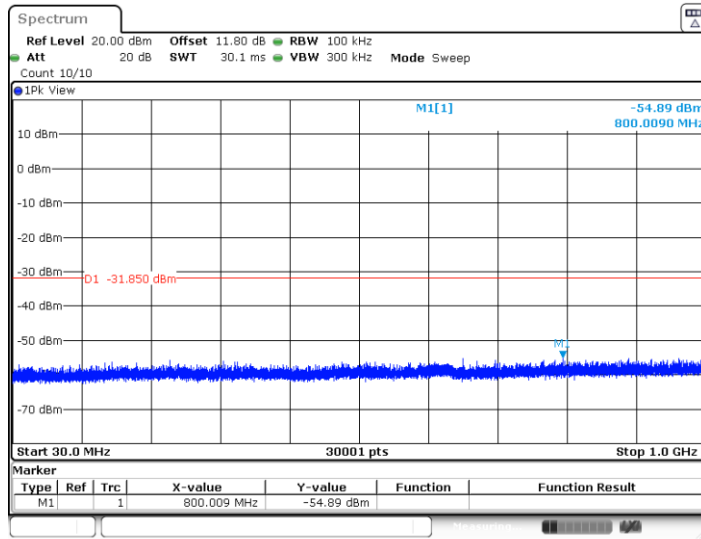
Date: 6.MAR.2024 18:14:27

BLE_1M_Ant1_2480_1000~26500
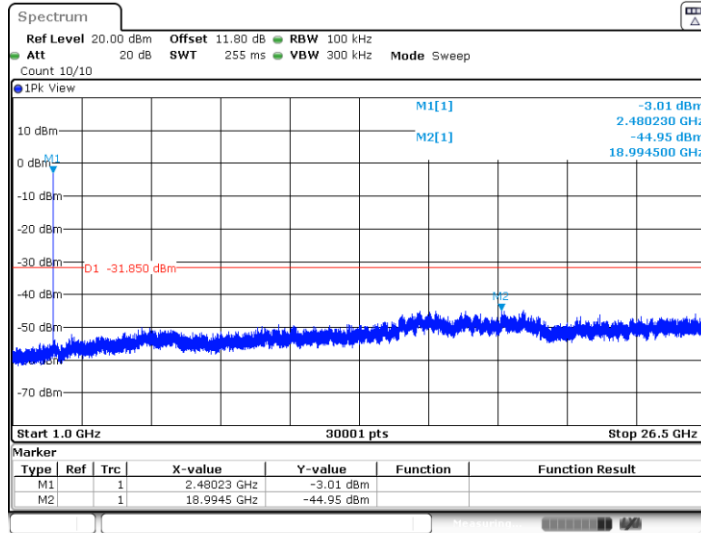
Date: 6.MAR.2024 18:14:48

BLE_2M_Ant1_2402_30~1000
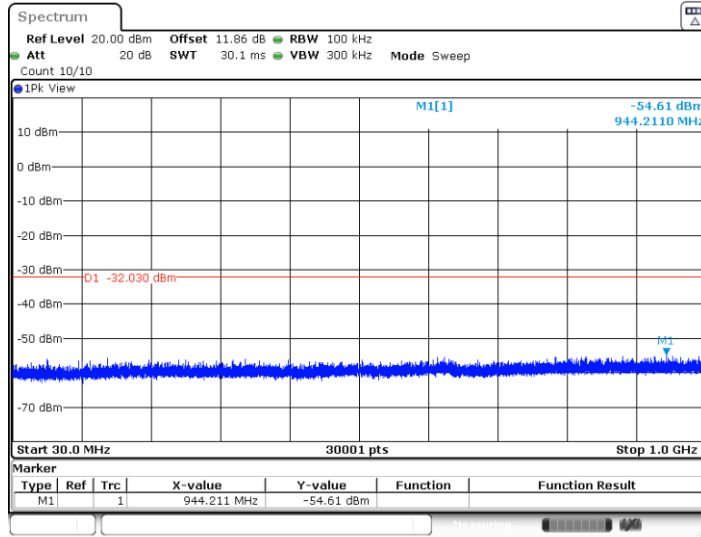
Date: 6.MAR.2024 18:16:56

BLE_2M_Ant1_2402_1000~26500
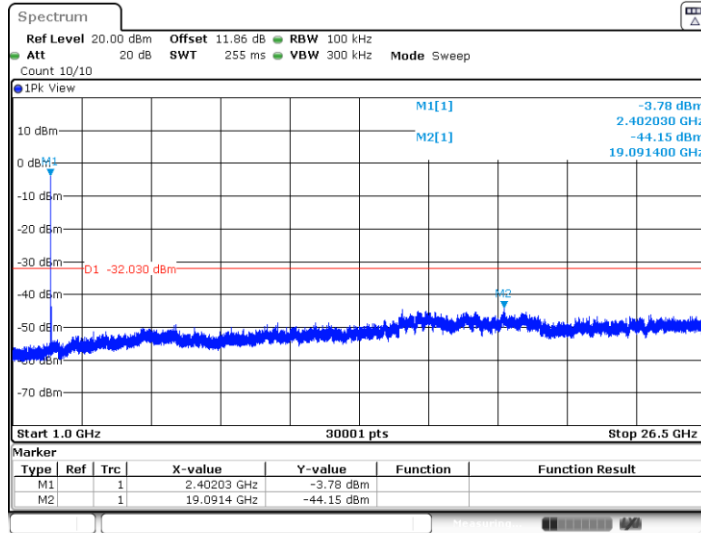
Date: 6.MAR.2024 18:17:37

BLE_2M_Ant1_2440_30~1000
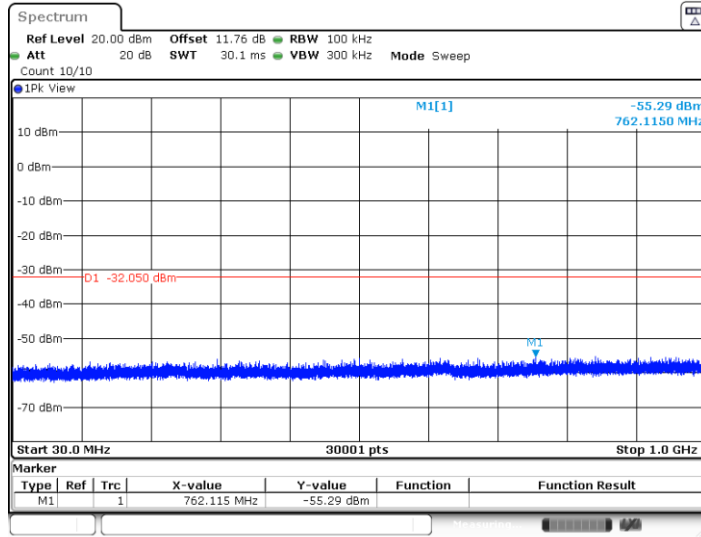
Date: 6.MAR.2024 18:20:51

BLE_2M_Ant1_2440_1000~26500
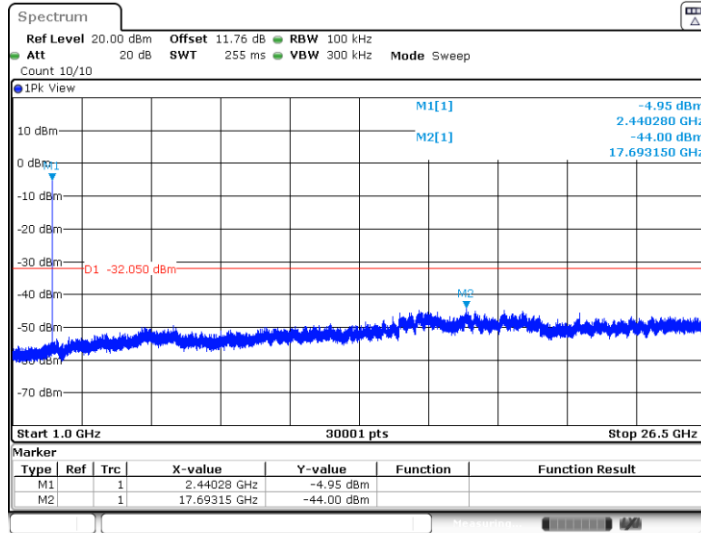
Date: 6.MAR.2024 18:21:27

BLE_2M_Ant1_2480_30~1000
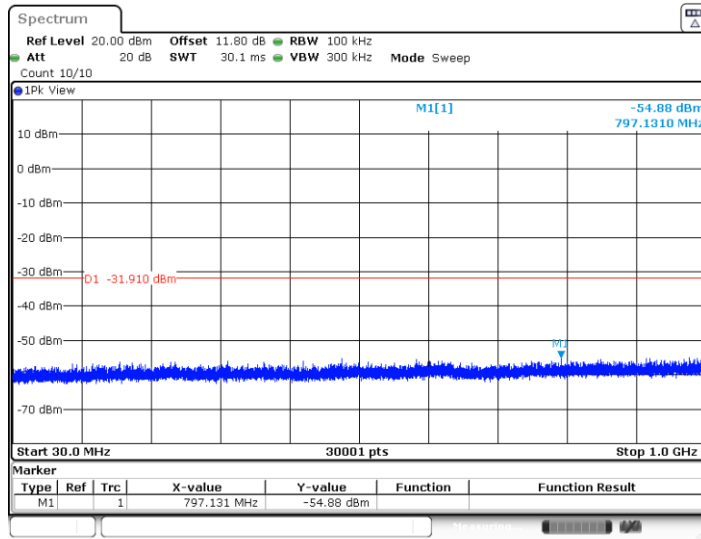
Date: 6.MAR.2024 18:25:51

BLE_2M_Ant1_2480_1000~26500
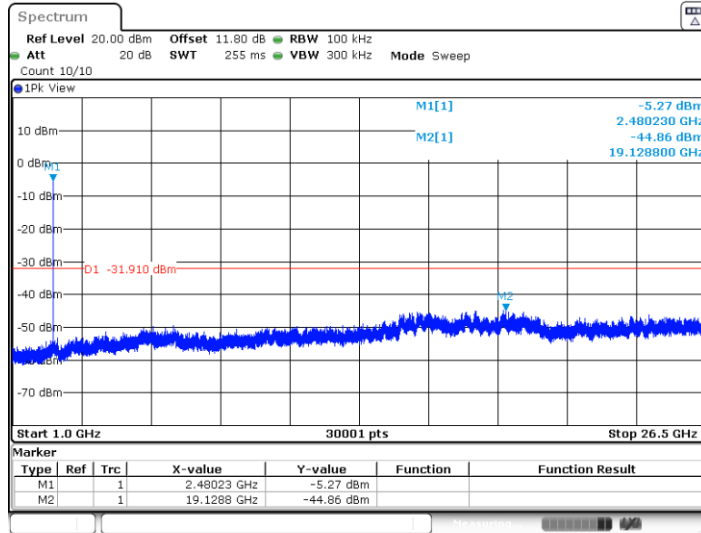
Date: 6.MAR.2024 18:26:14

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Amos	Temperature :	24.2~25.6℃
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		
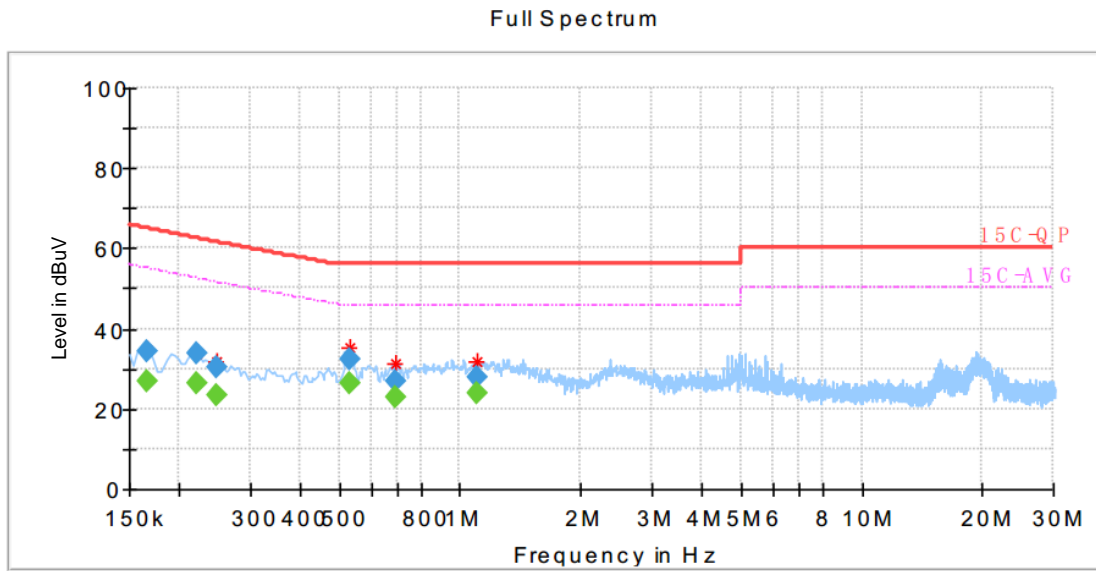
Full Spectrum

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.166406	---	26.97	55.06	28.09	L1	OFF	20.0
0.166406	34.16	---	65.07	30.92	L1	OFF	20.0
0.220894	---	26.34	52.57	26.23	L1	OFF	20.0
0.220894	33.75	---	62.60	28.86	L1	OFF	20.0
0.247725	---	23.63	51.59	27.96	L1	OFF	19.9
0.247725	30.23	---	61.63	31.40	L1	OFF	19.9
0.532069	---	26.54	46.00	19.46	L1	OFF	19.8
0.532069	32.48	---	56.00	23.52	L1	OFF	19.8
0.693225	---	22.89	46.00	23.11	L1	OFF	19.8
0.693225	26.99	---	56.00	29.01	L1	OFF	19.8
1.099988	---	23.94	46.00	22.06	L1	OFF	19.8
1.099988	27.76	---	56.00	28.24	L1	OFF	19.8

Test Engineer :	Amos	Temperature :	24.2~25.6℃
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		
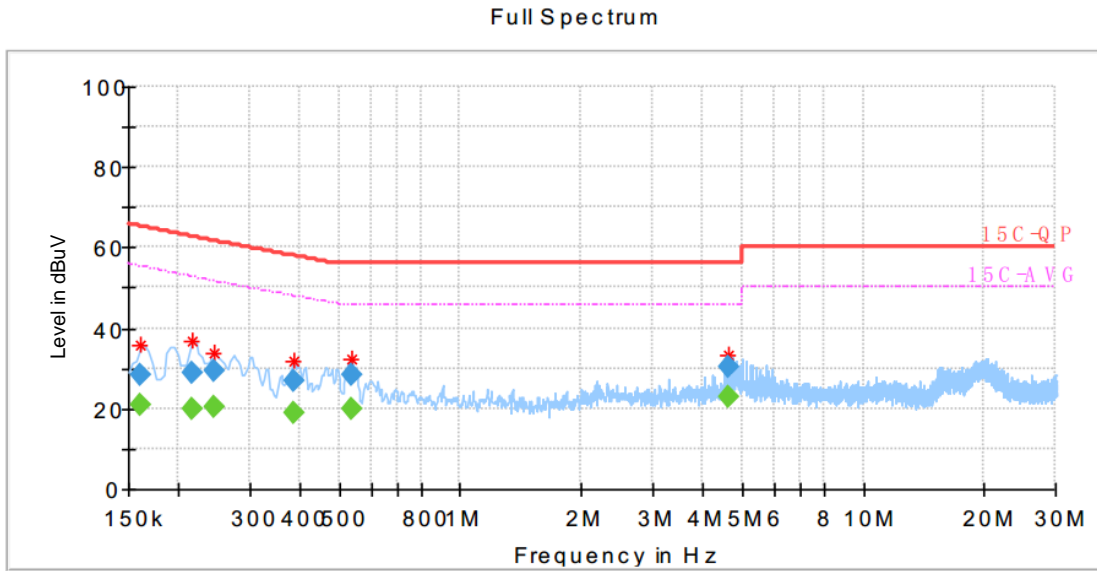
Full Spectrum

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.160425	---	20.96	55.39	34.43	N	OFF	20.2
0.160425	28.58	---	65.40	36.82	N	OFF	20.2
0.214912	---	20.06	52.81	32.74	N	OFF	20.2
0.214912	28.69	---	62.84	34.15	N	OFF	20.2
0.244762	---	20.22	51.69	31.47	N	OFF	20.1
0.244762	29.14	---	61.73	32.59	N	OFF	20.1
0.384300	---	18.97	48.02	29.05	N	OFF	20.0
0.384300	26.99	---	58.05	31.06	N	OFF	20.0
0.535799	---	20.11	46.00	25.89	N	OFF	19.9
0.535799	28.27	---	56.00	27.73	N	OFF	19.9
4.640251	---	22.66	46.00	23.34	N	OFF	19.9
4.640251	30.16	---	56.00	25.84	N	OFF	19.9

Appendix C Radiated Spurious Emission Test Data

Test Engineer :	Carry Xu	Relative Humidity :	41~42%
		Temperature :	22~23℃

Radiated Spurious Emission Test Modes

Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	SISO	Bluetooth-LE	00	2402	1Mbps	-
Mode 2	2400-2483.5	SISO	Bluetooth-LE	19	2440	1Mbps	-
Mode 3	2400-2483.5	SISO	Bluetooth-LE	39	2480	1Mbps	-
Mode 4	2400-2483.5	SISO	Bluetooth-LE	00	2402	2Mbps	-
Mode 5	2400-2483.5	SISO	Bluetooth-LE	19	2440	2Mbps	-
Mode 6	2400-2483.5	SISO	Bluetooth-LE	39	2480	2Mbps	-

Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth-LE	00	2369.02	44.10	54.00	-9.90	H	AVERAGE	Pass	Band Edge
1	Bluetooth-LE	00	4804.00	40.63	74.00	-33.37	H	PEAK	Pass	Harmonic
2	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
2	Bluetooth-LE	19	7320.00	43.44	74.00	-30.56	V	PEAK	Pass	Harmonic
3	Bluetooth-LE	39	2484.70	44.26	54.00	-9.74	H	AVERAGE	Pass	Band Edge
3	Bluetooth-LE	39	7440.00	43.12	74.00	-30.88	V	PEAK	Pass	Harmonic
4	Bluetooth-LE	00	2369.02	44.78	54.00	-9.22	H	AVERAGE	Pass	Band Edge
4	Bluetooth-LE	00	4804.00	39.84	74.00	-34.16	V	PEAK	Pass	Harmonic
5	Bluetooth-LE	19	-	-	-	-	-	-	-	Band Edge
5	Bluetooth-LE	19	7320.00	43.37	74.00	-30.63	H	PEAK	Pass	Harmonic
6	Bluetooth-LE	39	2483.92	44.74	54.00	-9.26	V	AVERAGE	Pass	Band Edge
6	Bluetooth-LE	39	7440.00	43.18	74.00	-30.82	H	PEAK	Pass	Harmonic

Mode	1
	Band Edge
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	**SISO**
Pol.	**Horizontal** / **Fundamental**

Pol.	Horizontal	Fundamental

Peak

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2382.67	55.67	74.00	-18.33	39.39	32.37	8.84	30.93	6.00	100	286	PEAK

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	96.56	------	------	80.16	32.40	8.93	30.93	6.00	100	286	PEAK

Avg

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2369.02	44.10	54.00	-9.90	27.92	32.34	8.78	30.94	6.00	100	286	AVERAGE

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	95.71	------	------	79.31	32.40	8.93	30.93	6.00	100	286	AVERAGE

Mode	1
	Band Edge
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	**SISO**
Pol.	**Vertical** **Fundamental**

Peak

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2388.65	54.96	74.00	-19.04	38.64	32.38	8.87	30.93	6.00	308	132	PEAK

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	92.24	------	------	75.84	32.40	8.93	30.93	6.00	308	132	PEAK

Avg

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2363.95	44.07	54.00	-9.93	27.93	32.33	8.75	30.94	6.00	308	132	AVERAGE

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	91.37	------	------	74.97	32.40	8.93	30.93	6.00	308	132	AVERAGE

Mode	1
	Harmonic
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	SISO

Pol.	Horizontal	Vertical
Peak Avg		

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4804.00	40.63	74.00	-33.37	59.73	34.29	12.30	65.69	0.00	--	--	PEAK

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4804.00	40.42	74.00	-33.58	59.52	34.29	12.30	65.69	0.00	--	--	PEAK

Mode	2
	Harmonic
	2400-2483.5_Bluetooth-LE _CH19_2440MHz
ANT	SISO

Pol.	Horizontal	Vertical
Peak Avg		

Horizontal:

```
           Limit        Read  Ant  Cable Preamp  Aux  APos  TPos
     Freq  Level  Line Margin Level Factor Loss Factor Factor        Remark

      MHz dBuV/m dBuV/m  dB   dBuV  dB/m   dB    dB    dB    cm   deg
 1  4880.00 38.72 74.00 -35.28 58.00 34.20 12.07 65.55  0.00  --   -- PEAK
 2  7320.00 42.94 74.00 -31.06 57.01 35.80 14.98 64.85  0.00  --   -- PEAK
```

Vertical:

```
           Limit        Read  Ant  Cable Preamp  Aux  APos  TPos
     Freq  Level  Line Margin Level Factor Loss Factor Factor        Remark

      MHz dBuV/m dBuV/m  dB   dBuV  dB/m   dB    dB    dB    cm   deg
 1  4880.00 38.13 74.00 -35.87 57.41 34.20 12.07 65.55  0.00  --   -- PEAK
 2  7320.00 43.44 74.00 -30.56 57.51 35.80 14.98 64.85  0.00  --   -- PEAK
```

Mode	3
	Band Edge
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	**SISO**
Pol.	**Horizontal** **Fundamental**

Peak

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2495.92	55.28	74.00	-18.72	38.98	32.40	8.87	30.97	6.00	100	353	PEAK

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2480.00	95.06	------	------	78.75	32.40	8.88	30.97	6.00	100	353	PEAK

Avg

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2484.70	44.26	54.00	-9.74	27.95	32.40	8.88	30.97	6.00	100	353	AVERAGE

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2480.00	94.12	------	------	77.81	32.40	8.88	30.97	6.00	100	353	AVERAGE

Mode	3
	Band Edge
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	**SISO**
Pol.	**Vertical** / **Fundamental**

Pol.	Vertical	Fundamental
Peak		

Peak — Vertical

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2498.20	54.55	74.00	-19.45	38.25	32.40	8.87	30.97	6.00	367	174	PEAK

Peak — Fundamental

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2480.00	94.48	------	------	78.17	32.40	8.88	30.97	6.00	367	174	PEAK

Pol.	Vertical	Fundamental
Avg		

Avg — Vertical

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2485.42	44.11	54.00	-9.89	27.80	32.40	8.88	30.97	6.00	367	174	AVERAGE

Avg — Fundamental

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2480.00	93.61	------	------	77.30	32.40	8.88	30.97	6.00	367	174	AVERAGE

Mode	3
	Harmonic
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	SISO

Pol.	Horizontal	Vertical
Peak **Avg**		

Horizontal:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4960.00	40.35	74.00	-33.65	59.50	34.24	12.01	65.40	0.00	--	--	PEAK
2	7440.00	42.53	74.00	-31.47	56.60	35.80	15.32	65.19	0.00	--	--	PEAK

Vertical:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4960.00	40.62	74.00	-33.38	59.77	34.24	12.01	65.40	0.00	--	--	PEAK
2	7440.00	43.12	74.00	-30.88	57.19	35.80	15.32	65.19	0.00	--	--	PEAK

Mode	4
	Band Edge
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	**SISO**
Pol.	**Horizontal** / **Fundamental**

Pol.	Horizontal	Fundamental
Peak		

Horizontal Peak data:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2366.68	54.99	74.00	-19.01	38.84	32.33	8.76	30.94	6.00	100	331	PEAK

Fundamental Peak data:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	95.22	------	------	78.82	32.40	8.93	30.93	6.00	100	331	PEAK

Pol.	Horizontal	Fundamental
Avg		

Horizontal Avg data:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2369.02	44.78	54.00	-9.22	28.60	32.34	8.78	30.94	6.00	100	331	AVERAGE

Fundamental Avg data:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2402.00	93.05	------	------	76.65	32.40	8.93	30.93	6.00	100	331	AVERAGE

Mode	4
	Band Edge
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	SISO
Pol.	Vertical	Fundamental

Peak

	Freq	Level	Limit Line Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	2366.42	54.69	74.00 -19.31	38.54	32.33	8.76	30.94	6.00	396	176	PEAK

	Freq	Level	Limit Line Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
1	2402.00	96.11	------ ------	79.71	32.40	8.93	30.93	6.00	396	176	PEAK

Avg

	Freq	Level	Limit Line Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
1	2371.88	44.53	54.00 -9.47	28.34	32.34	8.79	30.94	6.00	396	176	AVERAGE

	Freq	Level	Limit Line Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
1	2402.00	93.88	------ ------	77.48	32.40	8.93	30.93	6.00	396	176	AVERAGE

Mode	4
	Harmonic
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	SISO

Pol.	Horizontal	Vertical
Peak Avg		
Peak Avg		

Horizontal (Peak/Avg) table:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	4804.00	39.45	74.00	-34.55	58.55	34.29	12.30	65.69	0.00	--	--	PEAK

Vertical (Peak/Avg) table:

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	4804.00	39.84	74.00	-34.16	58.94	34.29	12.30	65.69	0.00	--	--	PEAK

Note: Only the worst case has assessed 18G ~25GHz to test.

Mode	5
	Harmonic
	2400-2483.5_Bluetooth-LE _CH19_2440MHz
ANT	SISO
Pol.	Horizontal / Vertical

Peak Avg	

Horizontal

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	4880.00	39.03	74.00	-34.97	58.31	34.20	12.07	65.55	0.00	--	--	PEAK
2	7320.00	43.37	74.00	-30.63	57.44	35.80	14.98	64.85	0.00	--	--	PEAK

Vertical

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	4880.00	38.41	74.00	-35.59	57.69	34.20	12.07	65.55	0.00	--	--	PEAK
2	7320.00	42.73	74.00	-31.27	56.80	35.80	14.98	64.85	0.00	--	--	PEAK

Mode	6
	Band Edge
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	**SISO**
Pol.	**Horizontal** / **Fundamental**

Peak

Horizontal:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2494.48	54.77	74.00	-19.23	38.47	32.40	8.87	30.97	6.00	140	322	PEAK

Fundamental:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2480.00	96.07	------	------	79.76	32.40	8.88	30.97	6.00	140	322	PEAK

Avg

Horizontal:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2493.82	44.73	54.00	-9.27	28.43	32.40	8.87	30.97	6.00	140	322	AVERAGE

Fundamental:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2480.00	93.93	------	------	77.62	32.40	8.88	30.97	6.00	140	322	AVERAGE

Mode	6
	Band Edge
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	**SISO**
Pol.	**Vertical** / **Fundamental**

Pol.	**Vertical**	**Fundamental**

Peak

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2494.60	55.21	74.00	-18.79	38.91	32.40	8.87	30.97	6.00	327	189	PEAK

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2480.00	93.51	------	------	77.20	32.40	8.88	30.97	6.00	327	189	PEAK

Avg

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2483.92	44.74	54.00	-9.26	28.43	32.40	8.88	30.97	6.00	327	189	AVERAGE

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	2480.00	91.32	------	------	75.01	32.40	8.88	30.97	6.00	327	189	AVERAGE

Mode	6
	Harmonic
	2400-2483.5_Bluetooth-LE _CH39_2480MHz
ANT	SISO

Pol.	Horizontal	Vertical
Peak Avg		

Horizontal:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4960.00	40.23	74.00	-33.77	59.38	34.24	12.01	65.40	0.00	--	--	PEAK
2	7440.00	43.18	74.00	-30.82	57.25	35.80	15.32	65.19	0.00	--	--	PEAK

Vertical:

	Freq MHz	Level dBuV/m	Limit Line dBuV/m	Margin dB	Read Level dBuV	Ant Factor dB/m	Cable Loss dB	Preamp Factor dB	Aux Factor dB	APos cm	TPos deg	Remark
1	4960.00	39.91	74.00	-34.09	59.06	34.24	12.01	65.40	0.00	--	--	PEAK
2	7440.00	42.59	74.00	-31.41	56.66	35.80	15.32	65.19	0.00	--	--	PEAK

Mode	4
	30M-1G
	2400-2483.5_Bluetooth-LE _CH00_2402MHz
ANT	**SISO**
Pol.	**Horizontal** / **Vertical**

Peak

QP

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phas
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg		
1	60.07	13.17	-26.83	40.00	32.34	12.58	1.15	32.90	---	---	Peak	HORIZONT
2	164.83	13.52	-29.98	43.50	28.29	16.12	1.94	32.83	---	---	Peak	HORIZONT
3	299.66	21.36	-24.64	46.00	32.22	19.32	2.64	32.82	---	---	Peak	HORIZONT
4	593.57	24.95	-21.05	46.00	29.35	24.96	3.72	33.08	---	---	Peak	HORIZONT
5	784.66	27.95	-18.05	46.00	30.30	26.13	4.28	32.76	---	---	Peak	HORIZONT
6	957.32	30.39	-15.61	46.00	29.67	27.53	4.73	31.54	---	---	Peak	HORIZONT

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phas
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg		
1	32.91	25.08	-14.92	40.00	34.20	23.06	0.76	32.94	---	---	Peak	VERTICAL
2	60.07	26.22	-13.78	40.00	45.39	12.58	1.15	32.90	---	---	Peak	VERTICAL
3	179.38	31.47	-12.03	43.50	46.44	15.83	2.03	32.83	---	---	Peak	VERTICAL
4	250.19	19.21	-26.79	46.00	31.14	18.42	2.42	32.77	---	---	Peak	VERTICAL
5	593.57	24.88	-21.12	46.00	29.28	24.96	3.72	33.08	---	---	Peak	VERTICAL
6	830.25	27.44	-18.56	46.00	29.10	26.46	4.40	32.52	---	---	Peak	VERTICAL

Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE 1Mbps	61.11	0.383	2.614	2.7k
Bluetooth LE 2Mbps	31.48	0.197	5.074	5.1k

Bluetooth LE 1Mbps

Bluetooth LE 2Mbps