FCC RF Test Report

APPLICANT	:	Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	:	Smart Module
BRAND NAME	:	Quectel
MODEL NAME	:	SG885G-WF
FCC ID	:	XMR2023SG885GWF
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Dec. 14, 2023 ~ Mar. 05, 2024

We, Sporton International Inc. (Shenzhen), 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.

This report contains data that were produced under subcontract by Sporton International Inc. (Kunshan)

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

Jason Jia

Approved by: Jason Jia

ACCREDITED Cert #5145.01

Sporton International Inc. (ShenZhen)

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055

People's Republic of China

TABLE OF CONTENTS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3N0102B	Rev. 01	Initial issue of report	Mar. 18, 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	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.81 dB at 2483.54 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 16.18 dB at 0.292 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.

1 General Description

1.1 Applicant

Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233, China

1.2 Manufacturer

Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233, China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Module
Brand Name	Quectel
Model Name	SG885G-WF
FCC ID	XMR2023SG885GWF
SN Code	Conducted: E1Y23IA0Y000008/E1Y23IB25000010 Conduction: E1Y23IA0Y0000021 Radiation: E1Y23IA0Y000031
HW Version	R1.0
SW Version	SG885GWFNAR01A03
EUT Stage	Identical Prototype

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

1.4 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	**<Ant. 1>** BLE 1Mbps: 0.70 dBm (0.0012 W) BLE 2Mbps: 0.67 dBm (0.0012 W) **<Ant. 2>** BLE 1Mbps: -0.26 dBm (0.0009 W) BLE 2Mbps: -0.31 dBm (0.0009 W)
99% Occupied Bandwidth	**<Ant. 1>** BLE 1Mbps: 1.047MHz BLE 2Mbps: 2.062MHz **<Ant. 2>** BLE 1Mbps: 1.055MHz BLE 2Mbps: 2.078MHz
Antenna Type / Gain	**<Ant.1>:** Dipole Antenna type with gain 0.47 dBi **<Ant.2>:** Dipole Antenna type with gain 0.47 dBi
Type of Modulation	Bluetooth LE : GFSK

Note: The device supports Bluetooth LE SISO mode only.

1.5 Modification of EUT

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

1.6 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	CN1257	314309

Note: Test data subcontracted: conduction test case in section 3.6 of this report

Sporton International Inc. (ShenZhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	TH01-SZ	CN1256	421272

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	03CH01-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	CO01-KS	AUDIX	E3	6.2009-8-24
2.	03CH01-SZ	AUDIX	E3	6.2009-8-24

1.8 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 (Y plane) were recorded in this report.

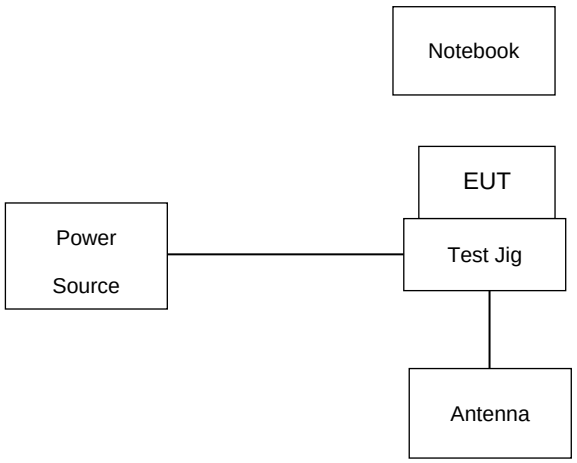
b. AC power line Conducted Emission was tested under maximum output power.

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 + WLAN Link (2.4G) + Charging from Test Jig

2.3 Connection Diagram of Test System

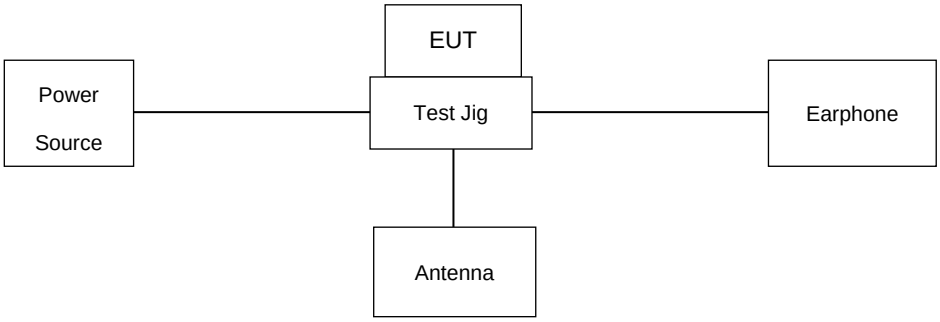
AC Conducted Emission:



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:



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	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
2.	Adapter	N/A	N/A	N/A	N/A	N/A
3.	Antenna	N/A	N/A	N/A	N/A	N/A
4.	Test Jig	N/A	N/A	N/A	N/A	N/A
5.	Earphone	N/A	N/A	N/A	Unshielded, 1.2m	N/A

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 was set to connect with the notebook under large package sizes transmission.

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 1.70 dB and 10dB attenuator.

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

= 1.70 + 10 = 11.70 (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.

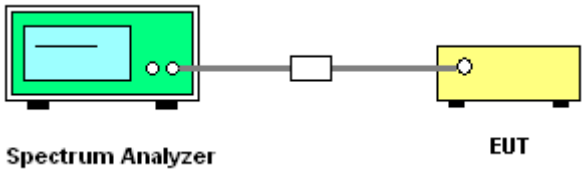
3.1.2 Measuring Instruments

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



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.

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 peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak 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.

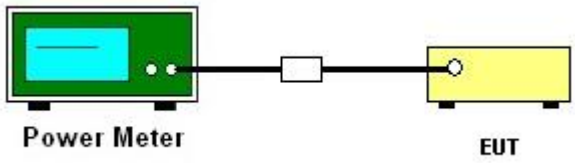
3.2.2 Measuring Instruments

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 Peak Output Power

<Ant.1>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	0.64	30.00	0.47	1.11	36.00	Pass
BLE	1Mbps	1	19	2440	0.70	30.00	0.47	1.17	36.00	Pass
BLE	1Mbps	1	39	2480	0.45	30.00	0.47	0.92	36.00	Pass

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	0.60	30.00	0.47	1.07	36.00	Pass
BLE	2Mbps	1	19	2440	0.67	30.00	0.47	1.14	36.00	Pass
BLE	2Mbps	1	39	2480	0.50	30.00	0.47	0.97	36.00	Pass

<Ant.2>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	-0.90	30.00	0.47	-0.43	36.00	Pass
BLE	1Mbps	1	19	2440	-0.26	30.00	0.47	0.21	36.00	Pass
BLE	1Mbps	1	39	2480	-0.34	30.00	0.47	0.13	36.00	Pass

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	-0.92	30.00	0.47	-0.45	36.00	Pass
BLE	2Mbps	1	19	2440	-0.31	30.00	0.47	0.16	36.00	Pass
BLE	2Mbps	1	39	2480	-0.38	30.00	0.47	0.09	36.00	Pass

3.2.6 Test Result of Average Output Power (Reporting Only)

<Ant.1>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	2.01	-0.24	30.00	0.47	0.23	36.00	Pass
BLE	1Mbps	1	19	2440	2.01	-0.08	30.00	0.47	0.39	36.00	Pass
BLE	1Mbps	1	39	2480	2.01	-1.35	30.00	0.47	-0.88	36.00	Pass

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	4.77	-0.25	30.00	0.47	0.22	36.00	Pass
BLE	2Mbps	1	19	2440	4.77	-0.13	30.00	0.47	0.34	36.00	Pass
BLE	2Mbps	1	39	2480	4.77	-1.38	30.00	0.47	-0.91	36.00	Pass

<Ant.2>

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	2.01	-1.11	30.00	0.47	-0.64	36.00	Pass
BLE	1Mbps	1	19	2440	2.01	-0.45	30.00	0.47	0.02	36.00	Pass
BLE	1Mbps	1	39	2480	2.01	-0.56	30.00	0.47	-0.09	36.00	Pass

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	2Mbps	1	0	2402	4.77	-1.16	30.00	0.47	-0.69	36.00	Pass
BLE	2Mbps	1	19	2440	4.77	-0.51	30.00	0.47	-0.04	36.00	Pass
BLE	2Mbps	1	39	2480	4.77	-0.62	30.00	0.47	-0.15	36.00	Pass

Note: Power setting is the default.

.

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.

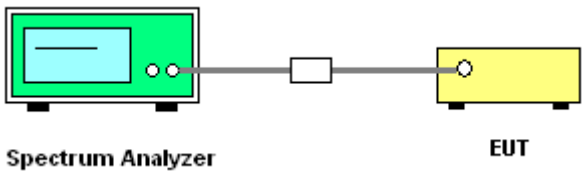
3.3.2 Measuring Instruments

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 11.10.2 Method PKPSD.
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 = peak, 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 20dBc 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 20 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

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

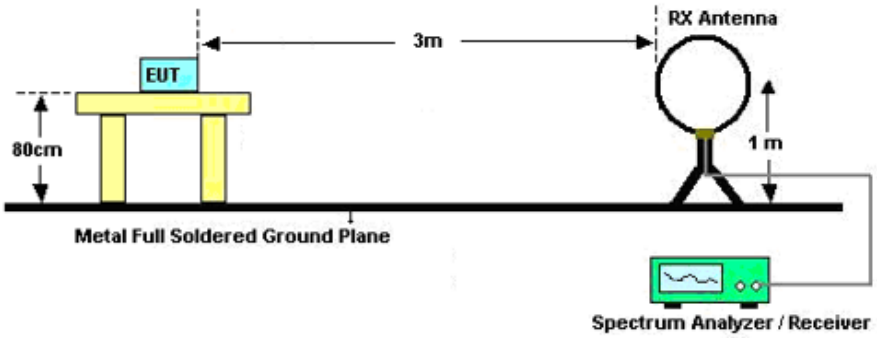
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.5.3 Test Procedures

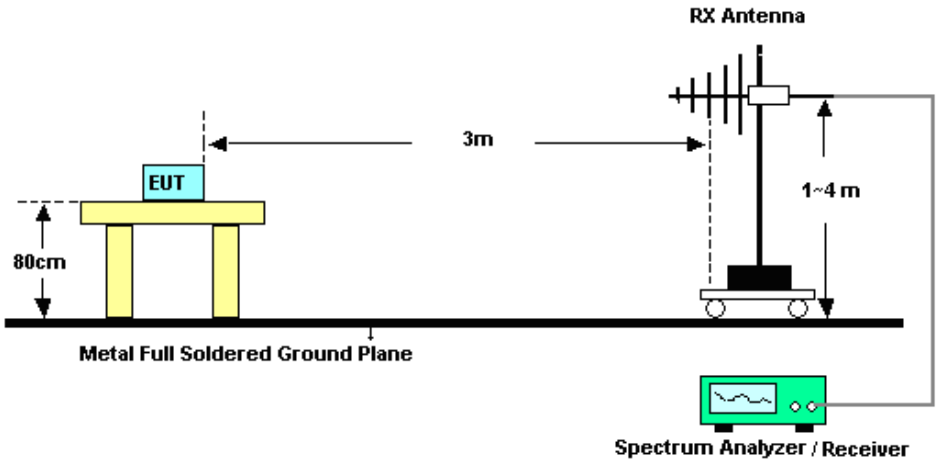
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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.

3.5.4 Test Setup

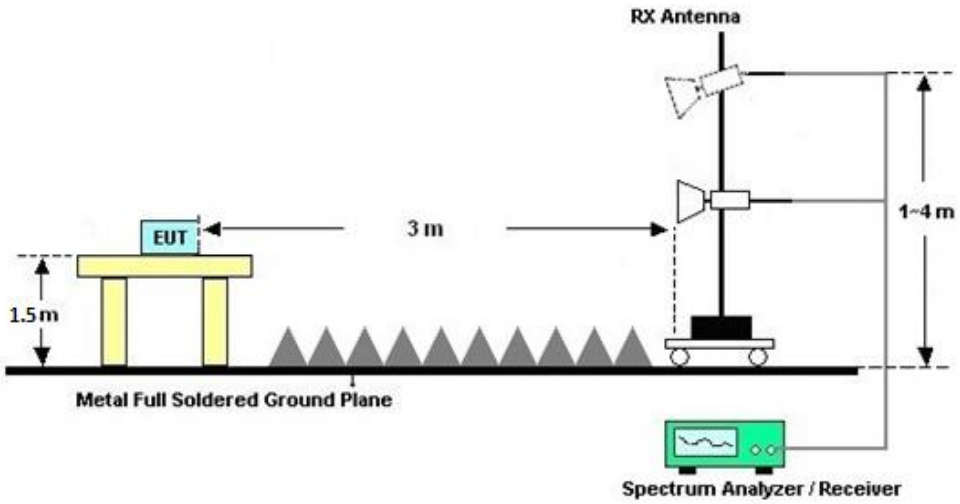
For radiated emissions below 30MHz



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.

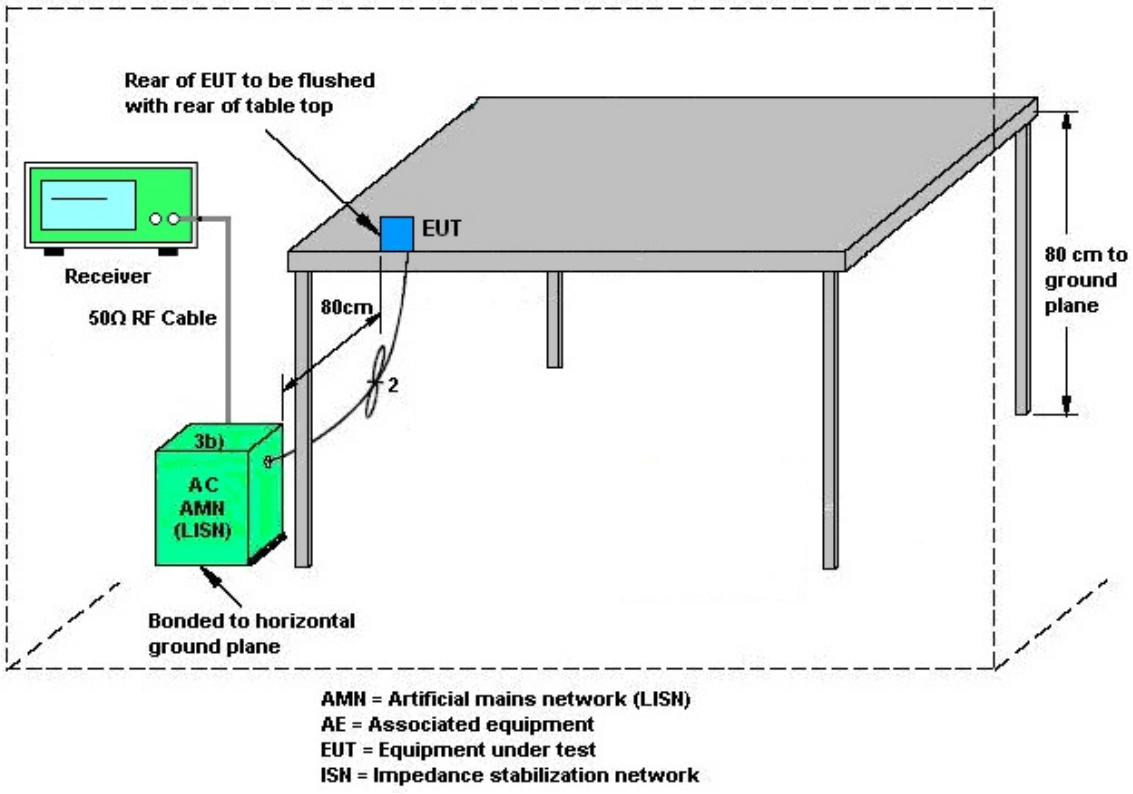
3.6.2 Measuring Instruments

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.

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

Non-standard antenna connector 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 Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 16, 2023	Dec. 14, 2023	May 15, 2024	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 11, 2023	Dec. 14, 2023	Oct. 10, 2024	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 16, 2023	Dec. 14, 2023	May 15, 2024	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 11, 2023	Dec. 14, 2023	Oct. 10, 2024	Conduction (CO01-KS)
EMI Test Receiver&SA	Agilent	N9038A	MY522601 85	20Hz~26.5GHz	Dec. 27, 2023	Jan. 10, 2024~ Mar. 05, 2024	Dec. 26, 2024	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY551502 13	10Hz~44GHz	Jul. 07, 2023	Jan. 10, 2024~ Mar. 05, 2024	Jul. 06, 2024	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jul. 28, 2022	Jan. 10, 2024~ Mar. 05, 2024	Jul. 27, 2024	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Oct. 24, 2023	Jan. 10, 2024~ Mar. 05, 2024	Oct. 23, 2025	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 08, 2023	Jan. 10, 2024~ Mar. 05, 2024	Jul. 07, 2024	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 08, 2023	Jan. 10, 2024~ Mar. 05, 2024	Apr. 07, 2024	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 04, 2023	Jan. 10, 2024~ Mar. 05, 2024	Apr. 03, 2024	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P-R	1943528	1GHz~18GHz	Oct. 18, 2023	Jan. 10, 2024~ Mar. 05, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY532701 05	0.5GHz~26.5Ghz	Oct. 18, 2023	Jan. 10, 2024~ Mar. 05, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 07, 2023	Jan. 10, 2024~ Mar. 05, 2024	Jul. 06, 2024	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001 985	N/A	Oct. 18, 2023	Jan. 10, 2024~ Mar. 05, 2024	Oct. 17, 2024	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jan. 10, 2024~ Mar. 05, 2024	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jan. 10, 2024~ Mar. 05, 2024	NCR	Radiation (03CH01-SZ)
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 06, 2023	Feb. 28, 2024~ Feb. 29, 2024	Apr. 05, 2024	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 26, 2023	Feb. 28, 2024~ Feb. 29, 2024	Dec. 25, 2024	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Aug. 21, 2023	Feb. 28, 2024~ Feb. 29, 2024	Aug. 20, 2024	Conducted (TH01-SZ)
Thermo meter	Anymetre	JR593	#7	- 10℃ ~ 50℃ 10%RH~99%RH	Apr. 08, 2023	Feb. 28, 2024~ Feb. 29, 2024	Apr. 07, 2024	Conducted (TH01-SZ)

NCR: No Calibration Required

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

Test Item	Uncertainty
Conducted Spurious Emission & Bandedge	±1.34 dB
Occupied Channel Bandwidth	±0.1%
Conducted Power	±1.34 dB
Conducted Power Spectral Density	±1.32 dB
Frequency	±1.3 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))	2.8 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.2 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.3 dB

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

Appendix A. Conducted Test Results

Ambient Condition: 24~26 ℃, 45~55 %RH	
Test Date: 2024/2/28 ~2024/2/29	**Test Engineer:** Ma Jie

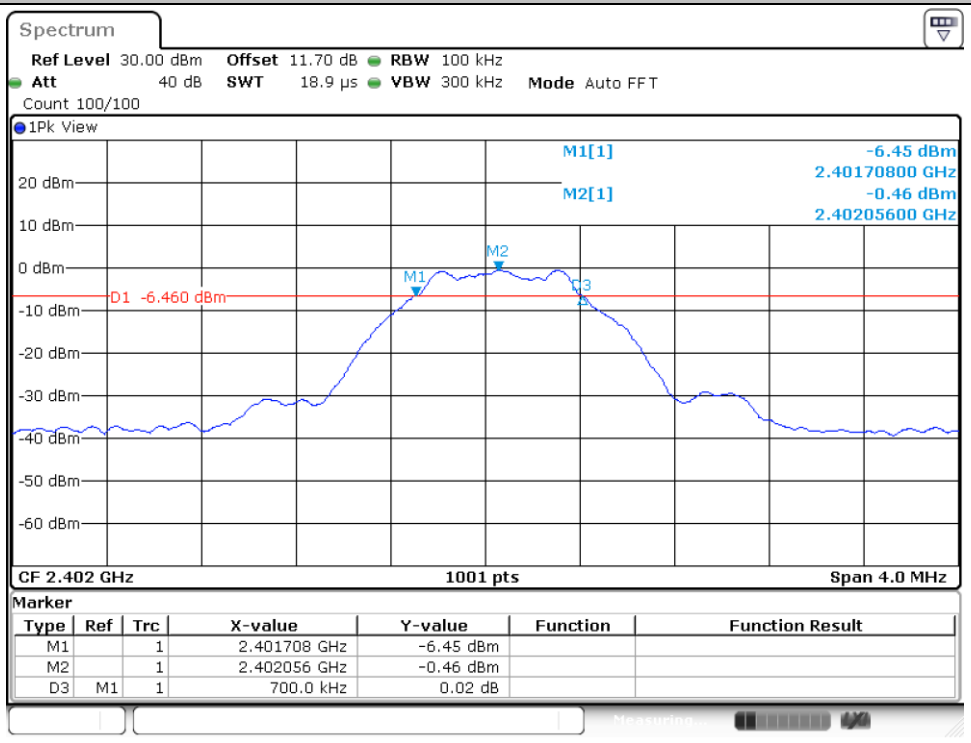
DTS Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.70	2401.71	2402.41	0.5	PASS
	Ant2	2402	0.68	2401.72	2402.40	0.5	PASS
	Ant1	2440	0.69	2439.72	2440.41	0.5	PASS
	Ant2	2440	0.68	2439.72	2440.41	0.5	PASS
	Ant1	2480	0.70	2479.71	2480.41	0.5	PASS
	Ant2	2480	0.68	2479.72	2480.40	0.5	PASS
BLE_2M	Ant1	2402	1.14	2401.50	2402.64	0.5	PASS
	Ant2	2402	1.14	2401.50	2402.64	0.5	PASS
	Ant1	2440	1.15	2439.49	2440.64	0.5	PASS
	Ant2	2440	1.14	2439.50	2440.64	0.5	PASS
	Ant1	2480	1.15	2479.49	2480.64	0.5	PASS
	Ant2	2480	1.14	2479.50	2480.64	0.5	PASS

Test Graphs

BLE_1M_Ant1_2402



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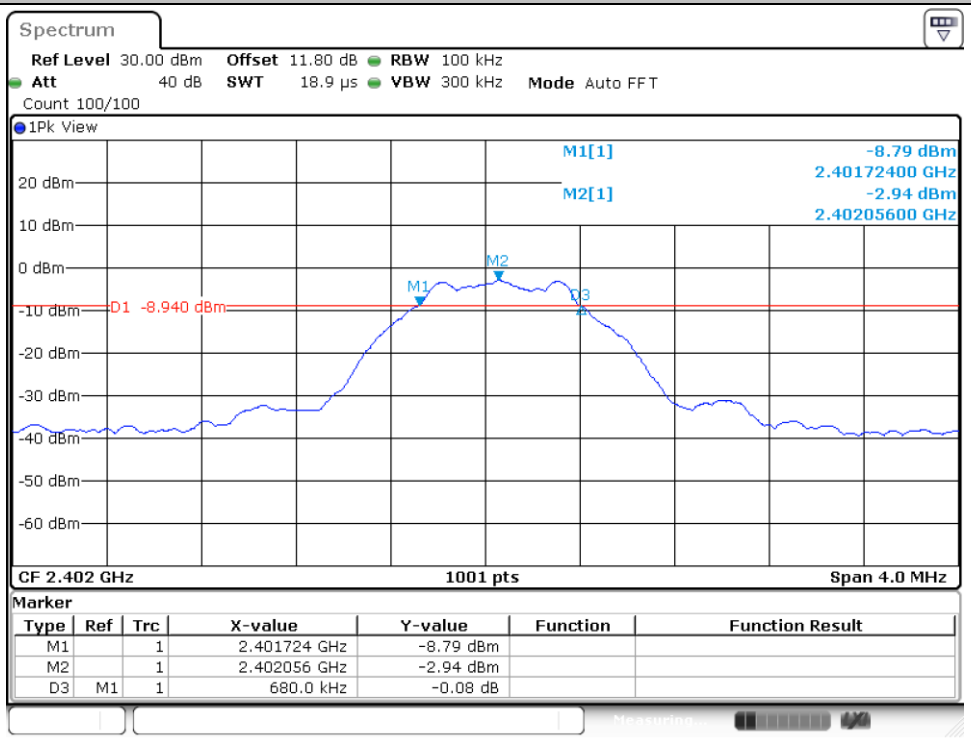
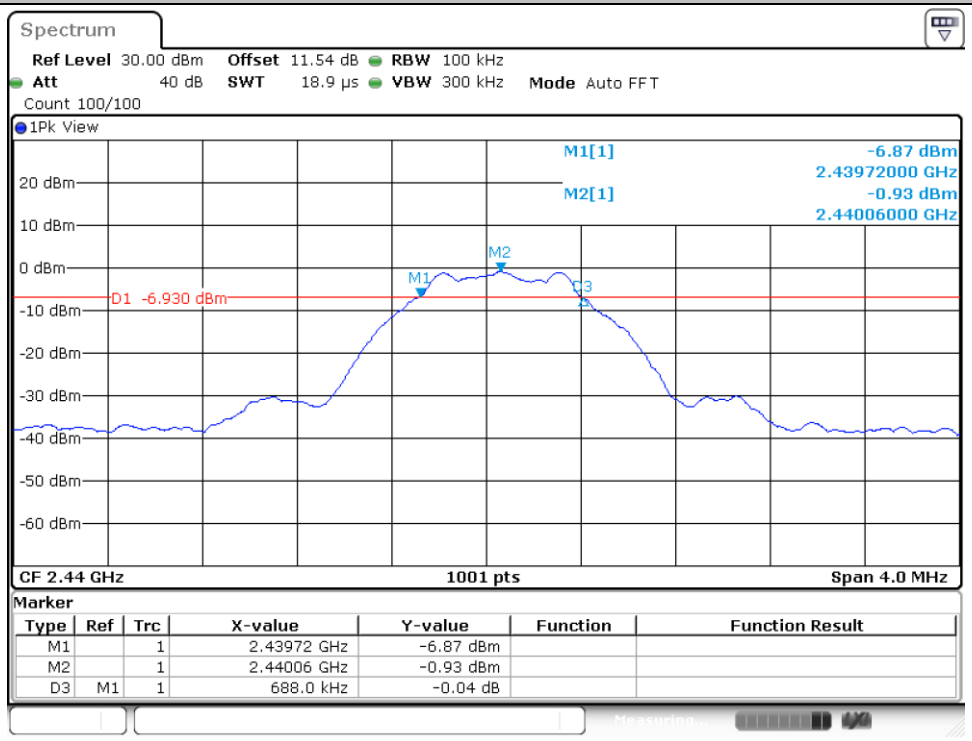
BLE_1M_Ant2_2402



Date: 29.FEB.2024 00:00:15

BLE_1M_Ant1_2440



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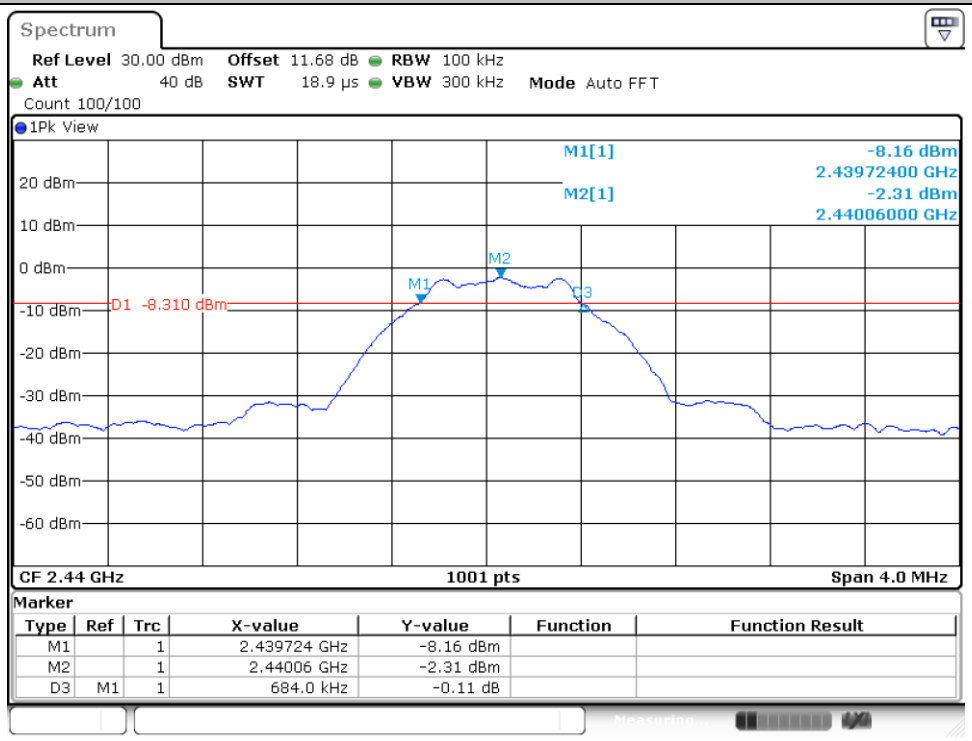
BLE_1M_Ant2_2440



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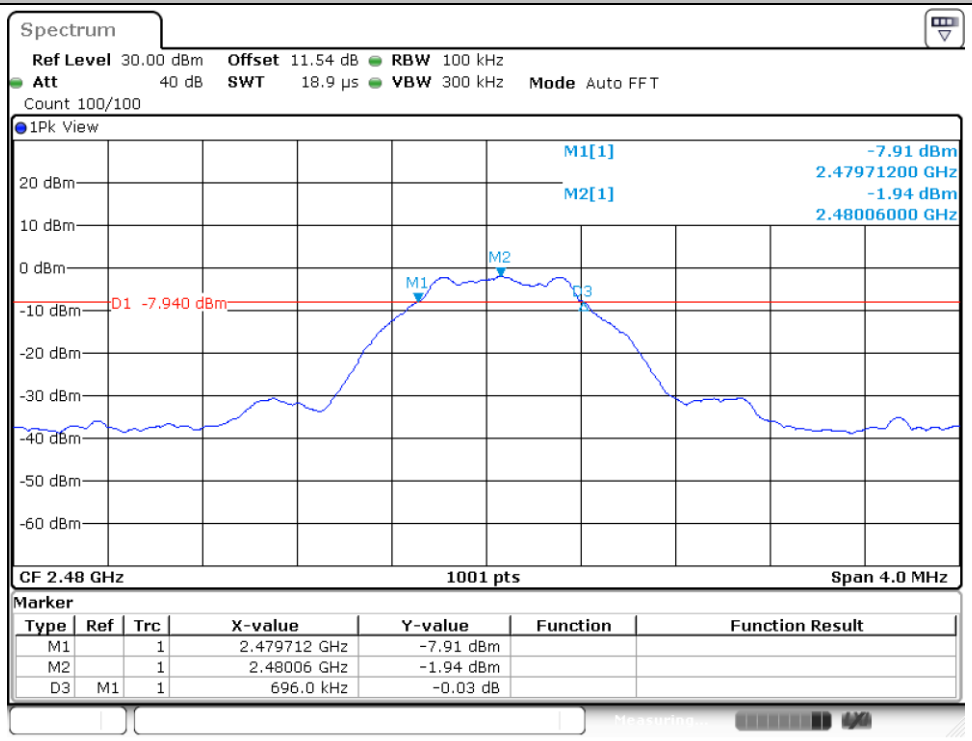
BLE_1M_Ant1_2480



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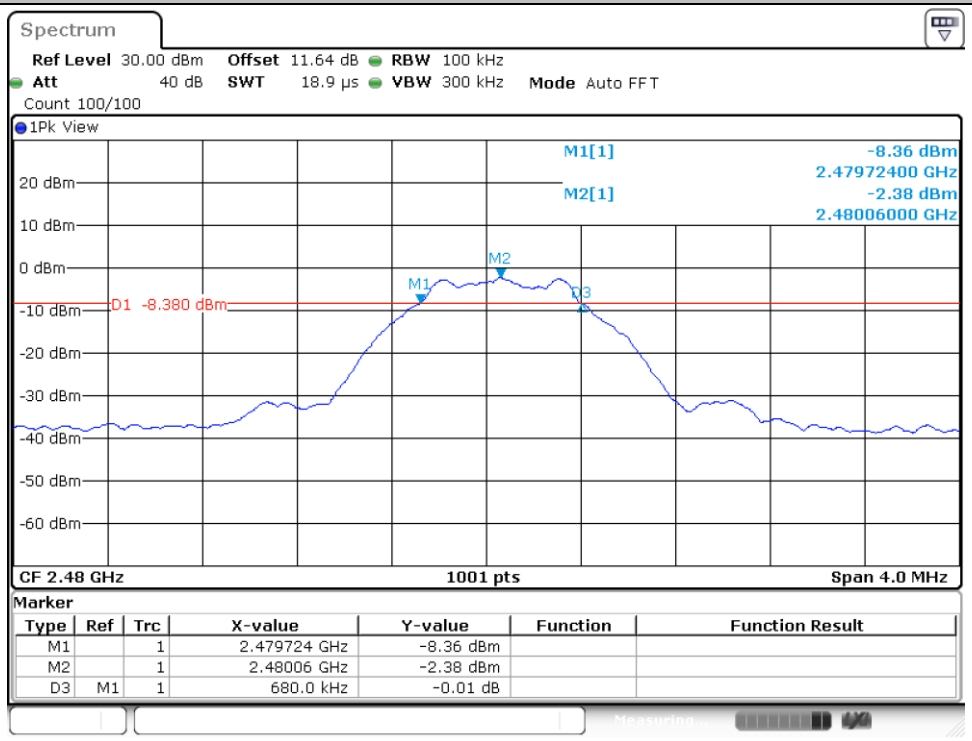
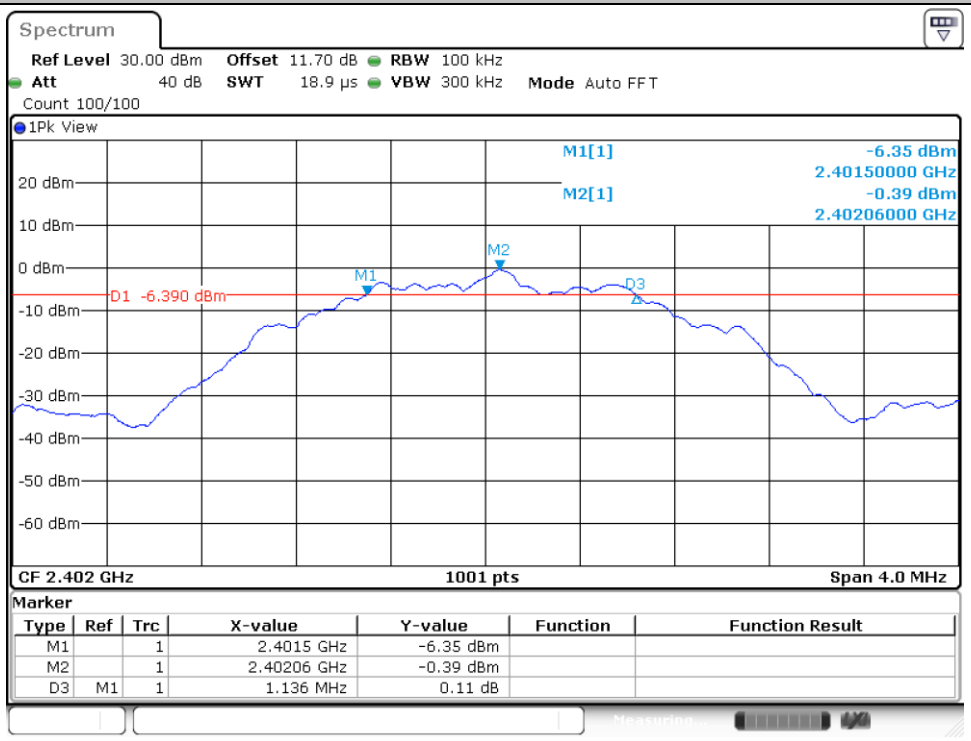
BLE_1M_Ant2_2480



Date: 29.FEB.2024 00:05:30

BLE_2M_Ant1_2402



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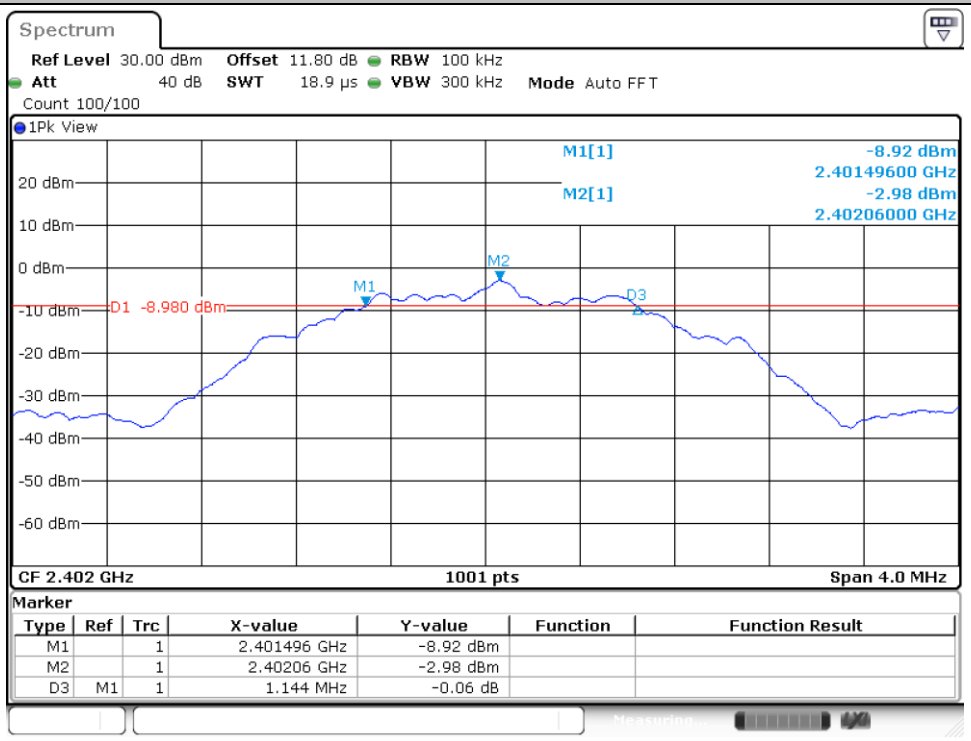
BLE_2M_Ant2_2402



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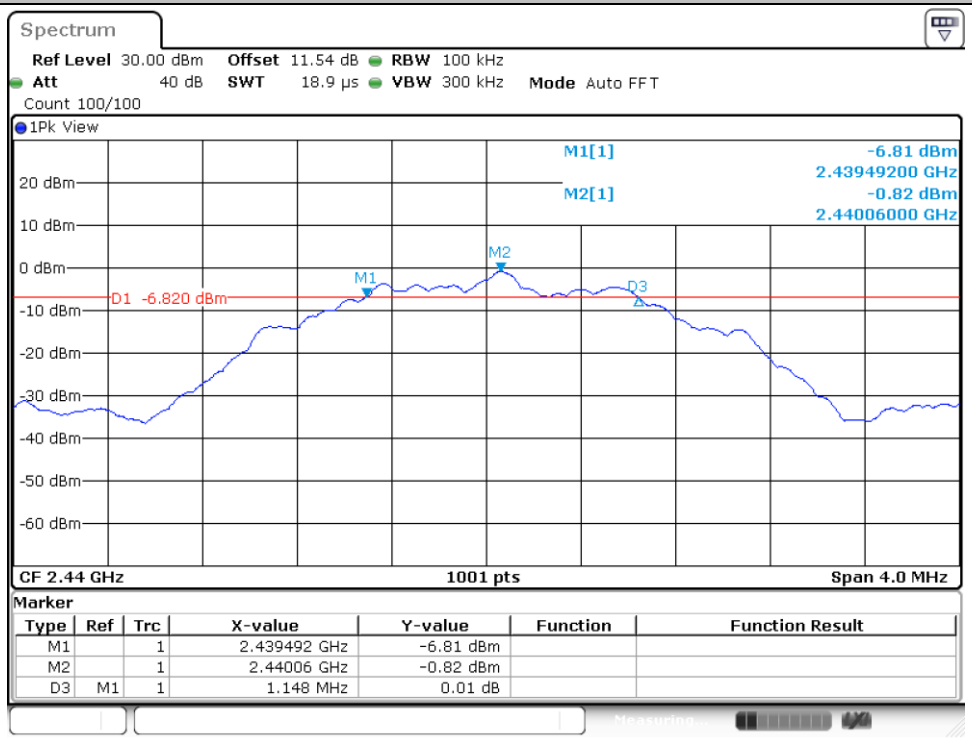
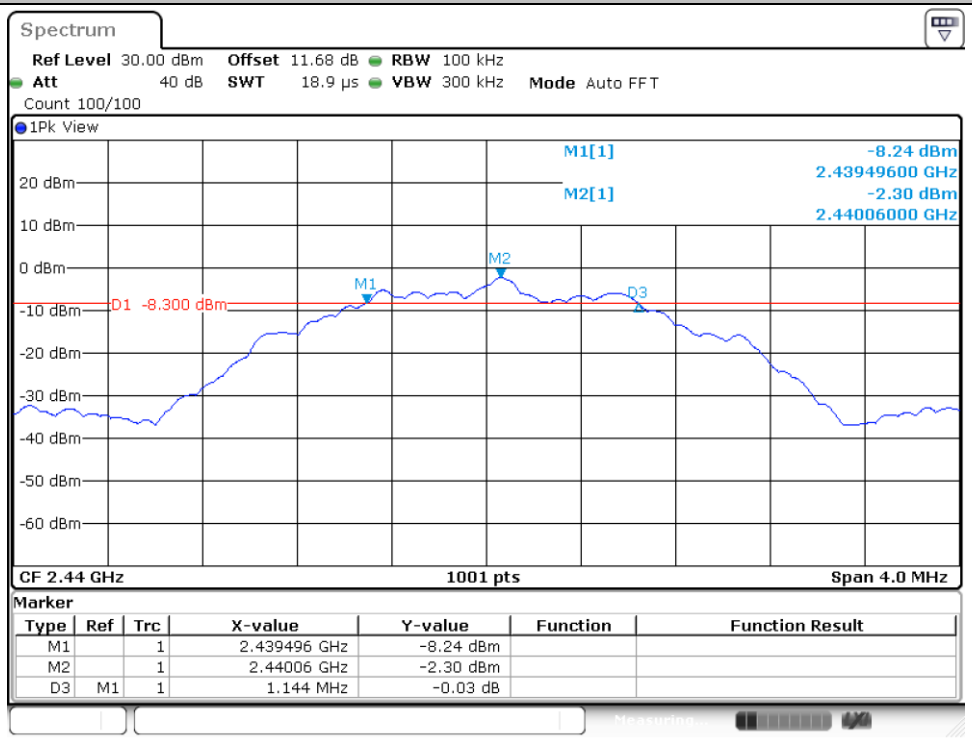
BLE_2M_Ant1_2440



Date: 28.FEB.2024 23:54:25

BLE_2M_Ant2_2440



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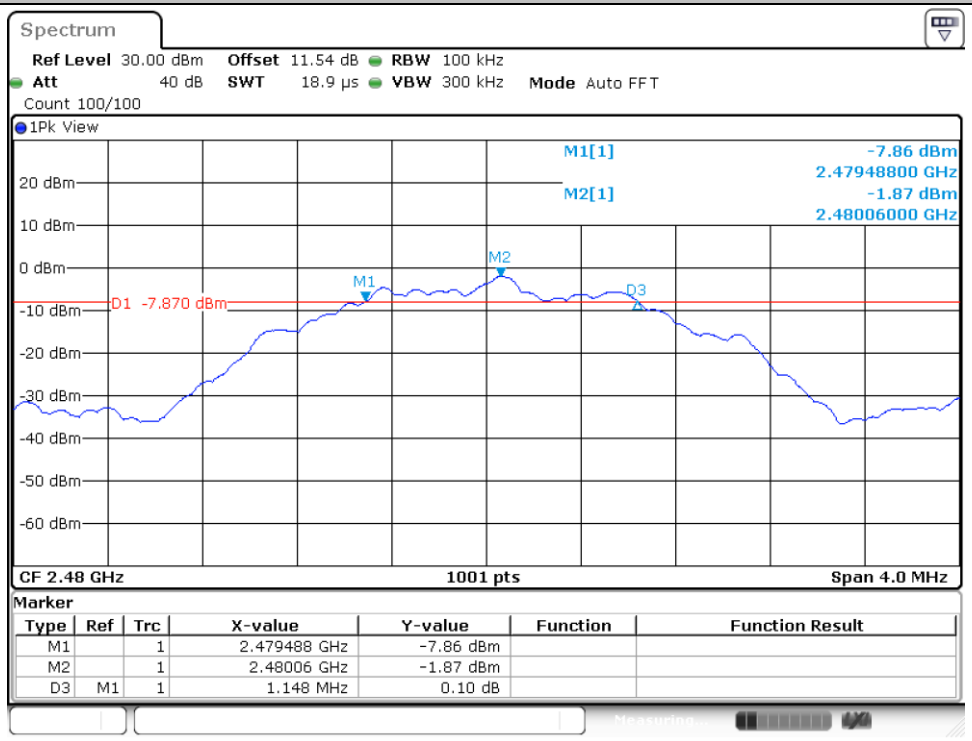
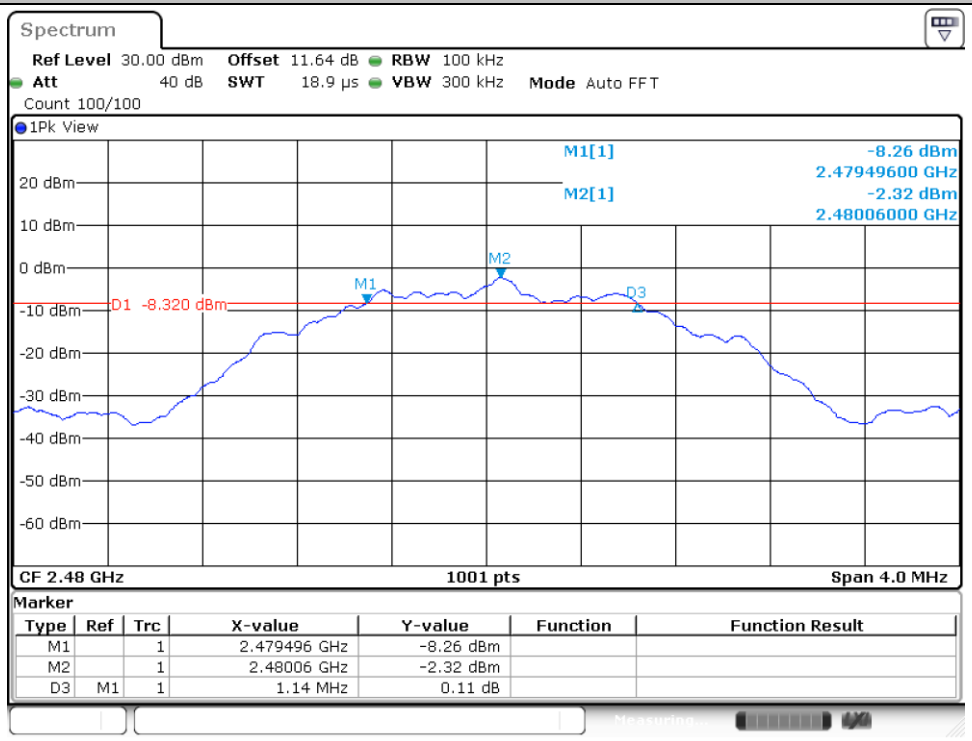


Date: 28.FEB.2024 23:56:03

BLE_2M_Ant2_2480



Date: 29.FEB.2024 00:12:18

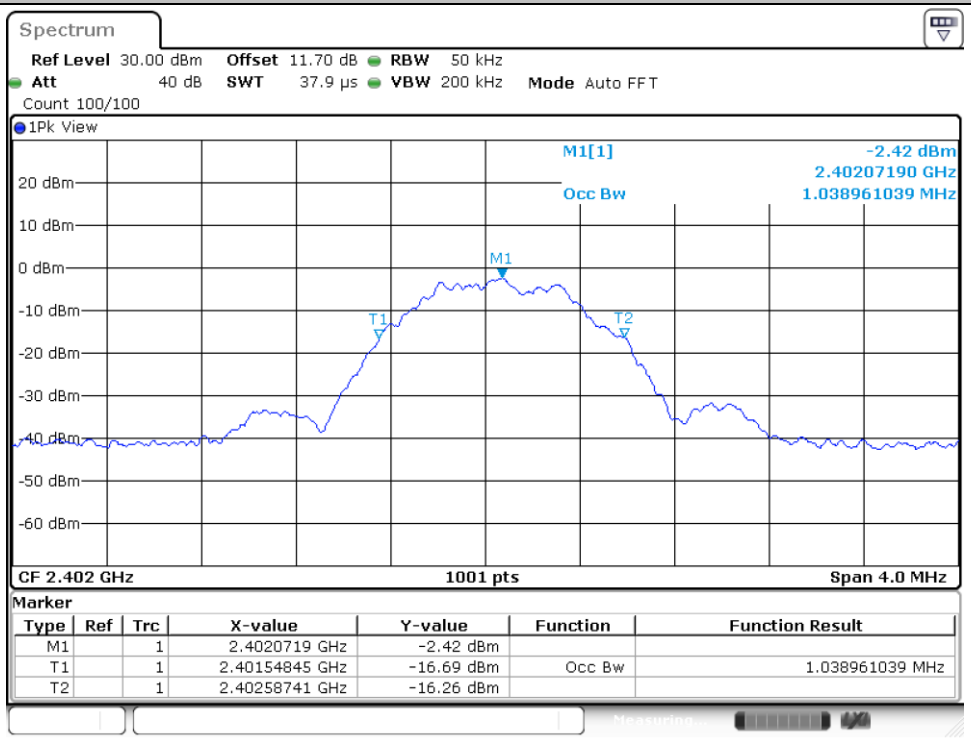
Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]
BLE_1M	Ant1	2402	1.039	2401.5485	2402.5874
	Ant2	2402	1.055	2401.5405	2402.5954
	Ant1	2440	1.043	2439.5485	2440.5914
	Ant2	2440	1.051	2439.5445	2440.5954
	Ant1	2480	1.047	2479.5445	2480.5914
	Ant2	2480	1.055	2479.5405	2480.5954
BLE_2M	Ant1	2402	2.058	2401.0490	2403.1069
	Ant2	2402	2.066	2401.0450	2403.1109
	Ant1	2440	2.062	2439.0450	2441.1069
	Ant2	2440	2.078	2439.0370	2441.1149
	Ant1	2480	2.062	2479.0410	2481.1029
	Ant2	2480	2.066	2479.0410	2481.1069

Test Graphs

BLE_1M_Ant1_2402



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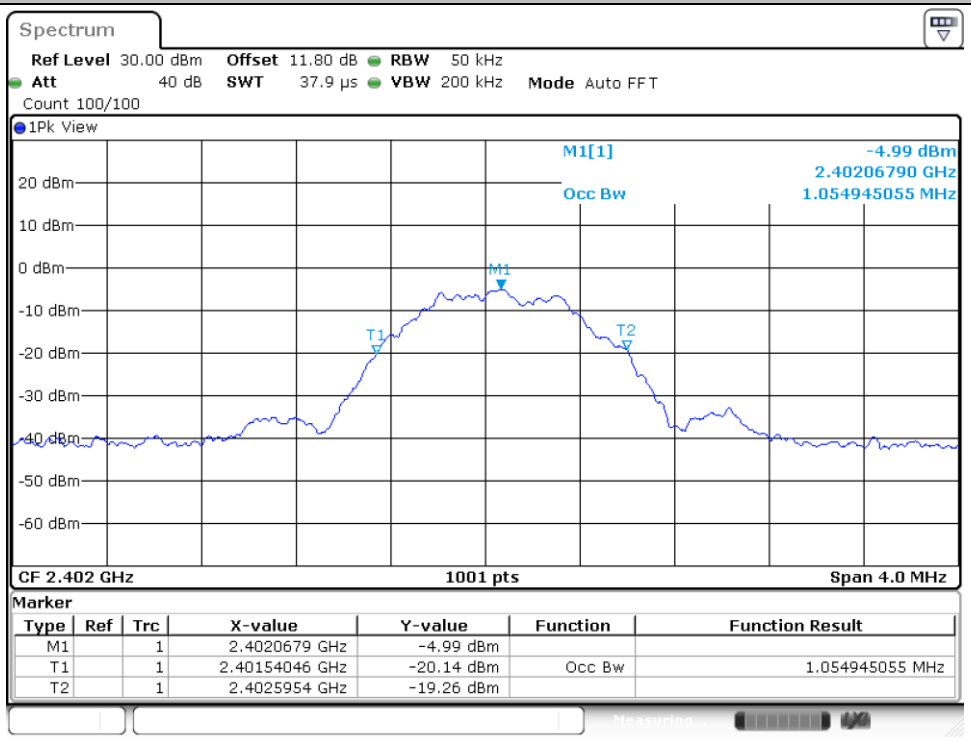
BLE_1M_Ant2_2402



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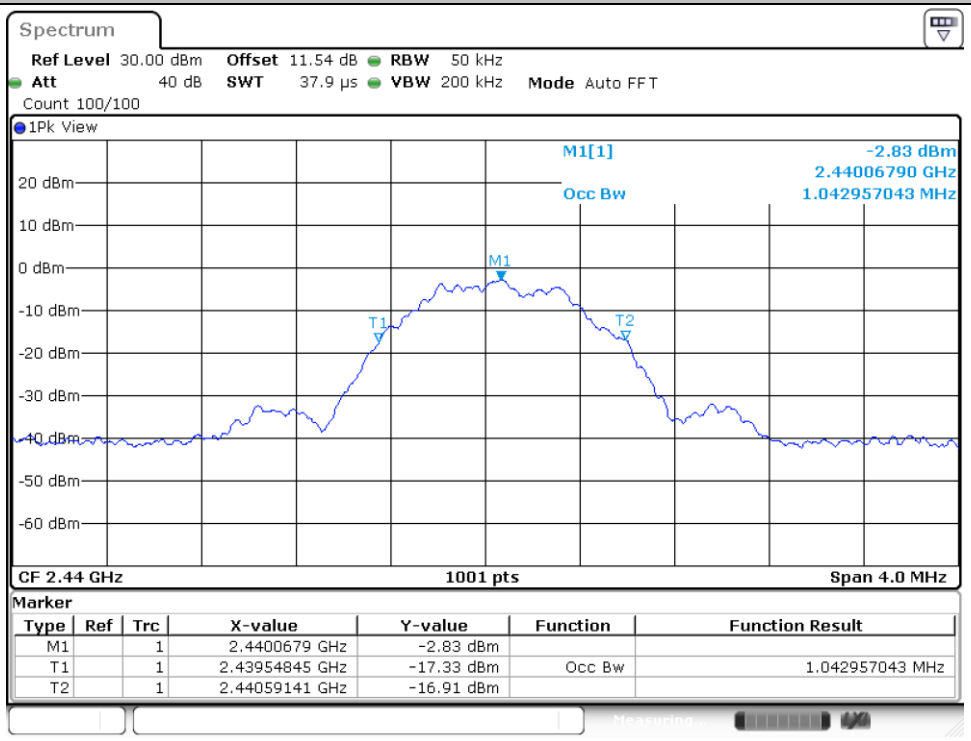
BLE_1M_Ant1_2440



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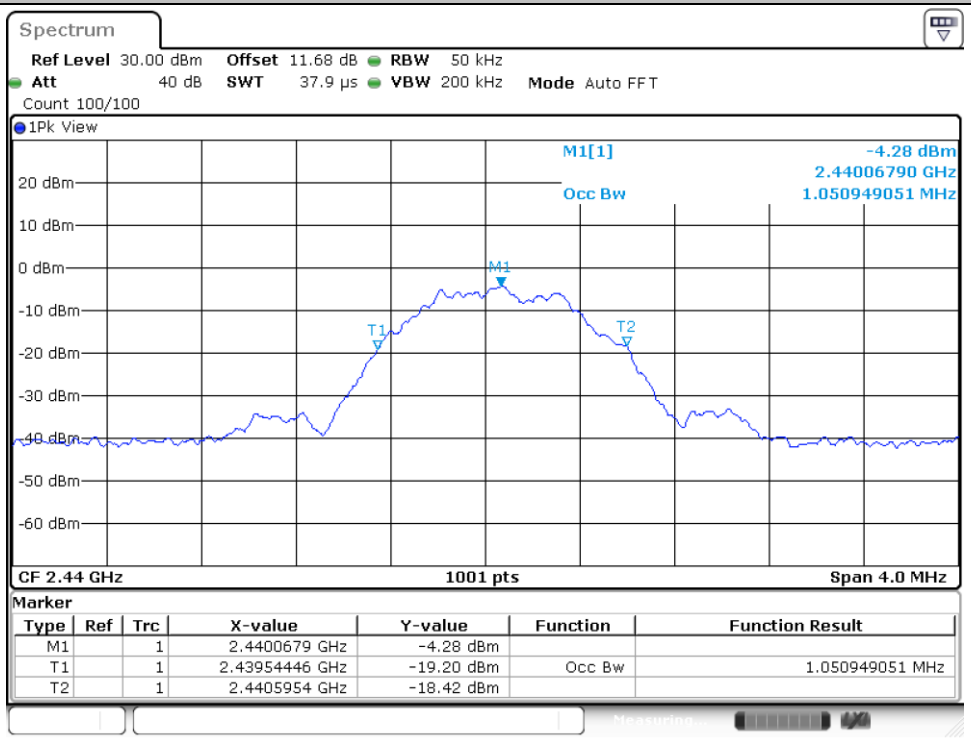

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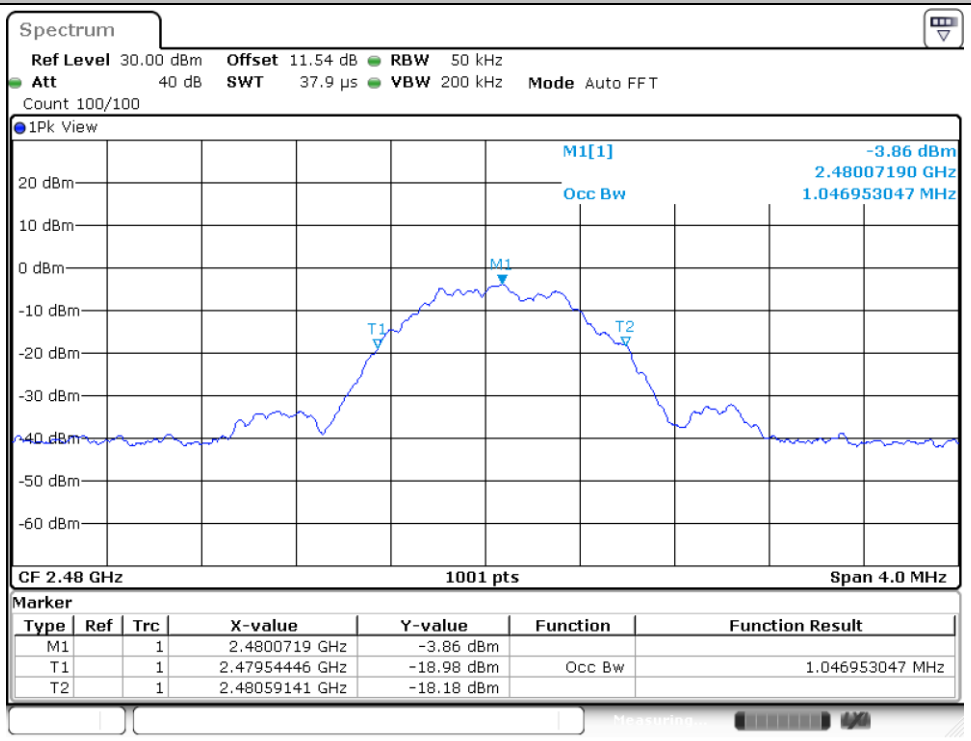

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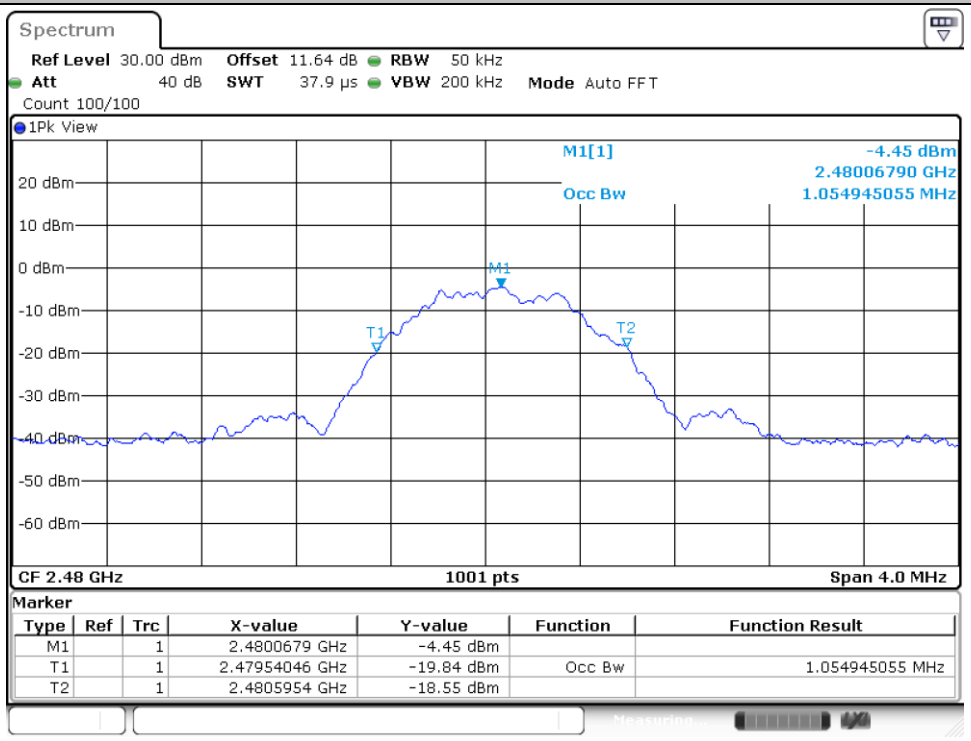
BLE_1M_Ant2_2480



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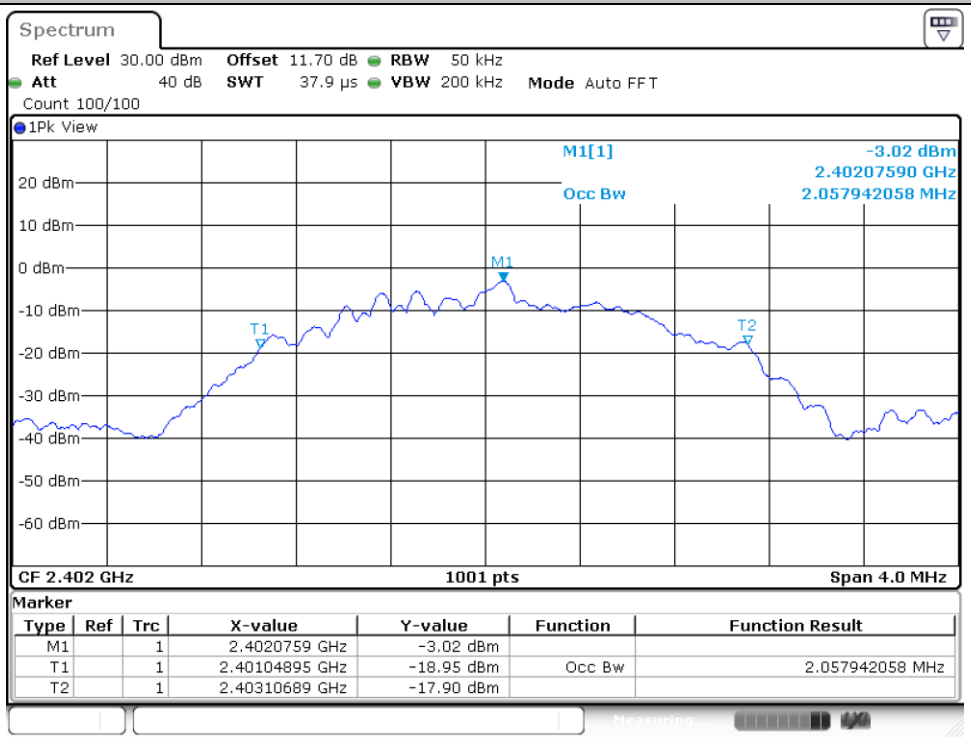

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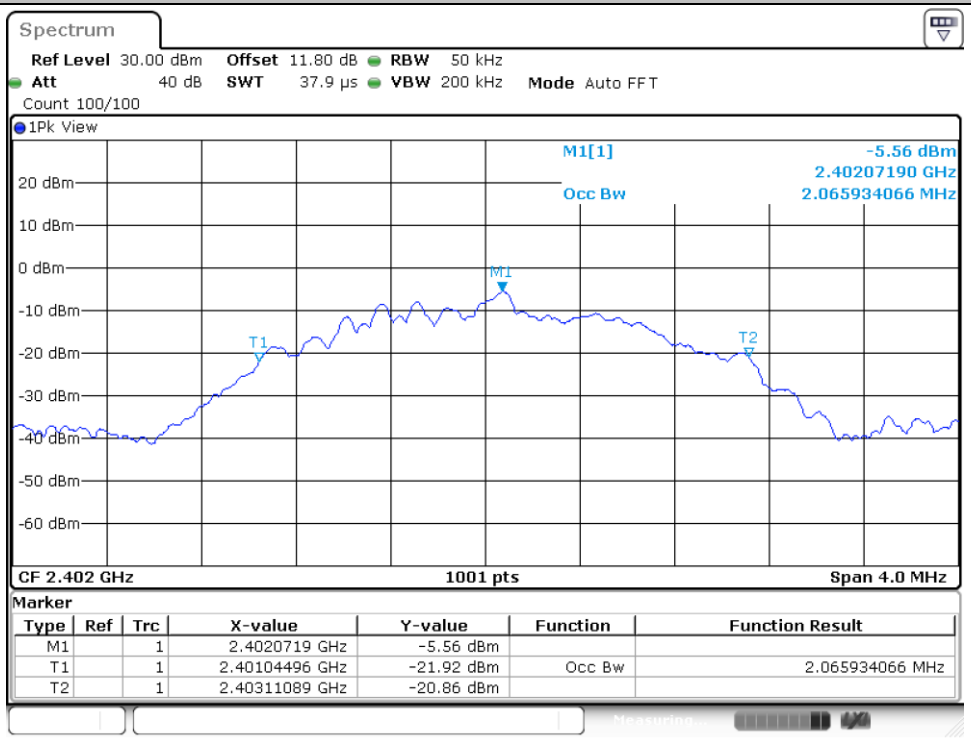
BLE_2M_Ant2_2402



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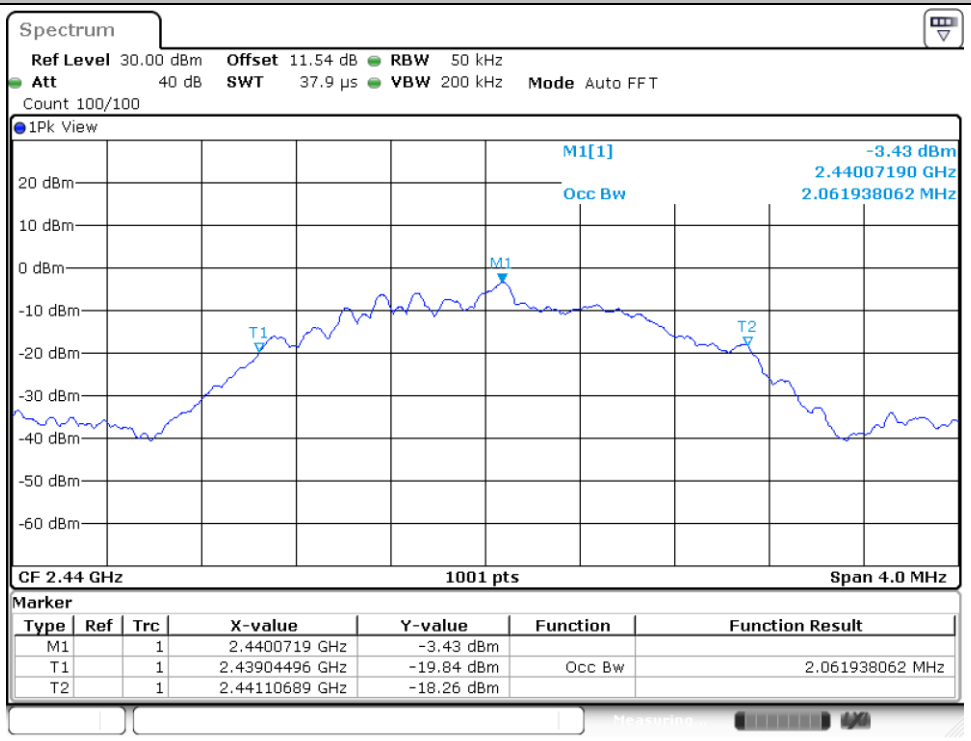

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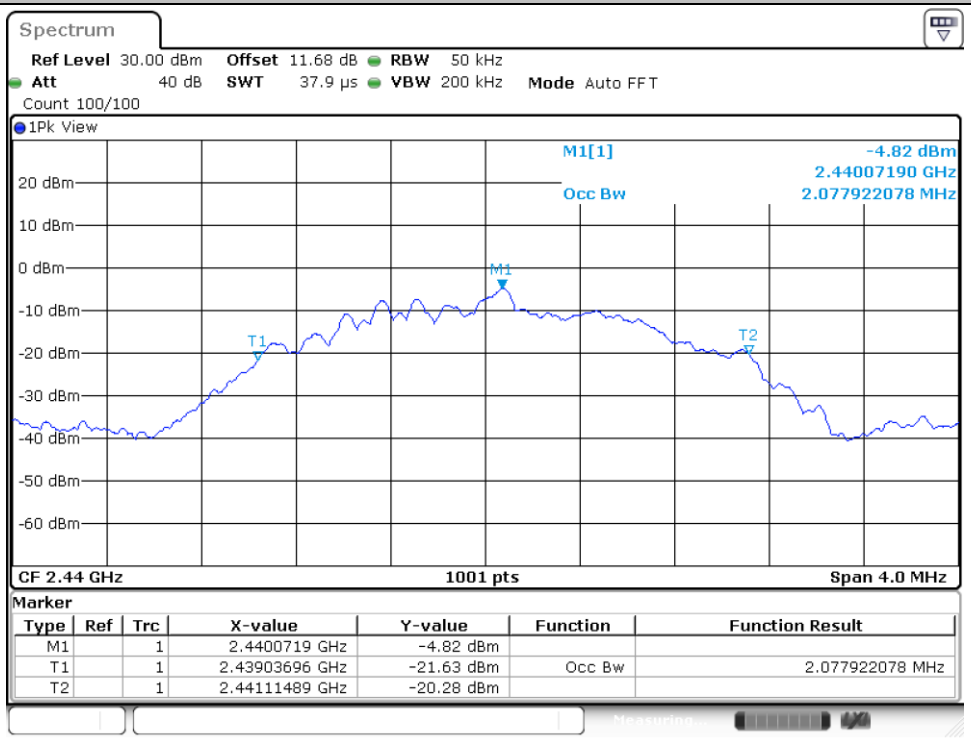

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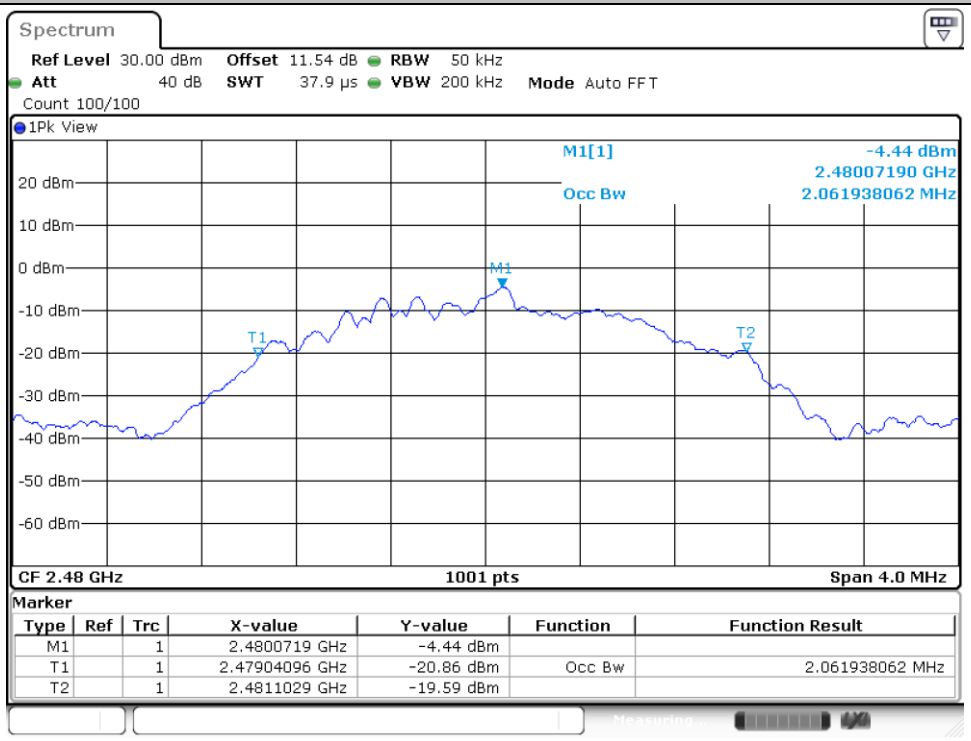

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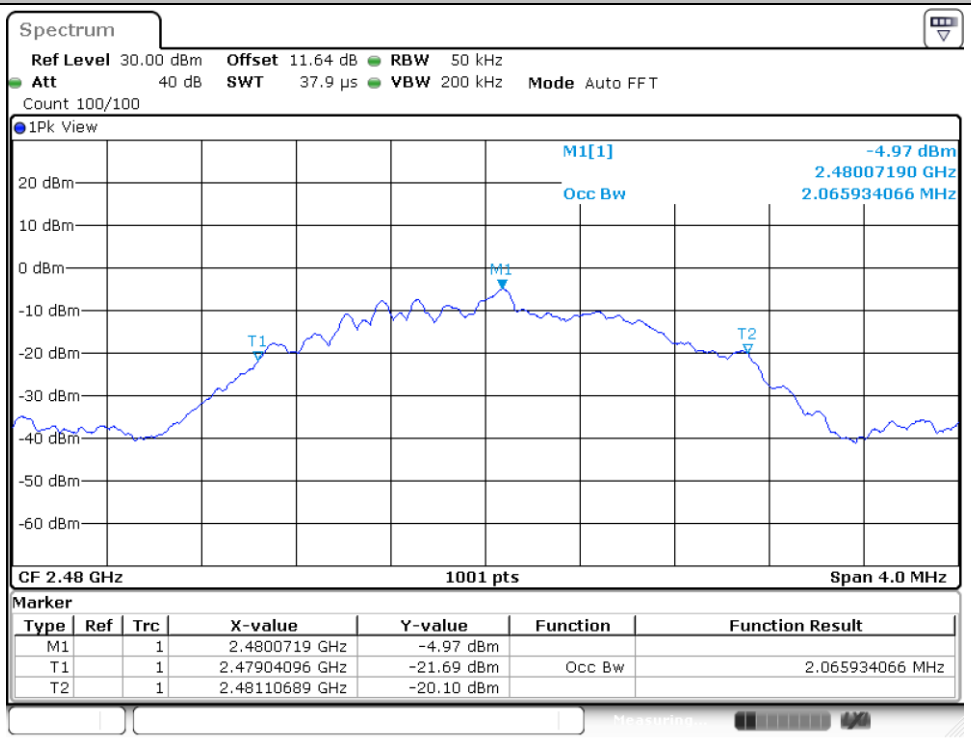

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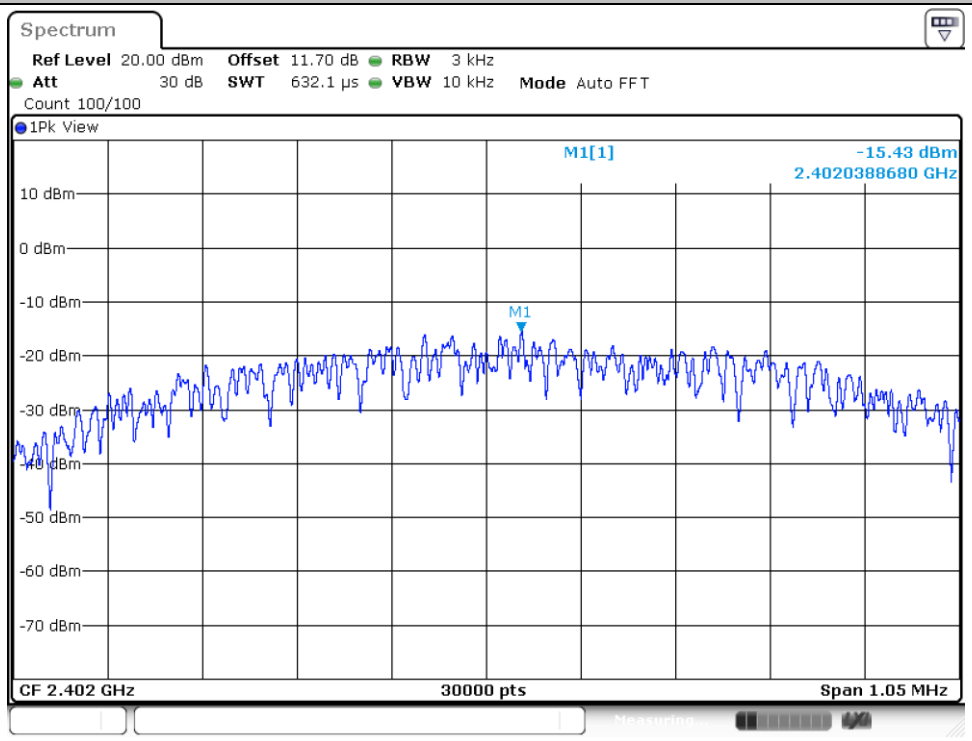
Maximum power spectral density

Test Result

TestMode	Antenna	Freq(MHz)	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-15.43	≤8.00	PASS
	Ant2	2402	-17.96	≤8.00	PASS
	Ant1	2440	-15.75	≤8.00	PASS
	Ant2	2440	-17.20	≤8.00	PASS
	Ant1	2480	-16.73	≤8.00	PASS
	Ant2	2480	-17.29	≤8.00	PASS
BLE_2M	Ant1	2402	-17.50	≤8.00	PASS
	Ant2	2402	-20.01	≤8.00	PASS
	Ant1	2440	-17.76	≤8.00	PASS
	Ant2	2440	-19.29	≤8.00	PASS
	Ant1	2480	-18.77	≤8.00	PASS
	Ant2	2480	-19.35	≤8.00	PASS

Test Graphs

BLE_1M_Ant1_2402



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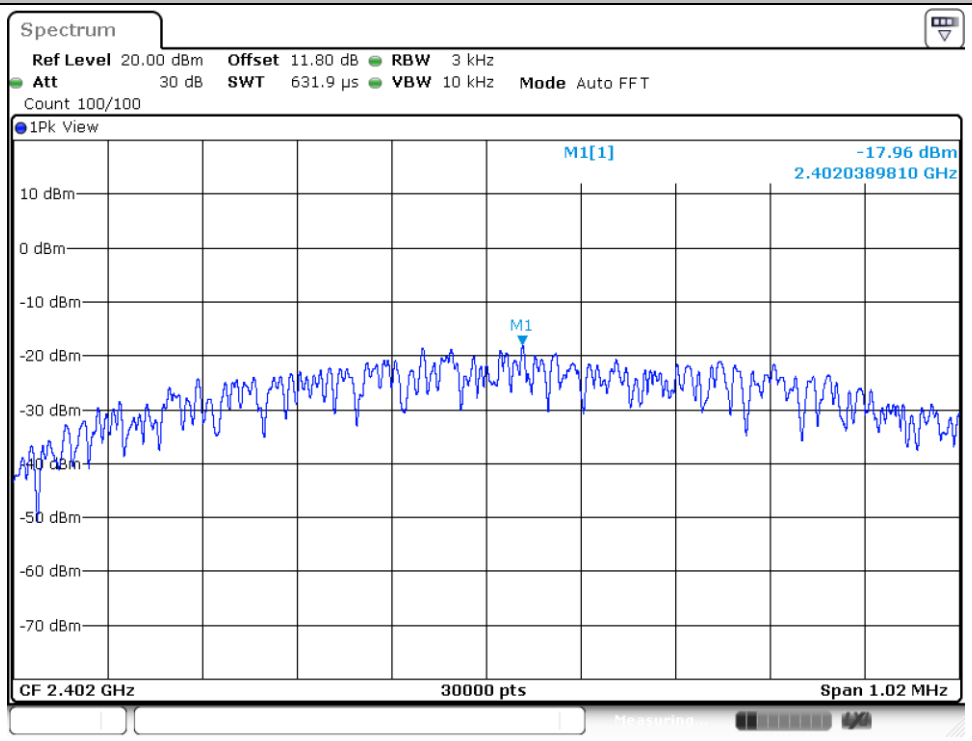
BLE_1M_Ant2_2402



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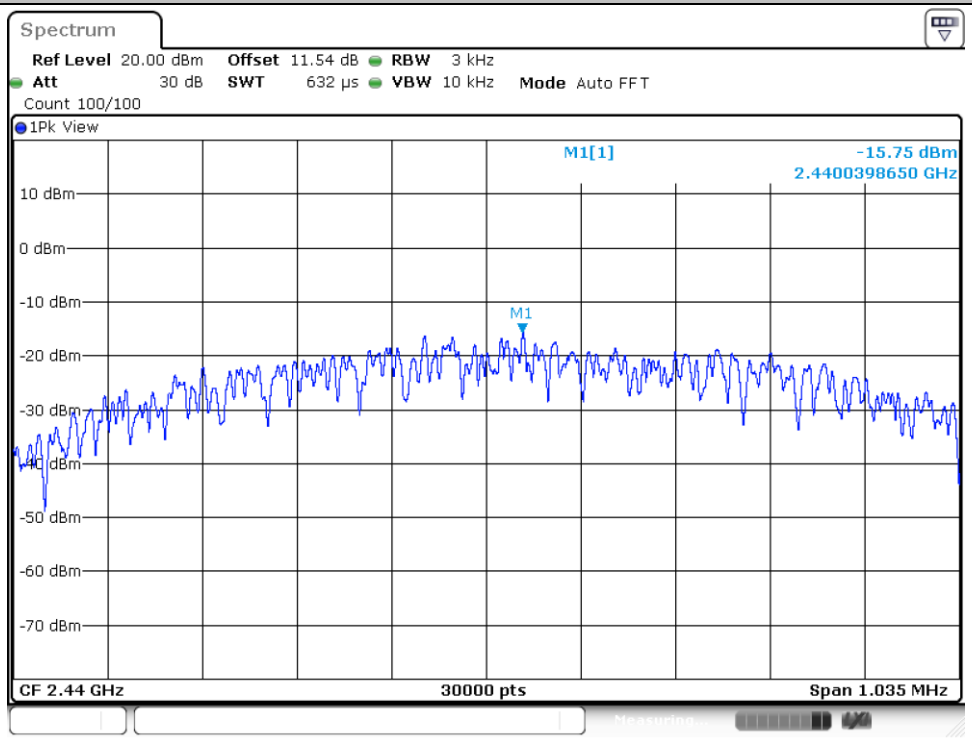

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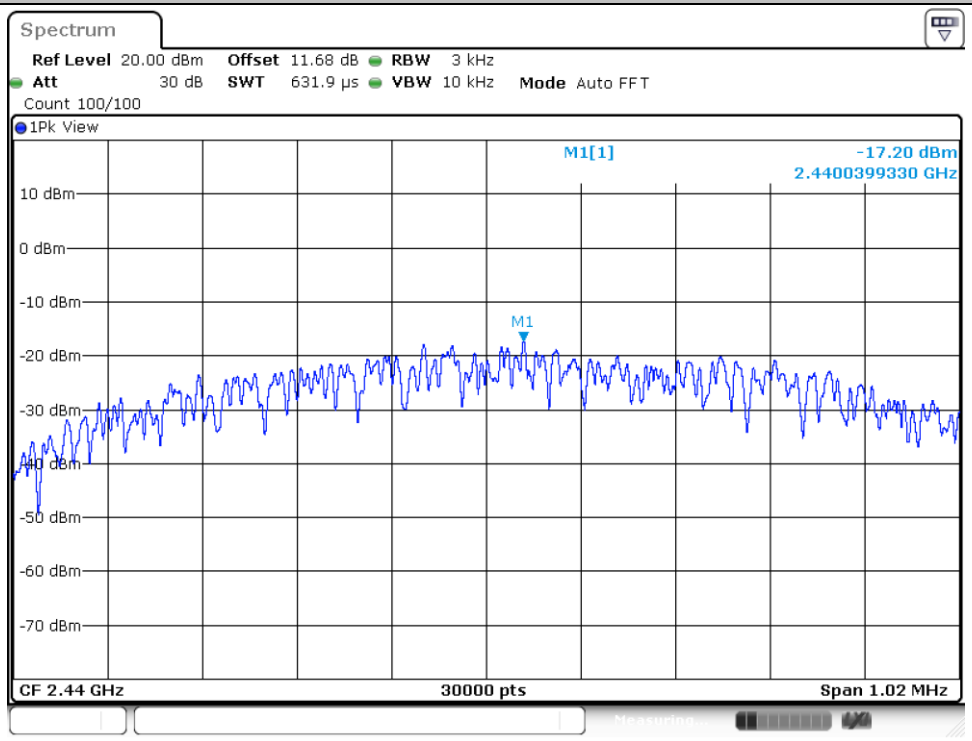
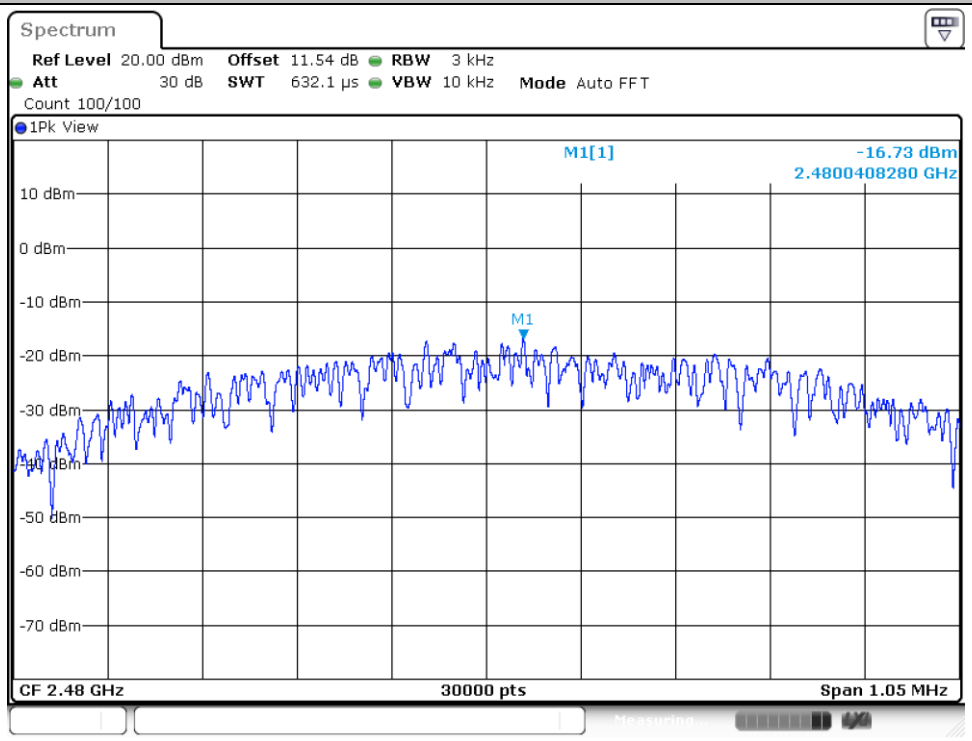


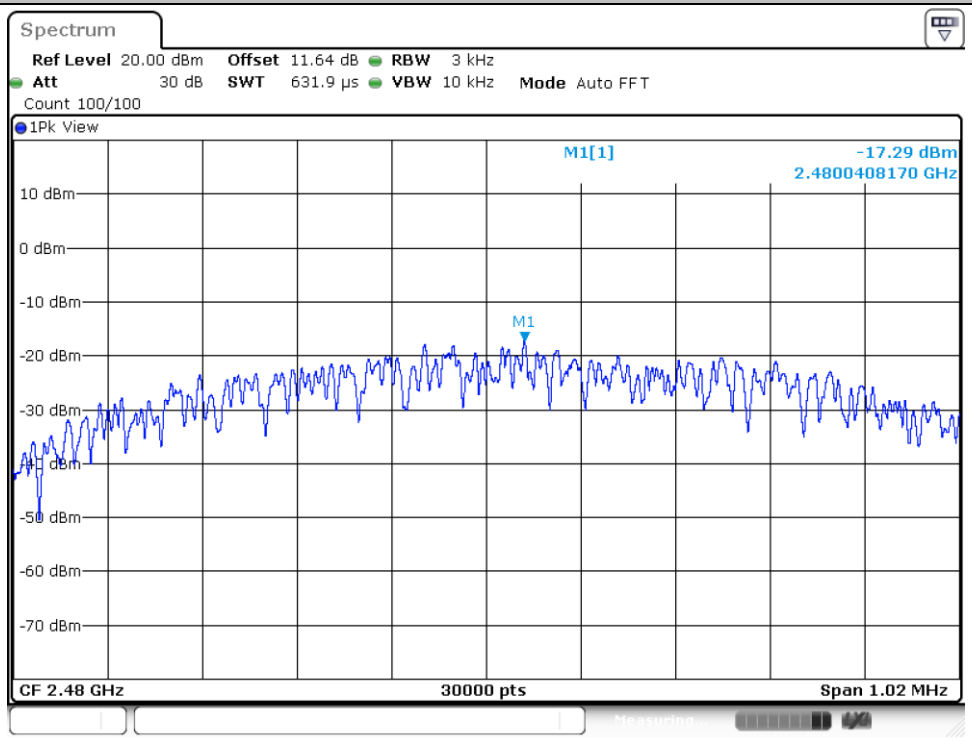
Date: 29.FEB.2024 00:03:41

BLE_1M_Ant1_2480



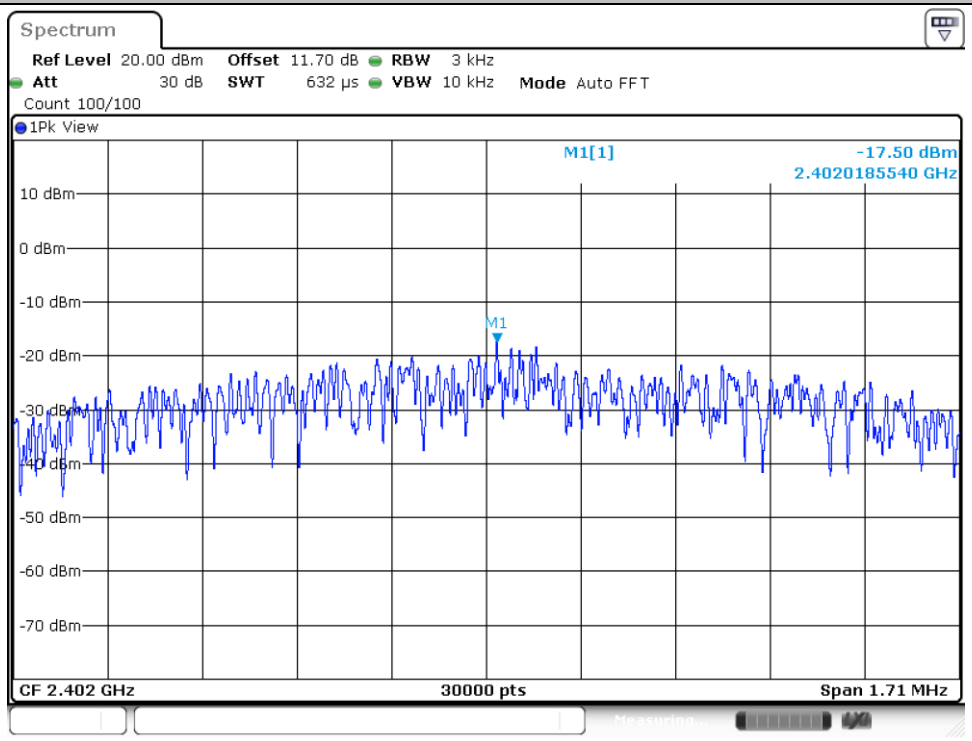
Date: 28.FEB.2024 23:50:40

BLE_1M_Ant2_2480



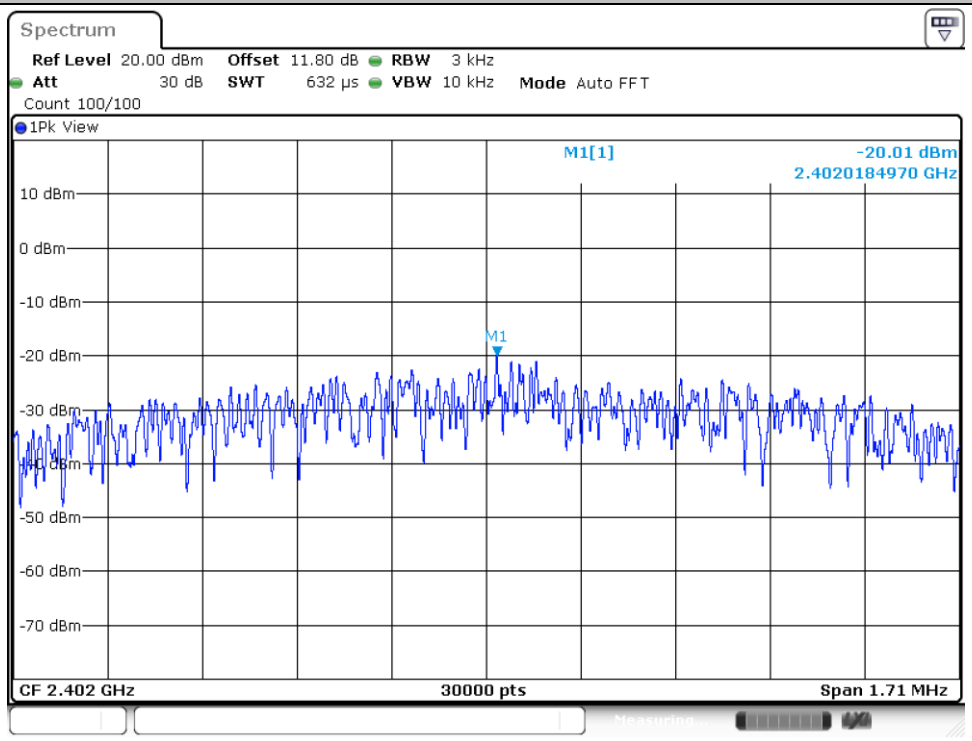
Date: 29.FEB.2024 00:05:53

BLE_2M_Ant1_2402



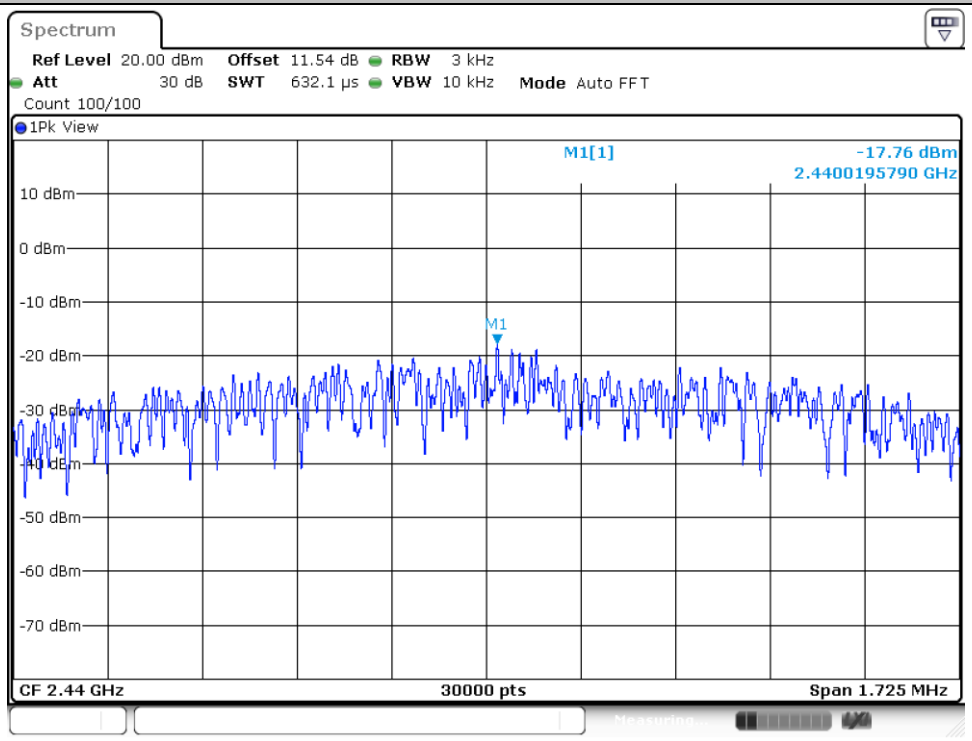
Date: 28.FEB.2024 23:53:05

BLE_2M_Ant2_2402



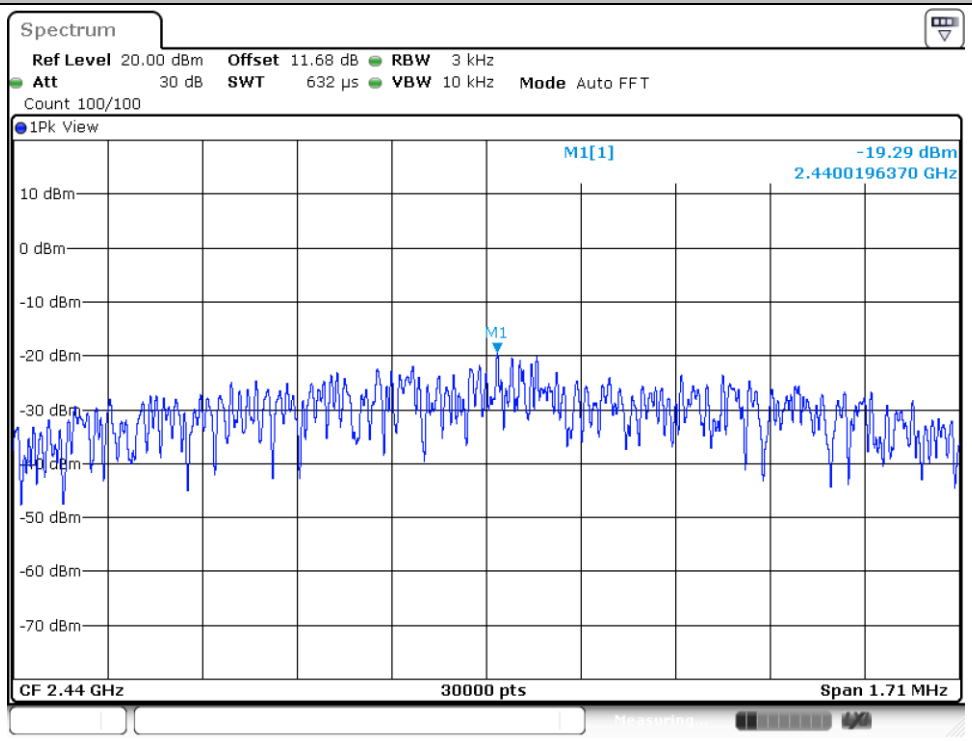
Date: 29.FEB.2024 00:08:18

BLE_2M_Ant1_2440



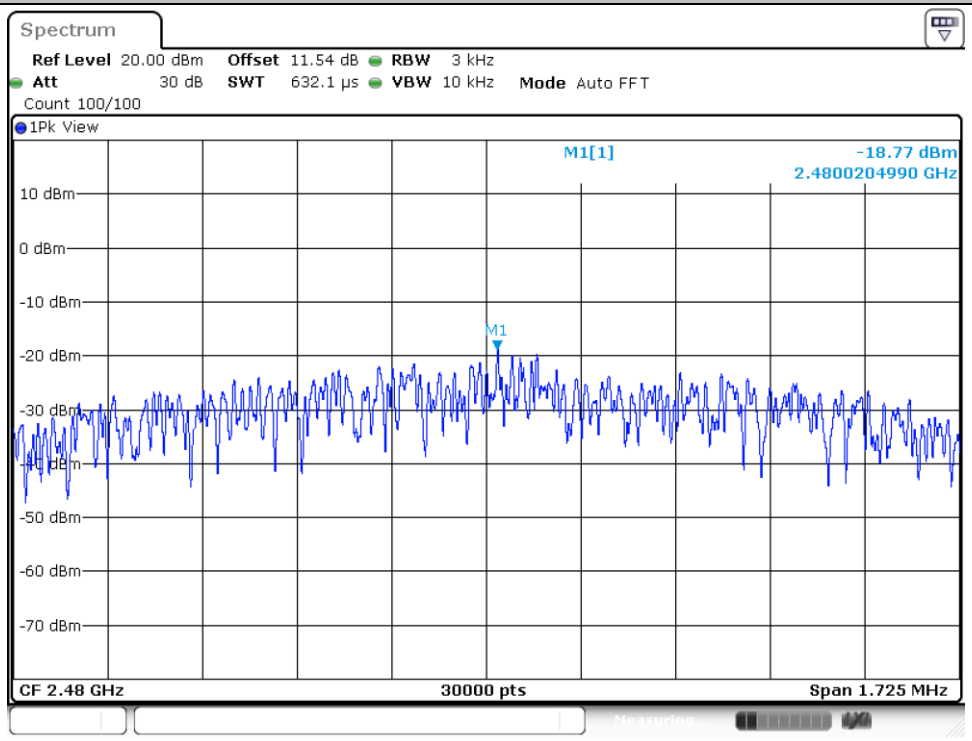
Date: 28.FEB.2024 23:54:48

BLE_2M_Ant2_2440



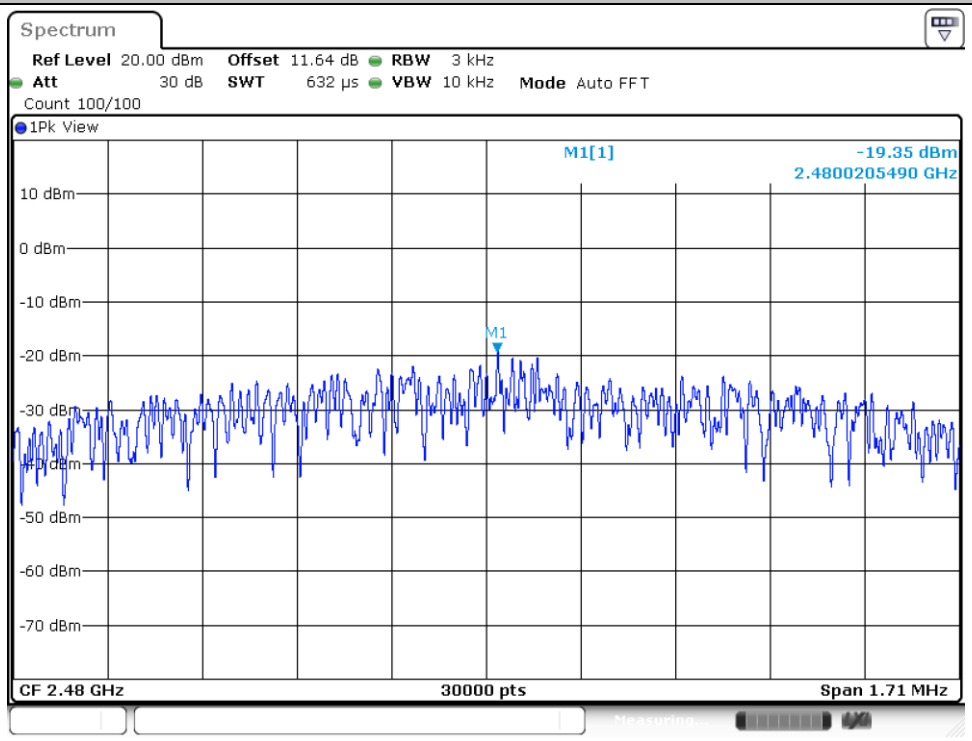
Date: 29.FEB.2024 00:10:56

BLE_2M_Ant1_2480



Date: 28.FEB.2024 23:56:26

BLE_2M_Ant2_2480



Date: 29.FEB.2024 00:12:41

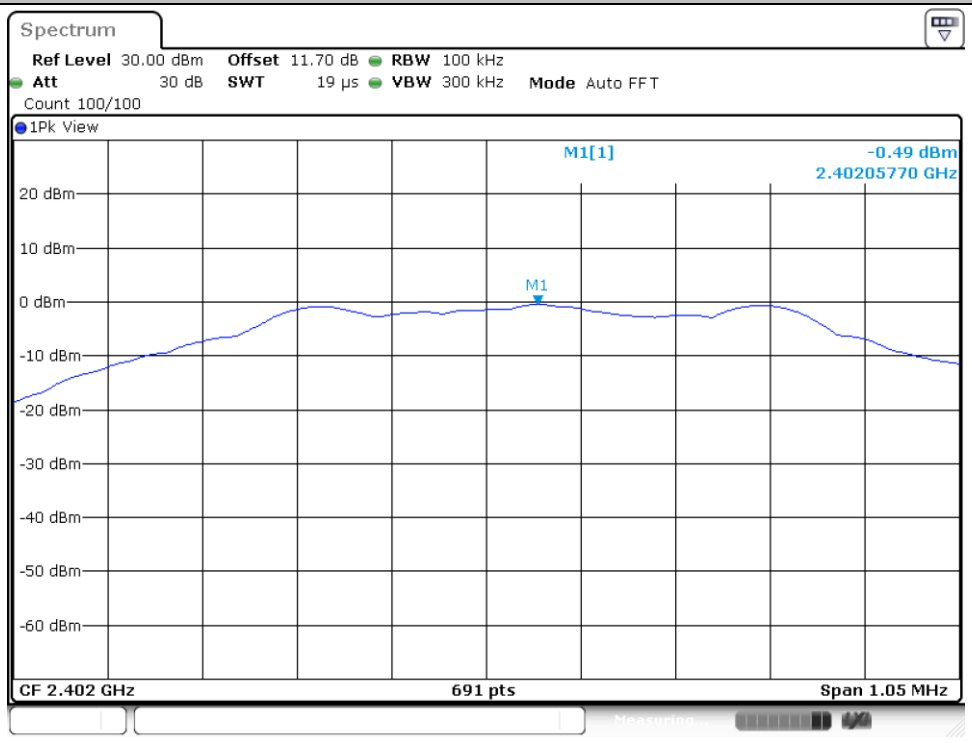
Reference level measurement

Test Result

TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm/100KHz]
BLE_1M	Ant1	2402	2402.06	-0.49
	Ant2	2402	2402.06	-3.04
	Ant1	2440	2440.06	-0.95
	Ant2	2440	2440.06	-2.38
	Ant1	2480	2480.06	-1.98
	Ant2	2480	2480.06	-2.42
BLE_2M	Ant1	2402	2402.06	-0.45
	Ant2	2402	2402.06	-3.01
	Ant1	2440	2440.06	-0.93
	Ant2	2440	2440.06	-2.36
	Ant1	2480	2480.06	-1.94
	Ant2	2480	2480.06	-2.40

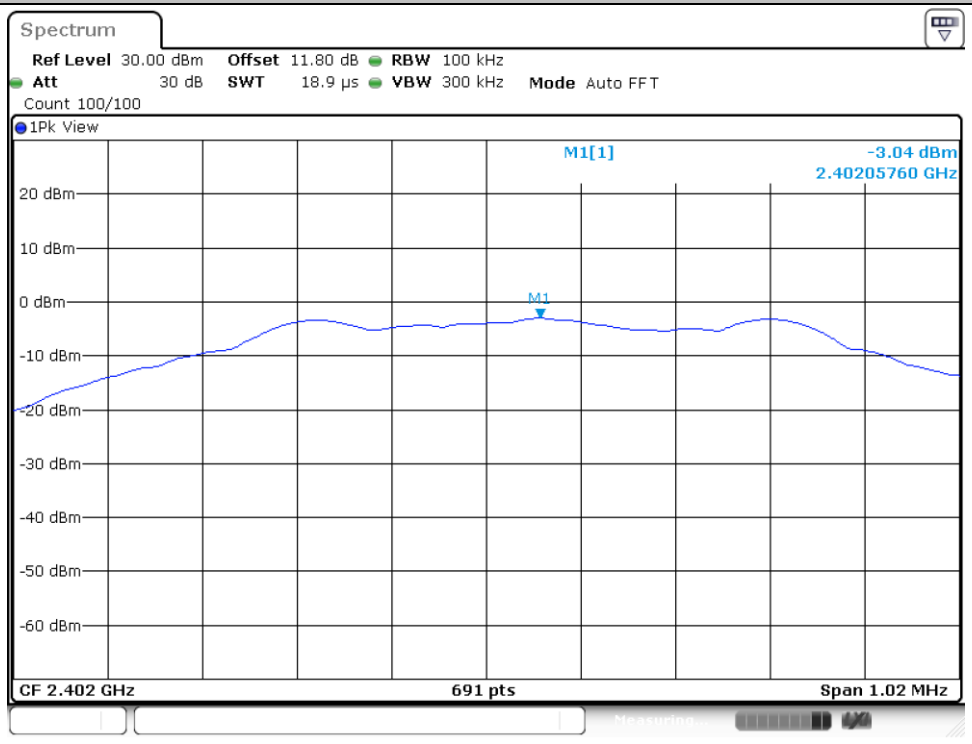
Test Graphs

BLE_1M_Ant1_2402



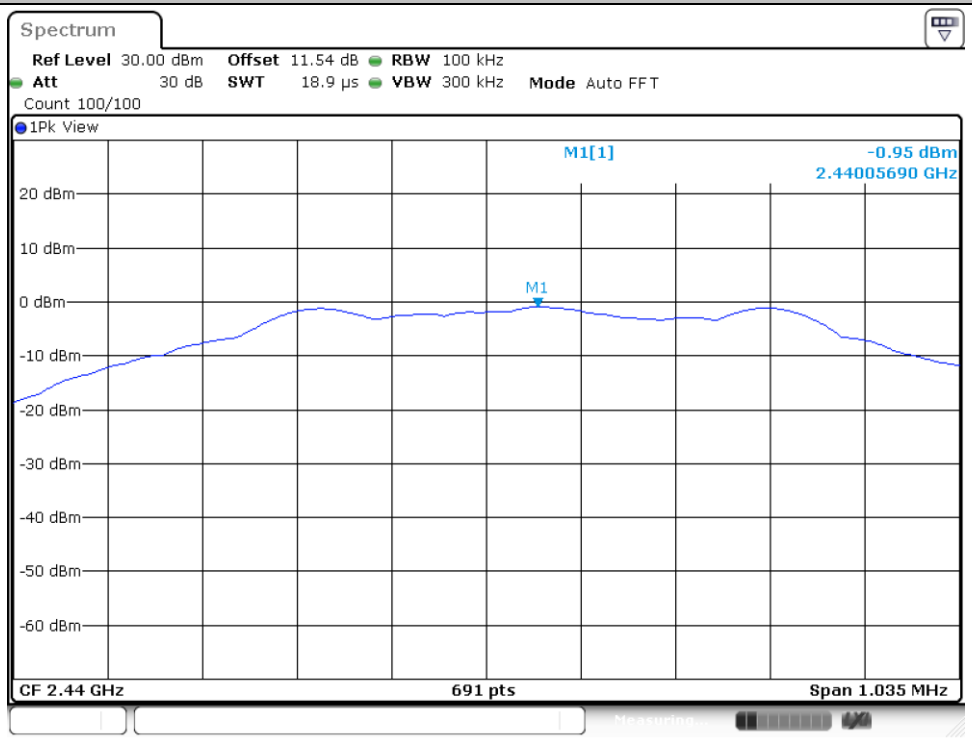
Date: 28.FEB.2024 23:45:11

BLE_1M_Ant2_2402



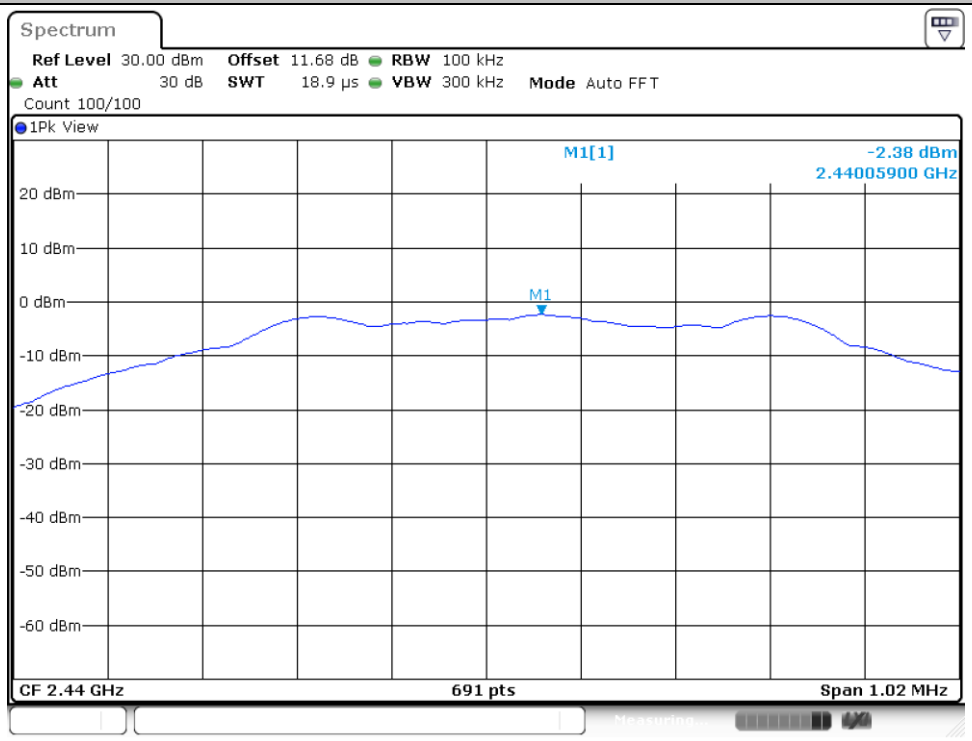
Date: 29.FEB.2024 00:00:50

BLE_1M_Ant1_2440



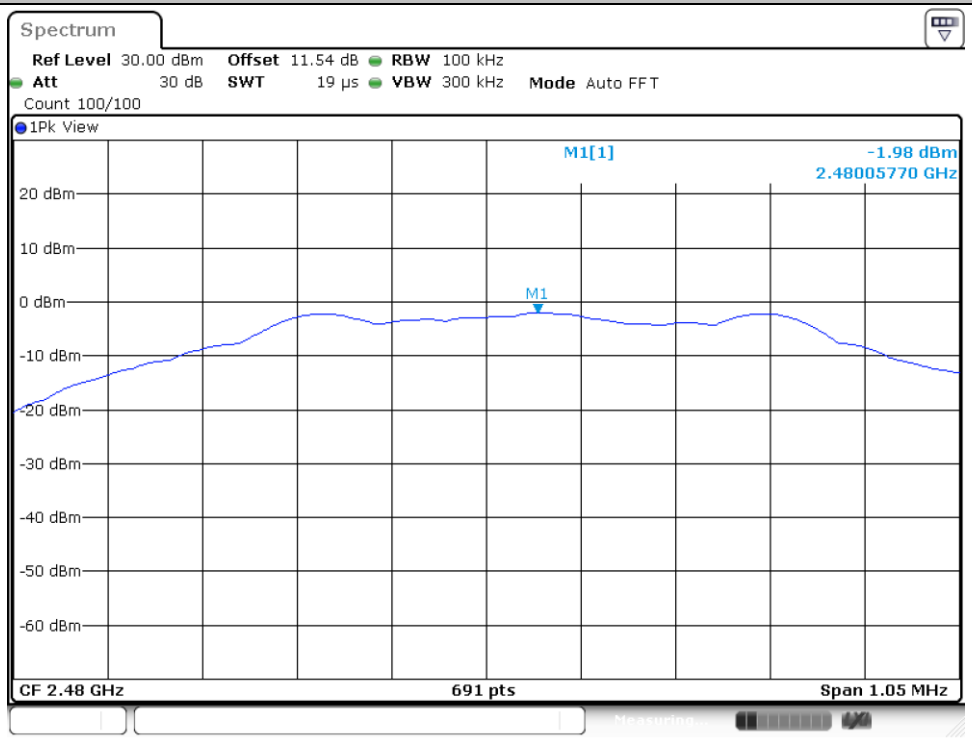
Date: 28.FEB.2024 23:47:37

BLE_1M_Ant2_2440



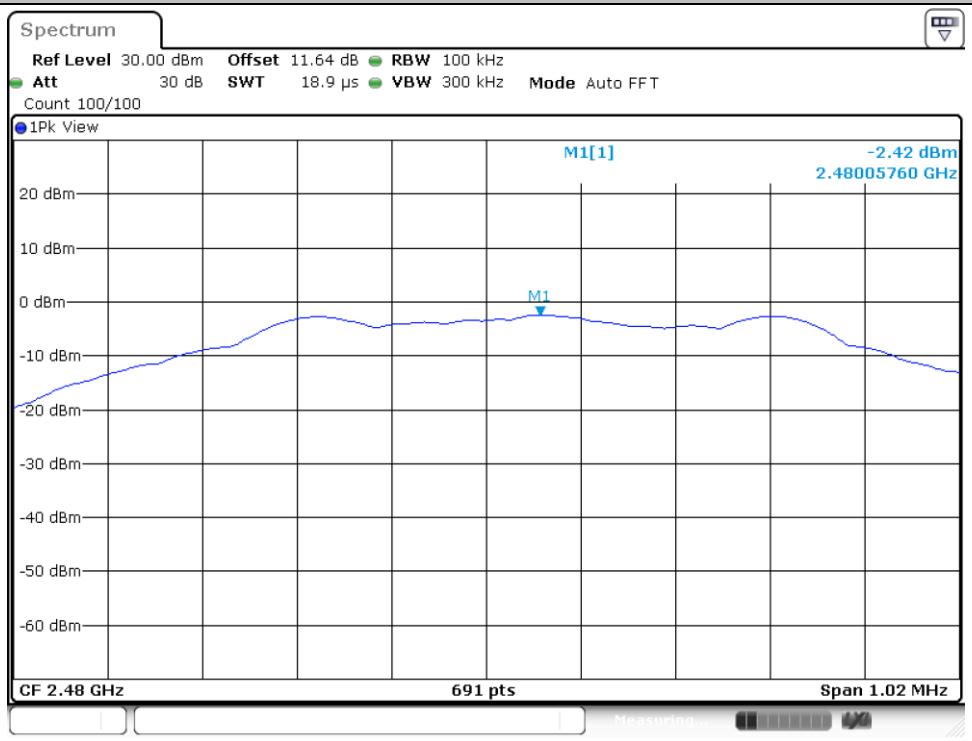
Date: 29.FEB.2024 00:03:53

BLE_1M_Ant1_2480



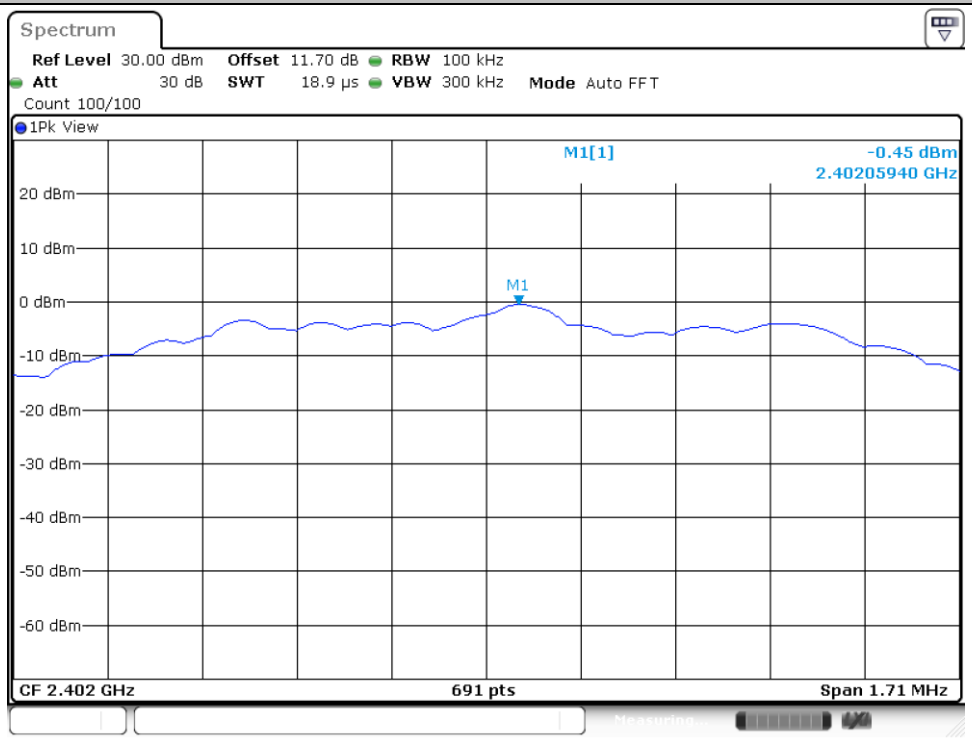
Date: 28.FEB.2024 23:50:53

BLE_1M_Ant2_2480



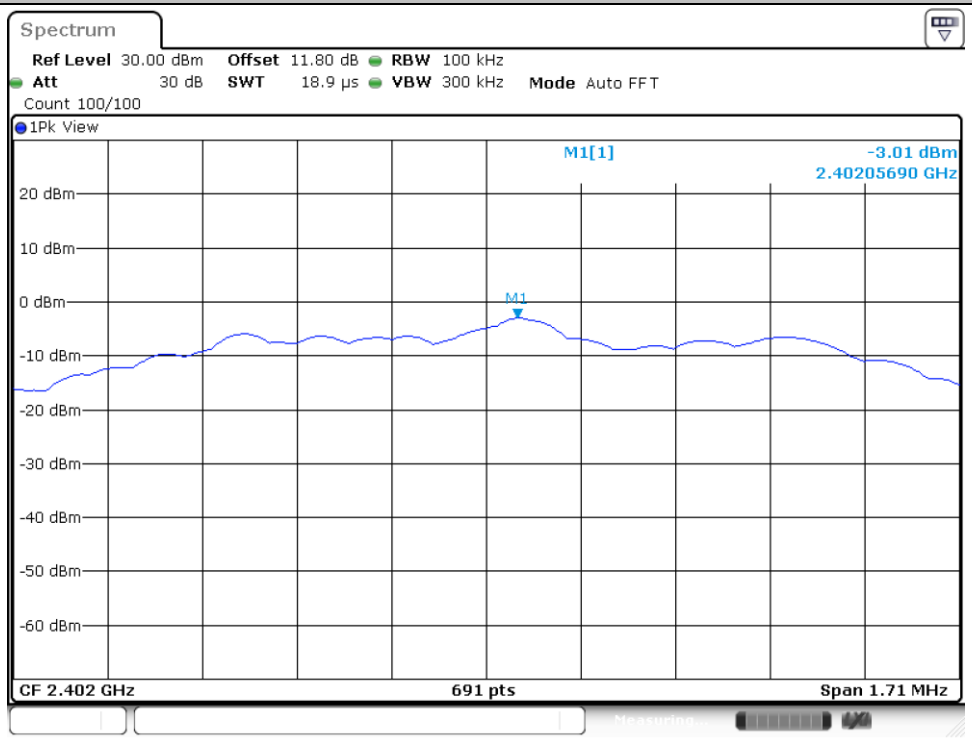
Date: 29.FEB.2024 00:06:06

BLE_2M_Ant1_2402



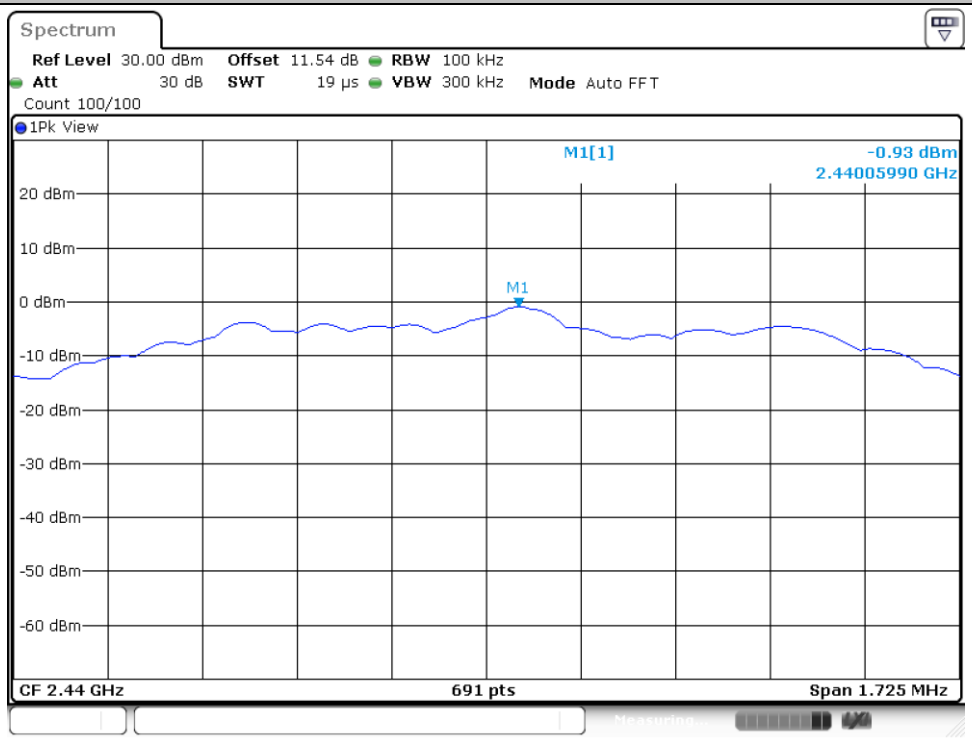
Date: 28.FEB.2024 23:53:18

BLE_2M_Ant2_2402



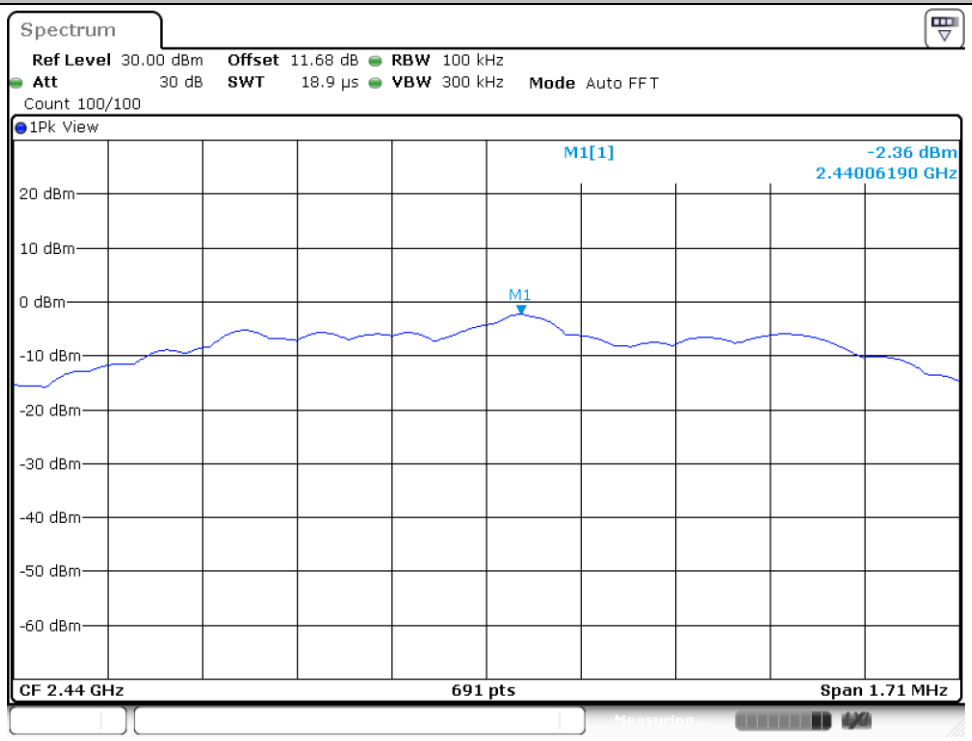
Date: 29.FEB.2024 00:08:31

BLE_2M_Ant1_2440



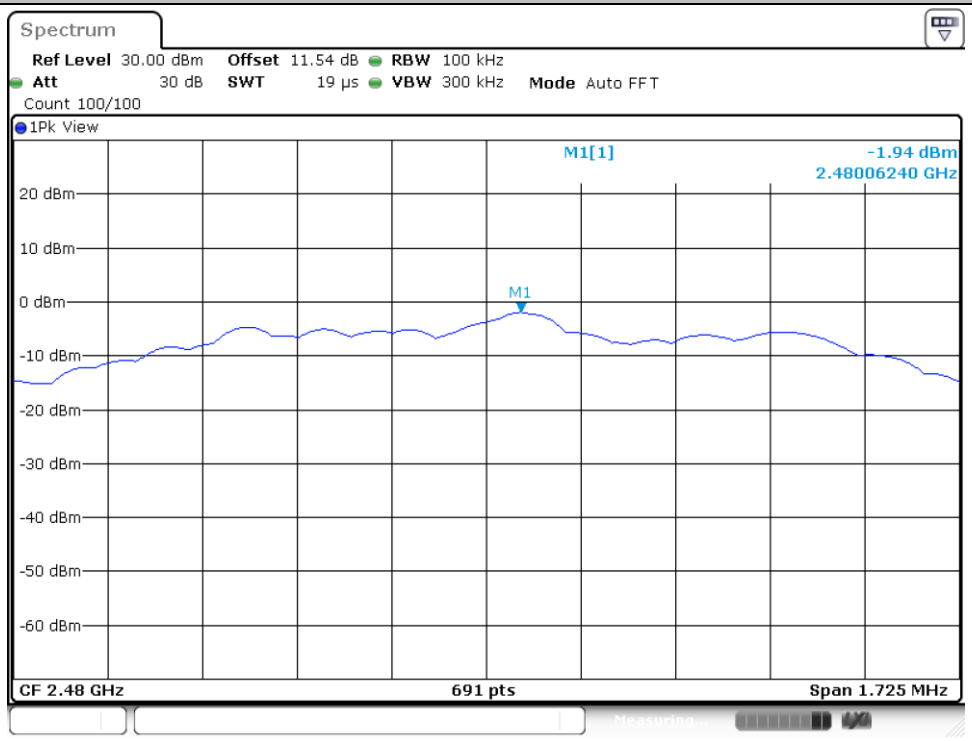
Date: 28.FEB.2024 23:55:01

BLE_2M_Ant2_2440



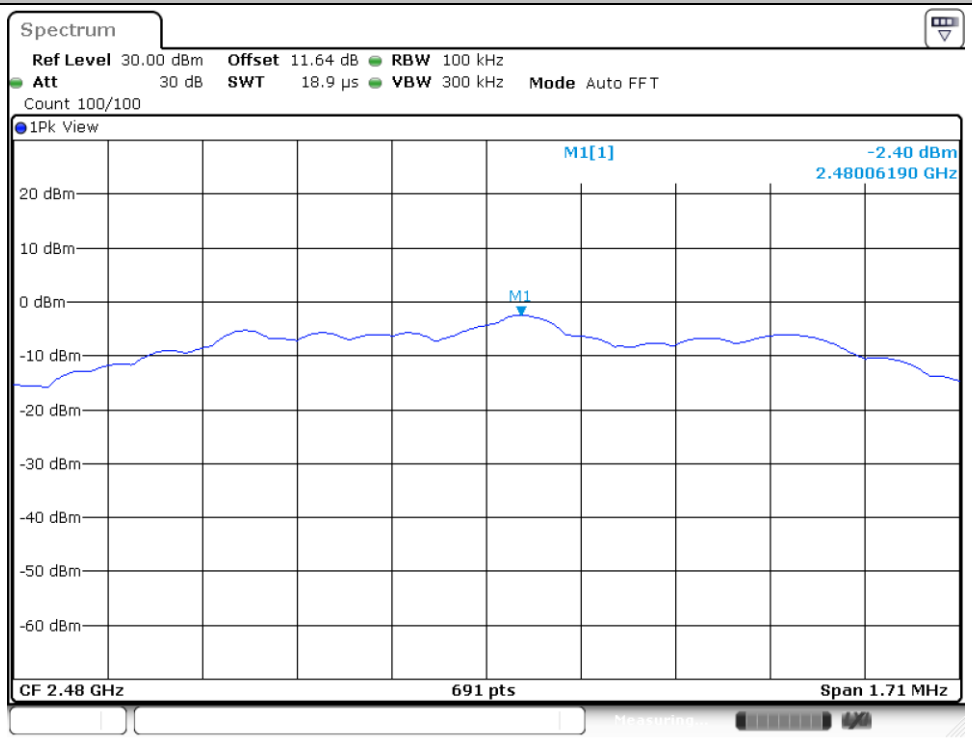
Date: 29.FEB.2024 00:11:09

BLE_2M_Ant1_2480



Date: 28.FEB.2024 23:56:39

BLE_2M_Ant2_2480



Date: 29.FEB.2024 00:12:54

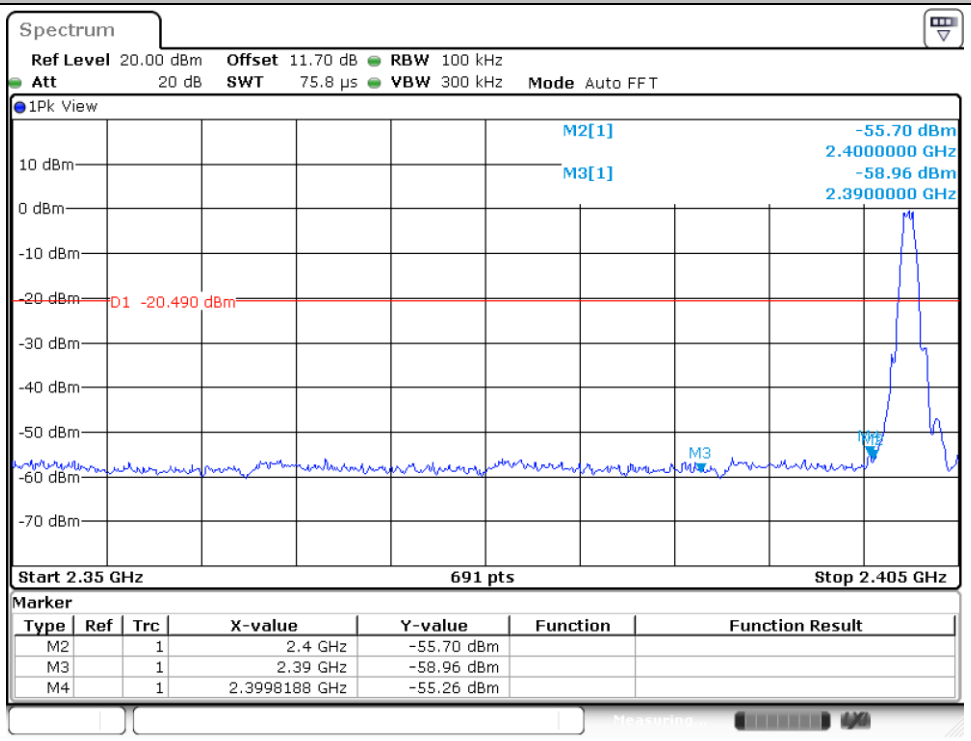
Band edge measurements

Test Result

TestMode	Antenna	ChName	Freq(MHz)	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
BLE_1M	Ant1	Low	2402	-0.49	-55.26	≤-20.49	PASS
	Ant2	Low	2402	-3.04	-55.33	≤-23.04	PASS
	Ant1	High	2480	-1.98	-54.61	≤-21.98	PASS
	Ant2	High	2480	-2.42	-54.92	≤-22.42	PASS
BLE_2M	Ant1	Low	2402	-0.45	-37.46	≤-20.45	PASS
	Ant2	Low	2402	-3.01	-38.91	≤-23.01	PASS
	Ant1	High	2480	-1.94	-54.49	≤-21.94	PASS
	Ant2	High	2480	-2.40	-54.41	≤-22.4	PASS

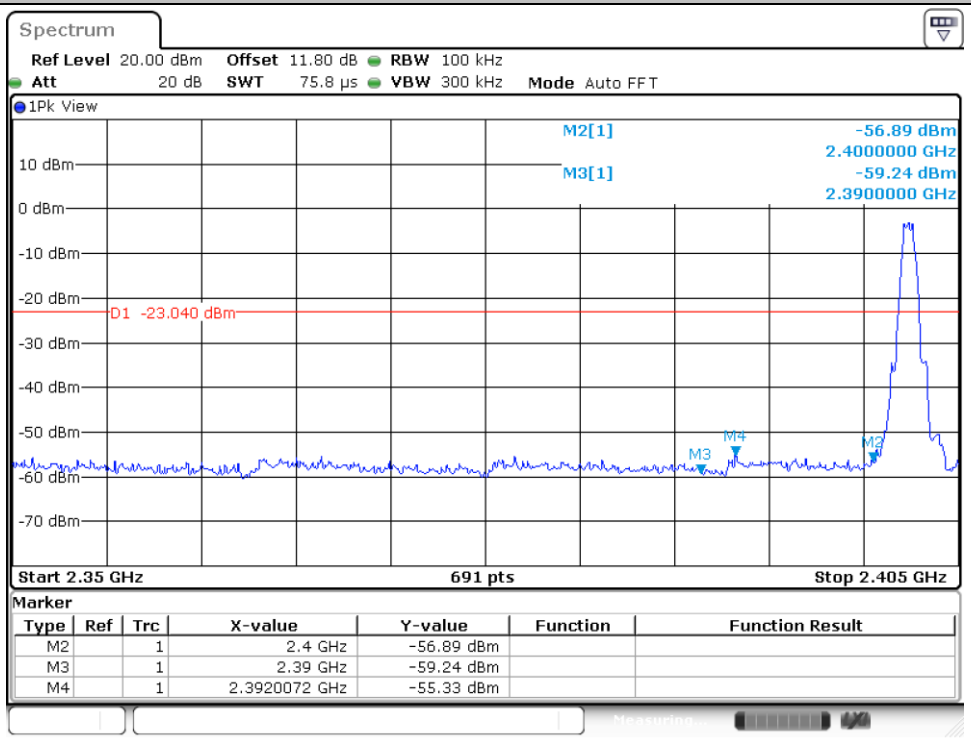
Test Graphs

BLE_1M_Ant1_Low_2402



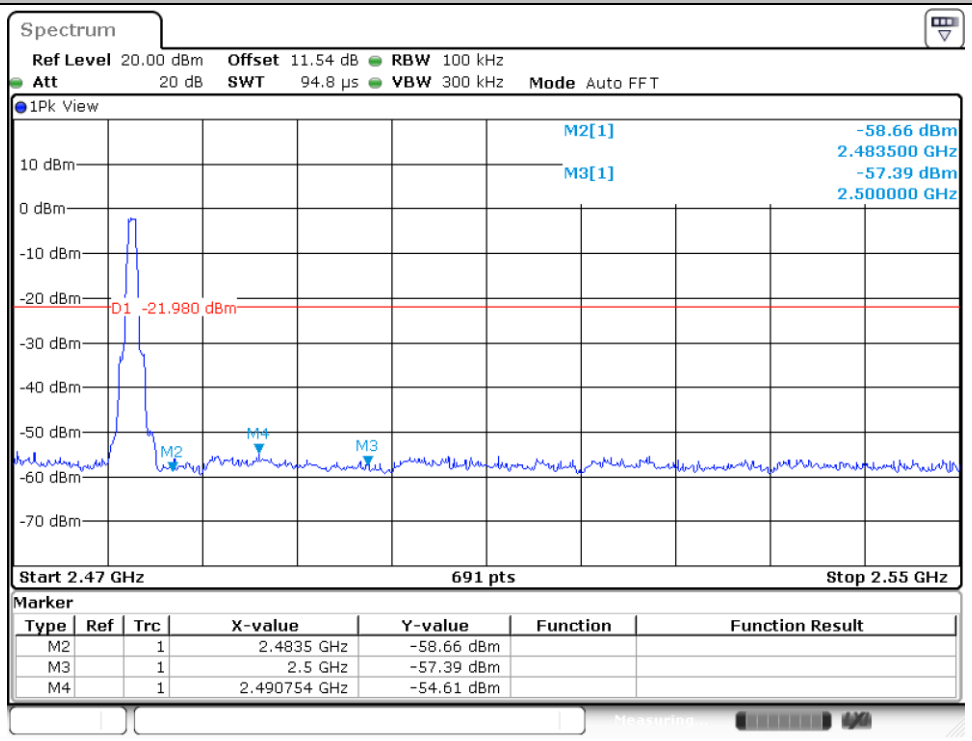
Date: 28.FEB.2024 23:45:24

BLE_1M_Ant2_Low_2402



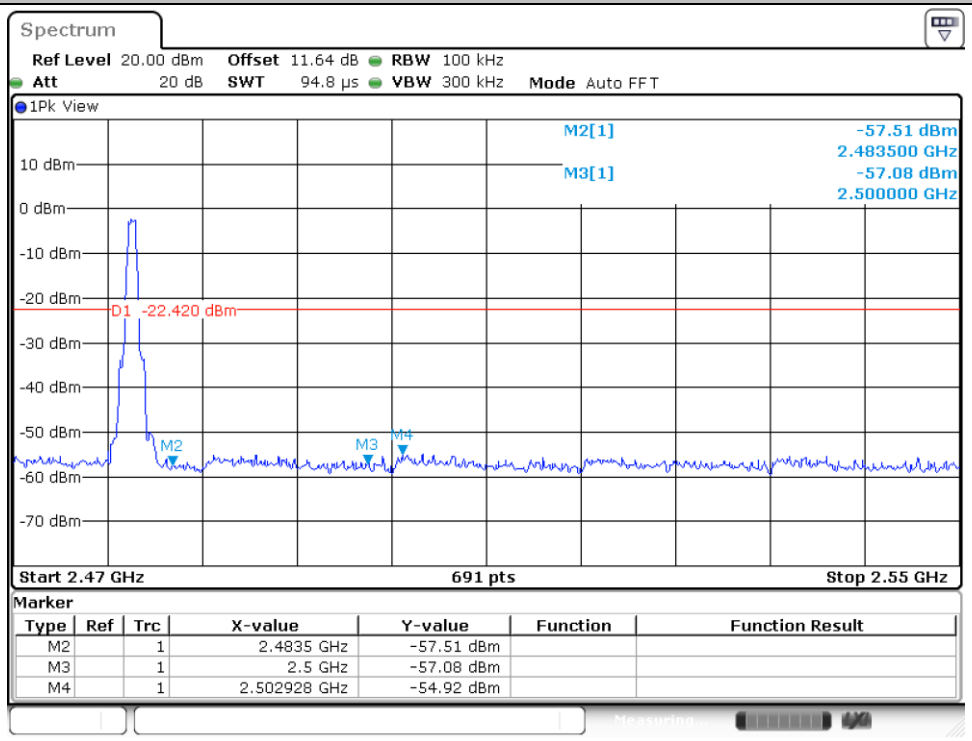
Date: 29.FEB.2024 00:01:04

BLE_1M_Ant1_High_2480



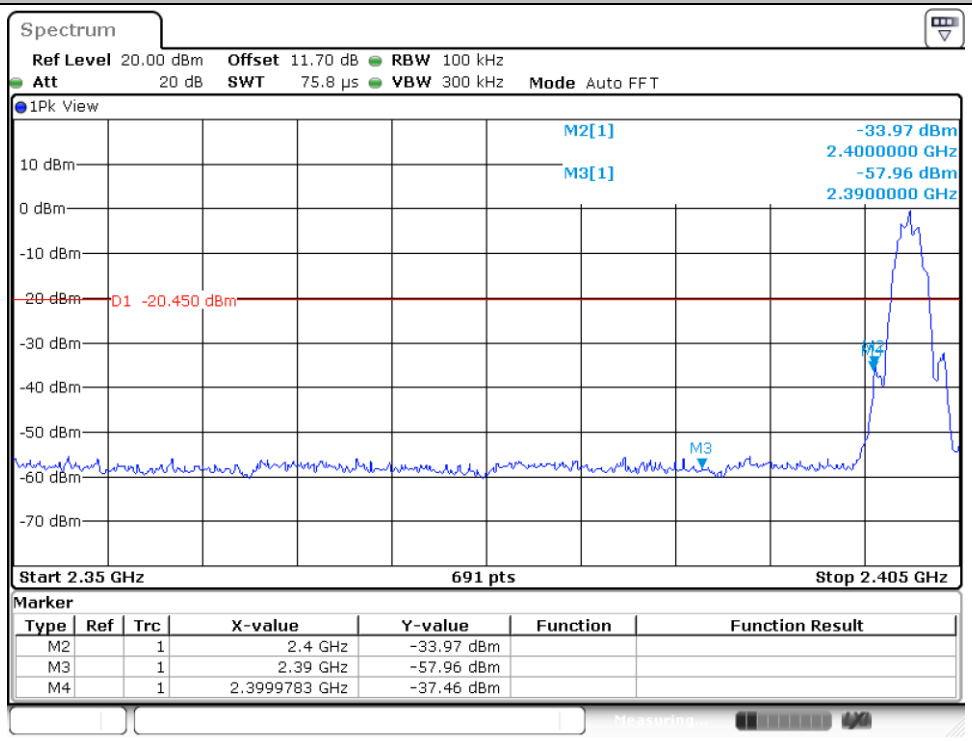
Date: 28.FEB.2024 23:51:06

BLE_1M_Ant2_High_2480



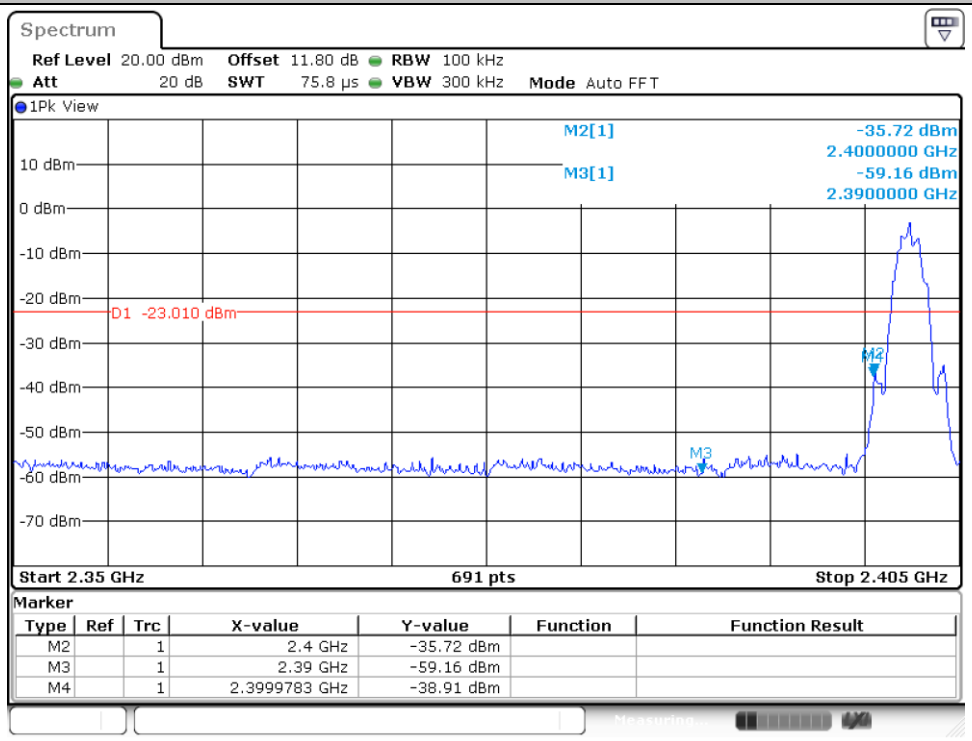
Date: 29.FEB.2024 00:06:20

BLE_2M_Ant1_Low_2402



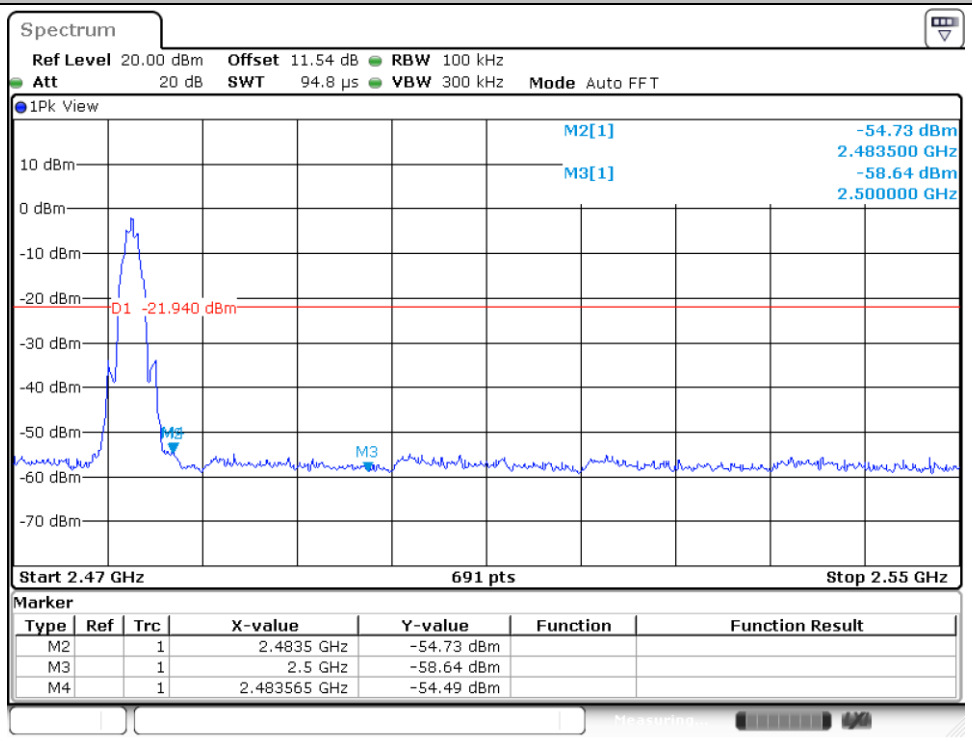
Date: 28.FEB.2024 23:53:32

BLE_2M_Ant2_Low_2402



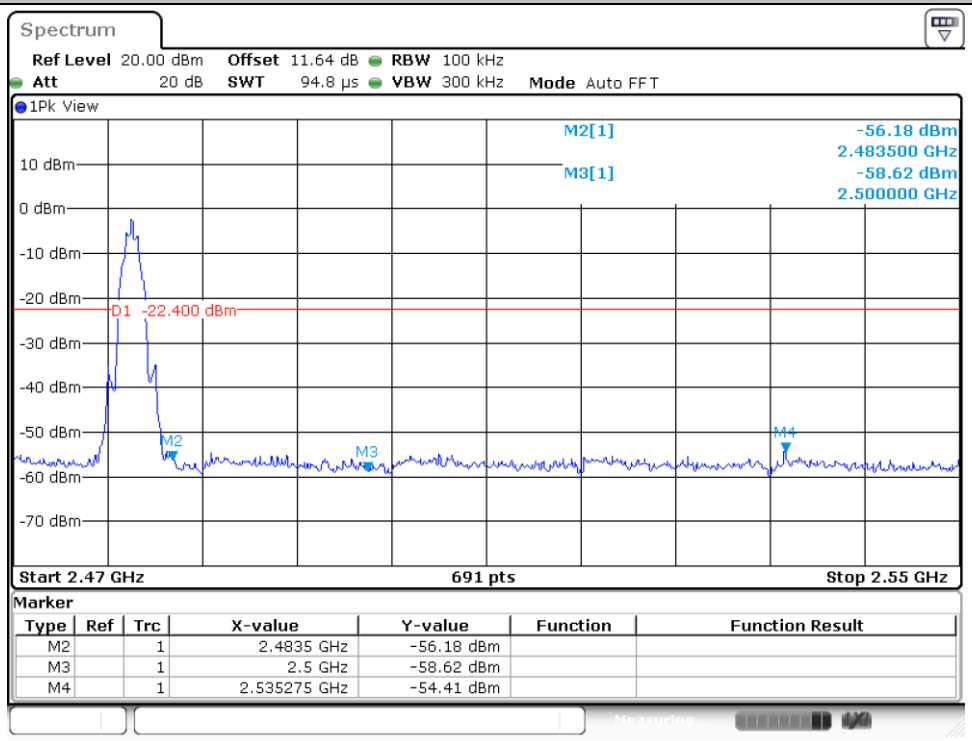
Date: 29.FEB.2024 00:08:45

BLE_2M_Ant1_High_2480



Date: 28.FEB.2024 23:56:52

BLE_2M_Ant2_High_2480



Date: 29.FEB.2024 00:13:08

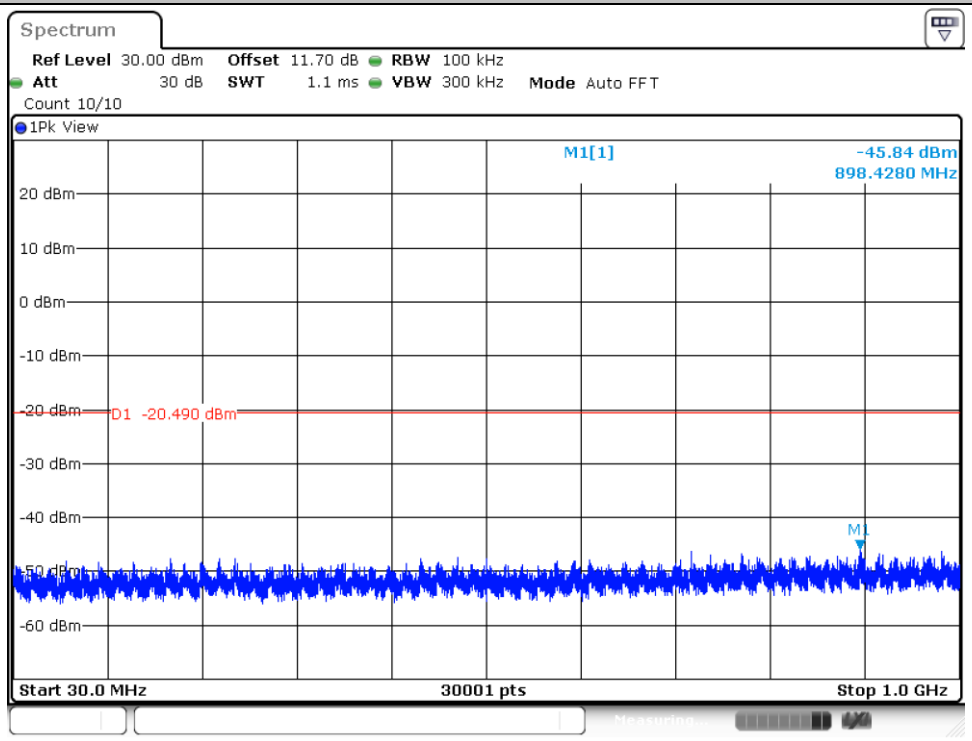
Conducted Spurious Emission

Test Result

TestMode	Antenna	Freq(MHz)	FreqRange [MHz]	RefLevel [dBm/100KHz]	Result [dBm/100KHz]	Limit [dBm/100KHz]	Verdict
BLE_1M	Ant1	2402	30~1000	-0.49	-45.84	≤-20.49	PASS
			1000~26500	-0.49	-36.47	≤-20.49	PASS
	Ant2	2402	30~1000	-3.04	-46.1	≤-23.04	PASS
			1000~26500	-3.04	-36.38	≤-23.04	PASS
	Ant1	2440	30~1000	-0.95	-46.02	≤-20.95	PASS
			1000~26500	-0.95	-37.27	≤-20.95	PASS
	Ant2	2440	30~1000	-2.38	-46.27	≤-22.38	PASS
			1000~26500	-2.38	-34.73	≤-22.38	PASS
	Ant1	2480	30~1000	-1.98	-46.23	≤-21.98	PASS
			1000~26500	-1.98	-36.75	≤-21.98	PASS
	Ant2	2480	30~1000	-2.42	-46.45	≤-22.42	PASS
			1000~26500	-2.42	-35.96	≤-22.42	PASS
BLE_2M	Ant1	2402	30~1000	-0.45	-46.55	≤-20.45	PASS
			1000~26500	-0.45	-37.09	≤-20.45	PASS
	Ant2	2402	30~1000	-3.01	-46.04	≤-23.01	PASS
			1000~26500	-3.01	-37.04	≤-23.01	PASS
	Ant1	2440	30~1000	-0.93	-46	≤-20.93	PASS
			1000~26500	-0.93	-36.96	≤-20.93	PASS
	Ant2	2440	30~1000	-2.36	-46.37	≤-22.36	PASS
			1000~26500	-2.36	-34.42	≤-22.36	PASS
	Ant1	2480	30~1000	-1.94	-46.87	≤-21.94	PASS
			1000~26500	-1.94	-36.19	≤-21.94	PASS
	Ant2	2480	30~1000	-2.40	-46.53	≤-22.4	PASS
			1000~26500	-2.40	-37.02	≤-22.4	PASS

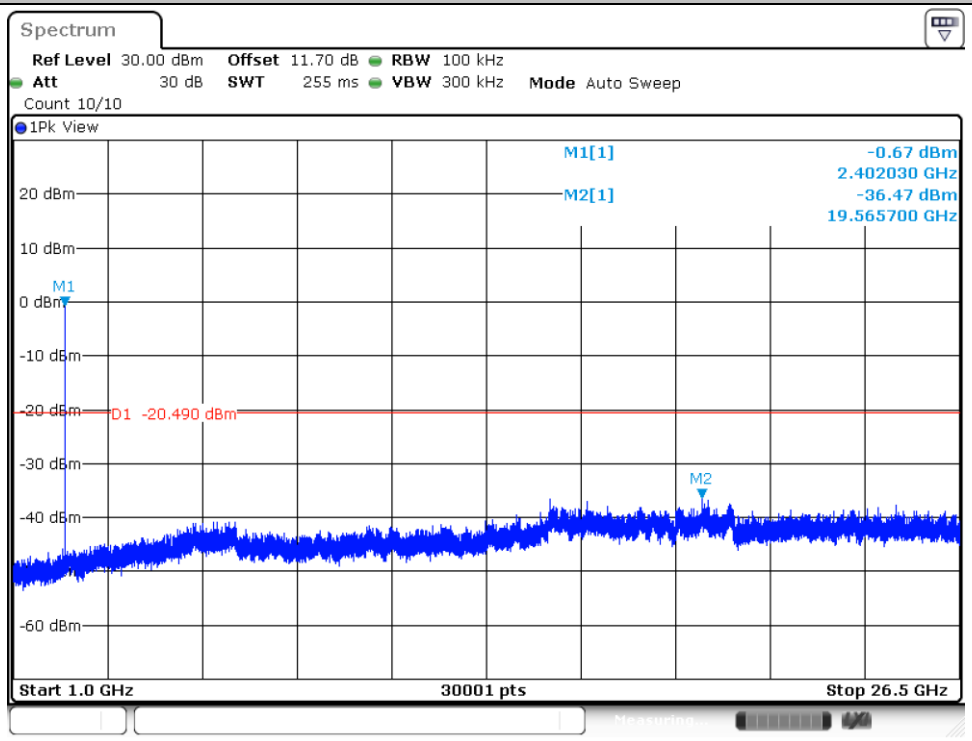
Test Graphs

BLE_1M_Ant1_2402_30~1000



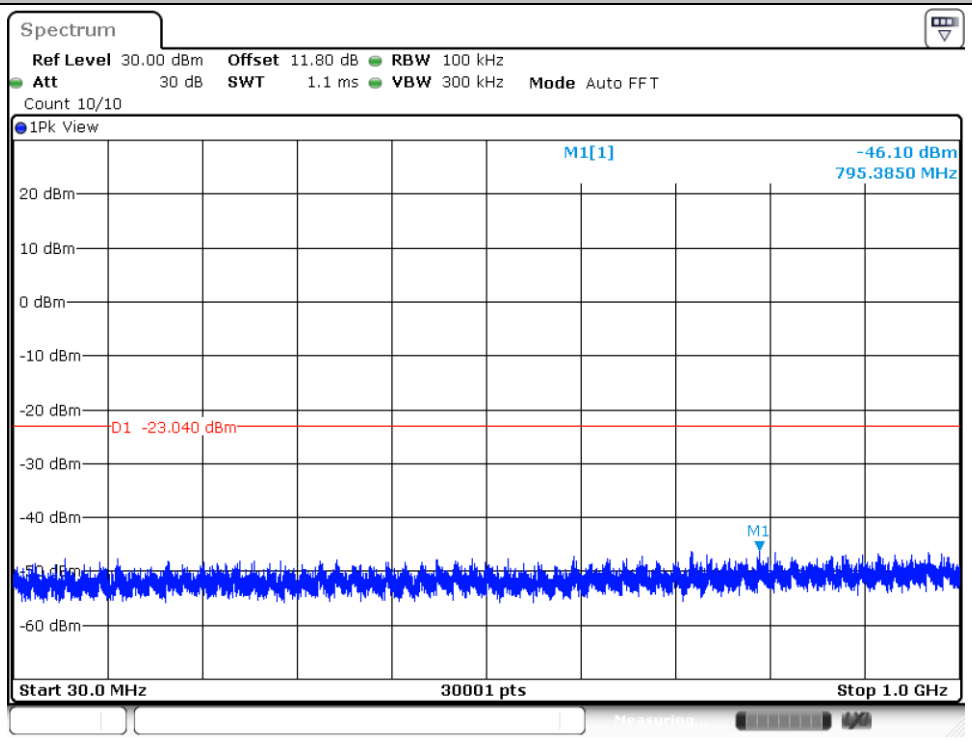
Date: 28.FEB.2024 23:45:37

BLE_1M_Ant1_2402_1000~26500



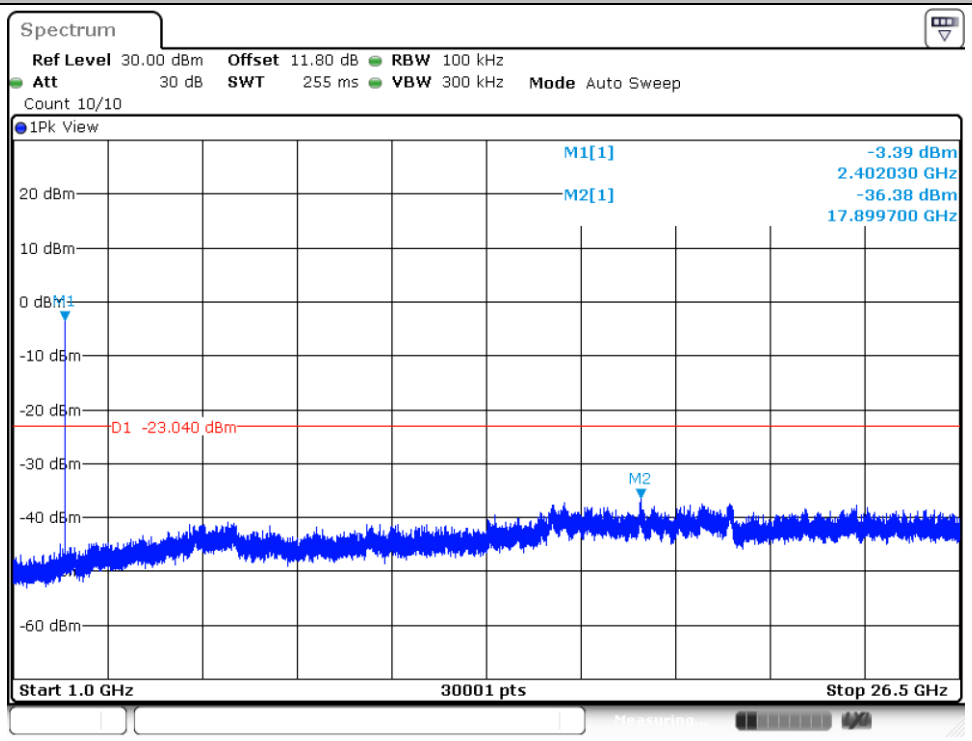
Date: 28.FEB.2024 23:45:59

BLE_1M_Ant2_2402_30~1000



Date: 29.FEB.2024 00:01:17

BLE_1M_Ant2_2402_1000~26500



Date: 29.FEB.2024 00:01:39