



PRODUCT ASSURANCE ENGINEERING  
Wireless Transceiver DTS Test Report

FCC ID: A94429358 IC: 3232A-429358



Test Type: Emissions  Immunity

Product Type: Wireless Headphones

Product Name/Number: *Model Number(s): 429358*  
*FCC ID: A94429358*  
*IC: 3232A-429358*

Prepared For: *Product Assurance Engineering Department,*  
*Bose Corporation*

Name of manufacturing agency applying for equipment type approval: *Bose Corporation*

Postal Address of manufacturing Agency: *The Mountain*  
*Framingham, MA 01701*  
*USA*

Test Results: Pass  Fail

Applicable Standards: FCC CFR 47 PART 15 SUBPART C  
Industry Canada RSS-247 Issue 2  
Industry Canada RSS-GEN Issue 5

Report Number: *EMC.429358.22.056.2*

General Comments/Special Test Conditions:

This report relates only to the items tested. This report covers EMC marking requirements for model 429358

	Print Name	Signature	Date
Prepared By:	Karl Klemm		26-Apr-2022
Electrical Engineer Review* By:	Bryan Cerqua		26-Apr-2022

\* Since every test result is separately reviewed after its completion, the electrical engineer review indicated above represents a higher level review to ensure this report lists and contains all applicable and appropriate requirements.

If the report carries the "accredited" logo, the reviewer must verify all the tests in this report are covered under the current ISO17025 accreditation. The A2LA-accredited logo must be removed if any of the tests in the report are not performed under the current scope of accreditation. It is the responsibility of the reviewer to ensure the A2LA advertising policy is followed.



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# Test Report Summary

## Product Information:

### Description

*The EUT is a wireless headphone that contains DSS/DTS transceivers, manufactured by Qualcomm Technologies, QCC5127. The EUT uses Adaptive Frequency Hopping (AFH) mode, using a reduced hop set if interference is detected in band, however a minimum of 20 channels is always maintained.*

### Setup (Cables and Accessories)

*For radio tests the radio was configured with Qualcomm Blue Suite software (details provided in SOFTWARE AND FIRMWARE section).*

### EUT Antenna Description

*The antenna is an SMD chip antenna with antenna gain of 2.2 dBi, Johanson Technology model 2450AT45A100.*

### SOFTWARE AND FIRMWARE

*The firmware installed in the EUT during testing was version 00.00.09  
The test utility software used during testing was Blue Suite version 3.3.10.*

### Scope:

*This report covers EMC requirements. FCC CFR 47 PART 15 SUBPART C, Industry Canada RSS-247 Issue 2, and Industry Canada RSS-GEN Issue 5.*

*All measurements in this report were made with a direct connection to the antenna terminal, with the antenna disconnected.*

### Test Objective:

*Verify product meets all applicable EMC requirements.*

### Results:

*Product complies with all applicable EMC requirements. All final results represent worst-case emissions and/or immunity.*

### Conclusions:

The device under test (D.U.T.):

meets all test standards selected in section 2 of this report.

does not meet all test standards selected in section 2 of this report.



# Test Standards

**Emissions:**

- Standard
- FCC Part 15C
- Canada RSS-247
- Canada RSS-GEN

# Environmental Conditions

**Ambient:**

- Temperature: 22±4°C
- Humidity: 30-60%RH
- Mains Voltage:  5 Vdc

# FCC Test Site Accreditation.

Firm Name	Location	Accreditation	MRA Designation Number	Expiration Date	Contact	Contact Title
<a href="#">Bose Corporation</a>	1 New York Avenue, Framingham, MA	American Association for Laboratory Accreditation	N/A US1088	07/31/2022	Mr. Cable Best	Quality Manager

# Canadian Test Site Registration.

Organization	CAR identifier	Scope/Recognition Date (yyyy-mm-dd)	Expiration (yyyy-mm-dd)
BOSE CORPORATION  1 New York Avenue Framingham, MA 01701 UNITED STATES  <b>Company Number: 3232A</b>  Contact: Mario Espinal <a href="mailto:mario_espinal@bose.com">mario_espinal@bose.com</a>	US0210	RSS-GEN (2019-02-11)  RSS-210 (2019-02-11) RSS-247 (2019-02-11) RSS-248 (2021-11-19)	<b>RECOGNIZED UNTIL: 2022-07-31</b>  A2LA ISO/IEC 17025:2017 Expires: 2022-07-31



# 6dB Bandwidth Requirement:

FCC 15.247(a)(2); IC RSS-247 5.2 (1)

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

# Test Procedure:

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the Occupied Bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.



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# Test Results:

6 dB OBW Summary Table (BLE 1M)				
Channel	Frequency (MHz)	Mode	6 dB OBW (MHz)	Limit NA
Low	2402	1M	0.712	-
Middle	2440	1M	0.715	-
High	2480	1M	0.712	-



BLE 1M on 2402 MHz

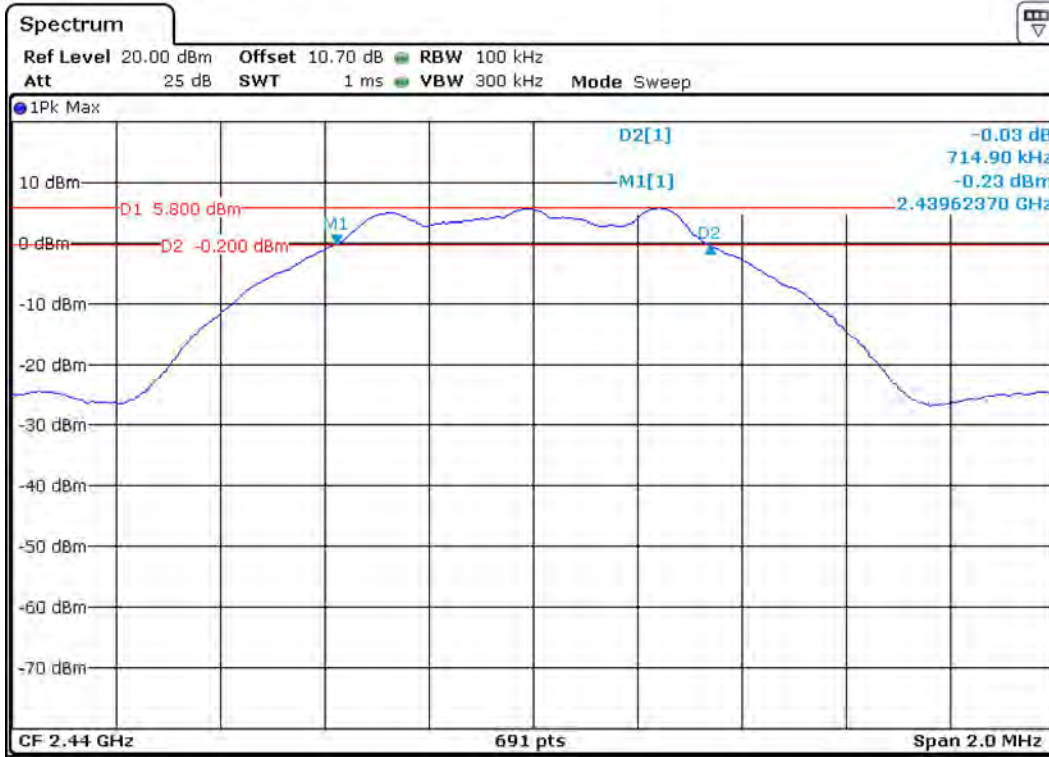


# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DTS Test Report

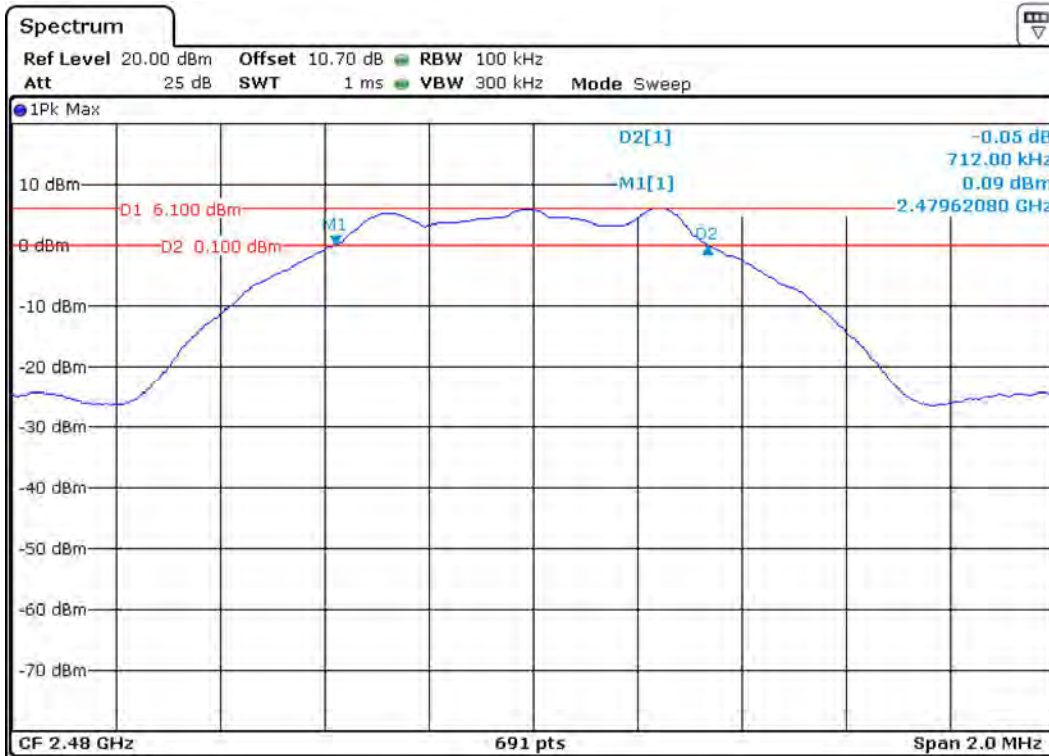
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CERT #1514.01



BLE 1M on 2440 MHz



BLE 1M on 2480 MHz

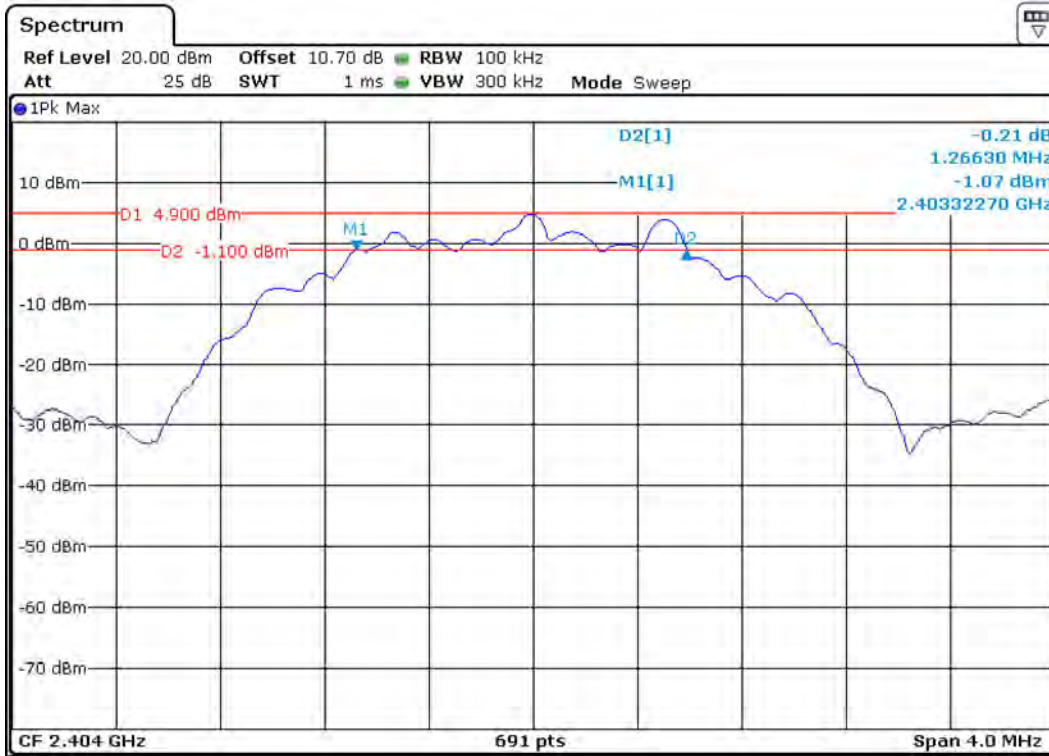


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6 dB OBW Summary Table (BLE 2M)				
Channel	Frequency (MHz)	Mode	6 dB OBW (MHz)	Limit NA
Low	2404	2M	1.266	-
Middle	2440	2M	1.274	-
High	2478	2M	1.274	-



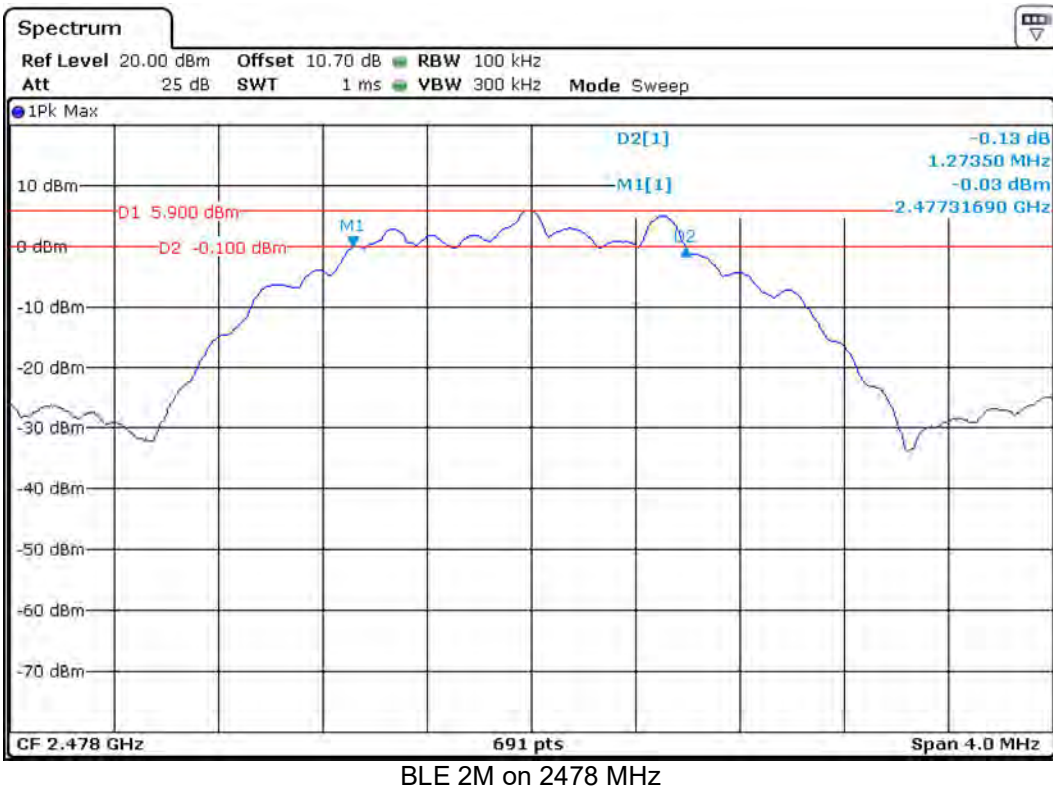
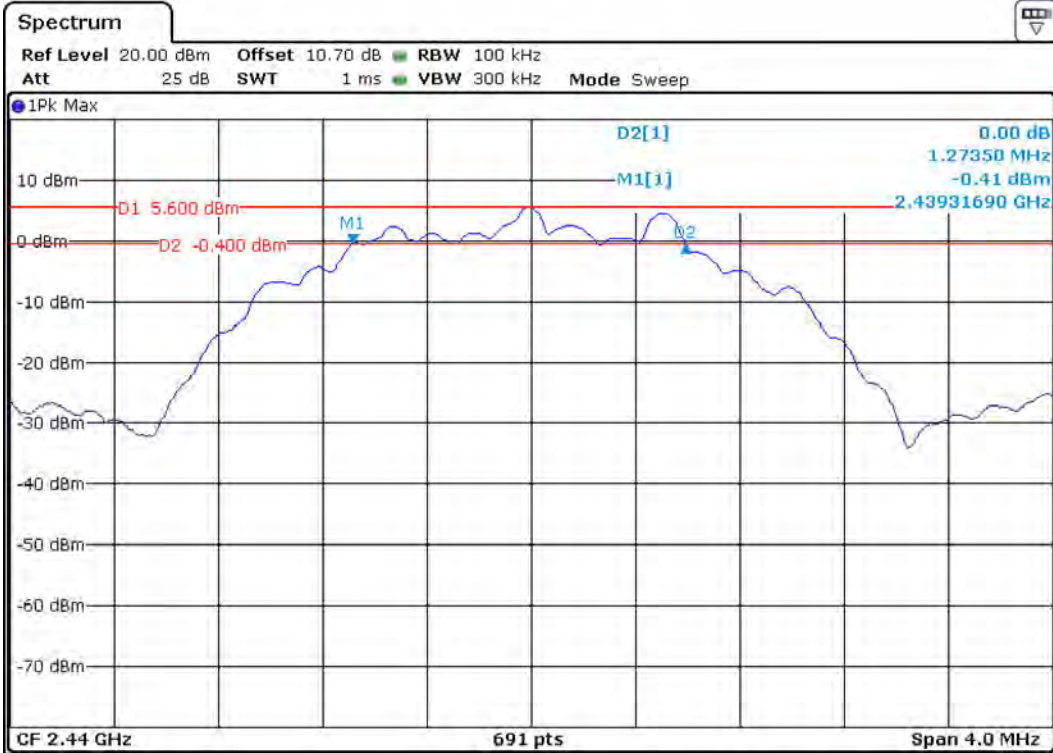
BLE 2M on 2404 MHz





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# 99% Bandwidth Requirement:

None; for reporting purposes, only. Test per FCC 15.247(a)(1); IC RSS-247 5.1 (1), RSS-Gen 6.6.

## Test Procedure:

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 99% Occupied Bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.



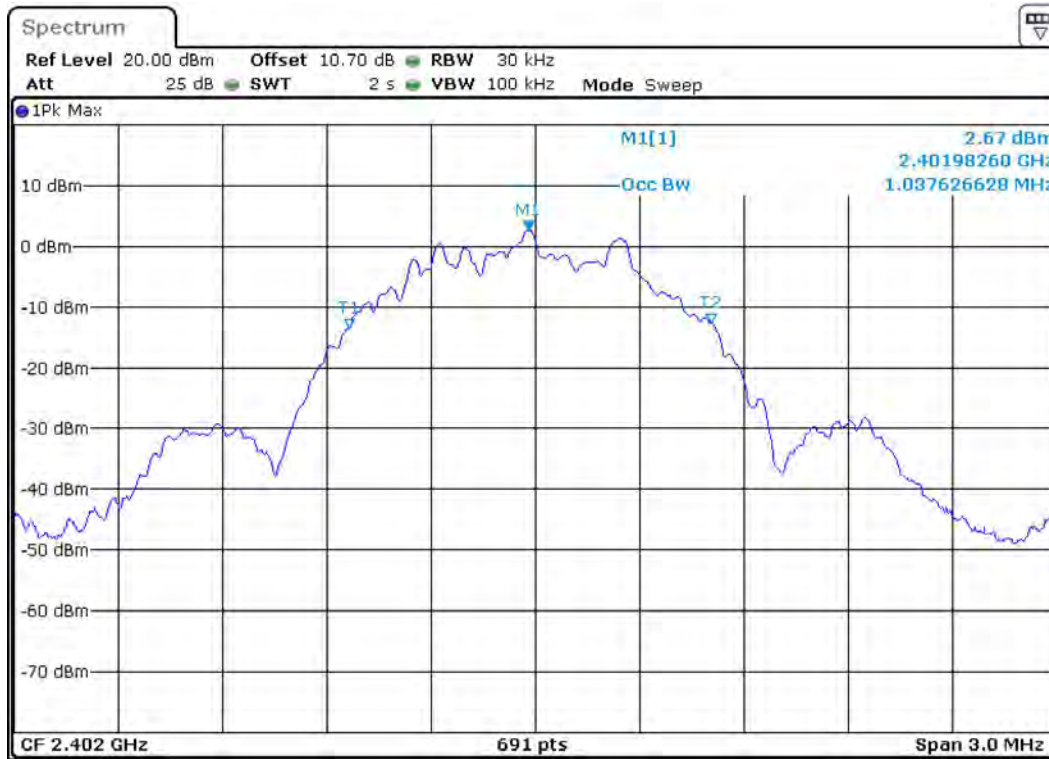
PRODUCT ASSURANCE ENGINEERING  
**Wireless Transceiver DTS Test Report**

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# Test Results:

99% Bandwidth Summary Table (BLE 1M)			
Channel	Frequency (MHz)	Mode	99% Bandwidth (kHz)
Low	2402	BLE 1M	1037.6
Middle	2440	BLE 1M	1037.6
High	2480	BLE 1M	1037.6



BLE 1M on 2402 MHz

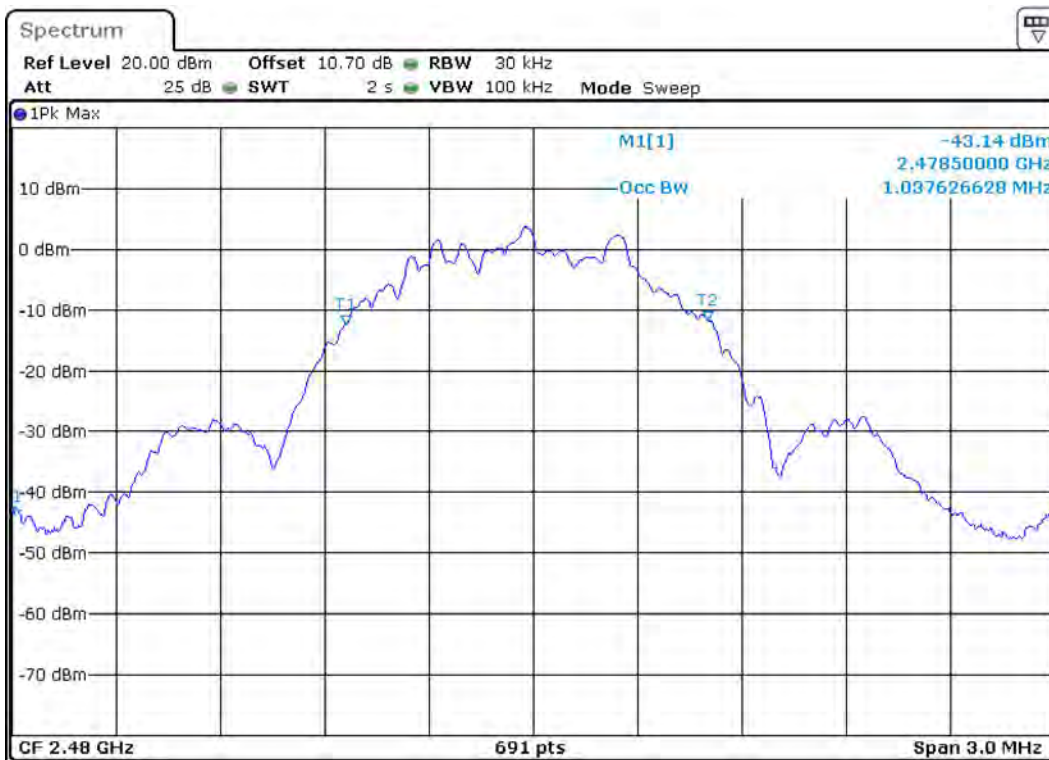


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BLE 1M on 2440 MHz



BLE 1M on 2480 MHz

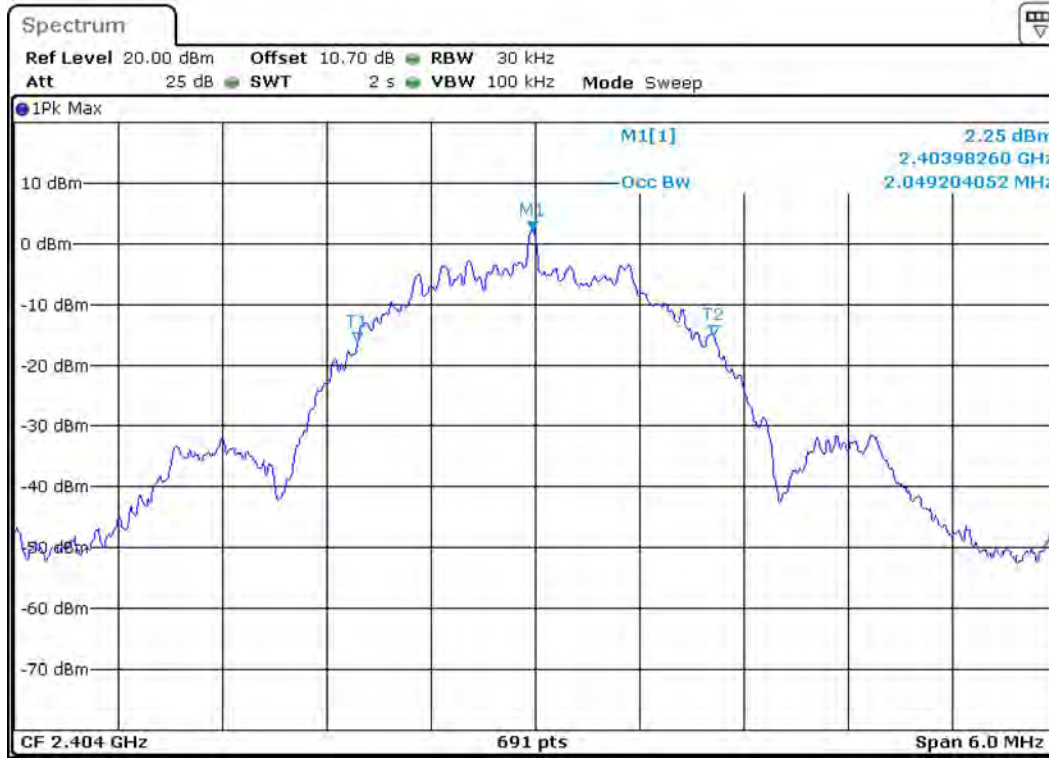


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99% Bandwidth Summary Table (BLE 2M)			
Channel	Frequency (MHz)	Mode	99% Bandwidth (kHz)
Low	2404	BLE 2M	2049.2
Middle	2440	BLE 2M	2057.9
High	2478	BLE 2M	2049.2

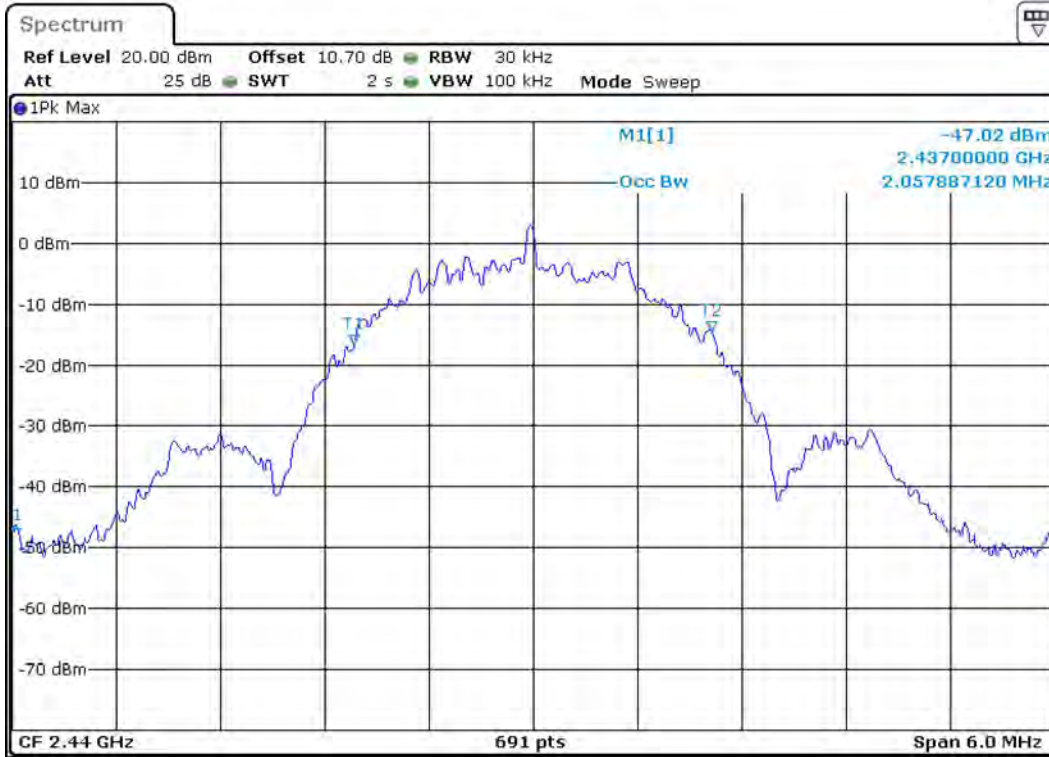


BLE 2M on 2404 MHz

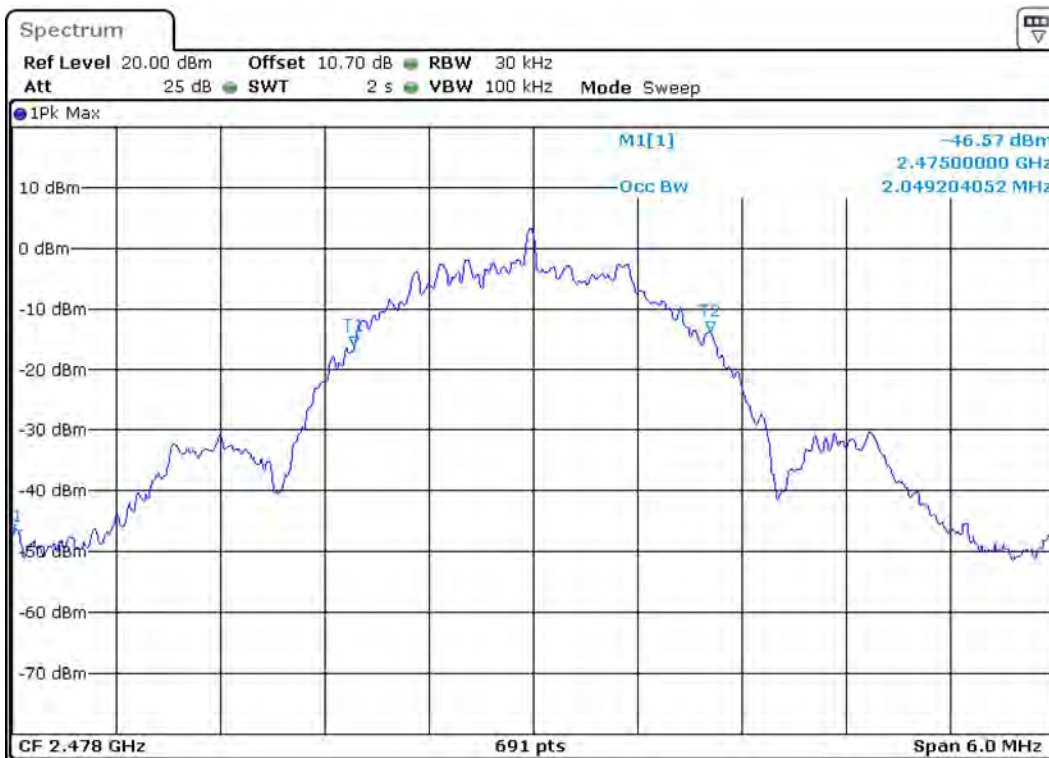


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BLE 2M on 2440 MHz



BLE 2M on 2478 MHz



# Conducted Output Power Requirements:

## FCC 15.247 (b) (3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## RSS-247 5.4 (4)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

# Test setup details:

The EUT is controlled via the USB port with Blue Suite software which is used to set the test modes of the Bluetooth device. The EUT antenna is disconnected. A temporary test connector is mounted to the PCB. An 8 inch SMA adapter cable with 0.7 dB loss and a 10 dB pad were used for all conducted measurements. To compensate for the cable loss and pad attenuation, the reference level offset feature of the spectrum analyzer was used. The EUT is programmed to operate on fixed frequencies at the low, middle, and high end of the authorized frequency band. The spectrum analyzer resolution bandwidth is set to 3 MHz (higher than the occupied bandwidth), peak detector and max hold. The maximum output power is recorded for each of the three frequencies.



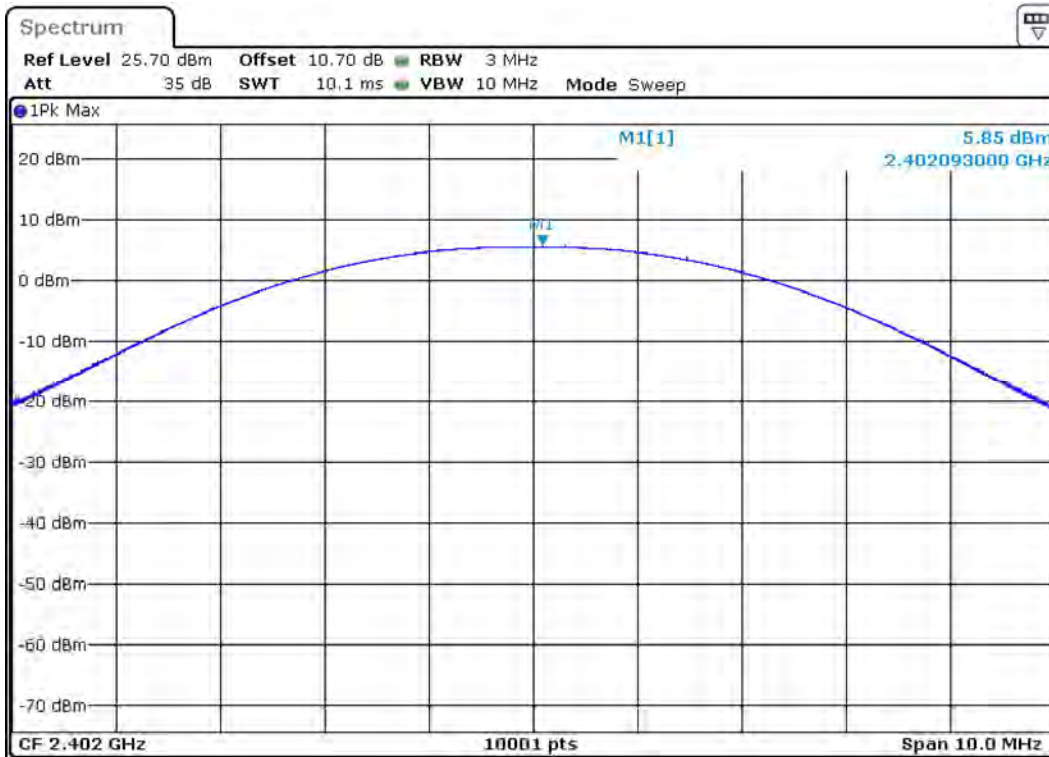
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# Test Results:

Output Power Summary Table (BLE 1M)						
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	5.9	0	30	24.1	Pass
Middle	2440	6.6	0	30	23.4	Pass
High	2480	6.8	0	30	23.2	Pass



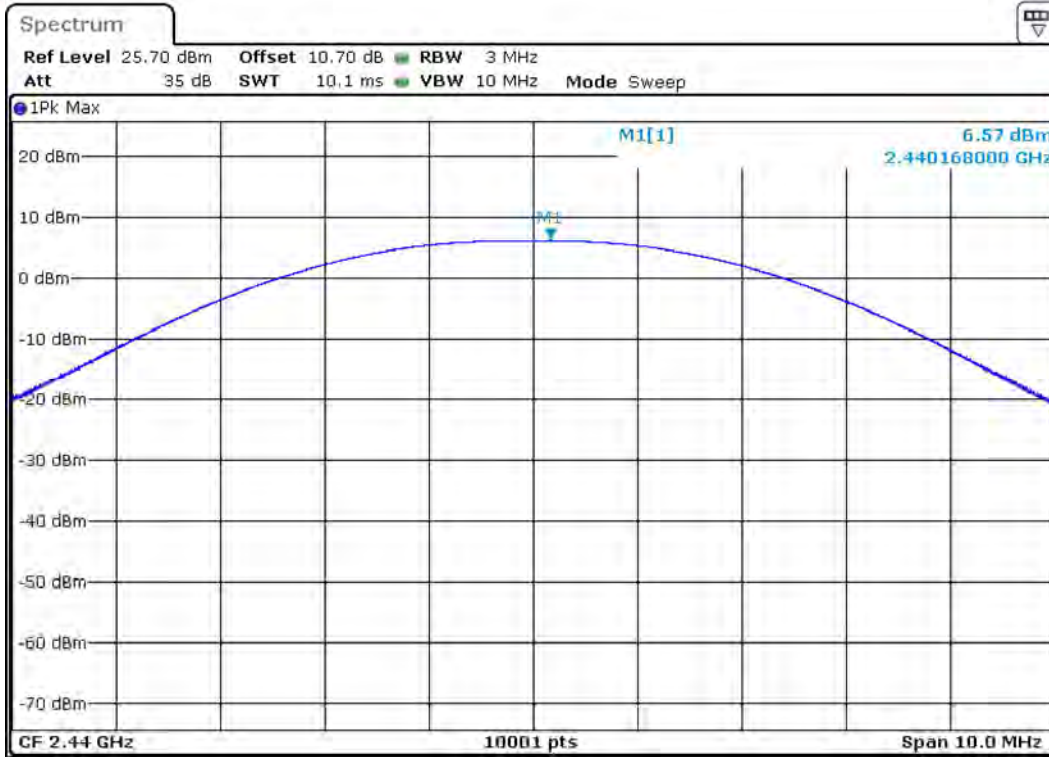
BLE 1M on 2402 MHz



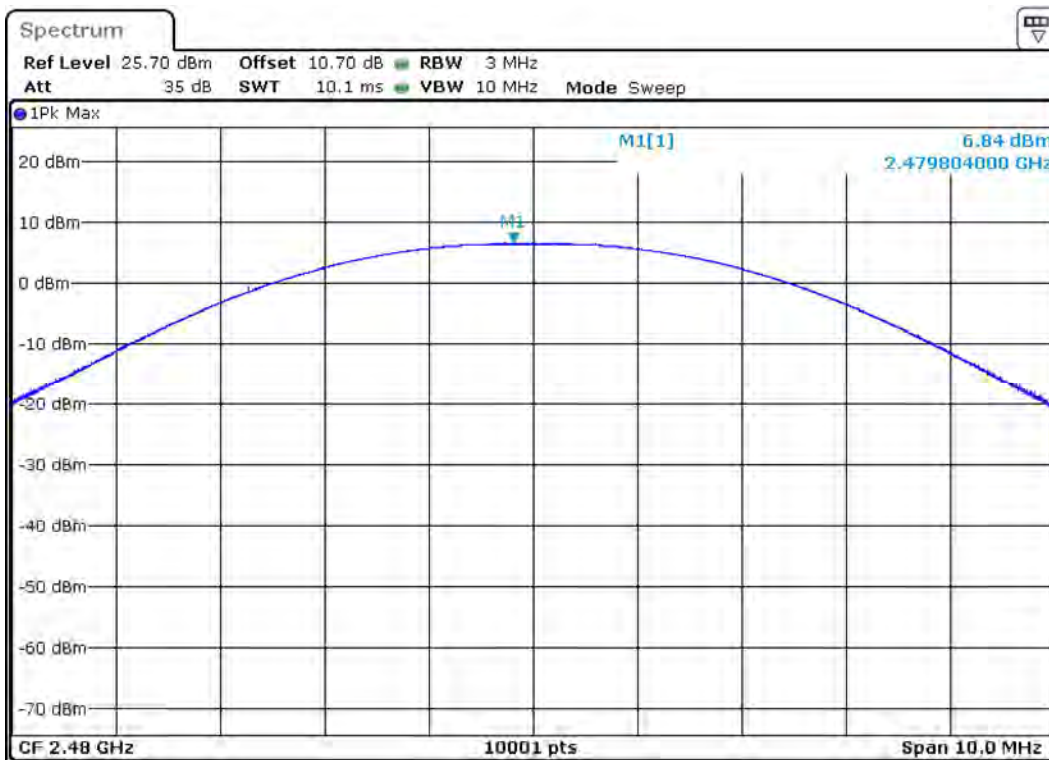


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BLE 1M on 2440 MHz



BLE 1M on 2480 MHz

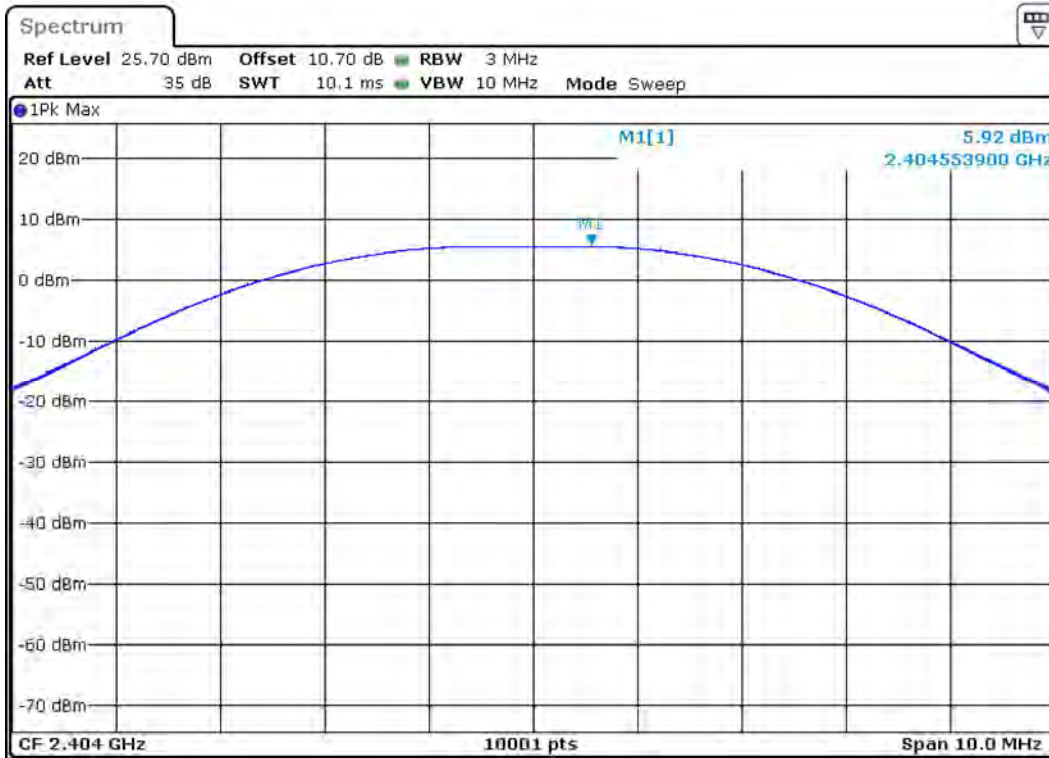


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Output Power Summary Table (BLE 2M)						
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2404	5.9	0	30	24.1	Pass
Middle	2440	6.2	0	30	23.8	Pass
High	2478	6.5	0	30	23.5	Pass

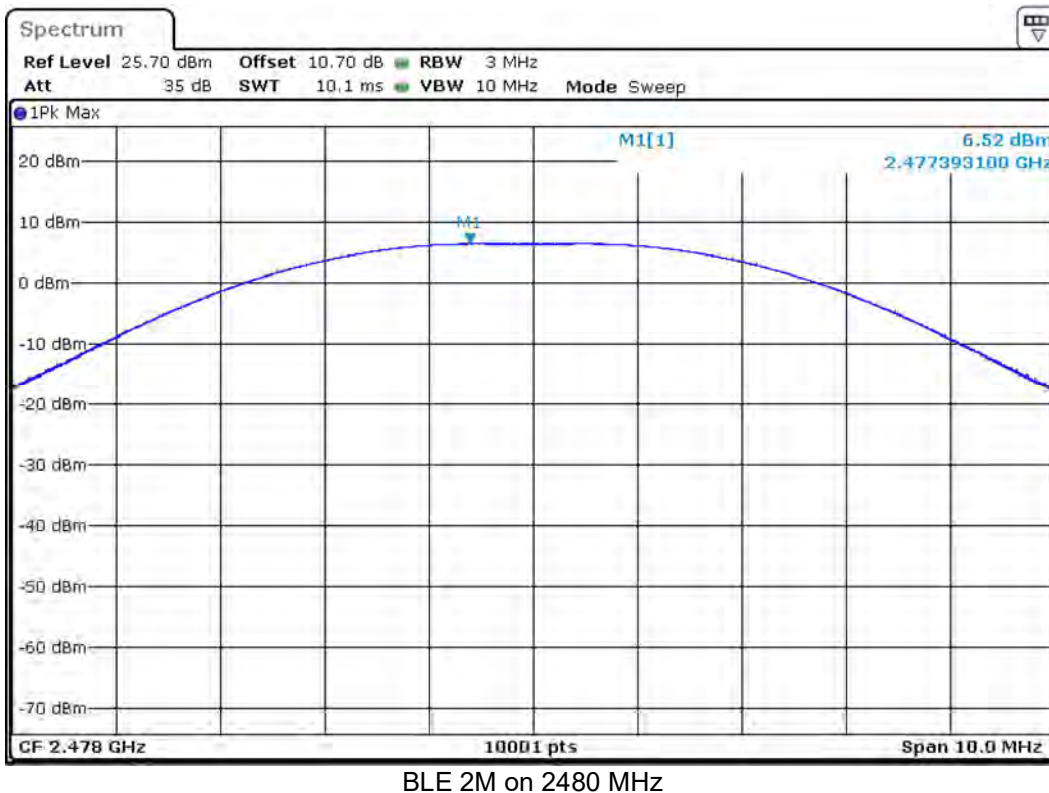
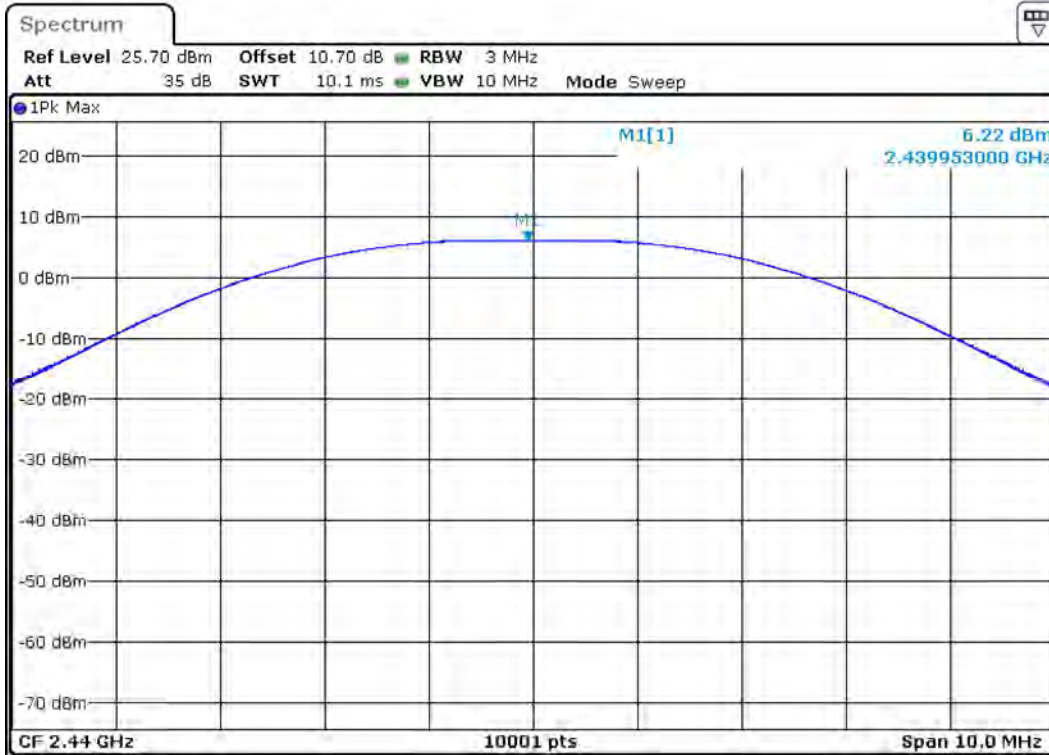


BLE 2M on 2404 MHz



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# Power Spectral Density

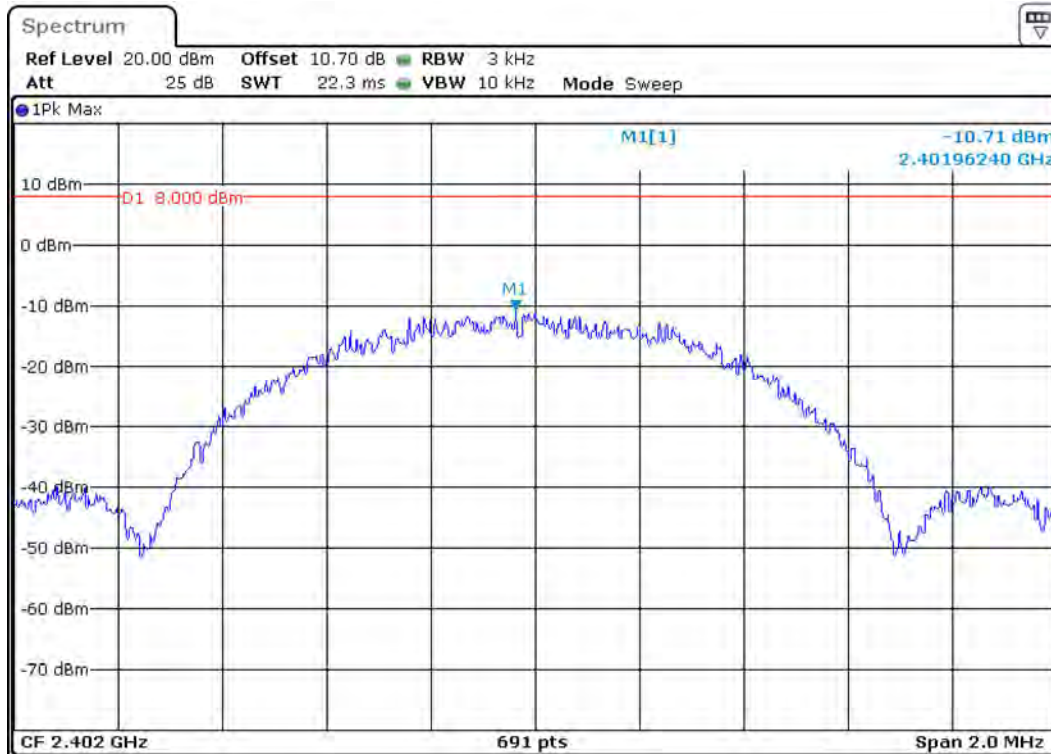
## Requirements:

**FCC 15.247 (e) and IC RSS-247 5.2 (2)**

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## Test Results:

Power Spectral Density Summary Table (BLE 1M)					
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2402	-10.7	8	18.7	Pass
Middle	2440	-10.0	8	18.0	Pass
High	2480	-9.5	8	17.5	Pass

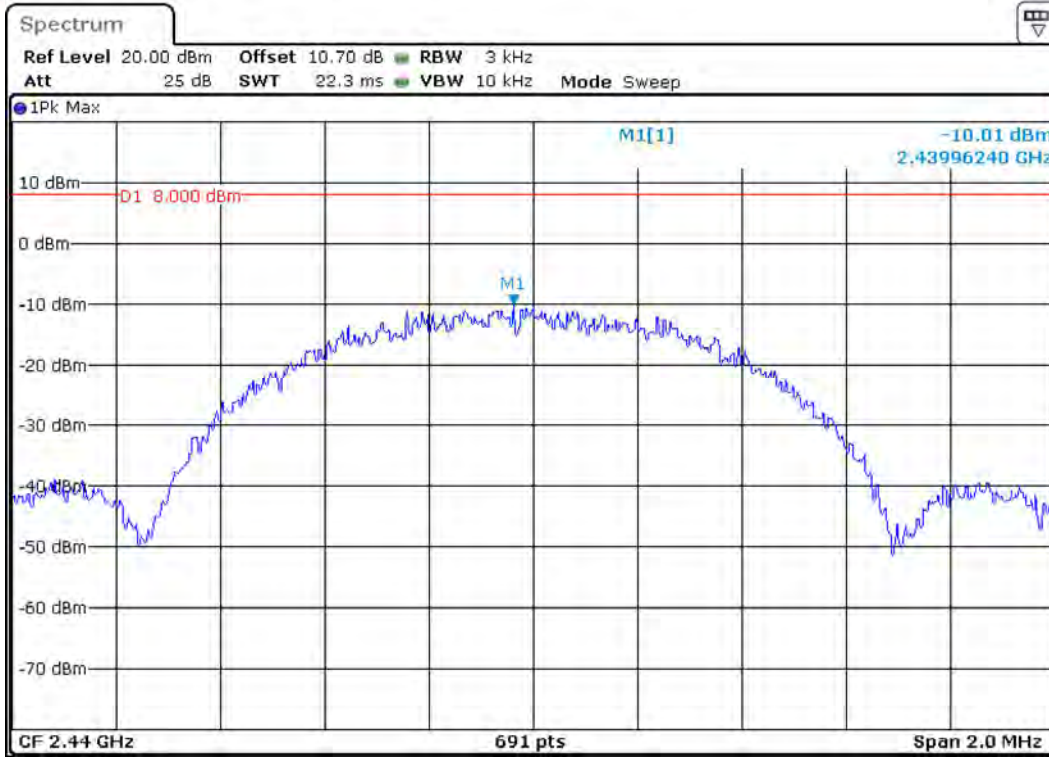


BLE 1M on 2402 MHz

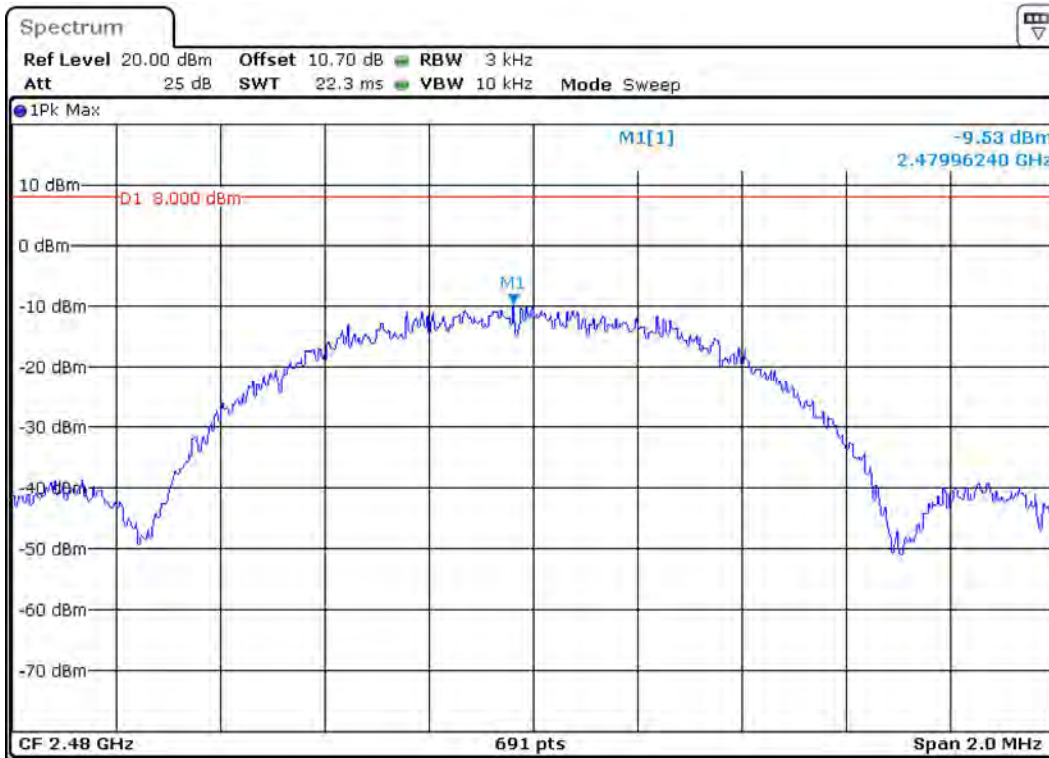


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BLE 1M on 2440 MHz



BLE 1M on 2480 MHz

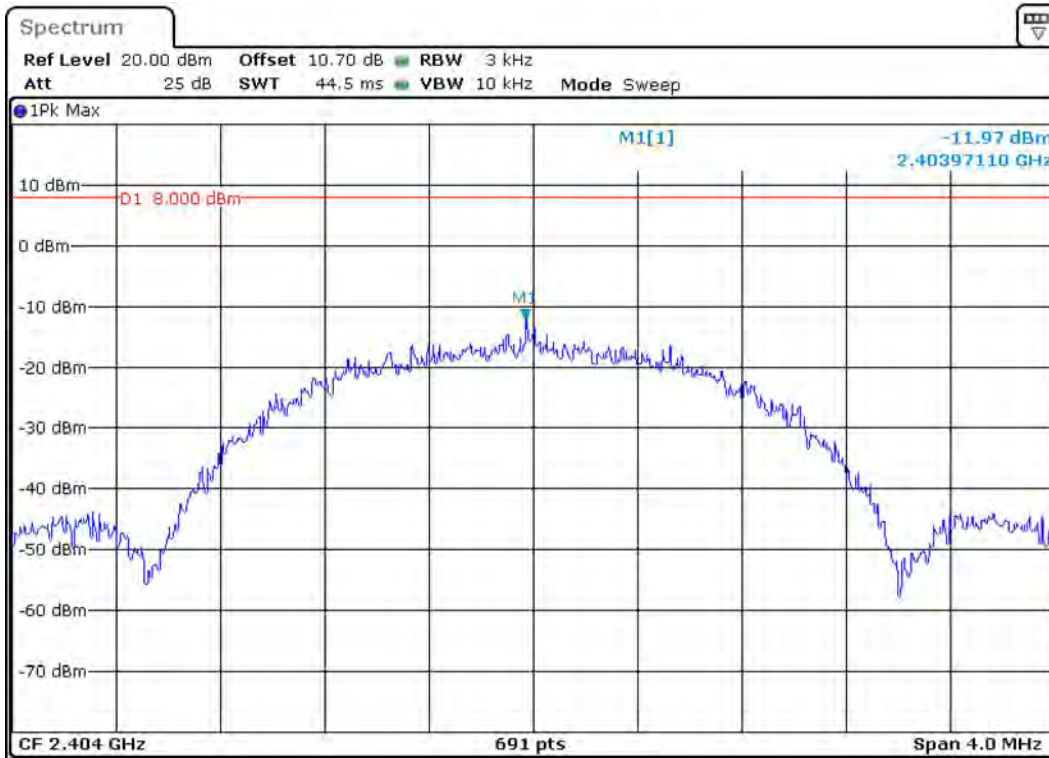


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Power Spectral Density Summary Table (BLE 2M)					
Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2404	-12.0	8	20.0	Pass
Middle	2440	-11.2	8	19.2	Pass
High	2478	-10.9	8	18.9	Pass

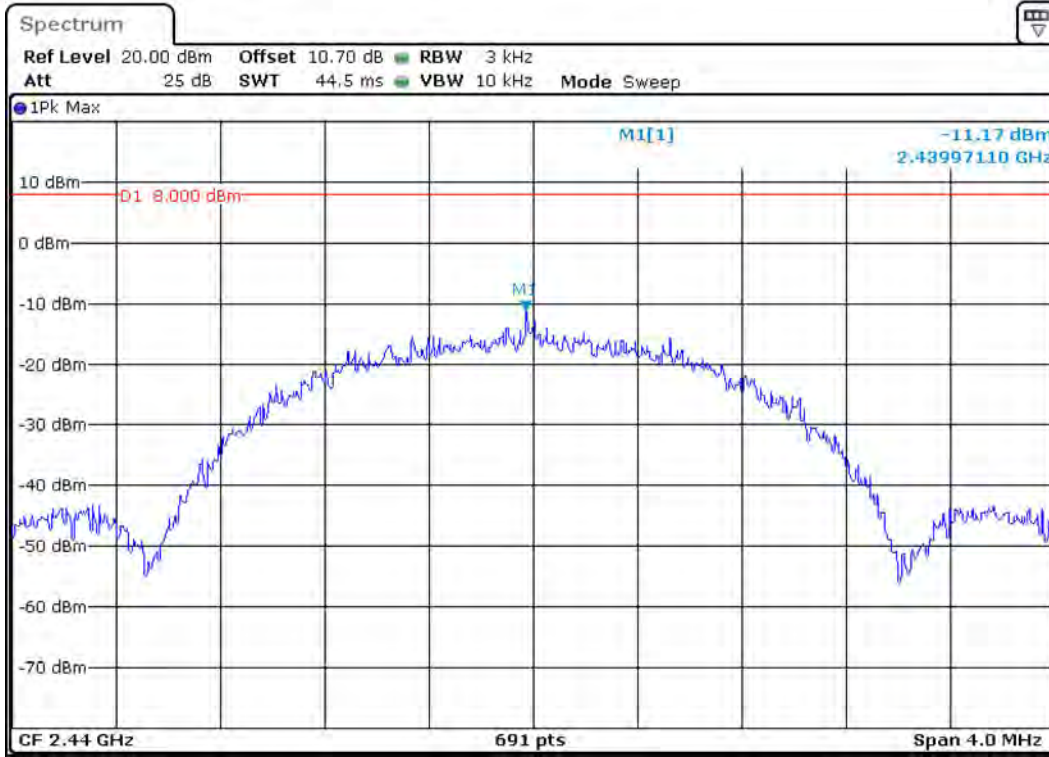


BLE 2M on 2404 MHz

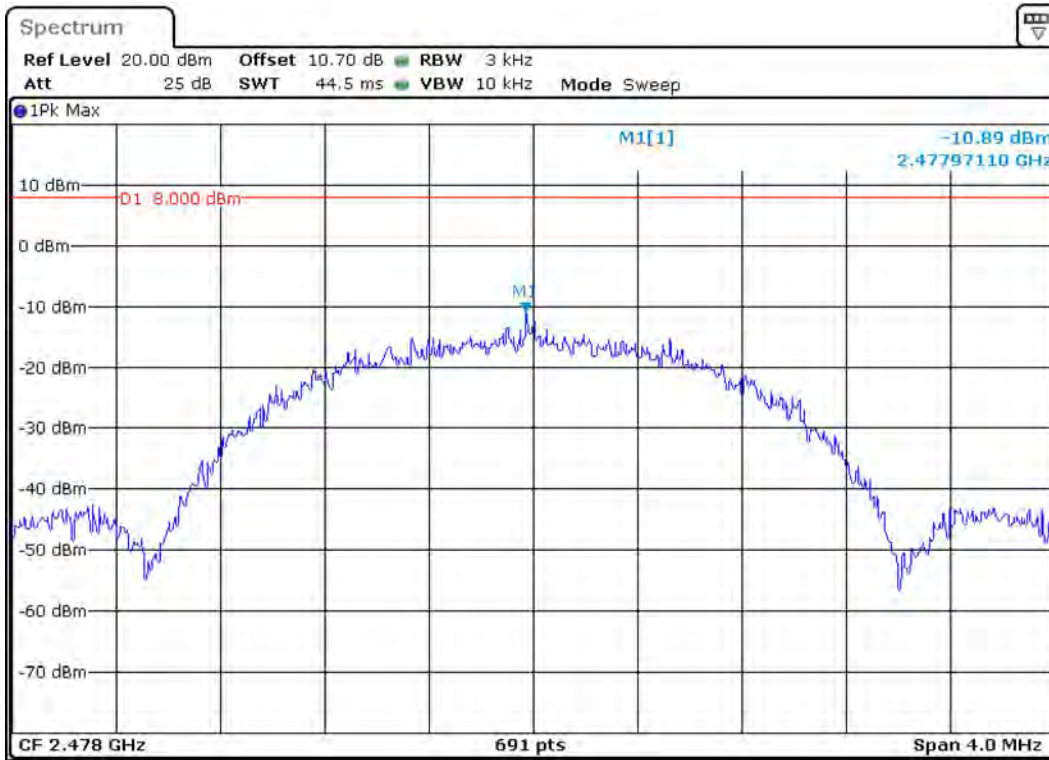


# PRODUCT ASSURANCE ENGINEERING Wireless Transceiver DTS Test Report

FCC ID: A94429358 IC: 3232A-429358



BLE 2M on 2440 MHz



BLE 2M on 2478 MHz



# Conducted Spurious Emissions

## Requirements:

### FCC 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

### IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

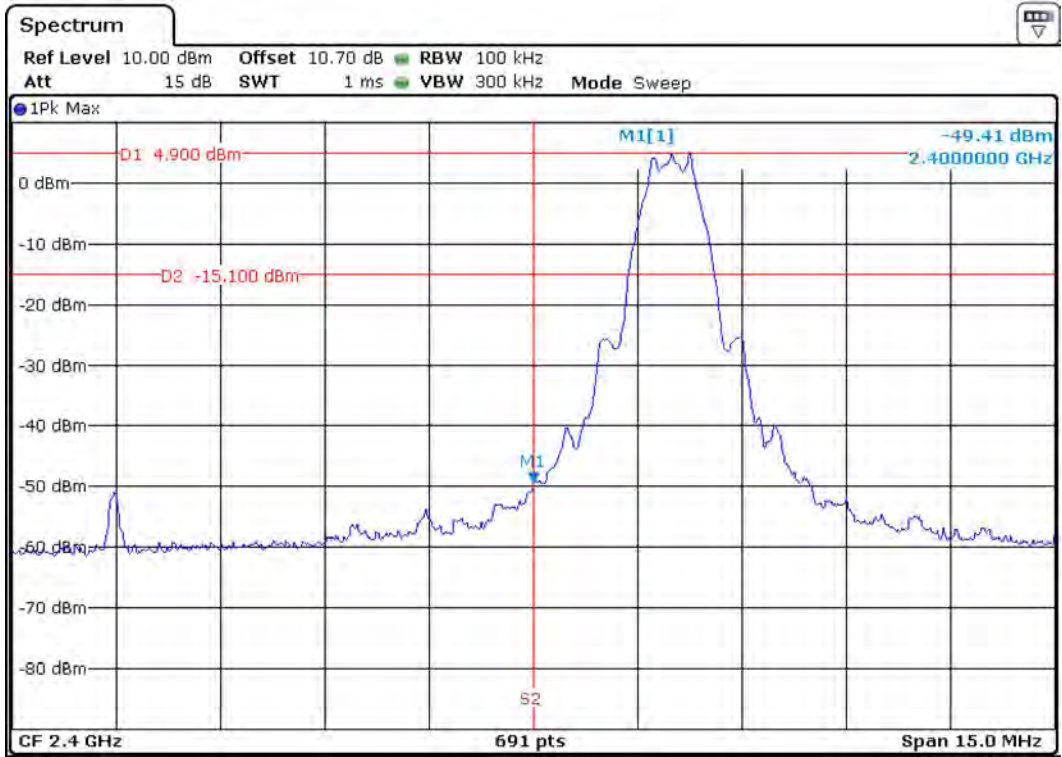
Note: Antenna gain outside of the wanted band was assumed to be zero. The conducted spurious readings are for additional information as the radiated readings take precedence.





# Spurious Band-edge Emissions

Lower Band Edge (BLE)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
Low	2402	BLE 1M	54.3	20	34.3	Pass
Low	2404	LE 2M	56.2	20	36.2	Pass

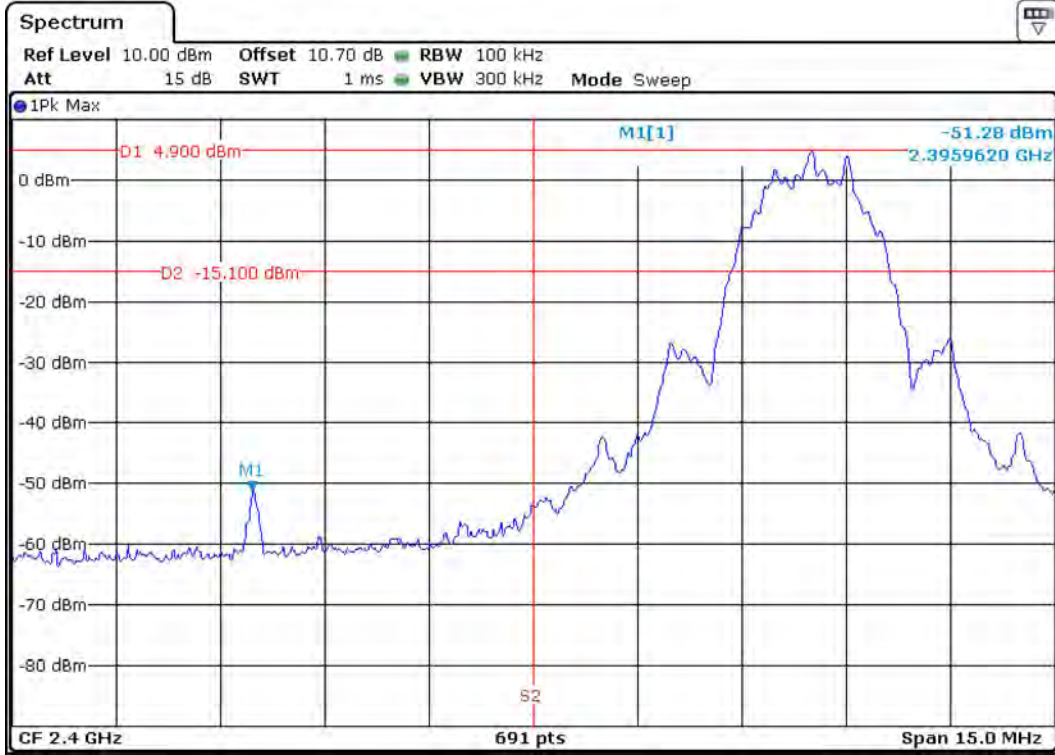


BLE 1M on 2402 MHz



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BLE 2M on 2404 MHz

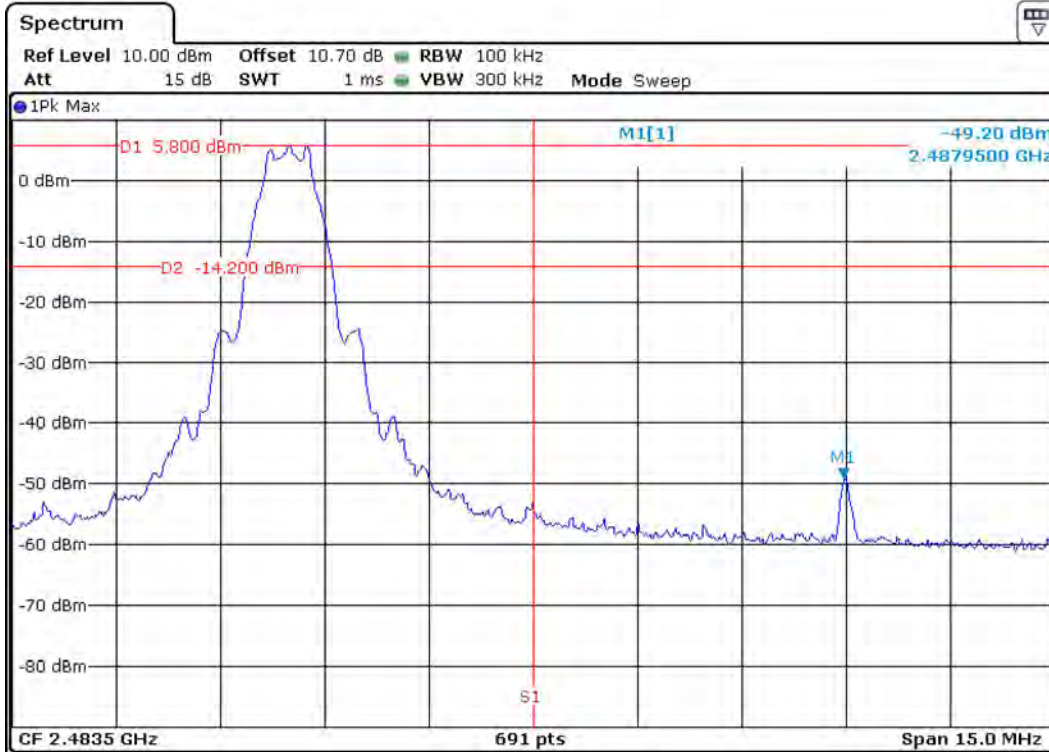


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Upper Band Edge (BLE) (Peak Detector)						
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result
High	2480	BLE 1M	55.0	20	35.0	Pass
High	2478	LE 2M	55.3	20	35.3	Pass

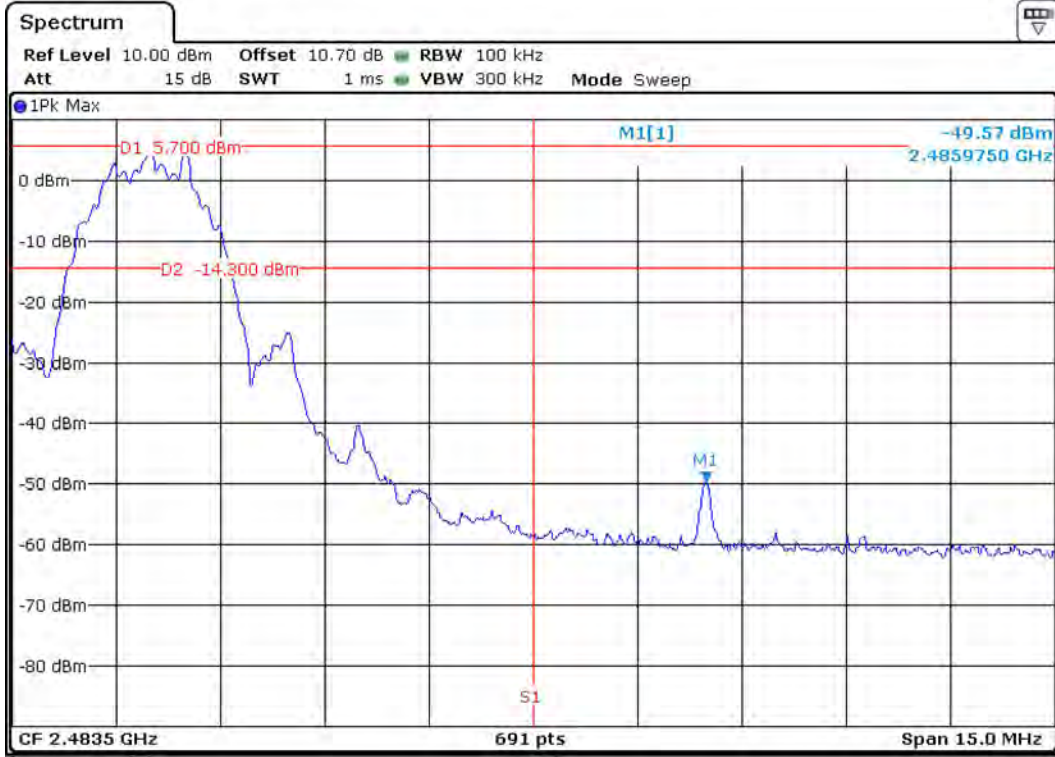


BLE 1M on 2480 MHz



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BLE 2M on 2478 MHz



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# Spurious Emissions

Spurious Summary Table (Rate: 1 Mbps)											
Channel	Band Range (MHz)	Mode	Peak Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Result
Low/Mid/High	30 To 1000	BLE 1M	-62.1	0.7	10.0	0.0	-51.4	43.83	54	10.17	Pass
Low/Mid/High	2483.5 To 25000	BLE 1M	-67.2	0.7	10.0	0.0	-56.5	38.73	54	15.27	Pass

Note: Peak reading applied to Average Limit

Spurious Summary Table (Rate: 2 Mbps)											
Channel	Band Range (MHz)	Mode	Peak Raw Measurement (dBm)	Test Cable Loss (dB)	Pad ATTN (dB)	EUT Antenna Gain At Harmonic Frequency (dBi)	Corrected Reading (dBm)	Convert to E-Field at 3 meters (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Result
Low/Mid/High	30 To 1000	BLE 2M	-63.2	0.7	10.0	0.0	-52.5	42.73	54	11.27	Pass
Low/Mid/High	2483.5 To 25000	BLE 2M	-68.4	0.7	10.0	0.0	-57.7	37.53	54	16.47	Pass

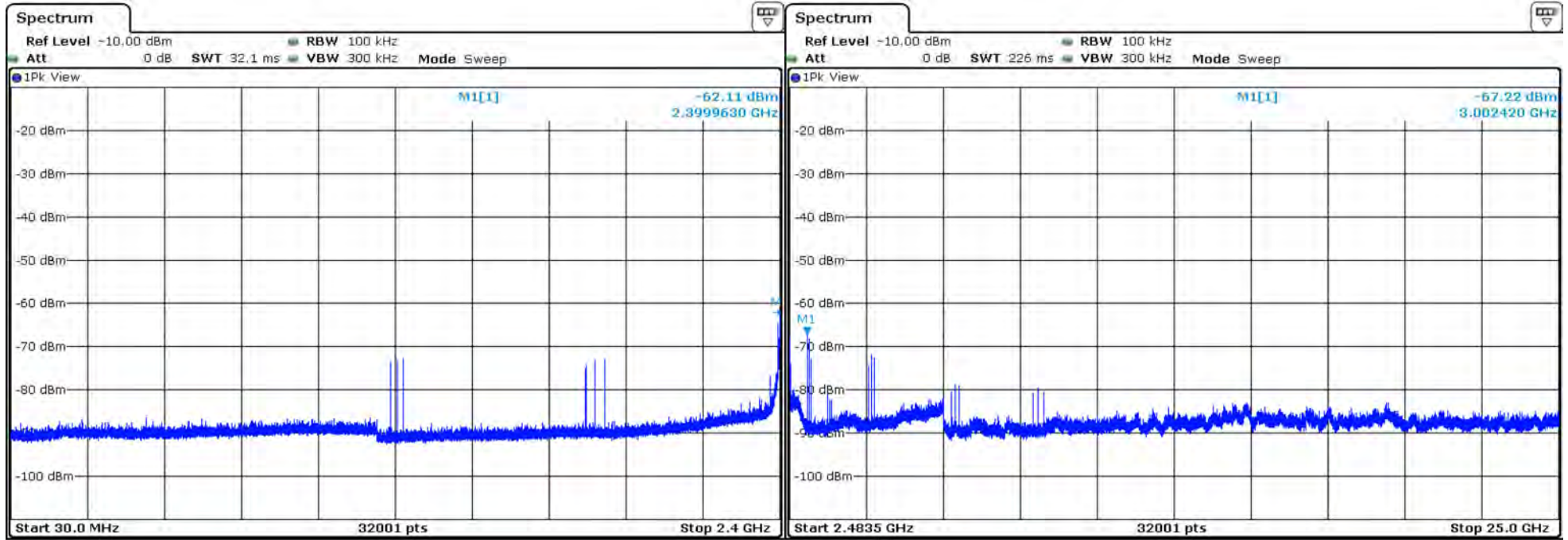
Note: Peak reading applied to Average Limit



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BOSE

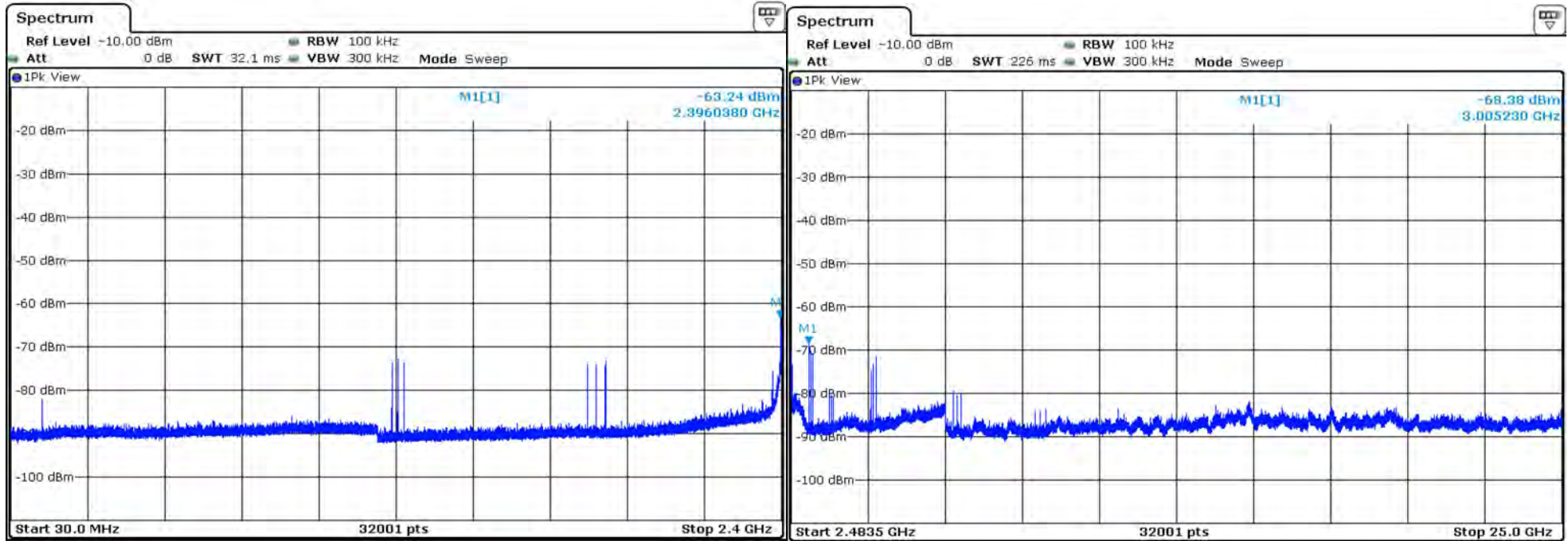


Transmitting BLE 1M on 2402 MHz, 2440 MHz, or 2480 MHz



PRODUCT ASSURANCE ENGINEERING  
Wireless Transceiver DTS Test Report

FCC ID: A94429358 IC: 3232A-429358



Transmitting BLE 2M on 2404 MHz, 2440 MHz, or 2478 MHz



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# Conducted Measurements Resources Used

TN	Description	Model	S/N	Manufacturer	Most Recent Service	Service Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	25-Mar-2020	25-Mar-2022
n/a	10 dB attenuator	VAT-10+	n/a	Minicircuits	Verify Before Use	

Date(s) of test: 10-Dec-2021 to 16-Dec-2021

TN	Description	Model	S/N	Manufacturer	Most Recent Service	Service Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	21-Mar-2022	21-Mar-2023
n/a	10 dB attenuator	VAT-10+	n/a	Minicircuits	Verify Before Use	

Date(s) of test: 13-Apr-2022





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# Revision History

Date	Author	Changes
10-Mar-2022	KK	Initial release
26-Apr-2022	KK	Updated 6 dB OBW plots and test procedure. Updated spurious bandedge plots Added attenuator to equipment list.



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# End of Report