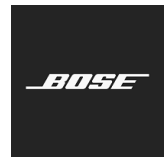




PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Bluetooth Low Energy Test Report



Test Type: Emissions Immunity

Product Type: Wireless Earbuds

Product Name/Number: Model Number(s): 926R (Bud) 438926 (Case/System)
FCC ID: A94926R
IC: 3232A-926R

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.442345.23.222.6

General Comments/Special Test Conditions:

This report relates only to the items tested. This report covers EMC marking requirements for model 440108

	Print Name	Signature	Date
Prepared By:	Kenneth Lee		19-Oct-2023
Electrical Engineer Review* By:	Bryan Cerqua		19-Oct-2023

* 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.



Table of Contents

1. Test Report Summary	3
2. Test Results Summary	4
3. Test Standards & Environmental Conditions	5
4. Lab Accreditations / Registrations	6
5. On Time & Duty Cycle	7
6. 6 dB and 99% Occupied Bandwidth.....	8
7. Conducted Output Power	12
8. Power Spectral Density	14
9. Conducted Spurious Emissions	16
10. Radiated Emissions 1 GHz to 25 GHz	22
11. Radiated Emissions 30 MHz to 1 GHz	33
12. AC Line Conducted Emissions.....	35
13. Equipment List.....	38
14. Measurement Uncertainty	39



1. Test Report Summary

Product Information:

Description

The EUT is a wireless earbud that contains DSS/DTS transceiver IC manufactured by Qualcomm Technologies.

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 inverted F antenna with a maximum gain of 1 dBi.

SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 0.7.10 for the buds and 0.7.4 for the case. The test utility software used during testing was Blue Suite version 3.3.16.

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 radiated emissions measurements performed using the internal non-removable antenna. The antenna is permanently attached, complies with 15.203.

All conducted RF measurements were done with 3" coaxial cable with SMA connector soldered to pad that leads to the antenna.

Test Objective:

Verify product meets all applicable EMC requirements.

Measurement Methods:

ANSI C63.10 (2013).
RSS-Gen Issue 5 (2018)

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.



2. Test Results Summary

TEST NAME	TEST RESULT PASS or N/A	COMMENT(S)
On Time and Duty Cycle	N/A	For reporting only
6 dB Occupied Bandwidth	Pass	
99% Occupied Bandwidth	N/A	For reporting only
Conducted Output Power	Pass	
Power Spectral Density	Pass	
Conducted Spurious Emissions	Pass	
Radiated Emissions 1 to 25 GHz	Pass	
Radiated Emissions 30 to 1000 MHz	Pass	
AC Line Conducted Emissions	Pass	

EUT serial numbers used for this test report:

Conducted RF:

Bud – ACBF71403A8B

Radiated Measurements:

Bud – ACB71405826

Conducted AC mains emissions:

Left Bud – ACB7140490E

Right Bud – ACB714049AC

Case/System – R3174008701879834S1FC10

Note: BLE 1M uses channels between and including 2402 to 2480 MHz which are determined by the Qualcomm Bluetooth IC.

BLE 2M uses channels between and including 2404 to 2478 MHz which are determined by the Qualcomm Bluetooth IC.



3. Test Standards & Environmental Conditions

Test Standards

Emissions:

	Standard
<input checked="" type="checkbox"/>	FCC Part 15C
<input checked="" type="checkbox"/>	Canada RSS-247
<input checked="" type="checkbox"/>	Canada RSS-GEN

Environmental Conditions

Ambient:	
Temperature:	22±4 °C
Humidity:	30-60 % RH
Internal Battery	3.7 VDC
Voltage:	Nominal



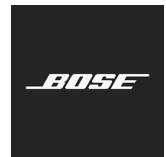
4. Lab Accreditations / Registrations

FCC Test Site Accreditation.

Firm Name	Location	Expiration Date	Accreditation	MRA	Designation Number	Contact	Contact Title	Address	PO Box	Mail Stop	City	State	Zip Code	Country	Email	Phone	Fax
Bose Corporation	1 New York Avenue, Framingham, MA	07/31/2024	American Association for Laboratory Accreditation	N/A	US1088	Mr. Cable Best	Quality Manager	Mail Stop 450 The Mountain	N/A	450	Framingham	Massachusetts	01701	United States	Cable_Best@bose.com	1 508 766 6137	508 766 1145

Canadian Test Site Registration.

<p>BOSE CORPORATION</p> <p>1 New York Avenue Framingham, MA 01701 UNITED STATES</p> <p>Company Number: 3232A</p> <p>Contact: Mario Espinal mario_espinal@bose.com</p>	US0210	<p>RSS-GEN (2019-02-11)</p> <p>RSS-210 (2019-02-11)</p> <p>RSS-247 (2019-02-11)</p> <p>RSS-248 (2021-11-19)</p>	<p>RECOGNIZED UNTIL: 2024-07-31</p> <p>A2LA ISO/IEC 17025:2017 Expires: 2024-07-31</p>
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5. On Time & Duty Cycle

Requirement:

None; for reporting purposes only.

Measurement Method:

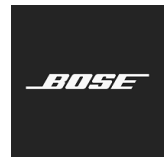
KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 Section 6 b), zero span method.

On time & duty cycle test results:

All testing is done using the maximum packet length for maximum duty cycle shown in the table below.

Frequency (MHz)	Mode	Packet Type	Data Rate (Mbps)	Max Packet Length (Bytes)	On Time (ms)	Period (ms)	Duty Cycle (%)
2402	BLE	LE1M	1	255	2.086	3.126	66.7
2404	BLE	LE2M	2	255	1.081	2.505	43.1

The duty cycle in the above table represents the maximum worst case duty cycle possible using the maximum packet length of 255 bytes. In a normal usage case the duty cycle will be less than what is shown above and will be dependent on packet length but never more than 255 bytes can be used.



6. 6 dB and 99% Occupied Bandwidth

Requirement:

None; 99% occupied bandwidth is for reporting purposes only.

FCC 15.247(a) (2) (DTS BW = 6 dB OBW)

RSS-247 5.2 (a) (6 dB OBW)

6 dB (DTS) occupied bandwidth > 500 kHz

Measurement Method:

ANSI C63.10-2013 Subclause 11.8.1 option 1 (6 dB Bandwidth)

ANSI C63.10-2013 Subclause 6.9.3 (99% Bandwidth)

RSS-Gen Issue 5, 6.7 (6 dB & 99% Bandwidth)

The EUT is connected to a spectrum analyzer, the 10 dB external pad and test cable loss (0.2 dB) is accounted for using the reference level offset feature of the spectrum analyzer. The reference level offset is set to 10.2 dB.

6 dB Occupied Bandwidth Results:

BLE 1M 6dB OBW Summary Table						
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	6dB OBW (kHz)	Limit (kHz)	Result
Low	2402	BLE 1M	1	720	>500	Pass
Mid	2440	BLE 1M	1	751	>500	Pass
High	2480	BLE 1M	1	723	>500	Pass
BLE 2M 6dB OBW Summary Table						
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	6dB OBW (kHz)	Limit (kHz)	Result
Low	2404	BLE 2M	2	1274	>500	Pass
Mid	2440	BLE 2M	2	1272	>500	Pass
High	2478	BLE 2M	2	1271	>500	Pass

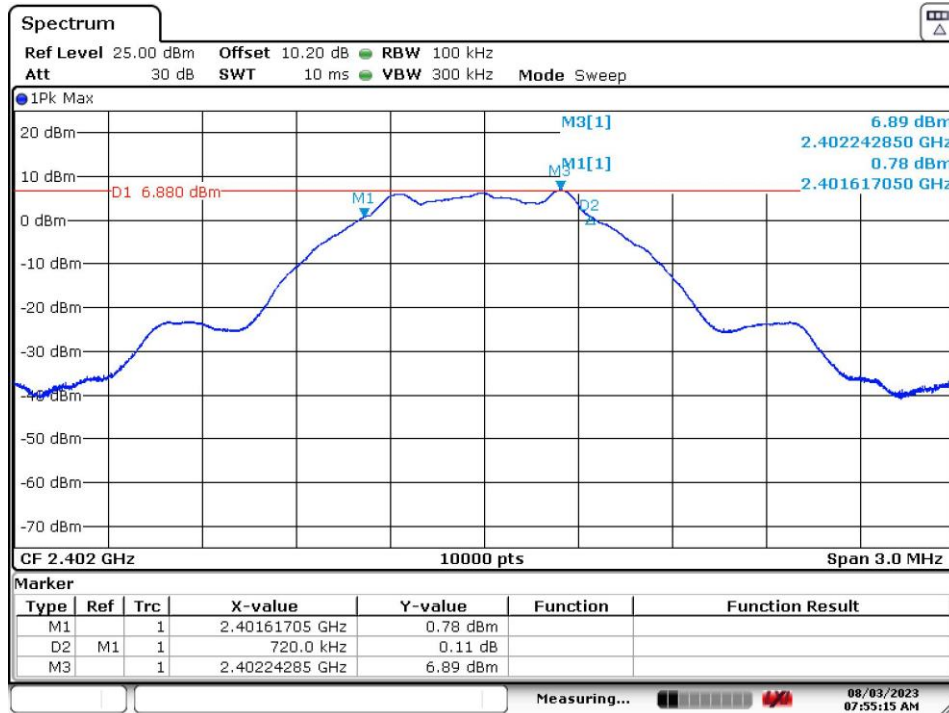


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report

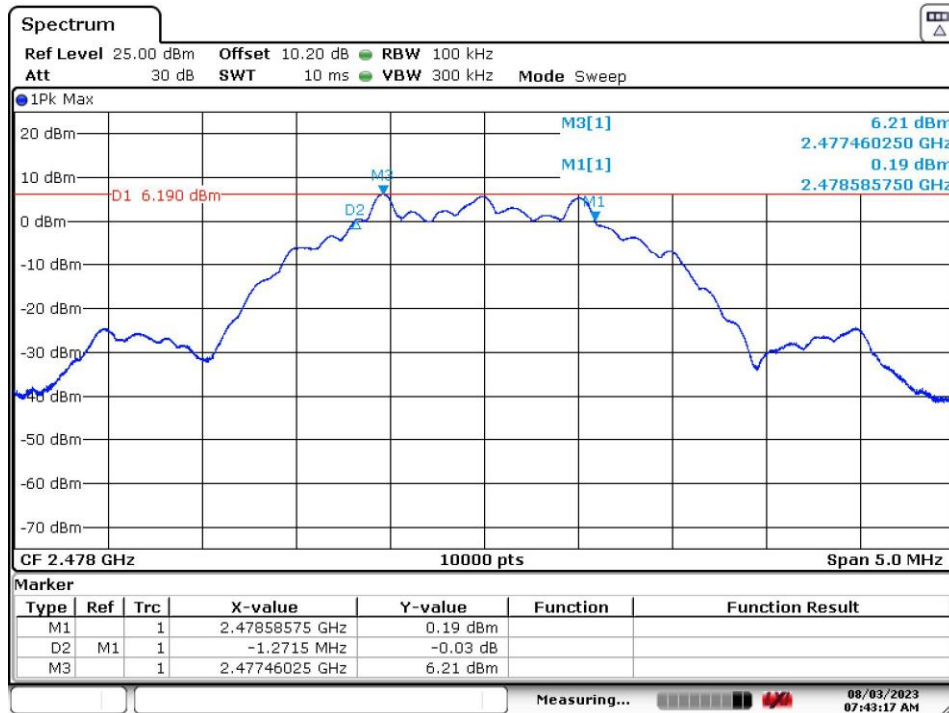


6 dB OBW worst-case plots, other frequencies measured the same way.
BLE 1M



Date: 3.AUG.2023 07:55:15

BLE 2M



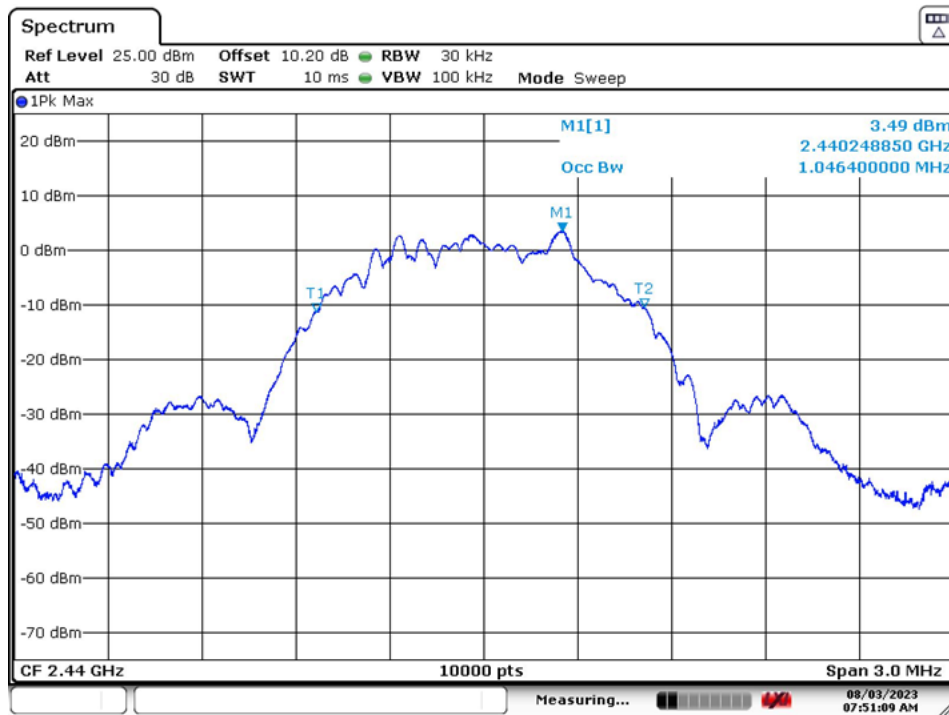
Date: 3.AUG.2023 07:43:17

99% Occupied bandwidth test results:

DH5 99% OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	99% OBW (kHz)	Limit N/A
Low	2402	BLE 1M	1	1045	-
Mid	2440	BLE 1M	1	1046	-
High	2480	BLE 1M	1	1044	-
3-DH5 99% OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	99% OBW (kHz)	Limit N/A
Low	2404	BLE 2M	2	2077	-
Mid	2440	BLE 2M	2	2077	-
High	2478	BLE 2M	2	2075	-

99% OBW worst-case plots, other frequencies measured the same way.

BLE 1M – Mid Ch



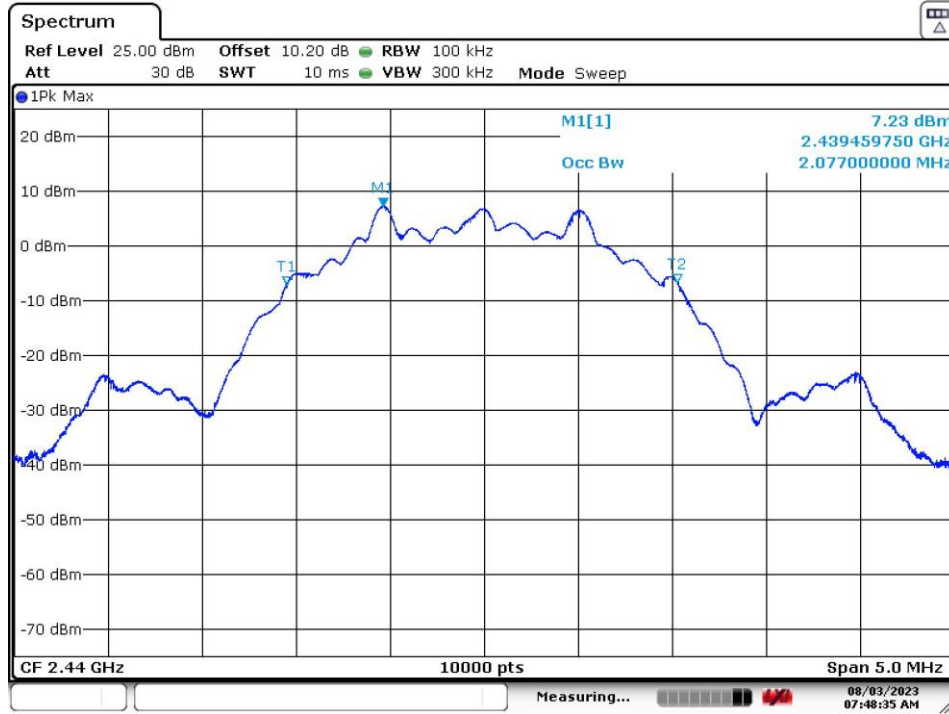
Date: 3.AUG.2023 07:51:09



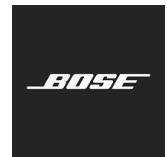
PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Bluetooth Low Energy Test Report



BLE 2M – Mid Ch



Date: 3.AUG.2023 07:48:35



7. Conducted Output Power

Requirements:

FCC 15.247 (b) (3)

The maximum peak conducted output power of digital modulation systems operating in the 2400 – 2483.5 MHz band is 1 Watt

RSS-247 5.4 (d)

For DTS devices employing digital modulation techniques operating in the 2400 – 2483.5 MHz band, the maximum peak conducted power shall not exceed 1W. The e.i.r.p shall not exceed 4W, except as provided in section 5.4 (e)

Measurement Method:

ANSI C63.10-2013 Subclause 11.9.1.1

RSS-Gen Issue 5, 6.12

The EUT is connected to a spectrum analyzer, the 10 dB external pad and test cable loss (0.2 dB) is accounted for using the reference level offset feature of the spectrum analyzer. The reference level offset is set to 10.2 dB.

Maximum antenna gain is 1 dBi therefore maximum e.i.r.p will be less than 4W (36 dBm) with the maximum power shown below in the following tables:

Conducted output power Test Results:

DH5 Output Power Summary Table							
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	Output Power (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2402	BLE 1M	1	7.01	21	13.99	Pass
Mid	2440	BLE 1M	1	7.72	21	13.28	Pass
High	2480	BLE 1M	1	6.50	21	14.50	Pass
3-DH5 Output Power Summary Table							
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	Output Power (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2404	BLE 2M	2	7.06	21	13.94	Pass
Mid	2440	BLE 2M	2	7.74	21	13.26	Pass
High	2478	BLE 2M	2	6.75	21	14.25	Pass

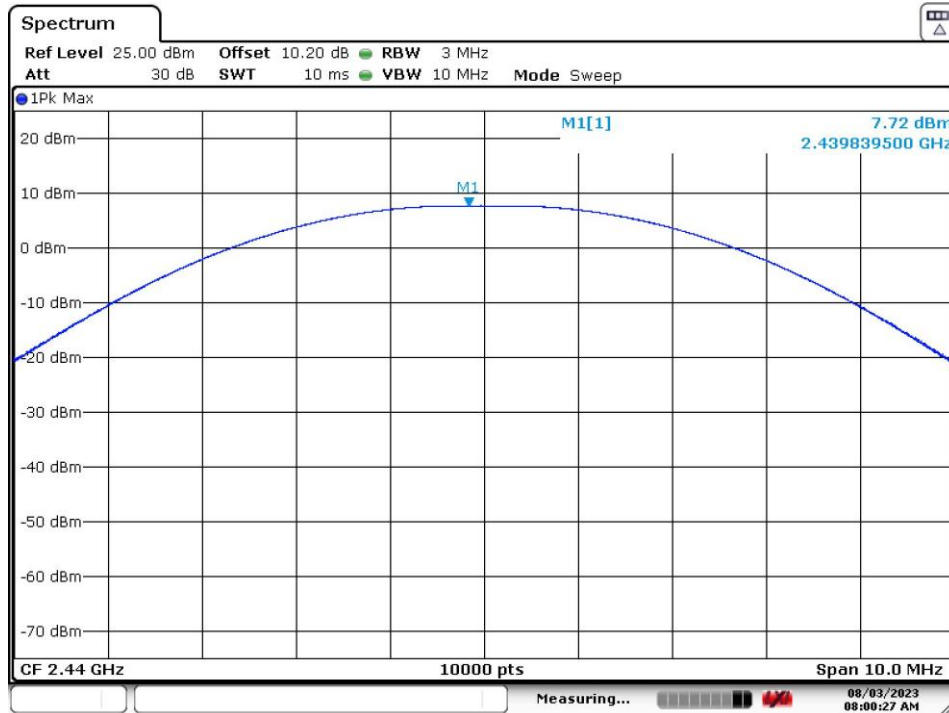


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report

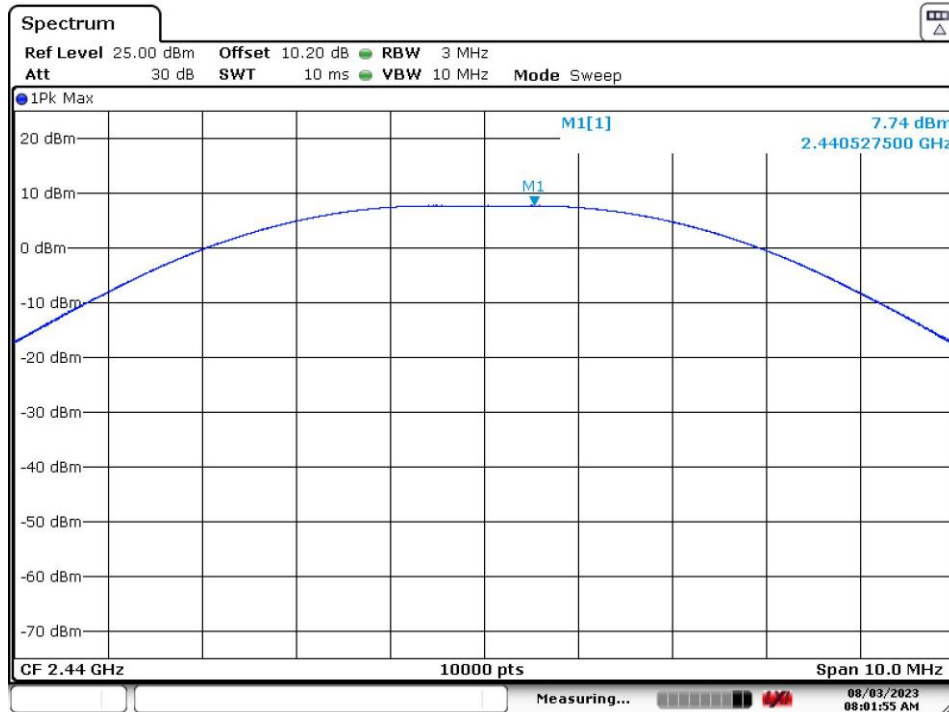


Output power worst-case plots, other frequencies measured the same way.
BLE 1M



Date: 3.AUG.2023 08:00:27

BLE 2M



Date: 3.AUG.2023 08:01:55



8. Power Spectral Density

Requirements:

FCC 15.247 (e)

RSS-247 5.2 (b)

The maximum permissible power spectral density is 8 dBm using 3 kHz resolution bandwidth.

Measurement Method:

ANSI C63.10-2013 Subclause 11.10.2

The EUT is connected to a spectrum analyzer, the 10 dB external pad and test cable loss (0.2 dB) is accounted for using the reference level offset feature of the spectrum analyzer. The reference level offset is set to 10.2 dB.

Power spectral density test results:

PSD Summary Table							
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	PSD (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2402	BLE 1M	1	-9.75	8	17.75	Pass
Mid	2440	BLE 1M	1	-8.97	8	16.97	Pass
High	2480	BLE 1M	1	-10.21	8	18.21	Pass
Low	2404	BLE 2M	2	-12.11	8	20.11	Pass
Mid	2440	BLE 2M	2	-11.53	8	19.53	Pass
High	2478	BLE 2M	2	-12.41	8	20.41	Pass

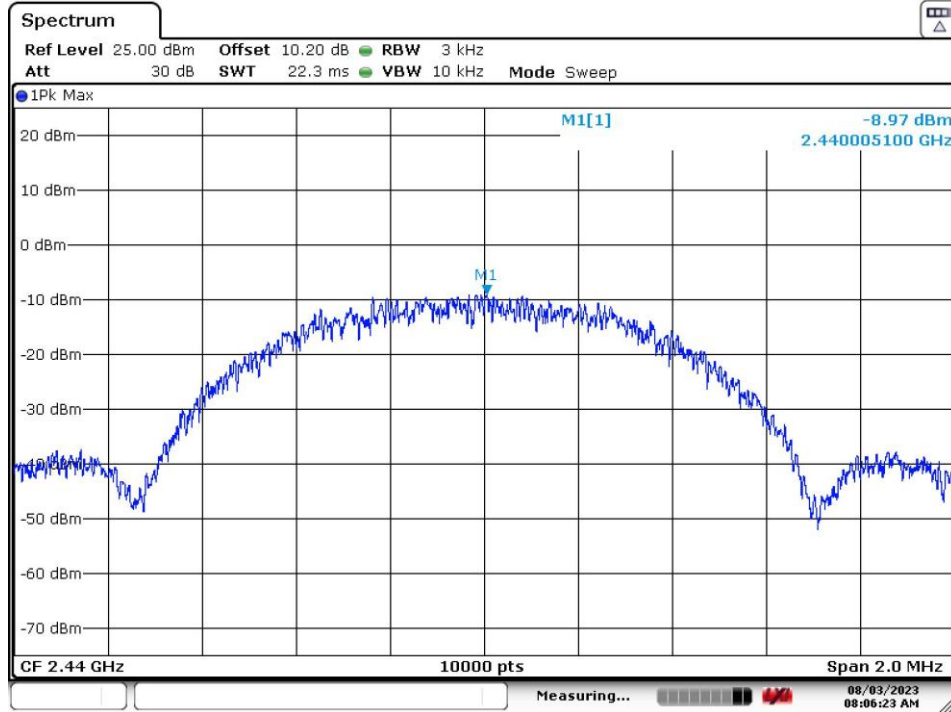


PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Bluetooth Low Energy Test Report



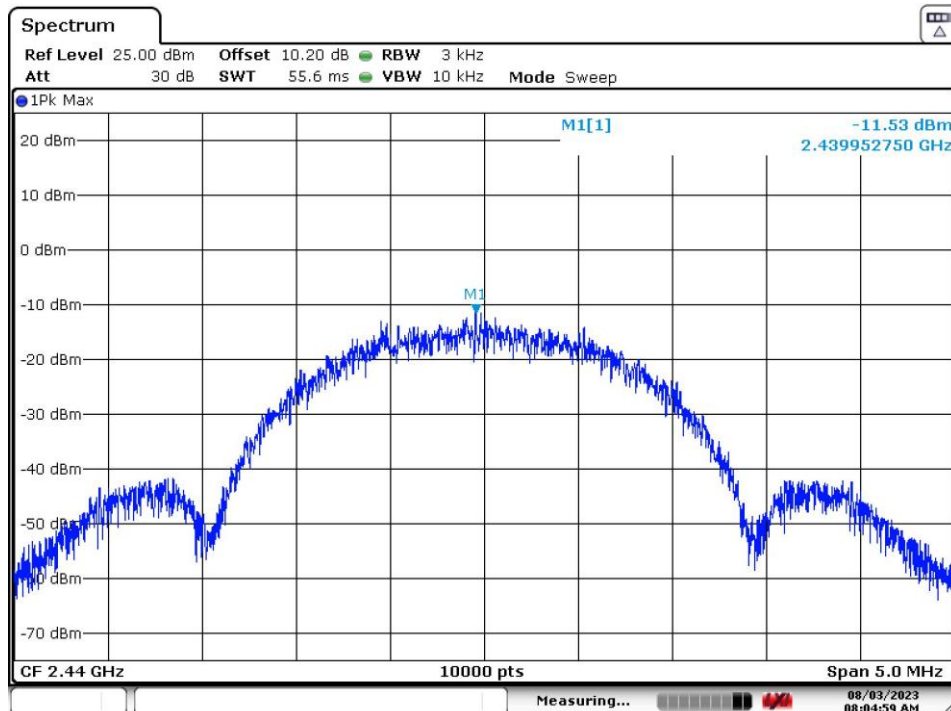
PSD worst-case plots, other frequencies measured the same way.

BLE 1M



Date: 3.AUG.2023 08:06:24

BLE 2M



Date: 3.AUG.2023 08:05:00



9. 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.

Measurement Method:

ANSI C63.10-2013 Subclause 11.11.3

The EUT was tested at the maximum power setting for each mode.

Note analyzer marker search limit featured used to block out peak search from finding in band emissions.

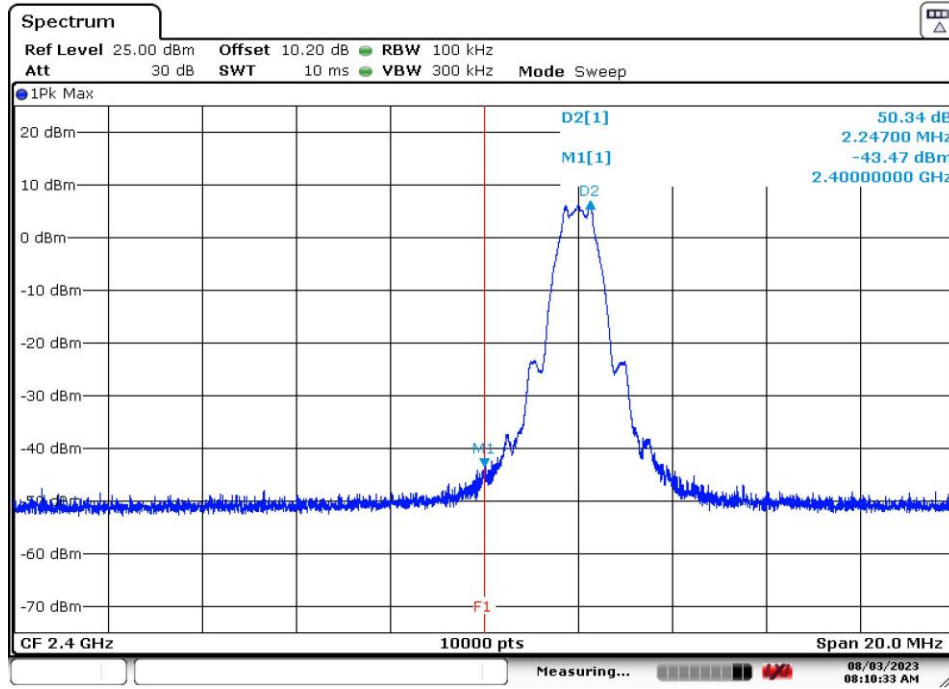
The EUT is connected to a spectrum analyzer, the 10 dB external pad and test cable loss (0.2 dB) is accounted for using the reference level offset feature of the spectrum analyzer. The reference level offset is set to 10.2 dB.

Auto sweep mode was used on the spectrum analyzer for the following measurements.



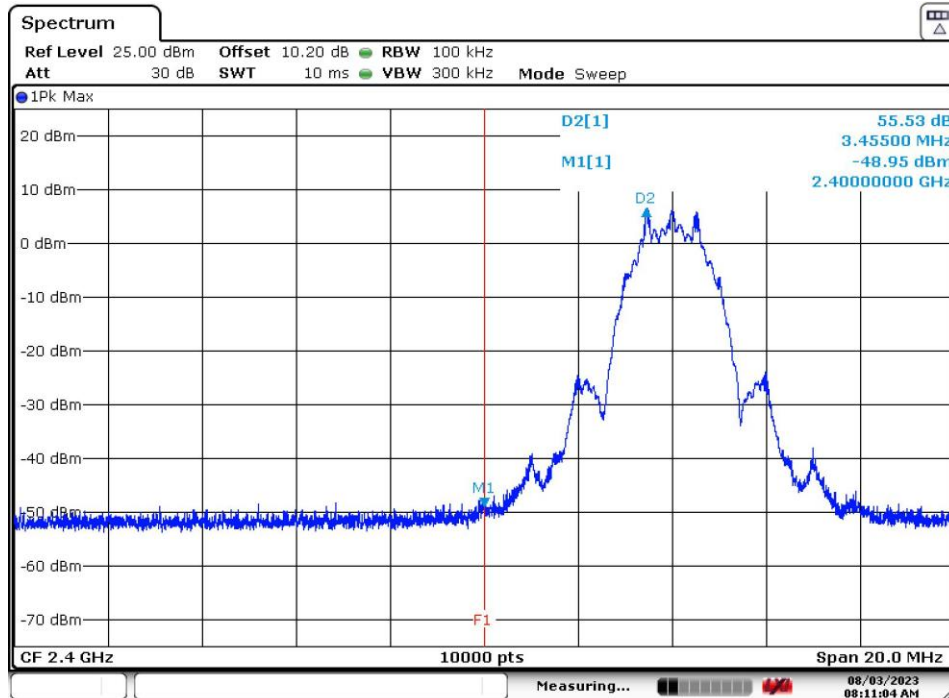
Conducted spurious emissions test results:

Low Channel Band Edge BLE 1M



Date: 3.AUG.2023 08:10:33

BLE 2M

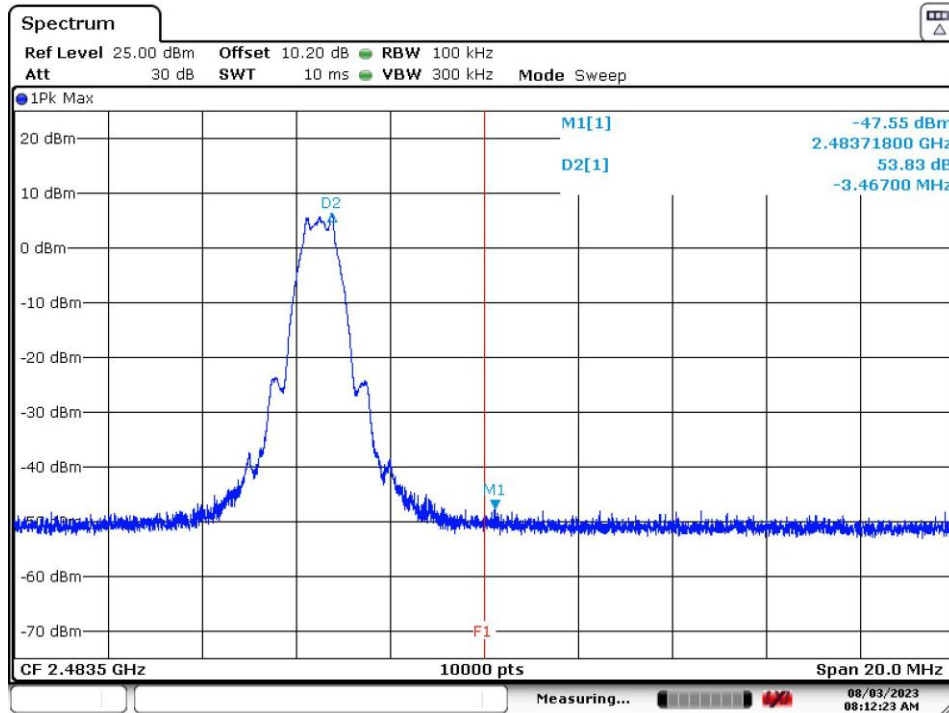


Date: 3.AUG.2023 08:11:04

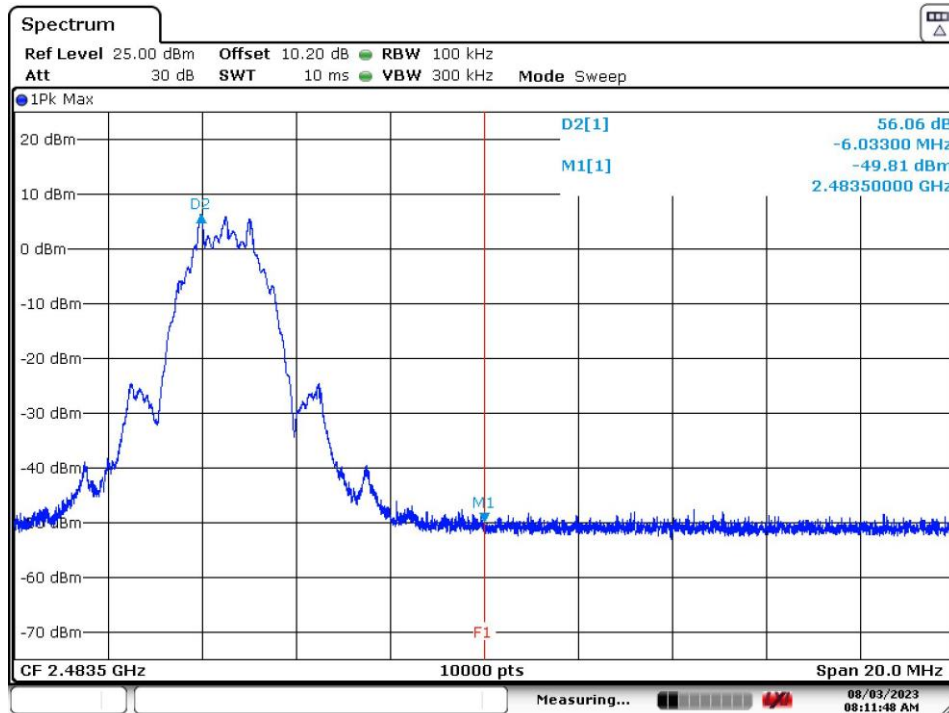
Emissions are more than 20 dBc, pass.



High Channel Band Edge BLE 1M



BLE 2M



Emissions are more than 20 dBc, pass.



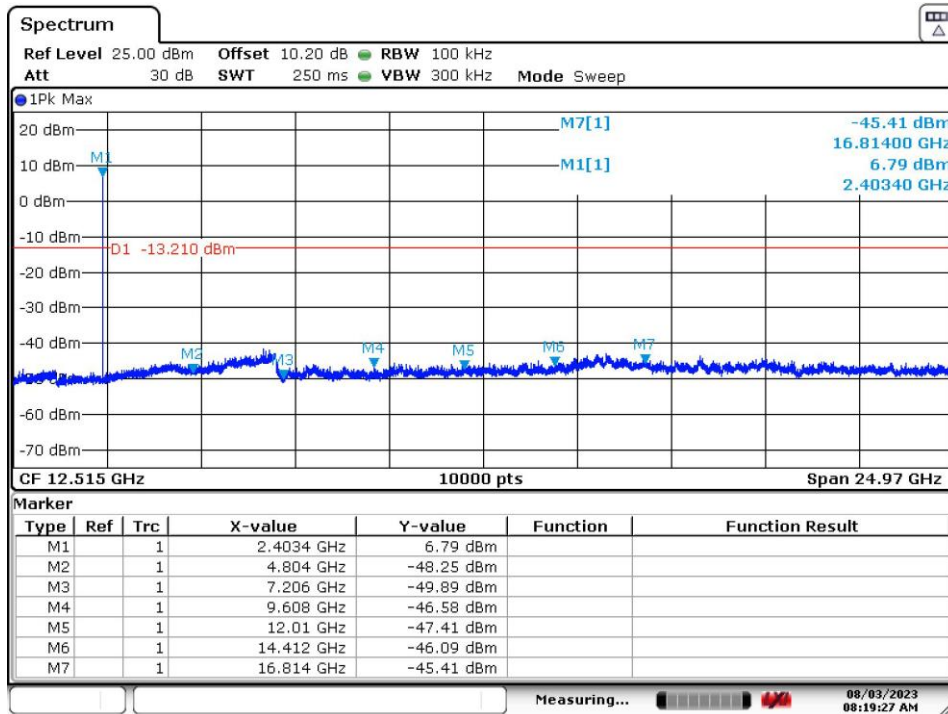
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Wireless Transceiver Bluetooth Low Energy Test Report



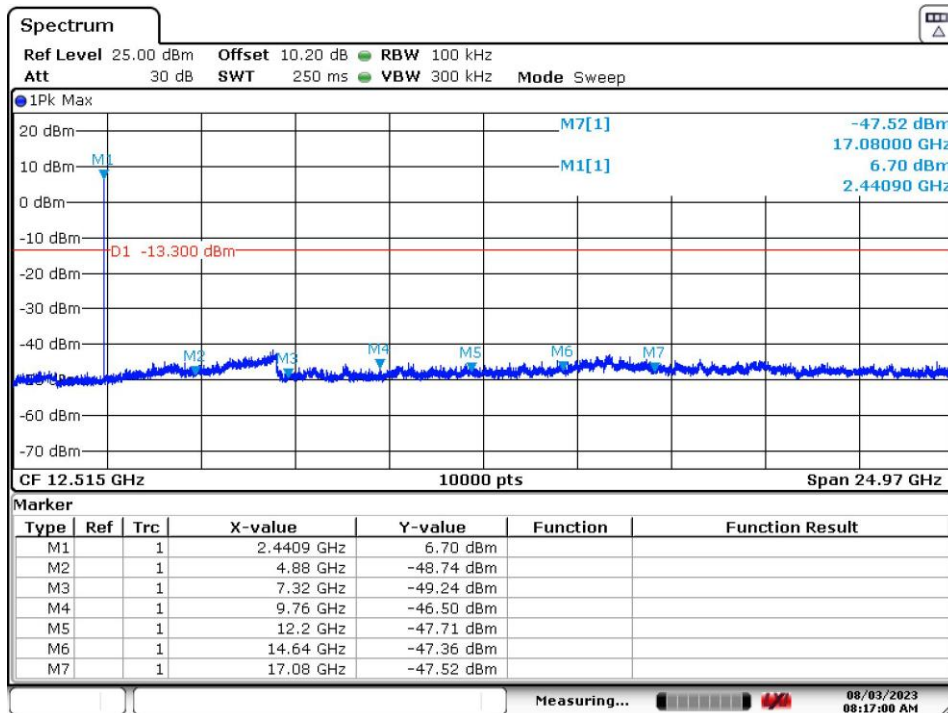
Wideband conducted spurious emissions, 30 MHz to 25000 MHz

BLE 1M – Low Ch



Date: 3.AUG.2023 08:19:27

BLE 1M – Mid Ch



Date: 3.AUG.2023 08:17:00

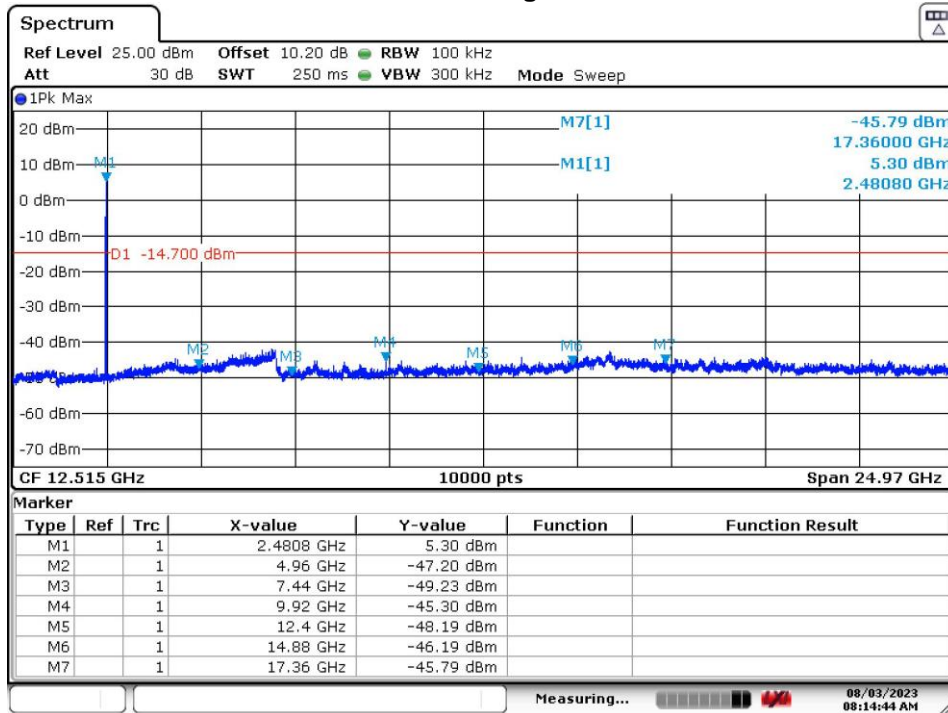


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report

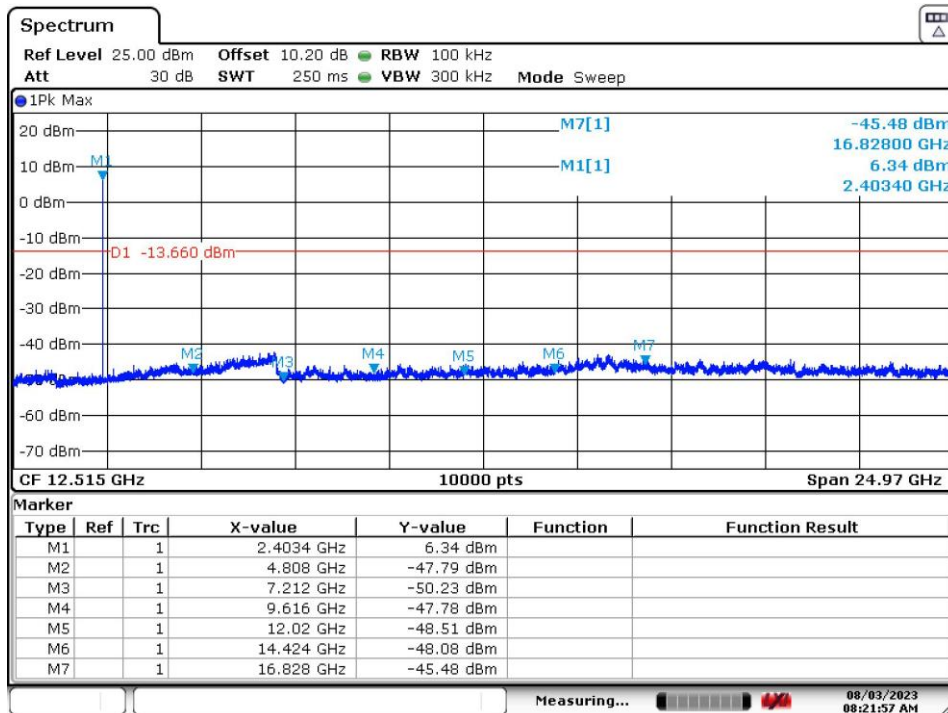


BLE 1M – High Ch



Date: 3.AUG.2023 08:14:44

BLE 2M – Low Ch



Date: 3.AUG.2023 08:21:58

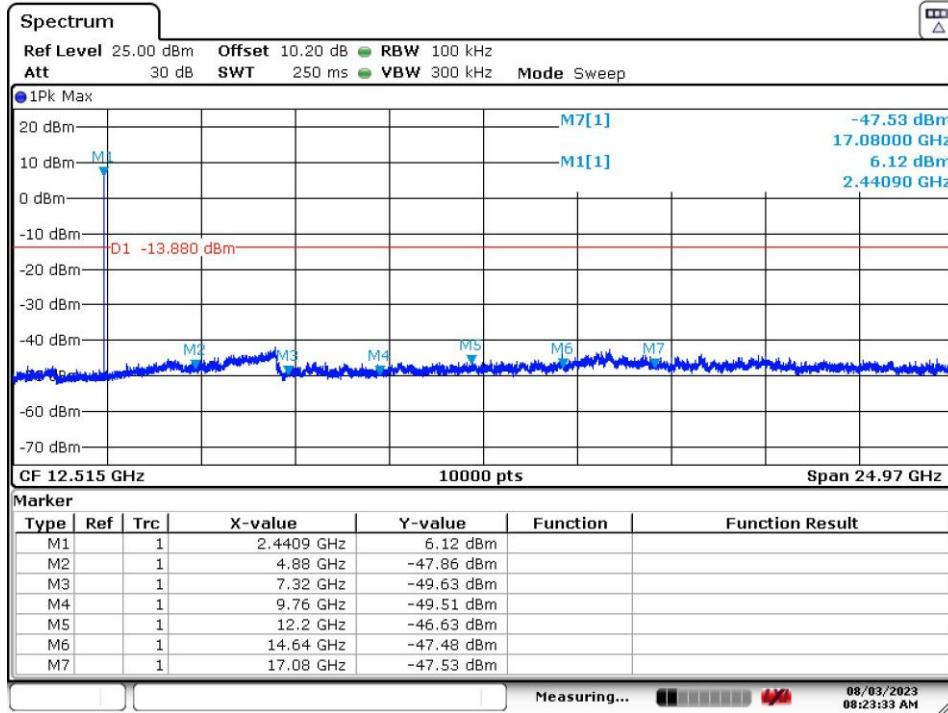


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report

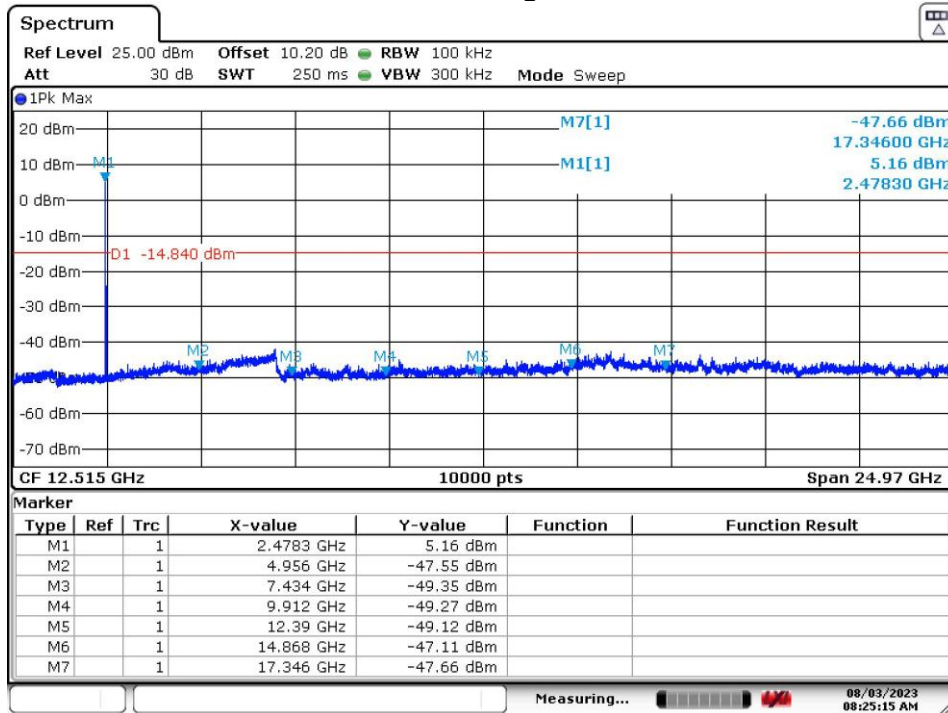


BLE 2M – Mid Ch



Date: 3.AUG.2023 08:23:34

BLE 2M – High Ch



Date: 3.AUG.2023 08:25:15

Emissions are more than 20 dBc, pass.



10. Radiated Emissions 1 GHz to 25 GHz

Requirement:

FCC 15.205, 15.209, 15.247 (d),
RSS-GEN Clause 8.9 (Transmitter)

Measurement Method:

ANSI C63.10-2013 11.12 (Emissions in restricted bands)
11.12.2.5.3 (Reduced VBW averaging across on and off times using trace max hold, D< 98%)
RSS-Gen 6.13

Reduced video bandwidth method used for making average measurements for lower and upper adjacent restricted bands using a peak detector. Trace max hold was left running for several minutes to allow meeting the 50x(1/D) trace requirement.

Note: The procedure listed in ANSI C63.10-2013 footnote **23** on page 28 was used to demonstrate that the proper analyzer settings were used for an average measurement using reduced video bandwidth method. The result was -6 dB different between peak using VBW = 3 MHz and average using VBW = 1 Hz.
The below table shows the minimum VBW allowed based on the $1/T_{on}$

Frequency (MHz)	Mode	Packet Type	Data Rate (Mbps)	Max Packet Length (Bytes)	On Time (ms)	Period (ms)	Duty Cycle (%)	$1/T_{on}$ (Hz)
-	BLE	LE1M	1	255	2.086	3.126	66.7	480
-	BLE	LE2M	2	255	1.081	2.505	43.1	926

The VBW must be above 480 Hz to prove compliance for BLE 1M and 926Hz to prove compliance for BLE 2M.

For radiated emissions above 1 GHz the EUT is positioned 1.5m off the ground plane.
The EUT was tested in three orientations per ANSI C63.10 6.3.1.
The EUT was tested at the maximum power setting for each mode.

For emissions other than the lower and upper adjacent restricted bands a 2.4 GHz notch filter is used between the measurement horn antenna and measurement preamp to prevent overload to the preamp due to the EUT fundamental.
The restricted band edge measurement is done using high dynamic range preamp.

Reference: ANSI C63.10 6.6.4.1:

Install an appropriate filter at the input of the measurement system power amplifier. This filter shall attenuate the fundamental emission of the EUT and allow an accurate measurement of the associated harmonics and spurious emissions. The filter shall be characterized, and any attenuation/loss factors shall be accounted for in the measurement results.

EUT was evaluated in **3 orthogonal axis with X-Axis orientation being worst case** showing the highest emissions.

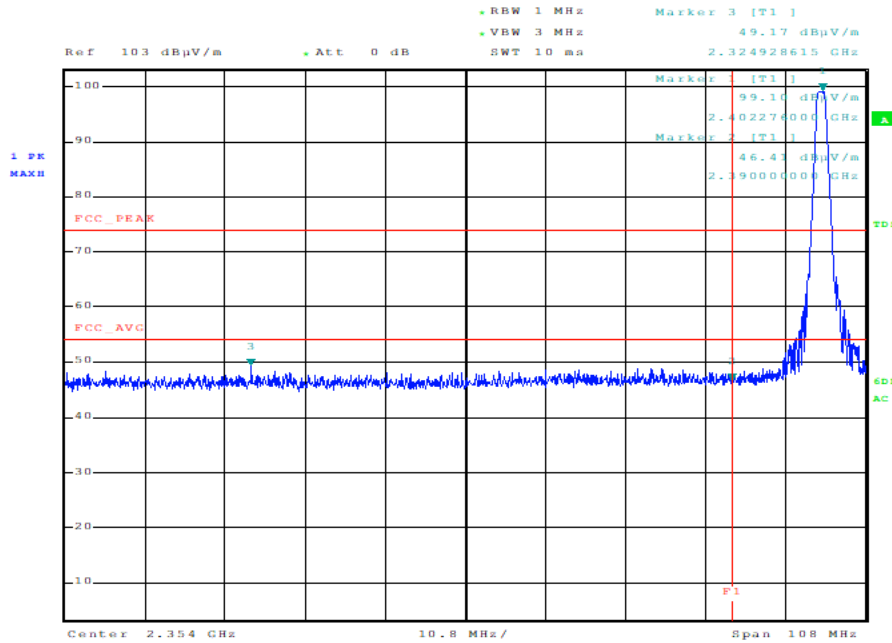
Radiated emission measurements performed using both horizontal and vertical measurement antenna polarizations with worst case highest emission being with **horizontal** antenna polarization.

Spectrum analyzer auto sweep mode used on the following plots.



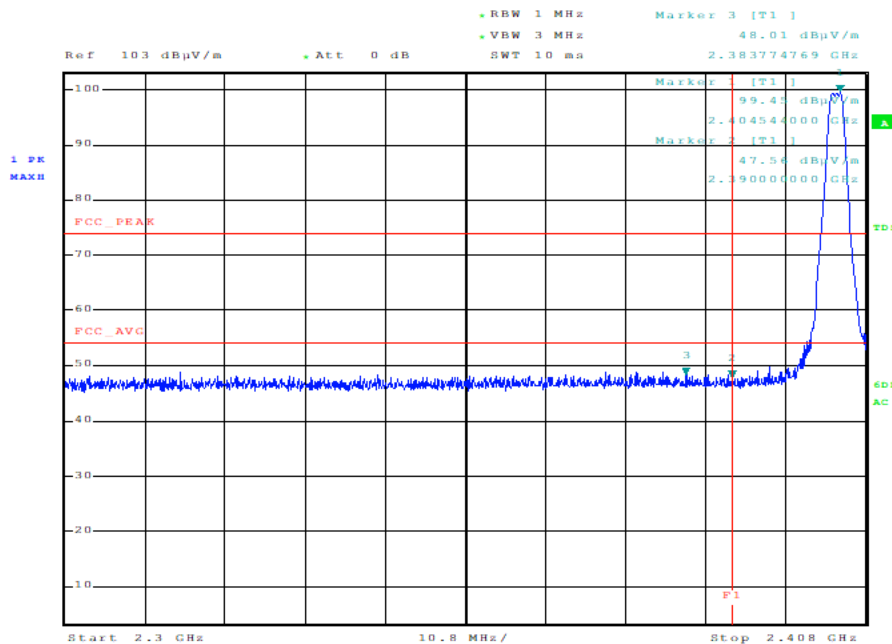
Radiated emissions 1 GHz to 25 GHz test results:

Lower restricted band: BLE 1M (2402 MHz)



Date: 7.AUG.2023 14:16:45

Lower restricted band: BLE 2M (2404 MHz)

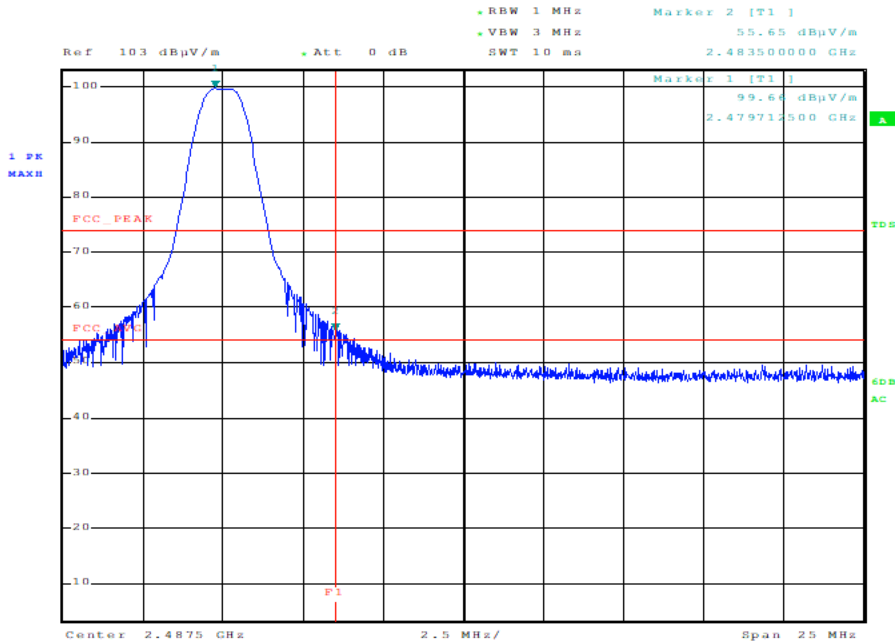


Date: 7.AUG.2023 14:14:08

Peak emissions below Average limit

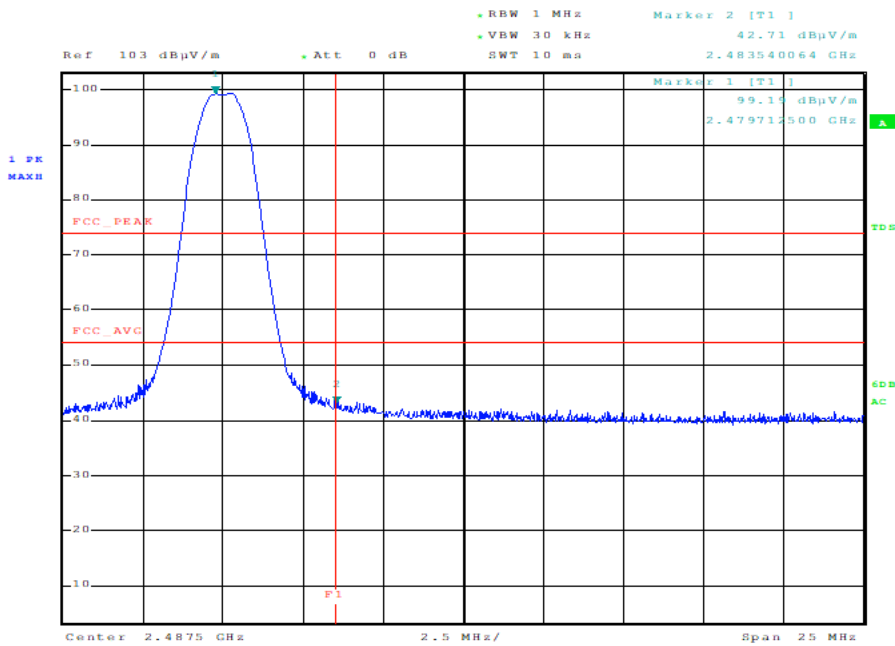


Upper restricted band: BLE 1M (2480 MHz) – Peak



Date: 7.AUG.2023 14:02:11

Upper restricted band: BLE 1M (2480 MHz) – VBW Average (30kHz VBW used)



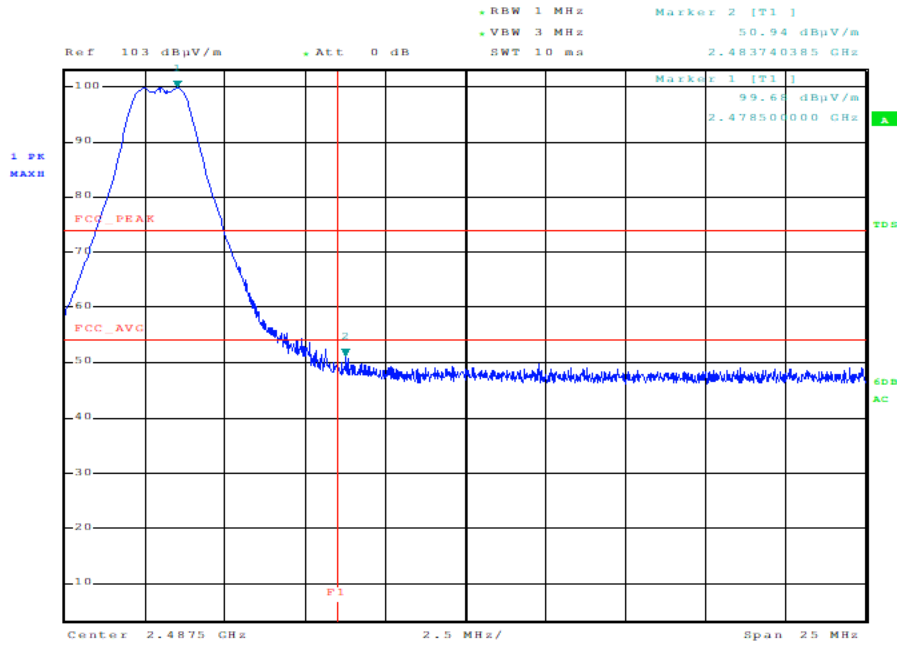
Date: 7.AUG.2023 14:03:07



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Bluetooth Low Energy Test Report

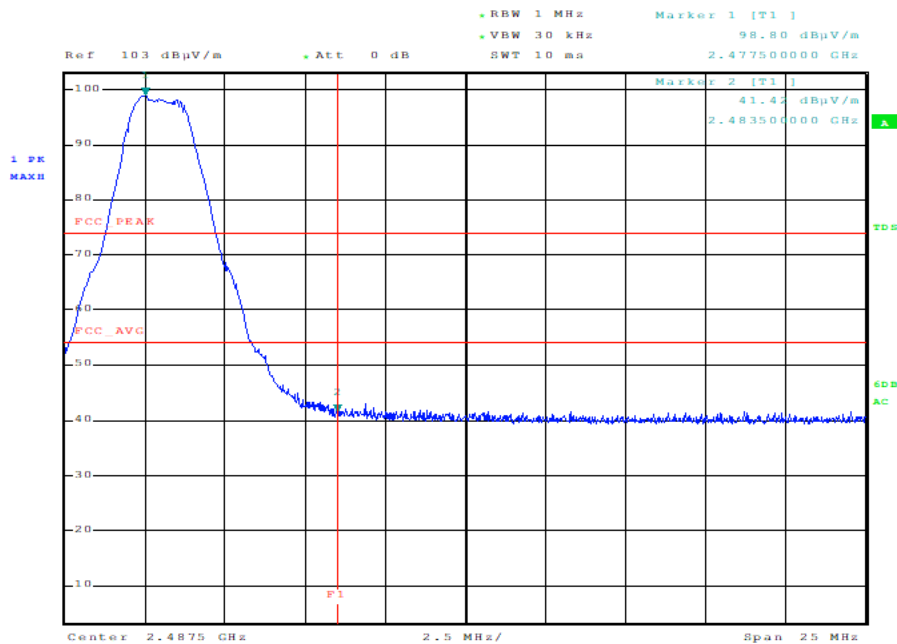


Upper restricted band; BLE 2M (2480 MHz) – Peak



Date: 7.AUG.2023 14:06:21

Upper restricted band; BLE 2M (2478 MHz) – VBW Average (30kHz VBW used)



Date: 7.AUG.2023 14:07:01



PRODUCT ASSURANCE ENGINEERING

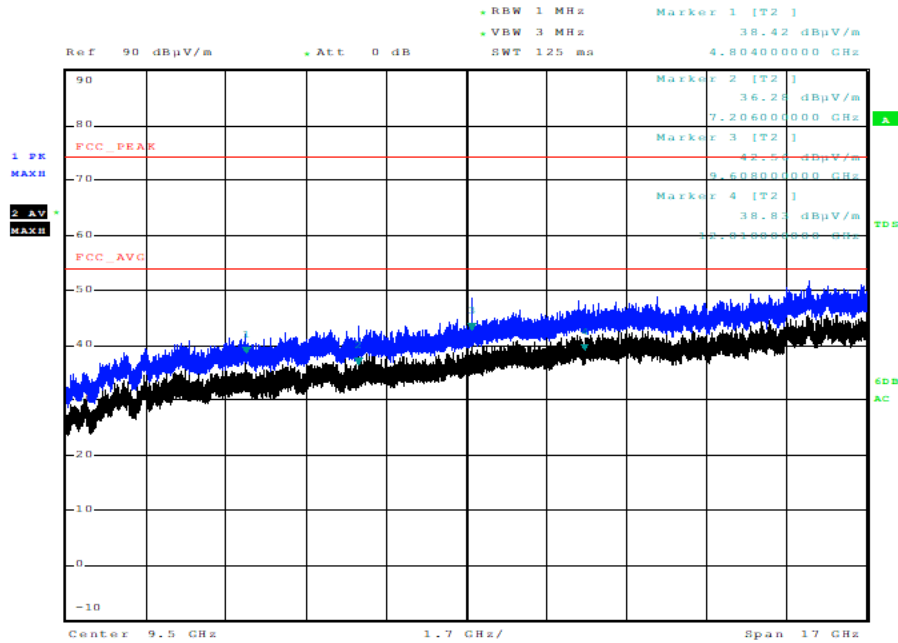
Wireless Transceiver Bluetooth Low Energy Test Report



Radiated emissions 1 GHz to 18 GHz

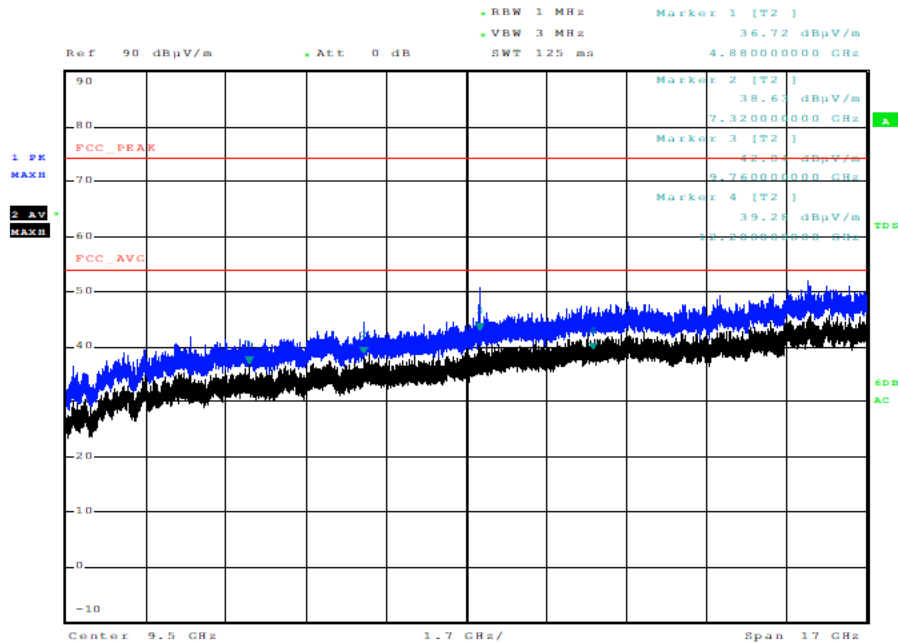
Blue trace is peak detector; black trace is average detector. (30,000 sweep points)
Measurement noise floor more than 6 dB below the respective limits.

BLE 1M – Low Channel (2402MHz)



Date: 8.AUG.2023 09:17:30

BLE 1M – Mid Channel (2440 MHz)



Date: 8.AUG.2023 09:21:09

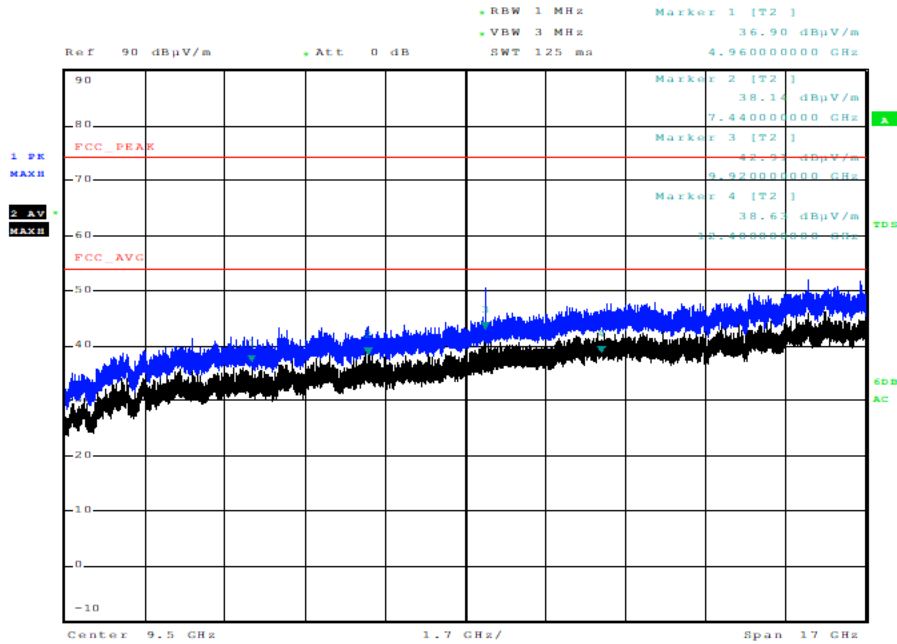


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Wireless Transceiver Bluetooth Low Energy Test Report

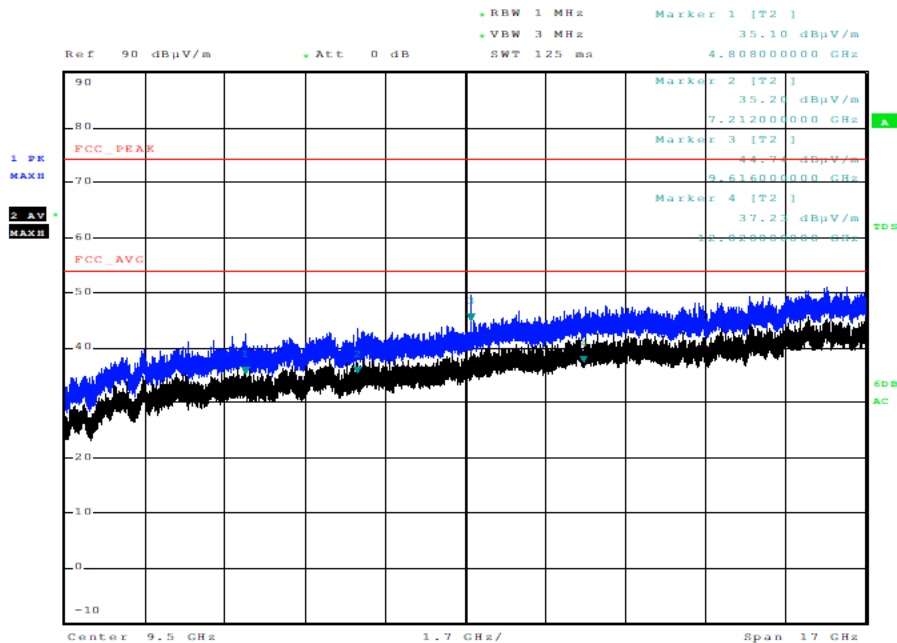


BLE 1M – High Channel (2480 MHz)



Date: 8.AUG.2023 09:24:31

BLE 2M – Low Channel (2404 MHz)



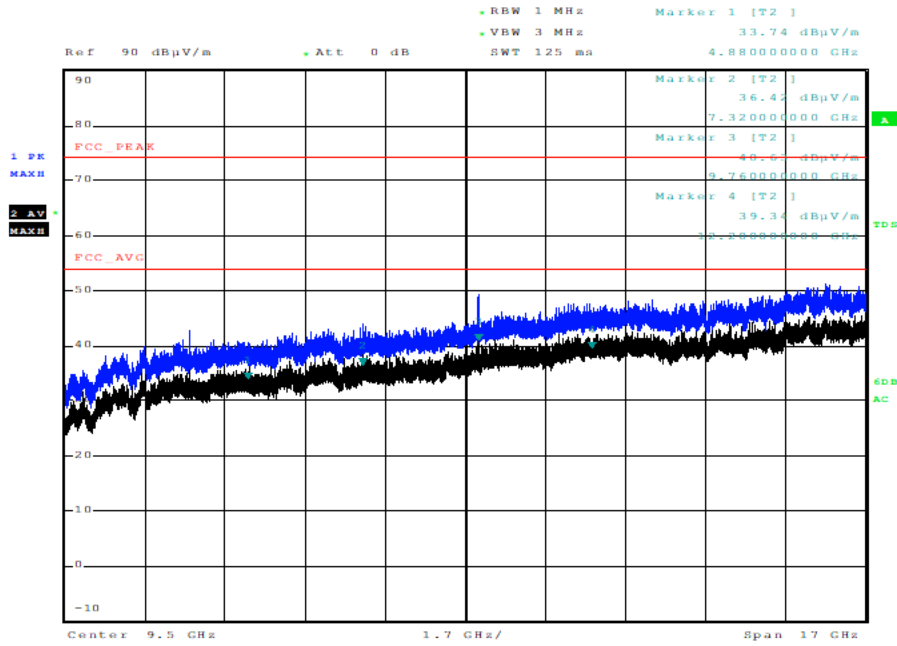
Date: 8.AUG.2023 09:27:49



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Wireless Transceiver Bluetooth Low Energy Test Report

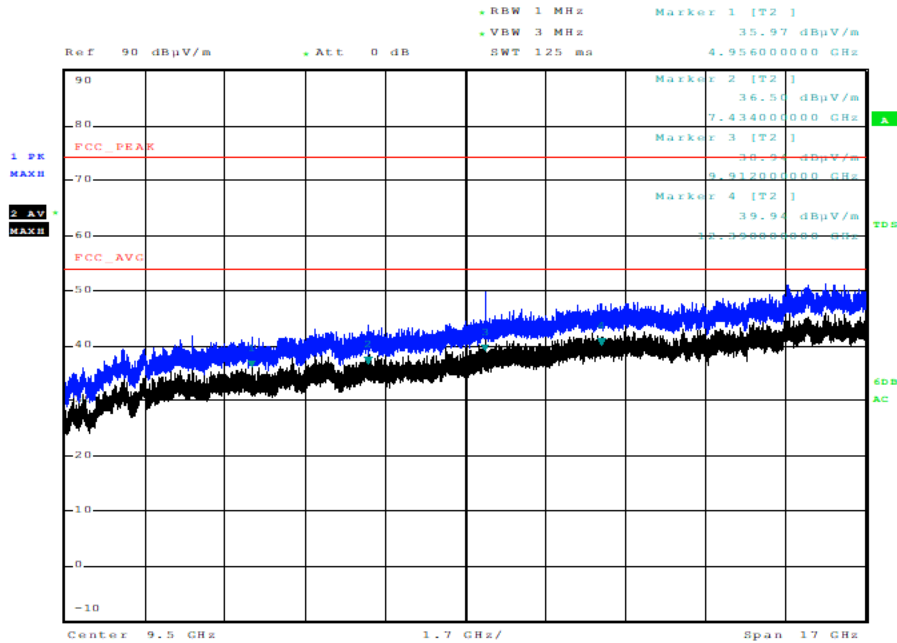


BLE 2M – Mid Channel (2440 MHz)



Date: 8.AUG.2023 09:30:46

BLE 2M – High Channel (2478 MHz)



Date: 8.AUG.2023 09:34:07

All Emissions are at least 10dB below the limit, Pass



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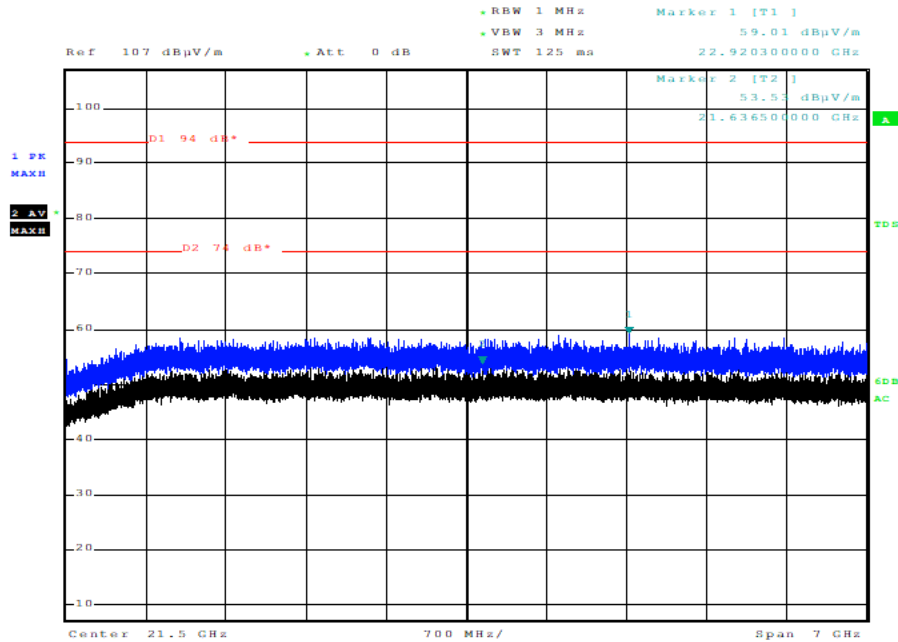
Radiated emissions 18 GHz to 25 GHz at 30 centimeter distance.

Distance is 30cm (0.3 meters), Limit lines settings based on scaling of $20\text{Log}(D1/D2) = 20\text{Log}(3\text{m}/.3) = 20\text{Log}(10) = 20\text{ dB}$
Peak limit = $74 + 20 = 94\text{ dBuV/m}$ (Display line 1)

Average limit = $54 + 20 = 74\text{ dBuV/m}$ (Display line 2)

As no emissions were detected in this range, the below plots are combined Vertical and Horizontal antenna polarizations. Blue trace is Peak detection and the Black trace is average detection.

BLE 1M – Low Ch (2402MHz)



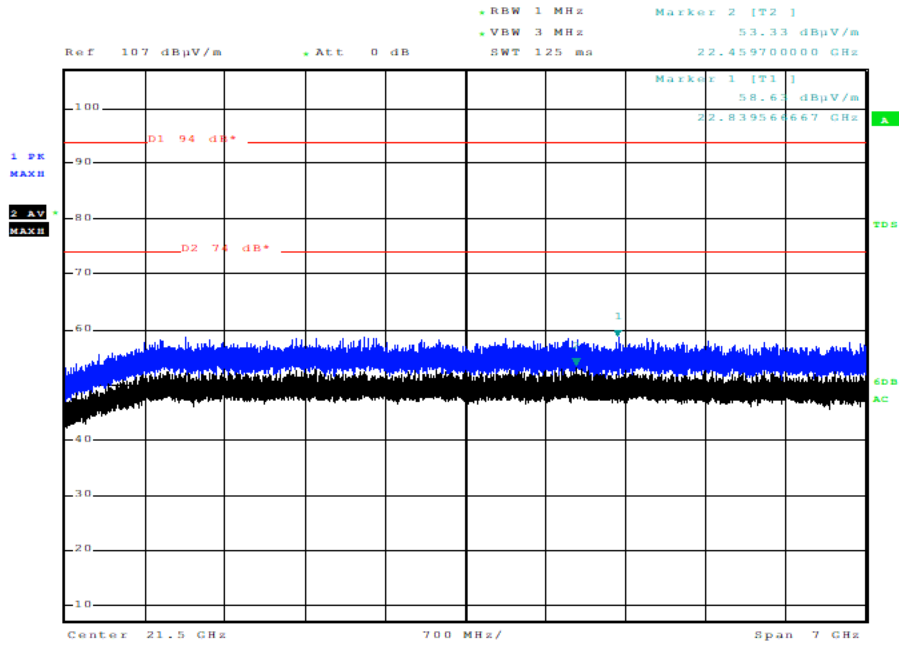
Date: 8.AUG.2023 11:17:41



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Bluetooth Low Energy Test Report

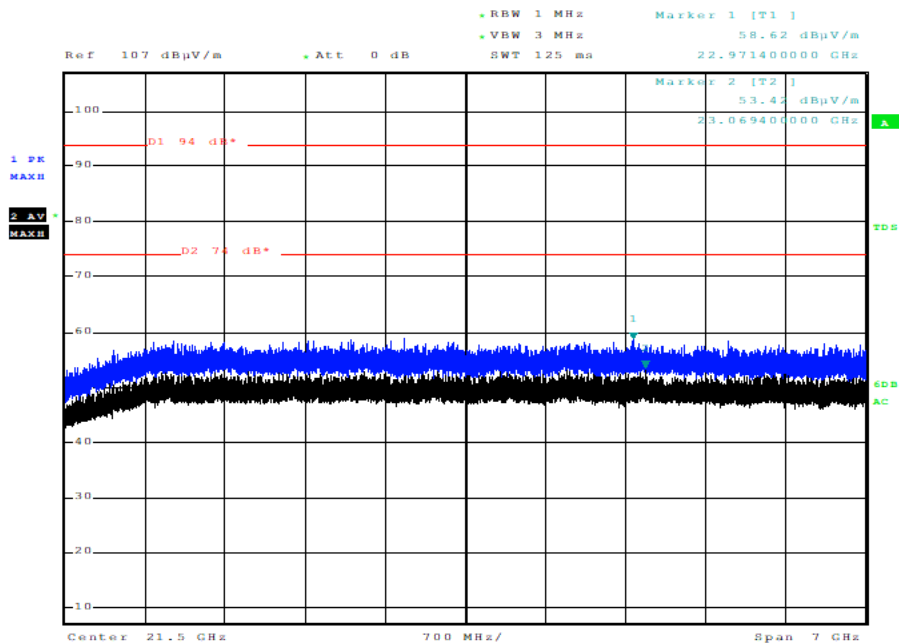


BLE 1M – Mid Ch (2440MHz)



Date: 8.AUG.2023 11:18:32

BLE 1M – High Ch (2480MHz)



Date: 8.AUG.2023 11:19:51

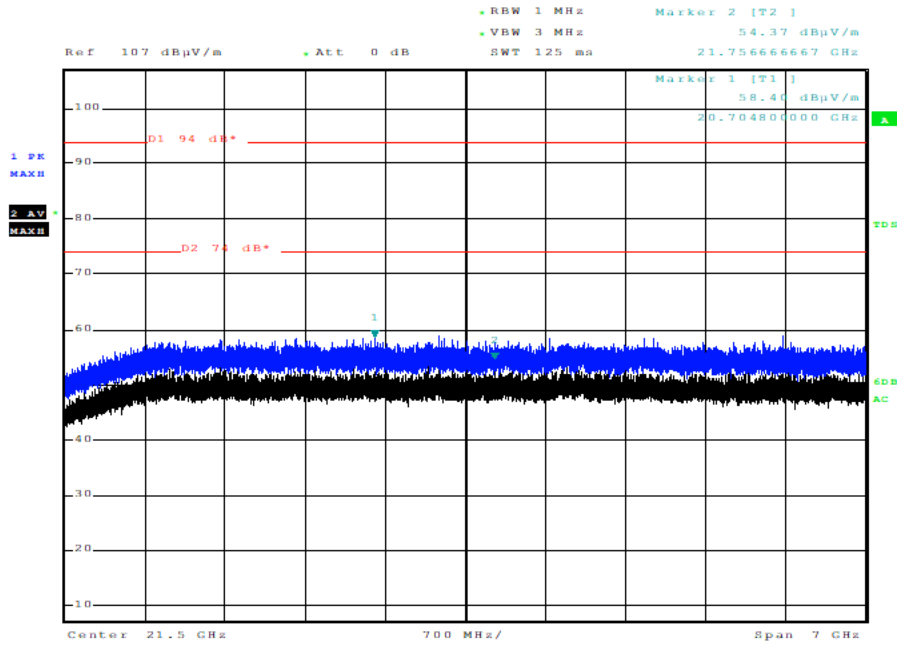


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report

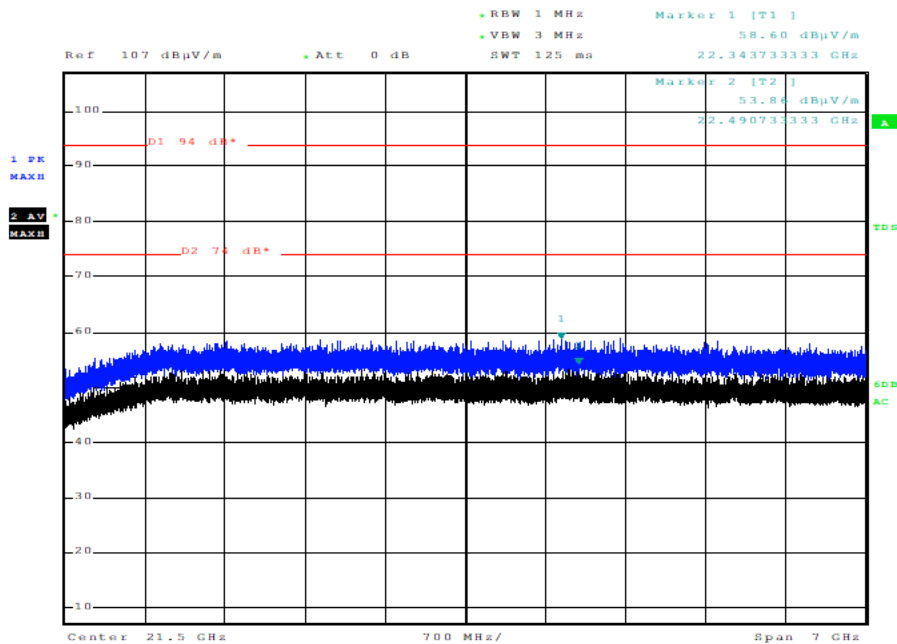


BLE 2M – Low Ch (2404MHz)



Date: 8.AUG.2023 11:20:33

BLE 2M – Mid Ch (2440MHz)



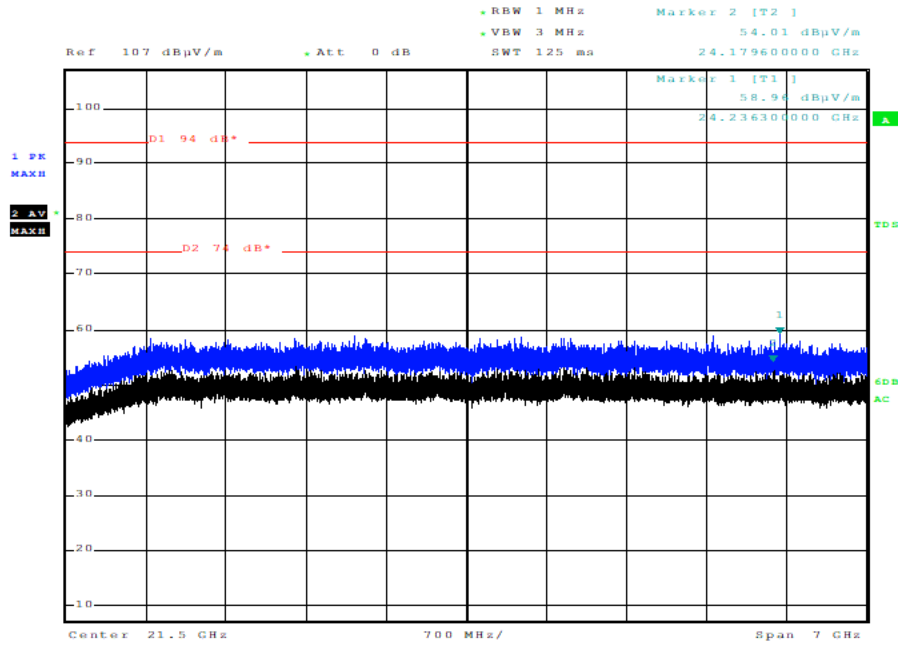
Date: 8.AUG.2023 11:21:20



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Wireless Transceiver Bluetooth Low Energy Test Report



BLE 2M – High Ch (2478MHz)



Date: 8.AUG.2023 11:22:01

All Peak Emissions measured are below the average limit.

11. Radiated Emissions 30 MHz to 1 GHz

Requirement:

FCC 15.205, 15.209
RSS-Gen Clause 8.9

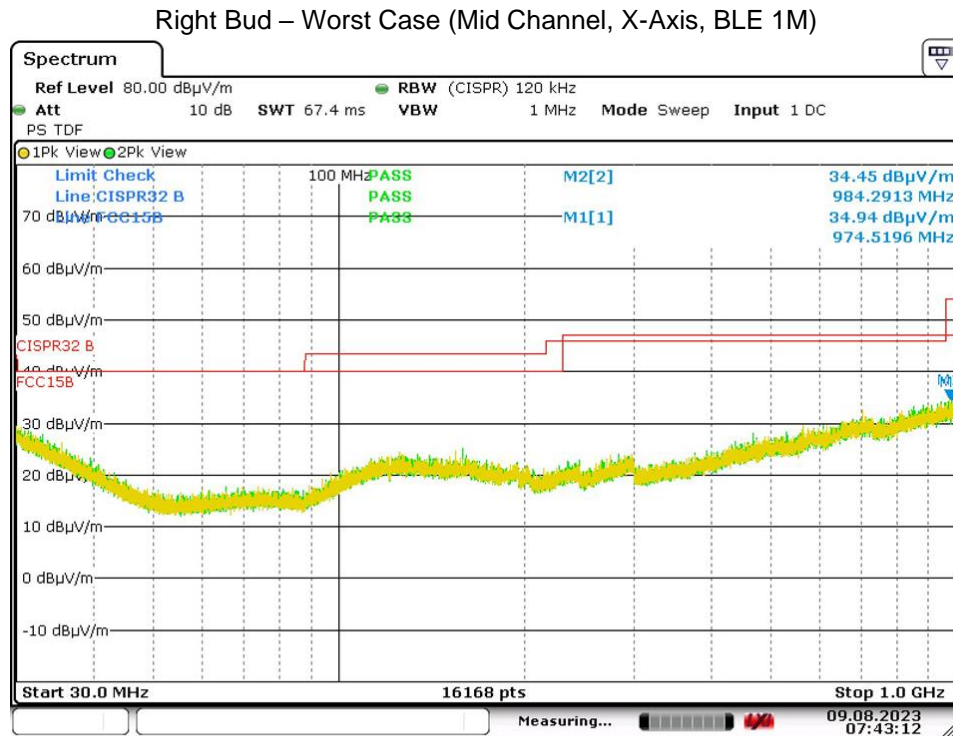
Measurement Method:

ANSI C63.10-2013 Subclause 6.5

EUT on wooden table 80cm off ground plane.
EUT was evaluated in 3 orthogonal axis with no difference between orientations.

Radiated emissions below 1 GHz test results:

The EUT was tested while in the X, Y and Z Axis transmitting at the Lowest, Middle and Highest channel of operation. All measurements were the same throughout (Noise Floor) and the worst-case plot is displayed below for reference.



Date: 9.AUG.2023 07:43:12

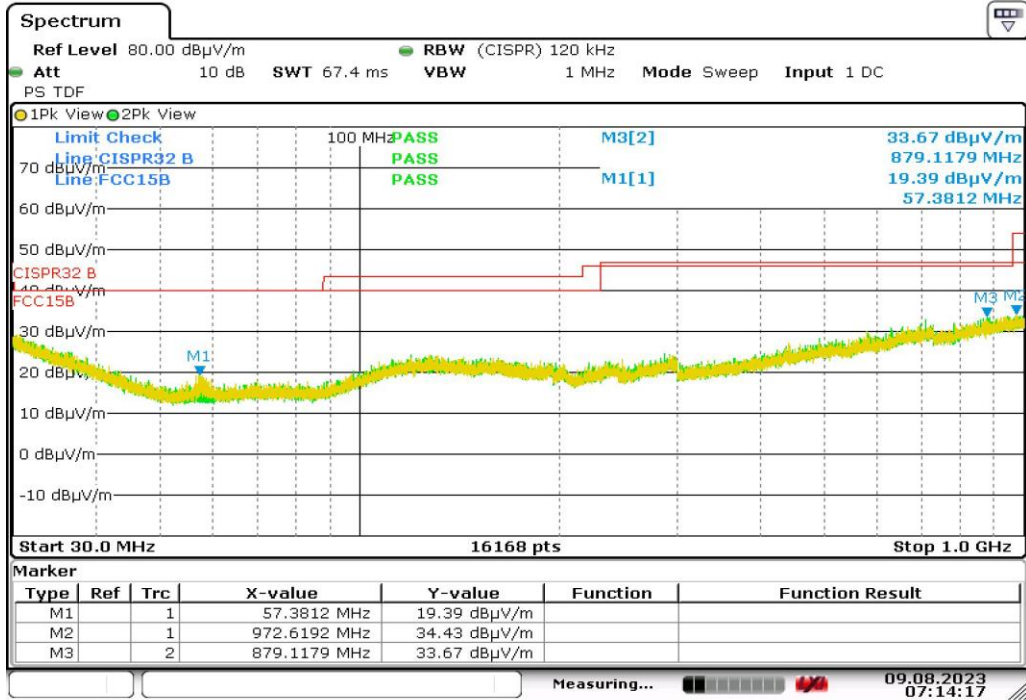


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Wireless Transceiver Bluetooth Low Energy Test Report



Both Buds Charging in Case, Case charging via AC Mains (120VAC 60Hz)



Date: 9.AUG.2023 07:14:17

Peak emissions are more than 10 dB below the limits



12. AC Line Conducted Emissions

Requirement:

FCC 15.207 (a)

RSS-Gen 8.8

Measurement Method:

ANSI C63.10-2013 Subclause 6.2

EUT on wooden table 80cm off ground plane.

AC Line conducted emissions test results:

The EUT is not able to use BT or QHS technologies while charging, only BLE pairing is available while in the charging case and only the charging case connects to the AC Mains. The EUT was tested with the buds in the charging case and the BLE advertising active.

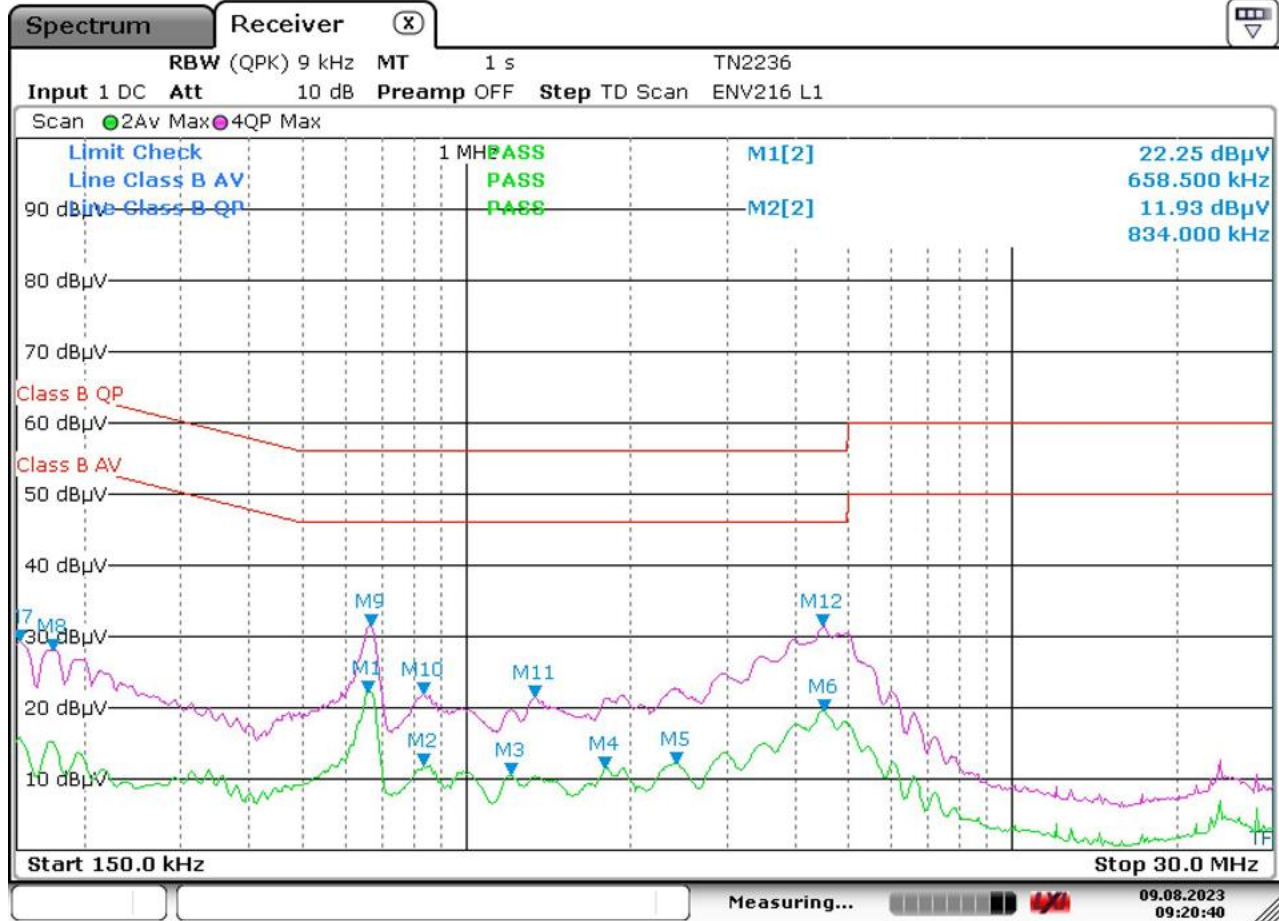


PRODUCT ASSURANCE ENGINEERING

Wireless Transceiver Bluetooth Low Energy Test Report



120VAC 60Hz – Line



Date: 9.AUG.2023 09:20:41

FCC 15B and CISPR 32 Class B Product

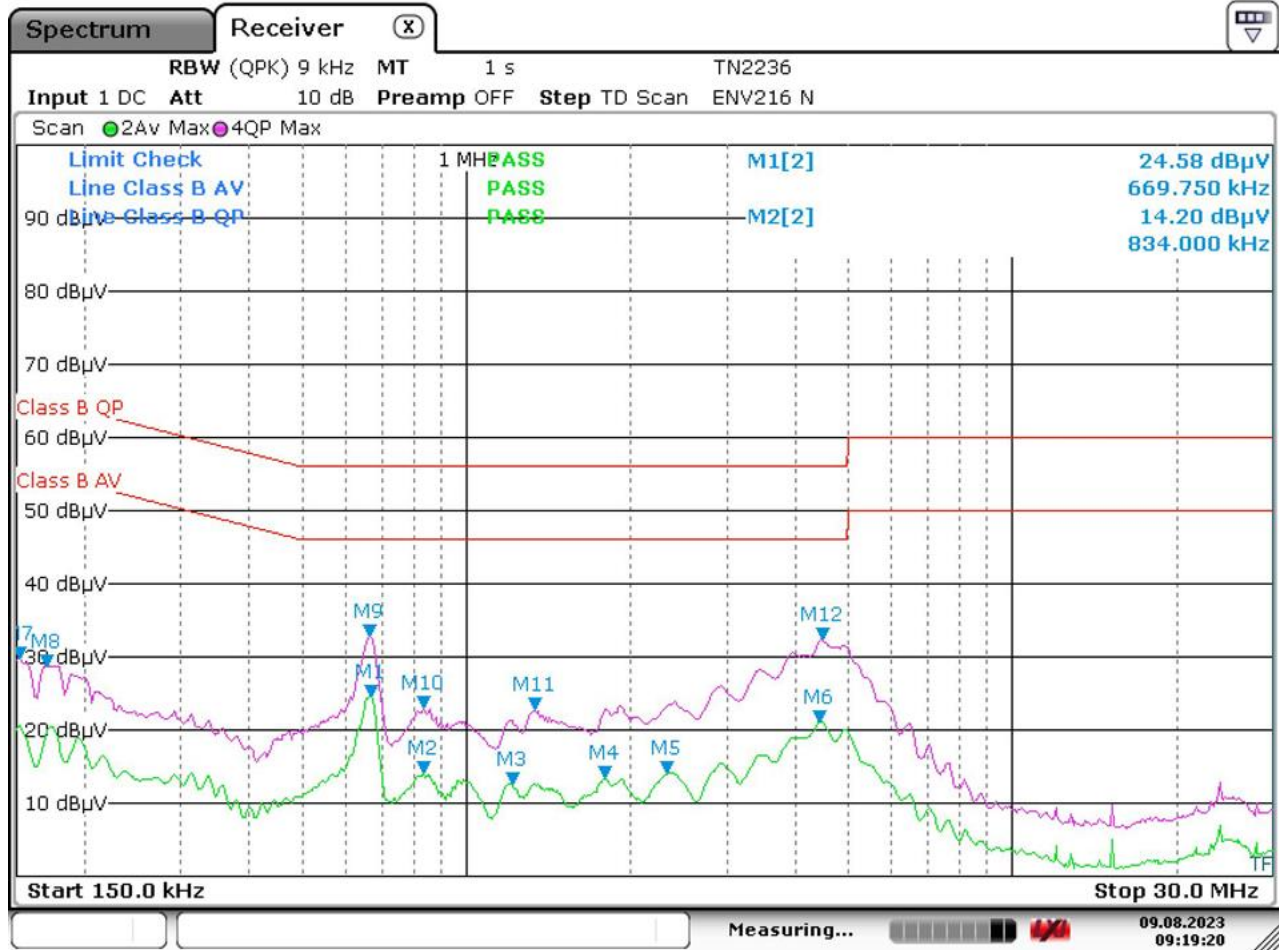
Mk #	Frequency MHz	MEASURED		LIMIT		MARGIN		Notes
		dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	
1	0.6585	31.30	22.20	56.0	46.0	24.7	23.8	
2	0.6698	31.40	22.10	56.0	46.0	24.6	23.9	
3	4.5060	31.60	19.60	56.0	46.0	24.4	26.4	
4	4.5218	31.50	19.60	56.0	46.0	24.5	26.4	
5	2.4315	22.70	12.30	56.0	46.0	33.3	33.7	
6	0.8340	21.90	11.90	56.0	46.0	34.1	34.1	
7	0.8340	21.90	11.90	56.0	46.0	34.1	34.1	
8	1.7970	21.20	11.60	56.0	46.0	34.8	34.4	
9	1.3358	21.50	10.40	56.0	46.0	34.5	35.6	
10	1.2075	19.80	10.60	56.0	46.0	36.2	35.4	
11	0.1523	29.30	16.00	65.9	55.9	36.6	39.9	
12	0.1748	28.00	15.20	64.7	54.7	36.7	39.5	



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Bluetooth Low Energy Test Report



120VAC 60Hz – Neutral



FCC 15B and CISPR 32 Class B Product

Mk #	Frequency MHz	MEASURED		LIMIT		MARGIN		Notes
		dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	
1	0.6698	32.70	24.60	56.0	46.0	23.3	21.4	
2	0.6653	32.70	24.50	56.0	46.0	23.3	21.5	
3	4.4835	32.40	21.10	56.0	46.0	23.6	24.9	
4	4.4363	32.20	21.10	56.0	46.0	23.8	24.9	
5	0.8340	23.00	14.20	56.0	46.0	33.0	31.8	
6	0.8340	23.00	14.20	56.0	46.0	33.0	31.8	
7	2.3370	23.40	14.00	56.0	46.0	32.6	32.0	
8	1.7970	22.70	13.40	56.0	46.0	33.3	32.6	
9	1.3335	22.70	12.60	56.0	46.0	33.3	33.4	
10	1.2120	21.20	12.70	56.0	46.0	34.8	33.3	
11	0.1523	29.80	20.70	65.9	55.9	36.1	35.2	
12	0.1703	28.80	19.70	64.9	54.9	36.1	35.2	



13. Equipment List

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2247	EMI Test Receiver, 7GHZ	ESR7	101263	Rohde & Schwarz	21-Mar-2023	20-Mar-2024		
2236	2-LINE V-NETWORK	ENV216	101193	Rohde & Schwarz	29-Mar-2022	28-Mar-2024		
1380	Conducted Comb Generator	CGC-510	311559	Com-Power Corporation			11-Jul-2023	10-Jul-2024
1375	System Controller	SC99V	050905-1	Sunol Sciences Corp				
2319	EMI Test Receiver	ESR26	101276	Rohde & Schwarz	29-Mar-2023	28-Mar-2024		
644	Maxwell House 3 Meter Semi-Anechoic Chamber	N/A	1698A	EM Test			VBU	Verified
1541	Antenna 30MHz - 6GHz	JB6	A050807	Sunol Sciences Corp	14-Dec-2021	14-Dec-2023		
2077	Maxwell House RE Pre-amp (20MHz-3GHz)	N/A	N/A	Bose Corporation			01-Sep-2022	01-Sep-2023
1445	Maxwell House Radiated Emissions Cable Set (10MHz-6GHz)	N/A	N/A	Bose Corporation			01-Sep-2022	01-Sep-2023
2602	Miteq pre-amp 1-18GHz 35dB	AFS42-01001800-28-10P-42	N/A	Miteq			06-Jul-2023	05-Jul-2024
1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	20-Mar-2023	19-Mar-2024		
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics			28-Mar-2023	27-Mar-2024
2342	2.4GHz Band Reject Filter	BRM50702-07	001	Micro-Tronics			28-Mar-2023	27-Mar-2024
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas			12-Jul-2023	
1757	18GHz-40GHz Preamp	JS4018004000-30-8P-A1	1406279	Miteq			12-Jul-2023	11-Jul-2024
1596	Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research			VBU	Verified
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	24-Feb-2023	23-Feb-2025		
3685	Marconi Manor 3M mast position RE cable set	3 cables (TN's 2373, 2479, 2357)					28-Mar-2023	27-Mar-2024
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	23-Mar-2023	22-Mar-2024		
3724	Conducted Emission Cable	RG223 N-Connectors 16'					VBU	Verified

14. Measurement Uncertainty

AC Mains conducted emissions uncertainty.

Uncertainty Budget (AC mains measurements)				
Title:	Conducted RF Emissions (Mains)			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Receiver - absolute level	0.3	Rect.	1.73	0.17
Receiver - frequency response	1.0	Rect.	1.73	0.58
Receiver - attenuator switching	0.2	Rect.	1.73	0.12
Receiver - bandwidth switching	0.2	Rect.	1.73	0.12
Receiver - display	0.5	Rect.	1.73	0.29
LISN impedance	2.6	Triang.	2.45	1.06
LISN insertion loss	0.6	Norm.	2.00	0.30
Cable correction factor	0.1	Norm.	2.00	0.05
Combined uncertainty (RSS):				1.30
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				2.60

Radiated emission uncertainty (30 MHz – 1 GHz)

Uncertainty Budget				
Title:	Radiated RF Emissions (30MHz-1GHz)			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Receiver - absolute level	0.3	Rect.	1.73	0.17
Receiver - frequency response	0.8	Rect.	1.73	0.46
Receiver - attenuator switching	0.2	Rect.	1.73	0.12
Receiver - bandwidth switching	0.2	Rect.	1.73	0.12
Receiver - display	0.5	Rect.	1.73	0.29
Antenna factor	0.8	Norm.	2.00	0.38
Antenna directivity	1.0	Norm.	2.00	0.50
Preamp correction factor	0.5	Norm.	2.00	0.25
Cable correction factor	0.5	Norm.	2.00	0.25
Site imperfection - NSA	4.0	Triang.	2.45	1.63
Test table impact	1.1	Rect.	1.73	0.64
Combined uncertainty (RSS):				1.98
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				3.97

Radiated emissions above 1 GHz

Uncertainty Budget				
Title:	Radiated Emissions above 1 GHz			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
RF spec anal-level-Ref.	0.6	Rect.	1.73	0.35
RF spec anal-level-Freq resp.	1.0	Rect.	1.73	0.58
RF spec anal-level-Display	0.3	Rect.	1.73	0.17
RF spec anal-level-QP det.	1.0	Rect.	1.73	0.58
Antenna factor	0.9	Norm.	2.00	0.45
Preamp corr. Factor	0.5	Rect.	1.73	0.29
Cable corr. Factor	0.5	Rect.	1.73	0.29
Combined uncertainty (RSS):				1.09
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				2.18

Conducted RF measurements

Uncertainty Budget				
Title:	Conducted RF measurements			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Analyzer - absolute level	0.3	Rect.	1.73	0.17
Analyzer - frequency response	0.5	Rect.	1.73	0.29
Analyzer - attenuator switching	0.2	Rect.	1.73	0.12
Analyzer - bandwidth switching	0.2	Rect.	1.73	0.12
Analyzer - display	0.5	Rect.	1.73	0.29
Cable correction factor	0.5	Norm.	2.00	0.25
Combined uncertainty (RSS):				0.54
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				1.07



End of Report