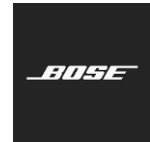




PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



Test Type: Emissions [X] Immunity []

Product Type: Wireless Open 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 [X] 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.442345.23.222.4

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.



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

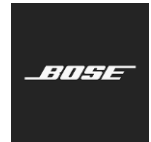


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1. Test Report Summary

Product Information:

Description

The EUT is a wireless earbud that contains DSS/DTS transceiver IC manufactured by Qualcomm Technologies. The EUT uses Adaptive Frequency Hopping (AFH) mode, using a reduced hop set if in band interference is detected, however a minimum of fifteen channels is always maintained Qualcomm documentation.

Setup (Cables and Accessories)

For all radio tests, the EUT was configured using 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 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
20 dB Occupied Bandwidth	N/A	For reporting only
99% Occupied Bandwidth	N/A	For reporting only
Conducted Output Power	Pass	
Hopping Frequency Separation	Pass	
Number of Hopping Channels	Pass	
Average Time of Occupancy	Pass	
Conducted Spurious Emissions	Pass	
Radiated Emissions 1 GHz to 25 GHz	Pass	
Radiated Emissions 30 MHz 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



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



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



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 a).

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 (%)
2404	QHS	P2	2	1023	4.191	5.010	83.6
2404	QHS	P6	6	1023	1.440	2.505	57.6



6. 20 dB and 99% Occupied Bandwidth

Requirement:

None; for reporting purposes only.

FCC 15.247(a)(1)

RSS-247 5.1 (1) (a)

Measurement Method:

ANSI C63.10-2013 Subclause 6.9.2 (20 dB Bandwidth)

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

RSS-Gen Issue 5, 6.7 (20 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.

20 dB Occupied Bandwidth Results:

QHS P2 20dB OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	20dB OBW (MHz)	Limit N/A
Low	2404	QHS P2	2	2.554	-
Mid	2440	QHS P2	2	2.535	-
High	2478	QHS P2	2	2.556	-
QHS P6 20dB OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	20dB OBW (MHz)	Limit N/A
Low	2404	QHS P6	6	2.553	-
Mid	2440	QHS P6	6	2.533	-
High	2478	QHS P6	6	2.536	-



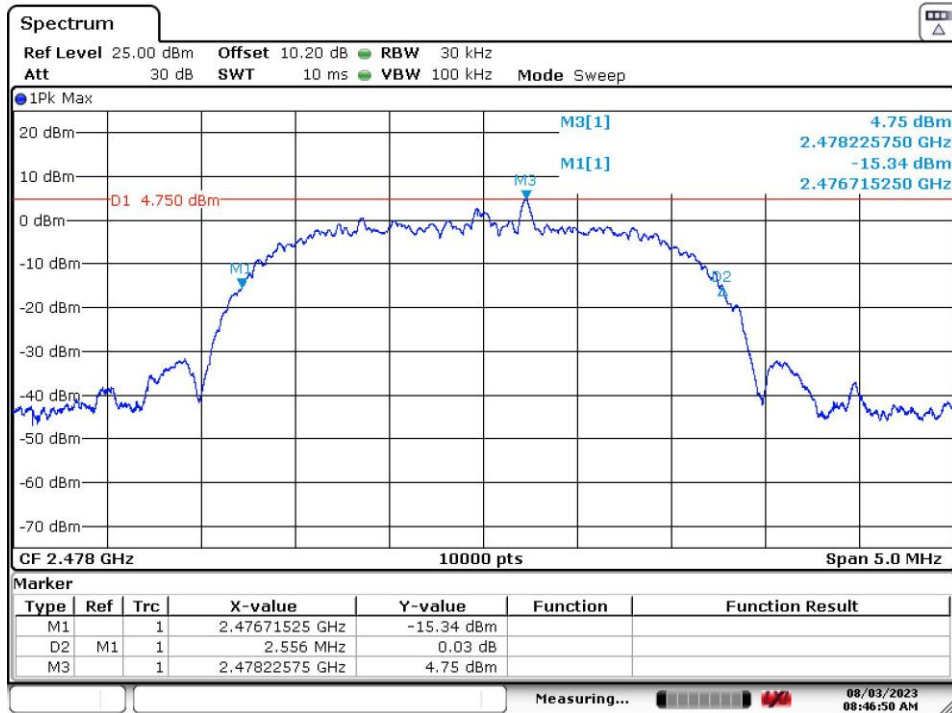
PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



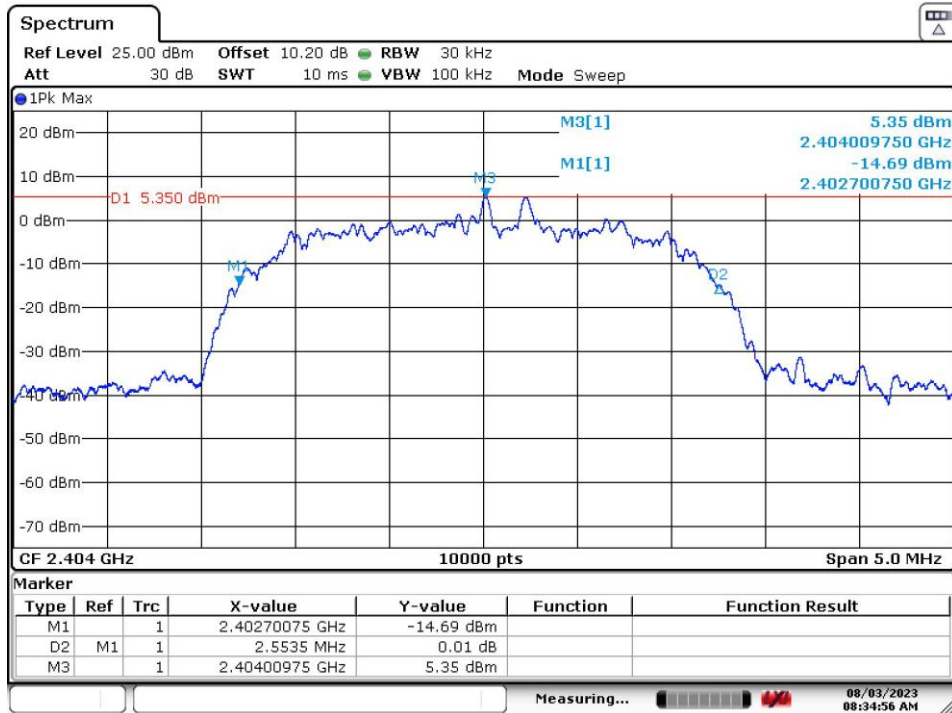
20 dB OBW worst-case plots, other frequencies measured the same way.

QHS P2



Date: 3.AUG.2023 08:46:50

QHS 6M



Date: 3.AUG.2023 08:34:56



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



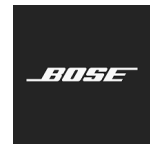
99% Occupied bandwidth test results:

DH5 99% OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	99% OBW (MHz)	Limit N/A
Low	2404	QHS P2	2	2.372	-
Mid	2440	QHS P2	2	2.368	-
High	2478	QHS P2	2	2.367	-
3-DH5 99% OBW Summary Table					
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	99% OBW (MHz)	Limit N/A
Low	2404	QHS P6	6	2.376	-
Mid	2440	QHS P6	6	2.371	-
High	2478	QHS P6	6	2.370	-



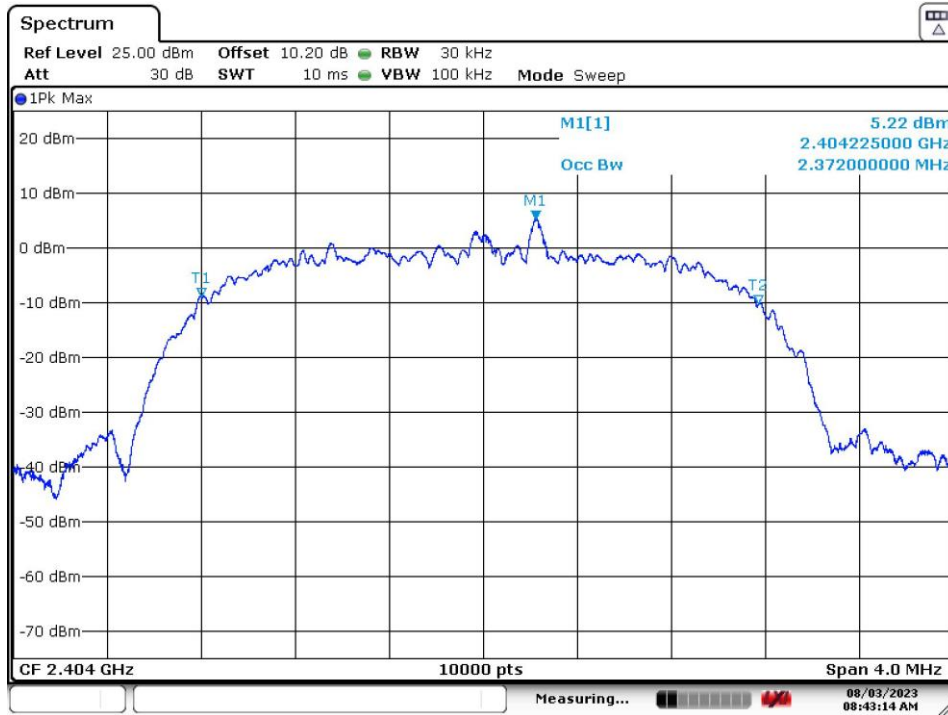
PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



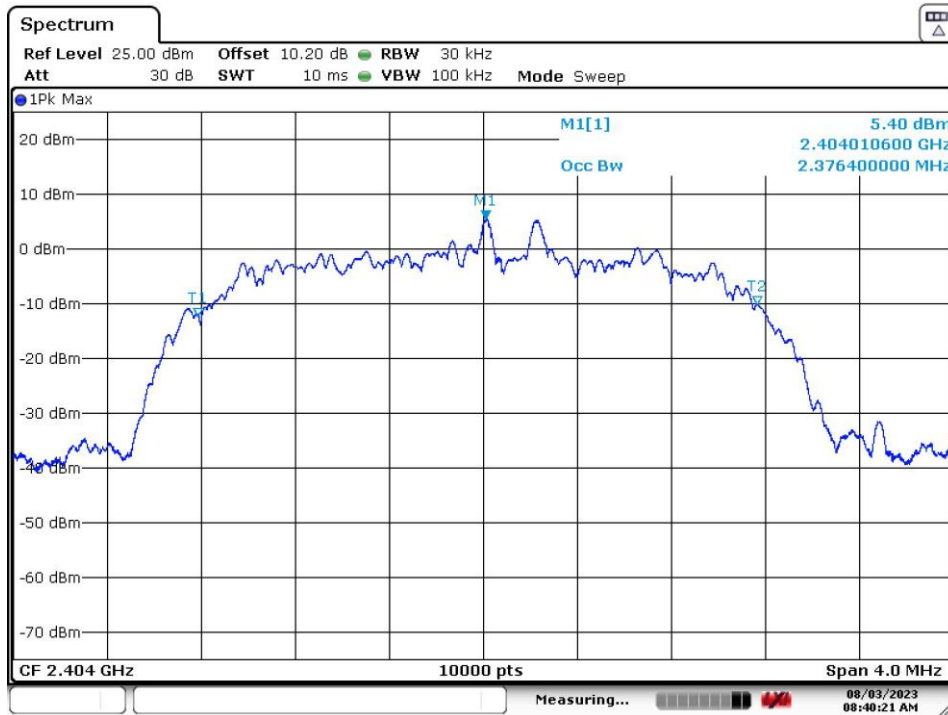
99% OBW worst-case plots, other frequencies measured the same way.

QHS P2

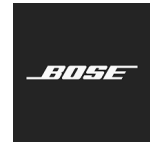


Date: 3.AUG.2023 08:43:14

QHS P6



Date: 3.AUG.2023 08:40:22



7. Conducted Output Power

Requirements:

FCC 15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21 dBm)

In adaptive frequency hopping mode, the number of hopping channels can be less than 75 therefore the power limit is 21 dBm.

RSS-247 5.4 (b)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W (21 dBm).

The e.i.r.p shall not exceed 4W, except as provide in section 5.4 (e).

In adaptive frequency hopping mode, the number of hopping channels can be less than 75 therefore the power limit is 21 dBm.

Maximum antenna gain is 1 dBi therefore maximum e.i.r.p will be less than 4W (36 dBm) at the maximum power limit of 21 dBm.

Measurement Method:

ANSI C63.10-2013 Subclause 7.8.5

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.

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	2404	QHS P2	2	12.05	21	8.95	Pass
Mid	2440	QHS P2	2	12.91	21	8.09	Pass
High	2478	QHS P2	2	11.92	21	9.08	Pass
3-DH5 Output Power Summary Table							
Channel	Frequency (MHz)	Mode	Data Rate (Mbps)	Output Power (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2404	QHS P6	6	12.12	21	8.88	Pass
Mid	2440	QHS P6	6	12.96	21	8.04	Pass
High	2478	QHS P6	6	11.97	21	9.03	Pass



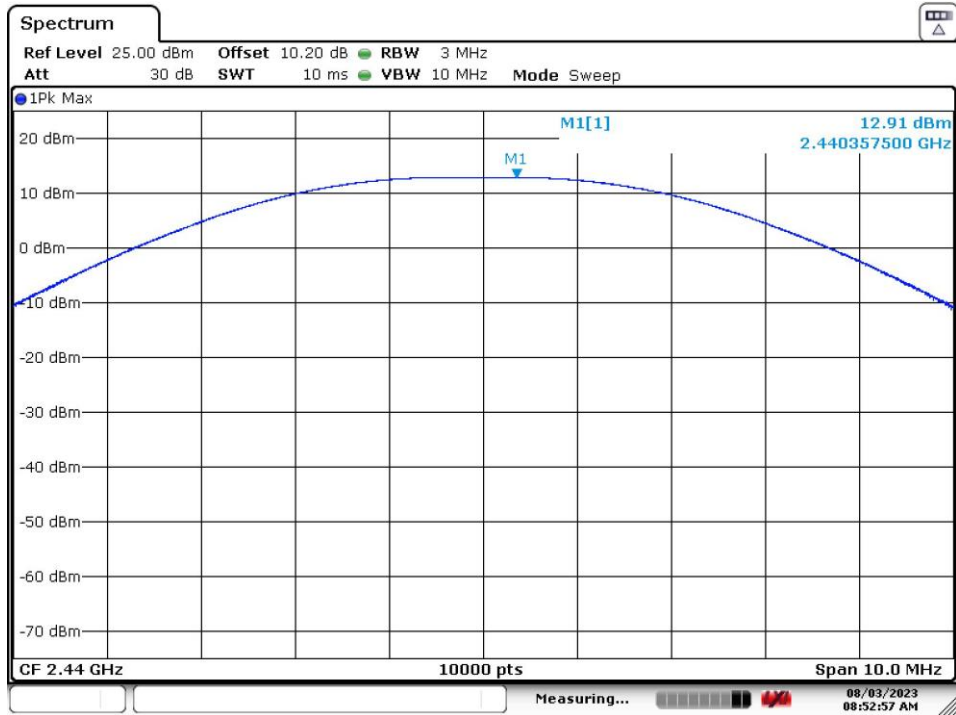
PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



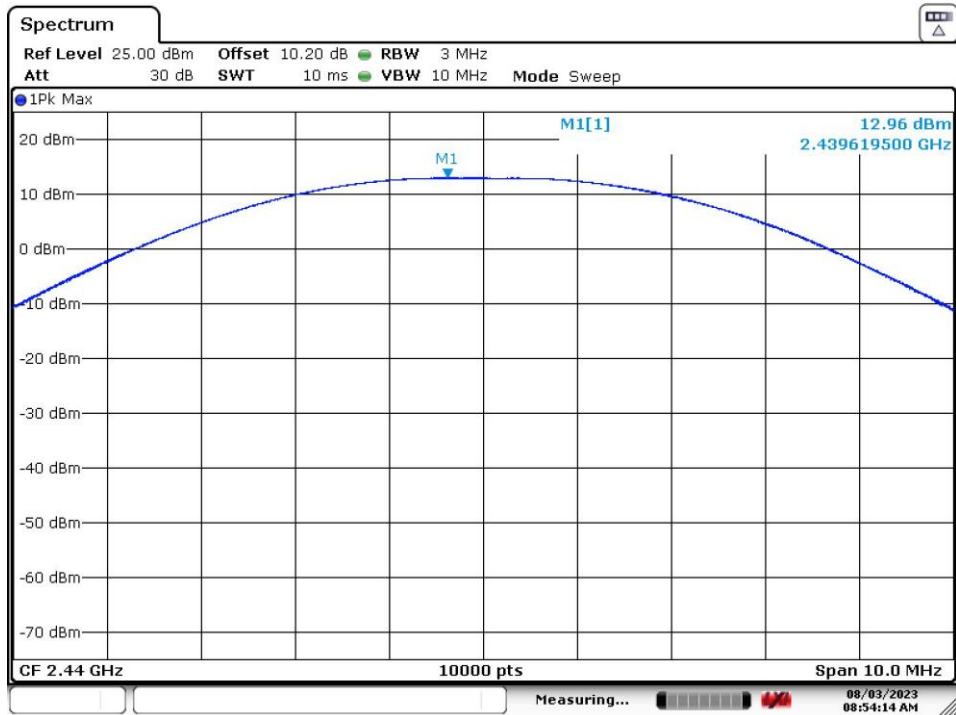
Output power worst-case plots, other frequencies measured the same way.

QHS P2



Date: 3.AUG.2023 08:52:57

QHS P6



Date: 3.AUG.2023 08:54:14

8. Hopping Frequency Separation

Requirements:

FCC 15.247 (a) (1)

RSS-247 5.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, **whichever is greater**, provided the systems operate with an output power no greater than 125 mW.

$$2/3 * (2377 \text{ kHz } 20 \text{ dB OBW}) = 1585 \text{ kHz (QHS-P2)}$$

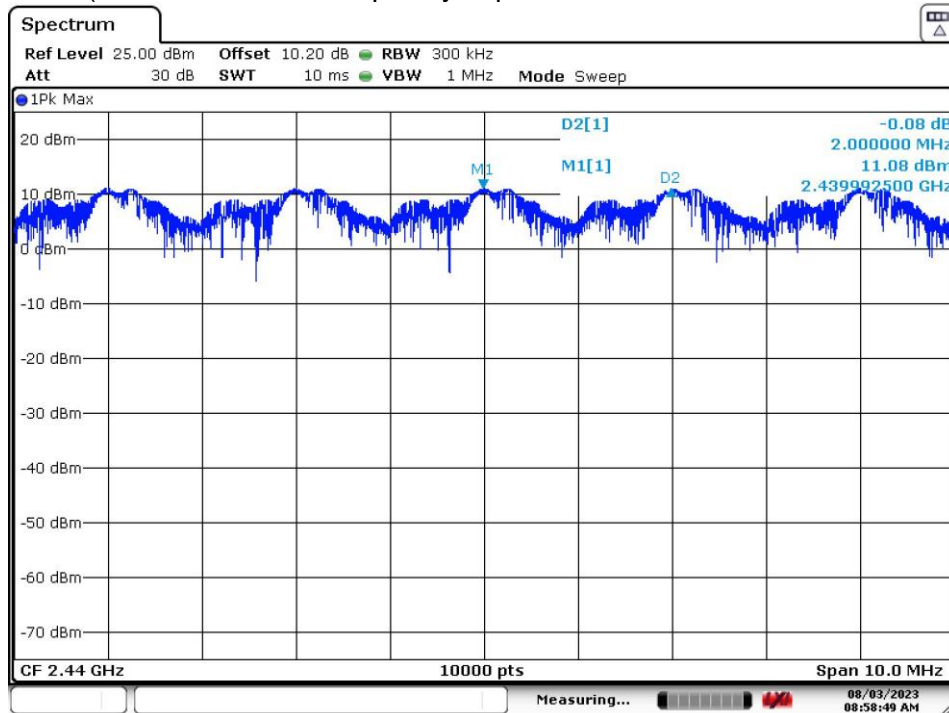
$$2/3 * (2389 \text{ kHz } 20 \text{ dB OBW}) = 1593 \text{ kHz (QHS-P6)}$$

Measurement Method:

ANSI C63.10 Subclause 7.8.2

Hopping frequency separation test results:

QHS P2 (Measured 2 MHz frequency separation > 25 kHz > 2/3 of 20dB OBW)



Date: 3.AUG.2023 08:58:49

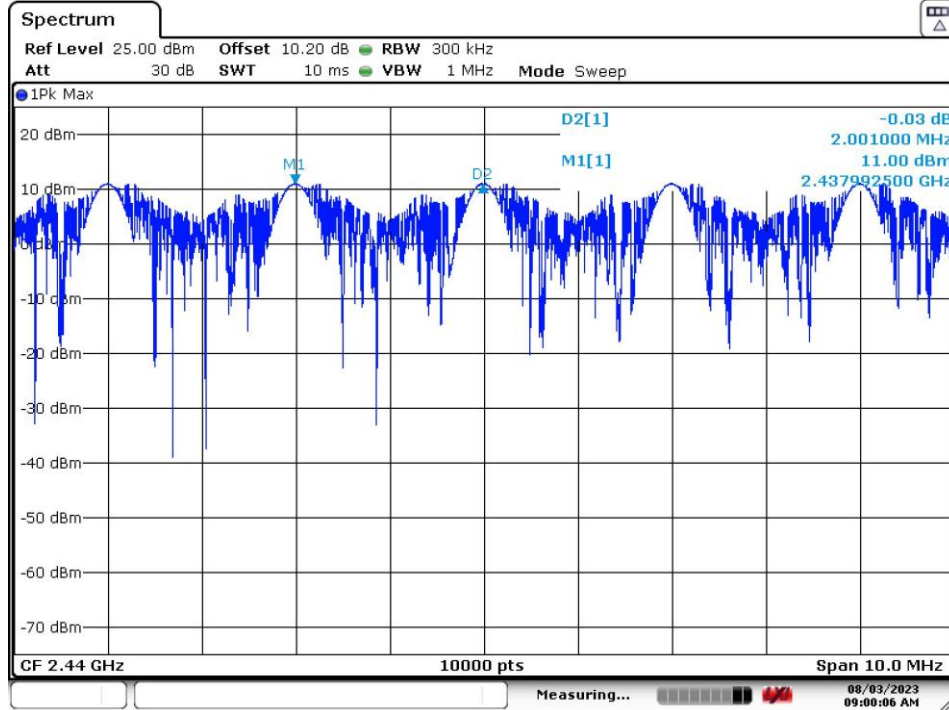


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



QHS P6 (Measured 2 MHz frequency separation > 25 kHz > 2/3 of 20 dB OBW)



Date: 3.AUG.2023 09:00:06



9. Number of Hopping Channels

Requirements:

FCC 15.247 (a) (1) (iii)

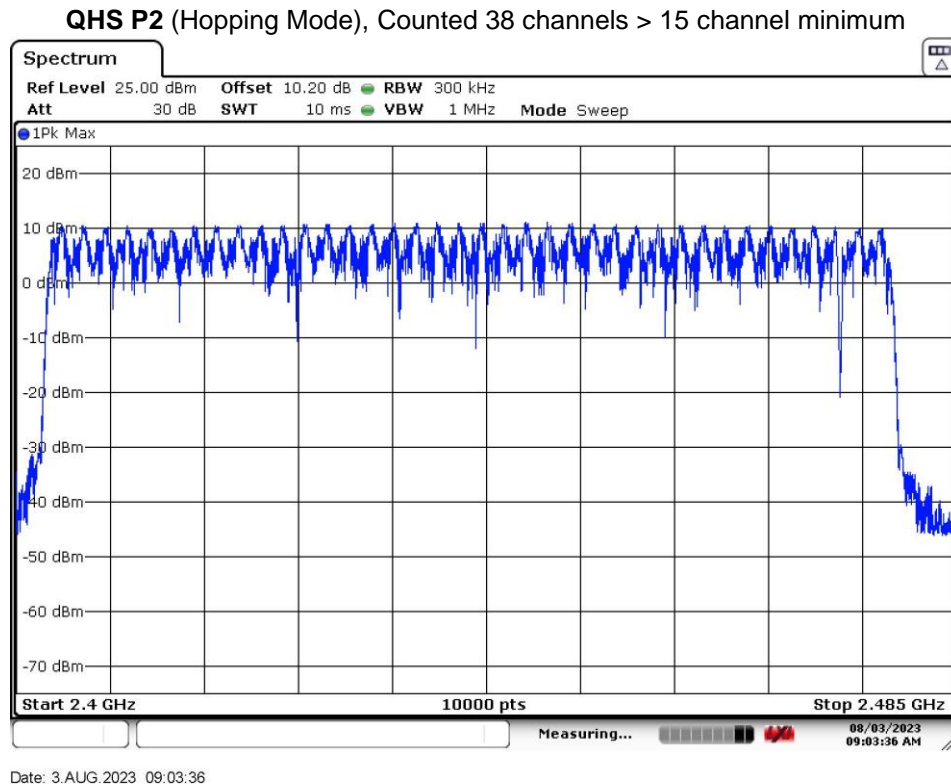
RSS-247 5.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

Measurement Method:

ANSI 63.10 Subclause 7.8.3

Number of hopping channels test results:



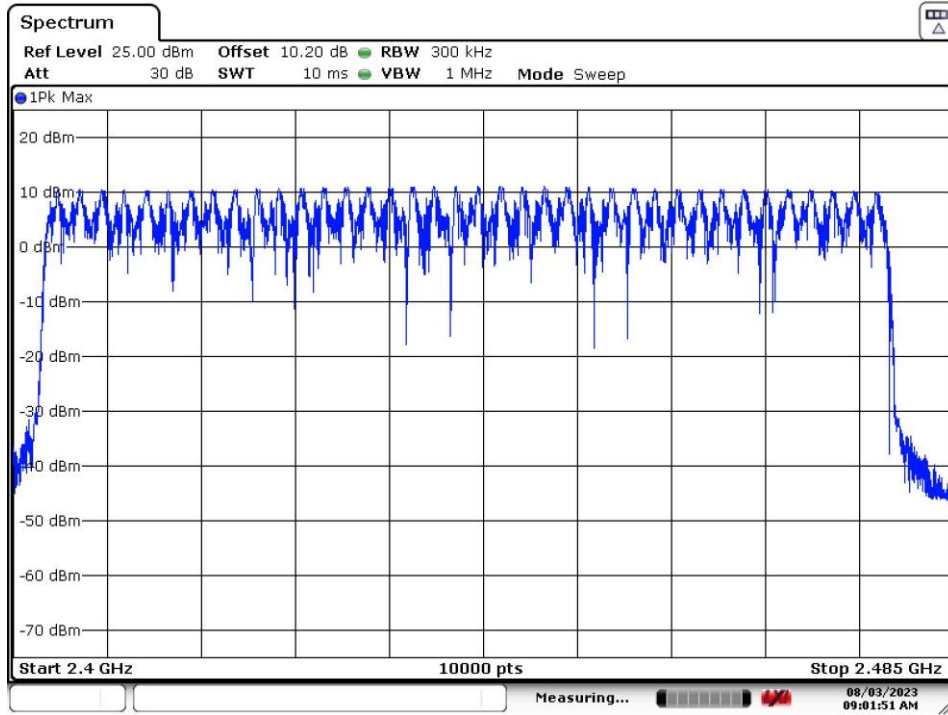


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



QHS P6 (Hopping Mode), Counted 38 channels > 15 channel minimum



Date: 3.AUG.2023 09:01:52



10. Average Time of Occupancy

Requirements:

FCC 15.247 (a) (1) (iii)

IC RSS-247 5.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Measurement Method

ANSI C63.10 Subclause 7.8.4

Observation time = (38 hopping Channels) * 400mS = 15.2 Seconds.

Average time of occupancy test results:

Time of Occupancy Summary Table

Hopping Mode									
Channel	Frequency (MHz)	Mode	Pulse Width (ms)	Number of Pulses in 1.52s	Number of Pulses in 1.52s (x10)	Time of Occupancy (Pulse Width X Number of Pulses)	Limit (ms)	Margin (ms)	Result
Low	2404	QHS P2	4.191	8	80	335.28	400	64.72	Pass
Low	2404	QHS P6	1.440	15	150	216	400	184	Pass

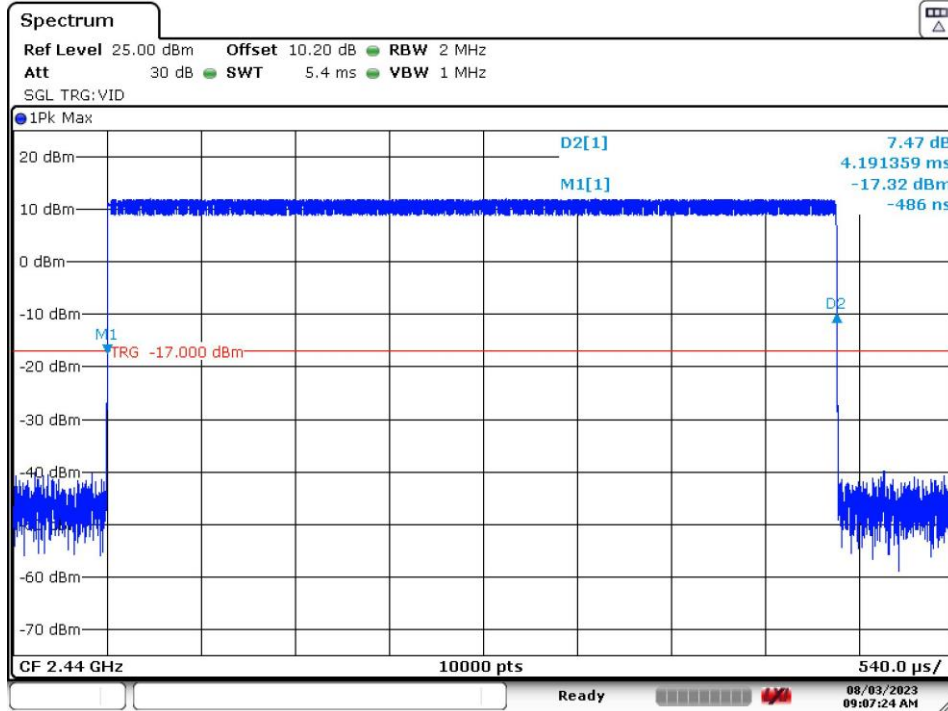


PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

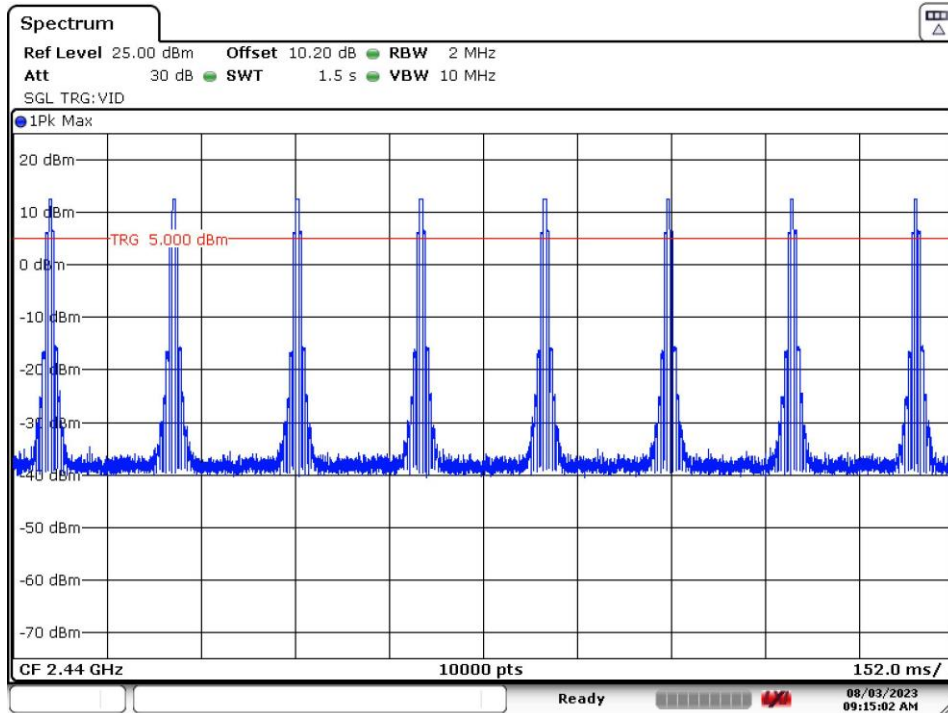


QHS P2 2404 MHz Pulse Width



Date: 3.AUG.2023 09:07:24

Pulse Count = 8



Date: 3.AUG.2023 09:15:03

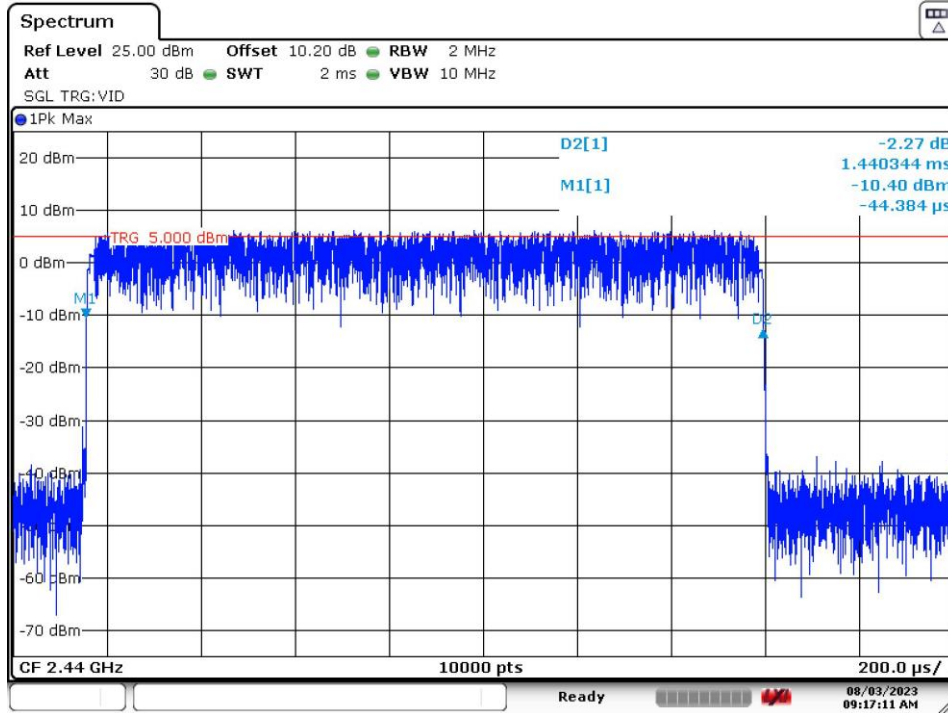


PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

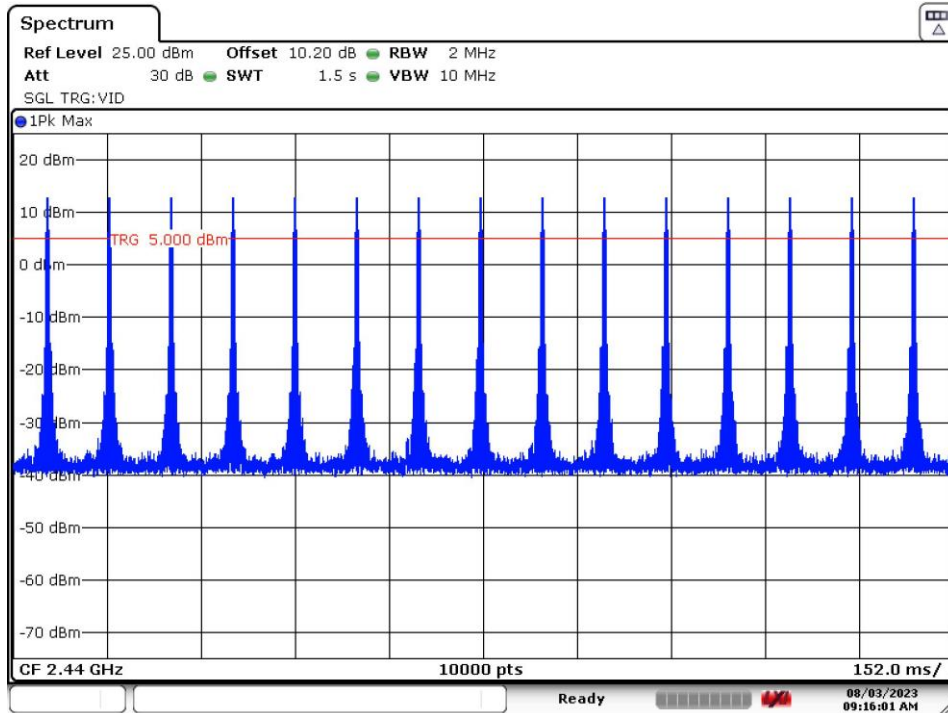


QHS P6 2404 MHz Pulse Width

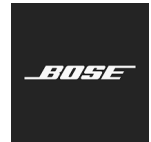


Date: 3.AUG.2023 09:17:11

Pulse Count = 15



Date: 3.AUG.2023 09:16:01



11. 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 Subclauses 6.10.4, 7.8.8

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

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.



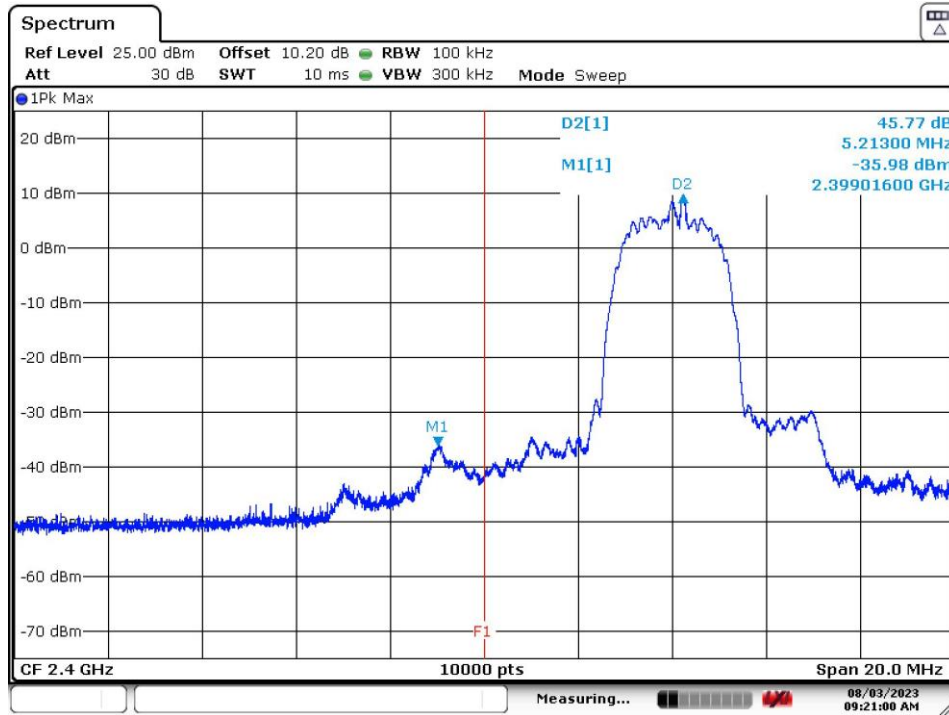
PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R



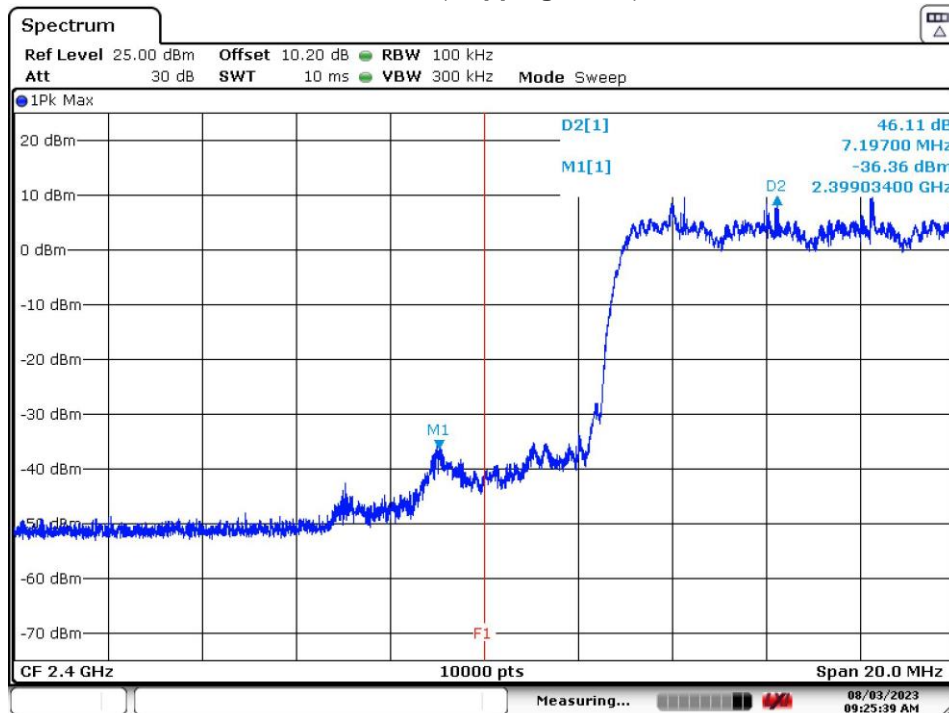
Conducted spurious emissions test results:

Low Channel Band Edge
CH1 (2404 MHz), QHS P2, (Non-Hopping Mode)



Date: 3.AUG.2023 09:21:01

QHS P2, (Hopping Mode)



Date: 3.AUG.2023 09:25:39

Emissions are more than 20 dBc both hopping and non-hopping, pass.

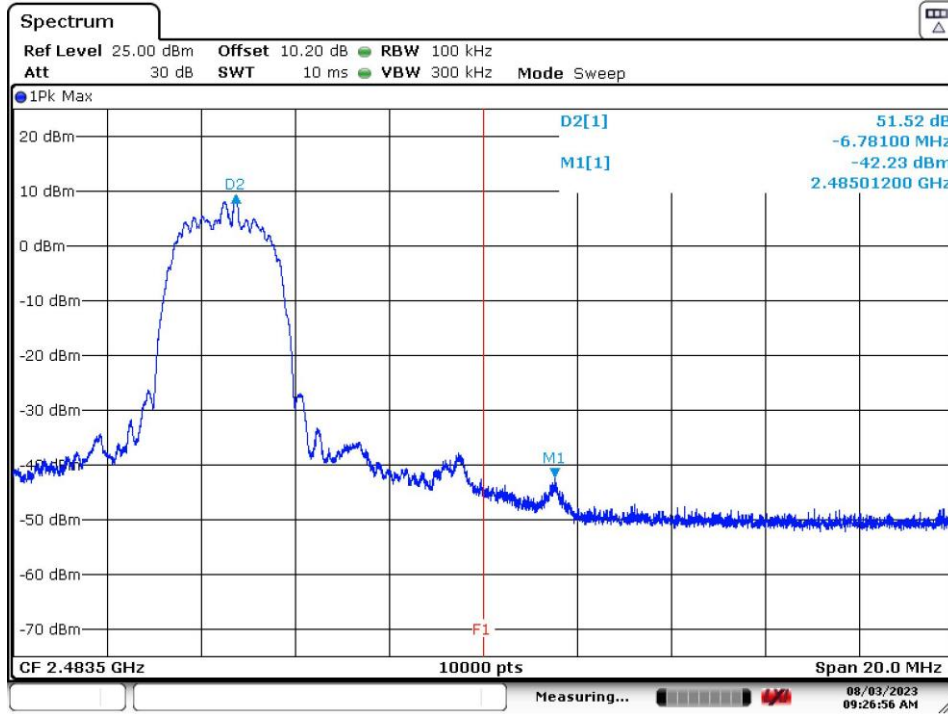


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

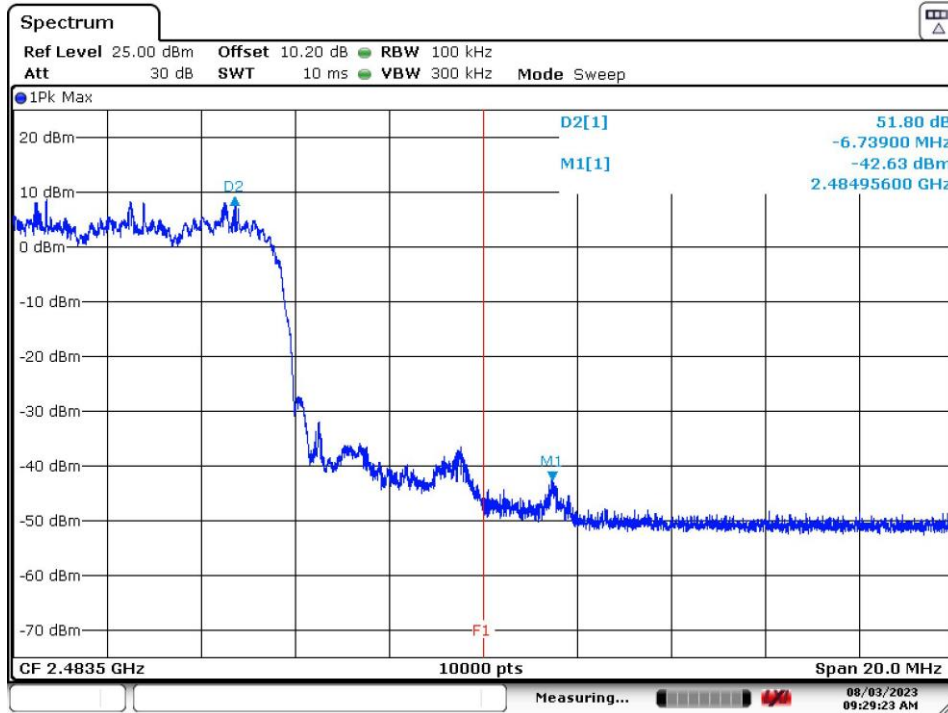


High Channel Band Edge
CH38 (2478 MHz), QHS P2, (Non-Hopping Mode)



Date: 3.AUG.2023 09:26:56

QHS P2, (Hopping Mode)



Date: 3.AUG.2023 09:29:24

Emissions are more than 20 dBc both hopping and non-hopping, pass.

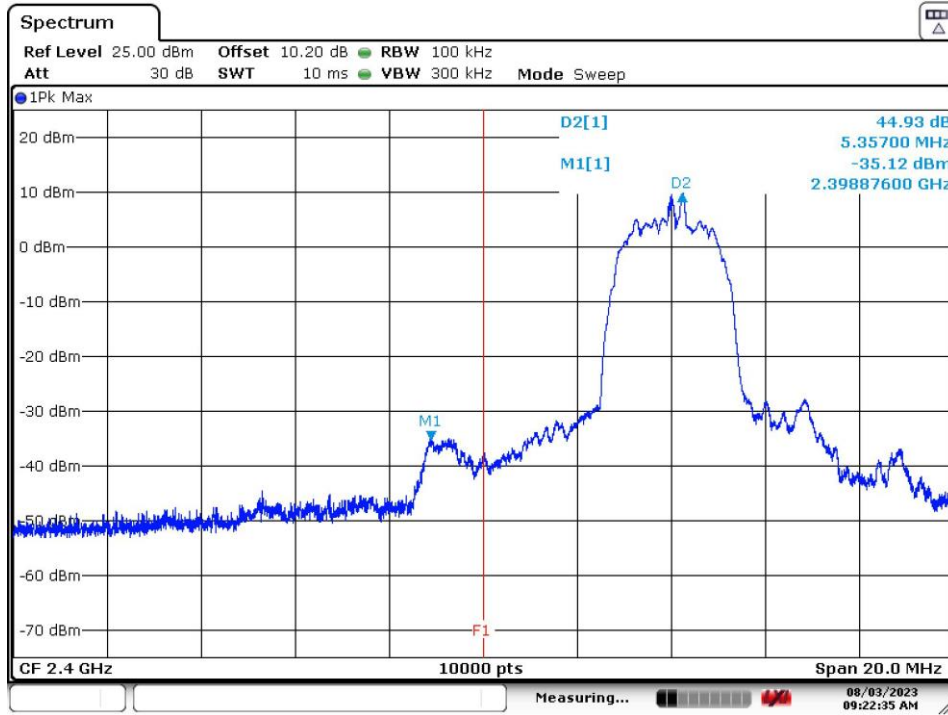


PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

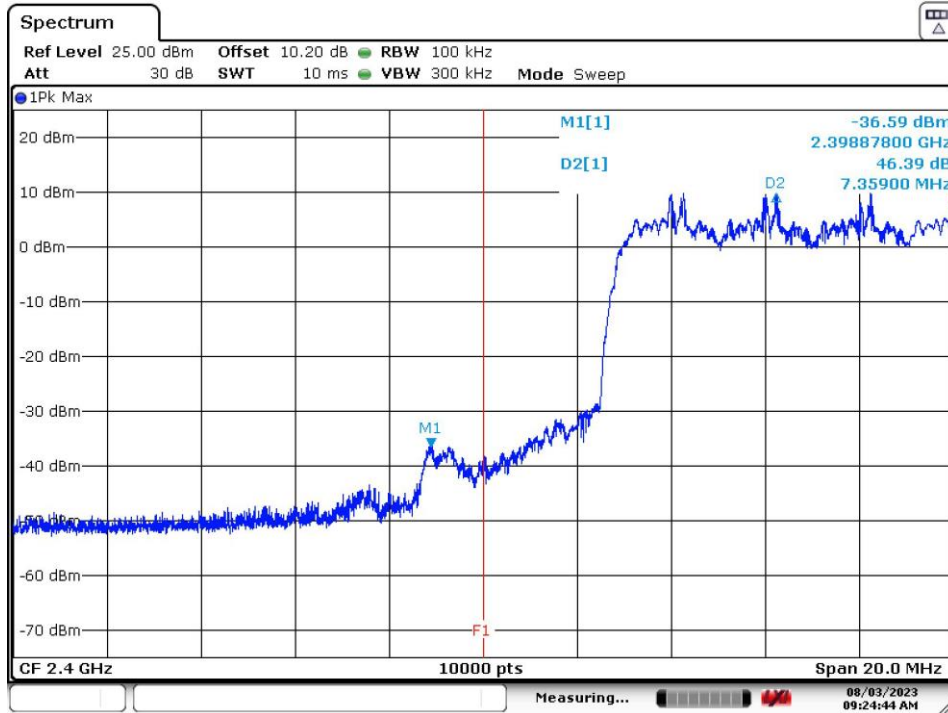


Low Channel Band Edge CH1 (2404 MHz), QHS P6, (Non-Hopping Mode)



Date: 3.AUG.2023 09:22:36

QHS P6, (Hopping Mode)



Date: 3.AUG.2023 09:24:44

Emissions are more than 20 dBc both hopping and non-hopping, pass.

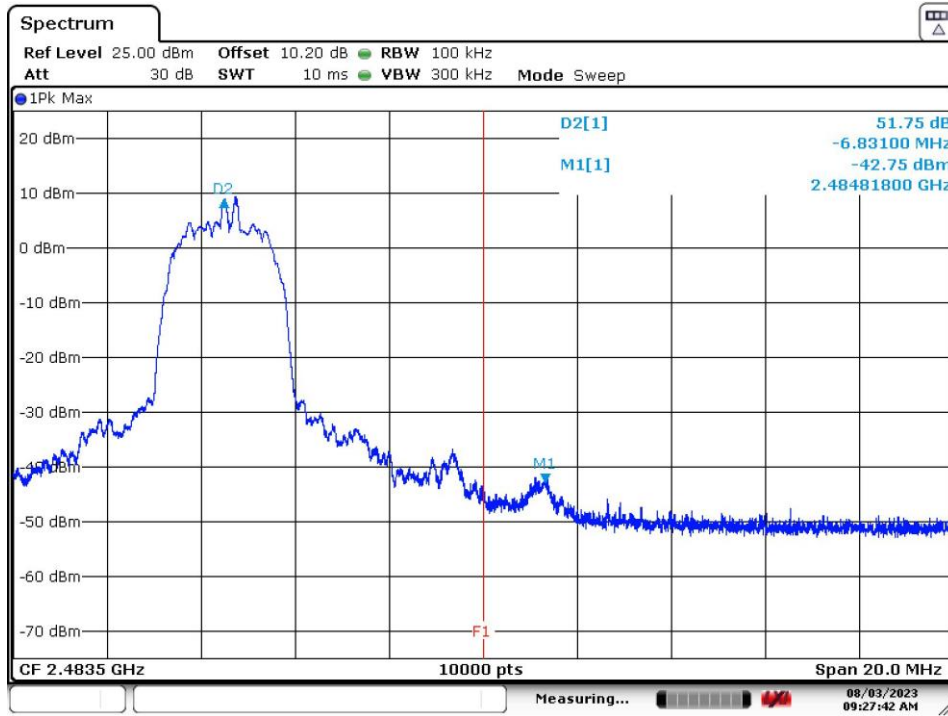


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

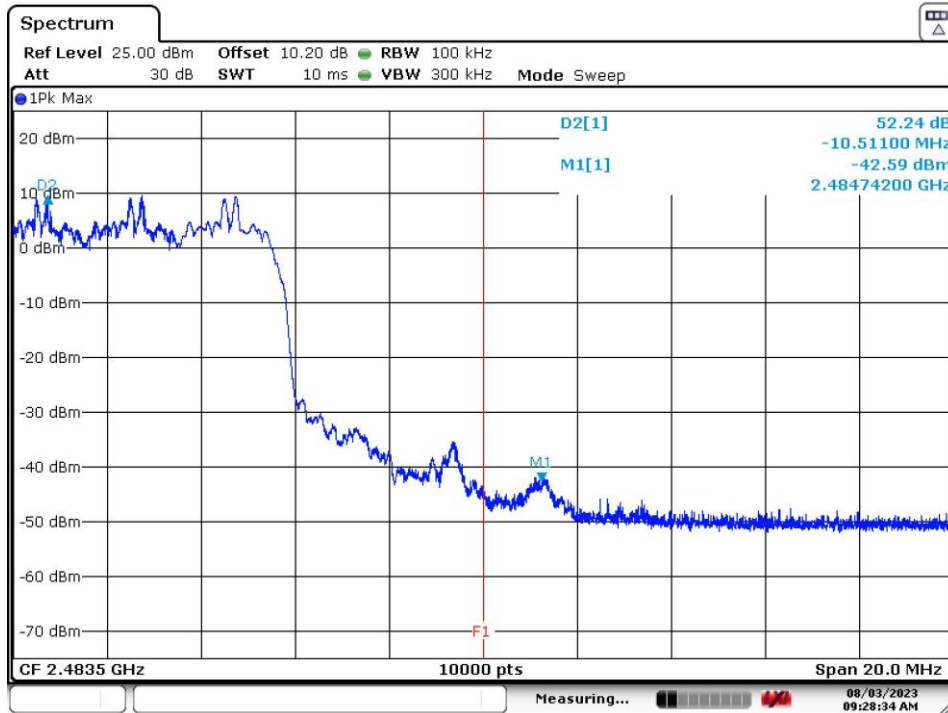


High Channel Band Edge
CH38 (2478 MHz), QHS P6, (Non-Hopping Mode)



Date: 3.AUG.2023 09:27:42

QHS P6, (Hopping Mode)



Date: 3.AUG.2023 09:28:35

Emissions are more than 20 dBc both hopping and non-hopping, pass.



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

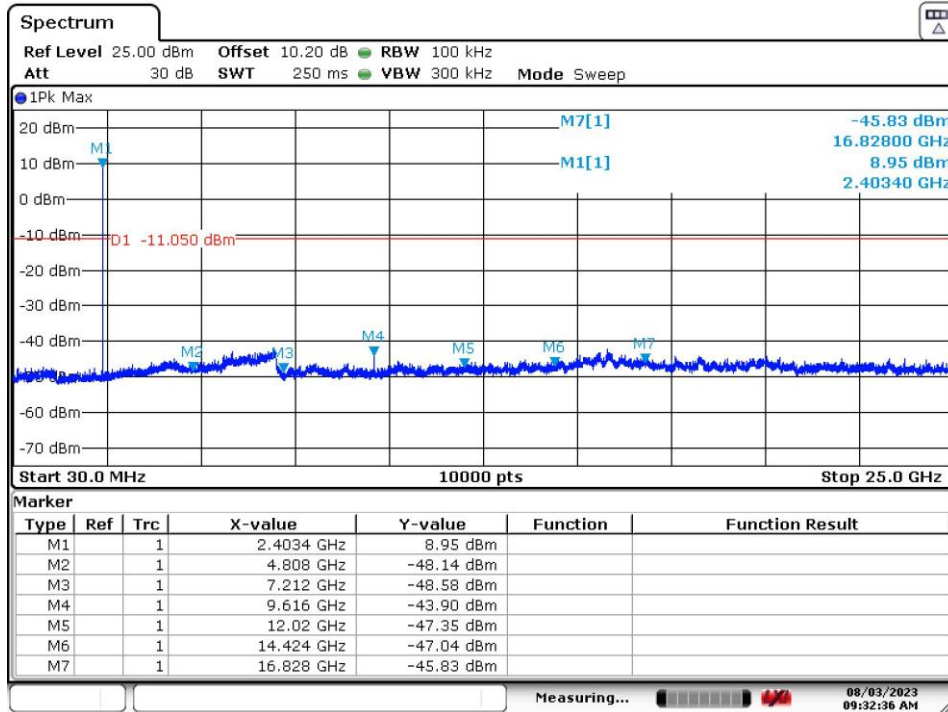


Wideband conducted spurious emissions, 30 MHz to 25000 MHz

On all the following plots, marker 1 is the fundamental frequency and should be ignored

Low Channel

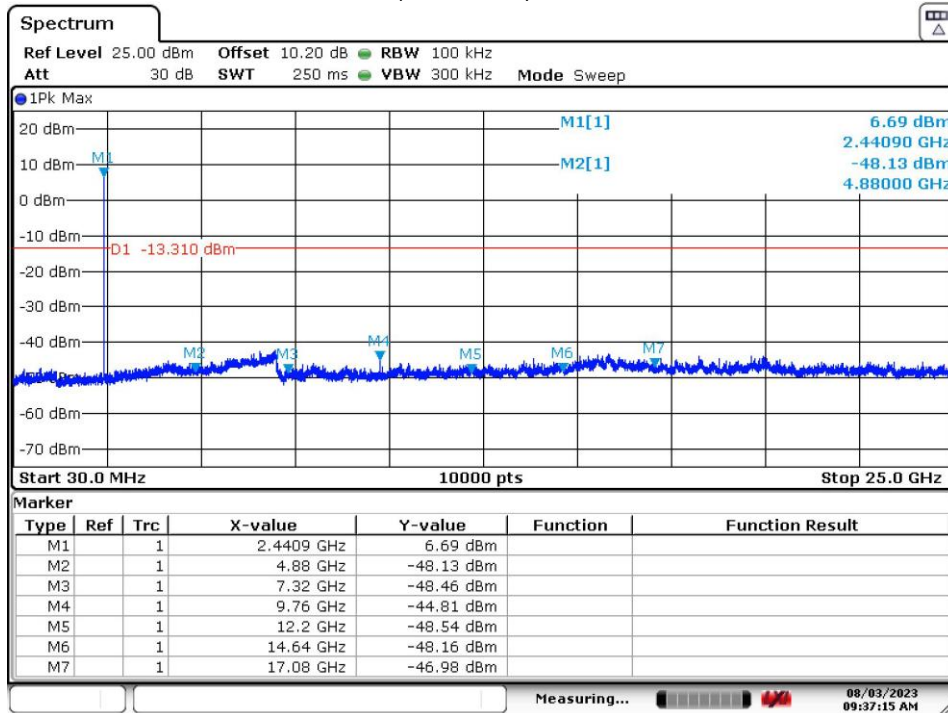
CH1 (2404 MHz), QHS P2



Date: 3.AUG.2023 09:32:36

Mid Channel

CH18 (2440 MHz), QHS P2



Date: 3.AUG.2023 09:37:15

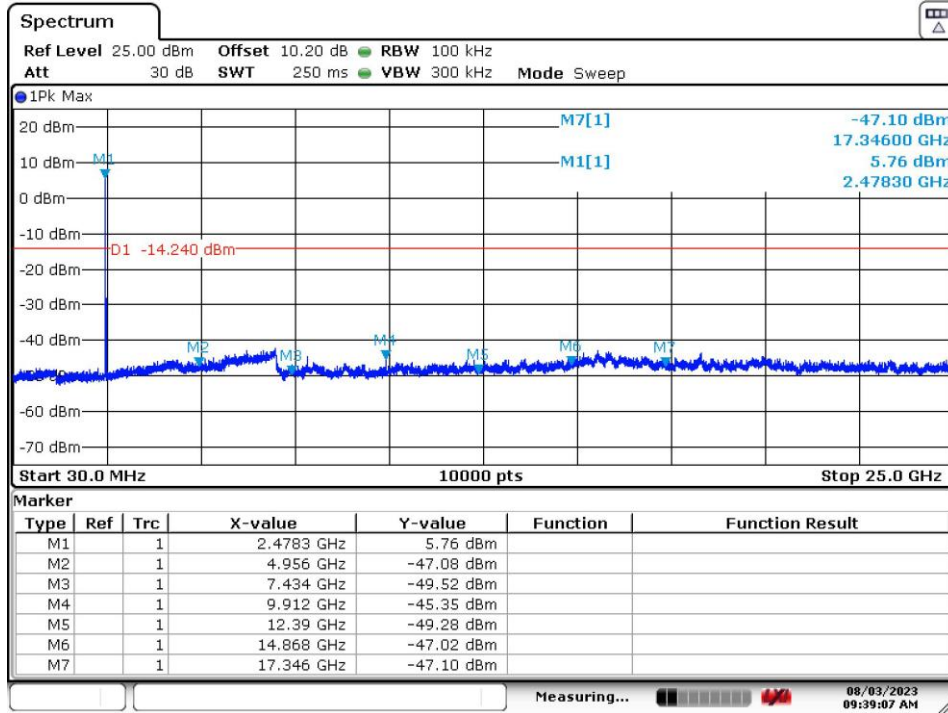


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

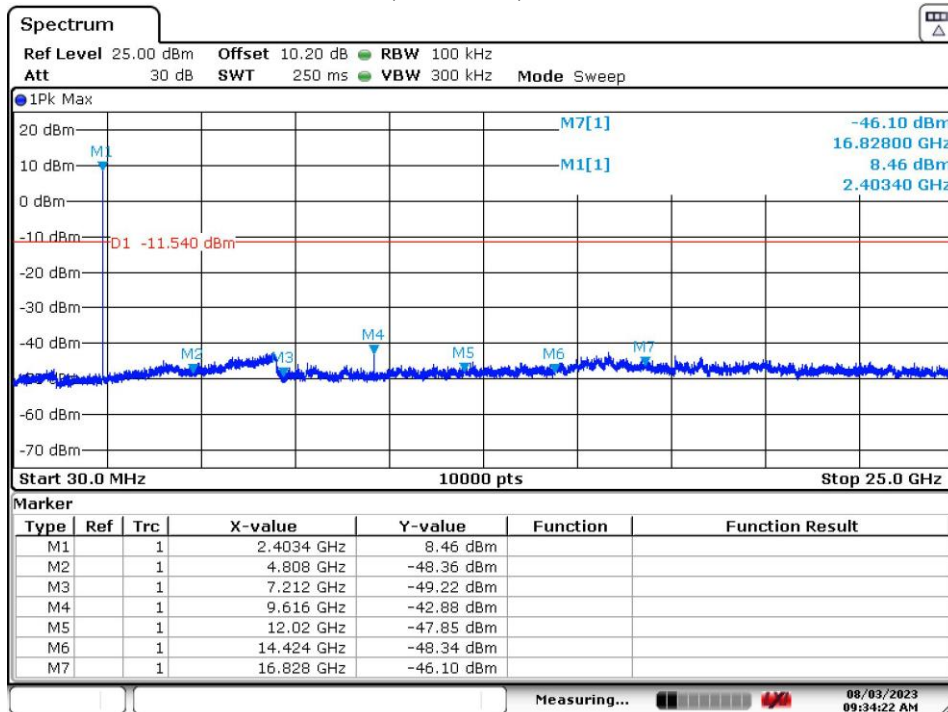


High Channel
CH38 (2478 MHz), QHS P2



Date: 3.AUG.2023 09:39:08

Low Channel
CH1 (2404 MHz), QHS P6



Date: 3.AUG.2023 09:34:22

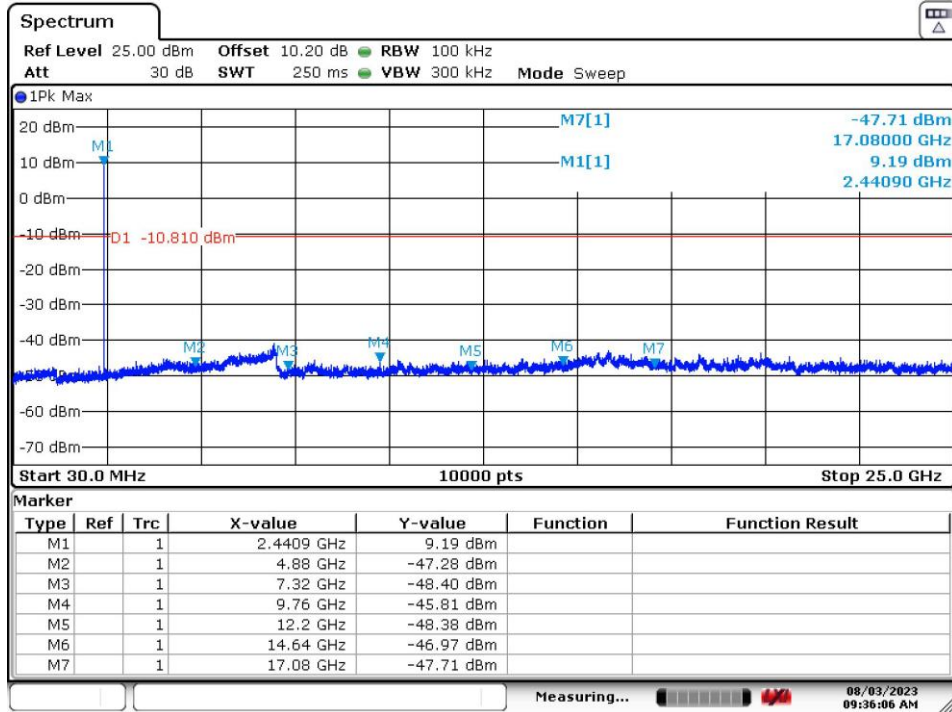


PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report

FCC ID: A94926R IC: 3232A-926R

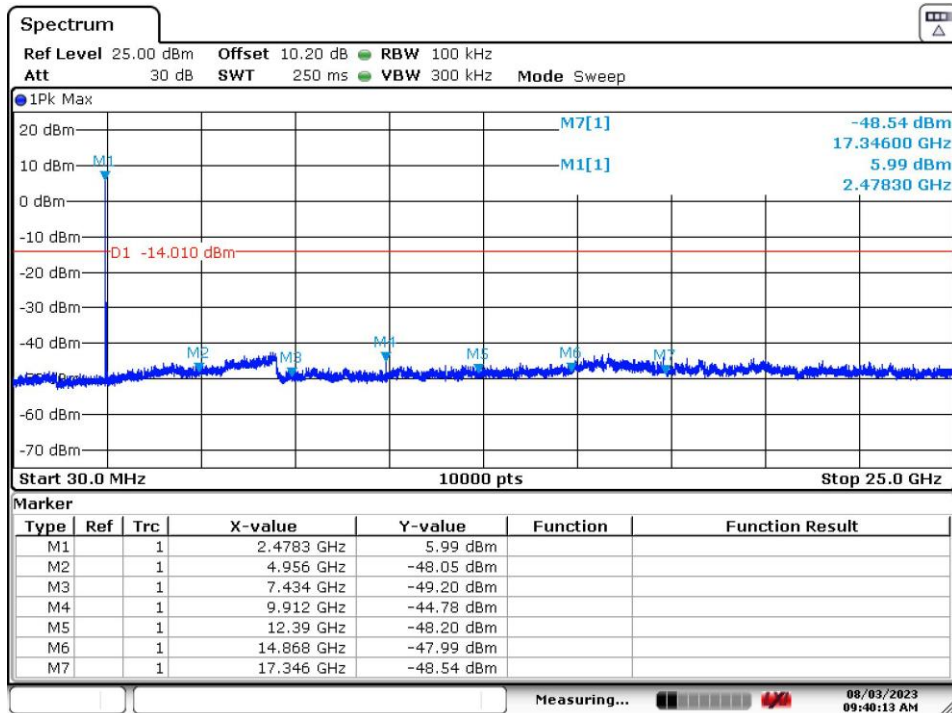


Mid Channel
CH18 (2440 MHz), QHS P6



Date: 3.AUG.2023 09:36:06

High Channel
CH38 (2478 MHz), QHS P6



Date: 3.AUG.2023 09:40:14

Emissions measured in both modes, on all channels, are more than 20 dBc, pass.



12. 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 6.3 to 6.6
RSS-Gen 6.13

For radiated emissions above 1 GHz the EUT is positioned 1.5m off the ground plane.
The EUT was evaluated in three orthogonal axis per ANSI C63.10 6.3.1.
The EUT was evaluated 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.

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.

For restricted band edge measurements, when the peak emissions are over the average limit, an additional plot is taken using the VB-A method of ANSI C63.10-2013 section 11.12.2.5.3. 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)
-	QHS	P2	2	1023	4.191	5.010	83.6	239
-	QHS	P6	6	1023	1.440	2.505	57.4	695

The VBW must be above 239 Hz to prove compliance for QHS 2P and 695 Hz to prove compliance for QHS P6.

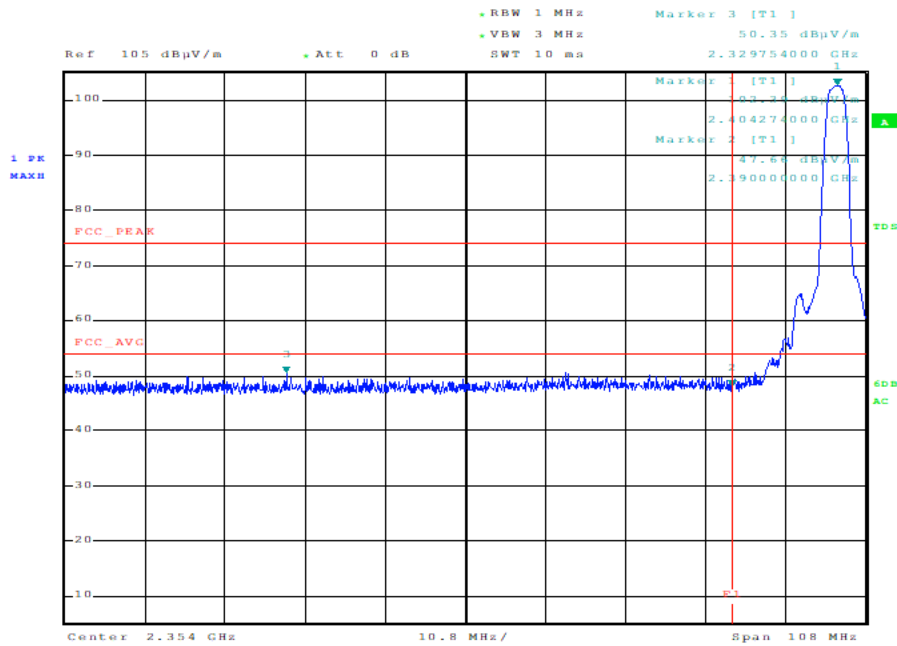


PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report



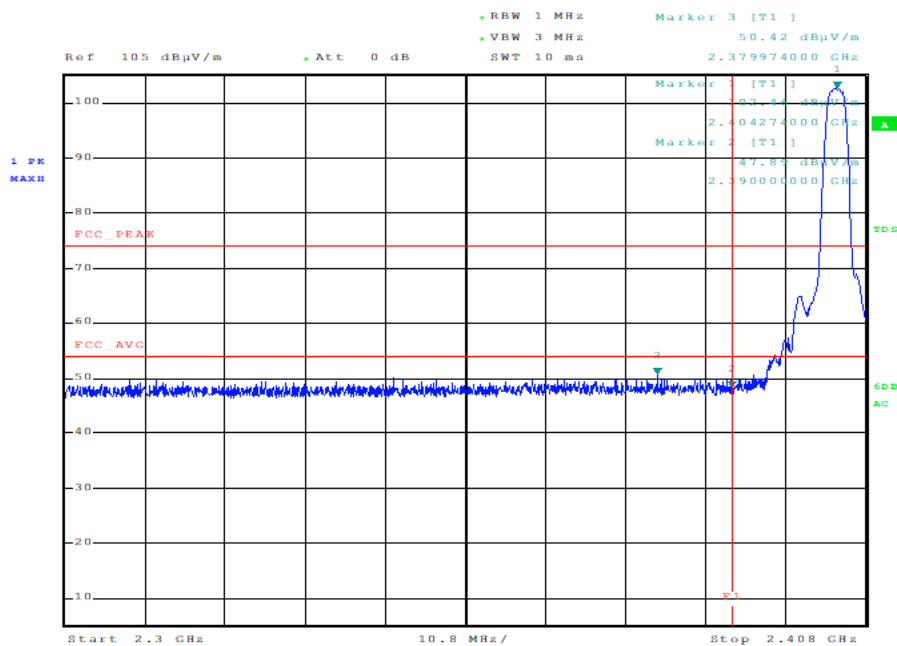
Radiated emissions 1 GHz to 25 GHz test results:

Lower restricted band: QHS P2 (CH1, 2404 MHz)



Date: 7.AUG.2023 14:29:16

Lower restricted band: QHS P6 (CH1, 2404 MHz)



Date: 7.AUG.2023 14:24:53

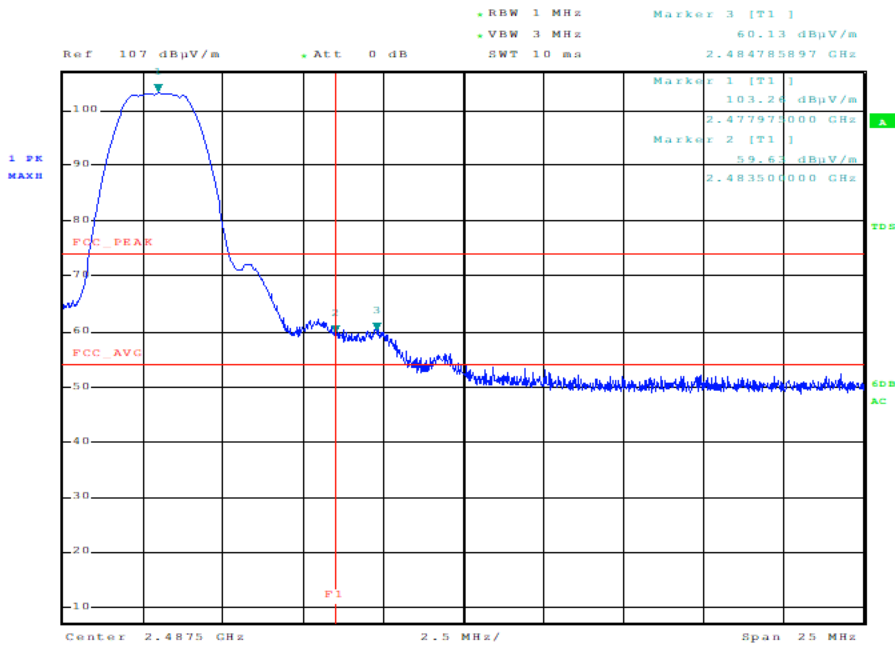
Peak emissions below Average limit



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

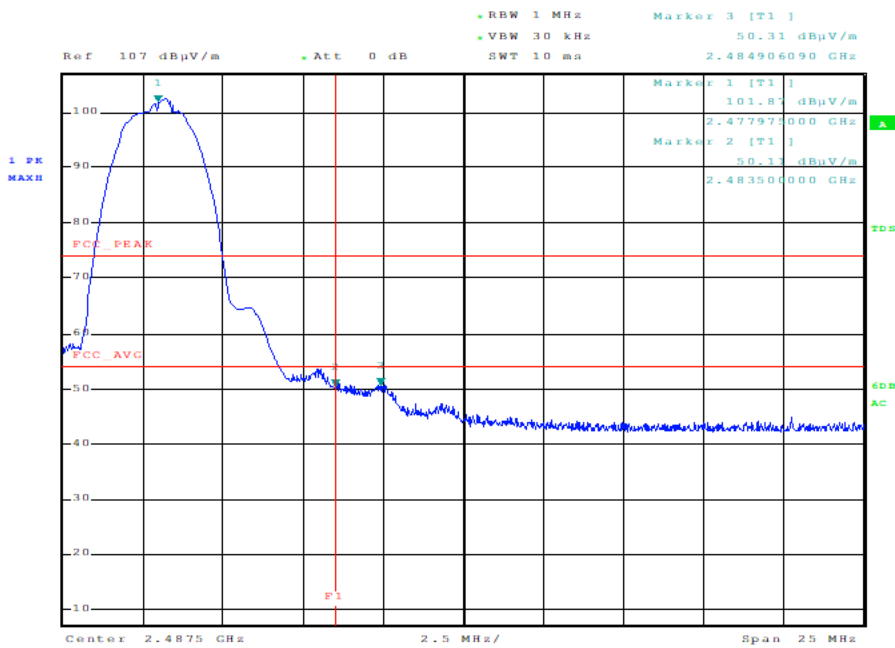


Upper restricted band: QHS P2 (CH38, 2478 MHz) – Peak



Date: 7.AUG.2023 13:52:45

Upper restricted band: QHS P2 (CH38, 2478 MHz) – VBW Average (30kHz VBW used)



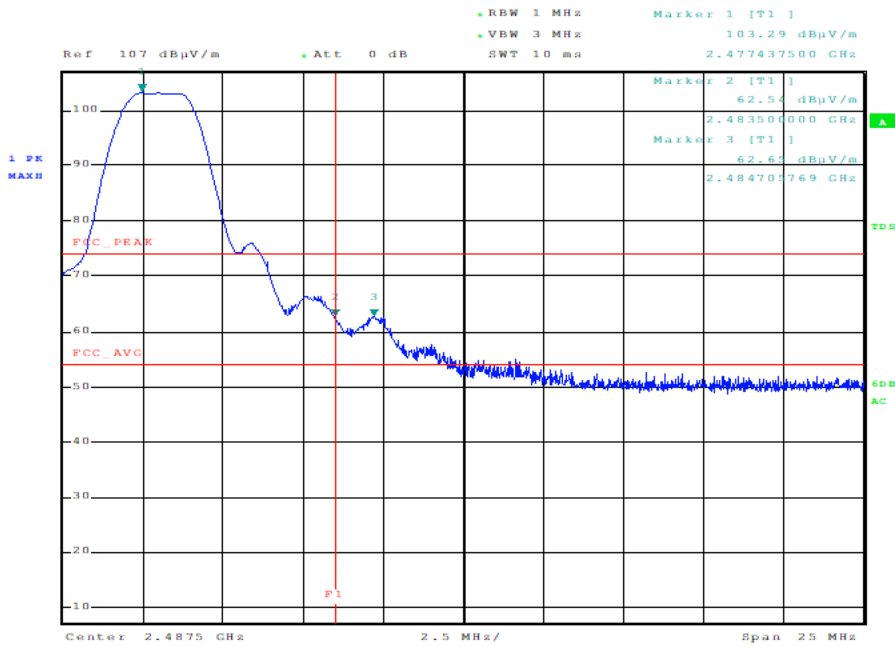
Date: 7.AUG.2023 13:53:29



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

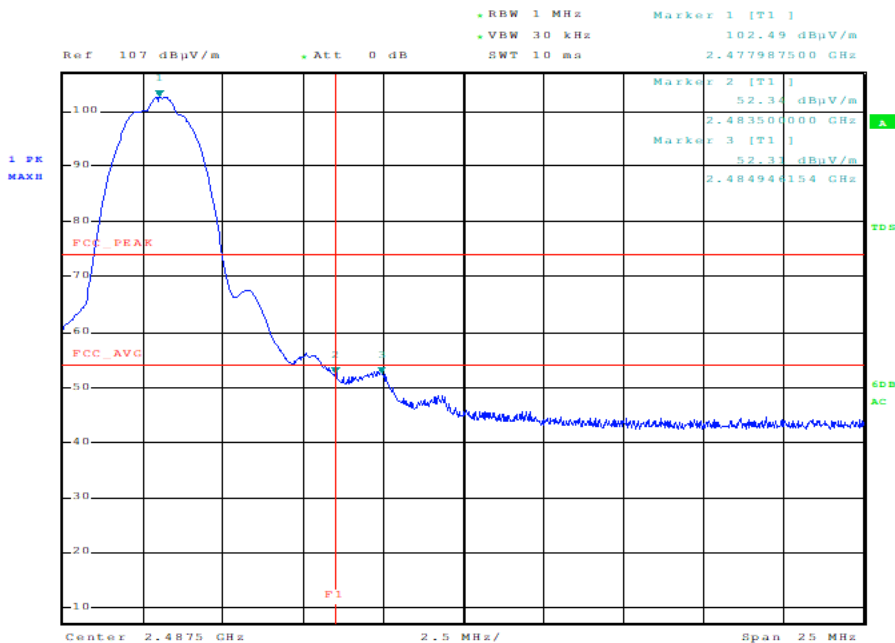


Upper restricted band: QHS P6 (CH38, 2478 MHz) – Peak



Date: 7.AUG.2023 13:57:13

Upper restricted band: QHS P6 (CH38, 2478 MHz) – VBW Average (30kHz VBW used)



Date: 7.AUG.2023 13:58:24



PRODUCT ASSURANCE ENGINEERING

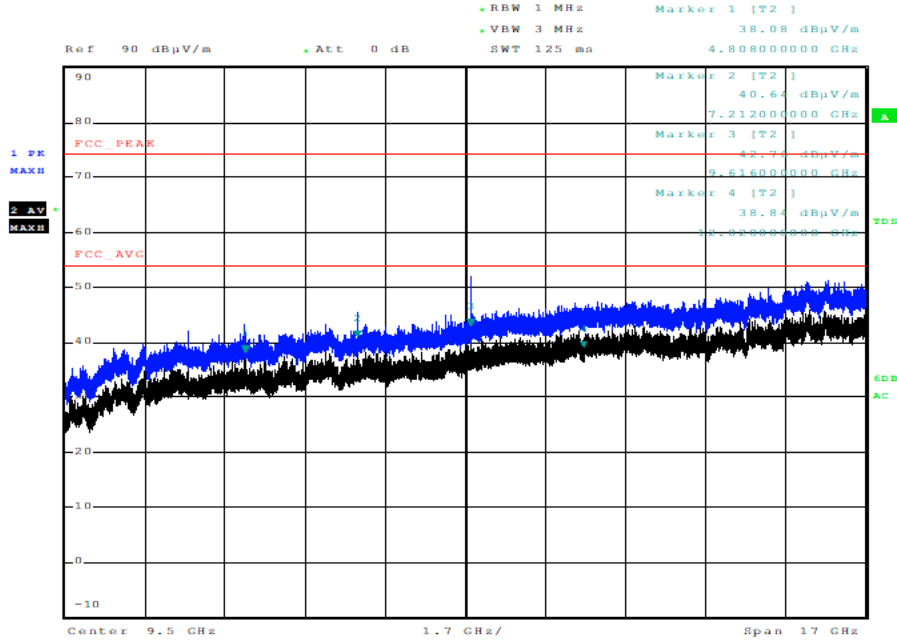
Wireless Transceiver Test Report



Radiated emissions 1 GHz to 18 GHz

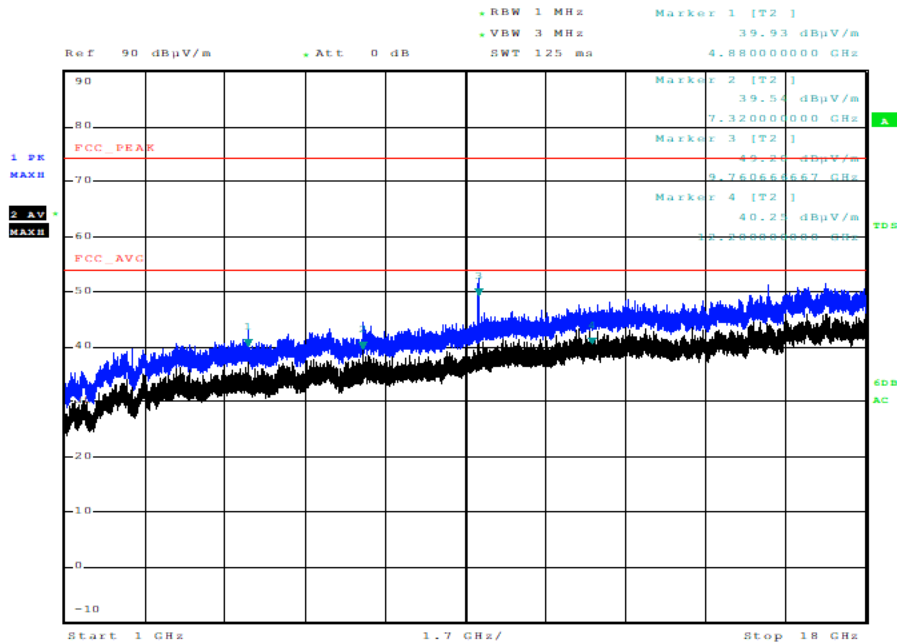
Blue trace is peak detector; black trace is average detector. (30,000 sweep points)
 Measurement noise floor more than 6 dB below the respective limits.

Low Channel (2404 MHz) QHS P6



Date: 8.AUG.2023 09:37:01

Mid Channel (2440 MHz) QHS P2



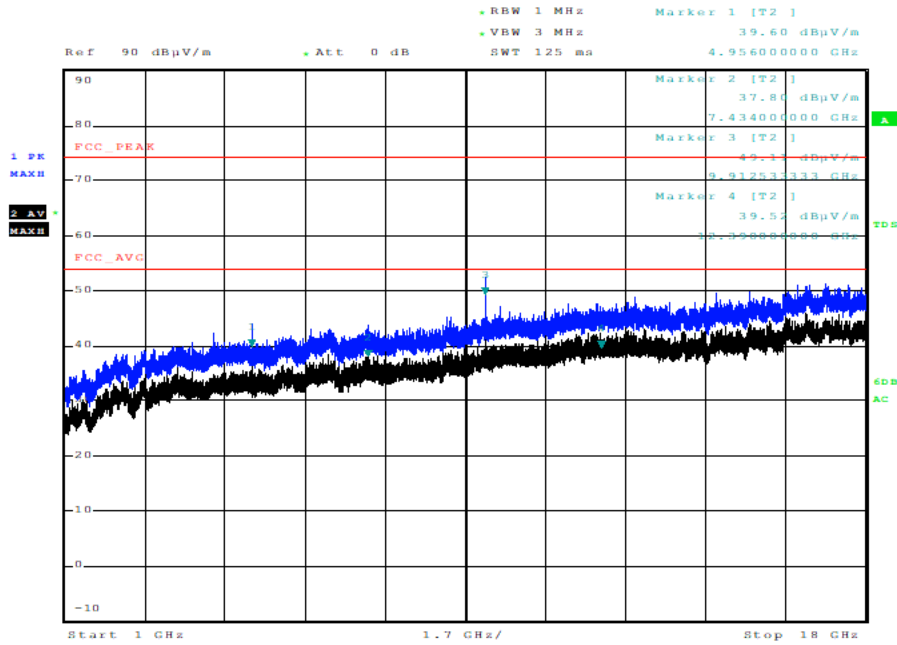
Date: 8.AUG.2023 09:43:16



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report



High Channel (2478 MHz) QHS P2



Date: 8.AUG.2023 09:47:54

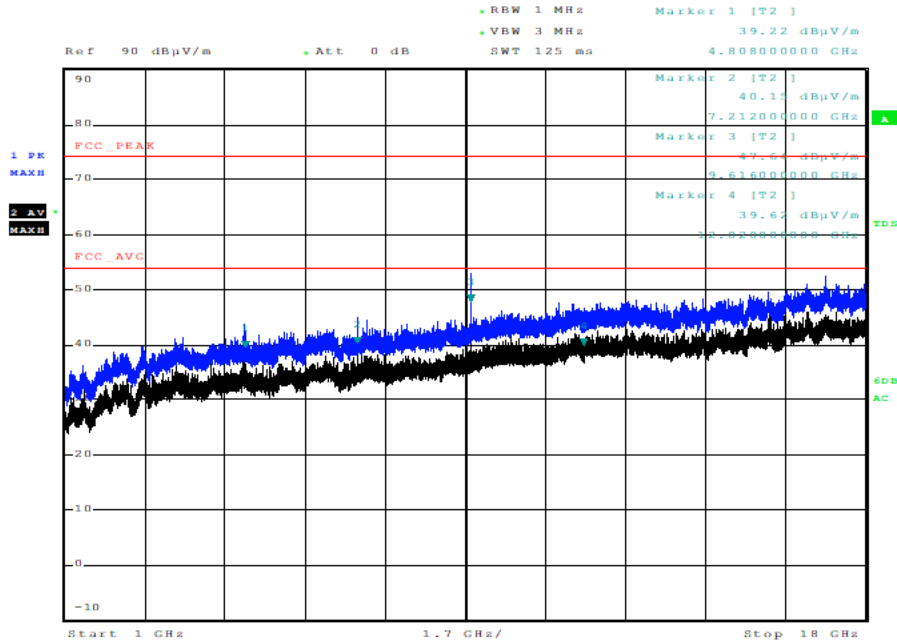
All Peak emissions below average limit, pass



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

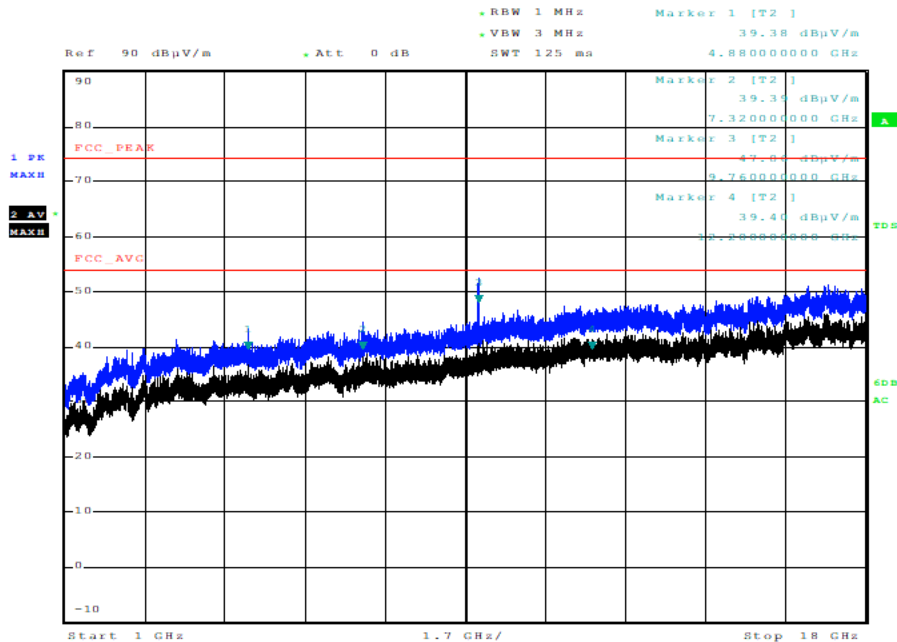


Low Channel (2404 MHz) QHS P6



Date: 8.AUG.2023 09:52:30

Mid Channel (2440 MHz) QHS P6



Date: 8.AUG.2023 09:56:51

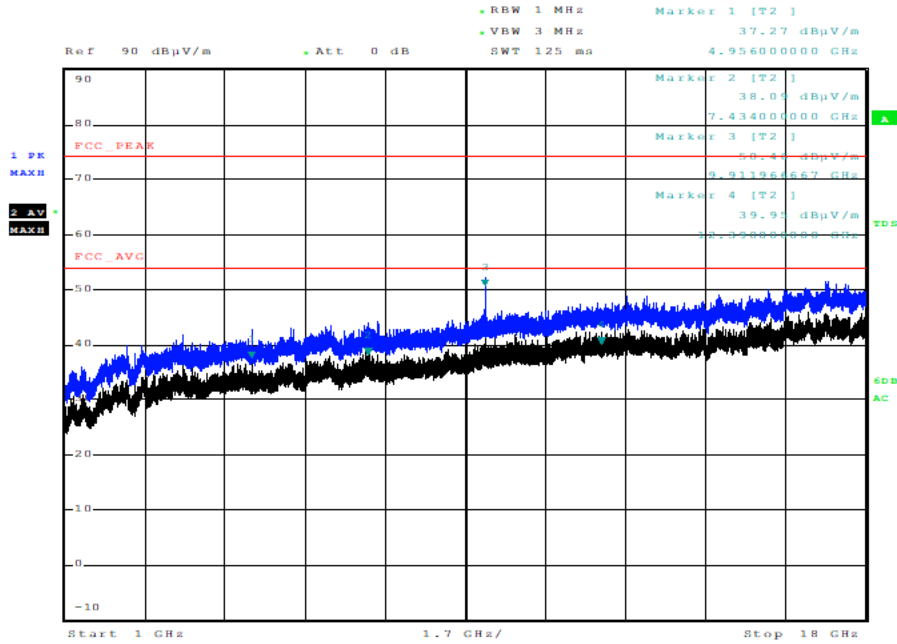
All Peak emissions below average limit, pass



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Wireless Transceiver Test Report

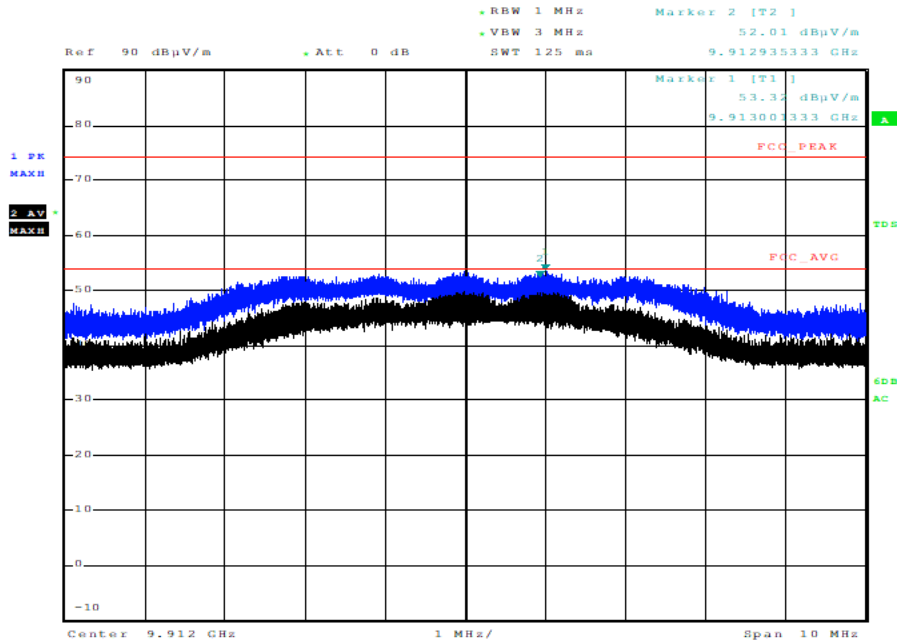


High Channel (2478 MHz) QHS P6



Date: 8.AUG.2023 10:01:56

Worst-Case Emission (9912MHz, High Ch QHS P6)



Date: 8.AUG.2023 10:02:49



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Wireless Transceiver Test Report

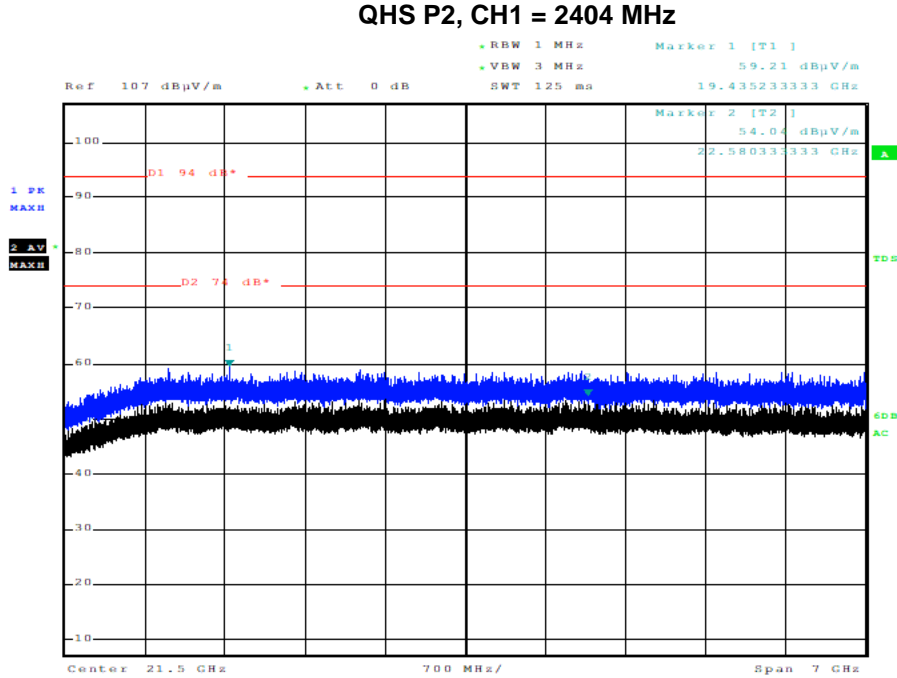


Radiated emissions 18 GHz to 25 GHz at 30-centimeter distance.

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 dBuV/m (Display line 1)

Average limit = 54 + 20 = 74 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.



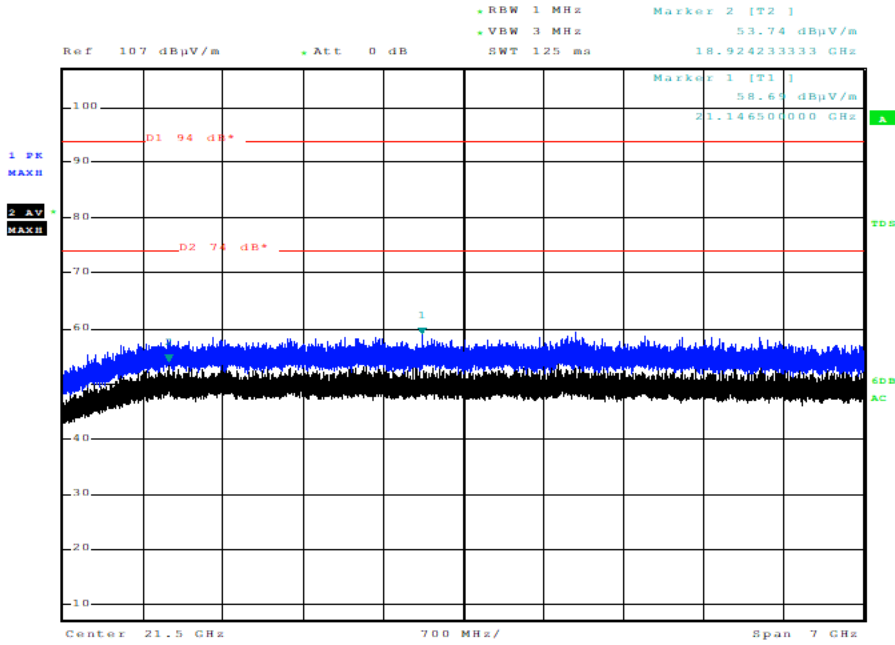
Date: 8.AUG.2023 11:23:07



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

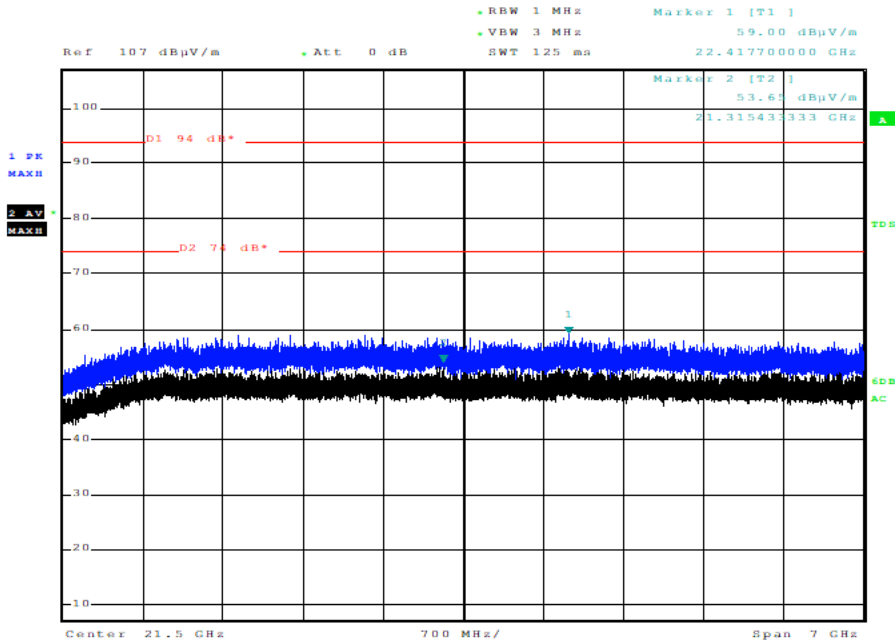


QHS P2, CH18 = 2440 MHz



Date: 8.AUG.2023 11:23:57

QHS P2, CH38 = 2478 MHz



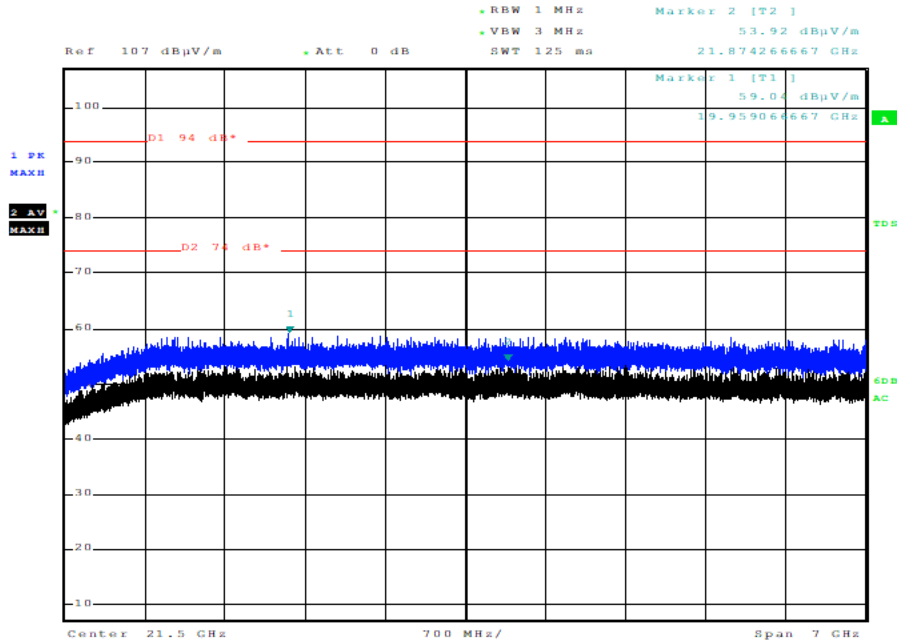
Date: 8.AUG.2023 11:24:43



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report

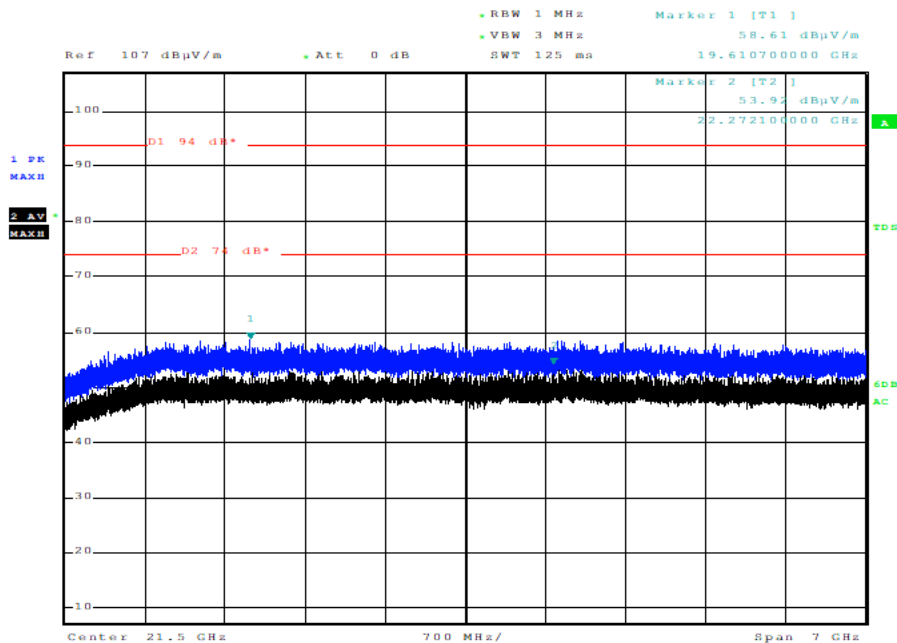


QHS P6, CH1 = 2404 MHz



Date: 8.AUG.2023 11:25:31

QHS P6, CH18 = 2440 MHz



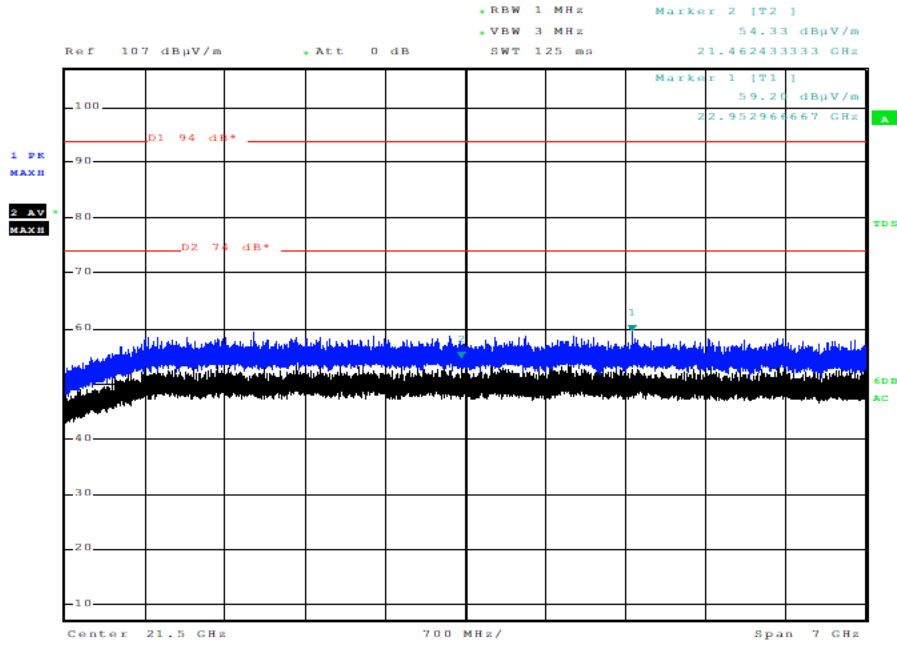
Date: 8.AUG.2023 11:26:12



PRODUCT ASSURANCE ENGINEERING Wireless Transceiver Test Report



QHS P6, CH38 = 2478 MHz



Date: 8.AUG.2023 11:27:03

All Peak Emissions measured are below the average limit.

13. Radiated Emissions 30 MHz to 1 GHz

Requirement:

FCC 15.205, 15.209

RSS-Gen Clause 8.9

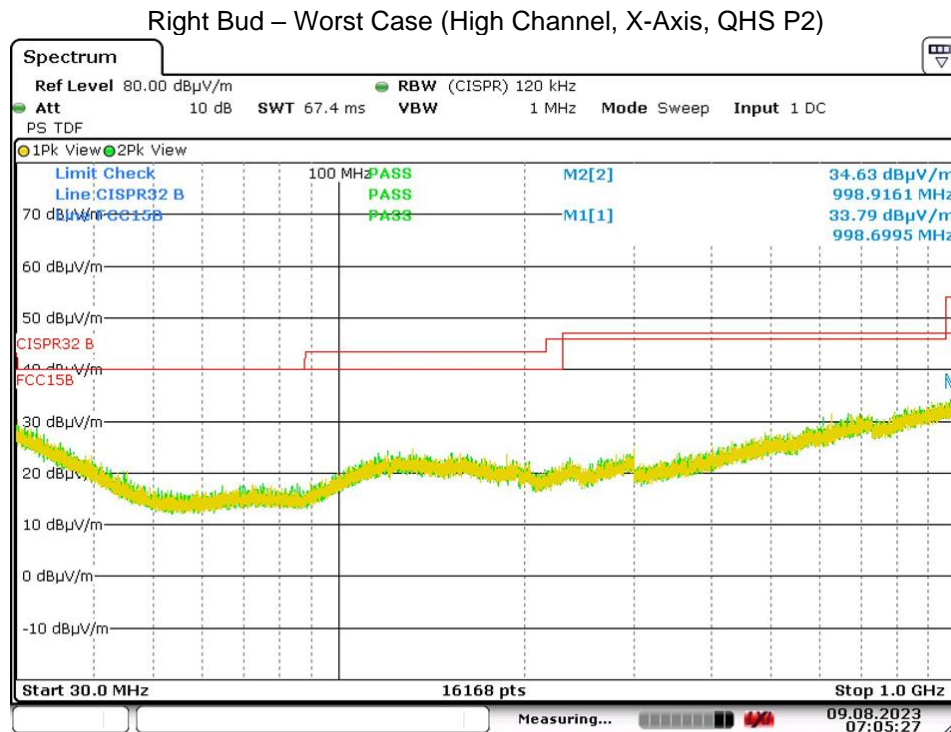
Measurement Method:

ANSI C63.10 Subclause 6.5.4

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 07:05:27

Peak emissions are more than 10 dB below the limits.

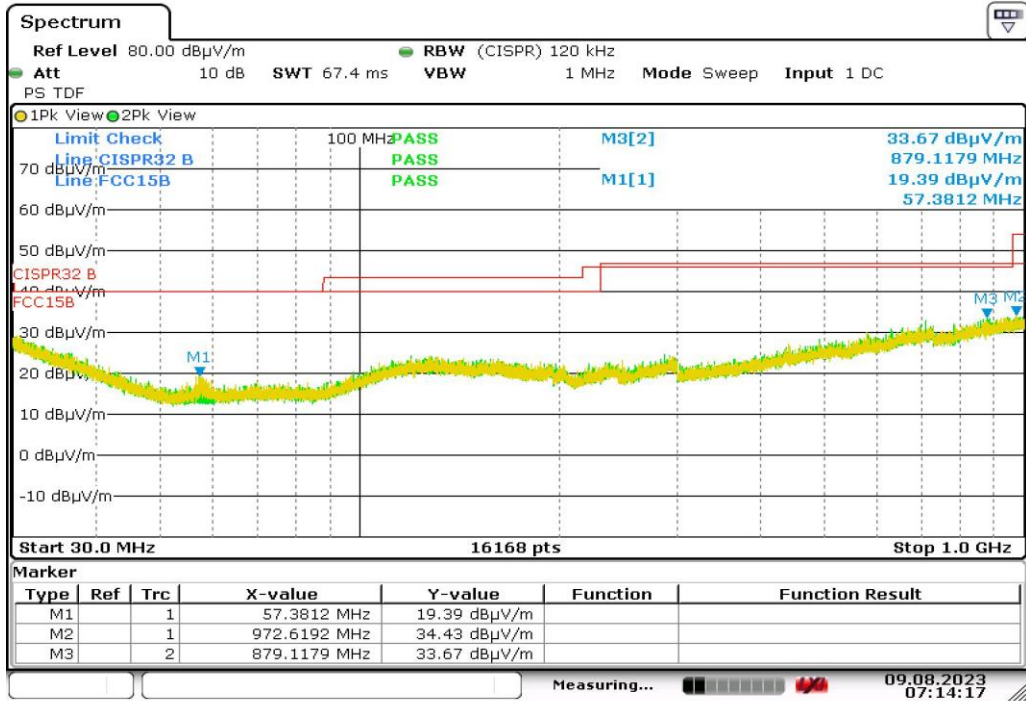


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Wireless Transceiver Test Report



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.



14. Conducted AC Mains Emission

Requirement:

FCC 15.207 (a)

RSS-Gen 8.8

Measurement Method:

ANSI C63.10 Subclause 6.2

AC Line conducted emissions test results:

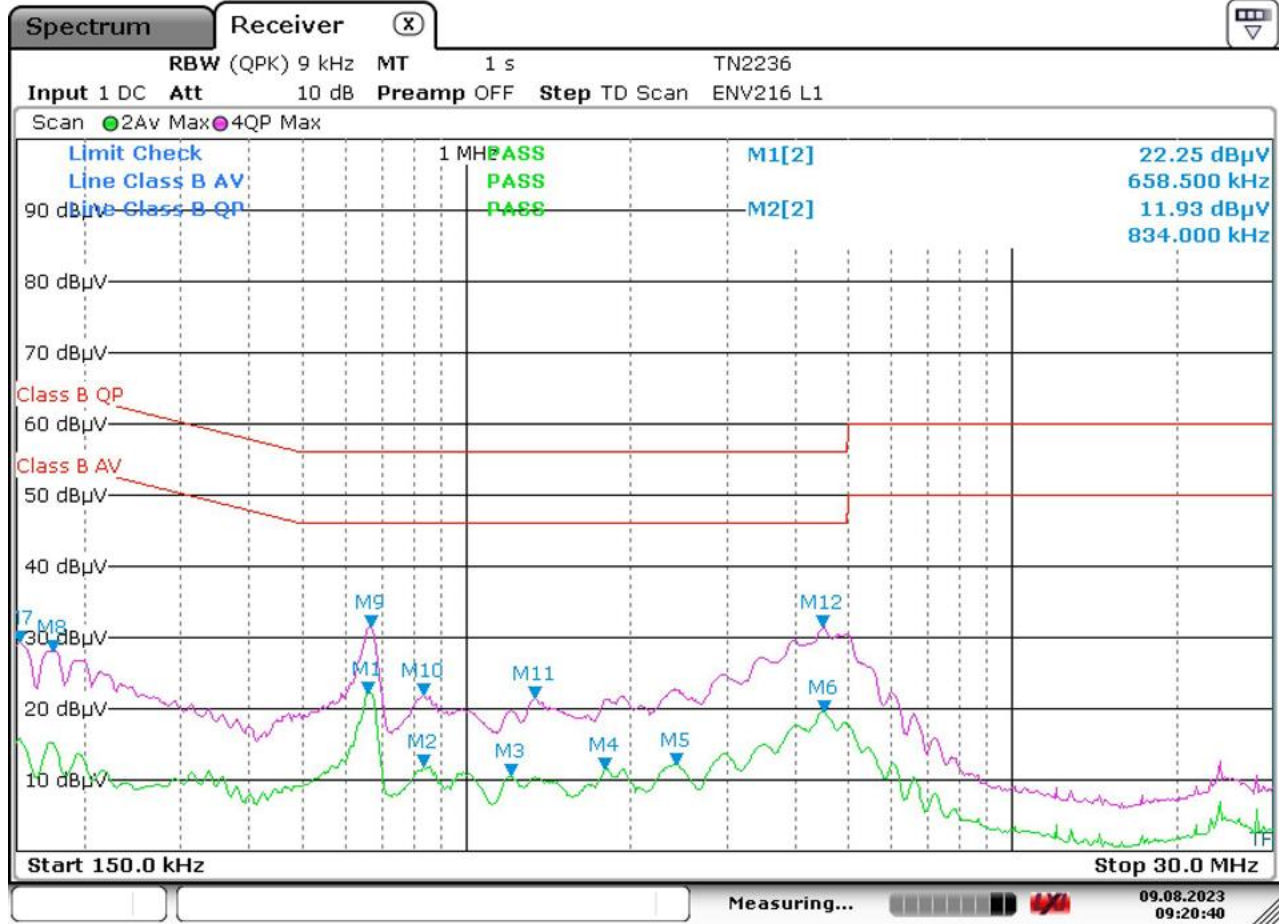
The EUT is not able to use BT or QHS technologies while charging, only BLE pairing is available while in the charging case and only the charging case connects to the AC Mains. The EUT was tested with the buds in the charging case and the BLE advertising active.



PRODUCT ASSURANCE ENGINEERING
Wireless Transceiver Test Report



120VAC 60Hz – Line

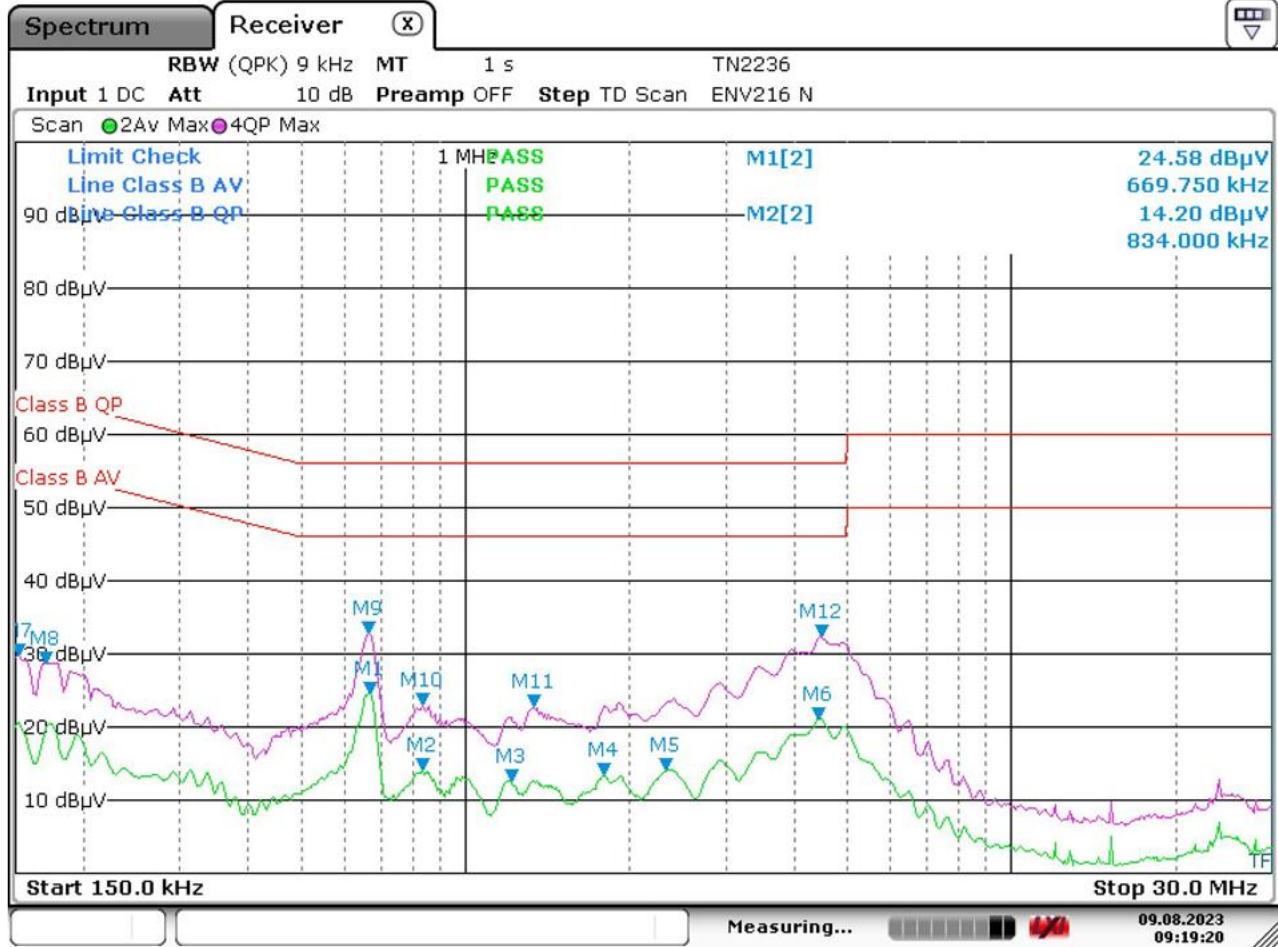


Date: 9.AUG.2023 09:20:41

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	

120VAC 60Hz – Neutral



Date: 9.AUG.2023 09:19:20

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	



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Wireless Transceiver Test Report



15. 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

16. 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

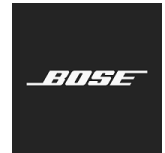
Uncertainty Budget				
Title: Radiated Emissions above 1 GHz				
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
RF spec anal-level-Ref.	0.6	Rect.	1.73	0.35
RF spec anal-level-Freq resp.	1.0	Rect.	1.73	0.58
RF spec anal-level-Display	0.3	Rect.	1.73	0.17
RF spec anal-level-QP 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



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End of Report