TEST REPORT

Report Number: 105786504MPK-001
Project Number: G105786504
Original Issue Date: June 25, 2024
Revision Date: December 19, 2024

Testing performed on
Rechargeable Toothbrush Handle
Model Number: HX742A

to

FCC Part 15 Subpart C (15.247)
ISED RSS-247 Issue 3

For

Philips Oral Healthcare LLC

Test Performed by:	**Test Authorized by:**
Intertek	Philips Oral Healthcare LLC
1365 Adams Court	22100 Bothell Everett Highway
Menlo Park, CA 94025 USA	Bothell, WA 98021 USA

Prepared by: Erica Chan **Date:** June 25, 2024

Erica Chan

Reviewed by: **Date:** June 25, 2024

Anderson Soungpanya

Report No. 105786504MPK-001	
Equipment Under Test:	Rechargeable Toothbrush Handle
Model Number:	HX742A
Applicant:	Philips Oral Healthcare LLC
Contact:	David Rodriguez
Address:	Philips Oral Healthcare LLC 22100 Bothell Everett Highway Bothell, WA 98021 USA
Country:	USA
Tel. Number:	(425) 487-7000
Email:	david.rodriguez@philips.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 3
Date of Test:	May 22, 2024 – May 31, 2024

We attest to the accuracy of this report:

Erica Chan
EMC Engineer

Anderson Soungpanya
EMC Team Leader

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1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
RF Output Power	15.247(b)(3)	RSS-247, 5.4.d)	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.a)	Complies
Power Density	15.247(e)	RSS-247, 5.2.b)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: April 15, 2024

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: May 22, 2024

Test completion date: May 31, 2024

The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

Philips Oral Healthcare LLC supplied the following description of the EUT:

The Philips HX742A is a rechargeable electric toothbrush that is inductively charged. Bluetooth connectivity allows the toothbrush to be connected to an app which provides real-time guidance on pressure, motion, position, duration and frequency of brushing. The toothbrush also tracks the brush head usage through RFID to alert the user when the heads need to be replaced.
For more information, see user's manual provided by the manufacturer.

This test report covers only the 2.4GHz BLE radio.

Information about the BLE radio is presented below:

Radio Information	
Applicant	Philips Oral Healthcare LLC
Model Number	Rechargeable Toothbrush Handle
Modulation Technique	Digital Transmission System (DTS)
Rated RF Output	0 dBm
Frequency Range	2402 – 2480 MHz
Type of modulation	GFSK
Data Rate	1 Mbit/s
Number of Channel(s)	40
Antenna(s) & Gain	Internal Antenna, Gain: 1.443 dBi
Applicant Name & Address	Philips Oral Healthcare LLC 22100 Bothell Everett Highway Bothell, WA 98021 USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents "Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247" (KDB 558074 D01 DTS Meas Guidance v05r02), and RSS-247 Issue 3, RSS-GEN Issue 5.

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this report.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions – antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)			
	0.15 MHz – 30MHz	30 – 200 MHz	200 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

3.0 System Test Configuration

3.1 Equipment Under Test (EUT) & Support Equipment

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number/ID**
Rechargeable Toothbrush Handle– Conducted Unit	Philips Oral Healthcare LLC	HX742A	BLE-004, BLE-005
Rechargeable Toothbrush Handle – Radiated Unit	Philips Oral Healthcare LLC	HX742A	BLE-007, BLE-008

Support Equipment		
Description	**Manufacturer**	**Model**
Toothbrush Head	Philips Oral Healthcare LLC	C3
Base Charger	Philips Oral Healthcare LLC	HX6100 ABA1

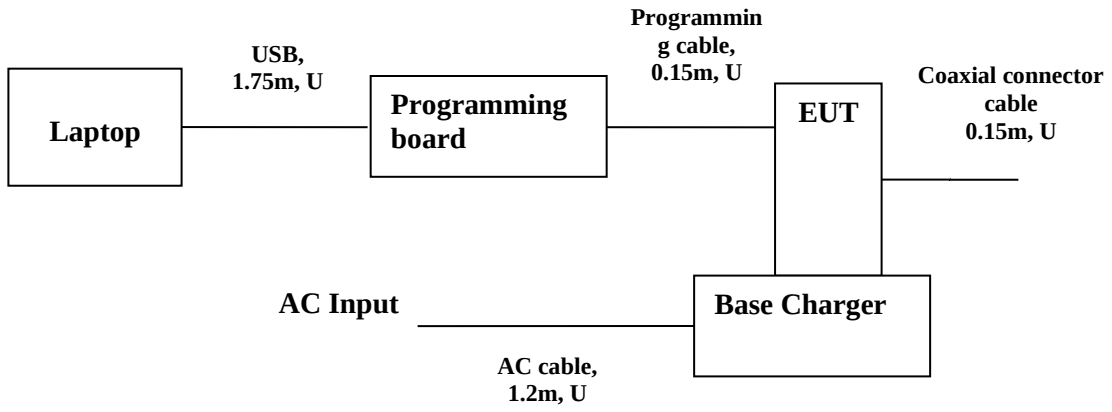
3.2 Variant Models

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

Description	Model	Remarks
Full Set product type reference	HX710n, HX711n, HX740n, HX741n, HX742n	Full Set is identified by type reference HX710n, HX711n, HX740n, HX741n, HX742n Where the last character n, is an alphanumeric character which differences are only for marketing purposes.
Power Toothbrush Handles Codes	HX710x, HX711x, HX740x, HX741x, HX742x	Handle HX742A is the representative model for testing. Toothbrush handles HX710x, HX711x, HX740x, HX741x, HX742x, Where x, is an alphanumeric character which differences are only for the handle color.
Toothbrush Base Charger	HX6100 ABA1	HX6100 ABA1 is the representative model for testing for: HX6100 AFA1, HX6100 AFA2 models. Where F can be B or C or blank, which are for different factory purposes. When B is for factory Bao Hui Science & Technology Co., Ltd. When C is for factory PI ELECTRONICS (VIETNAM) COMPANY LIMITED When blank is for factory PI Electronics (China Plant)
Toothbrush Base DC Charger	HX6110 ABA3	Model HX6110 ABA3 is representative model of testing for: HX6110 AFA3 models. Model of HX6110 AFA3 explanation, where F can be B or C or blank are not safety or EMC relevant, they are for different factories. When F = B is for factory of Bao Hui Science & Technology Co., Ltd. When F= C is for factory of PI ELECTRONICS (VIETNAM) COMPANY LIMITED When F = blank is for factory of PI Electronics (China Plant)
Toothbrush Base DC Charger	HX6110 ADB3	Model ADB3 is representative model of testing for: HX6110 AFB3. Model HX6110 AFB3, where F can be D or E are not safety or EMC relevant, they are the for different manufacturing locations: When F = D. Dongguan Aohai Technology Co.,Ltd Jiaoyitang No 2 Yinyuan Road, No 2 Yinyuan Road, Dongguan, Guangdong Sheng, 523723, China When F = E. Pt Aohai Technology Indonesia Kawasan Industri Tunas 1 No.C, Belian Batam Kota, Kota Batam Kepulauan Riau, Kepulauan Riau, Indonesia
Toothbrush Travel Charger	HYTC02	HYTC02 is the representative model for testing for: HYTC01. HYTC01 is electrically and mechanically identical the only difference is the color: 01 = white 02 = Black
Wall Adaptor	WAA2001	Model WAA2001 is the representative model for testing. Model WAA1001 (SSW-2924xx-WH), WAA2001 (SSW-2924xx-BK). The xx can be EU, UK2, UK3, AU, US, JP, TW, CN which represents different plug portion. All models are identical to WWA1001 (SSW-29254EU-WH) except for the differences of plug portion and PCB layout version.

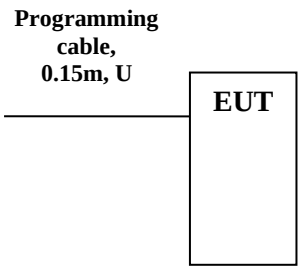
3.3 Block Diagram of Test Setup

Conducted Setup



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Meter

Radiated Setup



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Meter

EUT Photos

3.4 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. Different orientations of the EUT were tested and only the worse-case emissions were reported.

The EUT was tested in 1 configuration with EUT in horizontal and upright positions:

3.5 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Philips Oral Healthcare LLC.

3.6 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously using the RF power setting provided by the manufacturers using a laptop with proprietary software. . The corresponding output power in dBm can be found in section 4.2 of this report.

The table below reflects the RF power setting needed to be compliant with requirements of FCC 15.247.

Mode	Frequency (MHz)	Channel	EUT RF Setting
Low	2402	37	21 (hex15)
Mid	2440	17	21 (hex15)
High	2480	39	21 (hex15)

3.7 Modifications Required for Compliance

No modifications were made by the manufacturer or Intertek to the EUT in order to bring the EUT into compliance.

3.8 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

4.1 16-dB Bandwidth and 99% Occupied Bandwidth
FCC Rule: 15.247(a)(2); RSS-247, 5.2.a) and RSS-GEN;

4.1.1 Requirement
The minimum 6-dB bandwidth shall be at least 500 kHz

4.1.2 Procedure
A spectrum analyzer was connected to the antenna port of the transmitter.

For FCC 6dB Channel Bandwidth the Procedure described in the FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used to determine the DTS occupied bandwidth. Section 11.8.1 Option 1 of ANSI 63.10 was used.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Settings used:

RBW	100 kHz
VBW	300 kHz
Sweep time	Auto
Detector Type	Peak
Trace type	Max hold

For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

Settings used:

RBW	10 kHz
VBW	30 kHz
Sweep time	Auto
Detector Type	Peak
Trace type	Max hold

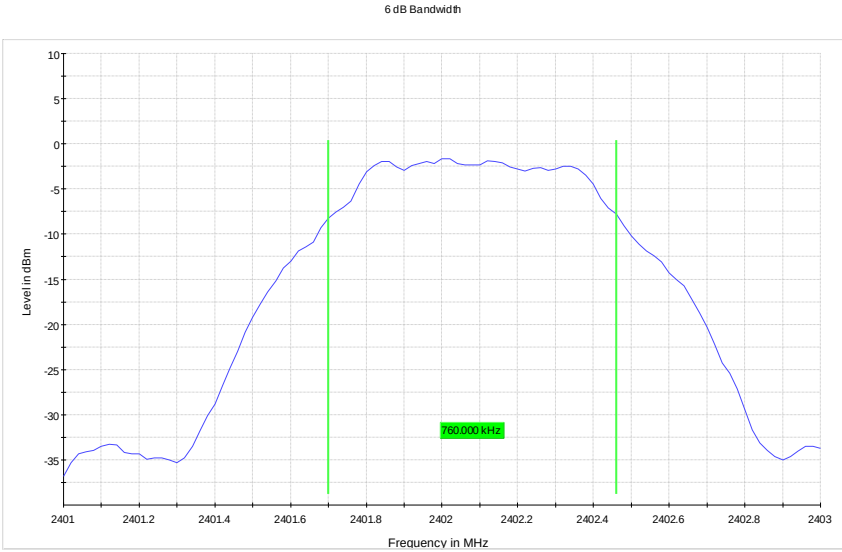
4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	760.000		1.1
		1.0025	1.2
2440	700.000		1.3
		1.0025	1.4
2480	780.000		1.5
		1.0025	1.6

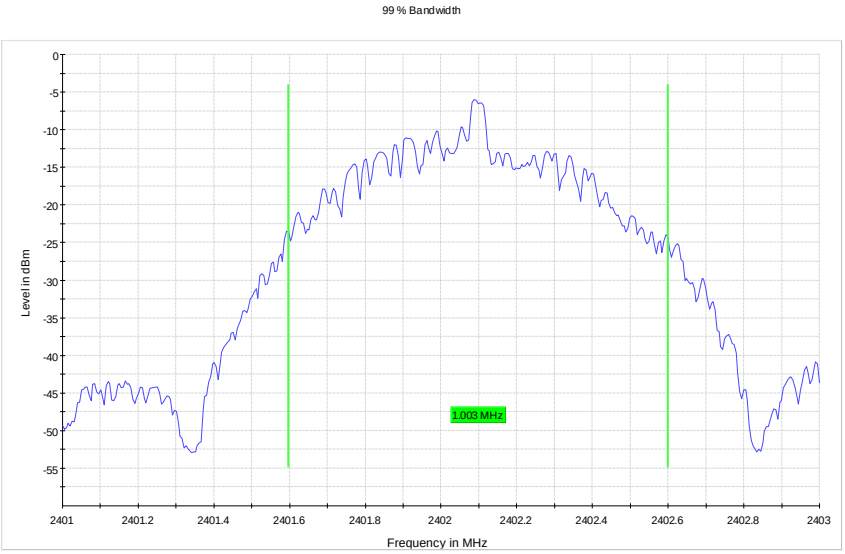
Tested By	Test Date	Results
Erica Chan	May 22, 2024	Complies

Occupied Bandwidths – 2402 MHz Low Channel

Plot 1.1 – 6dB Bandwidth (FCC)

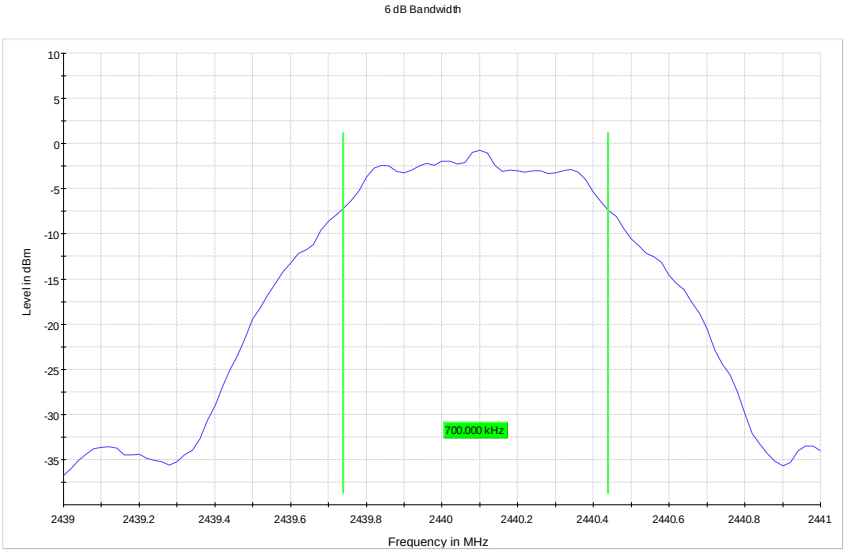


Plot 1.2 – 99% Bandwidth

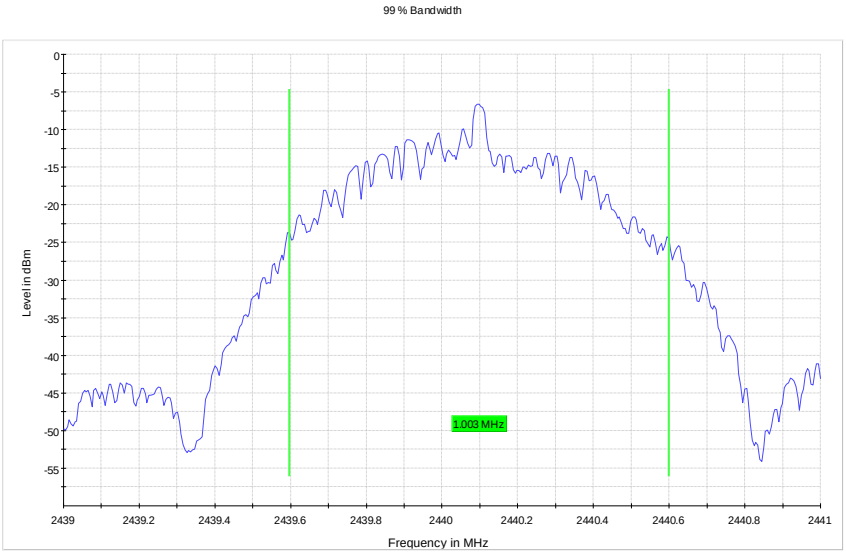


Occupied Bandwidths - 2440 MHz Mid Channel

Plot 1 3 – 6dB Bandwidth (FCC)

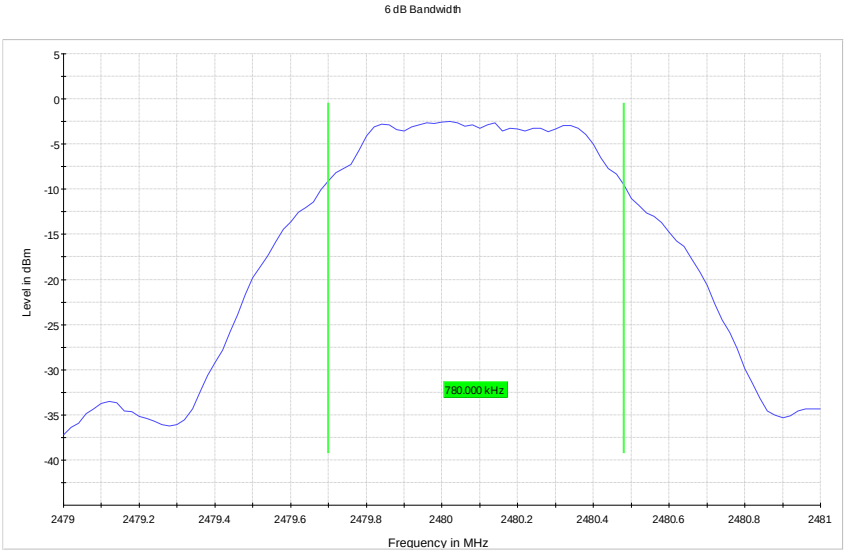


Plot 1.4 – 99% Bandwidth

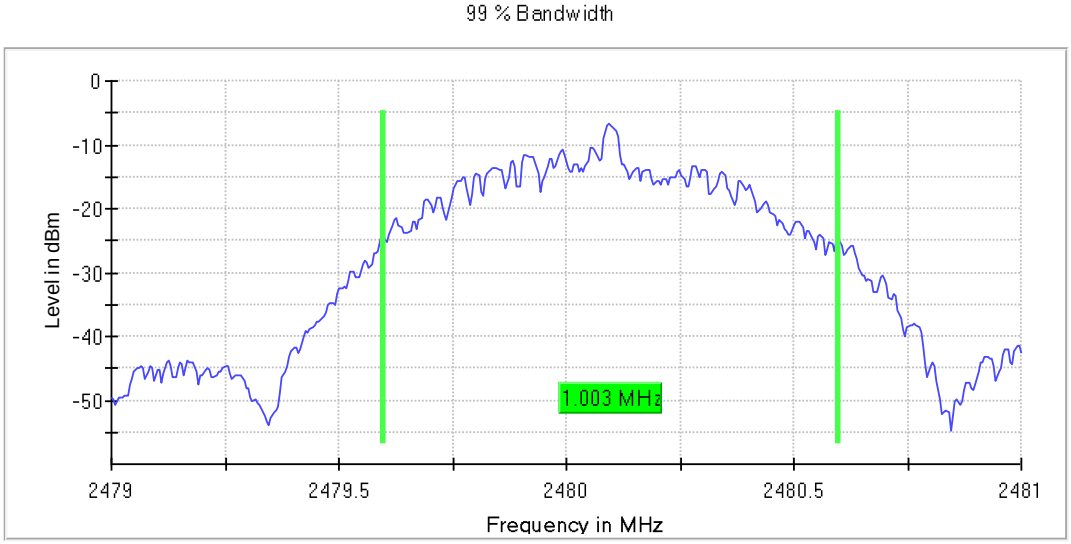


Occupied Bandwidths - 2480 MHz High Channel

Plot 1.5 – 6dB Bandwidth (FCC)



Plot 1.6 – 99% Bandwidth



4.2 Maximum Conducted Output Power at Antenna Terminals

FCC Rule: 15.247(b)(3); RSS-247, 5.4.d);

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).
For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Maximum Conducted Transmitter Output Power. The offset programmed on the analyzer is corrected to include cable loss, attenuator and duty cycle correction.

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used. Specifically, section 11.9.1.1 in ANSI 63.10 when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement.

The procedure for this method is as follows:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level

Settings used:

RBW	1 MHz
VBW	3 MHz
Sweep time	Auto
Detector Type	Peak
Trace type	Max hold

4.2.3 Test Result

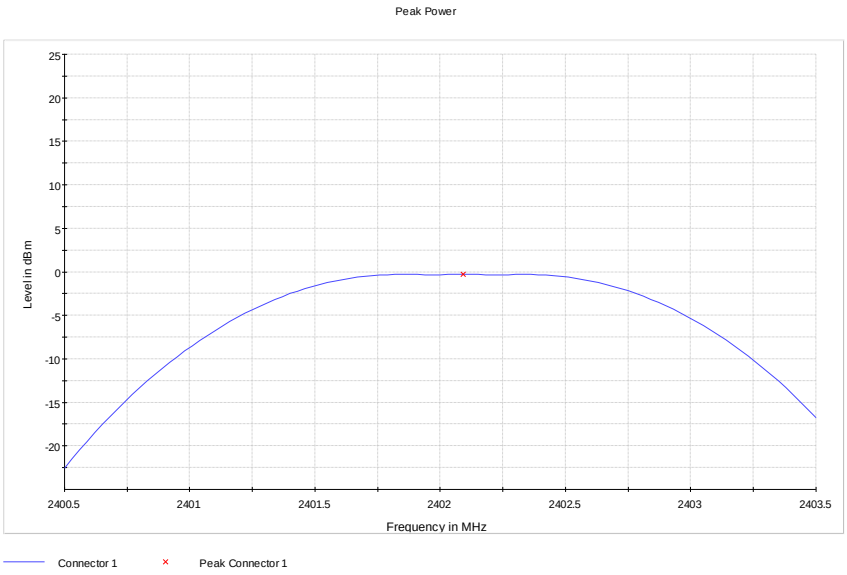
Frequency	Conducted Power (peak)		Plot
MHz	dBm	mW	
2402	-0.3	0.9332	2.1
2440	-0.6	0.8710	2.2
2480	-0.9	0.8128	2.3

Tested By	Test Date	Results
Erica Chan	May 22, 2024	Complies

Refer to the following plots 2.1 – 2.3 for the test details.

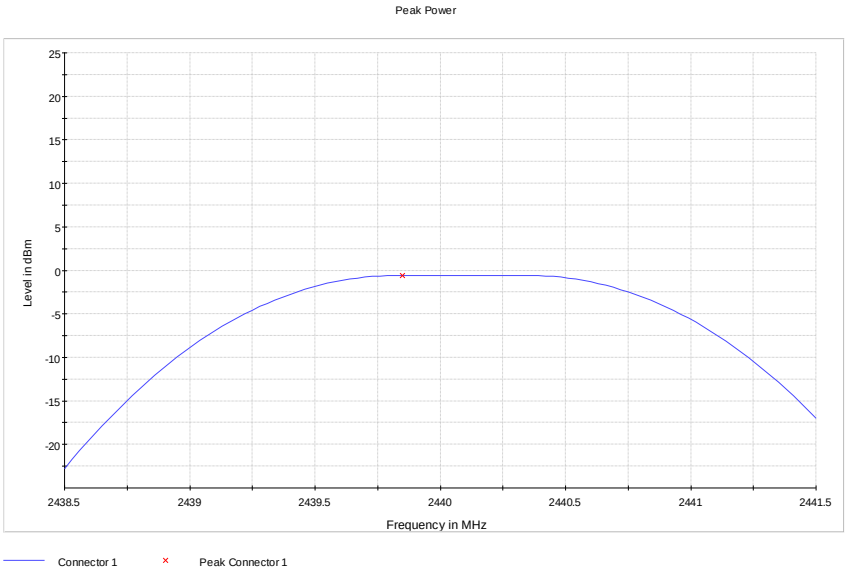
Peak Output Power - 2402 MHz Low Channel

Plot 2. 1



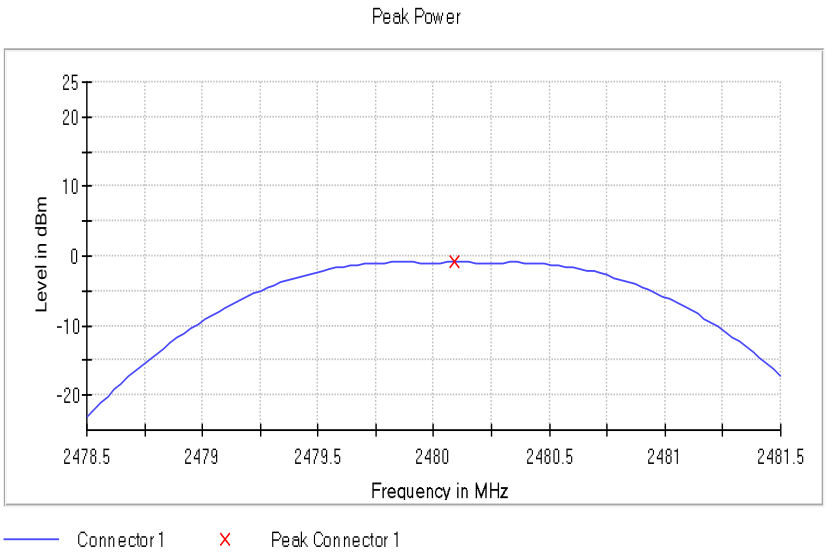
Peak Output Power - 2440 MHz Mid Channel

Plot 2. 2



Peak Output Power - 2480 MHz High Channel

Plot 2. 3



4.3 Power Spectral Density

FCC: 15.247 (e); RSS-247, 5.2.b);

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Transmitter Power Density (PSD). The offset programmed on the analyzer is corrected to include cable loss, attenuator.

The procedure described in FCC Publication FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.10.2 Method PKPSD (peak PSD) of ANSI 63.10.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Settings used:

RBW	10 kHz
VBW	30 kHz
Sweep time	Auto
Detector Type	Peak
Trace type	Max hold

4.3.3 Test Result

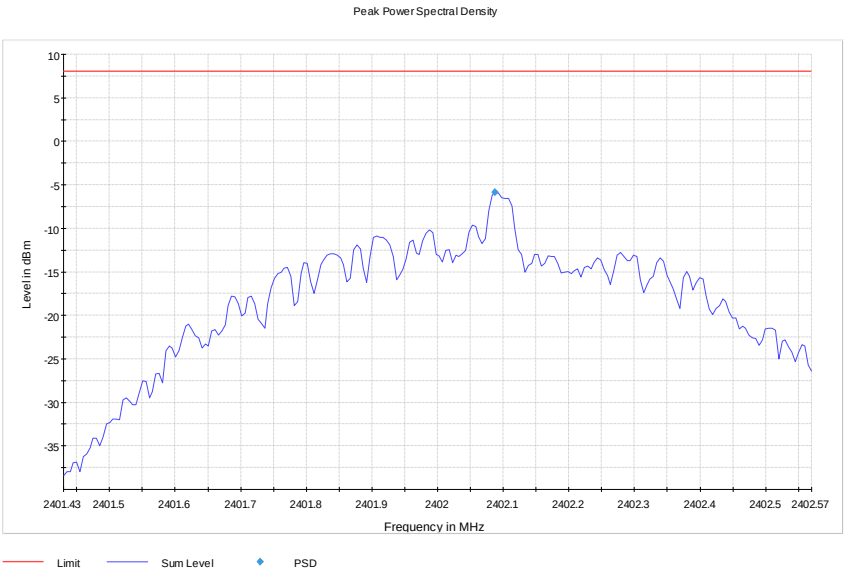
Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2402	-5.84	8.0	-13.84	3.1
2440	-6.61	8.0	-14.61	3.2
2480	-6.69	8.0	-14.69	3.3

Tested By	Test Date	Results
Erica Chan	May 22, 2024	Complies

Refer to the following plots 3.1 – 3.3 for test details.

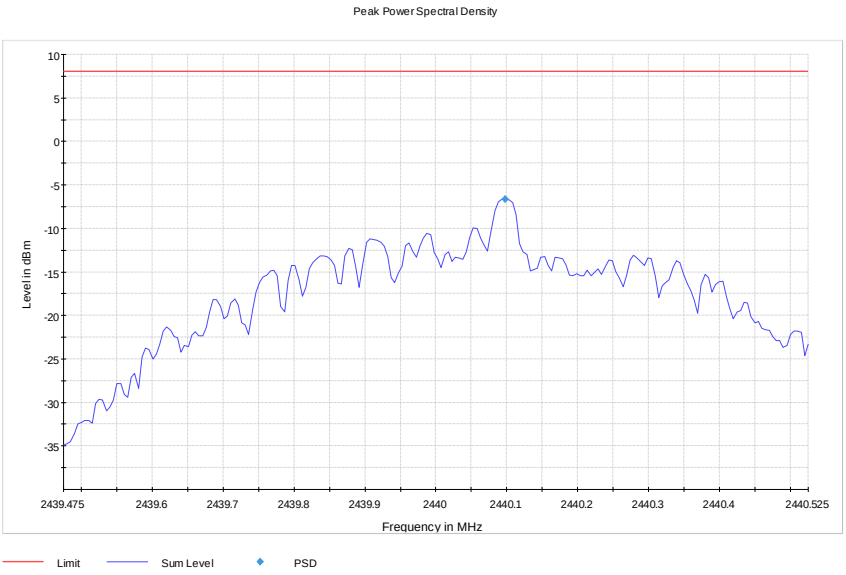
Peak Power Spectral Density - 2402 MHz Low Channel

Plot 3. 1



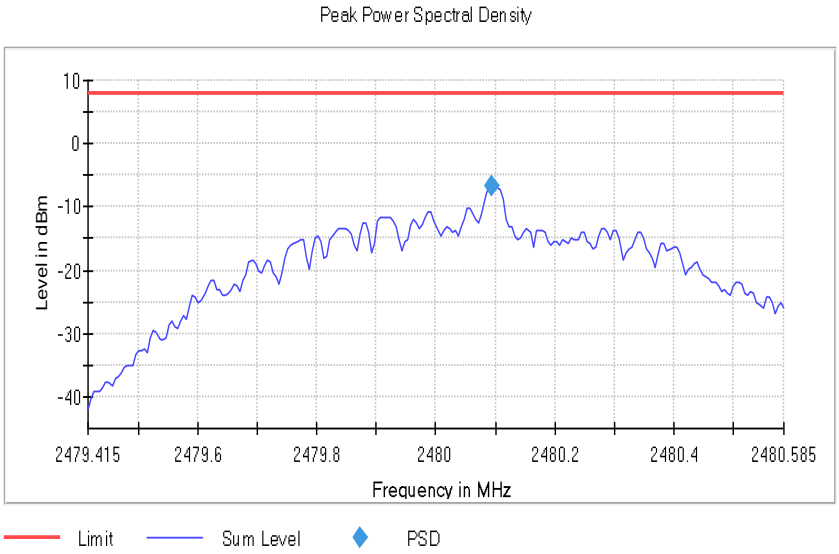
Peak Power Spectral Density - 2440MHz Mid Channel

Plot 3. 2



Peak Power Spectral Density - 2480 MHz High Channel

Plot 3. 3



4.4 Out-of-Band Conducted Emissions
FCC: 15.247(d); RSS-247, 5.5;

4.4.1 Requirement

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

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)

4.4.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.11 DTS Emissions in non-restricted frequency bands of ANSI 63.10.

A spectrum analyzer was connected to the antenna port of the transmitter.

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 3 x RBW.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Settings used:

RBW	100 kHz
VBW	300 kHz
Sweep time	Auto
Detector Type	Peak
Trace type	Max hold

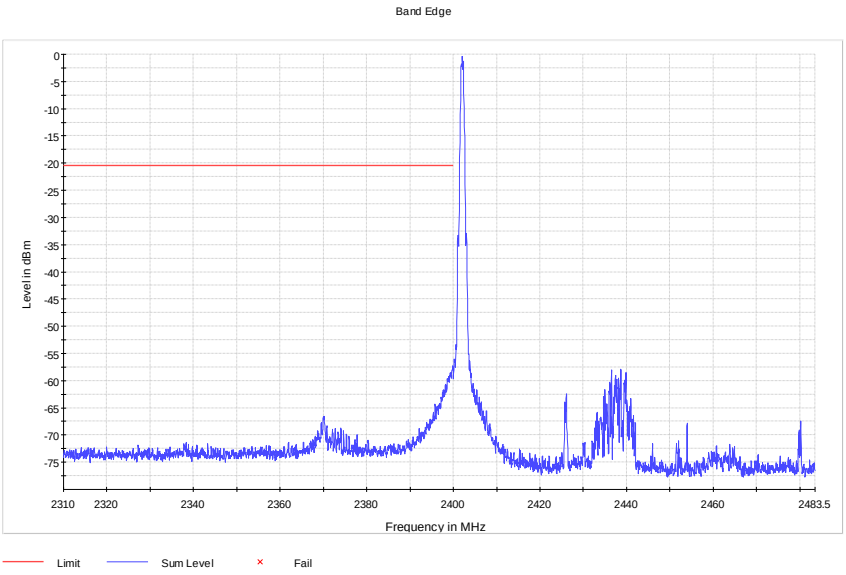
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

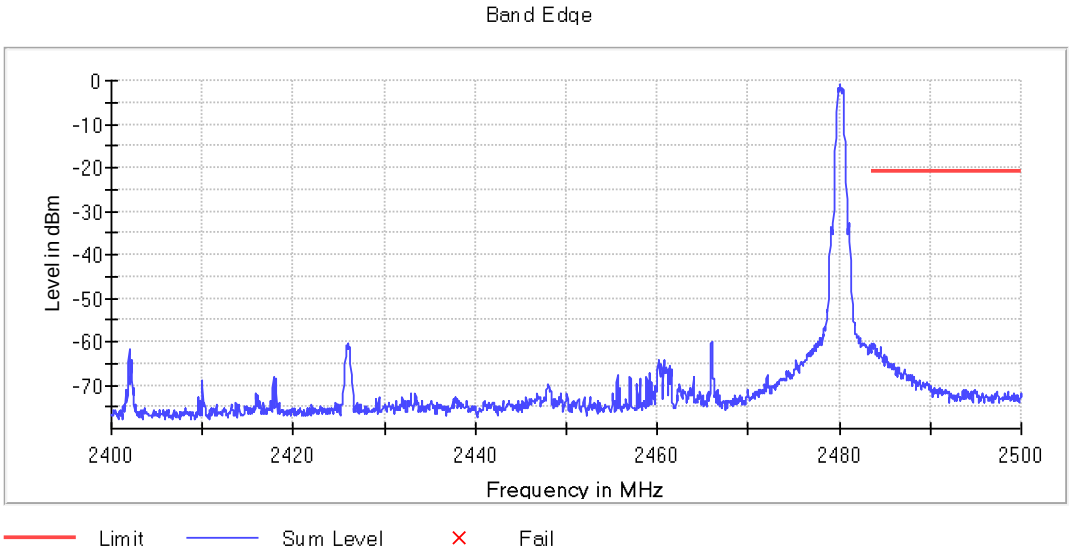
Refer to the following plots 4.1 – 4.9 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

Tested By	Test Date	Results
Erica Chan	May 22, 2024	Complies

Tx @ Low Channel, 2402 MHz Band Edge
Plot 4.1



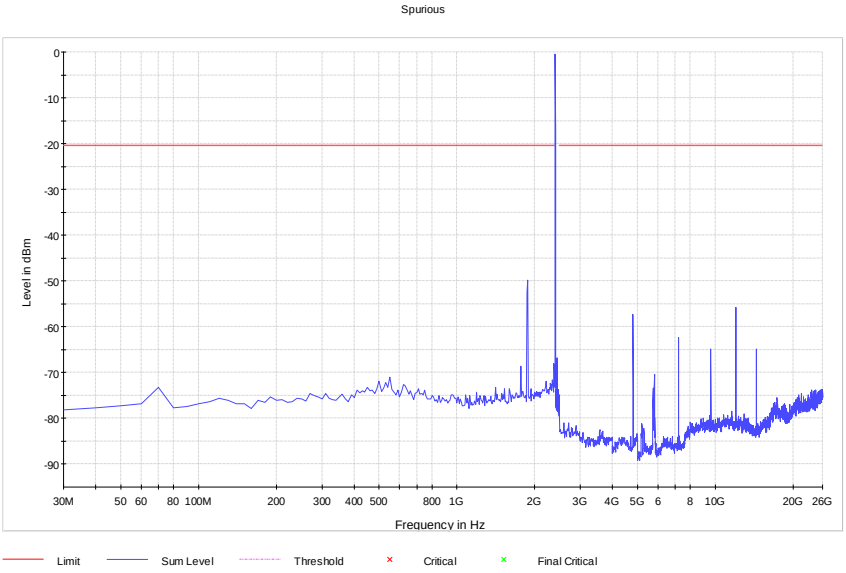
Tx @ High Channel, 2480 MHz Band Edge
Plot 4.2



Tx @ Low Channel, 2402 MHz

30MHz -26GHz Conducted Spurious

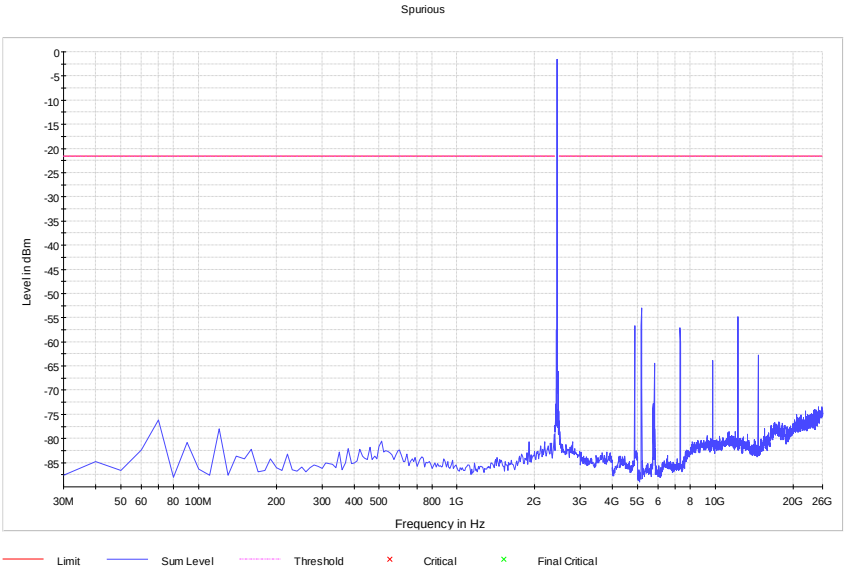
Plot 4.3



Tx @ Mid Channel, 2440 MHz

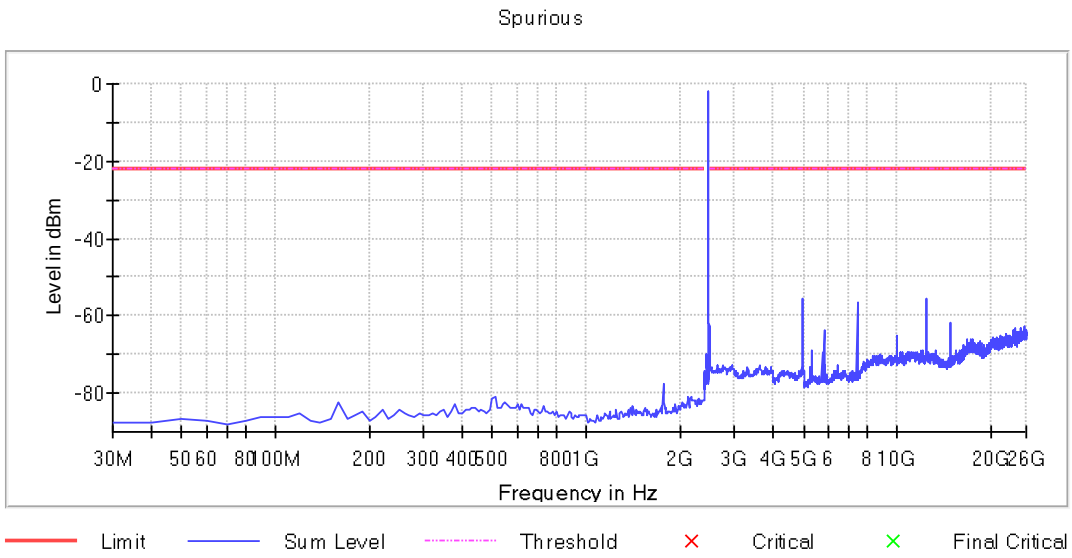
30MHz -26GHz Conducted Spurious

Plot 4.4



Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious

Plot 4.5



4.5 Transmitter Radiated Emissions

FCC Rules: 15.247(d), 15.209, 15.205; RSS-247, 5.5;

4.5.1 Requirement

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)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.5.2 Procedure – Radiated Emissions

Radiated emission measurements were performed from 9 kHz to 26.5 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 30MHz to 26GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26GHz.

Correlation measurements were performed below 30MHz between 10m ALSE and Open Field site according to FCC KDB 414788 D01 Radiated Test Site v01r01 section 2. All readings were within the acceptable tolerance.

EUT was tested in both horizontal and upright position. Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

Radiated Band Edge was measured at 1m and corrected to a 3m distance and compared to the 3m limits.

4.5.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m).
Level in μV/m = Com
mon Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

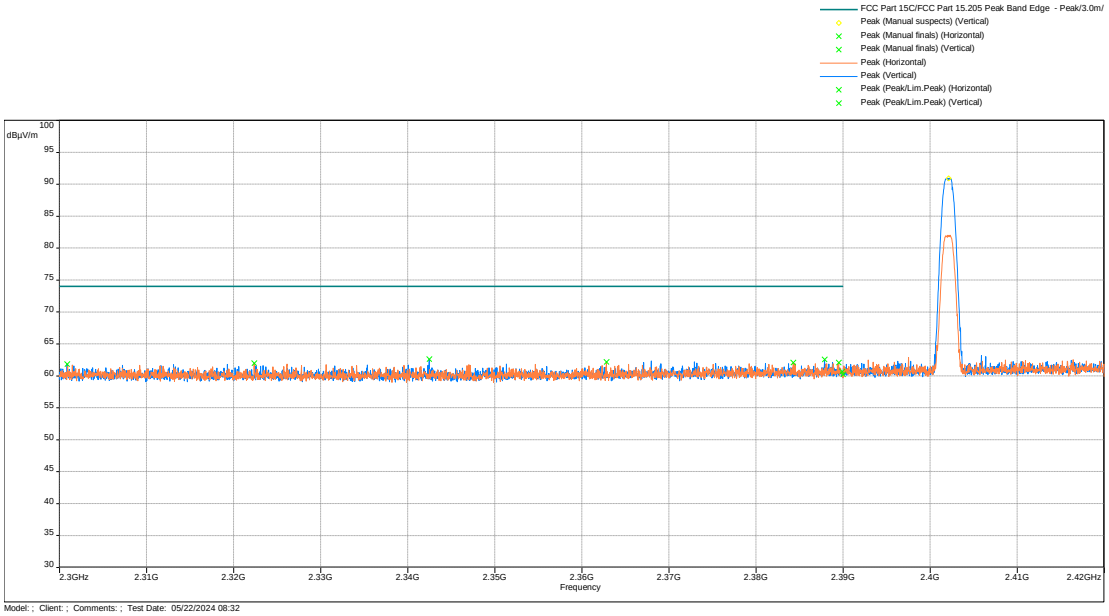
4.5.4 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

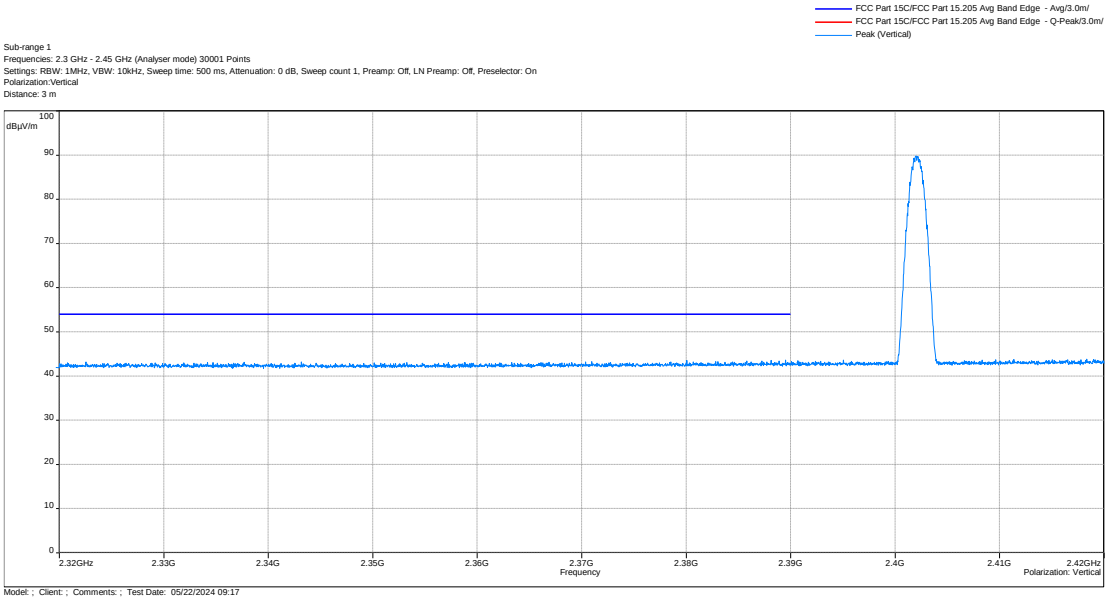
Tested By	Test Date	Results
Erica Chan	May 22 –31, 2024	Complies

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

Out-of-Band Spurious Emissions at the Band Edge
2402 MHz, Peak Scan with Peak Limits

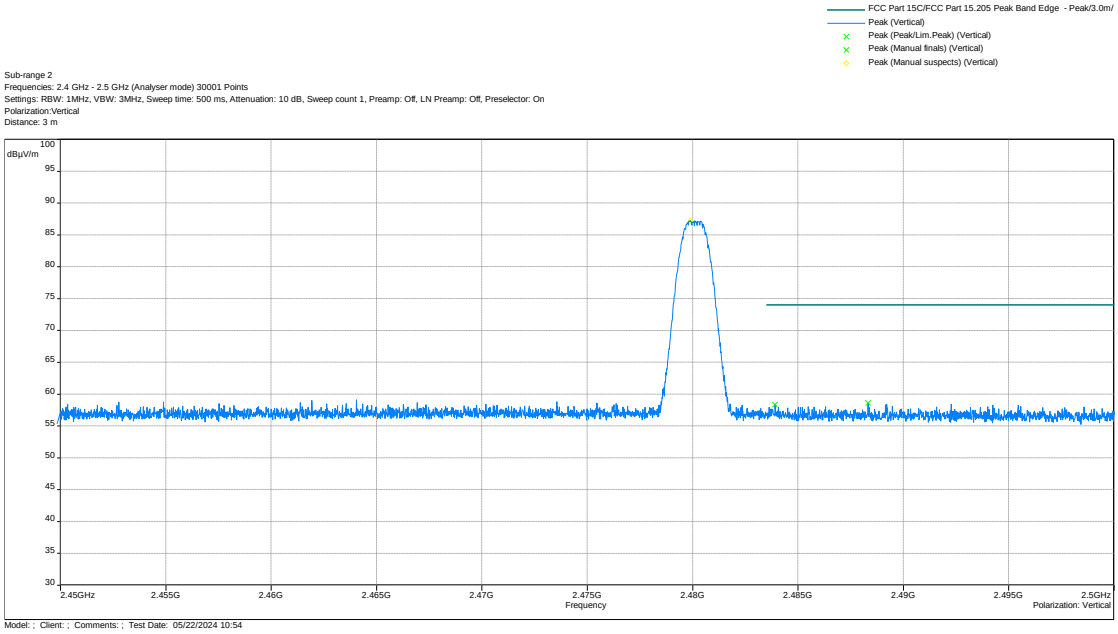


Out-of-Band Radiated spurious emissions at the Band-edge
2402 MHz, Average Scan with Average Limit

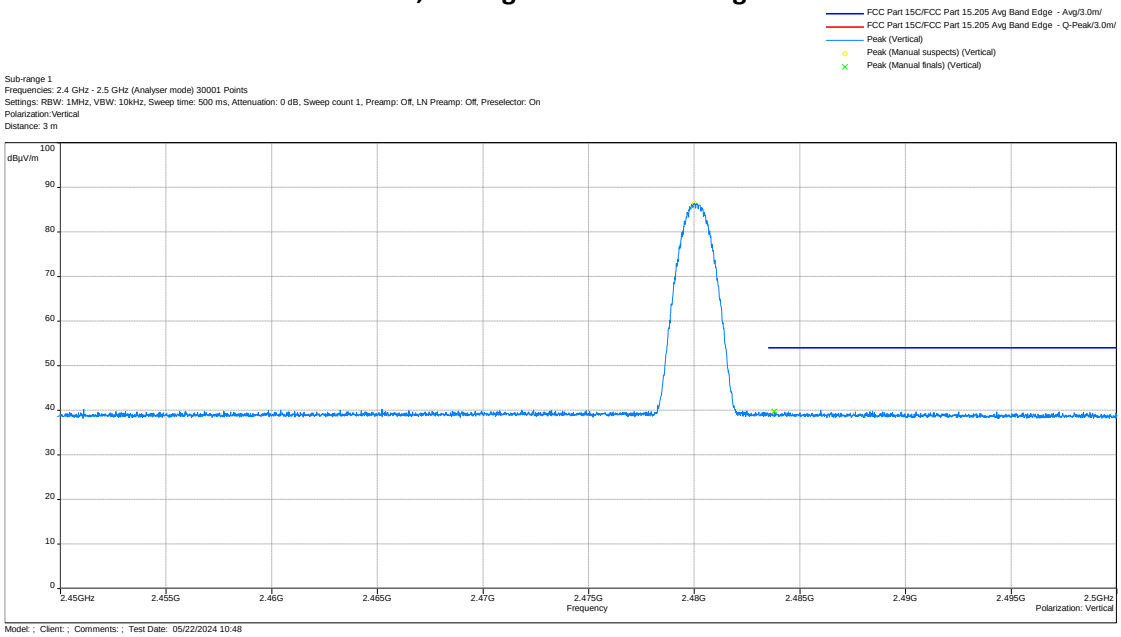


Freq. MHz	Ave @ 3m dB(uV/m)	Ave Limit @ 3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2389.510	43.62	54	-10.38	1.01	345.5	Vertical	27.18

Out-of-Band Spurious Emissions at the Band Edge
2480 MHz, Peak Scan with Peak Limits



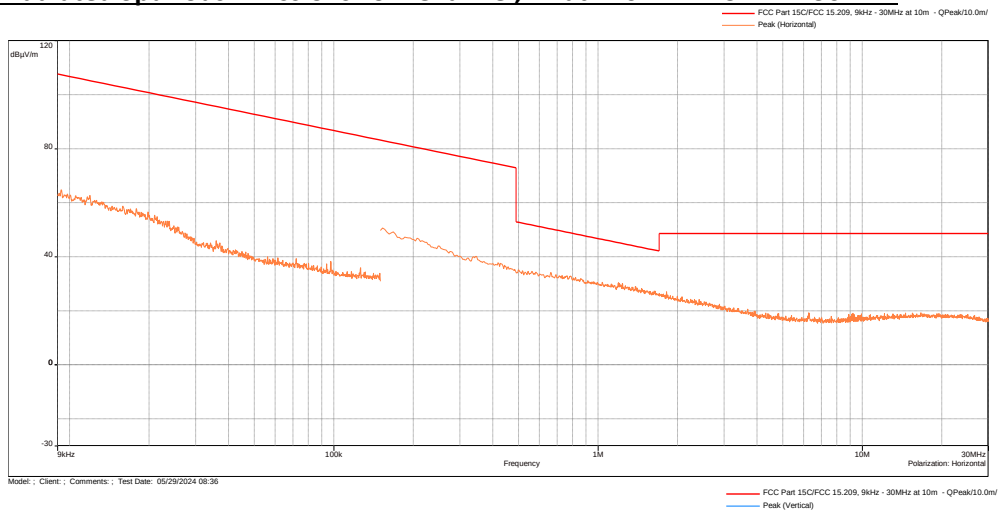
Out-of-Band Radiated spurious emissions at the Band-edge
2480 MHz, Average Scan with Average Limit



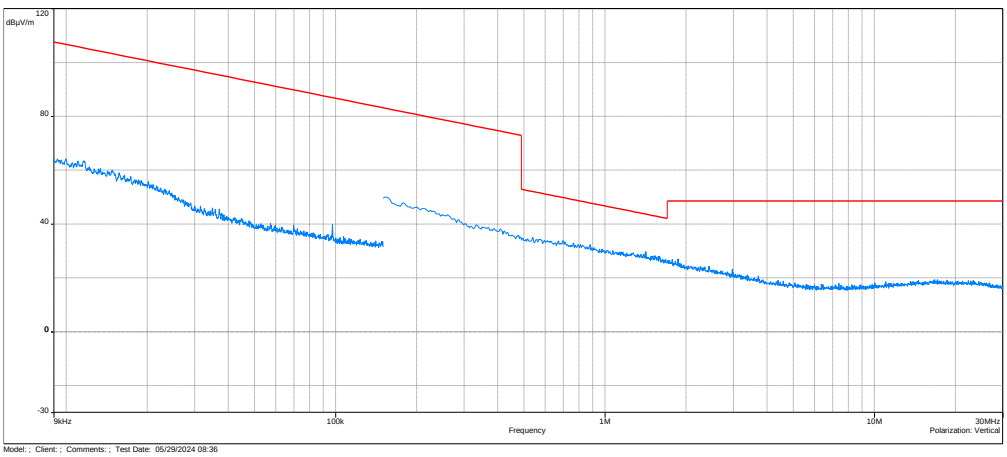
Freq. MHz	Ave @ 3m dB(uV/m)	Ave Limit @ 3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2483.5	39.74	54	-14.26	1.17	284.25	Vertical	23.66

Transmitter Radiated Spurious Emissions Low Channel, Tx at 2402MHz: 9kHz – 30MHz

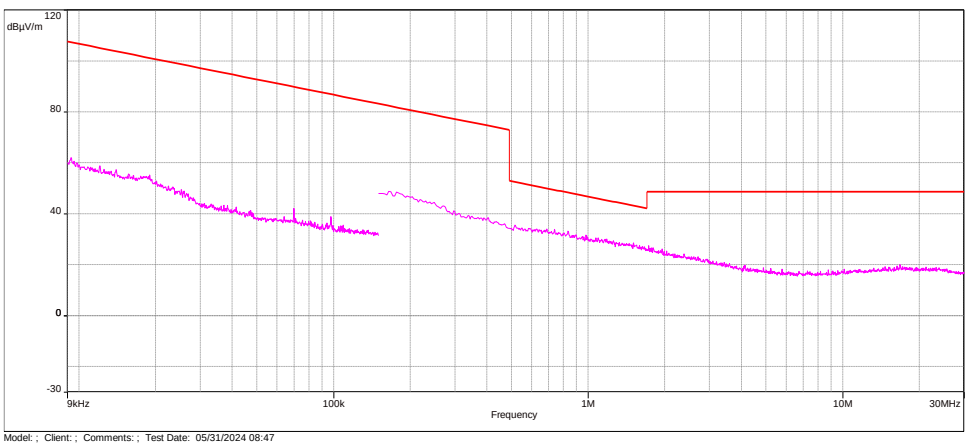
Antenna Position
-
Coaxial



Antenna Position
-
Coplanar

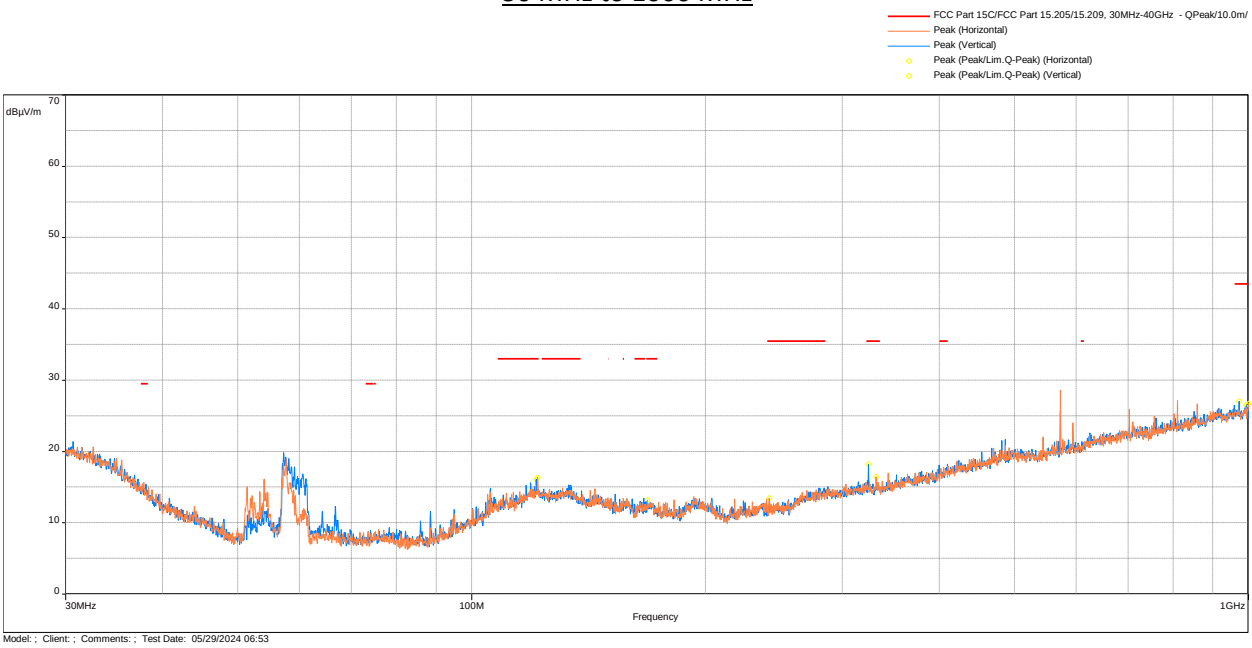


Antenna Position
-
Horizontal



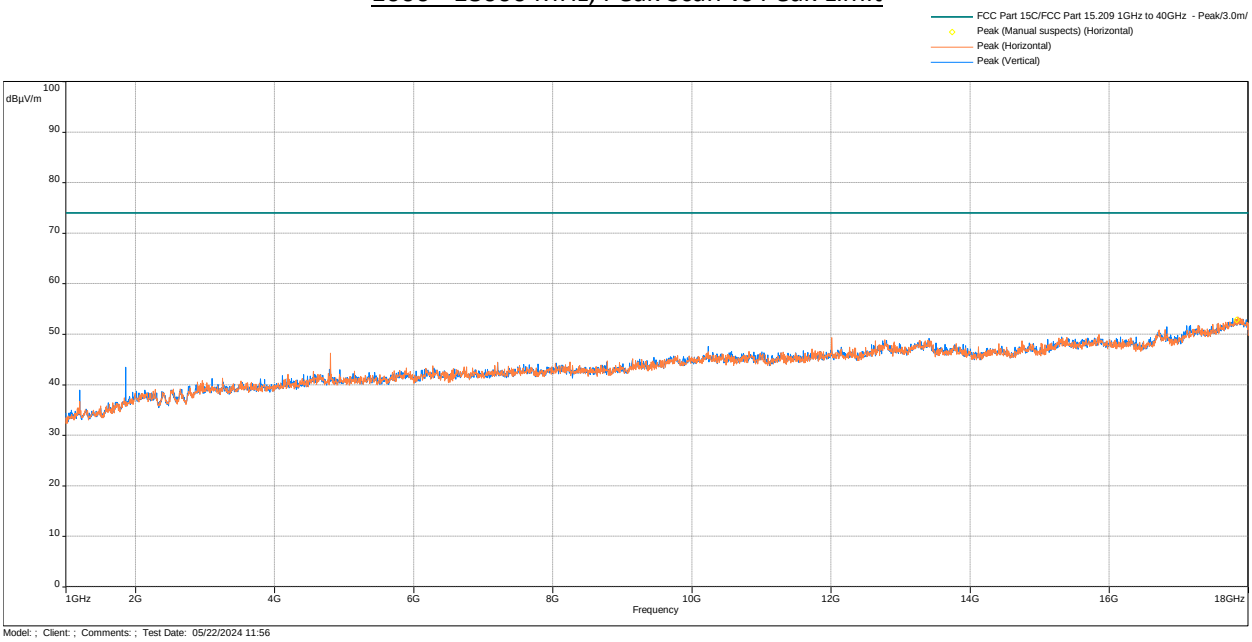
Transmitter Radiated Spurious Emissions Low Channel, Tx at 2402MHz

30 MHz to 1000 MHz



Model: ; Client: ; Comments: ; Test Date: 05/29/2024 06:53

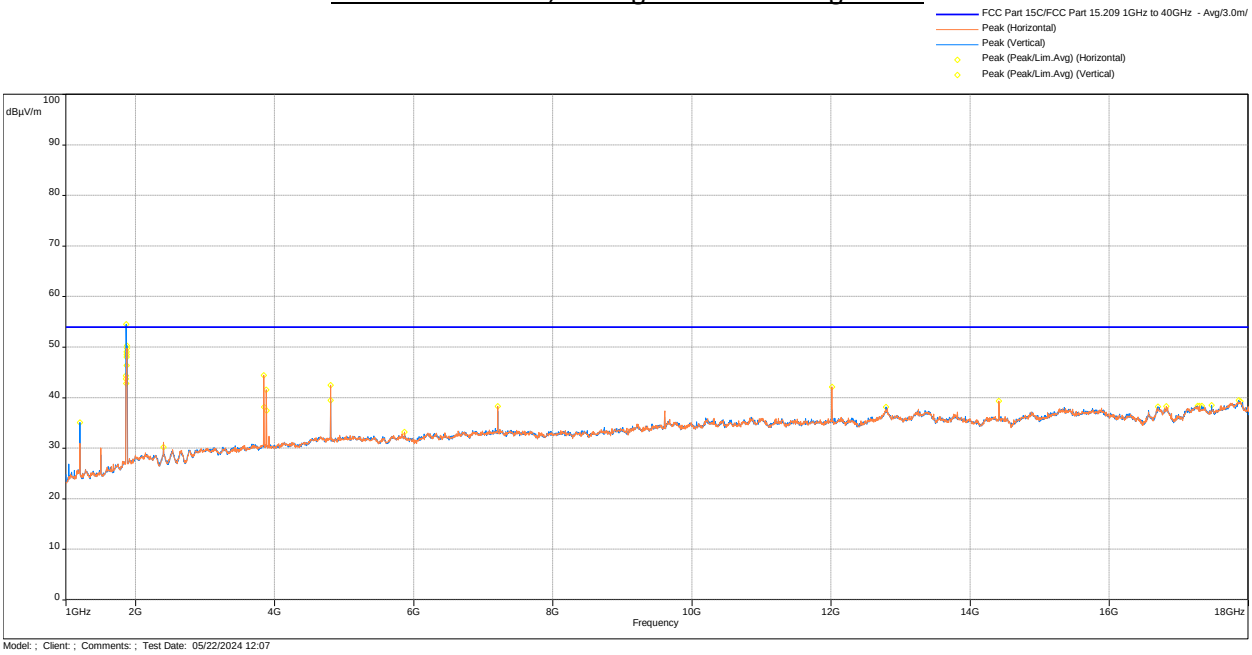
1000 - 18000 MHz, Peak Scan vs Peak Limit



Model: ; Client: ; Comments: ; Test Date: 05/22/2024 11:56

Transmitter Radiated Spurious Emissions Low Channel, Tx at 2402MHz

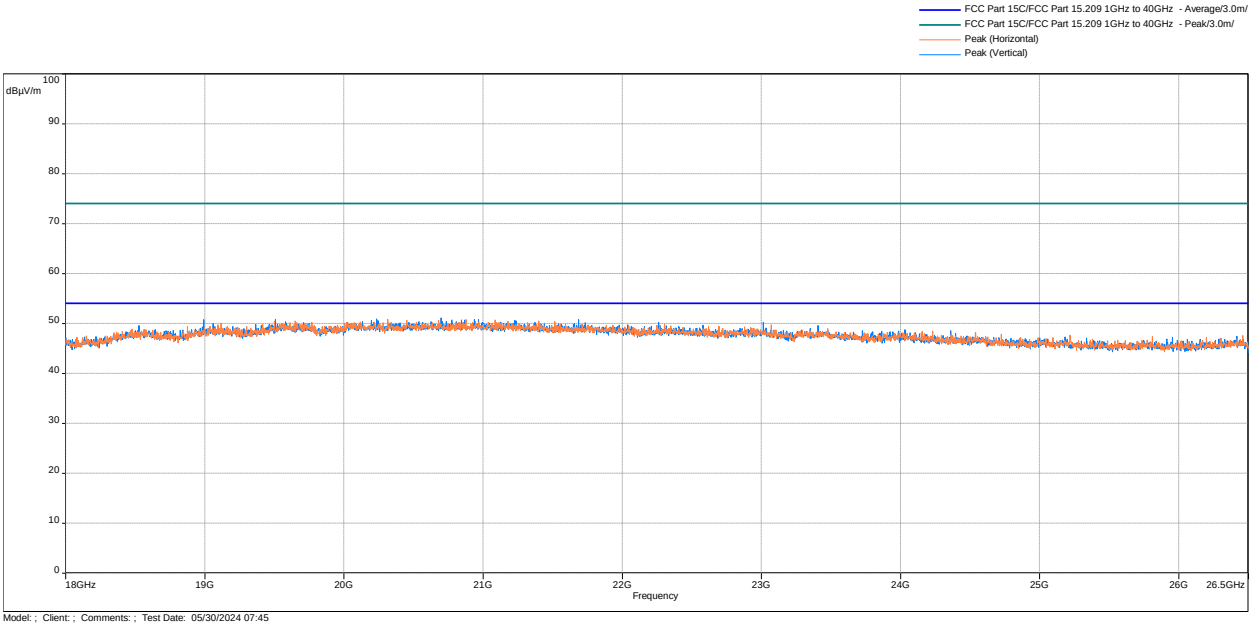
1000 - 18000 MHz, Average Scan vs Average Limit



Frequency (MHz)	Avg FS@3m (dBµV/m)	Avg Limit@3m (dB(uV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
1875.662	27.38	54	-26.62	8	2.19	Horizontal	-14.08
1863.532	35.36	54	-18.64	351	1.29	Vertical	-14.18
3843.533	44.4	54	-9.6	3.01	61	Horizontal	-7.1
4804.033	42.5	54	-11.5	2.01	167.25	Horizontal	-5.27
12012.033	42.13	54	-11.87	3.01	168.75	Horizontal	2.87
14411.300	39.36	54	-14.64	2.01	188.5	Horizontal	3.36
7206.133	38.28	54	-15.72	3.99	187.75	Horizontal	-1.85

Transmitter Radiated Spurious Emissions Low Channel, Tx at 2402MHz

18000 - 26000 MHz, Peak Scan vs Average Limit



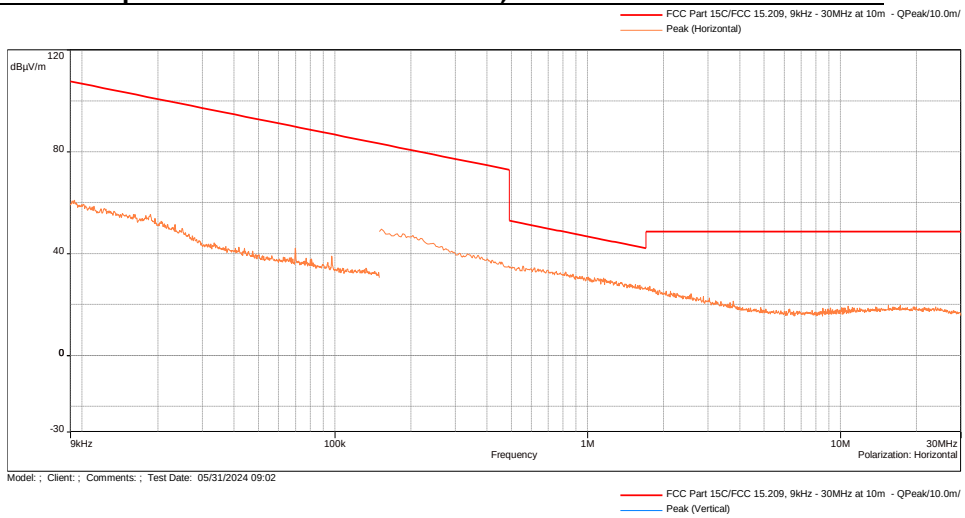
Frequency (MHz)	Avg FS@3m (dBµV/m)	Avg Limit@3m (dB(uV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
20698.467	51.1	54	-2.9	1.98	289	Vertical	-3.41
19508.750	50.87	54	-3.13	1.98	345.25	Vertical	-3.74
21687.583	50.74	54	-3.26	2.98	95.25	Vertical	-3.07
23407.983	49.56	54	-4.44	3.98	297.75	Vertical	-2.66

Note: Correction = AF + CF - Preamp

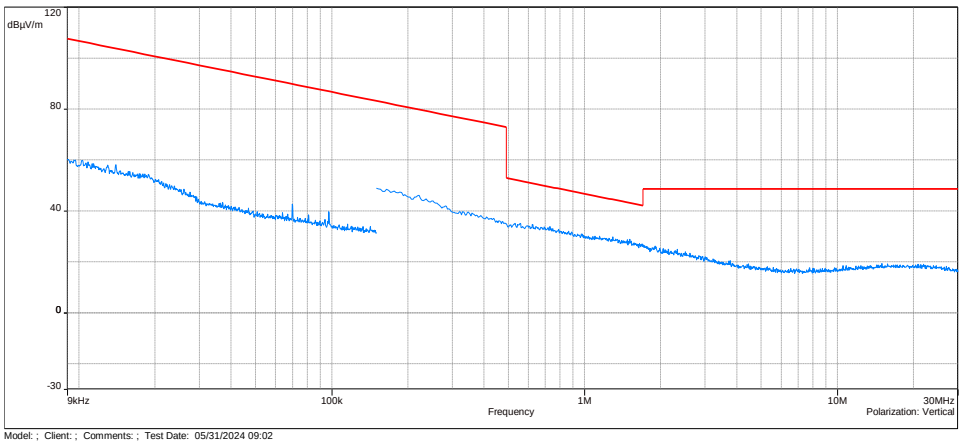
Results	Complies

Transmitter Radiated Spurious Emissions Mid Channel, Tx at 2440MHz: 9kHz – 30MHz

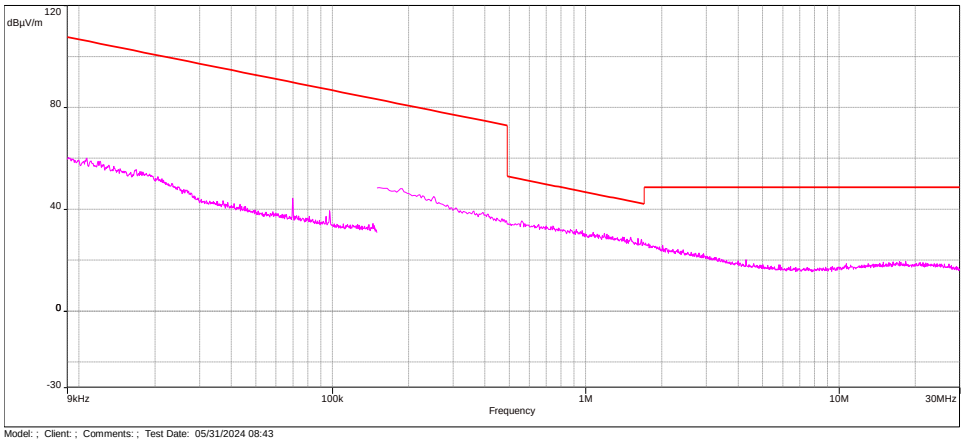
Antenna Position
-
Coaxial



Antenna Position
-
Coplanar

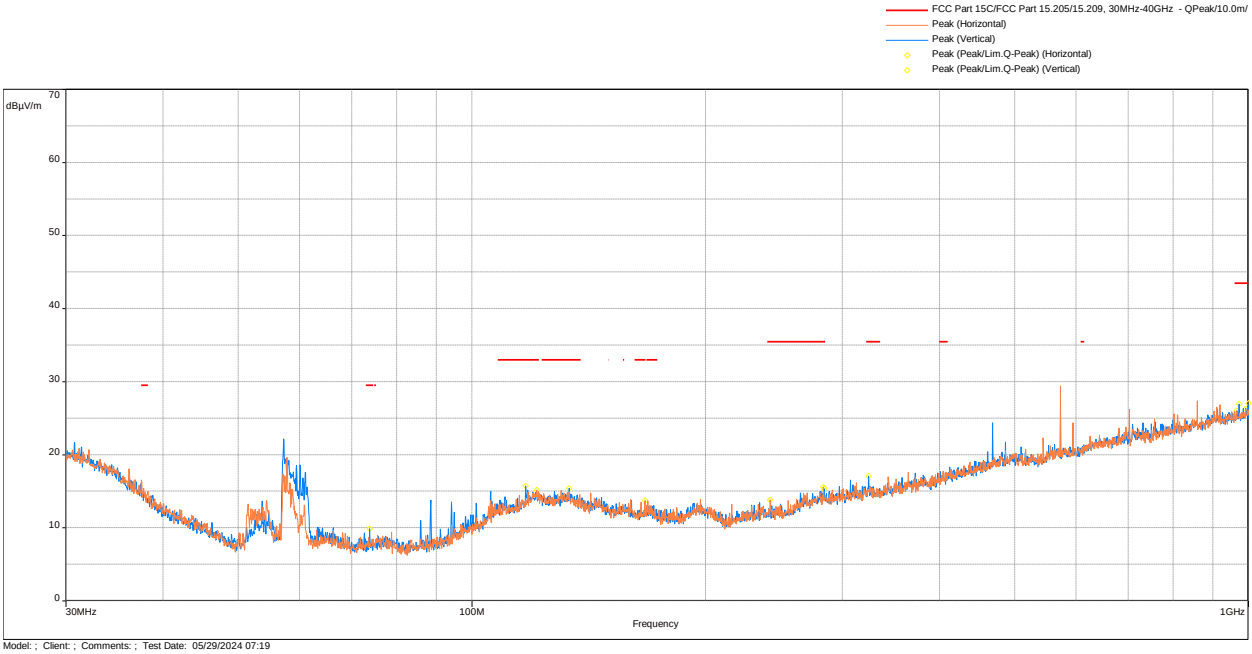


Antenna Position
-
Horizontal



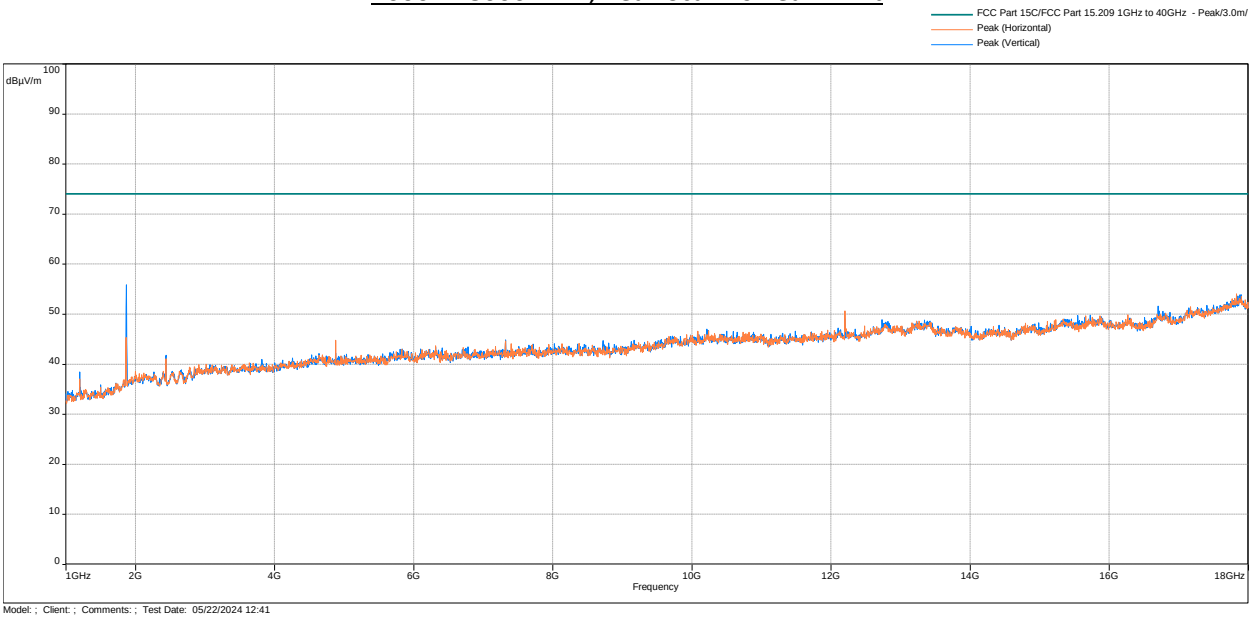
Transmitter Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz

30 MHz to 1000 MHz

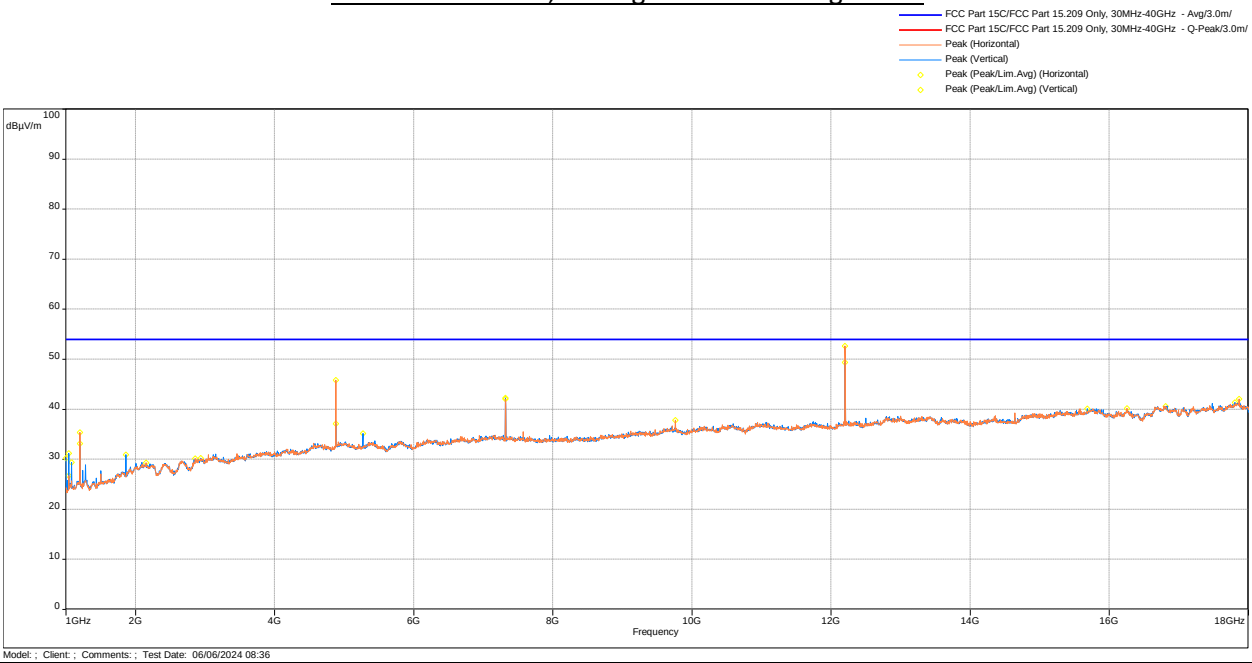


Transmitter Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz

1000 - 18000 MHz, Peak Scan vs Peak Limit



1000 - 18000 MHz, Average Scan vs Average Limit

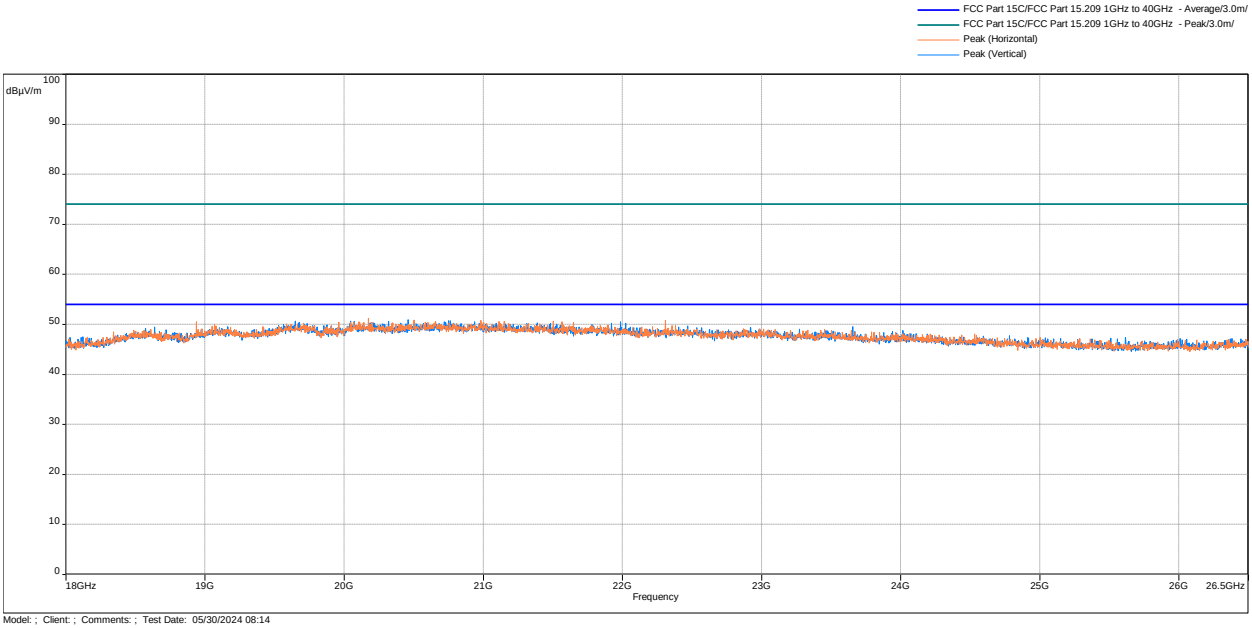


Frequency (MHz)	Avg FS@3m (dBµV/m)	Avg Limit@3m (dBµV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
12200.167	52.64	54	-1.36	2.01	319	Horizontal	-0.05
4879.967	45.8	54	-8.2	2.01	124.5	Horizontal	-7
7320.033	42.29	54	-11.71	1.99	19.5	Vertical	-4.07
1199.467	35.37	54	-18.63	1.01	148.75	Horizontal	-18.62

Note: Correction = AF + CF – Preamp

Transmitter Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz

18000 - 26000 MHz, Peak Scan vs Average Limit.



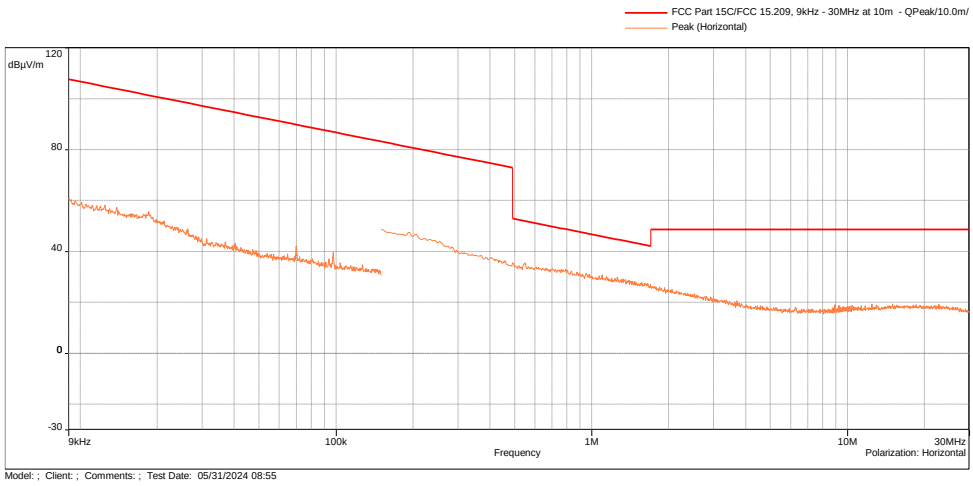
Frequency (MHz)	Avg FS@3m (dBµV/m)	Avg Limit@3m (dBµV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
20174.300	51.2	54	-2.8	3.99	125.5	Horizontal	-3.6
22310.067	50.75	54	-3.25	3.01	311.25	Horizontal	-2.95
19649.283	50.66	54	-3.34	1.01	133.25	Vertical	-3.67
18938.400	50.47	54	-3.53	3.01	210.75	Horizontal	-3.97

Note: Correction = AF + CF - Preamp

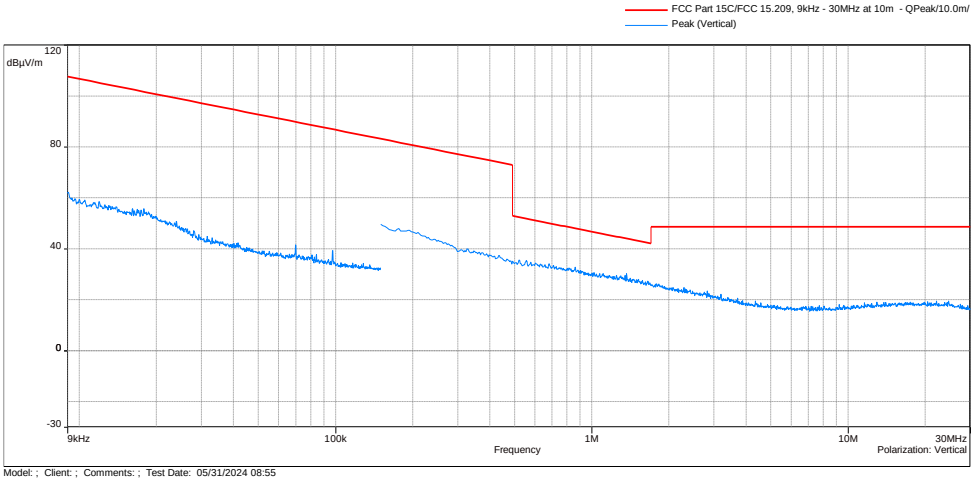
Results	Complies

Transmitter Radiated Spurious Emissions High Channel, Tx at 2480MHz: 9kHz – 30MHz

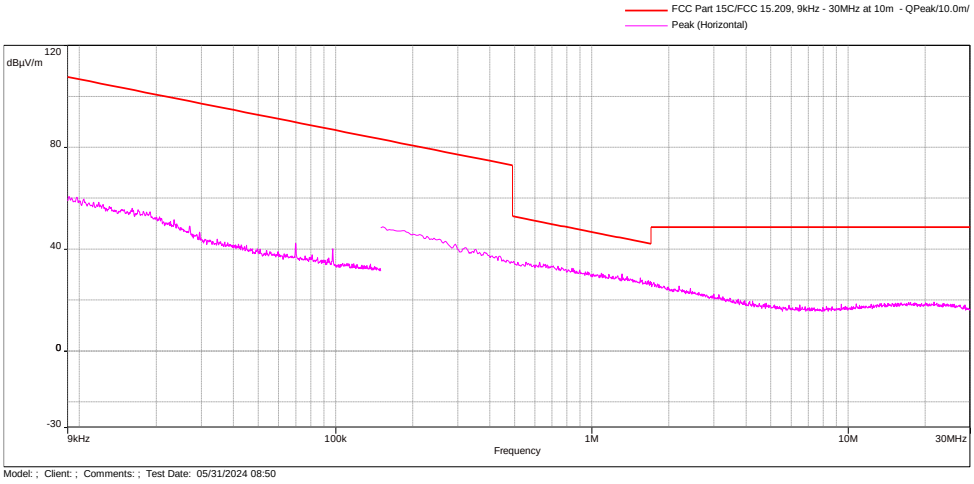
Antenna Position
-
Coaxial



Antenna Position
-
Coplanar

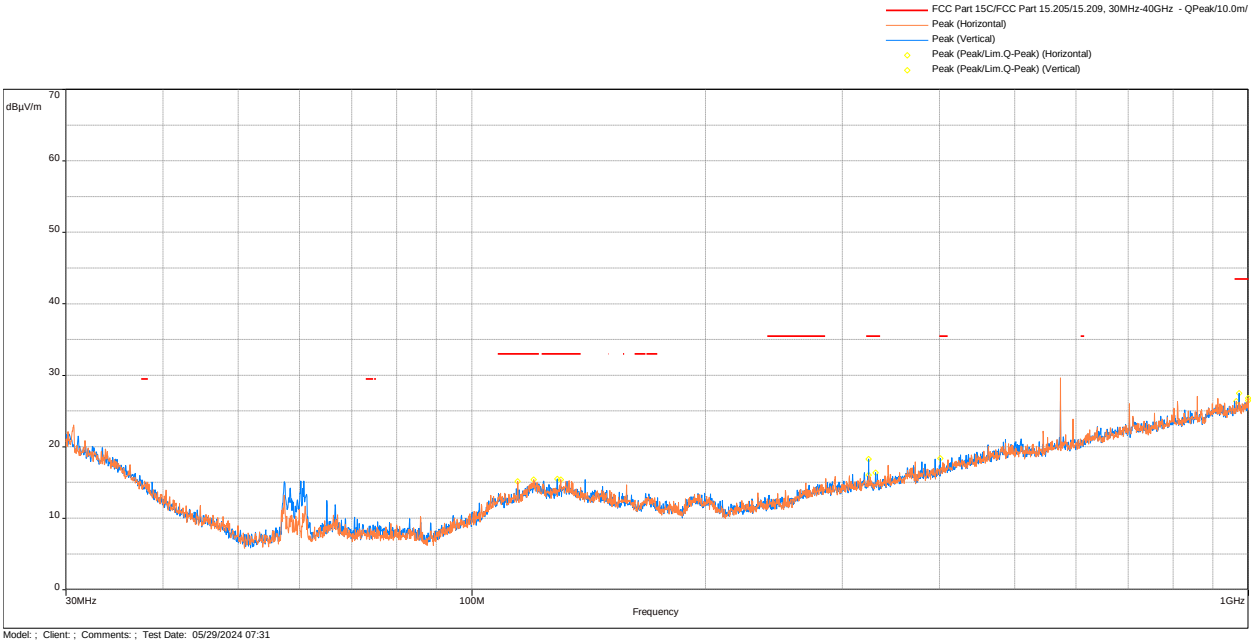


Antenna Position
-
Horizontal



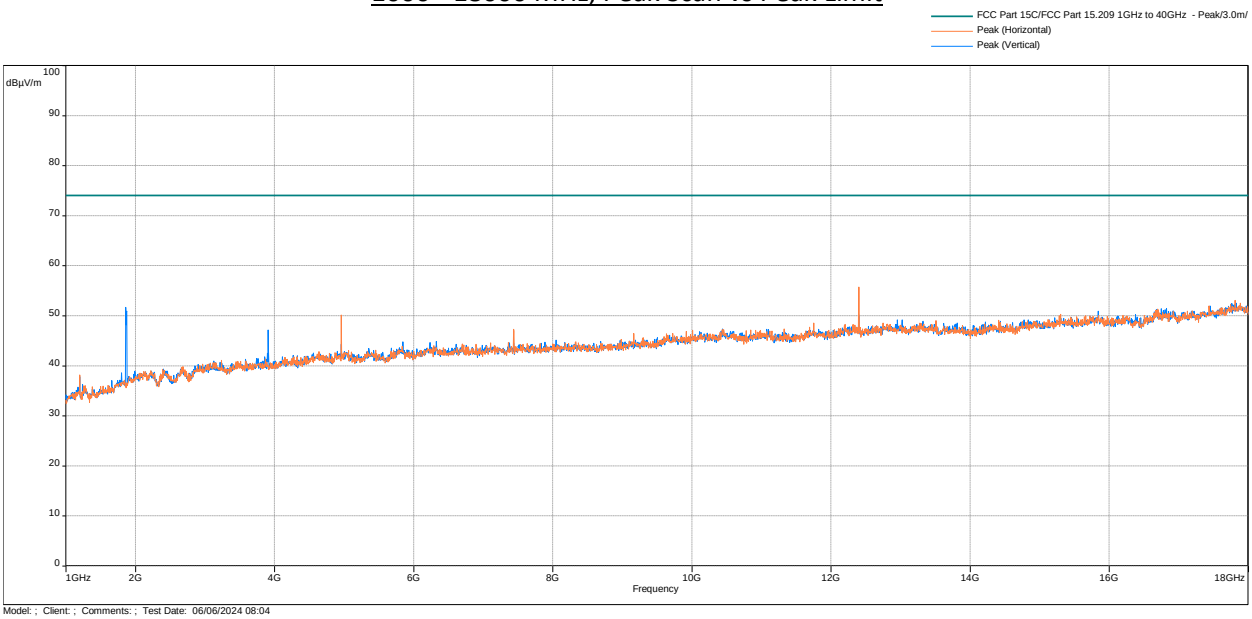
Transmitter Radiated Spurious Emissions High Channel, Tx at 2480MHz:

30 MHz to 1000 MHz

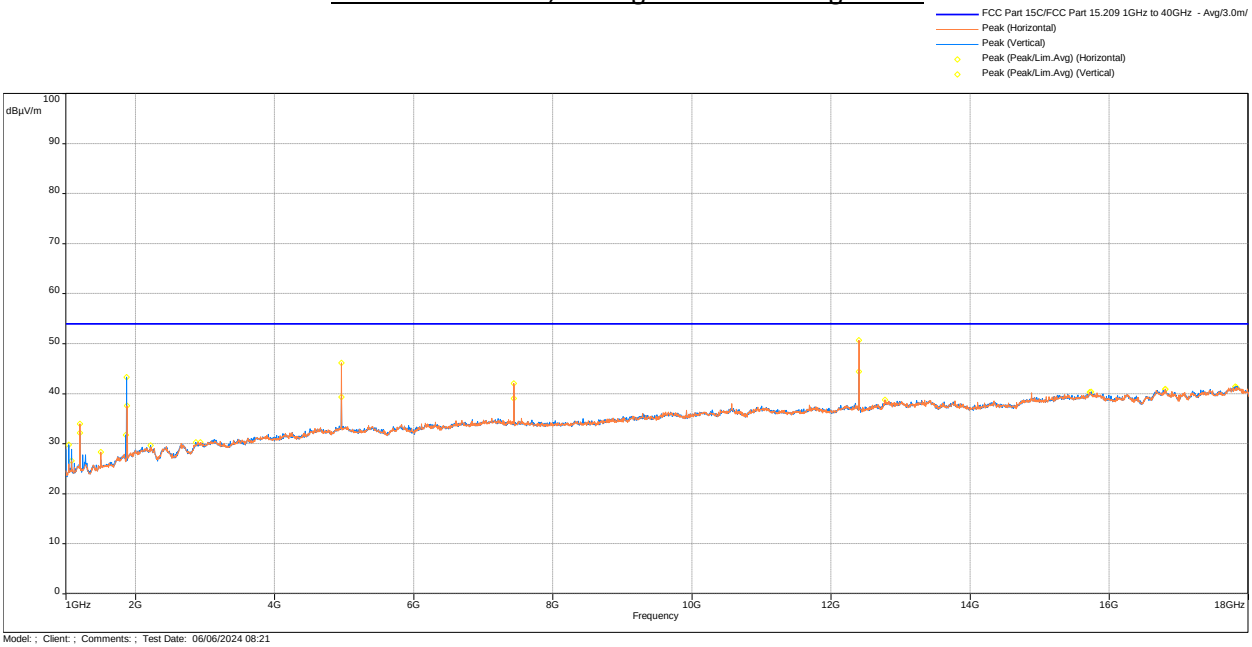


Transmitter Radiated Spurious Emissions High Channel, Tx at 2480MHz:

1000 - 18000 MHz, Peak Scan vs Peak Limit



1000 - 18000 MHz, Average Scan vs Average Limit

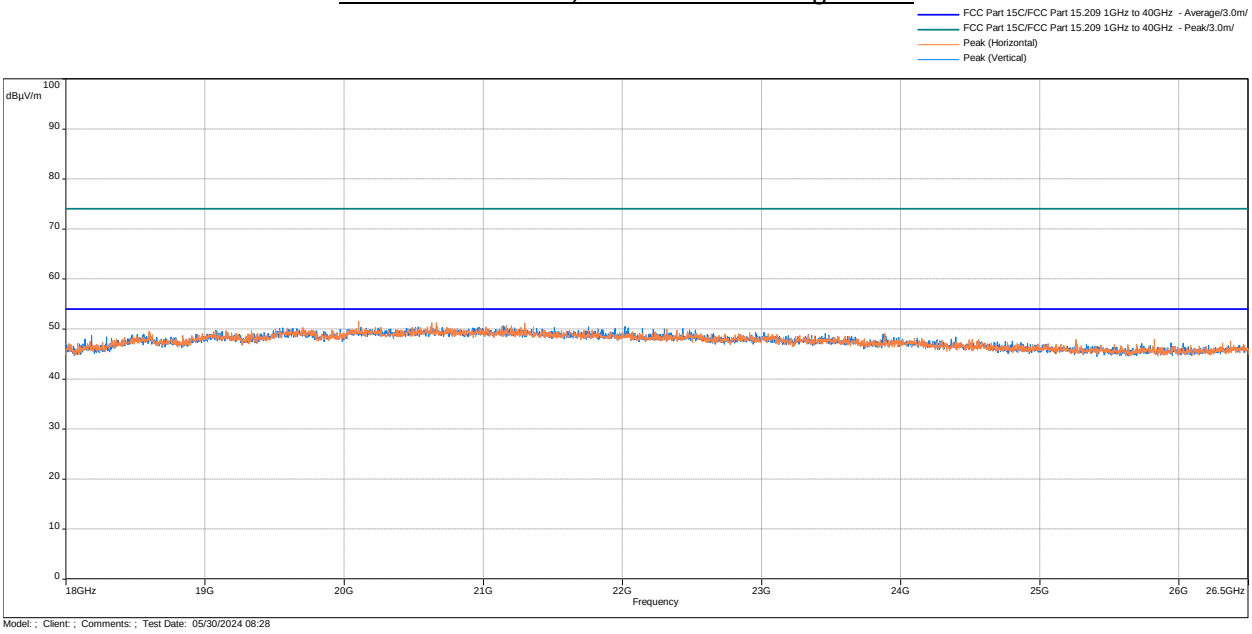


Frequency (MHz)	Avg FS@3m (dBµV/m)	Avg Limit@3m (dBµV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
12400.767	50.69	54	-3.31	1.99	278.25	Horizontal	0.24
4959.867	46.16	54	-7.84	1.99	104.25	Horizontal	-6.84
1872.667	43.31	54	-10.69	3.01	125.25	Vertical	-15.2
7440.167	42.06	54	-11.94	1.99	320.25	Horizontal	-3.83

Note: Correction = AF + CF - Preamp

Transmitter Radiated Spurious Emissions High Channel, Tx at 2480MHz:

18000 - 26000 MHz, Peak Scan vs Average Limit.



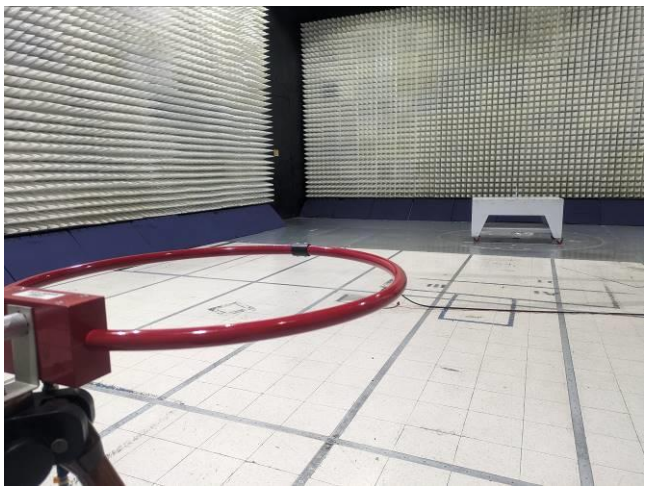
Frequency (MHz)	Peak FS@3m (dBµV/m)	Avg Limit@3m (dBµV/m))	Margin (dB)	Height (m)	Azimuth (deg)	Polarity	Correction (dB)
20106.02	51.52	54	-2.48	3.01	4	Horizontal	-3.63
21298.85	51.14	54	-2.86	3.99	34.5	Horizontal	-3.27
23018.4	49.28	54	-4.72	3.98	104.75	Vertical	-2.72
18477.13	48.82	54	-5.18	1.98	51.25	Vertical	-4.06

Note: Correction = AF + CF - Preamp

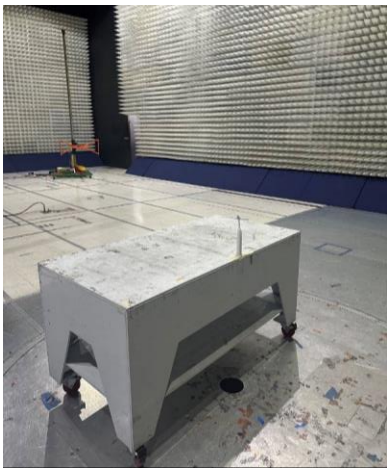
Results	Complies

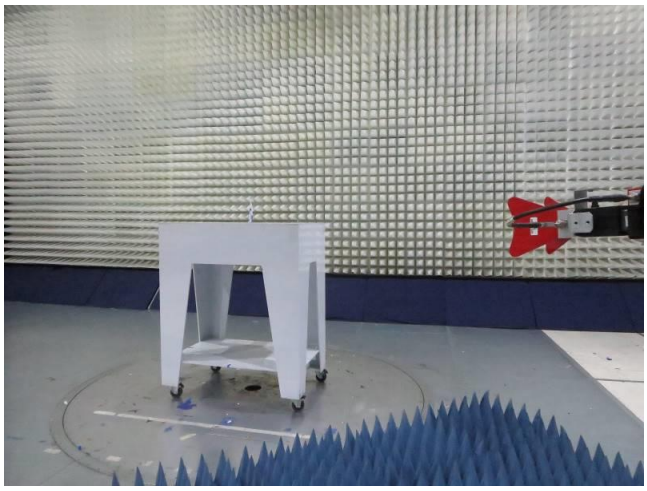
4.5.5 Test Setup Photographs

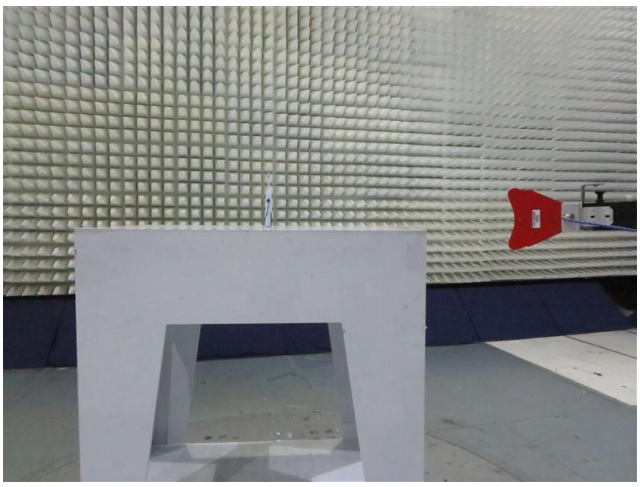
The following photographs show the testing configurations used.



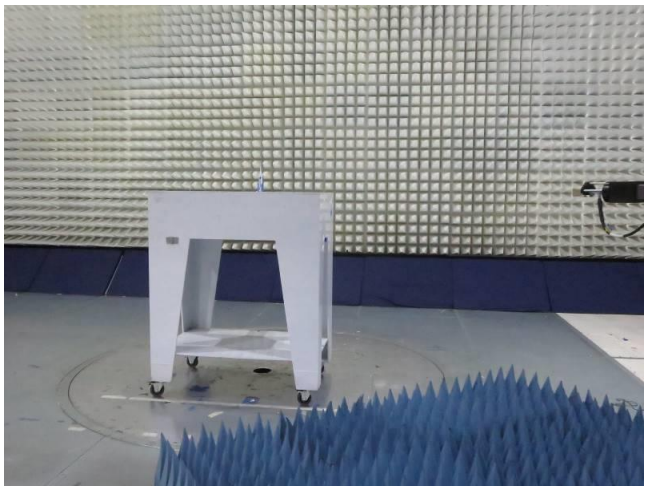
4.5.6 Test Setup Configuration (Continued)







4.5.6 Test Setup Configuration (Continued)



4.6 AC Line Conducted Emission

FCC: 15.207; RSS-GEN

4.6.1 Requirement

Frequency Band MHz	FCC Part 15.207 Limits	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: *Decreases linearly with the logarithm of the frequency*
At the transition frequency the lower limit applies.

4.6.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.10: 2013.

4.6.3 Test Results

Not applicable. The EUT is battery powered.

5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Asset #	Description	Manufacturer	Model	Cal Date	Cal Due
00942	9kHz to 1GHz Amplifier	Sonoma Instrument	310	04/20/2024	04/20/2025
01607	EMI Test Receiver	Rohde & Schwarz	ESR7	10/18/2023	10/18/2024
01573	9kHz-30MHz Loop Antenna (Passive)	ETS Lindgren	6512	11/30/2023	11/30/2024
01577	30MHz-2GHz Bi-Log Antenna	SunAR RF Motion	JB1	02/29/2024	02/28/2025
01325	1-18GHz Horn Antenna	ETS Lindgren	3117-PA	11/26/2023	11/26/2024
00961	EMI Test Receiver 40GHz	Rohde & Schwarz	ESU40	04/26/2024	04/26/2025
00571	18 - 26.5GHz Horn Antenna	EMCO	3160-09	#	#
01193	Open Switch and Control Platform	ROHDE & SCHWARZ	OSP120 1505.3009K12	09/08/2023	09/08/2024
01436	Humidity Temperature Test Chamber	ESPEC	BTX-475	11/03/2022	11/03/2023
00984	Radio Frquency Shielded System	Panashield	10 Meter Chamber	#	#
01799	18-40GHz Preamp	uComp Nordic	MCNS-50-18004000335P	03/20/2024	03/20/2025
00571	18 - 26.5GHz Horn Antenna	EMCO	3160-09	#	#
00984	Radio Frquency Shielded System	Panashield	10 Meter Chamber	#	#
02089	Signal Analyzer 43GHz	Rohde & Schwarz	FSW43	09/04/2023	09/04/2024
02090	8 Port Plus	Rohde & Schwarz	OSP-B157W8	10/19/2023	10/19/2024
02091	Extension Unit CAN-BUS	Rohde & Schwarz	OSP150	10/25/2023	10/25/2024

Calibration not required.

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.20.0.14	ESU and ESR Intertek Emissions Template
RS Commander	Rohde & Schwarz	1.6.4	Not Applicable (Screen grabber)
WMS32	Rohde & Schwarz	11.60.00	FCC 15.247 BLE template
UCPI	Philips Oral Healthcare LLC	1.4.0.0	Not applicable. Used to control EUT

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G105786504	EC	AS	June 25, 2024	Original document
1.1 / G105786504	EC	AS	December 19, 2024	Updated antenna gain in section 2.0. Added settings used to perform measurements in sections 4.1-4.4.

END OF TEST REPORT