

TEST REPORT

Report Number: 105220135MPK-001

Project Number: G105220135

Report Issue Date: January 30, 2023

**Testing performed on
Vector Sensor
Model Number: HSV.1A**

**FCC ID: TBD_FCC
IC: TBD_ID**

to

**FCC Part 15 Subpart C (15.247)
ISED RSS-247 Issue 2**

For

Nexxiot AG

Test Performed by:

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Test Authorized by:

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Prepared by:



Bryce Toma

Date: January 30, 2023

Reviewed by:



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Date: January 30, 2023

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Report No. 105220135MPK-001	
Equipment Under Test:	Vector Sensor
Model Number:	HSV.1A
Applicant:	Nexxiot AG
Contact:	Florencia Roshardt
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Applicable Regulation:	FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 2
Date of Test:	December 7, 2022 to January 20, 2023

We attest to the accuracy of this report, original Issued:



Bryce Toma
Engineer



Minh Ly
EMC Team Lead

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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	Not Applicable ¹
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

¹ EUT is battery powered.

EUT receive date: December 7, 2022

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: December 7, 2022

Test completion date: January 20, 2023

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

2.0 General Information

2.1 Product Description

Nexxiot AG supplied the following description of the EUT:

The Vector Sensor is a remote monitoring equipment that measures acceleration and magnet fields. These measurements are then communicated and transferred to a gateway. Vector Sensors are typically used in railway environments.

For more information, see user's manual provided by the manufacturer.

This test report covers only the 2.4GHz BLE radio.

Information about the 2.4 GHz radio is presented below:

Applicant	Nexxiot AG
Model No.	HSV.1A
FCC Identifier	TBD_FCC
IC Identifier	TBD_ID
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	+5.51 dBm
Antenna(s) & Gain	Internal Antenna, Gain: 3.0 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Nexxiot AG Hardstrasse 201, 8005 Zürich, Switzerland

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 2, 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

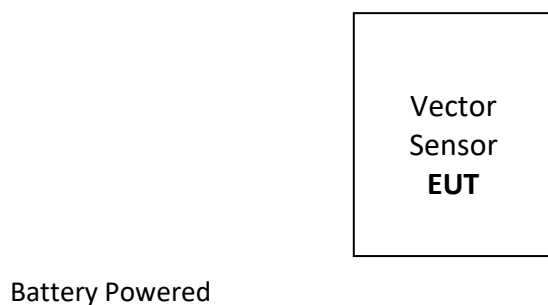
3.1 Support Equipment

The EUT does not have any support equipment.

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model	Serial Number
Vector Sensor	Nexxiot AG	HSV.1A	PVEC-0027

Support Equipment			
Description	Manufacturer	Model	Serial Number
Not applicable. The EUT does not have any support equipment			



EUT Photos

External Top



External Bottom



3.3 Justification

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

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Nexxiot AG

3.5 Mode of Operation during Test

Mode of operation during the tests was setup using a laptop which allows controlling the radio by test software. During the transmitter tests, the transmitter was setup to transmit maximum communication and RF power levels.

EUT was placed into transmit mode at the lowest (2402MHz) middle (2440MHz), and highest (2480MHz) channels for BLE mode.

3.6 Modifications Required for Compliance

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

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

4.1 6-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) $\geq 3 \times$ 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.

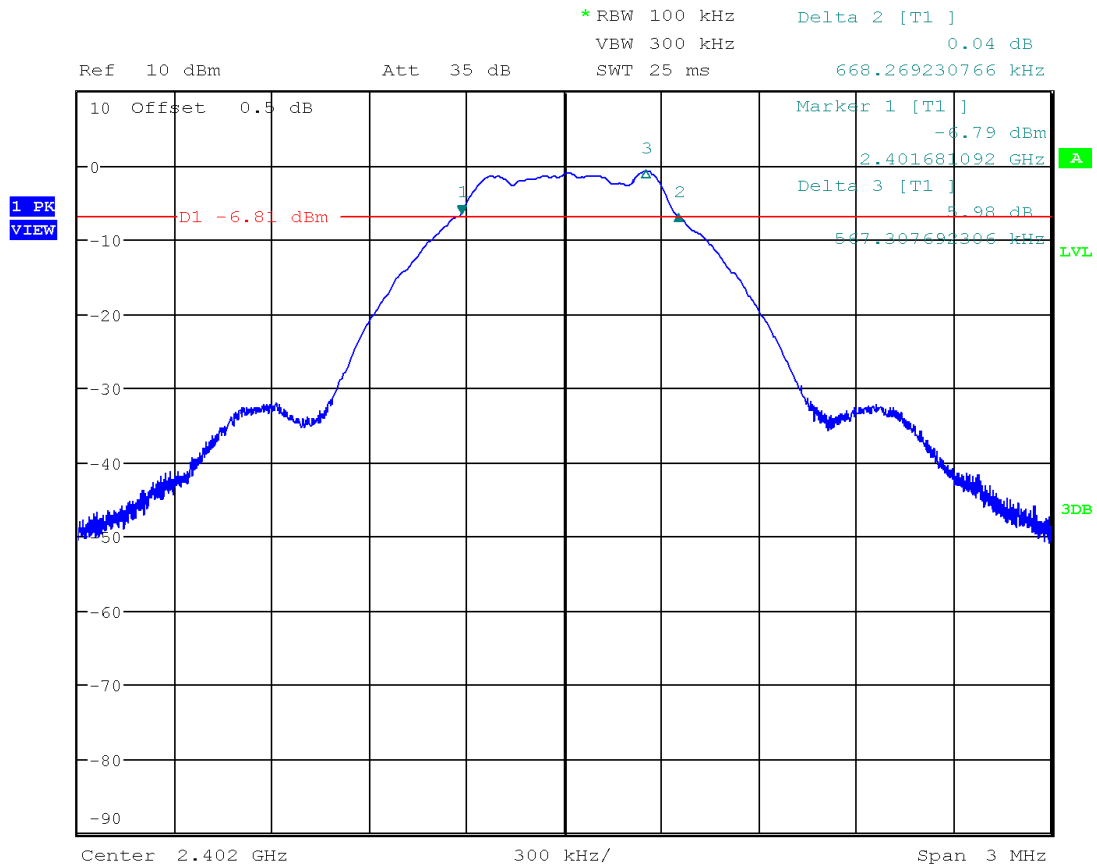
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Mode	Frequency (MHz)	6-dB bandwidth FCC 15.247 kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
BLE	2402	668.269	--	1.1
		--	1.019	1.4
	2440	673.077	--	1.2
		--	1.019	1.5
	2480	673.077	--	1.3
		--	1.019	1.6

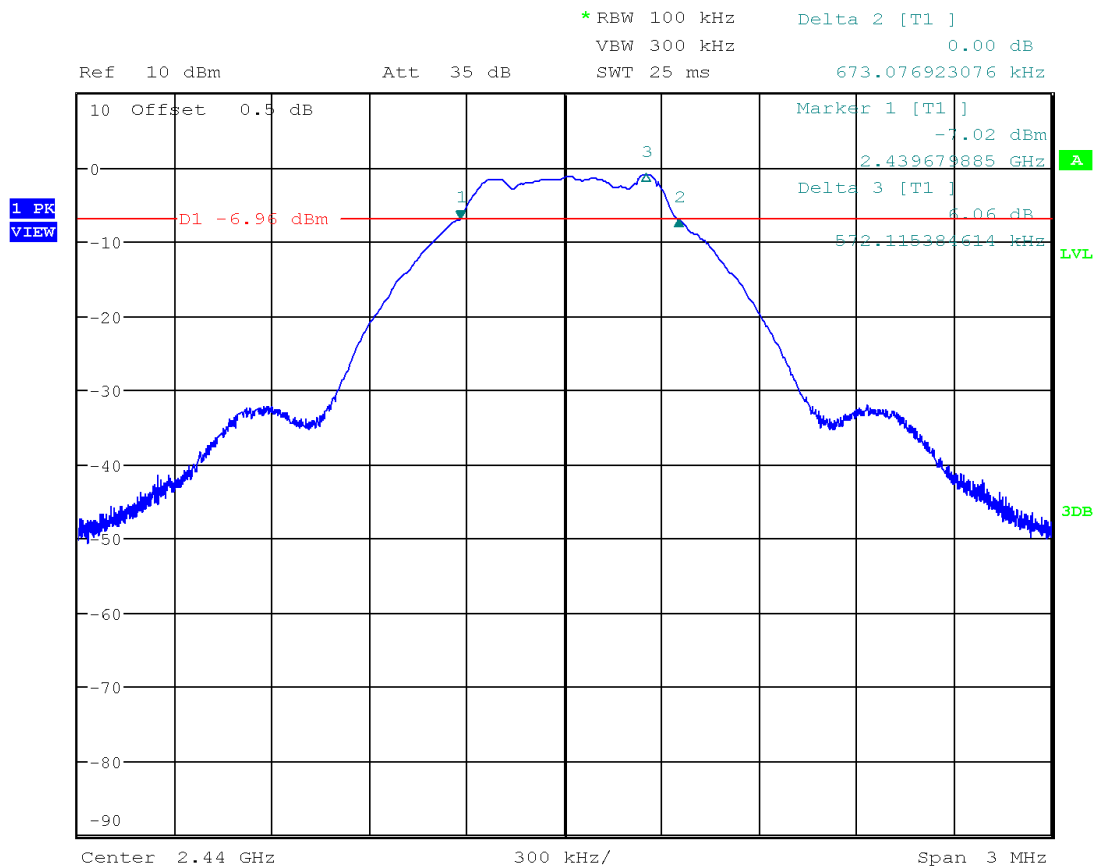
Tested By	Test Date	Results
Bryce Toma	December 21, 2022	Complies

Plot 1.1



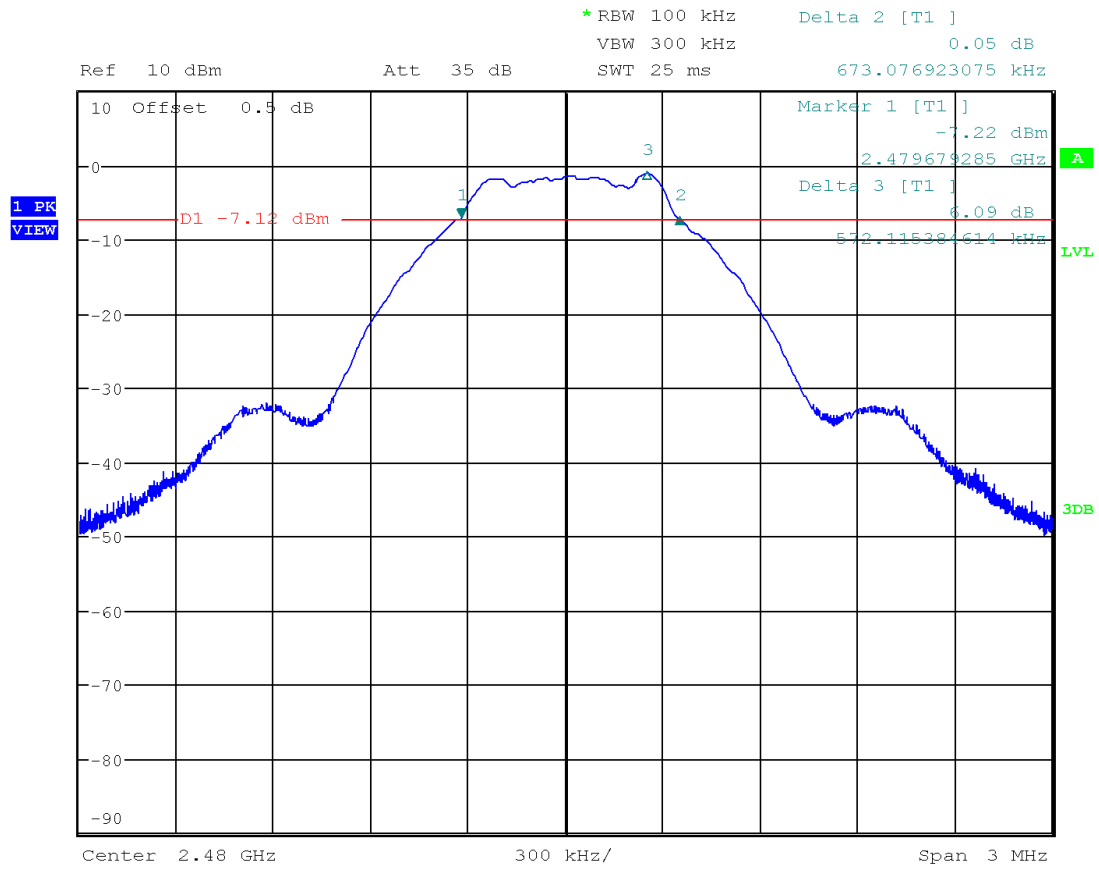
Date: 21.DEC.2022 03:55:09

Plot 1.2



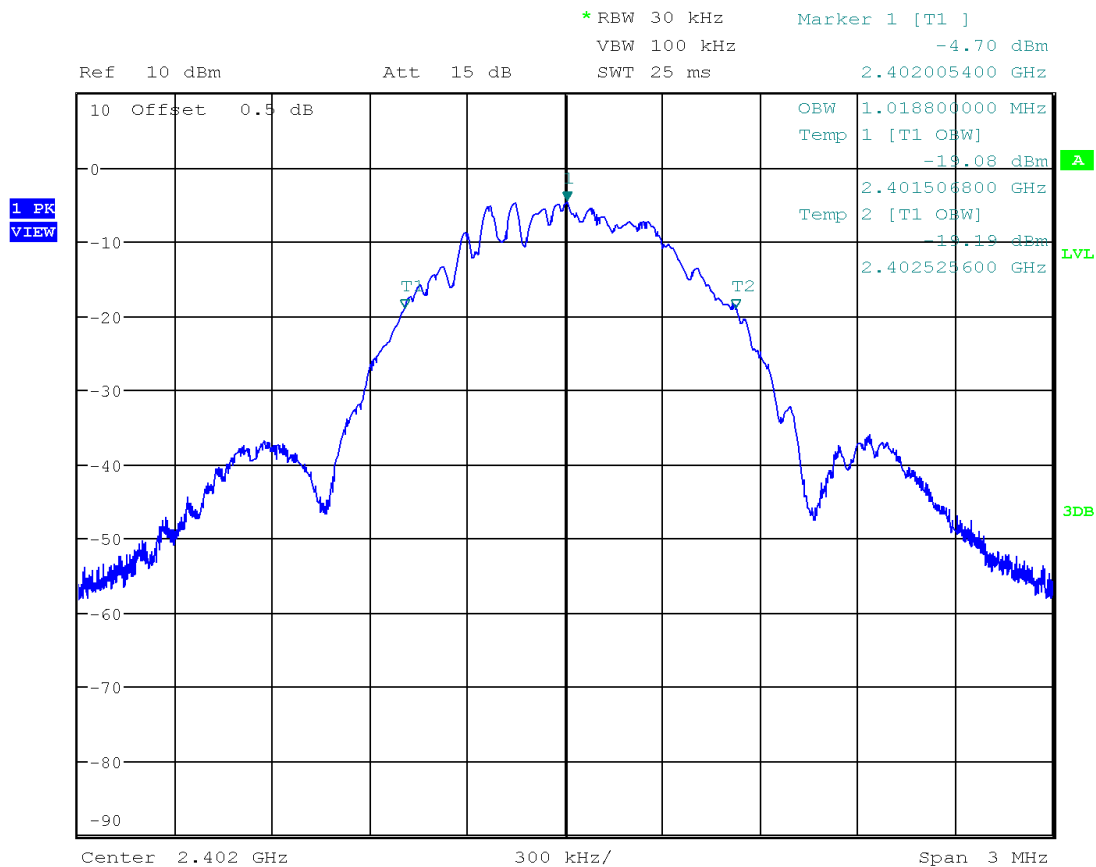
Date: 21.DEC.2022 03:57:07

Plot 1.3



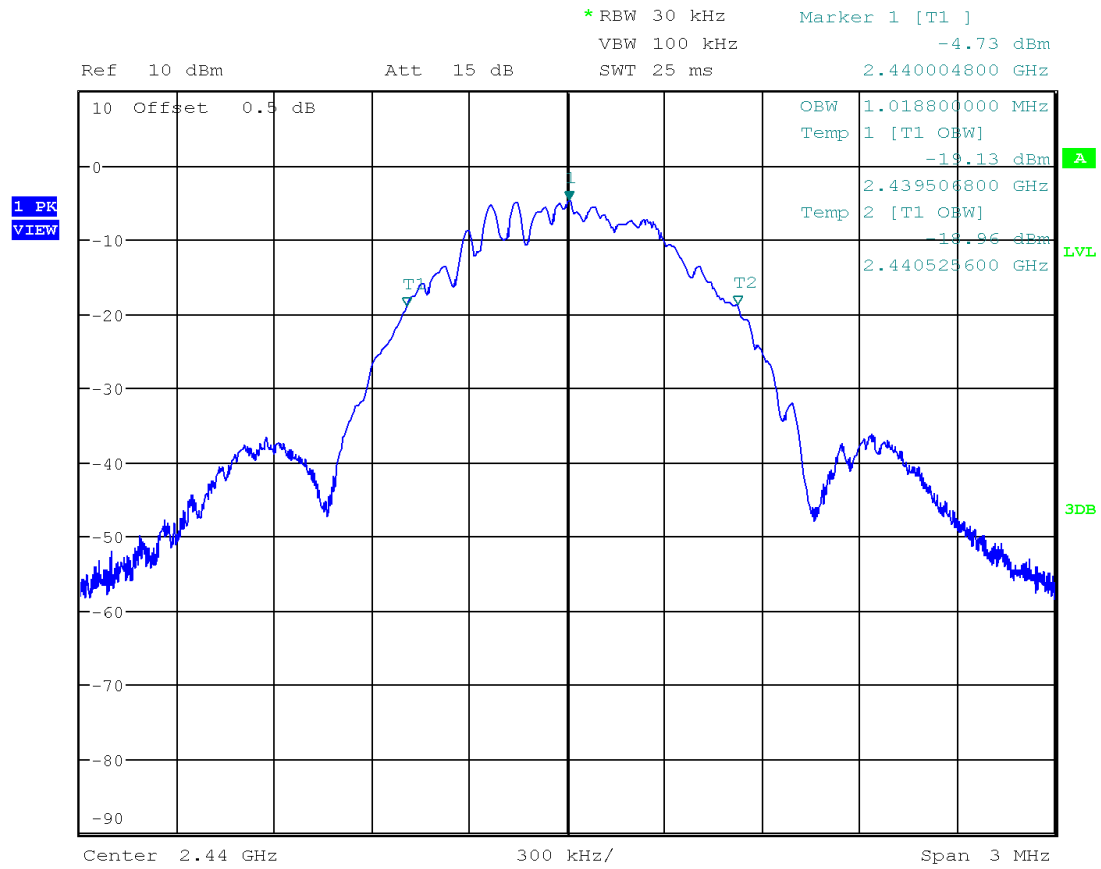
Date: 21.DEC.2022 03:59:34

Plot 1. 4



Date: 21.DEC.2022 04:04:12

Plot 1.5



Date: 21.DEC.2022 04:02:25

Plot 1.6



Date: 21.DEC.2022 04:01:26

Complies

4.2 Maximum Peak 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 or 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 procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used. Specifically, section 11.9.1.1 $RBW \geq DTS$ bandwidth in ANSI 63.10.

1. Set the $RBW \geq DTS$ Bandwidth
2. Set the $VBW \geq 3 \times RBW$
3. Set the span $\geq 3 \times RBW$
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max Hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

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

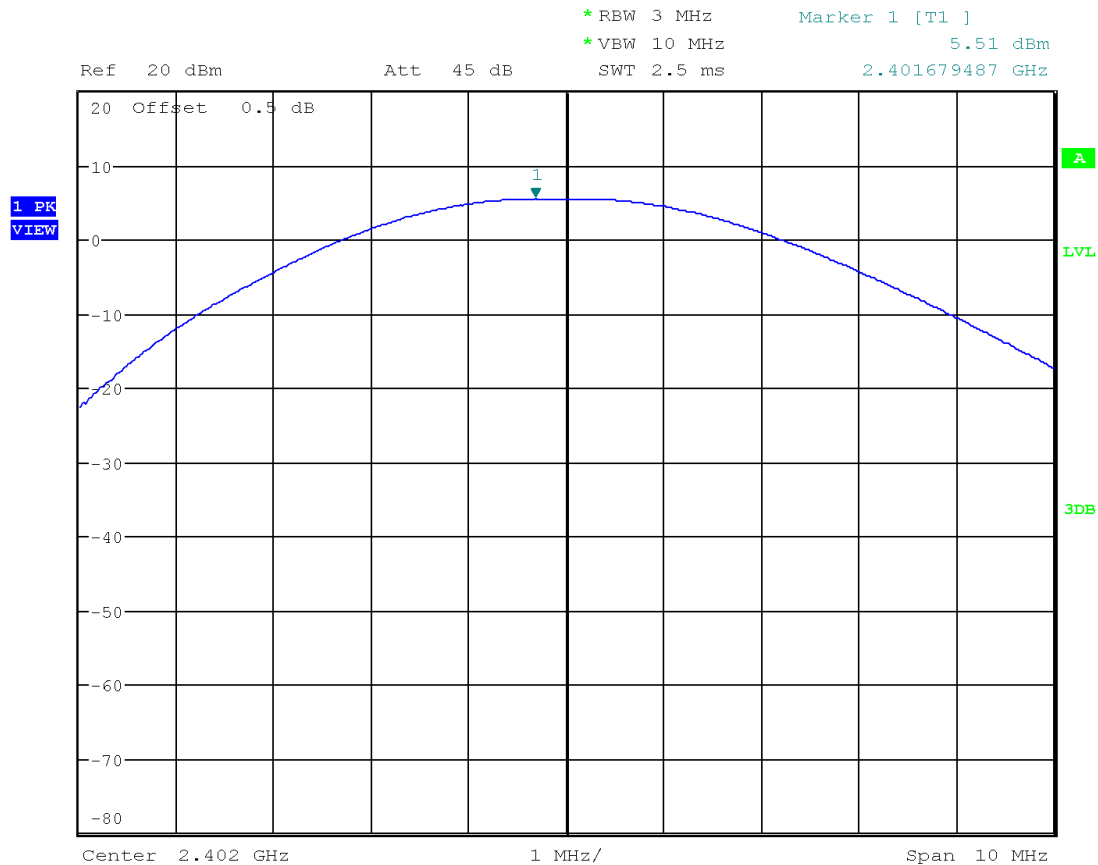
4.2.3 Test Result

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

Mode	Frequency	Conducted Power (peak)		Plot
	MHz	dBm	mW	
BLE	2402	5.51	3.56	2.1
	2440	5.38	3.45	2.2
	2480	5.20	3.31	2.3

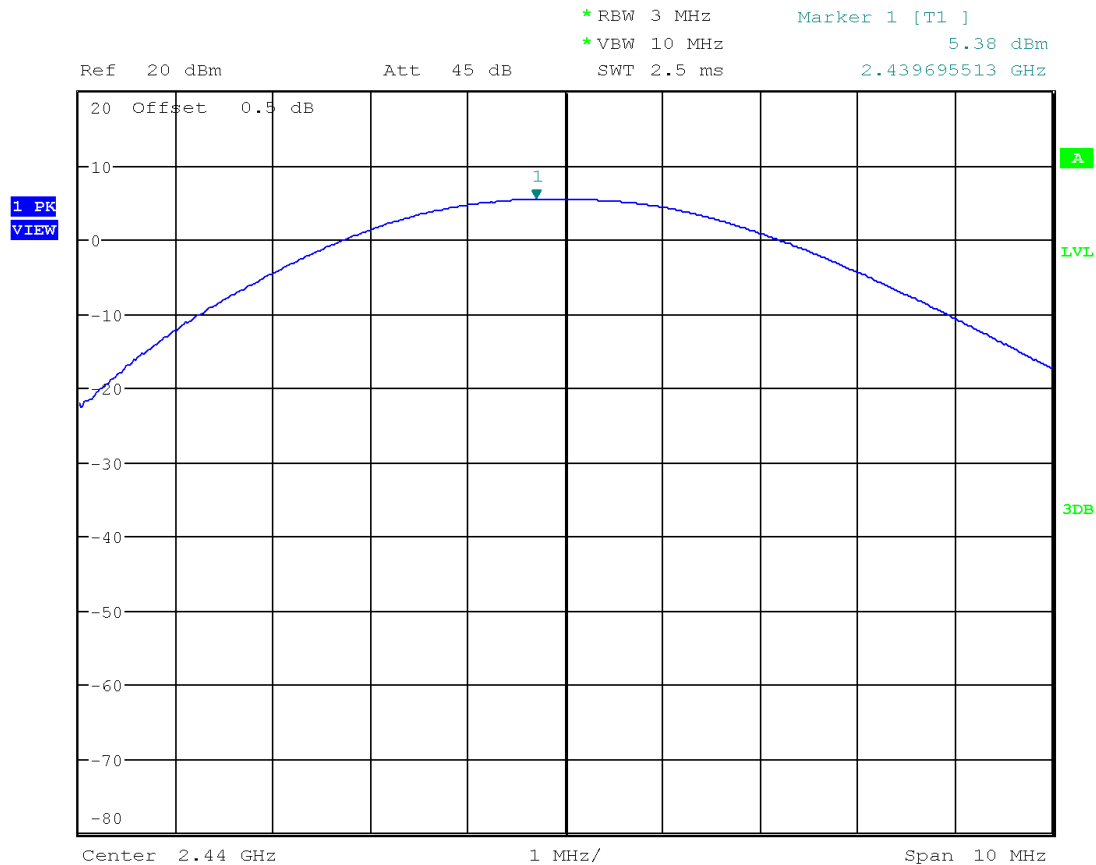
Tested By	Test Date	Results
Bryce Toma	January 12, 2023	Complies

Plot 2.1



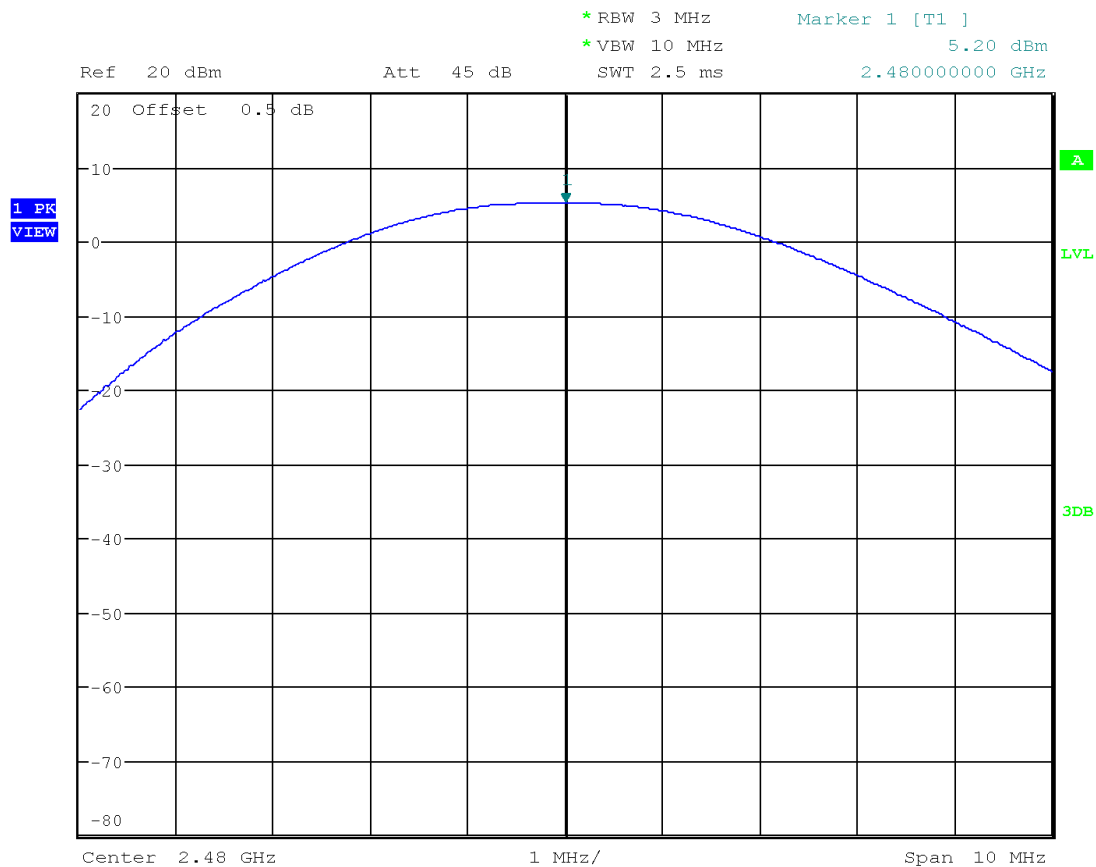
Date: 12.JAN.2023 23:39:54

Plot 2.2



Date: 12.JAN.2023 23:41:42

Plot 2.3



Date: 12.JAN.2023 23:43:27

Results

Complies

4.3 Maximum 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 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

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

The procedure described in 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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
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.

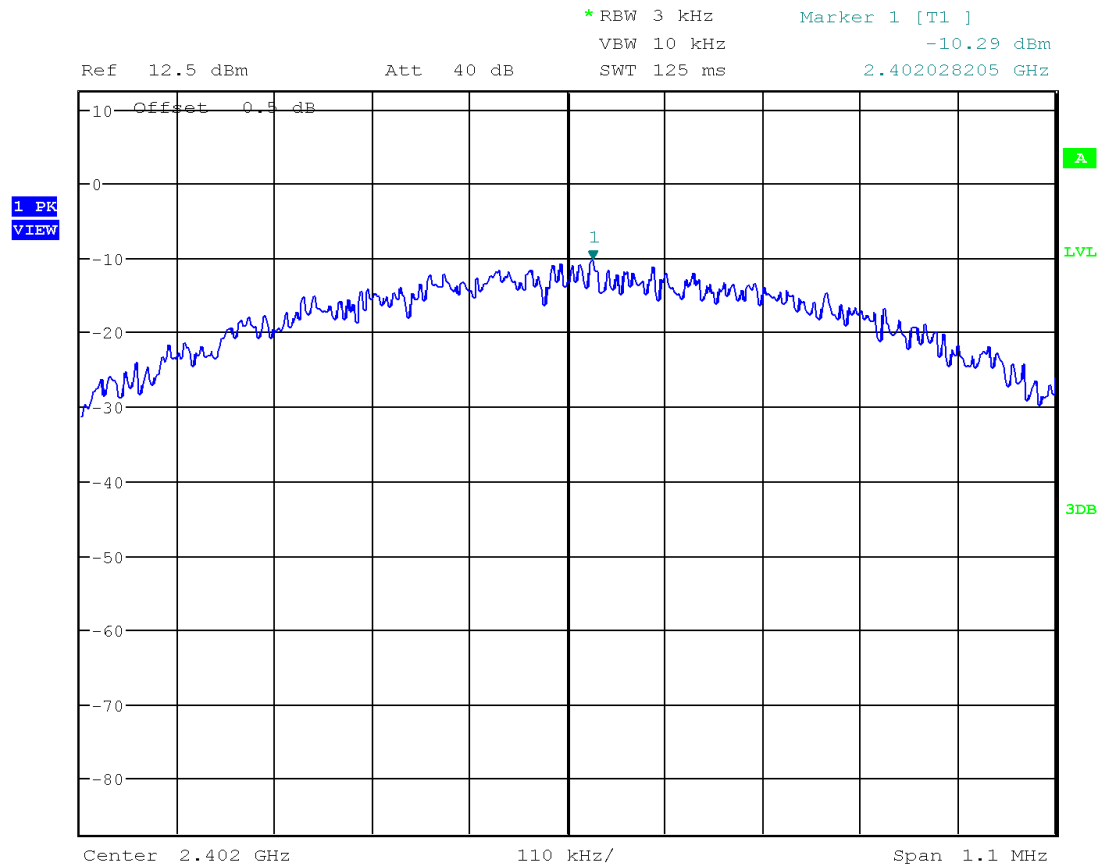
4.3.3 Test Result

Refer to the following plots for the test result

Mode	Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
BLE	2402	-10.29	8.0	-18.29	3.1
	2440	-10.39	8.0	-18.39	3.2
	2480	-10.56	8.0	-18.56	3.3

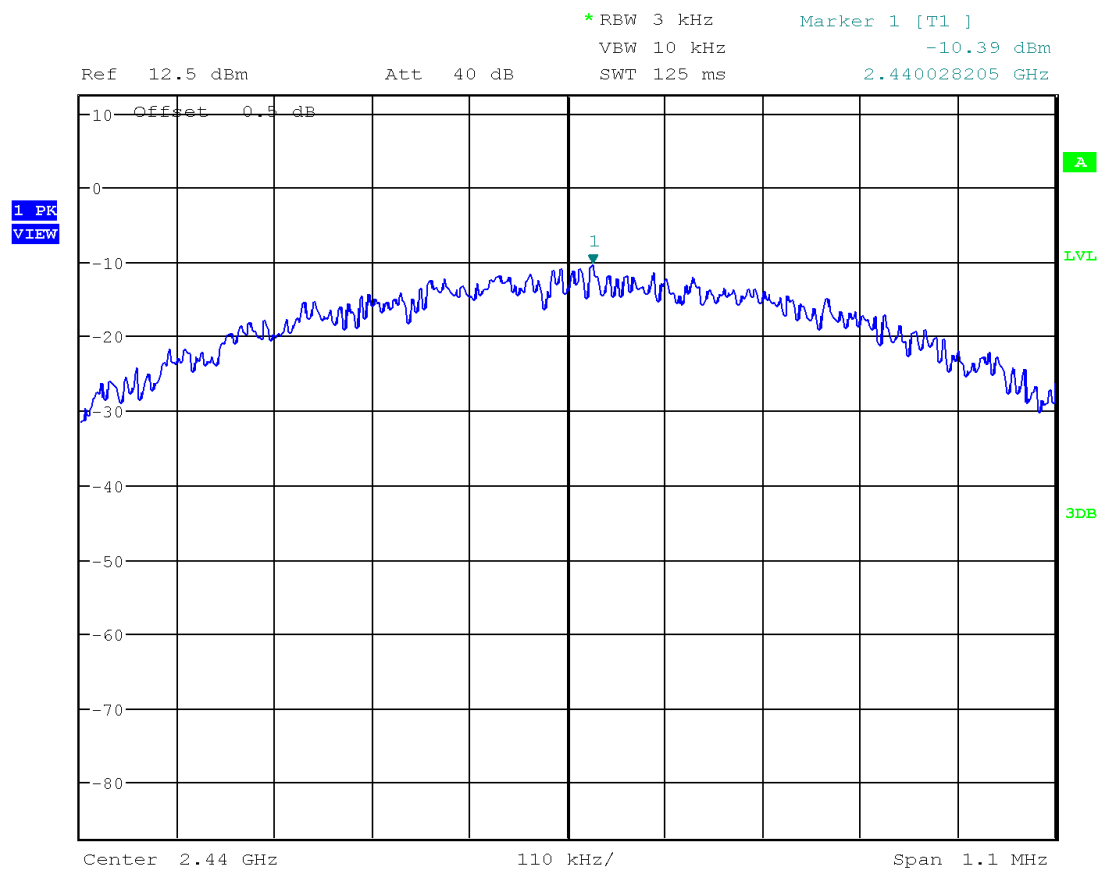
Tested By	Test Date	Results
Bryce Toma	January 12-13, 2023	Complies

Plot 3.1



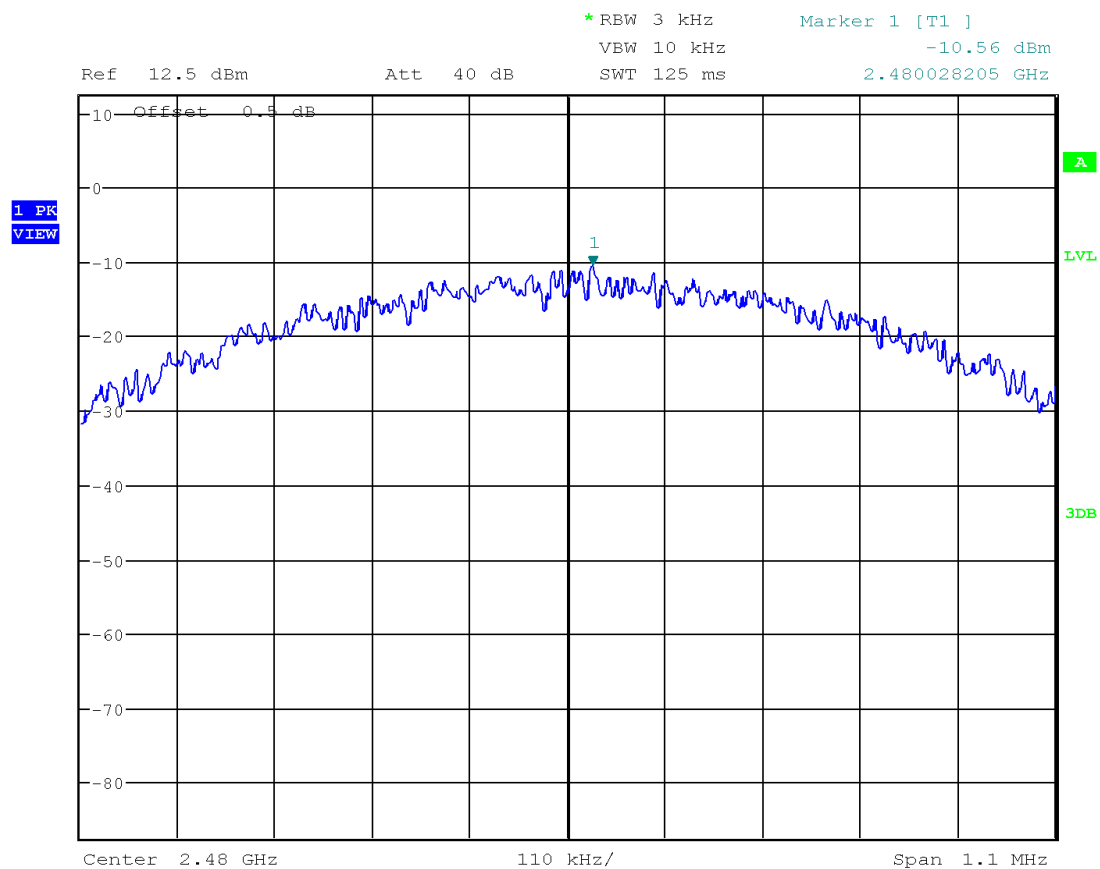
Date: 12.JAN.2023 23:32:36

Plot 3.2



Date: 12.JAN.2023 23:30:46

Plot 3.3



Date: 12.JAN.2023 23:29:25

Results

Complies

4.4 Out of Band Antenna Conducted Emission
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 $\geq 3 \times$ 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.

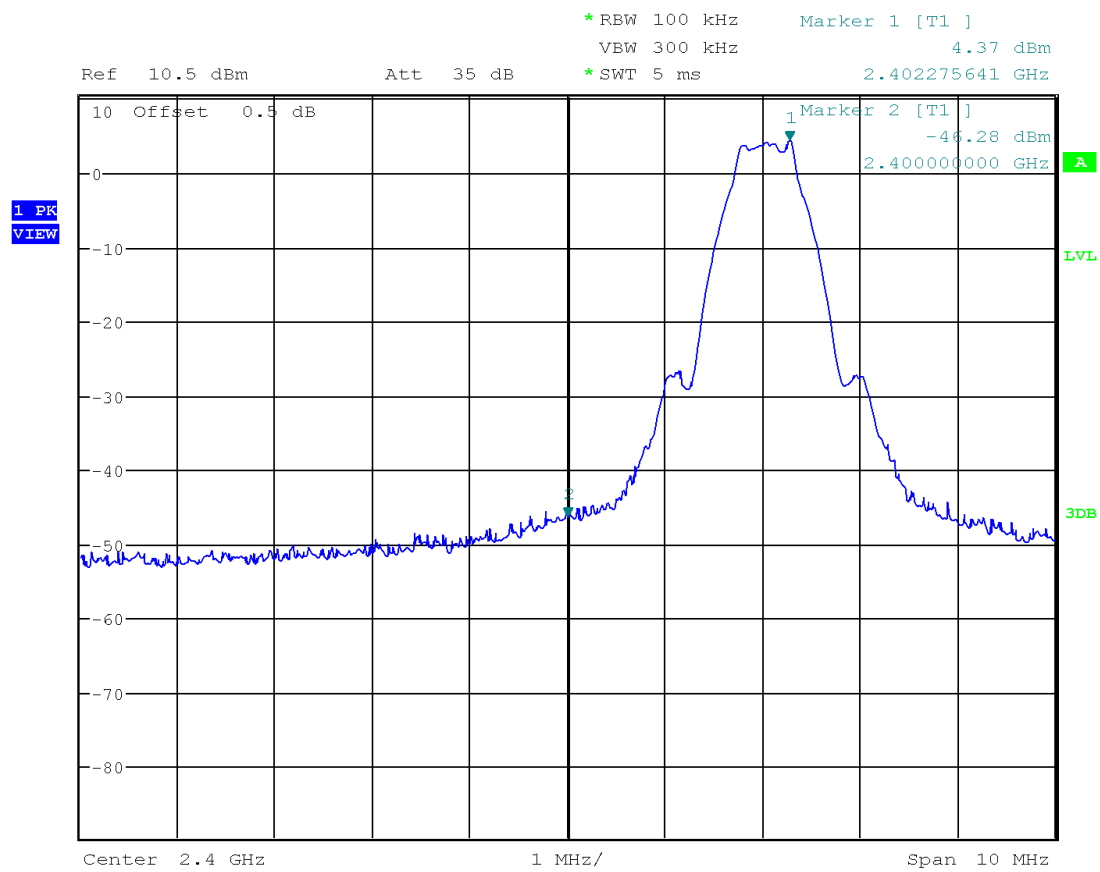
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

Refer to the following plots 4.1 – 4.5 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

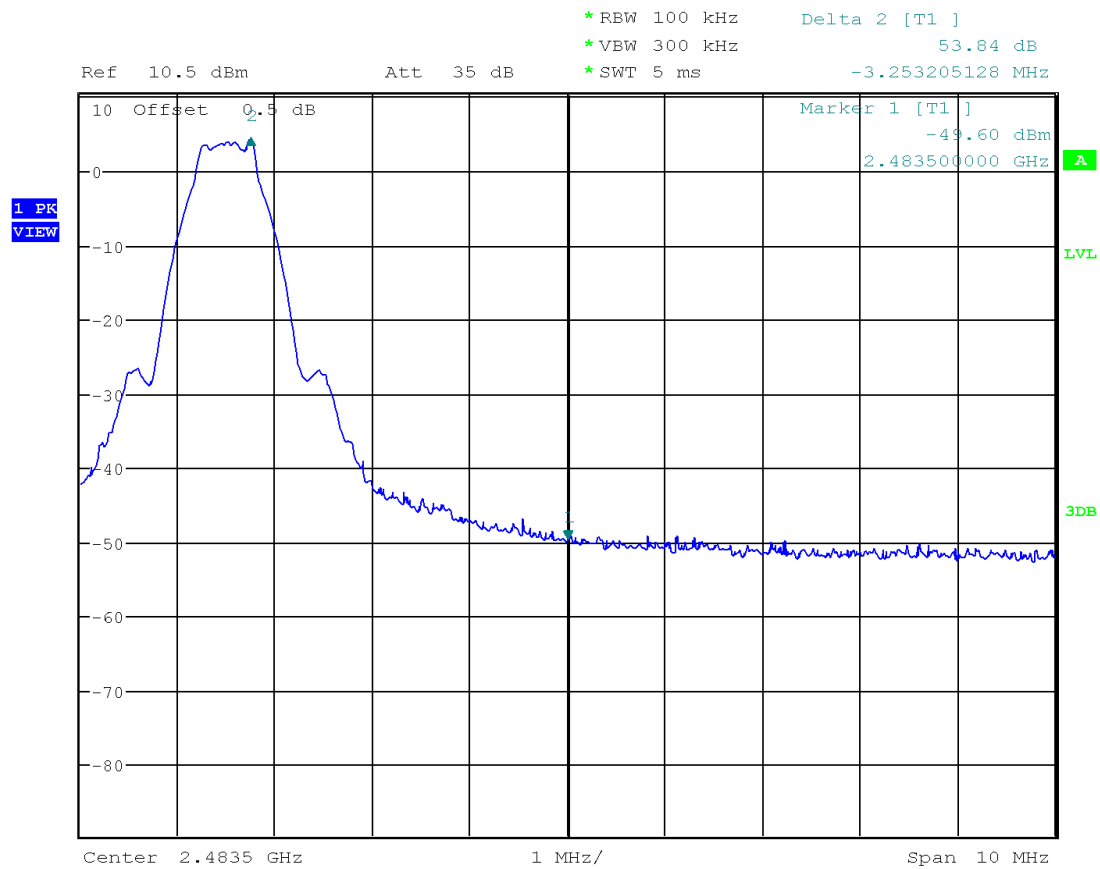
Tested By	Test Date	Results
Bryce Toma	January 13, 2023	Complies

BLE Mode
Tx @ Low Channel, 2402 MHz Band Edge
Plot 4.1



Date: 13.JAN.2023 00:16:21

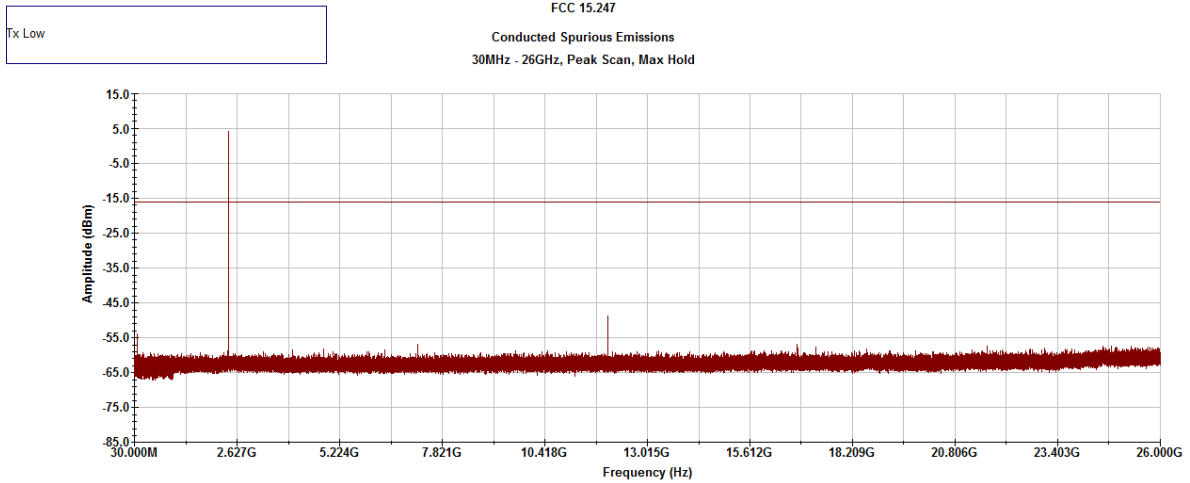
BLE Mode
Tx @ High Channel, 2480 MHz Band Edge
Plot 4.2



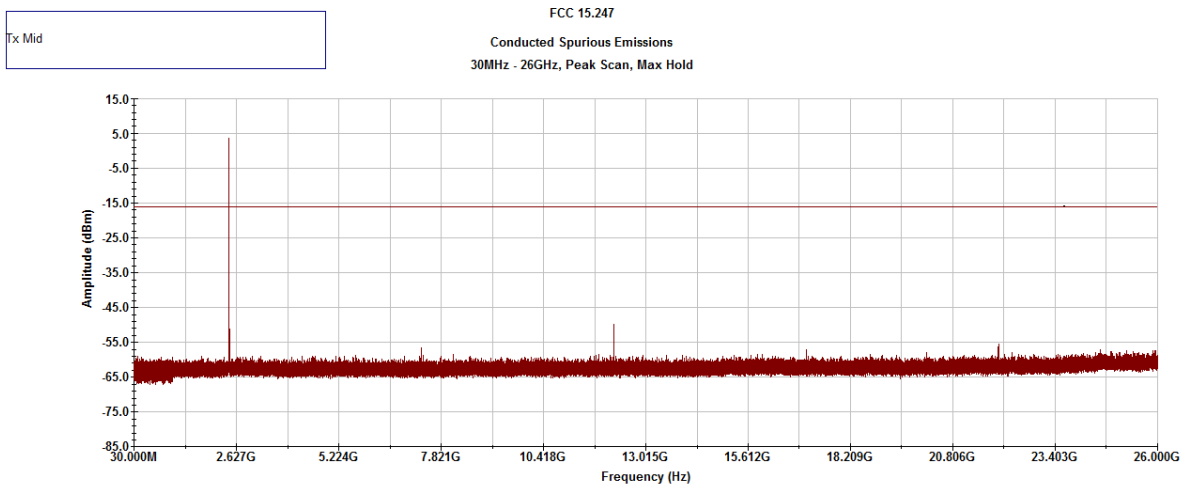
Date: 30.JAN.2023 04:39:35

Results	Complies
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BLE Mode
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



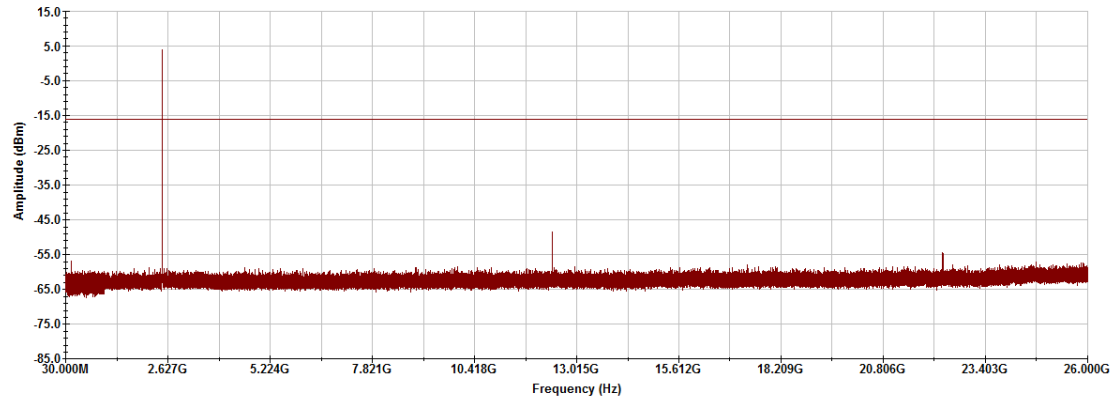
BLE Mode
Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Plot 4.4



BLE Mode
Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious
Plot 4.5

Tx High

FCC 15.247
Conducted Spurious Emissions
30MHz - 26GHz, Peak Scan, Max Hold



Results

Complies

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 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 9kHz to 26.5GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26.5GHz.

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.

Radiated measurements were performed on the X, Y and Z orientation of the EUT. Data is presented with the worst-case configuration (the configuration which resulted in the highest emission levels).

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(μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB(μ V); 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(μ V) 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(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

RA = 52.0 dB(μ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 \text{ dB}(\mu\text{V/m})$.

Level in μ V/m = Common Antilogarithm $[(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$.

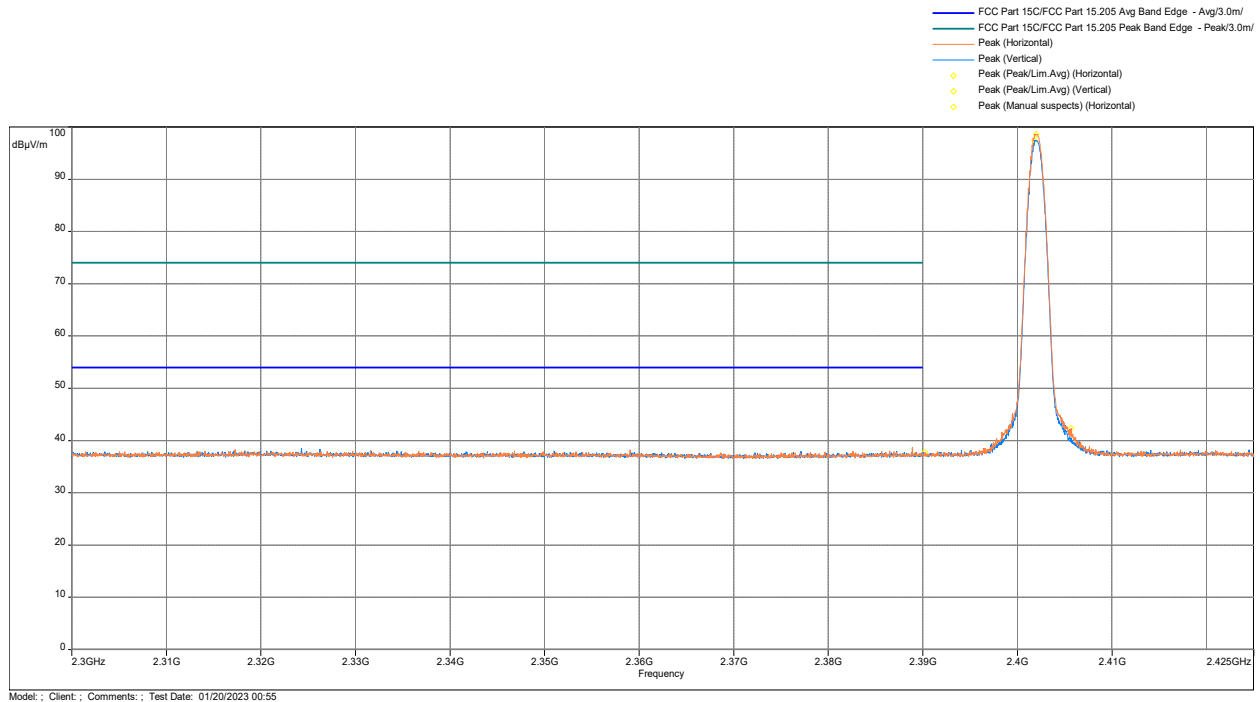
4.5.4 Test Results

All testing in this section were performed by radiated measurements.

Tested By	Test Date	Results
Bryce Toma	December 13, 2022 – January 20, 2023	Complies

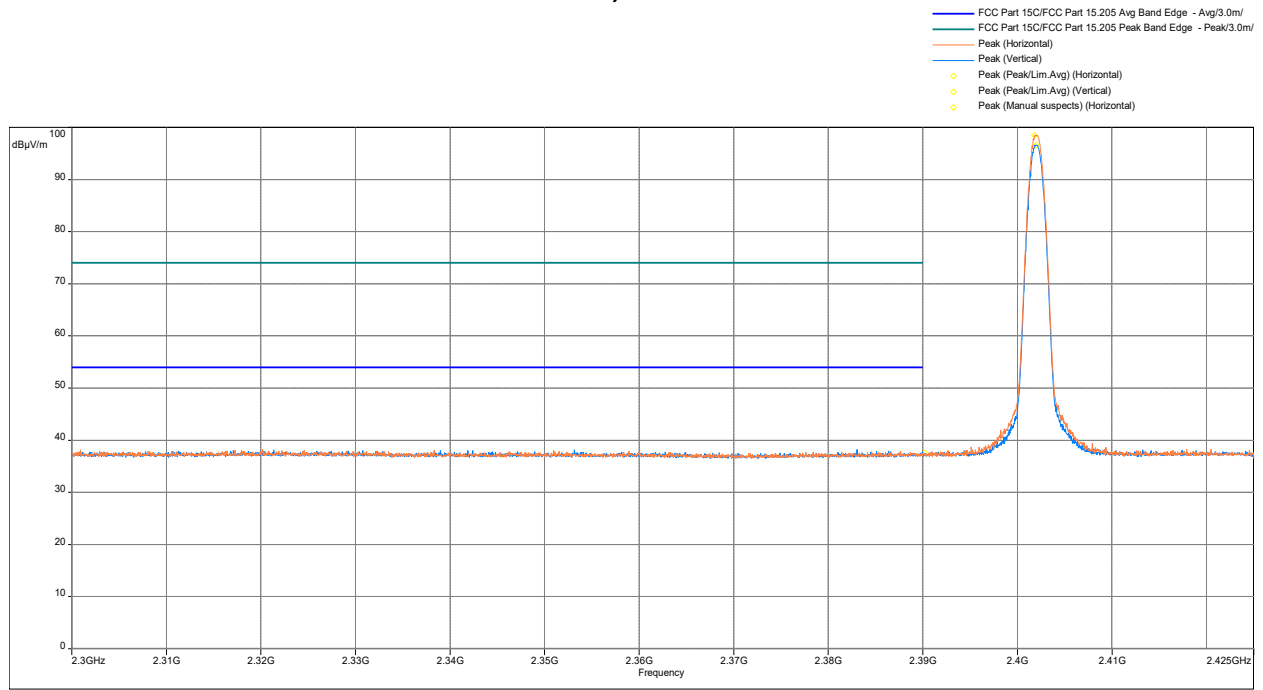
Test Results: 15.209/15.205 Radiated Restricted Band Emissions

**Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
BLE Mode; EUT Horizontal**



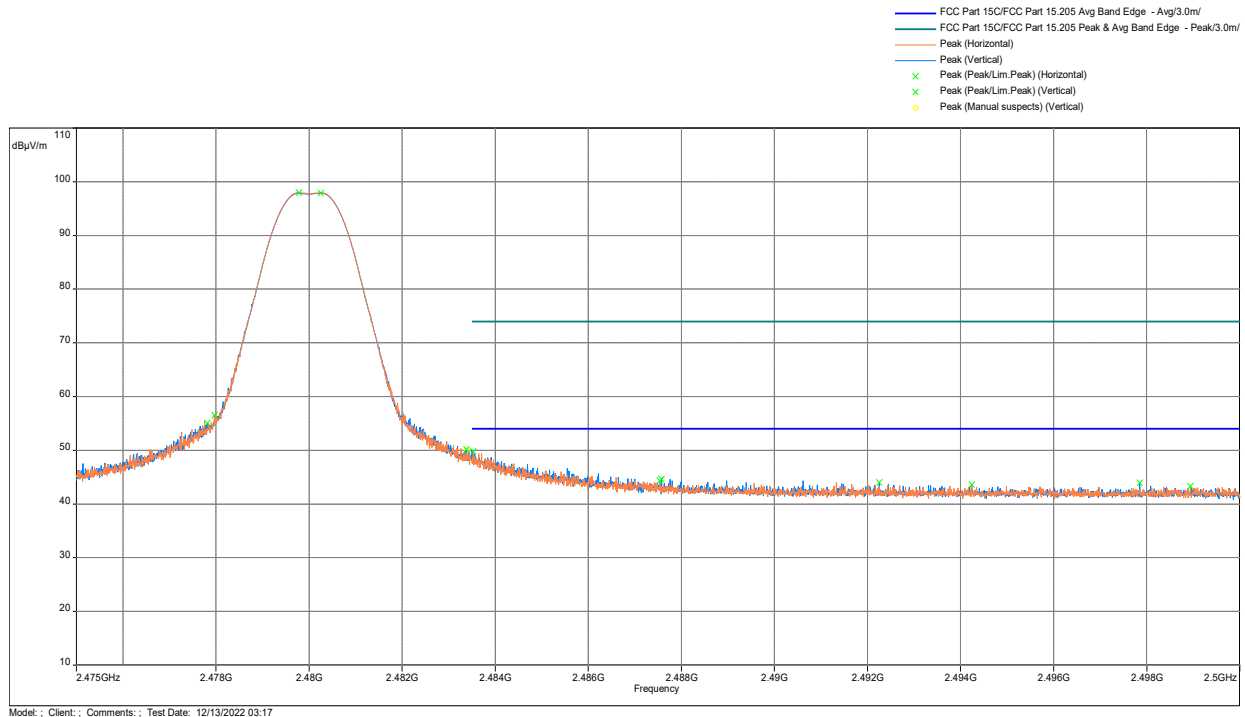
Freq. MHz	Peak@3m dB(uV/m)	Avg Limit dB(uV/m)	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2390	37.75	54.00	-16.25	2.01	197.25	Horizontal	21.85

Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
BLE Mode; EUT Vertical



Freq. MHz	Peak@3m dB(uV/m)	Avg Limit dB(uV/m)	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2390	37.52	54.00	-16.48	3.01	78	Horizontal	21.85

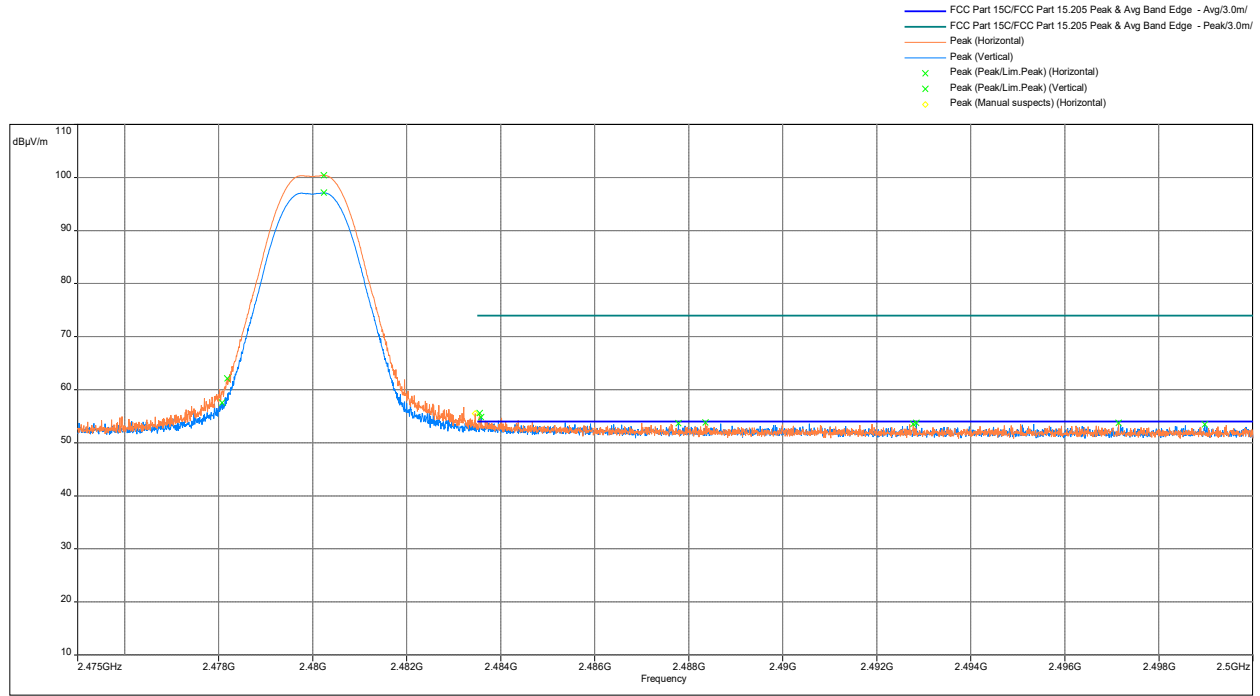
Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
BLE Mode; EUT Horizontal



Frequency (MHz)	Peak (dBμV/m)	Limit Avg (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
2483.5	50.12	54.00	-3.88	1.99	132.25	Vertical	22.15

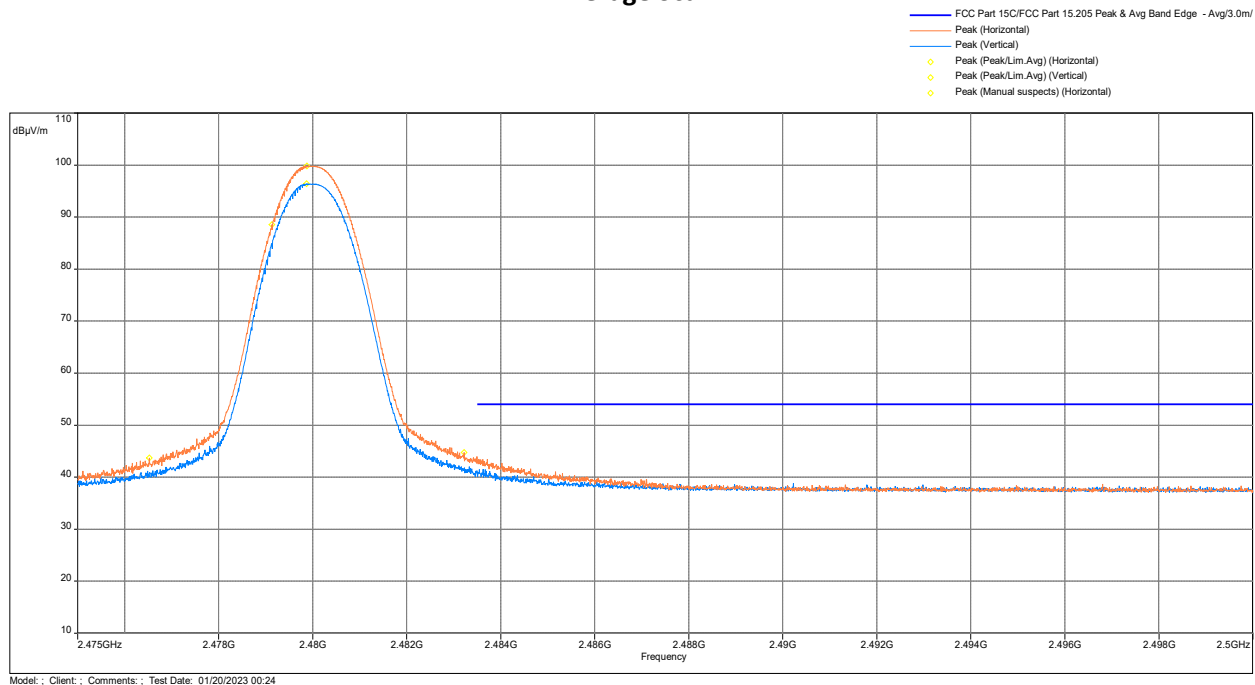
Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
BLE Mode; EUT Vertical

Peak Scan



Frequency (MHz)	Peak (dBμV/m)	Lim.Peak (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
2483.5	55.51	74	-18.49	1.01	142.5	Horizontal	22.15

Average Scan

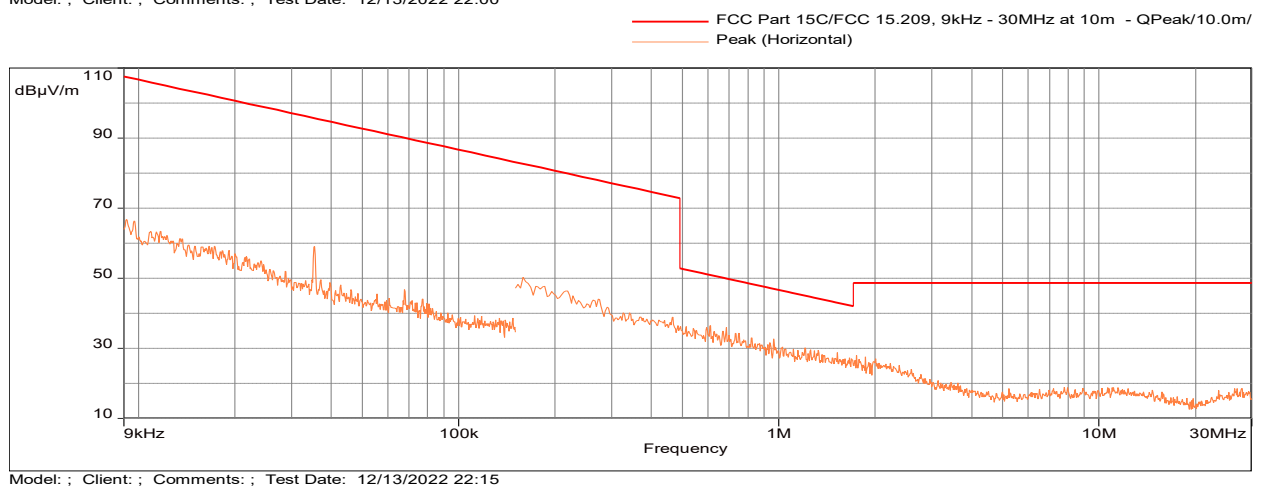
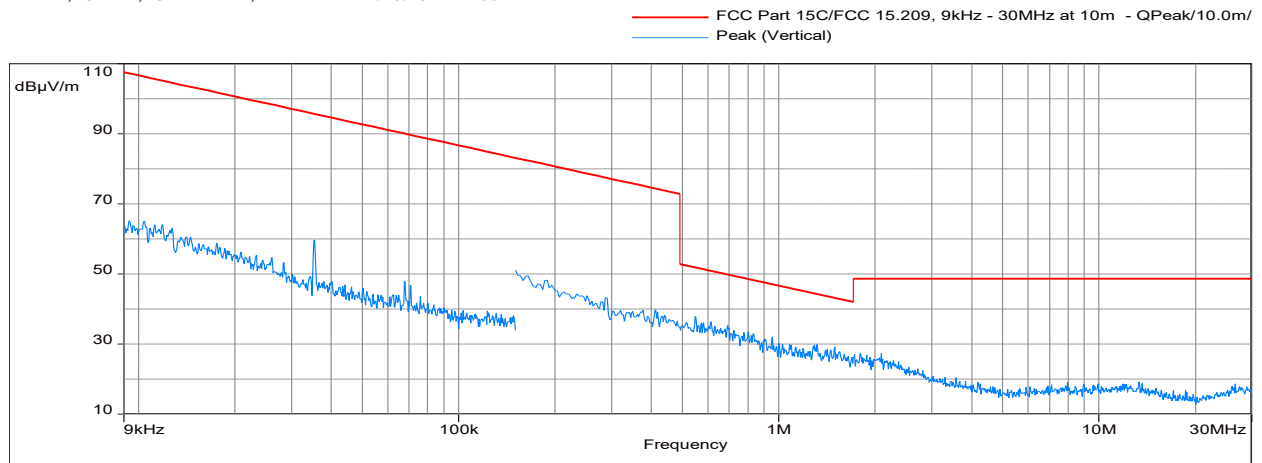
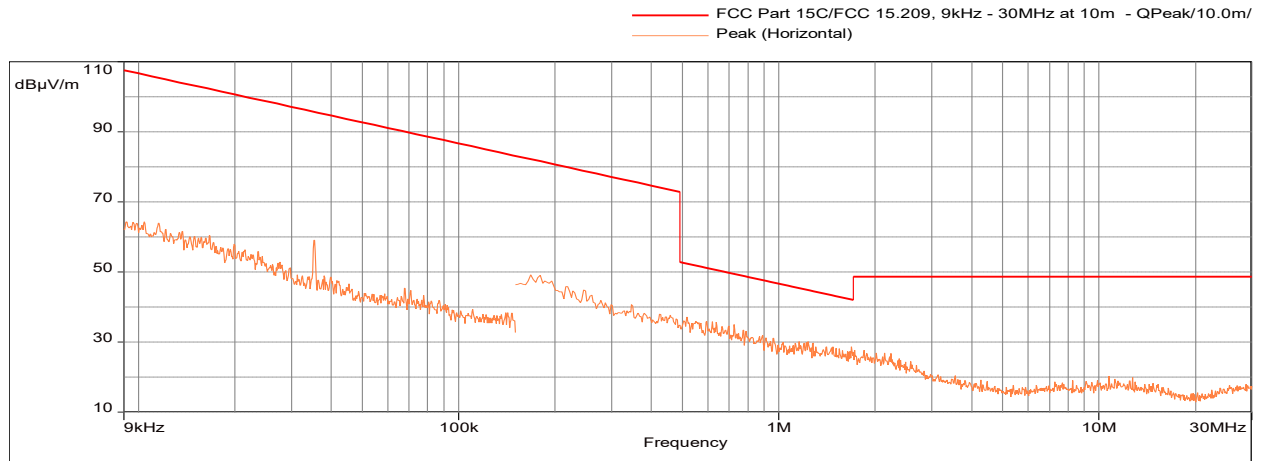


Frequency (MHz)	Peak (dBμV/m)	Lim.Avg (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
2483.5	44.76	54	-9.24	1.01	143	Horizontal	22.15

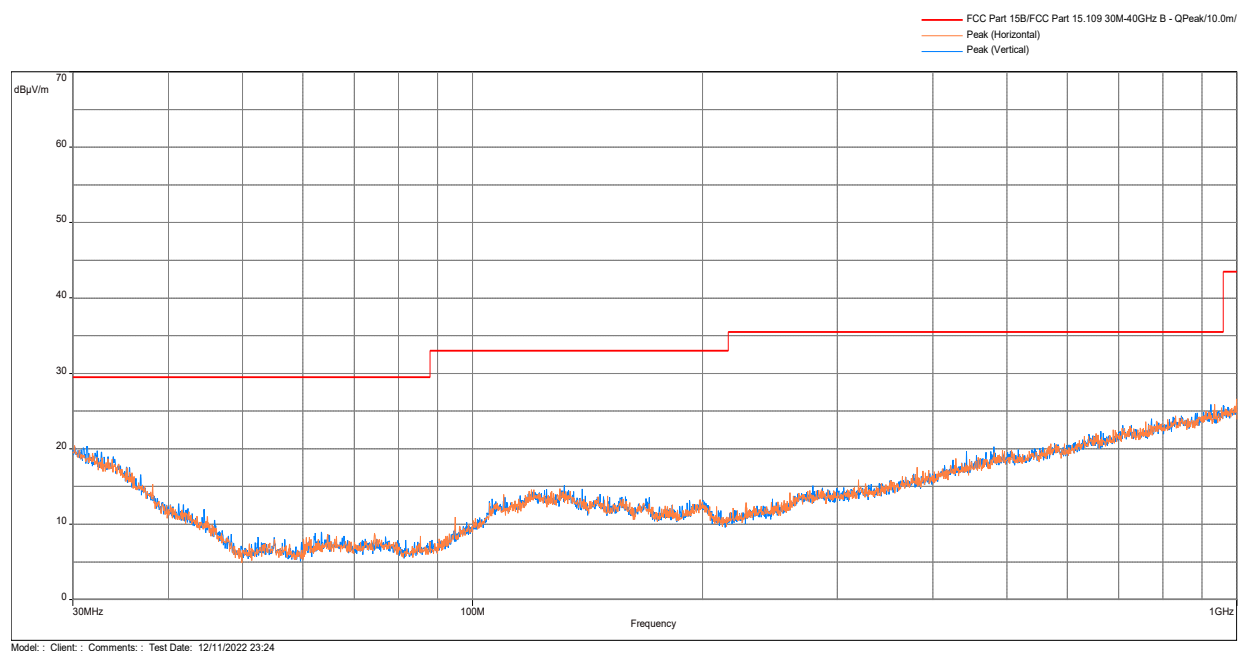
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
BLE Mode

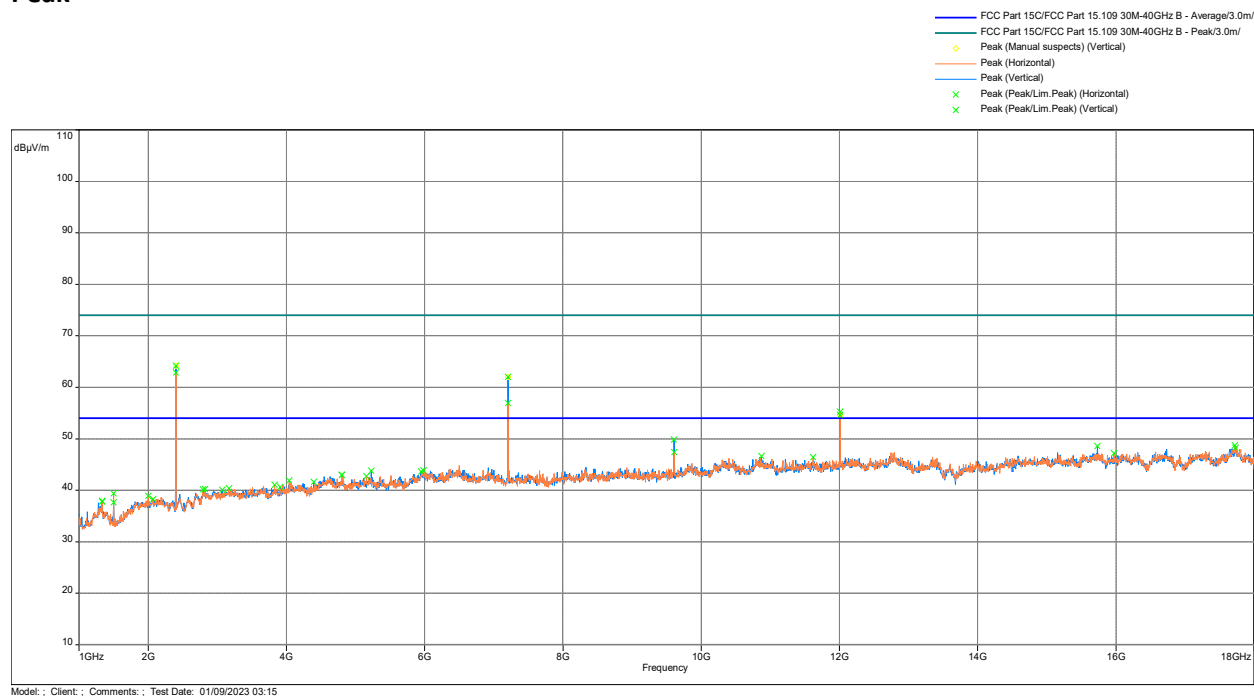
Radiated Spurious Emissions 9kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



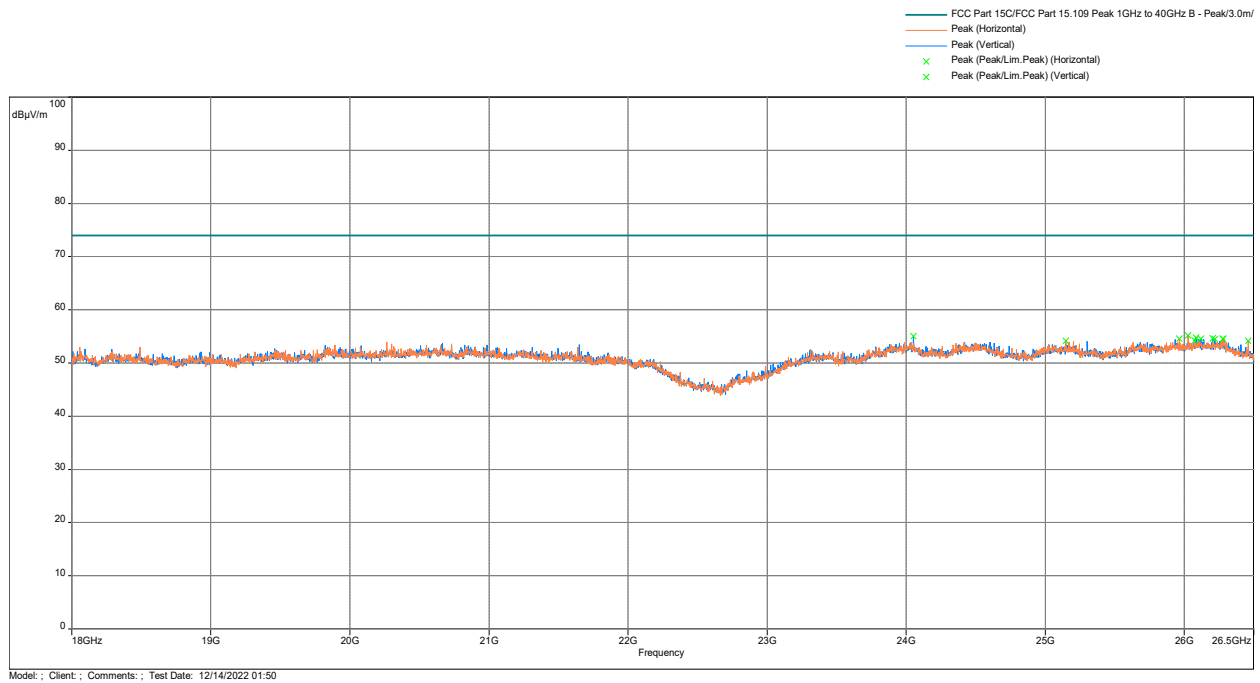
Radiated Spurious Emissions 30 MHz - 1000 MHz



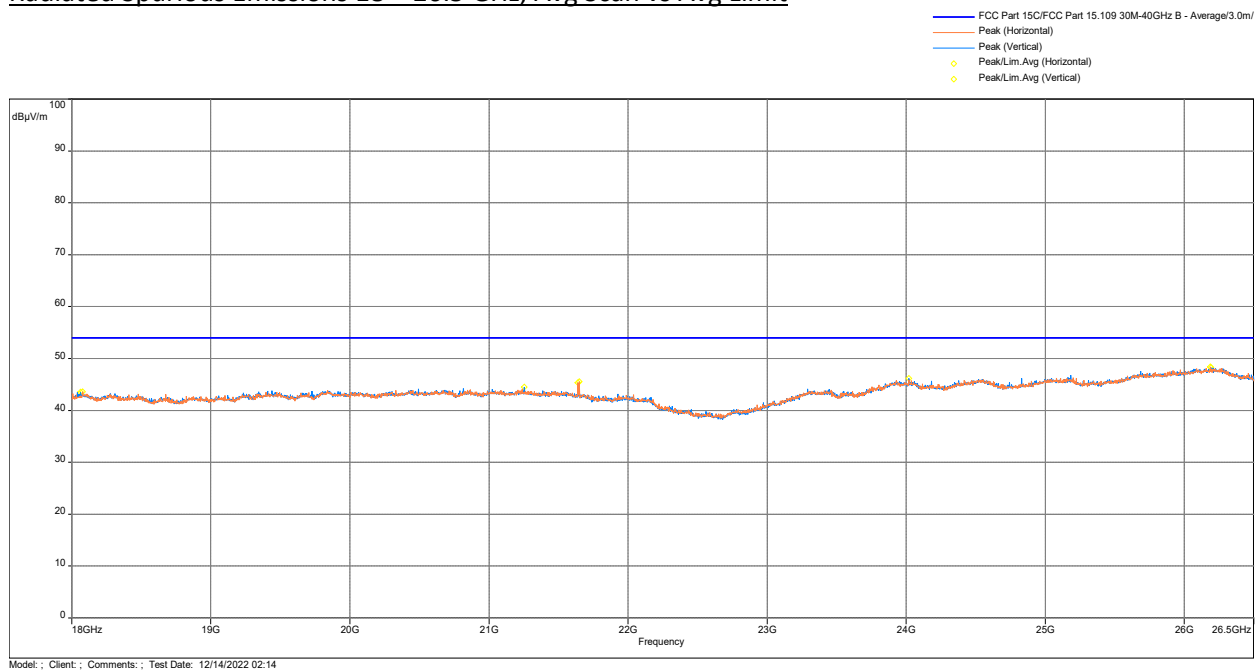
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan Peak



Radiated Spurious Emissions 18 – 26.5 GHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 18 – 26.5 GHz, Avg Scan vs Avg Limit



Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
BLE Mode

Frequency (MHz)	QPeak@ 10m (dBμV/m)	Lim. QPeak @10m (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
30.162	20.44	29.50	-9.06	3.00	107.25	Horizontal	-6.38
55.058	8.02	29.50	-21.48	2.00	13.25	Horizontal	-19.99
74.426	8.77	29.50	-20.73	3.59	238.75	Horizontal	-18.96
94.925	10.91	33.00	-22.09	0.99	139.75	Horizontal	-17.88
759.828	23.60	35.50	-11.90	3.00	46.75	Horizontal	-3.25
785.274	23.69	35.50	-11.81	3.59	218.00	Horizontal	-2.48

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Peak @3m (dBμV/m)	Lim. Peak @3m (dBμV/m)	Margin dB	Height (m)	Angle (°)	Comment	Correction (dB)
7206.7	56.97	74	-17.03	2.01	355.75	Horizontal	-4.83
7206.7	62.01	74	-11.99	1.99	328.25	Vertical	-4.83

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Ave @3m (dBμV/m)	Lim. Ave @3m (dBμV/m)	Margin dB	Height (m)	Angle (°)	Comment	Correction (dB)
7206.7	50.9	54	-3.1	2.32	262	Horizontal	-4.83
7206.7	51.7	54	-2.3	2.13	262.75	Vertical	-4.83

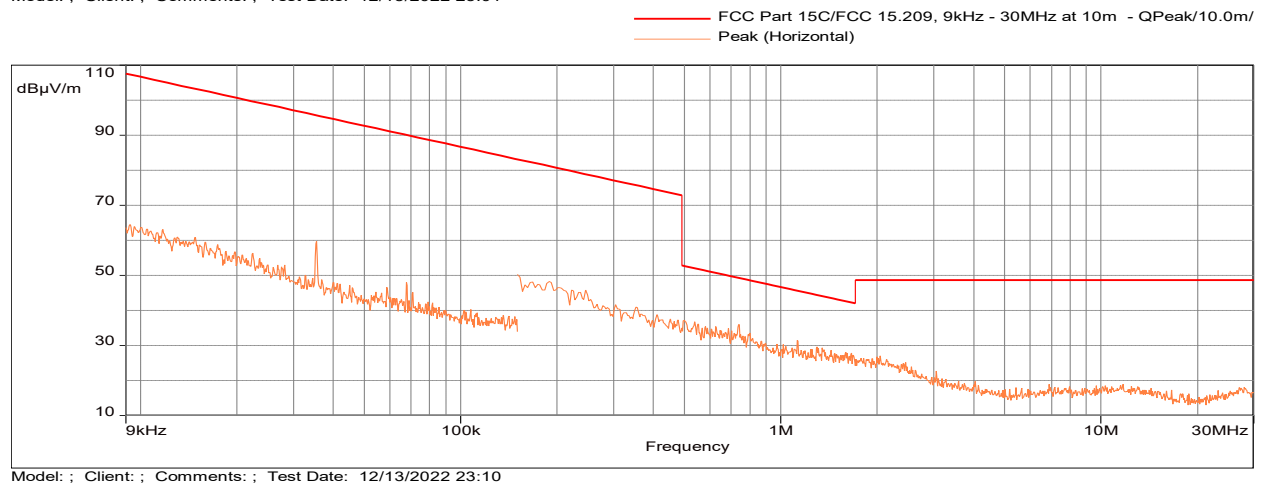
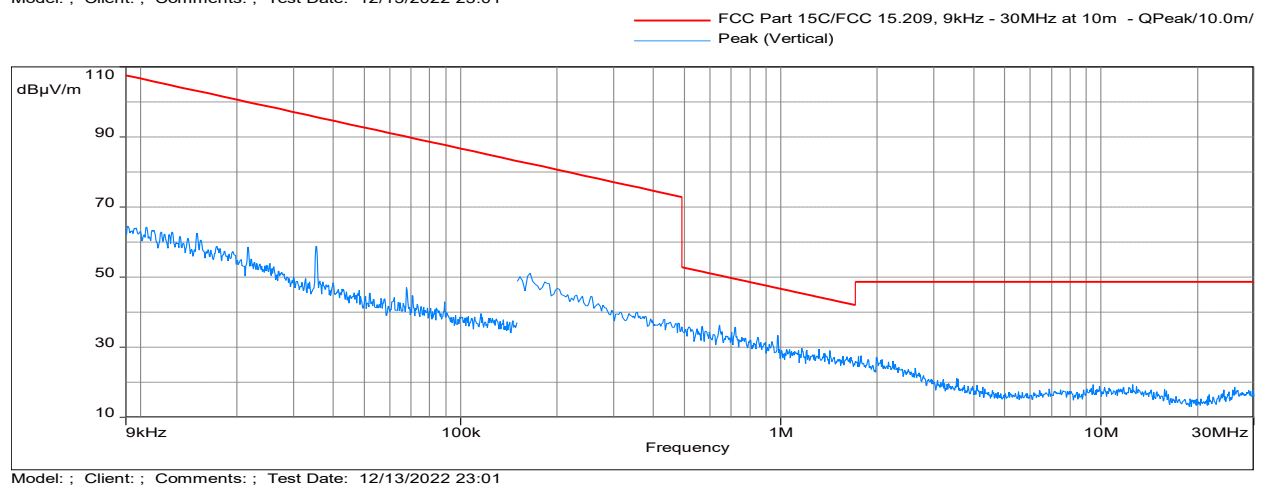
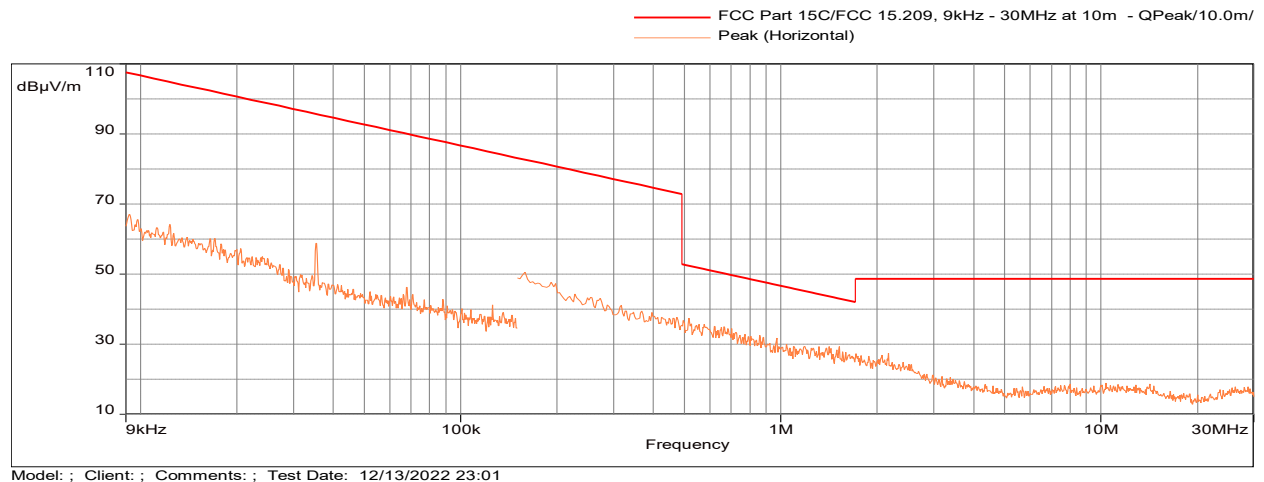
Note: Correction = AF + CF - Preamp

Note: The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at confidence level of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification limit.

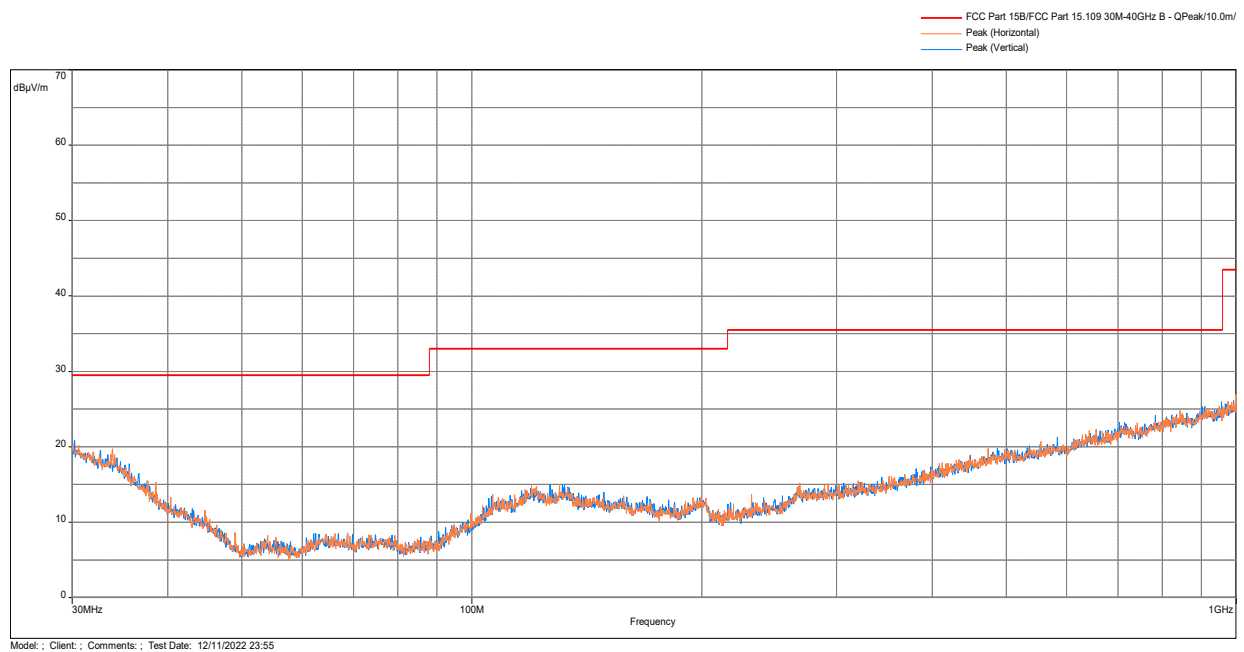
Results	Complies
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Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
BLE Mode

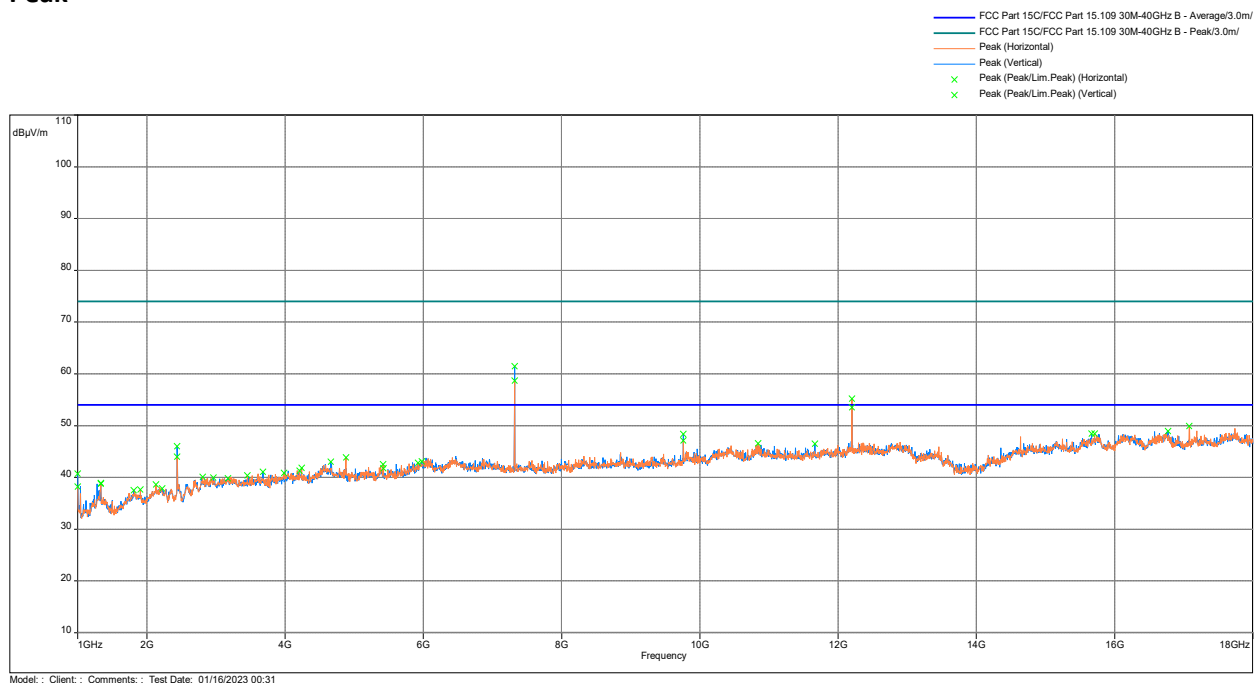
Radiated Spurious Emissions 9kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



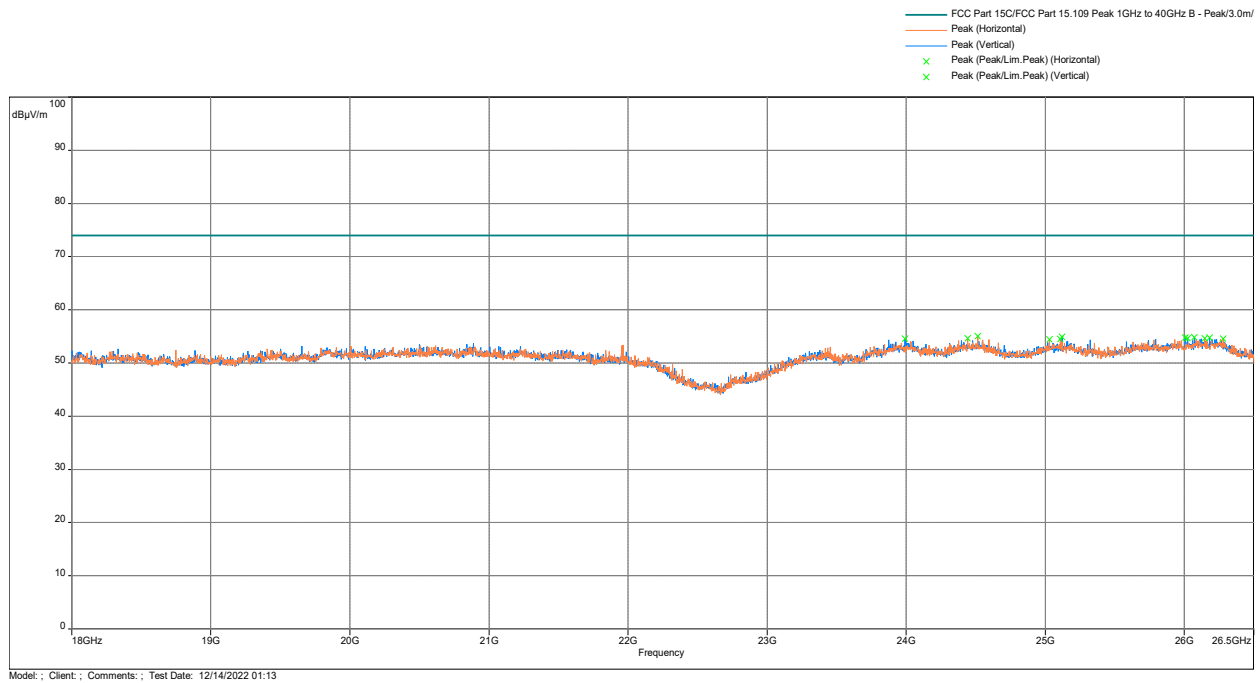
Radiated Spurious Emissions 30 MHz - 1000 MHz



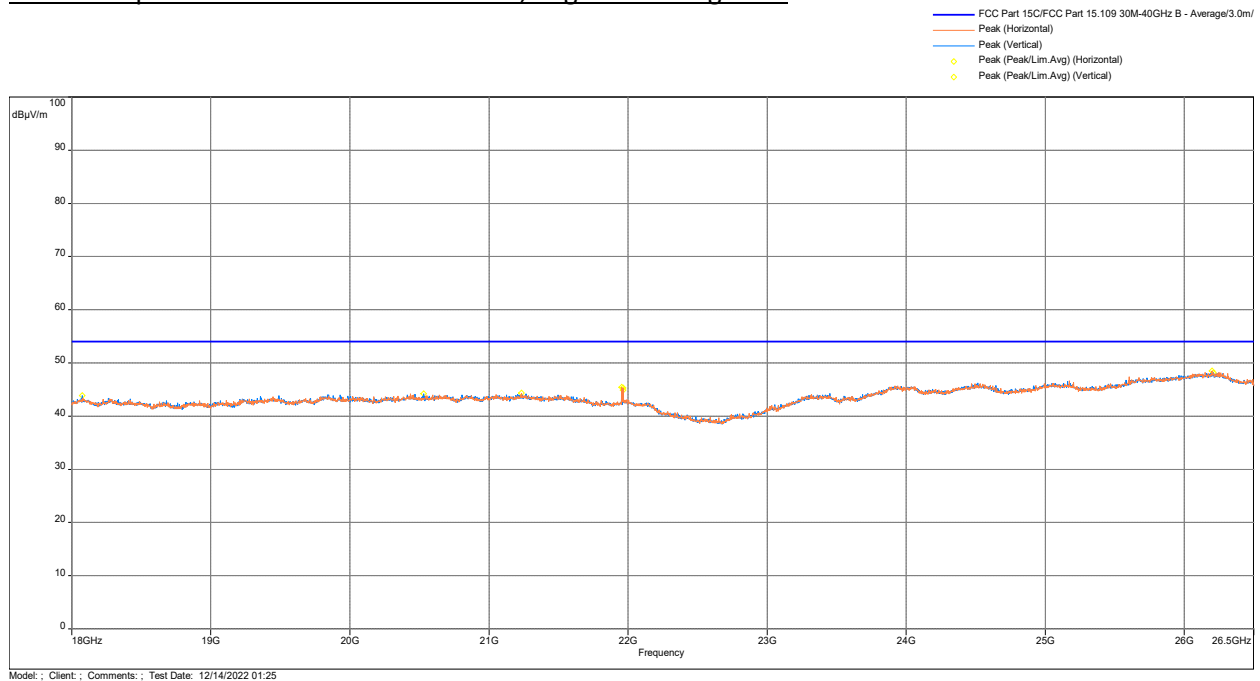
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan Peak



Radiated Spurious Emissions 18 – 26.5 GHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 18 – 26.5 GHz, Avg Scan vs Avg Limit



Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
BLE Mode

Frequency (MHz)	QPeak@ 10m (dBμV/m)	Lim. QPeak @10m (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
30.097	20.26	29.50	-9.24	2.00	178.00	Horizontal	-6.30
38.601	15.31	29.50	-14.19	1.00	297.25	Horizontal	-12.60
54.056	8.31	29.5	-21.19	3.00	218.25	Horizontal	-20
68.800	8.6	29.5	-20.9	2.00	200.75	Horizontal	-18.97
99.711	11.17	33	-21.83	2.00	82	Horizontal	-16.51
642.361	22.17	35.5	-13.33	2.00	281	Horizontal	-4.72

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBμV/m)	Lim. Peak @3m (dBμV/m)	Margin dB	Height (m)	Angle (°)	Comment	Correction (dB)
7320.6	61.44	74	-12.56	1.99	330.5	Vertical	-4.51
7320.6	58.72	74	-15.28	3.01	334	Horizontal	-4.51
12199.03	53.51	74	-20.49	3.99	335.5	Vertical	-0.12
12199.03	55.21	74	-18.79	2.01	268.25	Horizontal	-0.12

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Ave @3m (dBμV/m)	Lim. Ave @3m (dBμV/m)	Margin dB	Angle (°)	Height (m)	Comment	Correction (dB)
7320.6	52.85	54	-1.15	251.5	2.89	Horizontal	-4.52
7320.6	49.84	54	-4.16	251.5	2.03	Vertical	-4.52
12199.03	48.71	54	-5.29	275.25	2.36	Horizontal	-0.12
12199.03	46.72	54	-7.28	348.25	2.99	Vertical	-0.12

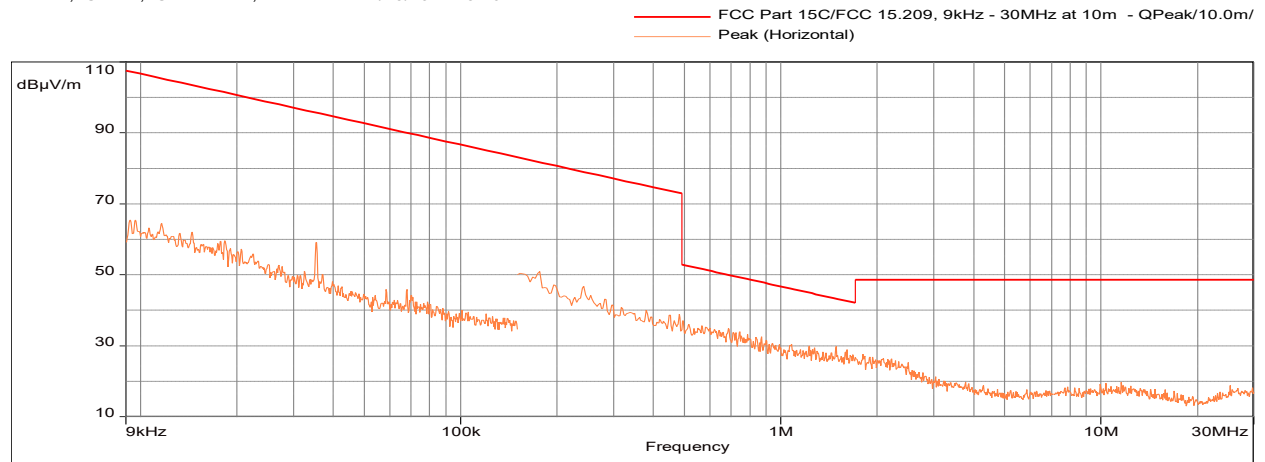
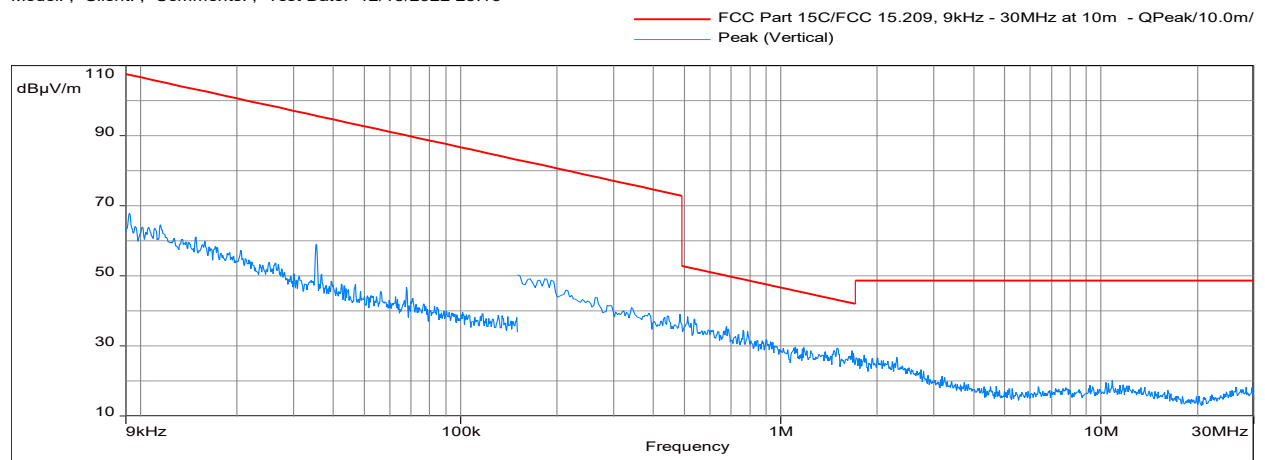
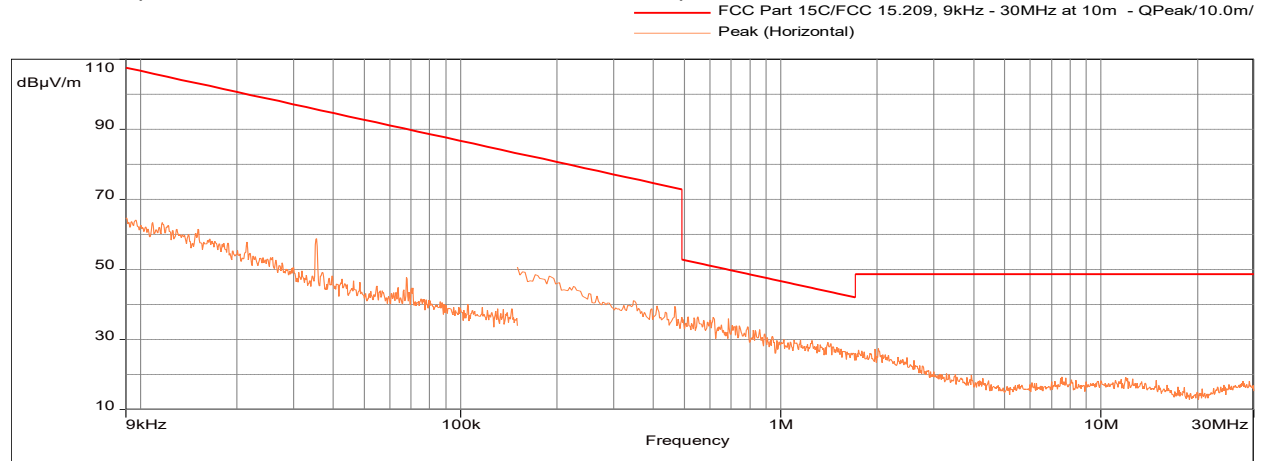
Note: Correction = AF + CF – Preamp

Note: The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at confidence level of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification limit.

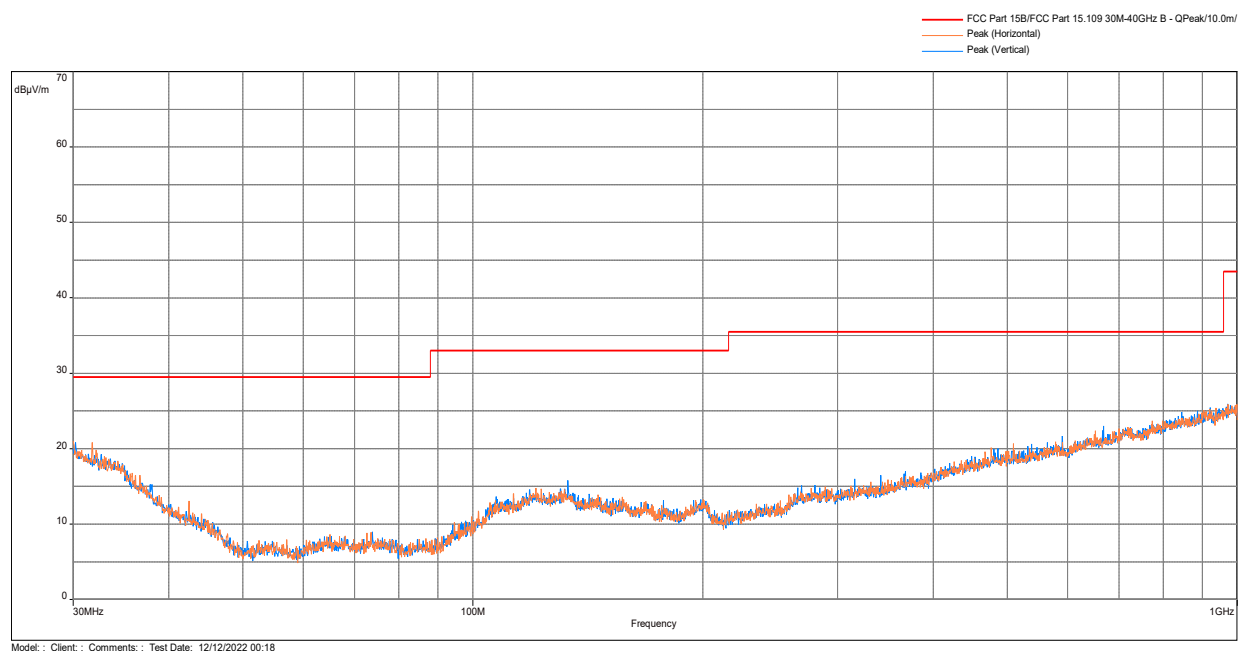
Results	Complies
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Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
BLE Mode

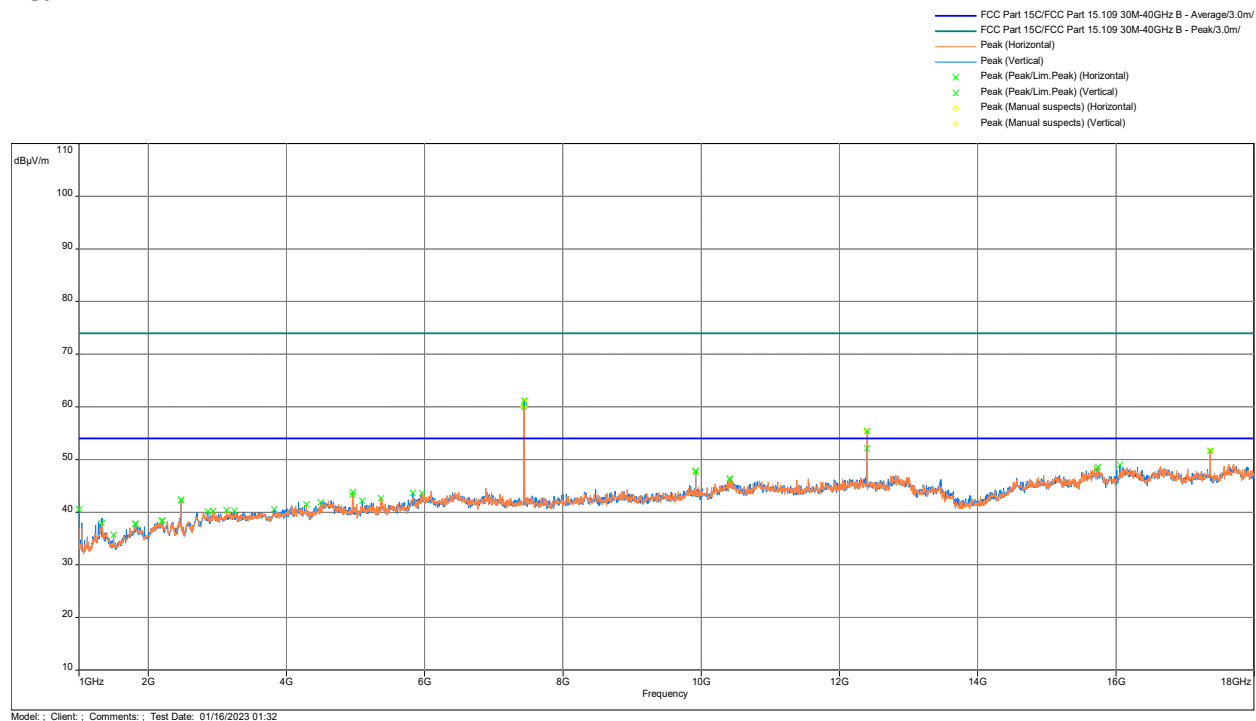
Radiated Spurious Emissions 9kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



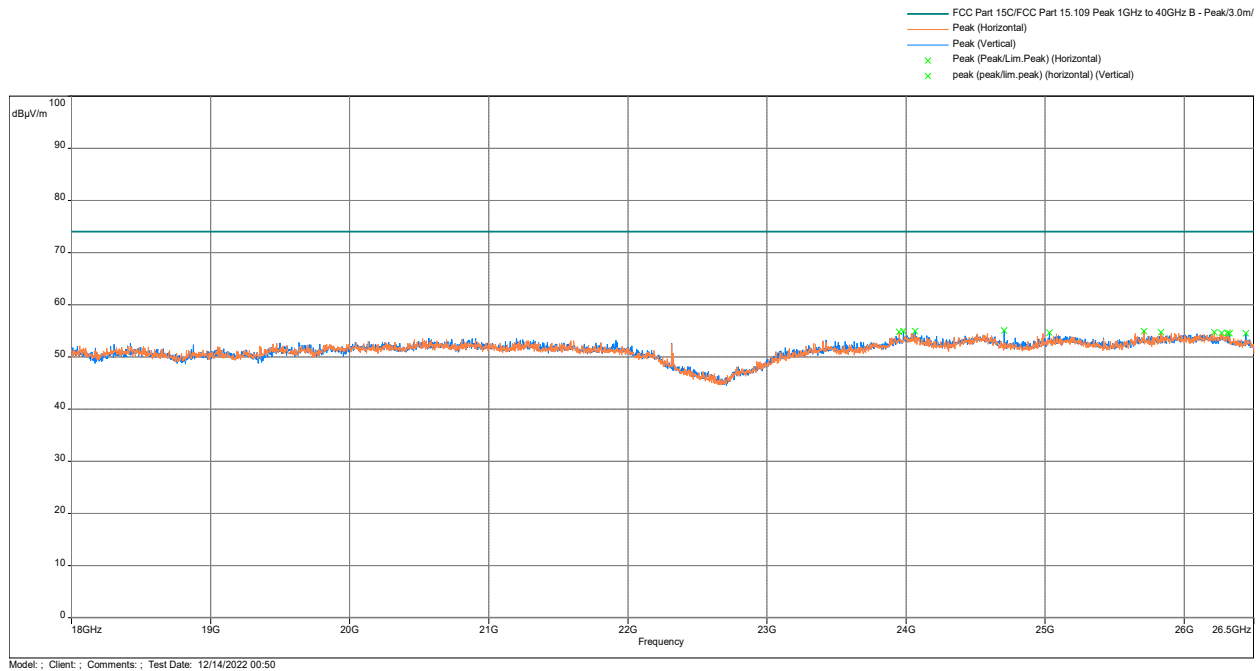
Radiated Spurious Emissions 30 MHz - 1000 MHz



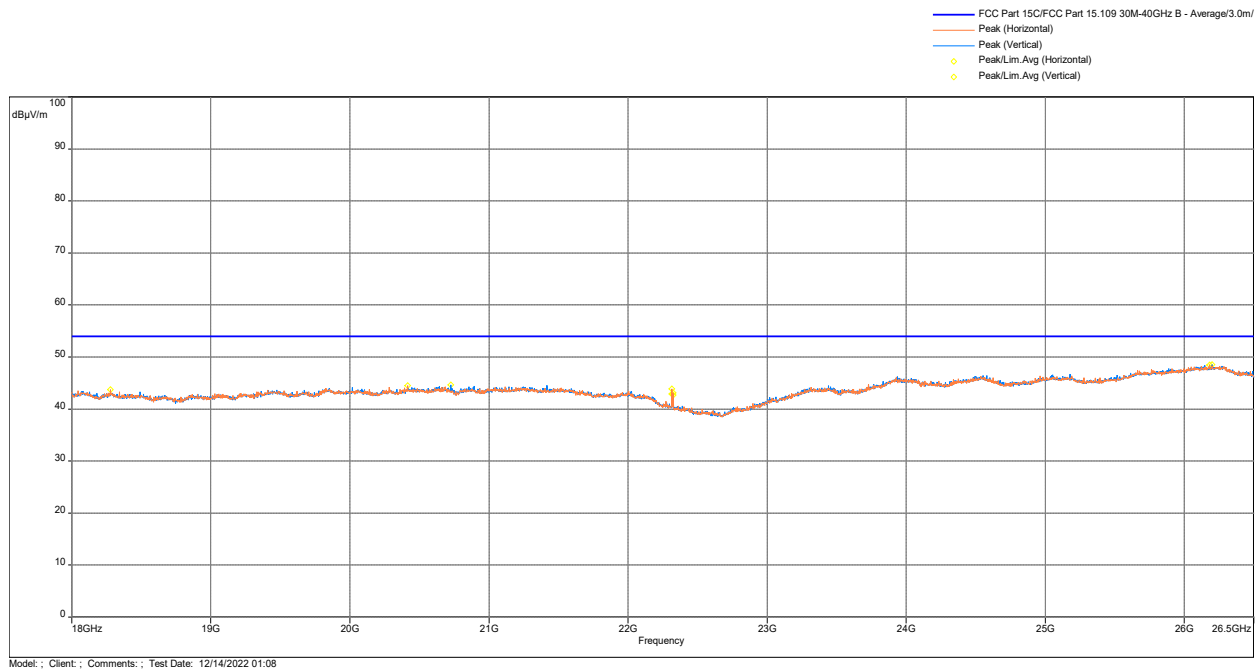
Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan Peak



Radiated Spurious Emissions 18 - 26 GHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 18 - 26 GHz, Avg Scan vs Avg Limit



Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
BLE Mode

Frequency (MHz)	QPeak@ 10m (dBμV/m)	Lim. QPeak @10m (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
30.000	20.99	29.5	-8.51	2	120.25	Horizontal	-6.19
42.513	13.08	29.5	-16.42	2	303.25	Horizontal	-15.37
73.553	8.91	29.5	-20.59	3	0	Horizontal	-18.93
99.678	10.98	33	-22.02	3.6	339.5	Horizontal	-16.52
773.958	23.67	35.5	-11.83	3	184.5	Horizontal	-2.84
798.854	23.68	35.5	-11.82	3.6	118.75	Horizontal	-2.46

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBμV/m)	Lim. Peak @3m (dBμV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
7439.033	60.01	74	-13.99	2.01	355.75	Horizontal	-4.06
7440.733	61.17	74	-12.83	1.99	323	Vertical	-4.06
12399.07	55.35	74	-18.65	2.01	313.75	Horizontal	0.02
17361.93	51.65	74	-22.35	2.01	277.25	Horizontal	5.06

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Ave @3m (dBμV/m)	Lim. Ave @3m (dBμV/m)	Margin (dB)	Angle (°)	Height (m)	Comment	Correction (dB)
7439.033	46.78	54	-7.22	271.5	1.15	Horizontal	-4.06
7440.733	53.89	54	-0.11	262.25	2.47	Vertical	-4.06
12399.07	49.54	54	-4.46	303.75	1.9	Horizontal	0.02
17361.93	42.53	54	-11.47	2.01	283.25	Horizontal	5.06

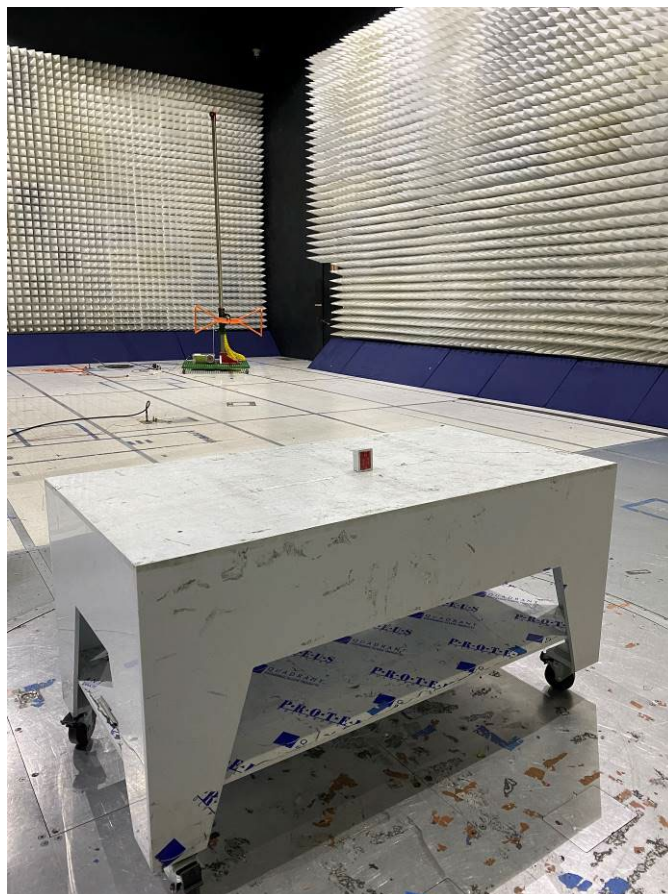
Note: Correction = AF + CF – Preamp

Note: The measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at confidence level of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification limit.

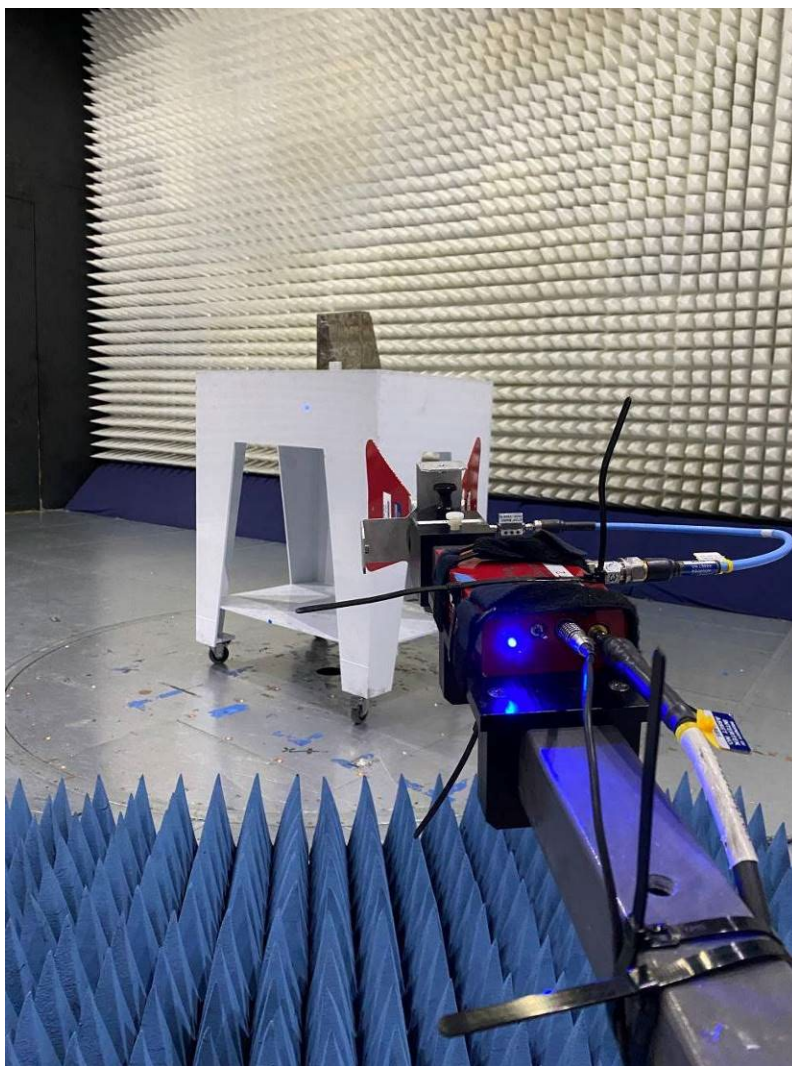
Results	Complies
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4.5.5 Test Setup Configuration

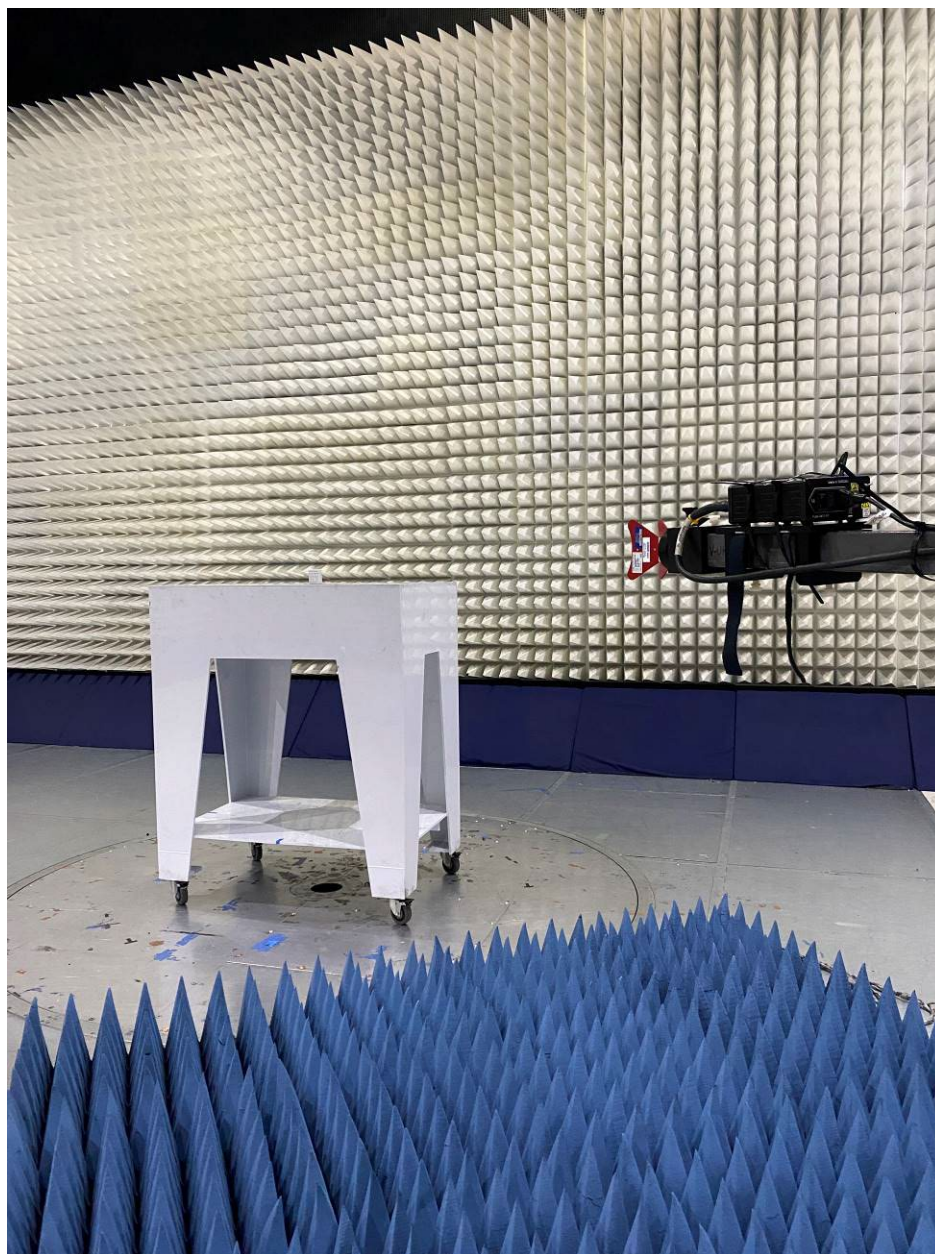
The following photographs show the testing configurations used.



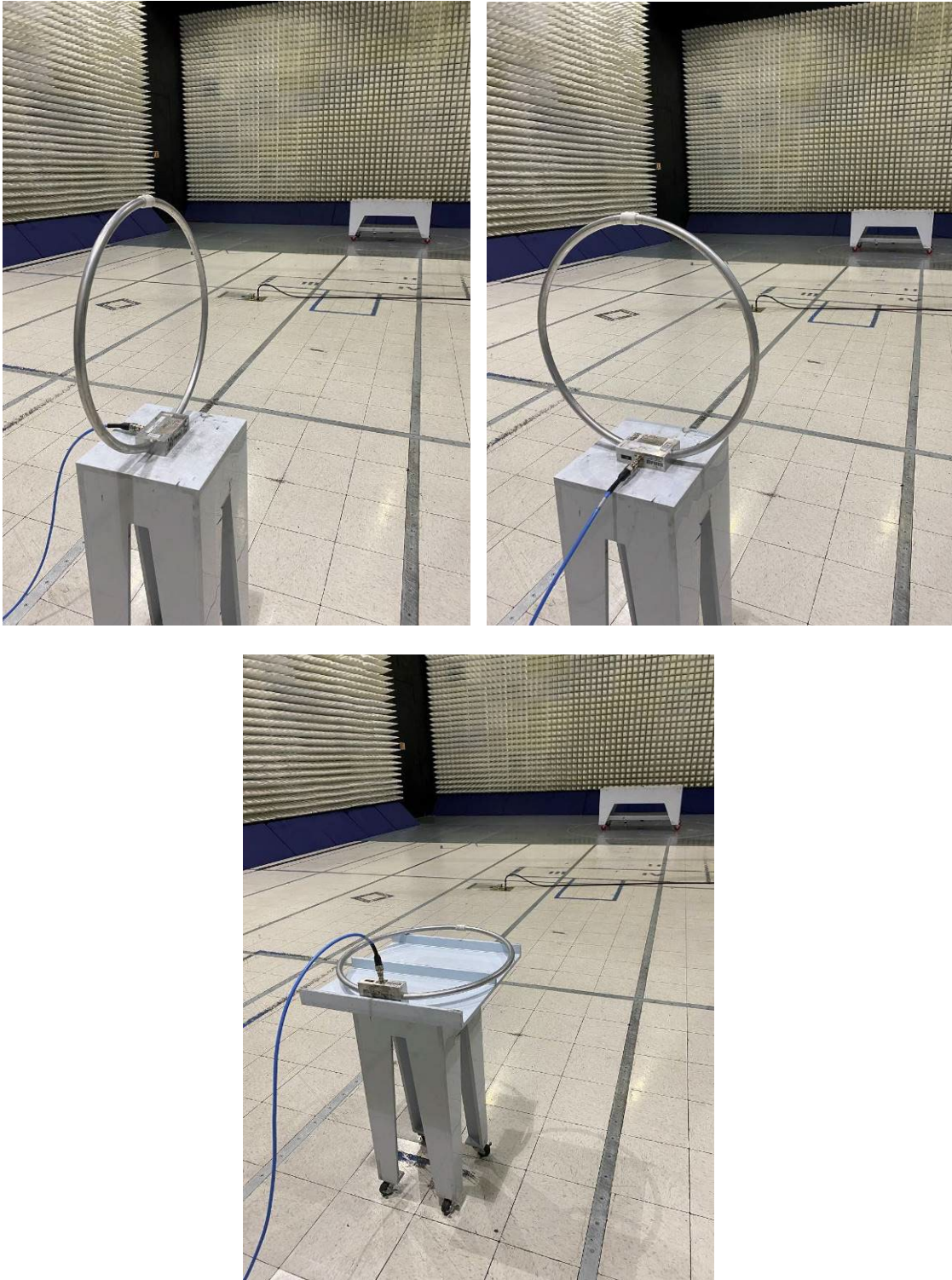
4.5.5 Test Setup Configuration (Continued)



4.5.5 Test Setup Configuration (Continued)



4.5.5 Test Setup Configuration (Continued)



5.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/10/23
Loop Antenna	EMCO	6512	ITS 001598	12	07/23/23
10m Semi-anechoic chamber	Panashield	10m Chamber	ITS 00984	36	07/29/23
Spectrum Analyzer 20hz-26.5ghz	Rohde & Schwarz	FSU	ITS 00913	12	05/17/2023
2Hz-43.5GHz Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	ITS 01818	12	07/19/2023
EMI Test Receiver	Rohde & Schwarz	ESR7	ITS 01607	12	11/17/2023
1-40GHz Passive Horn Antenna	ETS Lindgren	3116C	ITS 01776	12	11/01/2023
18-40GHz Preamp	uComp Nordic	MCNS-50-18004000335P	ITS 01799	12	03/24/2023
30MHz-2GHz Bi-Log Antenna	SunAR RF Motion	JB1	ITS 01577	12	02/10/2023
9kHz-1GHz Pre-amplifier	Sonoma Instrument	310N	ITS 01713	12	02/17/2023
10kHz-1GHz 2 meter RF Cable	TRU Corp.	TRU Core 300	ITS 01340	12	07/21/2023
1-18GHz Horn Antenna with Preamp	ETS Lindgren	3117-PA	ITS 01365	12	05/04/2023
Double-Ridged Waveguide Horn 1-18GHz (small horn)	ETS Lindgren	3115	ITS 00982	12	05/11/2023
1-40GHz RF Cable SMA to SMA SN# 1GVT420154801001	MEGA PHASE	EMC1-K1K1-236	ITS 01885	12	04/25/2023
1-18GHz 2 meter RF Cable SMA to N-Type	TRU Corp.	TRU Core 300	ITS 01320	12	09/20/2023

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.20.0.23	Nexxiot.bpp
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G105220135	BT	ML	January 30, 2023	Original Release.

END OF REPORT