

CLASS II PERMISSIVE CHANGE TEST REPORT

Report Number: 105041185MPK-005

Project Number: G105041185

Original Issued Date: June 10, 2022

Report Revision Date: April 03, 2023

**Testing performed on
Real Immersive System
Model: Xavier 1/Xavier 2
Part Number: 18284 (WSM, Wireless Sensor Module)**

FCC ID: 2AQU7-REAL02S

IC: 24199-REAL02S

to

FCC Part 15 Subpart C (15.247)

Industry Canada RSS-247 Issue 2

CAB identifier: 2042L

For

Penumbra Inc.

Test Performed by:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

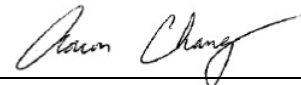
Test Authorized by:

Penumbra Inc.

One Penumbra Place

Alameda, CA 94502 USA

Prepared by:



Aaron Chang

Date: April 03, 2023

Reviewed by:



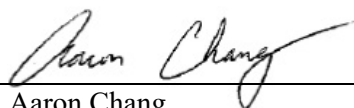
Minh Ly

Date: April 03, 2023

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Report No. 104407842MPK-026	
Equipment Under Test:	Real Immersive System - Wireless Sensor Module
Trade Name:	Penumbra Inc.
Model Number:	Xavier 1/Xavier 2
Part Number:	18284
Applicant:	Penumbra Inc.
Contact:	Puneet Goyal
Address:	Penumbra Inc. One Penumbra Place Alameda, CA 94502
Country:	USA
Tel. Number:	510-440-5598
Email:	pgoyal@penumbrainc.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	May 5-25, 2022

We attest to the accuracy of this report:



Aaron Chang
Project 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	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: May 5, 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: May 5, 2022

Test completion date: May 25, 2022

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

2.0 General Information

2.1 Product Description

Penumbra Inc. supplied the following description of the EUT:

Xavier is a digital hardware and software medical device platform utilizing virtual reality technology designed for use in healthcare and focusing on physical, neurorehabilitation and/or wellness needs. Xavier 1 is intended to be used in a clinical environment, or any other facility that may facilitate rehabilitation by healthcare providers who have received appropriate training in rehabilitation therapy. Xavier 2 is intended to be used in a residential environment, or any other facility that may facilitate rehabilitation individuals with physical, neurorehabilitation and/or wellness needs. A caregiver may be optionally present to help the user operate the system. The mode to test is in functional mode when the device is completely removed from the charging station and strapped to a patient/user.

Xavier is composed of:

- All-In-One Head Mounted Display (HMD)
- HMD Controller
- Wireless Sensor Modules (WSM)
- Wireless Transmitter Module (WTM)
- Sensor Charger (charging station)
- Tablet (Xavier 1 configuration only)

For more information, refer to the following product specification, declared by the manufacturer.

Information about the 2.4 GHz radio is presented below:

Applicant	Penumbra Inc.
Model No.	Xavier 1/Xavier 2
FCC Identifier	2AQU7-REAL02S
IC Identifier	24199-REAL02S
PMN	REAL System and REAL System 2
FVIN	02
HMN	N/A
HVIN	WSM2
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	7.77 dBm
Antenna(s) & Gain	Internal Antenna, Peak Gain: 1.3 dBi
Frequency Range	2402 – 2479 MHz
Type of modulation/data rate	Gaussian Frequency-shift Keying (GFSK) / 1&2Mbit/s
Number of Channel(s)	77
Applicant Name & Address	Penumbra Inc. One Penumbra Place Alameda, CA 94502 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” (558074 D01 15.247 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

Support Equipment		
Description	Manufacturer	Model/Part Number
Laptop*	Dell	Latitude 5400
Charging Station	Penumbra	112168-0385

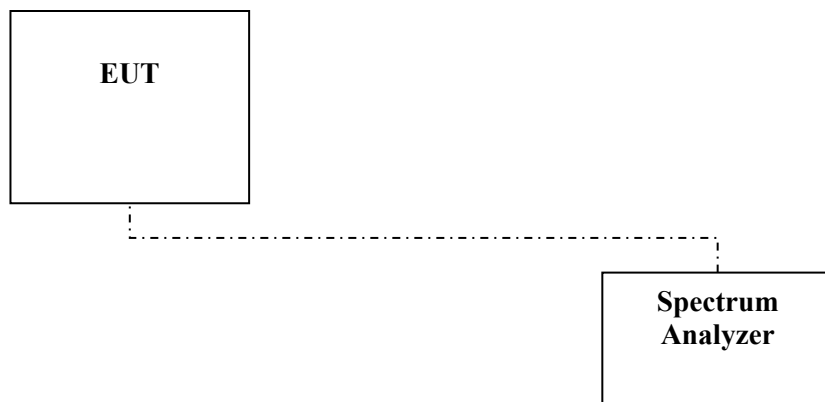
*Laptop was only used to configure radio channels. In normal usage no laptop will be present.

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Lot Number	Serial Number (LOT Number)
Radiated Sample of WSM, Wireless Sensor Module	Penumbra, Inc.	E00000543	Not Listed
Conducted Sample of WSM, Wireless Sensor Module	Penumbra, Inc.	E00000544	Not Listed

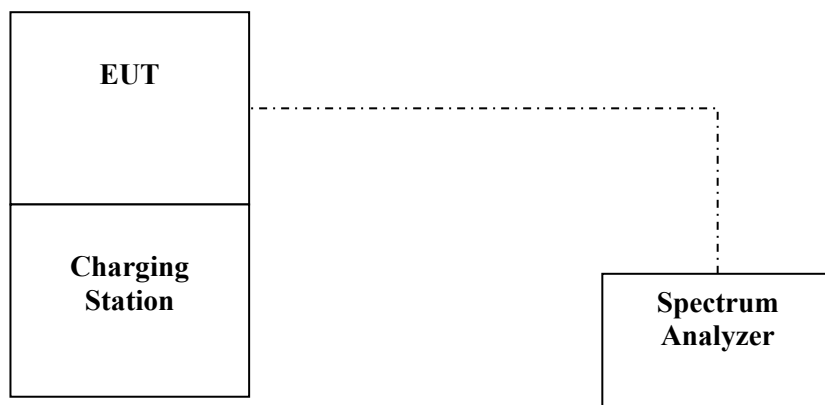
Battery Mode:

Antenna was removed and co-axial connector with a cable was installed for Conducted Measurements.



Charging Mode:

Antenna was removed and co-axial connector with a cable was installed for Conducted Measurements.



S = Shielded
U = Unshielded

F = With Ferrite
m = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table.

According to the manufacturer, each Real Immersive System will consist of Xavier 1: 5 WSM, 1 WTM & 1 HMD or Xavier 2: 2 WSM, 1 WTM & 1 HMD. The WSMs and WTM will be paired to the HMD. The HMD has two radios and WSM/WTM has one radio each. These pairing in this system will use one out of the 77 available channels at a time. The devices in the system share the channel.

The radio was originally tested and certified in battery mode at 2Mbps data rate under Intertek test report: 104407842MPK-026. Class II permissive change testing was performed with the radio operating during charging mode at 2Mbps data rate. Spurious radiated emissions and output power verification were performed.

Class II permissive change testing also performed for Bluetooth operating in battery and charging mode at 1Mbps data rate. Full testing was performed in charging mode; spurious radiated emissions verification was performed in battery mode.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Penumbra Inc.

3.5 Mode of Operation during Test

As instructed by the manufacturer, the EUT's power setting was set to +8 dBm on the low, middle and high frequencies/channels.

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.

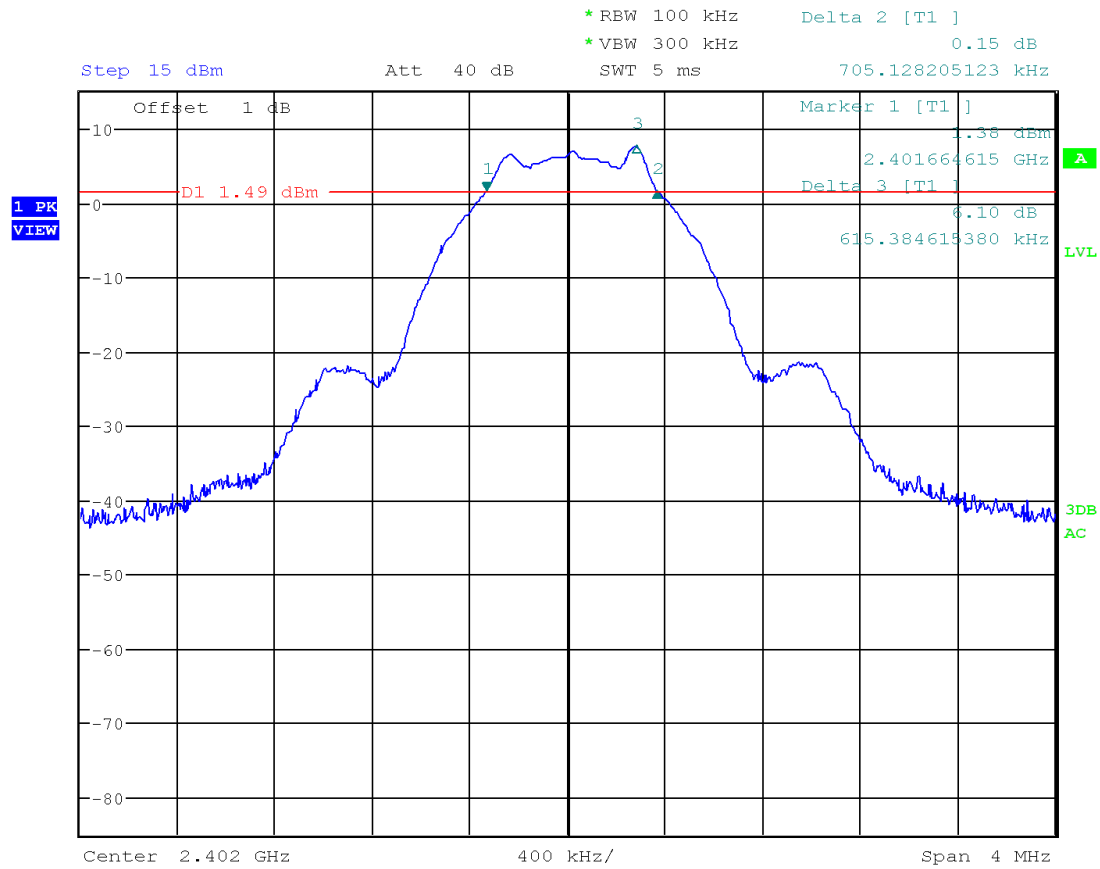
4.1.3 Test Result

1Mbps:

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN	Occupied bandwidth, RSS-GEN	Plot
MHz	kHz	MHz	
2402	705.128	--	1.1
	--	1.064	1.4
2440	737.179	--	1.2
	--	1.076	1.5
2479	724.359	--	1.3
	--	1.080	1.6

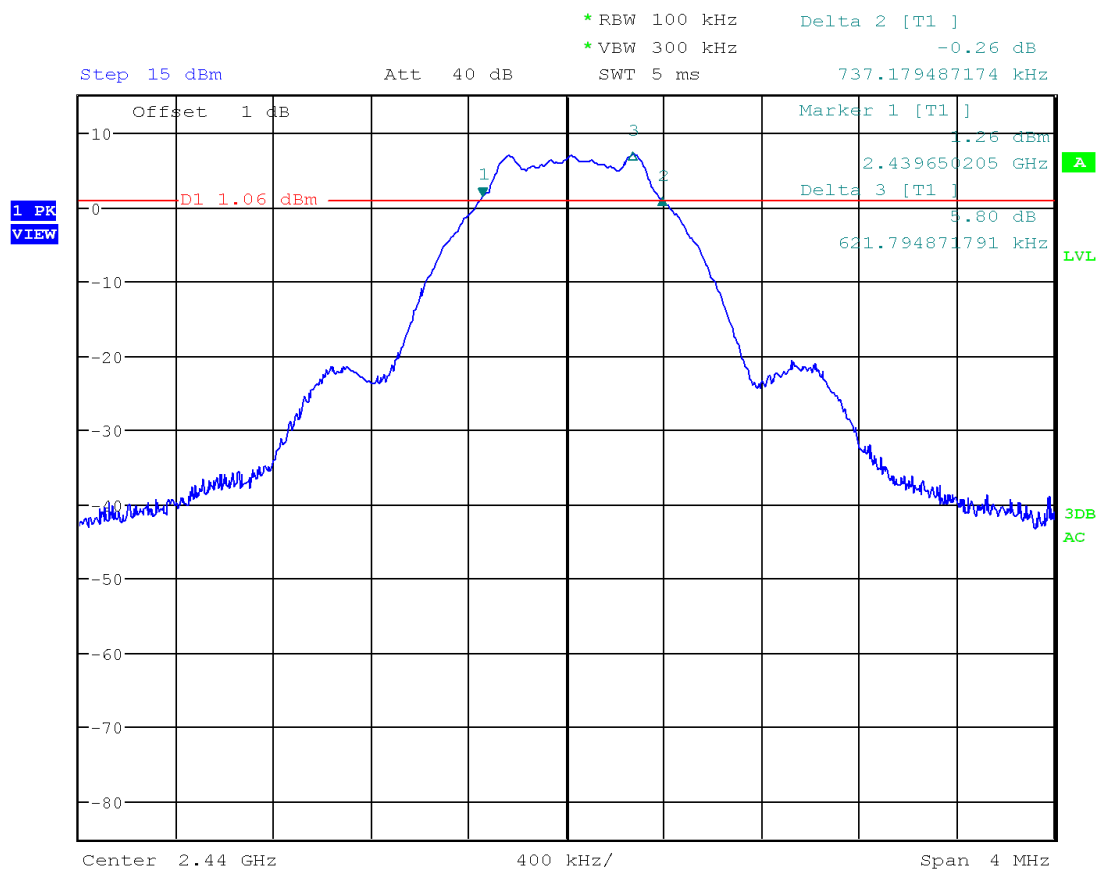
Tested By	Test Date
Aaron Chang	May 11, 2022

Plot 1. 1



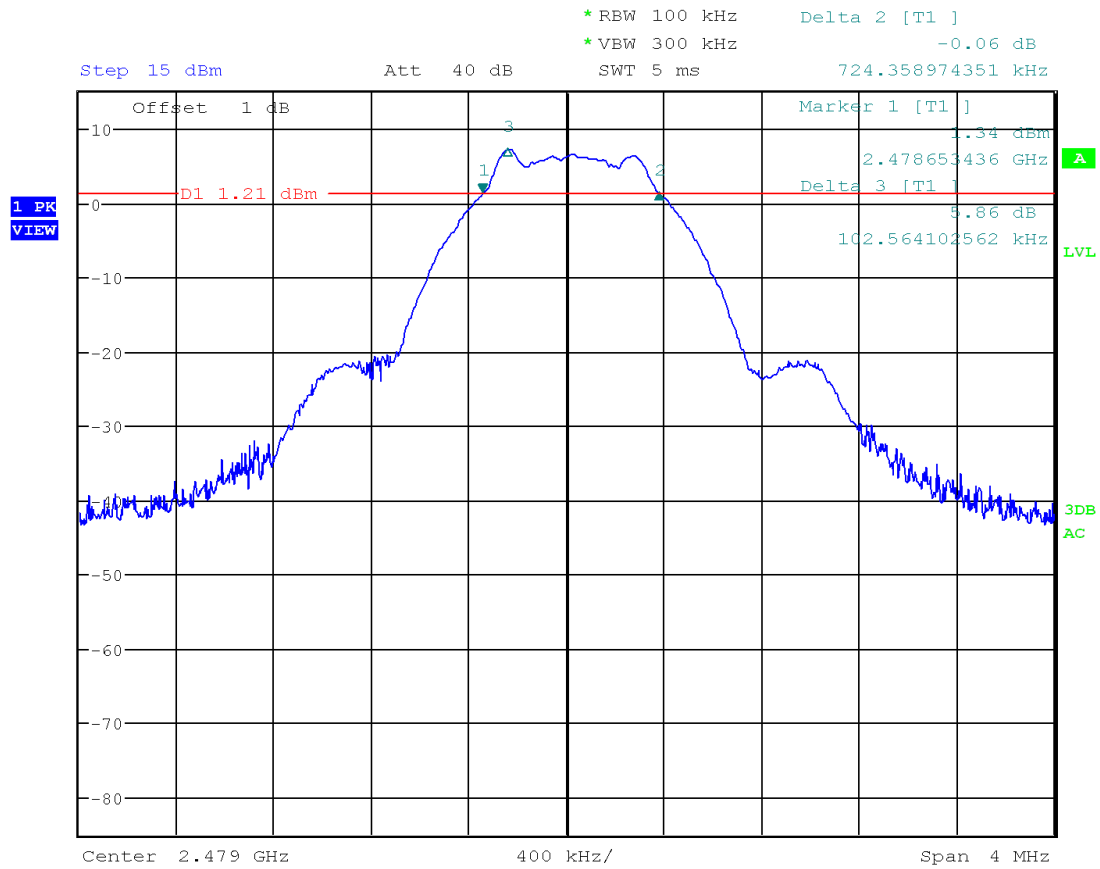
Date: 11.MAY.2022 01:34:40

Plot 1.2



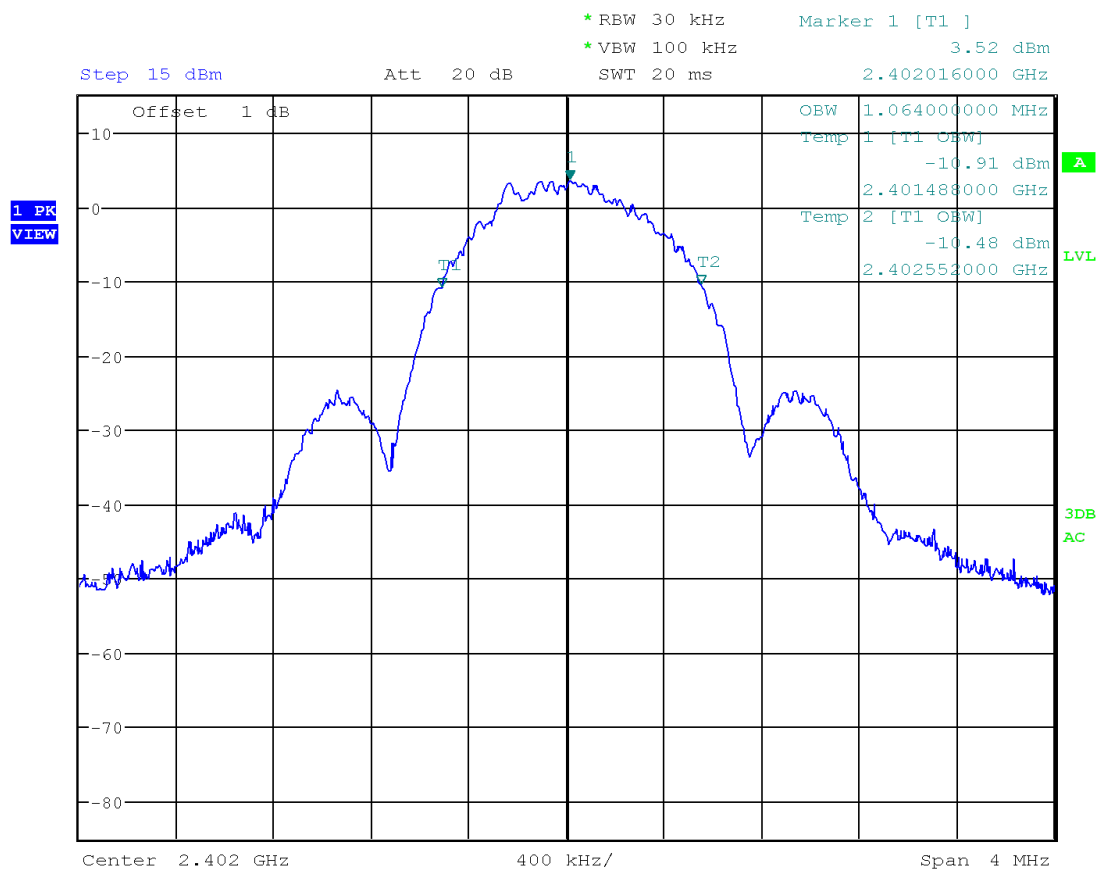
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Plot 1.3



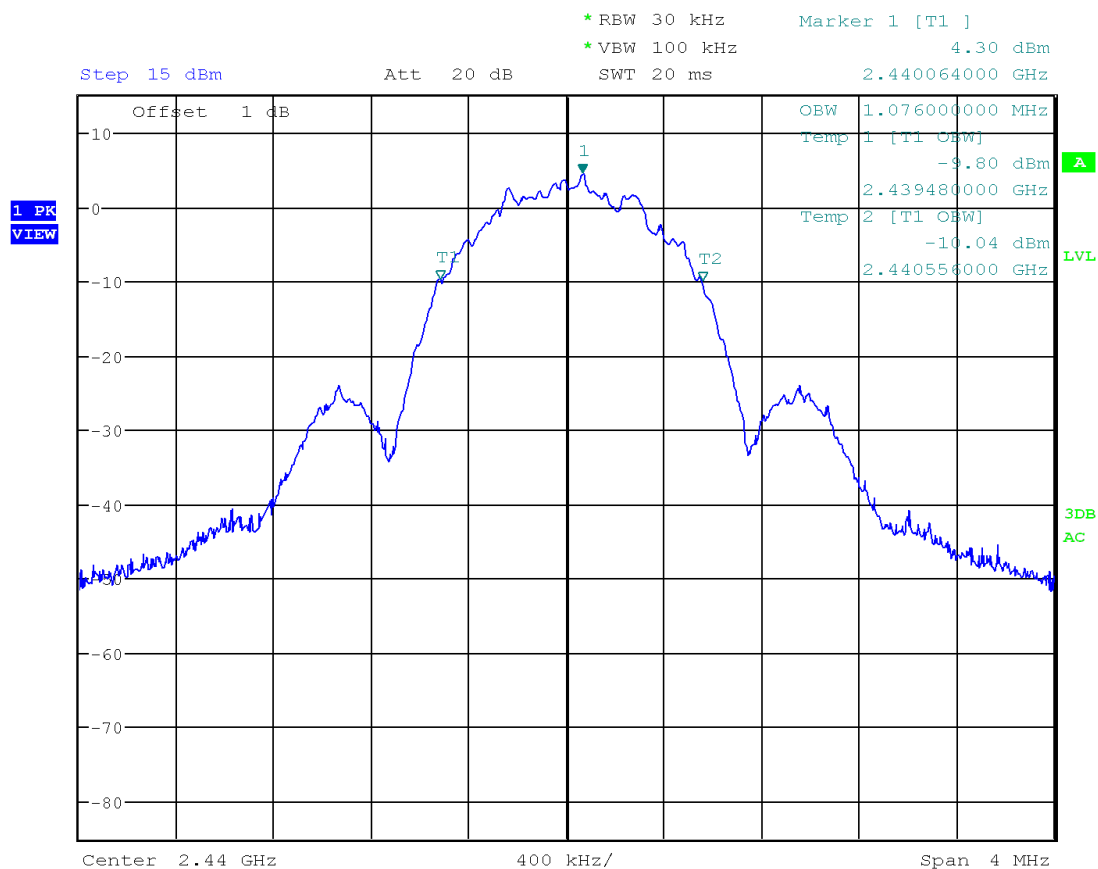
Date: 11.MAY.2022 01:37:22

Plot 1.4



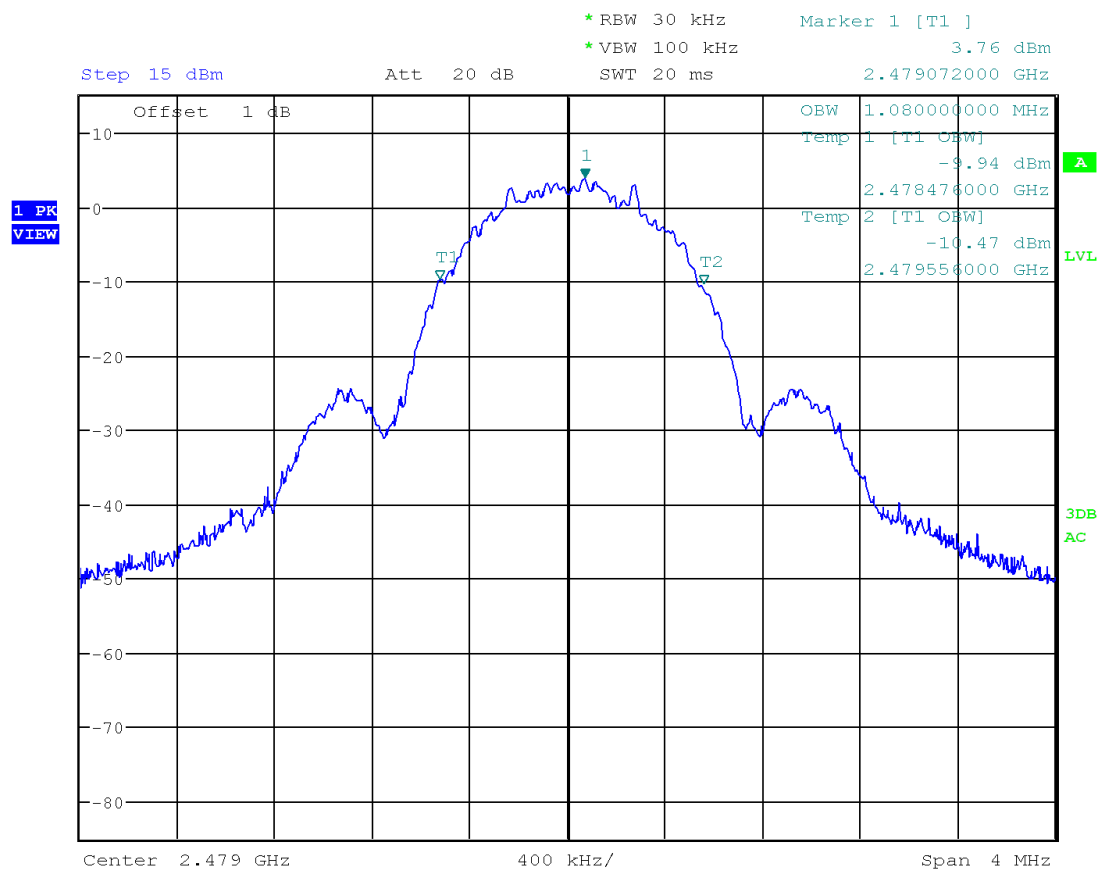
Date: 11.MAY.2022 01:40:45

Plot 1.5



Date: 11.MAY.2022 01:40:00

Plot 1.6



Date: 11.MAY.2022 01:38:59

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.

Charging mode @ 2Mbps:

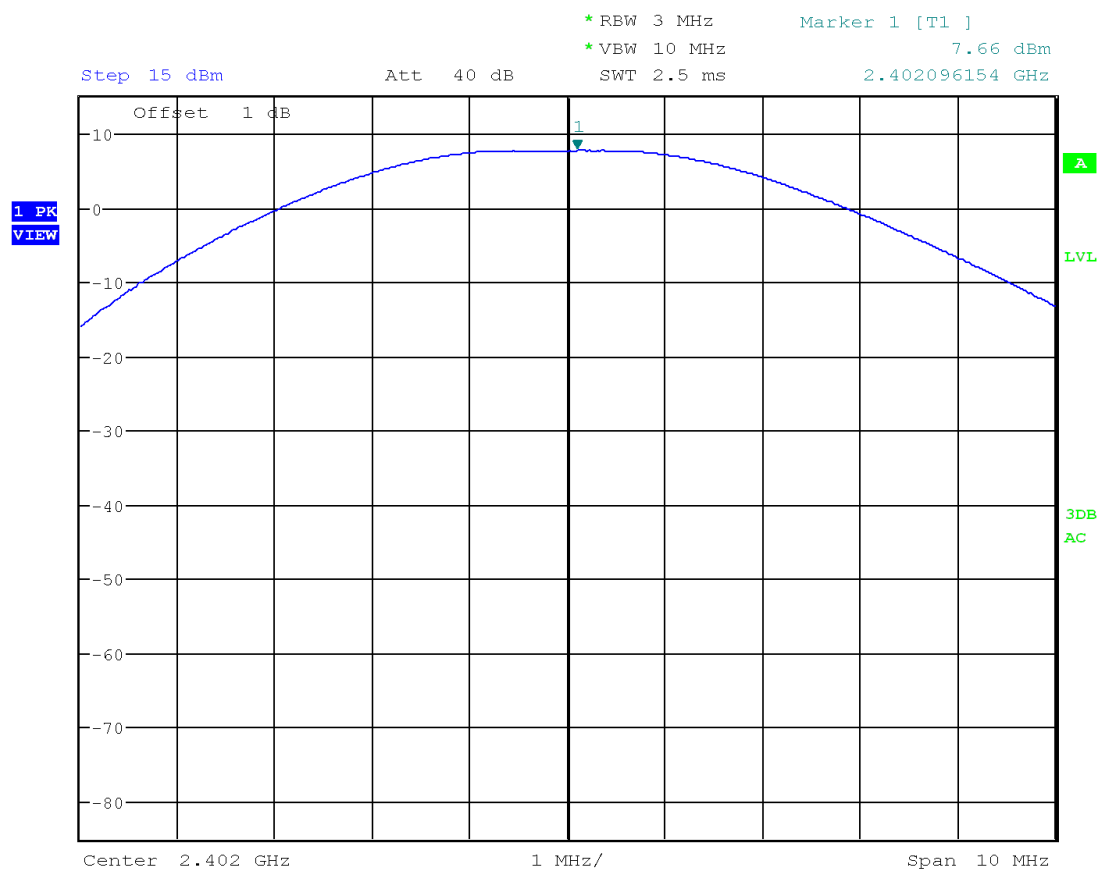
Frequency	Conducted Power (peak)		Plot
MHz	dBm	mW	
2402	7.66	5.83	2.1
2440	7.77	5.98	2.2
2479	7.71	5.90	2.3

Battery/Charging mode @ 1Mbps:

Frequency	Conducted Power (peak)		Plot
MHz	dBm	mW	
2402	7.59	5.74	2.4
2440	7.70	5.89	2.5
2479	7.71	5.90	2.6

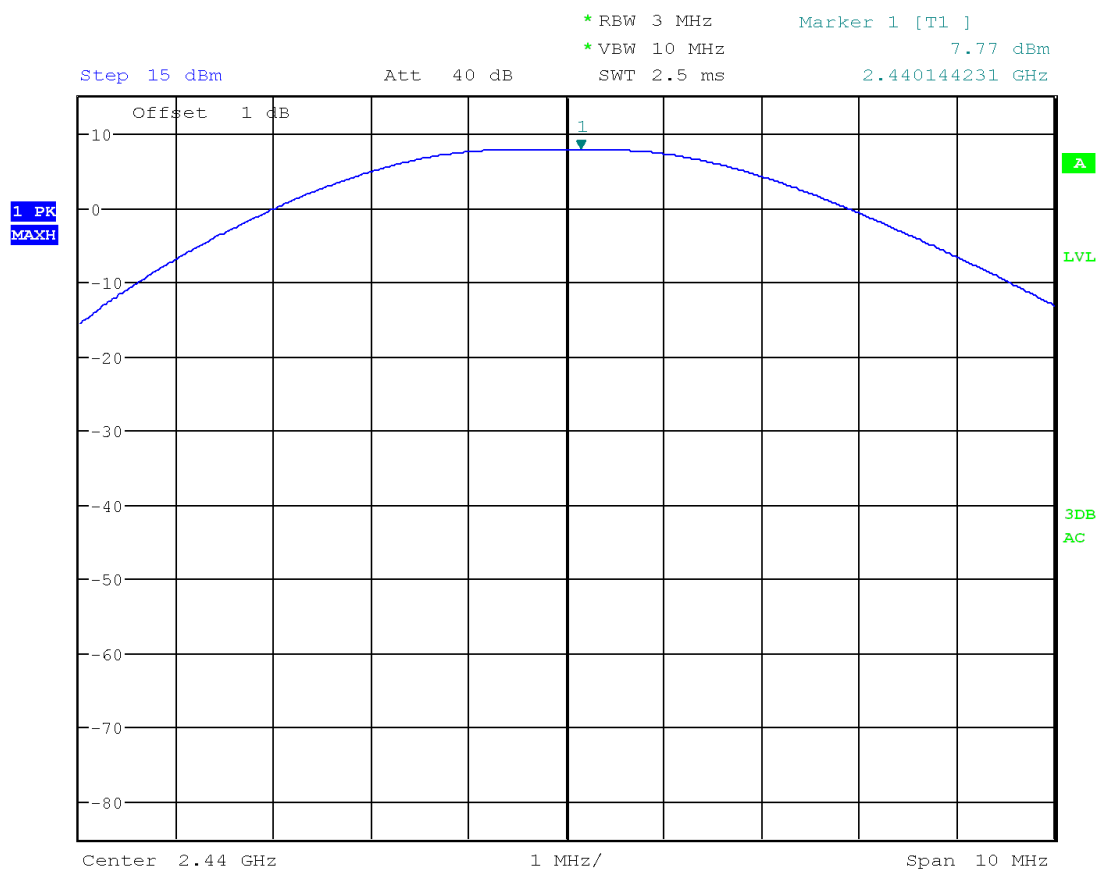
Tested By	Test Date
Aaron Chang	May 11, 2022

Plot 2. 1



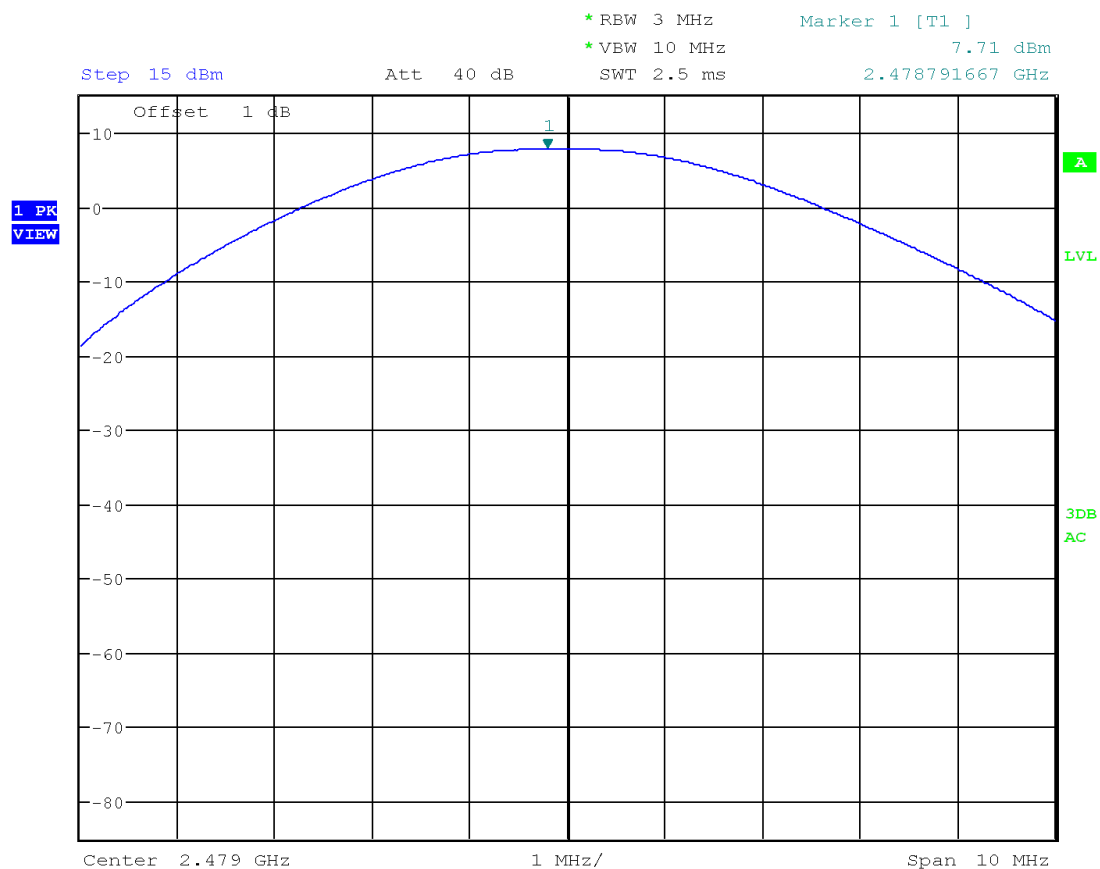
Date: 11.MAY.2022 01:26:58

Plot 2. 2



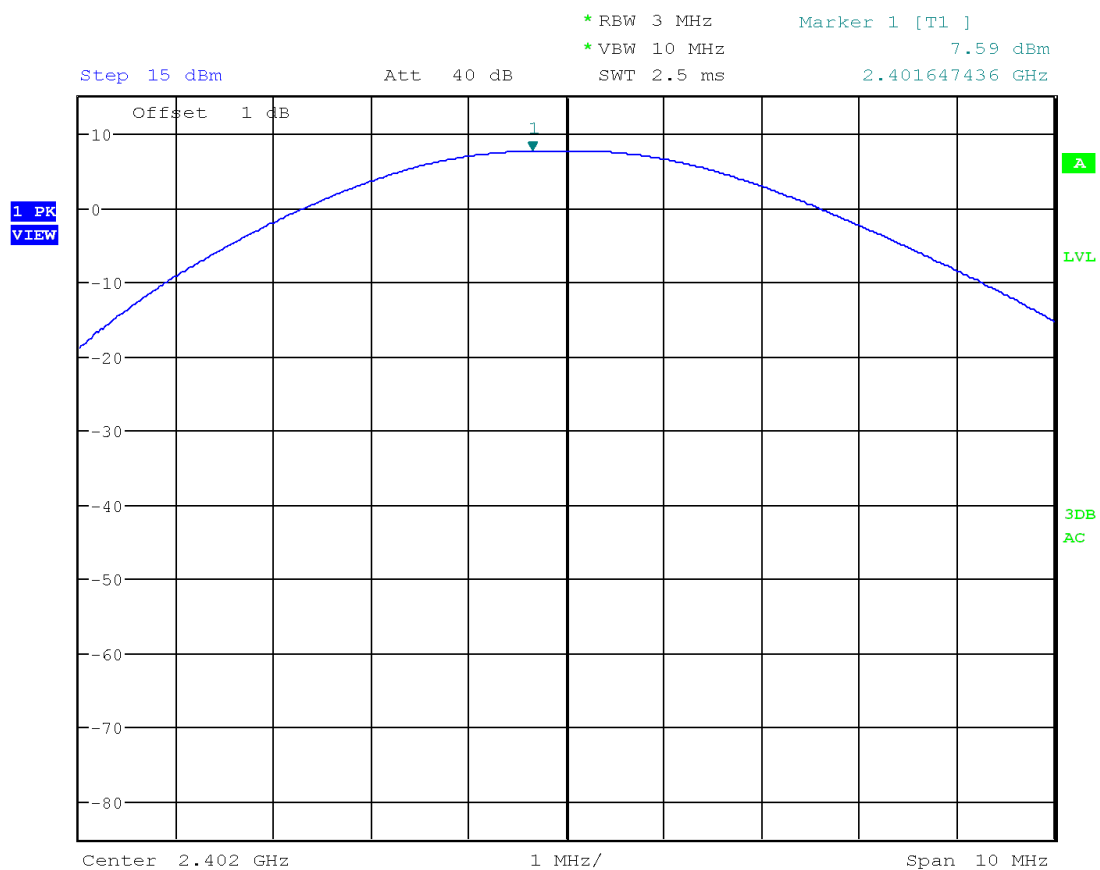
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Plot 2.3



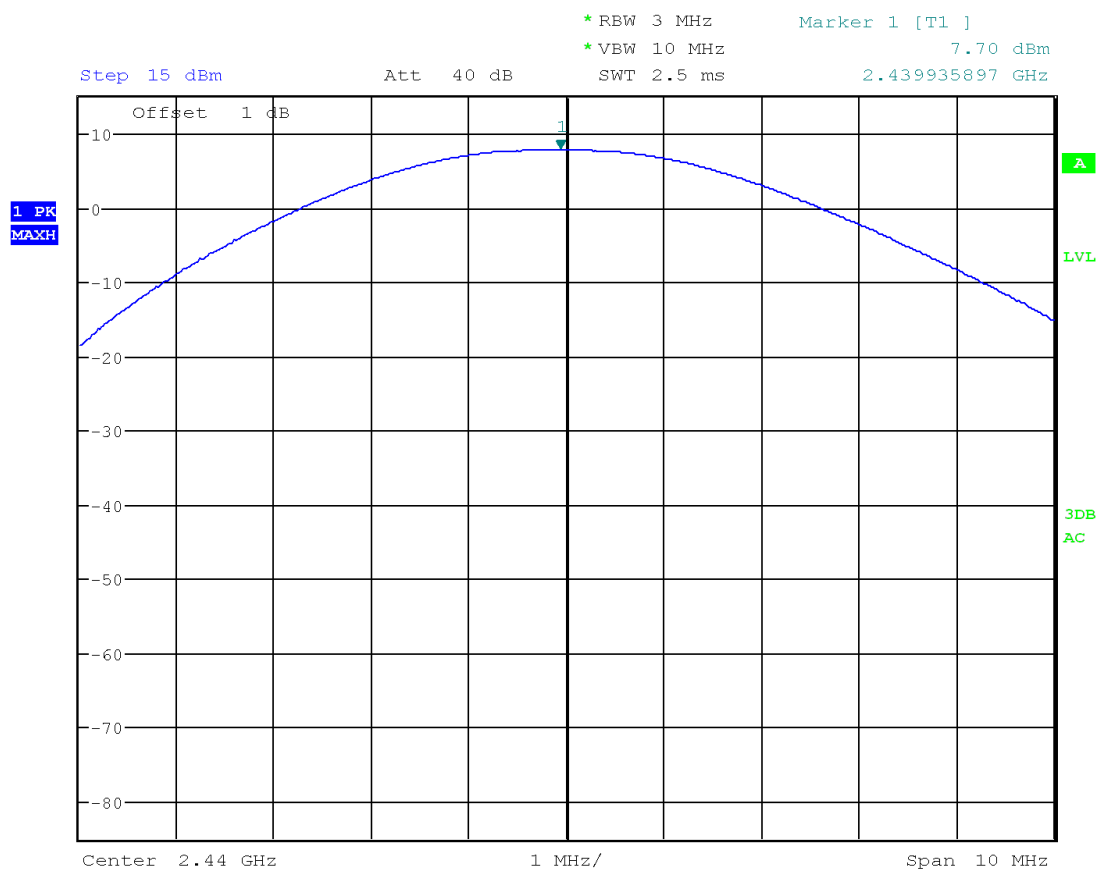
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Plot 2. 4



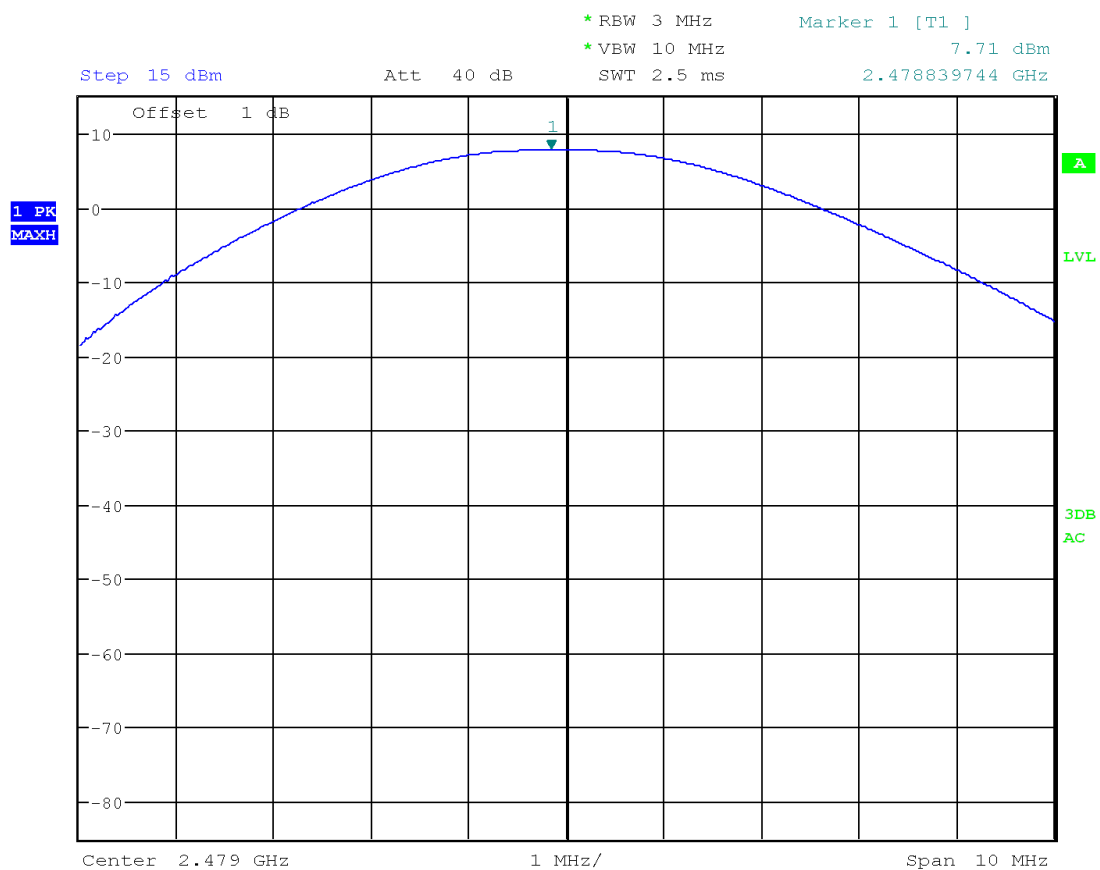
Date: 11.MAY.2022 01:32:45

Plot 2. 5



Date: 11.MAY.2022 01:32:12

Plot 2. 6



Date: 11.MAY.2022 01:31:24

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

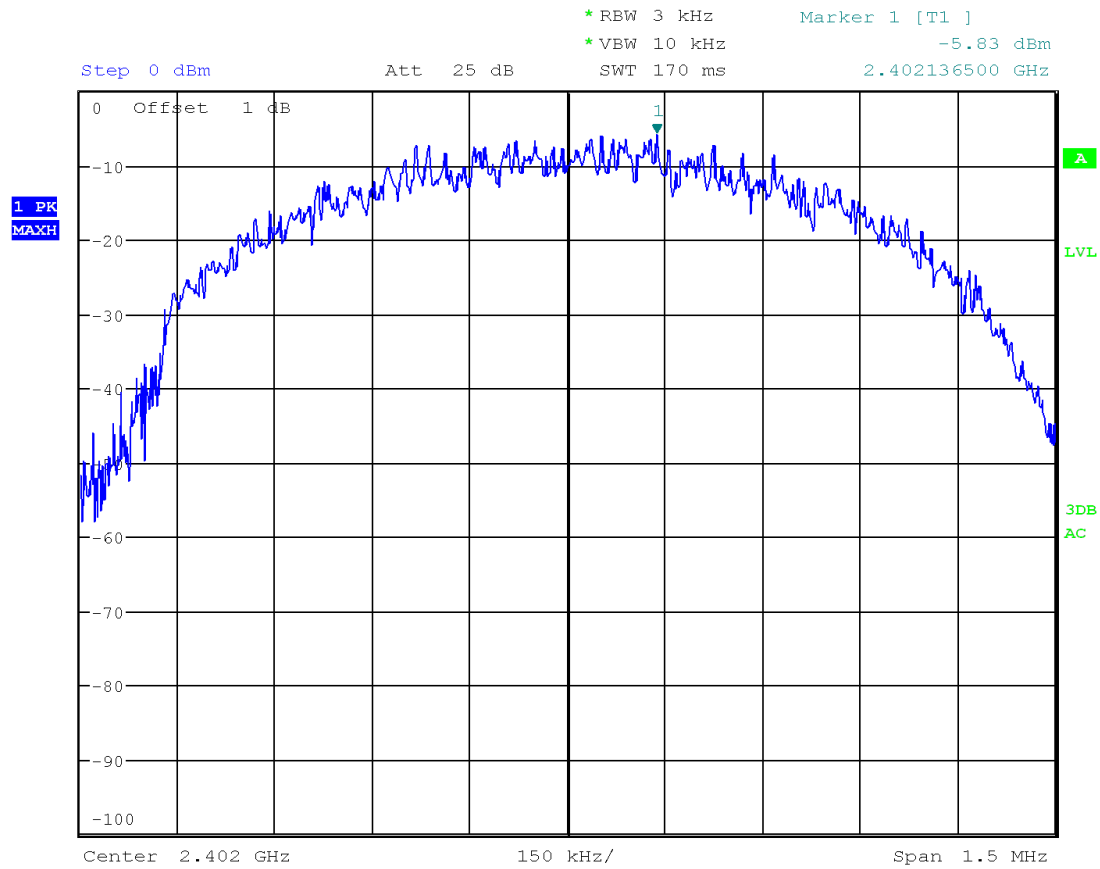
Refer to the following plots for the test result

1Mbps:

Frequency,	Maximum Power Spectral Density	Maximum Power Spectral Density Limit	Margin	Plot
MHz	dBm	dBm	dB	
2402	-5.83	8.0	-13.83	3.1
2440	-4.98	8.0	-12.98	3.2
2479	-5.47	8.0	-13.47	3.3

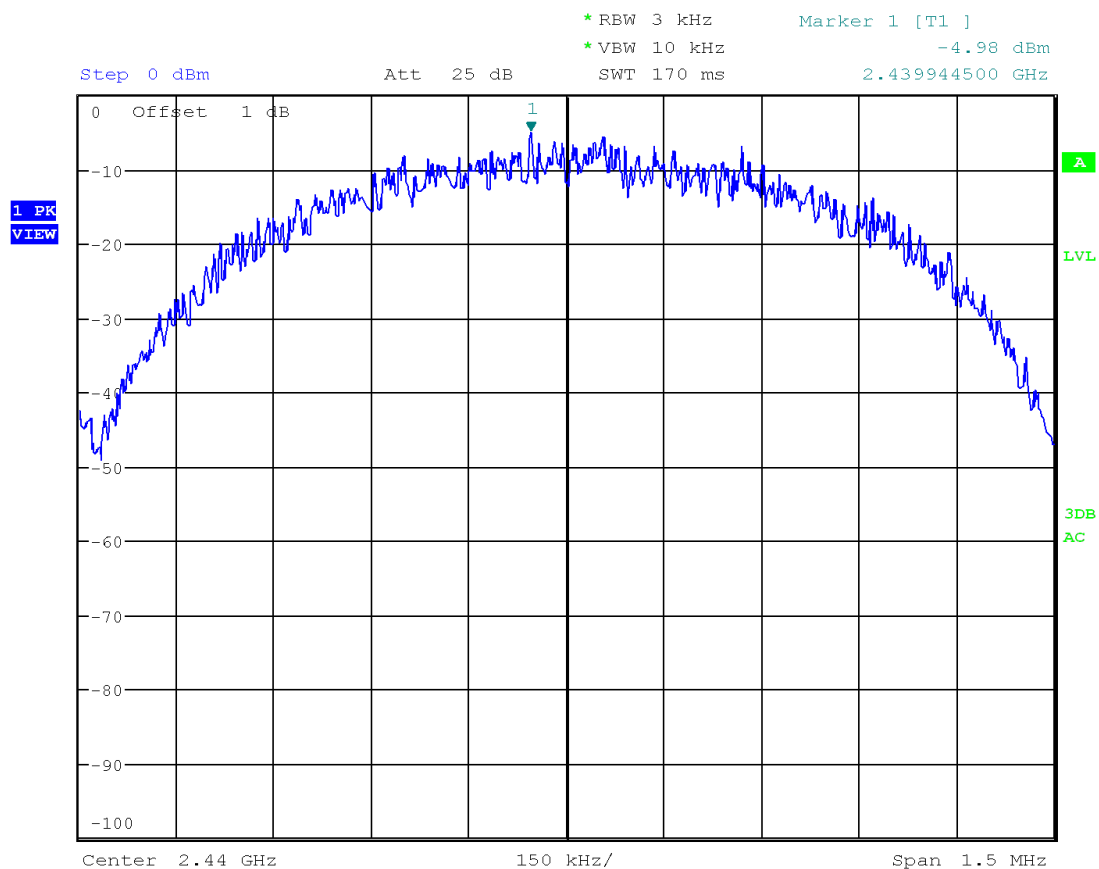
Tested By	Test Date
Aaron Chang	May 11, 2022

Plot 3. 1



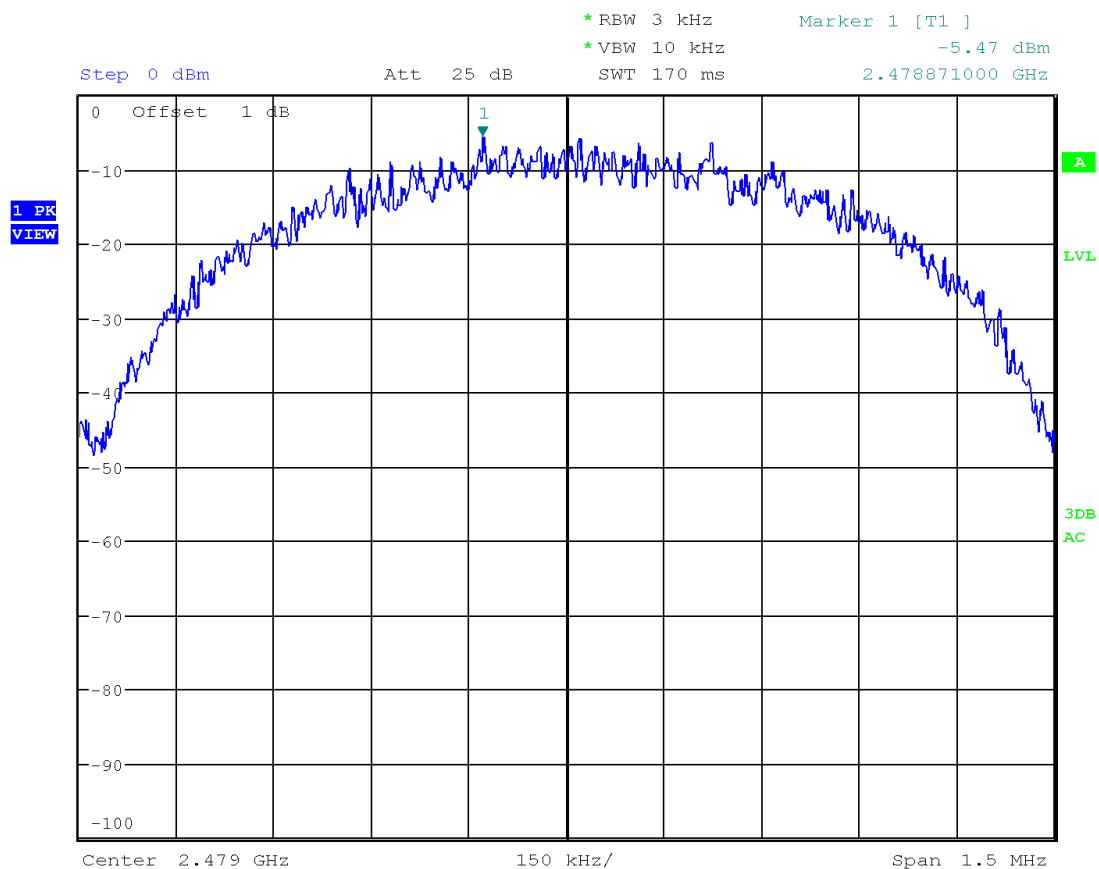
Date: 11.MAY.2022 01:44:00

Plot 3.2



Date: 11.MAY.2022 01:44:59

Plot 3.3



Date: 11.MAY.2022 01:45:42

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.

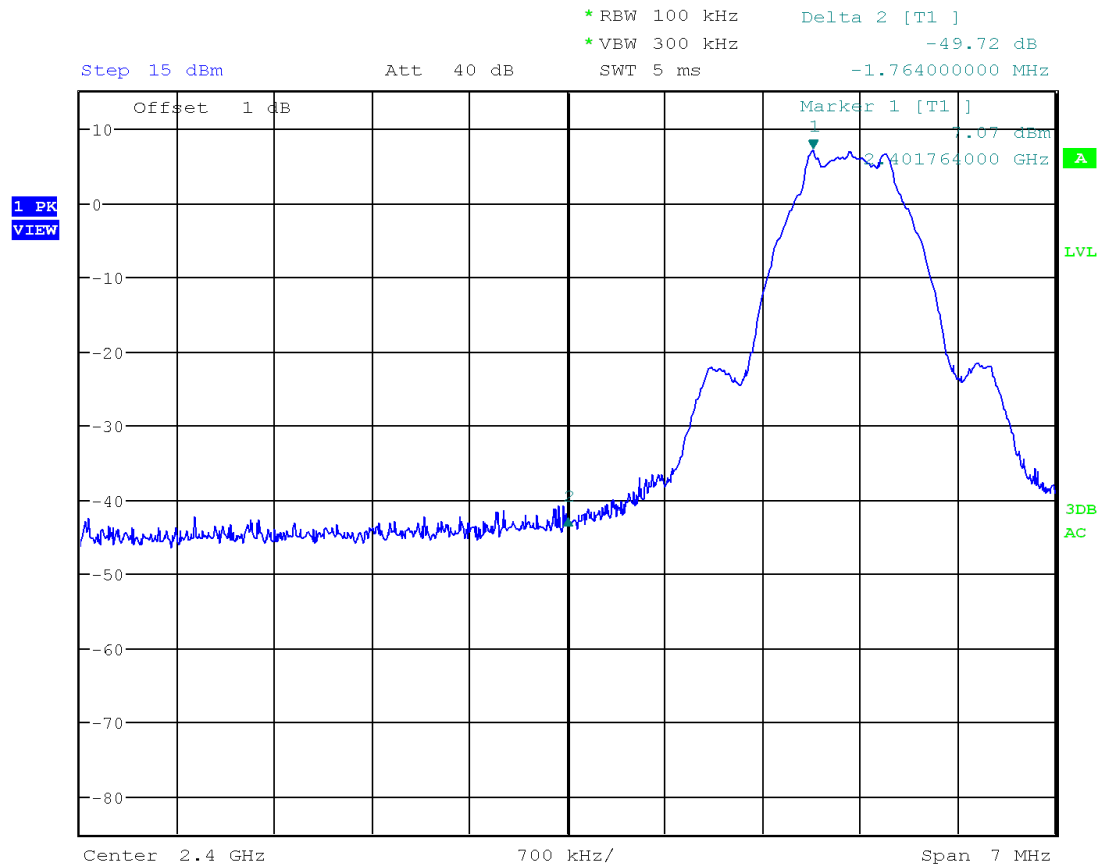
The unwanted emissions were measured from 9 kHz to 26 GHz. Plots below are corrected for cable loss and then compared to the limits.

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.

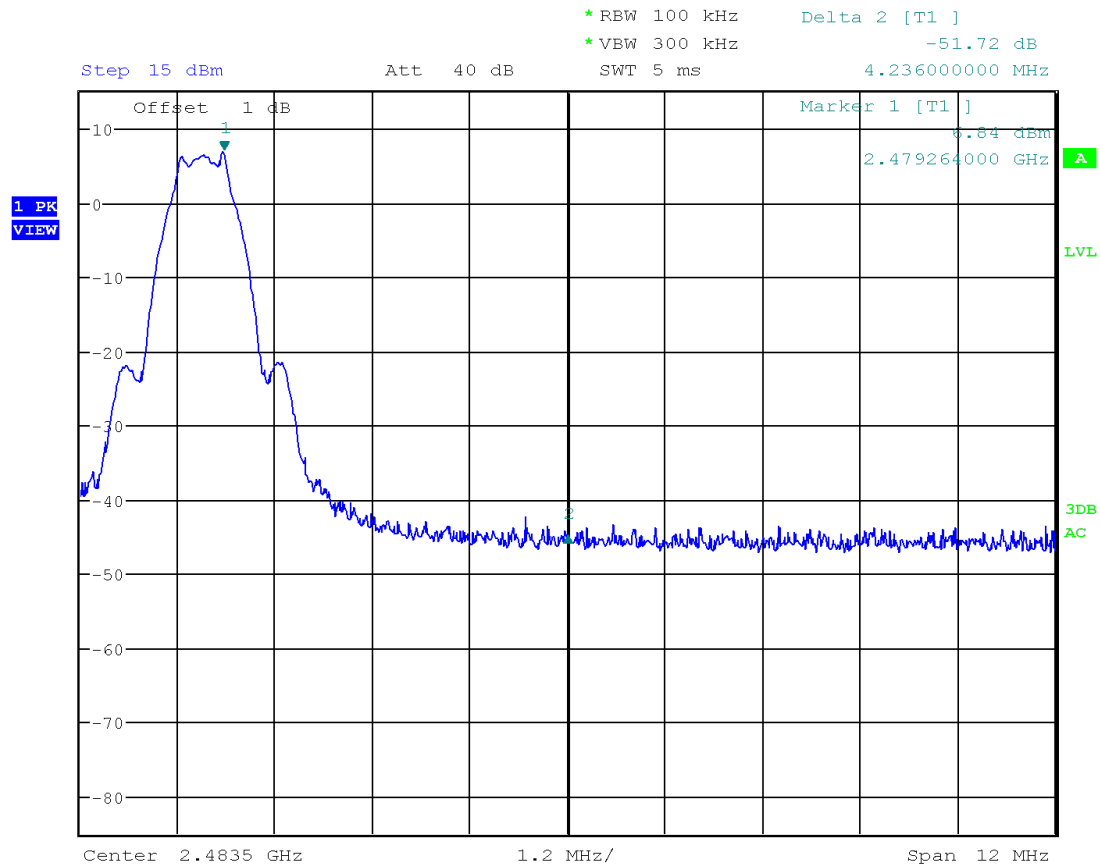
Tested By	Test Date
Aaron Chang	May 11, 2022

Tx @ Low Channel, 2400 MHz Band Edge, 1Mbps
Plot 4.1



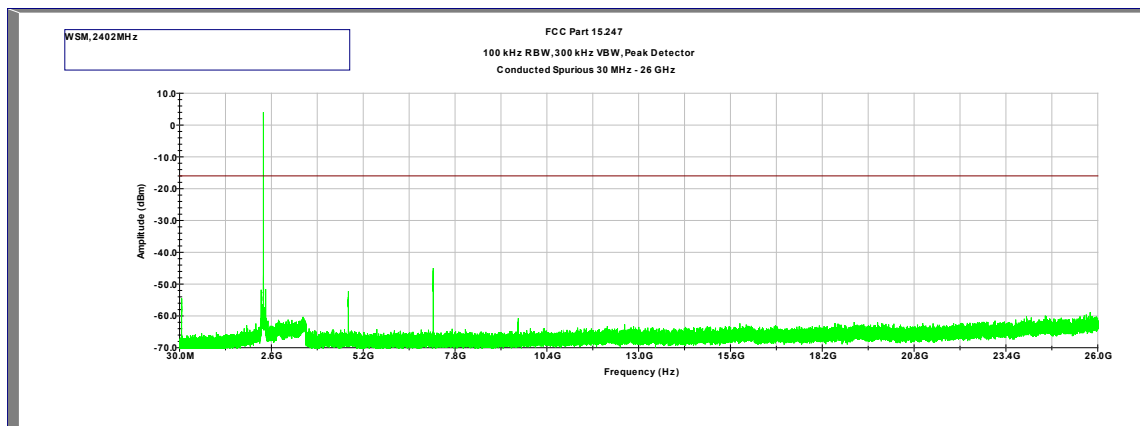
Date: 11.MAY.2022 01:49:19

Tx @ High Channel, 2483.5 MHz Band Edge, 1Mbps
Plot 4.2

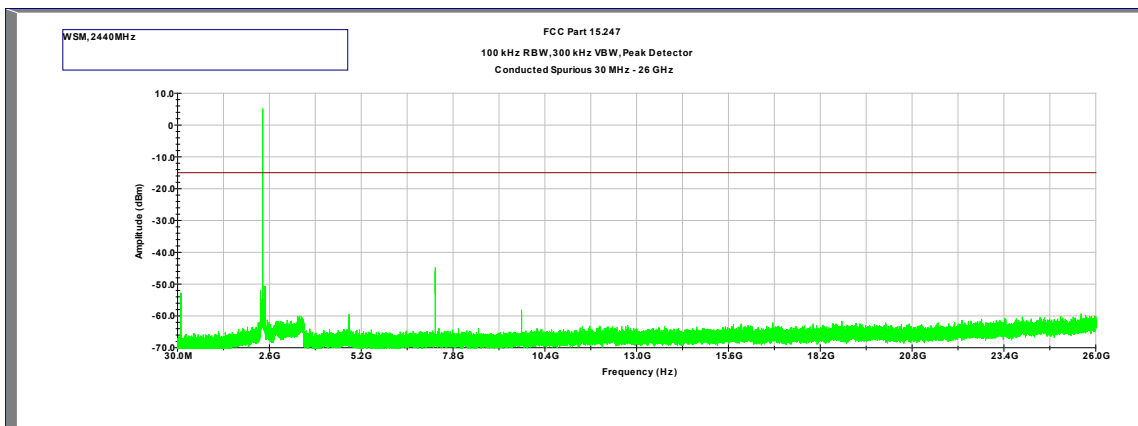


Date: 11.MAY.2022 01:48:09

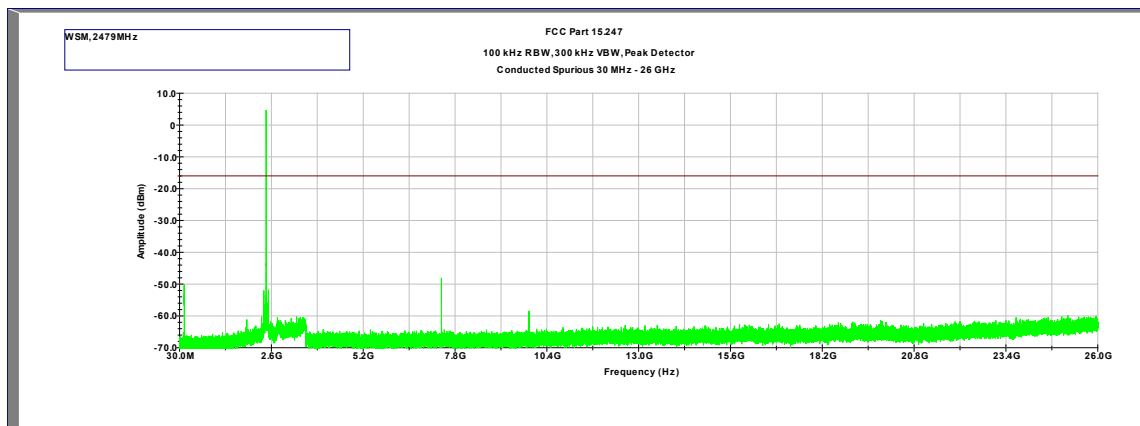
Tx @ Low Channel, 2402 MHz, 1Mbps
30MHz -26GHz Conducted Spurious
Plot 4.3



Tx @ Mid Channel, 2440 MHz, 1Mbps
30MHz -26GHz Conducted Spurious
Plot 4.4



Tx @ High Channel, 2479 MHz, 1Mbps
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 emission measurements were performed from 9 kHz to 26 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.

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).

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.

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

$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32$ dB(μ 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 Antenna-port conducted measurements

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

4.5.5 General Procedure for conducted measurements in restricted bands

- a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.
- b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
- c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
- d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).
- e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$$E = \text{EIRP} - 20\log D + 104.8 + \text{DCF}$$
(DCF for Average measurements)
where:
E = electric field strength in dB μ V/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
DCF = Duty Cycle Correction Factor
- f) Compare the resultant electric field strength level to the applicable limit.
- g) Perform radiated spurious emission test

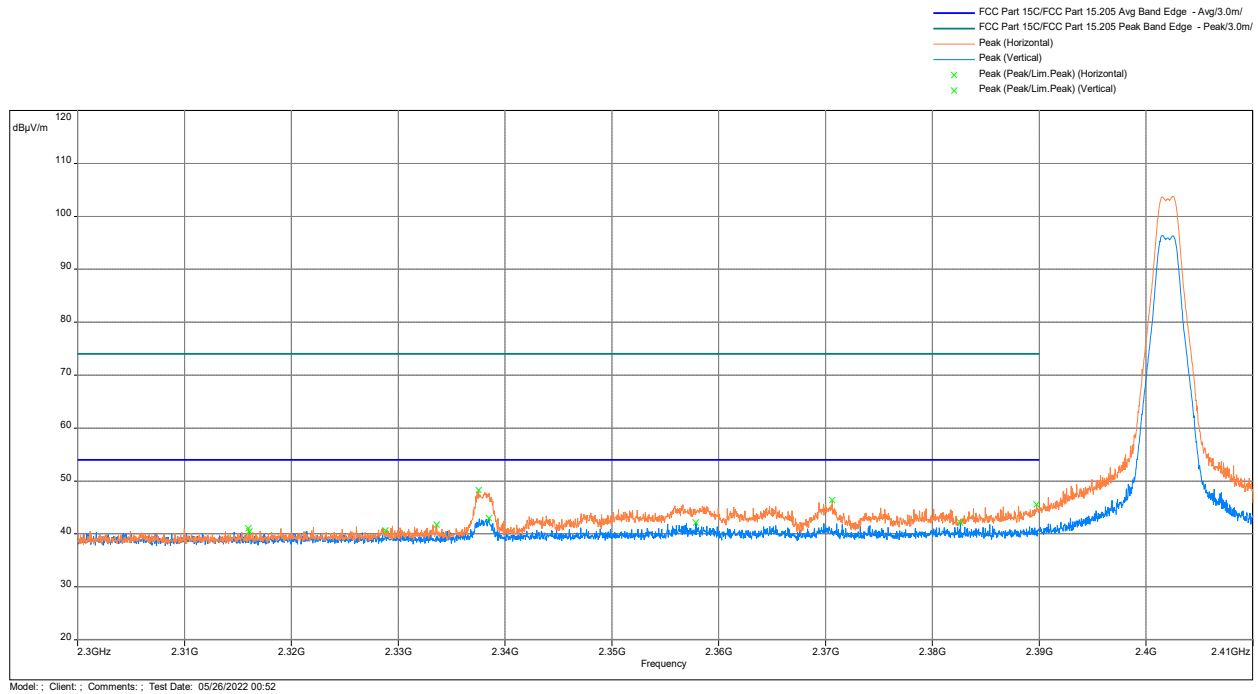
4.5.6 Test Results

All testing in this section were performed by radiated measurements.

Tested By	Test Date
Aaron Chang	May 5 – 25, 2022

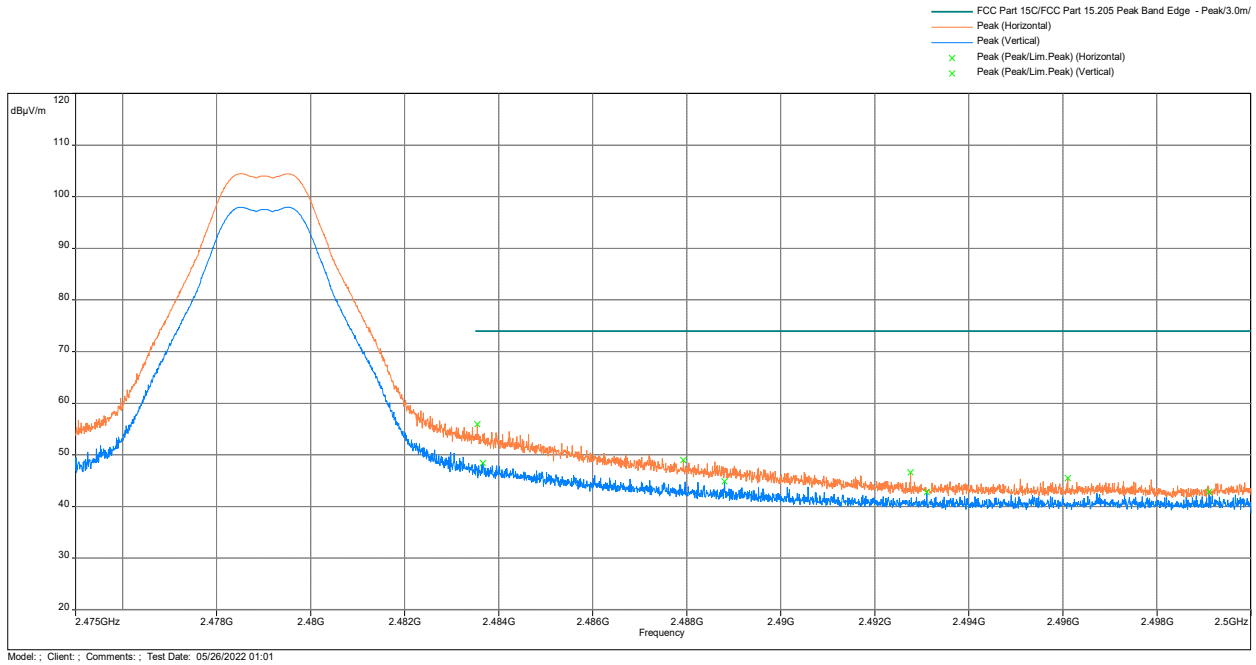
Test Results: 15.209/15.205 Radiated Restricted Band Emissions

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2402 MHz, 2Mbps Charging mode
Peak vs Peak & Average Limits

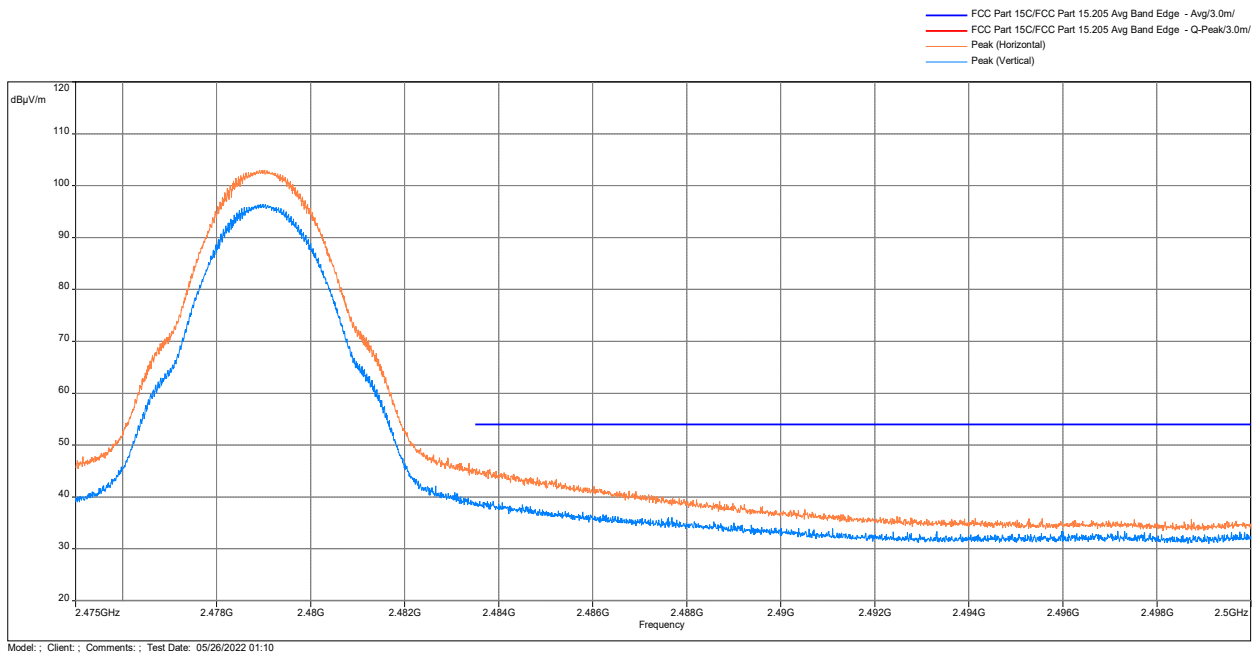


Frequency MHz	Peak@3m dBμV/m	Lim.@3m Avg dBμV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2337.536	48.28	54	-5.72	1.01	355	Horizontal	-12.27
2370.613	46.38	54	-7.62	1.51	343.25	Horizontal	-12.02
2390	45.54	54	-8.46	1.51	350.5	Horizontal	-11.87

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2479 MHz, 2Mbps Charging mode
Peak vs Peak Limit



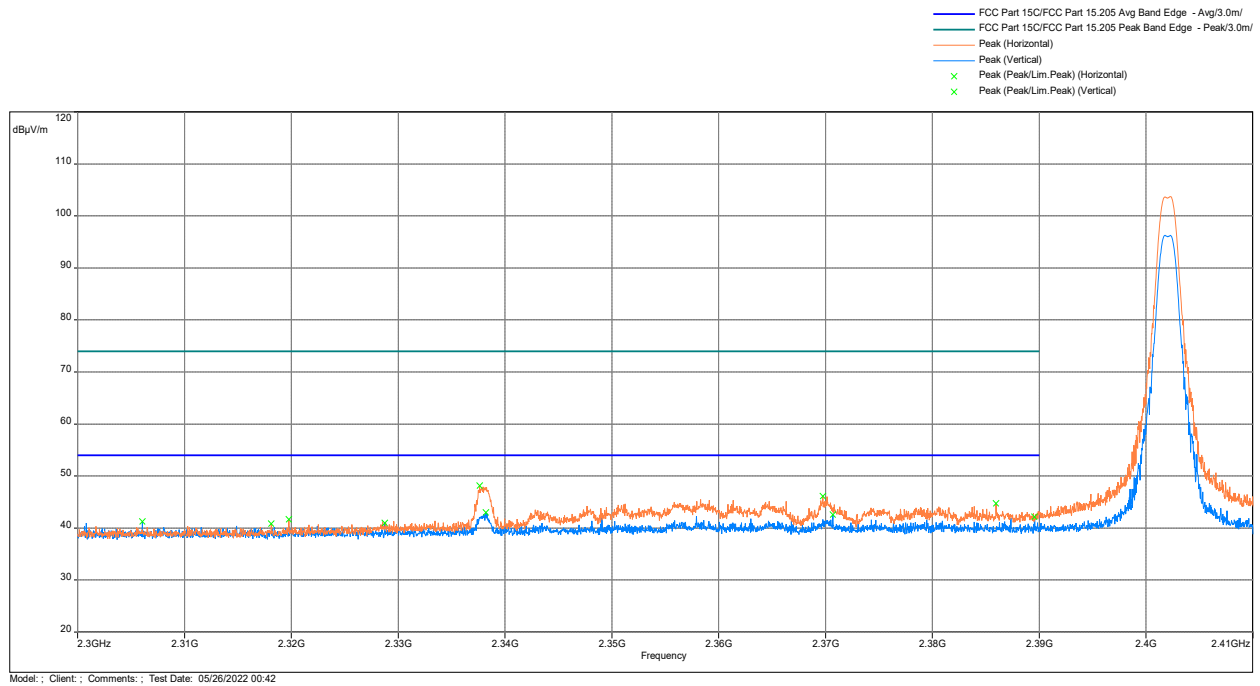
Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2479 MHz, 2Mbps Charging mode
Avg vs Avg Limit



Frequency MHz	Peak@3m dB μ V/m	Lim.@3m Peak dB μ V/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	54.08	74	-19.92	1.51	333.75	Horizontal	-11.55

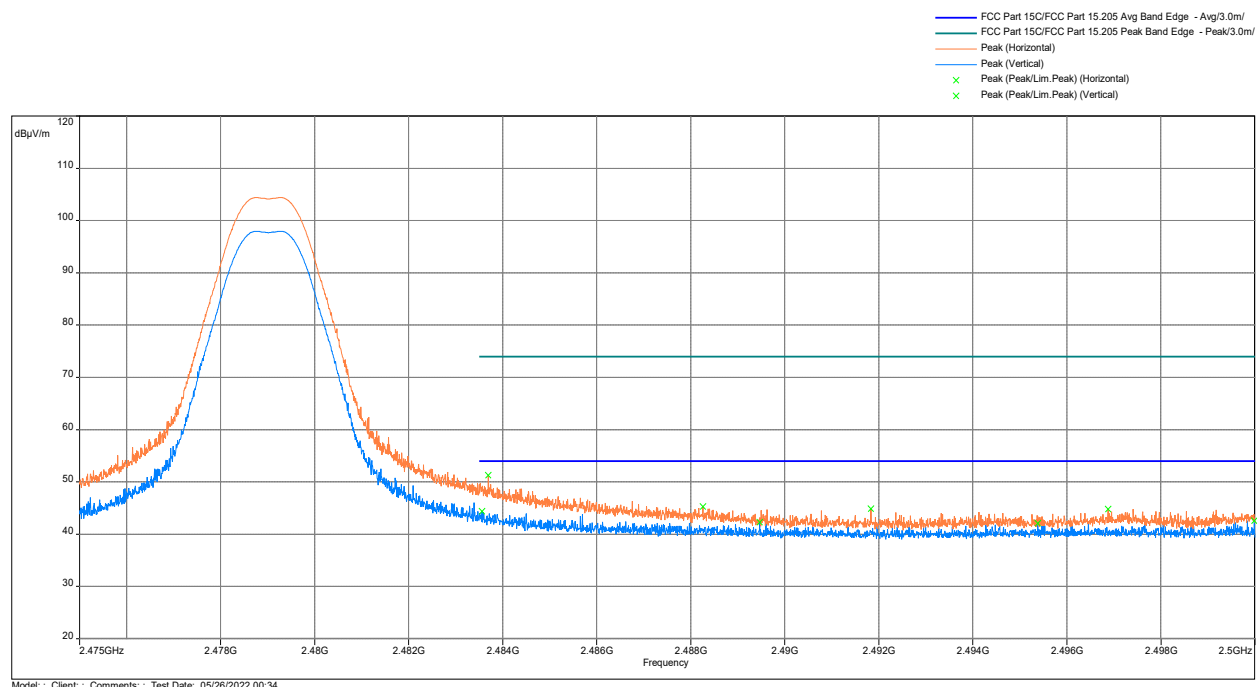
Frequency MHz	Avg@3m dB μ V/m	Lim.@3m Avg dB μ V/m	Marg in (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	44.78	54	-9.22	1.51	354	Horizontal	-11.55

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2402 MHz, 1Mbps Battery mode
Peak vs Peak & Average Limits



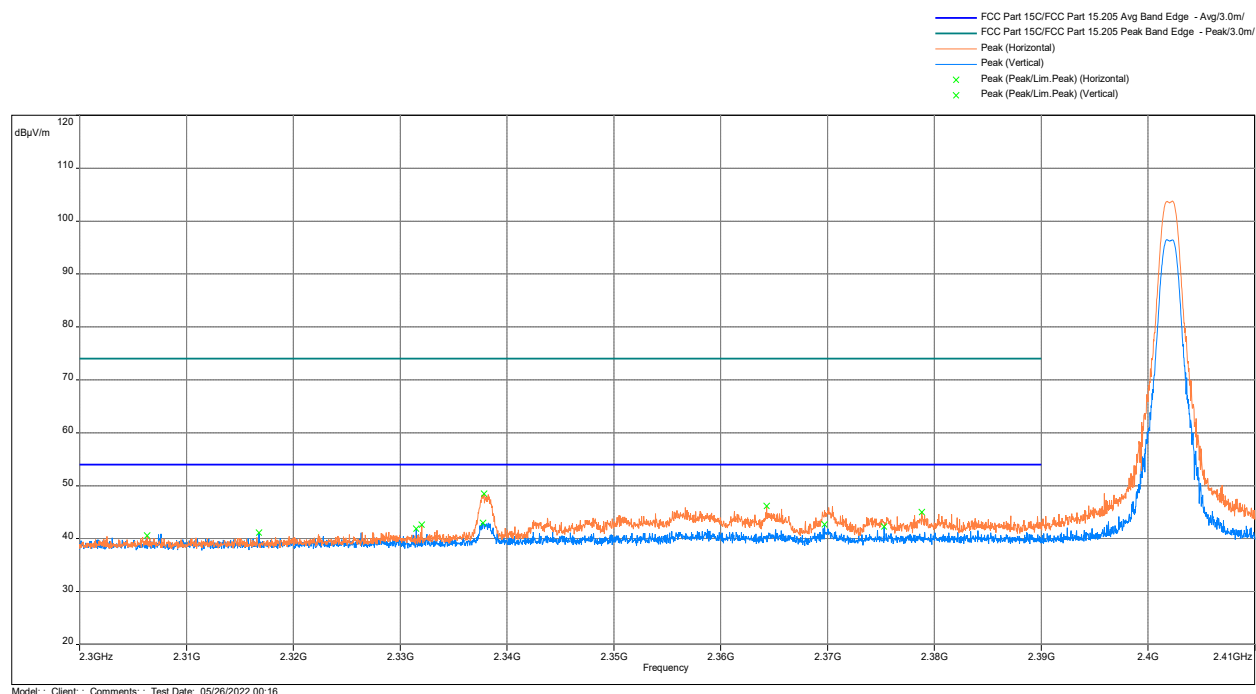
Frequency MHz	Peak@3m dBμV/m	Lim.@3m Avg dBμV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2337.620	48.12	54	-5.88	1.01	332	Horizontal	-12.27
2369.751	46.15	54	-7.85	1.01	339.5	Vertical	-12.03
2390.000	43.25	54	-10.75	1.51	354.75	Vertical	-11.87

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2479 MHz, 1Mbps Battery mode
Peak vs Peak & Average Limits



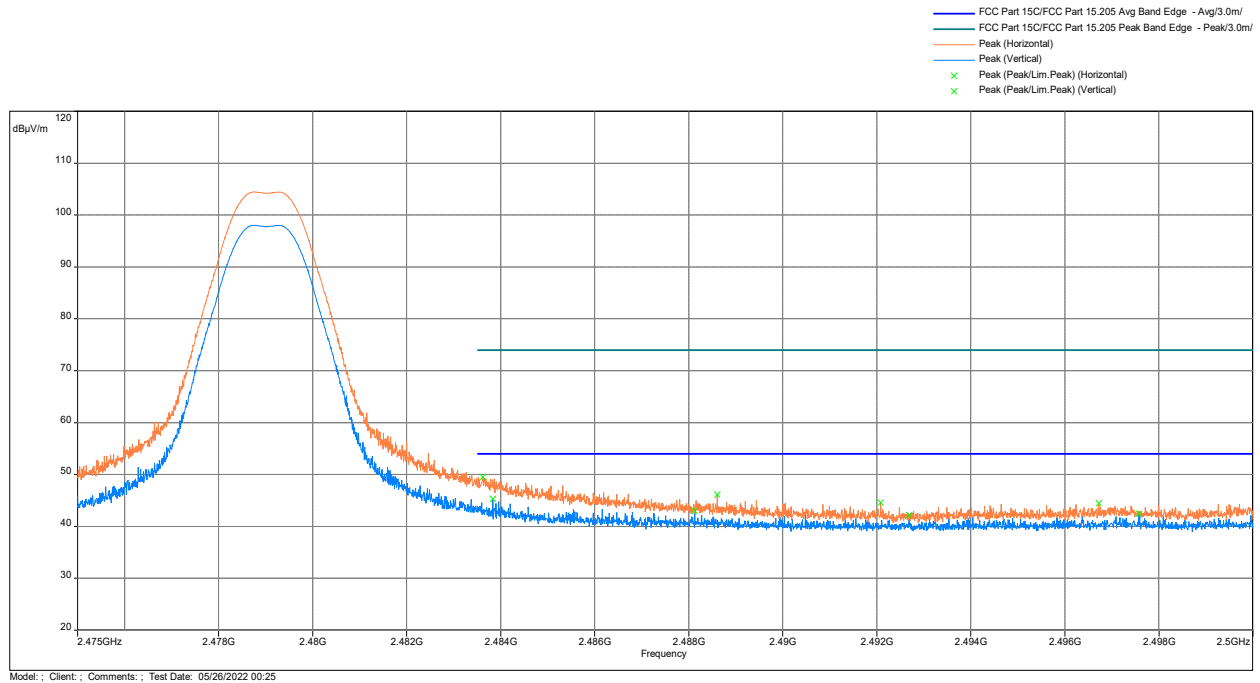
Frequency MHz	Peak@3m dBμV/m	Lim.@3m Avg dBμV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	49.8	54	-4.2	1.5	347.5	Horizontal	-11.55
2483.689	51.25	54	-2.75	1.5	333.75	Horizontal	-11.55

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2402 MHz, 1Mbps Charging mode
Peak vs Peak & Average Limits



Frequency MHz	Peak@3m dBμV/m	Lim.@3m Avg dBμV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2337.851	48.46	54	-5.54	1.01	333.25	Horizontal	-12.27
2390	43.07	54	-10.93	1.51	329.5	Horizontal	-11.87

Radiated Out-of-Band Spurious Emissions at the Band Edge with antenna
Tx @ 2479 MHz, 1Mbps Charging mode
Peak vs Peak & Average Limits

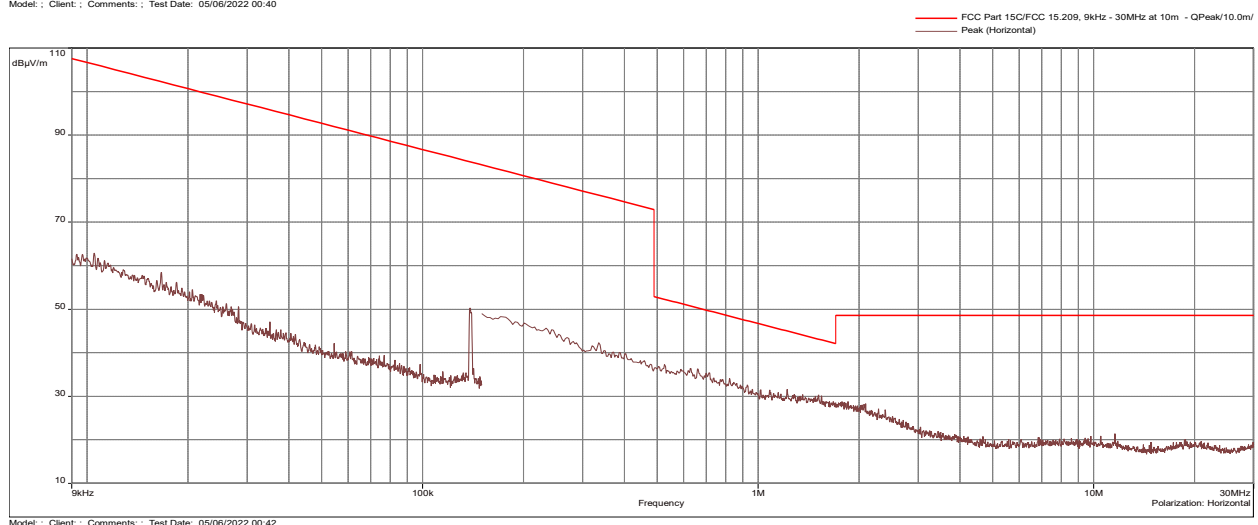
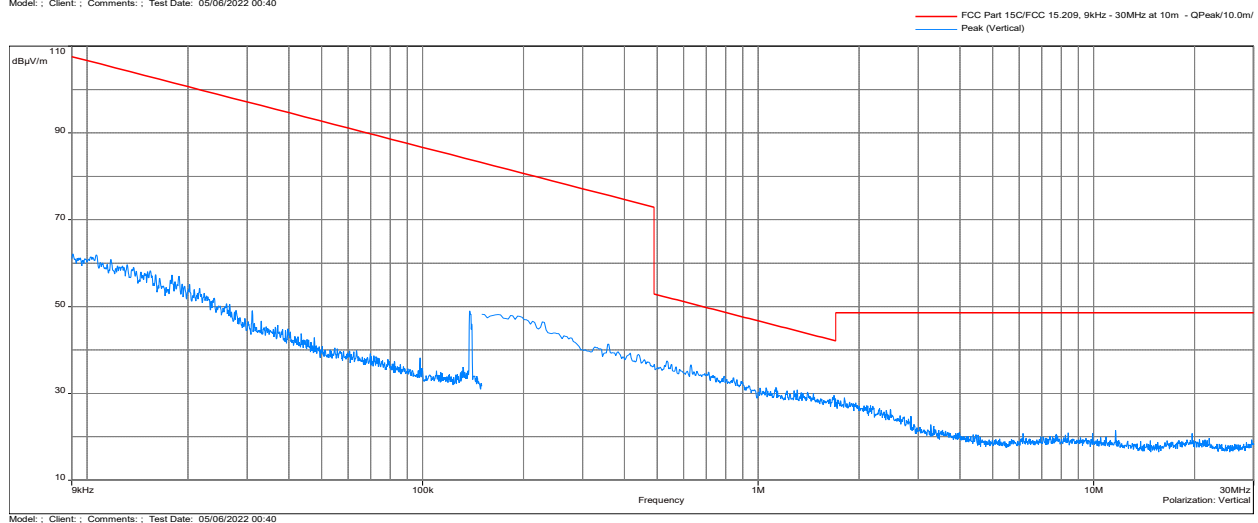
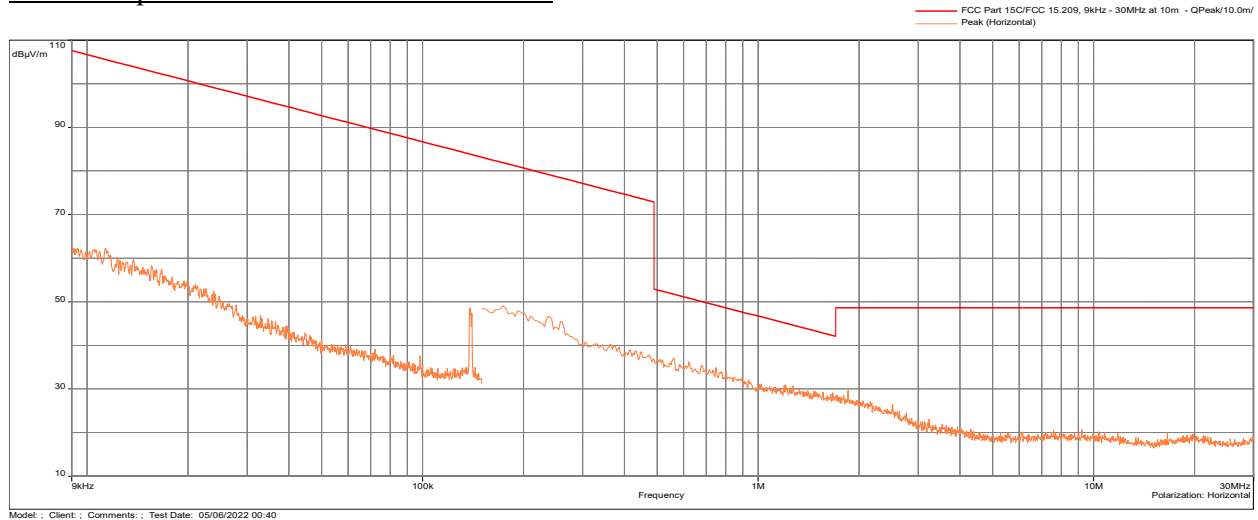


Frequency MHz	Peak@3m dBμV/m	Lim.@3m Avg dBμV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	48.39	54	-5.61	1.5	333	Horizontal	-11.55

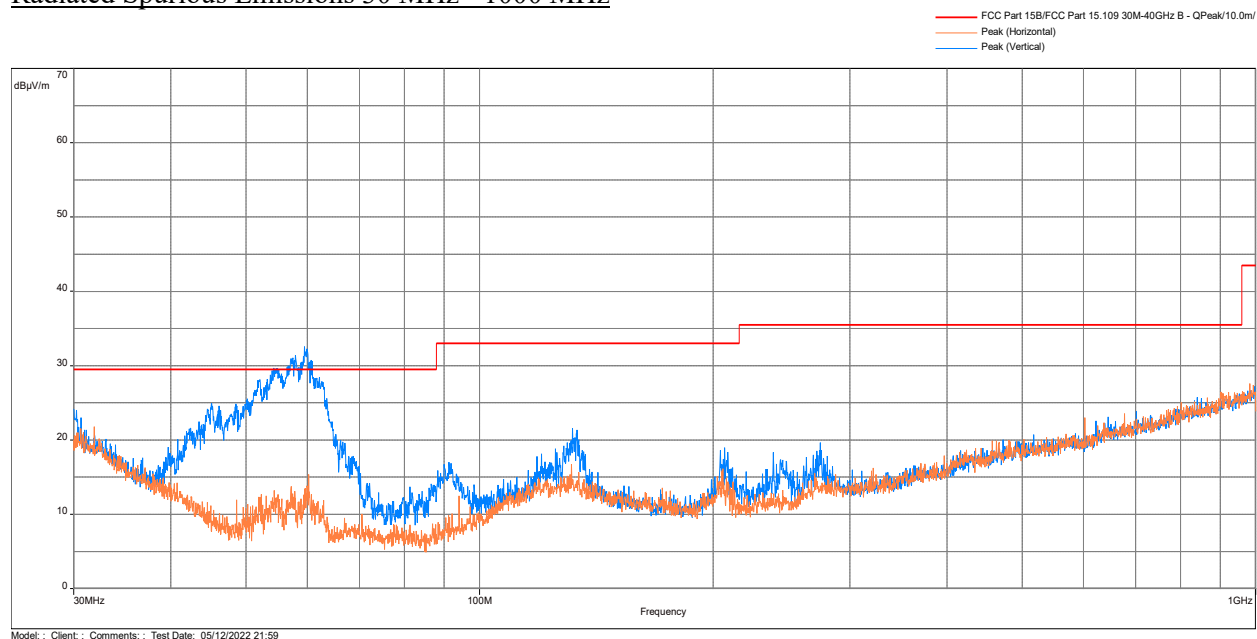
Out-of-Band Radiated Spurious Emissions

15.209 Radiated Spurious Emissions Low Channel
Tx at 2402MHz, 2Mbps Charging mode

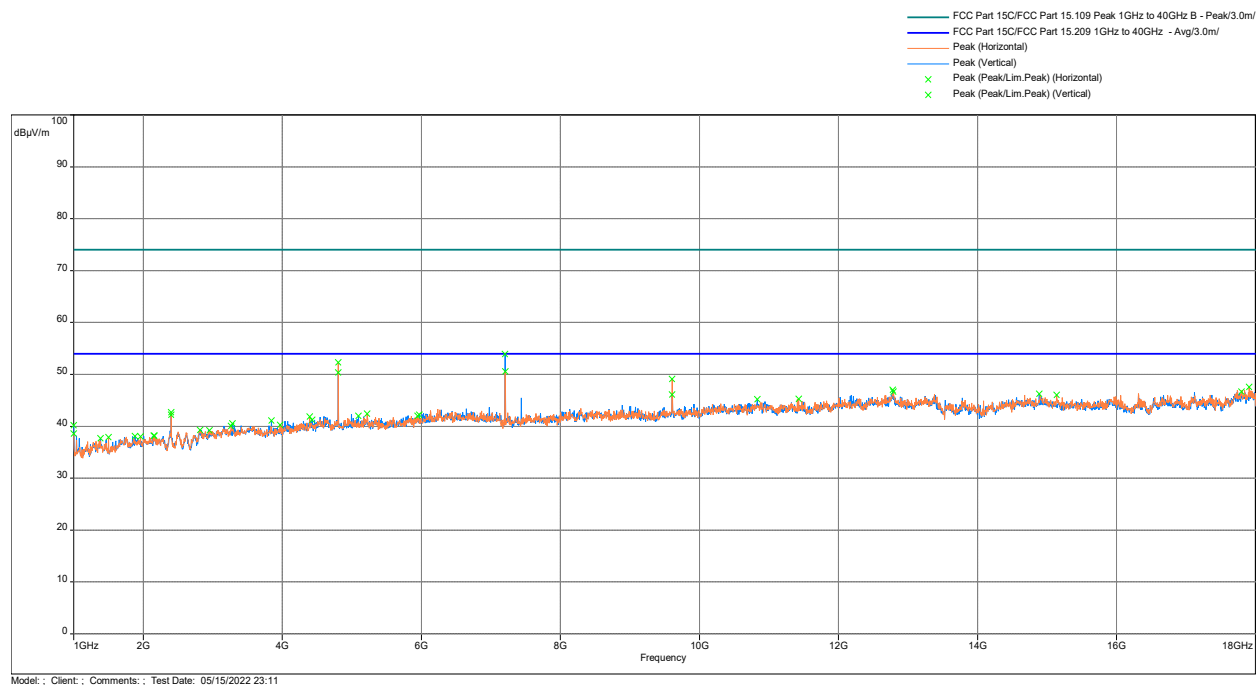
Radiated Spurious Emissions 9 kHz - 30 MHz



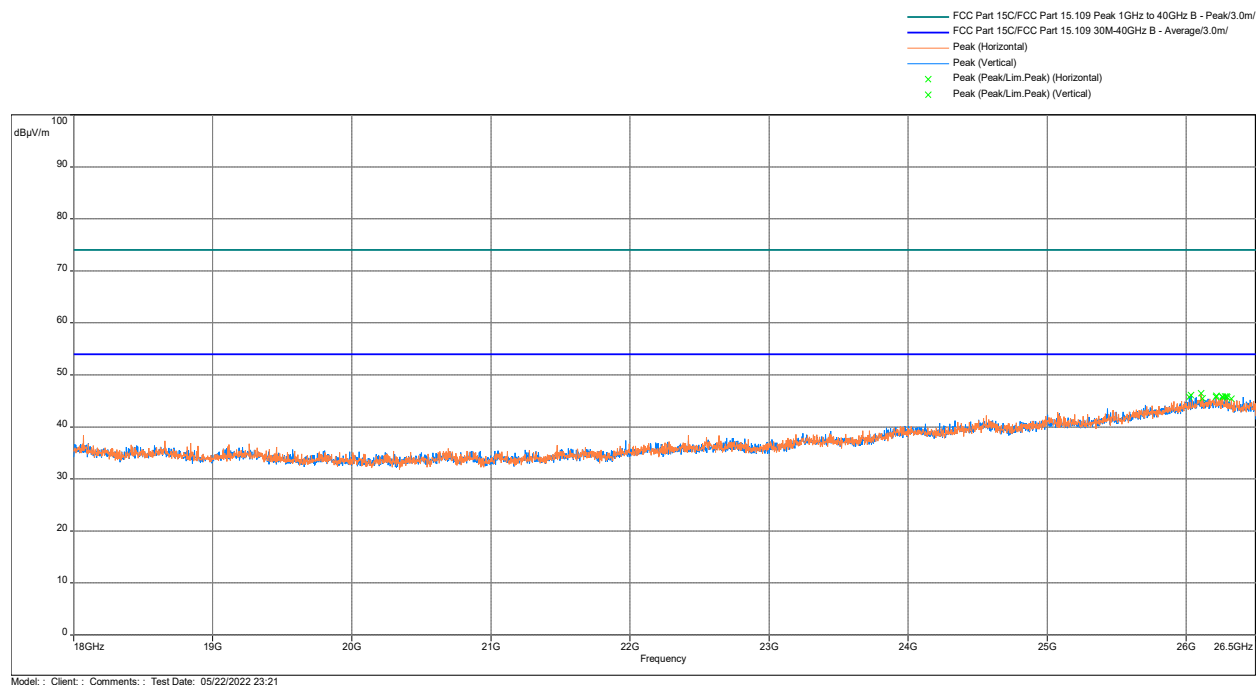
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
44.980	16.89	29.5	-12.61	1.06	78.25	Vertical	-16.84
51.938	22.01	29.5	-7.49	3.96	250.75	Vertical	-19.65
54.566	25.04	29.5	-4.46	3.74	10.25	Vertical	-19.94
57.442	25.41	29.5	-4.09	4	342.5	Vertical	-19.86
59.740	26.76	29.5	-2.74	3.55	40.5	Vertical	-19.61
60.580	24.96	29.5	-4.54	2.13	349	Vertical	-19.51

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4804.600	50.34	74	-23.66	2.99	4.25	Vertical	-6.92
4805.167	52.33	74	-21.67	3.01	14.25	Horizontal	-6.92
7204.433	53.9	74	-20.1	1.99	0	Vertical	-4.22
7207.267	50.59	74	-23.41	2.01	83.75	Horizontal	-4.21
9605.967	49.1	74	-24.9	1.01	331.25	Horizontal	-1.94
9605.967	46.13	74	-27.87	1.99	0.75	Vertical	-1.94

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4802.900	48.32	54	-5.68	3.01	0	Horizontal	-6.92
4802.900	46.57	54	-7.43	2.99	22.5	Vertical	-6.92
7204.433	44.38	54	-9.62	2.01	87.75	Horizontal	-4.22
7205.000	49.49	54	-4.51	1.99	358.75	Vertical	-4.21
9605.967	43	54	-11	1.01	317	Horizontal	-1.94
9605.967	39.48	54	-14.52	1.01	0.25	Vertical	-1.94

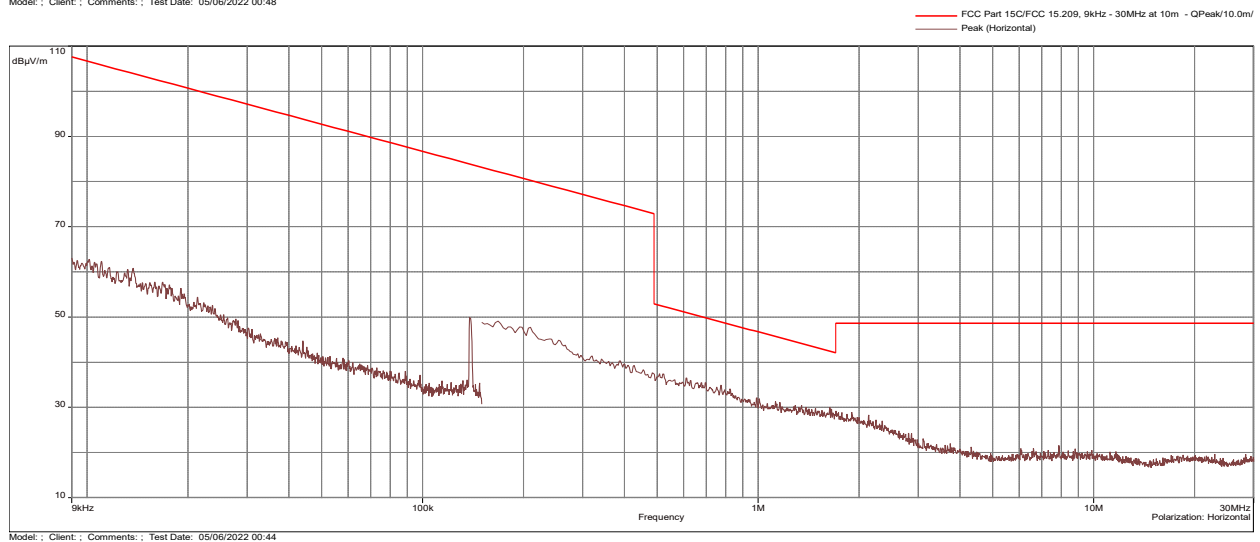
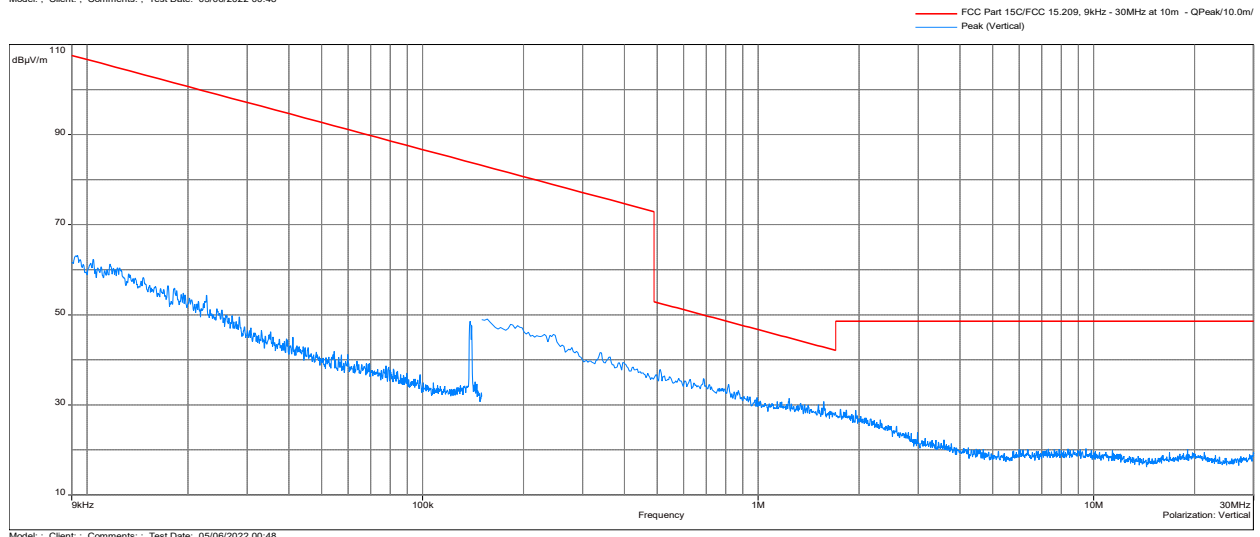
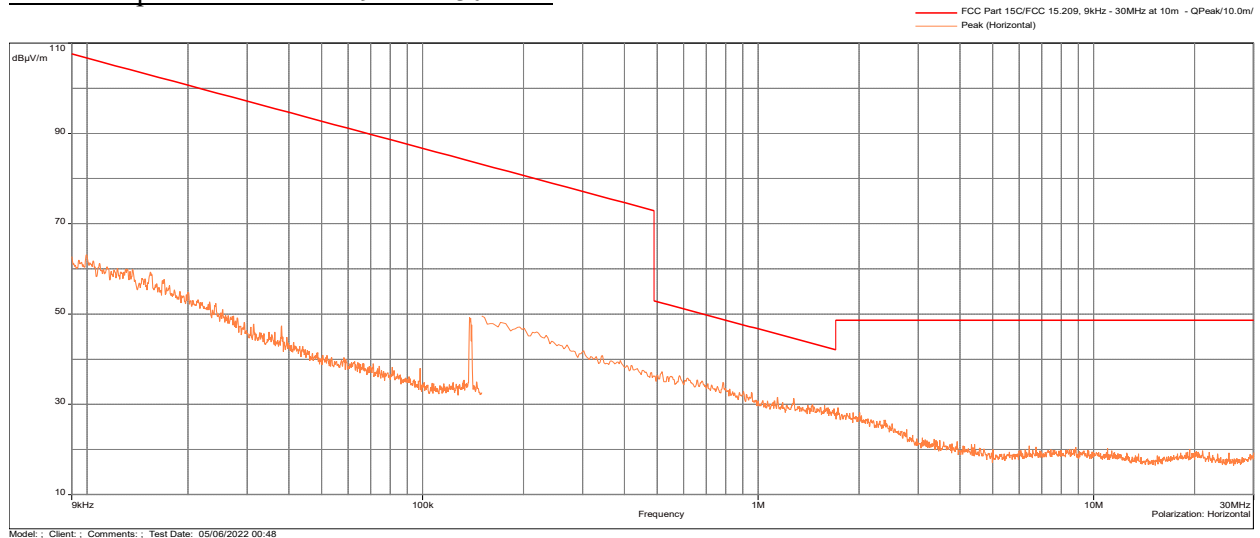
Note: FS = RA + Correction

Correction = AF + CF – Preamp

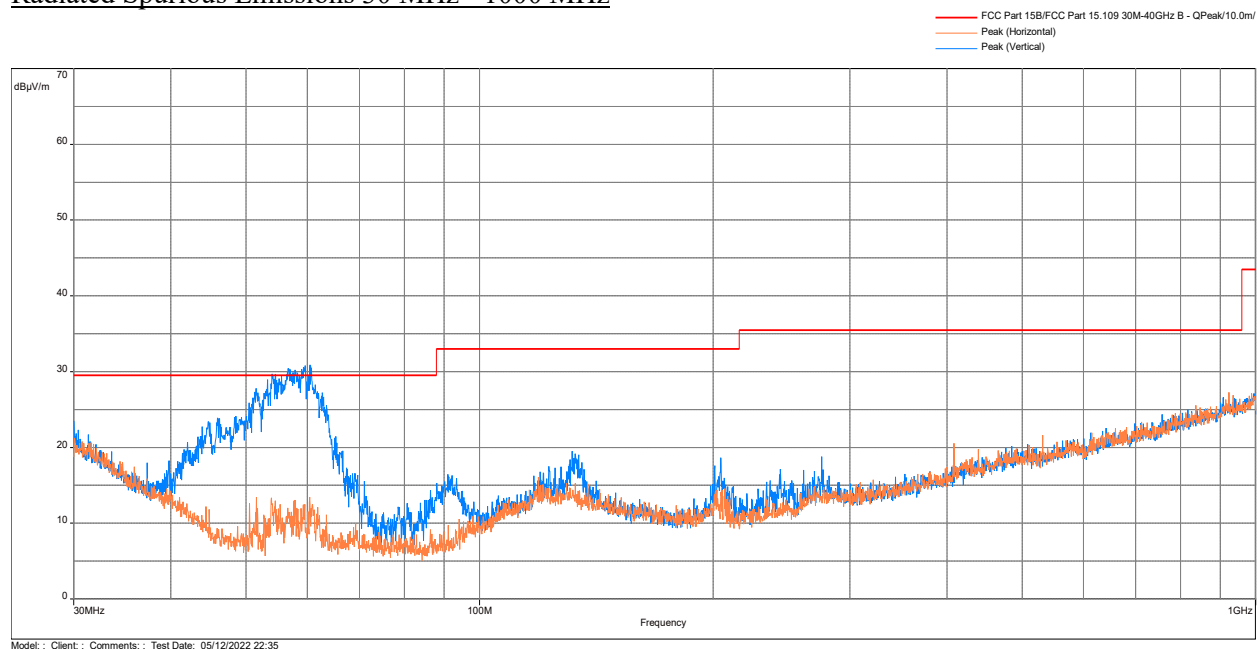
Results	Complies
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15.209 Radiated Spurious Emissions Mid Channel
Tx at 2440MHz, 2Mbps Charging mode

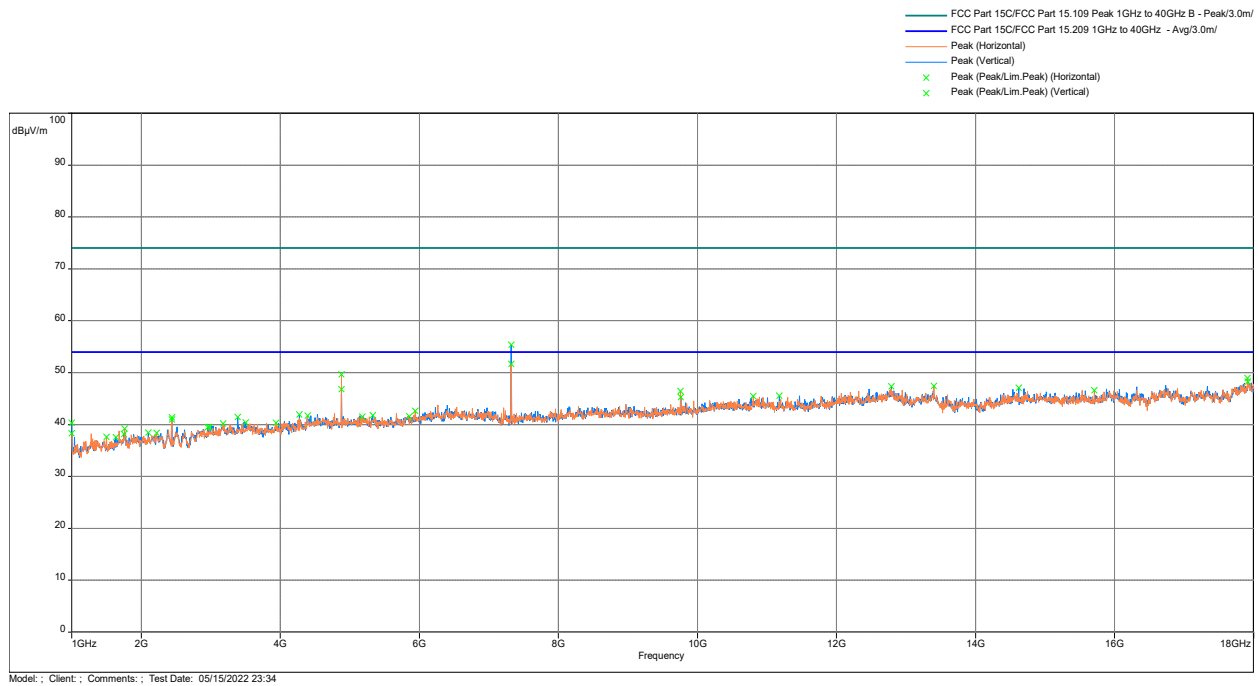
Radiated Spurious Emissions 9 kHz - 30 MHz



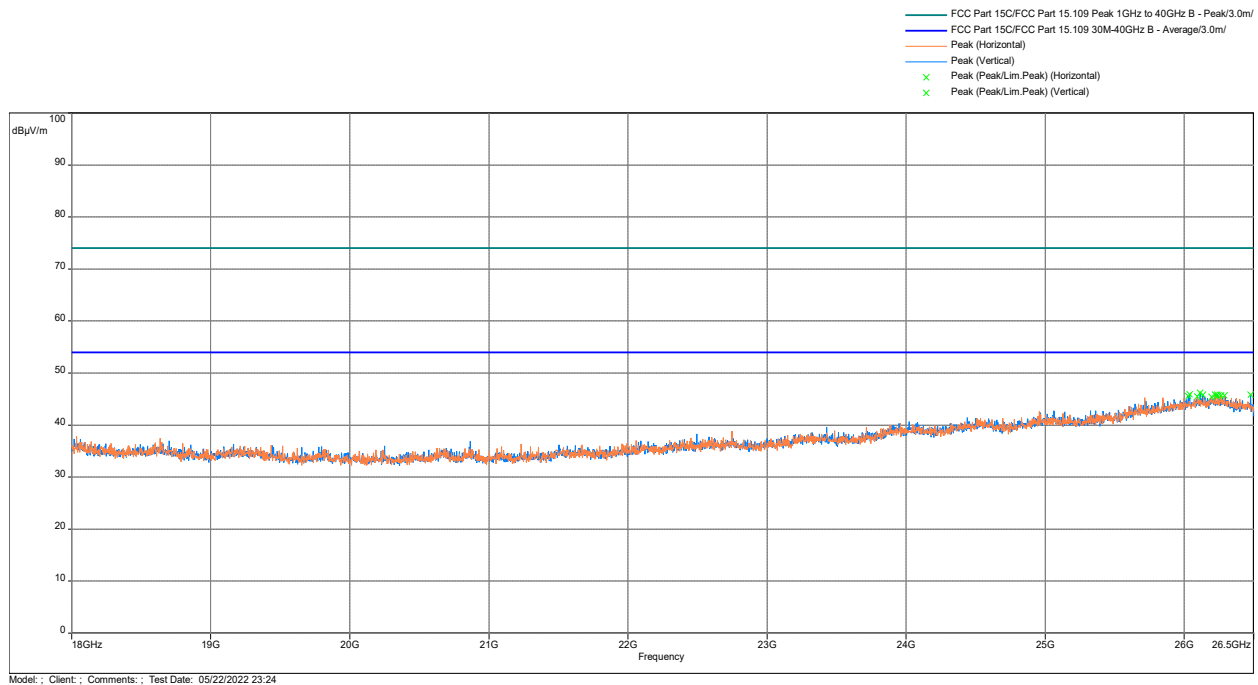
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
53.867	22.66	29.5	-6.84	3.9	236.75	Vertical	-19.93
56.790	24.84	29.5	-4.66	4	324.75	Vertical	-19.91
58.179	23.31	29.5	-6.19	3.92	11	Vertical	-19.77
59.479	24.41	29.5	-5.09	3.6	33.25	Vertical	-19.63
60.705	23.91	29.5	-5.59	1.69	6	Vertical	-19.5

Freq. MHz	Peak@3m dB(μV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4878.833	46.77	74	-27.23	1.49	37.25	Vertical	-6.9
4880.533	49.65	74	-24.35	1.51	355.25	Horizontal	-6.9
7321.167	55.36	74	-18.64	1.01	318	Vertical	-4.08
7321.733	51.66	74	-22.34	1.99	217.5	Horizontal	-4.08
9757.833	46.46	74	-27.54	1.51	0	Horizontal	-1.72
9761.800	45.26	74	-28.74	1.49	303.25	Vertical	-1.72

Freq. MHz	Avg@3m dB(μV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4880.533	44.22	54	-9.78	1.49	0	Horizontal	-6.9
4880.533	39.91	54	-14.09	1.51	44.5	Vertical	-6.9
7321.167	50.34	54	-3.66	1.01	316.5	Vertical	-4.08
7321.167	48.13	54	-5.87	1.99	109.5	Horizontal	-4.08
9758.400	39.01	54	-14.99	1.01	43.75	Horizontal	-1.72
9761.800	39.43	54	-14.57	1.01	43.75	Horizontal	-1.72

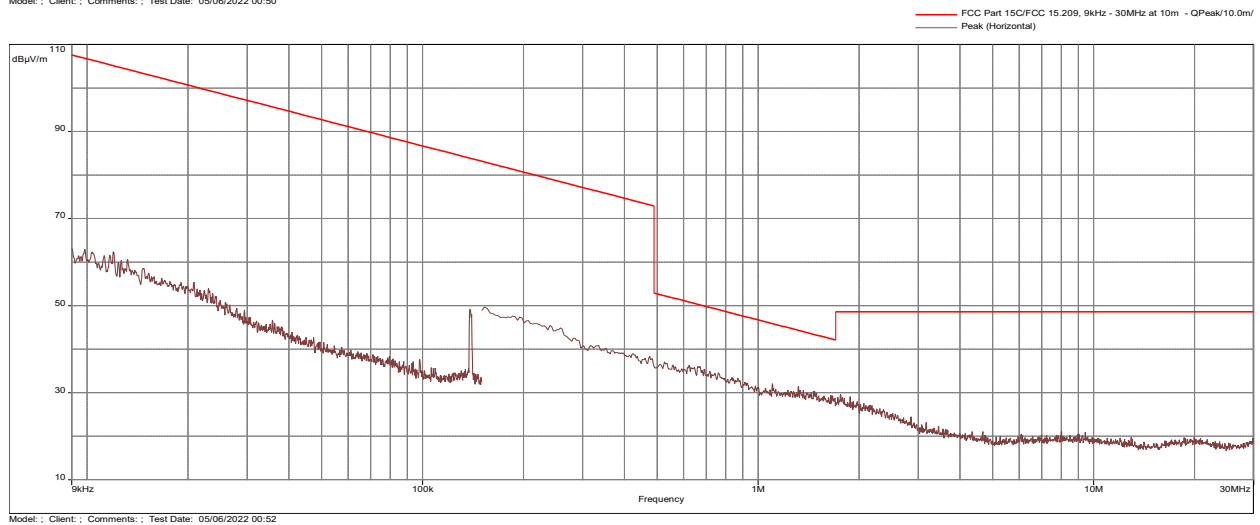
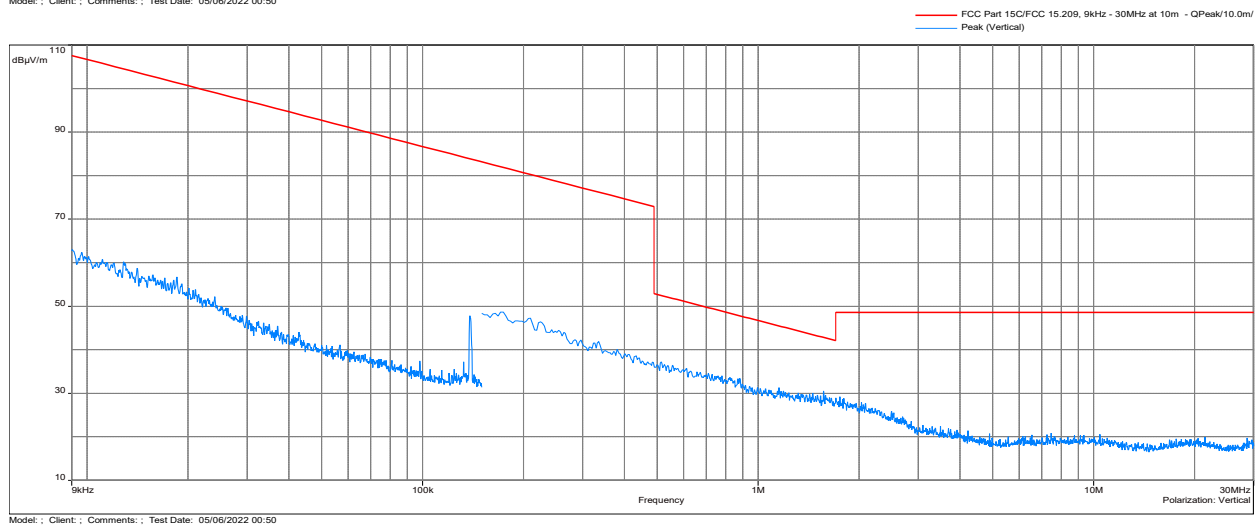
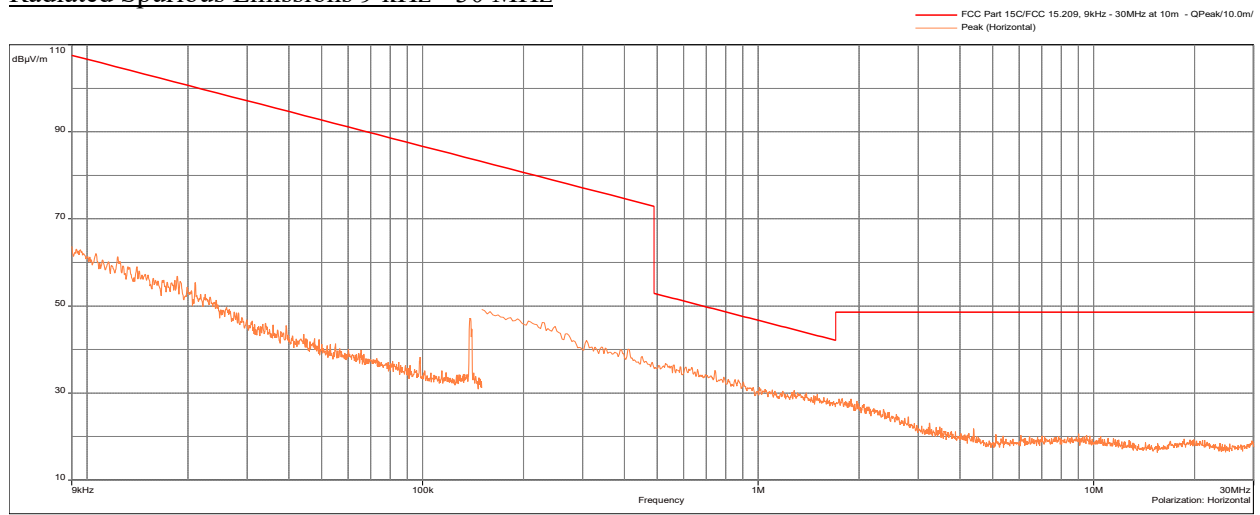
Note: FS = RA + Correction

Correction = AF + CF – Preamp

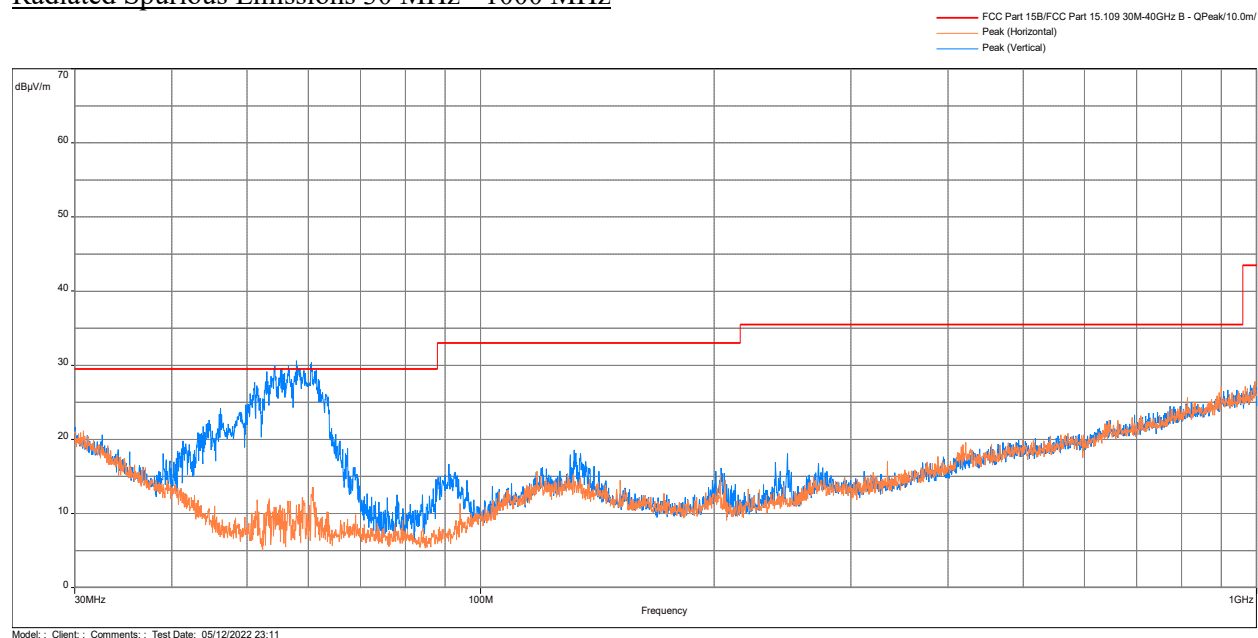
Results	Complies
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15.209 Radiated Spurious Emissions High Channel Tx at 2479 MHz, 2Mbps Charging mode

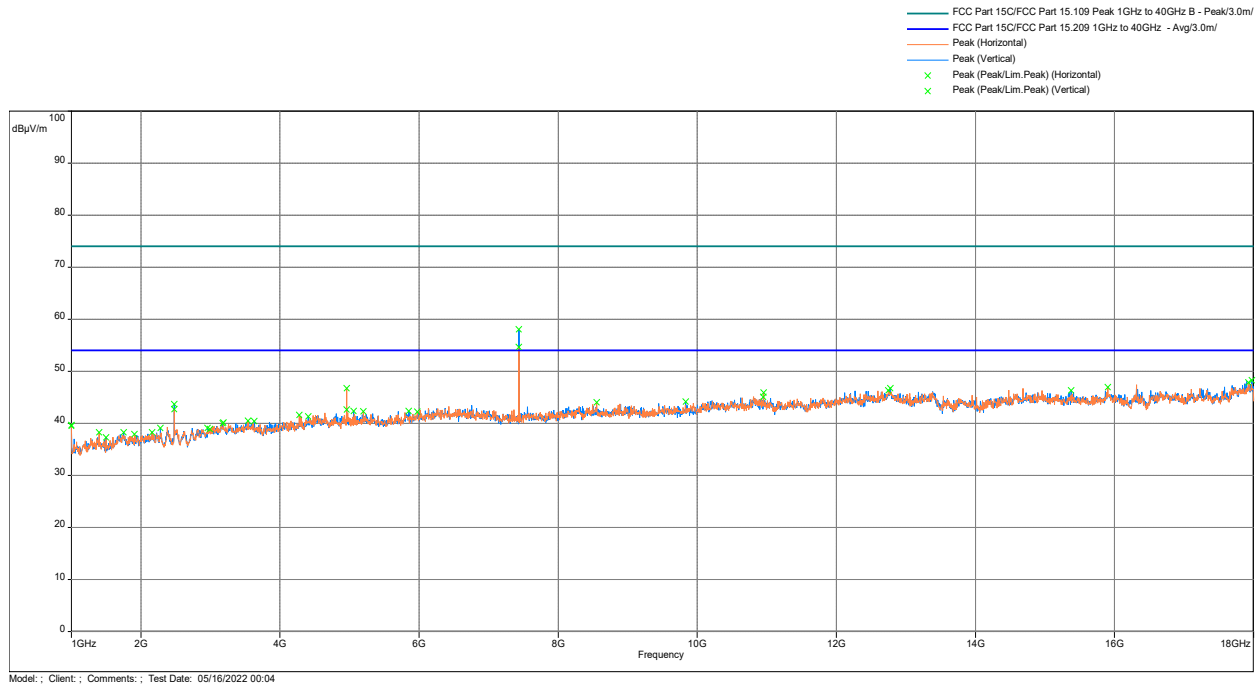
Radiated Spurious Emissions 9 kHz - 30 MHz



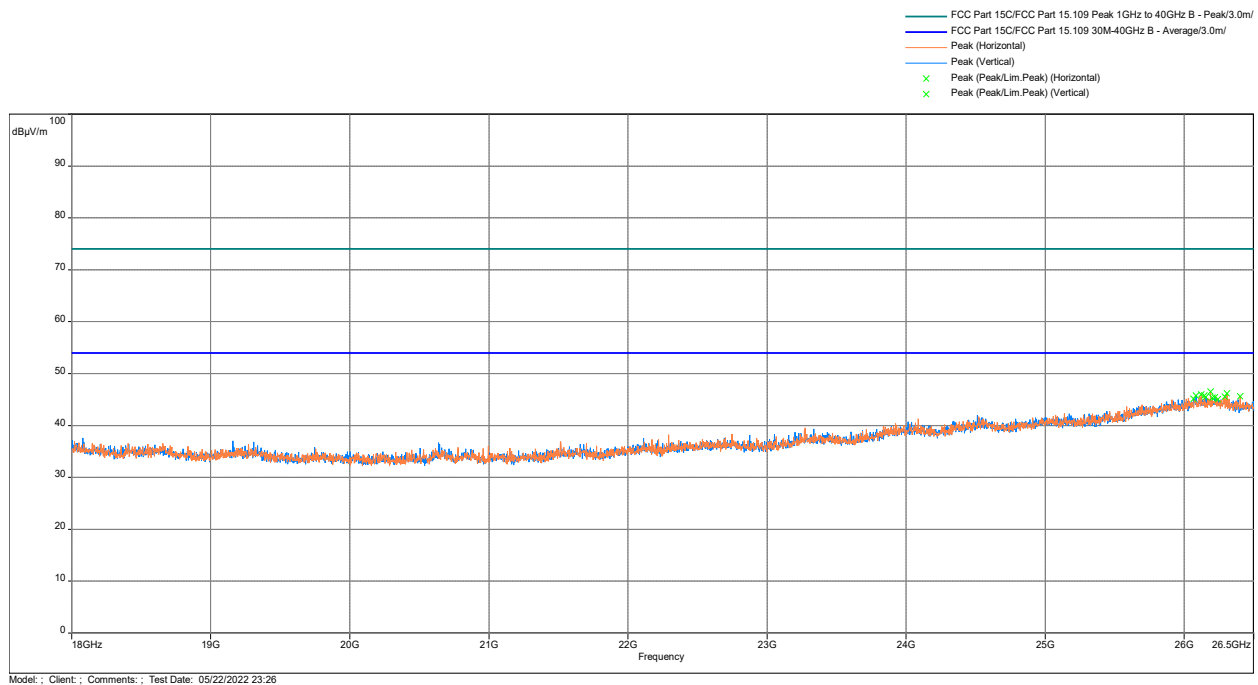
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
55.525	22.3	29.5	-7.2	4	17.25	Vertical	-19.93
56.607	23.56	29.5	-5.94	3.91	236.5	Vertical	-19.92
58.119	22.8	29.5	-6.7	4	199.25	Vertical	-19.78
58.228	23.55	29.5	-5.95	3.96	4	Vertical	-19.77
60.617	23.33	29.5	-6.17	3.36	341.5	Vertical	-19.51

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4958.733	46.76	74	-27.24	1.49	0	Horizontal	-6.89
4958.733	42.65	74	-31.35	1.99	37.5	Vertical	-6.89
7435.633	58.08	74	-15.92	1.01	321.25	Vertical	-3.88
7435.633	54.67	74	-19.33	1.01	0	Horizontal	-3.88

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4957.033	40.72	54	-13.28	1.49	358.75	Horizontal	-6.89
4957.600	35.46	54	-18.54	1.99	251.75	Vertical	-6.89
7437.900	52.21	54	-1.79	1.01	316.5	Vertical	-3.88
7438.467	47.34	54	-6.66	1.99	239.75	Horizontal	-3.88

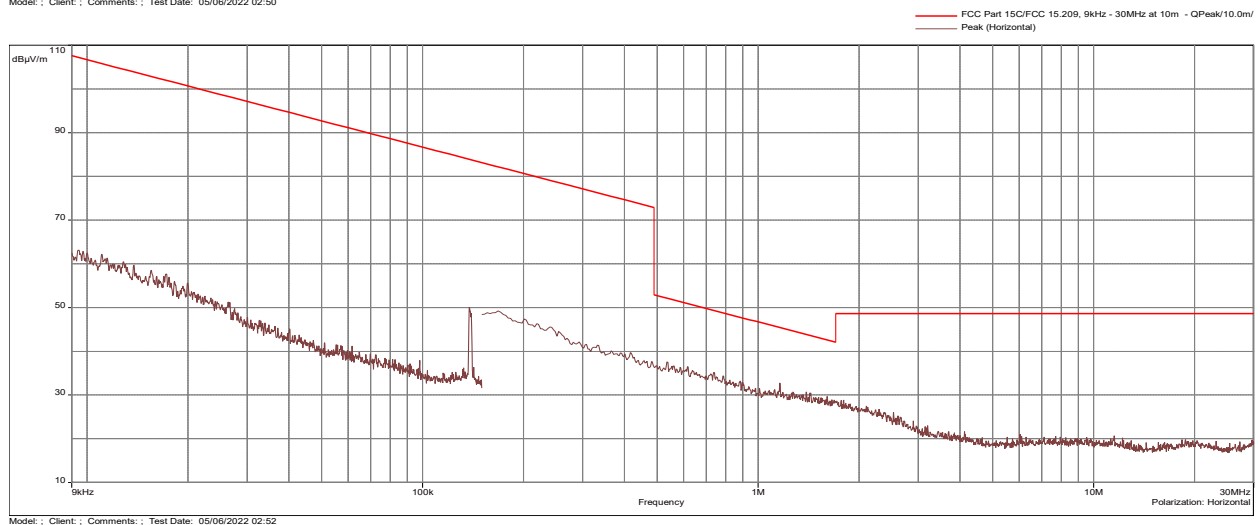
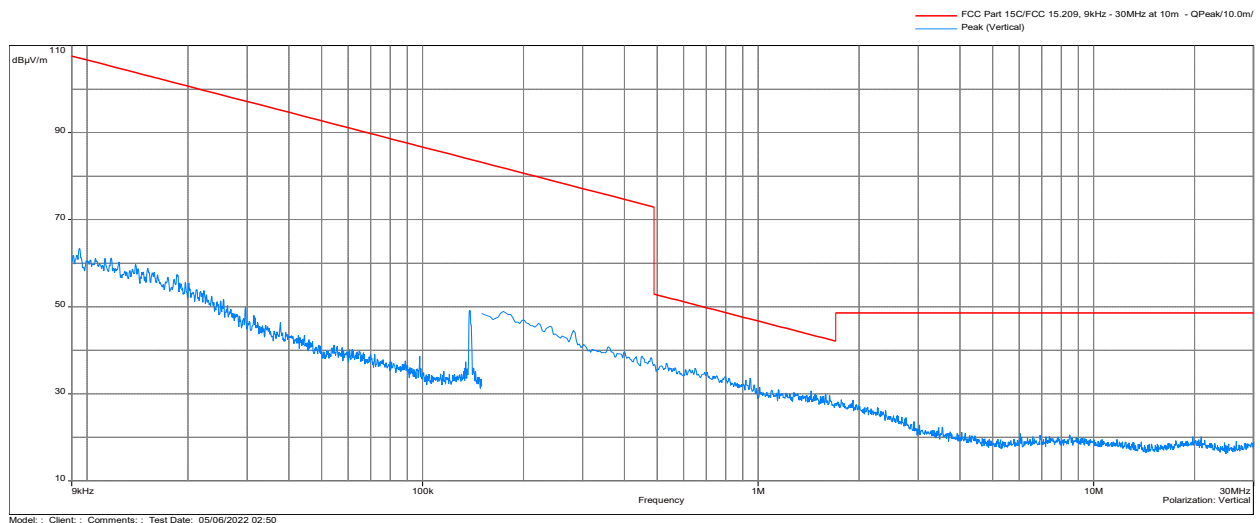
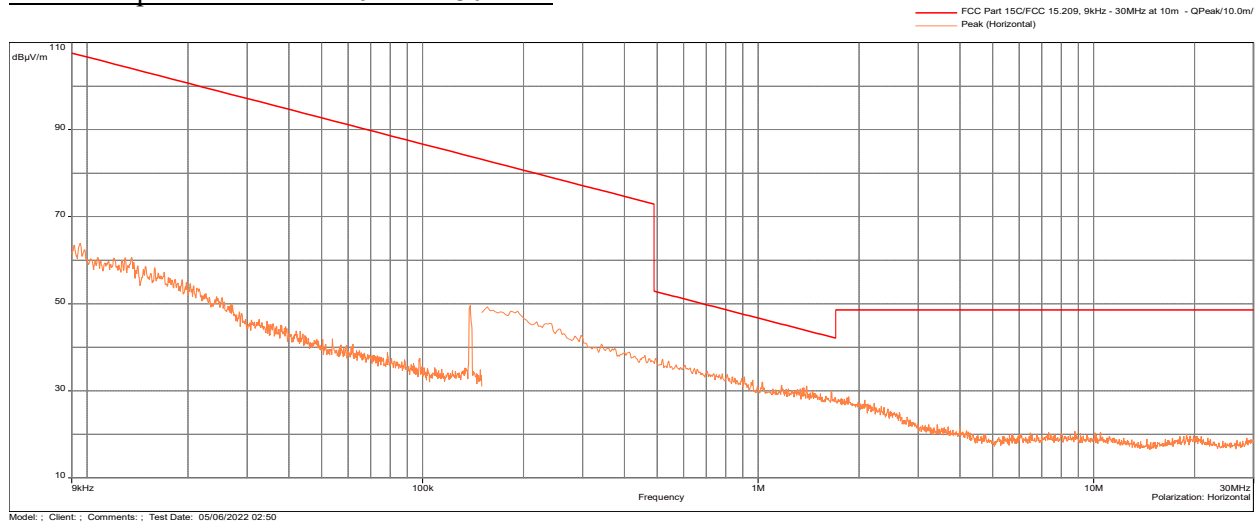
Note: FS = RA + Correction

Correction = AF + CF – Preamp

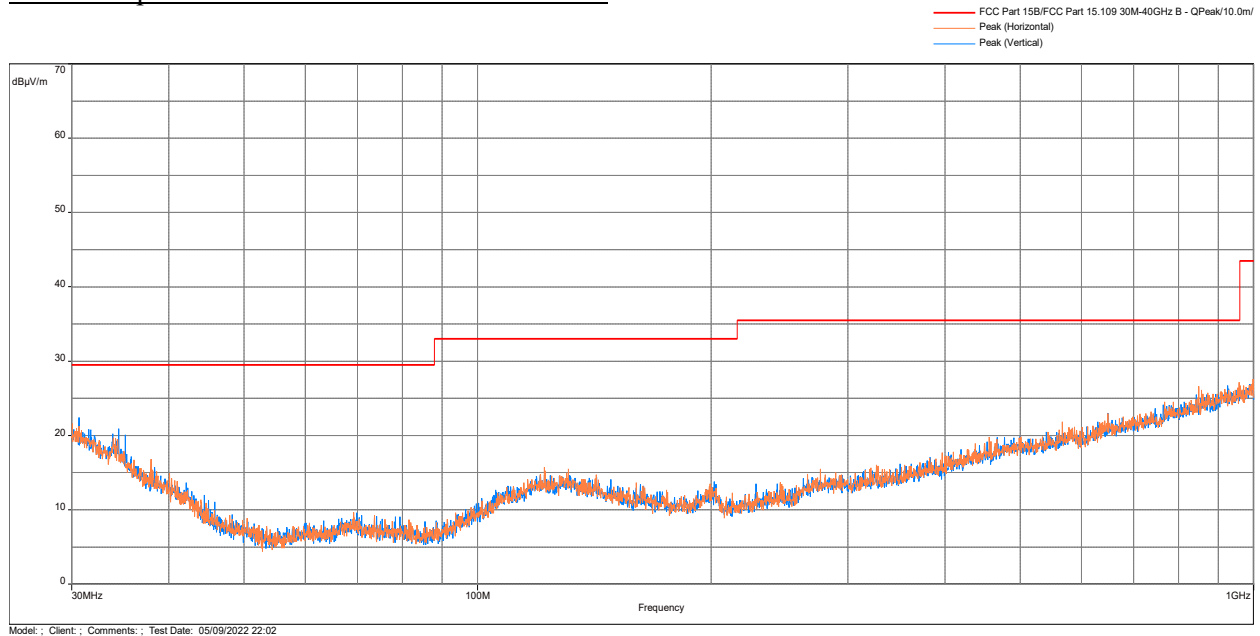
Results	Complies
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15.209 Radiated Spurious Emissions Low Channel Tx at 2402MHz, 1Mbps Battery mode

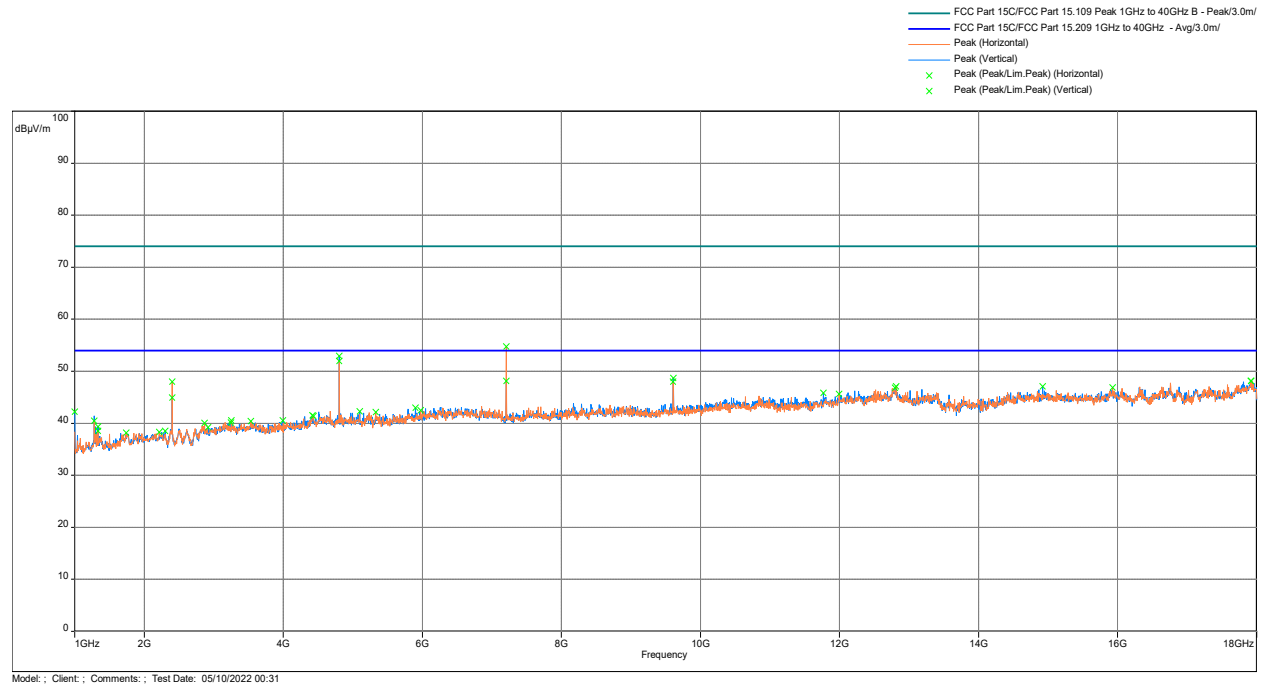
Radiated Spurious Emissions 9 kHz - 30 MHz



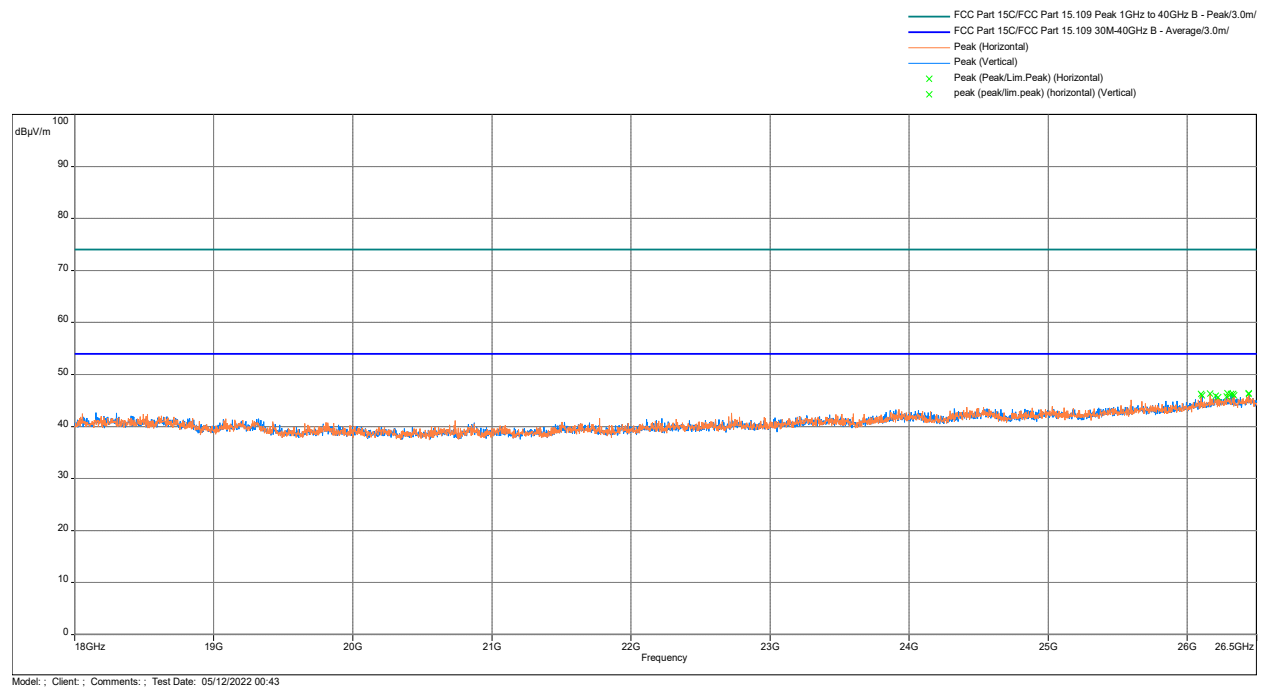
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
30.647	22.44	29.5	-7.06	4	40.75	Vertical	-6.58
34.494	20.93	29.5	-8.57	3	118.75	Vertical	-9.17
849.909	26.62	35.5	-8.88	2.96	66.75	Horizontal	-1.14
925.375	26.74	35.5	-8.76	4	128	Vertical	0.23
957.902	27.13	35.5	-8.37	2.96	40.25	Horizontal	0.83

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4803.467	51.94	74	-22.06	1.01	238	Horizontal	-6.92
4804.033	52.96	74	-21.04	1.01	262.5	Vertical	-6.92
7205.567	48.12	74	-25.88	3.01	74.25	Vertical	-4.21
7206.700	54.75	74	-19.25	1.99	244.75	Horizontal	-4.21
9609.367	48.7	74	-25.3	1.01	255.25	Vertical	-1.94
9607.667	47.96	74	-26.04	1.01	208	Horizontal	-1.94

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4804.033	48.63	54	-5.37	1.01	229.25	Horizontal	-6.92
4804.033	48.52	54	-5.48	3.99	252	Vertical	-6.92
7205.567	50.06	54	-3.94	1.99	283.5	Horizontal	-4.21
7205.567	42.23	54	-11.77	3.99	273.25	Vertical	-4.21
9607.100	41.99	54	-12.01	2.01	207.75	Vertical	-1.94
9609.367	41.88	54	-12.12	1.01	187.5	Horizontal	-1.94

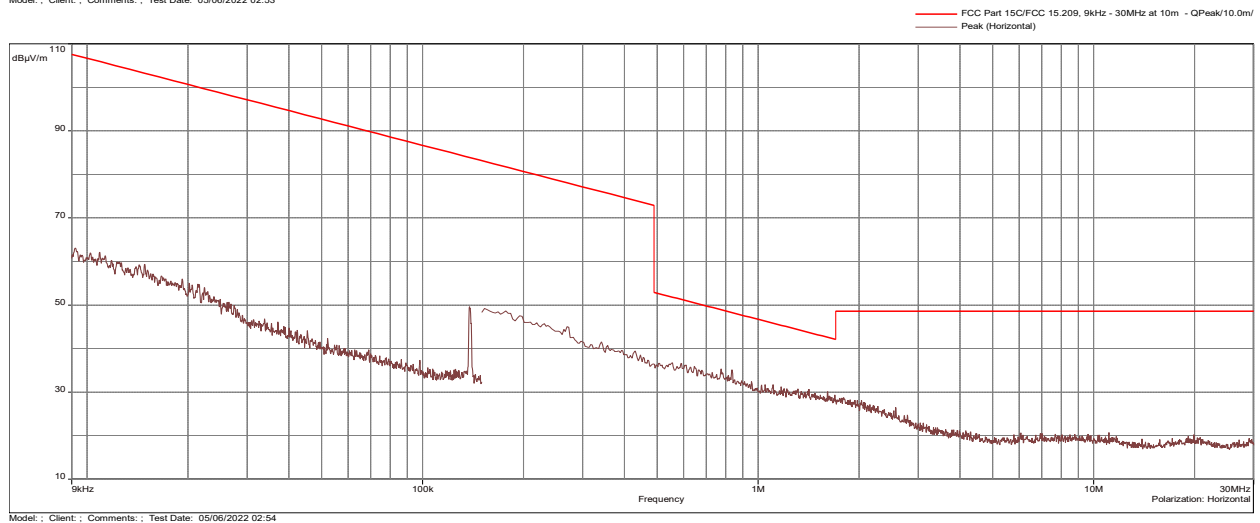
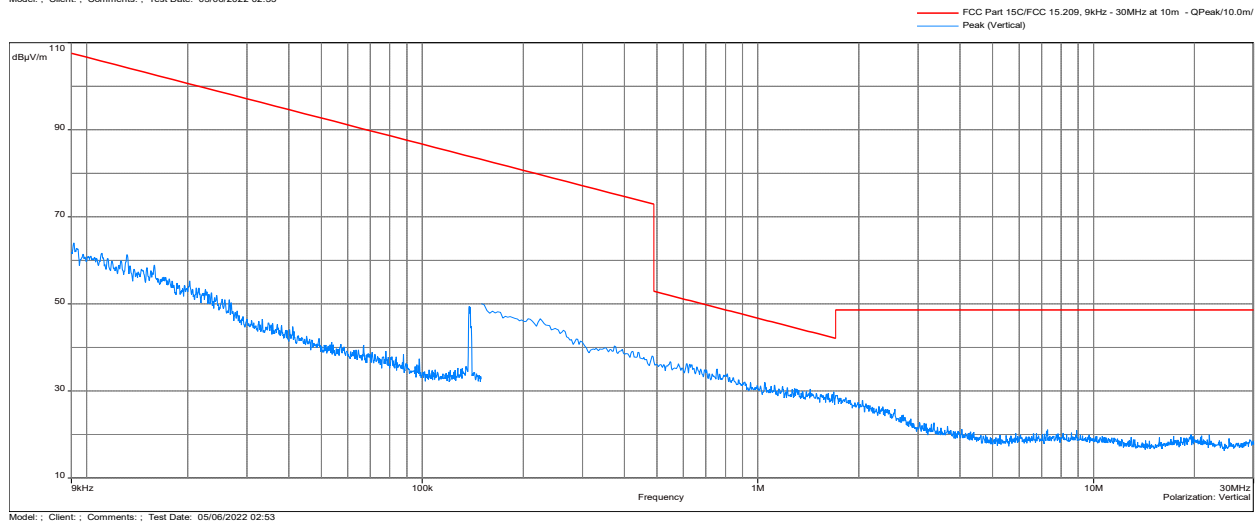
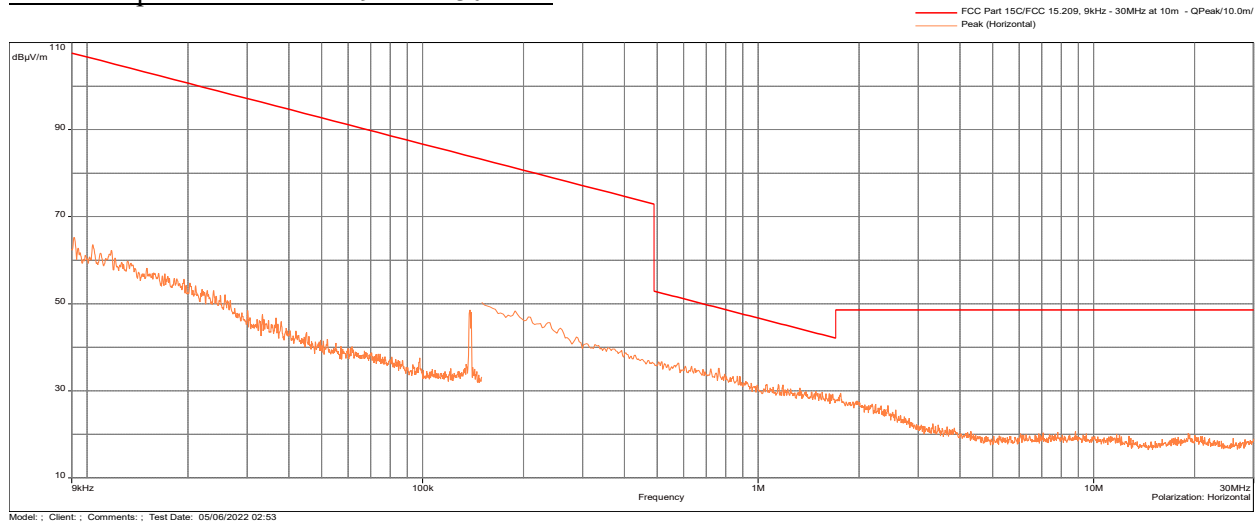
Note: FS = RA + Correction

Correction = AF + CF – Preamp

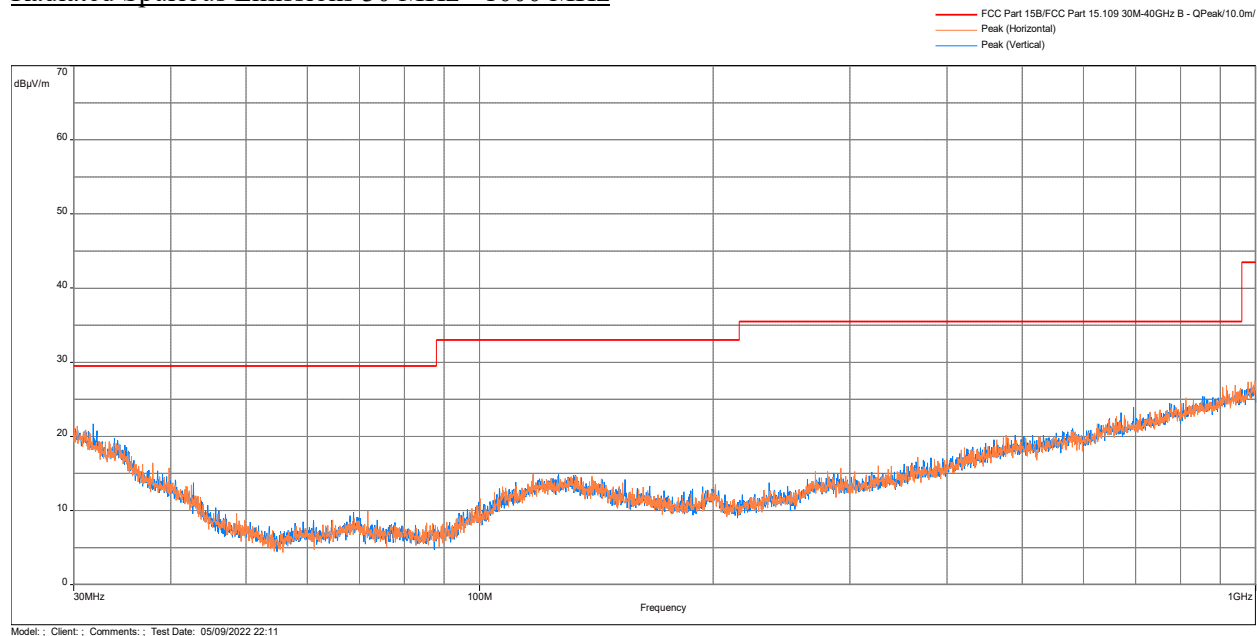
Results	Complies
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15.209 Radiated Spurious Emissions Mid Channel
Tx at 2440MHz, 1Mbps Battery mode

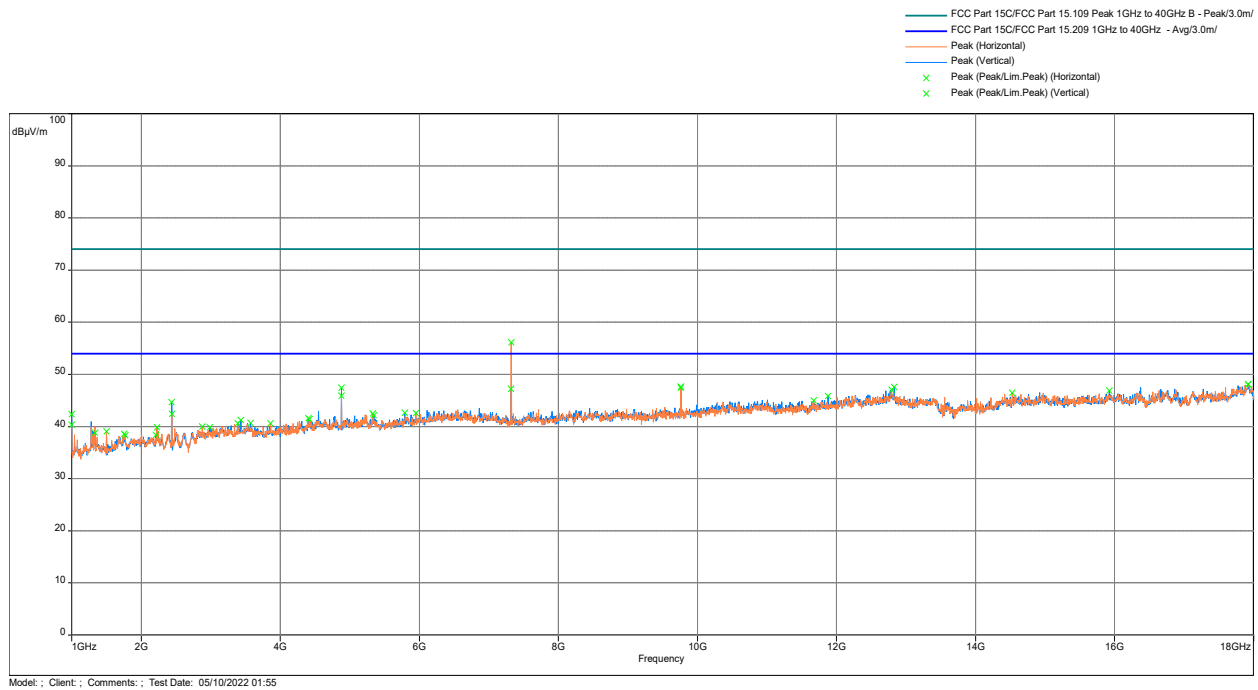
Radiated Spurious Emissions 9 kHz - 30 MHz



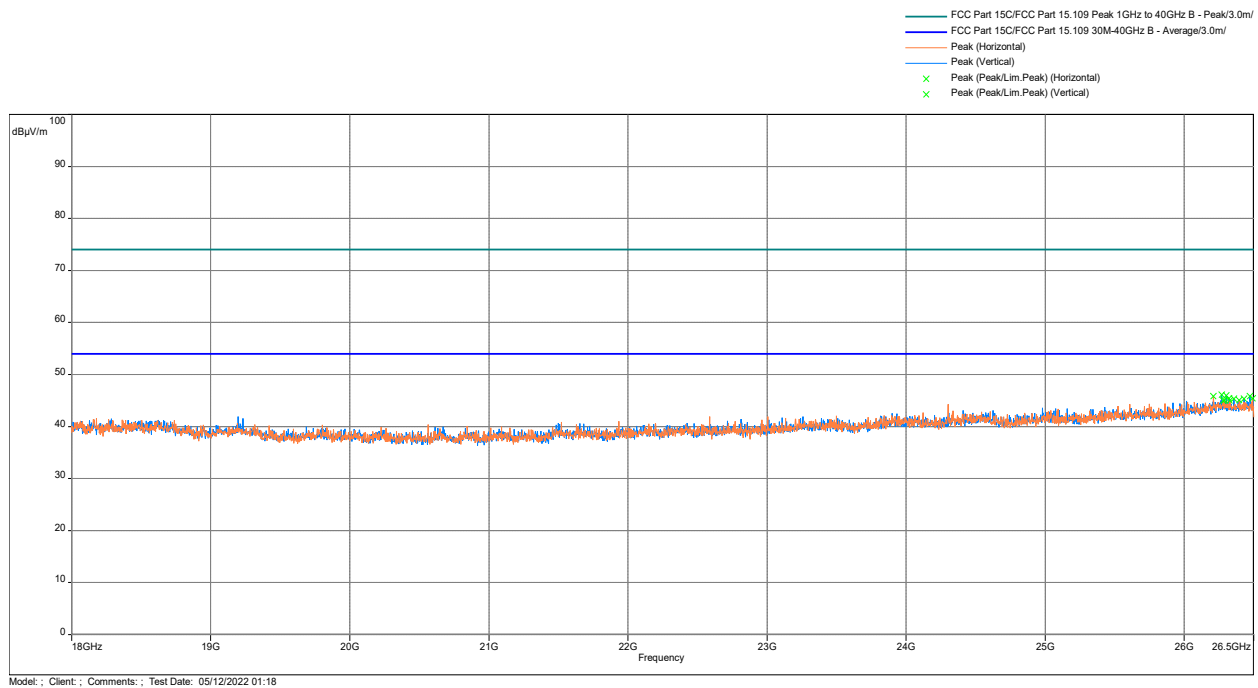
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
31.778	21.69	29.5	-7.81	1.97	346	Vertical	-7.29
906.524	26.67	35.5	-8.83	2	359.75	Horizontal	0.21
917.388	26.84	35.5	-8.66	3	345.75	Horizontal	0.3
941.056	26.9	35.5	-8.6	2	359.5	Horizontal	0.42
955.639	26.5	35.5	-9	2	14.25	Horizontal	0.73

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4879.400	45.87	74	-28.13	1.49	259.75	Horizontal	-6.9
4880.533	47.43	74	-26.57	1.99	248.5	Vertical	-6.9
7318.900	47.22	74	-26.78	1.99	262.25	Vertical	-4.09
7320.600	56.11	74	-17.89	1.99	281	Horizontal	-4.09
9758.967	47.46	74	-26.54	1.01	194	Horizontal	-1.72
9761.233	47.64	74	-26.36	1.99	248.5	Vertical	-1.72

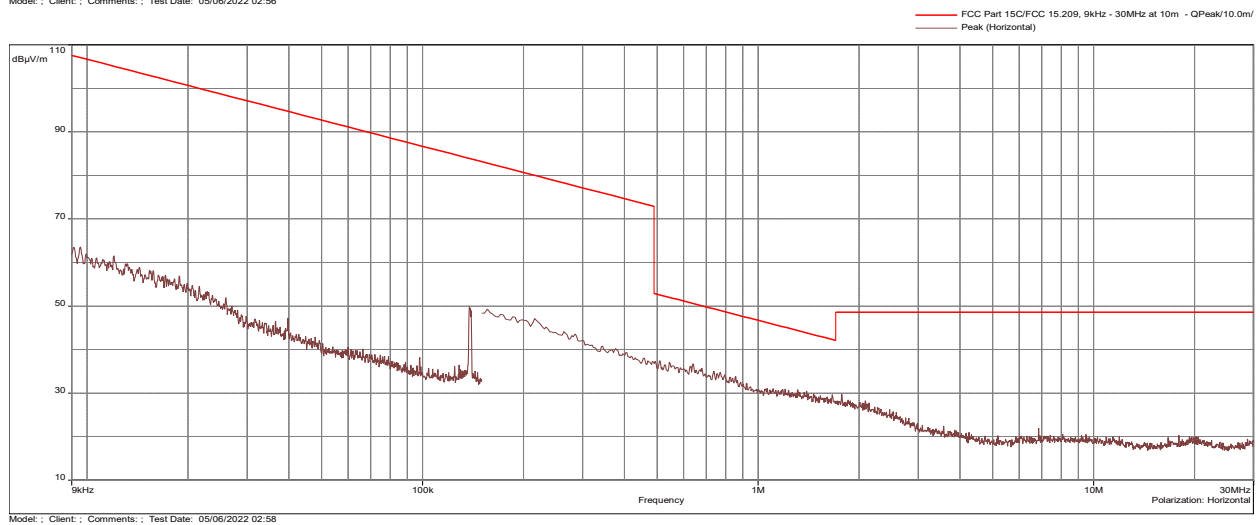
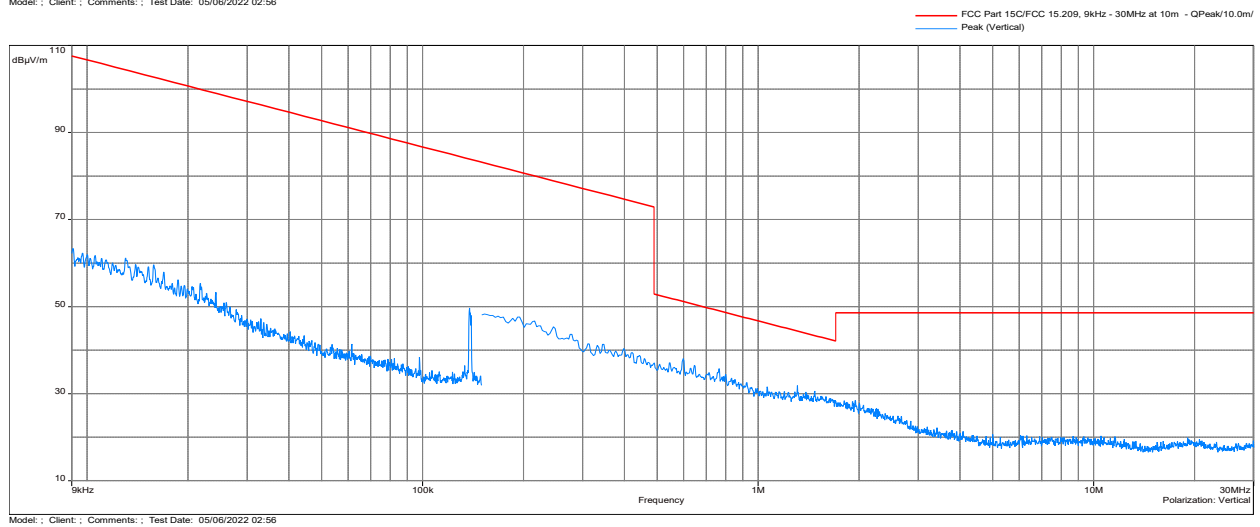
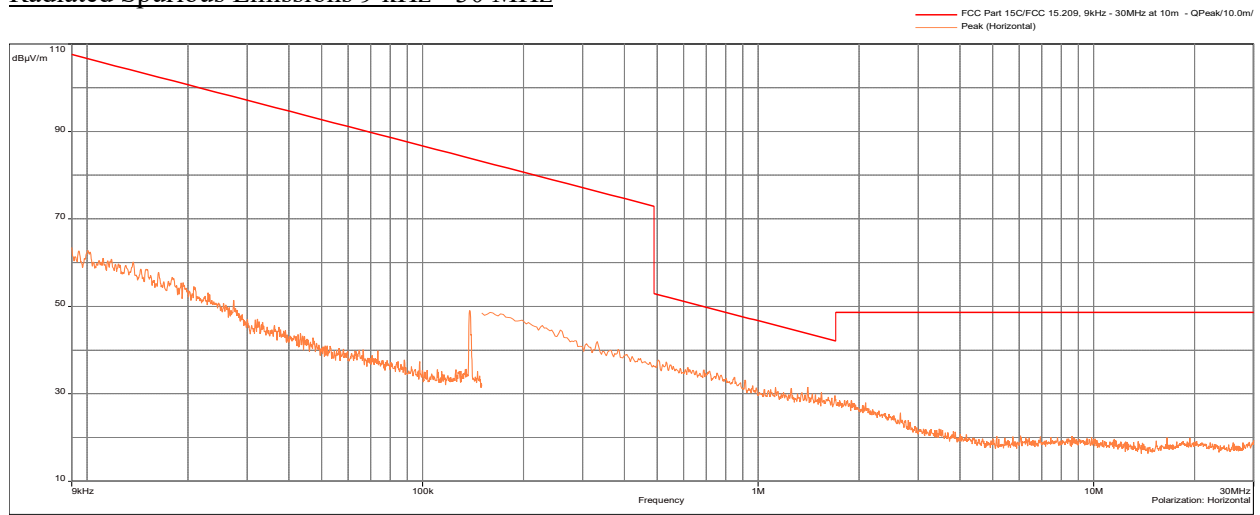
Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4879.400	42.86	54	-11.14	1.51	261.25	Horizontal	-6.9
4879.967	41.95	54	-12.05	1.49	228.25	Vertical	-6.9
7320.600	50.74	54	-3.26	1.51	283.25	Horizontal	-4.09
7320.600	42.54	54	-11.46	1.01	44.25	Vertical	-4.09
9758.967	42.96	54	-11.04	1.49	272.5	Vertical	-1.72
9760.667	42.62	54	-11.38	1.99	261.5	Vertical	-1.72

Note: FS = RA + Correction
Correction = AF + CF – Preamp

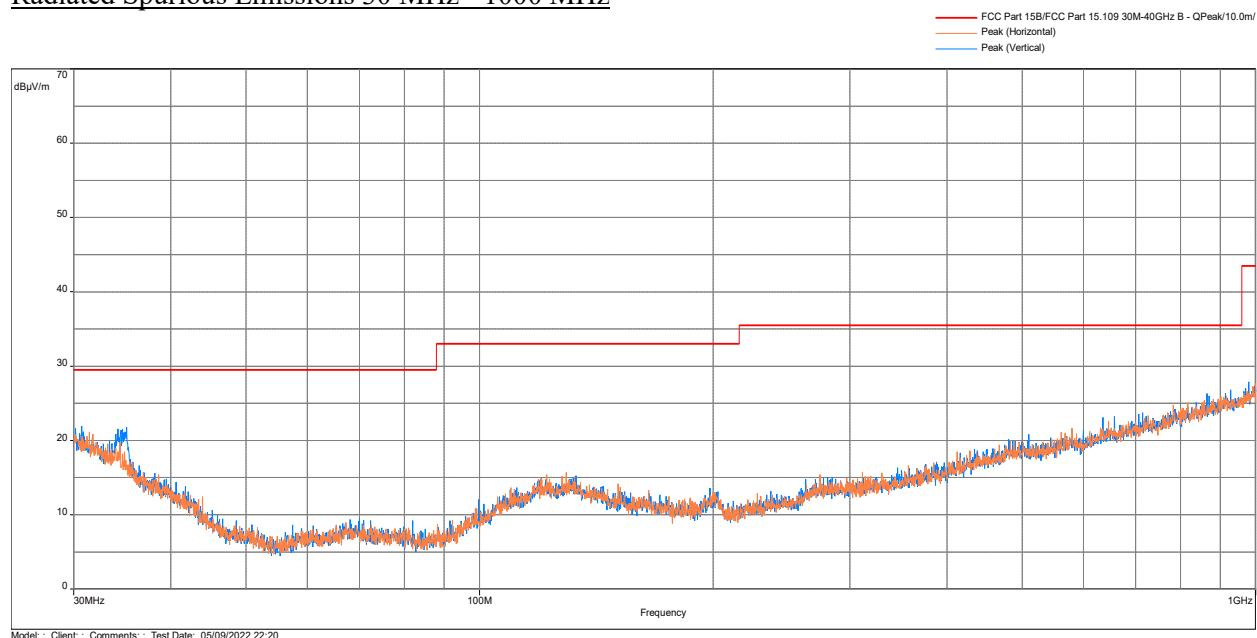
Results	Complies
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15.209 Radiated Spurious Emissions High Channel Tx at 2479 MHz, 1Mbps Battery mode

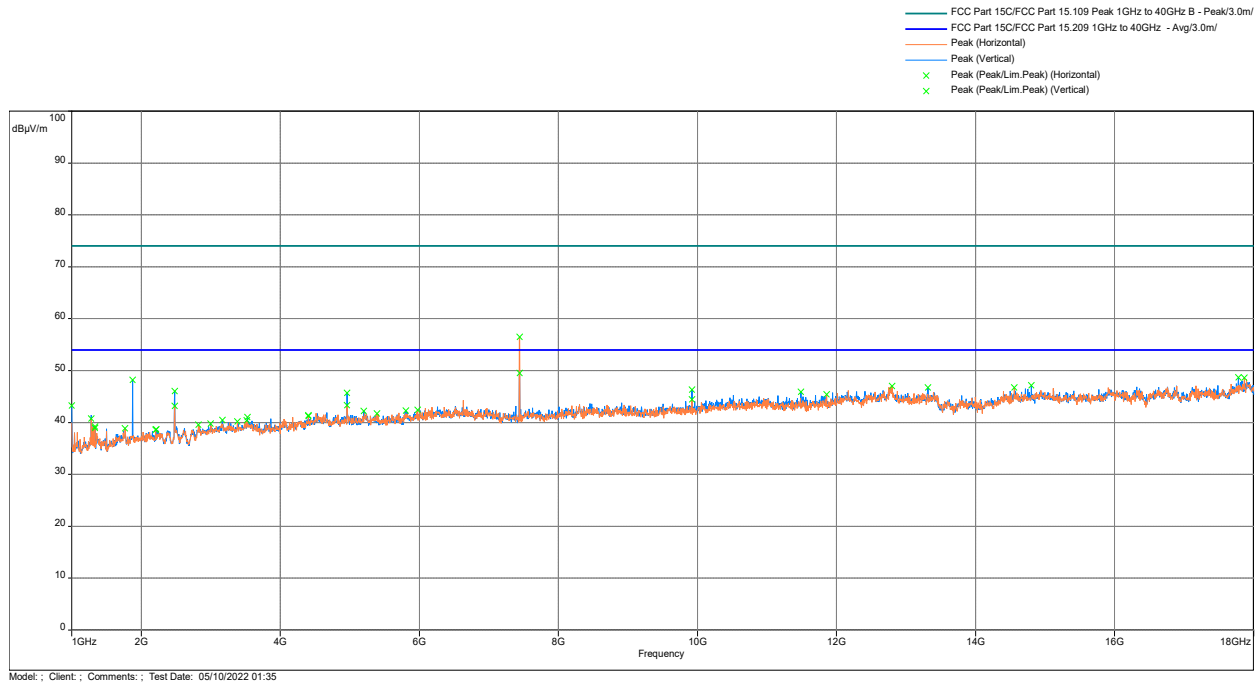
Radiated Spurious Emissions 9 kHz - 30 MHz



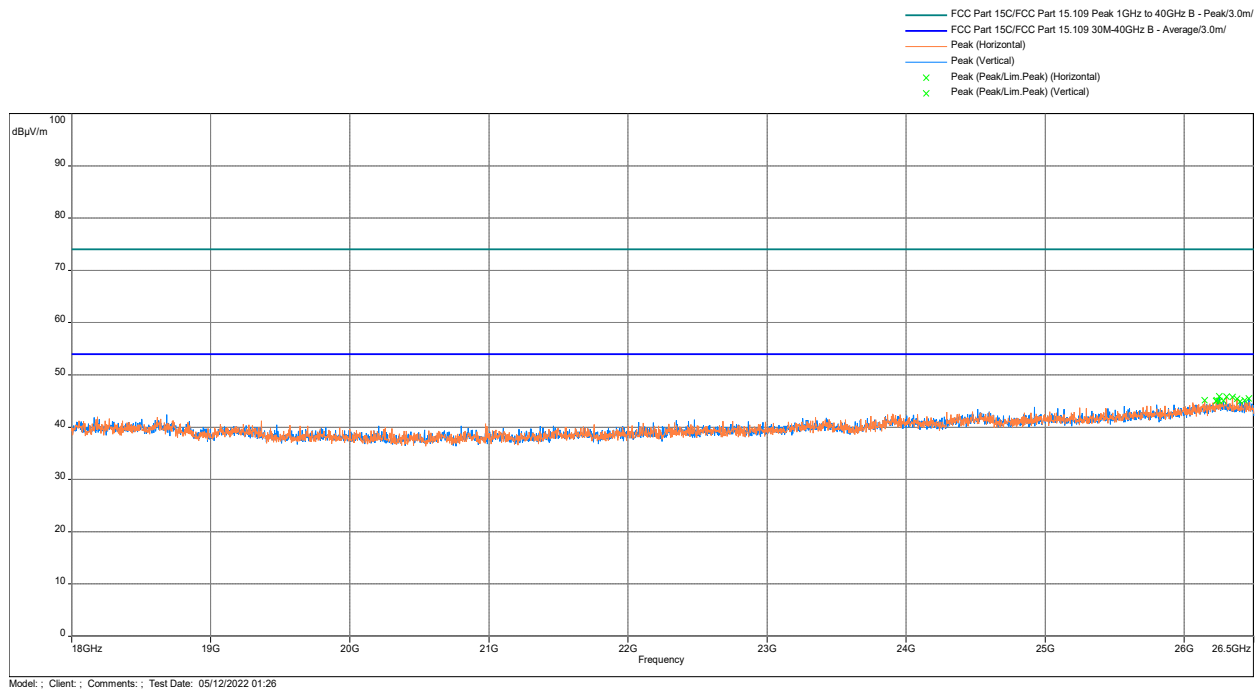
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
30.711	21.94	29.5	-7.56	1.98	15.75	Vertical	-6.63
31.423	21.17	29.5	-8.33	1	137	Horizontal	-7.08
31.746	20.85	29.5	-8.65	1	294.5	Horizontal	-7.27
35.109	21.73	29.5	-7.77	0.96	154.5	Vertical	-9.65
928.220	26.8	35.5	-8.7	1.98	162.5	Vertical	0.25

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4959.300	43.3	74	-30.7	1.49	239.25	Horizontal	-6.89
4959.867	45.66	74	-28.34	1.01	239.25	Vertical	-6.89
7440.733	56.49	74	-17.51	1.99	284.25	Horizontal	-3.87
7440.733	49.5	74	-24.5	1.51	273.75	Vertical	-3.87
9918.767	46.29	74	-27.71	2.01	243.75	Vertical	-1.53
9921.033	44.46	74	-29.54	1.01	202.75	Horizontal	-1.52

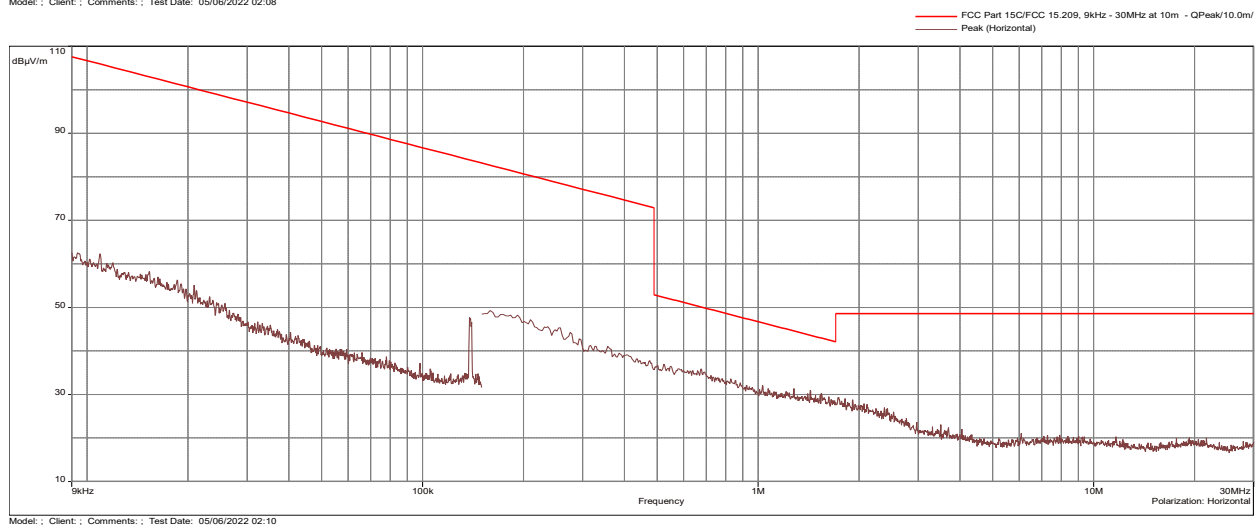
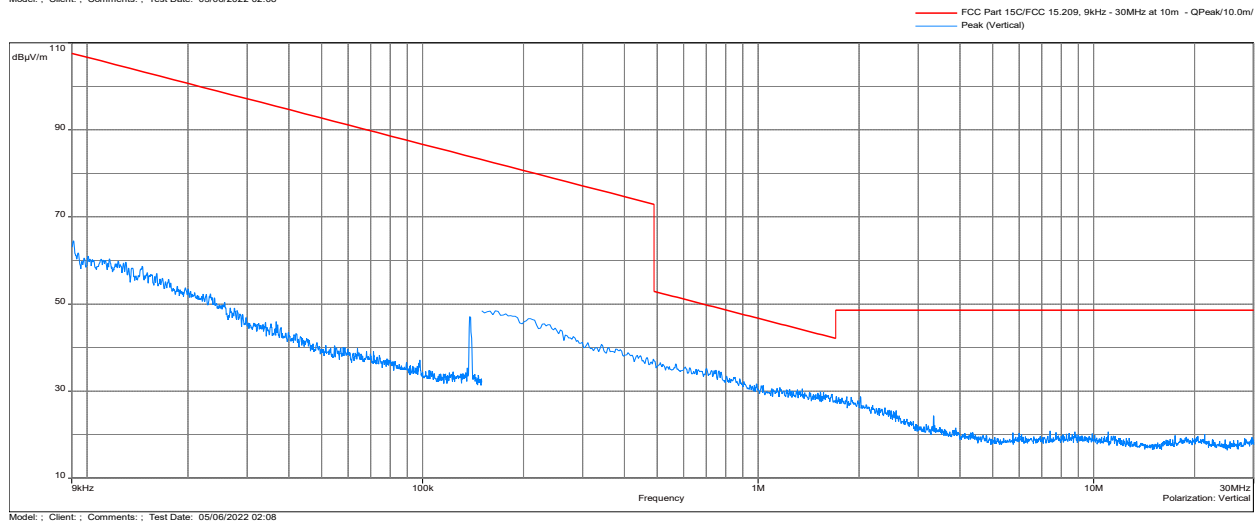
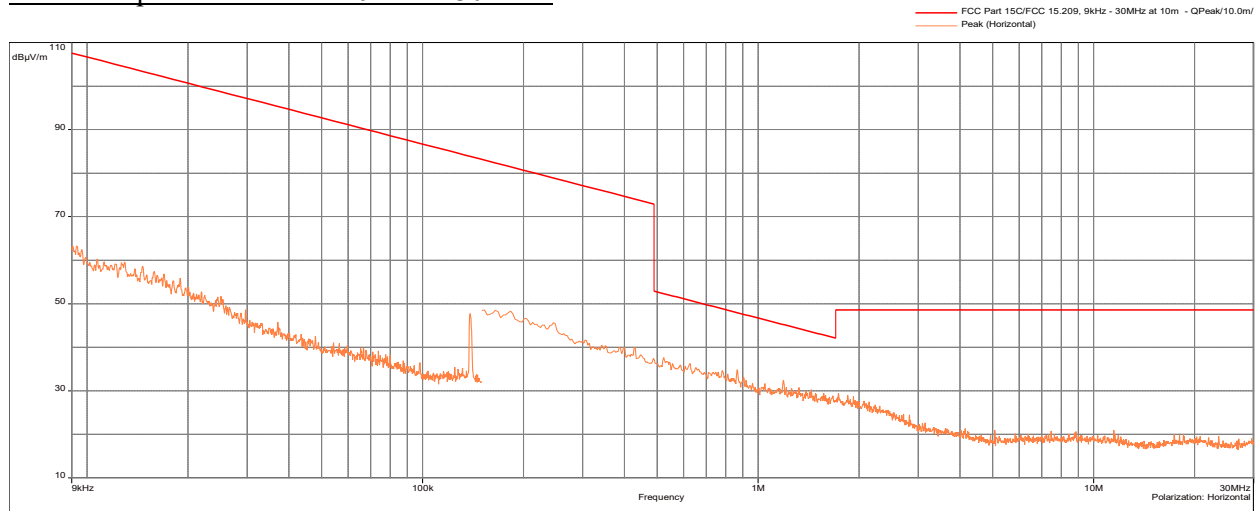
Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4959.867	40.5	54	-13.5	1.01	228.5	Vertical	-6.89
4960.433	38.21	54	-15.79	1.49	228.5	Horizontal	-6.89
7439.033	52.17	54	-1.83	1.99	260.75	Horizontal	-3.88
7440.733	45.74	54	-8.26	1.51	43.75	Vertical	-3.87
9921.033	40.2	54	-13.8	1.51	239	Vertical	-1.52
9921.033	38.54	54	-15.46	1.49	163.5	Horizontal	-1.52

Note: FS = RA + Correction
Correction = AF + CF – Preamp

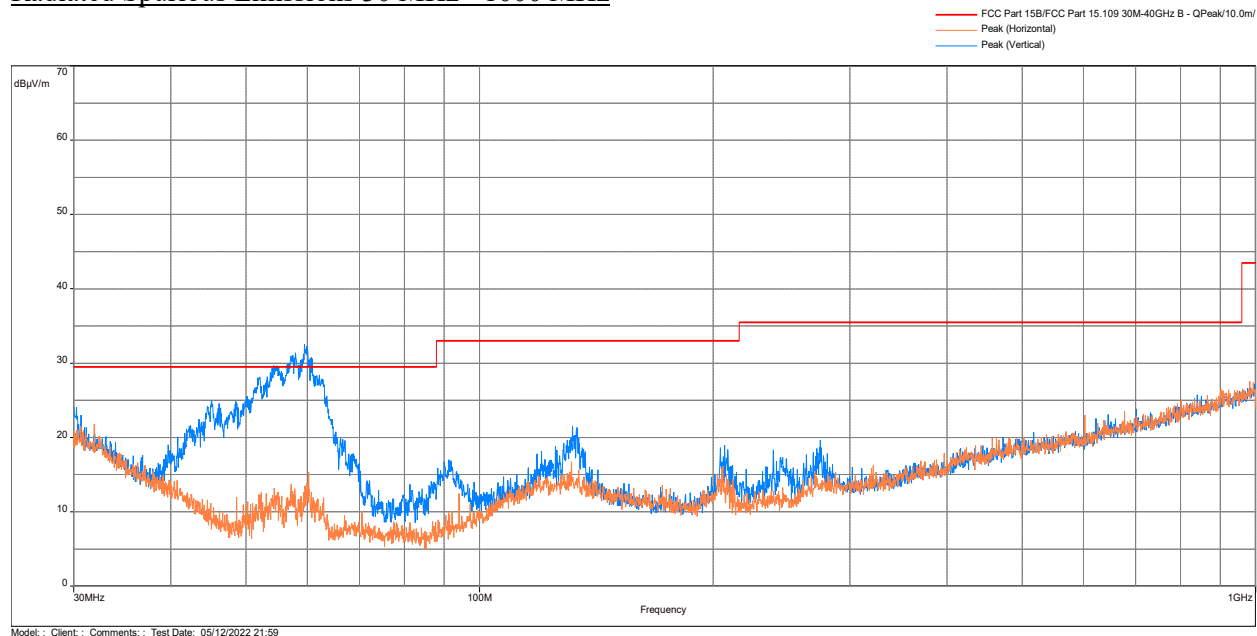
Results	Complies
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15.209 Radiated Spurious Emissions Low Channel
Tx at 2402MHz, 1Mbps Charging mode

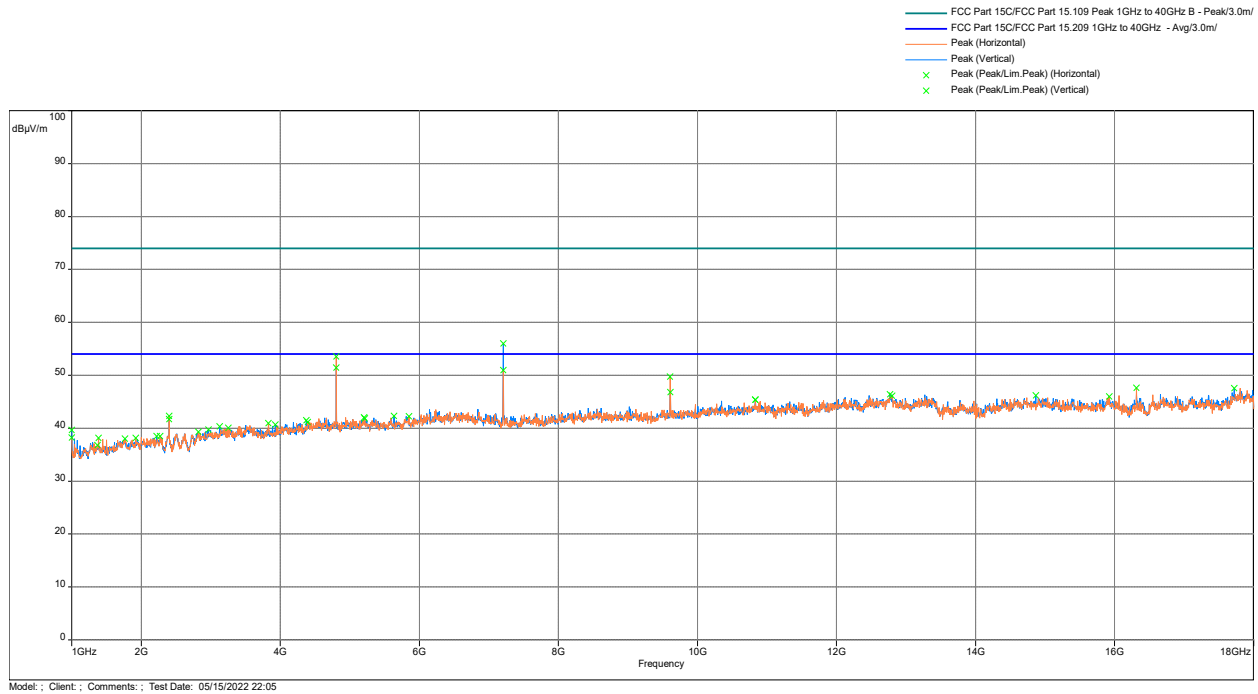
Radiated Spurious Emissions 9 kHz - 30 MHz



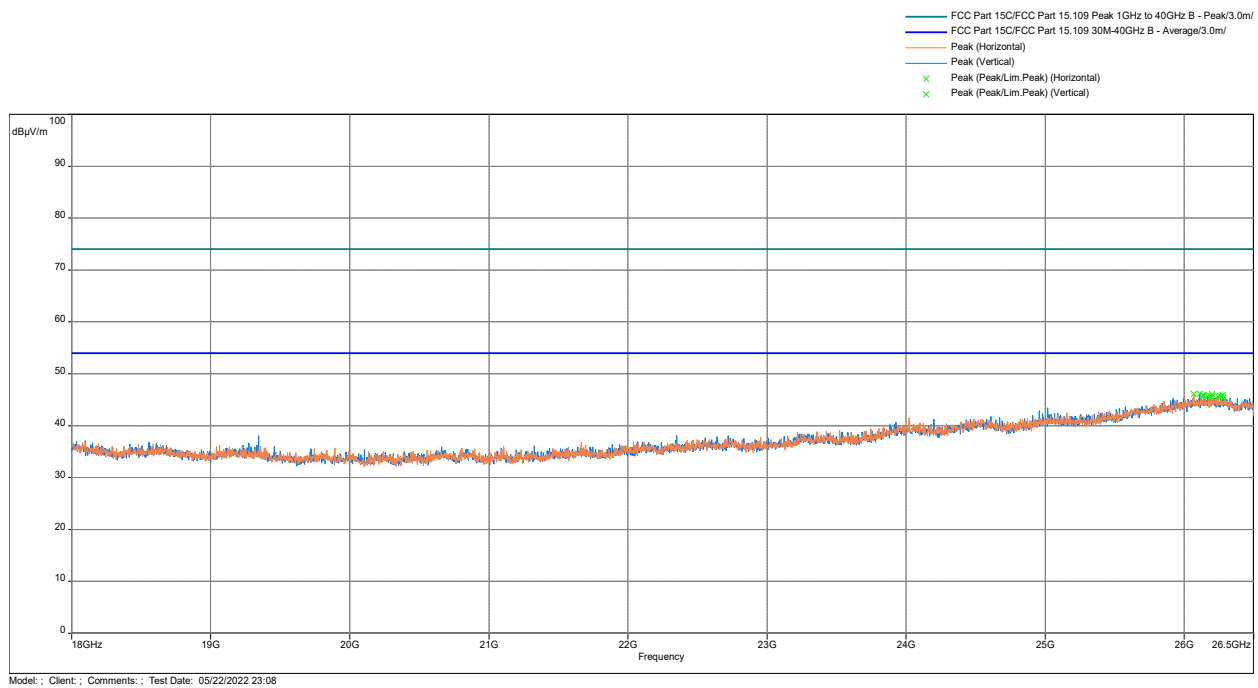
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
51.938	22.01	29.5	-7.49	3.96	250.75	Vertical	-19.65
54.566	25.04	29.5	-4.46	3.74	10.25	Vertical	-19.94
57.442	25.41	29.5	-4.09	4	342.5	Vertical	-19.86
59.740	26.76	29.5	-2.74	3.55	40.5	Vertical	-19.61
60.580	24.96	29.5	-4.54	2.13	349	Vertical	-19.51

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4803.467	53.53	74	-20.47	1.01	4	Horizontal	-6.92
4803.467	51.43	74	-22.57	1.99	18	Vertical	-6.92
7205.000	55.97	74	-18.03	1.99	316	Vertical	-4.21
7205.567	50.98	74	-23.02	2.01	77	Horizontal	-4.21
9607.100	49.77	74	-24.23	1.01	11	Horizontal	-1.94
9608.800	46.77	74	-27.23	1	336.5	Vertical	-1.94

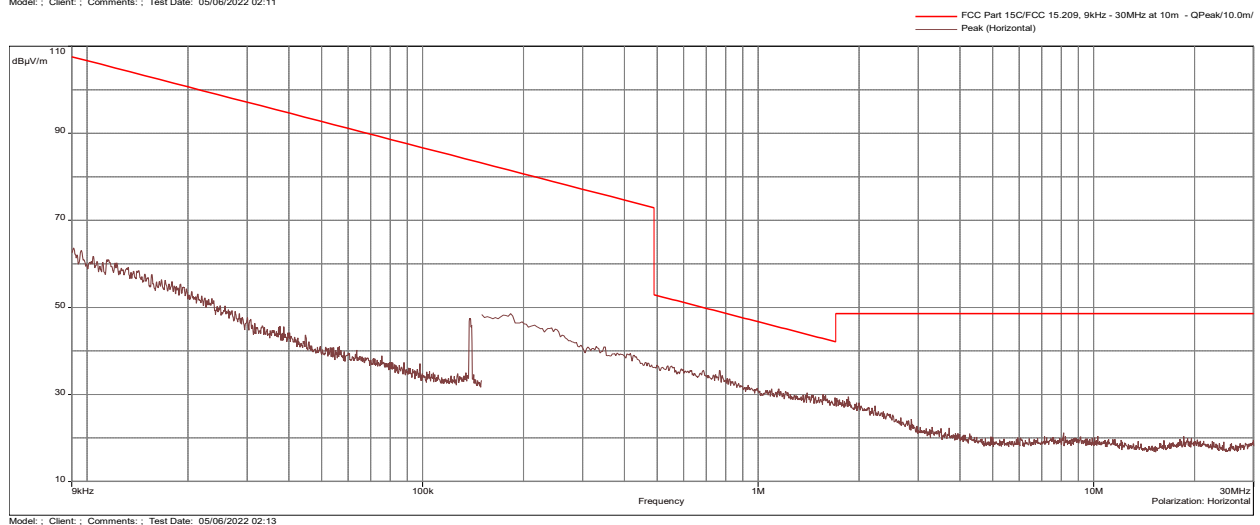
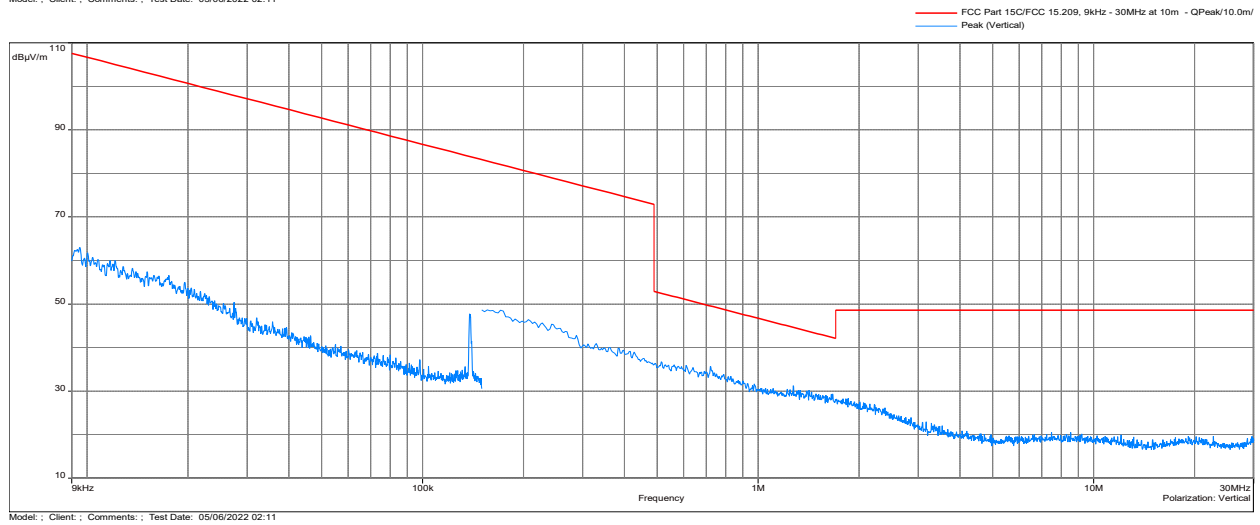
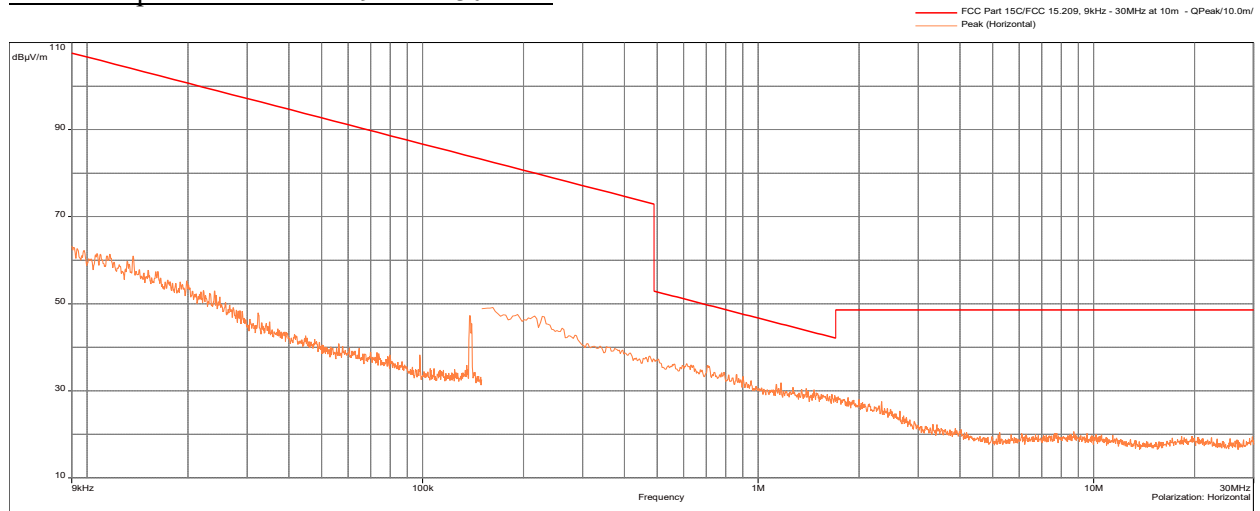
Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4803.467	50.51	54	-3.49	1.01	0	Horizontal	-6.92
4804.033	48.32	54	-5.68	2.99	0	Vertical	-6.92
7206.700	50.36	54	-3.64	1.99	348.25	Vertical	-4.21
7206.700	45.4	54	-8.6	3.01	217.5	Horizontal	-4.21
9608.800	41.1	54	-12.9	1.99	0	Vertical	-1.94
9609.367	43.37	54	-10.63	1.01	22.5	Horizontal	-1.94

Note: FS = RA + Correction
Correction = AF + CF – Preamp

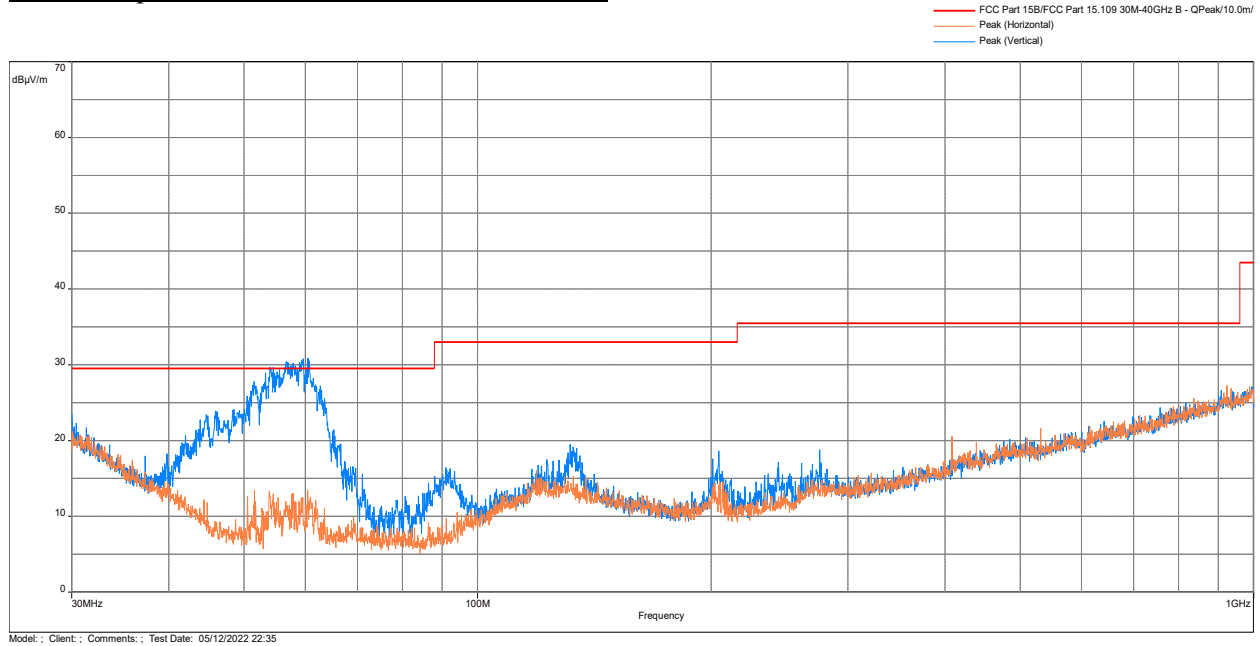
Results	Complies
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15.209 Radiated Spurious Emissions Mid Channel
Tx at 2440MHz, 1Mbps Charging mode

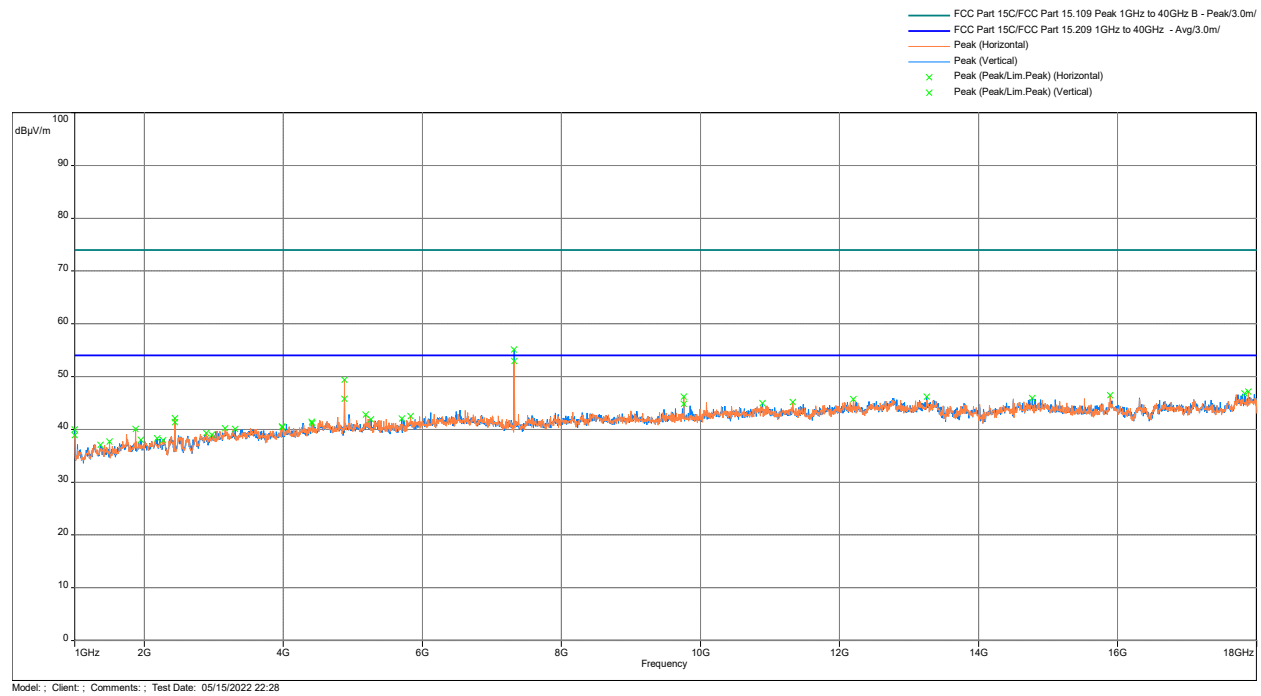
Radiated Spurious Emissions 9 kHz - 30 MHz



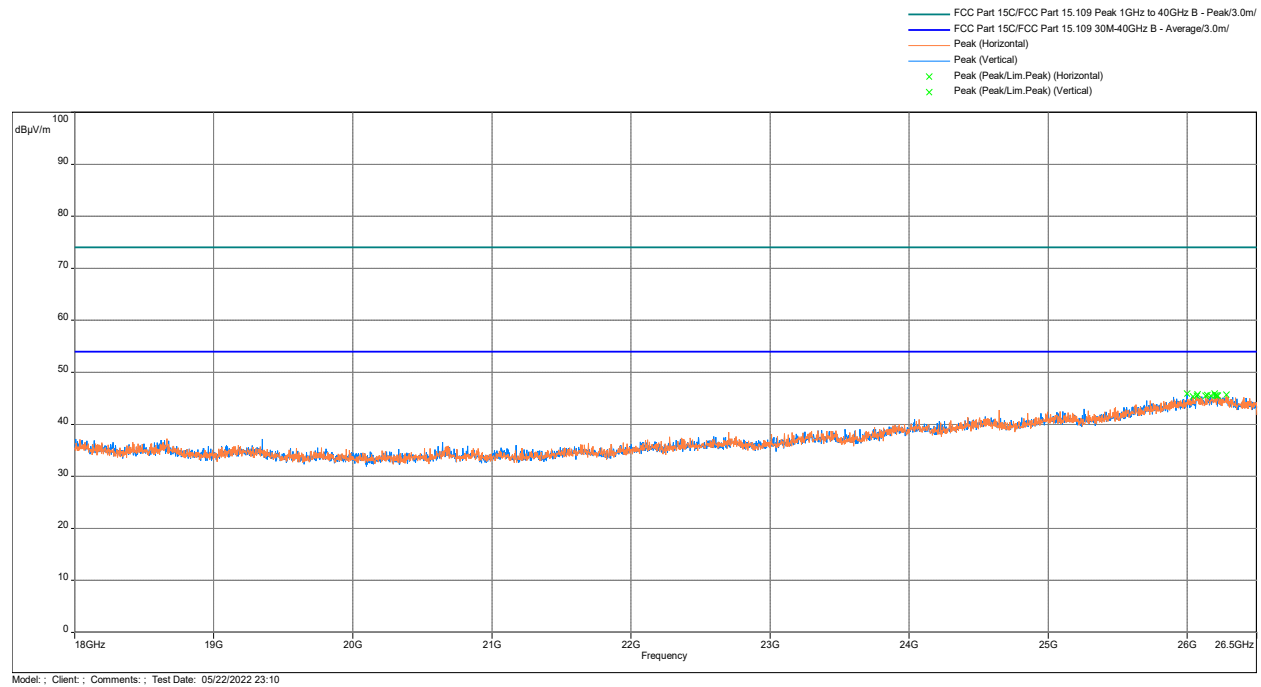
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
53.867	22.66	29.5	-6.84	3.9	236.75	Vertical	-19.93
56.790	24.84	29.5	-4.66	4	324.75	Vertical	-19.91
58.179	23.31	29.5	-6.19	3.92	11	Vertical	-19.77
59.479	24.41	29.5	-5.09	3.6	33.25	Vertical	-19.63
60.705	23.91	29.5	-5.59	1.69	6	Vertical	-19.5

Freq. MHz	Peak@3m dB(μV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7318.900	55.1	74	-18.9	1.01	300.25	Vertical	-4.09
7320.600	52.92	74	-21.08	1.99	226	Horizontal	-4.09
4879.400	49.37	74	-24.63	1.51	13.75	Horizontal	-6.9
4880.533	45.81	74	-28.19	1.49	25.5	Vertical	-6.9
9759.533	44.8	74	-29.2	1.49	0	Vertical	-1.72

Freq. MHz	Avg@3m dB(μV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7320.600	51.22	54	-2.78	1.01	304.25	Vertical	-4.09
7320.600	47.24	54	-6.76	1.99	78.5	Horizontal	-4.09
4879.400	45.93	54	-8.07	1.49	22.25	Horizontal	-6.9
4879.967	41.51	54	-12.49	1.51	14.5	Vertical	-6.9
9758.967	40.23	54	-13.77	1.49	44.25	Vertical	-1.72

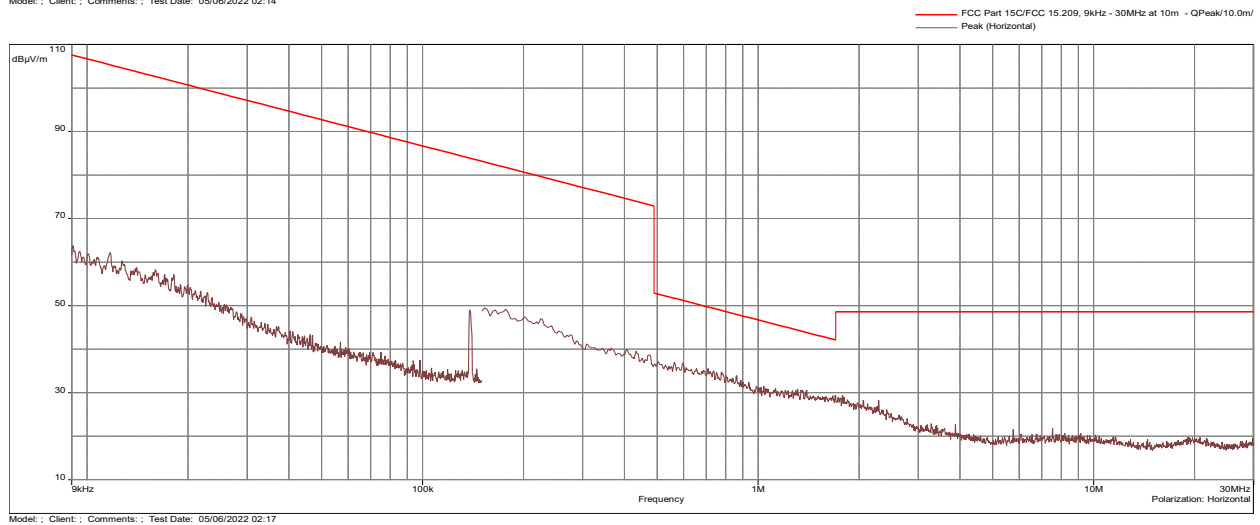
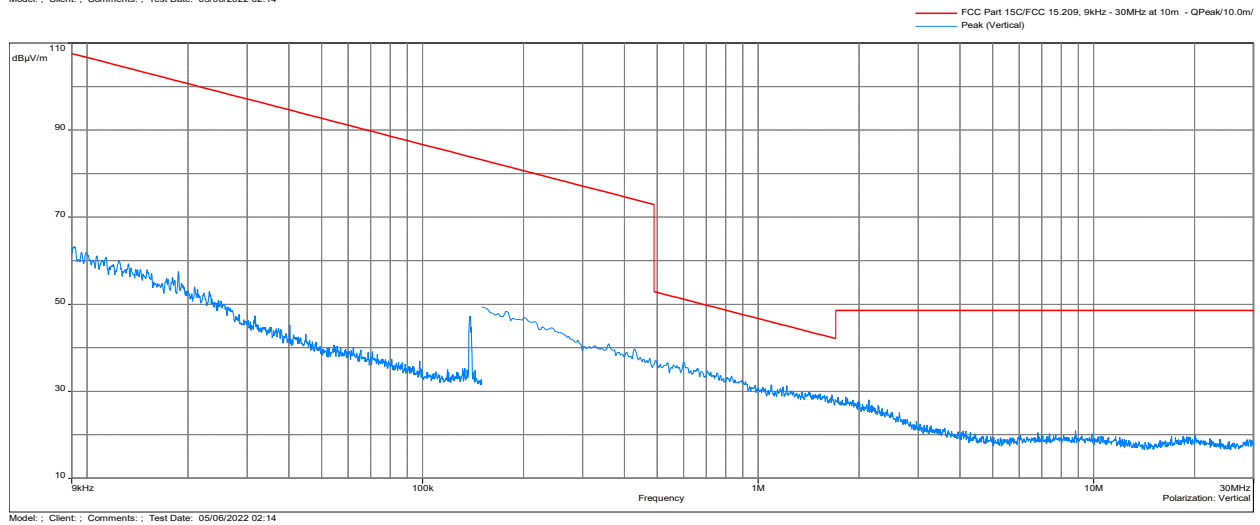
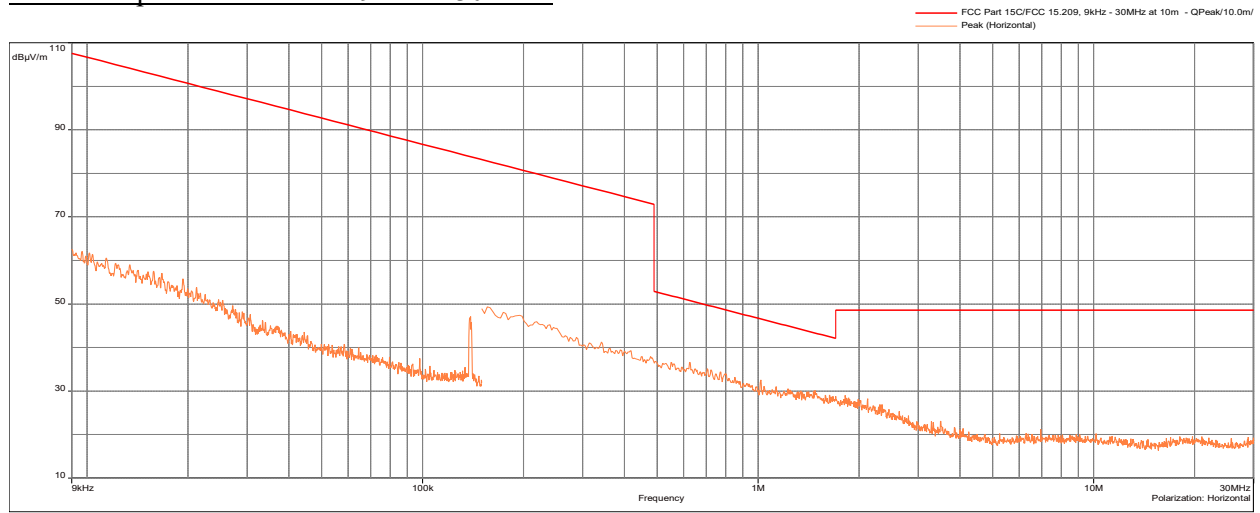
Note: FS = RA + Correction

Correction = AF + CF – Preamp

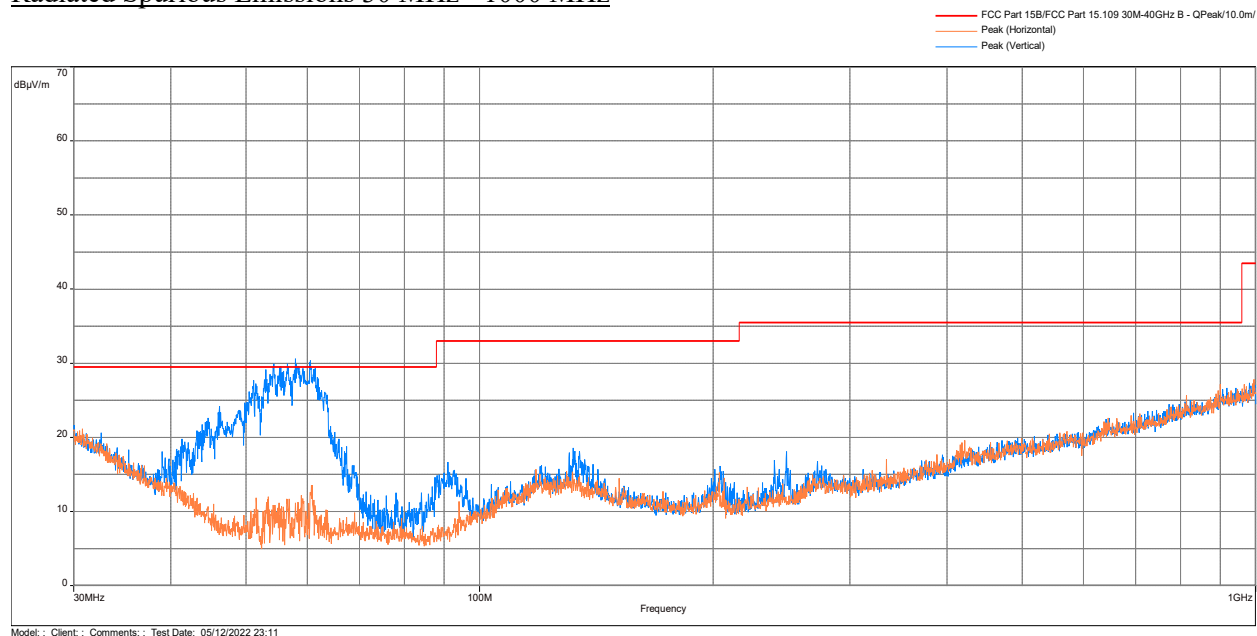
Results	Complies
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15.209 Radiated Spurious Emissions High Channel Tx at 2479 MHz, 1Mbps Charging mode

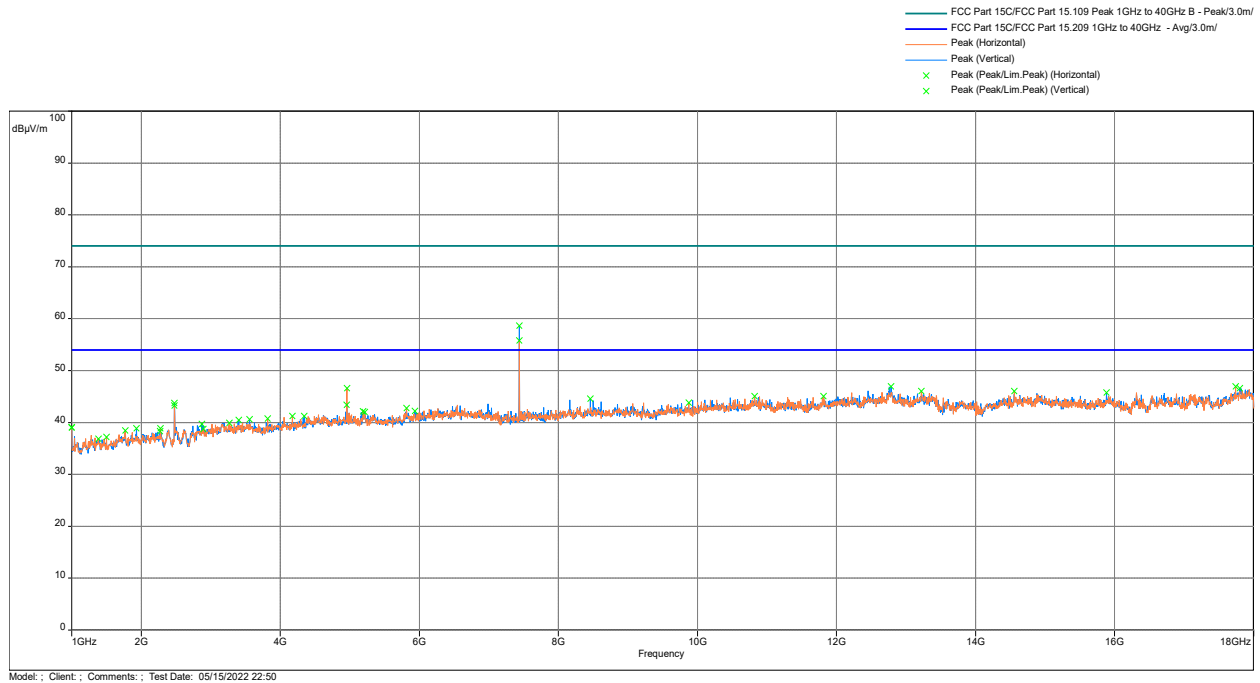
Radiated Spurious Emissions 9 kHz - 30 MHz



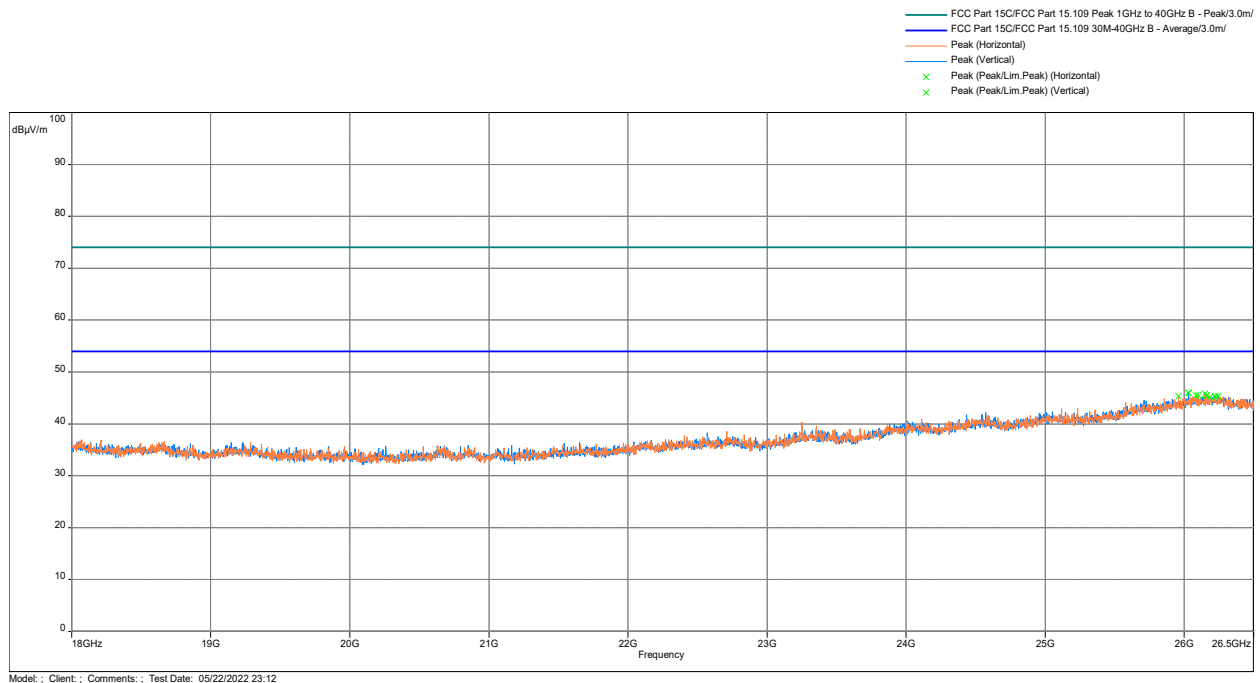
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Avg & Peak Limit



Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



Frequency MHz	QP@10m dB(μV/m)	Limit@10m dB(μV/m)	Margin dB	Height m	Angle deg	Polarization	Correction (dB)
55.525	22.3	29.5	-7.2	4	17.25	Vertical	-19.93
56.607	23.56	29.5	-5.94	3.91	236.5	Vertical	-19.92
58.119	22.8	29.5	-6.7	4	199.25	Vertical	-19.78
58.228	23.55	29.5	-5.95	3.96	4	Vertical	-19.77
60.617	23.33	29.5	-6.17	3.36	341.5	Vertical	-19.51

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7437.900	58.62	74	-15.38	1.01	304.75	Vertical	-3.88
7437.900	55.82	74	-18.18	1.01	0	Horizontal	-3.88
4957.600	46.61	74	-27.39	1.49	16.5	Horizontal	-6.89
4957.033	43.4	74	-30.6	1.01	238.5	Vertical	-6.89

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(μV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
4958.167	41.44	54	-12.56	1.49	0	Horizontal	-6.89
4958.167	37.52	54	-16.48	1.99	65.25	Vertical	-6.89
7437.333	53.62	54	-0.38	1.01	304	Vertical	-3.88
7437.333	49.34	54	-4.66	1.99	207.5	Horizontal	-3.88

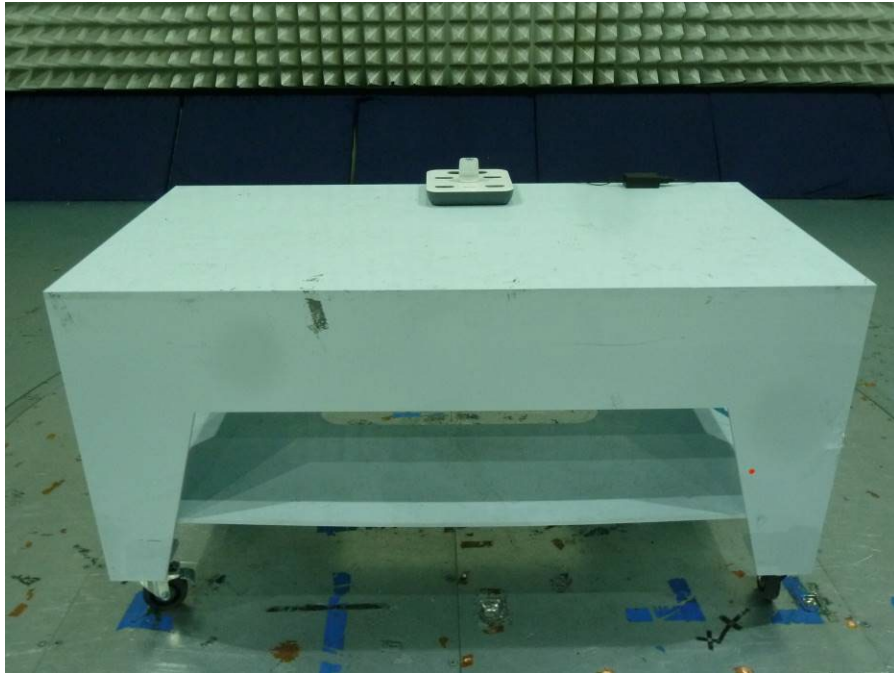
Note: FS = RA + Correction

Correction = AF + CF – Preamp

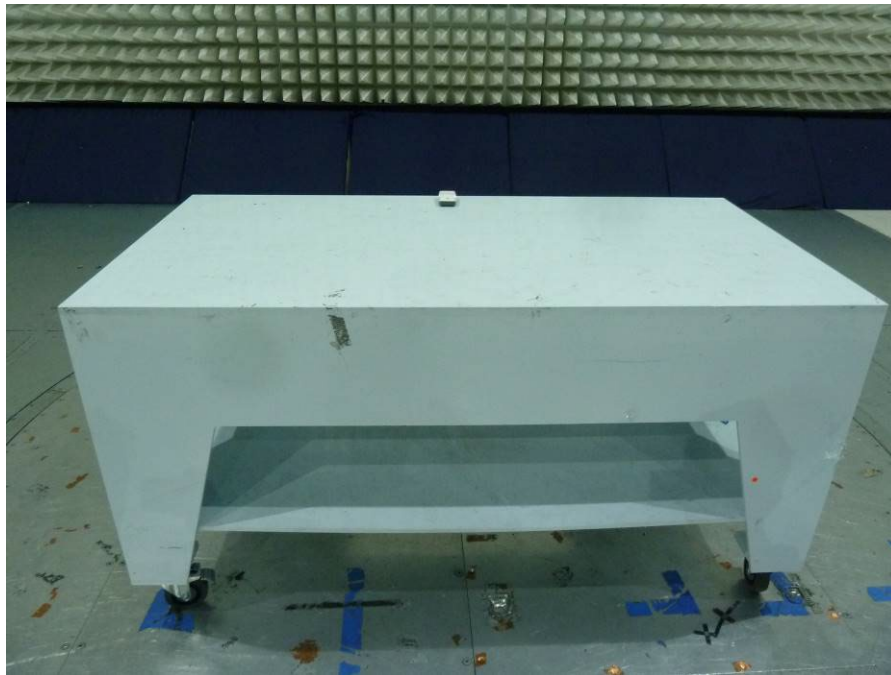
Results	Complies
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4.5.7 Test Setup Configuration

The following photographs show the testing configurations used.



4.5.7 Test Setup Configuration (Continued)



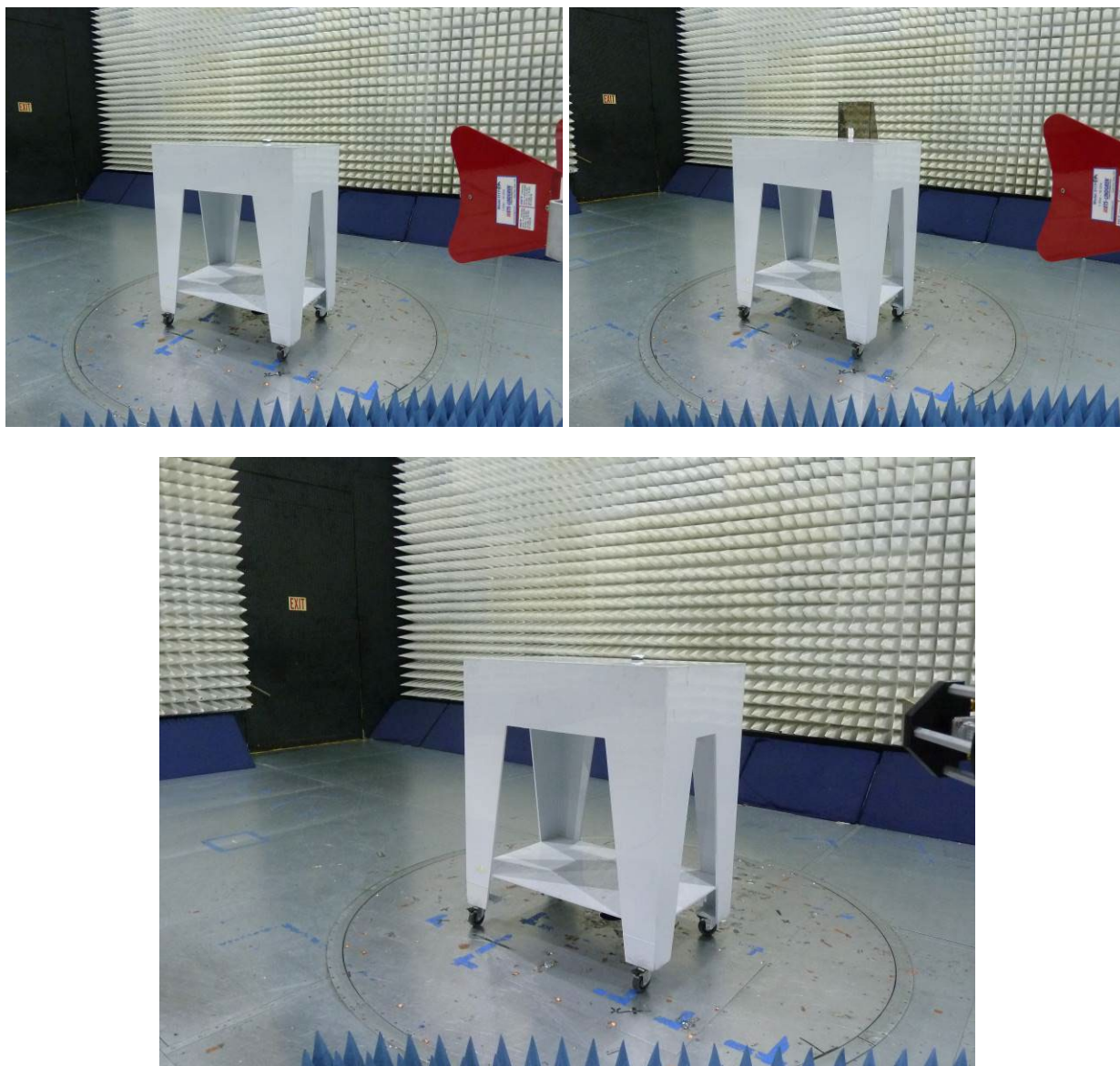
4.5.7 Test Setup Configuration (Continued)



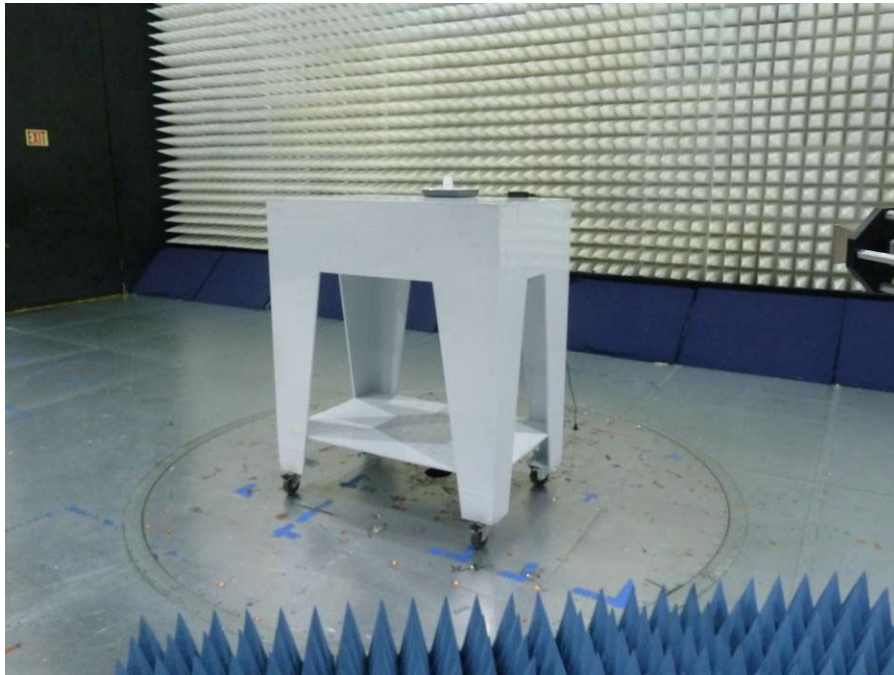
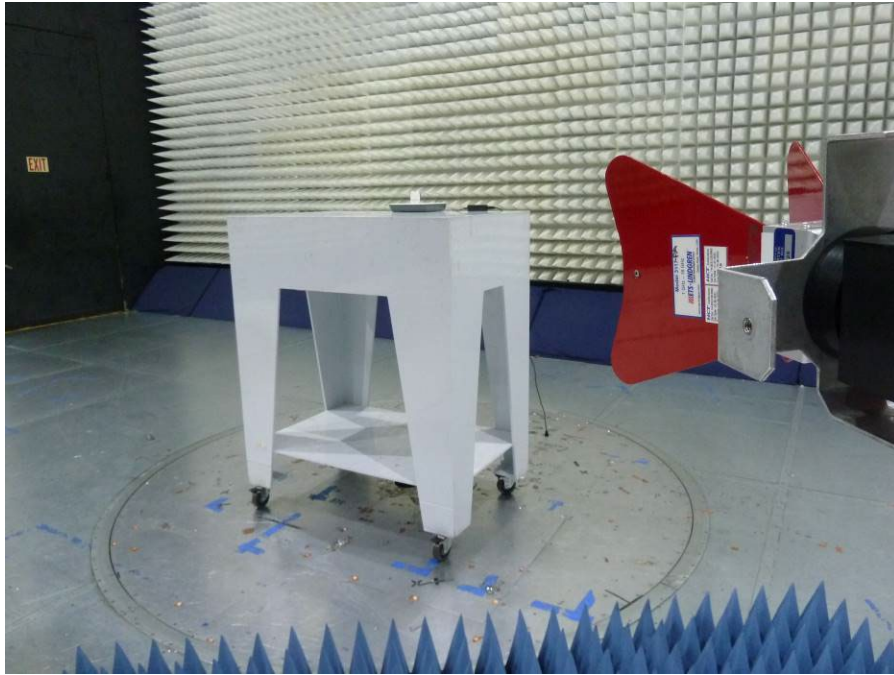
4.5.7 Test Setup Configuration (Continued)



4.5.7 Test Setup Configuration (Continued)



4.5.7 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 C63.4:2014.

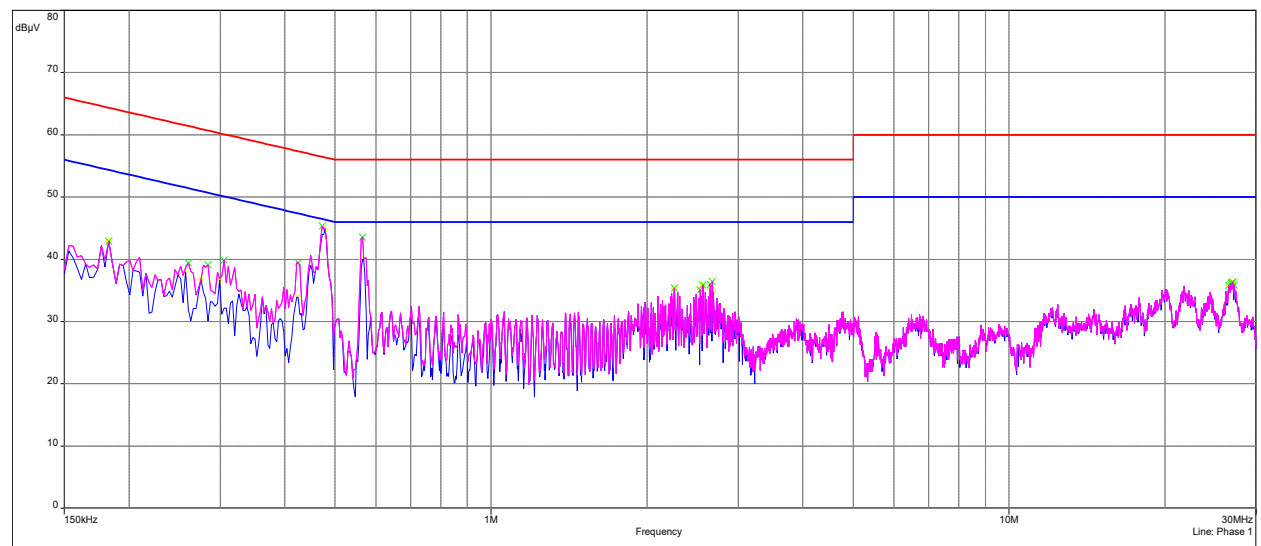
Tested By	Test Date
Aaron Chang	May 25, 2022

4.6.3 Test Results

15.207: Conducted Emissions 120VAC 60Hz

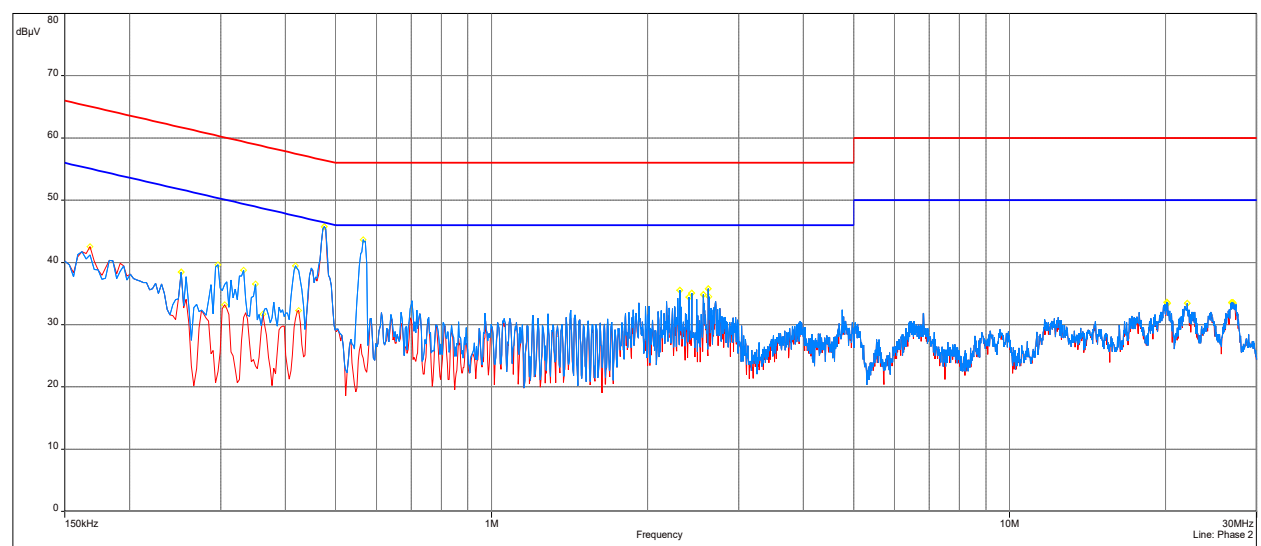
Phase 1

Sub-range 1
Frequencies: 150 kHz - 30 MHz (Analyser mode) 10001 Points
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 2e+03 ms, Attenuation: 10 dB, Sweep count 10, Preamp: Off, LN Preamp: Off, Preselector: On
Line: Phase 1



Phase 2

Sub-range 2
Frequencies: 150 kHz - 30 MHz (Analyser mode) 10001 Points
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 2e+03 ms, Attenuation: 10 dB, Sweep count 10, Preamp: Off, LN Preamp: Off, Preselector: On
Line: Phase 2



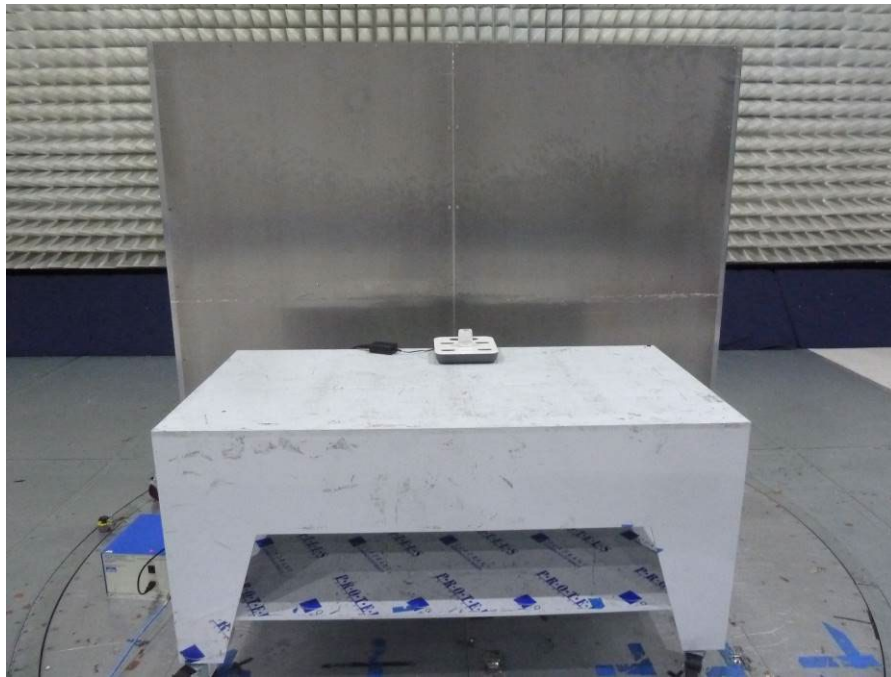
4.6.3 Test Results (Continued)

Frequency (MHz)	Q-Peak (dBμV)	CISPR AVG (dBμV)	Limit Q-Peak (dBμV)	Limit Avg (dBμV)	Margin Q-Peak (dB)	Margin Avg (dB)	Line	Correction (dB)
0.183	42.88	42.88	64.36	54.36	-21.48	-11.48	Phase 1	10.53
0.251	38.43	38.43	61.71	51.71	-23.27	-13.27	Phase 2	10.54
0.425	39.45	33.89	57.36	47.36	-17.91	-13.46	Phase 1	10.54
0.475	45.73	45.73	56.42	46.42	-10.69	-0.69	Phase 2	10.54
0.565	43.54	40	56	46	-12.46	-6	Phase 1	10.55
2.260	35.39	35.39	56	46	-20.61	-10.61	Phase 1	10.61
2.311	35.57	35.57	56	46	-20.43	-10.43	Phase 2	10.61
2.407	34.41	34.41	56	46	-21.59	-11.59	Phase 2	10.61
2.434	35.09	35.09	56	46	-20.91	-10.91	Phase 2	10.61
2.535	35.08	35.08	56	46	-20.92	-10.92	Phase 1	10.62
2.565	34.85	34.85	56	46	-21.15	-11.15	Phase 2	10.62
2.565	35.84	35.84	56	46	-20.16	-10.16	Phase 1	10.62
2.622	35.79	35.79	56	46	-20.21	-10.21	Phase 2	10.62
2.648	35.93	35.45	56	46	-20.07	-10.55	Phase 1	10.62
20.126	33.59	33.59	60	50	-26.41	-16.41	Phase 2	10.97
20.179	33.43	33.43	60	50	-26.57	-16.57	Phase 2	10.97
22.051	33.43	33.43	60	50	-26.57	-16.57	Phase 2	10.99
26.555	35.77	35.77	60	50	-24.23	-14.23	Phase 1	11.05
26.809	35.8	35.8	60	50	-24.2	-14.2	Phase 1	11.05
26.818	33.57	33.57	60	50	-26.43	-16.43	Phase 2	11.05
26.872	36.2	36.2	60	50	-23.8	-13.8	Phase 1	11.05
26.952	36.21	36.21	60	50	-23.79	-13.79	Phase 1	11.05
26.967	33.58	33.58	60	50	-26.42	-16.42	Phase 2	11.05

Results: Complies by 0.69 dB

4.6.4 Test Setup Photographs

The following photographs show the testing configurations used.



5.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde & Schwarz	ESU40	ITS 00961	12	03/10/23
Passive Loop Antenna	EMCO	6512	ITS 001598	12	06/21/22
Pre-Amplifier (18-40GHz)	Miteq	TTA1840-35-S-M	ITS 01393	12	03/14/23
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01365	12	05/04/23
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Bilog Antenna 30-1000MHz	SunAR RF Motion	JB1	ITS 01577	12	02/10/23
Pre-Amplifier	Sonoma Instrument	310	ITS 00942	12	04/25/23
LISN	COM-POWER	LIN-115A	ITS 01289	12	07/29/22
RF Cable	Mega Phase	TM40-K1K1-59	ITS 01655	12	01/11/23
RF Cable	Mega Phase	TM40-K1K1-19	ITS 01155	12	04/25/23
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/29/22
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01484	12	06/29/22
10m chamber	Panashield	10m Semi-	ITS 00984	36	07/29/23

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.17.0.10	Penumbra 5-5-2021.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 / G105041185	AC	ML	June 10, 2022	Original document
2.0 / G105041185	AC	ML	April 03, 2023	- Added CAB id. - Added PMN/HVIN/FVIN information in section 2.1.