

TEST REPORT

Report Number: 104424286MPK-003
Project Numbers: G104424286
Report Issue Date: November 20, 2020

Testing performed on
Bigfoot Unity System
Model Number: LCAP

FCC ID: 2AVAYUL001

to

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247 Issue 2

For

Bigfoot Biomedical, Inc.

Test Performed by:
Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

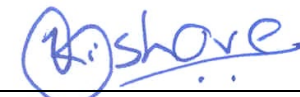
Test Authorized by:
Bigfoot Biomedical, Inc.
1820 McCarthy Blvd
Milpitas, CA 95035 USA

Prepared by:


Anderson Soungpanya

Date: November 20, 2020

Reviewed by:


Krishna K Vemuri

Date: November 20, 2020

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program. This report must not be used to claim product endorsement by A2LA, NIST nor any other agency of the U.S. Government.

Report No. 104424286MPK-003	
Equipment Under Test:	Bigfoot Unity System
Model Number:	LCAP
Applicant:	Bigfoot Biomedical, Inc.
Contact:	Ravi Shankar
Address:	Bigfoot Biomedical, Inc. 1820 McCarthy Blvd Milpitas, CA 95035
Country:	USA
Tel. Number:	(925) 949-6963
Email:	rshankar@bigfootbiomedical.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	September 24 – October 22, 2020

We attest to the accuracy of this report:



Anderson Soungpanya
Project Engineer



Krishna K Vemuri
EMC Manager

TABLE OF CONTENTS

1.0	Summary of Tests	4
2.0	General Information	5
2.1	Product Description	5
2.2	Related Submittal(s) Grants.....	6
2.3	Test Facility	6
2.4	Test Methodology.....	6
2.5	Measurement Uncertainty	6
3.0	System Test Configuration.....	7
3.1	Support Equipment.....	7
3.2	Block Diagram of Test Setup	7
3.3	Justification	9
3.4	Software Exercise Program	9
3.5	Mode of Operation during Test	9
3.6	Modifications Required for Compliance	9
3.7	Additions, Deviations and Exclusions from Standards.....	9
4.0	Measurement Results	10
4.1	6-dB Bandwidth and 99% Occupied Bandwidth	10
4.2	Maximum Peak Conducted Output Power at Antenna Terminals	18
4.3	Maximum Power Spectral Density.....	25
4.4	Out of Band Antenna Conducted Emission.....	29
4.5	Transmitter Radiated Emissions	34
4.6	AC Line Conducted Emission.....	62
5.0	List of Test Equipment.....	67
6.0	Document History	68
	Annex A – Duty Cycle	69

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: September 23, 2020

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: September 24, 2020

Test completion date: October 22, 2020

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

2.0 General Information

2.1 Product Description

Bigfoot Biomedical, Inc. supplied the following description of the EUT:

The v1 Pen Cap is a component of the Bigfoot Inject v1 System, which is an interconnected system of both hardware, firmware, and software. The complete system consists of two Pen Caps, a mobile application, and a continuous glucose monitor (CGM). Bigfoot Inject communicates wirelessly both with a compatible blood glucose meter (BGM) and with associated Web services via a Bigfoot Medical Device Data System (MDDS). One Pen Cap is for the user's rapid-acting insulin pen (RCAP) and the other is for the user's long-acting insulin pen (LCAP). Each Pen Cap connects to the mobile application. The LCAP and RCAP display their individual insulin dose recommendations as well as the time since the last injection was inferred to have been taken. The RCAP can also be used to scan the CGM and subsequently display the user's sensor glucose and trend information or acquire BG values from a BGM and subsequently display the user's meter glucose information. In addition, the rapid-acting cap displays correction and meal insulin dose recommendations based on information entered by the user in the mobile application. The Inject Mobile Application (IMA) facilitates wireless communication between the system components and displays recent glucose measurements and injection dose timing. All insulin dose recommendations displayed on the pen caps are based upon the information entered in the IMA.

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

Information about the 2.4 GHz radio is presented below:

Applicant	Bigfoot Biomedical, Inc.
Model No.	LCAP
FCC Identifier	2AVAYUL001
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	-2.52 dBm
Antenna(s) & Gain	Internal Antenna, Gain: 5.3 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Bigfoot Biomedical, Inc. 1820 McCarthy Blvd Milpitas, CA 95035 USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

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

2.4 Test Methodology

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

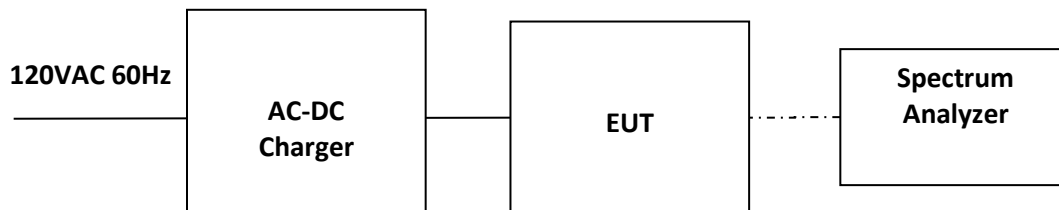
3.1 Support Equipment

Support Equipment		
Description	Manufacturer	Model
AC-DC Charger	Dongguan Aohai Technology Co., Ltd	A18A-050100U-US2

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model	Serial Number
Bigfoot Inject v1 System	Bigfoot Biomedical, Inc.	LCAP	SM19354002

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



S = Shielded	F = With Ferrite
U = Unshielded	m = Length in Meters

EUT Photo



3.3 Justification

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

BLE Circuitry in the LCAP and RCAP are identical. Conducted antenna port measurements were made on the RCAP. Conducted antenna port measurements were taken from the RCAP Report (Intertek Report # 104424286MPK-004)

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Bigfoot Biomedical, Inc.

3.5 Mode of Operation during Test

During the transmitter tests, the transmitter was setup to transmit maximum communication and RF power level of 0 dBm.

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

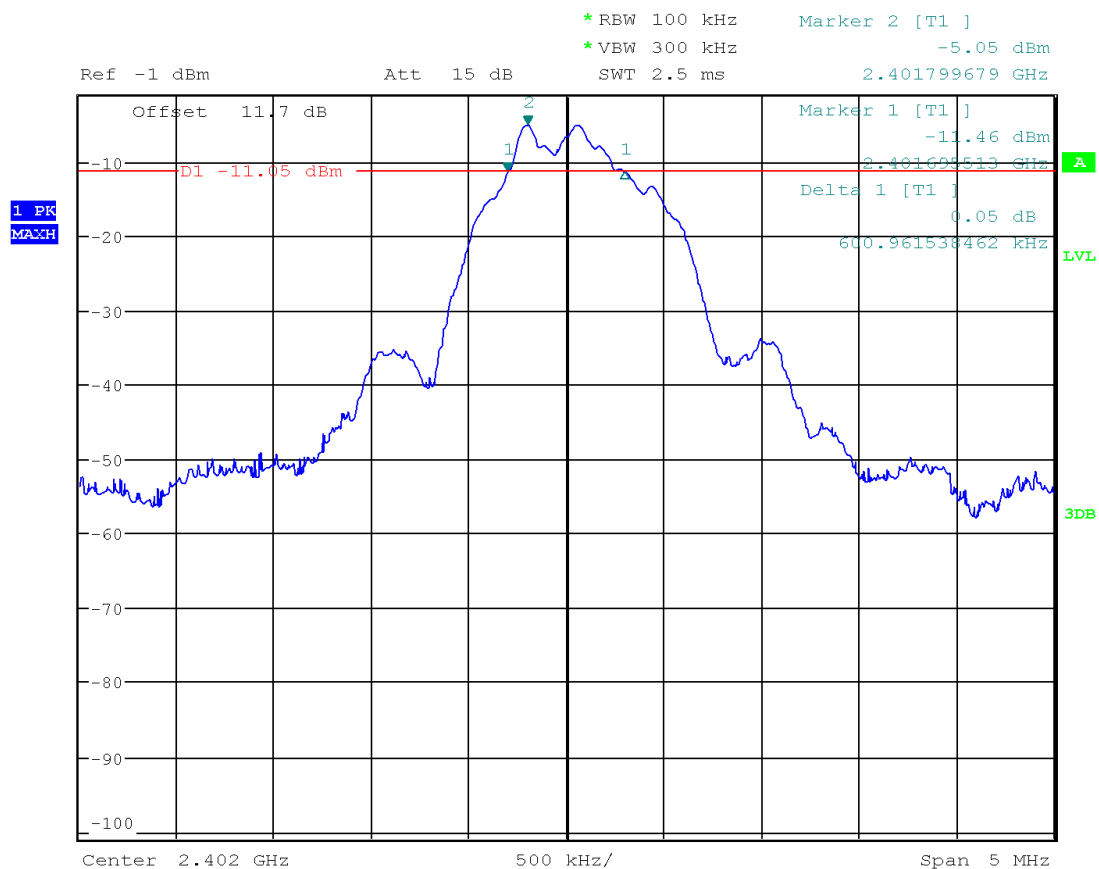
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	600.962	--	1.1
	--	1.050	1.4
2440	600.962	--	1.2
	--	1.050	1.5
2480	592.949	--	1.3
	--	1.050	1.6

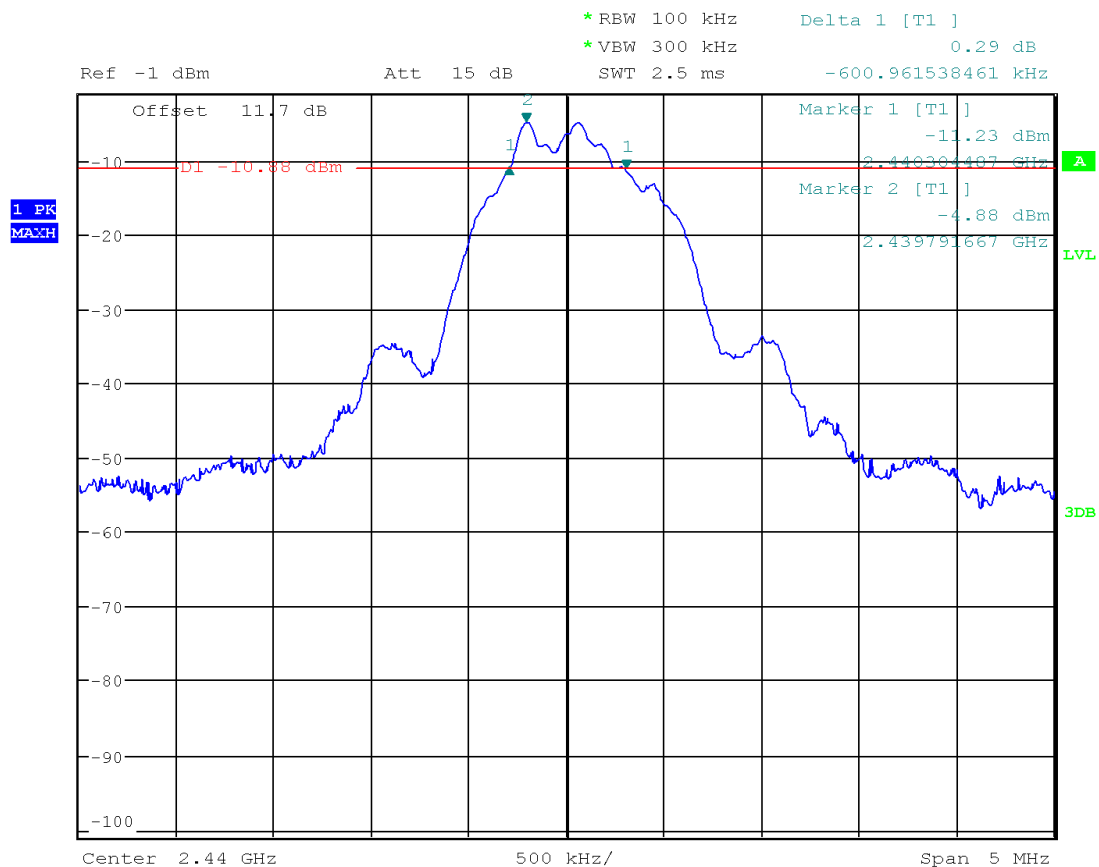
Tested By	Test Date	Results
Minh Ly	September 24, 2020	Complies

Plot 1. 1



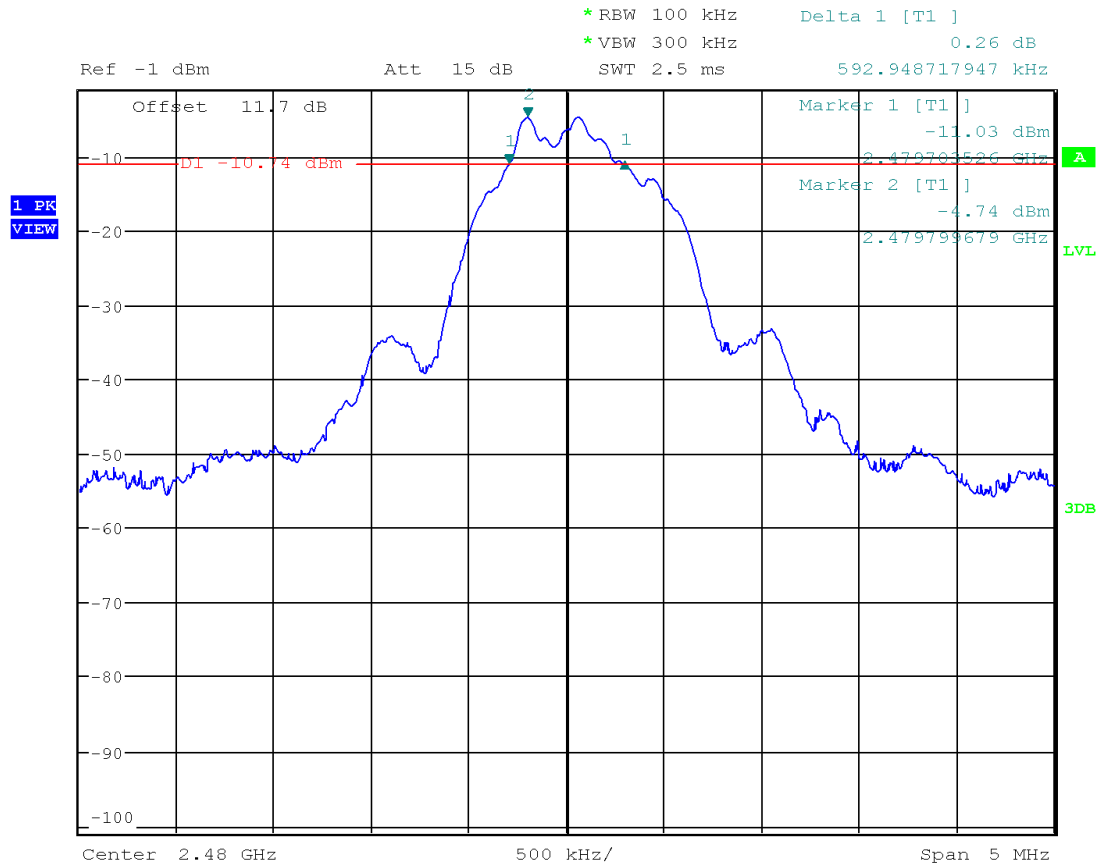
Date: 24.SEP.2020 14:48:53

Plot 1. 2



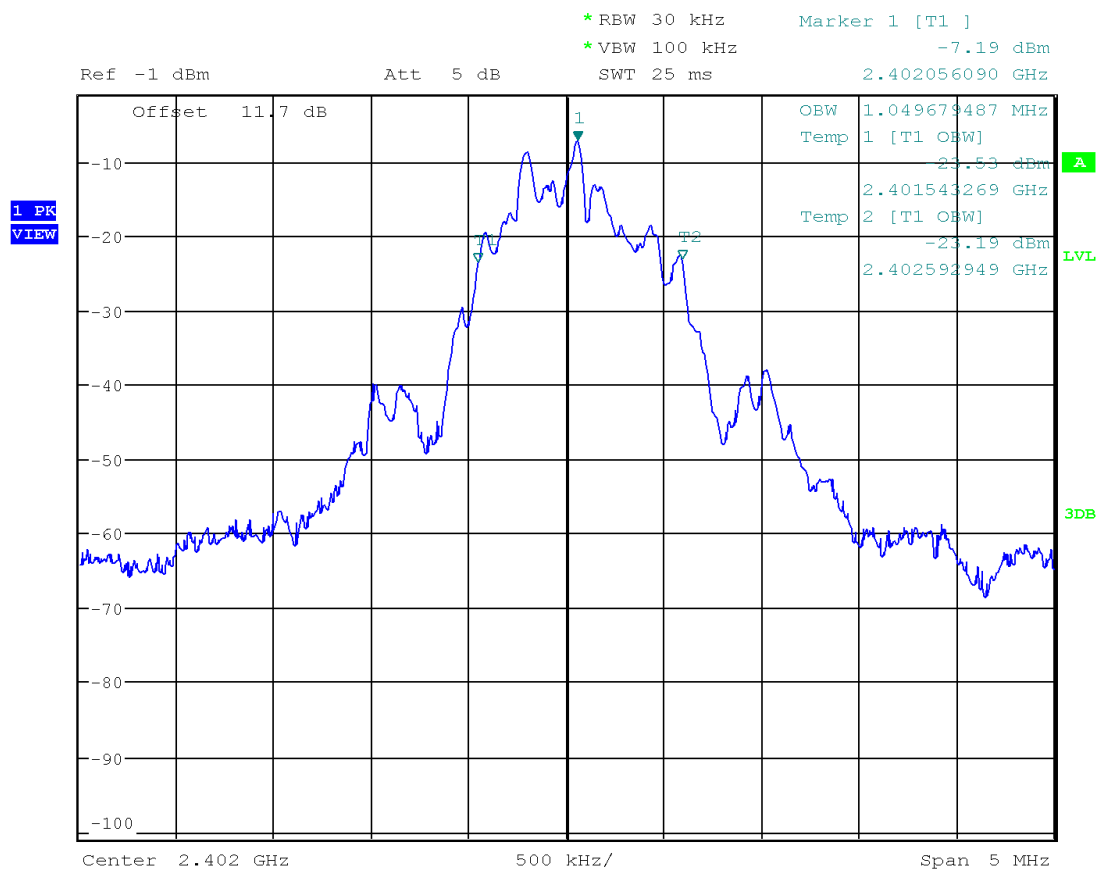
Date: 24.SEP.2020 14:50:41

Plot 1.3



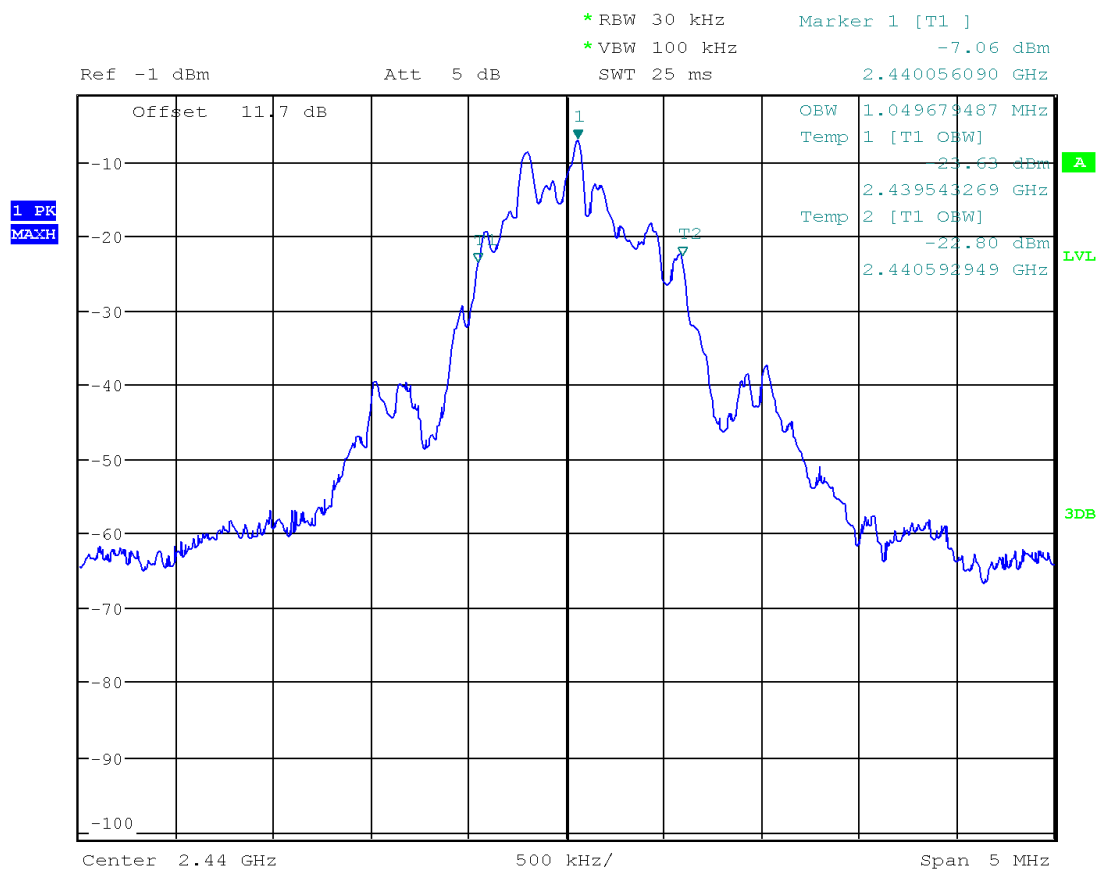
Date: 24.SEP.2020 14:46:02

Plot 1. 4



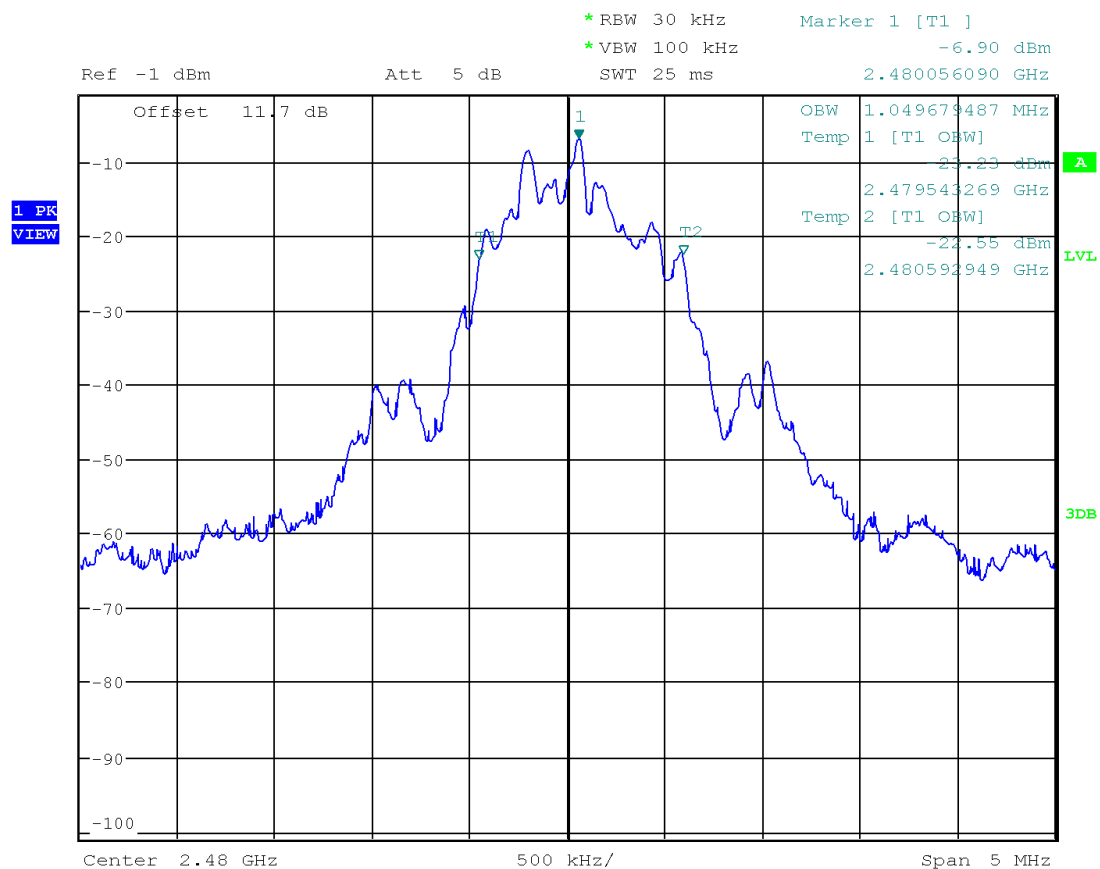
Date: 24.SEP.2020 14:54:26

Plot 1.5



Date: 24.SEP.2020 14:52:58

Plot 1.6



Date: 24.SEP.2020 14:53:42

Results

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.

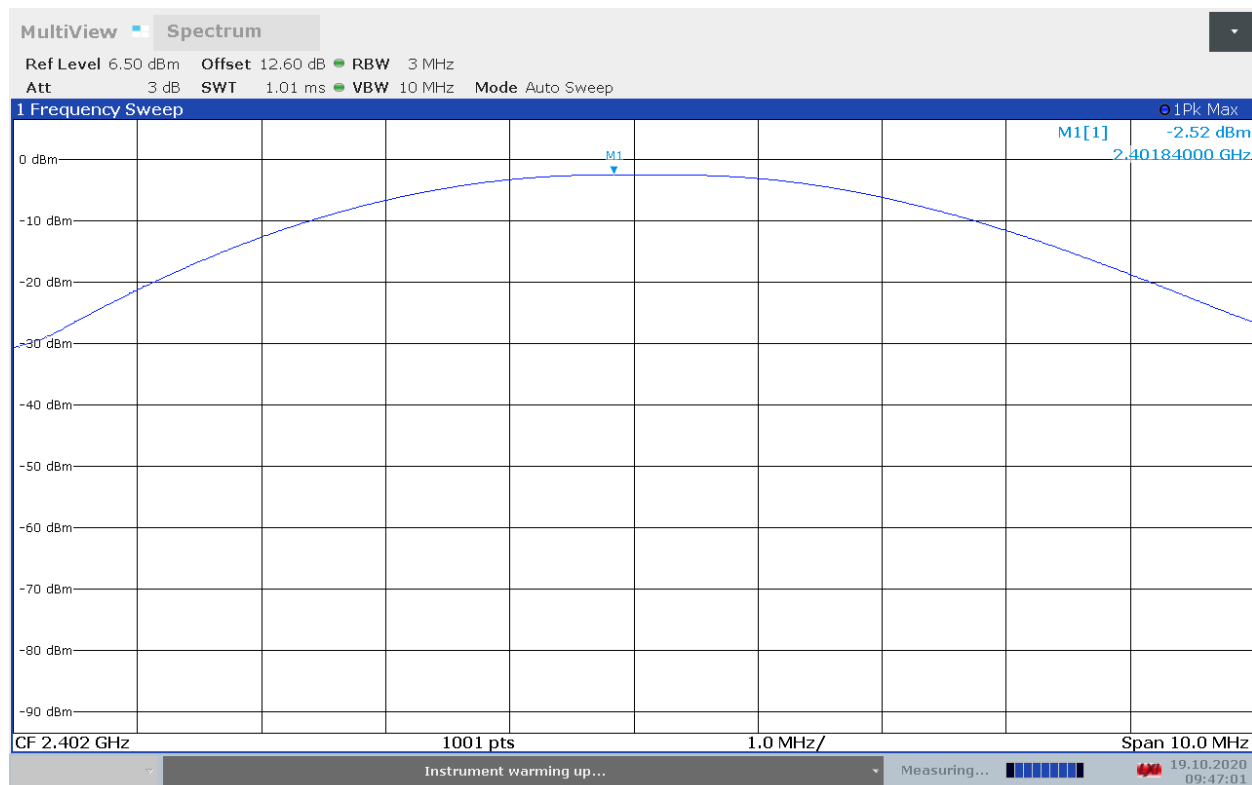
4.2.3 Test Result

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

Frequency MHz	Mode	Conducted Power (peak)		Plot
		dBm	mW	
2402	Battery Powered	-2.52	0.560	2.1
2440	Battery Powered	-2.65	0.543	2.2
2480	Battery Powered	-3.05	0.495	2.3
2402	AC-DC Charger connected	-2.80	0.525	2.4
2440	AC-DC Charger connected	-2.77	0.528	2.5
2480	AC-DC Charger connected	-3.08	0.492	2.6

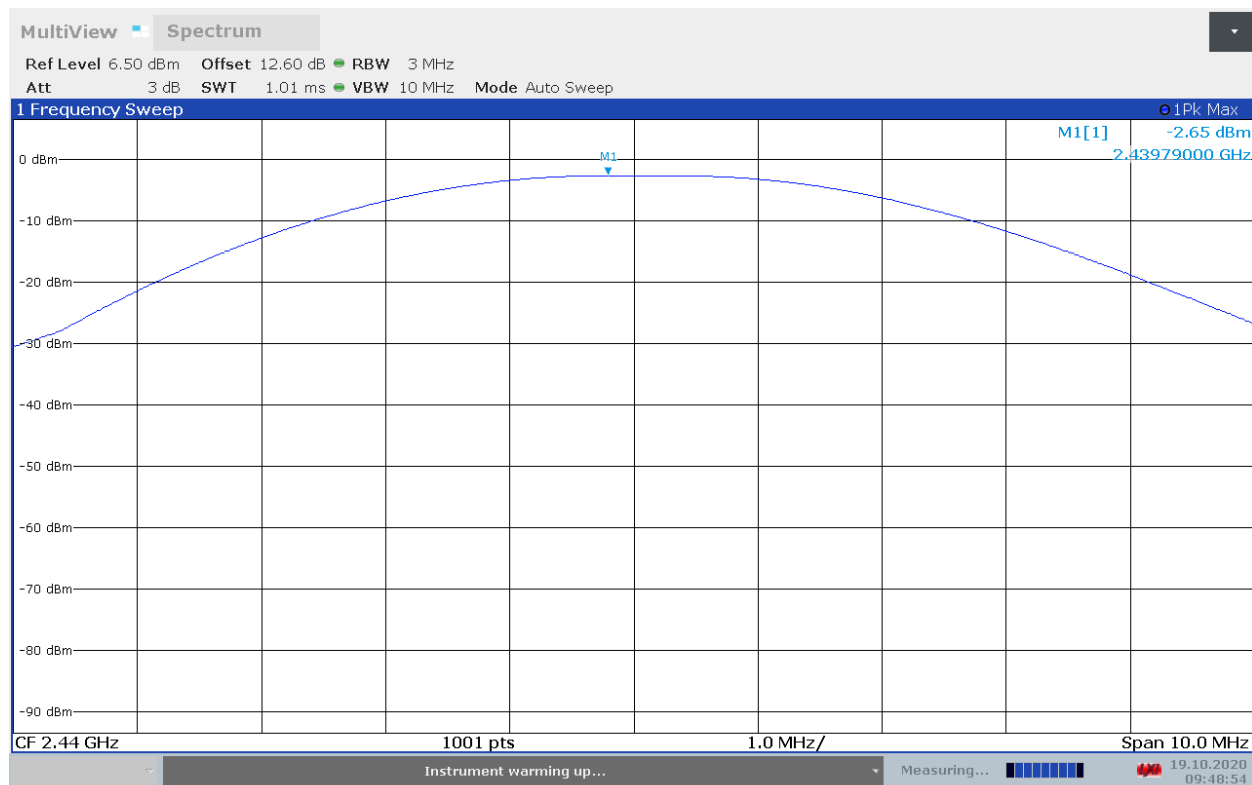
Tested By	Test Date	Results
Anderson Soungpanya	October 19, 2020	Complies

Plot 2. 1
Battery Mode



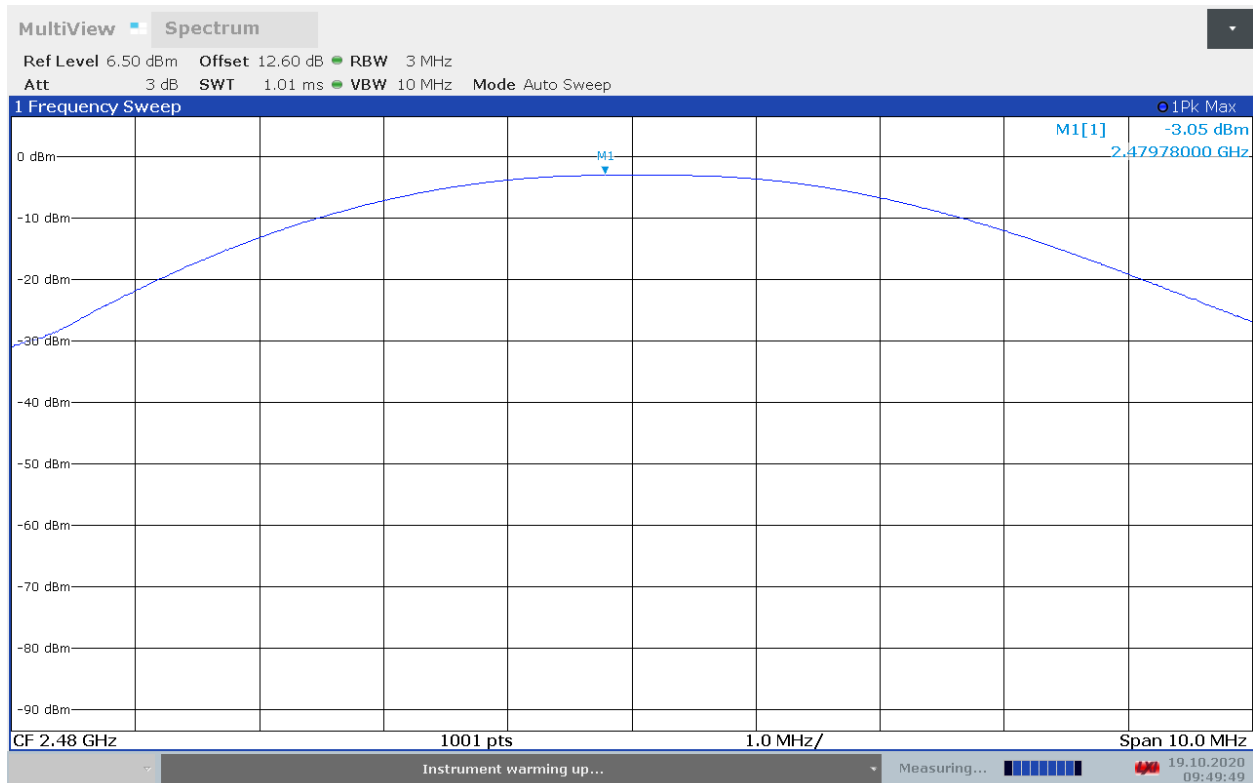
09:47:02 19.10.2020

Plot 2. 2 Battery Mode



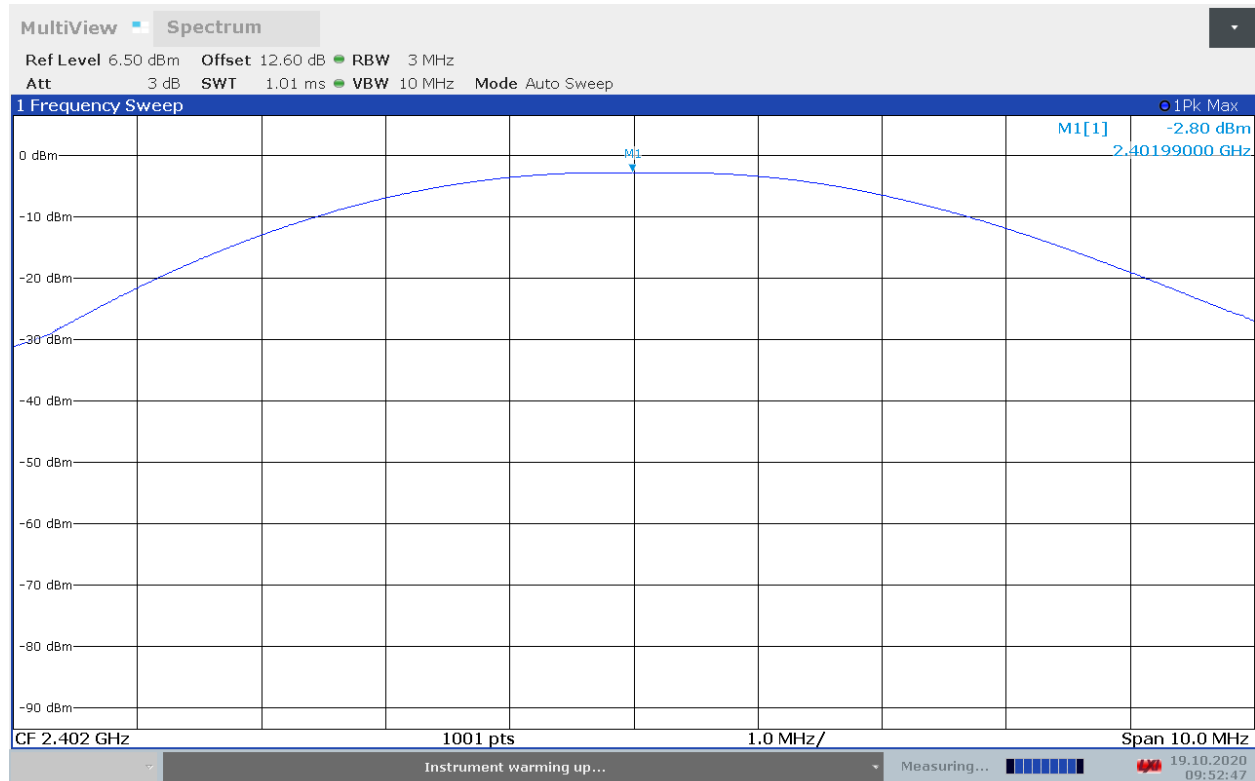
09:48:55 19.10.2020

Plot 2. 3
Battery Mode



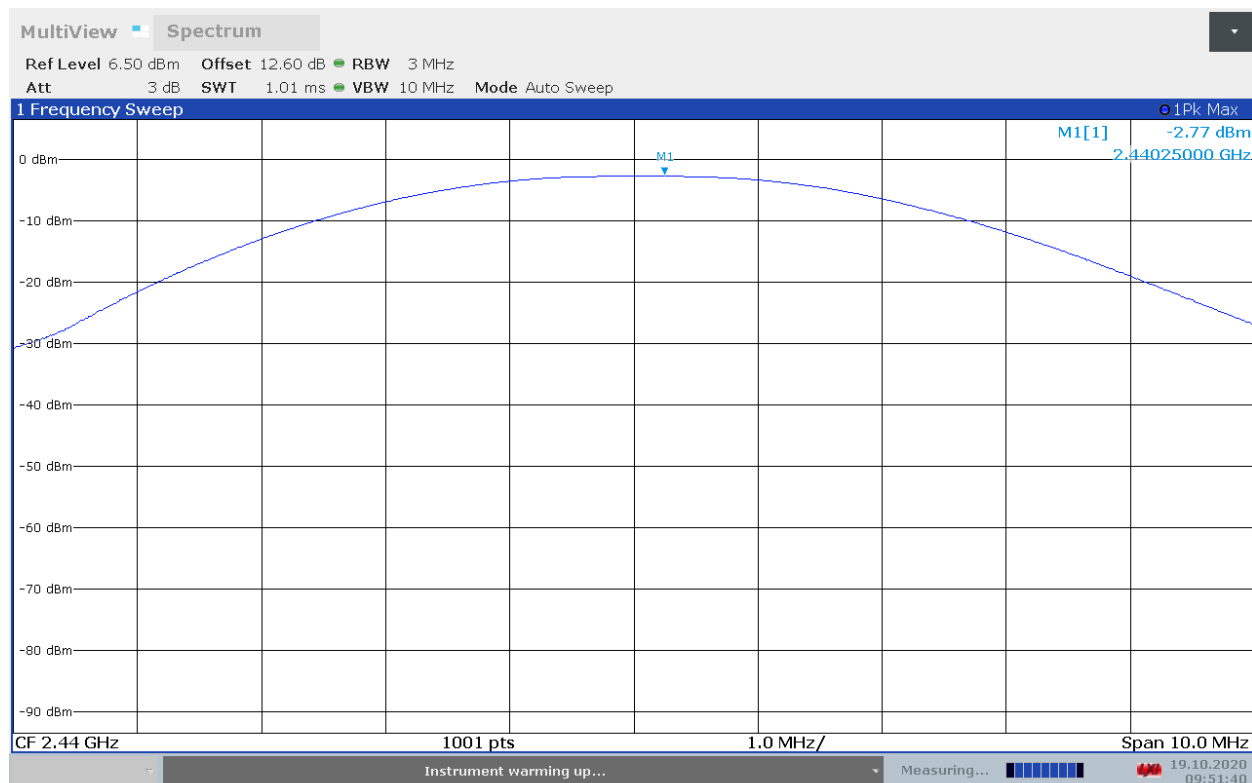
09:49:49 19.10.2020

Plot 2. 4
Charging Mode



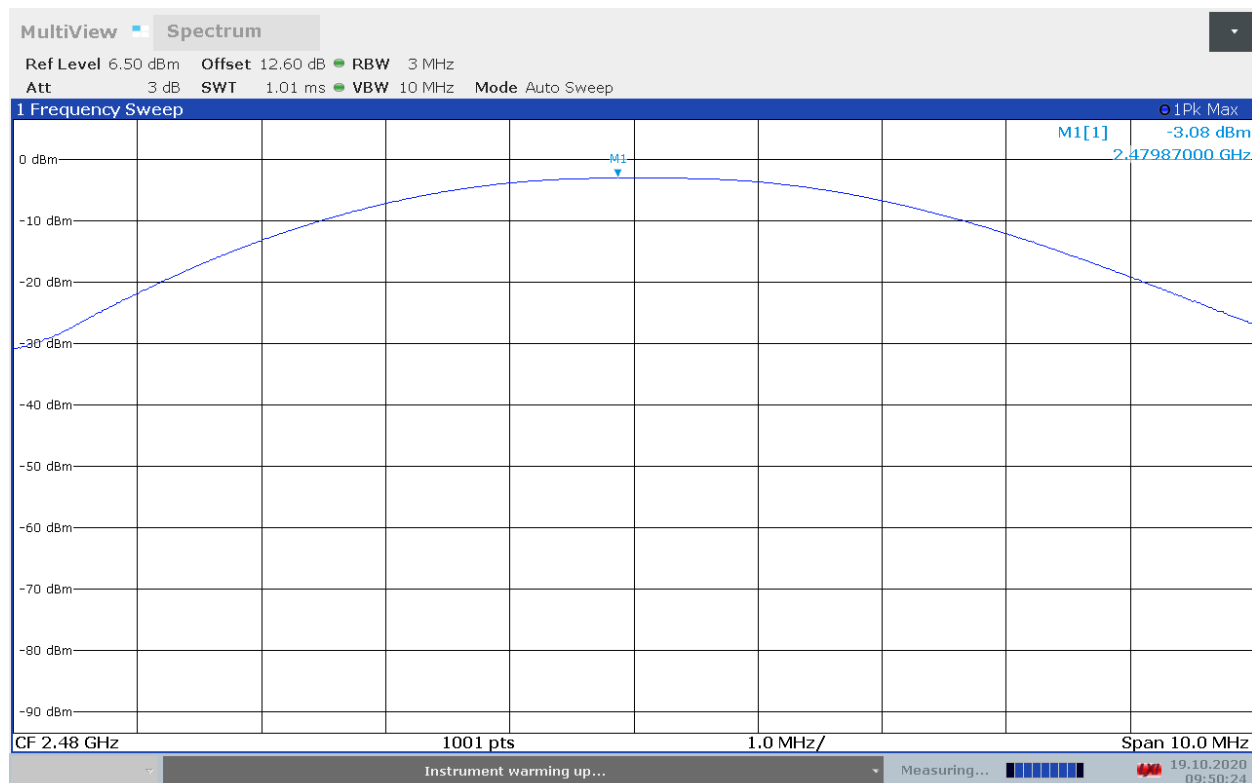
09:52:47 19.10.2020

Plot 2. 5 Charging Mode



09:51:41 19.10.2020

Plot 2. 6
Charging Mode



09:50:25 19.10.2020

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.

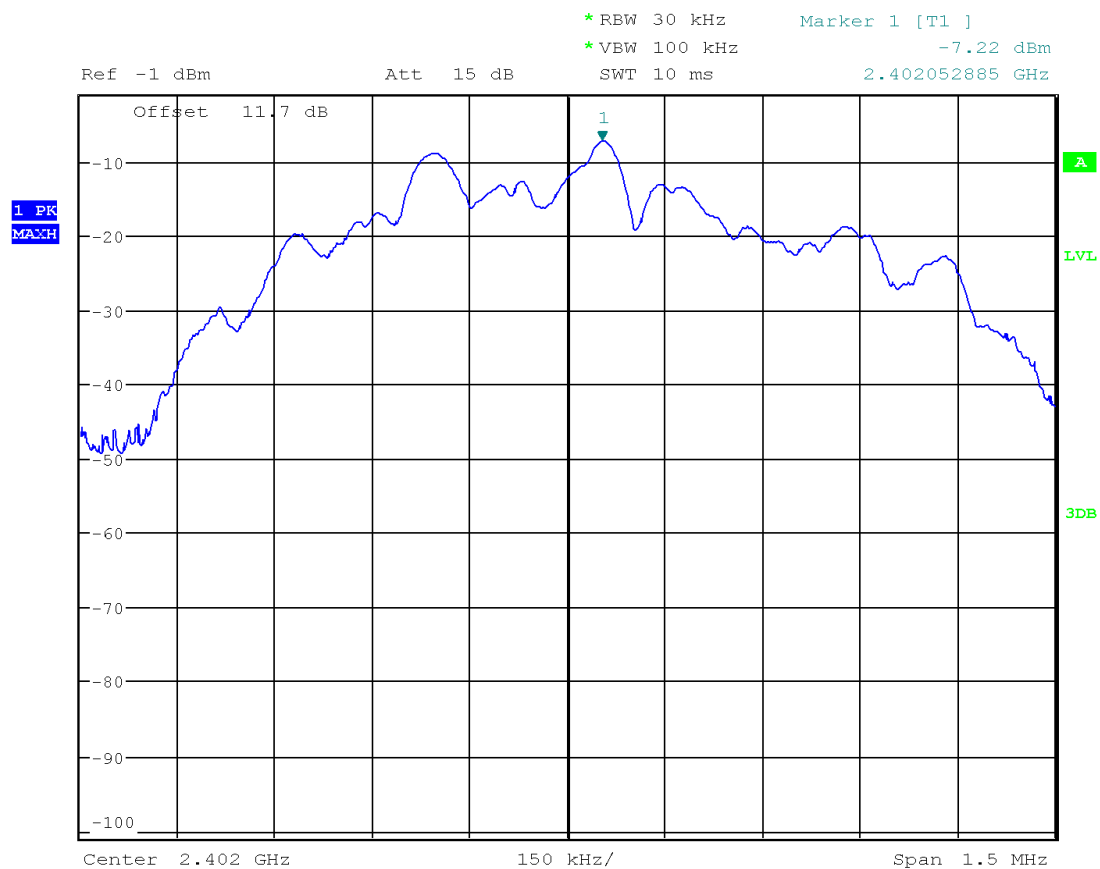
4.3.3 Test Result

Refer to the following plots for the test result

Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2402	-7.22	8.0	-15.22	3.1
2440	-7.07	8.0	-15.07	3.2
2480	-6.89	8.0	-14.89	3.3

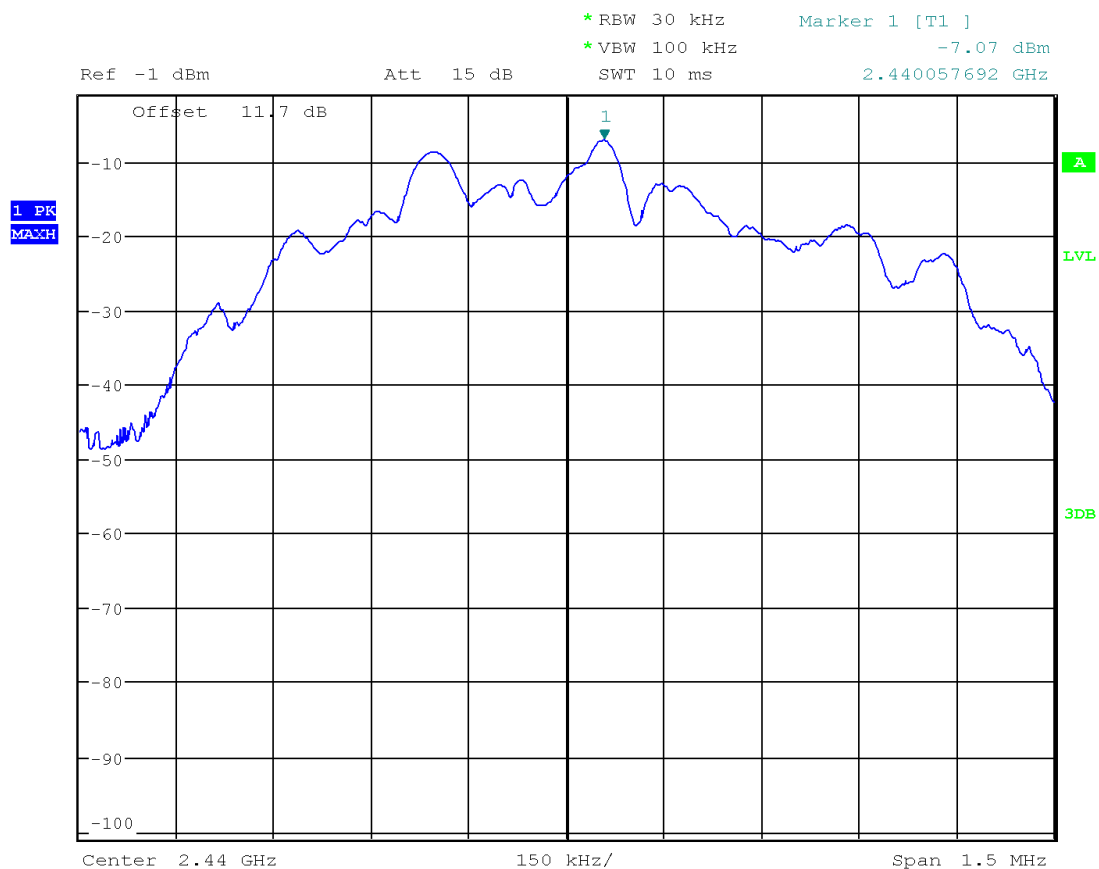
Tested By	Test Date	Results
Minh Ly	September 24, 2020	Complies

Plot 3.1



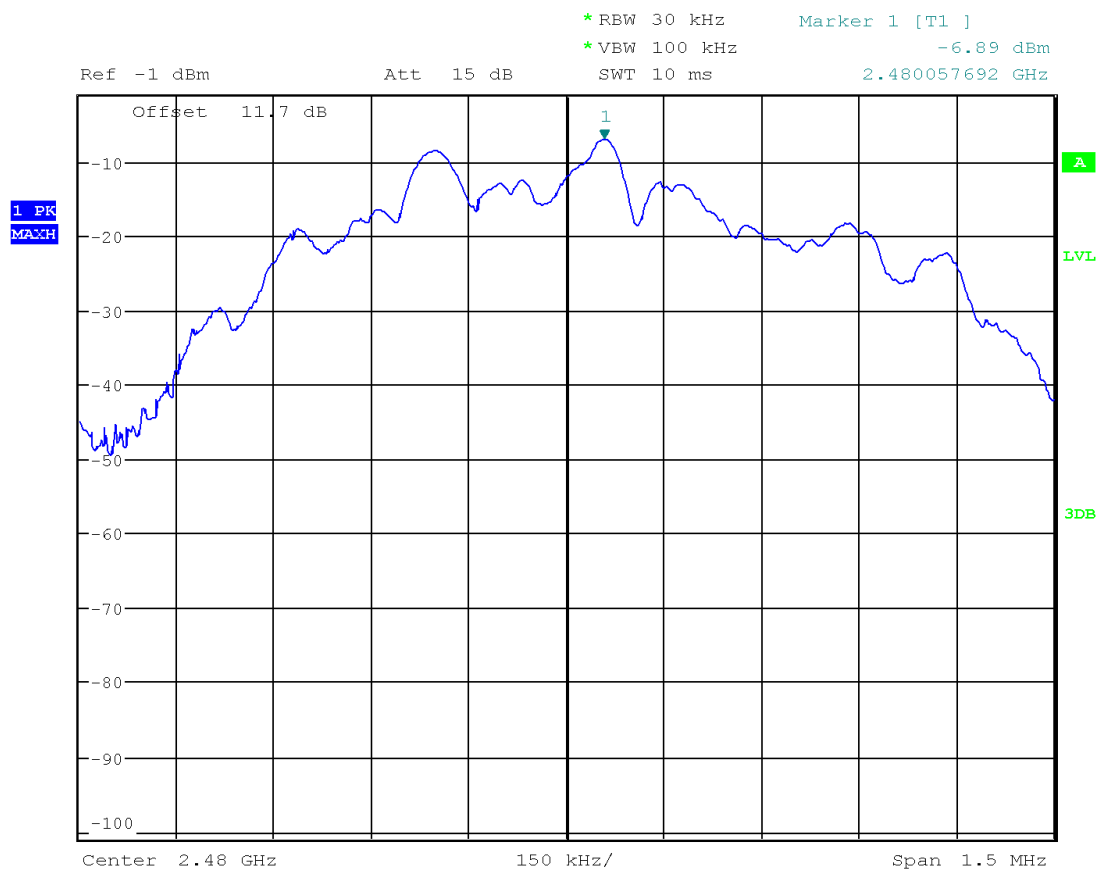
Date: 24.SEP.2020 14:41:04

Plot 3.2



Date: 24.SEP.2020 14:41:55

Plot 3.3



Date: 24.SEP.2020 14:42:52

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.

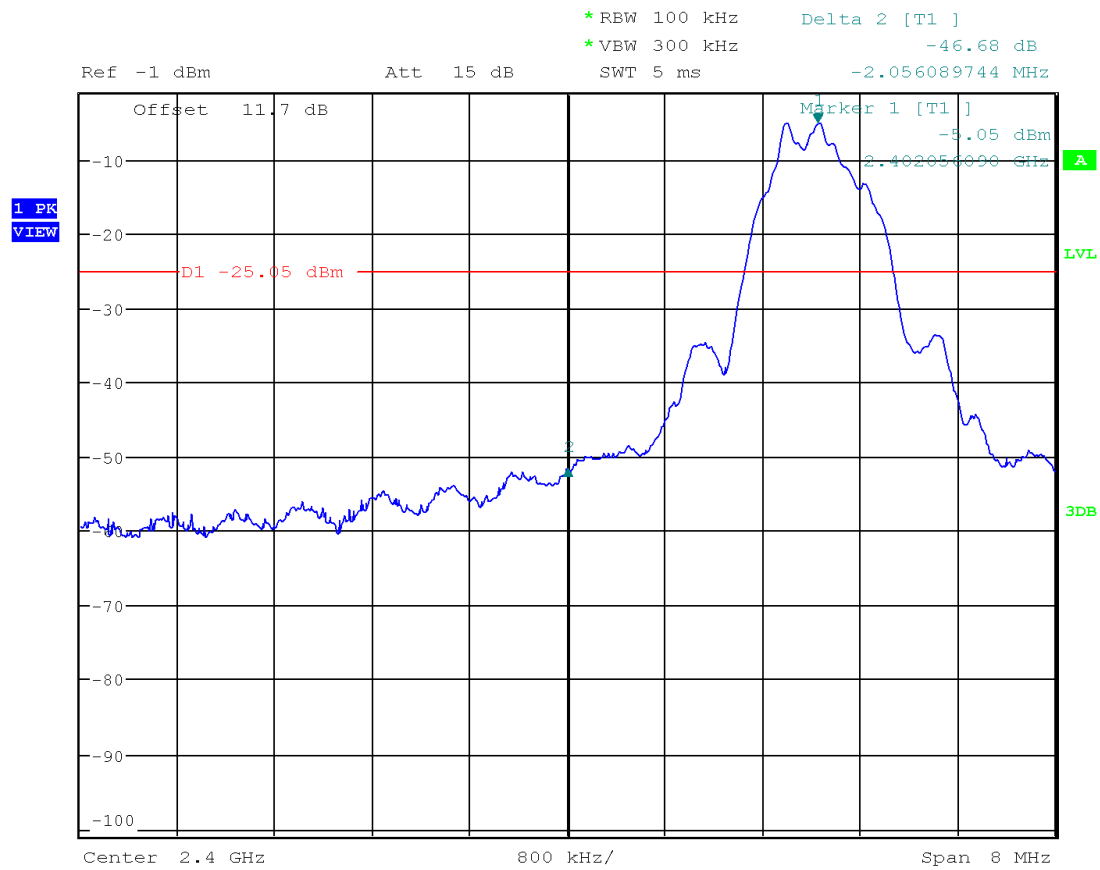
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

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.

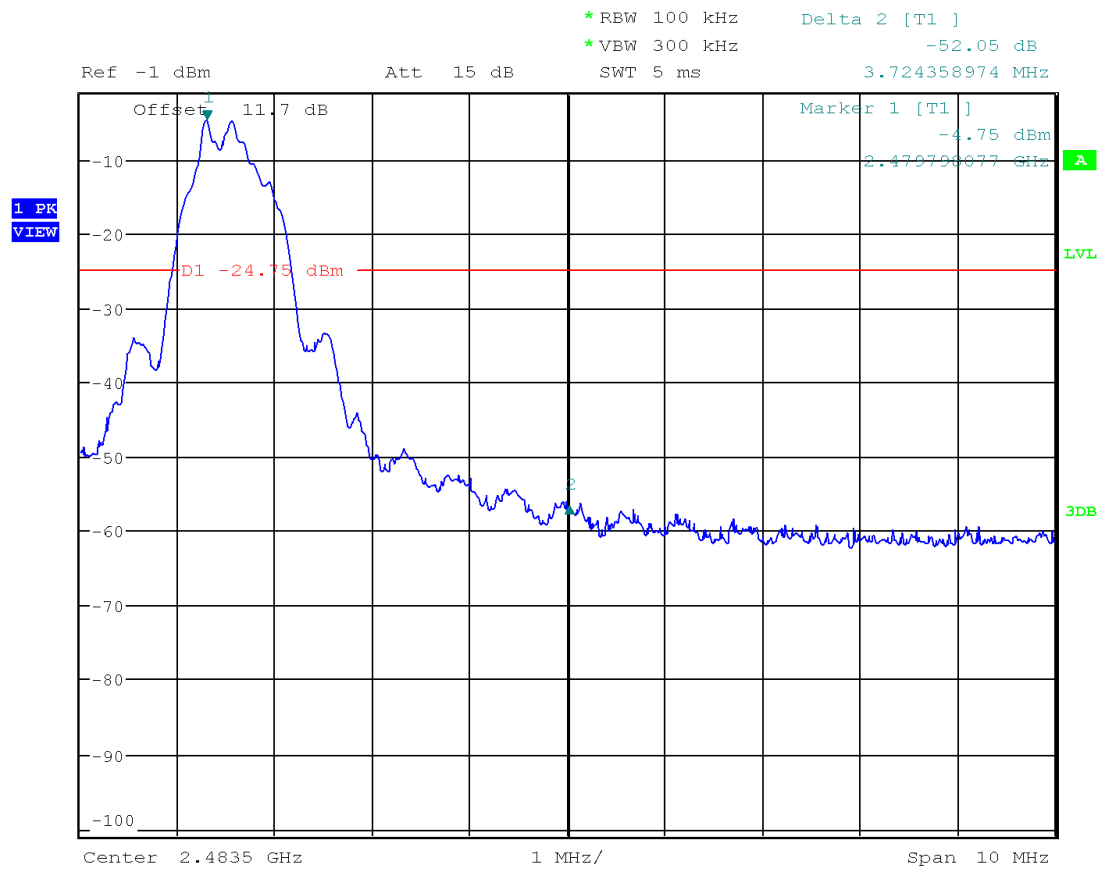
Tested By	Test Date	Results
Minh Ly	September 24, 2020	Complies

Tx @ Low Channel, 2400 MHz Band Edge
Plot 4.1



Date: 24.SEP.2020 15:07:56

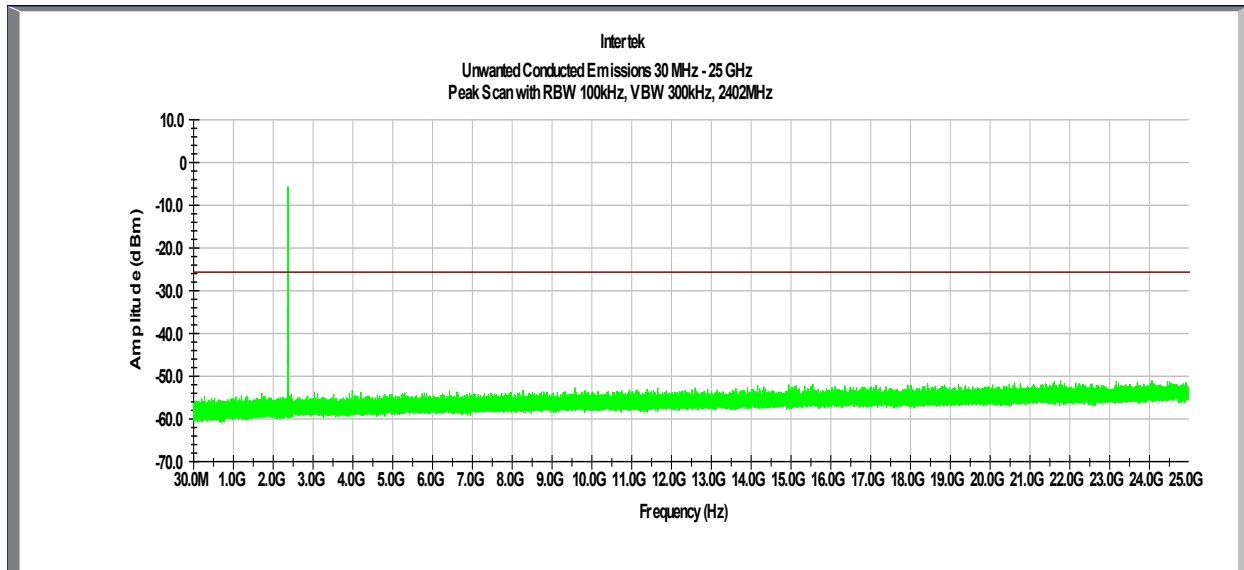
Tx @ High Channel, 2483.5 MHz Band Edge
Plot 4.2



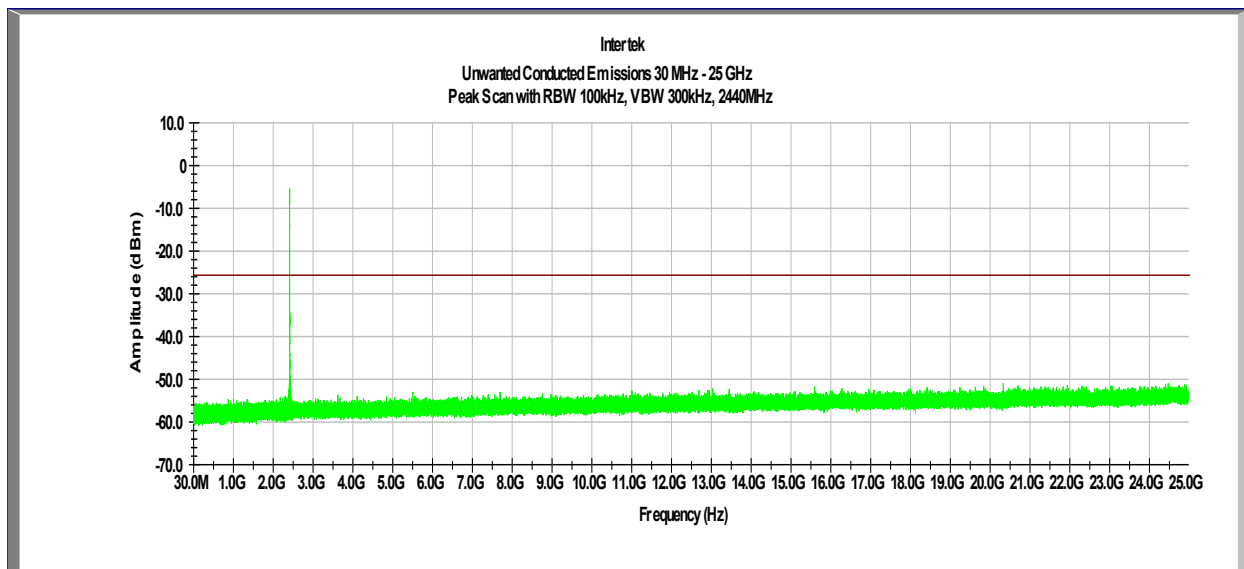
Date: 24.SEP.2020 15:10:44

Results	Complies
---------	----------

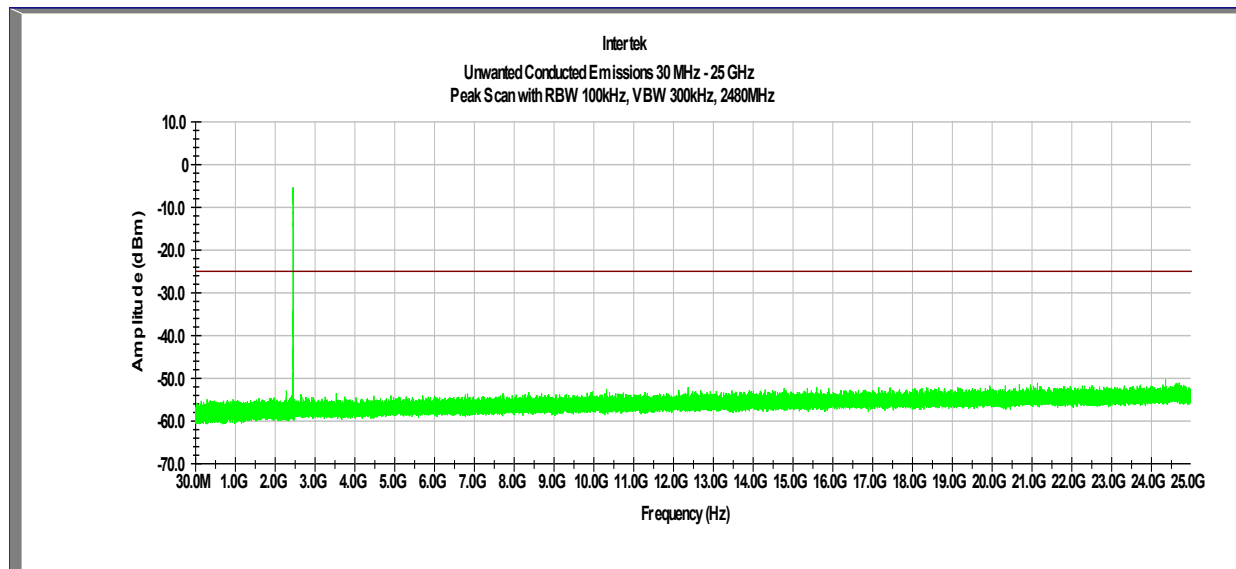
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



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



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



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 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.

EUT was measured on all 3 Axis, X, Y and Z. 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

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

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

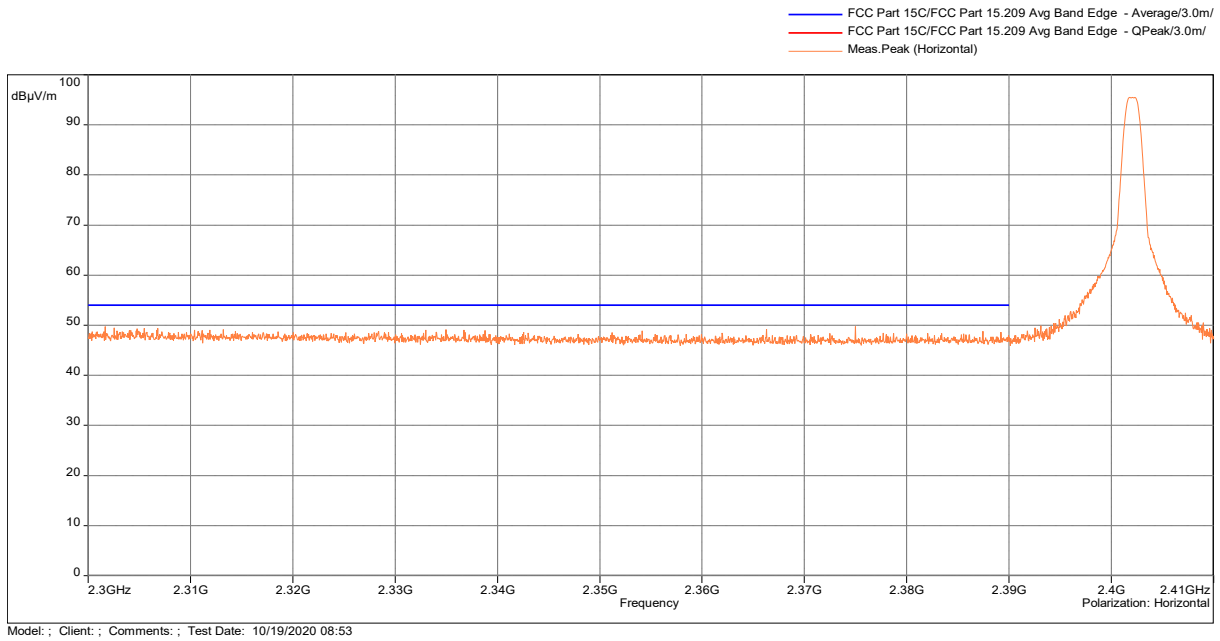
4.5.4 Test Results

All testing in this section were performed by radiated measurements.

Tested By	Test Date	Results
Anderson Soungpanya & Minh Ly	September 23 – October 22, 2020	Complies

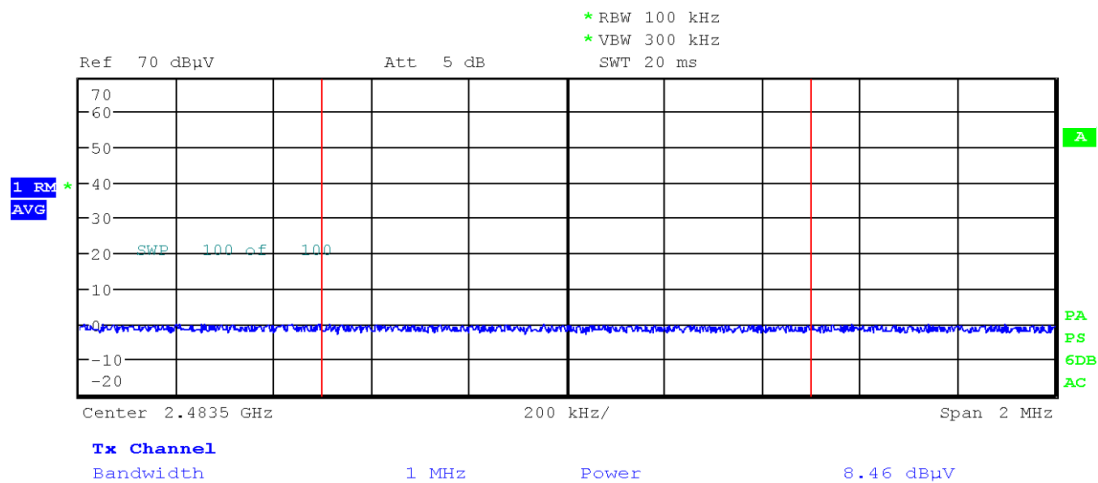
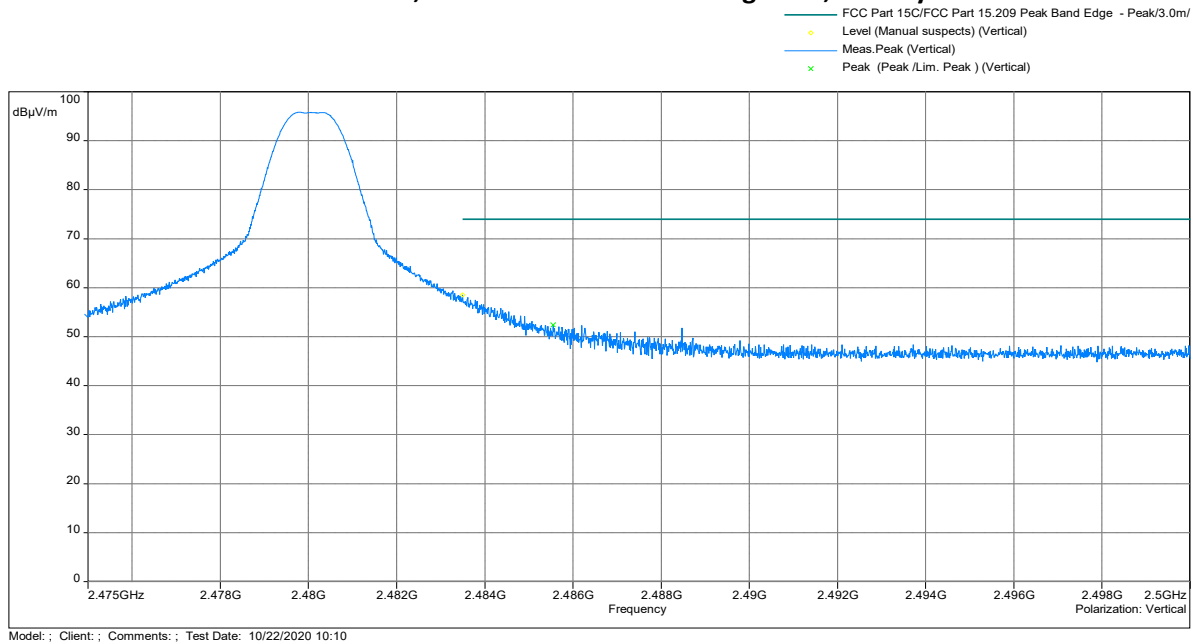
Test Results: 15.209/15.205 Radiated Restricted Band Emissions

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



Freq. MHz	Peak @3m dB(μV/m)	Ave Limit dB(μV/m)	Margin dB	Azimuth	Height m	Polarity	Correction dB
2390	49.59	54.0	-4.41	278	1.13	Horizontal	31.45

**Out-of-Band Radiated spurious emissions at the Band-edge, @3m distance
2483.5–2500 MHz, Peak Scan with Peak & Avg Limit, Battery Mode**

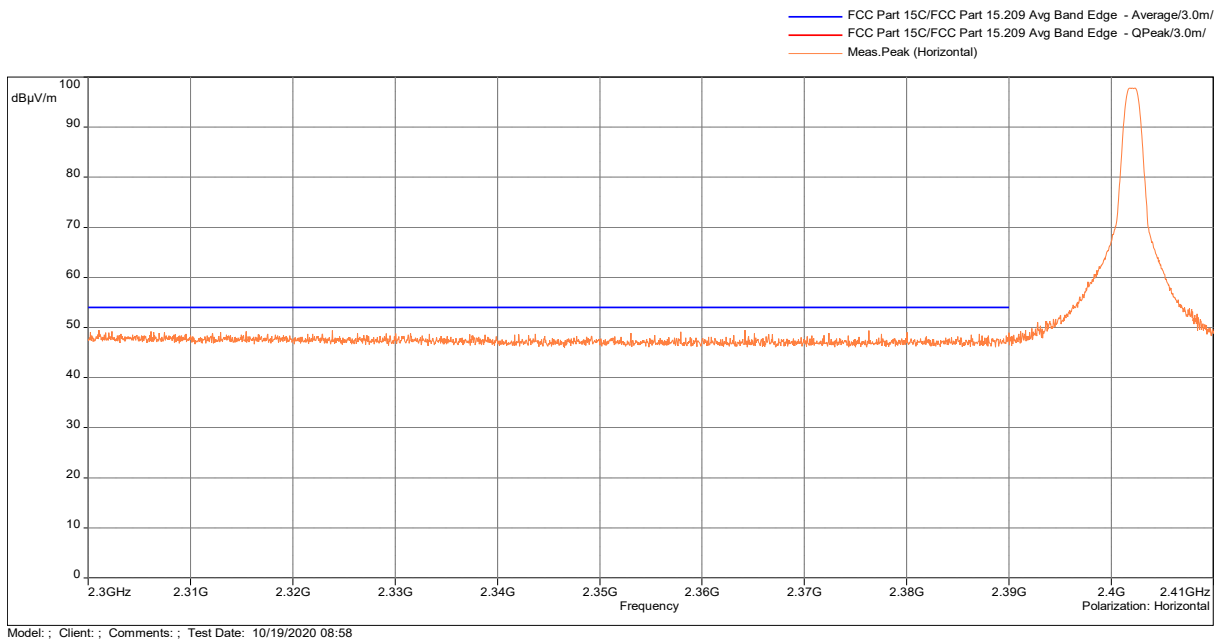


Freq. MHz	FS Ave @3m dB(μV/m)	Ave Limit dB(μV/m)	Margin dB	Azimuth	Height m	Polarity	Raw dB(μV/m)	Correction	Duty Cycle Correction
2483.5	48.11	54.0	-5.89	245	1.14	Vertical	8.46	31.35	8.4

FS Ave = Raw + Correction + Duty Cycle Correction

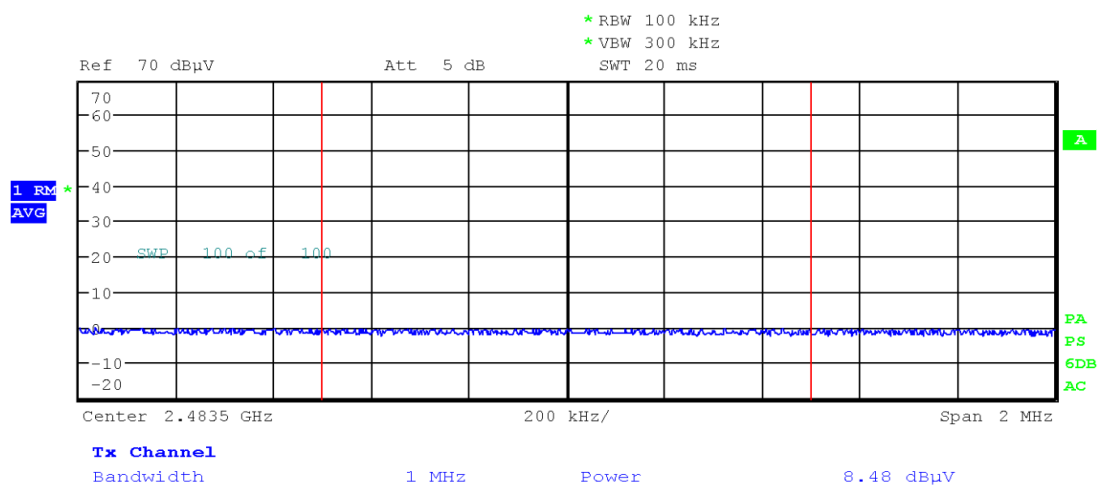
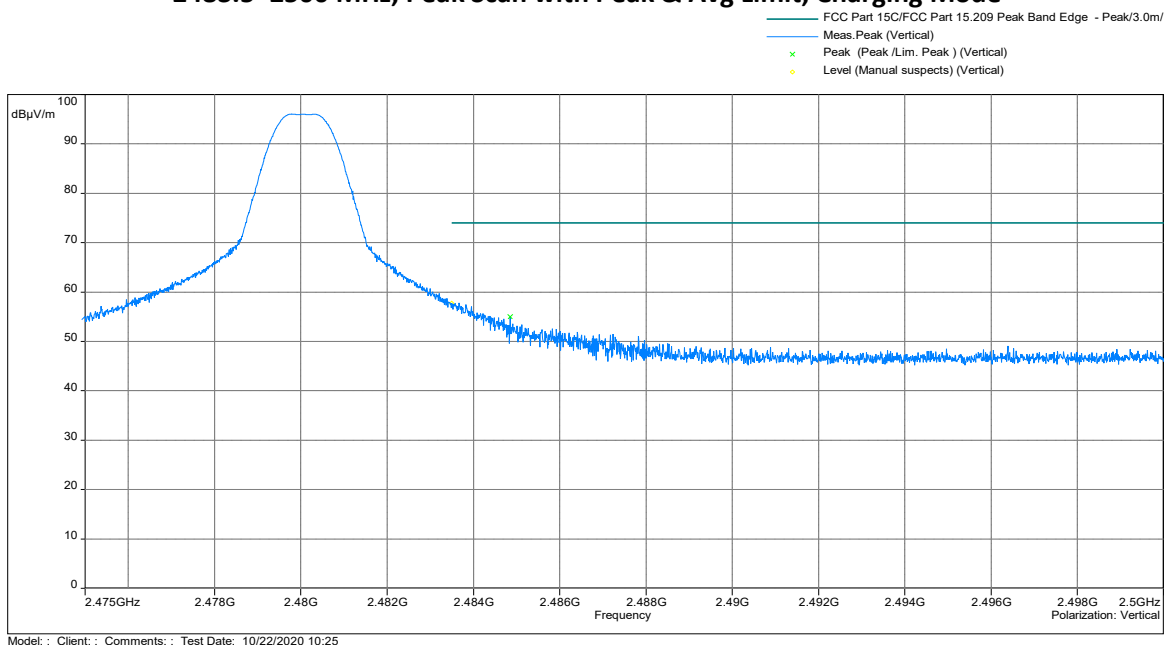
Section 11.13.3.4 "Trace averaging across on- and off-times of the EUT transmissions followed by duty cycle correction" of ANSI 63.10 was utilized per FCC Publication KDB 558074 D01 Meas Guidance v05r02.

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



Freq. MHz	Peak @3m dB(µV/m)	Ave Limit dB(µV/m)	Margin dB	Azimuth	Height m	Polarity	Correction dB
2390	48.54	54.0	-5.46	285	1.22	Horizontal	31.45

**Out-of-Band Radiated spurious emissions at the Band-edge, @3m distance
2483.5–2500 MHz, Peak Scan with Peak & Avg Limit, Charging Mode**



Freq. MHz	FS Ave @3m dB(μV/m)	Ave Limit dB(μV/m)	Margin dB	Azimuth	Height m	Polarity	Raw dB(μV/m)	Correction	Duty Cycle Correction
2483.5	48.13	54.0	-5.87	246	1.13	Vertical	8.48	31.35	8.4

FS Ave = Raw + Correction + Duty Cycle Correction

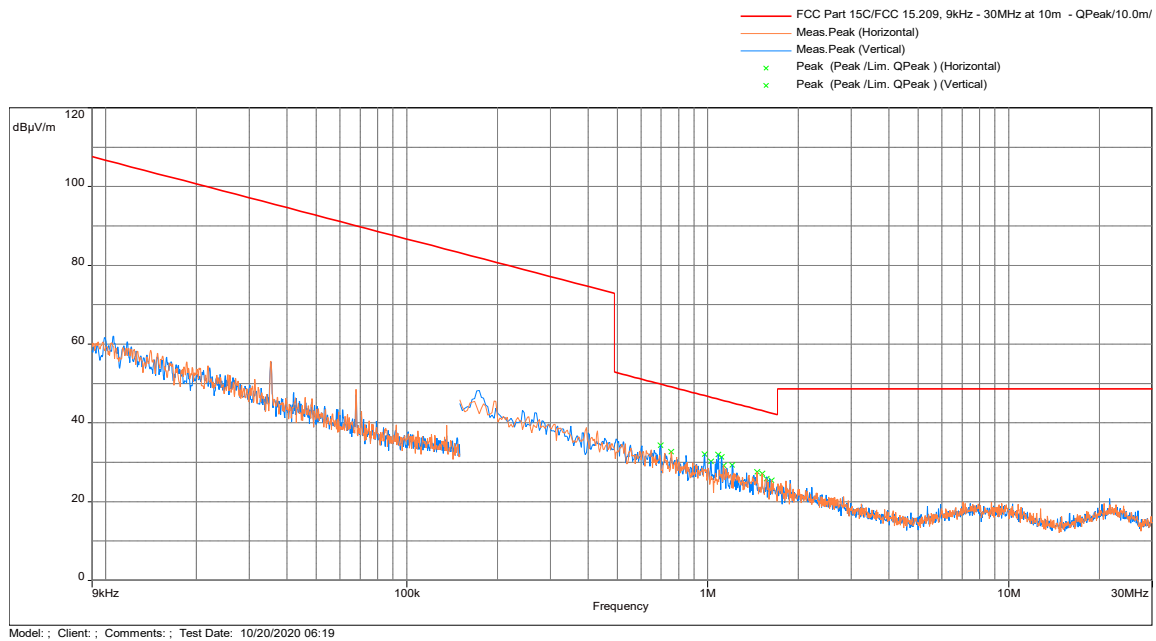
Section 11.13.3.4 "Trace averaging across on- and off-times of the EUT transmissions followed by duty cycle correction" of ANSI 63.10 was utilized per FCC Publication KDB 558074 D01 Meas Guidance v05r02.

Results **Complies**

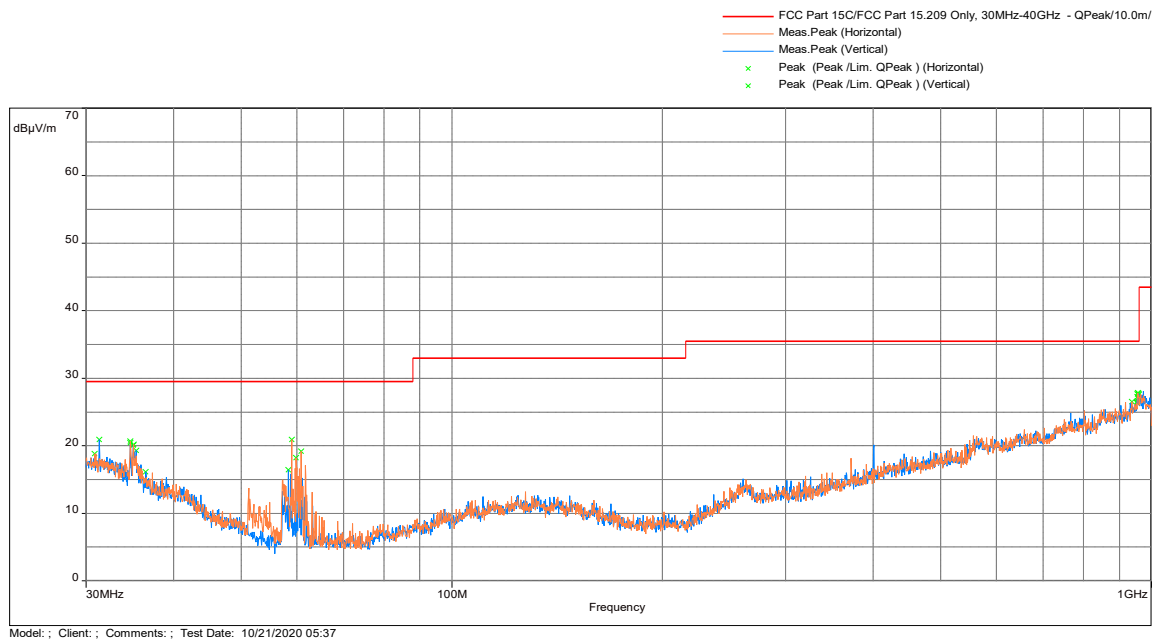
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2402MHz; Battery Mode

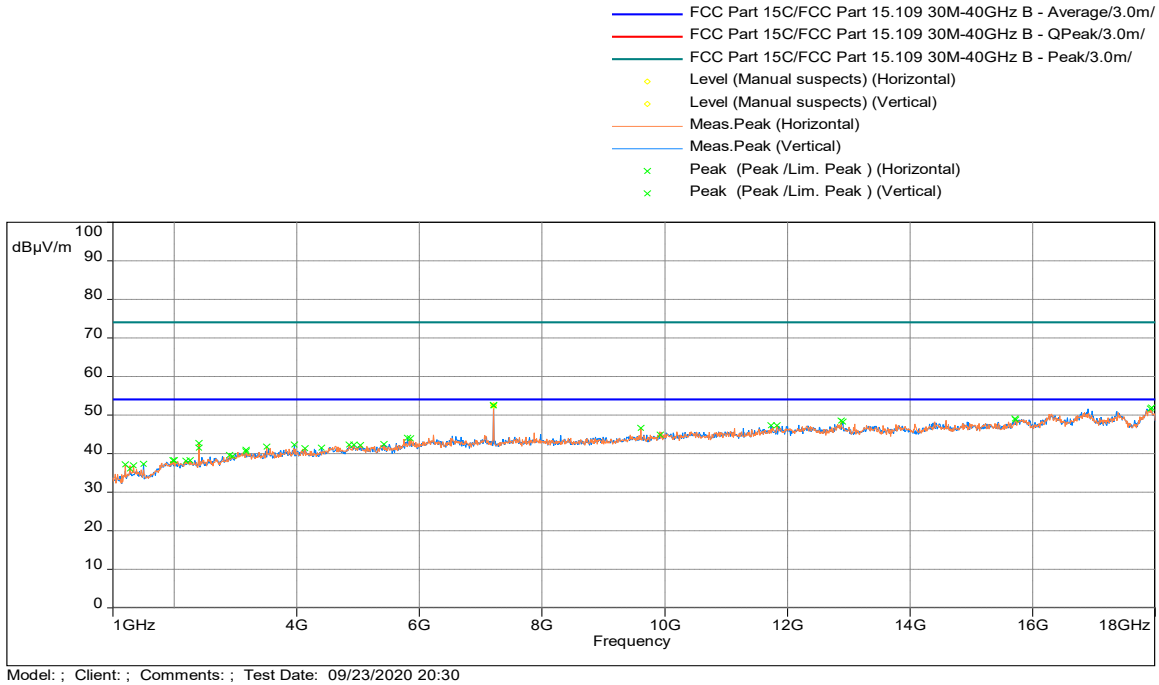
Radiated Spurious Emissions 9kHz - 30 MHz



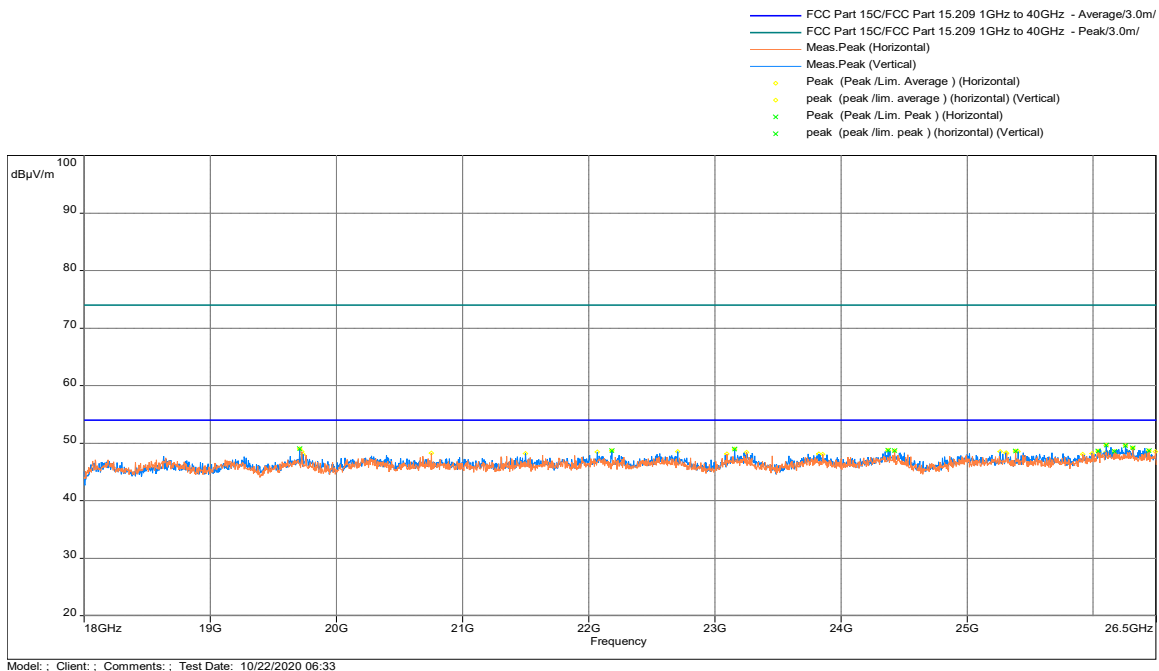
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2402MHz; Battery Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
4857.867	42.33	54	-11.67	1.52	227	Horizontal	-8.76
7206.133	52.45	69.81 (20dBc Limit)	-17.36	2.52	16	Horizontal	-4.81
9612.767	46.57	54	-7.43	1.52	64	Horizontal	-2.61
4928.700	42.37	54	-11.63	1.51	169	Vertical	-8.69
7205.567	52.55	69.81 (20dBc Limit)	-17.26	3.48	168	Vertical	-4.81
9926.133	44.89	54	-9.11	3.48	359	Vertical	-2.31

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

Note: FS = RA + Correction

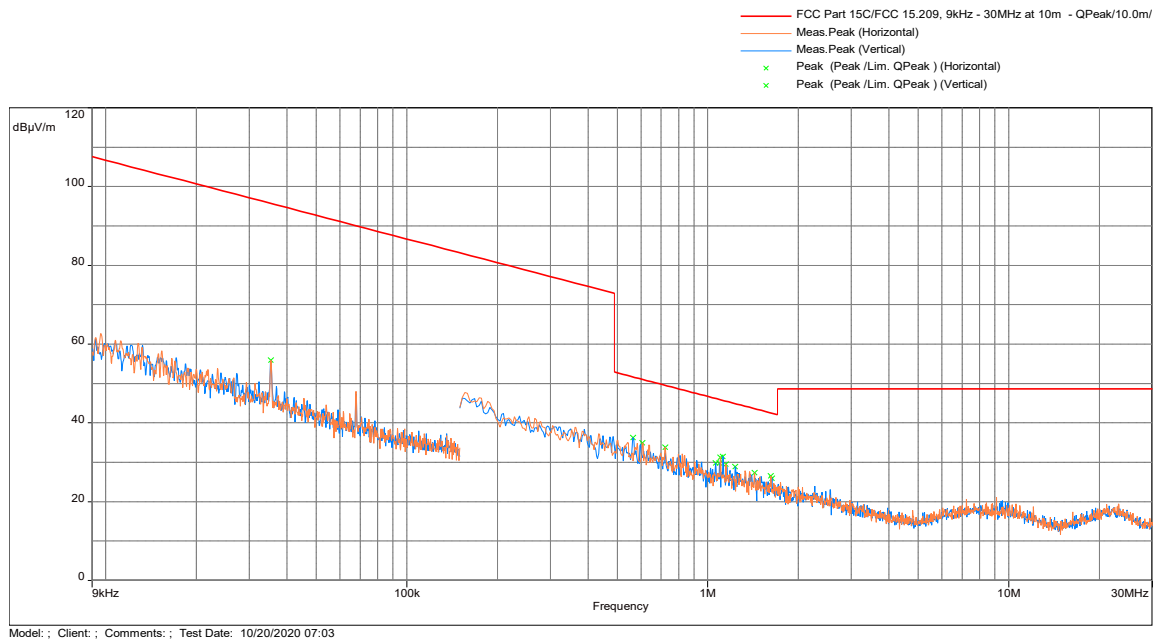
Correction = AF + CF – Preamp

Results	Complies
----------------	-----------------

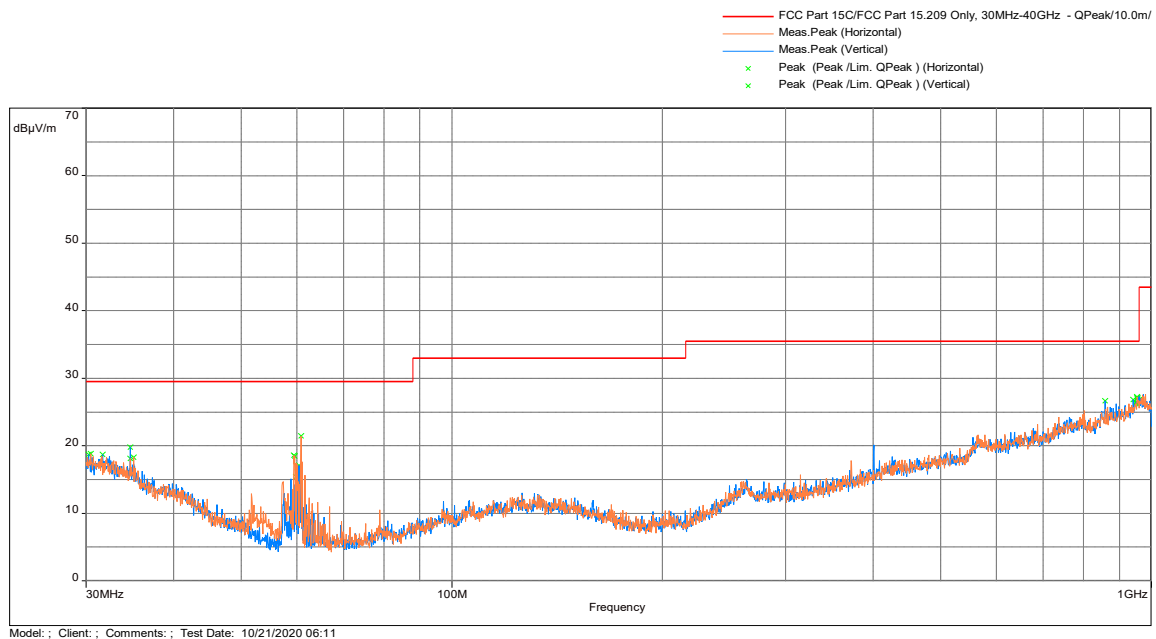
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2440MHz; Battery Mode

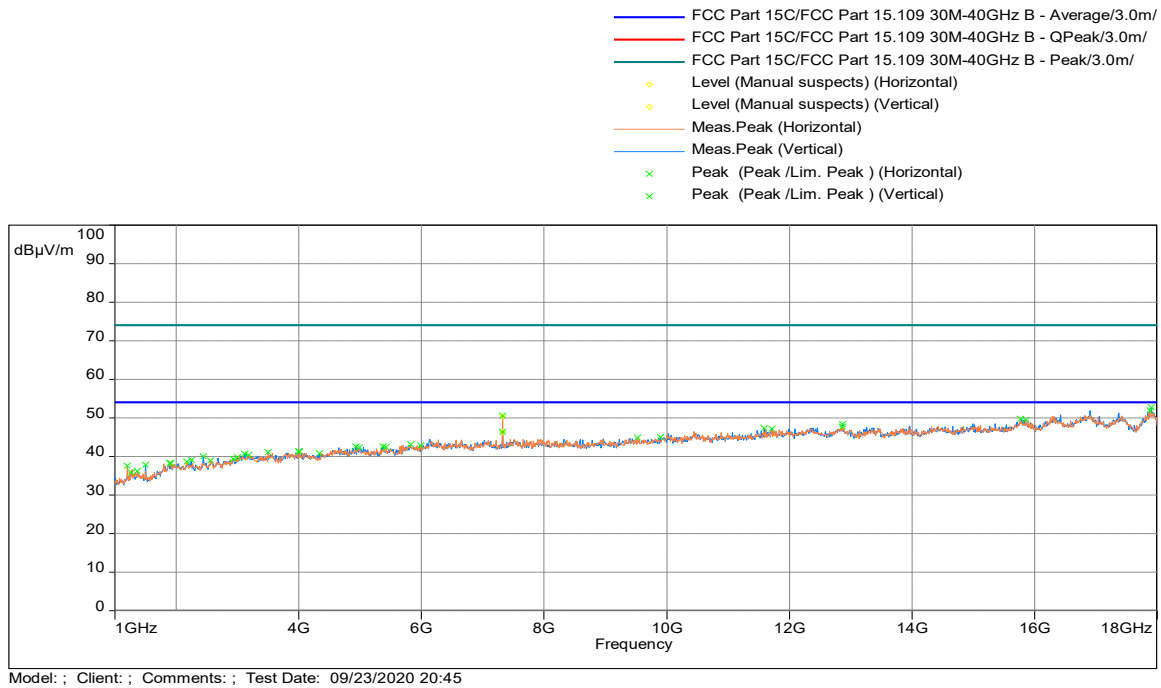
Radiated Spurious Emissions 9kHz - 30 MHz



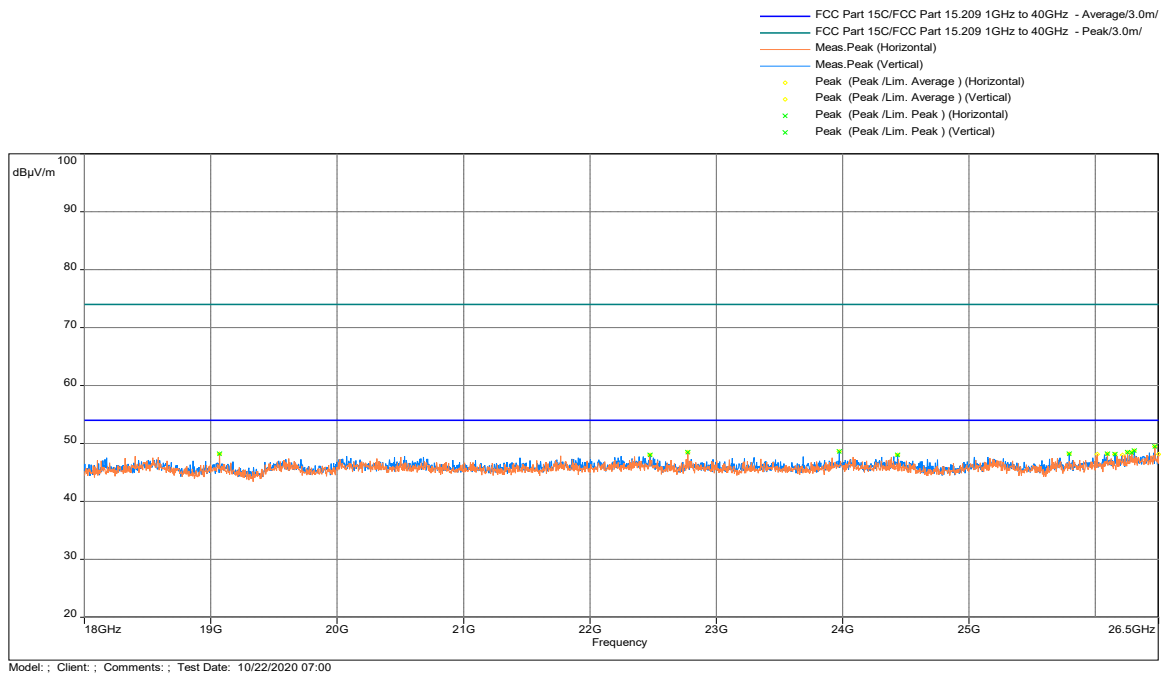
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2440MHz; Battery Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
4984.233	42.31	54	-11.69	2.52	359	Horizontal	-8.62
7319.467	50.54	69.81 (20dBc Limit)	-19.27	2.52	96	Horizontal	-4.93
9519.833	44.85	54	-9.15	1.52	208	Horizontal	-2.78
4927.000	42.58	54	-11.42	2.48	9	Vertical	-8.69
7318.900	46.43	69.81 (20dBc Limit)	-23.38	3.48	314	Vertical	-4.93
9897.233	44.94	54	-9.06	1.51	1	Vertical	-2.32

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

Note: FS = RA + Correction

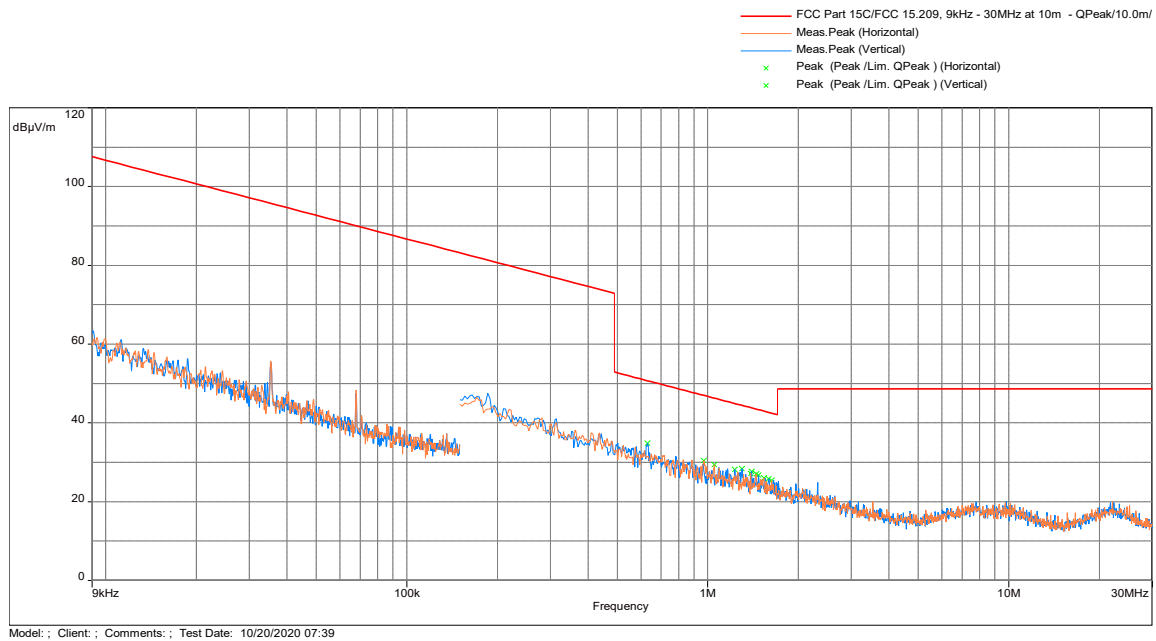
Correction = AF + CF – Preamp

Results	Complies
----------------	-----------------

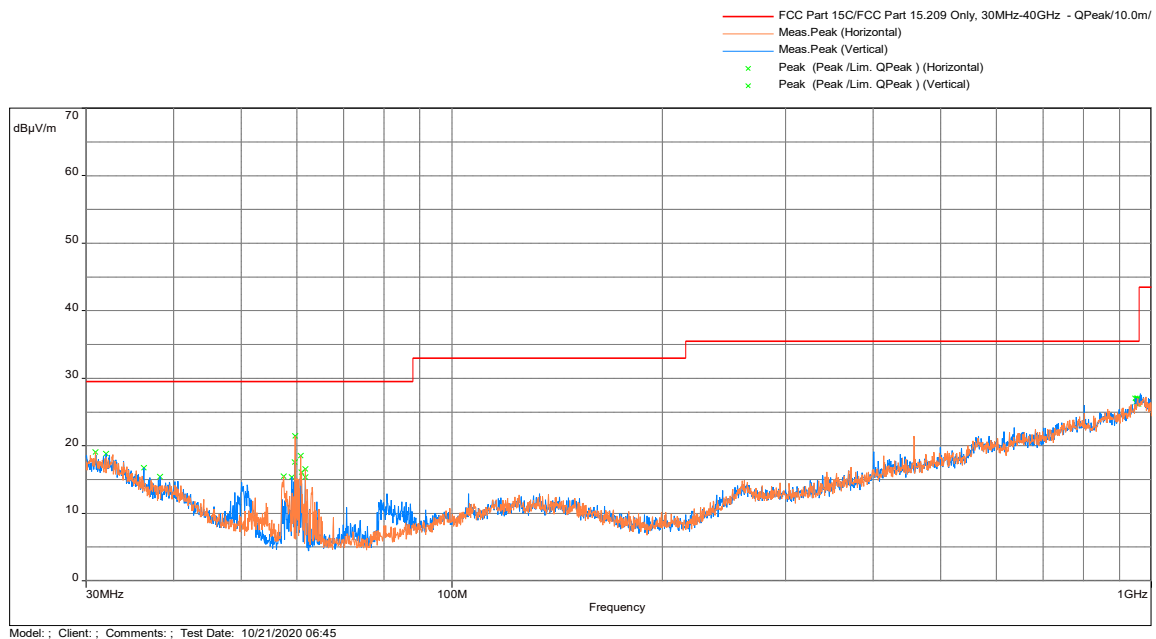
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2480MHz; Battery Mode

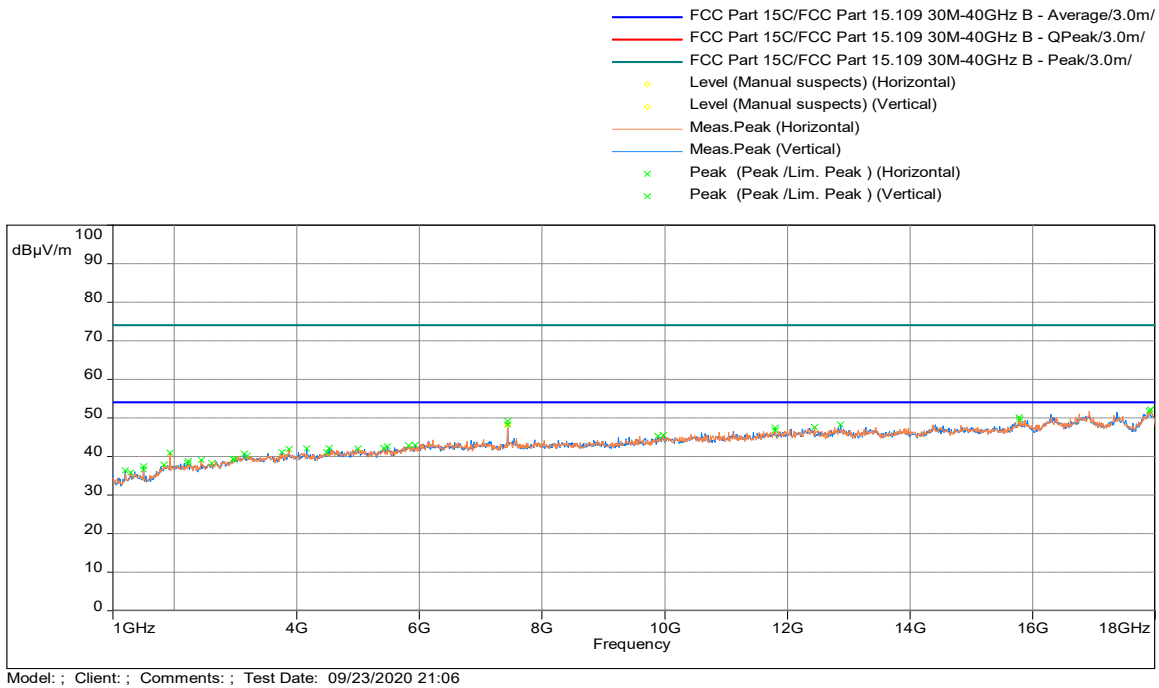
Radiated Spurious Emissions 9kHz - 30 MHz



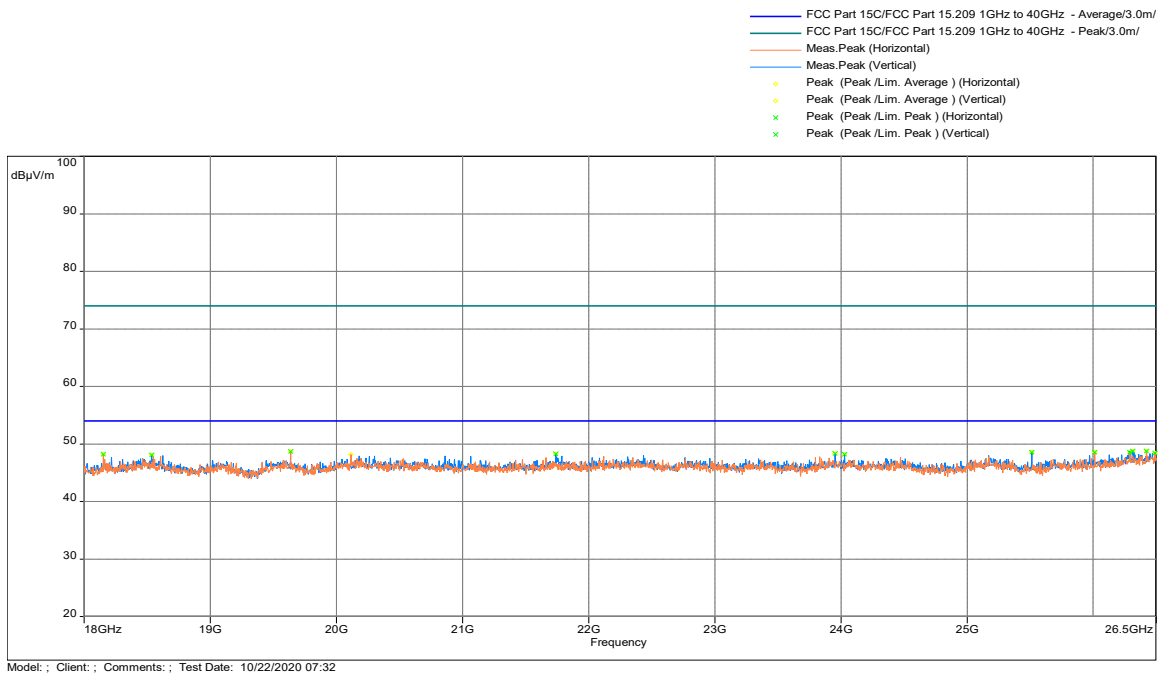
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2480MHz; Battery Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
4997.833	42.09	54	-11.91	1.51	64	Horizontal	-8.6
7439.033	48.27	69.81 (20dBc Limit)	-21.54	2.48	223	Horizontal	-4.59
9975.433	45.52	54	-8.48	2.48	0	Horizontal	-2.25
4522.400	42.21	54	-11.79	2.51	281	Vertical	-8.88
7440.167	49.21	69.81 (20dBc Limit)	-20.60	2.51	315	Vertical	-4.59
9884.767	45.32	54	-8.68	1.52	204	Vertical	-2.34

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

Note: FS = RA + Correction

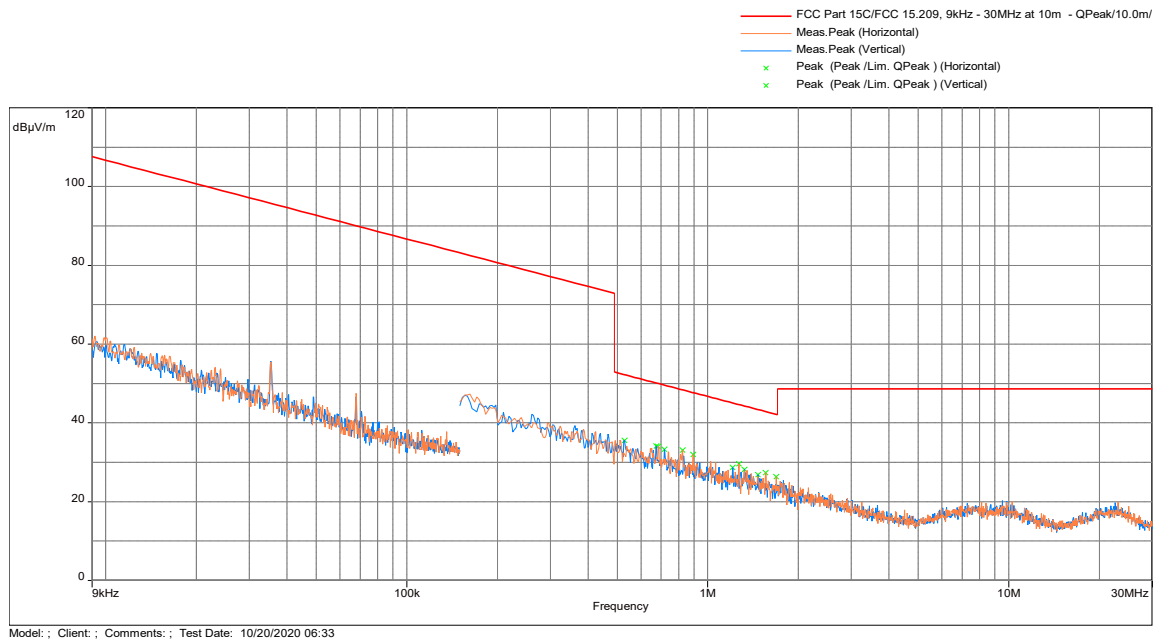
Correction = AF + CF – Preamp

Results	Complies
----------------	-----------------

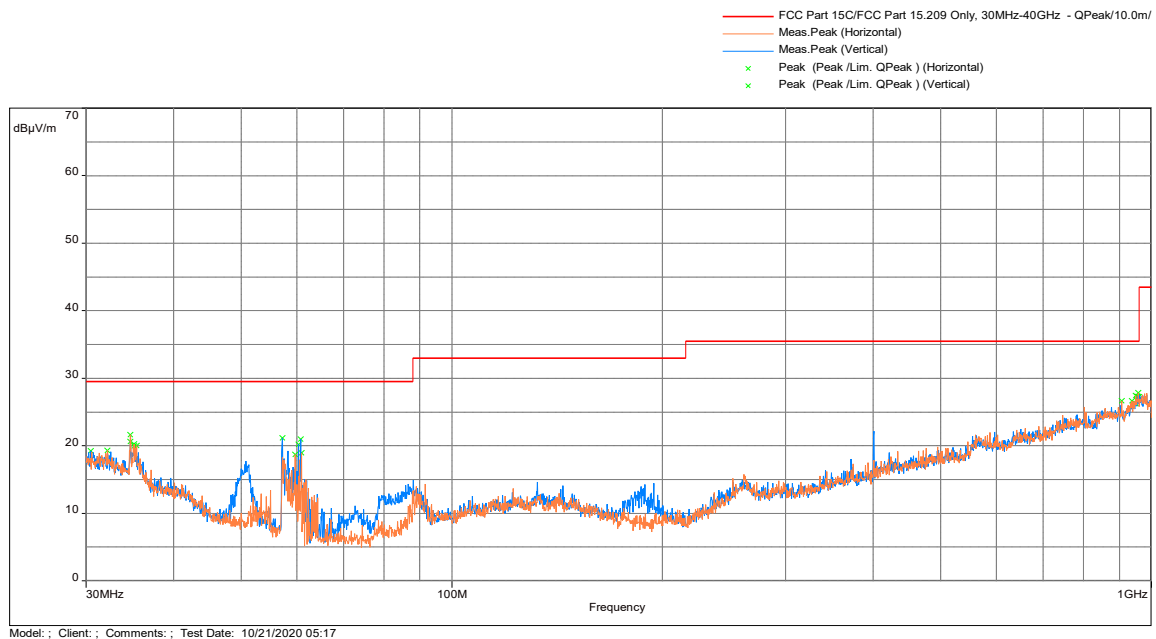
Out-of-Band Radiated Spurious Emissions

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2402MHz; Charging Mode

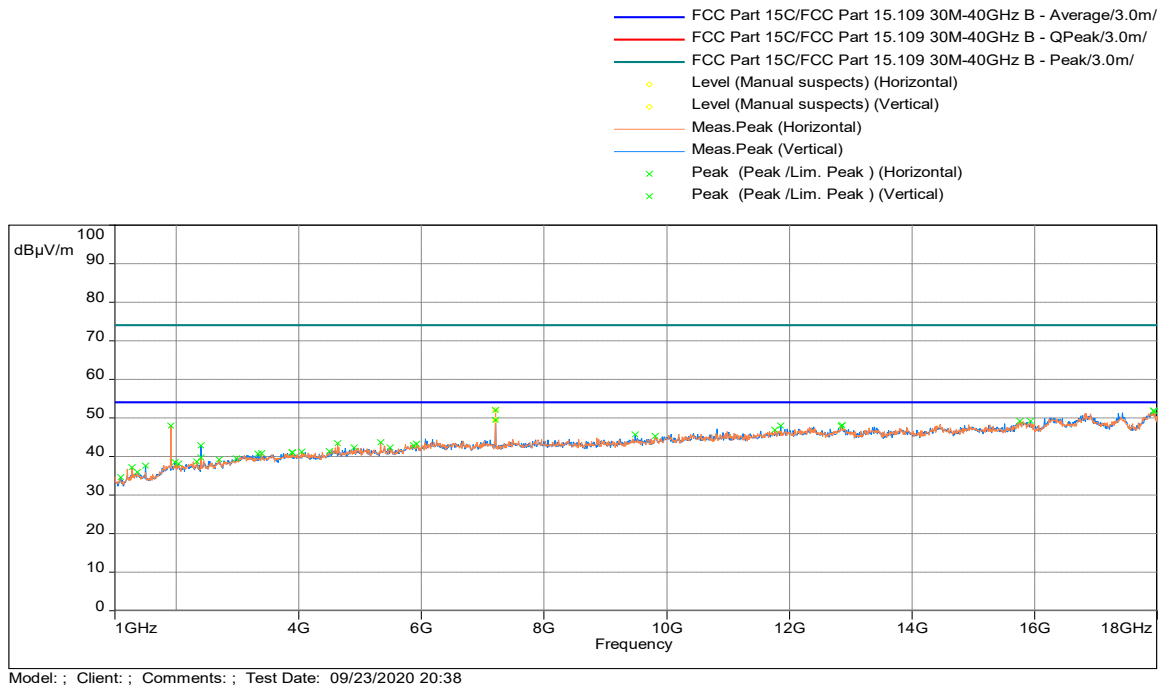
Radiated Spurious Emissions 9kHz - 30 MHz



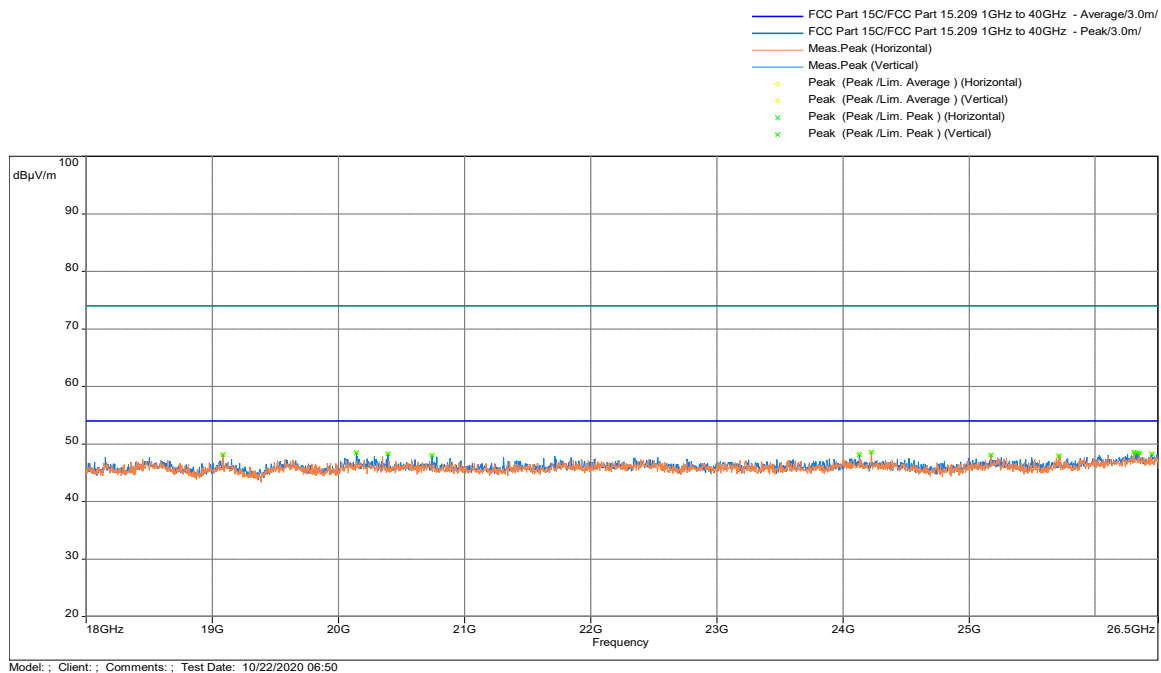
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2402MHz; Charging Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
1908.933	47.96	54	-6.04	2.52	151	Horizontal	-16.25
7205.567	52.08	69.81 (20dBc Limit)	-1.92	2.52	29	Horizontal	-4.81
9812.800	45.31	54	-8.69	2.52	295	Horizontal	-2.38
4900.933	42.24	54	-11.76	1.51	30	Vertical	-8.73
7206.700	49.48	69.81 (20dBc Limit)	-4.52	3.48	349	Vertical	-4.81
9490.367	45.75	54	-8.25	1.51	204	Vertical	-2.79

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

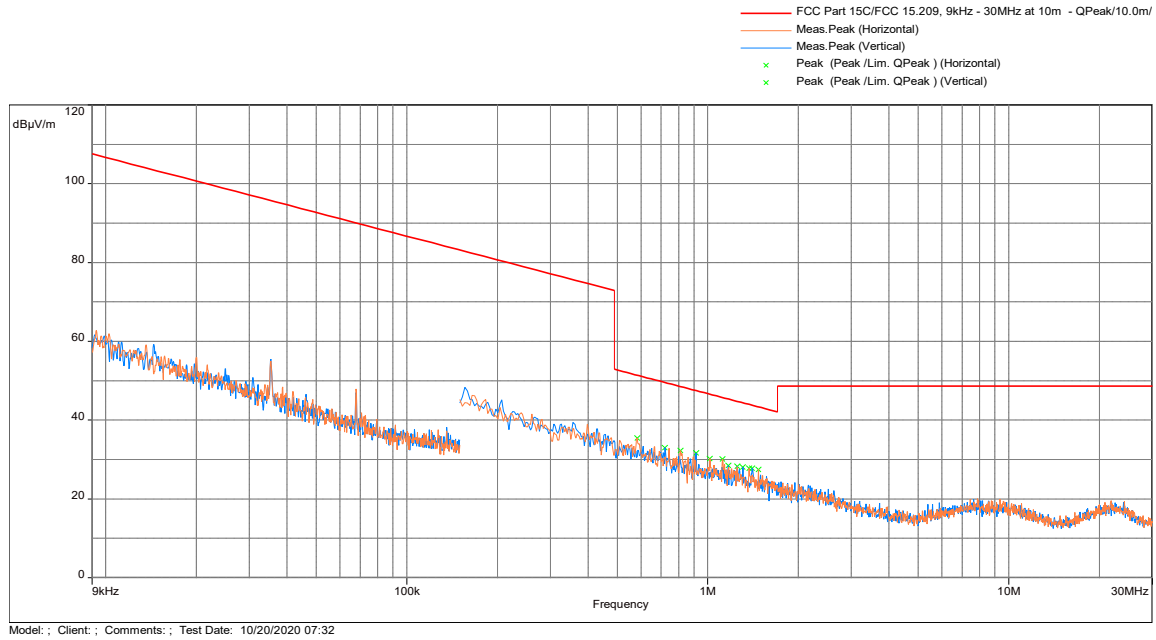
Note: FS = RA + Correction

Correction = AF + CF – Preamp

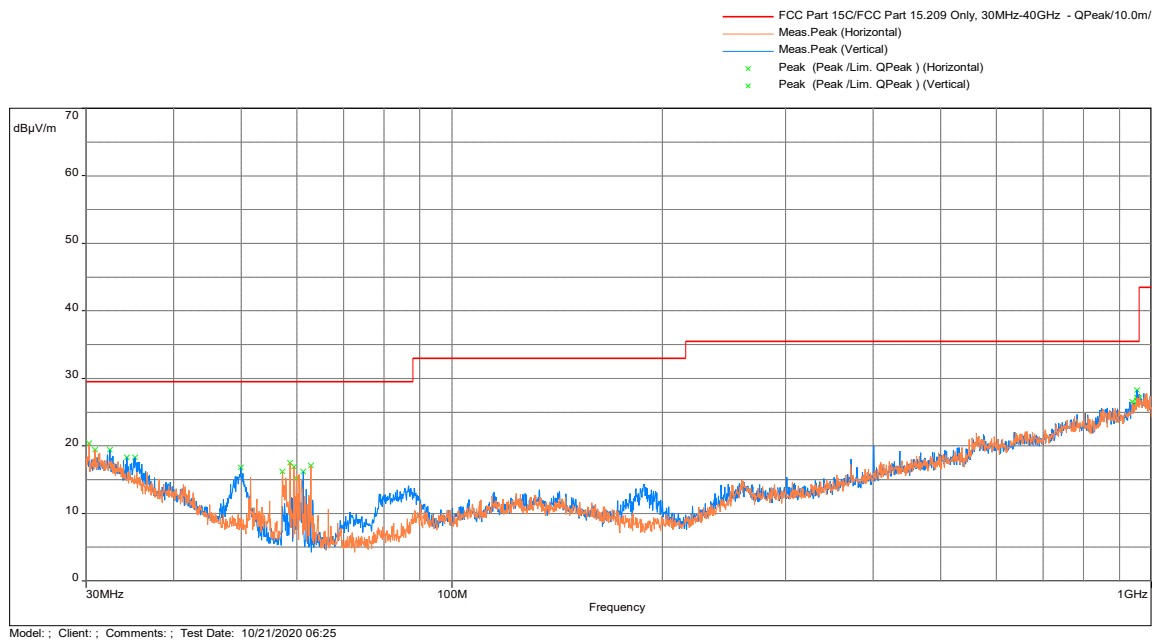
Results	Complies
----------------	-----------------

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2440MHz; Charging Mode

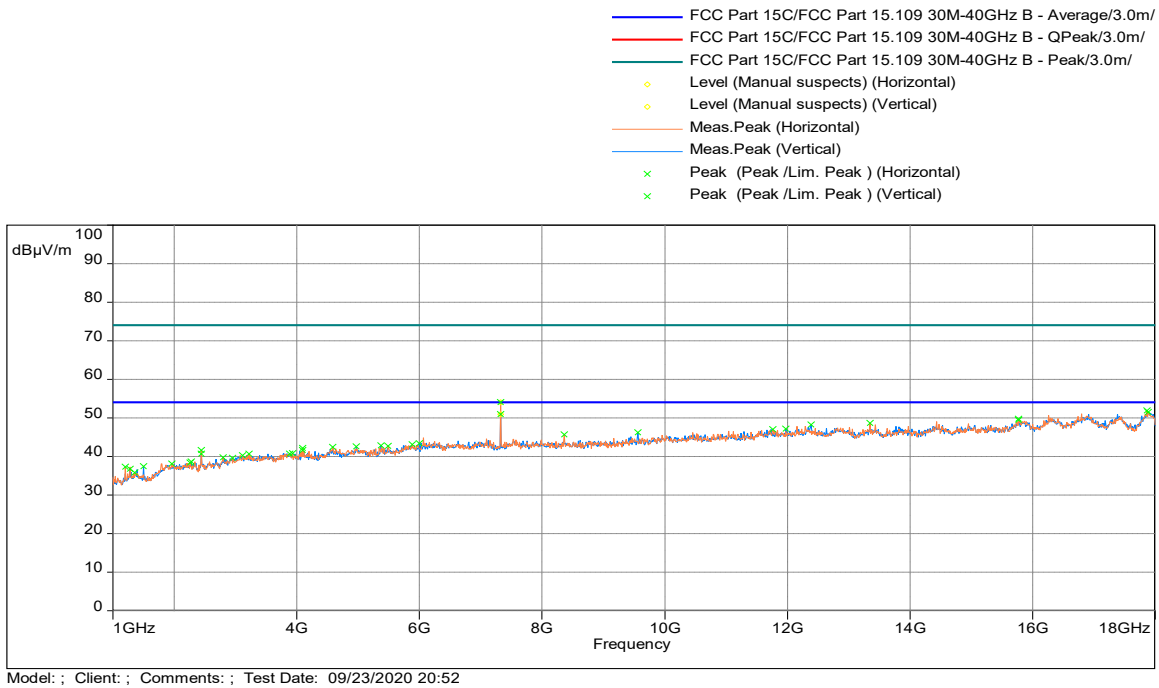
Radiated Spurious Emissions 9kHz - 30 MHz



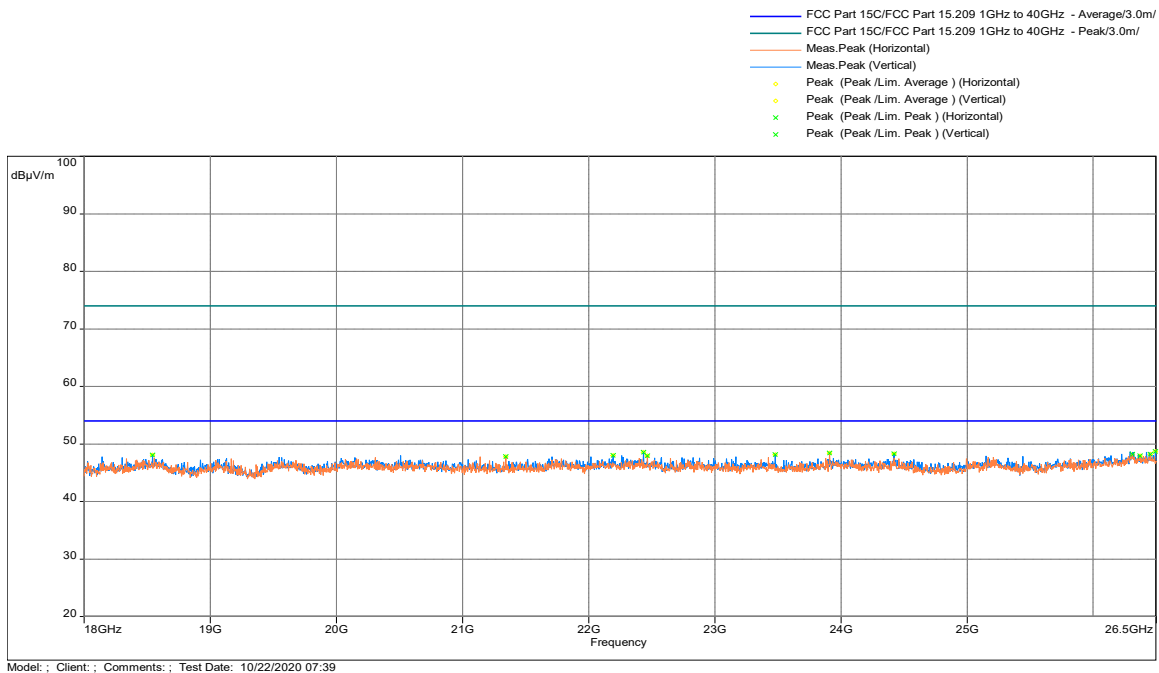
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2440MHz; Charging Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
4581.333	42.49	54	-11.51	2.52	61	Horizontal	-8.52
5879.000	43.15	54	-10.85	2.52	205	Horizontal	-6.31
7320.600	54.06	69.81 (20dBc Limit)	-15.75	2.52	61	Horizontal	-4.92
4968.367	42.57	54	-11.43	1.51	169	Vertical	-8.64
7321.167	50.92	69.81 (20dBc Limit)	-18.89	2.48	136	Vertical	-4.92
9567.433	46.29	54	-7.71	1.51	223	Vertical	-2.73

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

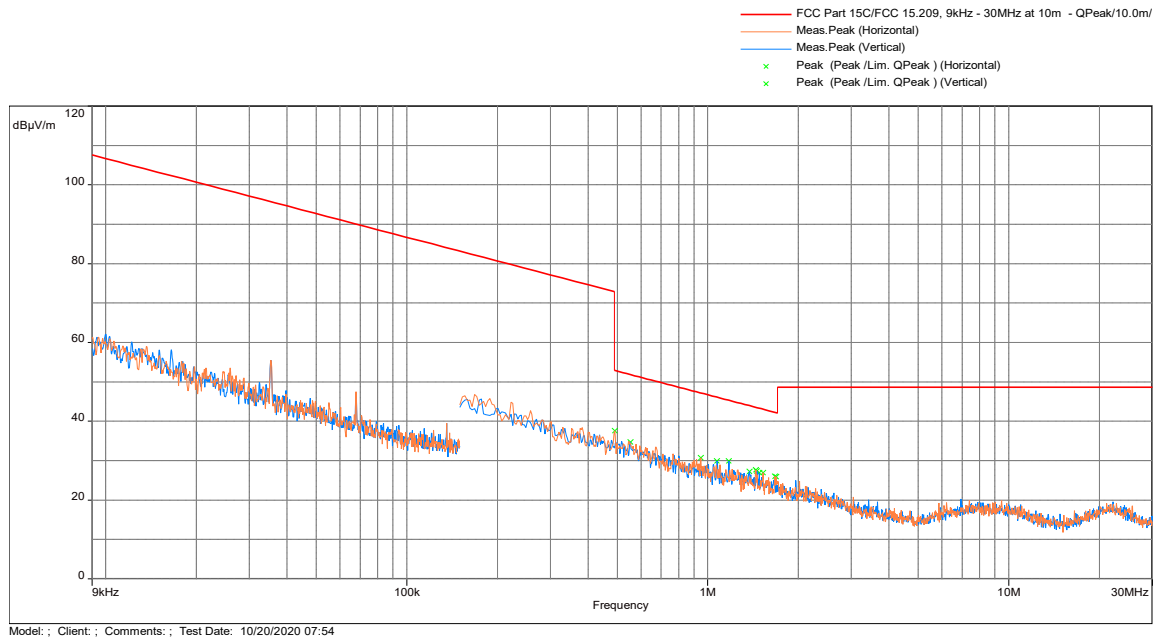
Note: FS = RA + Correction

Correction = AF + CF – Preamp

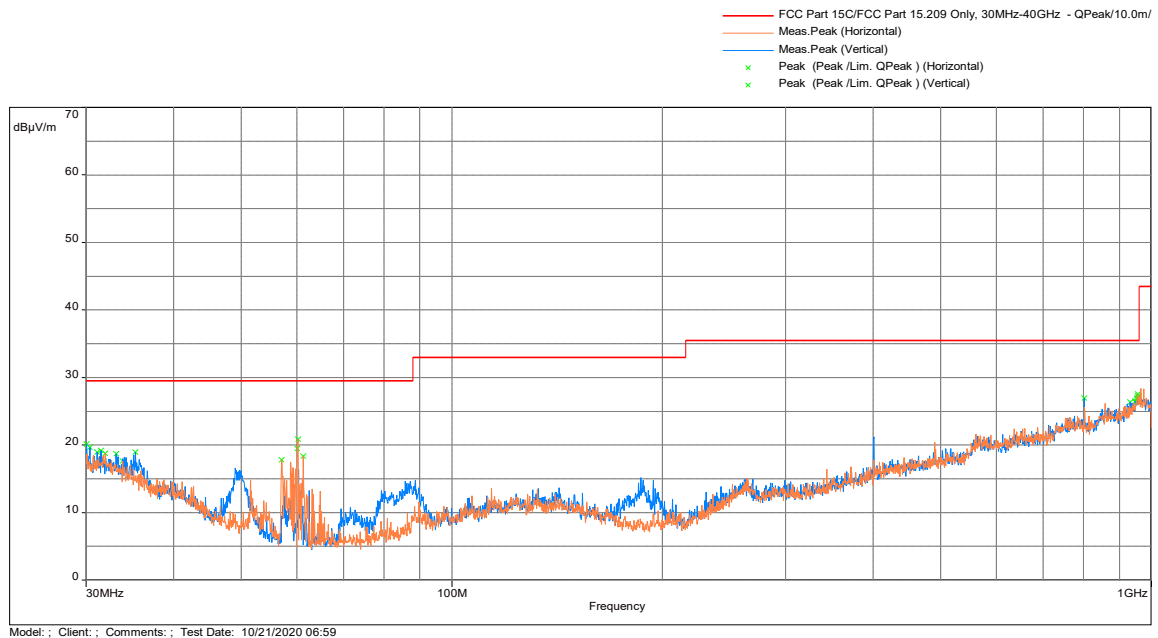
Results	Complies
----------------	-----------------

Test Results: 15.209 Radiated Spurious Emissions, Tx at 2480MHz; Charging Mode

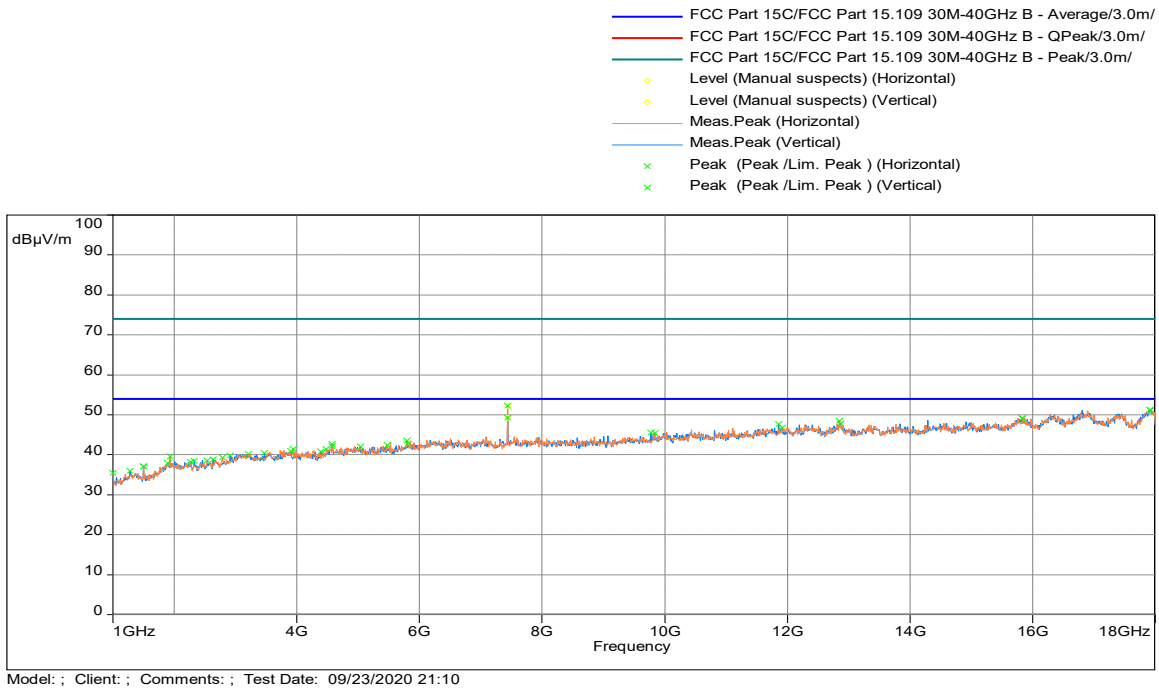
Radiated Spurious Emissions 9kHz - 30 MHz



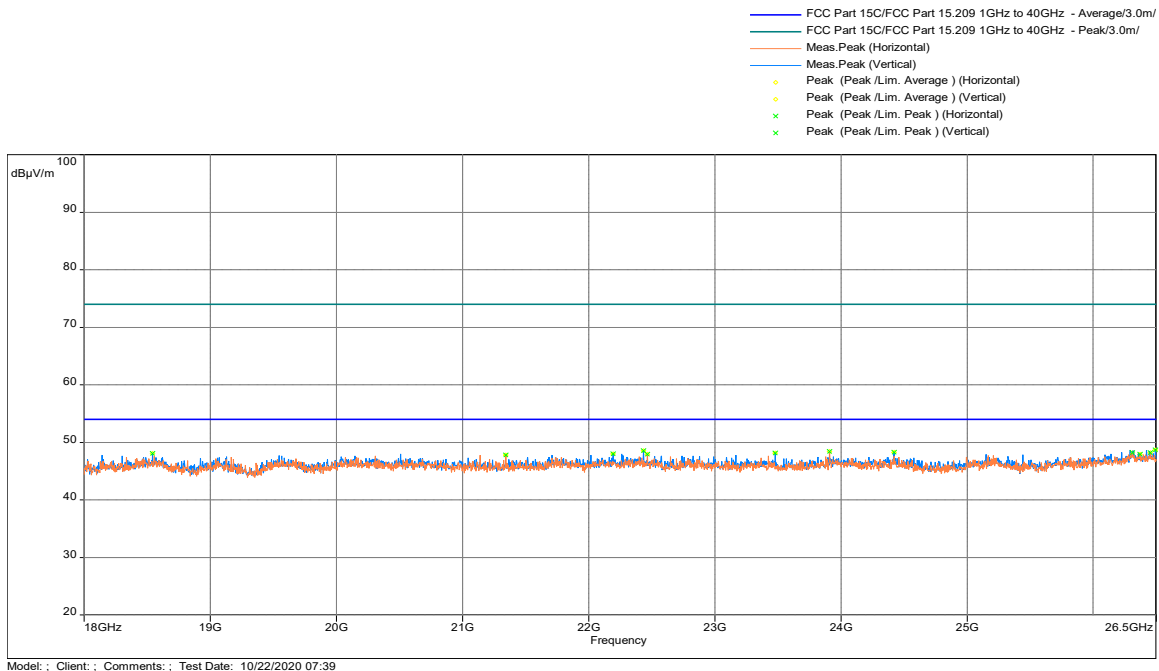
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



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



Test Results: 15.209 Radiated Spurious Emissions, Tx at 2480MHz; Charging Mode

Frequency (MHz)	Peak (dBμV/m)	3m Avg Limit (dBμV/m)	Peak-Lim (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
5799.100	43.51	54	-10.49	2.48	187	Horizontal	-6.27
7440.733	52.29	69.81 (20dBc Limit)	-	2.48	44	Horizontal	-4.59
9842.267	45.39	54	-8.61	2.48	132	Horizontal	-2.39
5814.400	42.77	54	-11.23	2.49	297	Vertical	-6.27
7440.733	49.32	69.81 (20dBc Limit)	-4.68	2.49	244	Vertical	-4.59
9773.700	45.52	54	-8.48	1.52	0	Vertical	-2.36

*Spurious emission frequencies does not fall under the restricted bands of 15.205, therefore the 15.209 limits does not apply to these frequencies.

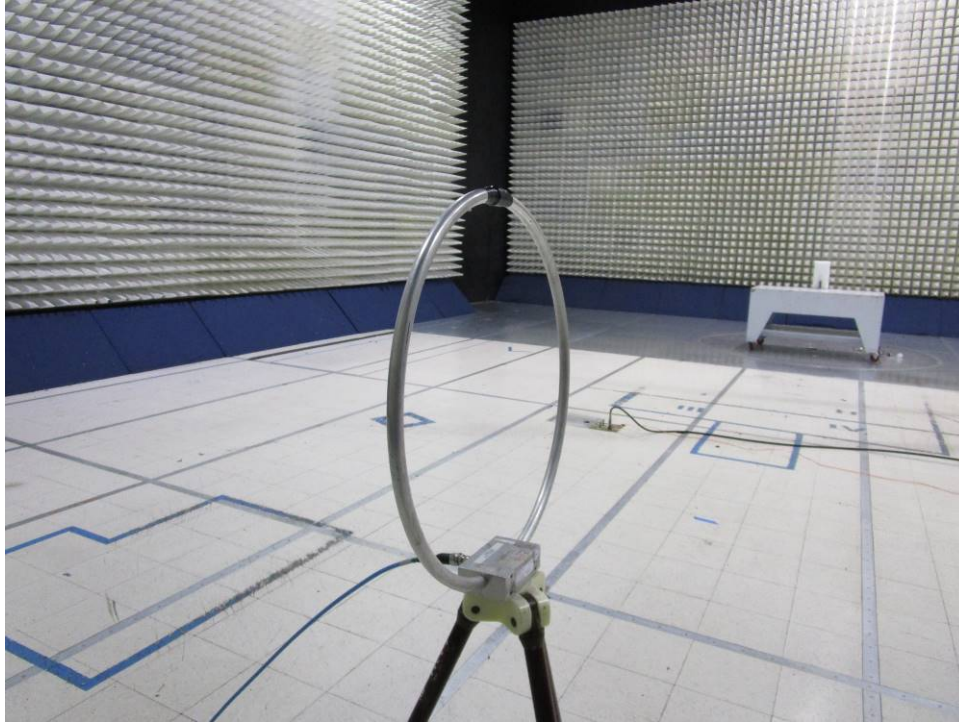
Note: FS = RA + Correction

Correction = AF + CF – Preamp

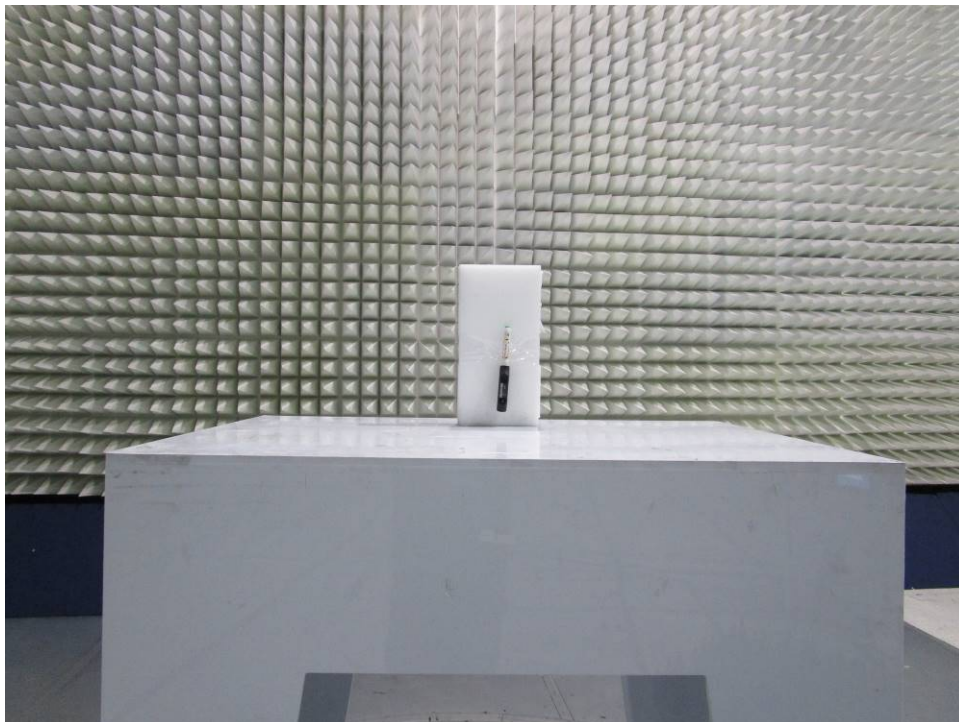
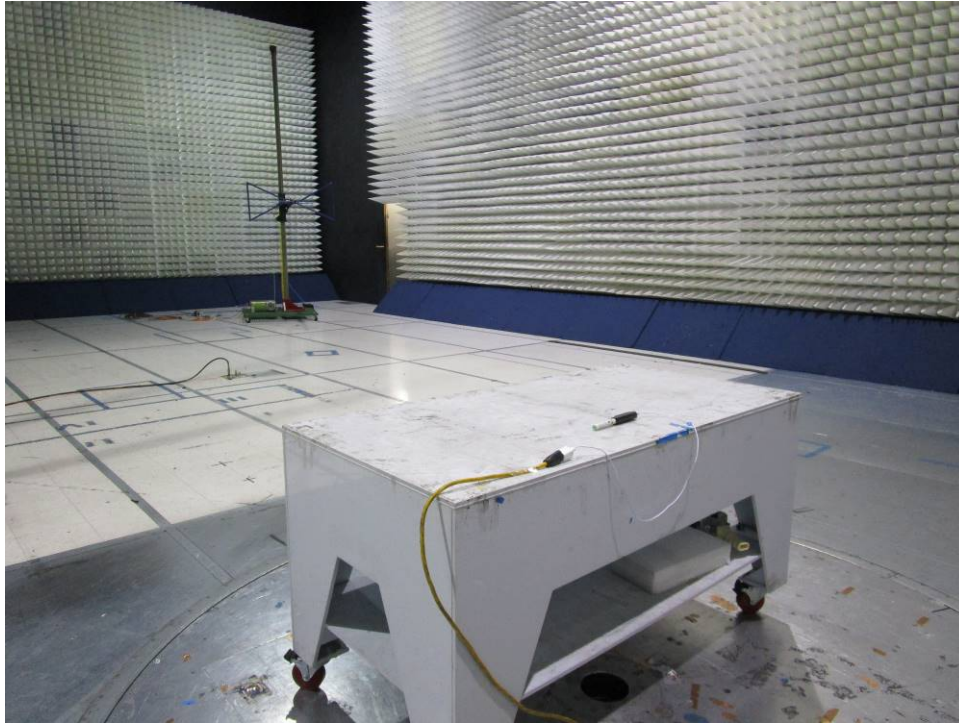
Results	Complies
----------------	-----------------

4.5.5 Test Setup Configuration

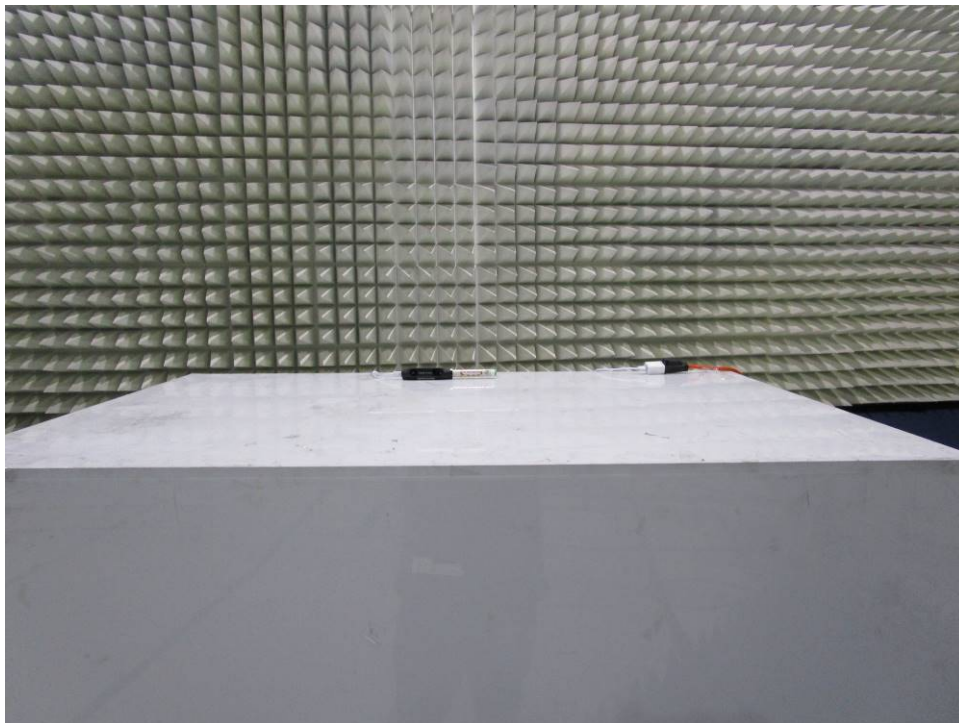
The following photographs show the testing configurations used.



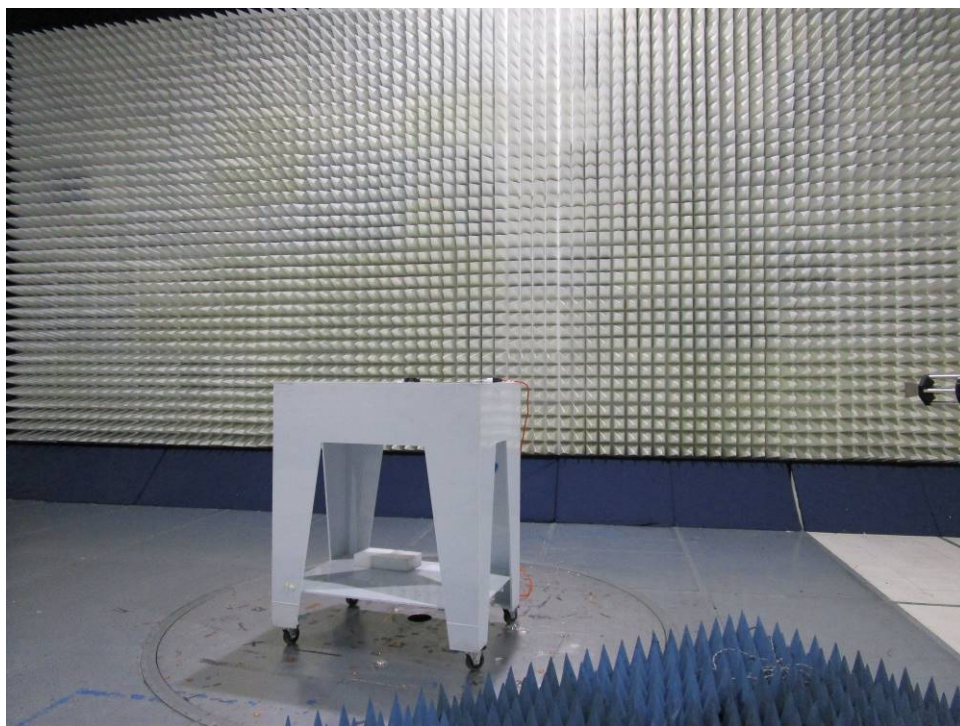
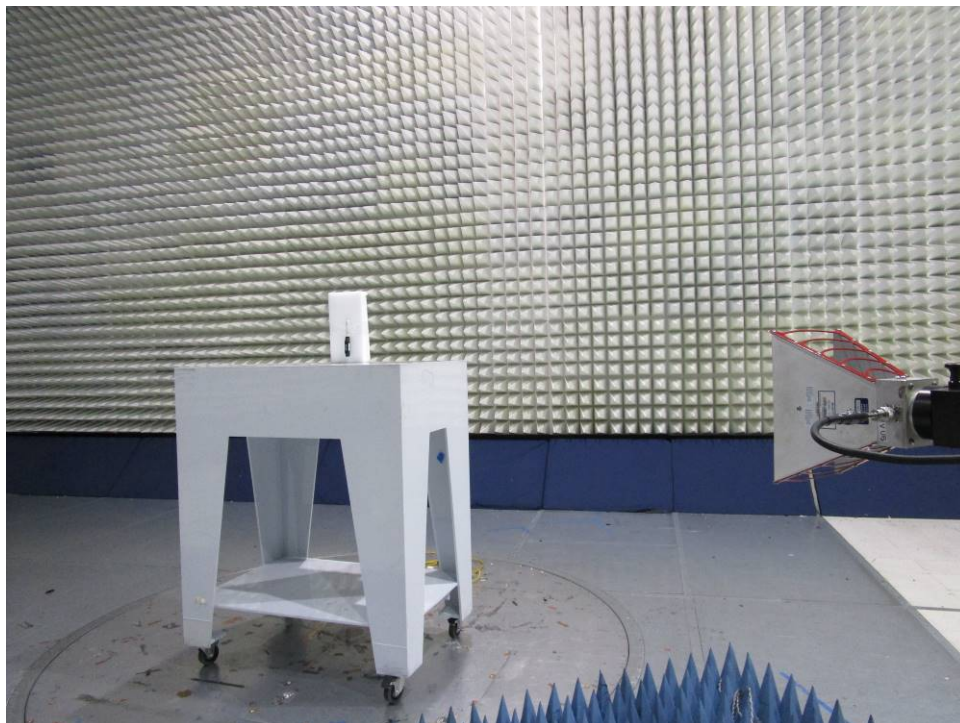
4.5.5 Test Setup Configuration (Continued)



4.5.5 Test Setup Configuration (Continued)



4.5.5 Test Setup Configuration (Continued)



4.6 AC Line Conducted Emission FCC: 15.207; RSS-GEN;

4.6.1 Requirement

Frequency Band MHz	Class B Limit dB(μ V)		Class A Limit dB(μ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

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

4.6.2 Procedure

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

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

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

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

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

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

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

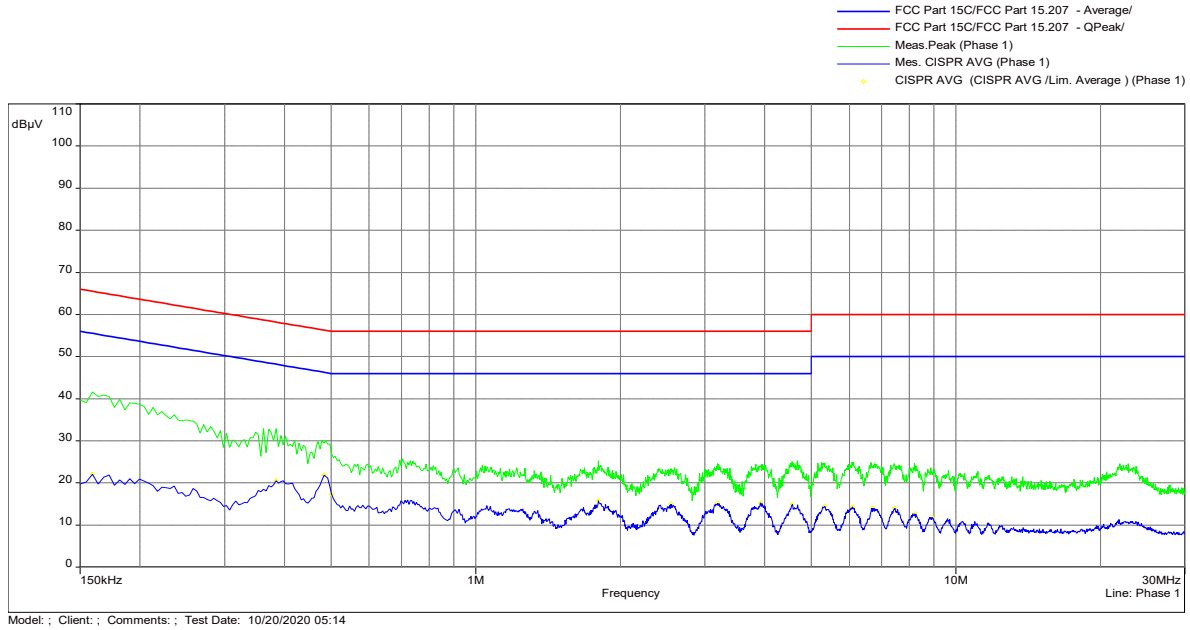
Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.10-2013.

Tested By	Test Date	Results
Anderson Sounghpanya	October 20, 2020	Complies

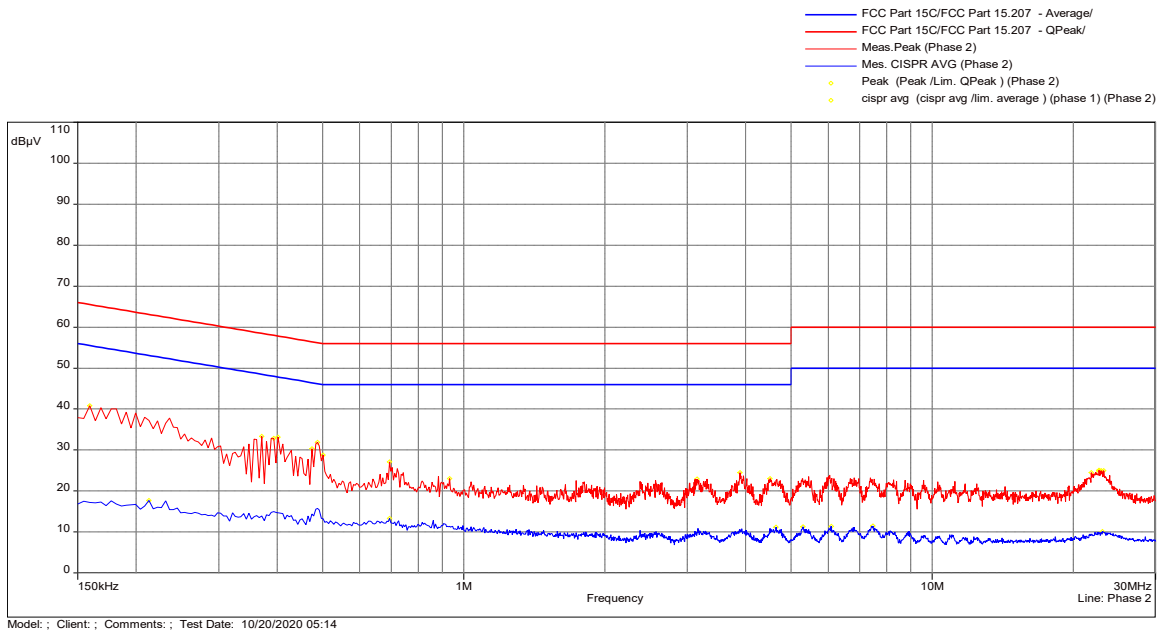
4.6.3 Test Result

15.207, 120VAC 60Hz with BLE Transmitter On

Phase 1



Phase 2



Quasi Peak Table

Frequency (MHz)	Peak (dBμV)	Lim. QPeak (dBμV)	Peak-Lim (dB)	Comment	Correction (dB)
0.159	40.83	65.52	-24.68	Phase 2	11.82
0.159	41.57	65.52	-23.95	Phase 1	11.77
0.362	32.92	58.69	-25.78	Phase 1	11.04
0.371	33.35	58.49	-25.14	Phase 2	11.04
0.384	32.95	58.19	-25.25	Phase 1	11.01
0.393	32.89	58.00	-25.11	Phase 2	11.02
0.402	33.10	57.81	-24.71	Phase 2	11.02
0.474	30.35	56.44	-26.09	Phase 2	10.97
0.479	30.08	56.37	-26.29	Phase 1	10.96
0.488	31.87	56.21	-24.34	Phase 2	10.96
0.501	26.92	56.00	-29.08	Phase 1	10.95
0.501	28.81	56.00	-27.19	Phase 2	10.95
0.695	27.16	56.00	-28.84	Phase 2	10.95
0.704	25.77	56.00	-30.23	Phase 1	10.94
0.933	23.06	56.00	-32.94	Phase 2	10.90
1.802	25.29	56.00	-30.71	Phase 1	10.87
3.147	22.93	56.00	-33.07	Phase 2	10.96
3.188	24.57	56.00	-31.43	Phase 1	10.95
3.831	24.47	56.00	-31.53	Phase 1	11.00
3.890	24.52	56.00	-31.48	Phase 2	11.01
4.511	23.01	56.00	-32.99	Phase 2	11.01
4.682	25.24	56.00	-30.76	Phase 1	11.01
5.253	24.85	60.00	-35.15	Phase 1	11.01
6.117	24.95	60.00	-35.05	Phase 1	11.03
6.662	24.88	60.00	-35.12	Phase 1	11.03
7.445	24.60	60.00	-35.40	Phase 1	11.07
8.201	24.65	60.00	-35.35	Phase 1	11.10
21.885	24.45	60.00	-35.55	Phase 2	11.47
22.709	25.06	60.00	-34.94	Phase 2	11.50
22.718	24.86	60.00	-35.14	Phase 2	11.50
22.848	24.70	60.00	-35.30	Phase 2	11.50
22.866	24.61	60.00	-35.39	Phase 1	11.48
22.952	24.94	60.00	-35.06	Phase 2	11.51
23.222	24.94	60.00	-35.06	Phase 2	11.52

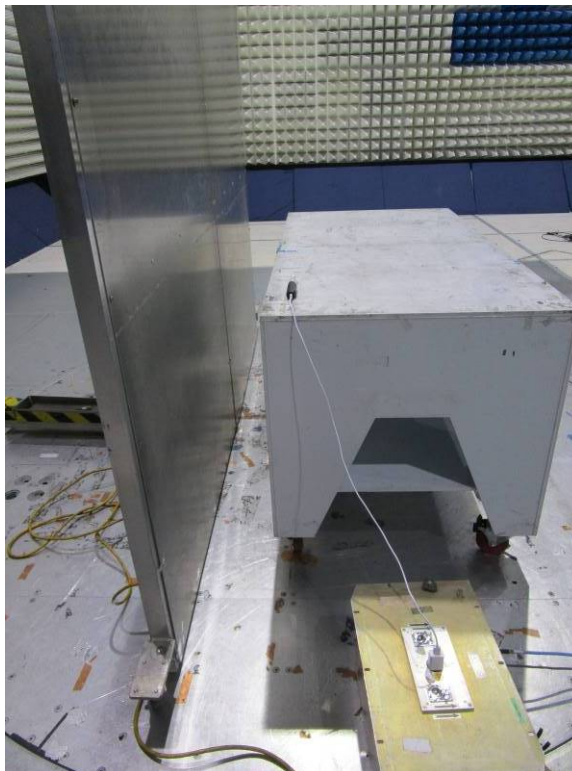
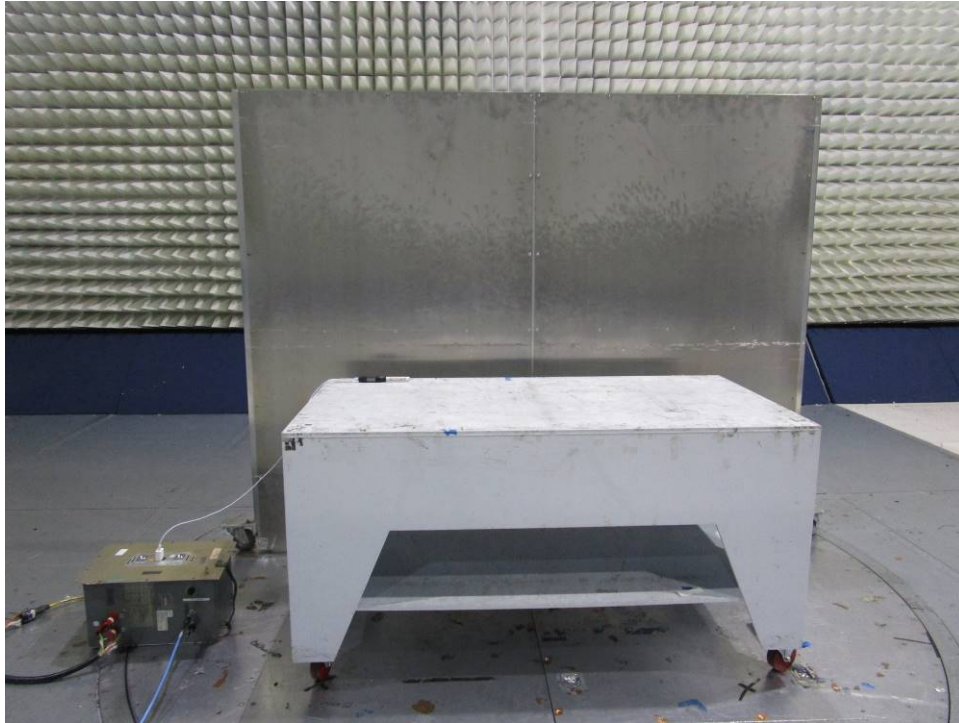
Average Table

Frequency (MHz)	CISPR AVG (dBμV)	Lim. Average (dBμV)	CISPR AVG-Lim (dB)	Comment	Correction (dB)
0.159	22.03	55.52	-33.49	Phase 1	11.77
0.213	17.70	53.09	-35.39	Phase 2	11.41
0.384	20.54	48.19	-27.65	Phase 1	11.01
0.483	21.83	46.29	-24.45	Phase 1	10.96
0.501	17.30	46.00	-28.70	Phase 1	10.95
0.695	13.36	46.00	-32.64	Phase 2	10.95
1.802	15.76	46.00	-30.24	Phase 1	10.87
2.549	15.02	46.00	-30.98	Phase 1	10.91
3.188	15.22	46.00	-30.78	Phase 1	10.95
3.926	15.28	46.00	-30.72	Phase 1	11.01
4.565	14.94	46.00	-31.06	Phase 1	11.01
4.641	11.14	46.00	-34.86	Phase 2	11.01
5.303	11.26	50.00	-38.74	Phase 2	11.01
5.339	14.39	50.00	-35.61	Phase 1	11.01
6.095	11.40	50.00	-38.60	Phase 2	11.03
6.095	14.28	50.00	-35.72	Phase 1	11.03
6.716	14.07	50.00	-35.93	Phase 1	11.03
7.467	14.06	50.00	-35.94	Phase 1	11.07
7.481	11.45	50.00	-38.55	Phase 2	11.07
8.214	12.72	50.00	-37.28	Phase 1	11.10
8.925	11.85	50.00	-38.15	Phase 1	11.08
23.123	10.10	50.00	-39.90	Phase 2	11.52

Results	Complies
----------------	-----------------

4.6.4 Test Configuration Photographs

The following photographs show the testing configurations used.



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	ESR7	ITS 01607	12	10/23/20
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	11/07/20
Spectrum Analyzer	Rohde and Schwarz	ESW44	ITS 01659	12	07/31/21
Pre-Amplifier (18-40GHz)	Miteq	TTA1840-35-S-M	ITS 01393	12	03/02/21
1-18GHz Preamplifier	uComp Nordic	MCN-40-001018002510P	ITS 01817	12	04/16/21
Horn Antenna	ETS-Lindgren	3115	ITS 00982	12	04/21/21
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Loop Antenna	EMCO	6512	ITS 01598	12	10/22/20
BI-Log Antenna	Teseq	CBL611D	ITS 01505	12	03/11/21
Pre-Amplifier	Sonoma Instrument	310N	ITS 01493	12	02/07/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	09/01/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	09/01/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	09/01/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	09/01/21
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/11/21
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01537	12	04/17/21
RF Cable	Mega Phase	TM40-K1K1-19	ITS 01155	12	04/17/21

No Calibration required

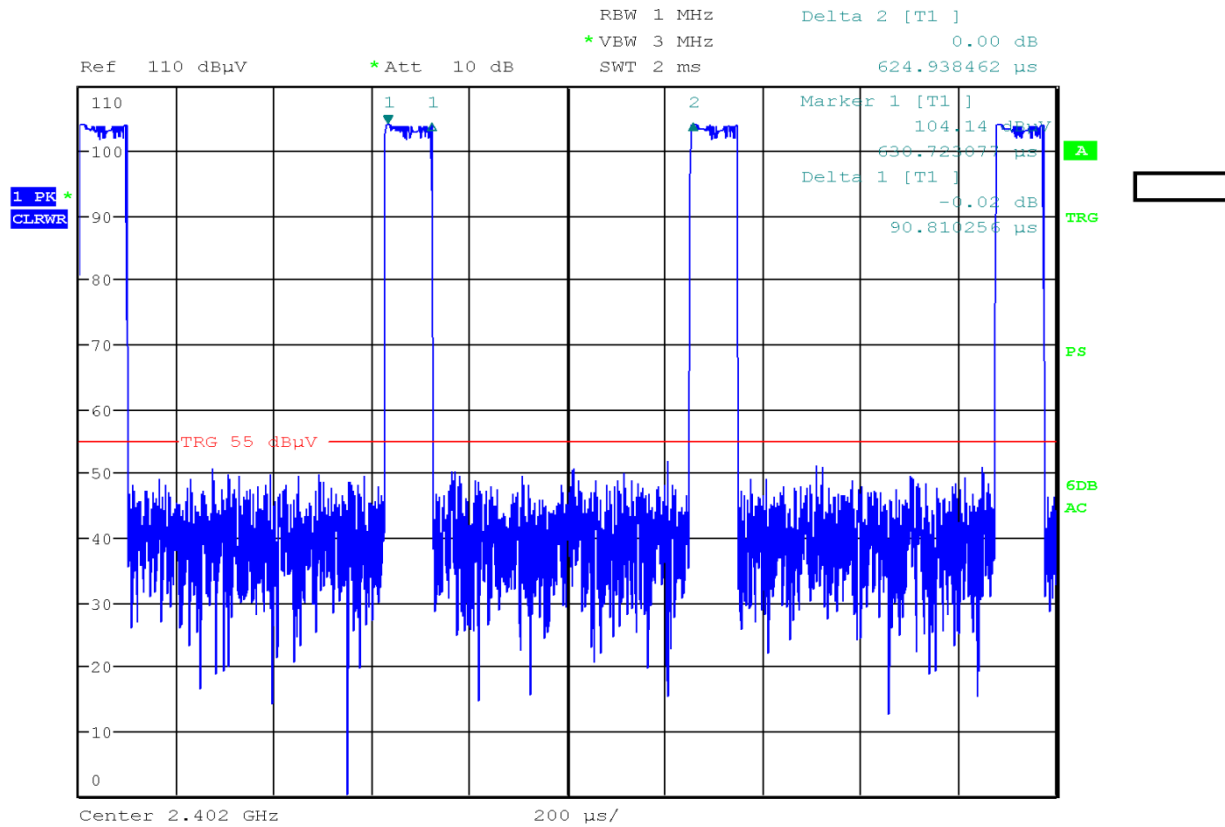
Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.19.1.19	Bigfoot BLE.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 / G104424286	AS	KV	November 20, 2020	Original document

Annex A – Duty Cycle



Date: 23.SEP.2020 18:16:39

Duty Cycle: $DC = 90.8/624.3 = 0.145$ or 14.5%

Duty Cycle Correction Factor δ (dB) = $10 \log (1/0.145) = 8.37$ dB

END OF REPORT