TEST REPORT

Report Number: 104781122MPK-001
Project Number: G104781122
Report Issue Date: November 17, 2021

Testing performed on
MIRROR's Connected Weights
Model Numbers: MCWD1, MCWD3

FCC ID: 2AOSD-MCW1
IC: 23685-MCW1

to

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

For

Curiouser Products, Inc.

Test Performed by:	**Test Authorized by:**
Intertek	Curiouser Products, Inc.
1365 Adams Court	1261 Broadway, Suite 208
Menlo Park, CA 94025 USA	New York, NY 10001 USA

Prepared by: Kenneth Roque **Date:** November 17, 2021
Kenneth Roque

Reviewed by: **Date:** November 17, 2021
Krishna K Vemuri

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Report No. 104781122MPK-001	
Equipment Under Test:	MIRROR's Connected Weights
Model Number:	MCWD1, MCWD3
Applicant:	Curiouser Products, Inc.
Contact:	Brad Augustine
Address:	Curiouser Products, Inc. 1261 Broadway, Suite 208 New York, NY 10001
Country:	USA
Tel. Number:	1 (917) 547-7277
Email:	brad@mirror.co
Applicable Regulation:	FCC Part 15 Subpart C (15.247) ISED RSS-247 Issue 2
Date of Test:	September 13, 2021 to September 27, 2021

We attest to the accuracy of this report:

Kenneth Roque
EMC Project Engineer

Krishna K Vemuri
EMC Manager

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1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
RF Output Power	15.247(b)(3)	RSS-247, 5.4.d)	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.a)	Complies
Power Density	15.247(e)	RSS-247, 5.2.b)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Not Applicable – EUT is battery powered.
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT Receive Date: September 9, 2021

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 13, 2021

Test Completion Date: September 27, 2021

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

2.0 General Information

2.1 Product Description

Curiouser Products. supplied the following description of the EUT:

MIRROR's Connected Weights: The Connected Weights are a variety of weight training equipment produced by MIRROR that track movement and send the data to the Mirror for user feedback.

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

Information about the 2.4 GHz radio is presented below:

Applicant	Curiouser Products, Inc.
Model No.	MCWD1, MCWD3
FCC Identifier	2AOSD-MCW1
IC Identifier	23685-MCW1
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	0.33 dBm
Antenna(s) & Gain	Internal Antenna Gain: 2.67 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Curiouser Products, Inc. 1261 Broadway, Suite 208 New York, NY 10001 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

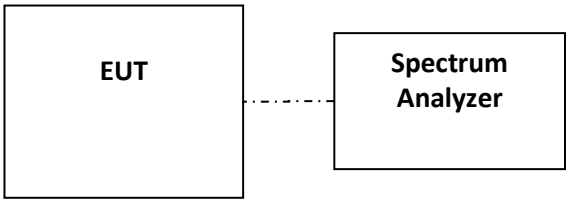
No support equipment was used.

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number**
1 lb Connected Dumbbell (Radiated Sample)	Curiouser Products, Inc.	MCWD1	N/A
3 lb Connected Dumbbell (Radiated Sample)	Curiouser Products, Inc.	MCWD3	N/A
1 lb, 3lb Connected Dumbbell (Conducted Sample) – See Note 1	Curiouser Products, Inc.	MCWD1, MCWD3	N/A

Note 1: For conducted samples, models grouped together contain identical internal PCBs. See Section 3.3 for more details.

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

EUT Photo

1 lb Connected Dumbbell

3 lb Connected Dumbbell

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. The highest clock frequency used in the EUT is 2.48 GHz and the lowest clock frequency used in the EUT is 32.768 kHz.

Per Curiouser Products, Inc., the following MIRROR's Connected Weights models share identical schematics and components of their respective internal PCB: MCWD1, MCWD3, MCWD5, MCWD10, MCWD15, MCWD20, MCWD25, MCWD30, MCWD35, MCWA1, and MCWA2. However, PCB layout sizing are model dependent to accommodate size differences across the weights – only specific models share completely identical PCBs (see table below).

Group of Models That Share Identical PCBs	Models With Individual PCB Sizing
• MCWD1 & MCWD3 • MCWD25, MCWD30, & MCWD35 • MCWA1, & MCWA2	• MCWD5 • MCWD10 • MCWD15 • MCWD20

Conducted Test Data (Sections 4.1, 4.3, 4.4) were borrowed from worst case sample (Model: MCWD5).

Each MIRROR's Connected Weights models were tested for Conducted Output Power and are presented per designated report. All radiated samples were tested for radiated testing.

For more information, see reports below:

Model	Report
MCWD5	104781122MPK-008
MCWD10, MCWD15, MCWD20, MCWD25, MCWD30, & MCWD35	104781122MPK-009
MCWA1, & MCWA2	104781122MPK-010

3.4 Software Exercise Program

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

3.5 Mode of Operation during Test

Mode of operation during the tests was setup by depressing a toggle button on the EUT. During the transmitter tests, the transmitter was setup to transmit maximum communication and RF power levels.

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

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

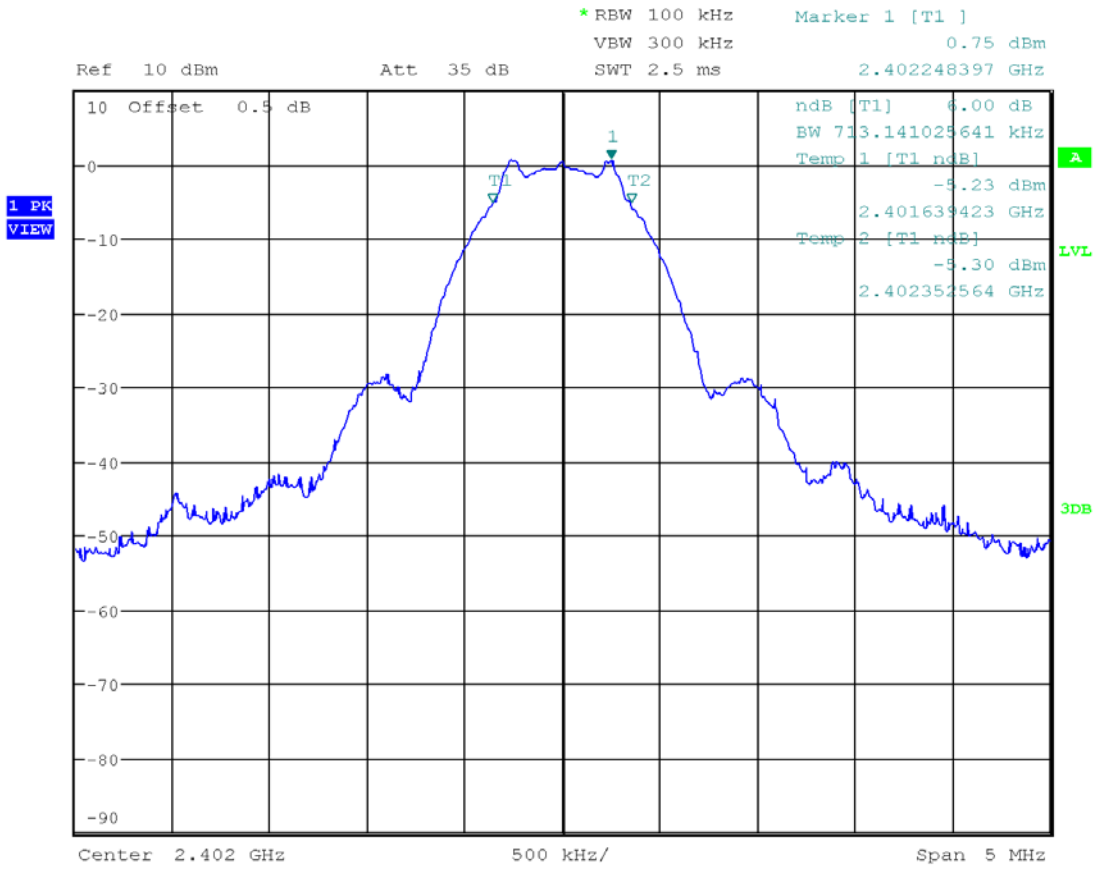
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 (kHz)	Occupied bandwidth, RSS-GEN, (MHz)	Plot
2402	713.141	--	1.1
	--	1.053	1.4
2440	721.154	--	1.2
	--	1.067	1.5
2480	753.205	--	1.3
	--	1.077	1.6

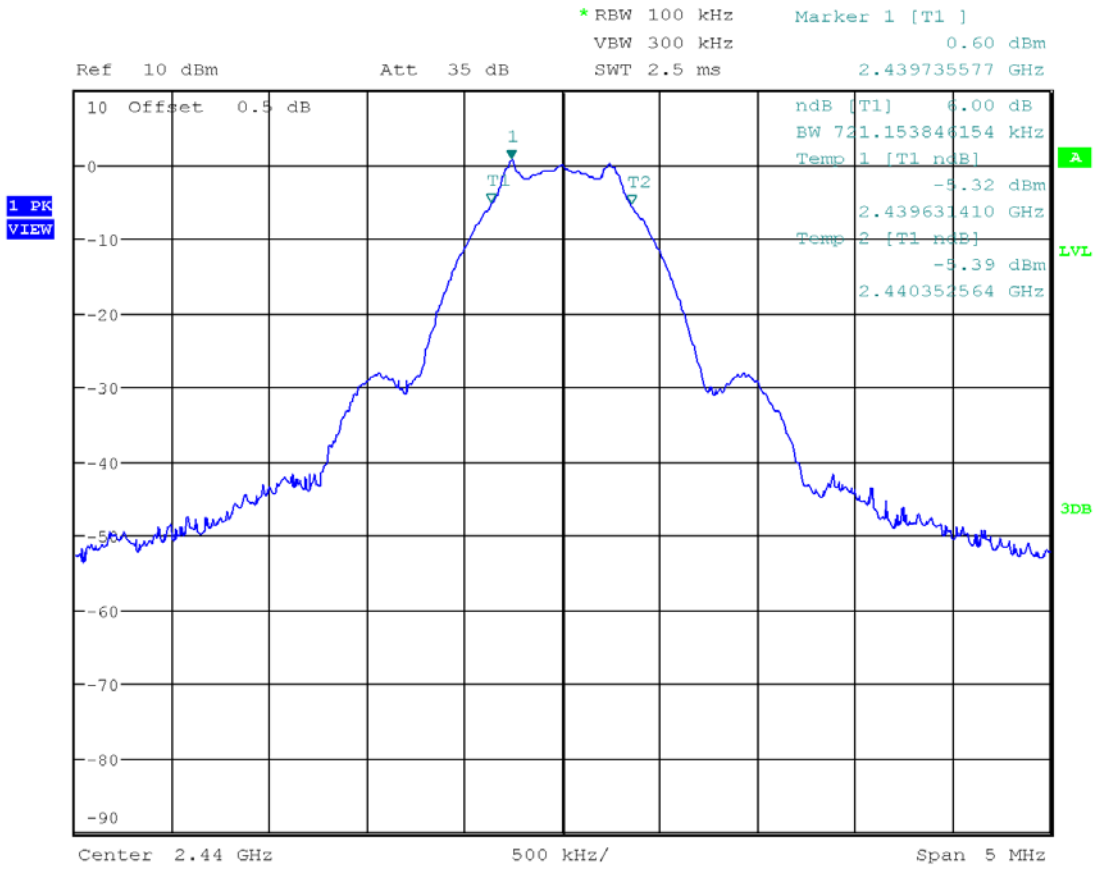
Tested By	Test Date	Results
Kenneth Roque	September 22, 2021	Complies

Plot 1.1



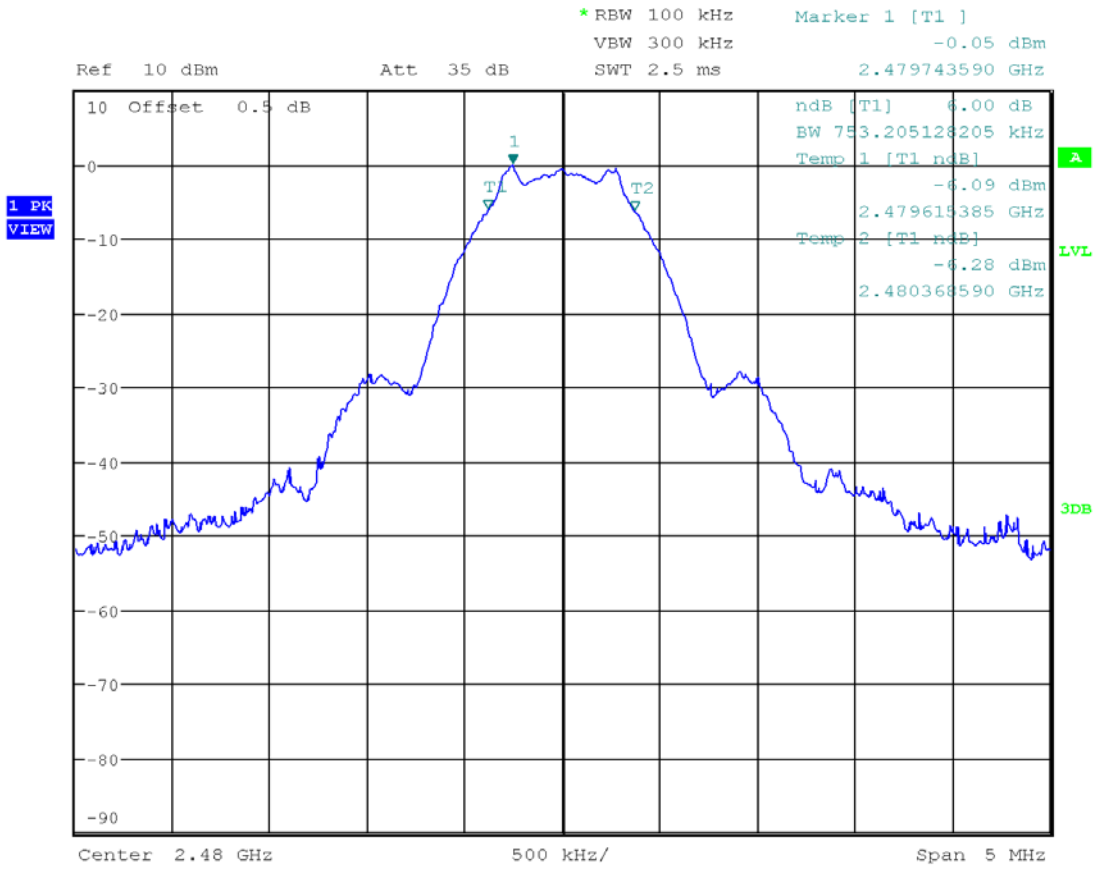
Date: 22.SEP.2021 20:14:37

Plot 1.2



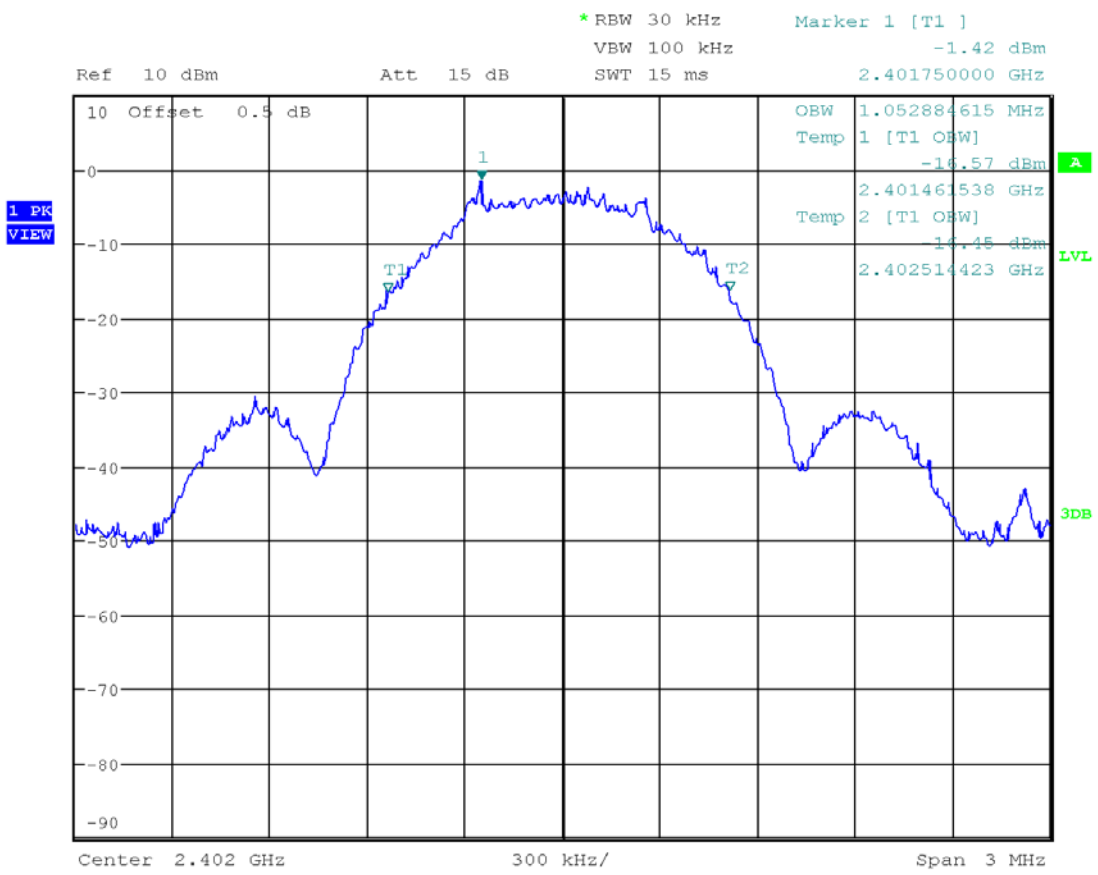
Date: 22.SEP.2021 20:15:54

Plot 1.3



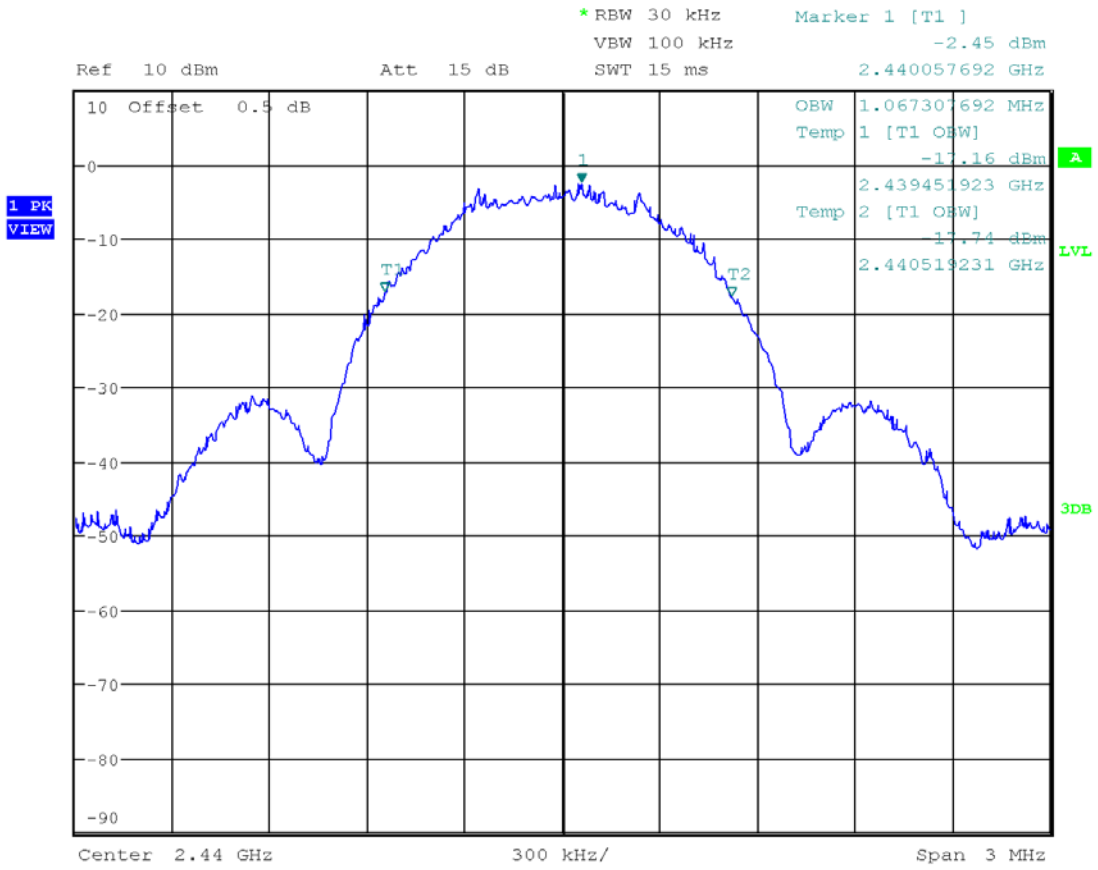
Date: 22.SEP.2021 20:16:58

Plot 1.4



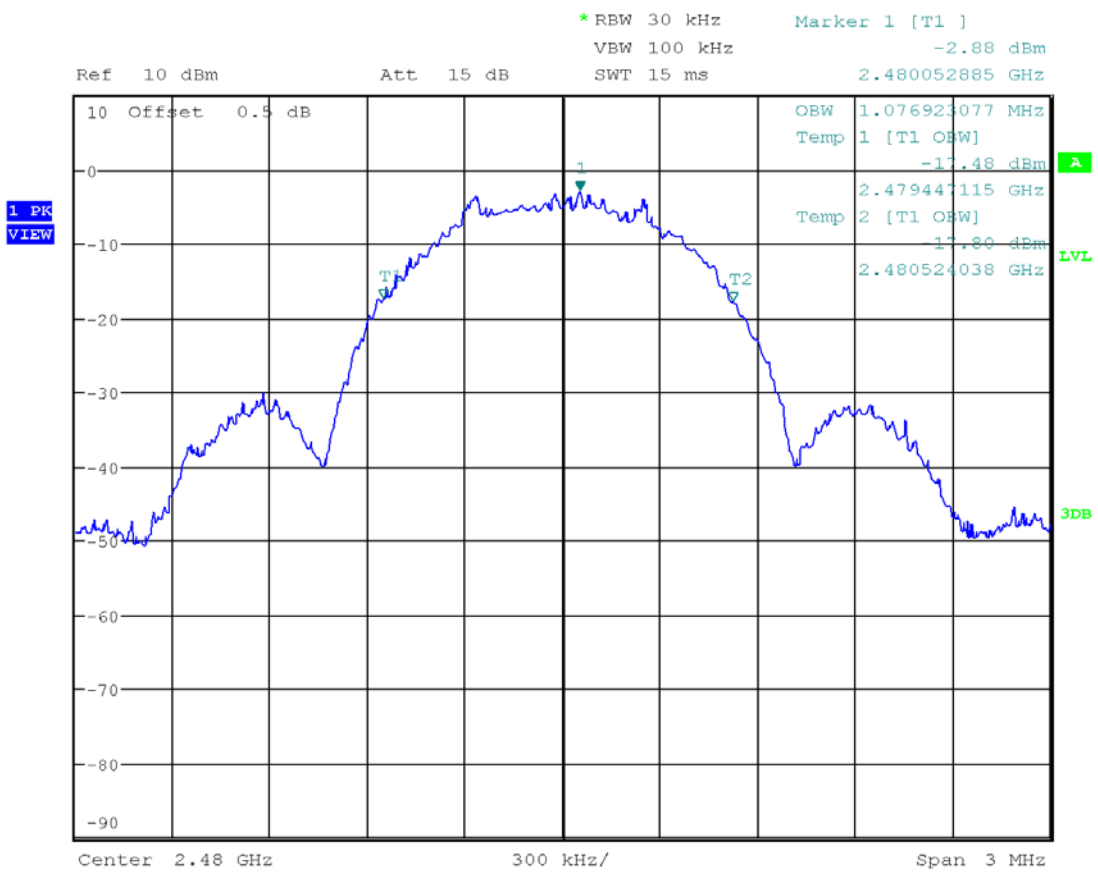
Date: 24.SEP.2021 15:37:42

Plot 1.5



Date: 24.SEP.2021 15:38:42

Plot 1.6



Date: 24.SEP.2021 15:40:04

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 ≥ DTS bandwidth in ANSI 63.10.

1. Set the RBW ≥ DTS Bandwidth
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 3 x 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

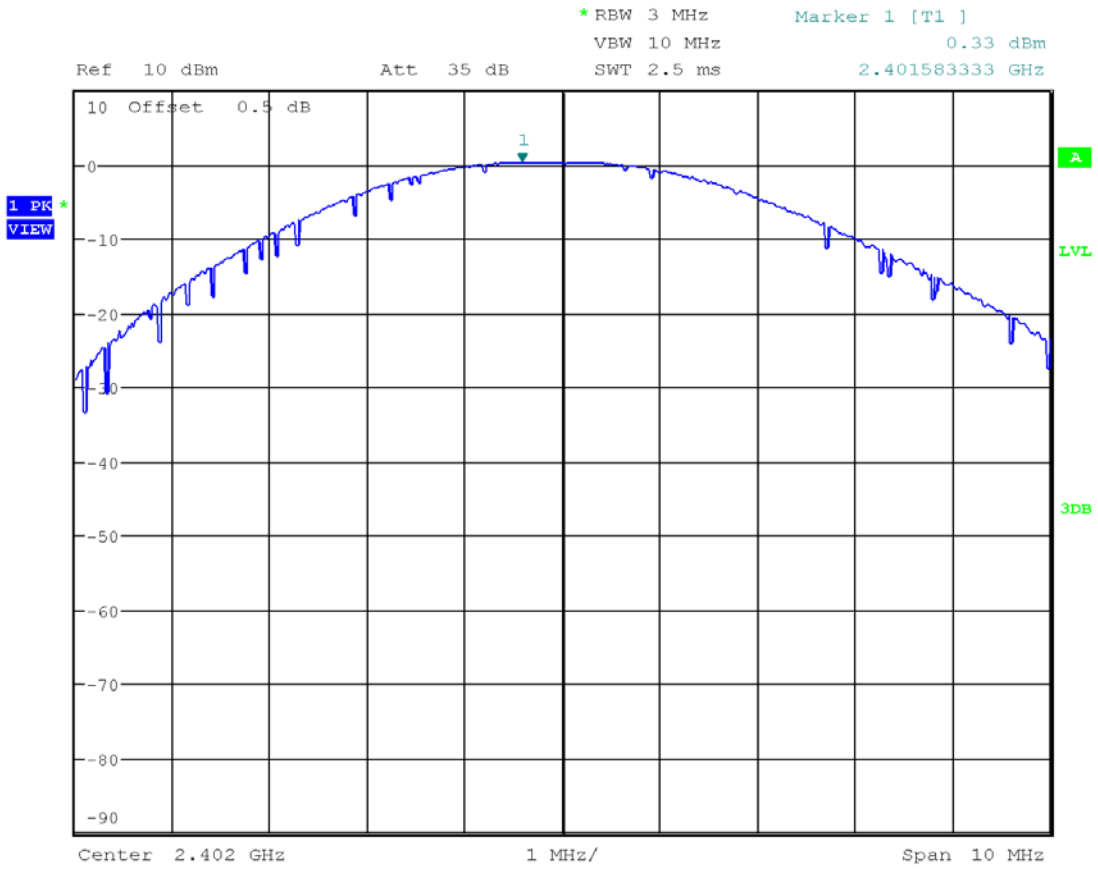
Refer to the following plots 2.1 – 2.3 for the test details.

Model	Frequency	Conducted Power (peak)		Plot
	MHz	dBm	mW	
MCWD1, MCWD3	2402	0.33	1.079	2.1
	2442	0.21	1.050	2.2
	2480	-0.02	0.995	2.3

Note 1: Models grouped together contain identical internal PCBs. See Section 3.3 for more details.

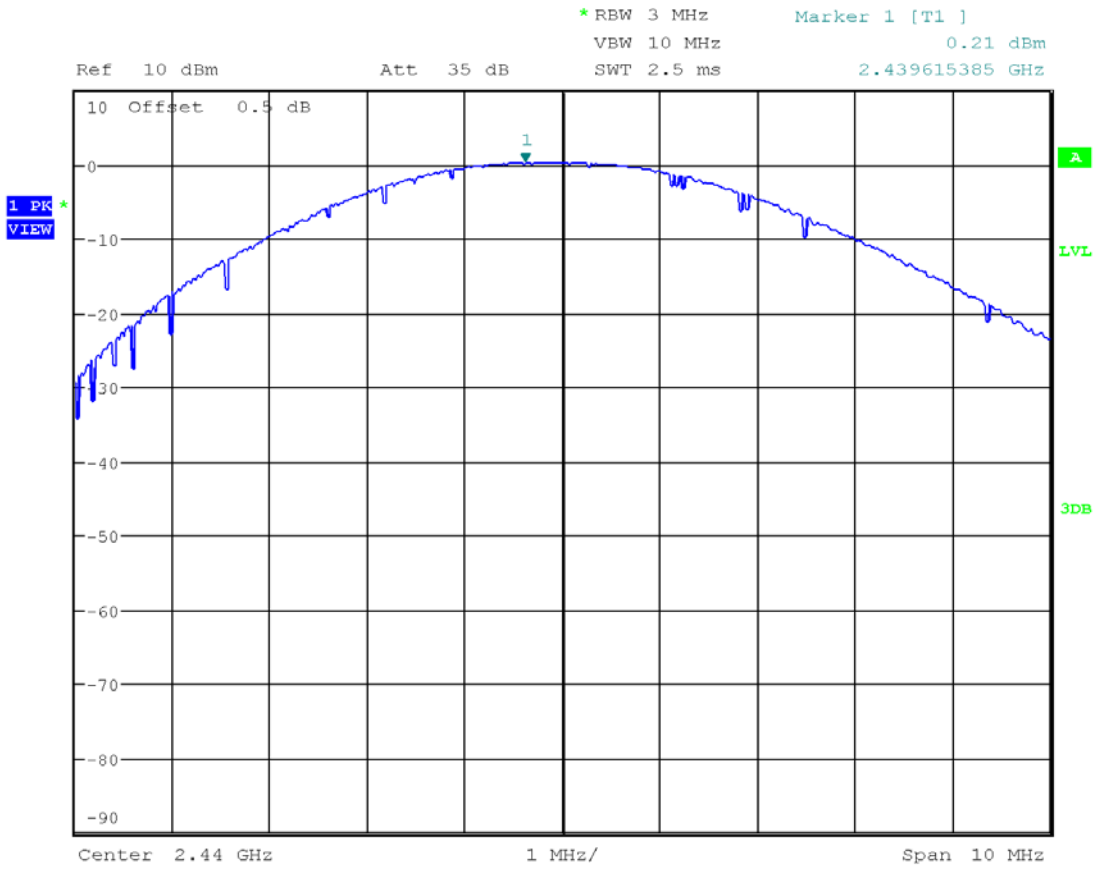
Tested By	Test Date	Results
Kenneth Roque	September 22, 2021	Complies

Plot 2.1



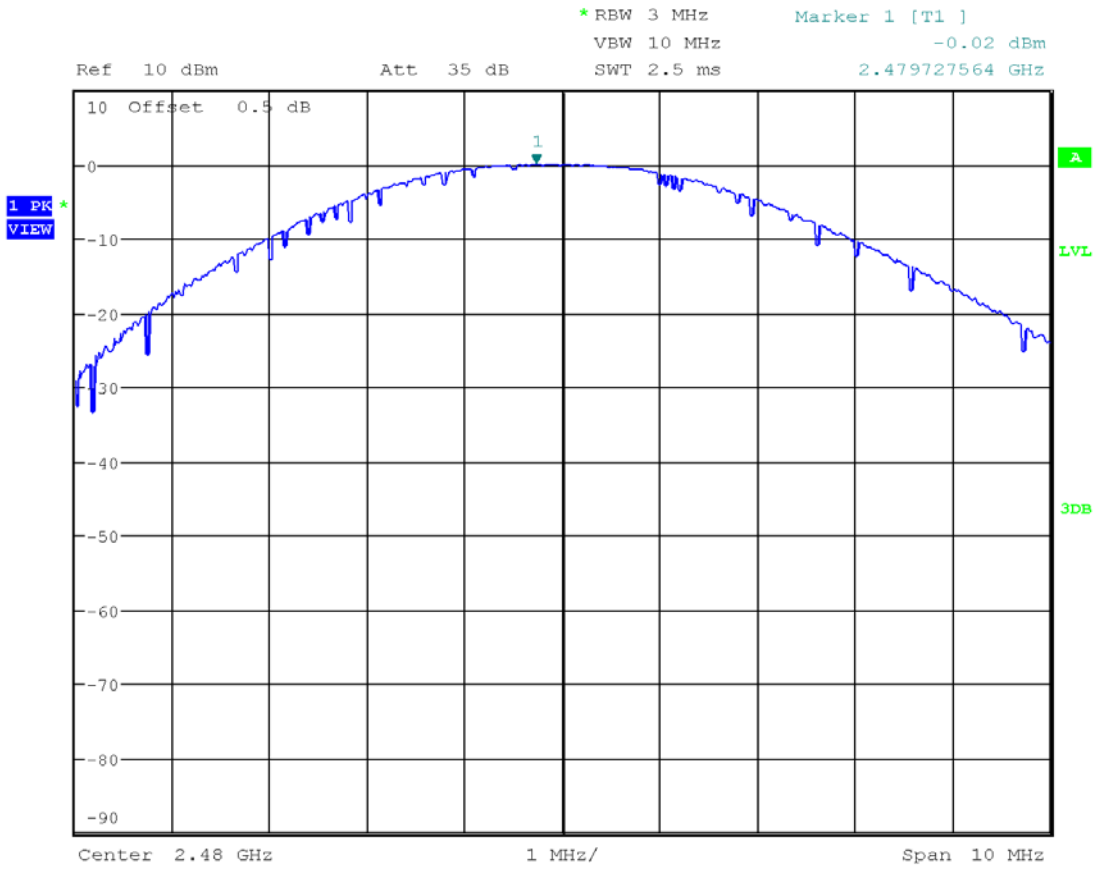
Date: 22.SEP.2021 15:09:09

Plot 2.2



Date: 22.SEP.2021 15:11:40

Plot 2.3



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

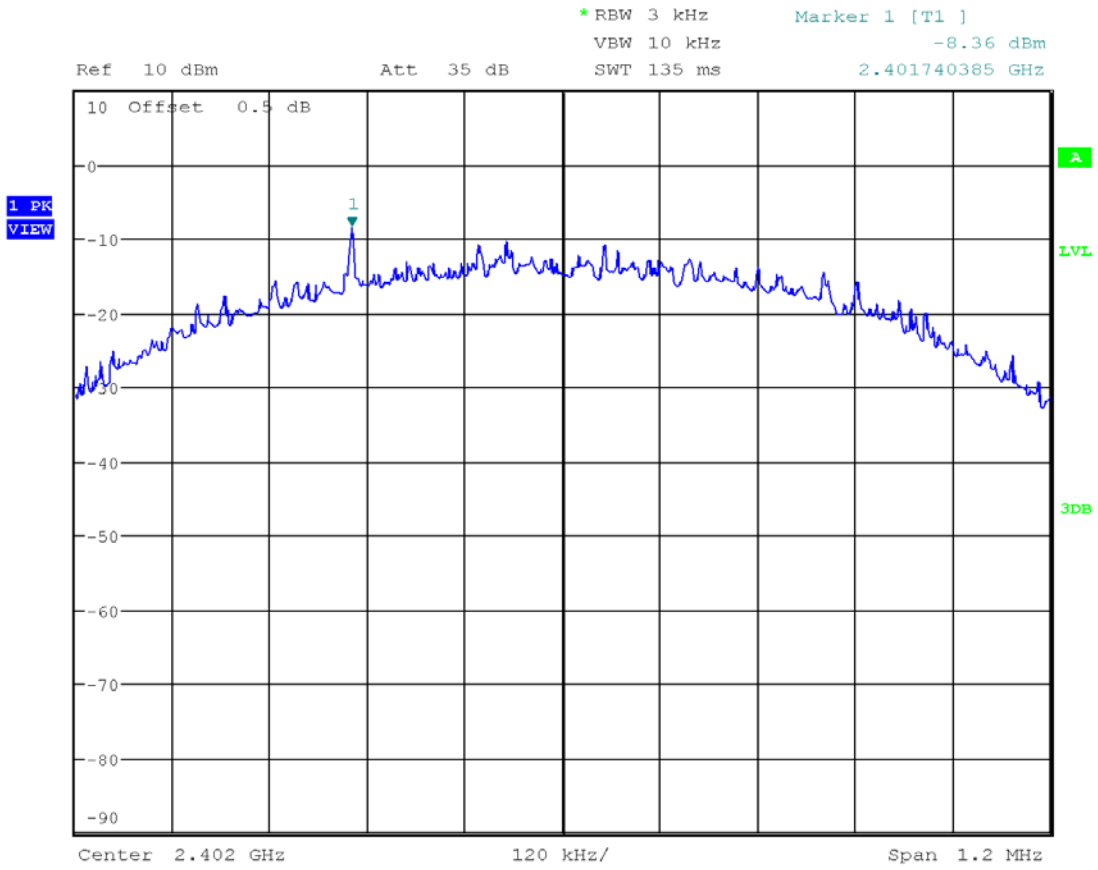
4.3.3 Test Result

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	-8.36	8.0	-16.36	3.1
2440	-9.26	8.0	-17.26	3.2
2480	-9.53	8.0	-17.53	3.3

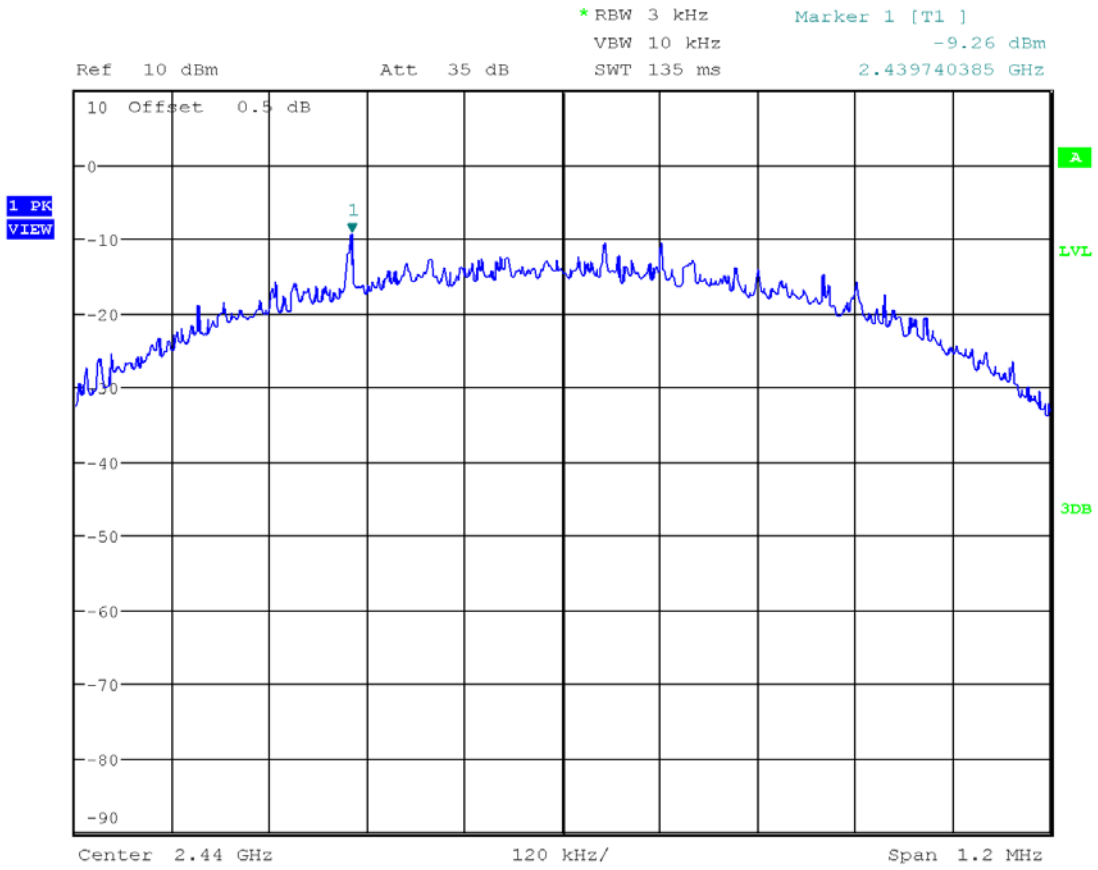
Tested By	Test Date	Results
Kenneth Roque	September 24, 2021	Complies

Plot 3.1



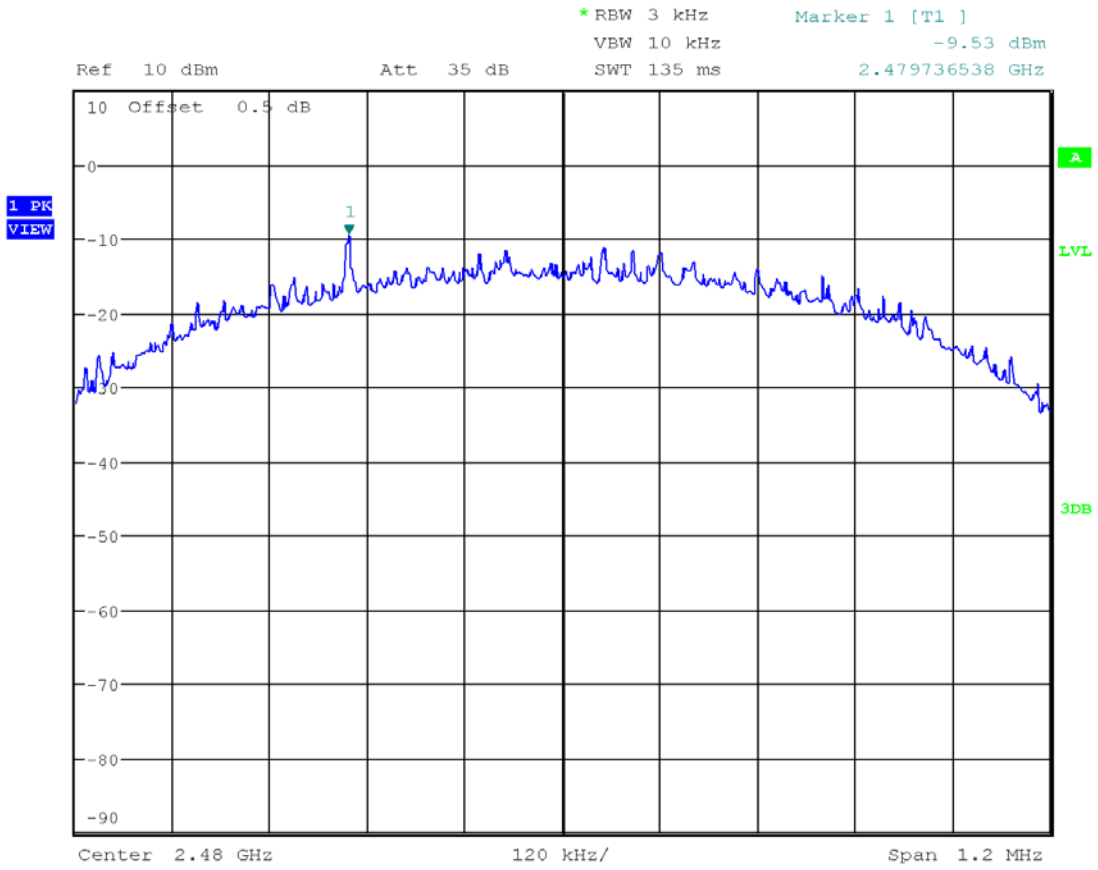
Date: 24.SEP.2021 13:55:52

Plot 3.2



Date: 24.SEP.2021 13:57:25

Plot 3.3



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

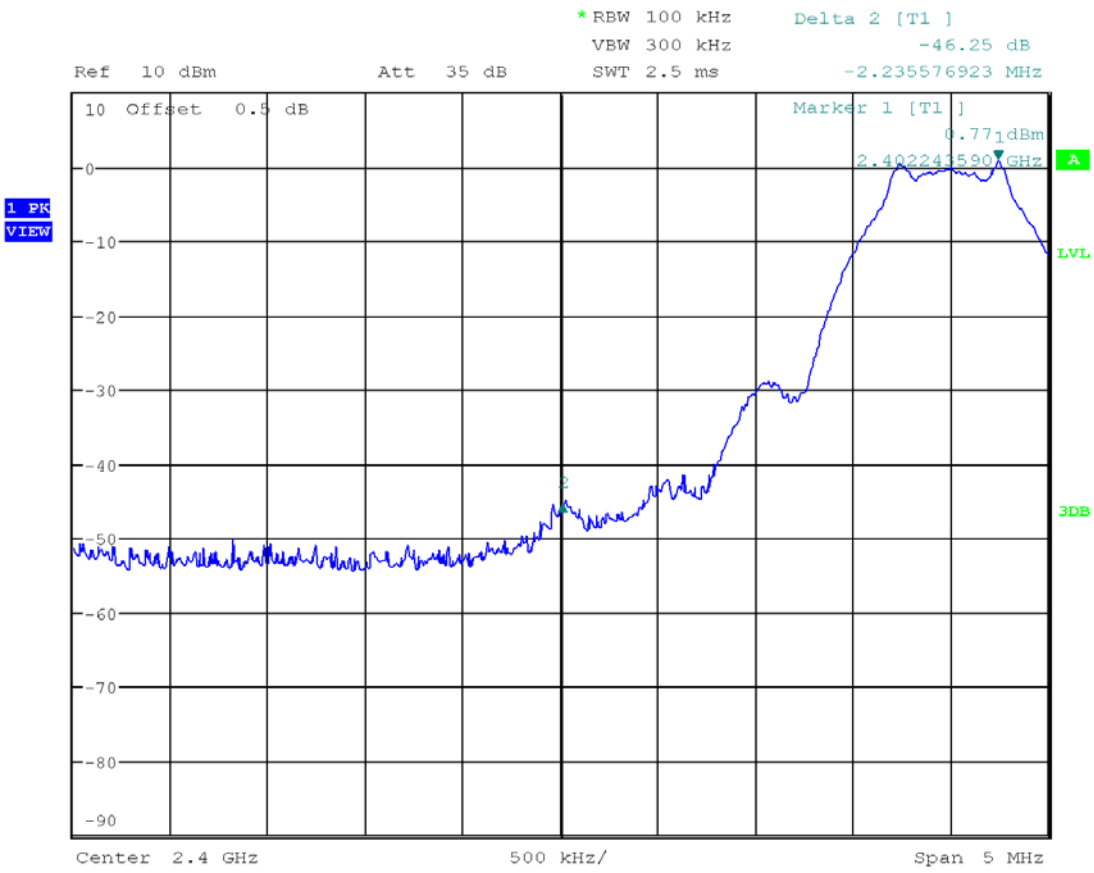
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

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.

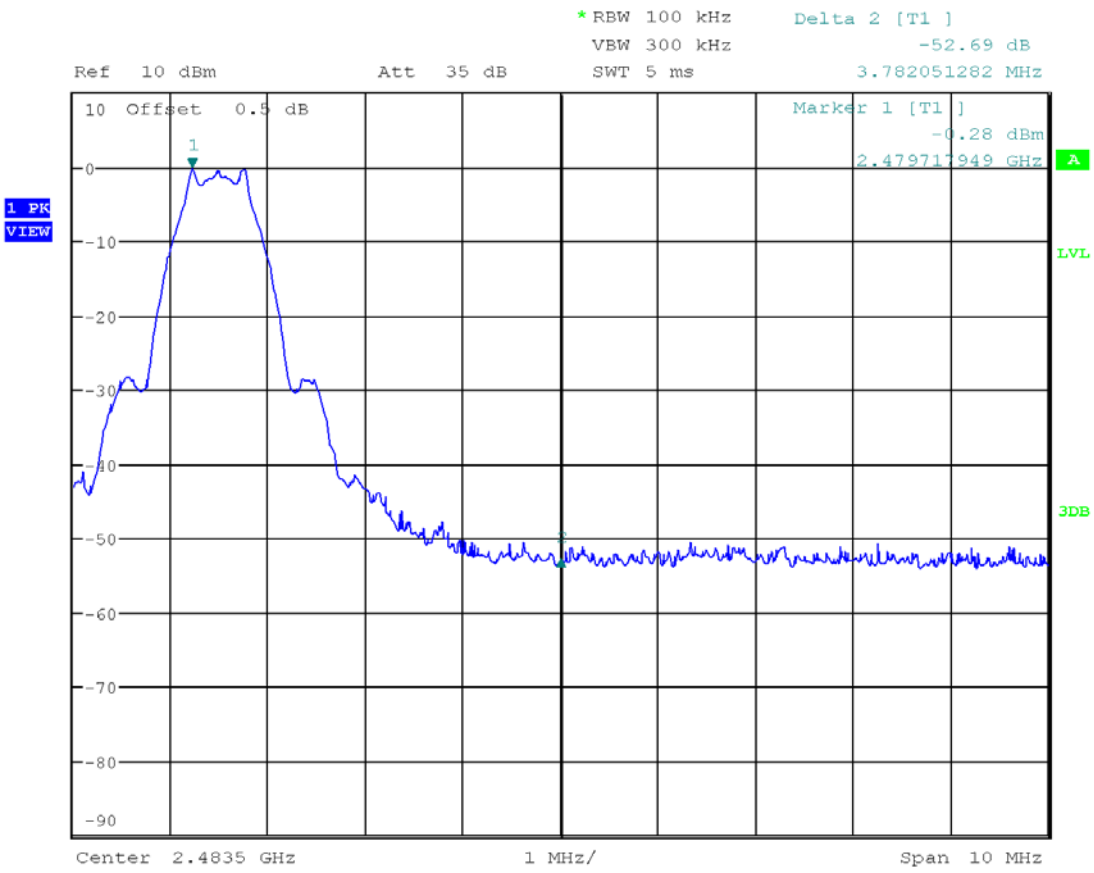
Tested By	Test Date	Results
Kenneth Roque	September 19, 2021	Complies

Tx @ Low Channel, 2402 MHz Band Edge
Plot 4.1



Date: 24.SEP.2021 14:12:56

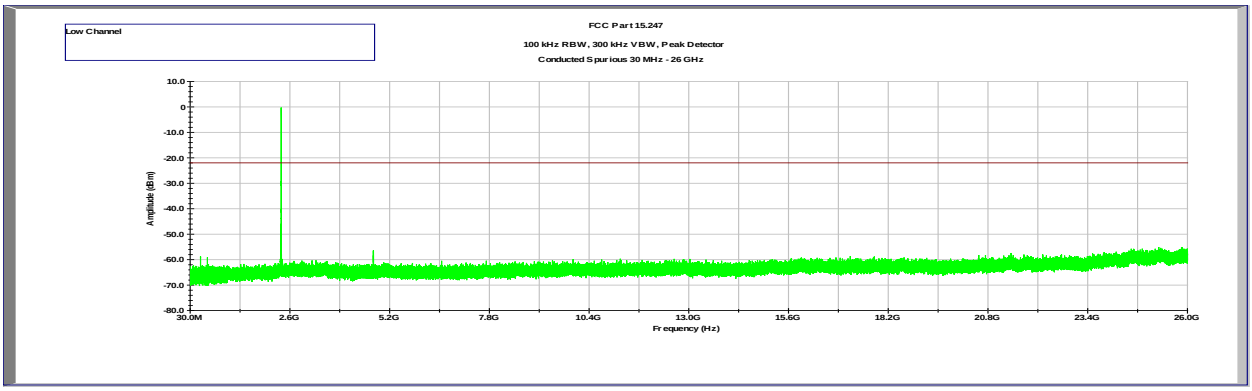
Tx @ High Channel, 2480 MHz Band Edge
Plot 4.2



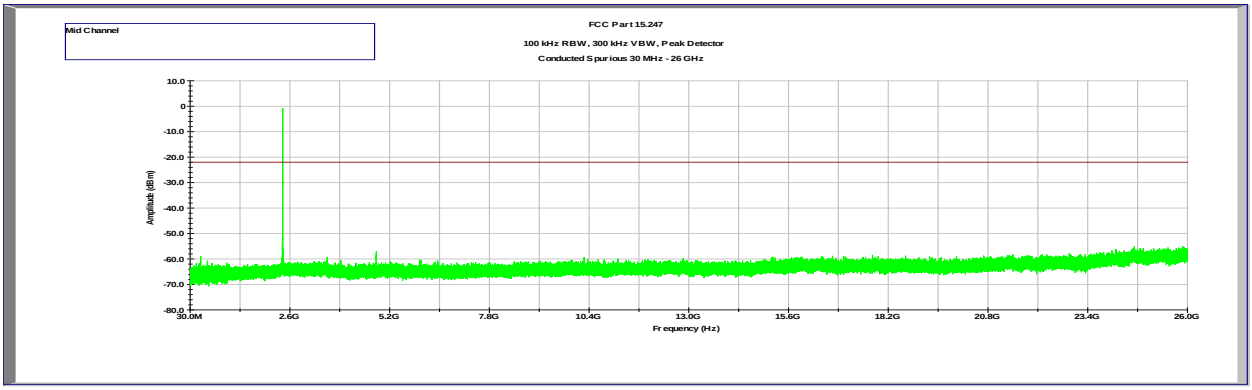
Date: 24.SEP.2021 14:15:48

Results	Complies

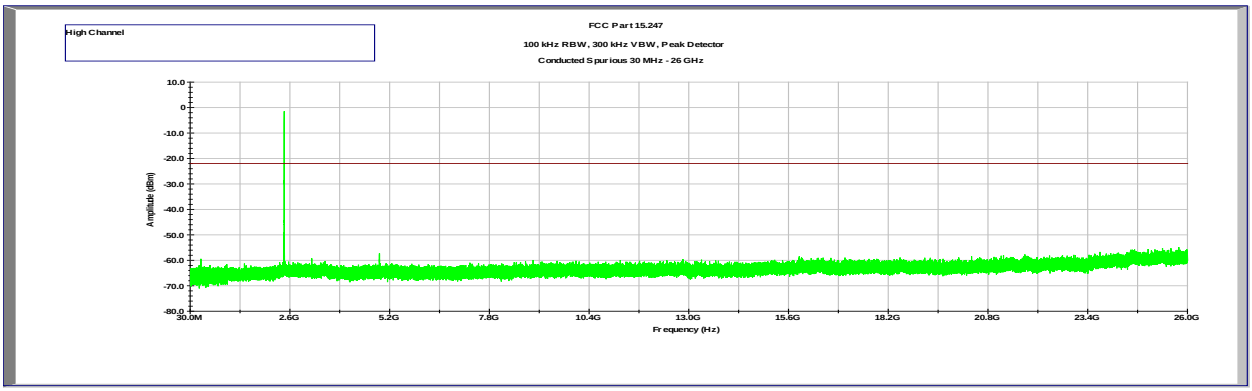
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



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 10 kHz to 26.5 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 10kHz 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 10kHz to 26.5GHz.

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

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

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

4.5.3 Field Strength Calculation

Field Strength Calculation

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

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

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

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

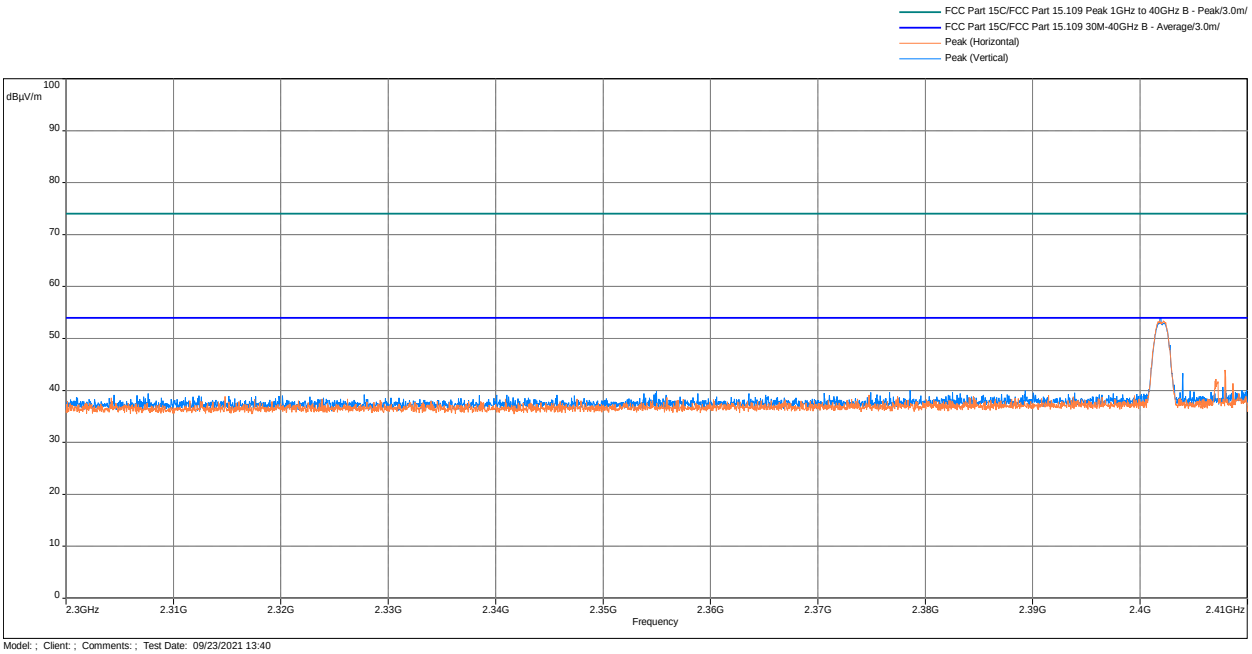
4.5.4 Test Results

All testing in this section were performed by radiated measurements.

Tested By	Test Date	Results
Kenneth Roque	September 13, 2021 September 27, 2021	Complies

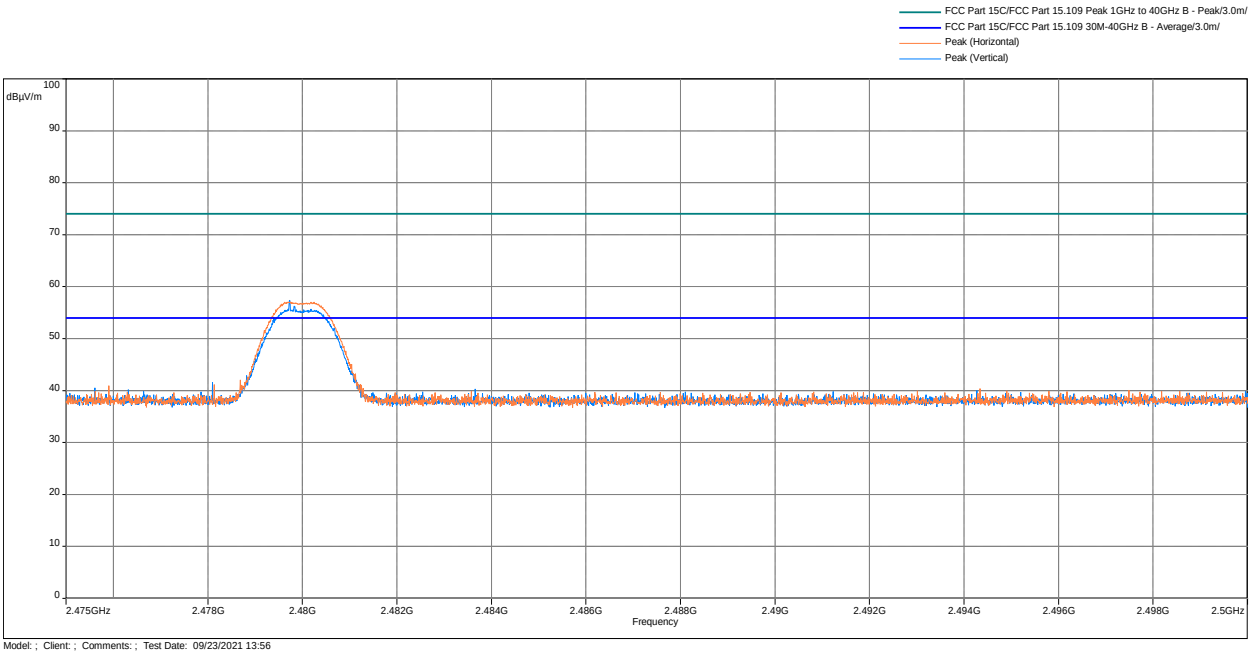
Test Results: 15.209/15.205 Radiated Restricted Band Emissions

Out-of-Band Radiated Spurious Emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
1 lb Connected Dumbbell



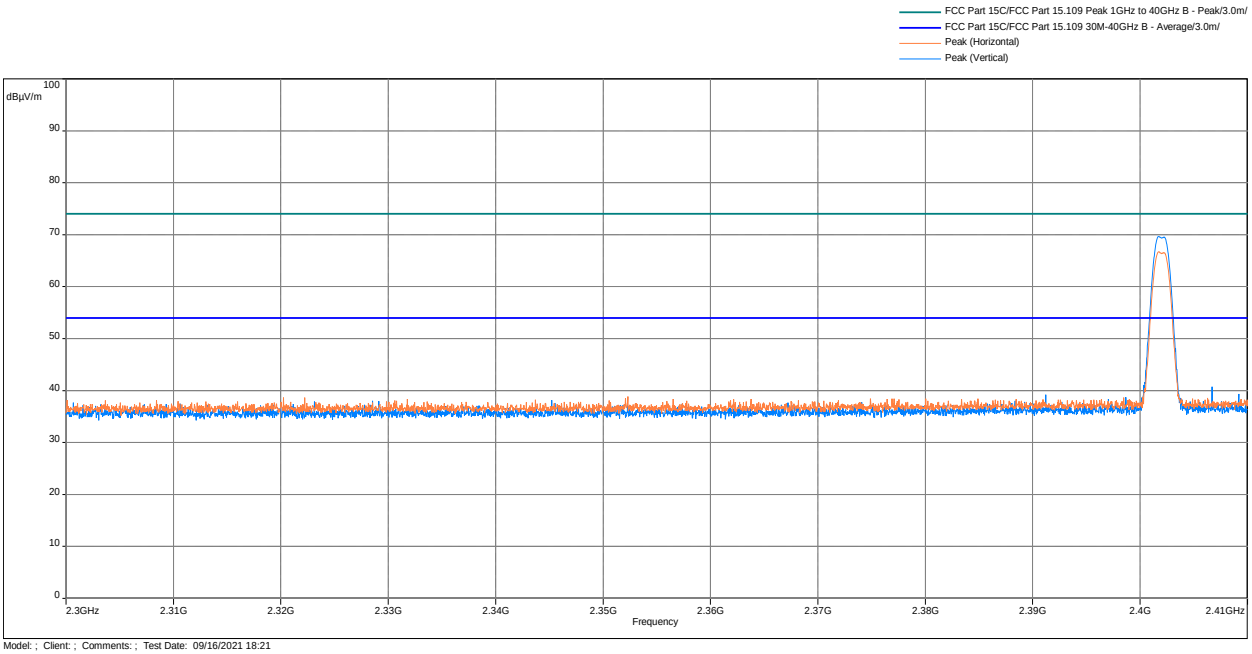
Freq. MHz	Peak@3m dB(uV/m)	Peak Limit dB(uV/m)	Avg@3m dB(uV/m)	Avg Limit dB(µV/m)	Peak Margin dB	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2390	35.82	74	27.49	54	-38.18	-26.51	1.51	316.75	Horizontal	-11.77
2390	37.39	74	27.59	54	-36.61	-26.41	1.51	331.75	Vertical	-11.77

Out-of-Band Radiated Spurious Emissions at the Band-edge @3m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
1 lb Connected Dumbbell



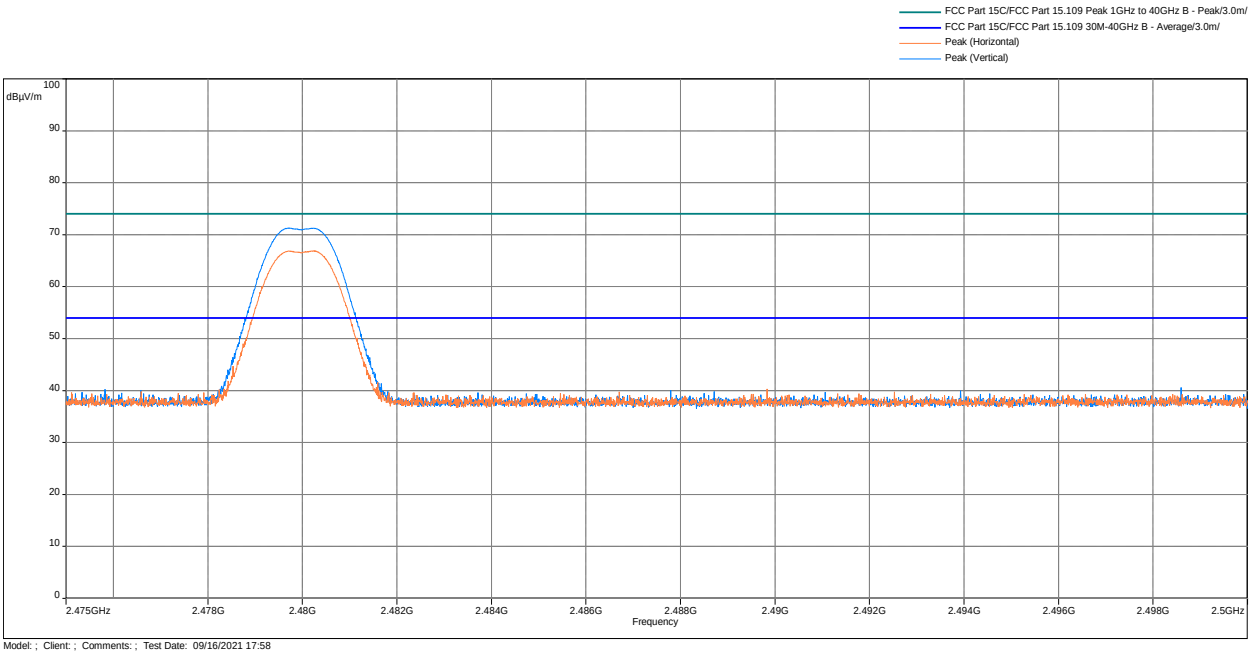
Freq. MHz	Peak@3m dB(uV/m)	Peak Limit dB(uV/m)	Avg@3m dB(uV/m)	Avg Limit dB(µV/m)	Peak Margin dB	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2483.5	37.35	74	28.99	54	-36.65	-25.01	3.49	0	Vertical	-10.68
2483.5	37.29	74	28.49	54	-36.71	-25.51	1.51	161.5	Horizontal	-10.68

Out-of-Band Radiated Spurious Emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak Limit and Average Limit
3 lb Connected Dumbbell



Freq. MHz	Peak@3m dB(uV/m)	Peak Limit dB(uV/m)	Avg@3m dB(uV/m)	Avg Limit dB(µV/m)	Peak Margin dB	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2390	35.43	74	27.08	54	-38.57	-26.92	1.51	260.75	Vertical	-12.05
2390	35.81	74	27.75	54	-38.19	-26.25	2.49	39.5	Horizontal	-12.05

Out-of-Band Radiated Spurious Emissions at the Band-edge @3m distance
2483.5–2500 MHz, Peak Scan with Peak Limit and Average Limit
3 lb Connected Dumbbell



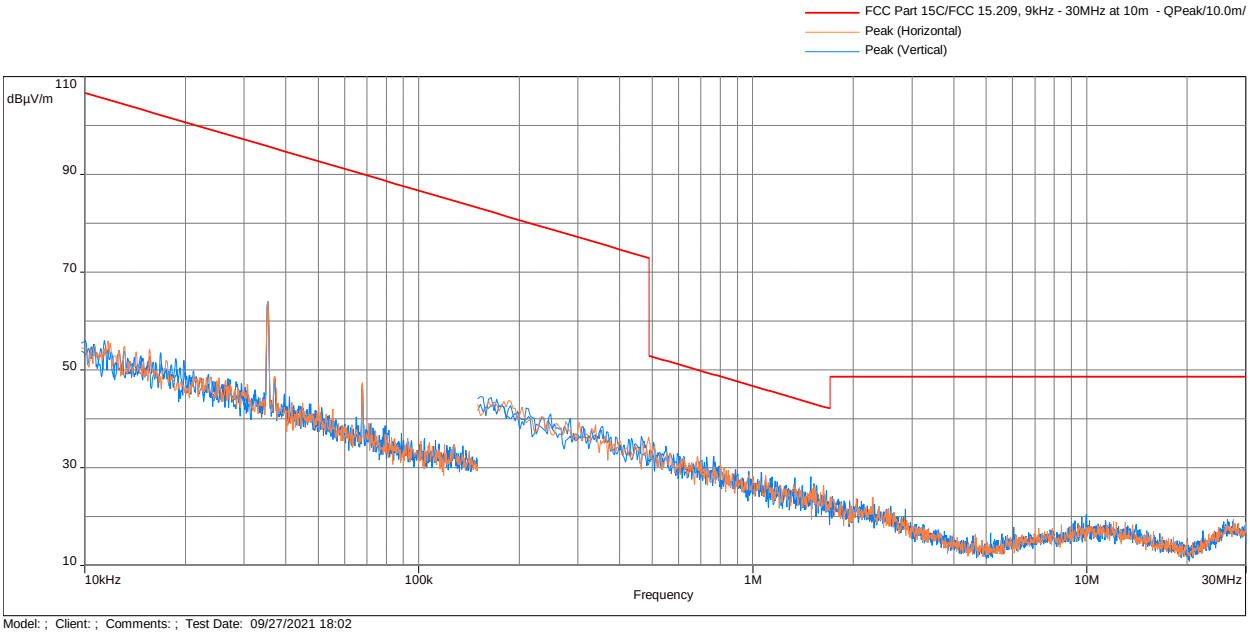
Freq. MHz	Peak@3m dB(uV/m)	Peak Limit dB(uV/m)	Avg@3m dB(uV/m)	Avg Limit dB(µV/m)	Peak Margin dB	Avg Margin dB	Height m	Azimuth deg	Polarity	Correction dB
2483.5	36.35	74	28.53	54	-37.65	-25.47	1.51	161.75	Vertical	-10.96
2483.5	37.03	74	28.13	54	-36.97	-25.87	3.49	56.75	Horizontal	-10.96

Results	Complies

Out-of-Band Radiated Spurious Emissions

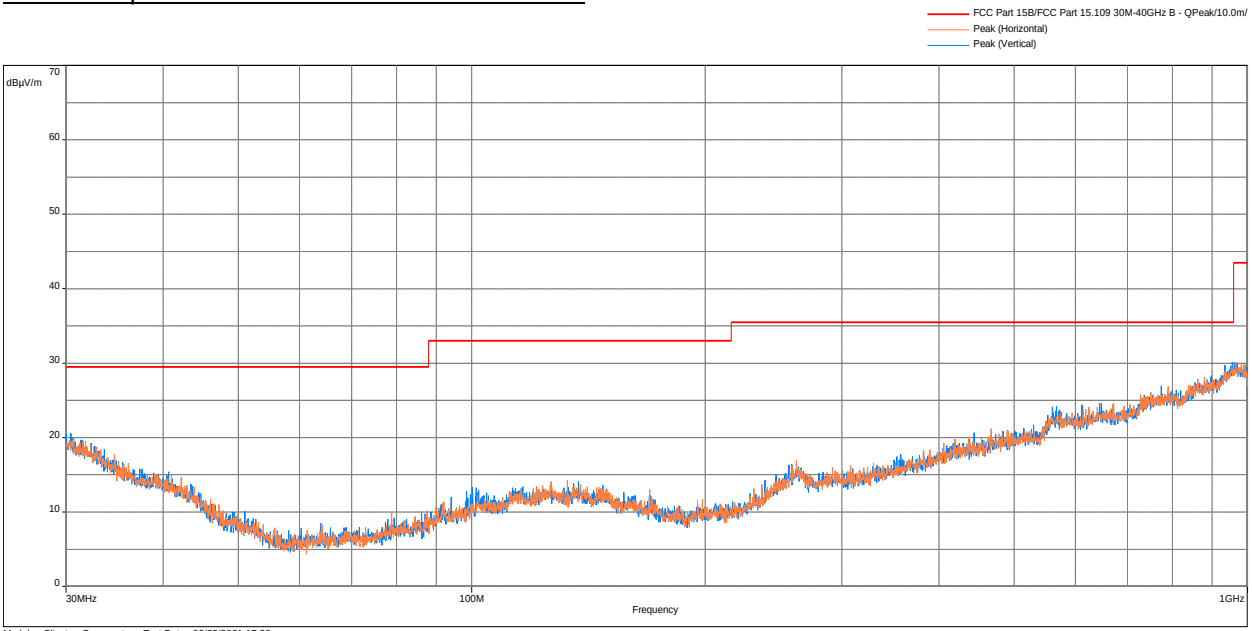
Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
1 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



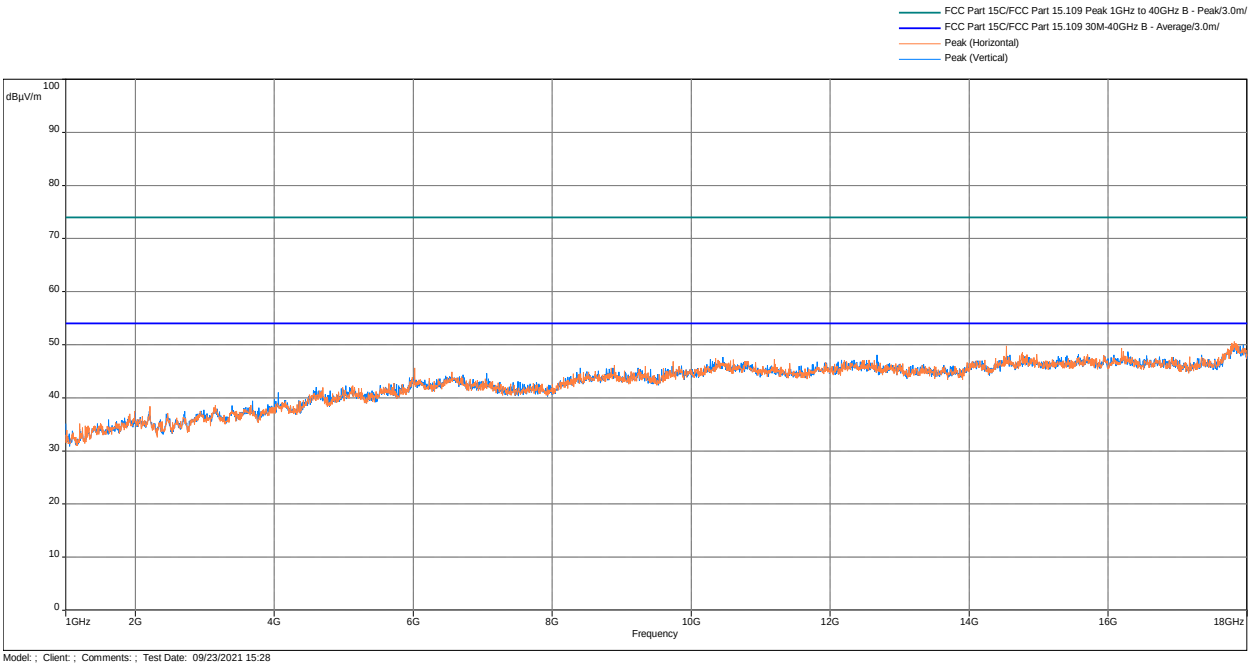
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 18:02

Radiated Spurious Emissions 30 MHz - 1000 MHz



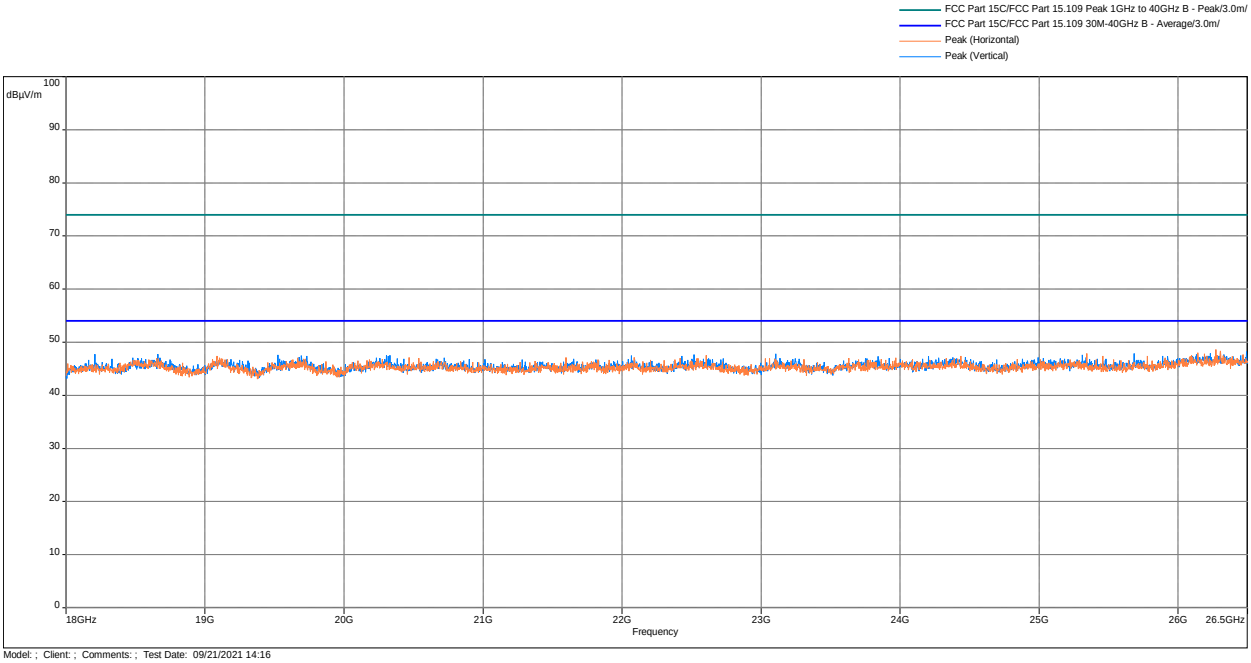
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 17:39

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



Model: ; Client: ; Comments: ; Test Date: 09/23/2021 15:28

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



Model: ; Client: ; Comments: ; Test Date: 09/21/2021 14:16

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
1 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
955.865	30.14	35.5	-5.36	4	165.25	Vertical	3.75
958.7103	29.88	35.5	-5.62	1	284.75	Horizontal	3.89
935.107	29.74	35.5	-5.76	0.98	332.5	Vertical	2.55
958.1607	29.71	35.5	-5.79	2	253	Horizontal	3.87
951.7263	29.58	35.5	-5.92	0.98	0.25	Vertical	3.47
953.3107	29.5	35.5	-6	1	0.25	Horizontal	3.62

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17816.4	50.62	74	-23.38	2.51	70.25	Horizontal	9.52
17822.07	50.04	74	-23.96	2.49	328.25	Vertical	9.48
14538.8	49.78	74	-24.22	2.51	242.25	Horizontal	2.41
15570.7	48.24	74	-25.76	1.51	160	Vertical	4.71
12672.2	48.1	74	-25.9	1.51	188.5	Vertical	2.49
10458.8	47.71	74	-26.29	2.49	213.5	Vertical	1.67

Note: Correction = AF + CF - Preamp

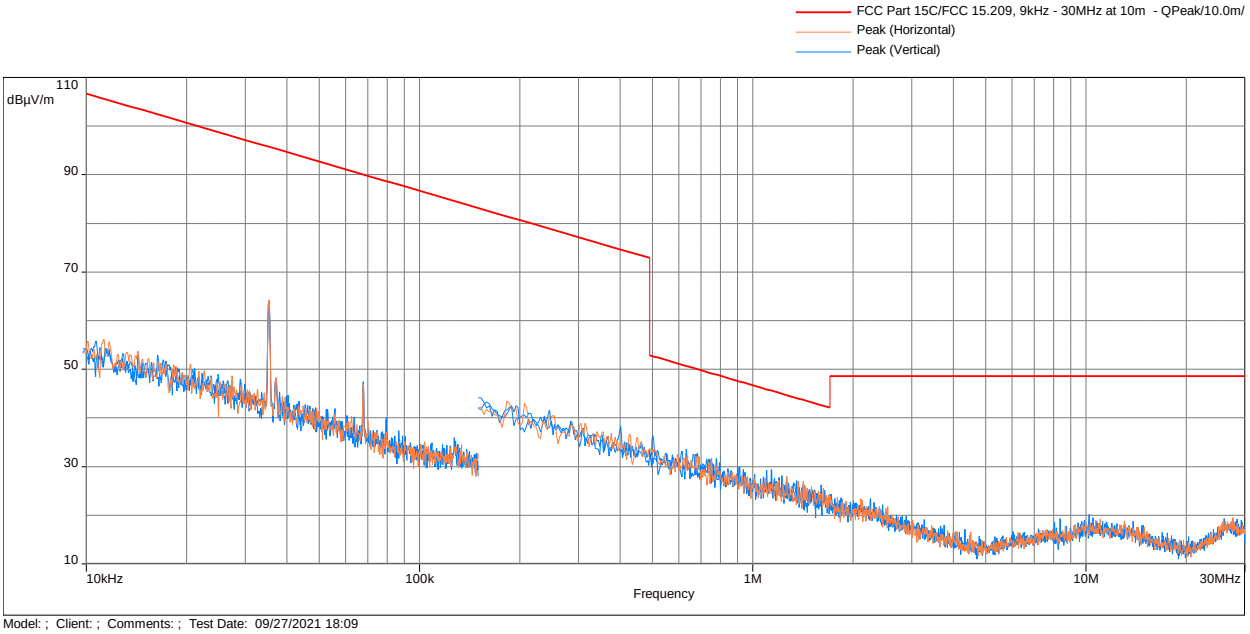
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17826.03	41.42	54	-12.58	1.51	162.25	Horizontal	9.45
17796	41.15	54	-12.85	2.49	77.25	Vertical	9.57
16083.53	39.49	54	-14.51	1.51	248.25	Horizontal	4.56
16264.87	39.34	54	-14.66	2.49	248.5	Vertical	4.46
4804.033	39.24	54	-14.76	1.51	199.5	Vertical	-5.38
14137.6	38.91	54	-15.09	2.51	0	Horizontal	2.72

Note: Correction = AF + CF - Preamp

Results	Complies

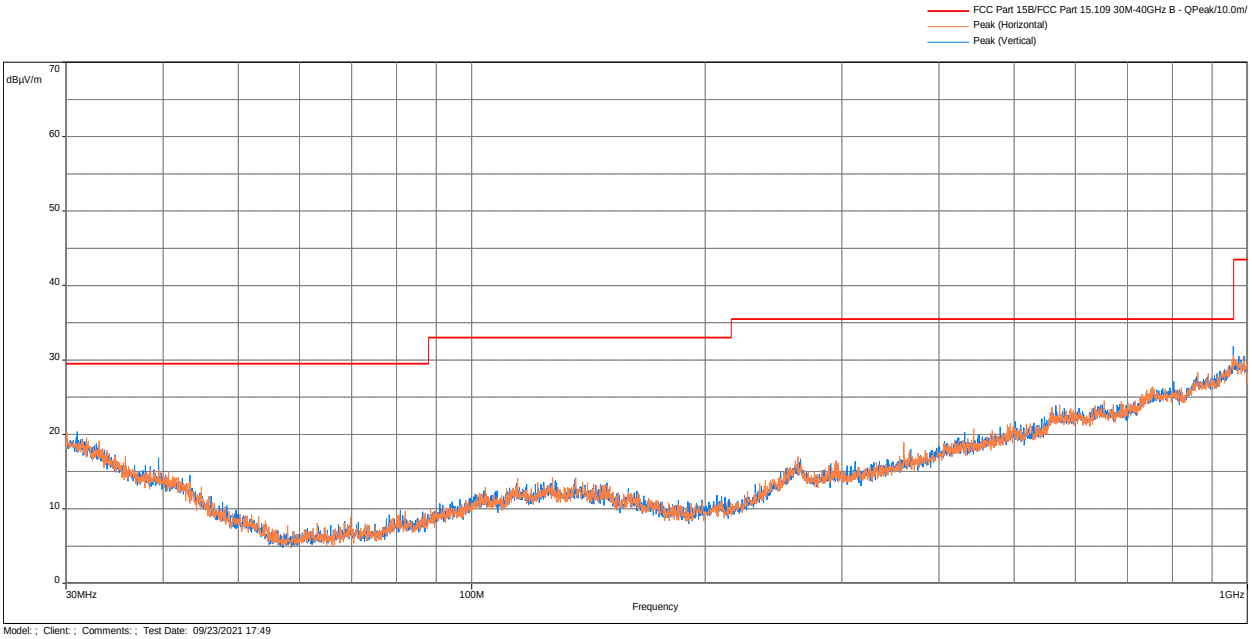
Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
1 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



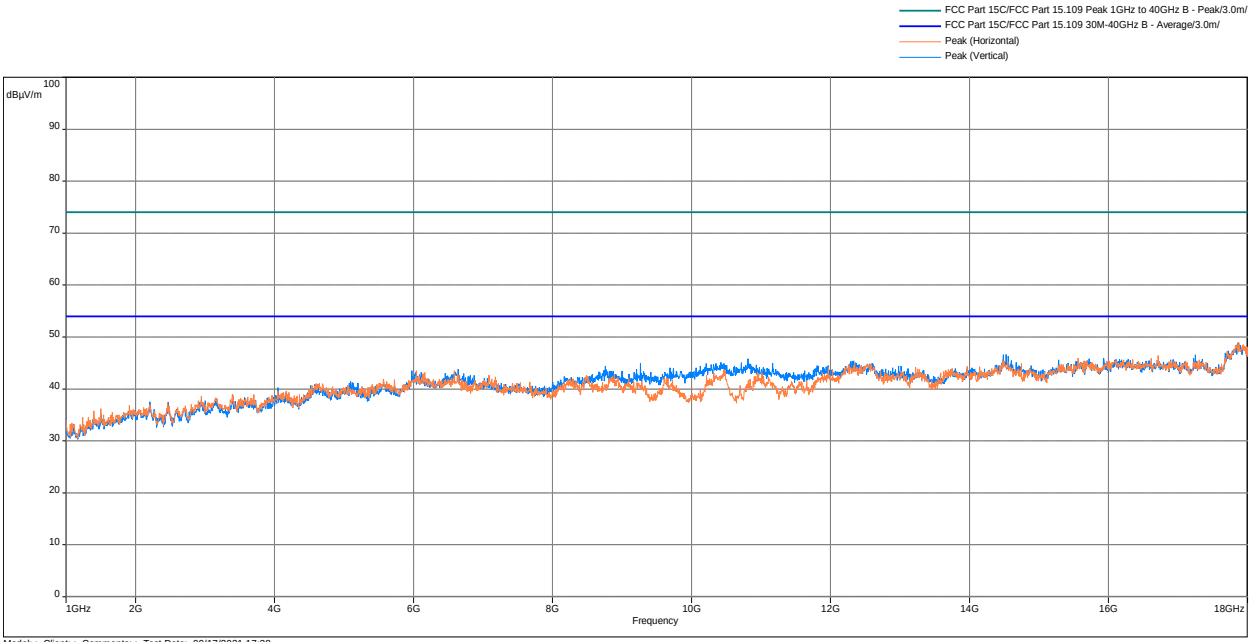
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 18:09

Radiated Spurious Emissions 30 MHz - 1000 MHz



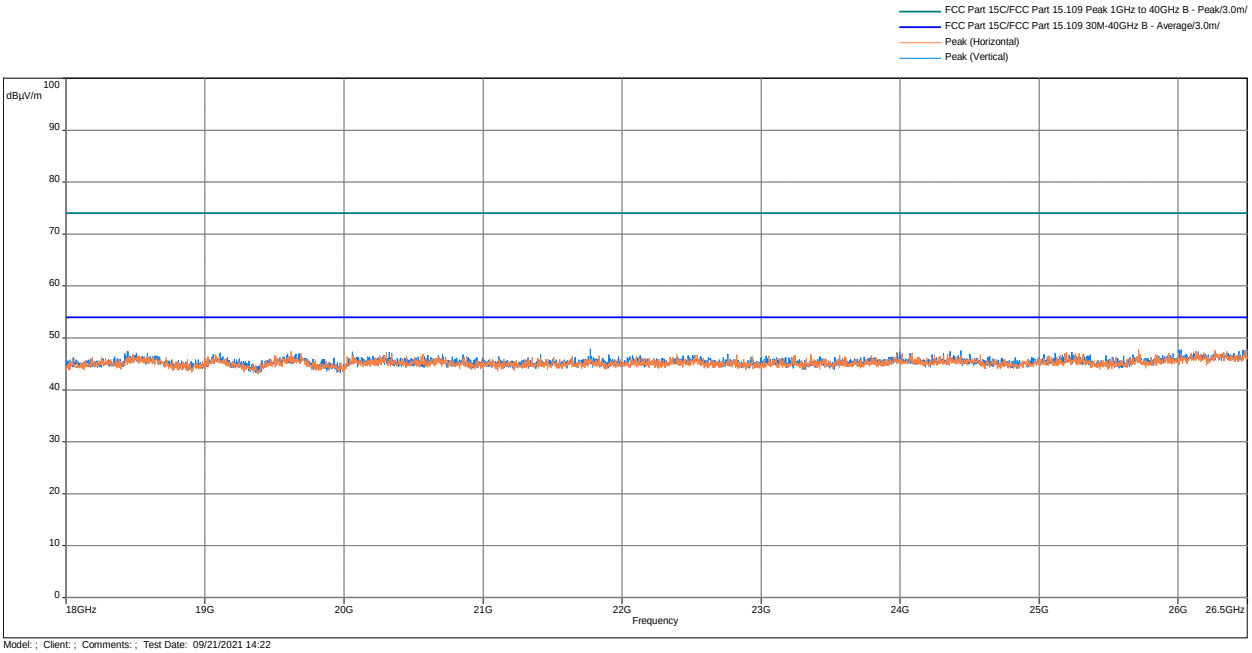
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 17:49

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



Model: ; Client: ; Comments: ; Test Date: 09/17/2021 17:38

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



Model: ; Client: ; Comments: ; Test Date: 09/21/2021 14:22

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
1 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
958.4193	31.82	35.5	-3.68	3	5.5	Vertical	3.88
959.2923	30.67	35.5	-4.83	2	332.75	Horizontal	3.9
959.6157	30.4	35.5	-5.1	3	336.5	Horizontal	3.9
955.5093	30.2	35.5	-5.3	4	173.25	Horizontal	3.75
959.0983	29.82	35.5	-5.68	1	293	Vertical	3.89
954.604	29.74	35.5	-5.76	4	85.25	Horizontal	3.7

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17866.27	48.93	74	-25.07	2.51	254.75	Horizontal	8.46
17857.77	48.9	74	-25.1	3.49	259.5	Vertical	8.5
14528.6	46.64	74	-27.36	1.51	224.5	Vertical	1.78
15560.5	45.98	74	-28.02	2.51	14.5	Horizontal	3.93
10812.97	45.81	74	-28.19	1.51	1.75	Vertical	1
12318.6	45.39	74	-28.61	1.51	99.25	Vertical	1.63

Note: Correction = AF + CF - Preamp

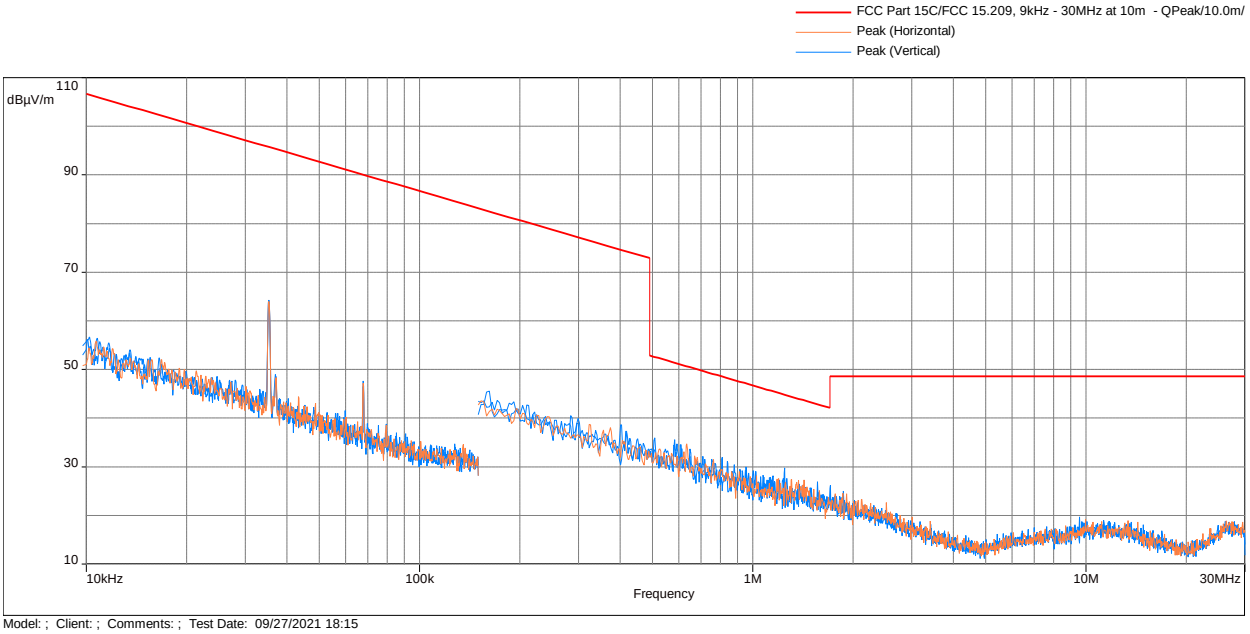
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17840.77	40.04	54	-13.96	1.51	285.75	Vertical	8.58
17945.03	39.91	54	-14.09	1.51	203.25	Horizontal	7.84
16118.67	37.76	54	-16.24	1.51	203.25	Horizontal	3.79
14509.33	37.6	54	-16.4	1.51	291	Horizontal	1.85
16110.73	37.15	54	-16.85	2.49	291.5	Vertical	3.79
12351.47	36.82	54	-17.18	1.51	334	Horizontal	1.55

Note: Correction = AF + CF - Preamp

Results	Complies

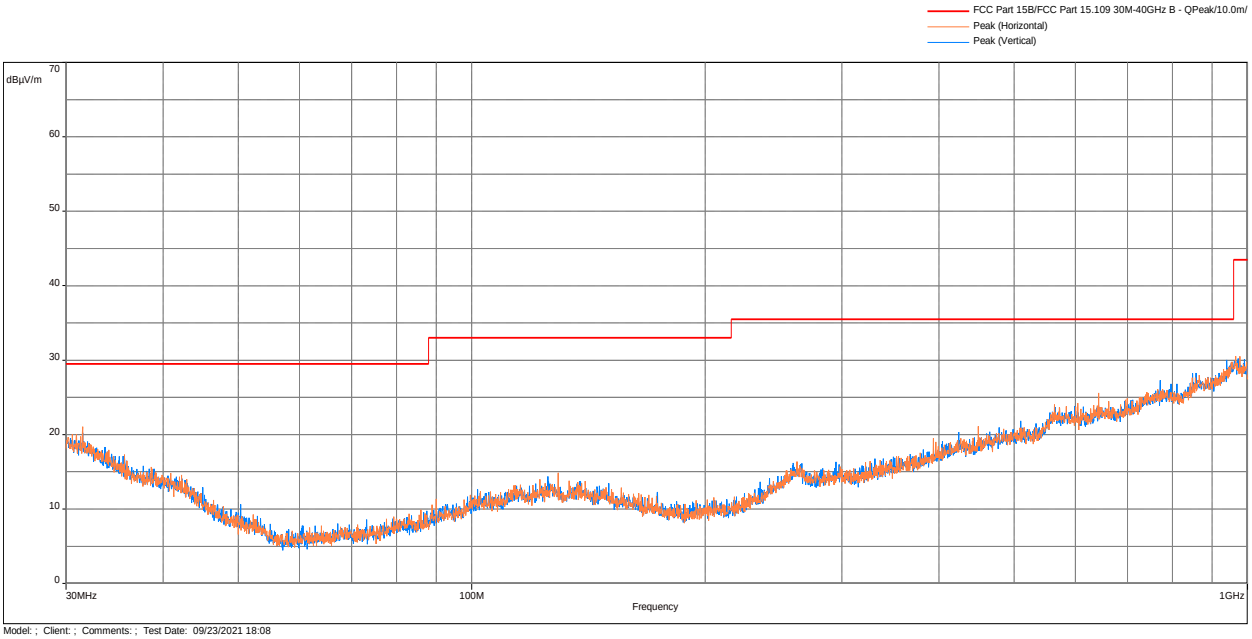
Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
1 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



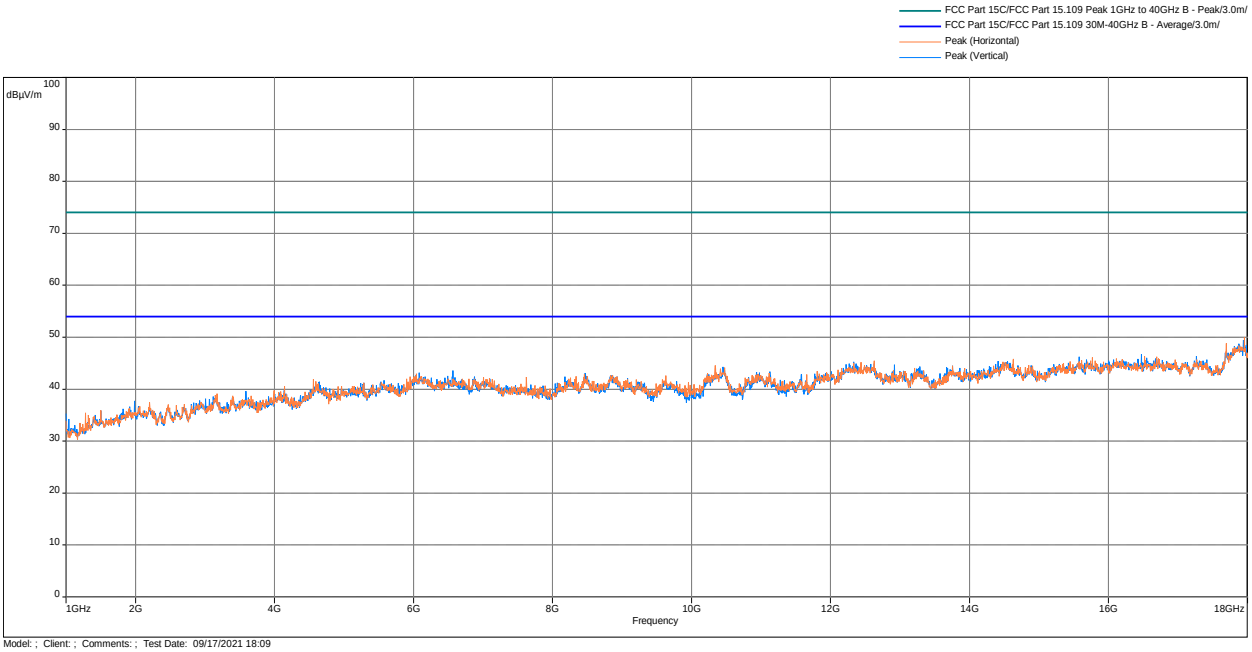
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 18:15

Radiated Spurious Emissions 30 MHz - 1000 MHz



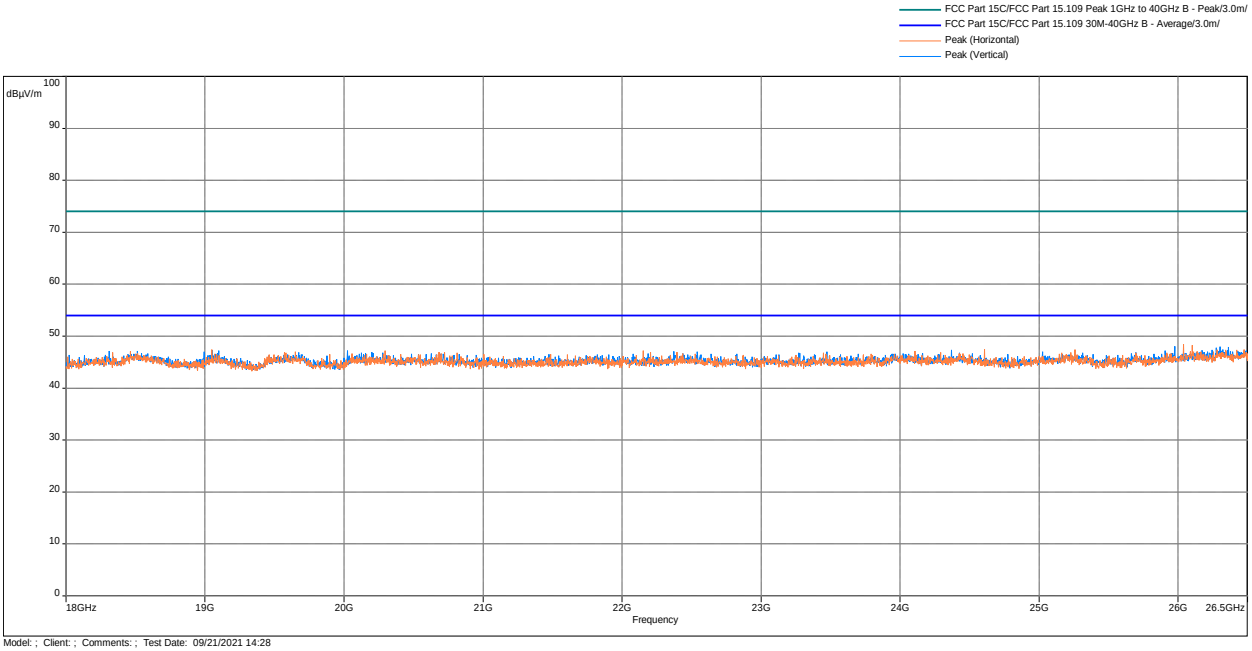
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 18:08

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



Model: ; Client: ; Comments: ; Test Date: 09/17/2021 18:09

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



Model: ; Client: ; Comments: ; Test Date: 09/21/2021 14:28

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
1 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
939.9247	30.05	35.5	-5.45	4	209.5	Vertical	2.82
954.1837	29.8	35.5	-5.7	4	306.5	Horizontal	3.65
952.4377	29.68	35.5	-5.82	3	354.25	Horizontal	3.55
955.186	29.62	35.5	-5.88	2	165.25	Horizontal	3.74
952.9873	29.54	35.5	-5.96	2.01	0	Vertical	3.61
953.052	29.5	35.5	-6	0.99	143	Horizontal	3.61

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17952.97	50.02	74	-23.98	3.49	29.5	Horizontal	7.75
17938.23	49.45	74	-24.55	1.51	0	Vertical	7.91
15576.37	46.25	74	-27.75	2.49	354	Vertical	4.01
15770.17	46.11	74	-27.89	2.51	248.75	Horizontal	3.92
12630.83	45.48	74	-28.52	3.49	1.75	Horizontal	1.89
12331.63	45.27	74	-28.73	3.49	107.75	Vertical	1.6

Note: Correction = AF + CF - Preamp

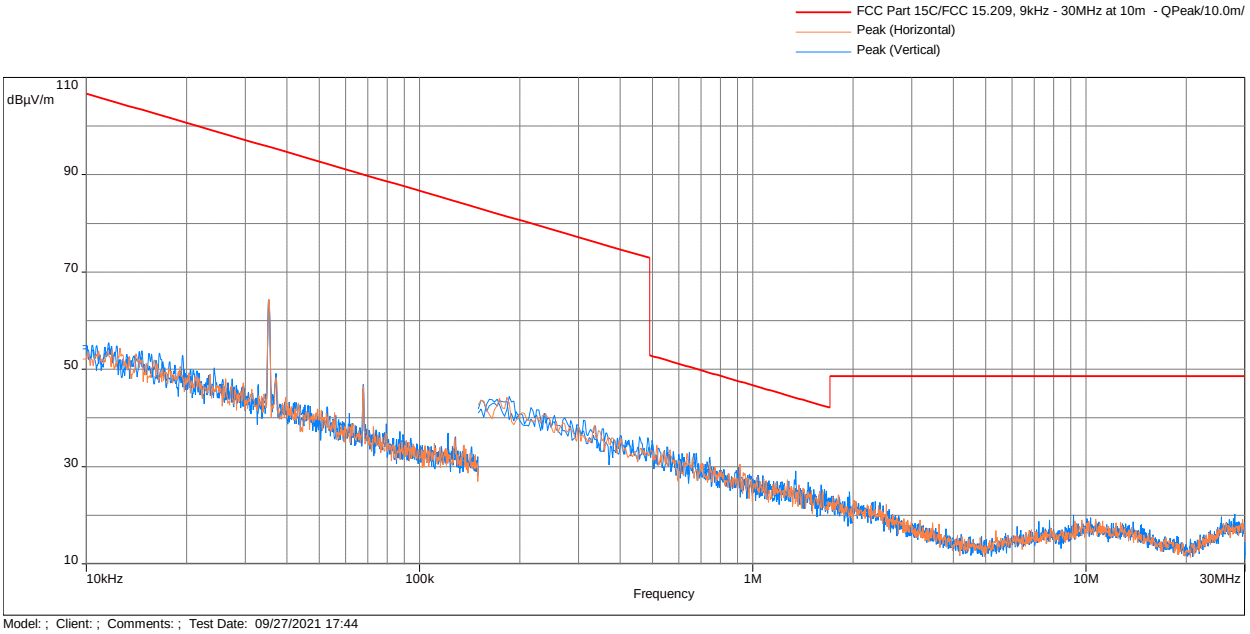
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17856.07	39.96	54	-14.04	2.49	0	Horizontal	8.51
17810.17	39.89	54	-14.11	3.49	0	Vertical	8.72
16594.1	37.39	54	-16.61	3.49	199.75	Vertical	3.22
16295.47	37.05	54	-16.95	2.49	0	Horizontal	3.55
15703.87	37.01	54	-16.99	3.49	0	Horizontal	4.14
14507.63	36.91	54	-17.09	3.49	156.25	Vertical	1.85

Note: Correction = AF + CF - Preamp

Results	Complies

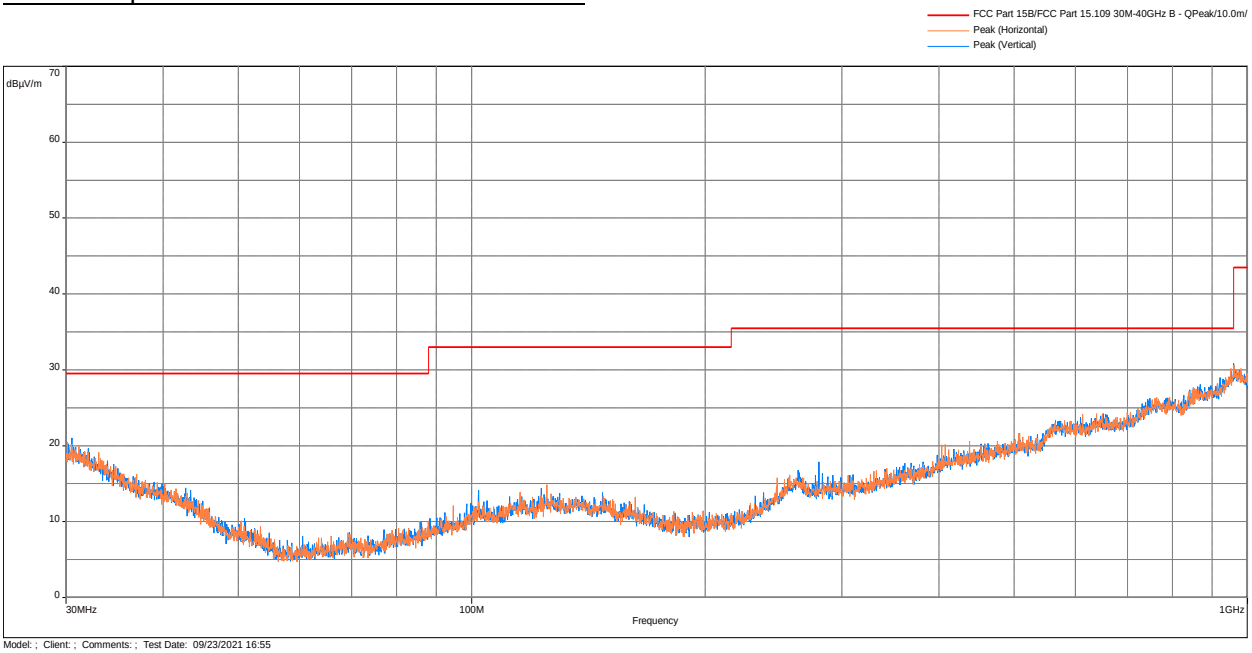
Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
3 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



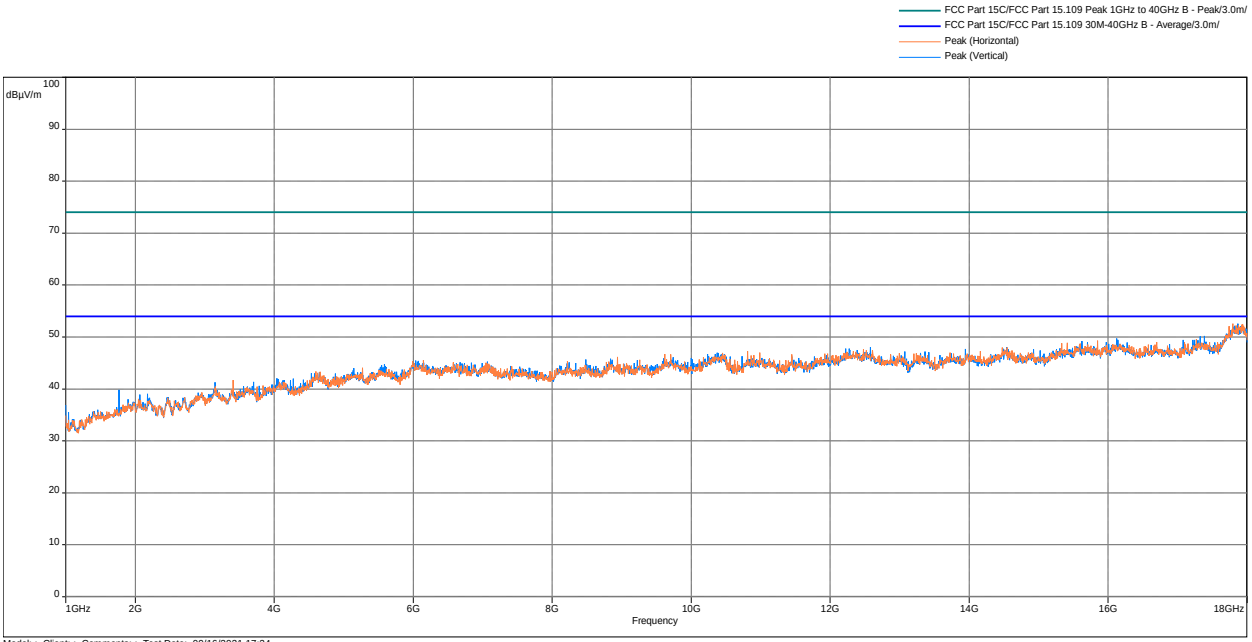
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 17:44

Radiated Spurious Emissions 30 MHz - 1000 MHz



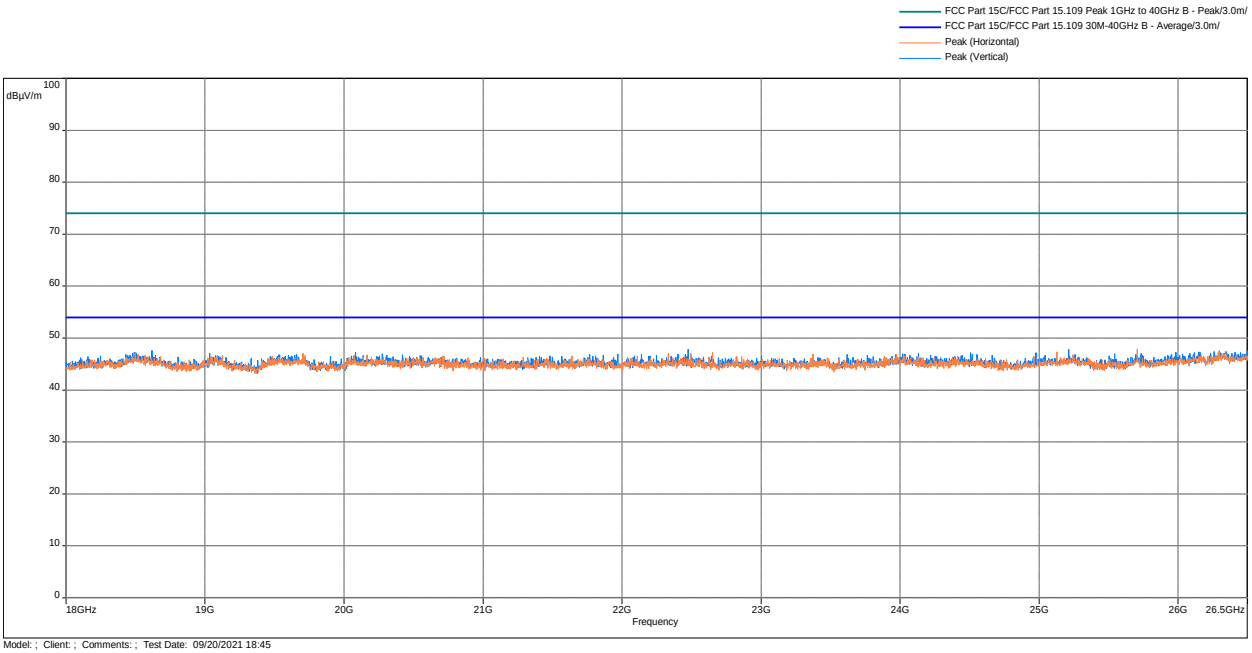
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 16:55

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



Model: ; Client: ; Comments: ; Test Date: 09/16/2021 17:24

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



Model: ; Client: ; Comments: ; Test Date: 09/20/2021 18:45

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz
3 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
959.745	30.86	35.5	-4.64	4	310.5	Vertical	3.91
951.403	30.18	35.5	-5.32	3	67.5	Horizontal	3.44
953.3753	29.79	35.5	-5.71	3	332.75	Vertical	3.62
958.4193	29.27	35.5	-6.23	1.01	76.75	Horizontal	3.88
952.9227	29.18	35.5	-6.32	3	33.5	Vertical	3.61
946.6823	29.09	35.5	-6.41	2	218.25	Vertical	3.12

Note: Correction = AF + CF - Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17865.13	52.6	74	-21.4	1.51	144.25	Vertical	8.46
17796.57	52.58	74	-21.42	3.49	215.75	Horizontal	8.73
15849.5	49.32	74	-24.68	3.49	348.25	Horizontal	3.68
15623.4	49.22	74	-24.78	1.51	0	Vertical	4.13
12577.57	48.03	74	-25.97	3.49	325.5	Vertical	1.92
12479.53	47.61	74	-26.39	3.49	104	Horizontal	1.69

Note: Correction = AF + CF - Preamp

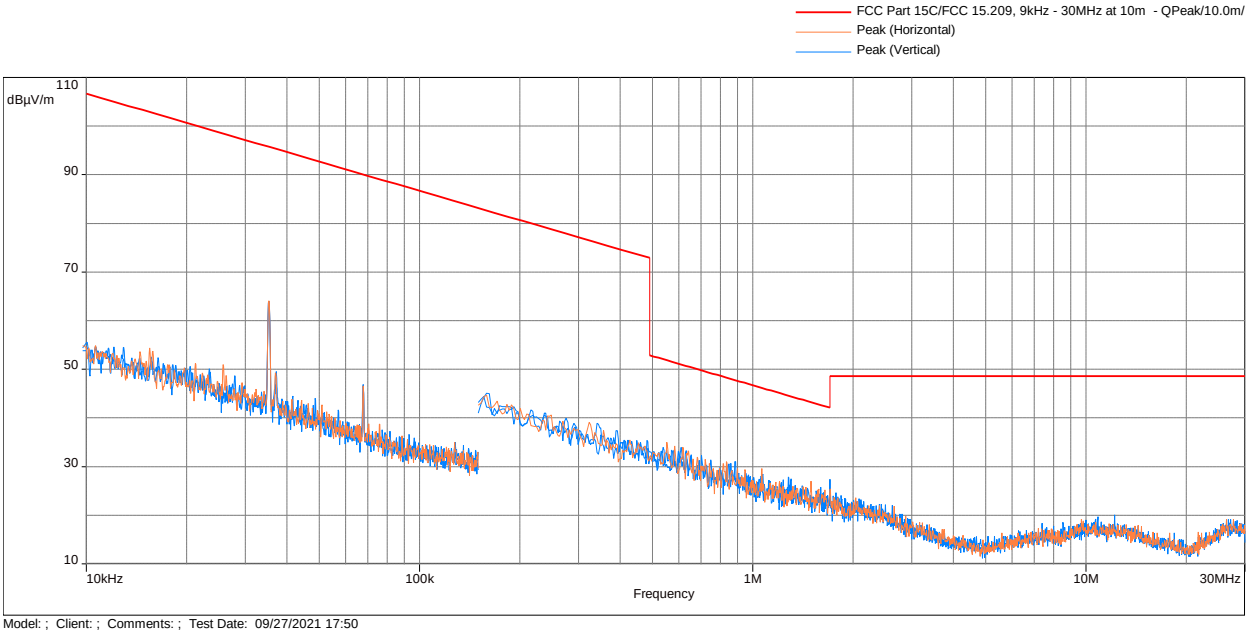
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17895.73	41.4	54	-12.6	1.51	290.75	Vertical	8.32
17822.63	40.84	54	-13.16	3.49	285.25	Horizontal	8.66
14503.67	38.58	54	-15.42	3.49	0	Horizontal	1.87
16550.47	38.5	54	-15.5	1.51	32.25	Vertical	2.98
16108.47	38.38	54	-15.62	3.49	328	Horizontal	3.79
12530.53	38.09	54	-15.91	1.51	118.75	Vertical	1.83

Note: Correction = AF + CF - Preamp

Results	Complies

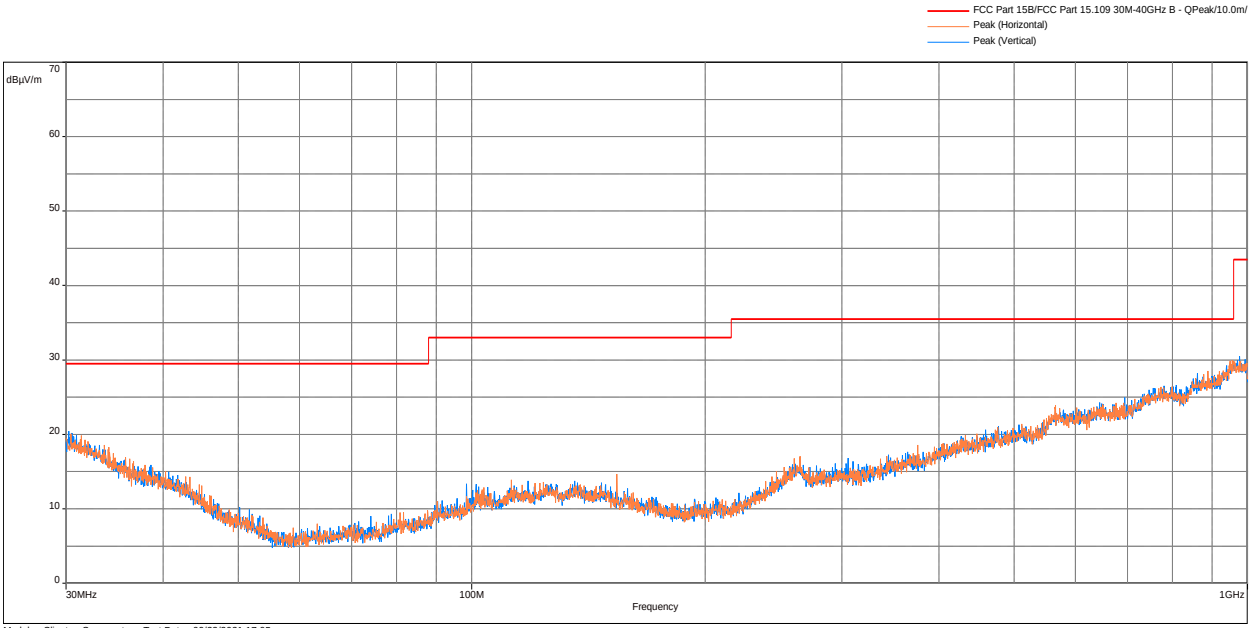
Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
3 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



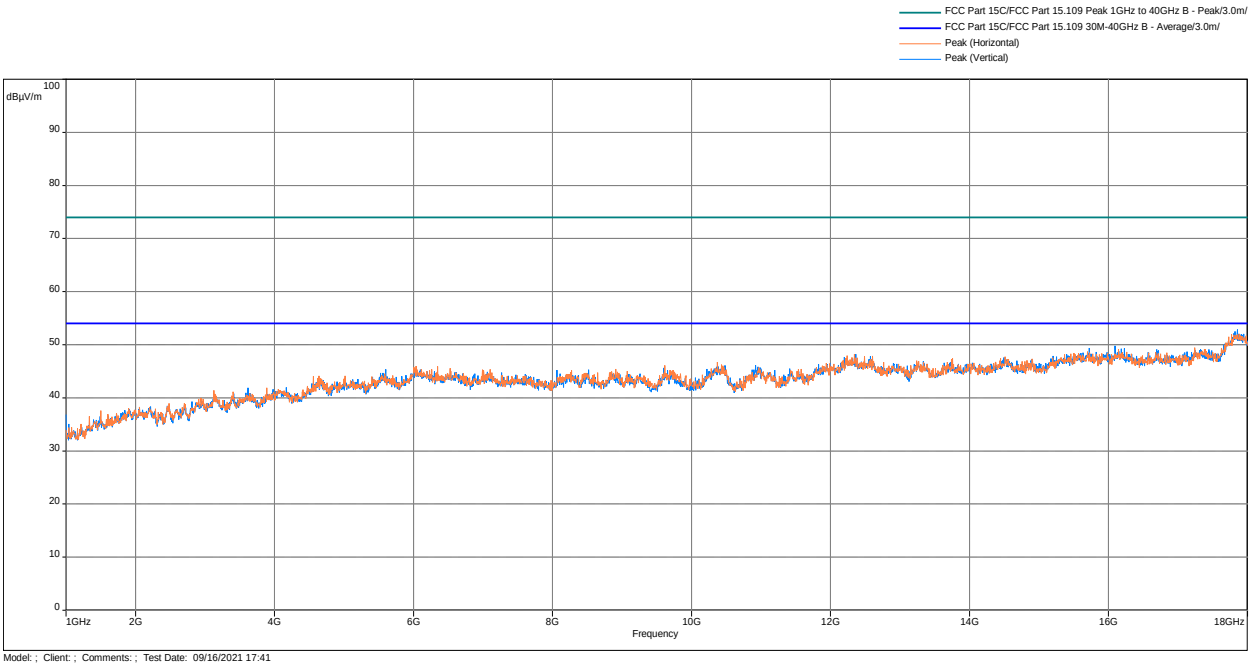
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 17:50

Radiated Spurious Emissions 30 MHz - 1000 MHz



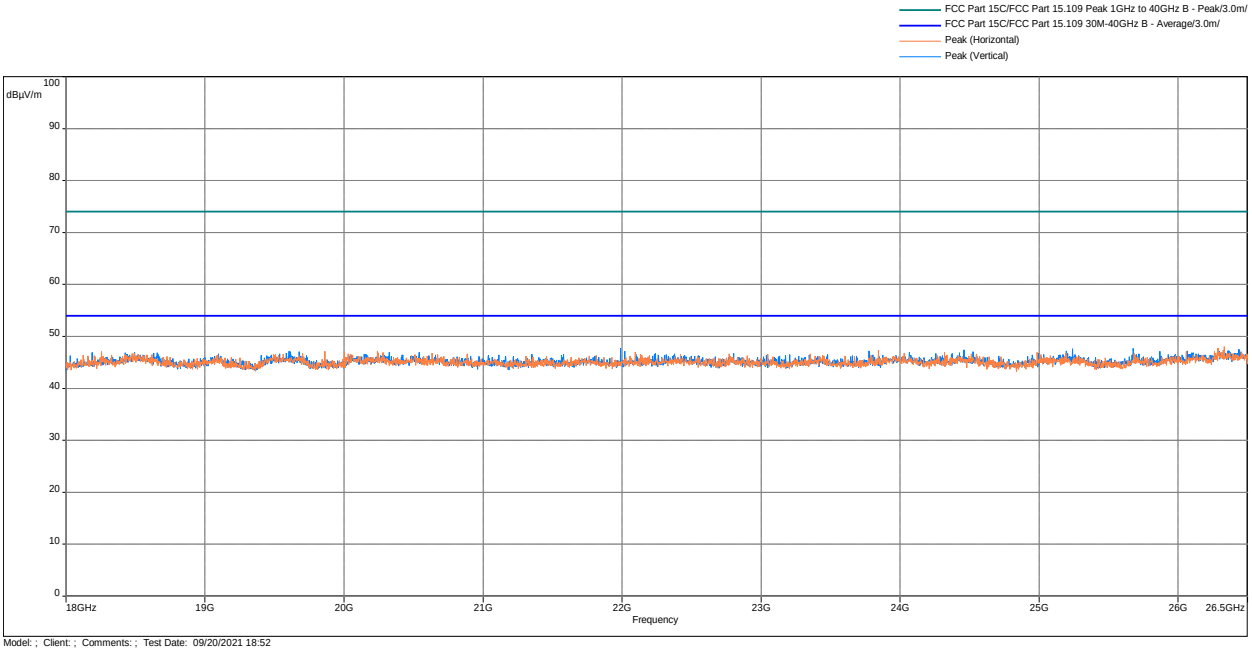
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 17:05

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



Model: ; Client: ; Comments: ; Test Date: 09/16/2021 17:41

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



Model: ; Client: ; Comments: ; Test Date: 09/20/2021 18:52

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz
3 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
955.1537	29.98	35.5	-5.52	4	95.25	Horizontal	3.74
949.5923	29.87	35.5	-5.63	4	354.75	Horizontal	3.37
958.8397	29.84	35.5	-5.66	3	213.5	Horizontal	3.89
959.454	29.64	35.5	-5.86	2	125.75	Horizontal	3.9
948.6223	29.62	35.5	-5.88	4	147.5	Horizontal	3.33
949.4953	29.51	35.5	-5.99	3	106.5	Vertical	3.37

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17854.93	52.89	74	-21.11	3.49	349.75	Vertical	8.51
17879.87	52.06	74	-21.94	3.49	0	Horizontal	8.39
15721.43	49.38	74	-24.62	1.51	206	Vertical	4.08
15697.07	48.72	74	-25.28	1.51	80.25	Horizontal	4.15
12342.97	48.27	74	-25.73	3.49	356.25	Horizontal	1.57
12361.67	48.22	74	-25.78	2.49	226.75	Vertical	1.52

Note: Correction = AF + CF - Preamp

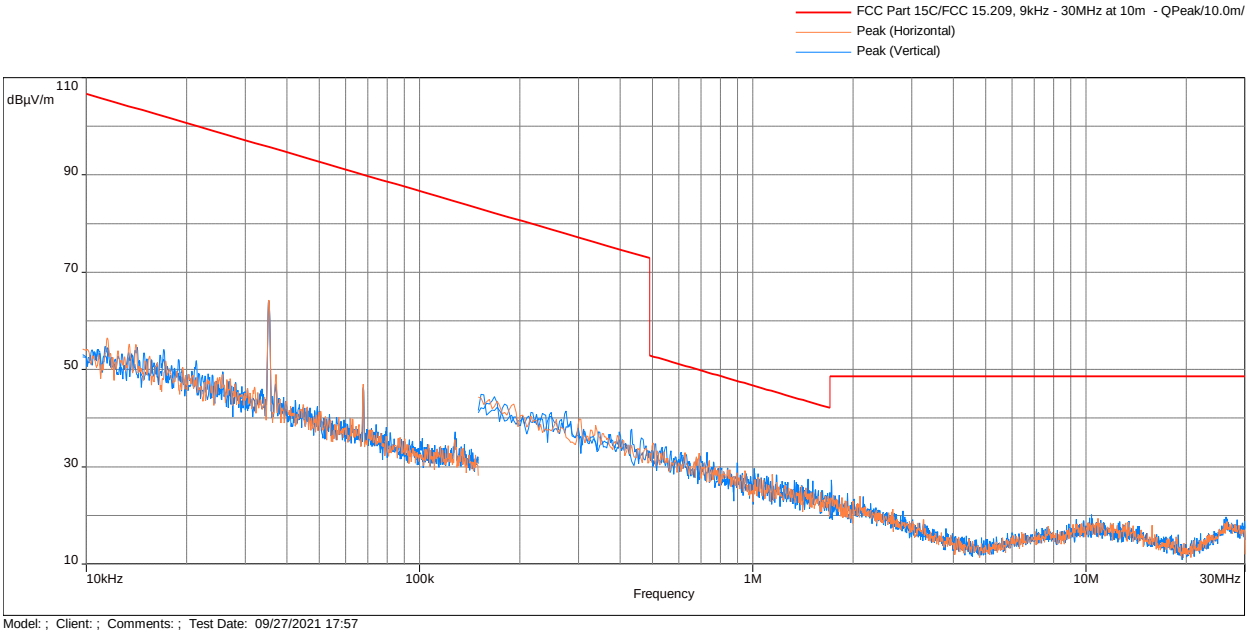
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17952.97	41.04	54	-12.96	1.51	69.5	Horizontal	7.75
17813	40.64	54	-13.36	1.51	291.25	Vertical	8.71
16723.87	38.37	54	-15.63	1.51	240.75	Horizontal	3.36
14507.63	38.31	54	-15.69	1.51	327	Horizontal	1.85
16072.77	38.01	54	-15.99	3.49	76.75	Vertical	3.76
12617.23	37.93	54	-16.07	1.51	284	Horizontal	1.93

Note: Correction = AF + CF - Preamp

Results	Complies

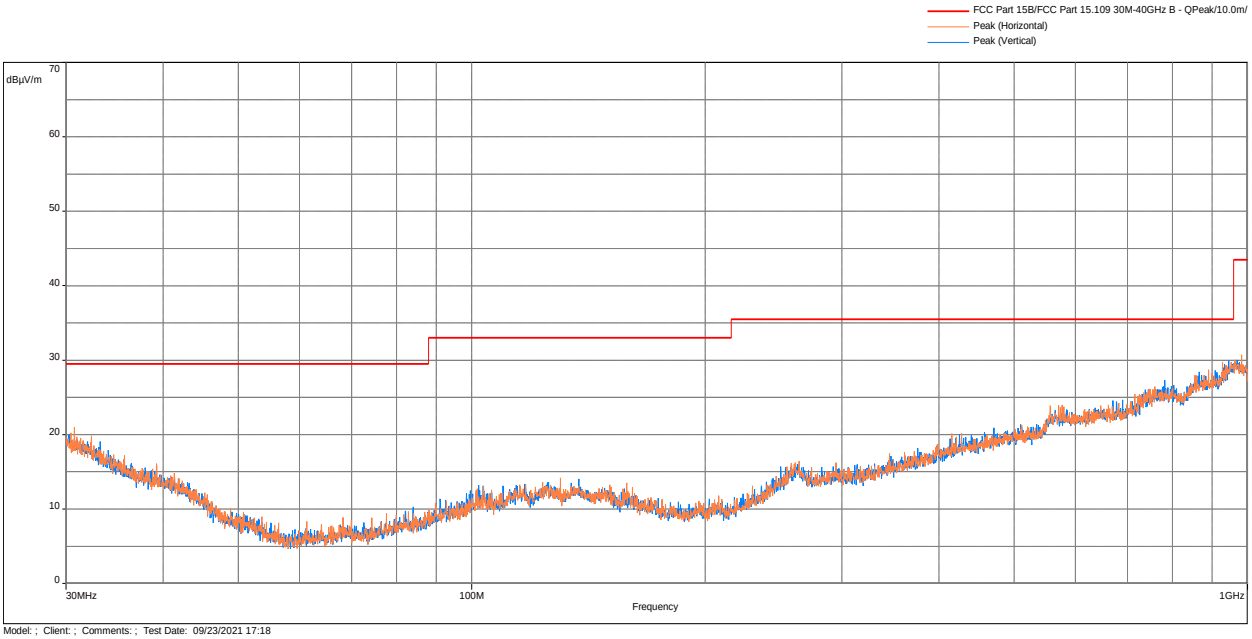
Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
3 lb Connected Dumbbell

Radiated Spurious Emissions 10kHz - 30 MHz Parallel, Perpendicular & Horizontal Antenna Polarization



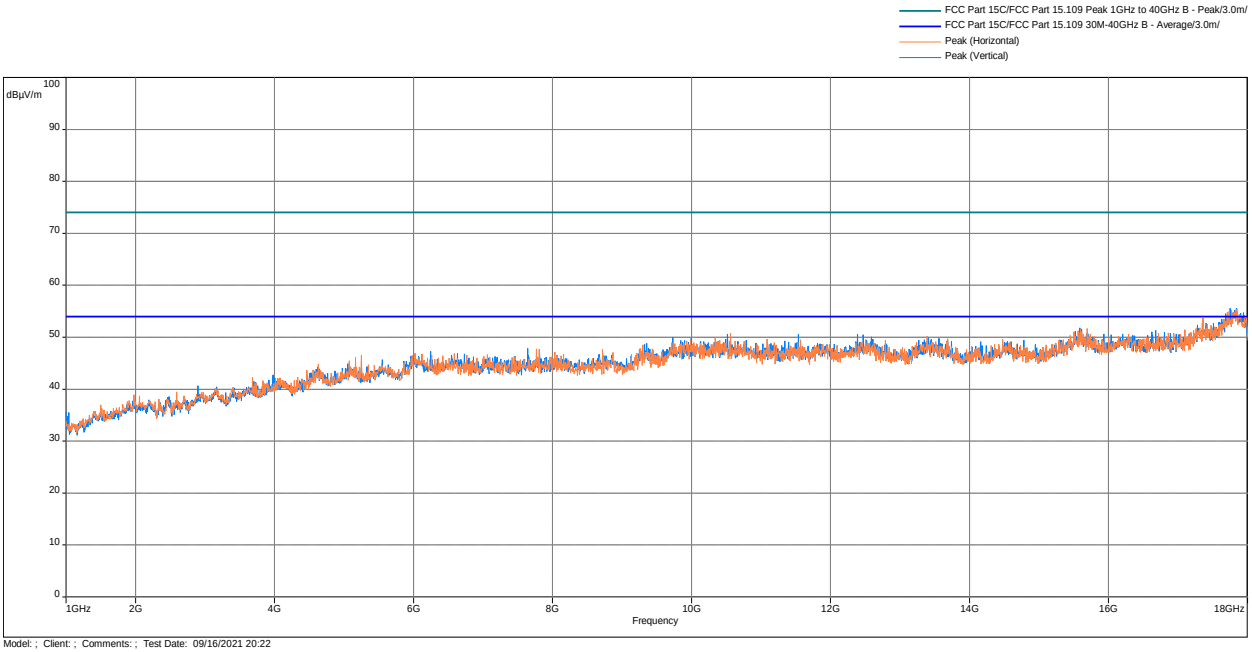
Model: ; Client: ; Comments: ; Test Date: 09/27/2021 17:57

Radiated Spurious Emissions 30 MHz - 1000 MHz



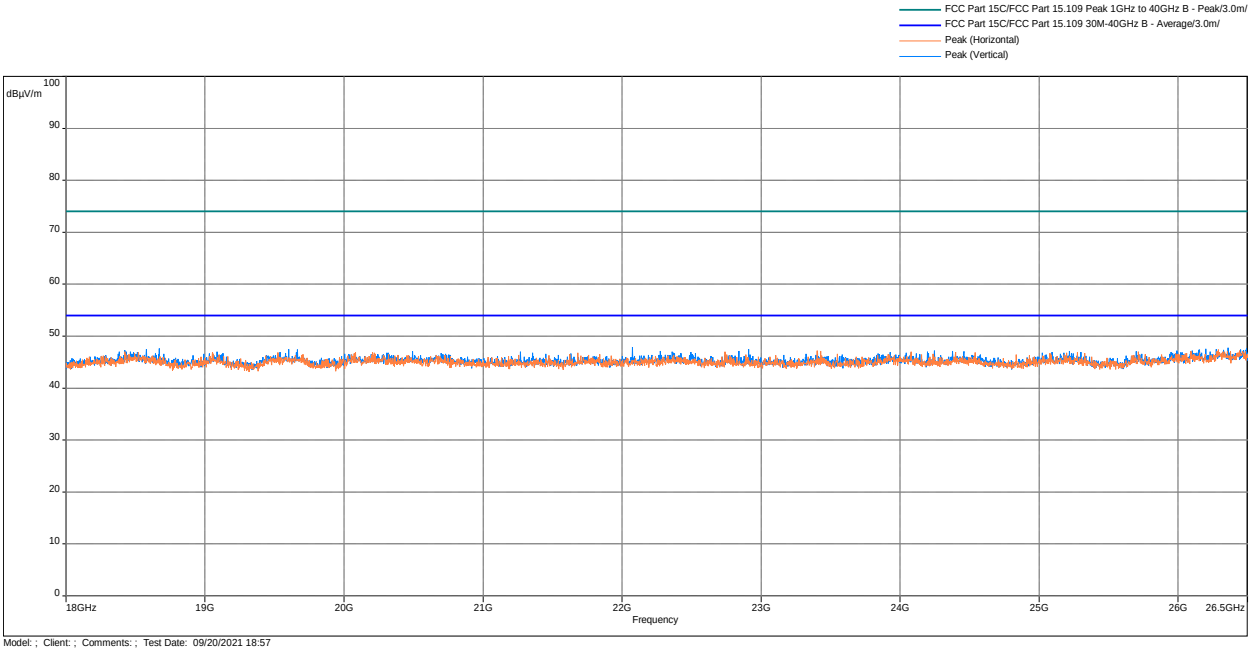
Model: ; Client: ; Comments: ; Test Date: 09/23/2021 17:18

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



Model: ; Client: ; Comments: ; Test Date: 09/16/2021 20:22

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



Model: ; Client: ; Comments: ; Test Date: 09/20/2021 18:57

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz
3 lb Connected Dumbbell

Frequency (MHz)	QPeak@ 10m (dBµV/m)	Lim. QPeak @10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
945.7447	29.91	35.5	-5.59	2	213.25	Vertical	3.04
952.761	29.74	35.5	-5.76	4	103.25	Horizontal	3.59
927.9613	29.73	35.5	-5.77	0.98	50	Horizontal	2.15
958.5163	29.56	35.5	-5.94	2	253	Vertical	3.88
958.581	29.51	35.5	-5.99	0.99	156.25	Vertical	3.88
959.5833	29.46	35.5	-6.04	3	121.5	Horizontal	3.9

Note: Correction = AF + CF – Preamp

Frequency (MHz)	Peak @3m (dBµV/m)	Lim. Peak @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17835.1	55.36	74	-18.64	3.49	0	Horizontal	8.61
15691.97	51.67	74	-22.33	3.49	0	Horizontal	4.15
10561.37	50.79	74	-23.21	3.49	0	Horizontal	0.66
13392.43	50.22	74	-23.78	3.49	0	Horizontal	2.23
9983.933	49.63	74	-24.37	3.49	0	Horizontal	0.72
7768.833	47.76	74	-26.24	3.49	0	Horizontal	-2.22

Note: Correction = AF + CF - Preamp

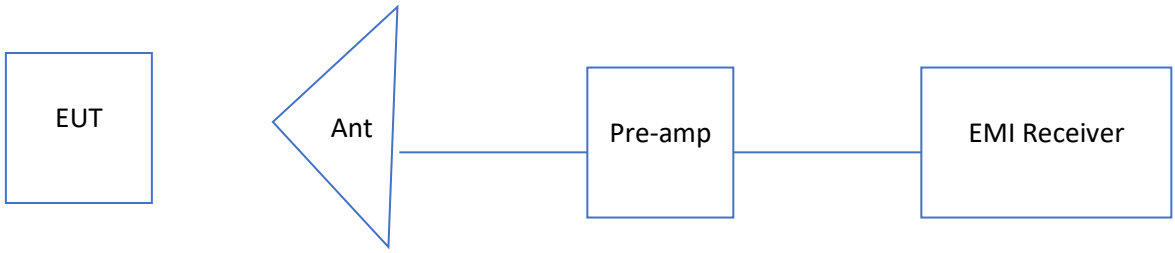
Frequency (MHz)	Ave @3m (dBµV/m)	Lim. Ave @3m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
17867.4	40.98	54	-13.02	3.49	70.5	Horizontal	8.45
17935.97	40.68	54	-13.32	1.51	32.75	Vertical	7.93
16363.47	38.21	54	-15.79	3.49	0	Horizontal	3.07
16620.73	37.99	54	-16.01	1.51	291	Vertical	3.28
17090.5	37.93	54	-16.07	2.51	359.75	Horizontal	3.66
17267.87	37.89	54	-16.11	3.49	28.5	Horizontal	5.01

Note: Correction = AF + CF - Preamp

Results	Complies

4.5.5 Test Setup Configuration

The following photographs show the testing configurations used.



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

4.6.1 Requirement

Frequency Band MHz	Class B Limit dB(μV)		Class A Limit dB(μV)	
	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.

4.6.3 Test Result

Not applicable. The EUT is battery powered only.

5.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	03/09/22
Spectrum Analyzer	Rohde and Schwarz	FSU26	ITS 00913	12	05/24/22
Horn Antenna	ETS Lindgren	3117PA	ITS 01365	12	04/20/22
18-40GHz Preamp	uComp Nordic	MCNS-50-18004000335P	ITS 01799	12	03/19/22
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Loop Antenna	EMCO	6512	ITS 001598	12	06/21/22
BI-Log Antenna	Teseq	CBL 6111D	ITS 01505	12	03/22/22
Pre-Amplifier	Sonoma Instrument	310N	ITS 01714	12	11/13/21
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/29/22
RF Cable	Mega Phase	EMC1-K1K1-19	ITS 01483	12	04/28/22
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01908	12	05/24/22
10m Semi-Anechoic Chamber	Panashield	10m Chamber	ITS 00984	36	07/29/23

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.20.0.23	Curiouser.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 / G104781122	KR	KV	November 17, 2021	Original document

END OF REPORT