TEST REPORT

Report Number: 104243565MPK-013
Project Number: G104243565
June 02, 2020

Testing performed on
Toothbrush
Part Numbers: 900-00127, 900-00128, and 900-00129

FCC ID: 2AT6D-85000070RA

to

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

For

Quip NYC, Inc.

Test Performed by:	Test Authorized by:
Intertek	Quip NYC, Inc.
1365 Adams Court	45 Main Street
Menlo Park, CA 94025 USA	Suite 630
	Brooklyn, NY 11201 USA

Prepared by: _____ **Date:** June 02, 2020
Amar Kacel

Reviewed by: _____ **Date:** June 02, 2020
Krishna K Vemuri

Report No. 104243565MPK-013	
Equipment Under Test:	Toothbrush
Trade Name:	Quip
Part Numbers:	900-00127 900-00128 900-00129
Applicant:	Quip NYC, Inc.
Contact:	Kiley Boehler
Address:	Quip NYC, Inc. 45 Main Street Suite 630 Brooklyn, NY 11201
Country:	USA
Tel. Number:	(843) 321-7148
Email:	kiley@getquip.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	May 11 to May 26, 2020

We attest to the accuracy of this report:

Amar Kacel
EMC Engineer

Krishna K Vemuri
EMC Manager

TABLE OF CONTENTS

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 operated
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: May 11, 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: May 11, 2020

Test completion date: May 26, 2020

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

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2.0 General Information

2.1 Product Description

Quip NYC, Inc supplied the following description of the EUT:

The quip Smart Toothbrush is a toothbrush that tracks user brushing behavior. The data stored in the toothbrush can be read through Bluetooth via a smartphone application

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

Information about the 2.4 GHz radio is presented below:

Applicant	Quip NYC, Inc.
Model No.	900-00127 900-00128 900-00129
FCC Identifier	2AT6D-85000070RA
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	-1.65 dBm
Antenna(s) & Gain	Internal Antenna, Peak Gain: -0.3 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Quip NYC, Inc. 45 Main Street Suite 630 Brooklyn, NY 11201 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

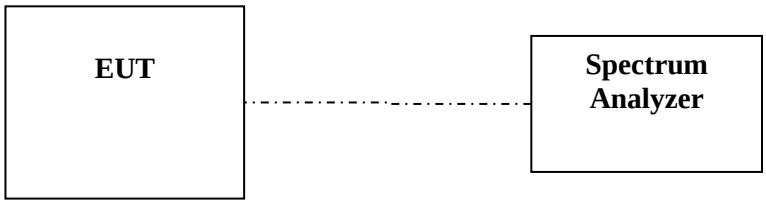
3.1 Support Equipment

No Support Equipment was used.

3.2 Block Diagram of Test Setup

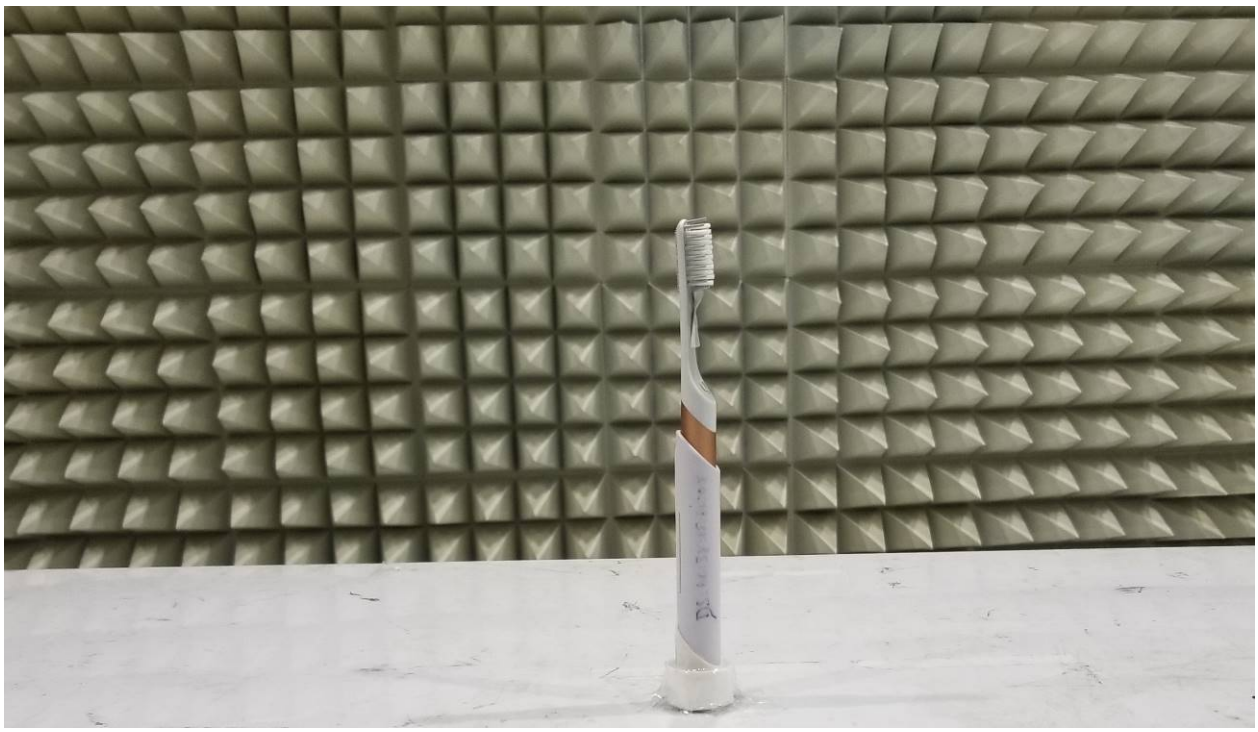
Equipment Under Test			
Description	**Manufacturer**	**Part Number**	**Sample ID**
Radiated Sample of Toothbrush –Adult Metal Toothbrush	Quip NYC	900-00127	MPK2005281548-001
Radiated Sample of Toothbrush –Adult Plastic Toothbrush	Quip NYC	900-00128	MPK2005281548-002
Radiated Sample of Toothbrush –Kids Soft Plastic Toothbrush	Quip NYC	900-00129	MPK2005281548-003
Conducted Sample of Toothbrush	Quip NYC	900-00128	MPK2005281548-004

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



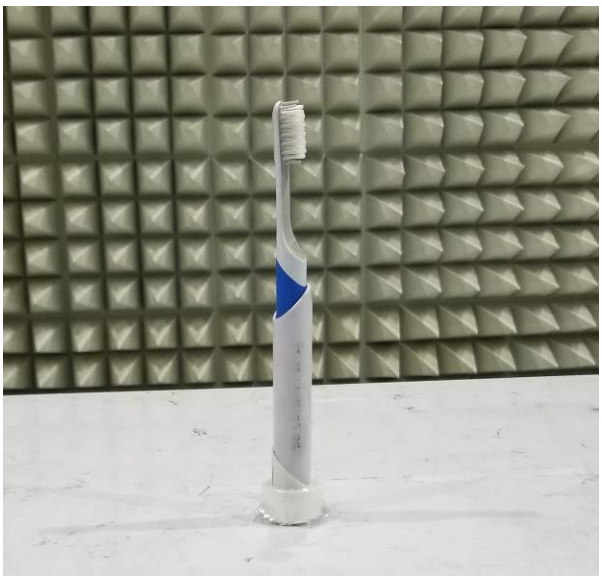
S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

EUT Photo



Adult Metal Toothbrush--900-00127

Kids Soft Plastic Toothbrush--900-00129



Adult Plastic Toothbrush--900-00128

3.3 Justification

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

3.4 Software Exercise Program

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

3.5 Mode of Operation during Test

As instructed by the manufacturer, the EUT's power setting was set to 0 dBm on the low, middle, and high frequencies/channels.

3.6 Modifications Required for Compliance

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

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

4.1 6-dB Bandwidth and 99% Occupied Bandwidth
FCC Rule: 15.247(a)(2); RSS-247, 5.2.a) and RSS-GEN;

4.1.1 Requirement

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

4.1.2 Procedure

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

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

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 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.

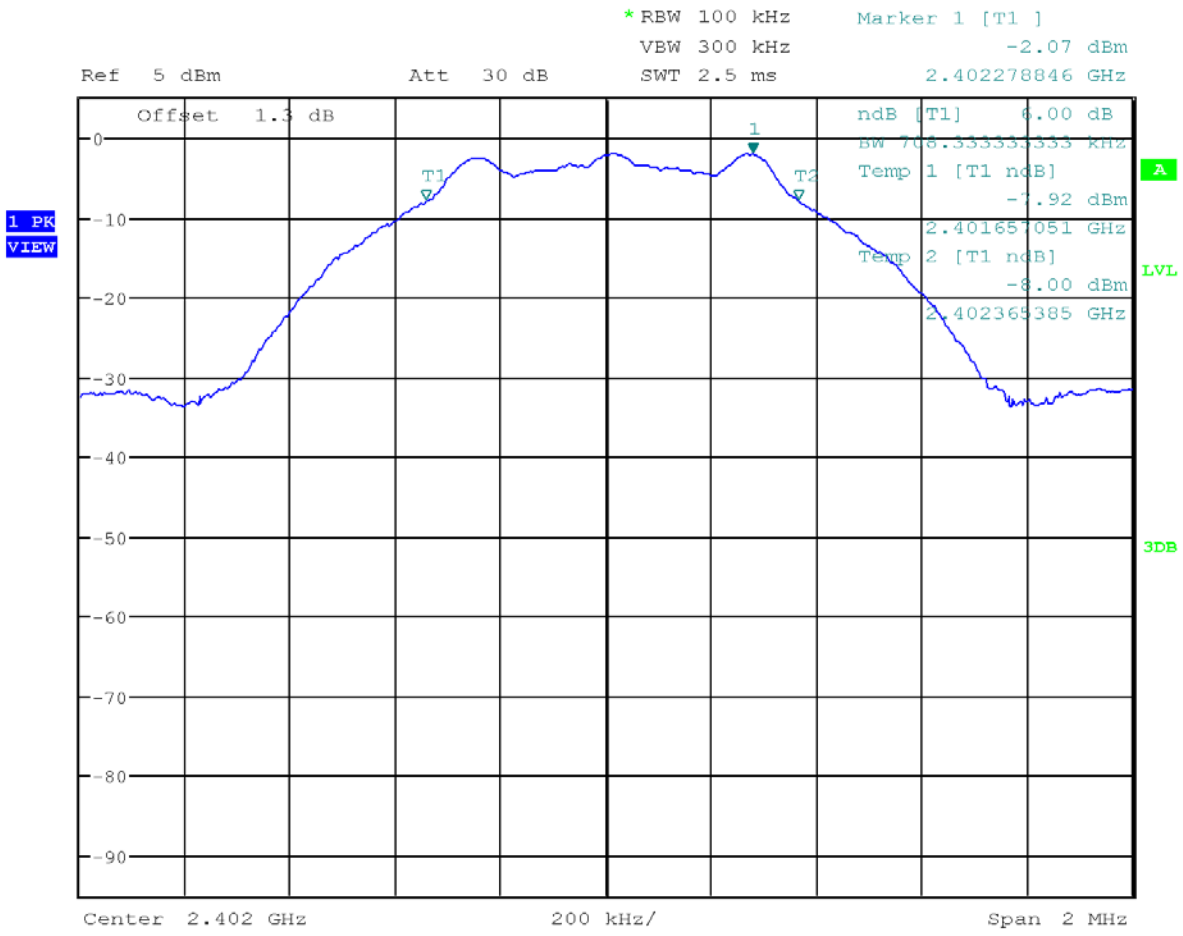
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN	Occupied bandwidth, RSS-GEN	Plot
MHz	kHz	MHz	
2402	708.333	--	1.1
	--	1.052	1.4
2440	717.948	--	1.2
	--	1.052	1.5
2480	714.743	-	1.3
	--	1.062	1.6

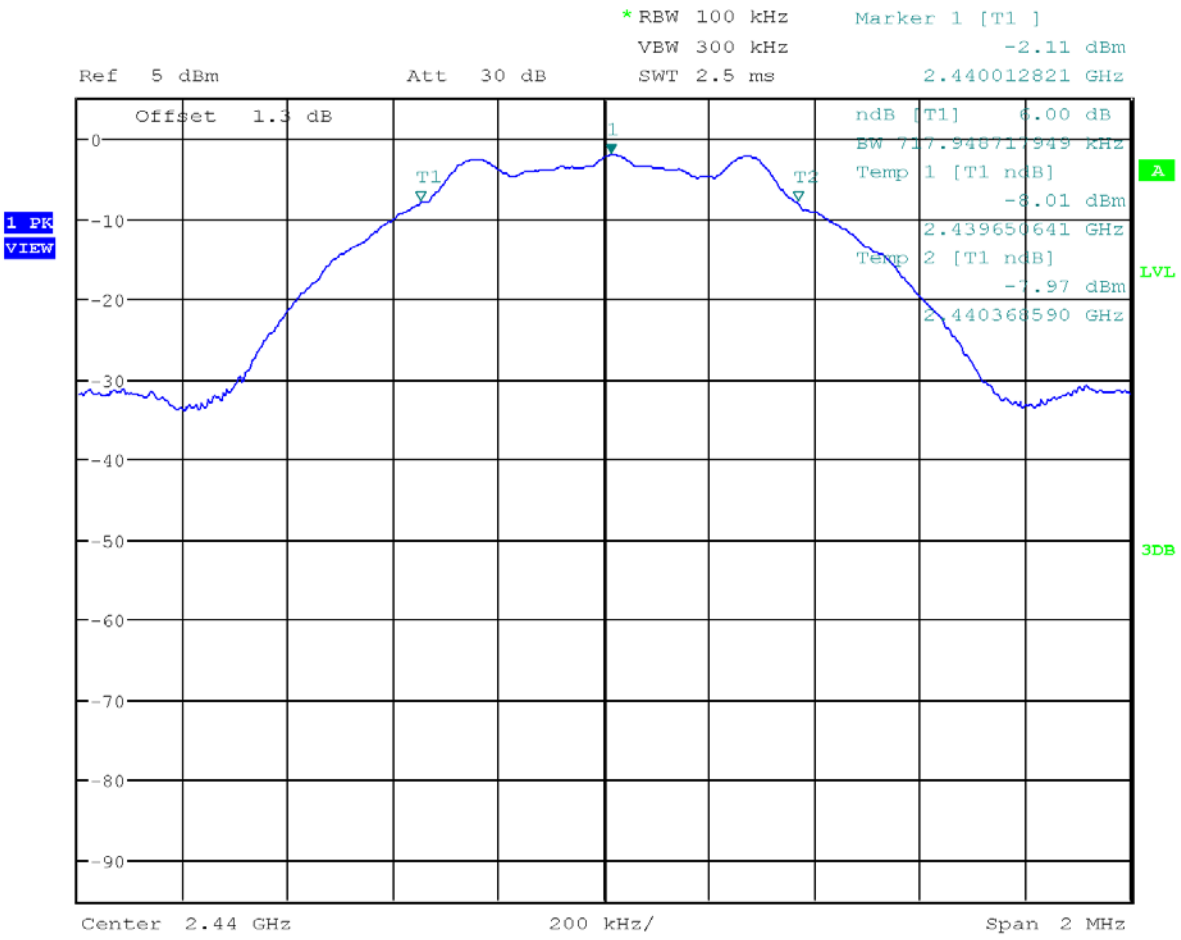
Tested By	Test Date
Amar Kacel	May 22, 2020 & May 26, 2020

Plot 1. 1



Date: 22.MAY.2020 10:43:25

Plot 1. 2



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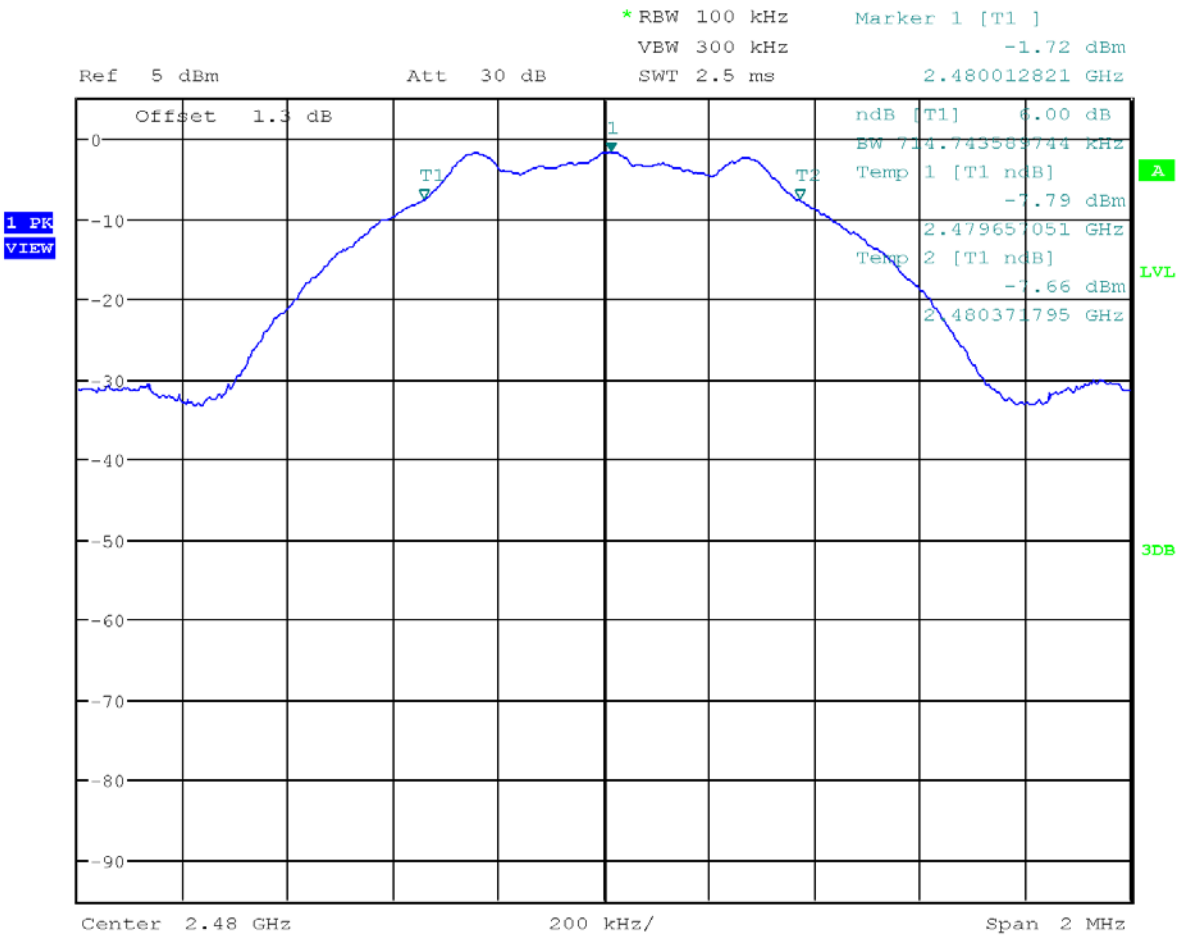
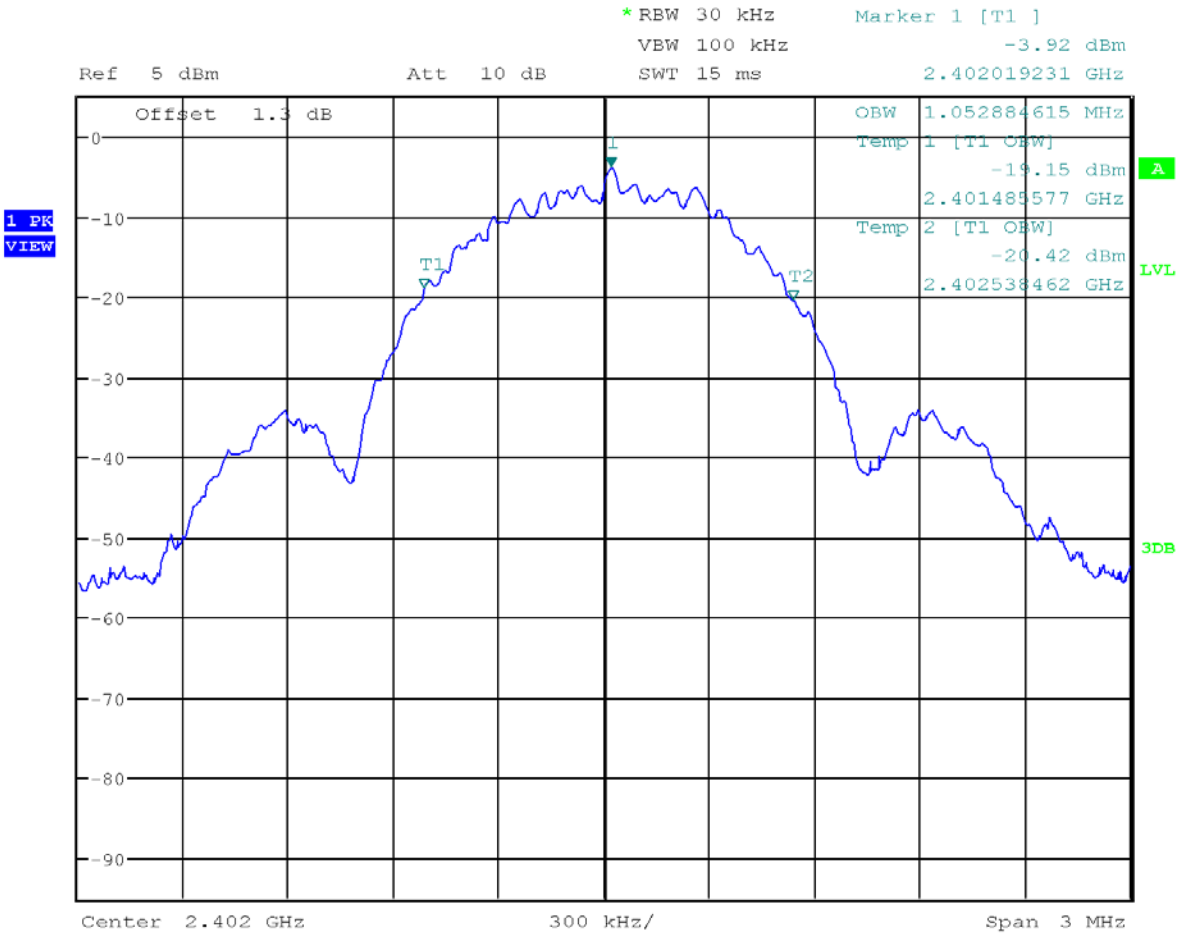
Plot 1. 3



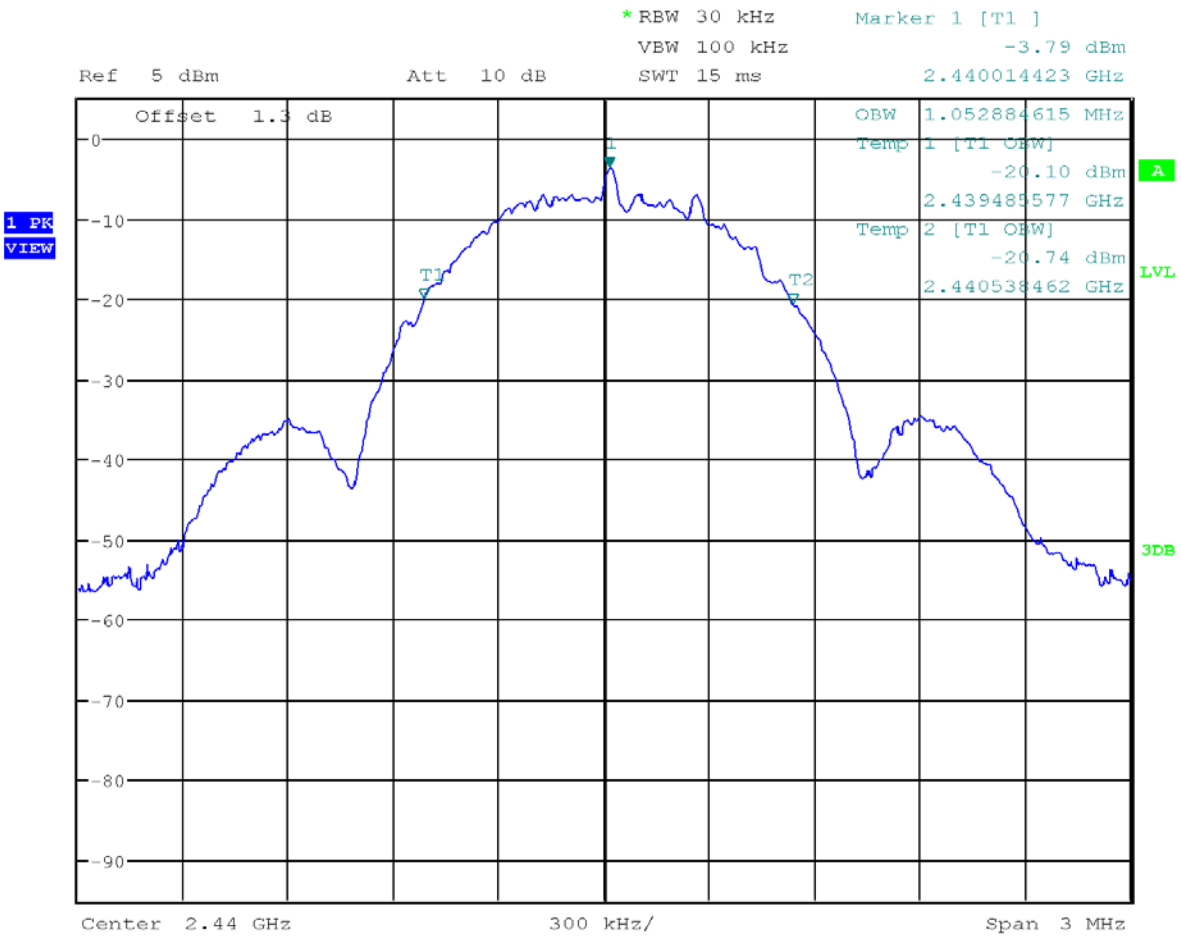
Date: 22.MAY.2020 10:41:12

Plot 1. 4



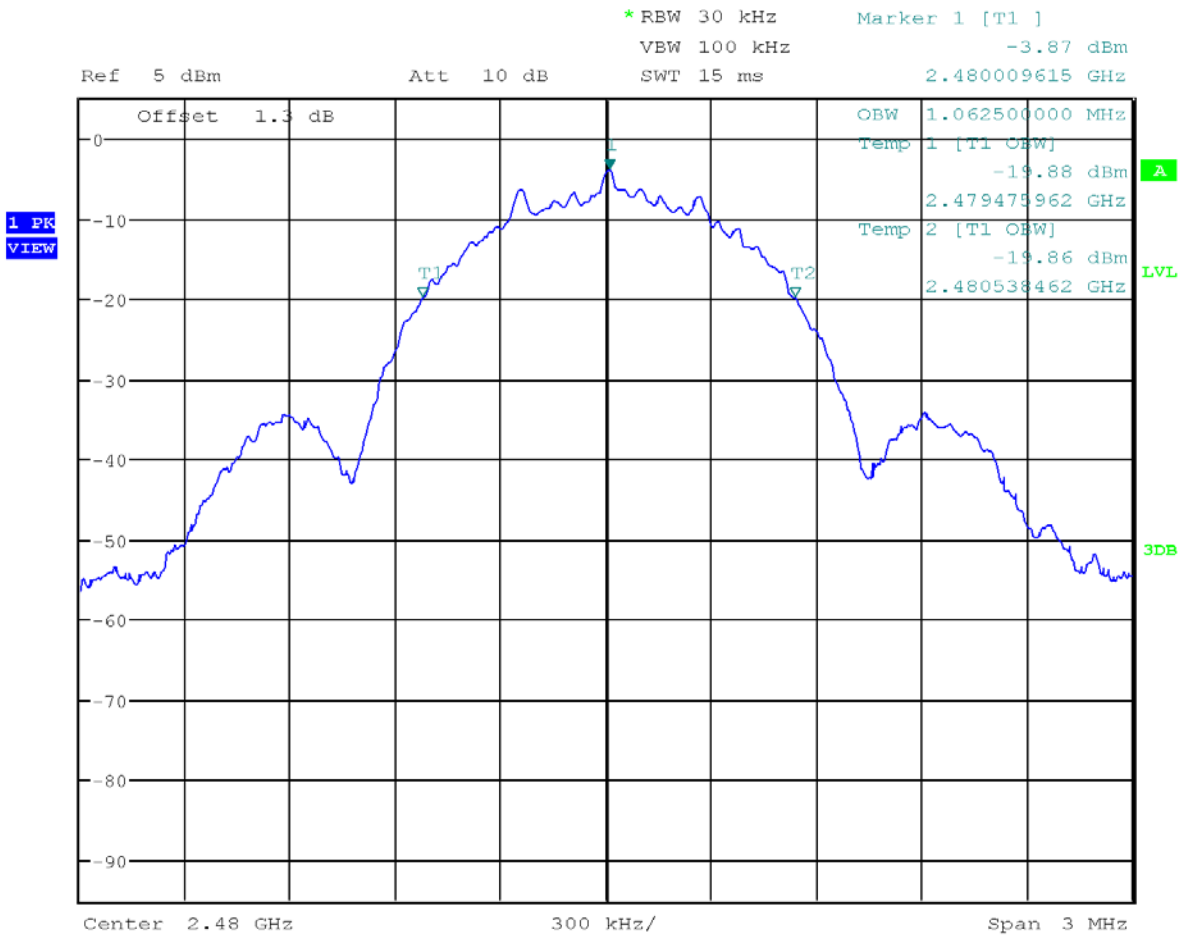
Date: 26.MAY.2020 16:23:15

Plot 1.5



Date: 26.MAY.2020 16:26:59

Plot 1.6



Date: 26.MAY.2020 16:30:01

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.

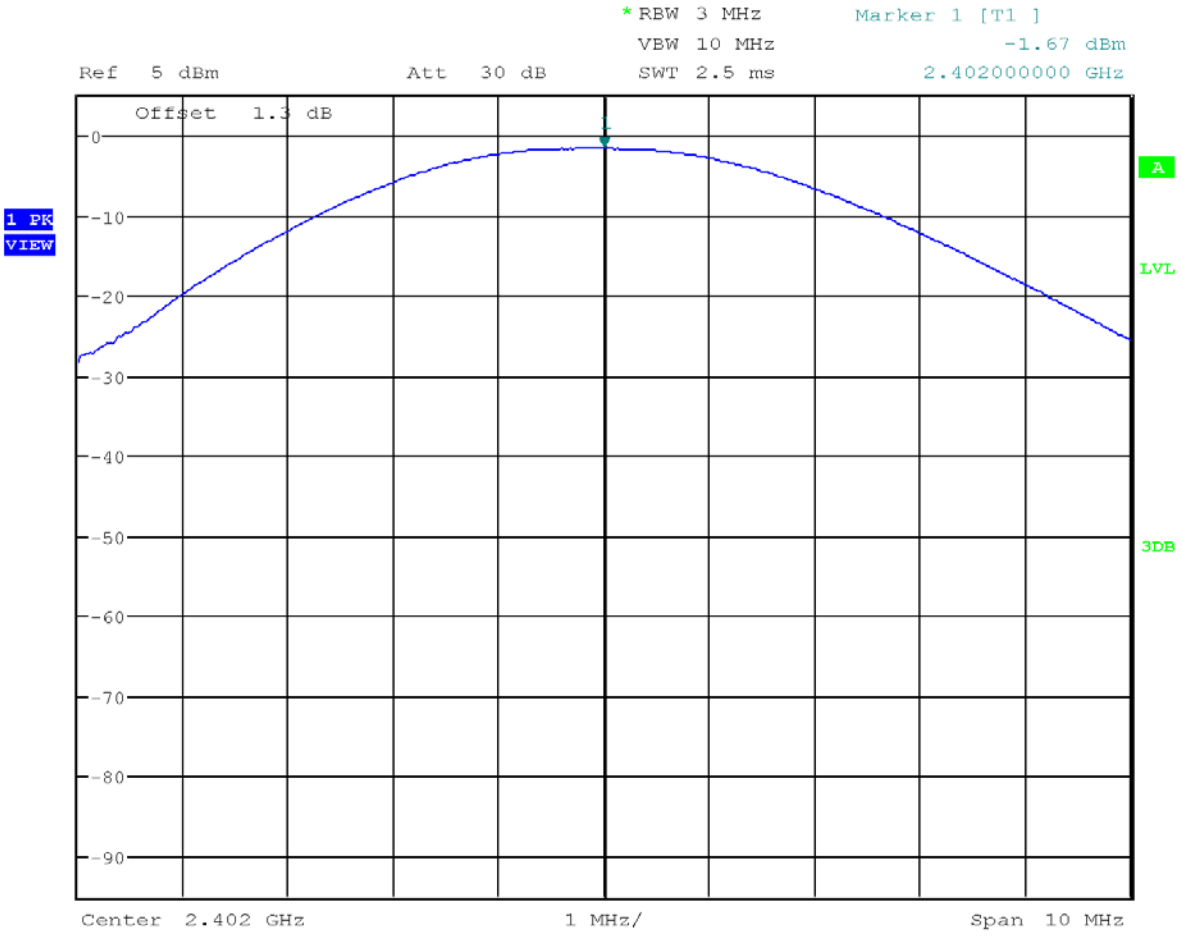
4.2.3 Test Result

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

Frequency	Conducted Power (peak)		Plot
MHz	dBm	mW	
2402	-1.67	0.680	2.1
2440	-1.73	0.671	2.2
2480	-1.65	0.684	2.3

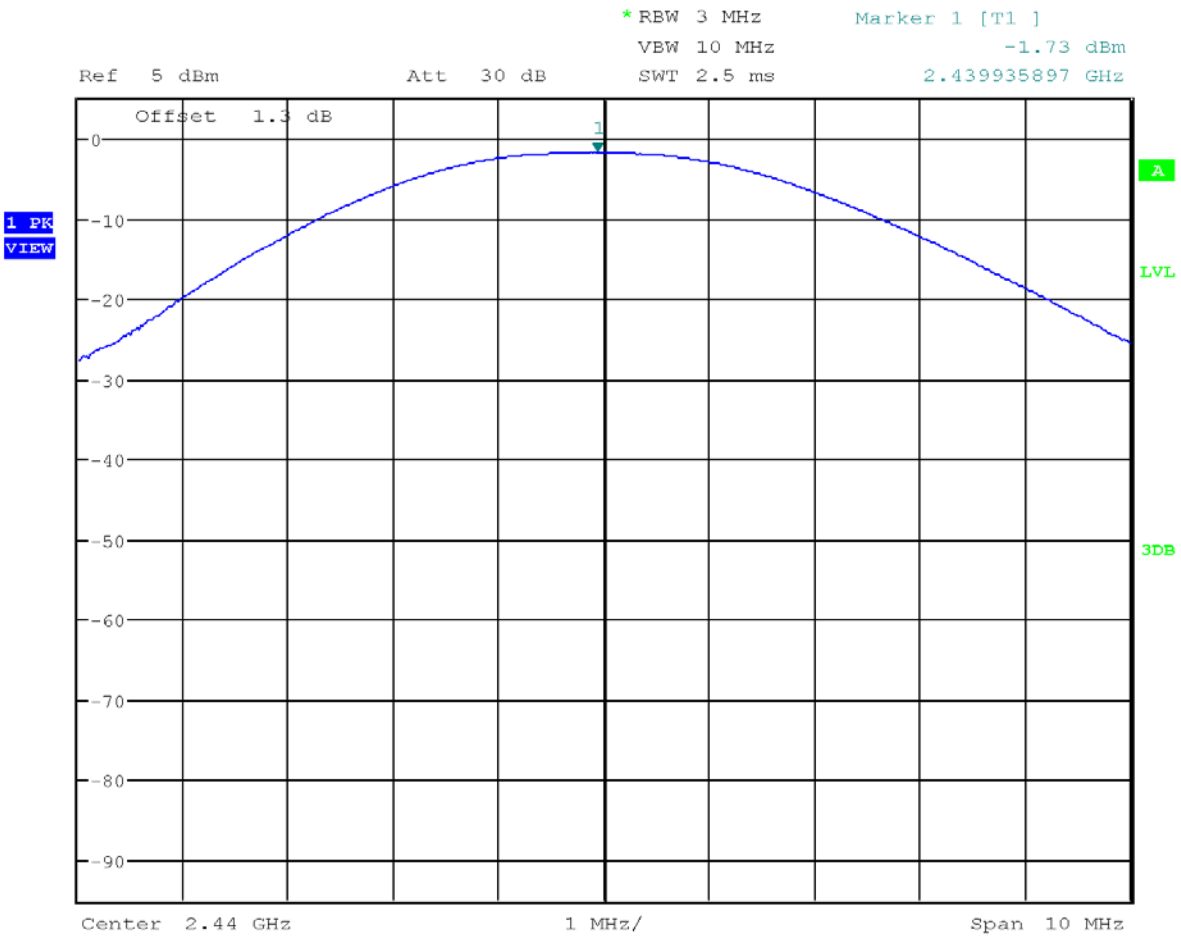
Tested By	Test Date
Amar Kacel	May 26, 2020

Plot 2. 1



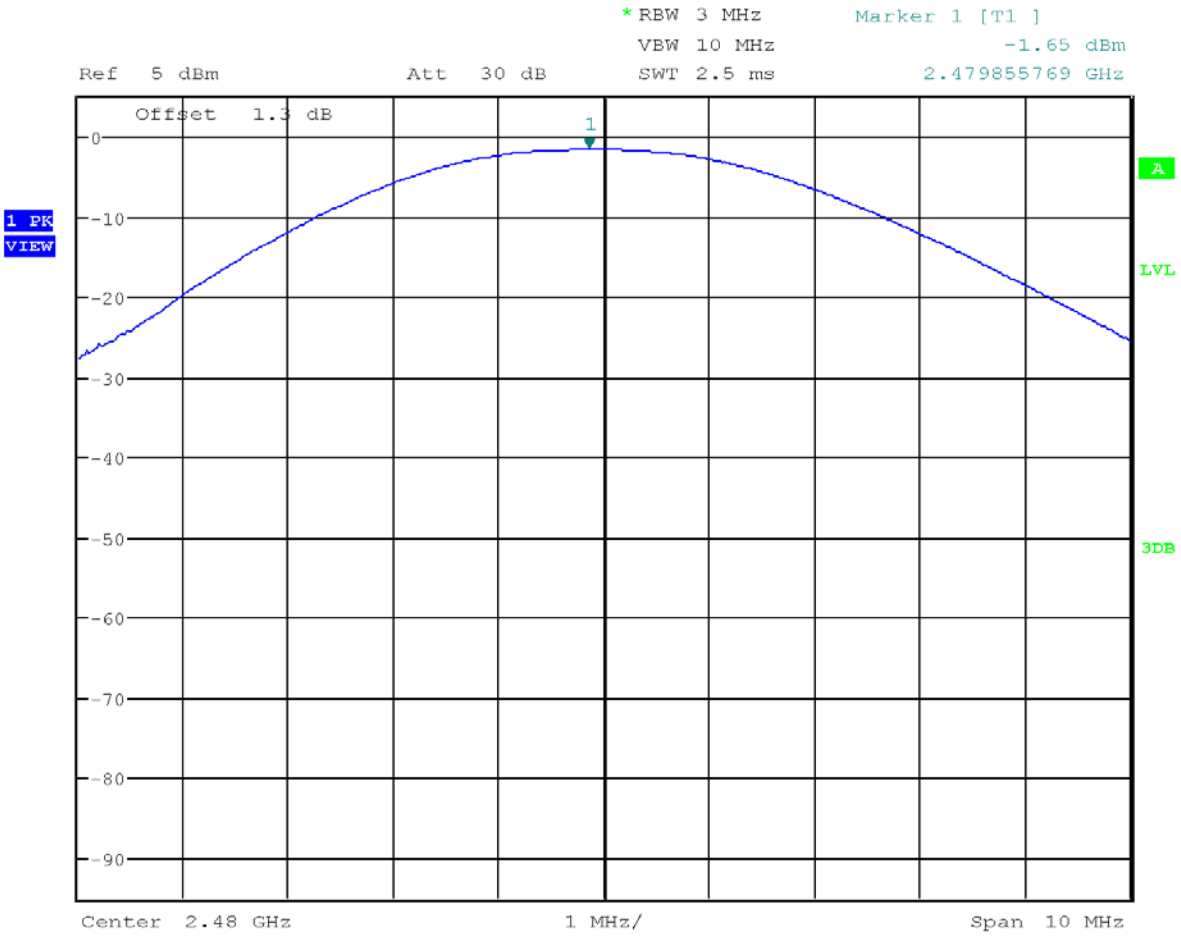
Date: 26.MAY.2020 16:47:39

Plot 2. 2



Date: 26.MAY.2020 16:44:01

Plot 2. 3


* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-1.65 dBm
2.479855769 GHz
Ref 5 dBm
Att 30 dB
Offset 1.3 dB
1 PK
VIEW
A
LVL
3DB
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
1 MHz/
Span 10 MHz
Date: 26.MAY.2020 16:39:59

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.

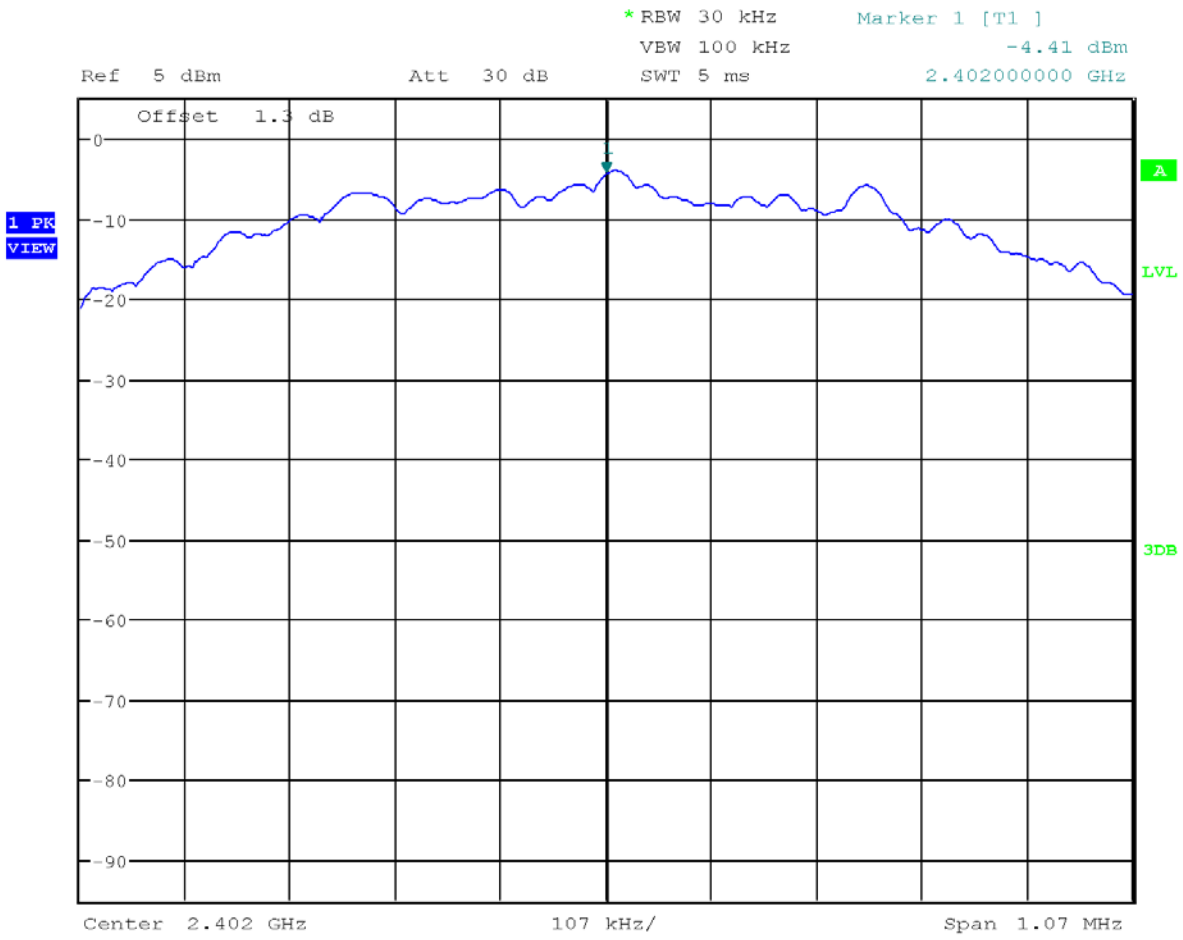
4.3.3 Test Result

Refer to the following plots for the test result

Frequency,	Maximum Power Spectral Density	Maximum Power Spectral Density Limit	Margin	Plot
MHz	dBm	dBm	dB	
2402	-4.41	8.0	-12.41	3.1
2440	-4.28	8.0	-12.28	3.2
2480	-3.48	8.0	-11.48	3.3

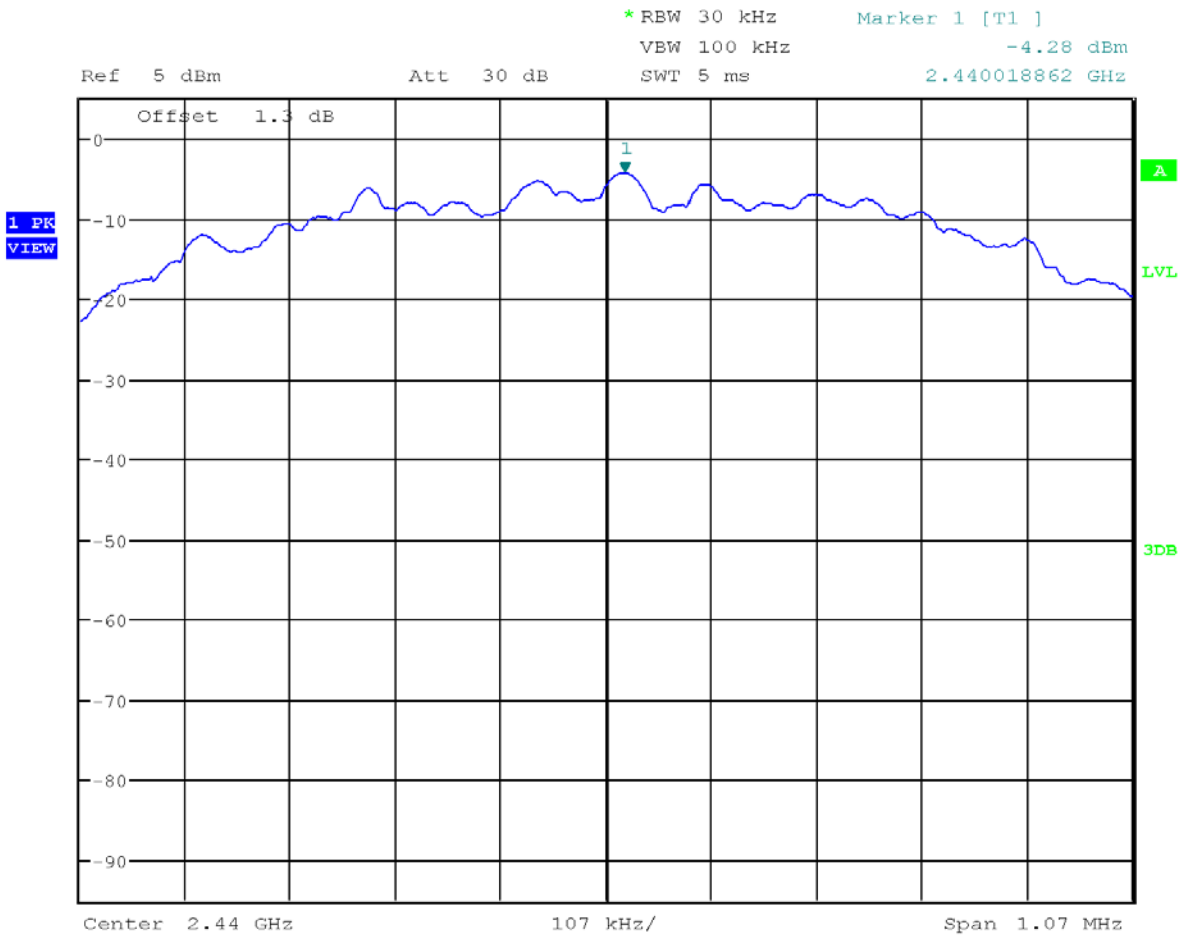
Tested By	Test Date
Amar Kacel	May 26, 2020

Plot 3. 1



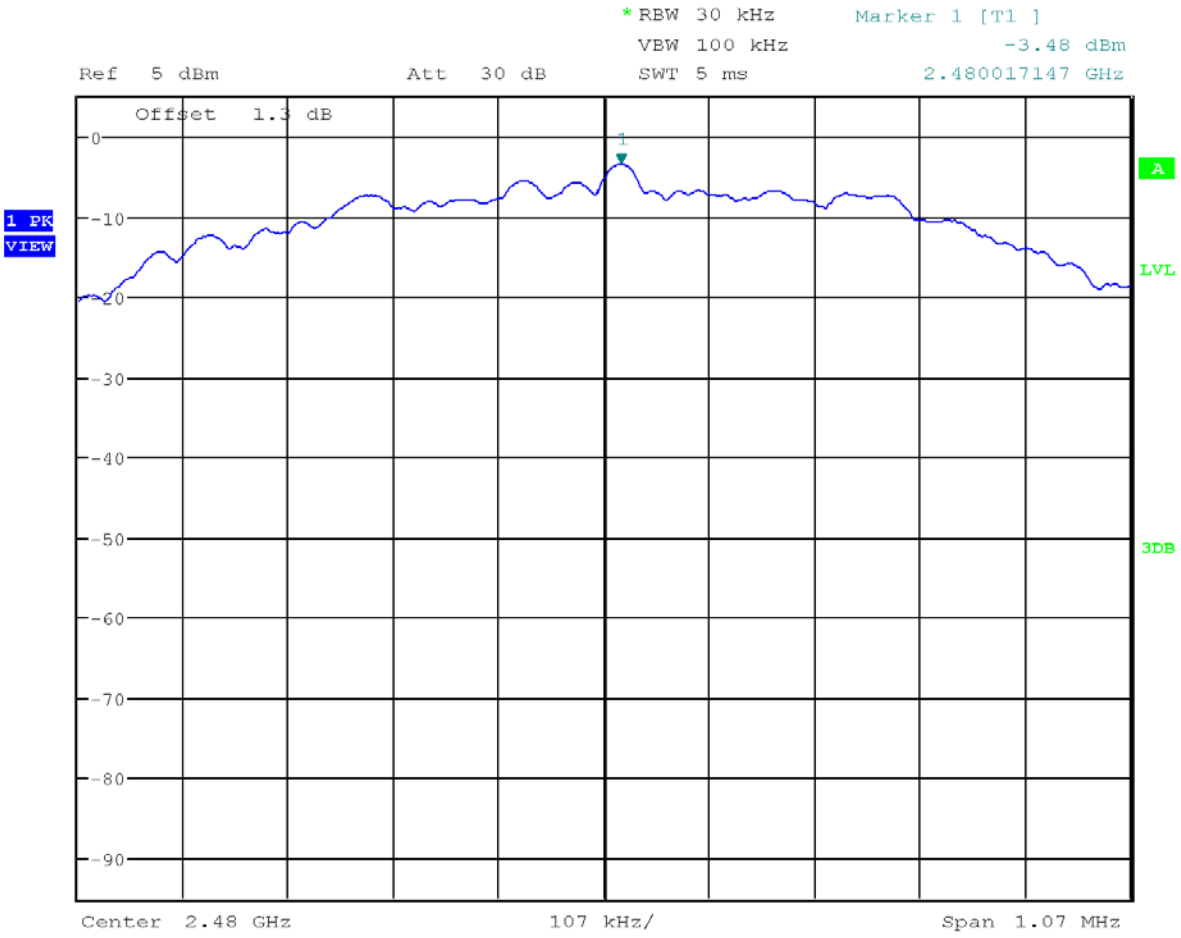
Date: 26.MAY.2020 17:05:18

Plot 3. 2



Date: 26.MAY.2020 17:08:48

Plot 3. 3



Date: 26.MAY.2020 17:11:31

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.

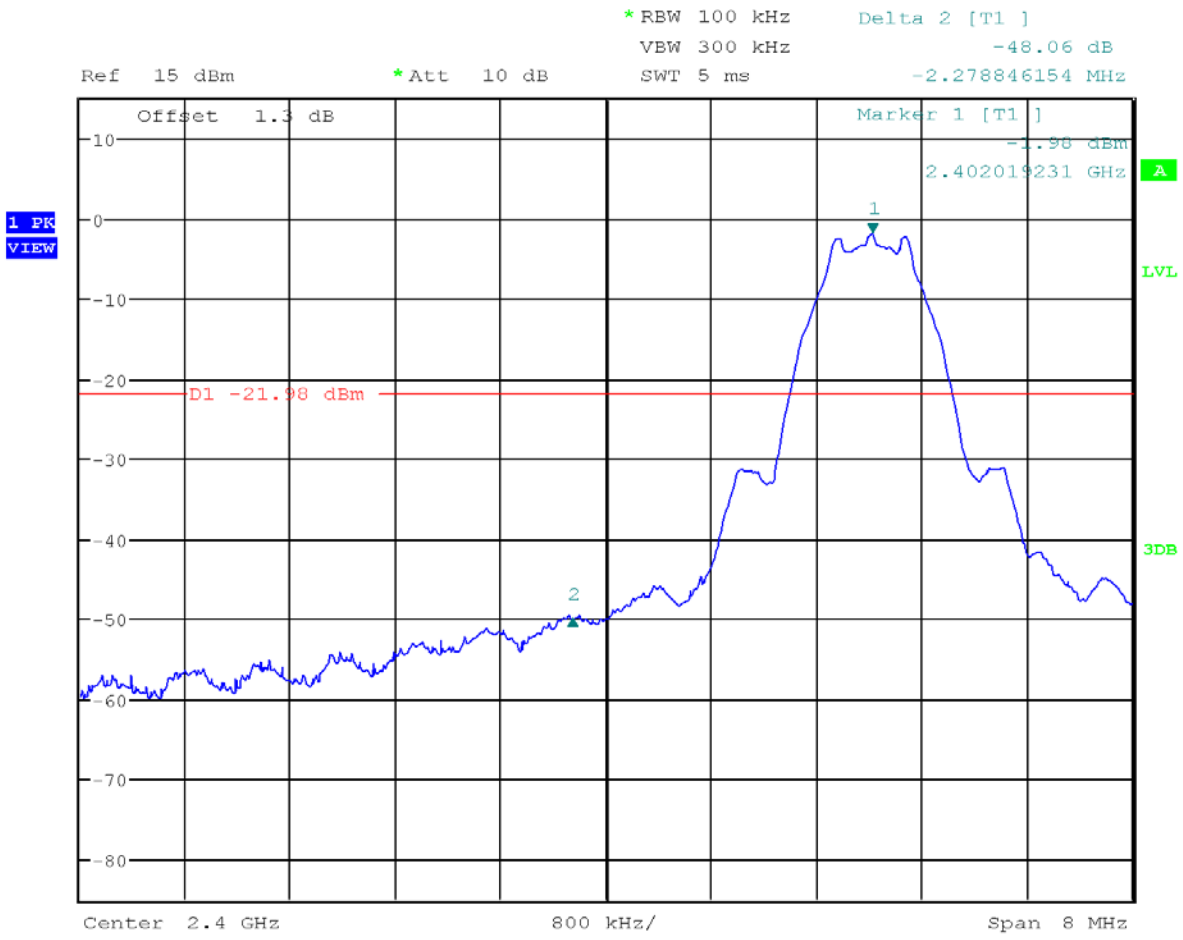
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

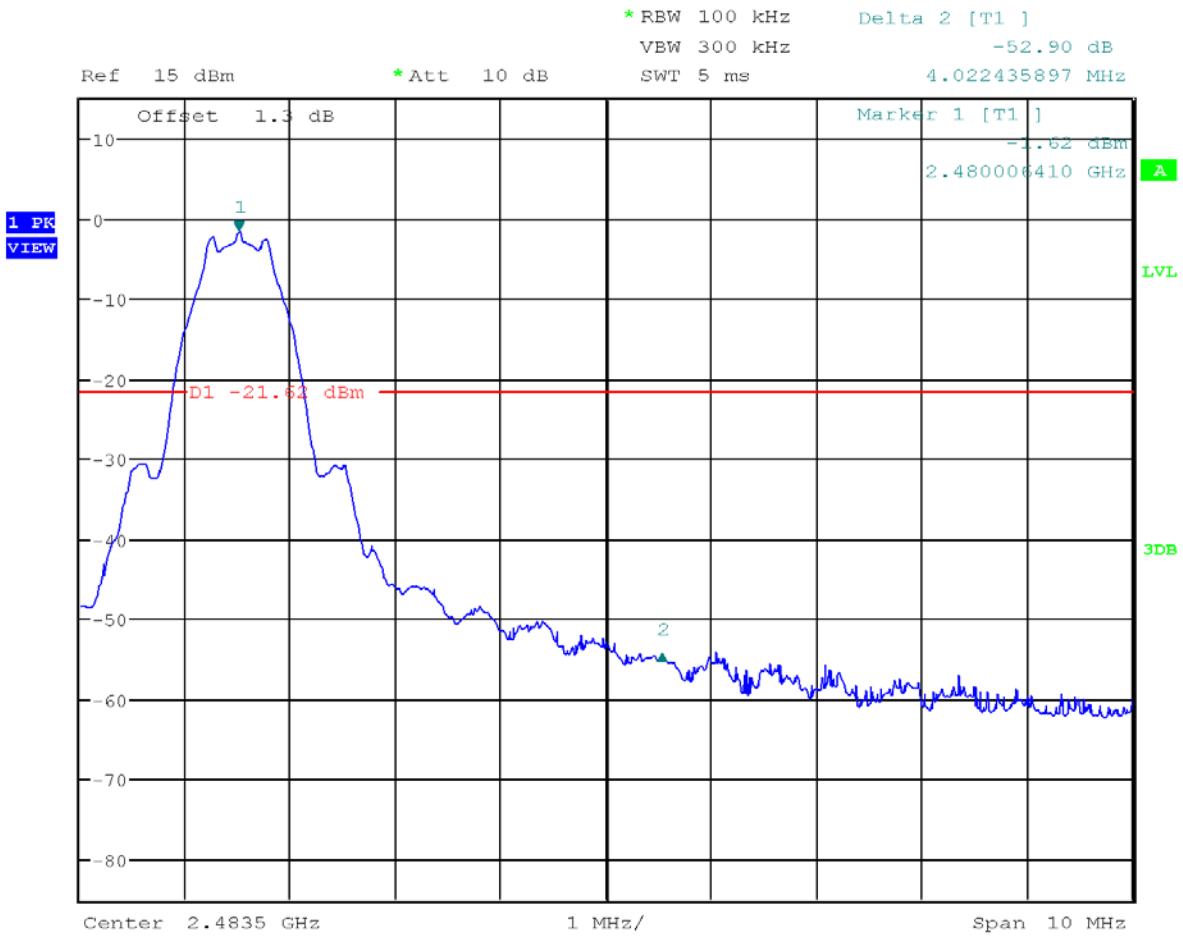
Refer to the following plots 4.1 – 4.5 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

Tested By	Test Date
Amar Kacel	May 22, 2020

Tx @ Low Channel, 2400 MHz Band Edge
Plot 4.1

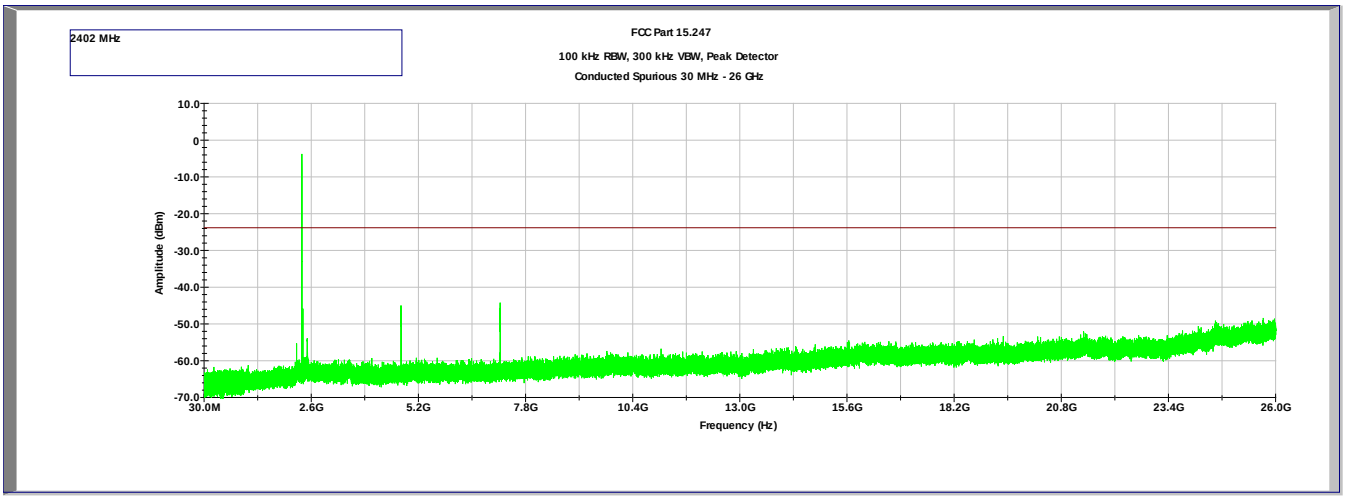


Tx @ Low Channel, 2483.5 MHz Band Edge
Plot 4.2

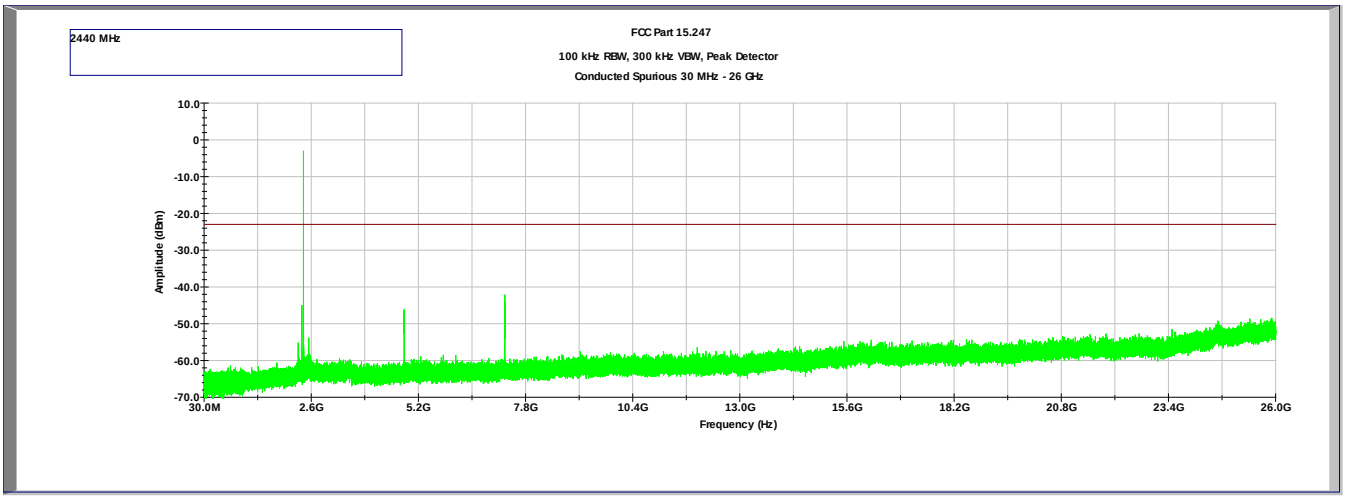


Date: 22.MAY.2020 11:28:18

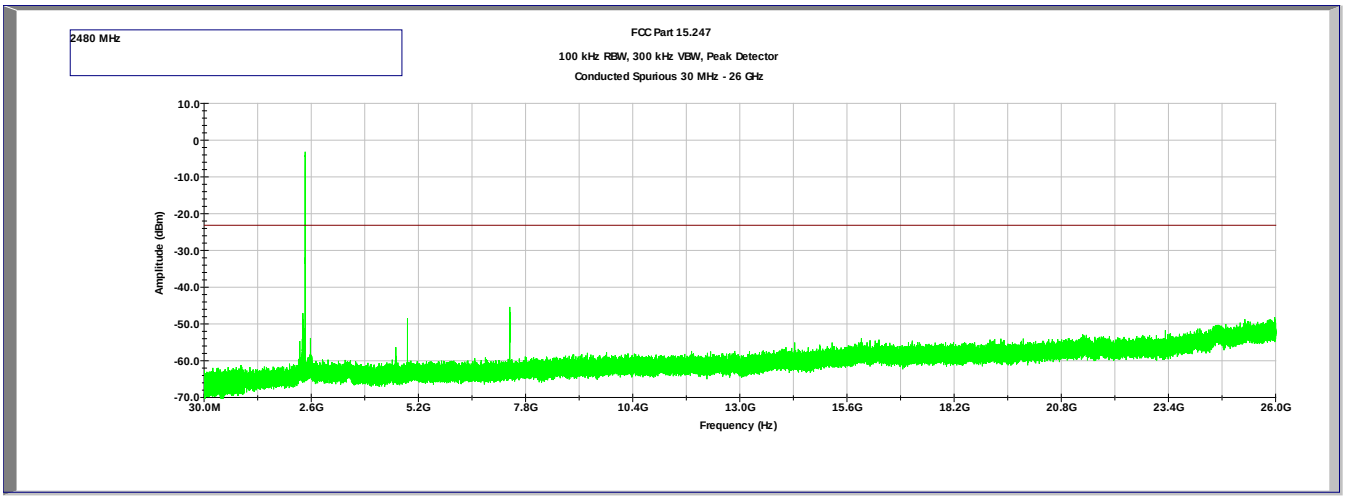
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



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



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



4.5 Transmitter Radiated Emissions
FCC Rules: 15.247(d), 15.209, 15.205; RSS-247, 5.5;

4.5.1 Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

4.5.2 Procedure

Radiated emission measurements were performed from 30 MHz to 25 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

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

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

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

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

Radiated measurements were performed on the X, Y and Z orientation of the EUT. Z-axis was the worst case orientation. Data and setup pictures were 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

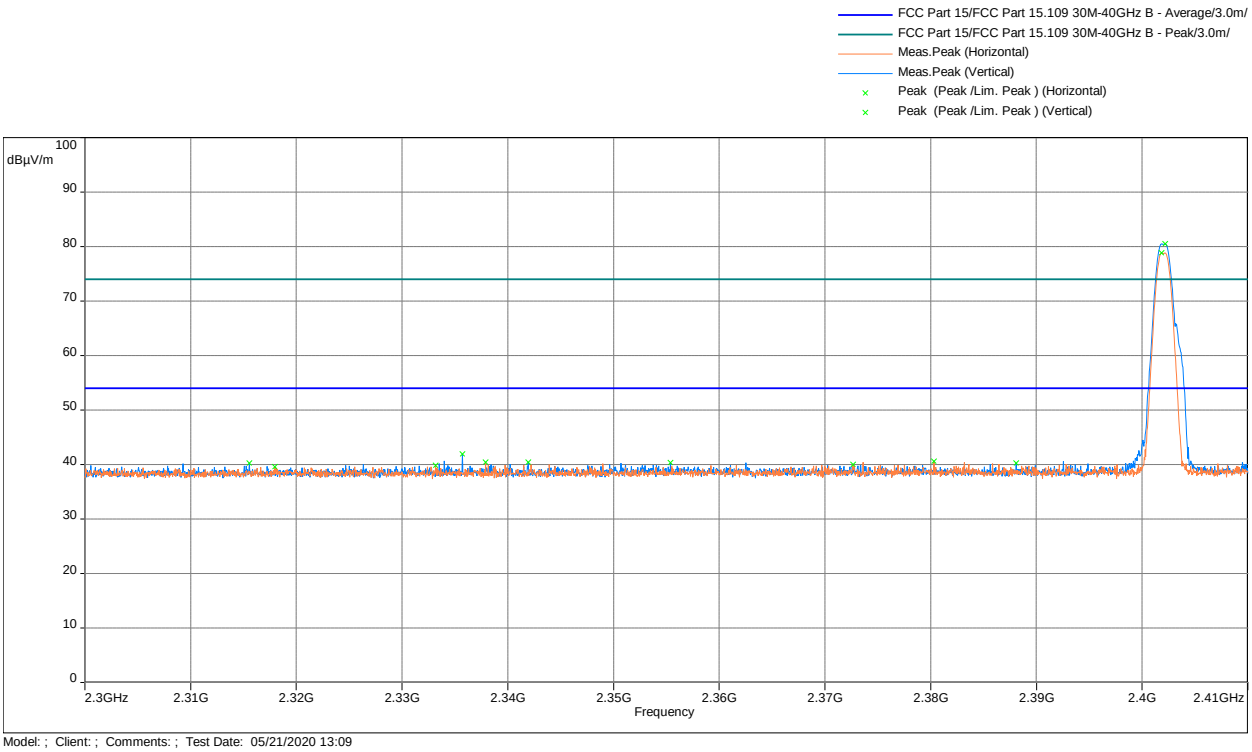
All testing in this section were performed by radiated measurements.

Tested By	Test Date
Amar Kacel	May 18, 2020 to May 22, 2020

4.5.4.1 Adult Metal Toothbrush (900-00127)

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

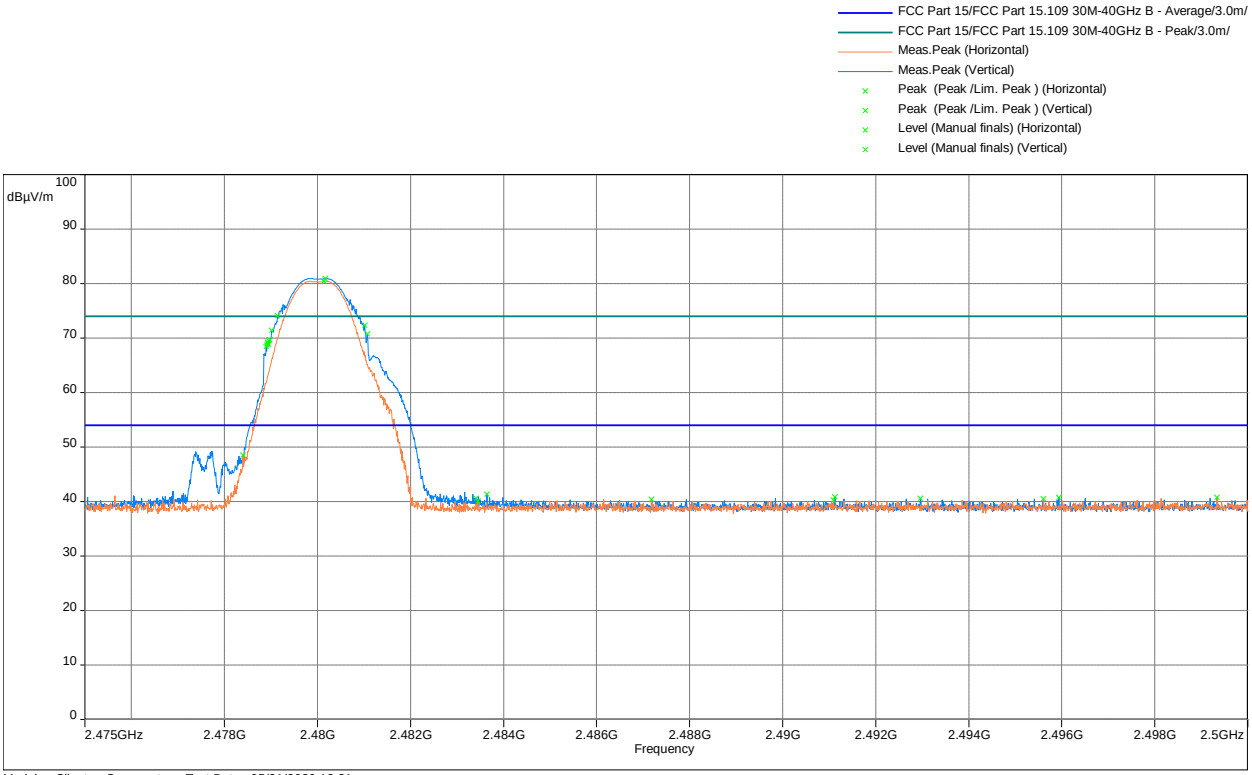
Out-of-Band Radiated spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak and Average Limit



Model: ; Client: ; Comments: ; Test Date: 05/21/2020 13:09

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.390	39.29	54	-14.71	Peak	Pass

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



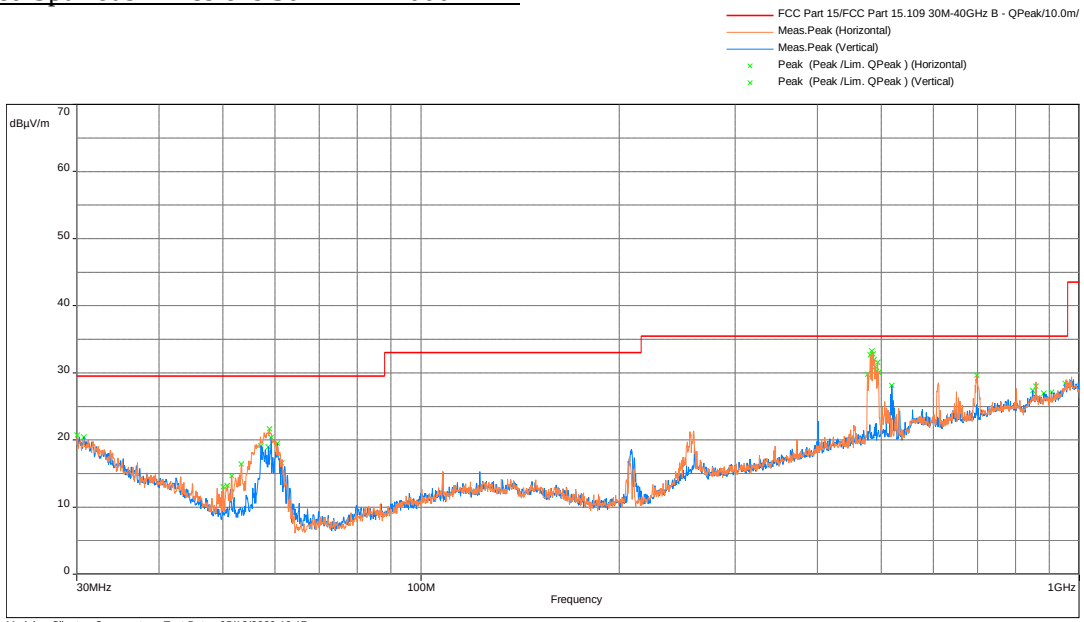
Model: ; Client: ; Comments: ; Test Date: 05/21/2020 13:31

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.4835	40.56	54	-13.44	Peak	Pass

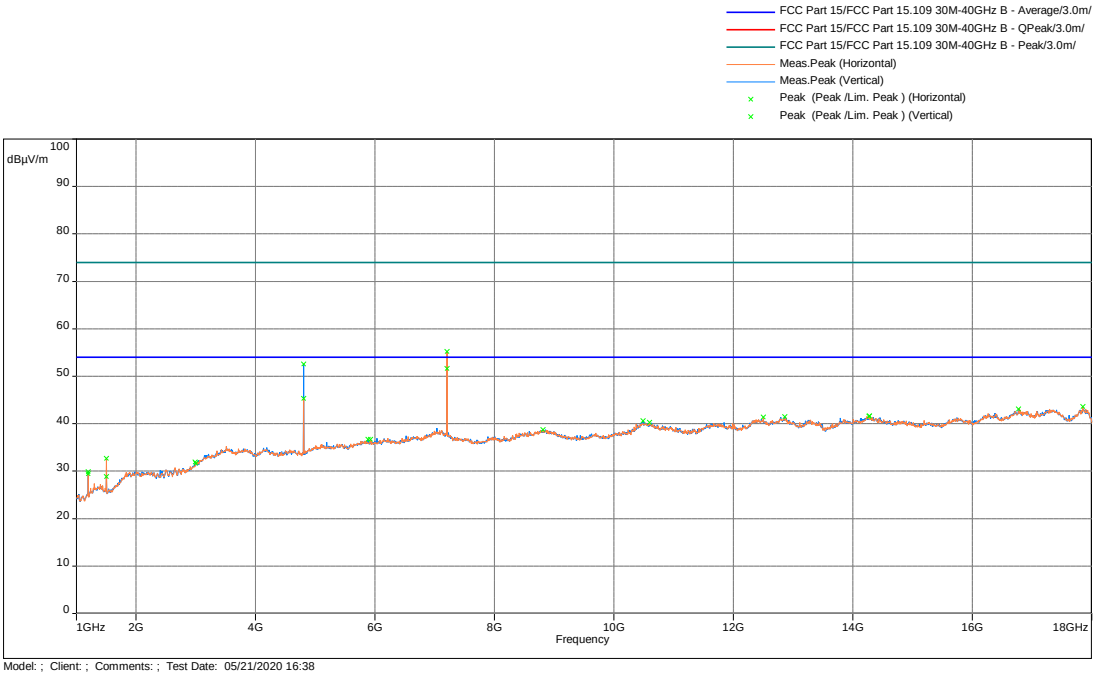
Out-of-Band Radiated Spurious Emissions

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

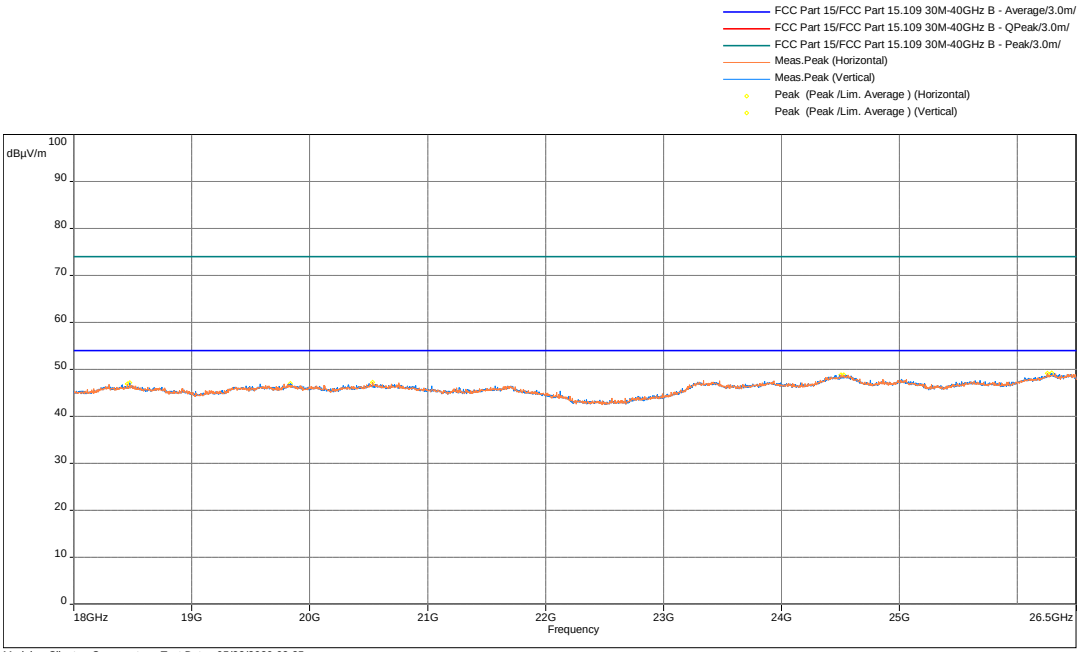
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
483.5006	14.73	35.5	-20.77	135.5	3.76	Horizontal	-5.73
485.8847	14.78	35.5	-20.72	142.75	2.77	Horizontal	-5.62
492.7829	14.8	35.5	-20.7	168.25	3.74	Horizontal	-5.48
699.6412	17.44	35.5	-18.06	148.25	3.01	Horizontal	-2.34
519.2986	14.95	35.5	-20.55	165.5	3.96	Vertical	-5.23
859.0823	25.36	35.5	-10.14	41	1.59	Vertical	1.08

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	55.18	74	-18.82	1.51	256.75	Horizontal	-1.22
4804.033	52.54	74	-21.46	2.49	214.25	Vertical	-7.63
7206.133	51.65	74	-22.35	1.51	0	Vertical	-1.22
4804.033	45.32	74	-28.68	1.98	256.5	Horizontal	-7.63

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	35.18	54	-18.82	1.51	256.75	Horizontal	-1.22
4804.033	32.54	54	-21.46	2.49	214.25	Vertical	-7.63
7206.133	31.65	54	-22.35	1.51	0	Vertical	-1.22
4804.033	25.32	54	-28.68	1.98	256.5	Horizontal	-7.63

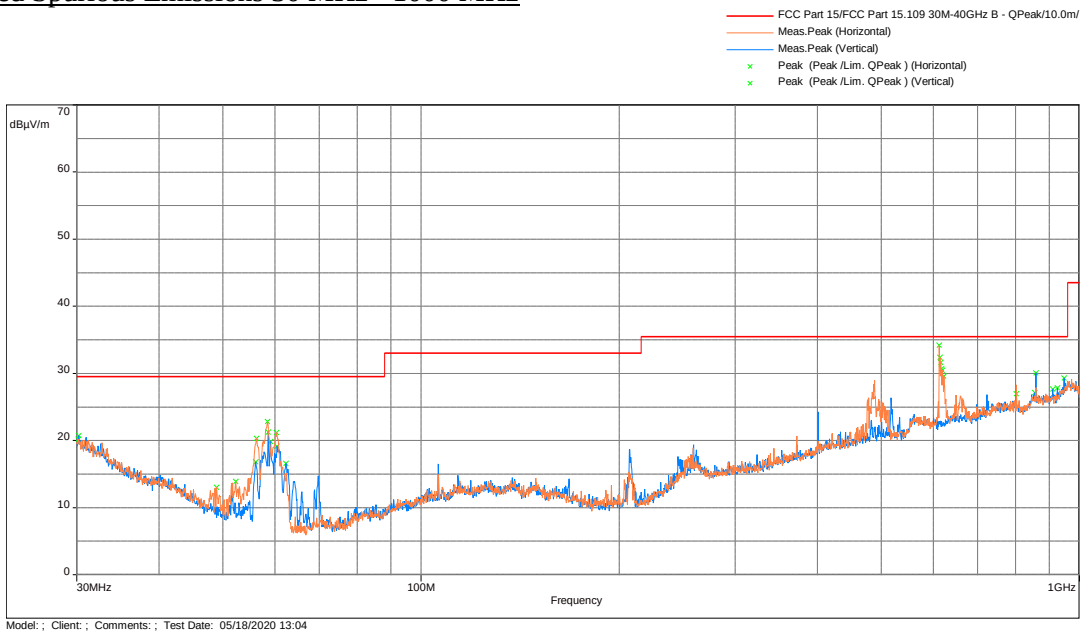
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

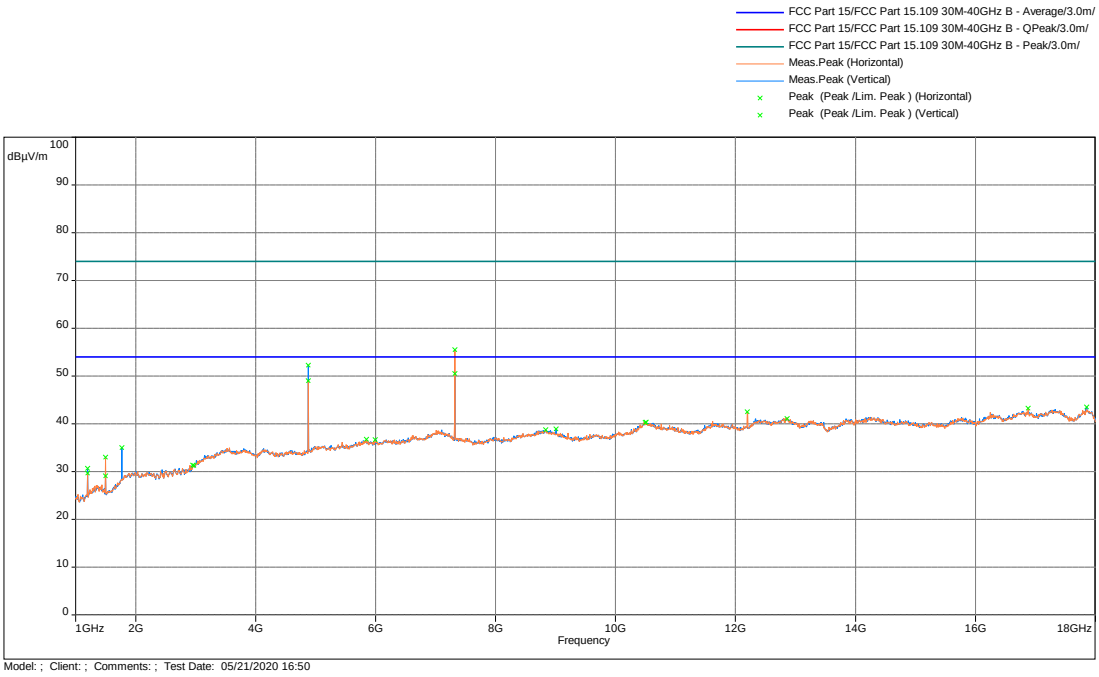
Results	**Complies**

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

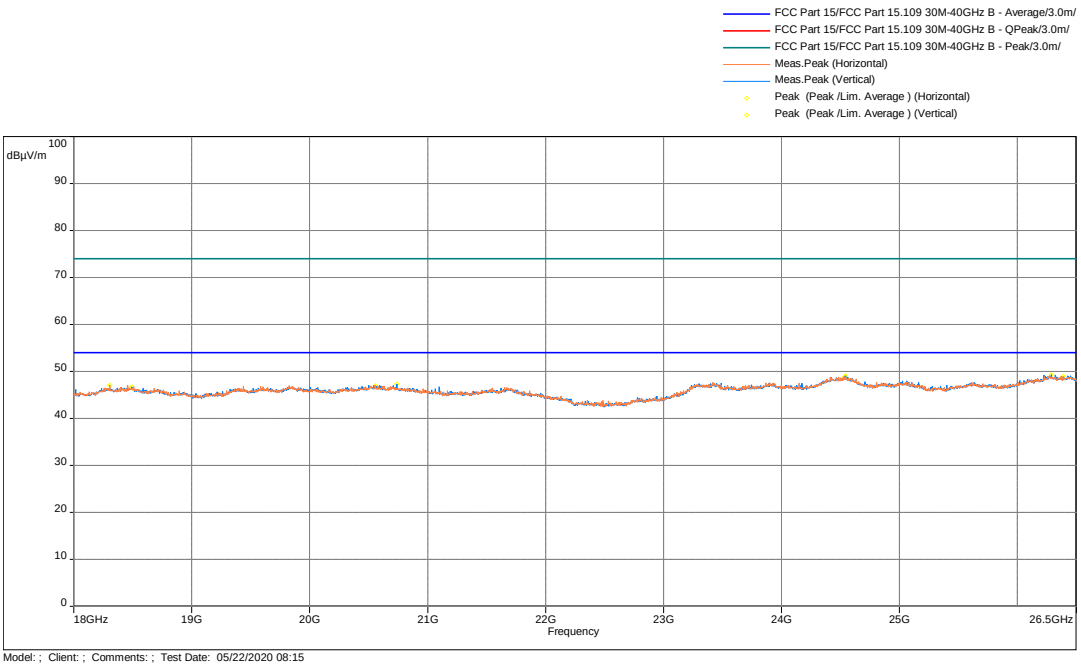
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
612.0376	16.58	35.5	-18.92	136	3.45	Horizontal	-3.48
613.6329	16.48	35.5	-19.02	204.25	4	Horizontal	-3.55
618.0425	16.46	35.5	-19.04	135.25	2.46	Horizontal	-3.58
622.2999	16.53	35.5	-18.97	179.25	2.71	Horizontal	-3.59
859.0848	26.07	35.5	-9.43	152	1.35	Vertical	1.08
948.4791	20.94	35.5	-14.56	54	3.3	Vertical	3.27

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	55.5	74	-18.5	1.52	257	Horizontal	-1.93
4879.967	52.23	74	-21.77	2.01	258.5	Vertical	-7.22
7319.467	50.49	74	-23.51	1.51	15.75	Vertical	-1.93
4879.967	49.03	74	-24.97	2.02	233.75	Horizontal	-7.22

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	35.5	54	-18.5	1.52	257	Horizontal	-1.93
4879.967	32.23	54	-21.77	2.01	258.5	Vertical	-7.22
7319.467	30.49	54	-23.51	1.51	15.75	Vertical	-1.93
4879.967	29.03	54	-24.97	2.02	233.75	Horizontal	-7.22

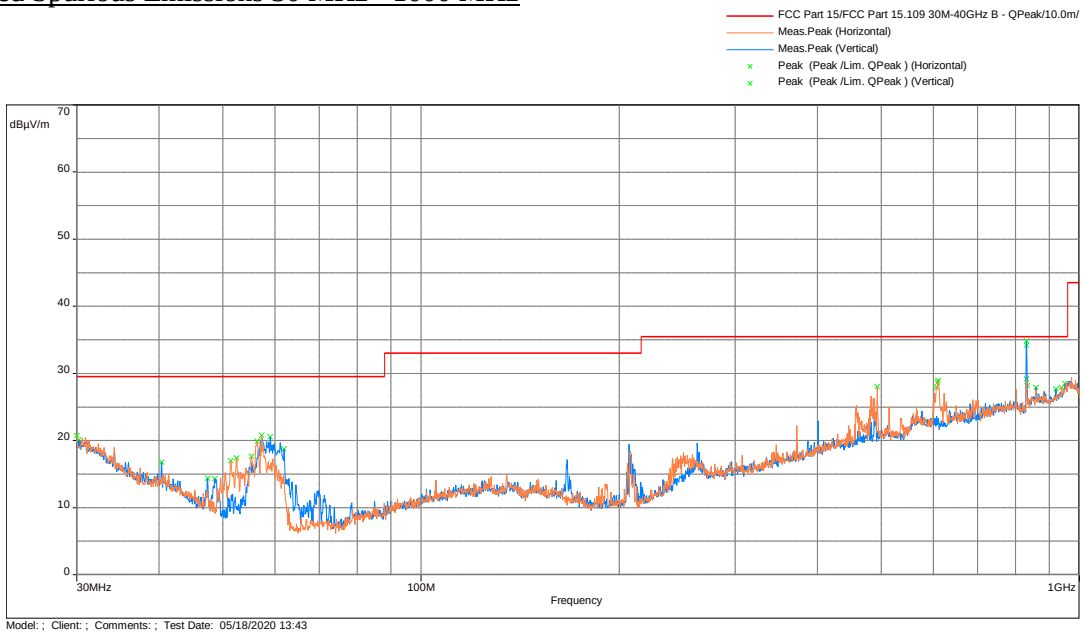
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

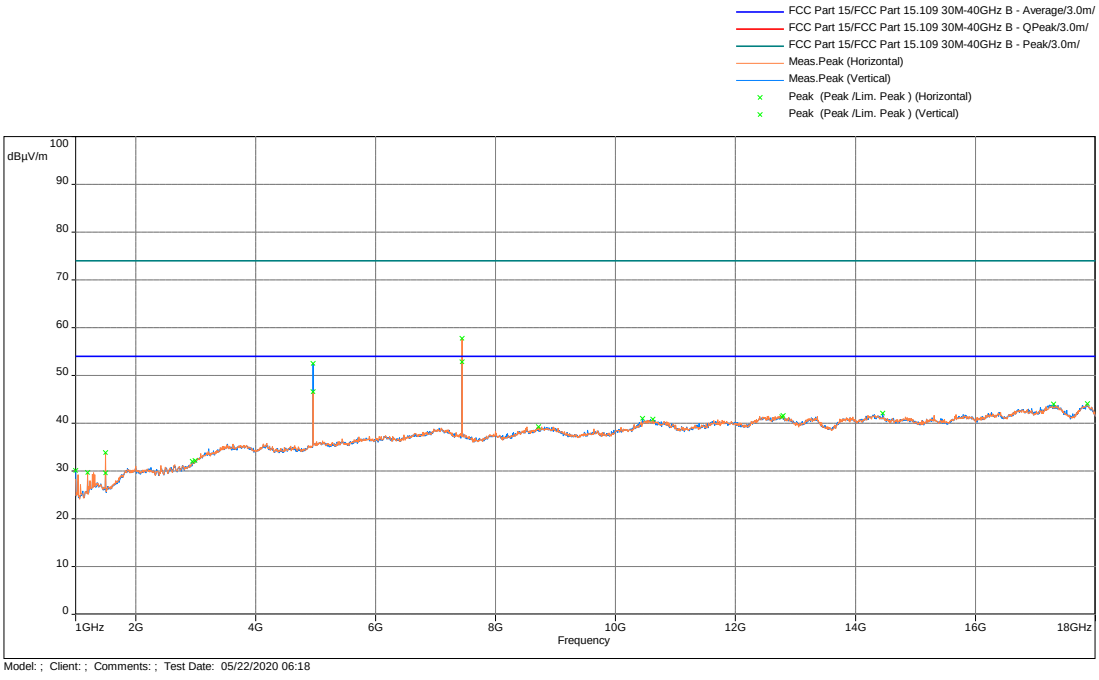
Results	**Complies**

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

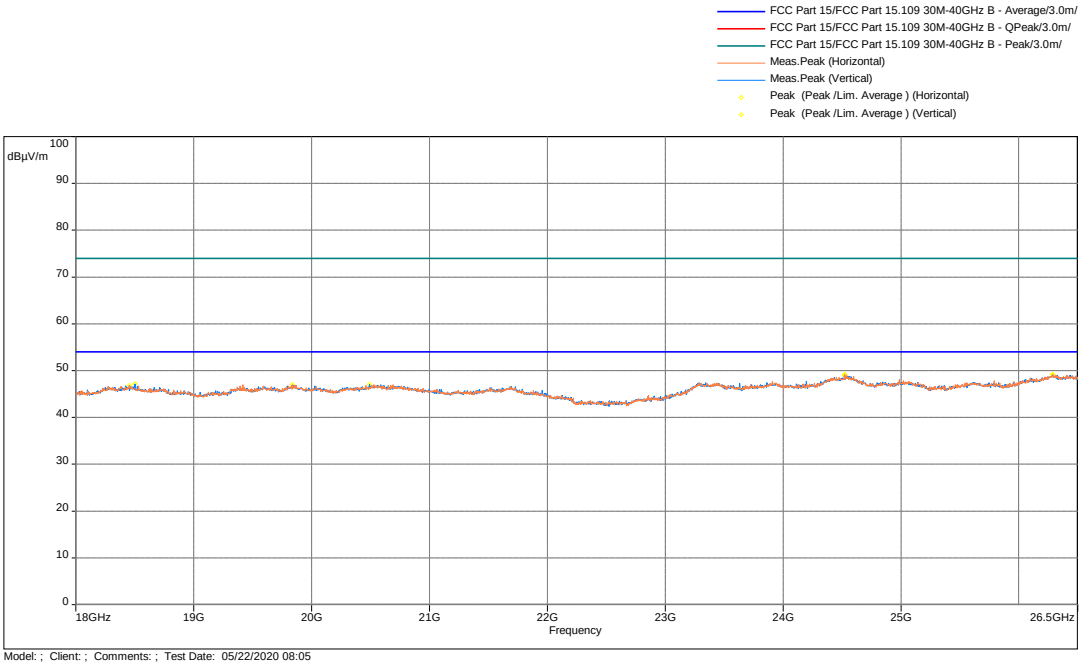
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
492.7276	14.71	35.5	-20.79	346	3.38	Horizontal	-5.48
607.047	16.68	35.5	-18.82	269.75	3.52	Horizontal	-3.47
609.999	16.73	35.5	-18.77	317.75	3.78	Horizontal	-3.48
830.3459	18.78	35.5	-16.72	64	3.96	Horizontal	-0.27
831.4062	18.78	35.5	-16.72	267	2.82	Vertical	-0.2
951.6727	21.38	35.5	-14.12	251.5	3.21	Vertical	3.44

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7439.6	57.77	74	-16.23	1.5	102	Horizontal	-1.91
7440.167	52.87	74	-21.13	2.49	214.25	Vertical	-1.91
4959.867	52.47	74	-21.53	1.99	82.5	Vertical	-6.72
4959.867	46.59	74	-27.41	1.98	146	Horizontal	-6.72

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	37.77	54	-16.23	1.5	102	Horizontal	-1.91
4804.033	32.87	54	-21.13	2.49	214.25	Vertical	-1.91
7206.133	32.47	54	-21.53	1.99	82.5	Vertical	-6.72
4804.033	26.59	54	-27.41	1.98	146	Horizontal	-6.72

Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

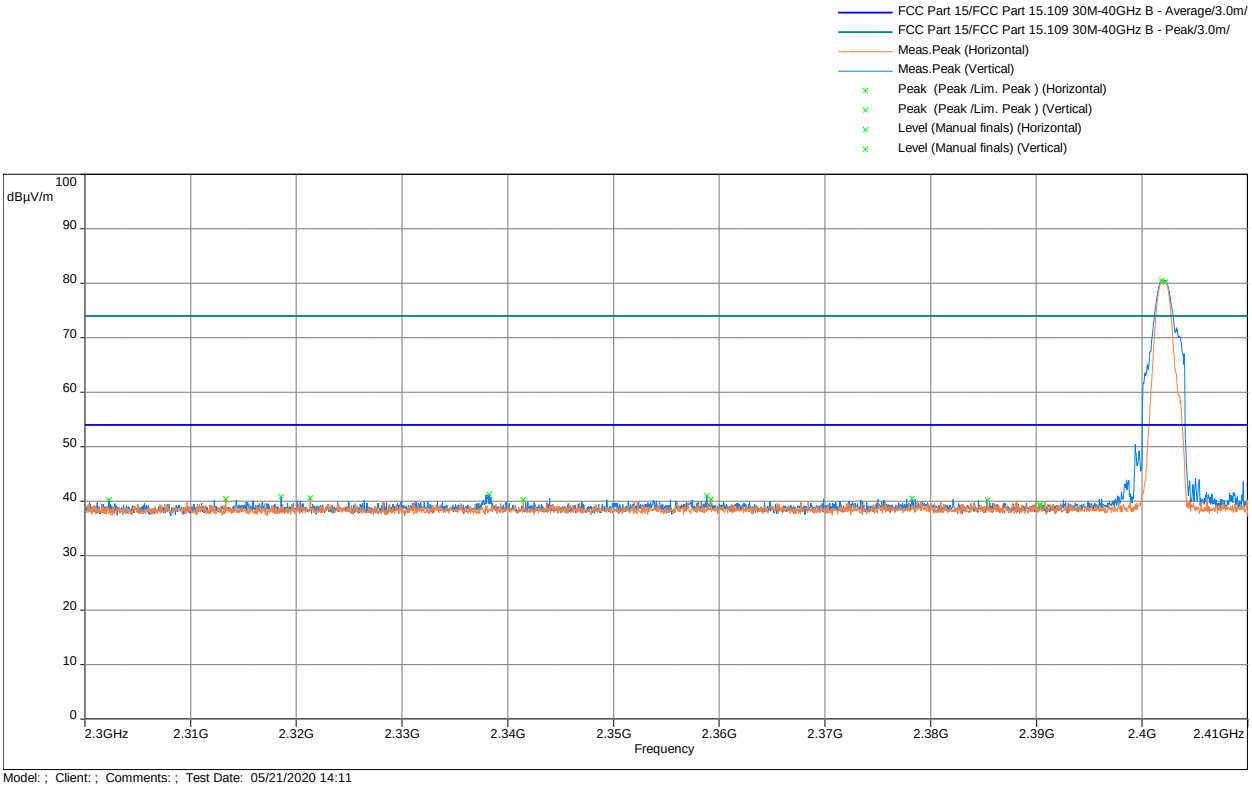
Note: FS= RA + Correction
Correction = AF + CF – Preamp

Results	**Complies**

4.5.4.2 Adult Plastic Toothbrush (900-00128)

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

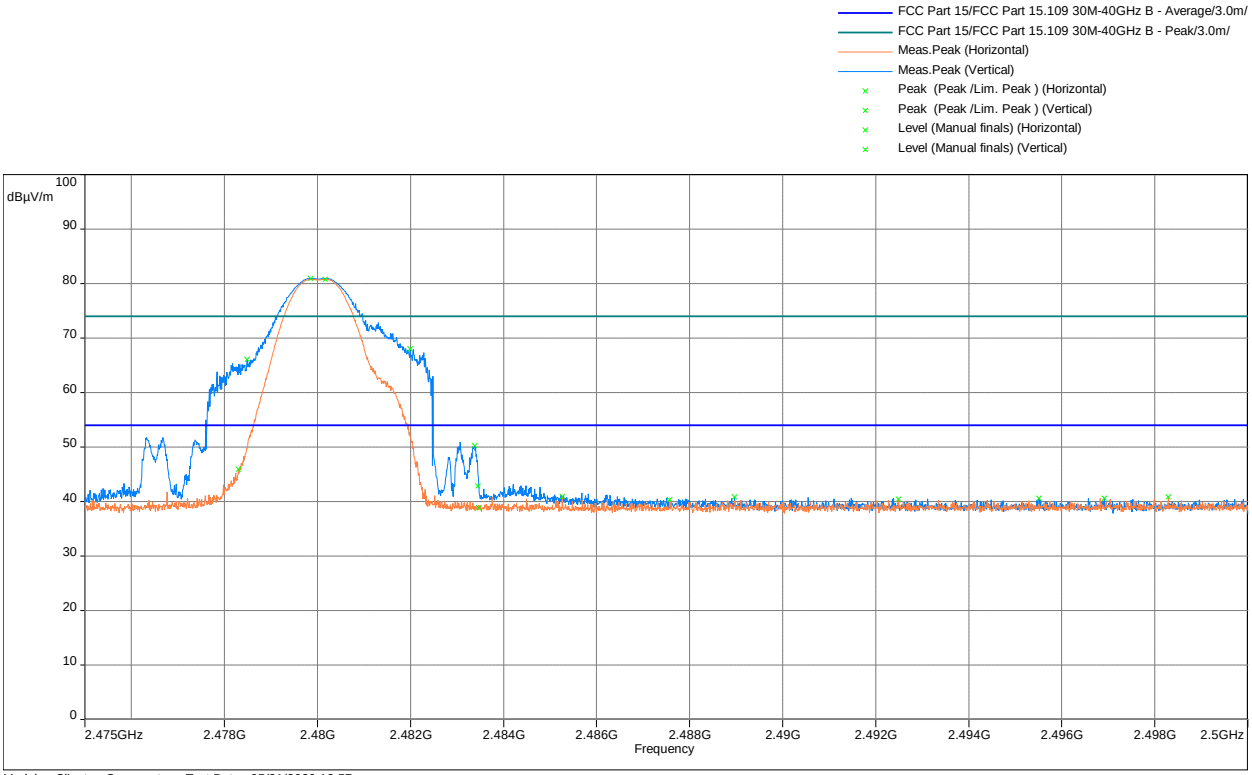
Radiated Out-of-Band spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak and Average Limit



Model: ; Client: ; Comments: ; Test Date: 05/21/2020 14:11

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.390	39.36	54	-14.64	Peak	Pass

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



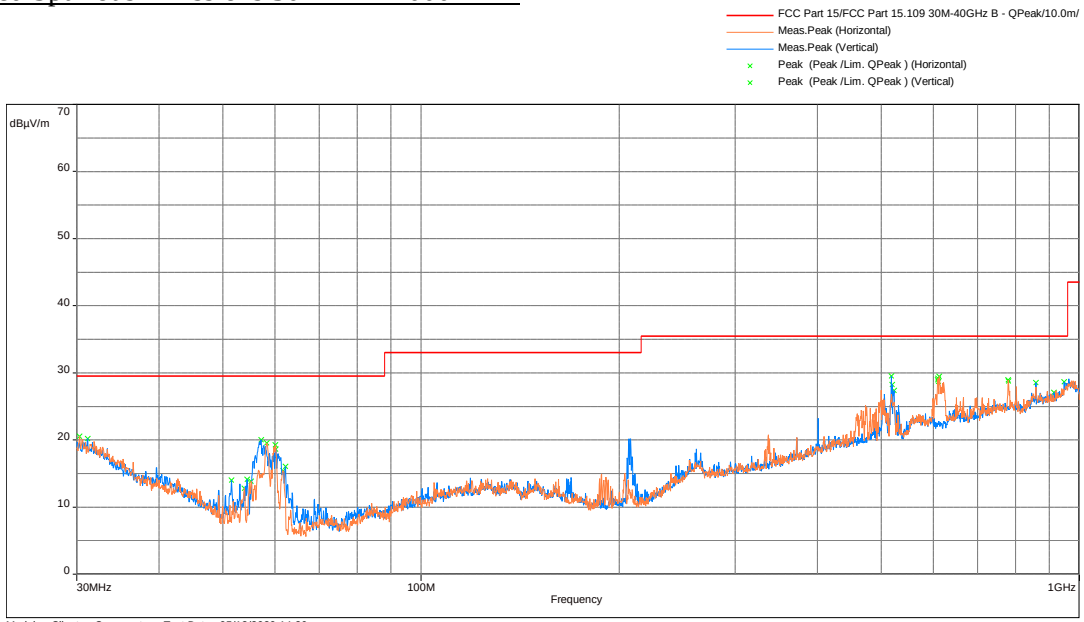
Model: ; Client: ; Comments: ; Test Date: 05/21/2020 13:57

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.4835	42.85	54	-11.15	Peak	Pass

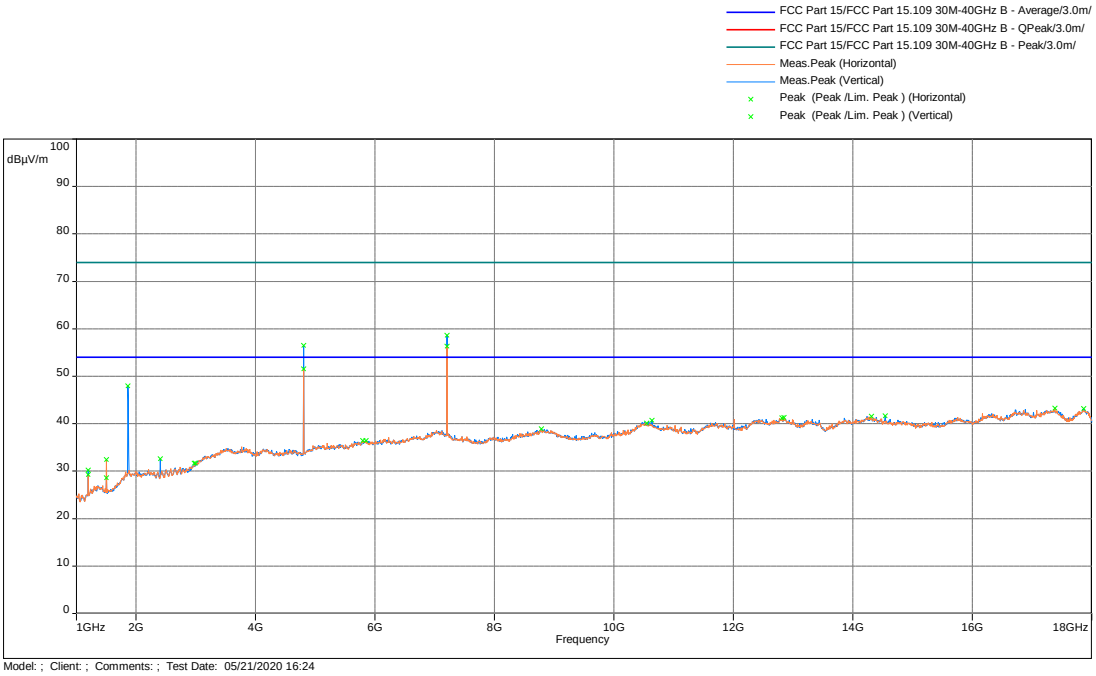
Out-of-Band Radiated Spurious Emissions

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

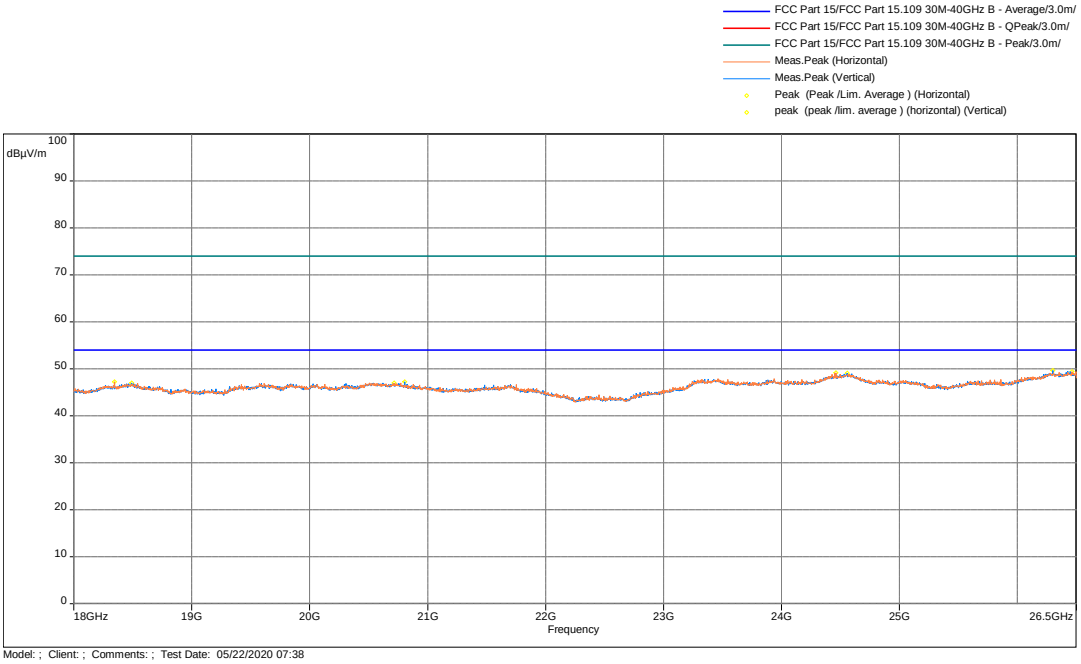
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
608.8502	16.65	35.5	-18.85	336.5	2.28	Horizontal	-3.47
612.8921	16.64	35.5	-18.86	94.5	3.99	Horizontal	-3.48
778.7676	18.83	35.5	-16.67	322.75	1.66	Horizontal	-0.5
517.8337	14.84	35.5	-20.66	282.5	3.92	Vertical	-5.23
859.0762	24.76	35.5	-10.74	108.5	2.3	Vertical	1.08
948.577	20.96	35.5	-14.54	9	3.22	Vertical	3.28

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	58.66	74	-15.34	1.51	258.5	Vertical	-1.22
4804.033	56.53	74	-17.47	2.49	258.5	Vertical	-7.63
7206.133	56.35	74	-17.65	1.52	80	Horizontal	-1.22
4804.033	51.54	74	-22.46	2.02	15.5	Horizontal	-7.63

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	38.66	54	-15.34	1.51	258.5	Vertical	-1.22
4804.033	36.53	54	-17.47	2.49	258.5	Vertical	-7.63
7206.133	36.35	54	-17.65	1.52	80	Horizontal	-1.22
4804.033	31.54	54	-22.46	2.02	15.5	Horizontal	-7.63

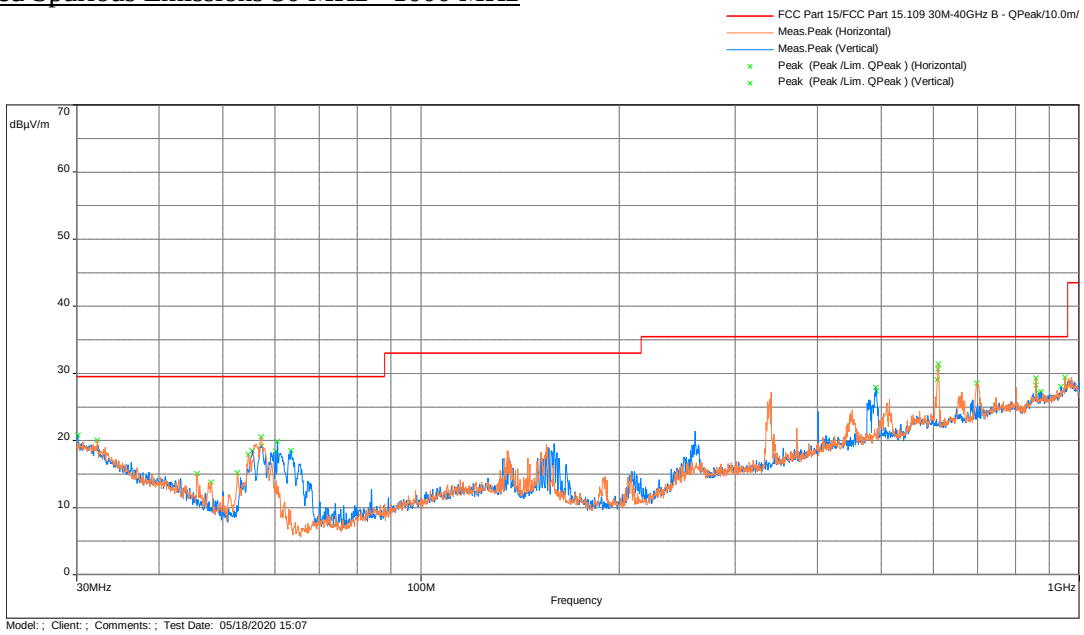
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

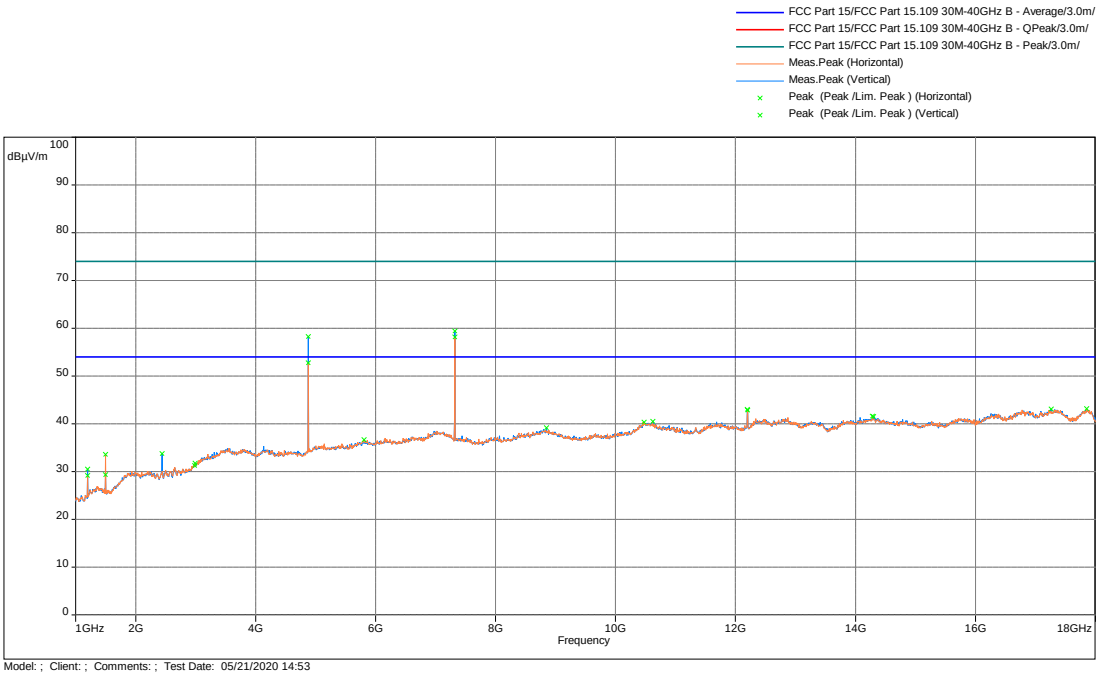
Results	**Complies**

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

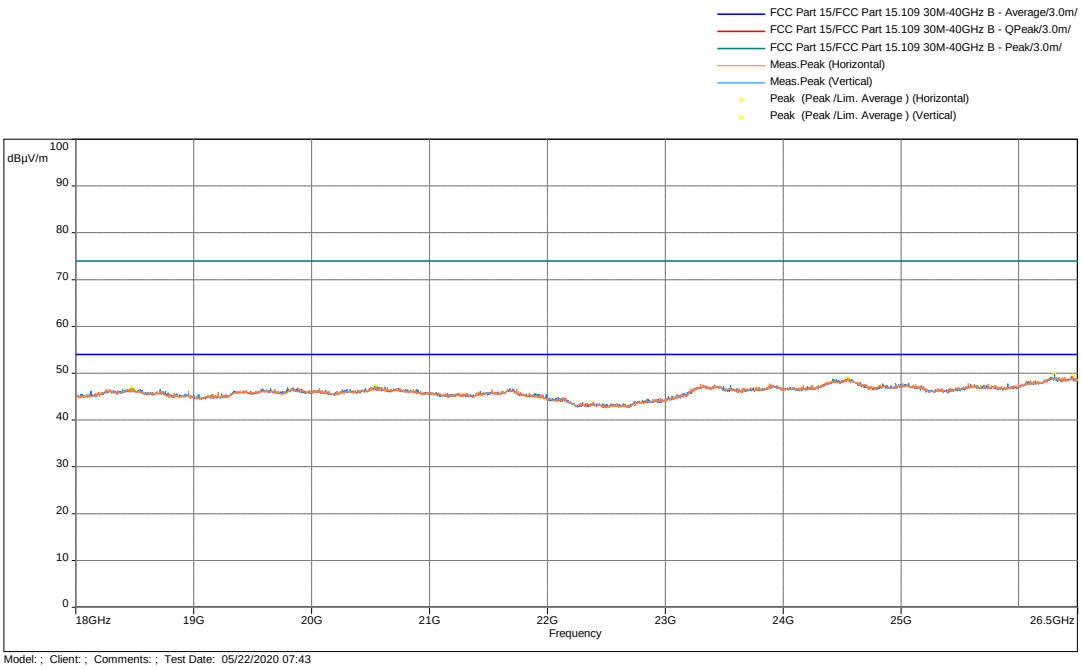
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
610.6216	16.79	35.5	-18.71	43.5	3.29	Horizontal	-3.48
698.5136	17.64	35.5	-17.86	305.5	3.28	Horizontal	-2.35
859.0787	27.33	35.5	-8.17	268.5	1.04	Horizontal	1.08
950.2233	21.2	35.5	-14.3	113.25	2.58	Horizontal	3.35
859.0991	25.2	35.5	-10.3	112.75	1.38	Vertical	1.08
937.2914	20.62	35.5	-14.88	41.5	3.84	Vertical	2.53

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	59.43	74	-14.57	1.51	59	Vertical	-1.93
4879.4	58.27	74	-15.73	1.99	258.75	Vertical	-7.23
7320.033	58.17	74	-15.83	1.51	36.25	Horizontal	-1.93
4880.533	52.77	74	-21.23	1.98	80.25	Horizontal	-7.22

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	39.43	54	-14.57	1.51	59	Vertical	-1.93
4879.4	38.27	54	-15.73	1.99	258.75	Vertical	-7.23
7320.033	38.17	54	-15.83	1.51	36.25	Horizontal	-1.93
4880.533	32.77	54	-21.23	1.98	80.25	Horizontal	-7.22

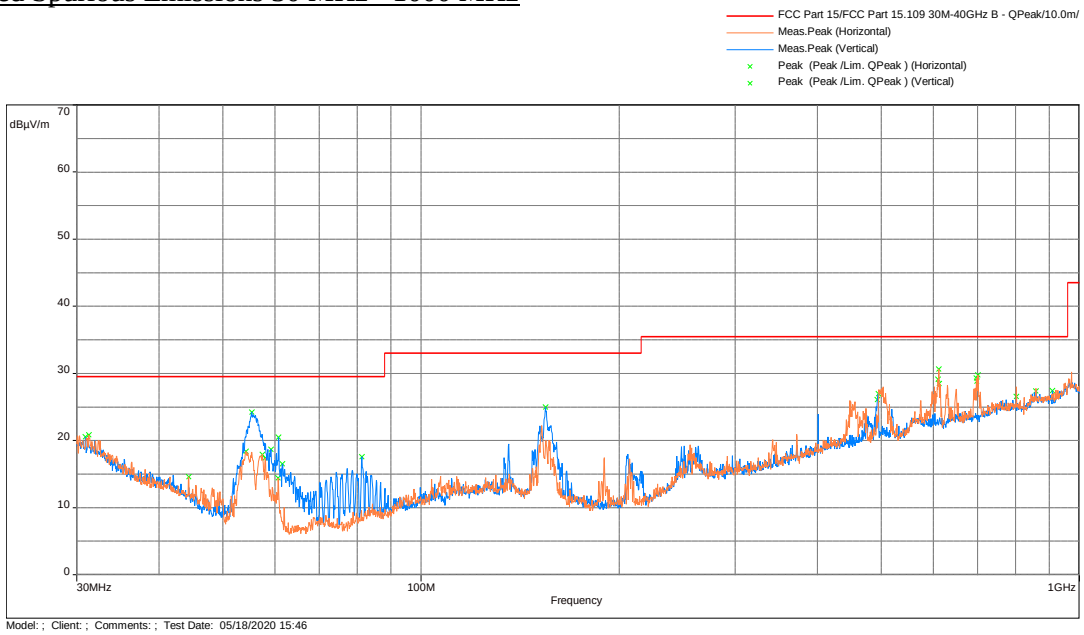
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

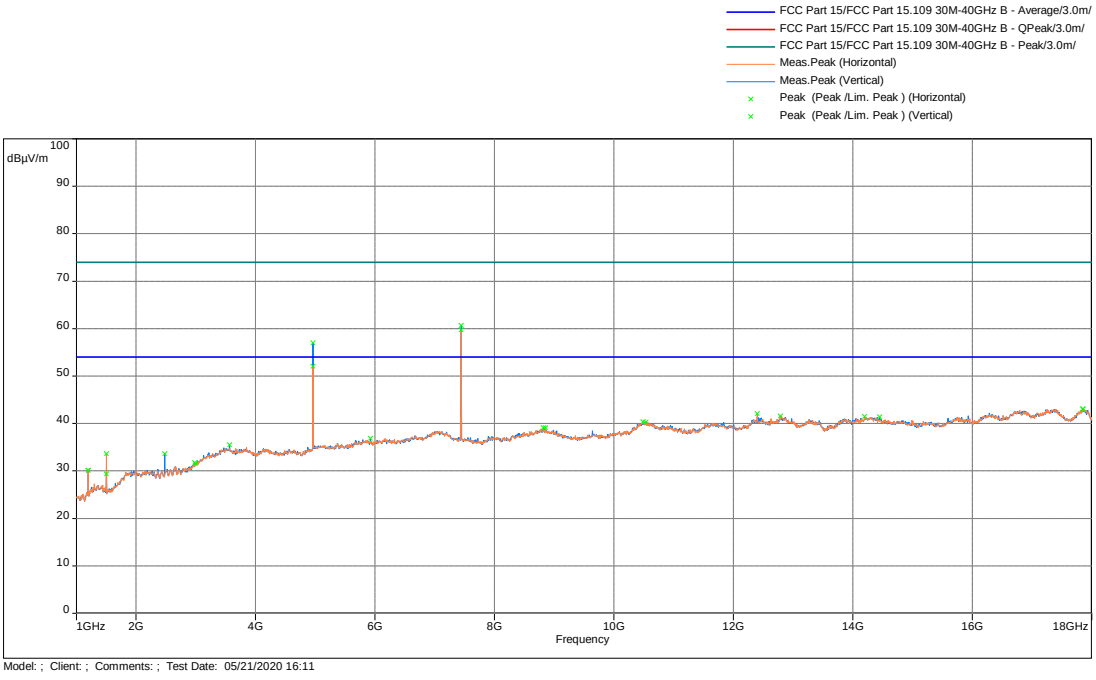
Results	**Complies**

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

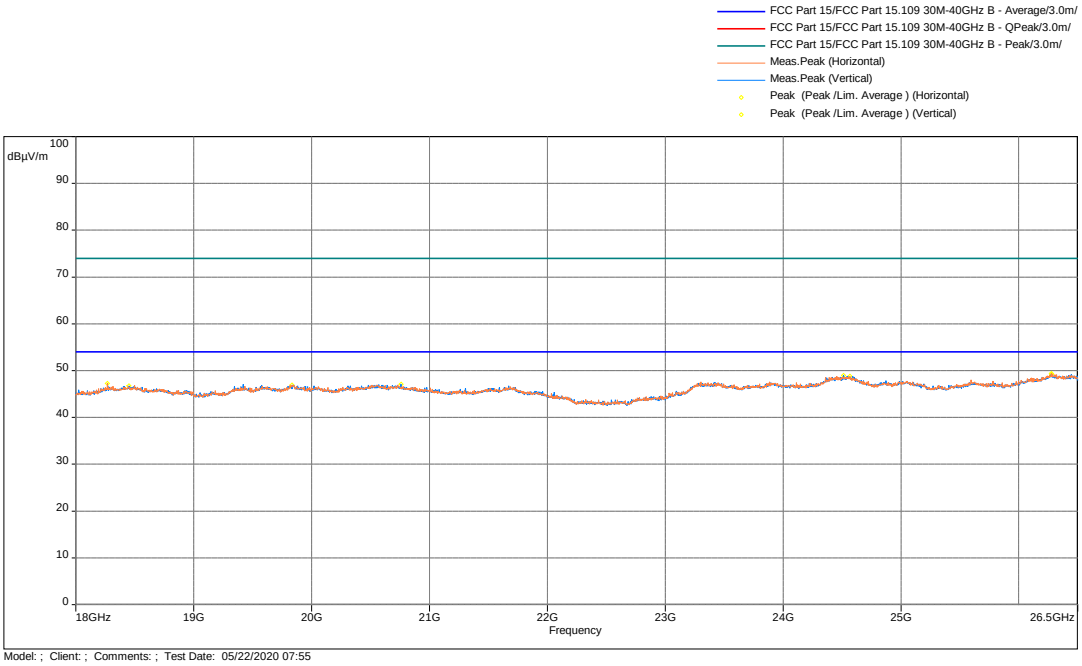
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
611.5703	16.75	35.5	-18.75	234.25	3.71	Horizontal	-3.48
698.067	17.44	35.5	-18.06	60.5	1.23	Horizontal	-2.35
701.8263	17.42	35.5	-18.08	100.75	2.12	Horizontal	-2.34
55.11057	9.09	29.5	-20.41	110.75	3.24	Vertical	-19.84
154.6848	7.03	33	-25.97	213.75	3.26	Vertical	-14.21
910.5799	19.74	35.5	-15.76	253.5	3.52	Vertical	1.49

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7440.167	60.67	74	-13.33	1.51	103.75	Vertical	-1.91
7440.167	59.69	74	-14.31	2.48	0	Horizontal	-1.91
4959.867	57.04	74	-16.96	2.49	259.25	Vertical	-6.72
4959.867	52.06	74	-21.94	1.98	145.5	Horizontal	-6.72

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7440.167	40.67	54	-13.33	1.51	103.75	Vertical	-1.91
7440.167	39.69	54	-14.31	2.48	0	Horizontal	-1.91
4959.867	37.04	54	-16.96	2.49	259.25	Vertical	-6.72
4959.867	32.06	54	-21.94	1.98	145.5	Horizontal	-6.72

Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

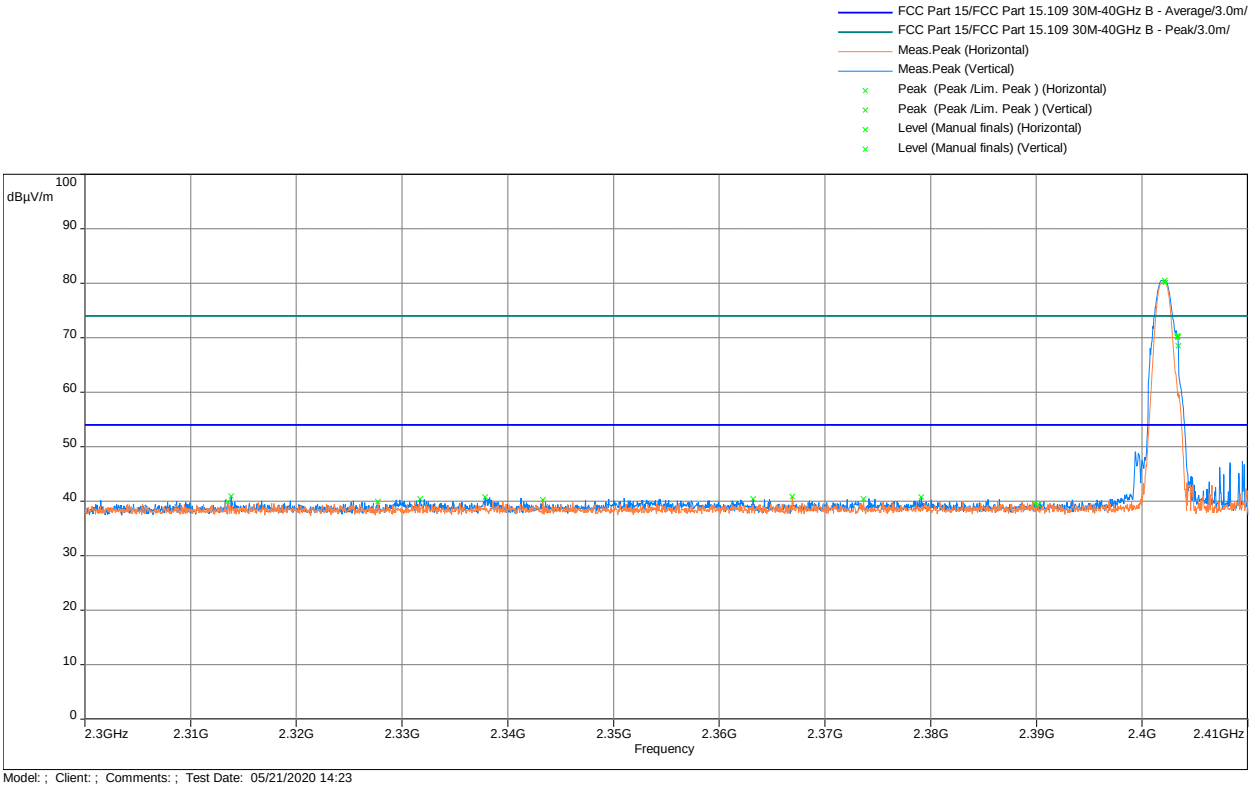
Note: FS= RA + Correction
Correction = AF + CF – Preamp

Results	**Complies**

4.5.4.3 Kids Soft Plastic Toothbrush (900-00129)

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

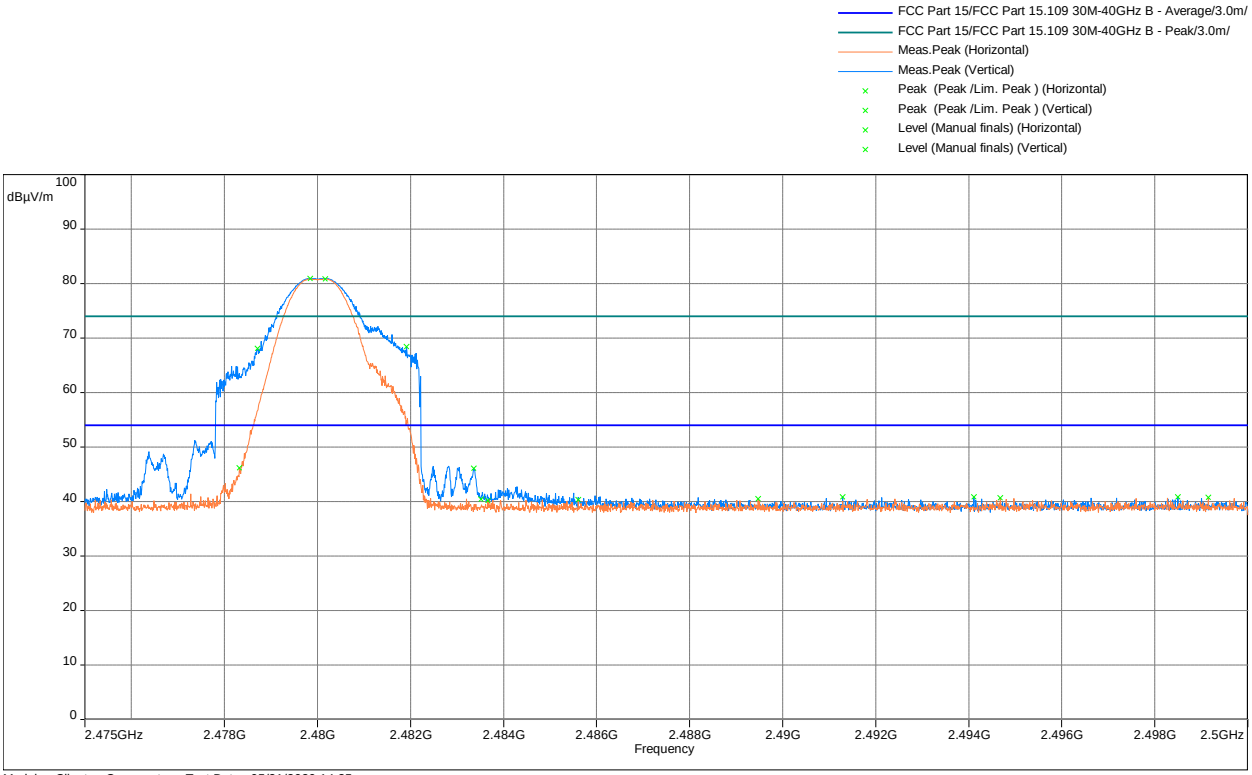
Radiated Out-of-Band spurious emissions at the Band-edge @3m distance
2310–2390 MHz, Peak Scan with Peak and Average Limit



Model: ; Client: ; Comments: ; Test Date: 05/21/2020 14:23

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.390	39.62	54	-14.38	Peak	Pass

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



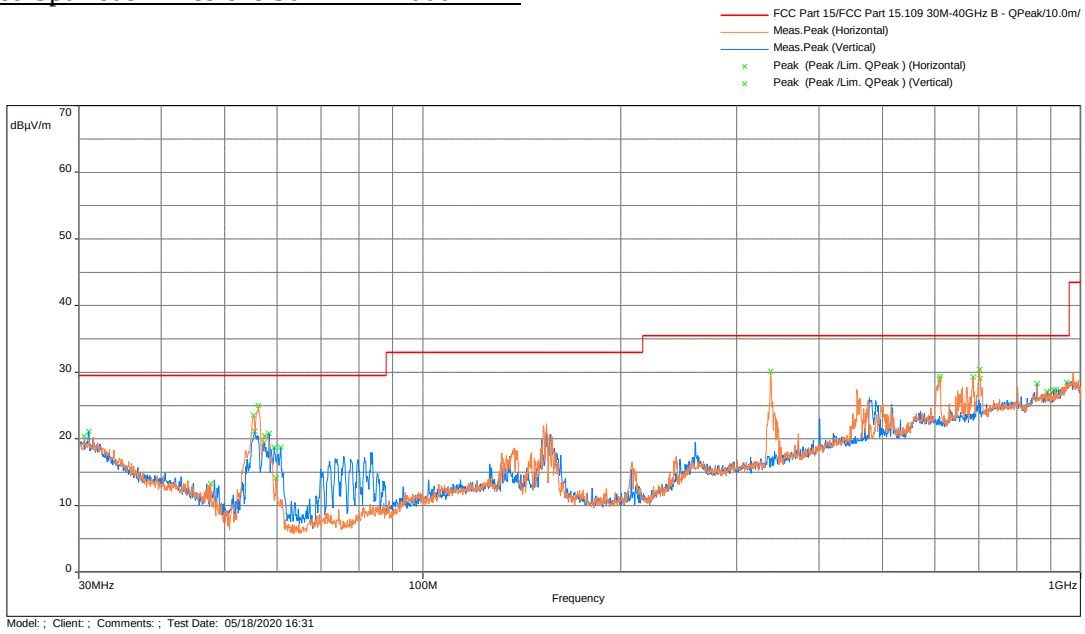
Model: ; Client: ; Comments: ; Test Date: 05/21/2020 14:35

Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dB(µV/m)	dB(µV/m)	dB		
2.4835	40.40	54	-13.60	Peak	Pass

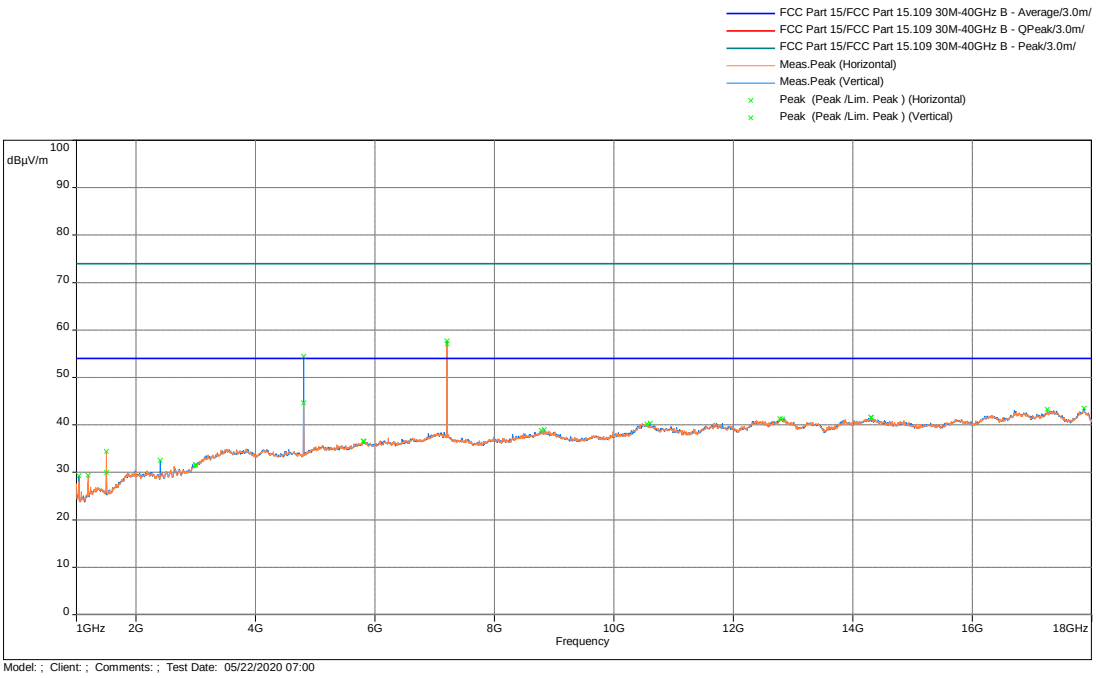
Out-of-Band Radiated Spurious Emissions

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

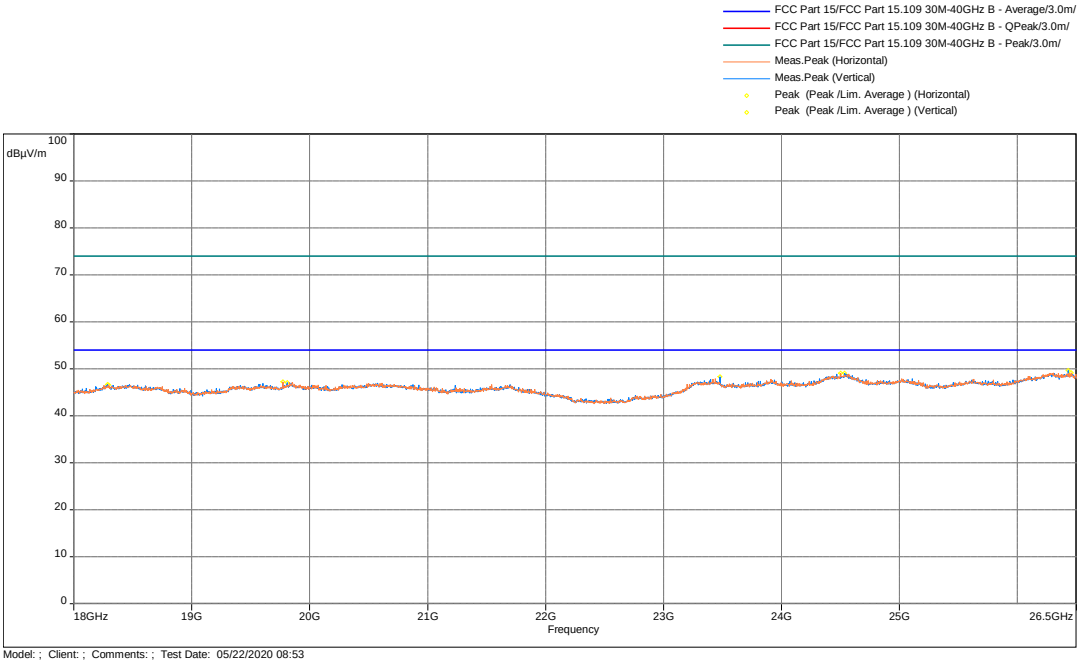
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
56.22897	10.61	29.5	-18.89	99.75	3.96	Horizontal	-20.13
337.6778	11.53	35.5	-23.97	331.75	4	Horizontal	-9.78
610.9911	16.91	35.5	-18.59	210.5	3.23	Horizontal	-3.48
701.2025	17.47	35.5	-18.03	92	3.73	Horizontal	-2.34
859.0667	24.93	35.5	-10.57	192.75	3.06	Vertical	1.08
952.0387	21.43	35.5	-14.07	80.75	1.99	Vertical	3.47

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	57.72	74	-16.28	1.51	303	Vertical	-1.22
7206.133	57.13	74	-16.87	1.52	145.25	Horizontal	-1.22
4804.033	54.46	74	-19.54	2.01	236.75	Vertical	-7.63
4804.033	44.60	74	-29.4	2.02	343	Horizontal	-7.63

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.133	37.72	54	-16.28	1.51	303	Vertical	-1.22
4804.033	37.13	54	-16.87	1.52	145.25	Horizontal	-1.22
7206.133	34.46	54	-19.54	2.01	236.75	Vertical	-7.63
4804.033	24.60	54	-29.4	2.02	343	Horizontal	-7.63

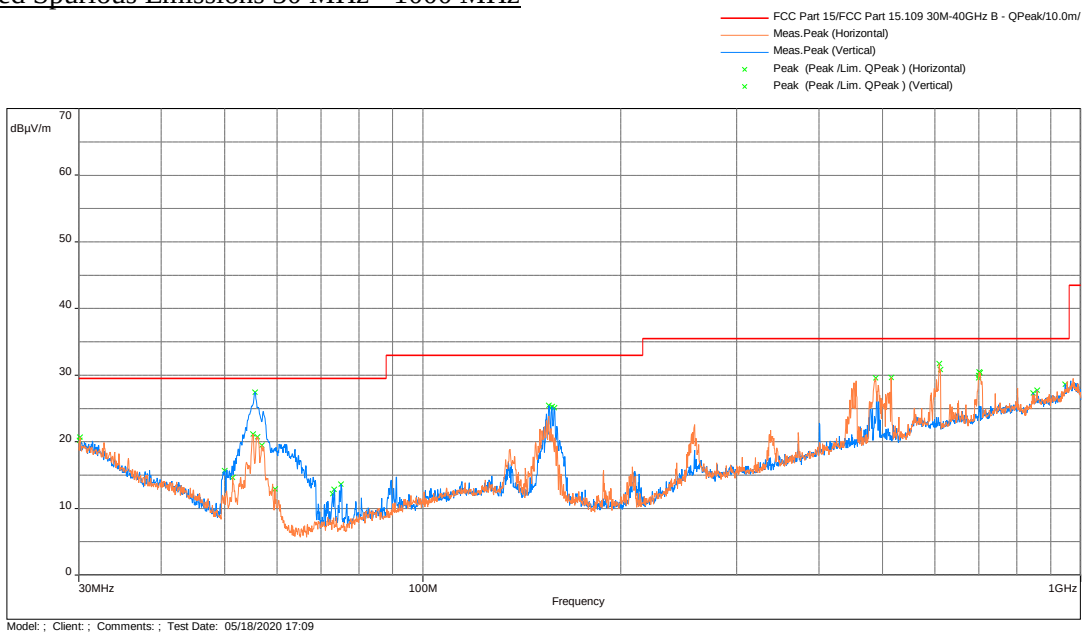
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

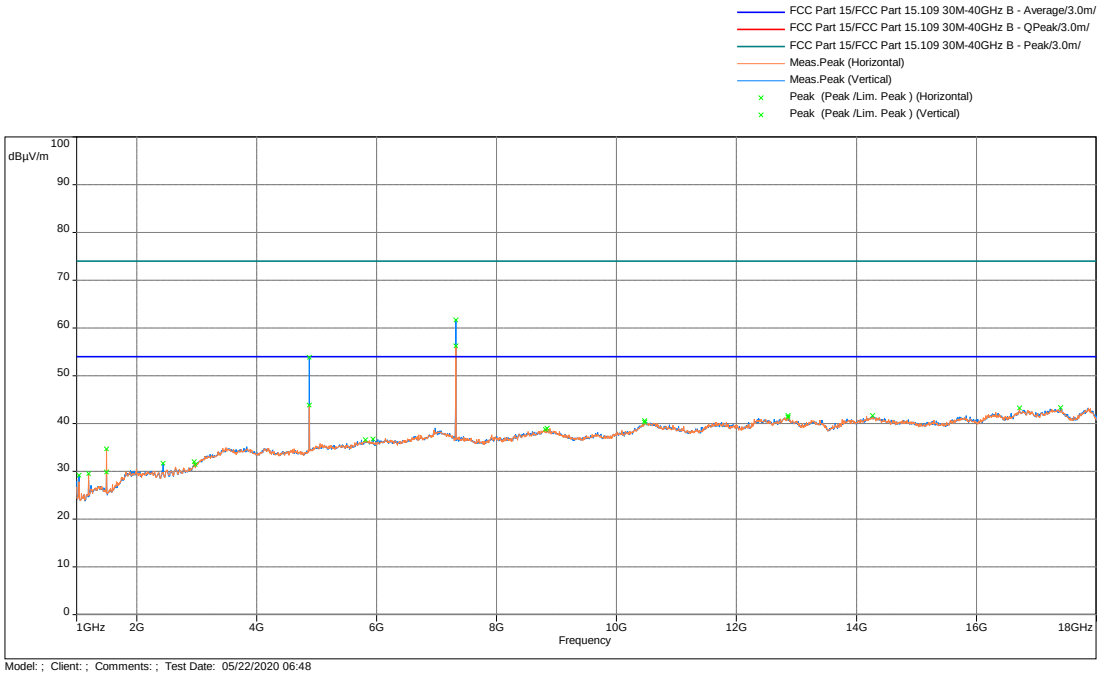
Results	**Complies**

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

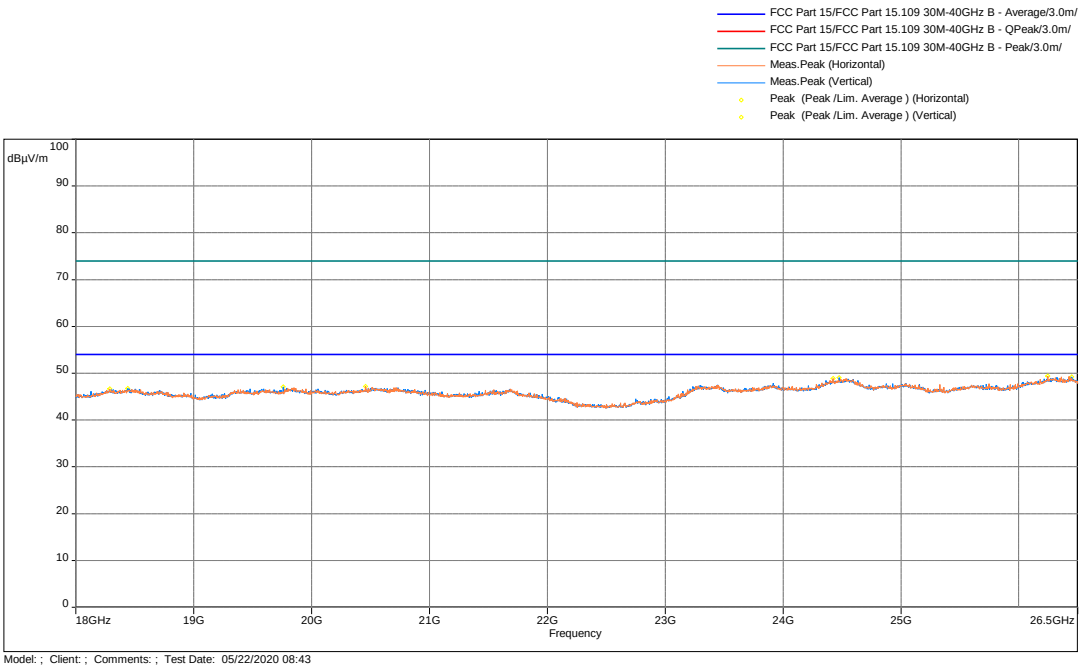
Radiated Spurious Emissions 30 MHz - 1000 MHz



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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
56.00225	15.03	29.5	-14.47	24	3.78	Vertical	-20.09
487.947	15.06	35.5	-20.44	180.75	3.52	Horizontal	-5.61
515.7296	15.13	35.5	-20.37	174.75	3.55	Horizontal	-5.22
609.663	16.85	35.5	-18.65	277.75	2.54	Horizontal	-3.47
611.4068	16.84	35.5	-18.66	246.25	2.47	Horizontal	-3.48
700.7996	17.56	35.5	-17.94	31.75	3.76	Horizontal	-2.34

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	61.67	74	-12.33	1.51	7320.033	Vertical	-1.93
7320.600	56.24	74	-17.76	2.48	7320.6	Horizontal	-1.93
4879.967	53.82	74	-20.18	2.49	4879.967	Vertical	-7.22
4879.967	43.82	74	-30.18	1.98	4879.967	Horizontal	-7.22

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7320.033	41.67	54	-12.33	1.51	7320.033	Vertical	-1.93
7320.600	36.24	54	-17.76	2.48	7320.6	Horizontal	-1.93
4879.967	33.82	54	-20.18	2.49	4879.967	Vertical	-7.22
4879.967	23.82	54	-30.18	1.98	4879.967	Horizontal	-7.22

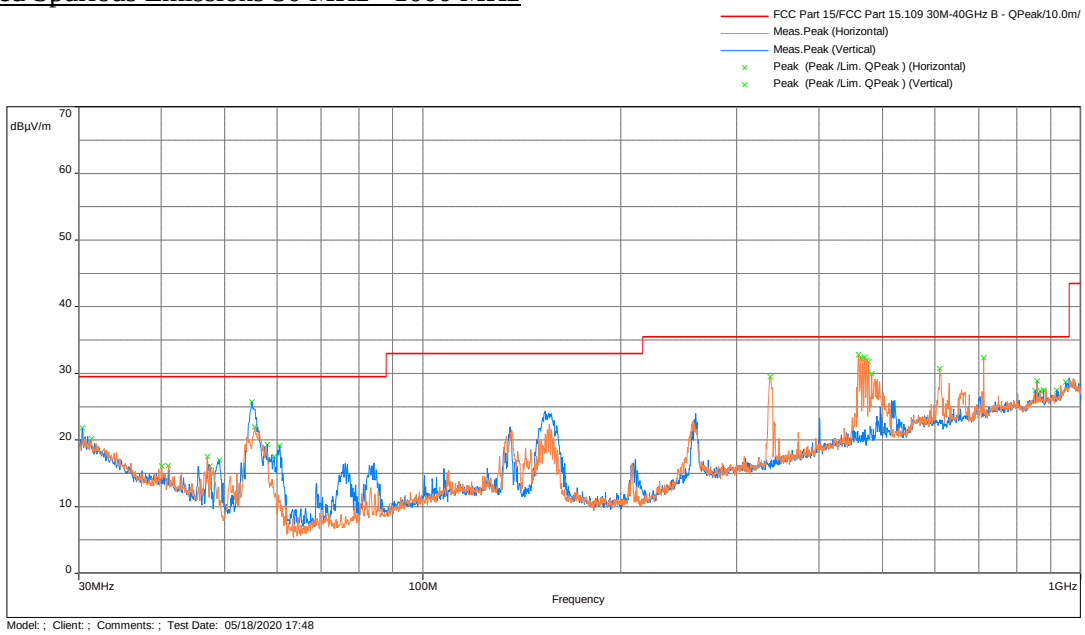
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

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

Results	**Complies**

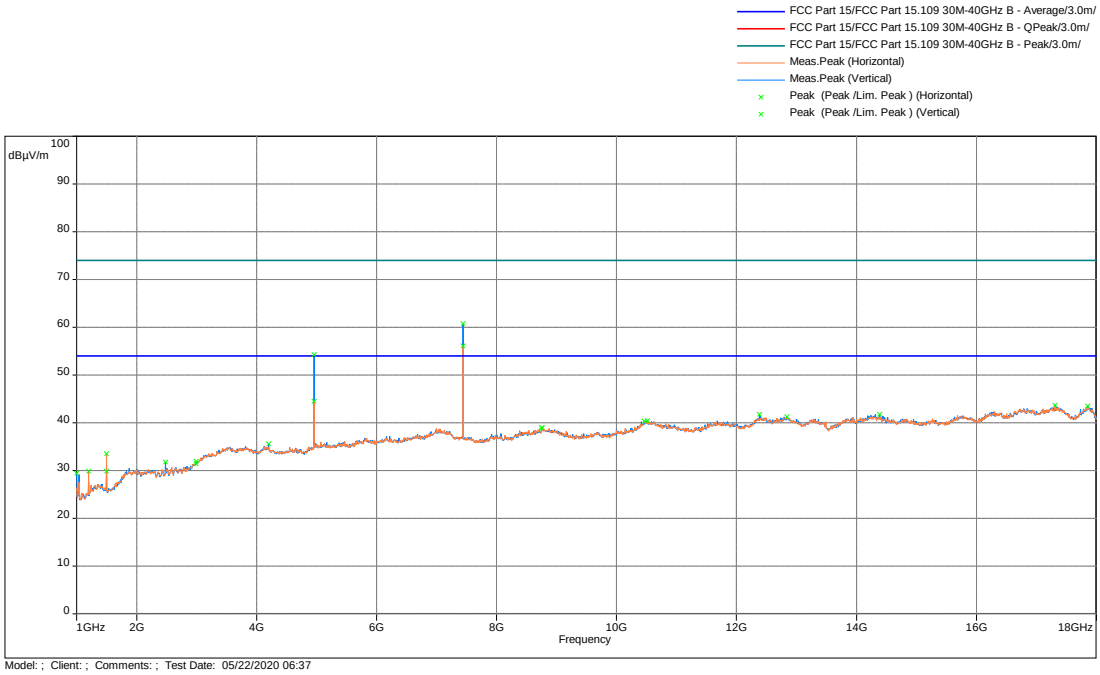
Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz

Radiated Spurious Emissions 30 MHz - 1000 MHz



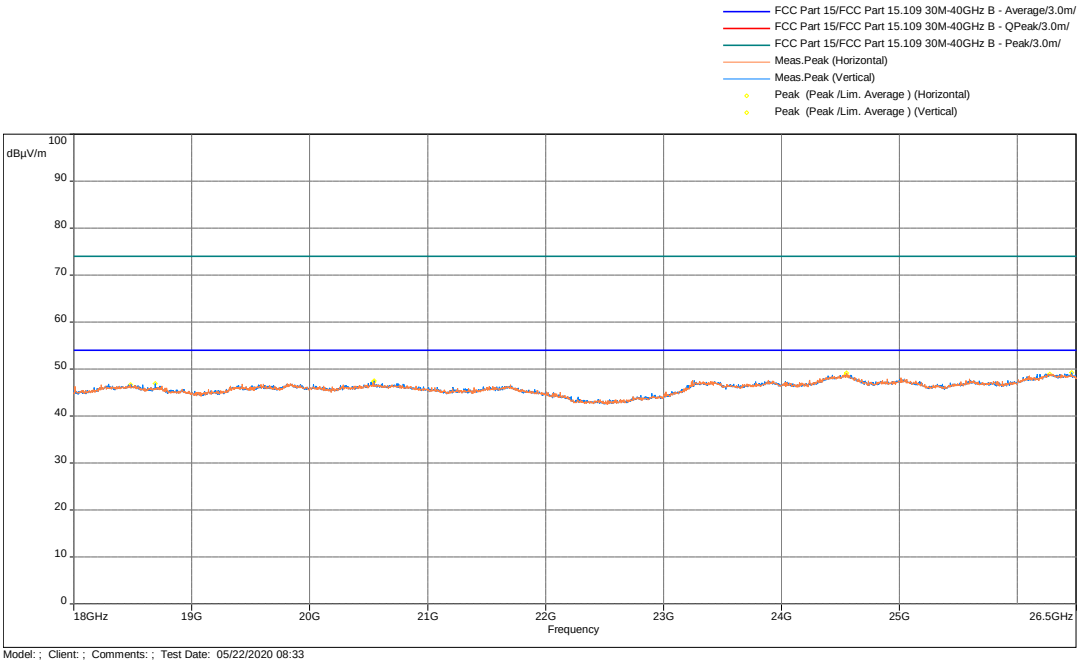
Model: ; Client: ; Comments: ; Test Date: 05/18/2020 17:48

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



Model: ; Client: ; Comments: ; Test Date: 05/22/2020 06:37

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



Freq. MHz	QP FS @ 10m dB(uV/m)	Limit @ 10m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
459.4838	14.21	35.5	-21.29	56.75	3.65	Horizontal	-6.24
461.8217	14.49	35.5	-21.01	52.25	3.96	Horizontal	-6.23
466.2361	14.35	35.5	-21.15	107.75	1.98	Horizontal	-6.11
469.1467	14.27	35.5	-21.23	119.25	3.51	Horizontal	-6.00
711.4829	17.38	35.5	-18.12	209.25	3.33	Horizontal	-2.21
55.55652	14.3	29.5	-15.2	267.5	3.92	Vertical	-19.96

Freq. MHz	FS @ 3m Peak dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7440.167	60.74	74	-13.26	1.51	325	Vertical	-1.91
7440.167	56.12	74	-17.88	1.52	167.5	Horizontal	-1.91
4959.867	54.24	74	-19.76	2.49	236.5	Vertical	-6.72
4959.867	44.47	74	-29.53	2.49	191.25	Horizontal	-6.72

Freq. MHz	FS @ 3m Avg dB(uV/m))	Limit @ 3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7440.167	40.74	54	-13.26	1.51	325	Vertical	-1.91
7440.167	36.12	54	-17.88	1.52	167.5	Horizontal	-1.91
4959.867	34.24	54	-19.76	2.49	236.5	Vertical	-6.72
4959.867	24.47	54	-29.53	2.49	191.25	Horizontal	-6.72

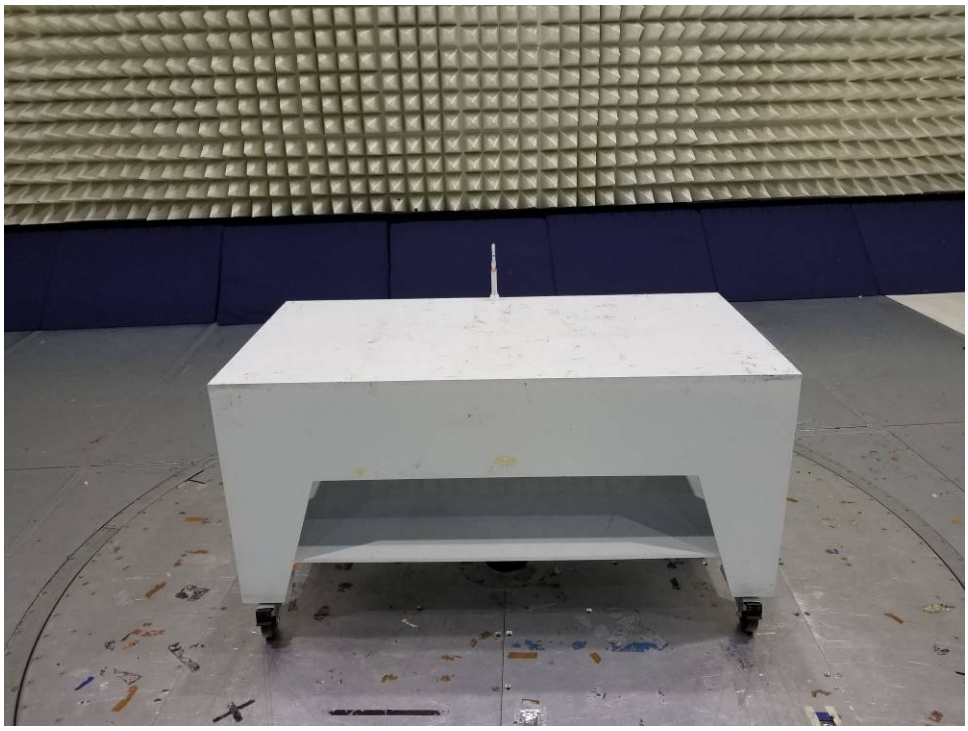
Note: Average measurement was derived from applying a duty cycle correction to the Peak measurement. See Annex A.

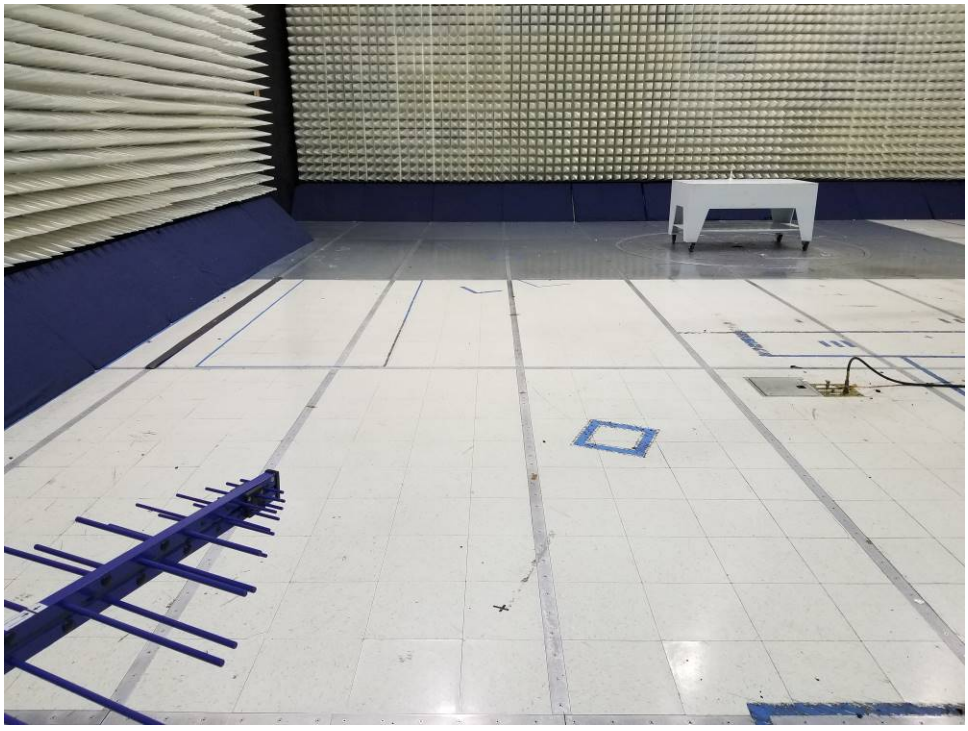
Note: FS= RA + Correction
Correction = AF + CF – Preamp

Results	**Complies**

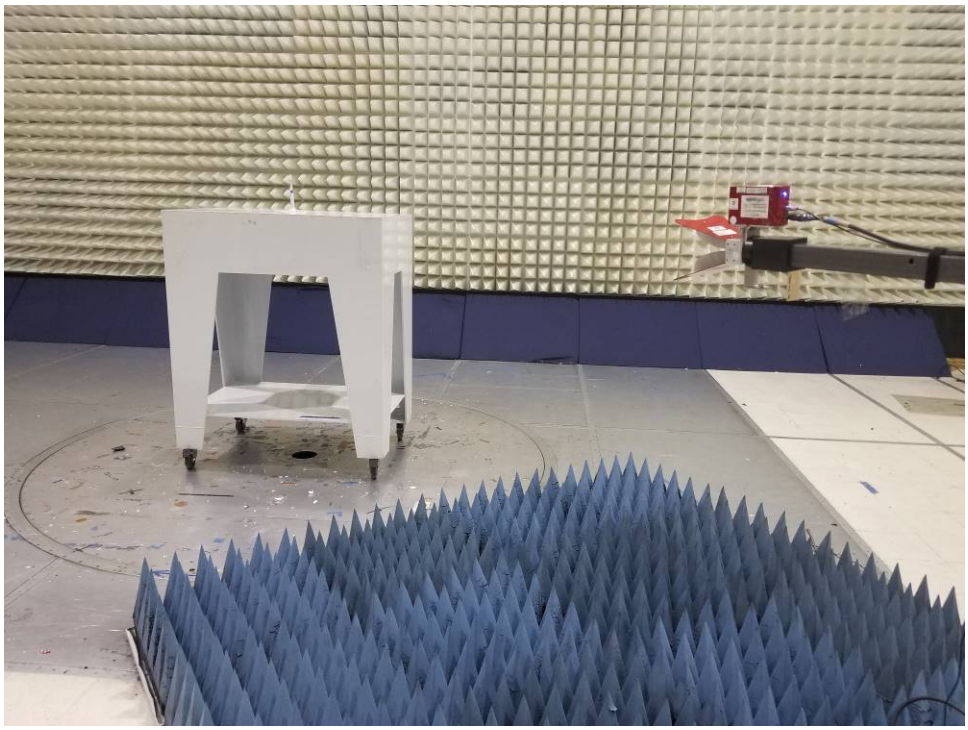
4.5.7 Test Setup Configuration

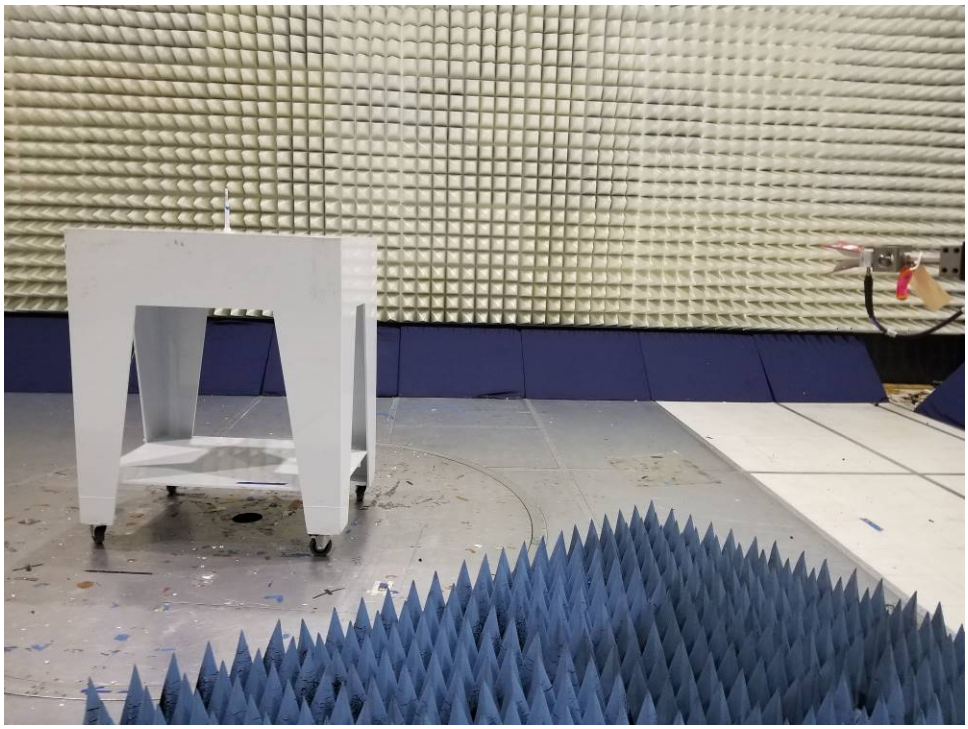
The following photographs show the testing configurations used.



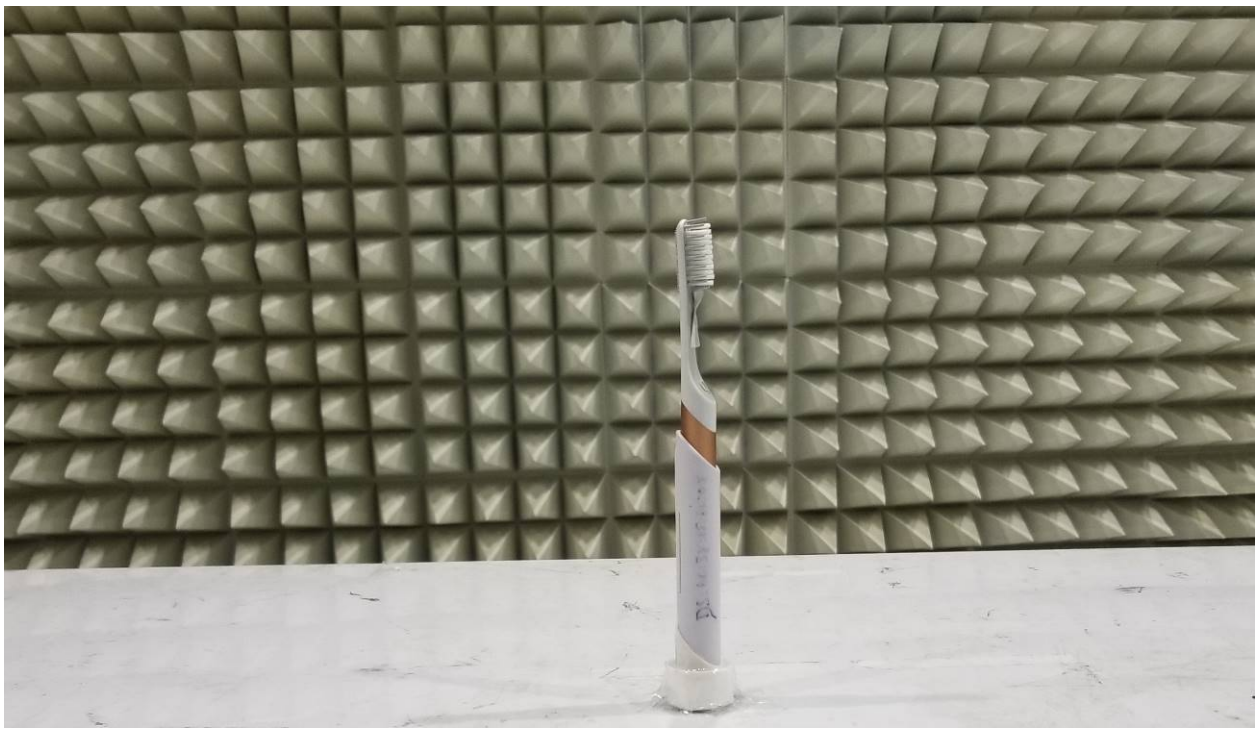


4.5.8 Test Setup Configuration (Continued)



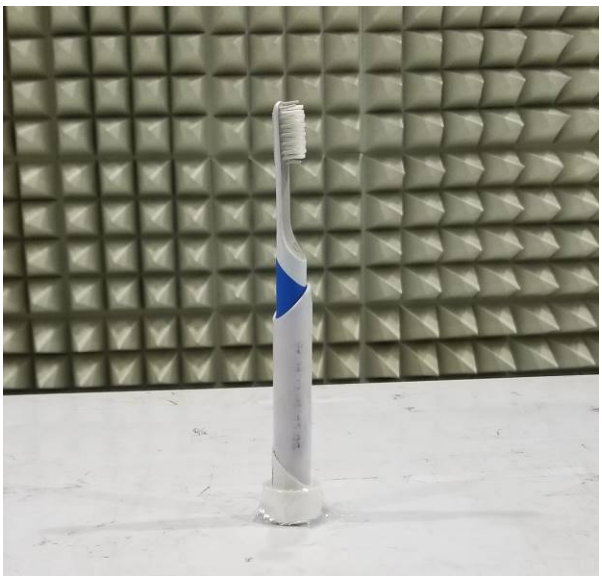


4.5.8 Test Setup Configuration (Continued)



Adult Metal Toothbrush --900-00127

Kids Soft Plastic Toothbrush--900-00129



Adult Plastic Toothbrush--900-00128

5.0 List of Test Equipment

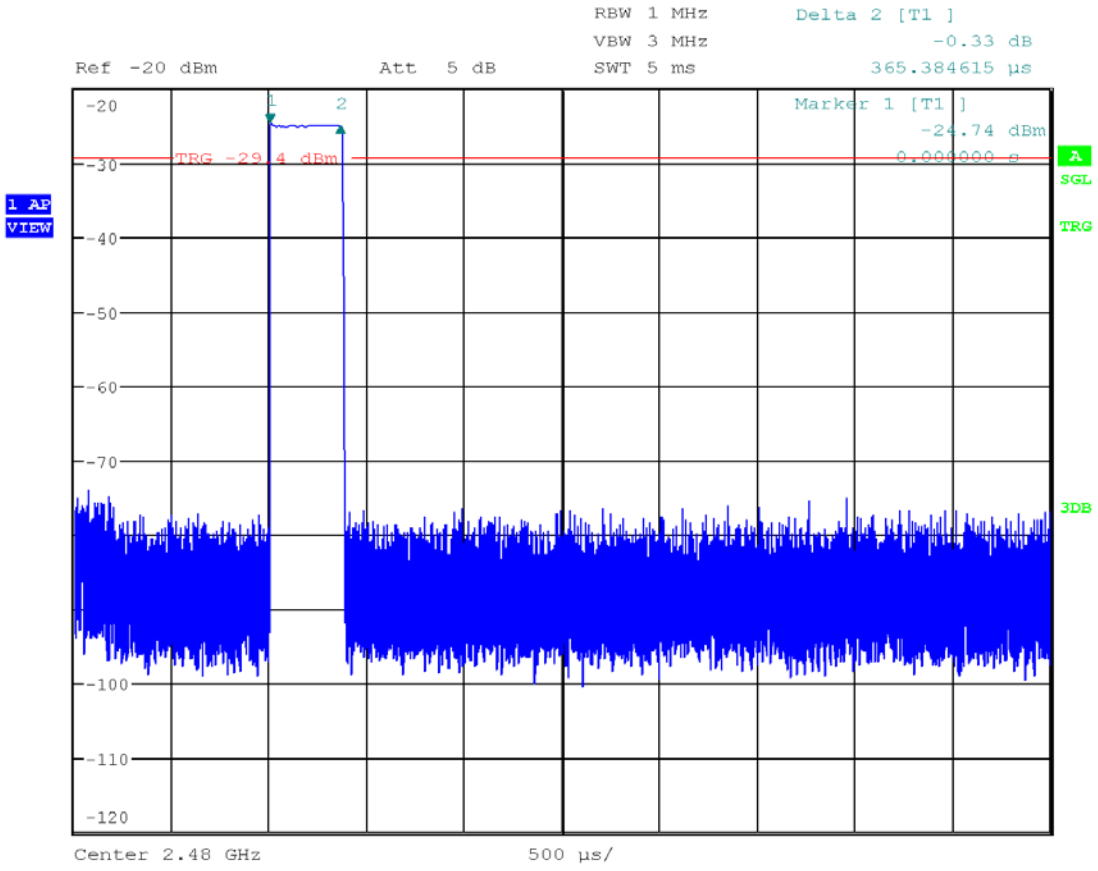
Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
Spectrum Analyzer	Rohde &	FSU	00913	12	05/11/2021
ESR-EMI Test Receiver	Rohde &	ESR7	01607	12	10/23/2020
EMI Test Receiver	Rohde &	ESU40	00961	12	03/09/2021
18-40GHz Passive Horn Antenna	ETS Lindgren	3116C	01776	12	10/16/2020
18-40GHz Pre Amplifier	MITEQ	TTA1840-35-S-M	01542	12	06/24/2020
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	3117-PA	01365	12	07/08/2020
RF Cable	MEGA PHASE	EMC1-K1K1-19	01777	12	02/07/2021
RF Cable	MEGA PHASE	EMC1-K1K1-236	01543	12	11/11/2020
Bilog Antenna 30-1000MHz	Teseq	CBL6111D	01505	12	03/11/2021
Pre-amplifier	Sonoma	310N	01714	12	11/11/2020
RF Cable	TRU Corp.	TRU Core 300	01470	12	08/27/2020
RF cable	TRU Corp.	TRU Core 300	01630	12	03/28/2020
RF Cable	TRU Corp.	TRU Core 300	01342	12	10/07/2020

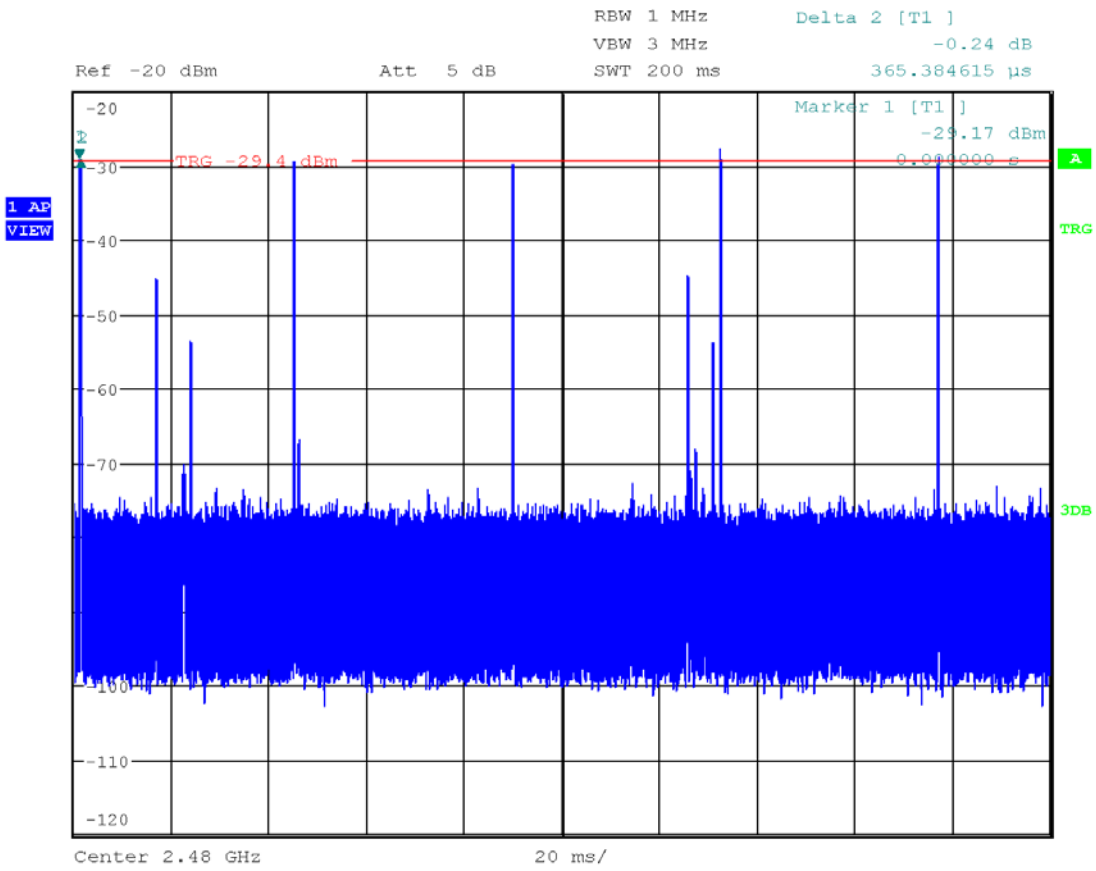
Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.19.1.19	Galvani_1-14-2020.bpp
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

ANNEX A: Duty Correction Factor



Date: 26.MAY.2020 11:53:16



Date: 26.MAY.2020 11:51:04

Duty Cycle:
DC = [(0.365*3)ms/100 ms]*100= 1.1%

DCF = 20 Log (DC) = -39.17 dB
Max DCF = -20 dB was used.

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G104243565	AK	KV	June 02, 2020	Original document

END OF REPORT