TEST REPORT

Report Number: 104407842MPK-014
Project Number: G104407842
December 28, 2020

Testing performed on
Real Immersive System
Model: Xavier 1/Xavier 2
Part Number: 19135 (HMD, All-In-One Head Mounted Display)

FCC ID: 2AQU7-REAL02
IC: 24199-REAL02
to

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

For

Penumbra Inc.

Test Performed by:	**Test Authorized by:**
Intertek	Penumbra Inc.
1365 Adams Court	One Penumbra Place
Menlo Park, CA 94025 USA	Alameda, CA 94502 USA

Prepared by: _____ **Date:** December 28, 2020
Aaron Chang

Reviewed by: _____ **Date:** December 28, 2020
Krishna K Vemuri

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Report No. 104407842MPK-014	
Equipment Under Test:	Real Immersive System - All-In-One Head Mounted Display
Trade Name:	Penumbra Inc.
Model Number:	Xavier 1/Xavier 2
Part Number:	19135
Applicant:	Penumbra Inc.
Contact:	Puneet Goyal
Address:	Penumbra Inc. One Penumbra Place Alameda, CA 94502
Country:	USA
Tel. Number:	(510) 440-5598
Email:	pgoyal@penumbrainc.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	September 22-30, 2020 & December 6-9, 2020

We attest to the accuracy of this report:

Aaron Chang
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 operated and does not operate while charging
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)

EUT receive date: September 21, 2020

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: September 22, 2020

Test completion date: December 9, 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

Penumbra Inc. supplied the following description of the EUT:

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

Xavier is composed of:

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

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

Information about the 2.4 GHz radio is presented below:

Applicant	Penumbra Inc.
Model No.	Xavier 1/Xavier 2
FCC Identifier	2AQU7-REAL02
IC Identifier	24199-REAL02
Type of transmission	Digital Transmission System (DTS), 2 x Radios
Rated RF Output	8.04 dBm
Antenna(s) & Gain	Internal Antenna, Peak Gain: 0.7 dBi
Frequency Range	2402 – 2479 MHz
Type of modulation/data rate	Gaussian Frequency-shift Keying (GFSK) / 2Mbit/s
Number of Channel(s)	77
Applicant Name & Address	Penumbra Inc. One Penumbra Place Alameda, CA 94502 USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

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

2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents "Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247" (558074 D01 15.247 Meas Guidance v05r02), and RSS-247 Issue 2, RSS-GEN Issue 5.

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10: 2013. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this report.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	**Expanded Uncertainty (k=2)**		
	0.15 MHz – 1 GHz	**1 GHz – 2.5 GHz**	**> 2.5 GHz**
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	**Expanded Uncertainty (k=2)**			
	0.15 MHz – 30MHz	**30 – 200 MHz**	**200 MHz – 1 GHz**	**1 GHz – 18 GHz**
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

3.0 System Test Configuration

3.1 Support Equipment

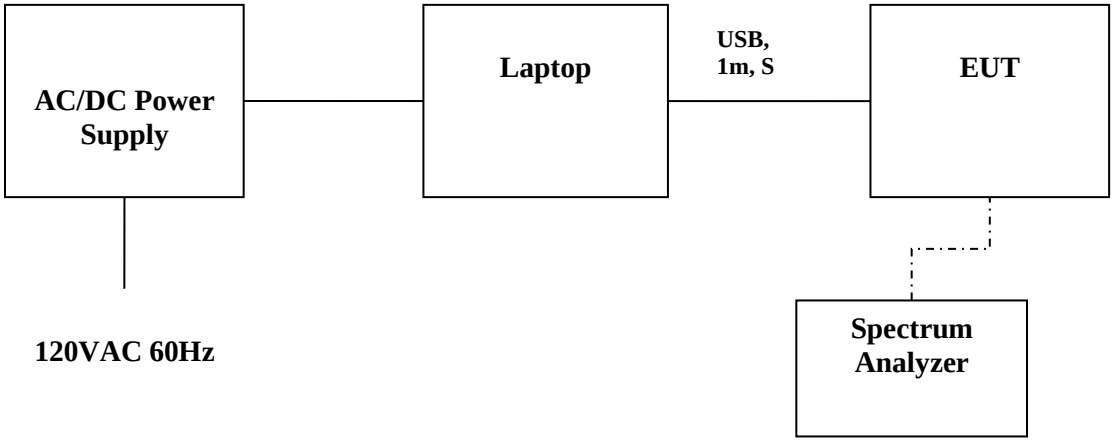
Support Equipment		
Description	**Manufacturer**	**Model Number**
Laptop*	Dell	Latitude 5400

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

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Part Number**	**Serial Number (LOT Number)**
Radiated Sample of HMD, All-In-One Head Mounted Display	Penumbra, Inc.	19135	E11910
Conducted Sample of HMD, All-In-One Head Mounted Display	Penumbra, Inc.	19135	E11909

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



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

3.3 Justification

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

According to the manufacturer, each Real Immersive System will consist of Xavier 1: 5 WSM, 1 WTM & 1 HMD or Xavier 2: 2 WSM, 1 WTM & 1 HMD. The WSMs and WTM will be paired to the HMD. The HMD has two radios and WSM/WTM has one radio each. These pairing in this system will use one out of the 77 available channels at a time. The devices in the system share the channel. The devices will not transmit simultaneously on the same channel at any given time. In normal use HMD is mounted on to a VR Headset. The VR Headset transmit using 2.4GHz or 5GHz band. Therefore, HMD was tested while co-located with the VR Headset operating at 2.4GHz and 5GHz. Xavier 2 HMD has an extended piece of plastic but both HMDs are electrically equivalent. Therefore, test results will apply to both HMDs.

3.4 Software Exercise Program

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

3.5 Mode of Operation during Test

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

3.6 Modifications Required for Compliance

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

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

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

4.1.1 Requirement

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

4.1.2 Procedure

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

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

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

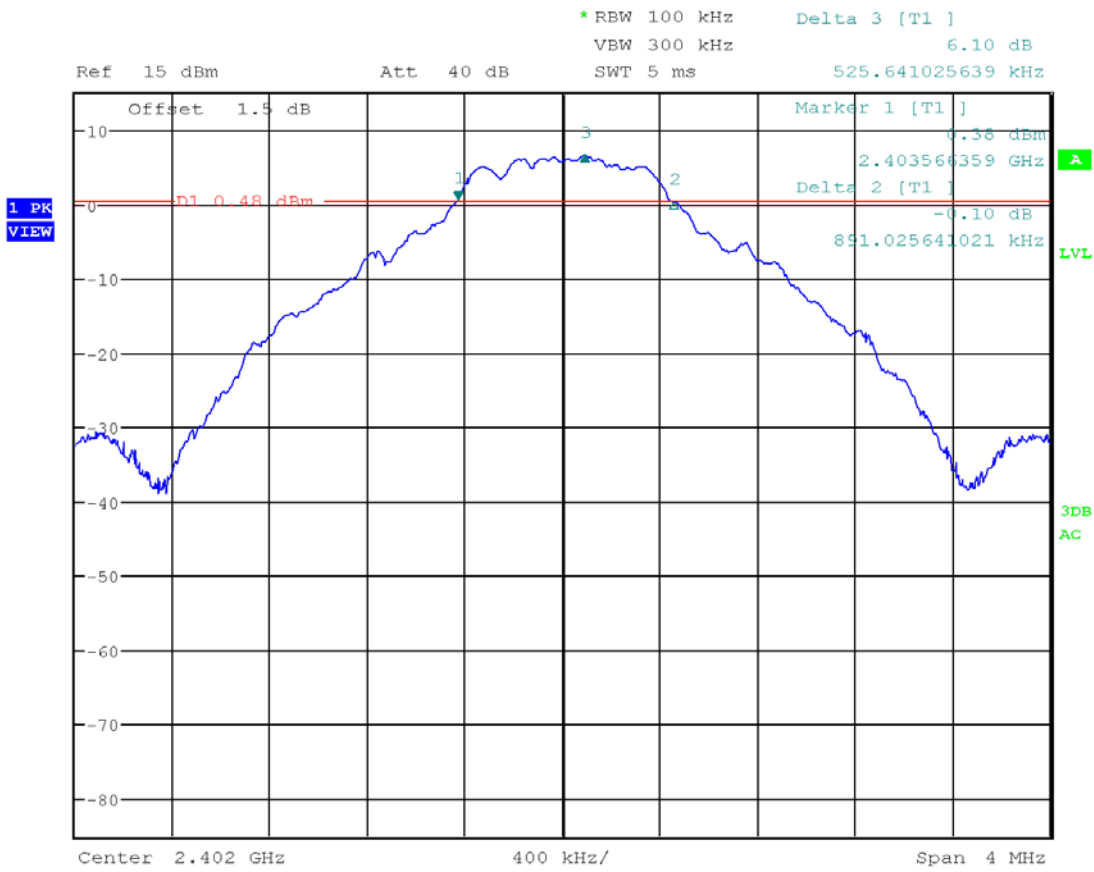
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Radio	Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN	Plot	Occupied bandwidth, RSS-GEN	Plot
	MHz	kHz		MHz	
1	2402	891.026	1.1	1.816	1.4
	2440	871.795	1.2	1.780	1.5
	2479	891.026	1.3	1.812	1.6
2	2402	903.846	1.7	1.860	1.10
	2440	903.846	1.8	1.764	1.11
	2479	936.667	1.9	1.788	1.12

Tested By	Test Date
Aaron Chang	September 22, 2020

Plot 1. 1



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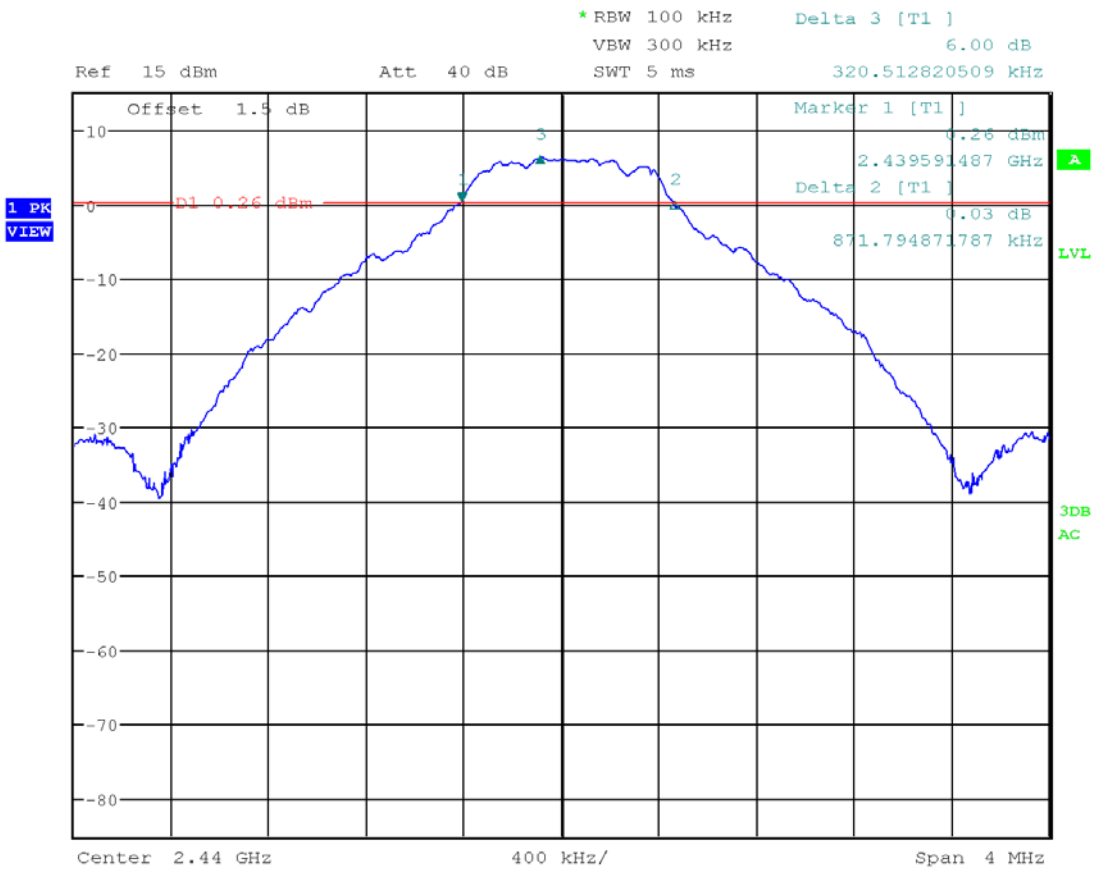
Plot 1. 2



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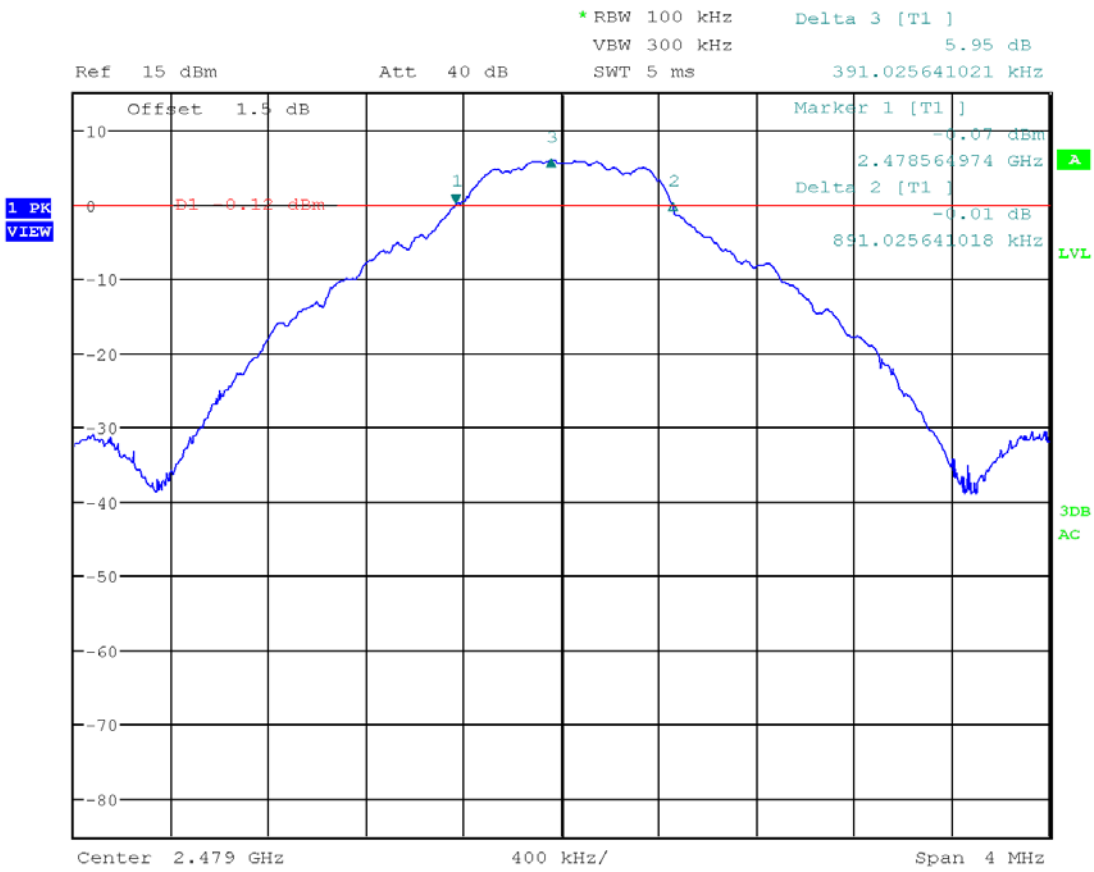
Plot 1. 3



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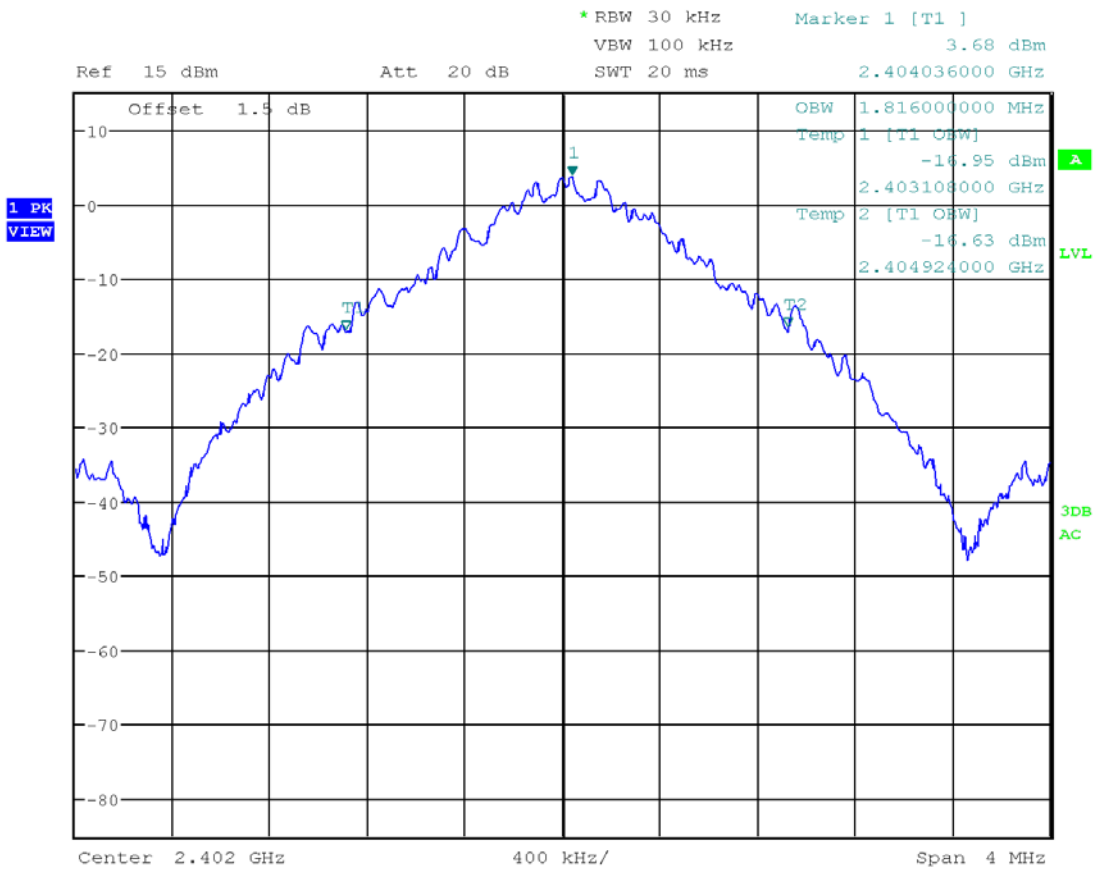
Plot 1. 4



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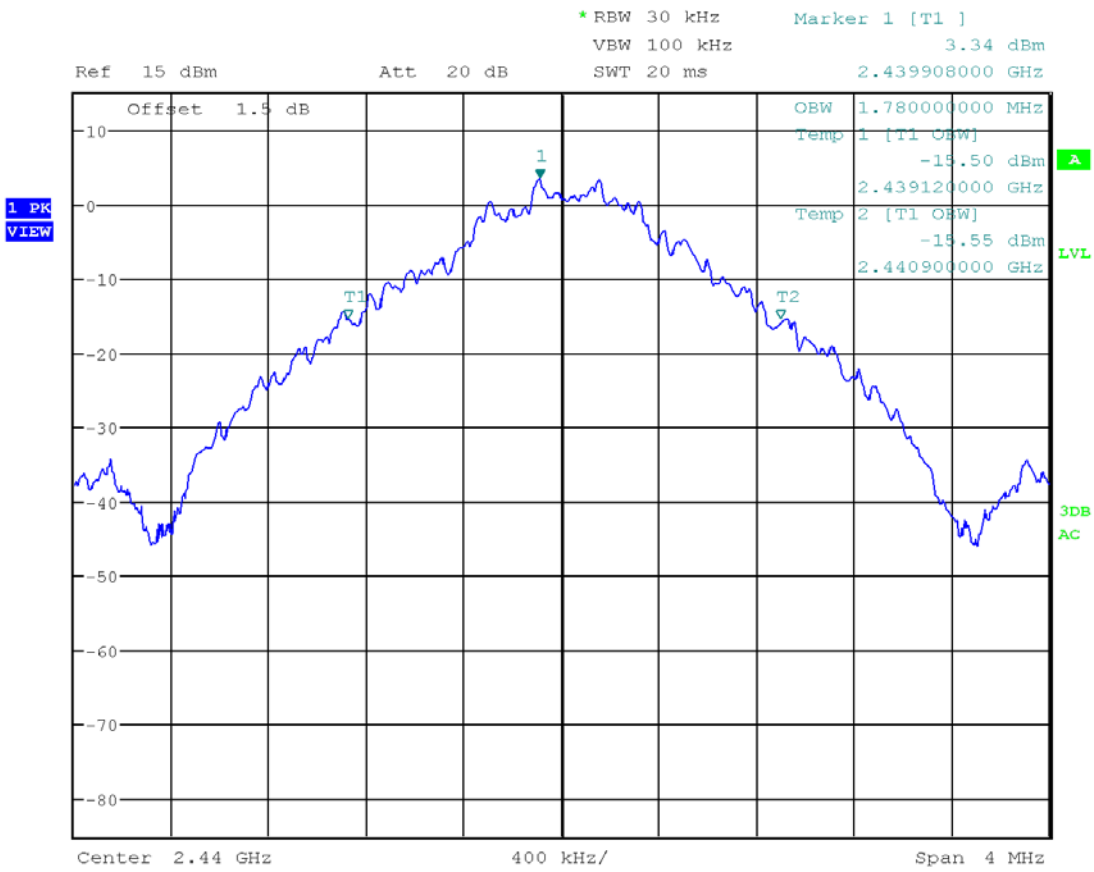
Plot 1.5



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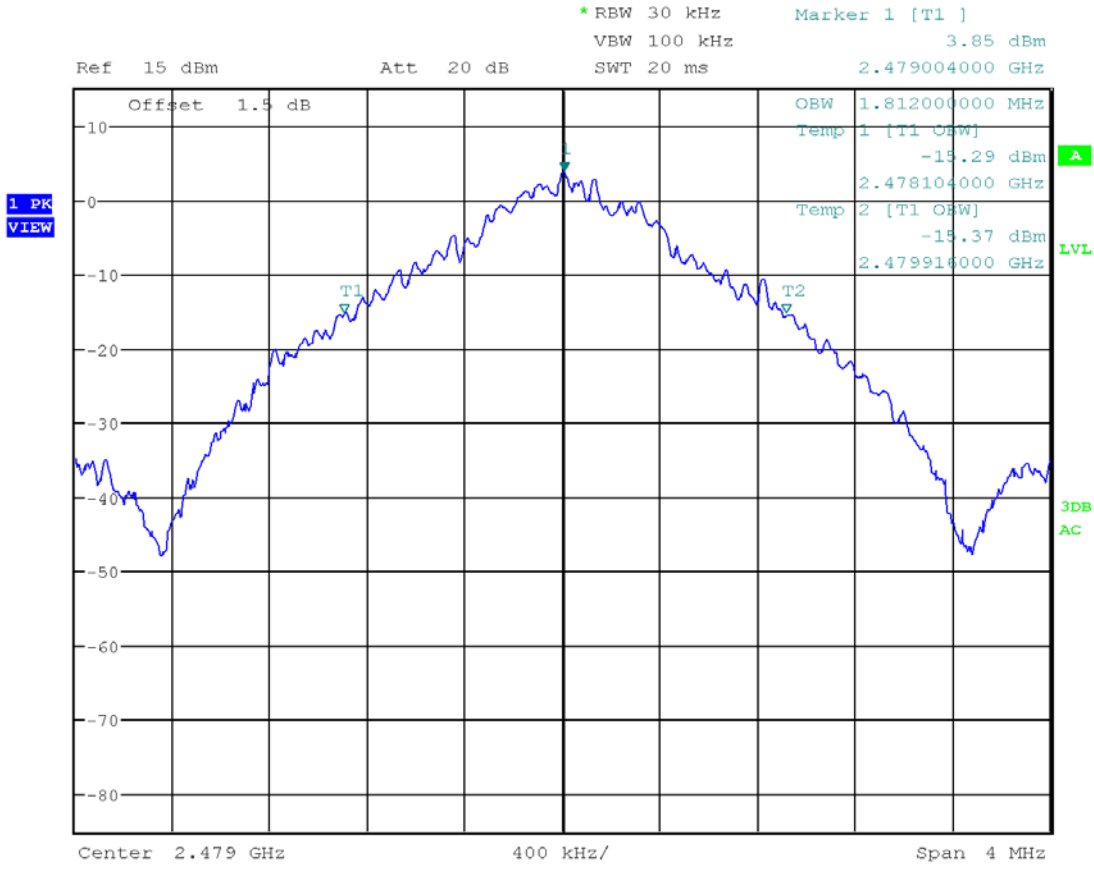
Plot 1.6



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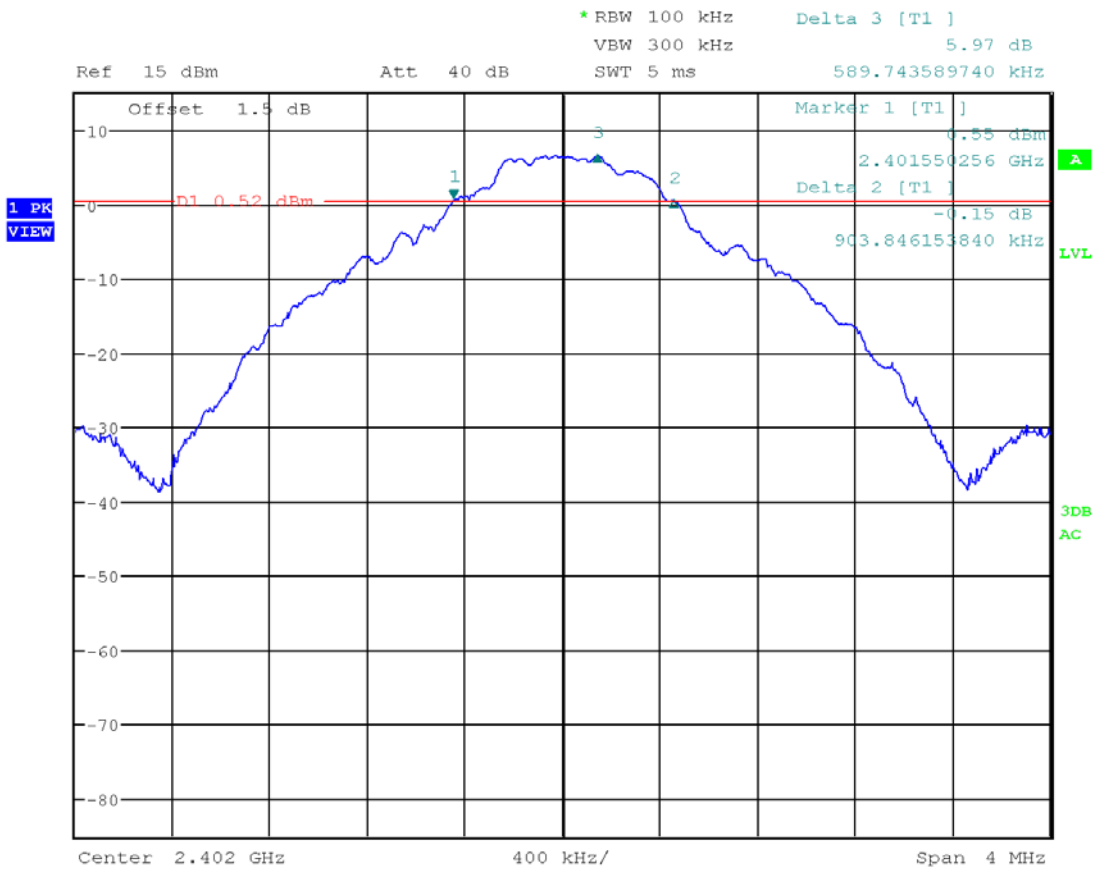

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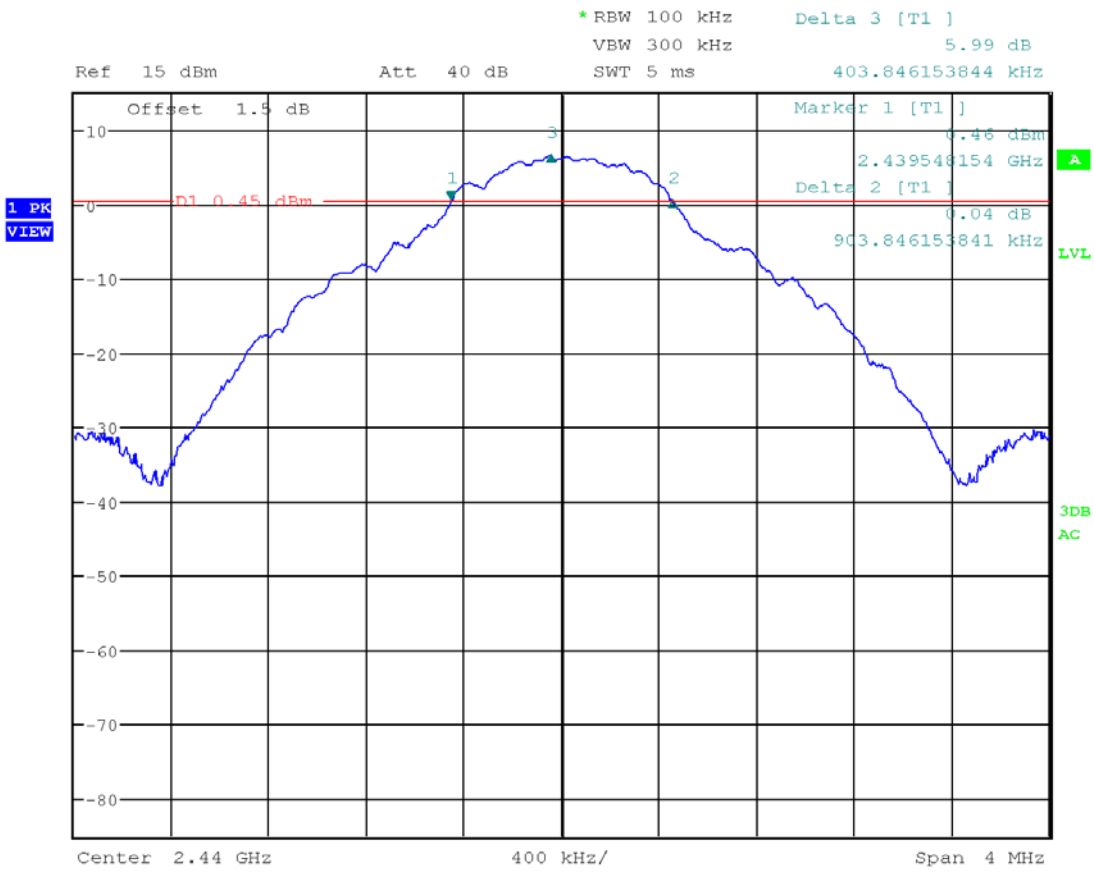
Plot 1.8



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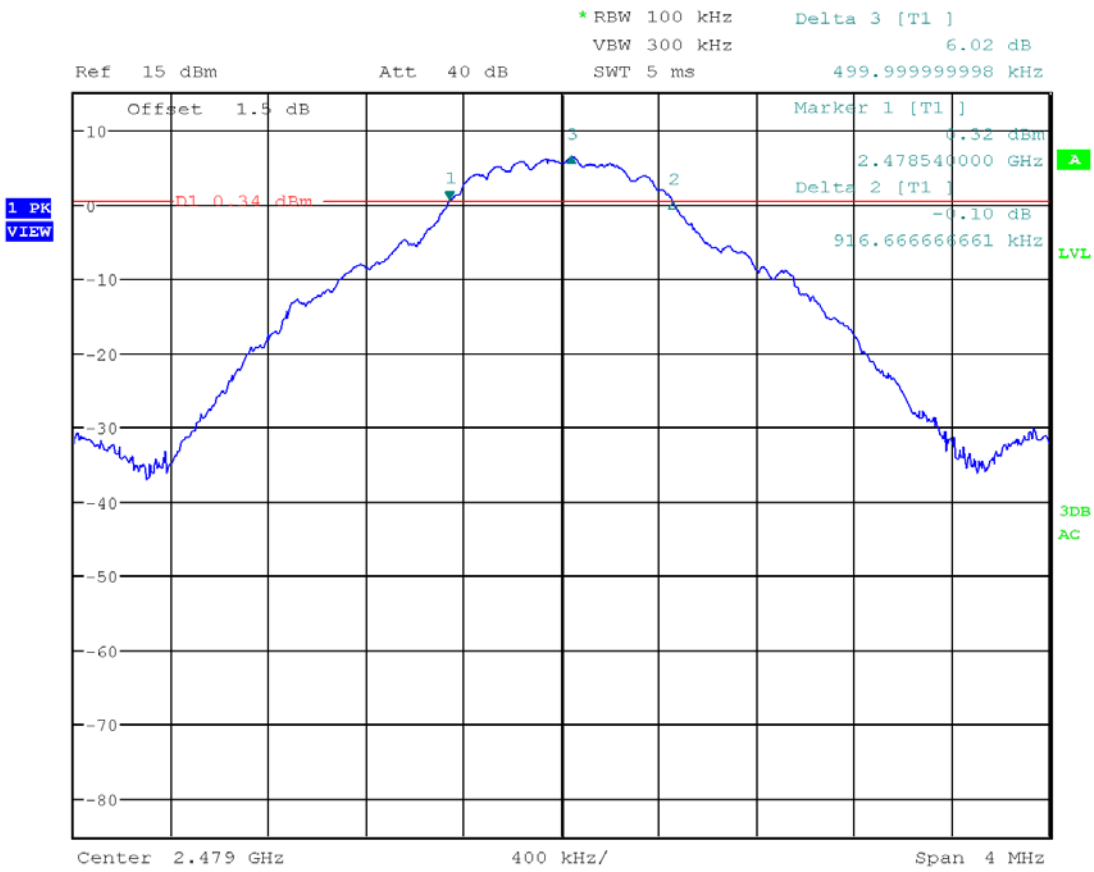
Plot 1.9



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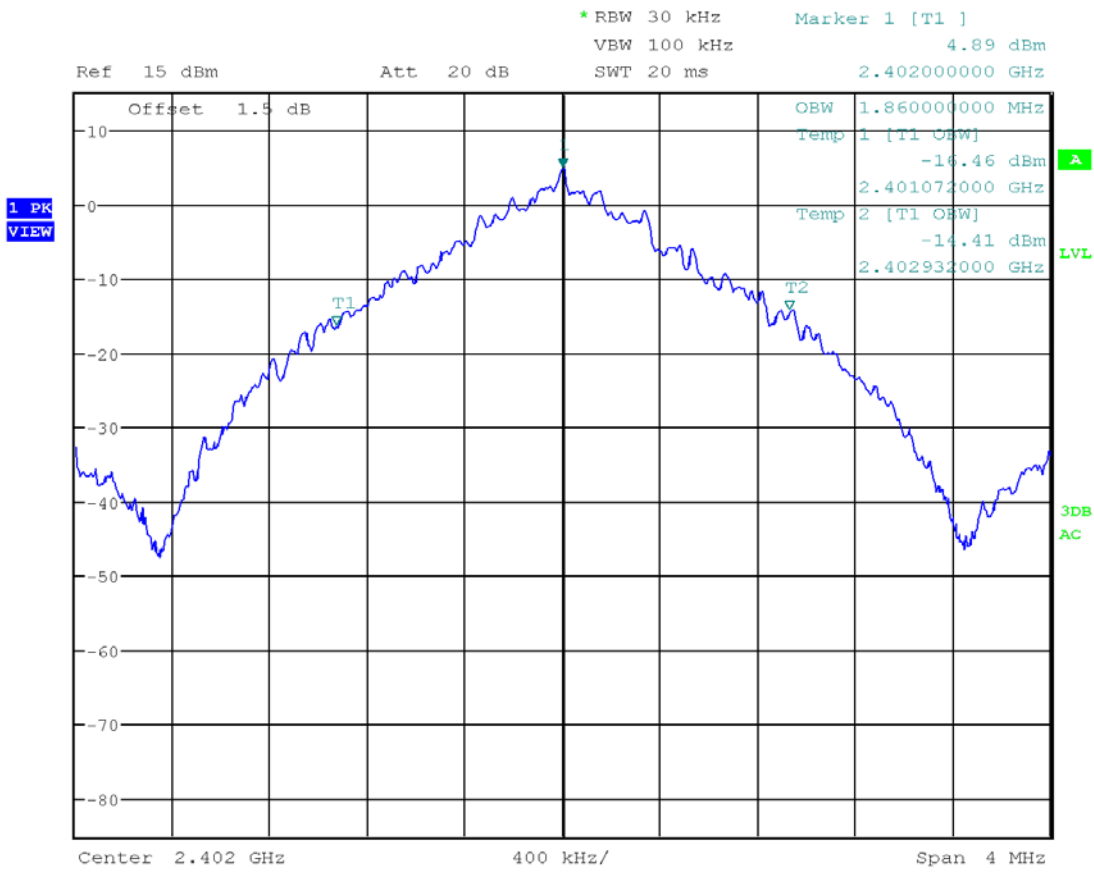
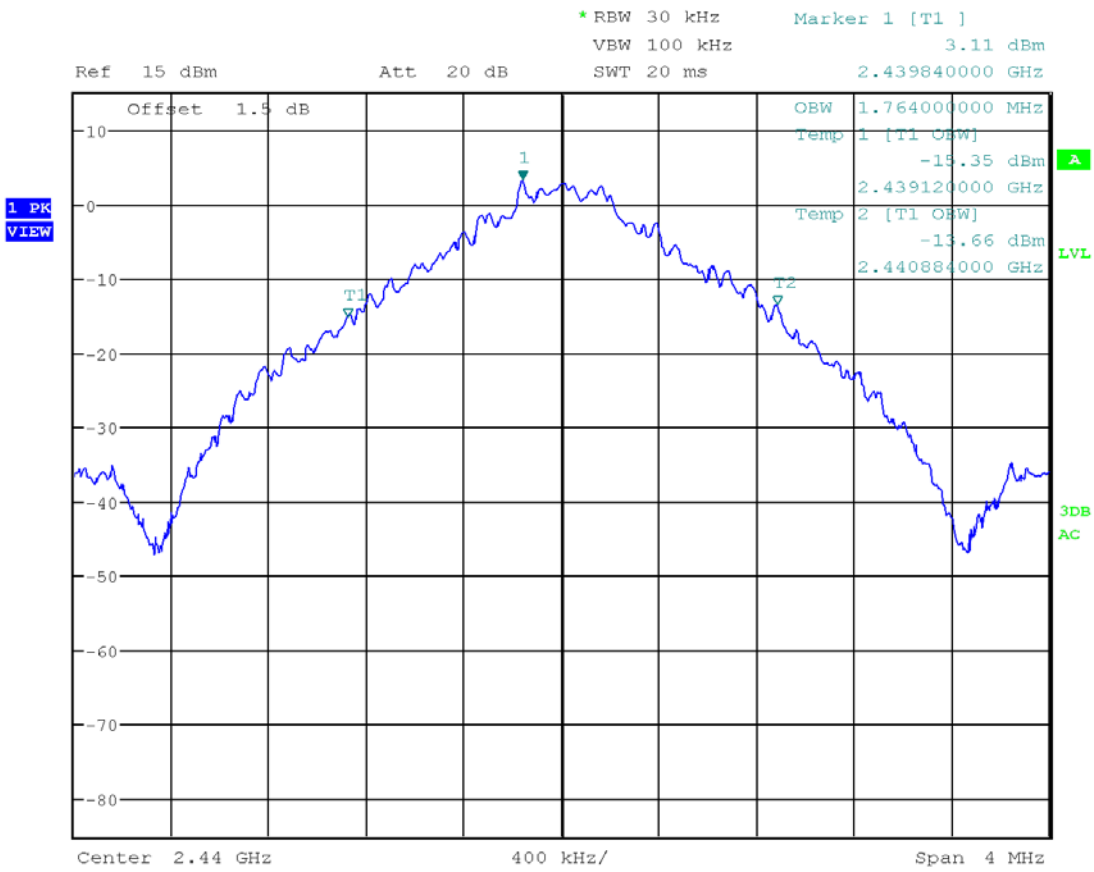
Plot 1.10



Date: 22.SEP.2020 23:07:03

Plot 1.11



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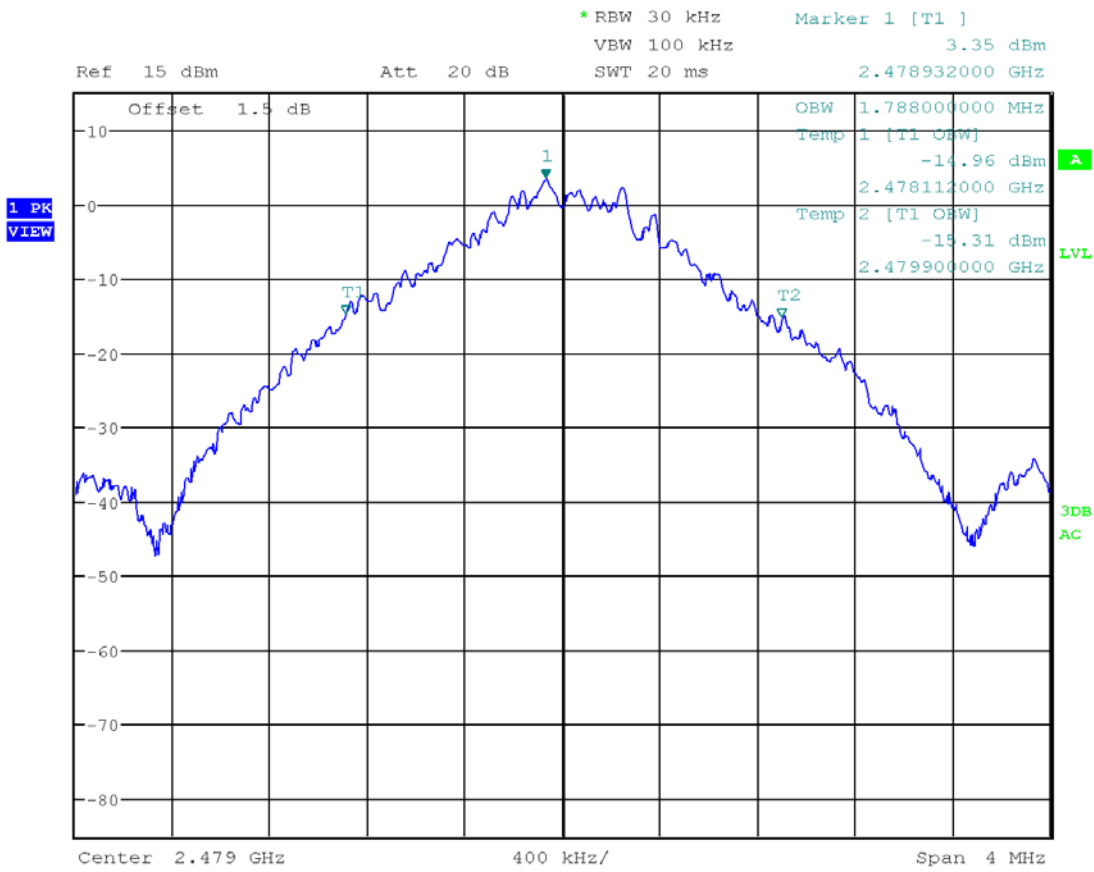
Plot 1.12



Date: 22.SEP.2020 23:08:36

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.

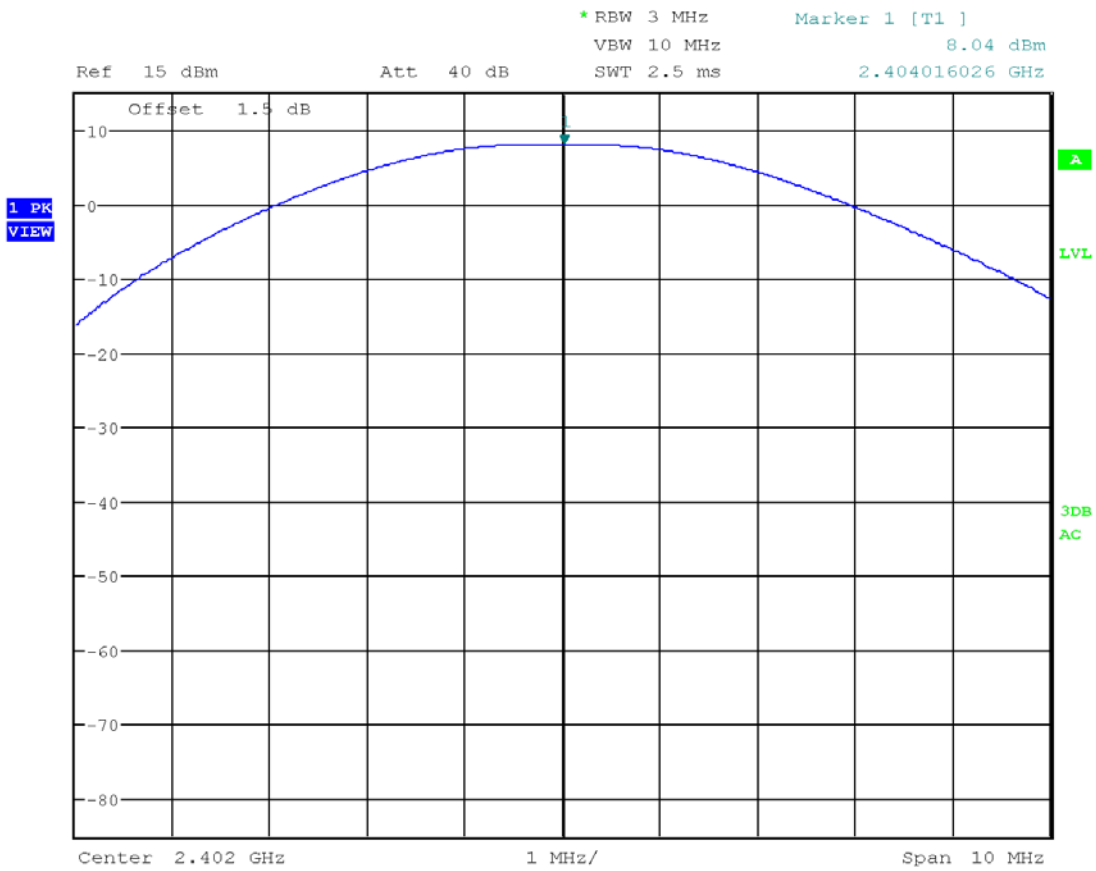
4.2.3 Test Result

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

Radio	Frequency	Conducted Power (peak)		Plot
	MHz	dBm	mW	
1	2402	8.04	6.368	2.1
	2440	7.97	6.266	2.2
	2479	7.62	5.781	2.3
2	2402	7.71	5.902	2.4
	2440	7.97	6.266	2.5
	2479	7.66	5.834	2.6

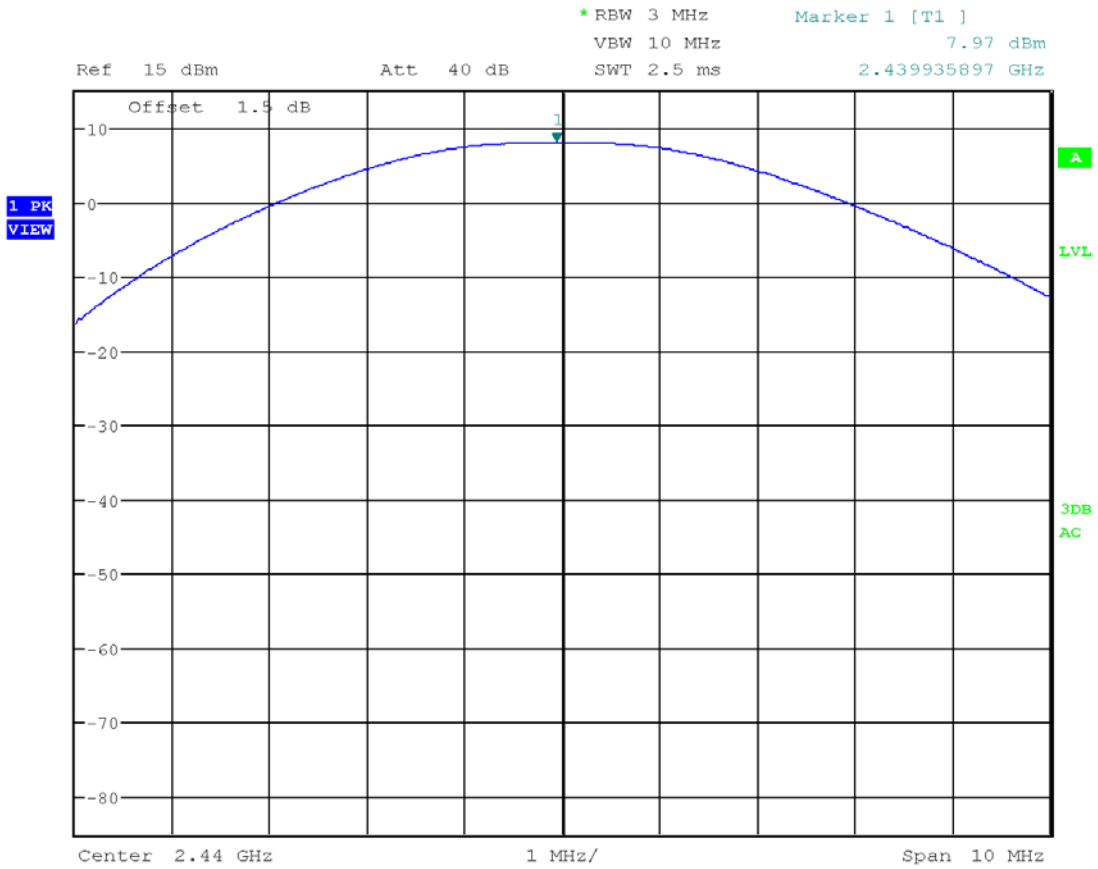
Tested By	Test Date
Aaron Chang	September 22, 2020

Plot 2. 1



Date: 22.SEP.2020 02:08:32

Plot 2. 2

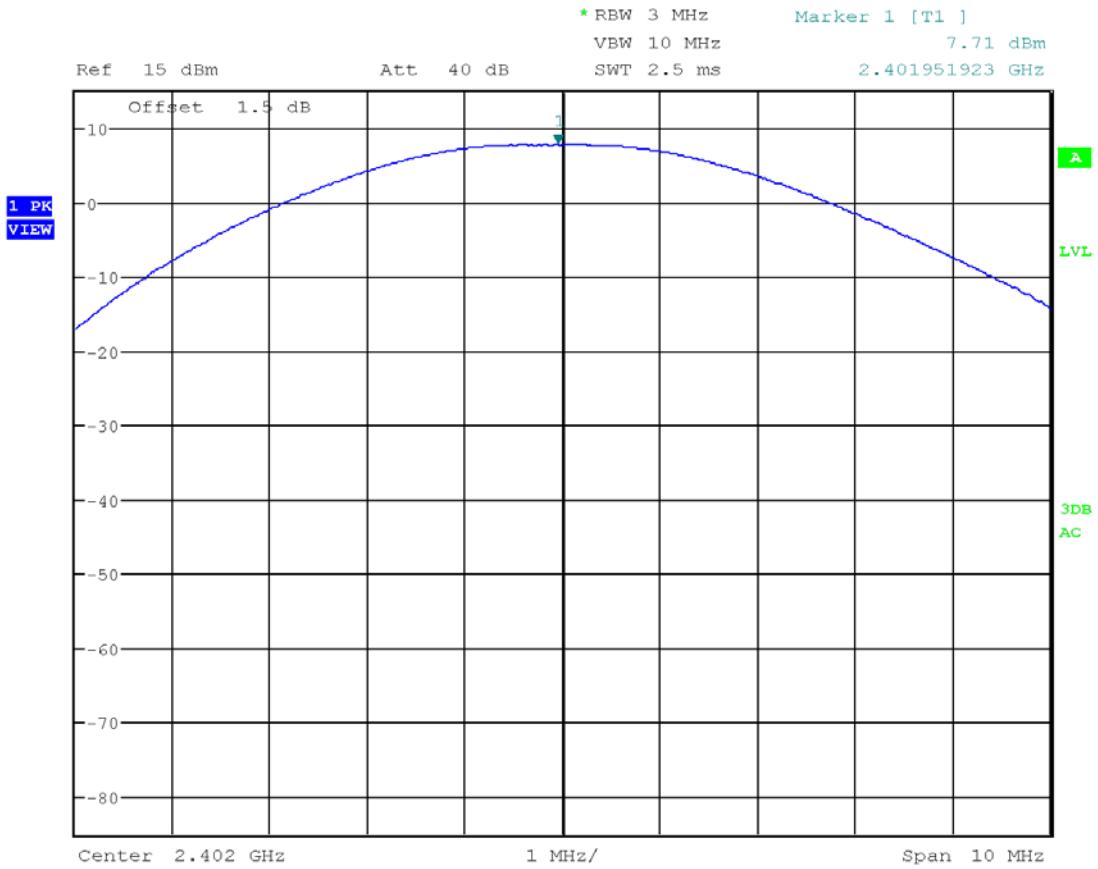


Date: 22.SEP.2020 02:09:27

Plot 2. 3

* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
7.62 dBm
2.479160256 GHz
Ref 15 dBm
Att 40 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.479 GHz
1 MHz/
Span 10 MHz
Date: 22.SEP.2020 02:10:15

Plot 2.4



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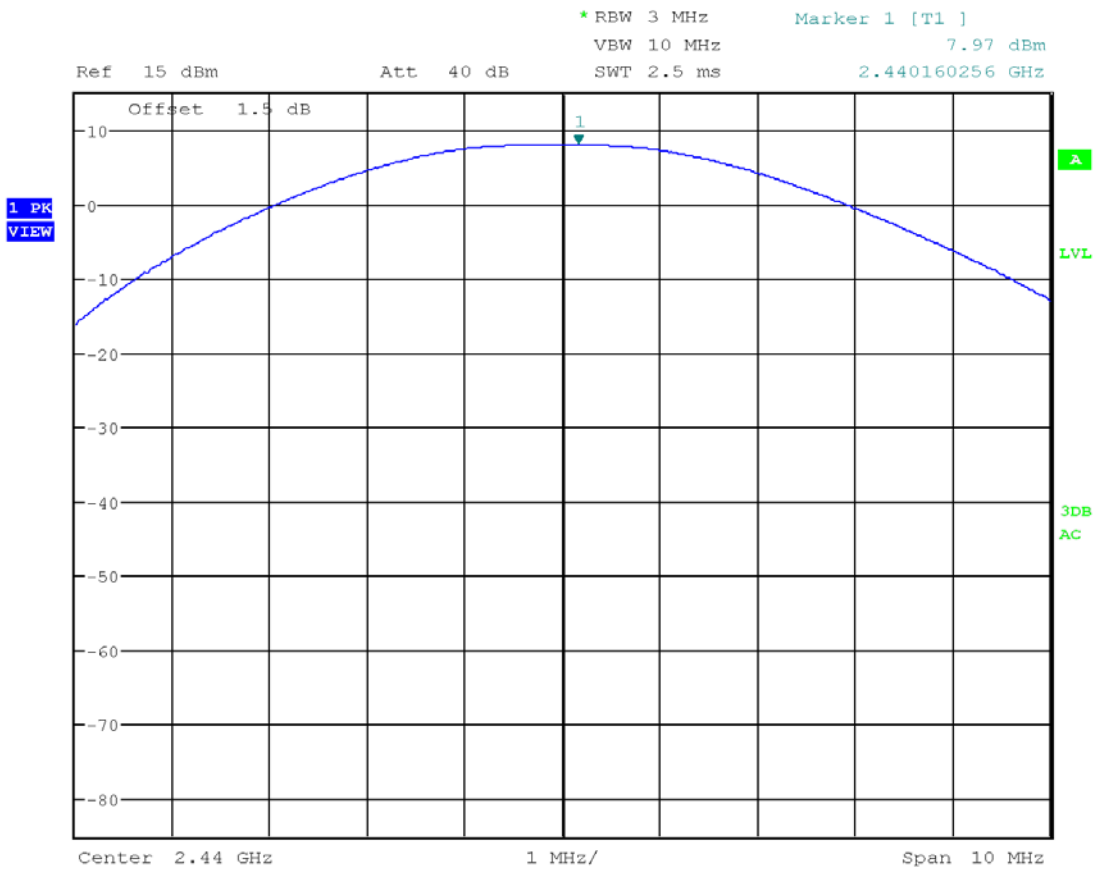
Plot 2.5



Date: 22.SEP.2020 02:15:31

Plot 2.6

* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
7.66 dBm
2.479224359 GHz
Ref 15 dBm
Att 40 dB
Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.479 GHz
1 MHz/
Span 10 MHz
Date: 22.SEP.2020 02:14:48

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.

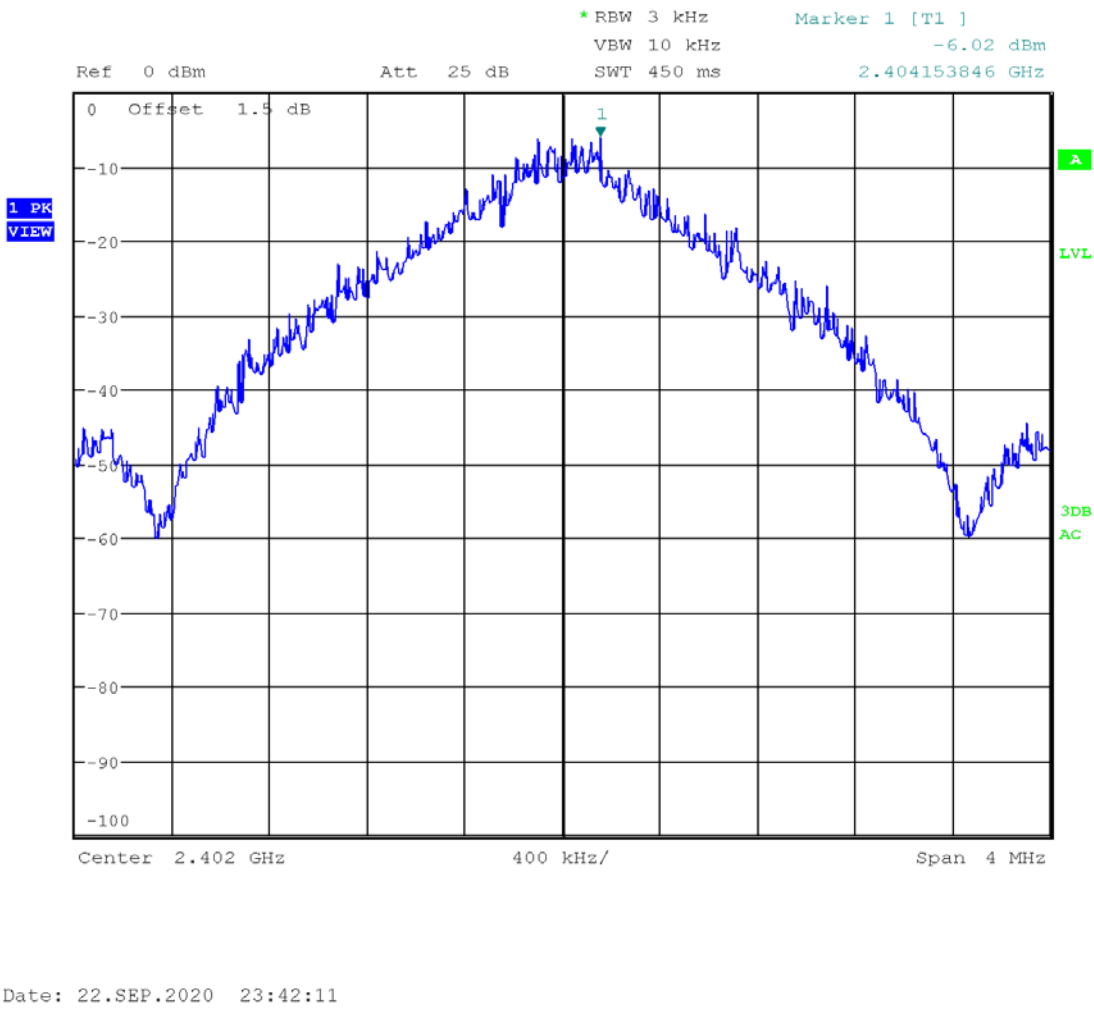
4.3.3 Test Result

Refer to the following plots for the test result

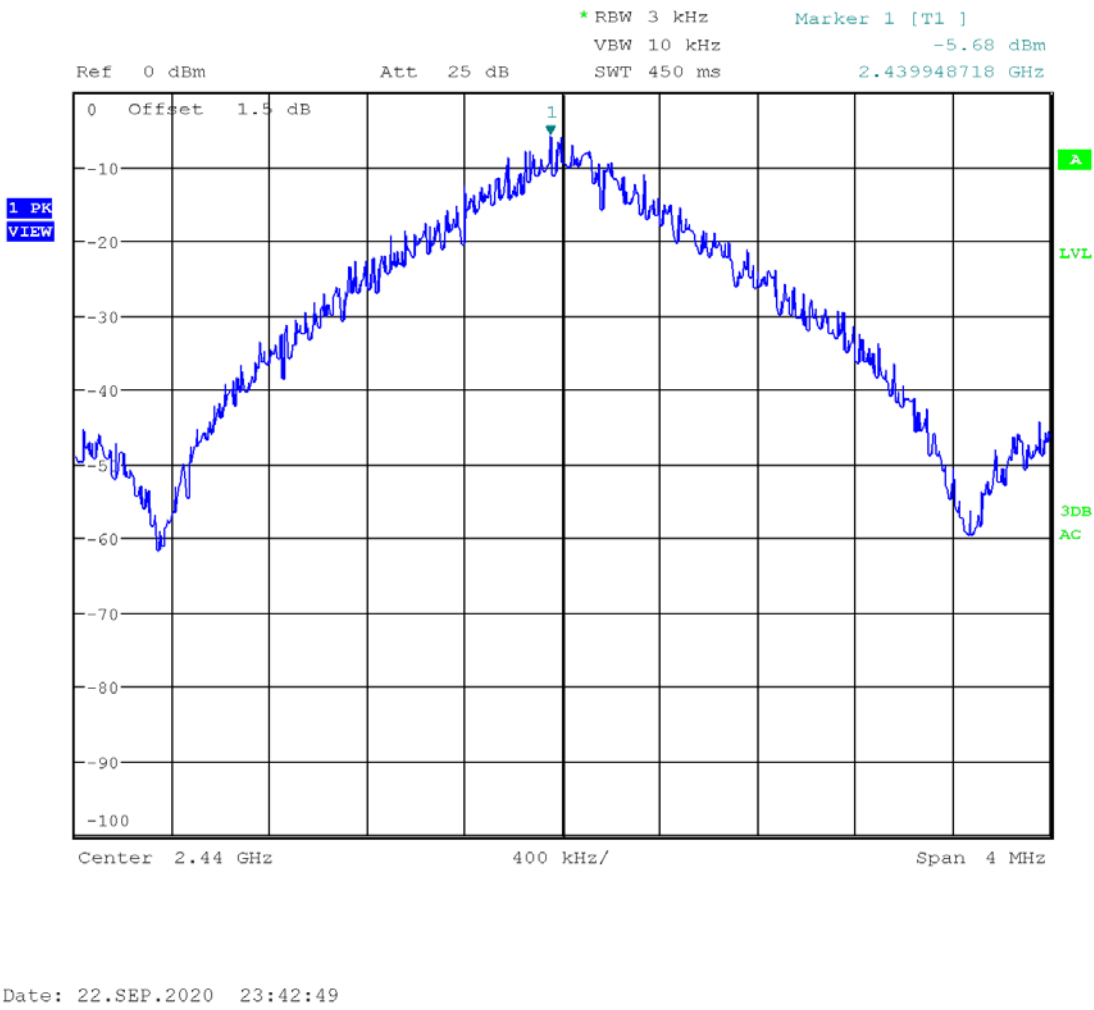
Radio	Frequency,	Maximum Power Spectral Density	Maximum Power Spectral Density Limit	Margin	Plot
	MHz	dBm	dBm	dB	
1	2402	-6.02	8.0	-14.02	3.1
	2440	-5.68	8.0	-13.68	3.2
	2479	-6.58	8.0	-14.58	3.3
2	2402	-6.40	8.0	-14.40	3.4
	2440	-4.59	8.0	-12.59	3.5
	2479	-6.28	8.0	-14.28	3.6

Tested By	Test Date
Aaron Chang	September 22, 2020

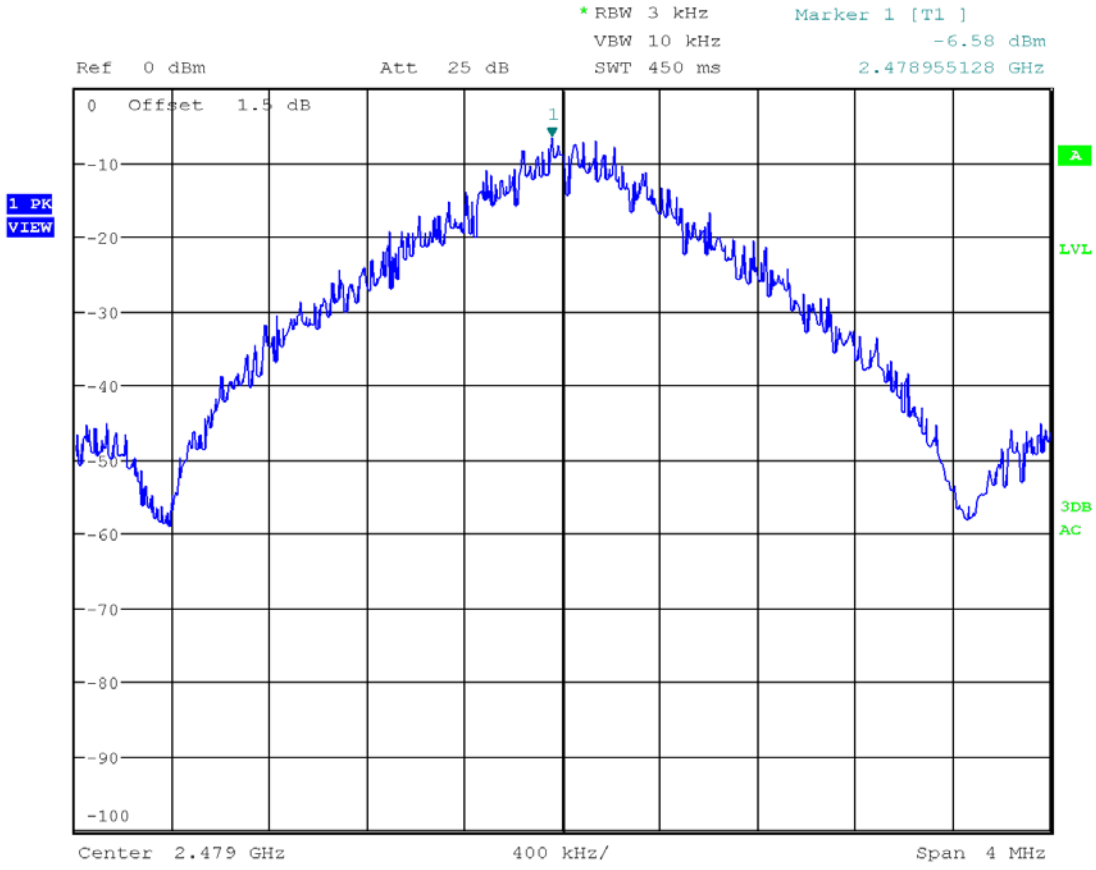
Plot 3. 1


* RBW 3 kHz
VBW 10 kHz
SWT 450 ms
Marker 1 [T1]
-6.02 dBm
2.404153846 GHz
Ref 0 dBm
Att 25 dB
0 Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 2.402 GHz
400 kHz/
Span 4 MHz
Date: 22.SEP.2020 23:42:11

Plot 3. 2

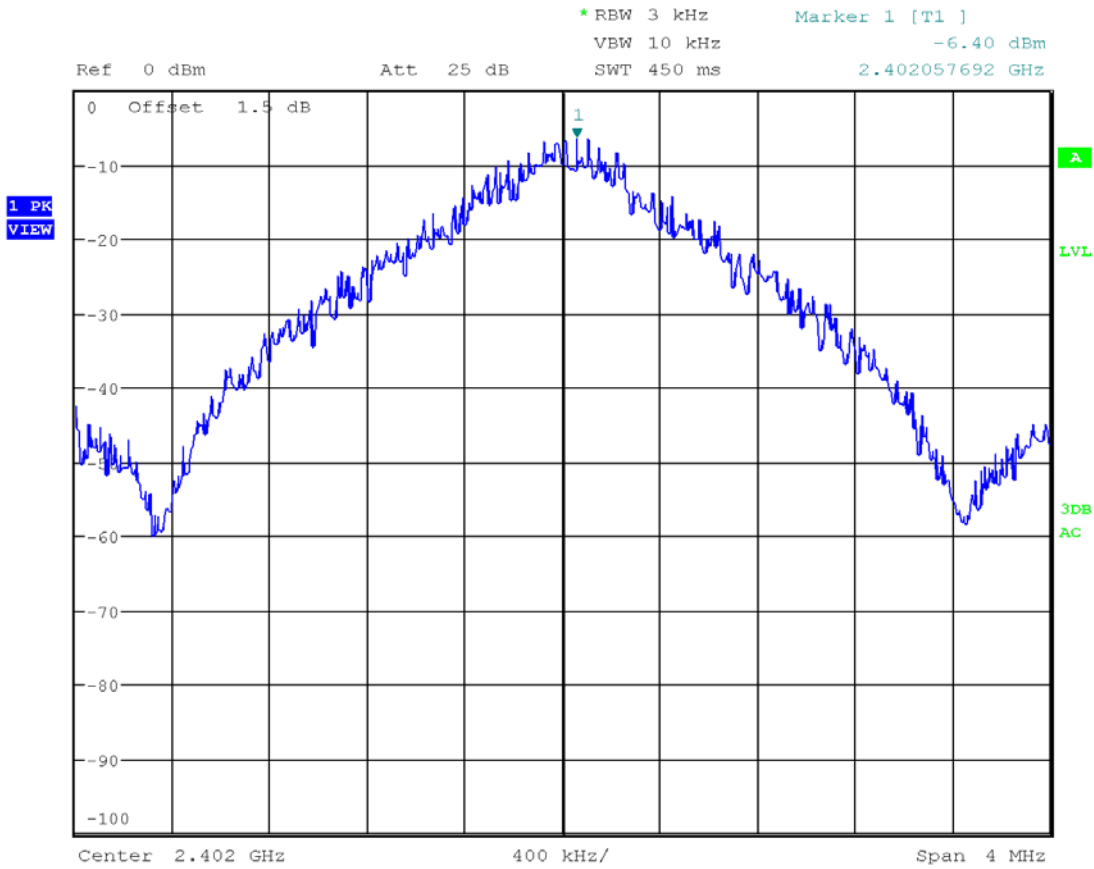

* RBW 3 kHz
VBW 10 kHz
SWT 450 ms
Marker 1 [T1]
-5.68 dBm
2.439948718 GHz
Ref 0 dBm
Att 25 dB
0 Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 2.44 GHz
400 kHz/
Span 4 MHz
Date: 22.SEP.2020 23:42:49

Plot 3. 3



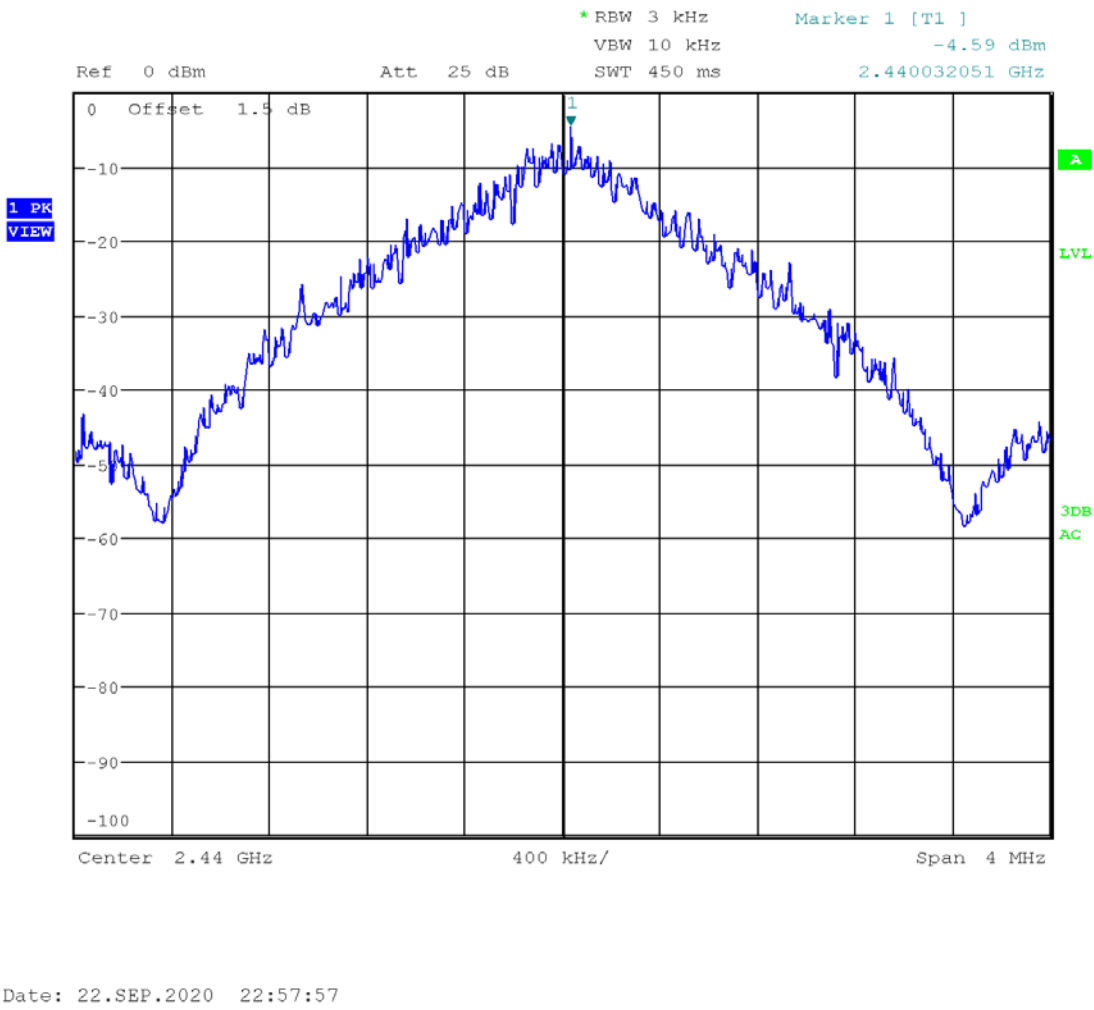
Date: 22.SEP.2020 23:41:21

Plot 3.4

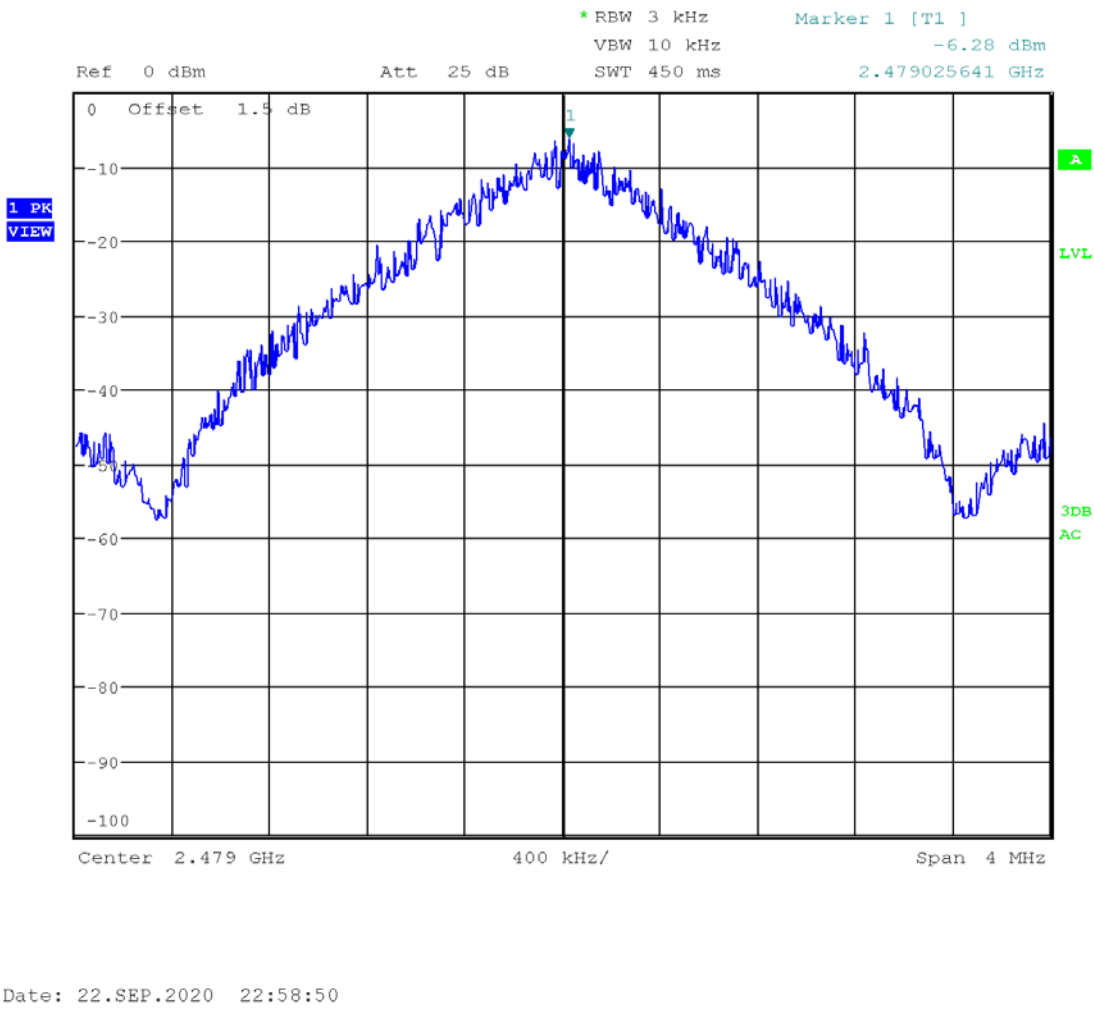


Date: 22.SEP.2020 22:57:08

Plot 3.5


* RBW 3 kHz
VBW 10 kHz
SWT 450 ms
Marker 1 [T1]
-4.59 dBm
2.440032051 GHz
Ref 0 dBm
Att 25 dB
0 Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 2.44 GHz
400 kHz/
Span 4 MHz
Date: 22.SEP.2020 22:57:57

Plot 3.6


* RBW 3 kHz
VBW 10 kHz
SWT 450 ms
Marker 1 [T1]
-6.28 dBm
2.479025641 GHz
Ref 0 dBm
Att 25 dB
0 Offset 1.5 dB
1 PK
VIEW
A
LVL
3DB
AC
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 2.479 GHz
400 kHz/
Span 4 MHz
Date: 22.SEP.2020 22:58:50

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 9 kHz to 26 GHz. Plots below are corrected for cable loss and then compared to the limits.

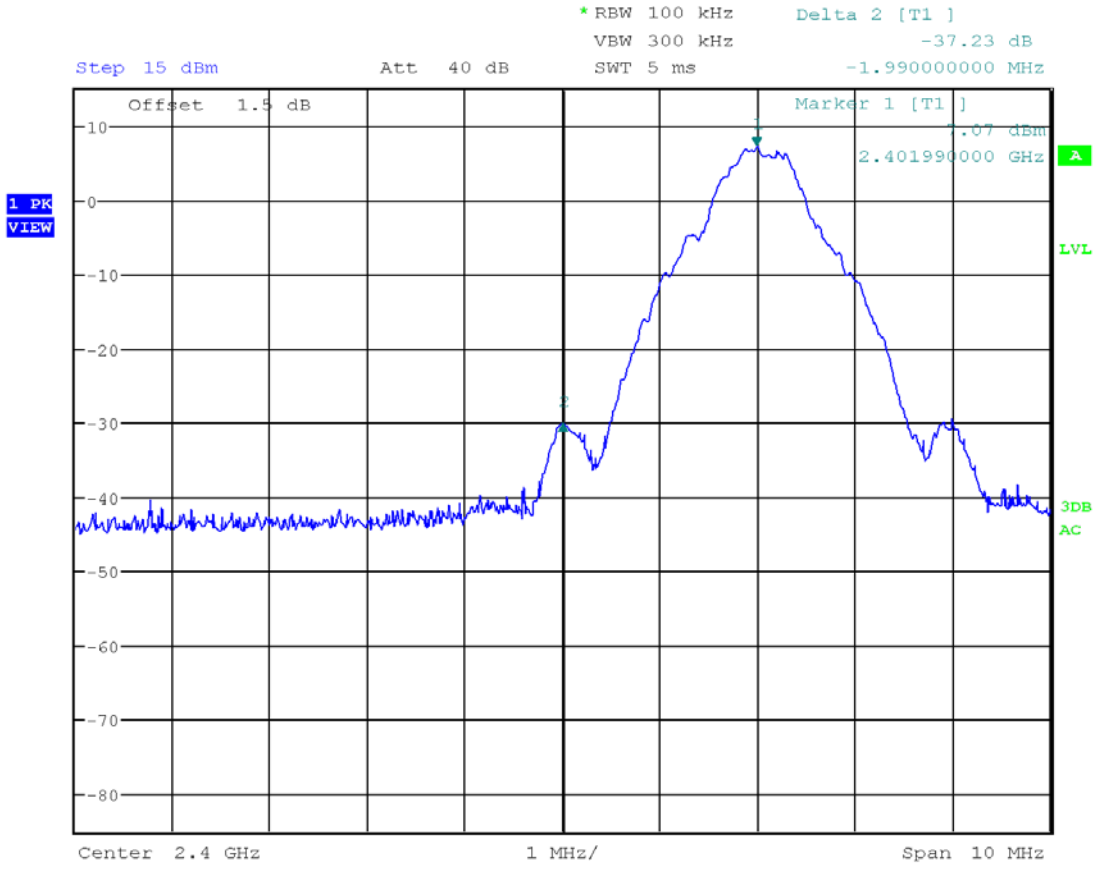
4.4.3 Test Result

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

Tested By	Test Date
Aaron Chang	September 22, 2020

Tx @ Low Channel Radio 1, 2400 MHz Band Edge

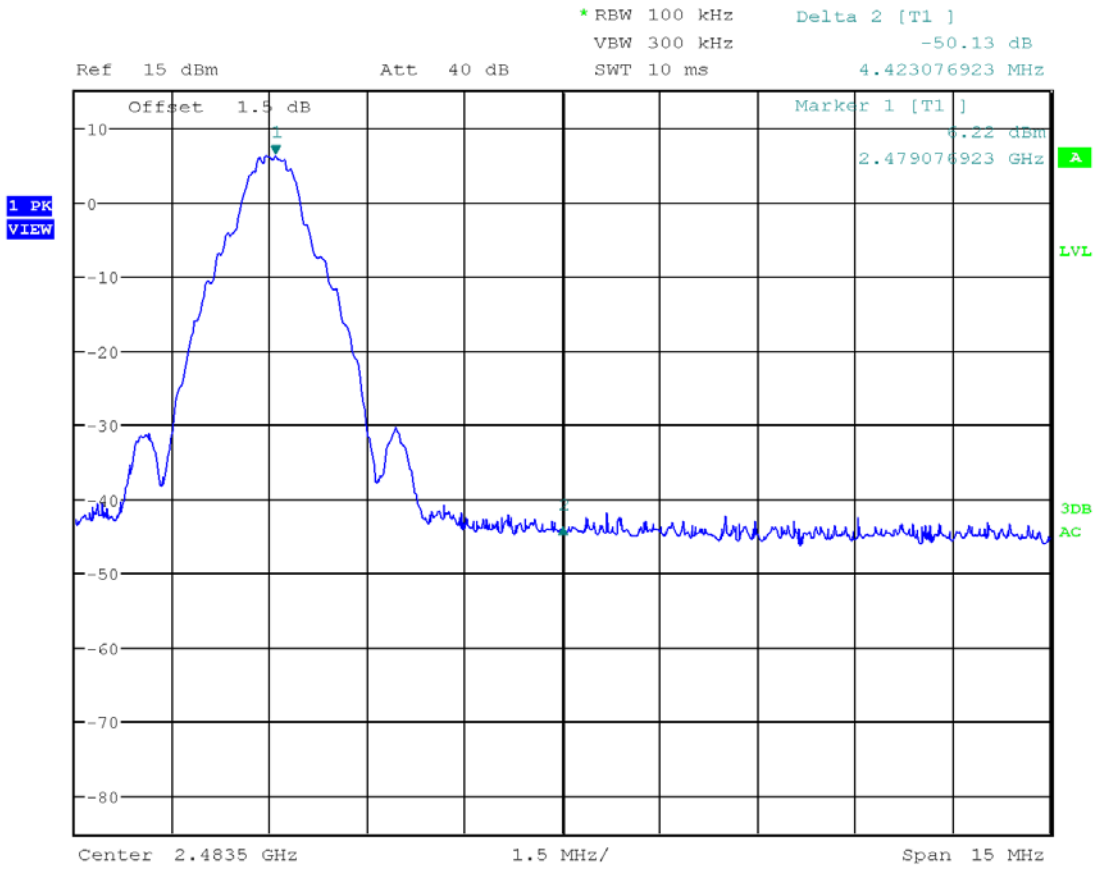
Plot 4.1



Date: 25.SEP.2020 00:22:26

Tx @ High Channel Radio 1, 2483.5 MHz Band Edge

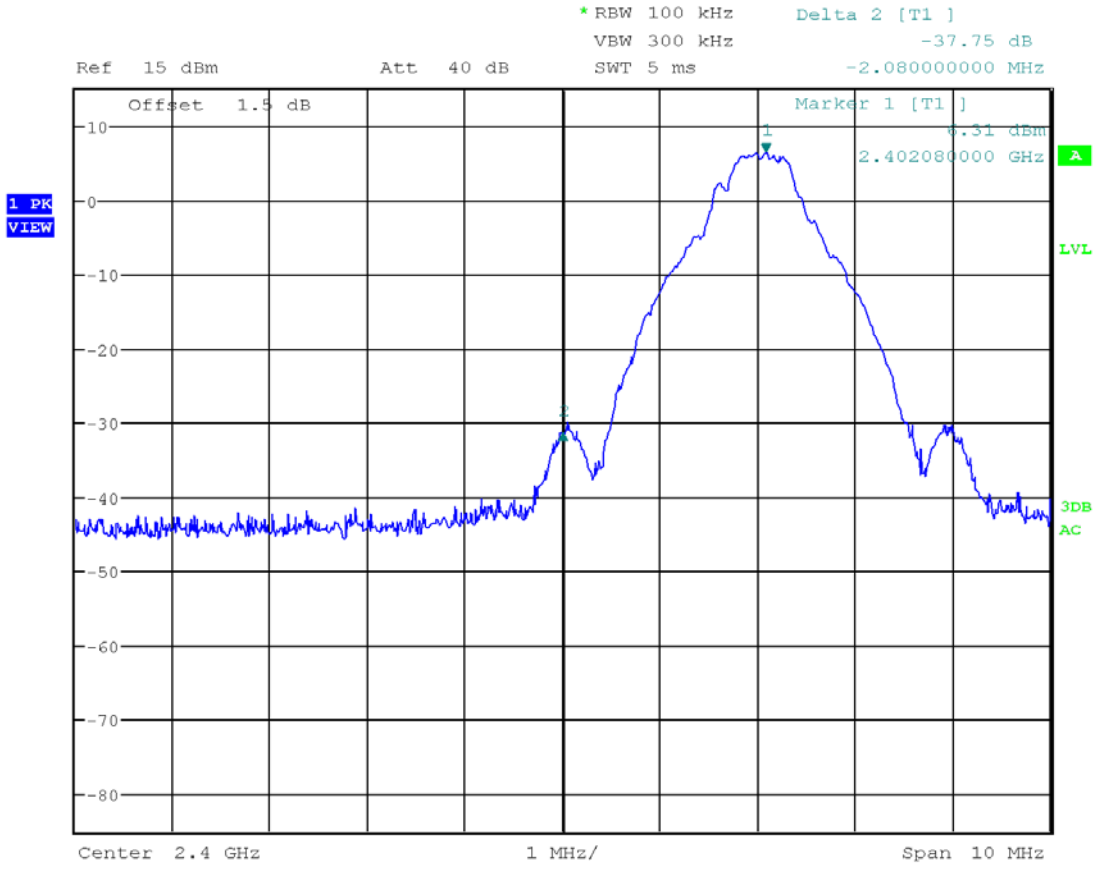
Plot 4.2



Date: 22.SEP.2020 23:39:52

Tx @ Low Channel Radio 2, 2400 MHz Band Edge

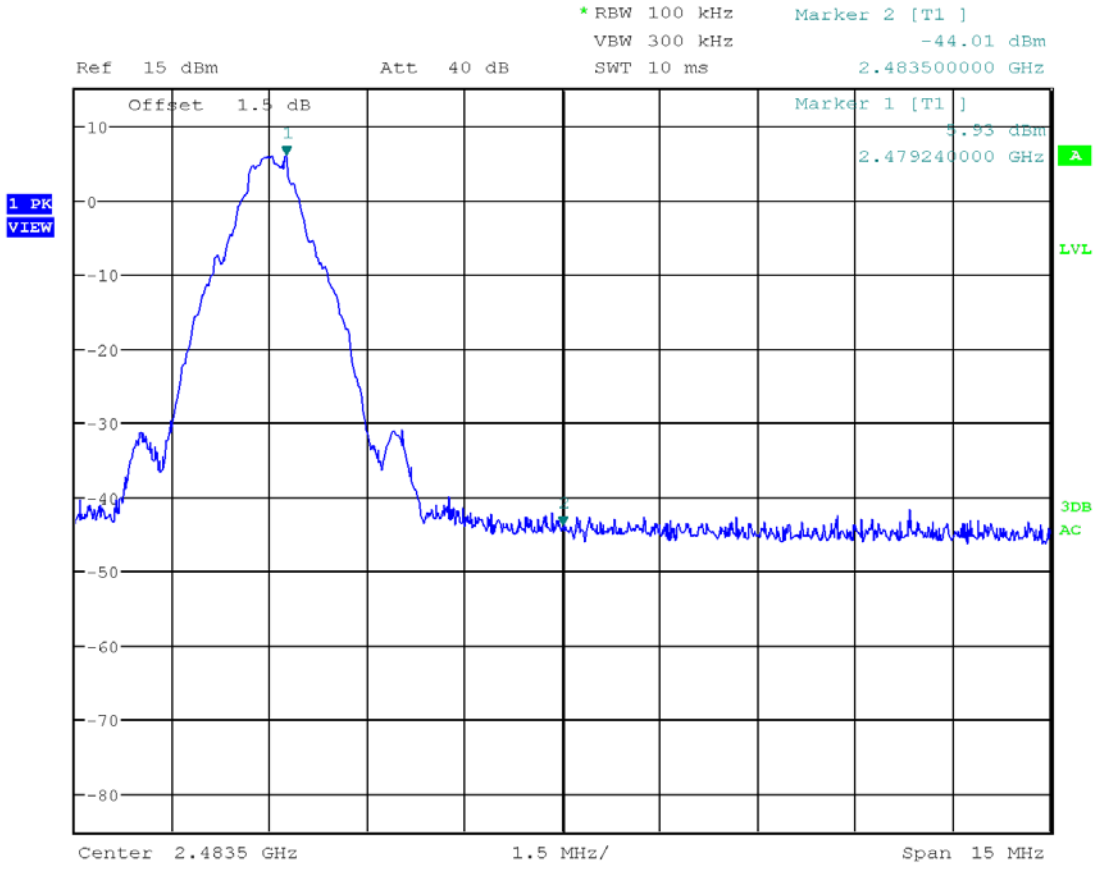
Plot 4.3



Date: 22.SEP.2020 23:10:45

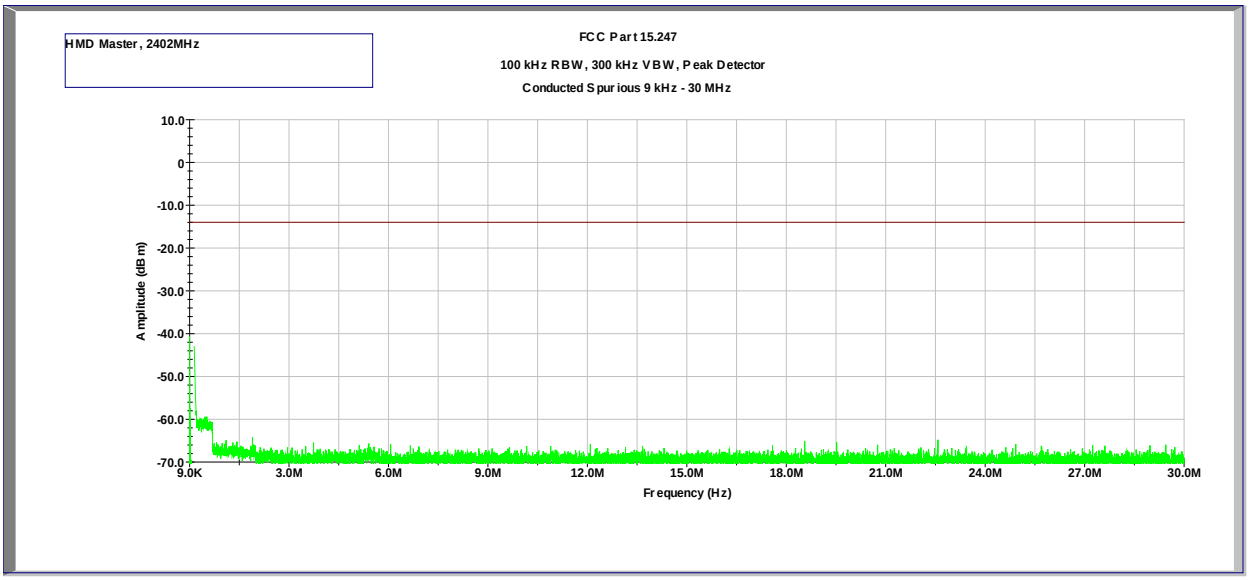
Tx @ High Channel Radio 2, 2483.5 MHz Band Edge

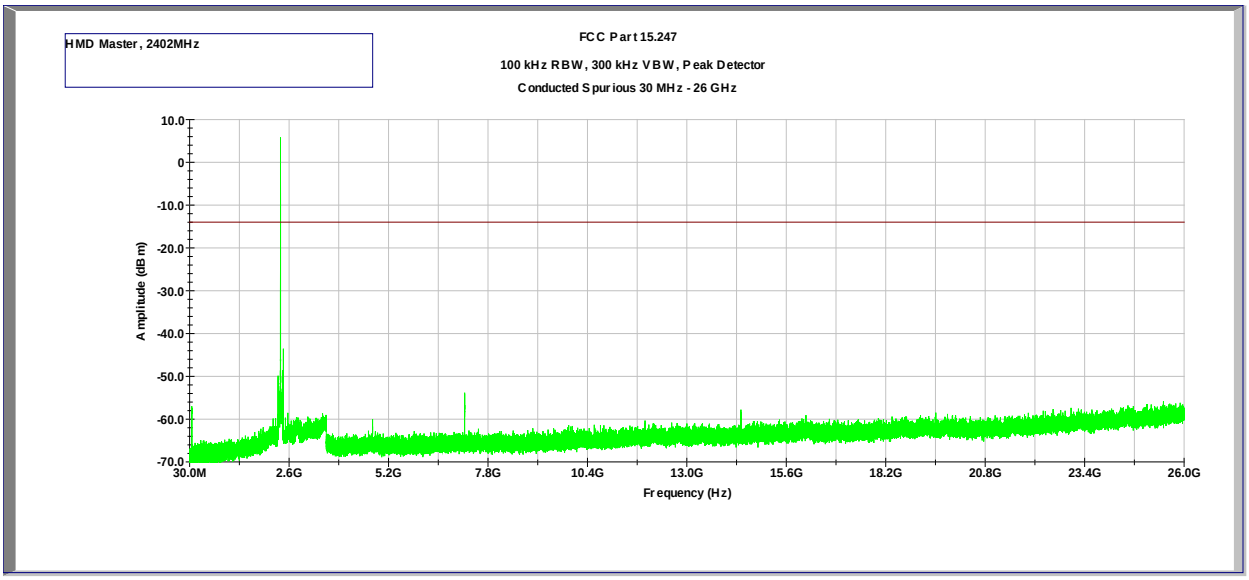
Plot 4.4



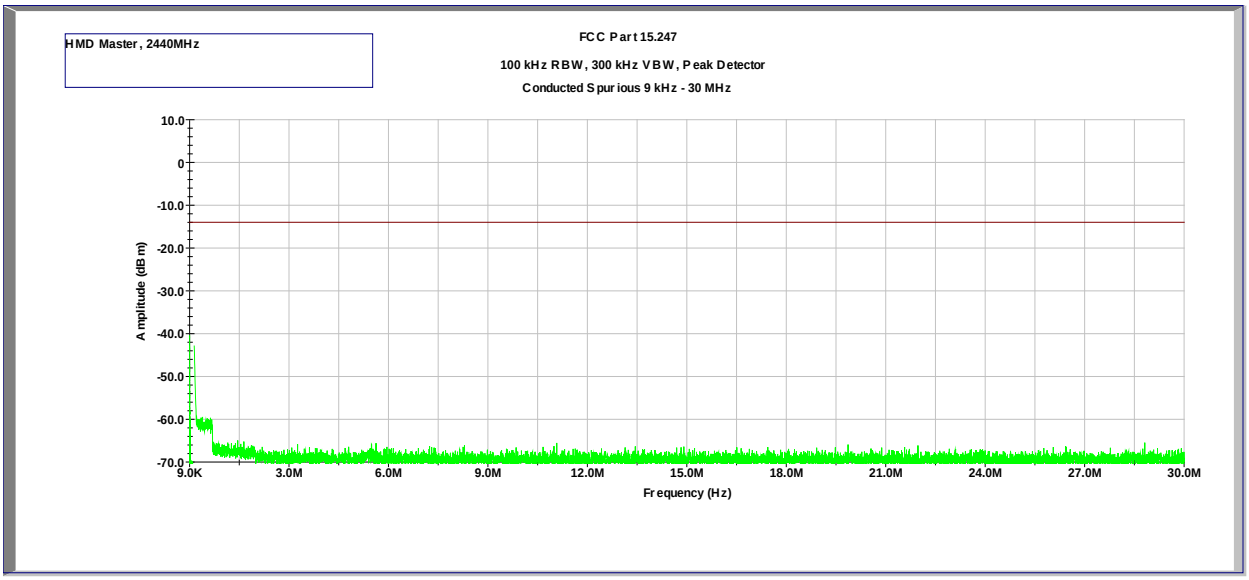
Date: 22.SEP.2020 23:09:55

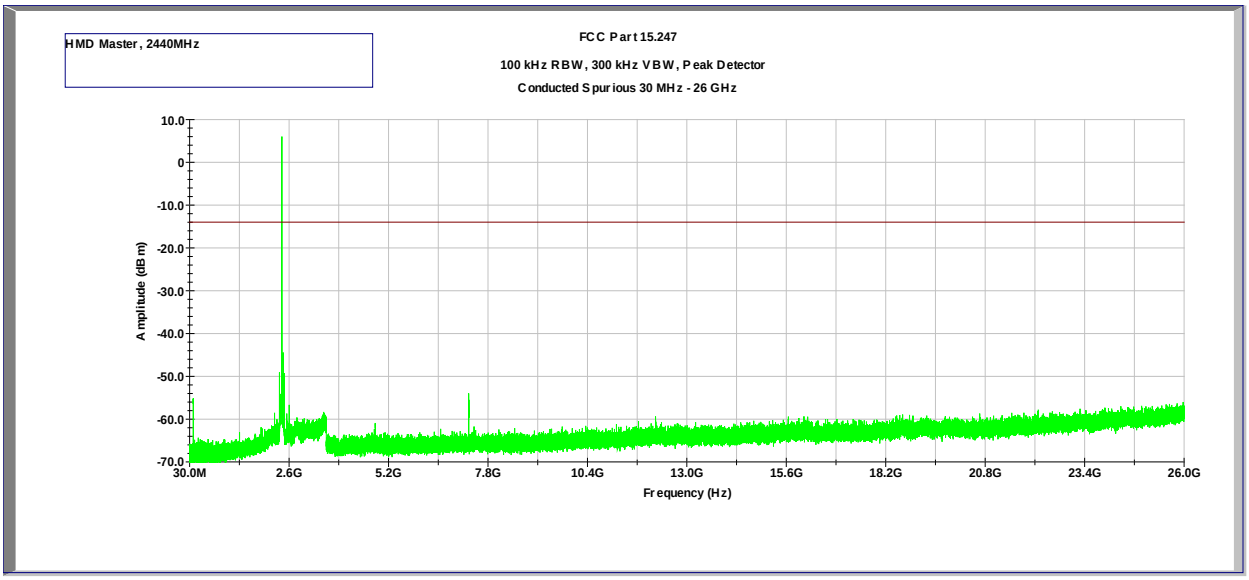
Tx @ Low Channel Radio 1, 2402 MHz
9kHz -26GHz Conducted Spurious
Plot 4.5



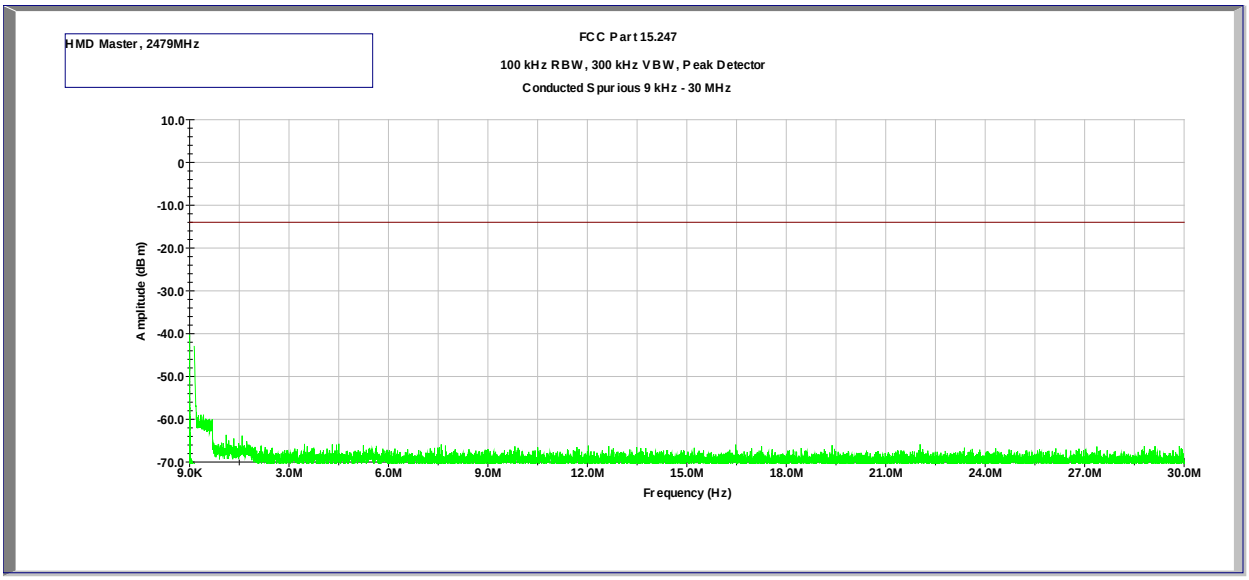


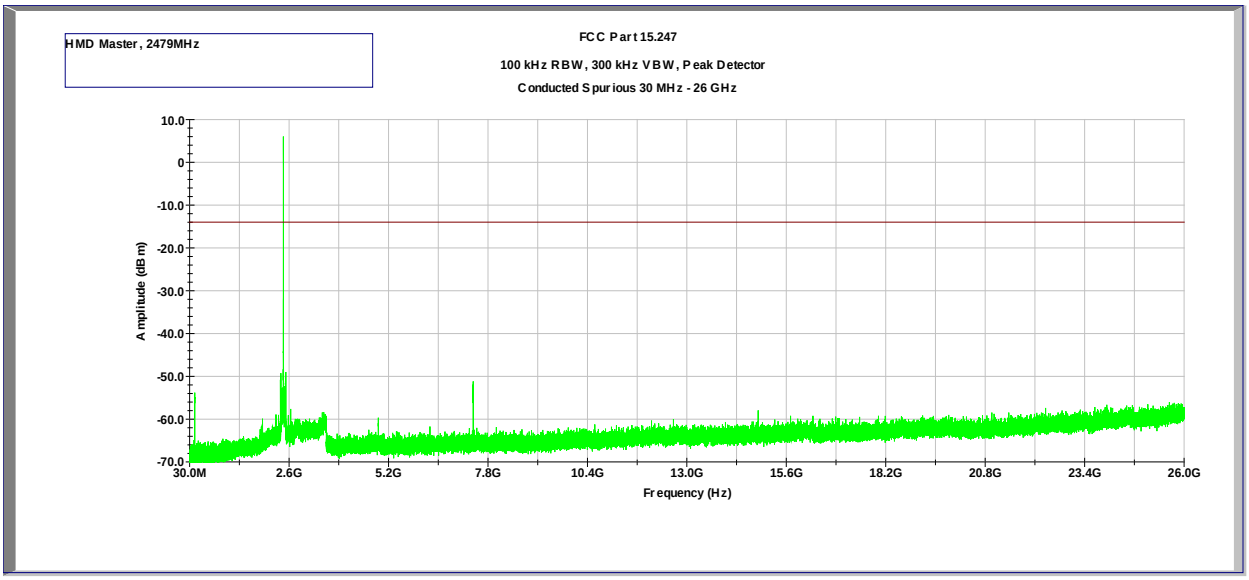
Tx @ Mid Channel Radio 1, 2440 MHz
9kHz -26GHz Conducted Spurious
Plot 4.6



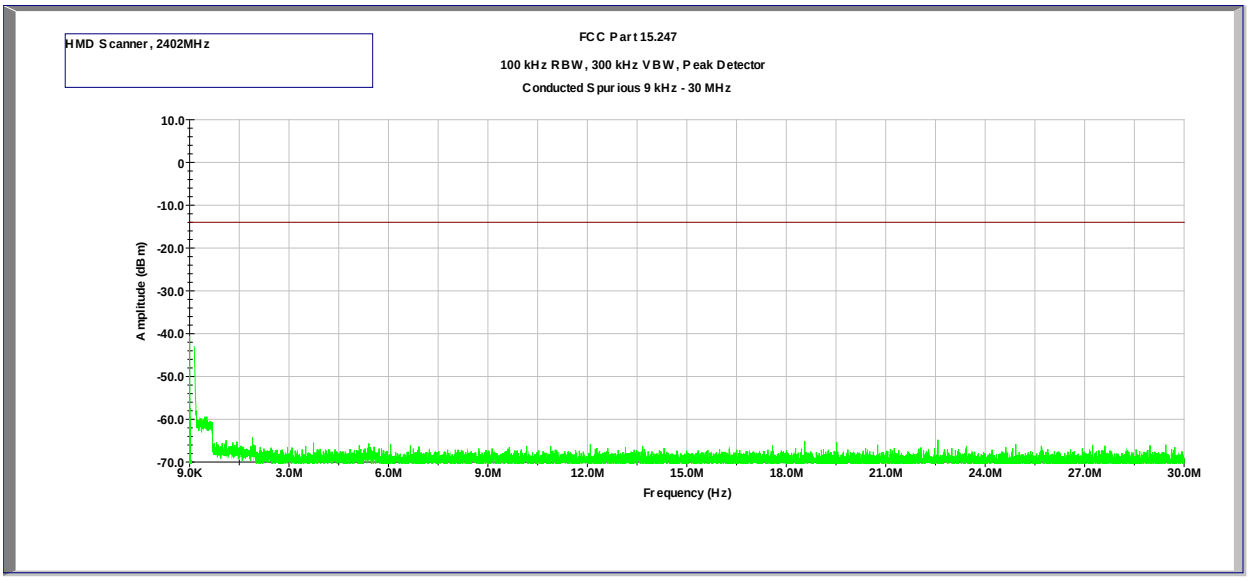


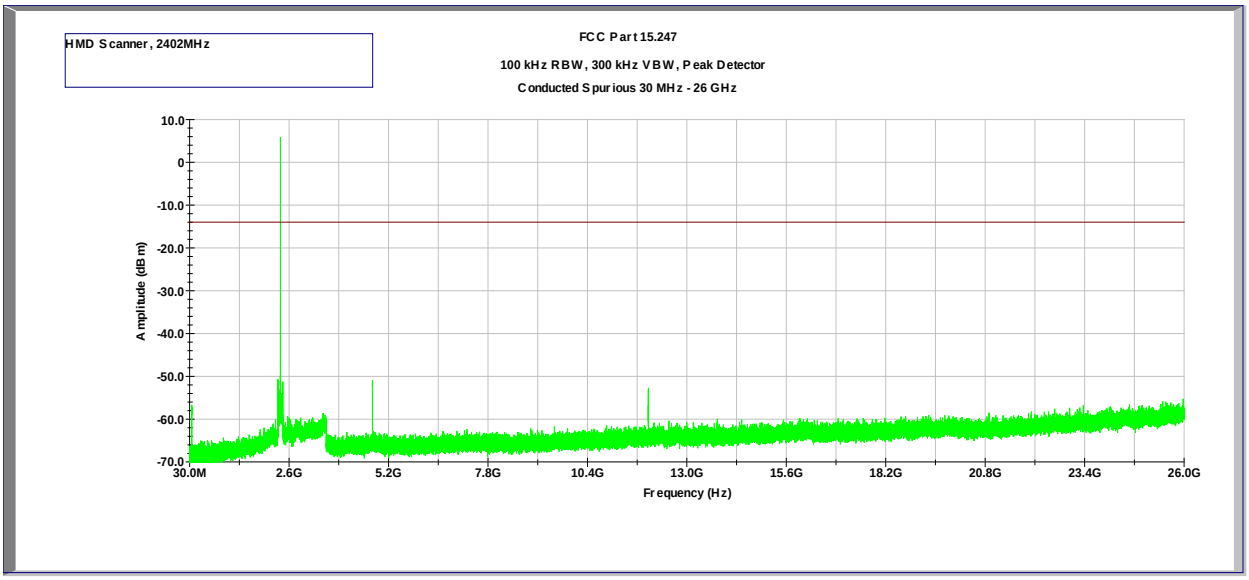
Tx @ High Channel Radio 1, 2479 MHz
9kHz -26GHz Conducted Spurious
Plot 4.7



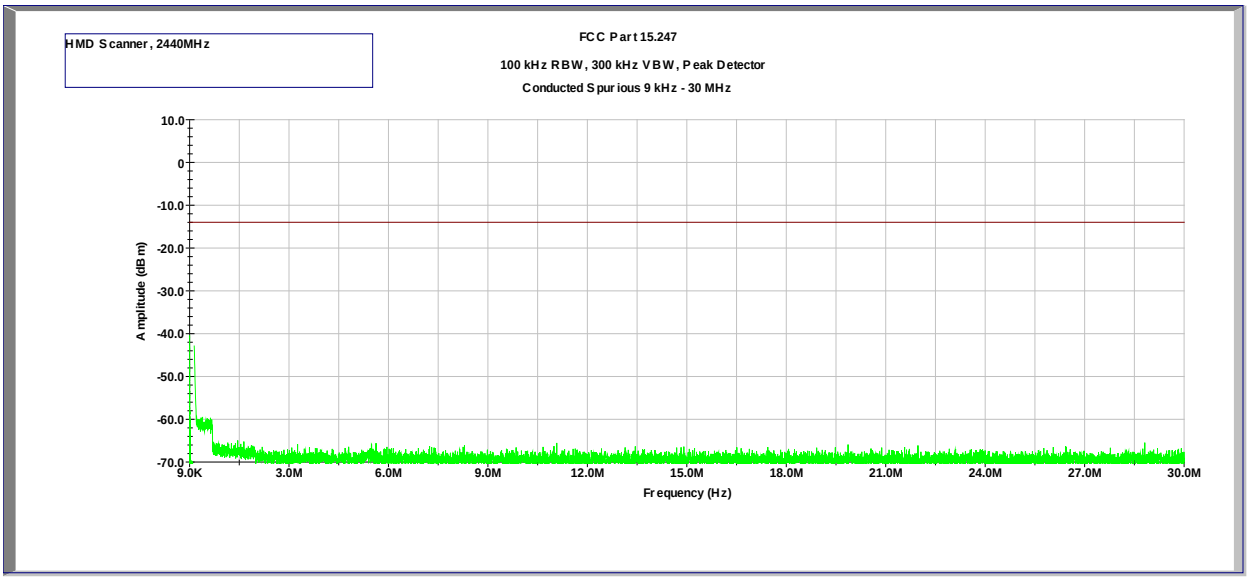


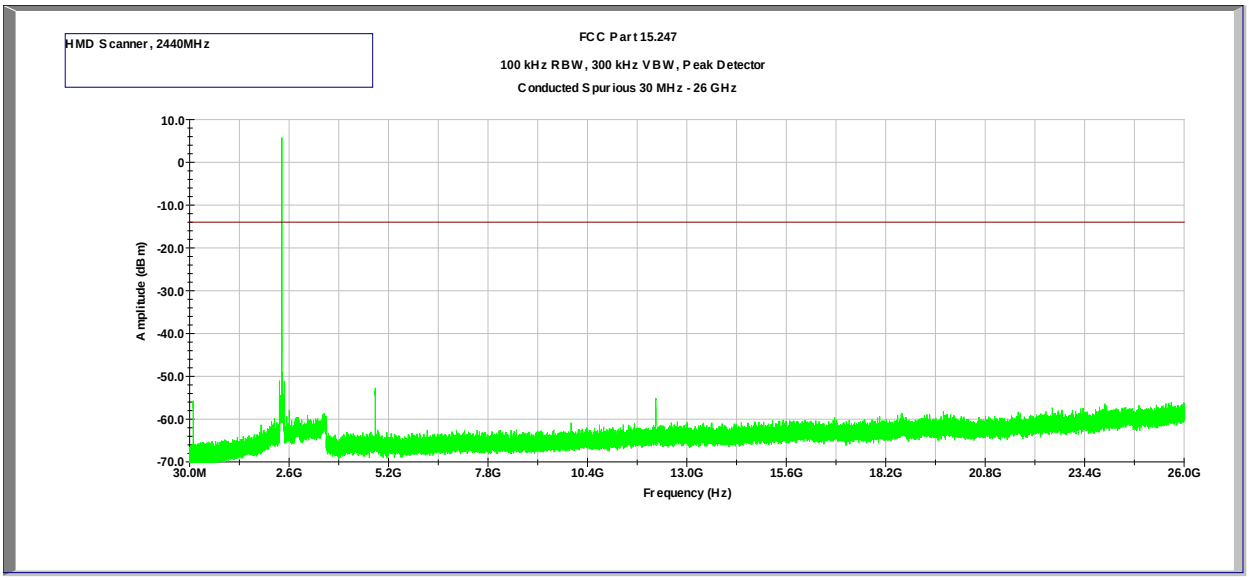
Tx @ Low Channel Radio 2, 2402 MHz
9kHz -26GHz Conducted Spurious
Plot 4.8



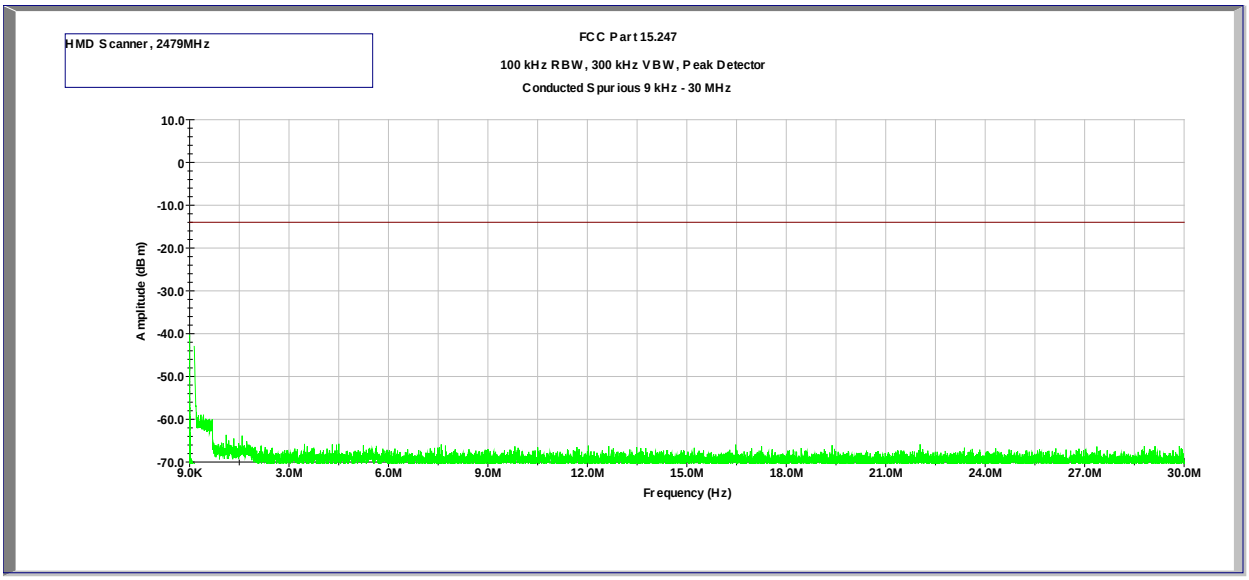


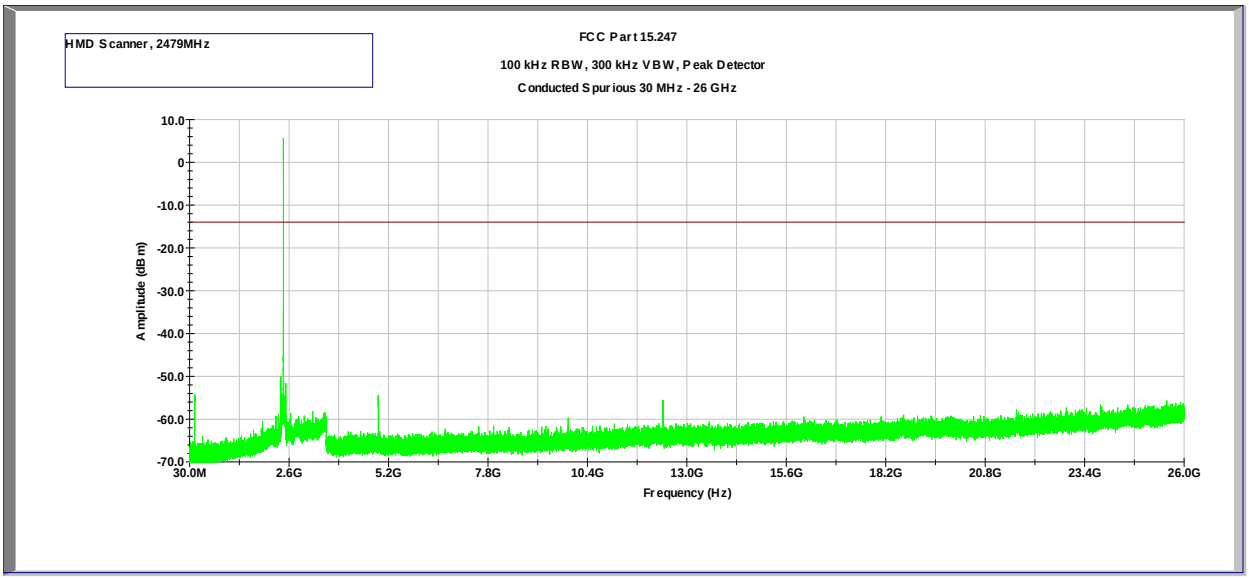
Tx @ Mid Channel Radio 2, 2440 MHz
9kHz -26GHz Conducted Spurious
Plot 4.9





Tx @ High Channel Radio 2, 2479 MHz
9kHz -26GHz Conducted Spurious
Plot 4.10





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

4.5.1 Requirement

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

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

4.5.2 Procedure

Radiated emission measurements were performed from 9 kHz to 26 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 200Hz or greater for frequencies 9kHz to 30MHz, 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

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

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

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

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

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

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

4.5.3 Field Strength Calculation

Field Strength Calculation

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

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

Where FS = Field Strength in dB(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 Antenna-port conducted measurements

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

4.5.5 General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP – 20log D + 104.8+DCF (DCF for Average measurements)
where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
DCF = Duty Cycle Correction Factor
f) Compare the resultant electric field strength level to the applicable limit.
g) Perform radiated spurious emission test

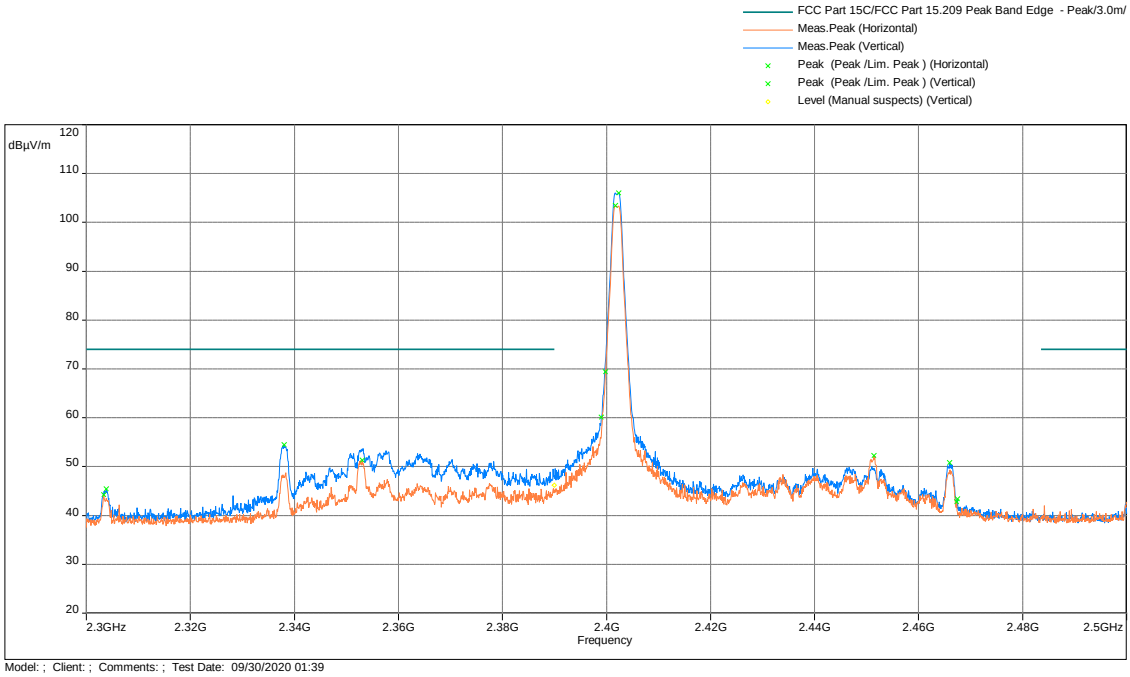
4.5.6 Test Results

All testing in this section were performed by radiated measurements.

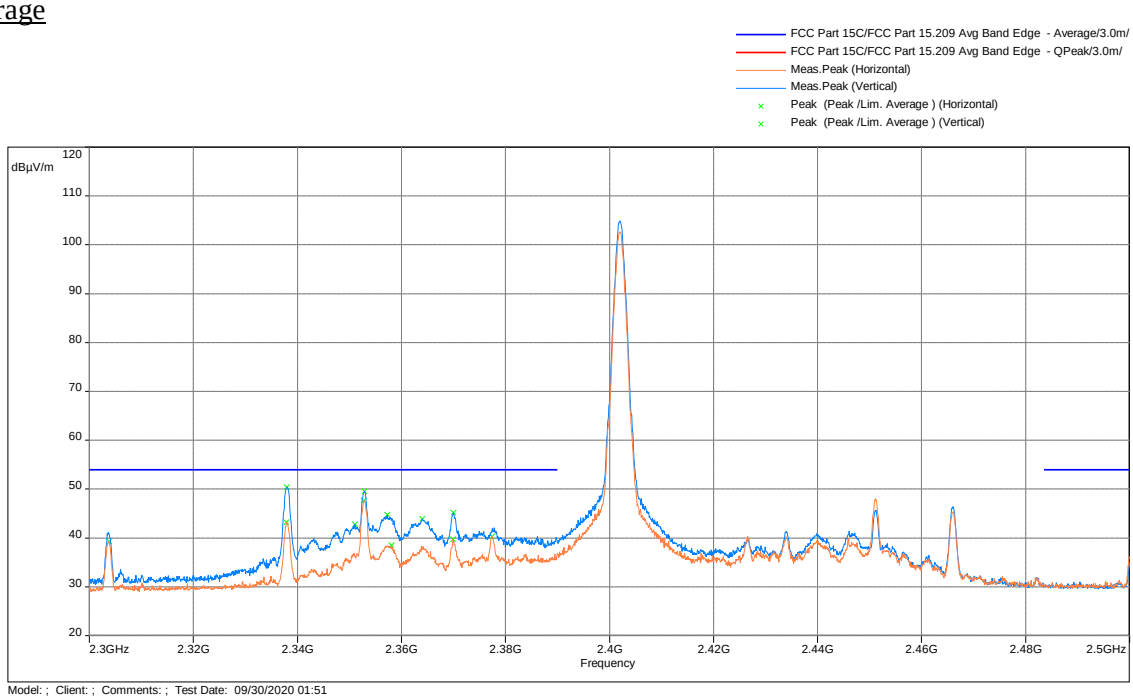
Tested By	Test Date
Aaron Chang	September 24 - 30, 2020

Test Results: 15.209/15.205 Radiated Restricted Band Emissions

Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2402 MHz, Radio 1, Peak

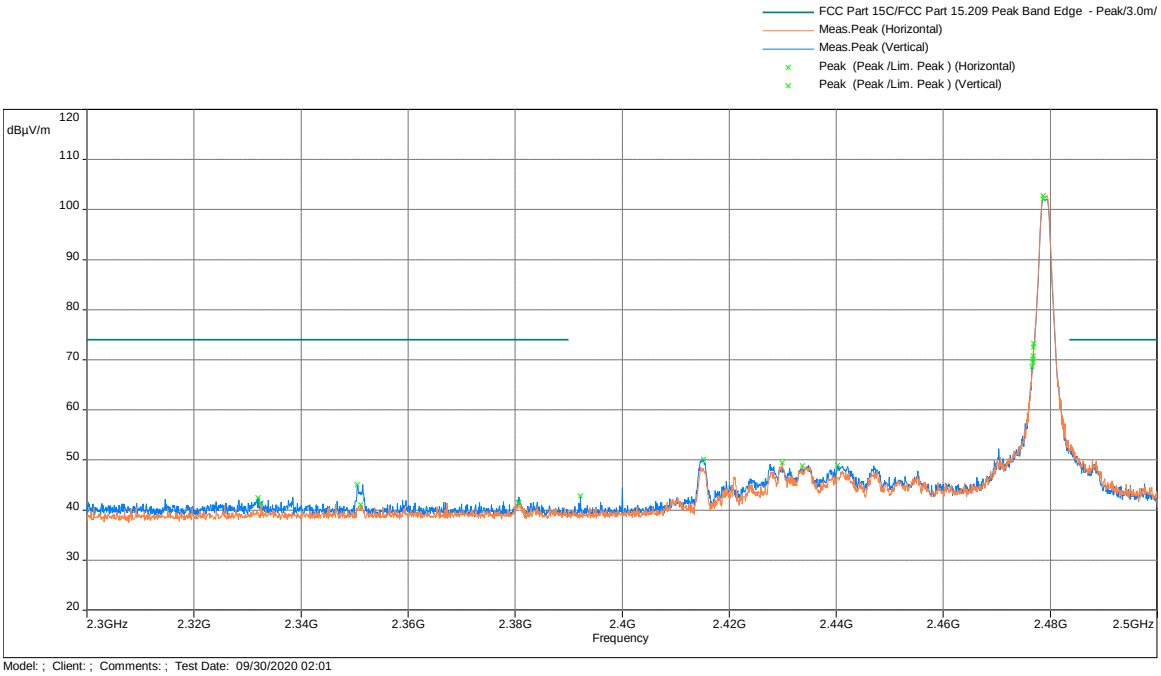


Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2402 MHz, Radio 1, Average



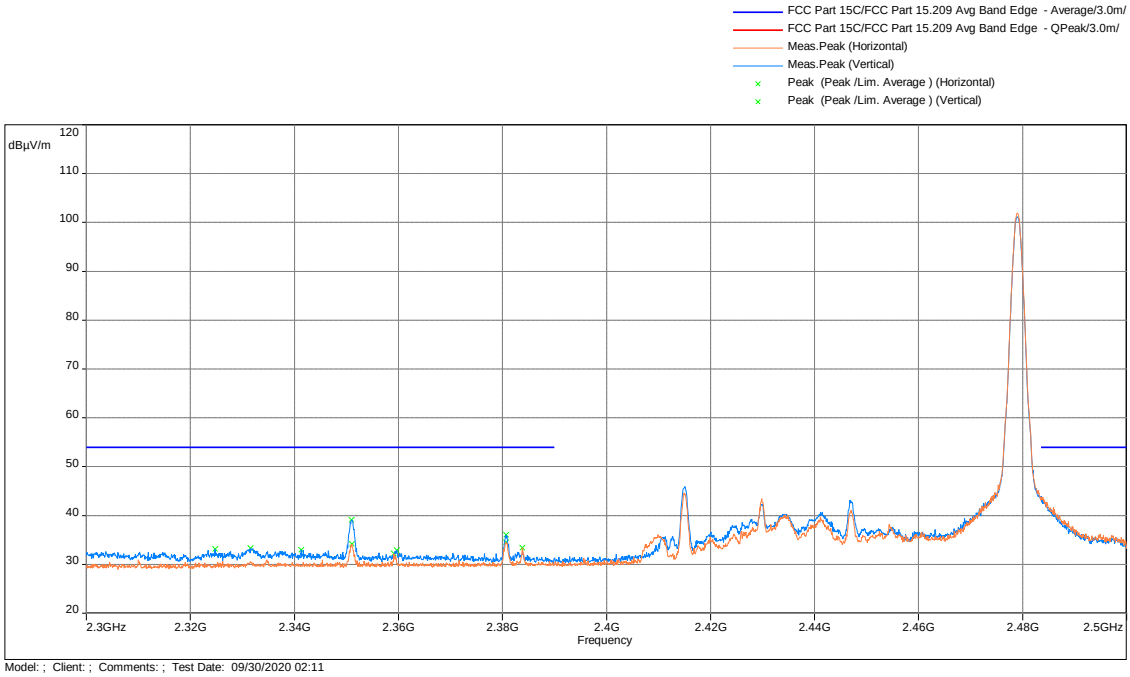
Frequency MHz	Avg@3m dBµV/m	Lim.@3m Avg dBµV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2337.953	50.42	54	-3.58	1.01	37	Vertical	-13.44
2352.9	49.53	54	-4.47	1.01	173	Vertical	-13.31

Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2479 MHz, Radio 1, Peak



Model: ; Client: ; Comments: ; Test Date: 09/30/2020 02:01

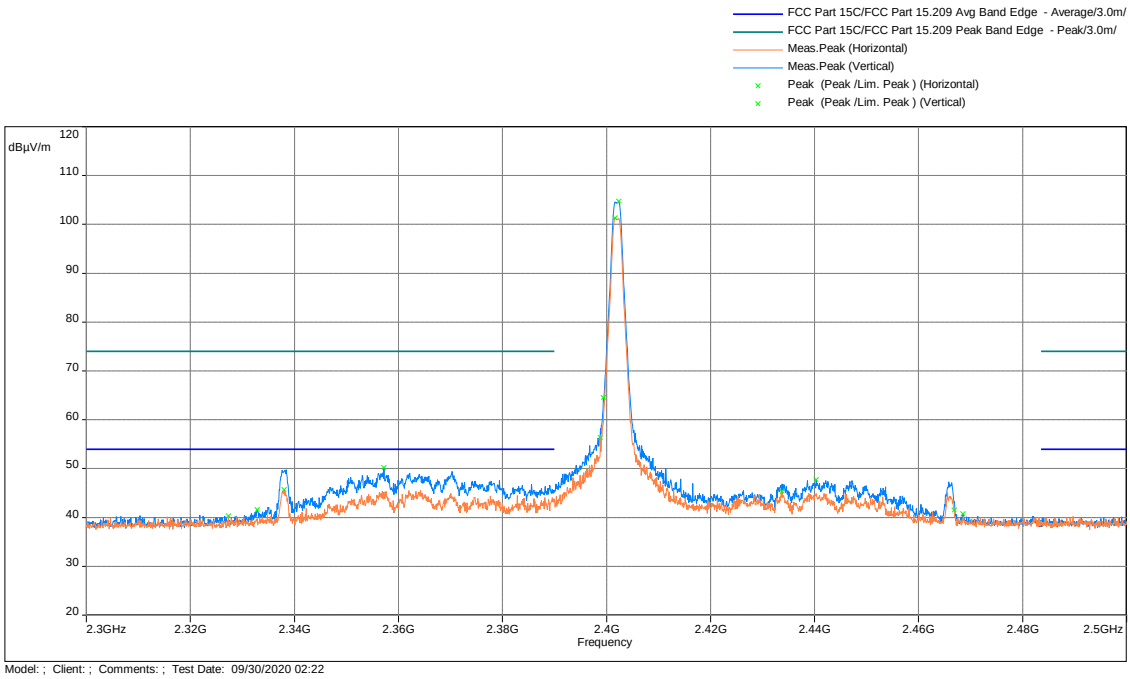
Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2479 MHz, Radio 1, Average



Model: ; Client: ; Comments: ; Test Date: 09/30/2020 02:11

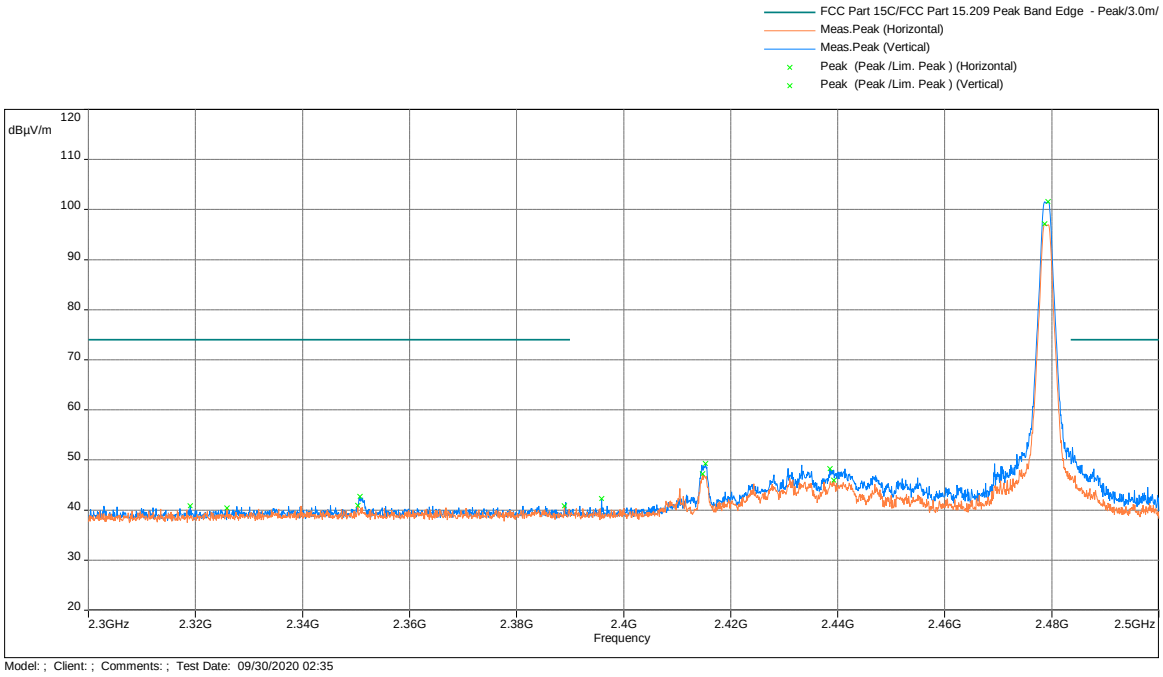
Frequency MHz	Avg@3m dBµV/m	Lim.@3m Avg dBµV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	43.99	54	-10.01	1.01	340.5	Vertical	-13.13

Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2402 MHz, Radio 2, Peak vs Average Limits



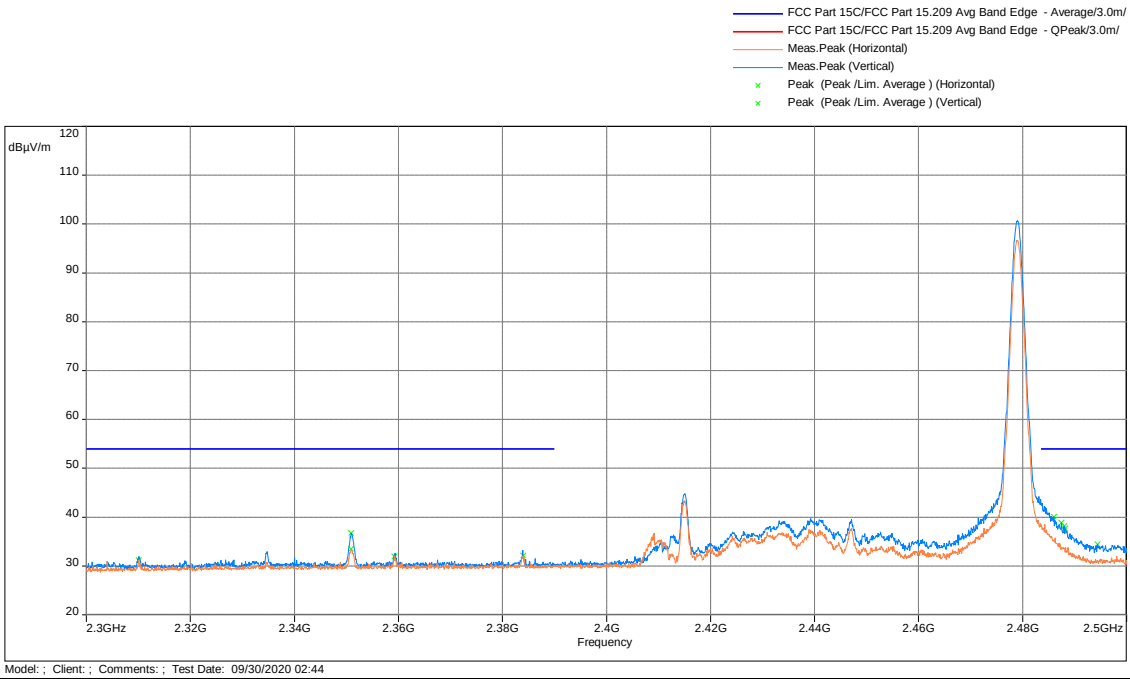
Frequency MHz	Avg@3m dBµV/m	Lim.@3m Avg dBµV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2357.213	50.19	54	-3.81	1.01	45	Vertical	-13.29
2338.427	49.75	54	-4.25	1.01	37.25	Vertical	-13.44

Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2479 MHz, Radio 2, Peak



Model: ; Client: ; Comments: ; Test Date: 09/30/2020 02:35

Radiated Out-of-Band Spurious Emissions with antenna at the Band Edge – Tx @ 2479 MHz, Radio 2, Average



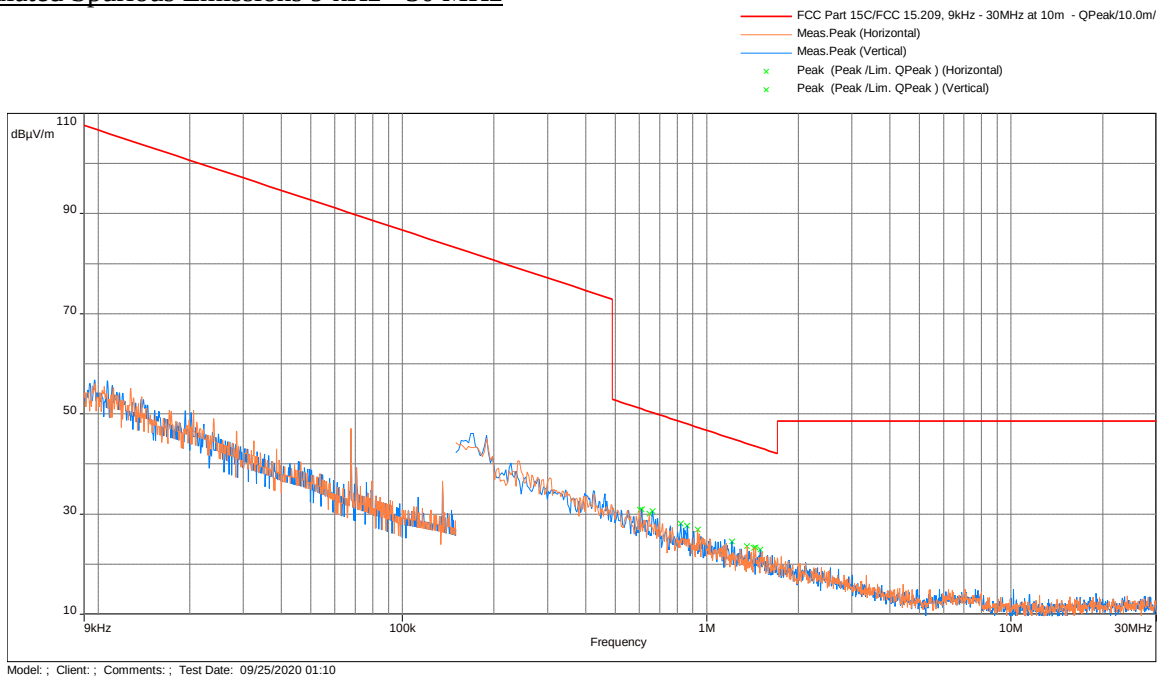
Model: ; Client: ; Comments: ; Test Date: 09/30/2020 02:44

Frequency MHz	Avg@3m dBµV/m	Lim.@3m Avg dBµV/m	Margin (dB)	Height (m)	Angle (°)	Comment	Correction (dB)
2483.5	43.69	54	-10.31	1.01	337	Vertical	-13.13

Out-of-Band Radiated Spurious Emissions

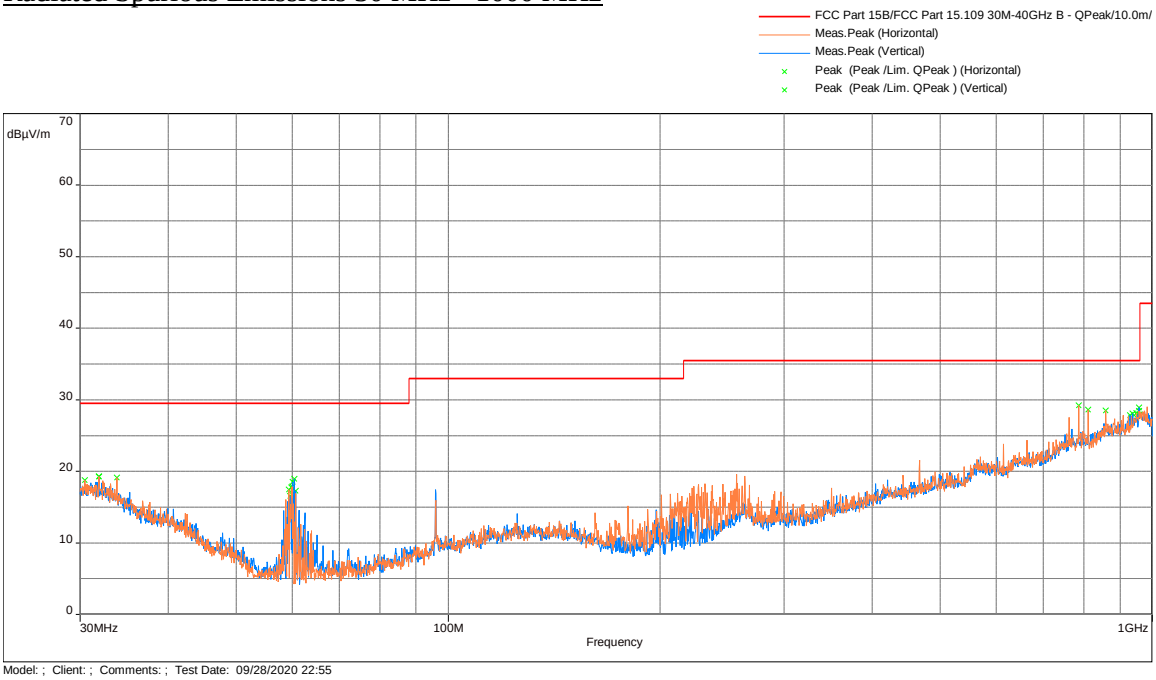
Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz, Radio 1

Radiated Spurious Emissions 9 kHz - 30 MHz



Model: ; Client: ; Comments: ; Test Date: 09/25/2020 01:10

Radiated Spurious Emissions 30 MHz - 1000 MHz

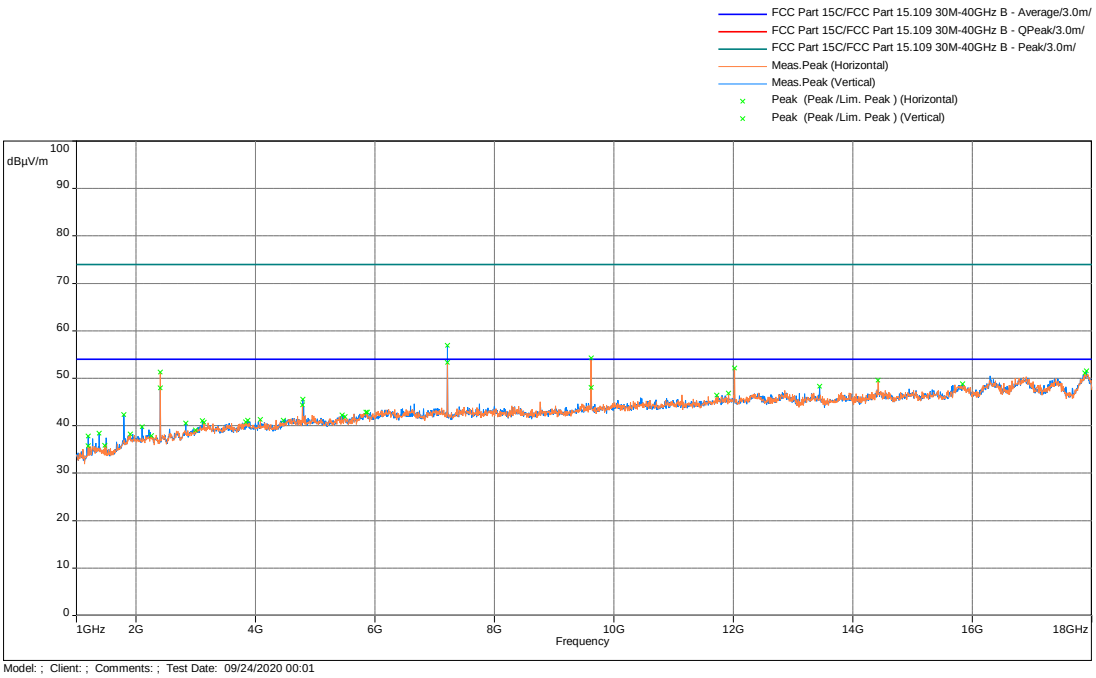


Model: ; Client: ; Comments: ; Test Date: 09/28/2020 22:55

Frequency	QP@10m	Limit@10m	Margin	Height	Angle	Polarization	Correction
MHz	dB(µV/m)	dB(µV/m)	(dB)	(m)	(°)		(dB)
786.4707	29.2	35.5	-6.3	1.02	356.5	Horizontal	-1.7

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

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



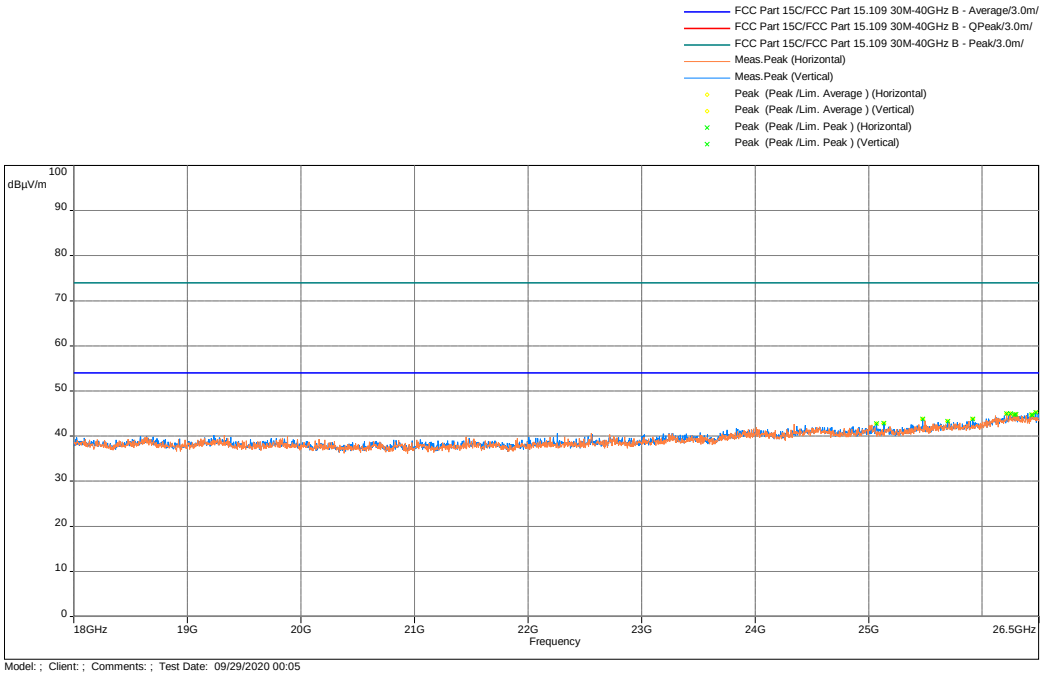
Model: ; Client: ; Comments: ; Test Date: 09/24/2020 00:01

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7211.233	56.88	74	-17.12	1.98	339.75	Vertical	-5.26
9617.3	54.24	74	-19.76	2.02	335	Horizontal	-3.13
7212.933	53.34	74	-20.66	2.49	0	Horizontal	-5.27
12021.67	52.14	74	-21.86	2.02	54.75	Horizontal	-2.03
14422.63	49.61	74	-24.39	2.02	352.25	Horizontal	1.16
9617.867	48.08	74	-25.92	1.51	177.75	Vertical	-3.13

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7212.933	51.34	54	-2.66	1.98	0	Vertical	-5.27
9617.3	47.91	54	-6.09	2.02	343.75	Horizontal	-3.13
7212.933	46.34	54	-7.66	2.02	255.5	Horizontal	-5.27
12018.27	45.4	54	-8.6	2.02	57.5	Horizontal	-2.04
12021.67	44.35	54	-9.65	2.02	57.5	Horizontal	-2.03
14422.63	42.32	54	-11.68	2.02	0	Horizontal	1.16

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

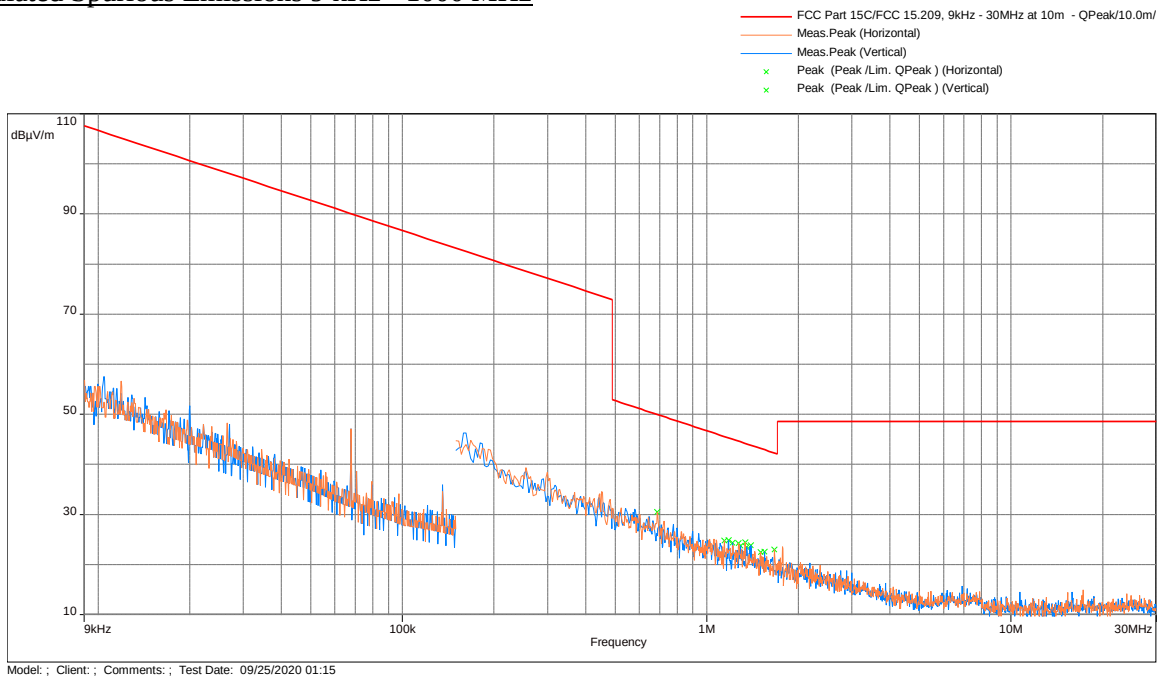
Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



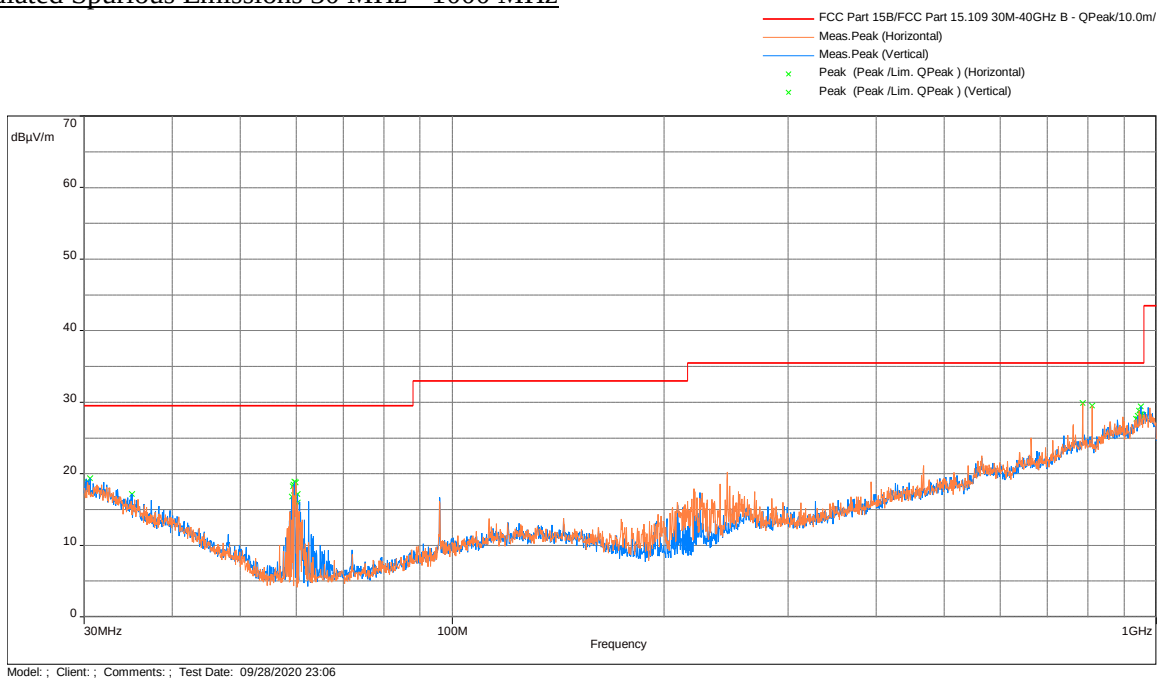
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz, Radio 1

Radiated Spurious Emissions 9 kHz - 1000 MHz



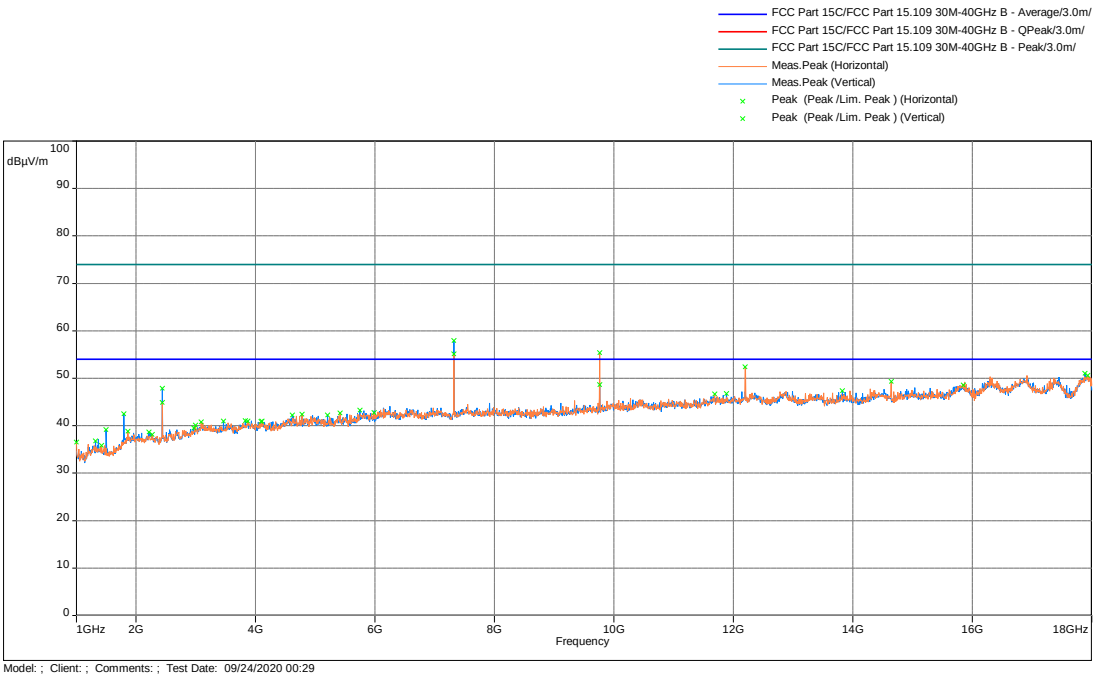
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
786.438	29.85	35.5	-5.65	1.02	347.25	Horizontal	-1.7

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

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

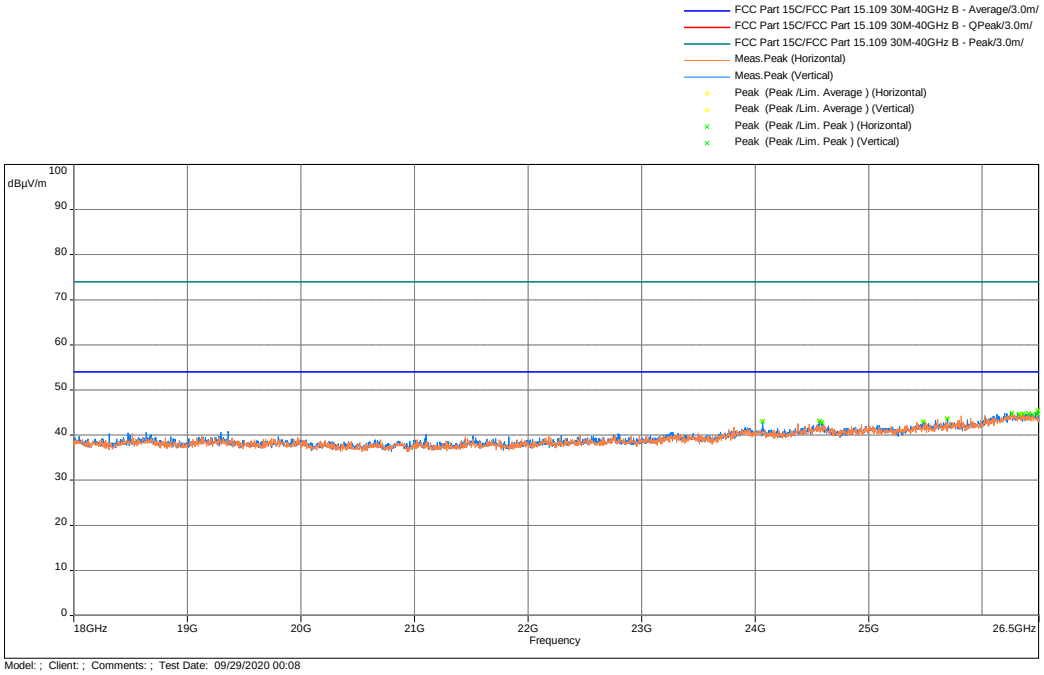


Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7321.167	57.98	74	-16.02	1.98	322.5	Vertical	-5.37
9761.233	55.34	74	-18.66	2.02	54.75	Horizontal	-2.88
7321.167	55.09	74	-18.91	2.02	265	Horizontal	-5.37
12198.470	52.39	74	-21.61	2.02	54.75	Horizontal	-1.98
14642.500	49.36	74	-24.64	2.02	15	Horizontal	0.37
9758.967	48.65	74	-25.35	1.98	329.75	Vertical	-2.88

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7320.033	51.36	54	-2.64	2.48	344.75	Vertical	-5.37
9758.967	49.76	54	-4.24	2.02	321.75	Horizontal	-2.88
7321.167	49.43	54	-4.57	2.02	233.5	Horizontal	-5.37
12201.870	46.42	54	-7.58	2.02	57.75	Horizontal	-1.98
12199.030	46.15	54	-7.85	2.02	277.5	Horizontal	-1.98
9758.967	43.11	54	-10.89	1.98	303	Vertical	-2.88

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

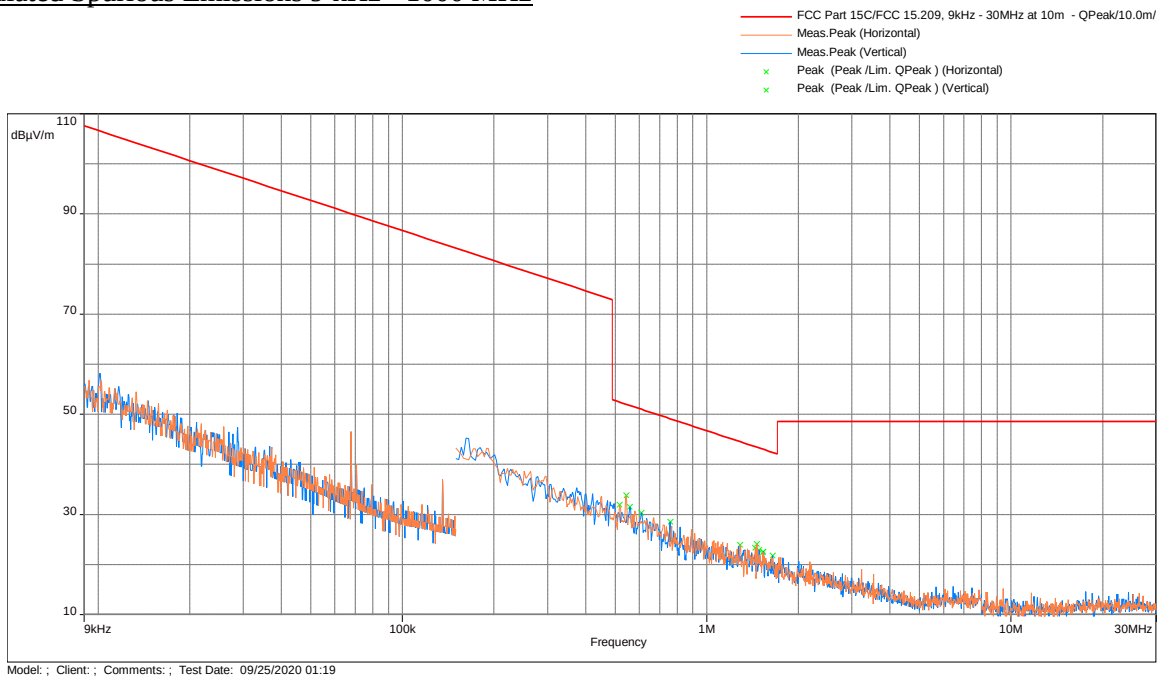
Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



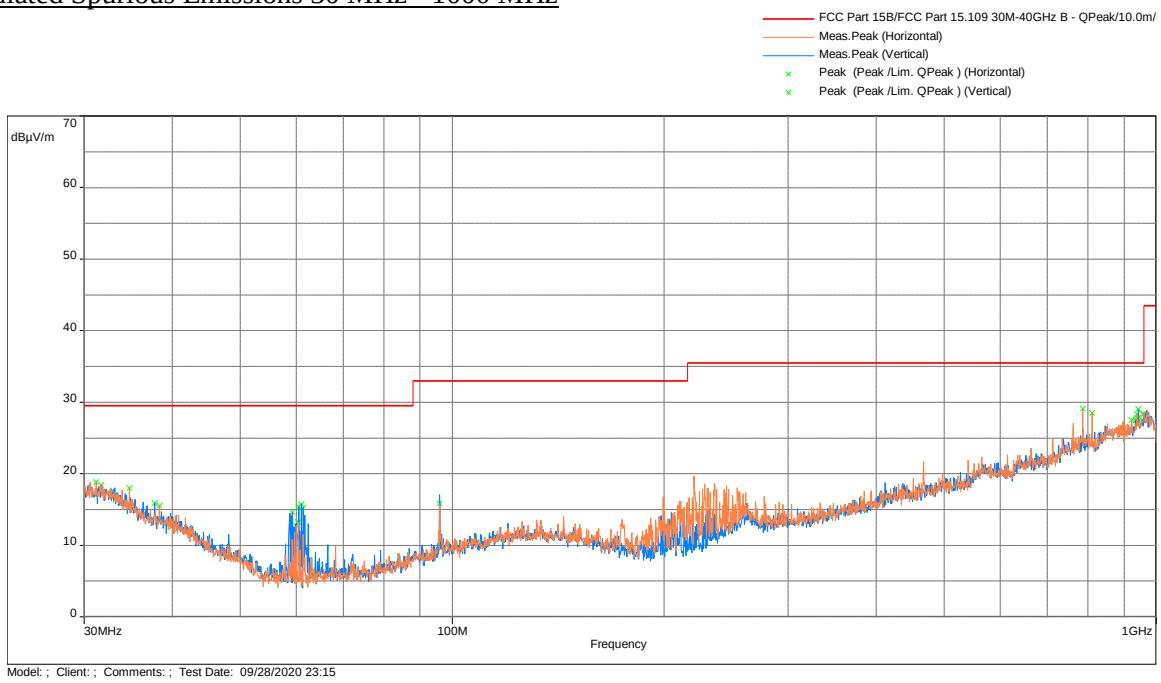
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2479MHz, Radio 1

Radiated Spurious Emissions 9 kHz - 1000 MHz



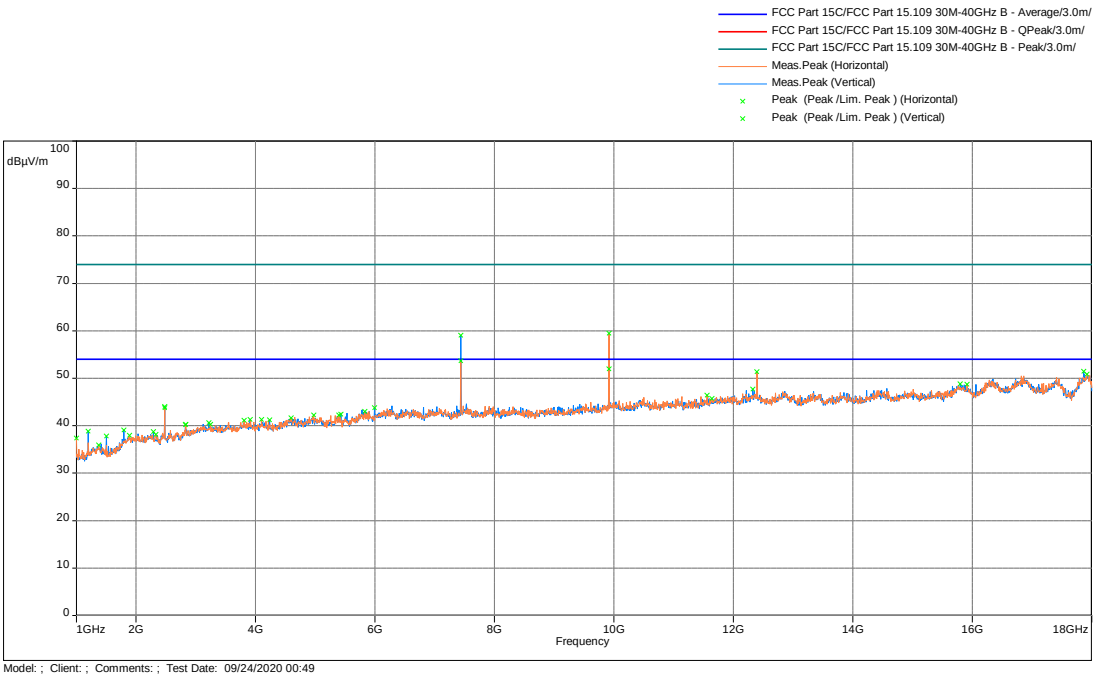
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
786.4383	29.11	35.5	-6.39	1.02	343	Horizontal	-1.7

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

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

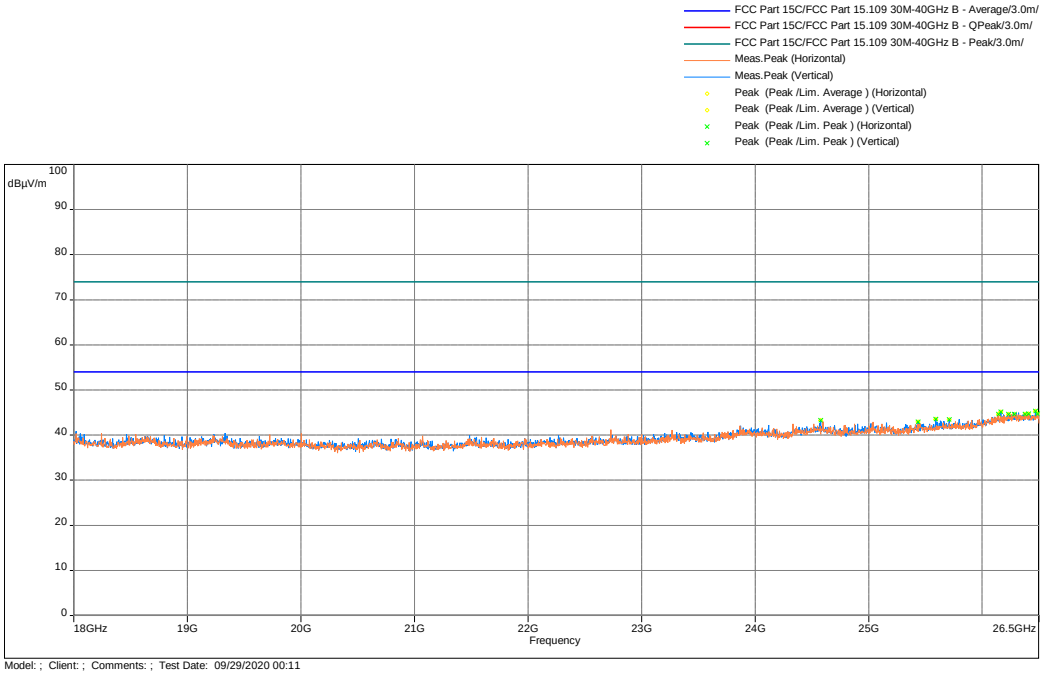


Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
9917.633	59.48	74	-14.52	2.02	55.25	Horizontal	-2.86
7437.900	59.04	74	-14.96	1.98	346.5	Vertical	-5.04
7436.200	53.71	74	-20.29	2.49	0	Horizontal	-5.04
9914.800	51.99	74	-22.01	1.98	289.25	Vertical	-2.86
12393.400	51.34	74	-22.66	2.02	291	Horizontal	-1.28
12327.670	47.73	74	-26.27	1.98	289.25	Vertical	-1.56

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7437.900	53.86	54	-0.14	1.98	347.25	Vertical	-5.04
9917.067	53.28	54	-0.72	2.02	321.75	Horizontal	-2.86
7437.900	47.65	54	-6.35	2.02	255.5	Horizontal	-5.04
9914.800	45.21	54	-8.79	1.98	325	Vertical	-2.86
9917.067	45.1	54	-8.9	1.98	302.5	Vertical	-2.86
12396.800	44.43	54	-9.57	2.02	57.25	Horizontal	-1.26

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

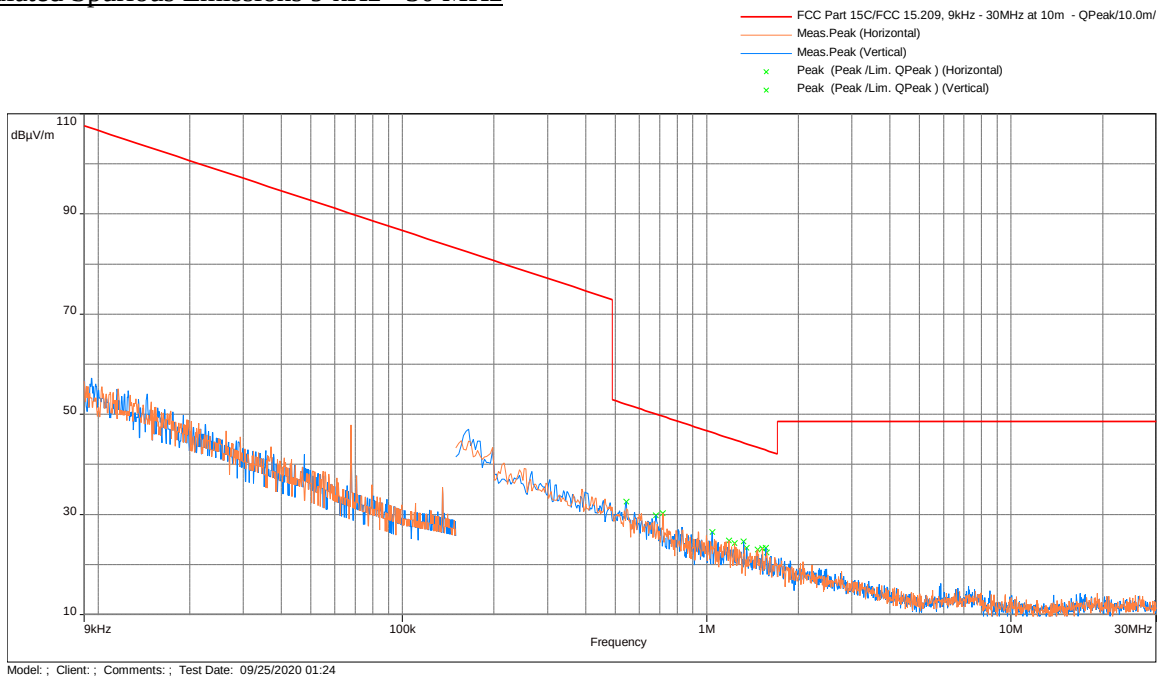
Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



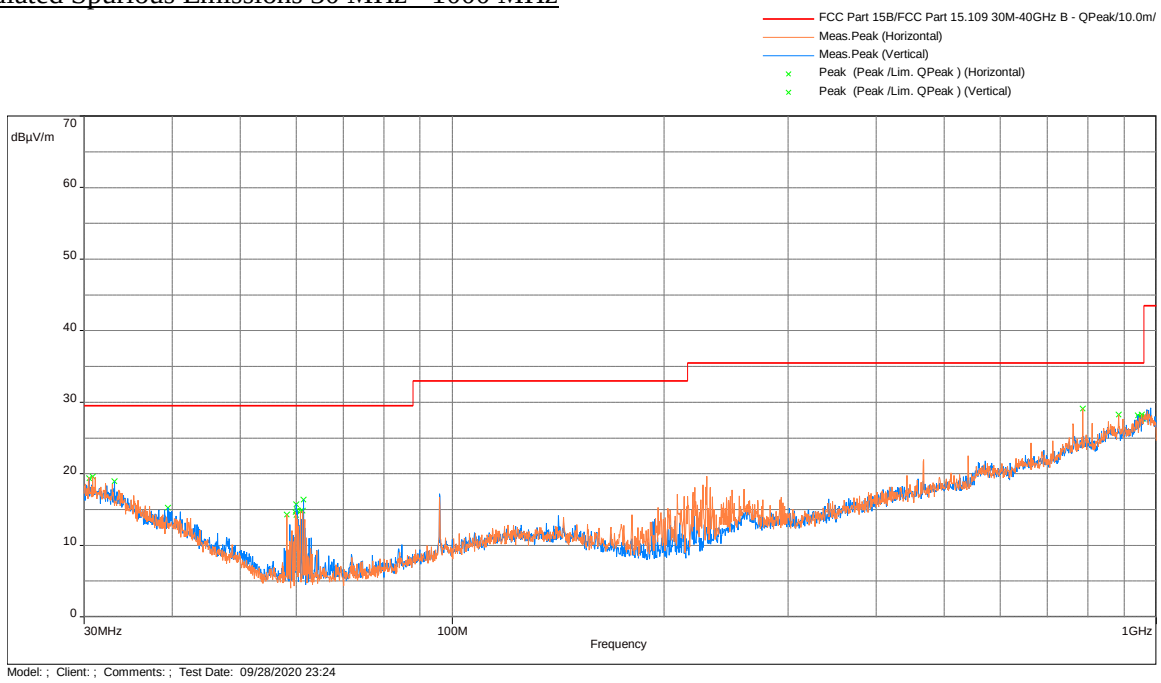
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz, Radio 2

Radiated Spurious Emissions 9 kHz - 30 MHz



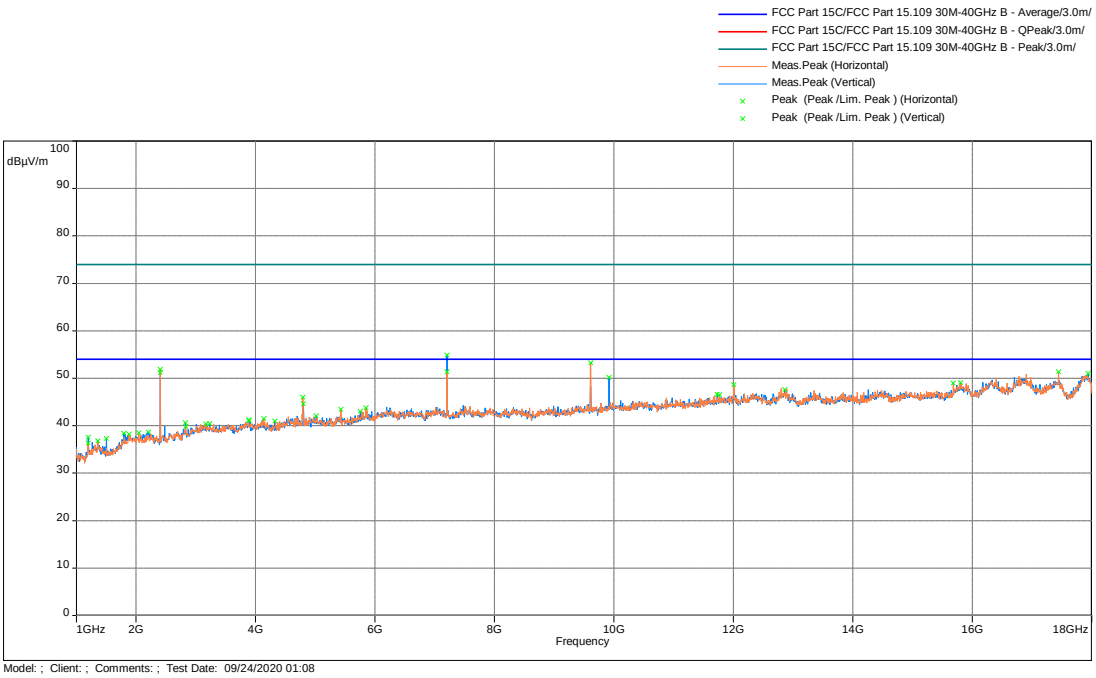
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency	QP@10m	Limit@10m	Margin	Height	Angle	Polarization	Correction
MHz	dB(µV/m)	dB(µV/m)	(dB)	(m)	(°)		(dB)
786.470	29.12	35.5	-6.38	1.02	339.25	Horizontal	-1.7

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

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

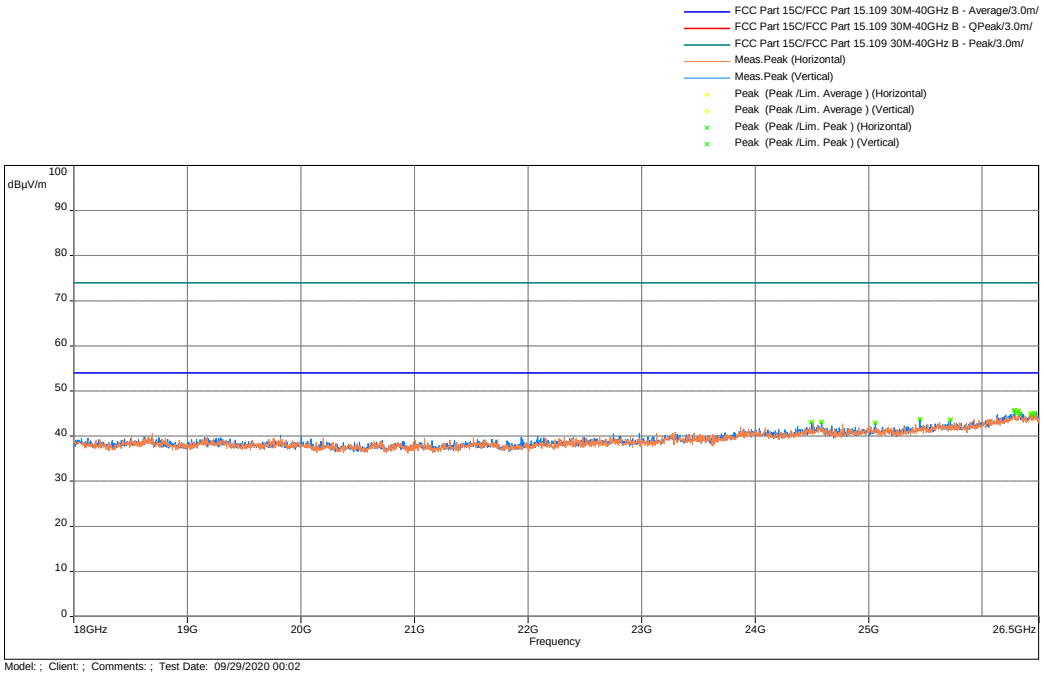


Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7206.700	54.88	74	-19.12	2.48	55	Vertical	-5.25
9609.367	53.24	74	-20.76	2.49	68.5	Horizontal	-3.15
7206.700	51.41	74	-22.59	2.49	68.5	Horizontal	-5.25
17440.700	51.34	74	-22.66	2.49	227.25	Horizontal	4.74
12008.630	48.61	74	-25.39	2.49	33.5	Horizontal	-2.05
9914.800	50.22	74	-23.78	1.51	359.5	Vertical	-2.86

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
7206.700	48.6	54	-5.4	2.48	57.5	Vertical	-5.25
9609.367	47.91	54	-6.09	2.02	0	Horizontal	-3.15
7206.700	44.26	54	-9.74	2.49	59.25	Horizontal	-5.25
9609.367	41.76	54	-12.24	1.98	0	Vertical	-3.15
12011.470	40.34	54	-13.66	2.49	82.25	Horizontal	-2.04
12011.470	39.06	54	-14.94	1.51	79	Vertical	-2.04

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

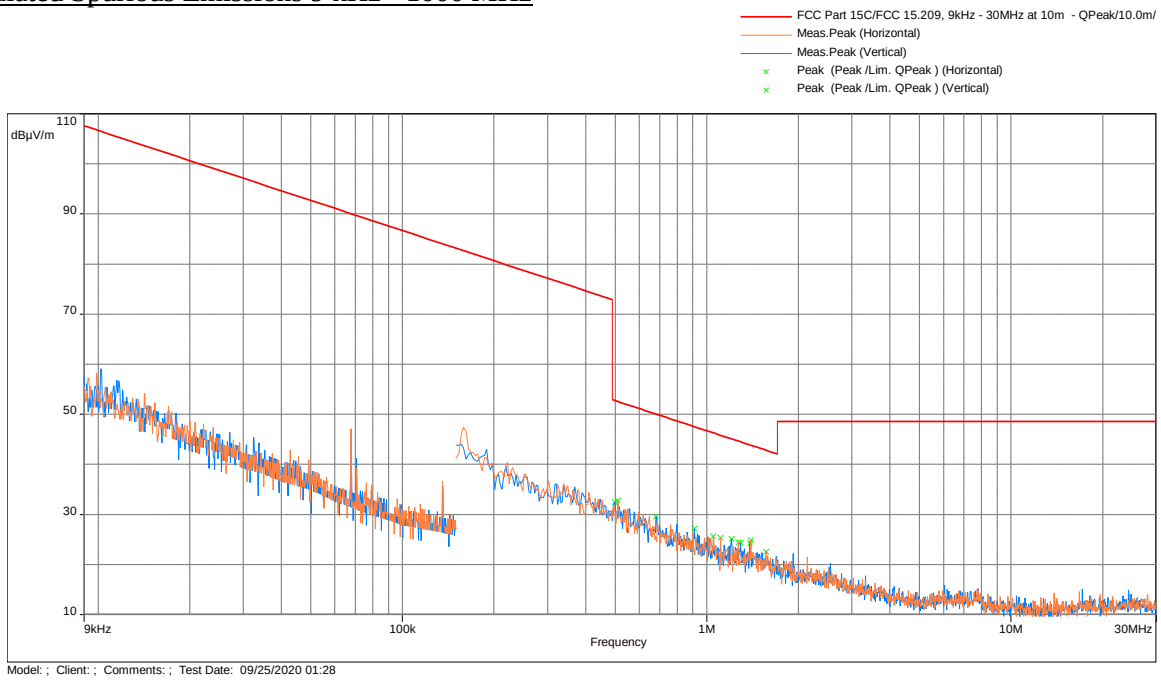
Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit



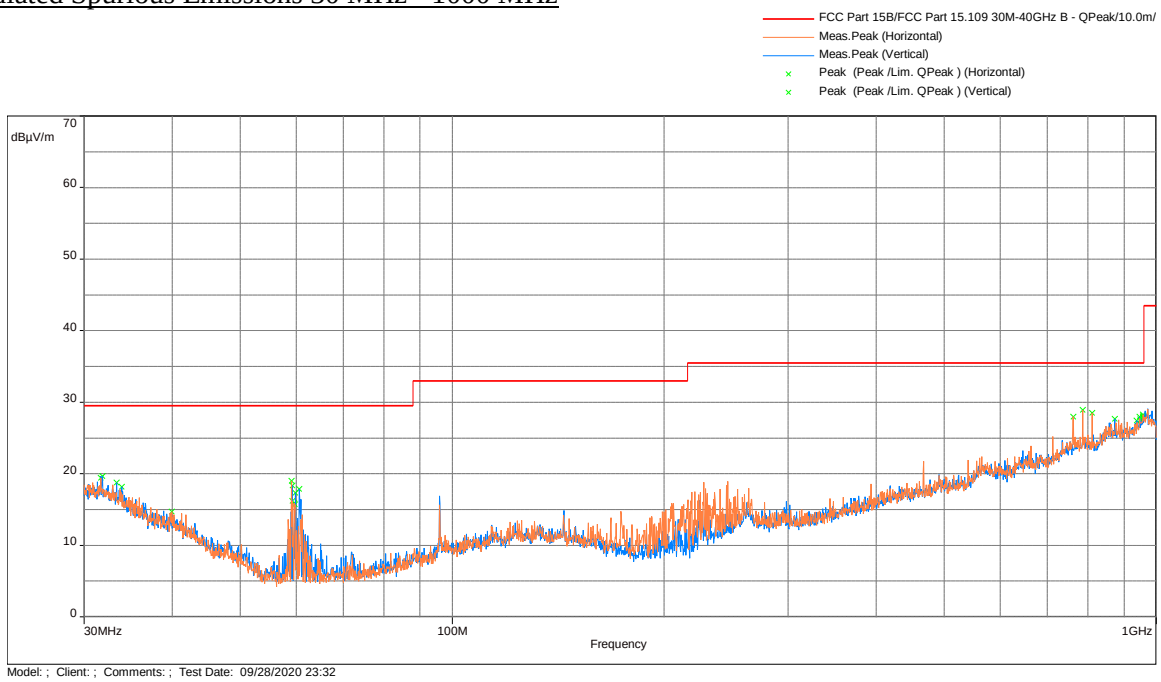
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz, Radio 2

Radiated Spurious Emissions 9 kHz - 1000 MHz



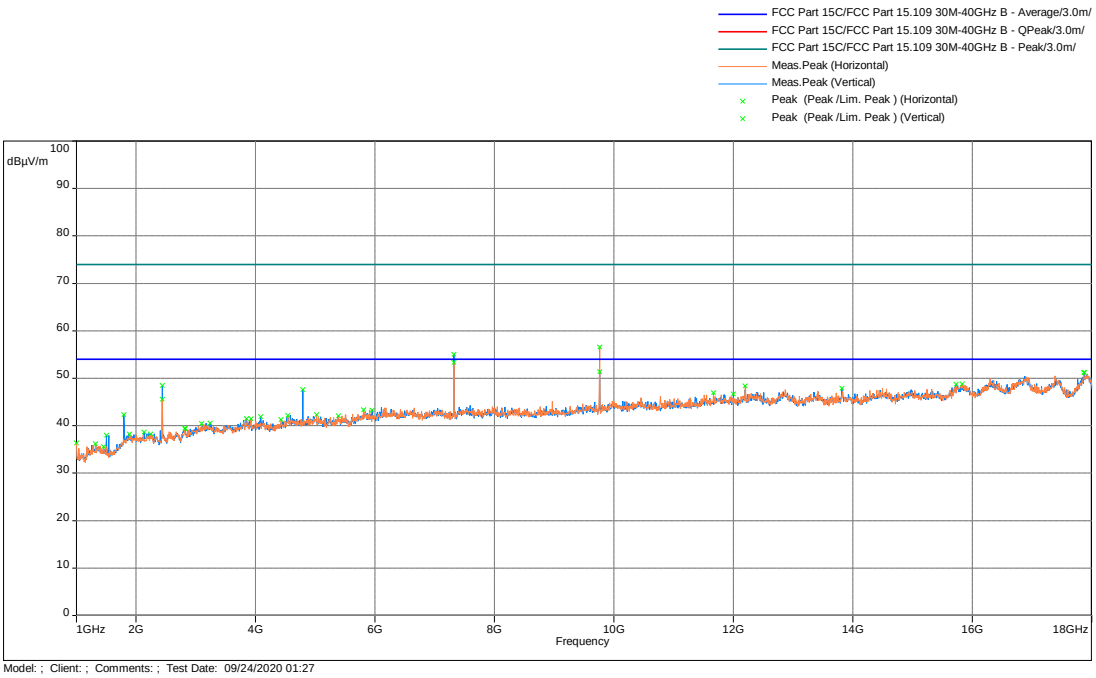
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
786.438	28.9	35.5	-6.6	1.02	347.25	Horizontal	-1.7

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

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

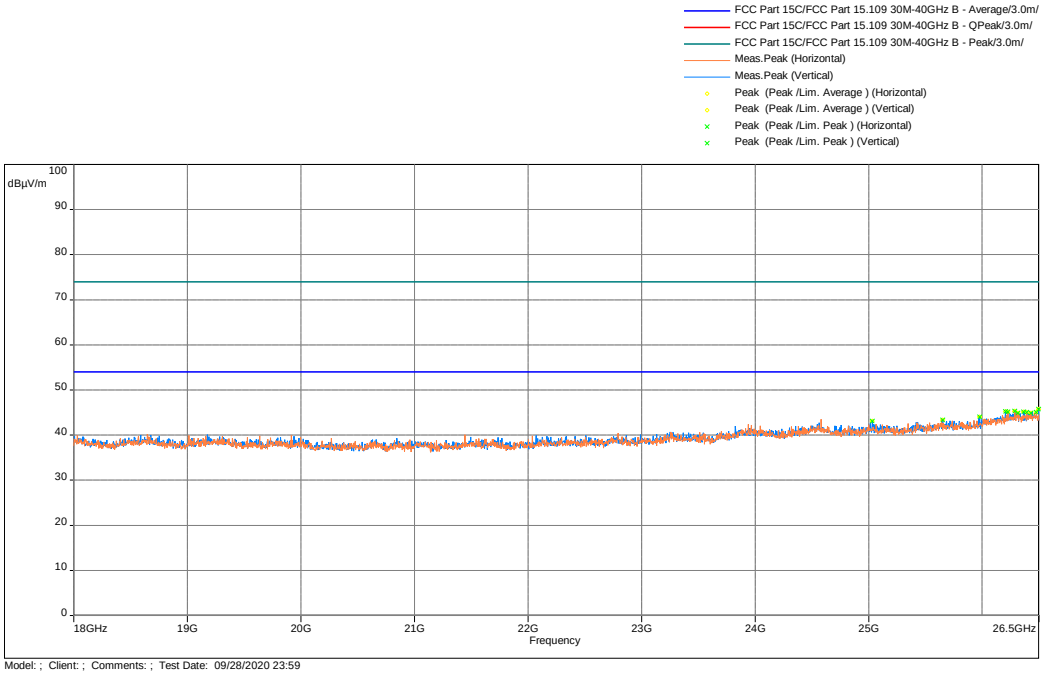


Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
9758.967	56.55	74	-17.45	2.49	330.5	Horizontal	-2.88
7318.900	55.03	74	-18.97	2.48	8	Vertical	-5.37
7321.167	53.3	74	-20.7	2.49	0	Horizontal	-5.37
9758.967	51.36	74	-22.64	2.48	8	Vertical	-2.88

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
9758.967	51.66	54	-2.34	2.02	359.5	Horizontal	-2.88
7320.600	48.45	54	-5.55	2.48	0.25	Vertical	-5.37
9758.967	44.82	54	-9.18	1.98	359.75	Vertical	-2.88
7320.600	43.74	54	-10.26	2.49	324.75	Horizontal	-5.37

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

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

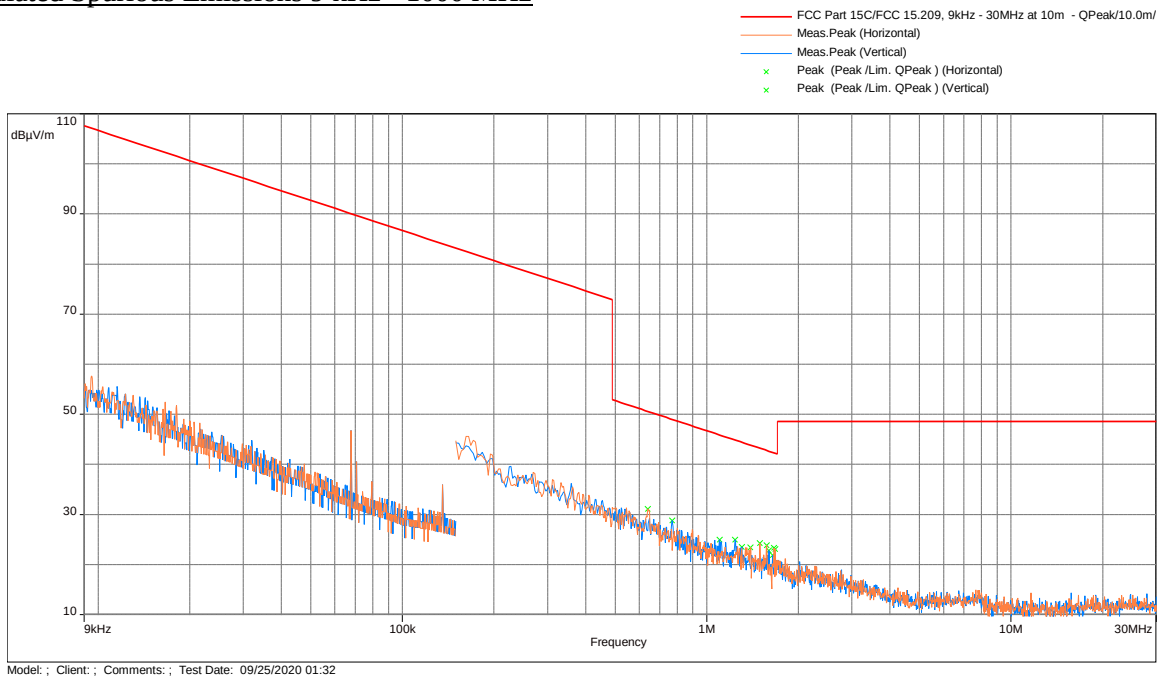


Model: ; Client: ; Comments: ; Test Date: 09/28/2020 23:59

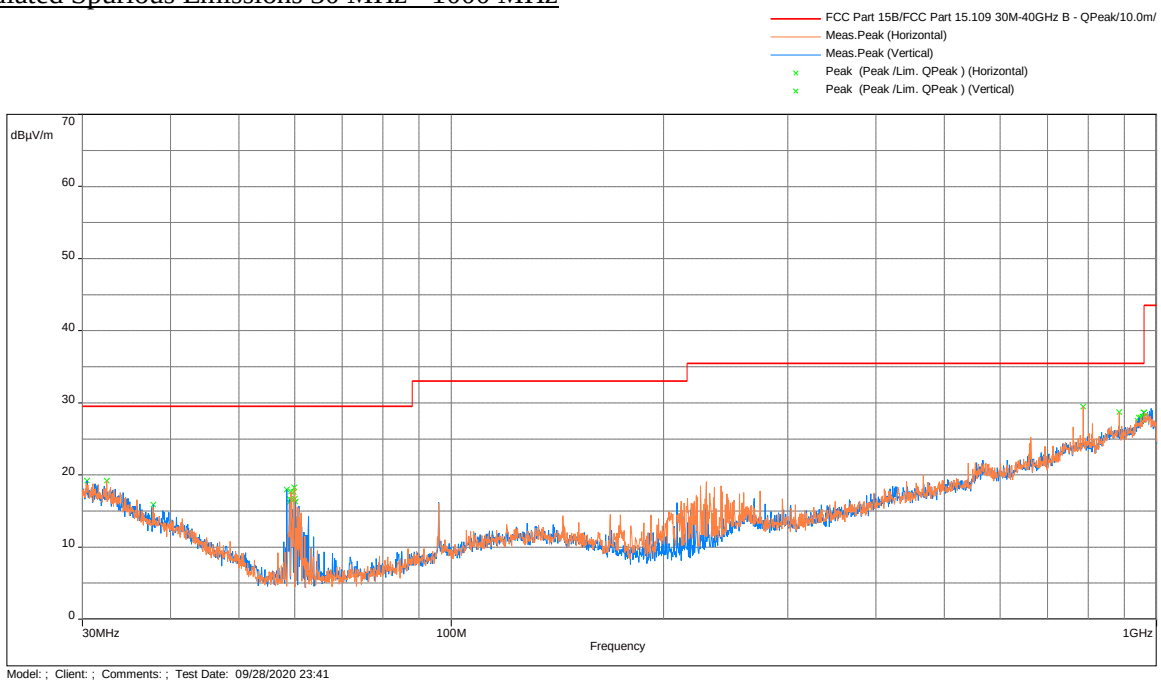
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2479MHz, Radio 2

Radiated Spurious Emissions 9 kHz - 1000 MHz



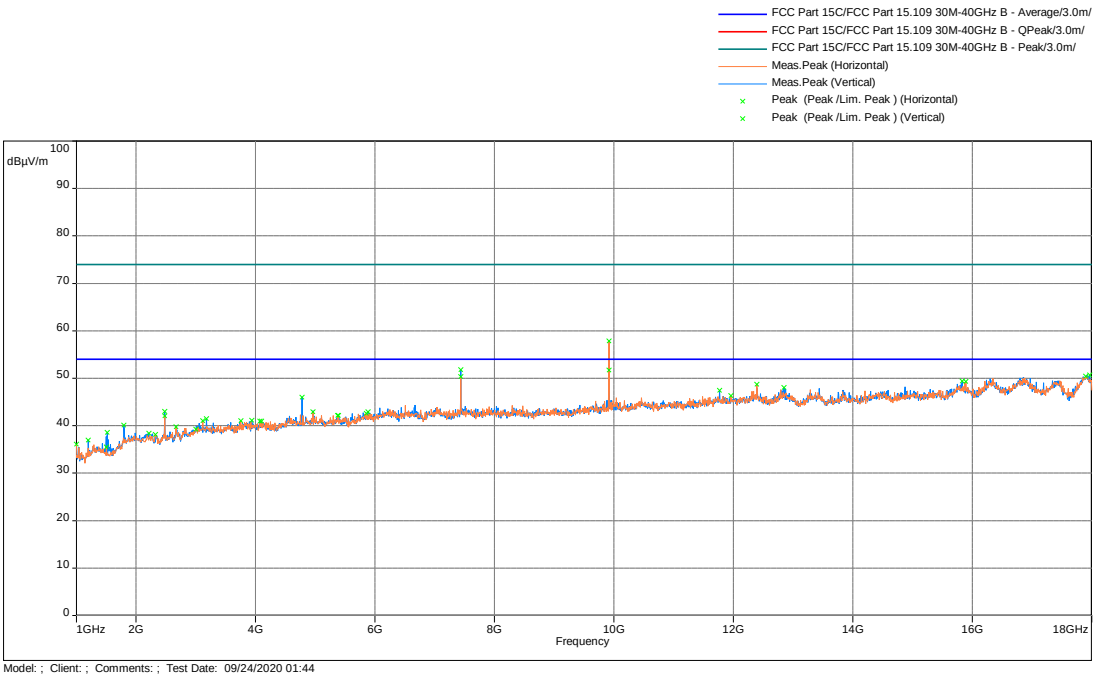
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
786.4383	29.49	35.5	-6.01	1.02	347.5	Horizontal	-1.7

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

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



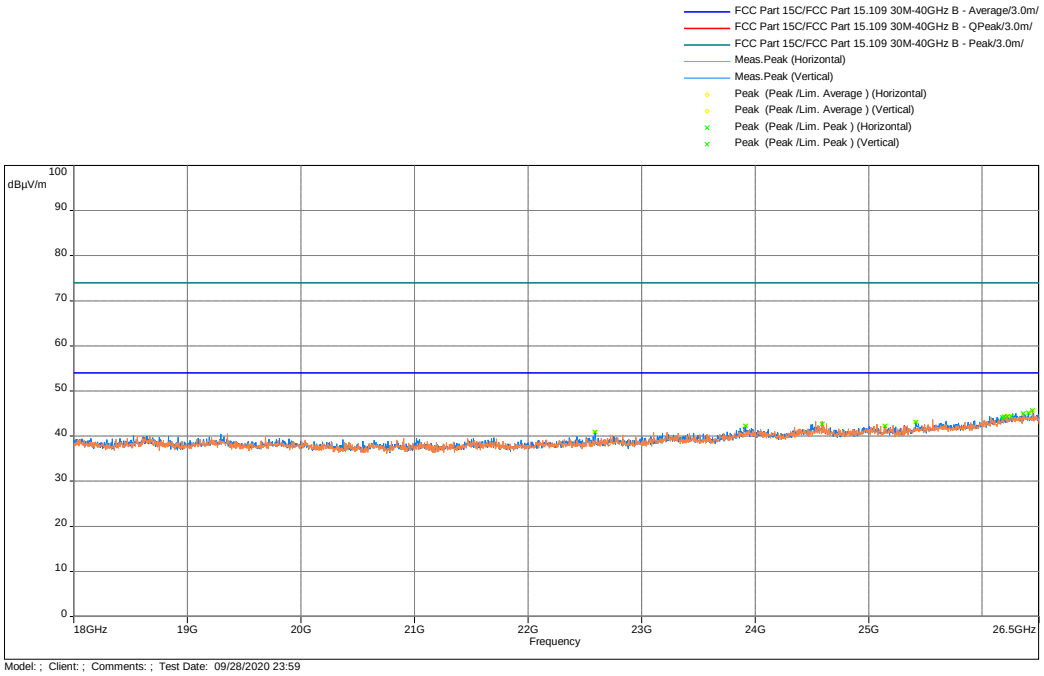
Model: ; Client: ; Comments: ; Test Date: 09/24/2020 01:44

Freq. MHz	Peak@3m dB(uV/m)	Peak Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
9917.633	57.88	74	-16.12	2.49	68.25	Horizontal	-2.86
7435.633	51.76	74	-22.24	2.48	54.75	Vertical	-5.04
9914.800	51.72	74	-22.28	1.98	15.25	Vertical	-2.86
7437.900	50.38	74	-23.62	2.49	305.25	Horizontal	-5.04

Freq. MHz	Avg@3m dB(uV/m)	Avg Limit@3m dB(µV/m)	Margin dB	Height m	Azimuth deg	Polarity	Correction dB
9914.800	53.07	54	-0.93	2.02	359.75	Horizontal	-2.86
9914.800	46.14	54	-7.86	1.98	15.25	Vertical	-2.86
7437.333	44.7	54	-9.3	2.48	57.5	Vertical	-5.04
7436.200	43.73	54	-10.27	2.49	302.5	Horizontal	-5.04

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

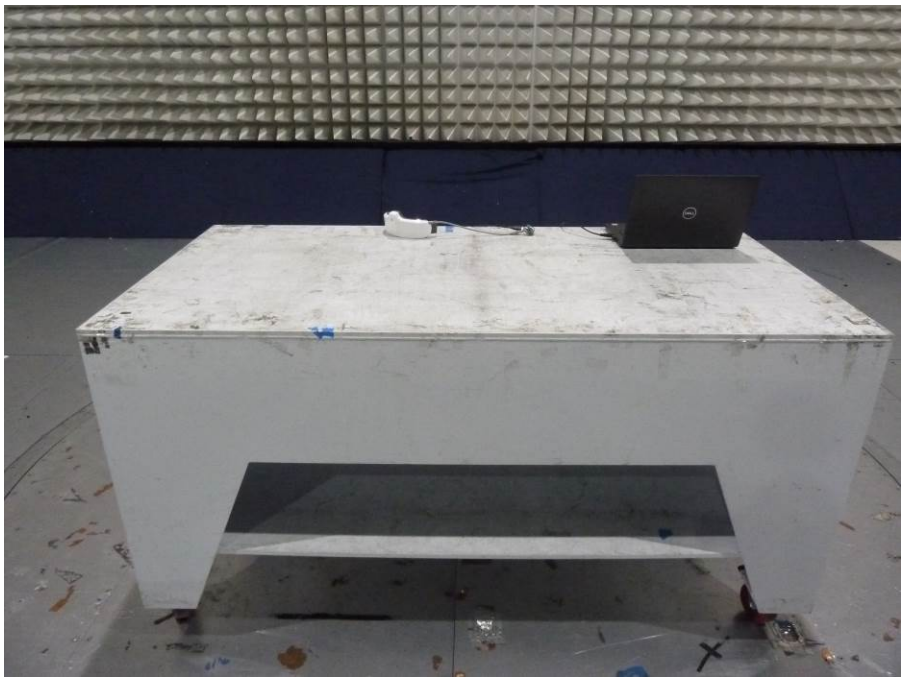
Radiated Spurious Emissions 18000 - 26000 MHz, Peak Scan vs Avg & Peak Limit

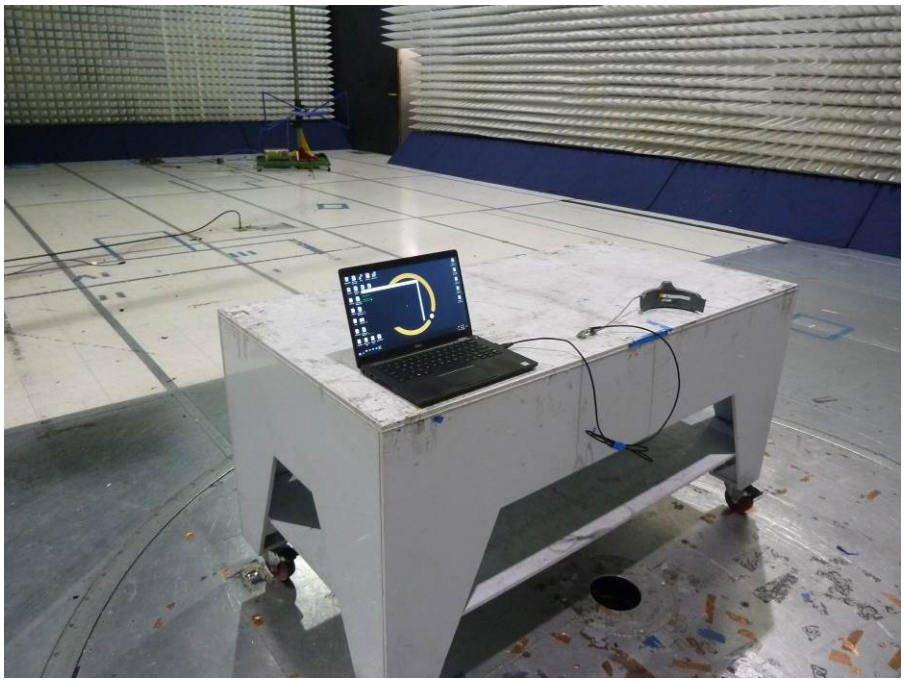


Results	**Complies**

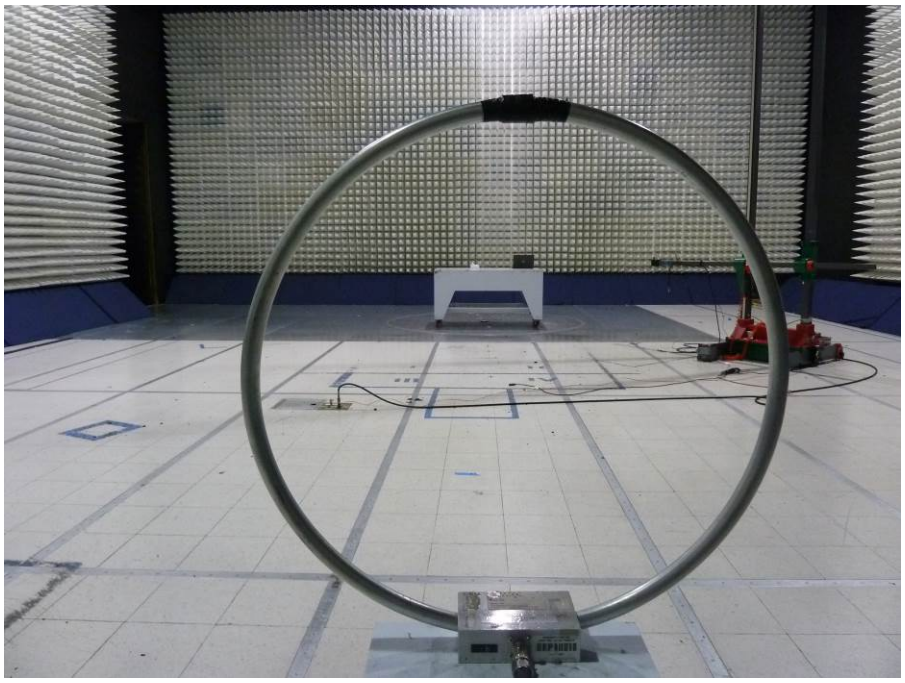
4.5.7 Test Setup Configuration

The following photographs show the testing configurations used.

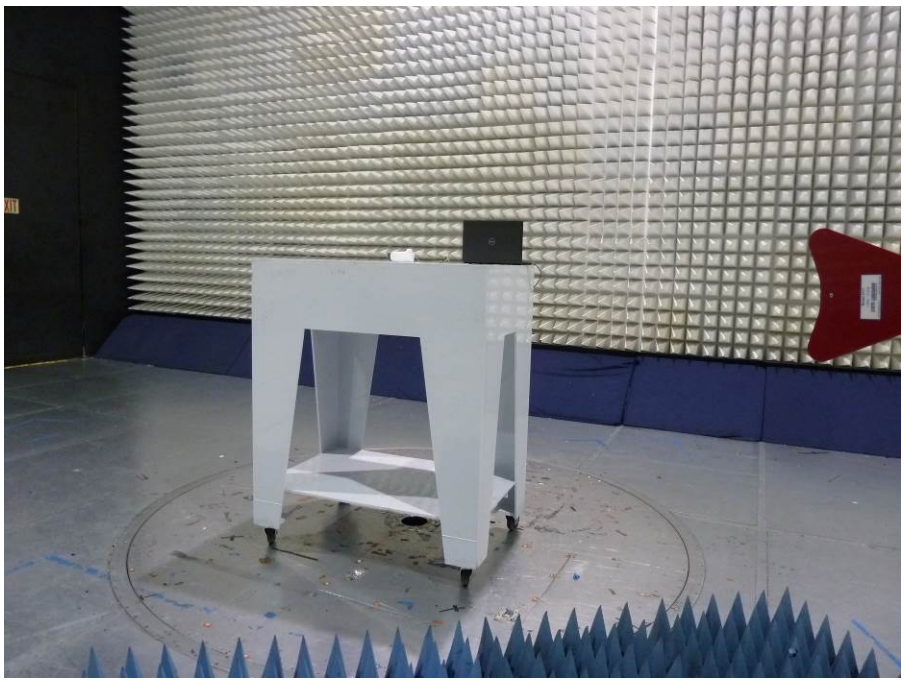


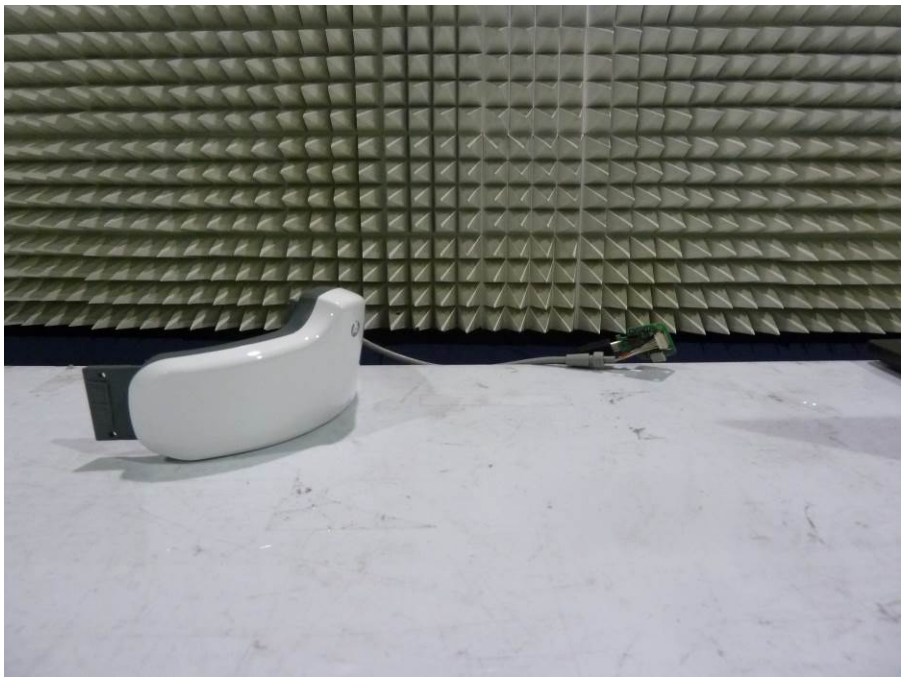


4.5.8 Test Setup Configuration (Continued)

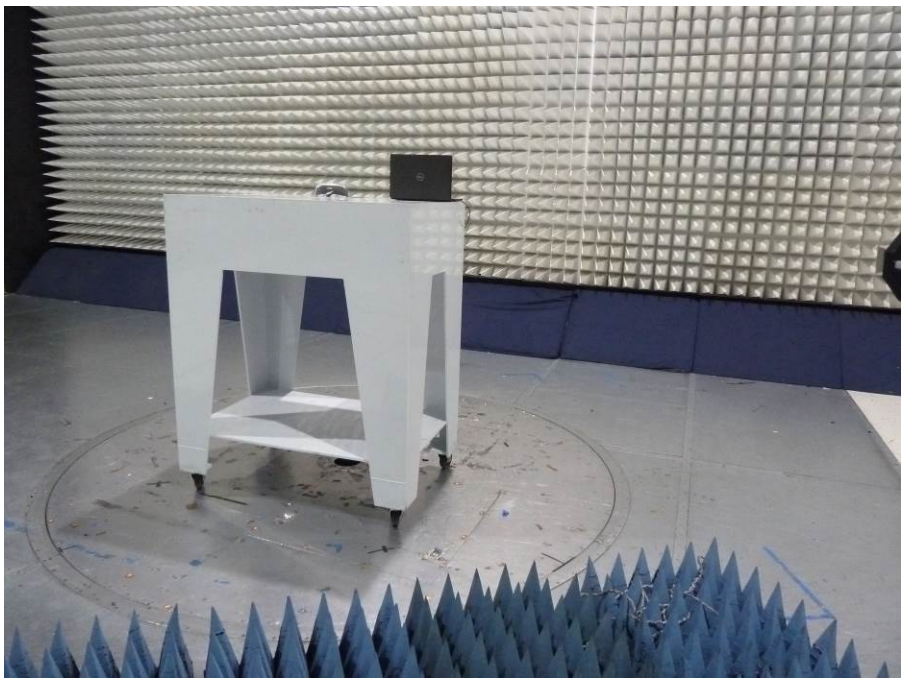


4.5.8 Test Setup Configuration (Continued)





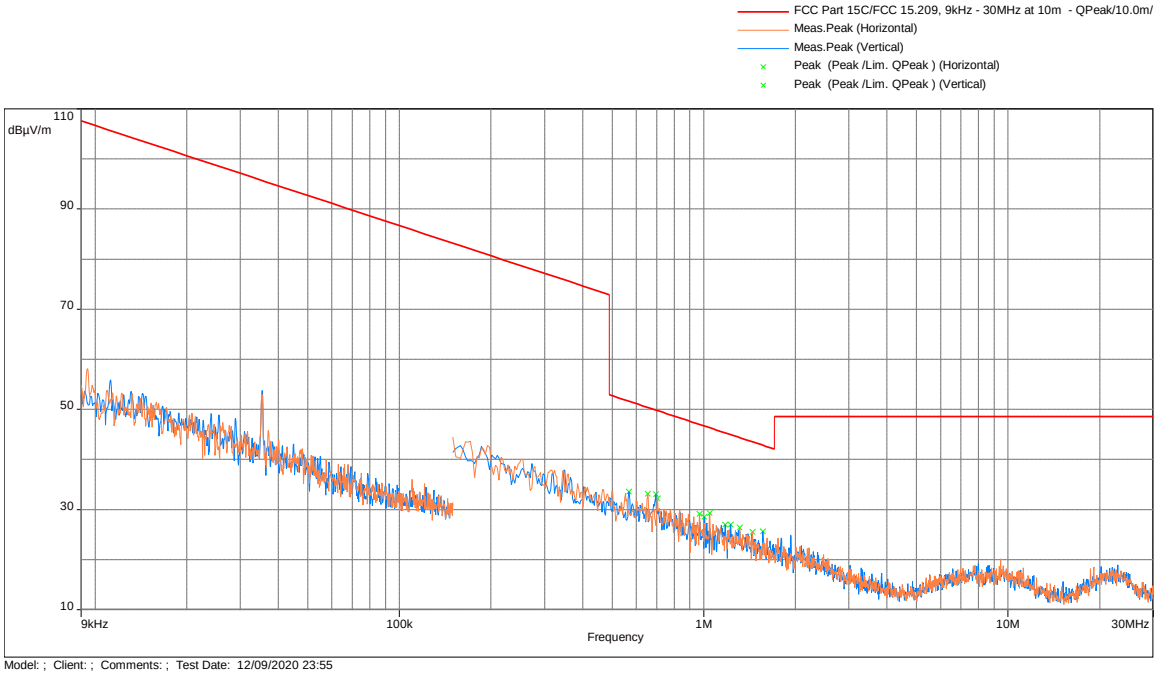
4.5.8 Test Setup Configuration (Continued)



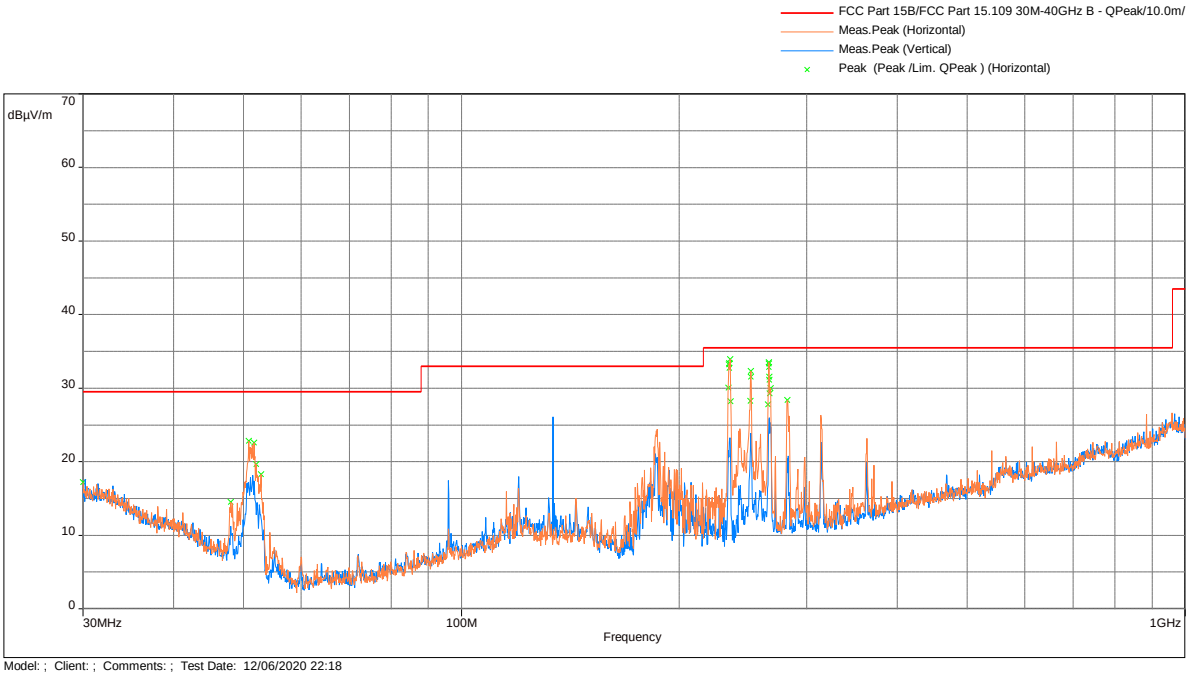
4.5.8 Co-located with WIFI (2.4 GHz) & BLE

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



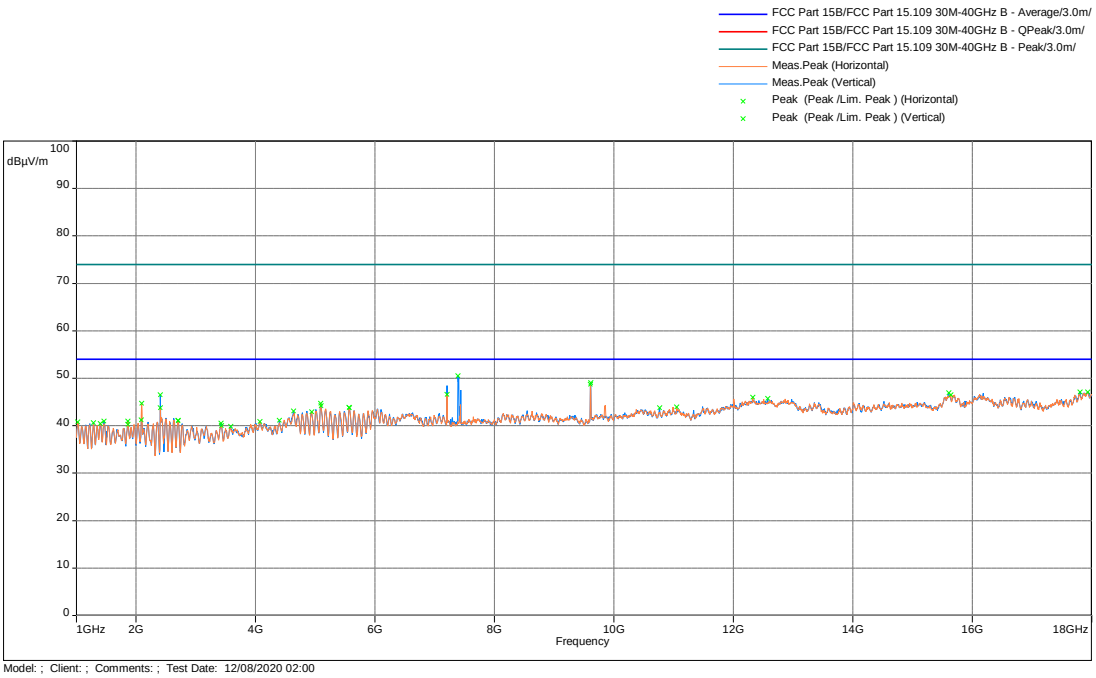
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
234.120	33.21	35.5	-2.29	2.98	196.75	Horizontal	-16.06
234.508	33.42	35.5	-2.08	3.98	0	Horizontal	-16.02
235.123	33.93	35.5	-1.57	1.98	10	Horizontal	-15.96
265.807	33.34	35.5	-2.16	2.98	63.75	Horizontal	-12.6
265.936	33.5	35.5	-2	2.98	78.25	Horizontal	-12.63
266.001	32.87	35.5	-2.63	1.98	68	Horizontal	-12.64

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.700	46.56	54	-7.44	1.52	302.75	Horizontal	-2.47
7386.333	50.49	54	-3.51	2.48	124	Vertical	-2.21
9607.100	48.76	54	-5.24	1.52	192.75	Horizontal	0.43
9609.367	49.11	54	-4.89	1.51	190.75	Vertical	0.45

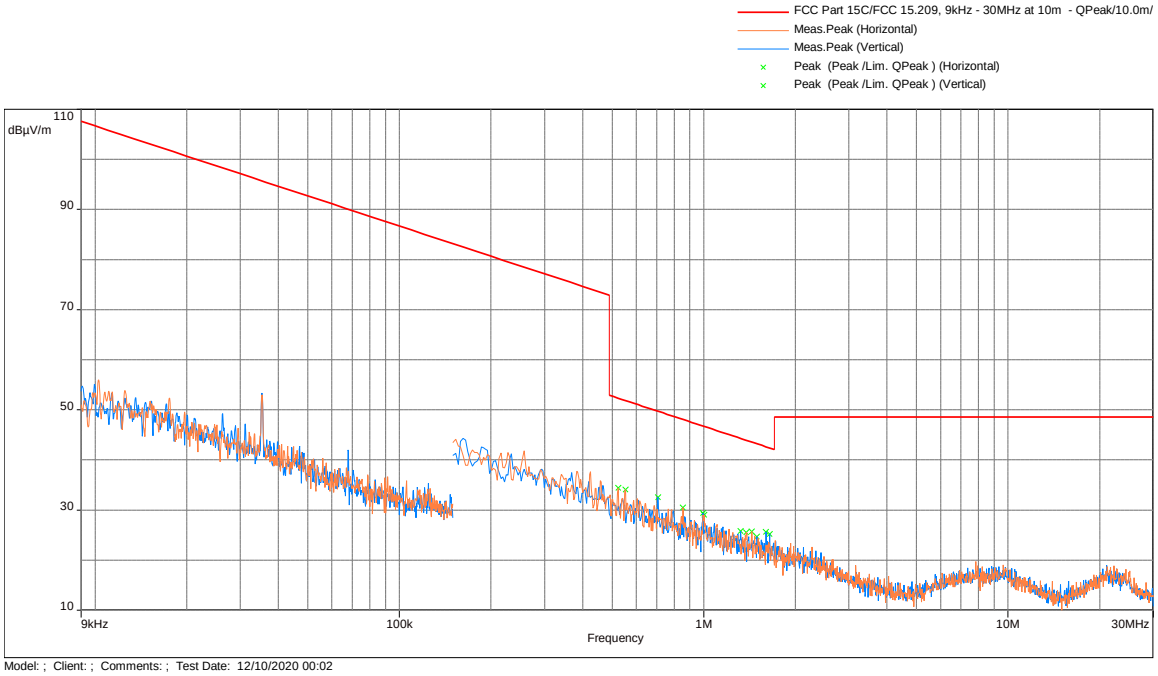
Note: FS = RA + Correction
Correction = AF + CF – Preamp

Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Results	**Complies**

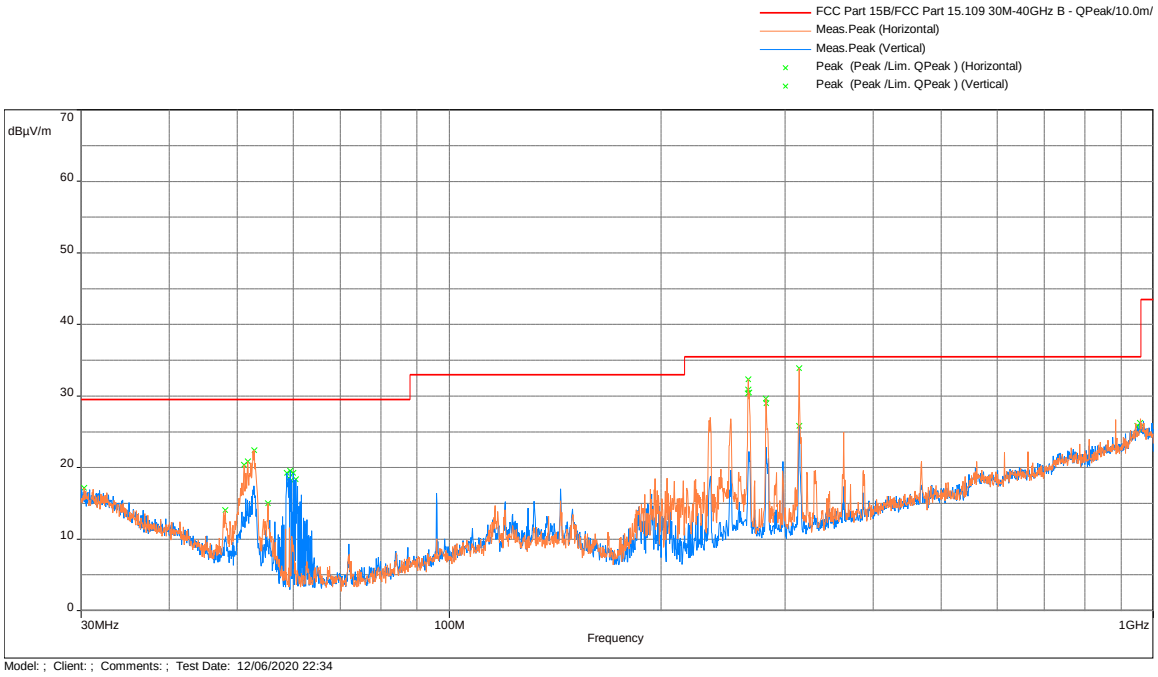
Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



Model: ; Client: ; Comments: ; Test Date: 12/10/2020 00:02

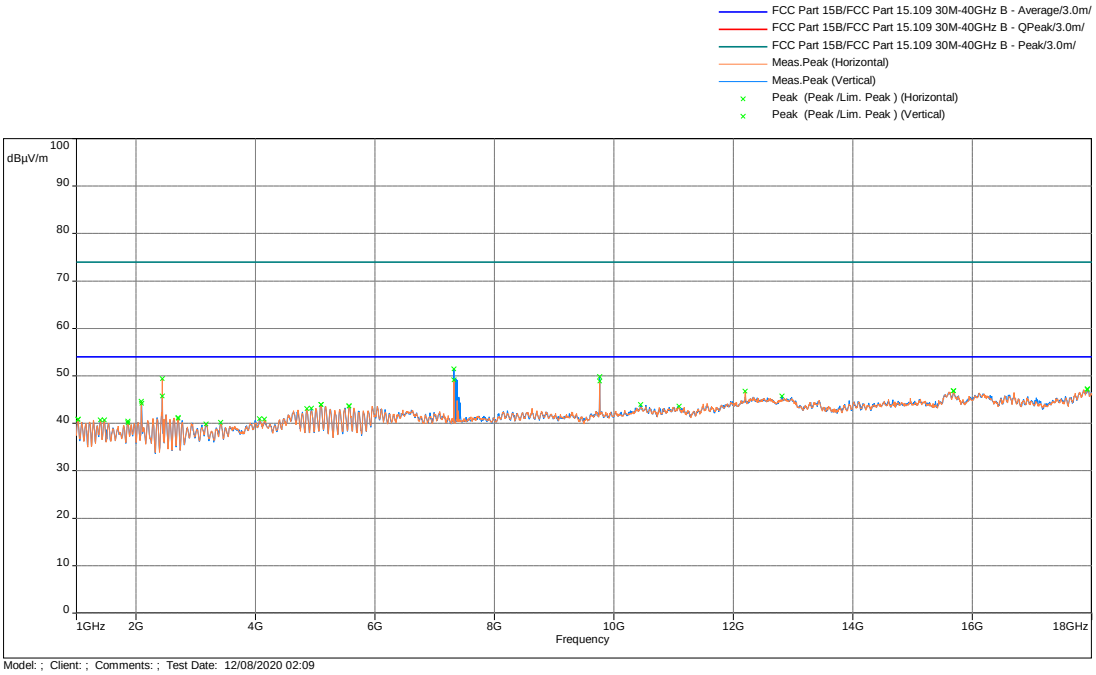
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
265.678	30.37	35.5	-5.13	1.98	5.25	Horizontal	-12.58
265.775	32.33	35.5	-3.17	1.98	5.25	Horizontal	-12.6
265.872	30.88	35.5	-4.62	2.98	0	Horizontal	-12.62
266.712	30.46	35.5	-5.04	1.98	355	Horizontal	-12.85
281.747	29.66	35.5	-5.84	2.98	358.75	Horizontal	-13.69
314.016	33.88	35.5	-1.62	2.98	0	Horizontal	-12.91

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarization	Correction dB
7320.6	51.48	54	-2.52	1.98	215.25	Vertical	-2.37
9761.233	49.86	54	-4.14	1.51	191	Vertical	1.24
7320.6	49.17	54	-4.83	2.49	281.5	Horizontal	-2.37
9758.967	48.87	54	-5.13	2.02	145.5	Horizontal	1.24

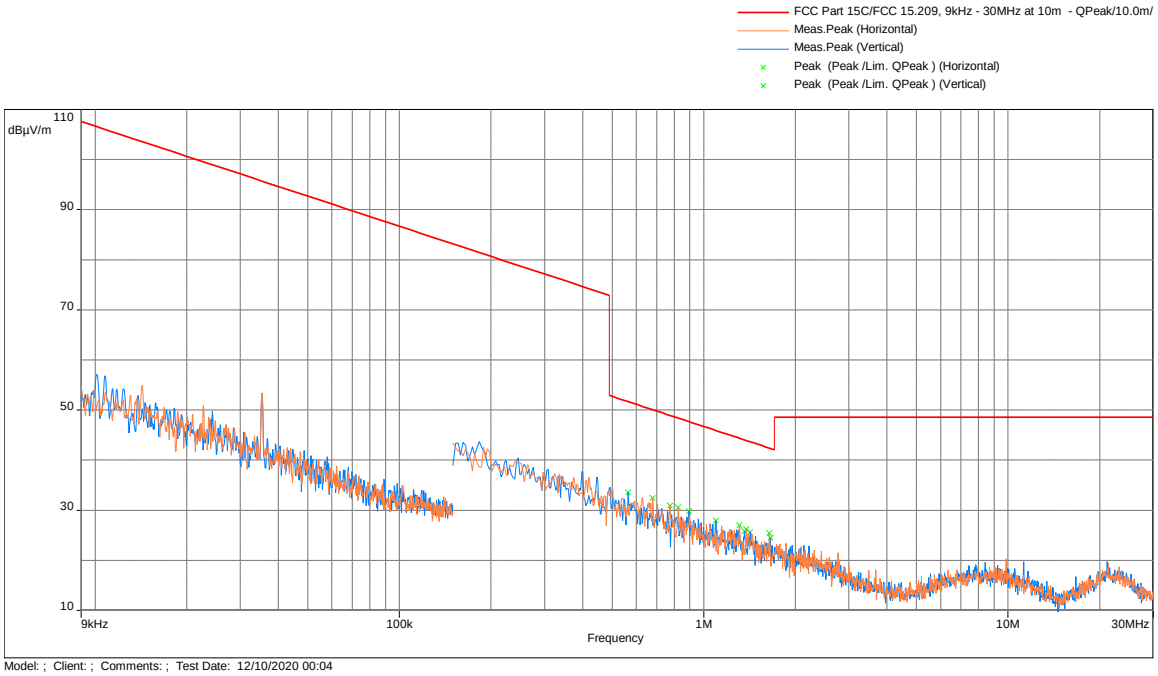
Note: FS = RA + Correction
Correction = AF + CF – Preamp

Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

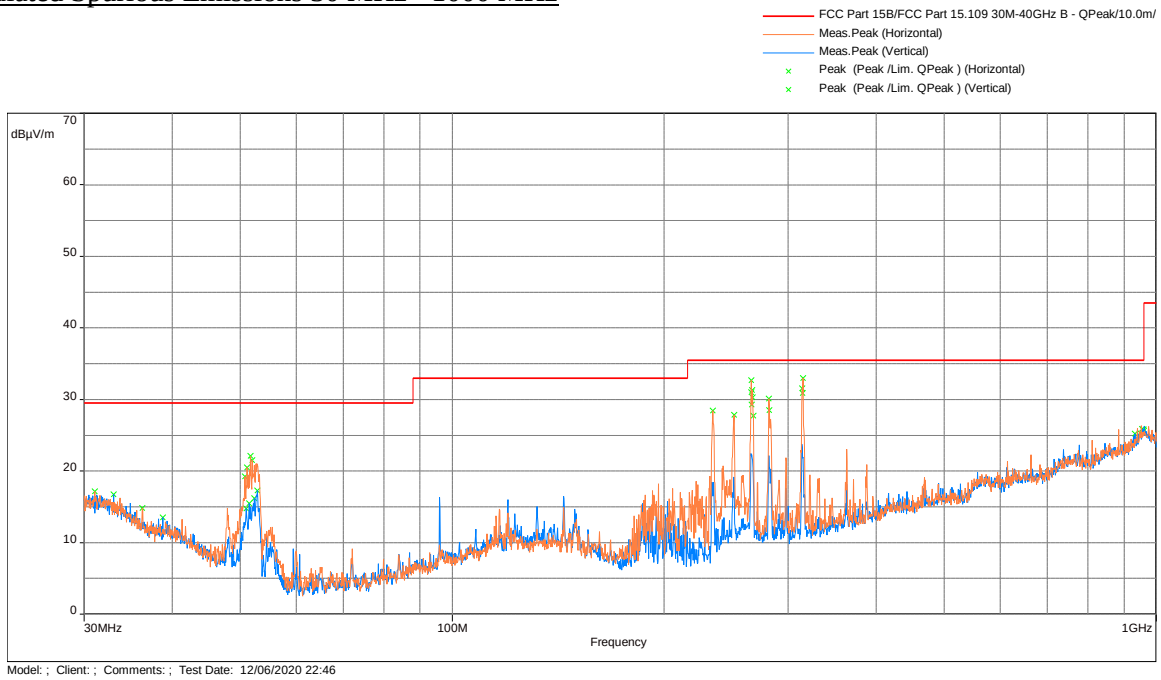
Results	Complies

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2479 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



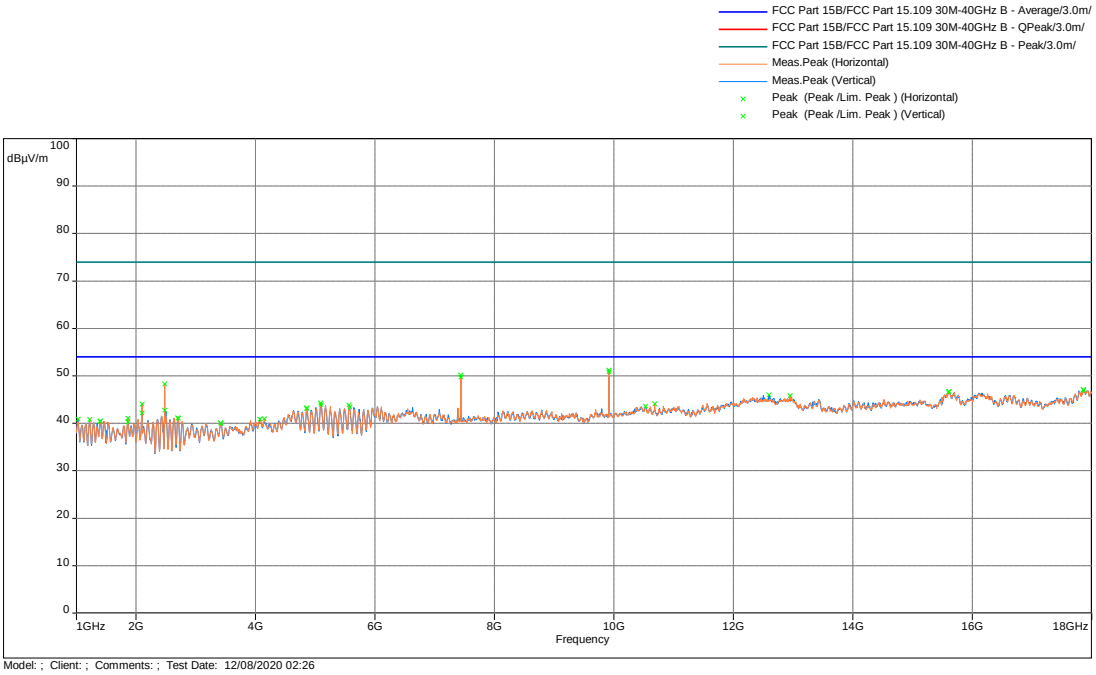
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
265.807	32.66	35.5	-2.84	1.98	9	Horizontal	-12.6
266.033	31.01	35.5	-4.49	1.98	9	Horizontal	-12.65
266.712	31.28	35.5	-4.22	1.98	18.75	Horizontal	-12.85
314.081	31.55	35.5	-3.95	2.98	36.5	Horizontal	-12.91
314.501	30.87	35.5	-4.63	1.98	4.75	Horizontal	-12.91
314.889	32.95	35.5	-2.55	2.98	359.5	Horizontal	-12.91

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarization	Correction dB
9914.8	51.23	54	-2.77	1.51	212	Vertical	1.12
9914.8	50.82	54	-3.18	2.49	149.25	Horizontal	1.12
7436.2	50.15	54	-3.85	2.48	167	Vertical	-2.09
7435.633	49.77	54	-4.23	2.49	258.75	Horizontal	-2.09

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

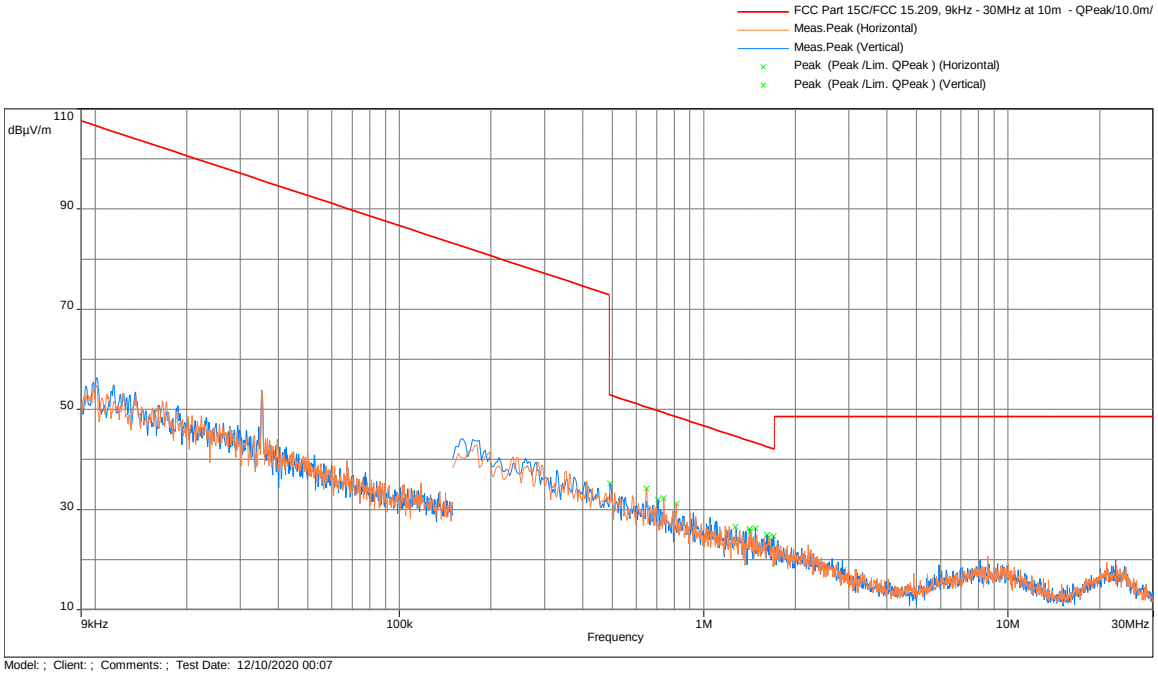
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Results	Complies

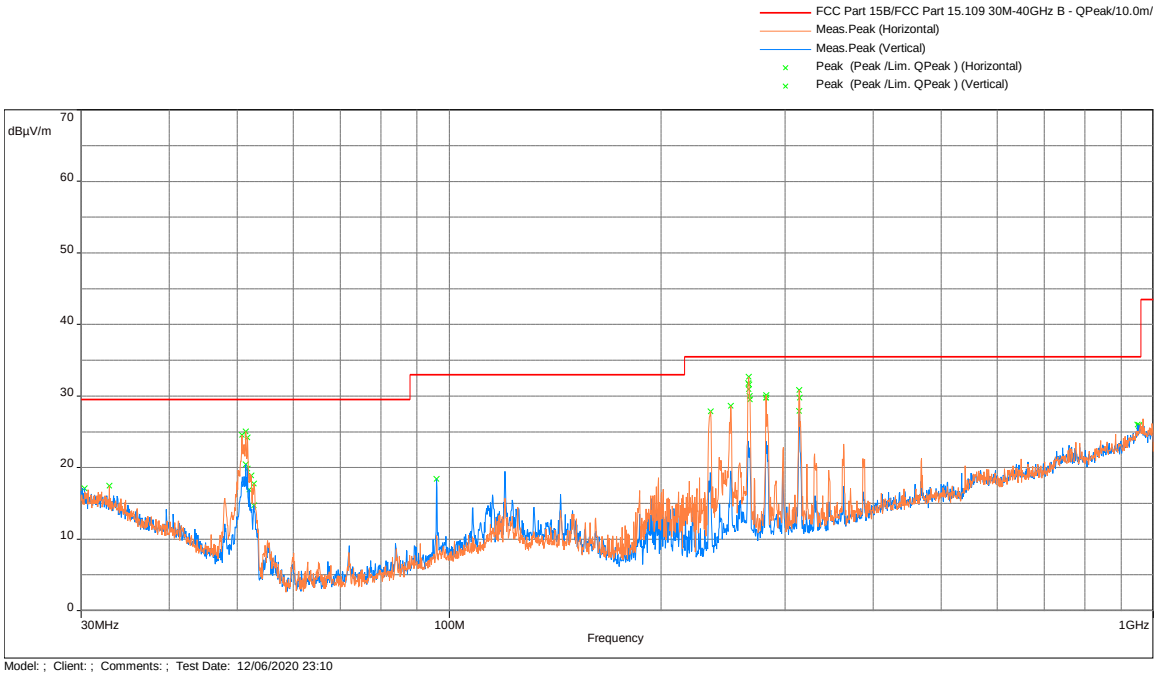
4.5.9 Co-located with WIFI (5 GHz) & BLE

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



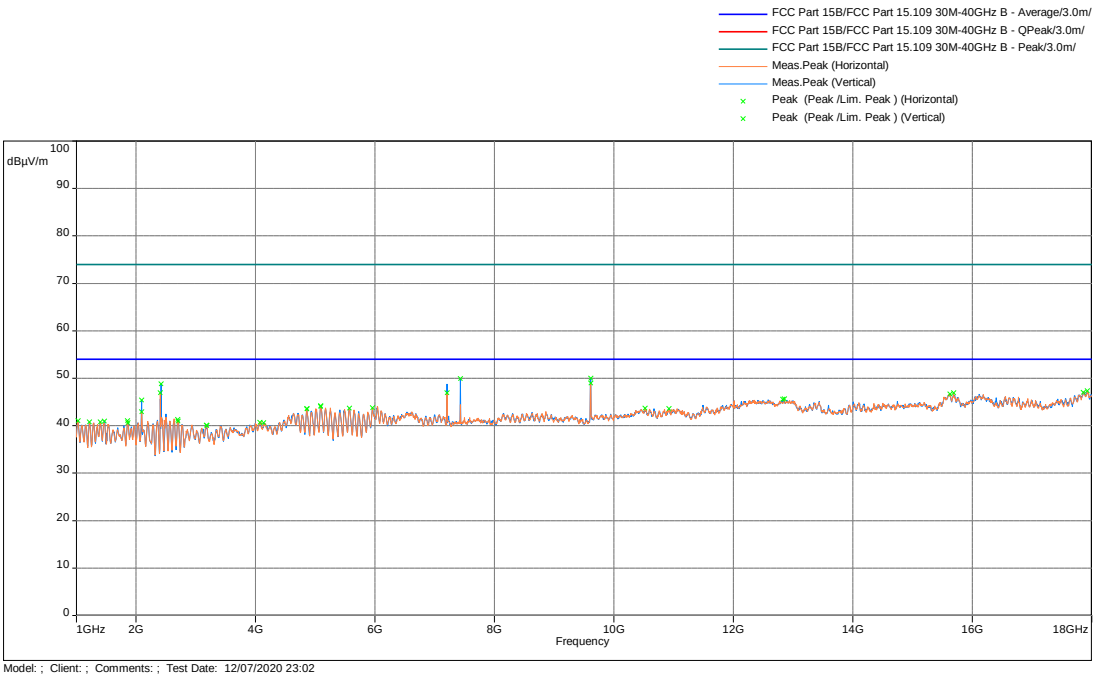
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
51.405	25.04	29.5	-4.46	3.98	32	Horizontal	-19.88
265.807	31.79	35.5	-3.71	1.98	351.25	Horizontal	-12.6
266.195	32.68	35.5	-2.82	1.98	351.25	Horizontal	-12.7
266.486	30.96	35.5	-4.54	1.98	7.5	Horizontal	-12.78
266.777	31.63	35.5	-3.87	1.98	0	Horizontal	-12.87
314.113	30.85	35.5	-4.65	1.98	7.5	Horizontal	-12.91

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
7206.700	46.97	54	-7.03	1.52	0	Horizontal	-2.47
7427.700	49.95	54	-4.05	2.48	101.75	Vertical	-2.11
9609.367	50.02	54	-3.98	1.49	212.25	Vertical	0.45
9609.367	48.97	54	-5.03	1.52	258.75	Horizontal	0.45

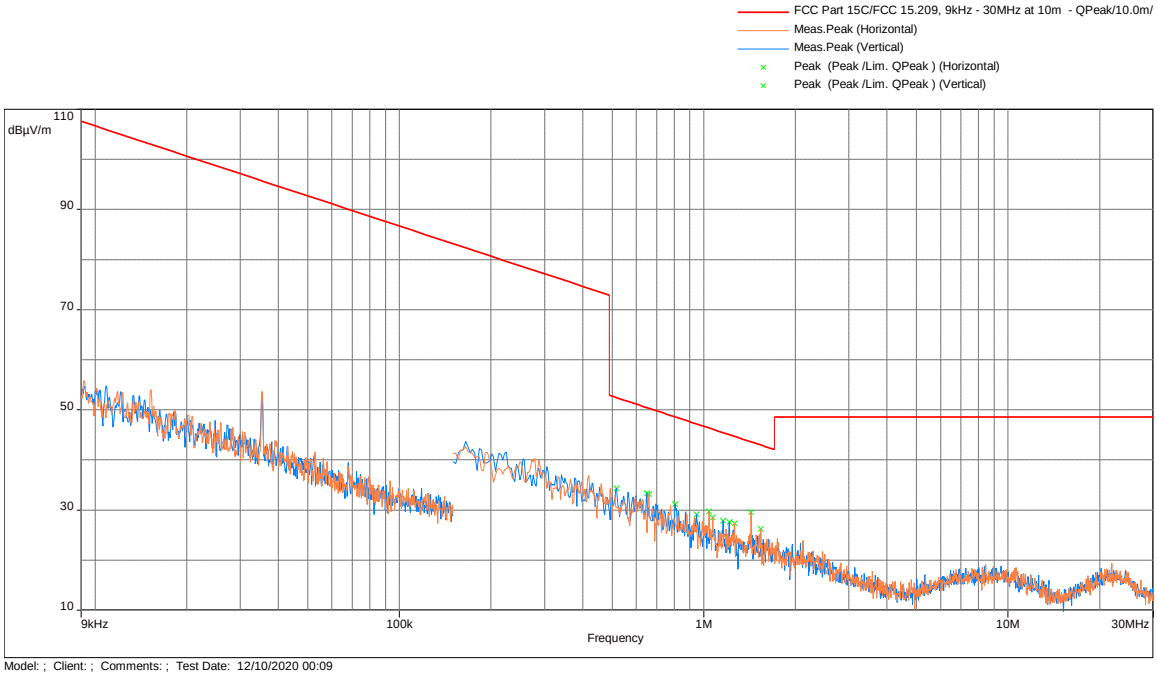
Note: FS = RA + Correction
Correction = AF + CF – Preamp

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz

Results	**Complies**

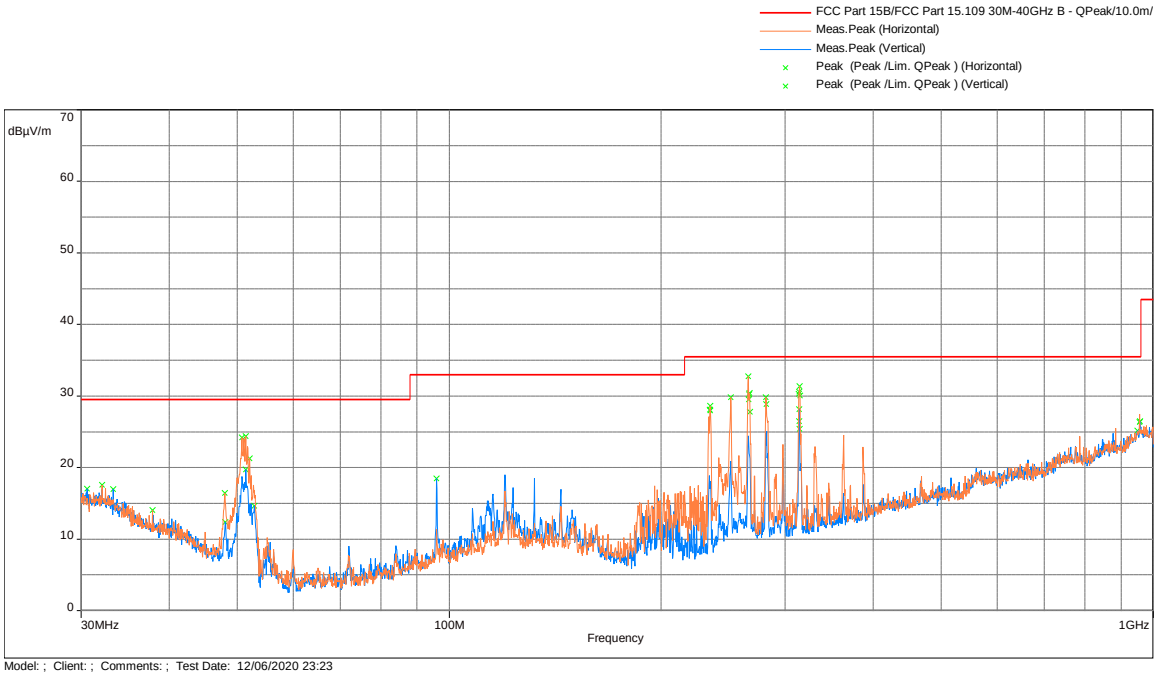
Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



Model: ; Client: ; Comments: ; Test Date: 12/10/2020 00:09

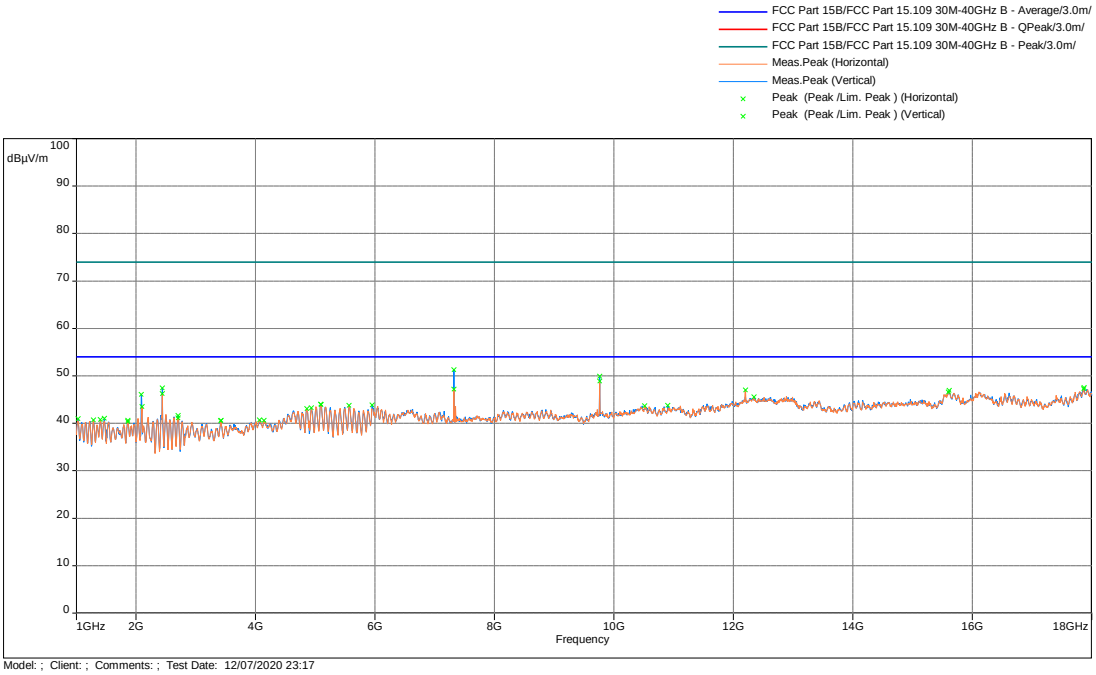
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
51.405	24.38	29.5	-5.12	3.98	19	Horizontal	-19.88
266.033	32.71	35.5	-2.79	1.98	0.5	Horizontal	-12.65
267.036	30.4	35.5	-5.1	2.98	168.25	Horizontal	-12.94
313.563	30.27	35.5	-5.23	2.98	177.5	Horizontal	-12.96
314.210	30.56	35.5	-4.94	1.98	32.75	Horizontal	-12.91
314.404	31.35	35.5	-4.15	2.98	359.25	Horizontal	-12.91

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarization	Correction dB
7321.167	51.28	54	-2.72	1.51	232.75	Vertical	-2.37
7321.167	47.16	54	-6.84	2.49	281.25	Horizontal	-2.37
9758.967	48.87	54	-5.13	1.52	258.75	Horizontal	1.24
9761.233	49.91	54	-4.09	1.51	211.25	Vertical	1.24

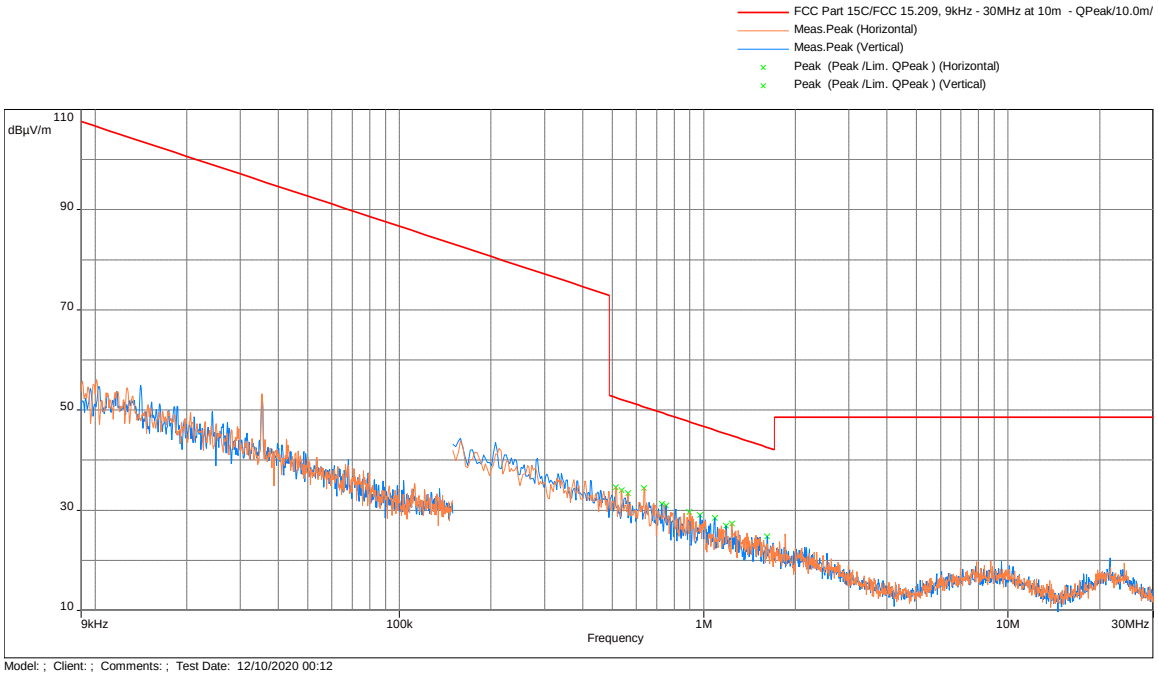
Note: FS = RA + Correction
Correction = AF + CF – Preamp

Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz

Results	Complies

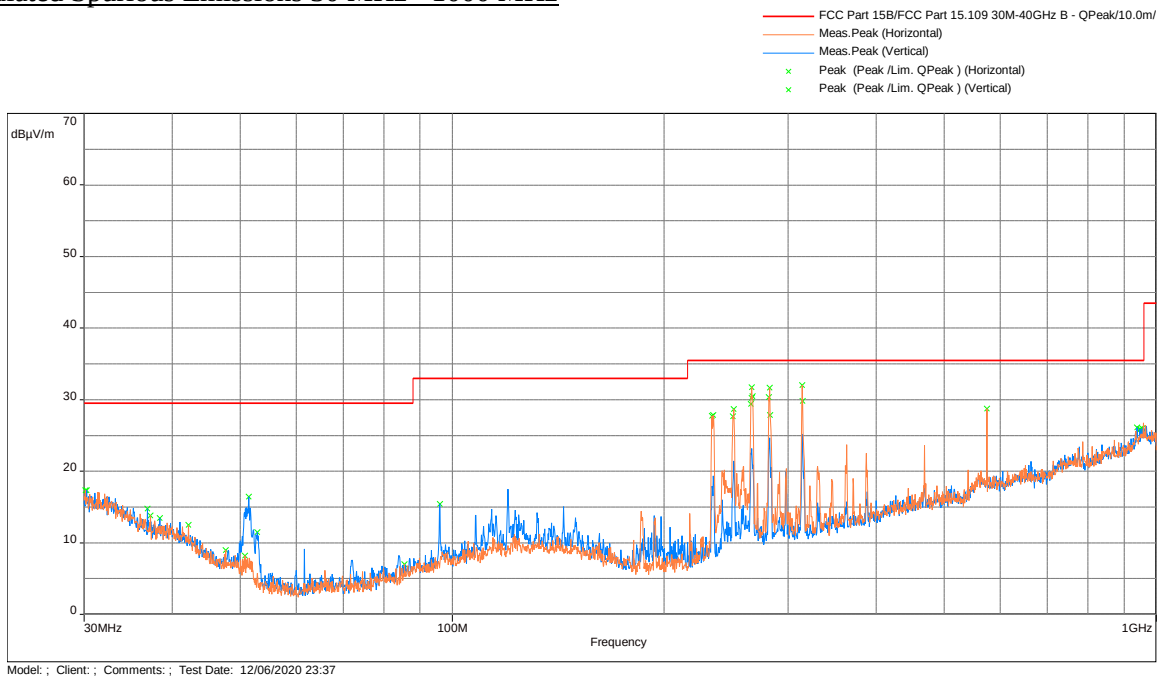
Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2479 MHz (Radio1 & 2)

Radiated Spurious Emissions 9 kHz - 30 MHz



Model: ; Client: ; Comments: ; Test Date: 12/10/2020 00:12

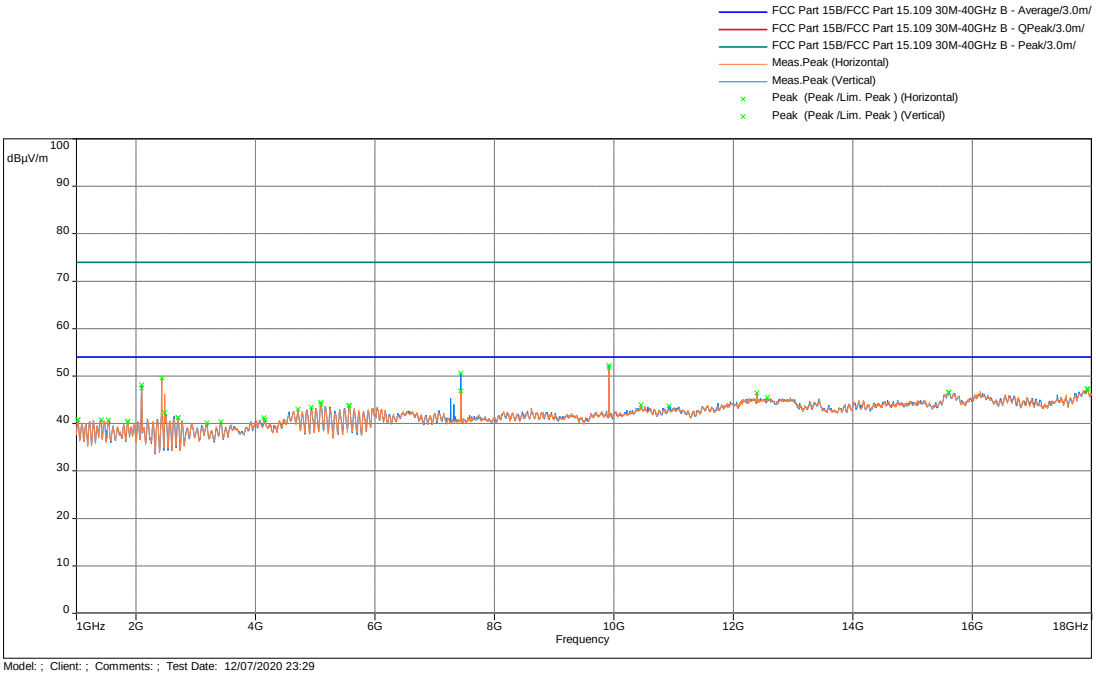
Radiated Spurious Emissions 30 MHz - 1000 MHz



Frequency MHz	QP@10m (dBµV/m)	Limit@10m (dBµV/m)	Margin (dB)	Height (m)	Angle (°)	Polarization	Correction (dB)
266.130	31.74	35.5	-3.76	3.98	179.25	Horizontal	-12.68
266.292	30.24	35.5	-5.26	1.98	13.75	Horizontal	-12.73
267.133	30.49	35.5	-5.01	1.98	343.25	Horizontal	-12.96
281.618	30.33	35.5	-5.17	2.98	3.5	Horizontal	-13.69
282.459	31.65	35.5	-3.85	2.98	352.25	Horizontal	-13.69
314.113	32.04	35.5	-3.46	1.98	13.75	Horizontal	-12.91

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

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



Freq. MHz	Peak@3m dB(uV/m)	Ave Limit@3m dB(µV/m)	Margin dB	Azimuth deg	Height m	Polarization	Correction dB
7436.200	50.58	54	-3.42	1.51	167.25	Vertical	-2.09
7437.900	46.82	54	-7.18	2.49	281.5	Horizontal	-2.09
9914.800	52.27	54	-1.73	1.51	211.75	Vertical	1.12
9914.800	51.77	54	-2.23	1.52	237	Horizontal	1.12

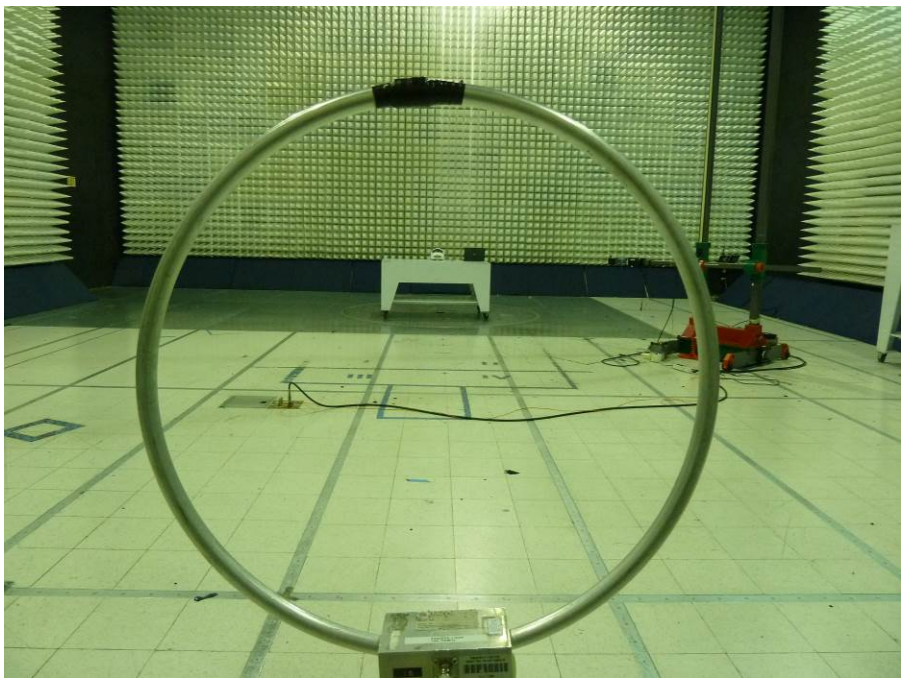
Note: FS = RA + Correction
Correction = AF + CF – Preamp

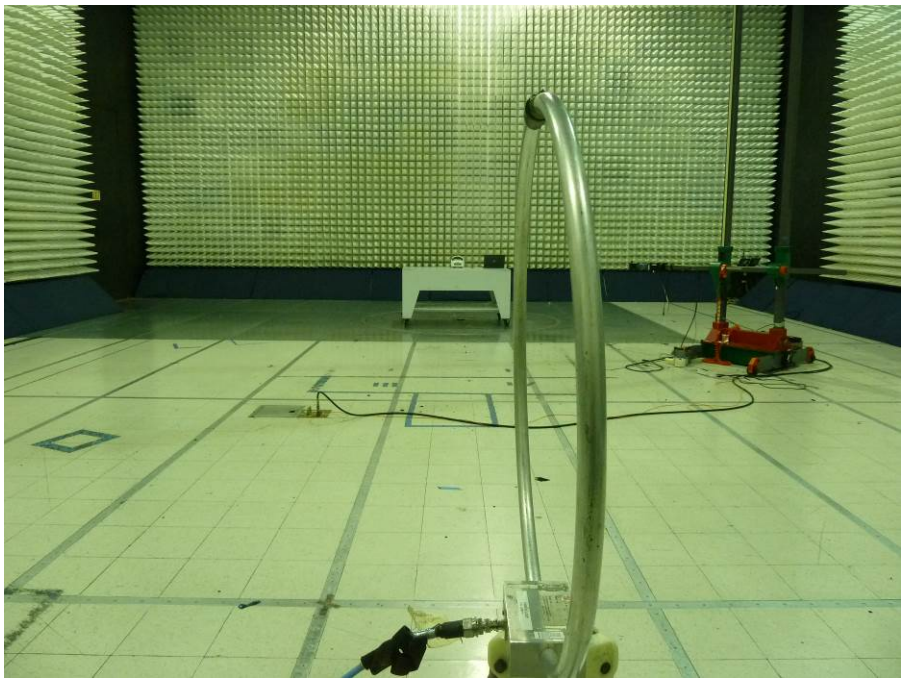
Note: Radiated emission measurements were performed up to 40GHz. No Emissions were identified when scanned from 18-40 GHz

Results	Complies

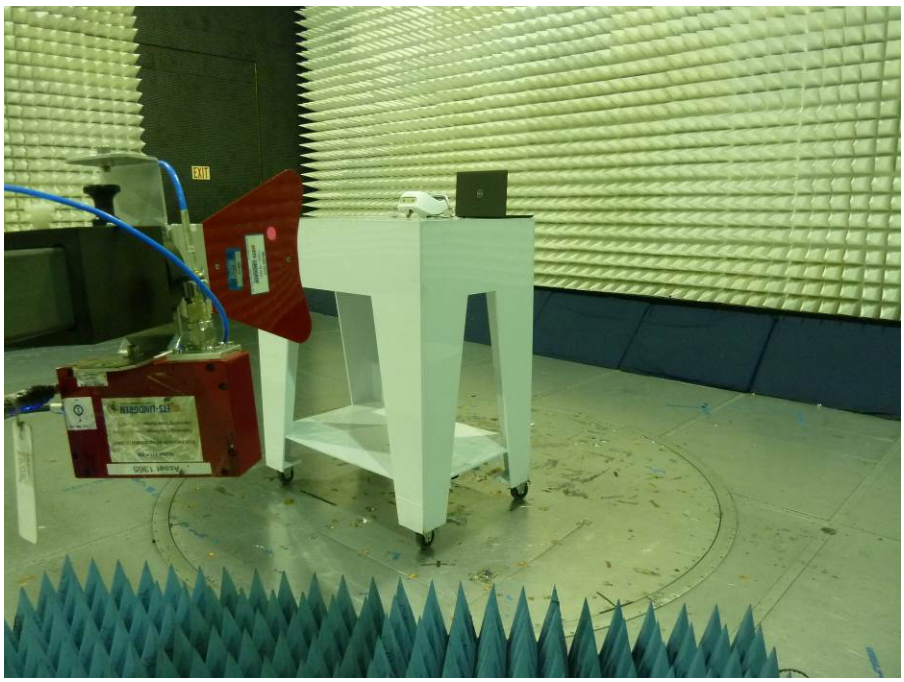
4.5.10 Test Setup Configuration (Co-located)

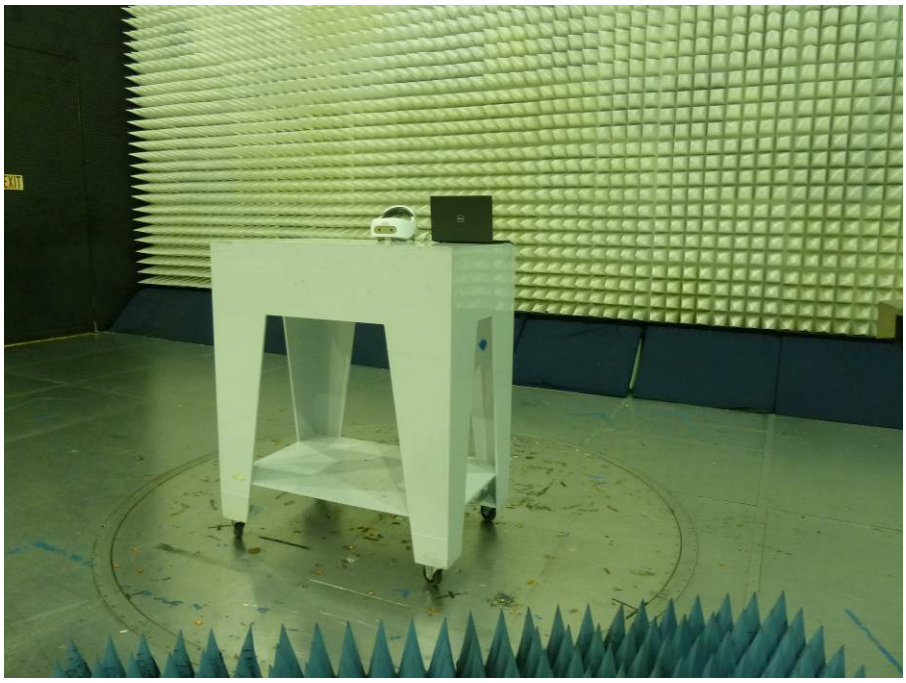
4.5.10 Test Setup Configuration (Co-located) Continued





4.5.10 Test Setup Configuration (Co-located) Continued





5.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	04/02/21
Pre-Amplifier (18-40GHz)	Miteq	TTA1840-35-S-M	ITS 01393	12	03/02/21
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01824	12	08/04/21
Pyramidal Horn Antenna (18-26.5 GHz)	EMCO	3160-09	ITS 00571	#	#
Pyramidal Horn Antenna (26.5-40 GHz)	EMCO	3160-10	ITS 00572	#	#
Bilog Antenna 30-1000MHz	Teseq	CBL6111D	01505	12	03/11/21
Pre-Amplifier	Sonoma Instrument	310	ITS 00942	12	04/14/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01336	12	07/04/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01339	12	07/04/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01334	12	07/04/21
RF Cable	TRU Corporation	TRU CORE 300	ITS 01340	12	07/04/21
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	06/11/22
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01484	12	06/12/21
10m chamber	Panashield	10m Semi-	ITS 00984	36	07/29/23

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.17.0.10	103902894_Penumbra.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 / G104407842	AC	KV	December 28, 2020	Original document