

CLASS II PERMISSIVE CHANGE TEST REPORT

Report Number: 104122920MPK-001

Project Number: G104122920

Issue Date: November 13, 2019

**Testing performed on the
Bayer U.S. LLC Rodent Sensor
Model: RS V7.X.X**

FCC ID: AU792U13A16858

IC: 125A-0055

to

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

For

Bayer U.S. LLC

Test Performed by:

Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:

Bayer U.S. LLC
5000 CentreGreen Waym, Suite 400
Cary, NC 27513-2323 USA

Prepared by:



Aaron Chang

Date: November 13, 2019

Reviewed by:



Krishna Vemuri

Date: November 13, 2019

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Report No. 104122920MPK-001

Equipment Under Test:	Bayer U.S. LLC Rodent Sensor
Trade Name:	Bayer U.S. LLC
Model Number:	RS V7.X.X
Serial Number:	00-80-00-00-04-01-4f-a5 (Radiated) 00-80-00-00-04-01-4f-3b (Conducted)
Applicant:	Bayer U.S. LLC
Contact:	Gaelle Fages
Address:	Bayer U.S. LLC 5000 CentreGreen Waym, Suite 400 Cary, NC 27513-2323
Country:	USA
Tel. Number:	1 (919) 612-8816
Email:	gaelle.fages@bayer.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025 USA
Date(s) of Test:	October 22 to November 13, 2019

We attest to the accuracy of this report:

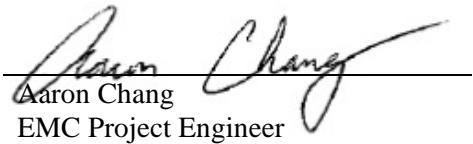

Aaron Chang
EMC Project Engineer
Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

TEST	REFERENCE FCC 15.247	REFERENCE RSS-247	RESULTS
RF Output Power	15.247(b)(3)	RSS-247, 5.4.4	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
Line Conducted Emissions	15.207	RSS-GEN	Not Applicable ²
Antenna Requirement	15.203	RSS-GEN	Complies ¹

¹ EUT utilizes an internal Antenna.

² EUT is battery powered.

2.0 General Description

2.1 Product Description

Bayer U.S. LLC supplied the following description of the EUT:

The Bayer U.S. LLC Crop Sciences “RS” provides a wireless means to communicate the capture or triggering of a trap or station to a common gateway device for data collection and alerting service personnel.

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

Overview of the EUT	
Applicant name & address:	Bayer U.S. LLC 5000 CentreGreen Waym, Suite 400 Cary, NC 27513-2323 USA
Contact info / Email:	Gaelle Fages / gaelle.fages@Bayer.com
Model:	RS V7.X.X
FCC Identifier:	AU792U13A16858
IC Identifier:	125A-0055
Operating Frequency:	902.3 - 914.9 MHz
Number of Channels:	64
Type of Modulation:	LoRa
Antenna Type:	PCB antenna / 2.18 dBi

EUT receive date: October 22, 2019

EUT receive condition: 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: October 22, 2019

Test completion date: November 13, 2019

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Antenna conducted measurements were performed according to the FCC documents "Guidance for Performing Compliance Measurement on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System devices Operating under §15.247" (KDB 558074 D01 Meas Guidance v05r02), RSS-247 Issue 2, ANSI C63.10: 2013 and 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.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

3.0 System Test Configuration

3.1 Support Equipment and description

Support Equipment			
Type	Model #	Quantity	S/N
Laptop*	Vostro 3550	1	J9Y3PP1

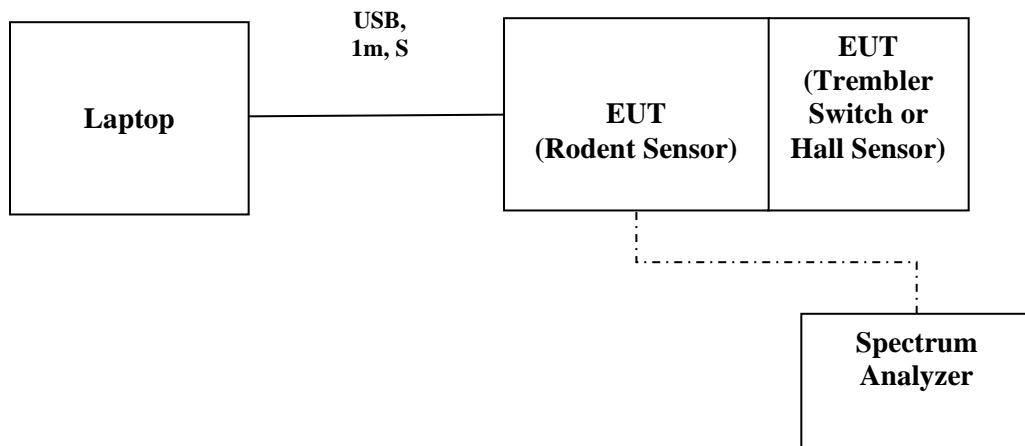
*Only used to configure channels on EUT.

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Bayer U.S. LLC Rodent Sensor	Bayer U.S. LLC	RS V7.X.X	00-80-00-00-04-01-4f-a5 (Radiated)
Bayer U.S. LLC Rodent Sensor	Bayer U.S. LLC	RS V7.X.X	00-80-00-00-04-01-4f-3b (Conducted)
Trembler Switch Probe	Bayer U.S. LLC	V1	N/A
Hall Sensor Probe	Bayer U.S. LLC	V1	N/A

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.

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.

Class II permissive change testing was performed based on a new PCB antenna with a gain of 2.18 dBi.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Bayer U.S. LLC

3.5 Mode of Operation during test

During transmitter testing, the transmitter was setup to transmit at maximum RF power on low, middle and high frequencies/channels.

3.6 Modifications required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Output Power at Antenna Terminals FCC Rule: 15.247(b)(3); RSS-247 A8.4;

4.1.1 Requirements

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.

4.1.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02 was used. Specifically, section 7.8.5 “Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices” in ANSI 63.10

- a) Use the following spectrum analyzer settings:
 1. Span: Approximately five times the 20dB bandwidth, centered on a hopping channel.
 2. RBW > 20 dB bandwidth of the emission being measured.
 3. VBW \geq RBW.
 4. Sweep: Auto.
 5. Detector function: Peak.
 6. Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables

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

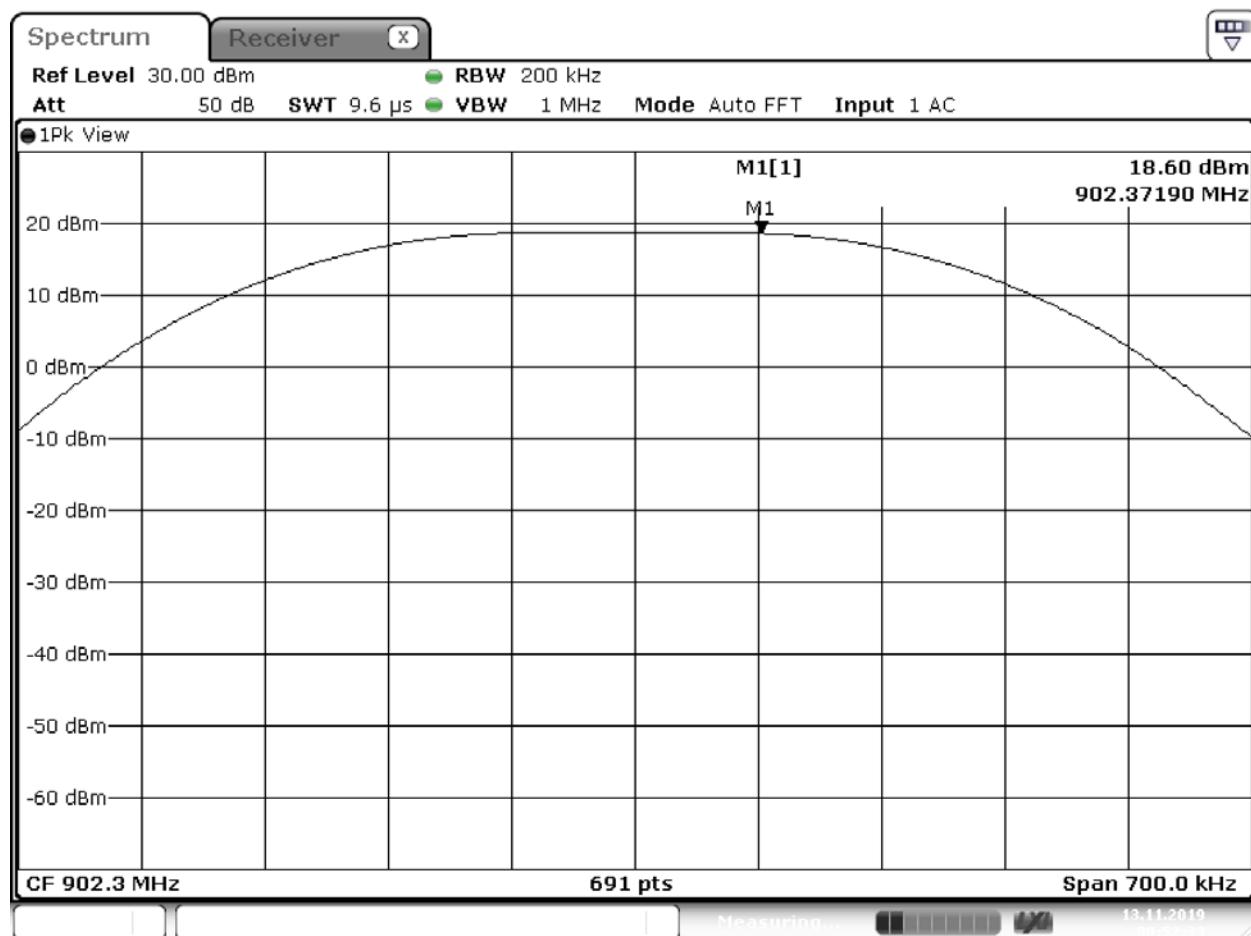
Note: OBW was taken from original report# MLTI0058.1

4.1.3 Test Results

Frequency, MHz	Conducted Power (average), dBm	Conducted Power (average), mW	Plot
902.3	18.60	72.44	2.1
908.7	18.57	71.94	2.2
914.9	18.57	71.94	2.3

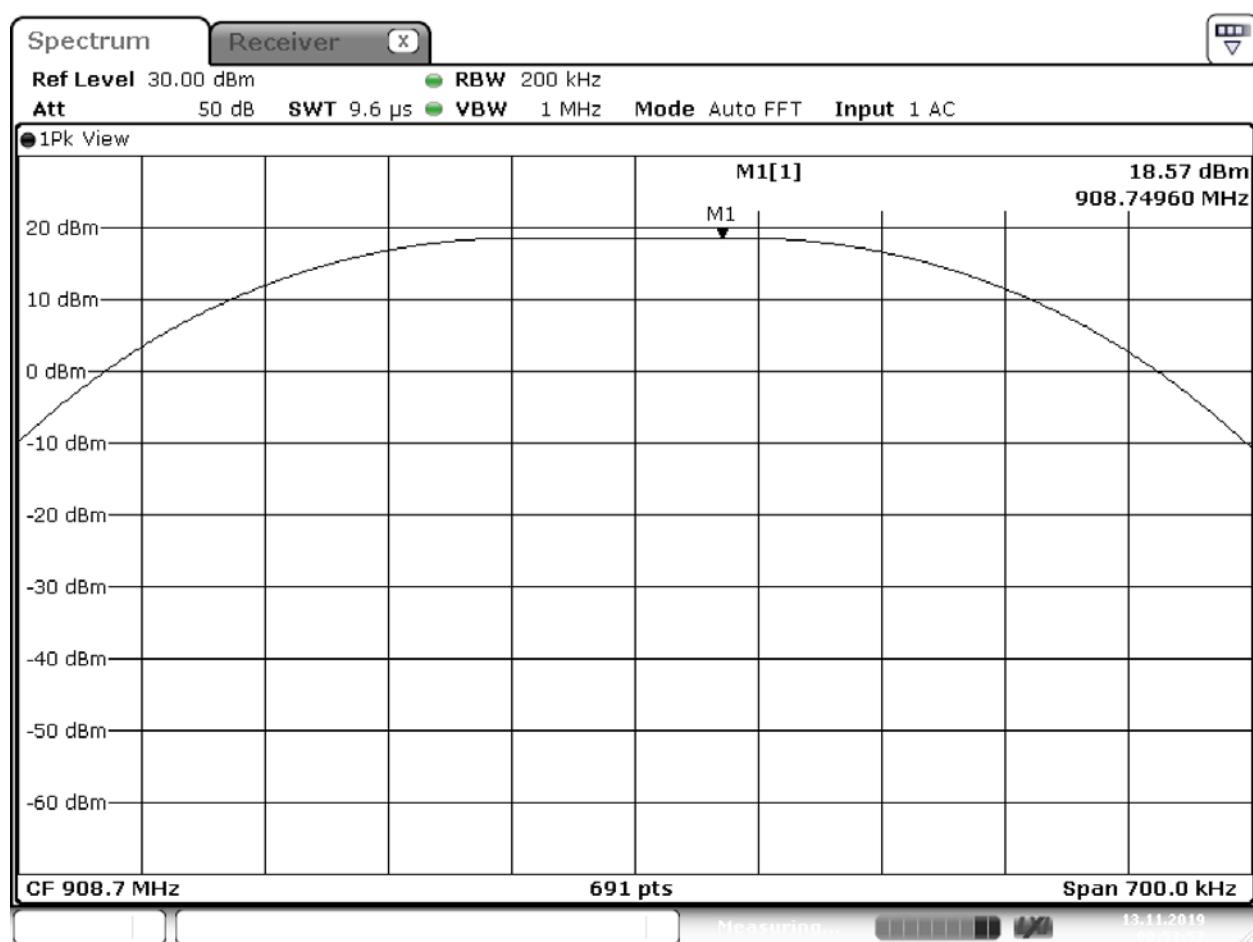
Results	Complies
Test date:	November 5, 2019

Plot 2.1



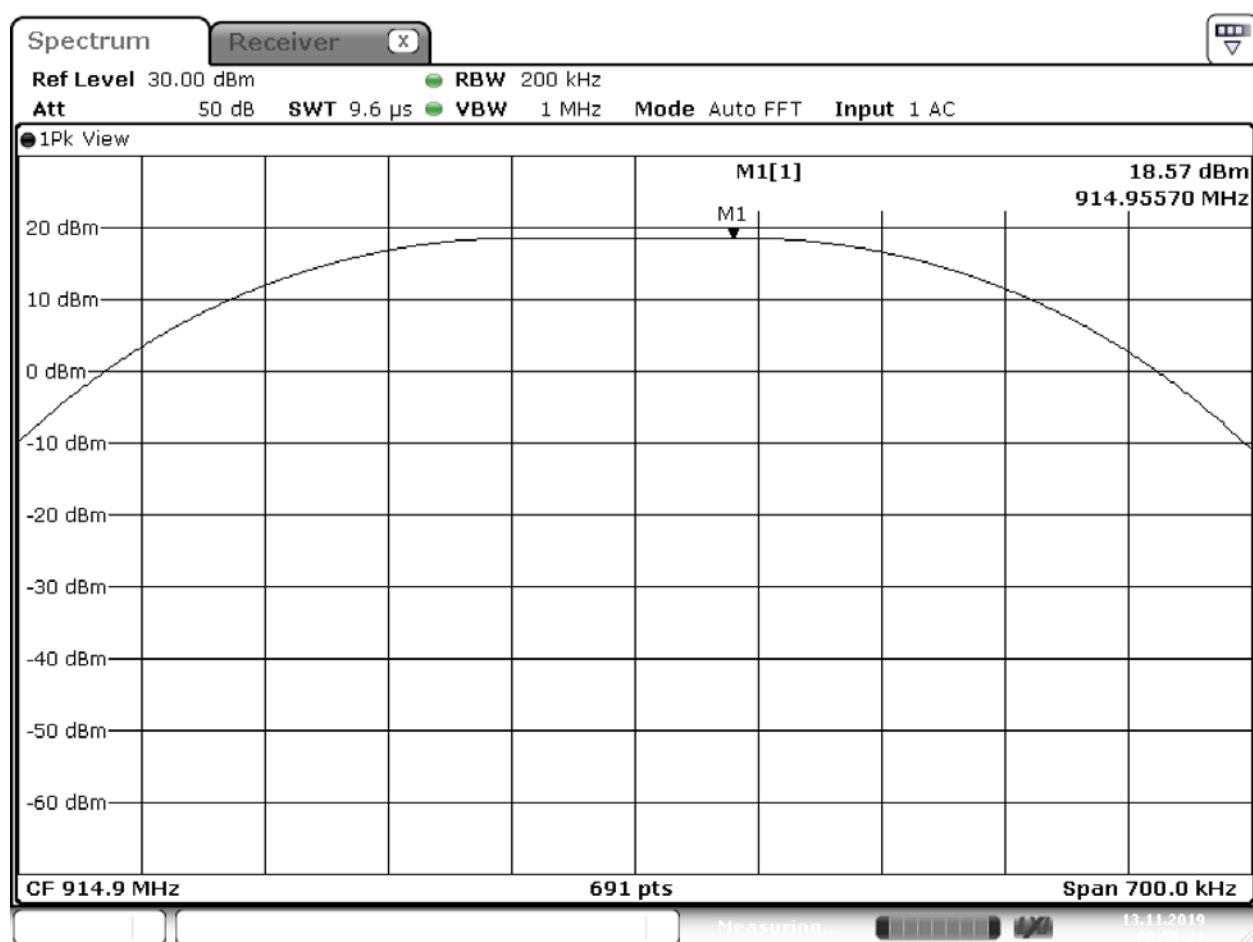
Date: 13.NOV.2019 00:52:34

Plot 2.2



Date: 13.NOV.2019 00:53:58

Plot 2.3



Date: 13.NOV.2019 00:55:22

4.2 Transmitter Radiated Emissions

FCC Rules: 15.247(d), 15.209, 15.205; RSS-247;

4.2.1 Requirements

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.

4.2.2 Procedure

Radiated emission measurements were performed from 30 MHz to 18 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 1 meter for frequencies 1 to 4 GHz, 3 meters for frequencies above 4 GHz and at 10 meters for frequencies below 1 GHz.

A preamp was used from 30 MHz to 1 GHz and 4-18 GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 18GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

4.2.3 Field Strength Calculation

Field Strength Calculation

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

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

Where FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB(μ V); AF = Antenna Factor in dB(1/m)

CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

RA = 52.0 dB(μ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

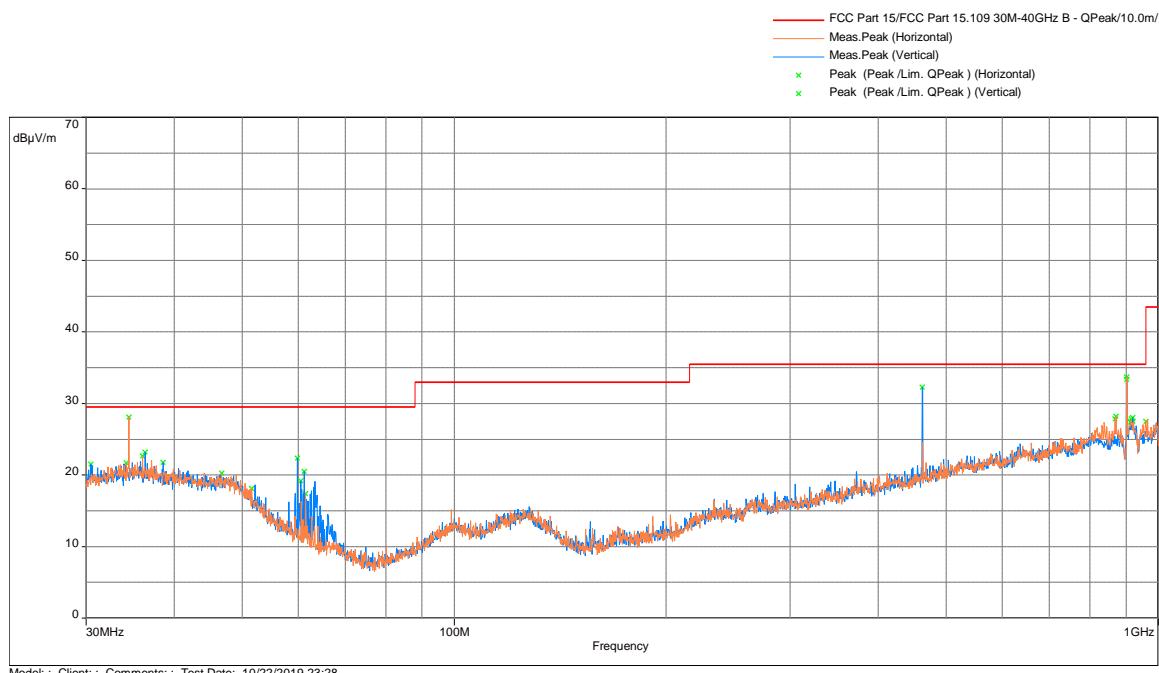
FS = 52.0+7.4+1.6-29.0 = 32 dB(μ V/m).

Level in μ V/m = Common Antilogarithm [(32 dB μ V/m)/20] = 39.8 μ V/m.

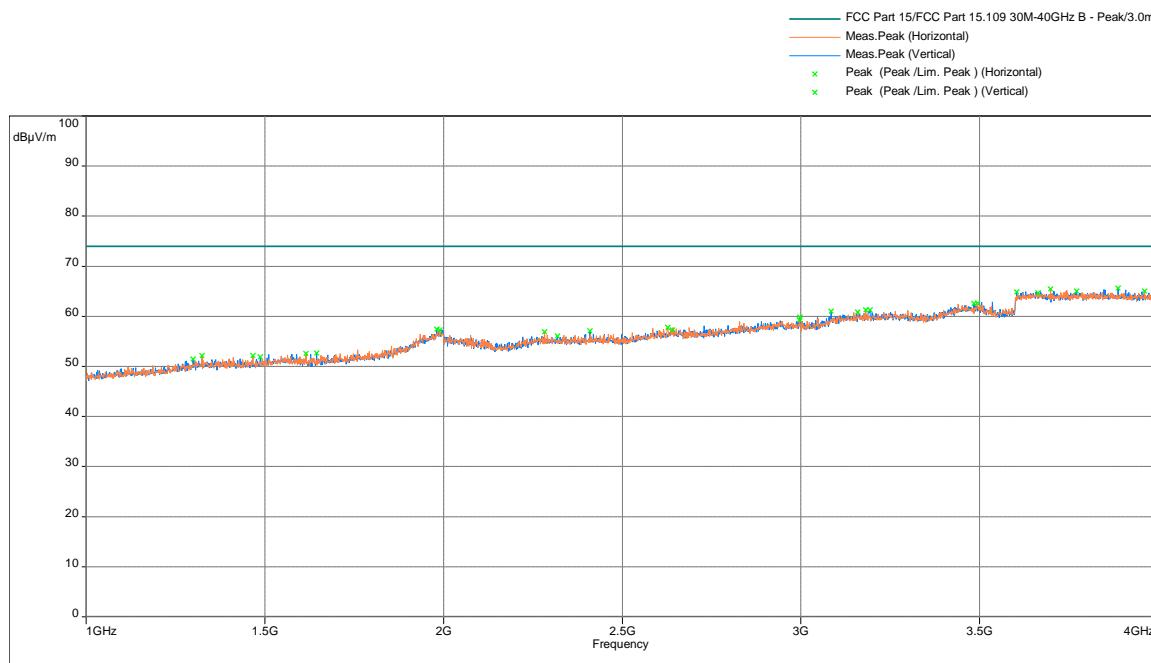
4.2.4 Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance. Note: Measurements were performed at vertical and horizontal orientations of EUT.

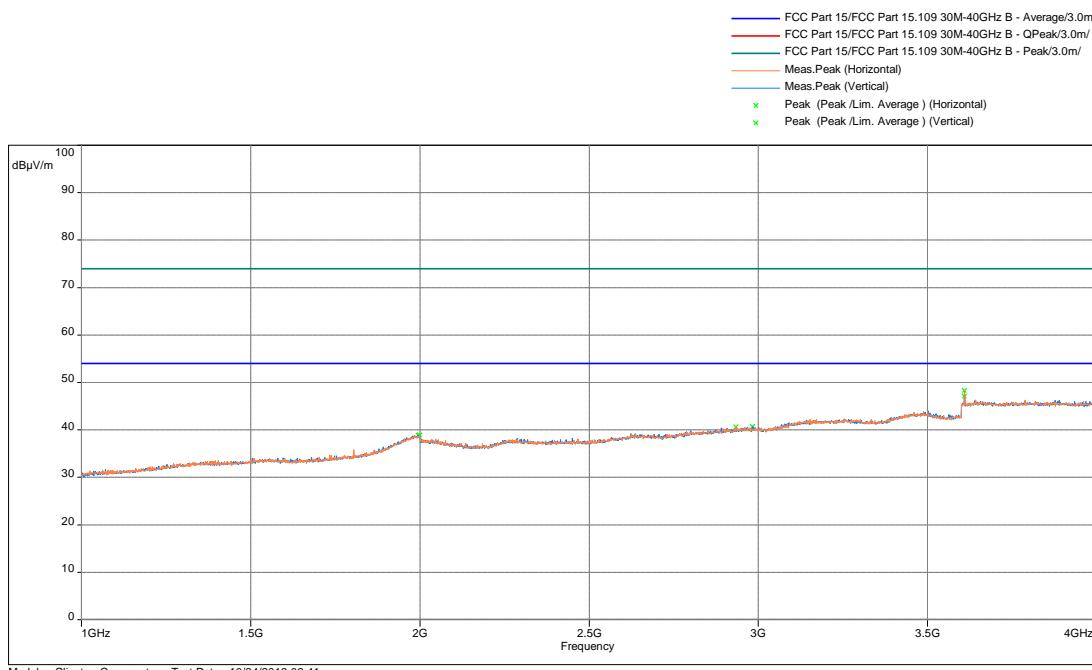
15.209 Radiated Spurious Emissions Low Channel, Tx at 902.3 MHz
EUT with Hall Sensor



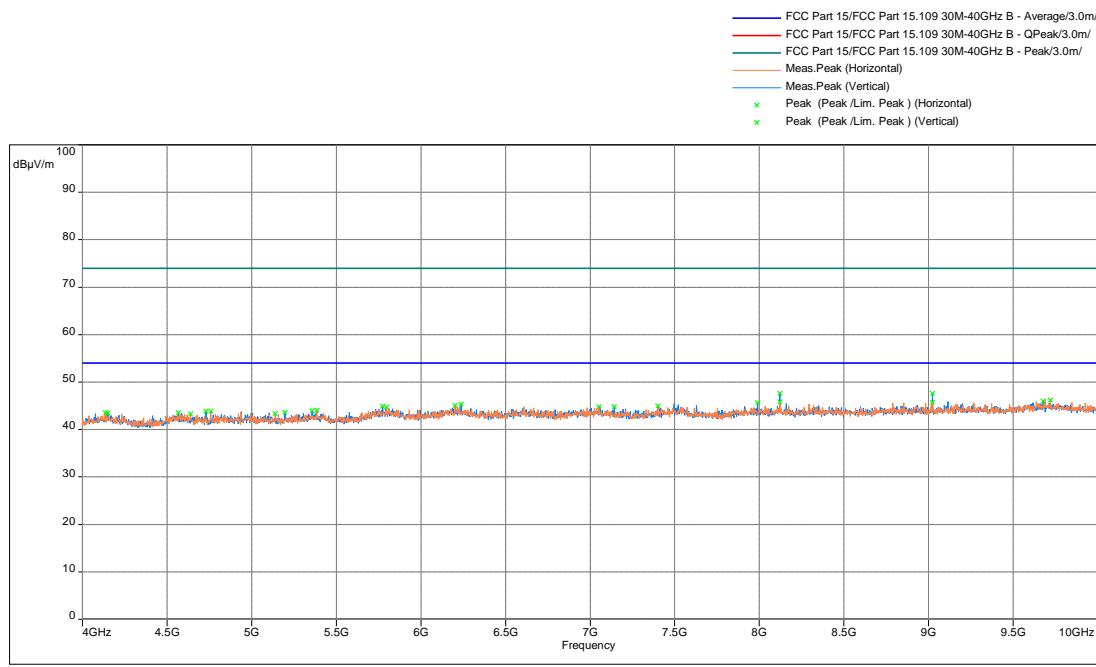
Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
34.36	15.46	29.5	-14.03	344.25	1.32	Horizontal	-6.2

Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit

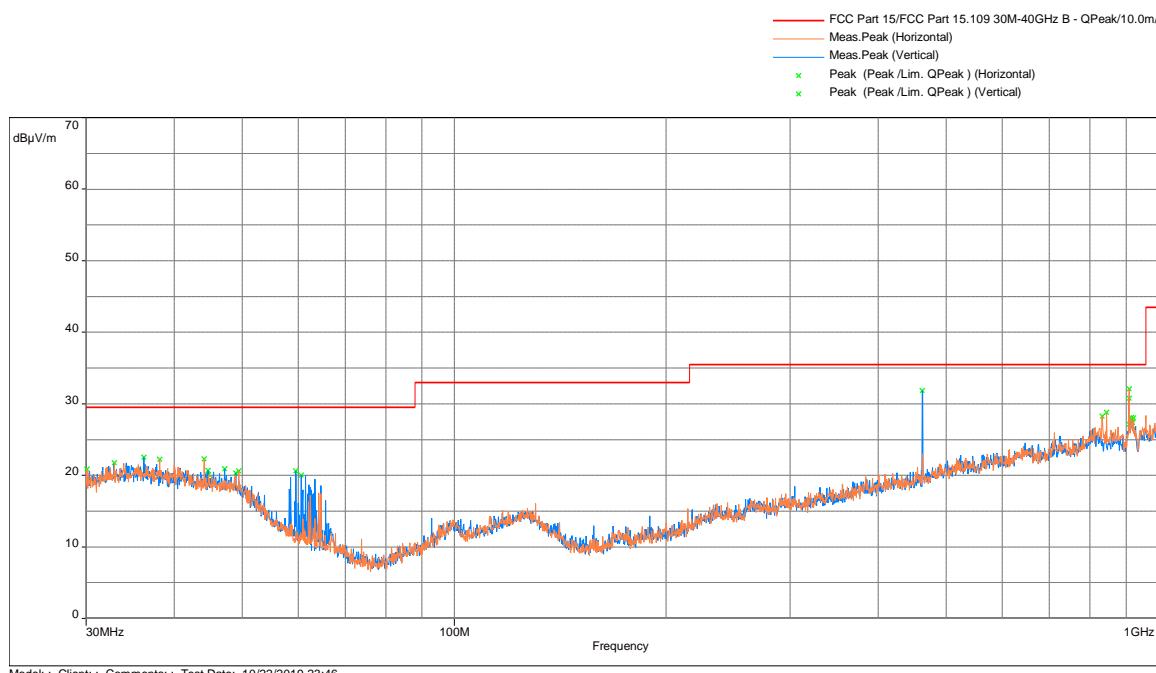


Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3609.3	48.29	54	-5.71	1.52	290.5	Horizontal	25.71
2983	40.67	54	-13.33	1.51	359.75	Vertical polarization	23.79

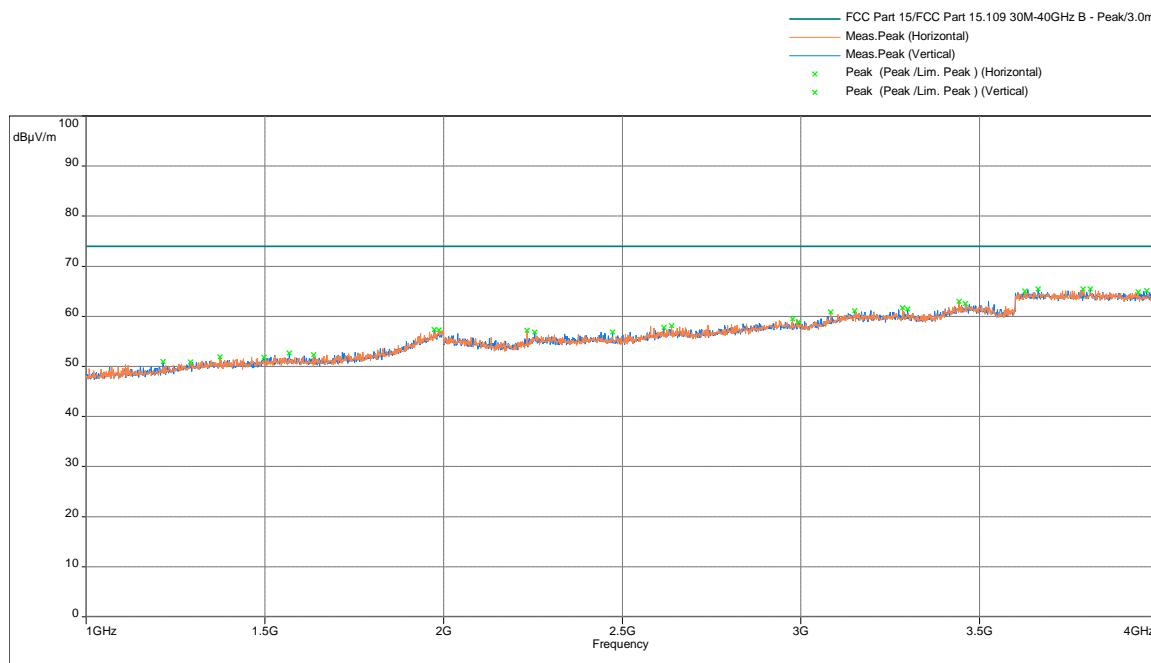
Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit

Model: ; Client: ; Comments: ; Test Date: 10/24/2019 00:52

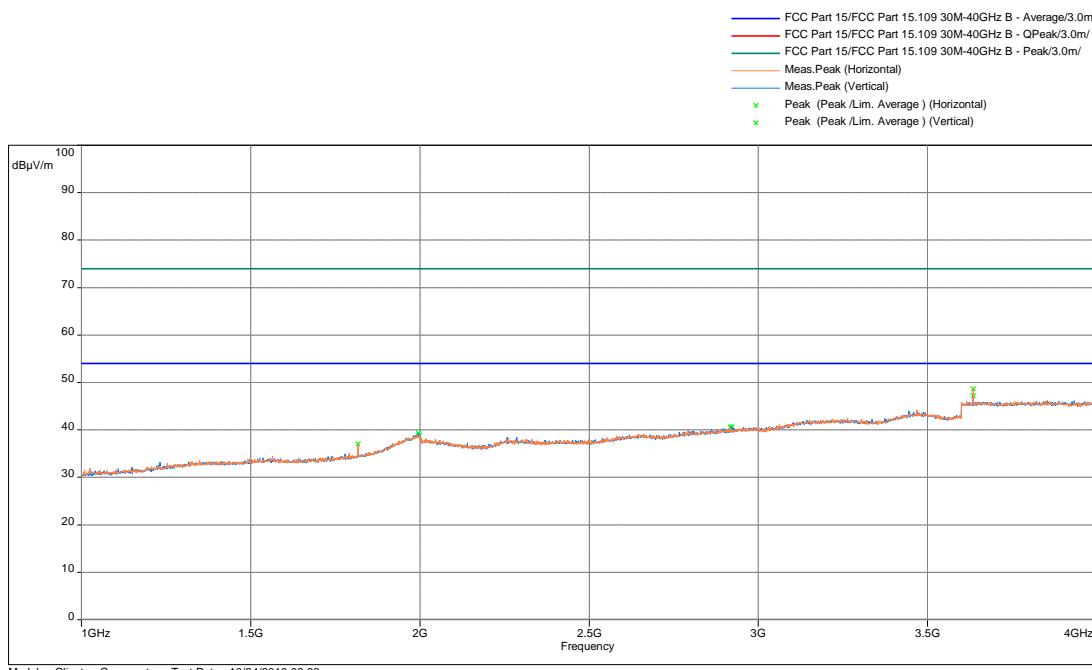
**15.209 Radiated Spurious Emissions Mid Channel, Tx at 908.7 MHz
EUT with Hall Sensor**



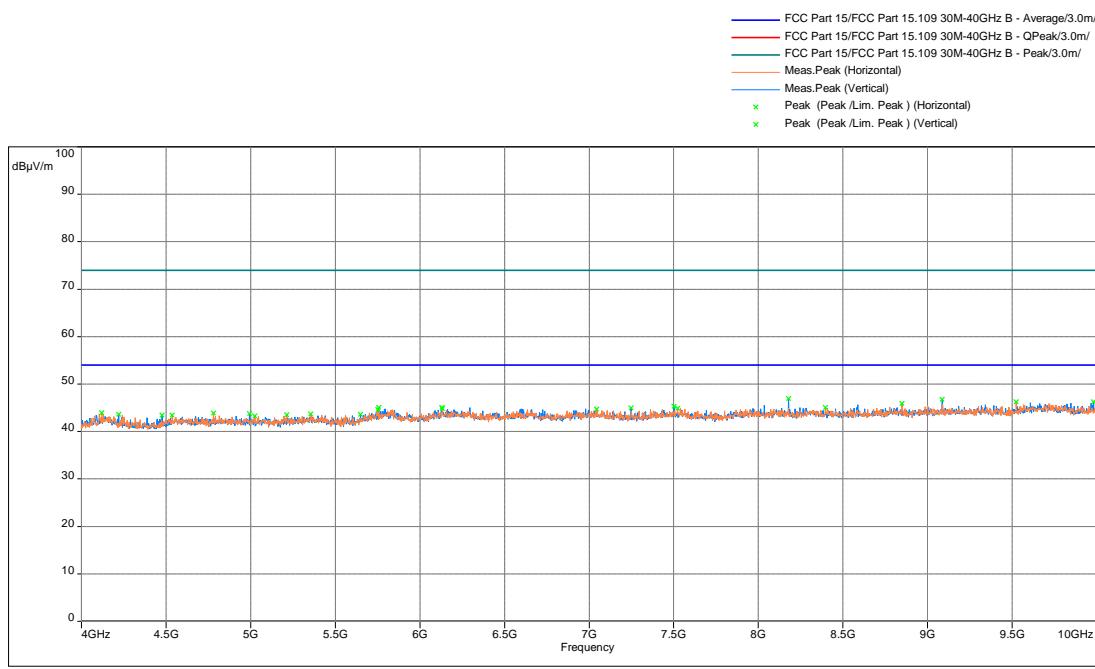
Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
462.393	32.0	35.5	-3.5	175.5	1.0	Vertical	-6.2

Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit

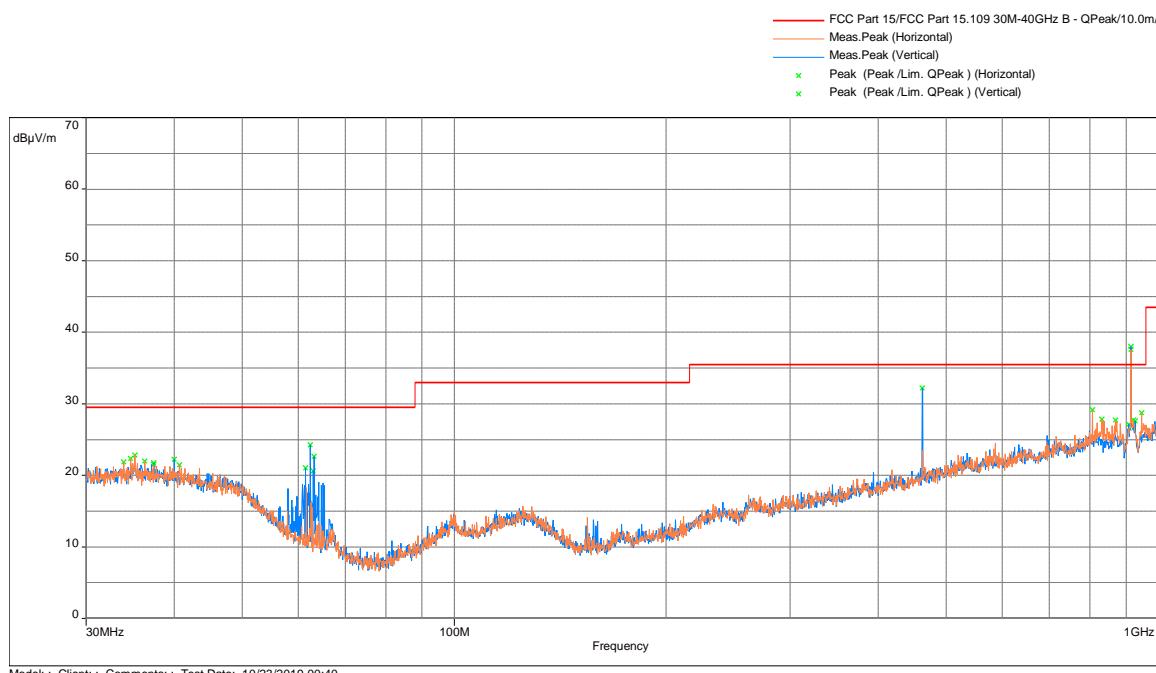


Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3634.9	48.68	54	-5.32	1.48	325.5	Horizontal	25.79
2922	40.66	54	-13.34	1.99	359.75	Vertical	23.45

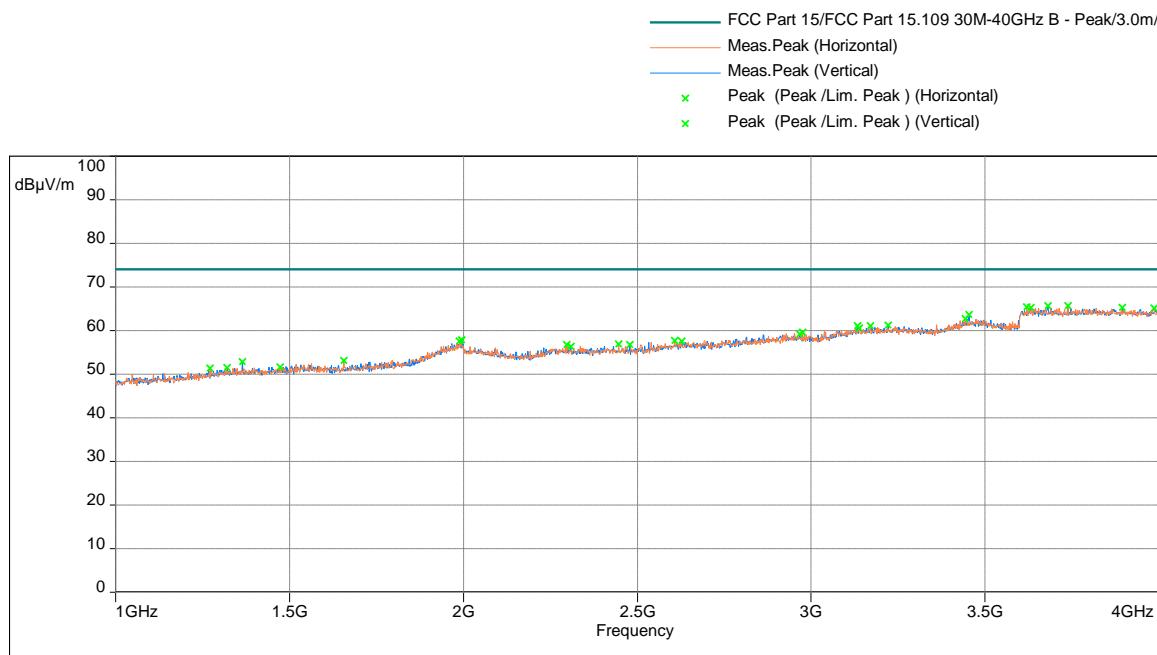
Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit

Model: ; Client: ; Comments: ; Test Date: 10/24/2019 01:03

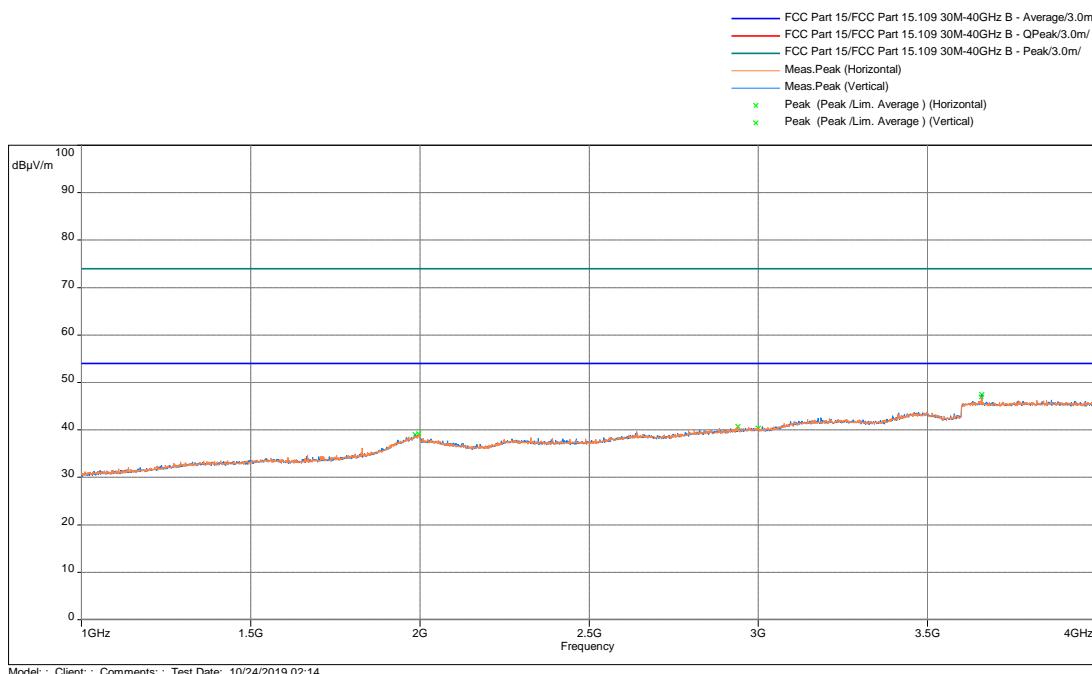
**15.209 Radiated Spurious Emissions High Channel, Tx at 914.9 MHz
EUT with Hall Sensor**



Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
462.393	32.18	35.5	-3.32	175.5	1.0	Vertical	-6.2

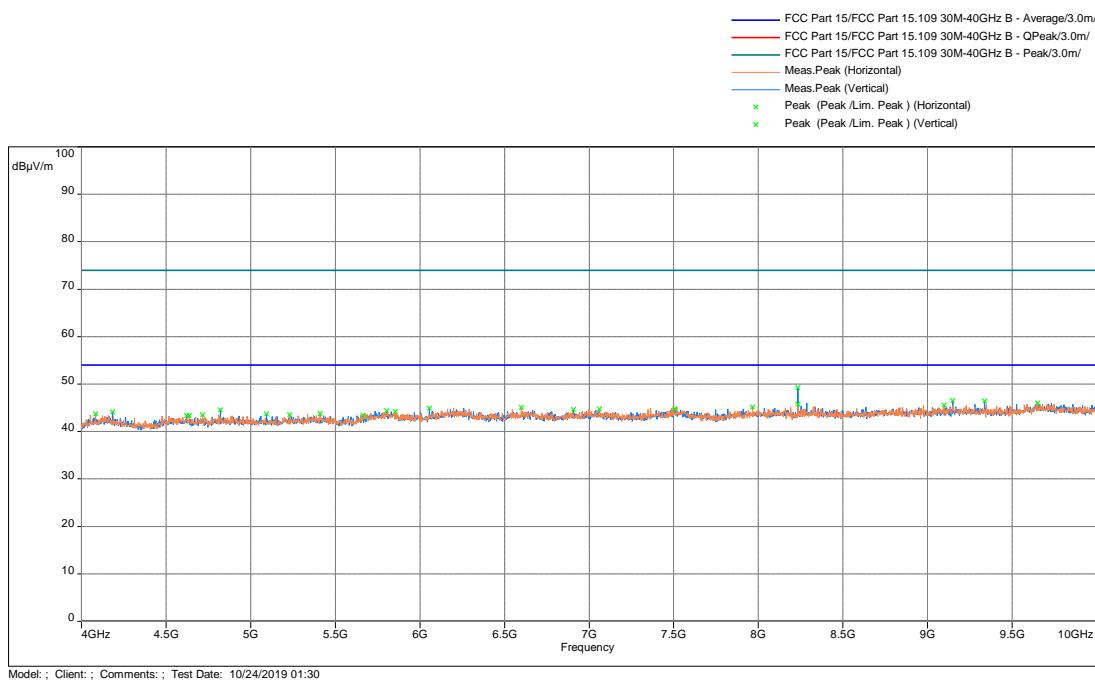
Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit



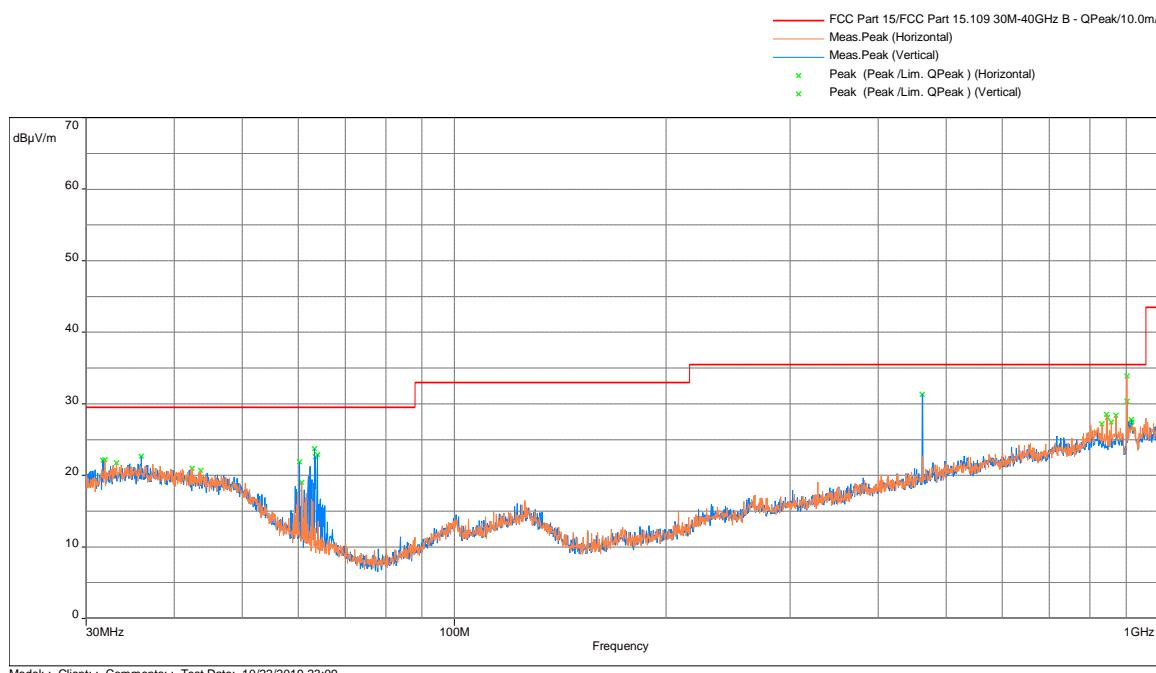
Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3659.8	47.44	54	-6.56	1.01	325	Vertical	25.87
2940.1	40.72	54	-13.28	1.48	140	Horizontal	23.54

Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit

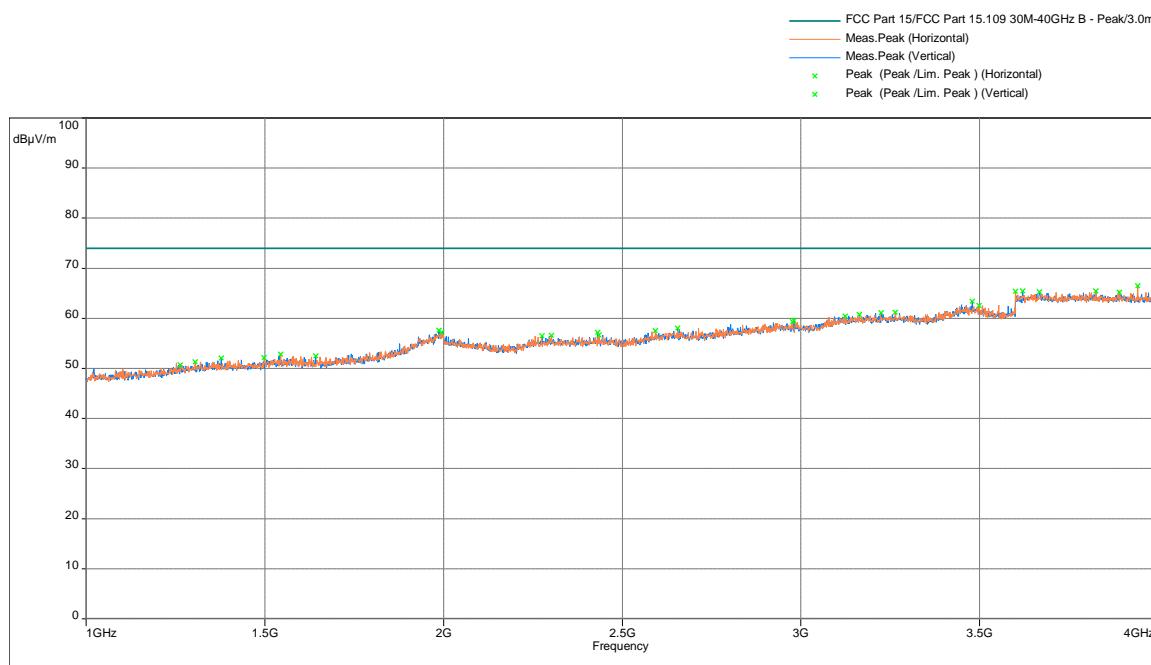


Frequency (MHz)	Peak@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
8234	49.28	54	-4.72	1.01	250.25	Vertical	-4.65

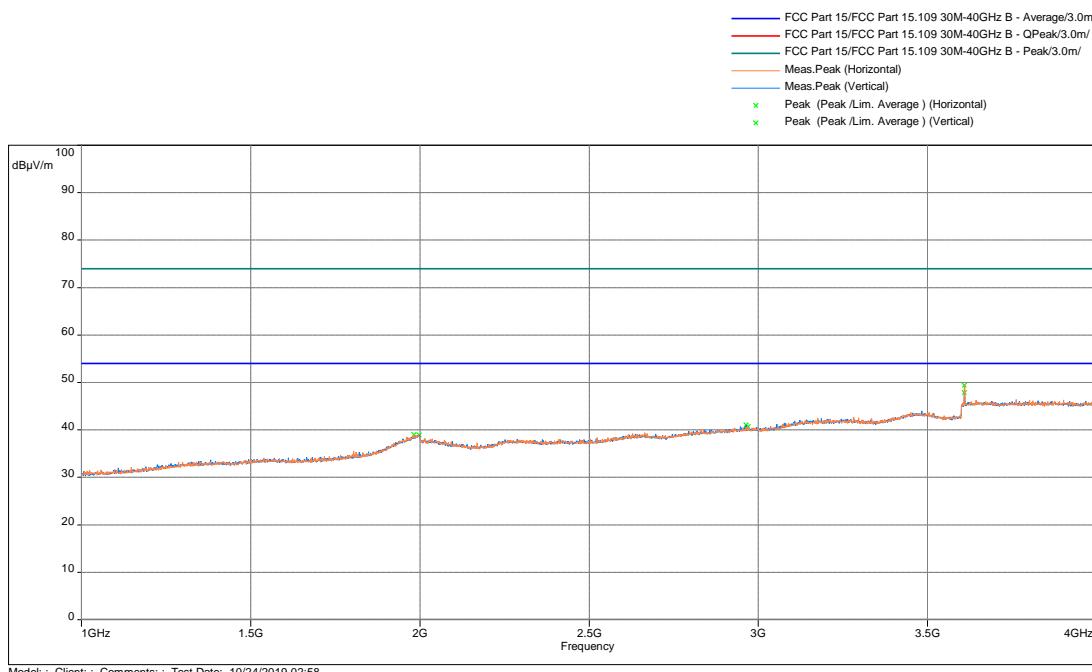
15.209 Radiated Spurious Emissions Low Channel, Tx at 902.3 MHz
EUT with Trembler Switch



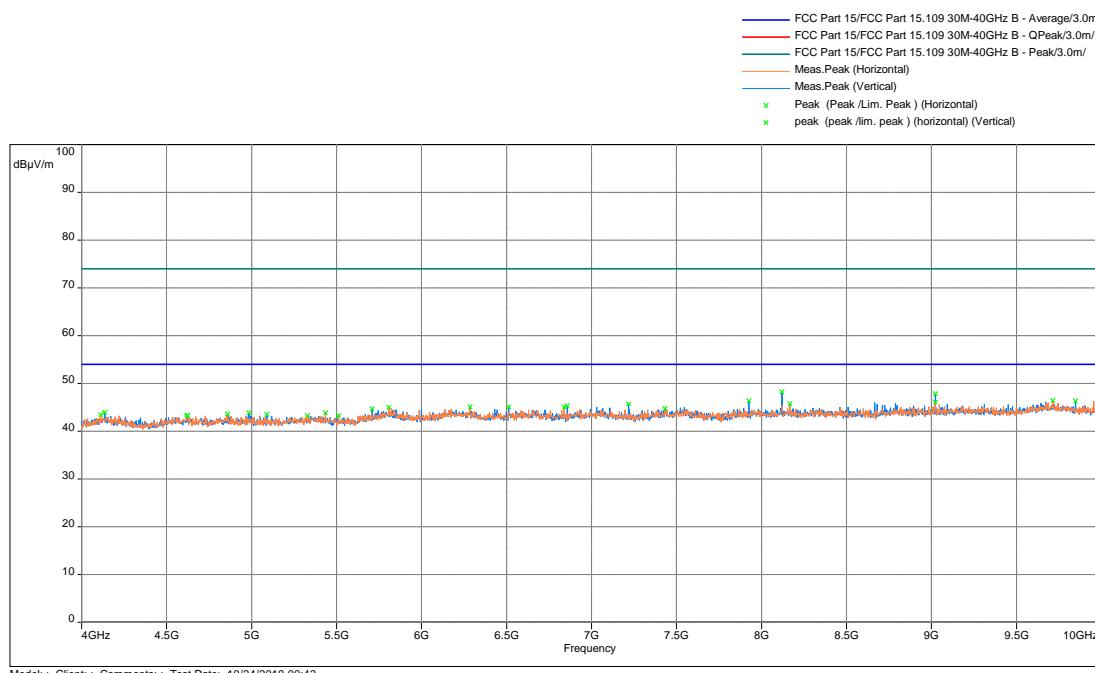
Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
462.393	31.98	35.5	-3.52	175.5	1.0	Vertical	-6.2

Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit

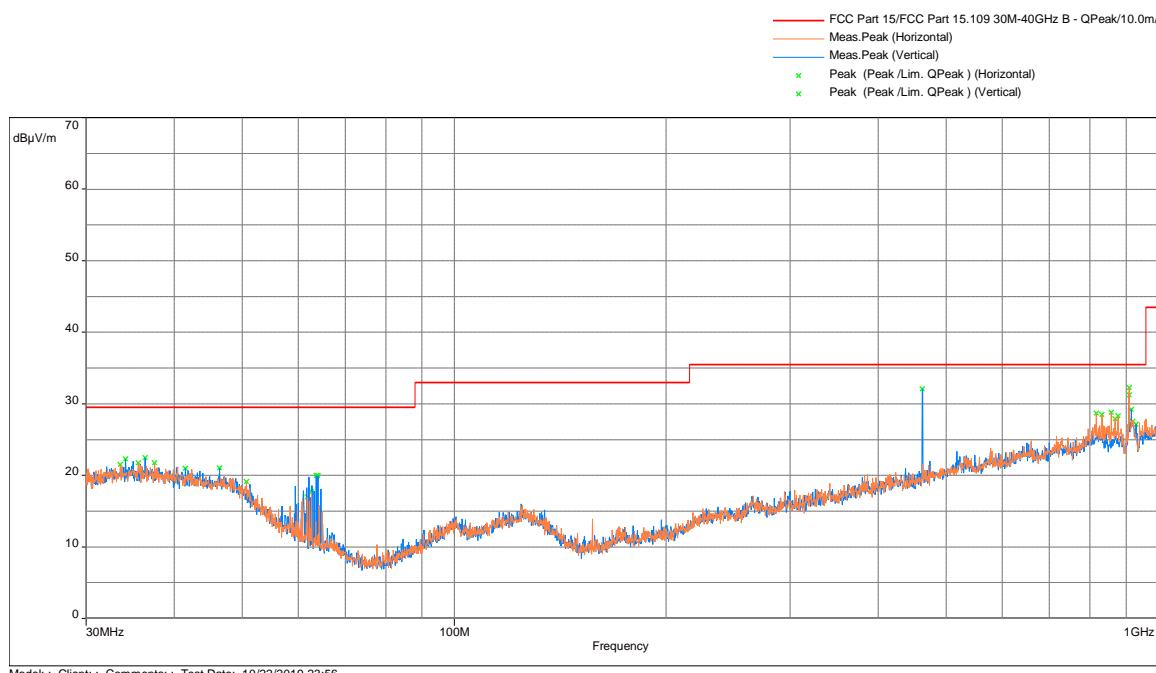


Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3609.3	49.43	54	-4.57	1.48	323.5	Horizontal	25.71
2963.3	41.07	54	-12.93	1.01	351.25	Vertical polarization	23.67

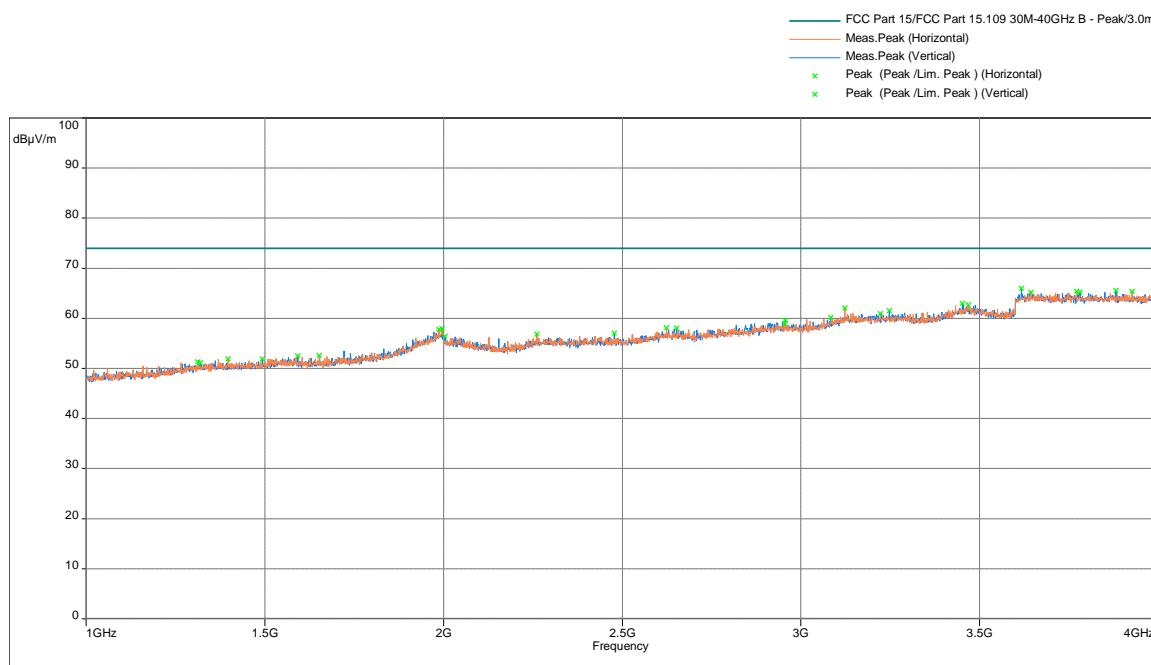
Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit

Model: ; Client: ; Comments: ; Test Date: 10/24/2019 00:43

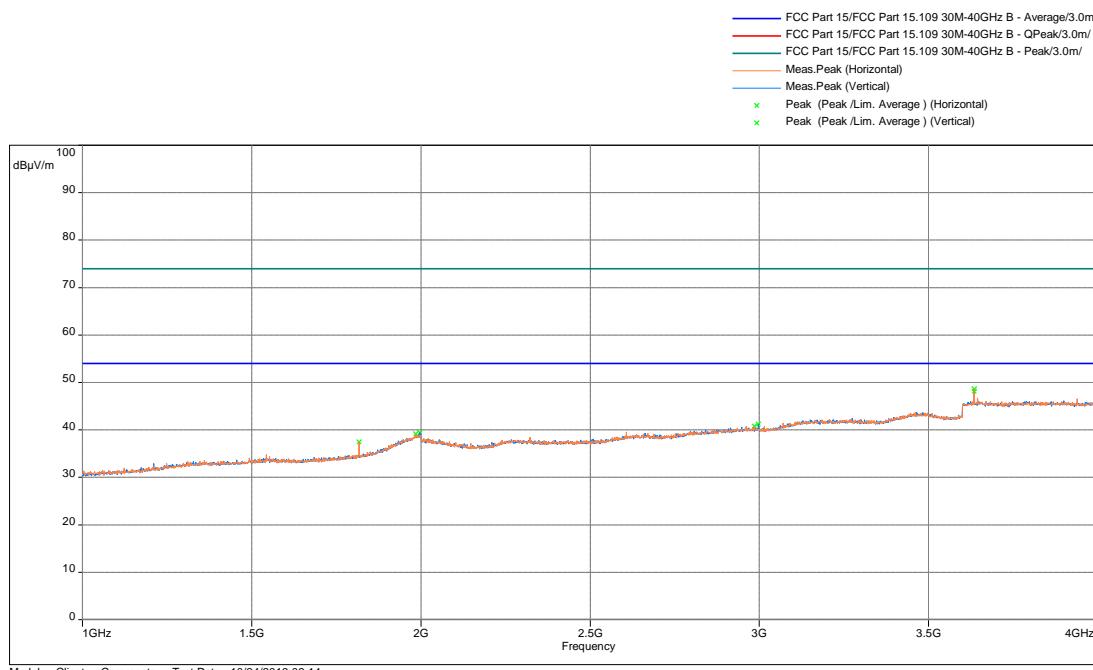
15.209 Radiated Spurious Emissions Mid Channel, Tx at 908.7 MHz
EUT with Trembler Switch



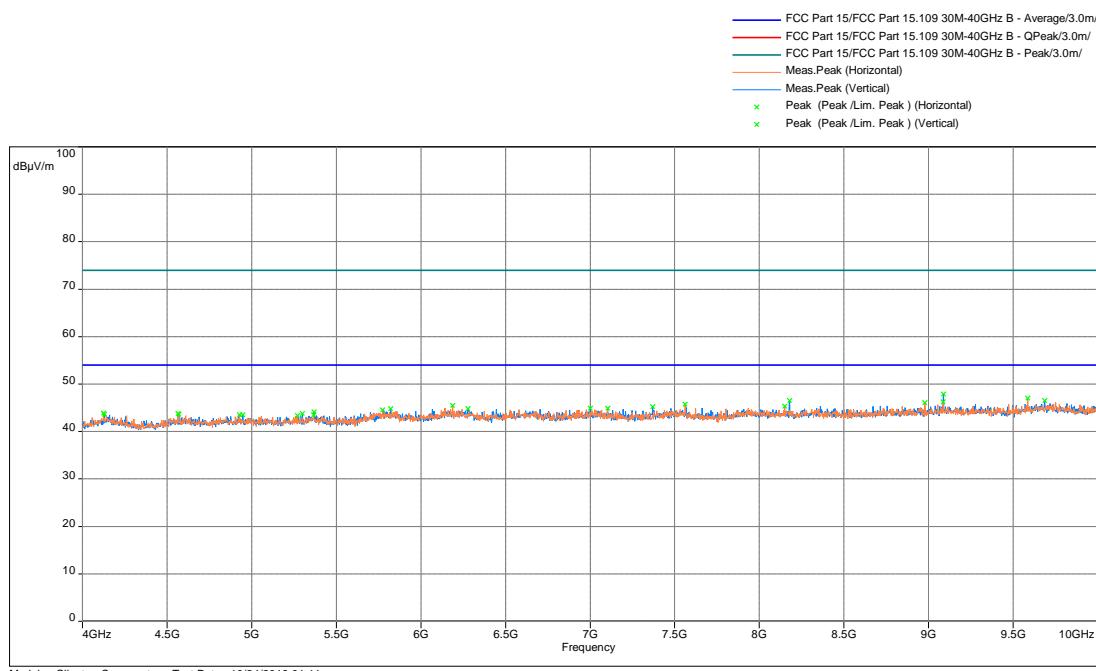
Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
462.393	32.06	35.5	-3.44	175.5	1.0	Vertical	-6.2

Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit

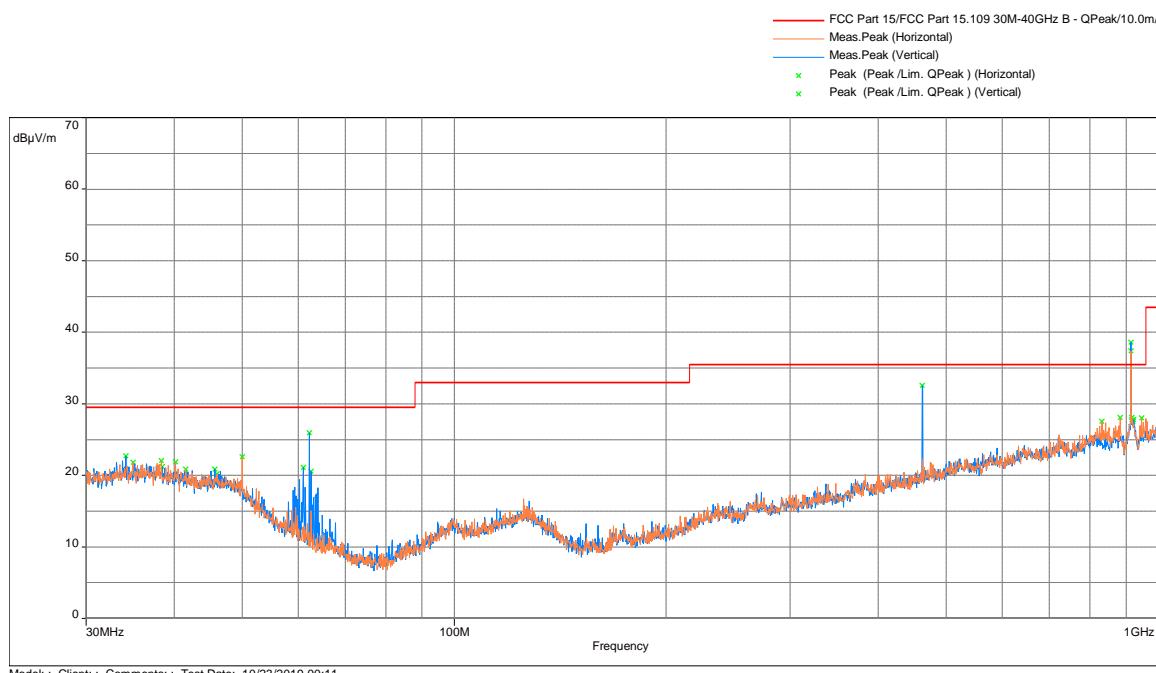


Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3634.6	48.68	54	-5.32	1.52	326	Horizontal polarization	25.79
2997.8	41.18	54	-12.82	1.01	17.25	Vertical polarization	23.88

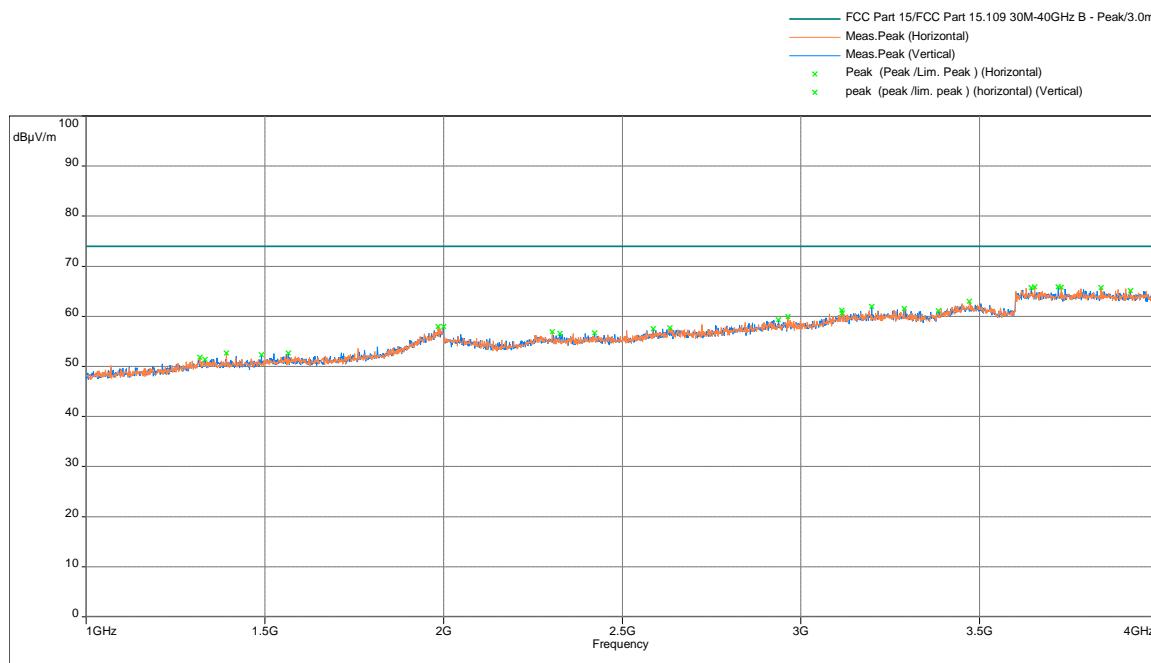
Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit

Model: ; Client: ; Comments: ; Test Date: 10/24/2019 01:11

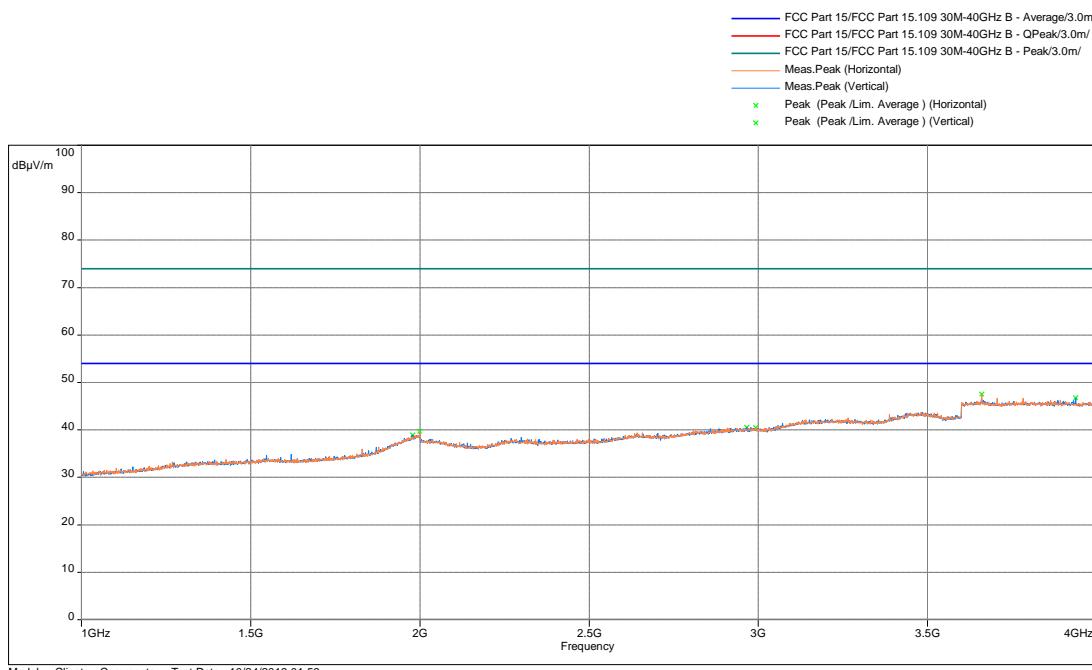
15.209 Radiated Spurious Emissions High Channel, Tx at 914.9 MHz
EUT with Trembler Switch



Frequency (MHz)	QPeak@10m dB(μV/m)	Lim. QPeak dB(μV/m)	Margin (dB)	Angle (°)	Height (m)	Antenna Polarization	Correction (dB)
462.394	32.53	35.5	-2.97	0	1.0	Vertical	-6.2

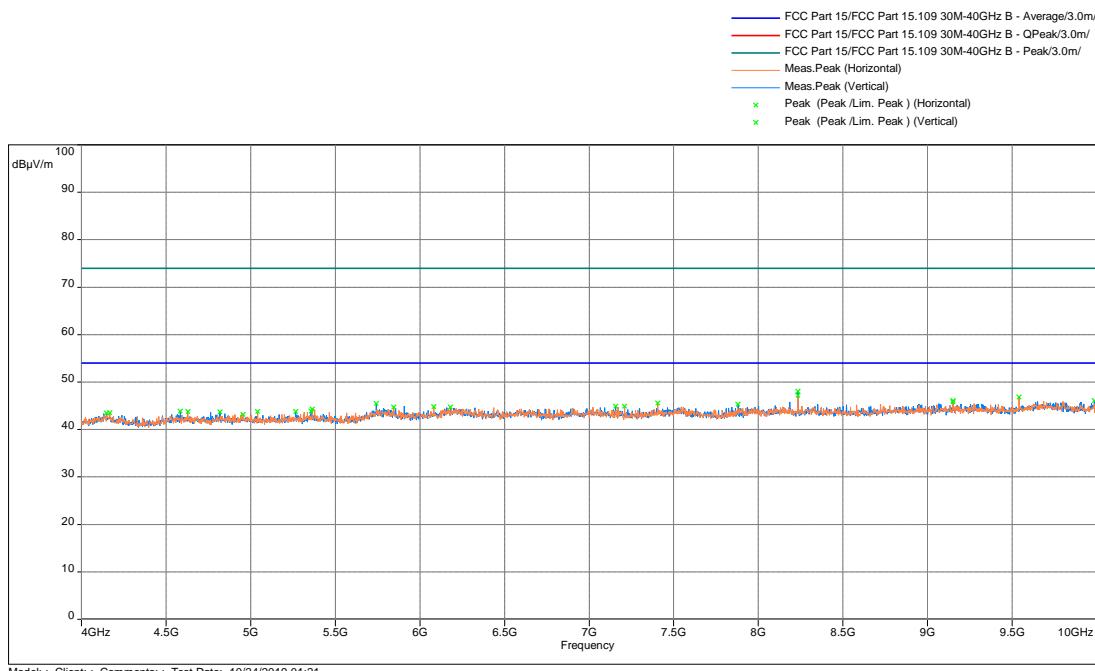
Radiated Spurious Emissions 1000 - 4000 MHz, Peak Scan vs Peak Limit

Radiated Spurious Emissions 1000 - 4000 MHz, Average Scan vs Average Limit



Frequency (MHz)	Avg@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
3659.5	48.29	54	-5.71	1.52	140.75	Horizontal	25.87
2995.7	40.6	54	-13.4	1.99	0	Vertical	23.86

Radiated Spurious Emissions 4000 - 18000 MHz, Peak Scan vs Avg Limit



Frequency (MHz)	Peak@3m dB(μV/m)	Lim. Avg dB(μV/m)	Margin (dB)	Height (m)	Angle (°)	Antenna Polarization	Correction (dB)
8234.2	48.08	54	-5.92	1.49	252.25	Vertical	-4.64

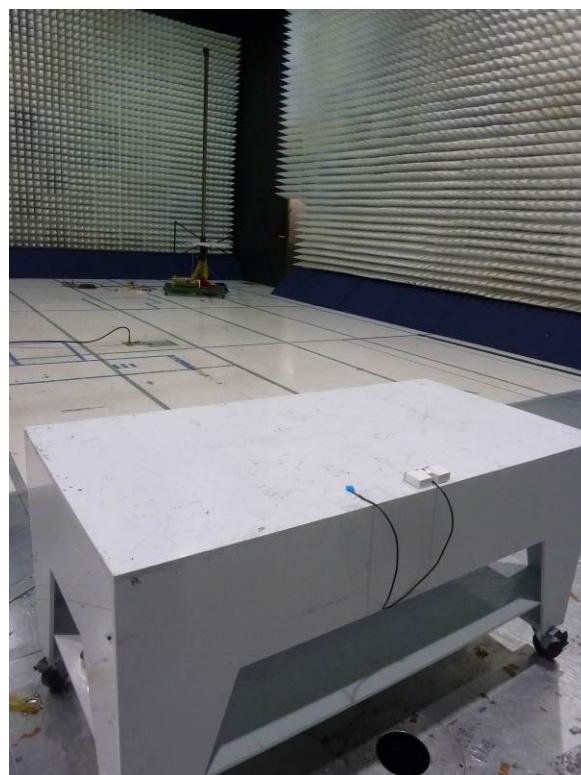
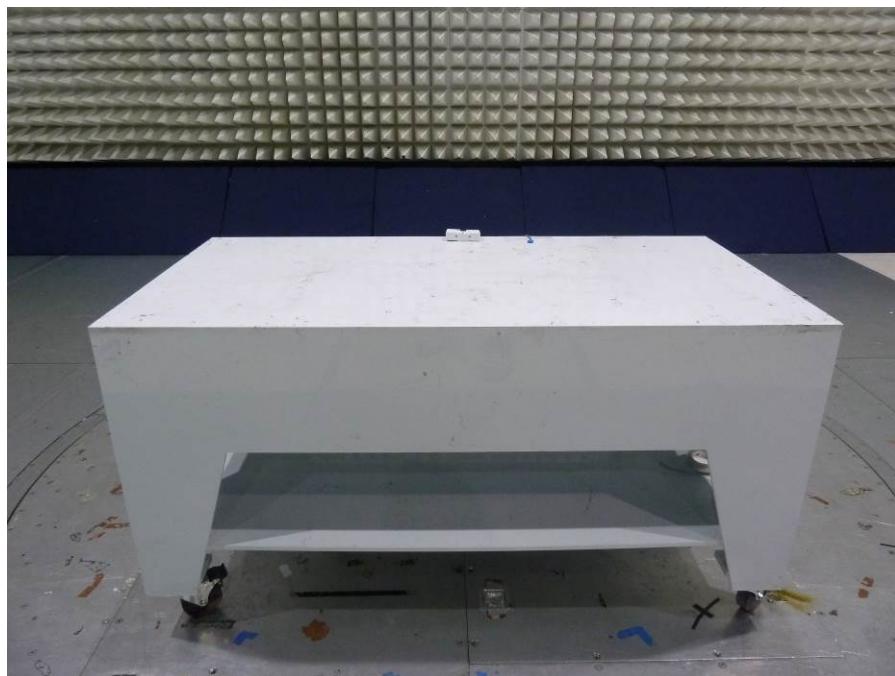
Results	Complies
Test date:	October 24, 2019

4.2.5 Test Configuration Photographs

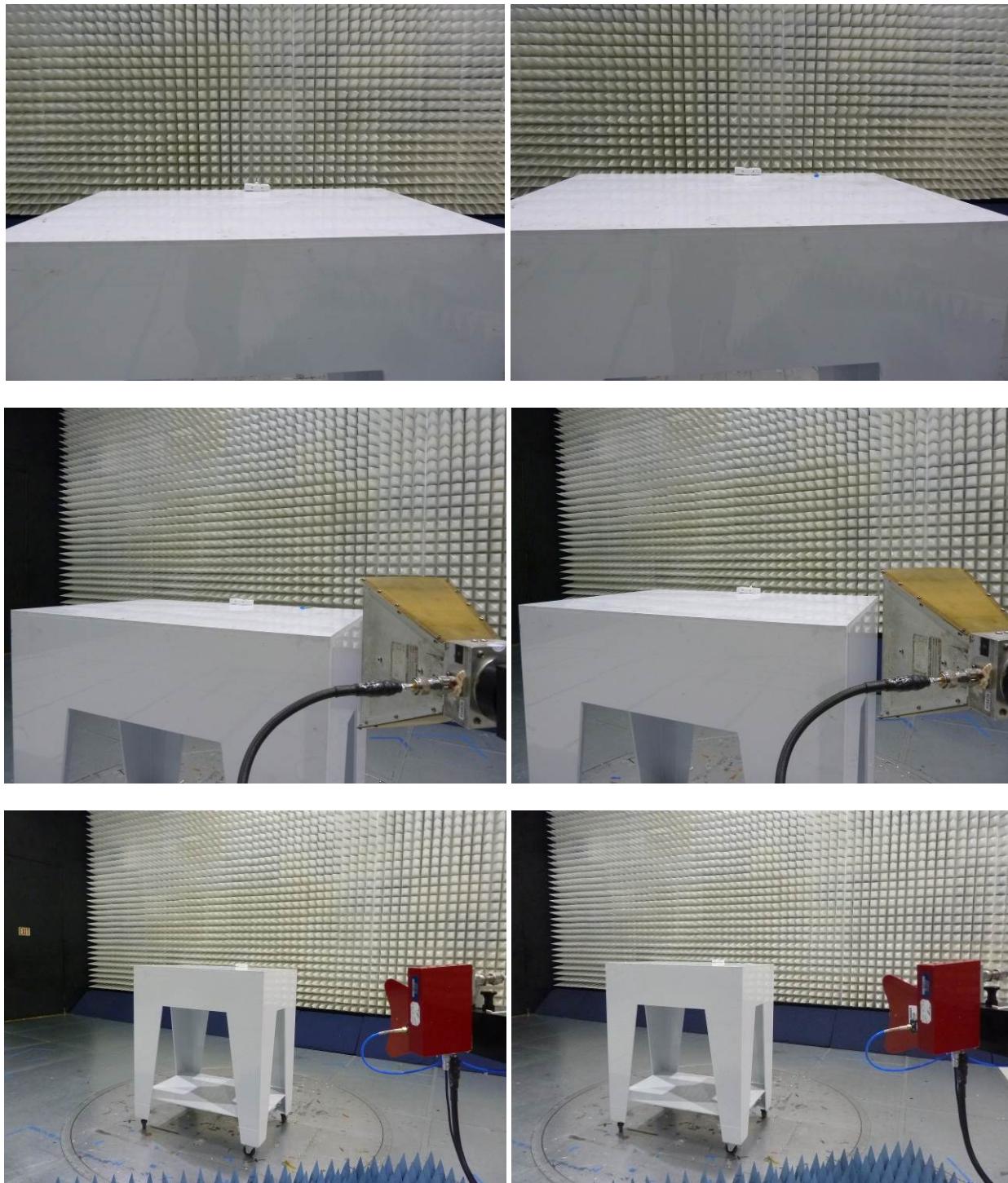
The following photographs show the testing configurations used.



4.2.5 Test Configuration Photographs (Continued)



4.2.5 Test Configuration Photographs (Continued)



4.3 AC Line Conducted Emission
FCC Rule 15.107/15.207

4.3.1 Requirement

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

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

4.3.2 Procedure

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

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

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

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

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

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

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

EUT was placed in transmission mode then tested for conducted emissions per 15.207 and 15.107.

4.3.3 Test Result

Not Applicable. EUT is battery powered.

5.0 List of test equipment

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

Equipment	Manufacturer	Model/Type	Serial No.	Calibration Interval	Cal Due
EMI Receiver	Rohde and Schwarz	ESR	ITS 01607	12	10/23/20
EMI Receiver	Rohde and Schwarz	ESU40	ITS 01375	12	6/12/20
Bi-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/20
Pre-Amplifier	Sonoma Instrument	310N	ITS 00415	12	04/17/20
Active Horn Antenna	ETS Lindgren	3117-PA	ITS 01636	12	01/17/20
Horn Antenna	EMCO	3115	ITS 001595	12	03/06/20
Notch Filter	Micro-Tronics	BRC50722	ITS 01170	12	03/18/20
High Pass Filter	Reactel	7HS-4-18 S11	ITS 01171	12	02/15/20

* Calibration performed by ITS prior to the test. # Calibration not required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.16.0.64	Connected_Development 10-22-2019.bat

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G104122920	AC	KV	November 13, 2019	Original document

END OF REPORT