

TEST REPORT

Report Number: 103993771MPK-001
Project Number: G103993771
October 25, 2019

Testing performed on
TrueTear 2.0 System
Model(s): F-0071

consists of
TrueTear 2.0 Base Unit, Model: F-0072 and
TrueTear 2.0 Charger Case, Model: F-0073

FCC ID: 2AUA2-OCUTT20

to

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247 Issue 2
FCC Part 15, Subpart B
Industry Canada ICES-003

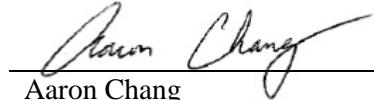
For

Allergan PLC

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

Test Authorized by:
Allergan PLC
4410 Rosewood Drive
Pleasanton, CA 94588 USA

Prepared by:


Aaron Chang

Date: October 25, 2019

Reviewed by:


Krishna K Vemuri

Date: October 25, 2019

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

Report No. 103993771MPK-001

Equipment Under Test:	TrueTear 2.0 System
Trade Name:	Allergan PLC
Model Tested Number:	F-0071 consists of TrueTear 2.0 Base Unit, Model: F-0072 and TrueTear 2.0 Charger Case, Model: F-0073
Applicant:	Allergan PLC
Contact:	Jarren Baldwin
Address:	Allergan PLC 4410 Rosewood Drive Pleasanton, CA 94588 USA
Country:	USA
Tel. Number:	(415) 580-6177
Email:	Jarren.baldwin@allergan.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2 FCC Part 15, Subpart B Industry Canada ICES-003 Issue 6
Date of Test:	October 8 – 16, 2019

We attest to the accuracy of this report:


 Aaron Chang
 Project Engineer


 Krishna K Vemuri
 Engineering Team Lead

TABLE OF CONTENTS

1.0	Summary of Tests	4
2.0	General Information.....	5
2.1	Product Description	5
2.2	Related Submittal(s) Grants.....	6
2.3	Test Facility	6
2.4	Test Methodology	6
2.5	Measurement Uncertainty.....	6
3.0	System Test Configuration.....	7
3.1	Support Equipment	7
3.2	Block Diagram of Test Setup.....	7
3.3	Justification.....	8
3.4	Software Exercise Program.....	8
3.5	Mode of Operation during Test.....	8
3.6	Modifications Required for Compliance	8
3.7	Additions, Deviations and Exclusions from Standards.....	8
4.0	Measurement Results.....	9
4.1	6-dB Bandwidth and 99% Occupied Bandwidth	9
4.2	Maximum Peak Conducted Output Power at Antenna Terminals	23
4.3	Maximum Power Spectral Density	31
4.4	Out of Band Antenna Conducted Emission	39
4.5	Transmitter Radiated Emissions	49
4.6	Radiated Emissions on Digital Parts.....	72
4.7	AC Line Conducted Emission	79
5.0	List of Test Equipment	83
6.0	Document History	84

1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
RF Output Power	15.247(b)(3)	RSS-247, 5.4.d)	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.a)	Complies
Power Density	15.247(e)	RSS-247, 5.2.b)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)
Radiated Emissions	15.109	ICES-003	Complies
AC Line Conducted Emission	15.107	ICES-003	Complies

EUT receive date: October 8, 2019

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: October 8, 2019

Test completion date: October 16, 2019

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

2.0 General Information

2.1 Product Description

Allergan PLC supplied the following description of the EUT:

The TrueTear 2.0 System is an Intranasal Tear Neurostimulator. The F-0071 is the complete system which includes F-0072 - TrueTear 2.0 Base Unit and F-0073 - TrueTear 2.0 Charger Case.

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

Information about the 2.4 GHz radio is presented below:

Applicant	Allergan PLC
Model Tested No.	F-0071 consists of F-0072 & F-0073
FCC Identifier	2AUA2-OCUTT20
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	3.73 dBm
Antenna(s) & Gain	Internal Antenna, Peak Gain: -2 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK 1MB/s
Number of Channel(s)	40, Channel 0-39
Applicant Name & Address	Allergan PLC 4410 Rosewood Drive Pleasanton, CA 94588 USA

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

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

2.4 Test Methodology

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

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

2.5 Measurement Uncertainty

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

Estimated Measurement Uncertainty

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

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

3.0 System Test Configuration

3.1 Support Equipment

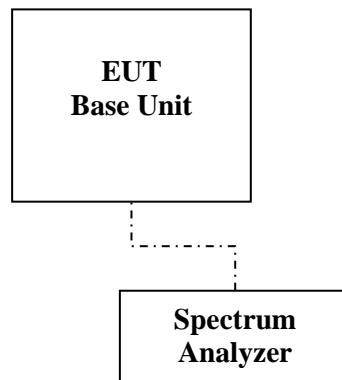
No Support Equipment was used for testing.

3.2 Block Diagram of Test Setup

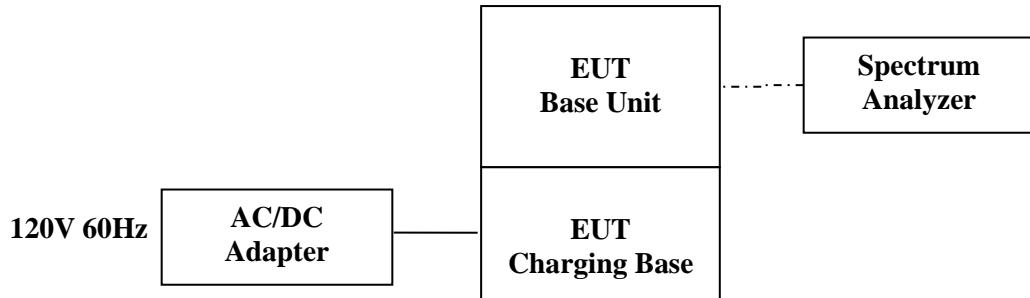
Equipment Under Test			
Description	Manufacturer	Model	Serial Number
Conducted Sample	Allergan PLC	F-0072	B0002828
Charging Base	Allergan PLC	F-0073	C0002629
AC/DC Adapter	GlobTek, Inc.	GTM410780605-USB	N/A

Battery Mode

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



Charging Mode



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. The EUT was configured to continuously transmit and looking for tags. The highest clock frequency used in the EUT is less than 2.5 GHz. Therefore, radiated emissions were performed upto 18GHz for FCC Part 15B.

The F-0071 is the complete system which includes F-0072 - TrueTear 2.0 Base Unit and F-0073 - TrueTear 2.0 Charger Case.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Allergan PLC

3.5 Mode of Operation during Test

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

3.6 Modifications Required for Compliance

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

3.7 Additions, Deviations and Exclusions from Standards

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

4.0 Measurement Results

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

4.1.1 Requirement

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

4.1.2 Procedure

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

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

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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

4.1.3 Test Result

Battery Mode:

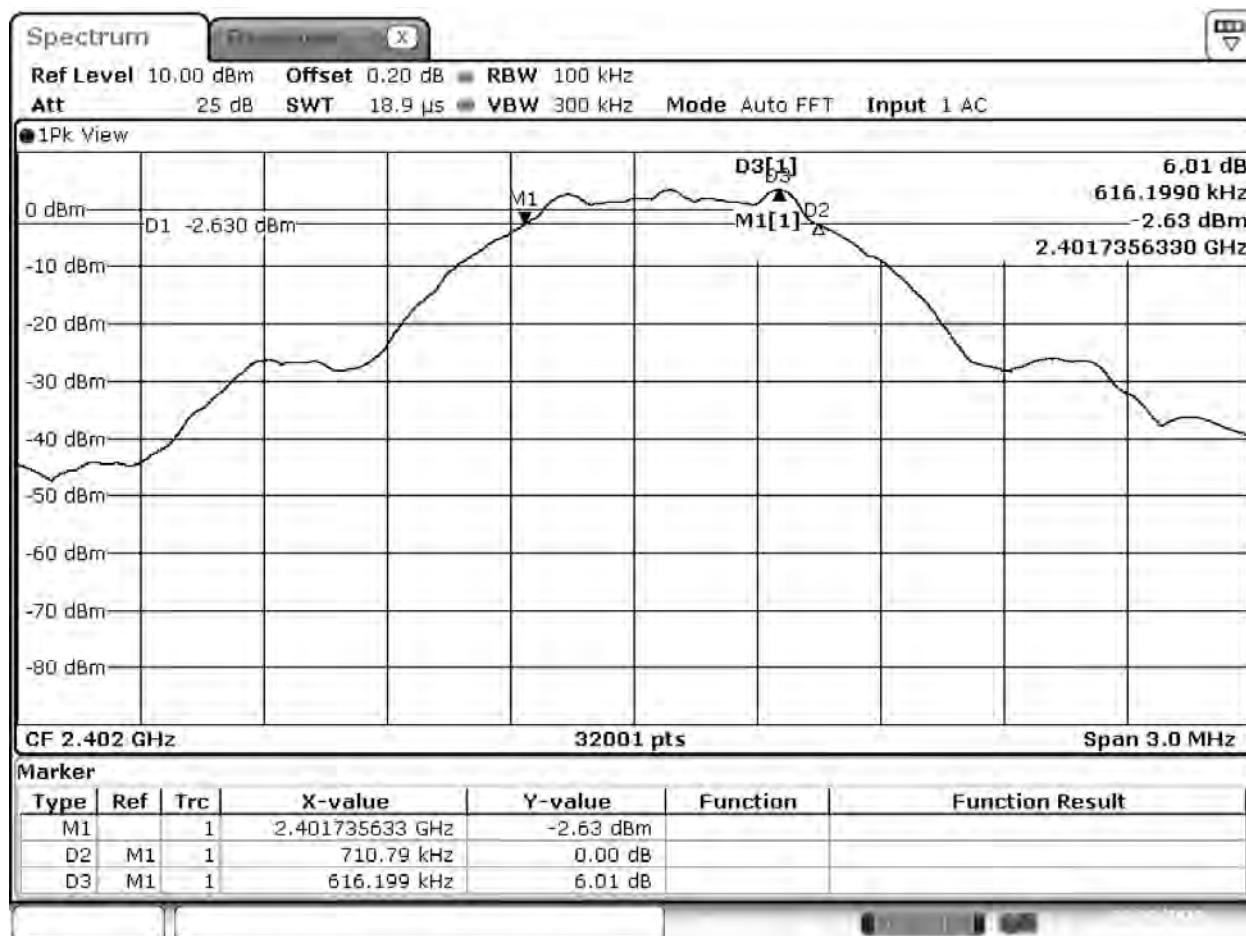
Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN	Occupied bandwidth, RSS-GEN	Plot
MHz	kHz	MHz	
2402	710.790	--	1.1
	--	1.046	1.7
2440	715.665	--	1.2
	--	1.050	1.8
2480	712.853	--	1.3
	--	1.052	1.9

Charging Mode:

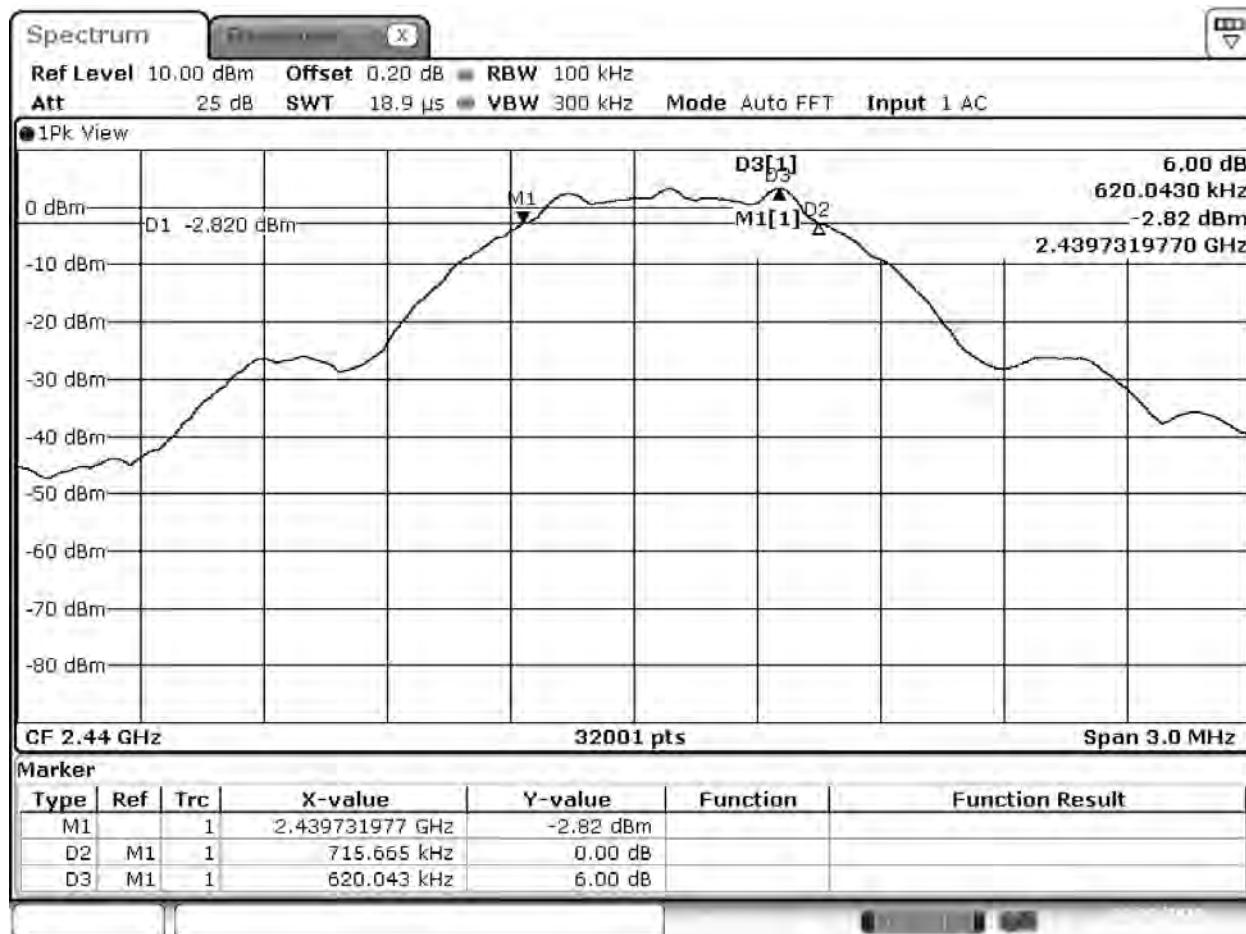
Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN	Occupied bandwidth, RSS-GEN	Plot
MHz	kHz	MHz	
2402	711.915	--	1.4
	--	1.046	1.10
2440	710.228	--	1.5
	--	1.049	1.11
2480	715.384	--	1.6
	--	1.054	1.12

Tested By	Test Date
Aaron Chang	October 10 & 13, 2019

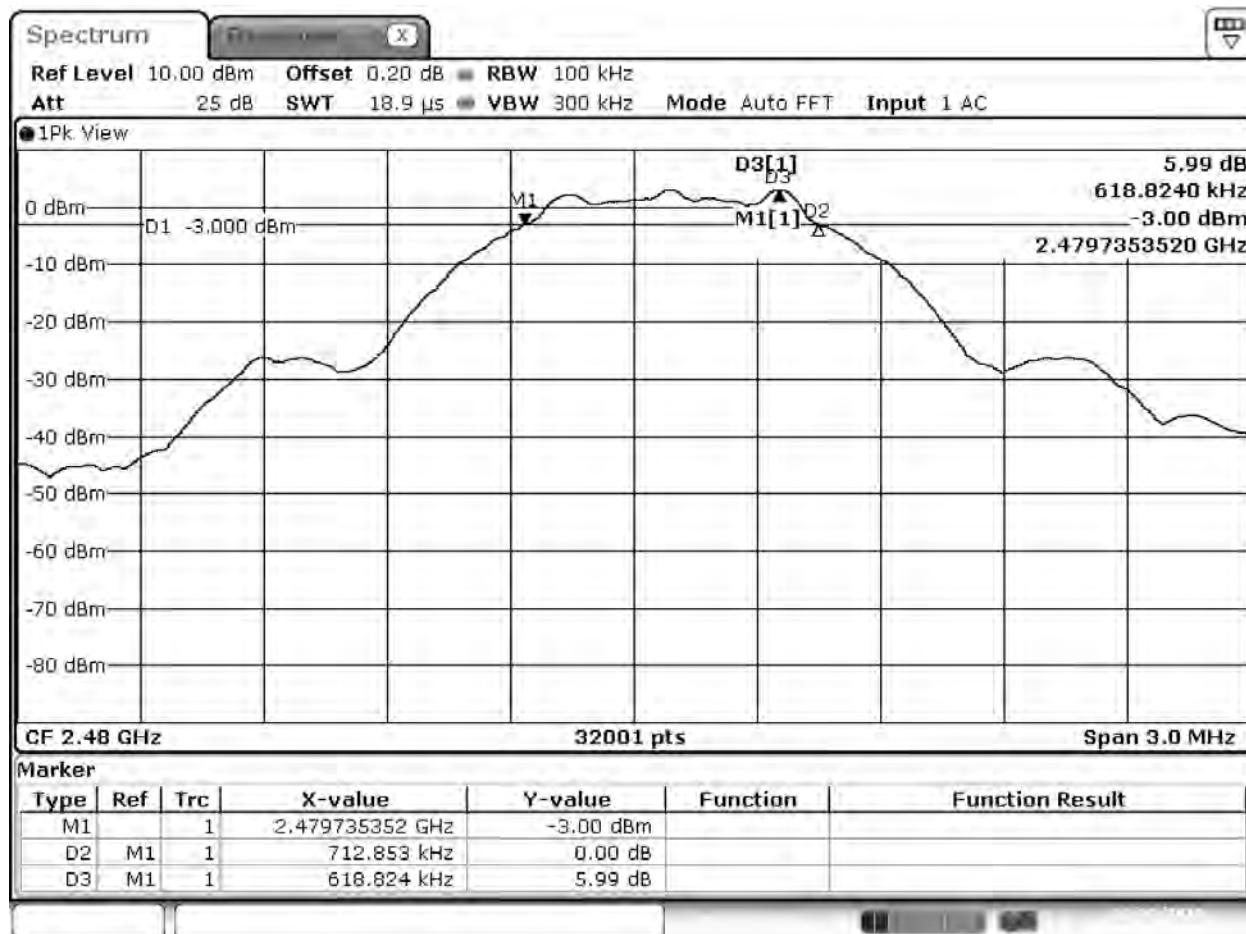
Plot 1. 1



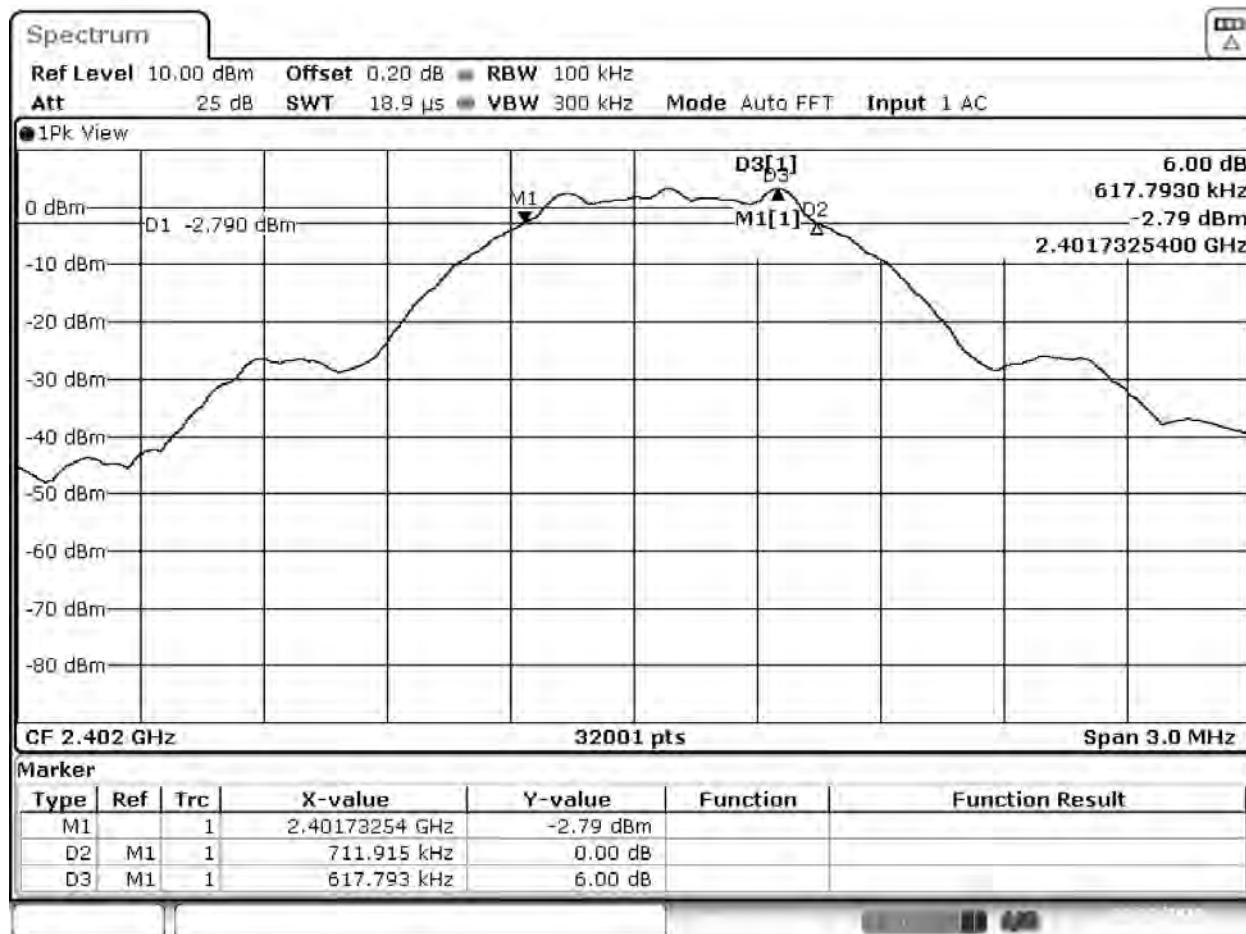
Plot 1. 2



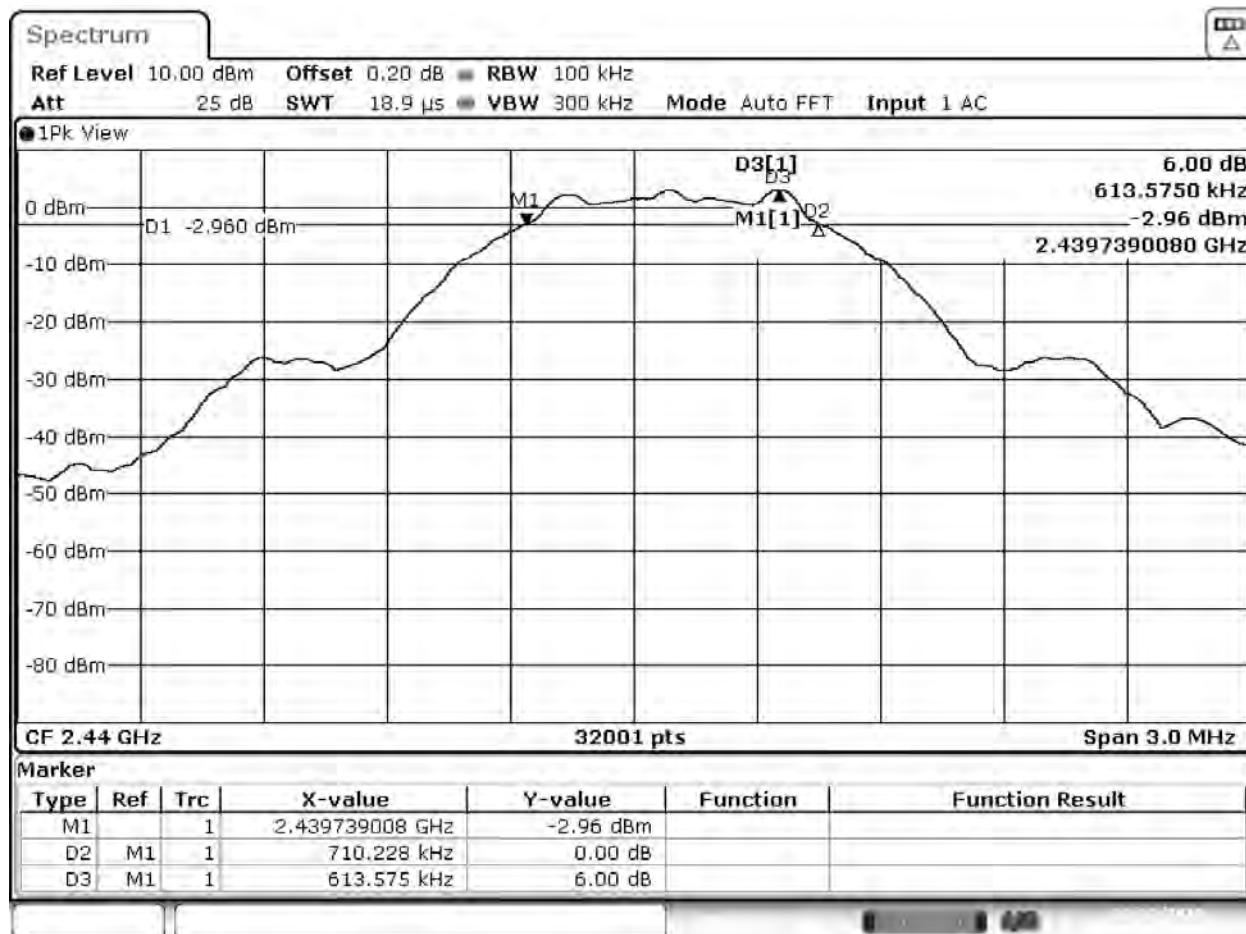
Plot 1. 3



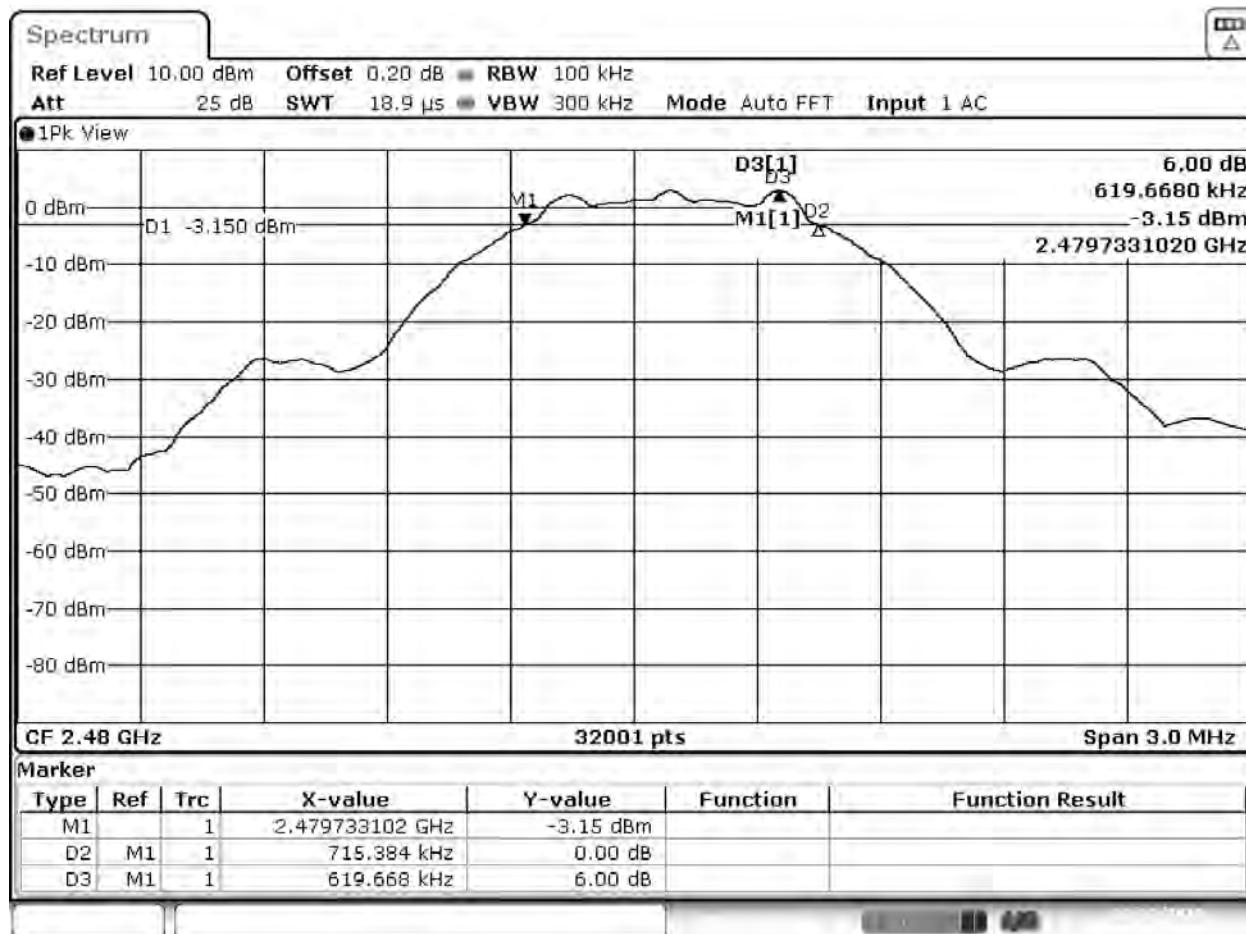
Plot 1. 4



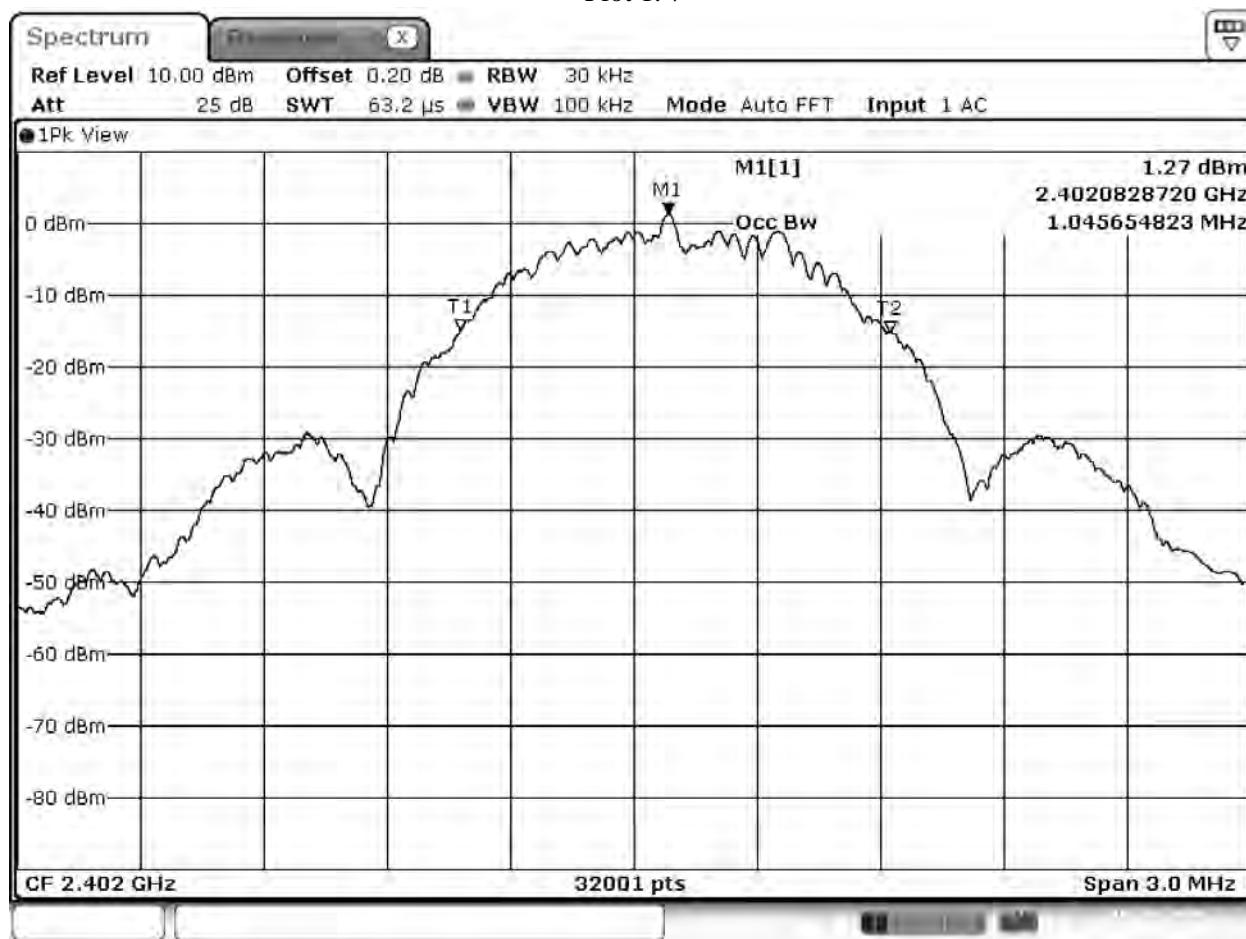
Plot 1.5



Plot 1.6

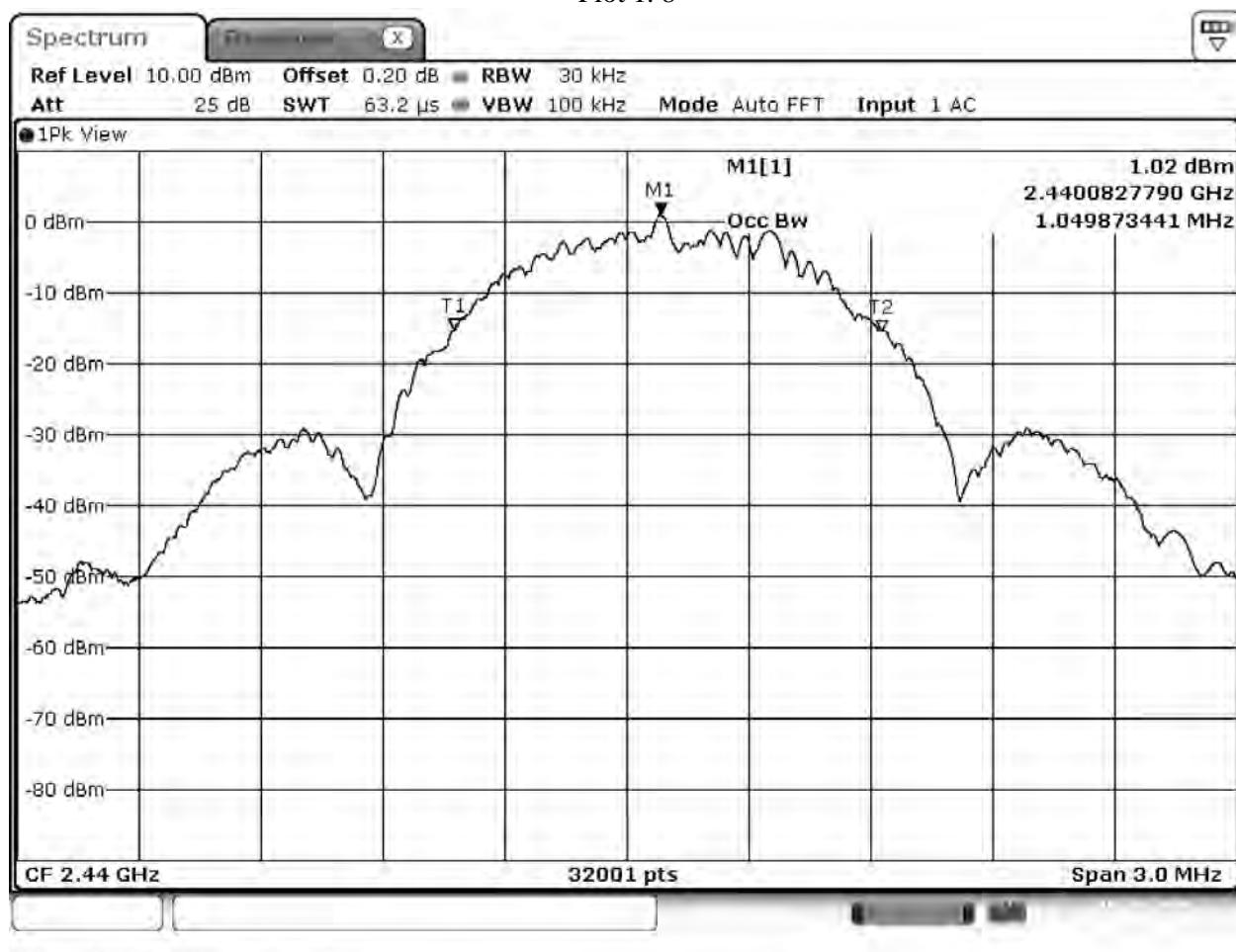


Plot 1.7

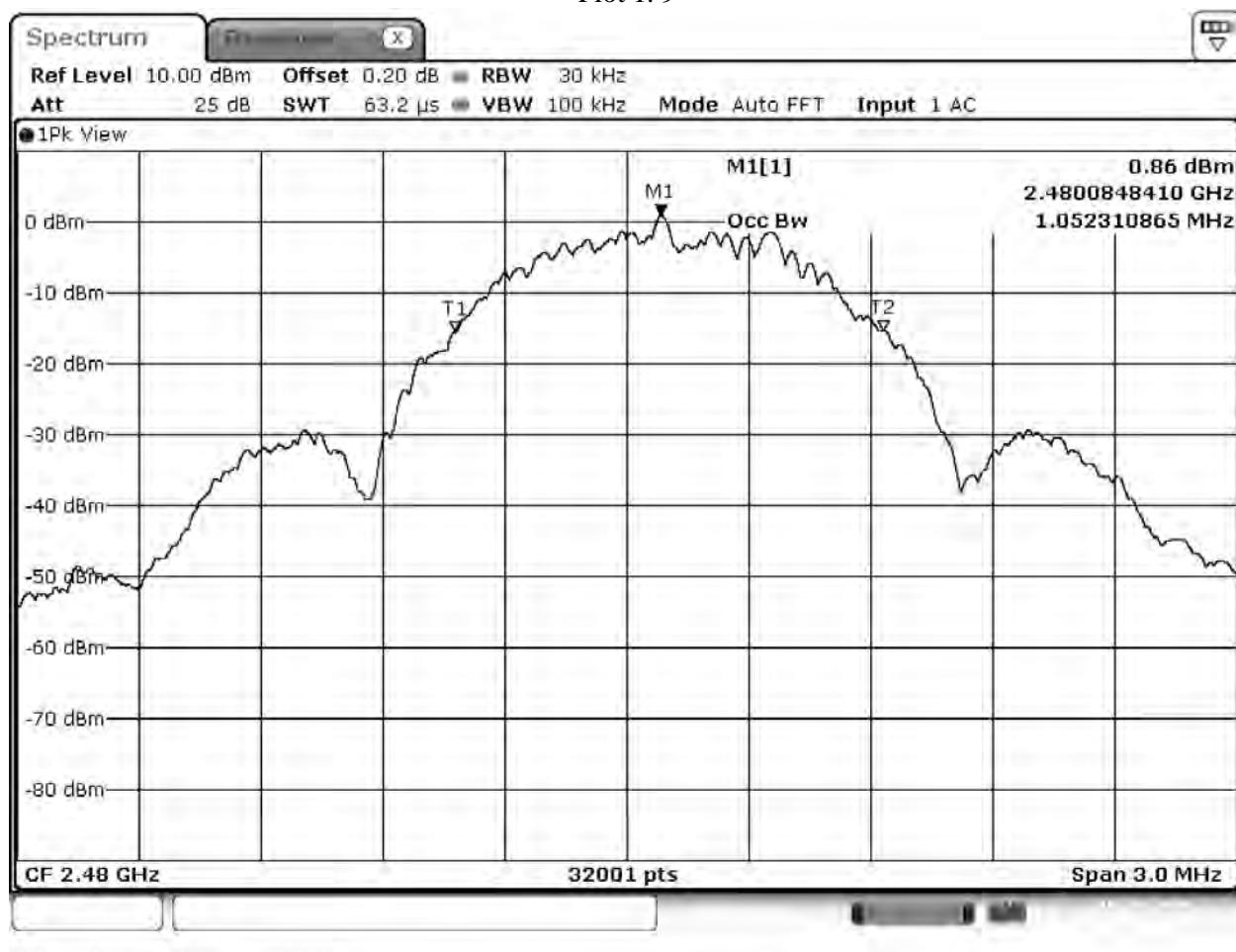


Date: 10.OCT.2019 00:36:06

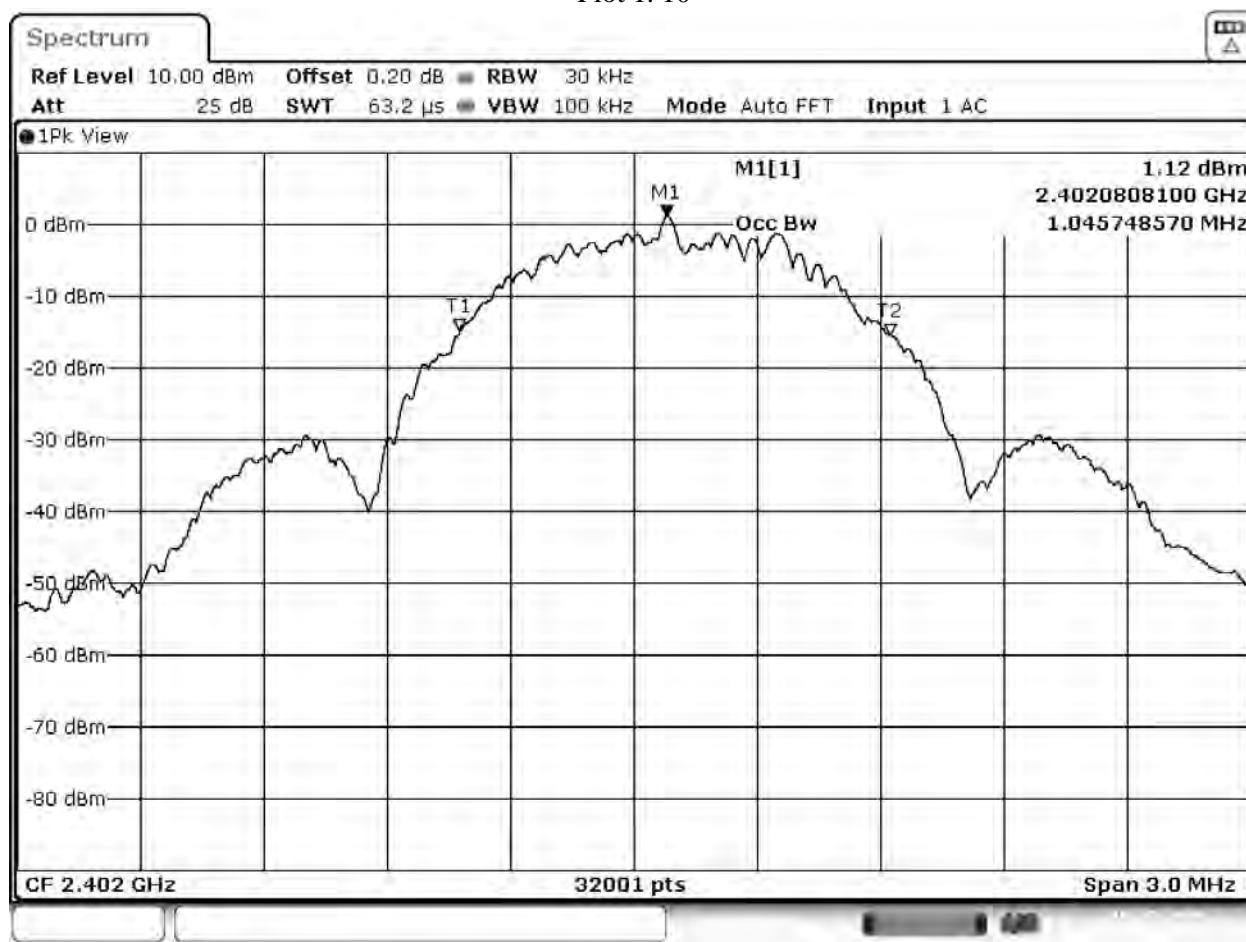
Plot 1. 8



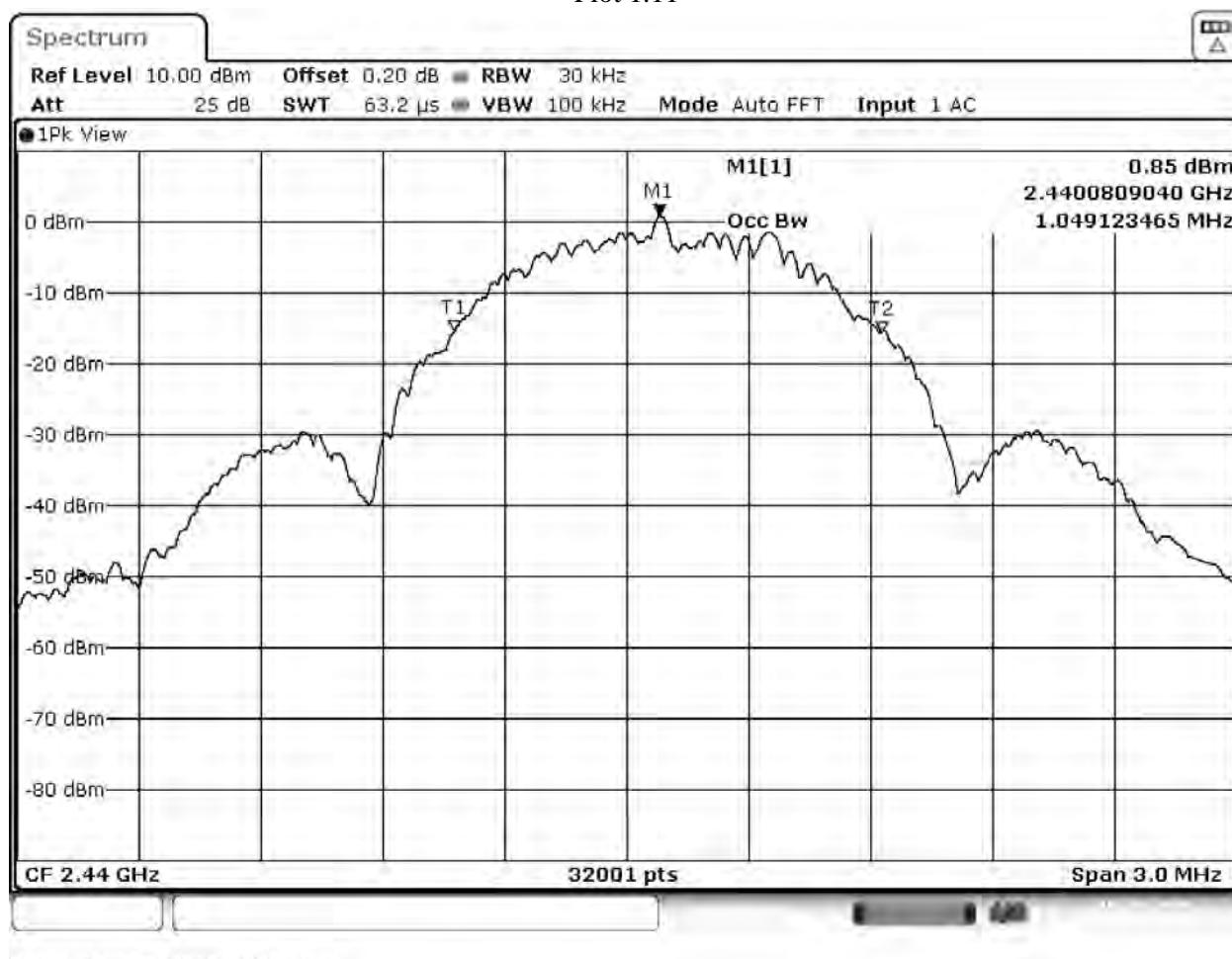
Plot 1. 9



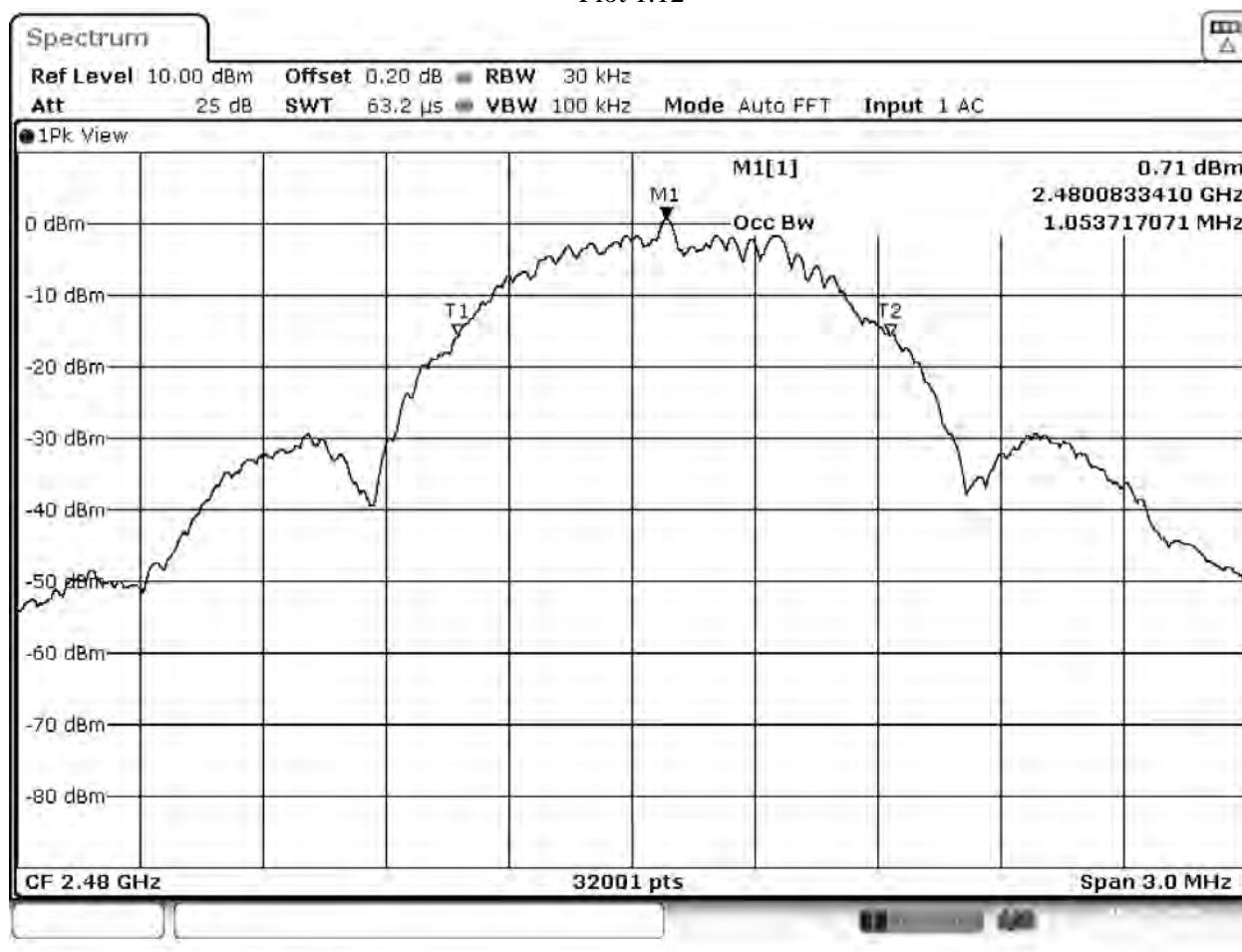
Plot 1. 10



Plot 1.11



Plot 1.12



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 $\text{RBW} \geq \text{DTS}$ bandwidth in ANSI 63.10.

1. Set the $\text{RBW} \geq \text{DTS}$ Bandwidth
2. Set the $\text{VBW} \geq 3 \times \text{RBW}$
3. Set the span $\geq 3 \times \text{RBW}$
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.

Battery Mode:

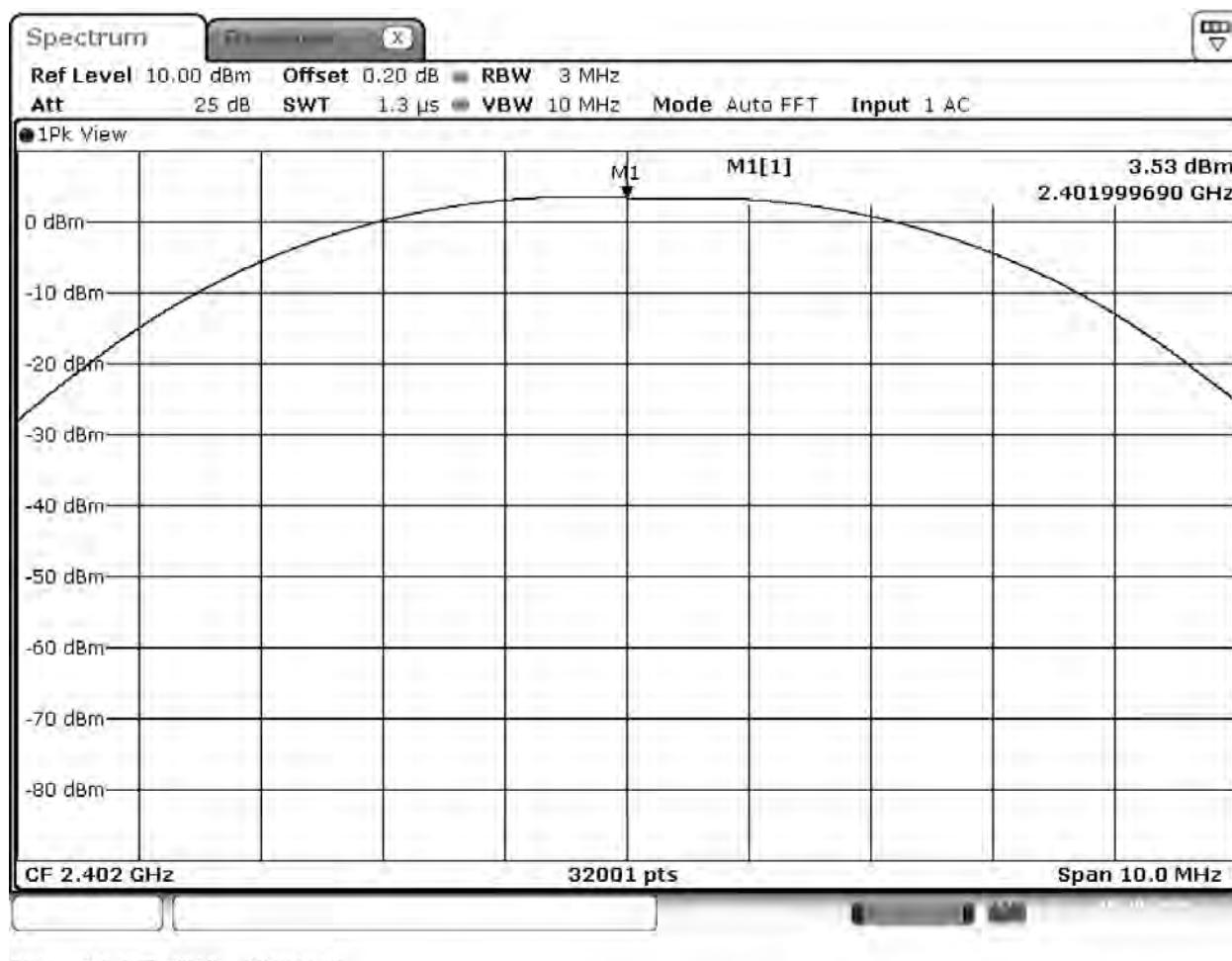
Frequency	Conducted Power (peak)		Plot
	MHz	dBm	
2402	3.53	2.254	2.1
2440	3.36	2.168	2.2
2480	3.17	2.075	2.3

Charging Mode:

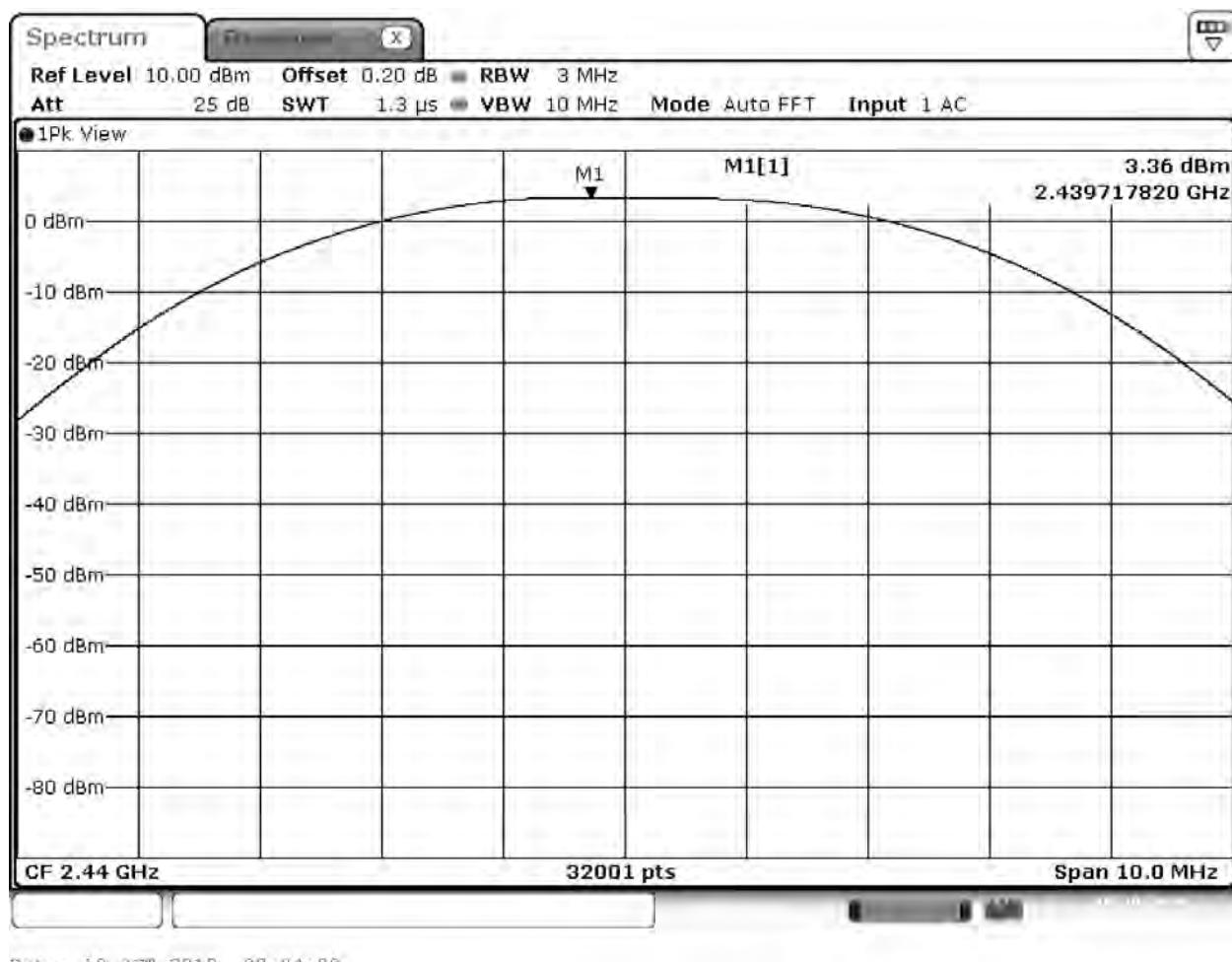
Frequency	Conducted Power (peak)		Plot
	MHz	dBm	
2402	3.73	2.360	2.4
2440	3.38	2.178	2.5
2480	3.11	2.046	2.6

Tested By	Test Date
Aaron Chang	October 10 & 13, 2019

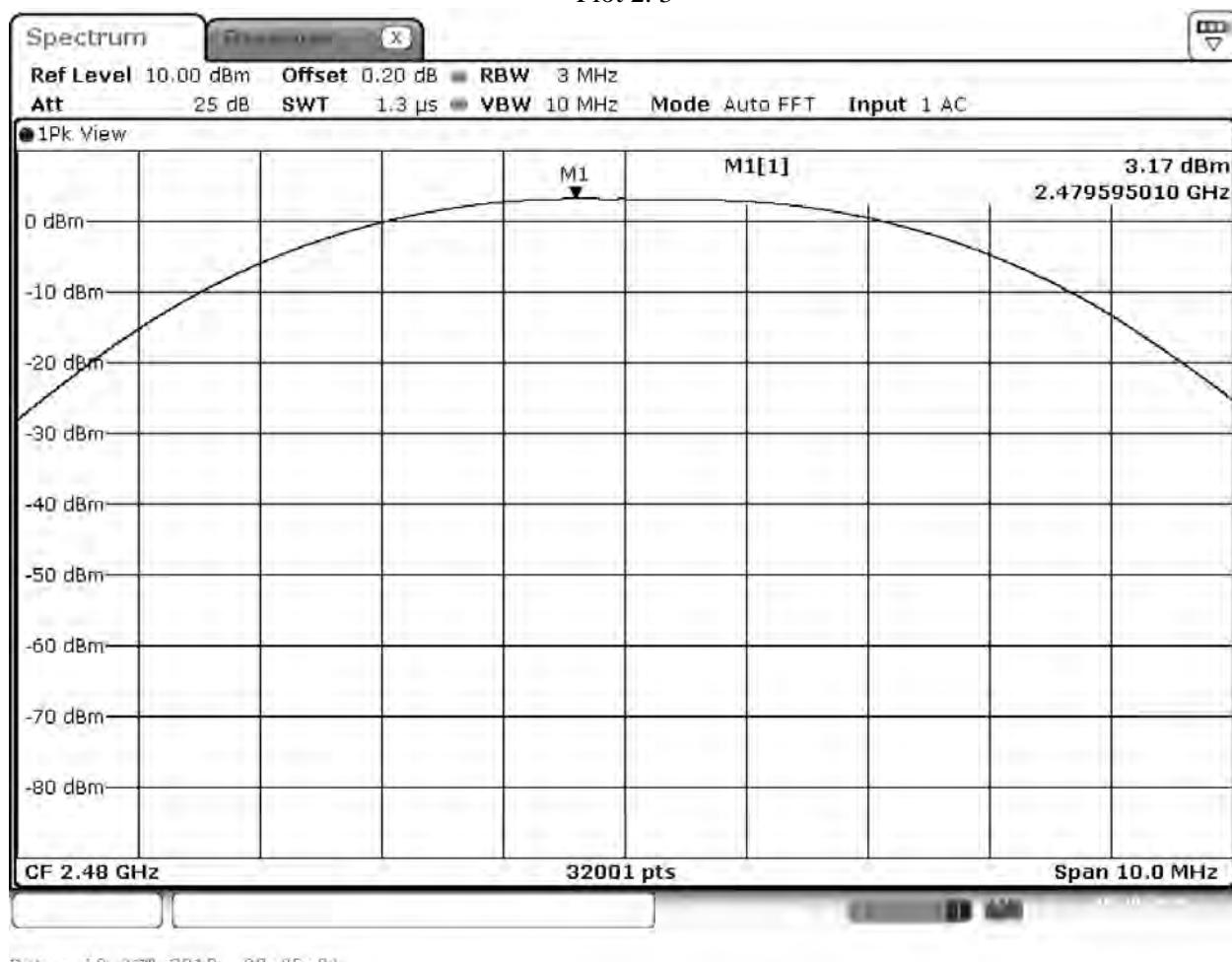
Plot 2. 1



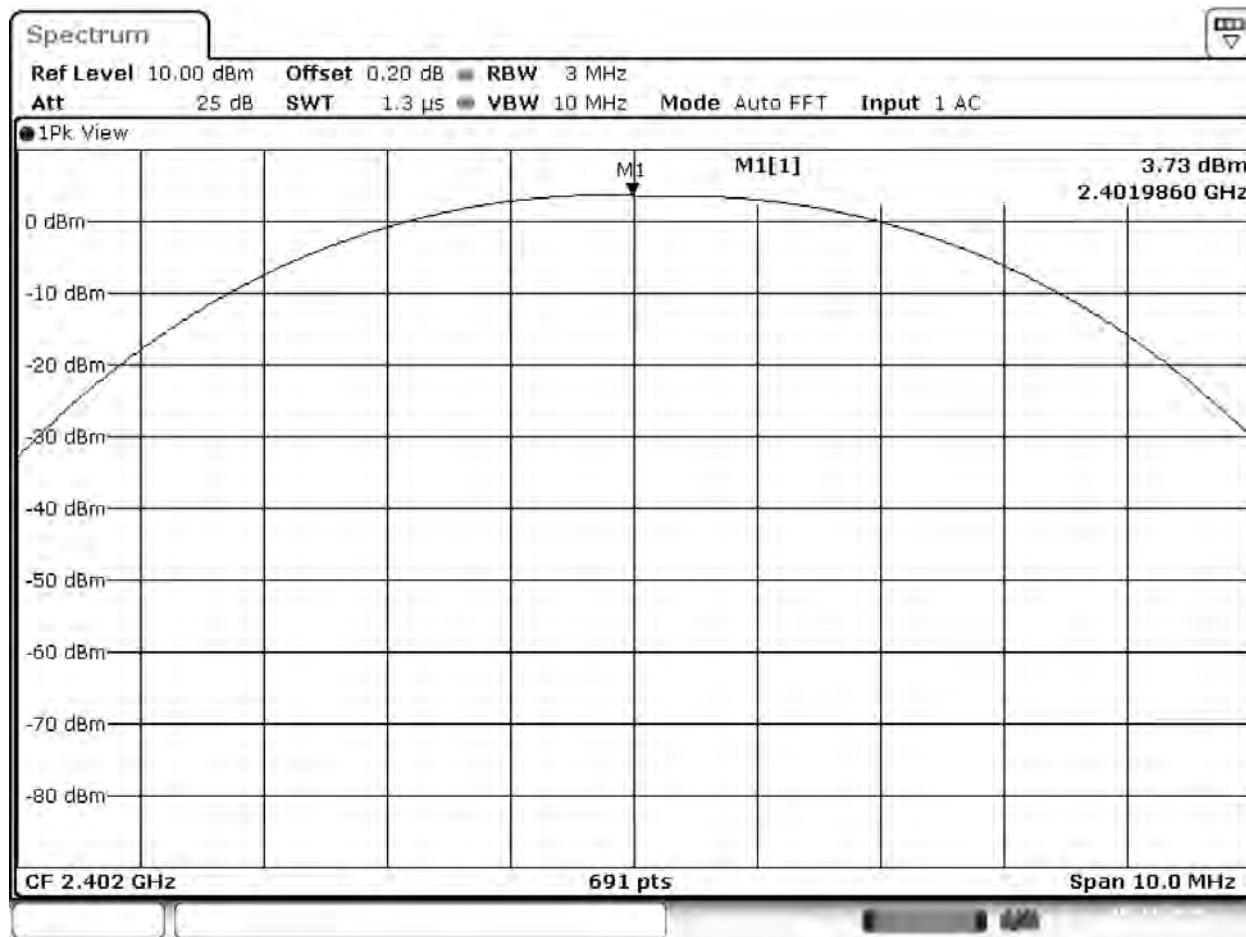
Plot 2. 2



Plot 2.3

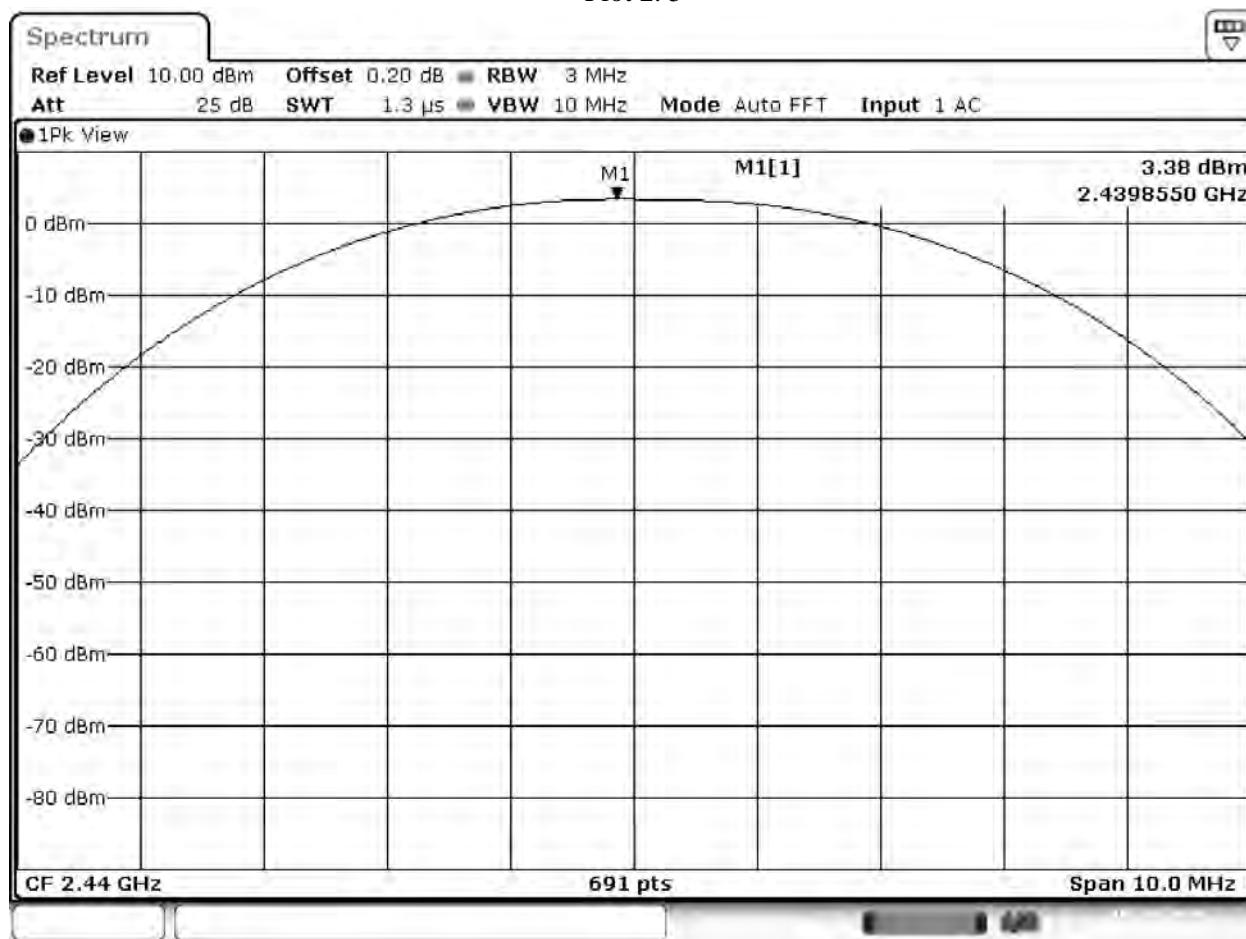


Plot 2.4

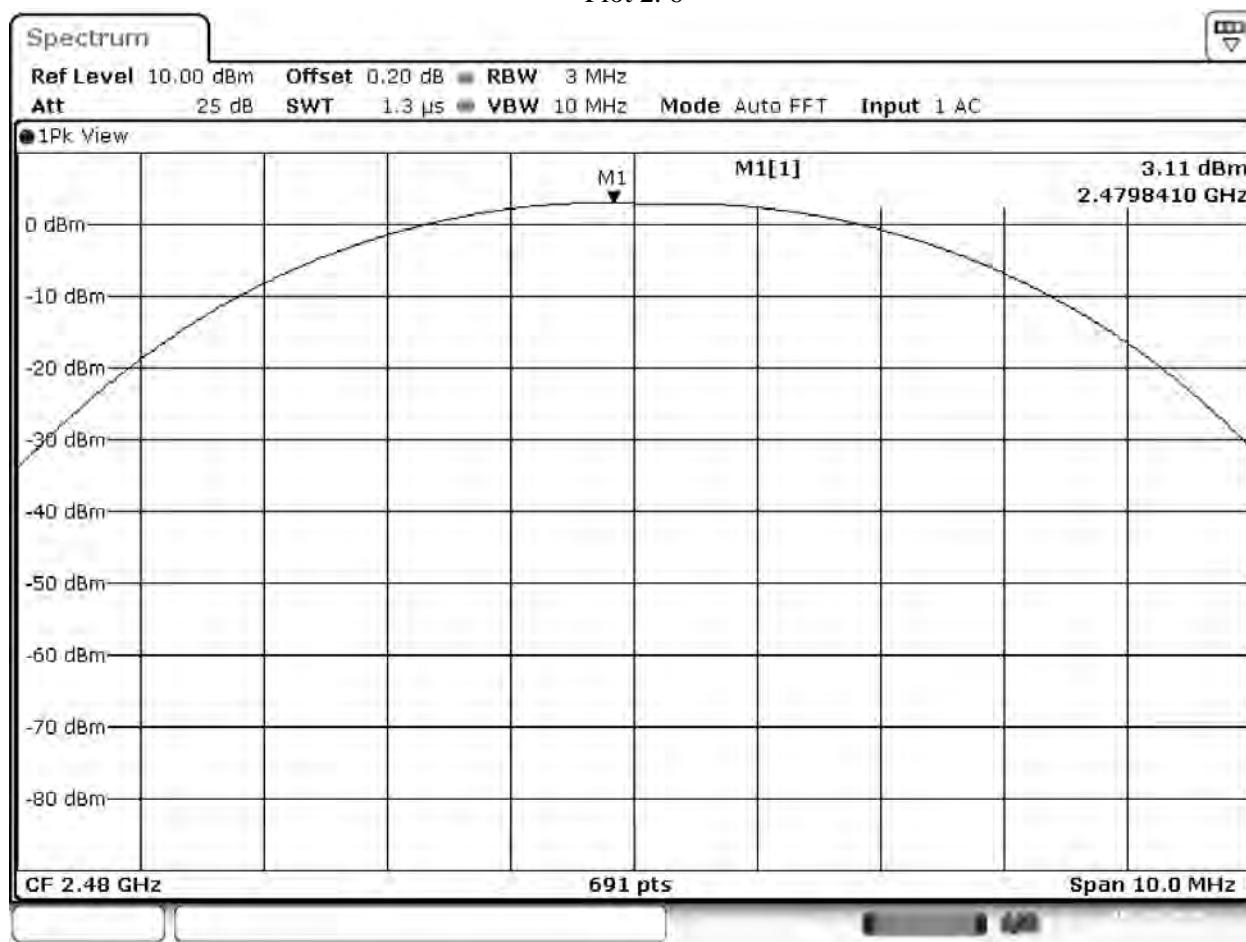


Date: 19.OCT.2019 22:20:31

Plot 2. 5



Plot 2. 6



4.3 Maximum Power Spectral Density
FCC: 15.247 (e); RSS-247, 5.2.b);

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

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

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.10.2 Method PKPSD (peak PSD) of ANSI 63.10.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

4.3.3 Test Result

Refer to the following plots for the test result

Battery Mode:

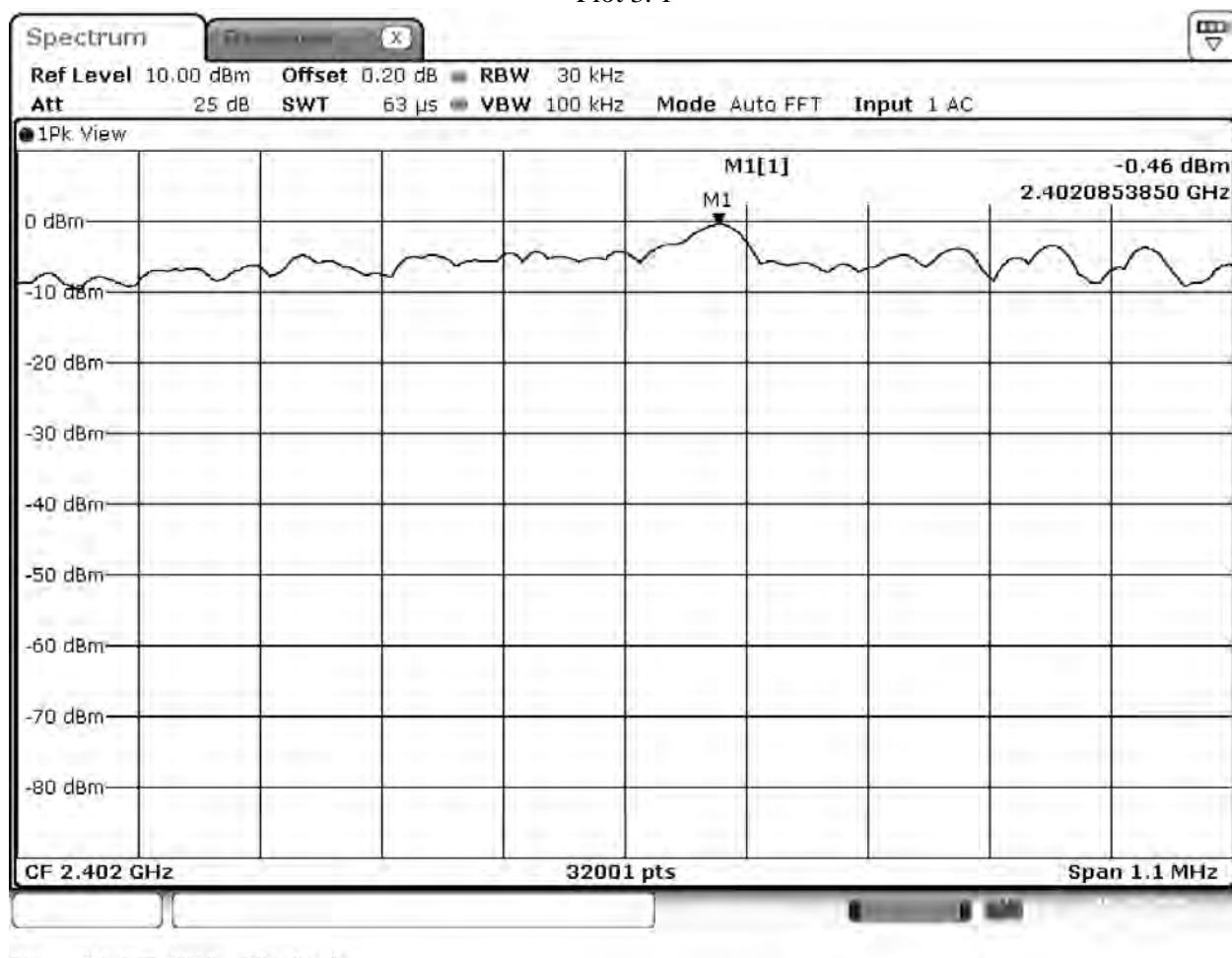
Frequency, MHz	Maximum Power Spectral Density dBm	Maximum Power Spectral Density Limit dBm	Margin dB	Plot
2402	-0.46	8.0	-8.46	3.1
2440	-0.71	8.0	-8.71	3.2
2480	-0.96	8.0	-8.96	3.3

Charging Mode:

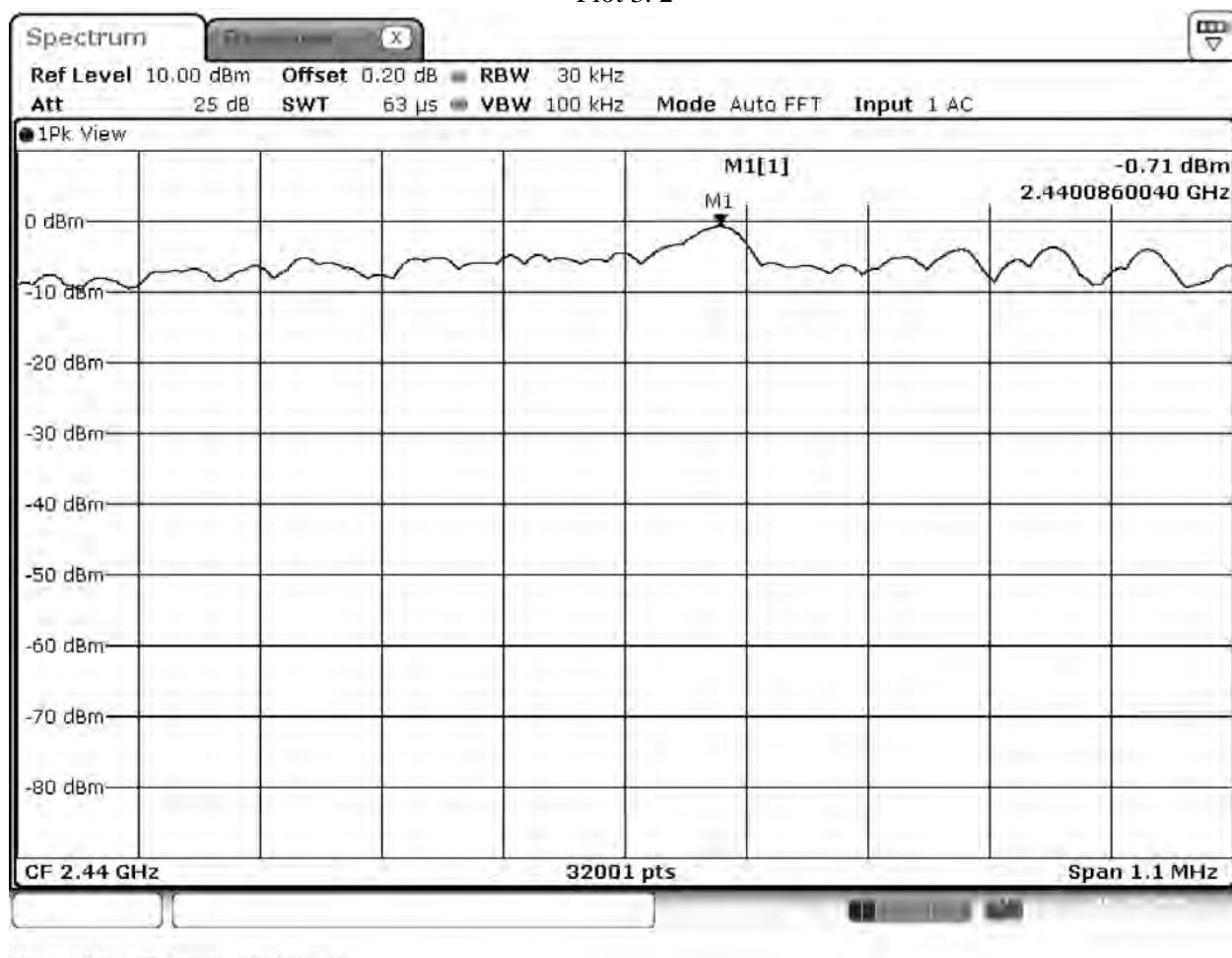
Frequency, MHz	Maximum Power Spectral Density dBm	Maximum Power Spectral Density Limit dBm	Margin dB	Plot
2402	1.18	8.0	-6.82	3.4
2440	0.98	8.0	-7.02	3.5
2480	0.77	8.0	-7.23	3.6

Tested By	Test Date
Aaron Chang	October 10 & 13, 2019

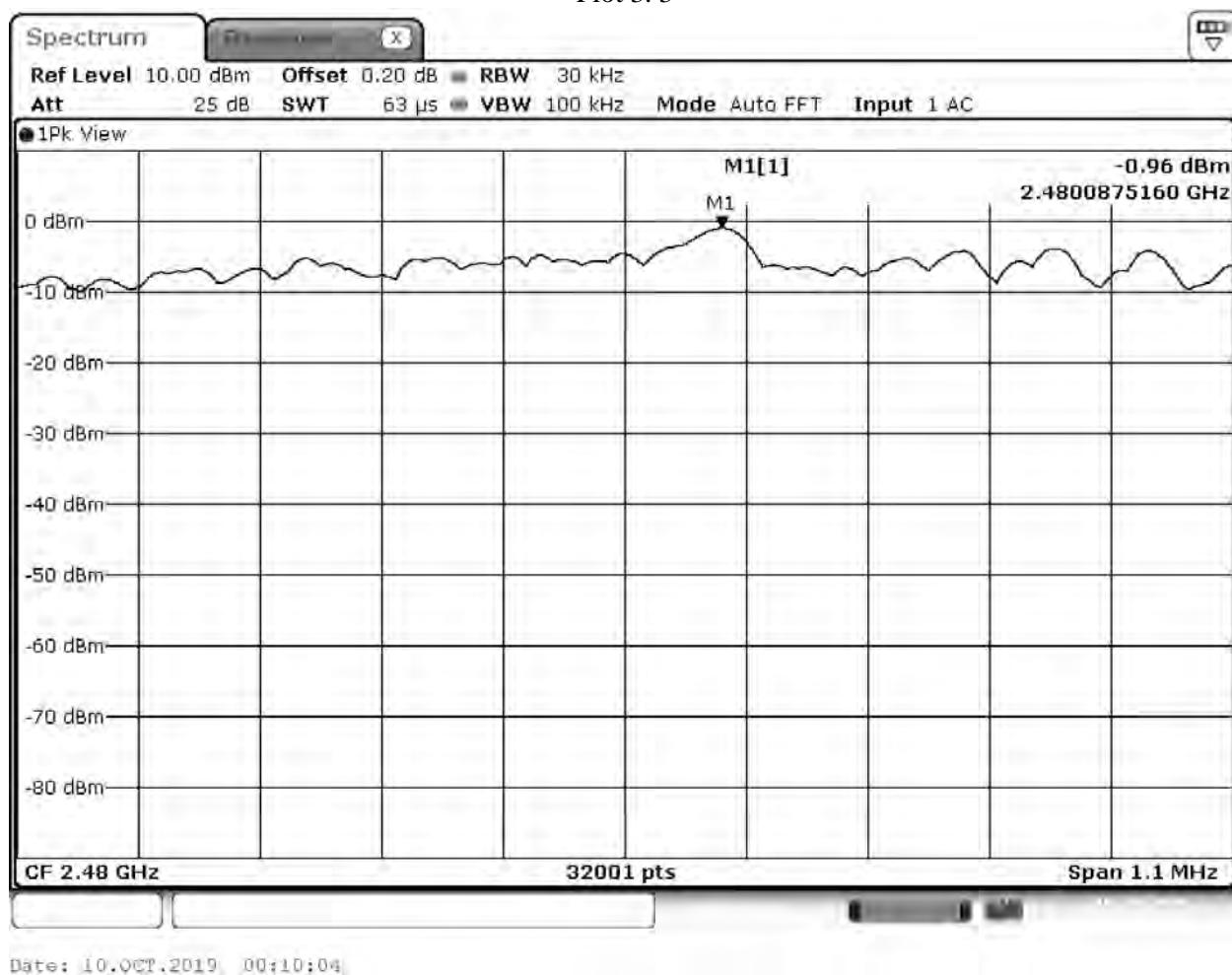
Plot 3. 1



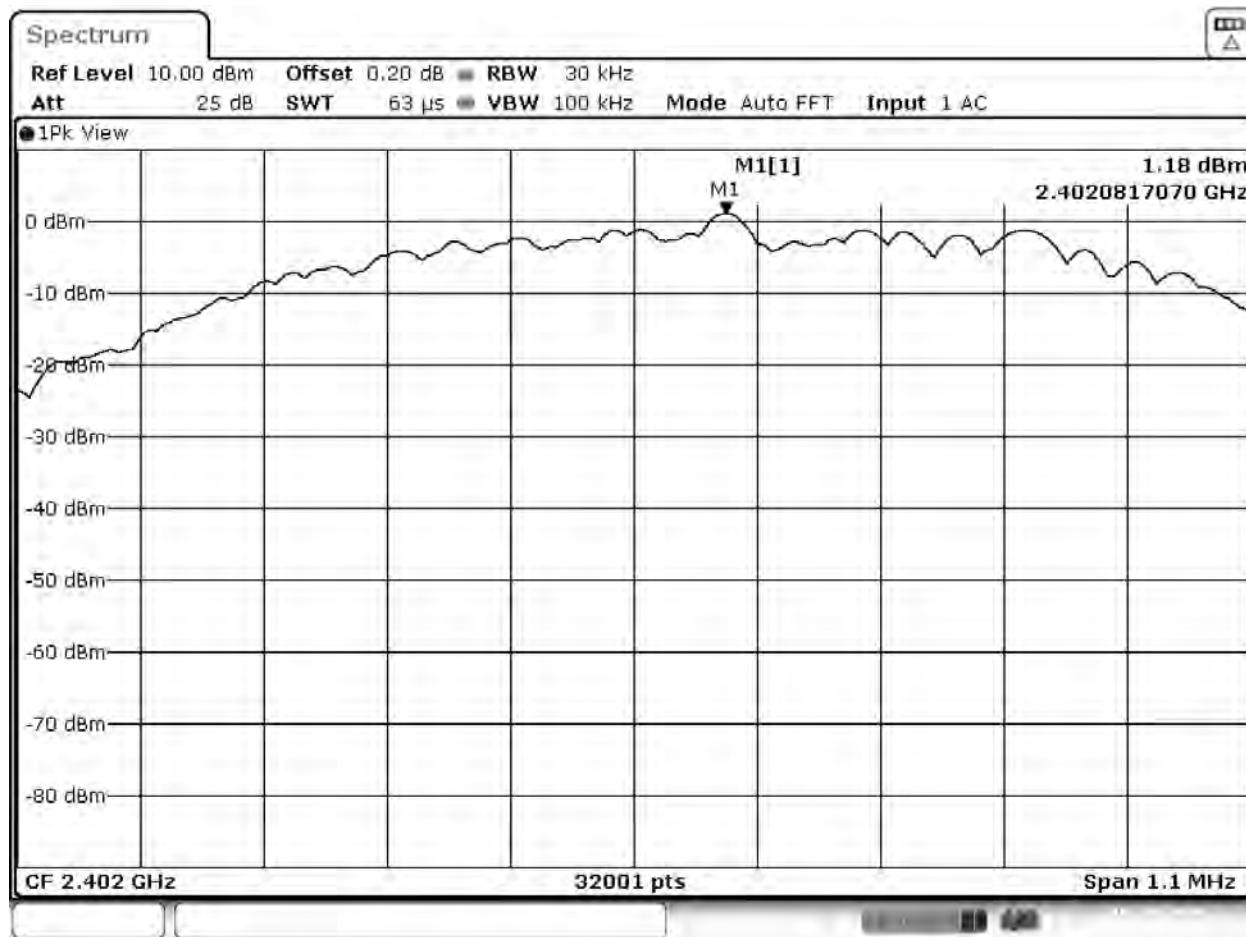
Plot 3. 2



Plot 3. 3

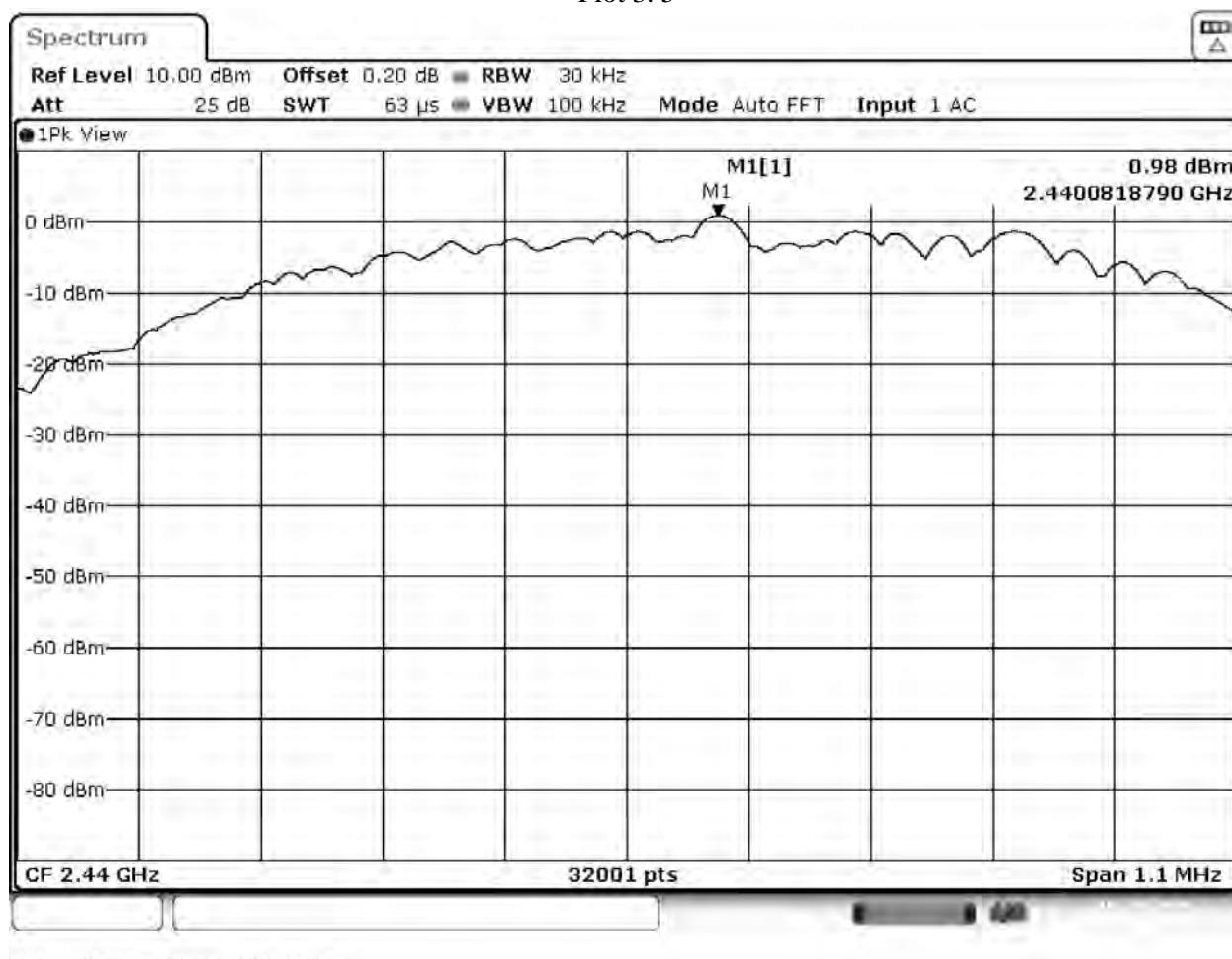


Plot 3.4



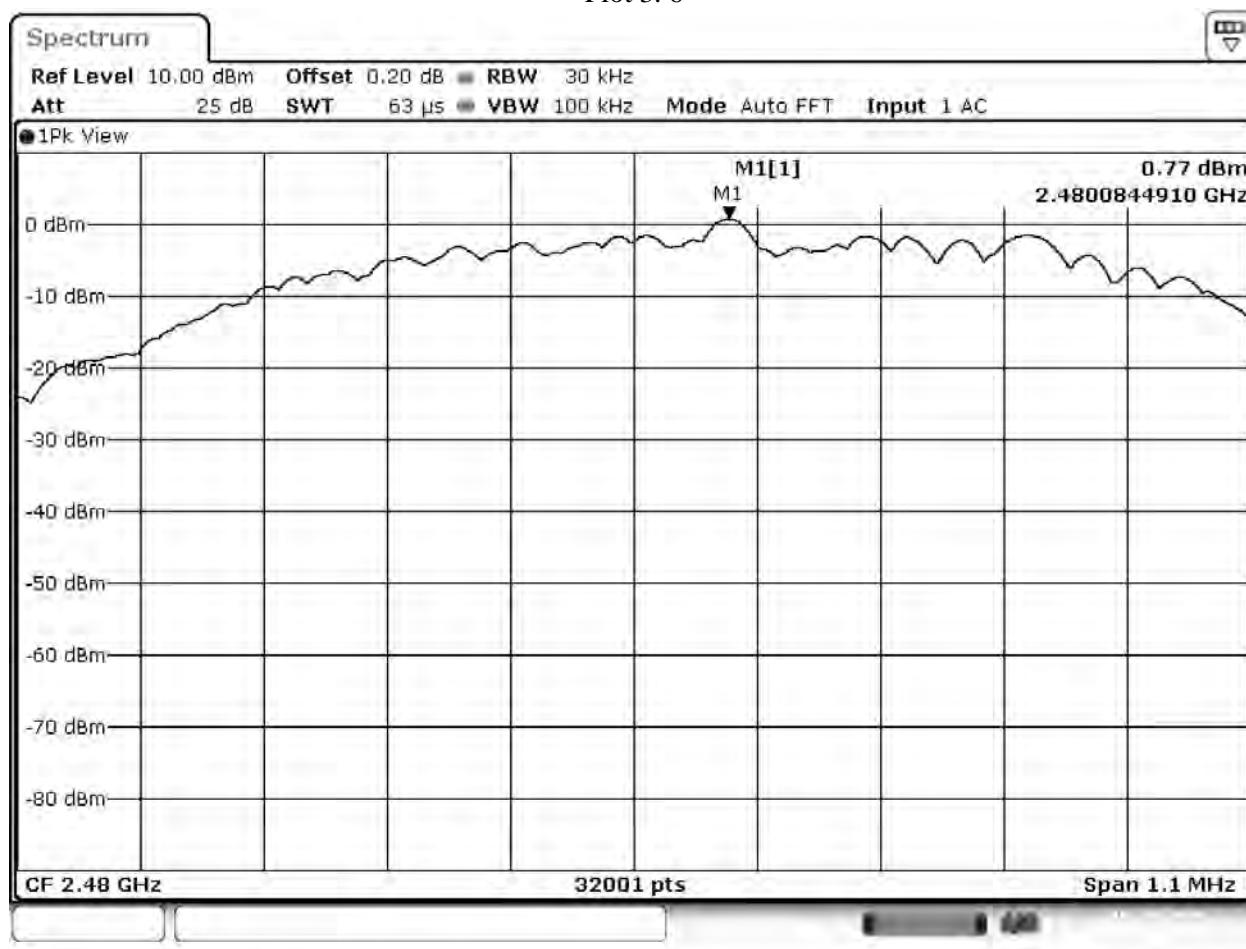
Date: 19.OCT.2019 22:21:08

Plot 3.5



Date: 13.OCT.2019 22:33:37

Plot 3. 6



Date: 13.OCT.2019 22:29:12

4.4 Out of Band Antenna Conducted Emission
FCC: 15.247(d); RSS-247, 5.5;

4.4.1 Requirement

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

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

4.4.2 Procedure

The procedure described in FCC Publication KDB 558074 D01 Meas Guidance v05r02, specifically section 11.11 DTS Emissions in non-restricted frequency bands of ANSI 63.10.

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

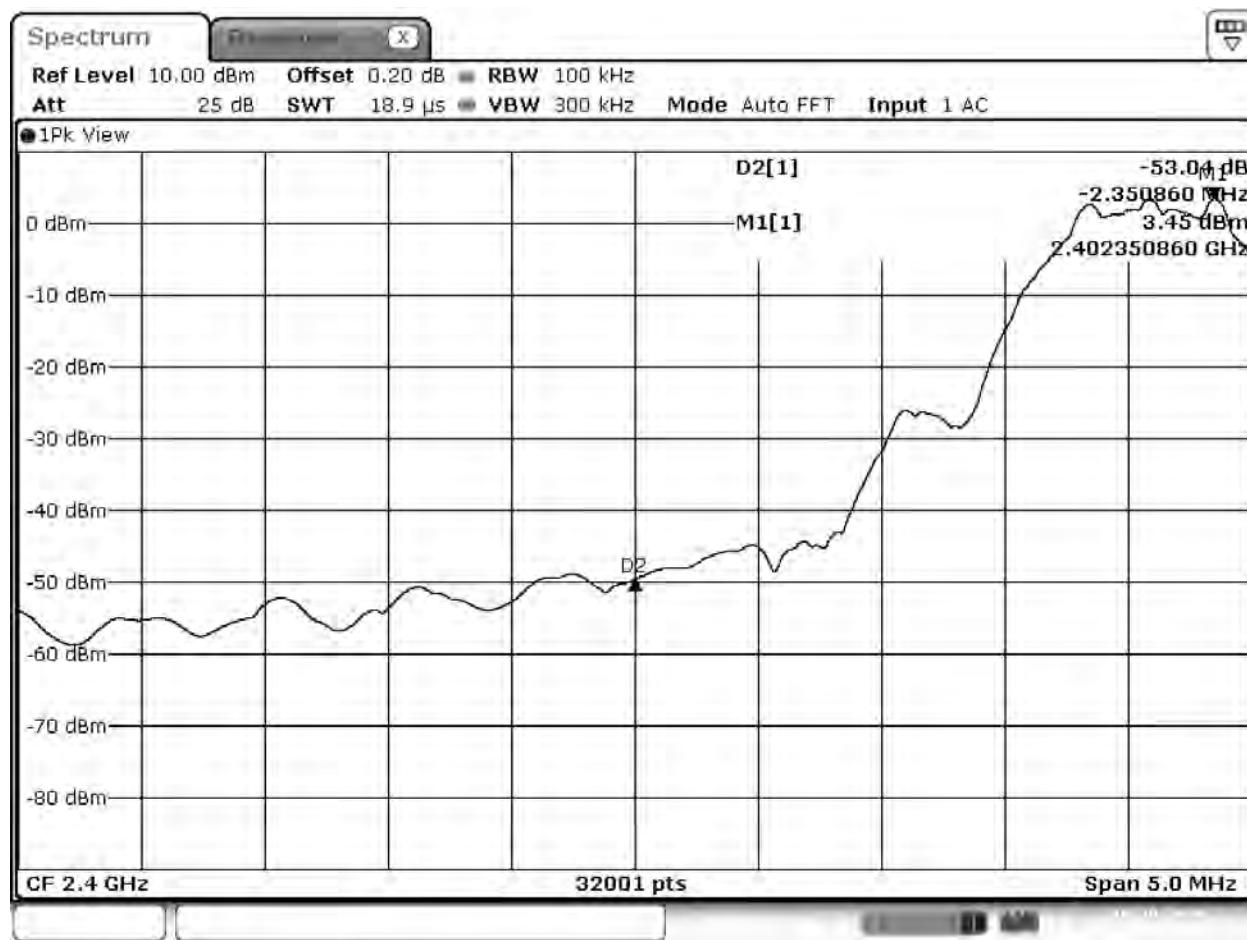
1. Set the RBW = 100 kHz.
2. Set the VBW \geq 3 x RBW.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

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

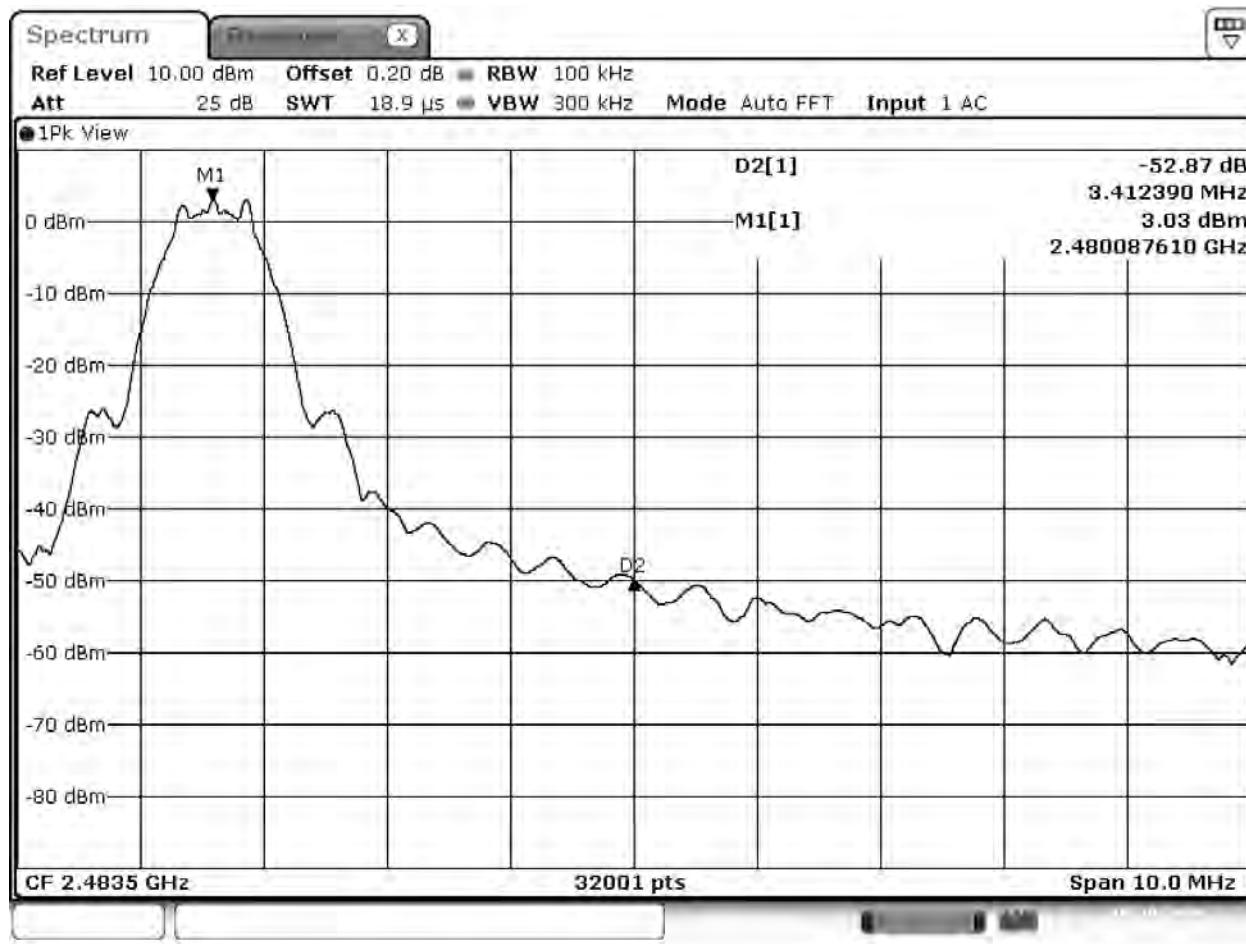
4.4.3 Test Result

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

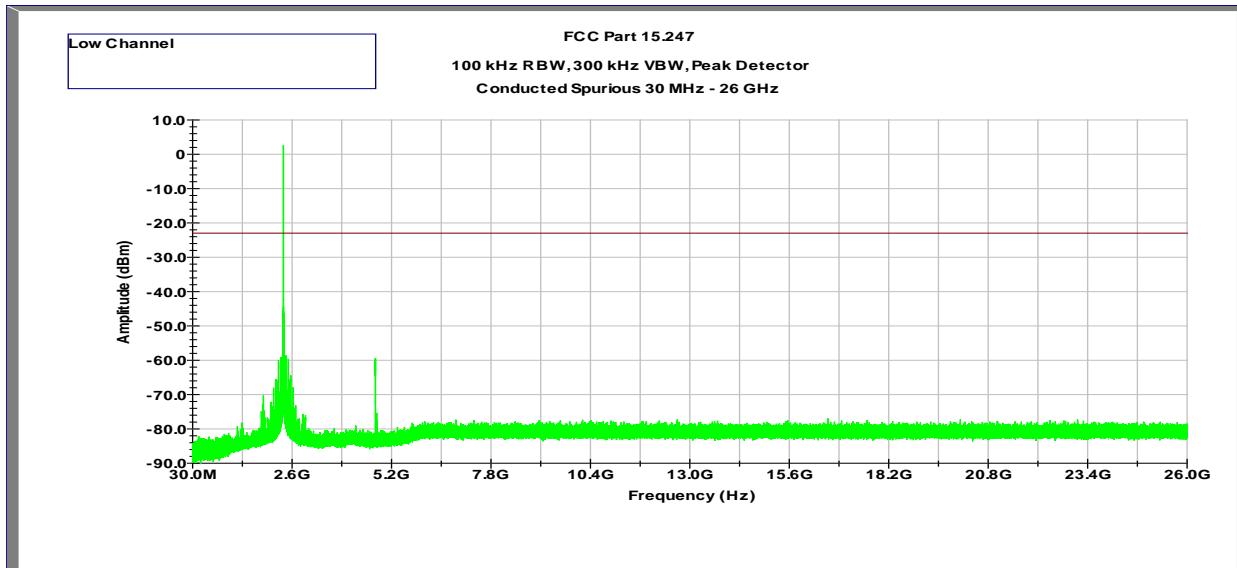
Tested By	Test Date
Aaron Chang	October 10 & 13

Tx @ Low Channel, 2400 MHz Band Edge, Battery Mode
Plot 4.1

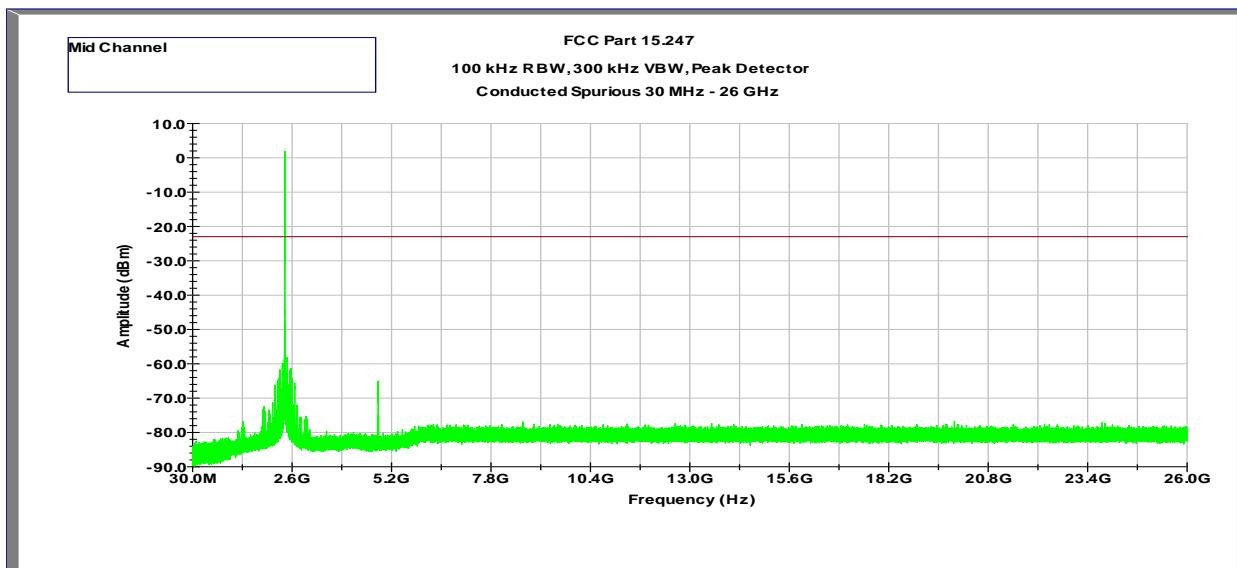
Date: 10.OCT.2019 00:41:08

Tx @ Low Channel, 2483.5 MHz Band Edge, Battery Mode
Plot 4.2

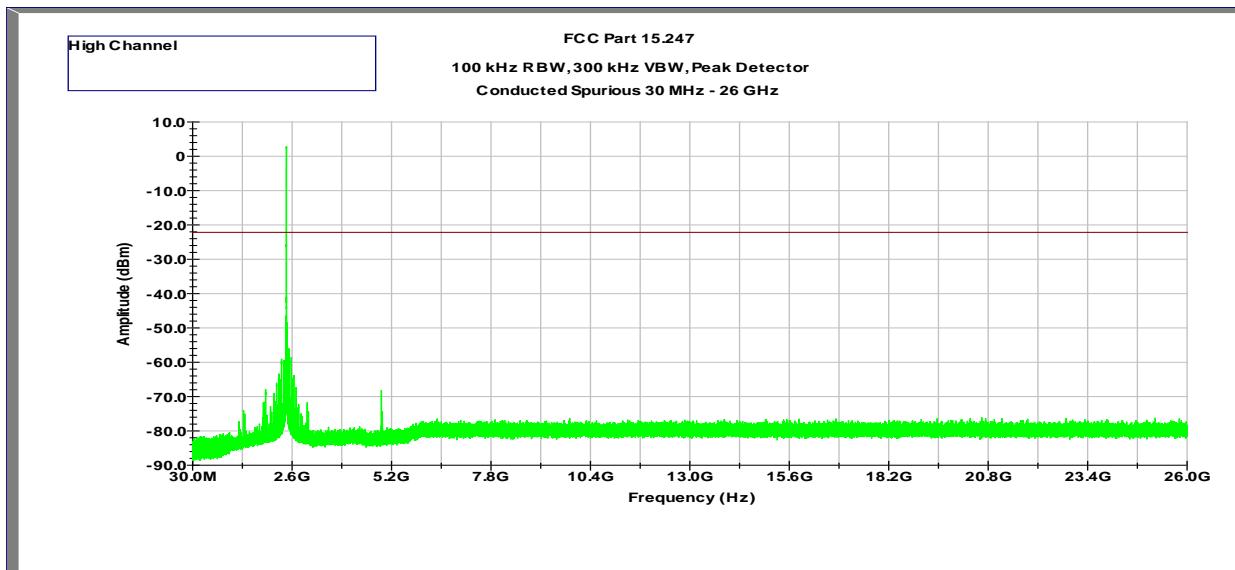
Tx @ Low Channel, 2402 MHz, Battery Mode
30MHz -26GHz Conducted Spurious
Plot 4.3



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

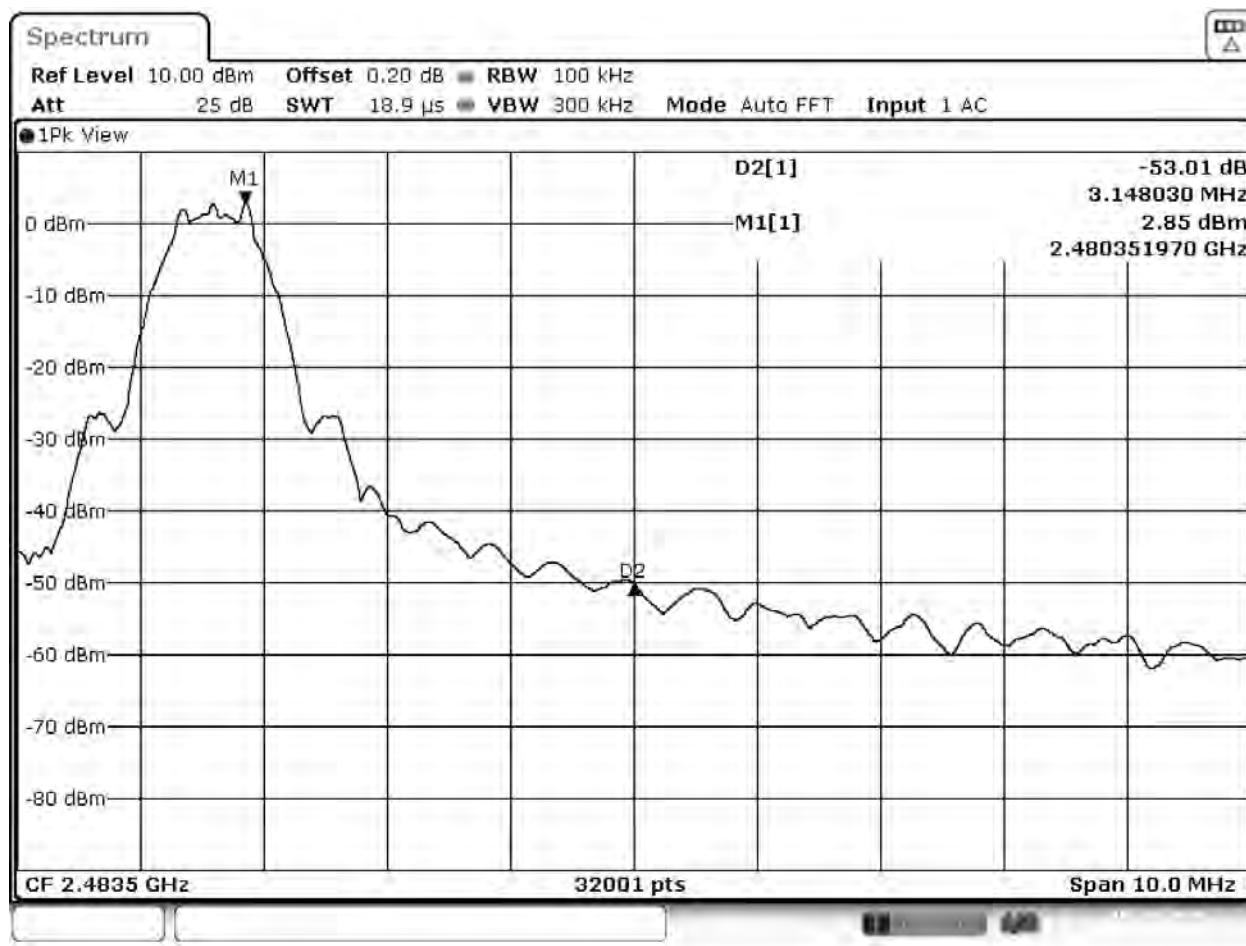


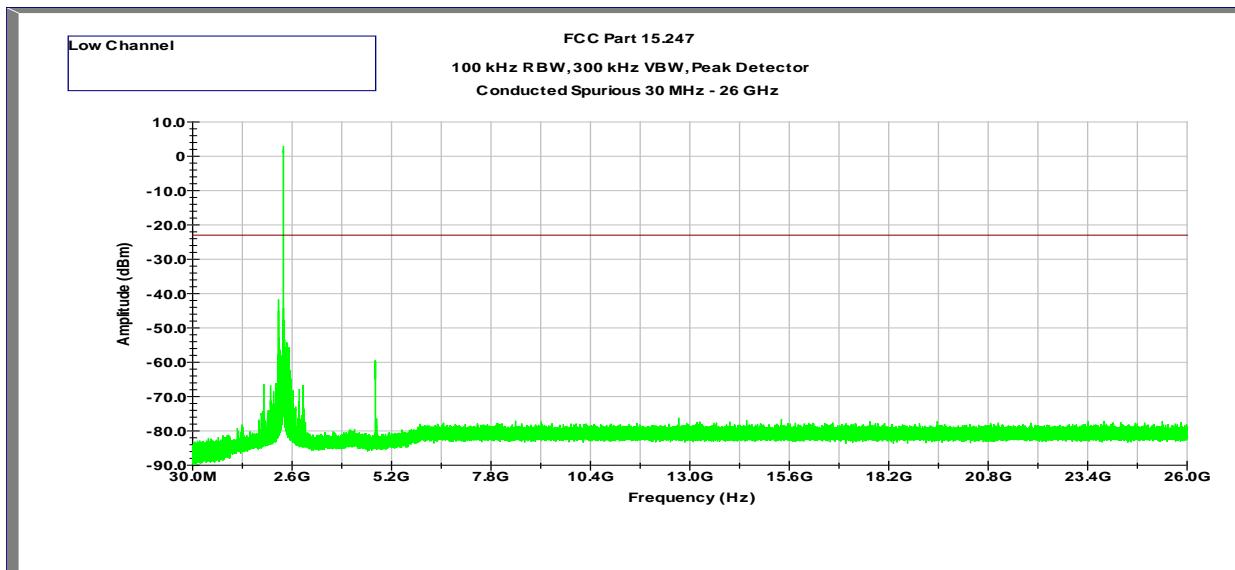
Tx @ High Channel, 2480 MHz, Battery Mode
30MHz -26GHz Conducted Spurious
Plot 4.5



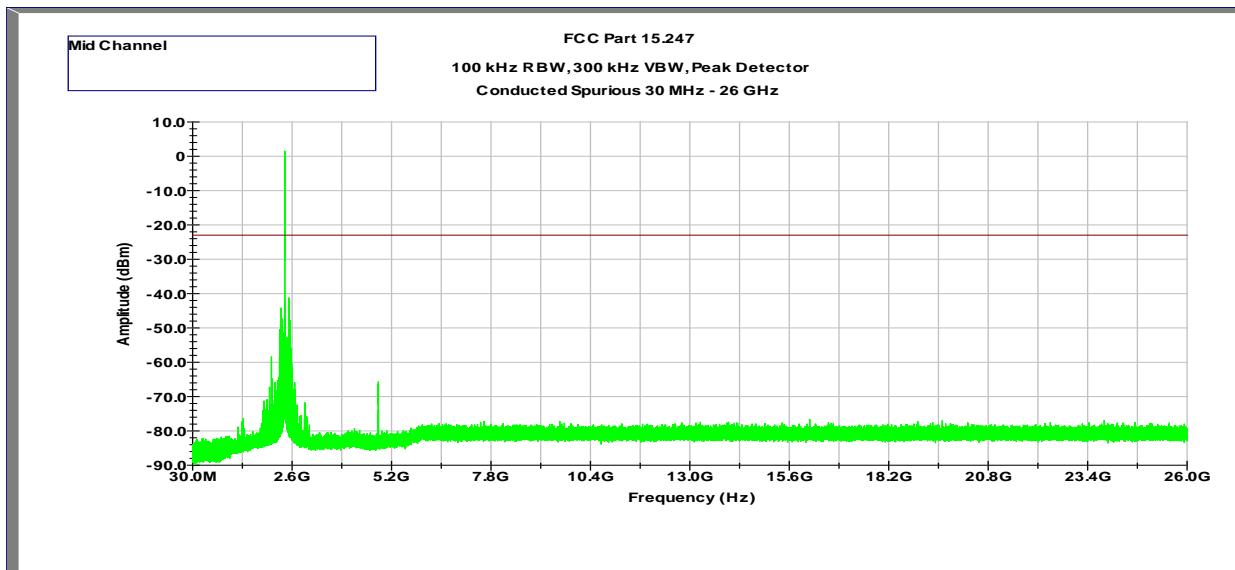
Tx @ Low Channel, 2400 MHz Band Edge, Charging Mode
Plot 4.6



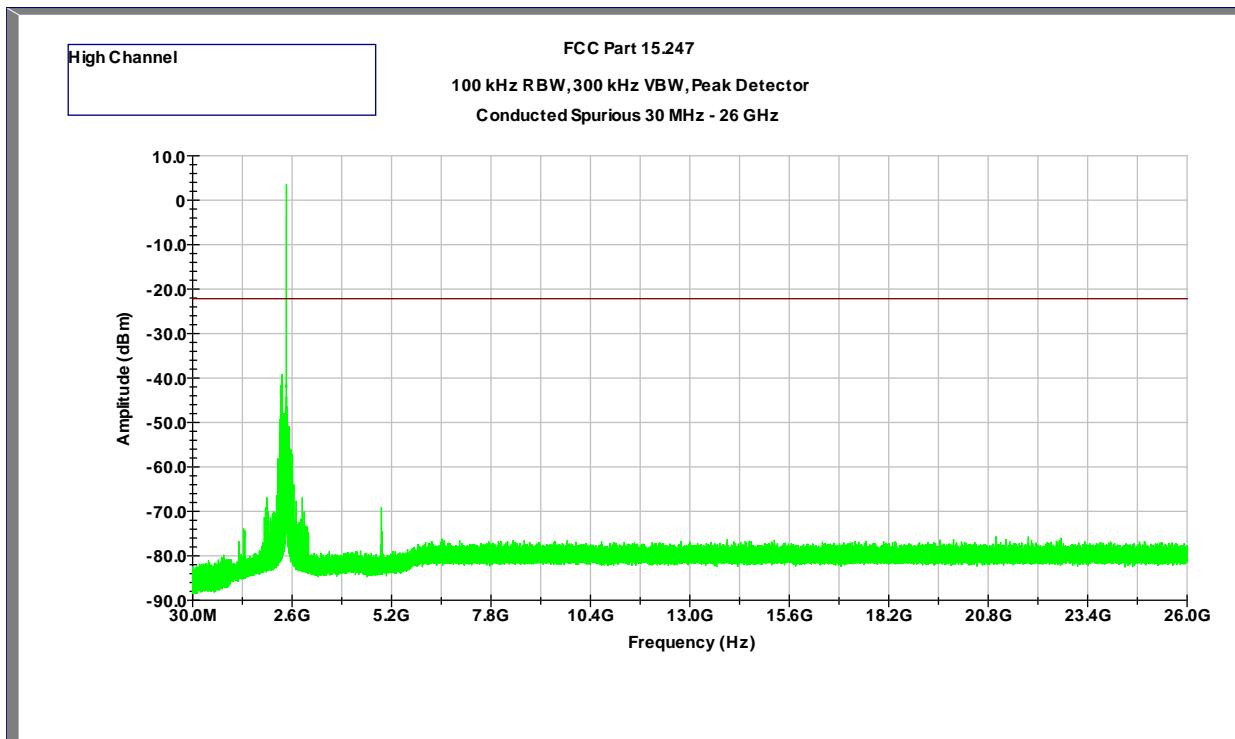
Tx @ Low Channel, 2483.5 MHz Band Edge, Charging Mode
Plot 4.7

Tx @ Low Channel, 2402 MHz, Charging Mode
30MHz -26GHz Conducted Spurious
Plot 4.8

Tx @ Mid Channel, 2440 MHz, Charging Mode
30MHz -26GHz Conducted Spurious
Plot 4.9



Tx @ High Channel, 2480 MHz, Charging Mode
30MHz -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 30 MHz to 25 GHz according to the procedure described in ANSI C63.10: 2013. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

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

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

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

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

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

4.5.3 Field Strength Calculation

Field Strength Calculation

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

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

Where FS = Field Strength in dB(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.

4.5.4 Antenna-port conducted measurements

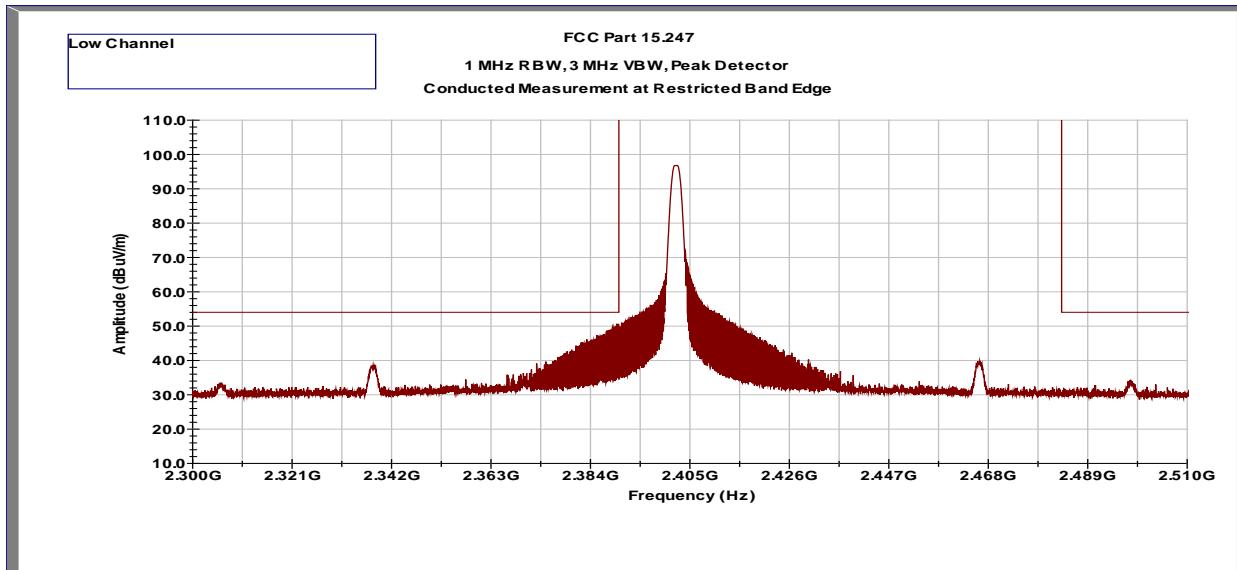
Antenna-port conducted measurements August also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious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

4.5.6 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 \leq 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:
$$E = EIRP - 20\log D + 104.8 + DCF$$
 (DCF for Average measurements)
where:
E = electric field strength in dB μ V/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

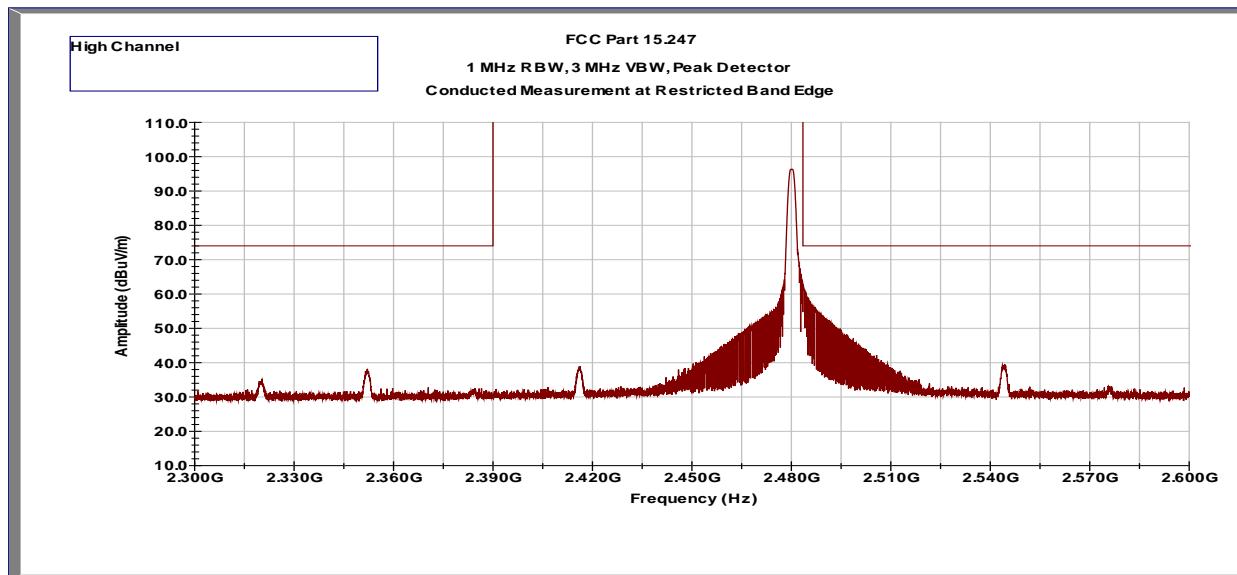
4.5.7 Test Results

Tested By	Test Date
Aaron Chang	October 9 - 13, 2019

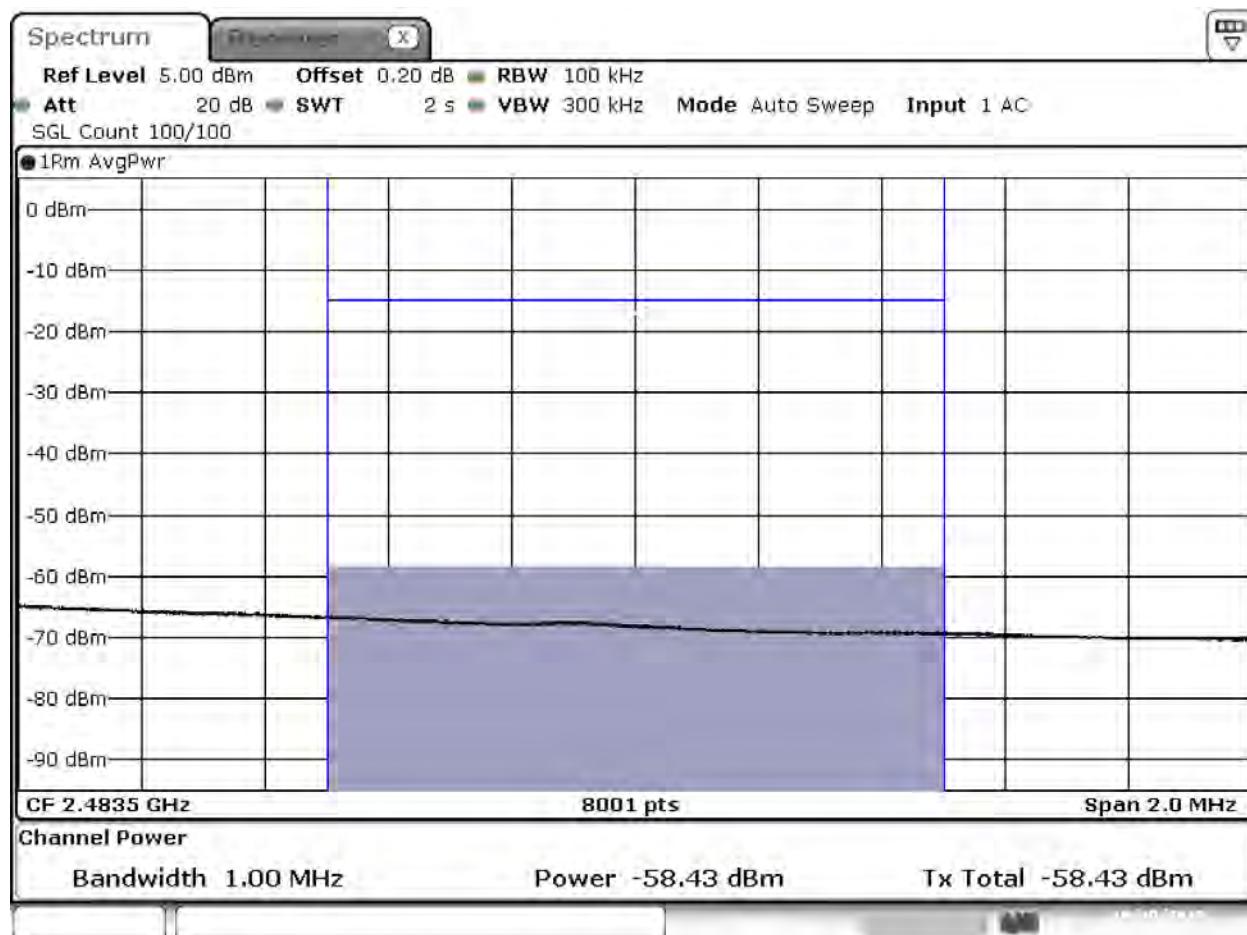
Test Results: 15.209/15.205 Restricted Band Emissions at Antenna Port
**Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2402 MHz, Battery Mode
Peak detector vs Average limits**


Frequency	Corrected Amplitude	Average Limit	Margin	Detector	Results
GHz	dB(μ V/m)	dB(μ V/m)	dB		
2.390	50.7	54	-3.3	Peak	Pass

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2480 MHz, Battery Mode
Peak detector vs Peak limits



Frequency	Corrected Amplitude	Peak Limit	Margin	Detector	Results
	GHz	dB(µV/m)	dB		
2.4835	62.8	74.0	-11.2	Peak	Pass



Frequency	Corrected Amplitude	Ave Limit	Margin	Detector	Results
GHz	dB μ V/m	dB μ V/m	dB		
2.4835	36.8	54.0	-17.2	RMS	Pass

E = EIRP - 20log D + 104.8

EIRP = -58.43

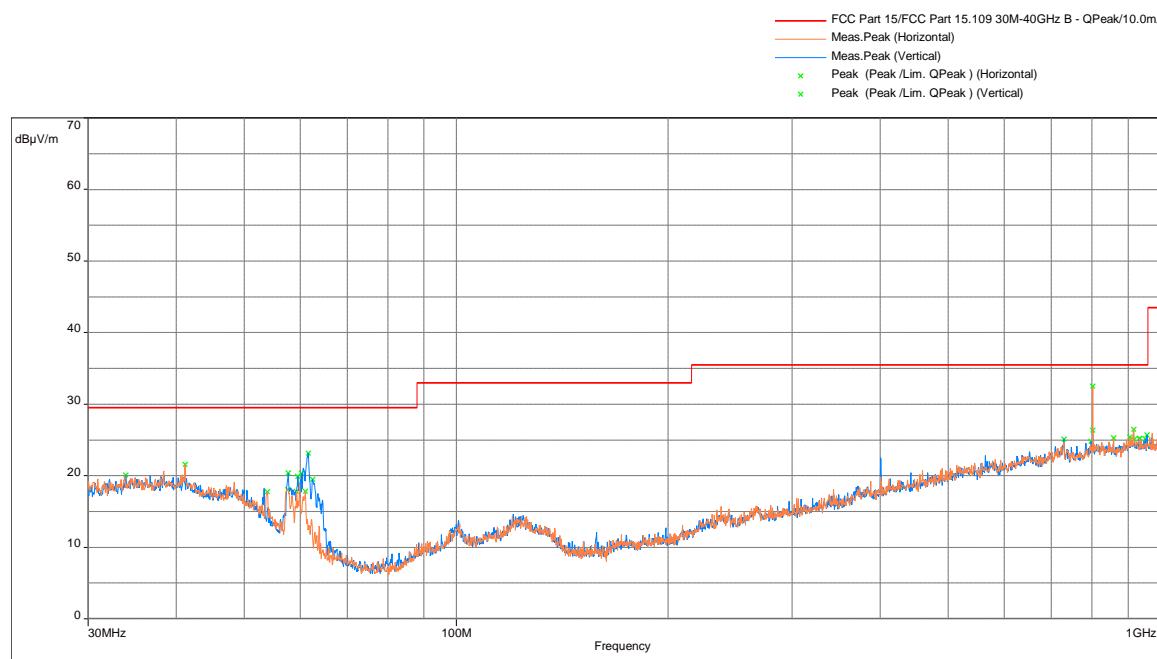
D = 3 (meters)

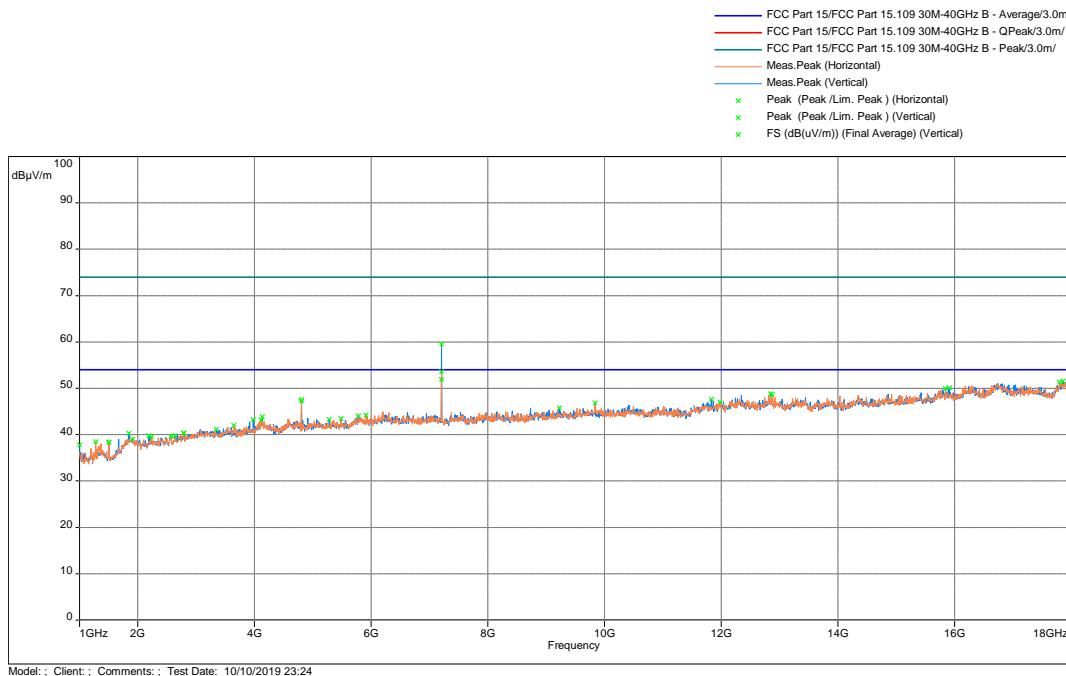
Section 11.13.3 "Trace averaging with continuous EUT transmission at full power" of ANSI 63.10 was utilized per KDB 558074 D01 DTS Meas Guidance v05.

Out-of-Band Radiated Spurious Emissions

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7207.021	51.85	54	-2.15	296.5	1.01	Vertical	57.22	-5.37

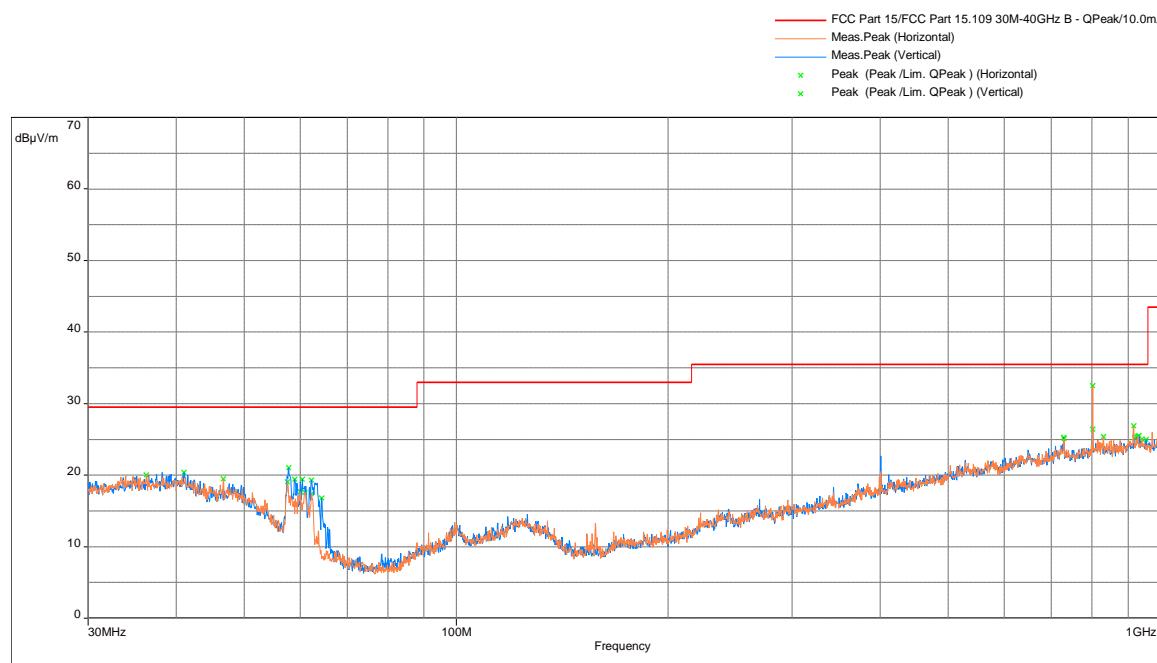
Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented. Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

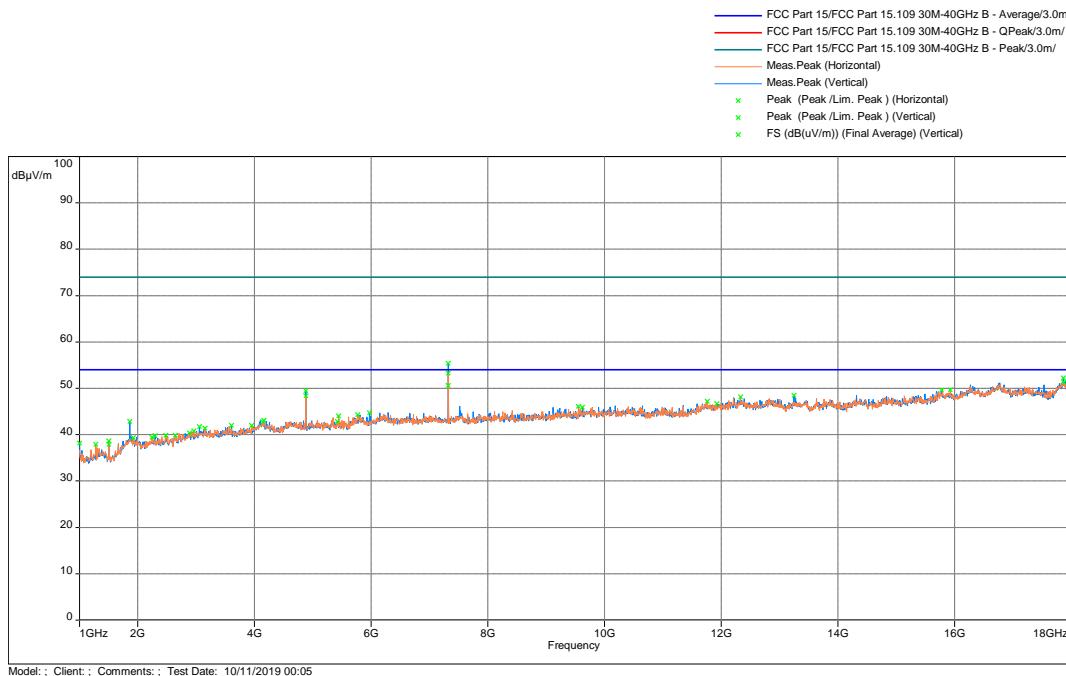
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

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

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

Radiated Spurious Emissions 30 MHz - 1000 MHz

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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7319.601	50.62	54	-3.38	332.75	1.59	Vertical	56.08	-5.46

Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented.
Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

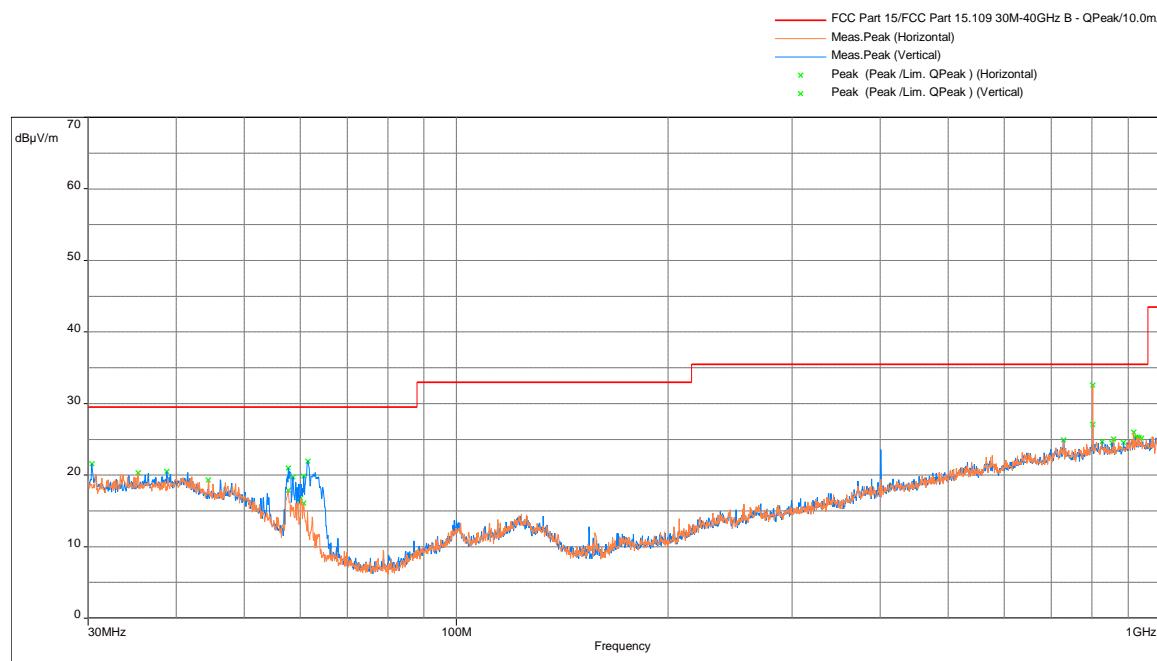
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

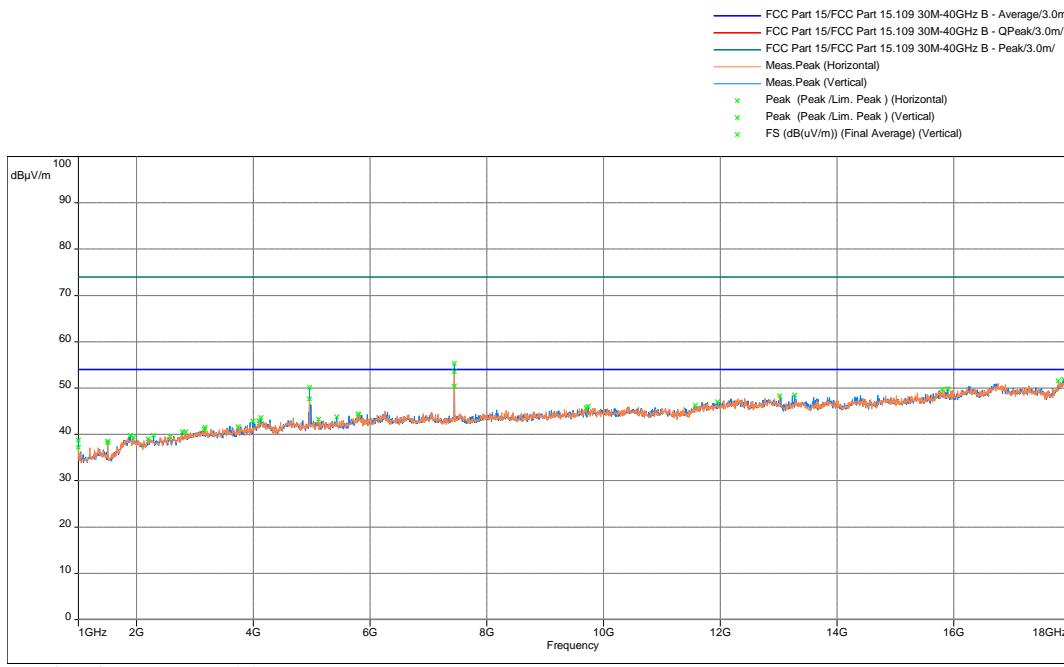
Results	Complies
----------------	-----------------

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



Freq. MHz	QP@10m dB(uV/m)	QP Limit@10m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
801.829	32.53	35.5	-2.97	268.25	1	Horizontal	-1.64

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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7441.028	50.4	54	-3.6	334.5	1.36	Vertical	55.41	-5

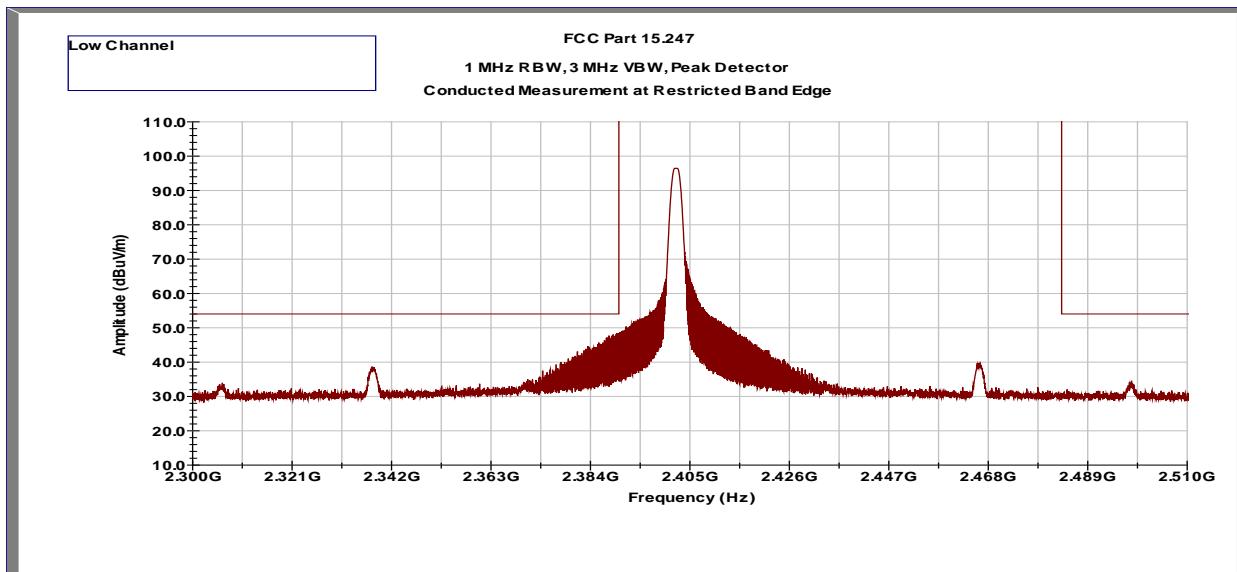
Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented. Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

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

Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

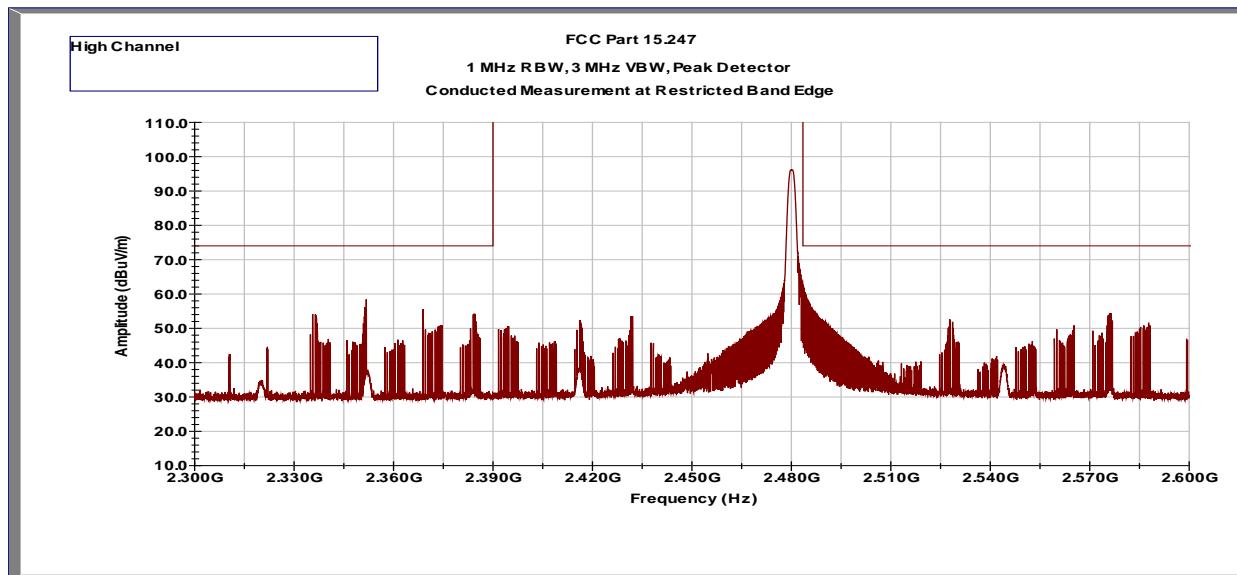
Results	Complies
----------------	-----------------

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2402 MHz, Charging Mode
Peak detector vs Average limits

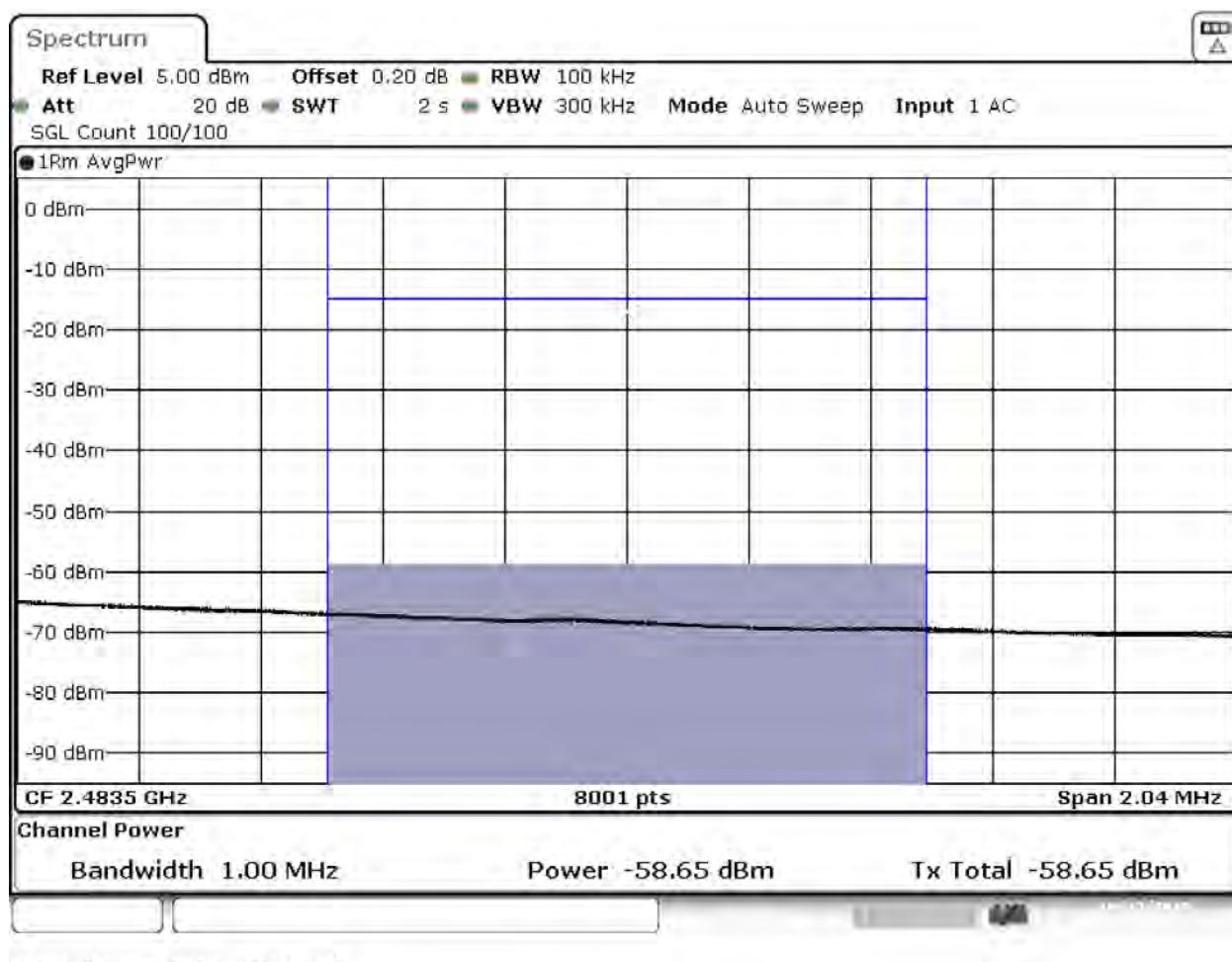


Frequency	Corrected Amplitude	Average Limit	Margin	Detector	Results
GHz	dB(μ V/m)	dB(μ V/m)	dB		
2.390	48.4	54	-5.6	Peak	Pass

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2480 MHz, Charging Mode
Peak detector vs Peak limits



Frequency	Corrected Amplitude	Peak Limit	Margin	Detector	Results
	GHz	dB(µV/m)	dB(µV/m)		
2.4835	62.2	74.0	-11.8	Peak	Pass



Frequency	Corrected Amplitude	Ave Limit	Margin	Detector	Results
GHz	dB μ V/m	dB μ V/m	dB		
2.4835	36.6	54.0	-17.4	RMS	Pass

E = EIRP - 20log D + 104.8

EIRP = -58.65

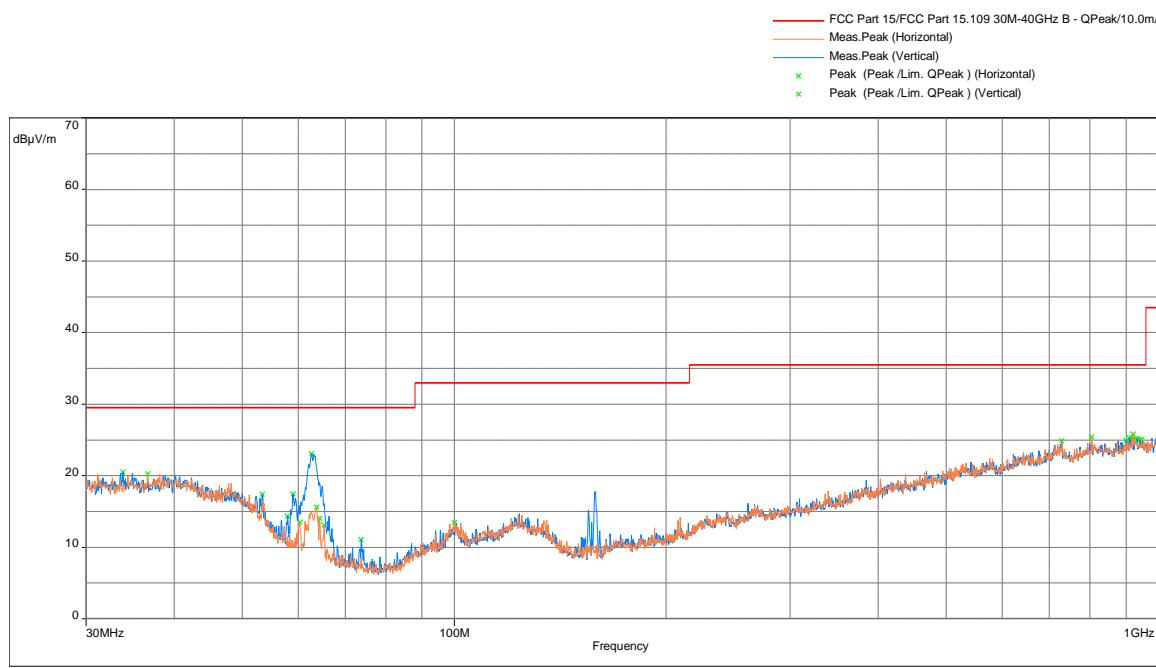
D = 3 (meters)

Section 11.13.3 "Trace averaging with continuous EUT transmission at full power" of ANSI 63.10 was utilized per KDB 558074 D01 DTS Meas Guidance v05.

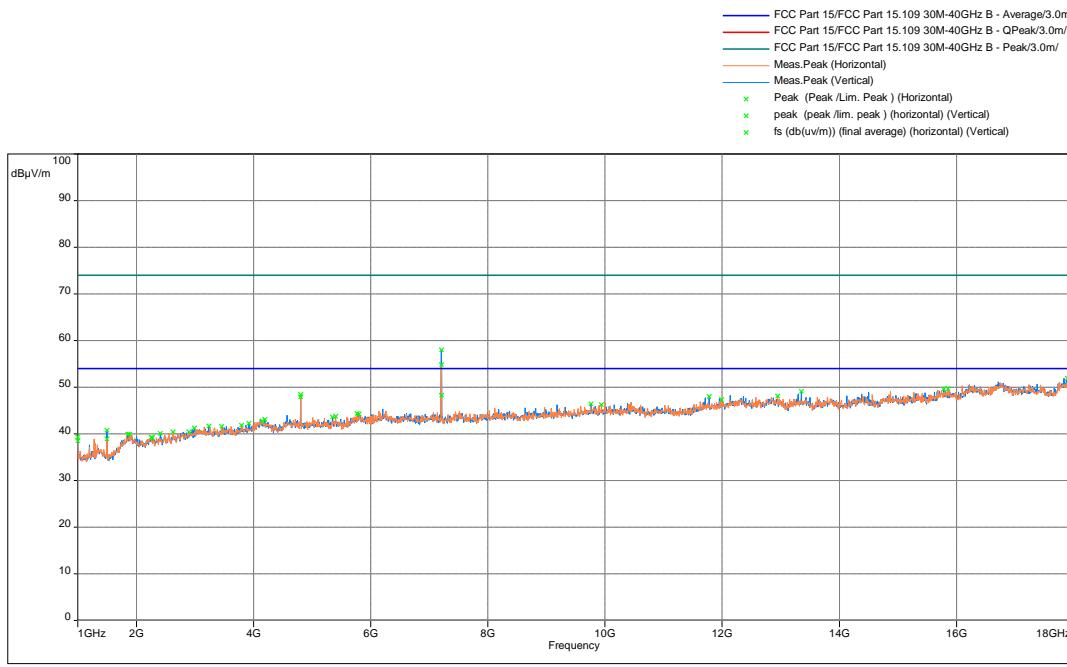
Out-of-Band Radiated Spurious Emissions

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



Freq. MHz	QP@10m dB(uV/m)	QP Limit@10m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Correction dB
62.721	23.08	29.5	-6.42	297.5	2.5	Vertical	-16.08

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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7207.015	48.23	54	-5.77	333.75	1.9	Vertical	53.6	-5.37

Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented.
Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

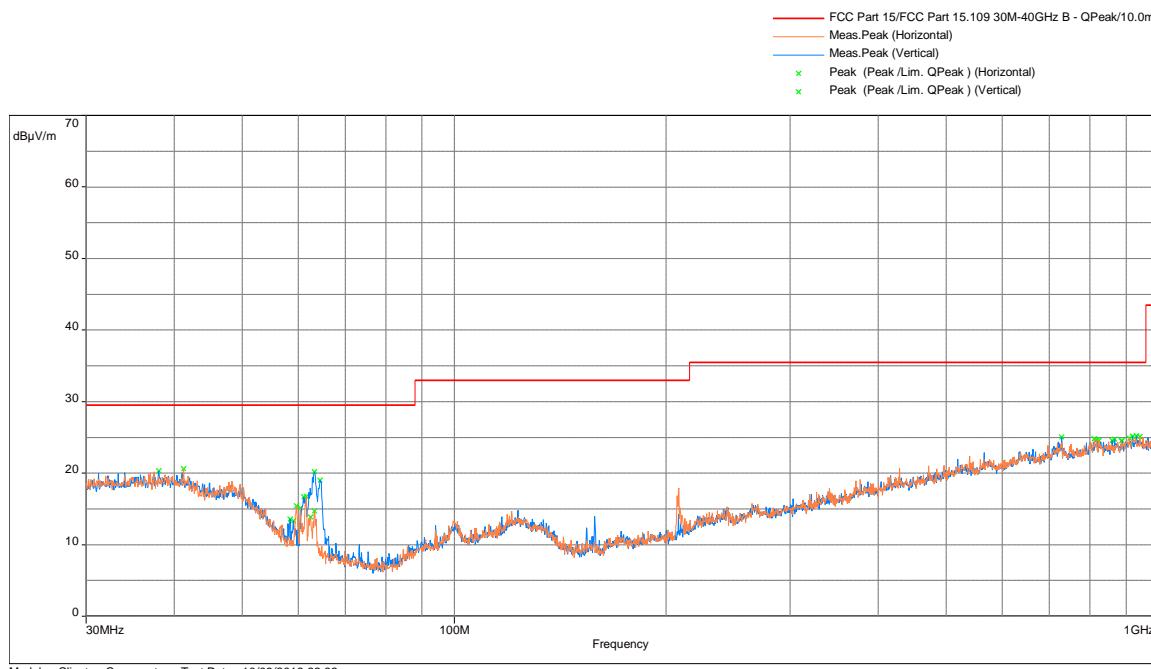
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

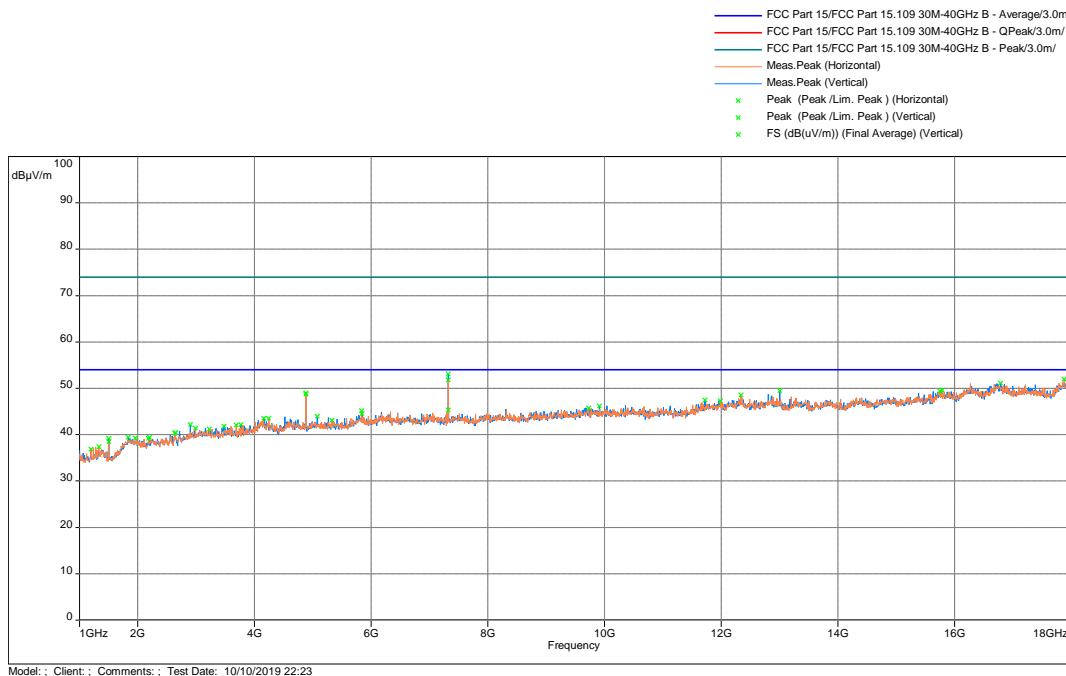
Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

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

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7319.598	45.32	54	-8.68	104.5	1.97	Vertical	50.78	-5.46

Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented.
Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

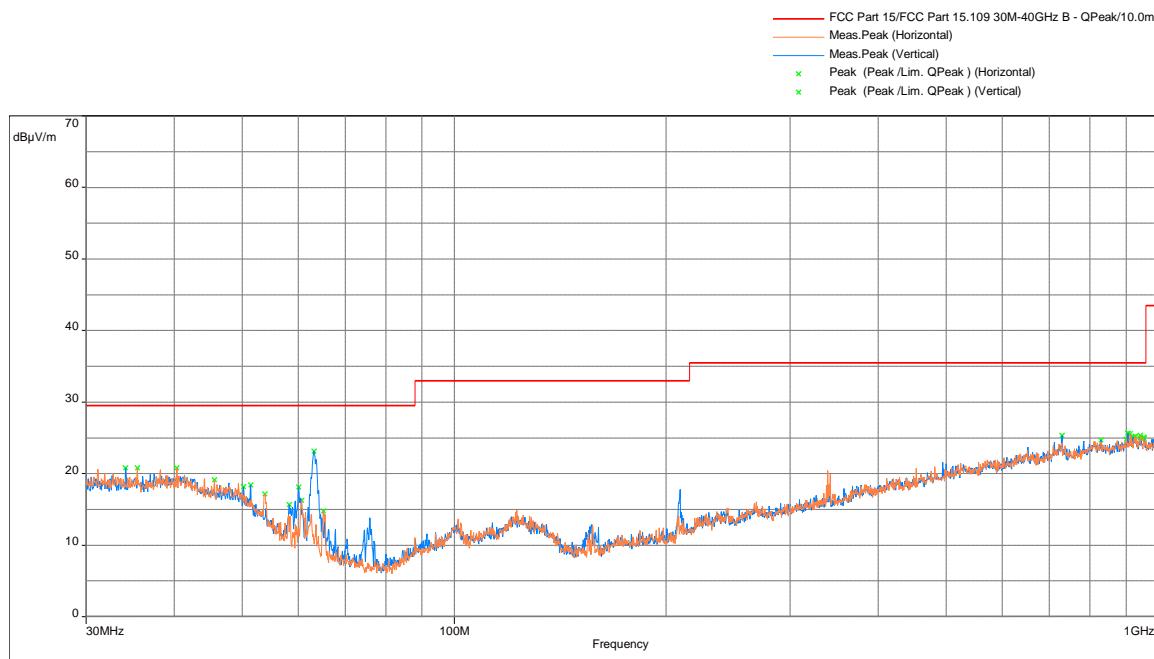
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

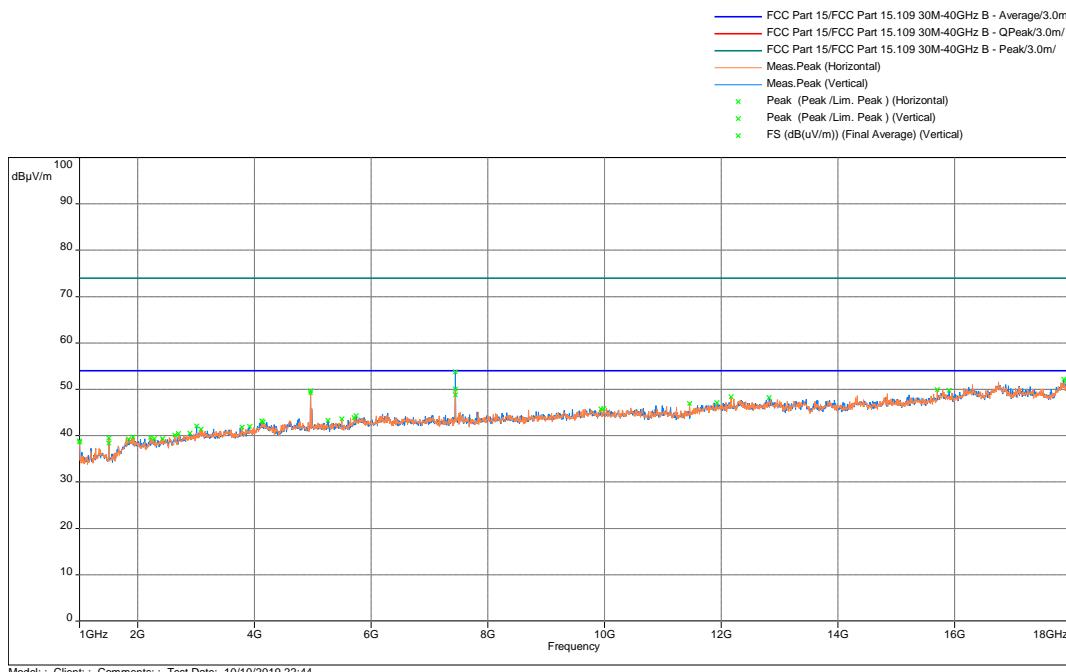
Note: FS@3m = RA + Correction
Correction = AF + CF – Preamp

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

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



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


Freq. MHz	Ave @3m dB(uV/m)	Ave Limit@3m dB(μV/m)	Margin dB	Azimuth deg	Height m	Polarity	Raw	Correction dB
7439.603	48.8	54	-5.2	251.25	1.78	Vertical	53.81	-5.01

Note: Measurements were performed in X, Y, Z planes of the EUT and worst cast data was presented.
 Final average measurements were performed using section 11.12.2.5.1 of ANSI 63.10.

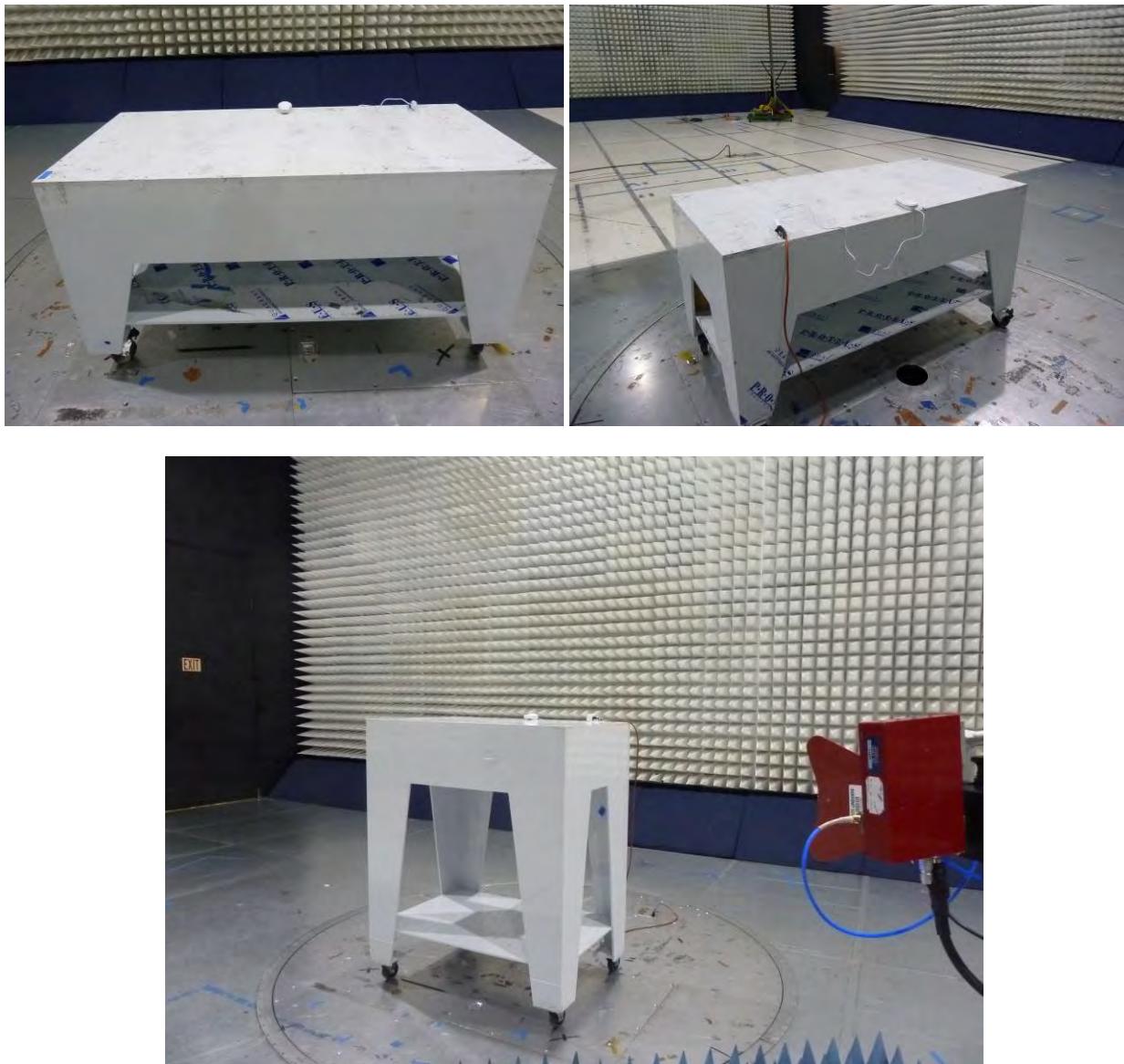
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + Correction
 Correction = AF + CF – Preamp

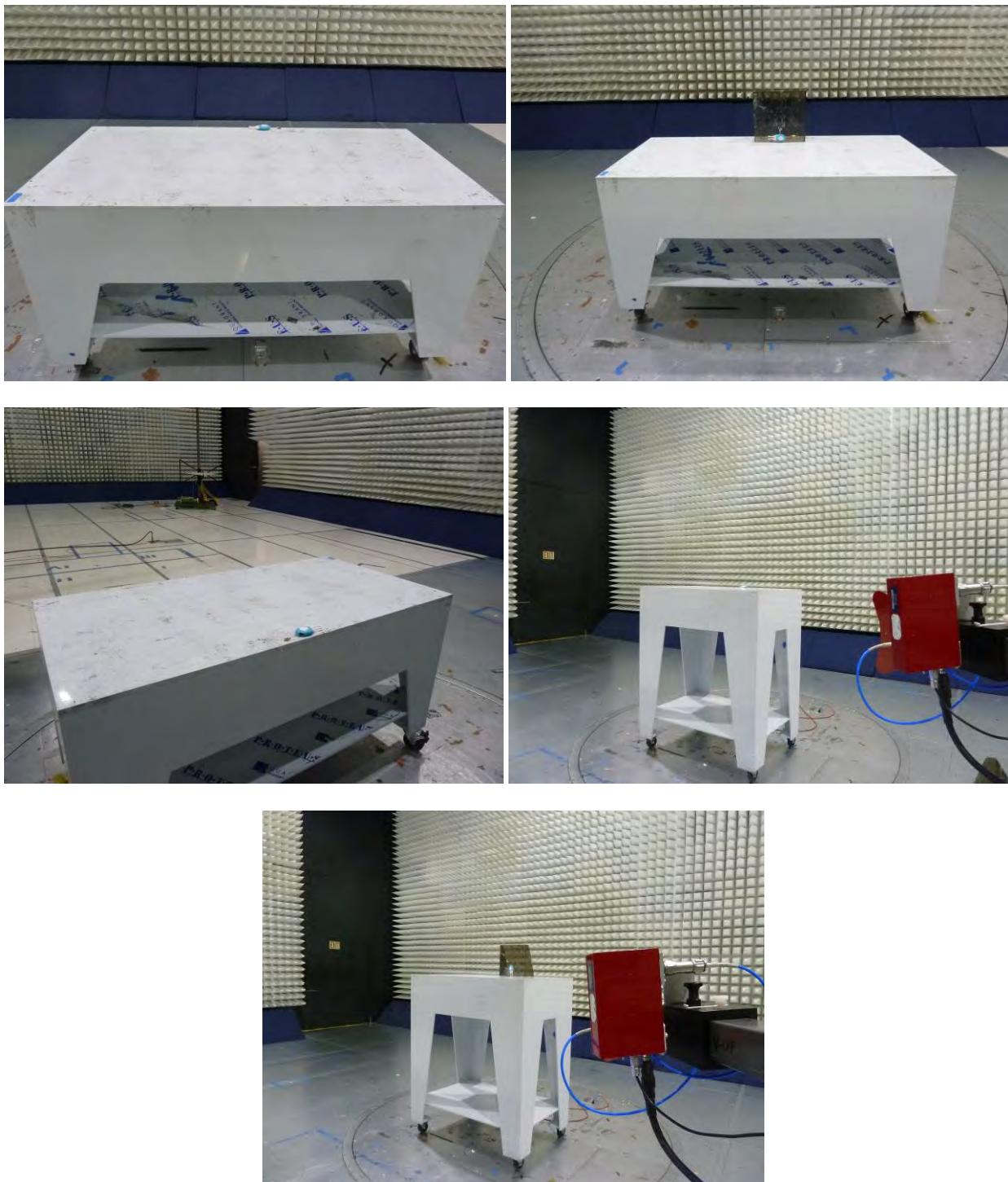
Results	Complies
----------------	-----------------

4.5.8 Test Setup Configuration

The following photographs show the testing configurations used.



4.5.8 Test Setup Configuration (Continue)



4.6 Radiated Emissions on Digital Parts FCC Ref: 15.109, ICES 003, RSS Gen

4.6.1 Test Limit

Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003*, RSS GEN

Frequency (MHz)	Class A at 10m dB(μ V/m)	Class B at 3m dB(μ V/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.6.2 Procedure

Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

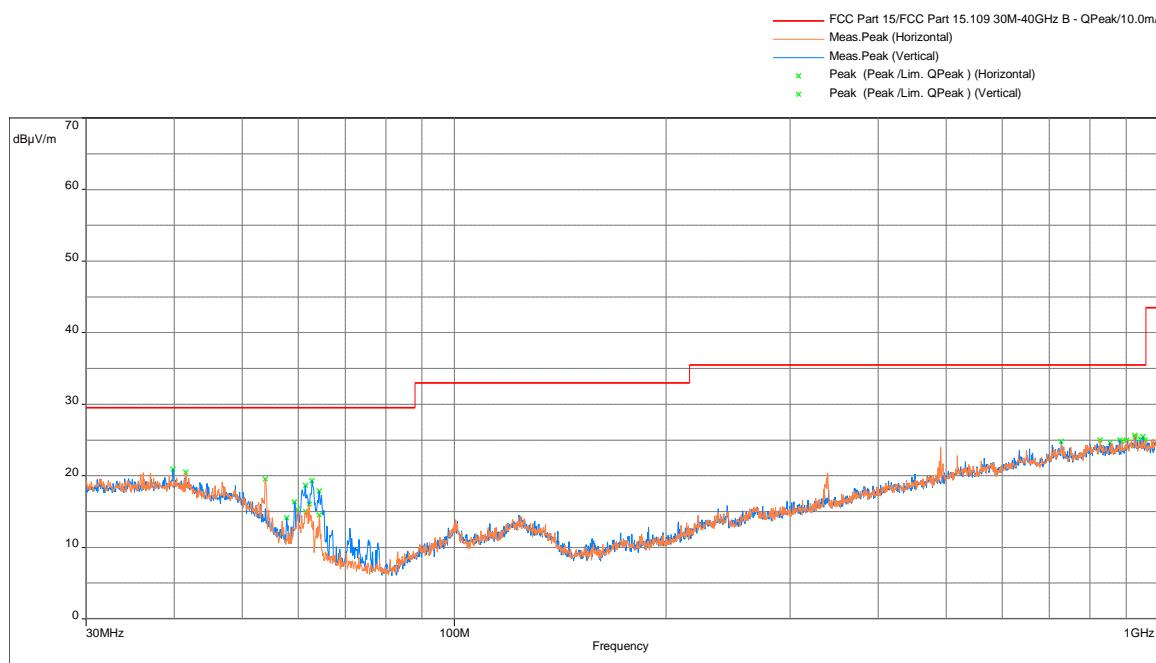
Radiated emission measurements were performed from 30 MHz to 18000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Measurements recorded in this section were made with the Transmitter in standby mode (Receive mode).

4.6.3 Test Results

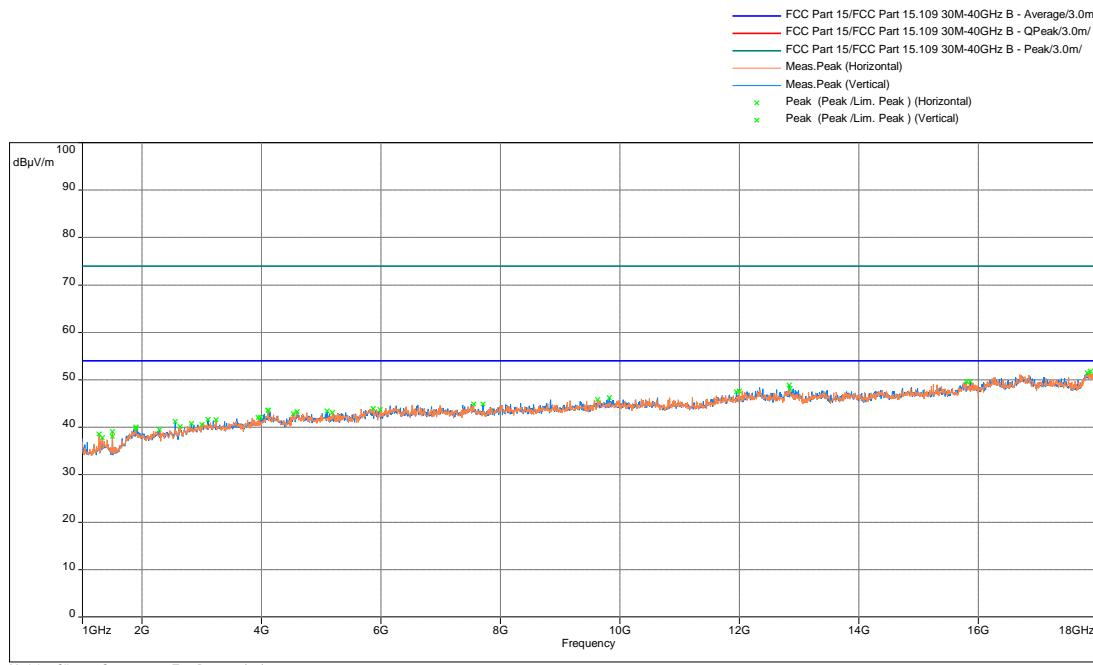
The EUT met the radiated disturbance requirements of FCC Part 15, Subpart B and ICES-003 Industry Canada for a Class B device.

FCC Part 15 Subpart B, ICES-003 Radiated Disturbance, 30MHz-1GHz, Battery Mode

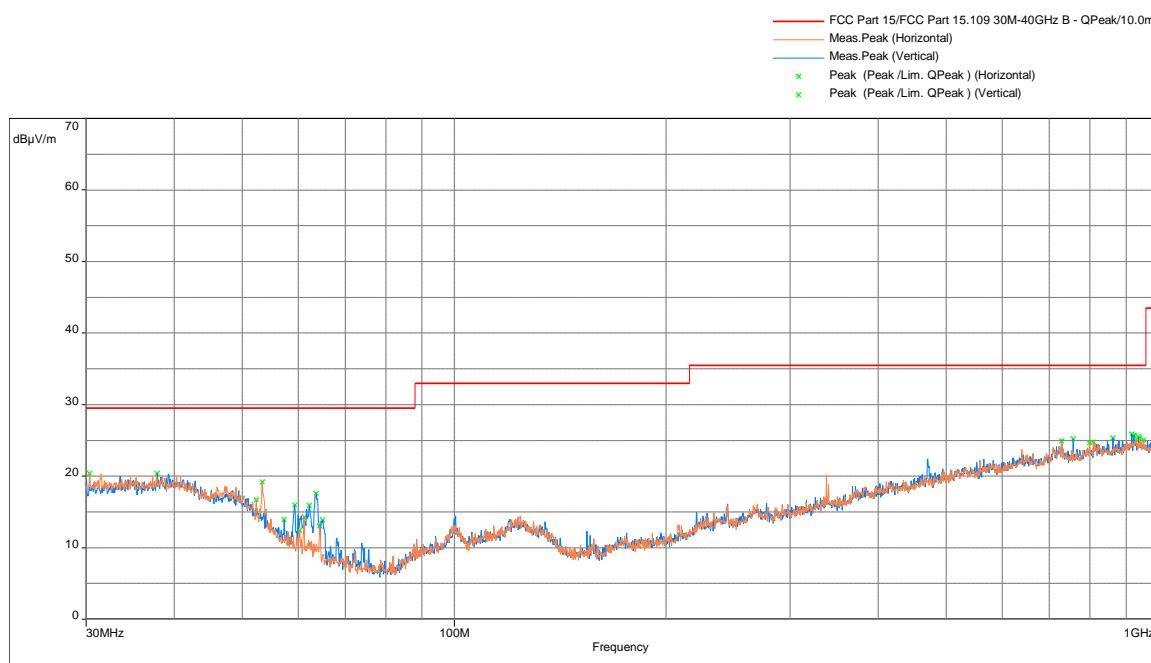


Frequency (MHz)	FS @10m dB(µV/m)	Limit @10m dB(µV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
39.829	20.89	29.5	-8.61	67.75	1	Vertical	27.66	-6.77
41.575	20.48	29.5	-9.02	239	2.52	Horizontal	27.09	-6.61
925.892	25.66	35.5	-9.84	73.75	1.02	Horizontal	25.67	-0.01
53.894	19.53	29.5	-9.97	216.25	3.99	Horizontal	31.44	-11.91
951.468	25.46	35.5	-10.04	263.5	2.5	Vertical	25.59	-0.13
927.412	25.39	35.5	-10.11	155.5	3.99	Vertical	25.3	0.09

4.6.3 Test Results (Continued)

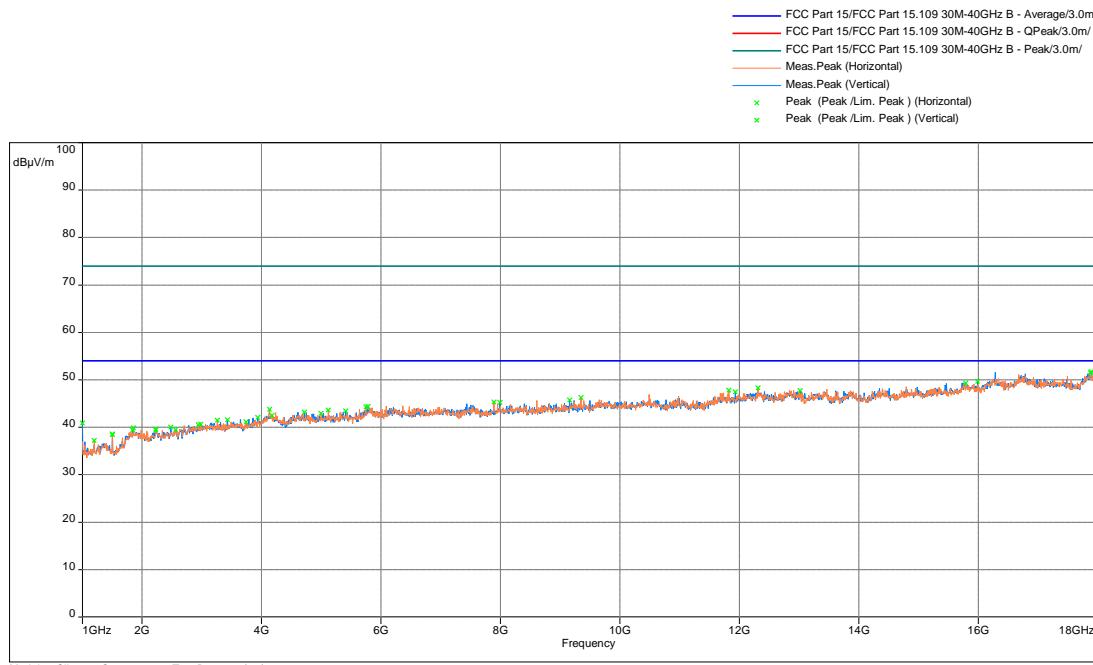
FCC Part 15 Subpart B, ICES-003 Radiated Disturbance, 1GHz-18GHz, Peak Detector

Result:	Complies by 8.61 dB for FCC Part 15 Subpart B and ICES-003
----------------	---

FCC Part 15 Subpart B, ICES-003 Radiated Disturbance, 30MHz-1GHz, Charging Mode


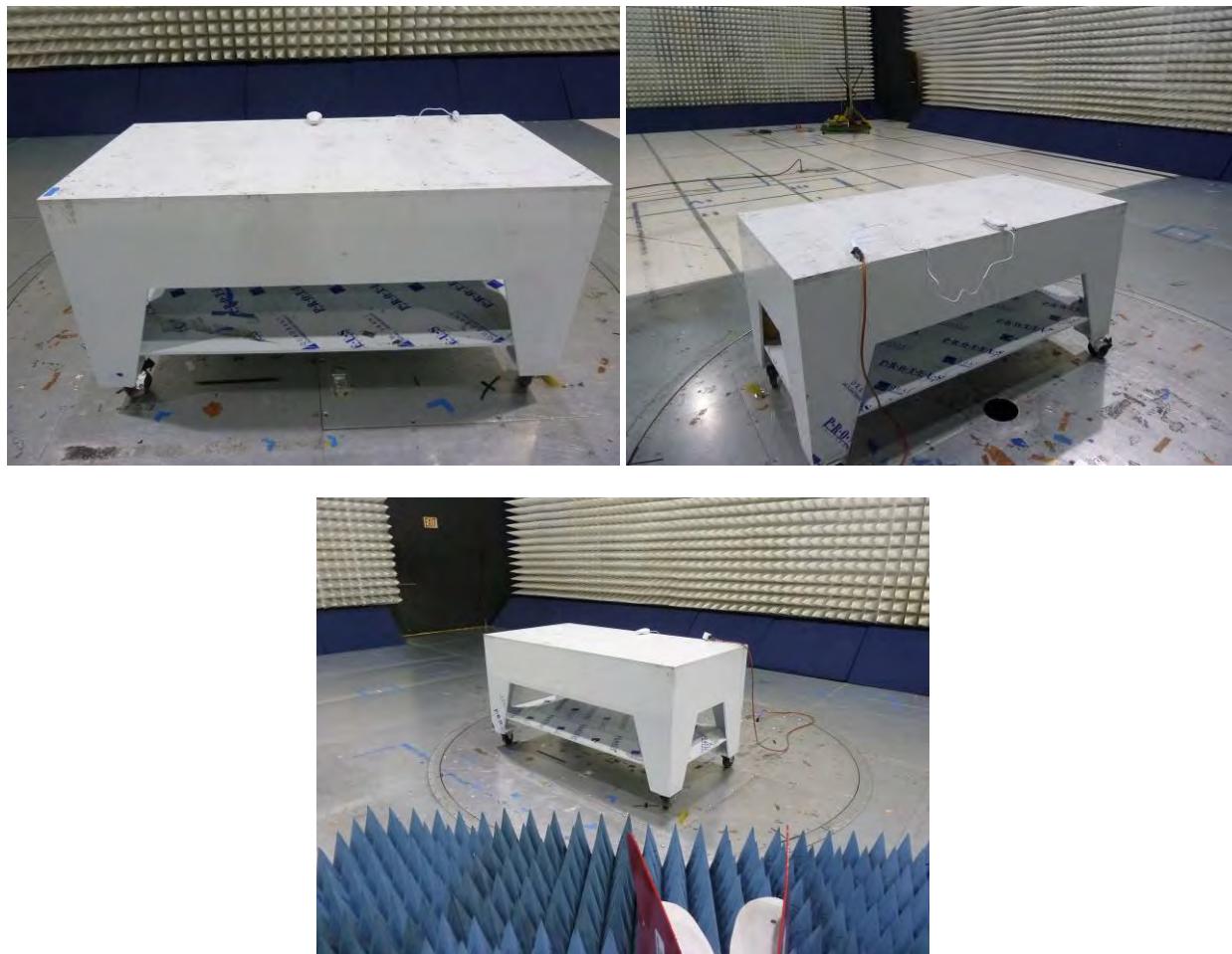
Frequency (MHz)	FS @10m dB(µV/m)	Limit @10m dB(µV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
37.857	20.38	29.5	-9.12	2.5	205.25	Vertical	27.07	-6.69
30.356	20.35	29.5	-9.15	0.99	173	Horizontal	27.09	-6.74
916.968	25.89	35.5	-9.61	3.99	28.5	Vertical	26.3	-0.41
923.208	25.7	35.5	-9.8	0.99	343.75	Vertical	25.81	-0.11
922.077	25.67	35.5	-9.83	0.99	259.25	Vertical	25.87	-0.2
937.467	25.48	35.5	-10.02	3.99	299	Vertical	25.48	0

4.6.3 Test Results (Continued)

FCC Part 15 Subpart B, ICES-003 Radiated Disturbance, 1GHz-18GHz, Peak Detector

Result:	Complies by 9.12 dB for FCC Part 15 Subpart B and ICES-003
----------------	---

4.6.4 Test Setup Photographs:



4.6.4 Test Setup Photographs (Continued)



4.7 AC Line Conducted Emission
 FCC Rule 15.207, FCC 15.107

4.7.1 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.*

4.7.2 Procedure

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

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

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

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

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

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

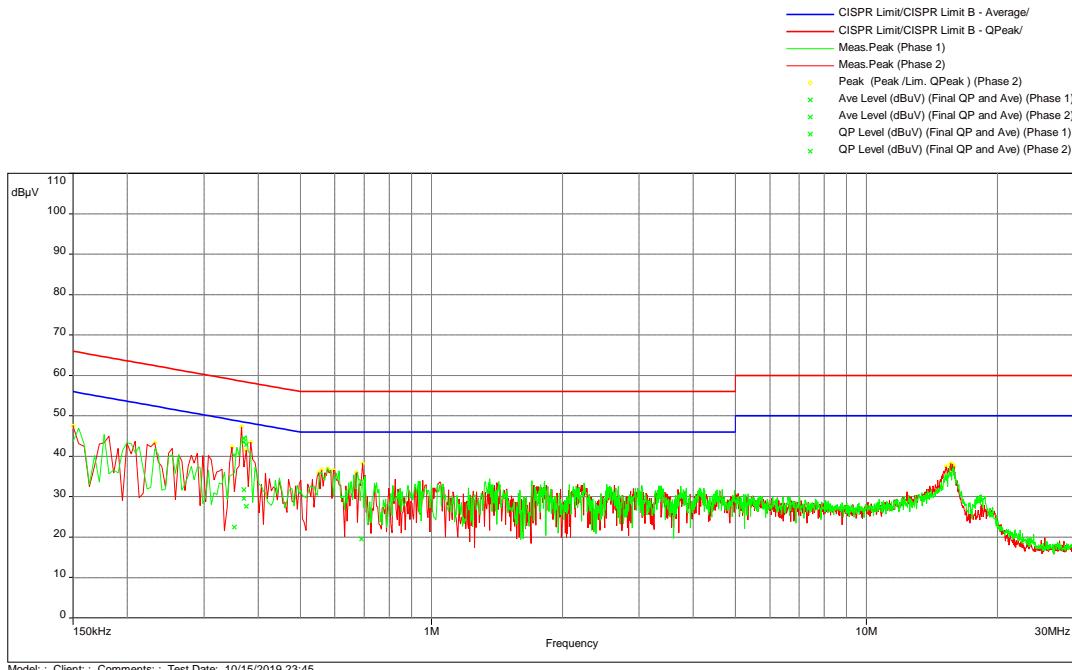
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207. EUT was placed in standby mode (Receive mode) then tested for conducted emissions per 15.107 to ensure the device complies with 15.107.

4.7.3 Test Results

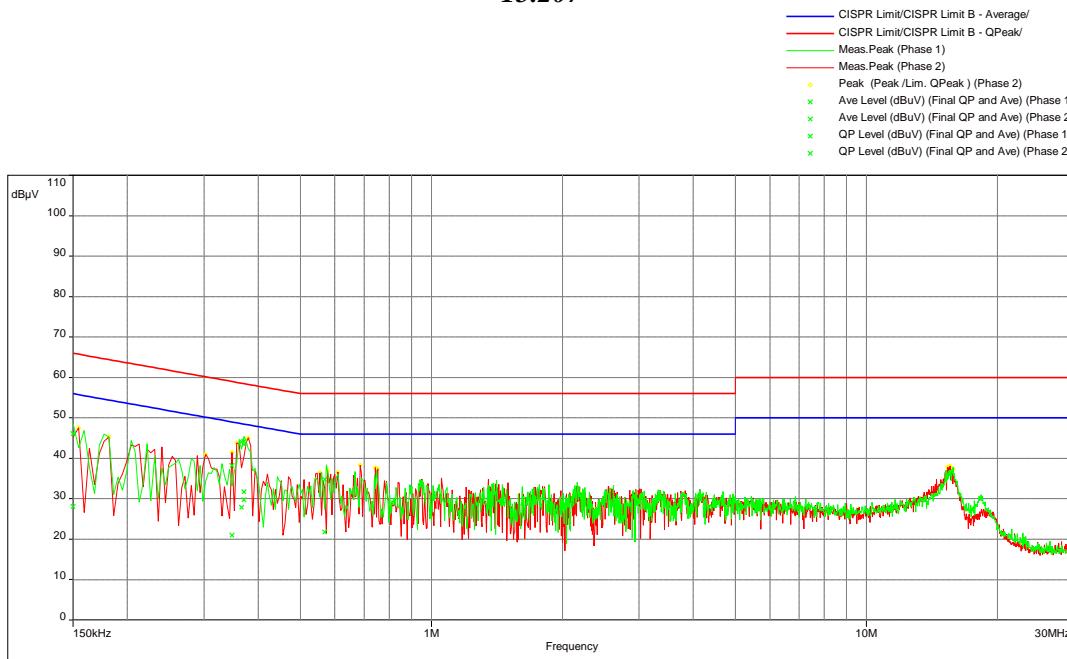
The EUT met the radiated disturbance requirements of FCC Part 15, Subpart B and ICES-003 Industry Canada for a Class B device.

FCC Part 15 Subpart B and ICES-003 Conducted Disturbance @ 120 Vac 60 Hz 15.107



Frequency (MHz)	Ave Level (dBuV)	QP Level (dBuV)	Ave Limit (dBuV)	QP Limit (dBuV)	Ave Margin (dB)	QP Margin (dB)	Line	Correction (dB)
0.150	27.14	45.89	56	66	-28.86	-20.11	Phase 2	10.73
0.354	22.5	40.33	48.9	58.9	-26.4	-18.58	Phase 2	10.66
0.372	29.57	44.38	48.49	58.49	-18.92	-14.11	Phase 2	10.65
0.371	31.69	43.49	48.49	58.49	-16.8	-15	Phase 1	10.66
0.377	27.55	42.86	48.39	58.39	-20.84	-15.53	Phase 2	10.66
0.691	19.51	33.82	46	56	-26.49	-22.18	Phase 2	10.7

Conducted Disturbance @ 120 Vac 60 Hz
15.207

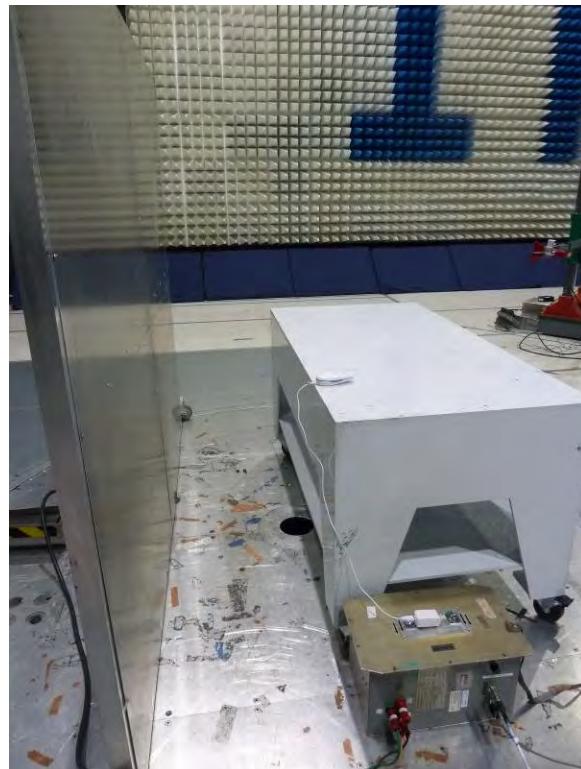
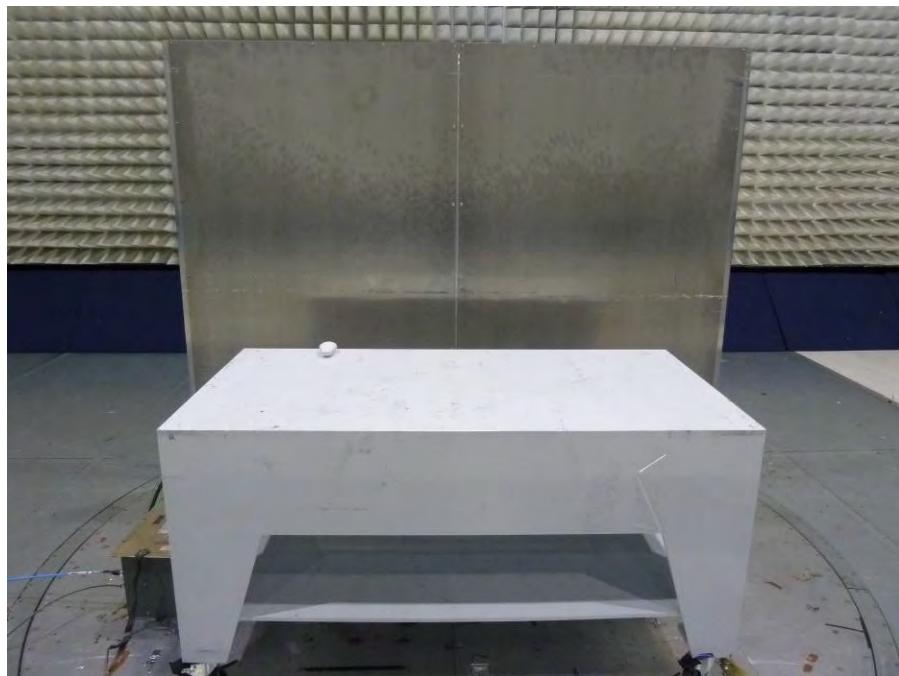


Model: ; Client: ; Comments: ; Test Date: 10/15/2019 23:18

Frequency (MHz)	Ave Level (dBuV)	QP Level (dBuV)	Ave Limit (dBuV)	QP Limit (dBuV)	Ave Margin (dB)	QP Margin (dB)	Line	Correction (dB)
0.150	28.06	46.09	56	66	-27.94	-19.91	Phase 1	10.73
0.371	31.7	43.47	48.49	58.49	-16.79	-15.02	Phase 1	10.66
0.568	21.73	34.74	46	56	-24.27	-21.26	Phase 1	10.68
0.346	21	38.24	49.01	59.01	-28.01	-20.77	Phase 2	10.66
0.367	27.87	44.08	48.59	58.59	-20.72	-14.51	Phase 2	10.67
0.372	29.73	44.25	48.49	58.49	-18.76	-14.24	Phase 2	10.65

Result: Complies by 14.11 dB for FCC Part 15 Subpart B and ICES-003

4.7.4 Test Setup Configuration



5.0 List of Test Equipment

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

Equipment	Manufacturer	Model Tested/Type	Asset #	Cal Int	Cal Due
EMI Receiver	Rohde and Schwarz	ESR7	ITS 01607	12	10/23/19
EMI Receiver	Rohde and Schwarz	ESU40	ITS 00961	12	10/27/20
Active Horn Antenna	ETS-Lindgren	3117-PA	ITS 01636	12	01/17/20
Bi-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	04/24/20
Pre-Amplifier	Sonoma Instrument	310N	ITS 00415	12	04/17/20
RE Cable	TRU Corporation	TRU CORE 300	ITS 01462	12	08/27/20
RE Cable	TRU Corporation	TRU CORE 300	ITS 01465	12	08/27/20
RE Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/27/20
RF Cable	TRU Corporation	TRU CORE 300	ITS 01342	12	12/05/19
Notch Filter	MICRO-TRONICS	BRM50702	ITS 01166	12	05/14/20
RF Cable	Mega Phase	EMC1-K1K1-236	ITS 01537	12	02/20/20
RF Cable	Mega Phase	TM40-K1K1-59	ITS 01156	12	02/20/20

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	Oculeve 10-8-2019.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 / G103993771	AC	KV	October 25, 2019	Original document
2.0 / G103993771	AC	KV	November 21, 2019	Per manufacturer request report was issued under Allergan PLC.