TEST REPORT

Report Number: 103319970MPK-009
Project Number: G103319970
December 21, 2017

Testing performed on
Radial Medical Compression System
Model: FG-0053
FCC ID: 2AOQW-FG-0053
to

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

For

Radial Medical, Inc.

Test Performed by:	Test Authorized by:
Intertek	Radial Medical, Inc.
1365 Adams Court	2500 Grant Road G01
Menlo Park, CA 94025 USA	Mountain View, CA 94040 USA

Prepared by: _____ **Date:** December 21, 2017
Aaron Chang

Reviewed by: _____ **Date:** December 21, 2017
Krishna K Vemuri

Report No. 103319970MPK-009

Equipment Under Test:	Radial Medical Compression System
Trade Name:	Radial Medical, Inc.
Model Number:	FG-0053
Applicant:	Radial Medical, Inc.
Contact:	Eric Johnson
Address:	Radial Medical, Inc. 2500 Grant Road G01 Mountain View, CA 94040
Country	USA
Tel. Number:	(707) 843-0871
Email:	Ejohnson@radialmedical.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	December 4-15, 2017

We attest to the accuracy of this report:

Aaron Chang
Project Engineer

Krishna K Vemuri
Engineering Team Lead

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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, 5.4.4	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.1	Complies
Power Density	15.247(e)	RSS-247, 5.2.2	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)
RF Exposure	15.247(i), 2.1093(d)	RSS-102	Complies

EUT receive date: December 4, 2017

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: December 4, 2017

Test completion date: December 15, 2017

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

2.0 General Information

2.1 Product Description

Radial Medical, Inc. supplied the following description of the EUT:

The Radial Medical Compression System consists of two components:
1) a portable, battery powered compression unit placed on the calf, secured around the shin with a shin pad and hook and loop fasteners, and
2) an inductive charging unit which, when mechanically coupled with the compression unit, inductively charges the device.
The compression unit can be controlled wirelessly using a smartphone via BLE connection or directly on the device. When used for prescriptive applications, only the physician is able to control the treatment parameters and can monitor the patient's compliance and therapy progress remotely. The patient is able to turn the device on and off and monitor the progress of their therapy with the smartphone application.

For more information, see user's manual provided by the manufacturer.

Information about the Bluetooth 4.0 (BLE) radio is presented below:

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

Information about the 2.4 GHz radio is presented below:

Applicant	Radial Medical, Inc.
Model No.	FG-0053
FCC Identifier	2AOQW-FG-0053
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	-2.16 dBm
Antenna(s) & Gain	Internal Antenna, Gain: -1.5 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40, Channel 0-39
Applicant Name & Address	Radial Medical, Inc. 2500 Grant Road G01 Mountain View, CA 94040 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 v04), and RSS-247, RSS-GEN Issue 4.

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

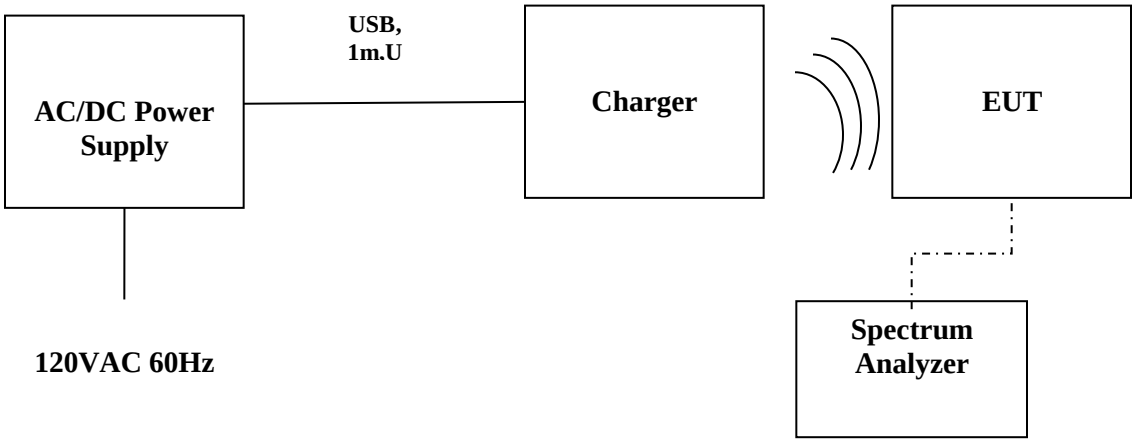
No support equipment was used for testing.

3.2 Block Diagram of Test Setup

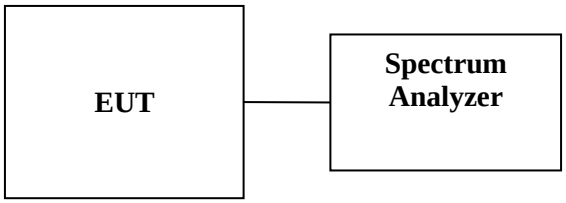
Equipment Under Test			
Description	**Manufacturer**	**Model Number**	**Serial Number**
Radial Medical Compression System	Radial Medical, Inc.	FG-0053	FCC2

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

Charging Mode



Battery Powered



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.

3.4 Software Exercise Program

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

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.

3.5 Modifications Required for Compliance

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

3.6 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 A8.2 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 558074 D01 DTS Meas Guidance v04 was used to determine the DTS occupied bandwidth. Section 8.1 Option 1 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

Battery Mode:

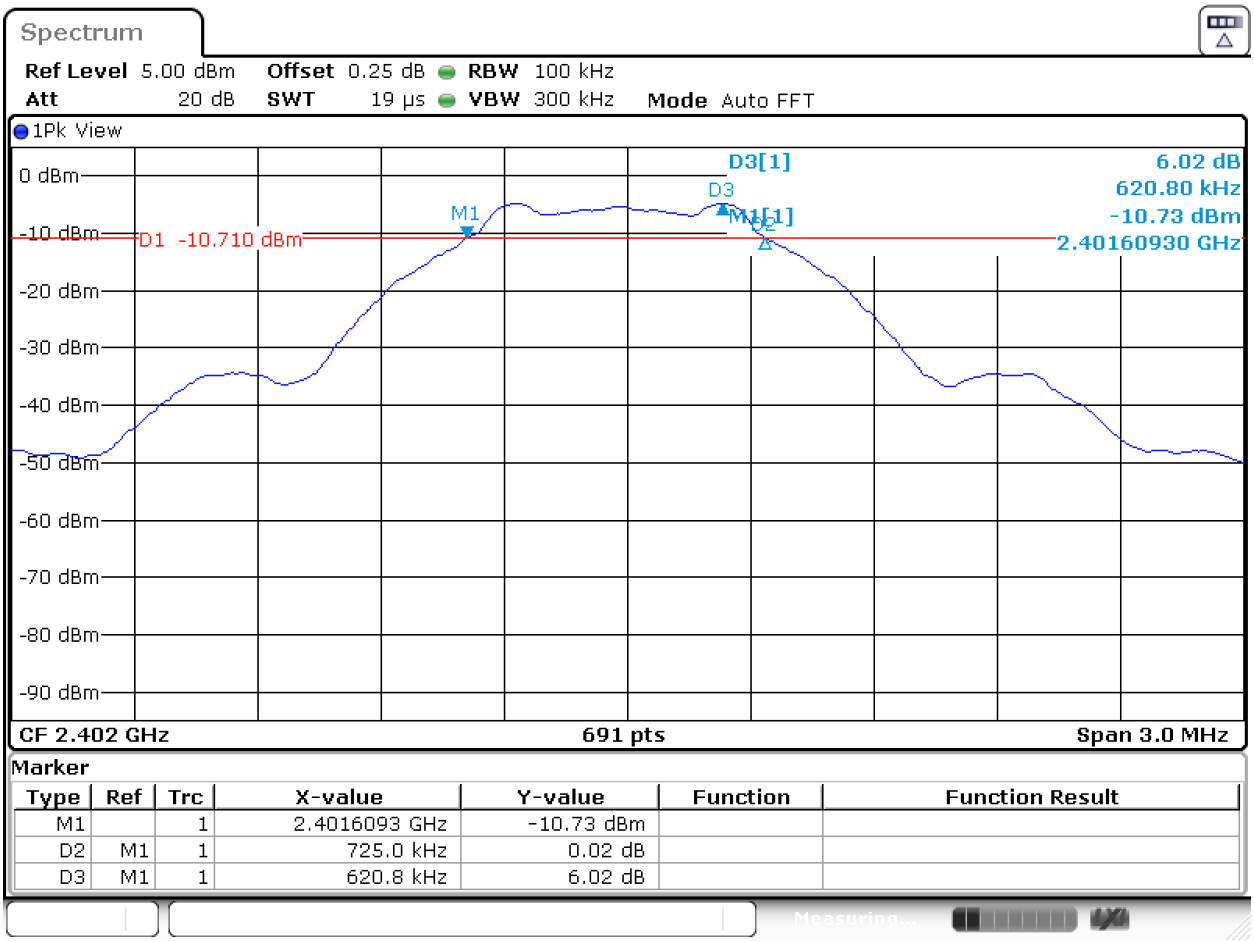
Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	725.000	--	1.1
	--	1.046	1.4
2440	738.100	--	1.2
	--	1.050	1.5
2480	742.400	--	1.3
	--	1.055	1.6

Charging Mode:

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	726.660	--	1.7
	--	1.039	1.10
2440	738.280	--	1.8
	--	1.063	1.11
2480	754.410	--	1.9
	--	1.052	1.12

Date of Test:	December 4&5, 2017
Results	**Complies**

Plot 1. 1



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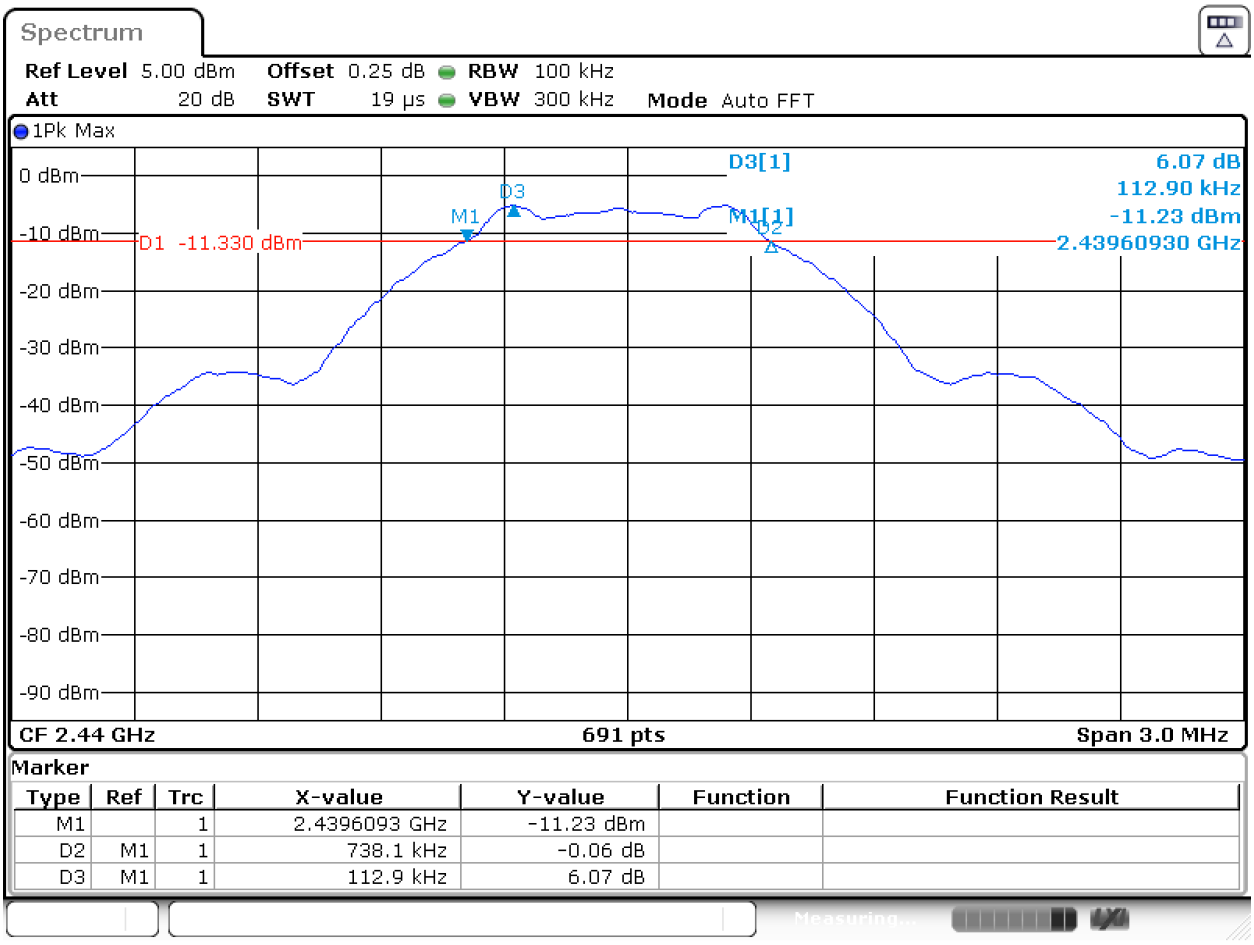
Plot 1. 2



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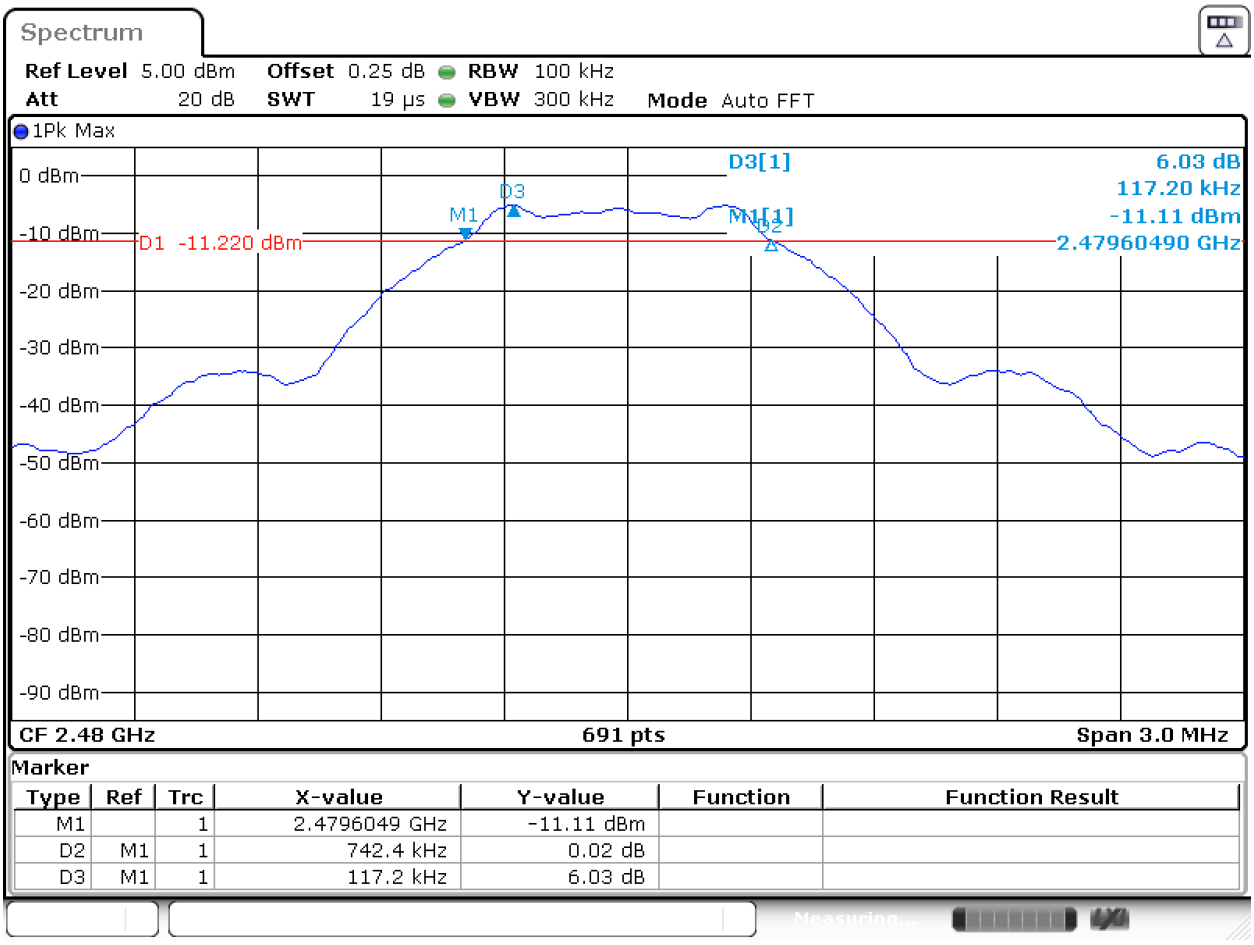

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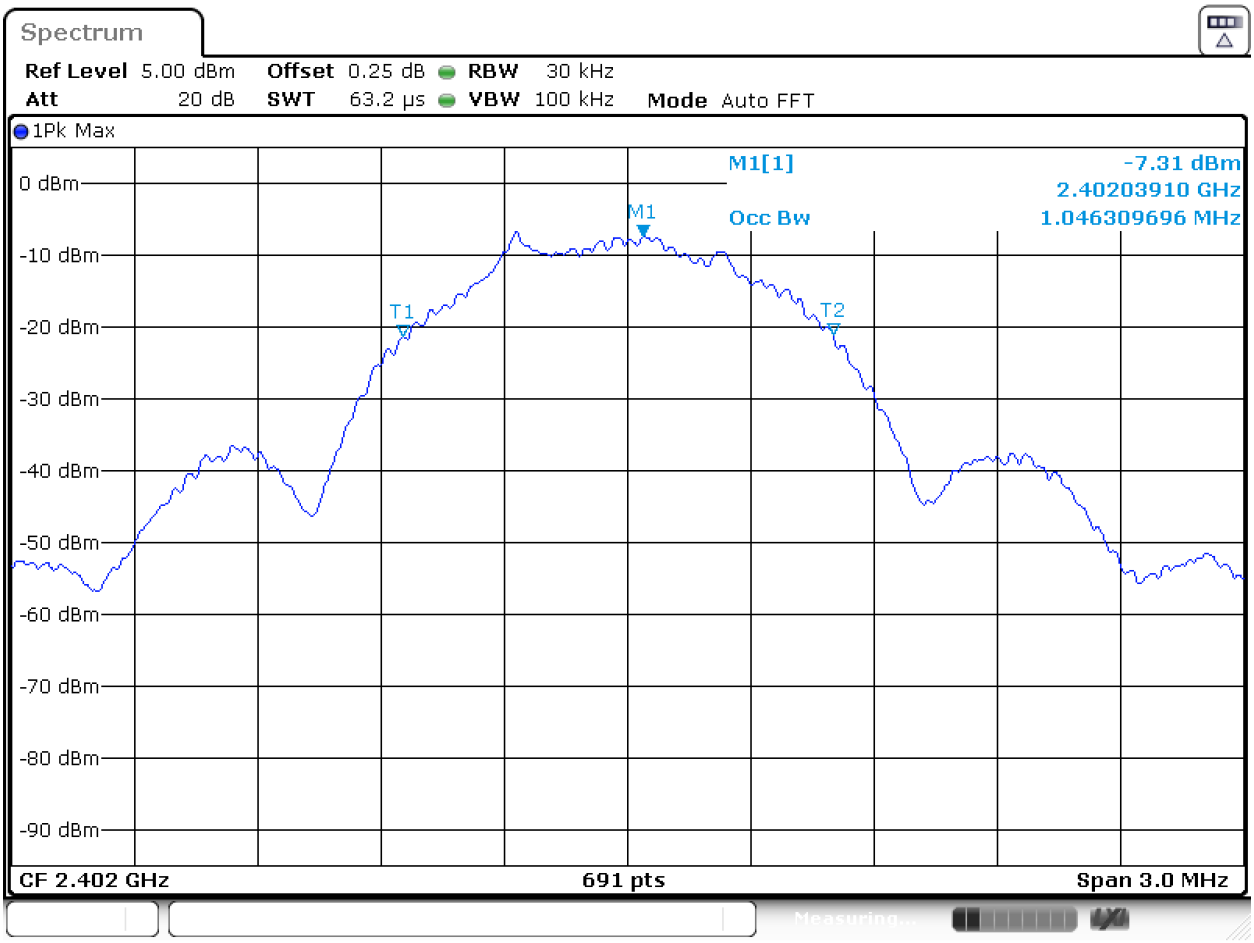
Plot 1. 4



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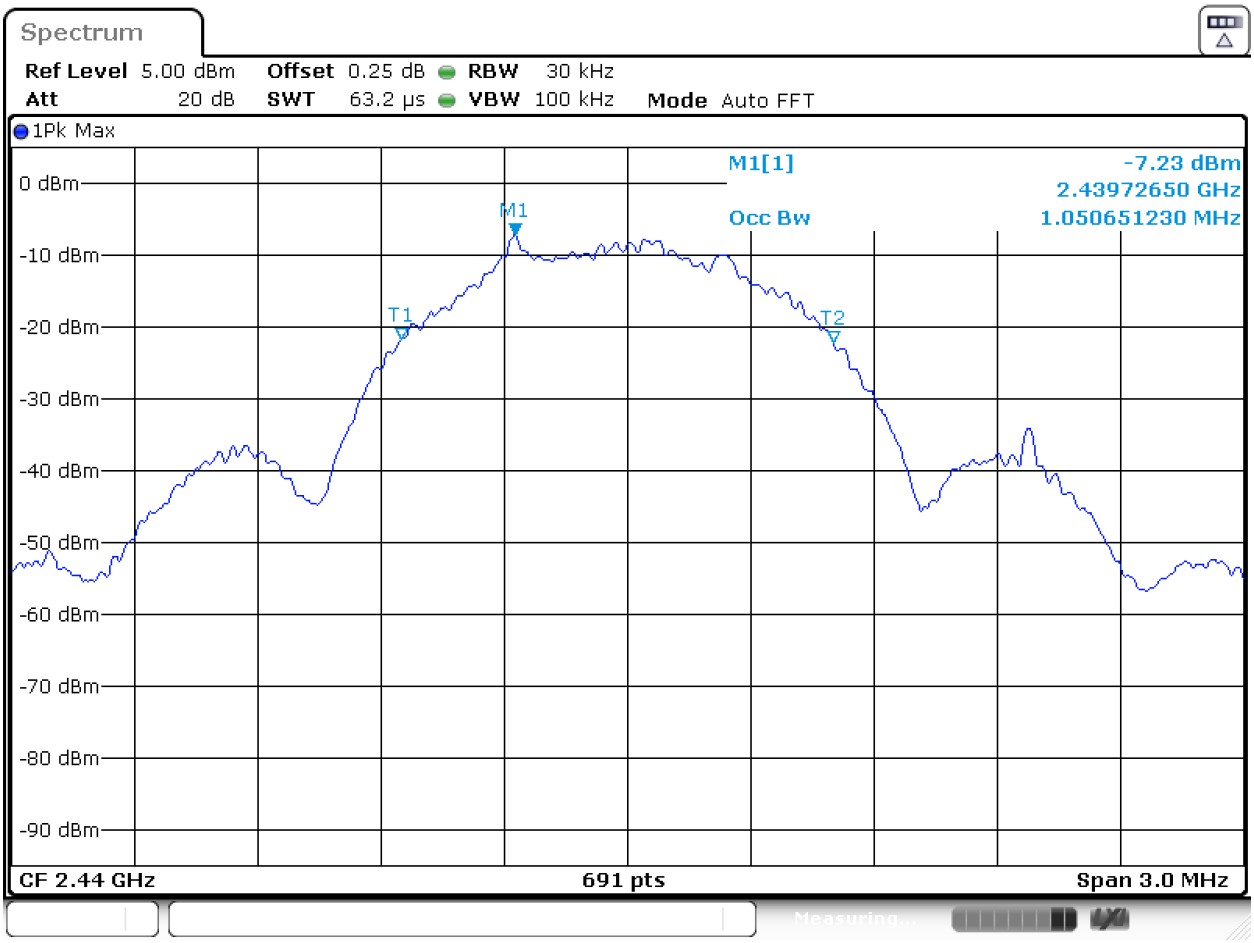
Plot 1.5



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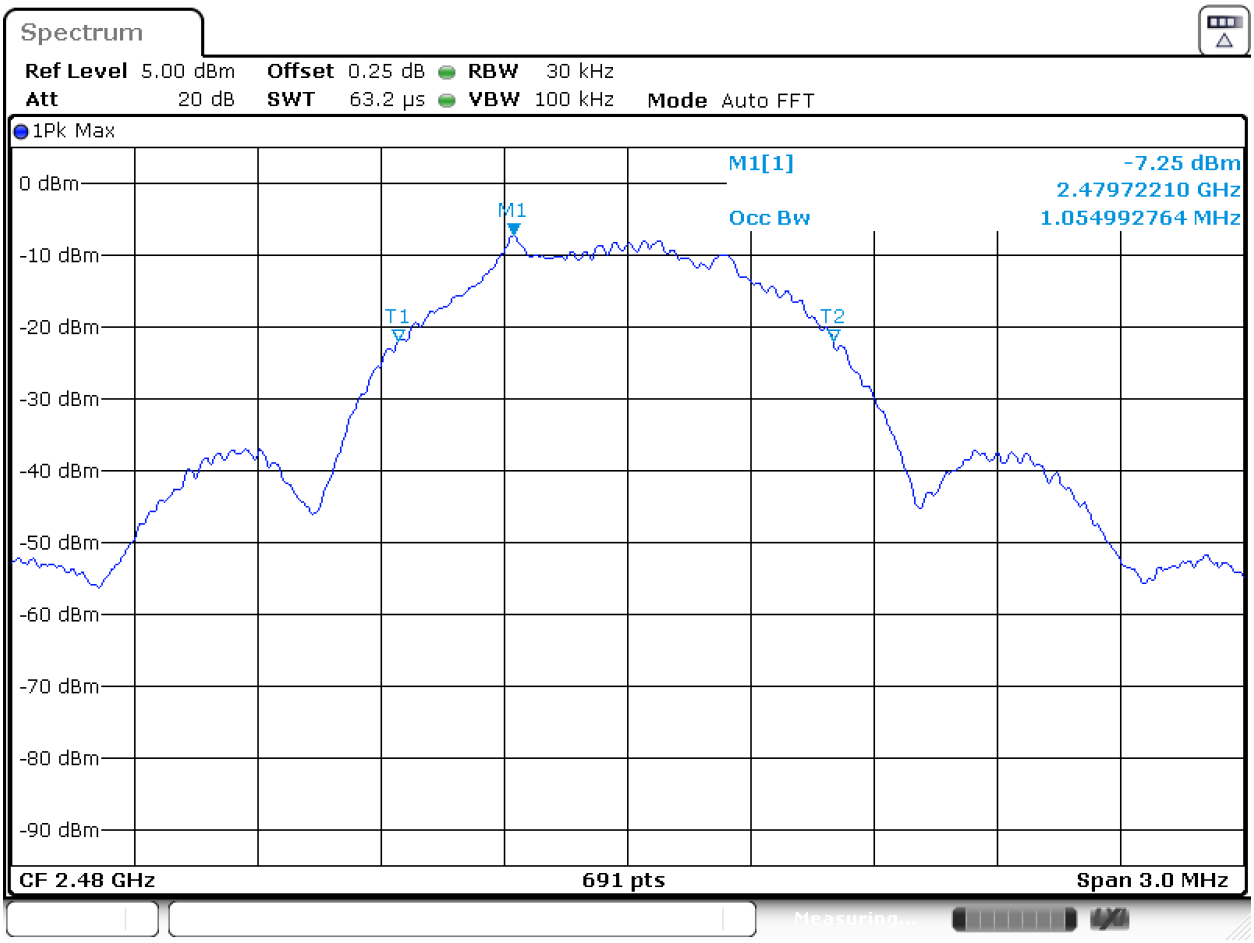
Plot 1.6



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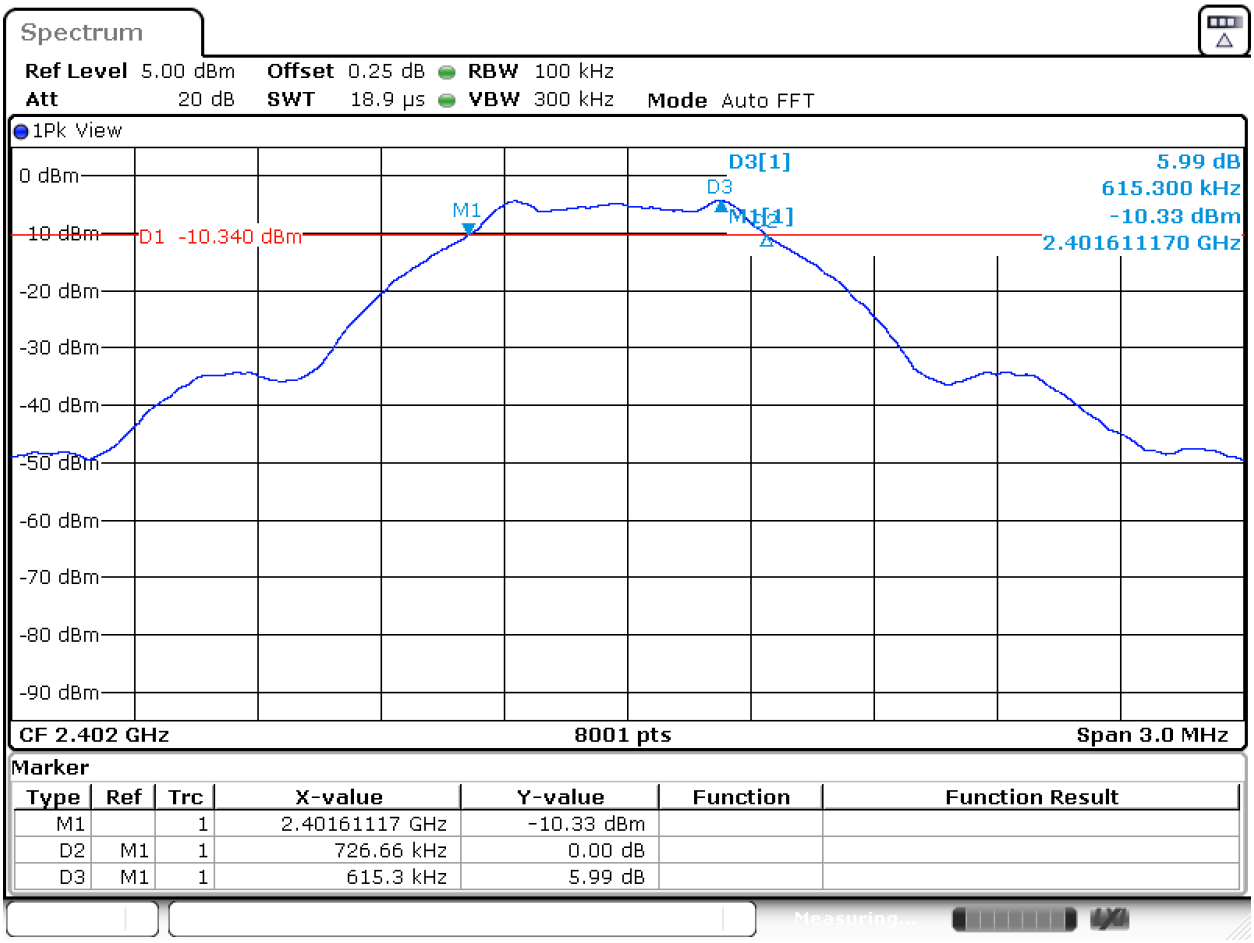
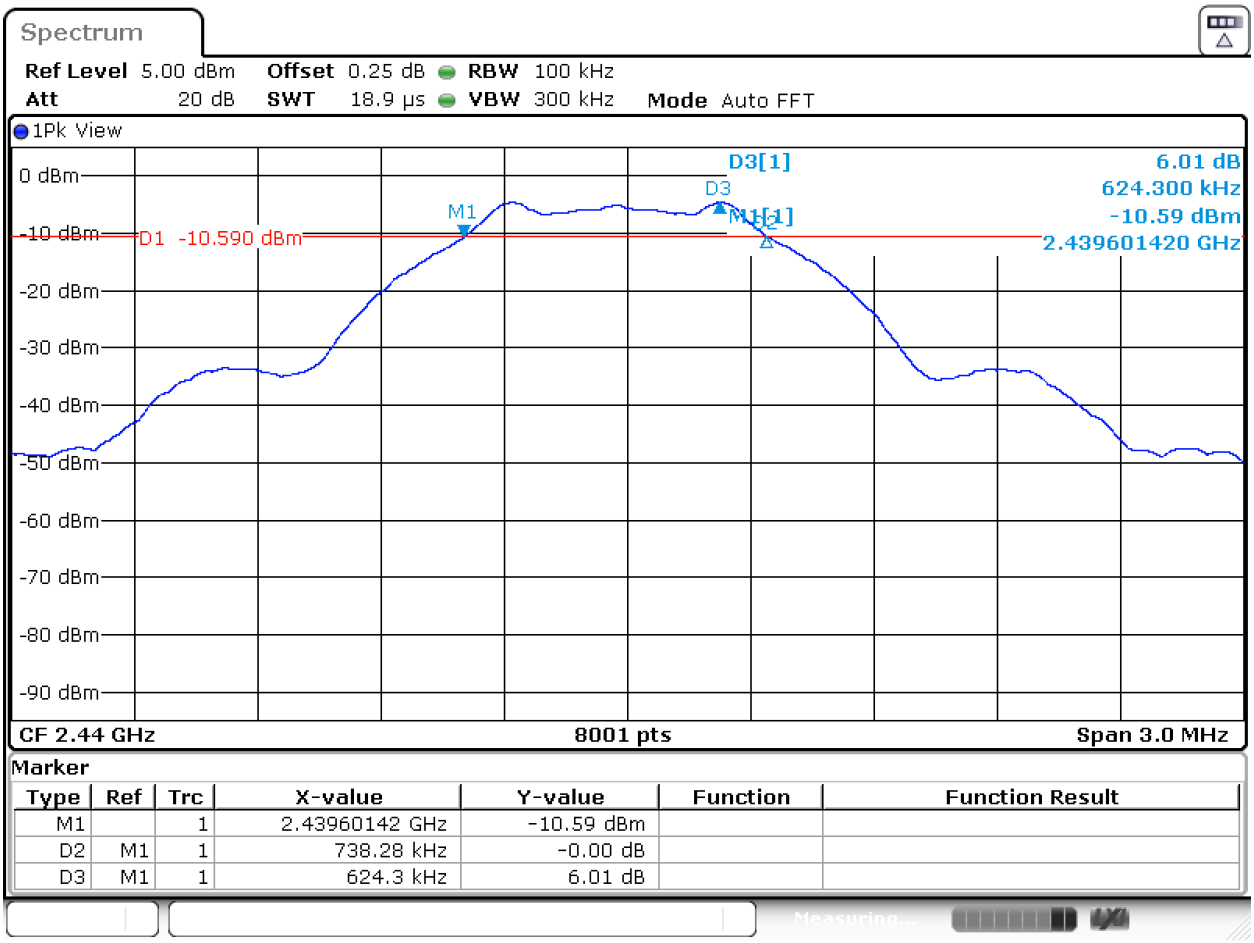
Plot 1.7



Date: 5.DEC.2017 13:36:32

Plot 1.8



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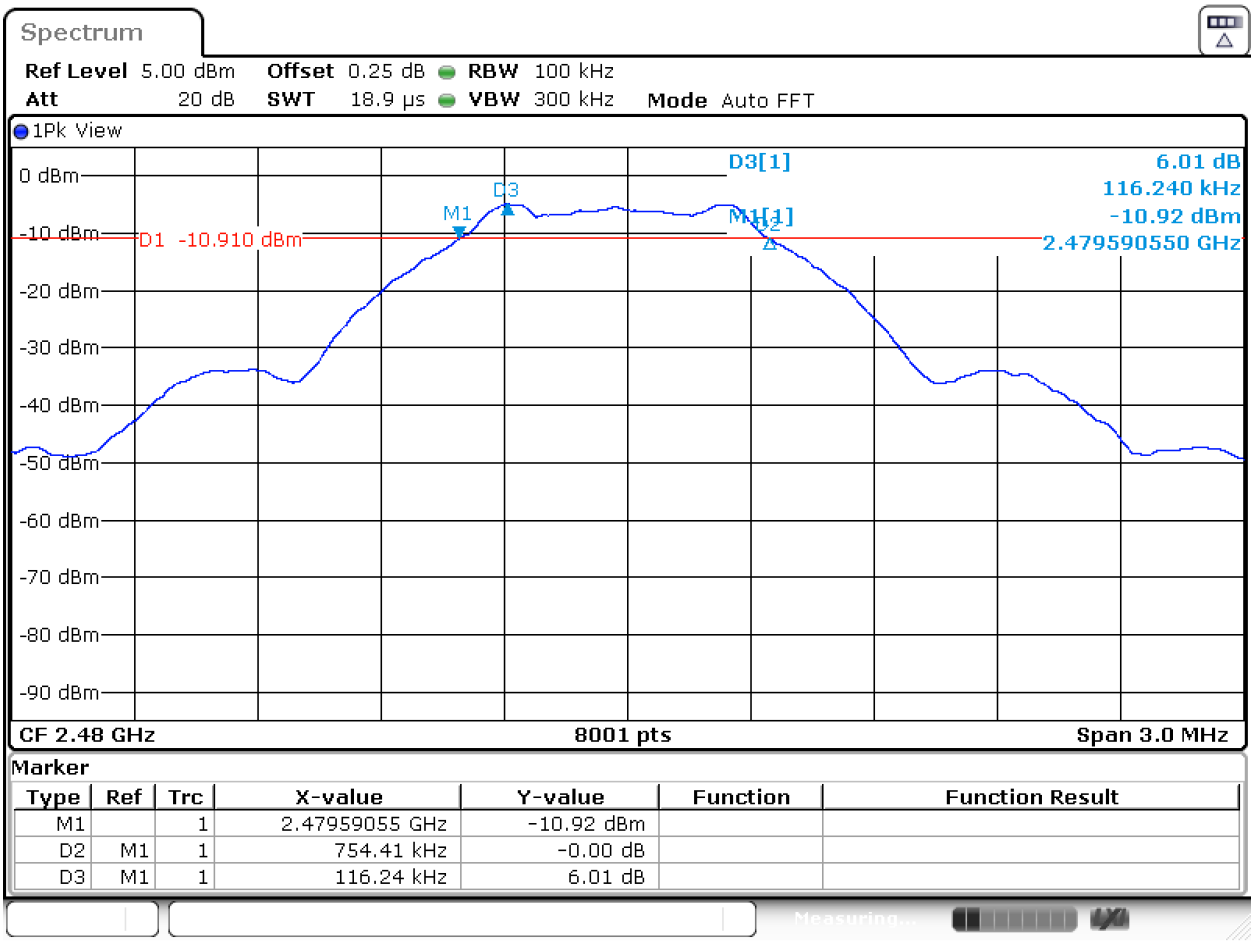
Plot 1.9



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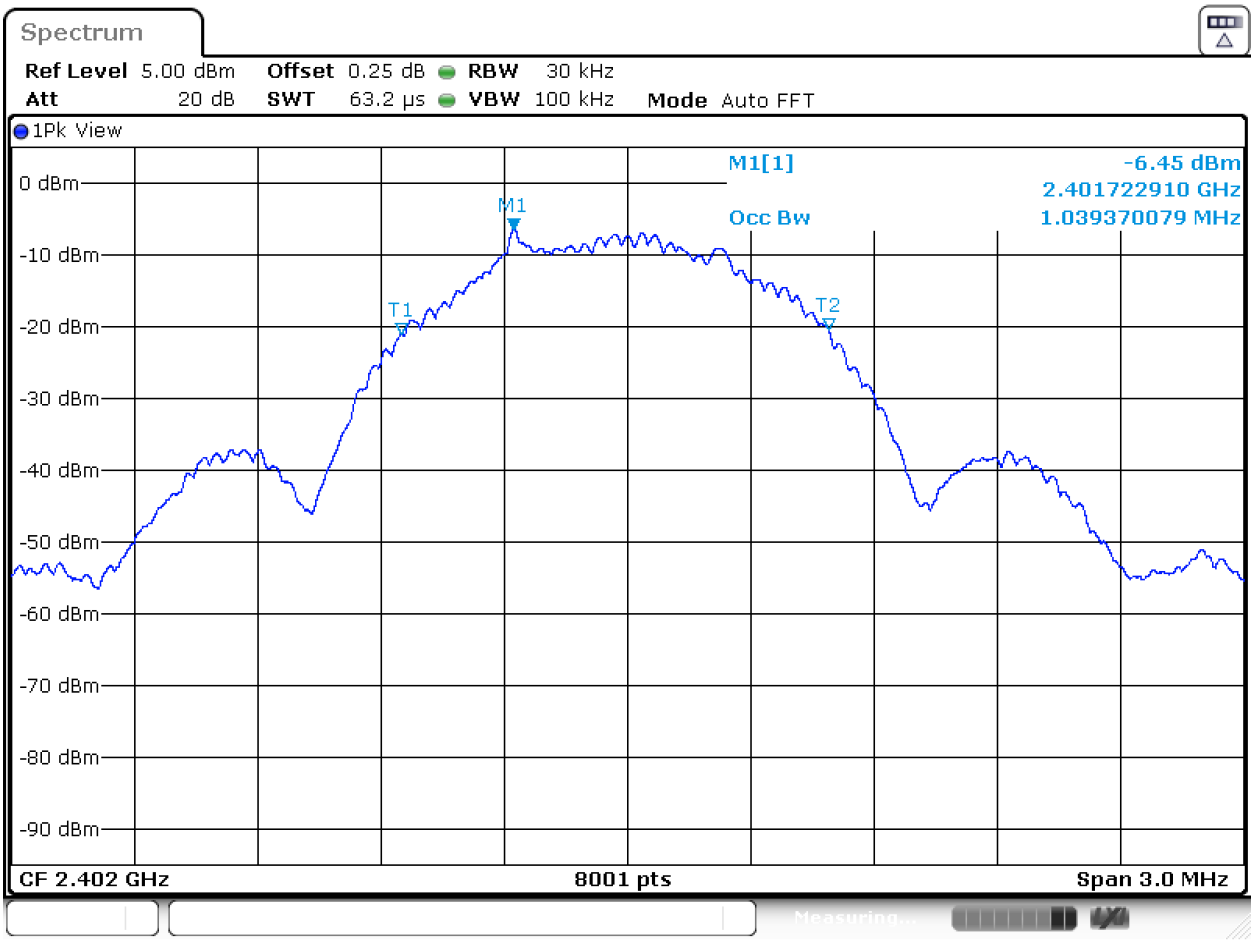
Plot 1.10



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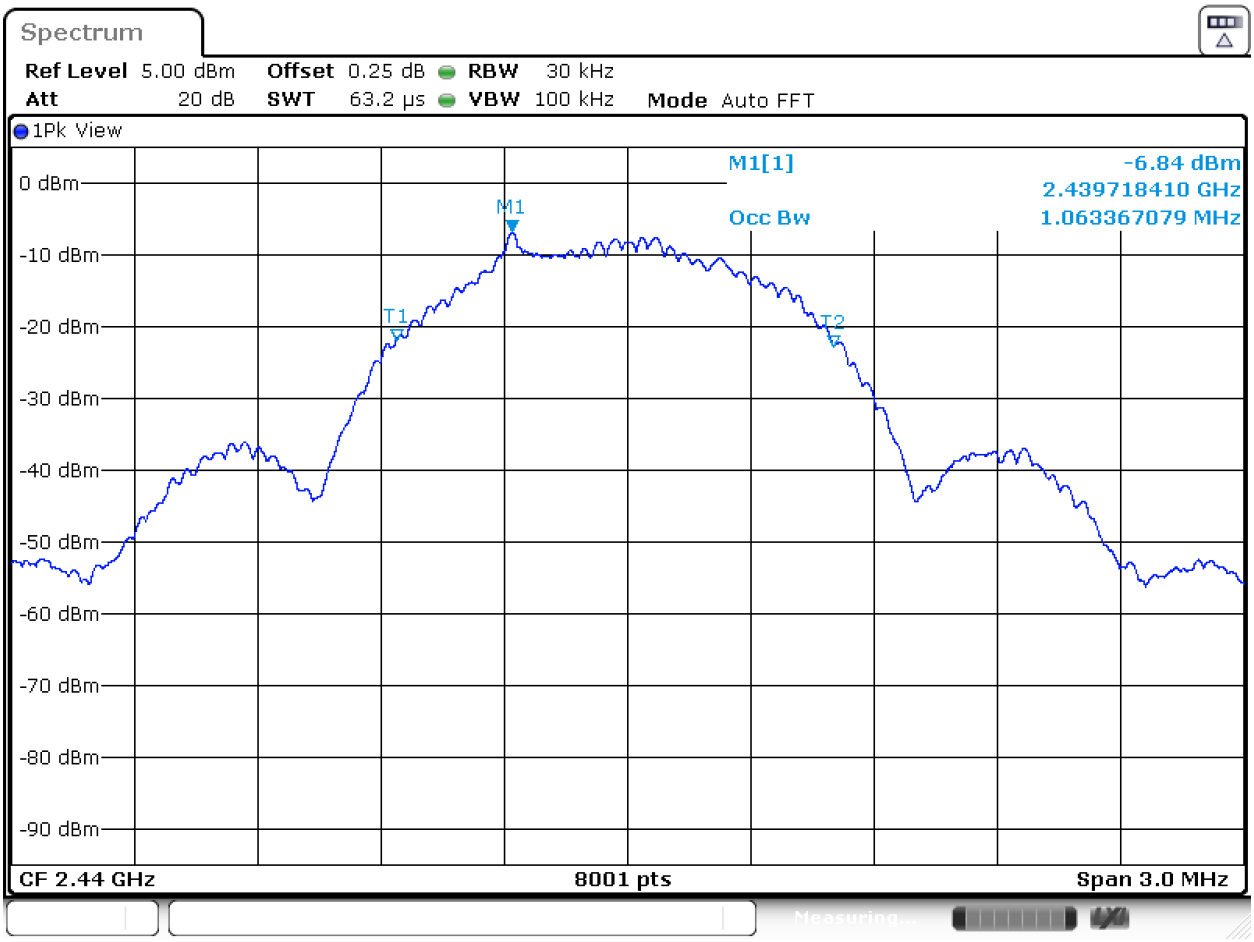
Plot 1.11



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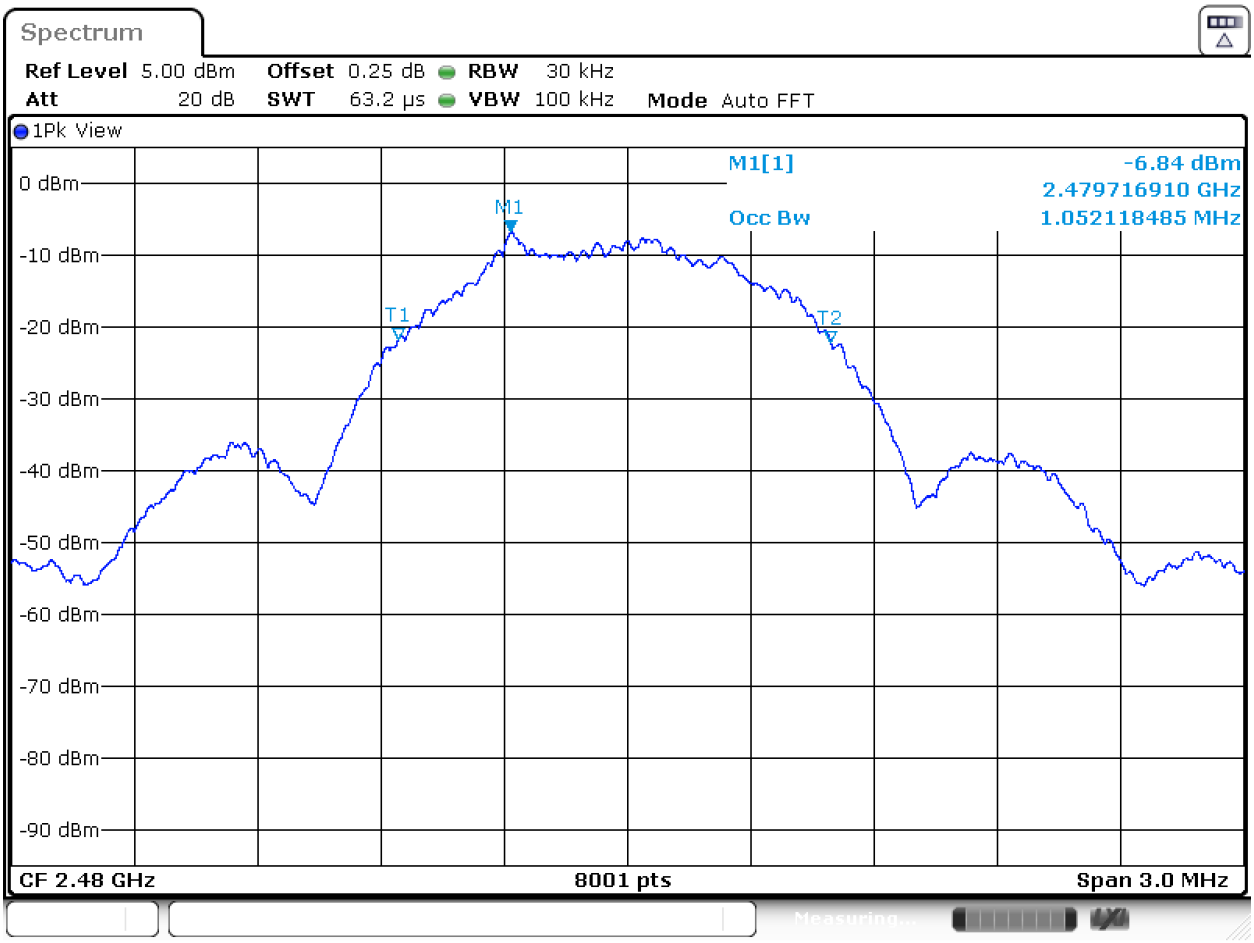
Plot 1.12



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

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 558074 D01 DTS Meas Guidance v04 was used.
Specifically, section 9.1.1 RBW ≥ DTS Bandwidth was utilized as the spectrum analyzer's resolution bandwidth was greater than the DTS bandwidth.

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.

4.3.3 Test Result

Refer to the following plots 2.1 – 2.6 for the test details.

Battery Mode:

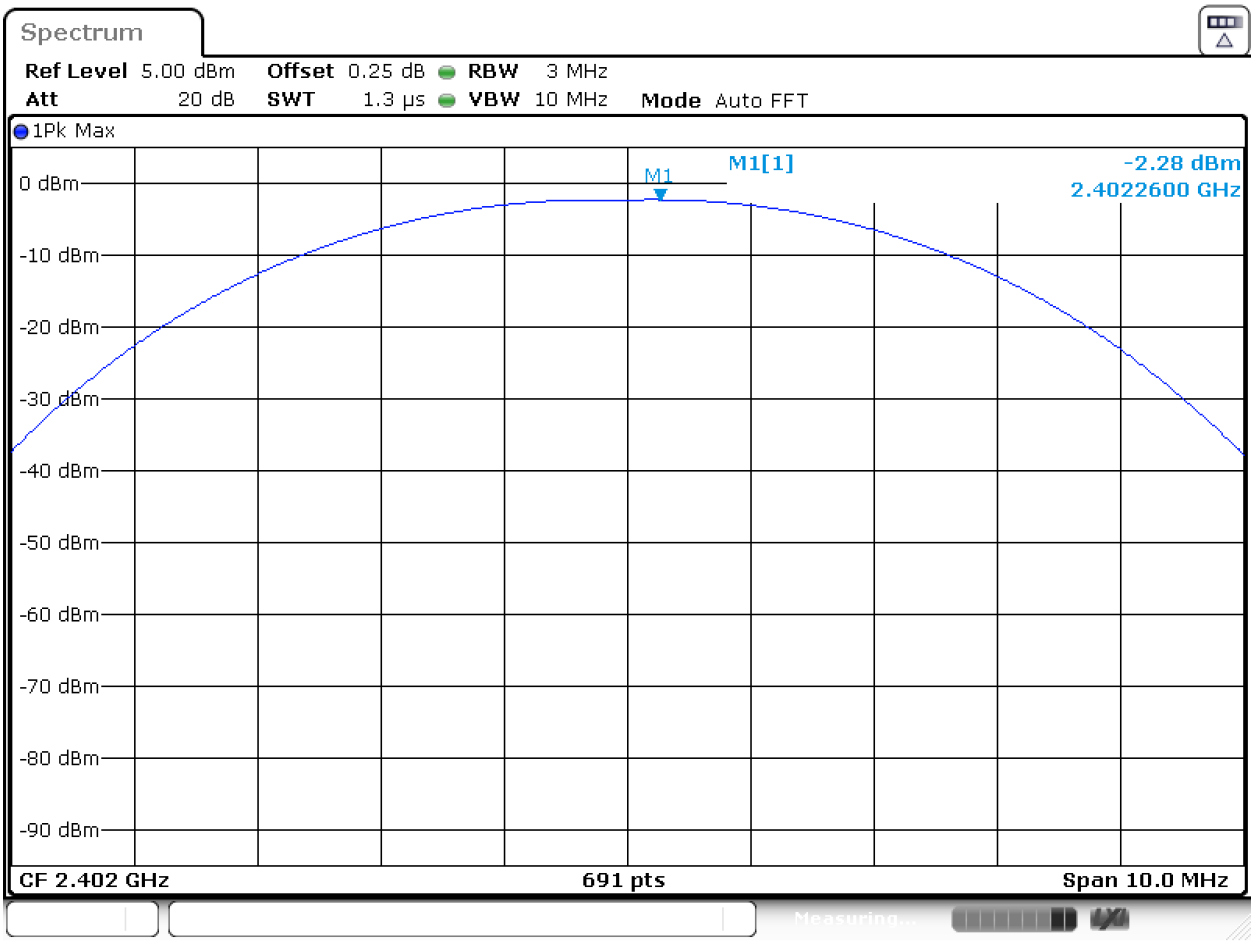
Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	-2.28	0.592	2.1
2440	-2.47	0.566	2.2
2480	-2.71	0.536	2.3

Charging Mode:

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	-2.27	0.593	2.4
2440	-2.16	0.608	2.5
2480	-2.69	0.538	2.6

Date of Test:	December 4&5, 2017
Results	**Complies**

Plot 2. 1



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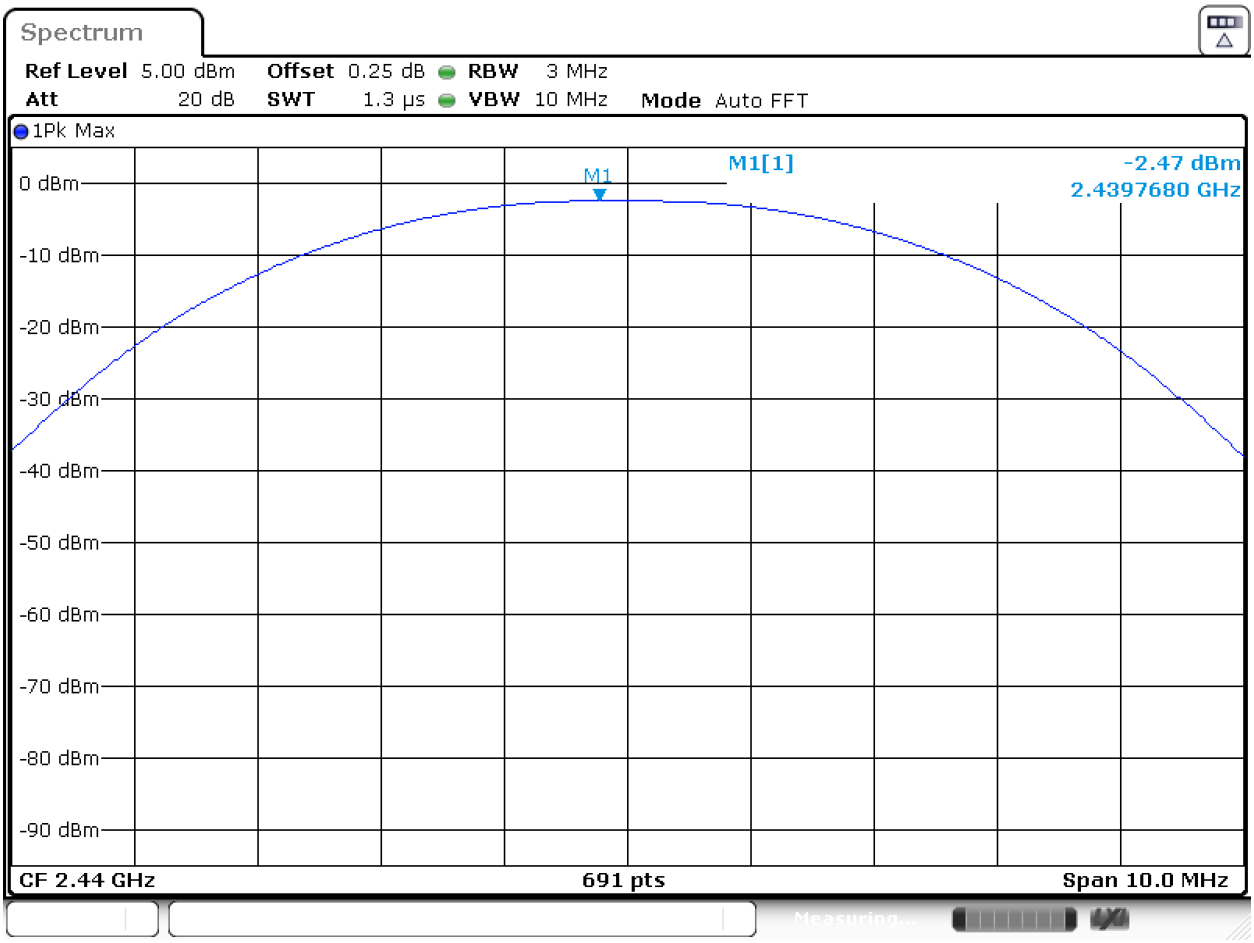
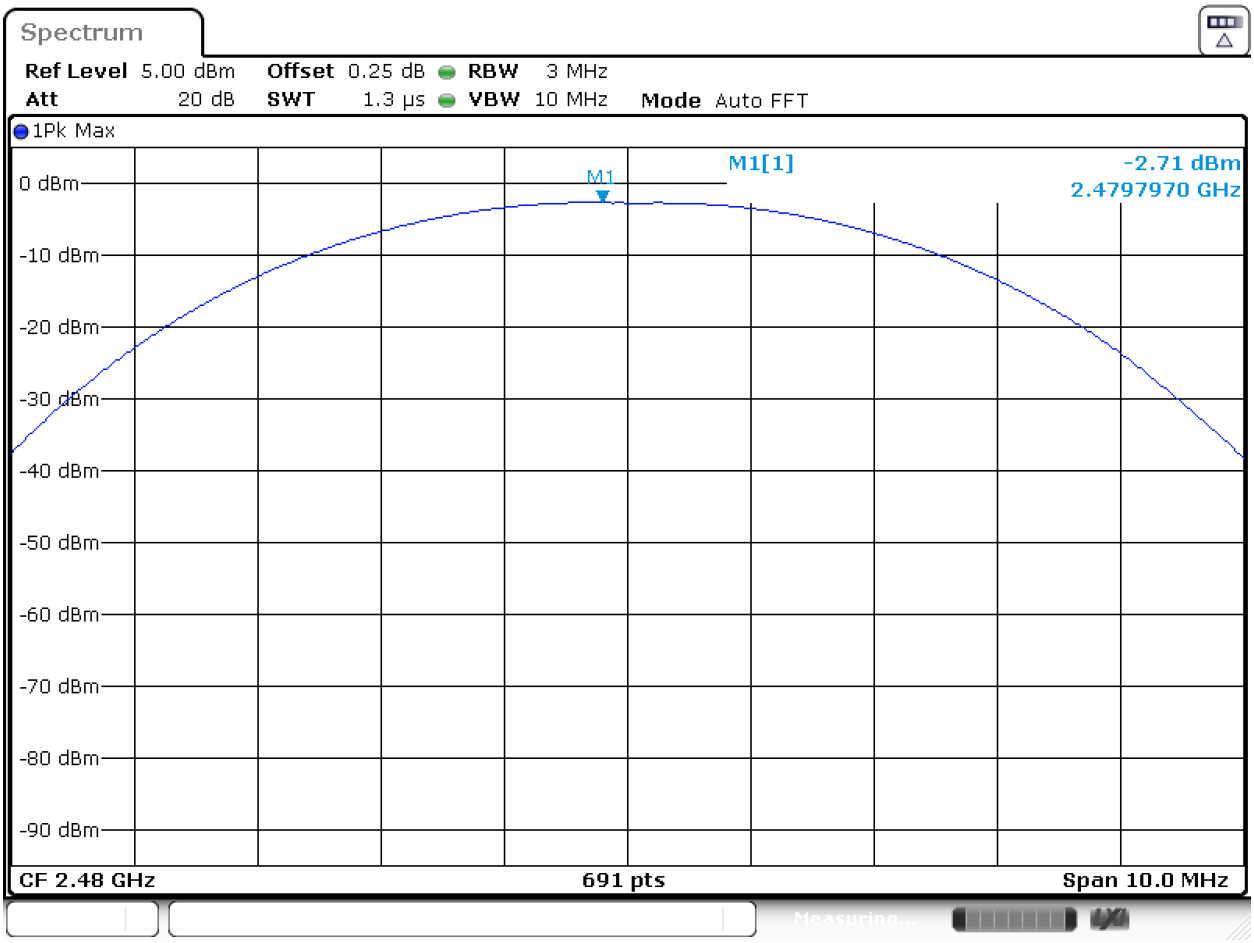
Plot 2. 2



Date: 4.DEC.2017 14:40:57

Plot 2. 3



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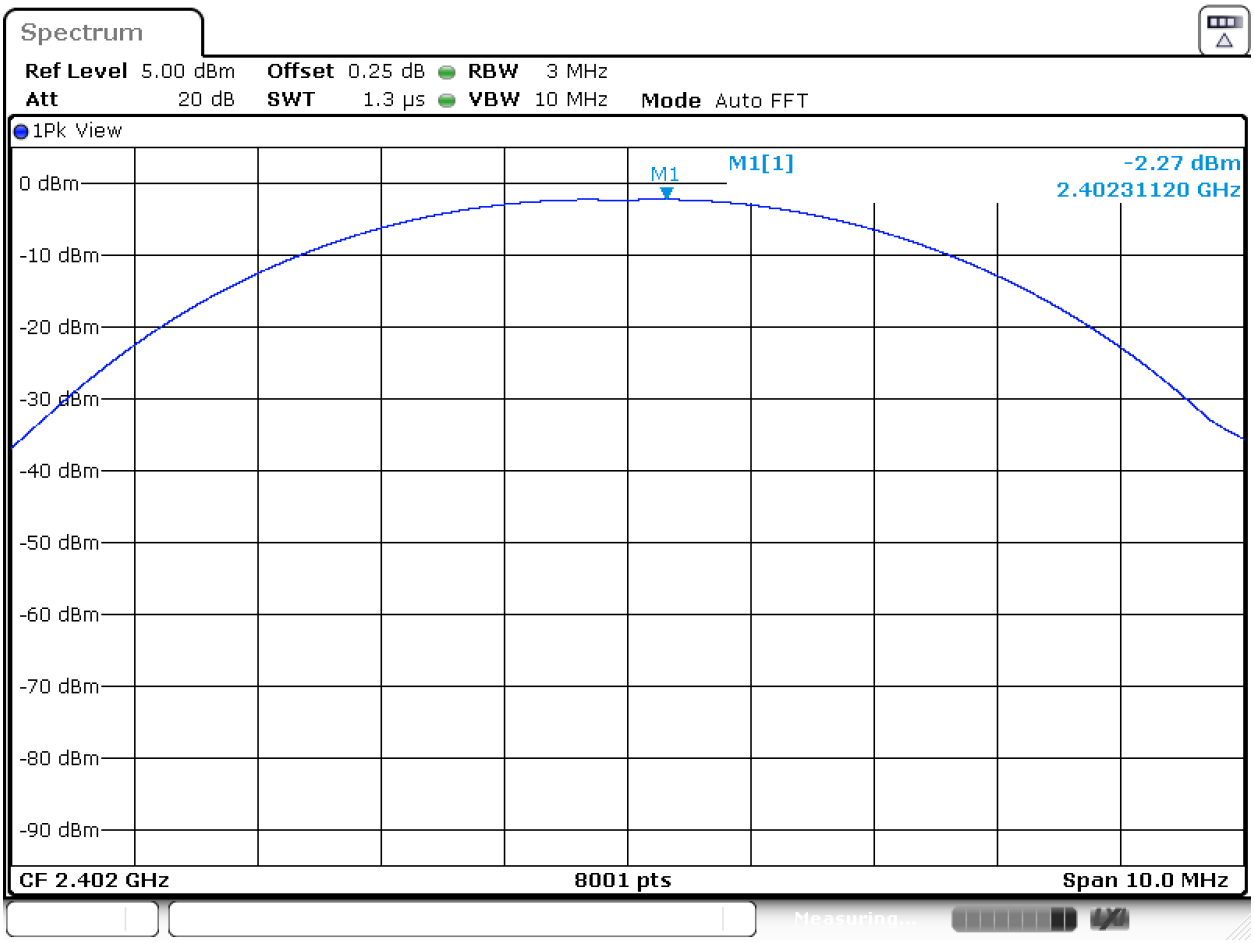
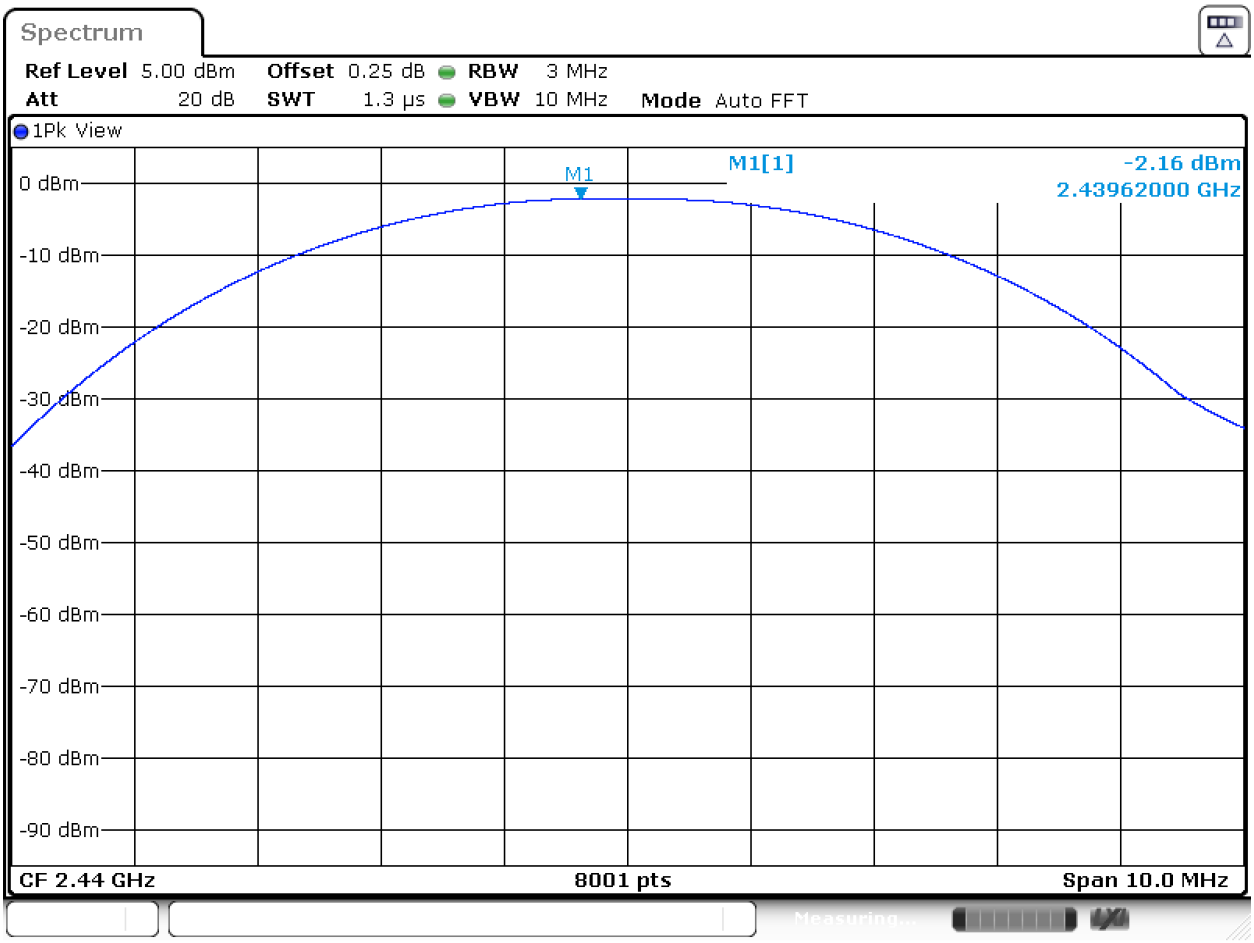
Plot 2.4



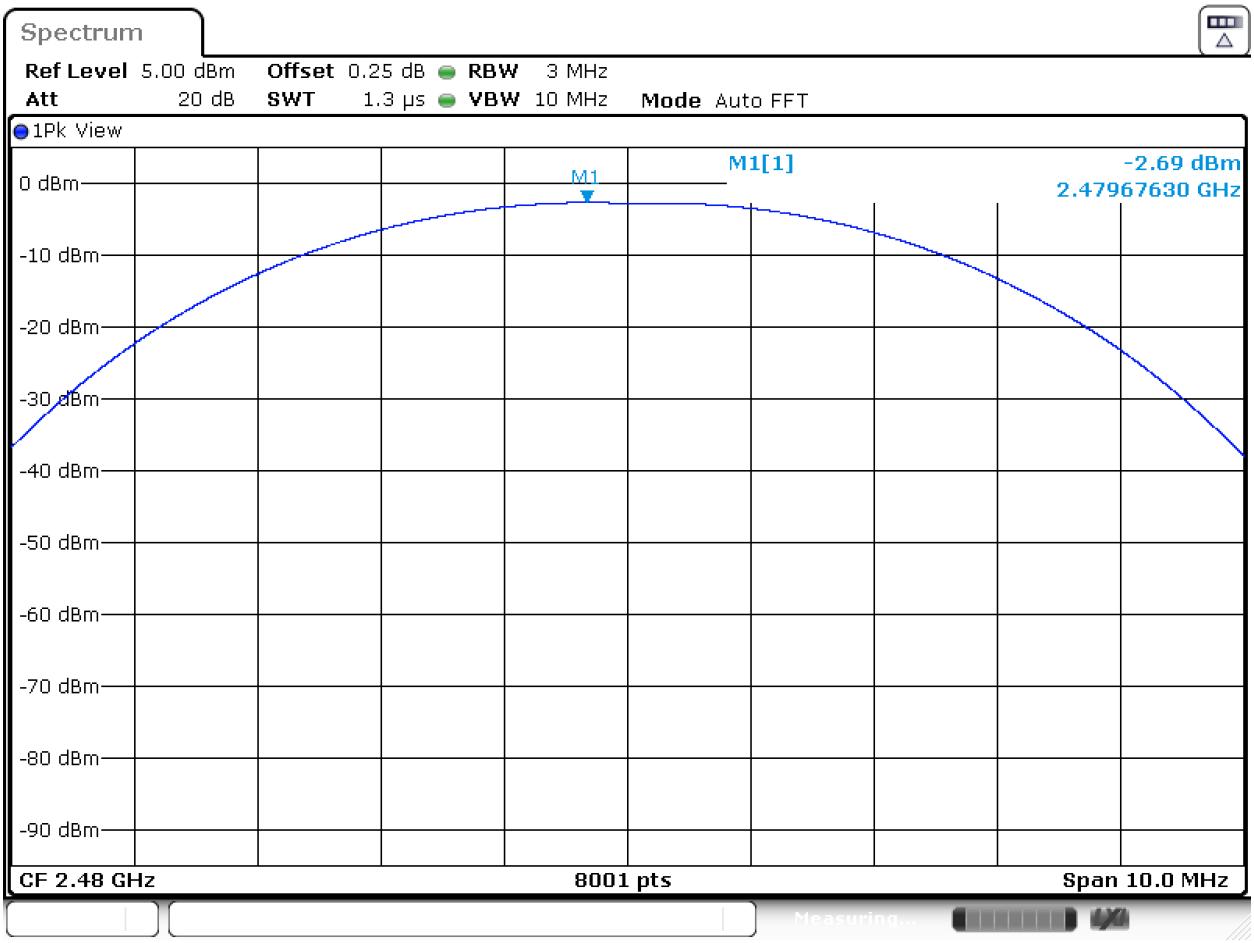
Date: 5.DEC.2017 13:46:21

Plot 2.5



Date: 5.DEC.2017 13:48:36

Plot 2.6



Date: 5.DEC.2017 13:49:20

4.3 Maximum Power Spectral Density
FCC: 15.247 (e); RSS-247 A8.2b;

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 558074 D01 DTS Meas Guidance v04, specifically section 10.2 Method PKPSD (peak PSD).

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

Battery Mode:

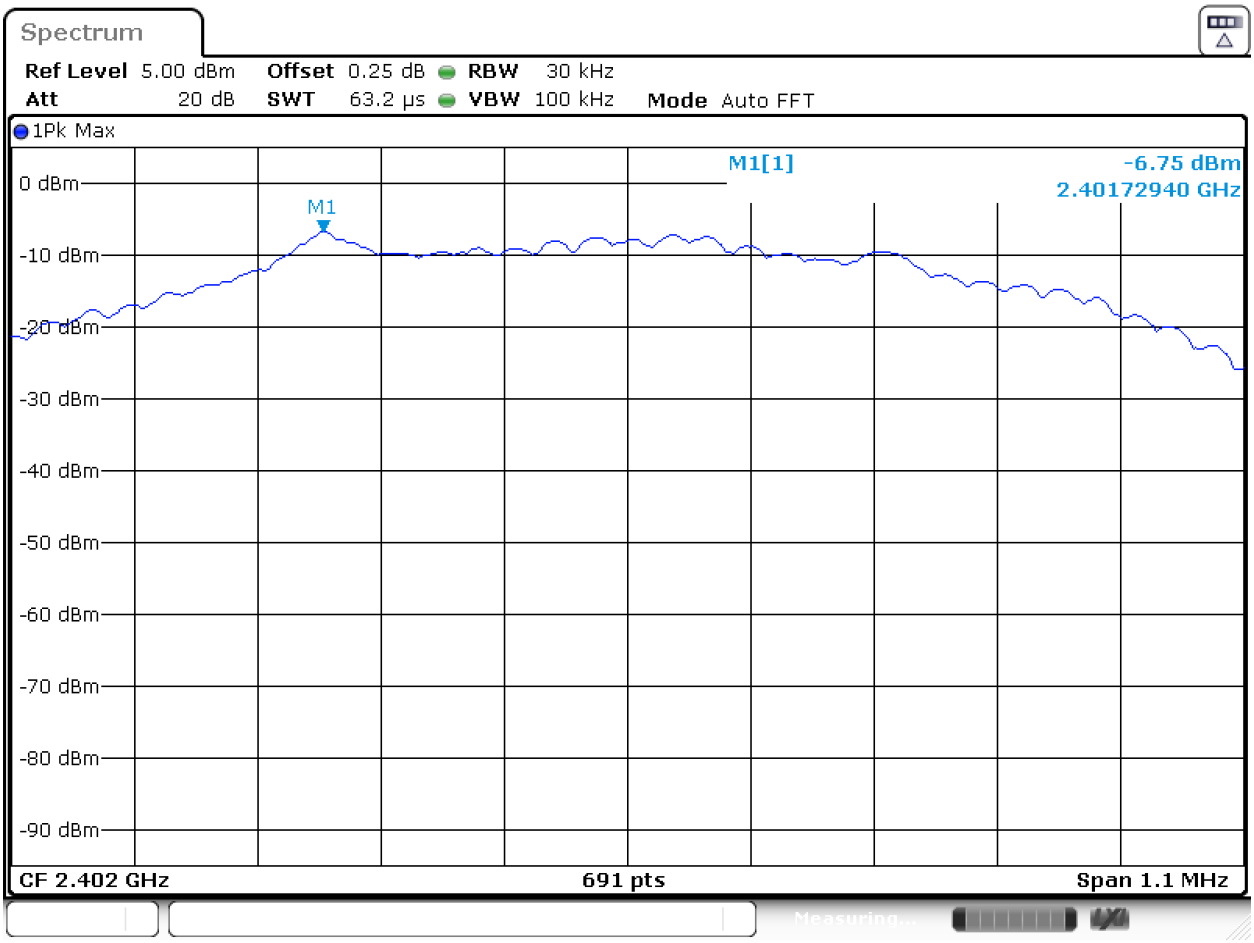
Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2402	-6.75	8.0	-14.75	3.1
2440	-7.21	8.0	-15.21	3.2
2480	-7.11	8.0	-15.11	3.3

Charging Mode:

Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2402	-6.49	8.0	-14.49	3.4
2440	-6.87	8.0	-14.87	3.5
2480	-7.04	8.0	-15.04	3.6

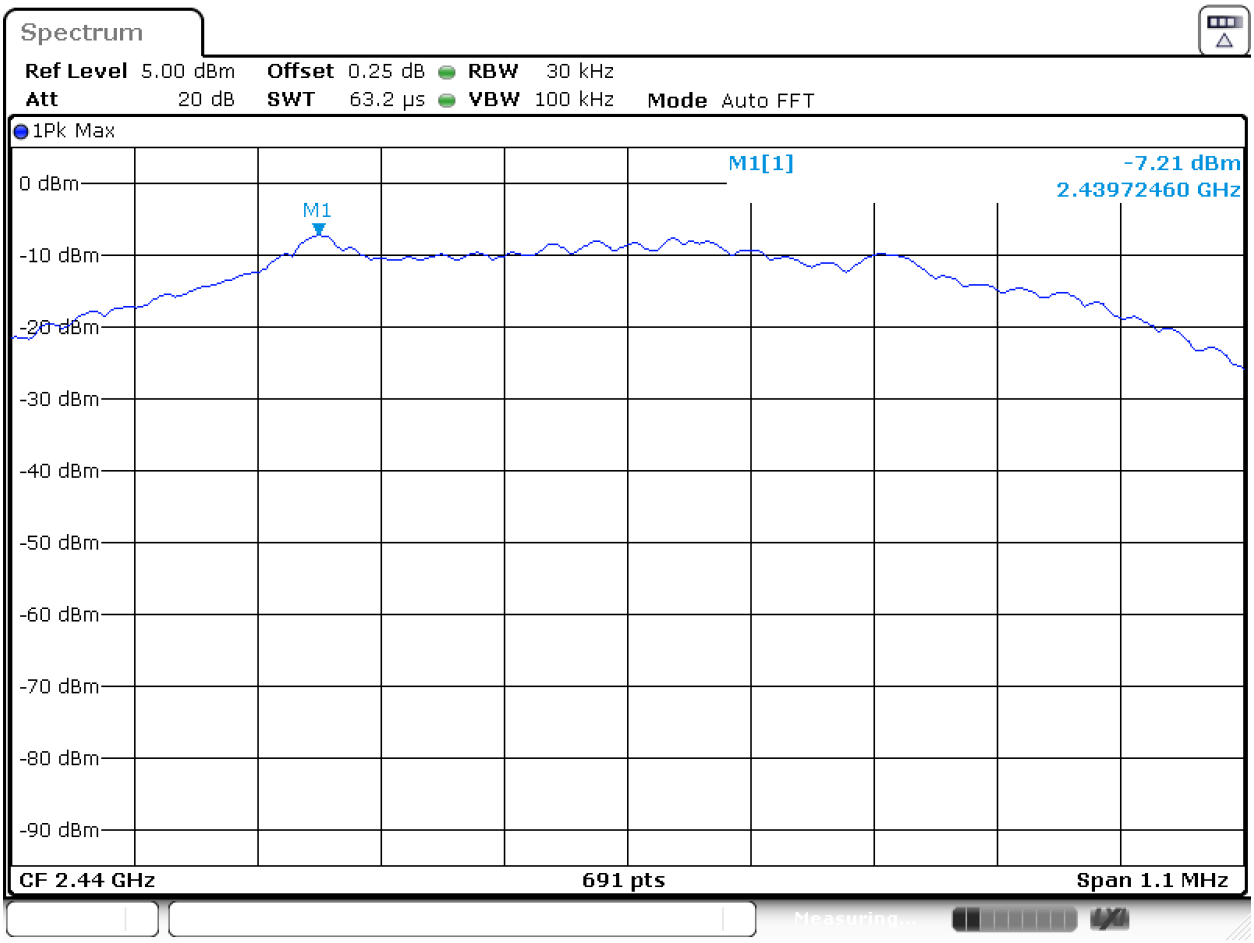
Date of Test:	December 4&5, 2017
Results	**Complies**

Plot 3. 1



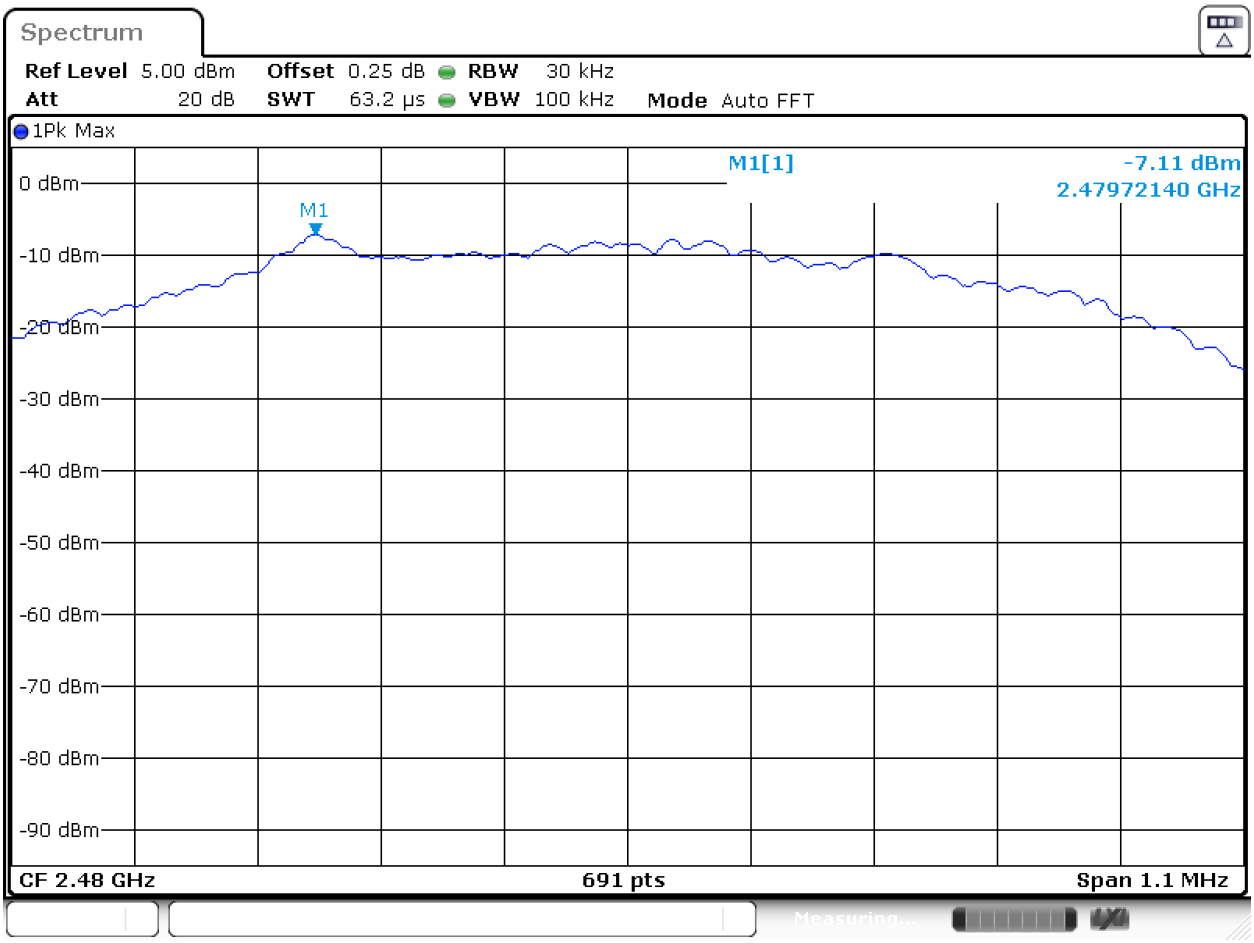
Date: 4.DEC.2017 14:55:49

Plot 3. 2



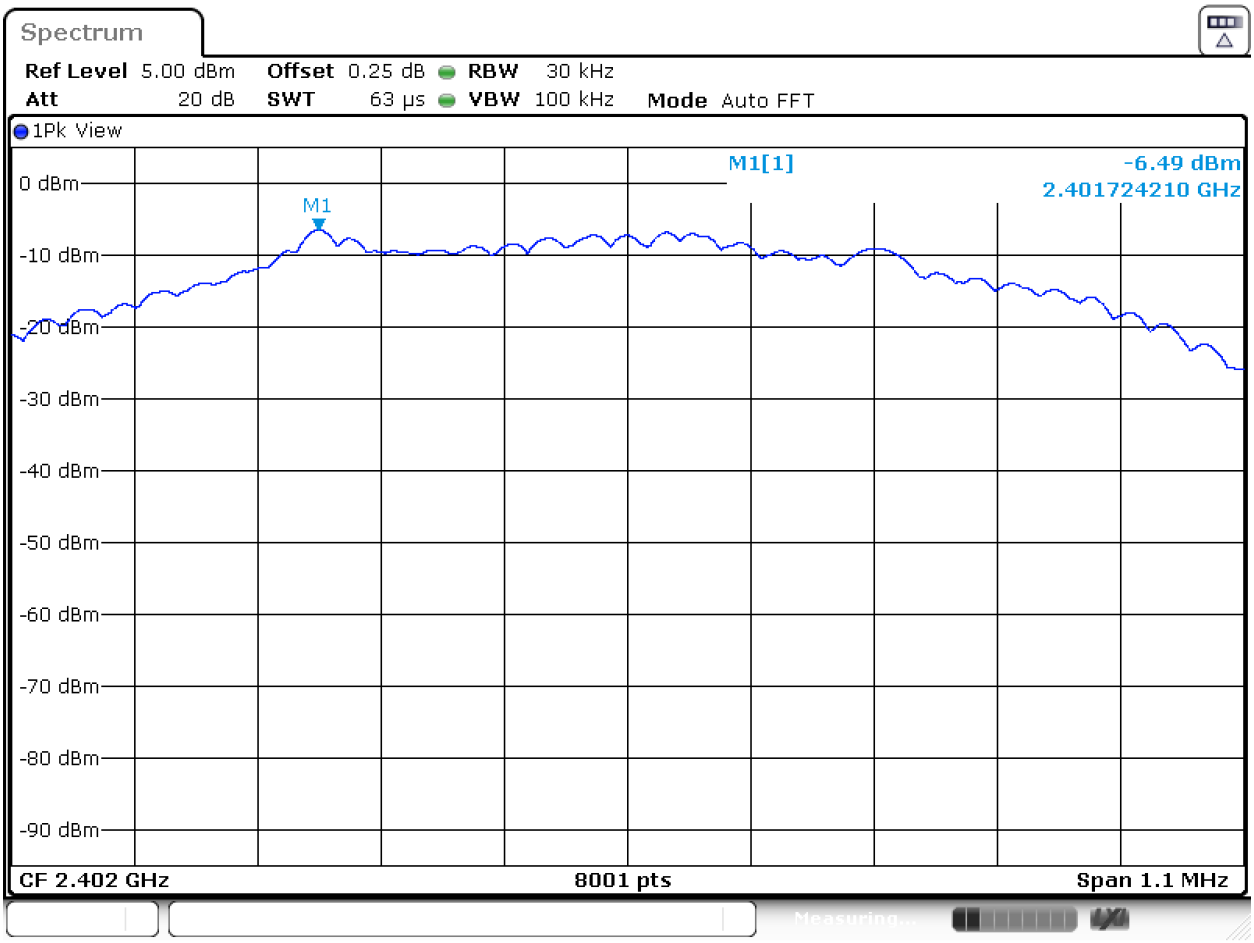
Date: 4.DEC.2017 14:56:37

Plot 3. 3



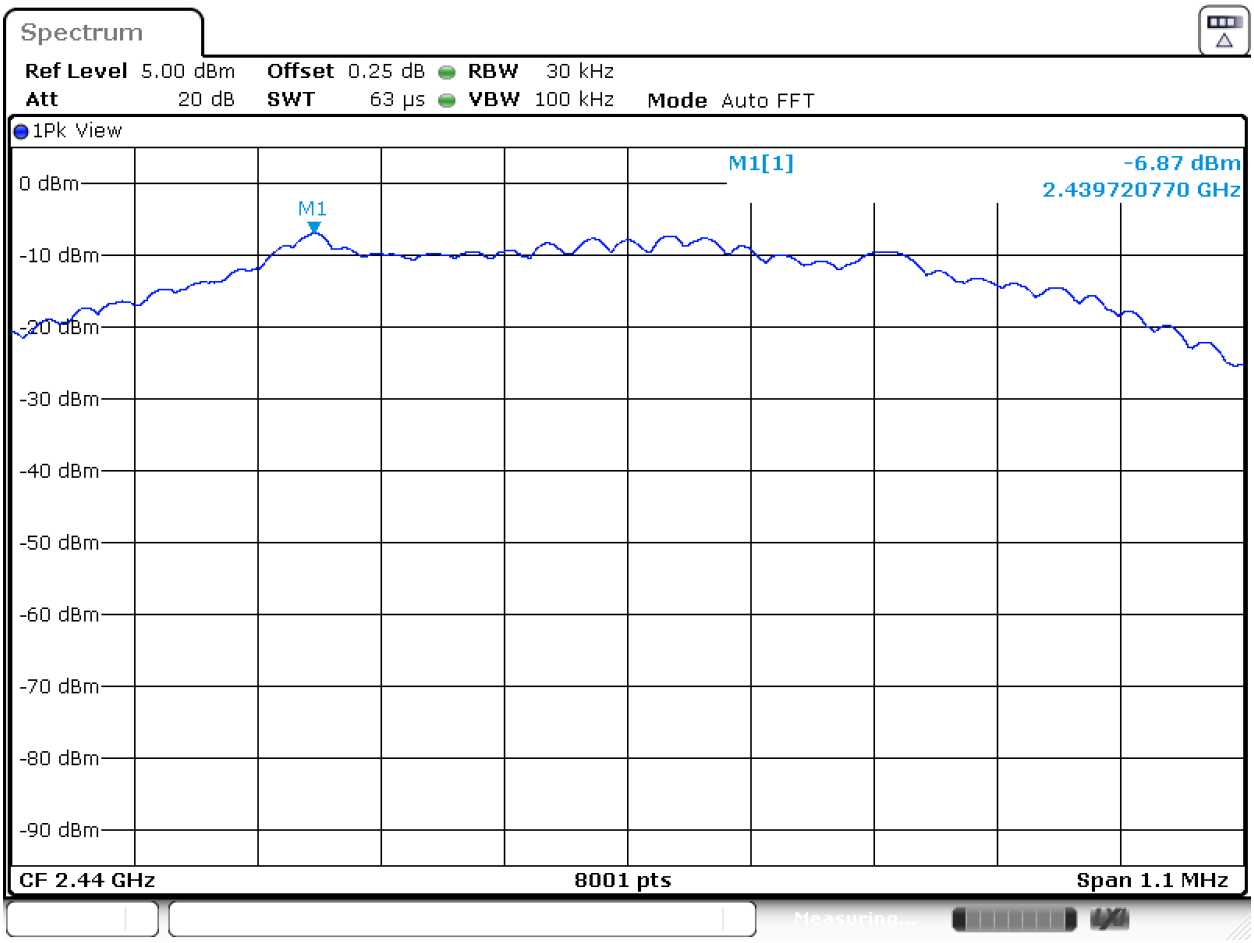
Date: 4.DEC.2017 14:54:26

Plot 3.4



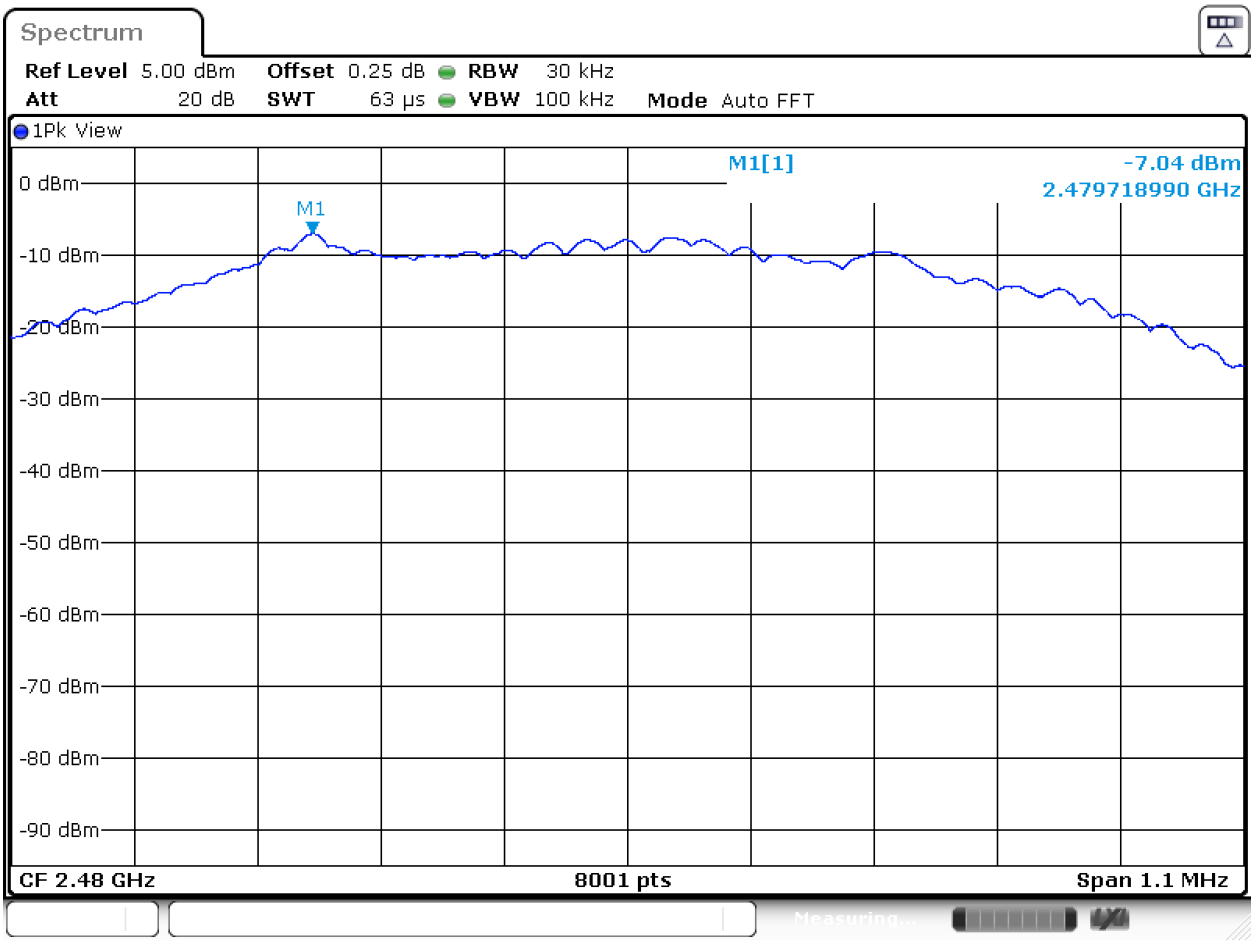
Date: 5.DEC.2017 13:45:23

Plot 3.5



Date: 5.DEC.2017 13:43:48

Plot 3.6



Date: 5.DEC.2017 13:44:41

4.4 Unwanted Conducted Emissions
FCC: 15.247(d); RSS-247 A8.5;

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 558074 D01 DTS Meas Guidance v04, specifically section 11.0 Emissions in non-restricted frequency bands.

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

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

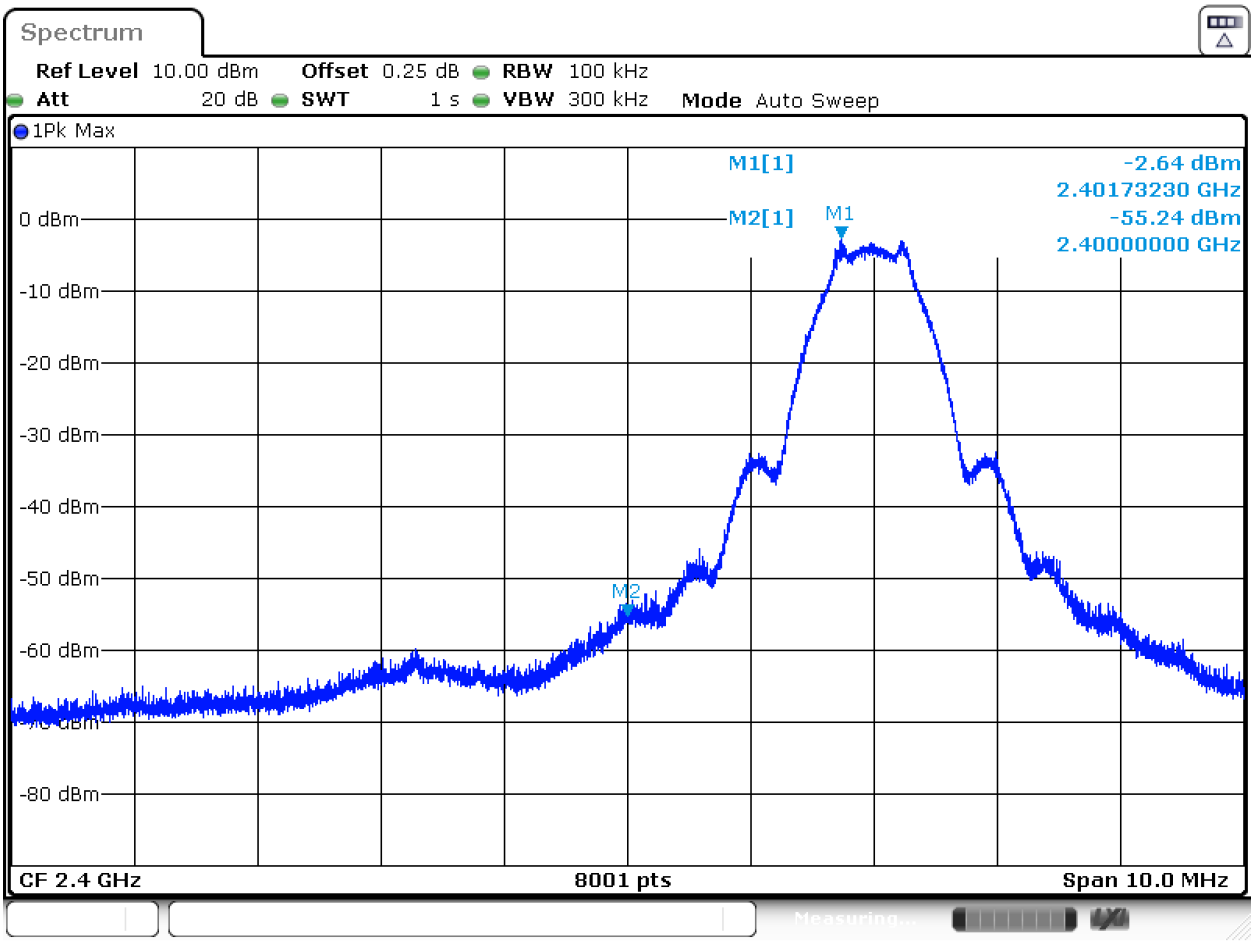
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

Refer to the following plots 4.1 – 4.10 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

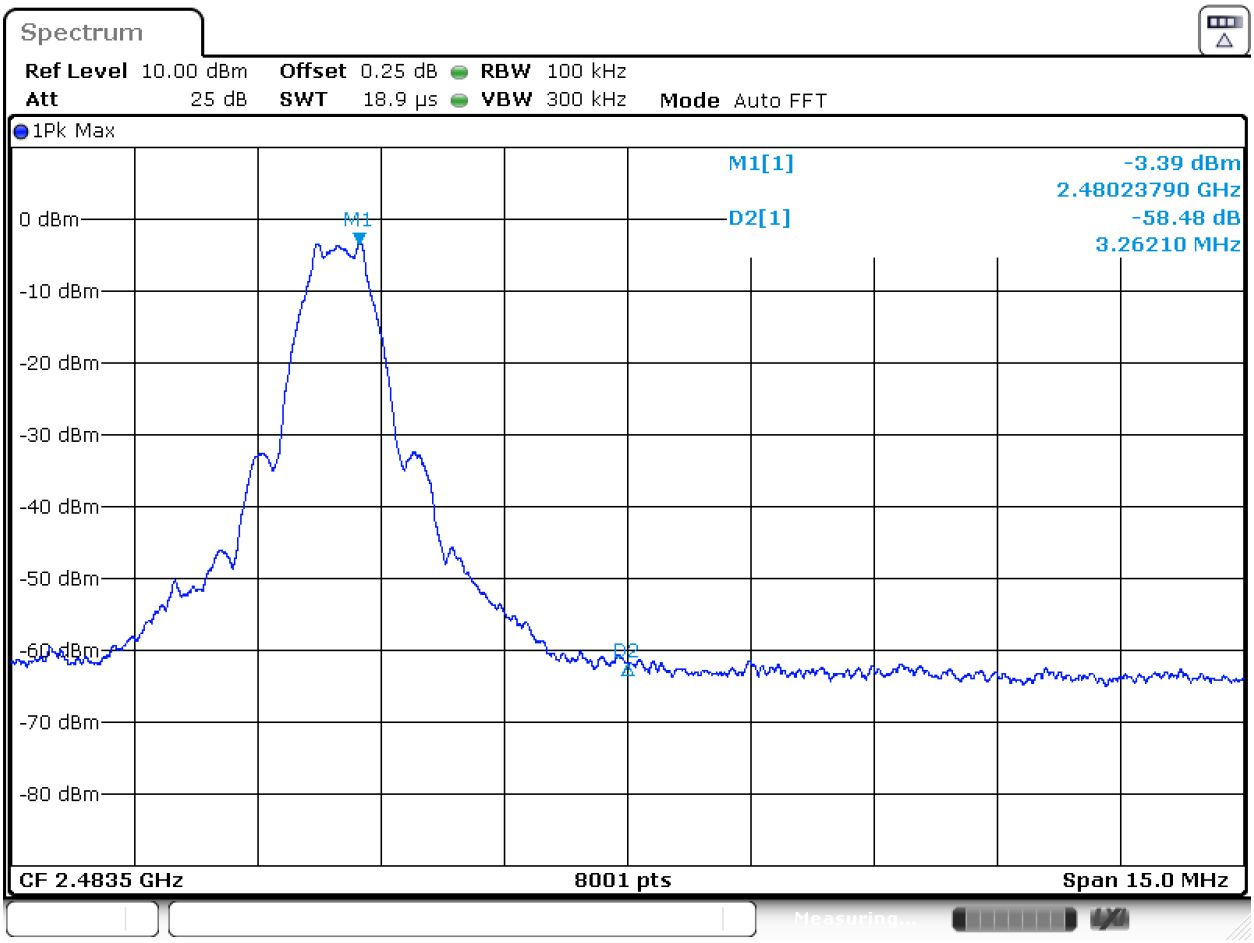
Date of Test:	December 4&5, 2017
Results	**Complies**

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



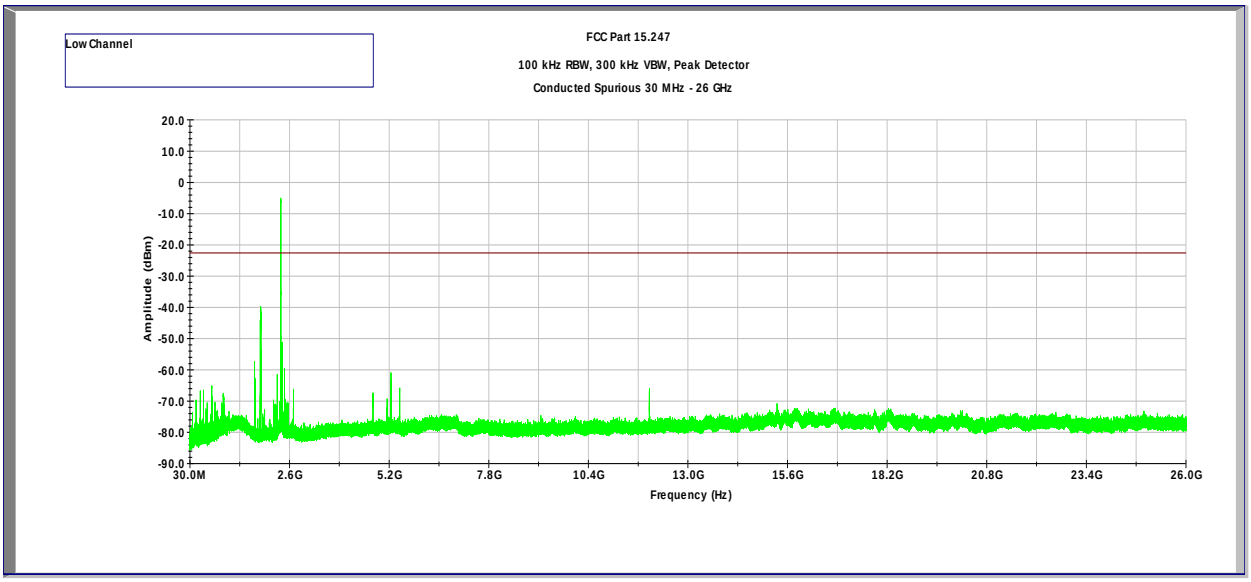
Date: 4.DEC.2017 14:04:04

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

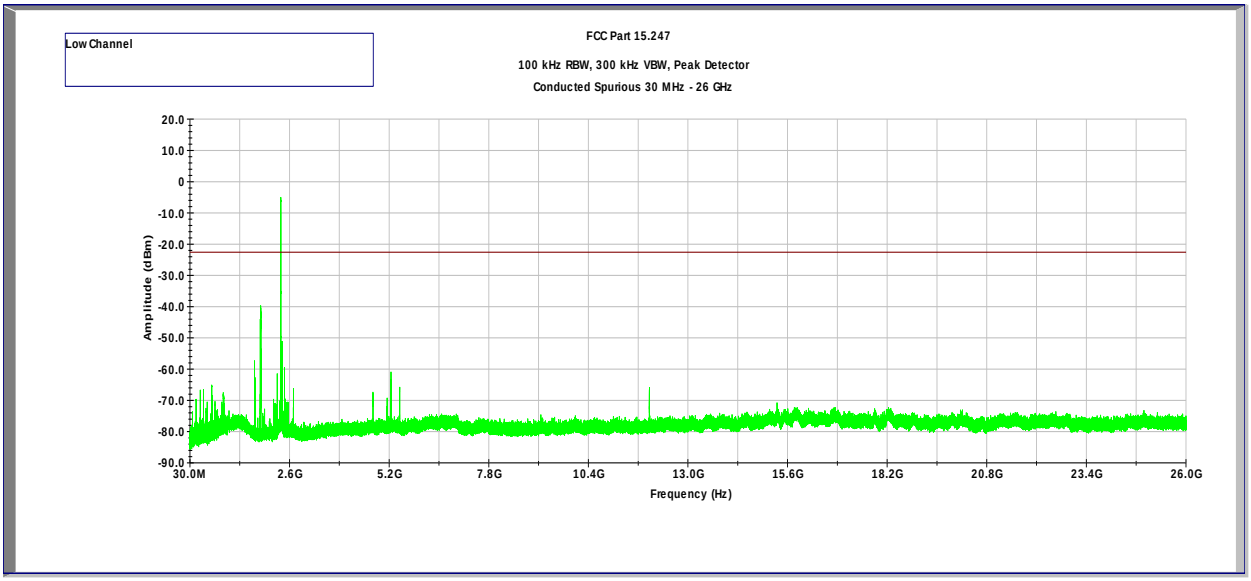


Date: 4.DEC.2017 15:20:56

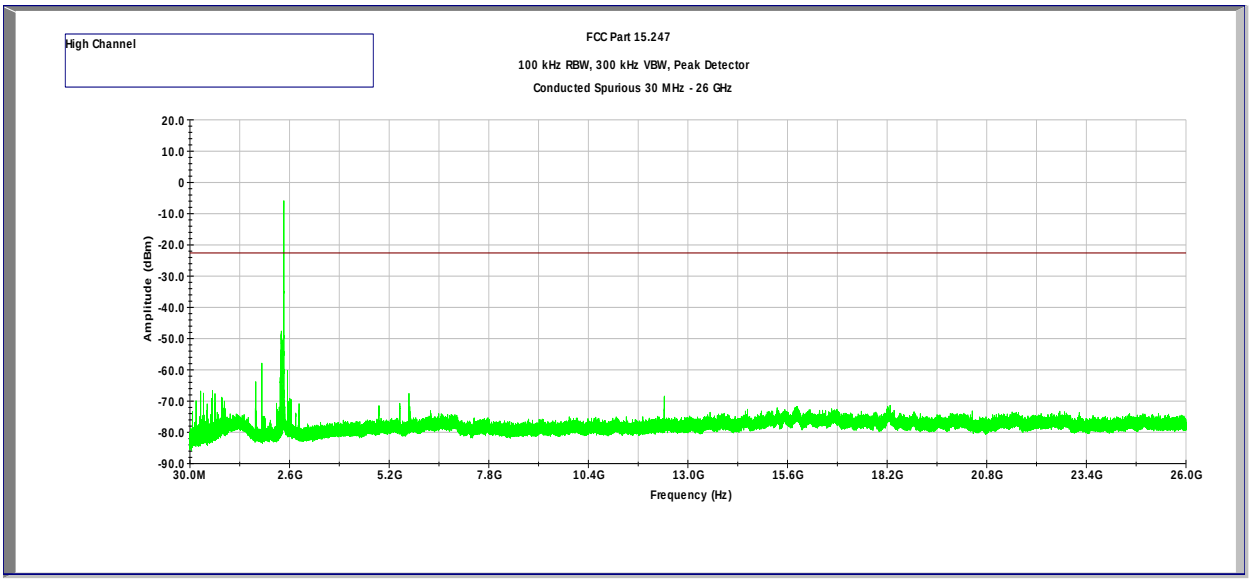
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Battery Mode
Plot 4.3



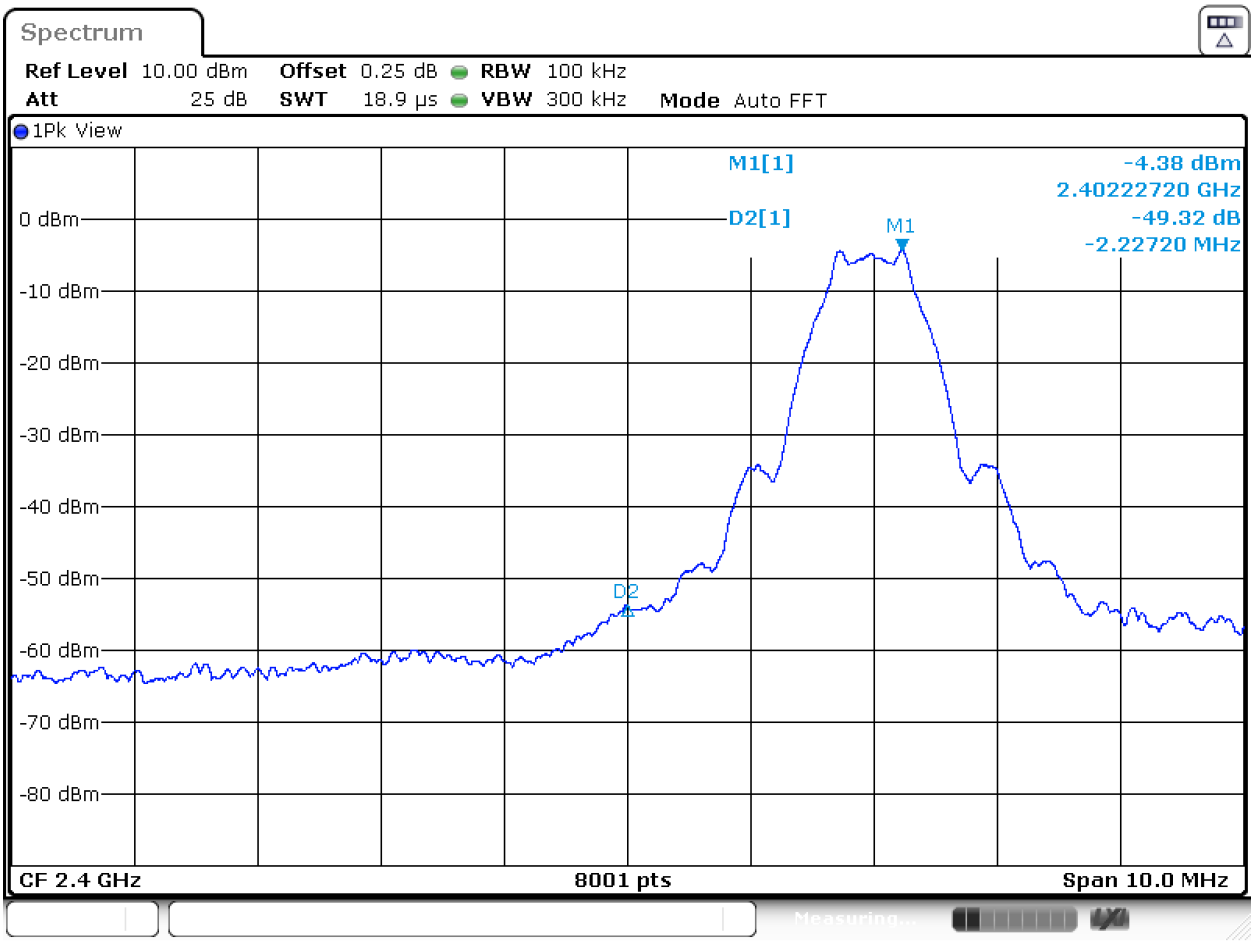
Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Battery Mode
Plot 4.4



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

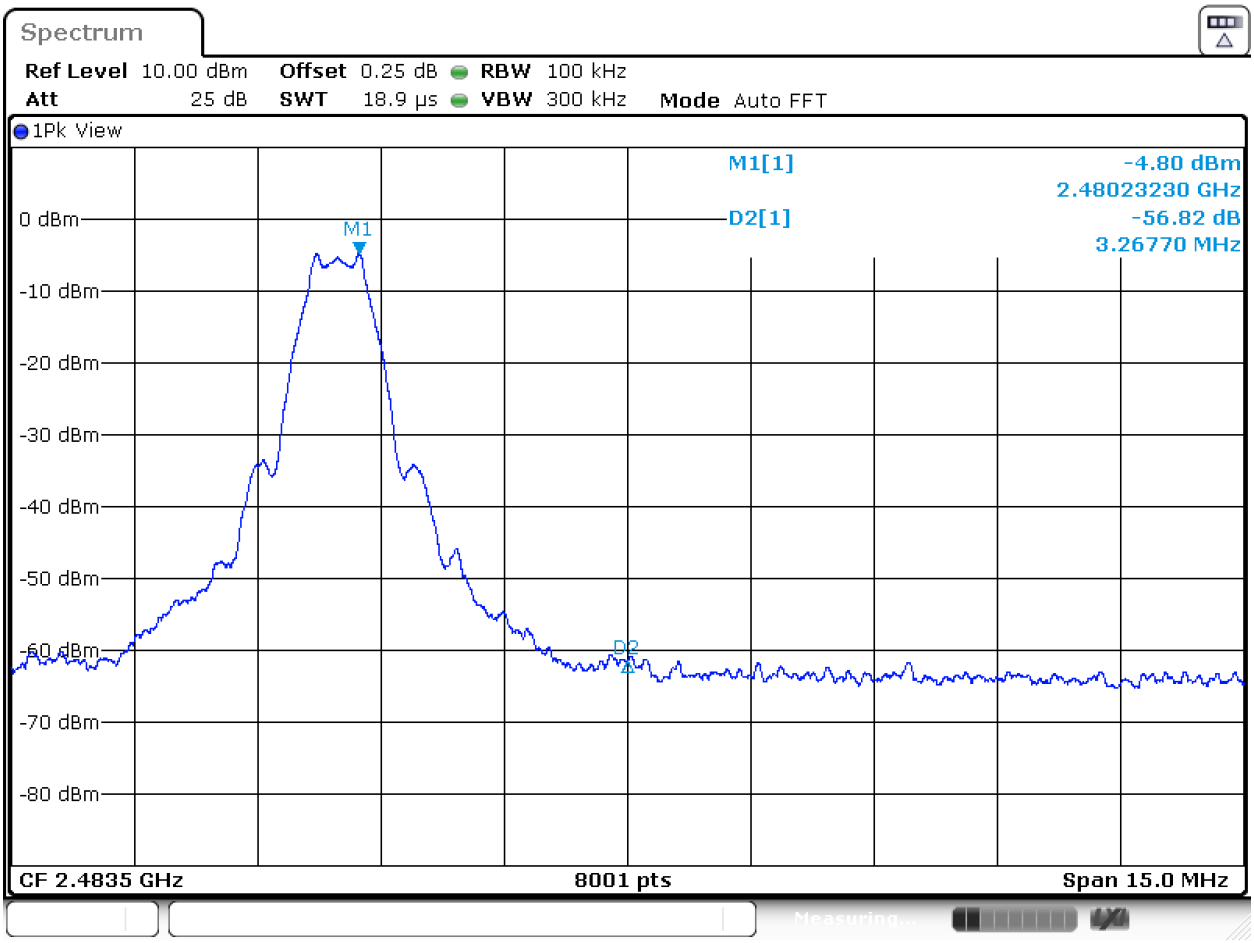


Tx @ Low Channel, 2400 MHz Band Edge
Charge Mode
Plot 4.6



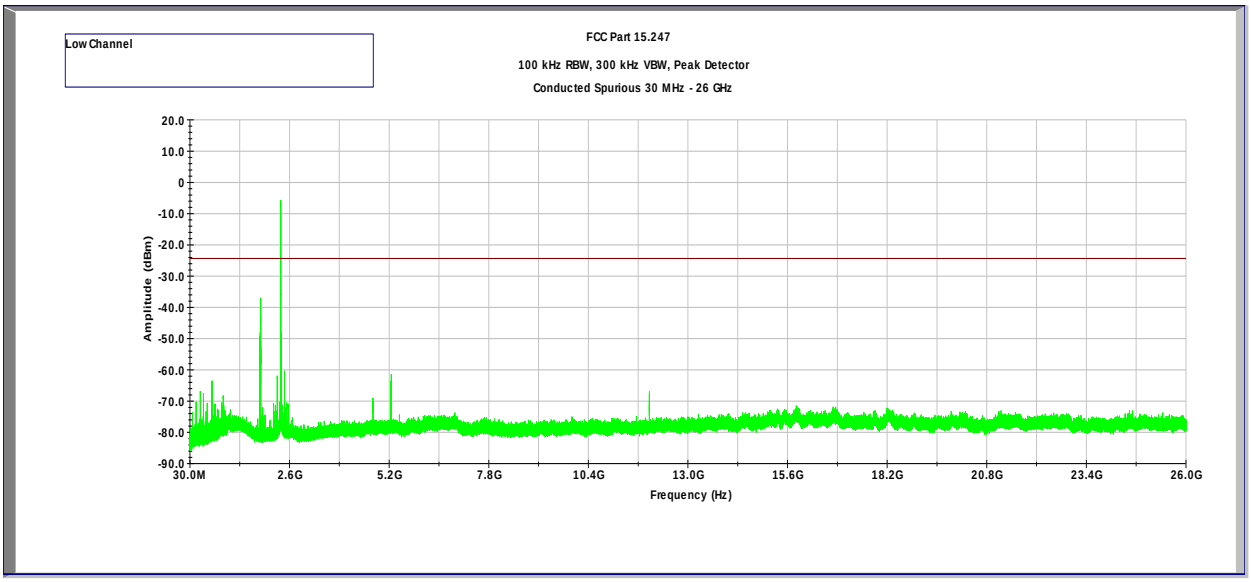
Date: 5.DEC.2017 13:52:21

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

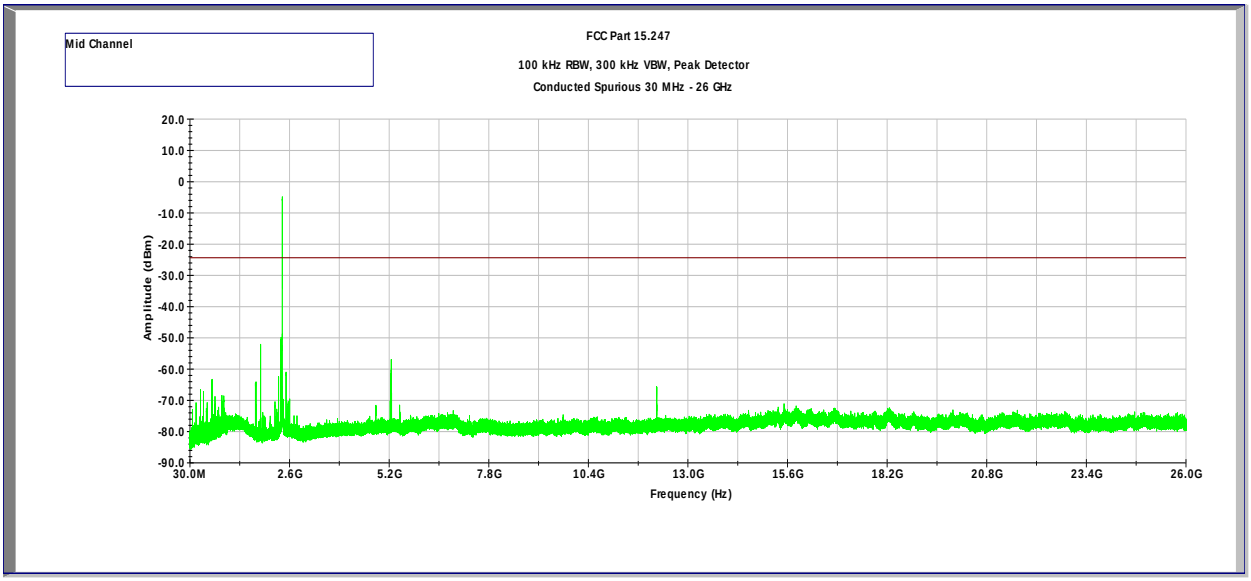


Date: 5.DEC.2017 13:53:15

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



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



Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious
Charge Mode
Plot 4.10