

# TEST REPORT

**Report Number: 102971715MPK-001**

**Project Number: G102971715**

**May 26, 2017**

**Testing performed on the  
M445-403-01-NAA-4  
Model: M400 WIFI/BT  
FCC ID: B32M400WIFIBT  
IC: 787C-M400WIFIBT**

to

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

For

**Verifone, Inc.**

Test Performed by:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

Test Authorized by:

Verifone, Inc.

1400 W Stanford Ranch Rd.

Rocklin, CA 95765 USA

Prepared by:



Anderson Soungpanya

Date: May 26, 2017

Reviewed by:



Krishna K Vemuri

Date: May 26, 2017

*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. 102971715MPK-001

<b>Equipment Under Test:</b>	M445-403-01-NAA-4
<b>Trade Name:</b>	Verifone, Inc
<b>Model Number:</b>	M400 WIFI/BT
<b>Applicant:</b>	Verifone, Inc.
<b>Contact:</b>	Edwin Mandapat
<b>Address:</b>	Verifone, Inc. 1400 W Stanford Ranch Rd. Rocklin, CA 95765
<b>Country</b>	USA
<b>Tel. Number:</b>	(916) 630-0550
<b>Email:</b>	Edwin_M1@Verifone.com
<b>Applicable Regulation:</b>	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
<b>Date of Test:</b>	April 12-May 26, 2017

*We attest to the accuracy of this report:*



---

Anderson Soungpanya  
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

2.3 Test Methodology .....6

2.4 Test Facility.....6

2.5 Measurement Uncertainty .....6

**3.0 System Test Configuration.....7**

3.1 Support Equipment and description .....7

3.2 Block Diagram of Test Setup .....7

3.3 Justification .....8

3.4 Mode of Operation During Test .....8

3.5 Modifications Required for Compliance .....8

3.6 Additions, Deviations and Exclusions from Standards .....8

**4.0 Measurement Results.....9**

4.1 6-dB Bandwidth and 99% Occupied Bandwidth .....9

4.1.1 Requirement.....9

4.1.2 Procedure .....9

4.1.3 Test Result .....10

4.2 Maximum Conducted Output Power at Antenna Terminals .....29

4.2.1 Requirement.....29

4.2.2 Procedure .....29

4.2.3 Test Result .....30

4.3 Power Spectral Density .....36

4.3.1 Requirement.....36

4.3.2 Procedure .....36

4.3.3 Test Result .....37

4.4 Out-of-Band Conducted Emissions.....47

4.4.1 Requirement.....47

4.4.2 Procedure .....47

4.4.3 Test Result .....47

4.5 Transmitter Radiated Emissions & Antenna Port Emissions.....59

4.5.1 Requirement.....59

4.5.2 Procedure – Radiated Emissions .....59

4.5.3 Field Strength Calculation.....60

4.5.4 Antenna-port conducted measurements.....61

4.5.6 General Procedure for conducted measurements in restricted bands.....61

4.5.7 Test Results.....61

**5.0 List of Test Equipment .....106**

**6.0 Document History .....107**

**Annex A - Duty Cycle Measurement .....108**

## 1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
<b>RF Output Power</b>	15.247(b)(3)	RSS-247, 5.4	Complies
<b>6 dB Bandwidth</b>	15.247(a)(2)	RSS-247, 5.2	Complies
<b>Power Density</b>	15.247(e)	RSS-247, 5.2	Complies
<b>Out of Band Antenna Conducted Emission</b>	15.247(d)	RSS-247, 5.5	Complies
<b>Transmitter Radiated Emissions</b>	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
<b>AC Line Conducted Emission</b>	15.207	RSS-GEN	Complies
<b>Antenna Requirement</b>	15.203	RSS-GEN	Complies (Unique Connector & Internal Antenna)
<b>RF Exposure</b>	15.247(i), 2.1093(d)	RSS-102	Complies

**EUT receive date:** April 07, 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:** April 12, 2017

**Test completion date:** May 26, 2017

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

## 2.0 General Information

### 2.1 Product Description

Verifone, Inc. supplied the following description of the EUT:

The M400 WIFI/BT is an Electronic Payment/POS Terminal for Retail.

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

This test report covers only the 2.4GHz WiFi radio.

Information about the WiFi radio is presented below:

The EUT supports a wide range of data rates in the 2.4GHz band:

IEEE 802.11b

IEEE 802.11g

IEEE 802.11n

<b>Applicant</b>	Verifone, Inc.
<b>Model Number</b>	M400 WIFI/BT
<b>FCC Identifier</b>	B32M400WIFIBT
<b>IC Identifier</b>	787C-M400WIFIBT
<b>Modulation Technique</b>	DSSS (BPSK, QPSK, CCK), OFDM (BPSK, QPSK, 16QAM, 64QAM)
<b>Rated RF Output</b>	802.11b: 15.22 dBm 802.11g: 12.16 dBm 802.11n: 11.92 dBm
<b>Frequency Range</b>	2412 – 2462 MHz, 802.11b/g/n
<b>Type of modulation</b>	BPSK, QPSK, 16QAM, 64QAM
<b>Number of Channel(s)</b>	11 for 802.11b/g/n
<b>Antenna(s) &amp; Gain</b>	Internal Antenna, 1.48 dBi peak gain
<b>Applicant Name &amp; Address</b>	Verifone, Inc. 1400 W Stanford Ranch Rd. Rocklin, CA 95765 USA

## 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 (DTS) Operating under §15.247” (KDB 558074 D01 DTS MEAS GUIDANCE V04), and RSS-247, RSS-GEN, and

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 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.

## 2.5 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

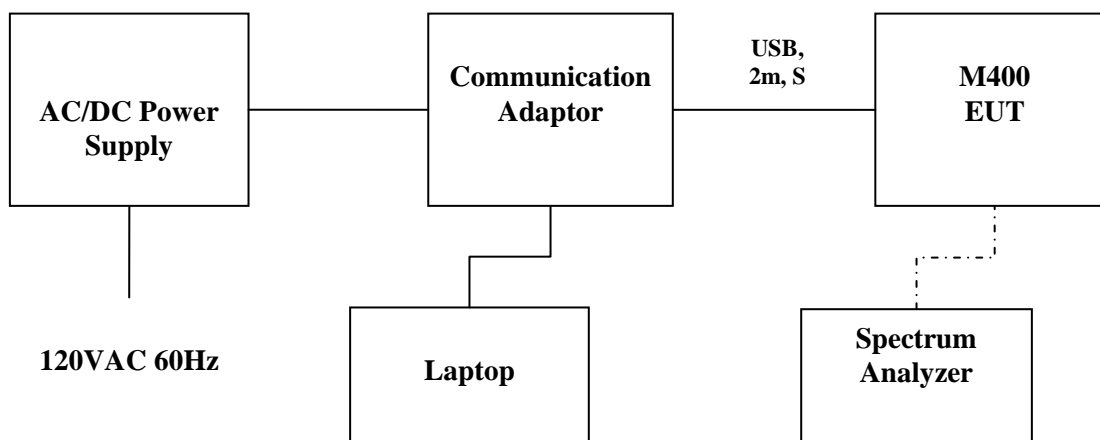
#### 3.1 Support Equipment and description

Description	Manufacturer	Model No./ Part No.
Laptop	HP	EliteBook 8470p
Communication Adapter	Verifone	NA
AC/DC Power Adapter	I.T.E Power Supply	AU112106u

#### 3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Electronic Payment Terminal	Verifone	M400	401-148-349

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



<b>S</b> = Shielded	<b>F</b> = With Ferrite
<b>U</b> = Unshielded	<b>M</b> = Meter

### 3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The worse-case data rate with highest power and widest spectrum were selected for final measurements:

CCK 1 Mbps – for 802.11b  
OFDM 6 Mbps – for 802.11g  
OFDM MCS0 – for 802.11n

Unless otherwise stated in this report, measurements made for Power Density, Bandwidth, Conducted Spurious, Radiated Spurious (Cabinet Radiation) were made with the worst case power setting (mid channel power).

### 3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously using the maximum RF power setting provided by the manufacturers via test scripts. Their corresponding output power in dBm can be found in section 4.2 of this report.

### 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)  $\geq 3 \times$  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.

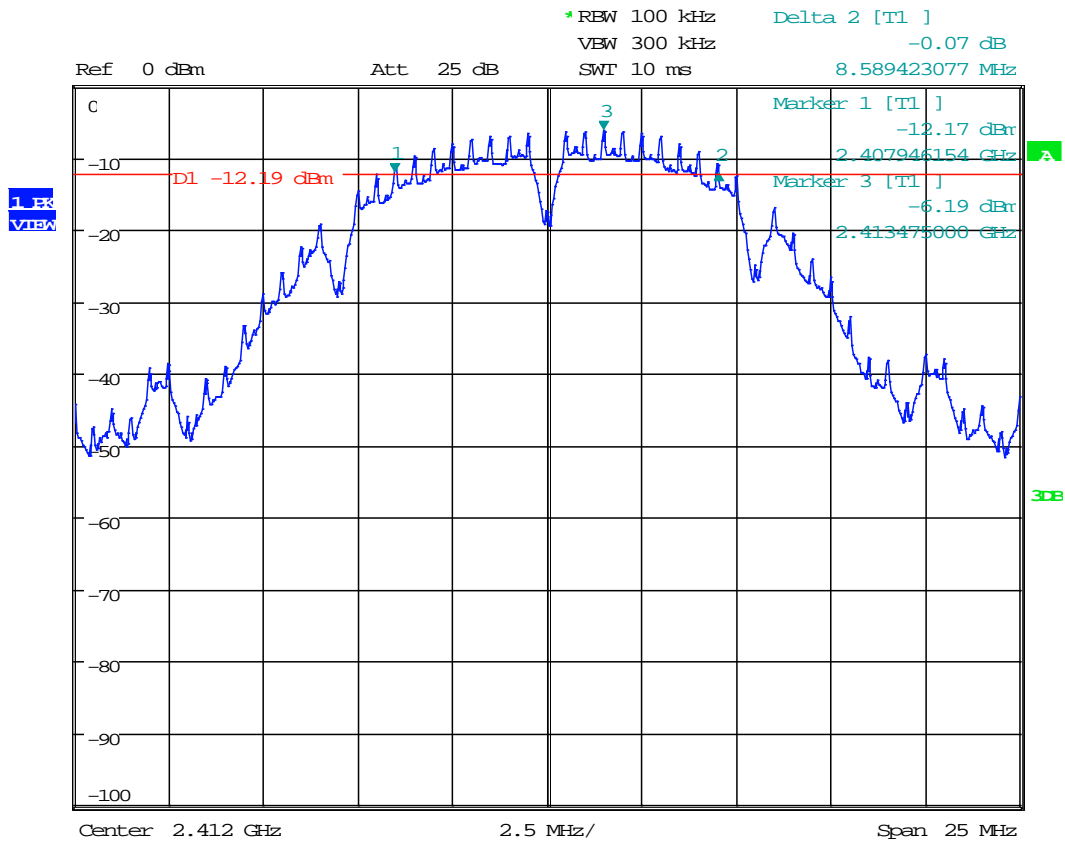
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

Test Date:	April 12 & 18, 2017
------------	---------------------

4.1.3 Test Result

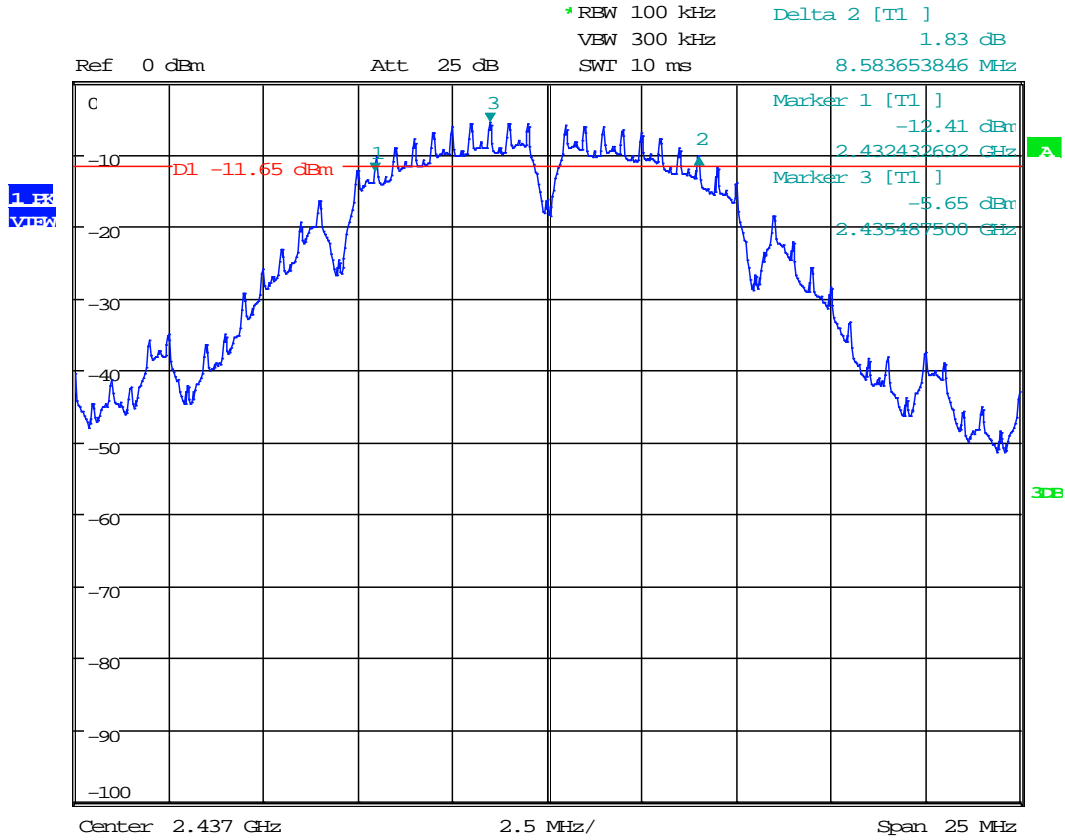
Frequency MHz	Ch.	Frequency MHz	6 dB FCC Bandwidth, MHz	Plot #	99% Bandwidth, MHz	Plot #
802.11b	1	2412	8.589	1.1	12.288	1.10
	6	2437	8.584	1.2	12.375	1.11
	11	2462	8.103	1.3	11.788	1.12
802.11g	1	2412	15.769	1.4	17.325	1.13
	6	2437	16.327	1.5	17.460	1.14
	11	2462	15.699	1.6	16.755	1.15
802.11n	1	2412	16.346	1.7	18.300	1.16
	6	2437	17.163	1.8	18.375	1.17
	11	2462	16.058	1.9	17.910	1.18

Plot 1.1 – 6dB Bandwidth (FCC)



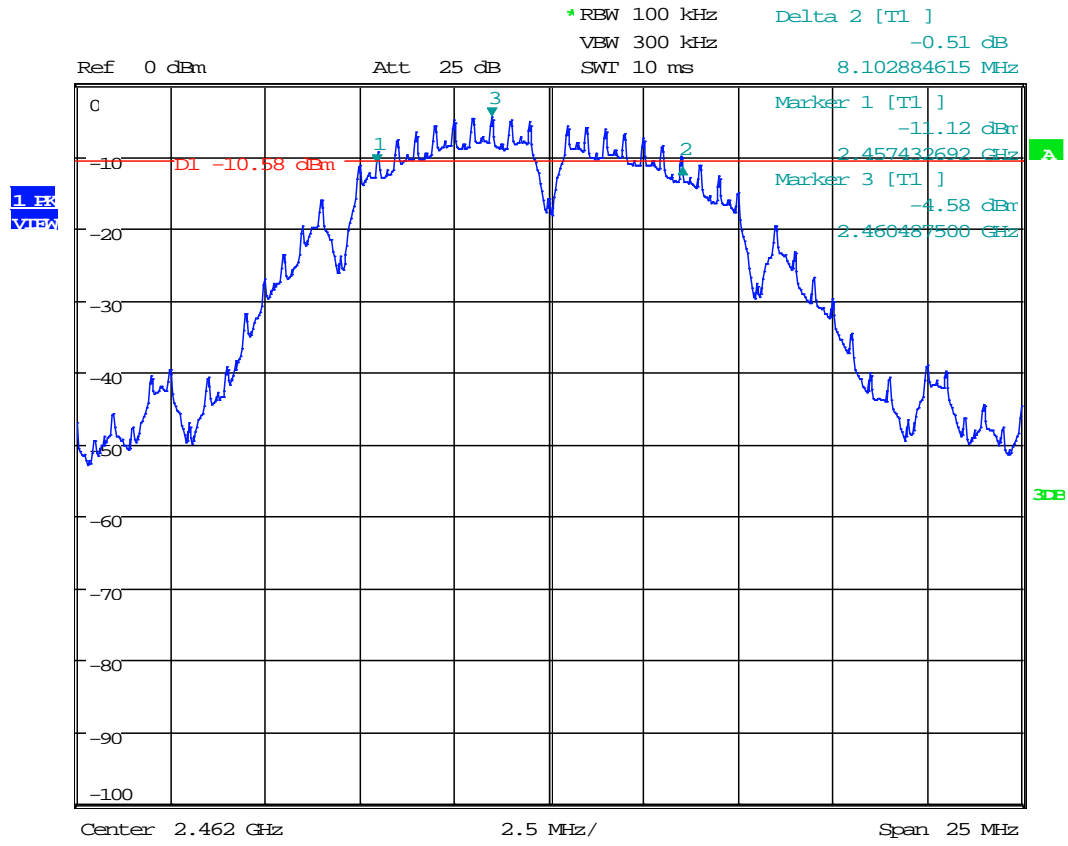
Date: 18.APR.2017 06:49:53

Plot 1.2 – 6dB Bandwidth (FCC)



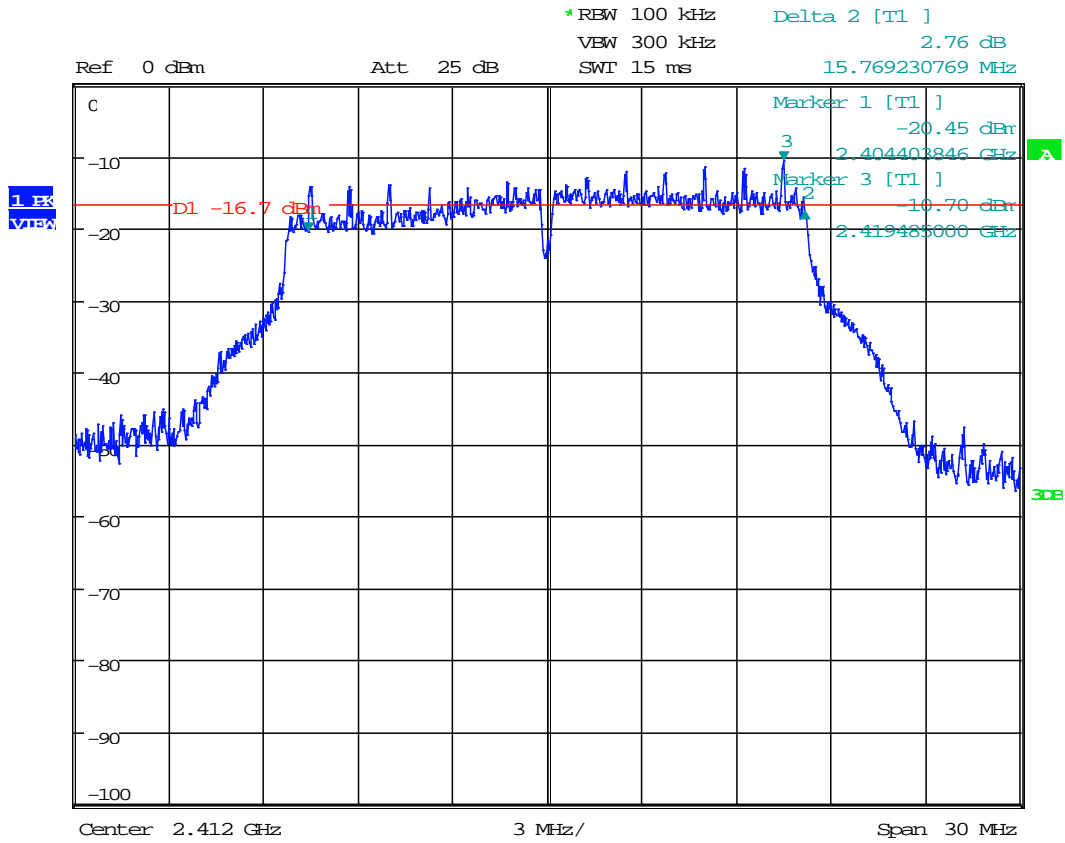
Date: 18.APR.2017 07:26:15

Plot 1 3 – 6dB Bandwidth (FCC)



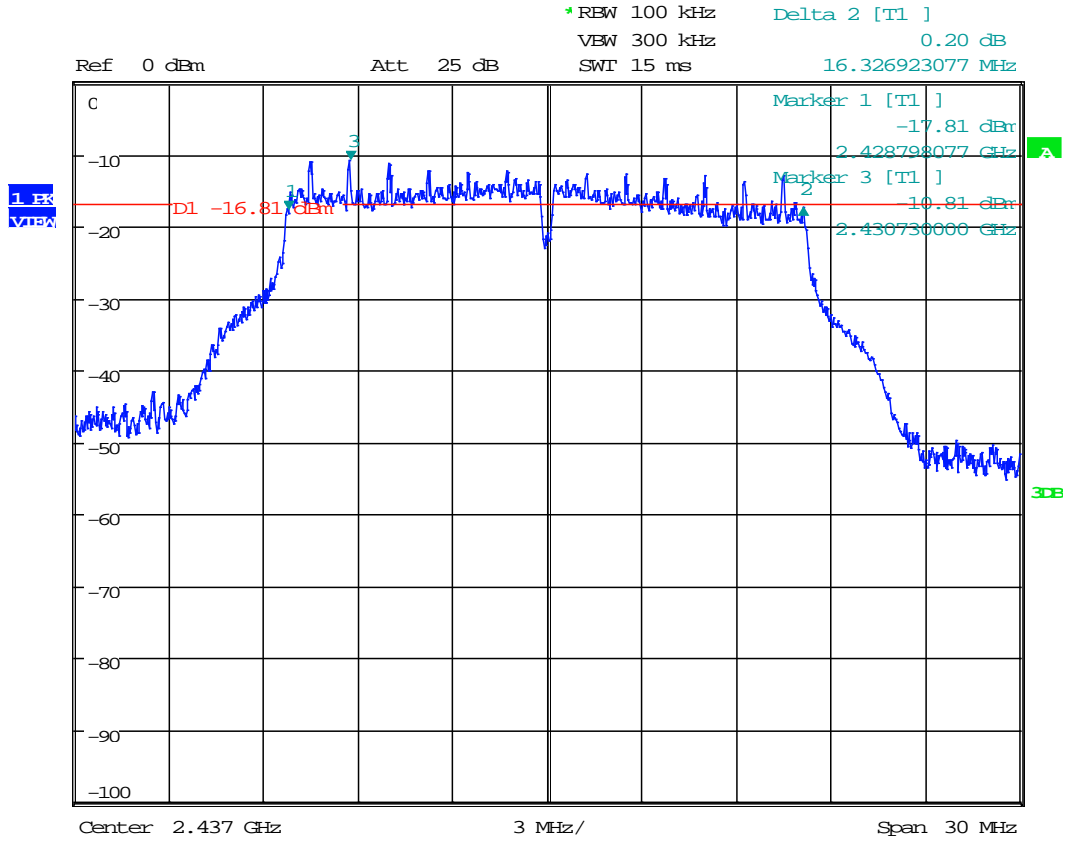
Date: 18.APR.2017 07:54:51

Plot 1.4 – 6dB Bandwidth (FCC)



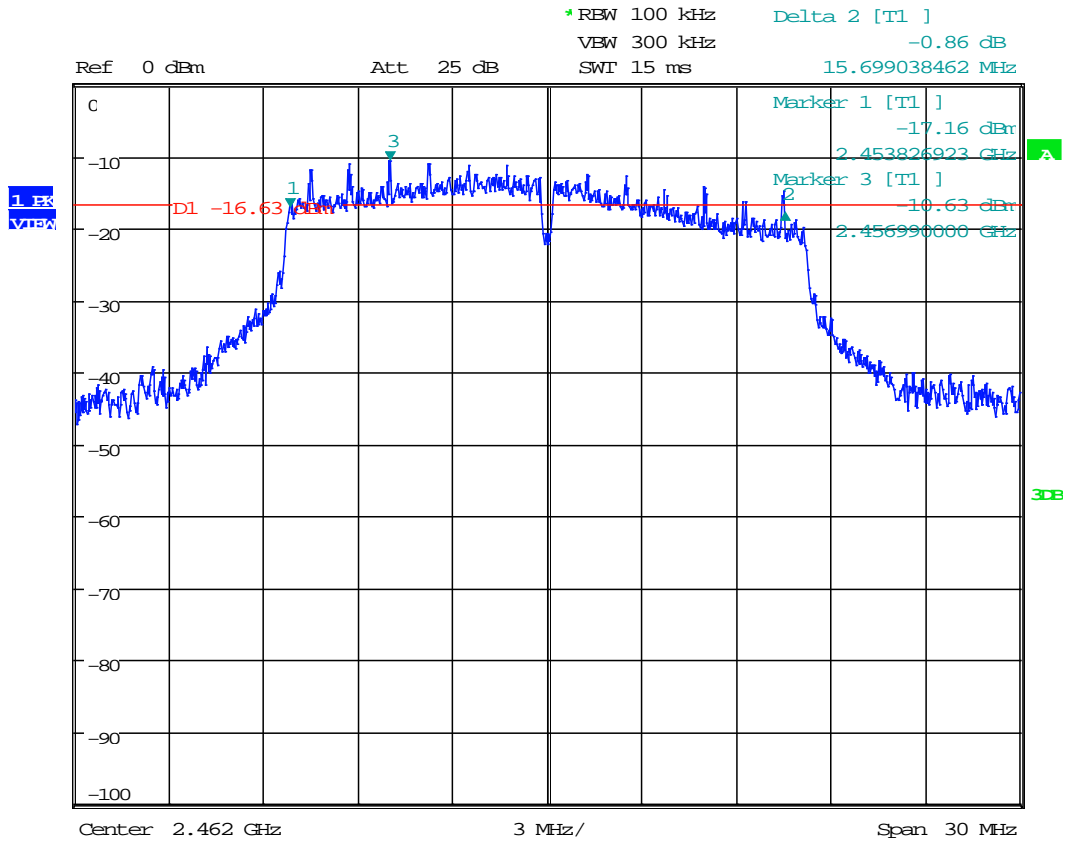
Date: 18.APR.2017 08:00:15

Plot 1.5 – 6dB Bandwidth (FCC)



Date: 18.APR.2017 07:58:47

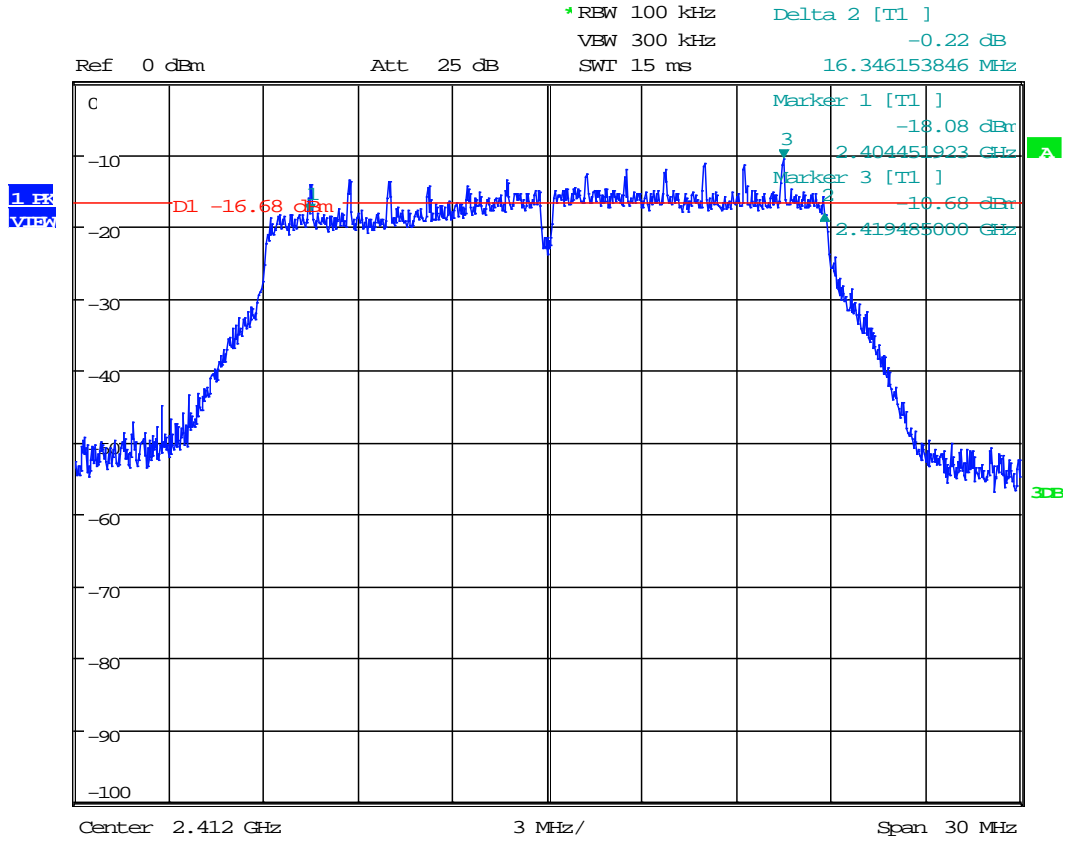
Plot 1.6 – 6dB Bandwidth (FCC)



Date: 18.APR.2017 07:57:15

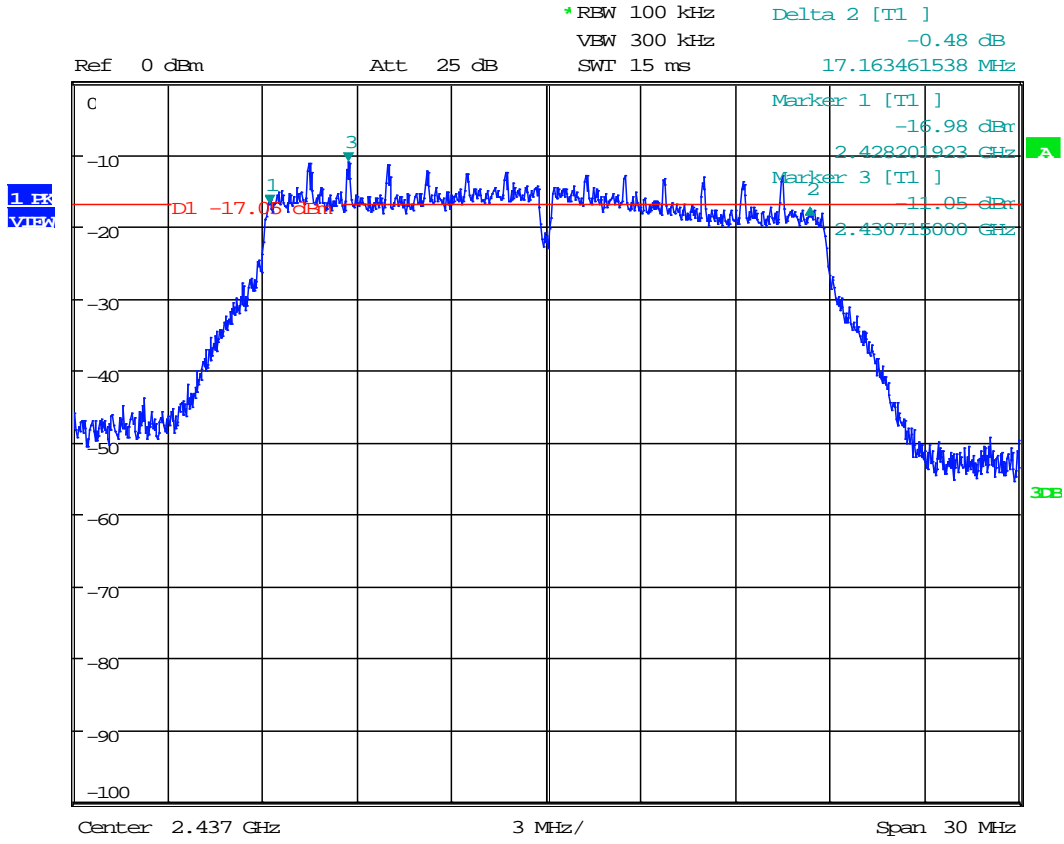


Plot 1.7 – 6dB Bandwidth (FCC)



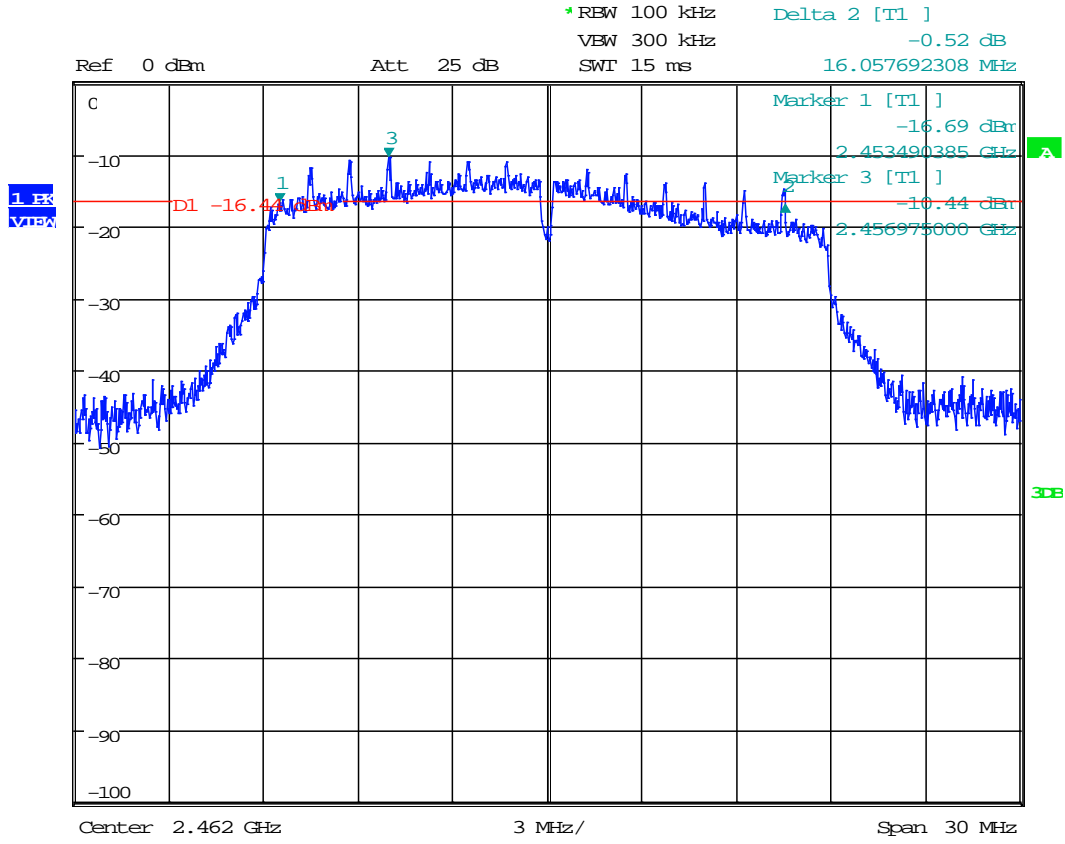
Date: 18.APR.2017 08:02:17

Plot 1.8 – 6dB Bandwidth (FCC)



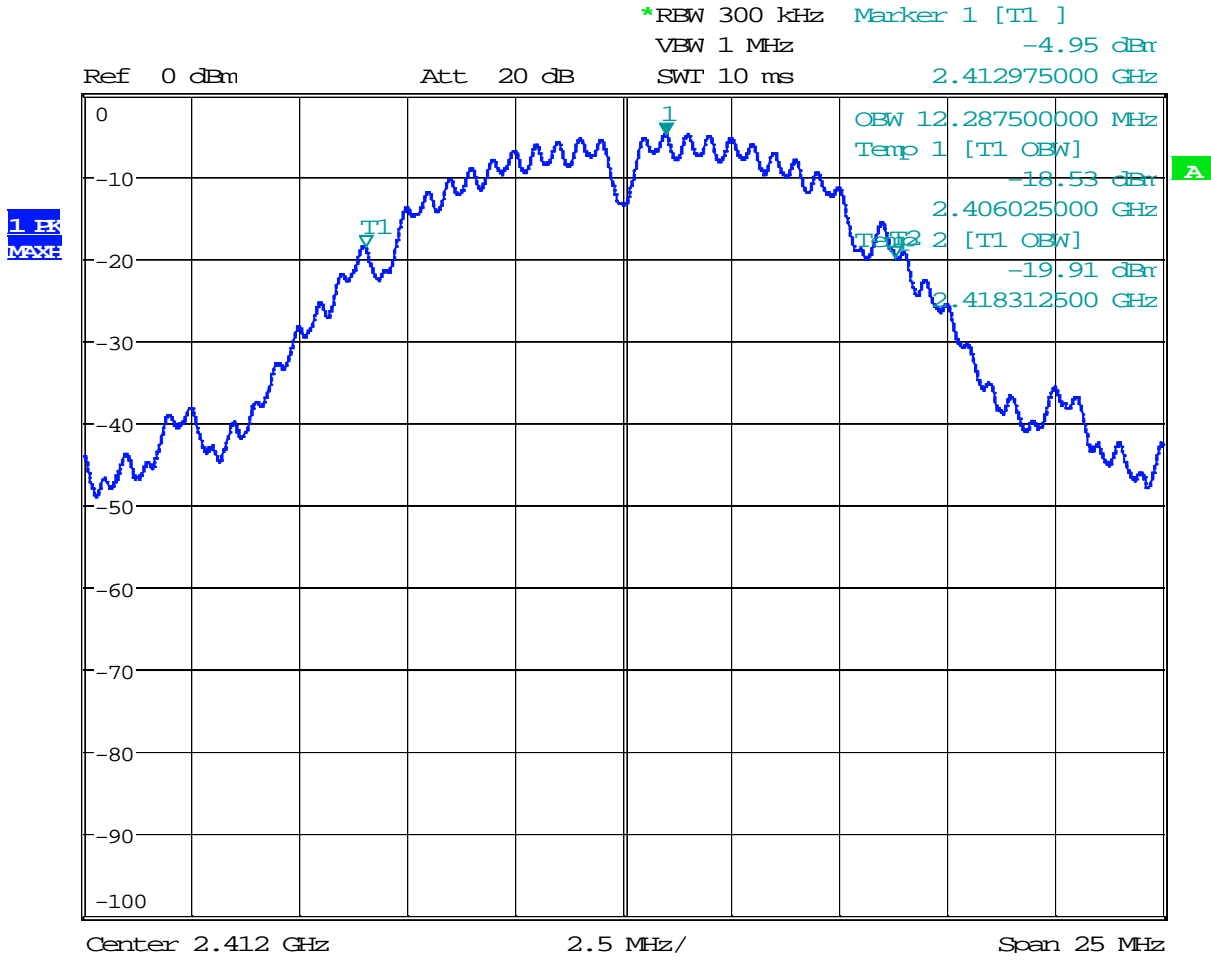
Date: 18.APR.2017 08:04:04

Plot 1.9 – 6dB Bandwidth (FCC)



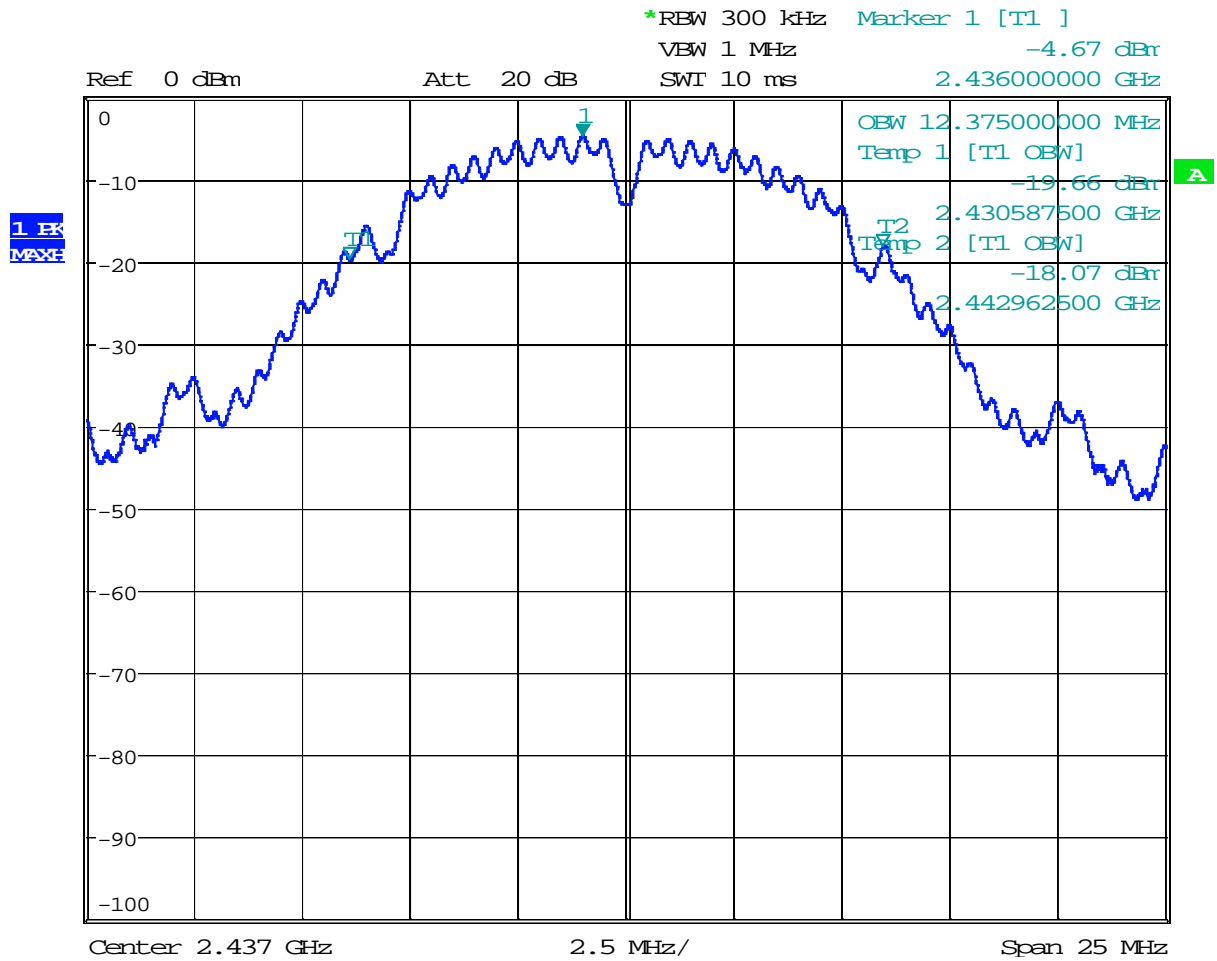
Date: 18.APR.2017 08:05:24

Plot 1.10 – 99% Bandwidth



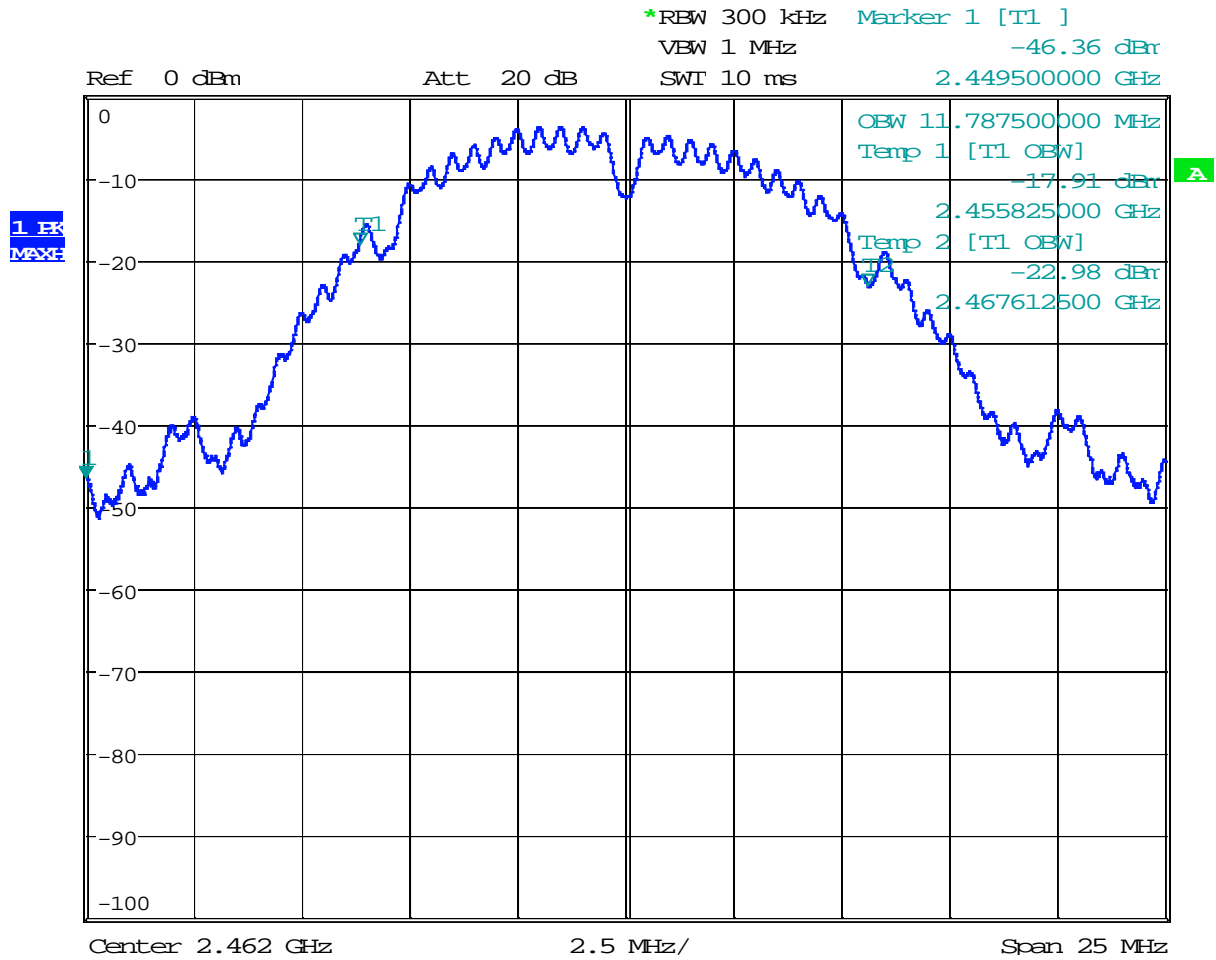
Date: 12.APR.2017 13:12:29

Plot 1.11 – 99% Bandwidth



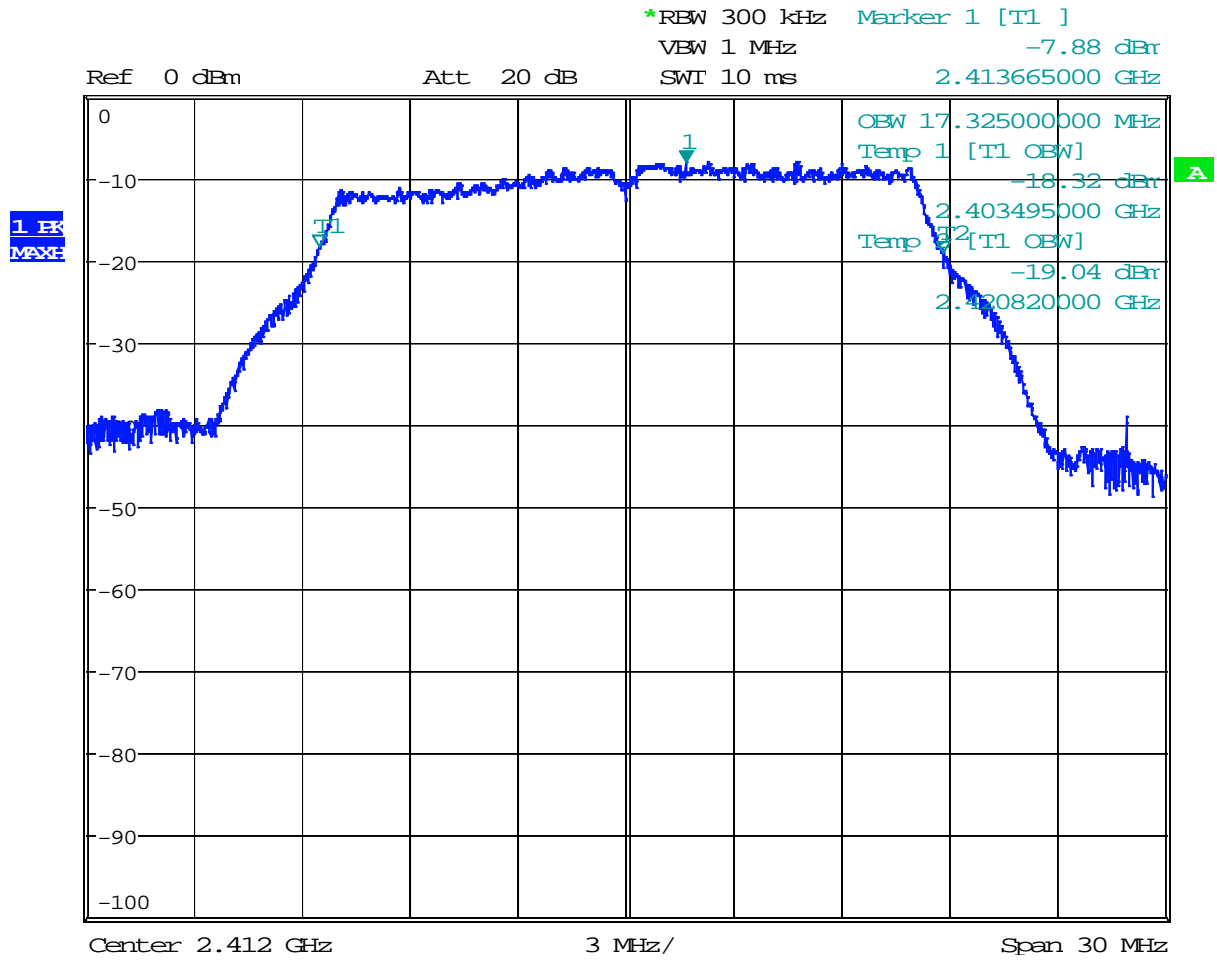
Date: 12.APR.2017 13:20:34

Plot 1.12 – 99% Bandwidth



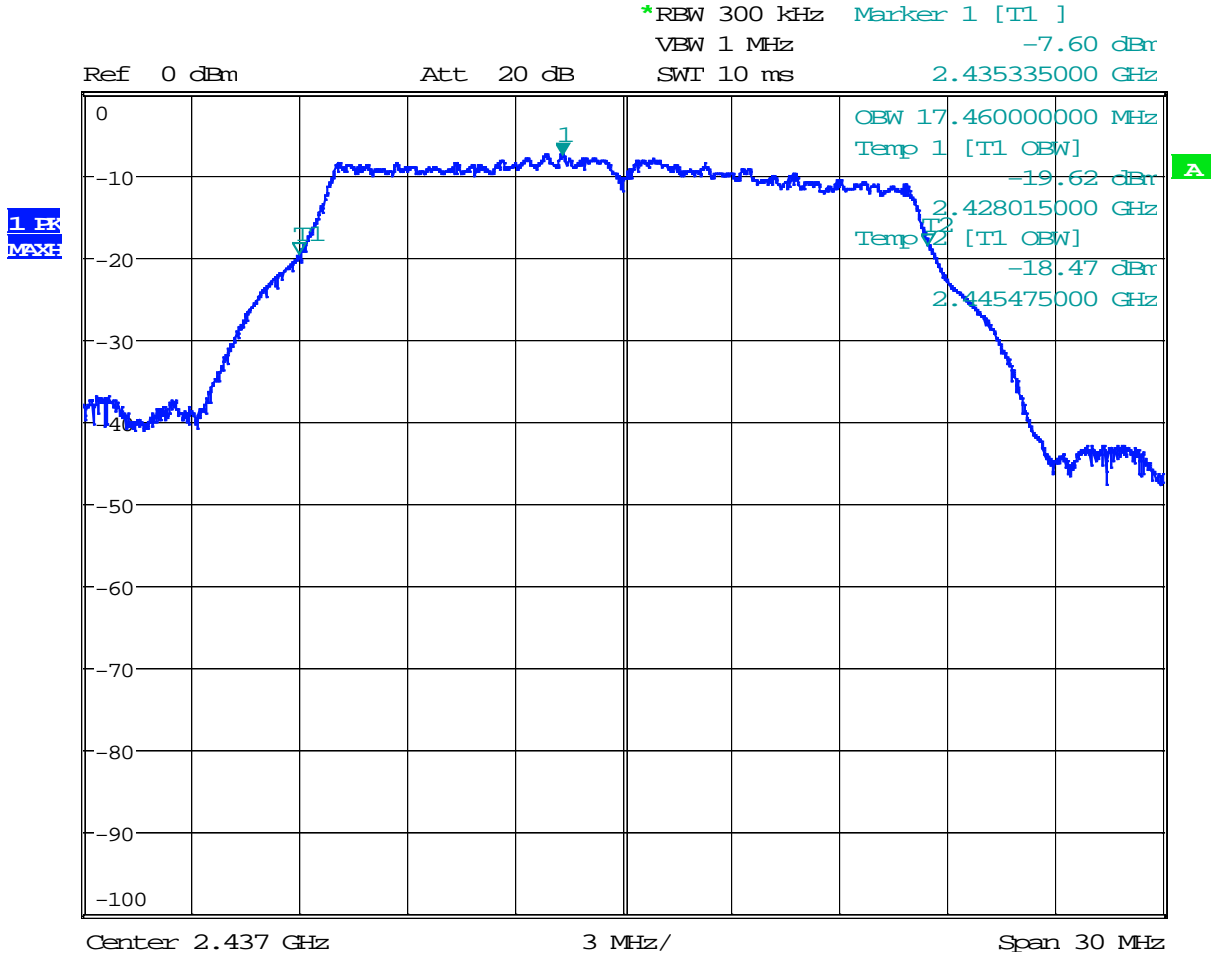
Date: 12.APR.2017 13:21:15

Plot 1.13 – 99% Bandwidth



Date: 12.APR.2017 13:24:10

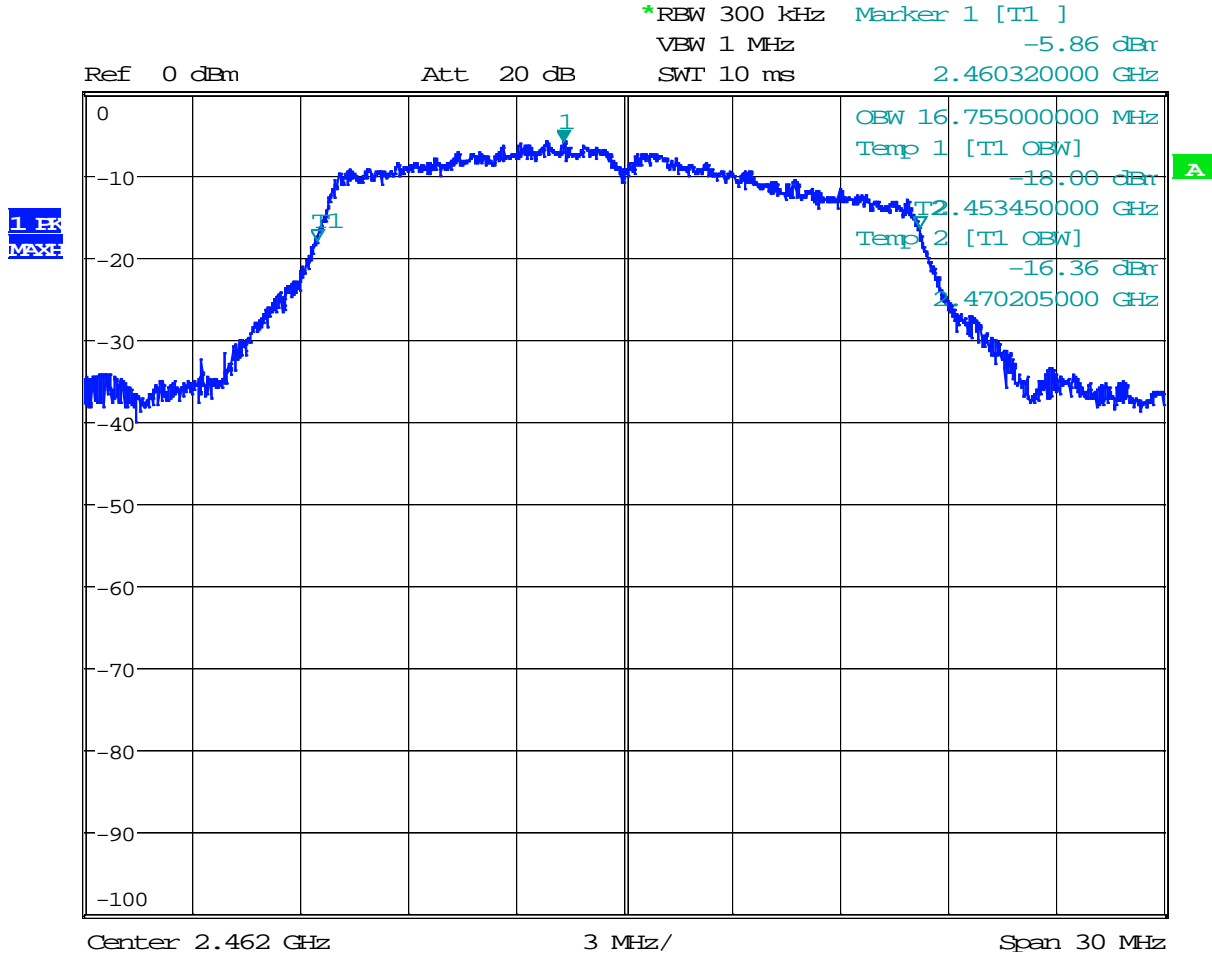
Plot 1.14 – 99% Bandwidth



Date: 12.APR.2017 13:23:32

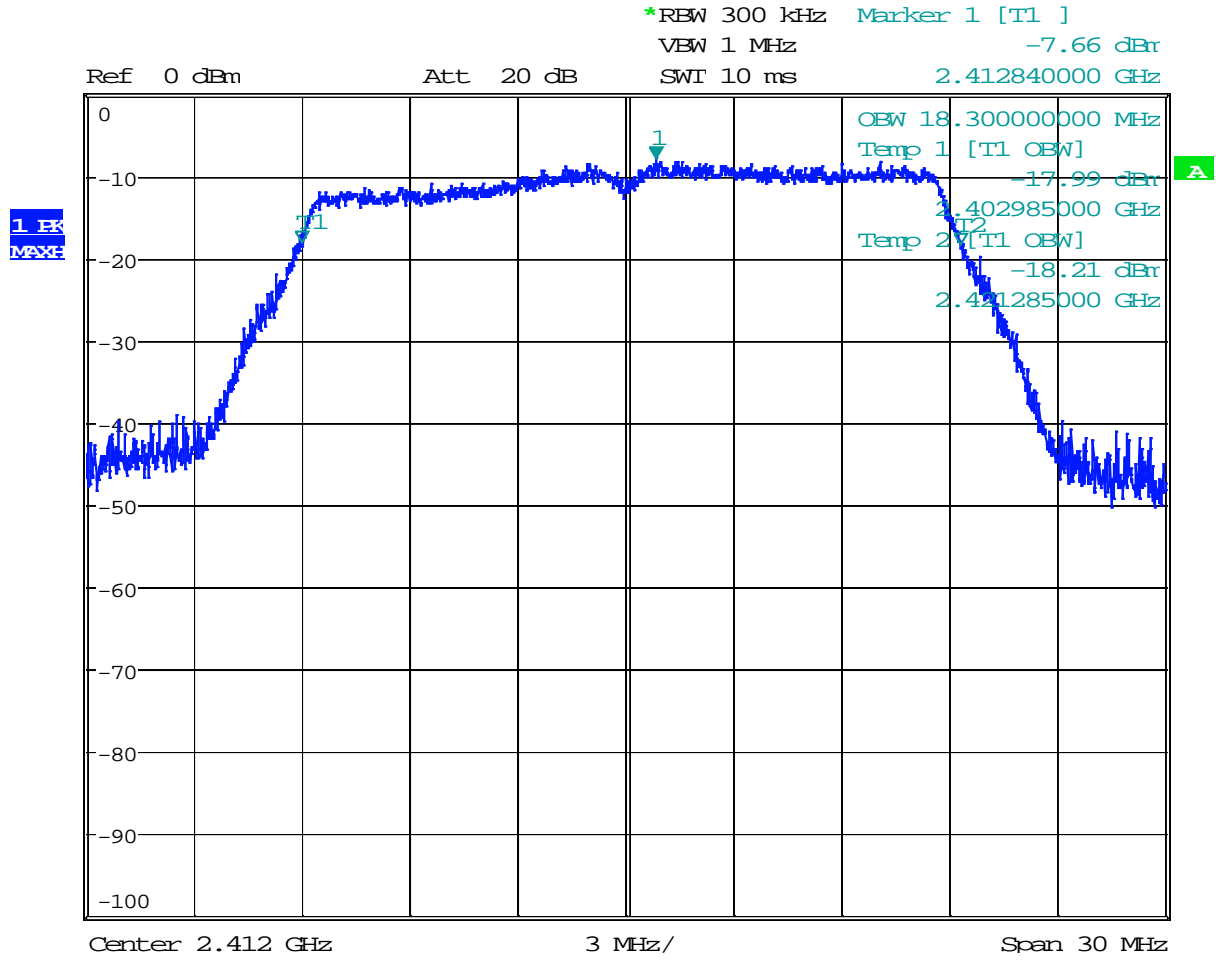


Plot 1.15 – 99% Bandwidth



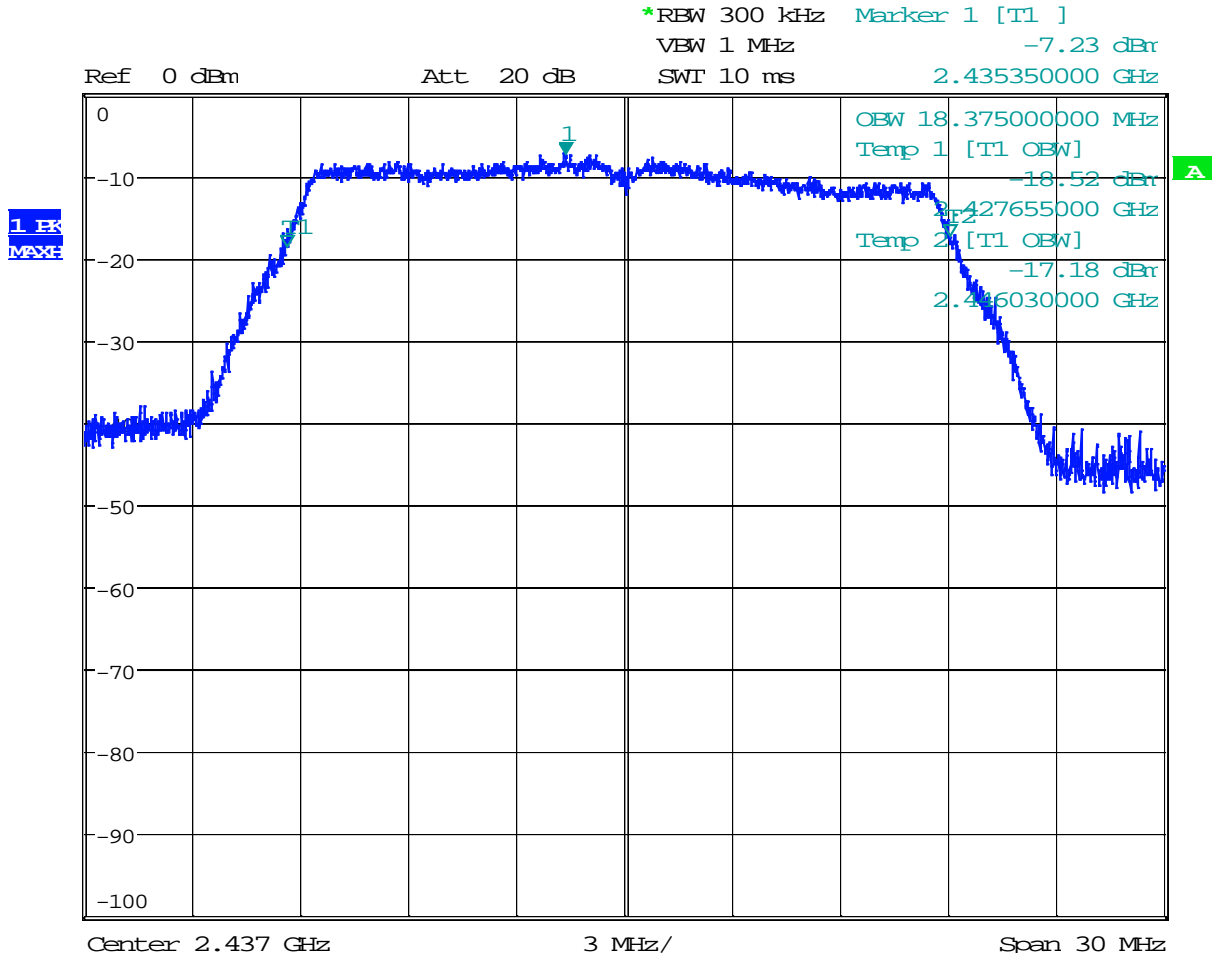
Date: 12.APR.2017 13:22:09

Plot 1.16 - 99% Bandwidth



Date: 12.APR.2017 13:25:22

Plot 1.17 – 99% Bandwidth



Date: 12.APR.2017 13:26:33



## 4.2 Maximum Conducted Output Power at Antenna Terminals FCC Rule 15.247(b)(3)

### 4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+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 antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Maximum Conducted Transmitter Output Power. The offset programmed on the analyzer is corrected to include cable loss, attenuator and duty cycle correction.

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance v04 was used. Specifically, section 9.2.2.5 Method AVGSA-2 Alternative (RMS detection with slow sweep with spectrum bin averaging across on- and off-times of the EUT transmissions, followed by duty cycle correction).

1. Measure the duty cycle,  $x$ , of the transmitter output signal.
2. Set span to at least  $1.5 \times \text{OBW}$ .
3. Set  $\text{RBW} = 1\% \text{ to } 5\%$  of the  $\text{OBW}$ , not to exceed 1 MHz.
4. Set  $\text{VBW} \geq 3 \times \text{RBW}$ .
5. Number of points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ . (This gives bin-to-bin spacing  $\leq \text{RBW}/2$ , so that narrowband signals are not lost between frequency bins.)
6. Manually set sweep time  $\geq 10 \times (\text{number of points in sweep}) \times (\text{total on/off period of the transmitted signal})$ .
7. Set detector = RMS.
8. Perform a single sweep.
9. Compute power by integrating the spectrum across the  $\text{OBW}$  of the signal using the instrument's band power measurement function with band limits set equal to the  $\text{OBW}$  band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the  $\text{RBW}$  extending across the entire  $\text{OBW}$ .
10. Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

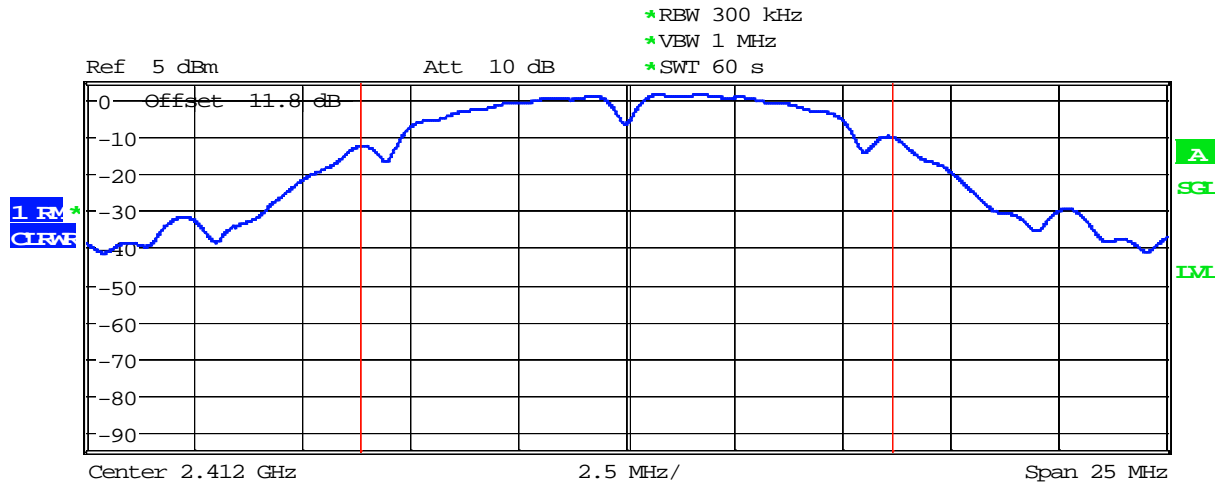
Test Date:	April 13, 2017
------------	----------------

4.2.3 Test Result

Refer to the following plots for the test result:

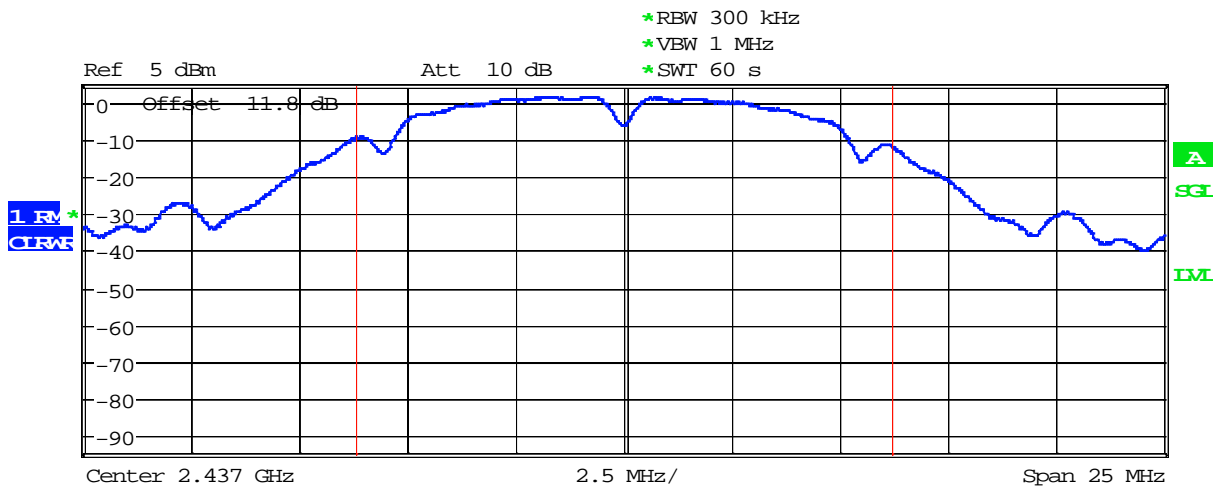
Standard	Data Rate	Channel	Frequency MHz	Conducted Average Power dBm	Conducted Average Power mW	Plot #
802.11b	1 Mbps	1	2412	14.24	26.546	2.1
		6	2437	14.65	29.174	2.2
		11	2462	15.22	33.266	2.3
802.11g	6 Mbps	1	2412	11.41	13.836	2.4
		6	2437	11.93	15.596	2.5
		11	2462	12.16	16.444	2.6
802.11n	0 MCS	1	2412	11.24	13.305	2.7
		6	2437	11.81	15.171	2.8
		11	2462	11.92	15.560	2.9

Plot 2.1



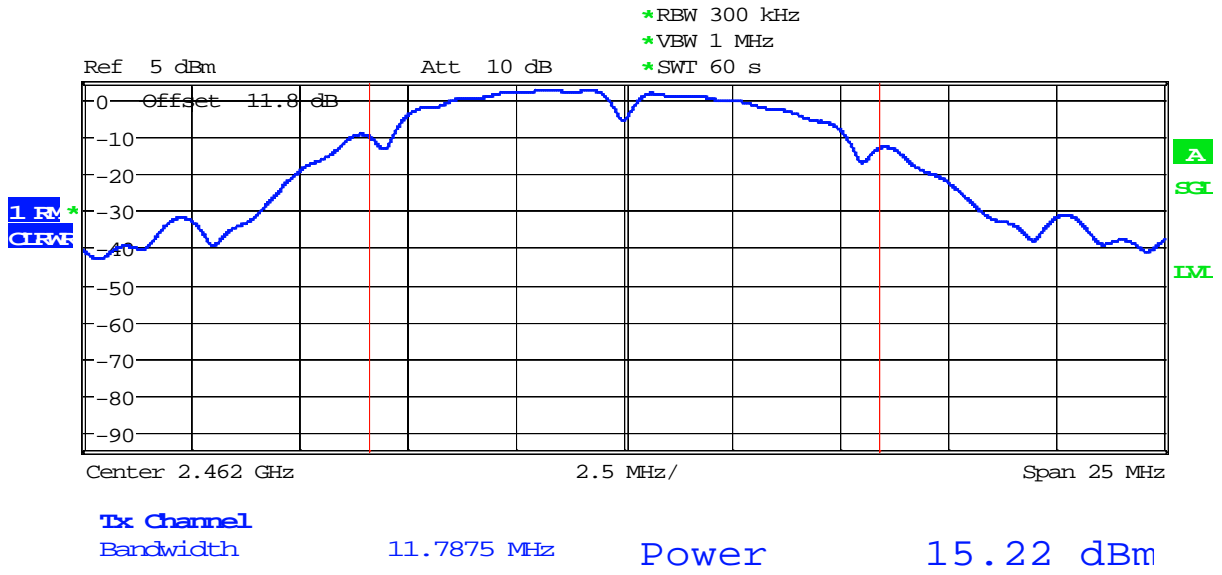
**Tx Channel**  
Bandwidth      12.2875 MHz      Power      14.24 dBm

Plot 2.2



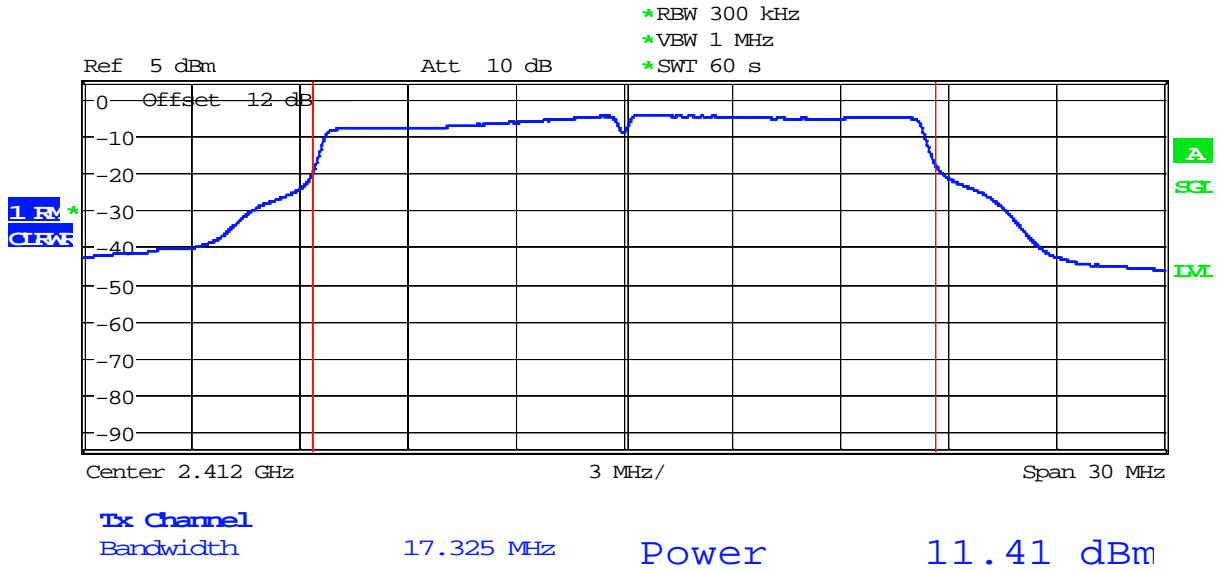
**Tx Channel**  
Bandwidth      12.375 MHz      Power      14.65 dBm

Plot 2.3

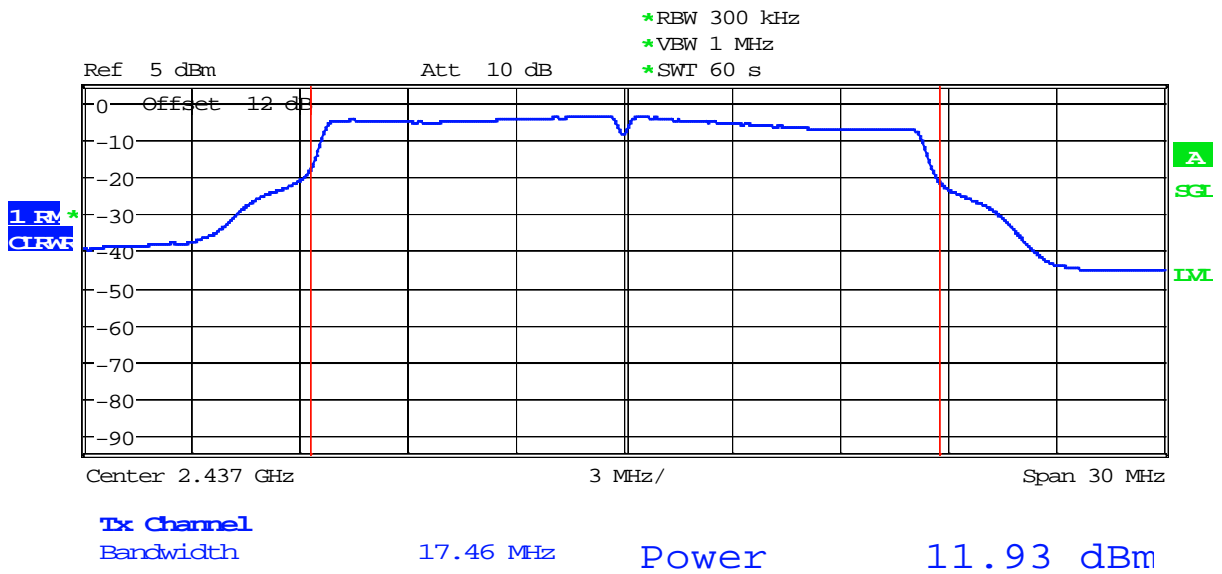




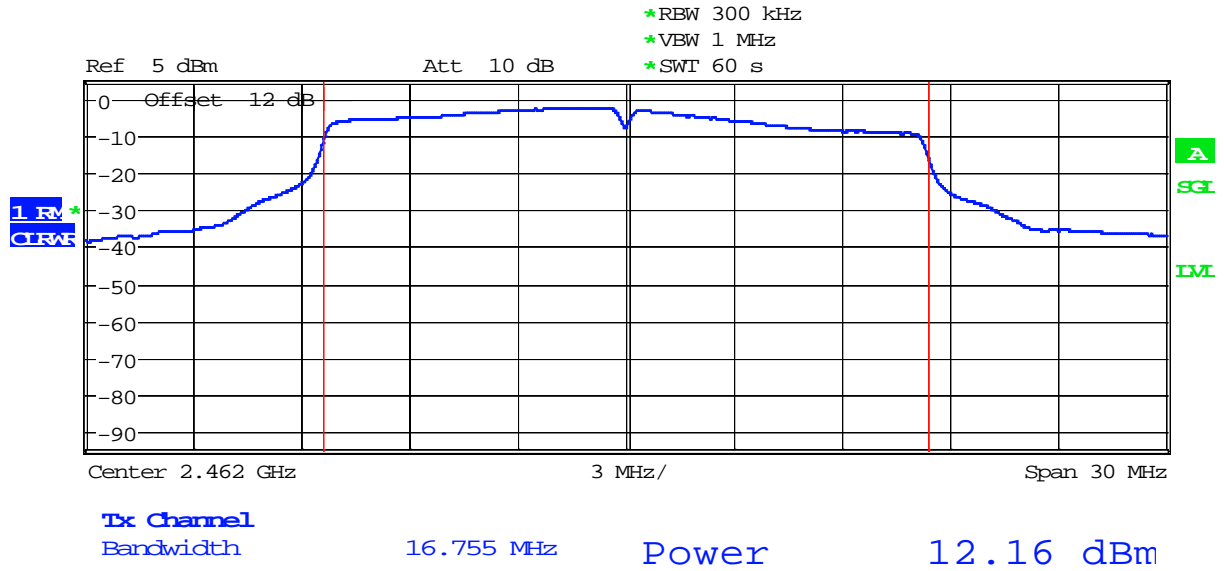
Plot 2.4



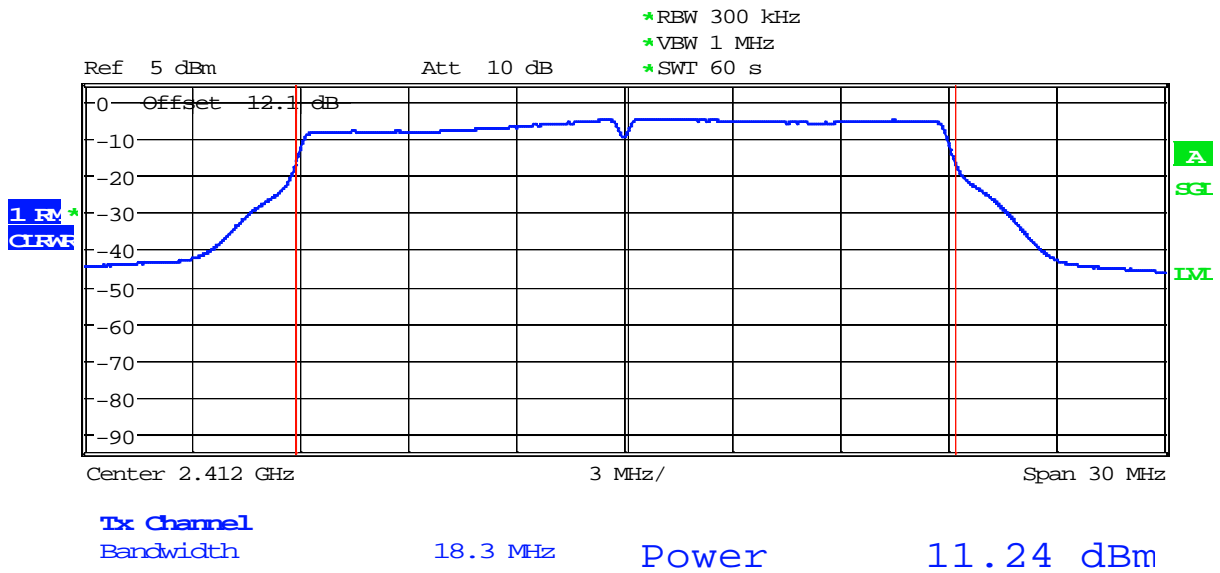
Plot 2.5



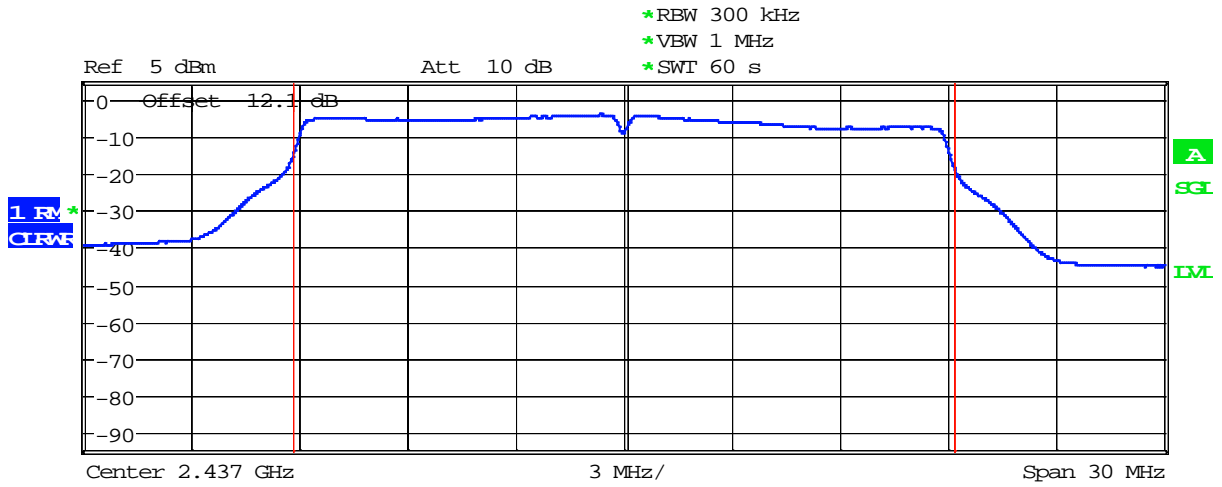
Plot 2. 6



Plot 2. 7

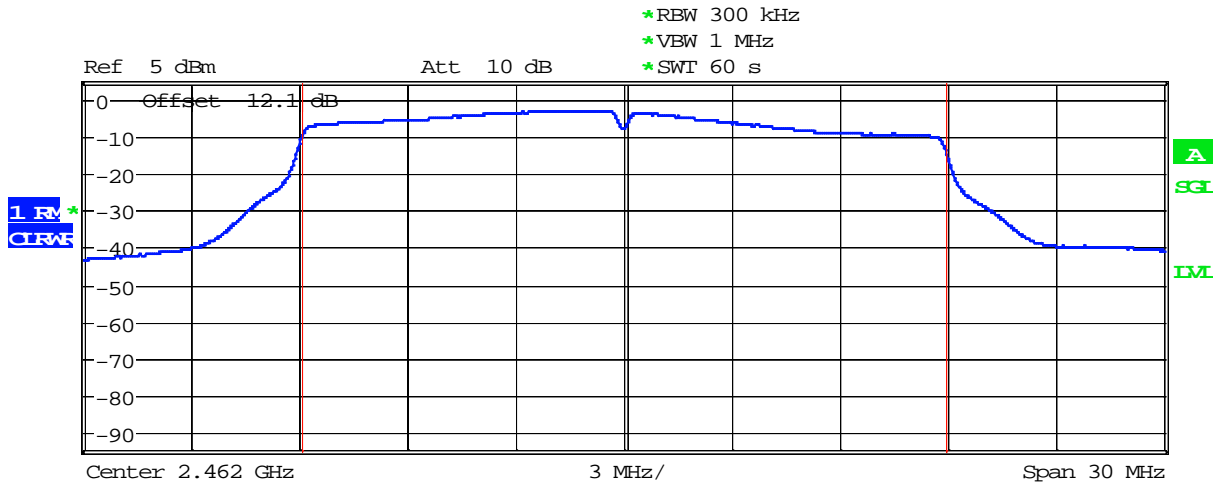


Plot 2. 8



**Tx Channel**  
Bandwidth                      18.375 MHz      Power                      11.81 dBm

Plot 2. 9



**Tx Channel**  
Bandwidth                      17.91 MHz      Power                      11.92 dBm

4.3 Power Spectral Density  
FCC 15.247 (e)

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 8dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Transmitter Power Density (PSD). The offset programmed on the analyzer is corrected to include cable loss, attenuator.

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance, 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:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
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.

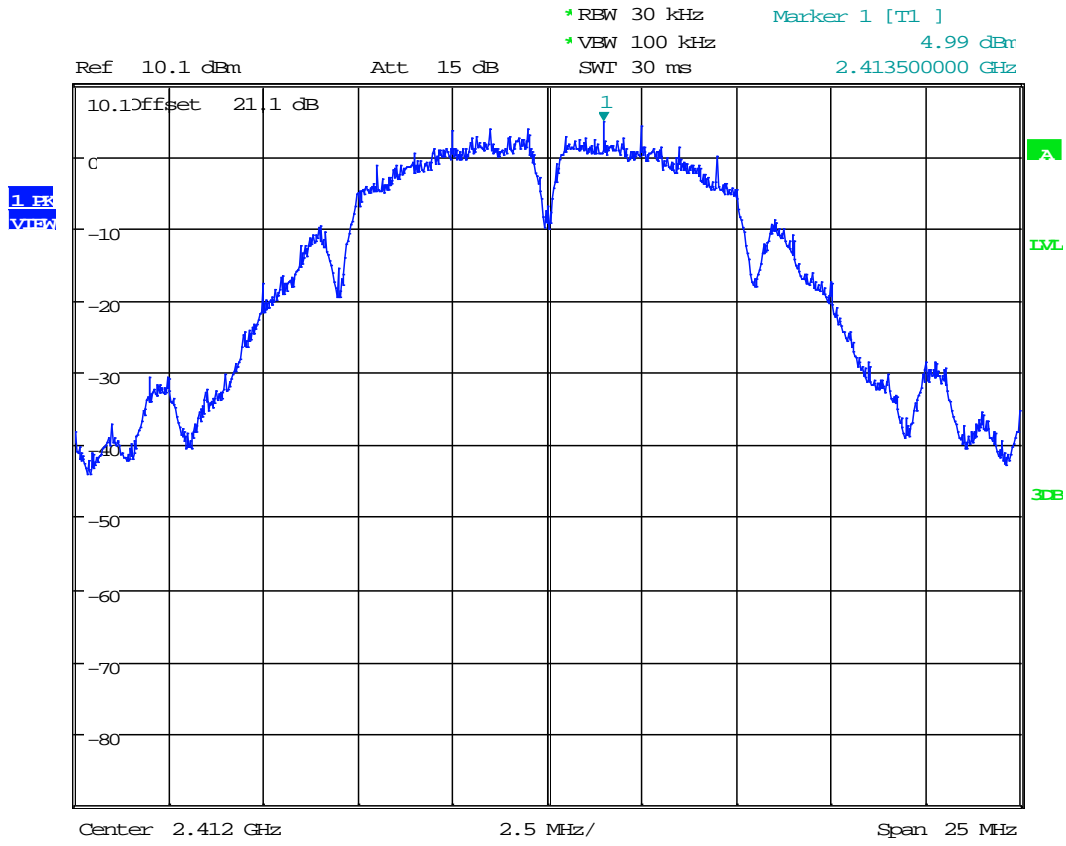
Test Date:	May 26, 2017
------------	--------------

4.3.3 Test Result

Refer to the following plots for the test result:

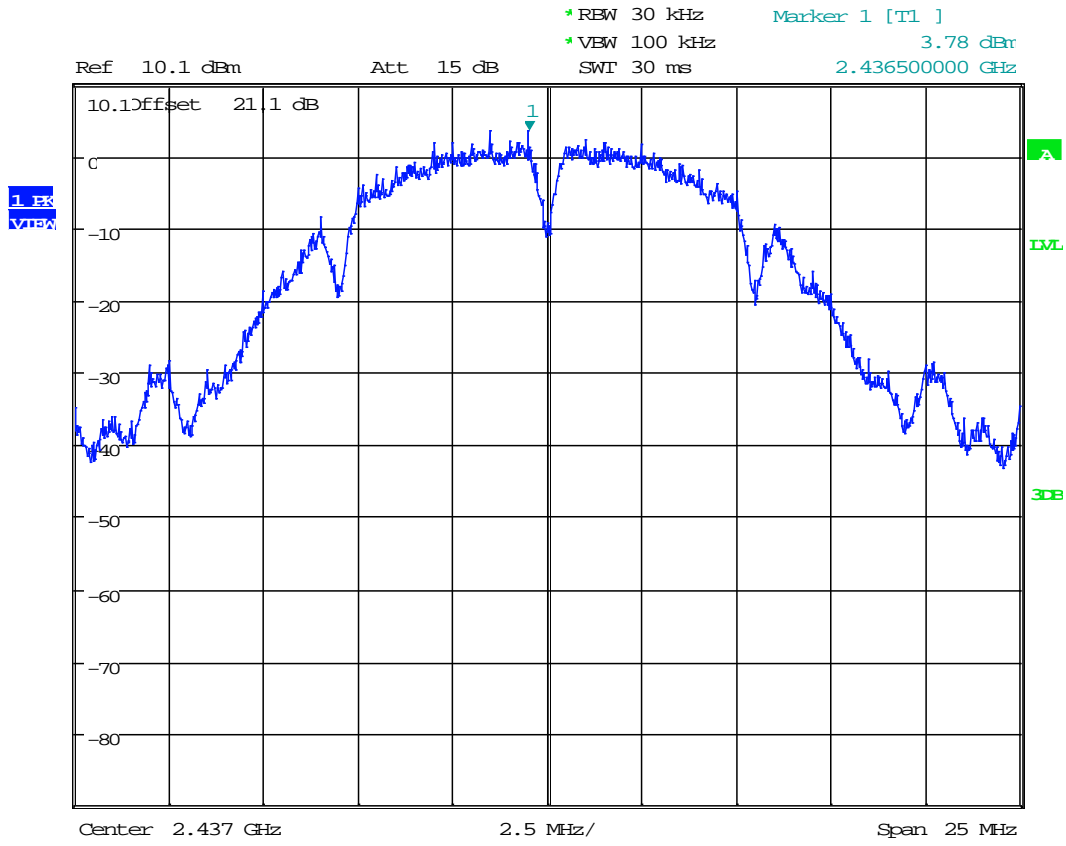
Standard	Channel	Frequency MHz	PSD (Peak) dBm	Margin to 8dBm Limit dB	Plot #
802.11b	1	2412	4.99	-3.01	3.1
	6	2437	3.78	-4.22	3.2
	11	2462	5.05	-2.95	3.3
802.11g	1	2412	-2.80	-10.80	3.4
	6	2437	-2.62	-10.62	3.5
	11	2462	-2.38	-10.38	3.6
802.11n	1	2412	-2.30	-10.30	3.7
	6	2437	-2.67	-10.67	3.8
	11	2462	-2.18	-10.18	3.9

Plot 3.1



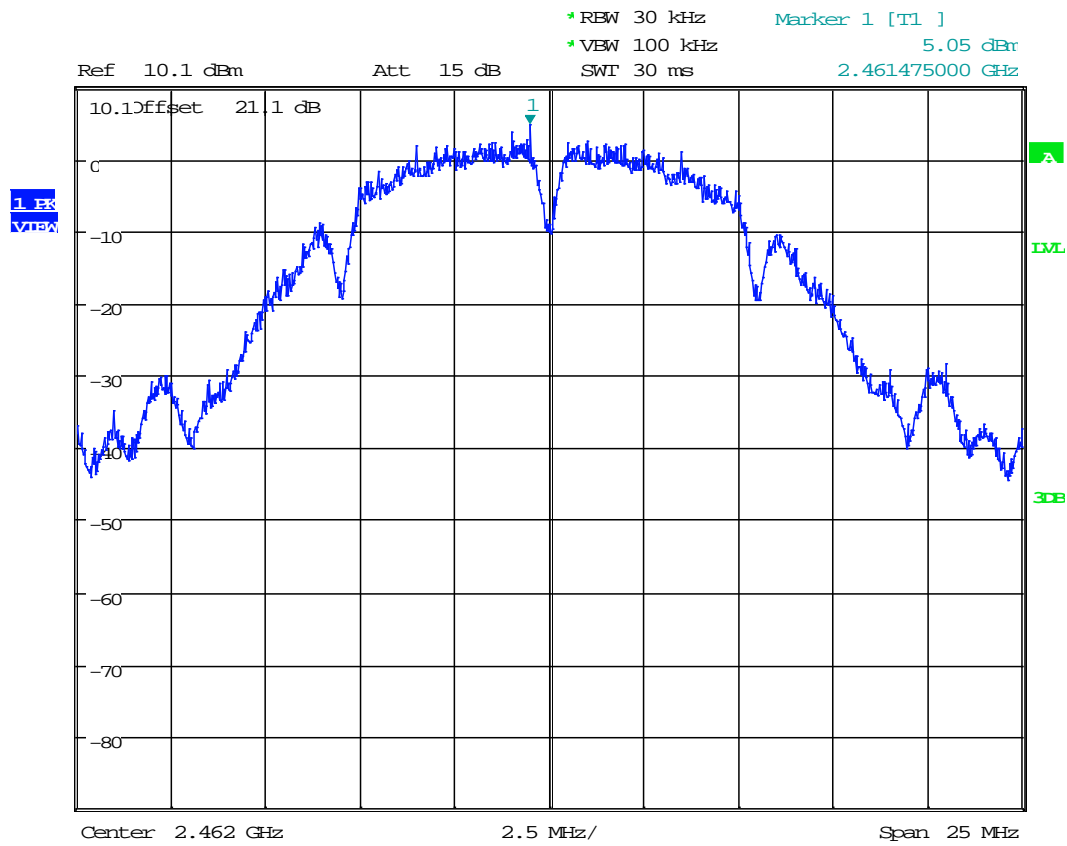
Date: 26.MAY.2017 07:28:18

Plot 3.2



Date: 26.MAY.2017 07:30:55

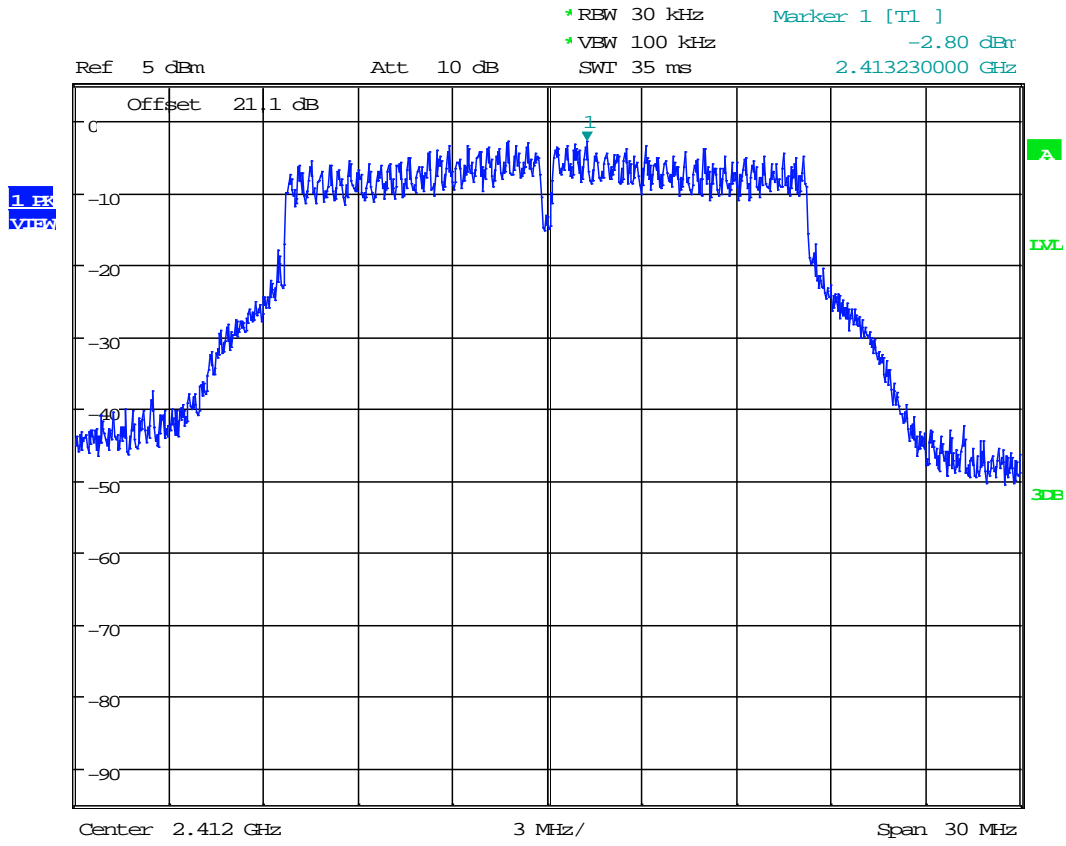
Plot 3.3



Date: 26.MAY.2017 07:31:45

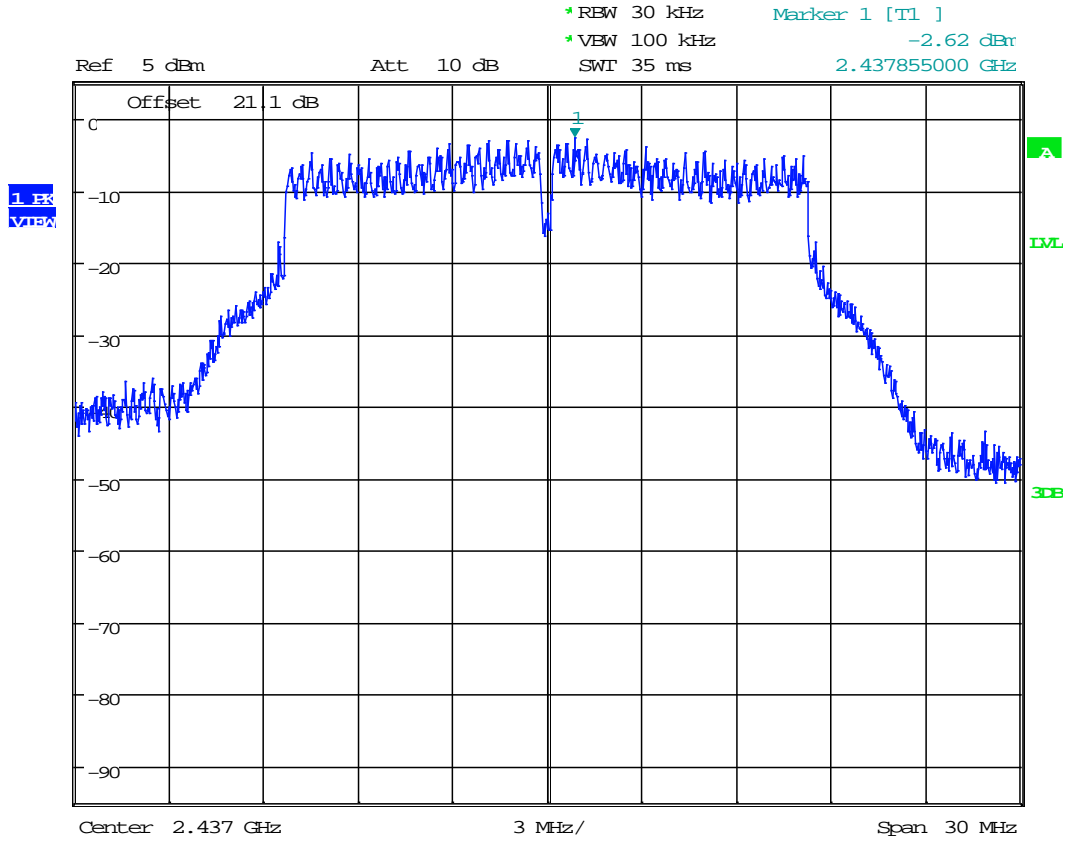


Plot 3.4



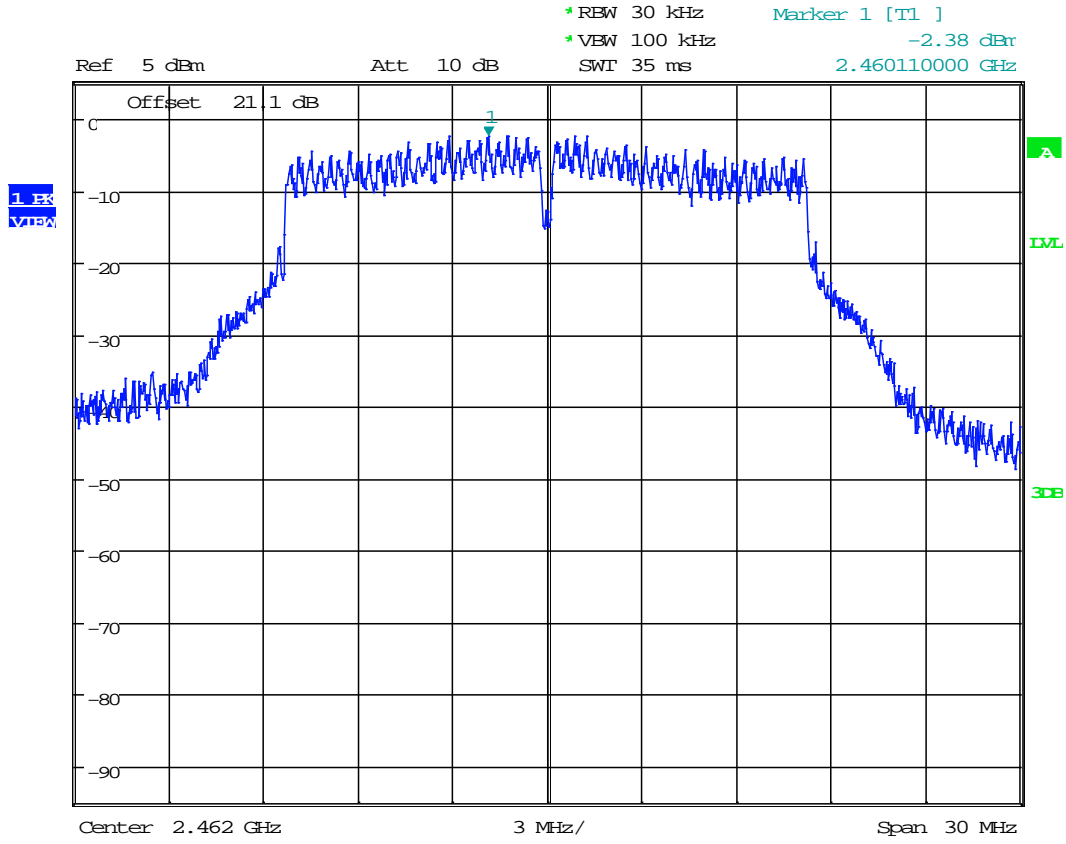
Date: 26.MAY.2017 07:34:09

Plot 3.5



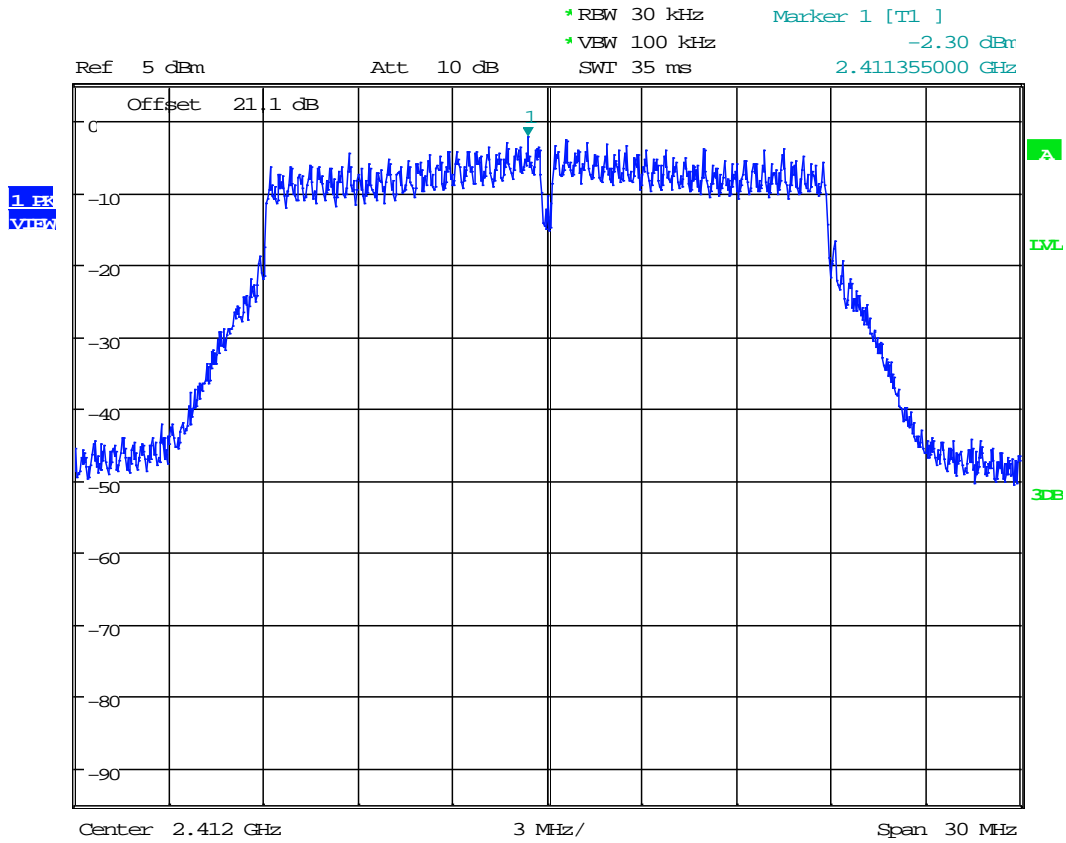
Date: 26.MAY.2017 07:33:13

Plot 3.6



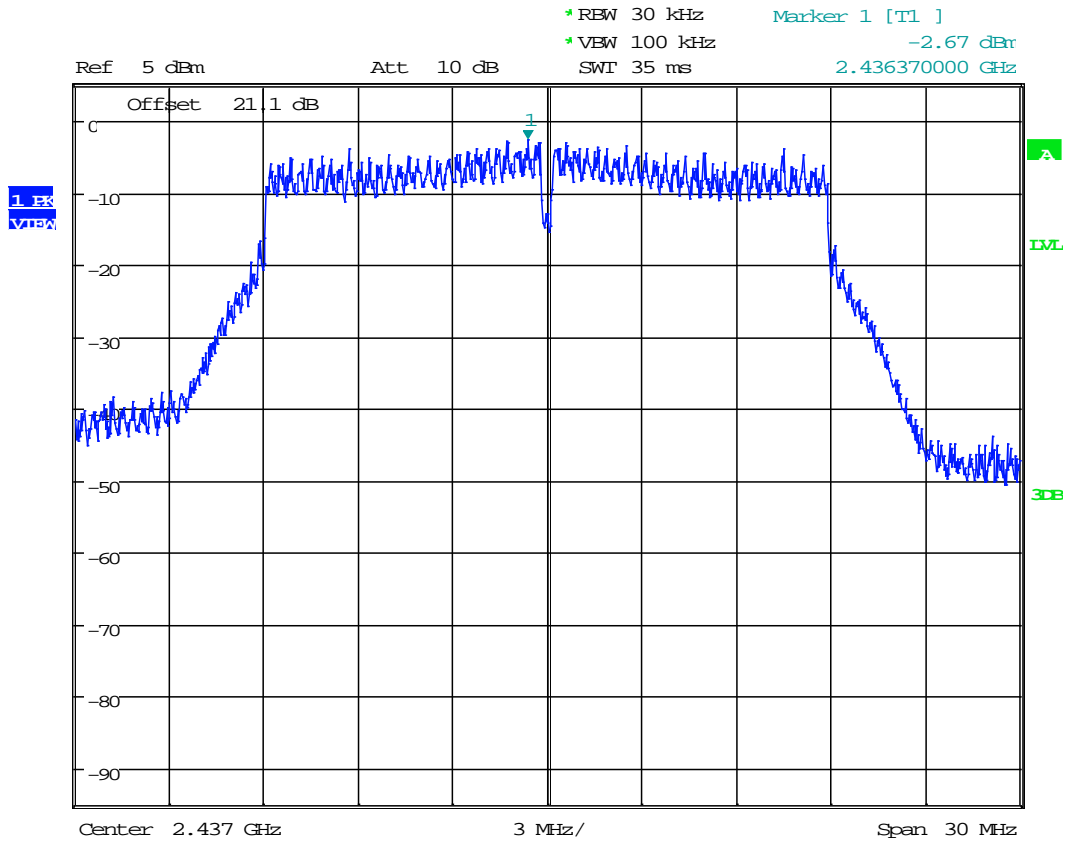
Date: 26.MAY.2017 07:32:38

Plot 3.7



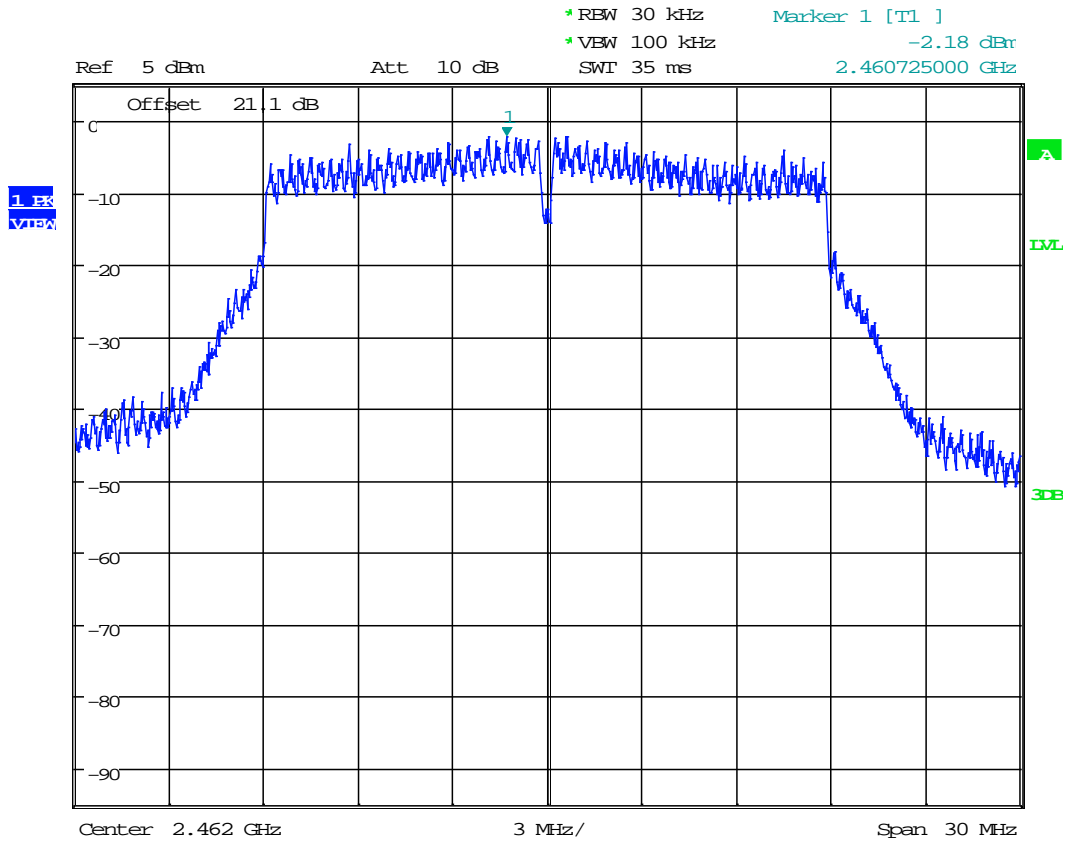
Date: 26.MAY.2017 07:35:22

Plot 3. 8



Date: 26.MAY.2017 07:37:08

Plot 3.9



Date: 26.MAY.2017 07:38:09

4.4 Out-of-Band Conducted Emissions  
FCC 15.247(d)

4.4.1 Requirement

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.

4.4.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 25 GHz.

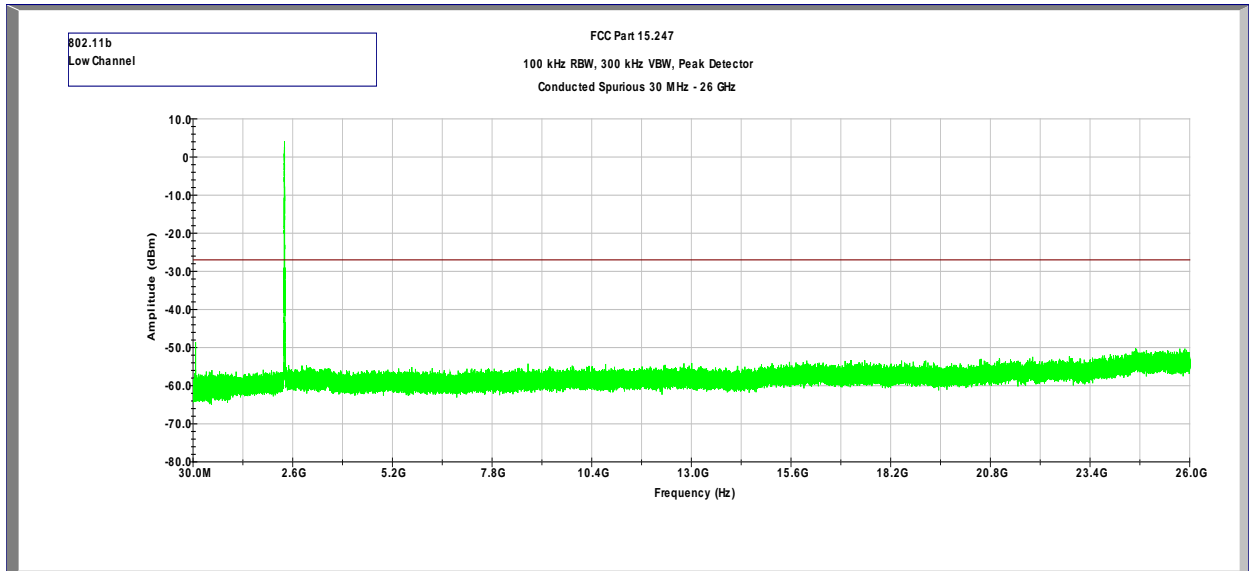
4.4.3 Test Result

Refer to the following plots 4.1 – 4.9 for unwanted conducted emissions. The plot shows -30dB attenuation limit line.

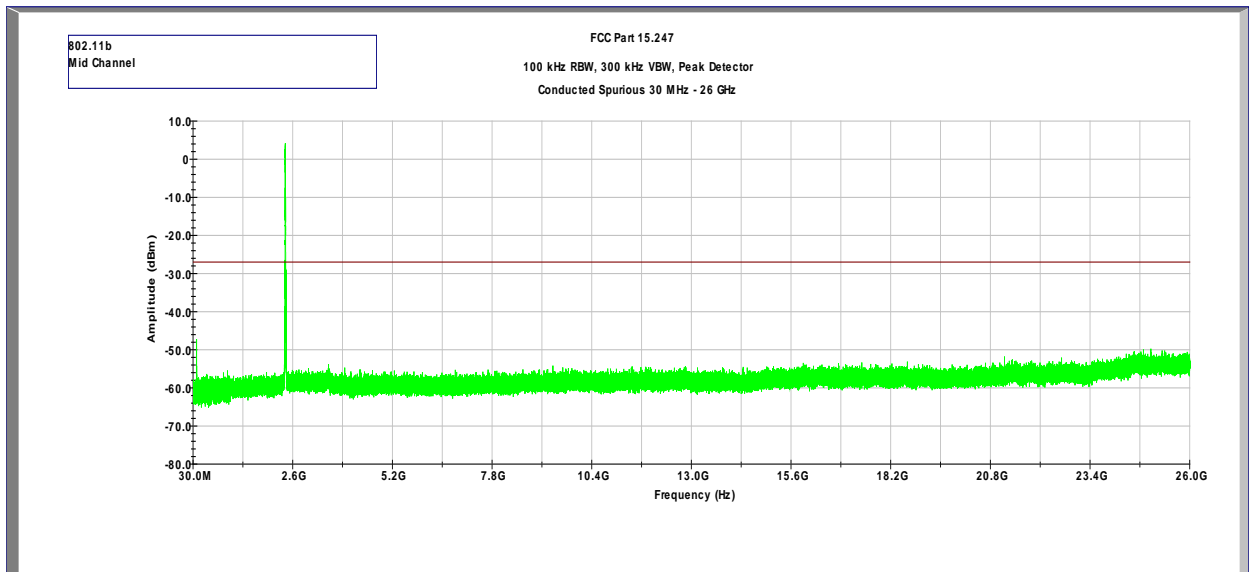
<b>Results</b>	<b>Complies</b>
----------------	-----------------

Test Date:	April 13, 2017
------------	----------------

Plot 4.1  
**Tx @ 2412MHz 802.11b**

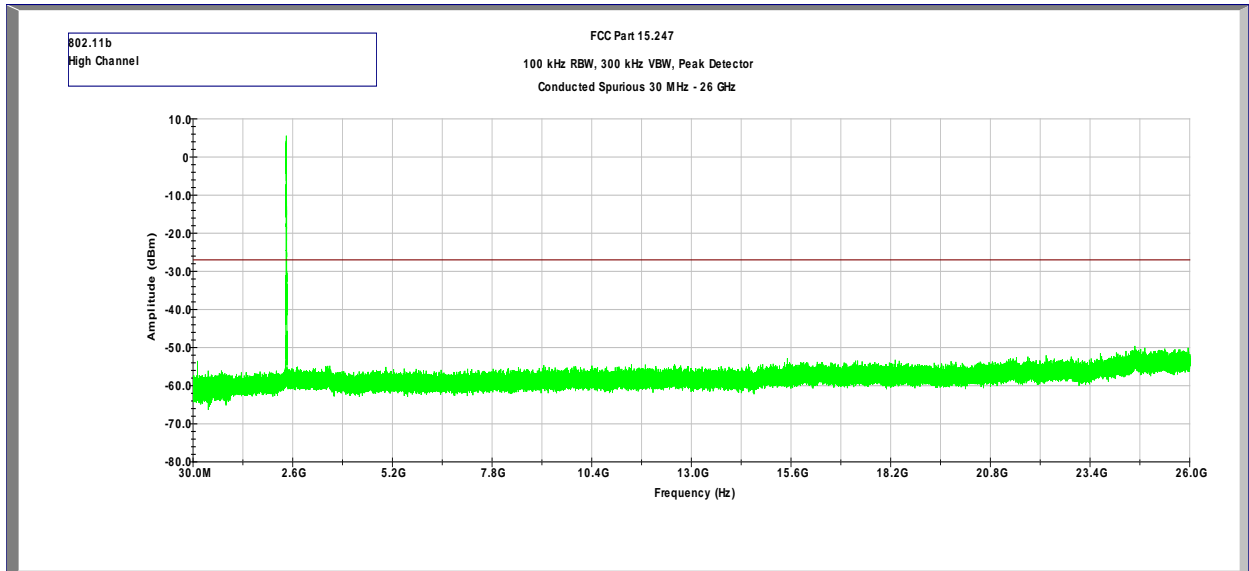


Plot 4.2  
**Tx @ 2437MHz 802.11b**

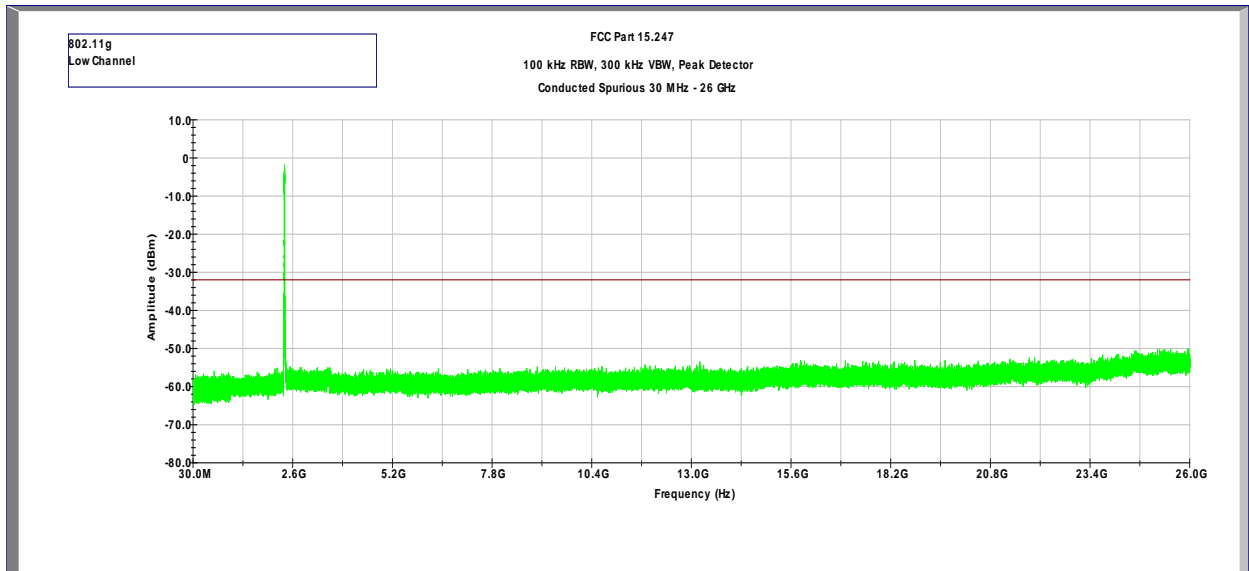




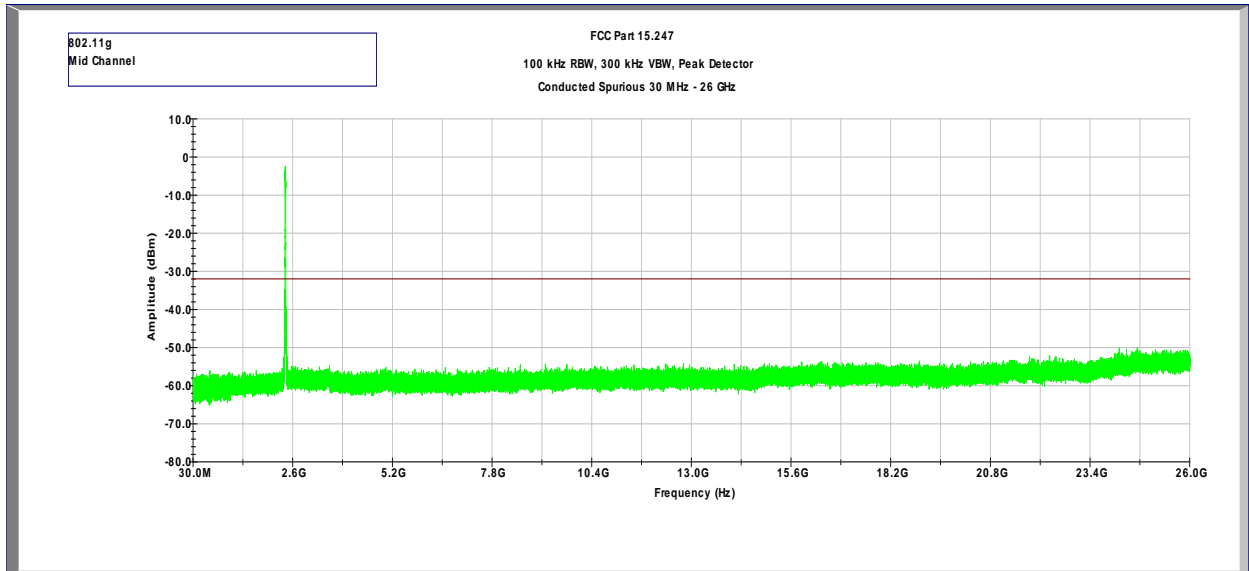
Plot 4.3  
**Tx @ 2462MHz 802.11b**



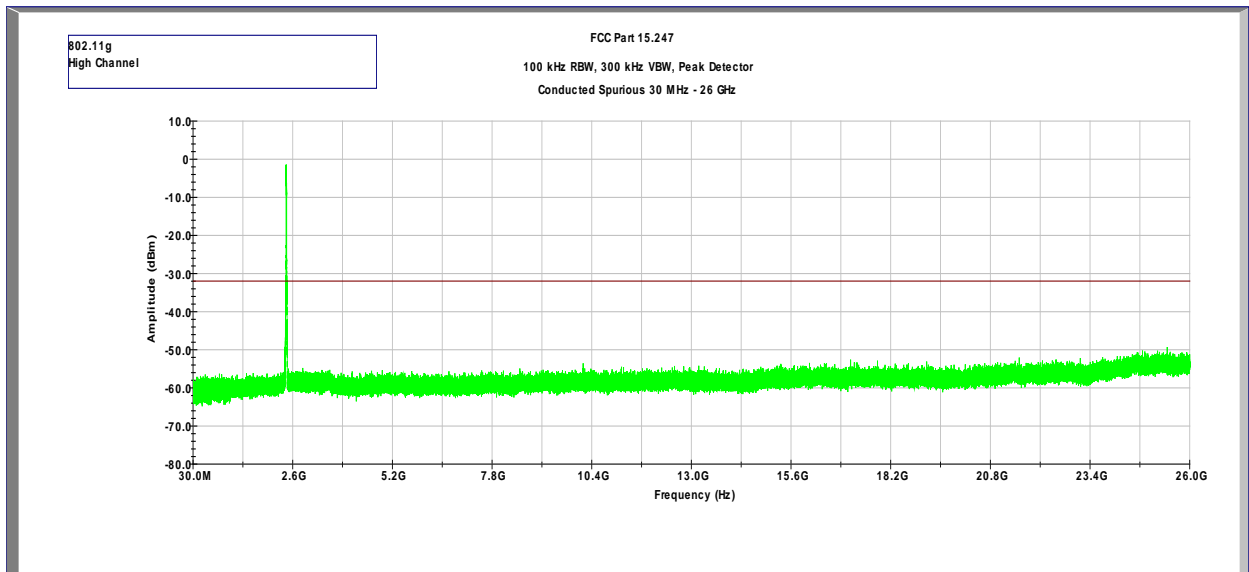
Plot 4.4  
**Tx @ 2412MHz 802.11g**



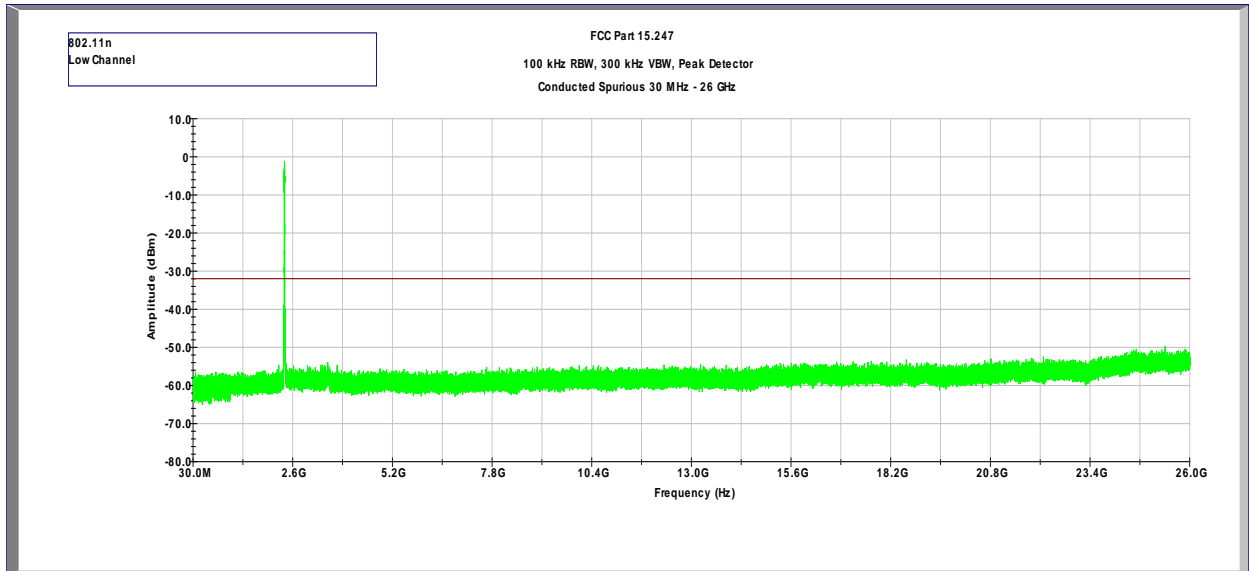
Plot 4.5  
**Tx @ 2437MHz 802.11g**



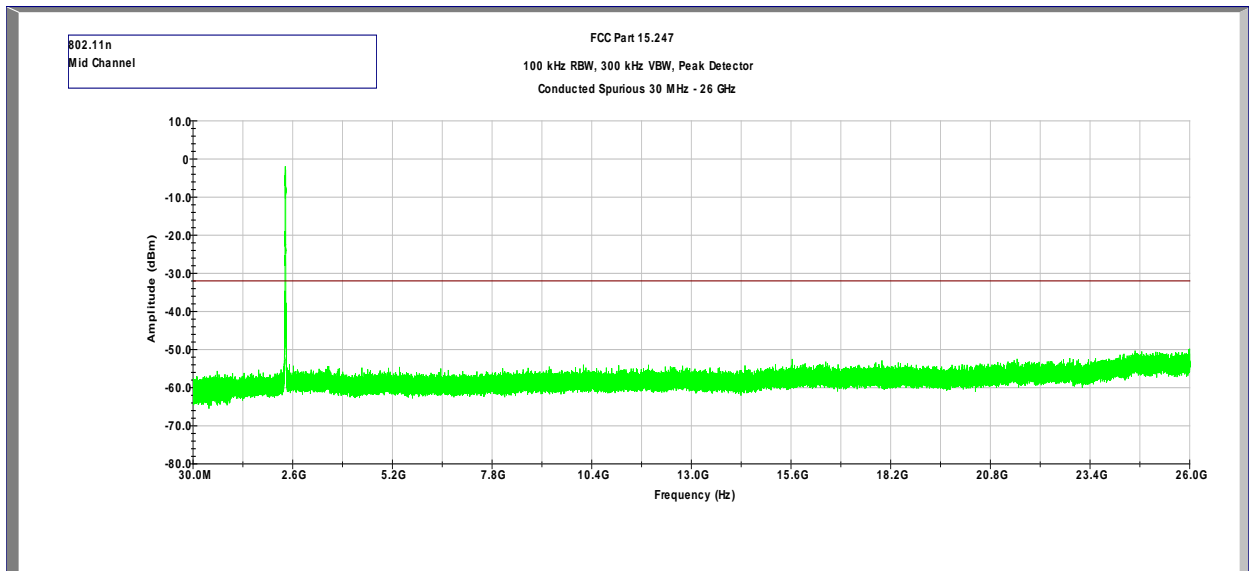
Plot 4.6  
**Tx @ 2462MHz 802.11g**



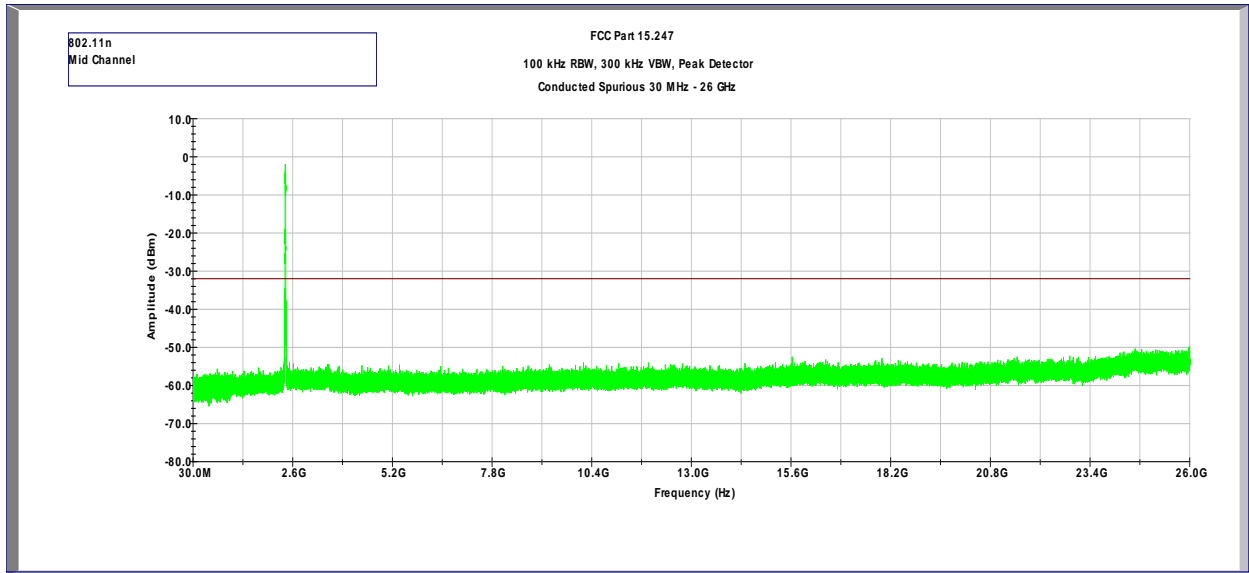
Plot 4.7  
**Tx @ 2412MHz 802.11n**



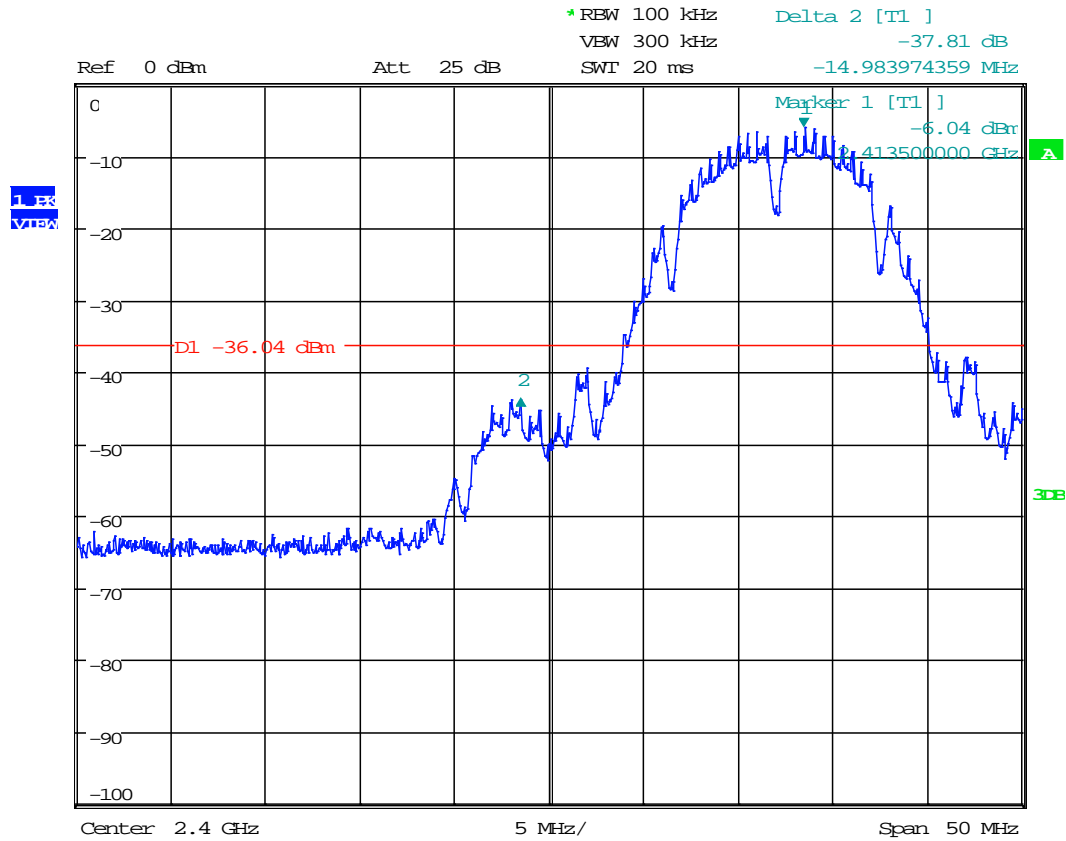
Plot 4.8  
**Tx @ 2437MHz 802.11n**



Plot 4.9  
**Tx @ 2462MHz 802.11n**

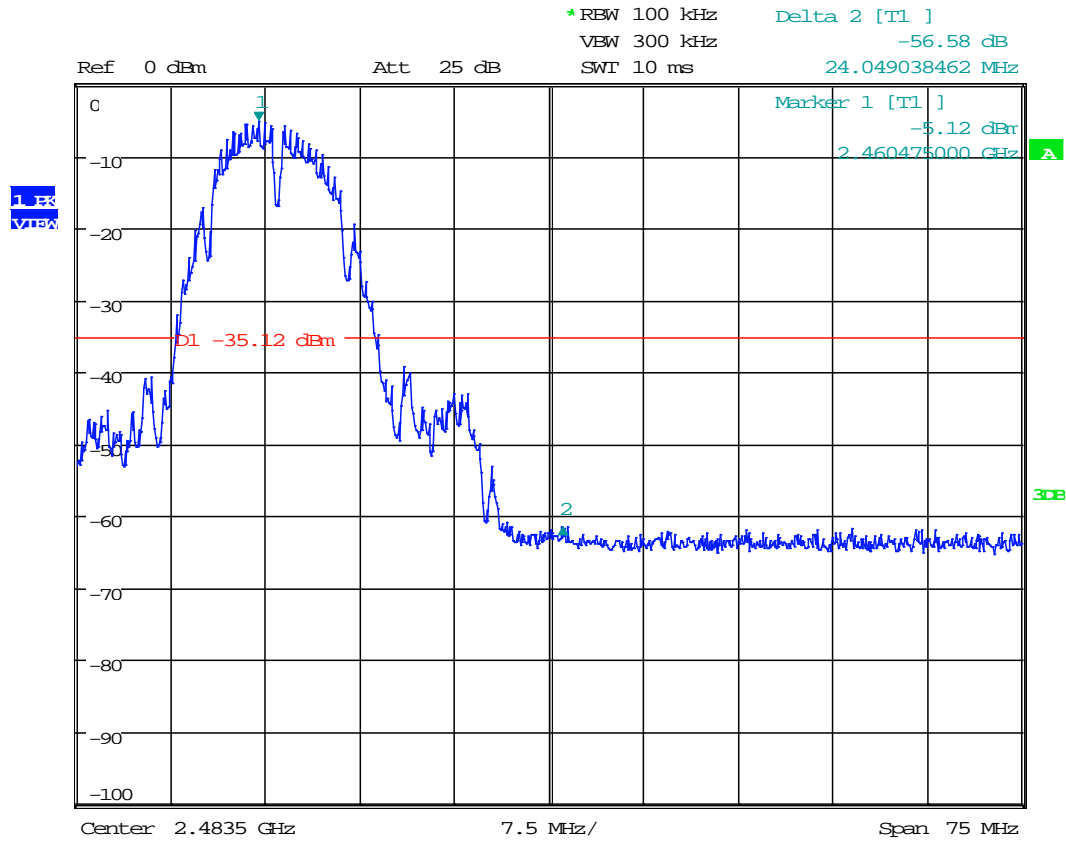


Plot 4.10  
Conducted Band Edge, Tx @ 2412MHz 802.11b



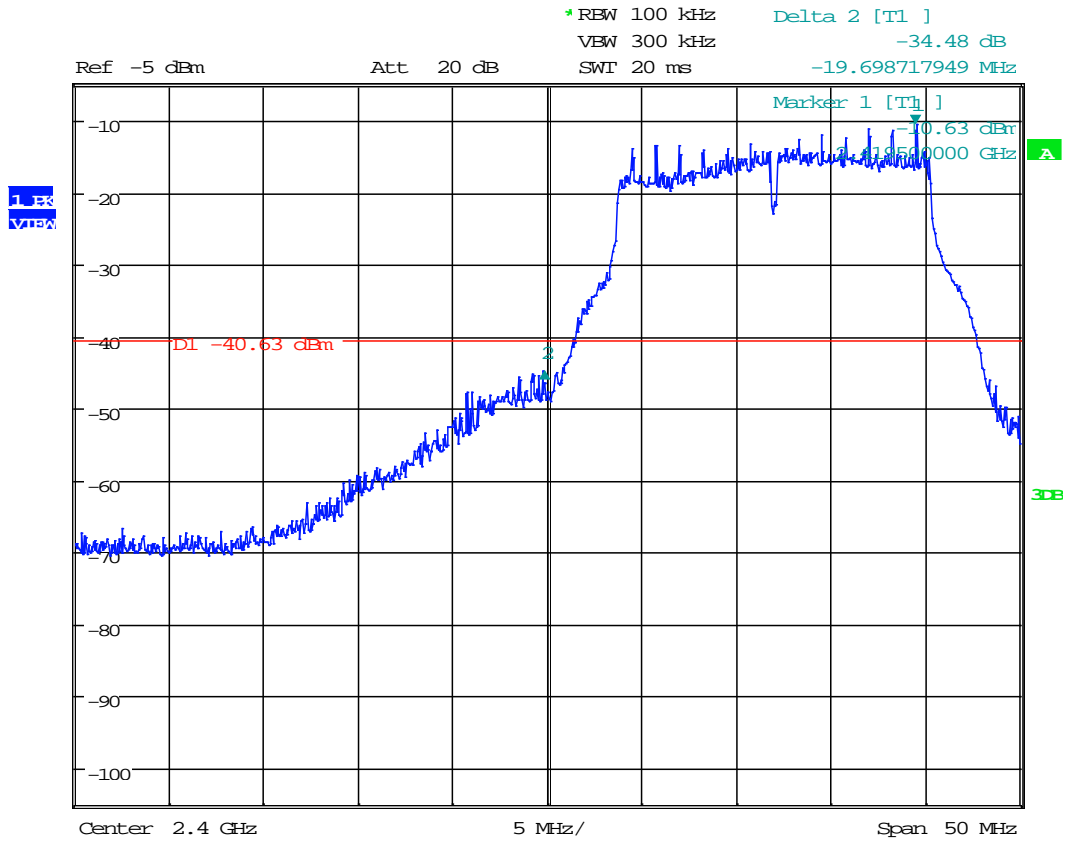
Date: 24.APR.2017 12:18:19

Plot 4.11  
Conducted Band Edge, Tx @ 2462MHz 802.11b



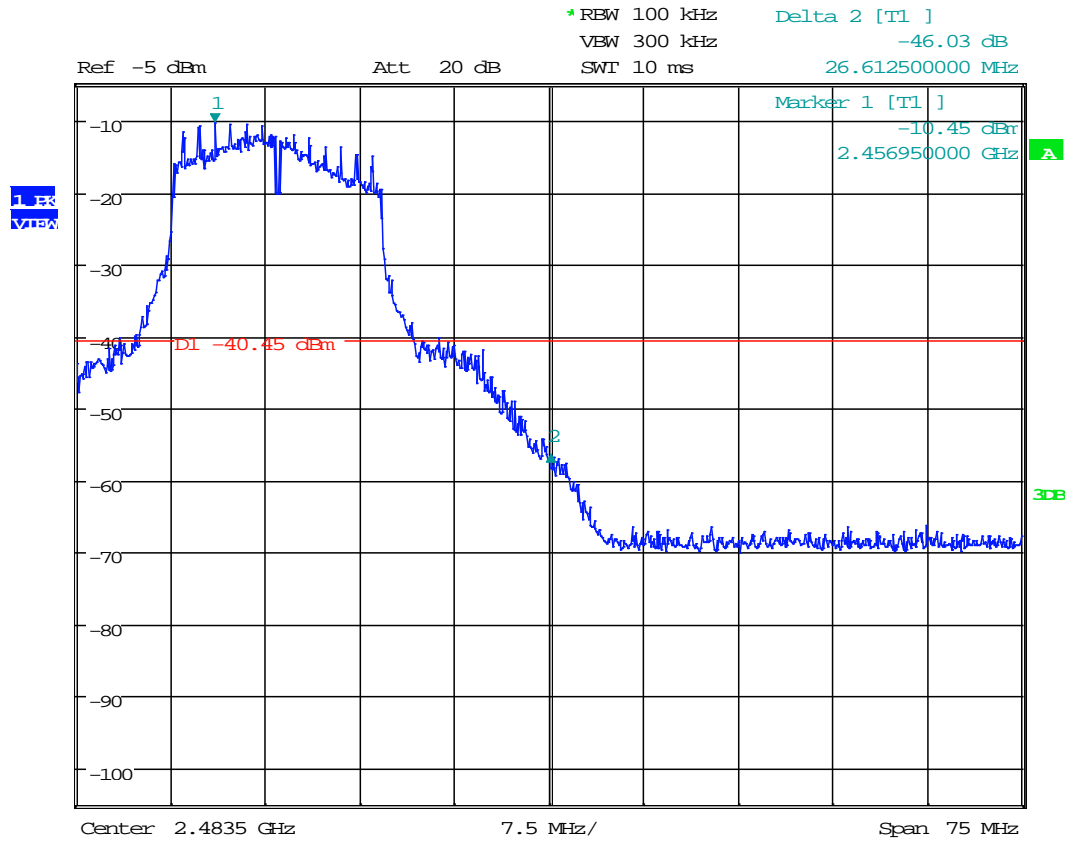
Date: 24.APR.2017 12:17:15

Plot 4.12  
Conducted Band Edge, Tx @ 2412MHz 802.11g



Date: 24.APR.2017 12:12:23

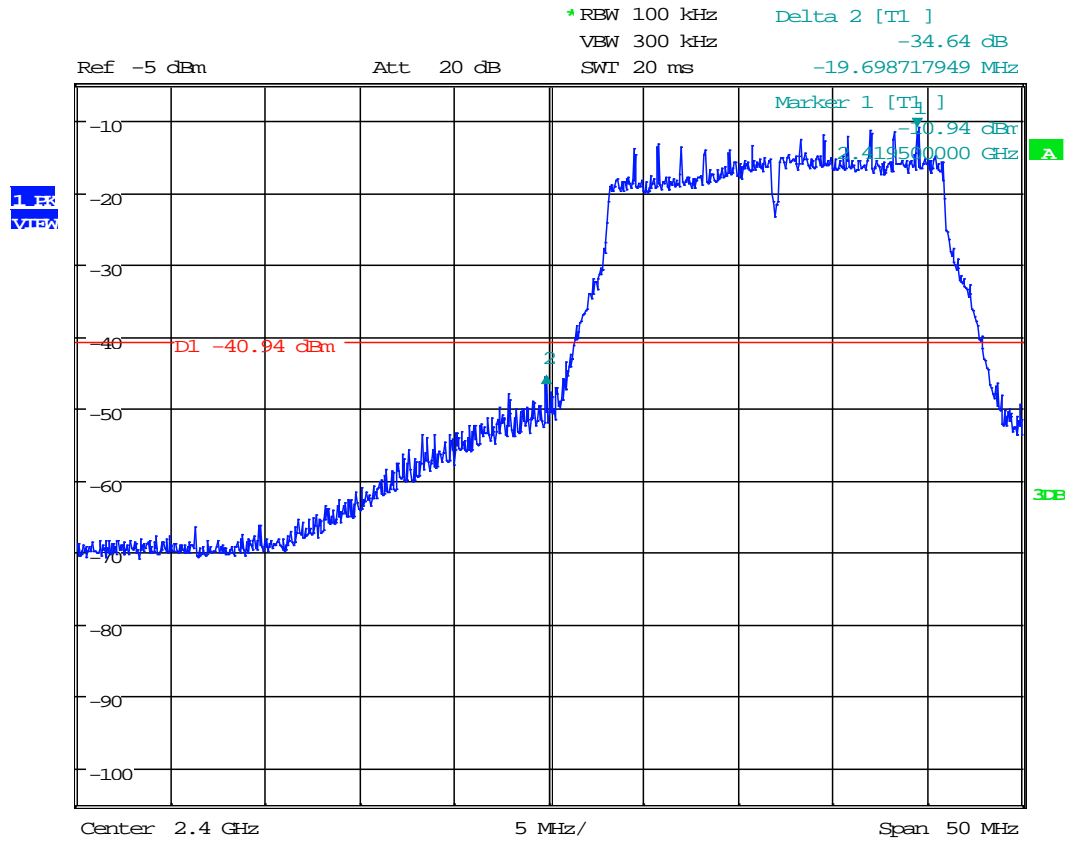
Plot 4.13  
Conducted Band Edge, Tx @ 2462MHz 802.11g



Date: 24.APR.2017 12:15:51

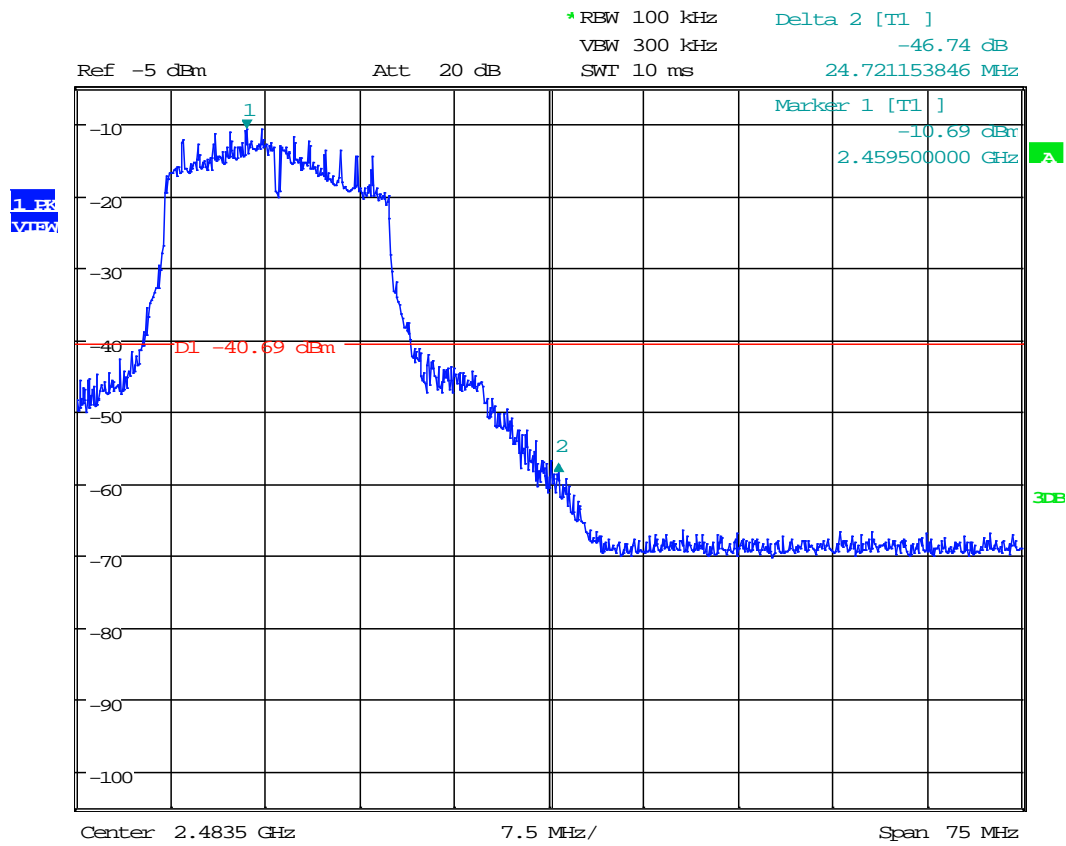


Plot 4.14  
Conducted Band Edge, Tx @ 2412MHz 802.11n



Date: 24.APR.2017 12:13:22

Plot 4.15  
Conducted Band Edge, Tx @ 2462MHz 802.11n



Date: 24.APR.2017 12:14:46