TEST REPORT

Report Number: 102248754MPK-010
Project Number: G102248754
October 22, 2015

Testing performed on the
Emberlight Smart Light Socket
Model: SE26W001

Manufacturer Declared Equivalent Model (Not Tested):
SE26G001

FCC ID: 2AF5C-SE26
IC: 20702- SE26

to

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247, Issue 1

for
Emberlight, Inc.

Test Performed by:	Test Authorized by:
Intertek	Emberlight, Inc.
1365 Adams Court	607 Market St #200
Menlo Park, CA 94025 USA	San Francisco, CA 94105, USA

Prepared by: _____ **Date:** October 22, 2015
Minh Ly

Reviewed by: _____ **Date:** October 22, 2015
Krishna K Vemuri

Report No. 102248754MPK-010

Equipment Under Test:	Emberlight Smart Light Socket
Trade Name:	Emberlight, Inc.
Model Tested:	SE26W001
Model Not Tested:	SE26G001
Serial Numbers	040232321115 040232321122
Applicant:	Emberlight, Inc.
Contact:	Atif Noori
Address:	Emberlight, Inc. 607 Market St. #200 San Francisco, CA 94105
Country	USA
Tel. Number:	(310) 569-7669
Email:	atif@emberlight.co
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247, Issue 1
Date of Test:	September 14 to October 09, 2015

We attest to the accuracy of this report:

Minh Ly
Project Engineer

Krishna K Vemuri
EMC Senior Staff Engineer

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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	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2	Complies
Power Density	15.247(e)	RSS-247, 5.2	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: September 14, 2015
EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.
Test start date: September 14, 2015
Test completion date: October 09, 2015
The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

The Equipment Under Test (EUT), model number SE26W001 and SE26G001, is a smart lamp holder with the Edison 26 bulb size.

This test report covers only the WiFi radio. A separate test report, report # 102248754MPK-011, covers the Bluetooth 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: 1, 2, 5.5, 11Mbps
IEEE 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
IEEE 802.11n: MCS0, MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7

Applicant	Emberlight, Inc.
Model Number	SE26W001 and SE26G001
FCC Identifier	2AF5C-SE26
IC Identifier	20702- SE26
Use of Product	Smart lamp holder
Modulation Technique	DSSS (BPSK, QPSK, CCK), OFDM (BPSK, QPSK, 16QAM, 64QAM)
Rated RF Output	802.11b: 11.26 dBm (13.39 mW) 802.11g: 10.11 dBm (10.28 mW) 802.11n: 10.08 dBm (10.21 mW)
Frequency Range	2412 – 2462 MHz
Type of modulation	BPSK, QPSK, 16QAM, 64QAM
Number of Channel(s)	11
Antenna(s) & Gain	Internal antenna: PCB antenna, -2dBi peak gain
Manufacturer Name & Address	Emberlight, Inc. 607 Market St, #200 San Francisco, CA 94105, 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), and RSS-247, RSS-GEN, and

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10. 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	-
Radiated emissions	4.2 dB	3.4 dB	4.4 dB
AC mains conducted emissions	2.4 dB	-	-

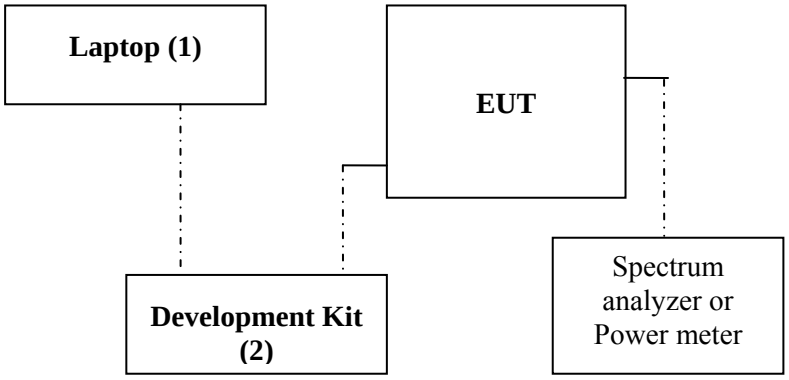
3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No./ Part No.	Serial No.
1	Samsung Laptop	NP900X3A	Not listed
2	Development Kit	Not Listed	Not Listed

3.2 Block Diagram of Test Setup

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



Note: A 3.3VDC power supply was used to power the EUT during Conducted testing and 120VAC was used to power the EUT during Radiated testing.

S = Shielded **U** = Unshielded	**F** = With Ferrite **M** = 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 11 Mbps – for 802.11b
OFDM 54 Mbps – for 802.11g
OFDM MCS7 – for 802.11n HT20

As declared by the Applicant, the models SE26W001 and SE26G001 are identical except for their housing color . All tests were performed on SE26W001 only. The results in this report are valid for other model: SE26G001 as well.

3.4 Mode of Operation During Test

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

3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product 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 6dB DTS Bandwidth, 6dB RSS Bandwidth and 99% Occupied Bandwidth
FCC Rule 15.247(a)(2)

4.1.1 Requirement

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

4.1.2 Procedure

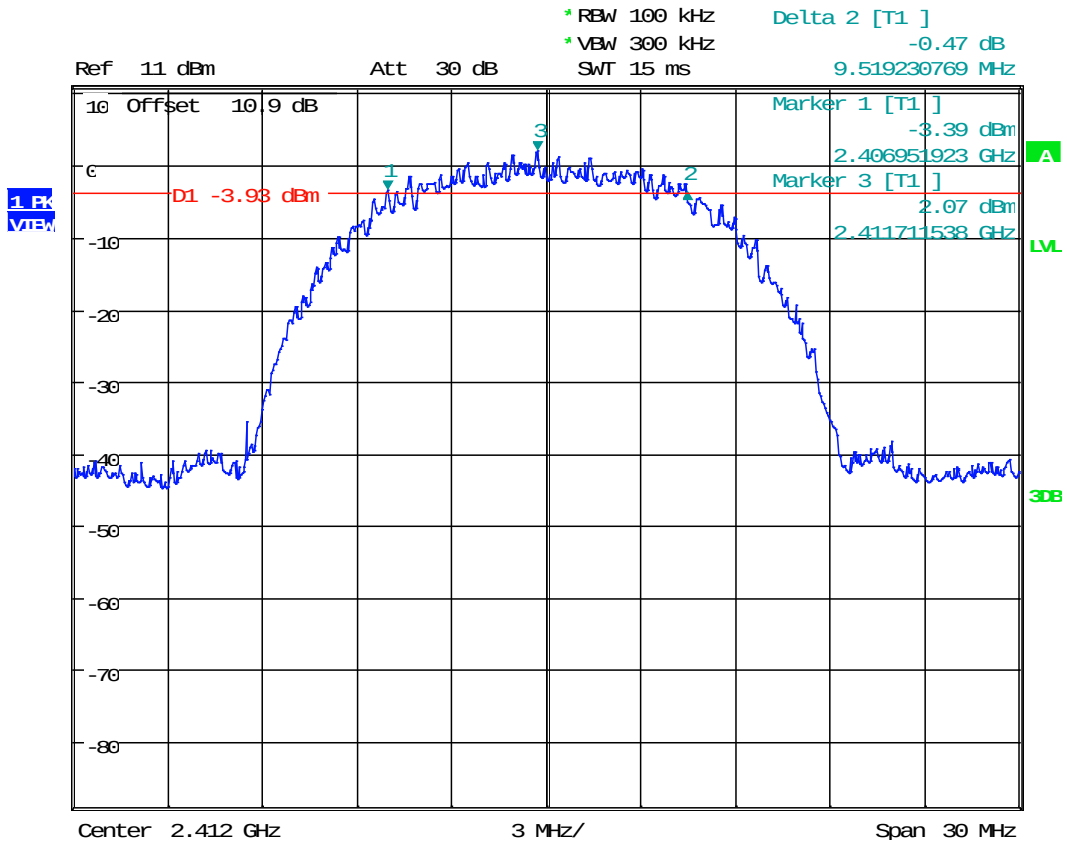
The Procedure described in the FCC Publication 558074 was used.
The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6-dB bandwidth was determined from where the channel output spectrum intersected the display line.

The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

4.1.3 Test Result

Frequency MHz	Channel	Frequency MHz	6 dB FCC Bandwidth, MHz	Plot #	6 dB RSS Bandwidth, MHz	99% Bandwidth, MHz	Plot #
802.11b	1	2412	9.51	1.1	10.24	13.36	1.10
	6	2437	10.00	1.2	10.12	13.44	1.11
	11	2462	10.33	1.3	10.32	13.44	1.12
802.11g	1	2412	16.58	1.4	16.64	16.80	1.13
	6	2437	16.58	1.5	16.72	16.88	1.14
	11	2462	16.58	1.6	16.72	16.80	1.15
802.11n HT20	1	2412	17.83	1.7	18.00	17.92	1.16
	6	2437	17.74	1.8	17.80	18.00	1.17
	11	2462	17.74	1.9	17.76	18.00	1.18

Plot 1. 1 – 6dB Bandwidth (FCC)



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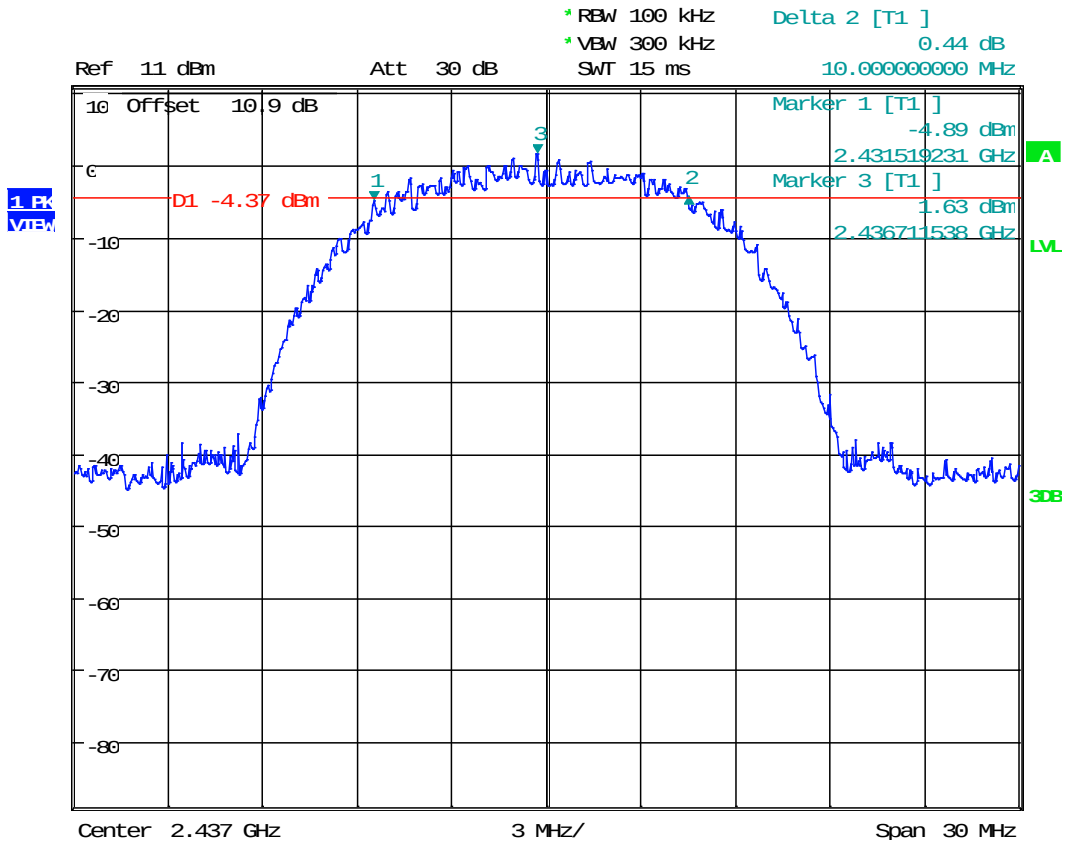
Plot 1. 2– 6dB Bandwidth (FCC)



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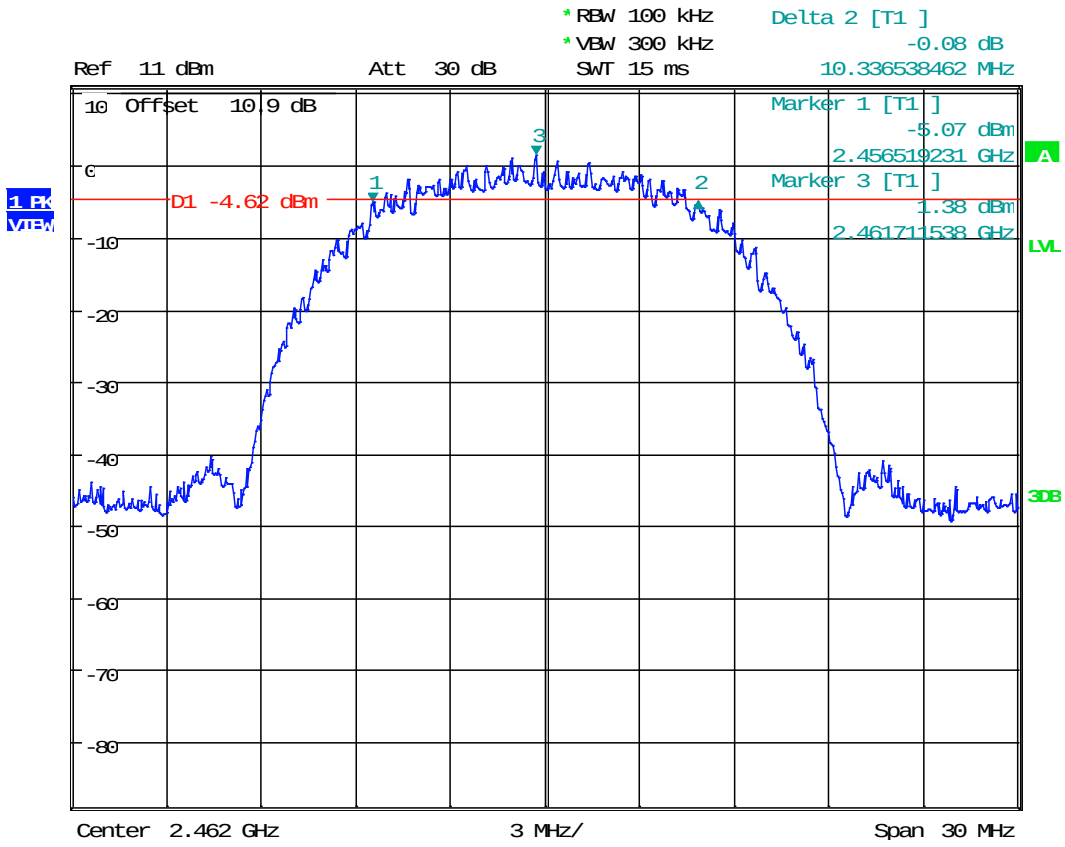
Plot 1. 3 – 6dB Bandwidth (FCC)



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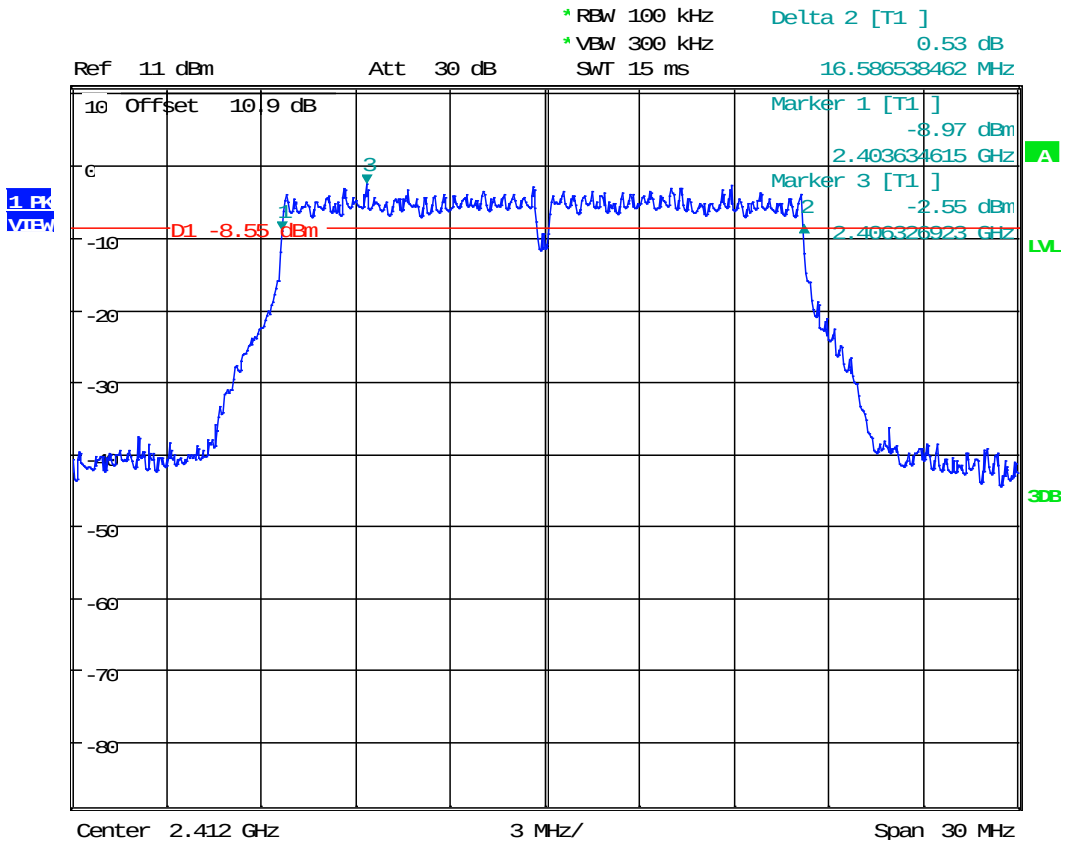
Plot 1. 4 – 6dB Bandwidth (FCC)



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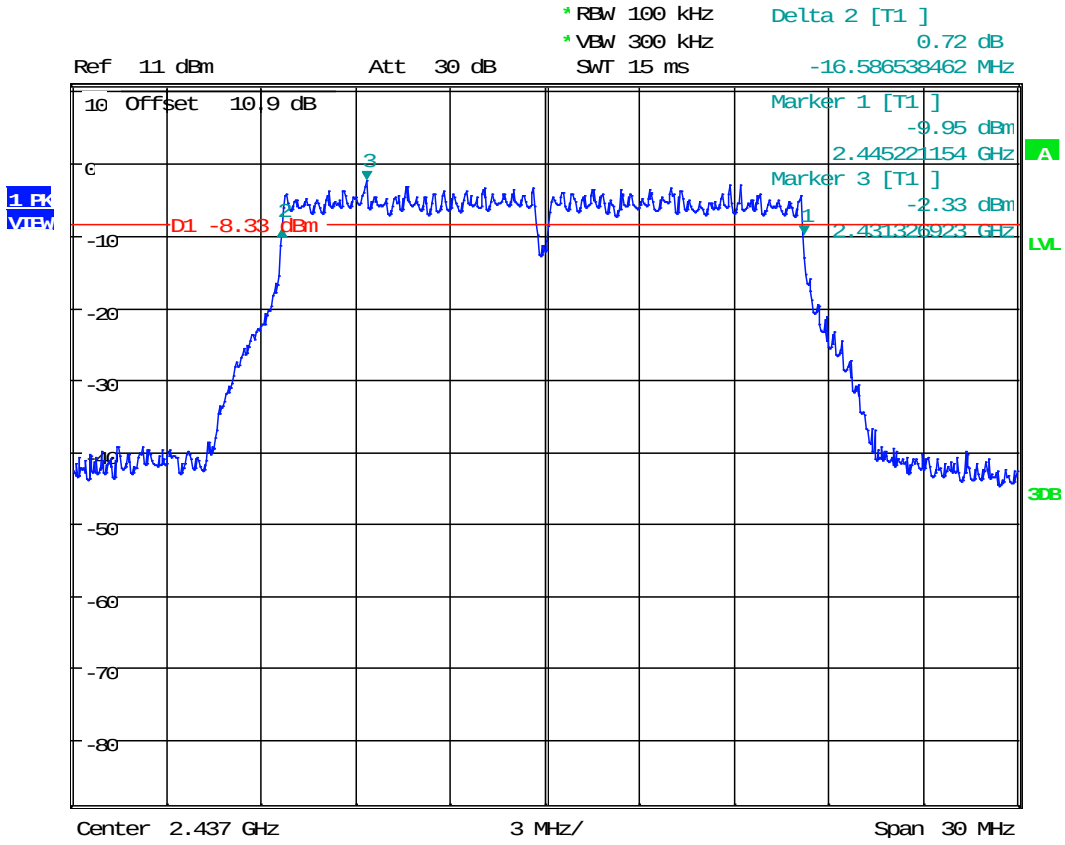
Plot 1. 5 – 6dB Bandwidth (FCC)



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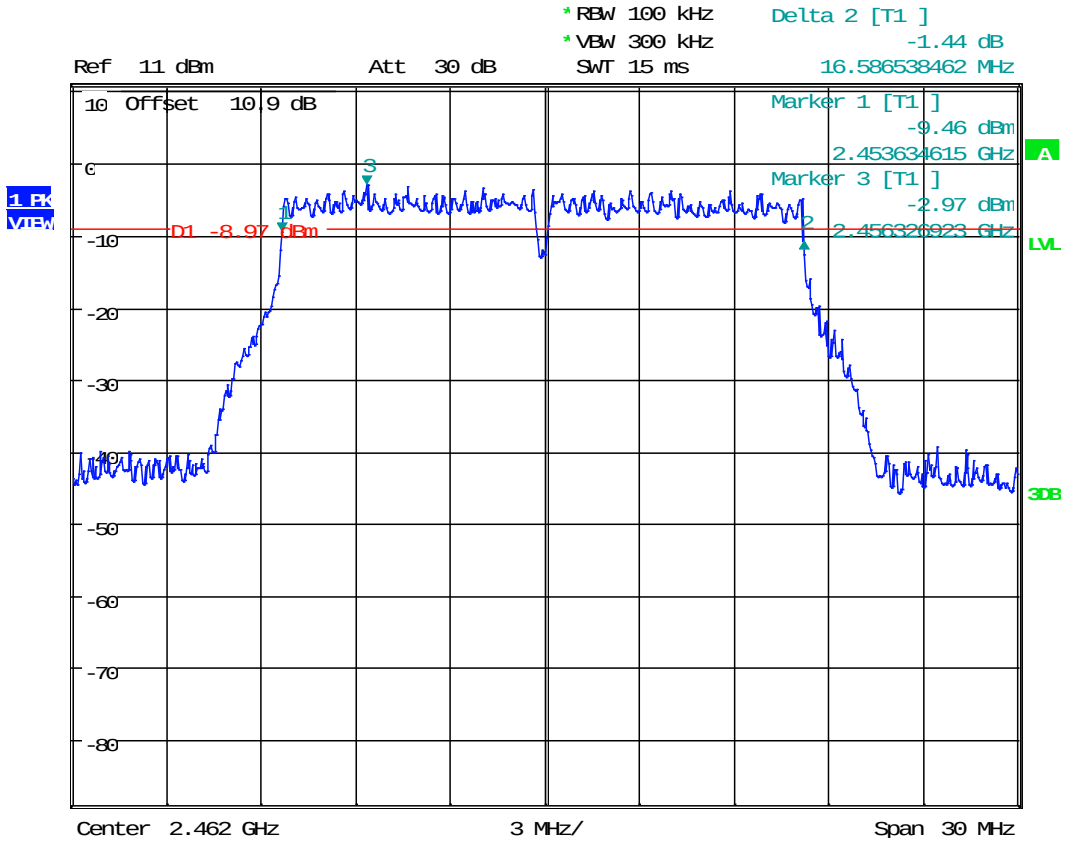
Plot 1. 6 – 6dB Bandwidth (FCC)



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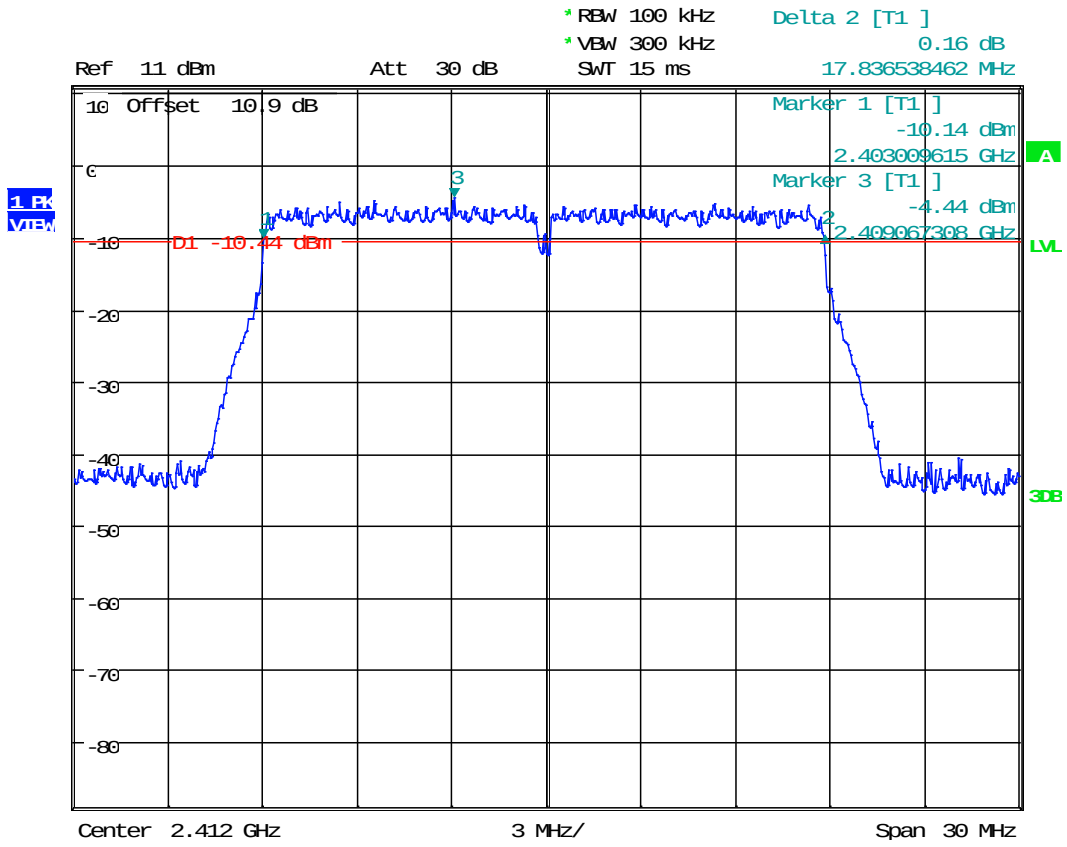
Plot 1. 7 – 6dB Bandwidth (FCC)



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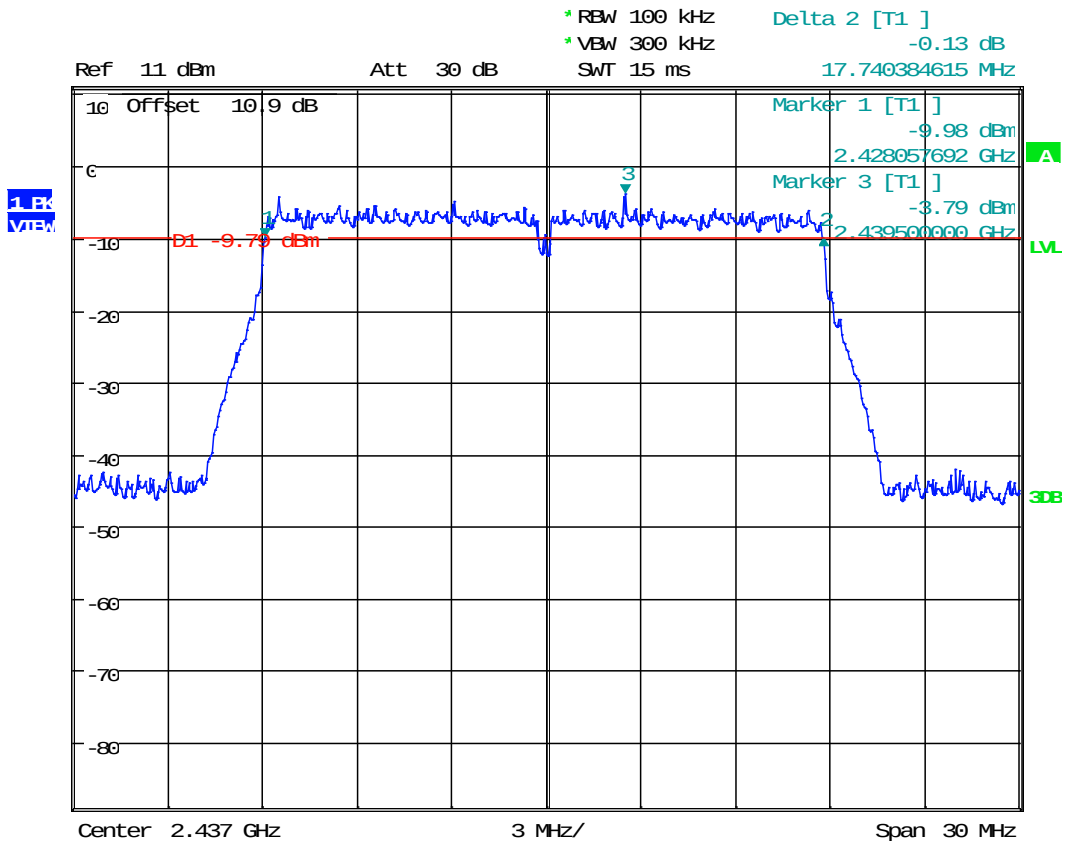
Plot 1. 8 – 6dB Bandwidth (FCC)



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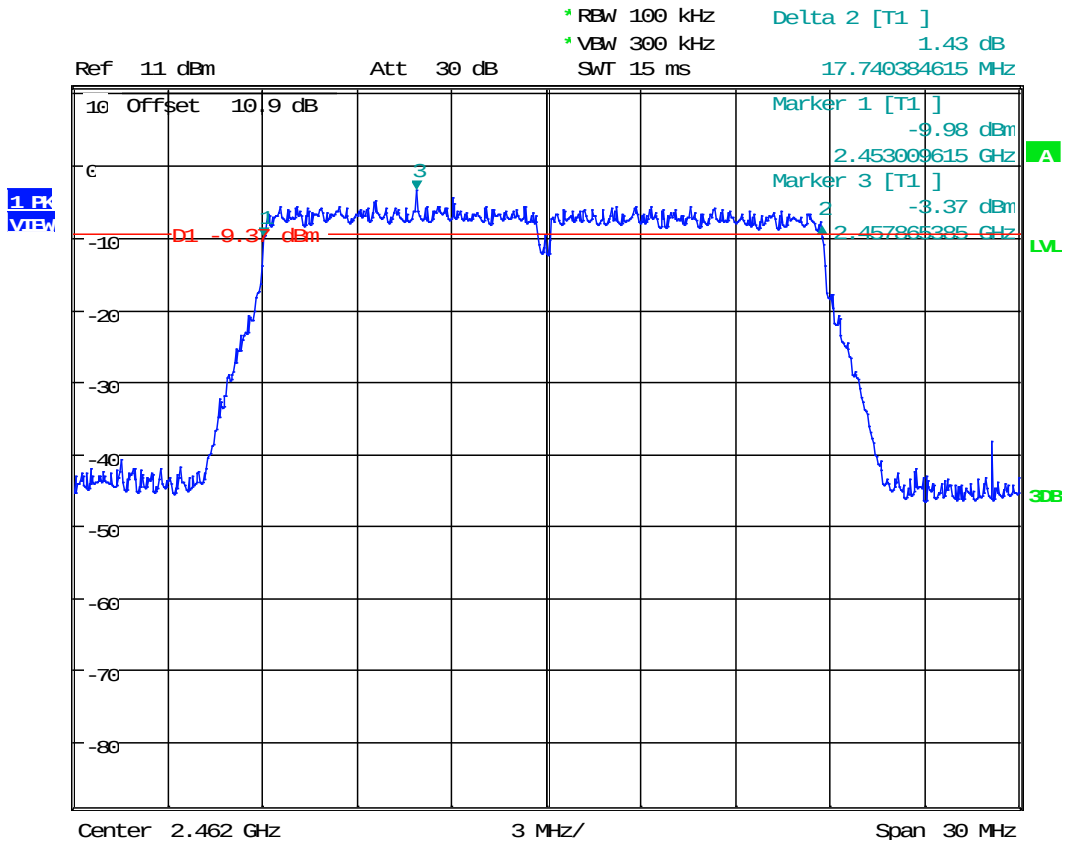
Plot 1. 9 – 6dB Bandwidth (FCC)



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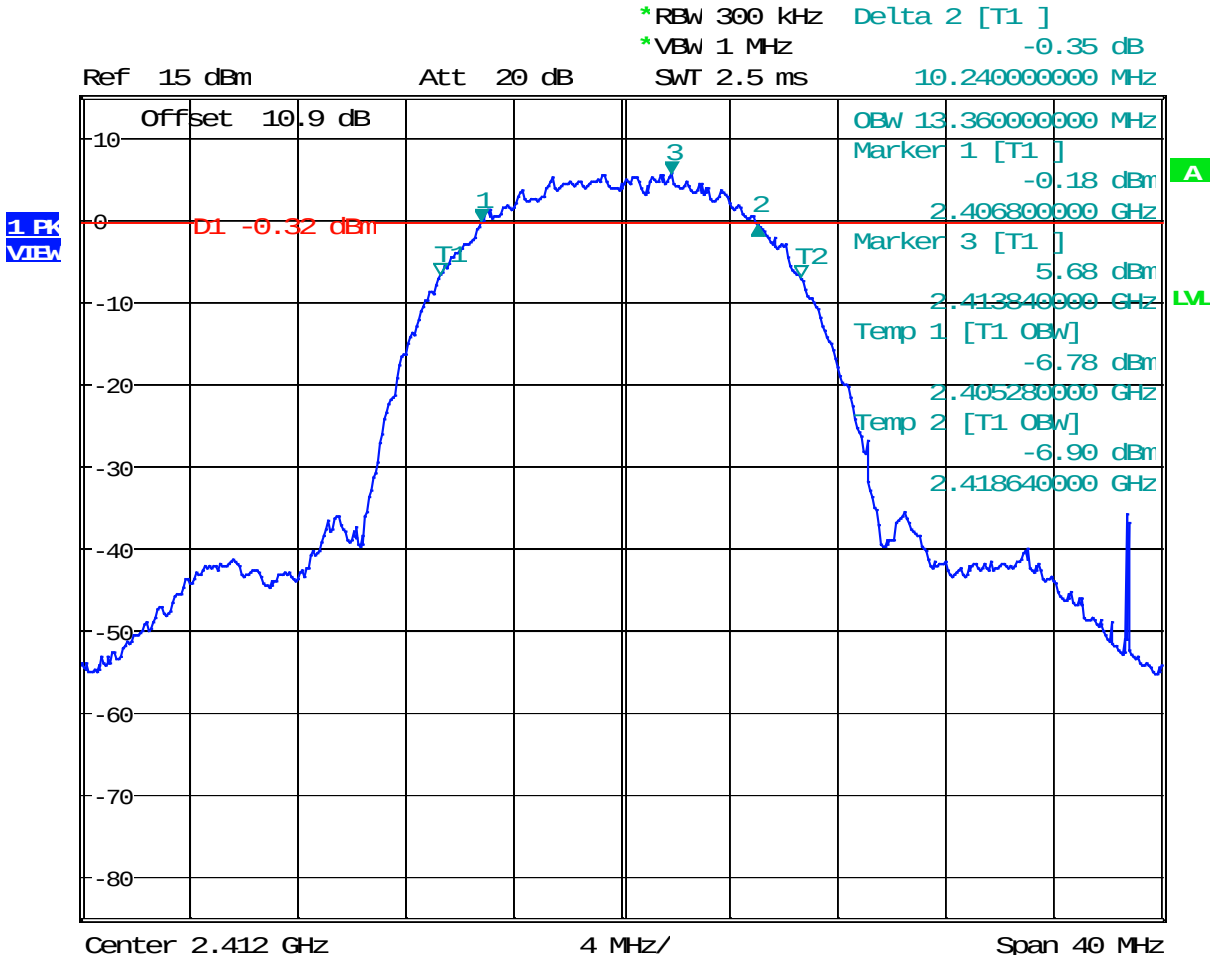
Plot 1. 10 –99% Bandwidth & 6dB Bandwidth (RSS)



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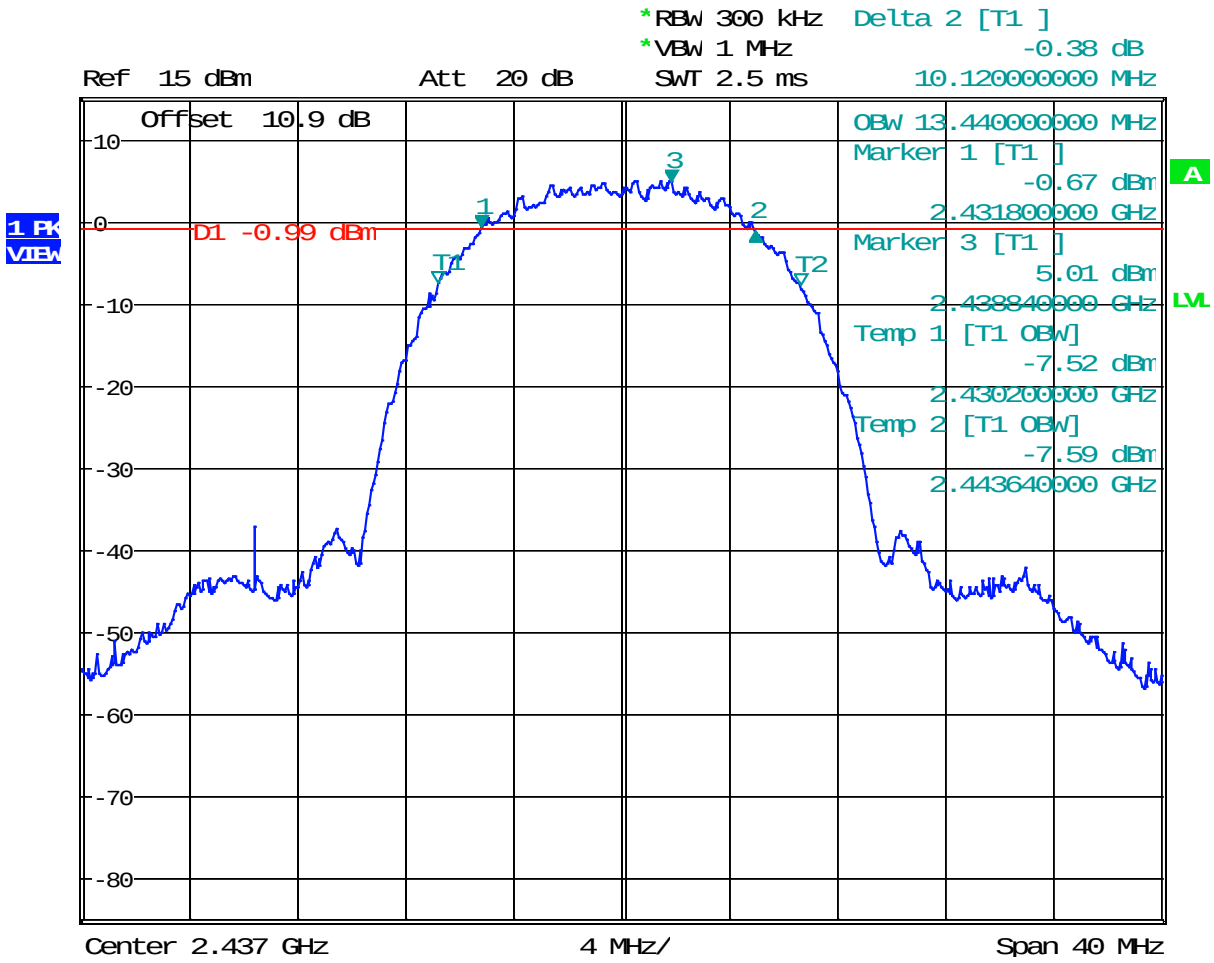
Plot 1. 11 –99% Bandwidth & 6dB Bandwidth (RSS)



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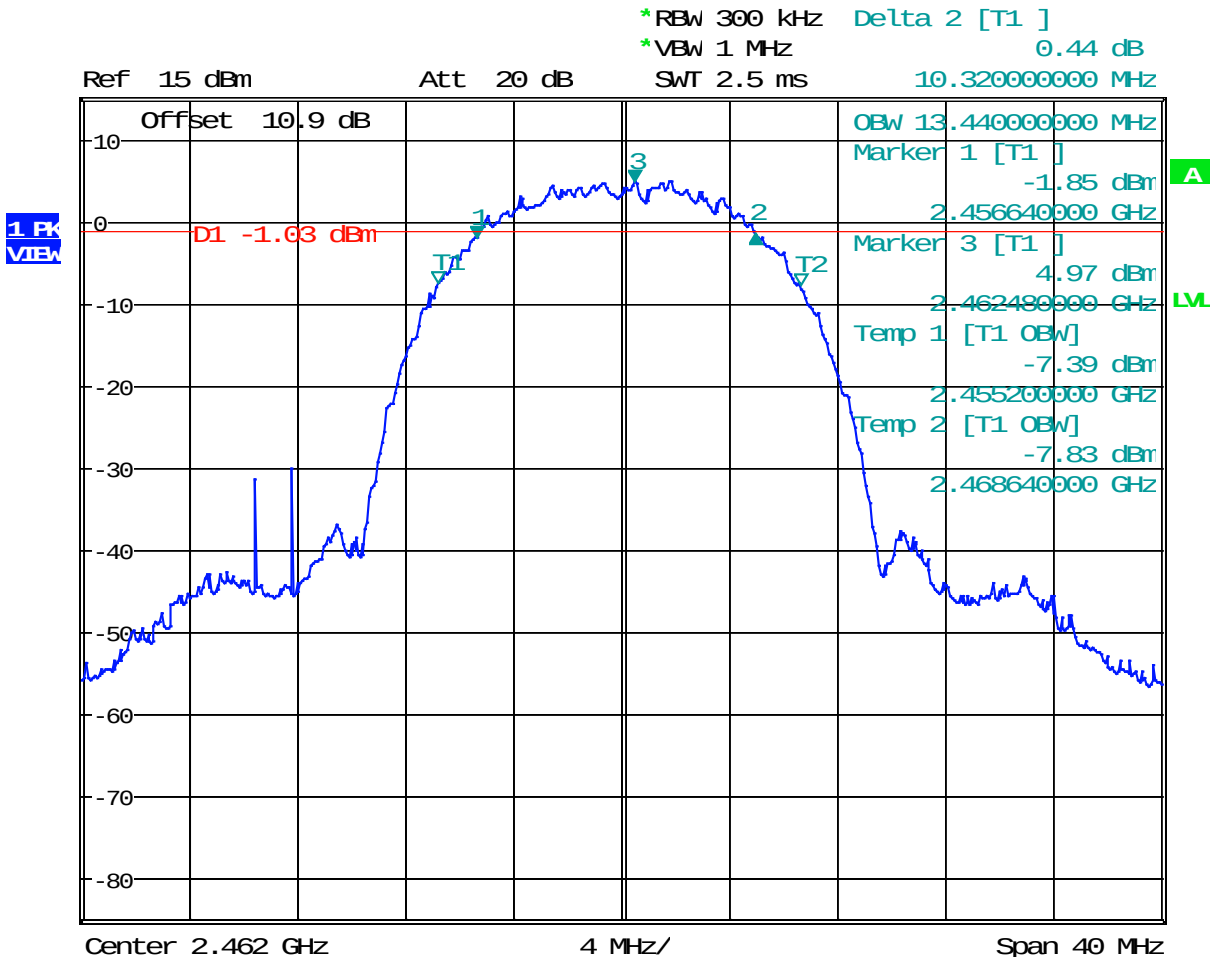
Plot 1. 12 – 99% Bandwidth & 6dB Bandwidth (RSS)



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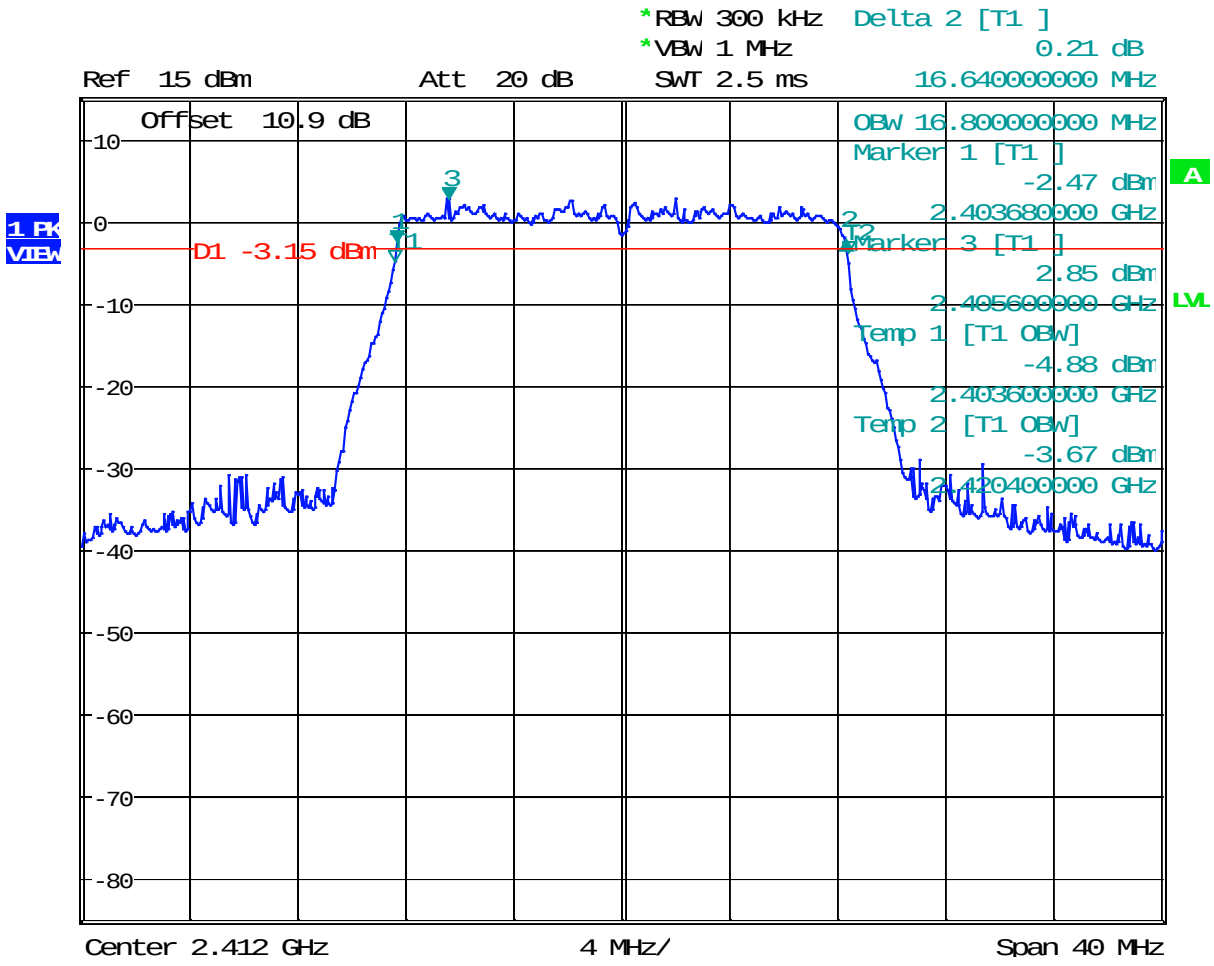
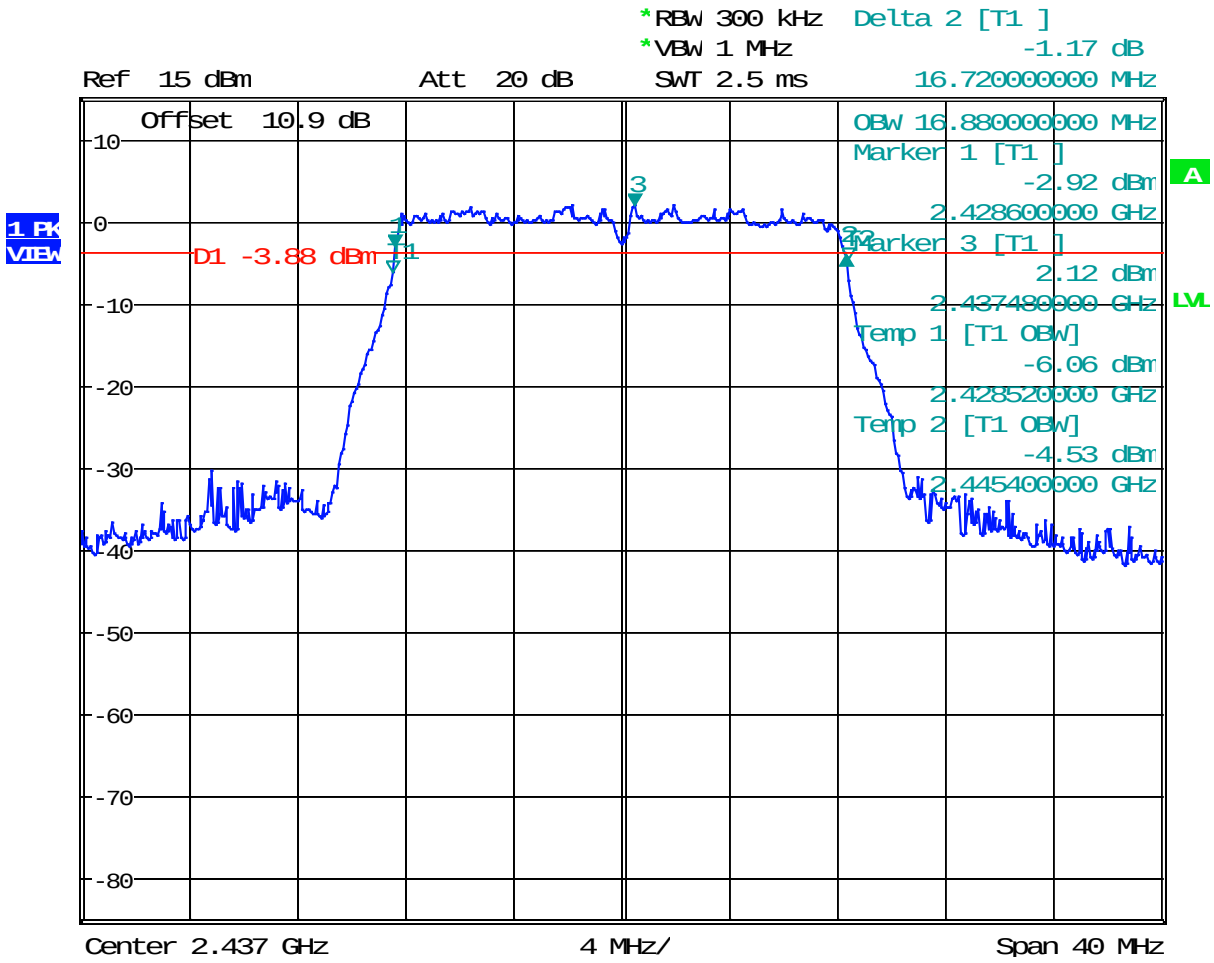
Plot 1. 13 – 99% Bandwidth & 6dB Bandwidth (RSS)



Plot 1. 14 – 99% Bandwidth & 6dB Bandwidth (RSS)



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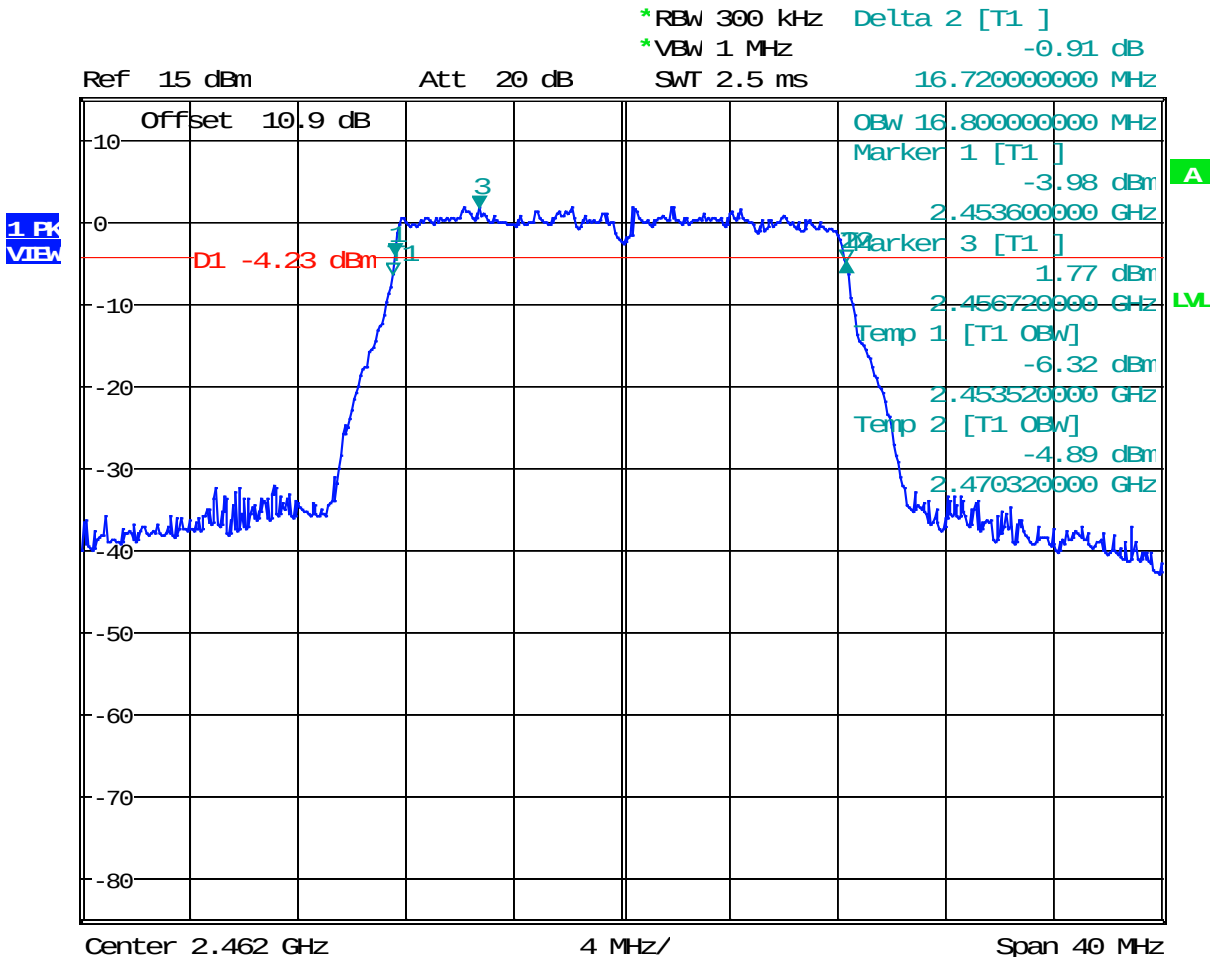
Plot 1. 15 – 99% Bandwidth & 6dB Bandwidth (RSS)



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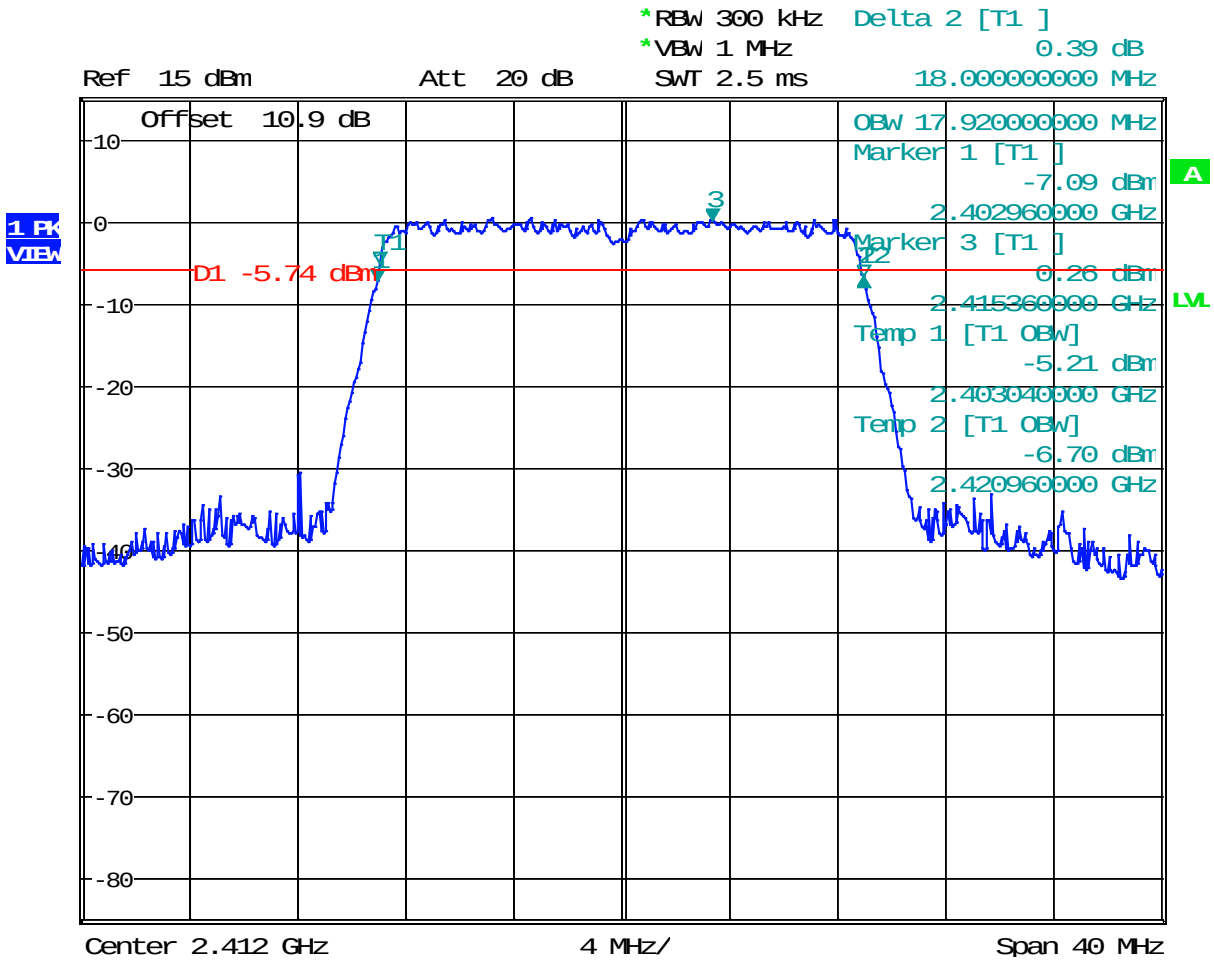
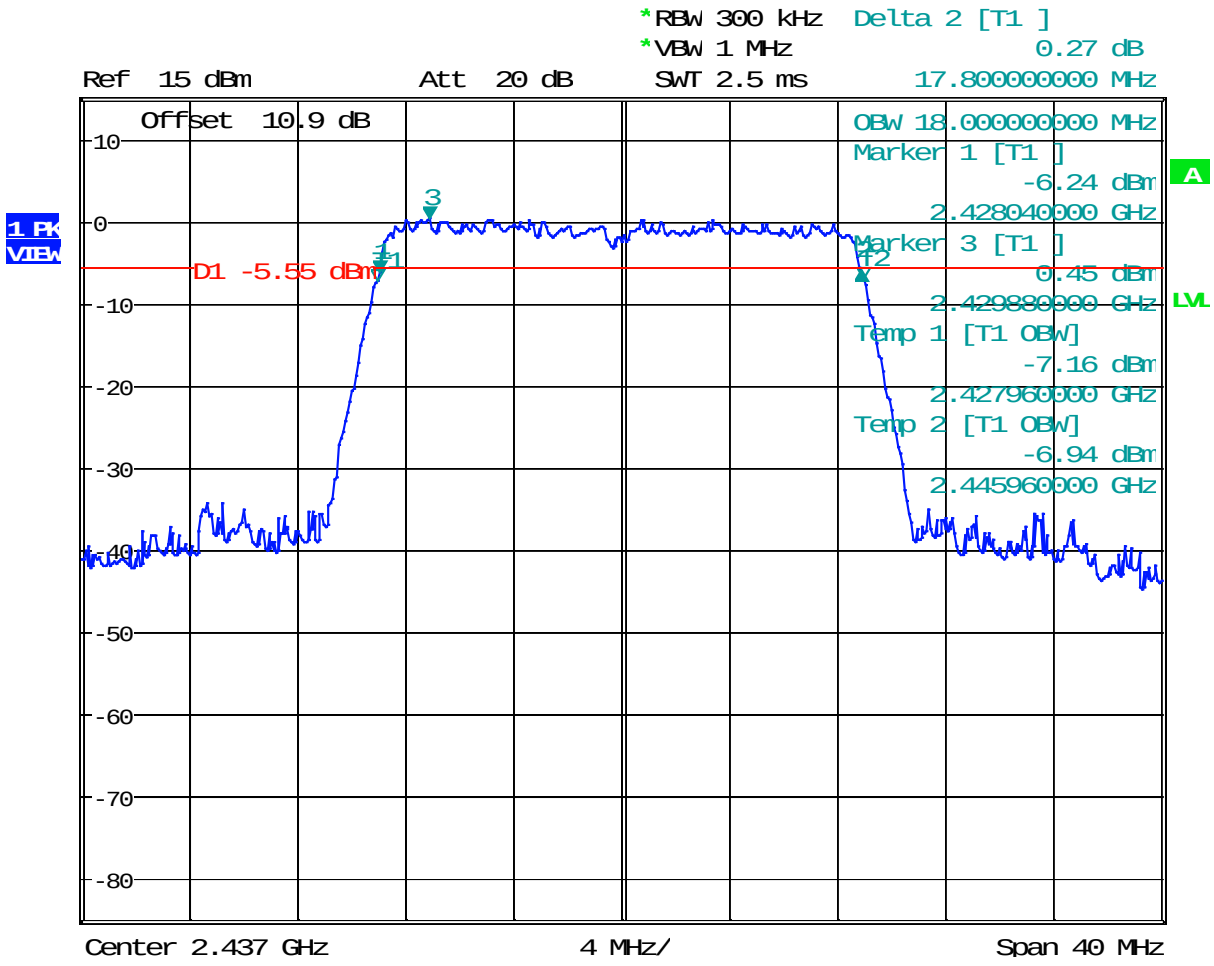
Plot 1. 16 – 99% Bandwidth & 6dB Bandwidth (RSS)



Plot 1. 17 – 99% Bandwidth & 6dB Bandwidth (RSS)



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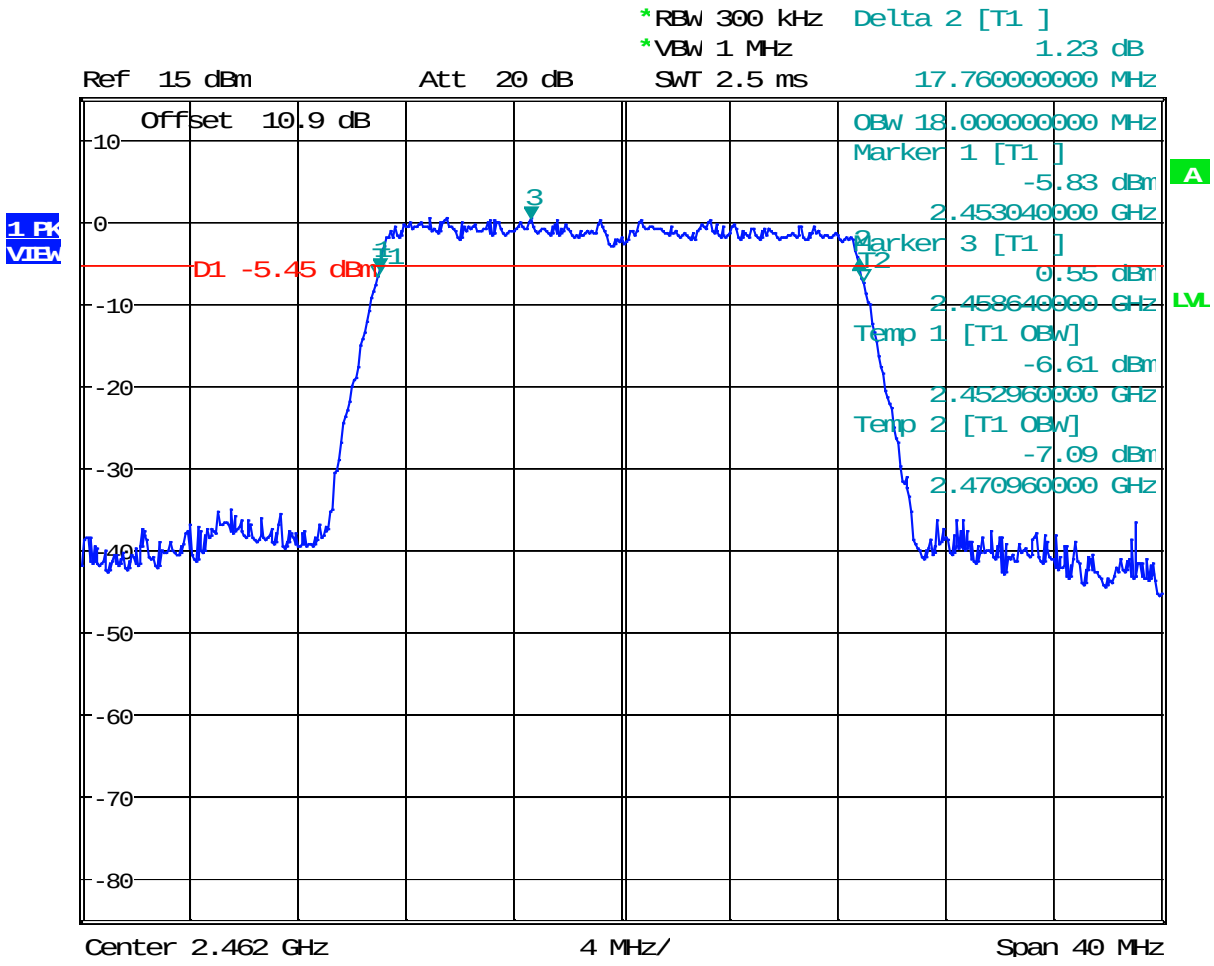
Plot 1. 18 – 99% Bandwidth & 6dB Bandwidth (RSS)



Date: 23.SEP.2015 18:08:34

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/power meter to measure the Maximum Conducted Transmitter Output Power.

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 09, 2015 was used. Specifically, section 9.2.2.2 Method AVGSA-1.

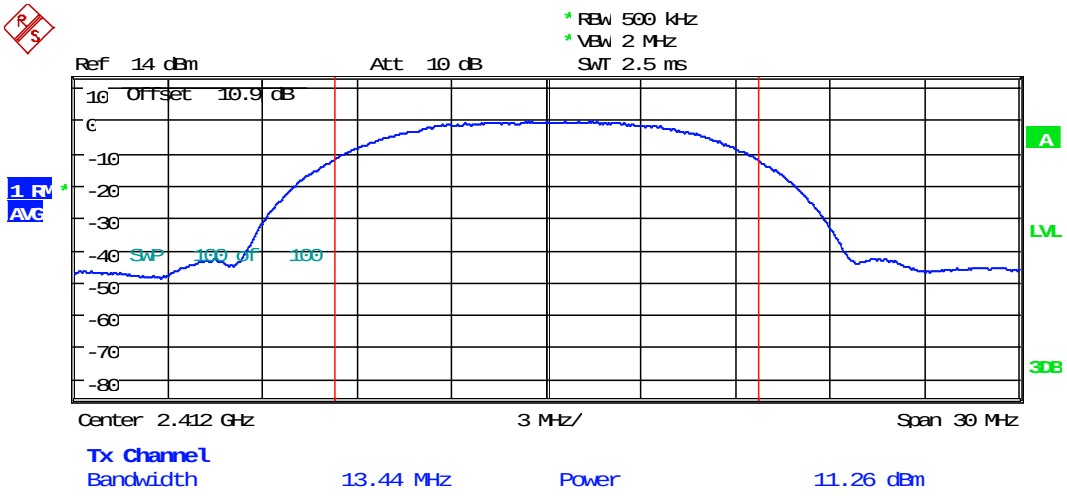
1. Set the RBW = 1-5% of the OBW, not to exceed 1MHz.
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 1.5 x *OBW*.
4. Detector = RMS.
5. Sweep time = auto couple.
6. Trace mode = power averaging (100 traces)
7. Number of points in sweep ≥ 2 x span/RBW.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the OBW band edges If the instrument does not have a band power function, sum the spectrum levels at intervals equal to the RBW extending across the entire OBW of the spectrum.

4.3.3 Test Result

Refer to the following plots for the test result:

Standard	Data Rate	Channel	Frequency MHz	Conducted Peak Power dBm	Conducted Peak Power mW	Plot #
802.11b	11 Mbps	1	2412	11.26	13.39	2.1
		6	2437	11.07	12.82	2.2
		11	2462	11.05	12.76	2.3
802.11g	54 Mbps	1	2412	9.71	9.37	2.4
		6	2437	10.11	10.28	2.5
		11	2462	9.49	8.91	2.6
802.11n HT20	MCS 7	1	2412	10.08	10.21	2.7
		6	2437	9.69	9.33	2.7
		11	2462	9.40	8.73	2.9

Plot 2. 1



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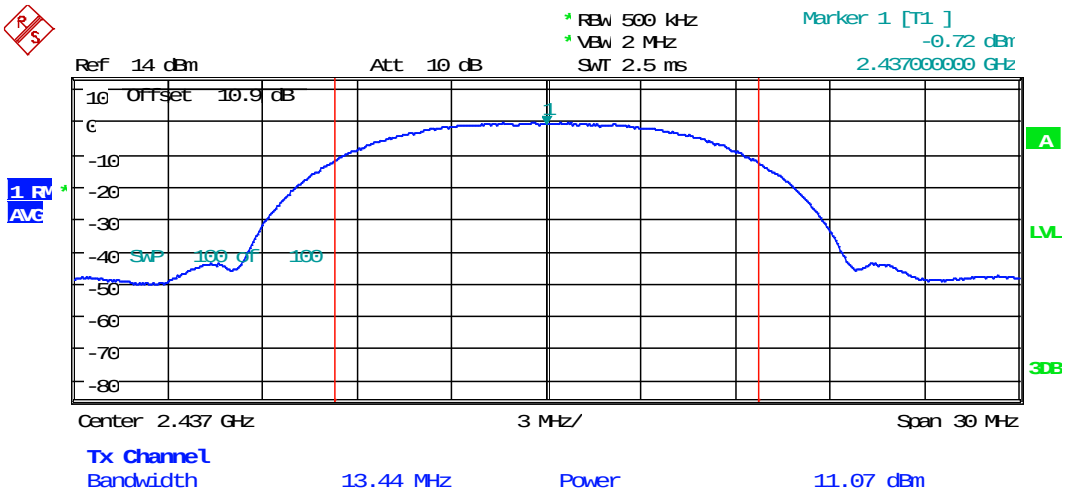
Plot 2. 2



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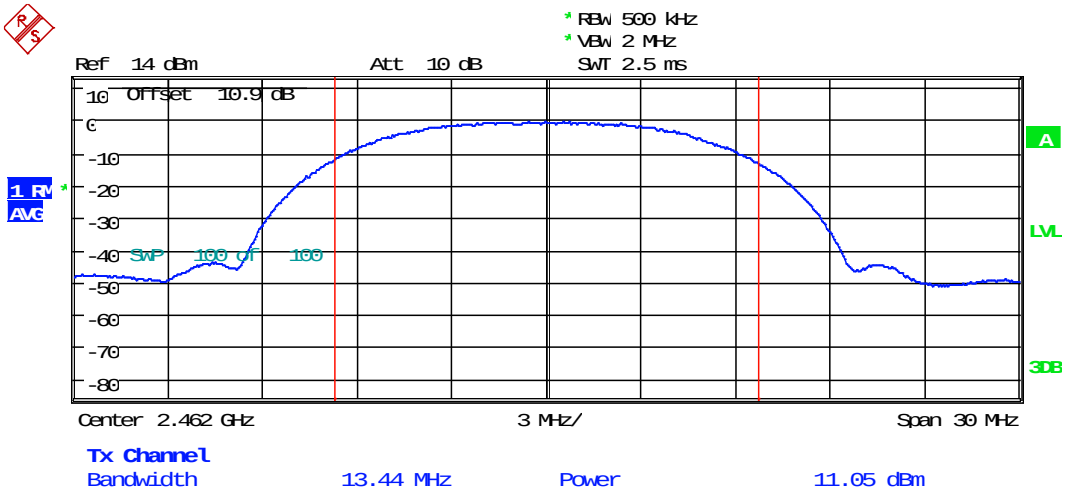
Plot 2. 3



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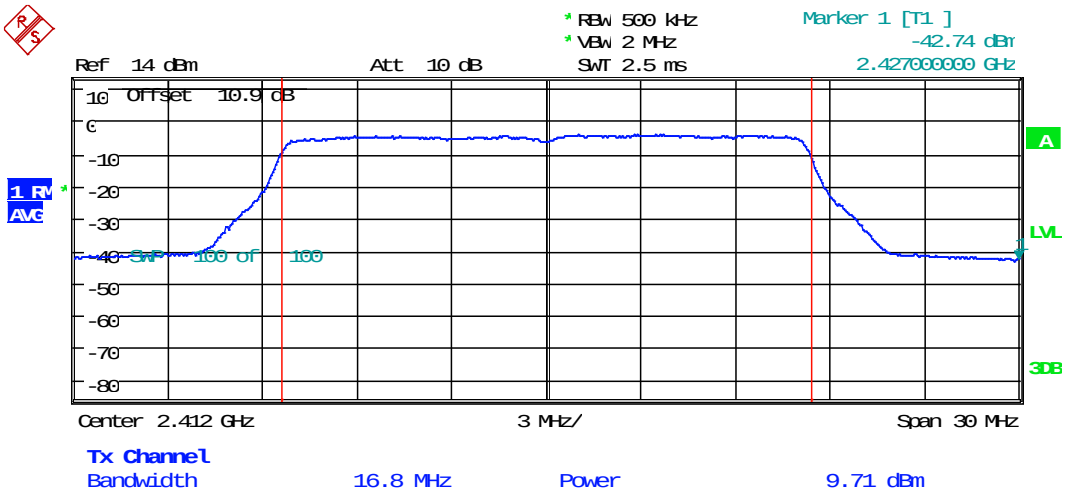
Plot 2. 4



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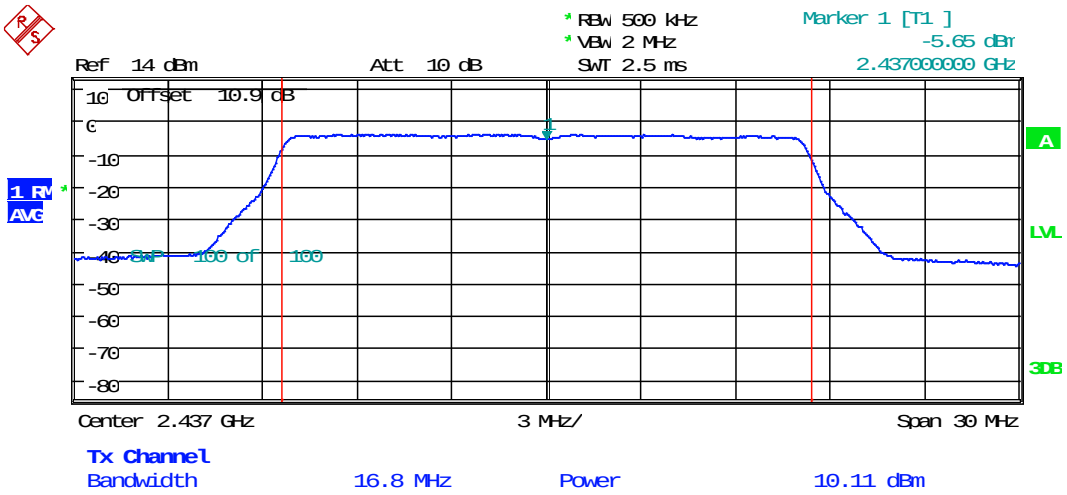
Plot 2. 5



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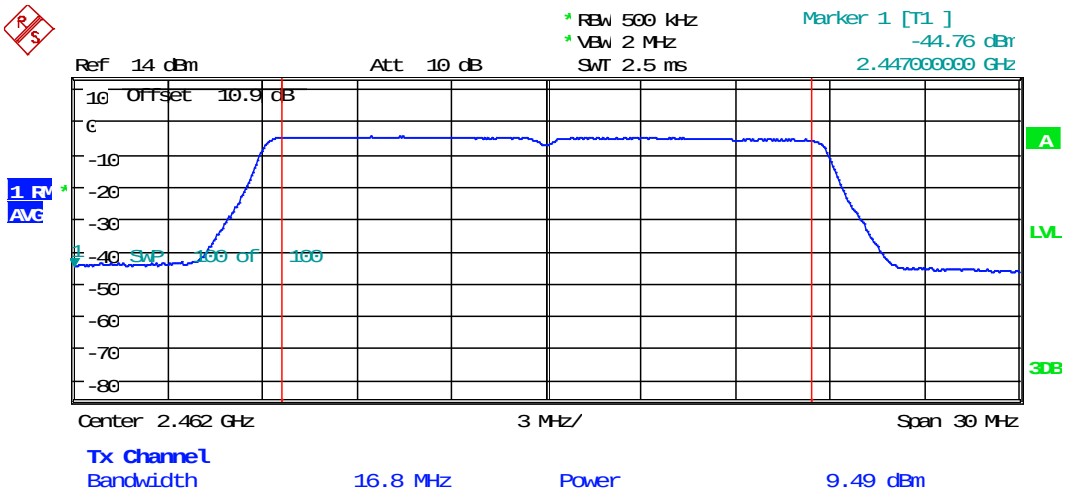
Plot 2. 6



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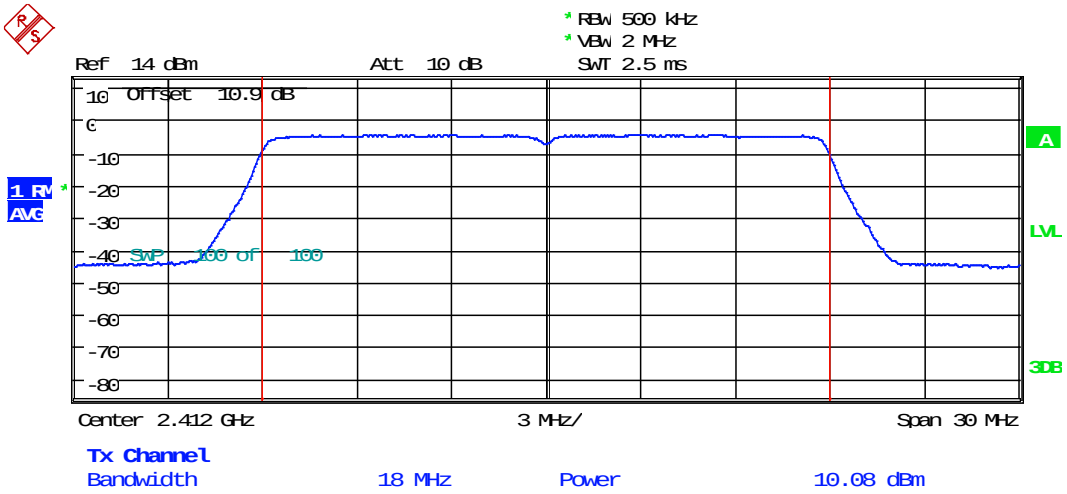
Plot 2. 7



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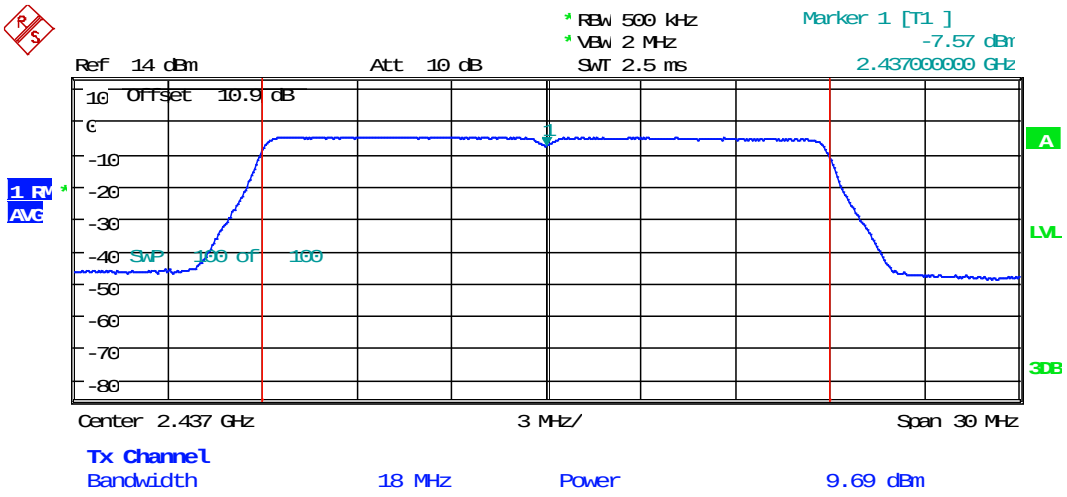
Plot 2. 8



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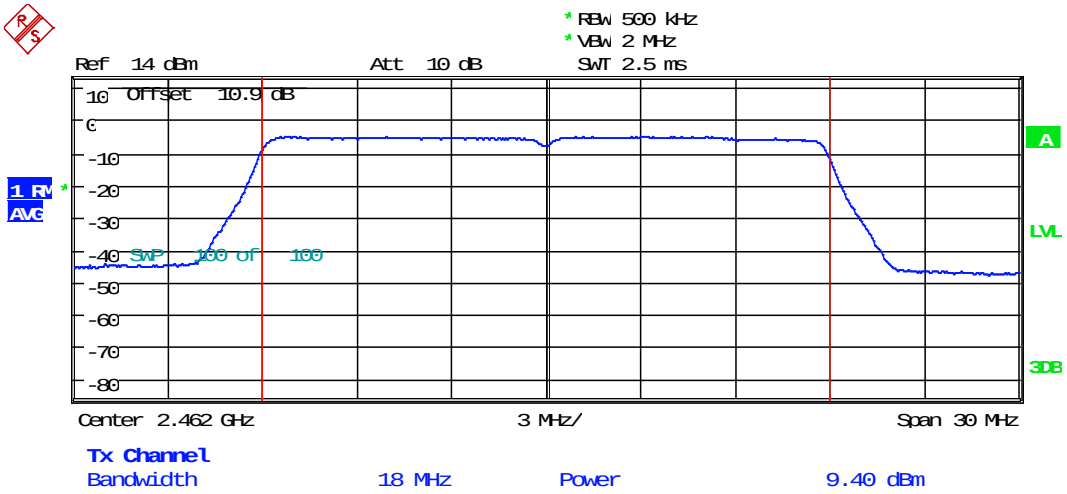
Plot 2. 9



Date: 20.OCT.2015 11:17:26

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 procedure described in FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 09 2015, specifically section 10.2 Method PKPSD (peak PSD).

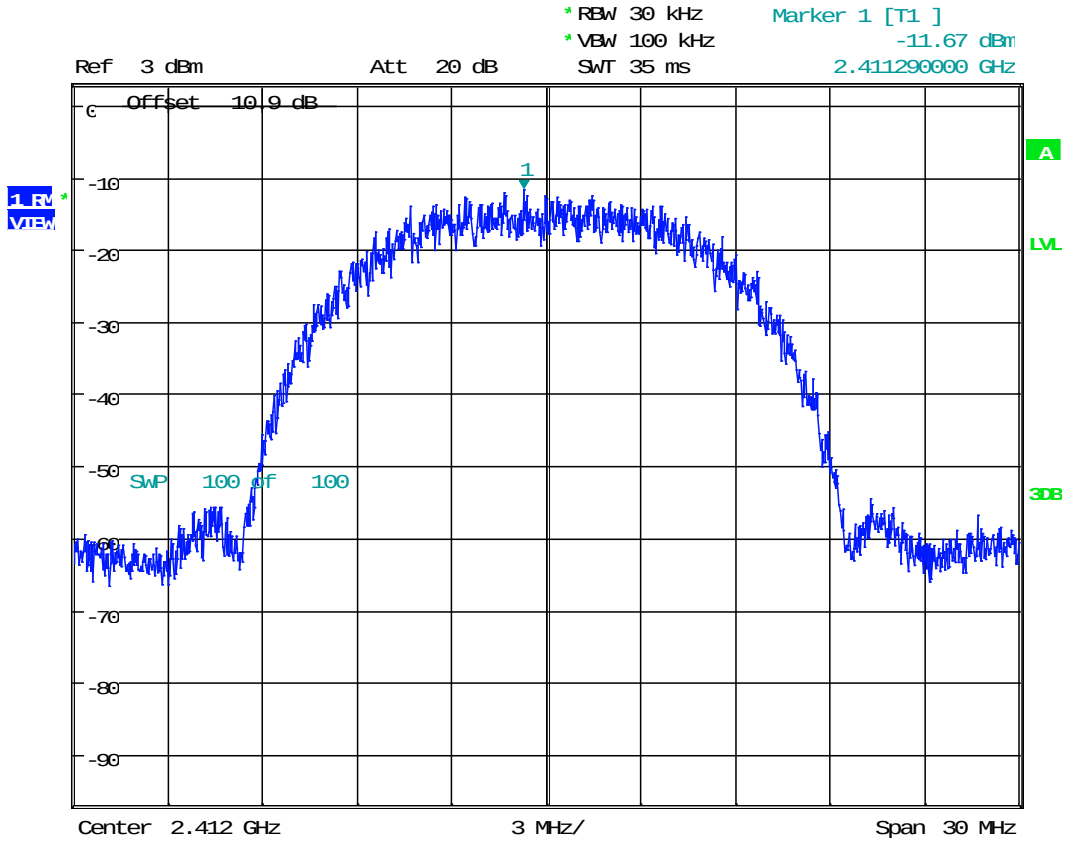
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use 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:

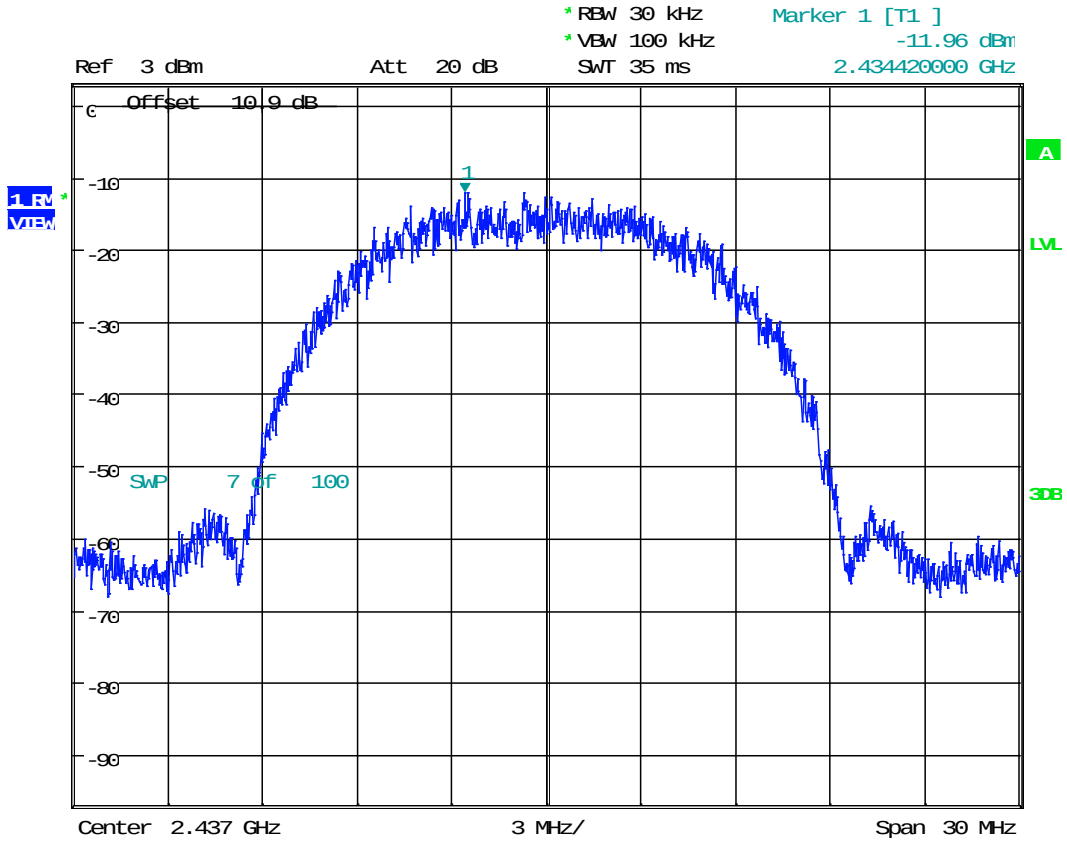
Standard	Channel	Frequency MHz	PSD (Peak) dBm	Margin to -8dBm Limit dB	Plot #
802.11b	1	2412	-11.67	-19.67	3.1
	6	2437	-11.96	-19.96	3.2
	11	2462	-11.37	-19.37	3.3
802.11g	1	2412	-15.56	-23.56	3.4
	6	2437	-15.59	-23.59	3.5
	11	2462	-15.65	-23.65	3.6
802.11n HT20	1	2412	-16.06	-24.06	3.7
	6	2437	-17.14	-25.14	3.7
	11	2462	-17.72	-25.72	3.9

Plot 3. 1



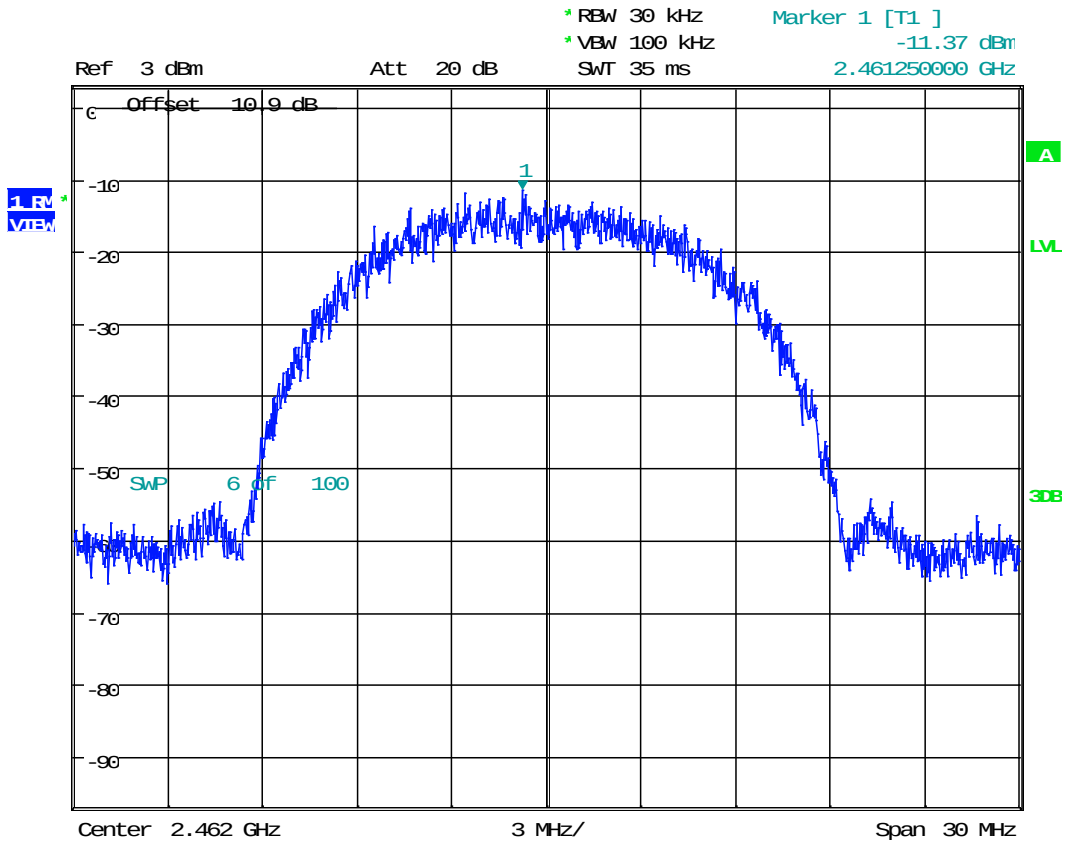
Date: 18.SEP.2015 09:45:41

Plot 3. 2



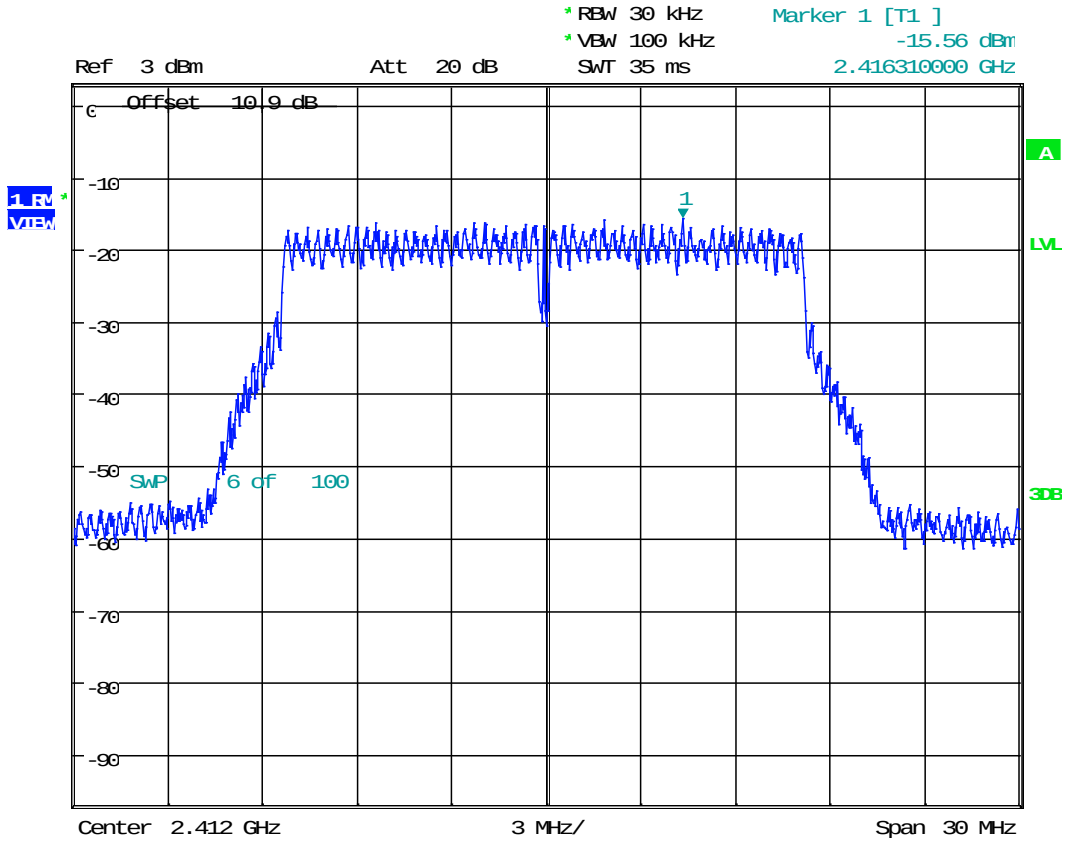
Date: 18.SEP.2015 09:48:19

Plot 3. 3



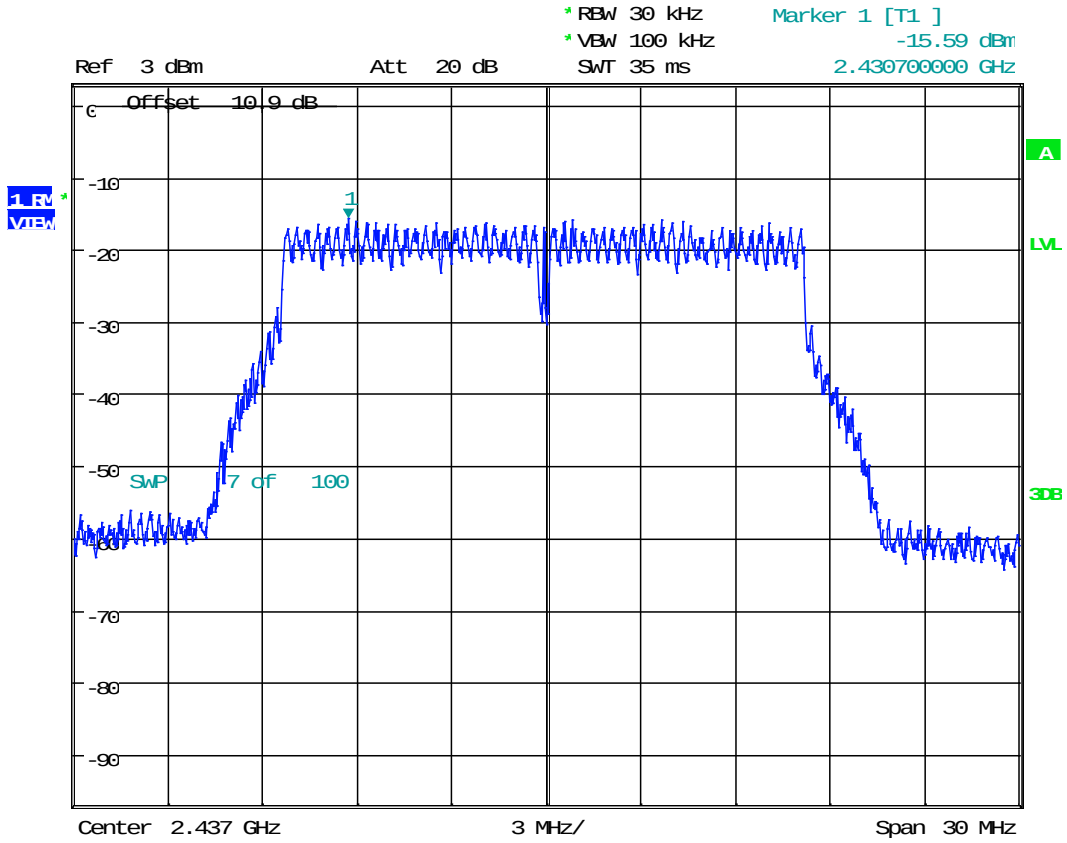
Date: 18.SEP.2015 09:59:34

Plot 3. 4



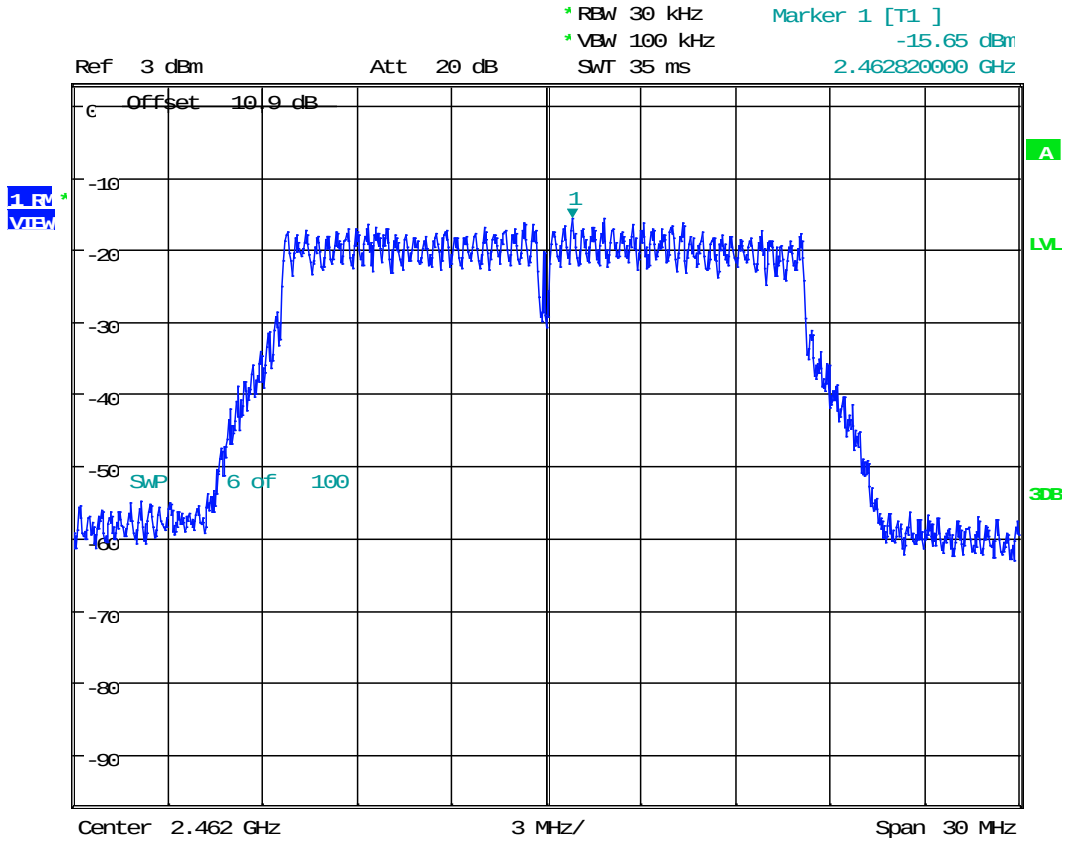
Date: 18.SEP.2015 10:01:29

Plot 3. 5

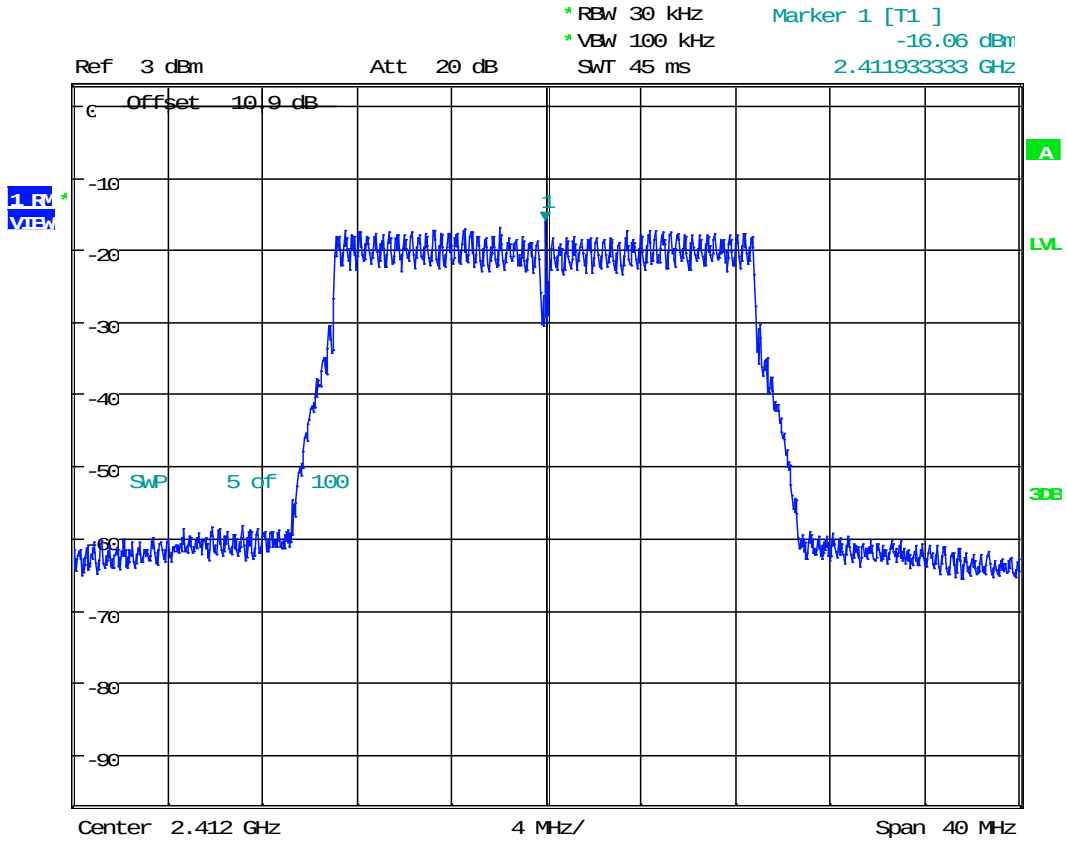


Date: 18.SEP.2015 10:02:51

Plot 3. 6

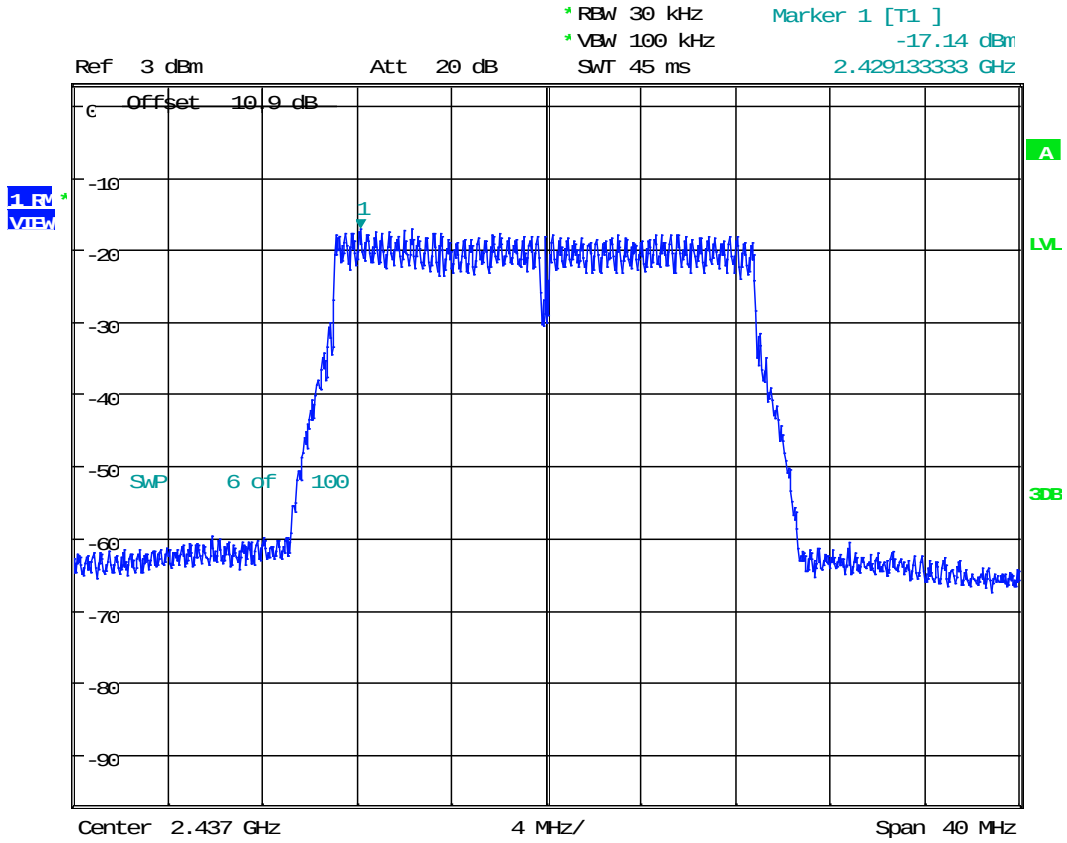

RBW 30 kHz
VBW 100 kHz
SWT 35 ms
Marker 1 [T1]
-15.65 dBm
2.462820000 GHz
Ref 3 dBm
Att 20 dB
Offset 10.9 dB
1 RM VIEW
A
LVL
3DB
SWP 6 of 100
Center 2.462 GHz
3 MHz/
Span 30 MHz
Date: 18.SEP.2015 10:03:55

Plot 3. 7



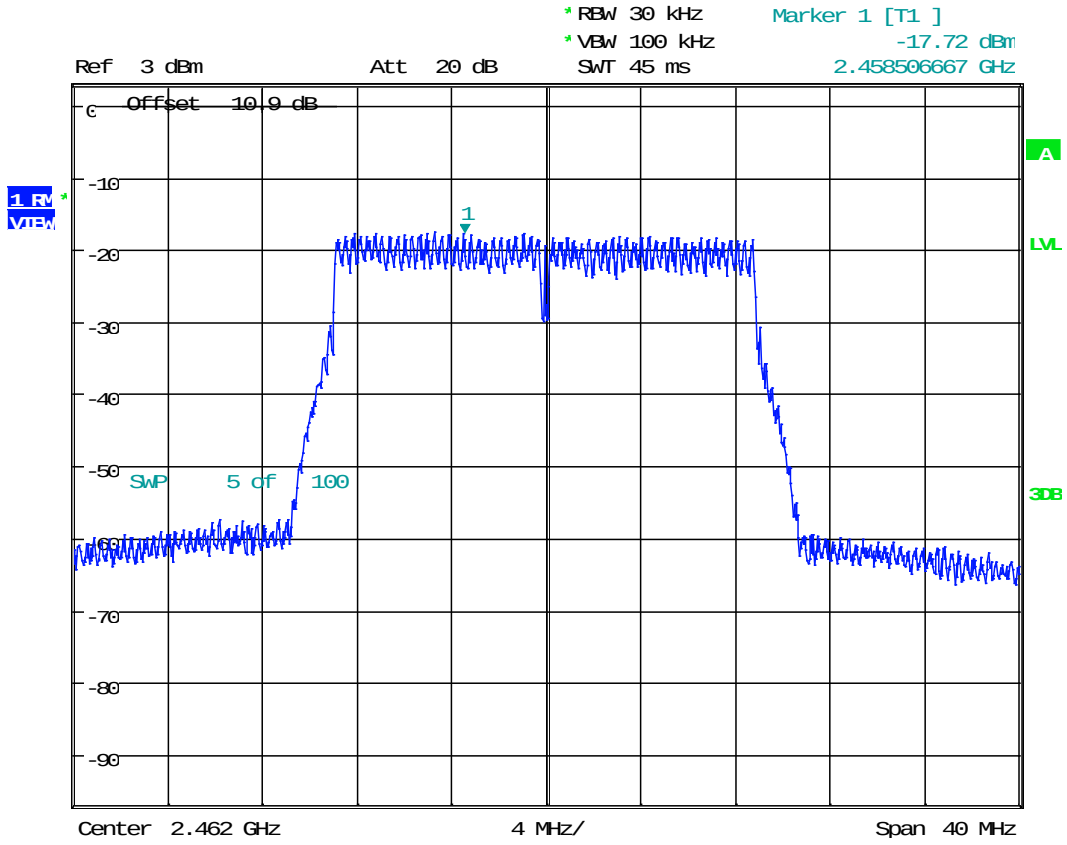
Date: 18.SEP.2015 10:06:04

Plot 3. 8



Date: 18.SEP.2015 10:08:07

Plot 3. 9


RBW 30 kHz
VBW 100 kHz
SWT 45 ms
Marker 1 [T1]
-17.72 dBm
2.458506667 GHz
Ref 3 dBm
Att 20 dB
Offset 10.9 dB
1 RM
VIEW
A
LVL
3DB
SWP 5 of 100
Center 2.462 GHz
4 MHz/
Span 40 MHz
Date: 18.SEP.2015 10:13:56

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

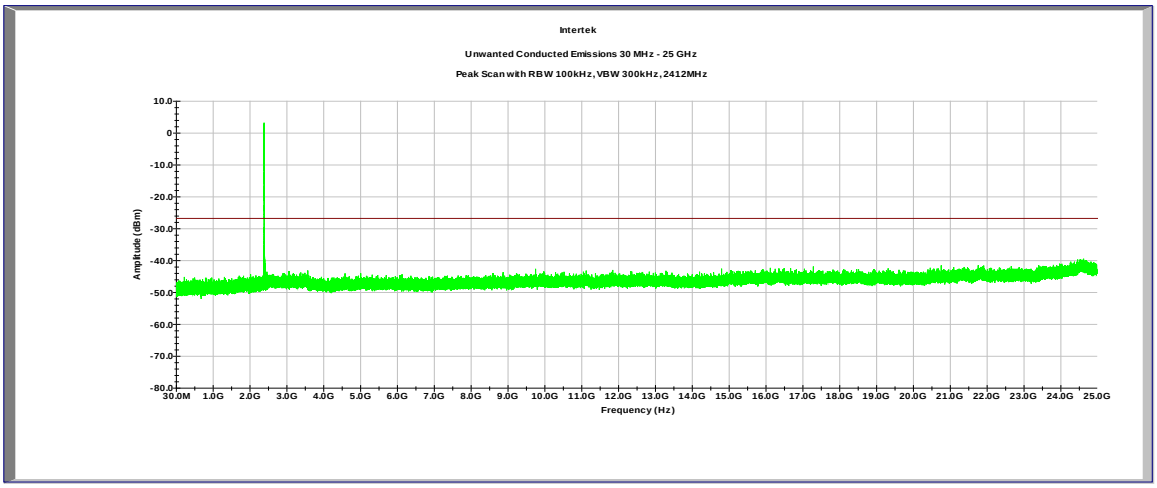
A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 25 GHz.

4.4.3 Test Result

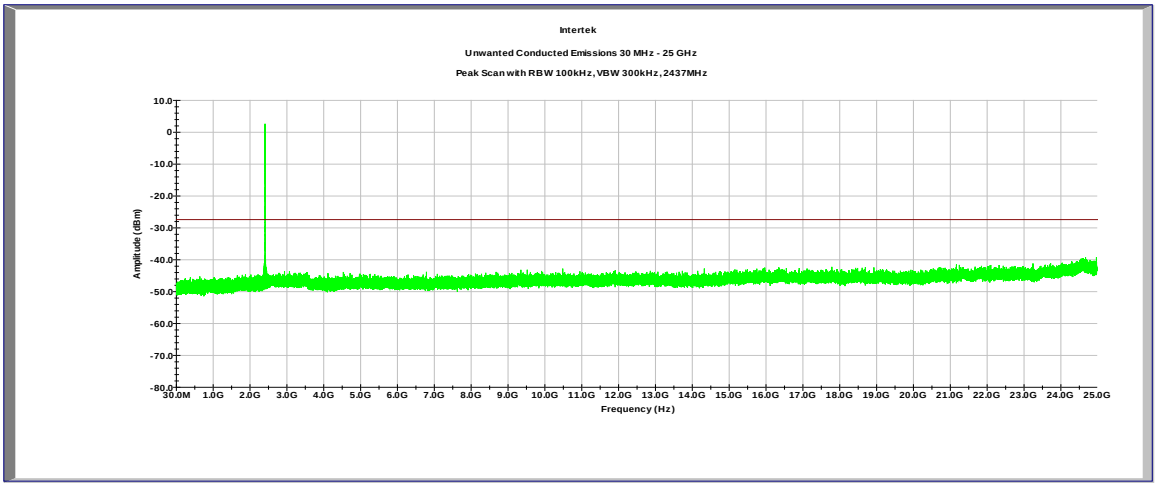
Refer to the following plots 4.1 – 4.9 for unwanted conducted emissions. The plot shows -30dB attenuation limit line.

Results	**Complies**

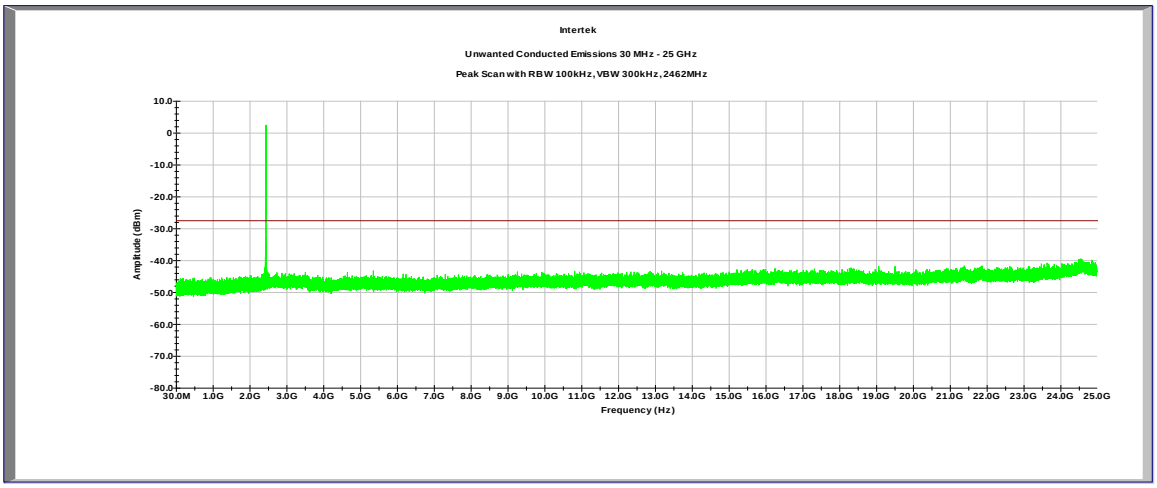
Plot 4.1
Tx @ 2412MHz 802.11b



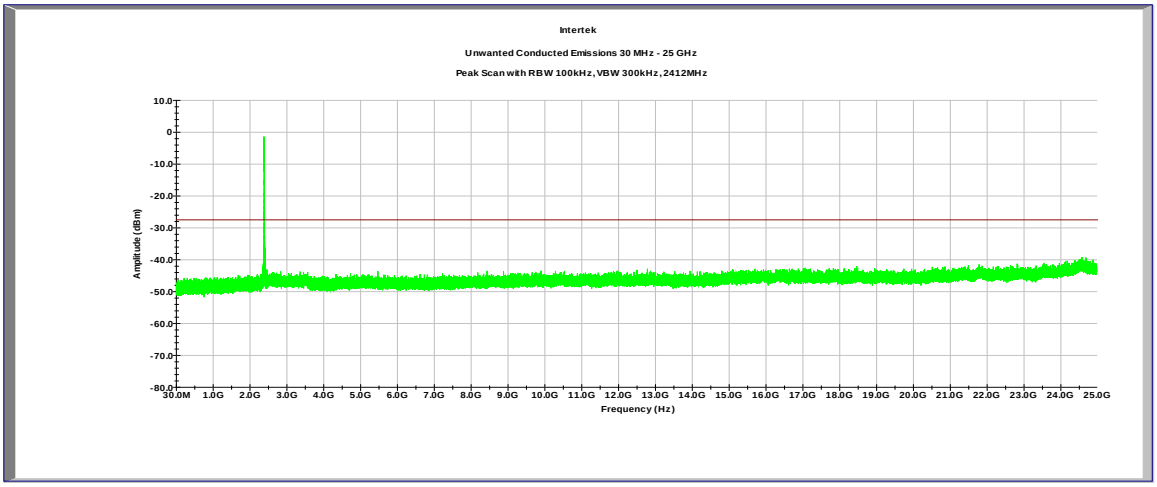
Plot 4.2
Tx @ 2437MHz 802.11b



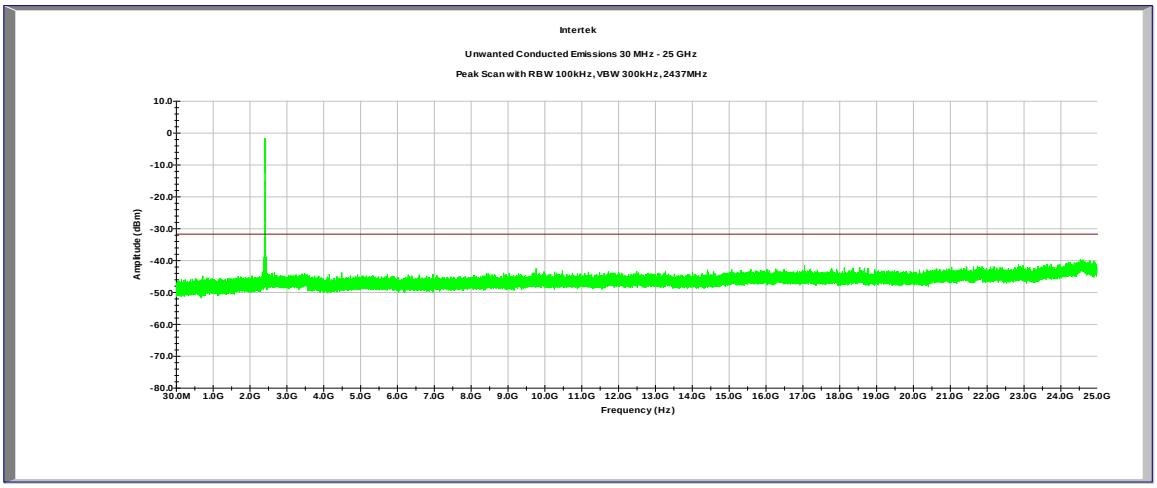
Plot 4.3
Tx @ 2462MHz 802.11b



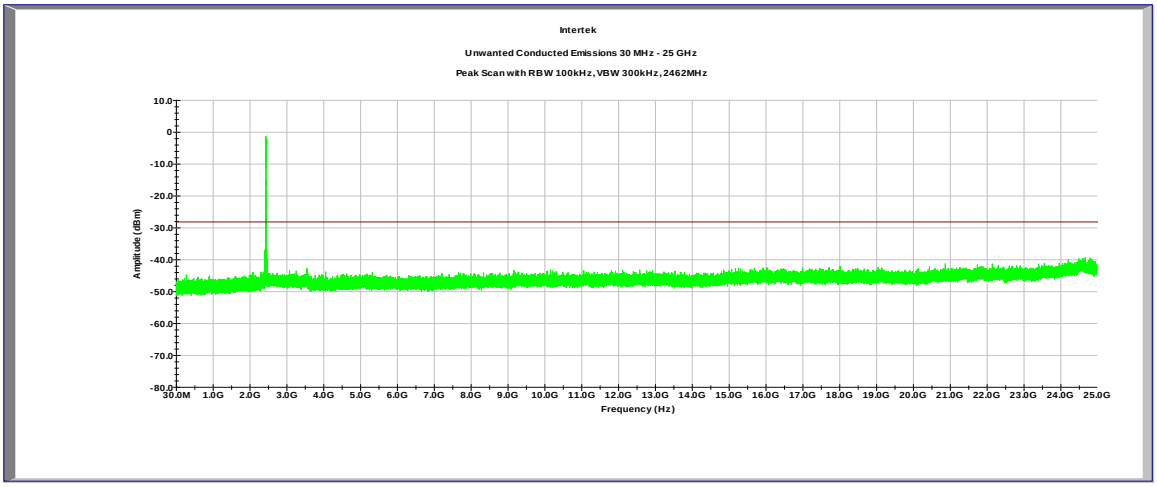
Plot 4.4
Tx @ 2412MHz 802.11g



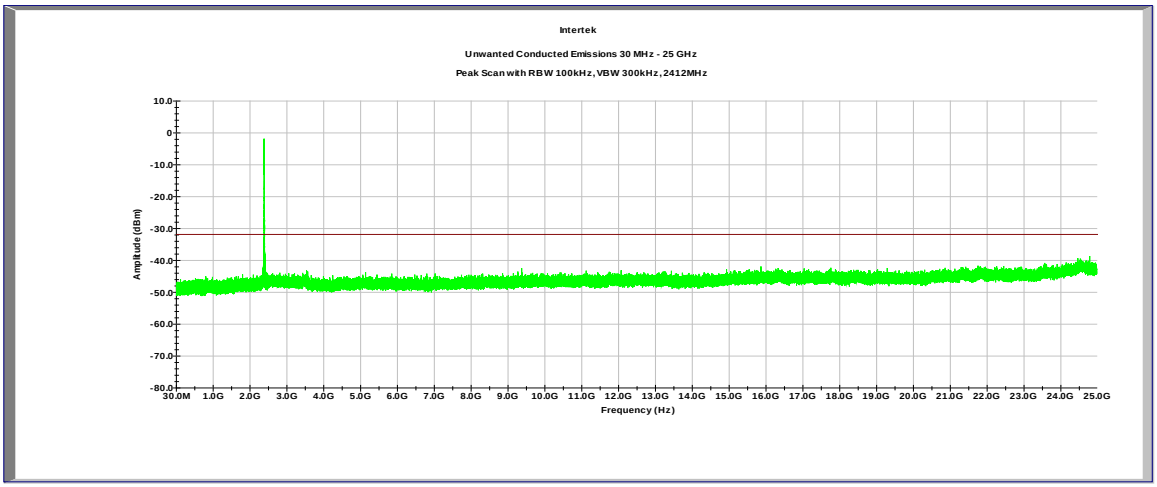
Plot 4.5
Tx @ 2437MHz 802.11g



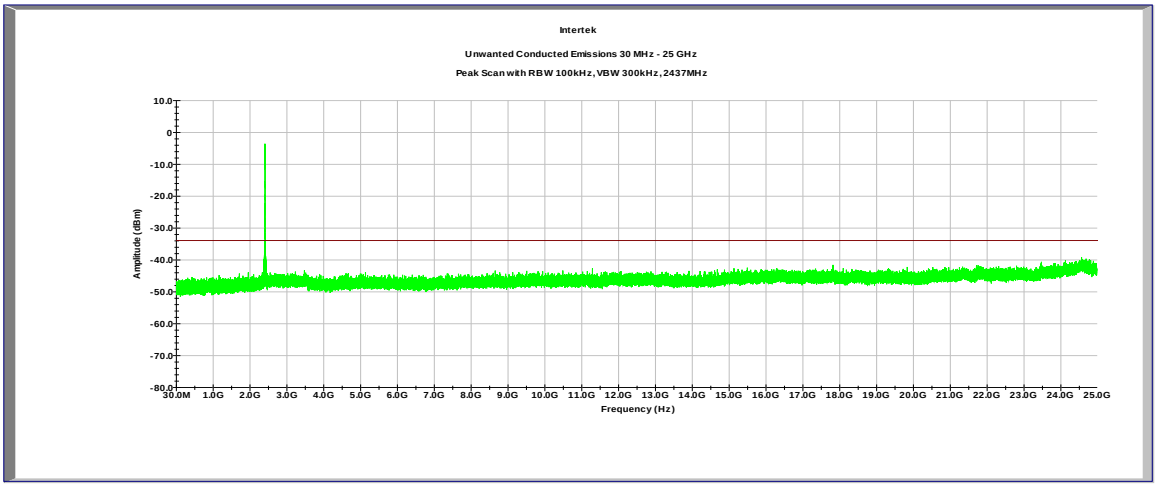
Plot 4.6
Tx @ 2462MHz 802.11g



Plot 4.7
Tx @ 2412MHz 802.11n, HT20



Plot 4.8
Tx @ 2437MHz 802.11n, HT20



Plot 4.9

Tx @ 2462MHz 802.11n, HT20