FCC / ISED Test Report

FOR:
Innophase Inc.

Model Name:
INP2045 Module

Product Description:
Low Power Wi-Fi/BLE IOT Module

FCC ID: 2AVAL-INP2045
IC ID: 25715-INP2045

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)
RSS-247 Issue 2 (DTS) & RSS-Gen Issue 5

REPORT #: EMC_INNOP_005_19001_15.247_WLAN

DATE: 2020-01-06

A2LA Accredited

IC recognized #
3462B-2

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
Innophase Inc.	Low Power Wi-Fi/BLE IOT Module	INP2045 Module

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2020-01-06	Compliance	Cindy Li (EMC Lab Manager)	Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-01-06 18:07:21

Responsible for the Report:

Date	Section	Name	Signature
2020-01-06	Compliance	Kevin Wang (Senior EMC Engineer)	Kevin Wang Digitally signed by: Kevin Wang DN: CN = Kevin Wang email = kevin.wang@cetecom.com C = US O = Cetecom Inc. Date: 2020.01.06 15:27:36 -08'00'

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Trina Noor

2.2 Identification of the Client

Client's Name:	Innophase Inc.
Street Address:	6815 Flanders Drive, Suite 150
City/Zip Code:	San Diego, CA 92121
Country:	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 EUT Specifications

Model No:	INP2045 Module
HW Version :	INP2045-H
SW Version :	7d721afe
FCC-ID:	2AVAL-INP2045
IC-ID:	25715-INP2045
HVIN:	INP2045-H
PMN:	Talaria-TWO
Product Description:	Low Power Wi-Fi/BLE IOT Module
Frequency Range / number of channels:	Module name: INP2045 Module Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels
Type(s) of Modulation:	BPSK, QPSK, 16-QAM, 64QAM
Modes of Operation:	802.11b/g/n, 20MHz
Antenna Information as declared:	0 dBi
Max. Average Output Power:	Conducted Power 17.31 dBm
Power Supply/ Rated Operating Voltage Range:	Vmin: 2.7 VDC/ Vnom: 3.3 VDC / Vmax: 3.6 VDC
Operating Temperature Range:	-10 ºC to 75 ºC
Other Radios included in the device:	❖ BLE • Module name: INP2045 Module • Antenna Gain: 0 dBi
Sample Revision:	☐Prototype Unit; ■ Production Unit; ☐ Pre-Production

3.2 EUT Sample details

EUT #	IMEI Number	HW Version	SW Version	Notes/Comments
1	3919055	INP2045-H	7d721afe	Radiated Emissions
2	533293	INP2045-H	7d721afe	Conducted RF

3.3 Support Equipment

SE #	Type	Model	Manufacturer	Serial Number
1	USB Power Cable	-	-	-

3.4 Test Sample Configuration

EUT Set-up #	Combination of SE used for test set up	Comments
1	EUT#1+ SE#1	Special commands through command window used to configure the WLAN radio to low, mid and high channels at maximum output power(with TX power set at 18dBm for 802.11b) provided by the client that will not be available to the end user. For radiated measurements, the internal antenna was connected.
2	EUT#2+ SE#1	Special commands through command window used to configure the WLAN radio to low, mid and high channel at maximum output power (with TX power set at 18dBm for 802.11b, 15dBm for 802.11g Ch1 to Ch10, 14dBm for 802.11g Ch11 and 12dBm for 802.11n) provided by the client that will not be available to the end user. For conducted measurements, the equipment was connected to 50 ohm RF port of the EUT.

3.5 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels with the maximum output power (with TX power set at 18dBm for 802.11b, 15dBm for 802.11g Ch1 to Ch10, 14dBm for 802.11g Ch11 and 12dBm for 802.11n) and the customer declared highest possible duty cycle. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – "GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247" - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(a)(1) RSS-247 5.2(1)	Emission Bandwidth	Nominal	802.11 b/g/n	■	☐	☐	Complies
§15.247(e) RSS-247 5.2(2)	Power Spectral Density	Nominal	802.11 b/g/n	■	☐	☐	Complies
§15.247(b)(1) RSS-247 5.4(4)	Maximum Conducted Output Power and EIRP	Nominal	802.11 b/g/n	■	☐	☐	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	802.11 b/g/n	■	☐	☐	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	802.11 b/g/n	■	☐	☐	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	802.11n_ HT20 MIMO	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	N/A	☐	■	☐	N/A[2]

Note1: NA= Not Applicable; NP= Not Performed.
Note2: EUT is powered by 5VDC USB cable

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

9 kHz to 30 MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)

Conducted measurement

150 kHz to 30 MHz	±0.7 dB (LISN)

RF conducted measurement	±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions during Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 Dates of Testing:

12/09/2019-12/19/2019

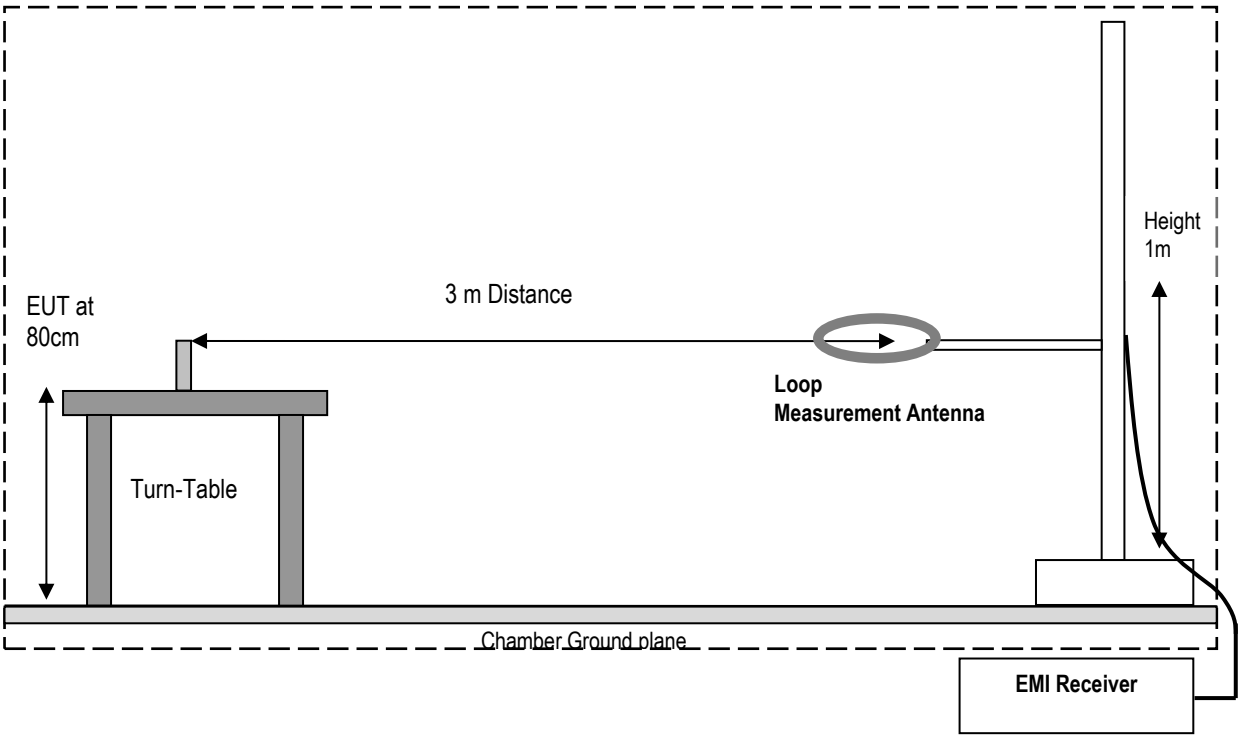
7 Measurement Procedures

7.1 Radiated Measurement

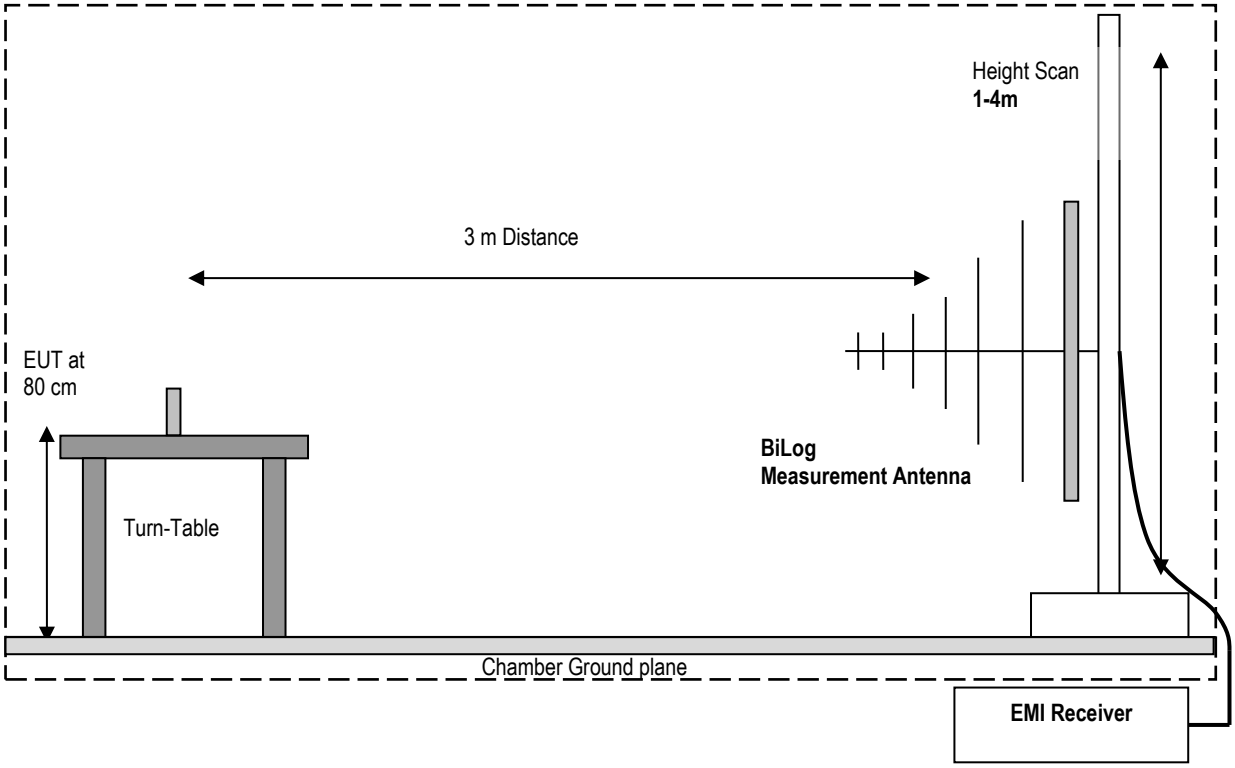
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

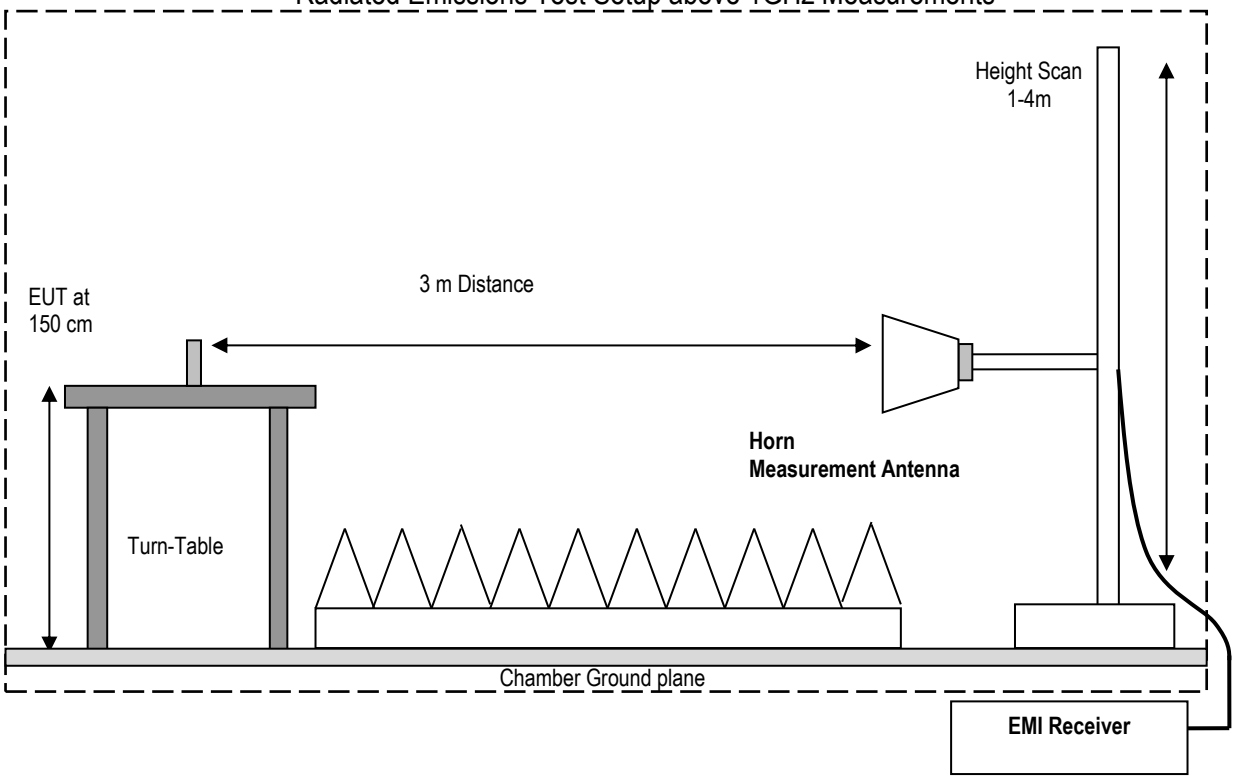
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

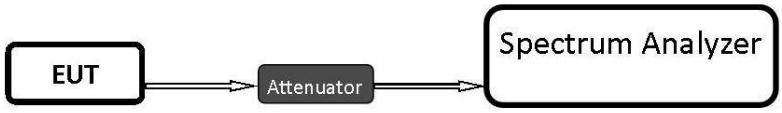
FS (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

7.2 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – "GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247" - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.
- Calculate the conducted power by taking into account attenuation of the cable and the attenuator

8 Test Result Data

8.1 Duty cycle

8.1.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v04

Spectrum Analyzer settings:

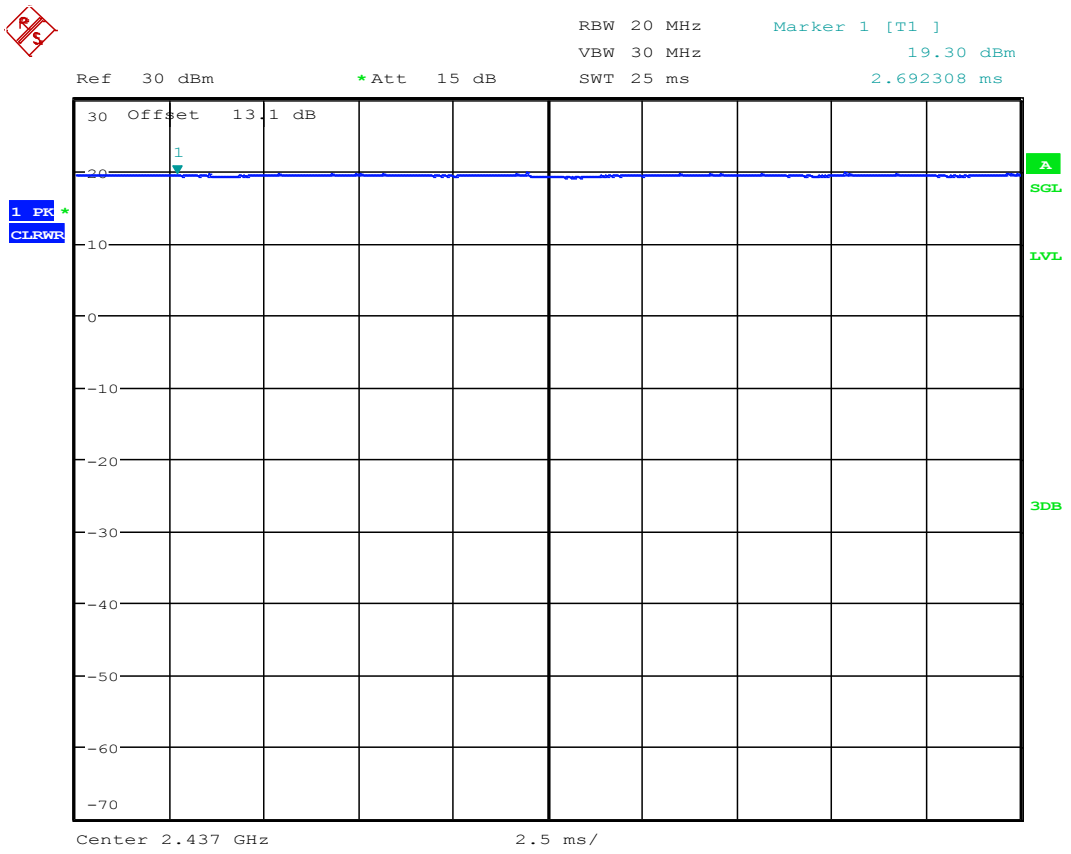
- Set the center frequency and of the instrument to the center frequency of the transmission
- Zero span
- Set RBW >=OBW if possible; otherwise, set RBW to the largest available value
- Detector = Peak or average

8.1.2 Measurement result

Plot #	Mode	Data Rate	Duty Cycle	Duty Cycle Correction Factor (dB)
1	802.11b	1Mbps	100.00%	0.00
2	802.11b	11Mbps	97.03%	0.13
3	802.11g	6Mbps	96.61%	0.15
4	802.11g	54Mbps	88.00%	0.56
5	802.11n_HT20	MCS0	96.39%	0.16
6	802.11n_HT20	MCS7	86.86%	0.61

Plot #1

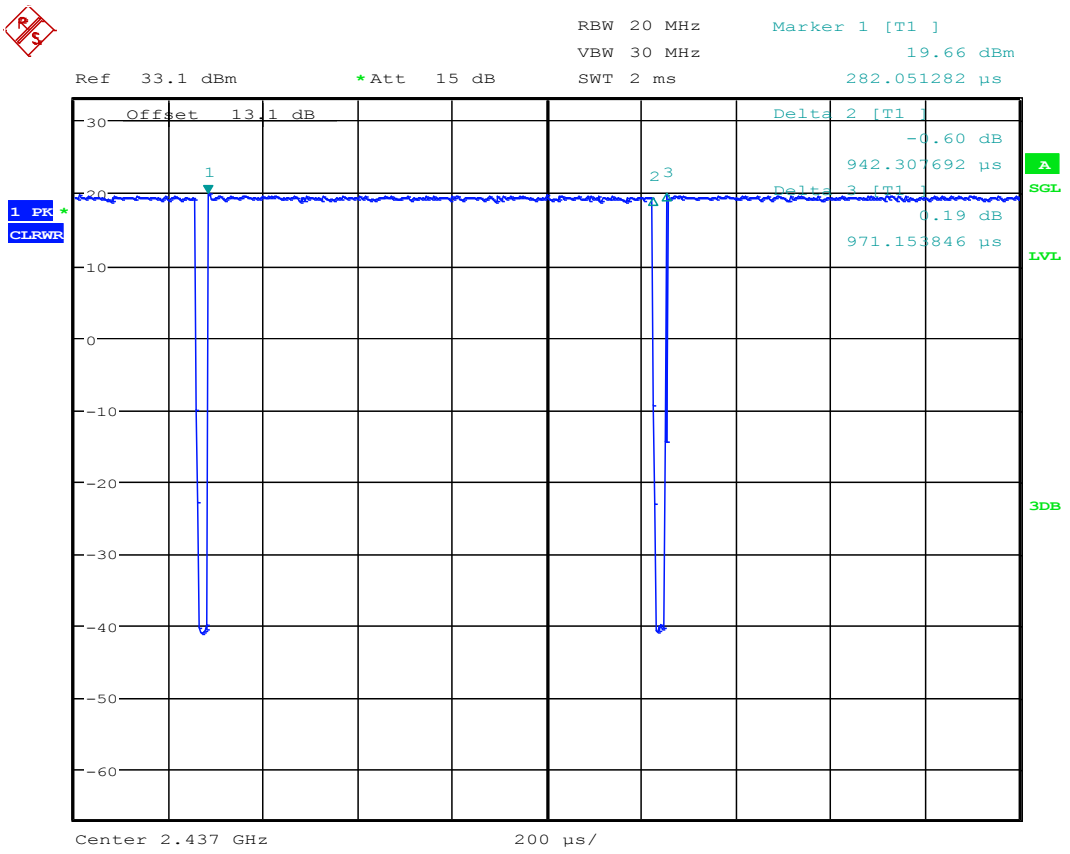
Mid channel / 2437 MHz	Modulation/Packet Type: 802.11b 1 Mbps



Date: 9.DEC.2019 11:11:00

Plot #2

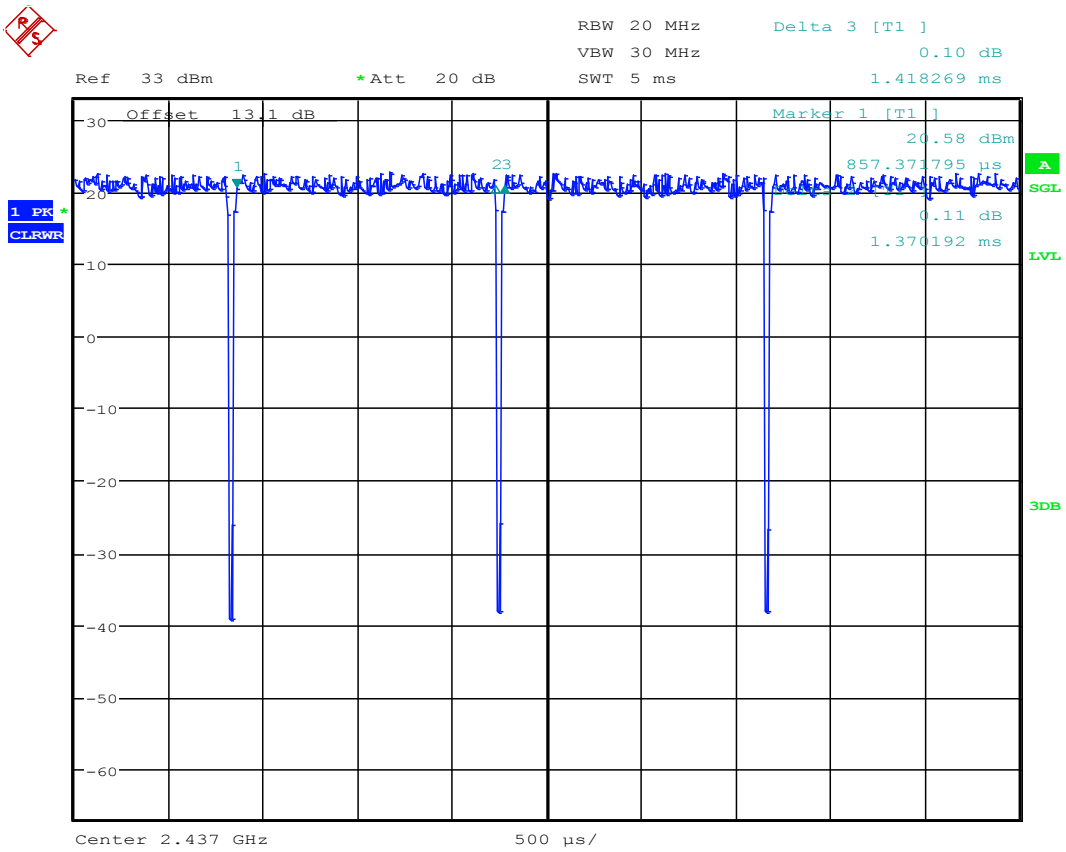
Low channel / 2437 MHz	Modulation/Packet Type: 802.11b 11 Mbps



Date: 9.DEC.2019 14:25:21

Plot #3

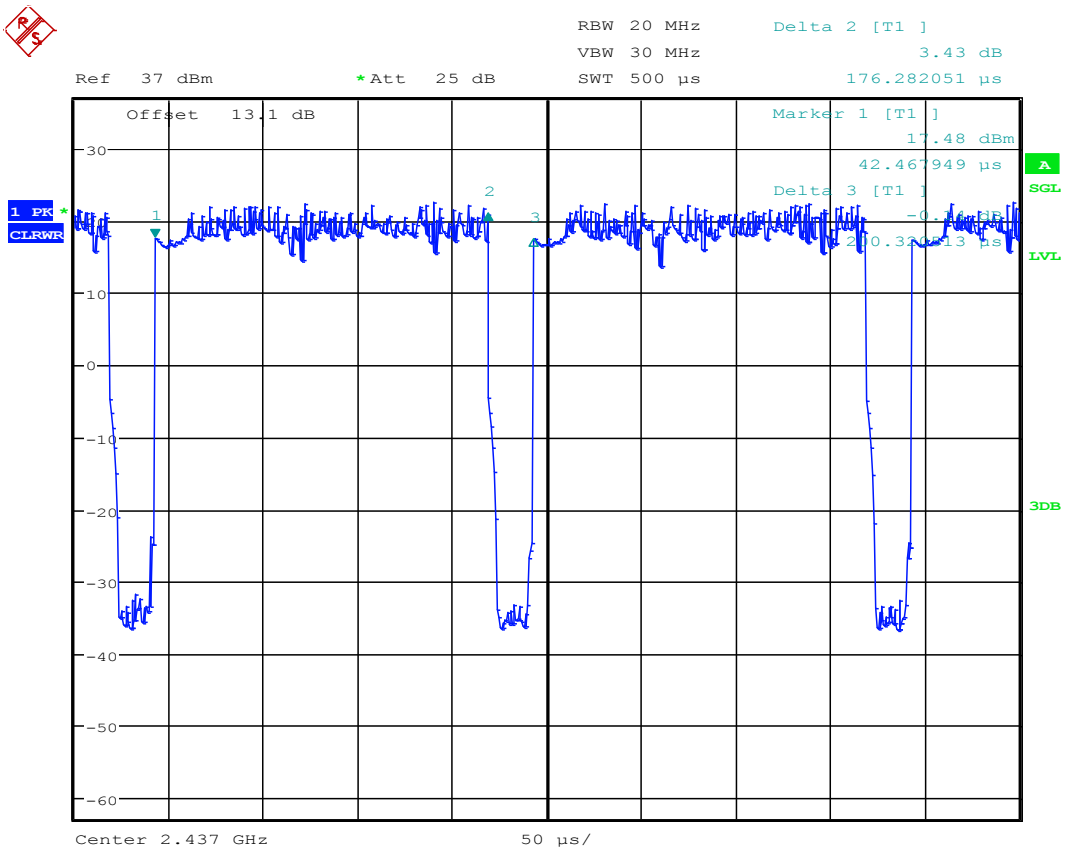
Mid channel / 2437 MHz	Modulation/Packet Type: 802.11g 6 Mbps



Date: 18.DEC.2019 18:04:59

Plot #4

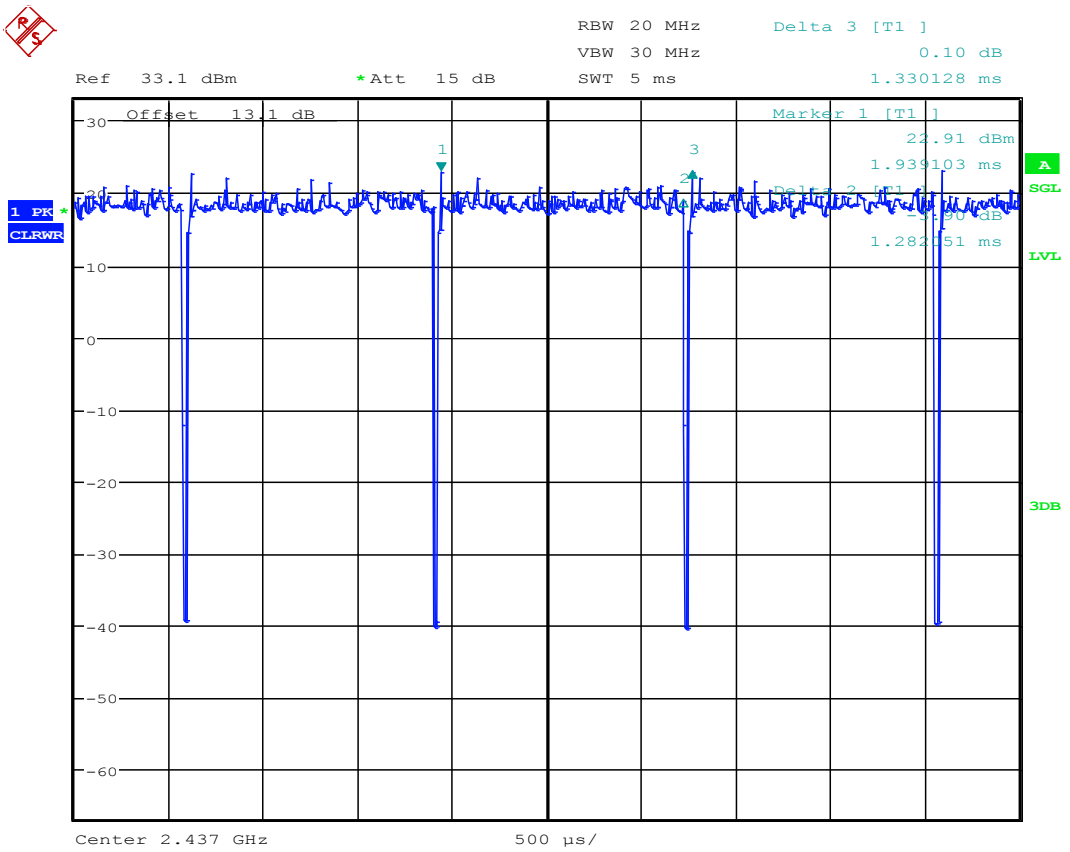
Mid channel / 2437 MHz	Modulation/Packet Type: 802.11g 54 Mbps



Date: 23.DEC.2019 17:28:30

Plot #5

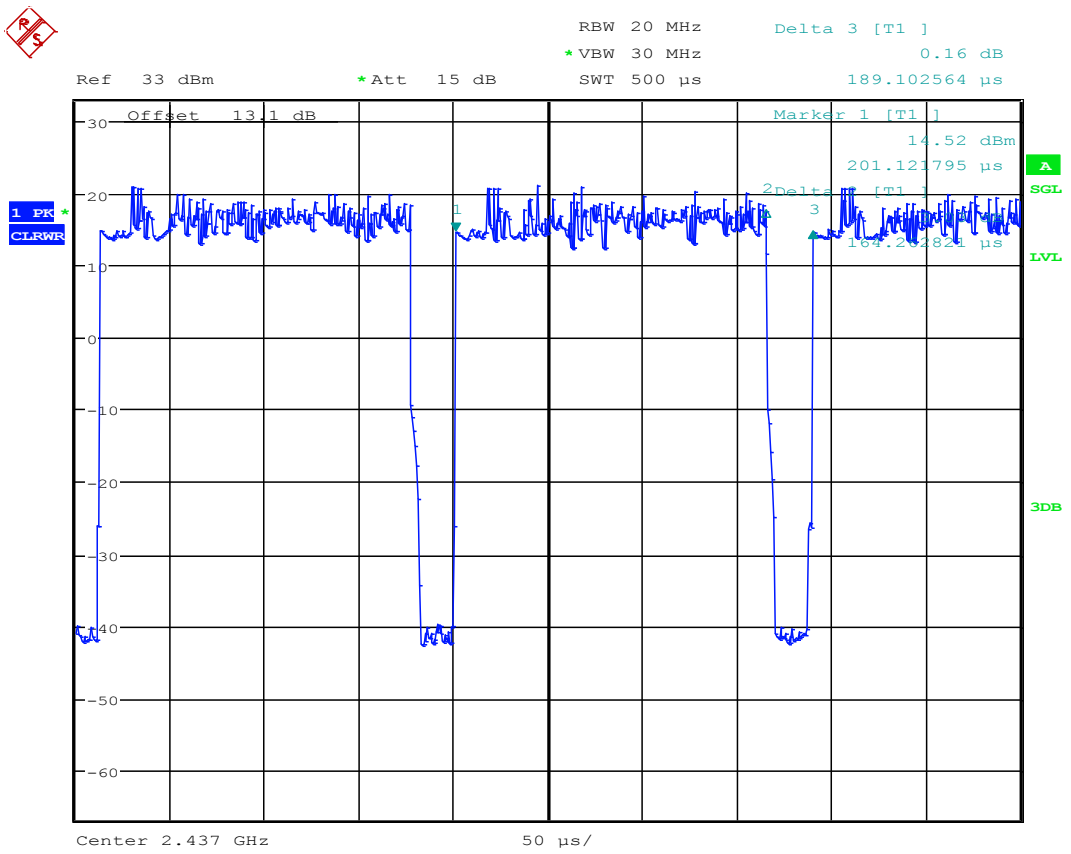
Mid channel / 2437 MHz	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:50:34

Plot #6

Low channel / 2437 MHz	Modulation/Packet Type: 802.11n_HT20 MCS7



Date: 9.DEC.2019 12:13:51

8.2 Maximum Conducted Output Power

8.2.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v04

Spectrum Analyzer settings:

- Measure the duty cycle, x, of the transmitter output signal.
- Set span to at least 1.5 □ OBW.
- Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
- Set VBW ≥ 3 □ RBW.
- Number of points in sweep ≥ 2 □ span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto.
- Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- Allow the sweep to "free run". RBW ≥ DTS bandwidth
- Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the on and off periods of the transmitter.
- Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the 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 RBW extending across the entire OBW of the spectrum.
- 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 (because the measurement represents an average over both the on- and off-times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25 %.

8.2.2 Limits:

Maximum Peak Output Power:

- FCC §15.247 (b)(1): 1 W
- IC RSS-247: 1 W

8.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Single Antenna Gain
22° C	2	802.11b/g/n	5VDC	0dBi

8.2.4 Measurement result:

Attenuation of cable and attenuator (already taken into account): 13.1 dB

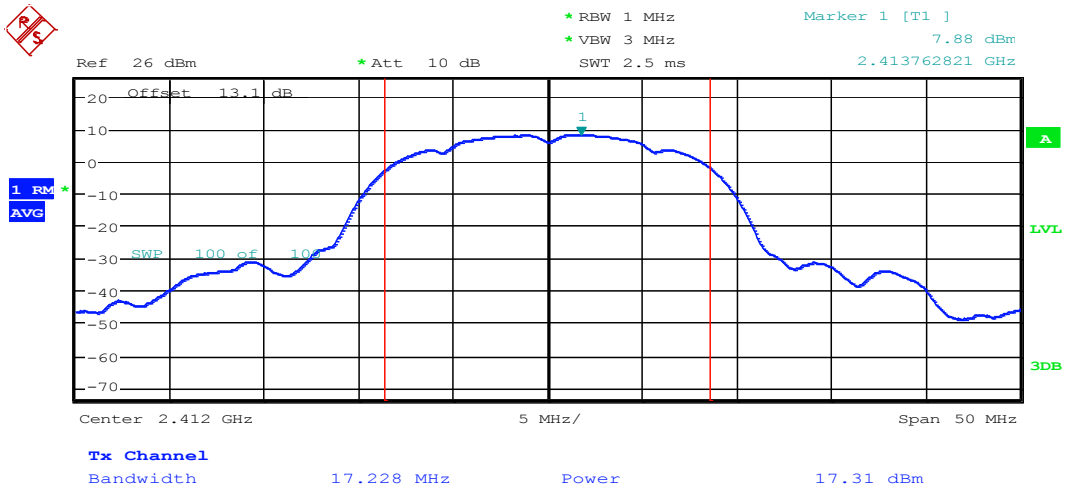
Plot #	Mode	Date Rate	Channel	Measured conducted powered(dBm)	Corrected by DCCF(dBm)	EIRP (dBm)	Limit (dBm)	Result
1	802.11b	1Mbps	1	17.31	17.31	19.31	30 / 36 (EIRP)	Pass
2			6	17.2	17.20	19.20	30 / 36 (EIRP)	Pass
3			11	16.94	16.94	18.94	30 / 36 (EIRP)	Pass
4		11Mbps	1	17.21	17.34	19.34	30 / 36 (EIRP)	Pass
5			6	17.02	17.15	19.15	30 / 36 (EIRP)	Pass
6			11	16.94	17.07	19.07	30 / 36 (EIRP)	Pass
7	802.11g	6Mbps	1	14.68	14.83	16.83	30 / 36 (EIRP)	Pass
8			6	14.51	14.66	16.66	30 / 36 (EIRP)	Pass
9			11	13.88	14.03	16.03	30 / 36 (EIRP)	Pass
10		54Mbps	1	14.52	15.08	17.08	30 / 36 (EIRP)	Pass
11			6	14.34	14.90	16.90	30 / 36 (EIRP)	Pass
12			11	13.06	13.62	15.62	30 / 36 (EIRP)	Pass
13	802.11n_HT20	MCS0	1	12.02	12.18	14.18	30 / 36 (EIRP)	Pass
14			6	11.9	12.06	14.06	30 / 36 (EIRP)	Pass
15			11	11.66	11.82	13.82	30 / 36 (EIRP)	Pass
16		MCS7	1	11.57	12.18	14.18	30 / 36 (EIRP)	Pass
17			6	11.41	12.02	14.02	30 / 36 (EIRP)	Pass
18			11	11.2	11.81	13.81	30 / 36 (EIRP)	Pass

Note: According to ANSI C63.10 §11.12.2.6, if Antenna Gain is less than 2 dBi, then 2 dBi should be used to determine the EIRP.

Plot #	Mode	Date Rate	Channel	Measured Peak conducted powered(dBm)	Limit (dBm)	Result
19	802.11b	1Mbps	6	20.78	30 / 36 (EIRP)	Pass
20	802.11b	11Mbps	6	23.46	30 / 36 (EIRP)	Pass
21	802.11g	6Mbps	6	22.7	30 / 36 (EIRP)	Pass
22	802.11g	54Mbps	6	23.16	30 / 36 (EIRP)	Pass
23	802.11n_HT20	MCS0	6	20.15	30 / 36 (EIRP)	Pass
24	802.11n_HT20	MCS7	6	20.17	30 / 36 (EIRP)	Pass

Plot #1

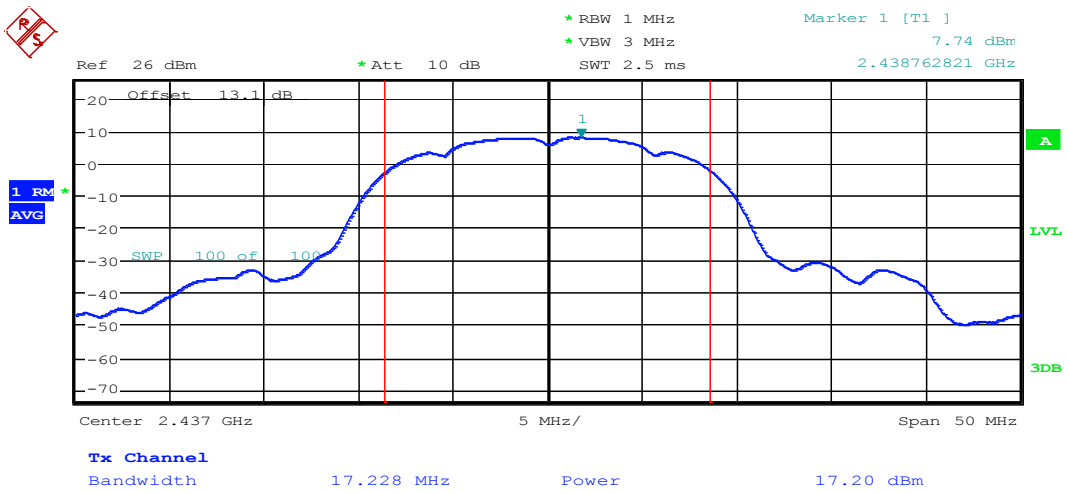
Low channel	Modulation/Packet Type: 802.11b 1 Mbps



Date: 9.DEC.2019 11:12:32

Plot #2

Mid channel	Modulation/Packet Type: 802.11b 1 Mbps

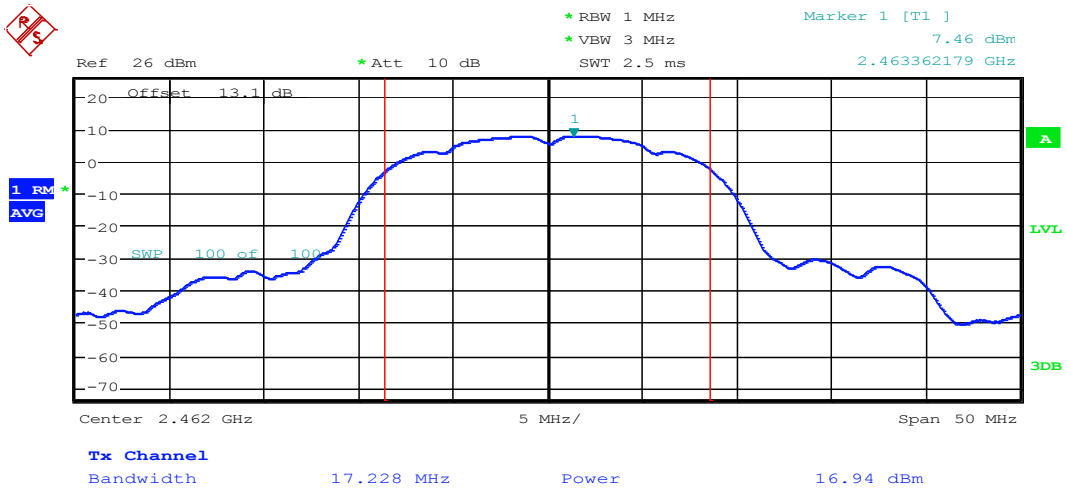


Tx Channel
Bandwidth 17.228 MHz Power 17.20 dBm

Date: 9.DEC.2019 11:03:49

Plot #3

High channel	Modulation/Packet Type: 802.11b 1 Mbps

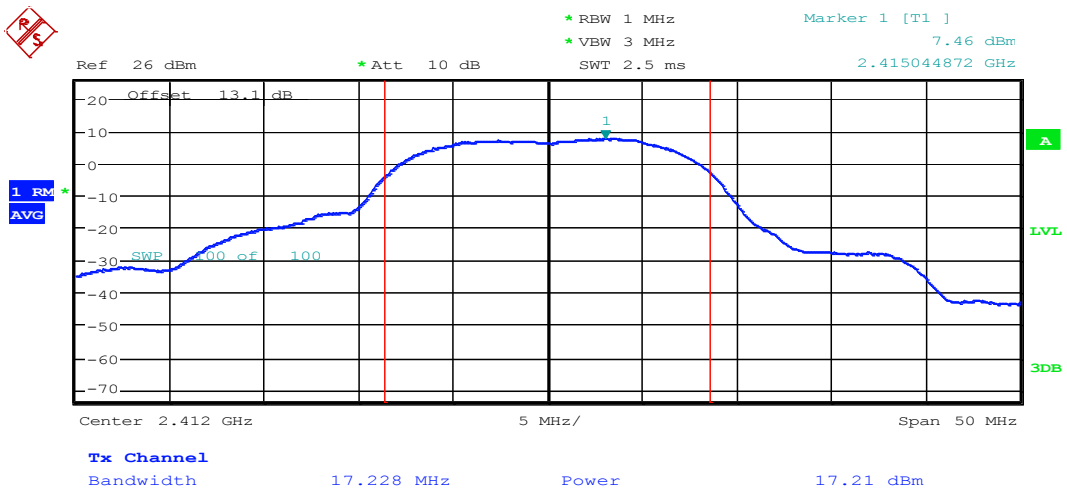


Tx Channel
Bandwidth 17.228 MHz Power 16.94 dBm

Date: 9.DEC.2019 11:11:40

Plot #4

Low channel	Modulation/Packet Type: 802.11b 11 Mbps

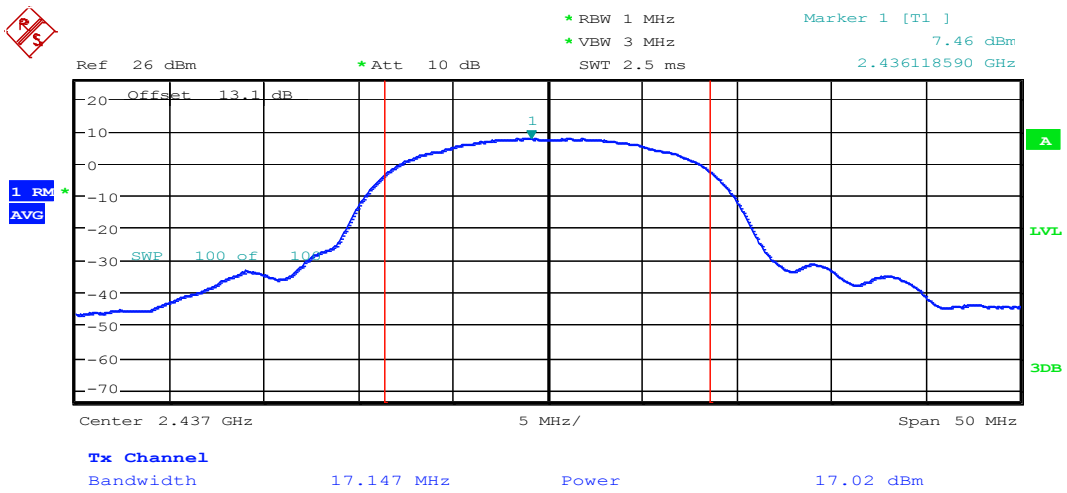


Tx Channel
Bandwidth 17.228 MHz Power 17.21 dBm

Date: 9.DEC.2019 14:22:28

Plot #5

Mid channel	Modulation/Packet Type: 802.11b 11 Mbps

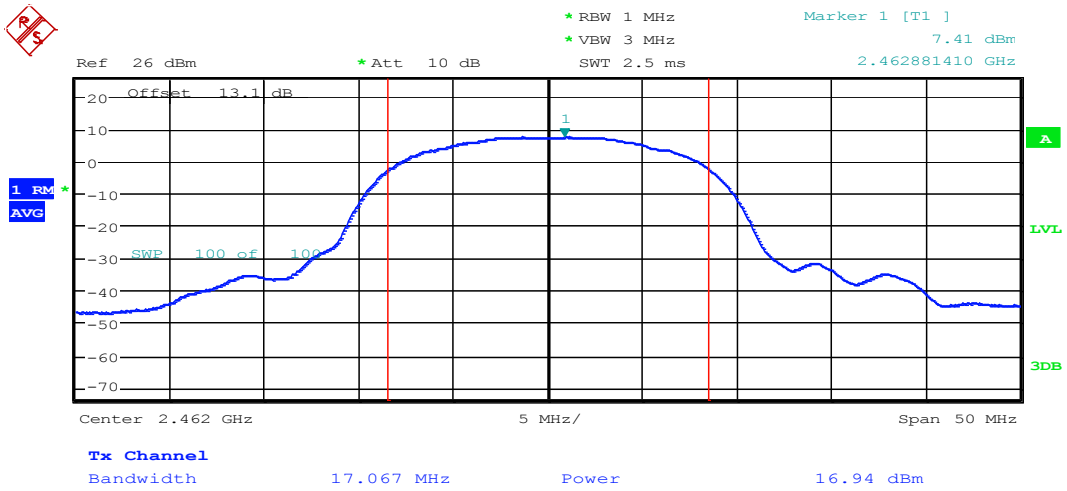


Tx Channel
Bandwidth 17.147 MHz Power 17.02 dBm

Date: 9.DEC.2019 14:22:49

Plot #6

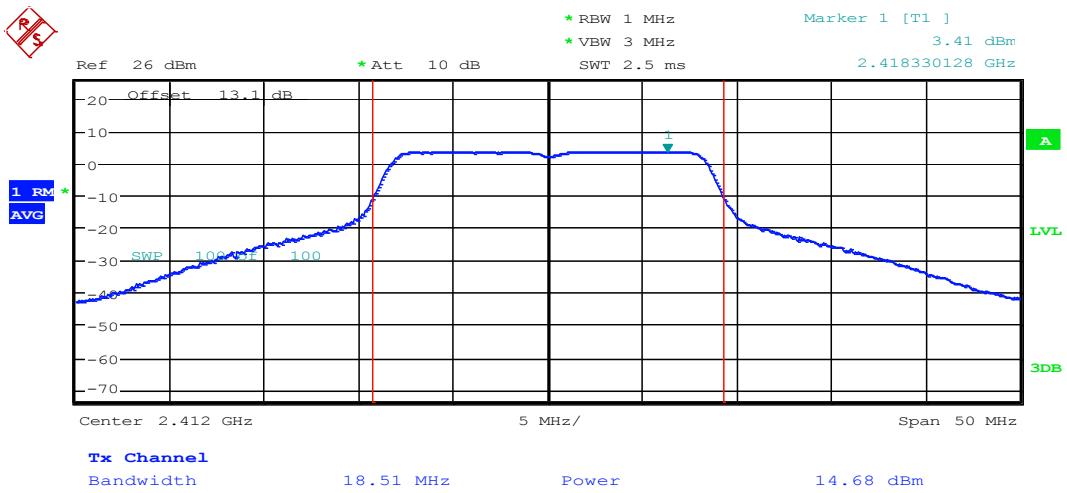
High channel	Modulation/Packet Type: 802.11b 11 Mbps



Date: 9.DEC.2019 14:27:54

Plot #7

Low channel	Modulation/Packet Type: 802.11g 6 Mbps

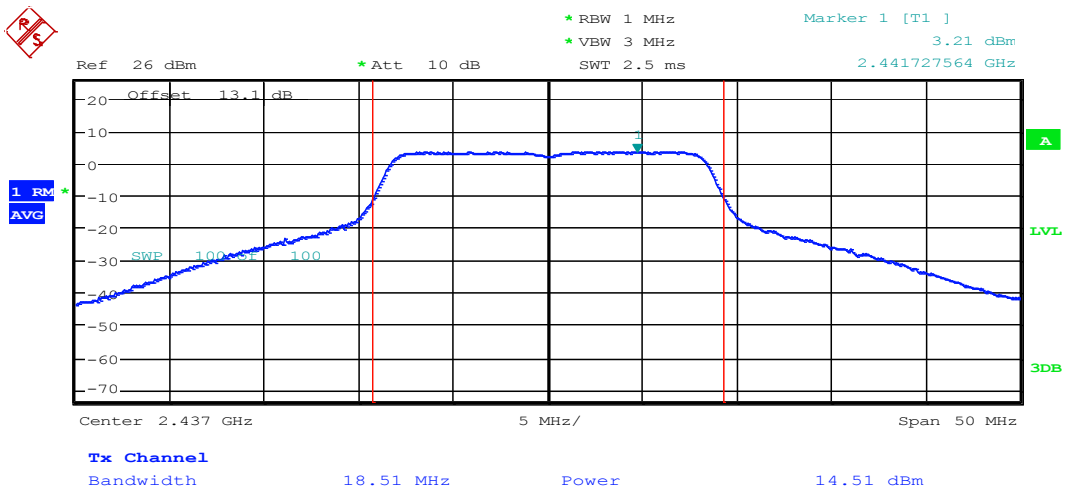


Tx Channel
Bandwidth 18.51 MHz Power 14.68 dBm

Date: 18.DEC.2019 17:56:29

Plot #8

Mid channel	Modulation/Packet Type: 802.11g 6 Mbps

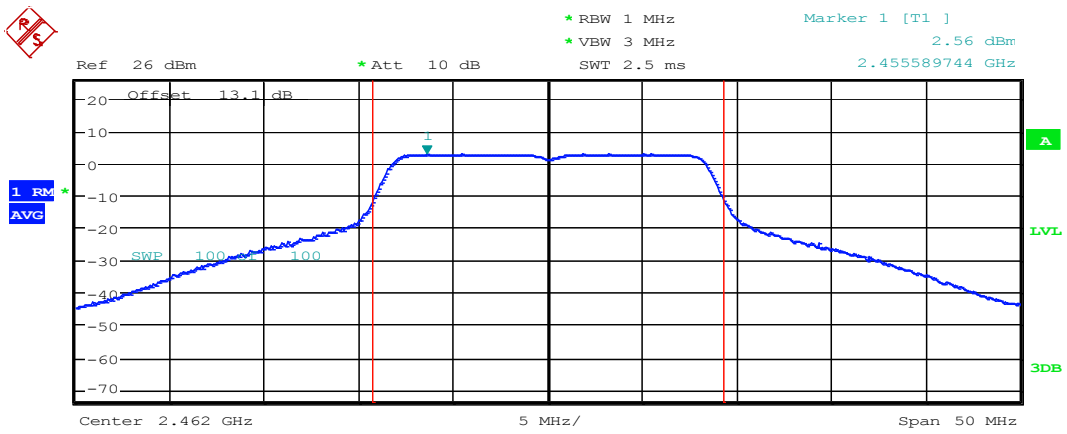


Tx Channel
Bandwidth 18.51 MHz Power 14.51 dBm

Date: 18.DEC.2019 18:02:16

Plot #9

High channel	Modulation/Packet Type: 802.11g 6 Mbps

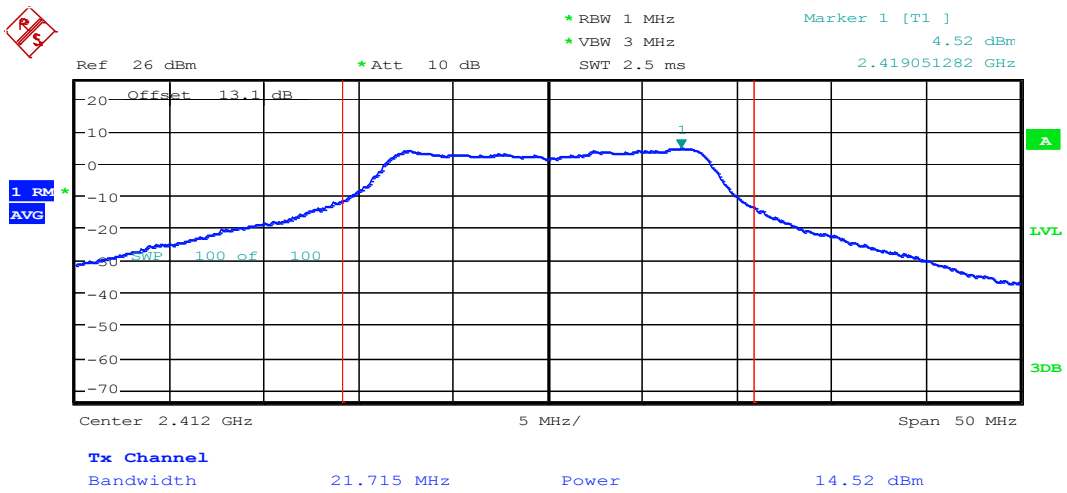


Tx Channel
Bandwidth 18.51 MHz Power 13.88 dBm

Date: 19.DEC.2019 10:52:04

Plot #10

Low channel	Modulation/Packet Type: 802.11g 54 Mbps

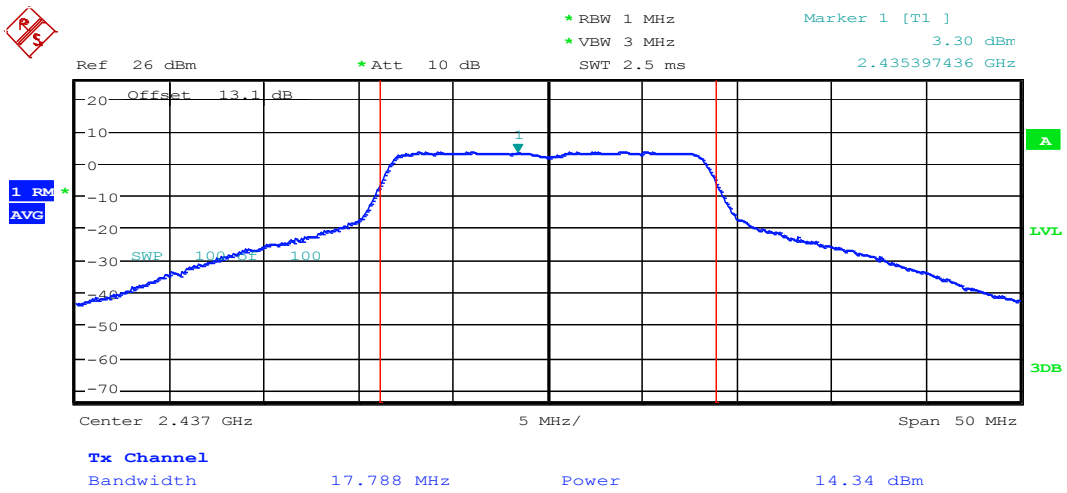


Tx Channel
Bandwidth 21.715 MHz Power 14.52 dBm

Date: 23.DEC.2019 17:29:33

Plot #11

Mid channel	Modulation/Packet Type: 802.11g 54 Mbps

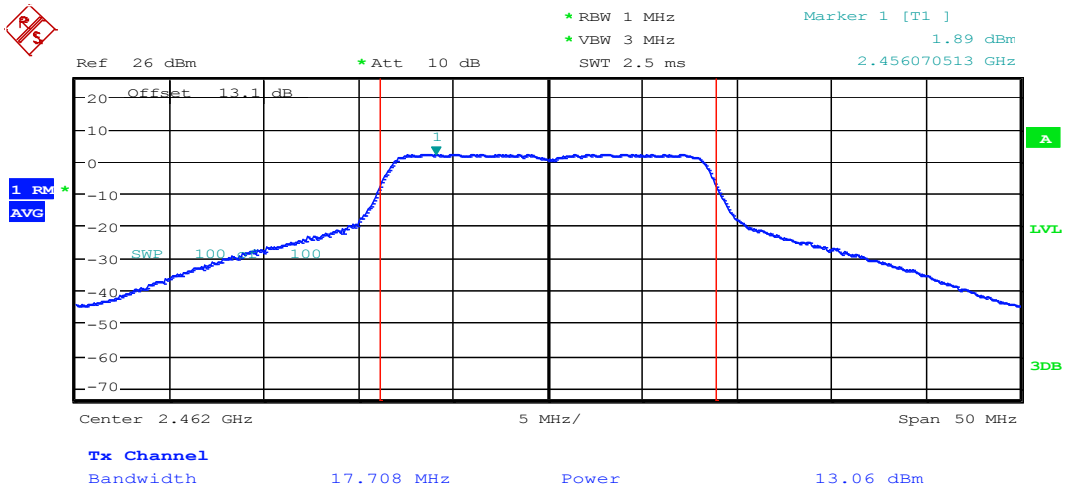


Tx Channel
Bandwidth 17.788 MHz Power 14.34 dBm

Date: 23.DEC.2019 17:31:12

Plot #12

High channel	Modulation/Packet Type: 802.11g 54 Mbps

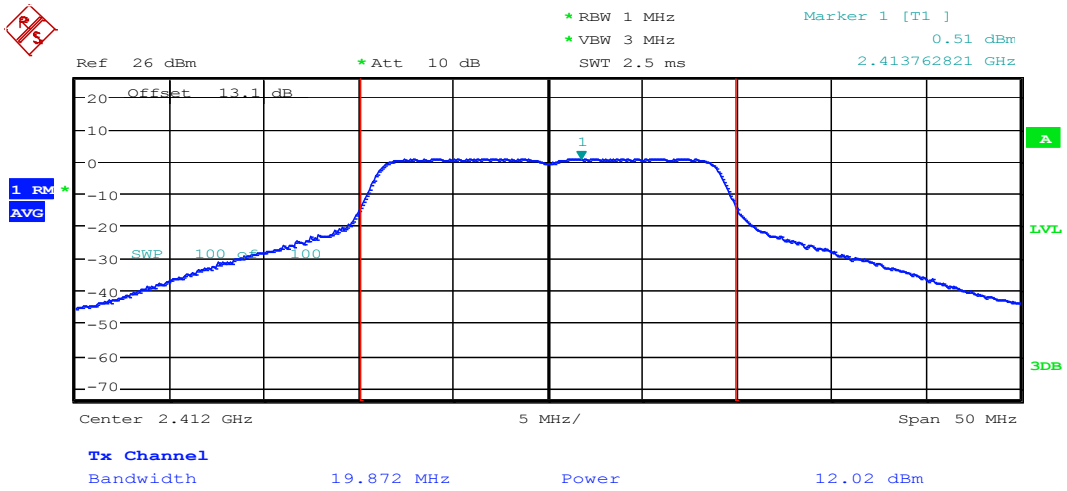


Tx Channel
Bandwidth 17.708 MHz Power 13.06 dBm

Date: 23.DEC.2019 17:34:33

Plot #13

Low channel	Modulation/Packet Type: 802.11n_HT20 MCS0

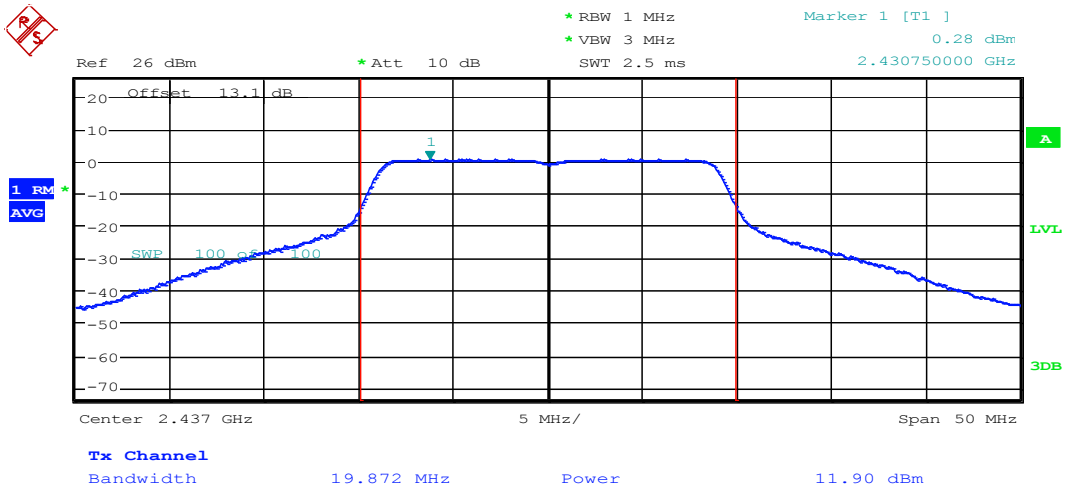


Tx Channel
Bandwidth 19.872 MHz Power 12.02 dBm

Date: 9.DEC.2019 11:45:29

Plot #14

Mid channel	Modulation/Packet Type: 802.11n_HT20 MCS0

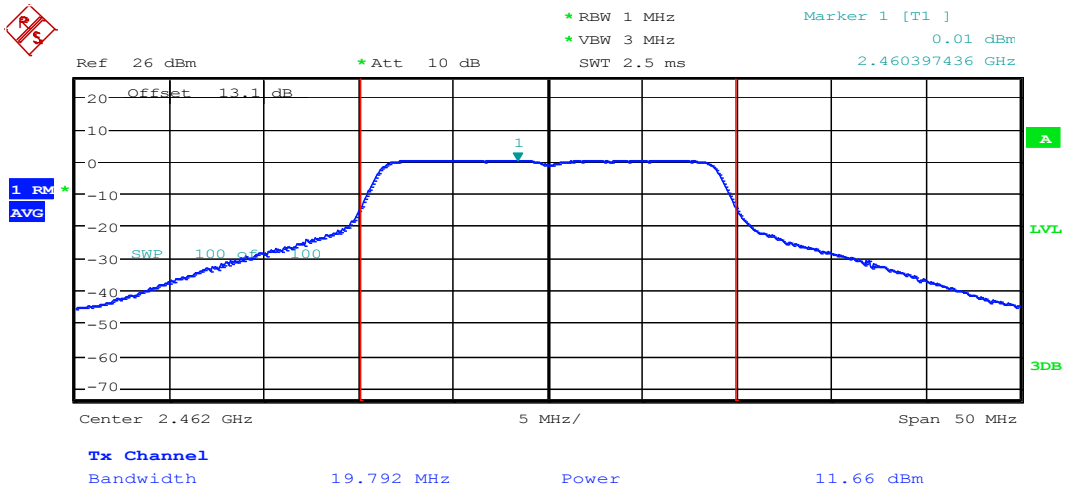


Tx Channel
Bandwidth 19.872 MHz Power 11.90 dBm

Date: 9.DEC.2019 11:48:50

Plot #15

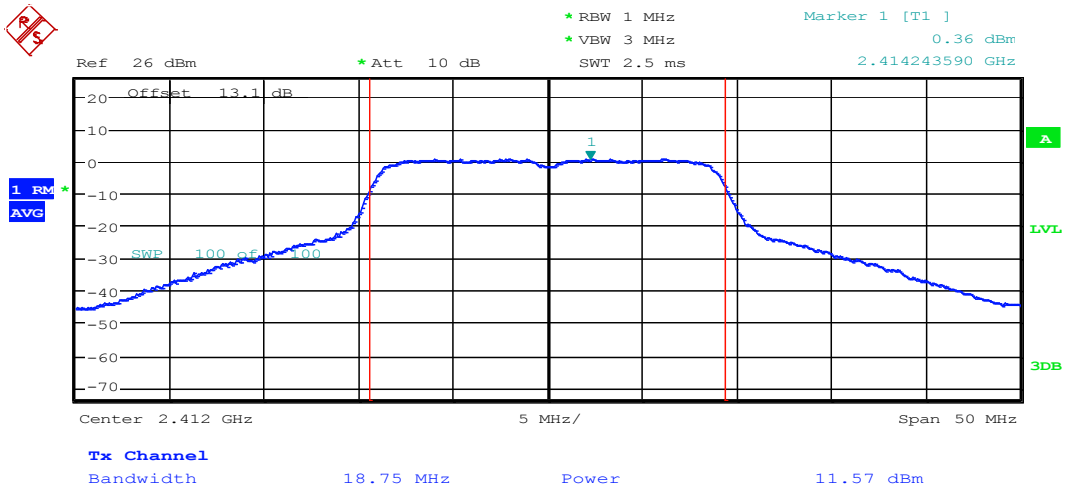
High channel	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:51:38

Plot #16

Low channel	Modulation/Packet Type: 802.11n_HT20 MCS7

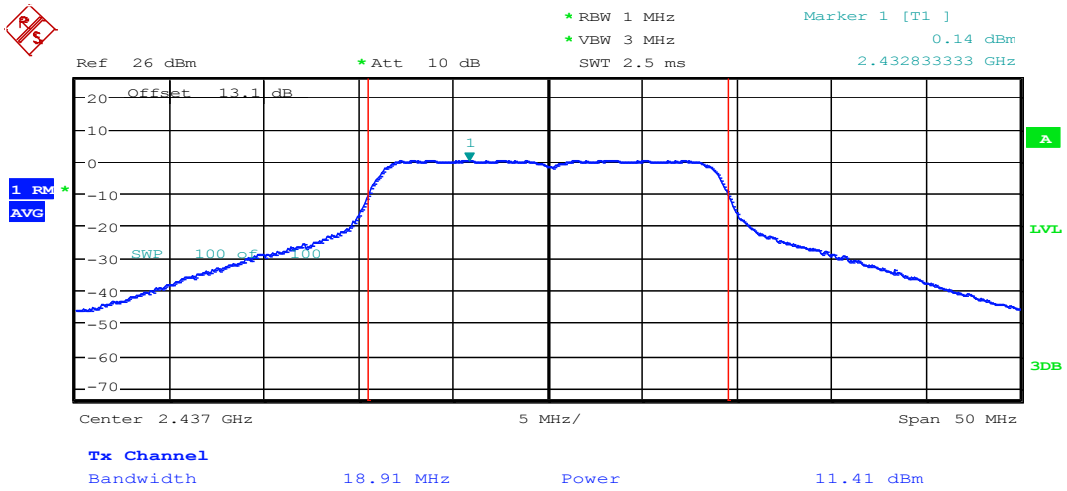


Tx Channel
Bandwidth 18.75 MHz Power 11.57 dBm

Date: 9.DEC.2019 12:09:33

Plot #17

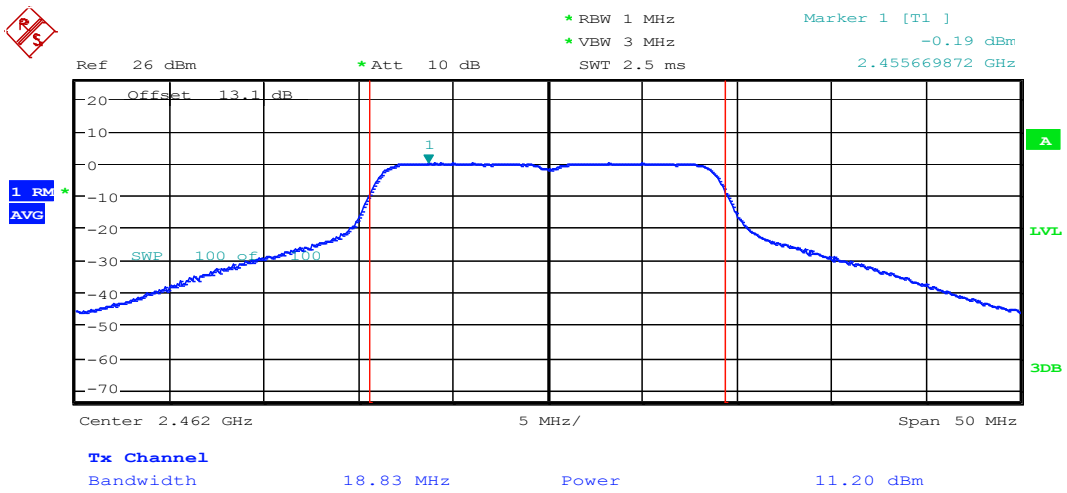
Mid channel	Modulation/Packet Type: 802.11n_HT20 MCS7



Date: 9.DEC.2019 12:10:46

Plot #18

High channel	Modulation/Packet Type: 802.11n_HT20 MCS0

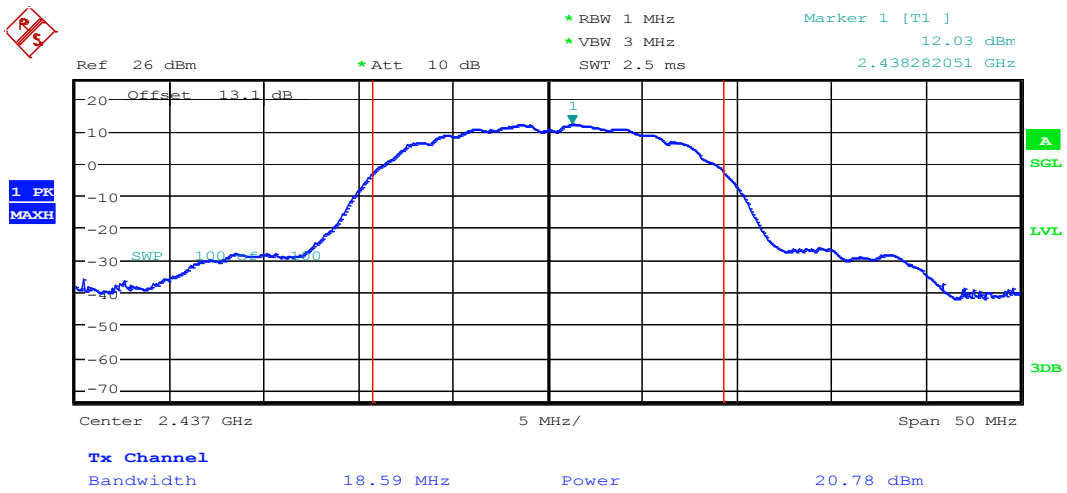


Tx Channel
Bandwidth 18.83 MHz Power 11.20 dBm

Date: 9.DEC.2019 12:14:36

Plot #19

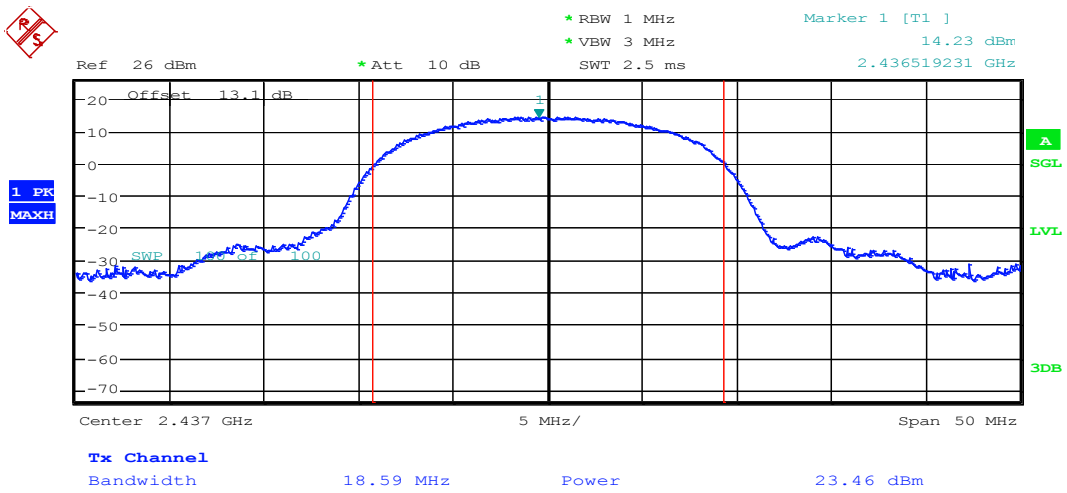
Mid channel	Modulation/Packet Type: 802.11b 1 Mbps



Date: 23.DEC.2019 17:39:08

Plot #20

Mid channel	Modulation/Packet Type: 802.11b 11 Mbps

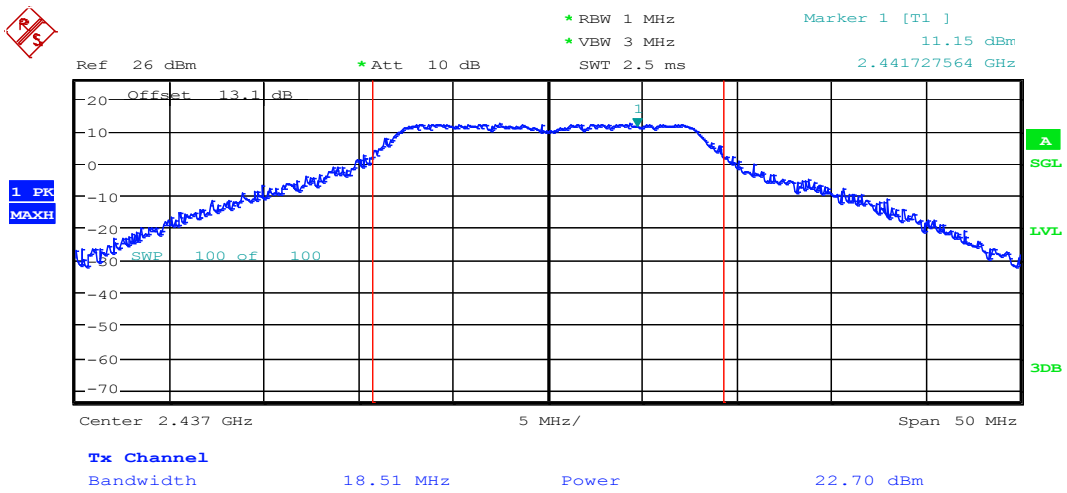


Tx Channel
Bandwidth 18.59 MHz Power 23.46 dBm

Date: 23.DEC.2019 17:40:01

Plot #21

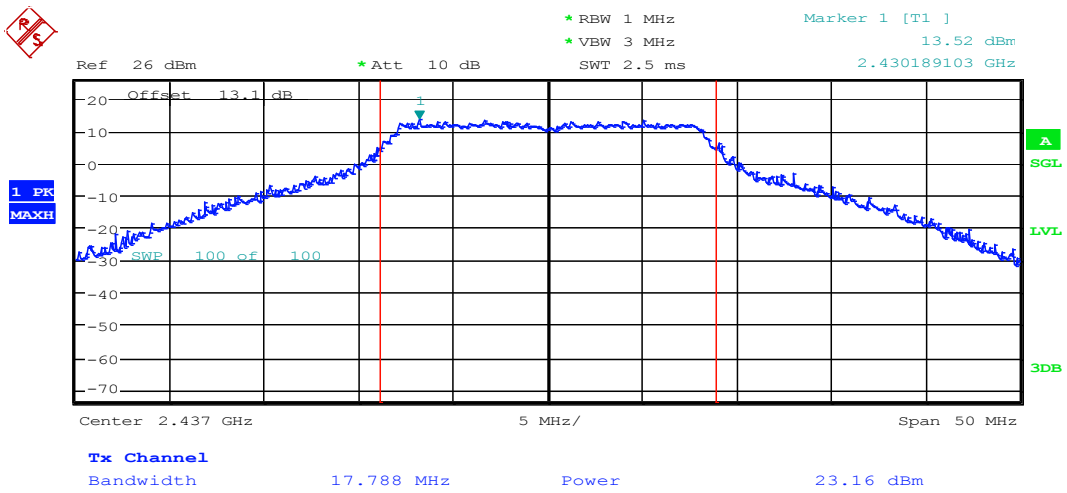
Mid channel	Modulation/Packet Type: 802.11g 6 Mbps



Date: 18.DEC.2019 18:02:47

Plot #22

Mid channel	Modulation/Packet Type: 802.11g 54 Mbps

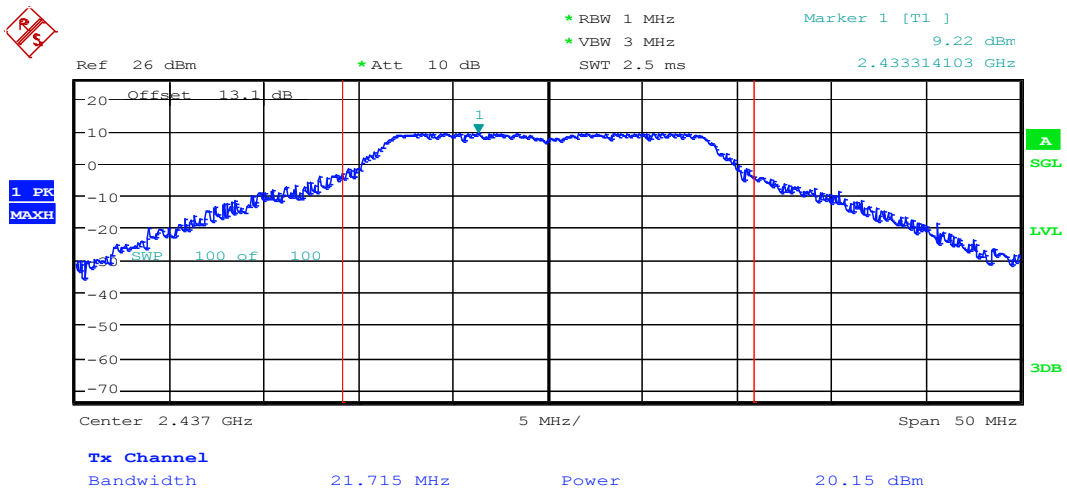


Tx Channel
Bandwidth 17.788 MHz Power 23.16 dBm

Date: 23.DEC.2019 17:32:12

Plot #23

Mid channel	Modulation/Packet Type: 802.11n_HT20 MCS0

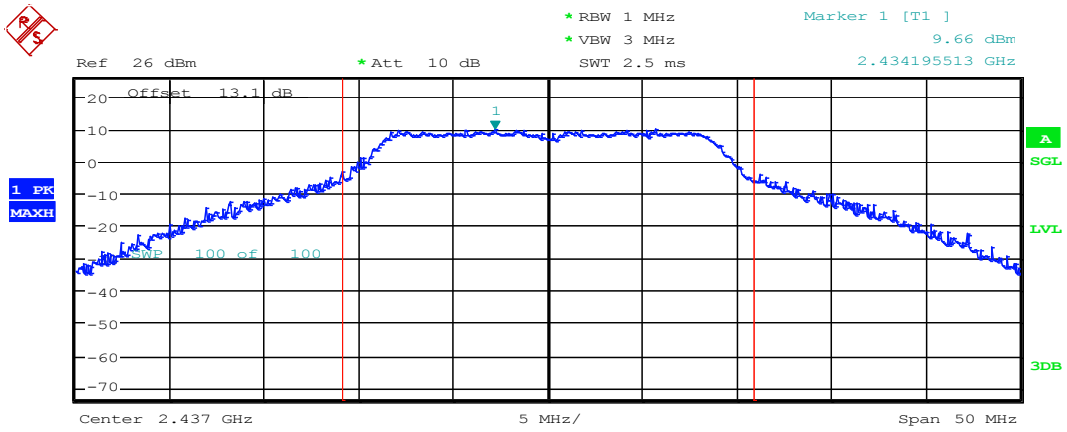


Tx Channel
Bandwidth 21.715 MHz Power 20.15 dBm

Date: 23.DEC.2019 17:55:25

Plot #24

Mid channel	Modulation/Packet Type: 802.11n_HT20 MCS7



Tx Channel

Bandwidth 21.715 MHz Power 20.17 dBm

Date: 23.DEC.2019 17:54:14

8.3 Power Spectral Density

8.3.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v04

Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 x DTS bandwidth
- Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz
- Set the VBW ≥ 3 x RBW
- Detector = Peak
- Sweep time = Auto couple
- Trace mode = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level within the RBW
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat

8.3.2 Limits:

FCC§15.247(e) & RSS-247 5.2(2)

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

8.3.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Single Antenna Gain
23° C	2	802.11b/g/n	5 VDC	0dBi

8.3.4 Measurement result:

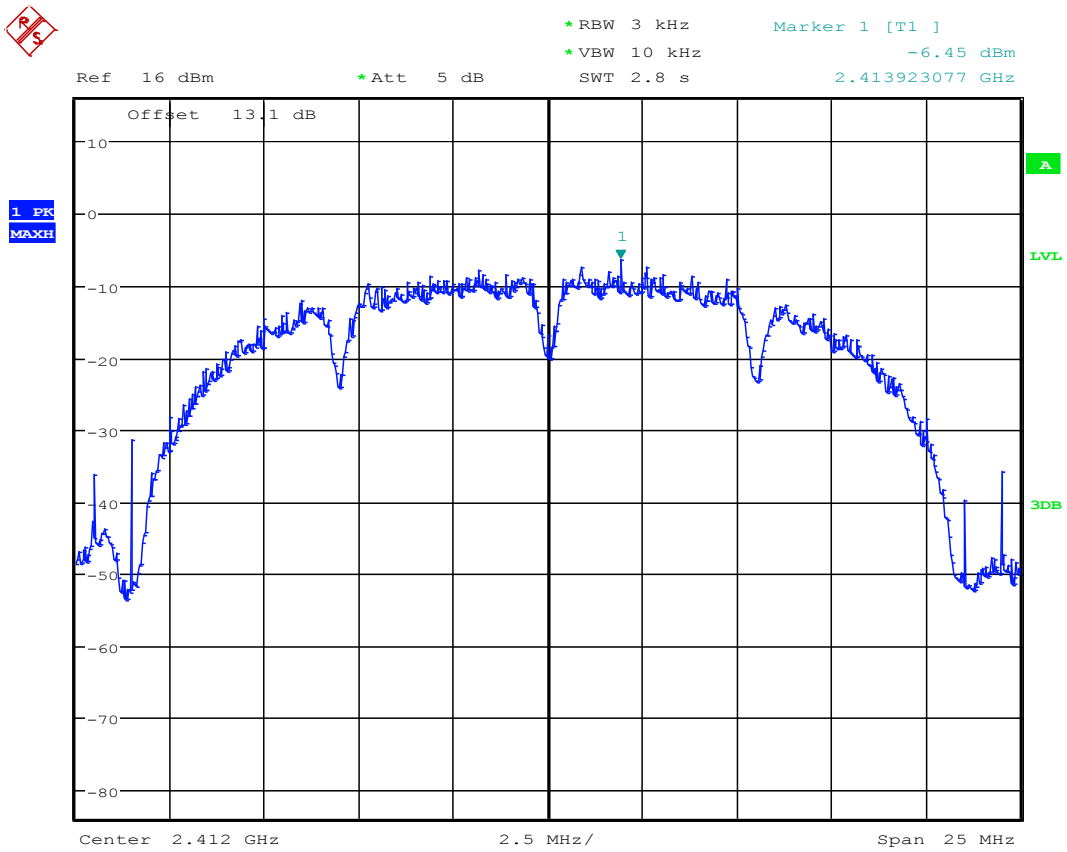
Attenuation of cable and attenuator (already taken into account): 13.1 dB

Plot #	Mode	Data Rate	channel	Maximum Power Spectral Density (dBm/3 kHz)	PSD Adjusted for Antenna Gain (dBm/3 kHz)	Limit (dBm / 3 kHz)	Result
1	802.11b	1Mpbs	1	-6.45	-4.45	8	Pass
2			6	-6.37	-4.37	8	Pass
3			11	-7.28	-5.28	8	Pass
4	802.11g	6Mpbs	1	-11.08	-9.08	8	Pass
5			6	-11.31	-9.31	8	Pass
6			11	-11.86	-9.86	8	Pass
7	802.11n_HT20	MCS0	1	-13.37	-11.37	8	Pass
8			6	-13.24	-11.24	8	Pass
9			11	-13.31	-11.31	8	Pass

Note: According to ANSI C63.10 §11.12.2.6, if Antenna Gain is less than 2 dBi, then 2 dBi should be used to determine the EIRP.

8.3.5 Measurement Plots:

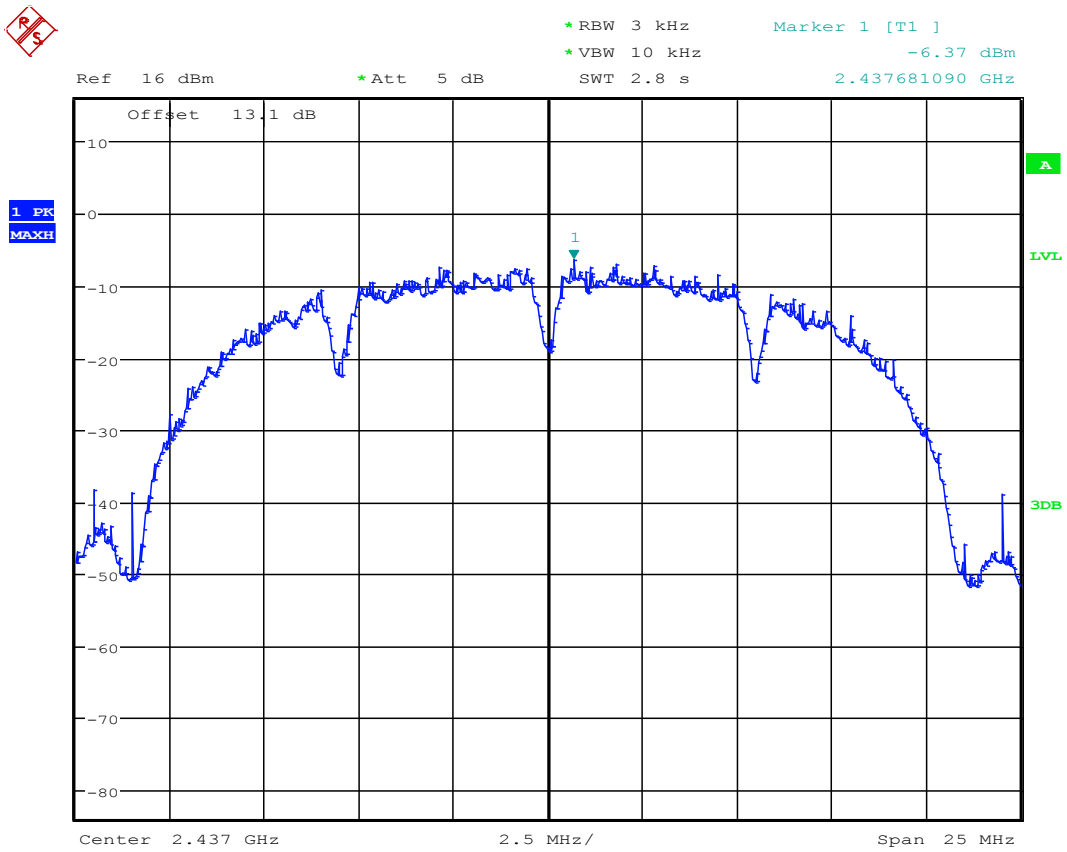
Plot #1	
Low channel	Modulation/Packet Type: 802.11b 1Mbps



Date: 9.DEC.2019 17:35:59

Plot #2

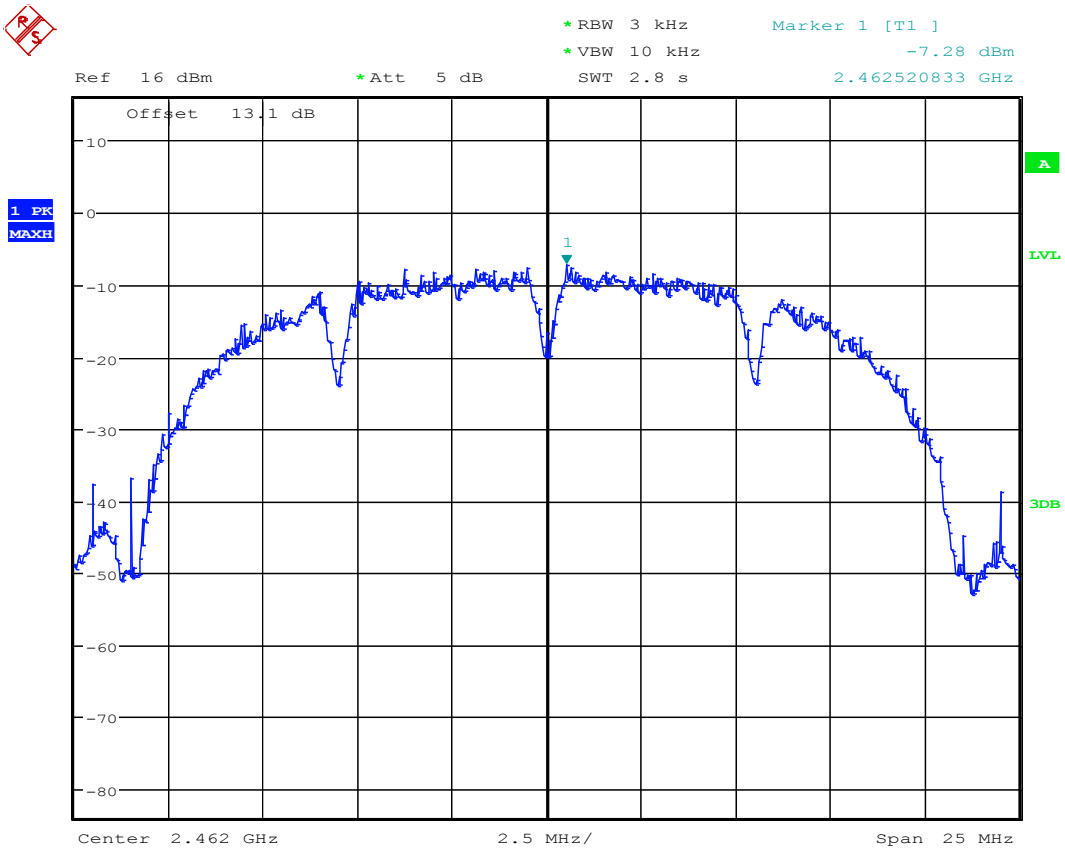
Mid channel	Modulation/Packet Type: 802.11b 1Mbps



Date: 9.DEC.2019 17:35:13

Plot #3

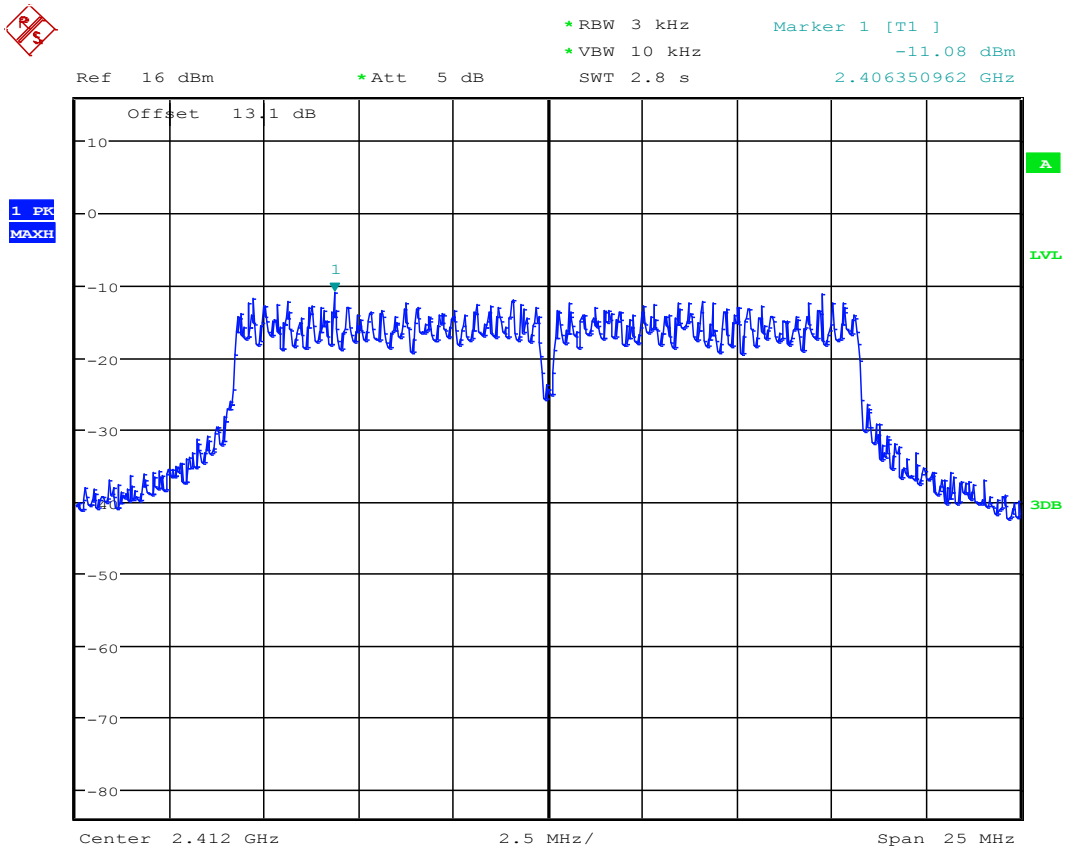
High channel	Modulation/Packet Type: 802.11b 1Mbps



Date: 9.DEC.2019 17:20:14

Plot #4

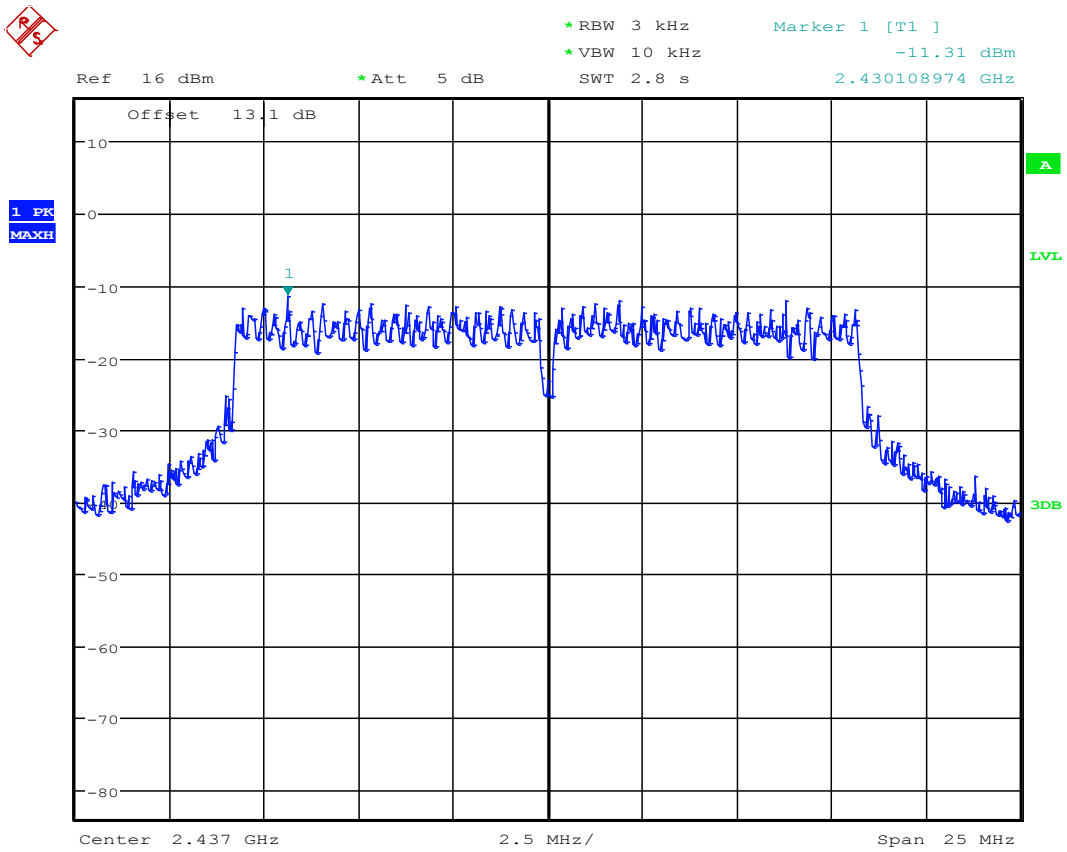
Low channel	Modulation/Packet Type: 802.11g 6Mbps



Date: 18.DEC.2019 17:57:32

Plot #5

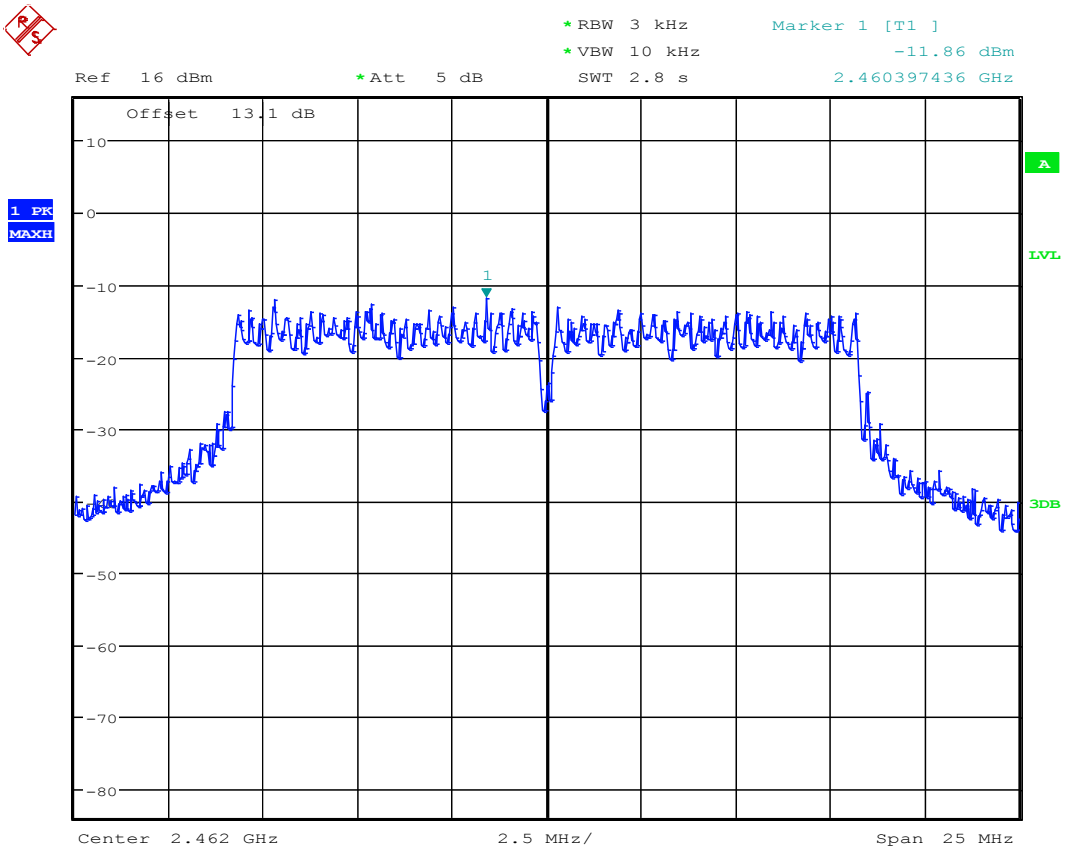
Mid channel	Modulation/Packet Type: 802.11g 6Mbps



Date: 18.DEC.2019 18:03:45

Plot #6

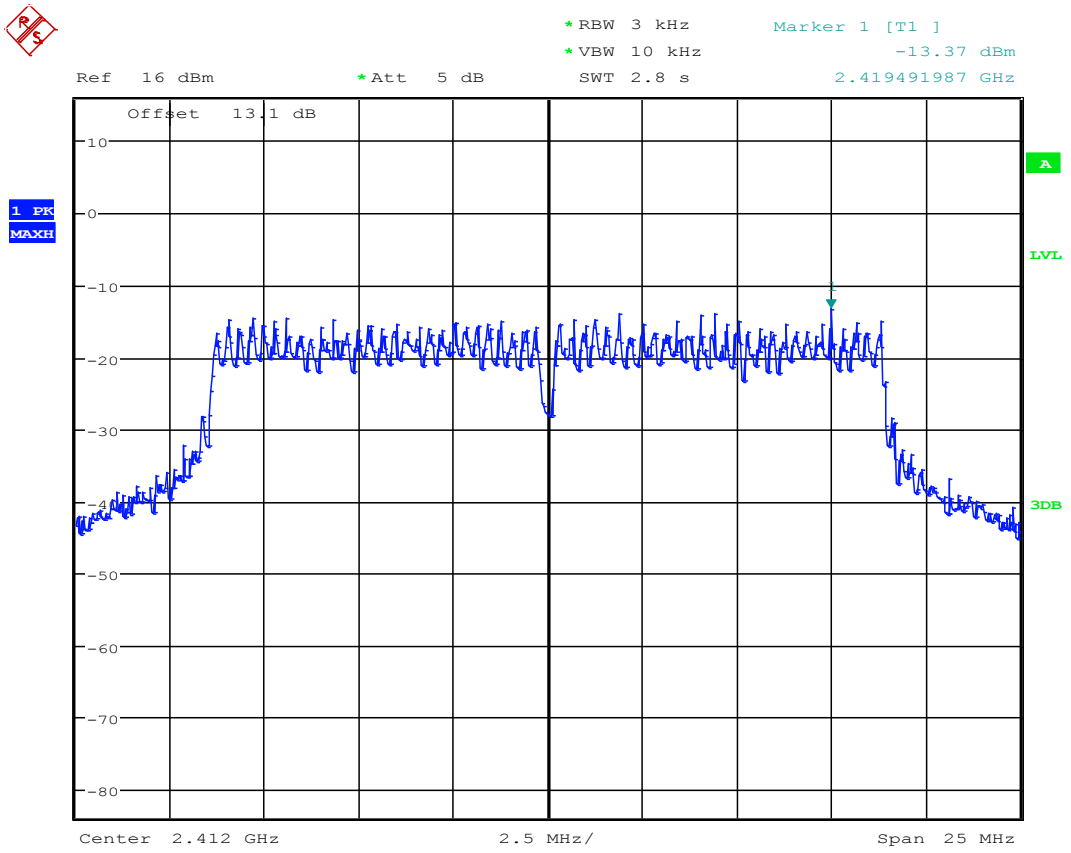
High channel	Modulation/Packet Type: 802.11g 6Mbps



Date: 19.DEC.2019 10:52:53

Plot #7

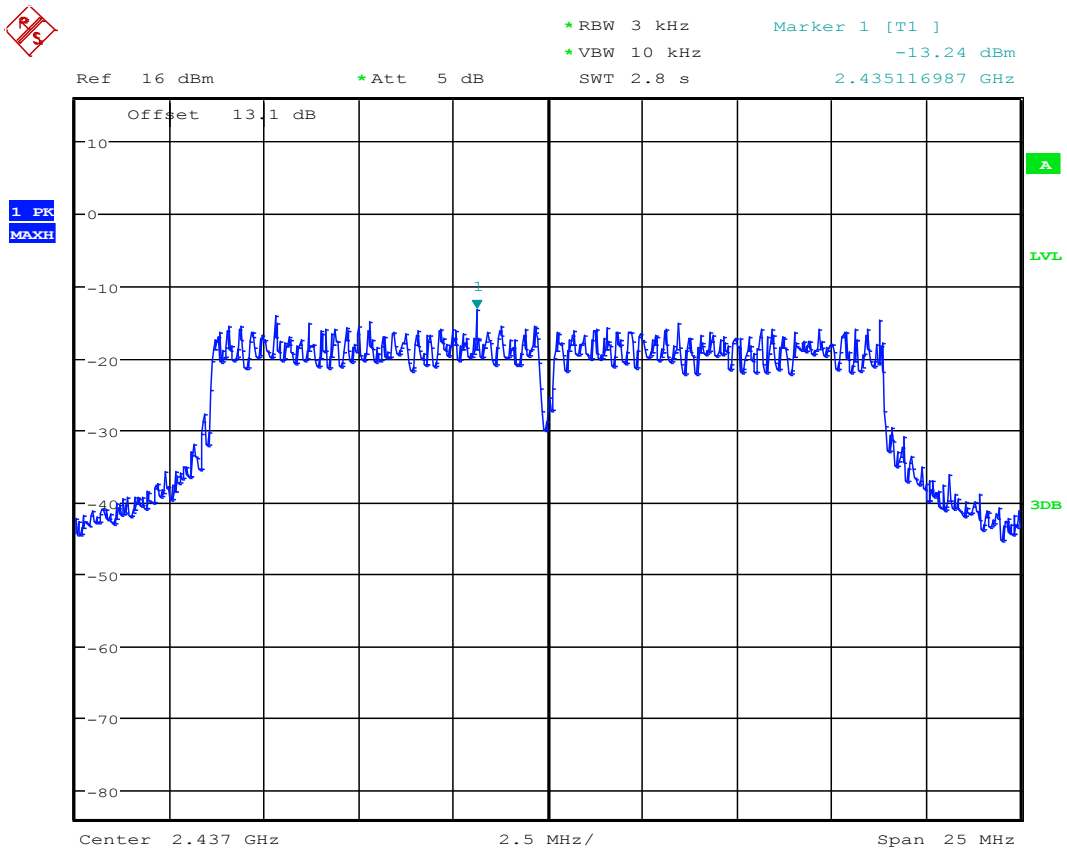
Low channel	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:47:39

Plot #8

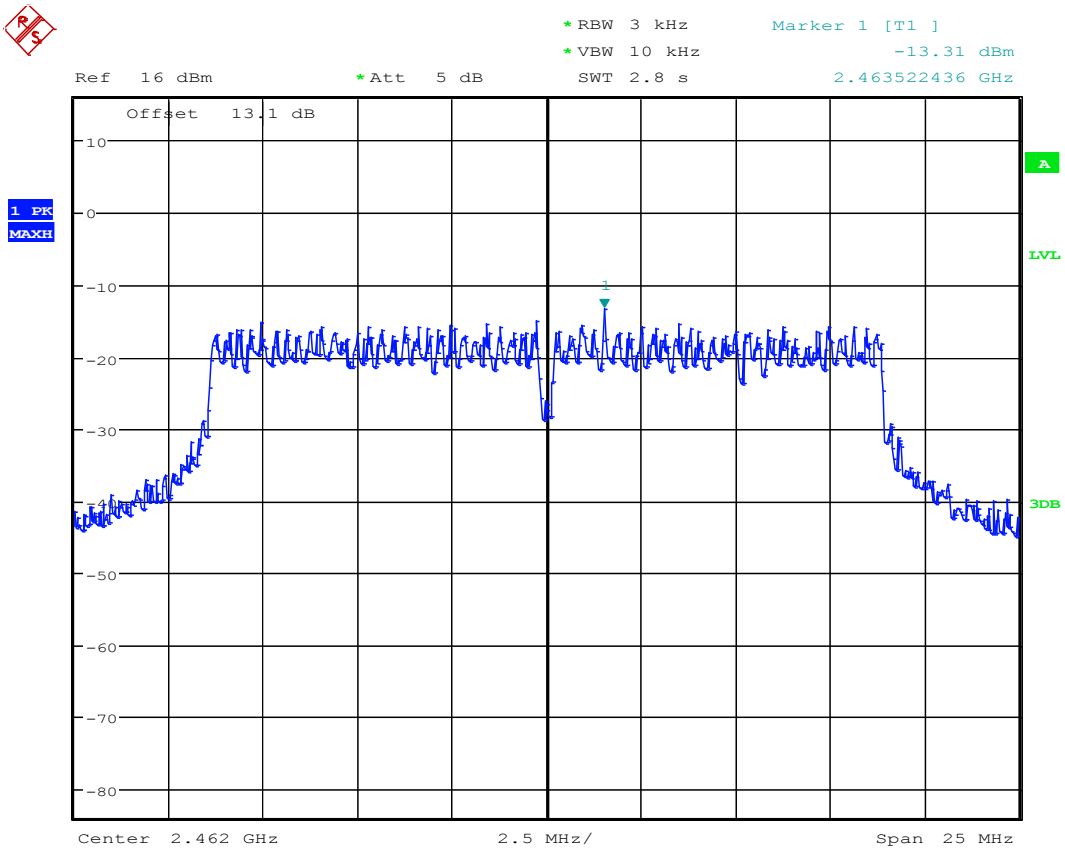
Mid channel	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:49:15

Plot #9

High channel	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:51:48

8.4 Band Edge Compliance

8.4.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v04

Spectrum Analyzer settings for band edge:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

8.4.2 Limits non restricted band:

FCC§15.247 (d)

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)).

RSS-247 5/5

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB.

Spectrum Analyzer settings for restricted band:

- Peak measurements are made using a peak detector and RBW=1 MHz

8.4.3 Limits restricted band §15.247/15.209/15.205 and RSS-Gen 8.9/8.10

- *PEAK LIMIT= 74 dBµV/m @3m =-21.23 dBm
- *AVG LIMIT= 54 dBµV/m @3m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

(b)

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

8.4.4 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Single Antenna Gain
22° C	2	802.11b/g/n	5 VDC	0 dBi

8.4.5 Measurement result:

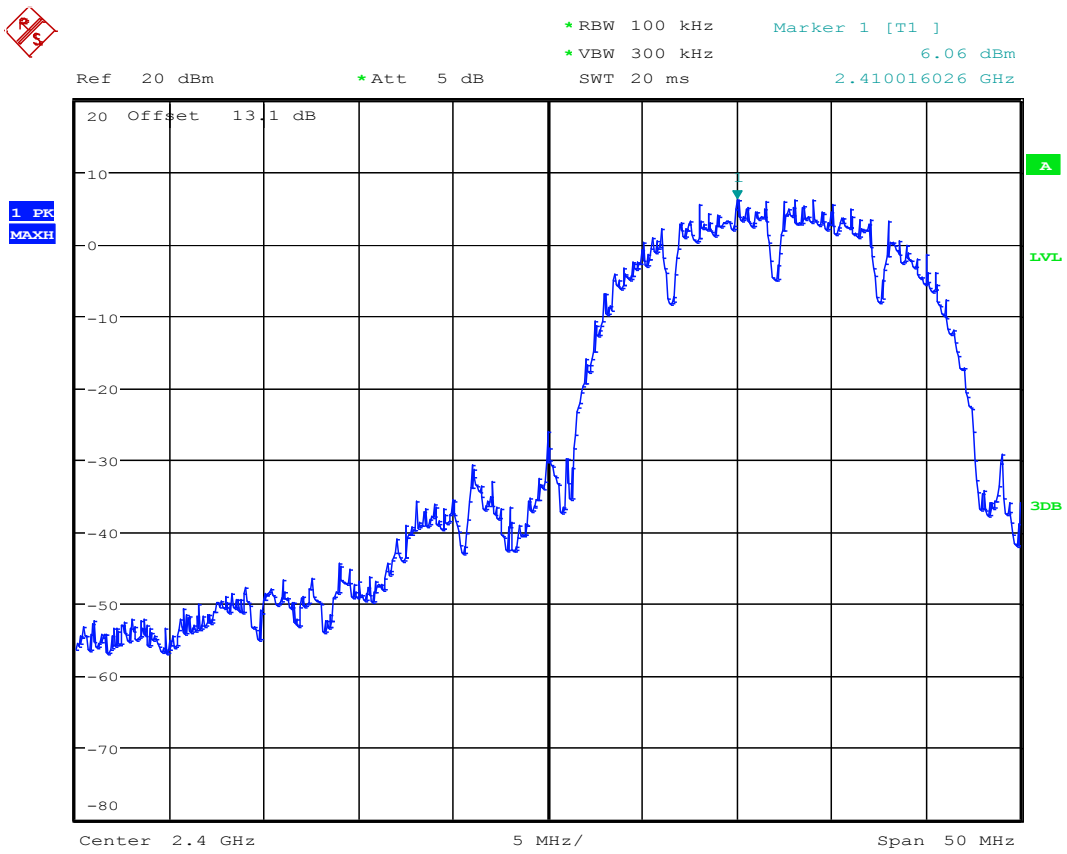
Plot #	EUT operating mode	Band Edge	Frequency (MHz)	Band Edge Delta (dBc)	Limit (dBc)	Result
1,2	802.11b	Lower, Non-restricted	2399.99	-31.29	-20	Pass
3,4	802.11g	Lower, Non-restricted	2399.59	-22.98	-20	Pass
5,6	802.11n_HT20	Lower, Non-restricted	2399.51	-23.38	-20	Pass

Plot #	EUT operating mode	Band Edge	Frequency (MHz)	Measured Peak Value (dBµV/m)	Corrected by duty cycle	Corrected by Antenna Gain (dBµV/m)	Limit (dBµV/m @3m)	Result
7	802.11b	Lower Restricted peak	2382.47	58.65	NA	58.65	74 Peak	Pass
7	802.11b	Lower Restricted Average	2382.47	51.49	51.49	51.49	54 AVG	Pass
8	802.11g	Lower Restricted peak	2390.00	71.03	NA	71.03	74 Peak	Pass
8	802.11g	Lower Restricted Average	2390.00	53.10	53.25	53.25	54 AVG	Pass
9	802.11n_HT20	Lower Restricted peak	2390.00	69.92	NA	69.92	74 Peak	Pass
9	802.11n_HT20	Lower Restricted Average	2390.00	46.26	46.41	46.41	54 AVG	Pass
10	802.11b	Upper Restricted peak	2491.59	56.85	NA	56.85	74 Peak	Pass
10	802.11b	Upper Restricted Average	2491.59	50.50	50.50	50.50	54 AVG	Pass
11,12	802.11g	Upper Restricted peak	2483.50	70.81	NA	70.81	74 Peak	Pass
11,12	802.11g	Upper Restricted Average	2483.50	52.66	52.81	52.81	54 AVG	Pass
13	802.11n_HT20	Upper Restricted peak	2483.50	69.50	NA	69.50	74 Peak	Pass
13	802.11n_HT20	Upper Restricted Average	2483.50	51.89	52.04	52.04	54 AVG	Pass

The value of above table shows worst case of each mode.

8.4.6 Measurement Plots:

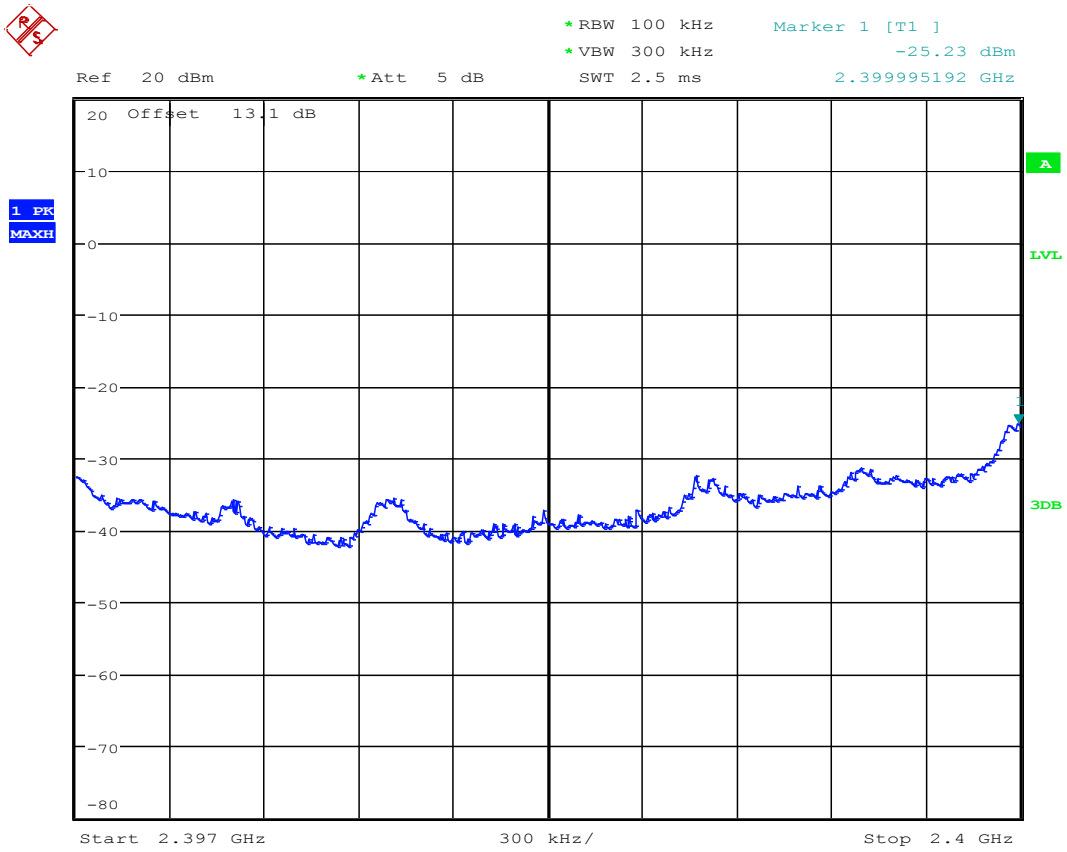
Plot #1	
Low channel / 2412 MHz	Modulation/Packet Type: 802.11b 1Mbps



Date: 9.DEC.2019 11:12:59

Plot #2

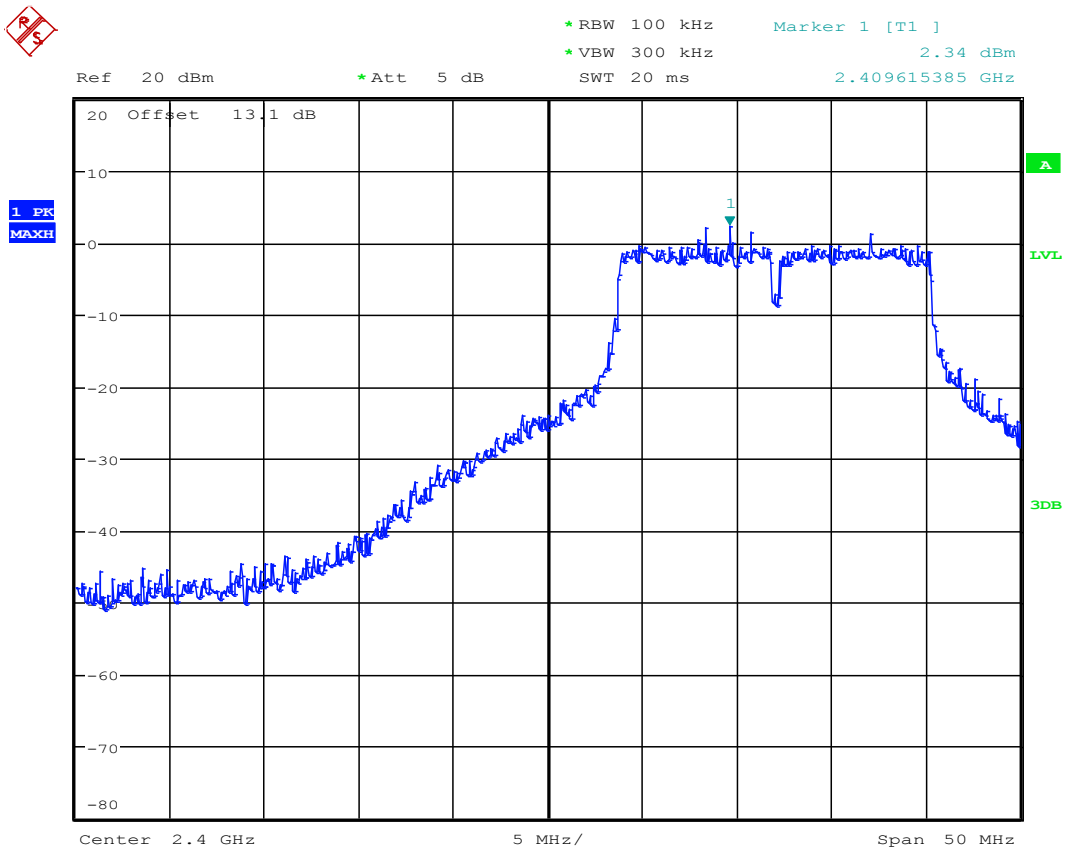
Low channel / 2412 MHz	Modulation/Packet Type: 802.11b 1Mbps



Date: 9.DEC.2019 11:13:04

Plot #3

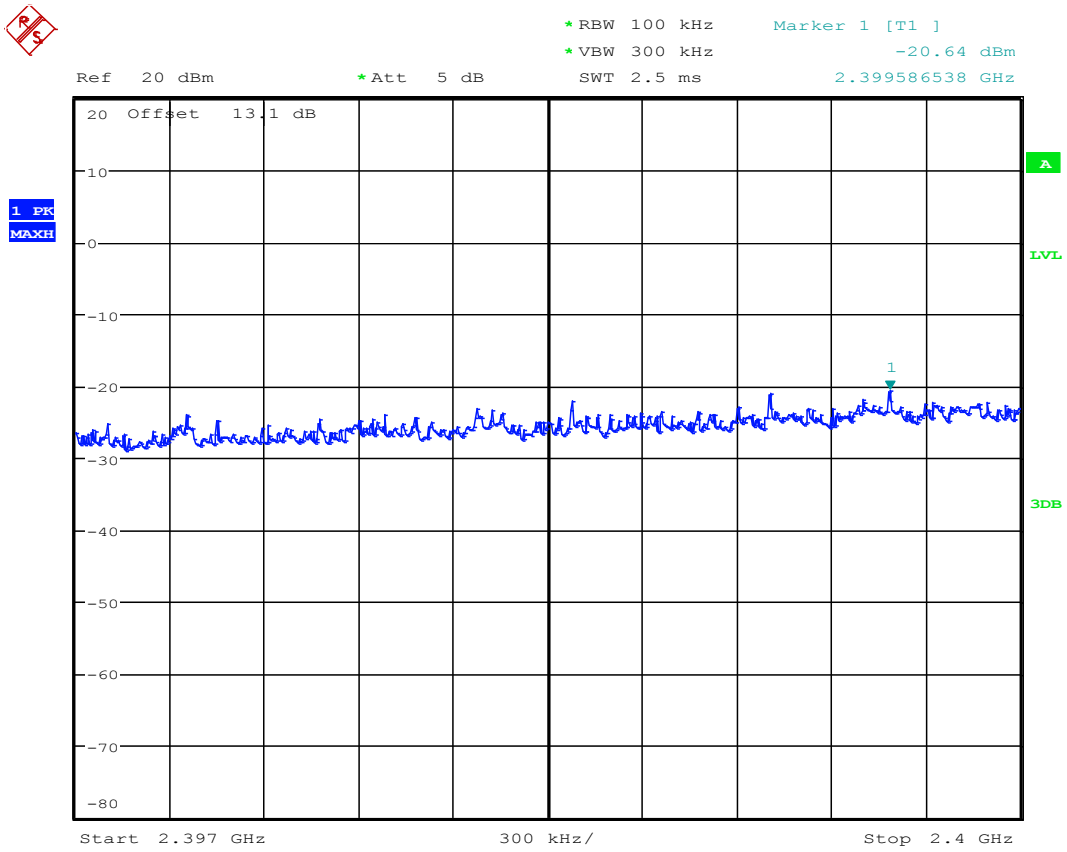
Low channel / 2412 MHz	Modulation/Packet Type: 802.11g 6Mpbs



Date: 18.DEC.2019 17:57:38

Plot #4

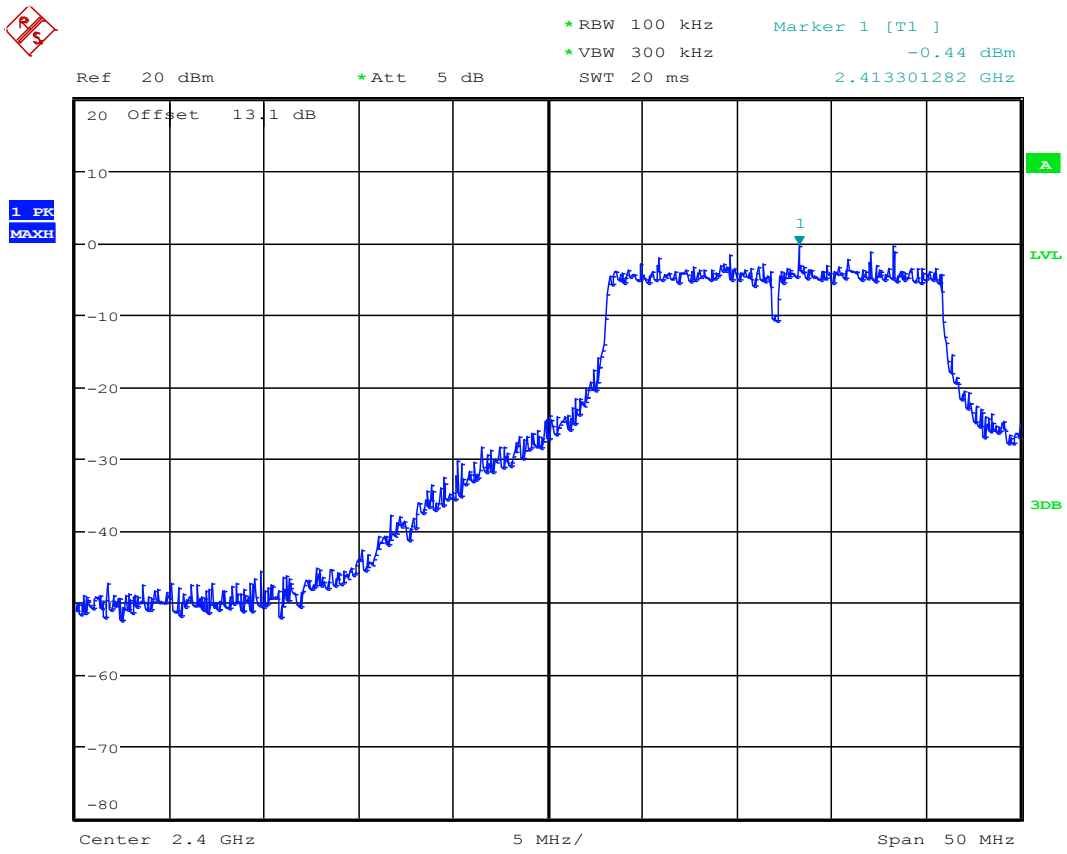
Low channel / 2412 MHz	Modulation/Packet Type: 802.11g 6Mpbs



Date: 18.DEC.2019 17:57:42

Plot #5

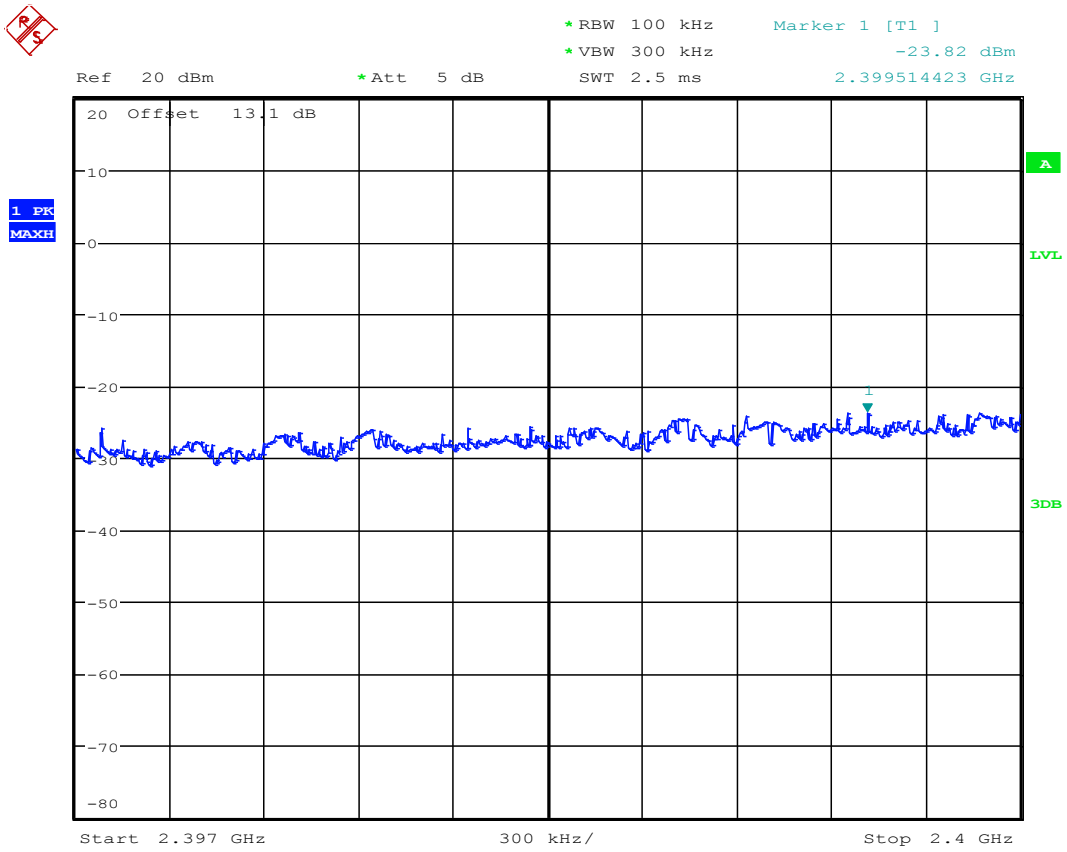
Low channel / 2412 MHz	Modulation/Packet Type: 802.11n_HT20 MCS0



Date: 9.DEC.2019 11:46:26

Plot #6

Low channel / 2412 MHz	Modulation/Packet Type: 802.11n_HT20 MCS0



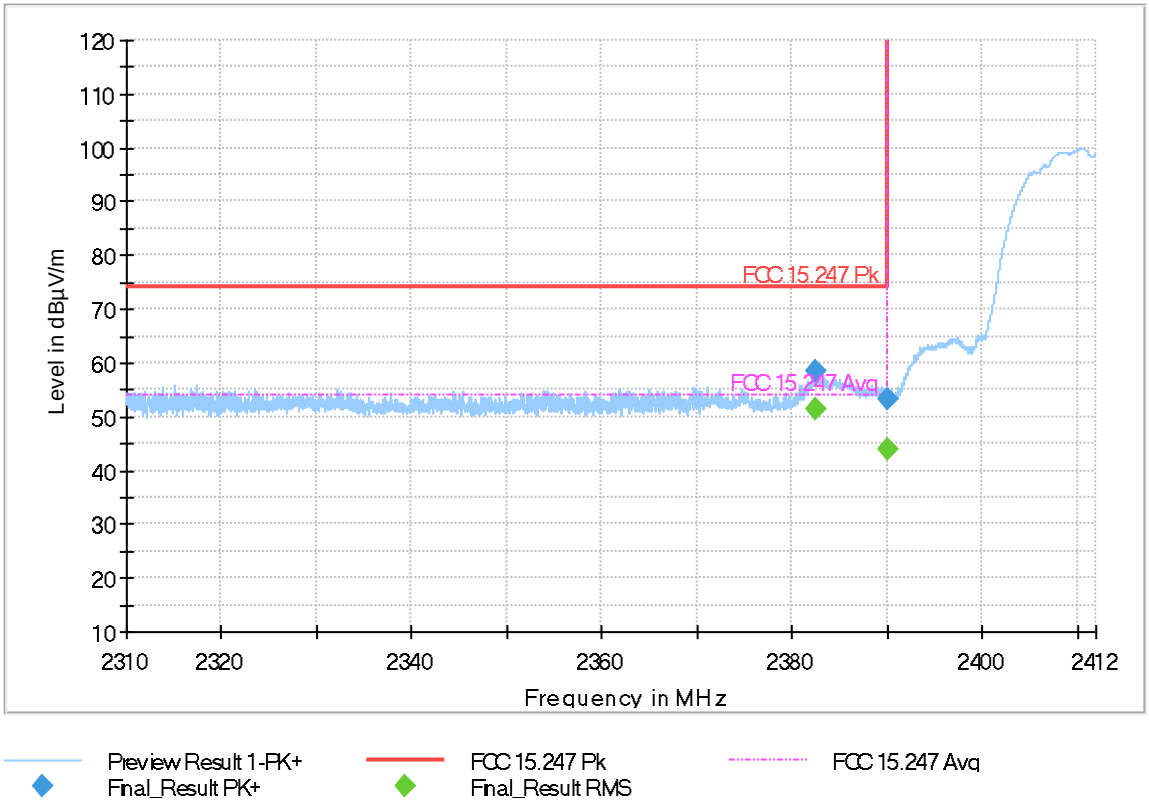
Date: 9.DEC.2019 11:46:31

Plot #7

Low channel / 2412 MHz	Modulation/Packet Type: 802.11b 1Mbps Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2382.471	---	51.486	54.00	2.51	300.0	1000.000	175.0	H	91.0	6.1	
2382.471	58.652	---	74.00	15.35	300.0	1000.000	175.0	H	91.0	6.1	
2390.000	---	43.792	54.00	10.21	300.0	1000.000	154.0	H	278.0	6.2	
2390.000	53.325	---	74.00	20.68	300.0	1000.000	154.0	H	278.0	6.2	

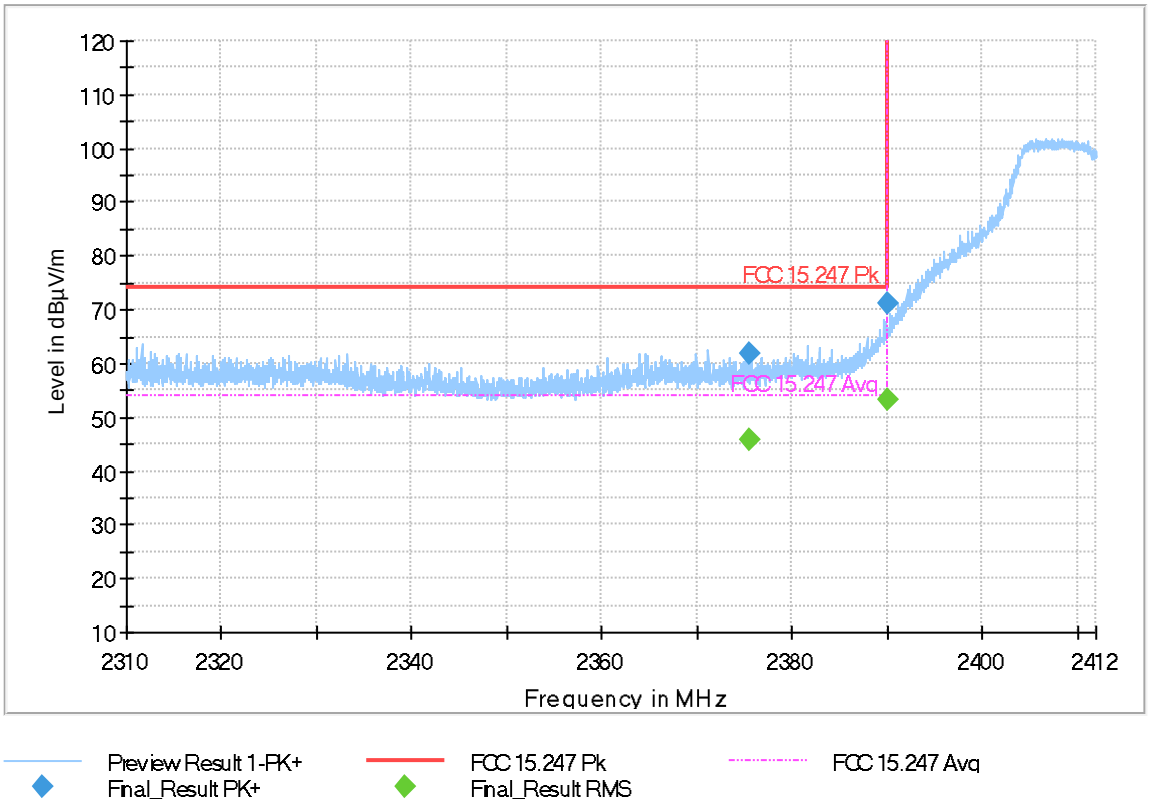


Plot #8

Low channel / 2412 MHz	Modulation/Packet Type: 802.11g 6Mbps Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2375.484	61.849	---	74.00	12.15	300.0	1000.000	181.0	H	91.0	6.0	
2375.484	---	45.850	54.00	8.15	300.0	1000.000	181.0	H	91.0	6.0	
2390.000	71.025	---	74.00	2.97	300.0	1000.000	175.0	H	94.0	6.2	
2390.000	---	53.096	54.00	0.90	300.0	1000.000	175.0	H	94.0	6.2	

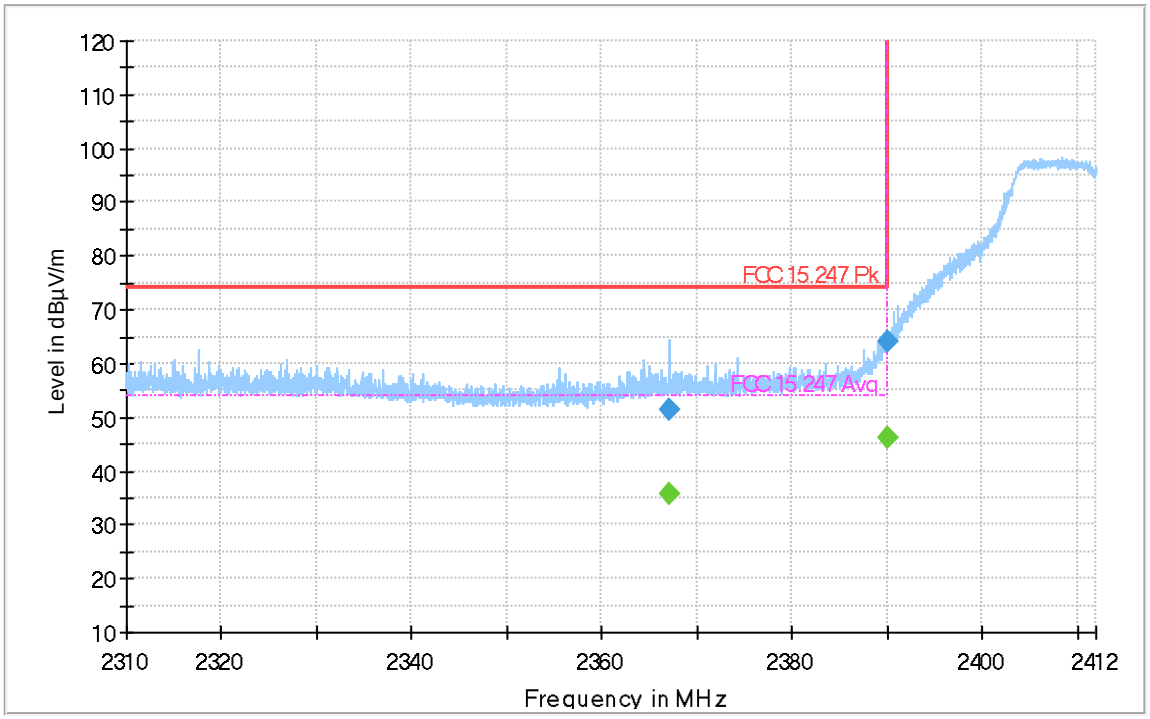


Plot #9

Low channel / 2412 MHz	Modulation/Packet Type: 802.11n_HT20 MCS0 Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2367.171	51.444	---	74.00	22.56	300.0	1000.000	107.0	H	319.0	6.0	
2367.171	---	35.779	54.00	18.22	300.0	1000.000	107.0	H	319.0	6.0	
2390.000	63.923	---	74.00	10.08	300.0	1000.000	134.0	H	75.0	6.2	
2390.000	---	46.255	54.00	7.74	300.0	1000.000	134.0	H	75.0	6.2	



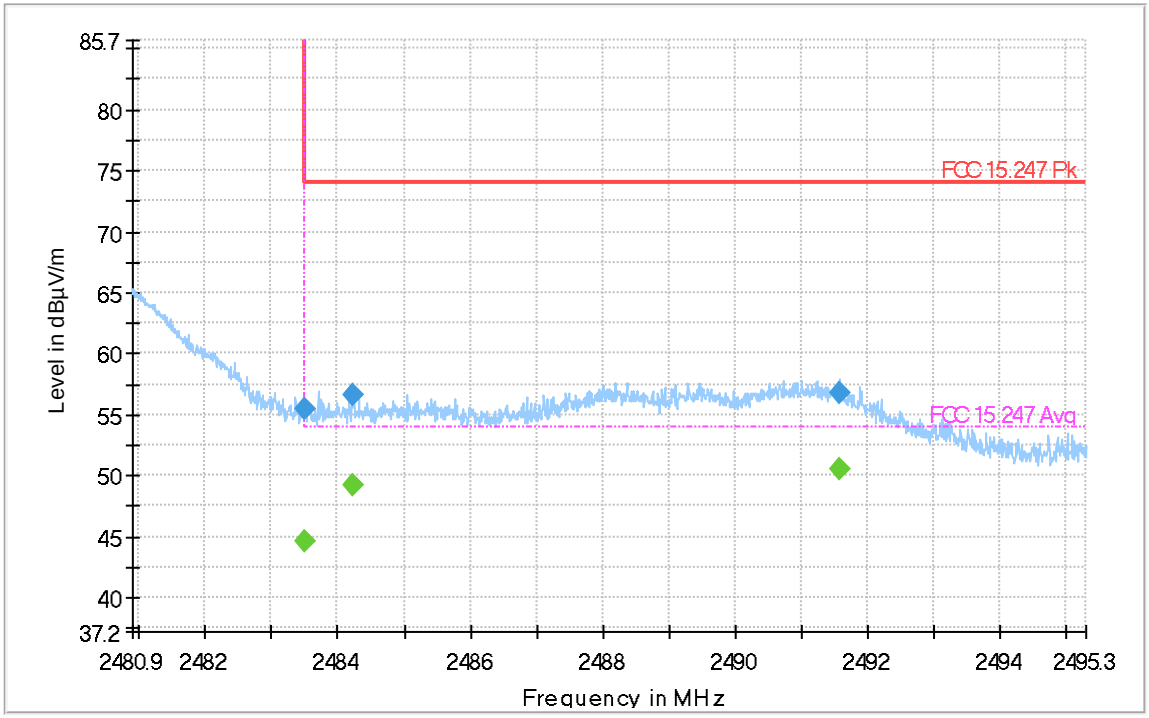
Preview Result 1-PK+ | FCC 15.247 Pk | FCC 15.247 Avg
Final_Result PK+ | Final_Result RMS

Plot #10

High channel/ 2462 MHz	Modulation/Packet Type: 802.11b 1Mbps Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2483.500	55.535	---	74.00	18.47	300.0	1000.000	160.0	H	86.0	6.3	
2483.500	---	44.681	54.00	9.32	300.0	1000.000	160.0	H	86.0	6.3	
2484.240	56.570	---	74.00	17.43	300.0	1000.000	189.0	H	94.0	6.3	
2484.240	---	49.260	54.00	4.74	300.0	1000.000	189.0	H	94.0	6.3	
2491.593	---	50.499	54.00	3.50	300.0	1000.000	161.0	H	92.0	6.4	
2491.593	56.846	---	74.00	17.15	300.0	1000.000	161.0	H	92.0	6.4	



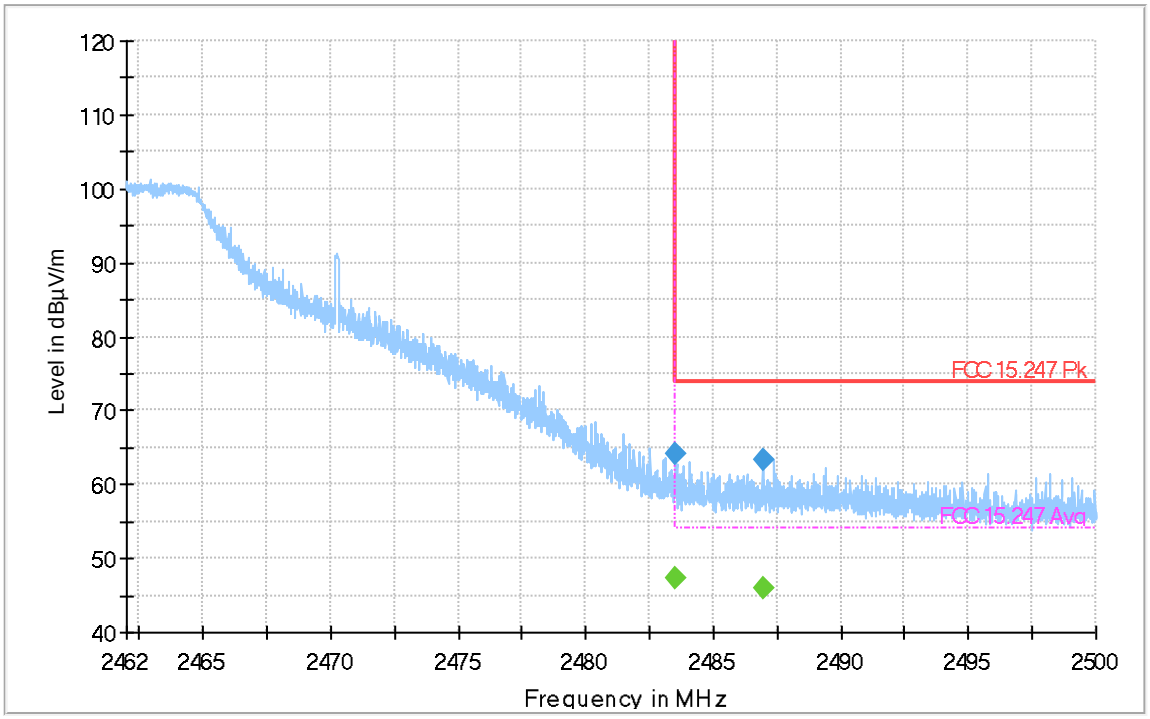
Preview Result 1-PK+ | FCC 15.247 Pk | FCC 15.247 Avg
Final_Result PK+ | Final_Result RMS

Plot #11

High channel/ 2457 MHz	Modulation/Packet Type: 802.11g 6Mbps Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2483.500	64.191	---	74.00	9.81	300.0	1000.000	172.0	H	91.0	6.3	
2483.500	---	47.405	54.00	6.59	300.0	1000.000	172.0	H	91.0	6.3	
2486.928	63.437	---	74.00	10.56	300.0	1000.000	162.0	H	91.0	6.3	
2486.928	---	46.016	54.00	7.98	300.0	1000.000	162.0	H	91.0	6.3	



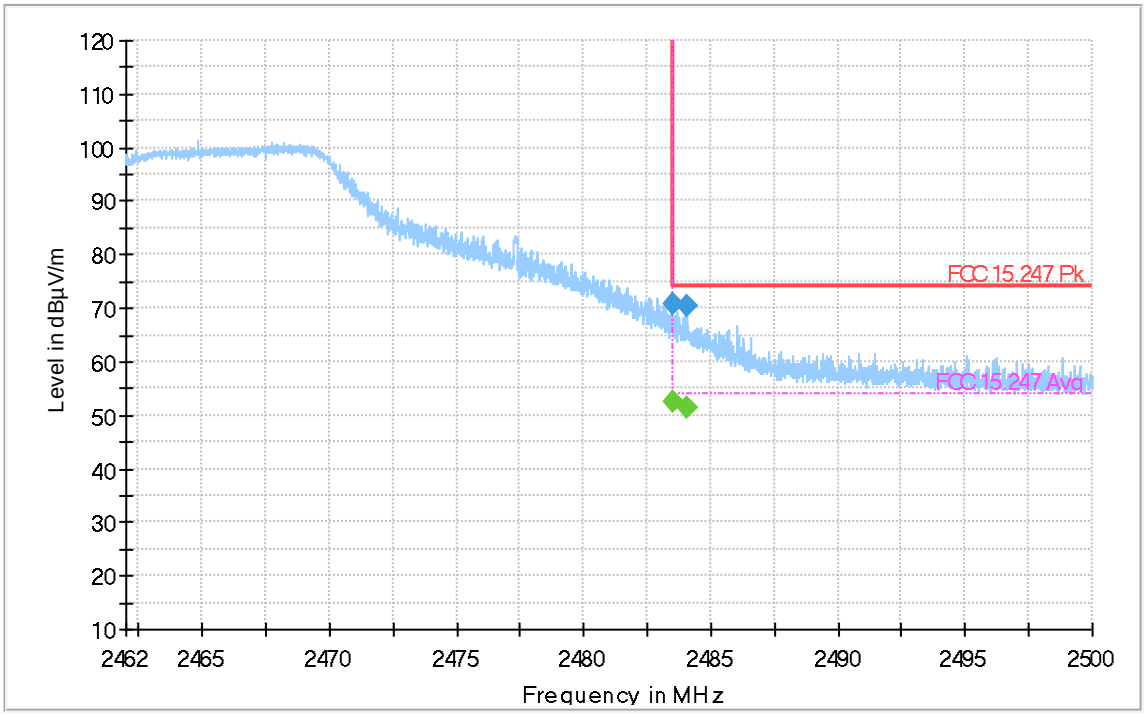
Preview Result 1-PK+ | FCC 15.247 Pk | FCC 15.247 Avg
Final_Result PK+ | Final_Result RMS

Plot #12

High channel/ 2462 MHz	Modulation/Packet Type: 802.11g 6Mbps Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2483.500	---	52.656	54.00	1.34	300.0	1000.000	141.0	H	90.0	6.3	
2483.500	70.808	---	74.00	3.19	300.0	1000.000	141.0	H	90.0	6.3	
2484.059	---	51.317	54.00	2.68	300.0	1000.000	162.0	H	90.0	6.3	
2484.059	70.453	---	74.00	3.55	300.0	1000.000	162.0	H	90.0	6.3	



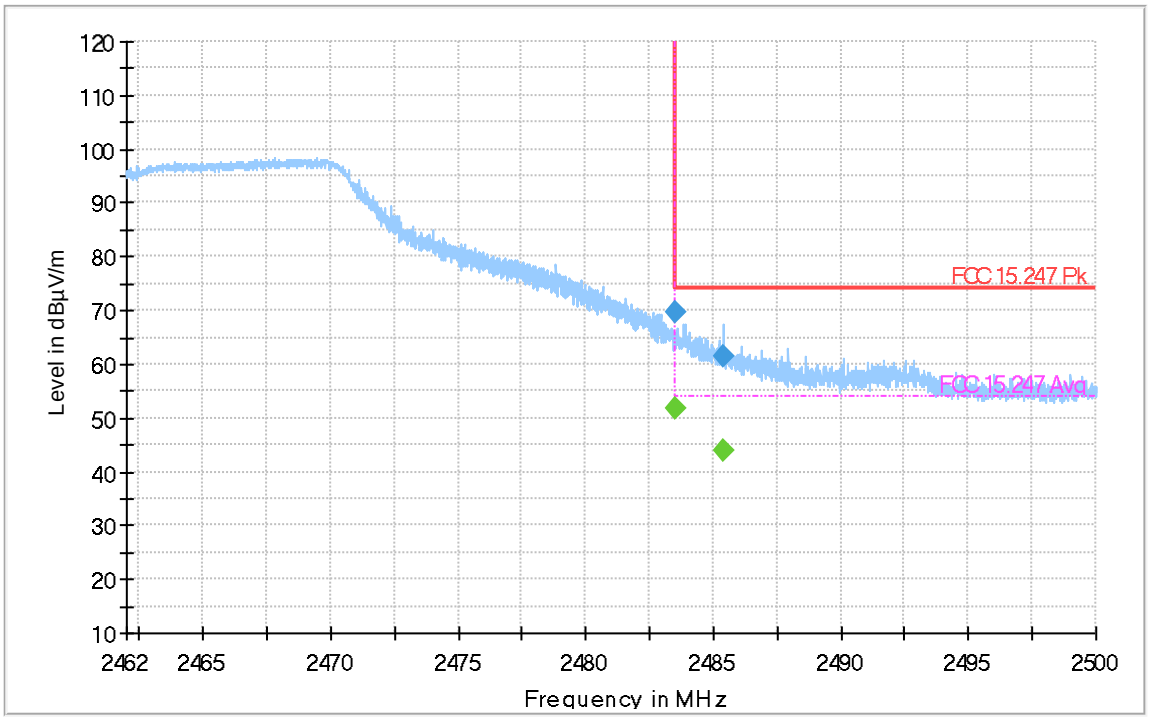
Preview Result 1-PK+
Final_Result PK+
FCC 15.247 Pk
Final_Result RMS
FCC 15.247 Avg

Plot #13

High channel/ 2462 MHz	Modulation/Packet Type: 802.11n_HT20 MCS0 Peak & Avg

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)	Comment
2483.500	---	51.885	54.00	2.11	300.0	1000.000	189.0	H	89.0	6.3	
2483.500	69.497	---	74.00	4.50	300.0	1000.000	189.0	H	89.0	6.3	
2485.418	---	43.960	54.00	10.04	300.0	1000.000	141.0	H	244.0	6.3	
2485.418	61.369	---	74.00	12.63	300.0	1000.000	141.0	H	244.0	6.3	



Preview Result 1-PK+ | FCC 15.247 Pk | FCC 15.247 Avg
Final_Result PK+ | Final_Result RMS

8.5 Emission Bandwidth 6 dB and 99% Occupied Bandwidth

8.5.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v04

Spectrum Analyzer settings:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- 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.

8.5.2 Limits:

FCC §15.247(a)(1) and RSS-247 5.2(1)

- Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

8.5.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	2	802.11 b/g/n	5 VDC

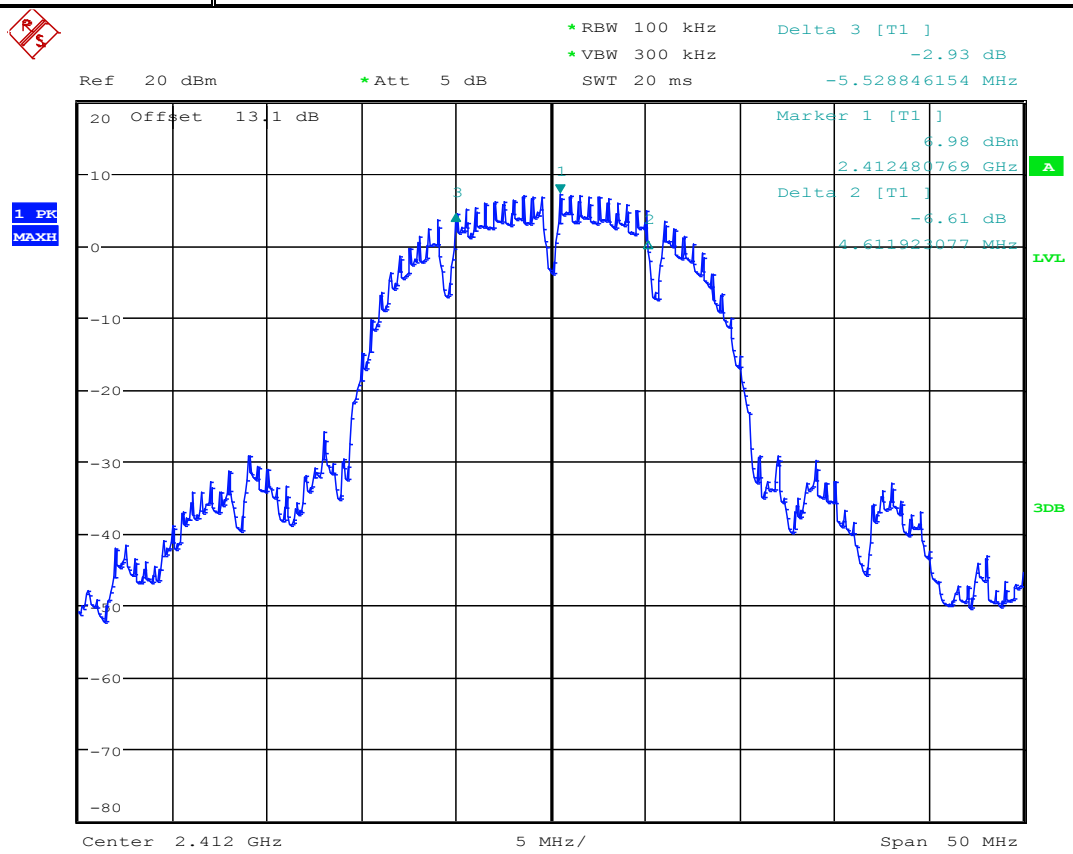
8.5.4 Measurement result:

Plot #	Mode	Channel	6 dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	802.11b	1	10.14	> 0.5	Pass
2	802.11b	6	10.17	> 0.5	Pass
3	802.11b	11	10.18	> 0.5	Pass
4	802.11g	1	16.47	> 0.5	Pass
5	802.11g	6	16.35	> 0.5	Pass
6	802.11g	11	16.43	> 0.5	Pass
7	802.11n_HT20	1	17.63	> 0.5	Pass
8	802.11n_HT20	6	17.63	> 0.5	Pass
9	802.11n_HT20	11	17.63	> 0.5	Pass

Plot #	Mode	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
10	802.11b	1	17.23	> 0.5	Pass
11	802.11b	6	17.23	> 0.5	Pass
12	802.11b	11	17.23	> 0.5	Pass
13	802.11g	1	18.51	> 0.5	Pass
14	802.11g	6	18.59	> 0.5	Pass
15	802.11g	11	18.51	> 0.5	Pass
16	802.11n_HT20	1	19.87	> 0.5	Pass
17	802.11n_HT20	6	19.87	> 0.5	Pass
18	802.11n_HT20	11	19.79	> 0.5	Pass

8.5.5 Measurement Plots:

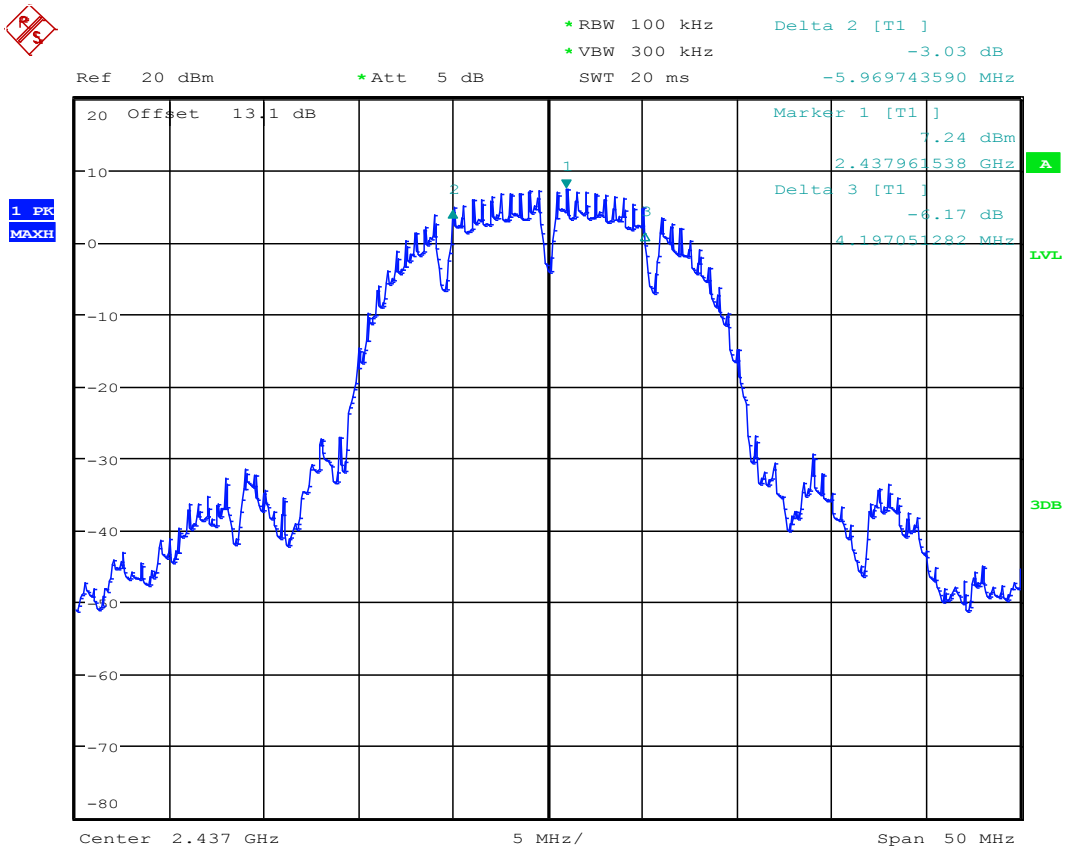
Plot #1	
Low channel	Mode: 802.11b



Date: 13.DEC.2019 17:09:51

Plot #2

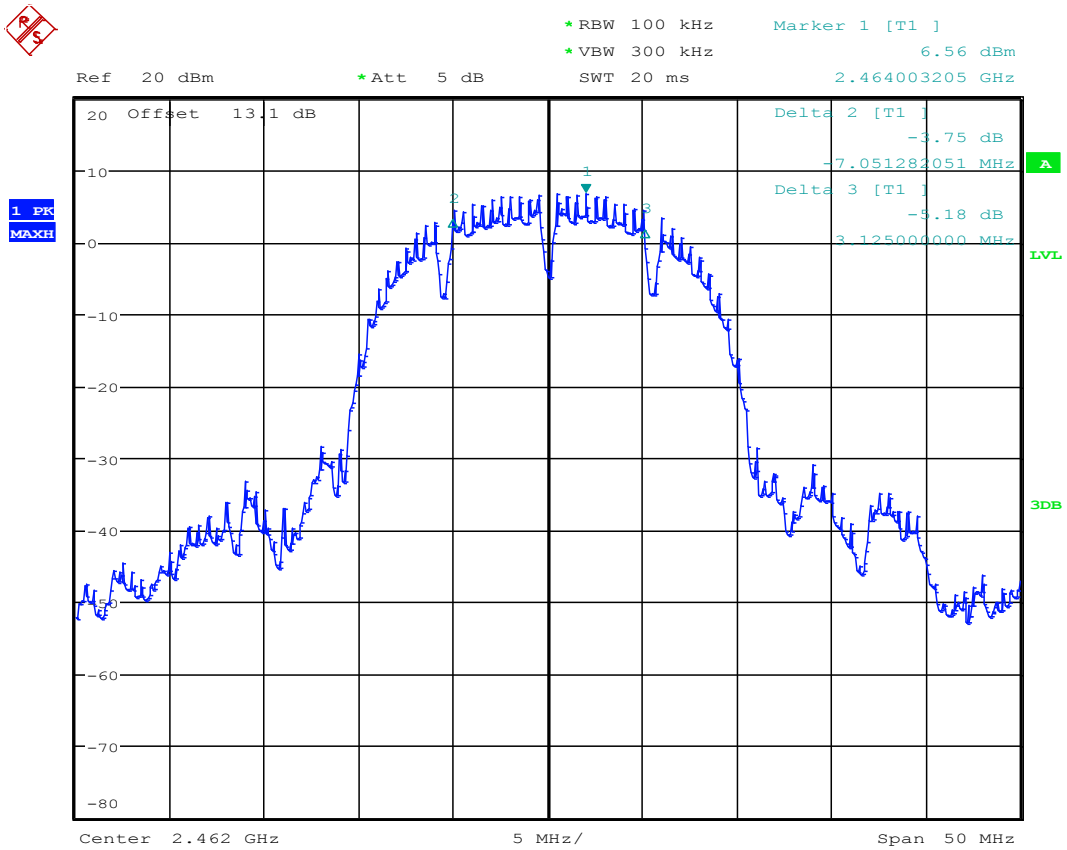
Mid channel	Mode: 802.11b



Date: 13.DEC.2019 17:12:51

Plot #3

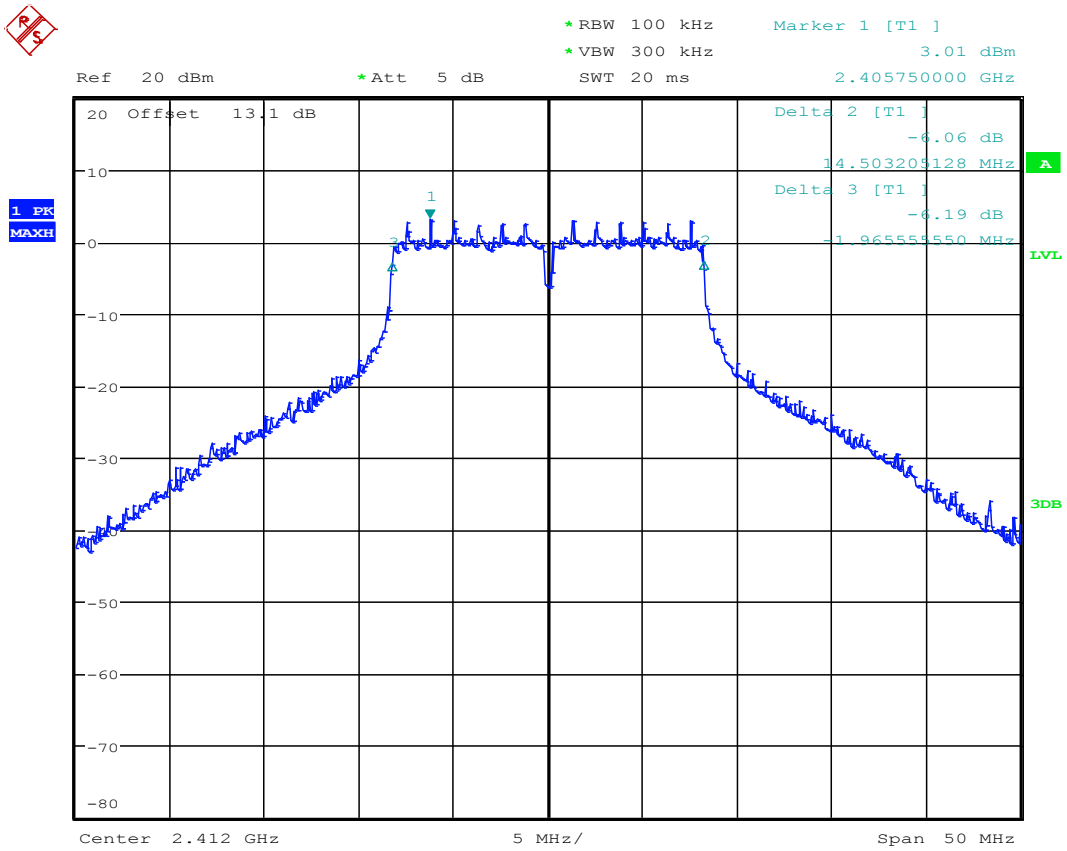
High channel	Mode: 802.11b



Date: 13.DEC.2019 17:13:50

Plot #4

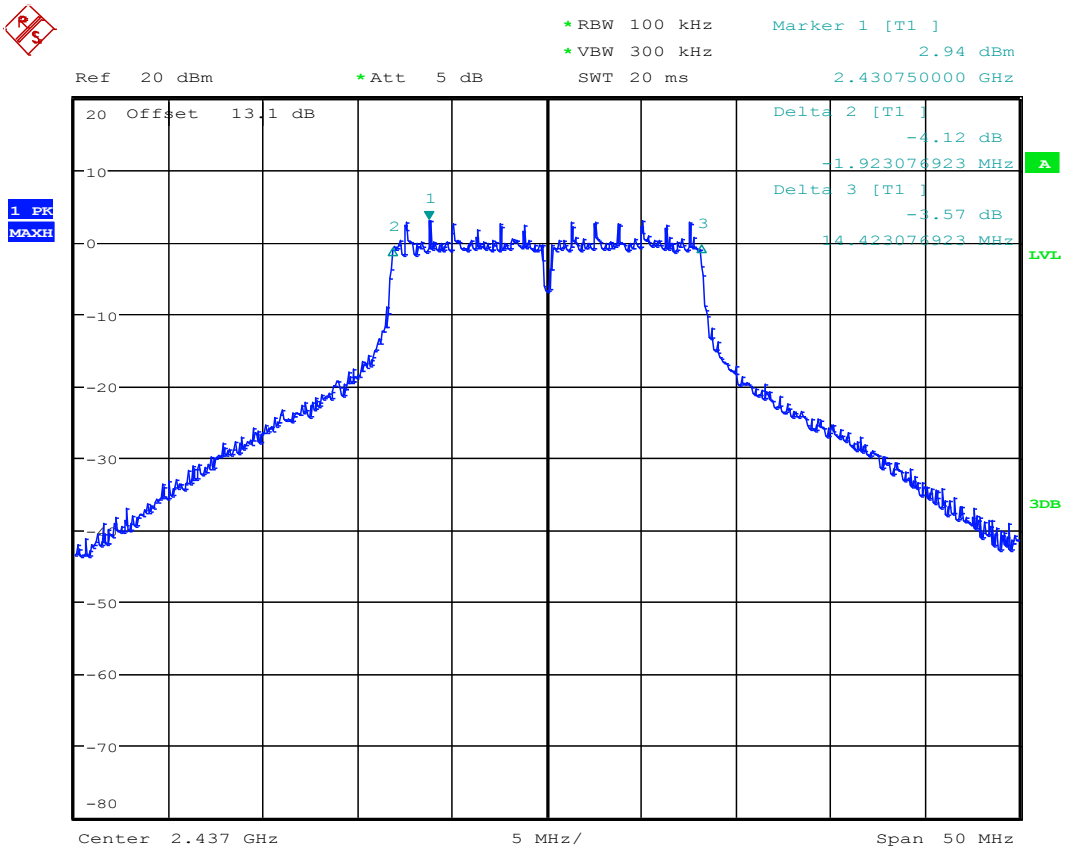
Low channel	Mode: 802.11g



Date: 18.DEC.2019 18:00:16

Plot #5

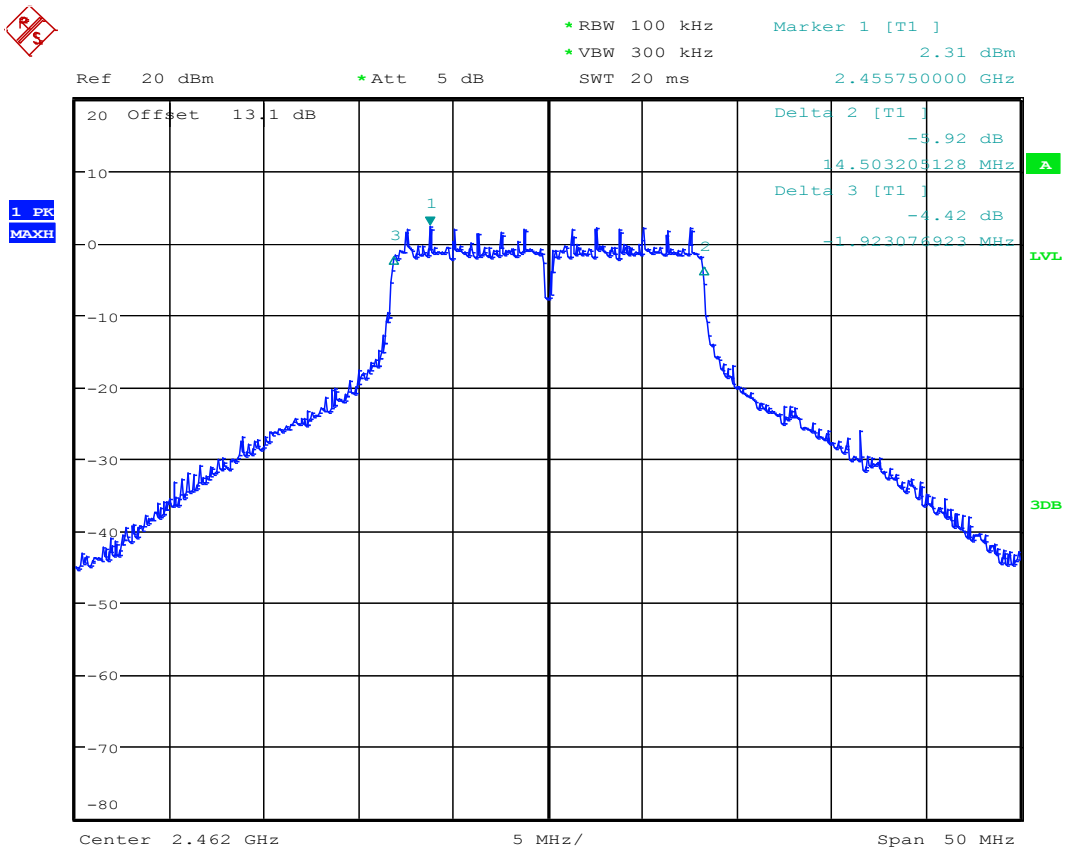
Mid channel	Mode: 802.11g



Date: 18.DEC.2019 18:01:57

Plot #6

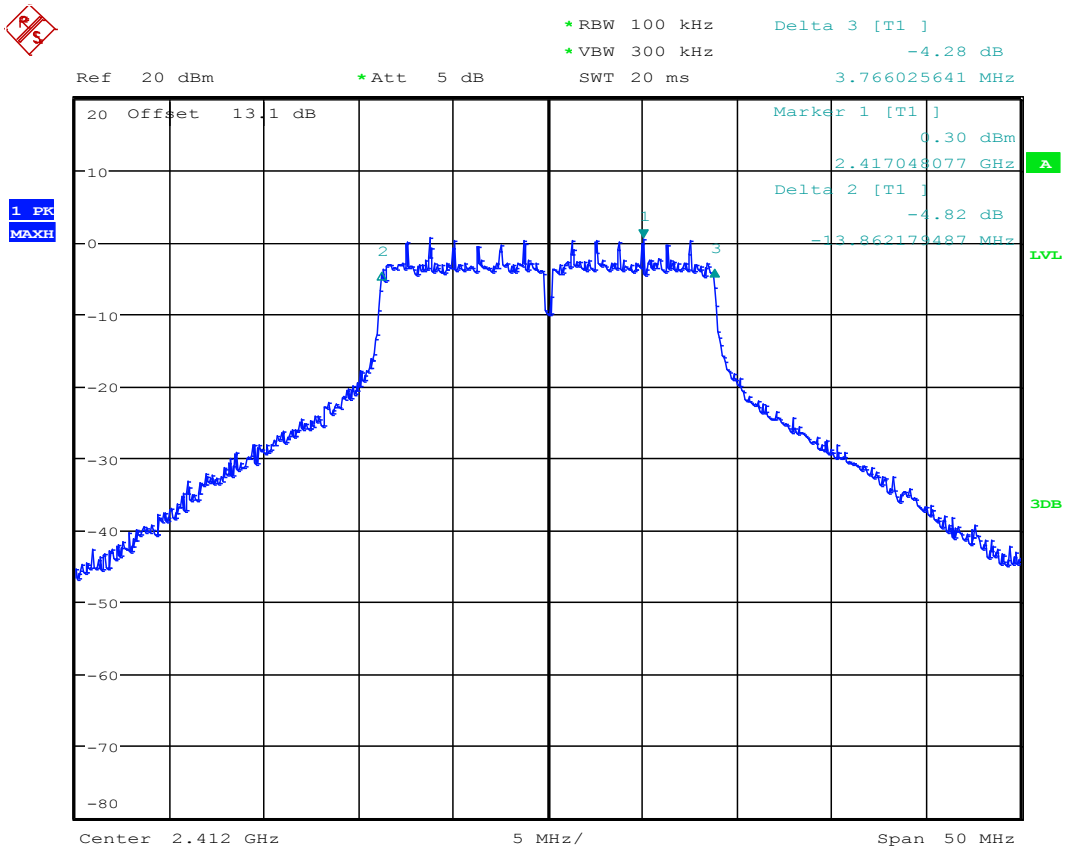
High channel	Mode: 802.11g



Date: 19.DEC.2019 10:53:43

Plot #7

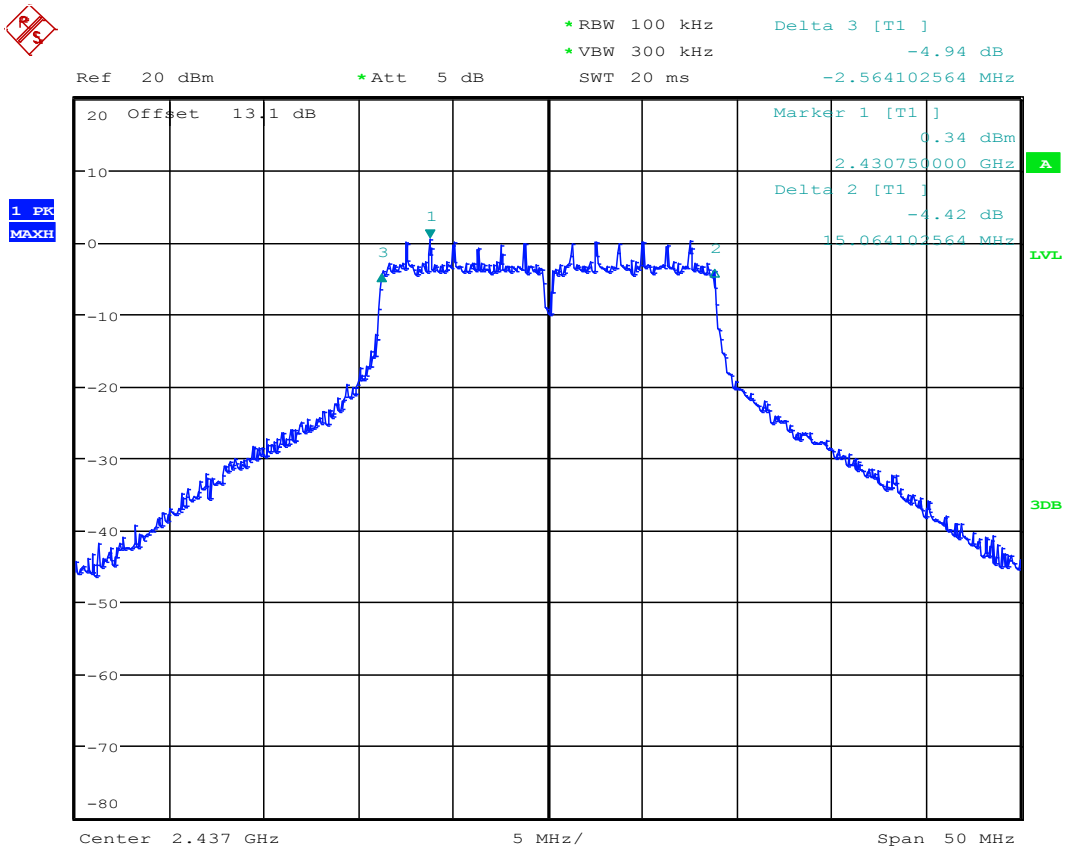
Low channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 17:06:20

Plot #8

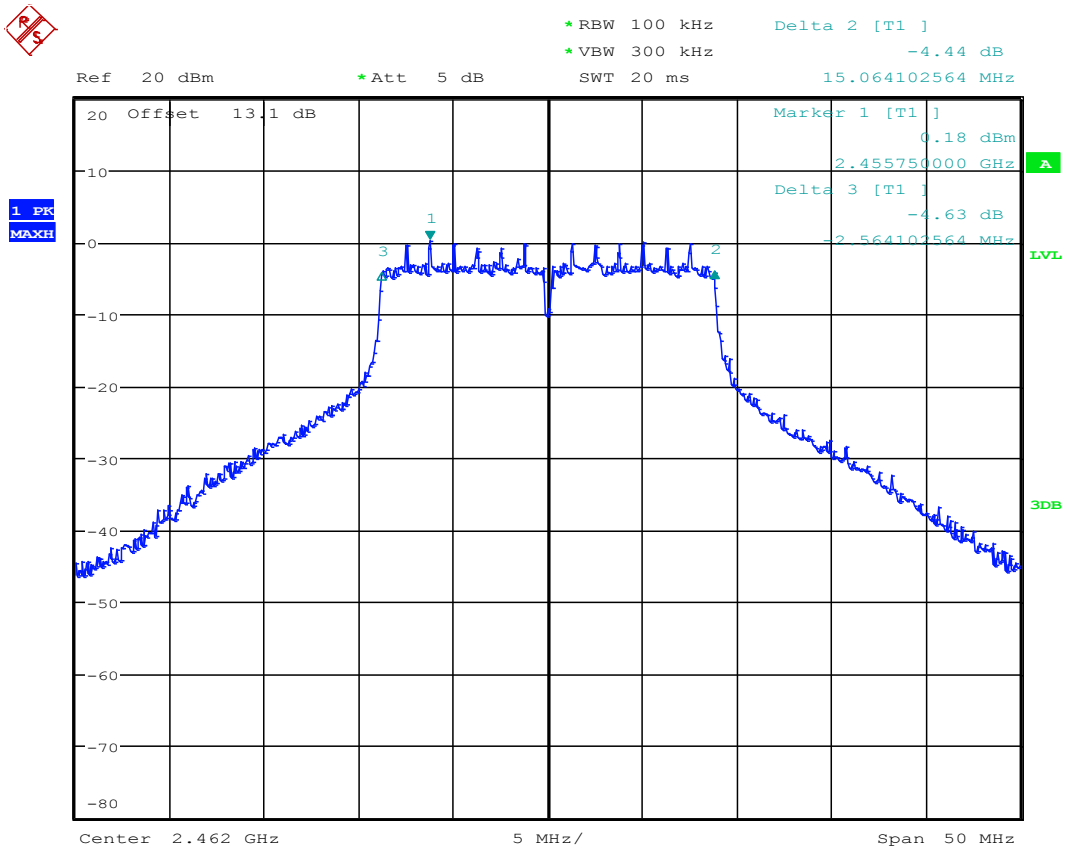
Mid channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 17:09:14

Plot #9

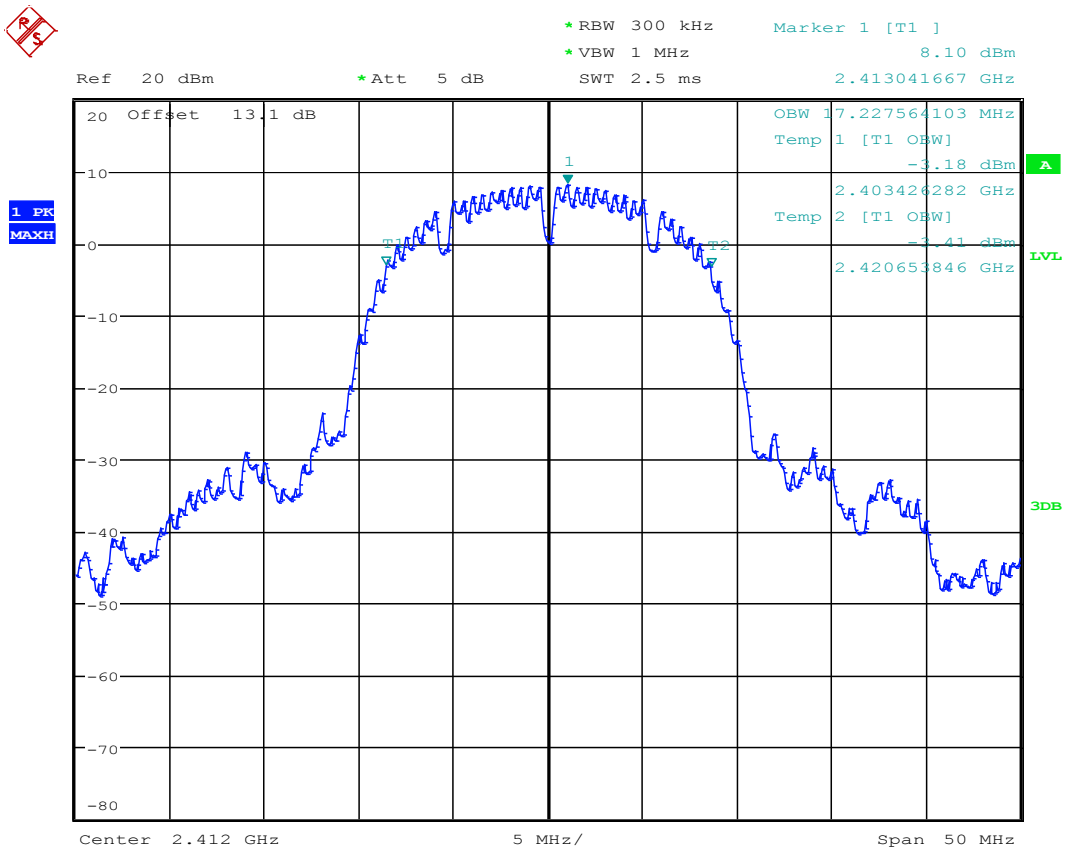
High channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 17:11:52

Plot #10

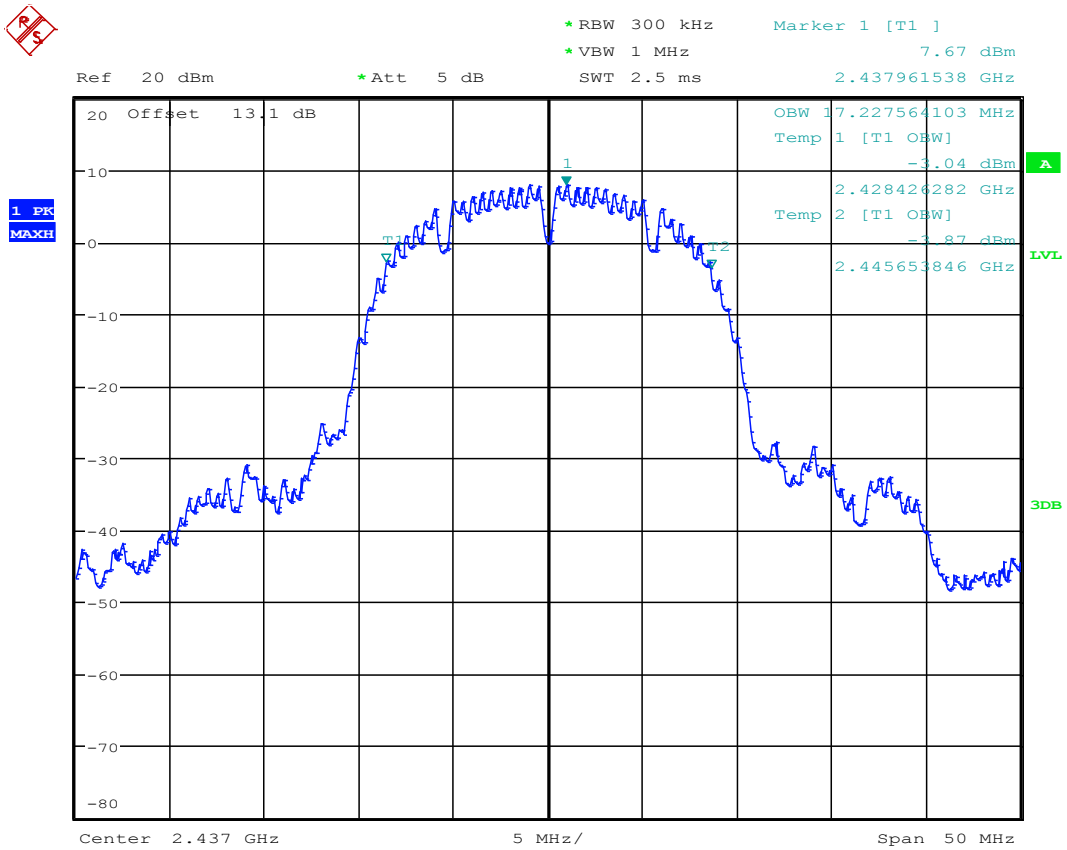
Low channel	Mode: 802.11b



Date: 9.DEC.2019 11:02:17

Plot #11

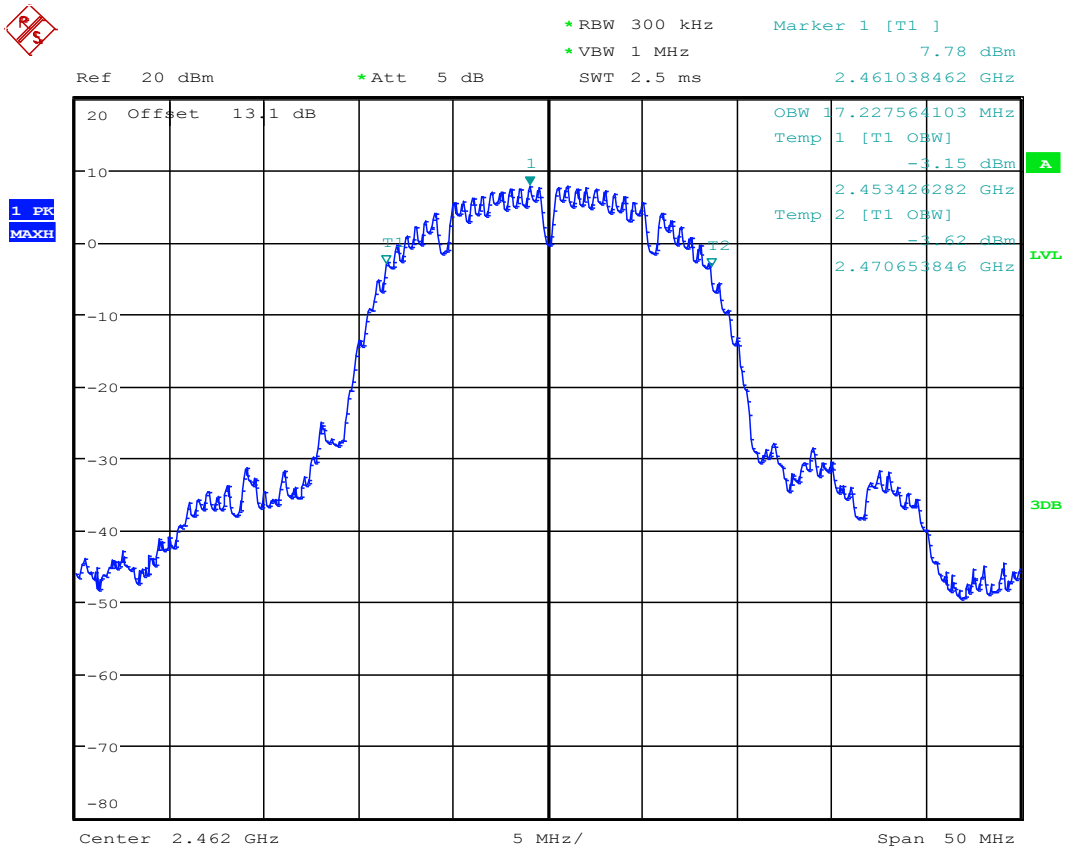
Mid channel	Mode: 802.11b



Date: 9.DEC.2019 11:03:37

Plot #12

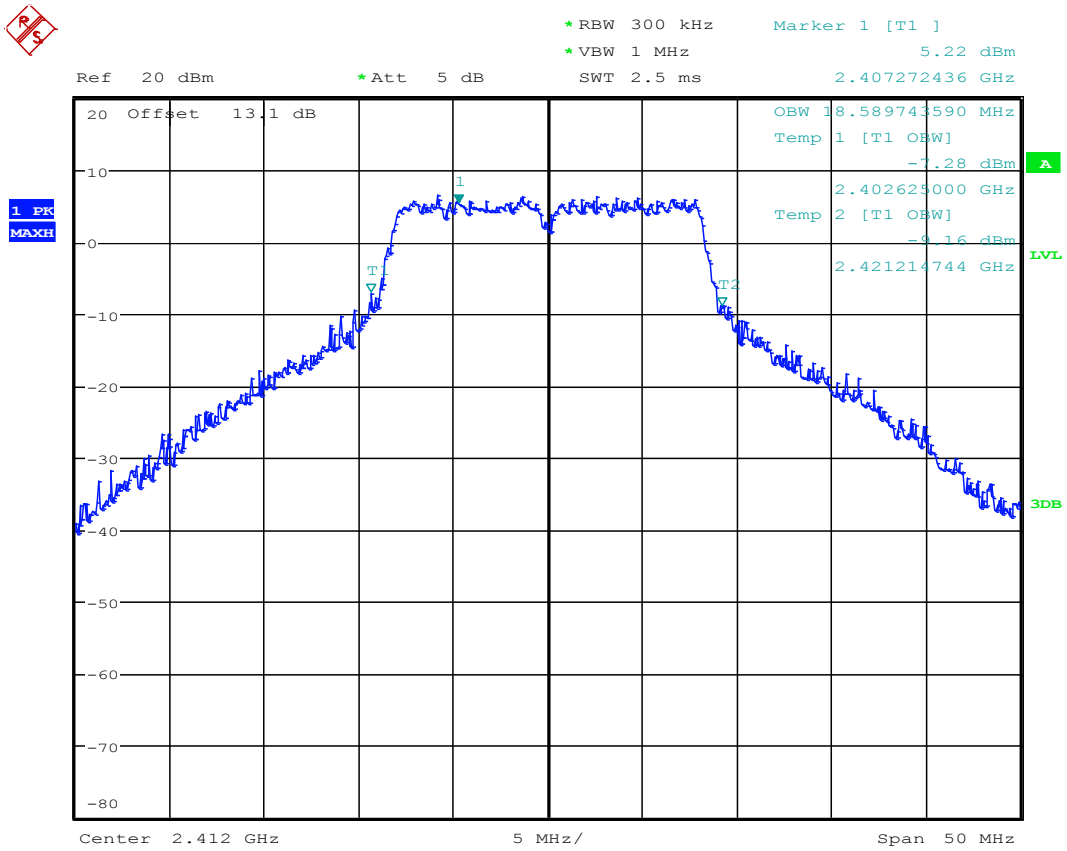
High channel	Mode: 802.11b



Date: 9.DEC.2019 11:11:31

Plot #13

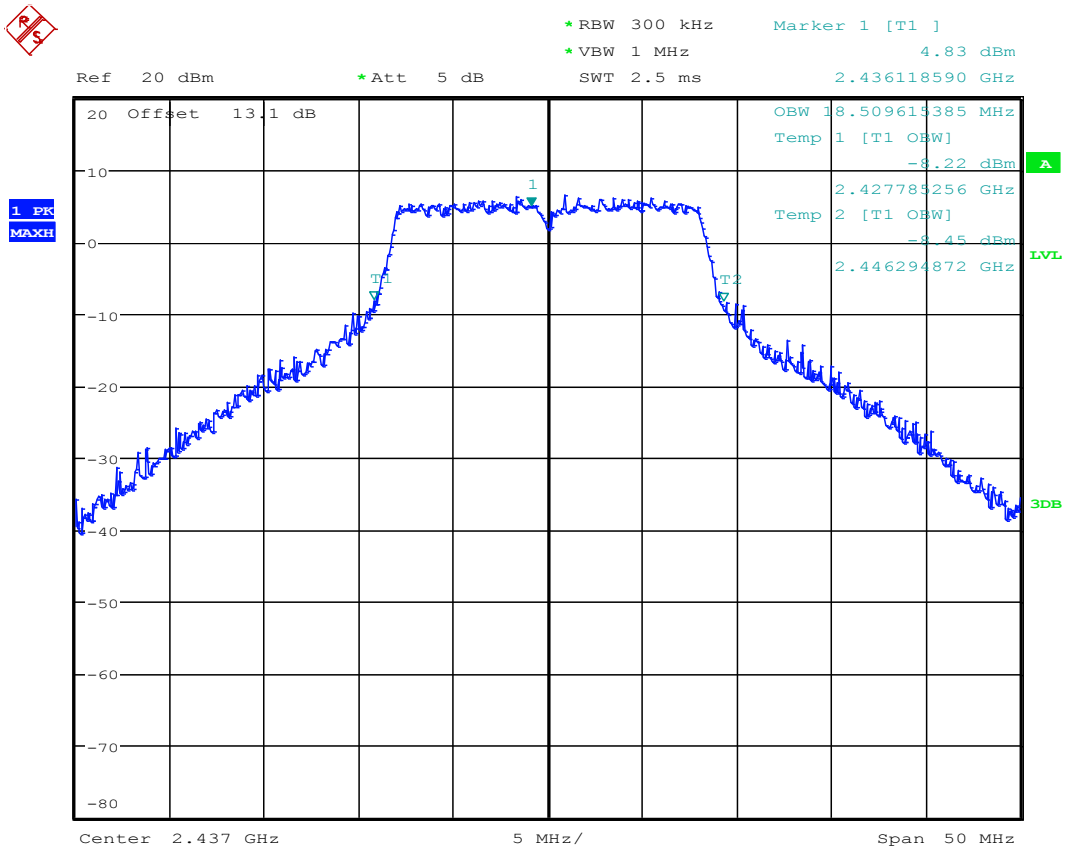
Low channel	Mode: 802.11g



Date: 18.DEC.2019 17:56:14

Plot #14

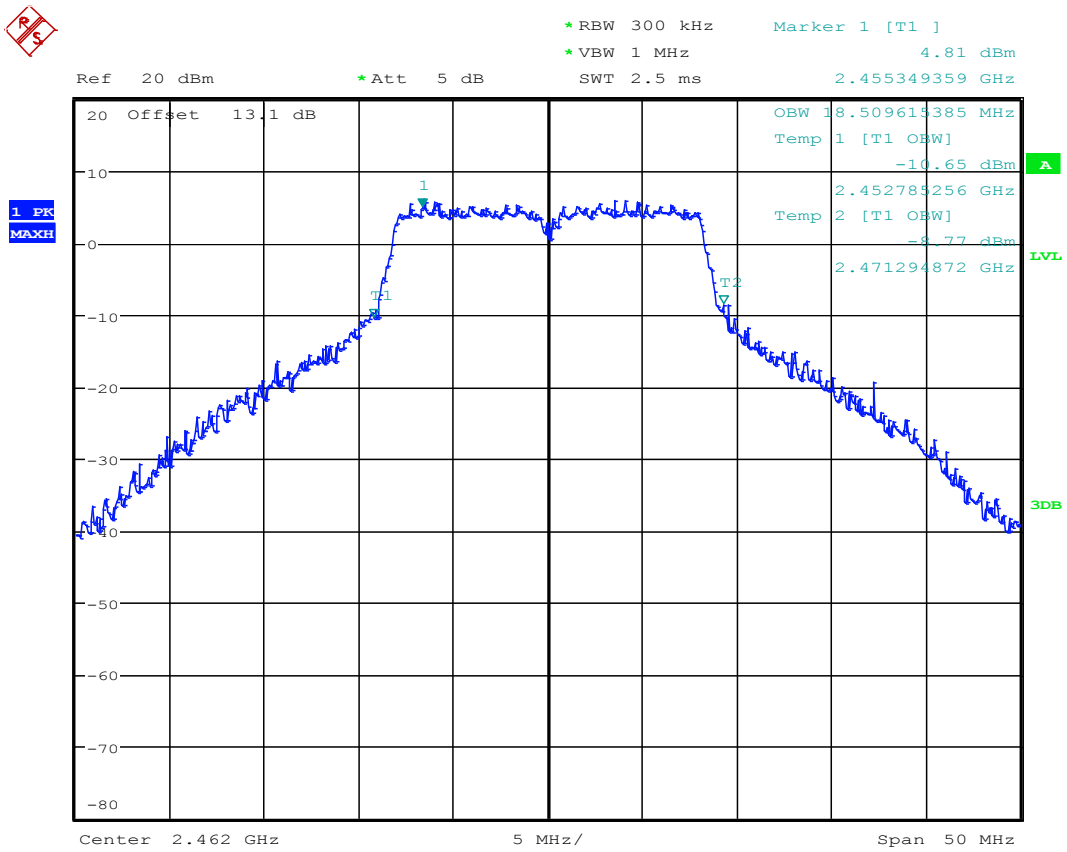
Mid channel	Mode: 802.11g



Date: 18.DEC.2019 18:01:03

Plot #15

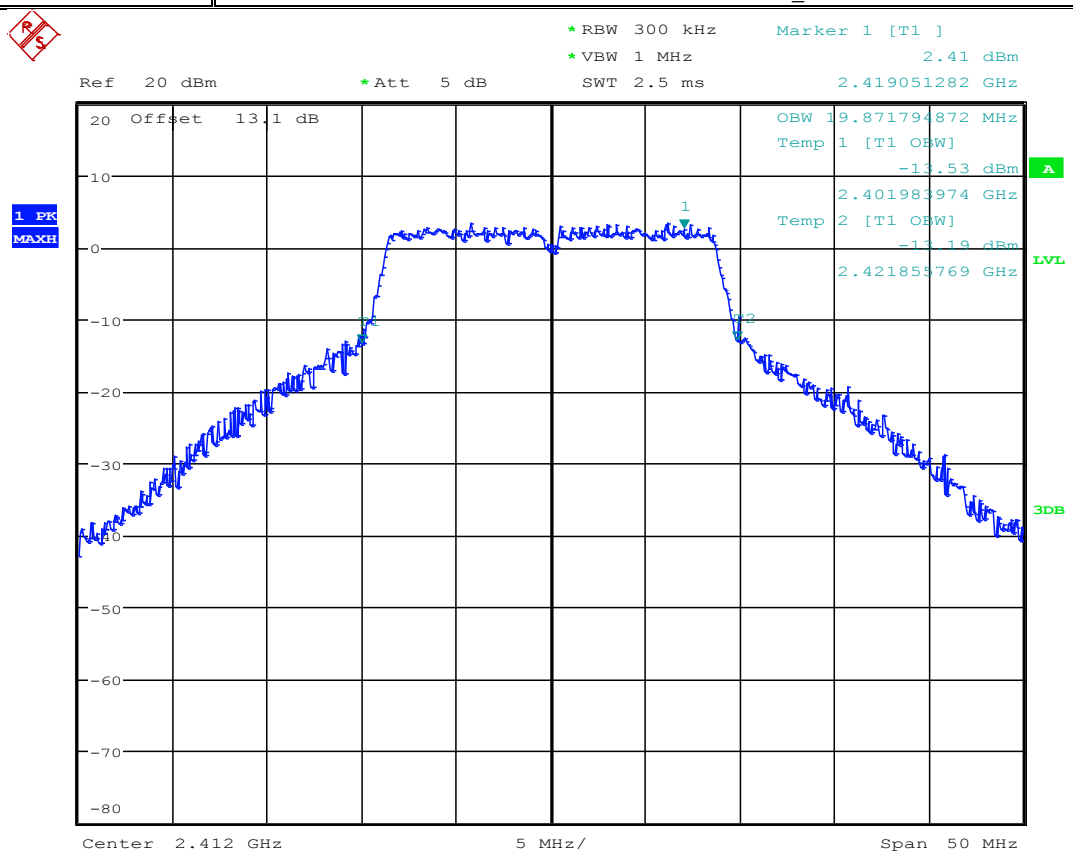
High channel	Mode: 802.11g



Date: 19.DEC.2019 10:51:57

Plot #16

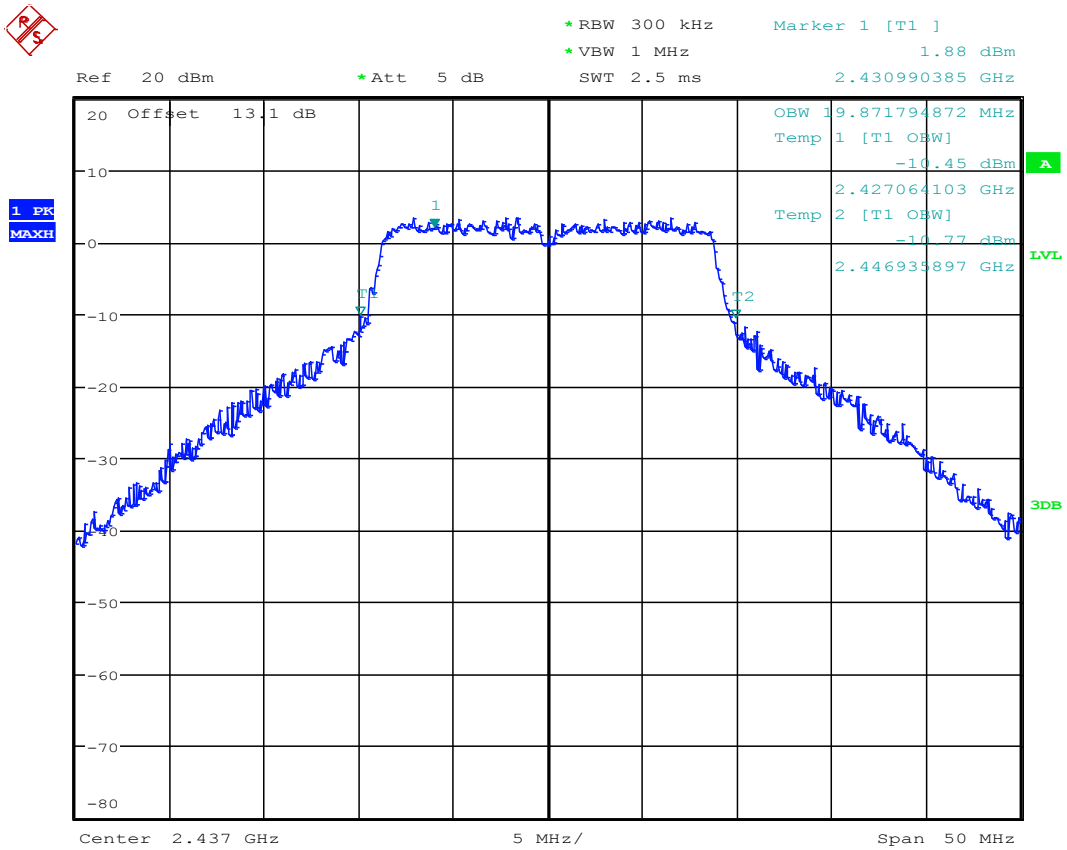
Low channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 11:45:10

Plot #17

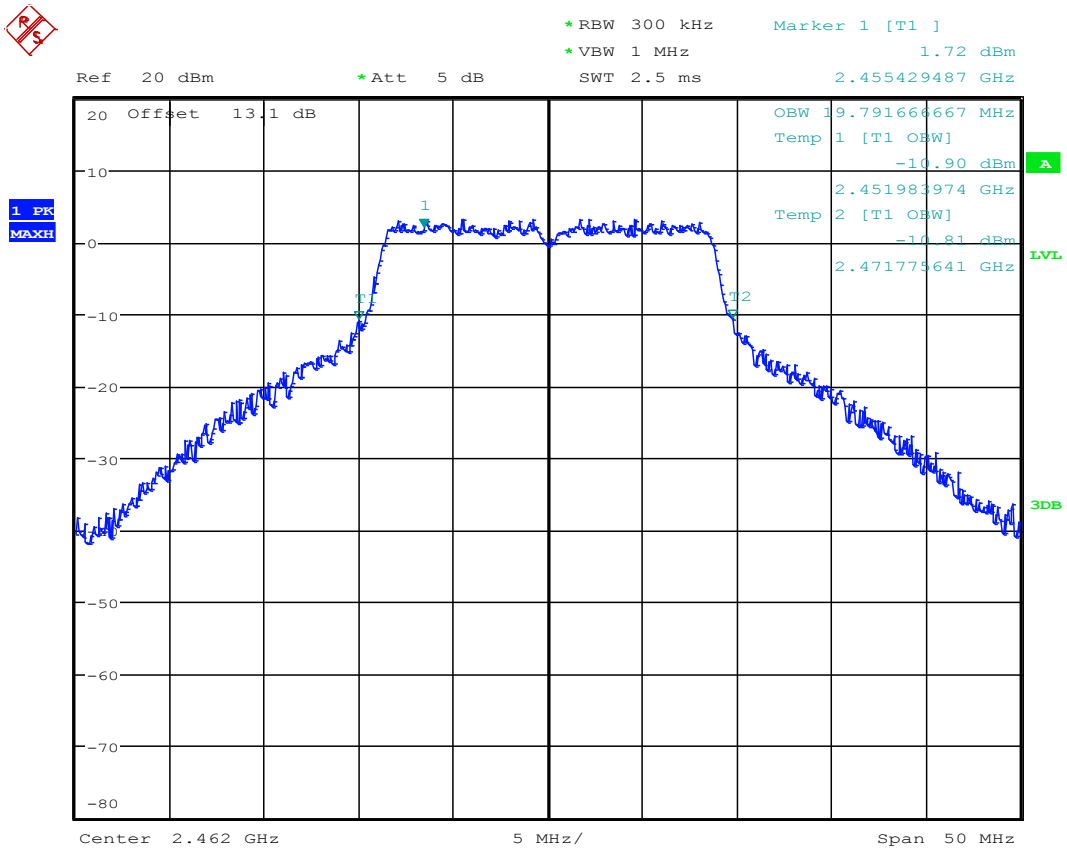
Mid channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 11:48:08

Plot #18

High channel	Mode: 802.11n_HT20



Date: 9.DEC.2019 11:51:19

8.6 Radiated Transmitter Spurious Emissions and Restricted Bands

8.6.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

8.6.2 Limits:

FCC §15.247

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- 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)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.6.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	802.11b	5 VDC

8.6.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1-3	Low	30 MHz – 18 GHz	See section 8.6.2	Pass
4-8	Mid	9 kHz – 26 GHz	See section 8.6.2	Pass
9-11	High	30 MHz – 18 GHz	See section 8.6.2	Pass

8.6.5 Measurement Plots:

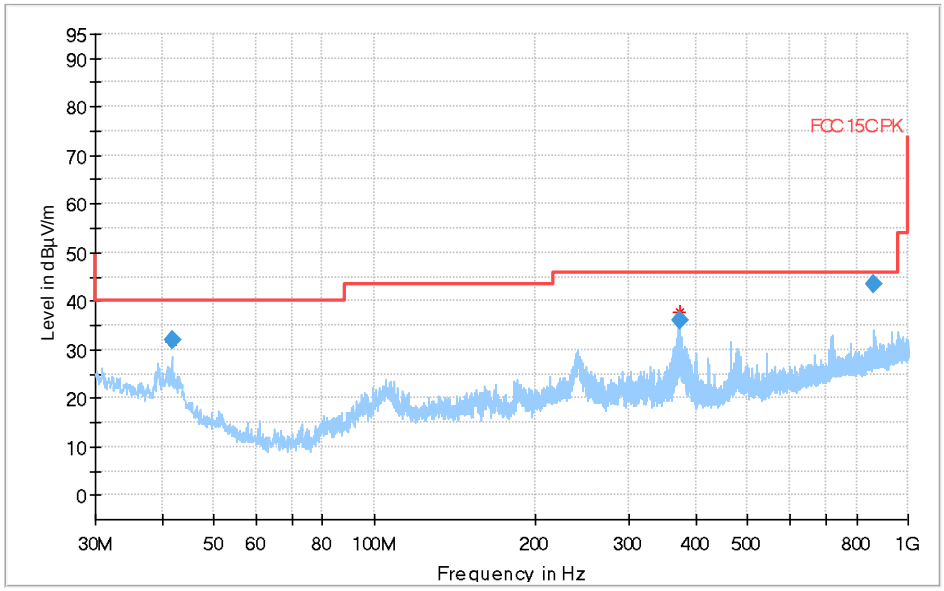
Plot #1 Radiated Emissions: 30 MHz – 1GHz		
Modulation: 802.11b	**Channel: Low**	**100% Duty Cycle**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
41.906	31.852	---	40.00	8.15	500.0	100.000	100.0	V	292.0	-15.2
373.304	36.024	---	46.00	9.98	500.0	100.000	108.0	H	236.0	-15.1
863.781	43.504	---	46.00	2.50	500.0	100.000	132.0	V	208.0	-5.9

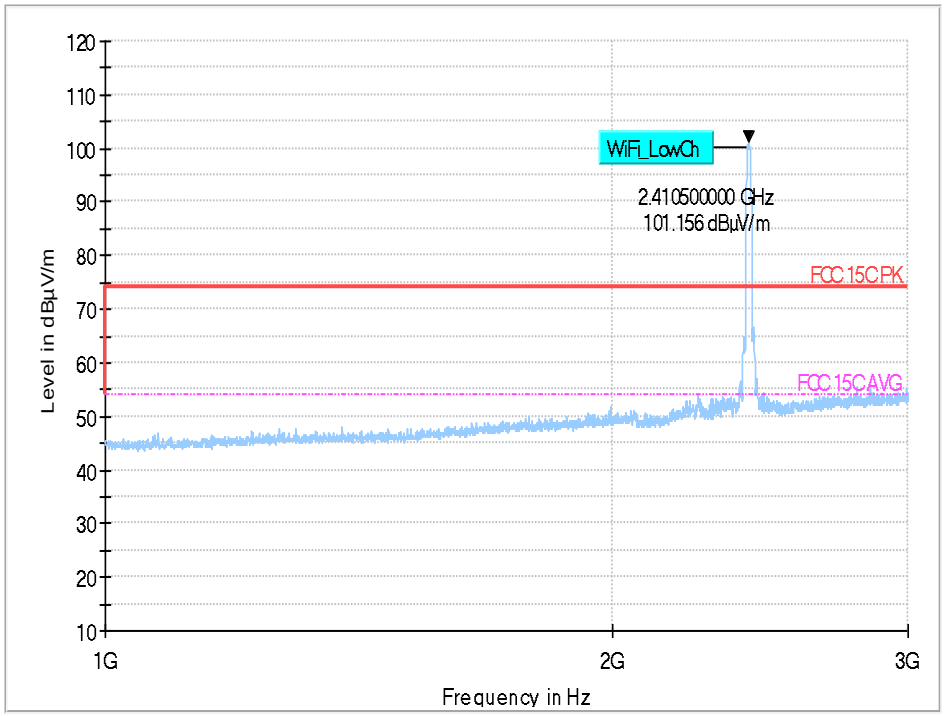
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
41.906	1:41:22 PM - 12/11/2019
373.304	1:44:19 PM - 12/11/2019
863.781	1:47:01 PM - 12/11/2019



Preview Result 1-PK+
Final_Result PK+
Critical_Freqs PK+
Final_Result RMS
FCC 15C PK

Plot #2 Radiated Emissions: 1-3 GHz		
Modulation: 802.11b	**Channel: Low**	**100% Duty Cycle**



Plot #3 Radiated Emissions: 3-18 GHz

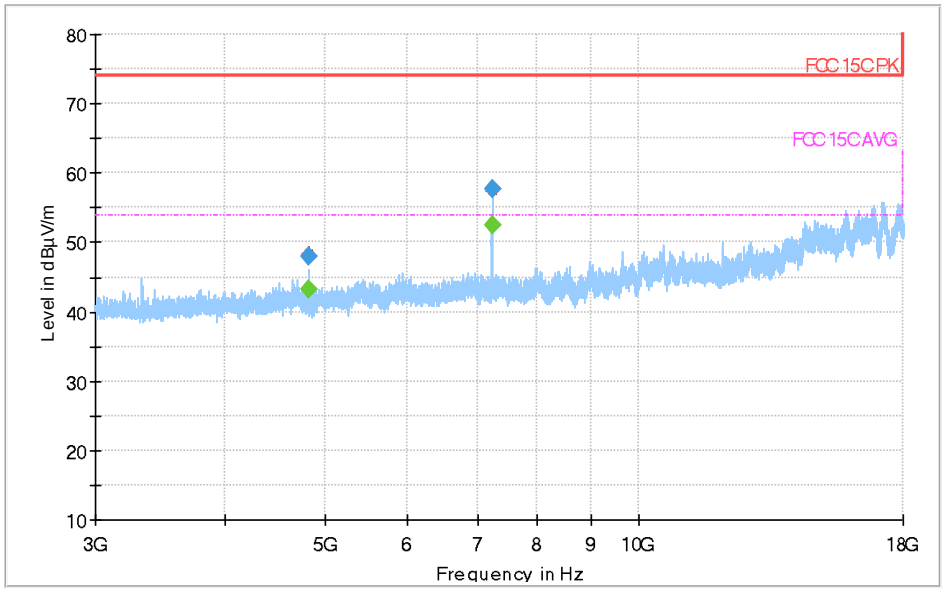
Modulation: 802.11b	Channel: Low	100% Duty Cycle

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
4823.983	---	43.249	53.98	10.73	200.0	1000.000	308.0	H	215.0	-6.0
4823.983	47.877	---	73.99	26.11	200.0	1000.000	308.0	H	215.0	-6.0
7237.753	---	52.426	53.98	1.55	200.0	1000.000	287.0	H	226.0	-2.8
7237.753	57.585	---	73.99	16.40	200.0	1000.000	287.0	H	226.0	-2.8

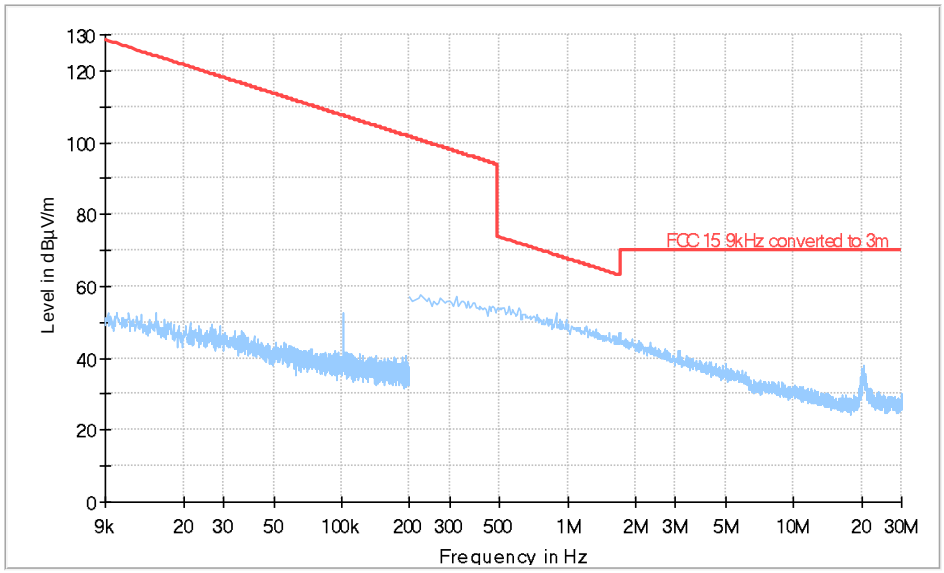
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
4823.983	1:23:45 PM - 12/10/2019
4823.983	1:23:45 PM - 12/10/2019
7237.753	1:26:42 PM - 12/10/2019
7237.753	1:26:41 PM - 12/10/2019



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #2 Radiated Emissions: 9 KHz – 30 MHz		
Modulation: 802.11b	**Channel: Mid**	**100% Duty Cycle**



Preview Result 1-PK+
FCC 15 9kHz converted to 3m
Final_Result RMS
Critical_Freqs PK+
Final_Result QPK

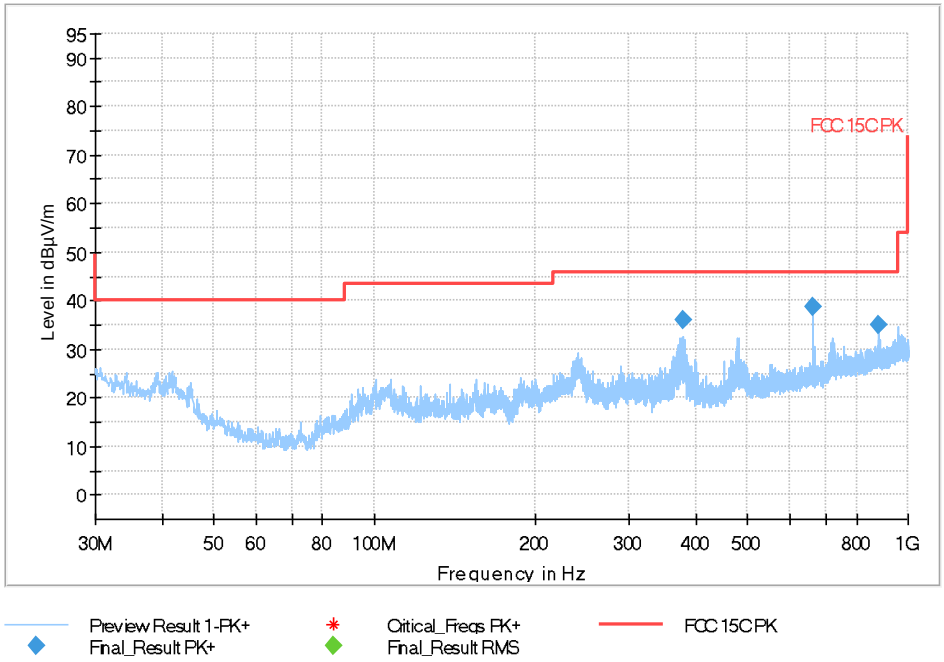
Plot #5 Radiated Emissions: 30 MHz – 1GHz		
Modulation: 802.11b	**Channel: Mid**	**100% Duty Cycle**

Final_Result

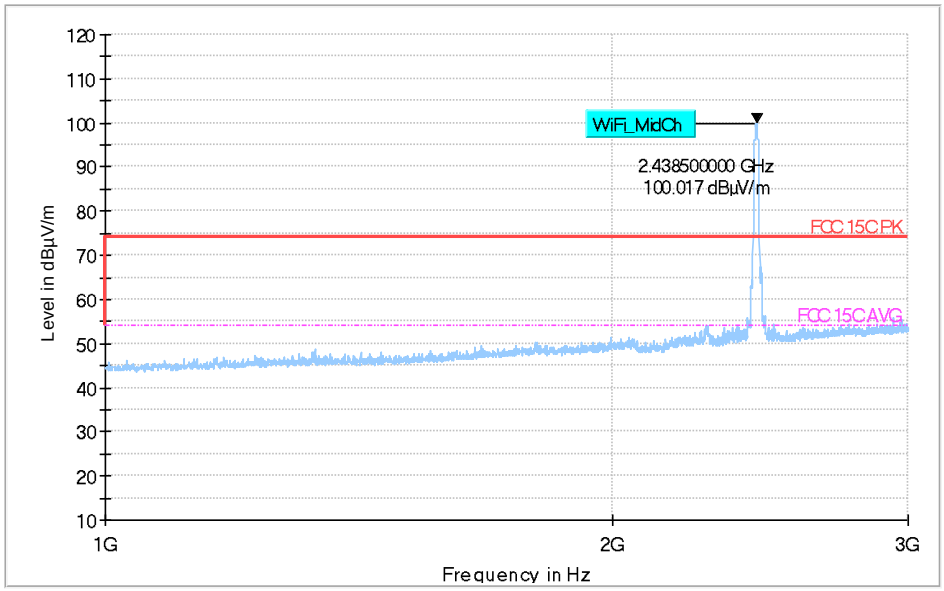
Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
379.275	35.932	---	46.00	10.07	500.0	100.000	191.0	H	237.0	-15.0
665.155	38.784	---	46.00	7.22	500.0	100.000	287.0	V	345.0	-9.1
882.682	35.014	---	46.00	10.99	500.0	100.000	300.0	V	217.0	-5.8

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
379.275	2:03:11 PM - 12/11/2019
665.155	2:08:30 PM - 12/11/2019
882.682	2:05:49 PM - 12/11/2019



Plot #6 Radiated Emissions: 1-3 GHz		
Modulation: 802.11b	**Channel: Mid**	**100% Duty Cycle**



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #7 Radiated Emissions: 3-18 GHz

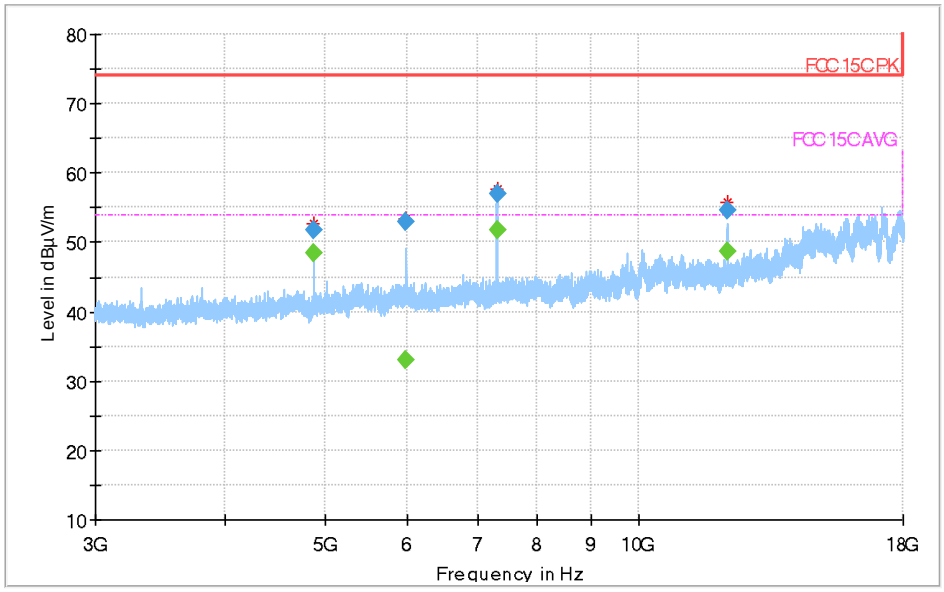
Modulation: 802.11b	Channel: Mid	100% Duty Cycle

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
4873.973	51.834	---	73.99	22.16	200.0	1000.000	267.0	H	23.0	-5.8
4873.973	---	48.458	53.98	5.52	200.0	1000.000	267.0	H	23.0	-5.8
5981.755	52.918	---	73.99	21.07	200.0	1000.000	224.0	V	333.0	-2.9
5981.755	---	33.123	53.98	20.86	200.0	1000.000	224.0	V	333.0	-2.9
7309.419	---	51.744	53.98	2.24	200.0	1000.000	140.0	V	90.0	-2.7
7309.419	57.016	---	73.99	16.97	200.0	1000.000	140.0	V	90.0	-2.7
12187.135	---	48.797	53.98	5.18	10.0	1000.000	276.0	H	-53.0	4.9
12187.135	54.565	---	73.98	19.42	10.0	1000.000	276.0	H	-53.0	4.9

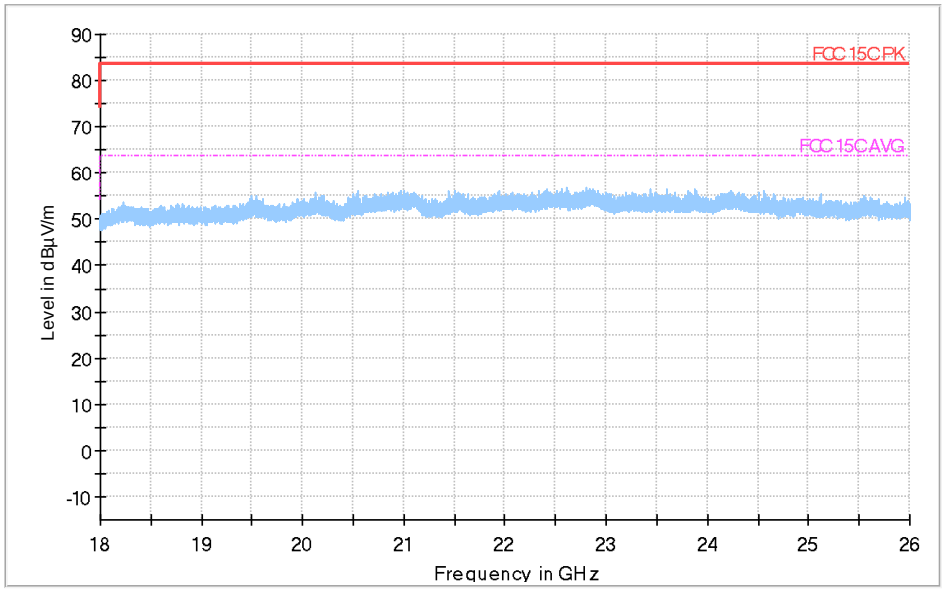
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
4873.973	5:17:39 PM - 12/10/2019
4873.973	5:17:39 PM - 12/10/2019
5981.755	5:24:17 PM - 12/10/2019
5981.755	5:24:18 PM - 12/10/2019
7309.419	5:20:59 PM - 12/10/2019
7309.419	5:20:58 PM - 12/10/2019
12187.135	5:14:31 PM - 12/10/2019
12187.135	5:14:30 PM - 12/10/2019



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #8 Radiated Emissions: 18-26 GHz		
Modulation: 802.11b	**Channel: Mid**	**100% Duty Cycle**



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #9 Radiated Emissions: 30 MHz – 1GHz

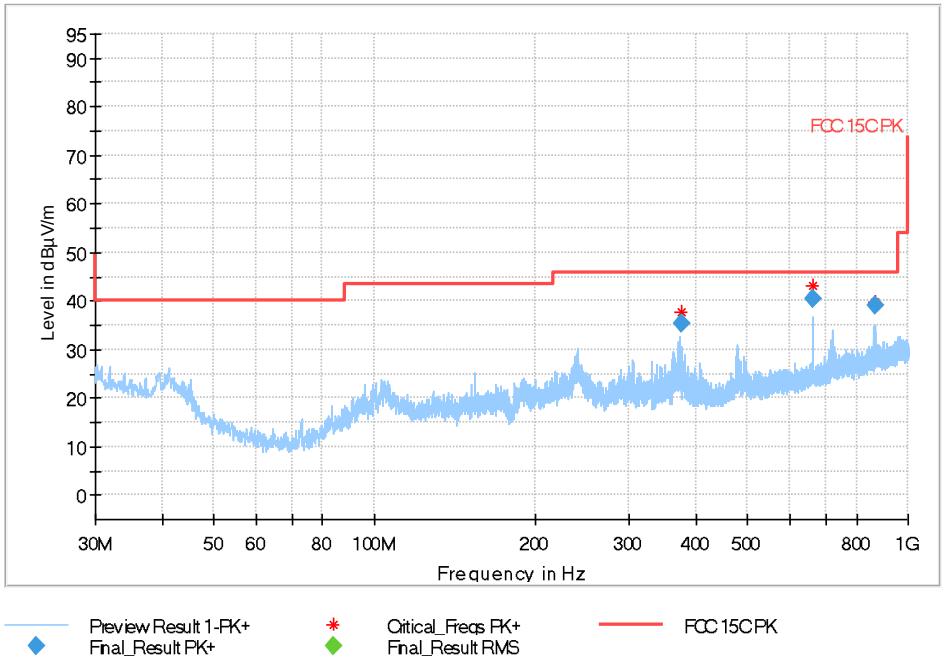
Modulation: 802.11b	Channel: High	100% Duty Cycle

Final_Result

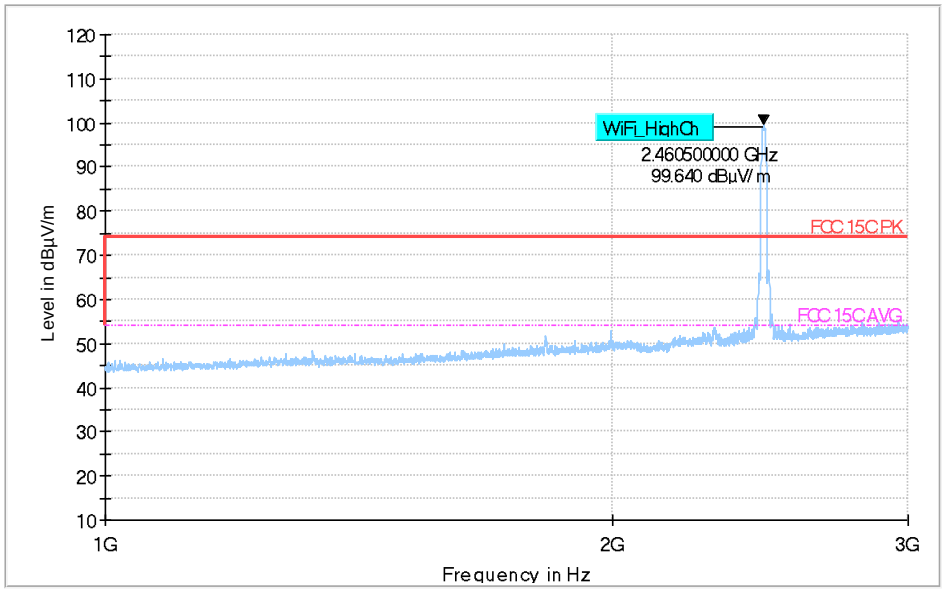
Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
375.110	35.487	---	46.00	10.51	500.0	100.000	100.0	H	234.0	-15.0
664.611	40.454	---	46.00	5.55	500.0	100.000	263.0	V	185.0	-9.2
866.015	38.922	---	46.00	7.08	500.0	100.000	210.0	H	313.0	-5.9

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
375.110	2:18:36 PM - 12/11/2019
664.611	2:21:12 PM - 12/11/2019
866.015	2:24:09 PM - 12/11/2019



Plot #10 Radiated Emissions: 1-3 GHz		
Modulation: 802.11b	**Channel: High**	**100% Duty Cycle**



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #11 Radiated Emissions: 3-18 GHz

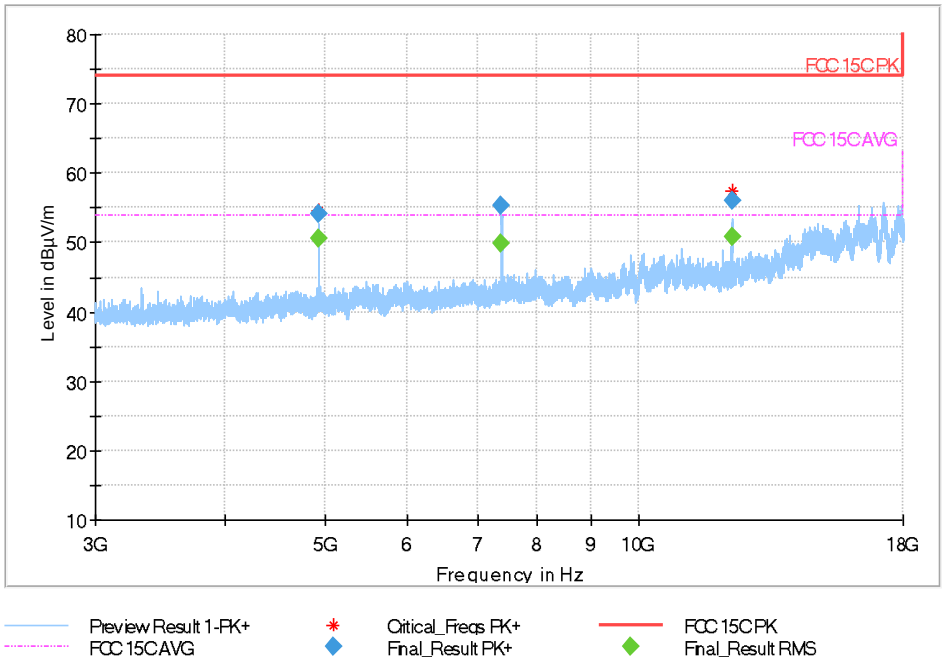
Modulation: 802.11b	Channel: High	100% Duty Cycle

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin	Meas. Time (ms)	Bandwidth	Height	Pol	Azimuth	Corr. (dB/m)
4924.018	54.093	---	73.99	19.90	200.0	1000.000	146.0	H	320.0	-5.5
4924.018	---	50.461	53.98	3.52	200.0	1000.000	146.0	H	320.0	-5.5
7387.305	55.395	---	73.99	18.59	200.0	1000.000	146.0	V	125.0	-2.4
7387.305	---	49.875	53.98	4.10	200.0	1000.000	146.0	V	125.0	-2.4
12312.159	---	50.776	53.98	3.20	10.0	1000.000	260.0	H	-50.0	5.5
12312.159	56.089	---	73.98	17.89	10.0	1000.000	260.0	H	-50.0	5.5

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
4924.018	5:38:10 PM - 12/10/2019
4924.018	5:38:10 PM - 12/10/2019
7387.305	5:41:31 PM - 12/10/2019
7387.305	5:41:32 PM - 12/10/2019
12312.159	5:34:35 PM - 12/10/2019
12312.159	5:34:34 PM - 12/10/2019



9 Test setup photos

Setup photos are included in supporting file name: “EMC_INNOP_005_19001_15.247_Setup_Photos.pdf”

10 Test Equipment and Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/26/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	07/31/2017
HORN ANTENNA	ETS LINDGREN	3117	00169547	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00169535	3 YEARS	09/24/2017
UNIVERSAL RADIO COMMUNICATION TESTER	R&S	CMU 200	101821	3 YEARS	07/06/2017
WIDEBAND RADIO COMMUNICATION	R&S	CMW500	127068	3 YEARS	07/01/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/15/2019
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	3 YEARS	06/20/2017
DIGITAL THRMOMETER	CONTROL COMPANY	36934-164	191871994	2 YEARS	01/10/2019

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
2020-01-06	EMC_INNOP_005_19001_15.247_WLAN	Initial version	Kevin Wang