



FCC / ISED Test Report

For:
Geotab Inc.

Model #:
GP9-LTE

Product Description:
GO9 Telematics device with on-board Wi-Fi hotspot functionality

FCC ID: 2AV57GP9LTE
IC ID: 11140A-GP9LTE

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

REPORT #: EMC_GEOTA_032_20001_FCC_15.247_ISED_Wi-Fi_DTS

DATE: 6/12/2020



A2LA Accredited

IC recognized #
3462B-2

CETECOM Inc.

411 Dixon Landing Road • Milpitas, CA 95035 • U.S.A.

Phone: + 1 (408) 586 6200 • Fax: + 1 (408) 586 6299 • E-mail: info@cetecom.com • <http://www.cetecom.com>
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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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 #
Geotab Inc.	GO9 Telematics device with on-board Wi-Fi hotspot functionality	GP9-LTE

Responsible for Testing Laboratory:

12/06/2020	Compliance	Li, Cindy (EMC Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

12/06/2020	Compliance	Ghanma, Issa (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.
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:	Li, Cindy
Responsible Project Leader:	Sivaraman, Sangeetha

2.2 Identification of the Client

Applicant's Name:	Geotab Inc.
Street Address:	2440 Winston Park Drive
City/Zip Code	Oakville, ON L6H 7V2
Country	Canada

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:	GP9-LTE
FCC-ID :	2AV57GP9LTE
IC-ID:	11140A-GP9LTE
HW Version :	A
SW Version :	123
HVIN:	GP9-LTE
PMN:	GP9-LTE
Product Description:	GO9 Telematics device with on-board Wi-Fi hotspot functionality
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels
Type(s) of Modulation:	Wi-Fi: 802.11b/ g/ n
Modes of Operation:	802.11b,g,n
Antenna Information as declared:	Max Gain: 4.2 dBi
Max. Conducted Output Power:	Peak measurement: 23.37 dBm
Power Supply/ Rated Operating Voltage Range:	Vehicle: 12, 24 V DC
Operating Temperature Range	-40°C to 85 °C

Other Radios included in the device:	❖ Cellular: - Module Name : Wistron NeWeb - Model Number : M18Q2F-1 - FCC \ IC ID : NKRM18Q2 \ 4441A-M18Q2 ❖ GPS Receiver: 72-channel engine (GPS/GLONASS/Beidou/Galileo/SBAS/WAAS/EGNOSMSAS/GAGAN)
Sample Revision	☐ Prototype Unit; ☐ Production Unit; ☒ Pre-Production

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	GP9000001	A	123	Conducted RF
2	GP9000002	A	123	Radiated

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
N/A	-	-	-	-

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The EUT was connected to an engineering test harnesses for test setup. These harnesses allow Powering the device on a bench setup and AT commands access.
2	EUT#2	The EUT was connected to an engineering test harnesses for test setup. These harnesses allow Powering the device on a bench setup and AT commands access.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Wi-Fi 2.4 GHz	❖ “QRCT 4” software tool was provided by the client, to configure the Wi-Fi 2.4GHz radio: ▪ Mode: b/g/n ▪ Transmit mode: Continuous TX ▪ Duty cycle: 100% ▪ Power: Max Power (Based on “Wi-Fi TX Operation mode” table below) ▪ Hopping: No ▪ Hopping Type: Single Frequency ▪ Channel: Low , Mid, High, Channel # 11 ▪ Data rate: (Based on “Wi-Fi TX Operation mode” table below) ❖ The measurement equipment was connected to the 50 ohm RF port of the EUT.

Mode	Rate (Mbps)	MOD.	target power										
Channel (HT20)			CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11
11b	1	DSSS-1	16	16	16	16	16	16	16	16	16	16	16
	2	DSSS-2	16	16	16	16	16	16	16	16	16	16	16
	5.5	CCK-5.5	16	16	16	16	16	16	16	16	16	16	16
	11	CCK-11	16	16	16	16	16	16	16	16	16	16	16
11g	6	OFDM-6	15	15	15	15	15	15	15	15	15	15	15
	9	OFDM-9	15	15	15	15	15	15	15	15	15	15	15
	12	OFDM-12	15	15	15	15	15	15	15	15	15	15	15
	18	OFDM-18	15	15	15	15	15	15	15	15	15	15	15
	24	OFDM-24	15	15	15	15	15	15	15	15	15	15	15
	36	OFDM-36	15	15	15	15	15	15	15	15	15	15	15
	48	OFDM-48	15	15	15	15	15	15	15	15	15	15	15
	54	OFDM-54	15	15	15	15	15	15	15	15	15	15	15
11n	6.5	MCS0	14	14	14	14	14	14	14	14	14	14	14
	13	MCS1	14	14	14	14	14	14	14	14	14	14	14
	19.5	MCS2	14	14	14	14	14	14	14	14	14	14	14
	26	MCS3	14	14	14	14	14	14	14	14	14	14	14
	39	MCS4	14	14	14	14	14	14	14	14	14	14	14
	52	MCS5	14	14	14	14	14	14	14	14	14	14	14
	58.5	MCS6	14	14	14	14	14	14	14	14	14	14	14
	65	MCS7	14	14	14	14	14	14	14	14	14	14	14

Note: For 40 MHz channel bandwidth, target power used same as for 20 MHz channel bandwidth listed in the table above.

3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle and output power.

For radiated measurements;

- All data in this report show the worst case of Wi-Fi radio in simultaneous transmission mode with Cellular, transmitting at the highest output power band (FCC/IC ID: NKRM18Q2/4441A-M18Q2).
- All data in this report show 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.

This test report is to support a request for new equipment authorization under the FCC ID: 2AV57GP9LTE IC ID: 11140A-GP9LTE

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – “GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES” - April 2, 2019, 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(a)	Emission Bandwidth	Nominal	Op. 1	■	□	□	Complies
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	Op. 1	■	□	□	Complies
§15.247(b)(1) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	Op. 1	■	□	□	Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	Op. 1	■	□	□	Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	Op. 1	■	□	□	Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions- Radiated	Nominal	Op. 2	■	□	□	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	N/A	□	□	■	See note1 See note 2

Note1: NA= Not Applicable; NP= Not Performed.

Note2: This device is powered by Vehicle: 12, 24 V DC; hence this test is not applicable.

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)
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RF conducted measurement	± 0.5 dB
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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:

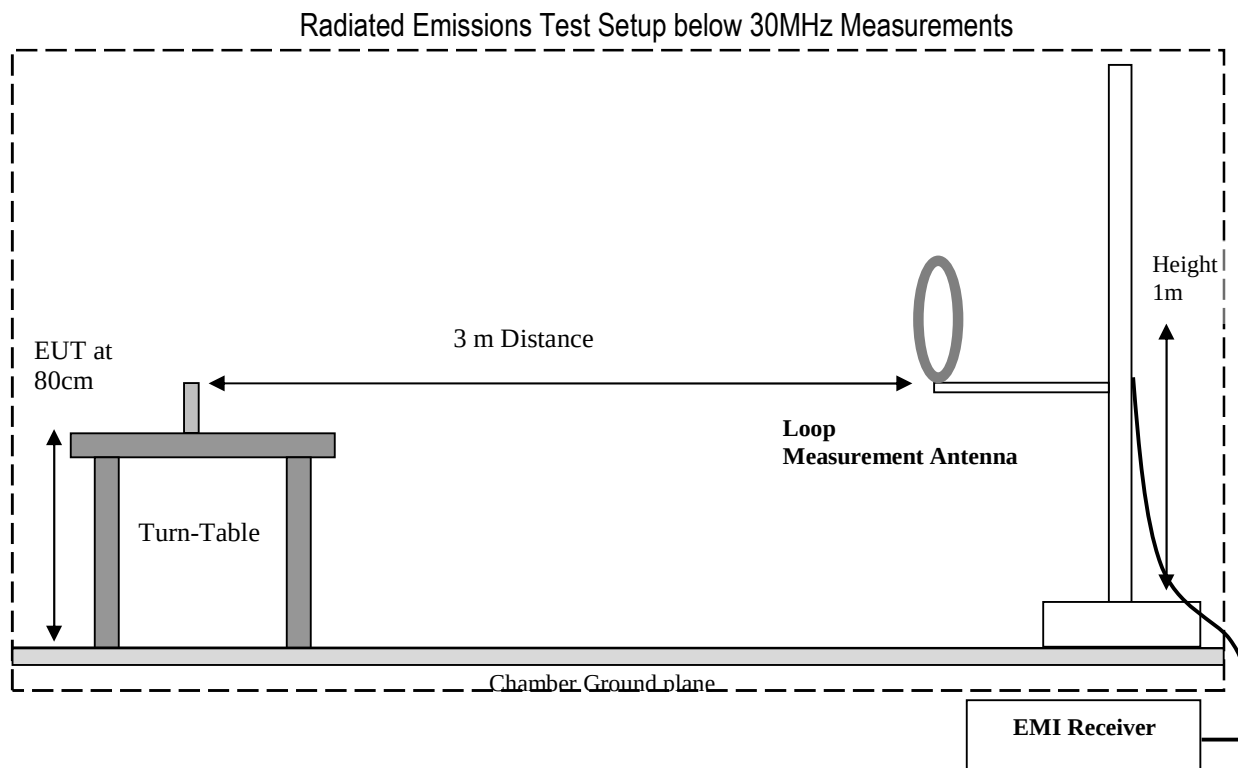
03/24/2020 – 04/17/2020

7 Measurement Procedures

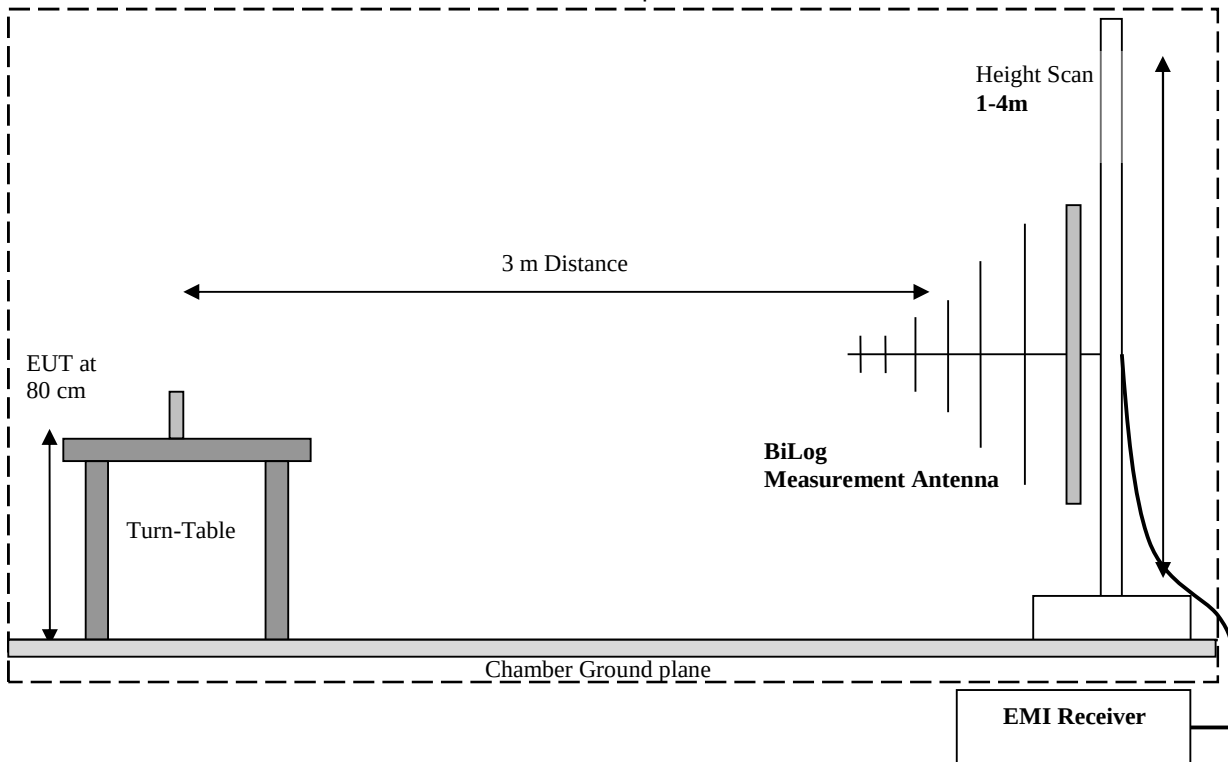
7.1 Radiated Measurement

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

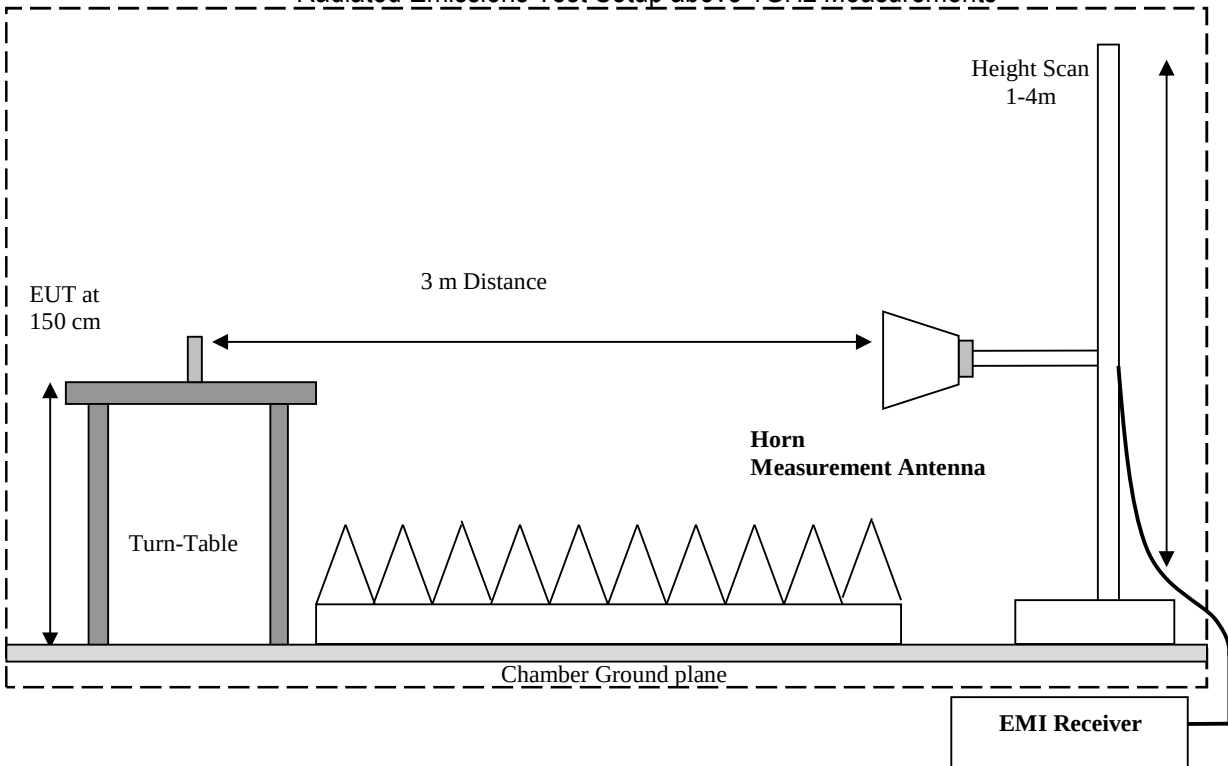
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360° continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above 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 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 dB μ V
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:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

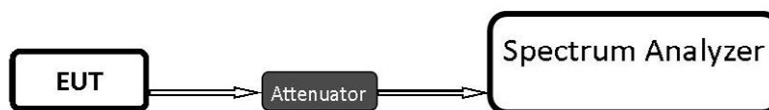
Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/m)
1000	80.5	3.5	14	98.0

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – “GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES” - April 2, 2019, 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.

8 Test Result Data

8.1 Duty Cycle

8.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02;

Measurements of duty cycle and transmission duration shall be performed using one of the following technique:

b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on-and off-times of transmitted signal.

1. Set the center frequency of the instrument to the center frequency of the transmission.
2. Set RBW $\geq$ OBW if possible; otherwise, set RBW to the largest available value.
3. Set detector = peak or average.
4. The zero-span measurement method shall not be used unless both RBW and VBW are $>50/T$ and the number of sweep points across duration T exceeds 100.
 (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \geq 16.7$ microseconds.)

8.1.2 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1	Op.1	12 VDC	4.2 dBi

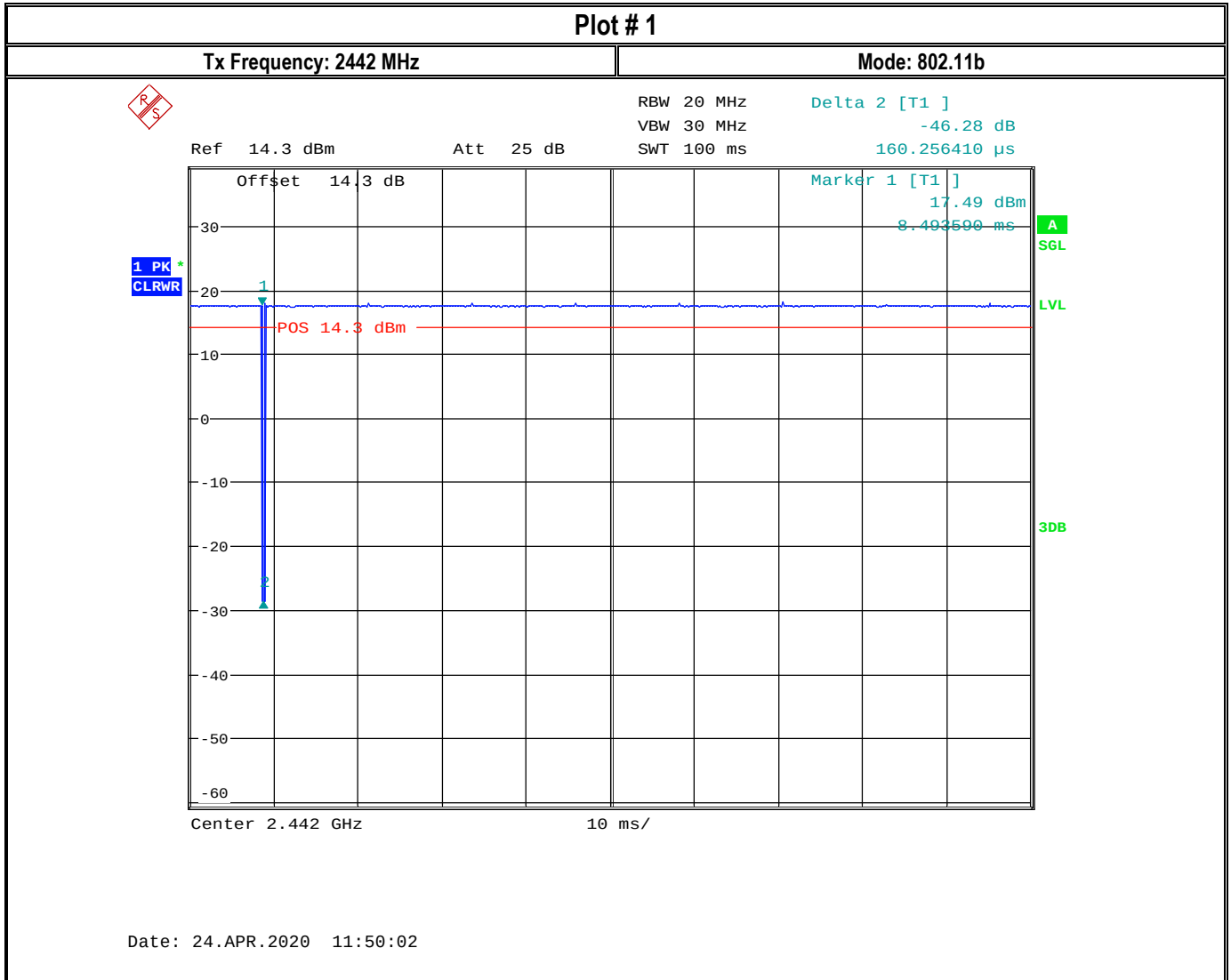
8.1.3 Measurement result:

Plot #	Mode	TX Frequency	Data Rate	Off-time over 100 ms *1	Duty cycle
1	802.11b	2442 MHz	1 Mb/s	160.3 μ s *2	99.84 %
2	802.11g	2442 MHz	6 Mb/s	480.5 μ s *2	99.52 %
3	802.11n HT20	2442 MHz	6.5 Mb/s	320.3 μ s *2	99.68 %
4	80211n HT40	2437	6.5 Mb/s	244.4 μ s *2	99.76 %

*1: Milliseconds.

*2: Microseconds.

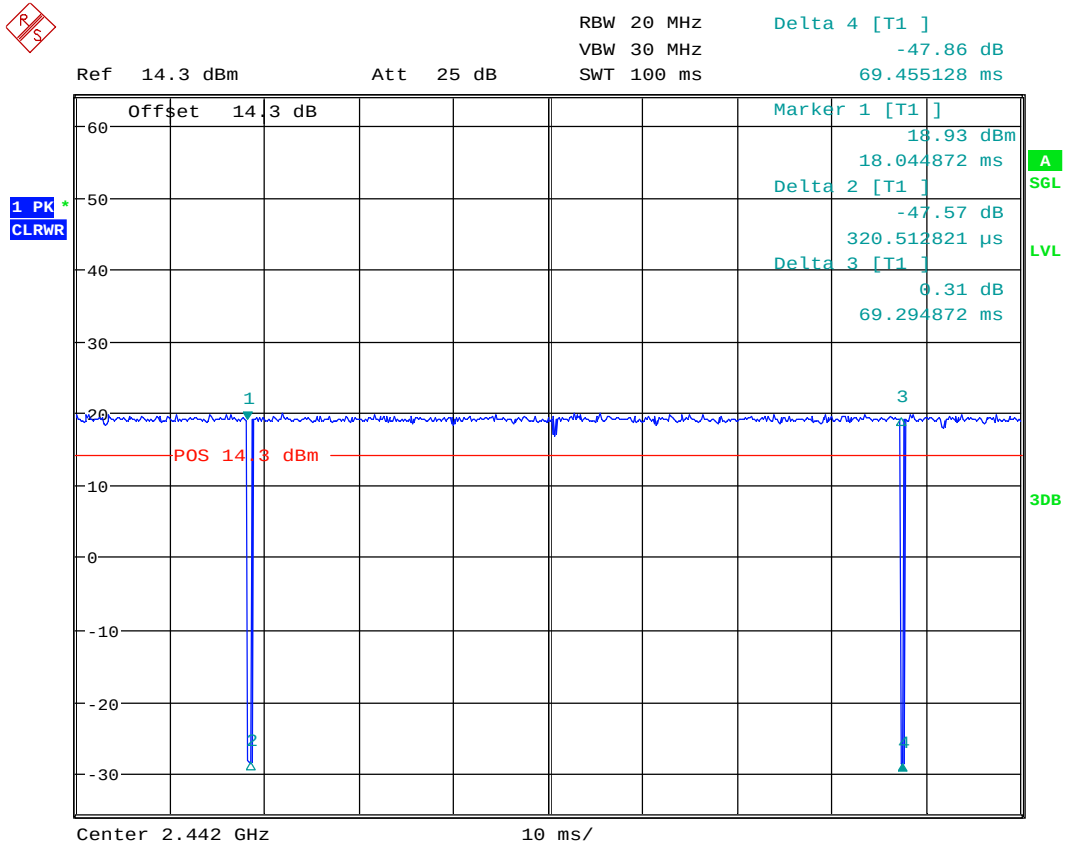
8.1.4 Measurement plots:



Plot # 2

Tx Frequency: 2442 MHz

Mode: 802.11g



Date: 24.APR.2020 11:55:06

Plot # 3

Tx Frequency: 2437 MHz

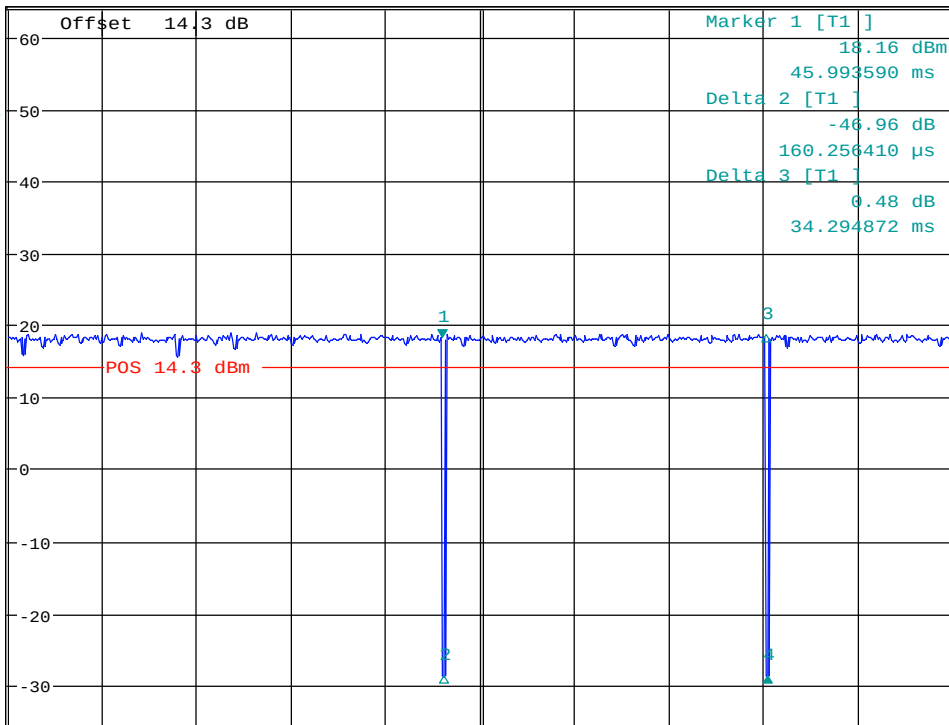
Mode: 802.11n HT20



RBW 20 MHz Delta 4 [T1]
 VBW 30 MHz -47.07 dB
 SWT 100 ms 34.455128 ms

Ref 14.3 dBm Att 25 dB

1 PK
 CLRWR



A
 SGL

LVL

3DB

Center 2.442 GHz

10 ms/

Date: 24.APR.2020 12:13:33

Plot # 4

Tx Frequency: 2437 MHz

Mode: 802.11n HT20



RBW 50 MHz

Delta 2 [T1]

VBW 30 MHz

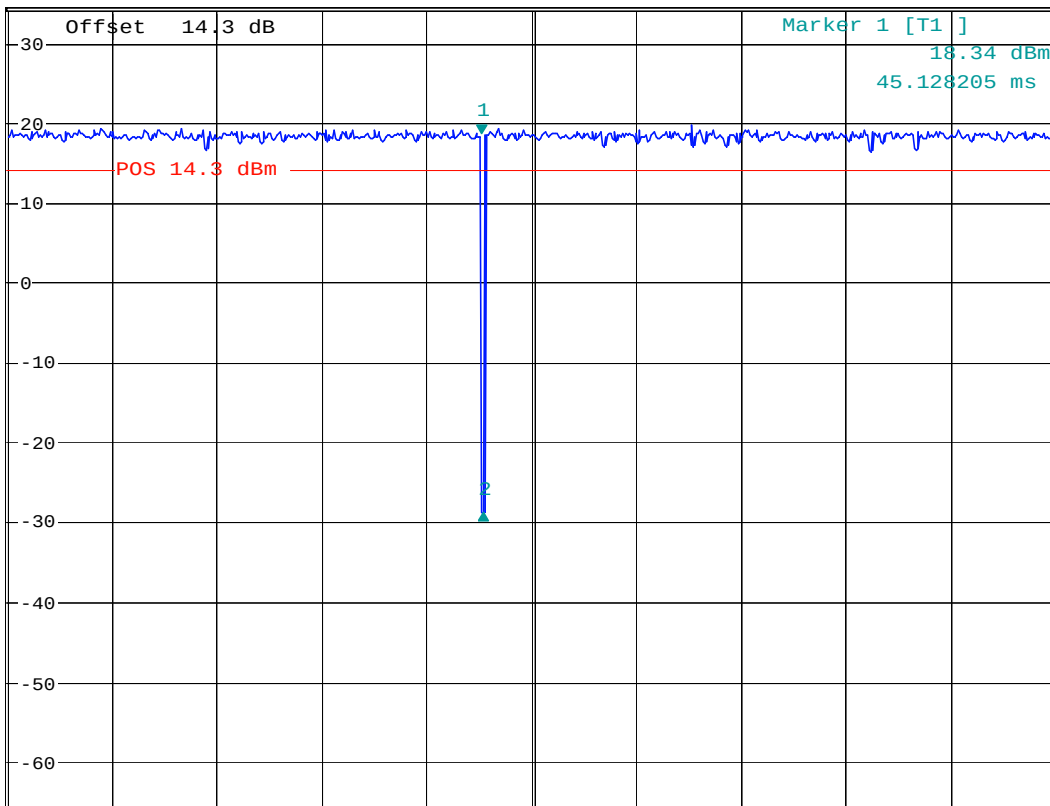
-47.43 dB

SWT 100 ms

224.358974 μ s

Ref 14.3 dBm

Att 25 dB



Center 2.437 GHz

10 ms/

Date: 1.JUN.2020 16:21:16

8.2 Emission Bandwidth 6dB and 99% Occupied Bandwidth

8.2.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings:

6dB (DTS) Bandwidth:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ 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.

99% Occupied Bandwidth:

- Set frequency = nominal EUT channel center frequency
- Set Span = 1.5 x to 5.0 x OBW
- Set RBW = 1% to 5% of OBW
- Set the video bandwidth (VBW) $\approx 3 \times$ RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

8.2.2 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.

8.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23.8°C	1	Op.1	12 VDC

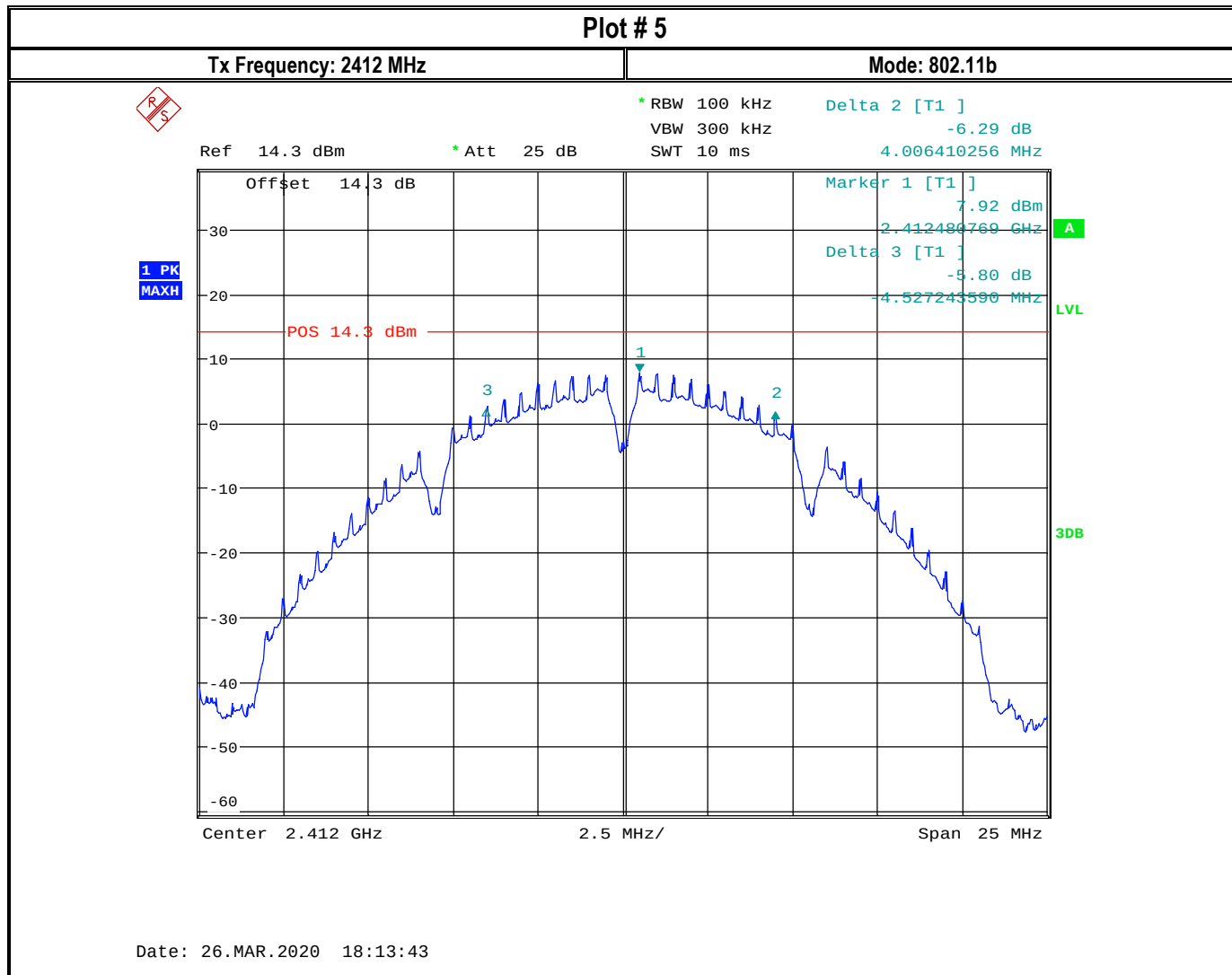
8.2.4 Measurement result:

Plot #	Frequency (MHz)	EUT Operating Mode	6dB Emission Bandwidth (MHz)	Limit (MHz)	Result
5	2412	802.11b	8.54	> 0.5	Pass
6	2442	802.11b	8.59	> 0.5	Pass
7	2462	802.11b	8.58	> 0.5	Pass
8	2412	802.11g	15.92	> 0.5	Pass
9	2442	802.11g	15.77	> 0.5	Pass
10	2462	802.11g	15.71	> 0.5	Pass
11	2412	802.11n HT20	16.03	> 0.5	Pass
12	2442	802.11n HT20	16.00	> 0.5	Pass
13	2462	802.11n HT20	15.75	> 0.5	Pass
14	2422	802.11n HT40	34.97	> 0.5	Pass
15	2462	802.11n HT40	33.80	> 0.5	Pass

Plot #	Frequency (MHz)	EUT Operating Mode	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
16	2412	802.11b	13.101	> 0.5	Pass
17	2442	802.11b	13.181	> 0.5	Pass
18	2462	802.11b	13.141	> 0.5	Pass
19	2412	802.11g	16.31	> 0.5	Pass
20	2442	802.11g	16.27	> 0.5	Pass
21	2462	802.11g	17.35	> 0.5	Pass
22	2412	802.11n HT20	17.47	> 0.5	Pass
23	2442	802.11n HT20	17.39	> 0.5	Pass
24	2462	802.11n HT20	16.27	> 0.5	Pass
25	2422	802.11n HT40	35.65	> 0.5	Pass
26	2462	802.11n HT40	35.60	> 0.5	Pass

8.2.5 Measurement Plots:

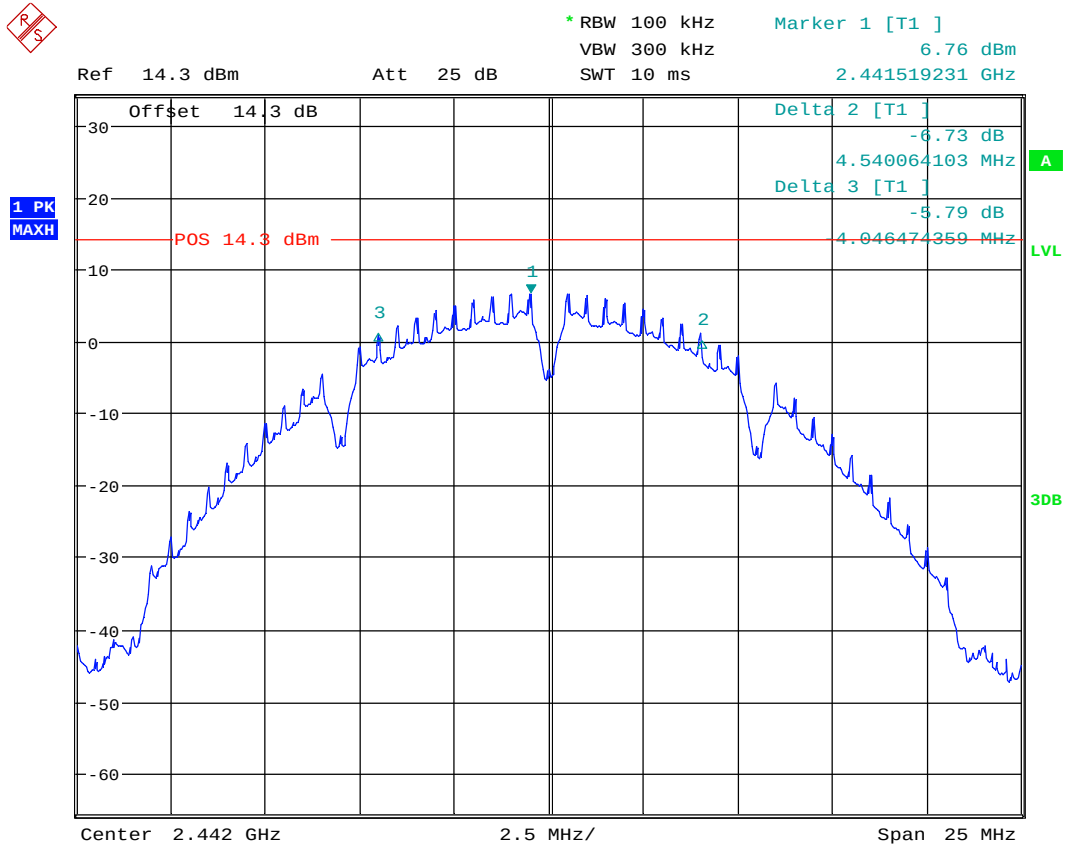
6 dB Emission Bandwidth



Plot # 6

Tx Frequency: 2442 MHz

Mode: 802.11b



Date: 24.MAR.2020 16:27:21

Plot # 7

Tx Frequency: 2462 MHz

Mode: 802.11b



* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Delta 3 [T1]

-6.19 dB

-4.567307692 MHz

Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

Marker 1 [T1]

7.56 dBm

2.462512821 GHz

Delta 2 [T1]

-5.92 dB

4.006410256 MHz

1 PK
MAXH

POS 14.3 dBm

A

LVL

3DB

Center 2.462673077 GHz

2.5 MHz/

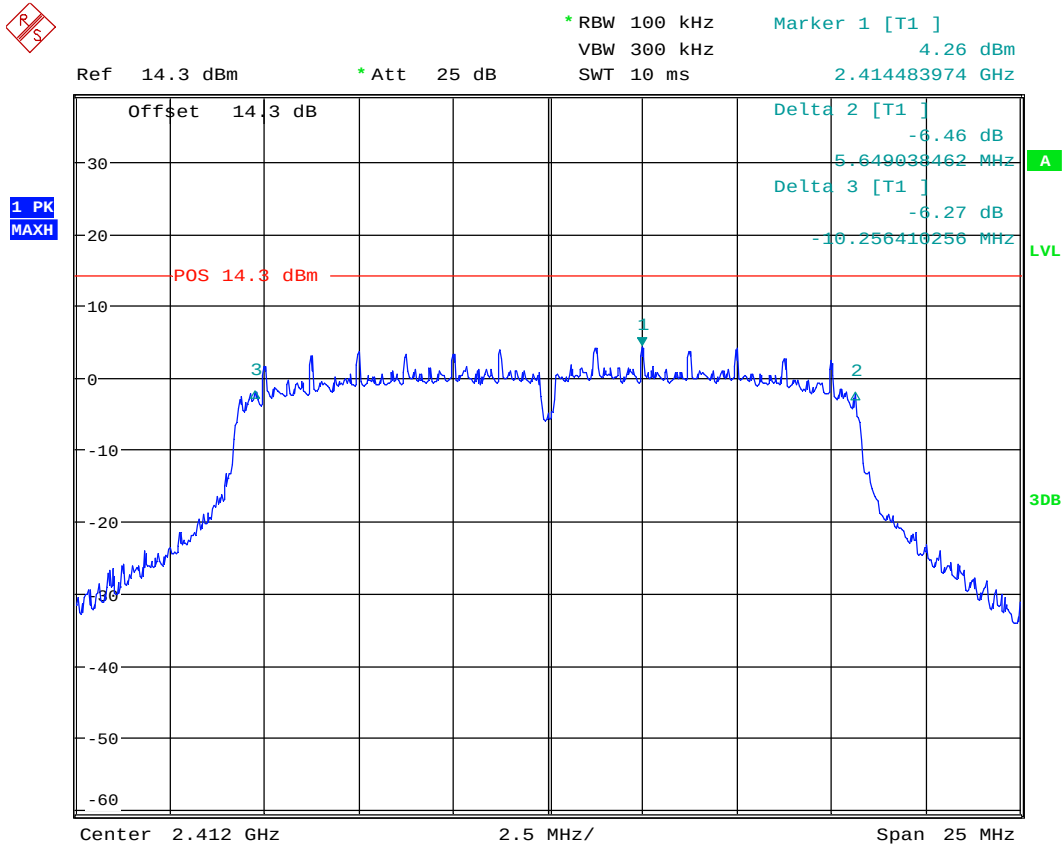
Span 25 MHz

Date: 30.MAR.2020 14:56:01

Plot # 8

Tx Frequency: 2412 MHz

Mode: 802.11g



Plot # 9

Tx Frequency: 2442 MHz

Mode: 802.11g

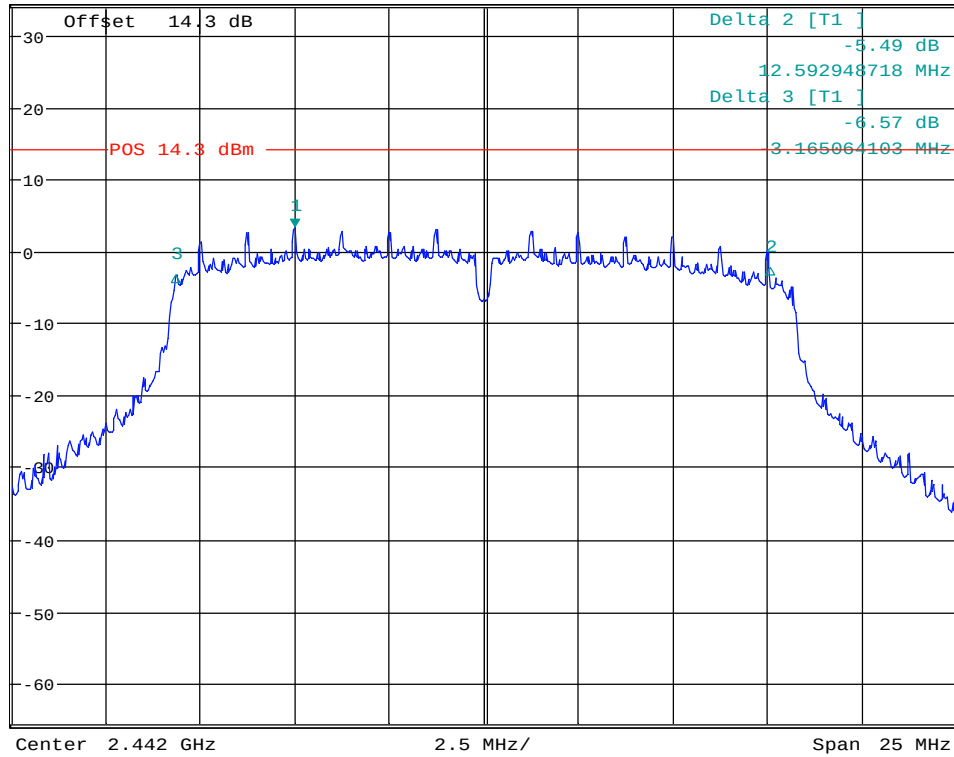


* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
3.23 dBm
2.436991987 GHz

Ref 14.3 dBm

Att 25 dB



Date: 24.MAR.2020 16:31:25

Plot # 10

Tx Frequency: 2462 MHz

Mode: 802.11g



*RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
4.10 dBm
2.464516026 GHz

Ref 14.3 dBm

*Att 25 dB

Offset 14.3 dB

Delta 2 [T1]
-6.52 dB

5.608974359 MHz

Delta 3 [T1]
-5.61 dB

-10.096153846 MHz

1 PK
MAXH

POS 14.3 dBm

LVL

3DB

Center 2.462673077 GHz

2.5 MHz/

Span 25 MHz

Date: 30.MAR.2020 15:00:51

Plot # 11

Tx Frequency: 2412 MHz

Mode: 802.11n HT20



* RBW 100 kHz Delta 3 [T1]
VBW 300 kHz -6.52 dB
SWT 10 ms -9.134615385 MHz

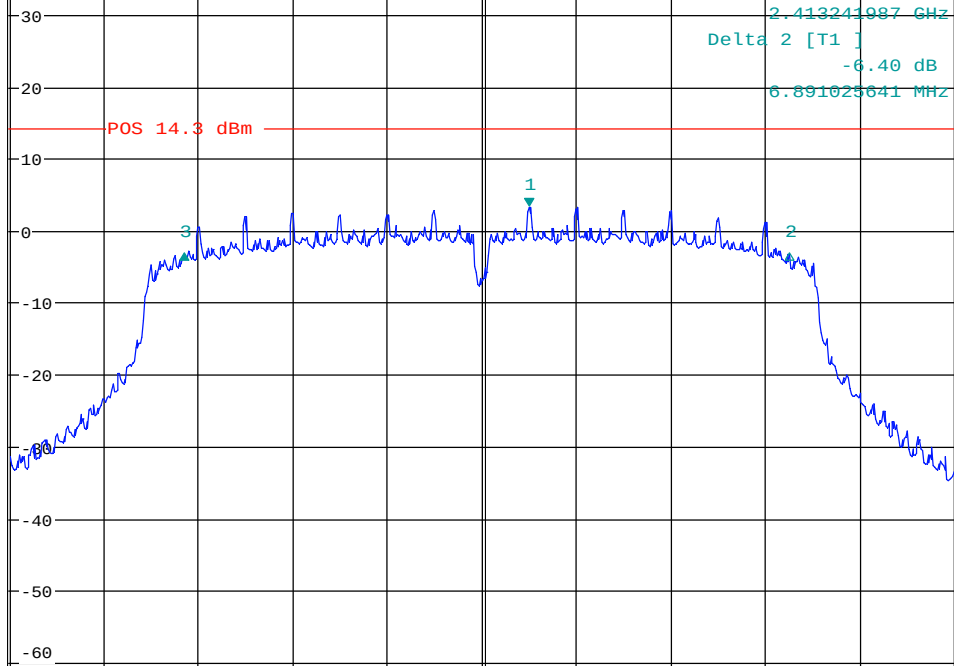
Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

Marker 1 [T1]

1 PK
MAXH



Center 2.412 GHz

2.5 MHz/

Span 25 MHz

Date: 26.MAR.2020 17:58:01

Plot # 12

Tx Frequency: 2442 MHz

Mode: 802.11n HT20



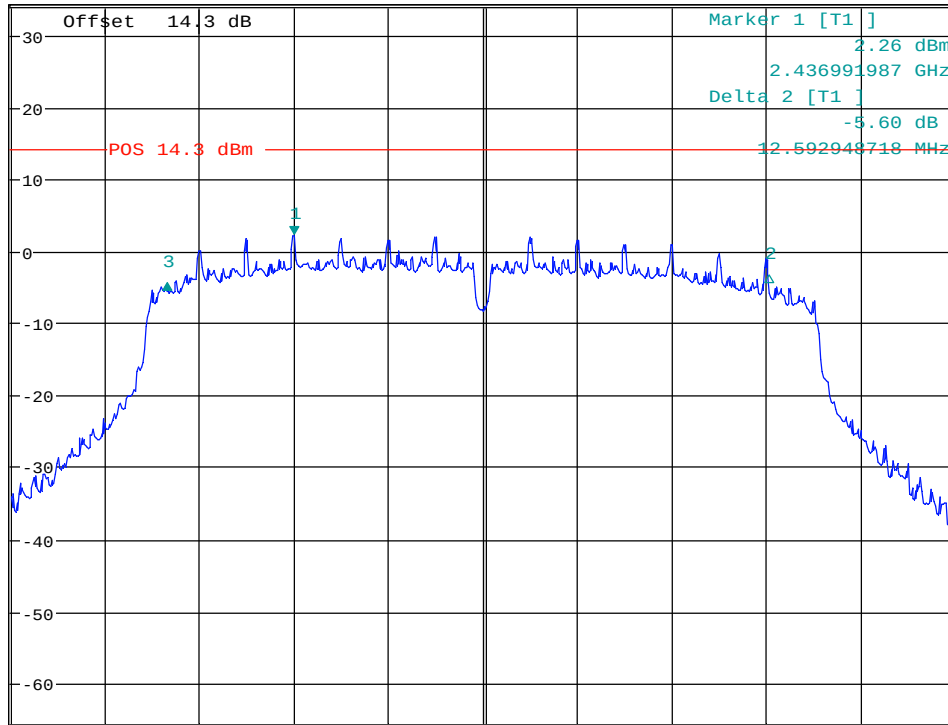
* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Delta 3 [T1]
-6.71 dB
-3.365384615 MHz

Ref 14.3 dBm

Att 25 dB

1 PK
MAXH



Center 2.442 GHz

2.5 MHz/

Span 25 MHz

Date: 24.MAR.2020 16:34:51

Plot # 13

Tx Frequency: 2462 MHz

Mode: 802.11n HT20



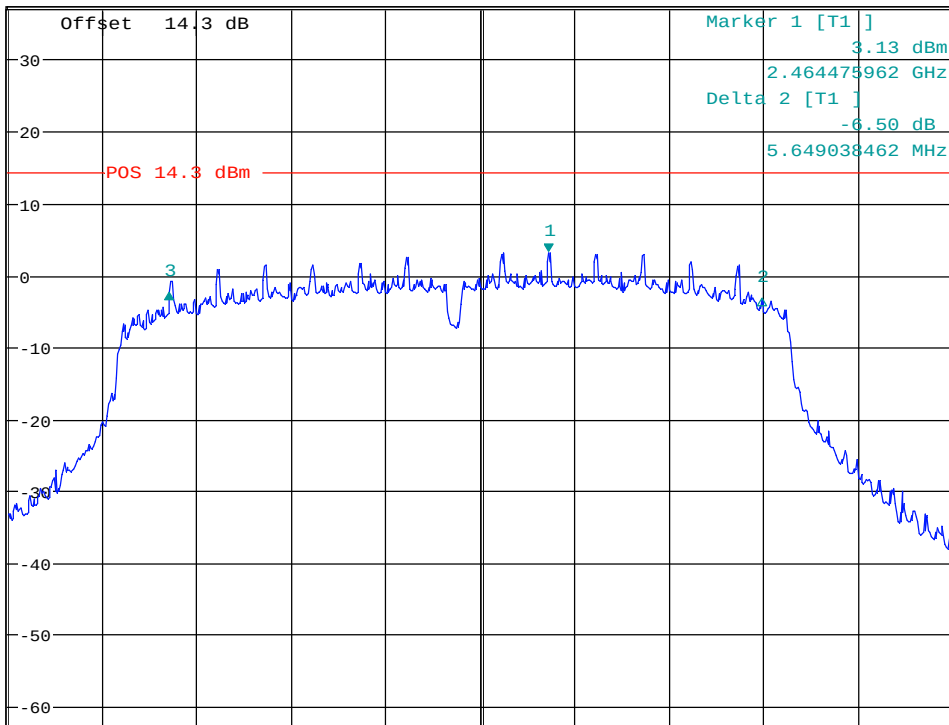
* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Delta 3 [T1]
-5.66 dB
-10.056089744 MHz

Ref 14.3 dBm

* Att 25 dB

1 PK
MAXH



Center 2.462673077 GHz

2.5 MHz/

Span 25 MHz

Date: 30.MAR.2020 15:03:14

Plot # 14

Tx Frequency: 2422 MHz

Mode: 802.11n HT40



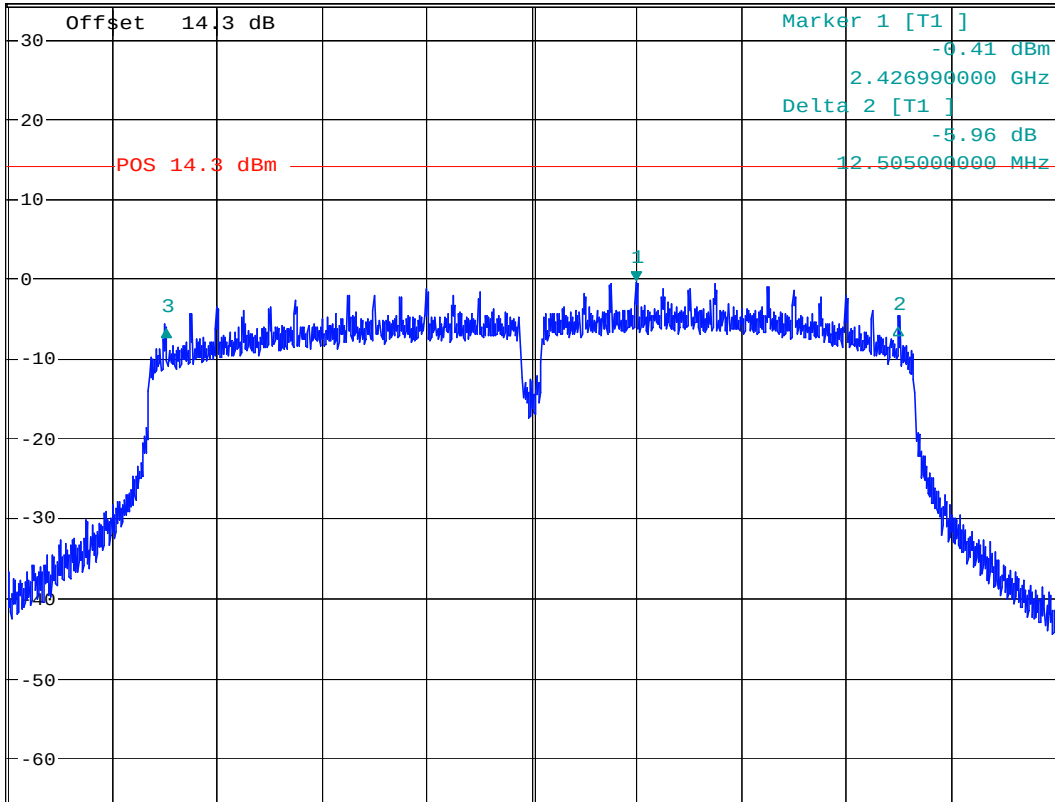
* RBW 100 kHz
VBW 300 kHz
SWT 45 ms

Delta 3 [T1]
-6.13 dB
-22.457948718 MHz

Ref 14.3 dBm

Att 25 dB

1 PK
MAXH



Center 2.422 GHz

5 MHz/

Span 50 MHz

Date: 1.JUN.2020 16:57:11

Plot # 15

Tx Frequency: 2462 MHz

Mode: 802.11n HT40

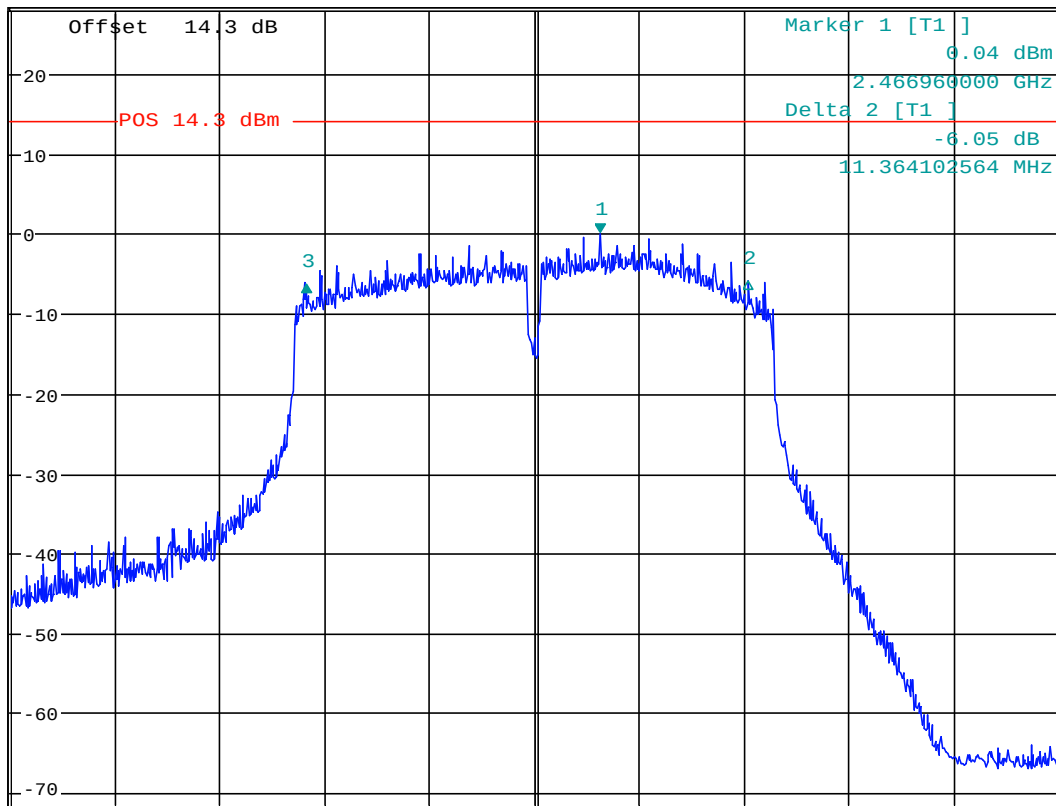


* RBW 100 kHz Delta 3 [T1]
* VBW 300 kHz -6.42 dB
SWT 20 ms -22.435897436 MHz

Ref 14.3 dBm

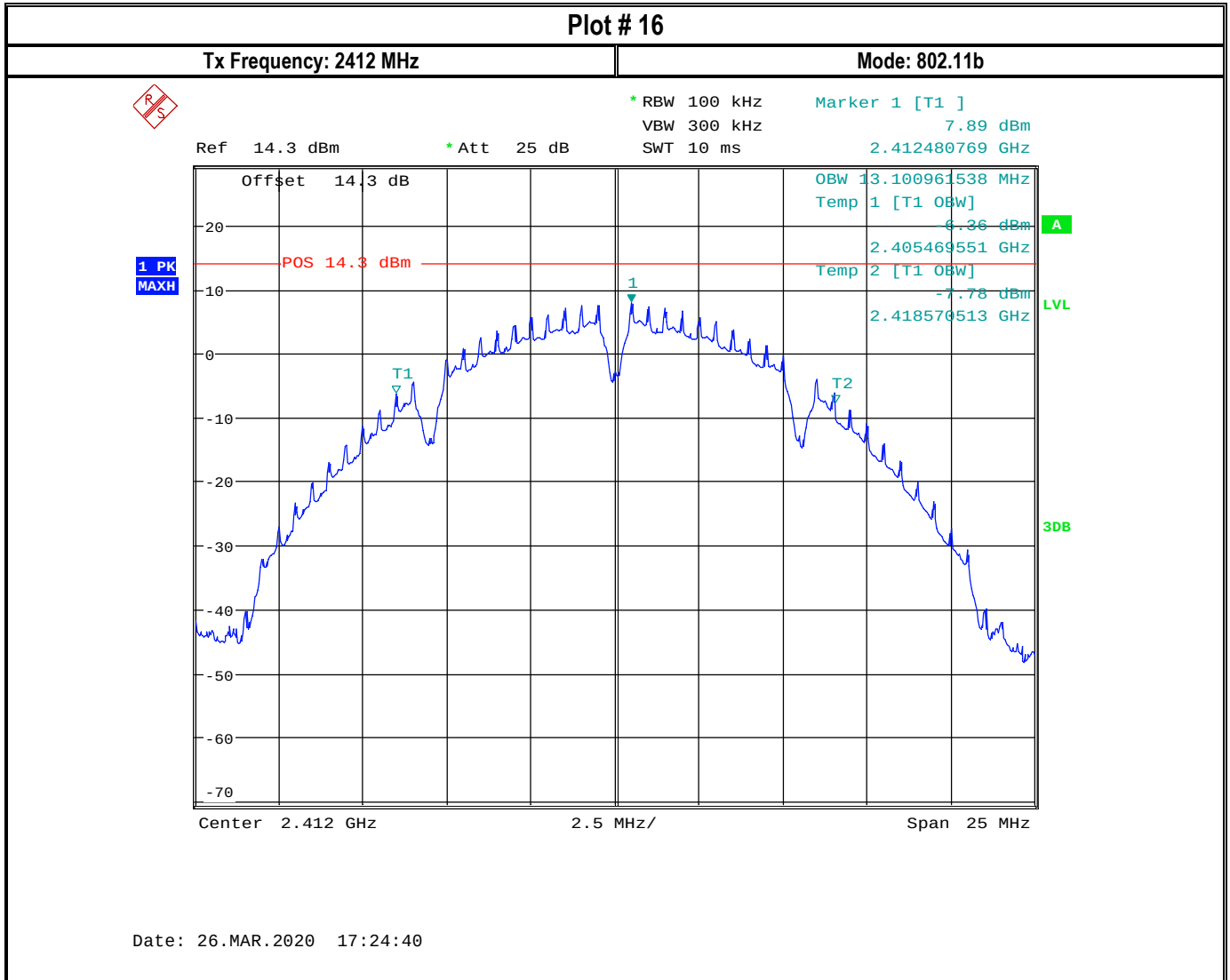
* Att 5 dB

1 PK
MAXH



Date: 1.JUN.2020 12:03:09

99% Occupied Bandwidth



Plot # 17

Tx Frequency: 2442 MHz

Mode: 802.11b



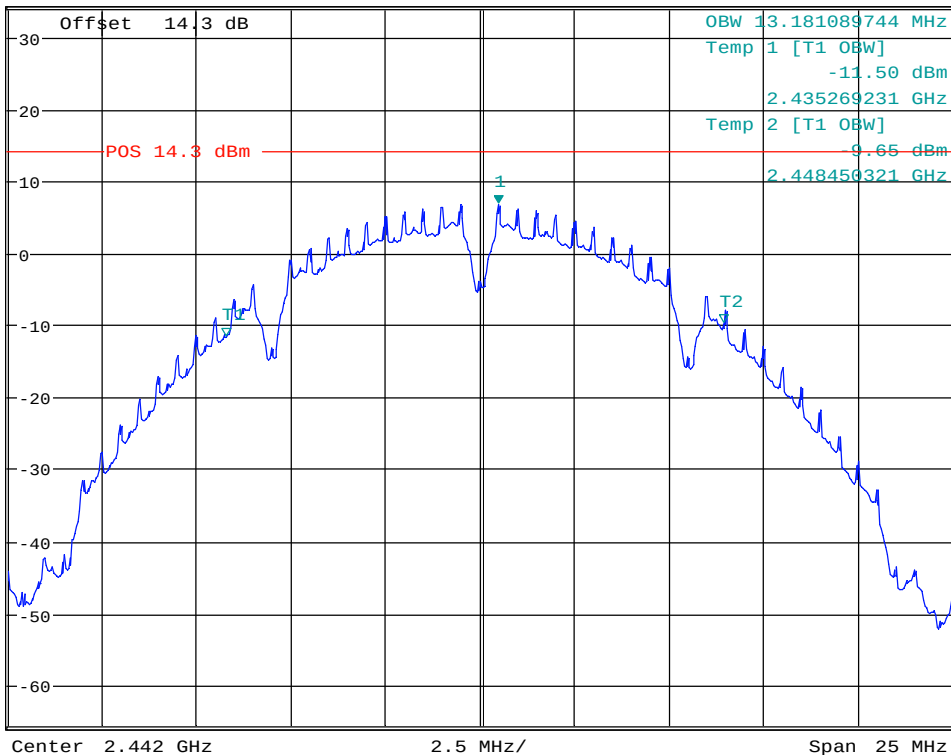
* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
6.85 dBm
2.442480769 GHz

Ref 14.3 dBm

Att 5 dB

2.442480769 GHz



Date: 24.MAR.2020 16:20:08

Plot # 18

Tx Frequency: 2462 MHz

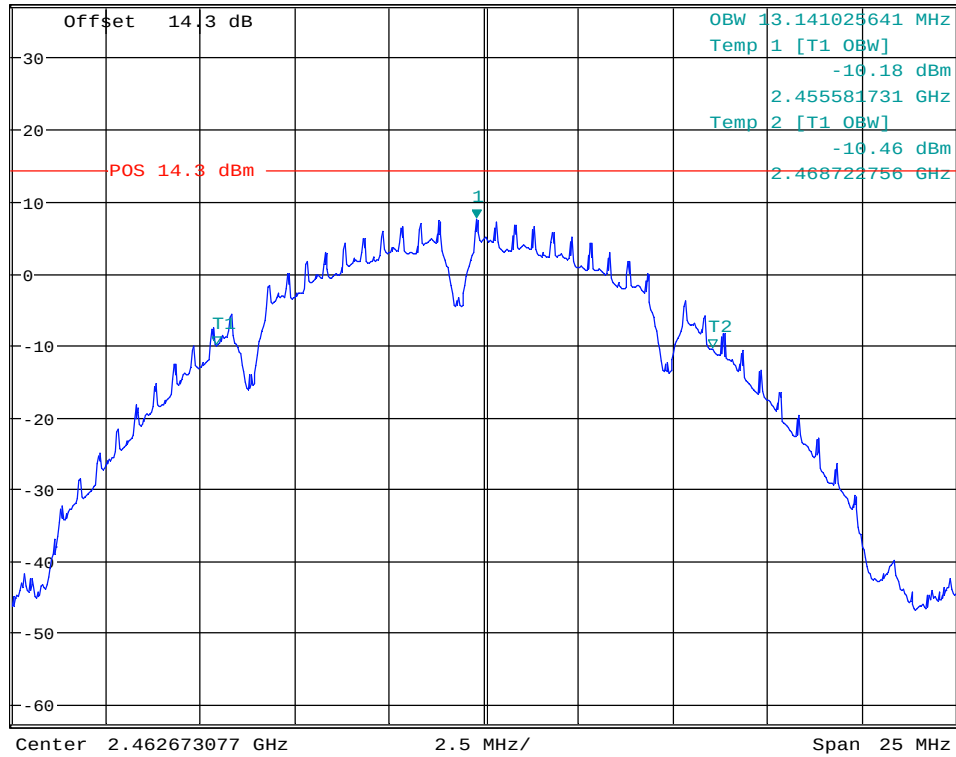
Mode: 802.11b



* RBW 100 kHz Marker 1 [T1]
VBW 300 kHz 7.48 dBm
SWT 10 ms 2.462472756 GHz

Ref 14.3 dBm

* Att 25 dB



Date: 30.MAR.2020 15:09:48

Plot # 19

Tx Frequency: 2412 MHz

Mode: 802.11g



* RBW 100 kHz Marker 1 [T1]
VBW 300 kHz 4.26 dBm
SWT 10 ms 2.413241987 GHz

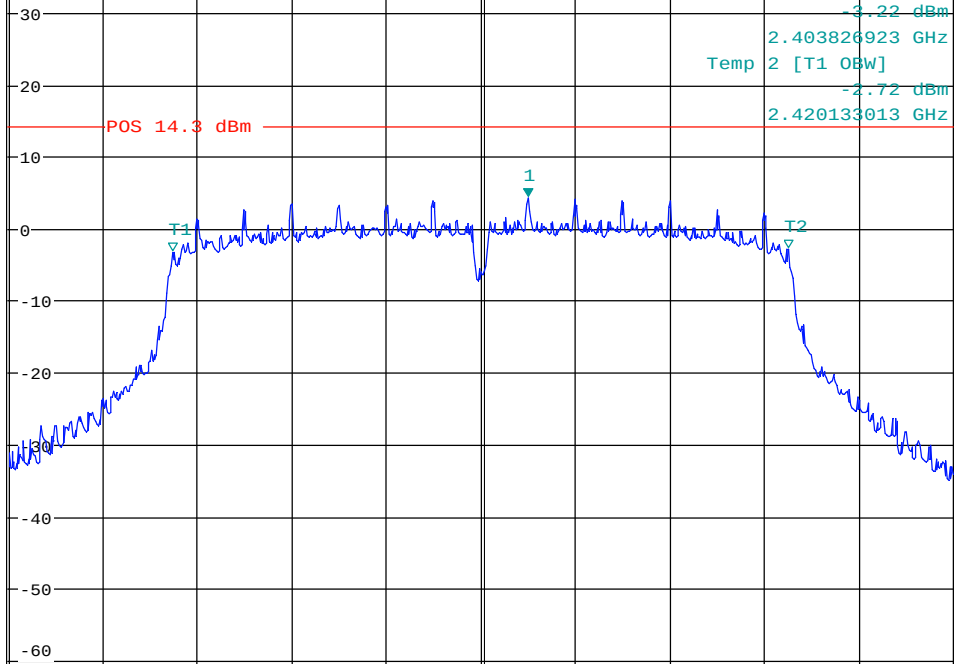
Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

OBW 16.306089744 MHz

1 PK
MAXH



Center 2.412 GHz

2.5 MHz/

Span 25 MHz

Date: 26.MAR.2020 17:43:34

Plot # 20

Tx Frequency: 2442 MHz

Mode: 802.11g



* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
3.24 dBm
2.436991987 GHz

Ref 14.3 dBm

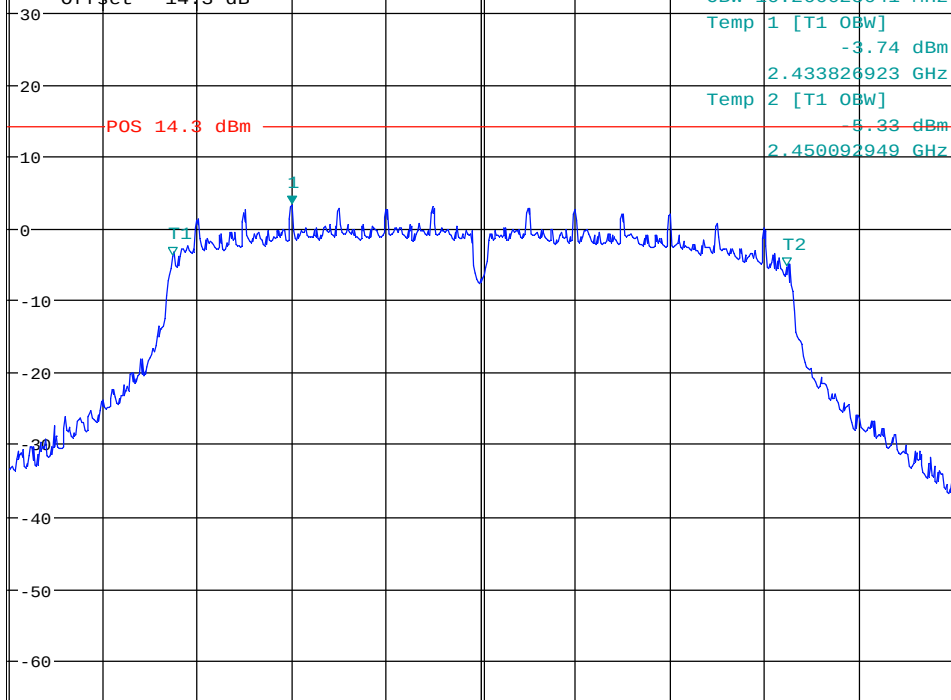
Att 5 dB

2.436991987 GHz

Offset 14.3 dB

OBW 16.266025641 MHz

1 PK
MAXH



Center 2.442 GHz

2.5 MHz/

Span 25 MHz

Date: 24.MAR.2020 16:10:19

Plot # 21

Tx Frequency: 2462 MHz

Mode: 802.11g



* RBW 100 kHz Marker 1 [T1]
VBW 300 kHz 3.14 dBm
SWT 10 ms 2.464516026 GHz

Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

OBW 17.347756410 MHz

Temp 1 [T1 OBW]

-7.60 dBm

2.453378205 GHz

Temp 2 [T1 OBW]

-4.99 dBm

2.470725962 GHz

1 PK
MAXH

POS 14.3 dBm

A

LVL

3DB

Center 2.462673077 GHz

2.5 MHz/

Span 25 MHz

Date: 30.MAR.2020 15:06:16

Plot # 22

Tx Frequency: 2412 MHz

Mode: 802.11n HT20



* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
3.15 dBm
2.413241987 GHz

Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

OBW 17.467948718 MHz

Temp 1 [T1 OBW]

-5.69 dBm

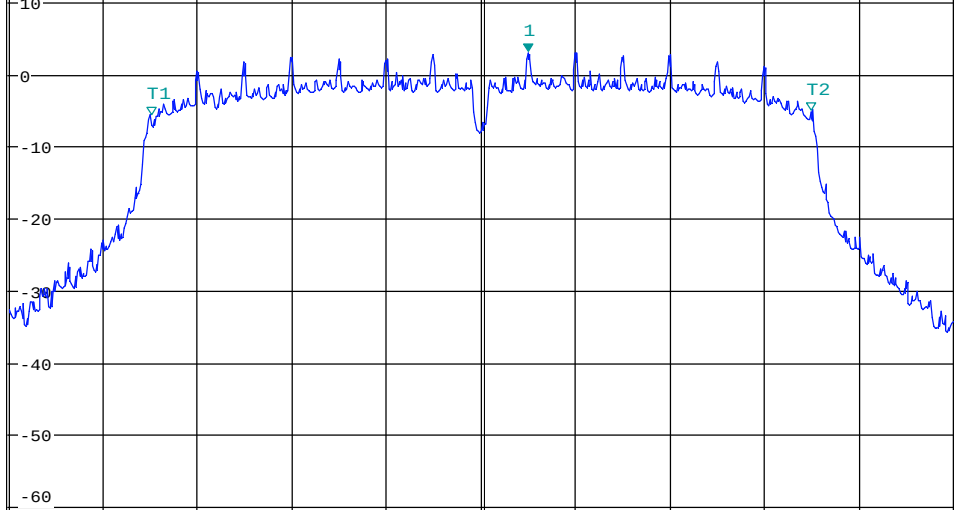
2.403266026 GHz

Temp 2 [T1 OBW]

-5.16 dBm

2.420733974 GHz

1 PK
MAXH



Center 2.412 GHz

2.5 MHz/

Span 25 MHz

Date: 26.MAR.2020 17:45:18

Plot # 23

Tx Frequency: 2442 MHz

Mode: 802.11n HT20



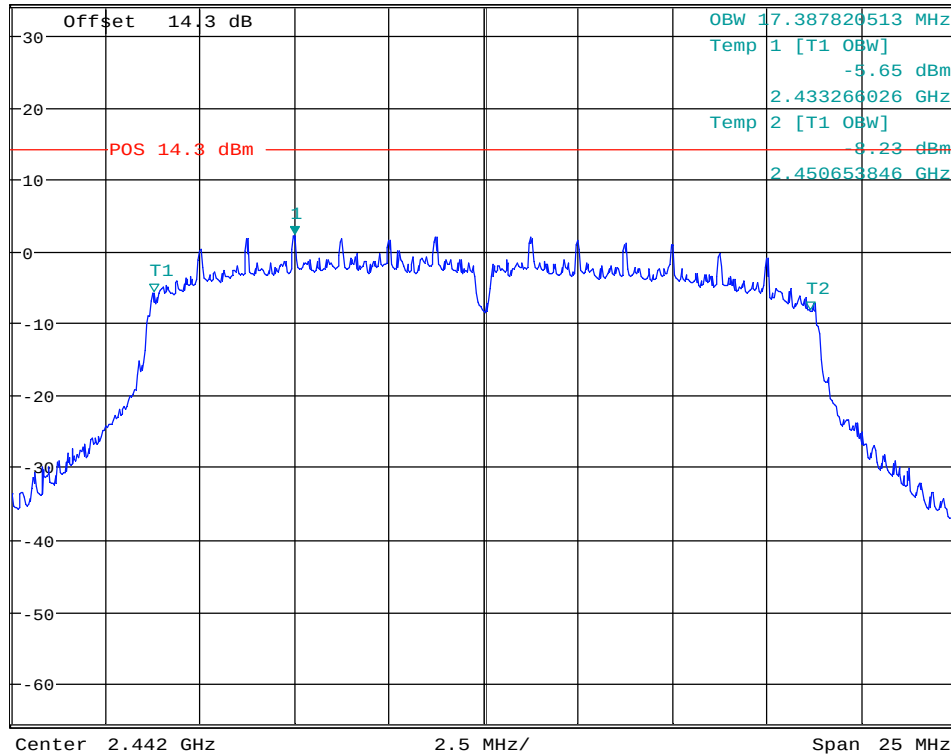
* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
2.28 dBm
2.436991987 GHz

Ref 14.3 dBm

Att 5 dB

2.436991987 GHz



Date: 24.MAR.2020 16:16:27

Plot # 24

Tx Frequency: 2462 MHz

Mode: 802.11n HT20



* RBW 100 kHz
VBW 300 kHz
SWT 10 ms

Marker 1 [T1]
4.13 dBm
2.464475962 GHz

Ref 14.3 dBm

* Att 25 dB

2.464475962 GHz

Offset 14.3 dB

OBW 16.266023641 MHz

Temp 1 [T1 OBW]

-5.66 dBm

2.453899038 GHz

Temp 2 [T1 OBW]

-2.52 dBm

2.470165064 GHz

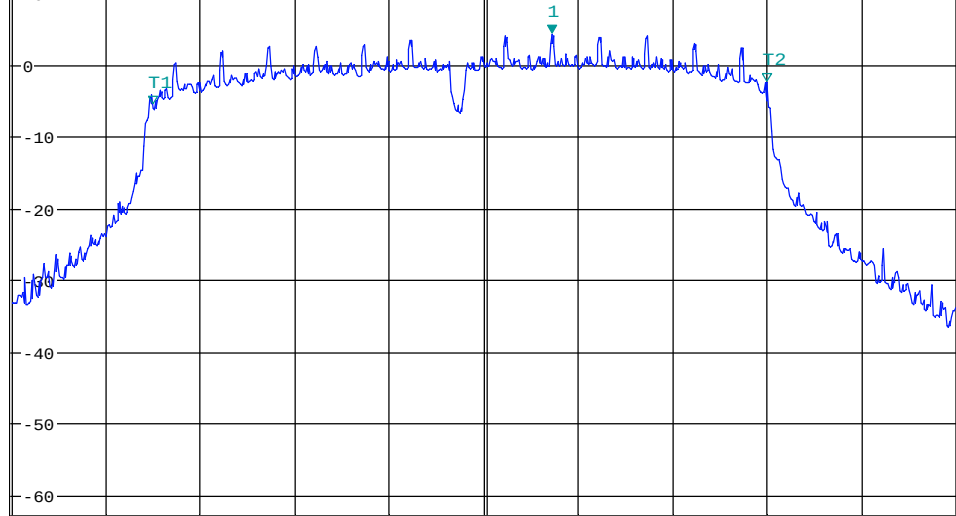
1 PK
MAXH

POS 14.3 dBm

A

LVL

3DB



Center 2.462673077 GHz

2.5 MHz/

Span 25 MHz

Date: 30.MAR.2020 15:11:26

Plot # 25

Tx Frequency: 2422 MHz

Mode: 802.11n HT40



* RBW 100 kHz
VBW 300 kHz
SWT 45 ms

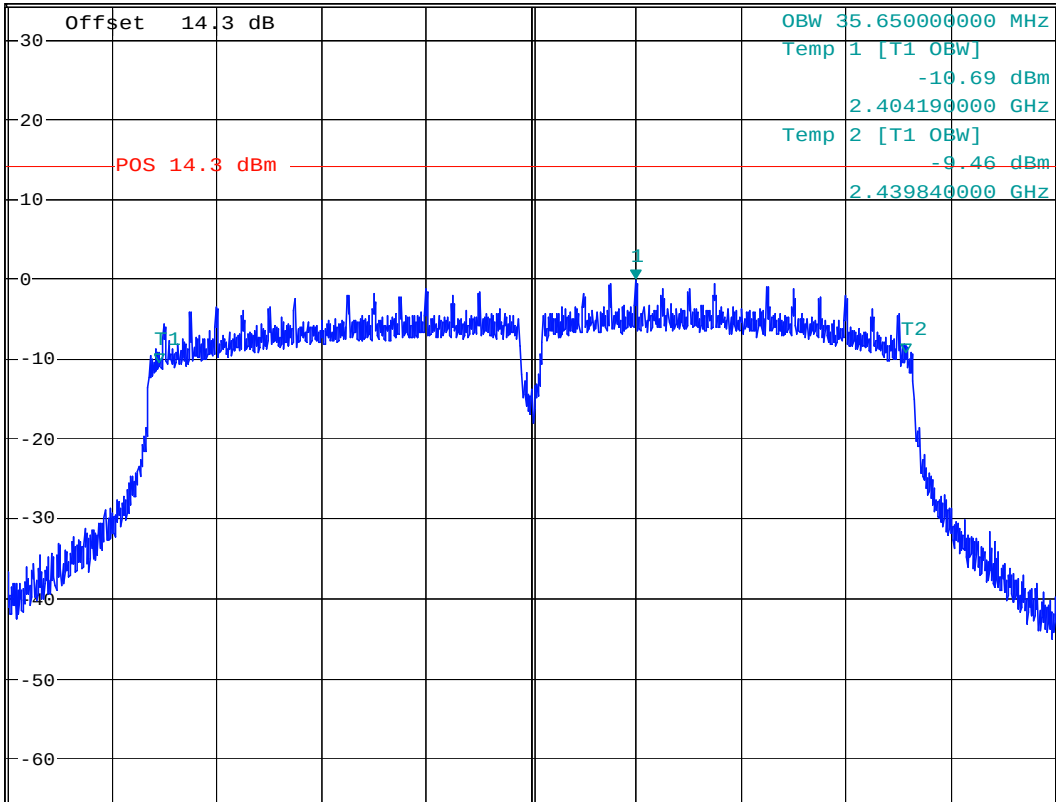
Marker 1 [T1]
-0.31 dBm
2.426985000 GHz

Ref 14.3 dBm

Att 5 dB

1 PK
MAXH

Offset 14.3 dB



Center 2.422 GHz

5 MHz/

Span 50 MHz

Date: 1.JUN.2020 17:00:02

Plot # 26

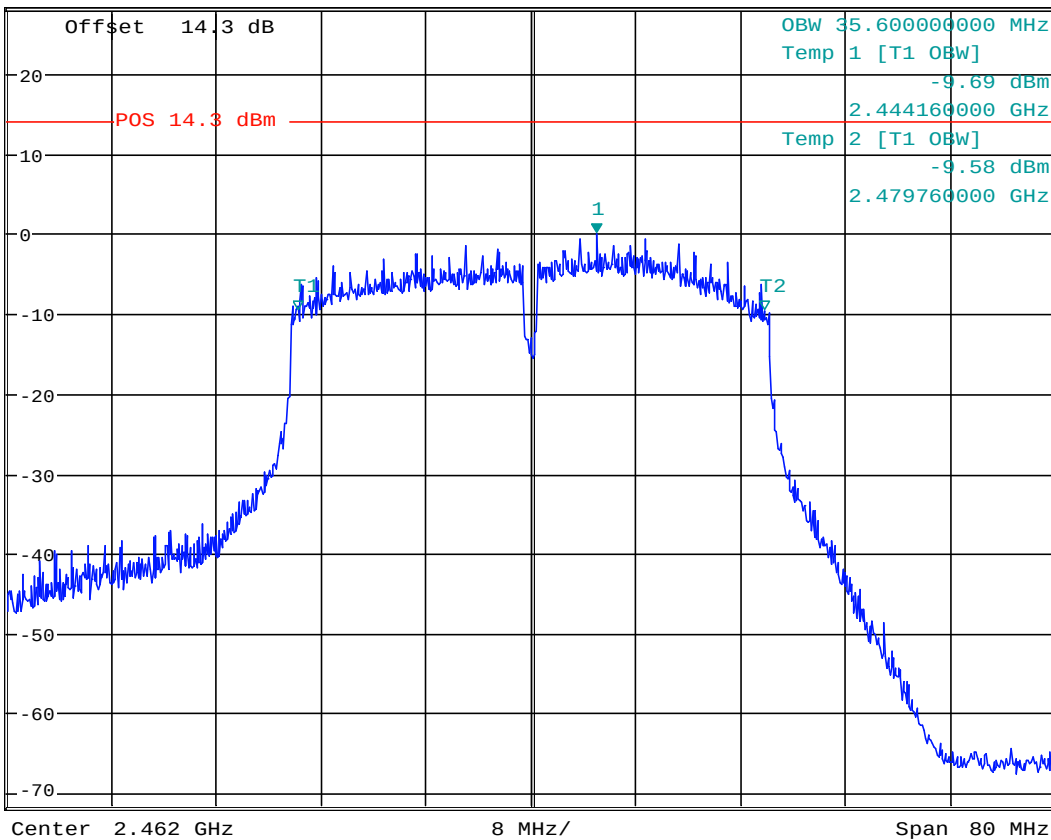
Tx Frequency: 2462 MHz

Mode: 802.11n HT40



Ref 14.3 dBm * Att 5 dB * RBW 100 kHz * VBW 300 kHz SWT 20 ms Marker 1 [T1] 0.01 dBm 2.466960000 GHz

1 PK
MAXH



Date: 1.JUN.2020 12:01:39

8.3 Maximum peak conducted output power

8.3.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2013 Subclause 11.9.1.2 Integrated band power method

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

- Set the RBW = 1 MHz.
- Set VBW $\geq [3 \times \text{RBW}]$.
- Set span $\geq [1.5 \times \text{DTS Bandwidth}]$.
- Detector function = peak.
- Sweep time = Auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the instrument's band/channel power measurement function with the band limit set equal to the DTS bandwidth edges.

8.3.2 Limits:

Maximum Output Power:

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

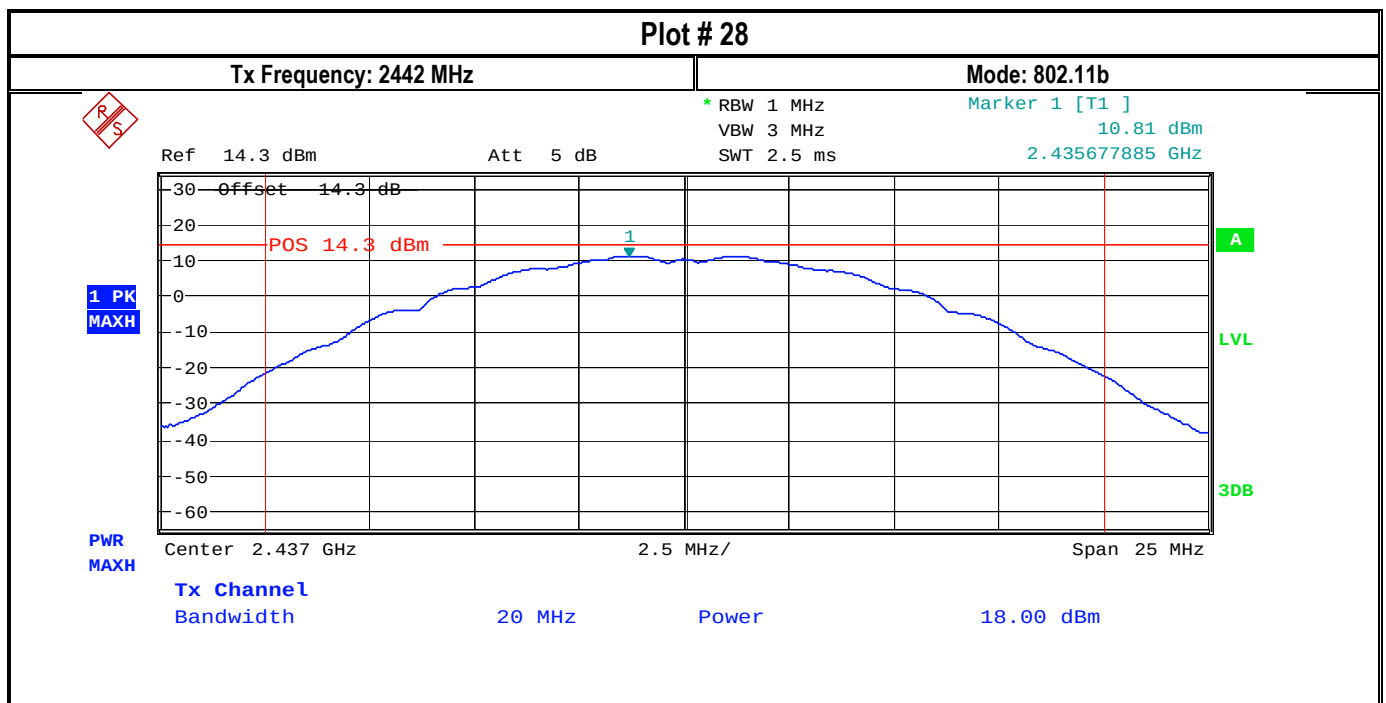
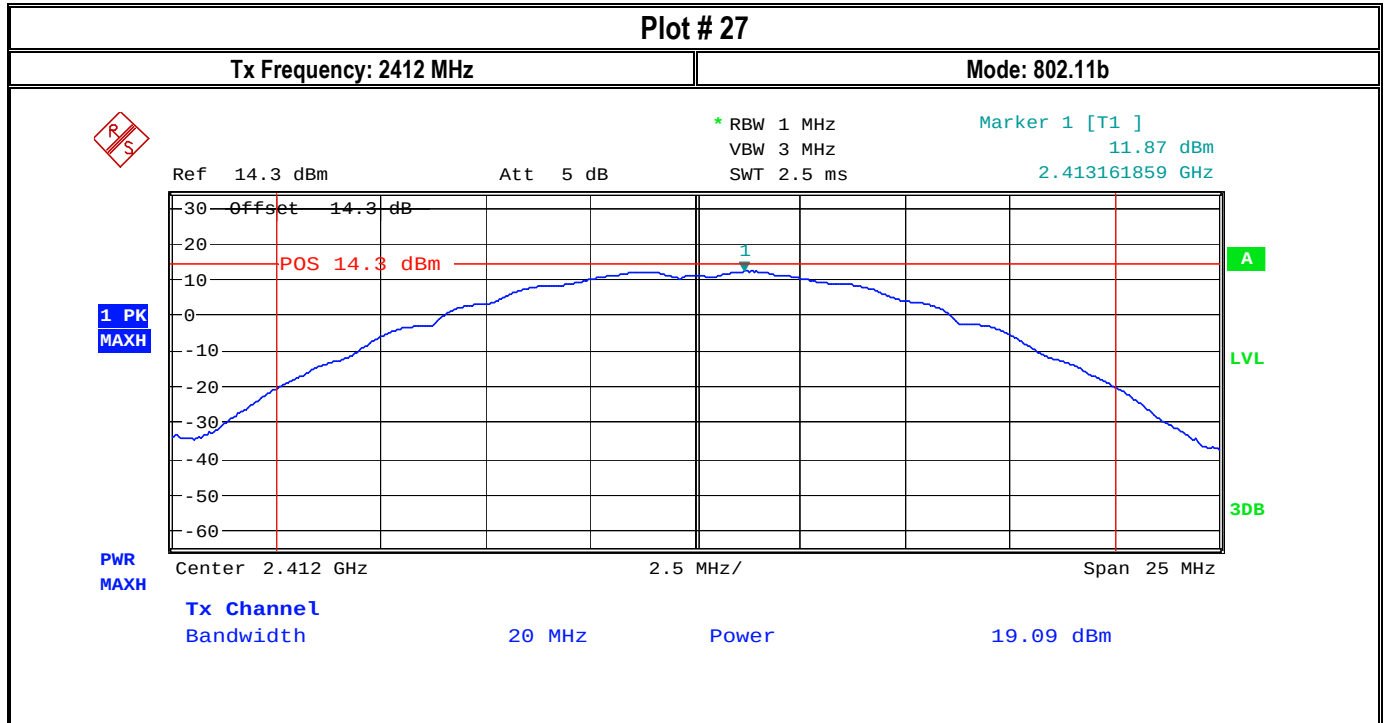
8.3.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1	Op.1	12 VDC	4.2 dBi

8.3.4 Measurement result:

Plot #	Frequency (MHz)	EUT Operating Mode	Output Power Conducted / EIRP (dBm)	Limit (dBm)	Result
27	2412	802.11b	19.09 / 23.29	30 (Pk) / 36 (EIRP)	Pass
28	2437	802.11b	18.0 / 22.20	30 (Pk) / 36 (EIRP)	Pass
29	2462	802.11b	18.76 / 22.96	30 (Pk) / 36 (EIRP)	Pass
30	2412	802.11g	23.37 / 27.57	30 (Pk) / 36 (EIRP)	Pass
31	2437	802.11g	22.15 / 26.35	30 (Pk) / 36 (EIRP)	Pass
32	2462	802.11g	23.05 / 27.25	30 (Pk) / 36 (EIRP)	Pass
33	2412	802.11n HT20	22.17 / 26.37	30 (Pk) / 36 (EIRP)	Pass
34	2437	802.11n HT20	20.93 / 25.13	30 (Pk) / 36 (EIRP)	Pass
35	2462	802.11n HT20	21.86 / 26.06	30 (Pk) / 36 (EIRP)	Pass
36	2422	802.11n HT40	21.57 / 25.77	30 (Pk) / 36 (EIRP)	Pass
37	2462	802.11n HT40	22.70 / 26.90	30 (Pk) / 36 (EIRP)	Pass

8.3.5 Measurement Plots:



Plot # 29

Tx Frequency: 2462 MHz

Mode: 802.11b



Ref 14.3 dBm

Att 5 dB

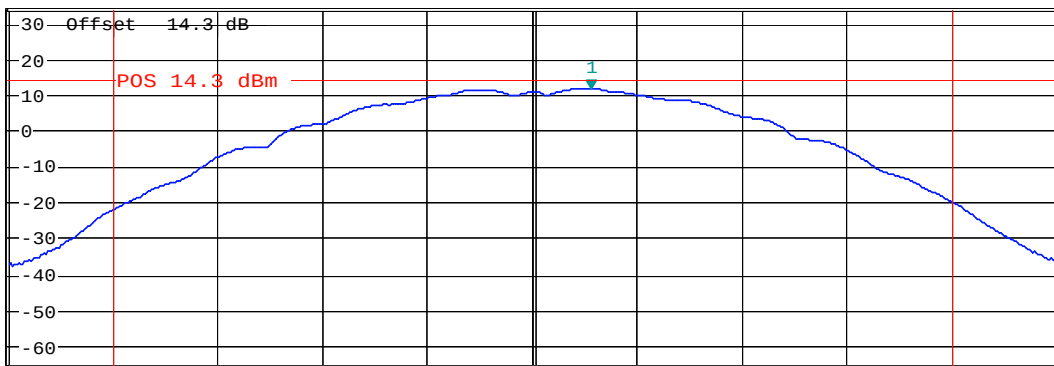
* RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms

Marker 1 [T1]

11.65 dBm

2.463402244 GHz

1 PK
MAXH



PWR
MAXH

Center 2.462 GHz

2.5 MHz/

Span 25 MHz

Tx Channel
Bandwidth

20 MHz

Power

18.76 dBm

A

LVL

3DB

Plot # 30

Tx Frequency: 2412 MHz

Mode: 802.11g



Ref 14.3 dBm

Att 5 dB

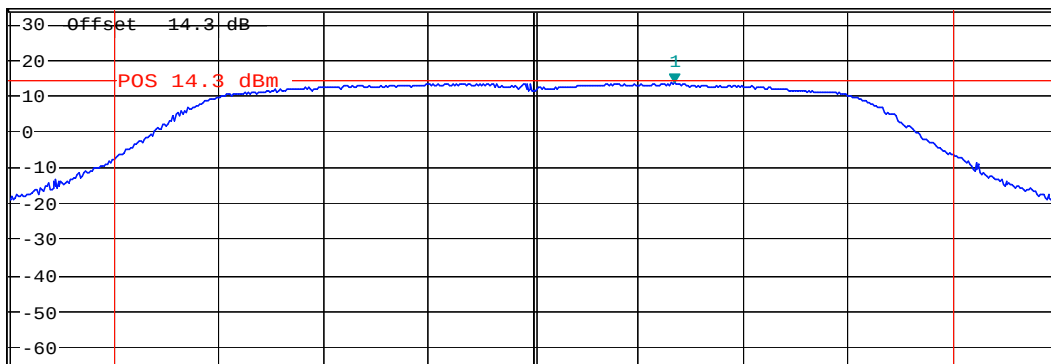
* RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms

Marker 1 [T1]

13.18 dBm

2.415365385 GHz

1 PK
MAXH



PWR
MAXH

Center 2.412 GHz

2.5 MHz/

Span 25 MHz

Tx Channel
Bandwidth

20 MHz

Power

23.35 dBm

A

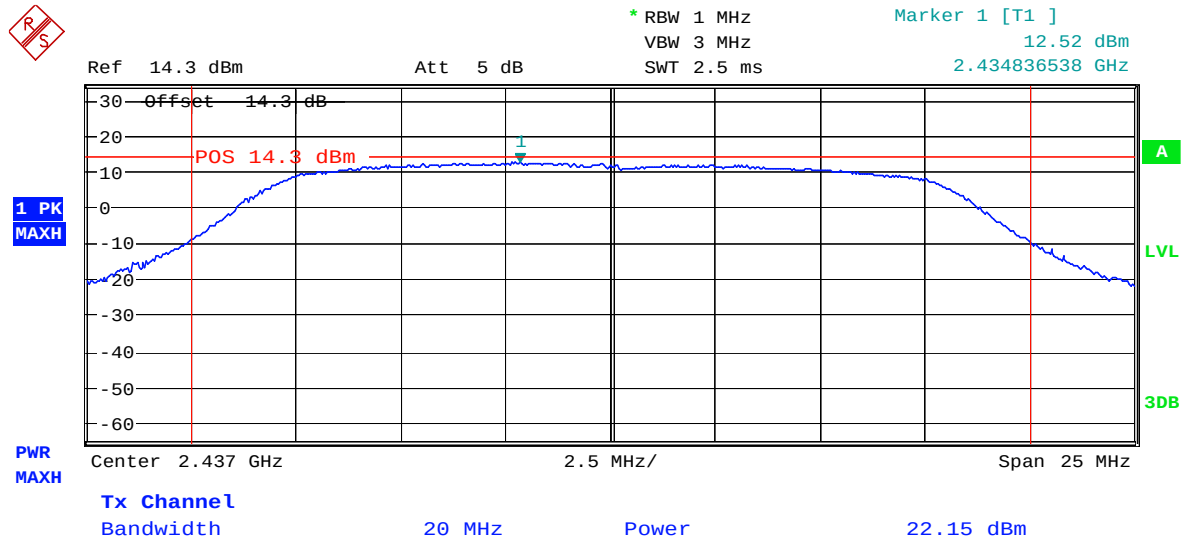
LVL

3DB

Plot # 31

Tx Frequency: 2442 MHz

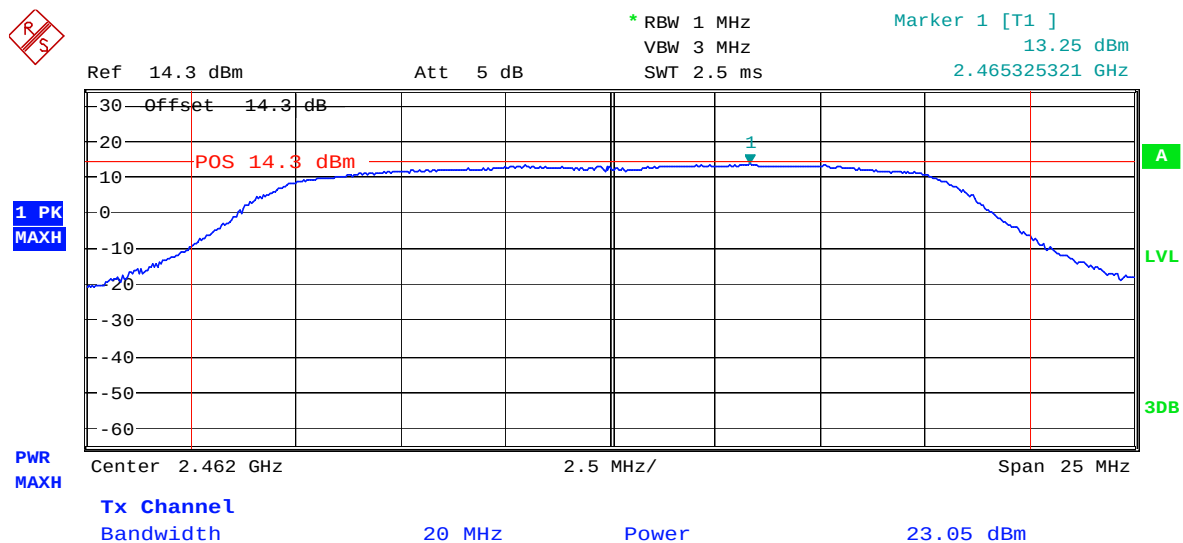
Mode: 802.11g



Plot # 32

Tx Frequency: 2462 MHz

Mode: 802.11g



Plot # 33

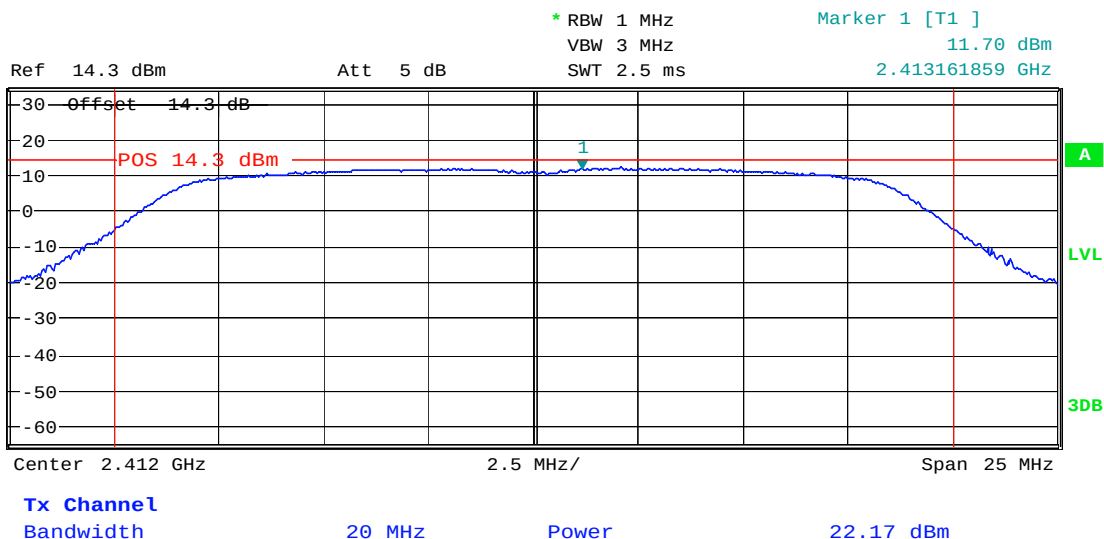
Tx Frequency: 2412 MHz

Mode: 802.11n HT20



1 PK
MAXH

PWR
MAXH



Plot # 34

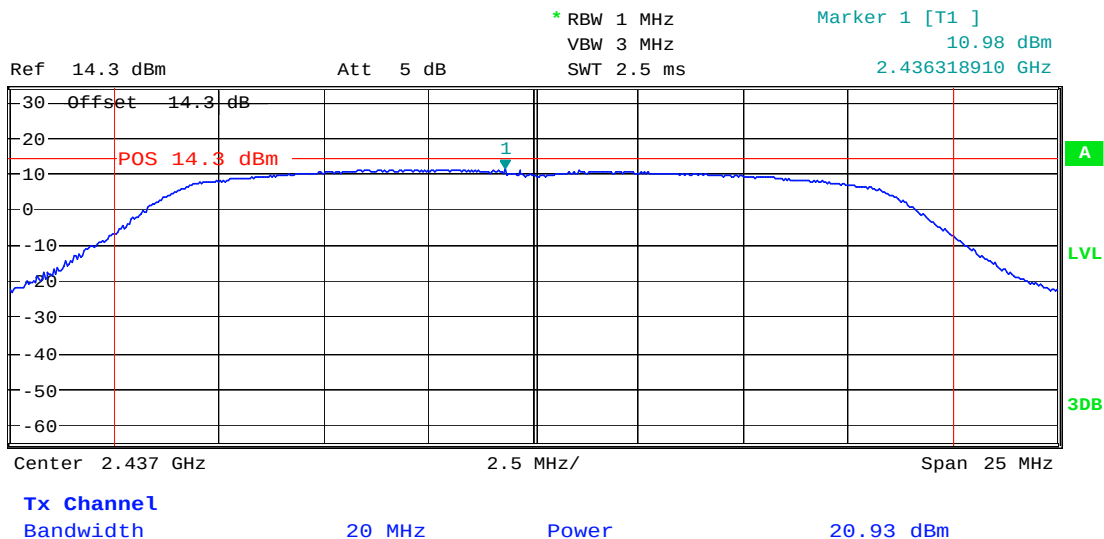
Tx Frequency: 2442 MHz

Mode: 802.11n HT20



1 PK
MAXH

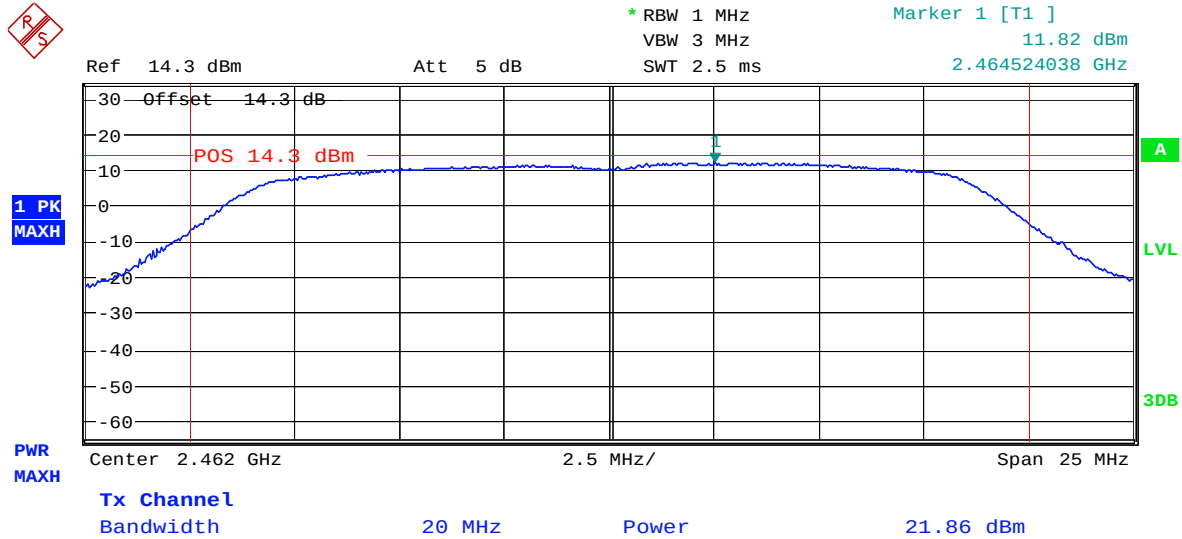
PWR
MAXH



Plot # 35

Tx Frequency: 2462 MHz

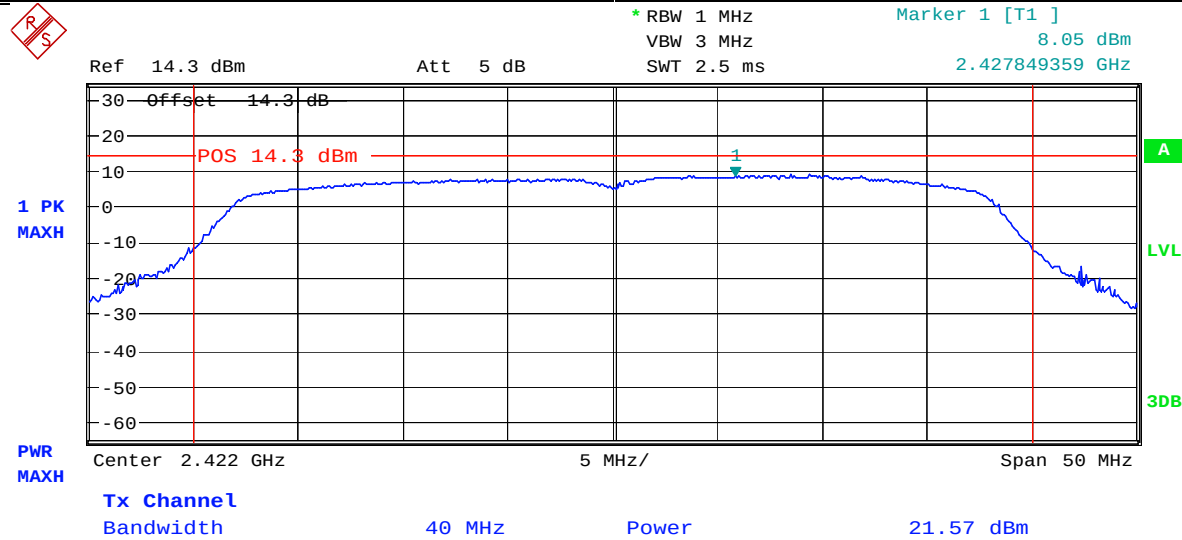
Mode: 802.11n HT20



Plot # 36

Tx Frequency: 2422 MHz

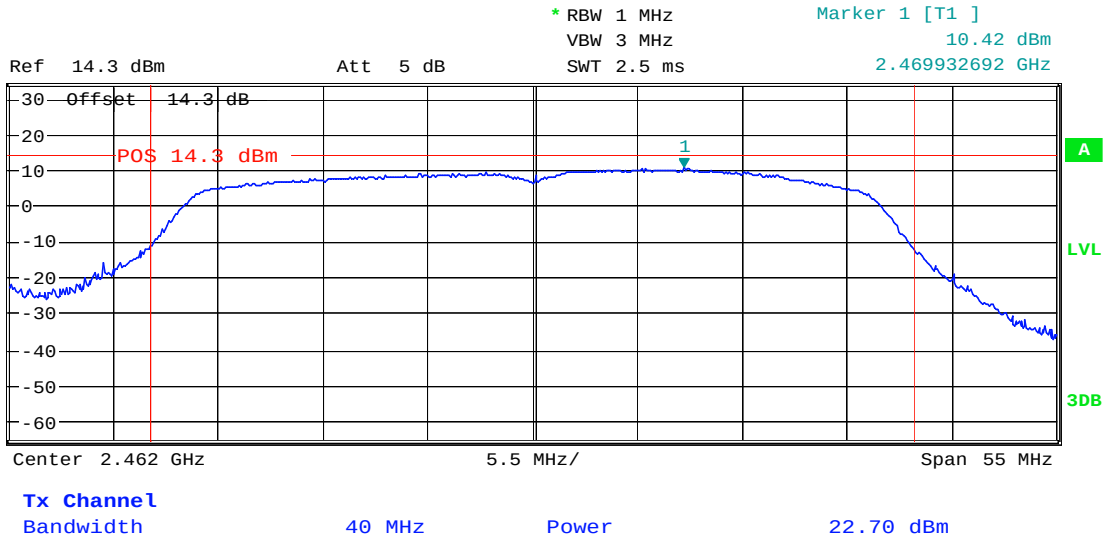
Mode: 802.11n HT40



Plot # 37

Tx Frequency: 2462 MHz

Mode: 802.11n HT40



8.4 Power Spectral Density

8.4.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD)

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq [3 \times \text{RBW}]$.
- 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, then reduce RBW (but no less than 3 kHz) and repeat.

8.4.2 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.

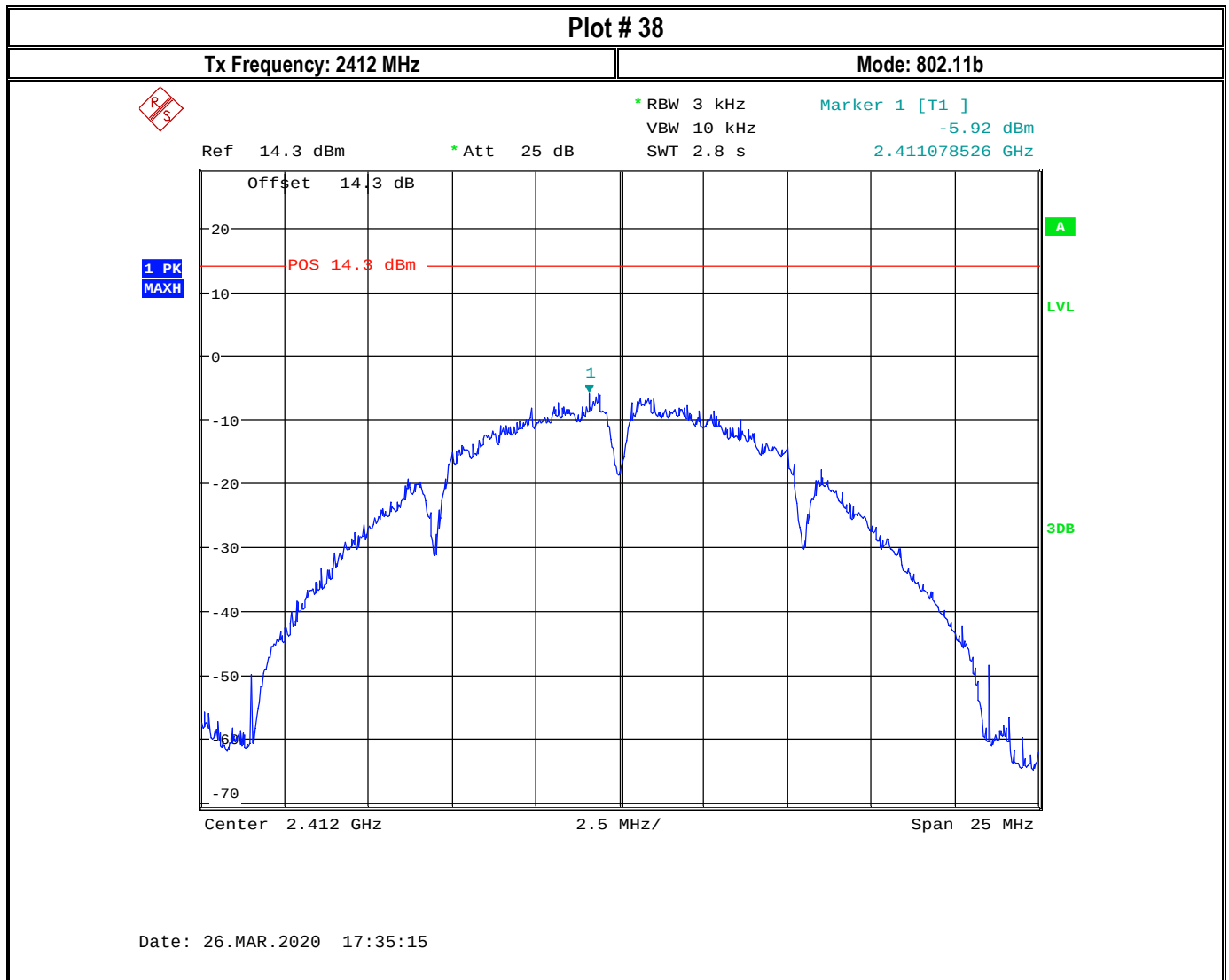
8.4.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1	Op.1	12 VDC	4.2 dBi

8.4.4 Measurement result:

Plot #	Frequency (MHz)	EUT Operating Mode	PSD (dBm / 3 KHz)	Limit (dBm / 3 kHz)	Result
38	2412	802.11b	-5.92	8	Pass
39	2442	802.11b	-6.83	8	Pass
40	2462	802.11b	-5.62	8	Pass
41	2412	802.11g	-8.72	8	Pass
42	2442	802.11g	-9.74	8	Pass
43	2462	802.11g	-9.16	8	Pass
44	2412	802.11n HT20	-10.81	8	Pass
45	2442	802.11n HT20	-12.30	8	Pass
46	2462	802.11n HT20	-11.06	8	Pass
47	2422	802.11n HT40	-8.94	8	Pass
48	2462	802.11n HT40	-12.95	8	Pass

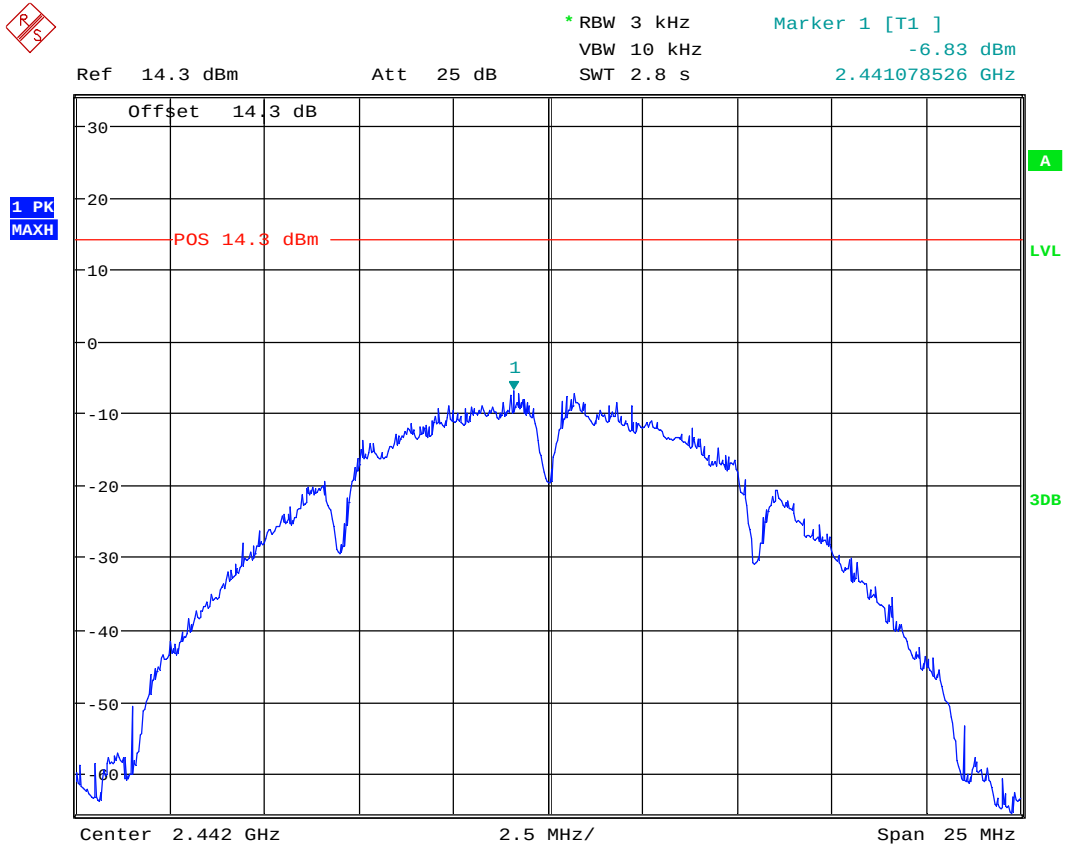
8.4.5 Measurement Plots:



Plot # 39

Tx Frequency: 2442 MHz

Mode: 802.11b



Date: 24.MAR.2020 17:18:05

Plot # 40

Tx Frequency: 2462 MHz

Mode: 802.11b



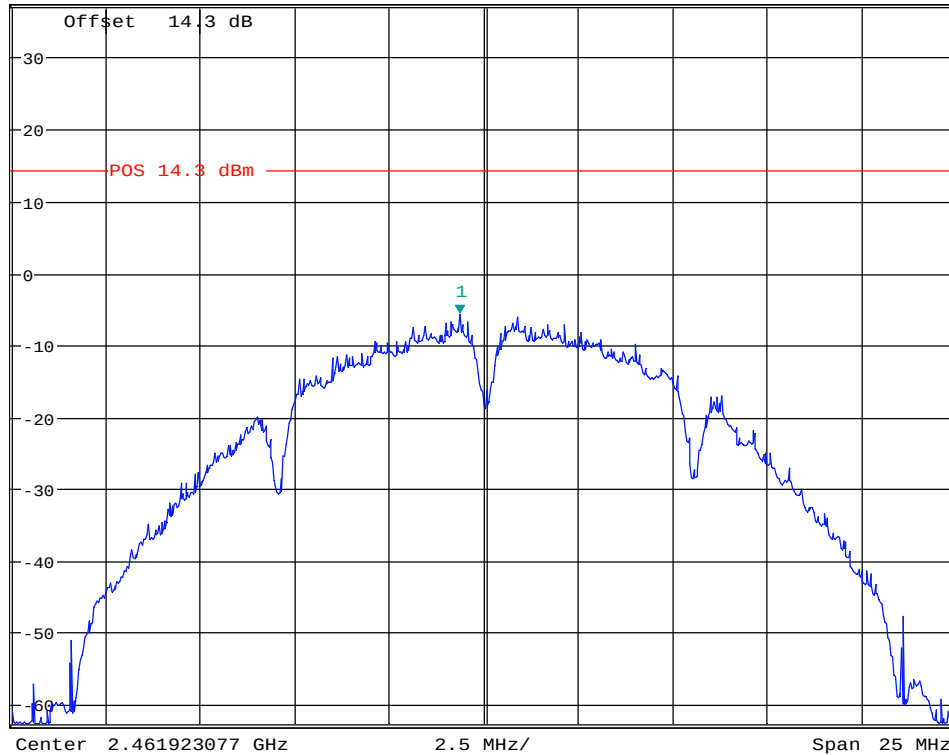
* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-5.62 dBm
2.461282051 GHz

Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

1 PK
MAXH



Date: 30.MAR.2020 15:26:52

Plot # 41

Tx Frequency: 2412 MHz

Mode: 802.11g

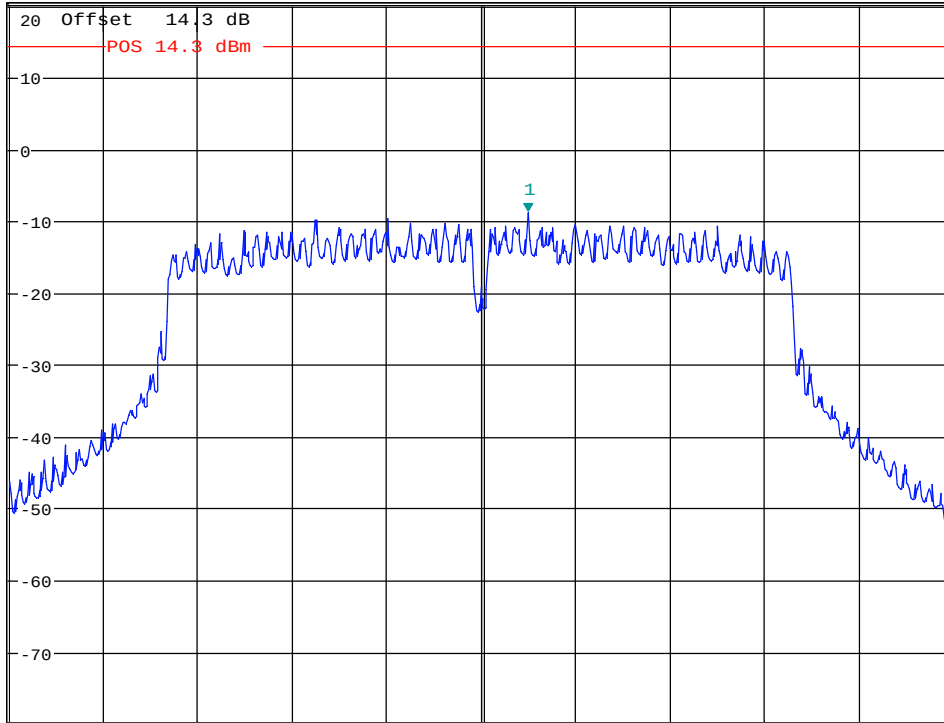


* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-8.72 dBm
2.413241987 GHz

Ref 14.3 dBm

* Att 25 dB

1 PK
MAXH



Center 2.412 GHz

2.5 MHz/

Span 25 MHz

Date: 26.MAR.2020 18:29:39

Plot # 42

Tx Frequency: 2442 MHz

Mode: 802.11g



* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s

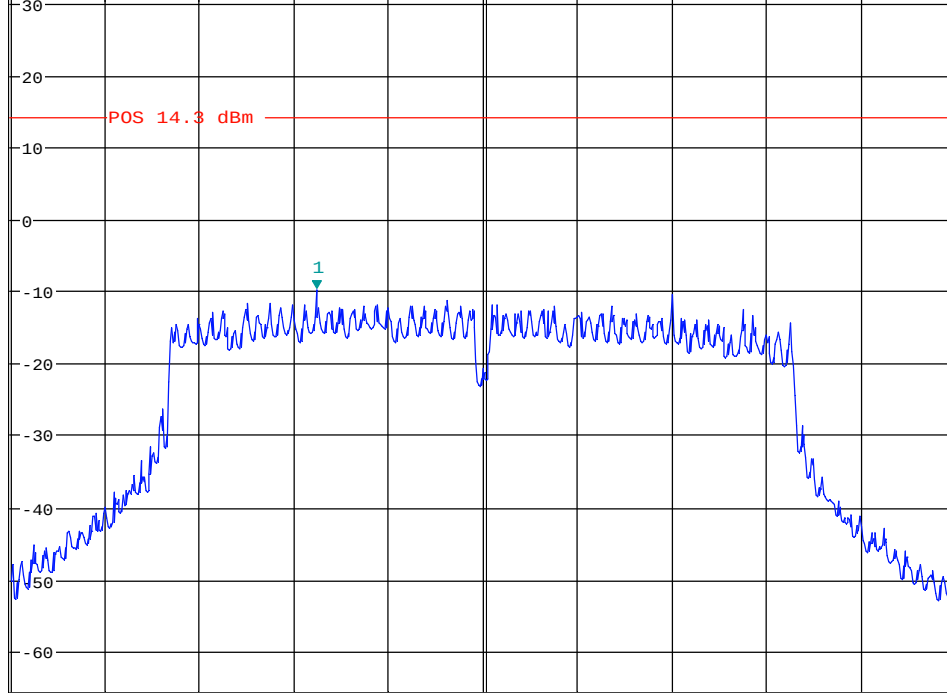
Marker 1 [T1]
-9.74 dBm
2.437592949 GHz

Ref 14.3 dBm

Att 25 dB

Offset 14.3 dB

1 PK
MAXH



Center 2.442 GHz

2.5 MHz/

Span 25 MHz

Date: 24.MAR.2020 17:20:41

Plot # 43

Tx Frequency: 2462 MHz

Mode: 802.11g



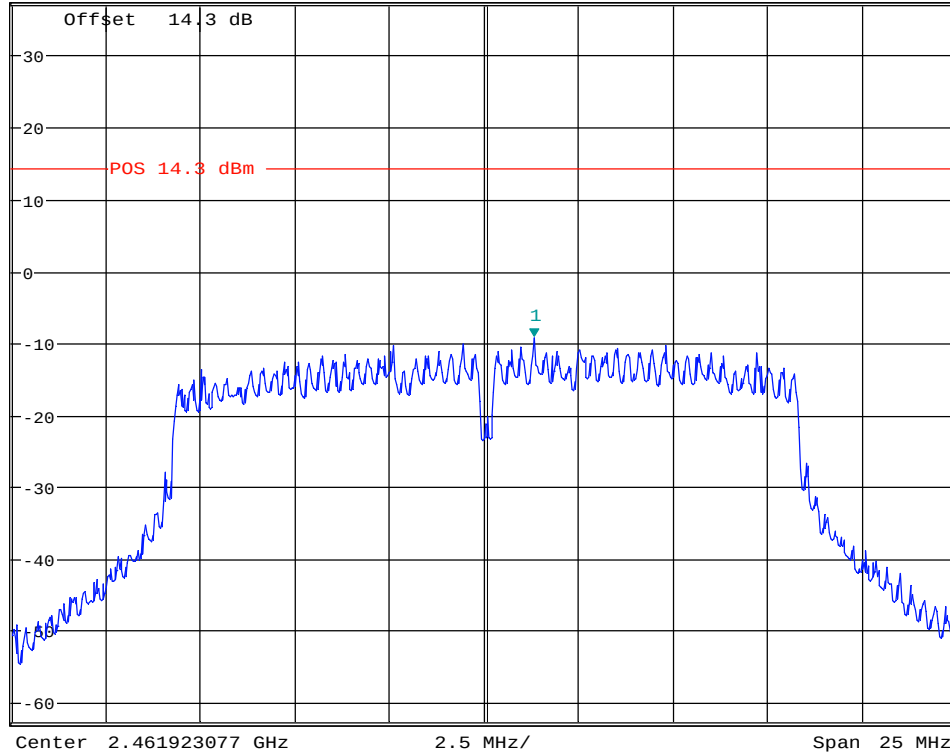
* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-9.16 dBm
2.463245192 GHz

Ref 14.3 dBm

* Att 25 dB

2.463245192 GHz

1 PK
MAXH



Date: 30.MAR.2020 15:22:37

Plot # 44

Tx Frequency: 2412 MHz

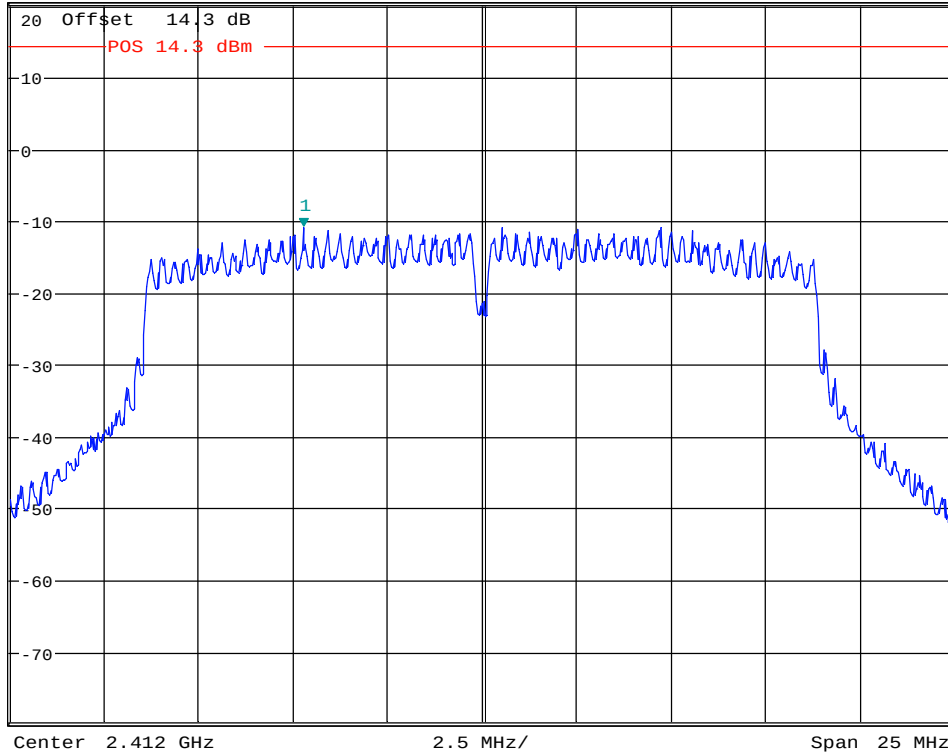
Mode: 802.11n HT20



* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-10.81 dBm
2.407272436 GHz

Ref 14.3 dBm

* Att 25 dB



Date: 26.MAR.2020 18:37:46

Plot # 45

Tx Frequency: 2442 MHz

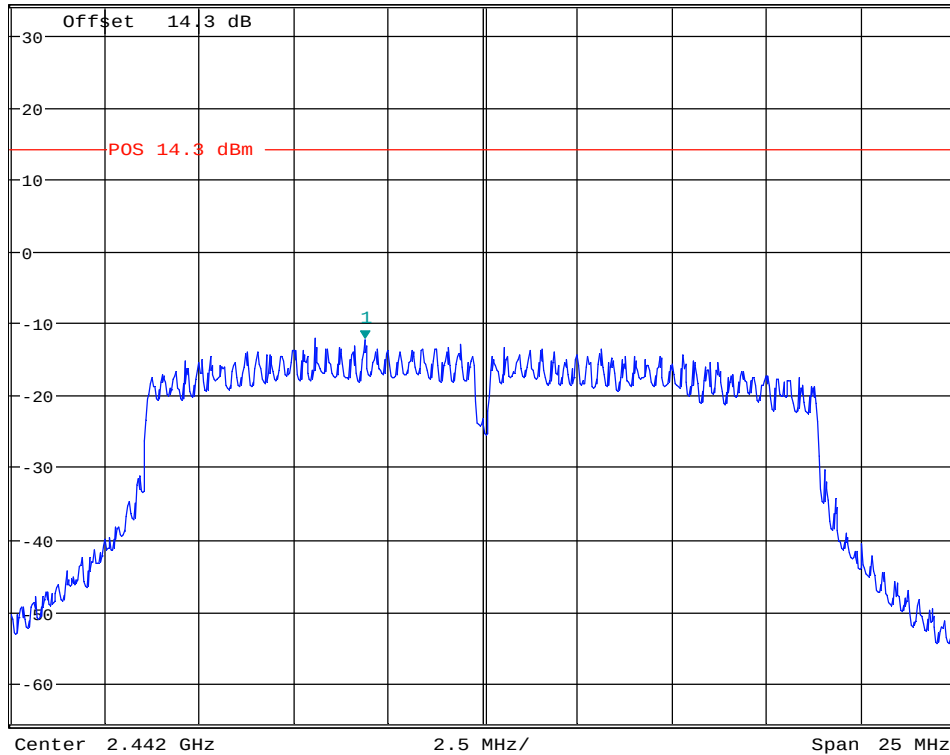
Mode: 802.11n HT20



* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-12.30 dBm
2.438875000 GHz

Ref 14.3 dBm

Att 25 dB



Date: 24.MAR.2020 17:23:20

Plot # 46

Tx Frequency: 2462 MHz

Mode: 802.11n HT20



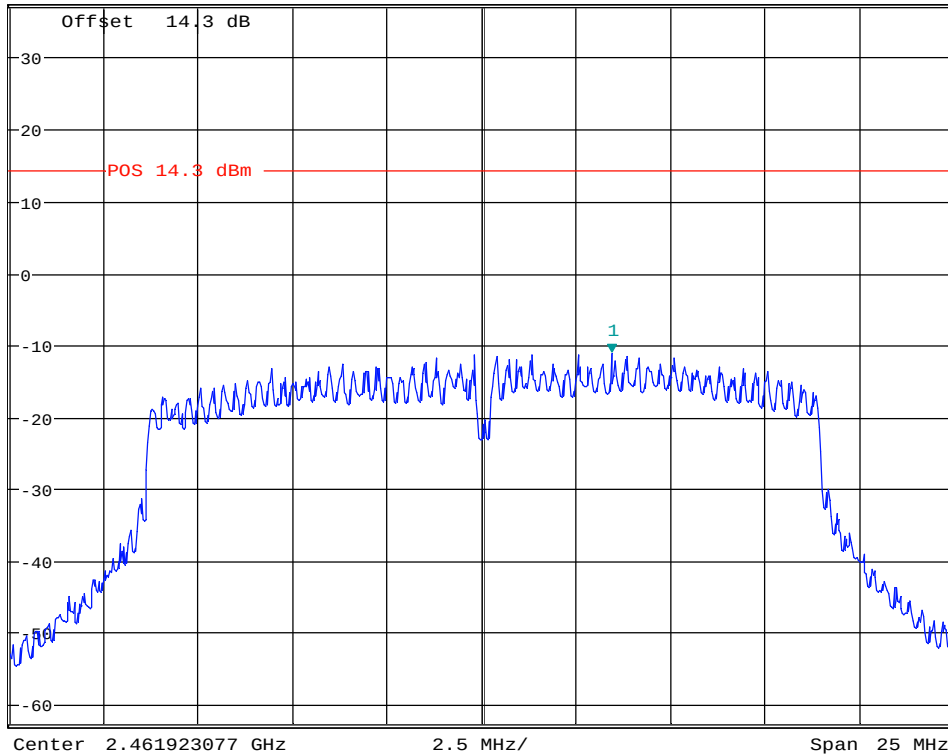
* RBW 3 kHz
VBW 10 kHz
SWT 2.8 s
Marker 1 [T1]
-11.06 dBm
2.465368590 GHz

Ref 14.3 dBm

* Att 25 dB

Offset 14.3 dB

1 PK
MAXH



Date: 30.MAR.2020 15:19:48

Plot # 47

Tx Frequency: 2422 MHz

Mode: 802.11n HT40

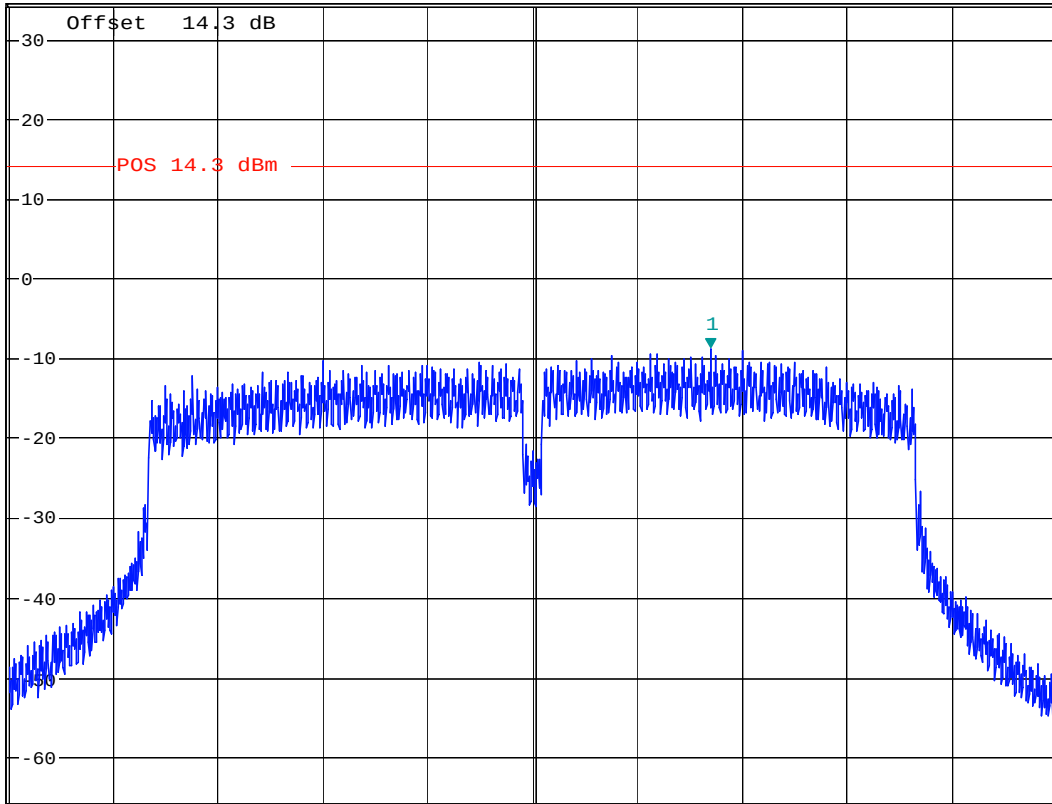


* RBW 10 kHz
VBW 30 kHz
SWT 500 ms

Marker 1 [T1]
-8.94 dBm
2.430490000 GHz

Ref 14.3 dBm

Att 25 dB



Center 2.422 GHz

5 MHz/

Span 50 MHz

Date: 1.JUN.2020 17:02:42

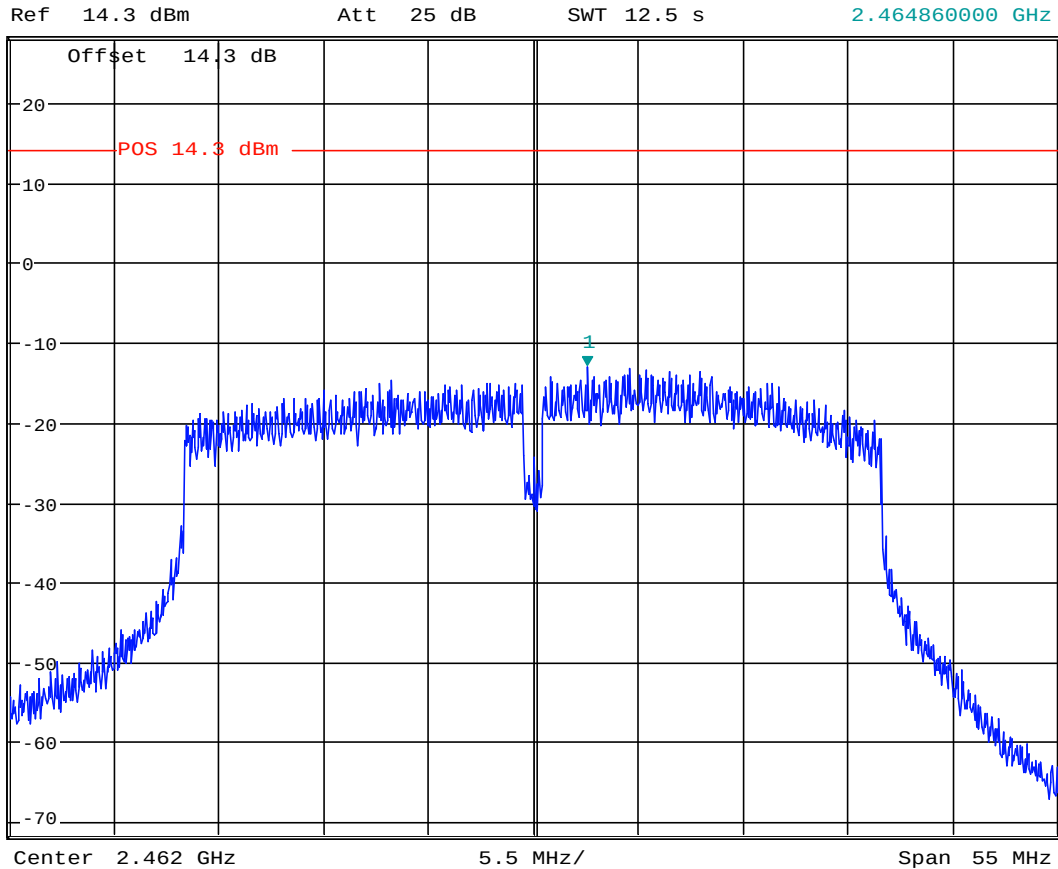
Plot # 48

Tx Frequency: 2462 MHz

Mode: 802.11n HT40



* RBW 3 kHz
VBW 10 kHz
SWT 12.5 s
Marker 1 [T1]
-12.95 dBm
2.464860000 GHz



Date: 1.JUN.2020 12:32:53

8.5 Band Edge Compliance

8.5.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

Spectrum Analyzer settings for band edge:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW $\geq 3 \times$ 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

8.5.2 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)).

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- 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

8.5.3 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:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	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			

8.5.4 Test conditions and setup:

Non-Restricted Band:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1	Op. 1	12 VDC	4.2 dBi

Restricted Band:

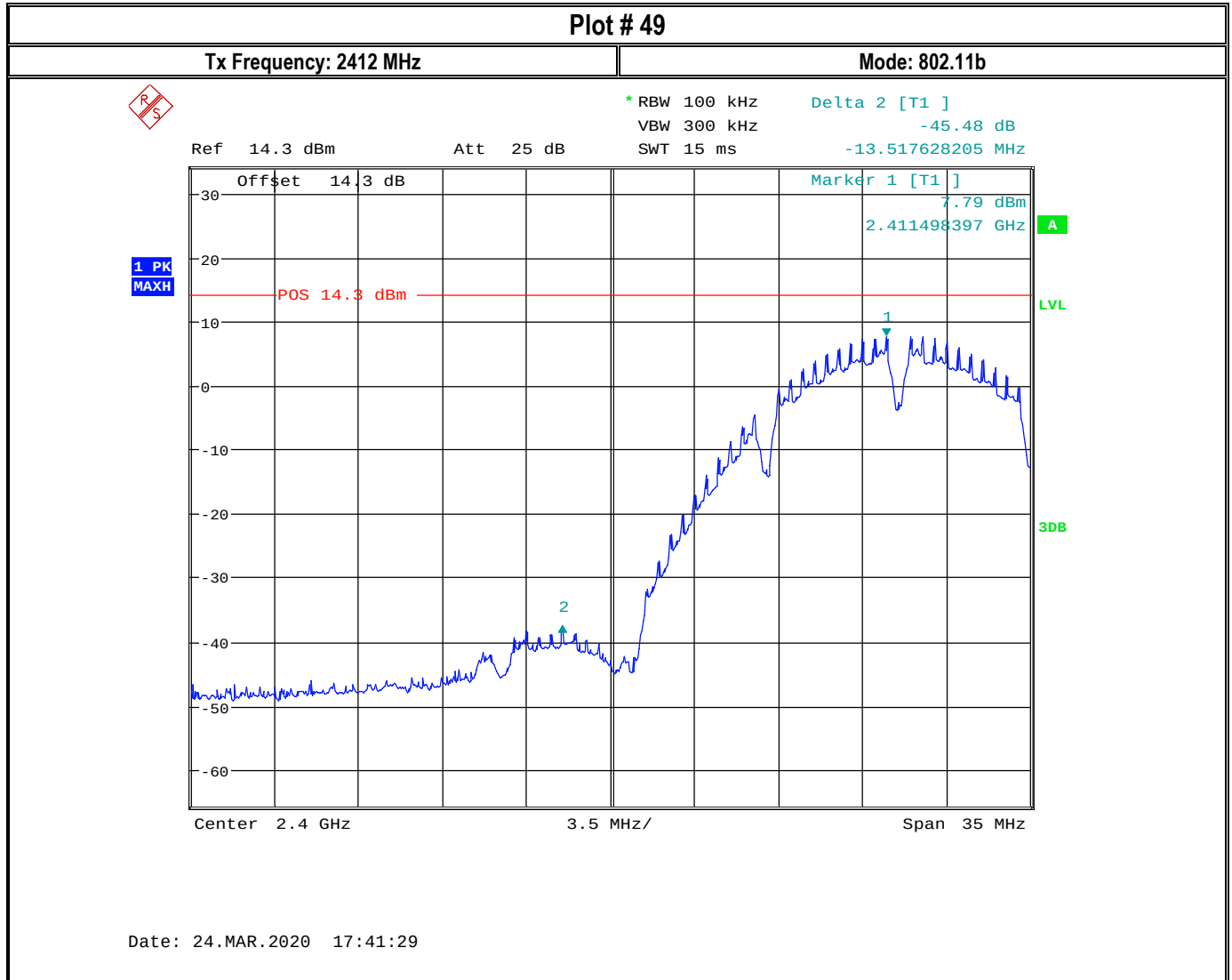
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1	Op. 1	12 VDC	4.2 dBi

8.5.5 Measurement result:

Plot #	EUT operating mode	Band Edge	Band Edge Delta (dBc)	Limit (dBc)	Result
49	802.11b	Lower, Non-restricted	-45.48	20	Pass
50	802.11g	Lower, Non-restricted	-35.52	20	Pass
51	802.11n HT20	Lower, Non-restricted	-31.18	20	Pass
52	802.11n HT40	Lower, Non-restricted	-32.10	20	Pass

Plot #	EUT operating mode	Band Edge	Measured Peak/AVG Value (dBm)	Corrected by Antenna Gain (dBm)	Limit (dBm)	Result
53	802.11b	Upper Restricted	Peak: -42.85	Peak: -38.65	Peak: -21.23	Pass
			AVG: -53.60	AVG: -49.40	AVG: -41.23	
54	802.11g	Upper Restricted	Peak: -38.72	Peak: -34.62	Peak: -21.23	Pass
			AVG: -50.57	AVG: -46.37	AVG: -41.23	
55	802.11n HT20	Upper Restricted	Peak: -41.15	Peak: -36.95	Peak: -21.23	Pass
			AVG: -46.65	AVG: -42.45	AVG: -41.23	
56	802.11n HT40	Upper Restricted	Peak: -33.78	Peak: -29.58	Peak: -21.23	Pass
			AVG: -46.72	AVG: -42.52	AVG: -41.23	

8.5.6 Measurement Plots:



Date: 24.MAR.2020 17:46:13

Plot # 51

Tx Frequency: 2412 MHz

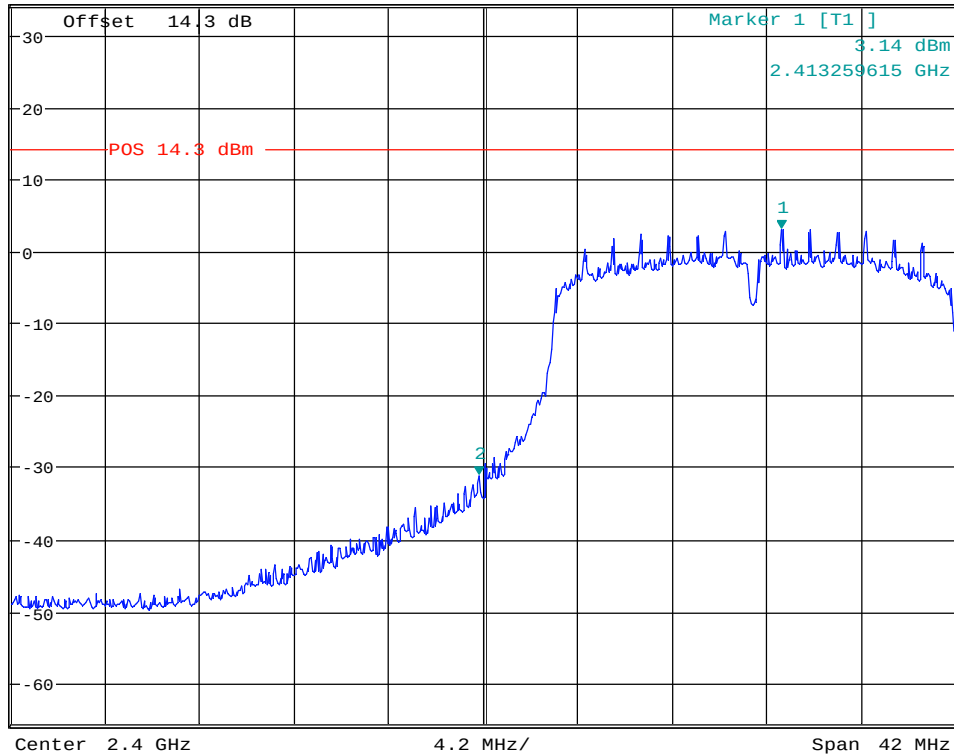
Mode: 802.11n HT20



* RBW 100 kHz Marker 2 [T1]
VBW 300 kHz -31.18 dBm
SWT 15 ms 2.399798077 GHz

Ref 14.3 dBm

Att 25 dB



Date: 24.MAR.2020 17:44:15

Plot # 52

Tx Frequency: 2422 MHz

Mode: 802.11n HT40



* RBW 100 kHz
VBW 300 kHz
SWT 20 ms

Delta 2 [T1]

-32.10 dB

-17.548076923 MHz

Ref 14.3 dBm

Att 25 dB

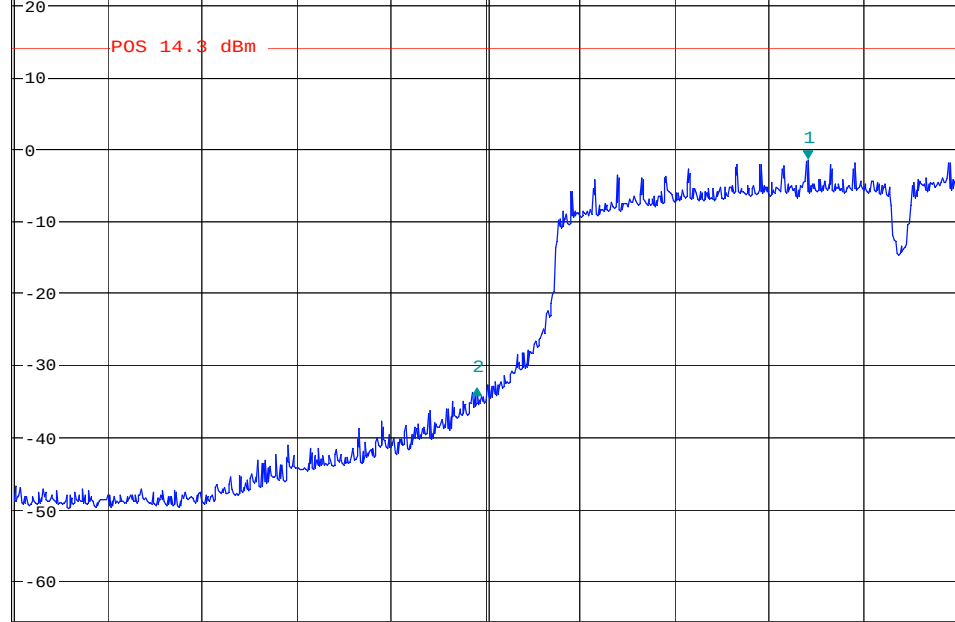
Offset 14.3 dB

Marker 1 [T1]

-1.43 dBm

2.417067308 GHz

1 PK
MAXH



Center 2.4 GHz

5 MHz/

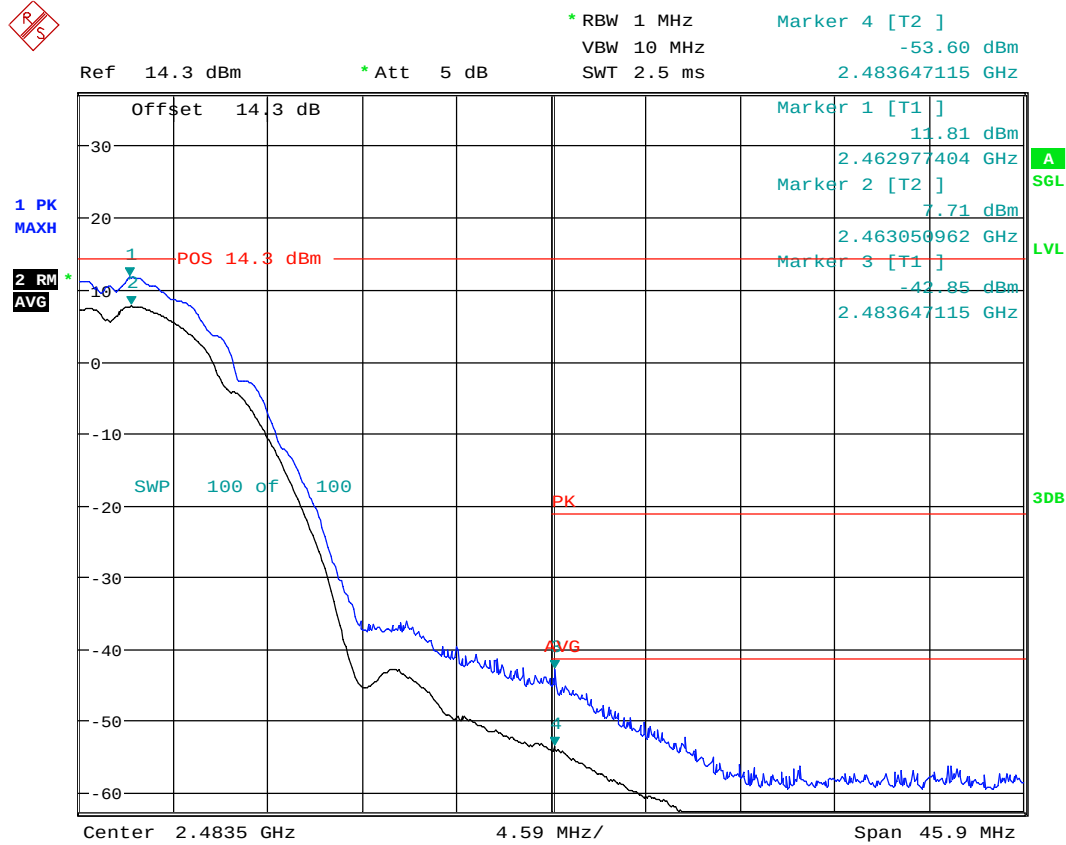
Span 50 MHz

Date: 1.JUN.2020 16:26:40

Plot # 53

Tx Frequency: 2462 MHz

Mode: 802.11b

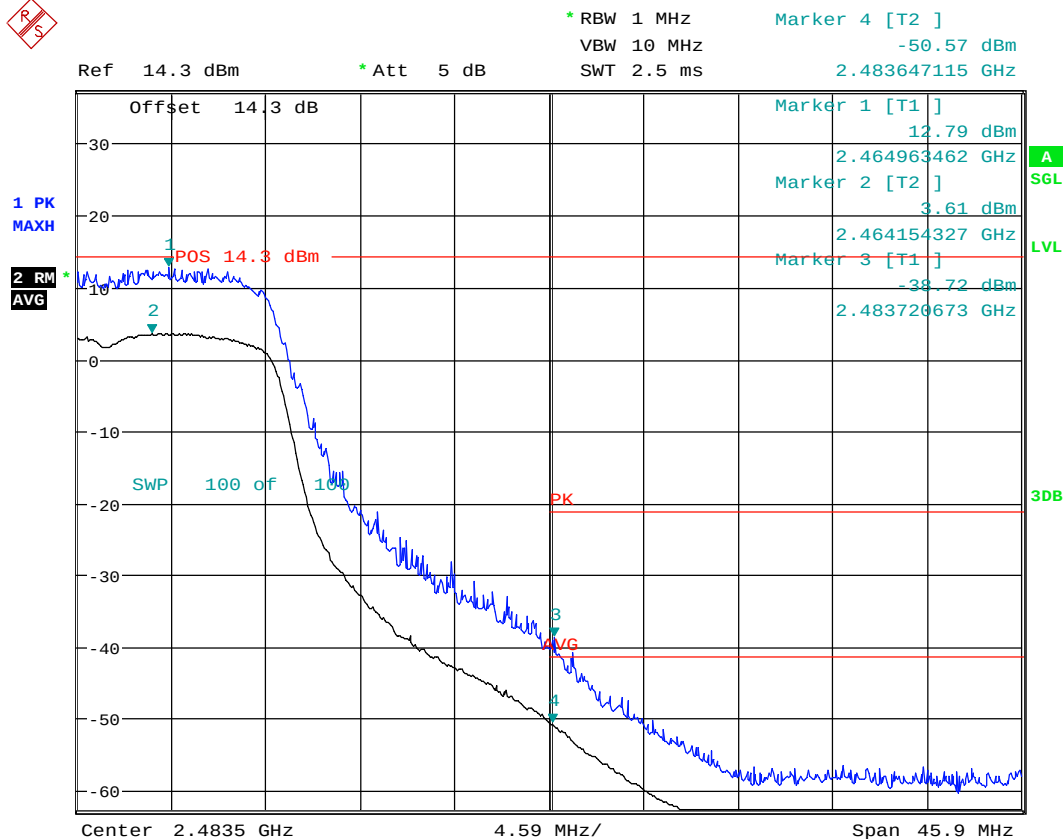


Date: 30.MAR.2020 16:05:30

Plot # 54

Tx Frequency: 2462 MHz

Mode: 802.11g

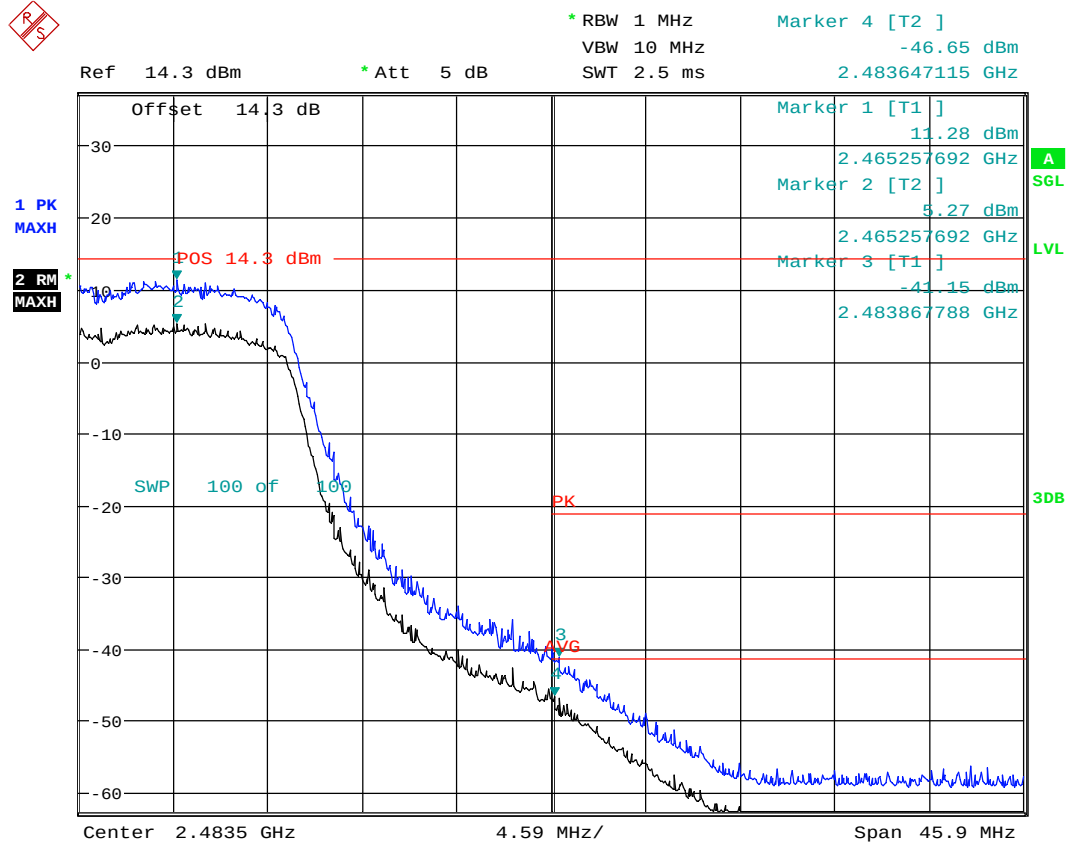


Date: 30.MAR.2020 16:03:16

Plot # 55

Tx Frequency: 2462 MHz

Mode: 802.11n HT20



Date: 30.MAR.2020 16:07:35

Plot # 56

Tx Frequency: 2462 MHz

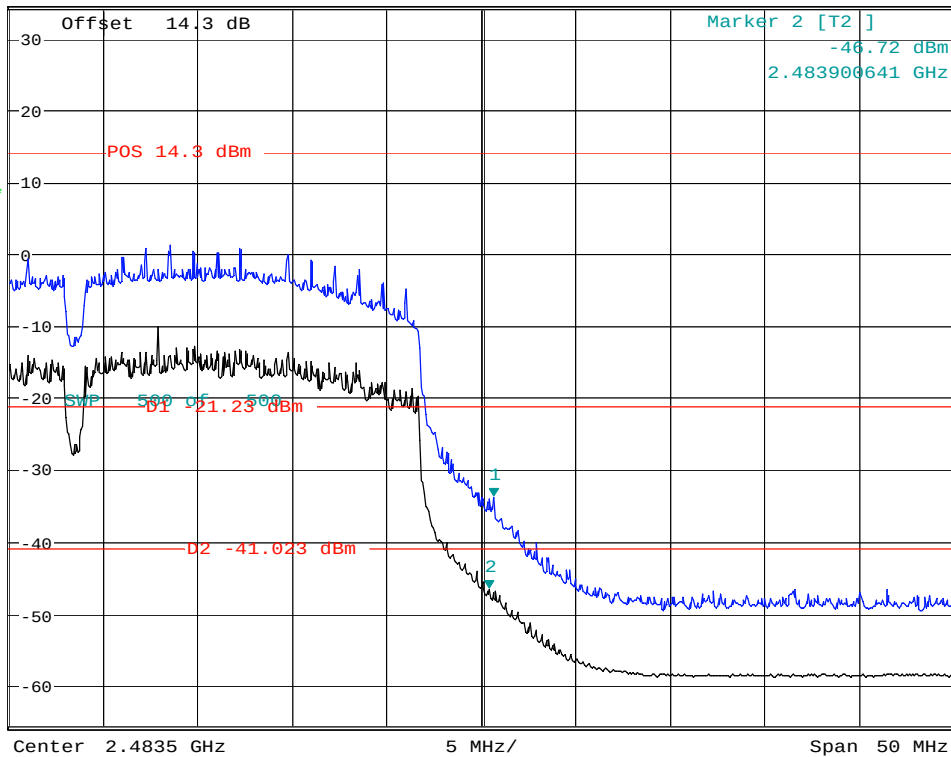
Mode: 802.11n HT40



Ref 14.3 dBm Att 25 dB * RBW 100 kHz Marker 1 [T1]
VBW 1 MHz -33.78 dBm
SWT 20 ms 2.484141026 GHz

1 PK
MAXH

2 RM
AVG



Date: 1.JUN.2020 16:31:47

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) = $40 \log (D/d) = 40 \log (300\text{m} / 3\text{m}) = 80\text{dB}$

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
10.495-0.505	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
23.8°C	2	Op. 1	12 VDC

8.6.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
46 – 48	Low	30 MHz – 18 GHz	See section 8.6.2	Pass
49 – 53	Mid	9 kHz – 26 GHz	See section 8.6.2	Pass
54 – 56	High	30 MHz – 18 GHz	See section 8.6.2	Pass

8.6.5 Measurement Plots:

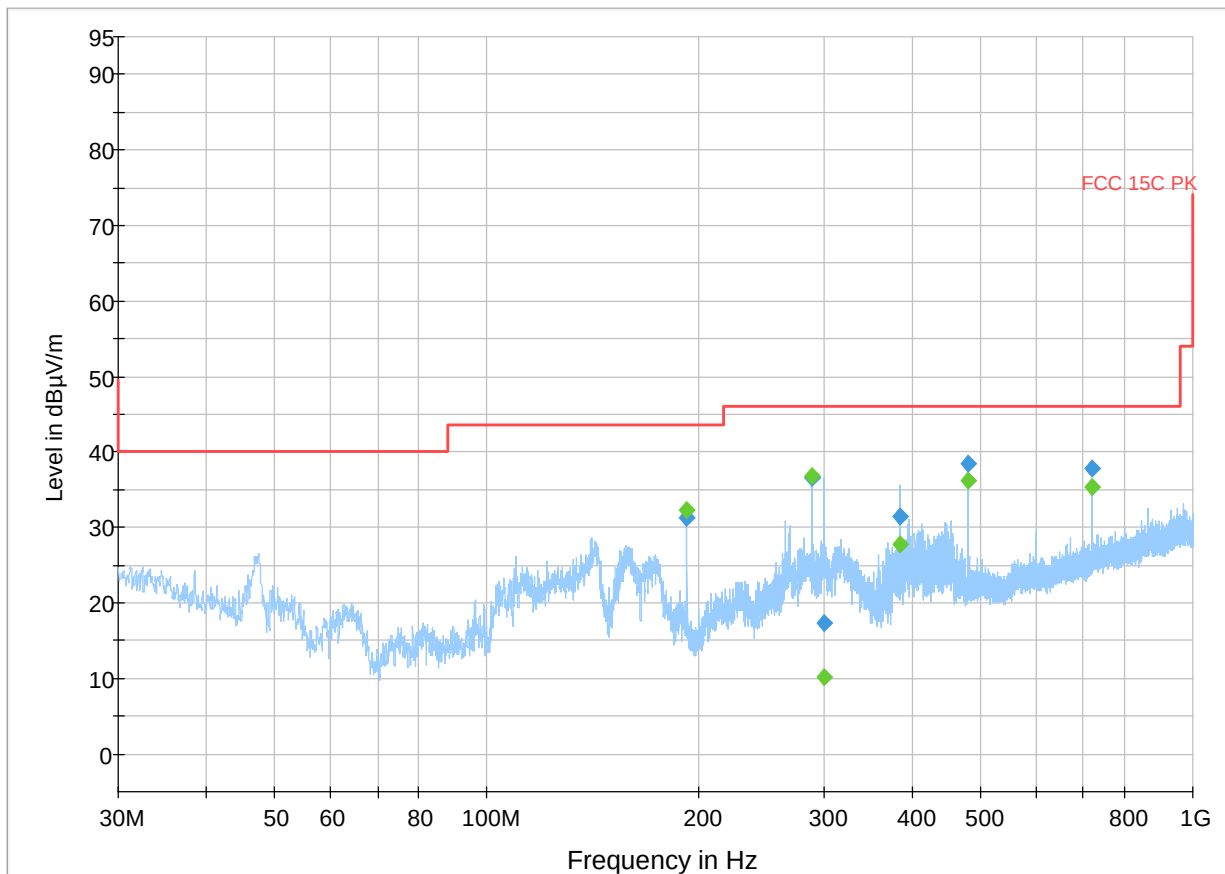
Plot # 57 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2412 MHz

Mode: 802.11g

Final Result

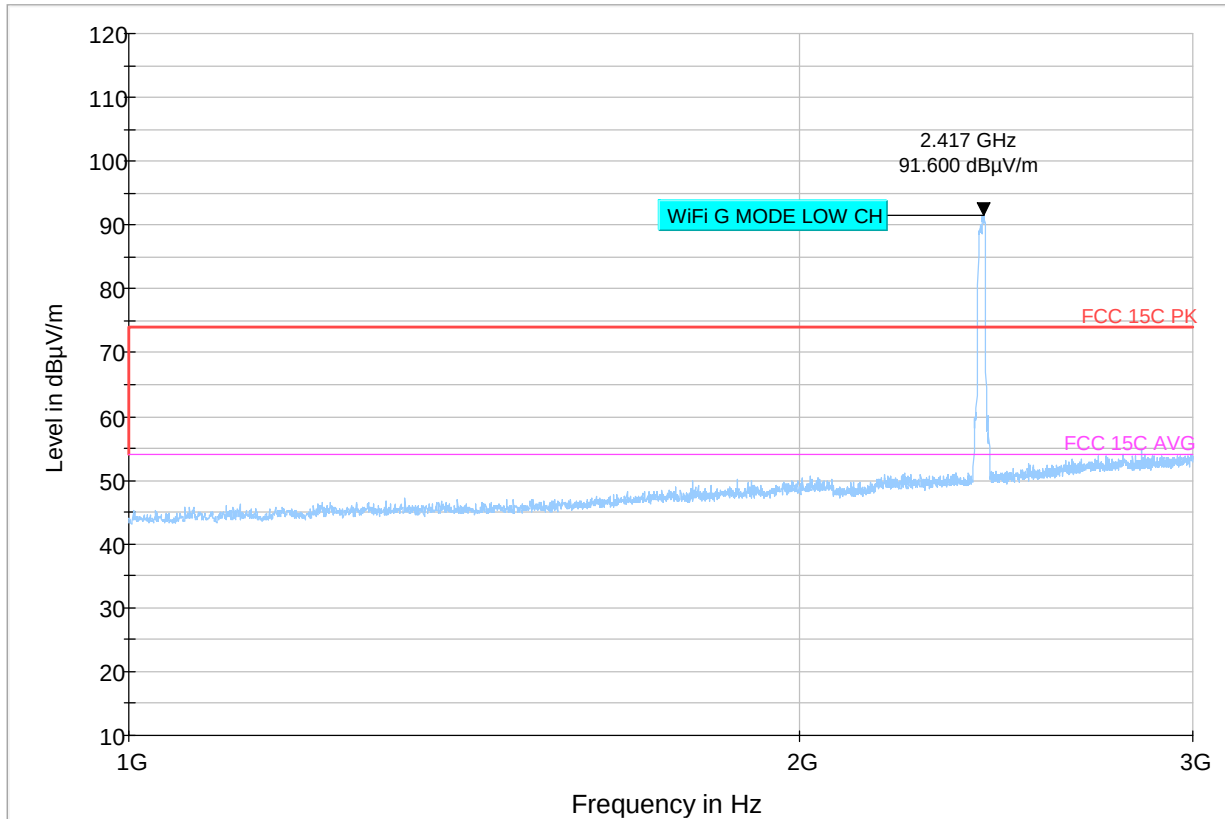
Frequency (MHz)	QuasiPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Corr. (dB/m)
192.012	31.21	---	43.50	12.29	500.0	120.000	124.0	H	-20.4
192.012	---	32.34	---	---	500.0	120.000	124.0	H	-20.4
288.007	---	36.73	---	---	500.0	120.000	145.0	H	-17.7
288.007	36.51	---	46.00	9.49	500.0	120.000	145.0	H	-17.7
300.281	17.35	---	46.00	28.65	500.0	120.000	209.0	H	-17.4
300.281	---	10.09	---	---	500.0	120.000	209.0	H	-17.4
384.024	31.40	---	46.00	14.60	500.0	120.000	100.0	H	-14.8
384.024	---	27.70	---	---	500.0	120.000	100.0	H	-14.8
480.010	38.41	---	46.00	7.59	500.0	120.000	300.0	H	-12.5
480.010	---	36.17	---	---	500.0	120.000	300.0	H	-12.5
720.036	---	35.38	---	---	500.0	120.000	124.0	H	-8.3
720.036	37.85	---	46.00	8.15	500.0	120.000	124.0	H	-8.3



Plot # 58 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2412 MHz

Mode: 802.11g



Preview Result 1-PK+
FCC 15C AVG

* Critical_Freqs PK+
◆ Final_Result PK+

— FCC 15C PK
◆ Final_Result RMS

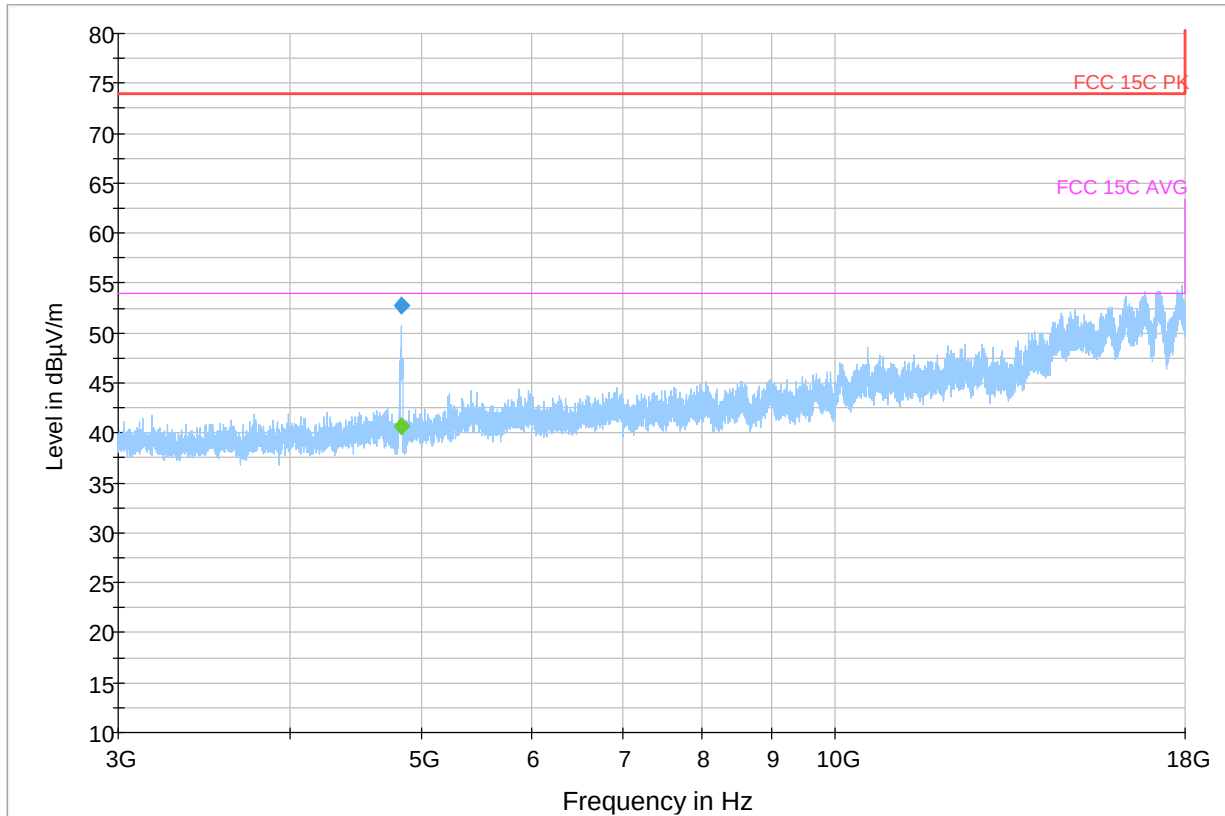
Plot # 59 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2412 MHz

Mode: 802.11g

Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4822.651	---	40.683	53.98	13.30	500.0	1000.000	125.0	V	59.0	-6.0	3:00:48 PM - 4/15/2020
4822.651	52.774	---	73.99	21.21	500.0	1000.000	125.0	V	59.0	-6.0	3:00:48 PM - 4/15/2020

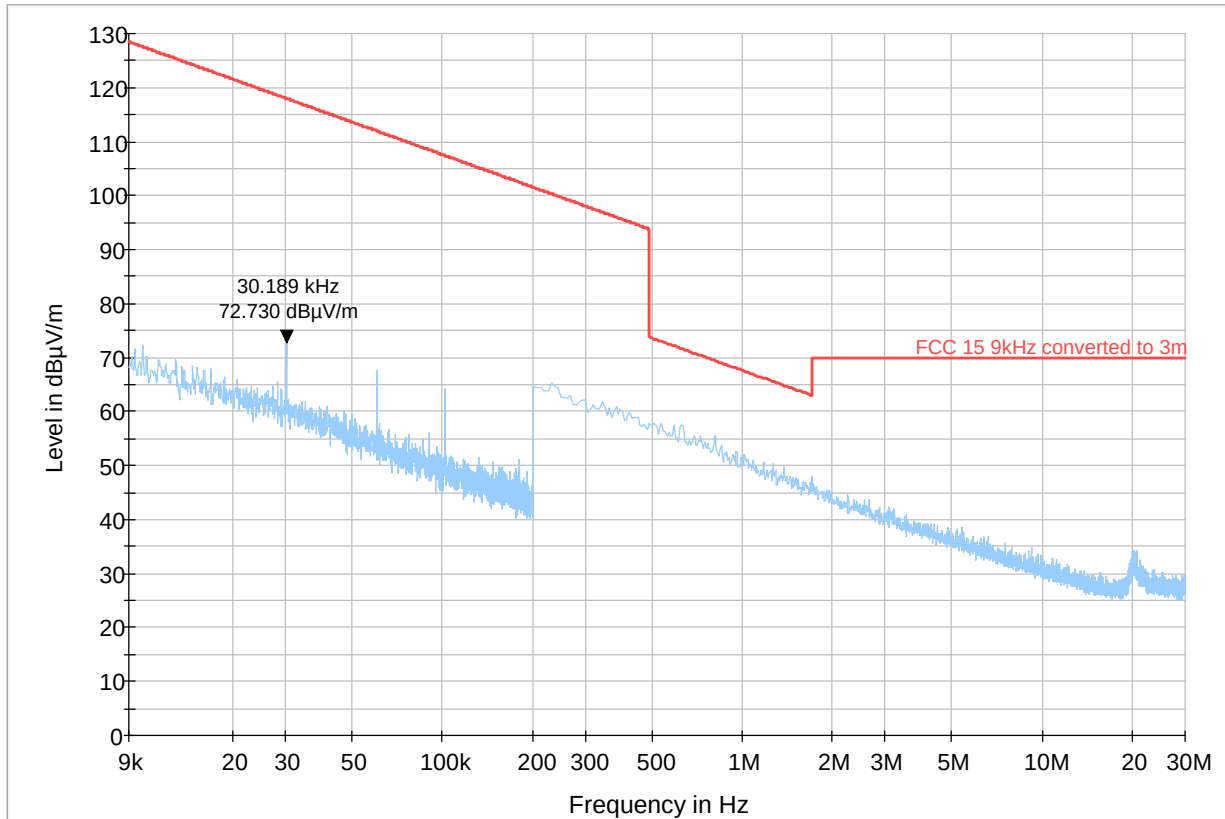


— Preview Result 1-PK+ * Critical_Freqs PK+ — FCC 15C PK
— FCC 15C AVG ◆ Final_Result PK+ ◆ Final_Result RMS

Plot # 60 Radiated Emissions: 9 KHz – 30 MHz

Tx Frequency: 2437 MHz

Mode: 802.11g



— Preview Result 1-PK+ * Critical_Freqs PK+
— FCC 15 9kHz converted to 3m ◆ Final_Result PK+

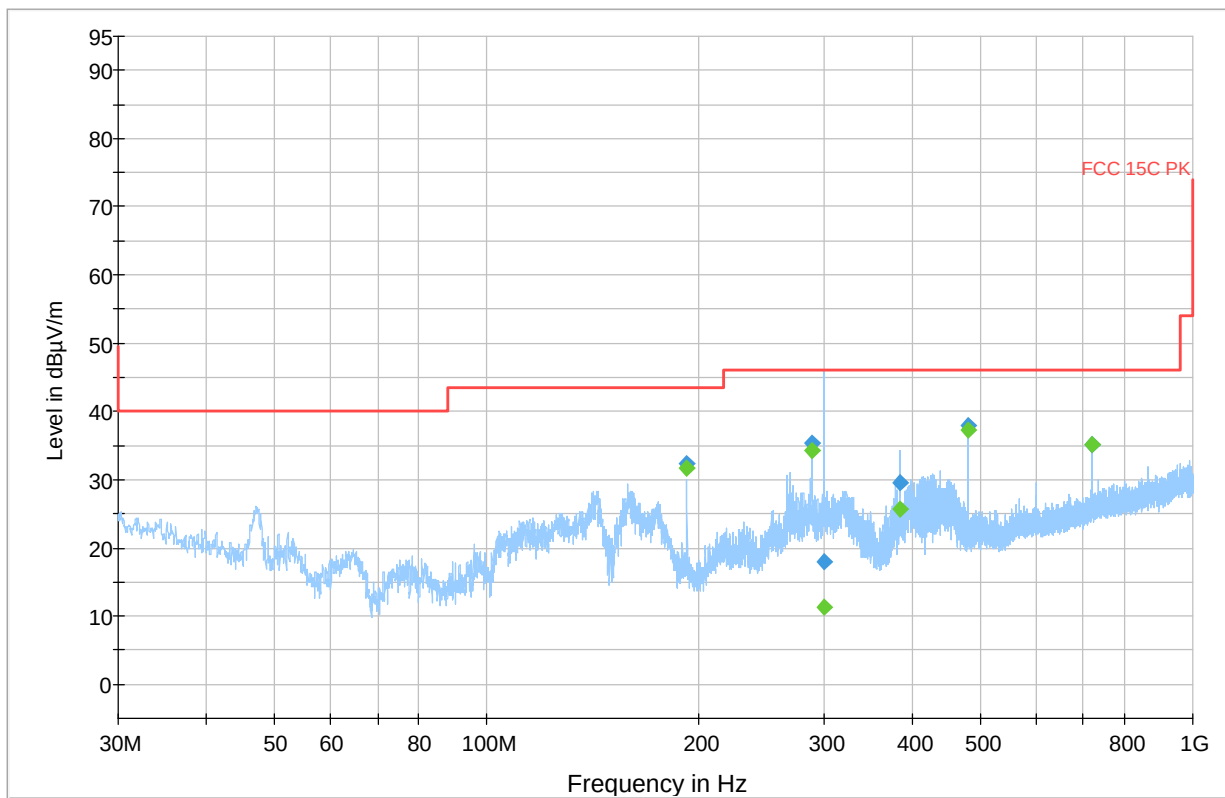
Plot # 61 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2437 MHz

Mode: 802.11g

Final_Result

Frequency (MHz)	QuasiPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Corr. (dB/m)
191.994	32.266	---	43.50	11.23	500.0	120.000	300.0	H	-20.4
191.994	---	31.645	---	---	500.0	120.000	300.0	H	-20.4
288.001	---	34.279	---	---	500.0	120.000	124.0	H	-17.7
288.001	35.330	---	46.00	10.67	500.0	120.000	124.0	H	-17.7
300.293	17.909	---	46.00	28.09	500.0	120.000	124.0	H	-17.4
300.293	---	11.244	---	---	500.0	120.000	124.0	H	-17.4
384.002	---	25.712	---	---	500.0	120.000	156.0	H	-14.8
384.002	29.636	---	46.00	16.36	500.0	120.000	156.0	H	-14.8
480.010	37.870	---	46.00	8.13	500.0	120.000	234.0	H	-12.5
480.010	---	37.350	---	---	500.0	120.000	234.0	H	-12.5
720.033	35.171	---	46.00	10.83	500.0	120.000	130.0	H	-8.3
720.033	---	35.101	---	---	500.0	120.000	130.0	H	-8.3

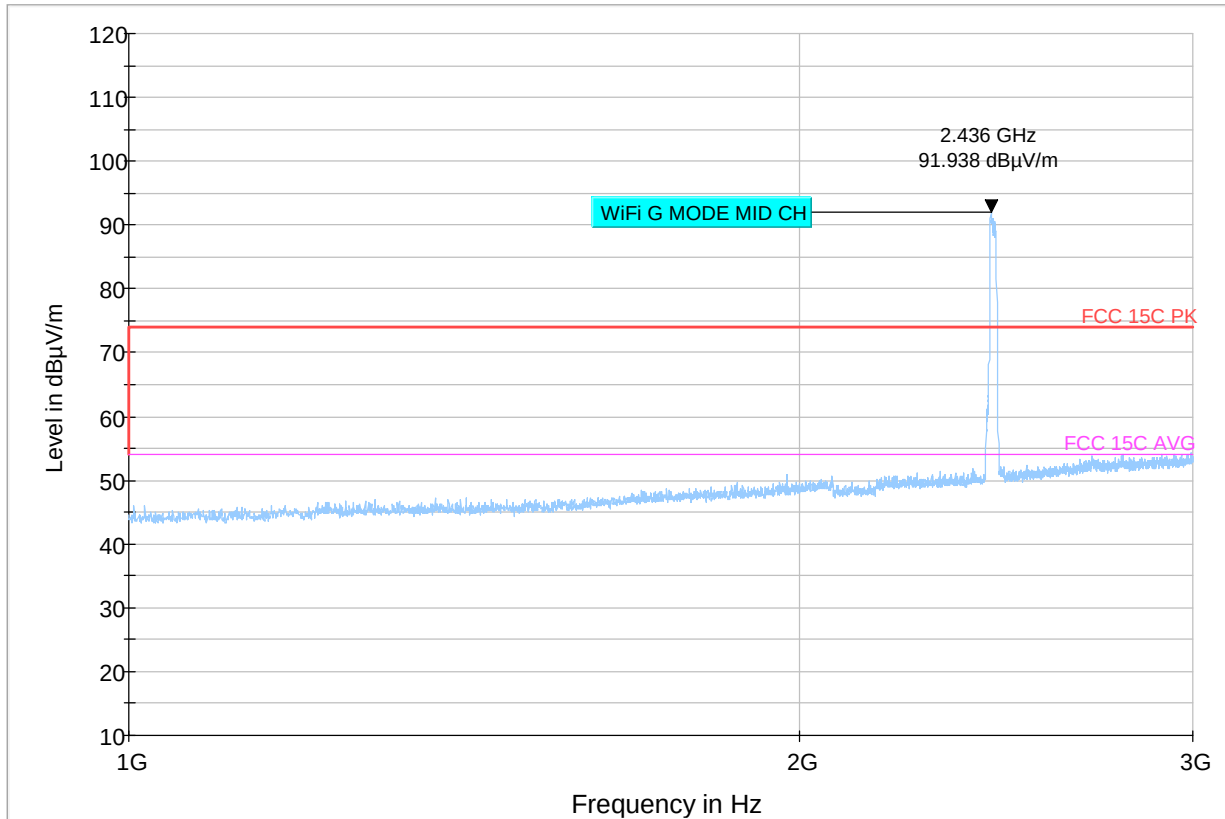


Preview Result 1-PK+ FCC 15C PK Final_Result QPK Final_Result RMS

Plot # 62 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2437 MHz

Mode: 802.11g



Preview Result 1-PK+
FCC 15C AVG



Critical_Freqs PK+
Final_Result PK+



FCC 15C PK
Final_Result RMS

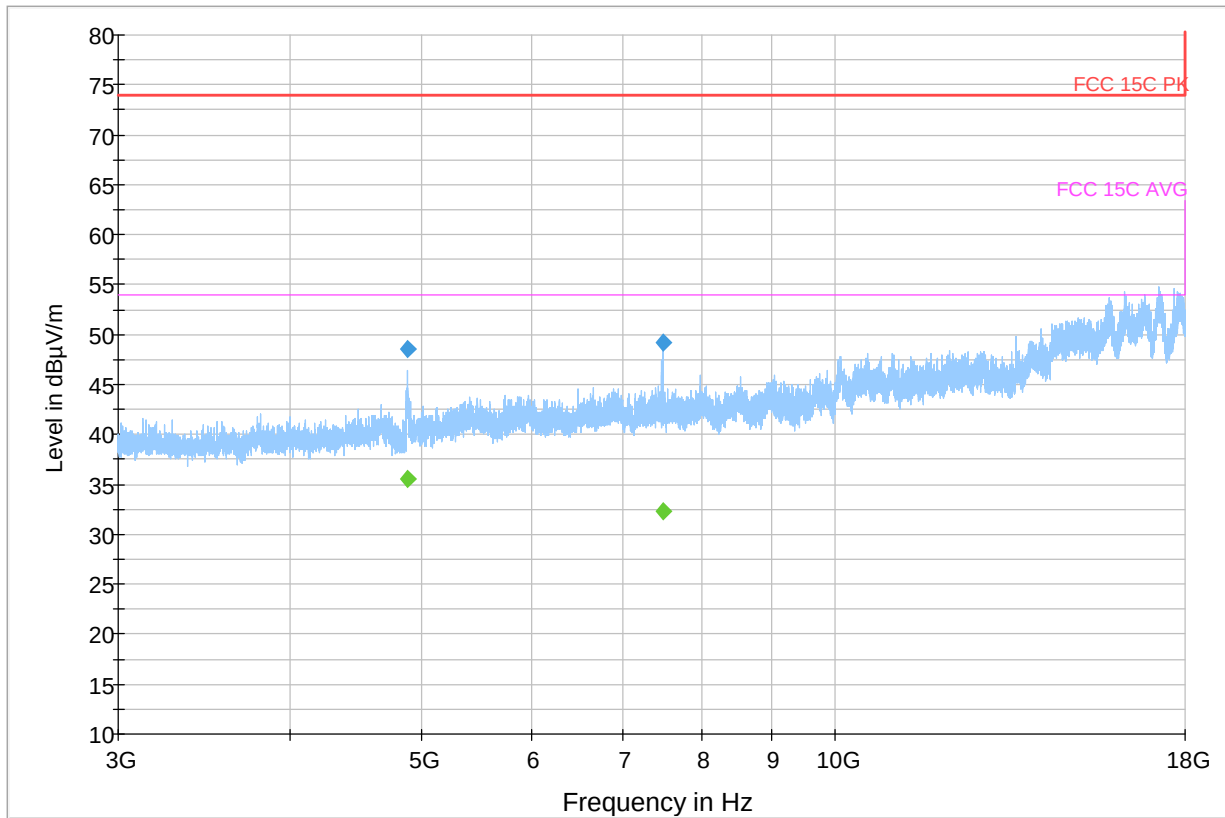
Plot # 63 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2437 MHz

Mode: 802.11g

Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4878.044	---	35.584	53.98	18.40	500.0	1000.000	210.0	V	224.0	-5.7	2:41:35 PM - 4/15/2020
4878.044	48.627	---	73.99	25.36	500.0	1000.000	210.0	V	224.0	-5.7	2:41:35 PM - 4/15/2020
7493.666	---	32.253	53.98	21.73	500.0	1000.000	142.0	V	342.0	-2.0	2:44:44 PM - 4/15/2020
7493.666	49.156	---	73.99	24.83	500.0	1000.000	142.0	V	342.0	-2.0	2:44:44 PM - 4/15/2020

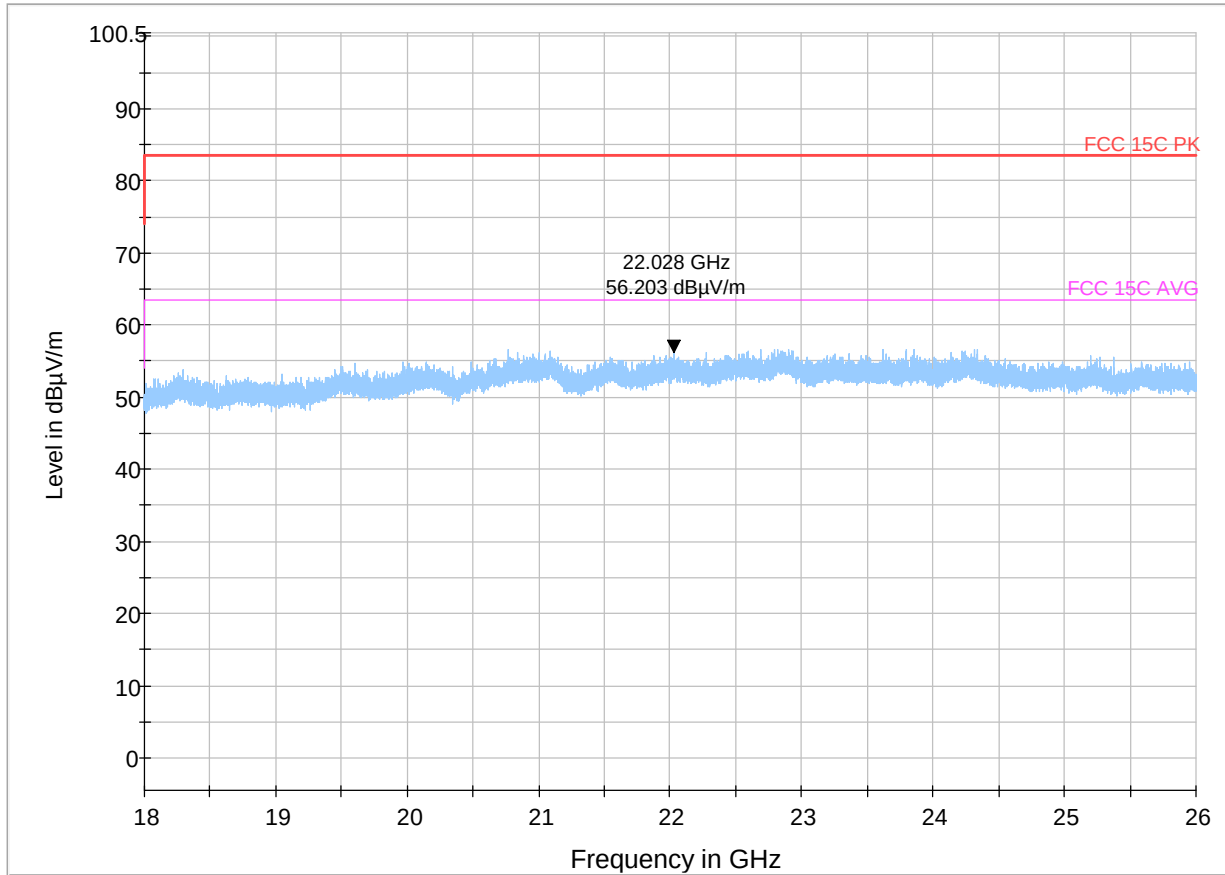


— Preview Result 1-PK+ ◆ Critical_Freqs PK+ Final_Result PK+ — FCC 15C PK
— FCC 15C AVG ◆ Final_Result RMS

Plot # 64 Radiated Emissions: 18 – 26 GHz

Tx Frequency: 2437 MHz

Mode: 802.11g



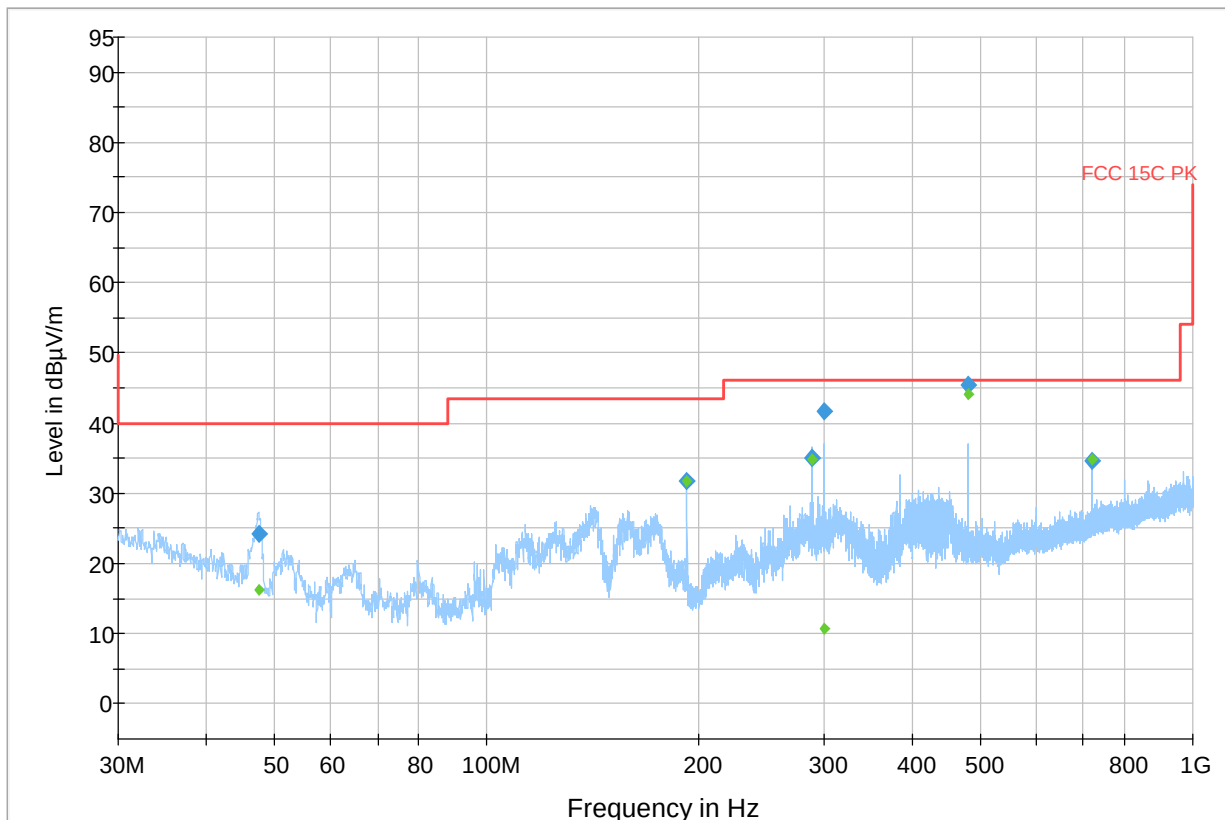
Plot # 65 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2462 MHz

Mode: 802.11g

Final_Result

Frequency (MHz)	QuasiPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Corr. (dB/m)
47.483	24.15	---	40.00	15.85	500.0	120.000	100.0	V	-18.0
47.483	---	16.25	---	---	500.0	120.000	100.0	V	-18.0
192.000	31.71	---	43.50	11.79	500.0	120.000	295.0	H	-20.4
192.000	---	31.69	---	---	500.0	120.000	295.0	H	-20.4
288.014	35.02	---	46.00	10.98	500.0	120.000	193.0	H	-17.7
288.014	---	34.92	---	---	500.0	120.000	193.0	H	-17.7
300.299	---	10.71	---	---	500.0	120.000	107.0	H	-17.4
300.299	41.60	---	46.00	4.40	500.0	120.000	107.0	H	-17.4
480.011	---	44.15	---	---	500.0	120.000	268.0	H	-12.5
480.011	45.37	---	46.00	0.63	500.0	120.000	268.0	H	-12.5
720.033	34.67	---	46.00	11.33	500.0	120.000	118.0	H	-8.3
720.033	---	34.83	---	---	500.0	120.000	118.0	H	-8.3

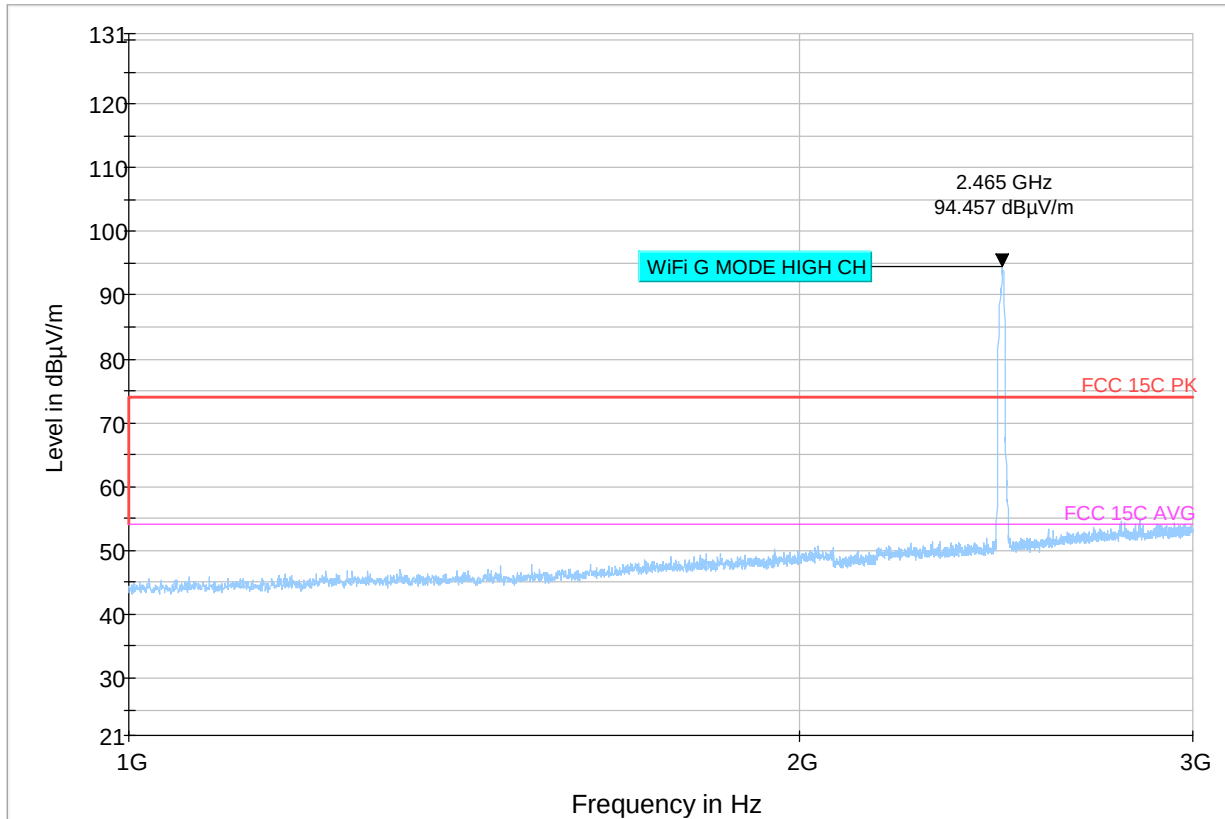


— Preview Result 1-PK+ [Preview Result 1.Result:1]
 — FCC 15C PK [..]
 ◆ Final_Result QPK [Final_Result.Result:4]
 ◆ Final_Result RMS [Final_Result.Result:5]

Plot # 66 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2462 MHz

Mode: 802.11g



Preview Result 1-PK+
FCC 15C AVG

* Critical_Freqs PK+
Final_Result PK+

FCC 15C PK
Final_Result RMS

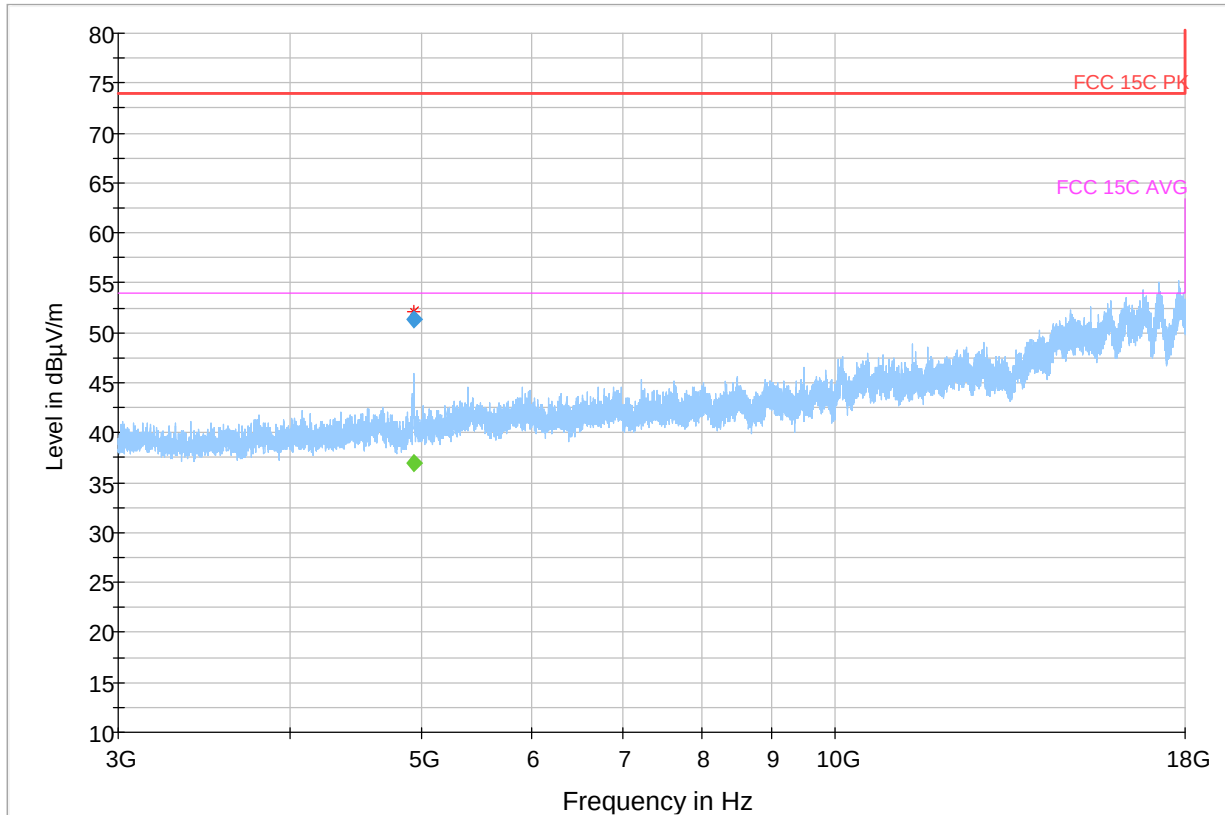
Plot # 67 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2462 MHz

Mode: 802.11g

Final_Result

Frequency (MHz)	MaxPeak (dBμV/m)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4931.535	---	36.895	53.98	17.08	500.0	1000.000	141.0	H	338.0	-5.5	3:13:02 PM - 4/15/2020
4931.535	51.317	---	73.99	22.67	500.0	1000.000	141.0	H	338.0	-5.5	3:13:02 PM - 4/15/2020



— Preview Result 1-PK+ * Critical_Freqs PK+ — FCC 15C PK
— FCC 15C AVG ◆ Final_Result PK+ ◆ Final_Result RMS

9 Test setup photos

Setup photos are included in supporting file name: "EMC_GEOTA_032_20001_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE 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	00035111	3 YEARS	04/17/2019
HORN ANTENNA	ETS LINDGREN	3117	00169547	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00169535	3 YEARS	09/24/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	3 YEARS	07/16/2019
Spectrum Analyzer	R&S	FSU26	200065	3 YEARS	07/16/2019
THERMOMETER HUMIDITY MONITOR	CONTROL COMPANY	36934-164	181230565	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. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

11 History

Date	Report Name	Changes to report	Report prepared by
6/12/2020	EMC_GEOTA_032_20001_FCC_15.247_ISED_WIFI_DTS	Initial Version	Issa Ghanma

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