FCC / ISED Test Report

For:
Motive Technologies, Inc.

Brand:
Motive Technologies, Inc.

Marketing Name:
Omnicam

Model Number:
OC-1

Product Description:
Is a vehicle camera, designed to be powered by vehicle power (12 or 24 V DC). It is designed to be always on and recording video while the vehicle is on. It will upload small video files to Motive back-end servers via LTE on request.

FCC ID: 2AQM7-OC1
IC: 24516-OC1

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

REPORT #: EMC_KPTRK_040_23001_FCC_15_247_ISED_WLAN_DTS

DATE: 6/28/2023

A2LA Accredited

IC recognized # 3462B

CETECOM **Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: Contact@cetecom.com ◆ http://www.cetecom.com
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following equipment (as identified in section 3 of this test report) 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.

According to section 5 of this report, the overall result is Pass.

Company	Description	Model #
Motive Technologies, Inc.	Is a vehicle camera, designed to be powered by vehicle power (12 or 24 V DC). It is designed to be always on and recording video while the vehicle is on. It will upload small video files to Motive back-end servers via LTE on request.	OC-1

Responsible for Testing Laboratory:

Date	Section	Name	Signature
6/28/2023	Compliance	Stoecker, Arndt (Director of Regulatory Services)	Arndt Stoecker Digitally signed by: Arndt Stoecker DN: CN = Arndt Stoecker email = arndt.stoecker@cetecom.com C = US O = CETECOM Inc Date: 2023.06.28 17:54:17 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
6/28/2023	Compliance	Ghanma, Issa (Deputy Lab Manager)	Digitally signed by: Issa Ghanma DN: CN = Issa Ghanma email = Issa.Ghanma@cetecom.com C = US O = CETECOM, Inc. OU = EMC Date: 2023.06.28 17:36:02 -07'00'

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 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
Director of Regulatory Services:	Stoecker, Arndt
Responsible Project Leader:	Baskaran, Akanksha

2.2 Identification of the Client

Applicant's Name:	Motive Technologies, Inc.
Street Address:	55 Hawthorne St., Suite 400
City/Zip Code	San Francisco, CA 94105
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

Brand:	Motive Technologies, Inc.
Model No:	OC-1
Marketing name:	Omnicam
FCC-ID :	2AQM7-OC1
IC:	24516-OC1
HW Version :	1
SW Version :	0.7.2
HVIN:	OC-1
PMN:	Omnicam
Product Description:	Is a vehicle camera, designed to be powered by vehicle power (12 or 24 V DC). It is designed to be always on and recording video while the vehicle is on. It will upload small video files to Motive back-end servers via LTE on request.
Frequency Range/number of channels:	❖ WLAN 2.4 GHz o Nominal band: 2400 MHz – 2483.5 MHz o Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 Channels
Radio information:	❖ WLAN 2.4 GHz Murata LBEE5XV1XZ o Modes, data rate: ▪ 802.11b, 1-11 Mbps ▪ 802.11g, 6-54 Mbps ▪ 802.11n, HT20, 6.5-65 Mbps, SISO, MCS0-7 ▪ 802.11n, HT20, 13-130 Mbps, MIMO, MCS8-15
Max. Measured Conducted Output Power:	802.11b: +20.4 dBm 802.11g: +24.93 dBm 802.11n: +24.33 dBm
Power Supply/ Rated Operating Voltage Range:	12 or 24 V DC
Operating Temperature Range:	T min: -40 °C / T Nom: 20 °C / T max: +60 °C
Other Radios included in the device:	❖ Cellular: Sierra Wireless RC7612 ❖ BT LE/WLAN 5 GHz: Murata LBEE5XV1XZ
Antenna Information as declared:	❖ BLE/WLAN 0 o Type: Inverted-F Antenna o Max Gain 2.4 -2.48 GHz: 1.7 dBi ❖ BLE/WLAN 1 o Type: Inverted-F Antenna o Max Gain 2.4 -2.48 GHz: 0.8 dBi
Sample Revision:	☐ Production Unit; ☑ Pre-Production
Product dimensions:	82mm tall x 82mm wide x 67mm deep
Note: The information of the EUT specifications in the table above is provided by the applicant.	

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	ACCS11AC240211	1	0.7.2	Conducted measurement
2	ACCS1BC332451	1	0.7.2	Radiated measurement

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	S/N	Notes/Comments
N/A	-	-	-	-	-

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test setup	Comments
1	EUT # 1	The measurement equipment was connected to the 50-ohm RF port of the EUT.
2	EUT # 2	The internal antenna was connected.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	WLAN 2.4 GHz	❖ An Ethernet to USB adaptor provided by the client used to communicate with the device and send commands, that will not be available to the end-user to configure the Wi-Fi radio to: • Maximum output power setting*1 • Maximum duty cycle • Modulated signal • Switch between TX chains: 0, 1, or 0 and 1 • Switch between supported modes: b, g, n-HT20 (SISO, MIMO) • Select data rates o 802.11b → 1Mbps o 802.11g → 6Mbps o 802.11n-HT20 SISO→ MCS0 o 802.11n-HT20 MIMO→ MCS8 • Select TX channel(s) o Low CH1→ 2412 MHz o Mid CH6 or CH7→ 2437 or 2442 MHz o High CH11→ 2462 MHz
Op. 2	WLAN 2.4 GHz	❖ An Ethernet to USB adaptor provided by the client used to communicate with the device and send commands, that will not be available to the end-user to configure the Wi-Fi radio to: • Maximum output power setting*1 • Maximum duty cycle • Modulated signal • Switch between supported modes: n-HT20 MIMO • Select data rates o 802.11n MIMO→ MCS8 • Select TX channel(s) o Low CH1→ 2412 MHz o Mid CH6 or CH7→ 2437 or 2442 MHz o High CH11→ 2462 MHz

*1: Refer to the EUT Operational Description: '*Omnicam OC-1 Product Description.pdf*' for full power settings table

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 the highest possible duty cycle and output power.

For conducted measurements;

- All data in this report show the worst case of Wi-Fi radio transmitting at the highest output power representing the worst case transmission mode.
- All measurements were performed with a peak detector" and that the highest possible duty cycle was used for the testing.
- As per manufacturer declaration, duty cycles used are protocol-determined. Test tooling has no mechanism for setting a specific duty cycle.

For radiated measurements;

- All data in this report show the worst case of Wi-Fi radio transmitting at the highest output power representing the worst case of BLE transmission mode.
- 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 following:

- FCC ID: 2AQM7-OC1
- IC: 24516-OC1

4.1 Test methodology of applied standards

- FCC part 15, Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01
- RSS-247 issue 2 Feb. 2017
- RSS-Gen issue 5 April 2018
- ANSI C63.10:2013

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	-	☐	☐	☑	Note 1 Note 2

Note 1: NA: Not Applicable; NP: Not Performed;
Note 2: The EUT is a vehicular device powered by DC mains (battery); 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 a 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Measurement System		EMC 1	EMC 2
Conducted emissions (mains port)		1.12 dB	0.46 dB
Radiated emissions	(< 30 MHz)	3.66 dB	3.88 dB
	(30 MHz – 1GHz)	3.17 dB	3.34 dB
	(1 GHz – 3 GHz)	5.01 dB	4.45 dB
	(>3 GHz)	4.0 dB	4.79 dB

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:

1/17/2023 – 6/28/2023

6.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

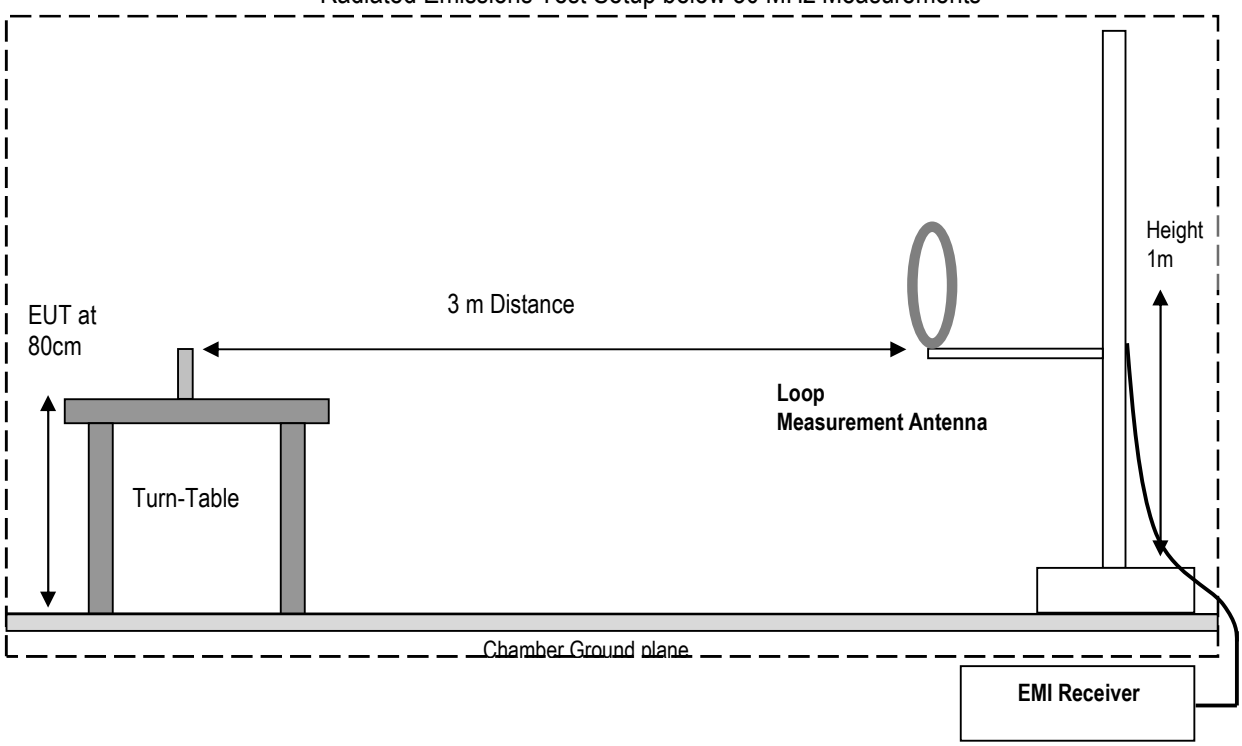
7 Measurement Procedures

7.1 Radiated Measurement

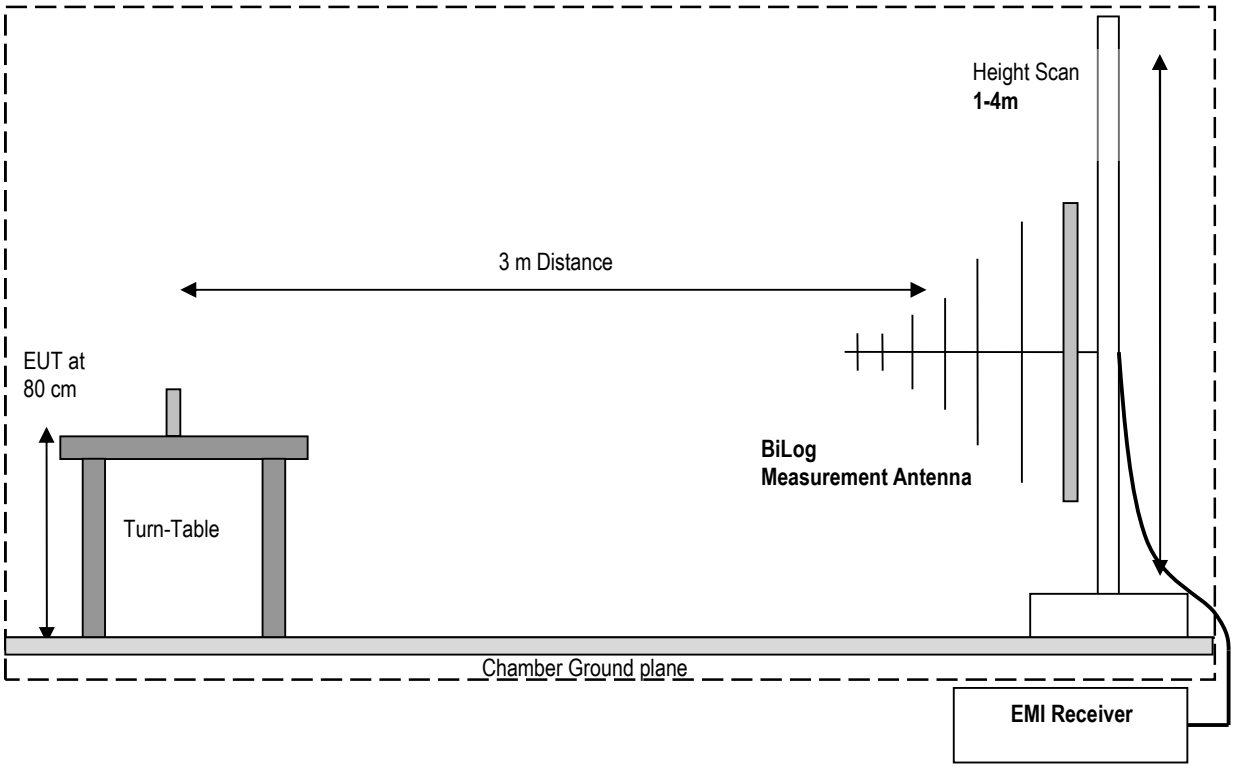
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360º 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 highest six 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 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.

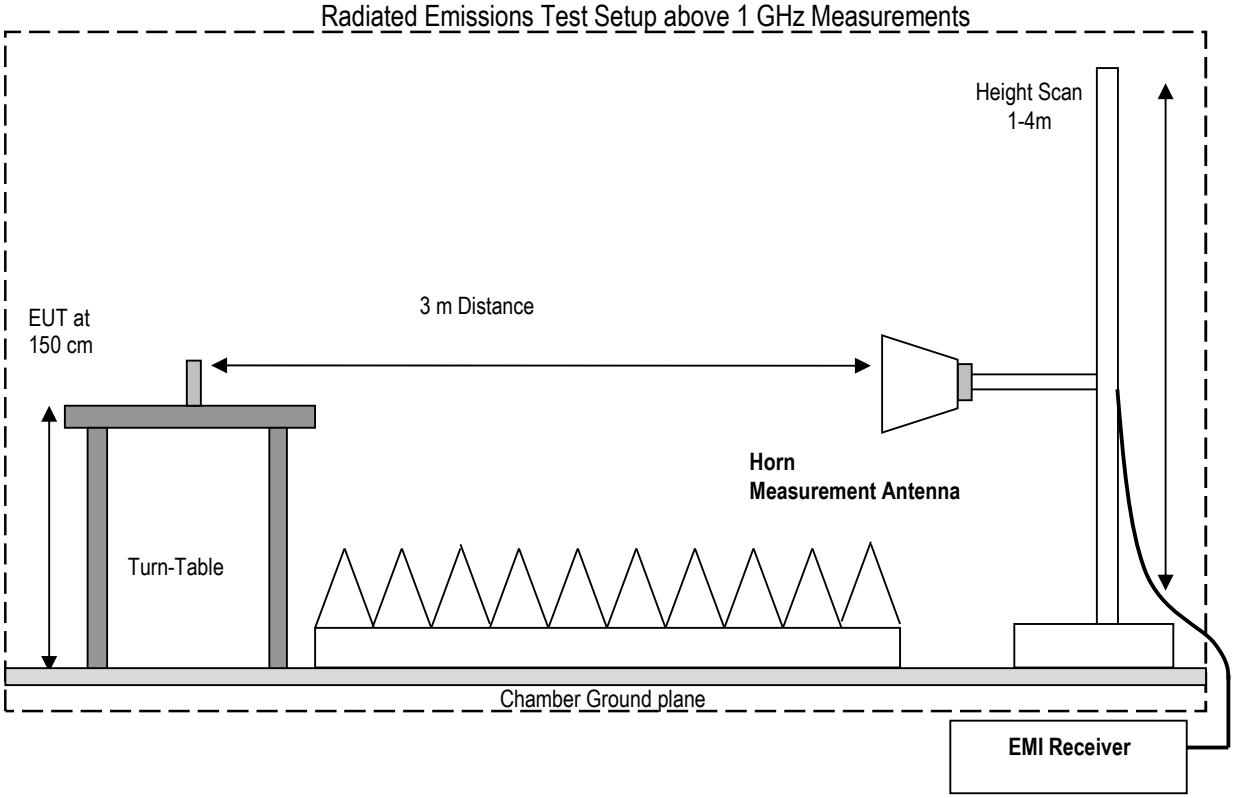
Radiated Emissions Test Setup below 30 MHz Measurements



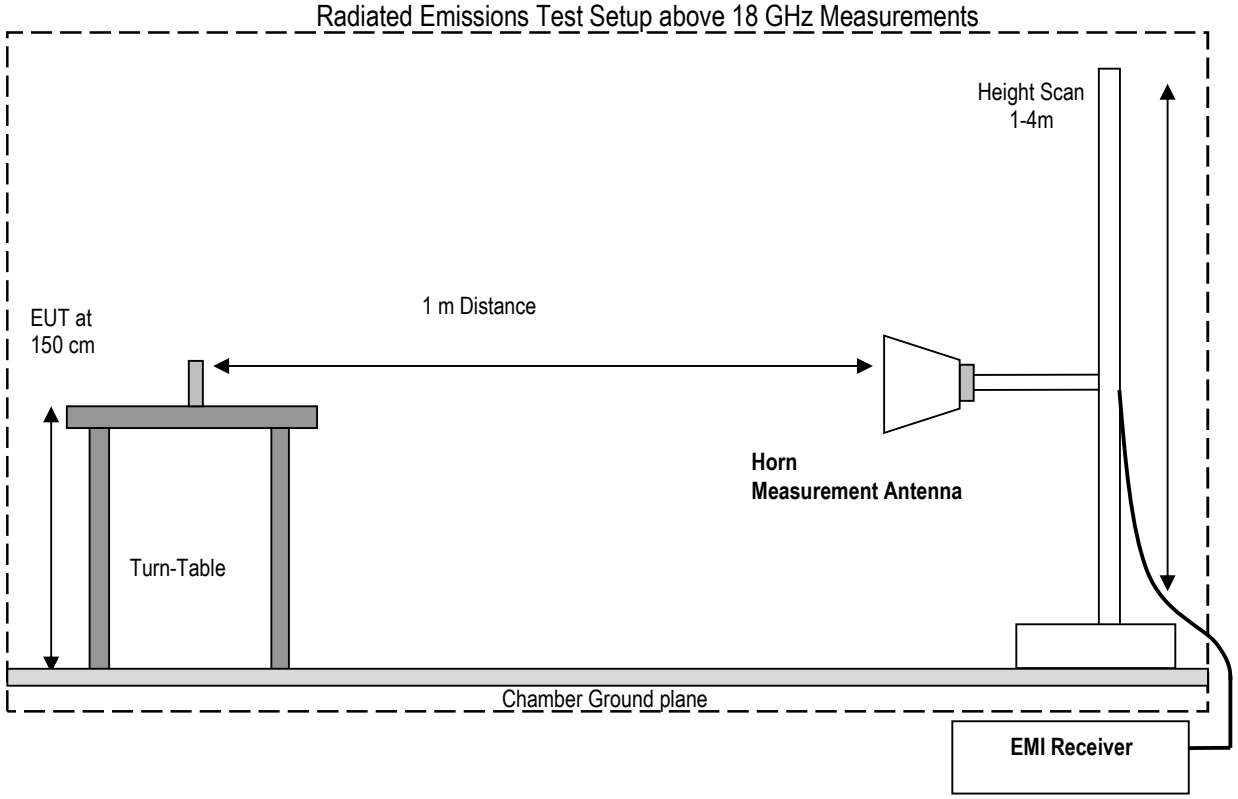
Radiated Emissions Test Setup 30 MHz-1 GHz Measurements



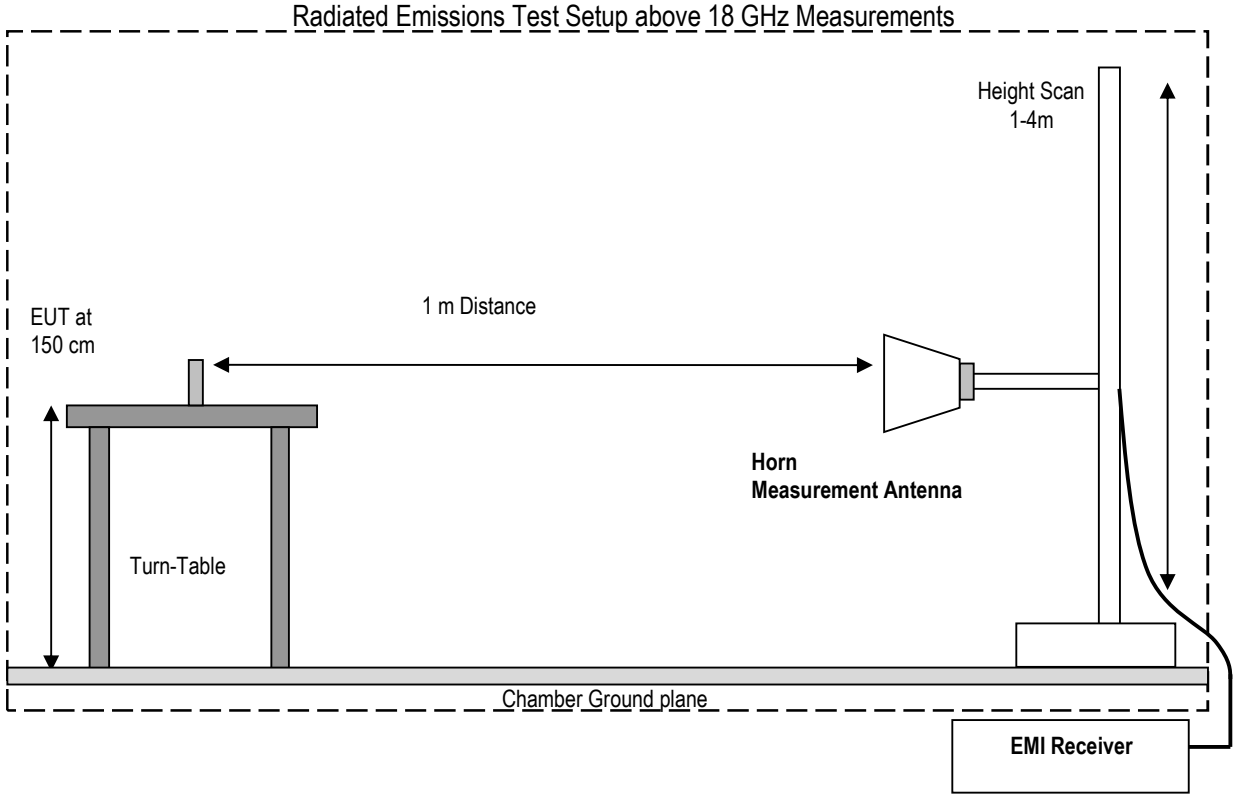
Radiated Emissions Test Setup above 1 GHz Measurements



Radiated Emissions Test Setup above 18 GHz Measurements



Radiated Emissions Test Setup above 18 GHz 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:

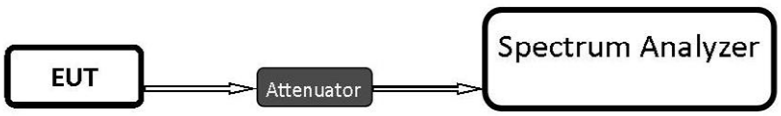
FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

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 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 ANSI C63.10 clause 11.6;

Measurements of duty cycle and transmission duration shall be performed using 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 ≥ OBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. 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 ≥ 16.7 microseconds.)

8.1.2 Test conditions and setup:

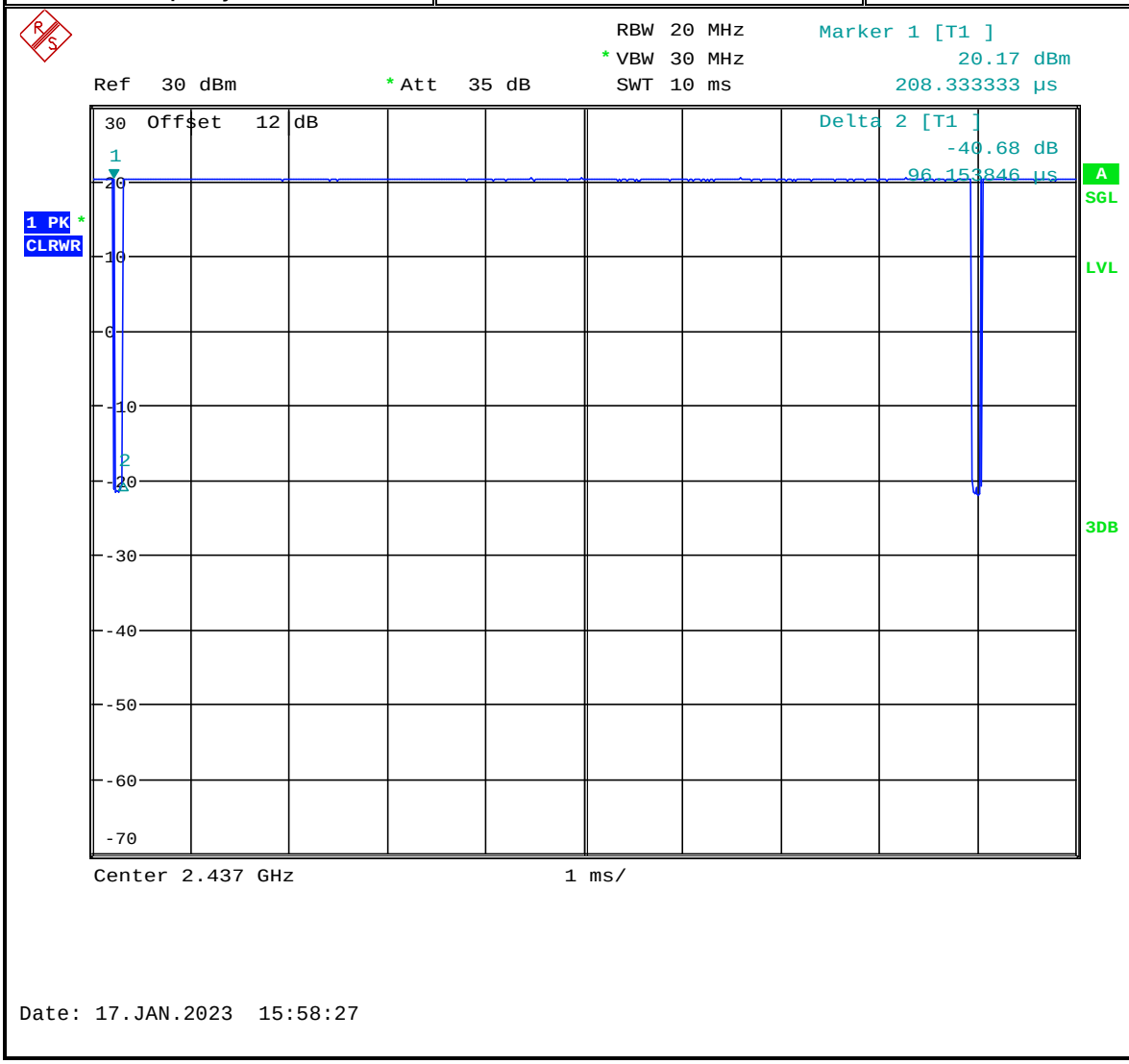
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23.8°C	1	Op.1	12V DC

8.1.3 Measurement result:

Plot #	Mode	TX Frequency	Data Rate	Duty cycle
1	802.11 b	2437 MHz	1 Mb/s	98.2%
2	802.11 g	2442 MHz	6 Mb/s	94.61%
3	802.11 n-HT20	2442 MHz	MCS0	93.51%

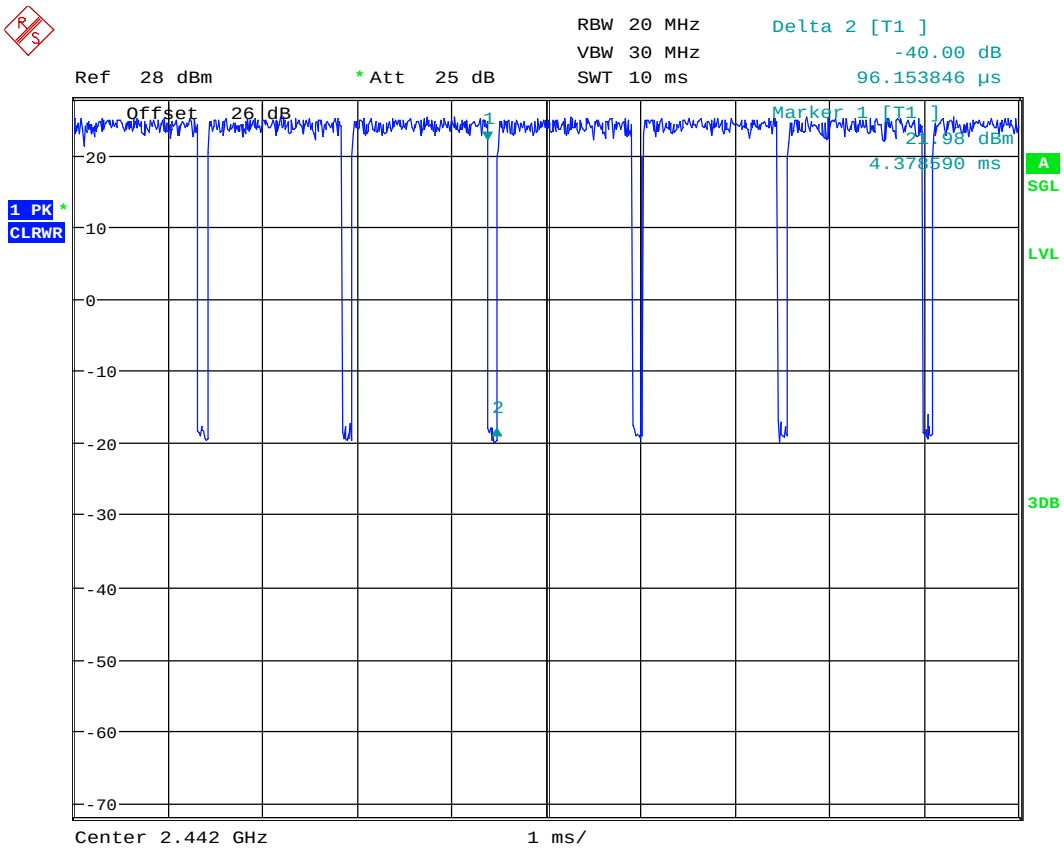
8.1.4 Measurement plots:

Plot # 1		
Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s



Plot # 2

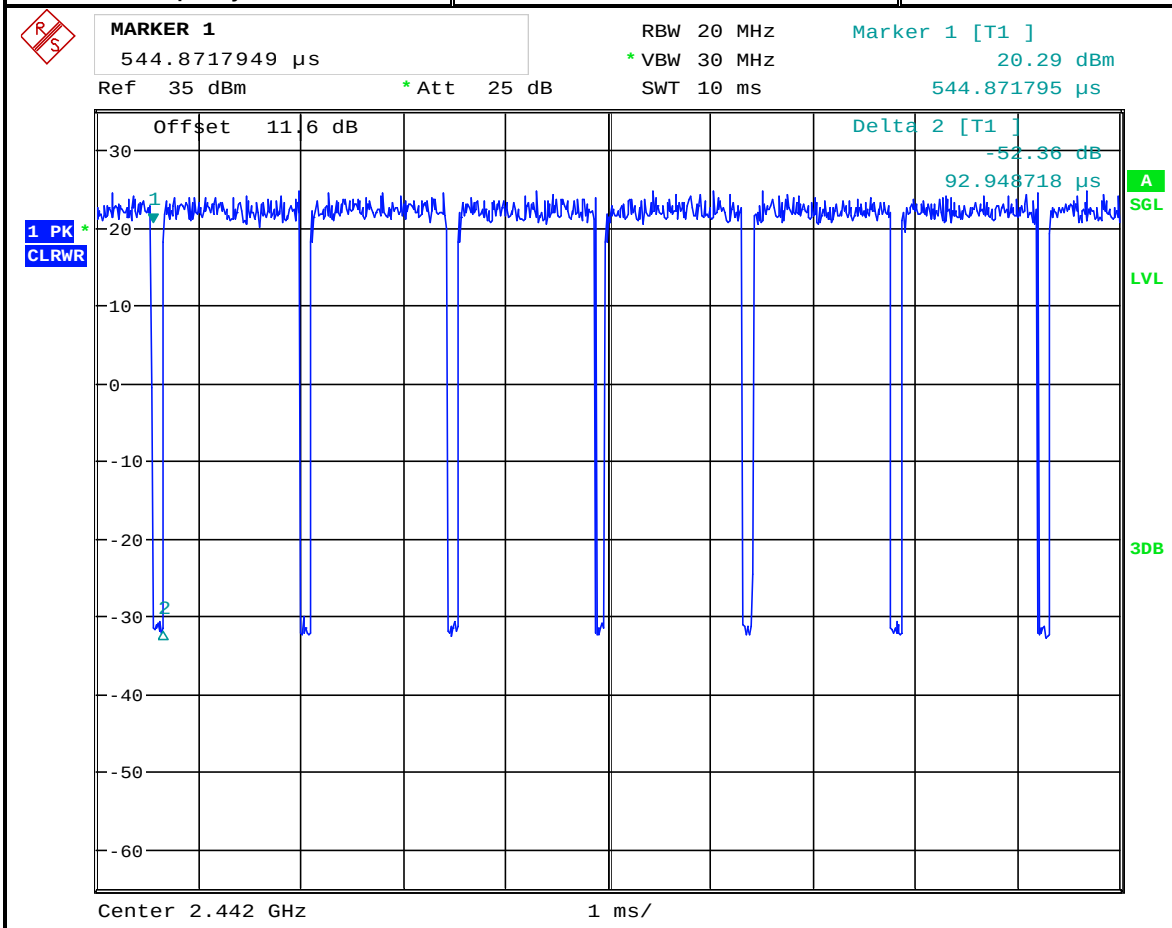
Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s



Date: 28.JUN.2023 11:48:50

Plot # 3

Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20	MCS0



Date: 25.JAN.2023 11:05:27

8.2 Emission Bandwidth 6dB and 99% Occupied Bandwidth

8.2.1 Measurement according to ANSI C63.10 clause 11.8

Spectrum Analyzer settings

6dB (DTS) Bandwidth

- 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.

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) ≈ 3 x 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)

- 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	12V DC

8.2.4 Measurement result:

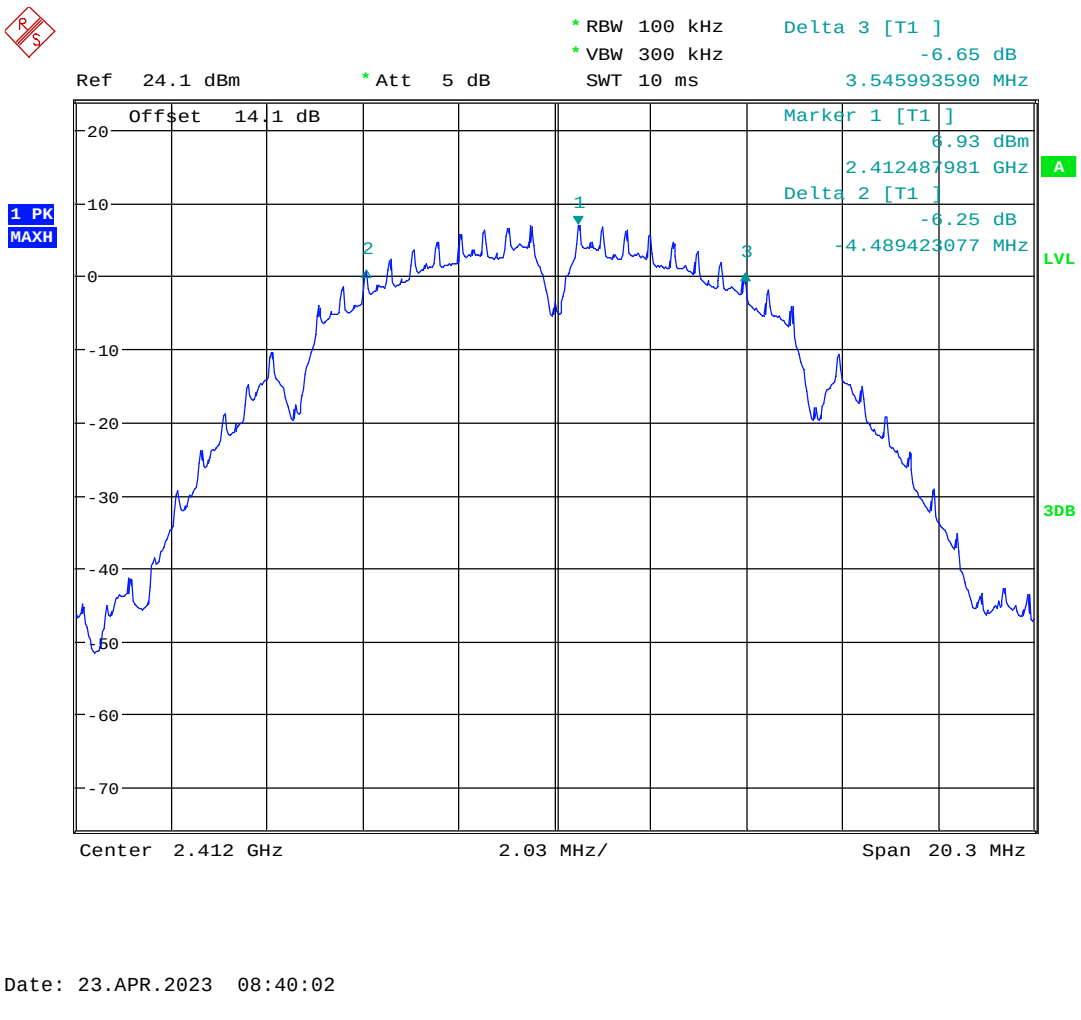
Plot #	Mode	Data rate	Frequency (MHz)	6dB Emission Bandwidth (MHz)	Limit (MHz)	Result
4	802.11 b	1 Mb/s	2412	8.04	> 0.5	Pass
5			2442	8.00	> 0.5	Pass
6			2462	8.00	> 0.5	Pass
7	802.11 g	6 Mb/s	2412	16.35	> 0.5	Pass
8			2442	16.31	> 0.5	Pass
9			2462	16.25	> 0.5	Pass
10	802.11 n-HT20	MCS0	2412	17.56	> 0.5	Pass
11			2442	17.54	> 0.5	Pass
12			2462	17.54	> 0.5	Pass

Plot #	Mode	Data rate	Frequency (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
13	802.11 b	1 Mb/s	2412	10.06	> 0.5	Pass
14			2442	10.10	> 0.5	Pass
15			2462	10.08	> 0.5	Pass
16	802.11 g	6 Mb/s	2412	16.38	> 0.5	Pass
17			2442	16.40	> 0.5	Pass
18			2462	16.40	> 0.5	Pass
19	802.11 n-HT20	MCS0	2412	17.60	> 0.5	Pass
20			2442	17.58	> 0.5	Pass
21			2462	17.58	> 0.5	Pass

8.2.5 Measurement Plots:

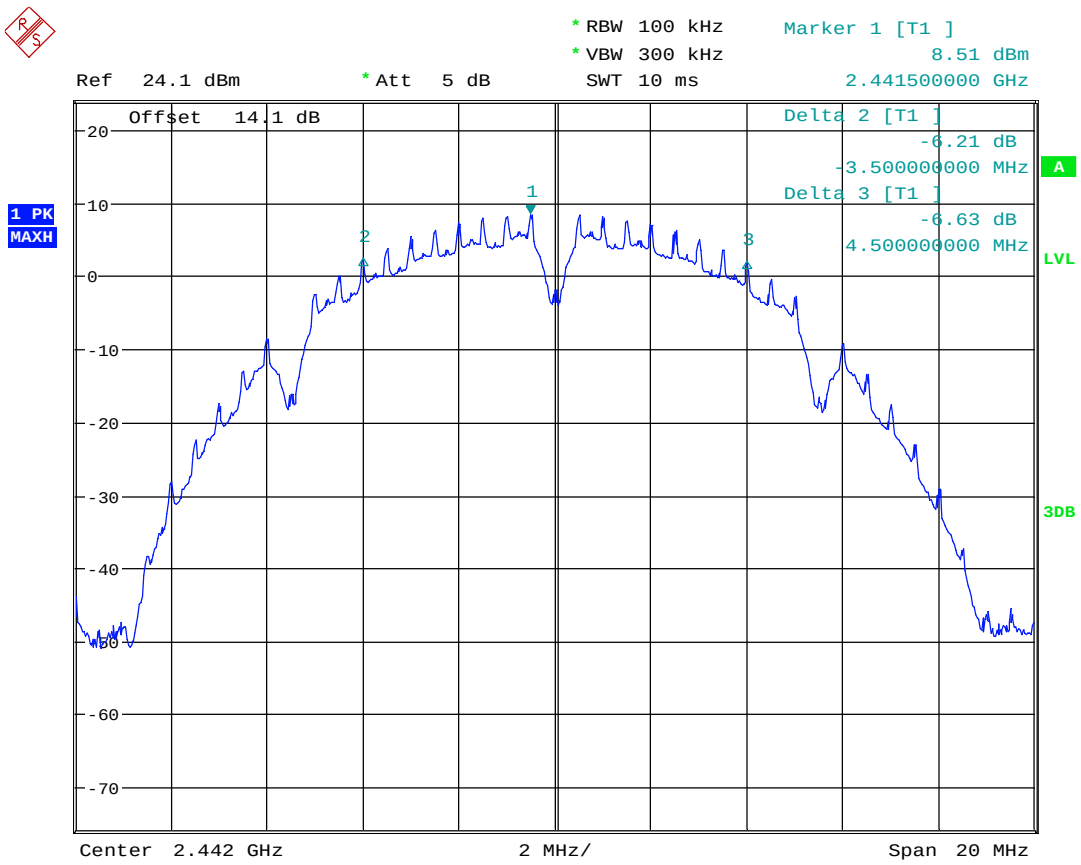
6 dB Emission Bandwidth

Plot # 4		
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**



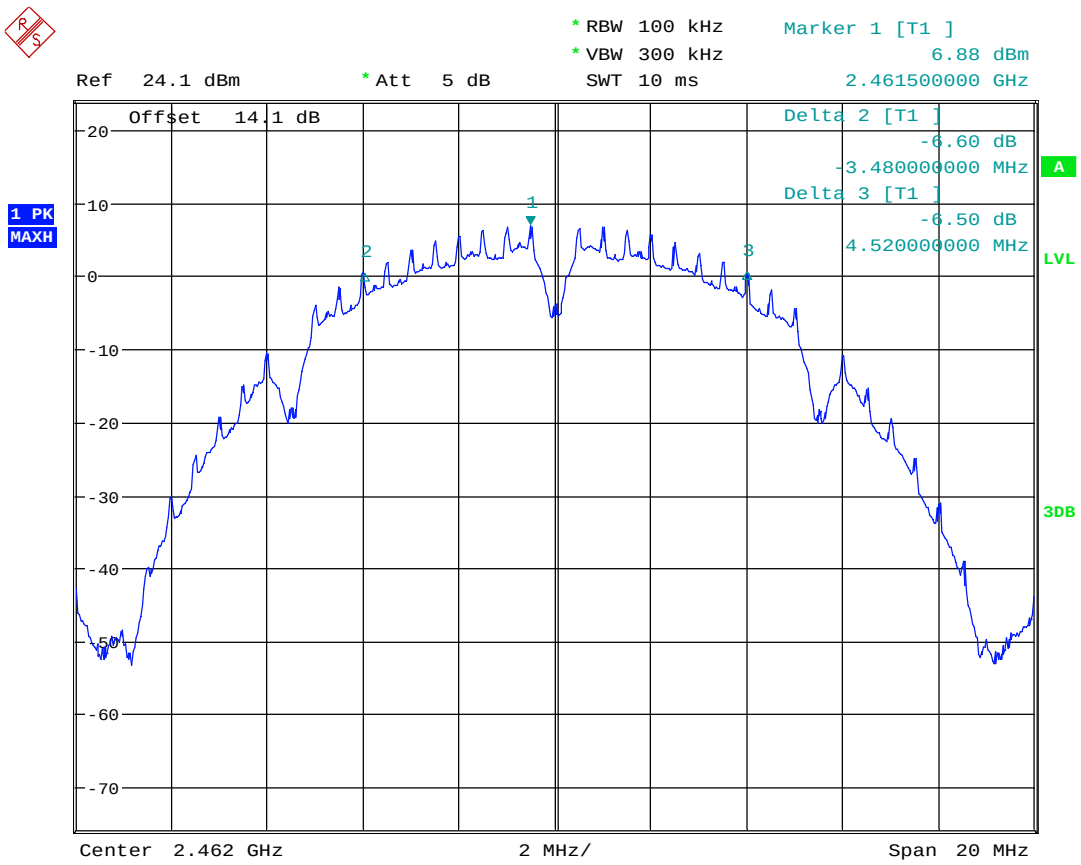
Plot # 5

Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s



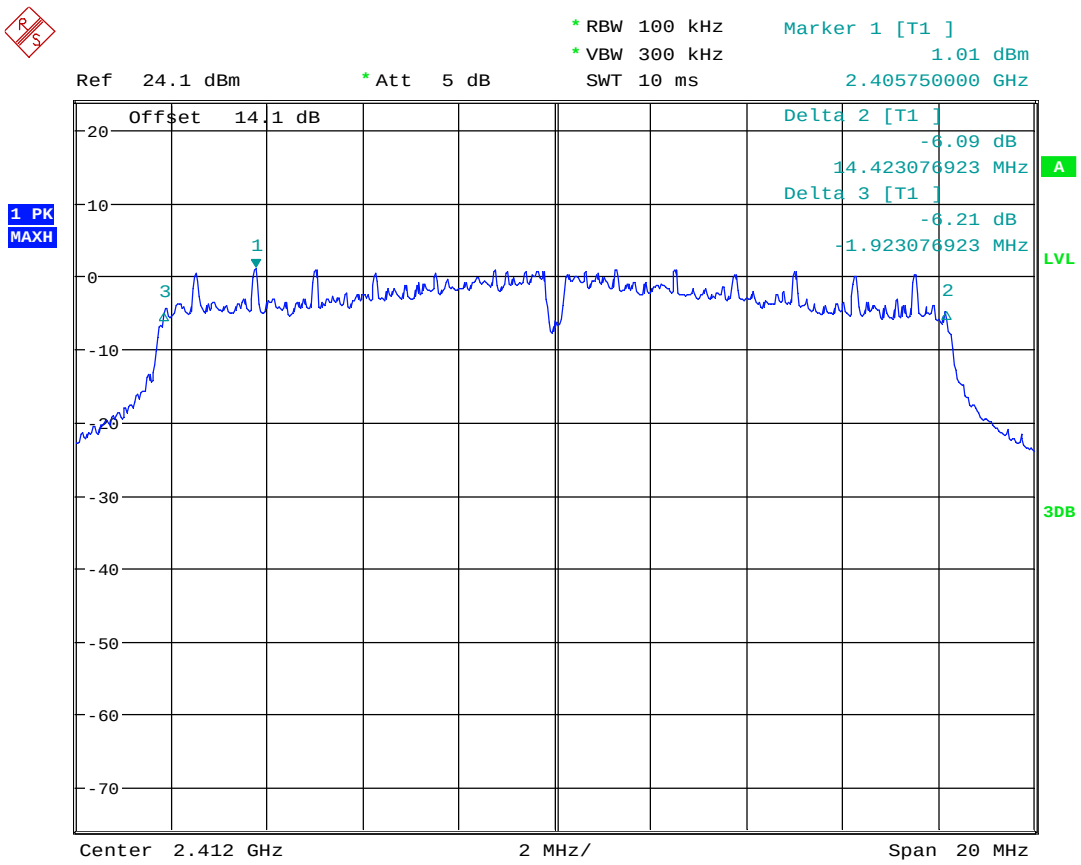
Plot # 6

Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s



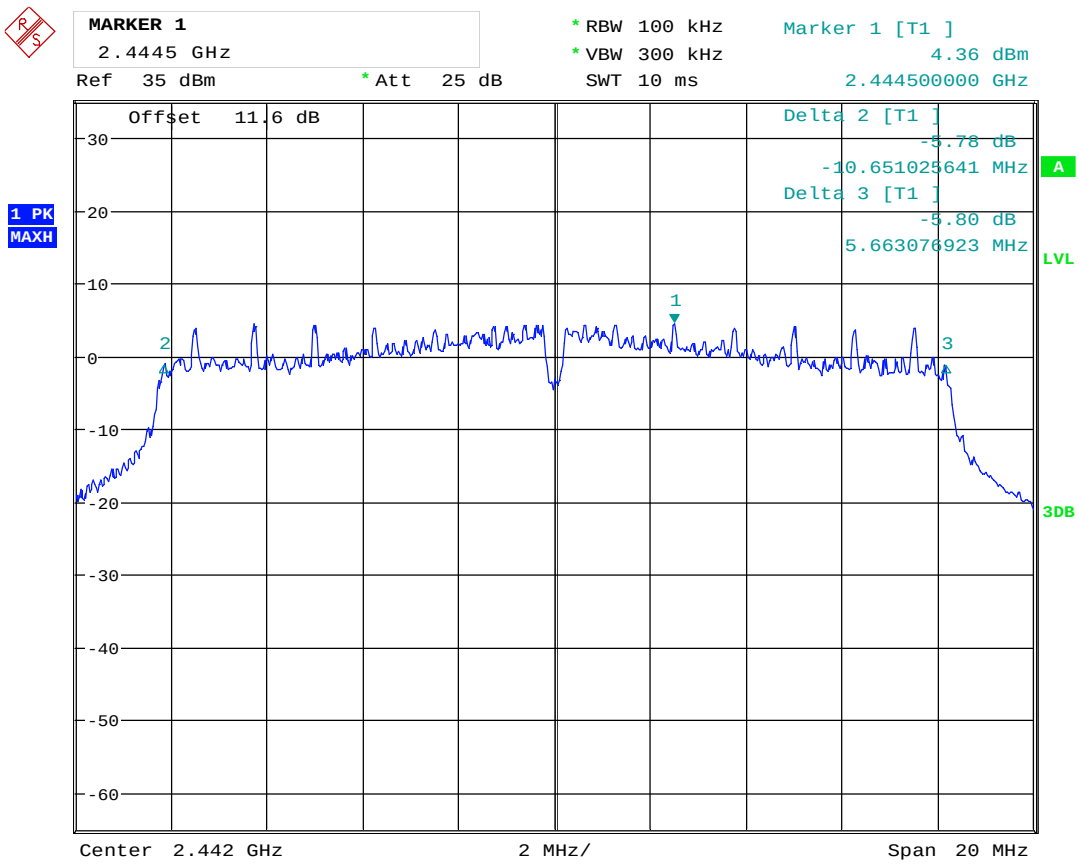
Date: 23.APR.2023 10:39:32

Plot # 7		
Tx Frequency: 2412 MHz	**Mode: 802.11 g**	**Data rate: 6 Mb/s**



Plot # 8

Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s



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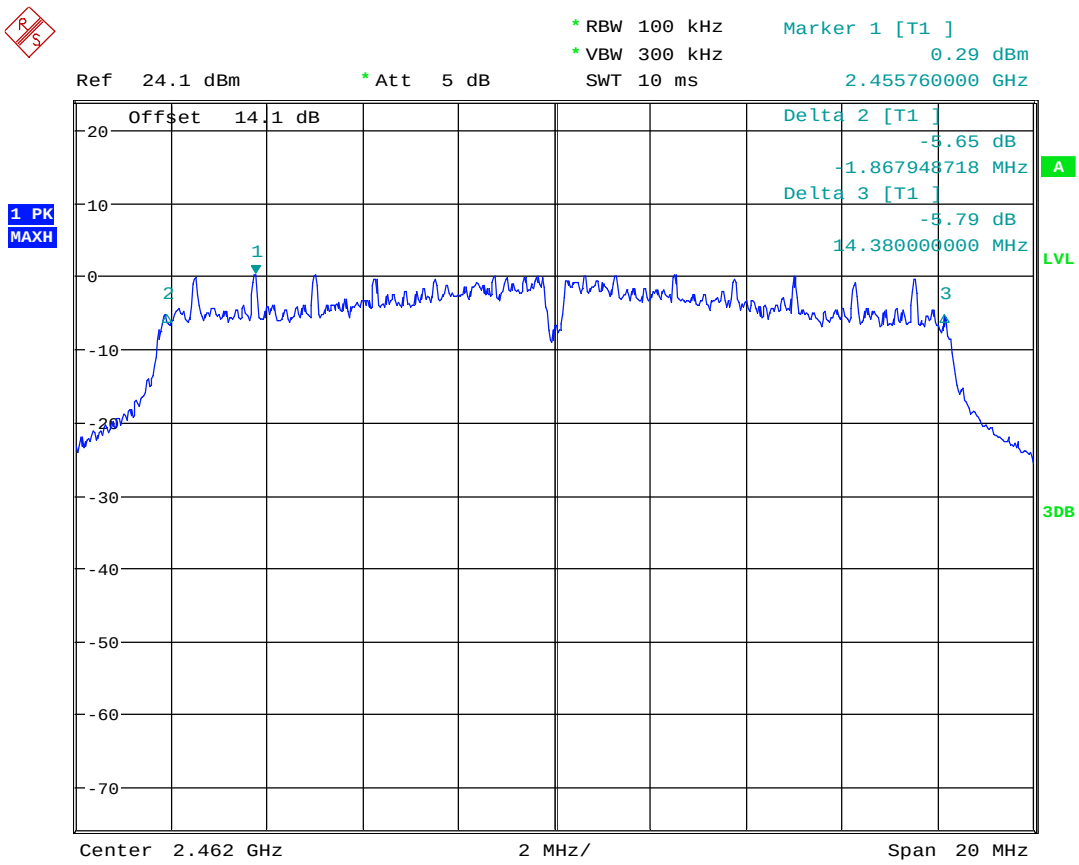
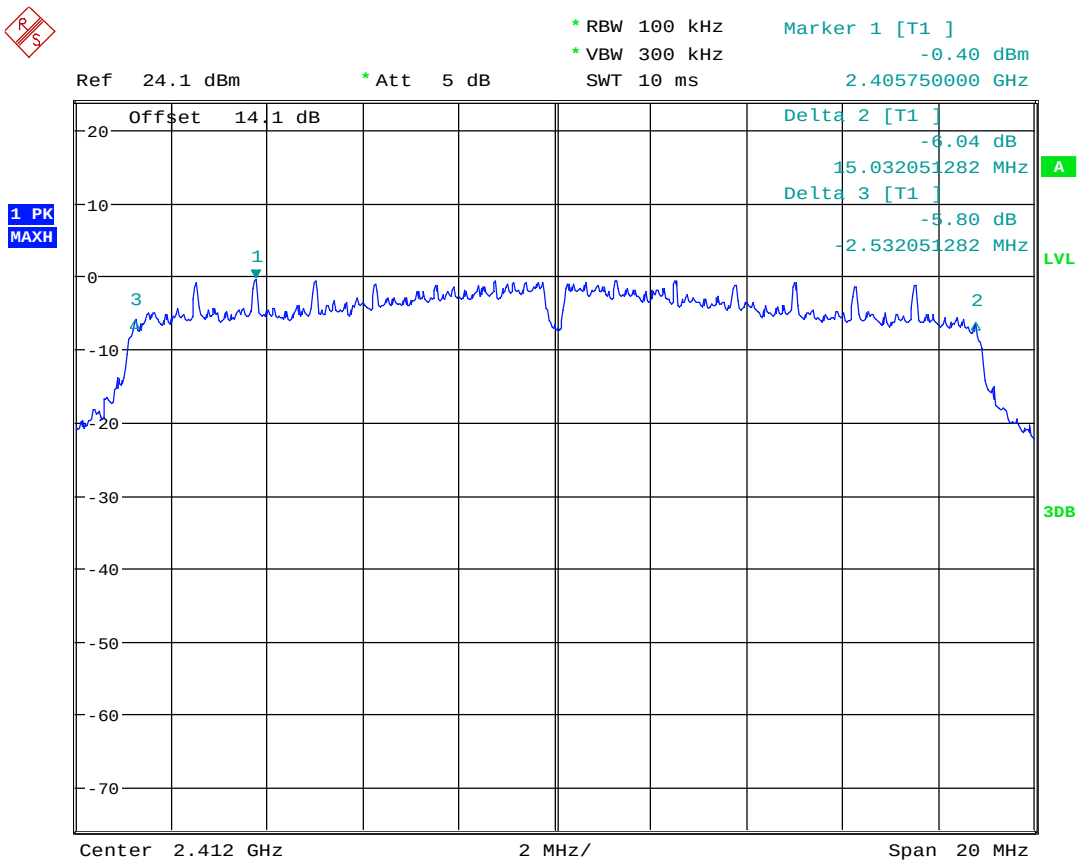
Plot # 9

Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s



Plot # 10

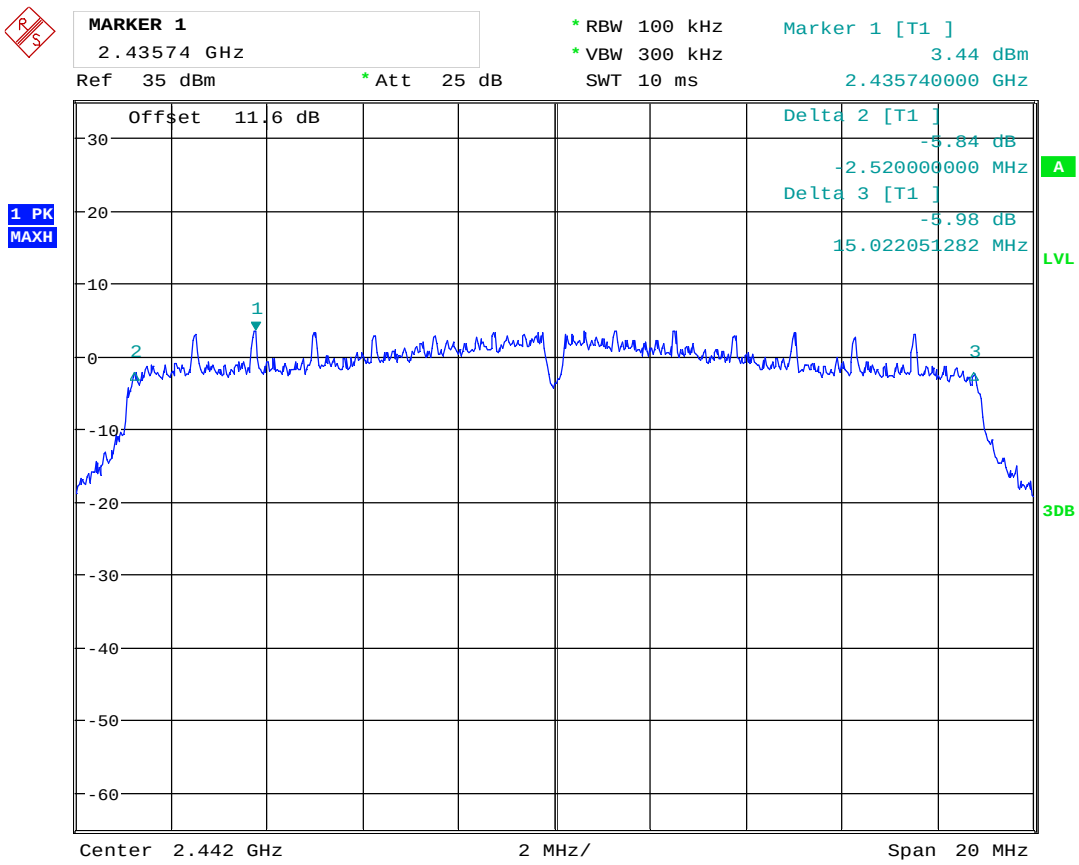
Tx Frequency: 2412 MHz	Mode: 802.11 n-HT20	MCS0



Date: 23.APR.2023 10:08:11

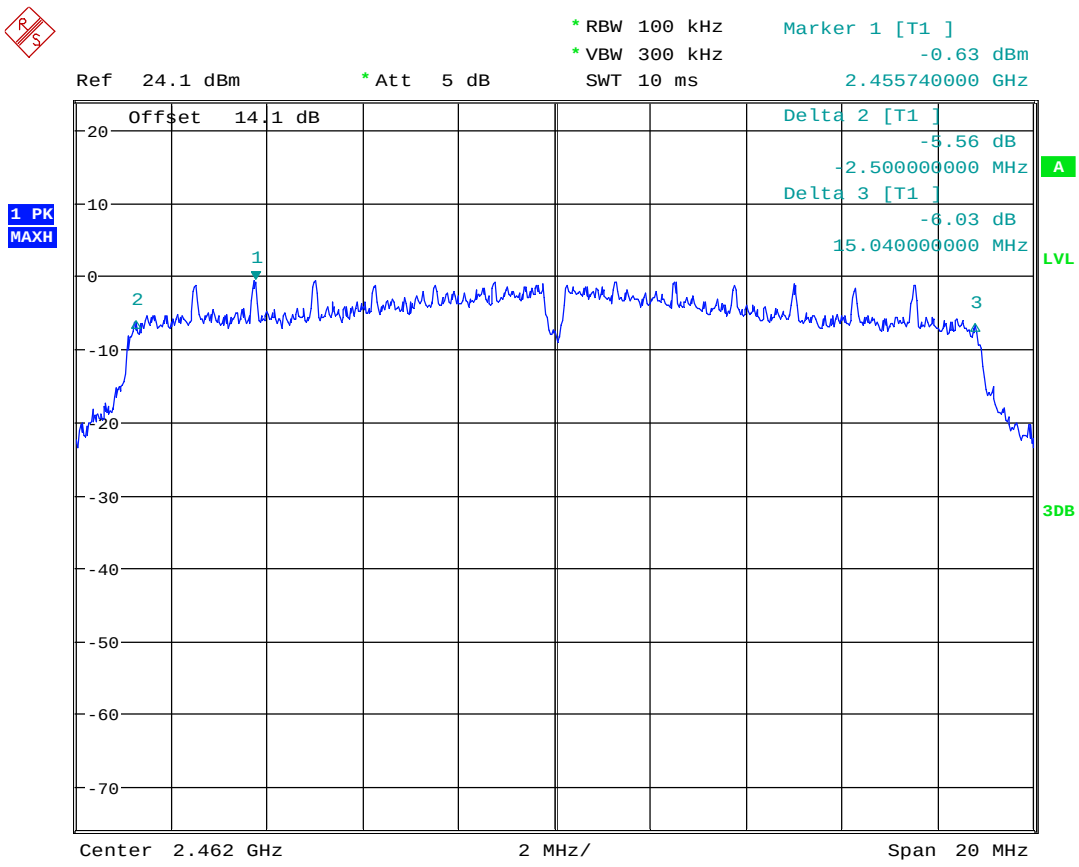
Plot # 11

Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20	MCS0



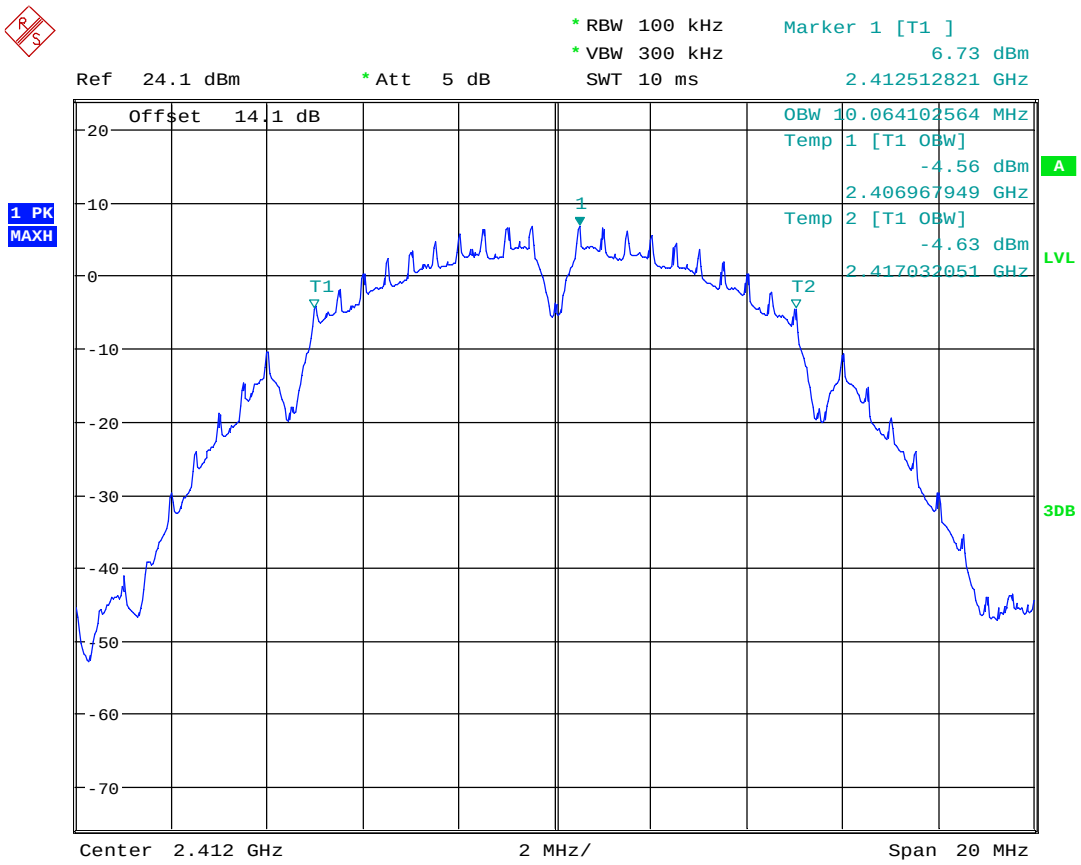
Plot # 12

Tx Frequency: 2462 MHz	Mode: 802.11 n-HT20	MCS0

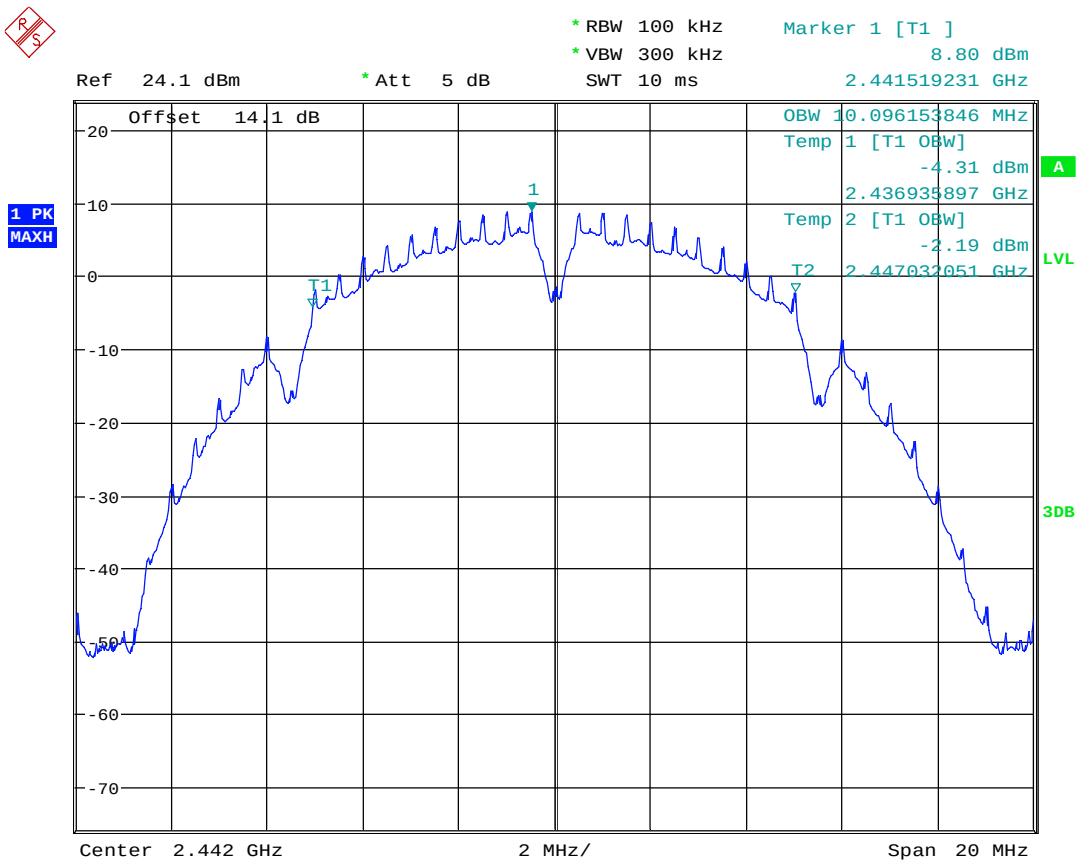


99% Occupied Bandwidth

Plot # 13		
Tx Frequency: 2412 MHz	Mode: 802.11 b	Data rate: 1 Mb/s

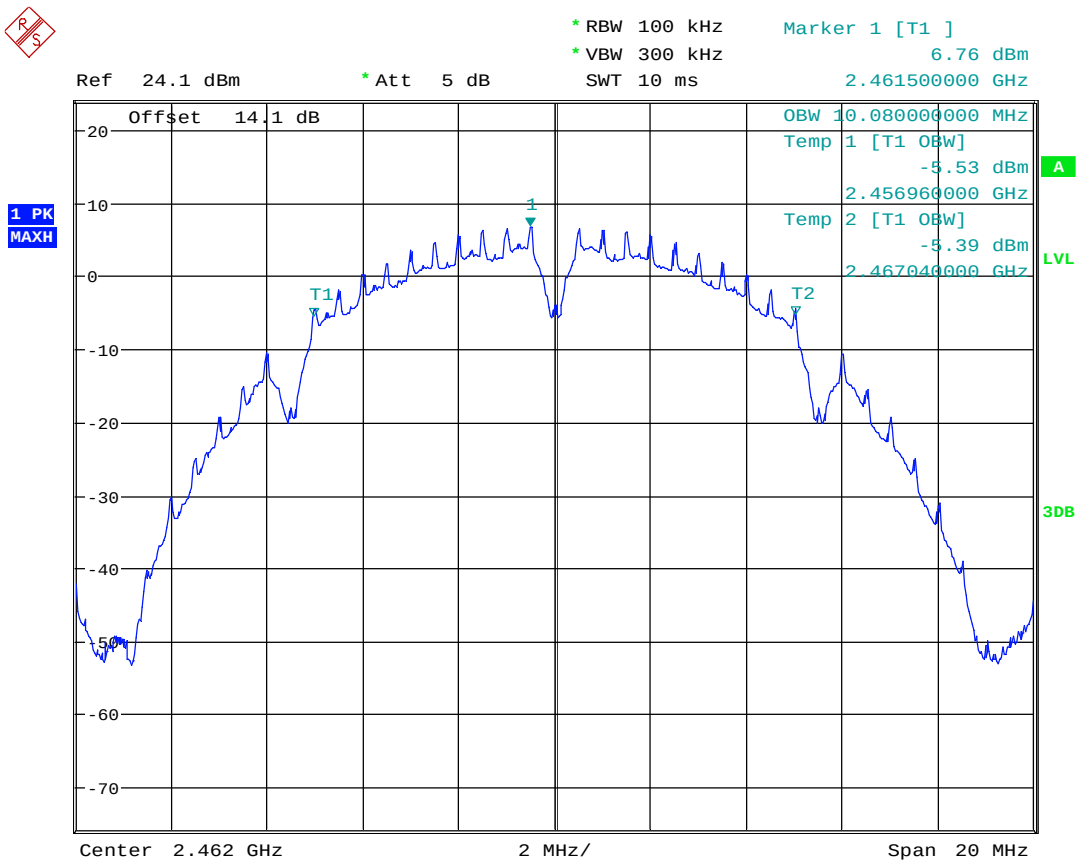


Plot # 14		
Tx Frequency: 2442 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**



Plot # 15

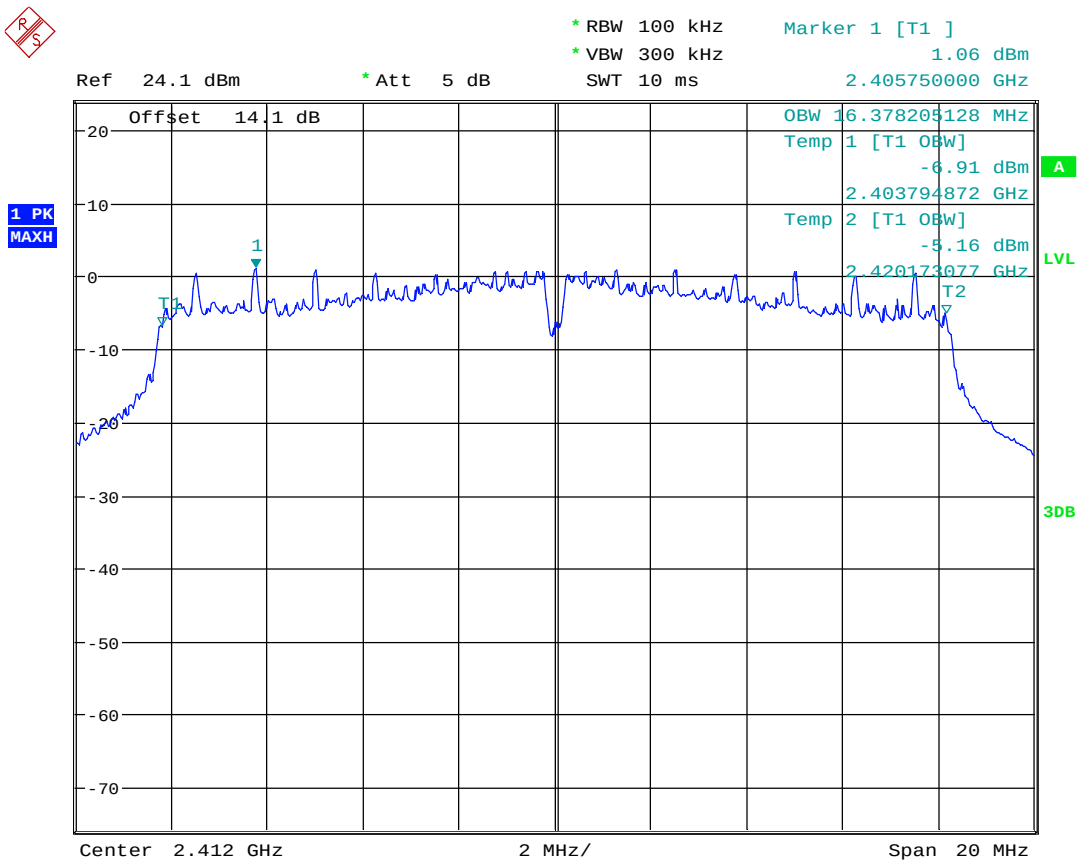
Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s



Date: 23.APR.2023 10:41:28

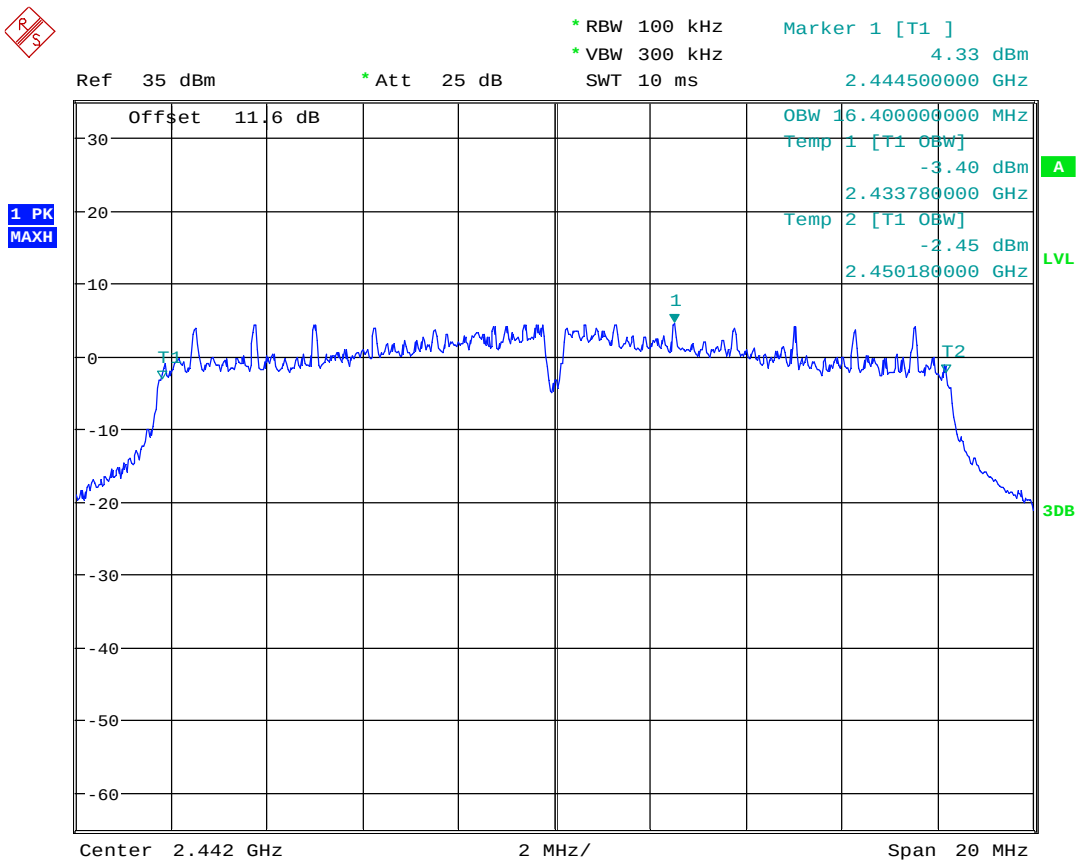
Plot # 16

Tx Frequency: 2412 MHz	Mode: 802.11 g	Data rate: 6 Mb/s



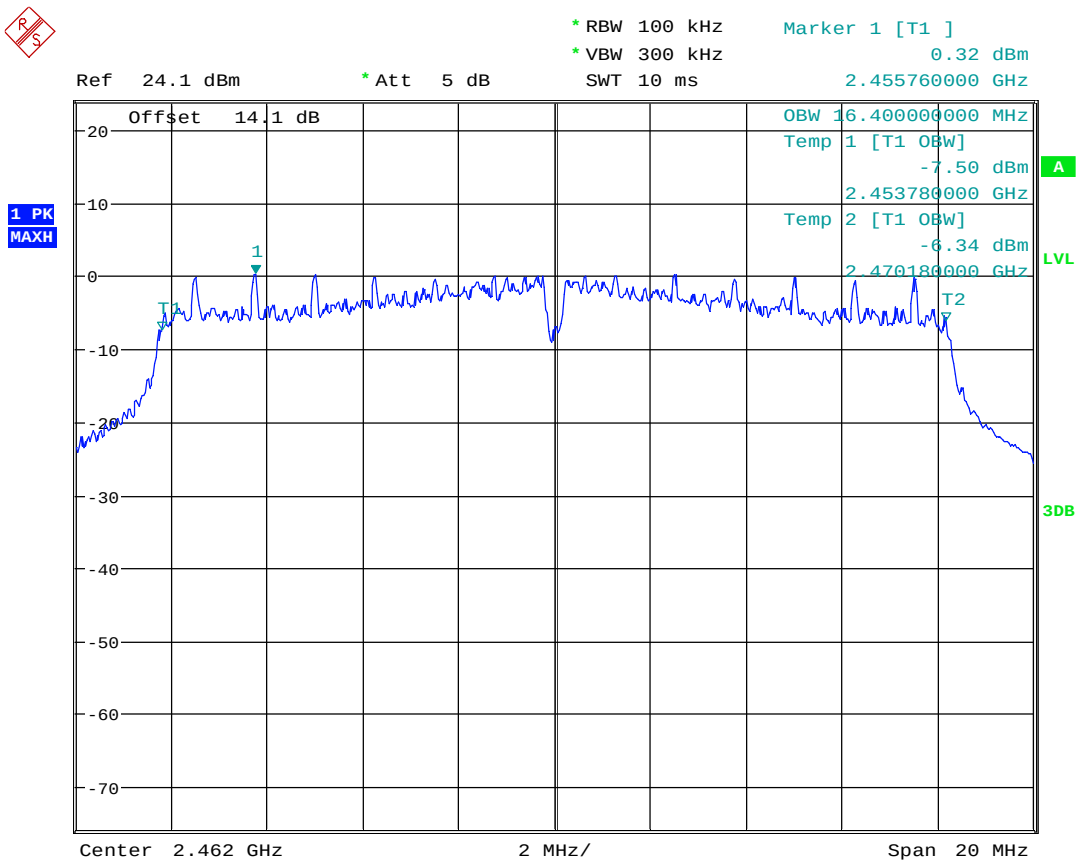
Plot # 17

Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s

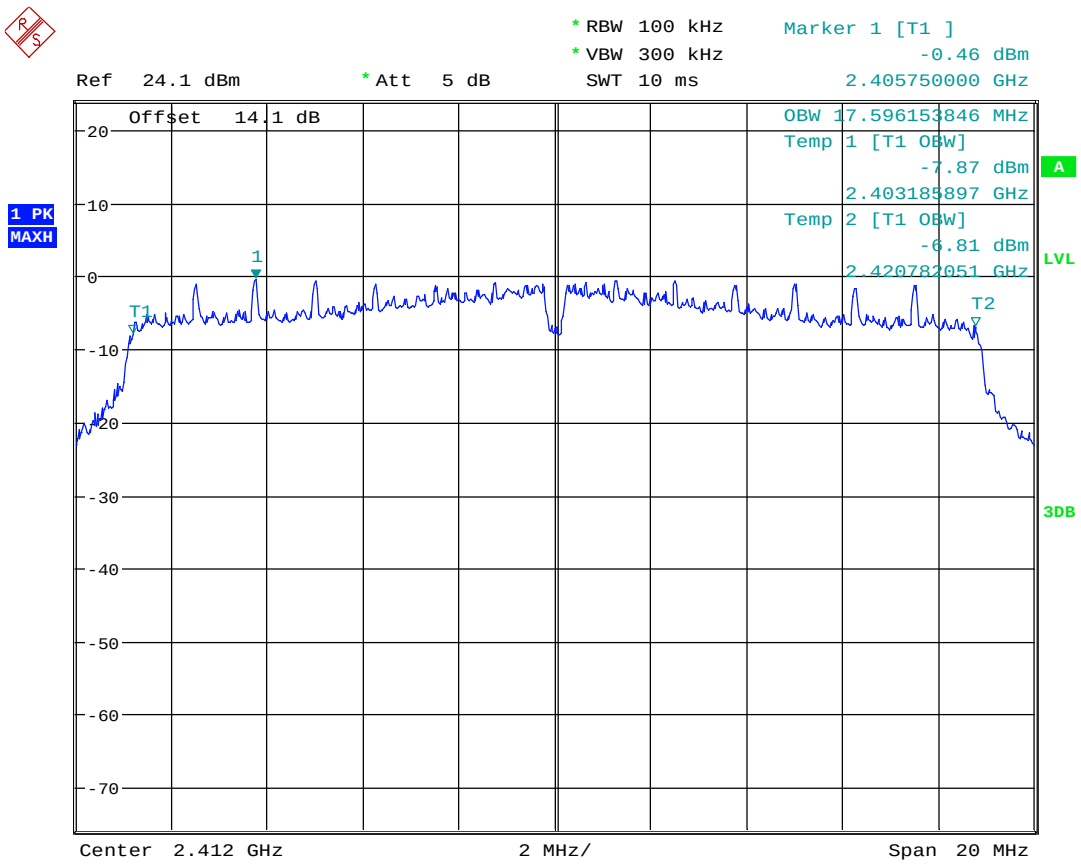


Plot # 18

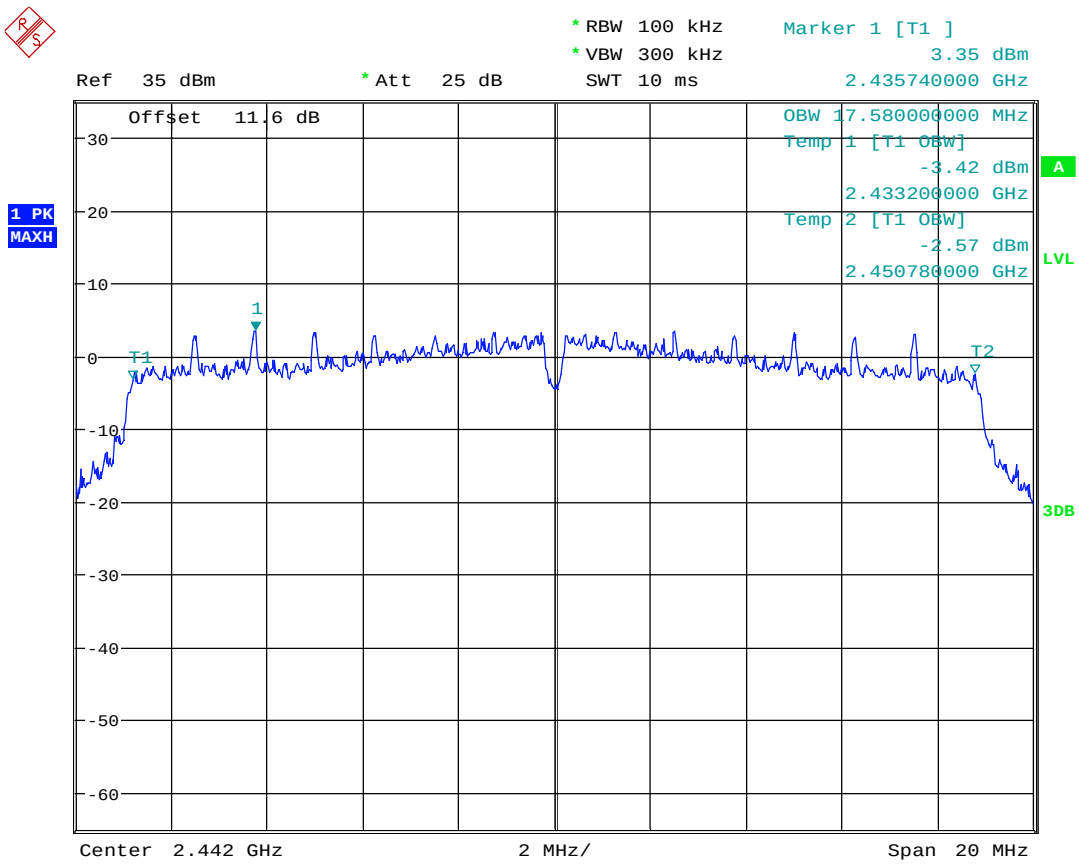
Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s



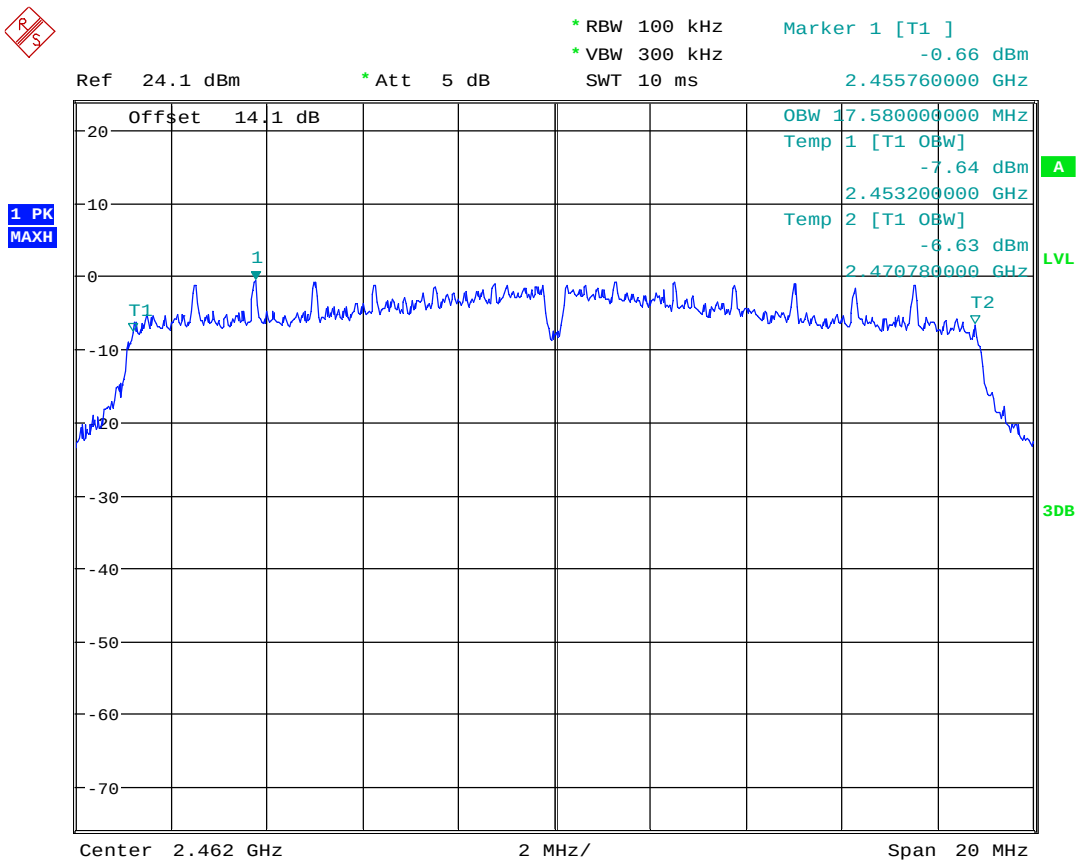
Plot # 19		
Tx Frequency: 2412 MHz	**Mode: 802.11 n-HT20**	**MCS0**



Plot # 20		
Tx Frequency: 2442 MHz	**Mode: 802.11 n-HT20**	**MCS0**



Plot # 21		
Tx Frequency: 2462 MHz	**Mode: 802.11 n-HT20**	**MCS0**



8.3 Maximum peak conducted output power

8.3.1 Measurement according to ANSI C63.10 clause 11.9.1.2 Integrated band power method

Spectrum Analyzer settings:

- RBW = 1 MHz.
- VBW ≥ [3 x RBW].
- Span ≥ [1.5 x DTS bandwidth].
- Detector = Peak.
- Sweep time = auto couple.
- Trace = Max hold.
- Allow trace to fully stabilize.
- Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges

8.3.2 Limits:

Maximum Output Power:

- FCC §15.247 (b)(1): 1 W (30 dBm)

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	12V DC	Ant 0: 1.7 dBi Ant 1: 0.8 dBi

8.3.4 Measurement result:

TX chain 0

Plot #	Mode	Data rate	Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Result
22	802.11 b	1 Mb/s	2412	17.59	30	Pass
23			2442	19.79	30	Pass
24			2462	17.74	30	Pass
25	802.11 g	6 Mb/s	2412	21.2	30	Pass
26			2442	24.76	30	Pass
27			2462	20.41	30	Pass
28	802.11 n-HT20	MCS0	2412	20.01	30	Pass
29			2442	24.24	30	Pass
30			2462	19.69	30	Pass

TX chain 1

Plot #	Mode	Data rate	Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Result
31	802.11 b	1 Mb/s	2412	18.18	30	Pass
32			2442	20.40	30	Pass
33			2462	18.36	30	Pass
34	802.11 g	6 Mb/s	2412	21.64	30	Pass
35			2442	24.93	30	Pass
36			2462	20.89	30	Pass
37	802.11 n-HT20	MCS0	2412	20.45	30	Pass
38			2442	24.33	30	Pass
39			2462	20.00	30	Pass

TX chain 0 & 1

According KDB 662911 D01 Multiple Transmitter output v02r01

- E) 1) In-Band Power Measurements: The measure-and-sum technique shall be used for measuring in-band transmit power of a device. Total power is the sum of the conducted power level measured at the various output ports.

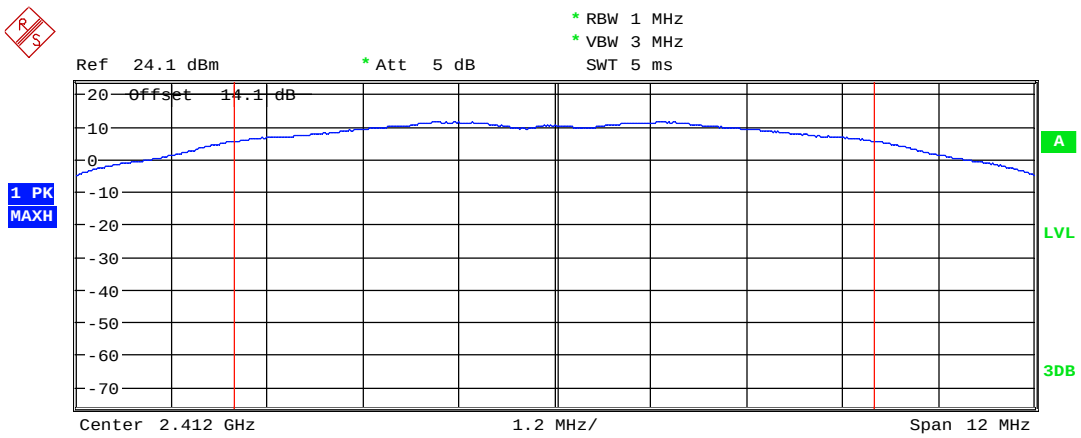
Mode	Data rate	Frequency (MHz)	Conducted output power (dBm)		Total power*1 (dBm)	Limit (dBm)	Result
			Chain 0	Chain 1			
802.11 n-HT20	MCS0	2412	20.01	20.45	23.25	30	Pass
		2442	24.24	24.33	27.30	30	Pass
		2462	19.69	20.00	22.86	30	Pass

*1: Total power = $10*\mathrm{Log}_{10}(10^{p\ chain0(dBm)/10}+10^{p\ chain1(dBm)/10})$

8.3.5 Measurement Plots:

TX chain 0

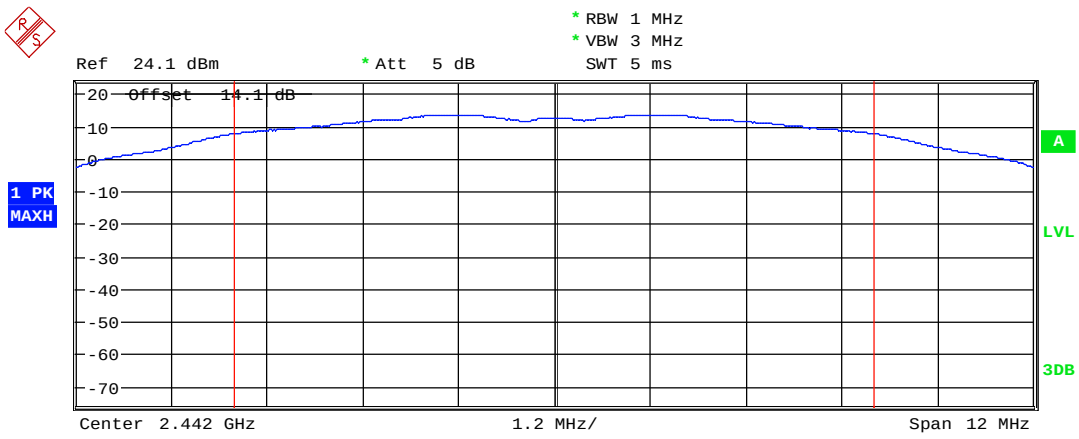
Plot # 22			
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**	**TX chain: 0**



Date: 23.APR.2023 11:50:14

Plot # 23

Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 0



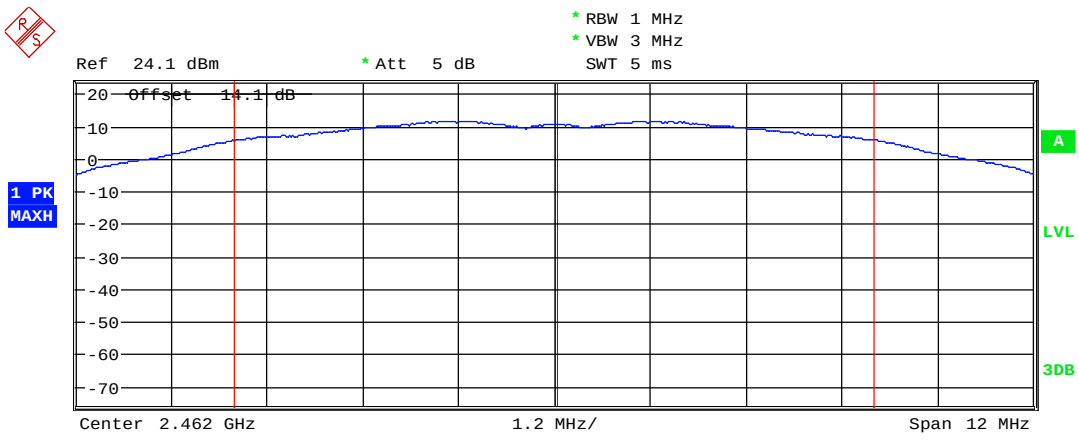
Tx Channel

Bandwidth	8 MHz	Power	19.79 dBm

Date: 23.APR.2023 11:53:09

Plot # 24

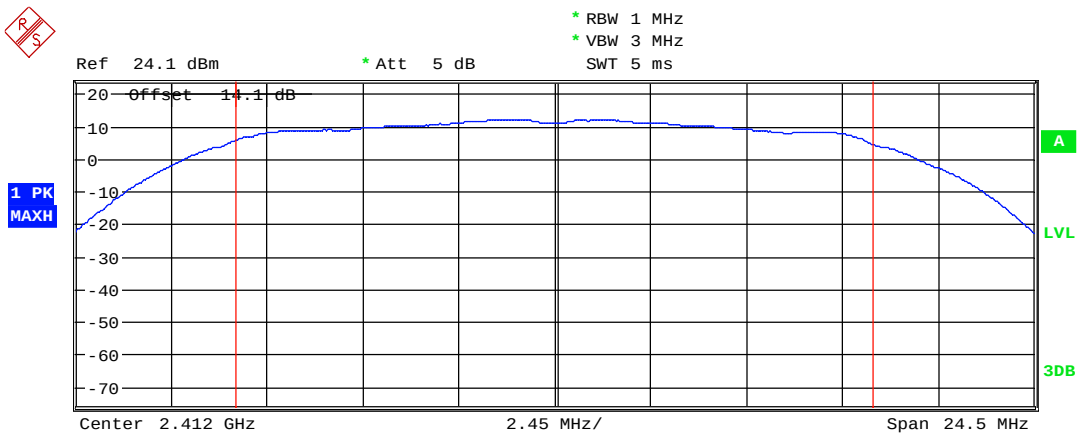
Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 0



Date: 23.APR.2023 11:55:16

Plot # 25

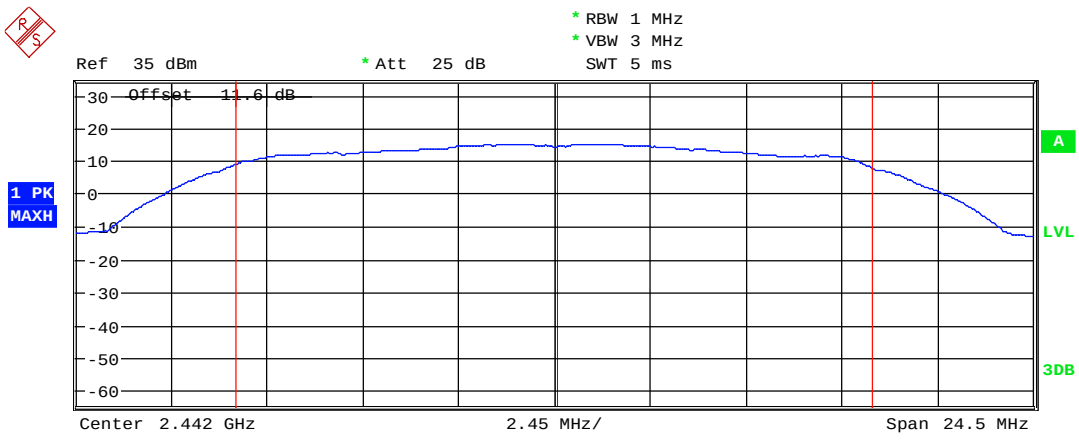
Tx Frequency: 2412 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



Date: 23.APR.2023 12:01:43

Plot # 26

Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



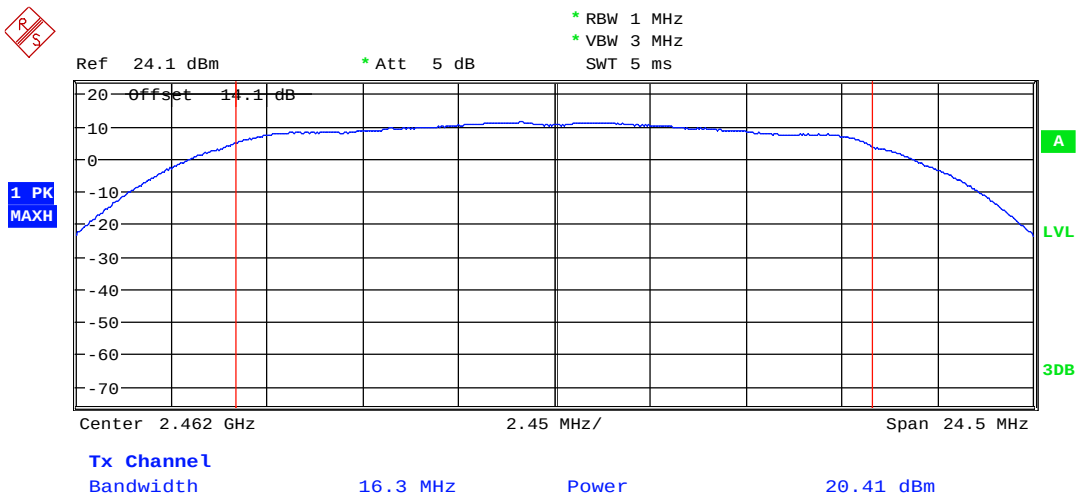
Tx Channel

Bandwidth 16.3 MHz Power 24.76 dBm

Date: 25.JAN.2023 10:24:09

Plot # 27

Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



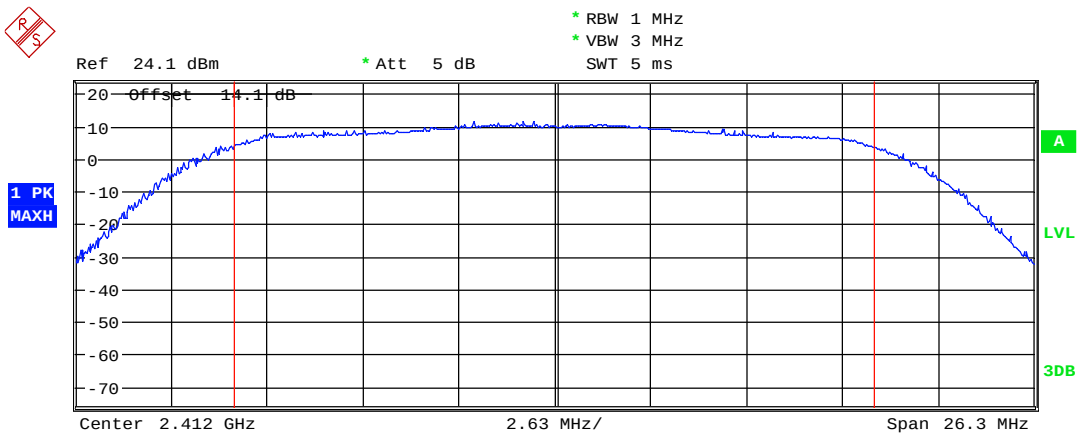
Tx Channel

Bandwidth 16.3 MHz Power 20.41 dBm

Date: 23.APR.2023 11:58:47

Plot # 28

Tx Frequency: 2412 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 0

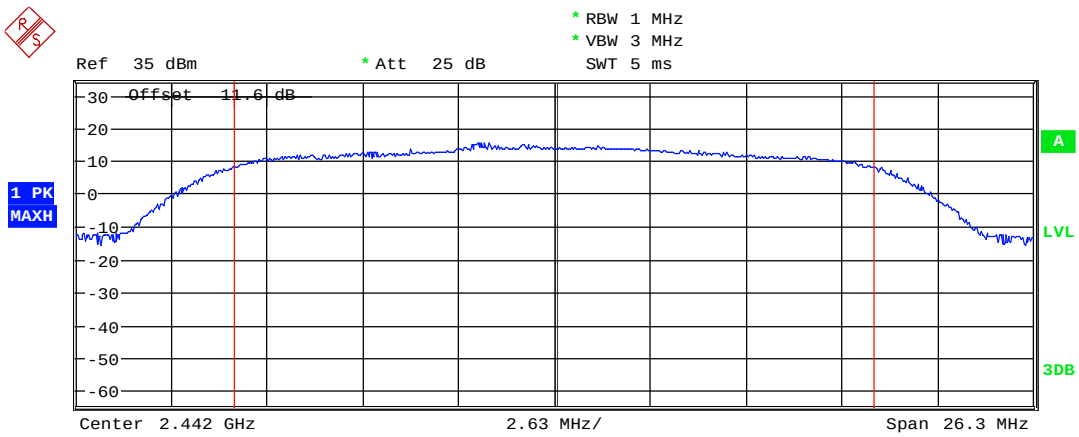


Tx Channel
Bandwidth 17.55 MHz Power 20.01 dBm

Date: 23.APR.2023 12:06:31

Plot # 29

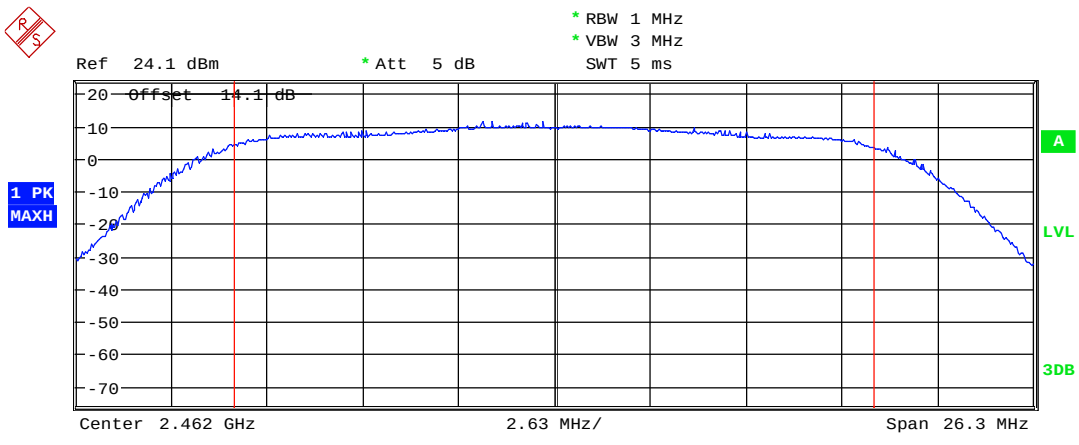
Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 0



Date: 25.JAN.2023 11:18:22

Plot # 30

Tx Frequency: 2462 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 0



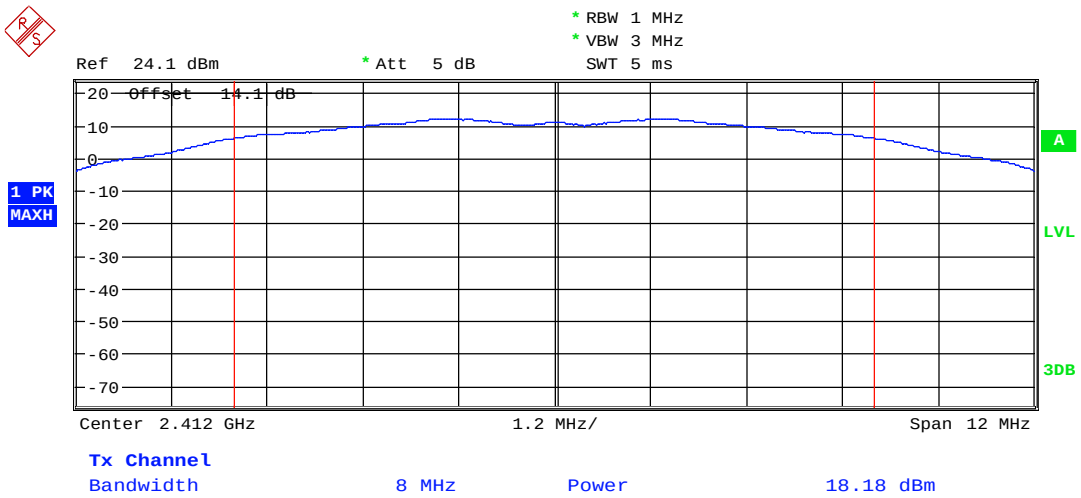
Tx Channel

Bandwidth	17.55 MHz	Power	19.69 dBm

Date: 23.APR.2023 12:09:38

TX chain 1

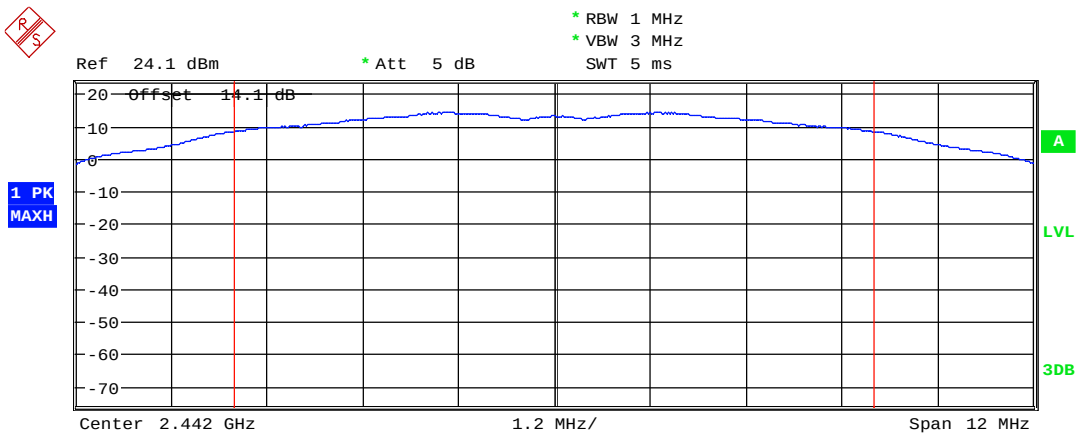
Plot # 31			
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**	**TX chain: 1**



Date: 23.APR.2023 12:33:39

Plot # 32

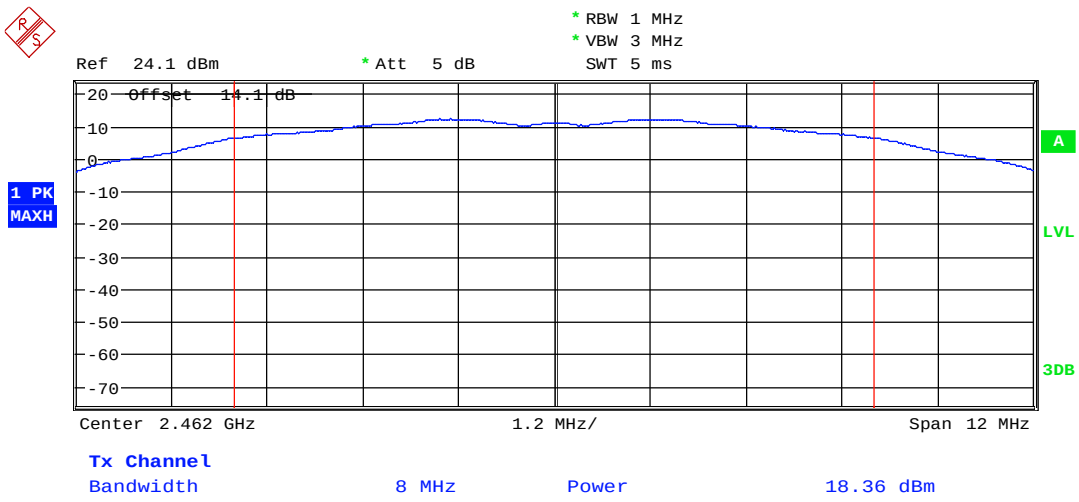
Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 1



Date: 23.APR.2023 12:30:14

Plot # 33

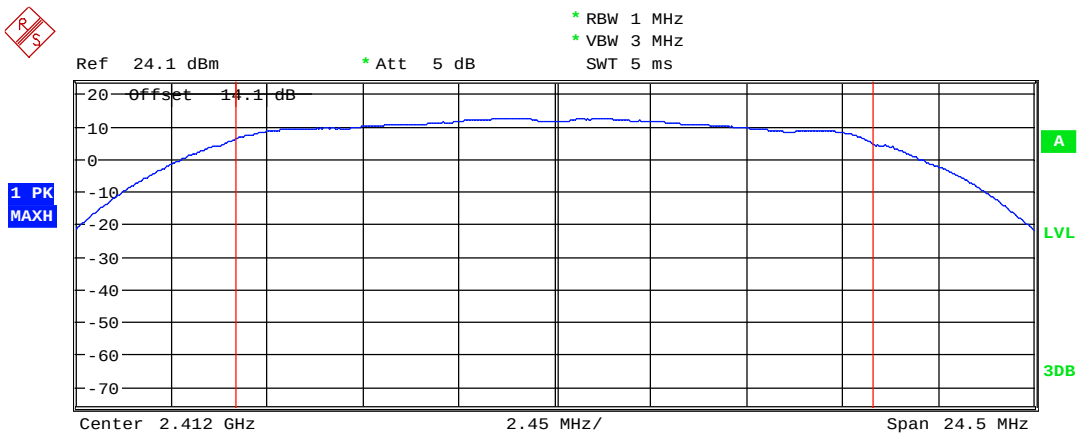
Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 1



Date: 23.APR.2023 12:27:58

Plot # 34

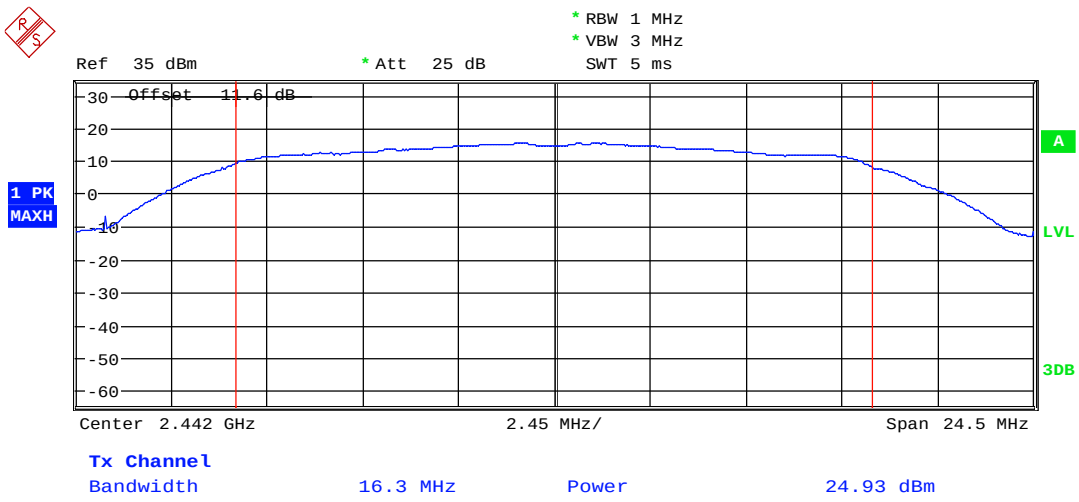
Tx Frequency: 2412 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1



Date: 23.APR.2023 12:21:31

Plot # 35

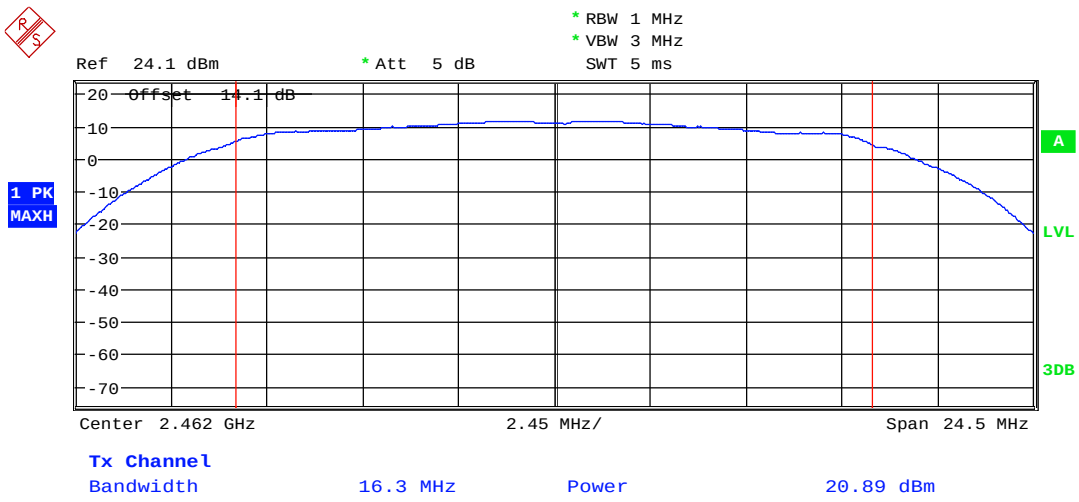
Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1



Date: 25.JAN.2023 10:37:51

Plot # 36

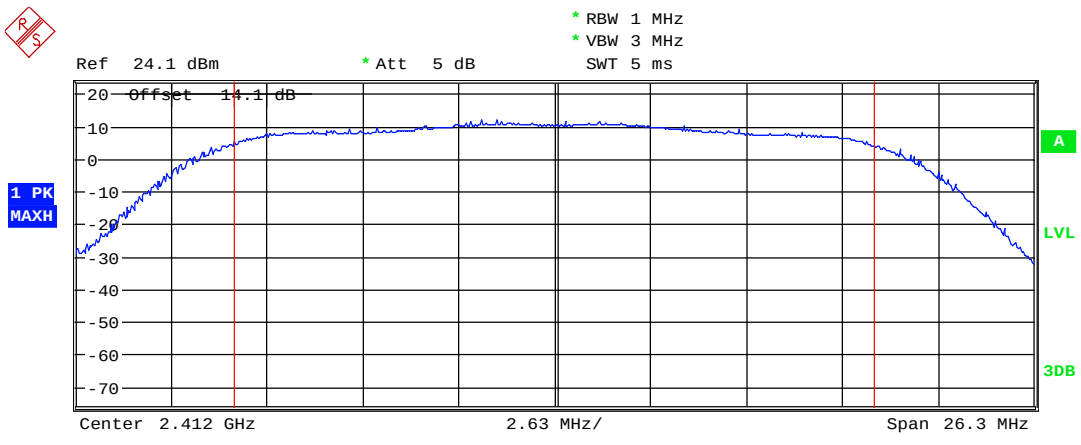
Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1



Date: 23.APR.2023 12:24:51

Plot # 37

Tx Frequency: 2412 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 1

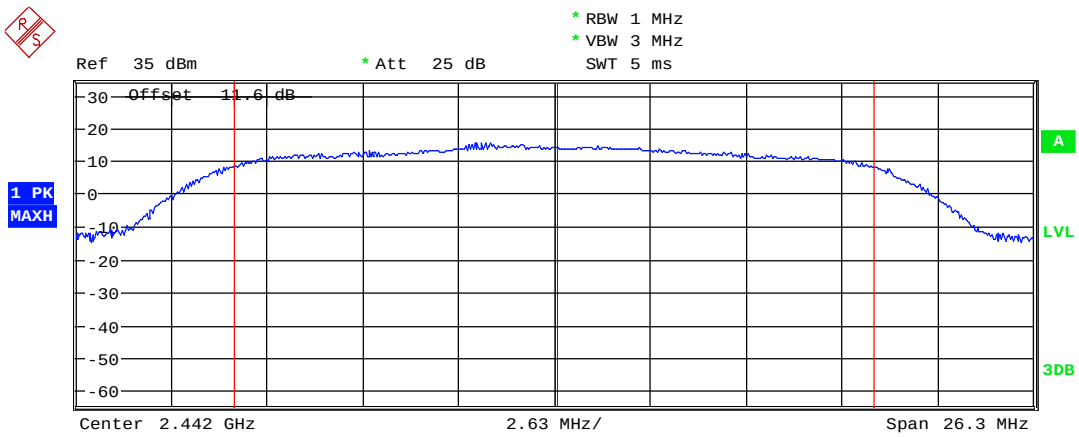


Tx Channel
Bandwidth 17.55 MHz Power 20.45 dBm

Date: 23.APR.2023 12:17:56

Plot # 38

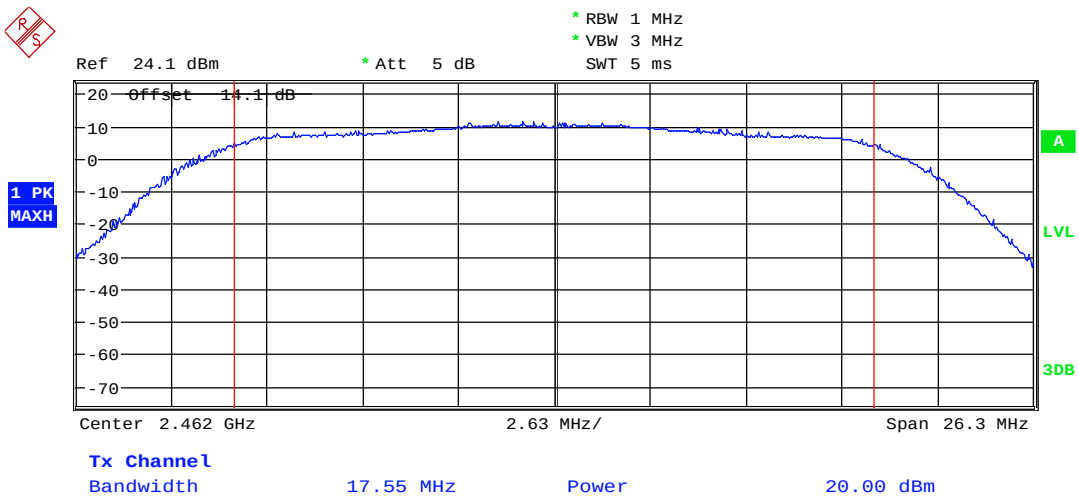
Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 1



Date: 25.JAN.2023 11:38:25

Plot # 39

Tx Frequency: 2462 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 1



8.4 Power Spectral Density

8.4.1 Measurement according to ANSI C63.10 clause 11.10.2

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 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, then reduce RBW (but no less than 3 kHz) and repeat.

8.4.2 Limits:

FCC§15.247(e)

- 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	12V DC	Ant 0: 1.7 dBi Ant 1: 0.8 dBi

8.4.4 Measurement result:

TX chain 0

Plot #	Mode	Data rate	Frequency (MHz)	Conducted output power (dBm)	Limit (dBm)	Result
40	802.11 b	1 Mb/s	2412	-5.34	8	Pass
41			2442	-3.97	8	Pass
42			2462	-6.20	8	Pass
43	802.11 g	6 Mb/s	2412	-10.00	8	Pass
44			2442	-6.45	8	Pass
45			2462	-10.86	8	Pass
46	802.11 n-HT20	MCS0	2412	-11.48	8	Pass
47			2442	-7.86	8	Pass
48			2462	-11.70	8	Pass

TX chain 1

Plot #	Mode	Data rate	Frequency (MHz)	Conducted output power	Limit	Result
				(dBm)	(dBm)	
49	802.11 b	1 Mb/s	2412	-4.58	8	Pass
50			2442	-3.83	8	Pass
51			2462	-4.46	8	Pass
52	802.11 g	6 Mb/s	2412	-9.74	8	Pass
53			2442	-6.49	8	Pass
54			2462	-10.49	8	Pass
55	802.11 n-HT20	MCS0	2412	-11.32	8	Pass
56			2442	-7.27	8	Pass
57			2462	-11.81	8	Pass

TX chain 0 & 1

According KDB 662911 D01 Multiple Transmitter output v02r01

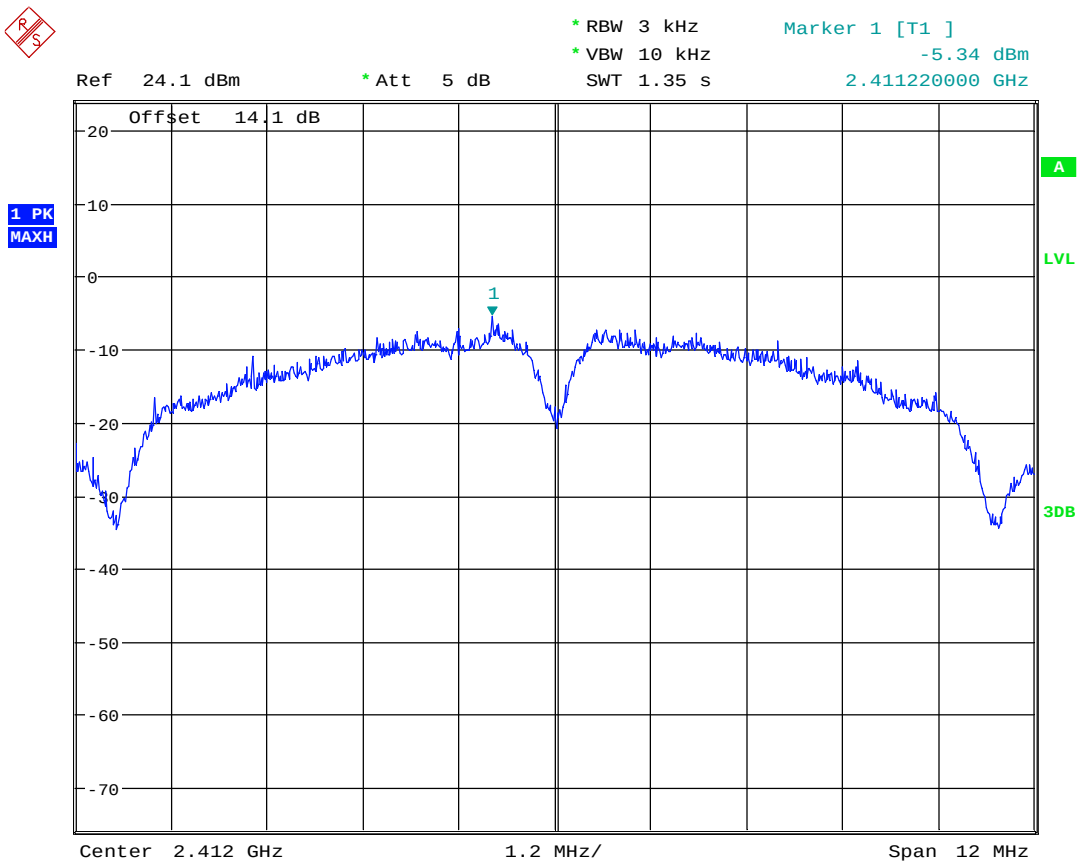
- E) 2) In-Band Power Spectral Density (PSD) Measurements: a) Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs [i.e., for a device with NANT transmitter outputs, if the spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value (in watts or milliwatts) in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NANTth output to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way).] This will likely require transferring the measured spectra to a computer, where the bin-by-bin summing can be performed.

Mode	Data rate	Frequency (MHz)	Power spectral density (dBm)		Sum across the outputs (dBm)	Limit (dBm)	Result
			Chain 0	Chain 1			
802.11 n-HT20	MCS0	2412	-11.48	-11.32	-8.39	8	Pass
		2442	-7.86	-7.27	-4.54	8	Pass
		2462	-11.70	-11.81	-8.74	8	Pass

8.4.5 Measurement Plots:

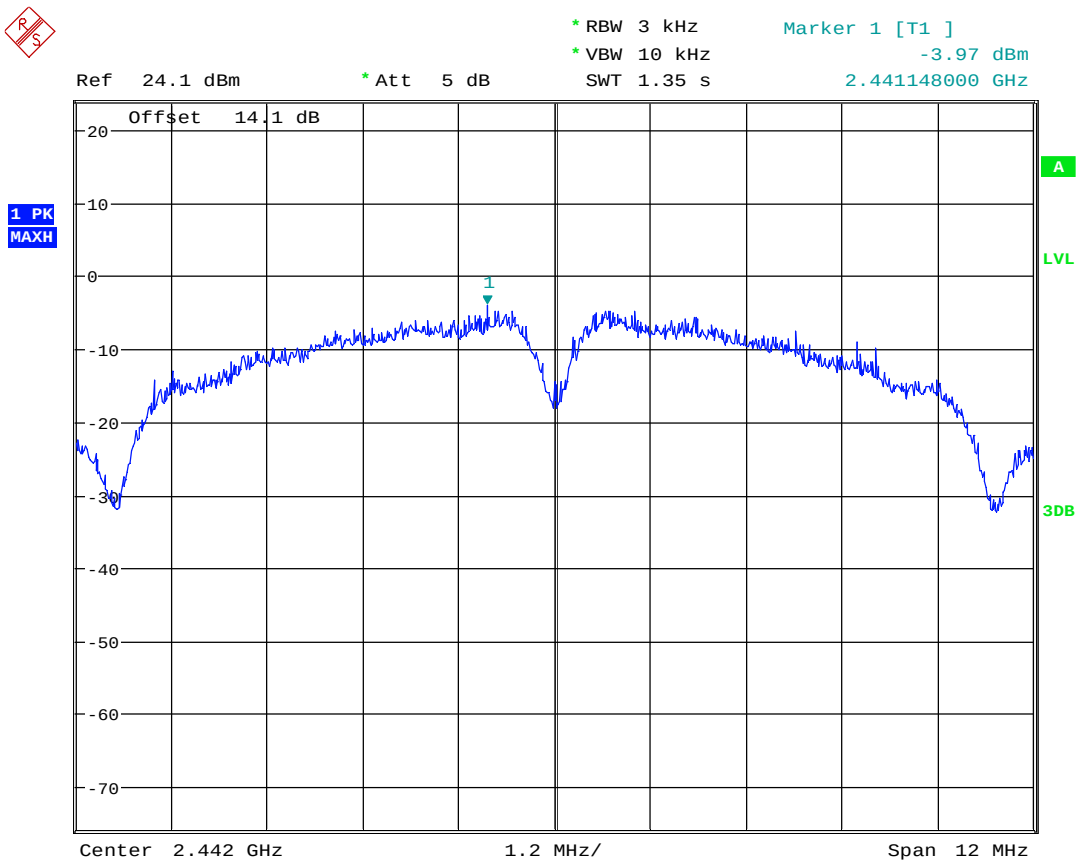
TX chain 0

Plot # 40			
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**	**TX chain: 0**



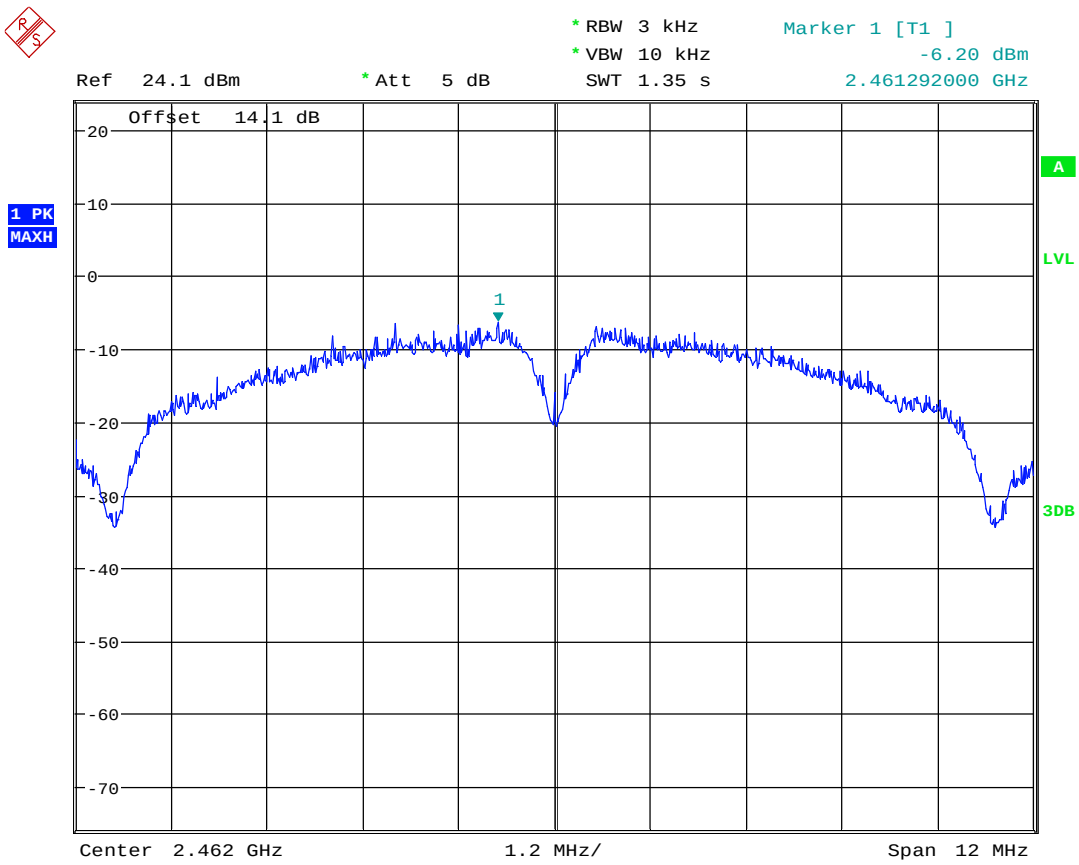
Plot # 41

Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 0



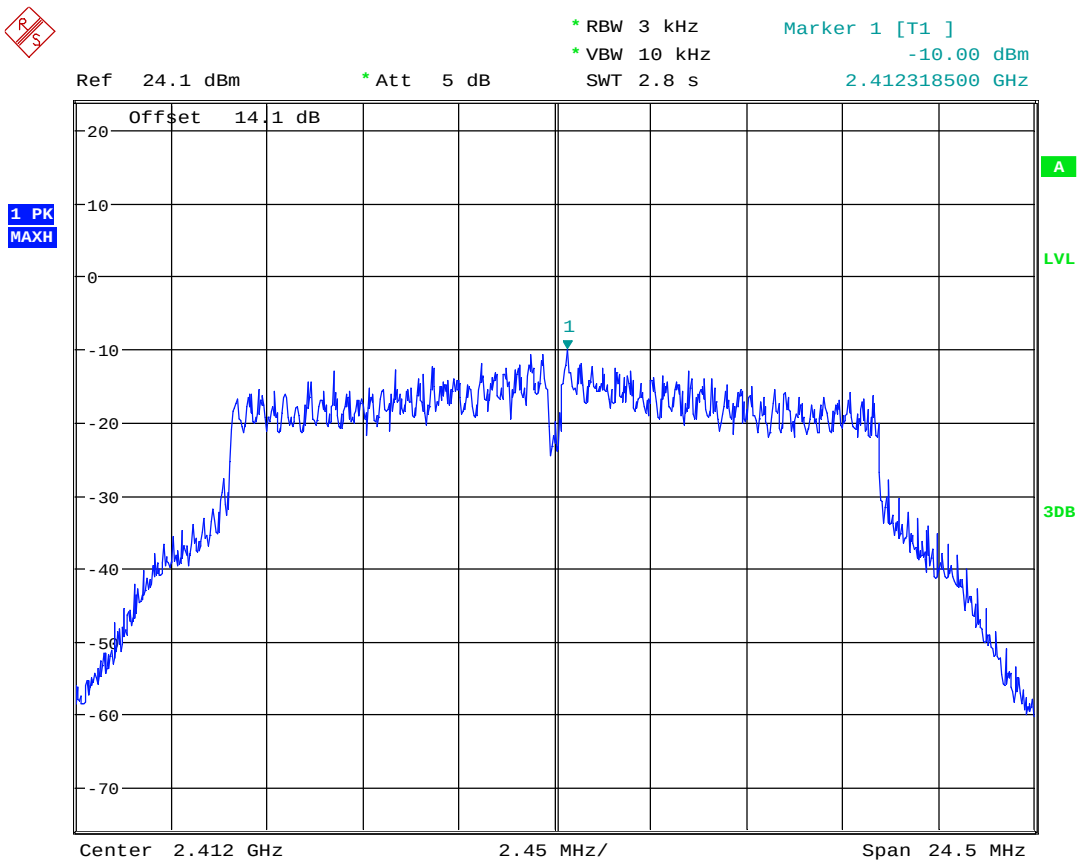
Plot # 42

Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 0



Plot # 43

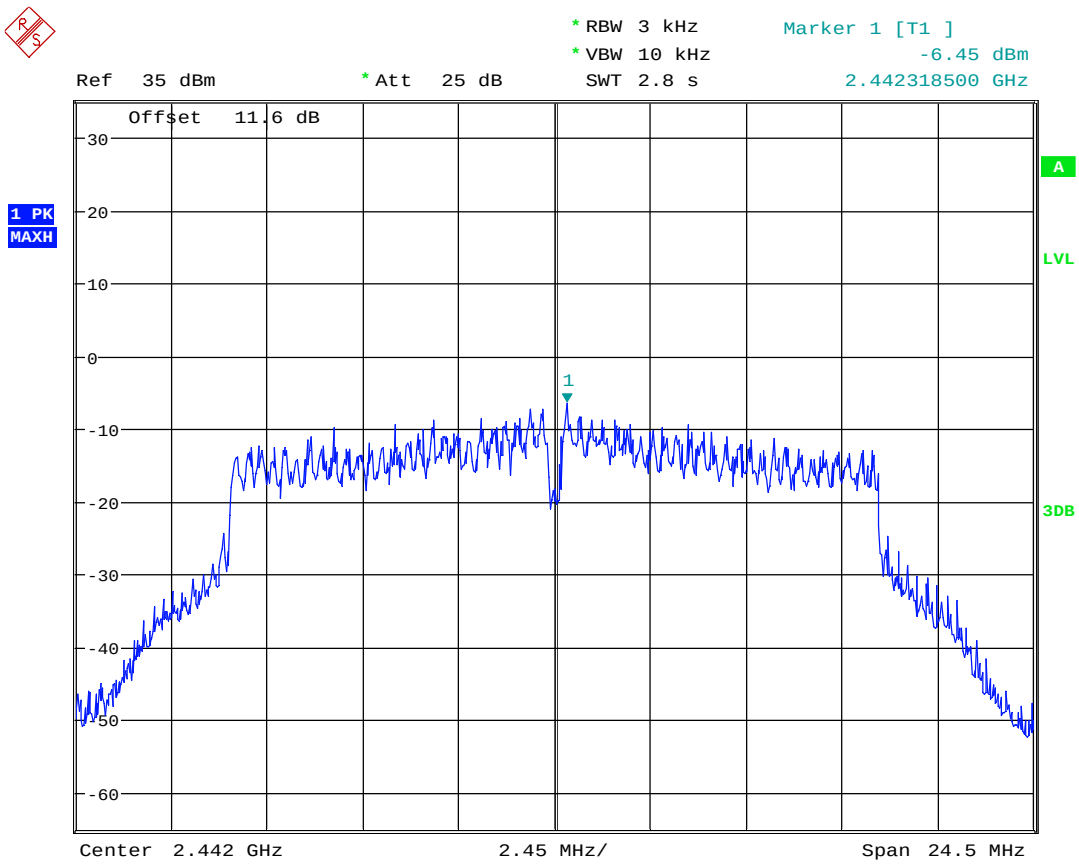
Tx Frequency: 2412 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



Date: 23.APR.2023 16:00:54

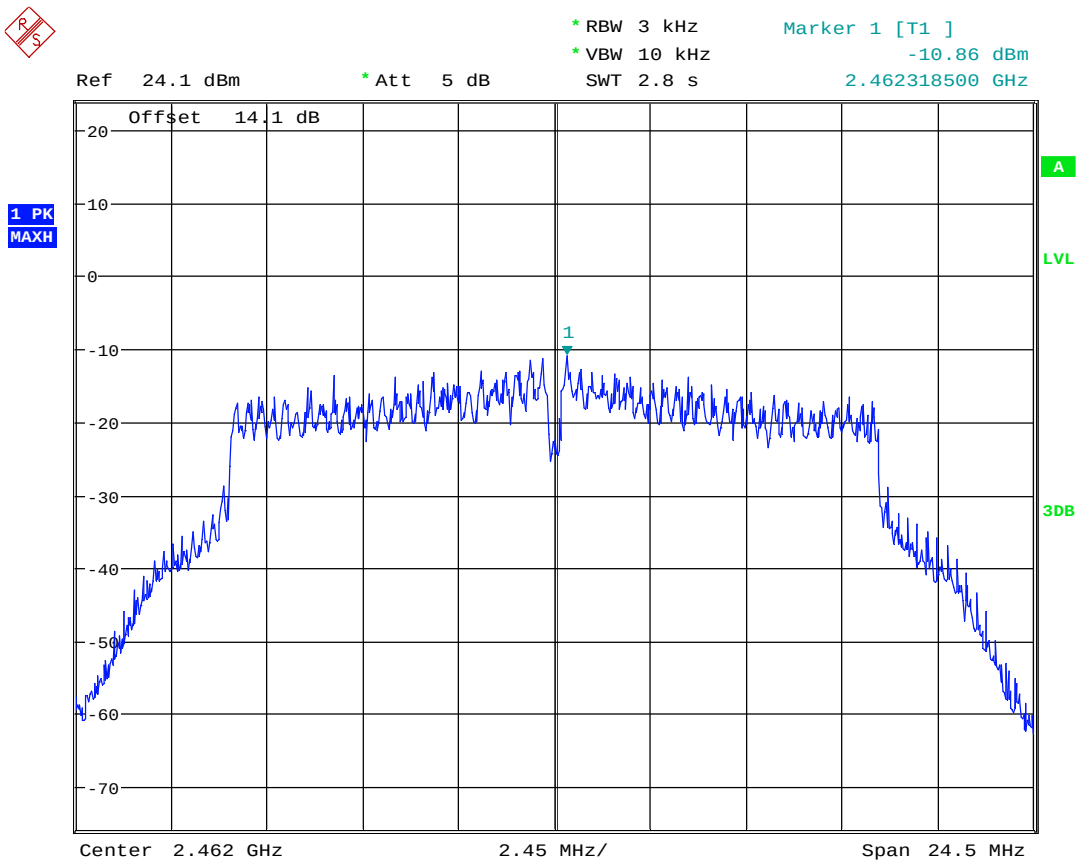
Plot # 44

Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



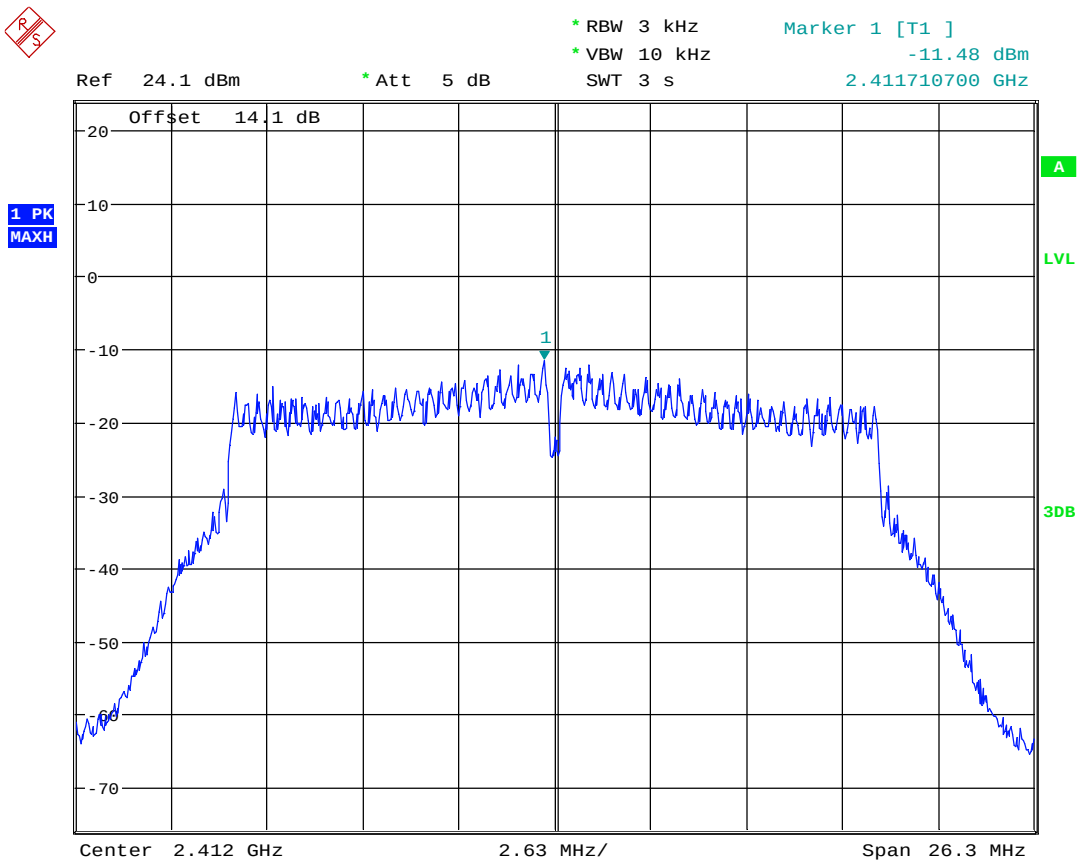
Plot # 45

Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 0



Plot # 46

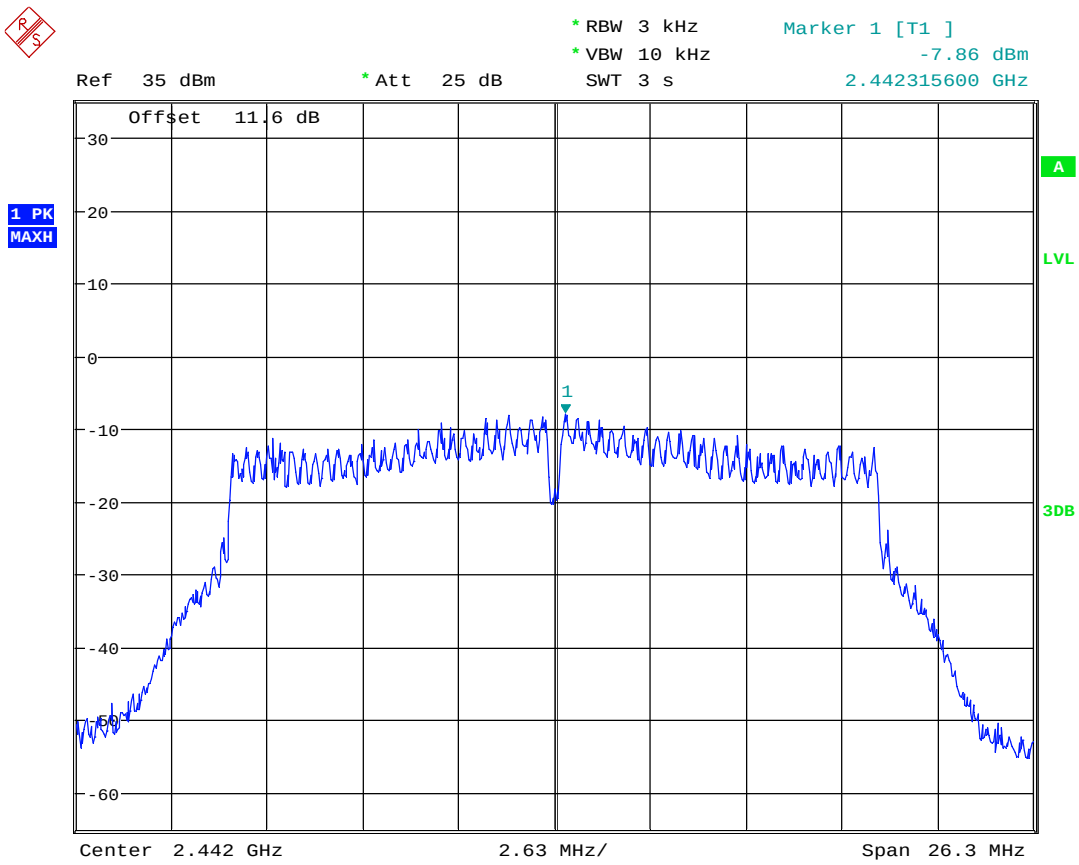
Tx Frequency: 2412 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 0



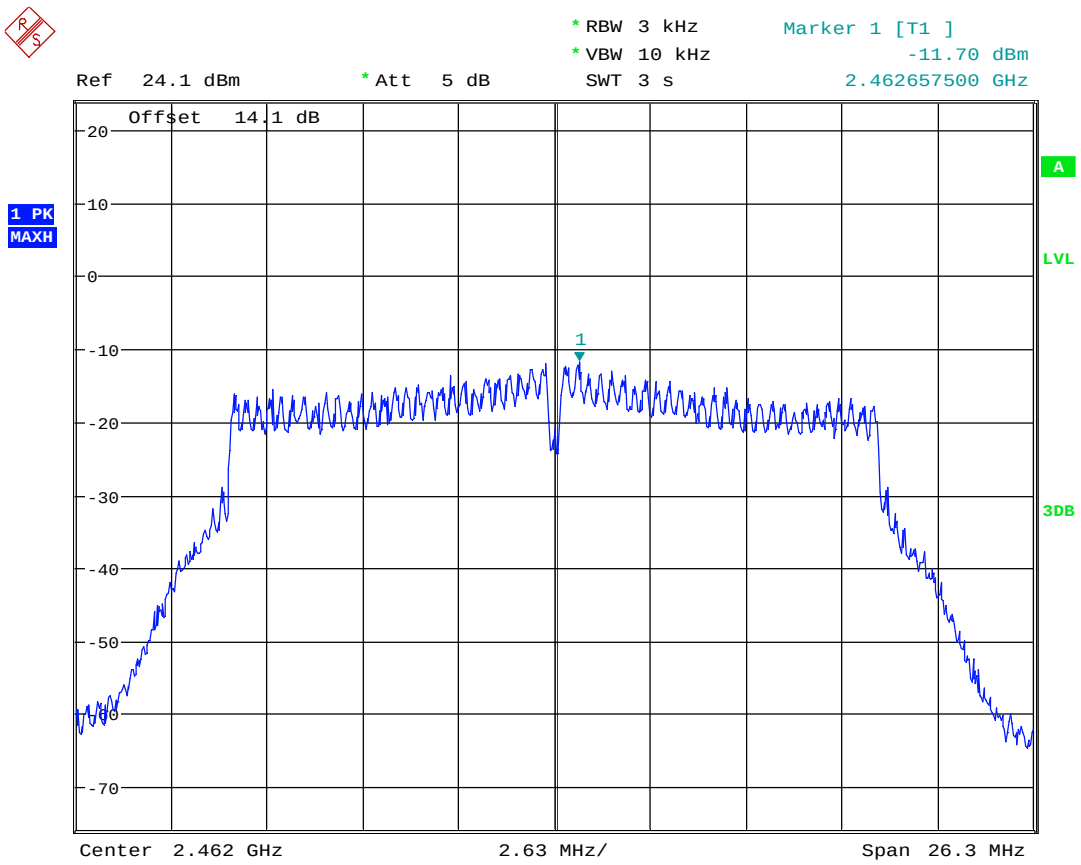
Date: 23.APR.2023 15:31:50

Plot # 47

Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 0

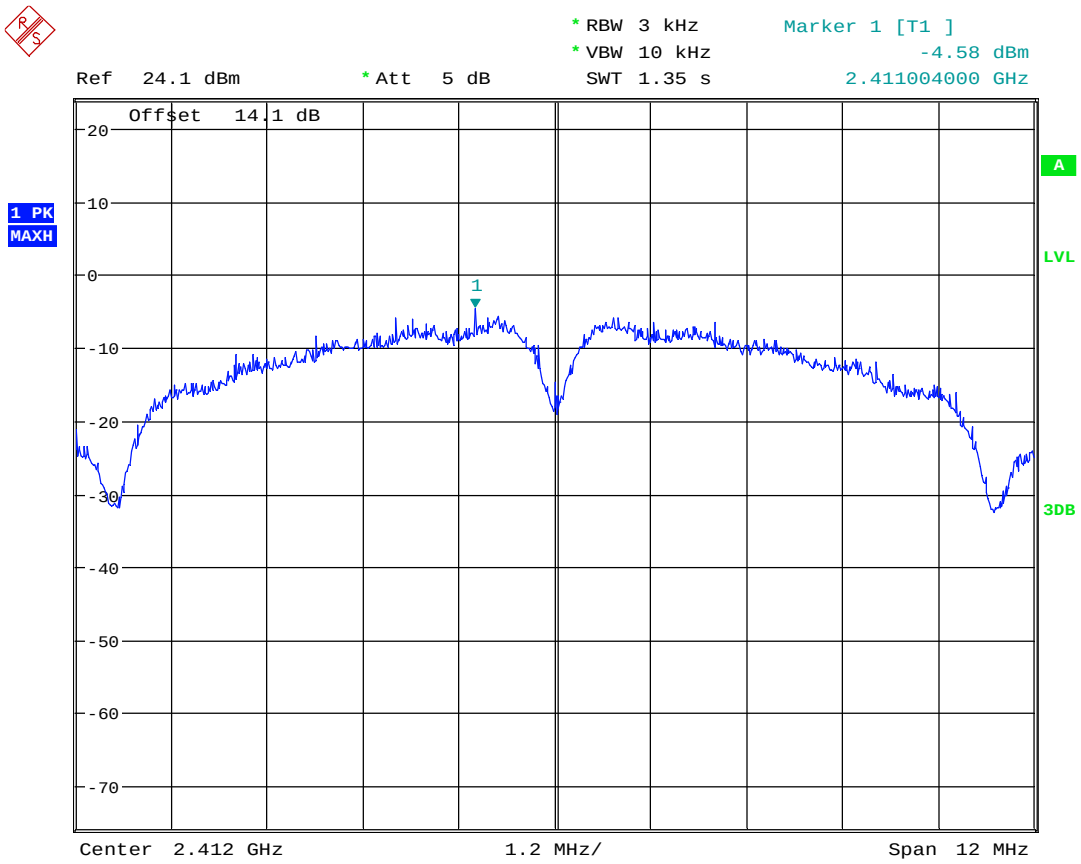


Plot # 48			
Tx Frequency: 2462 MHz	**Mode: 802.11 n-HT20**	**MCS0**	**TX chain: 0**



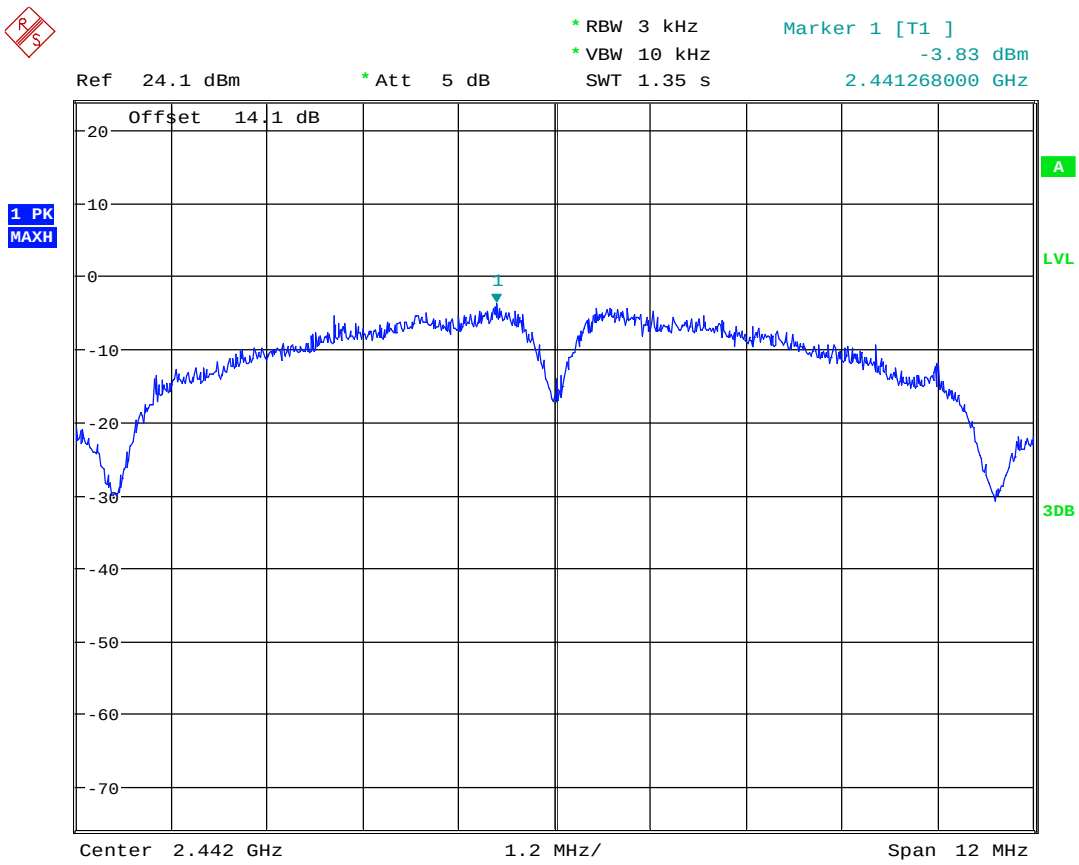
TX chain 1

Plot # 49			
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**	**TX chain: 1**



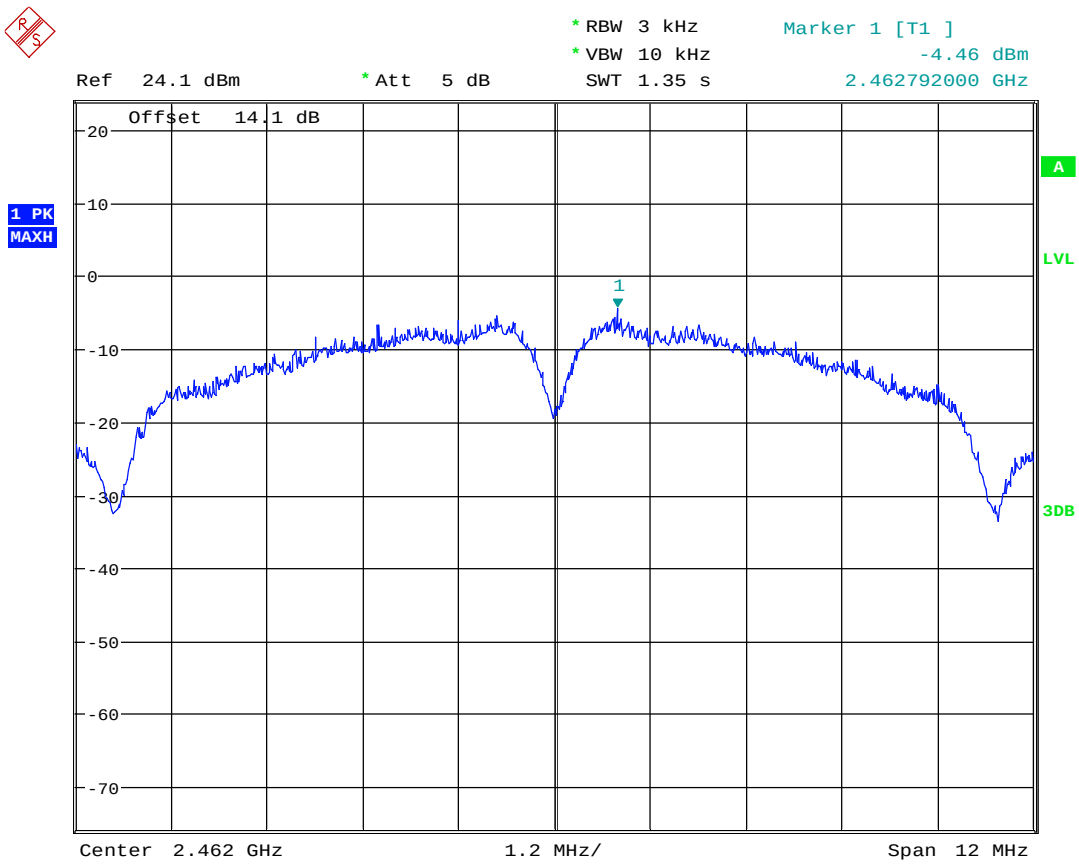
Plot # 50

Tx Frequency: 2442 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 1



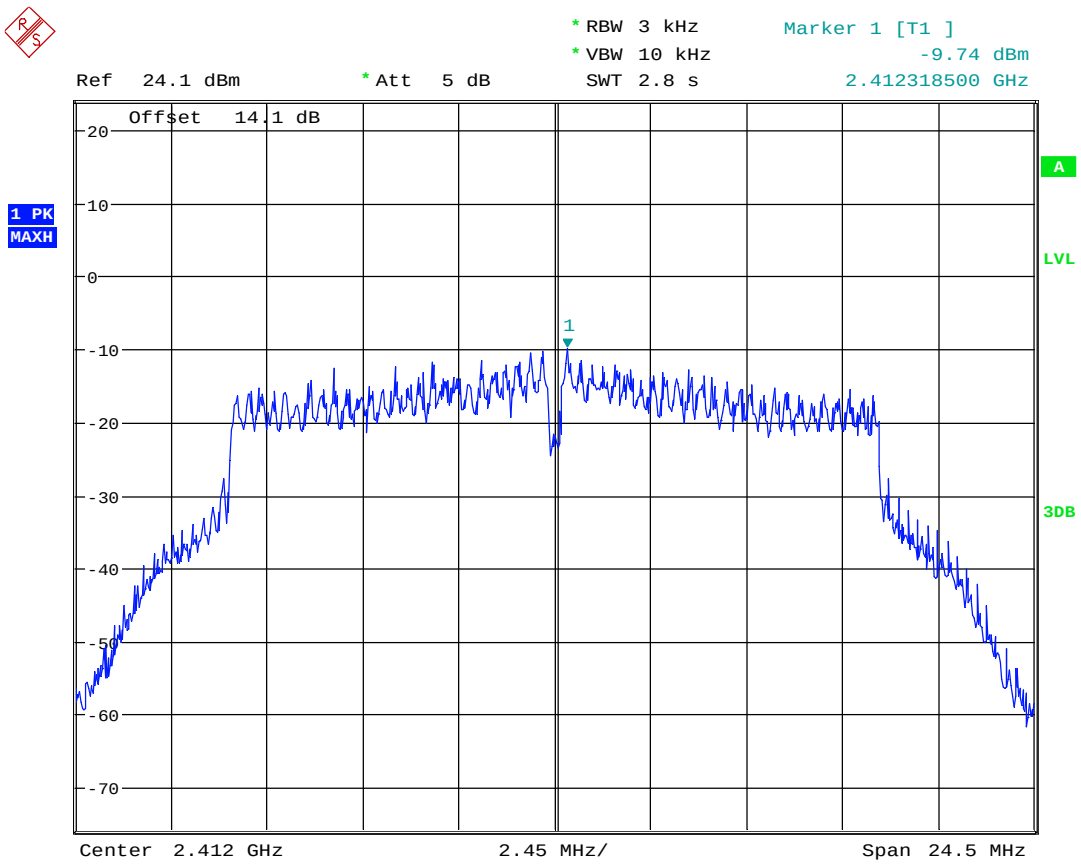
Plot # 51

Tx Frequency: 2462 MHz	Mode: 802.11 b	Data rate: 1 Mb/s	TX chain: 1



Plot # 52

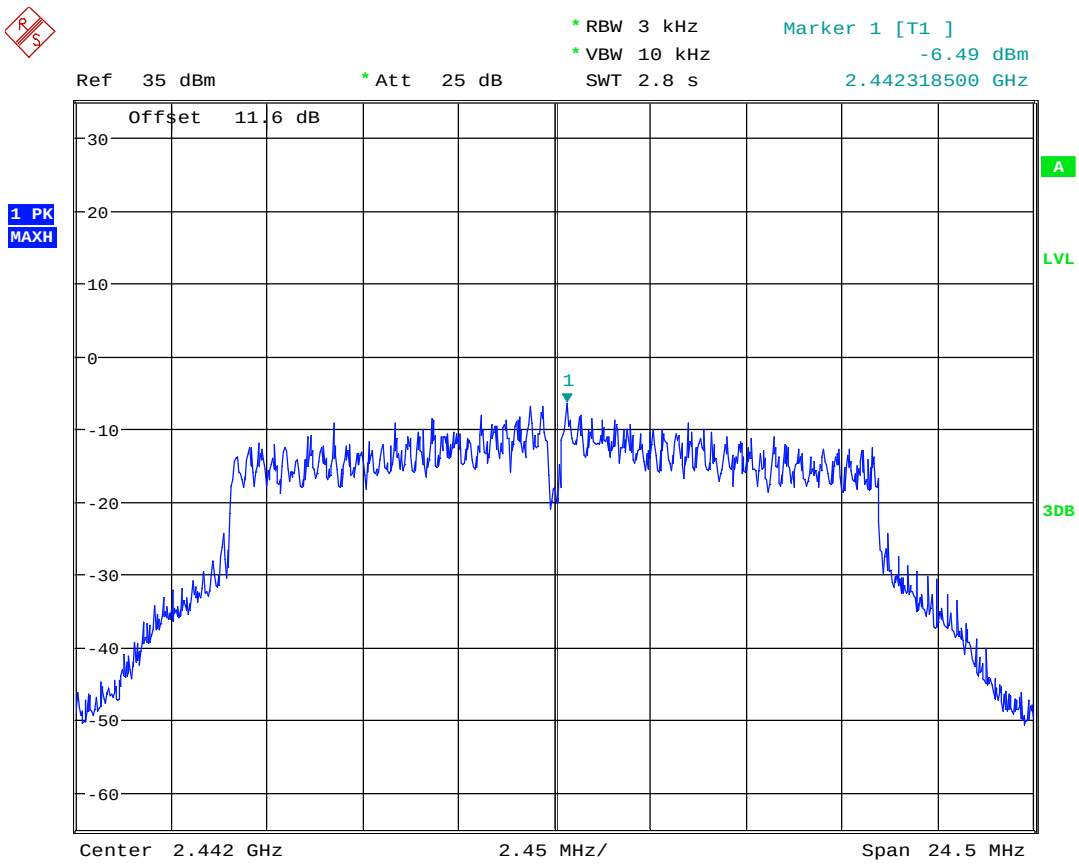
Tx Frequency: 2412 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1



Date: 23.APR.2023 15:00:08

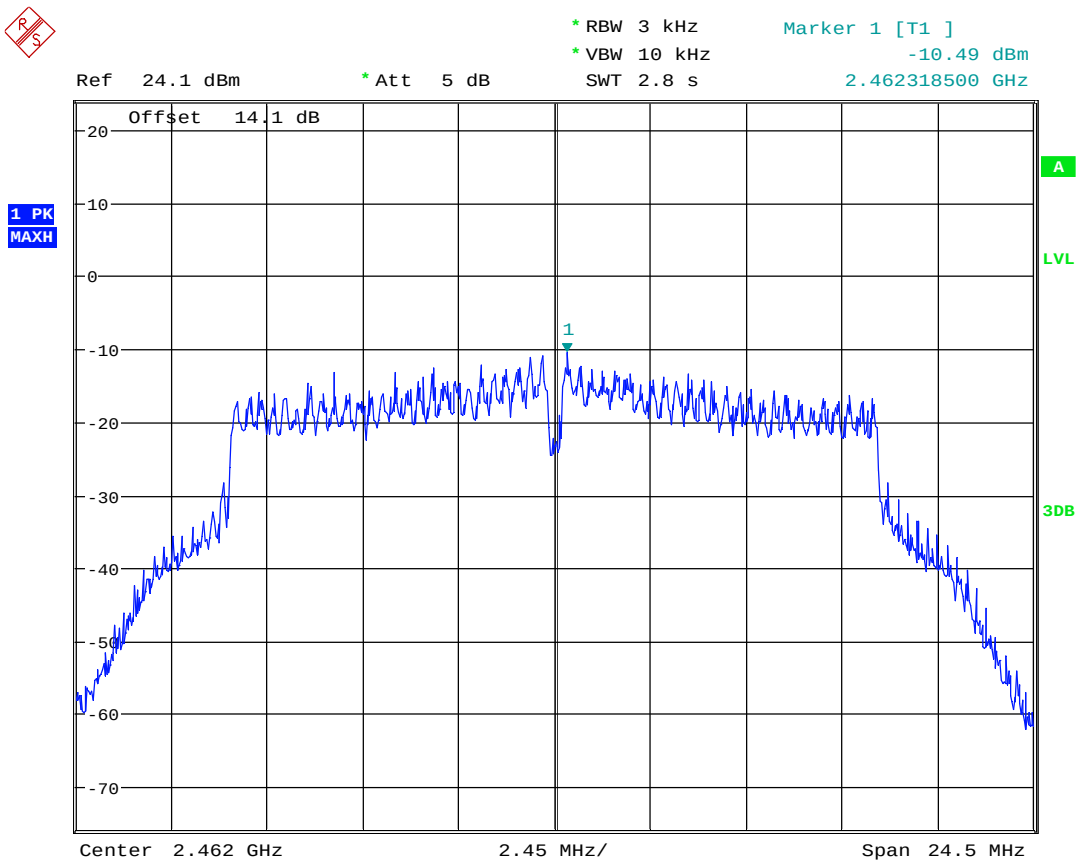
Plot # 53

Tx Frequency: 2442 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1

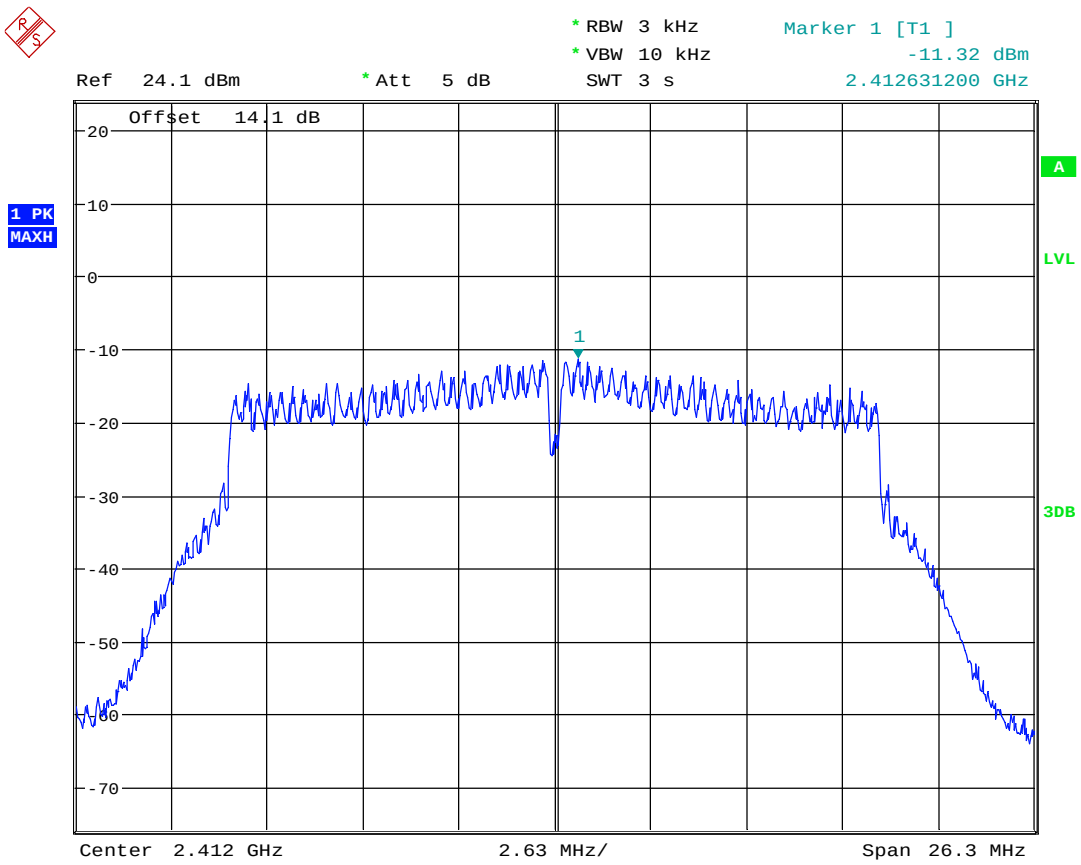


Plot # 54

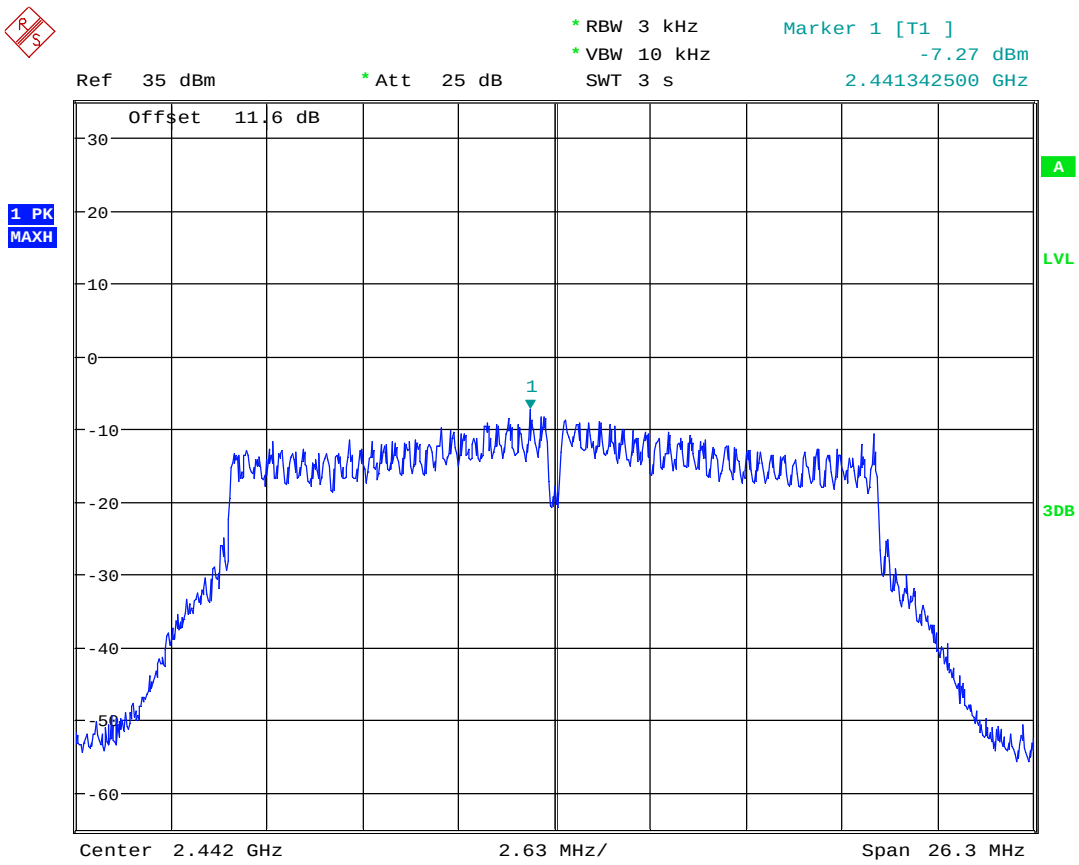
Tx Frequency: 2462 MHz	Mode: 802.11 g	Data rate: 6 Mb/s	TX chain: 1



Plot # 55			
Tx Frequency: 2412 MHz	**Mode: 802.11 n-HT20**	**MCS0**	**TX chain: 1**



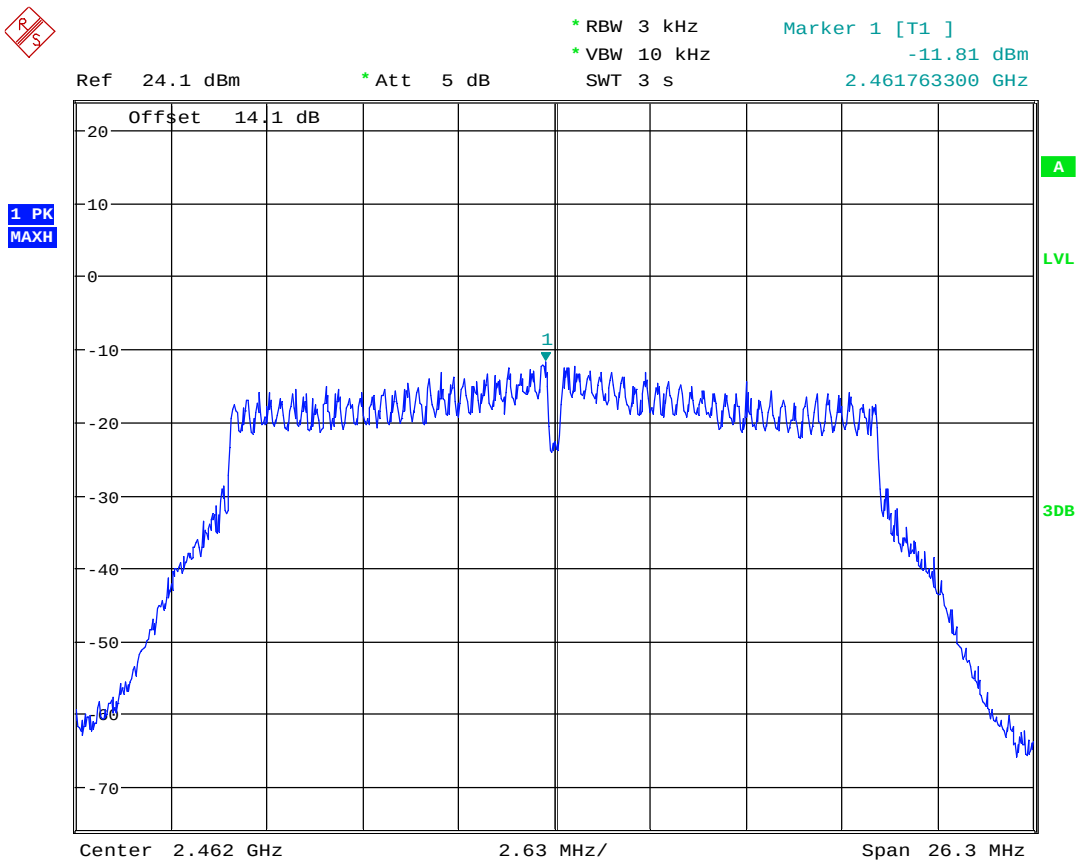
Plot # 56			
Tx Frequency: 2442 MHz	**Mode: 802.11 n-HT20**	**MCS0**	**TX chain: 1**



Date: 25.JAN.2023 11:30:01

Plot # 57

Tx Frequency: 2462 MHz	Mode: 802.11 n-HT20	MCS0	TX chain: 1



8.5 Band Edge Compliance

8.5.1 Emissions in non-restricted frequency bands

Measurement according to ANSI C63.10 clause 11.11 (Conducted)

- 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

8.5.2 Emissions in restricted frequency bands

Measurement according to ANSI C63.10 clause 11.12.1 (Radiated)

- RBW = 1 MHz
- Detector: Peak/RMS

8.5.3 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)).

8.5.4 Limits restricted band §15.247/15.209/15.205

- *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
- 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			

8.5.5 Test conditions and setup:

Restricted and Non-Restricted Band

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23.8°C	1 (Lower, Non-restricted)	Op.1	12V DC	Ant 0: 1.7 dBi Ant 1: 0.8 dBi
	2 (Upper, Restricted)	Op. 2		

8.5.6 Measurement result:

2390 – 2400 MHz

Plot #	Mode	Data rate	Frequency (MHz)	Band Edge	Band Edge Delta (dBc)	Limit (dBc)	Result
58	802.11 b	1 Mb/s	2412	Lower, Non-restricted	47.26	> 20	Pass
59	802.11 g	6 Mb/s	2412	Lower, Non-restricted	41.23	> 20	Pass
60	802.11 n-HT20	MCS0	2412	Lower, Non-restricted	41.63	> 20	Pass

TX chain 0 & 1

According KDB 662911 D01 Multiple Transmitter output v02r01

- E) 3) b) Relative Limits: When testing out-of-band and spurious emissions against relative emission limits, tests may be performed on each output individually without summing or adding 10 log(NANT) if the measurements are made relative to the in-band emissions on the individual outputs.

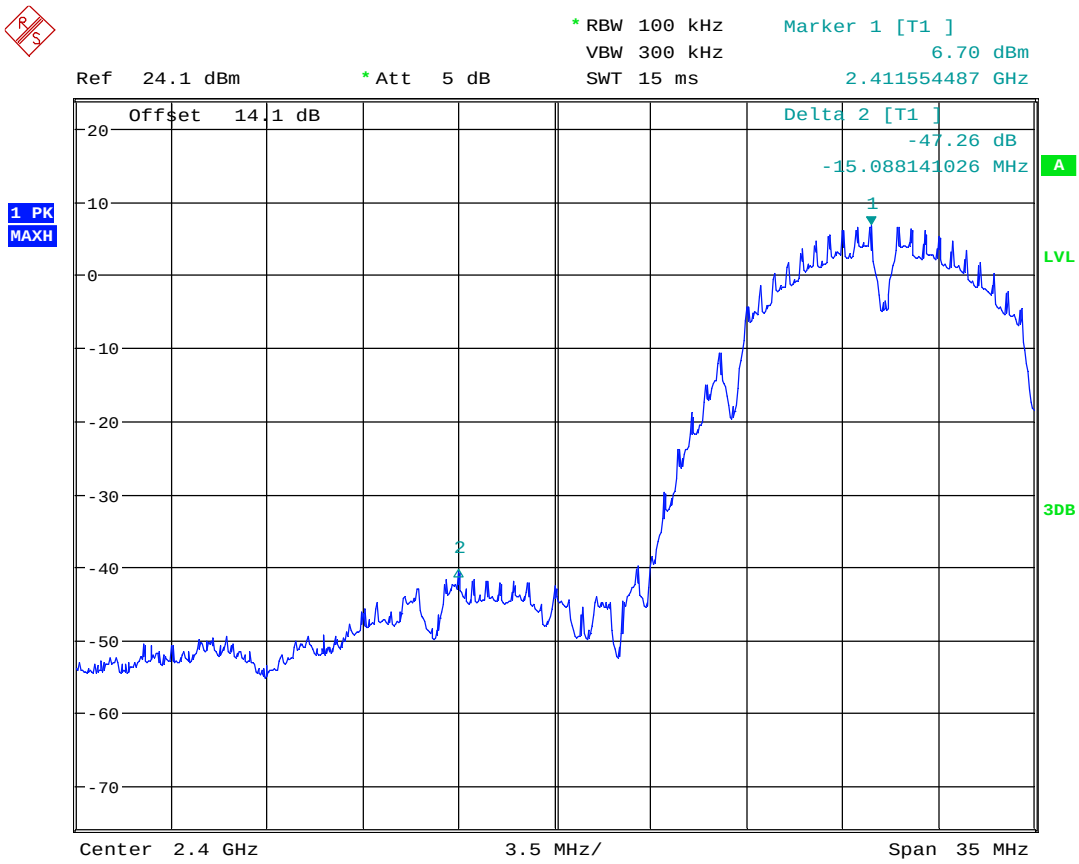
Mode	Data rate	Frequency (MHz)	Band Edge	Highest emission + 10*log(2) (dB)	Limit (dBc)	Result
802.11 n-HT20	MCS0	2412	Lower, Non-restricted	38.62	> 20	Pass

2483.5 – 2500 MHz

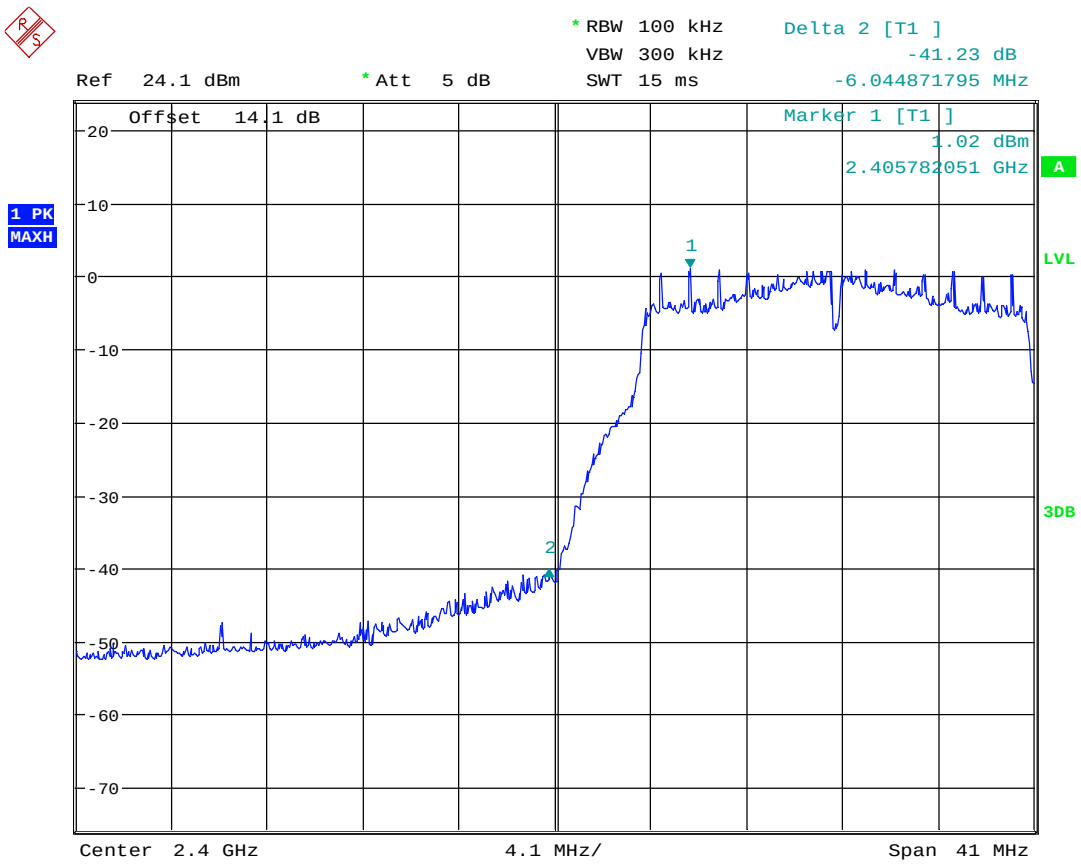
Plot #	Mode	Data rate	TX Frequency (MHz)	Band Edge	Measured Value (dBµV/m) @3m	Limit (dBµV/m) @3m	Result
61	802.11 n-HT20 MIMO	MCS8	2462	Upper Restricted (AVG)	39.03	54	Pass
62				Upper Restricted (Peak)	52.60	74	Pass

8.5.7 Measurement Plots:

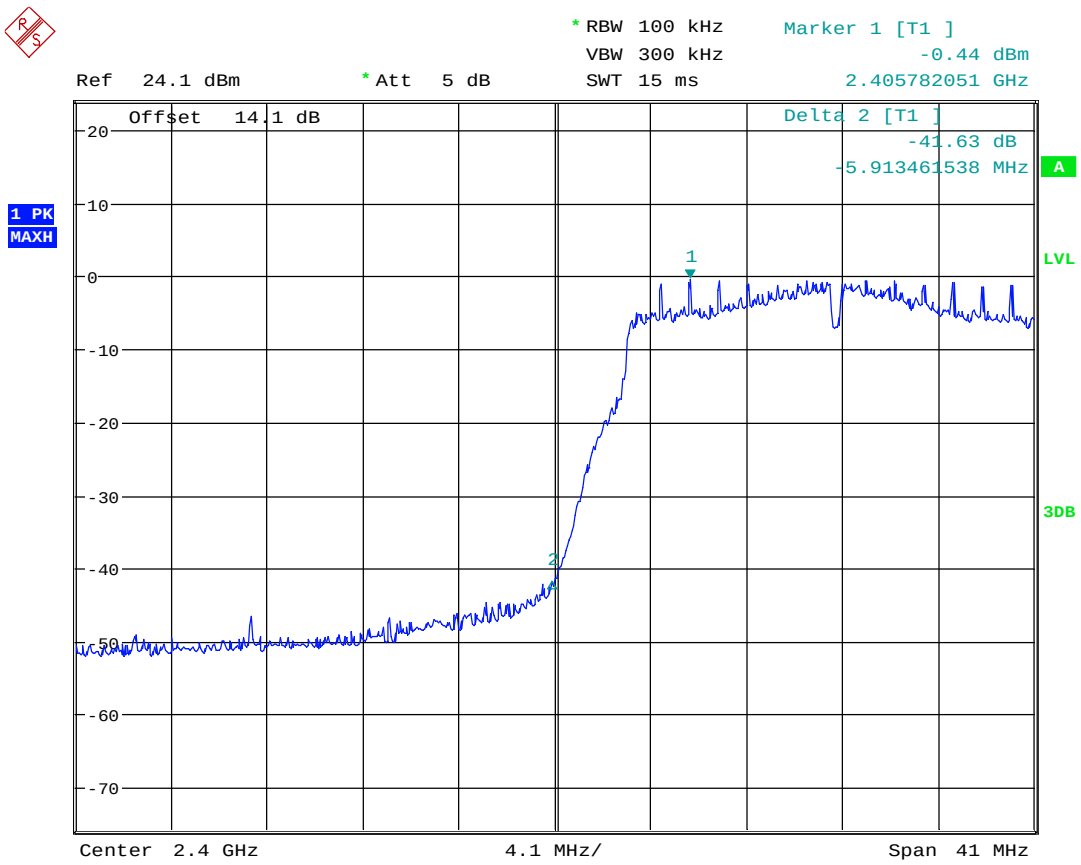
Plot # 58		
Tx Frequency: 2412 MHz	**Mode: 802.11 b**	**Data rate: 1 Mb/s**



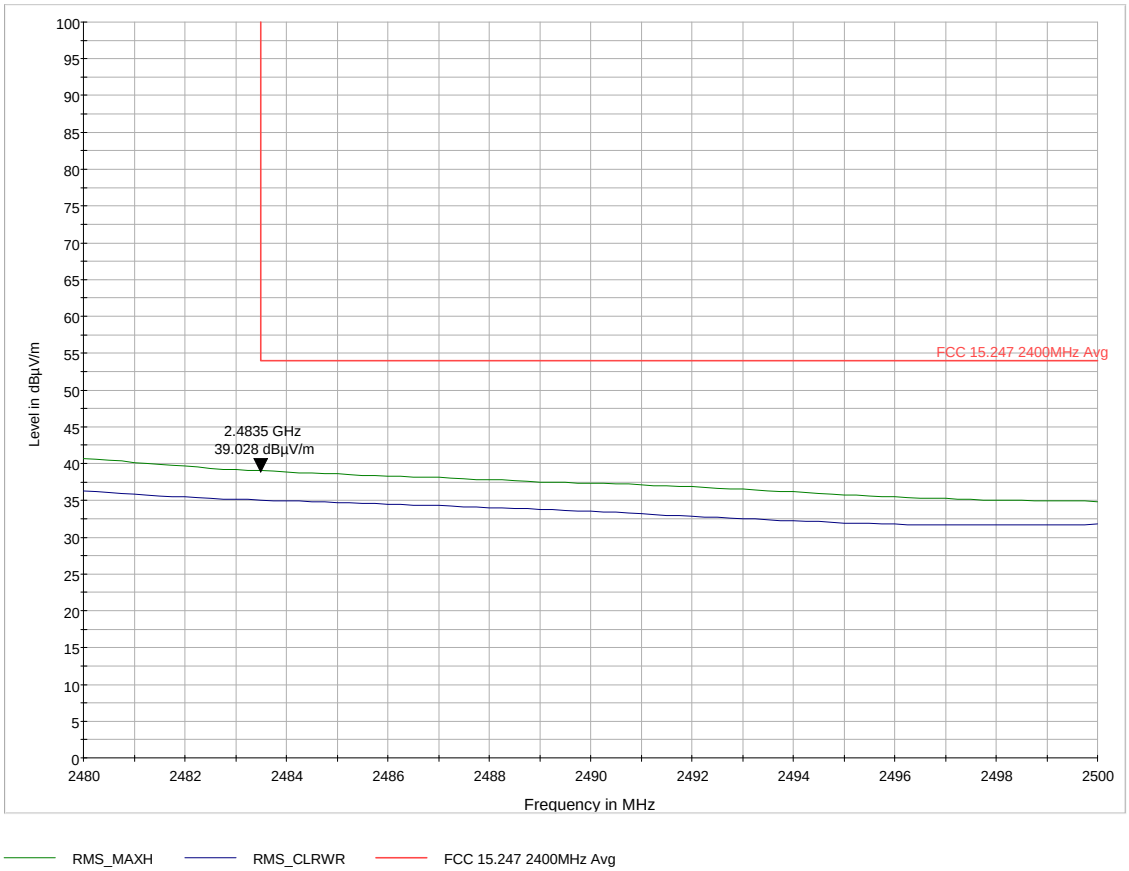
Plot # 59		
Tx Frequency: 2412 MHz	**Mode: 802.11 g**	**Data rate: 6 Mb/s**



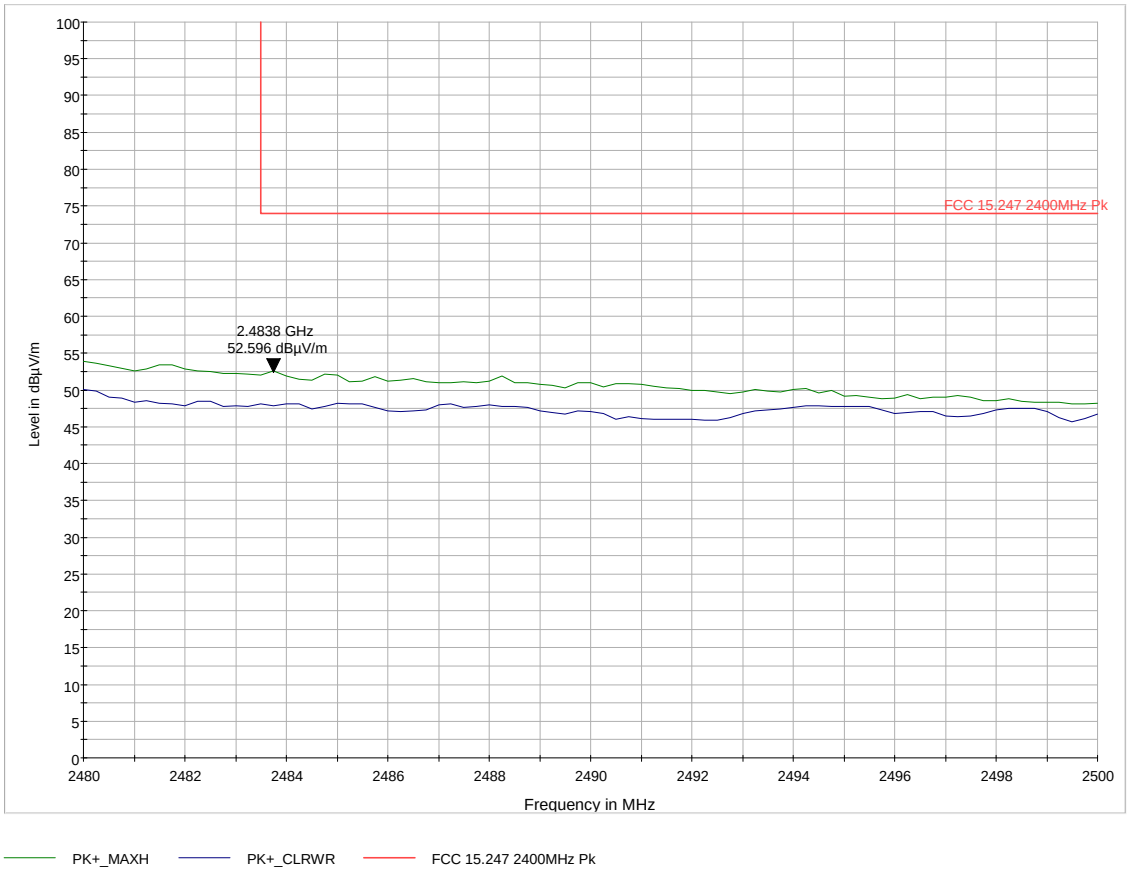
Plot # 60		
Tx Frequency: 2412 MHz	**Mode: 802.11 n-HT20**	**MCS0**



Plot # 61		
Tx Frequency: 2462 MHz	**Mode: 802.11 n-HT20 MIMO**	**Data rate: MCS8**



Plot # 62		
Tx Frequency: 2462 MHz	**Mode: 802.11 n-HT20 MIMO**	**Data rate: MCS8**



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	Antenna Gain
23.8°C	2	Op.2	12V DC	Ant 0: 1.7 dBi Ant 1: 0.8 dBi

8.6.4 Measurement result:

Plot #	Channel #	Scan Frequency	Lowest margin emission [dBµV/m] @ 3m	Limit	Result
63 – 65	Low	30 MHz – 18 GHz	40.97	See section 8.2.2	Pass
66 – 70	Mid	9 kHz – 26 GHz	53.42	See section 8.2.2	Pass
71 – 73	High	30 MHz – 18 GHz	40.85	See section 8.2.2	Pass

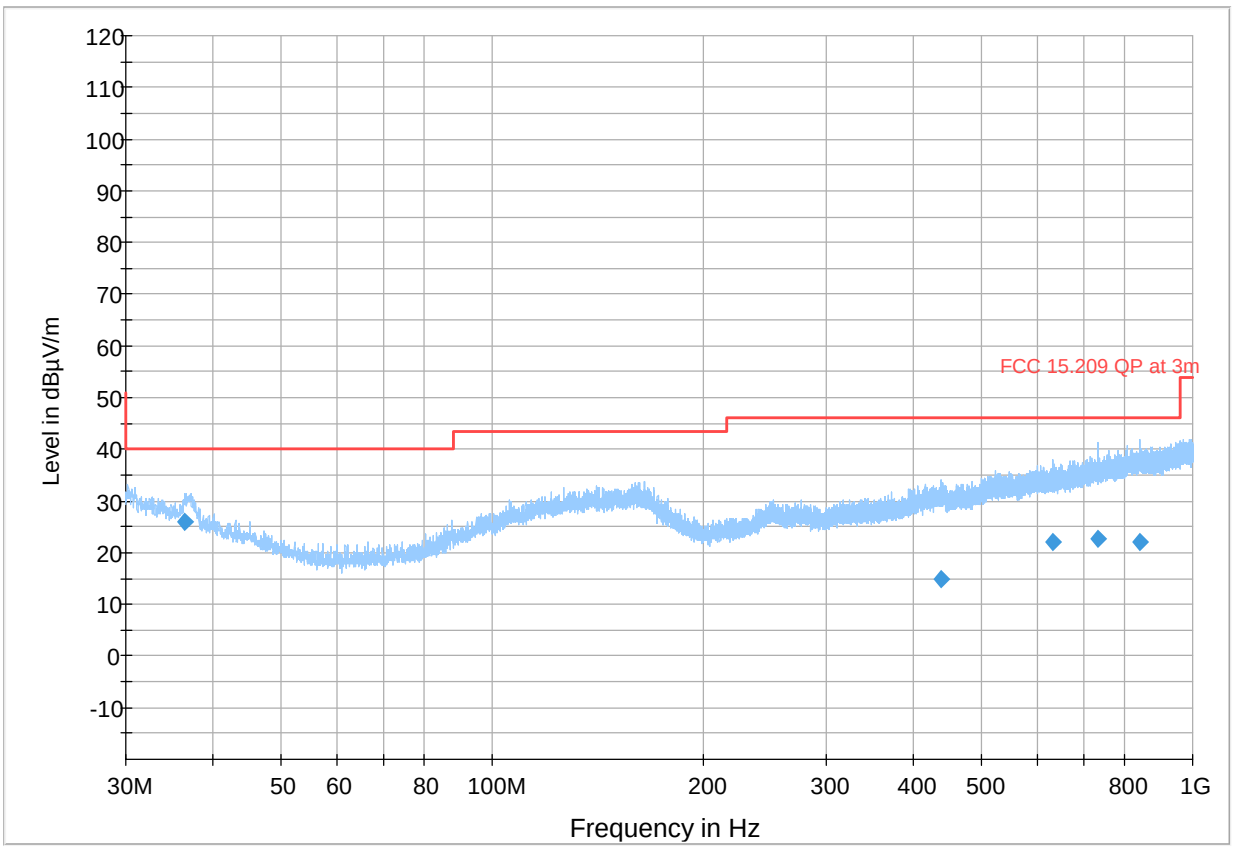
8.6.5 Measurement Plots:

Plot # 63 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2412 MHz	Mode: 802.11 n-HT20 MCS8 MIMO

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
36.45	26.09	40.00	13.91	500.0	120.0	100.0	V	264.0	-14.3	-35.2	0.0	20.9	40.4
438.27	14.86	46.02	31.16	500.0	120.0	107.0	V	239.0	-11.1	-33.6	0.0	22.5	26.0
632.03	22.14	46.02	23.88	500.0	120.0	170.0	V	153.0	-6.9	-32.9	0.0	26.1	29.0
732.33	22.54	46.02	23.48	500.0	120.0	160.0	V	170.0	-5.4	-32.7	0.0	27.3	27.9
840.29	22.17	46.02	23.85	500.0	120.0	275.0	H	188.0	-3.3	-32.3	0.0	29.1	25.4

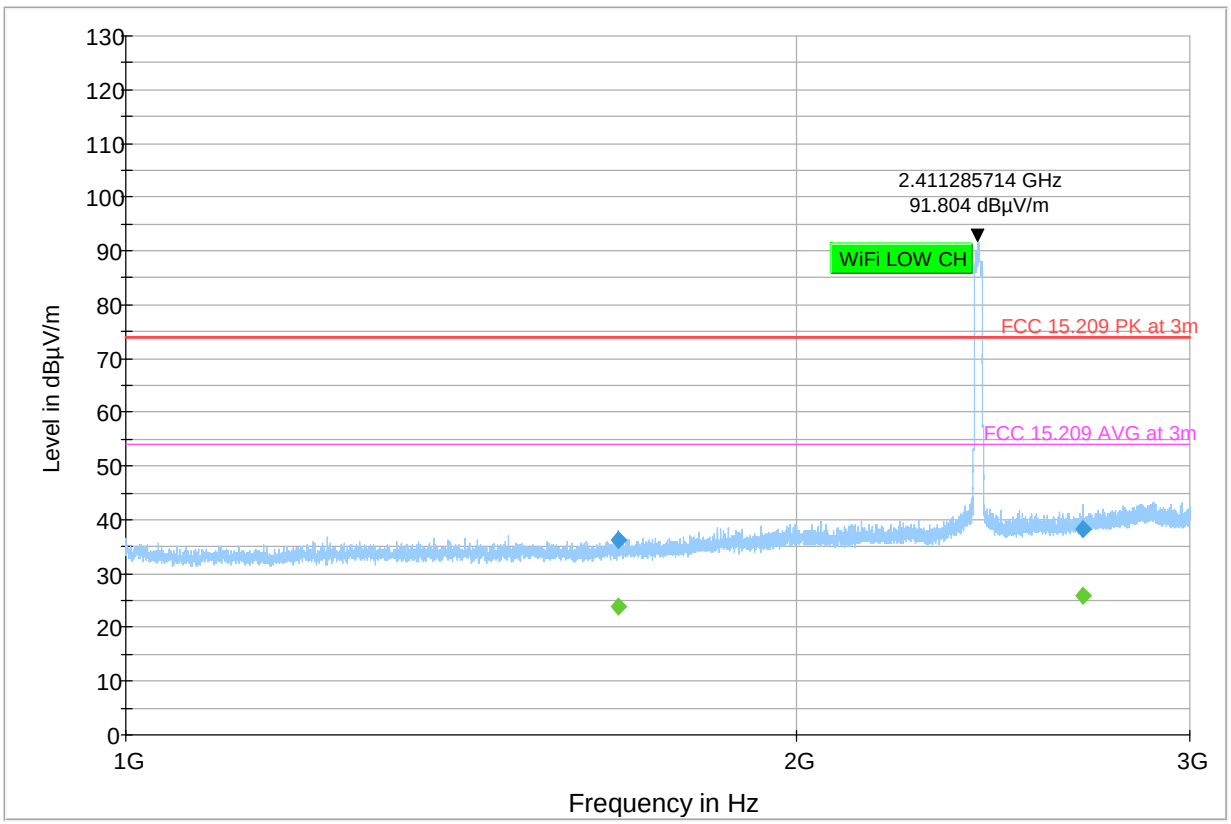


Plot # 64 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2412 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1662.14	---	23.85	53.98	30.13	500.0	1000.0	285.0	H	149.0	3.5
1662.14	36.30	---	73.98	37.68	500.0	1000.0	285.0	H	149.0	3.5
2686.29	---	25.78	53.98	28.20	500.0	1000.0	168.0	V	299.0	7.1
2686.29	38.20	---	73.98	35.78	500.0	1000.0	168.0	V	299.0	7.1

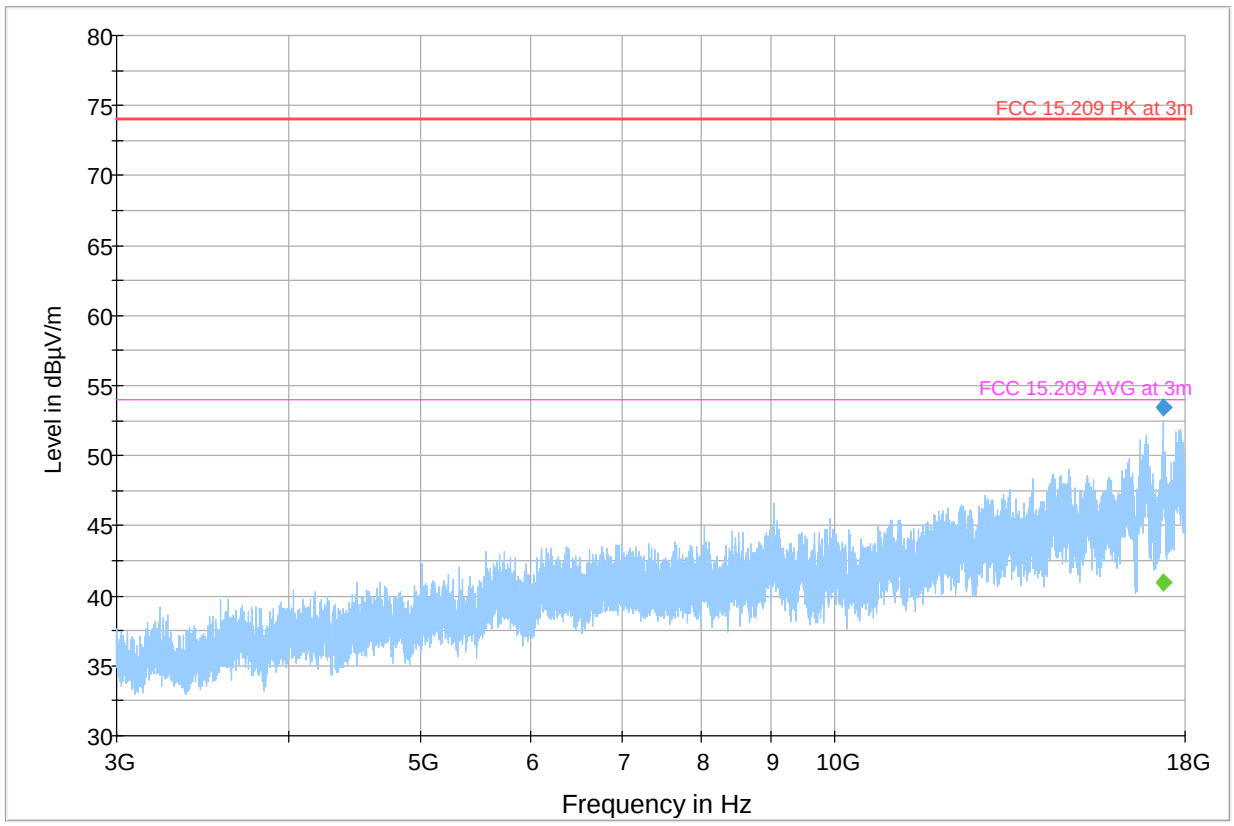


Plot # 65 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2412 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
17365.25	---	40.97	53.98	13.01	500.0	1000.0	167.0	V	268.0	15.9
17365.25	53.42	---	73.98	20.56	500.0	1000.0	167.0	V	268.0	15.9

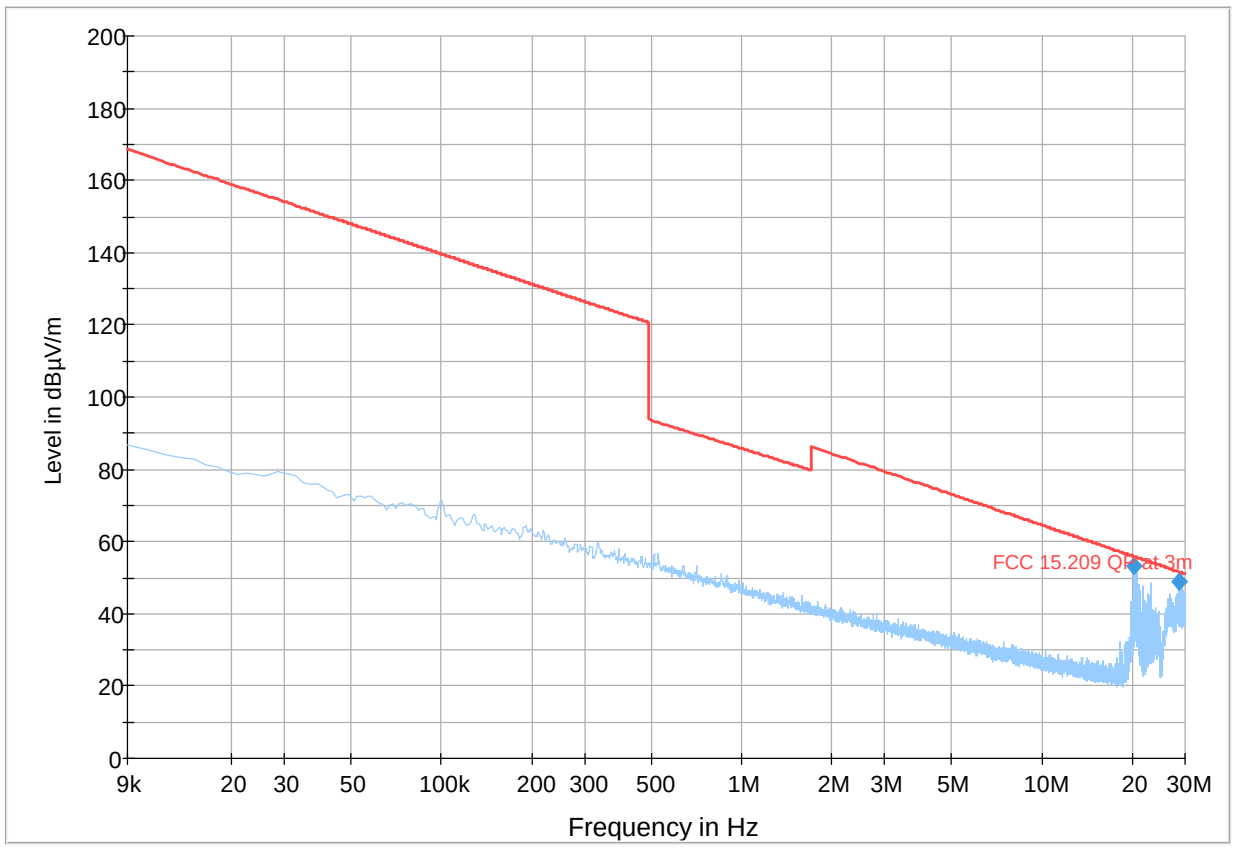


Plot # 66 Radiated Emissions: 9 KHz – 30 MHz

Tx Frequency: 2442 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20.26	53.42	55.87	2.46	500.0	9.0	100.0	H	103.0	16.5
28.69	48.99	51.59	2.60	500.0	9.0	100.0	H	83.0	15.9

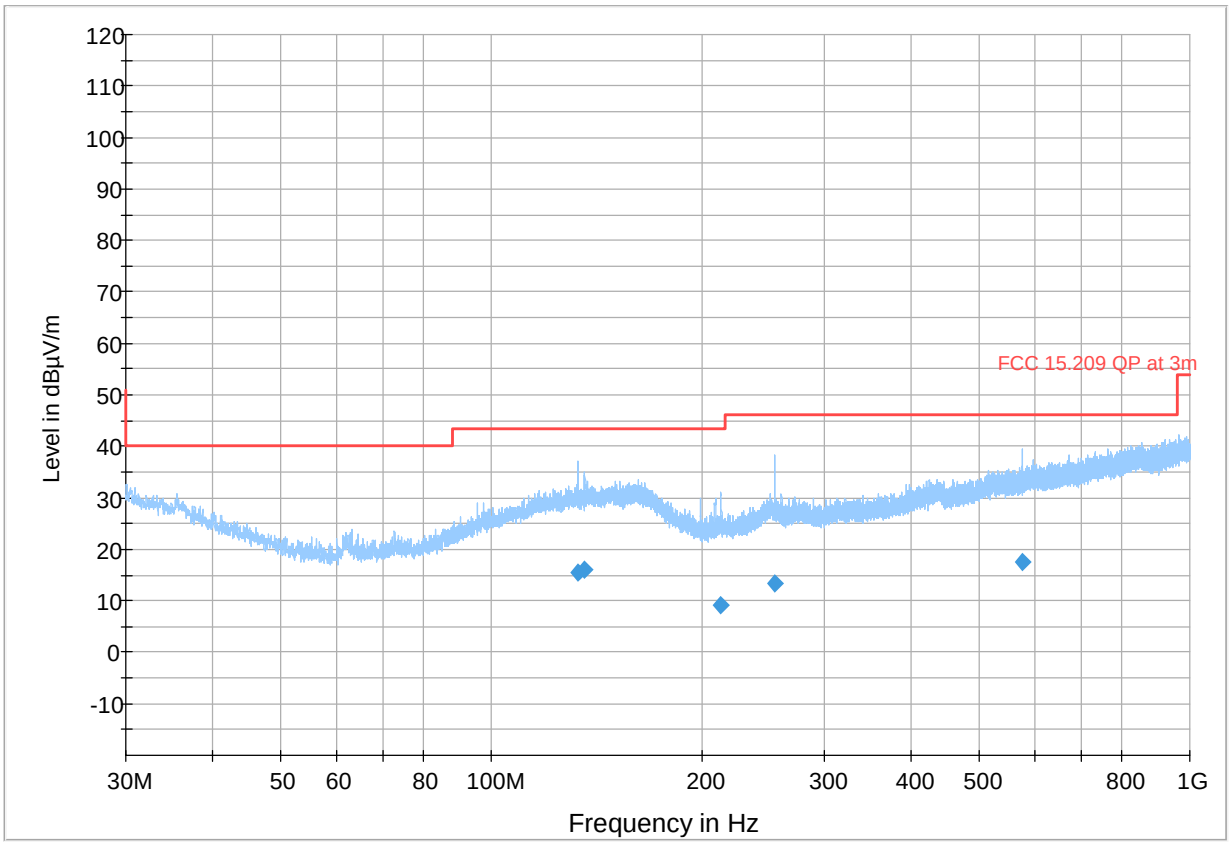


Plot # 67 Radiated Emissions: 30 MHz – 1 GHz

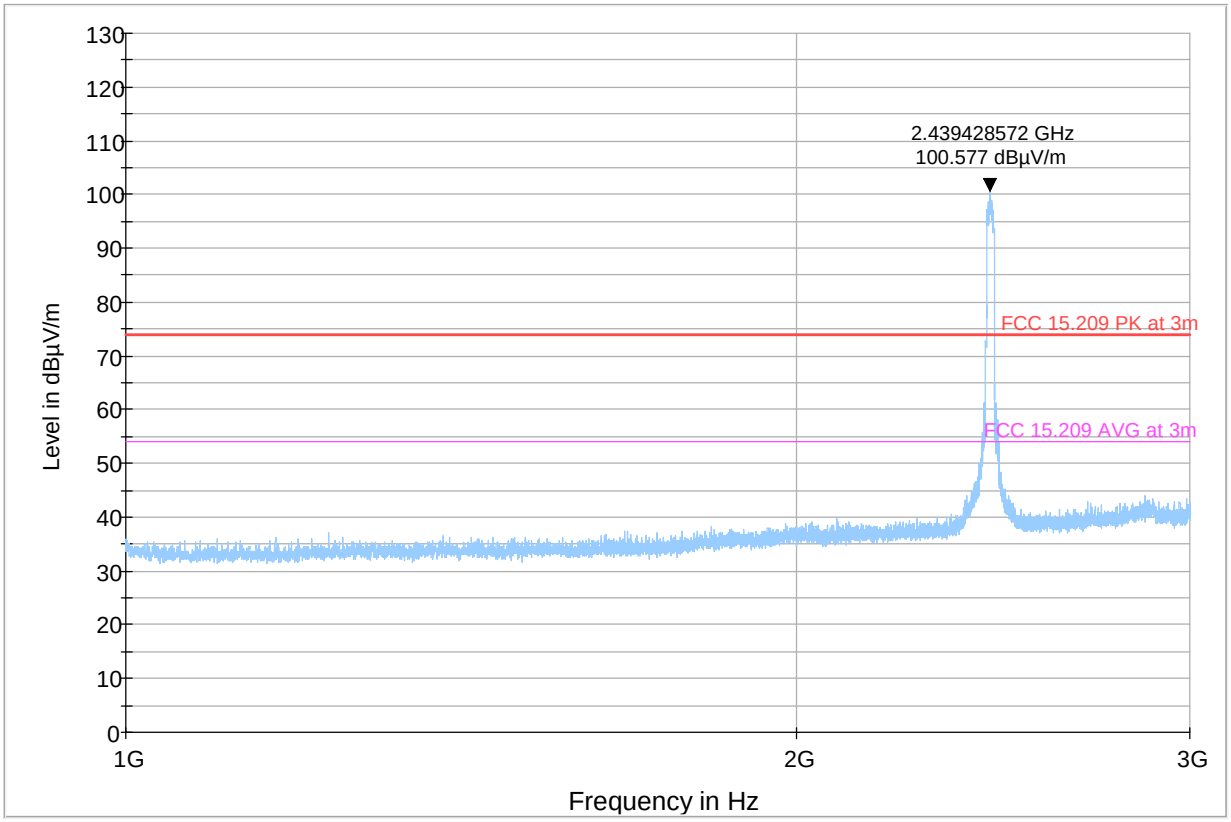
Tx Frequency: 2442 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
133.23	15.59	43.50	27.91	500.0	120.0	211.0	H	322.0	-11.0	-34.8	0.0	23.8	26.6
136.09	16.03	43.50	27.47	500.0	120.0	241.0	H	274.0	-10.7	-34.8	0.0	24.1	26.7
213.43	9.19	43.50	34.31	500.0	120.0	275.0	H	243.0	-16.8	-34.4	0.0	17.6	26.0
254.51	13.36	46.02	32.66	500.0	120.0	133.0	H	254.0	-13.6	-34.3	0.0	20.7	26.9
577.52	17.63	46.02	28.40	500.0	120.0	225.0	H	311.0	-7.7	-33.0	0.0	25.3	25.3



Plot # 68 Radiated Emissions: 1 – 3 GHz	
Tx Frequency: 2442 MHz	**Mode: 802.11 n-HT20 MCS8 MIMO**

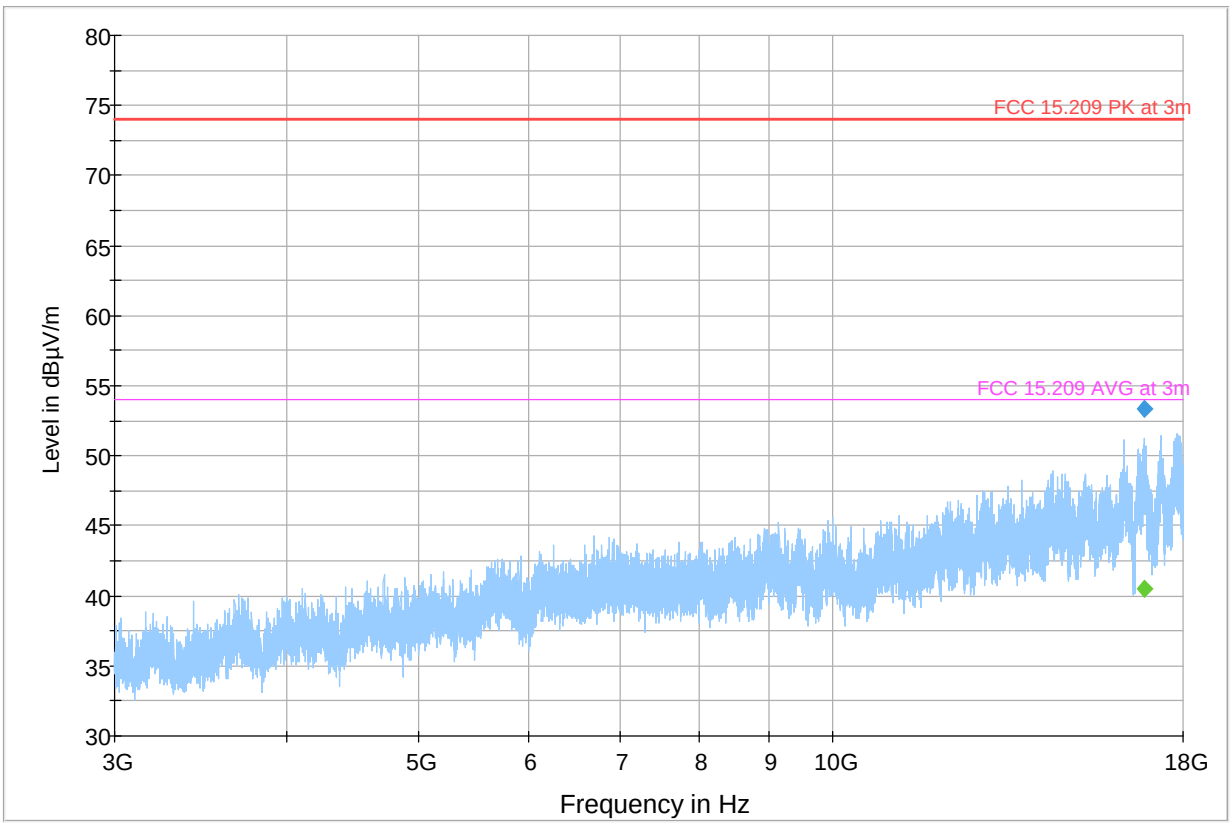


Plot # 69 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2442 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

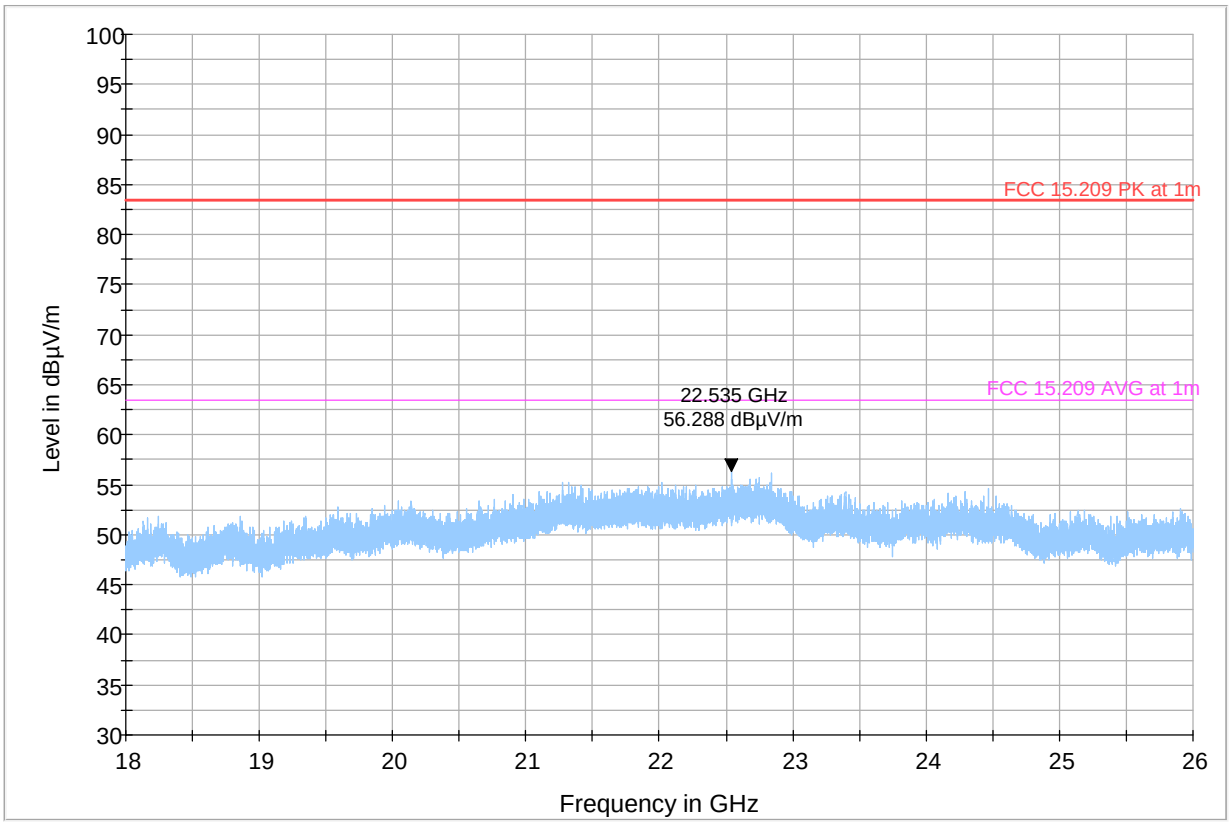
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
16846.25	---	40.47	53.98	13.51	500.0	1000.0	100.0	H	-54.0	14.4
16846.25	53.37	---	73.98	20.61	500.0	1000.0	100.0	H	-54.0	14.4



Plot # 70 Radiated Emissions: 18 – 26 GHz

Tx Frequency: 2442 MHz	Mode: 802.11 n-HT20 MCS8 MIMO

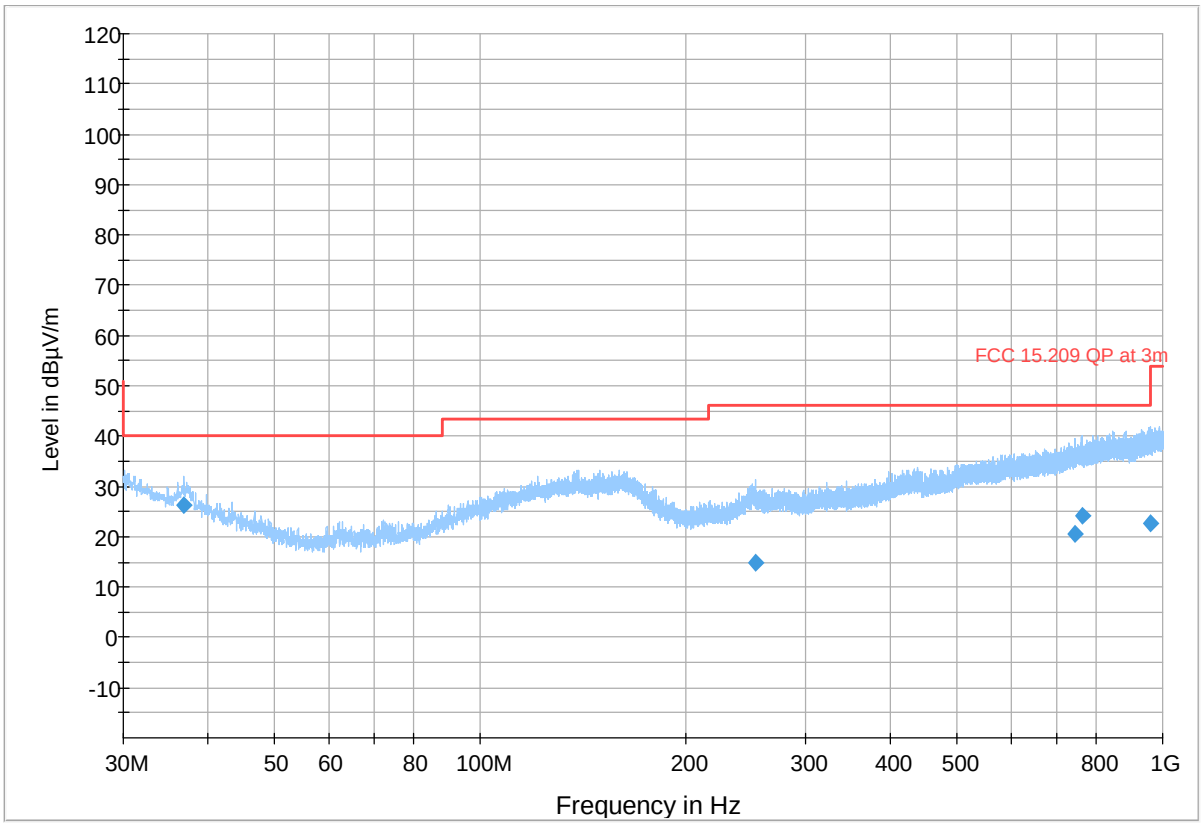


Plot # 71 Radiated Emissions: 30 MHz – 1 GHz

Tx Frequency: 2462 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
36.86	26.39	40.00	13.61	500.0	120.0	107.0	V	136.0	-14.5	-35.2	0.0	20.7	40.9
252.88	14.94	46.02	31.09	500.0	120.0	125.0	H	33.0	-12.9	-34.3	0.0	21.4	27.9
743.87	20.53	46.02	25.49	500.0	120.0	174.0	H	260.0	-4.9	-32.6	0.0	27.8	25.4
763.90	24.08	46.02	21.94	500.0	120.0	107.0	V	127.0	-4.8	-32.7	0.0	27.9	28.8
959.36	22.74	46.02	23.28	500.0	120.0	275.0	V	185.0	-2.4	-32.1	0.0	29.7	25.1

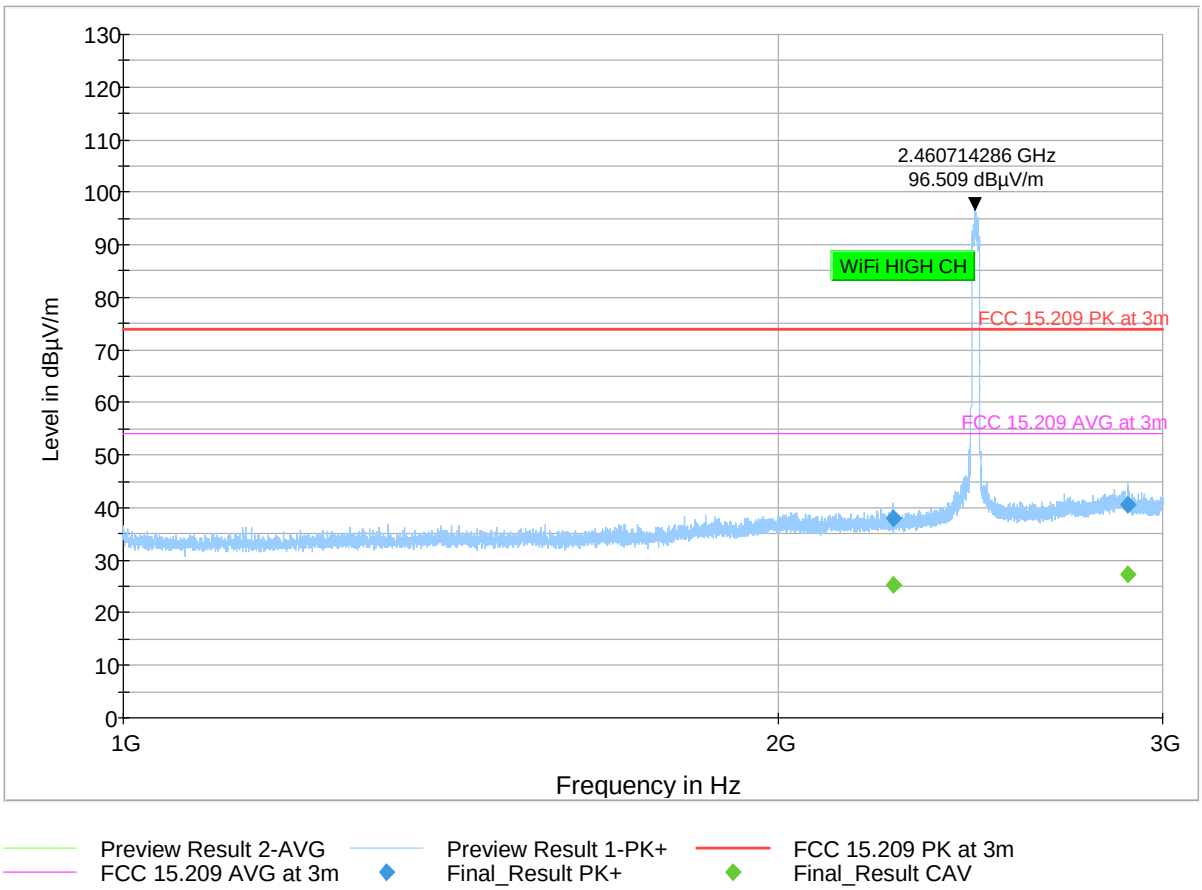


Plot # 72 Radiated Emissions: 1 – 3 GHz

Tx Frequency: 2462 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2256.00	37.89	---	73.98	36.09	500.0	1000.0	134.0	H	227.0	5.9
2256.00	---	25.44	53.98	28.54	500.0	1000.0	134.0	H	227.0	5.9
2893.43	40.59	---	73.98	33.39	500.0	1000.0	248.0	H	117.0	8.3
2893.43	---	27.40	53.98	26.58	500.0	1000.0	248.0	H	117.0	8.3

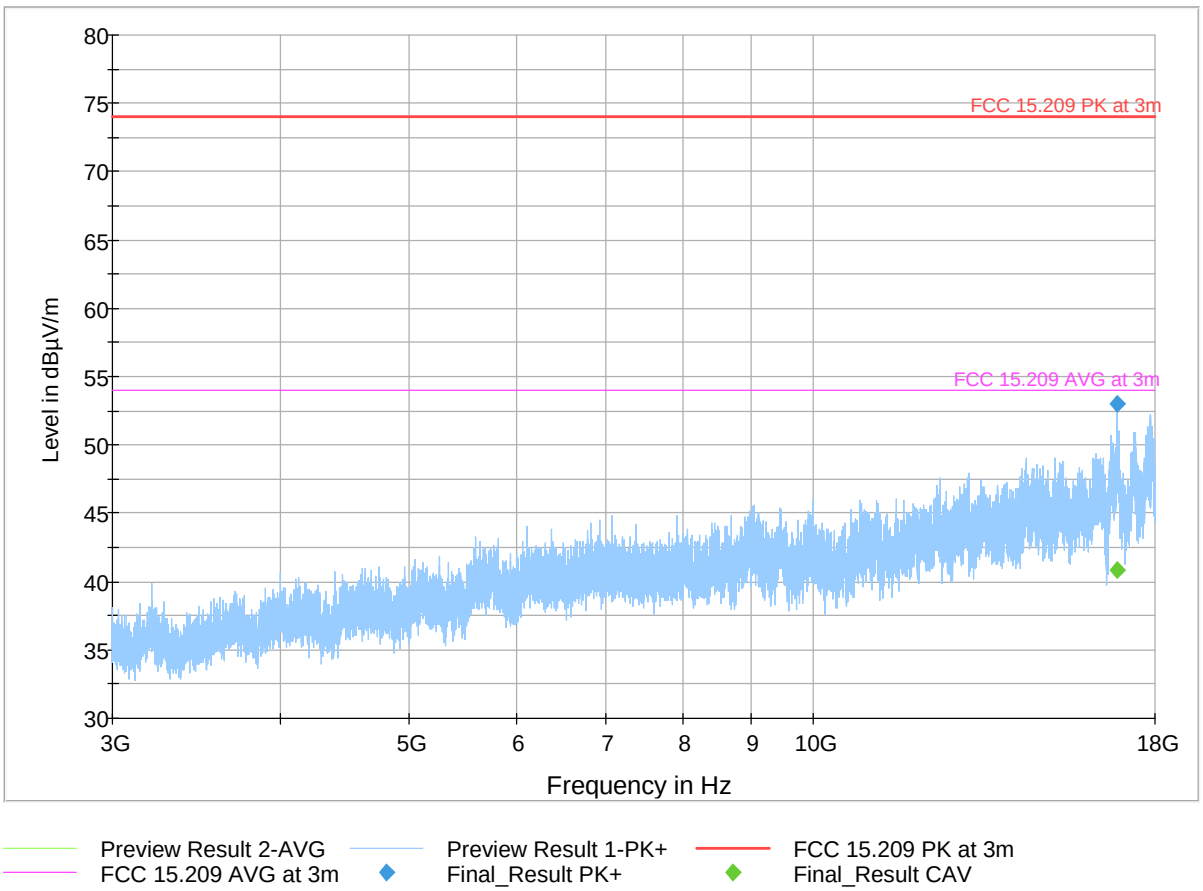


Plot # 73 Radiated Emissions: 3 – 18 GHz

Tx Frequency: 2462 MHz | **Mode: 802.11 n-HT20 MCS8 MIMO**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
16879.75	---	40.85	53.98	13.13	500.0	1000.0	185.0	V	135.0	14.3
16879.75	53.04	---	73.98	20.94	500.0	1000.0	185.0	V	135.0	14.3



9 Test setup photos

Setup photos are included in supporting file name: "EMC_KPTRK_040_23001_FCC_ISED_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	10/30/2020
BICONILOG ANTENNA	ETS Lindgren	3142E	00166067	3 YEARS	6/8/2022
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	8/10/2020
HORN ANTENNA	ETS LINDGREN	3117-PA	00215984	3 YEARS	1/31/2021
HORN ANTENNA	ETS LINDGREN	3116C-PA	00169535	3 YEARS	9/23/2020
EMI RECEIVER	R&S	ESU40	100251	3 YEARS	9/13/2021
SPECTRUM ANALYZER	R&S	FSU26	200065	3 YEARS	8/25/2021
DIGITAL THERMOMETER	CONTROL COMPANY	36934-164	191871986	3 YEARS	10/20/2021

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 are internally characterized before use.

11 History

Date	Report Name	Changes to report	Report prepared by
6/28/2023	EMC_KPTRK_040_23001_FCC_15_247_ISED_WLAN_DTS	Initial Version	Issa Ghanma

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