



FCC Test Report

FOR

Amazon

Model Name:
D5N83A

Product Description:
Networking Device

FCC ID: UUU-5411

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)

REPORT #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2

DATE: 2019-05-23



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

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

TABLE OF CONTENTS

1	ASSESSMENT	3
2	ADMINISTRATIVE DATA.....	4
2.1	IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT	4
2.2	IDENTIFICATION OF THE CLIENT	4
2.3	IDENTIFICATION OF THE MANUFACTURER	4
3	EQUIPMENT UNDER TEST (EUT).....	5
3.1	EUT SPECIFICATIONS	5
3.2	EUT SAMPLE DETAILS.....	6
3.3	ACCESSORY EQUIPMENT (AE) DETAILS.....	6
3.4	TEST SAMPLE CONFIGURATION	6
3.5	JUSTIFICATION FOR WORST CASE MODE OF OPERATION	7
4	SUBJECT OF INVESTIGATION	9
5	MEASUREMENT RESULTS SUMMARY	9
6	MEASUREMENT UNCERTAINTY	10
6.1	ENVIRONMENTAL CONDITIONS DURING TESTING:	10
6.2	DATES OF TESTING:.....	10
7	MEASUREMENT PROCEDURES.....	11
7.1	RADIATED MEASUREMENT	11
7.2	RF CONDUCTED MEASUREMENT PROCEDURE	13
8	TEST RESULT DATA	14
8.1	DUTY CYCLE.....	14
8.2	MAXIMUM CONDUCTED OUTPUT POWER.....	23
8.3	POWER SPECTRAL DENSITY.....	38
8.4	BAND EDGE COMPLIANCE	52
8.5	EMISSION BANDWIDTH 6 dB AND 99% OCCUPIED BANDWIDTH	81
8.6	RADIATED TRANSMITTER SPURIOUS EMISSIONS AND RESTRICTED BANDS	107
8.7	AC POWER LINE CONDUCTED EMISSIONS	132
9	TEST SETUP PHOTOS.....	134
10	TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING	135
11	REVISION HISTORY	136

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

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.

No deviations were ascertained.

Company	Description	Model #
Amazon	Networking Device	D5N83A

Responsible for Testing Laboratory:

2019-05-23 Compliance Cindy Li
(EMC Lab Manager)

Digitally signed by Cindy Li
DN: cn=Cindy Li, o=Cetecom
Inc., ou=EMC,
email=cindyl@cetecom.co
m, c=US
Date: 2019.05.23 13:21:51
-07'00'

Date	Section	Name	Signature
------	---------	------	-----------

Responsible for the Report:

2019-05-23 Compliance James Donnellan
(Compliance)

James Donnellan

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.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

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

2.2 Identification of the Client

Applicant's Name:	Amazon
Street Address:	410 Terry Ave,
City/Zip Code:	Seattle, WA 98109
Country:	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Foxconn Cloud Network Technology Singapore Pte.
Manufacturers Address:	No.2, 2nd Donghuan Road, 10th Yousong Industrial District, Longhua, Baoan,
City/Zip Code	Shenzhen City, Guangdong Province
Country	China

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

3 Equipment under Test (EUT)

3.1 EUT Specifications

Model No:	D5N83A
HW Version :	DVT
SW Version :	emmc-denali_dvt-ipq806x-1.0.0.217_1205
FCC-ID:	UUU-5411
HVIN:	N/A
PMN:	N/A
Product Description:	Networking device
Frequency Range / number of channels: / Radio	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels Device is using a Qualcomm QCA9882 2.4 GHz WiFi radio chip.
Type(s) of Modulation:	BPSK, QPSK, 16-QAM
Modes of Operation:	802.11b/g/n, 20MHz and 40MHz
Antenna Information as declared:	3.0 dBi
Max. Conducted Output Power:	Conducted Power 25.53 dBm
Power Supply/ Rated Operating Voltage Range:	AC/DC Adapter: Vlow:10.3 V/ Vnom: 12.0 VDC / Vmax: 15.0 VDC
Operating Temperature Range:	0 °C to 40 °C
Other Radios included in the device:	4X Qualcomm QCA9886, 5 GHz WiFi Wi-Fi Standards: 802.11a, 802.11ac, 802.11n, Wi-Fi Channel Utilization: 20/40 MHz MIMO Configuration: 2x2 (2-stream) Peak QAM: 256 QAM
Sample Revision:	☐ Prototype Unit; ☐ Production Unit; ☒ Pre-Production

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	PCB SN FQE01E0	DVT	emmc-denali_dvt-ipq806x-1.0.0.217_1205	Conducted Unit
2	G070R2027494003B	DVT	emmc-denali_dvt-ipq806x-1.0.0.217_1205	Radiated Unit

3.3 Accessory Equipment (AE) details.

AE #	Type	Model	Manufacturer	Serial Number
1	AC/DC Adapter	ADH006	Ac Bel	AH06F83V003P2
2	Laptop	Dell	Latitude E6430s	00186-210-105-587

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2 + AE#1 + AE#2	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software "QSPR" provided by client that is not available to the end user. The measurement equipment was connected to the 50 ohm RF ports of the EUT.
2	EUT#1 + AE#1 + AE#2	The radio of the EUT was configured to a specified channel with highest possible duty cycle using software "QSPR" provided by client that is not available to the end user. Unless otherwise stated the radio under test was tested with both chains active.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

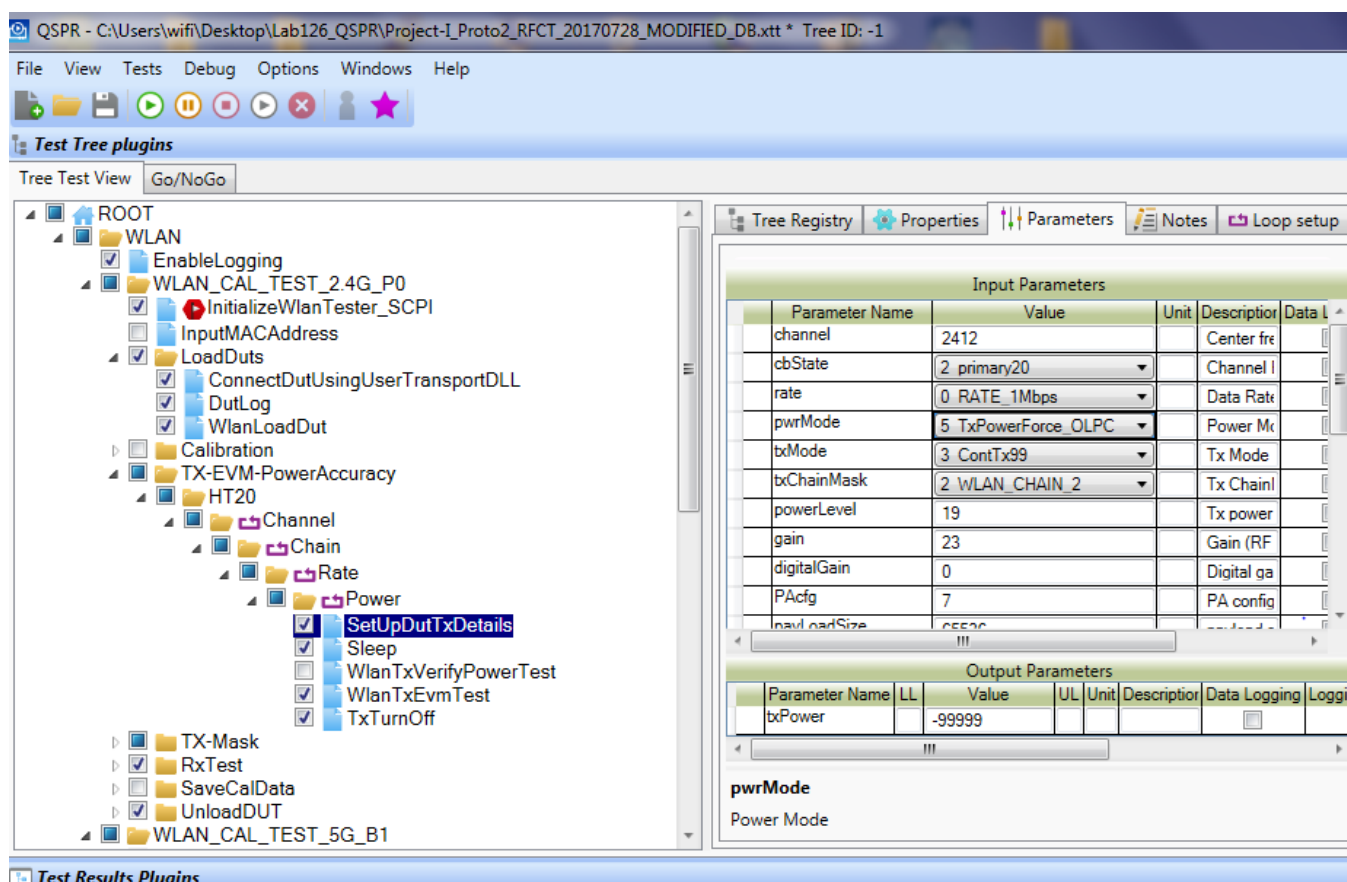
FCC ID: UUU-5411

3.5 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels with the highest possible duty cycle. For radiated measurements both chains were active with highest power settings, all data in this report shows the worst case between horizontal and vertical antenna polarizations and orientations of the EUT.

The EUT,s were configured by “QSPR” application provided by client (not available to the end user).

QSPR Application Snapshot on Supporting Laptop:



The screenshot shows the QSPR application interface. The left pane displays the 'Test Tree' with a hierarchical structure. The right pane shows the 'Input Parameters' table.

Test Tree Structure:

- ROOT
 - WLAN
 - EnableLogging
 - WLAN_CAL_TEST_2.4G_P0
 - InitializeWlanTester_SCPI
 - InputMACAddress
 - LoadDuts
 - ConnectDutUsingUserTransportDLL
 - DutLog
 - WlanLoadDut
 - Calibration
 - TX-EVM-PowerAccuracy
 - HT20
 - Channel
 - Chain
 - Rate
 - Power
 - SetUpDutTxDetails (highlighted)
 - Sleep
 - WlanTxVerifyPowerTest
 - WlanTxEvmTest
 - TxTurnOff
 - TX-Mask
 - RxTest
 - SaveCalData
 - UnloadDUT
 - WLAN_CAL_TEST_5G_B1

Input Parameters Table:

| Parameter Name | Value | Unit | Description | Data L |
|----------------|---------------------|------|-------------|--------|
| channel | 2412 | | Center fre | |
| cbState | 2 primary20 | | Channel I | |
| rate | 0 RATE_1Mbps | | Data Rate | |
| pwrMode | 5 TxPowerForce_OLPC | | Power M | |
| txMode | 3 ContTx99 | | Tx Mode | |
| txChainMask | 2 WLAN_CHAIN_2 | | Tx ChainI | |
| powerLevel | 19 | | Tx power | |
| gain | 23 | | Gain (RF) | |
| digitalGain | 0 | | Digital ga | |
| PAcfg | 7 | | PA config | |
| payloadSize | 65536 | | | |

Output Parameters Table:

| Parameter Name | LL | Value | UL | Unit | Description | Data Logging | Loggin |
|----------------|----|--------|----|------|-------------|--------------|--------|
| txPower | | -99999 | | | | | |

Power Mode:

pwrMode
Power Mode

Additional Testing Notes:

Radiated testing was executed with both 2.4GHz antenna chains transmitting.

The USB port on the device is considered as a maintenance port and was used during product setup and Channel configuration.

One of two Ethernet ports was connected to a laptop during radiated testing and was active via the QSPR application and a ping from the Laptop to the DUT. Ex. “ping -6 fe80::5153:d896::3955:1eB2 -s 6500 -t”.

An additional report which outlines testing of co transmission between the 2.4 GHz and other radios currently supported by this devise is included in supporting file “EMC_A2ZDE-048-18001_CO-TX.pdf”

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

Power Settings on the DUT:

The target power settings in below table were provided by client to set in QSPR for all the various test.

| WiFi 2.4 GHz | | | | | | | | | | | |
|------------------|----|----|----|----|----|----|----|----|----|----|----|
| 802.11 / channel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| b | 23 | 23 | 23 | 26 | 26 | 26 | 26 | 26 | 23 | 23 | 23 |
| g | 20 | 20 | 20 | 26 | 26 | 26 | 26 | 26 | 20 | 20 | 20 |
| n 20 | 19 | 19 | 19 | 26 | 26 | 26 | 26 | 26 | 18 | 18 | 18 |
| n 40 | 16 | | | | | 16 | 16 | | | | |

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.

Testing procedures are based on 558074 D01 DTS Meas Guidance v05 – “GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247” – August 24, 2018, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

The power level setting were specified as described in Section3 by the client are used as worst case power levels on the product

5 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | NA | NP | Result |
|-------------------------|--|------------------------------------|-----------------|------|----|----|----------|
| §15.247(a)(1) | Emission Bandwidth | Nominal | 802.11 b/g/n | ■ | □ | □ | Complies |
| §15.247€ | Power Spectral Density | Nominal | 802.11 b/g/n | ■ | □ | □ | Complies |
| §15.247(b)(1) | Maximum Conducted Output Power and EIRP | Nominal | 802.11 b/g/n | ■ | □ | □ | Complies |
| §15.247(d) | Band edge compliance Unrestricted Band Edges | Nominal | 802.11 b/g/n | ■ | □ | □ | Complies |
| §15.247; 15.209; 15.205 | Band edge compliance Restricted Band Edges | Nominal | 802.11 b/g/n | ■ | □ | □ | Complies |
| §15.247(d); §15.209 | TX Spurious emissions- Radiated | Nominal | 802.11n_20 MIMO | ■ | □ | □ | Complies |
| §15.207(a) | AC Conducted Emissions | Nominal | N/A | ■ | □ | □ | Complies |

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

6 Measurement Uncertainty

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

Radiated measurement

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

Conducted measurement

| | |
|-------------------|---------------------|
| 150 kHz to 30 MHz | ± 0.7 dB (LISN) |
|-------------------|---------------------|

| | |
|--------------------------|--------------|
| RF conducted measurement | ± 0.5 dB |
|--------------------------|--------------|

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: <http://physics.nist.gov/cuu/Uncertainty/typeb.html>.

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:

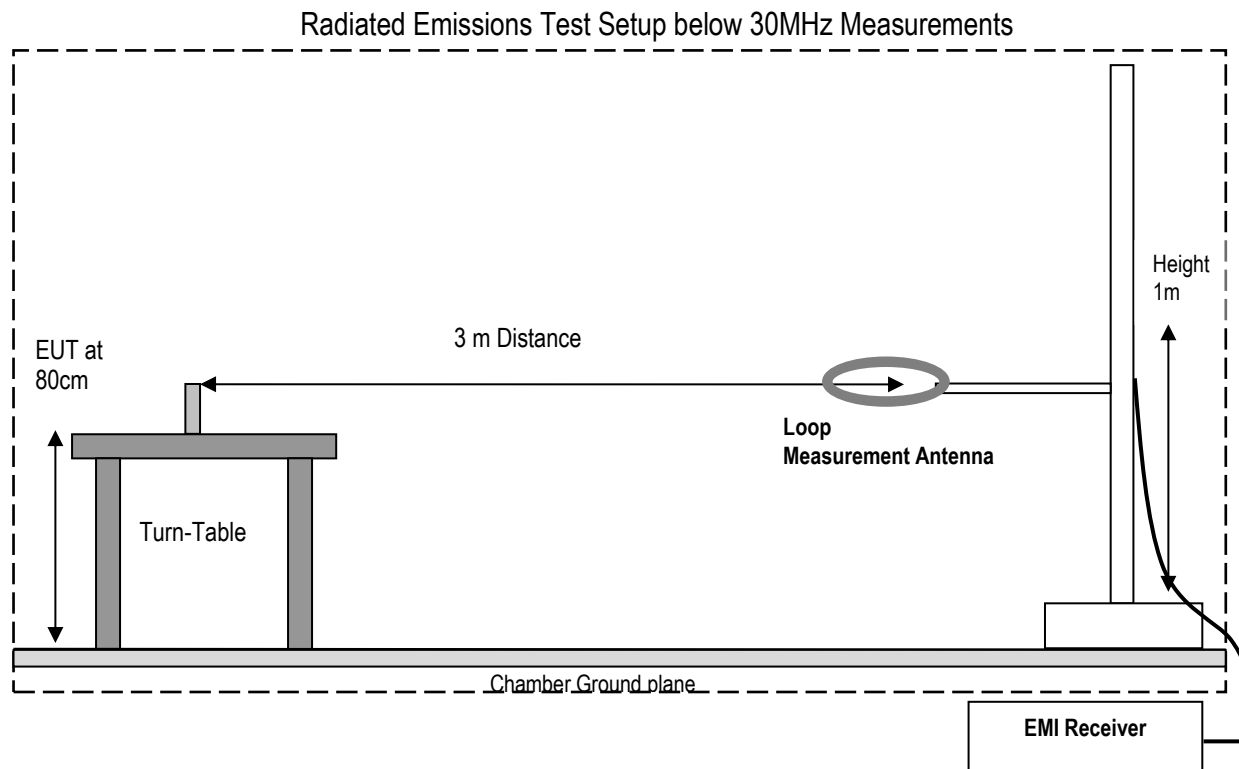
Nov 28, 2018 – Jan 18, 2019

7 Measurement Procedures

7.1 Radiated Measurement

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

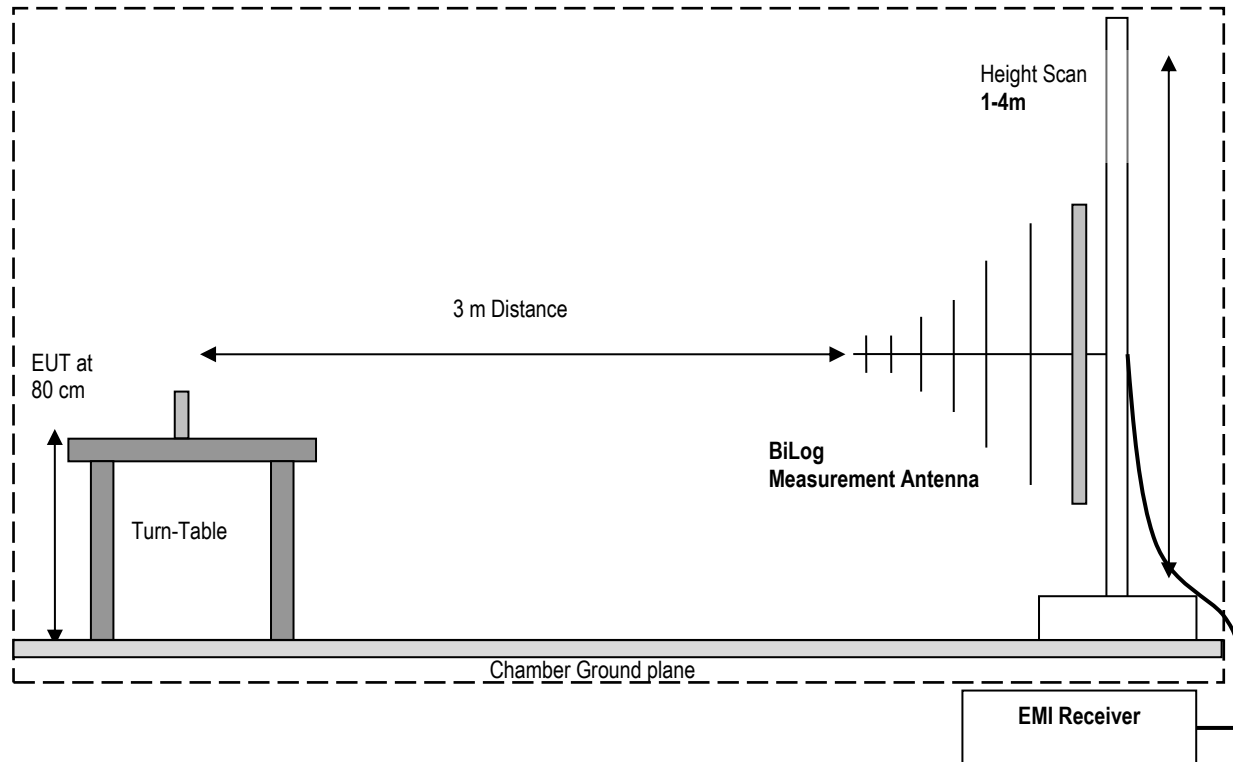
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of providing power to the EUT.
- 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 three different horn antennas are used to cover frequencies up to 40 GHz.



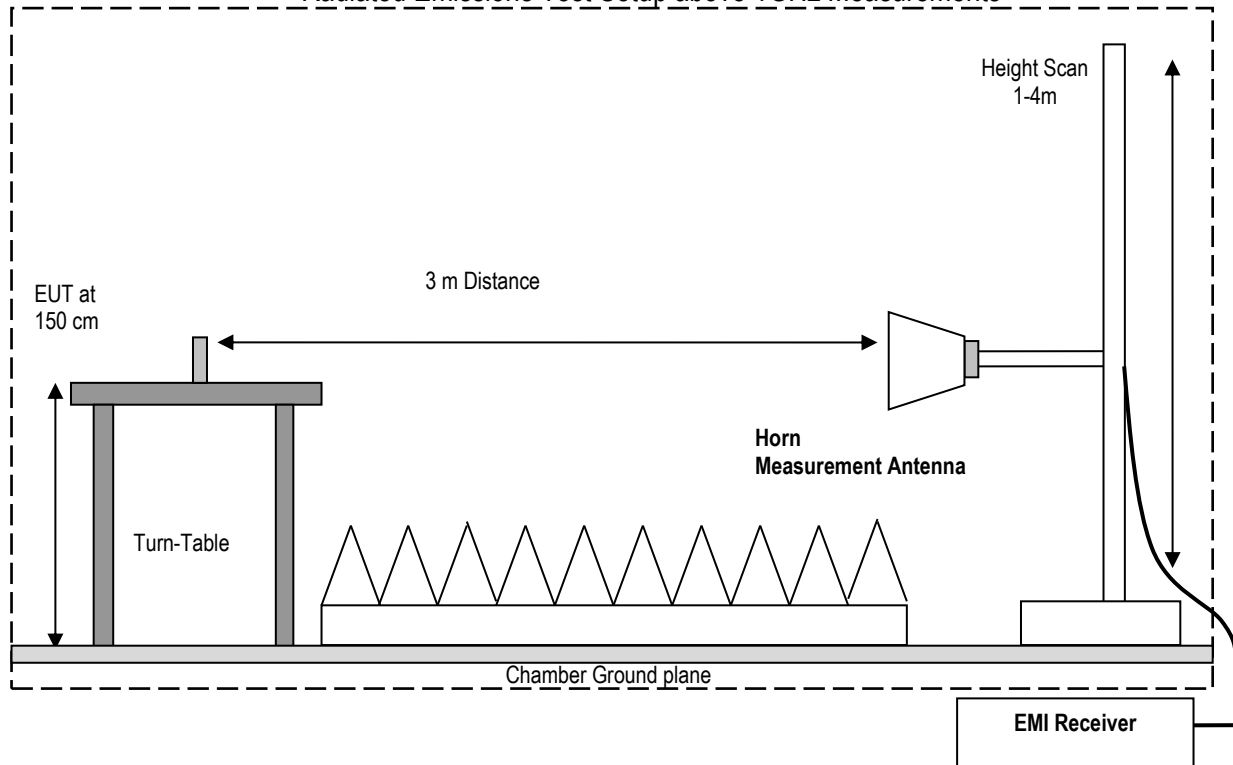
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

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

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

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

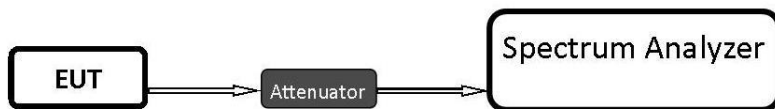
$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

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

7.2 RF Conducted Measurement Procedure

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



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

8 Test Result Data

8.1 Duty cycle

8.1.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

Spectrum Analyzer settings:

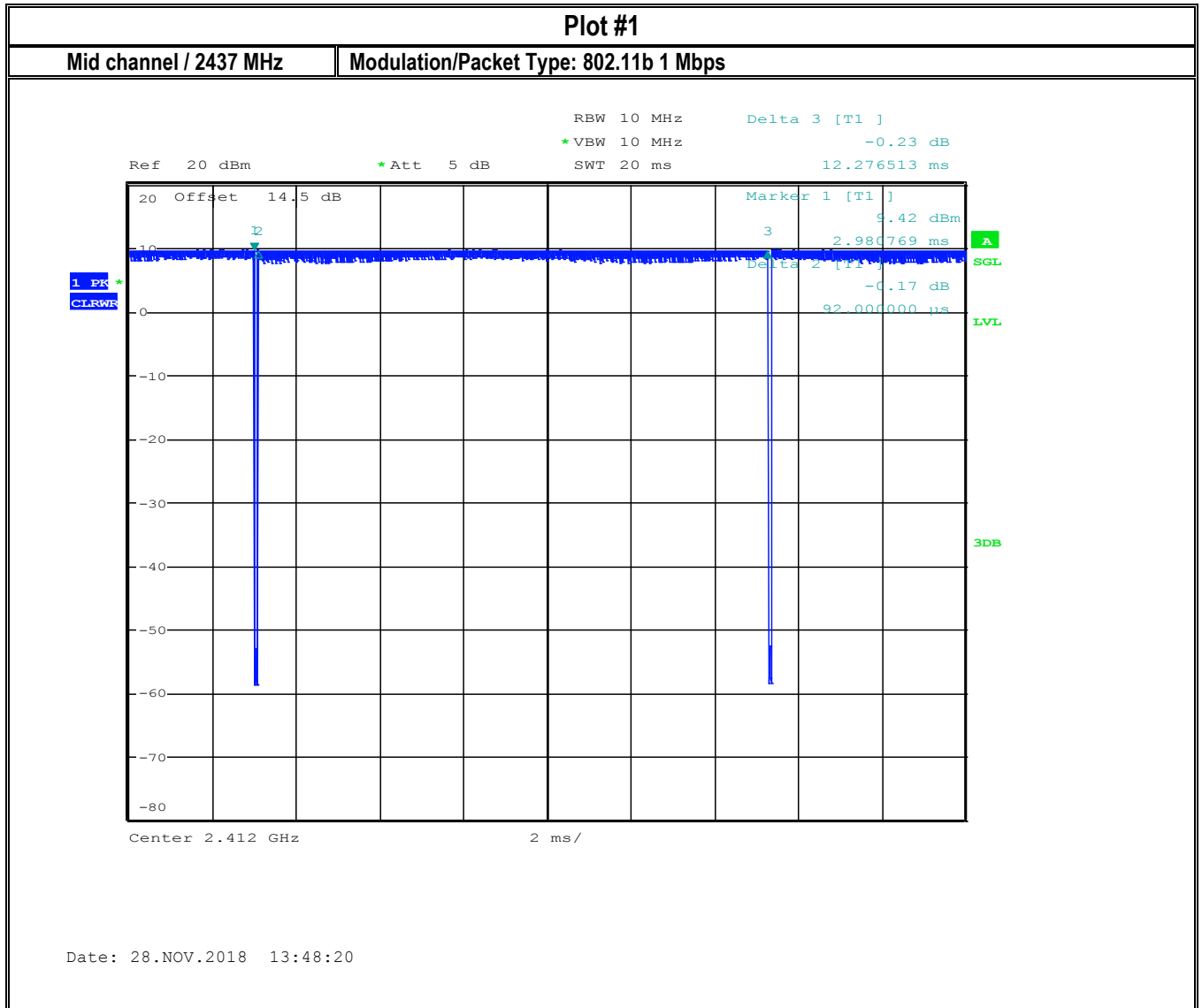
- Set the center frequency and of the instrument to the center frequency of the transmission
- Zero span
- Set RBW >=OBW if possible; otherwise, set RBW to the largest available value
- Detector = Peak or average

8.1.2 Measurement result

| Plot # | Mode | Data Rate | Duty Cycle | Duty Cycle Correction Factor (dB) |
|--------|--------------|-----------|------------|-----------------------------------|
| 1 | 802.11b | 1Mbps | 99.25% | 0.03 |
| 2 | 802.11b | 11Mbps | 94.81% | 0.23 |
| 3 | 802.11g | 6Mbps | 96.09% | 0.17 |
| 4 | 802.11g | 54Mbps | 75.76% | 1.21 |
| 5 | 802.11n_HT20 | MCS0 | 95.79% | 0.19 |
| 6 | 802.11n_HT20 | MCS7 | 75.14% | 1.24 |
| 7 | 802.11n_HT40 | MCS0 | 92.15% | 0.35 |
| 8 | 802.11n_HT40 | MCS7 | 64.31% | 1.92 |

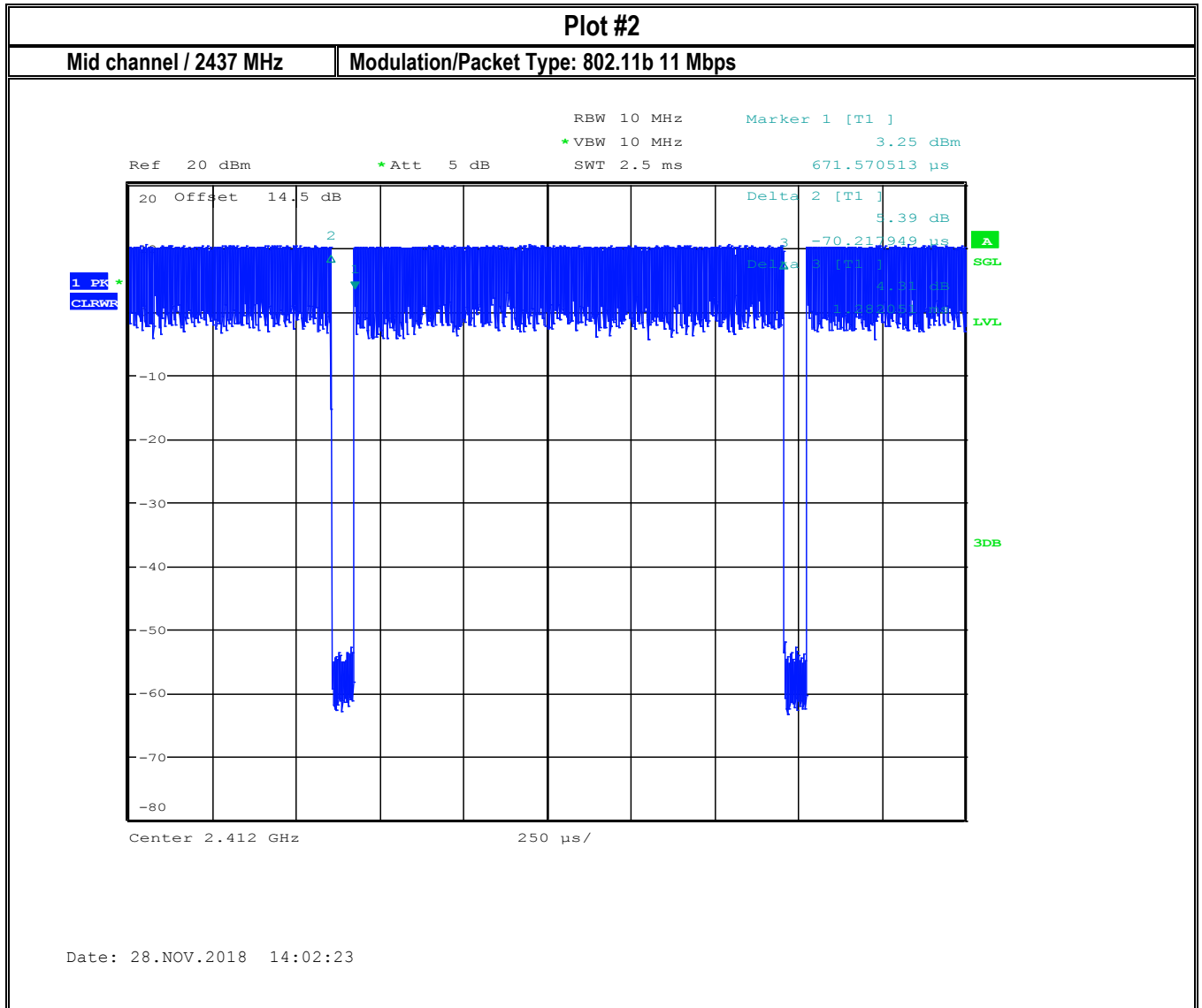
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



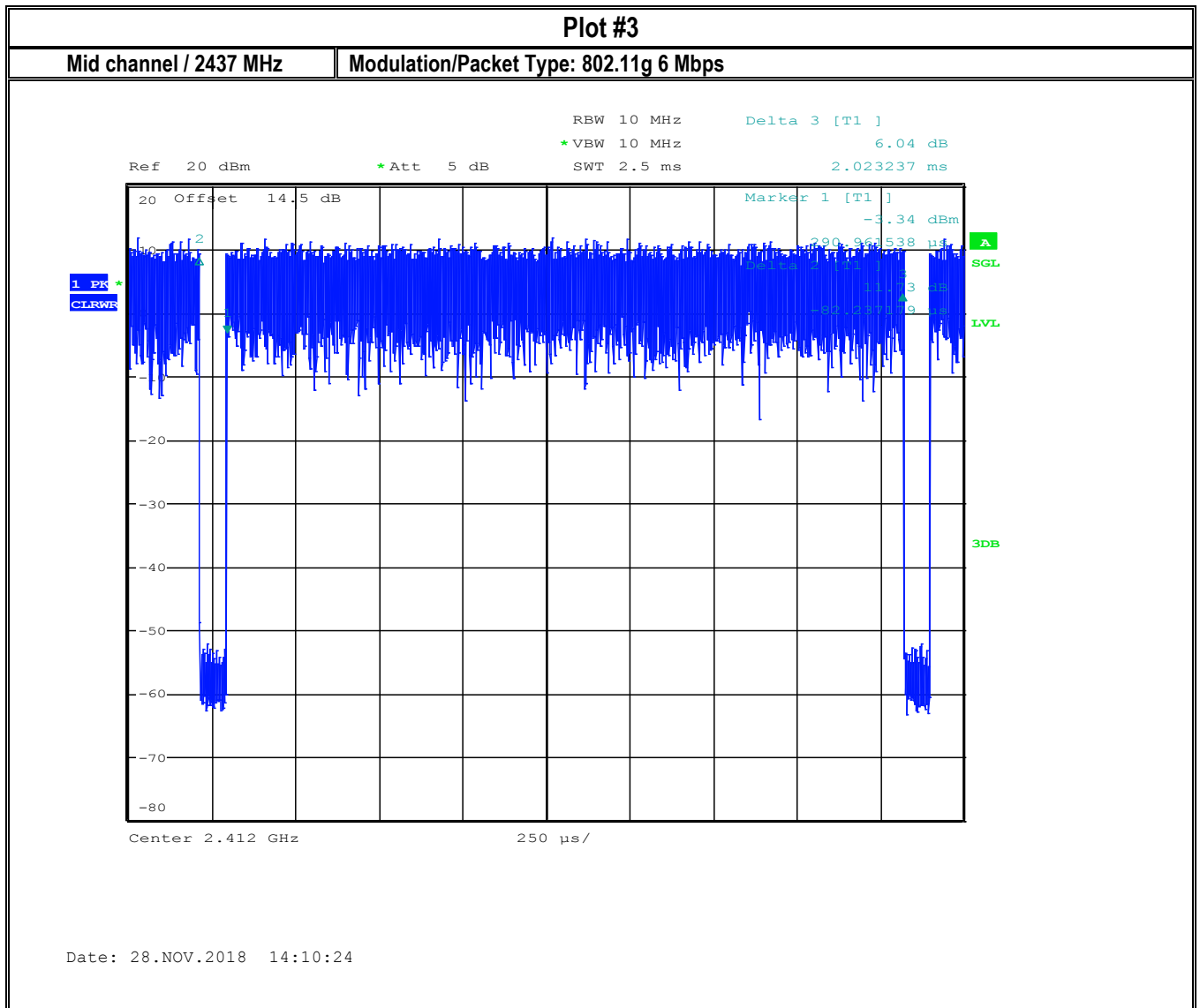
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



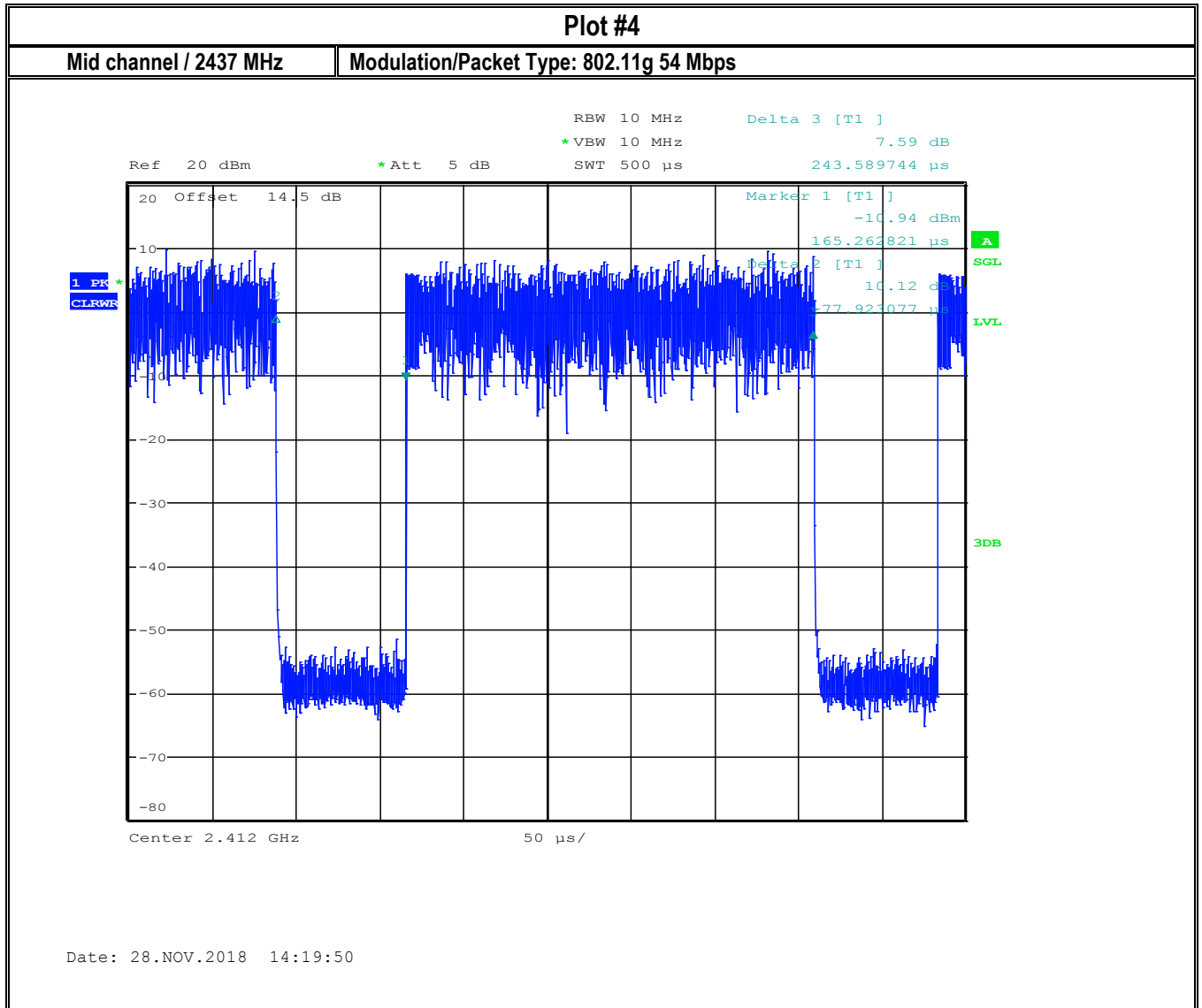
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



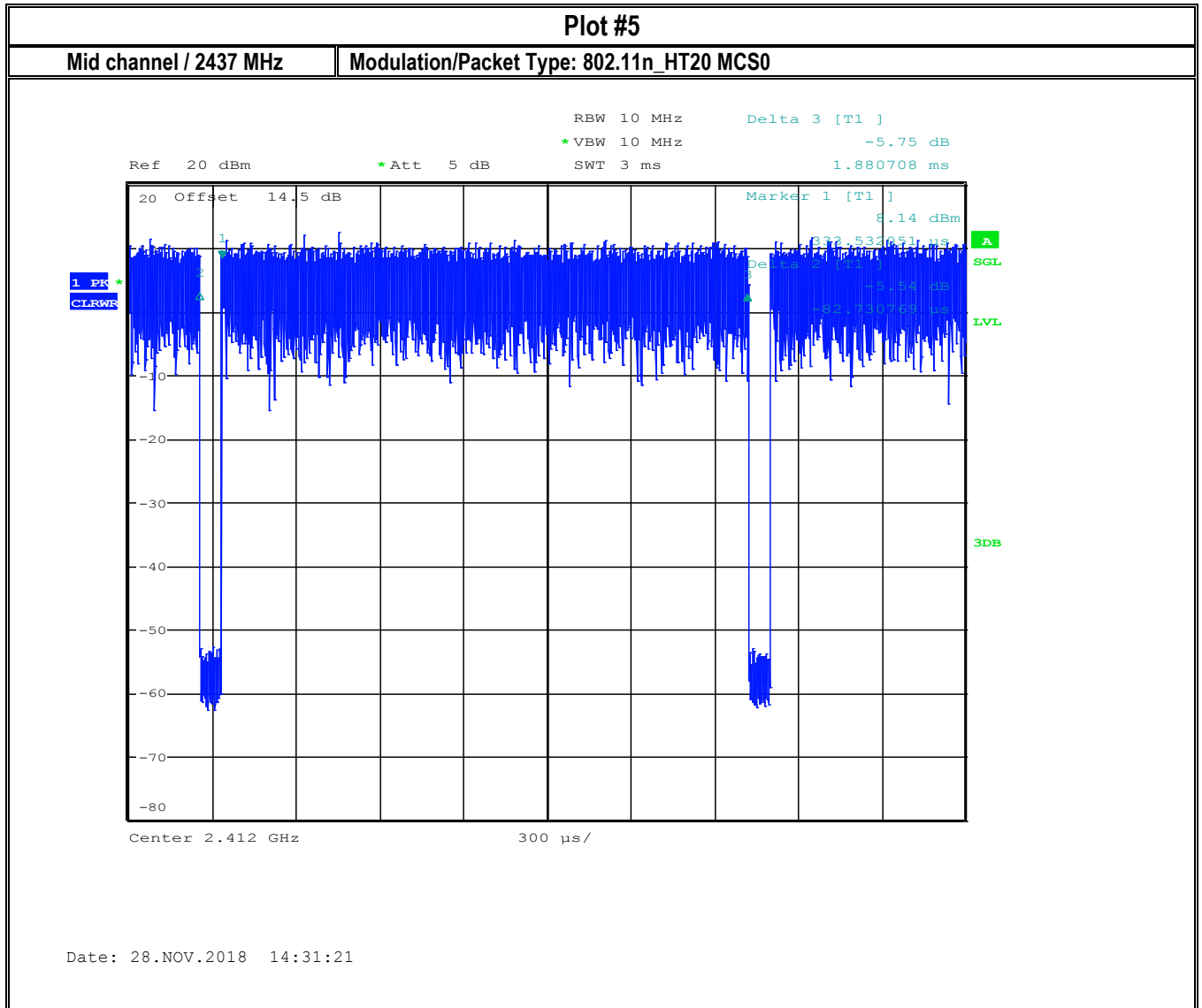
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



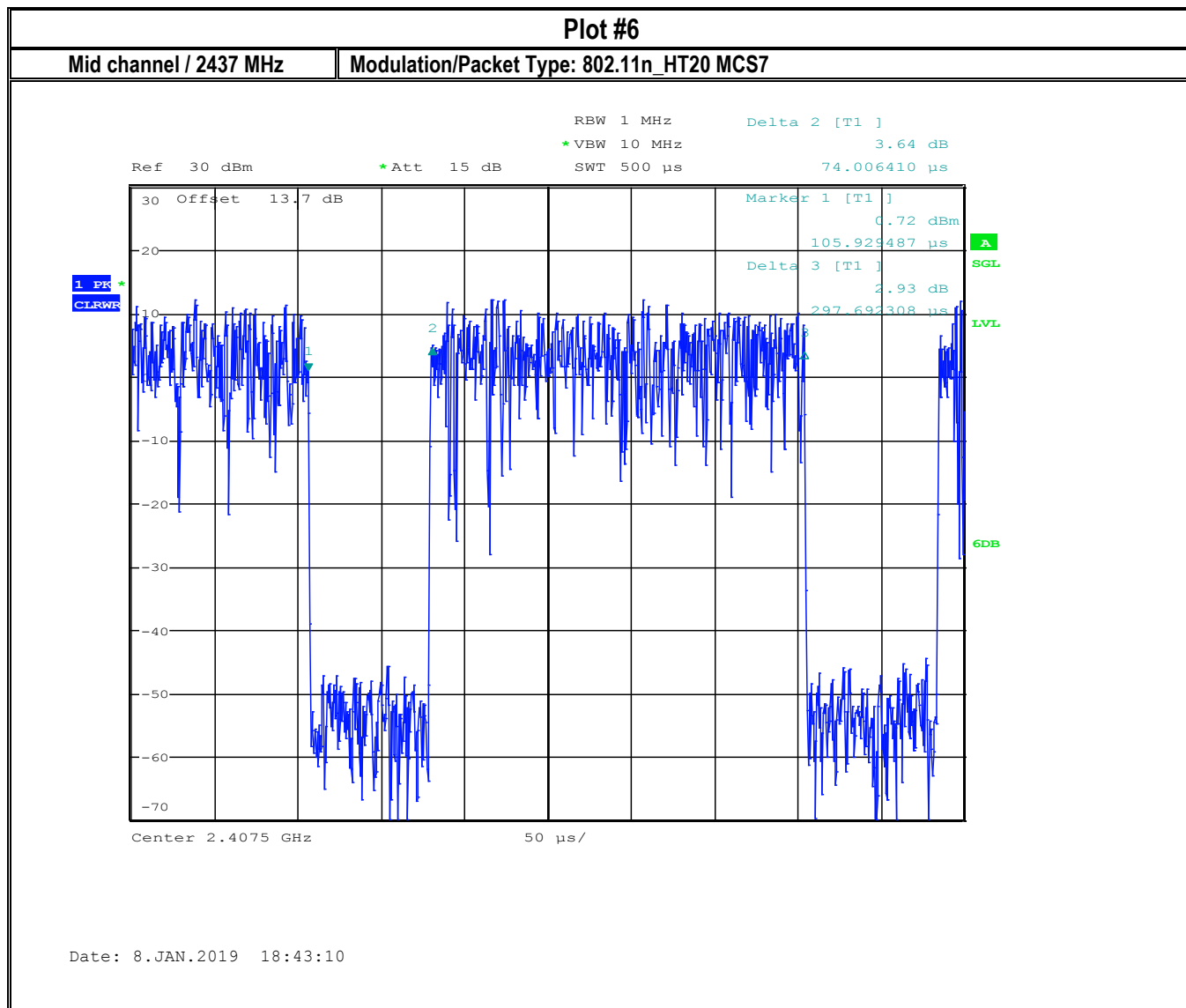
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



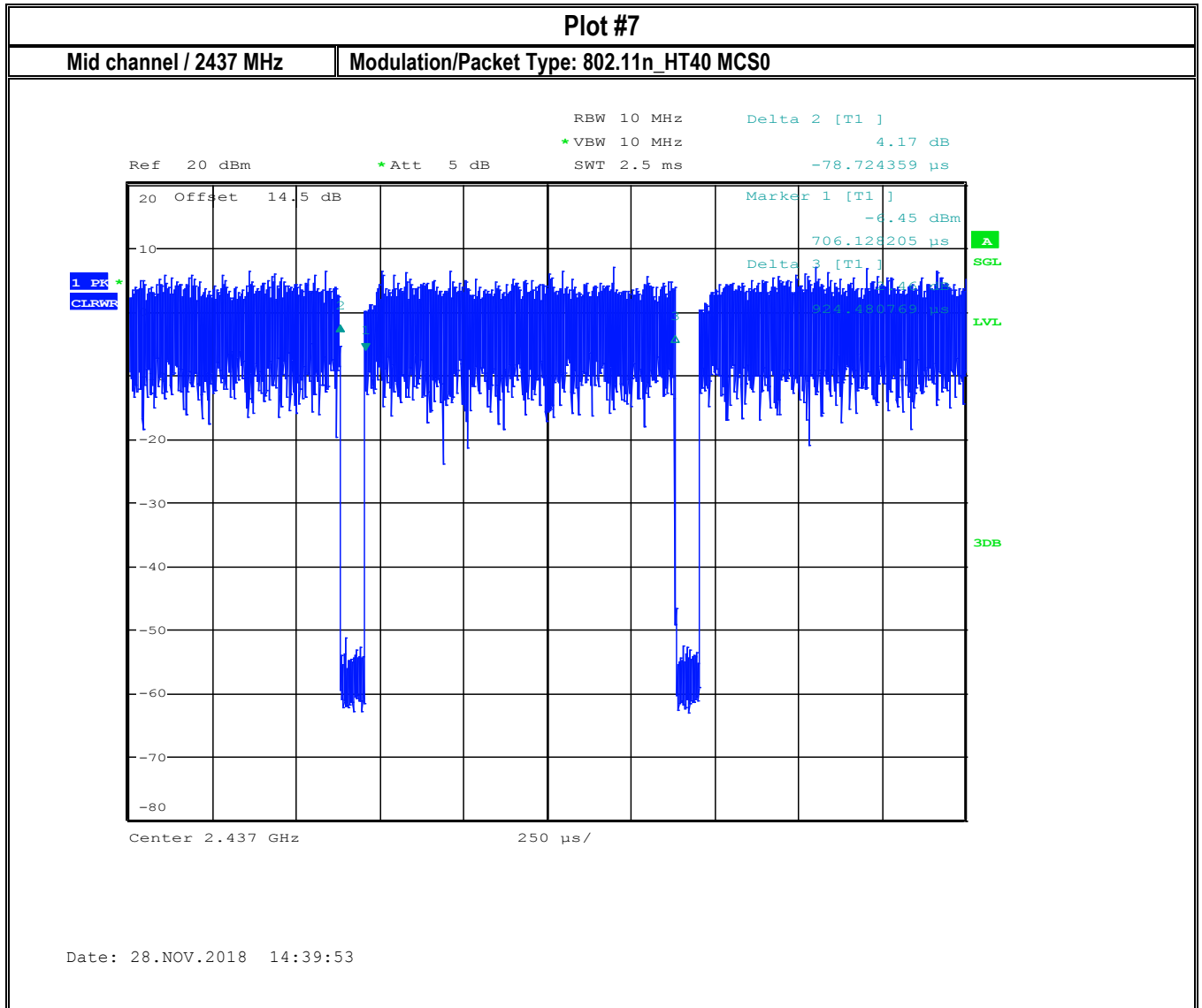
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



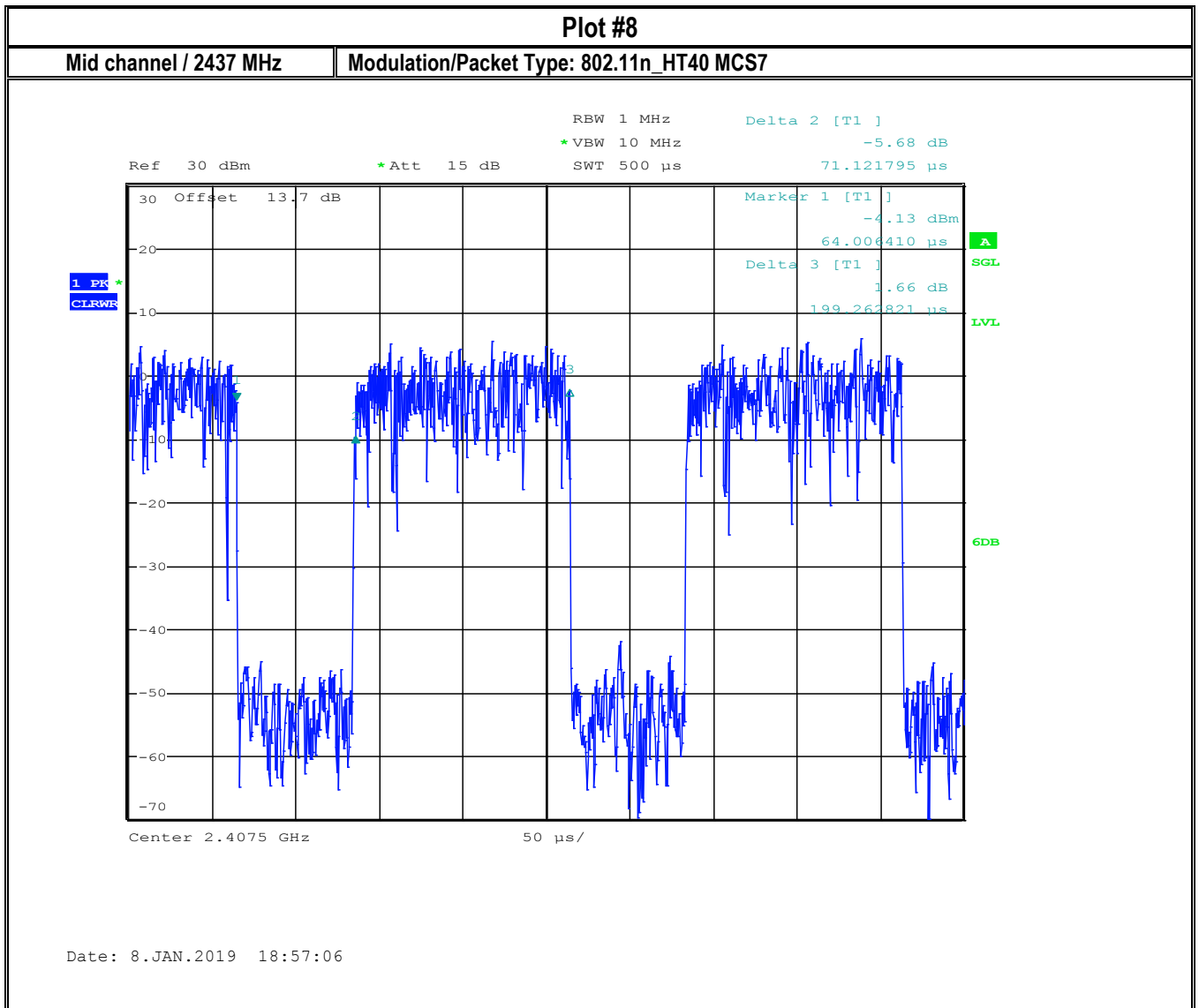
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



8.2 Maximum Conducted Output Power

8.2.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

Spectrum Analyzer settings:

- Measure the duty cycle, x , of the transmitter output signal.
- Set span to at least $1.5 * OBW$.
- Set RBW = 1 % to 5 % of the OBW, not to exceed 1 MHz.
- Set VBW $\geq 3 * RBW$.
- Number of points in sweep $\geq 2 * span / RBW$. Sweep time = auto.
- Detector = RMS (i.e., power averaging).
- Trace average at least 100 traces in power averaging (i.e., RMS) mode;
- Compute power by integrating the spectrum across the OBW of the signal
- Add $10 \log (1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission.

8.2.2 Measurement using a power meter (PM)

Per ANSI C63.10 2013 Method AVGPM

Method AVGPM is a measurement using an RF average power meter as follows:

- As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
- The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- If the transmitter does not transmit continuously. Measure the duty cycle, D , of the transmitter output signal as described in 11.6.
- Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.
- Adjust the measurement in dBm by adding $10 \log [1 / D]$ where D is the duty cycle.

8.2.3 Limits:

Maximum Peak Output Power:

- FCC §15.247 (b)(1): 1 W

8.2.4 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Single Antenna Gain |
|---------------------|--------------|--------------------|---------------|---------------------|
| 22.3° C | 1 | 802.11b/g/n | AC/DC Adapter | 3 dBi |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.2.5 Measurement result:

Attenuation of cable and attenuator (already taken into account): 13.7 dB

SISO Mode Power Table.

| Mode SISO | Tx Chain | Data Rate | Channel | Measured conducted powered(dBm) | Corrected by DCCF (dBm) | EIRP (dBm) | Conducted / EIRP Limit (dBm) | Result |
|--------------|----------|-----------|---------|---------------------------------|-------------------------|------------|------------------------------|--------|
| 802.11b | 0 | 1Mbps | 1 | 22.56 | 22.59 | 25.59 | 30 / 36 | Pass |
| | | | 6 | 25.5 | 25.53 | 28.53 | 30 / 36 | Pass |
| | | | 11 | 22.77 | 22.80 | 25.80 | 30 / 36 | Pass |
| | 1 | 1 Mbps | 1 | 23.09 | 23.12 | 26.12 | 30 / 36 | Pass |
| | | | 6 | 25.47 | 25.50 | 28.50 | 30 / 36 | Pass |
| | | | 11 | 22.56 | 22.59 | 25.59 | 30 / 36 | Pass |
| 802.11g | 0 | 6Mbps | 1 | 20.07 | 20.22 | 23.22 | 30 / 36 | Pass |
| | | | 6 | 25.29 | 25.44 | 28.44 | 30 / 36 | Pass |
| | | | 11 | 20.27 | 20.42 | 23.42 | 30 / 36 | Pass |
| | 1 | 54Mbps | 1 | 20.24 | 20.28 | 23.28 | 30 / 36 | Pass |
| | | | 6 | 25.22 | 25.26 | 28.26 | 30 / 36 | Pass |
| | | | 11 | 19.81 | 19.85 | 22.85 | 30 / 36 | Pass |
| 802.11n_HT20 | 0 | MCS0 | 1 | 18.89 | 19.03 | 22.03 | 30 / 36 | Pass |
| | | | 6 | 25.24 | 25.38 | 28.38 | 30 / 36 | Pass |
| | | | 11 | 19.22 | 19.36 | 22.36 | 30 / 36 | Pass |
| | 1 | MCS0 | 1 | 19.1 | 19.24 | 22.24 | 30 / 36 | Pass |
| | | | 6 | 25.14 | 25.28 | 28.28 | 30 / 36 | Pass |
| | | | 11 | 18.68 | 18.82 | 21.82 | 30 / 36 | Pass |
| 802.11n_HT40 | 0 | MCS0 | 3 | 15.03 | 15.37 | 18.37 | 30 / 36 | Pass |
| | | | 6 | 15.18 | 15.52 | 18.52 | 30 / 36 | Pass |
| | | | 9 | 15.44 | 15.78 | 18.78 | 30 / 36 | Pass |
| | 1 | MCS0 | 3 | 15.54 | 15.88 | 18.88 | 30 / 36 | Pass |
| | | | 6 | 15.49 | 15.83 | 18.83 | 30 / 36 | Pass |
| | | | 9 | 15.31 | 15.65 | 18.65 | 30 / 36 | Pass |

EIRP = Conducted output power + Antenna gain

TX Chain 1 power measurements were done using an ETS-Lindgren USB RF Power Sensor sampling at 5 M S /s.

Measurements are stored on associated project folder.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

Maximum conducted output is used to compute the Power for MIMO below.
MIMO Mode Power Table

| Mode | Tx Chain | Date Rate | Channel | Measured sum of Max conducted DCC powered (mw) | Summed power MIMO (dBm) | EIRP (dBm) | Conducted / EIRP Limit (dBm) | Result |
|---------------|----------|-----------|---------|--|-------------------------|------------|------------------------------|--------|
| 802.11n_H T20 | 0 / 1 | MCS0 | 1 | 165.71 | 22.19 | 25.19 | 30 / 36 | Pass |
| | | | 6 | 689.85 | 28.39 | 31.39 | 30 / 36 | Pass |
| | | | 11 | 164.27 | 22.16 | 25.16 | 30 / 36 | Pass |
| 802.11n_H T20 | 0 / 1 | MCS0 | 3 | 73.16 | 18.64 | 21.64 | 30 / 36 | Pass |
| | | | 6 | 73.93 | 18.69 | 21.69 | 30 / 36 | Pass |
| | | | 9 | 74.57 | 18.73 | 21.73 | 30 / 36 | Pass |

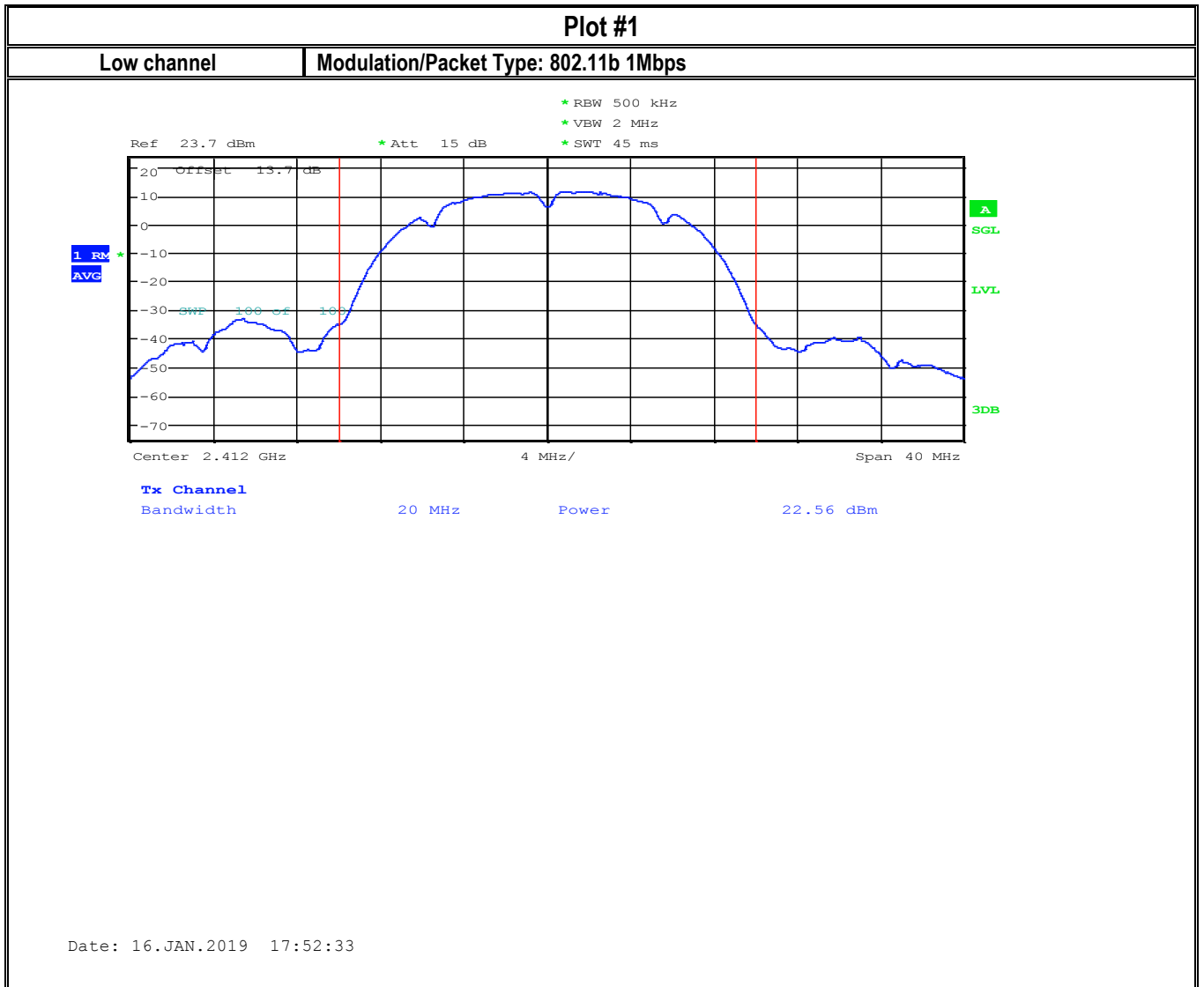
Conducted Limit for MIMO = 30 dBm. Directional Gain = GANT. No correlation between Spatial Streams for MIMO.
Note: For MIMO above the power of both chains was summed and the Antenna gain was added to this summed power to calculate the EIRP.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

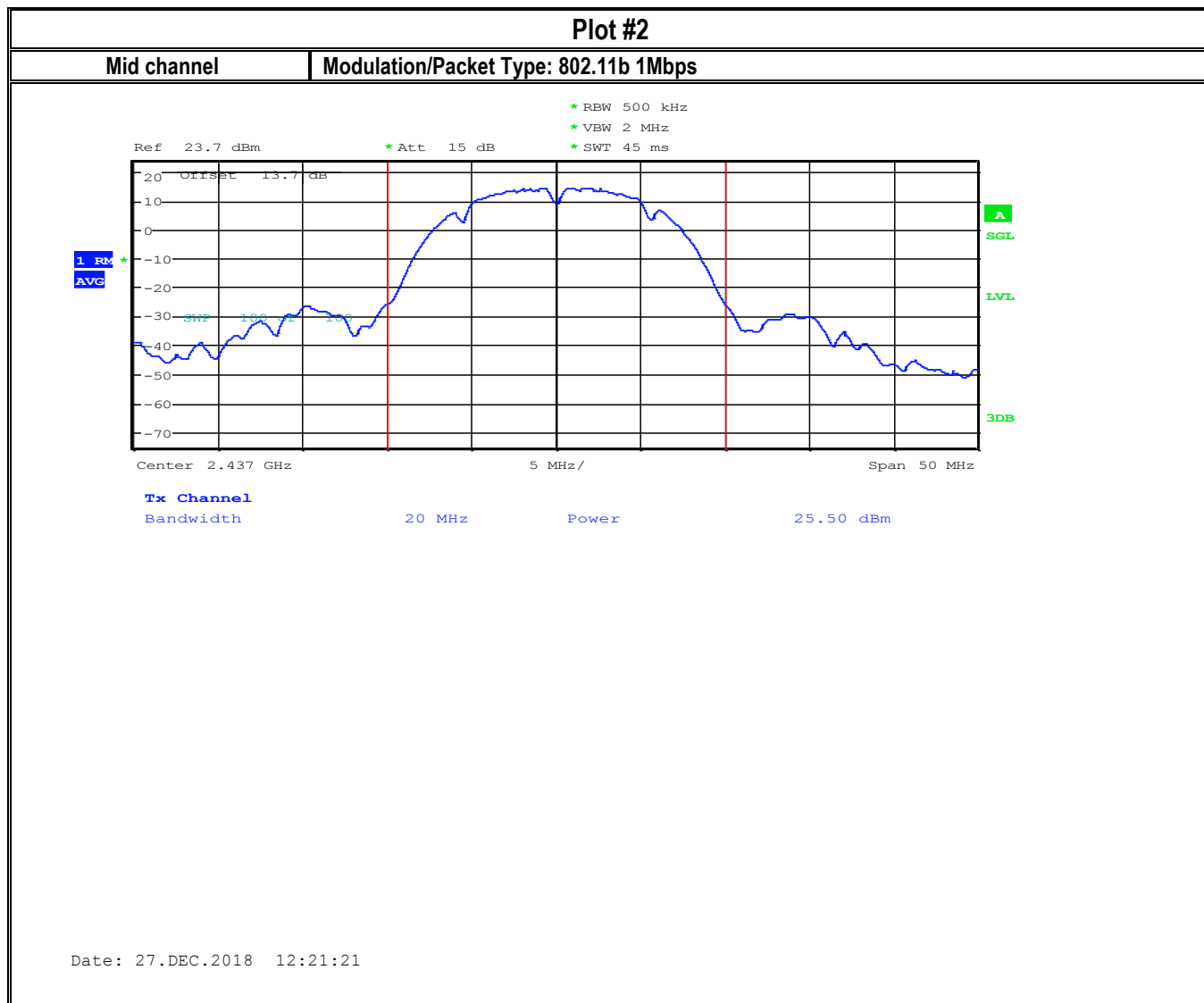
8.2.6 Plots

Power Plots for Antenna Chain 0



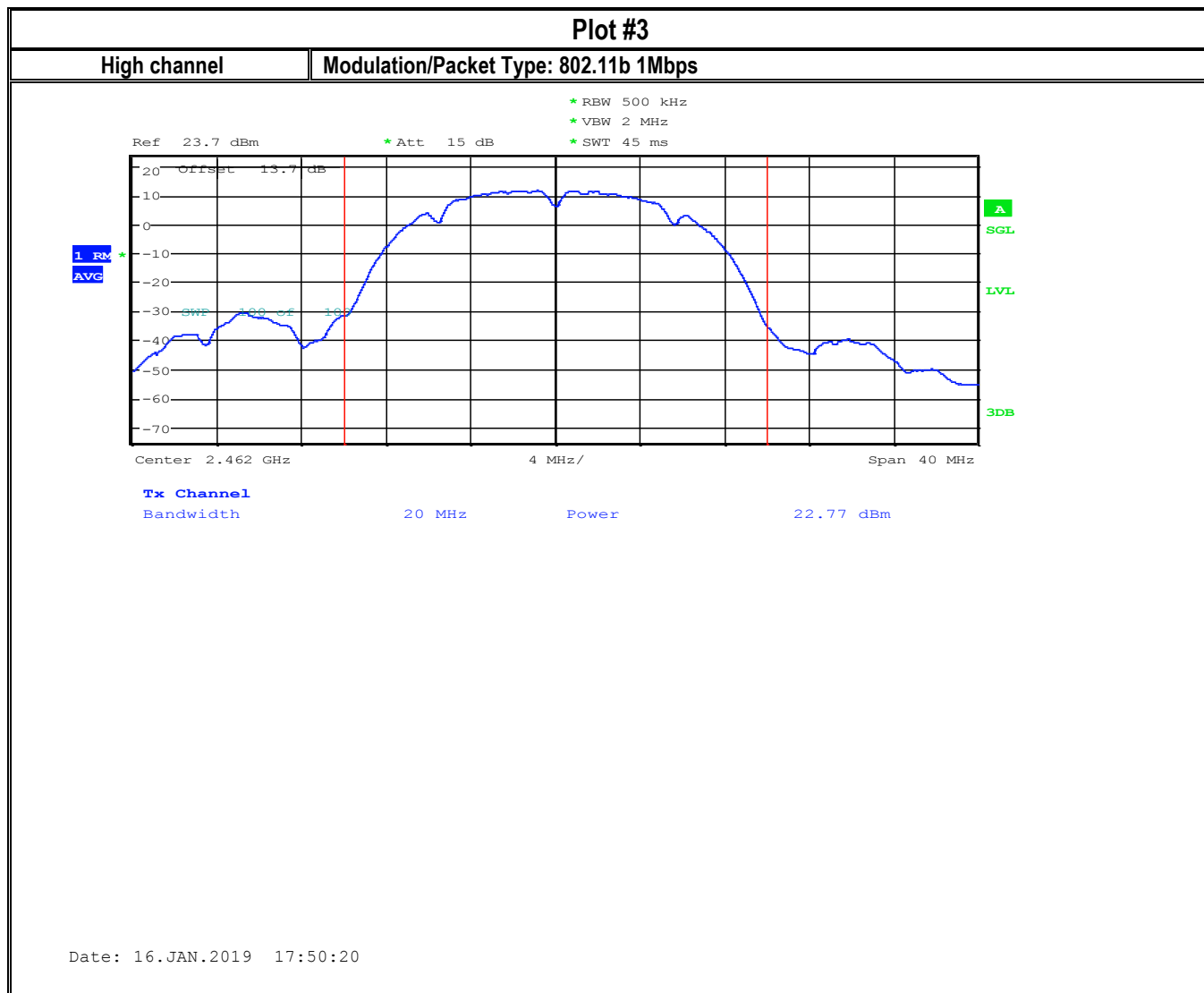
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411



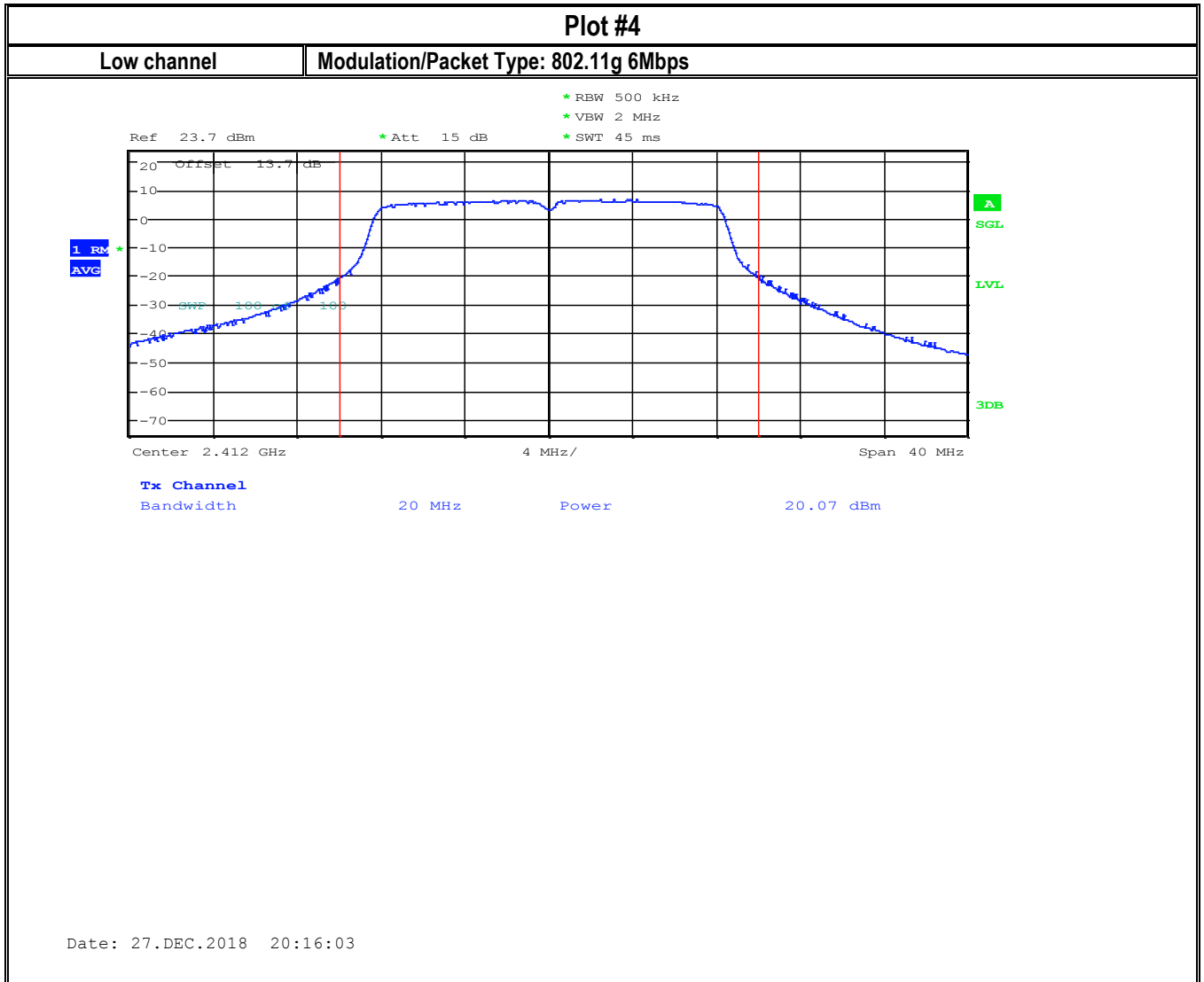
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



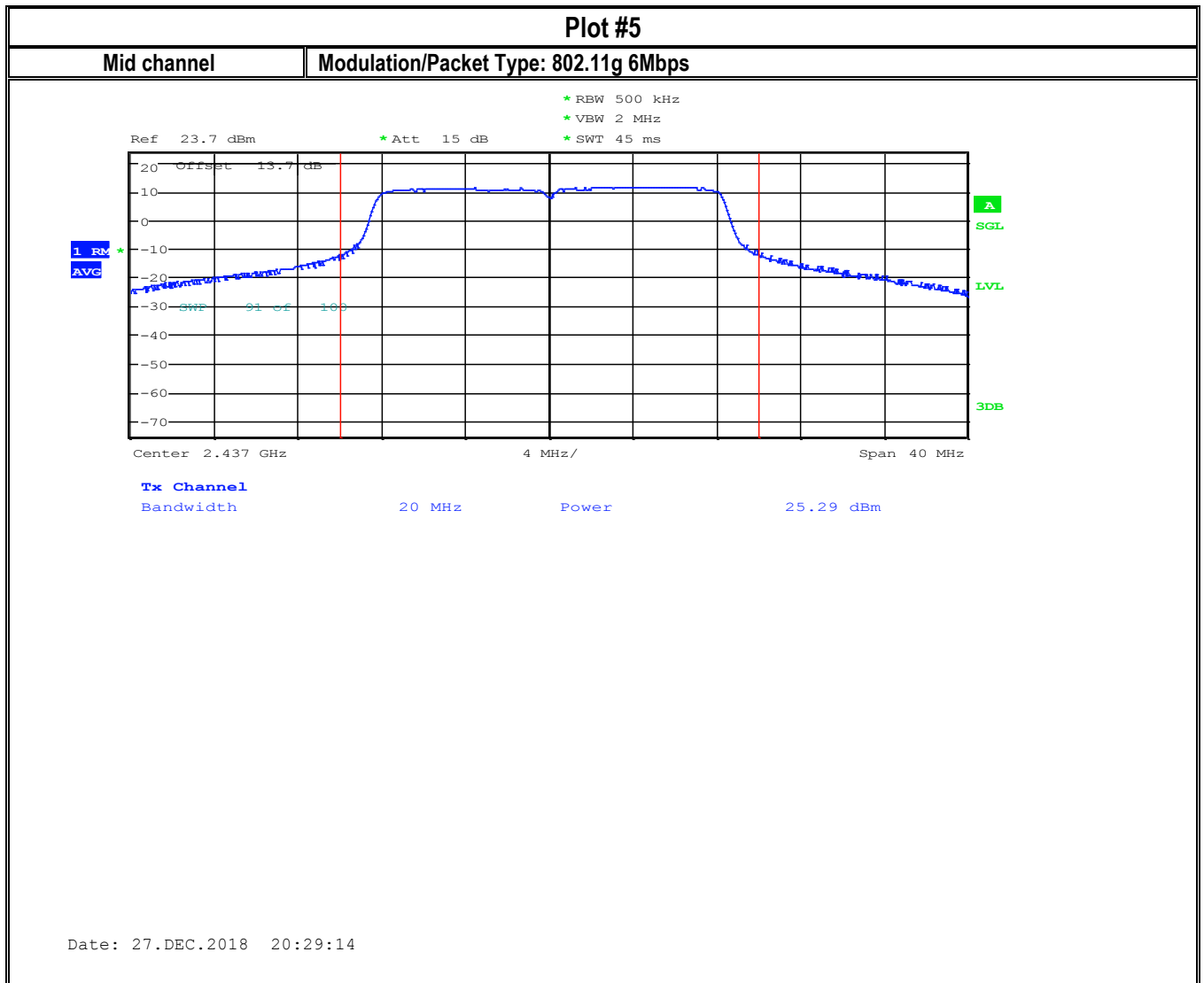
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



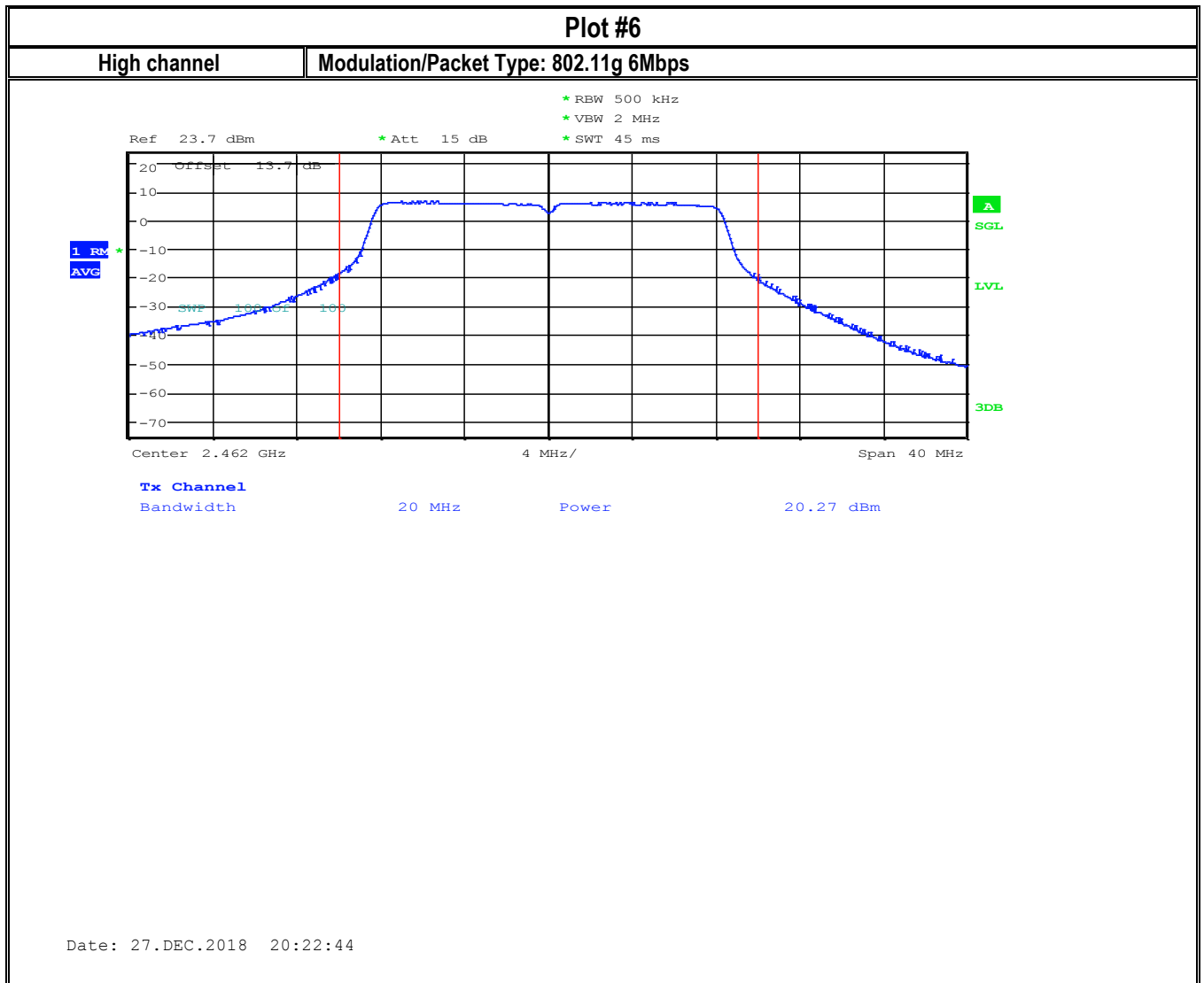
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



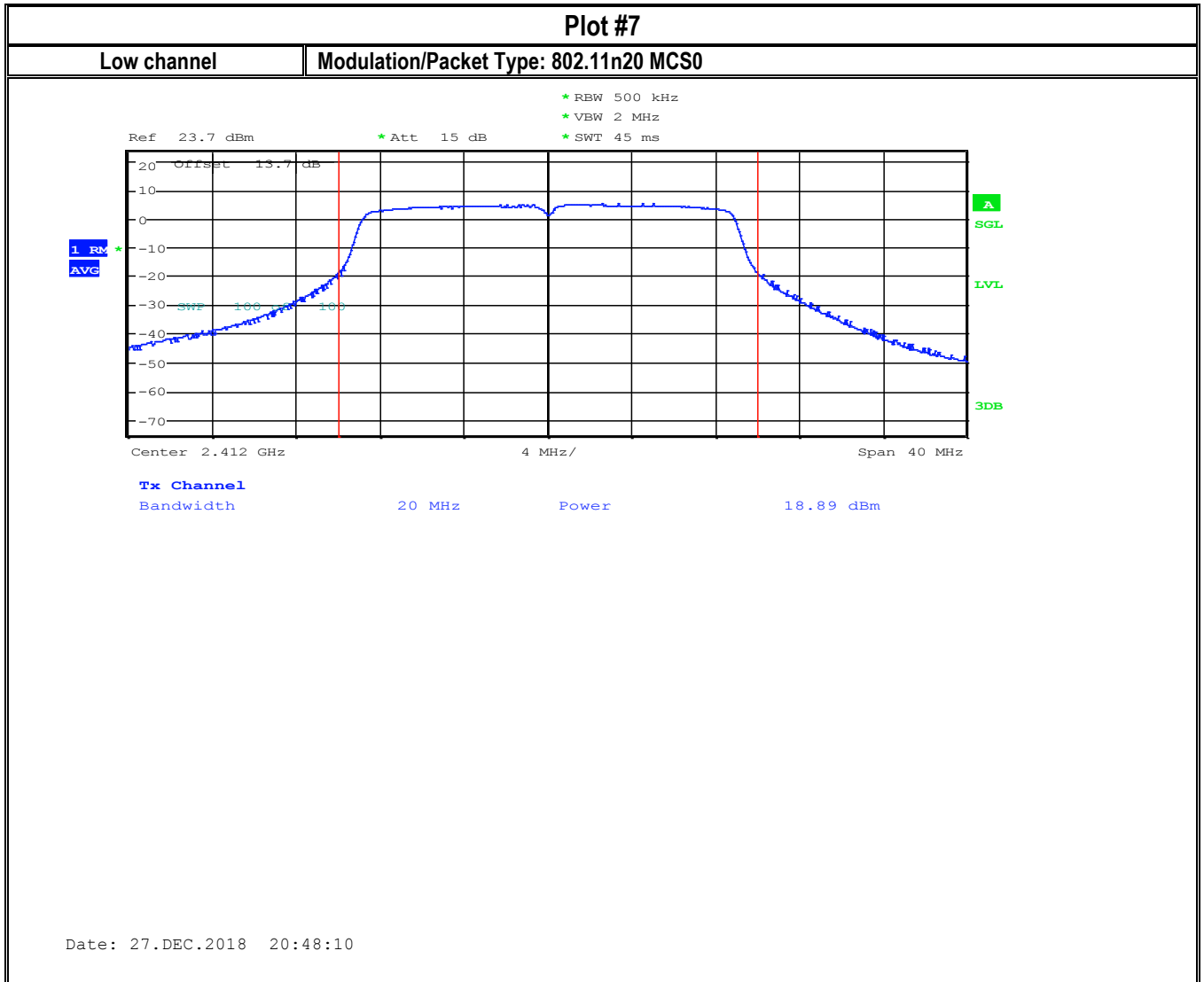
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



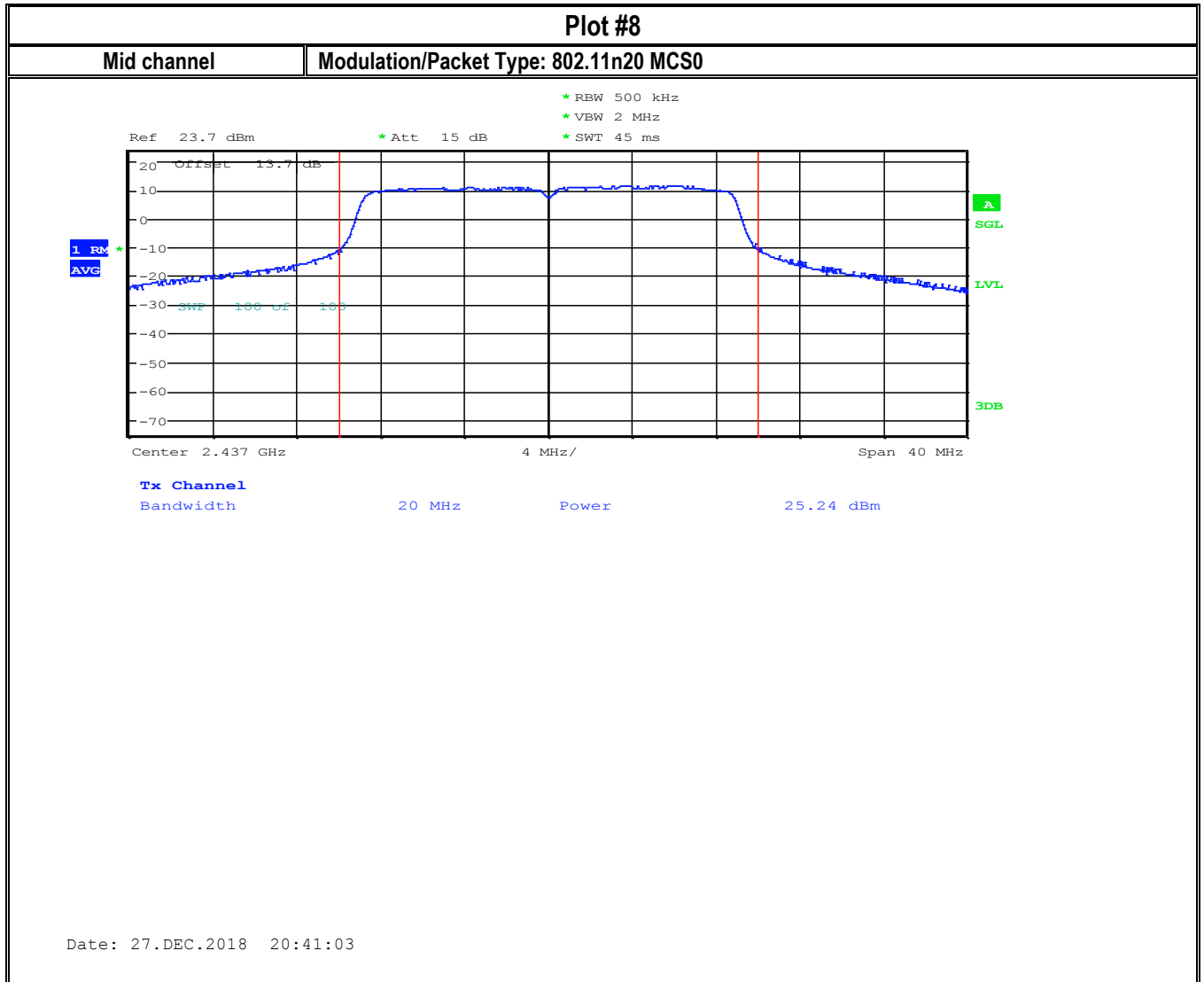
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



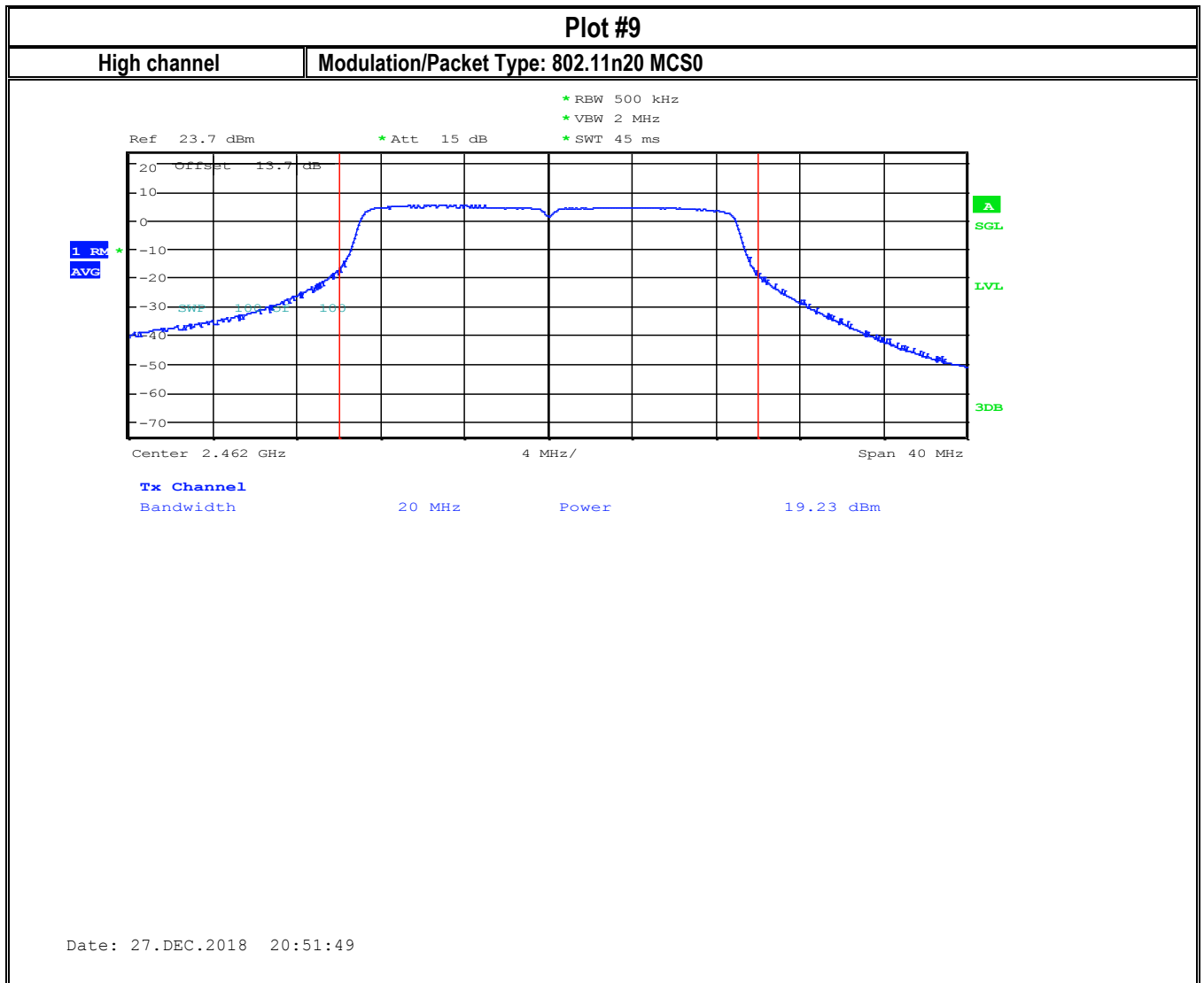
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



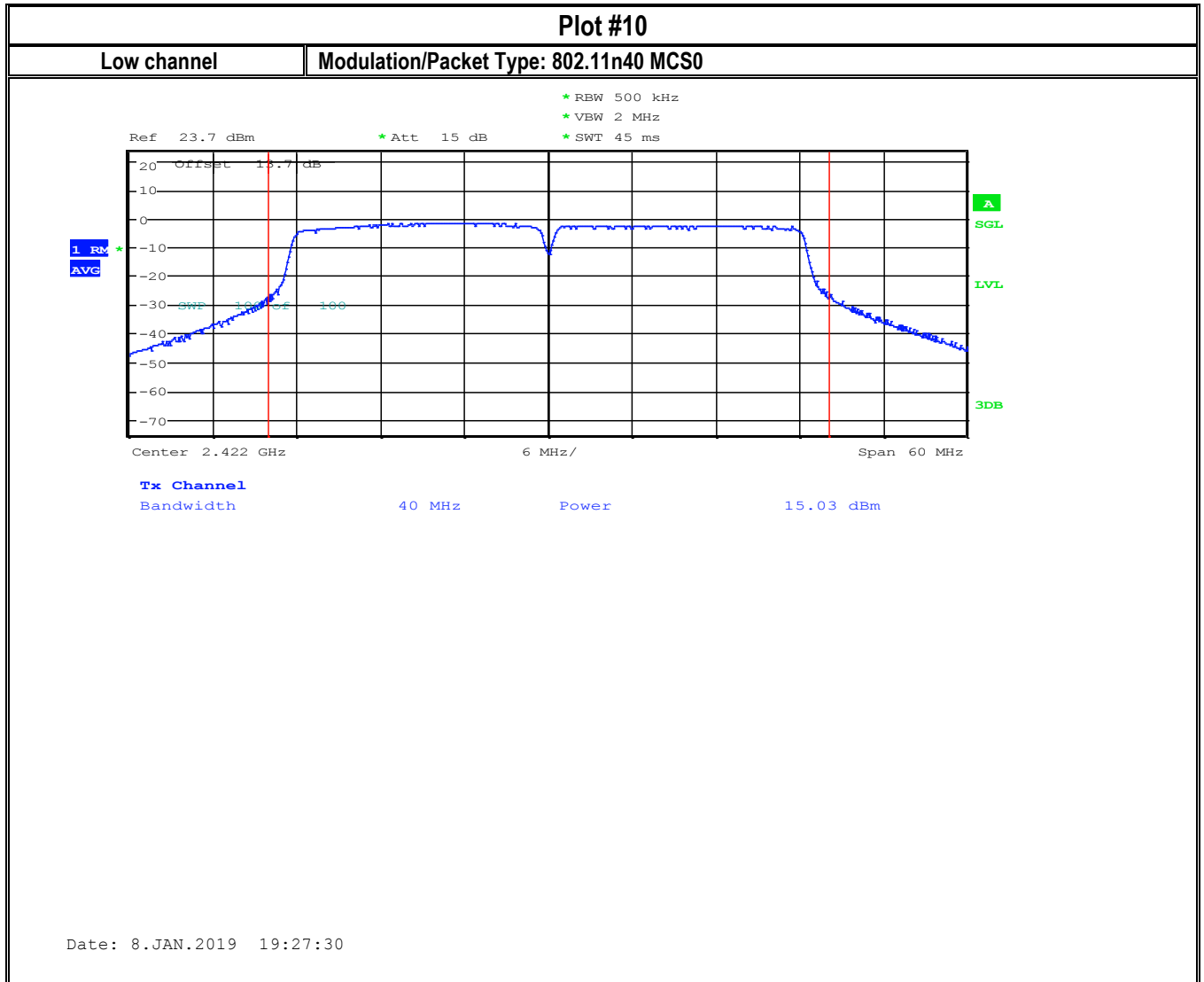
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



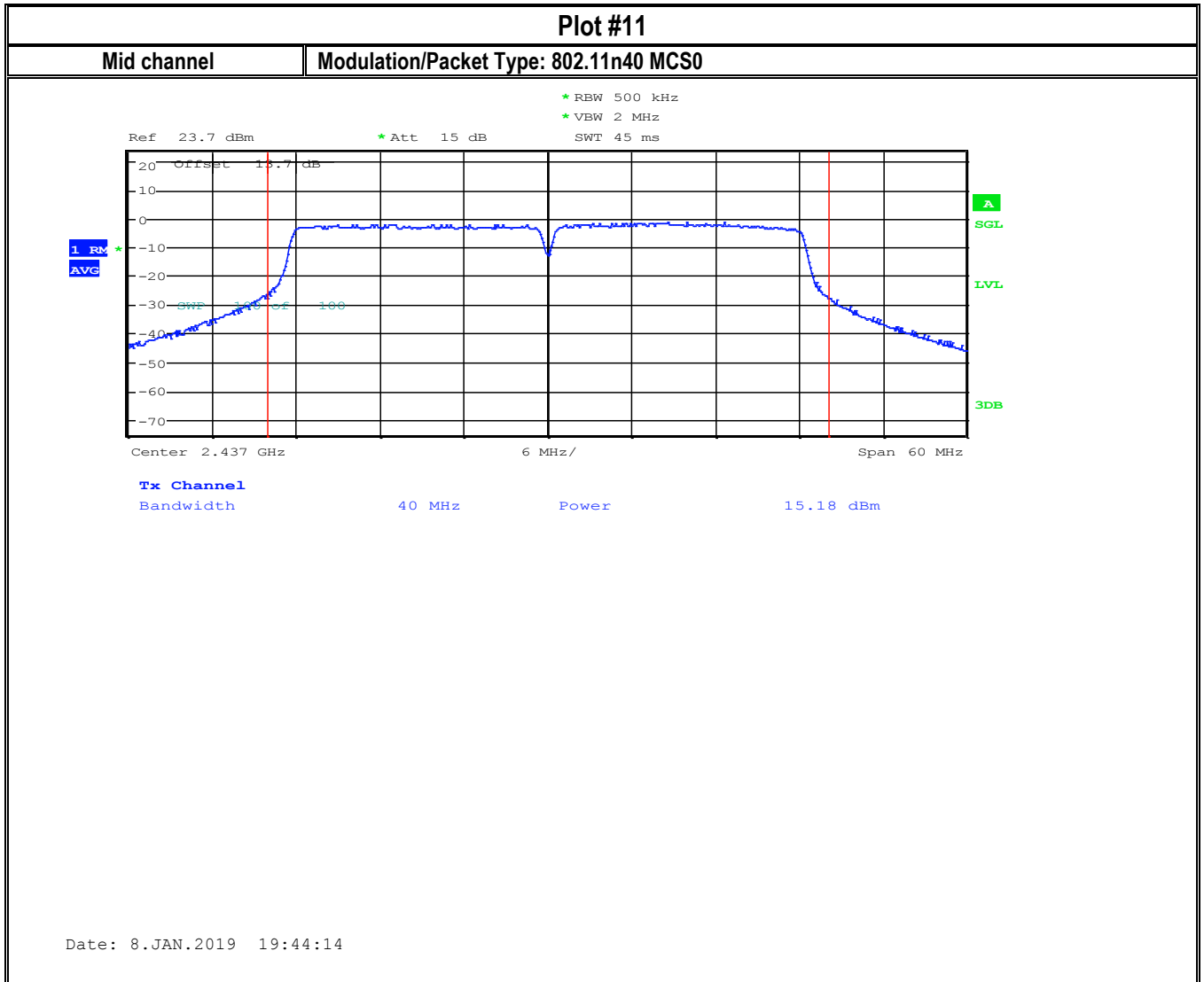
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



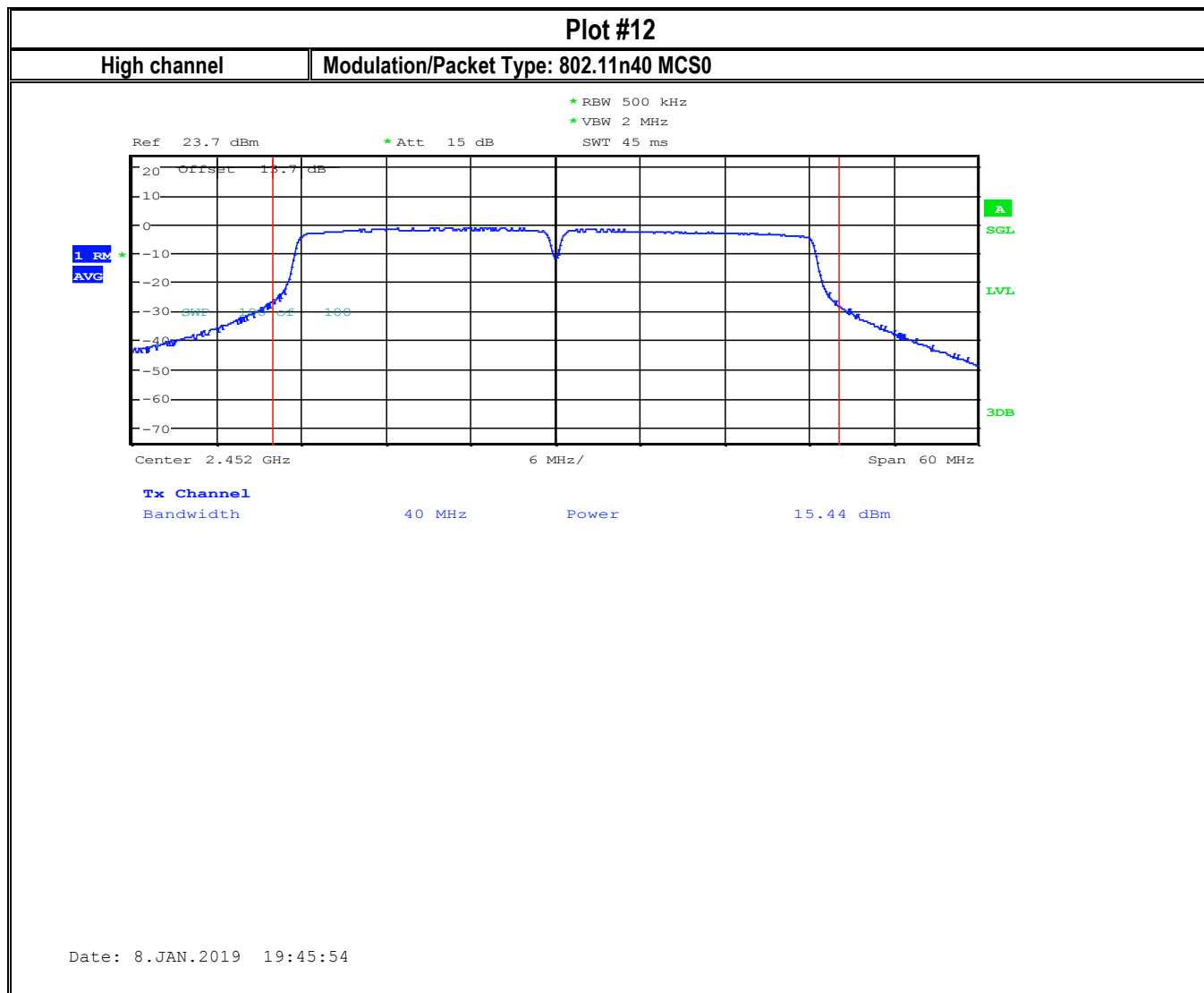
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411



8.3 Power Spectral Density

8.3.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

Per KDB guidance ANSI C63.10-2013 Section 11.10.1 / 2 Method PKPSD was used

8.3.2 Spectrum Analyzer settings for Peak PSD method:

- Set analyzer center frequency to DTS channel center frequency
- Set the span to 1.5 x DTS bandwidth
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- 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, reduce RBW (no less than 3 kHz) and repeat

8.3.3 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.

8.3.4 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Single Antenna Gain |
|---------------------|--------------|--------------------|-----------------------------|---------------------|
| 23.3° C | 1 | 802.11b/g/n | 12 VDC via
AC/DC Adapter | 3dBi |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.3.5 Measurement result:

Measurement results for SISO chain 0 PSD Plots 1-11.

| Plot # | Mode | Data Rate | Tx chain | channel | Maximum Power Spectral Density (dBm/3 kHz) | PSD Adjusted for Antenna Gain (dBm / 3 kHz) | Limit (dBm / 3 kHz) | Result |
|--------|------------|-----------|----------|---------|--|---|-----------------------|--------|
| 1 | 802.11b | 1Mbps | 0 | 1 | 0.46 | 3.46 | 8 | Pass |
| 2 | | | | 6 | 2.3 | 5.30 | 8 | Pass |
| 3 | | | | 11 | 0.26 | 3.26 | 8 | Pass |
| 4 | 802.11g | 6Mbps | 0 | 1 | -2.98 | 0.02 | 8 | Pass |
| 5 | | | | 6 | 2.26 | 5.26 | 8 | Pass |
| 6 | | | | 11 | -4.11 | -1.11 | 8 | Pass |
| 7 | 802.11n_20 | MCS0 | 0 | 1 | -6.19 | -3.19 | 8 | Pass |
| 8 | | | | 6 | 0.74 | 3.74 | 8 | Pass |
| 9 | | | | 11 | -5.42 | -2.42 | 8 | Pass |
| 10 | 802.11n_40 | MCS0 | 0 | 3 | -10.74 | -7.74 | 8 | Pass |
| 11 | | | | 6 | -11.29 | -8.29 | 8 | Pass |
| 12 | | | | 9 | -10.83 | -7.83 | 8 | Pass |

Attenuation of cable and attenuator (already taken into account): 13.7 dB

Chain 1 demonstrated same levels to Chain 0.

Using the measured results and accounting for antenna gain the following results are derived for MIMO Mode

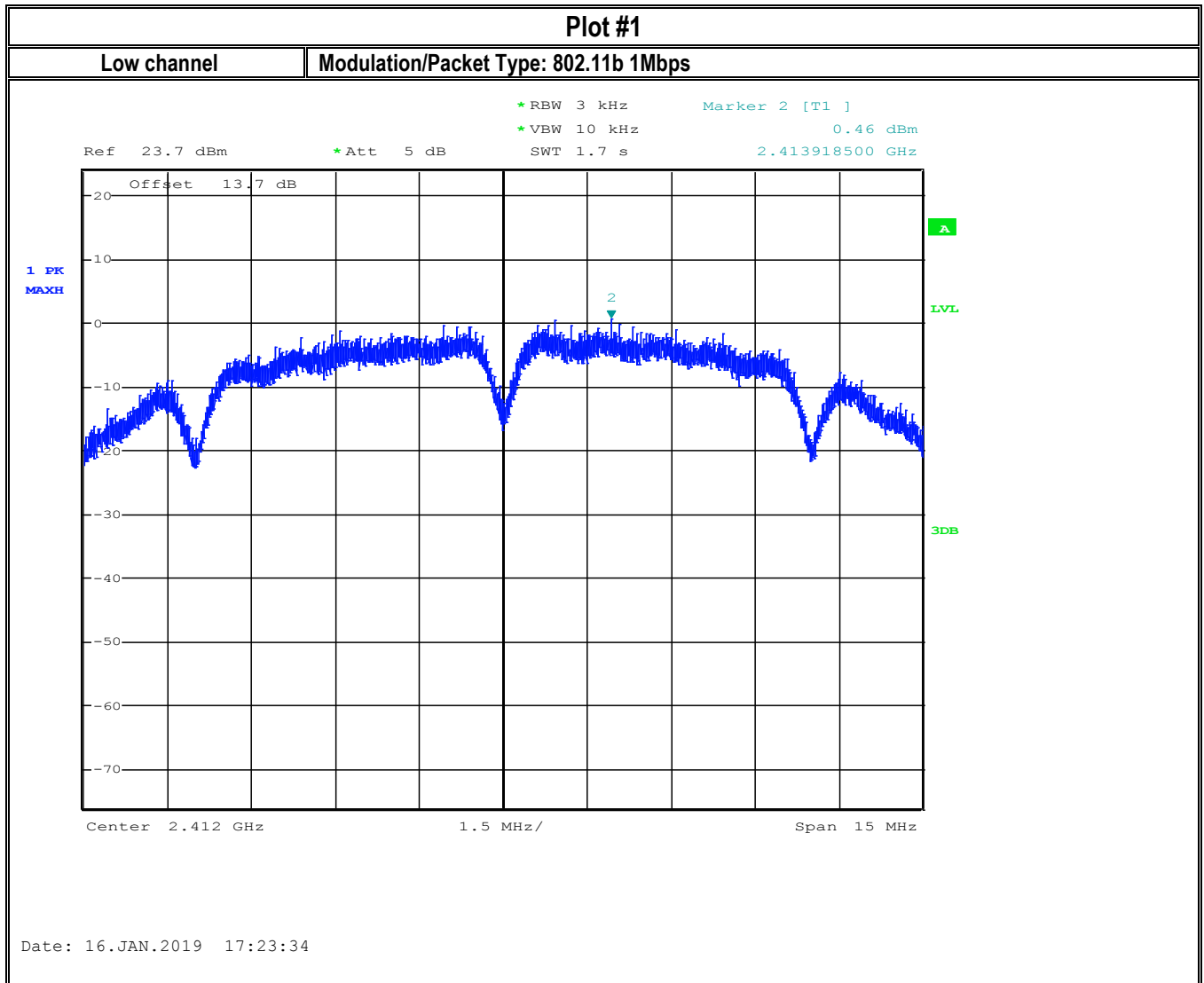
| Mode | Data Rate | Tx chain | channel | Summed Power Spectral Density for Chain 0&1 (dBm / 3 kHz) | PSD Adjusted for Antenna Gain (dBm / 3 kHz) | Limit (dBm / 3 kHz) | Result |
|------------|-----------|----------|---------|---|---|-----------------------|--------|
| 802.11n_20 | MCS0 | 0 / 1 | 1 | -3.18 | -0.18 | 8 | Pass |
| | | | 6 | 3.75 | 6.75 | 8 | Pass |
| | | | 11 | -2.41 | 0.59 | 8 | Pass |
| 802.11n_40 | MCS0 | 0 / 1 | 3 | -7.73 | -4.73 | 8 | Pass |
| | | | 6 | -8.28 | -5.28 | 8 | Pass |
| | | | 9 | -7.82 | -4.82 | 8 | Pass |

MIMO Directional Gain = GANT. No correlation between Spatial Streams for MIMO.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

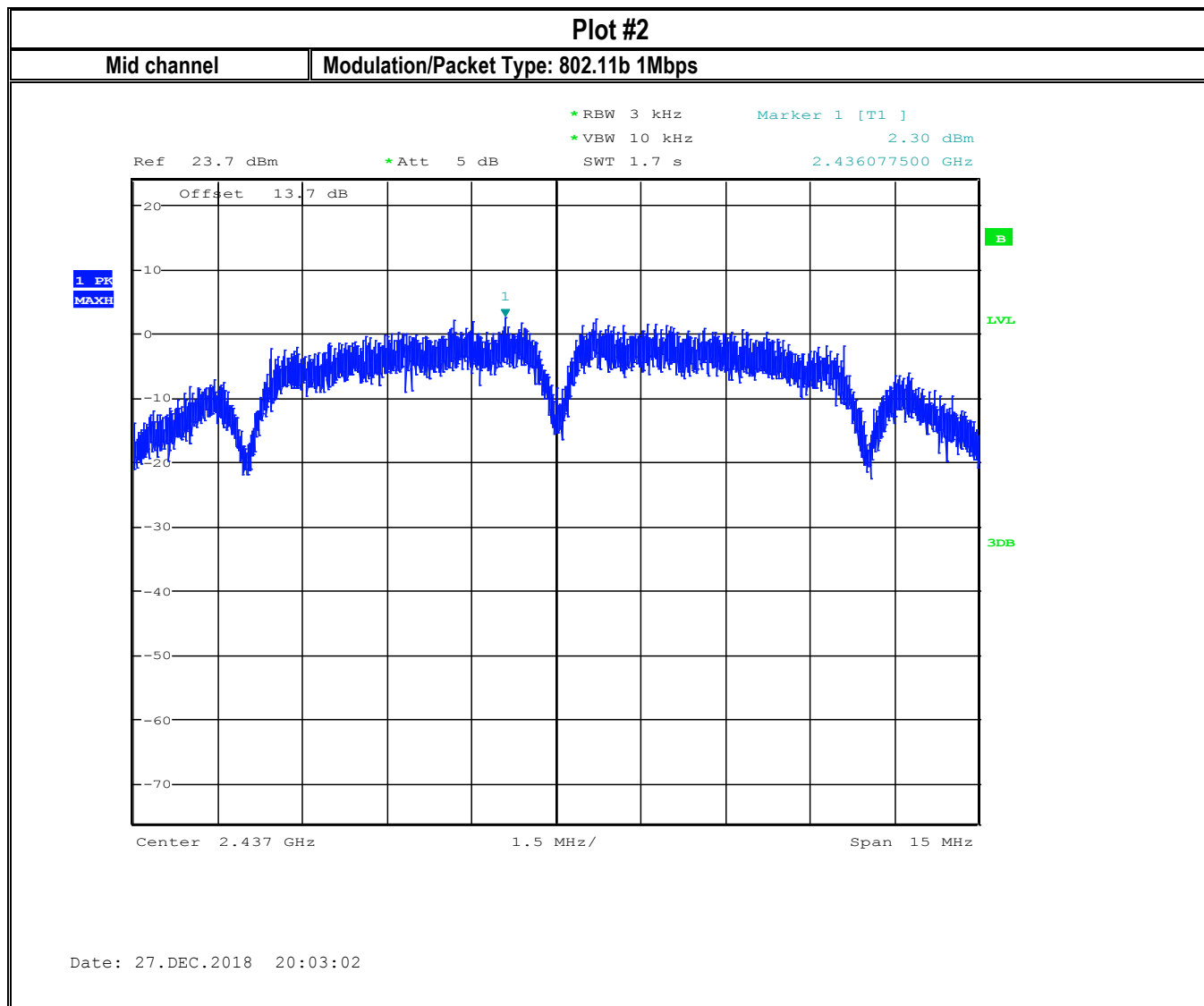
FCC ID: UUU-5411

8.3.6 Measurement Plots:



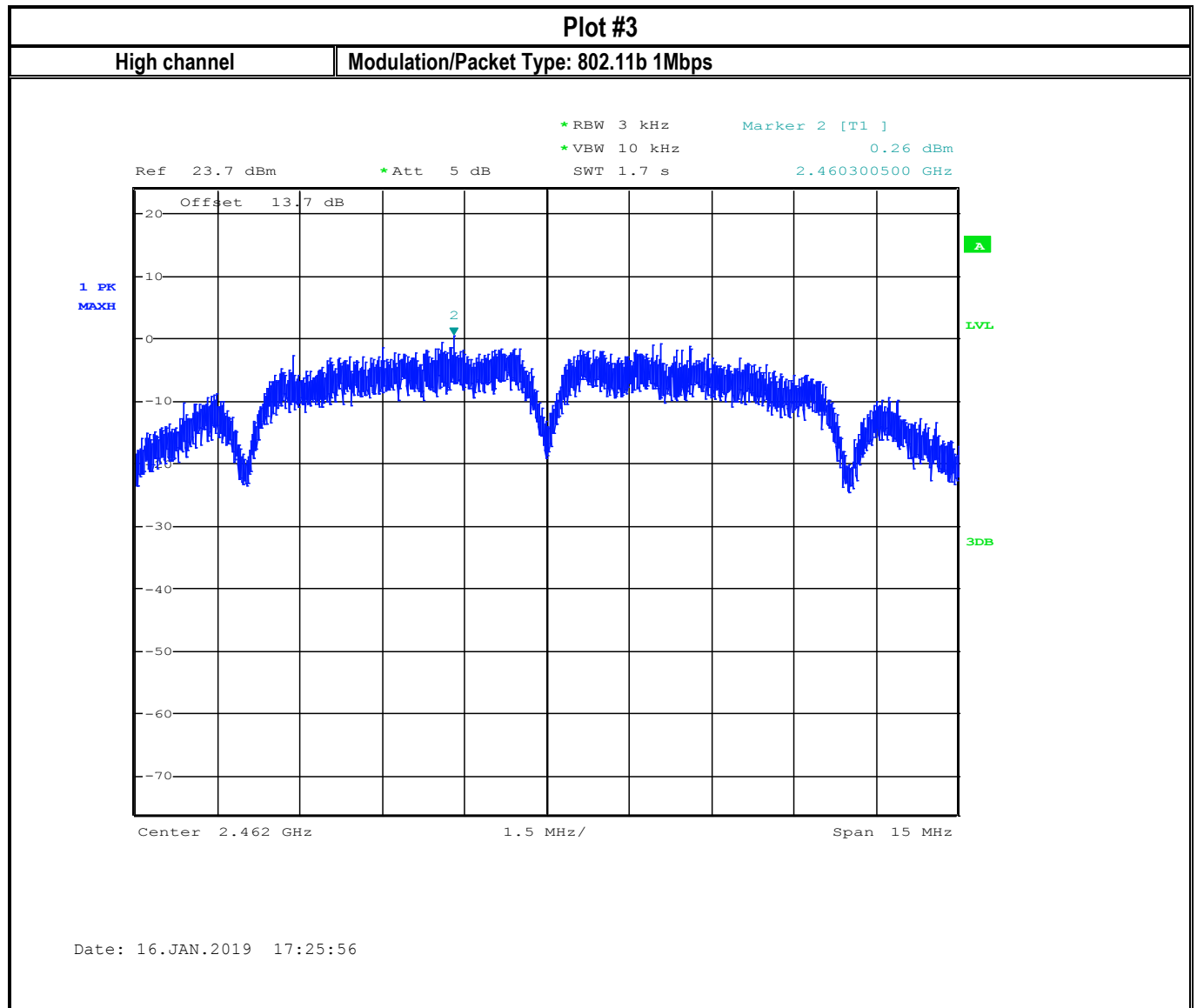
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



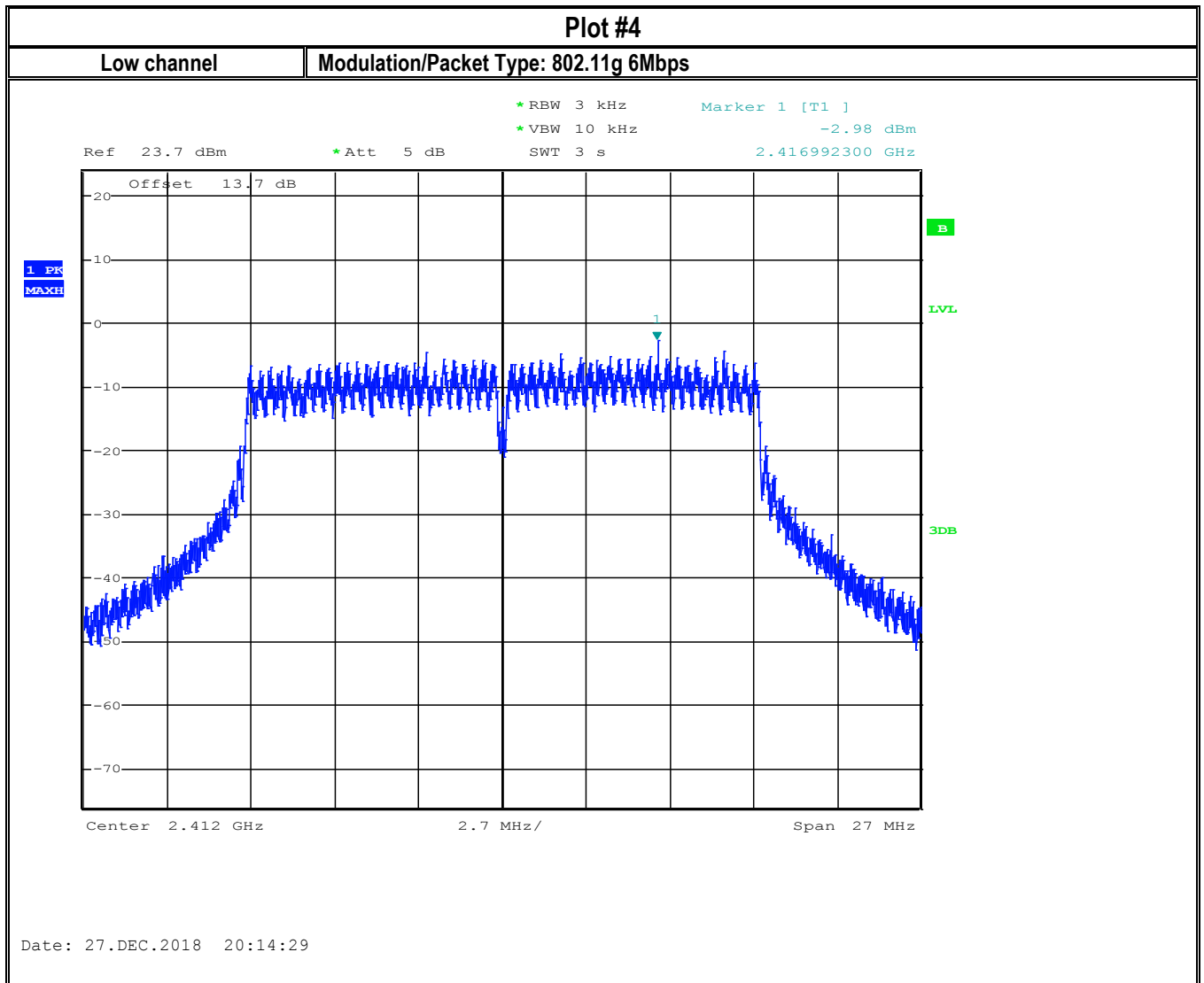
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



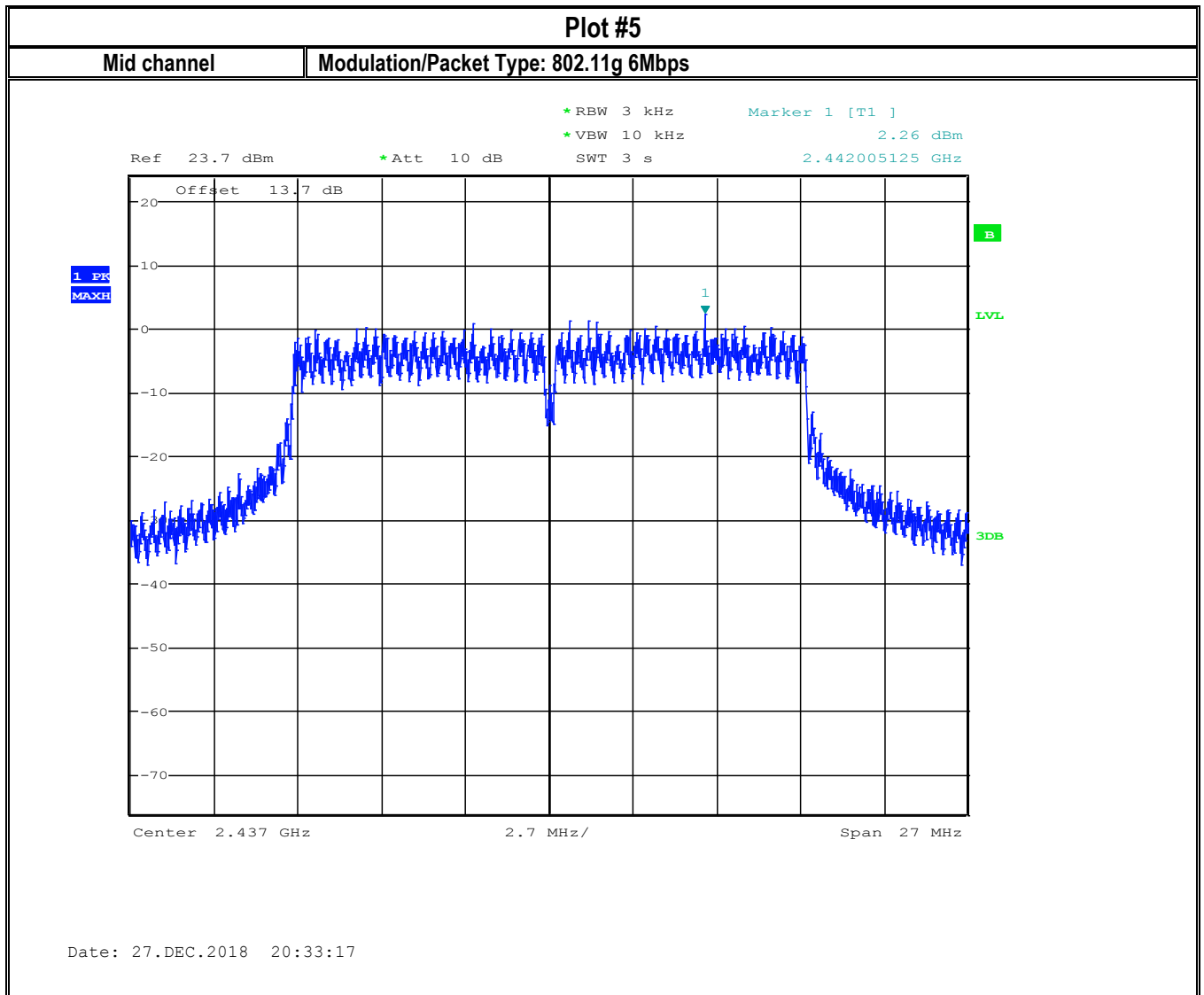
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



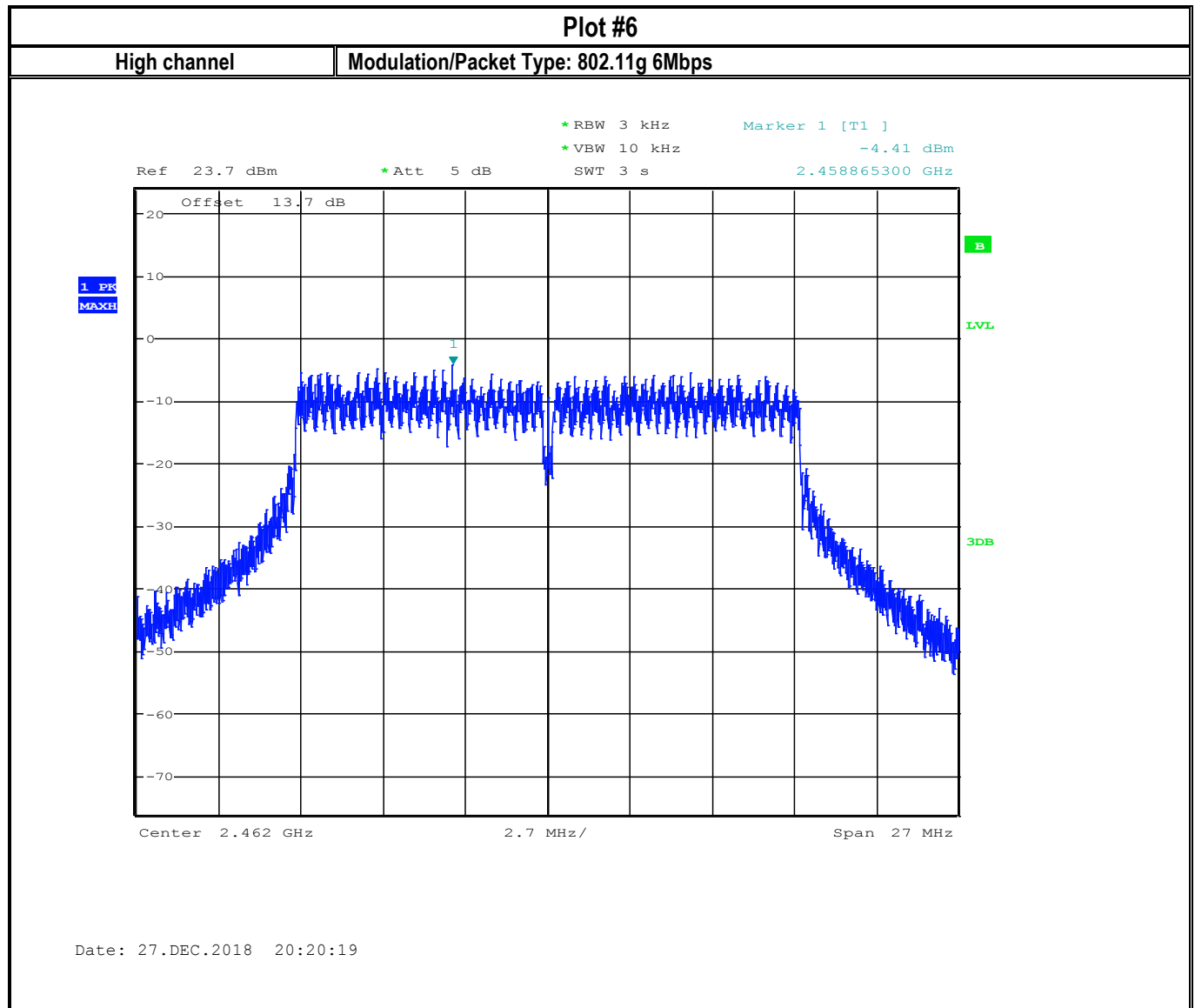
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



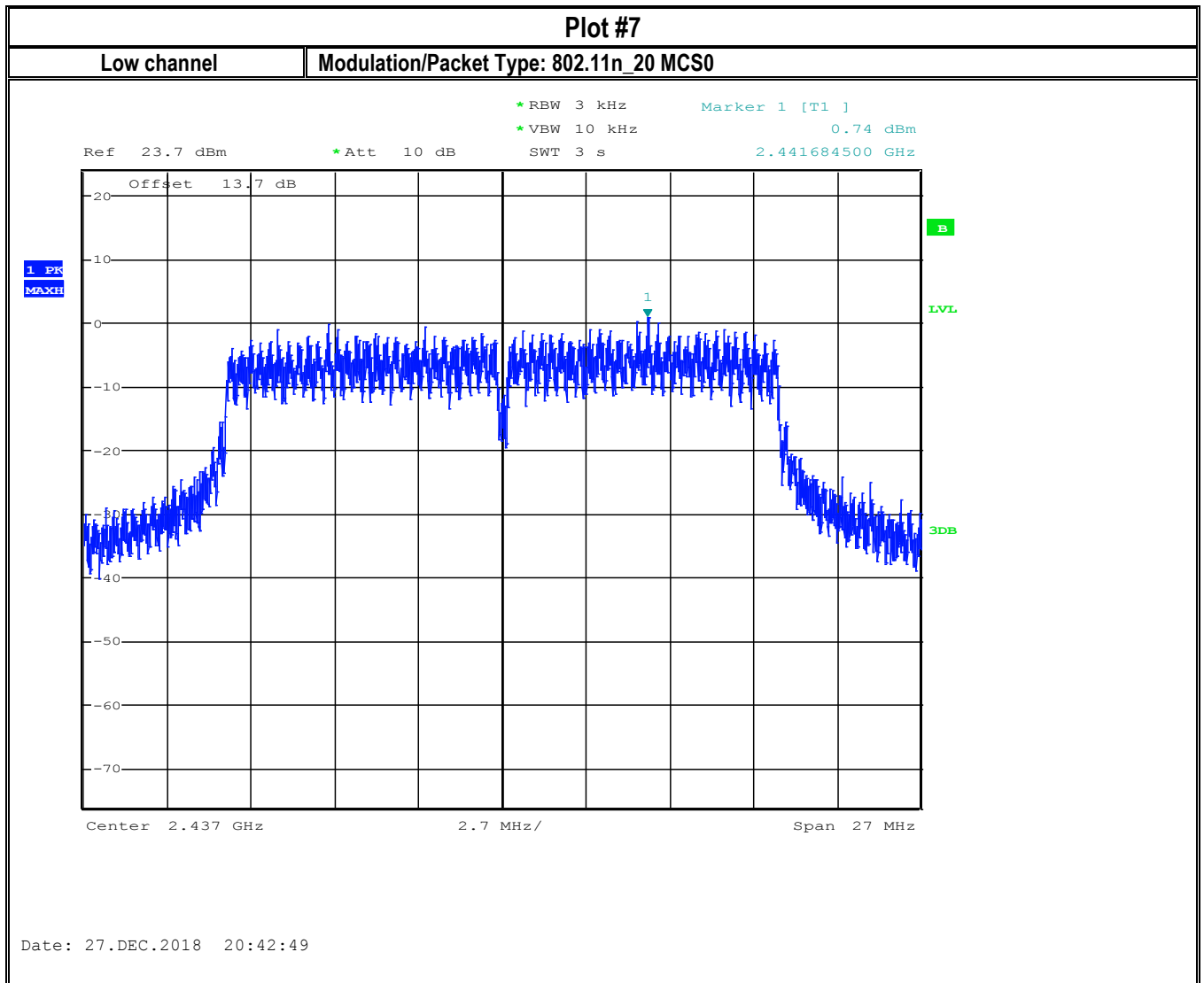
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



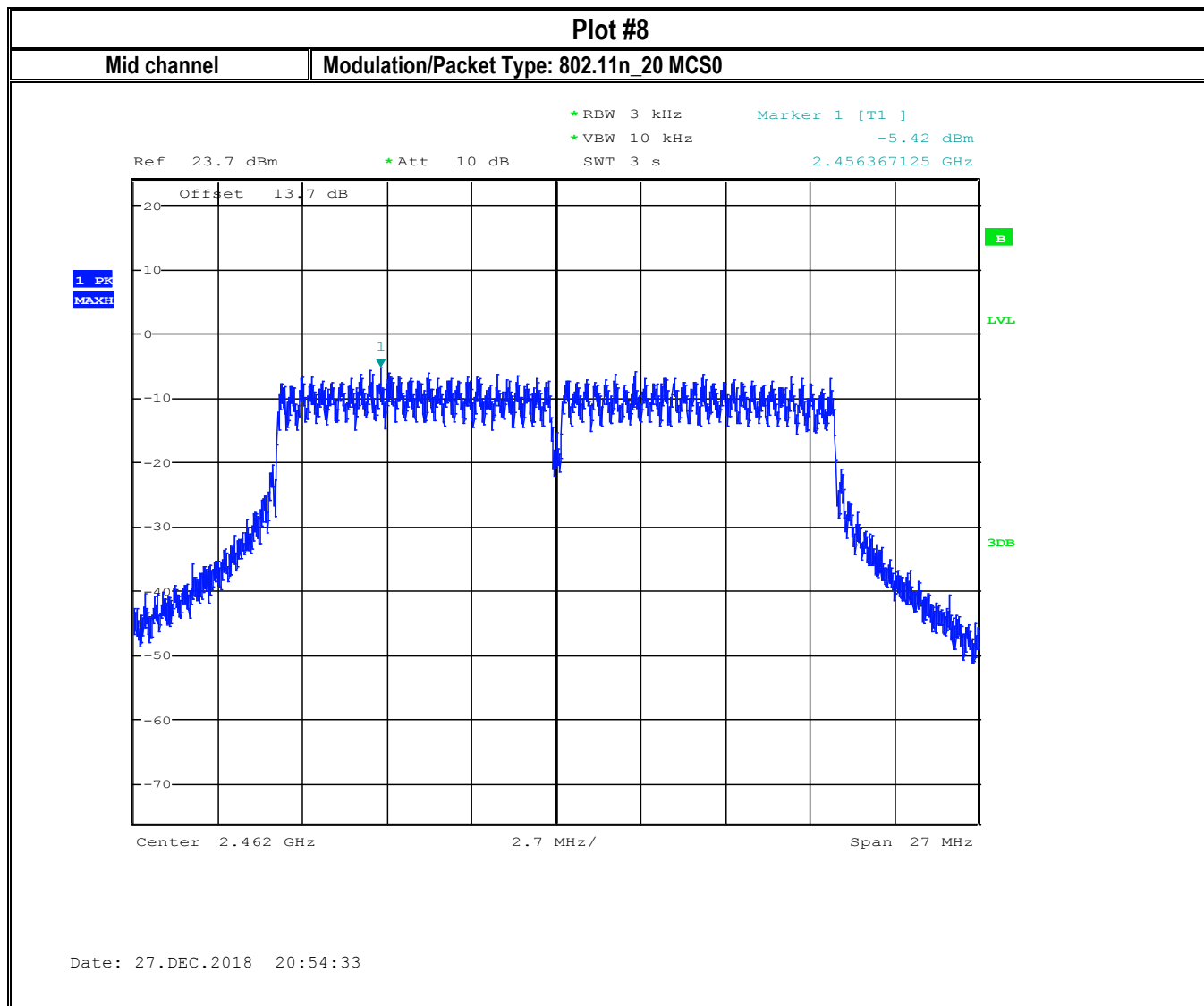
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



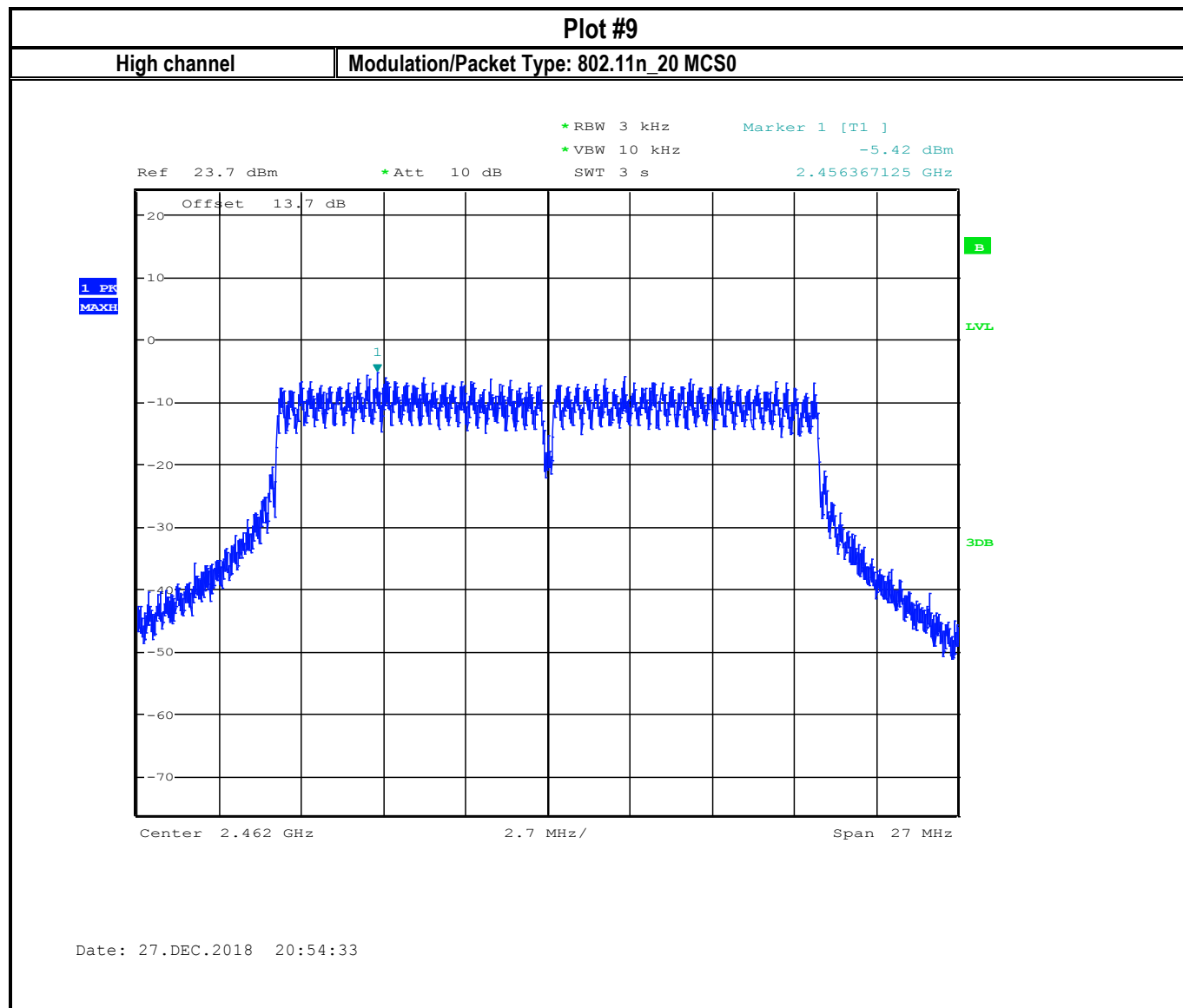
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



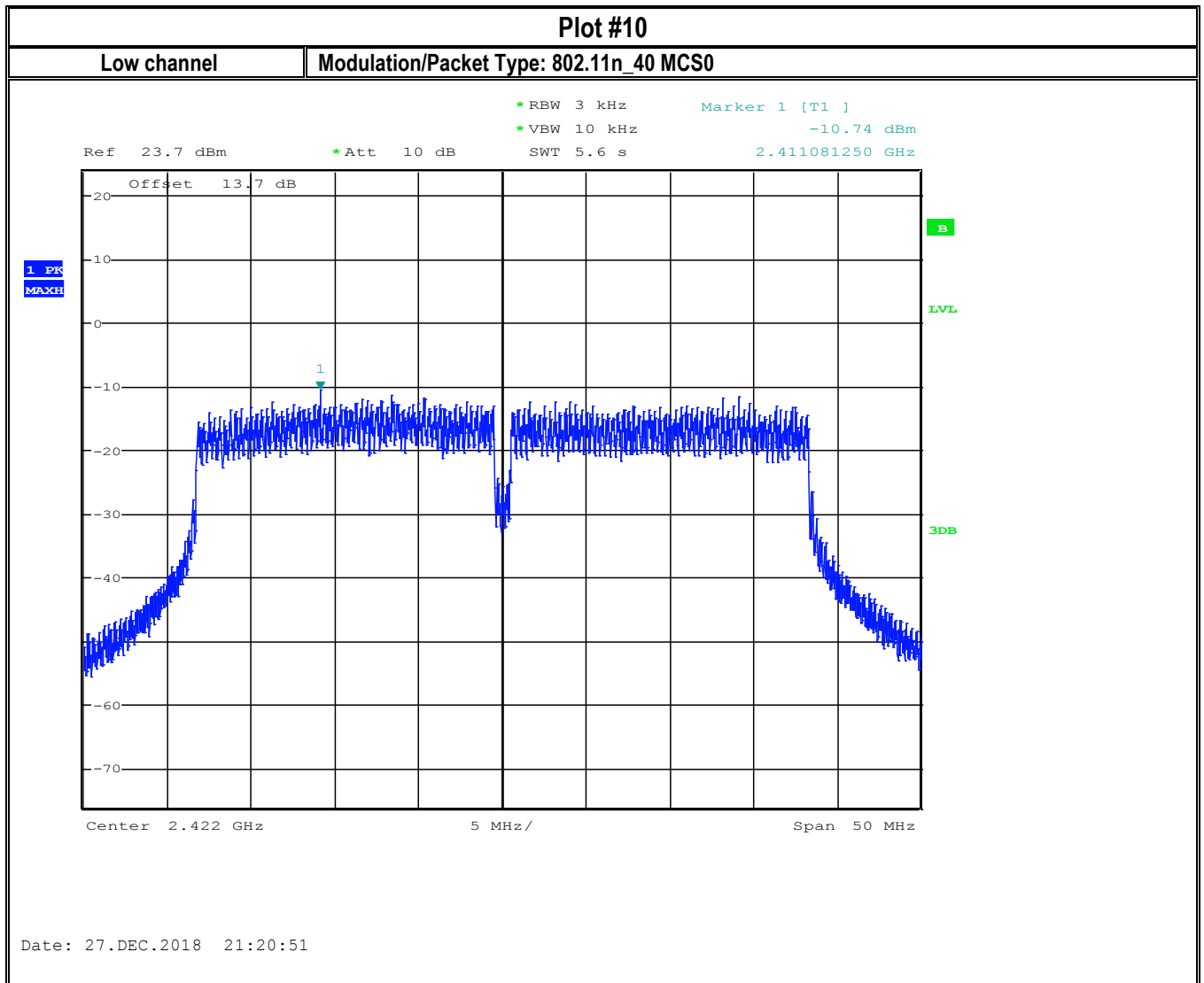
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



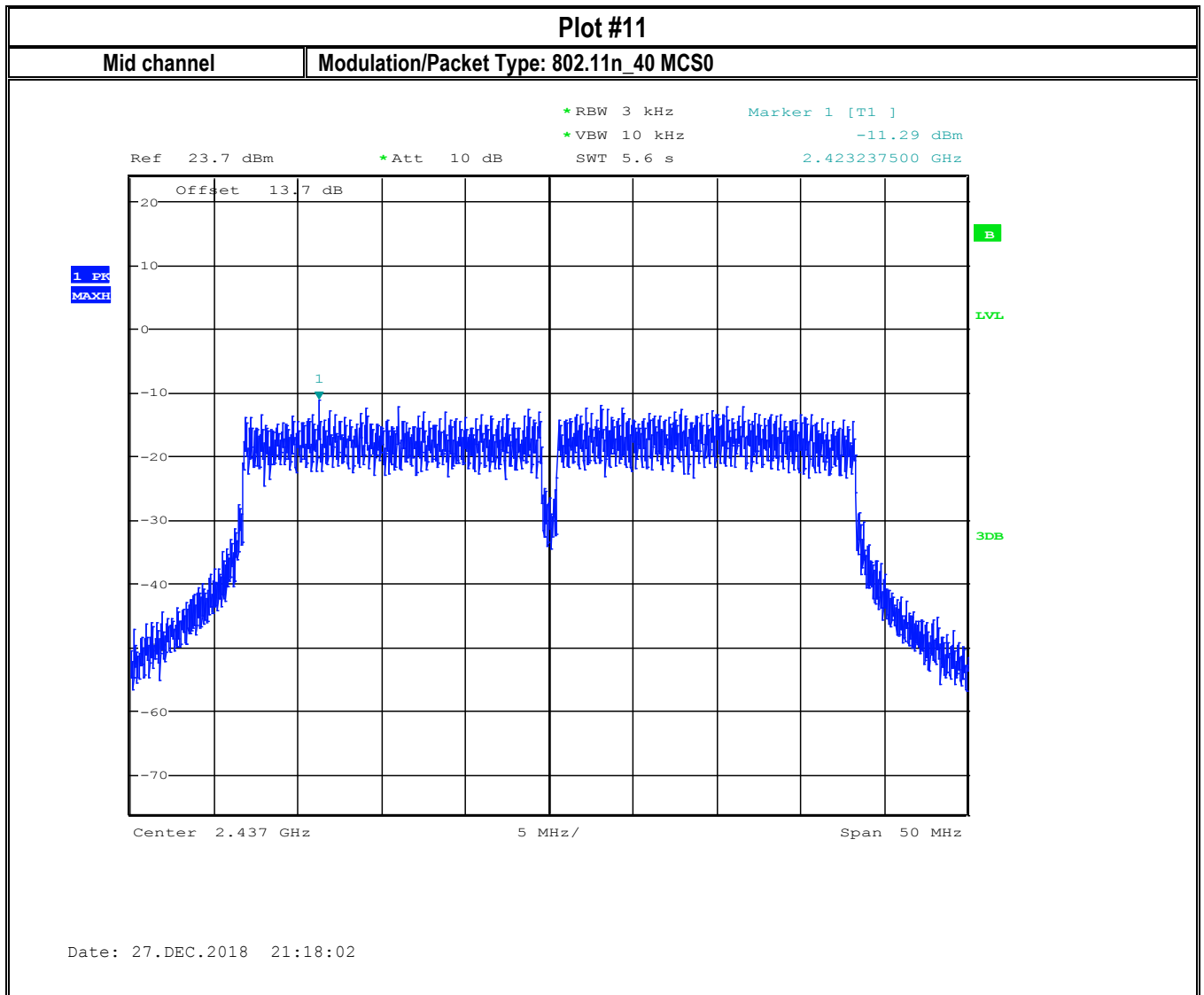
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



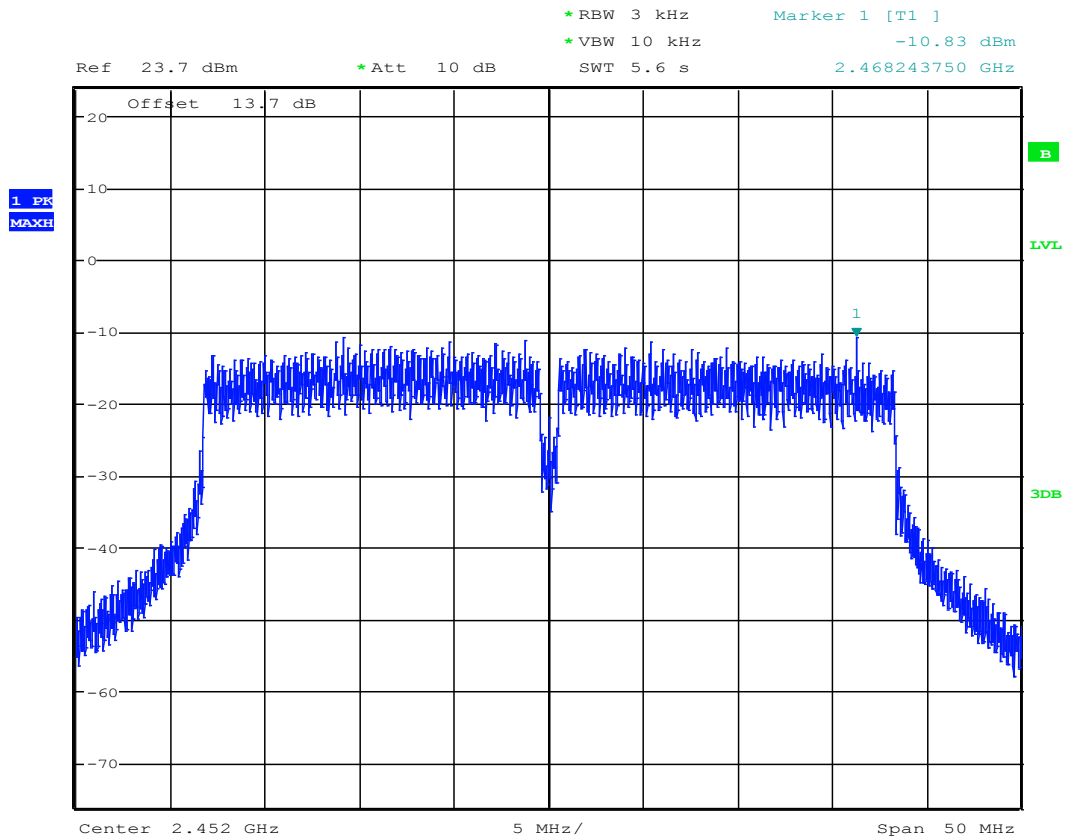
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #12

High channel

Modulation/Packet Type: 802.11n_40 MCS0



Date: 27.DEC.2018 21:06:22

8.4 Band Edge Compliance

8.4.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

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

8.4.2 Limits non restricted band:

FCC§15.247 (d)

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

Spectrum Analyzer settings for restricted band:

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

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.4.3 Limits restricted band §15.247/15.209/15.205

- *PEAK LIMIT= 74 dB μ V/m @3m =-21.23 dBm
 - *AVG LIMIT= 54 dB μ V/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:

(b)

| 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 | | | |

8.4.4 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Single Antenna Gain |
|---------------------|--------------|--------------------|---------------|---------------------|
| 22.5° C | 1 | 802.11b/g/n | AC/DC Adapter | 3 dBi |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.4.5 Measurement result:

| Plot # | Tx Chain | EUT operating mode | Band Edge | Frequency (MHz) | Band Edge Delta (dBc) | Limit (dBc) | Result |
|--------|----------|--------------------|-----------------------|-----------------|-----------------------|-------------|--------|
| 1 | 0 | 802.11b | Lower, Non-restricted | 2397 | -45 | 20 | Pass |
| 2 | 0 | 802.11g | Lower, Non-restricted | 2399.8 | -36.72 | 20 | Pass |
| 3 | 0 | 802.11n_20 | Lower, Non-restricted | 2399.9 | -35.86 | 20 | Pass |
| 4 | 0 | 802.11n_40 | Lower, Non-restricted | 2399.7 | -32.59 | 20 | Pass |
| 5 | 1 | 802.11b | Lower, Non-restricted | 2397 | -46.64 | 20 | Pass |
| 6 | 1 | 802.11g | Lower, Non-restricted | 2399.7 | -37.49 | 20 | Pass |
| 7 | 1 | 802.11n_20 | Lower, Non-restricted | 2399.9 | -36.28 | 20 | Pass |
| 8 | 1 | 802.11n_40 | Lower, Non-restricted | 2399.7 | -33.94 | 20 | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

| Plot # | Tx Chain | EUT operating mode | Band Edge | Frequency (MHz) | Measured Peak Value (dBm) | Corrected by duty cycle | Corrected by Antenna Gain (dBm) | Limit (dBm) | Result |
|--------|----------|--------------------|--------------------------|-----------------|---------------------------|-------------------------|---------------------------------|-------------|--------|
| 9 | 0 | 802.11b | Lower Restricted Peak | 2389.7 | -41.33 | N/A | -38.33 | -21.23 Peak | Pass |
| 9 | 0 | 802.11b | Lower Restricted Average | 2389.8 | -51.01 | 0.03 | -47.98 | -41.23 AVG | Pass |
| 10 | 0 | 802.11g | Lower Restricted Peak | 2388.9 | -40.14 | N/A | -37.14 | -21.23 Peak | Pass |
| 10 | 0 | 802.11g | Lower Restricted Average | 2389.9 | -49.99 | 0.17 | -46.82 | -41.23 AVG | Pass |
| 11 | 0 | 802.11n_20 | Lower Restricted Peak | 2389.2 | -33.91 | N/A | -30.91 | -21.23 Peak | Pass |
| 11 | 0 | 802.11n_20 | Lower Restricted Average | 2389.9 | -47.49 | 0.19 | -44.30 | -41.23 AVG | Pass |
| 12 | 0 | 802.11n_40 | Lower Restricted Peak | 2388.1 | -34.17 | N/A | -31.17 | -21.23 Peak | Pass |
| 12 | 0 | 802.11n_40 | Lower Restricted Average | 2389.7 | -47.93 | 0.35 | -44.58 | -41.23 AVG | Pass |
| 13 | 0 | 802.11b | Upper Restricted Peak | 2483.5 | -41.73 | N/A | -38.73 | -21.23 Peak | Pass |
| 13 | 0 | 802.11b | Upper Restricted Average | 2483.5 | -51.73 | 0.03 | -48.70 | -41.23 AVG | Pass |
| 14 | 0 | 802.11g | Upper Restricted Peak | 2483.6 | -30.6 | N/A | -27.6 | -21.23 Peak | Pass |
| 14 | 0 | 802.11g | Upper Restricted Average | 2483.5 | -50.66 | 0.17 | -47.49 | -41.23 AVG | Pass |
| 15 | 0 | 802.11n_20 | Upper Restricted Peak | 2384.6 | -29.54 | N/A | -26.54 | -21.23 Peak | Pass |
| 15 | 0 | 802.11n_20 | Upper Restricted Average | 2383.6 | -52.28 | 0.19 | -49.09 | -41.23 AVG | Pass |
| 16 | 0 | 802.11n_40 | Upper Restricted Peak | 2483.7 | -32.3 | N/A | -29.3 | -21.23 Peak | Pass |
| 16 | 0 | 802.11n_40 | Upper Restricted Average | 2483.5 | -49.26 | 0.35 | -45.91 | -41.23 AVG | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

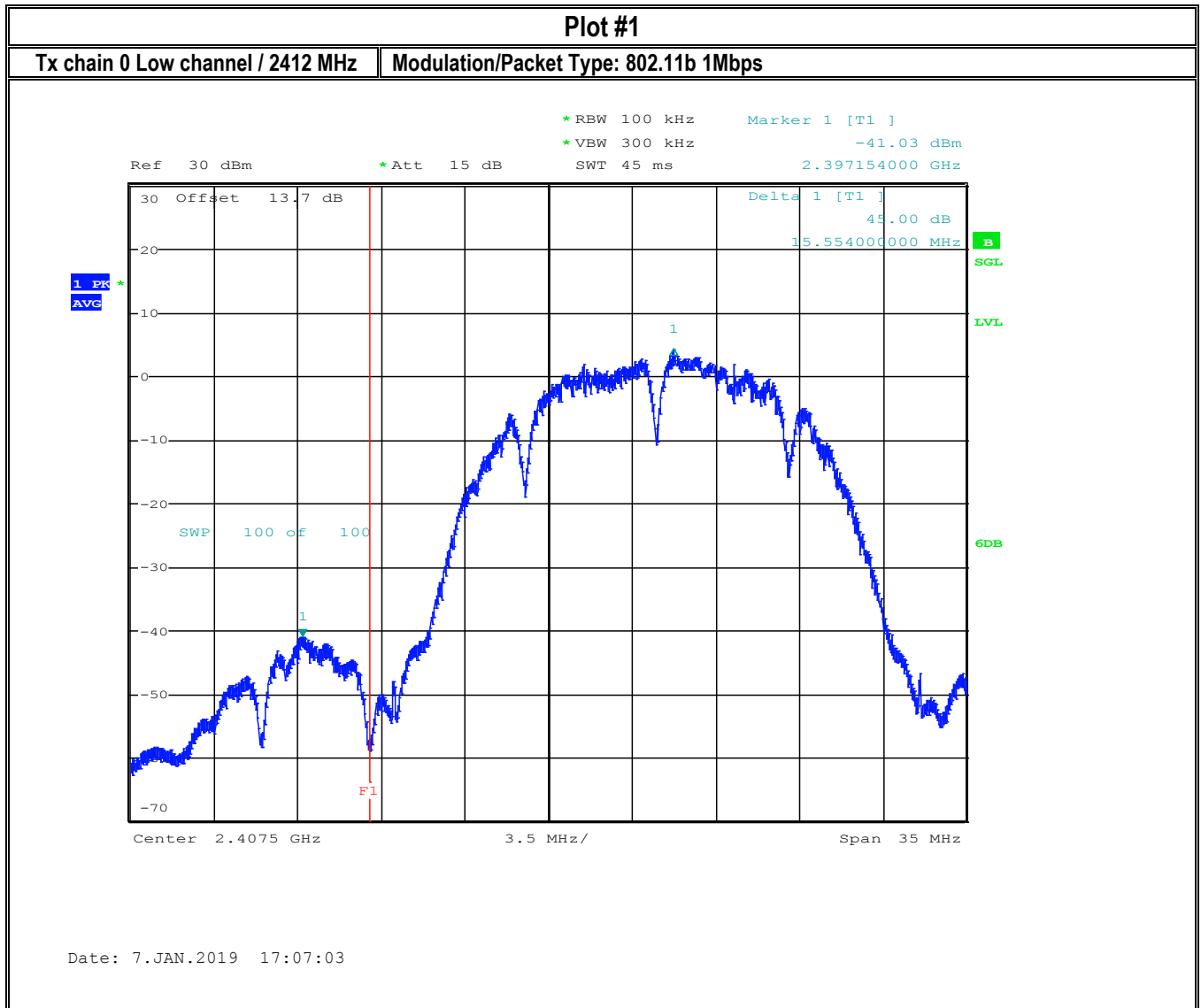
| | | | | | | | | | |
|----|---|------------|--------------------------|--------|--------|------|--------|-------------|------|
| 17 | 1 | 802.11b | Lower Restricted Peak | 2389.7 | -42.77 | N/A | -39.77 | -21.23 Peak | Pass |
| 17 | 1 | 802.11b | Lower Restricted Average | 2387.1 | -53.83 | 0.03 | -50.80 | -41.23 AVG | Pass |
| 18 | 1 | 802.11g | Lower Restricted Peak | 2387.5 | -32.76 | N/A | -29.76 | -21.23 Peak | Pass |
| 18 | 1 | 802.11g | Lower Restricted Average | 2389.9 | -49.76 | 0.17 | -46.59 | -41.23 AVG | Pass |
| 19 | 1 | 802.11n_20 | Lower Restricted Peak | 2388.8 | -32.76 | N/A | -29.76 | -21.23 Peak | Pass |
| 19 | 1 | 802.11n_20 | Lower Restricted Average | 2389.7 | -49.39 | 0.19 | -46.20 | -41.23 AVG | Pass |
| 20 | 1 | 802.11n_40 | Lower Restricted Peak | 2389.3 | -32.96 | N/A | -29.96 | -21.23 Peak | Pass |
| 20 | 1 | 802.11n_40 | Lower Restricted Average | 2389.8 | -48.64 | 0.35 | -45.29 | -41.23 AVG | Pass |

| | | | | | | | | | |
|----|---|------------|--------------------------|--------|--------|------|--------|-------------|------|
| 21 | 1 | 802.11b | Upper Restricted Peak | 2483.5 | -41.72 | N/A | -38.72 | -21.23 Peak | Pass |
| 21 | 1 | 802.11b | Upper Restricted Average | 2483.5 | -49.85 | 0.03 | -46.82 | -41.23 AVG | Pass |
| 22 | 1 | 802.11g | Upper Restricted Peak | 2484 | -28.66 | N/A | -25.66 | -21.23 Peak | Pass |
| 22 | 1 | 802.11g | Upper Restricted Average | 2483.5 | -50.07 | 0.17 | -46.90 | -41.23 AVG | Pass |
| 23 | 1 | 802.11n_20 | Upper Restricted Peak | 2483.6 | -29.67 | N/A | -26.67 | -21.23 Peak | Pass |
| 23 | 1 | 802.11n_20 | Upper Restricted Average | 2483.5 | -50.28 | 0.19 | -47.09 | -41.23 AVG | Pass |
| 24 | 1 | 802.11n_40 | Upper Restricted Peak | 2484.1 | -32.45 | N/A | -29.45 | -21.23 Peak | Pass |
| 24 | 1 | 802.11n_40 | Upper Restricted Average | 2483.5 | -48.06 | 0.35 | -44.71 | -41.23 AVG | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

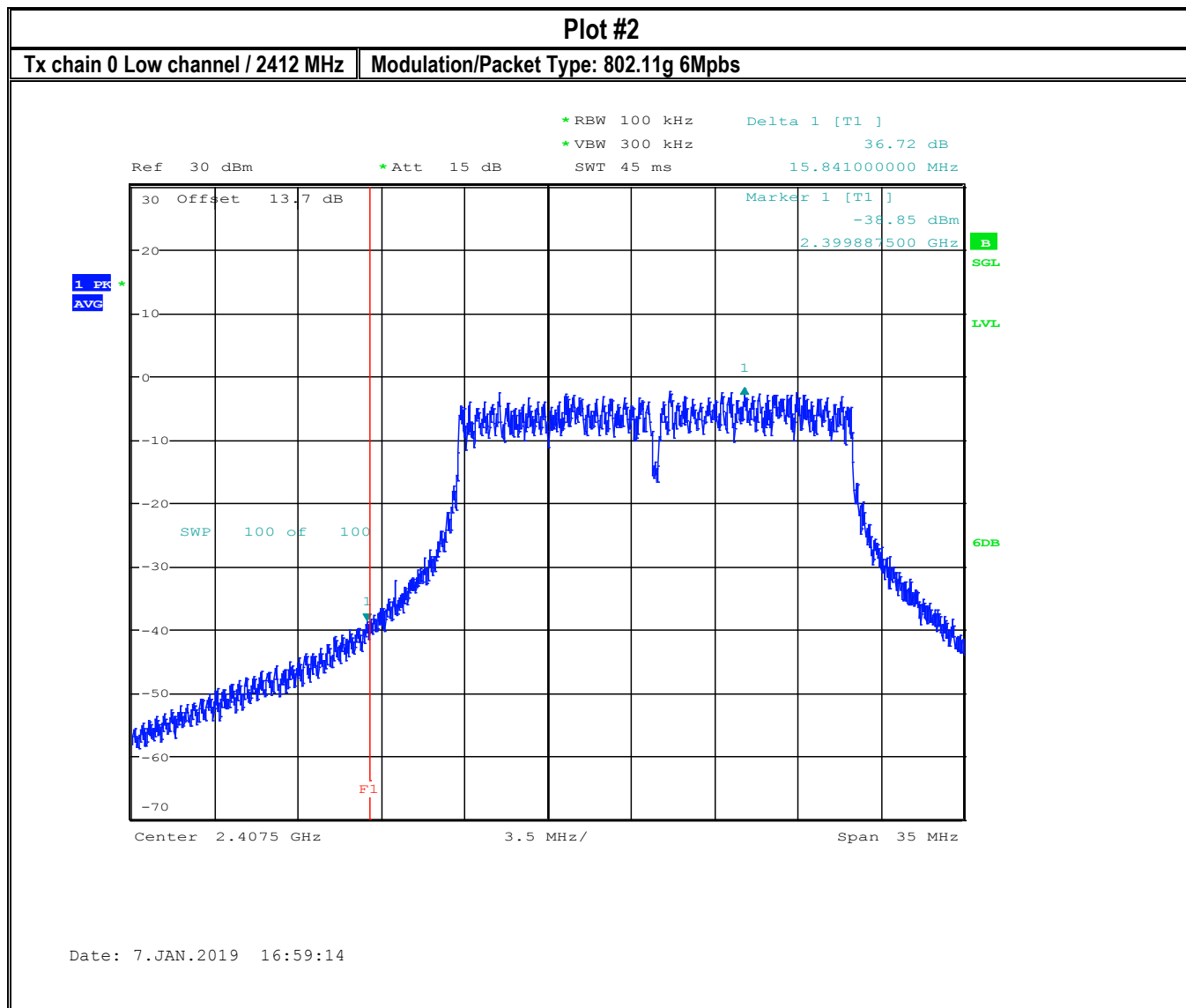
FCC ID: UUU-5411

8.4.6 Measurement Plots:



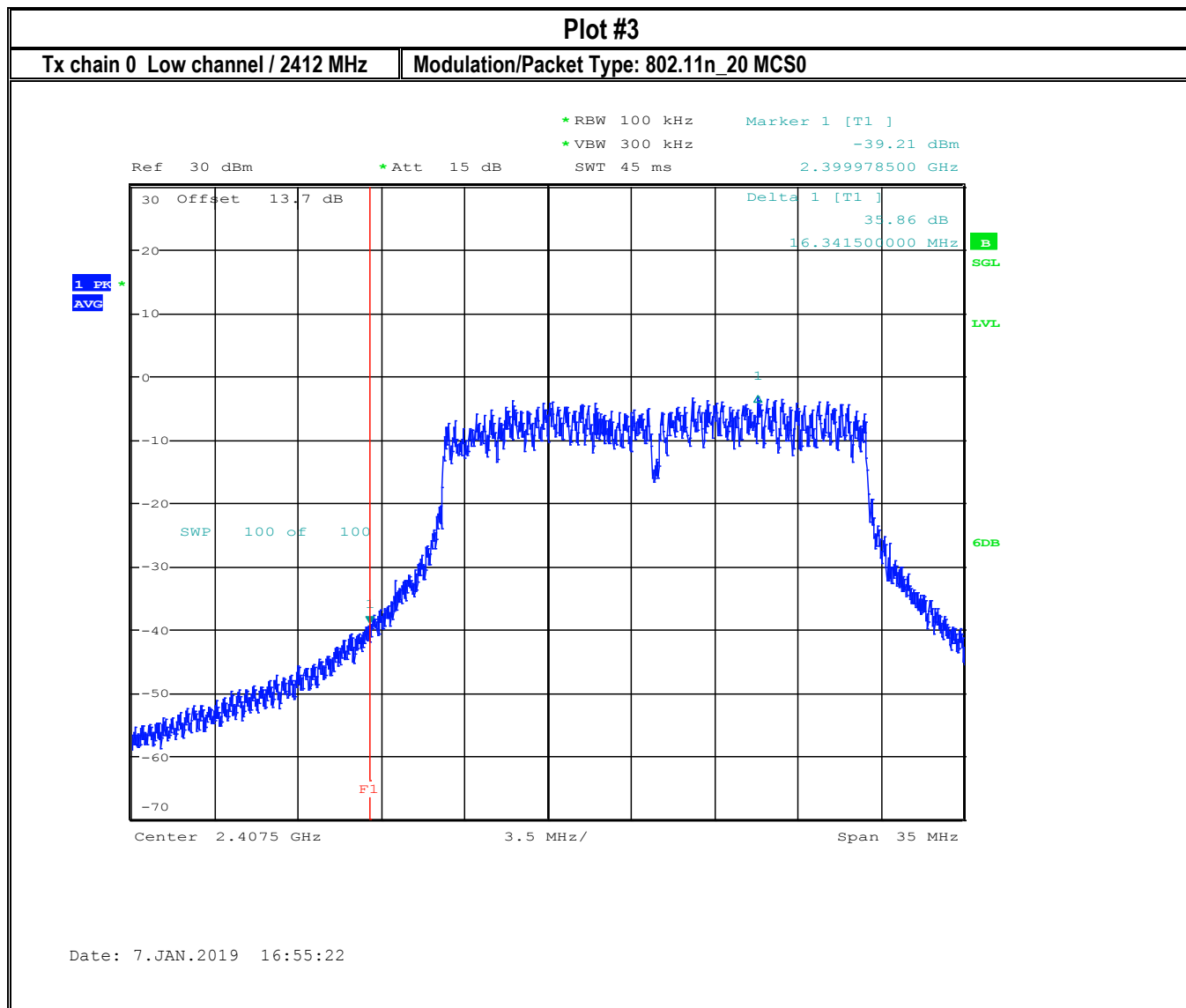
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

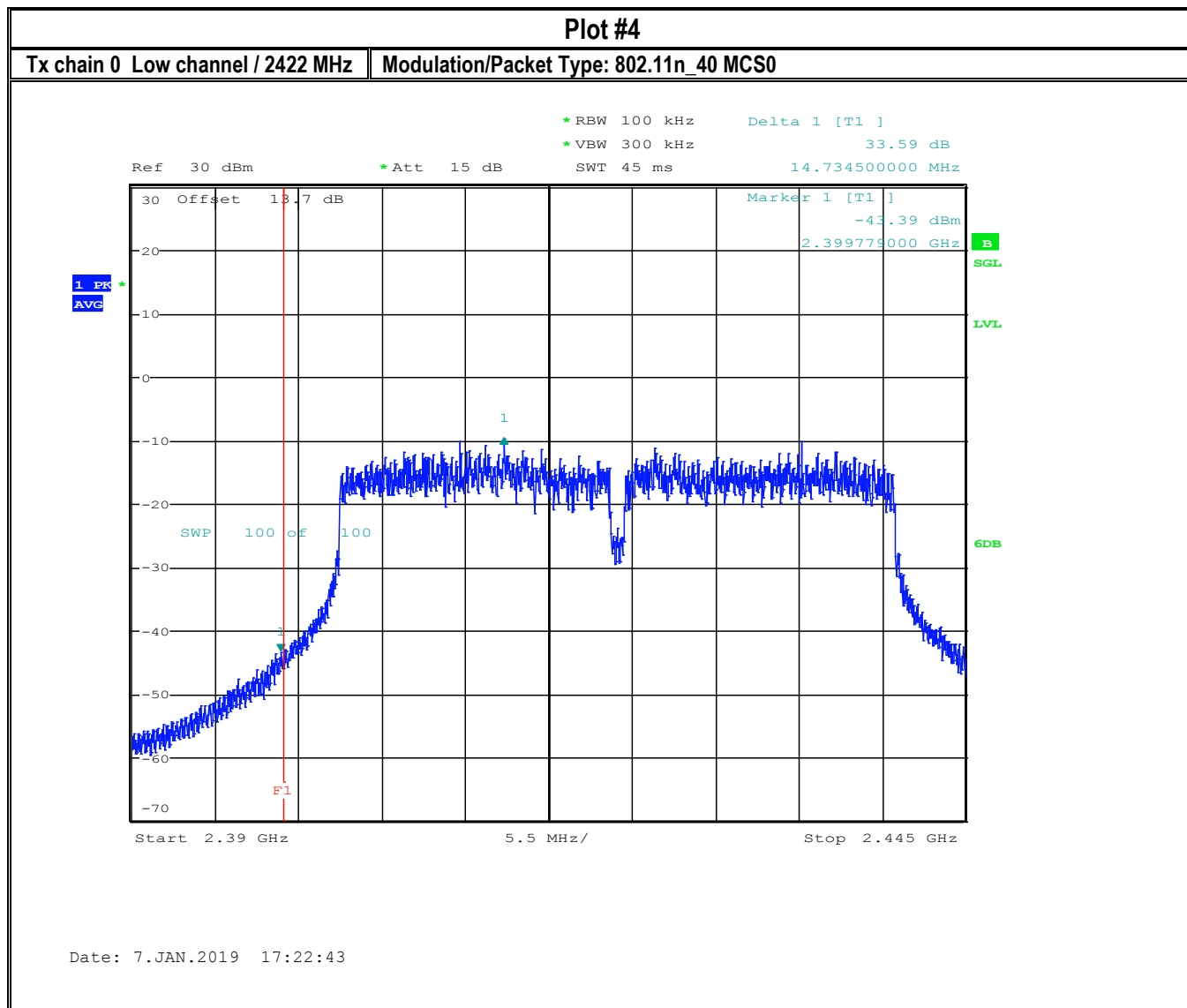
FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

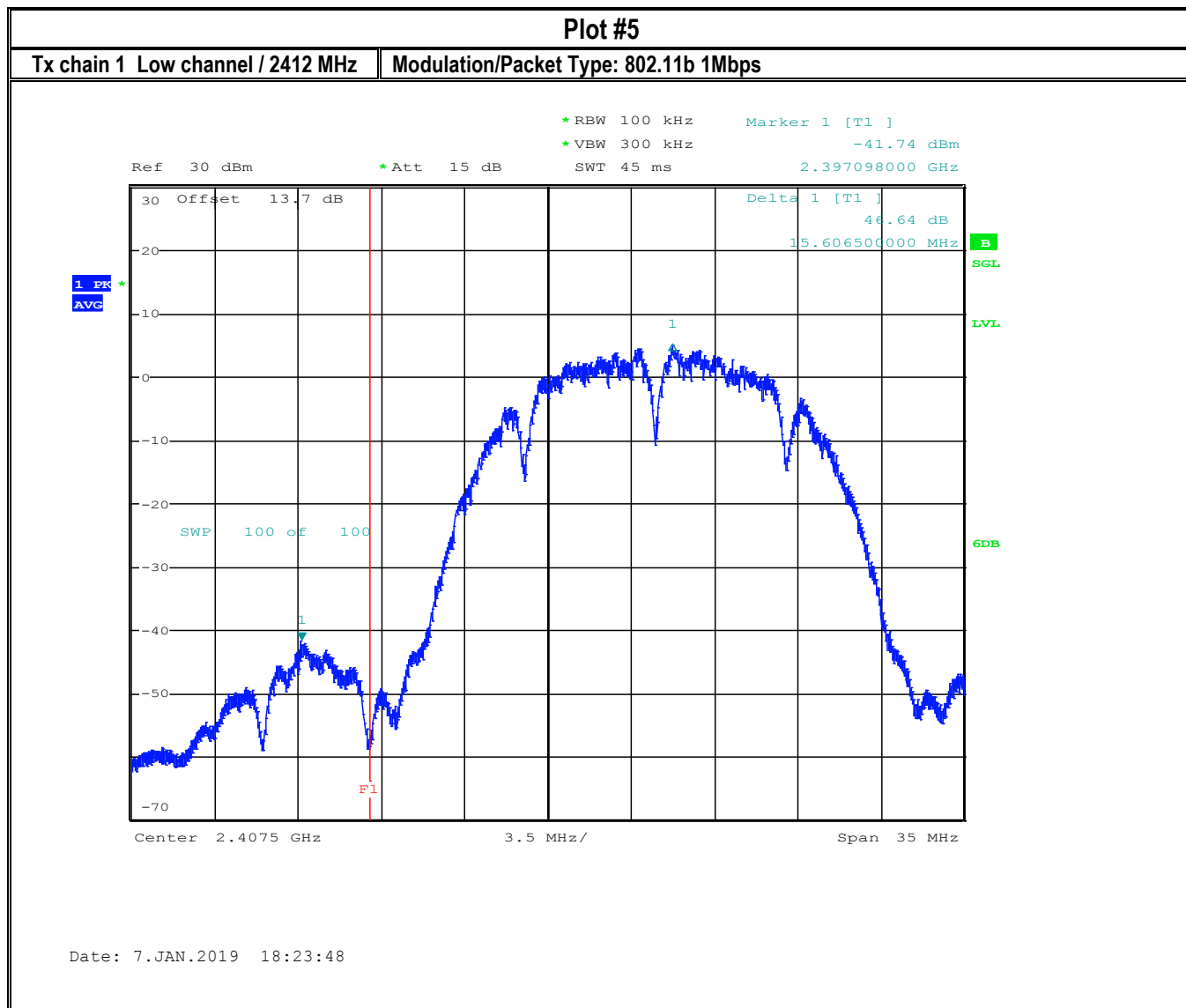
FCC ID: UUU-5411





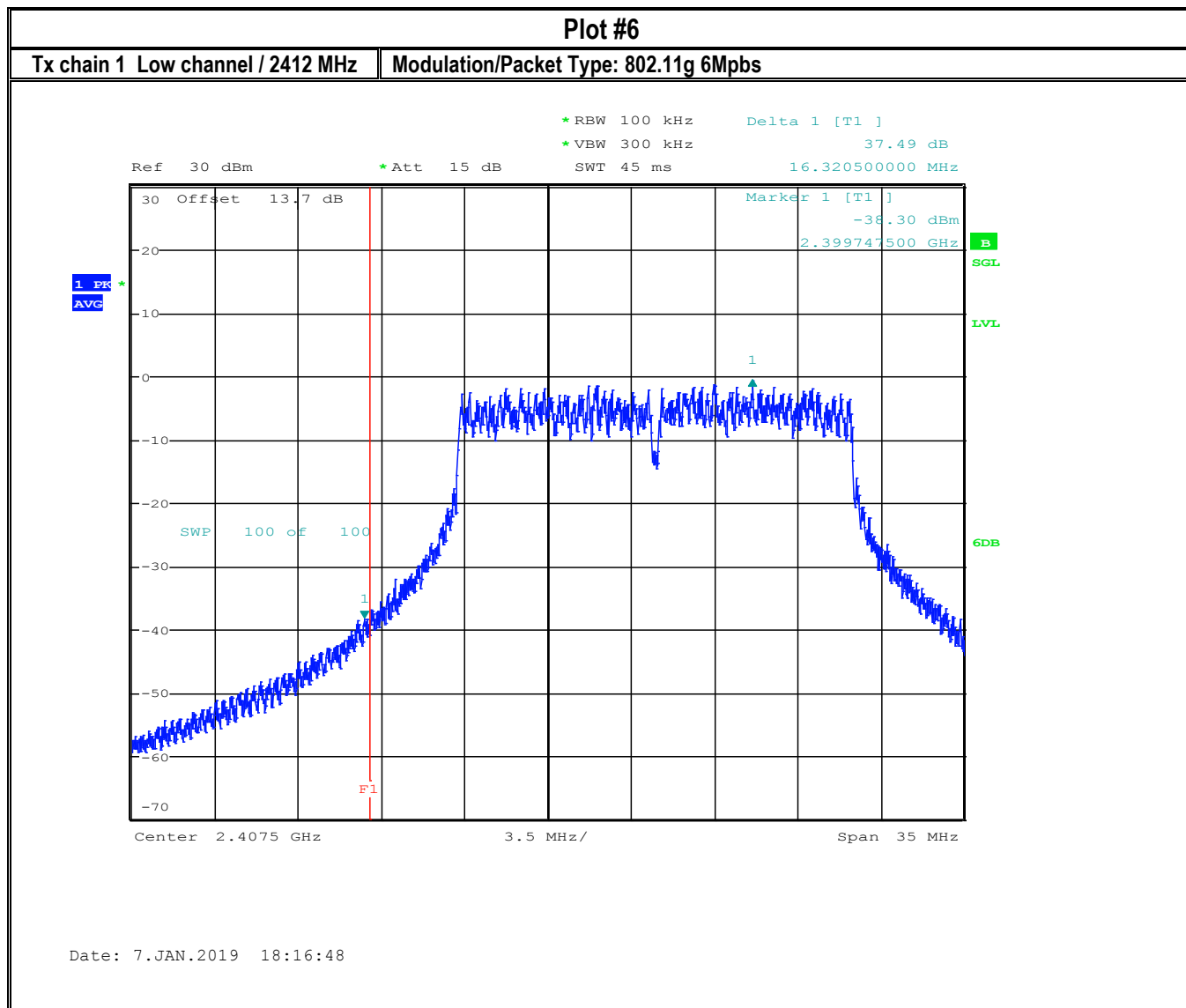
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



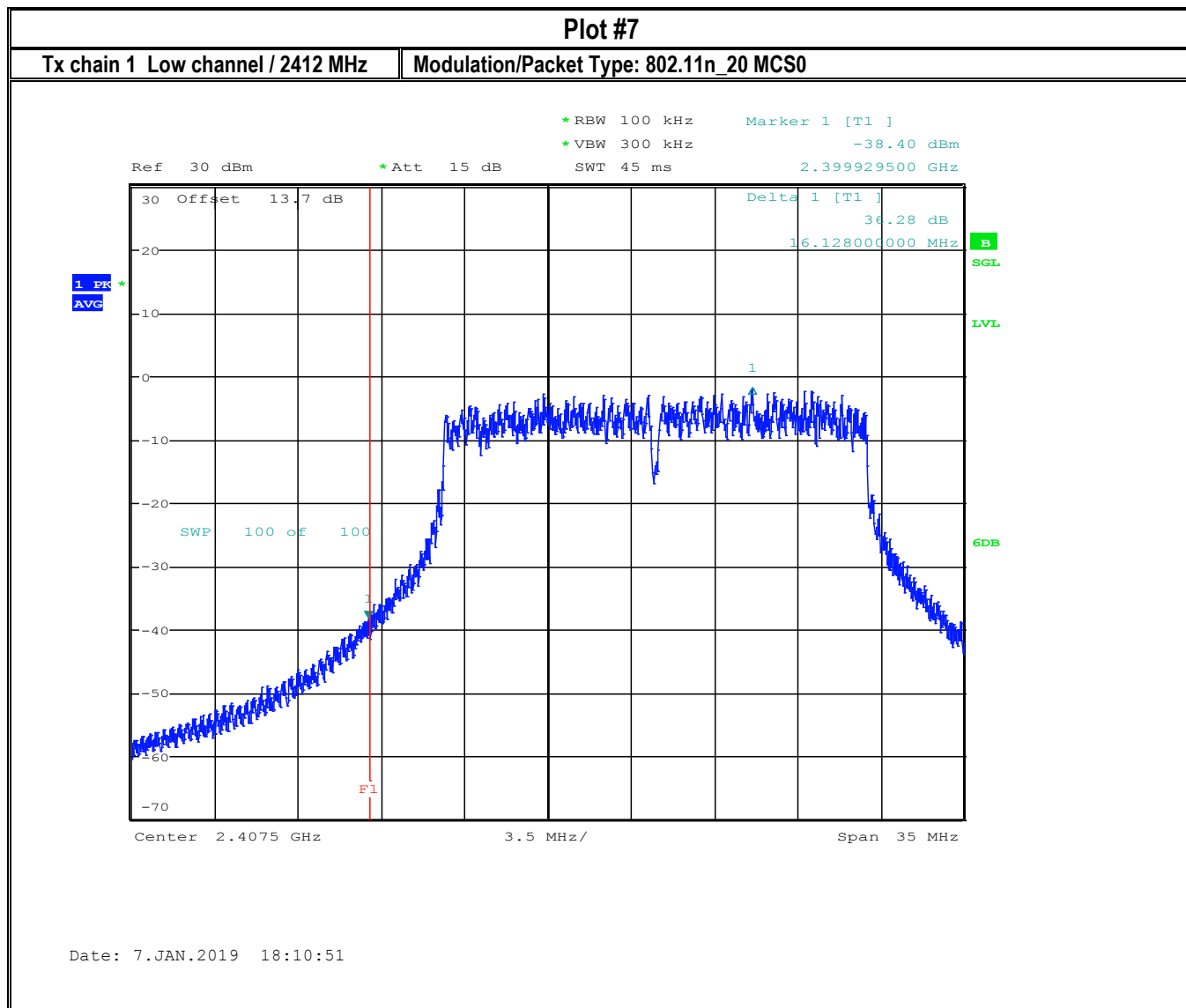
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

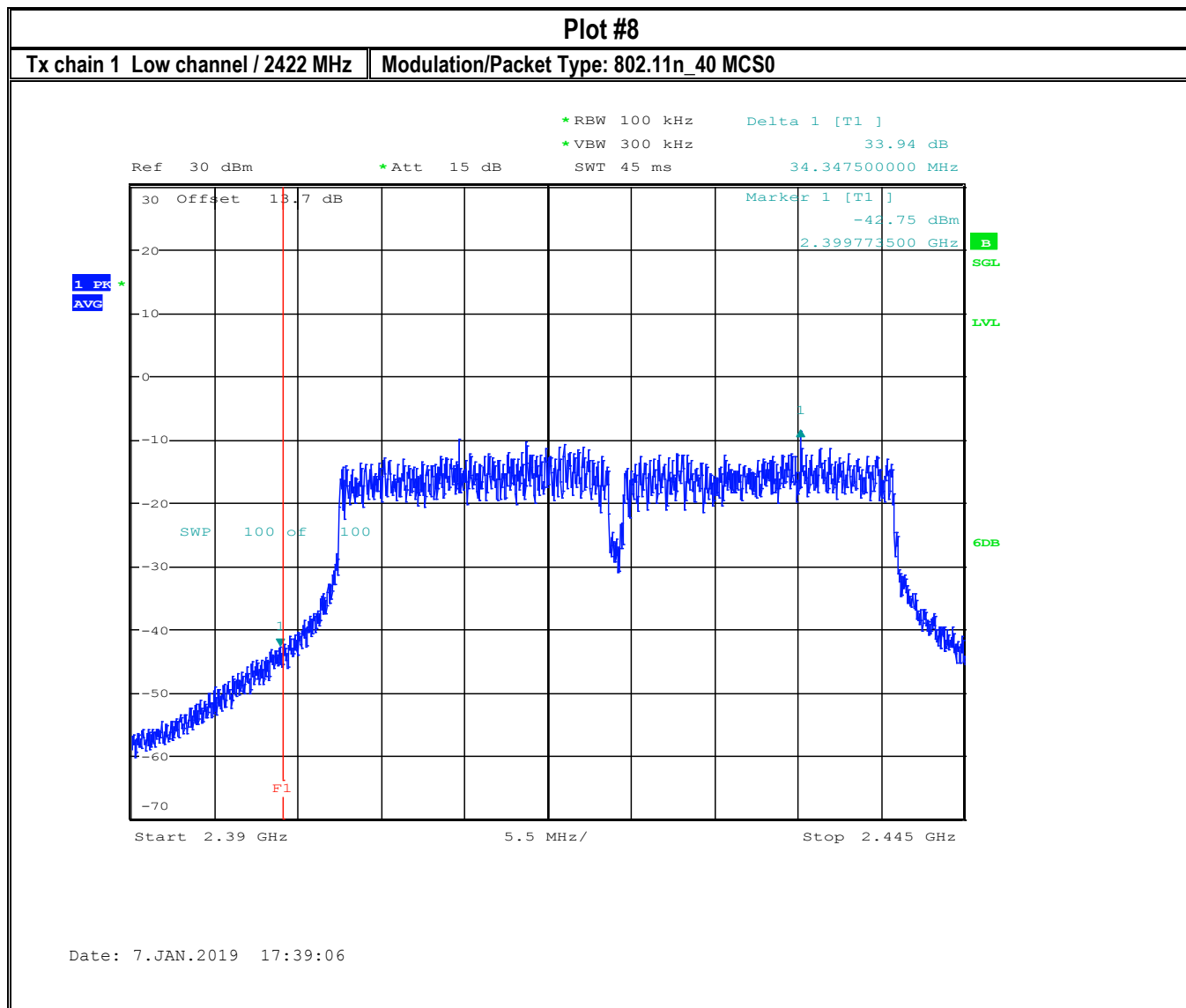
FCC ID: UUU-5411



Date: 7.JAN.2019 18:10:51

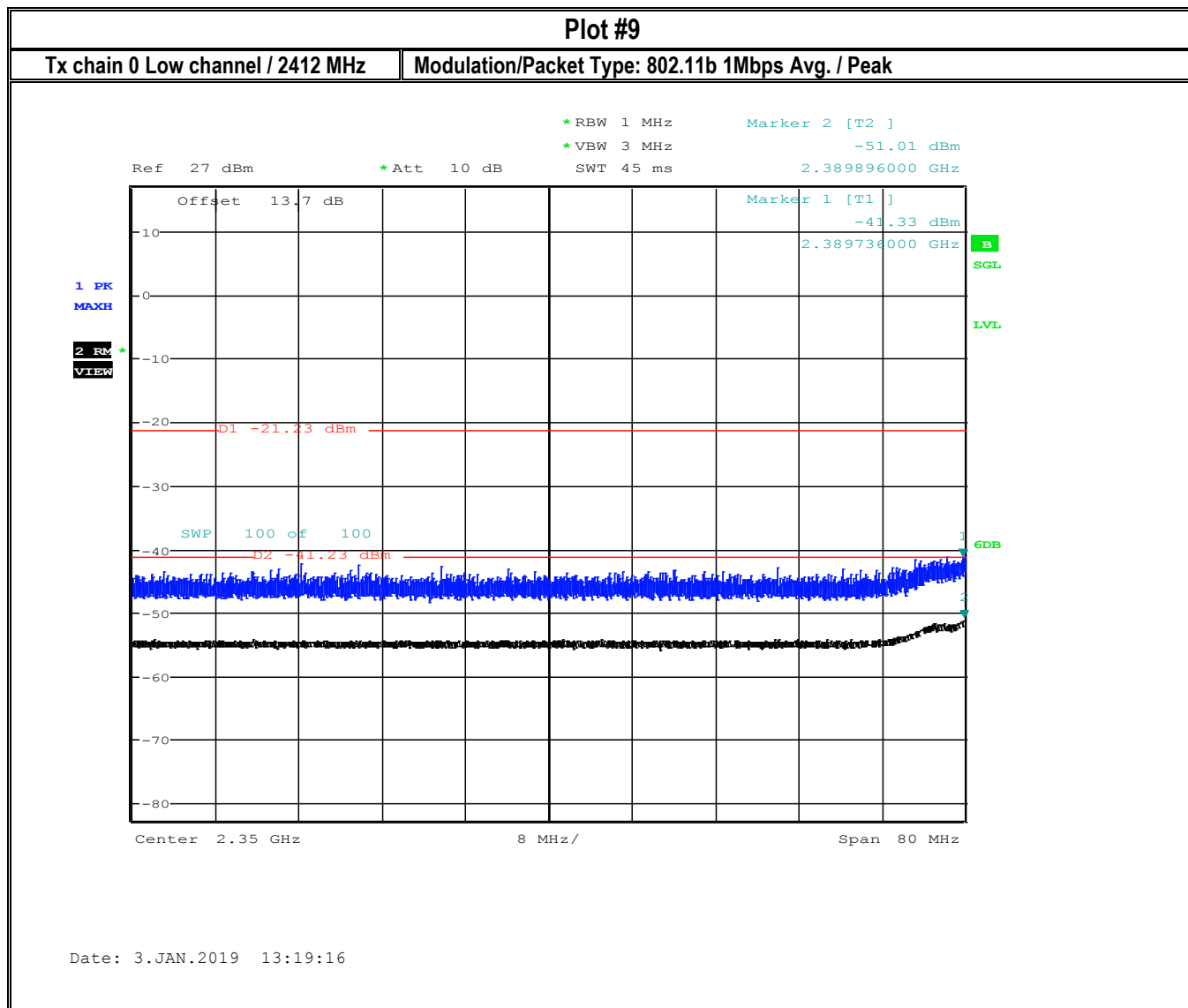
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



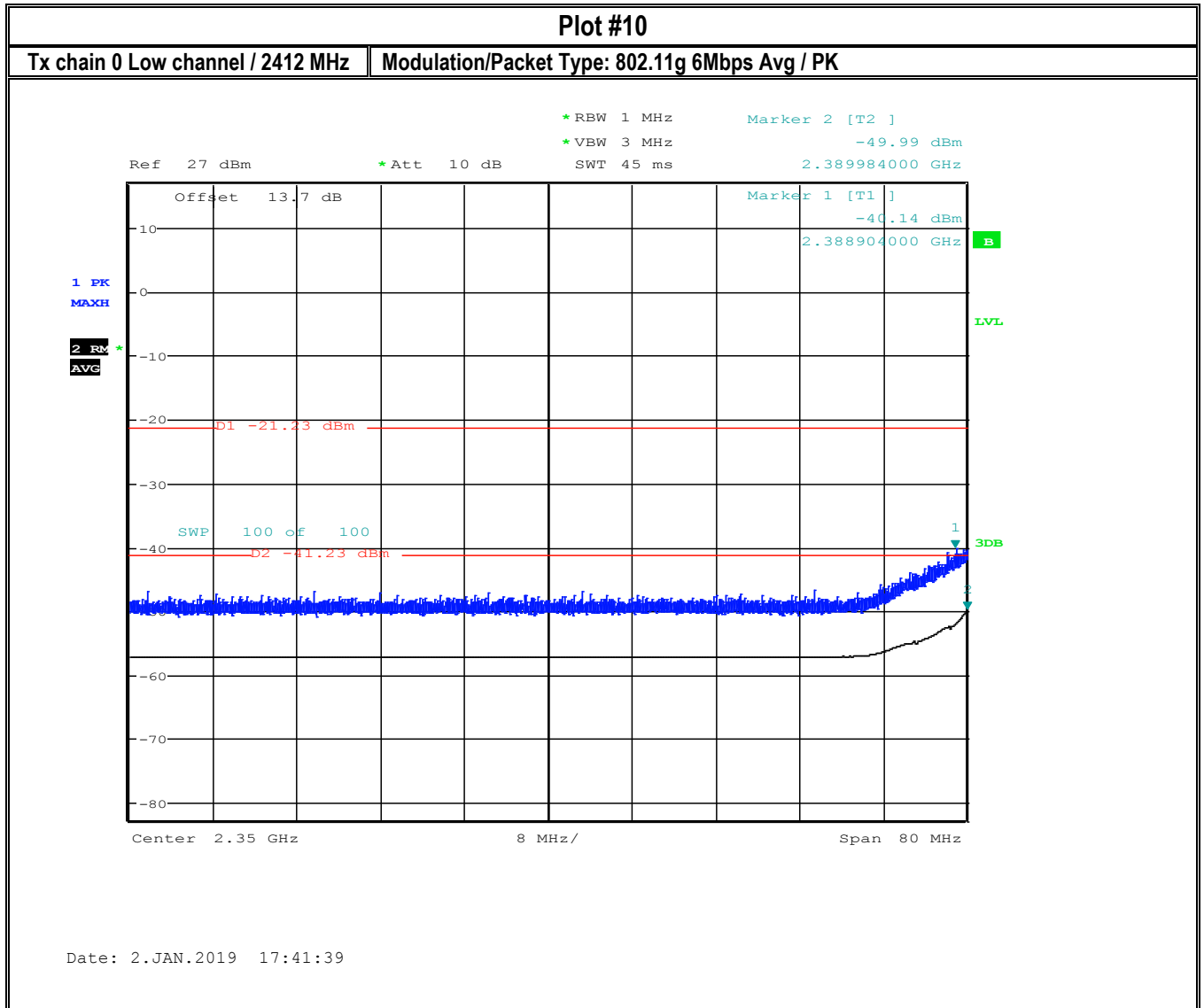
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



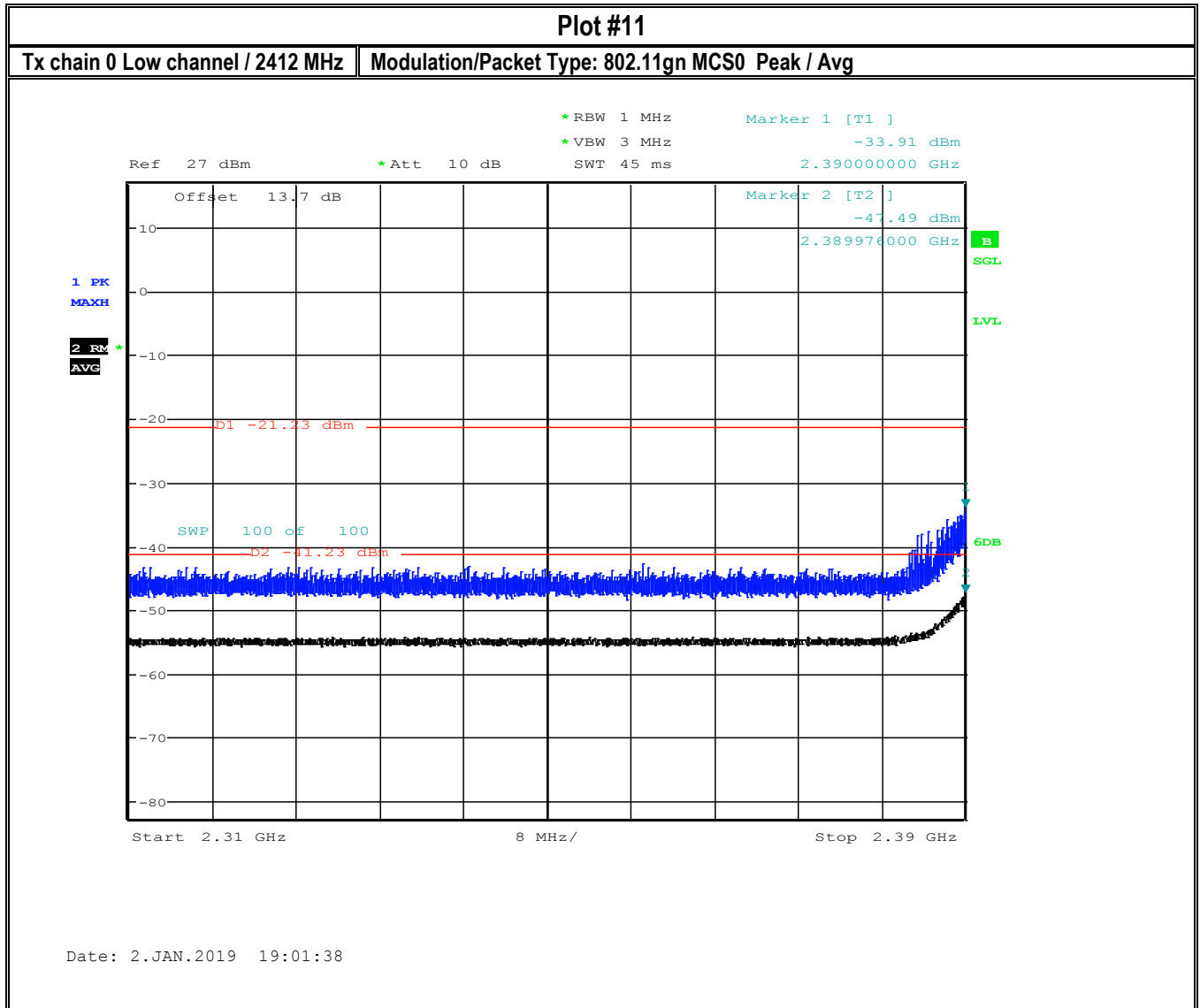
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



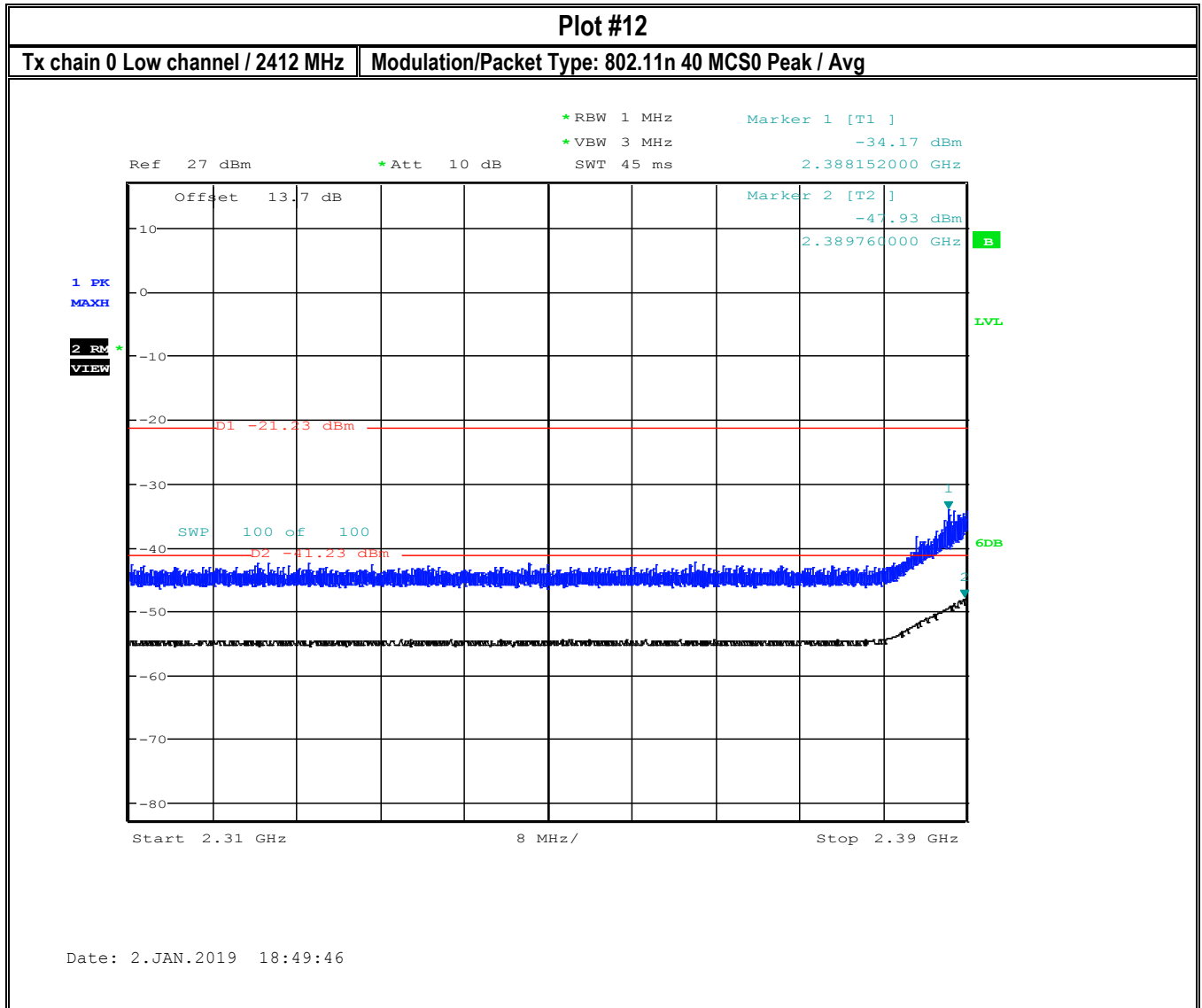
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



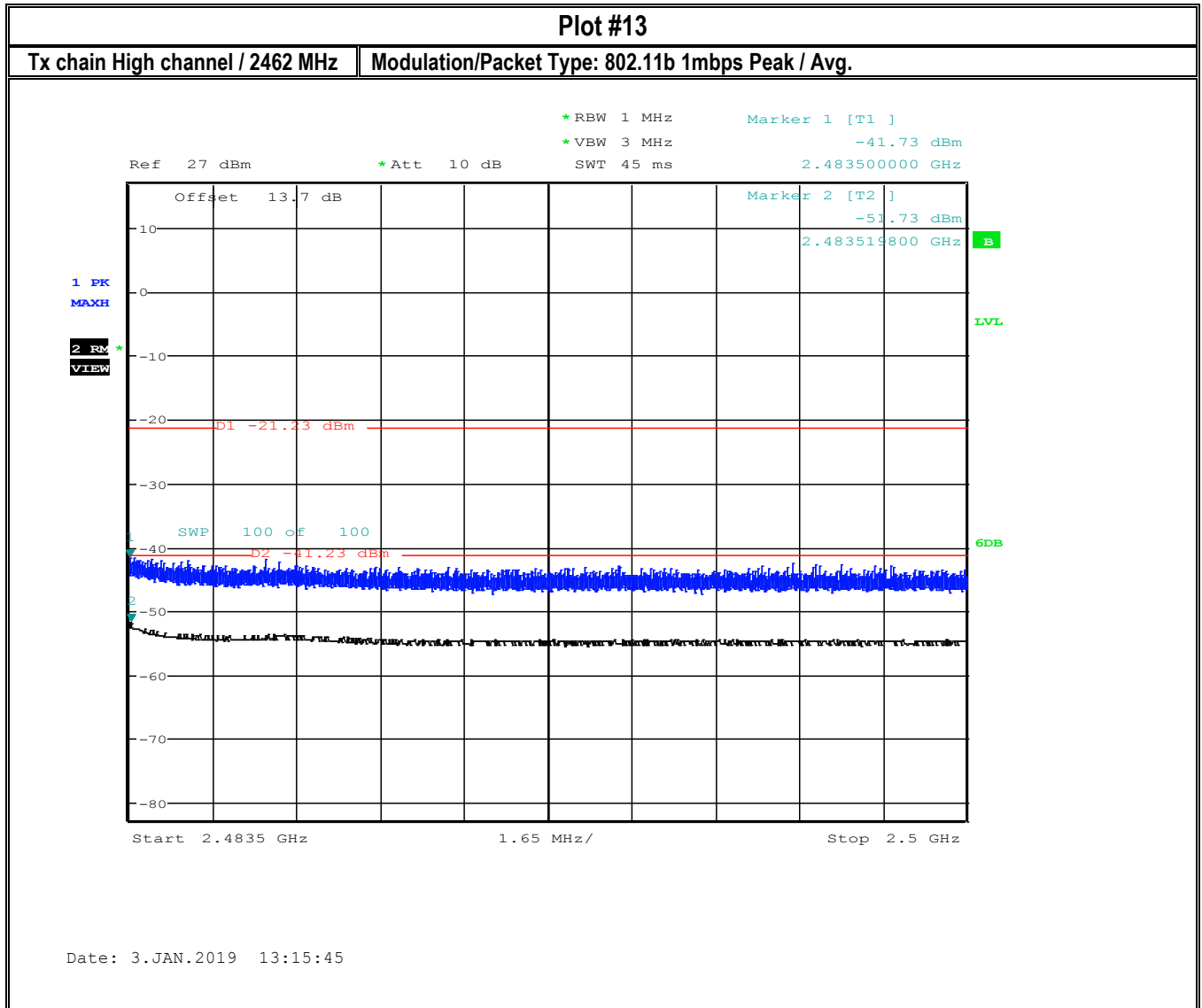
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



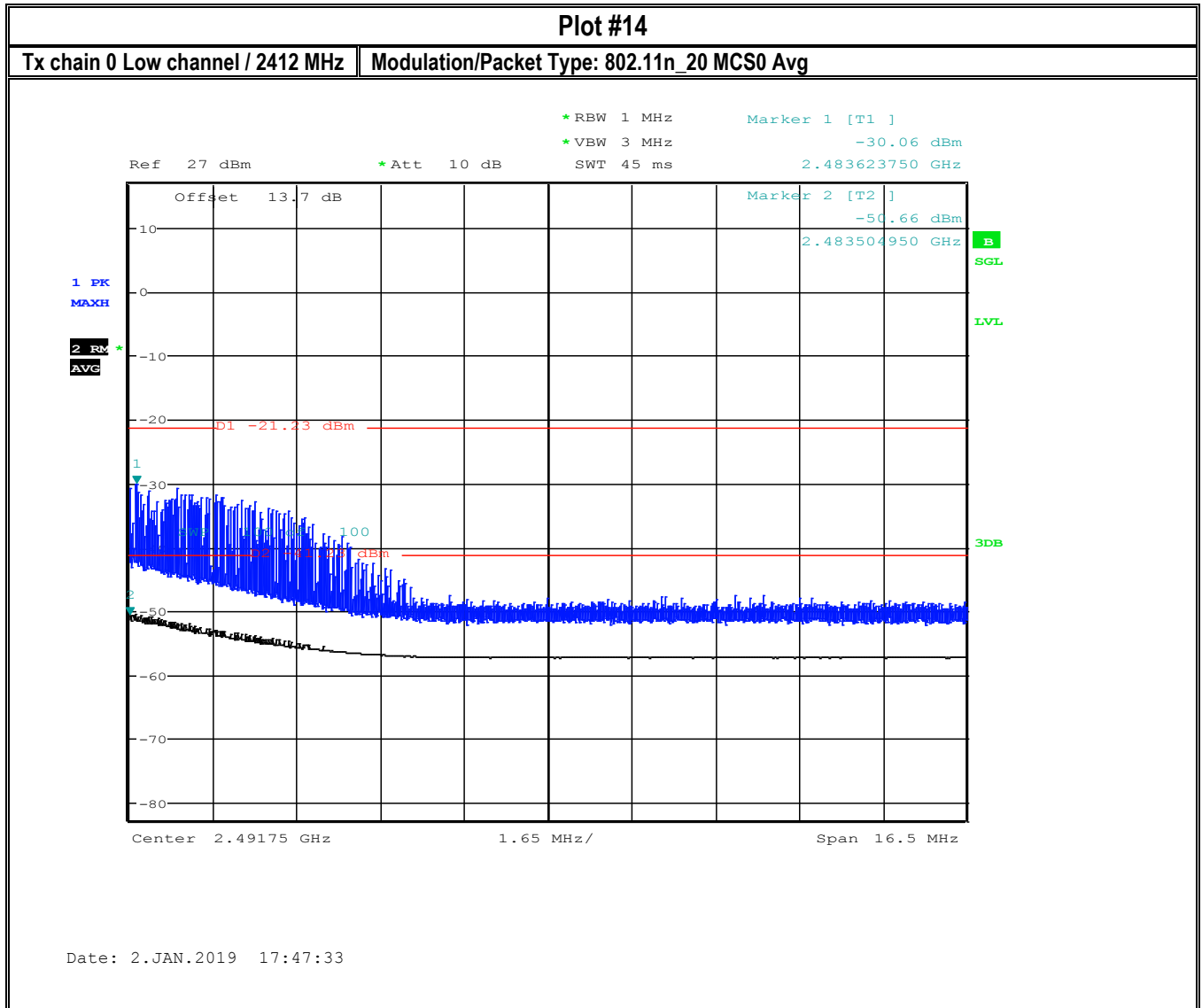
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



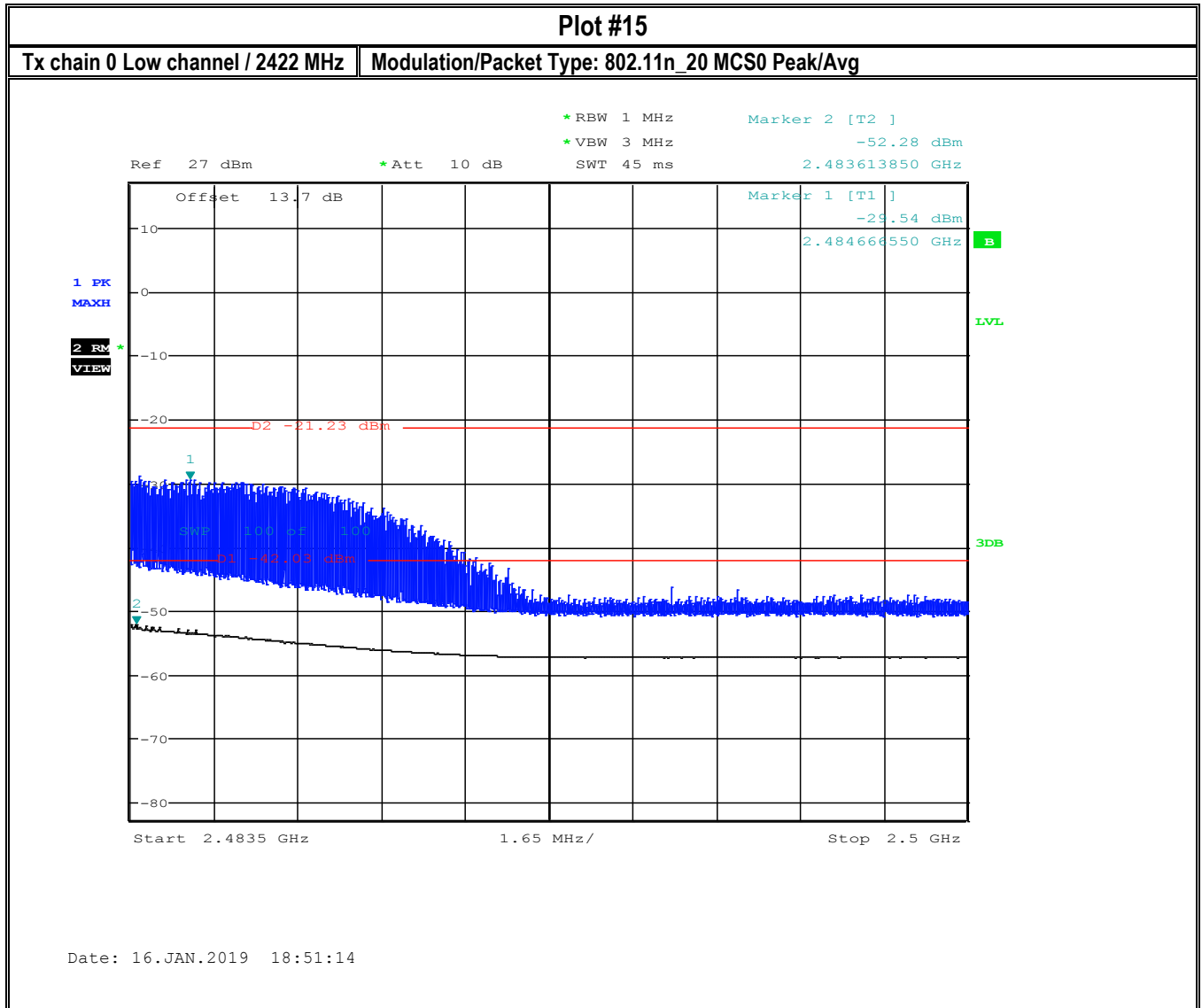
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



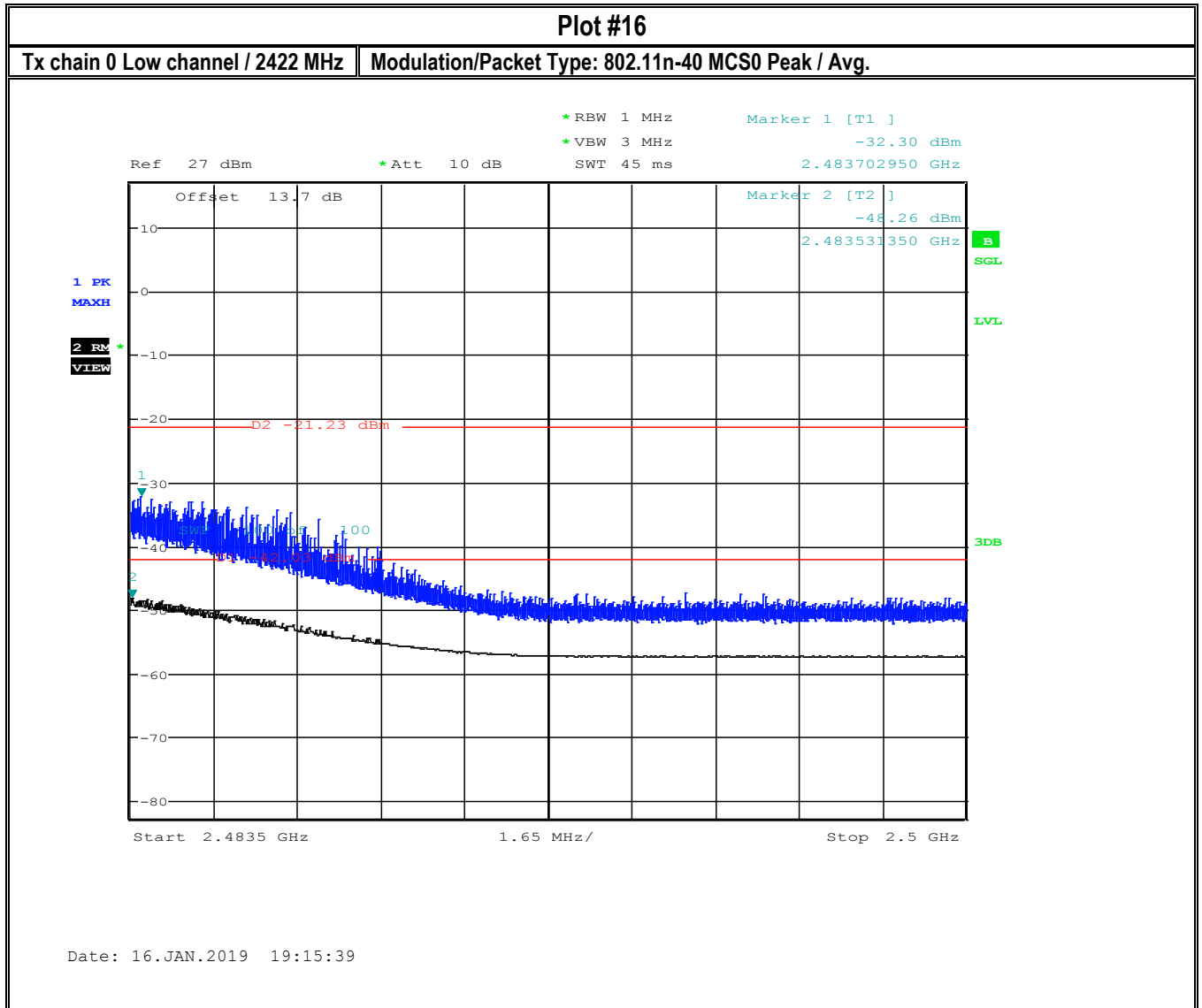
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411

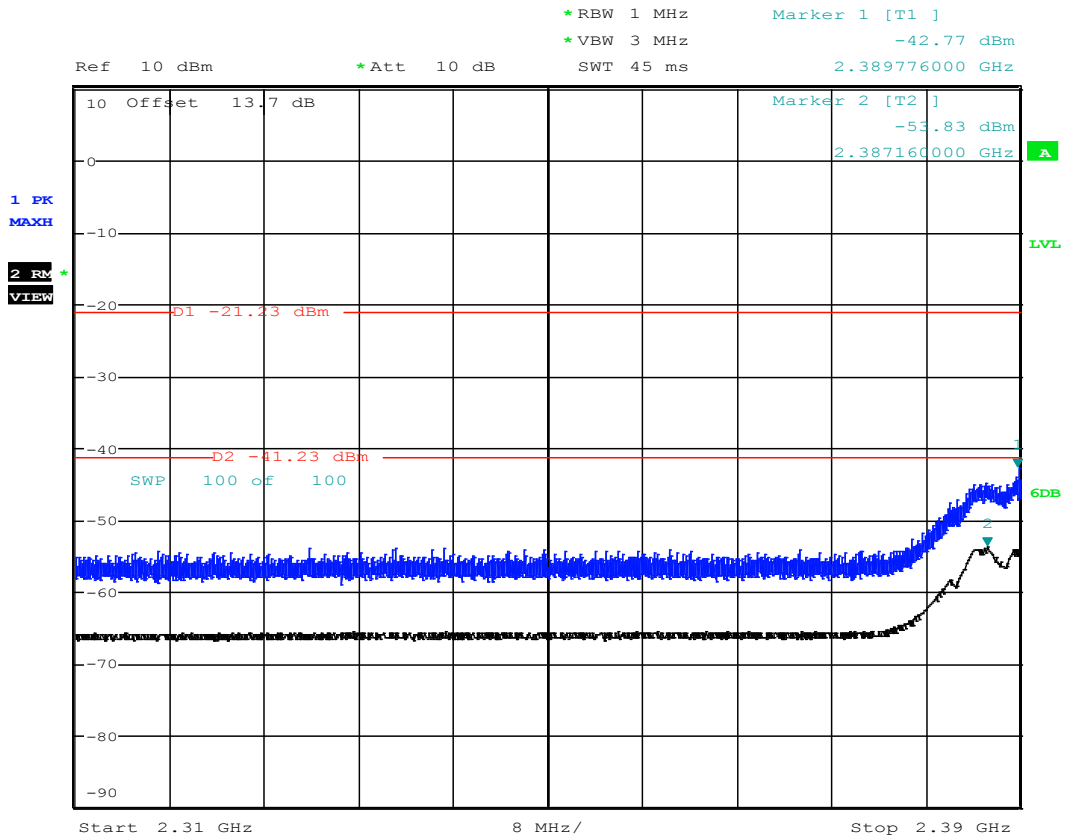


Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #17

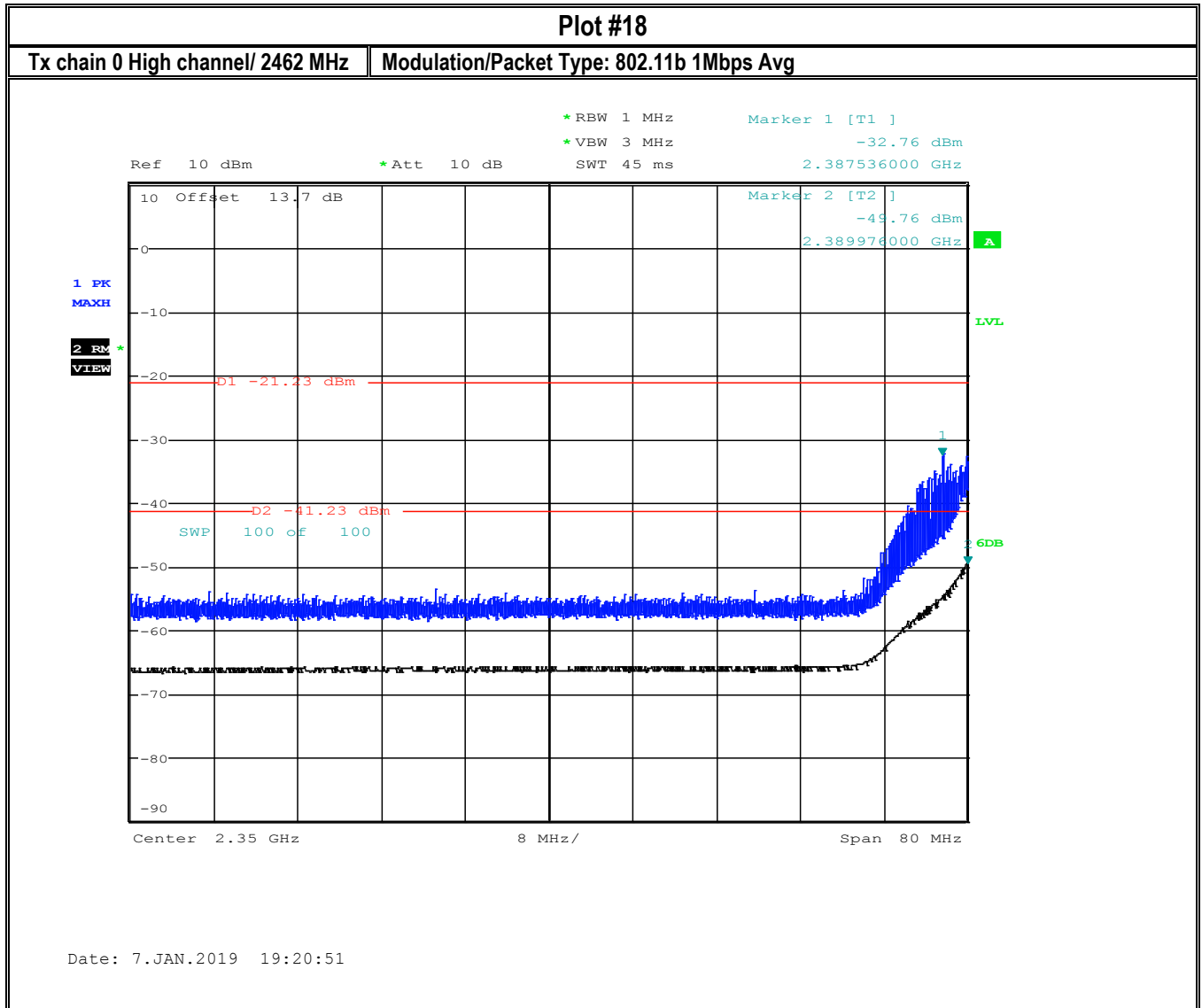
Tx chain 0 High channel/ 2462 MHz **Modulation/Packet Type: 802.11b 1Mbps Peak**



Date: 7.JAN.2019 19:36:10

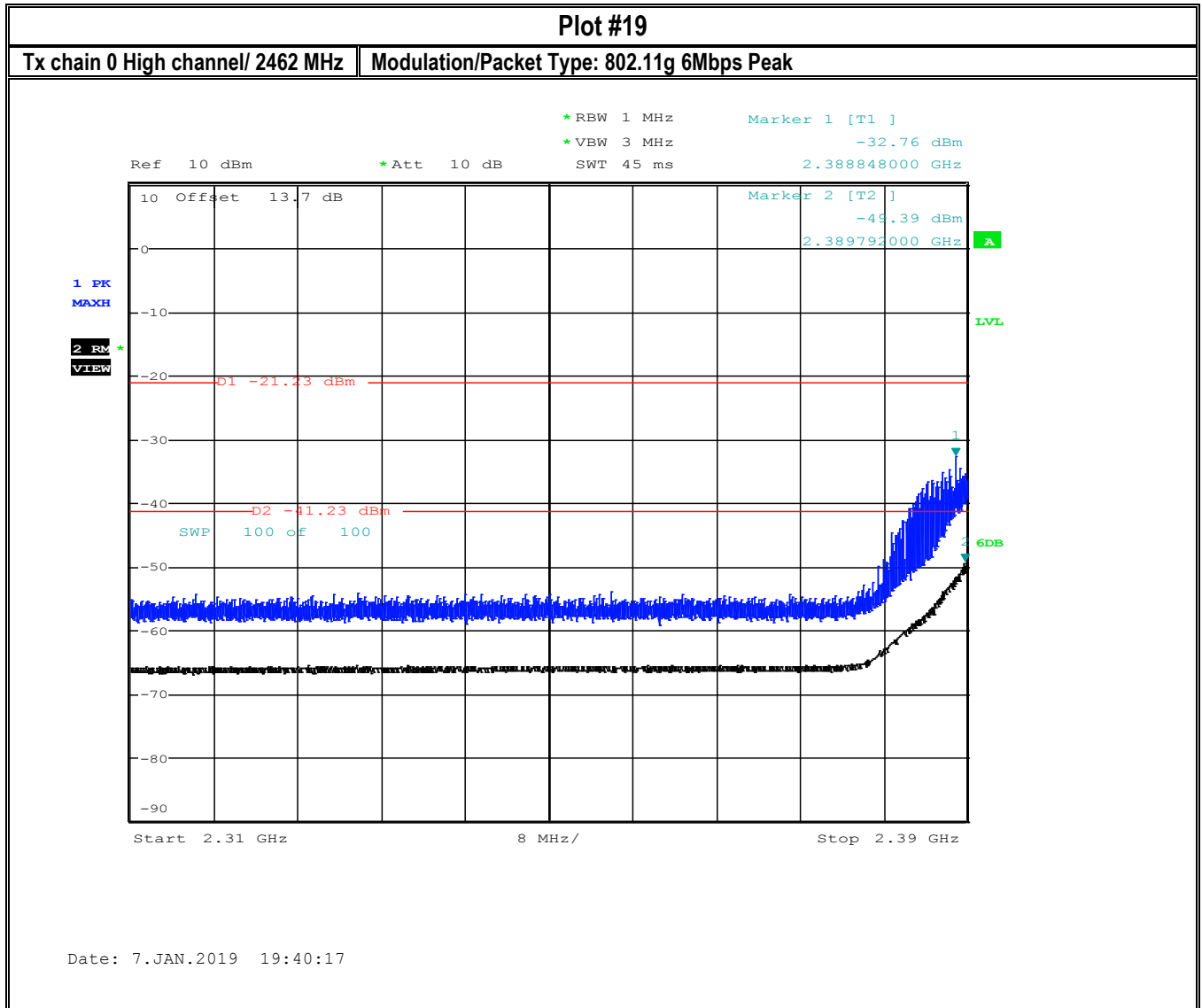
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



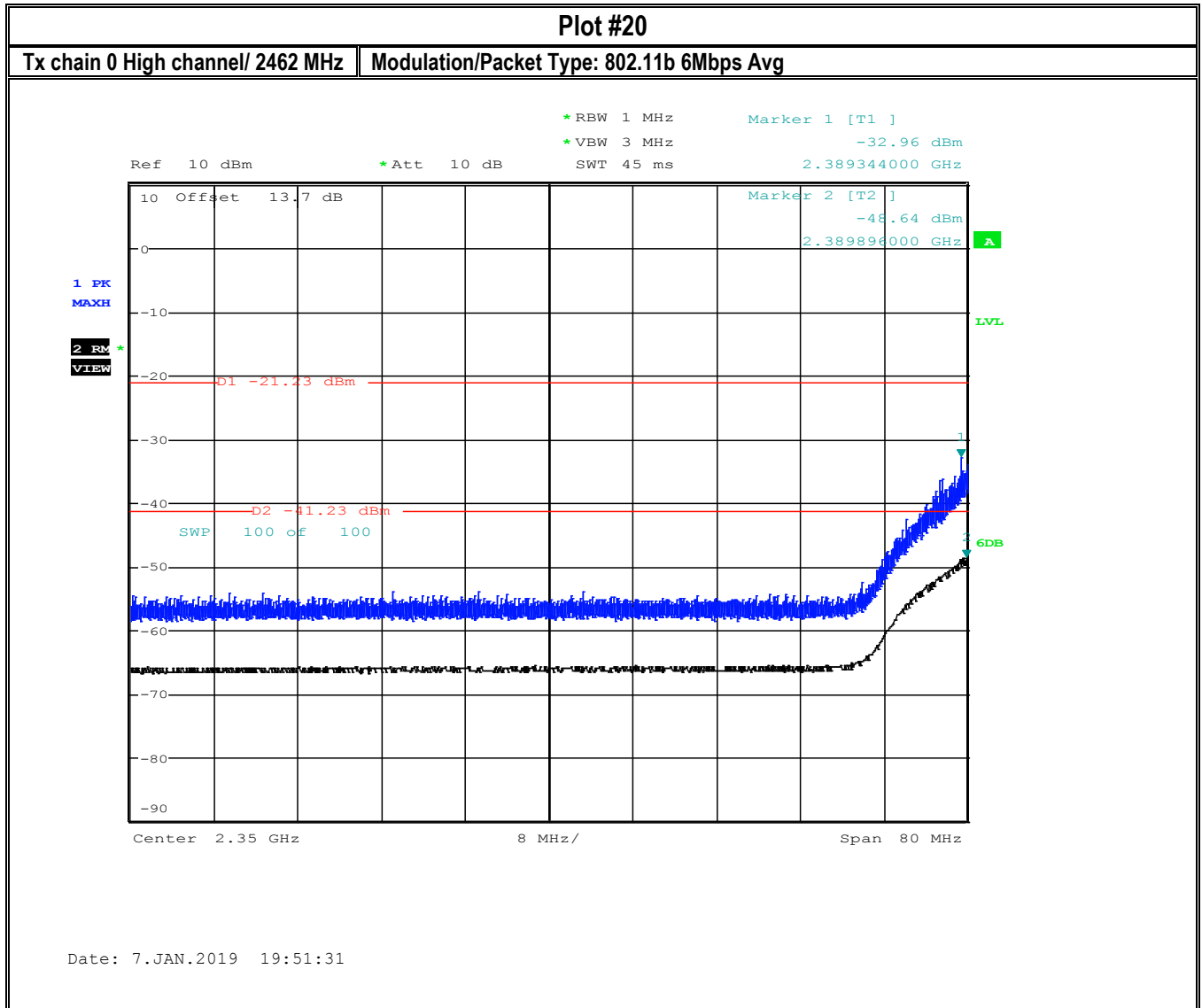
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



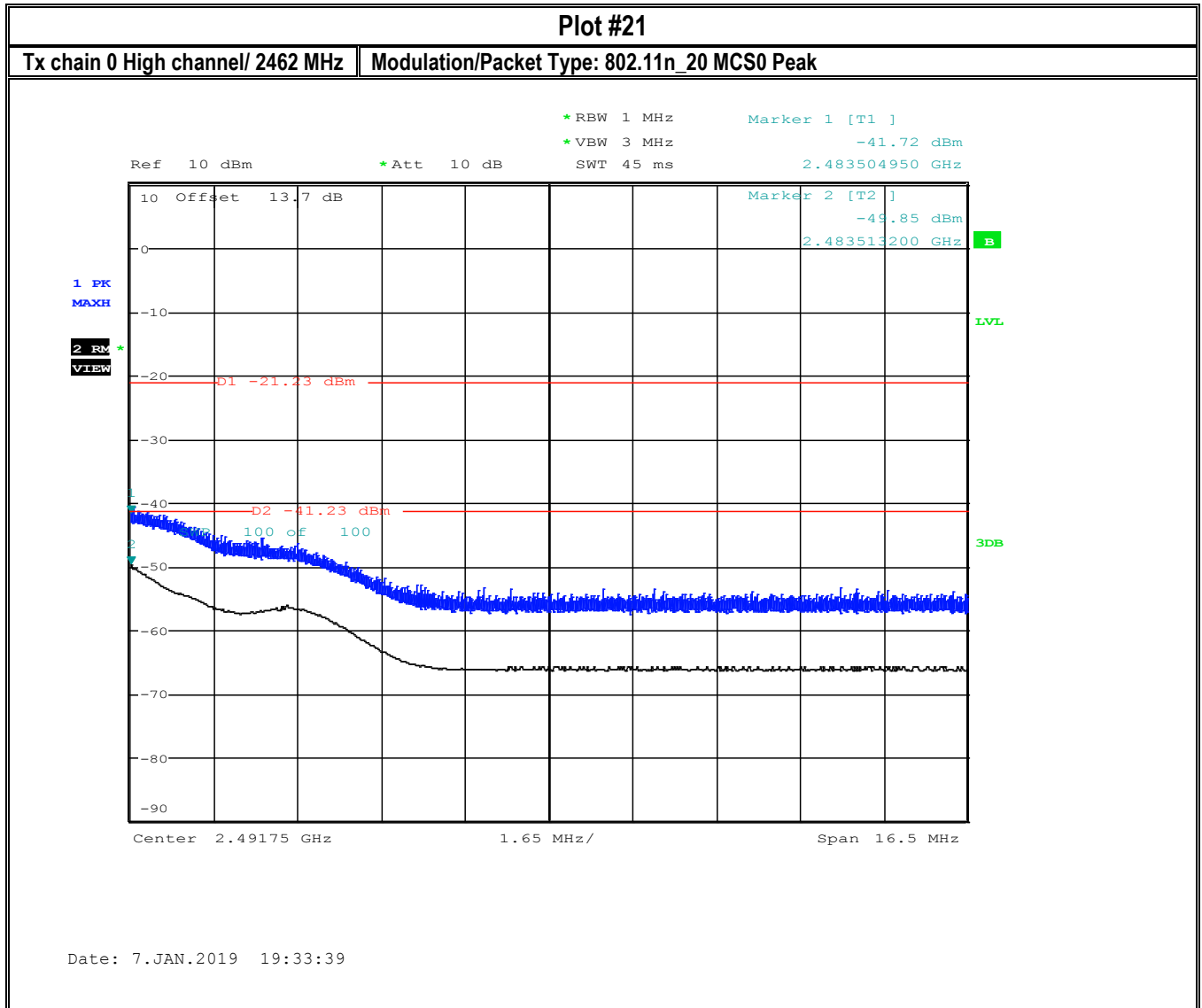
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



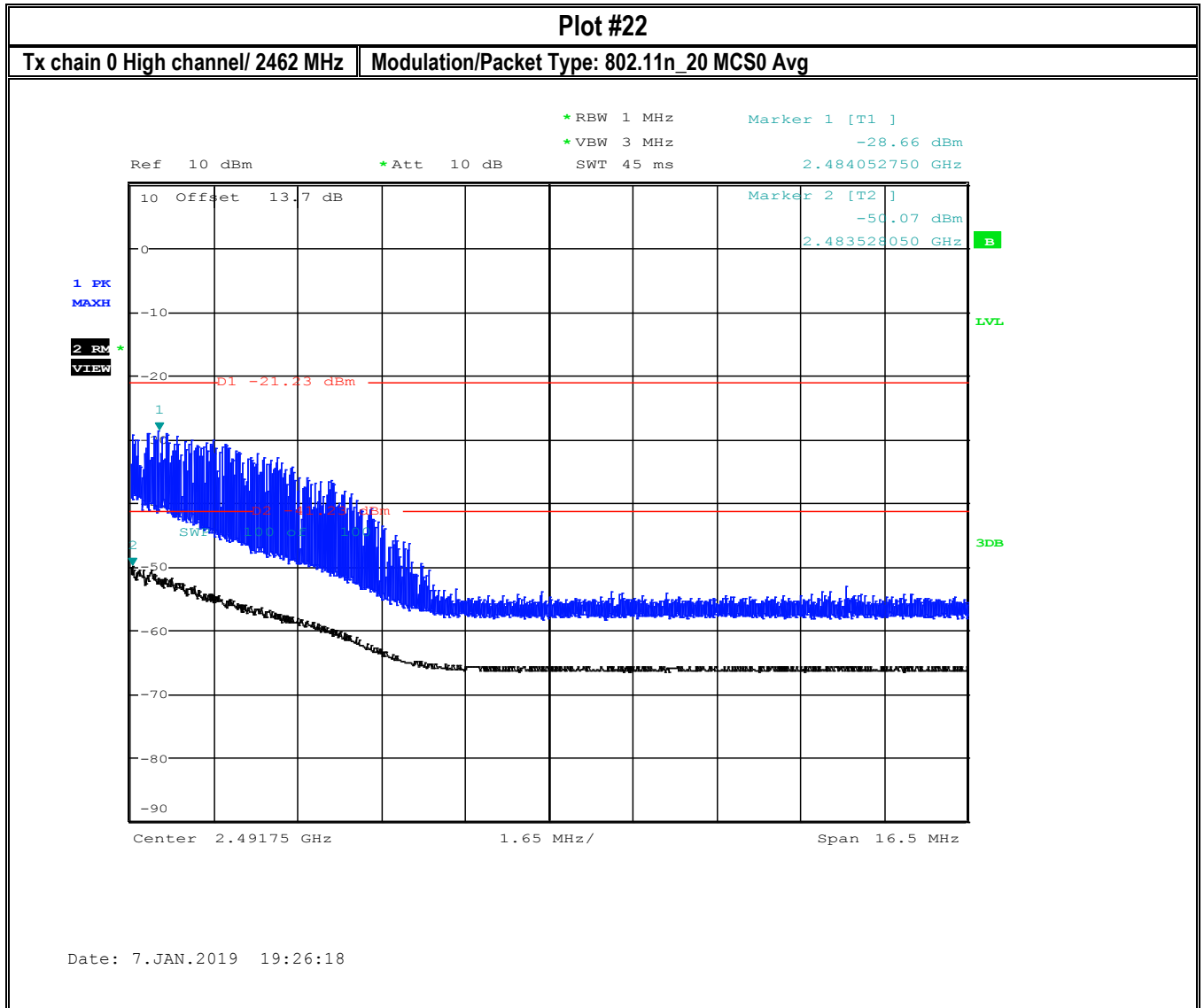
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



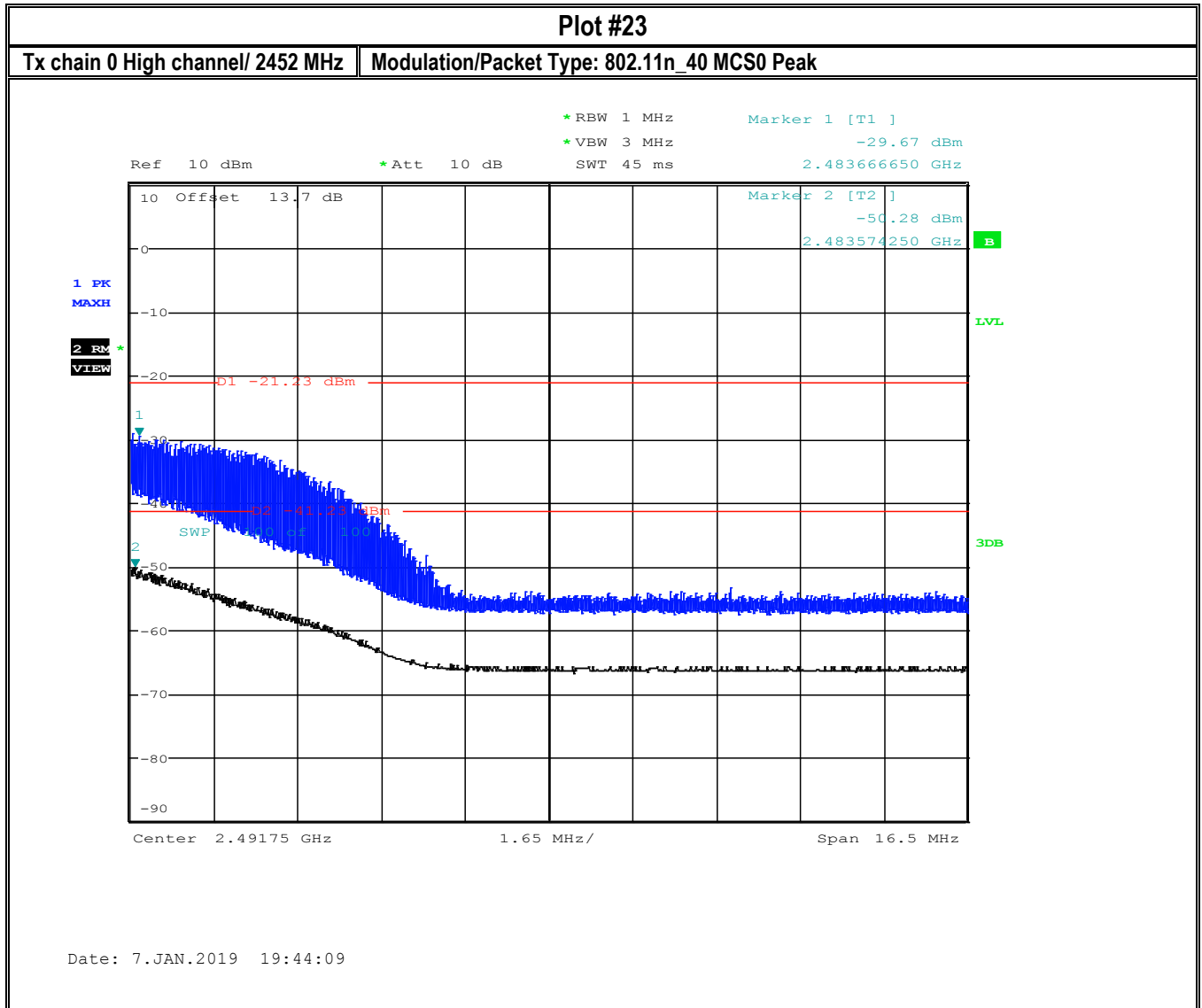
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



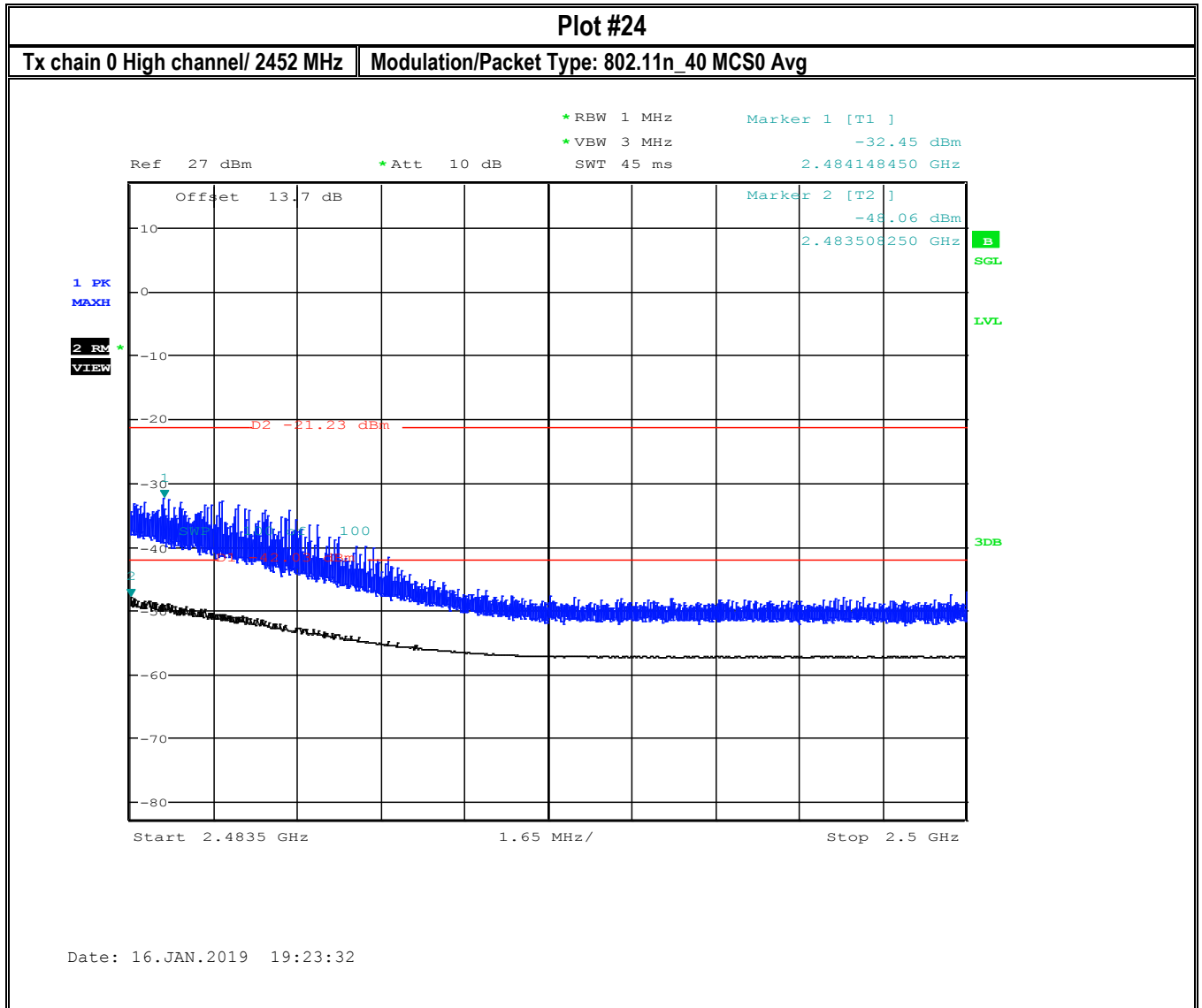
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



8.5 Emission Bandwidth 6 dB and 99% Occupied Bandwidth

8.5.1 Measurement according to FCC 558074 D01 v05 and ANSI C63. 10-2013

- DTS 6db Bandwidth per Section 11.8 ANSI C63. 10-2013
- 99% OBW per Section 6.9.3 of ANSI C63. 10-2013

Spectrum Analyzer settings:

- 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 attenuated by 6dB relative to the maximum level measured in the fundamental emission
- 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.

Note: the 99% power bandwidth function of the measurement instrument is used to measure the OBW per Section 6.9.3 of ANSI C63. 10-2013

8.5.2 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.

8.5.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------|---------------|
| 22° C | 1 | 802.11 b/g/n | AC/DC Adapter |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.5.4 Measurement result:

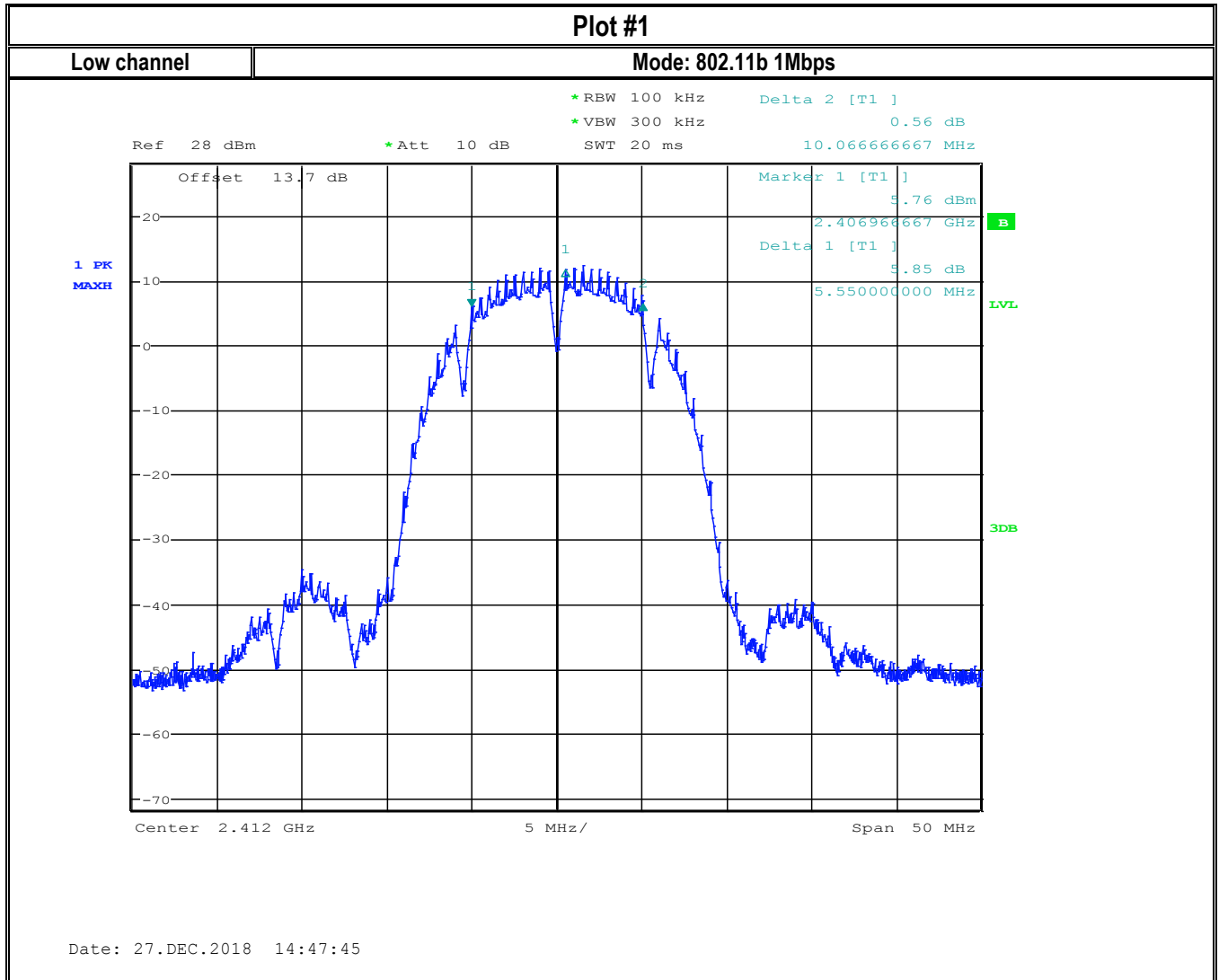
| Plot # | Mode | Channel | 6 dB Emissions Bandwidth (MHz) | Limit (MHz) | Result |
|--------|------------|---------|--------------------------------|-------------|--------|
| 1 | 802.11b | 1 | 10.06 | > 0.5 | Pass |
| 2 | 802.11b | 6 | 10.06 | > 0.5 | Pass |
| 3 | 802.11b | 11 | 10.06 | > 0.5 | Pass |
| 4 | 802.11g | 1 | 16.28 | > 0.5 | Pass |
| 5 | 802.11g | 6 | 16.17 | > 0.5 | Pass |
| 6 | 802.11g | 11 | 17.31 | > 0.5 | Pass |
| 7 | 802.11n_20 | 1 | 16.43 | > 0.5 | Pass |
| 8 | 802.11n_20 | 6 | 17.28 | > 0.5 | Pass |
| 9 | 802.11n_20 | 11 | 17.3 | > 0.5 | Pass |
| 10 | 802.11n_40 | 3 | 35.73 | > 0.5 | Pass |
| 11 | 802.11n_40 | 6 | 36.25 | > 0.5 | Pass |
| 12 | 802.11n_40 | 9 | 35.51 | > 0.5 | Pass |

| Plot # | Mode | Channel | 99% Occupied Bandwidth (MHz) | Limit (MHz) | Result |
|--------|------------|---------|------------------------------|-------------|--------|
| 13 | 802.11b | 1 | 13.6 | > 0.5 | Pass |
| 14 | 802.11b | 6 | 13.93 | > 0.5 | Pass |
| 15 | 802.11b | 11 | 13.86 | > 0.5 | Pass |
| 16 | 802.11g | 1 | 16.62 | > 0.5 | Pass |
| 17 | 802.11g | 6 | 17.02 | > 0.5 | Pass |
| 18 | 802.11g | 11 | 16.8 | > 0.5 | Pass |
| 19 | 802.11n_20 | 1 | 17.79 | > 0.5 | Pass |
| 20 | 802.11n_20 | 6 | 18.05 | > 0.5 | Pass |
| 21 | 802.11n_20 | 11 | 17.85 | > 0.5 | Pass |
| 22 | 802.11n_40 | 3 | 36.17 | > 0.5 | Pass |
| 23 | 802.11n_40 | 6 | 36.26 | > 0.5 | Pass |
| 24 | 802.11n_40 | 9 | 36.12 | > 0.5 | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

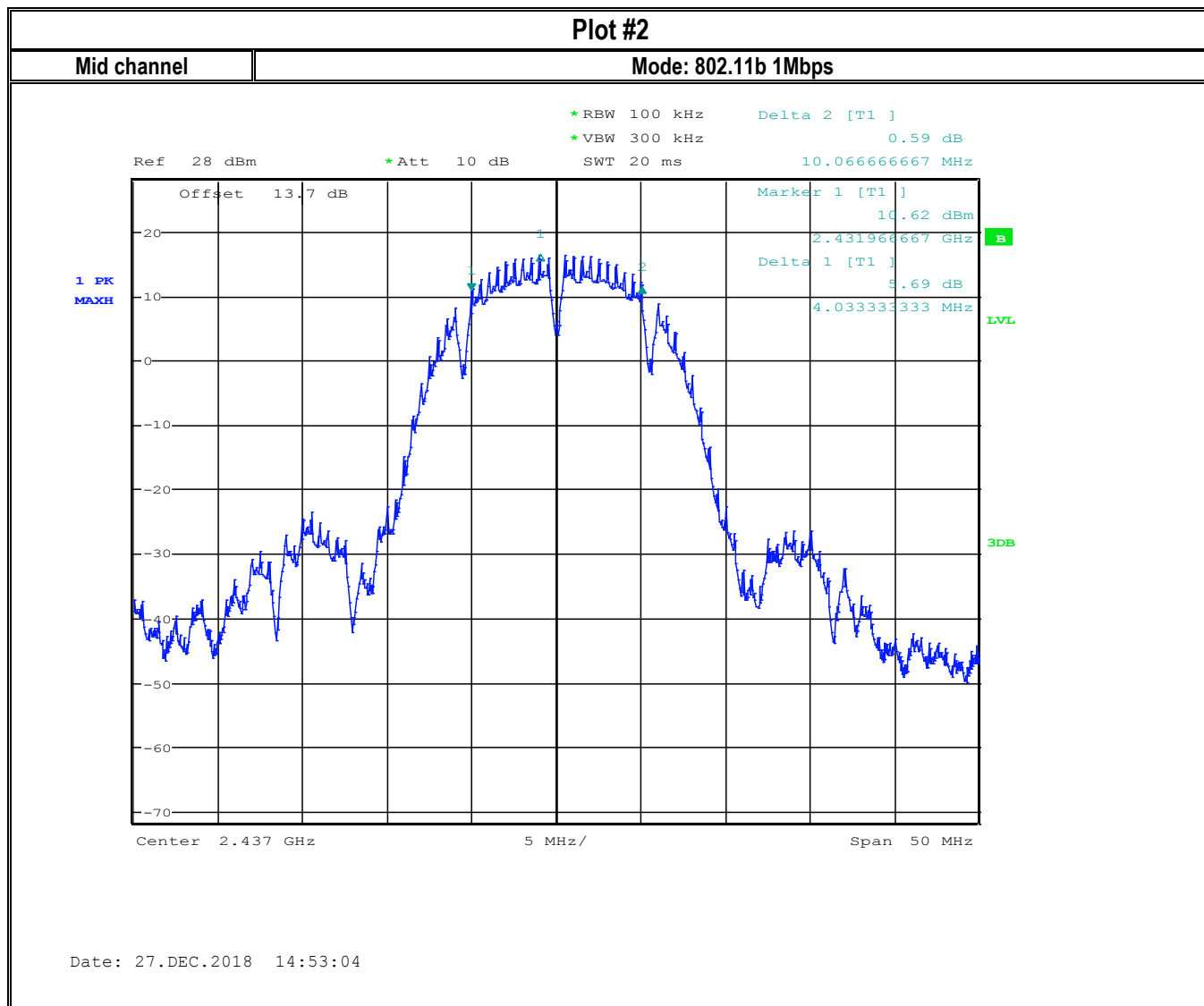
FCC ID: UUU-5411

8.5.5 Measurement Plots:



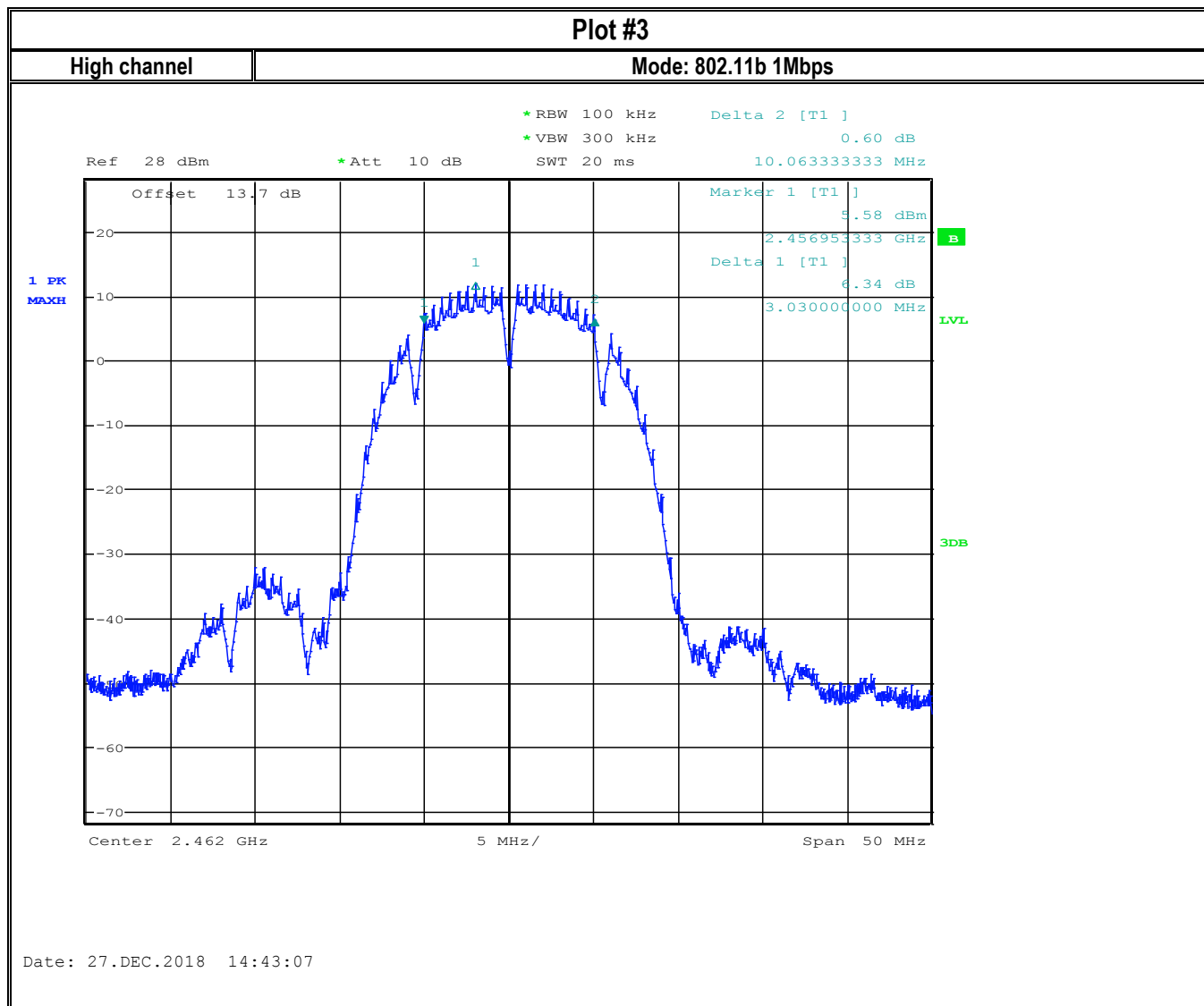
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



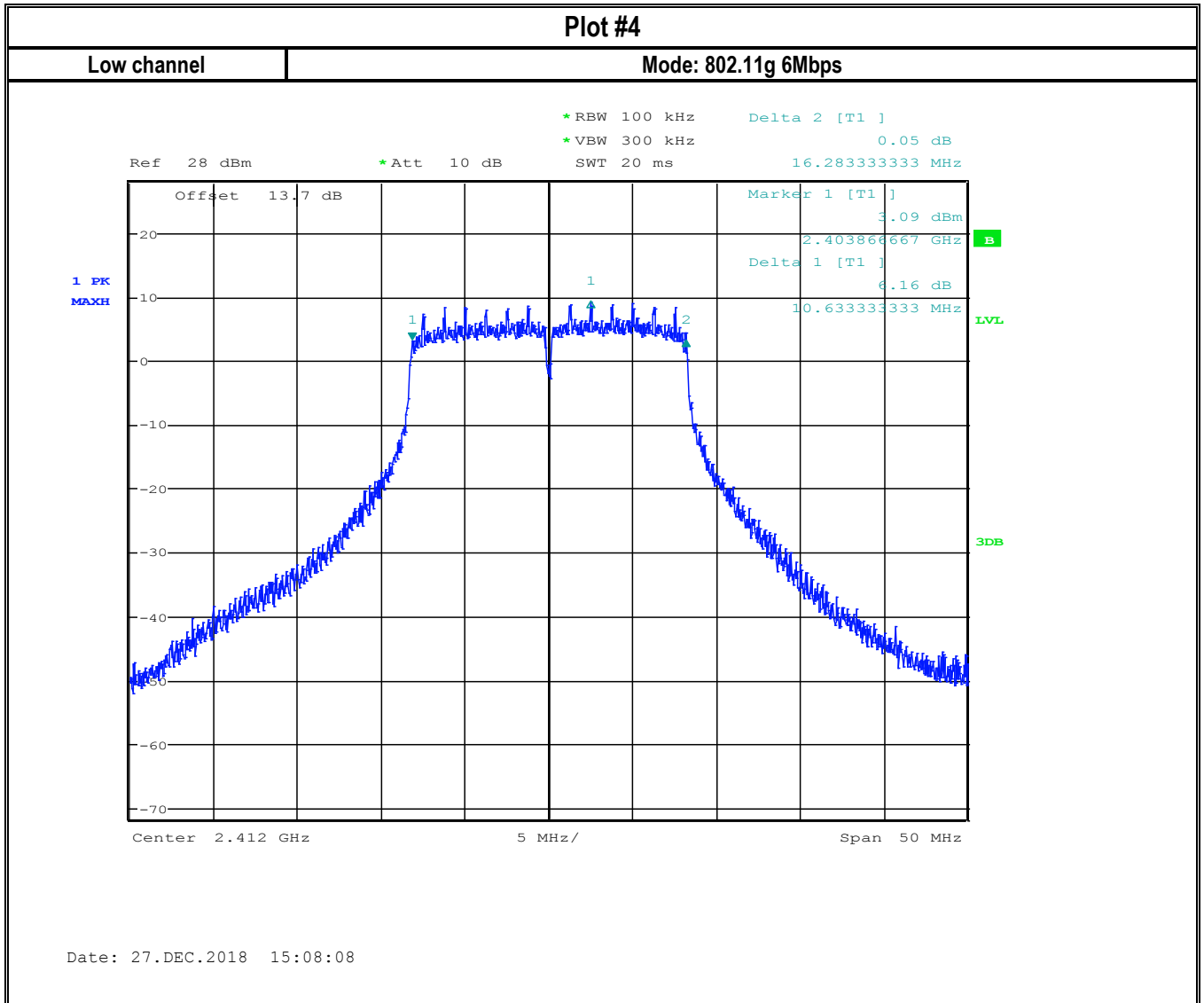
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



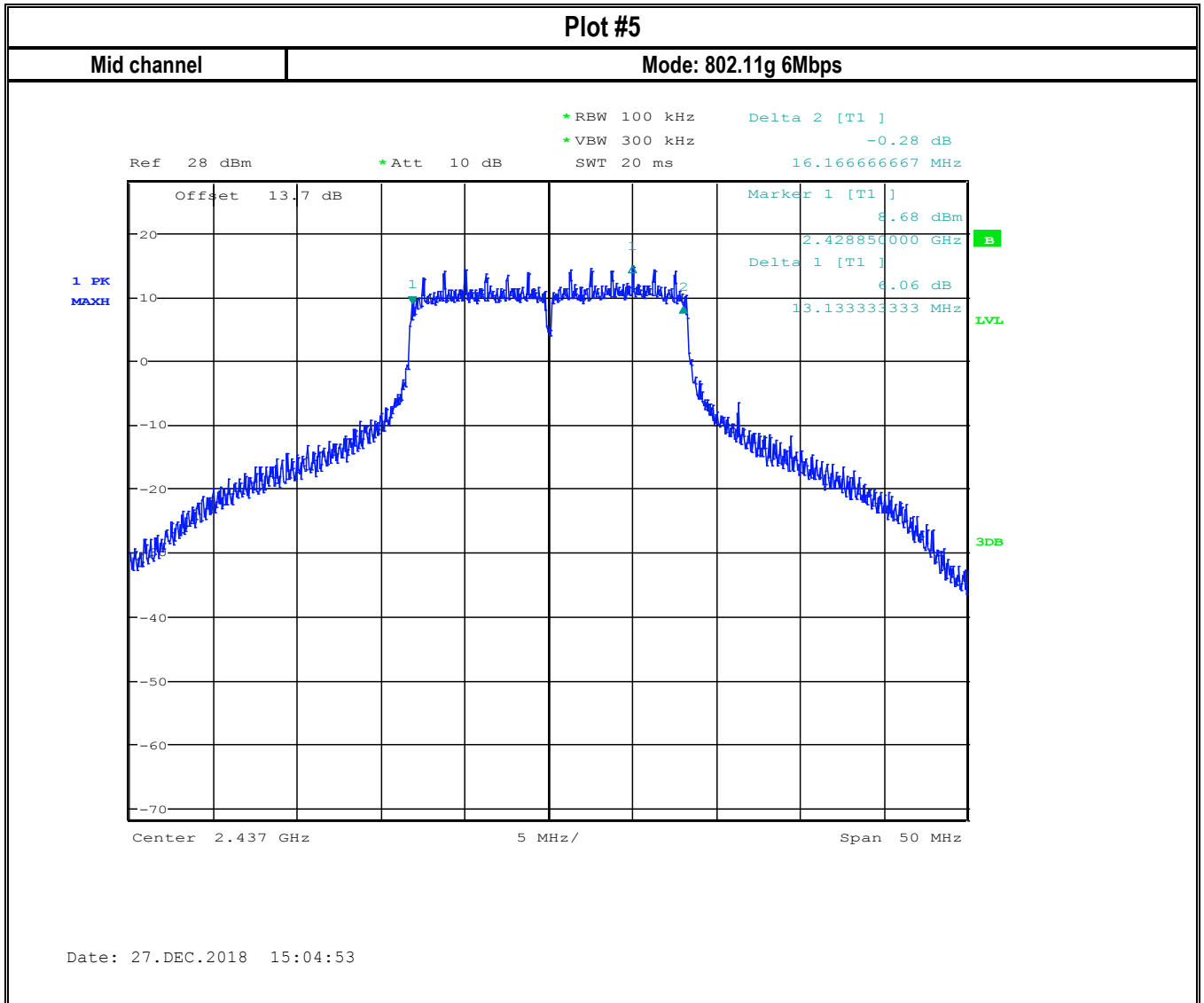
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



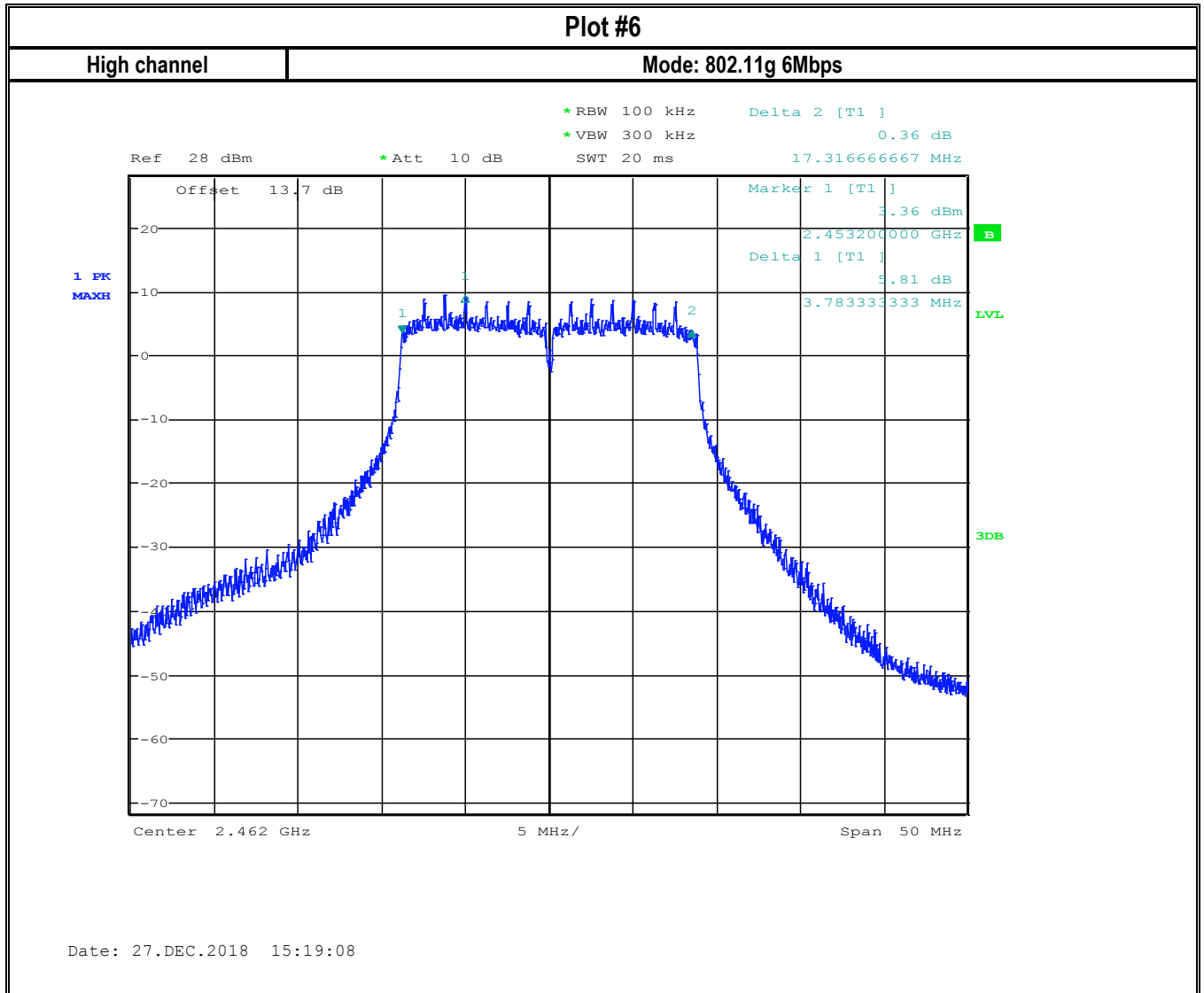
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



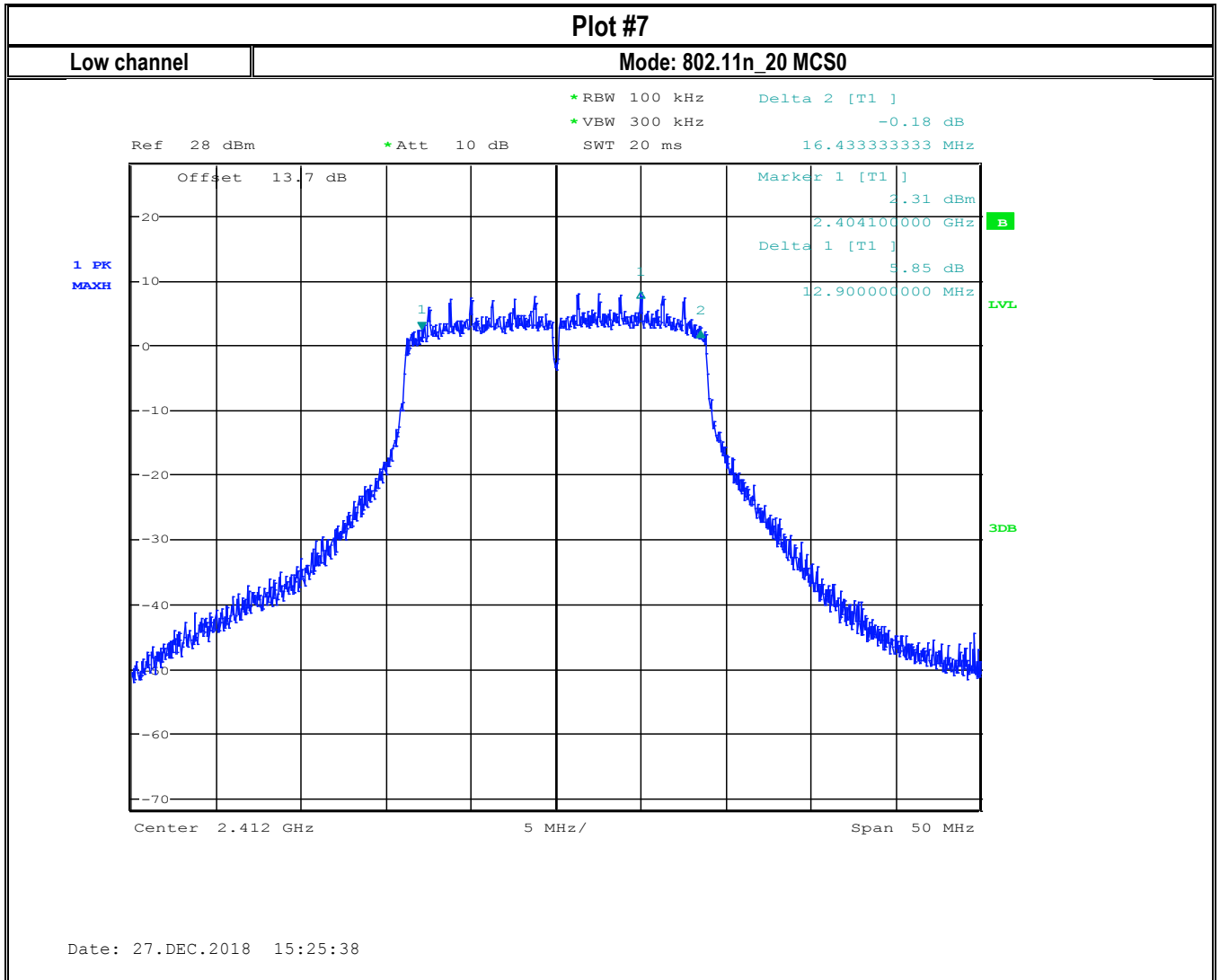
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



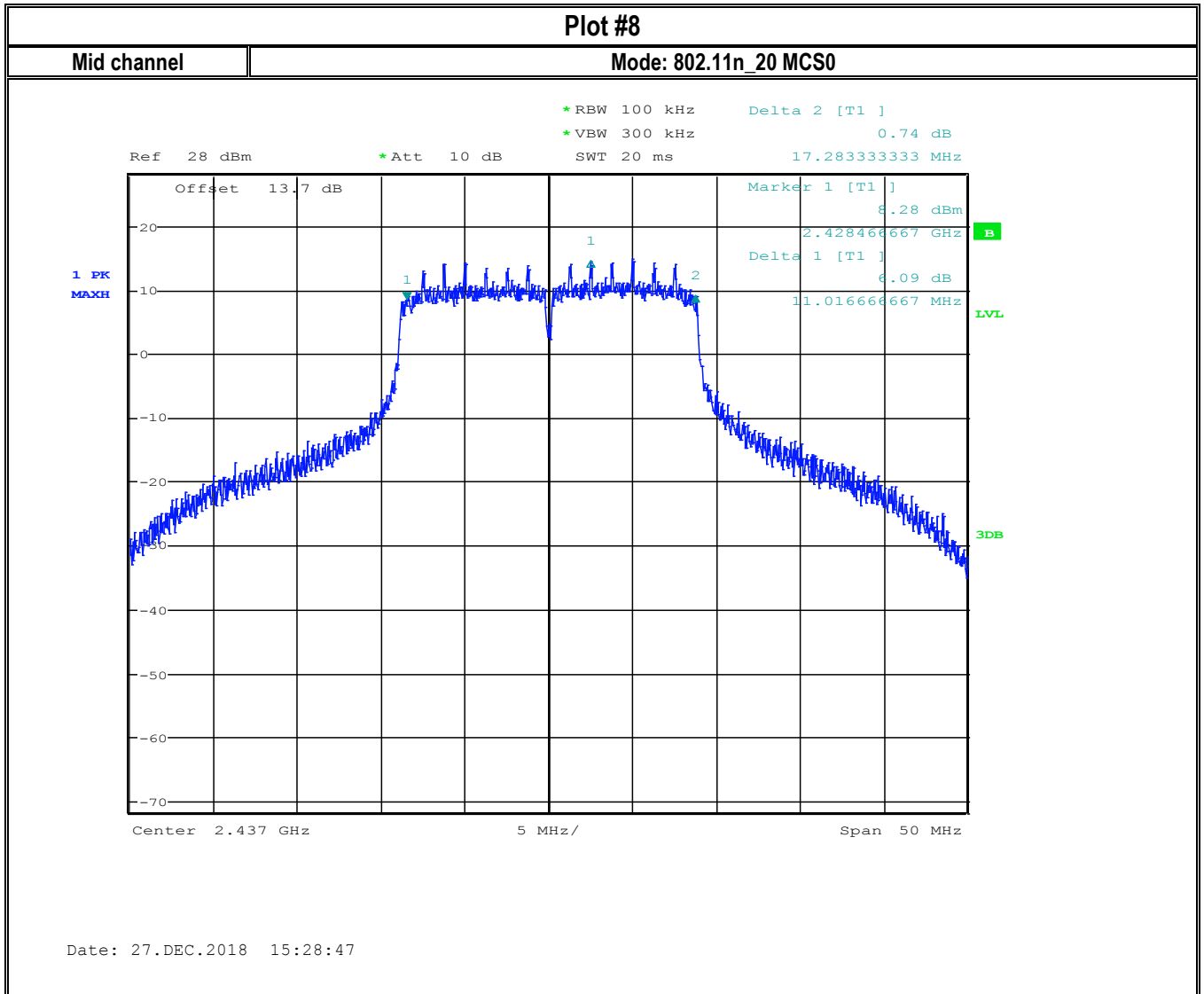
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



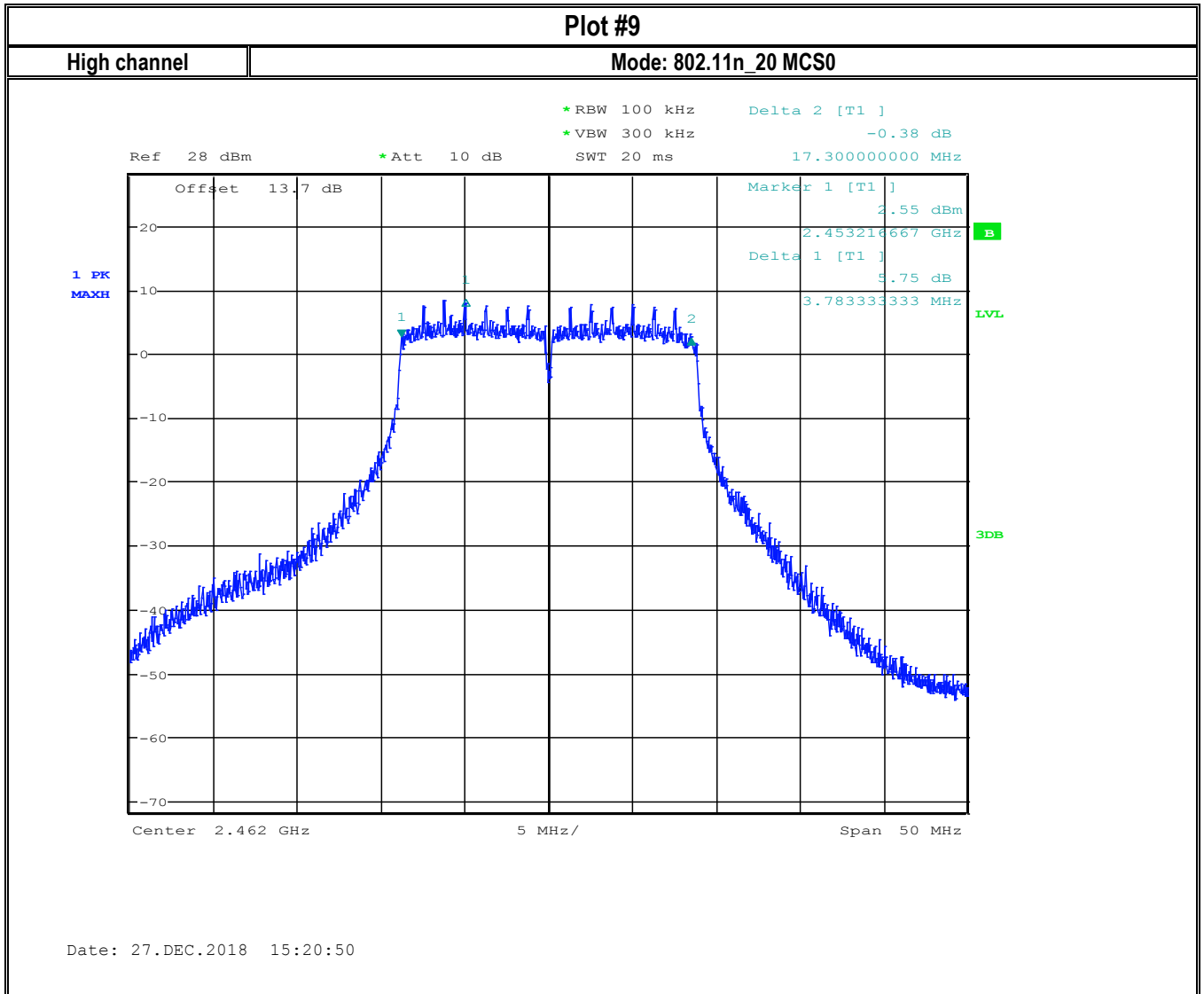
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



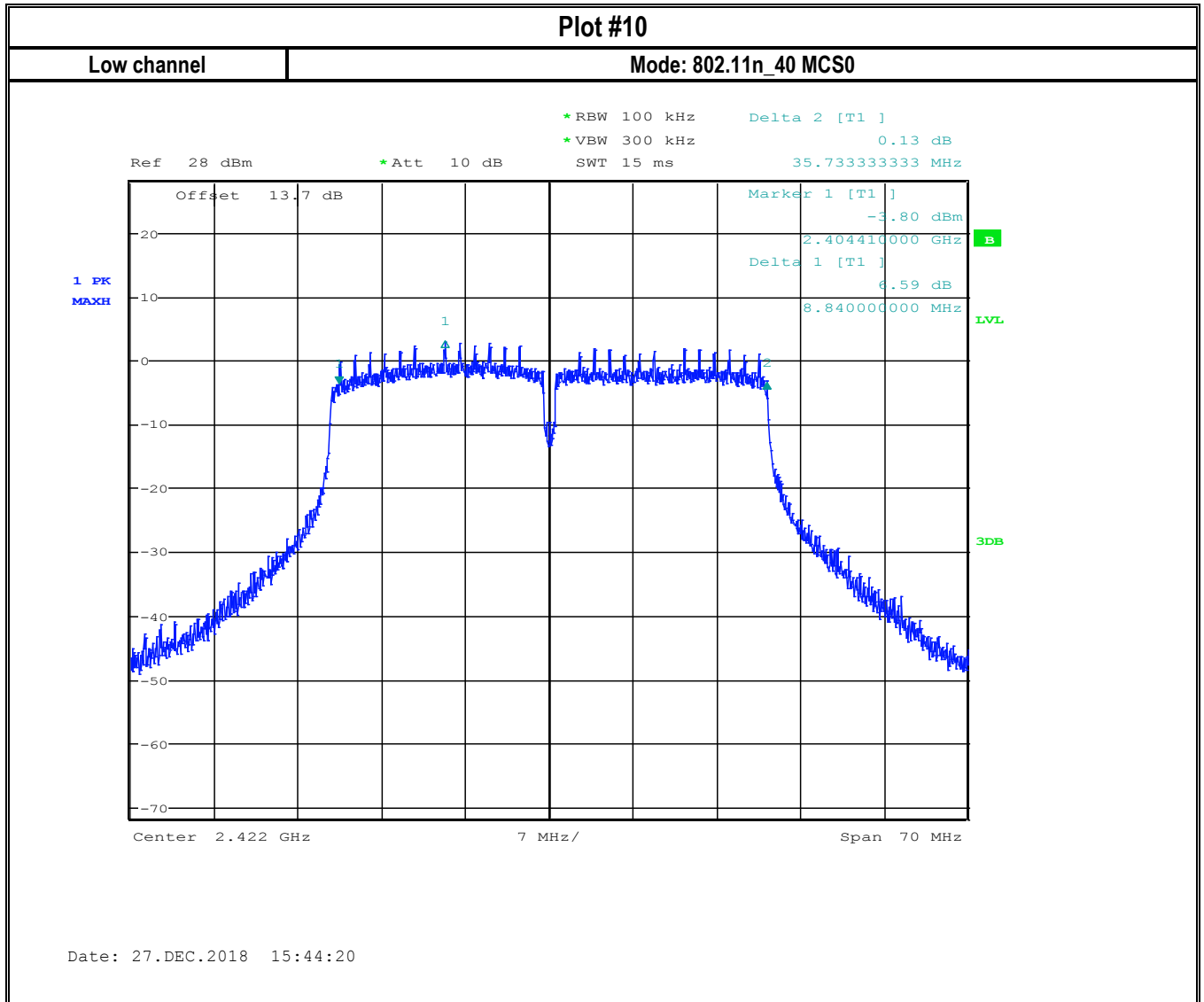
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



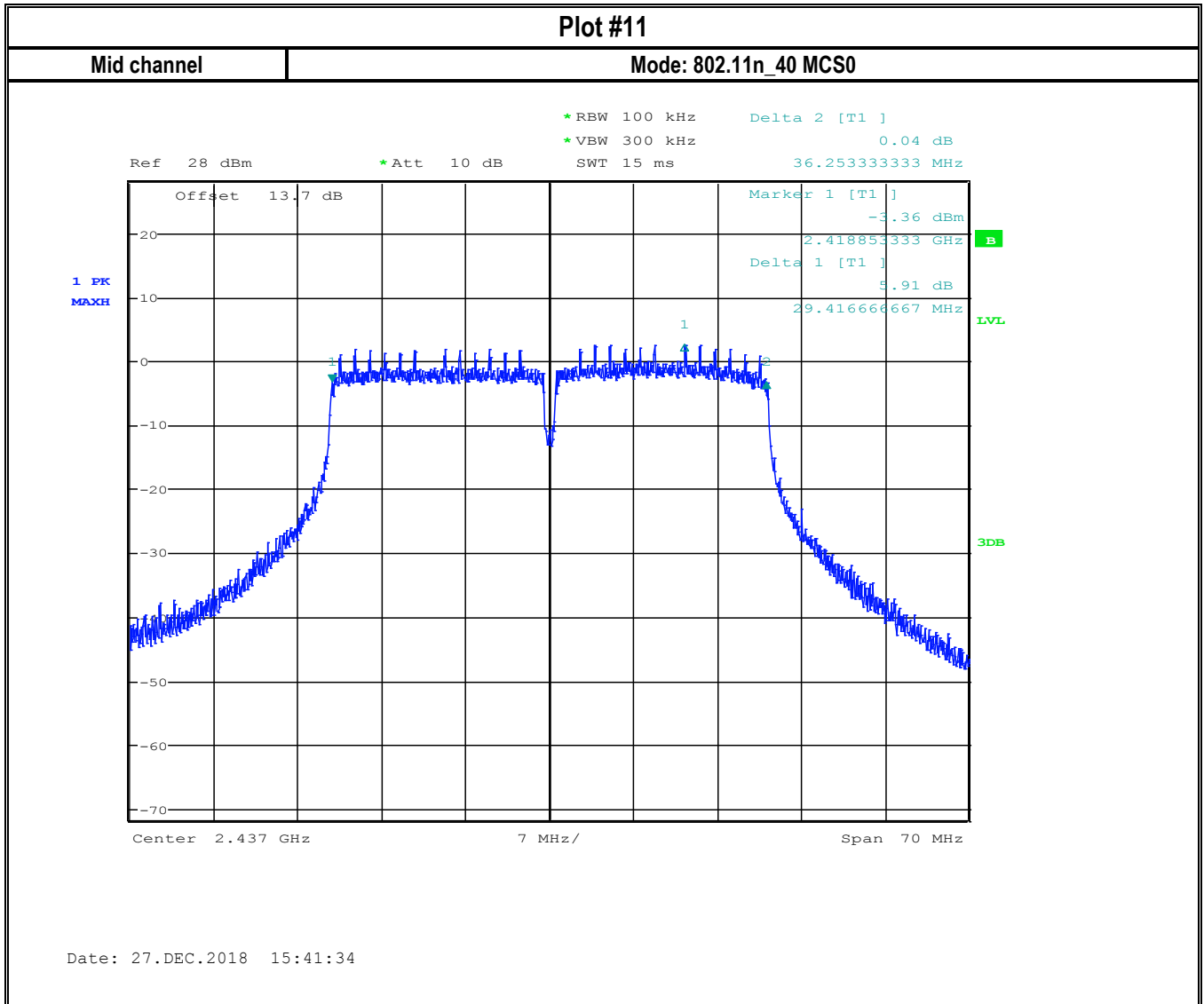
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



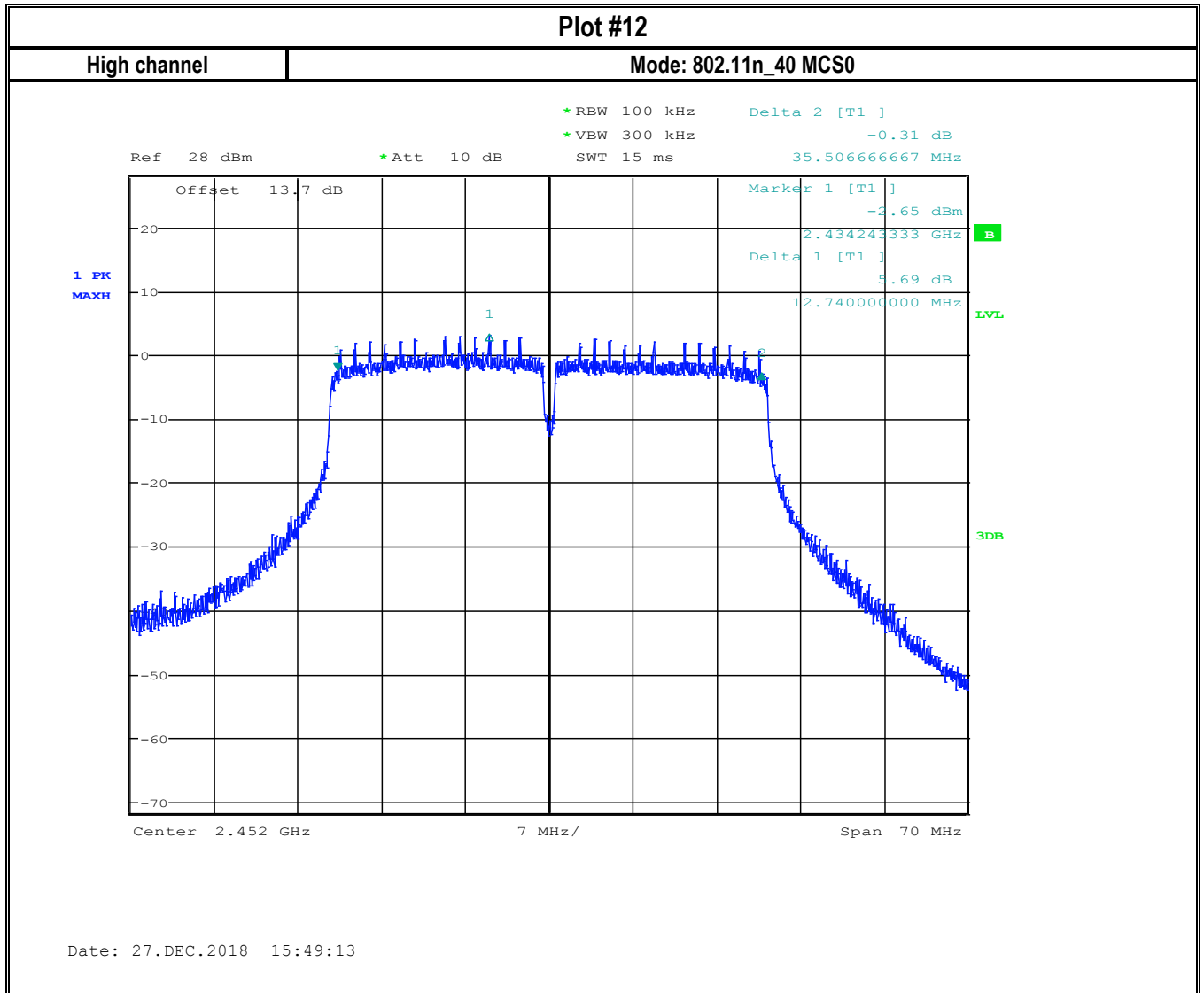
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



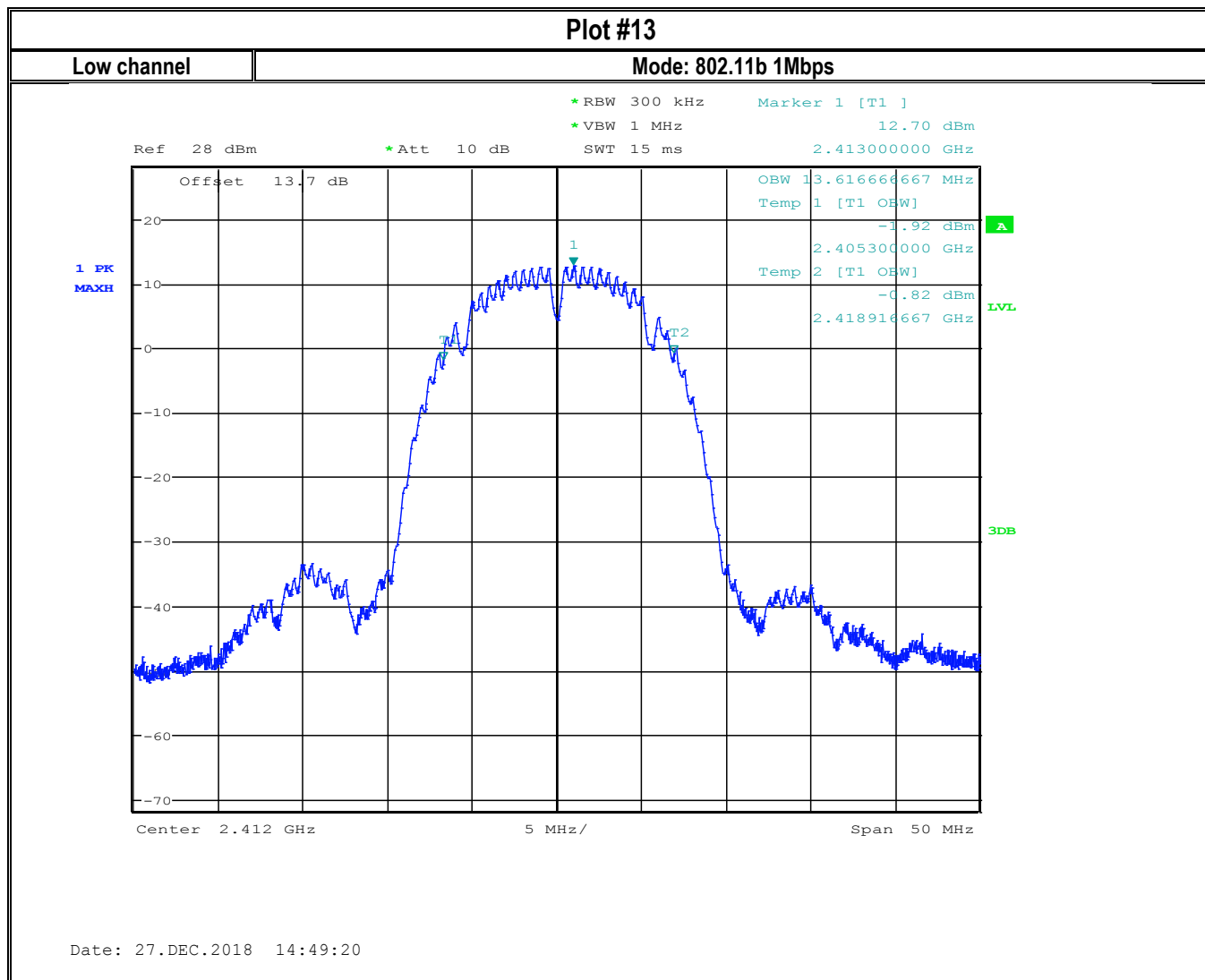
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



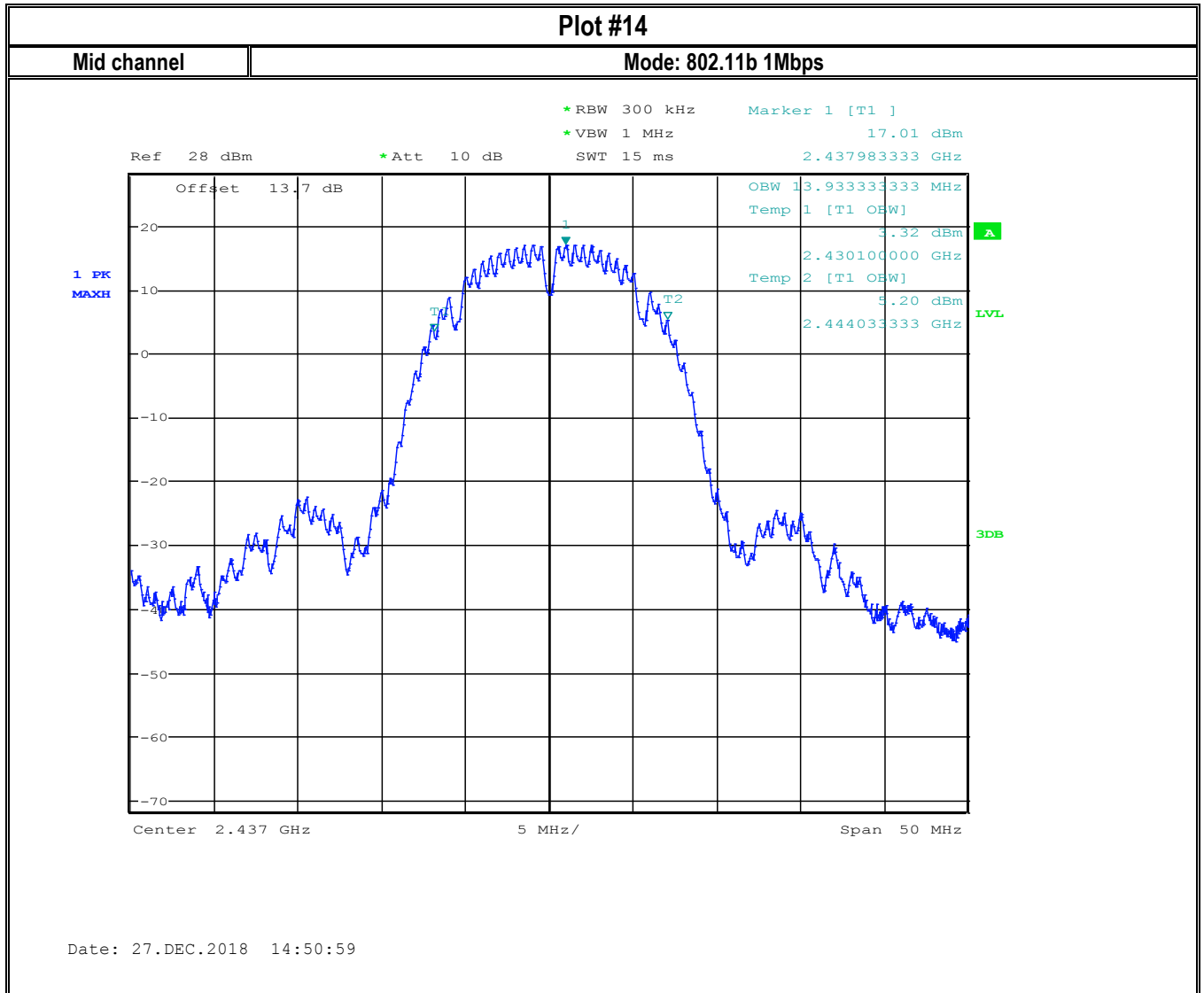
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



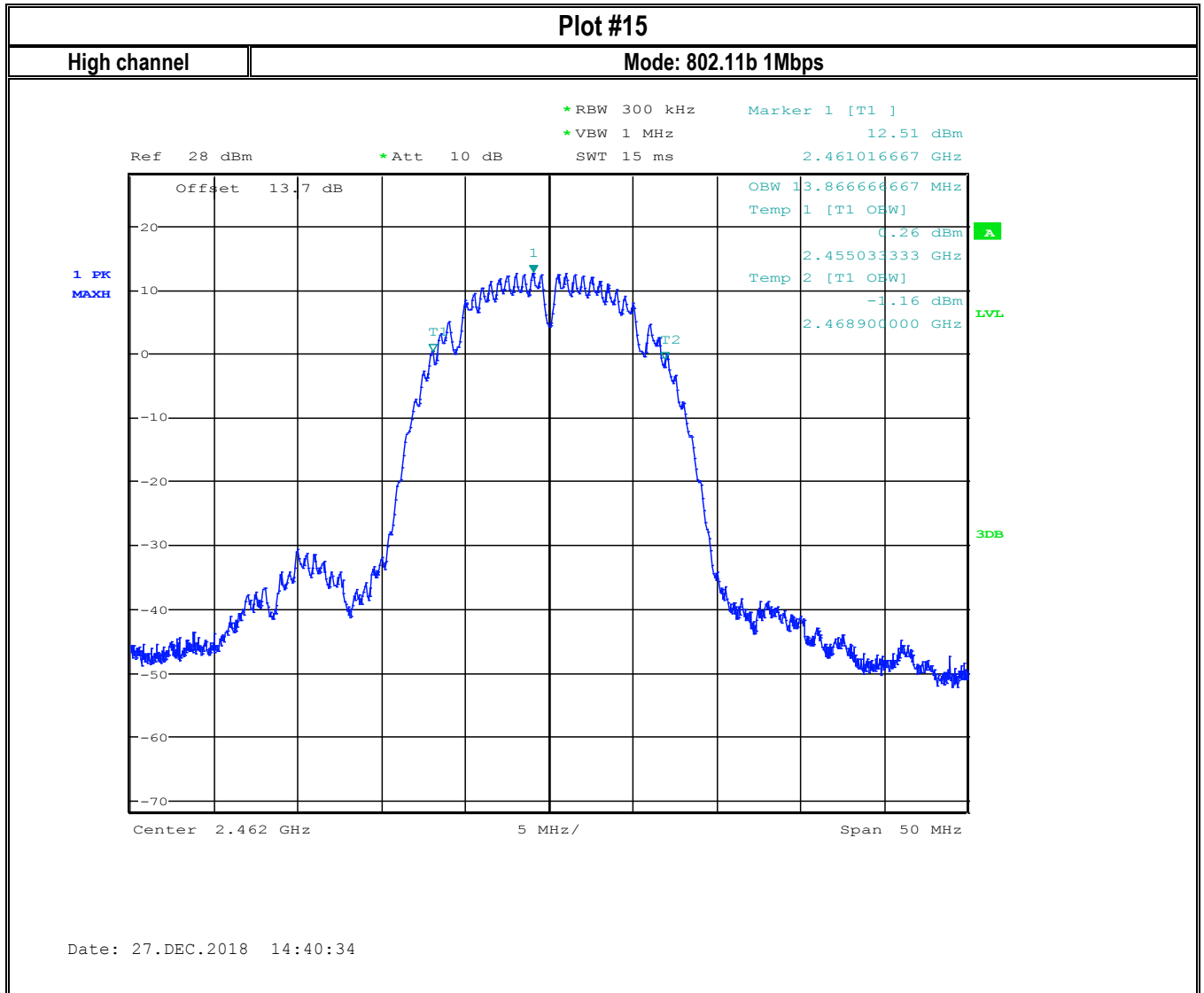
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



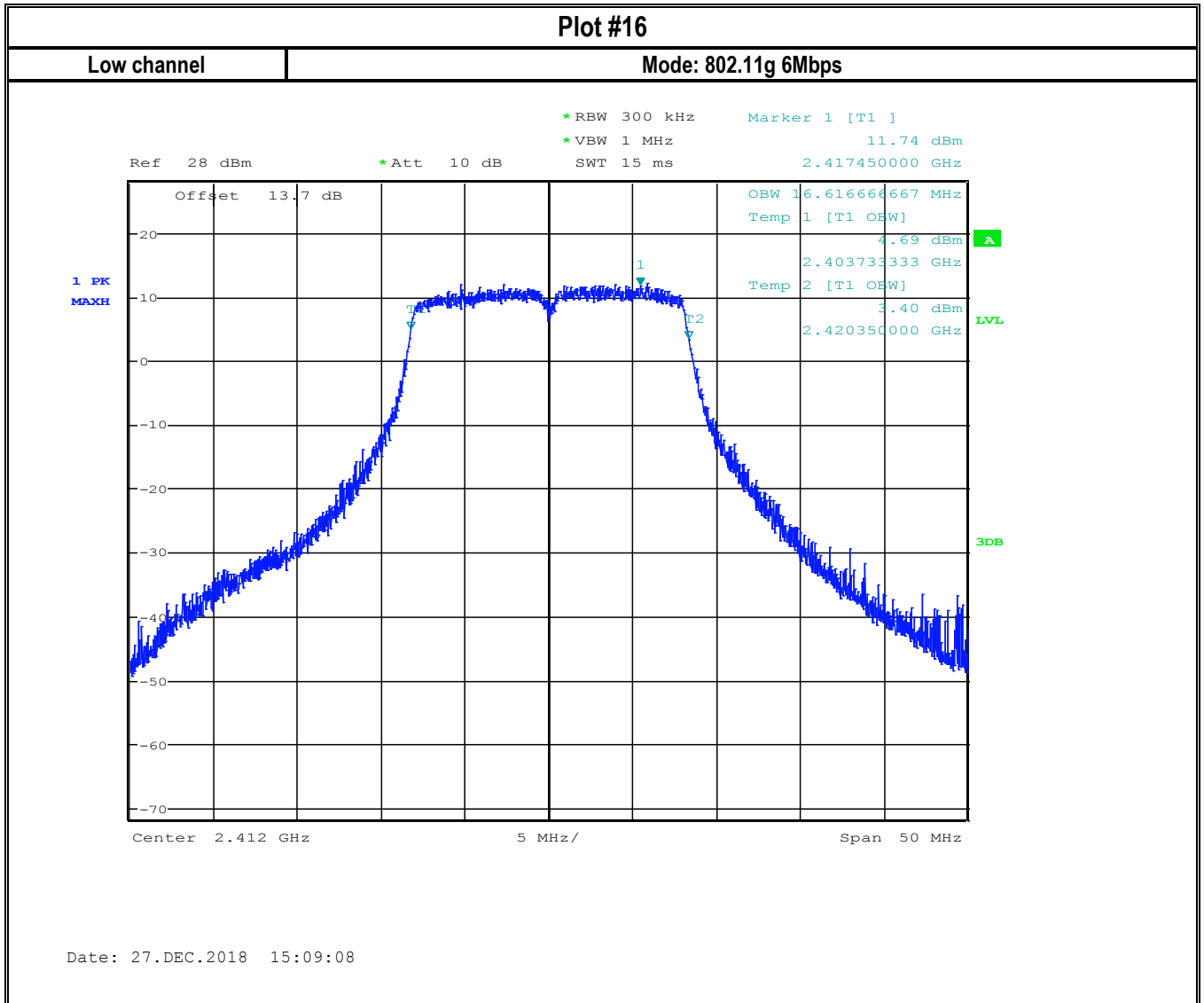
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



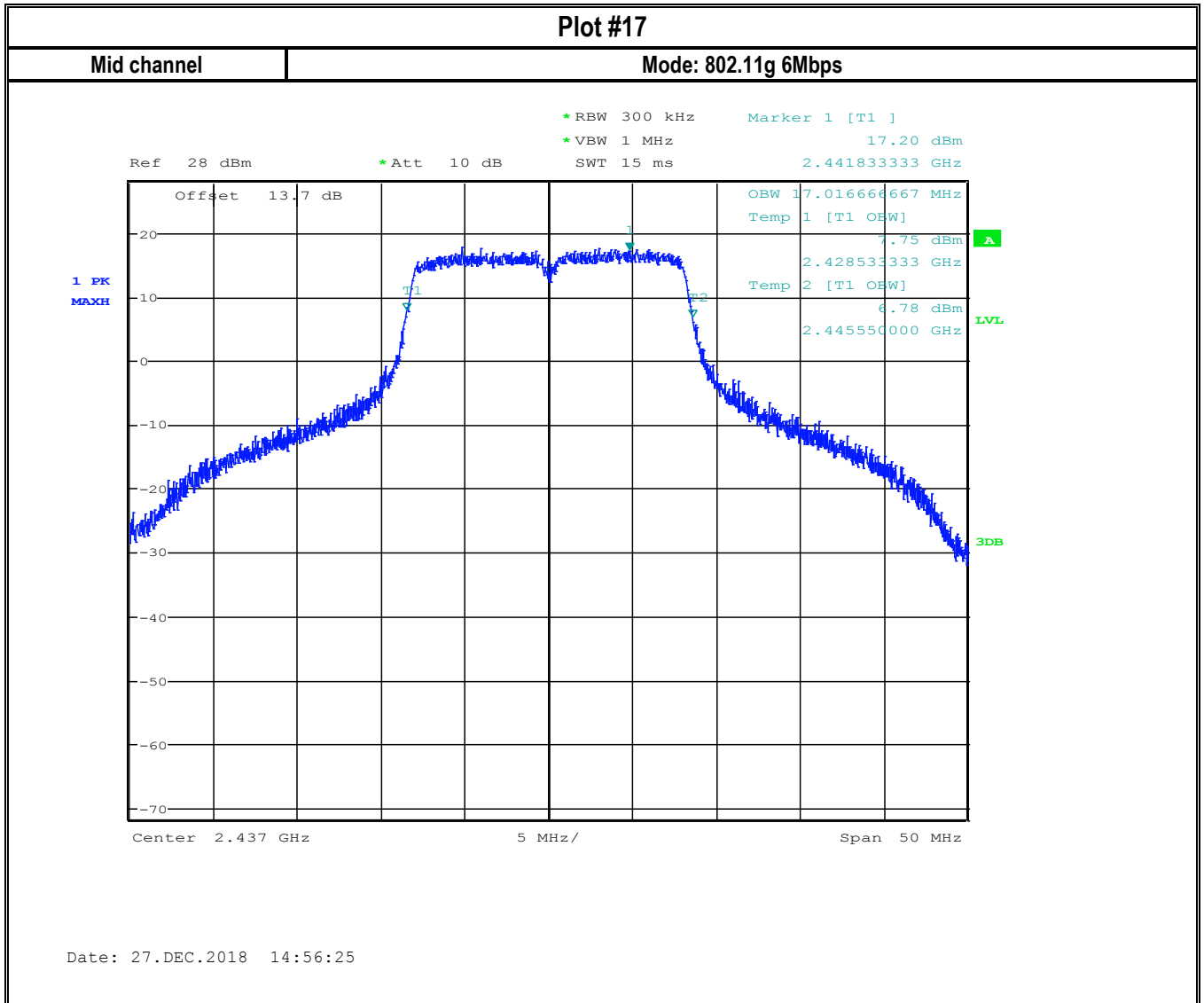
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



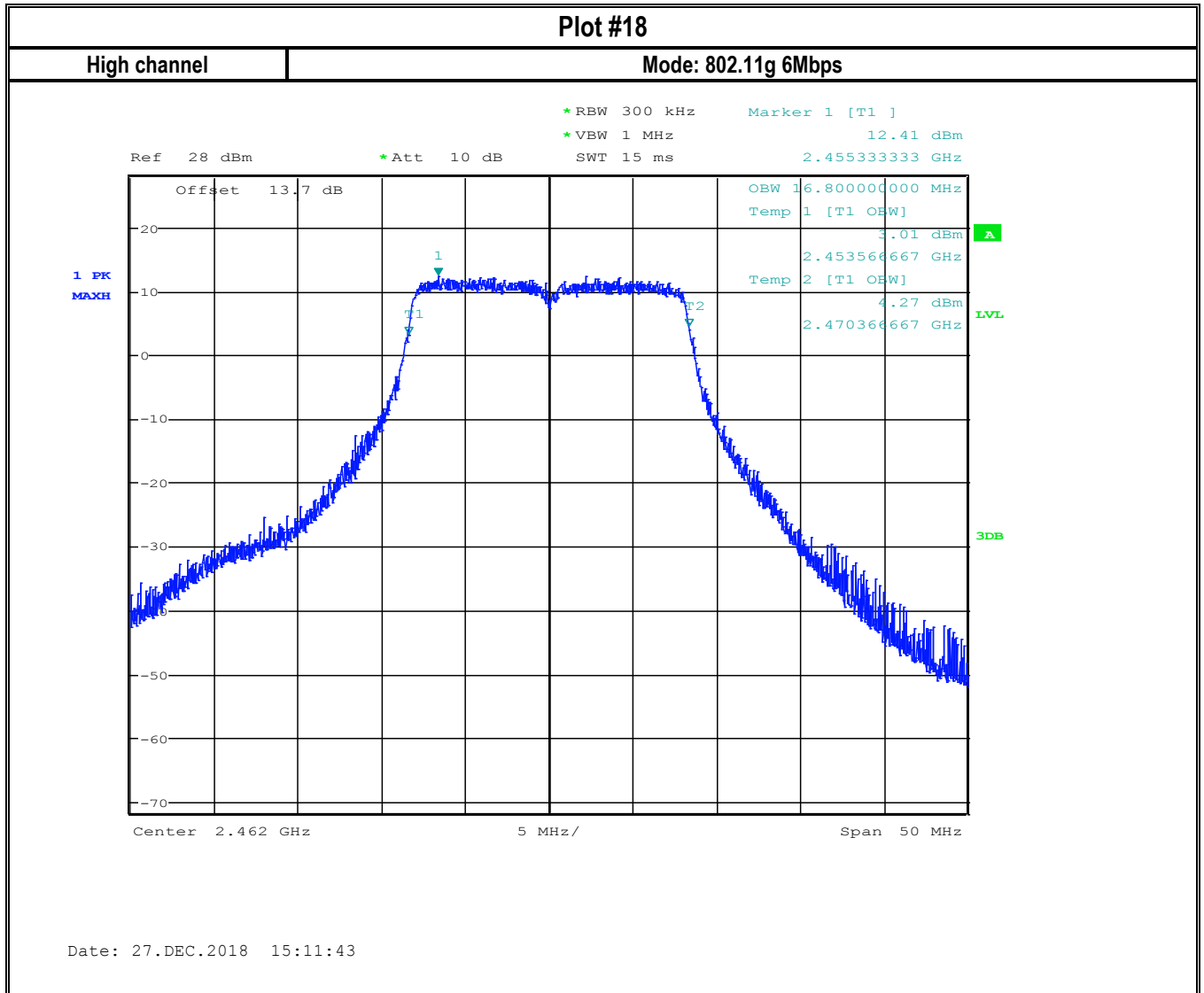
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



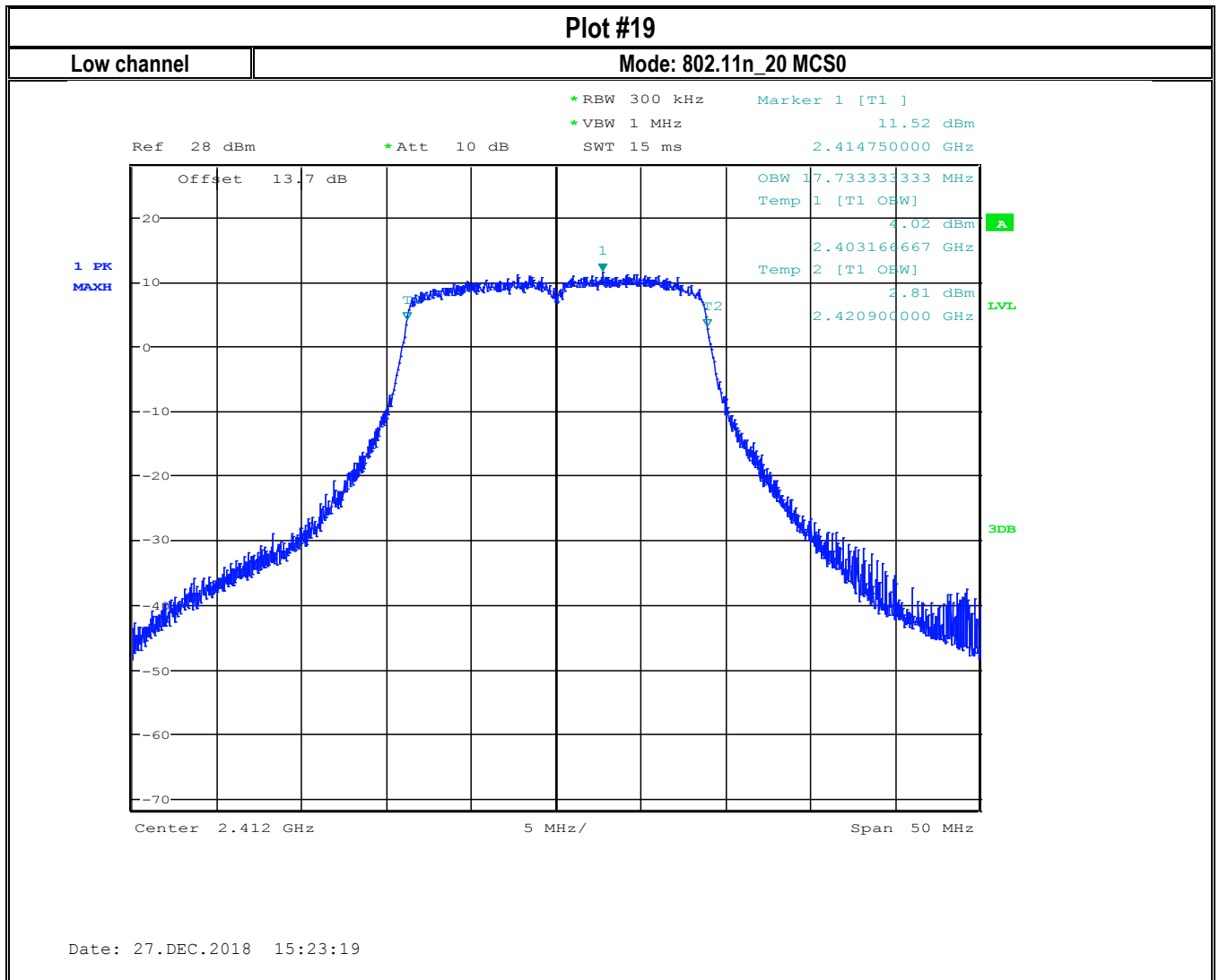
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



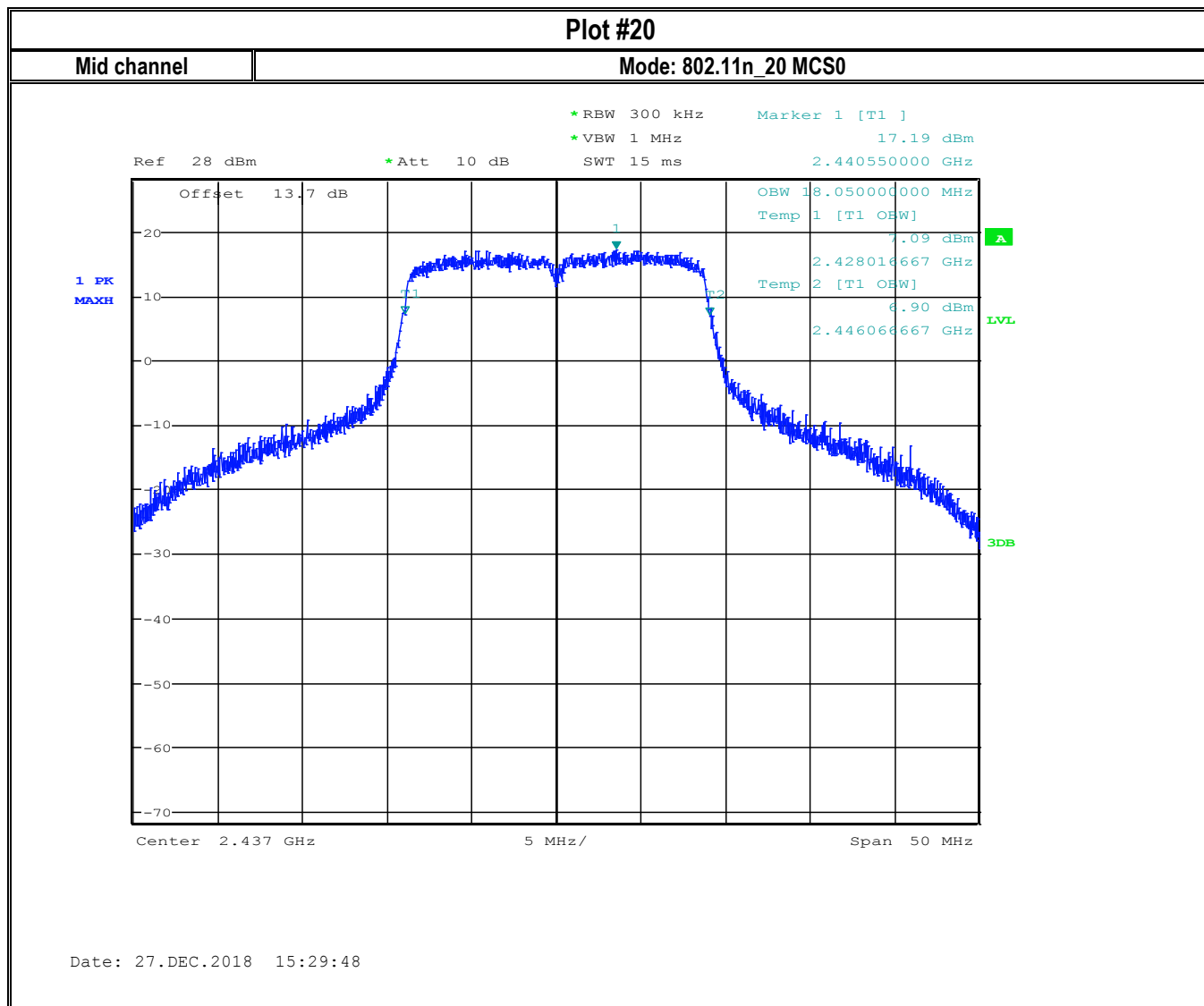
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



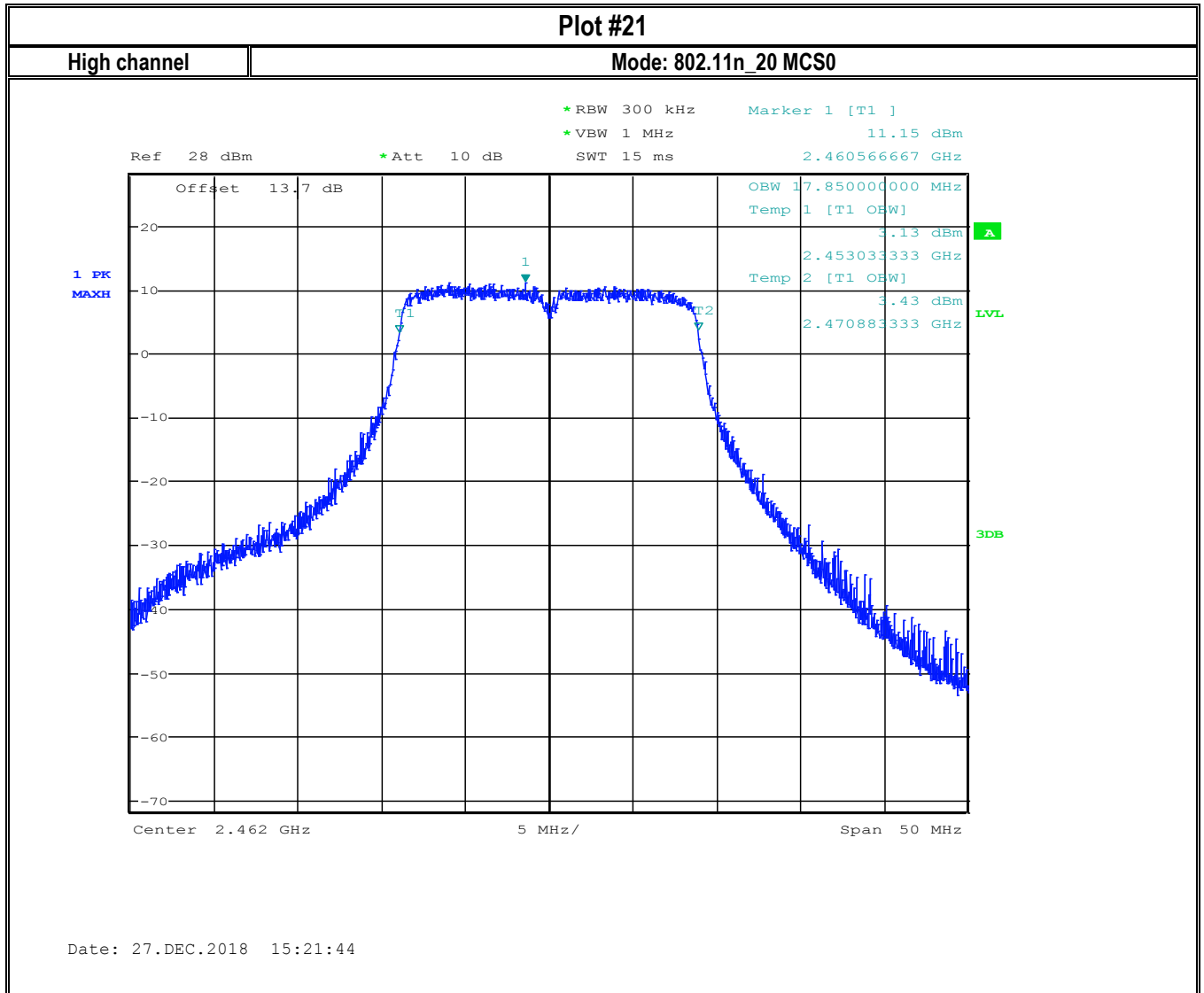
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411



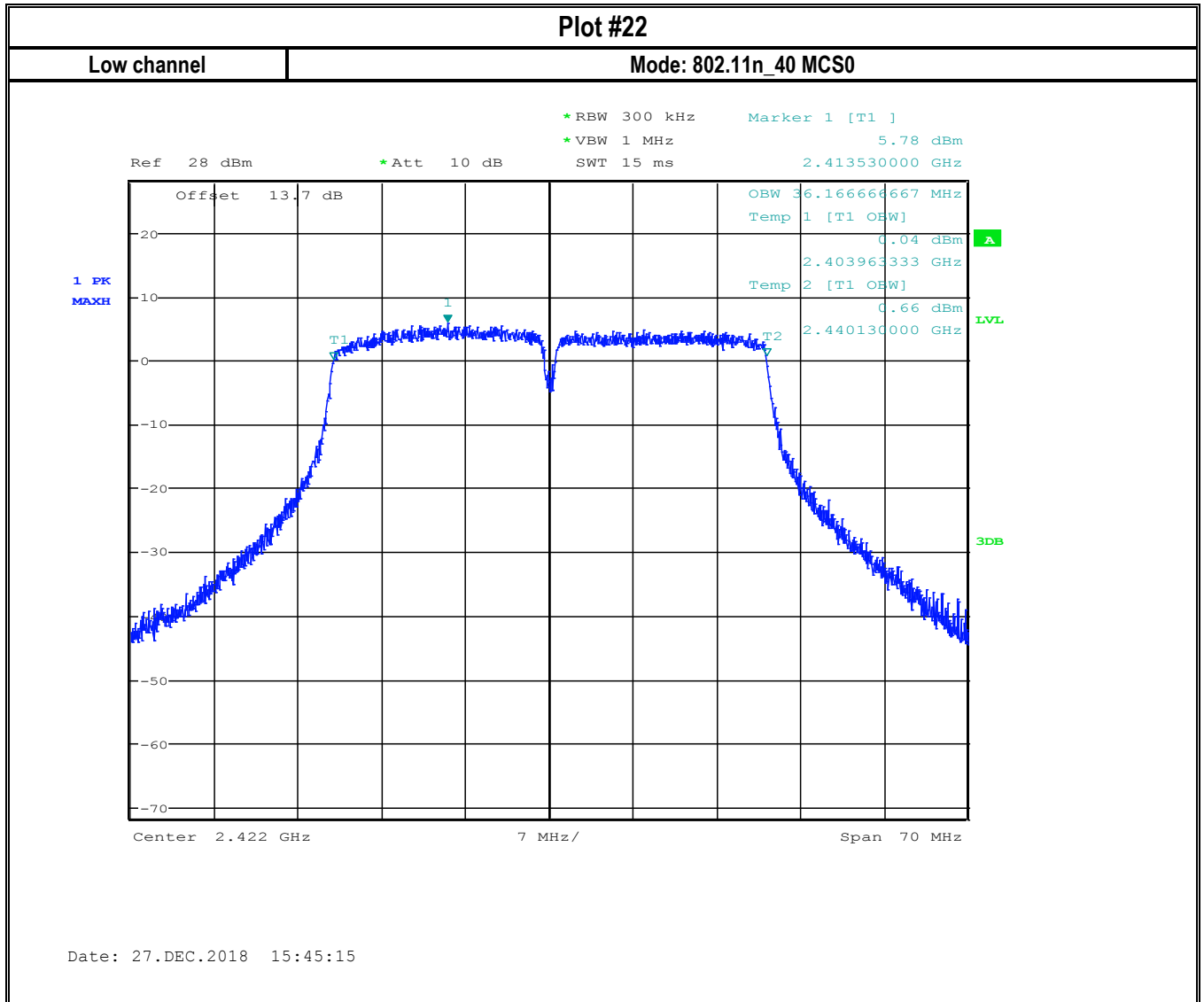
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



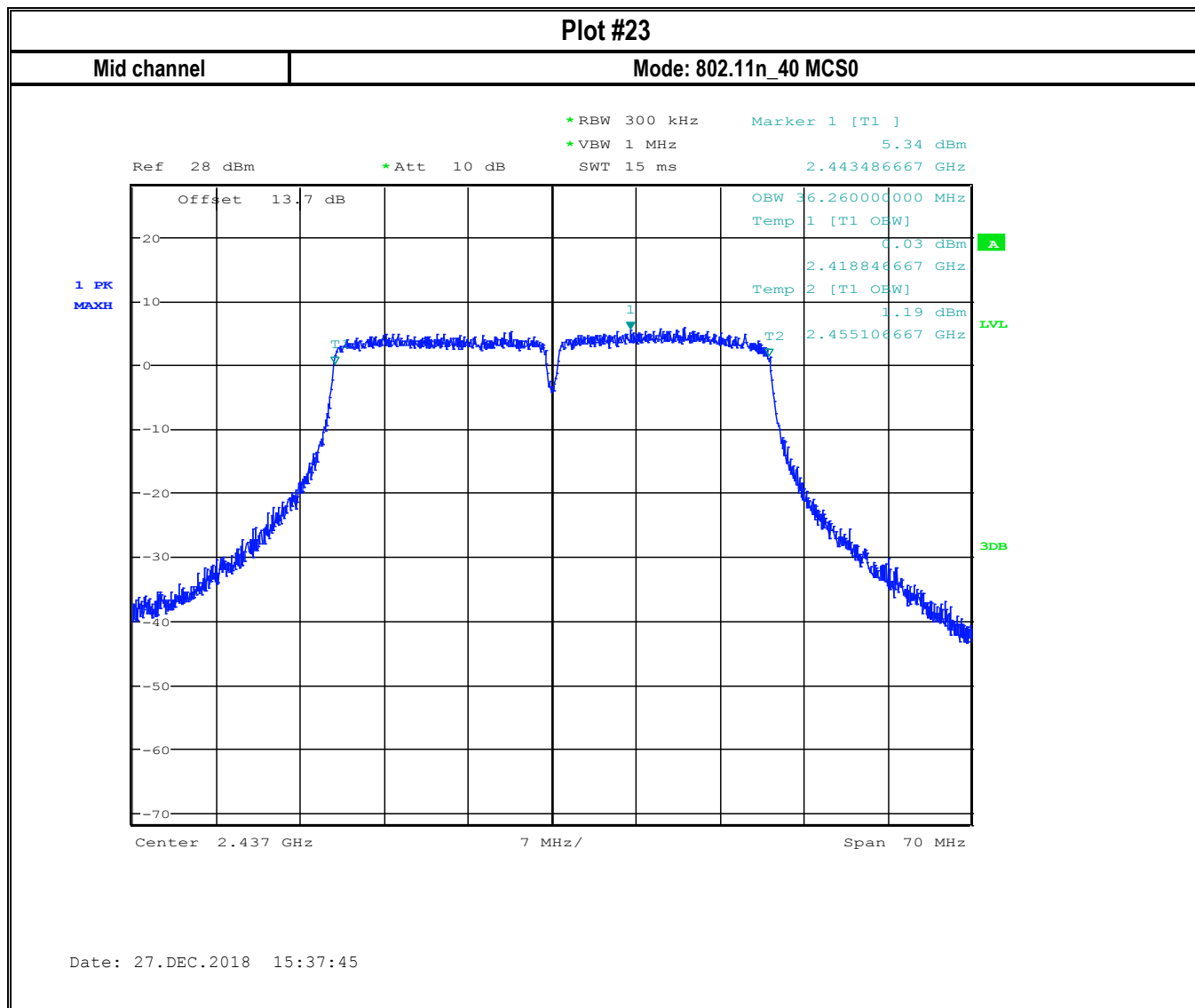
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



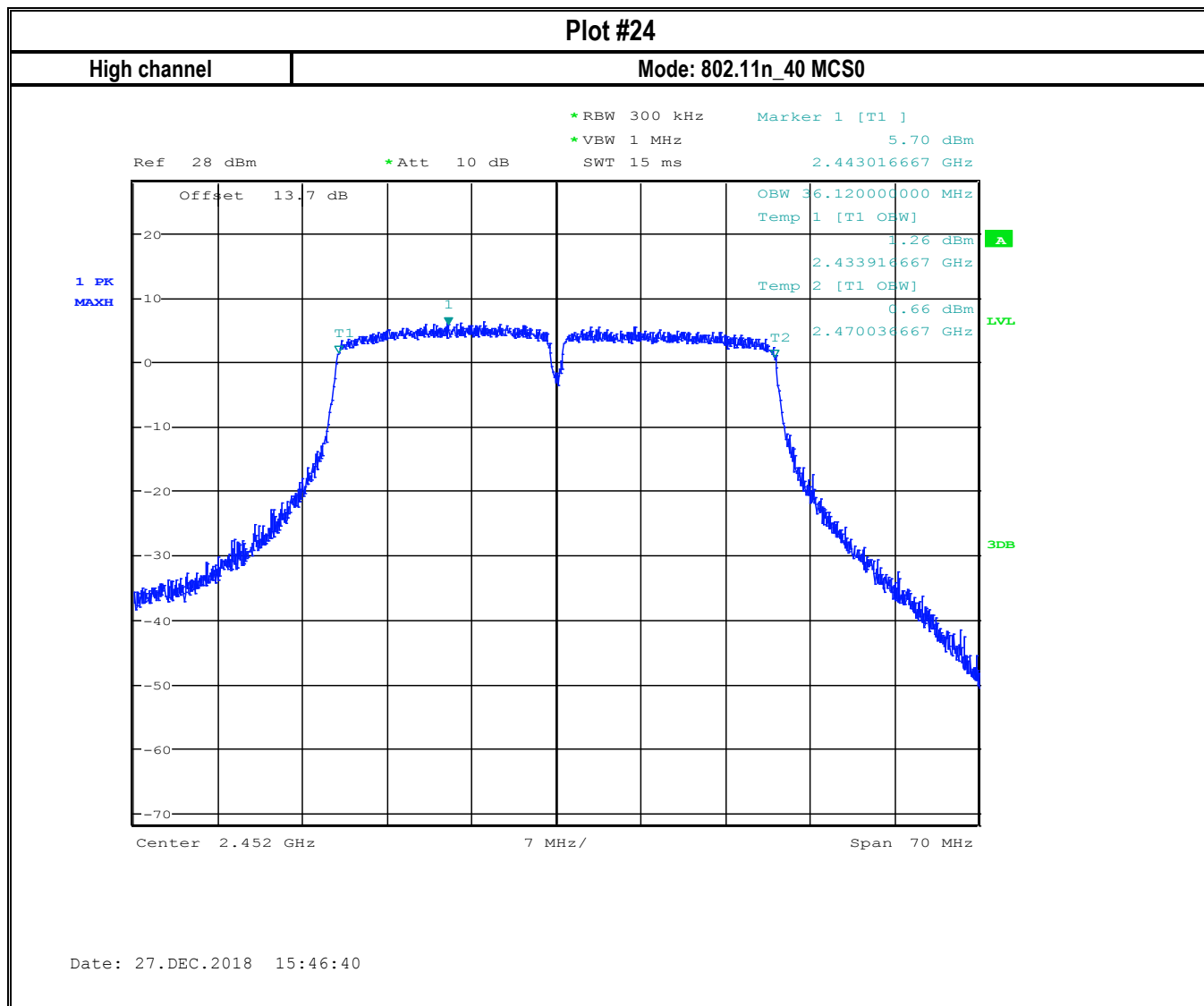
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411



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)).

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

FCC §15.209

- 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

- 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

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.6.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------|---------------|
| 23° C | 2 | 802.11n_20 MIMO | AC/DC Adapter |

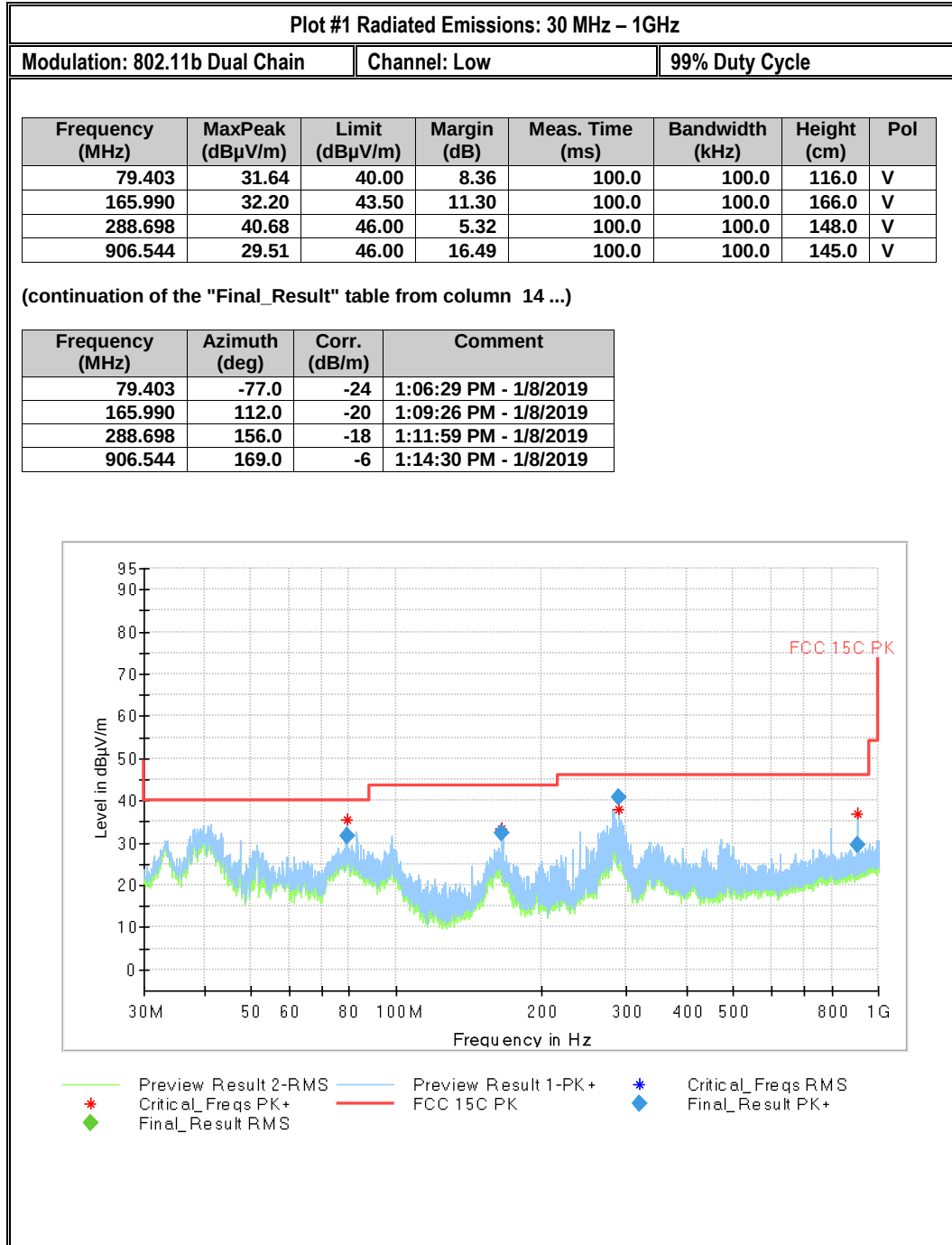
8.6.4 Measurement result:

| Plot # | Channel # | Scan Frequency | Limit | Result |
|--------|------------|-----------------|-------------------|--------|
| 1-3 | 11b Low | 30 MHz – 18 GHz | See section 8.6.2 | Pass |
| 4-8 | 11b Mid | 9 kHz – 26 GHz | See section 8.6.2 | Pass |
| 9-11 | 11b High | 30 MHz – 18 GHz | See section 8.6.2 | Pass |
| 12-16 | 11g mid | 9 KHz – 26 GHz | See section 8.6.2 | Pass |
| 17-19 | 11n 20 mi | 30 MHz – 18 GHz | See section 8.6.2 | Pass |
| 20-22 | 11n 40 mid | 30 MHz – 18 GHz | See section 8.6.2 | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

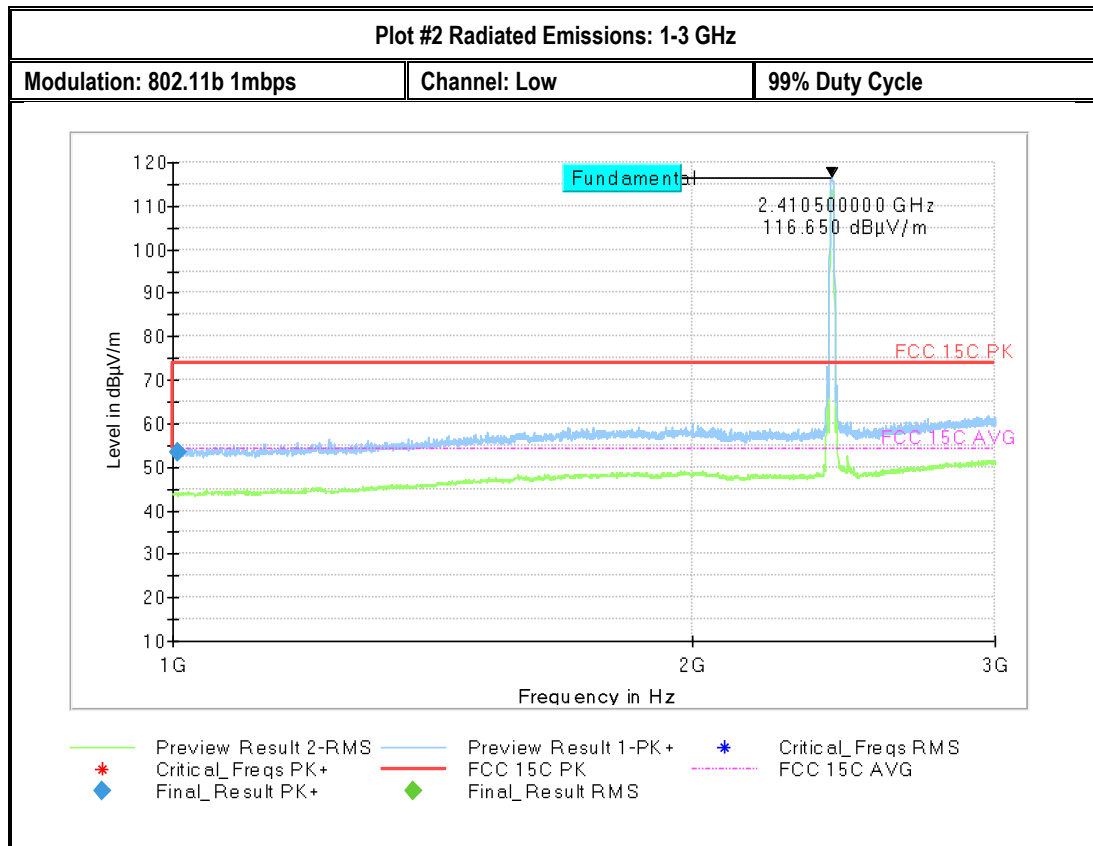
FCC ID: UUU-5411

8.6.5 Measurement Plots:



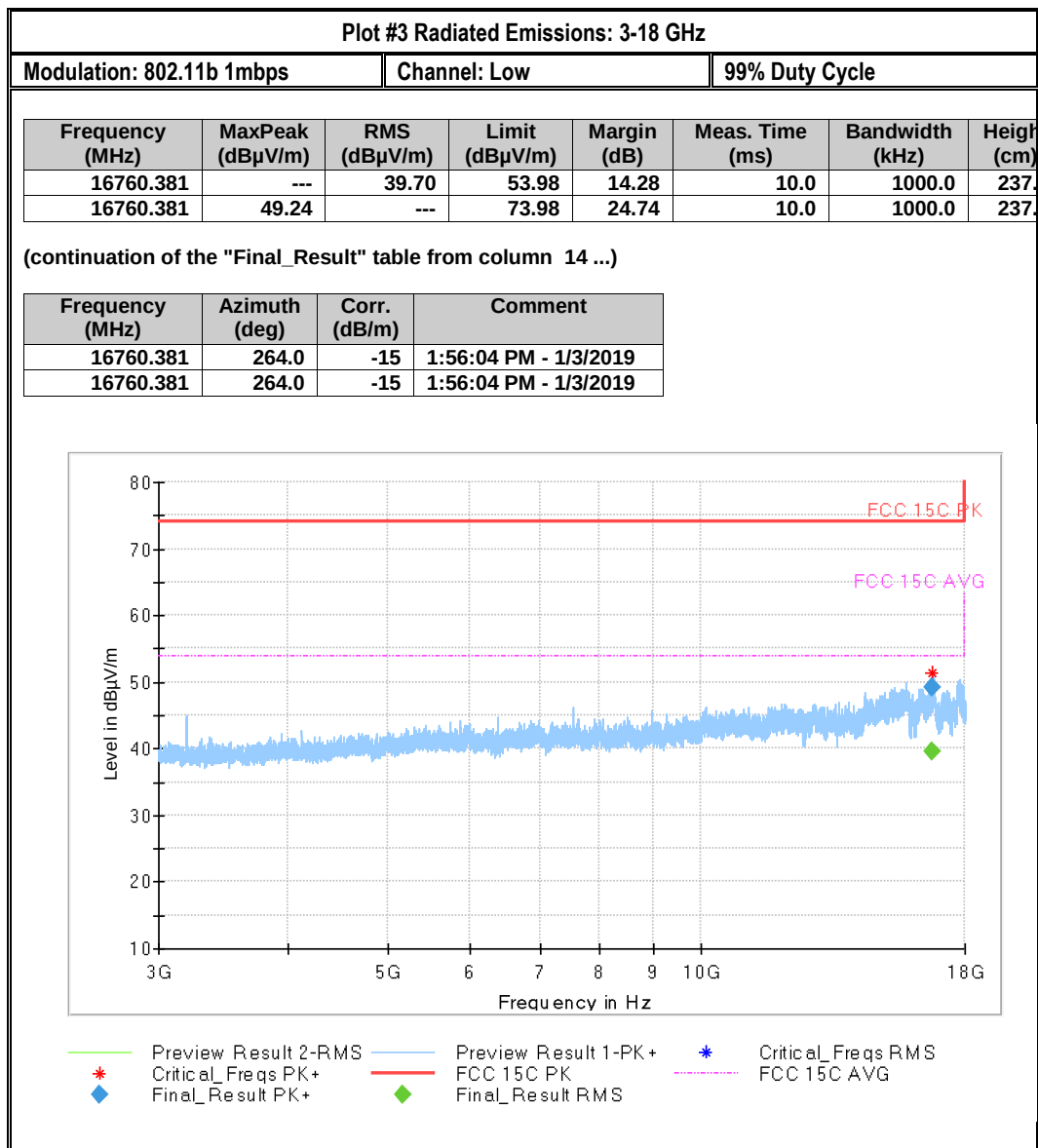
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



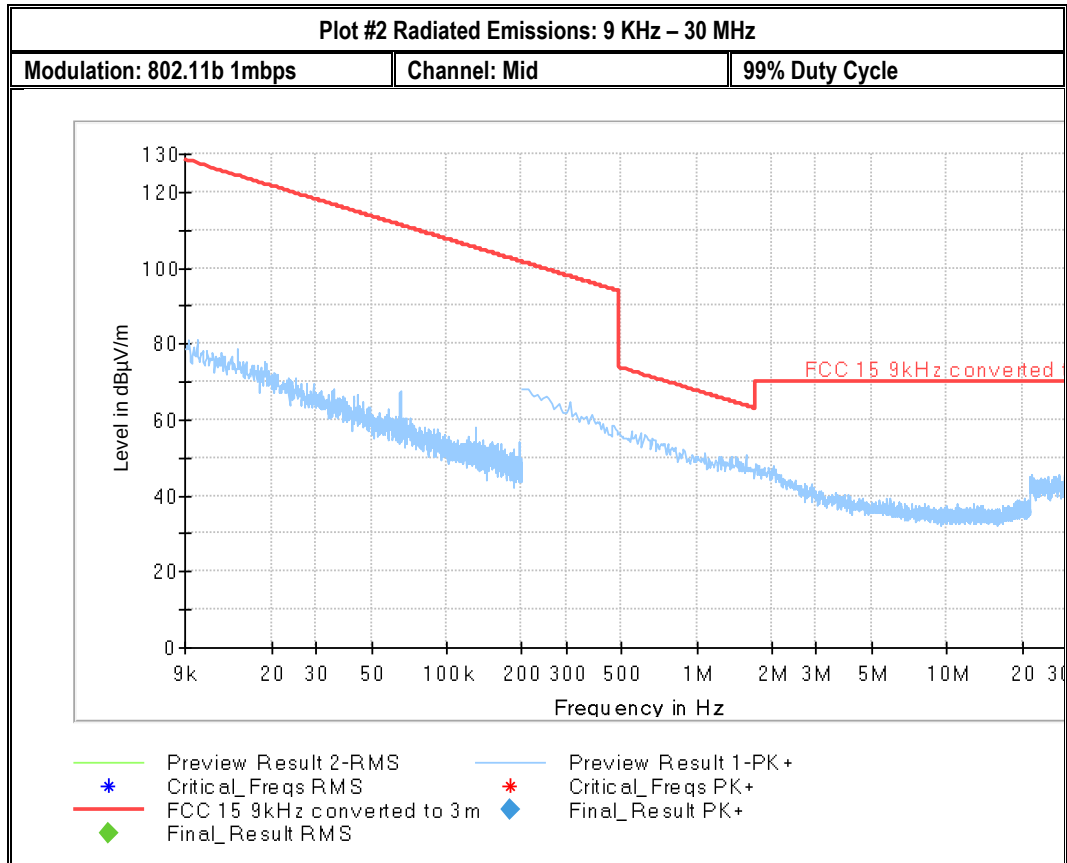
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #6 Radiated Emissions: 30 - 1 GHz

Modulation: 802.11b

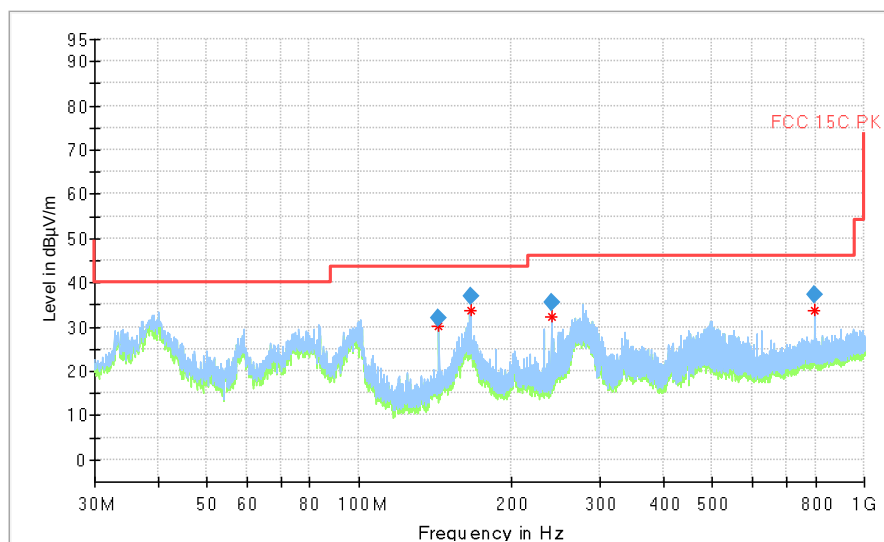
Channel: Mid

99% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 143.988 | 31.92 | 43.50 | 11.58 | 100.0 | 100.0 | 124.0 | V |
| 166.002 | 36.79 | 43.50 | 6.71 | 100.0 | 100.0 | 100.0 | V |
| 240.006 | 35.63 | 46.00 | 10.37 | 100.0 | 100.0 | 189.0 | H |
| 798.287 | 37.33 | 46.00 | 8.67 | 100.0 | 100.0 | 300.0 | H |

(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 143.988 | 192.0 | -19 | 2:12:25 PM - 1/8/2019 |
| 166.002 | 206.0 | -20 | 2:14:57 PM - 1/8/2019 |
| 240.006 | 259.0 | -19 | 2:17:29 PM - 1/8/2019 |
| 798.287 | 205.0 | -7 | 2:19:57 PM - 1/8/2019 |



* Critical_Freqs PK+ Preview Result 2-RMS Preview Result 1-PK+ * Critical_Freqs RMS
 ◆ Final_Result RMS FCC 15C PK ◆ Final_Result PK+

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #7 Radiated Emissions: 1 - 3 GHz

Modulation: 802.11b

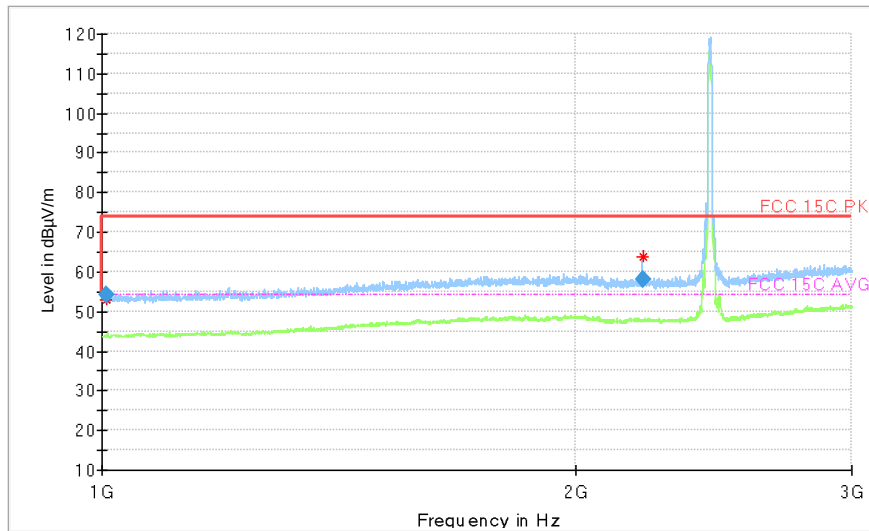
Channel: Mid

99% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 1005.720 | 53.98 | 74.00 | 20.02 | 300.0 | 1000.0 | 146.0 | H |
| 2211.895 | 57.98 | 73.99 | 16.01 | 300.0 | 1000.0 | 191.0 | V |

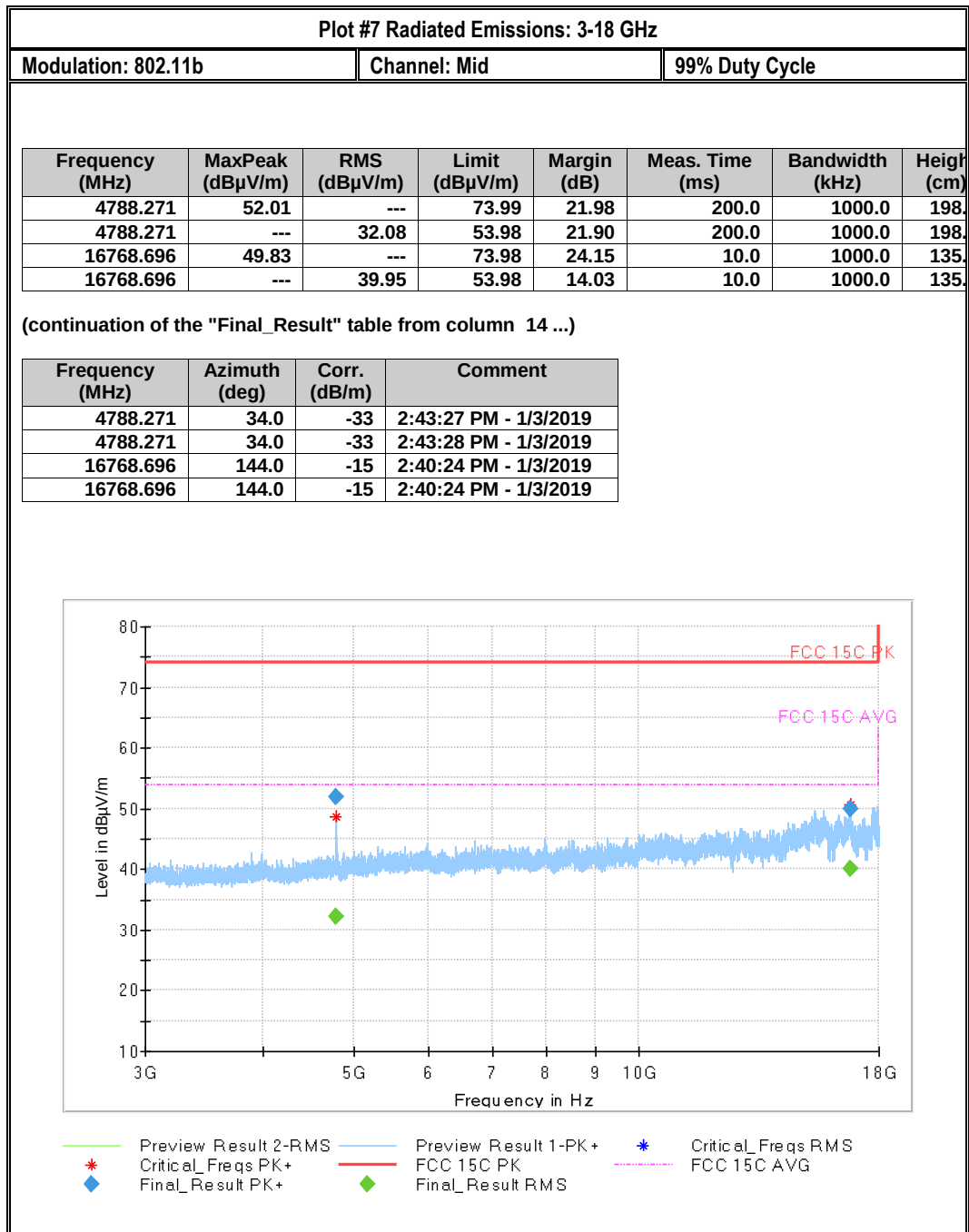
(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Sig Path (dB) | Trd Corr. (dB/m) | Raw Rec (dBμV) | Comment |
|-----------------|---------------|--------------|---------------|------------------|----------------|-----------------------|
| 1005.720 | 133.0 | 16 | -11 | 27 | 38 | 5:33:10 PM - 1/4/2019 |
| 2211.895 | 343.0 | 20 | -10 | 30 | 38 | 5:36:02 PM - 1/4/2019 |



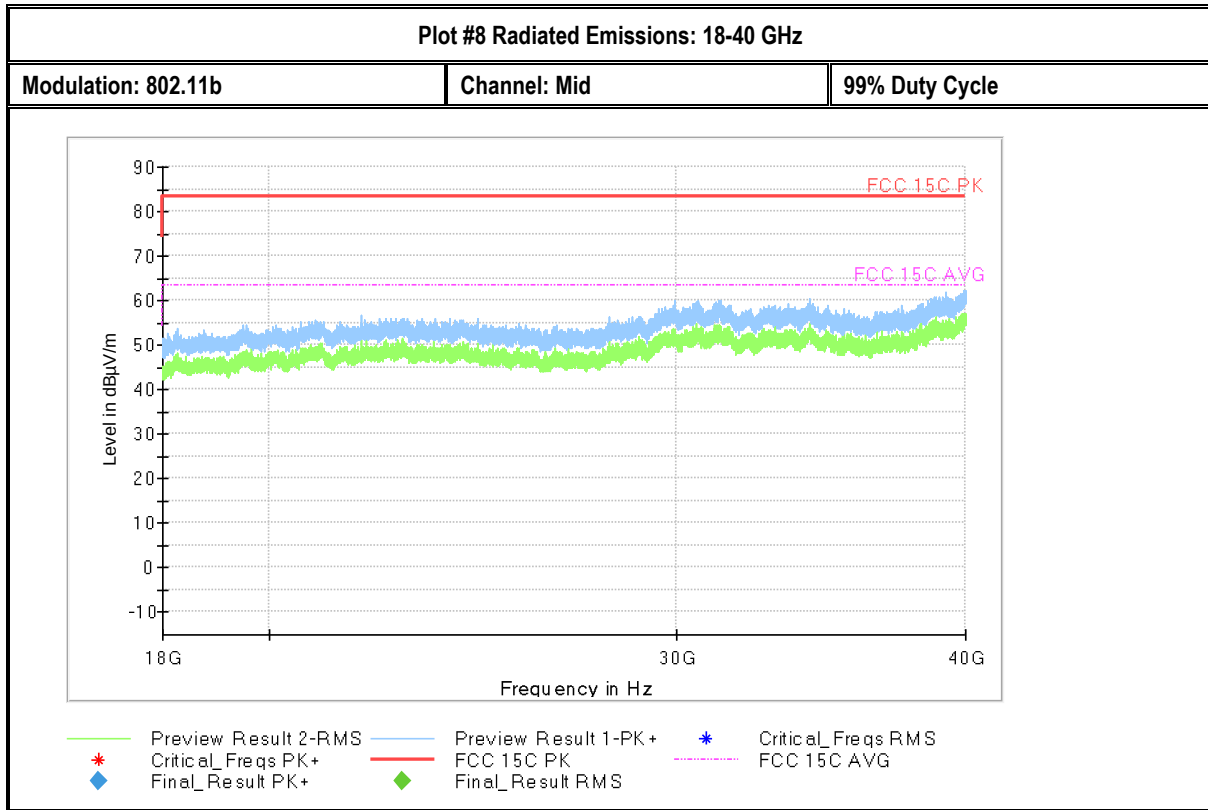
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #9 Radiated Emissions: 30 MHz – 1GHz

Modulation: 802.11b

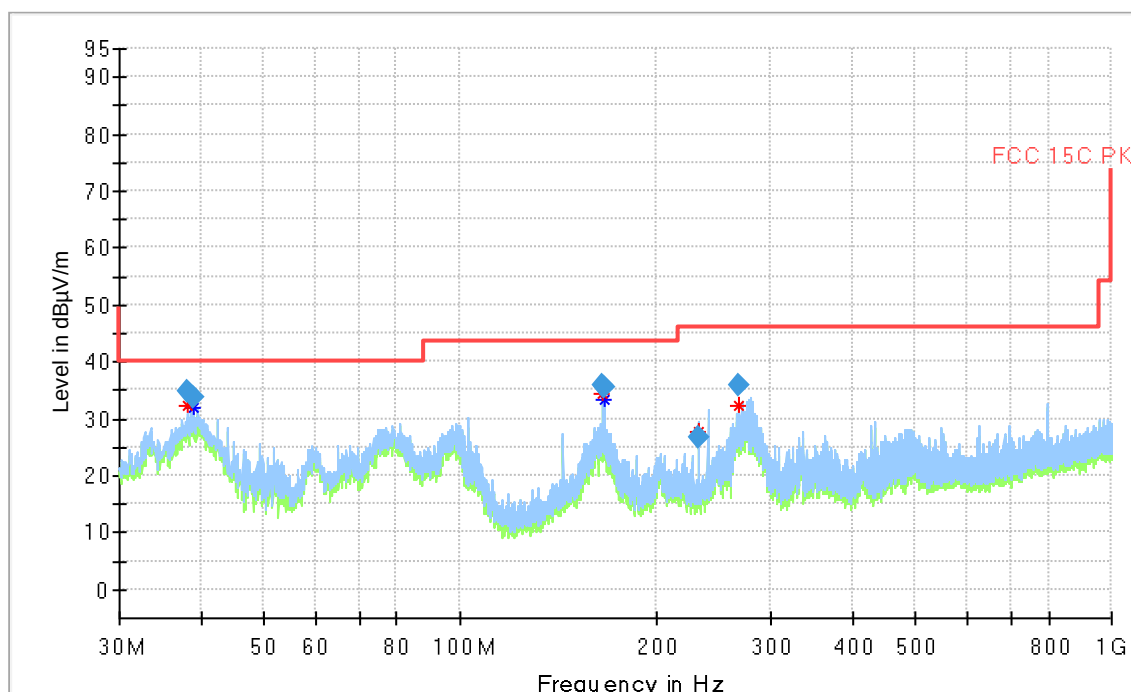
Channel: High

99% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 38.184 | 34.71 | 40.00 | 5.29 | 100.0 | 100.0 | 166.0 | V |
| 38.879 | 33.87 | 40.00 | 6.13 | 100.0 | 100.0 | 100.0 | V |
| 165.971 | 35.71 | 43.50 | 7.79 | 100.0 | 100.0 | 100.0 | V |
| 166.002 | 35.63 | 43.50 | 7.87 | 100.0 | 100.0 | 108.0 | V |
| 232.766 | 26.74 | 46.00 | 19.26 | 100.0 | 100.0 | 108.0 | V |
| 267.461 | 35.70 | 46.00 | 10.30 | 100.0 | 100.0 | 100.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

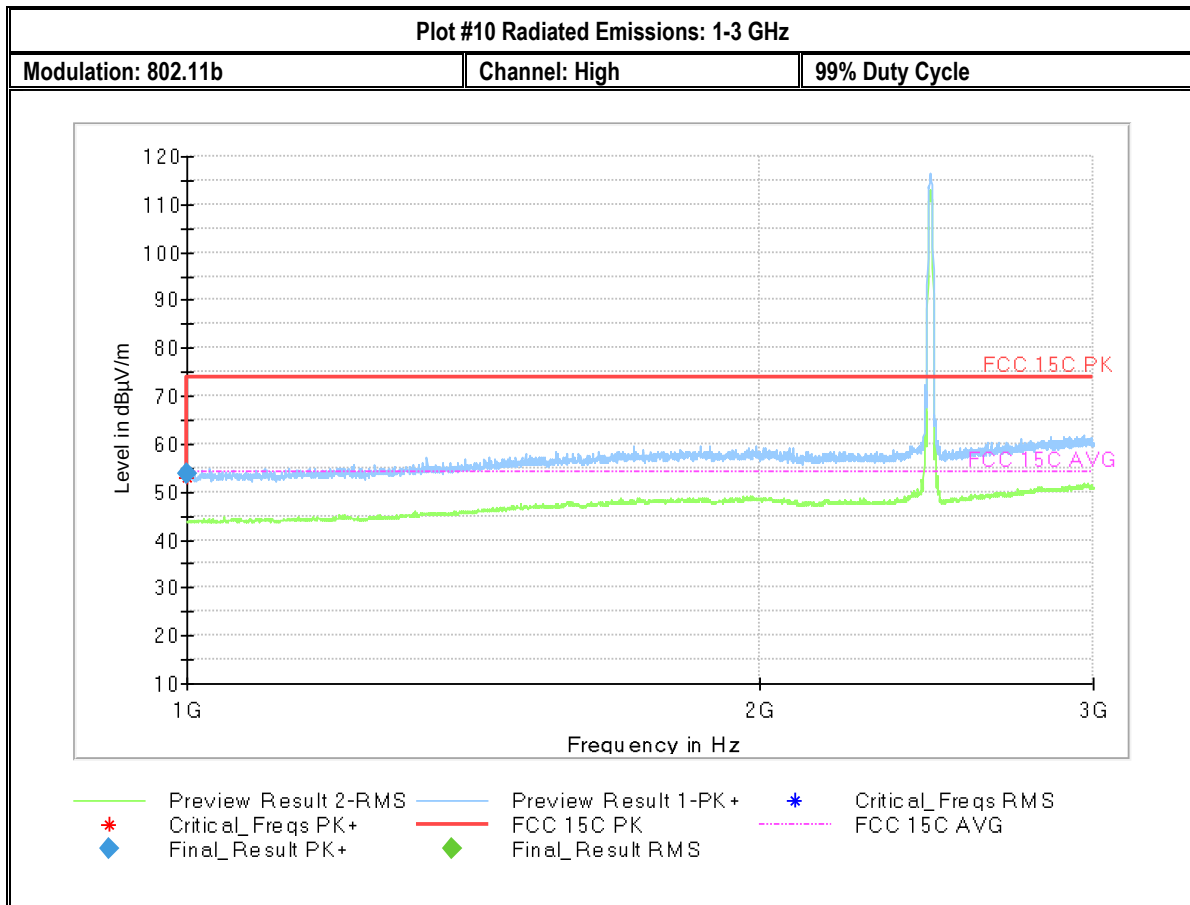
| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 38.184 | -56.0 | -14 | 1:47:58 PM - 1/8/2019 |
| 38.879 | -25.0 | -14 | 1:50:39 PM - 1/8/2019 |
| 165.971 | 236.0 | -20 | 1:55:48 PM - 1/8/2019 |
| 166.002 | 242.0 | -20 | 1:53:19 PM - 1/8/2019 |
| 232.766 | 238.0 | -19 | 1:58:20 PM - 1/8/2019 |
| 267.461 | -10.0 | -18 | 2:01:10 PM - 1/8/2019 |



* Critical_Freqs PK+ Preview Result 1-PK+ * Critical_Freqs RMS
 ◆ Final_Result RMS Preview Result 2-RMS ◆ Final_Result PK+

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #11 Radiated Emissions: 3-18 GHz

Modulation: 802.11b 1Mbps Dual Chain

Channel: High

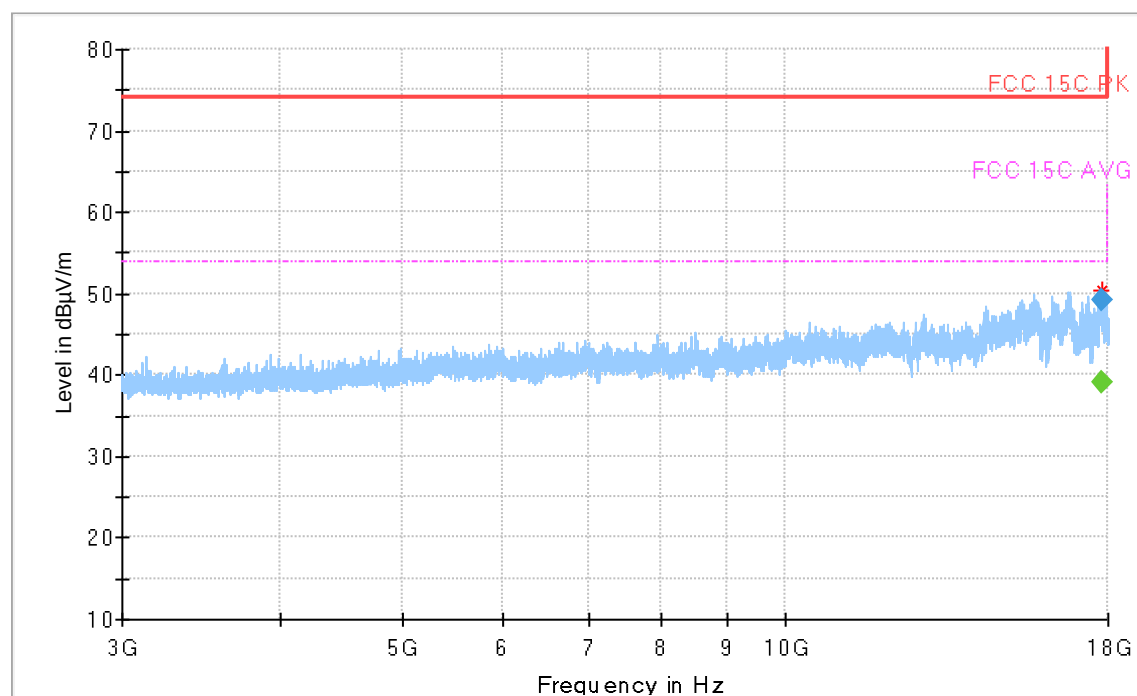
99% Duty Cycle

Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 17783.055 | --- | 39.07 | 53.98 | 14.91 | 10.0 | 1000.0 | 168.0 | H |
| 17783.055 | 49.07 | --- | 73.98 | 24.91 | 10.0 | 1000.0 | 168.0 | H |

(continuation of the "Final Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 17783.055 | 304.0 | -13 | 2:11:33 PM - 1/3/2019 |
| 17783.055 | 304.0 | -13 | 2:11:33 PM - 1/3/2019 |



Preview Result 2-RMS Preview Result 1-PK+ * Critical_Freqs RMS
 * Critical_Freqs PK+ Final Result PK+ Final Result RMS FCC 15C PK FCC 15C AVG

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

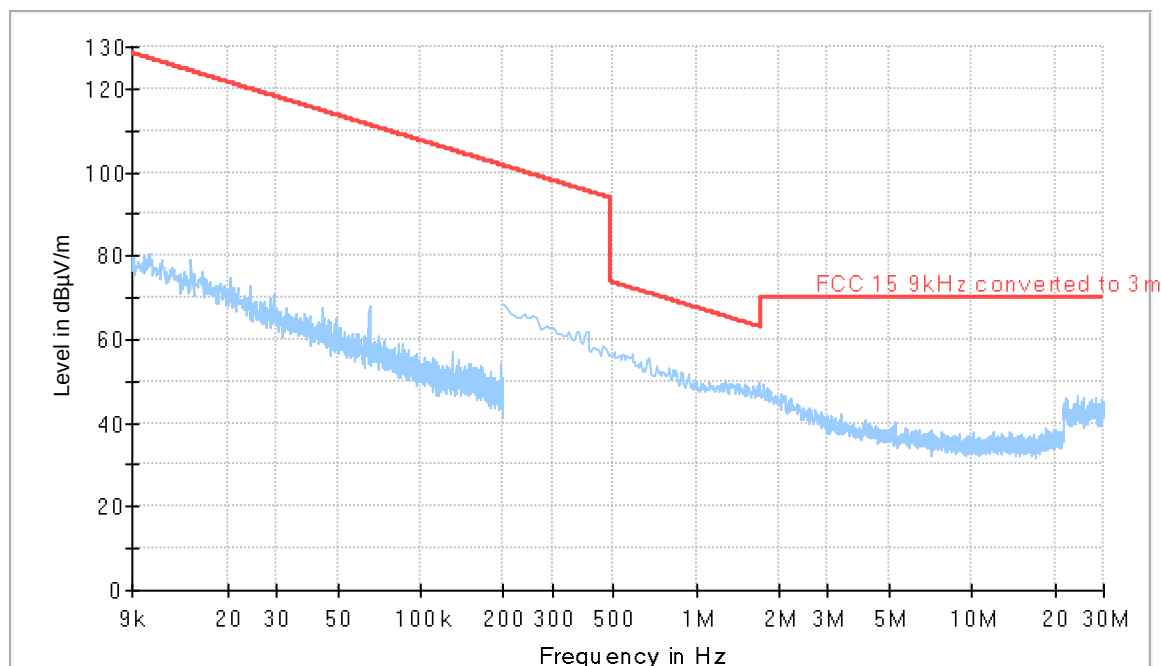
FCC ID: UUU-5411

Plot #12 Radiated Emissions: 9KHz -30 MHz

Modulation: 802.11g 6Mbps Dual Chain

Channel: Mid

96% Duty Cycle



- Preview Result 2-RMS
- Preview Result 1-PK+
- Critical_Freqs RMS
- Critical_Freqs PK+
- FCC 15 9kHz converted to 3m
- Final_Result PK+
- Final_Result RMS

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #13 Radiated Emissions: 30-1 GHz

Modulation: 802.11g 6Mbps Dual Chain

Channel: Mid

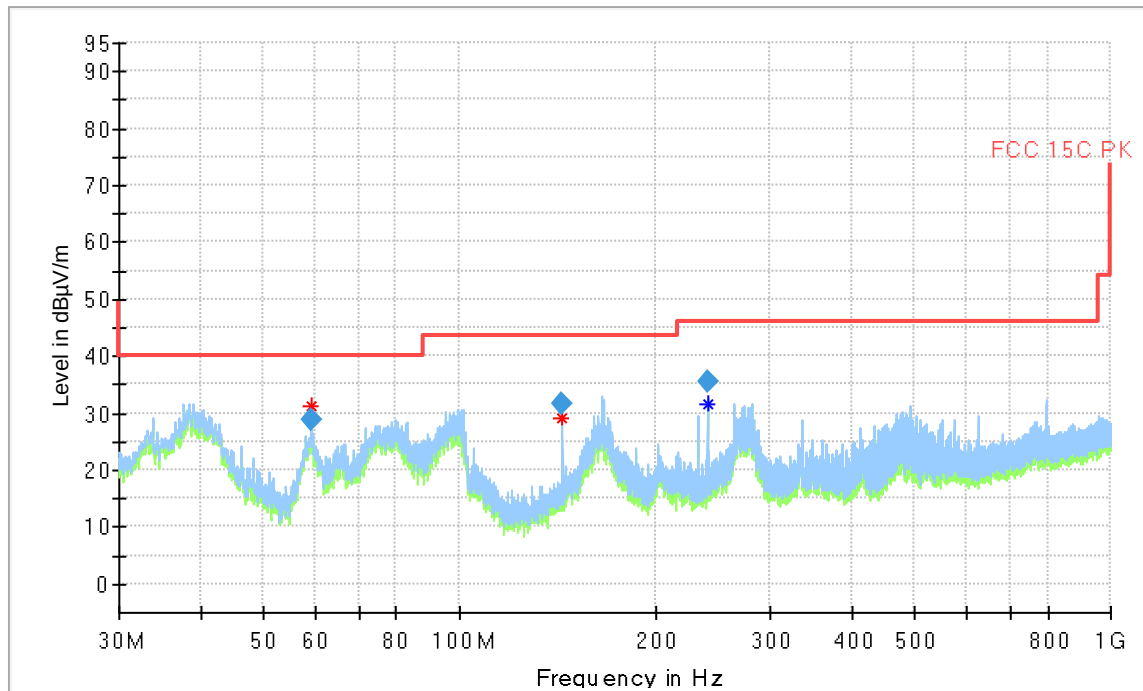
96% Duty Cycle

Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 59.259 | 28.78 | 40.00 | 11.22 | 100.0 | 100.0 | 116.0 | V |
| 143.995 | 31.56 | 43.50 | 11.94 | 100.0 | 100.0 | 100.0 | V |
| 240.003 | 35.36 | 46.00 | 10.64 | 100.0 | 100.0 | 194.0 | H |

(continuation of the "Final Result" table from column 14 ...)

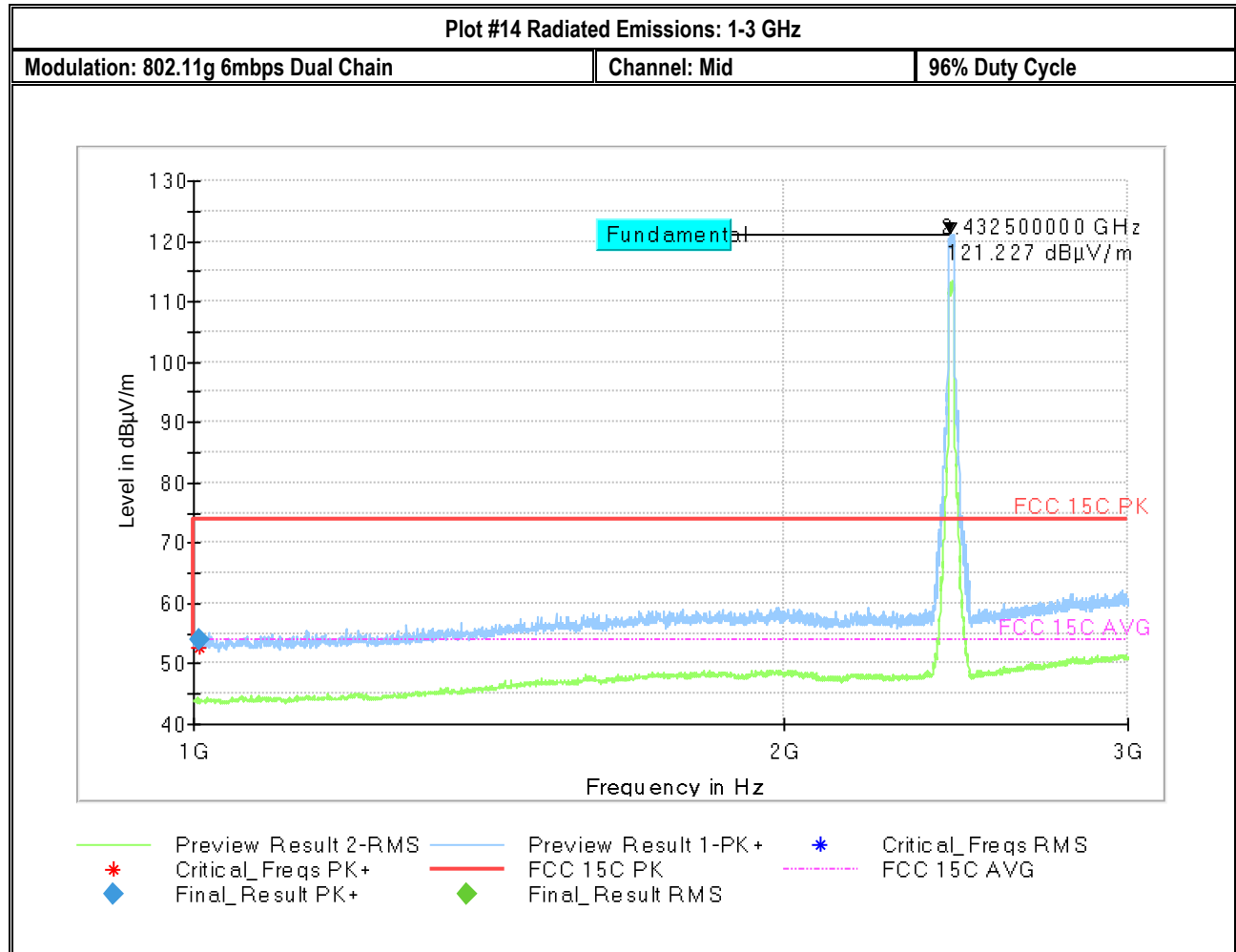
| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 59.259 | 353.0 | -23 | 2:32:35 PM - 1/8/2019 |
| 143.995 | 213.0 | -19 | 2:35:20 PM - 1/8/2019 |
| 240.003 | 250.0 | -19 | 2:37:53 PM - 1/8/2019 |



— Preview Result 2-RMS — Preview Result 1-PK+ * Critical_Freqs RMS
— FCC 15C PK ◆ Final_Result PK+

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #15 Radiated Emissions: 3-18 GHz

Modulation: 802.11g 6mbps Dual Chain

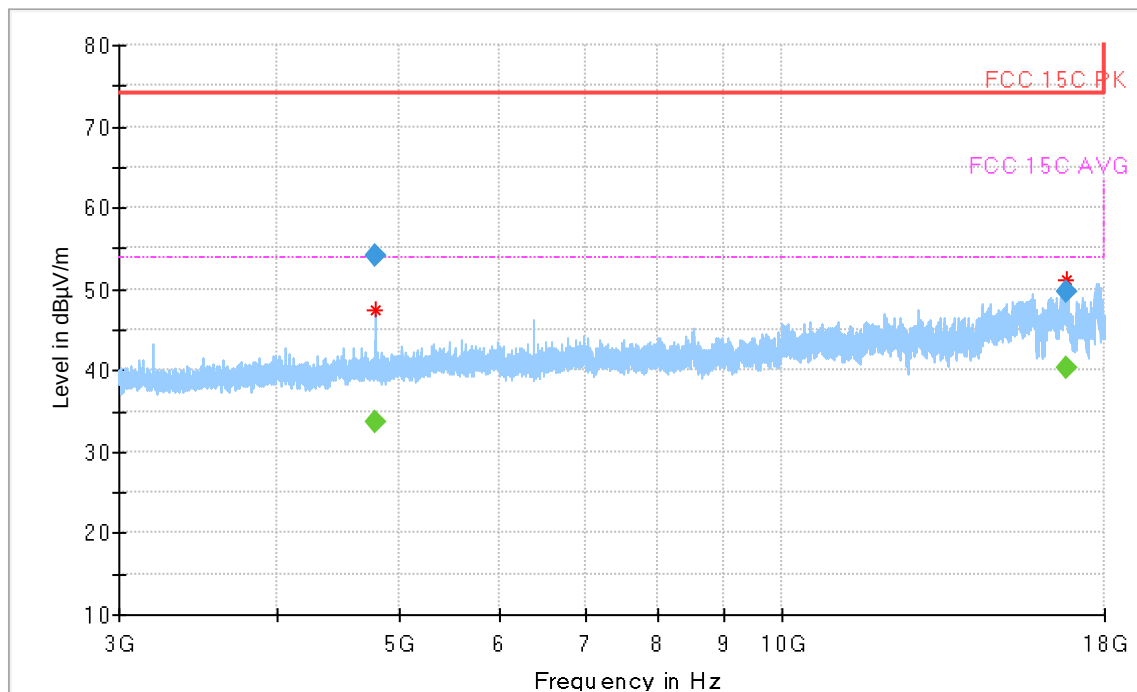
Channel: Mid

96% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 4782.661 | 54.02 | --- | 73.99 | 19.97 | 200.0 | 1000.0 | 182.0 | V |
| 4782.661 | --- | 33.61 | 53.98 | 20.37 | 200.0 | 1000.0 | 182.0 | V |
| 16773.012 | 49.70 | --- | 73.98 | 24.28 | 10.0 | 1000.0 | 304.0 | V |
| 16773.012 | --- | 40.22 | 53.98 | 13.76 | 10.0 | 1000.0 | 304.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

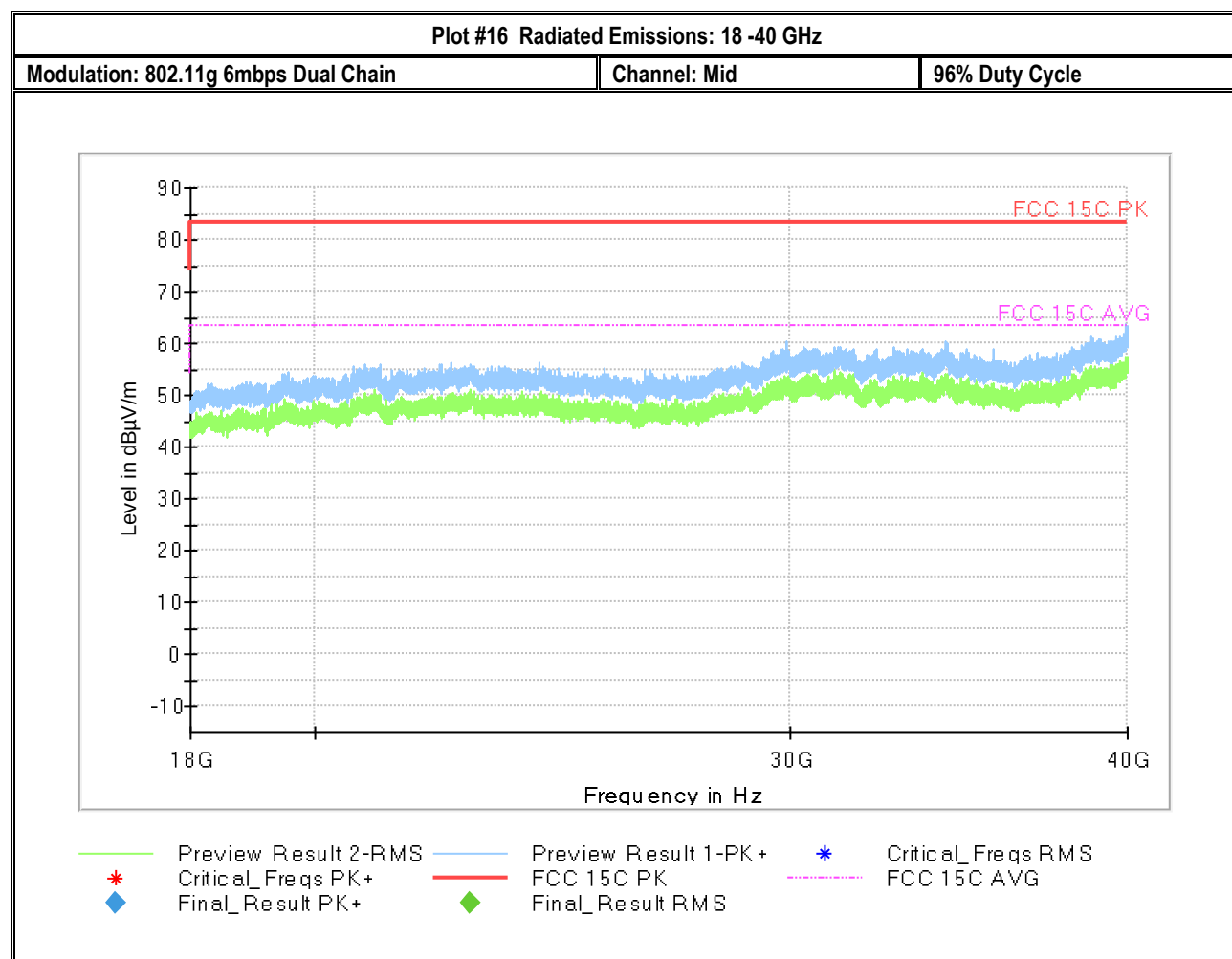
| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 4782.661 | -42.0 | -33 | 3:09:19 PM - 1/3/2019 |
| 4782.661 | -42.0 | -33 | 3:09:20 PM - 1/3/2019 |
| 16773.012 | 28.0 | -15 | 3:06:15 PM - 1/3/2019 |
| 16773.012 | 28.0 | -15 | 3:06:15 PM - 1/3/2019 |



— Preview Result 2-RMS — Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ — FCC 15C PK --- FCC 15C AVG
◆ Final_Result PK+ ◆ Final_Result RMS

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #17 Radiated Emissions: 30-1 GHz

Modulation: 802.11n 20 MSC0 Dual Chain

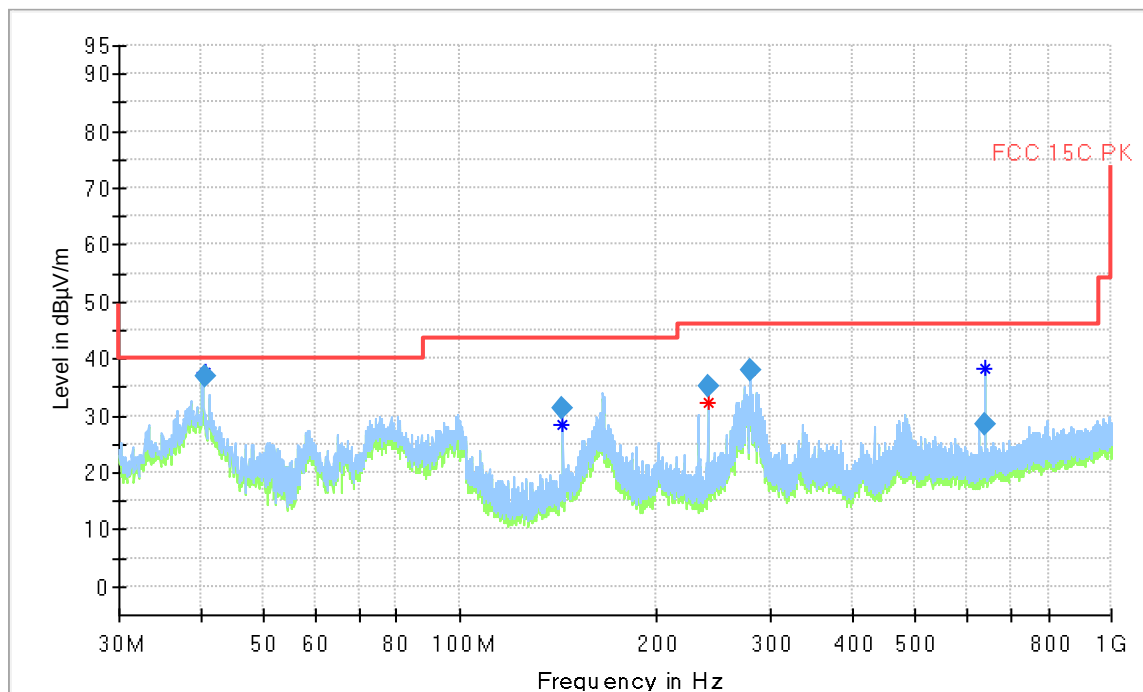
Channel: Mid

95% Duty Cycle

| Frequency (MHz) | MaxPeak (dB μ V/m) | RMS (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------------|--------------------|----------------------|-------------|-----------------|-----------------|-------------|-----|
| 40.653 | 36.88 | --- | 40.00 | 3.12 | 100.0 | 100.0 | 145.0 | V |
| 144.005 | 31.17 | --- | 43.50 | 12.33 | 100.0 | 100.0 | 109.0 | V |
| 240.001 | 35.26 | --- | 46.00 | 10.74 | 100.0 | 100.0 | 186.0 | H |
| 279.706 | 37.88 | --- | 46.00 | 8.12 | 100.0 | 100.0 | 100.0 | V |
| 640.213 | 28.37 | --- | 46.00 | 17.63 | 100.0 | 100.0 | 272.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

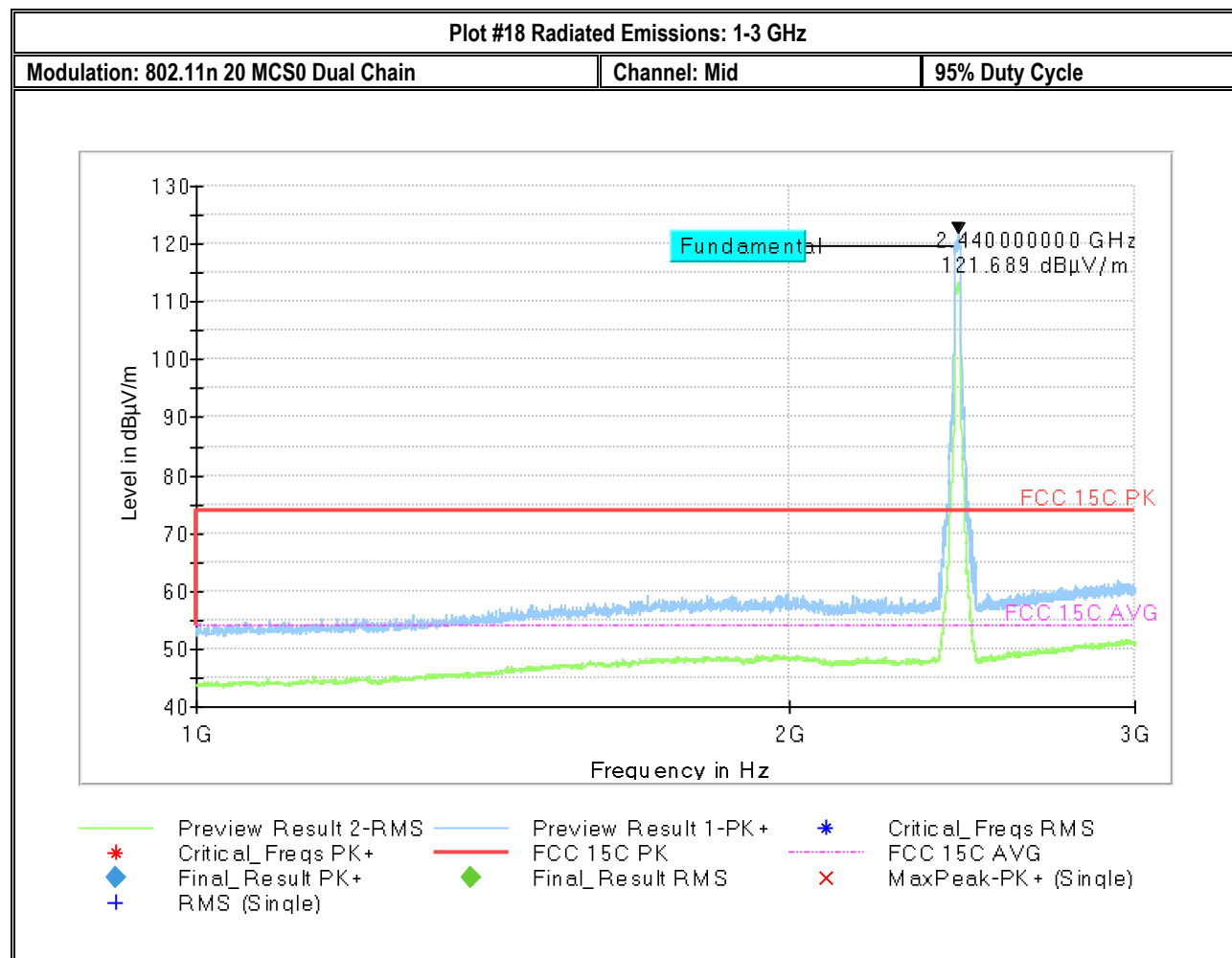
| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 40.653 | 67.0 | -15 | 2:52:14 PM - 1/8/2019 |
| 144.005 | 191.0 | -19 | 2:55:01 PM - 1/8/2019 |
| 240.001 | 252.0 | -19 | 2:57:44 PM - 1/8/2019 |
| 279.706 | 188.0 | -18 | 3:00:34 PM - 1/8/2019 |
| 640.213 | 169.0 | -10 | 3:03:02 PM - 1/8/2019 |



— Preview Result 2-RMS — Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ — FCC 15C PK ◆ Final_Result PK+
◆ Final_Result RMS

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #19 Radiated Emissions: 3-18 GHz

Modulation: 802.11n 20 MCS0 Dual Chain

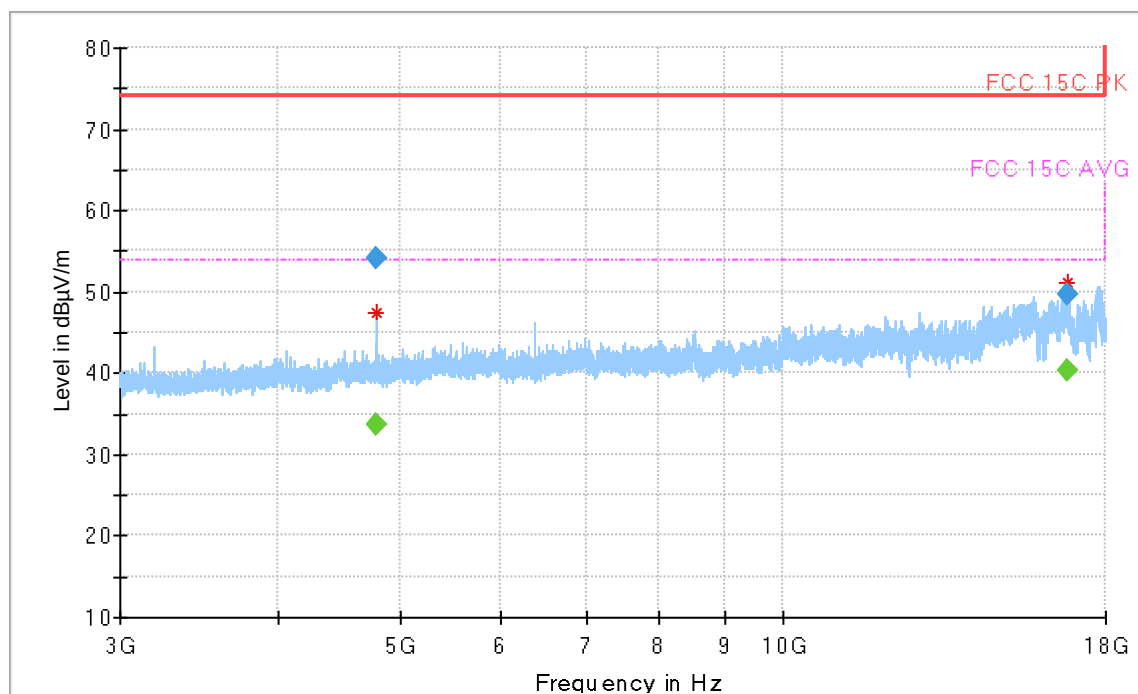
Channel: Mid

95% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 4782.661 | 54.02 | --- | 73.99 | 19.97 | 200.0 | 1000.0 | 182.0 | V |
| 4782.661 | --- | 33.61 | 53.98 | 20.37 | 200.0 | 1000.0 | 182.0 | V |
| 16773.012 | 49.70 | --- | 73.98 | 24.28 | 10.0 | 1000.0 | 304.0 | V |
| 16773.012 | --- | 40.22 | 53.98 | 13.76 | 10.0 | 1000.0 | 304.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 4782.661 | -42.0 | -33 | 3:09:19 PM - 1/3/2019 |
| 4782.661 | -42.0 | -33 | 3:09:20 PM - 1/3/2019 |
| 16773.012 | 28.0 | -15 | 3:06:15 PM - 1/3/2019 |
| 16773.012 | 28.0 | -15 | 3:06:15 PM - 1/3/2019 |



* Preview Result 2-RMS Critical_Freqs PK+ Final_Result PK+
 * Preview Result 1-PK+ FCC 15C PK Final_Result RMS
 * Critical_Freqs RMS FCC 15C AVG

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #20 Radiated Emissions: 30-1 GHz

Modulation: 802.11n 40 MCS0 Dual Chain

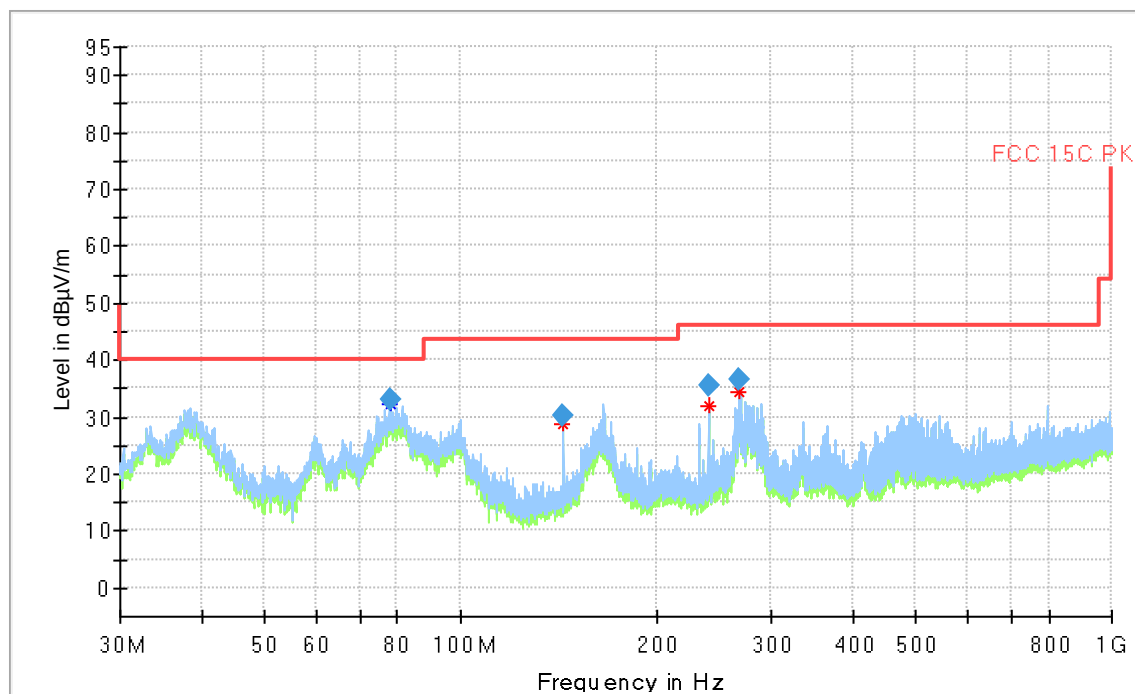
Channel: Mid

92% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 78.058 | 32.87 | --- | 40.00 | 7.13 | 100.0 | 100.0 | 117.0 | V |
| 144.006 | 30.08 | --- | 43.50 | 13.42 | 100.0 | 100.0 | 195.0 | V |
| 239.998 | 35.50 | --- | 46.00 | 10.50 | 100.0 | 100.0 | 191.0 | H |
| 268.373 | 36.49 | --- | 46.00 | 9.51 | 100.0 | 100.0 | 163.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 78.058 | 344.0 | -25 | 3:23:14 PM - 1/8/2019 |
| 144.006 | 188.0 | -19 | 3:20:35 PM - 1/8/2019 |
| 239.998 | 251.0 | -19 | 3:15:09 PM - 1/8/2019 |
| 268.373 | 174.0 | -18 | 3:17:57 PM - 1/8/2019 |



Preview Result 2-RMS Preview Result 1-PK+ Critical_Freqs RMS
 Critical_Freqs PK+ FCC 15C PK Final_Result PK+
 Final_Result RMS

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #21 Radiated Emissions: 1-3 GHz

Modulation: 802.11n 40 MCS0 Dual Chain

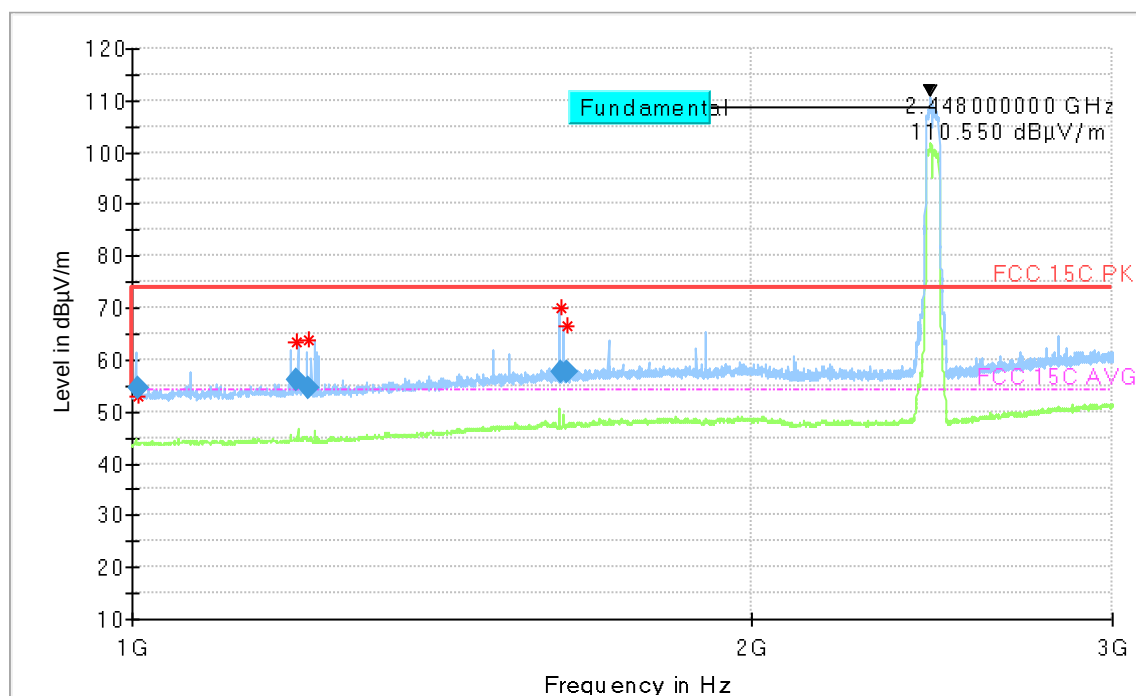
Channel: Mid

92% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 1007.675 | 54.56 | 74.00 | 19.44 | 300.0 | 1000.0 | 108.0 | V |
| 1202.280 | 55.98 | 74.00 | 18.01 | 300.0 | 1000.0 | 185.0 | H |
| 1219.015 | 54.67 | 74.00 | 19.33 | 300.0 | 1000.0 | 291.0 | V |
| 1619.155 | 57.52 | 74.00 | 16.48 | 300.0 | 1000.0 | 203.0 | H |
| 1627.310 | 57.63 | 74.00 | 16.37 | 300.0 | 1000.0 | 210.0 | H |

(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Sig Path (dB) | Preampl (dB) | Trd Corr. (dB/m) | Raw Rec (dBμV) | Comment |
|-----------------|---------------|--------------|---------------|--------------|------------------|----------------|-----------------------|
| 1007.675 | 111.0 | 16 | -11 | 0 | 27 | 38 | 7:07:28 PM - 1/4/2019 |
| 1202.280 | 248.0 | 17 | -11 | 0 | 28 | 39 | 7:10:21 PM - 1/4/2019 |
| 1219.015 | 192.0 | 18 | -10 | 0 | 28 | 37 | 7:18:33 PM - 1/4/2019 |
| 1619.155 | 323.0 | 20 | -10 | 0 | 30 | 38 | 7:12:52 PM - 1/4/2019 |
| 1627.310 | 189.0 | 20 | -10 | 0 | 30 | 38 | 7:15:39 PM - 1/4/2019 |



— Preview Result 2-RMS — Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ — FCC 15C PK — FCC 15C AVG
◆ Final_Result PK+ ◆ Final_Result RMS

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411

Plot #22 Radiated Emissions: 3-18 GHz

Modulation: 802.11n 40 MCS0 Dual Chain

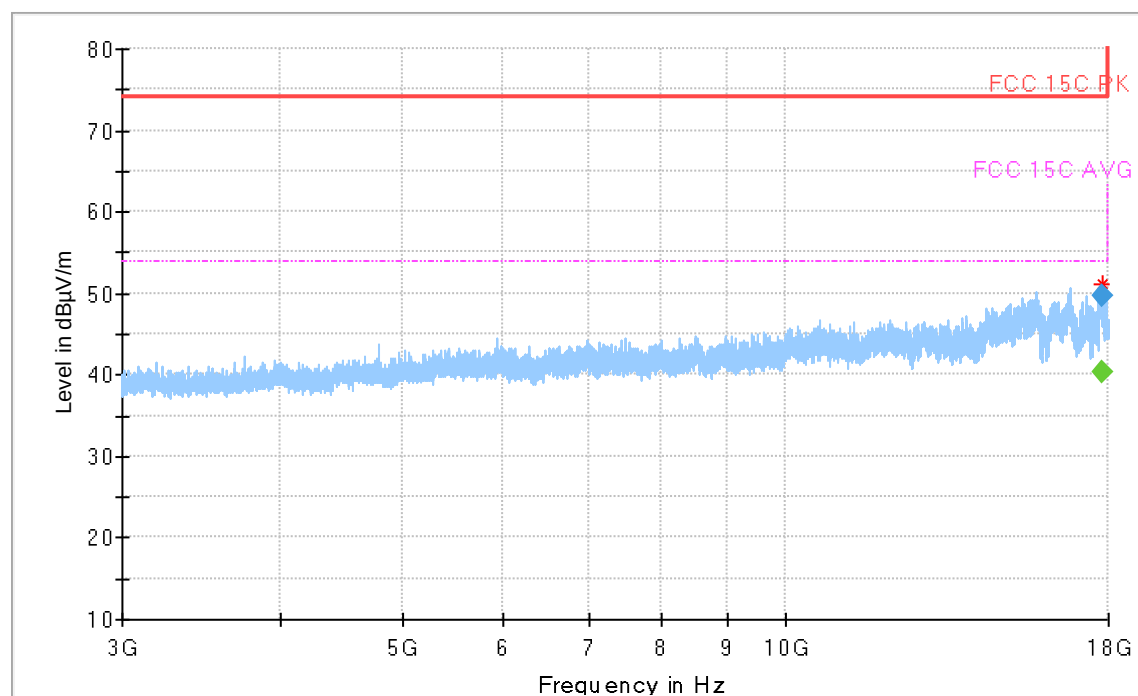
Channel: Mid

92% Duty Cycle

| Frequency (MHz) | MaxPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 17776.321 | --- | 40.40 | 53.98 | 13.58 | 10.0 | 1000.0 | 154.0 | V |
| 17776.321 | 49.60 | --- | 73.98 | 24.38 | 10.0 | 1000.0 | 154.0 | V |

(continuation of the "Final_Result" table from column 14 ...)

| Frequency (MHz) | Azimuth (deg) | Corr. (dB/m) | Comment |
|-----------------|---------------|--------------|-----------------------|
| 17776.321 | 68.0 | -13 | 3:59:22 PM - 1/3/2019 |
| 17776.321 | 68.0 | -13 | 3:59:22 PM - 1/3/2019 |



— Preview Result 2-RMS — Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ — FCC 15C PK --- FCC 15C AVG
◆ Final_Result PK+ ◆ Final_Result RMS

8.7 AC Power Line Conducted Emissions

8.7.1 Measurement according to ANSI C63.4

Analyzer Settings:

- RBW = 9 KHz (CISPR Bandwidth)
- Detector: Peak / Average for Pre-scan
- Quasi-Peak/Average for Final Measurements

8.7.2 Limits: §15.207

FCC §15.207(a)

- Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15–0.5 | 66 to 56* | 56 to 46* |
| 0.5–5 | 56 | 46 |
| 5–30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

8.7.3 Test conditions and setup:

| Ambient Temperature © | EUT Set-Up # | EUT operating mode | Power line (L1, L2, L3, N) | Power Input |
|-----------------------|--------------|-----------------------|----------------------------|-------------|
| 22° C | 2 | Mid channel
80211b | Line & Neutral | 110V / 60Hz |

8.7.4 Measurement Result:

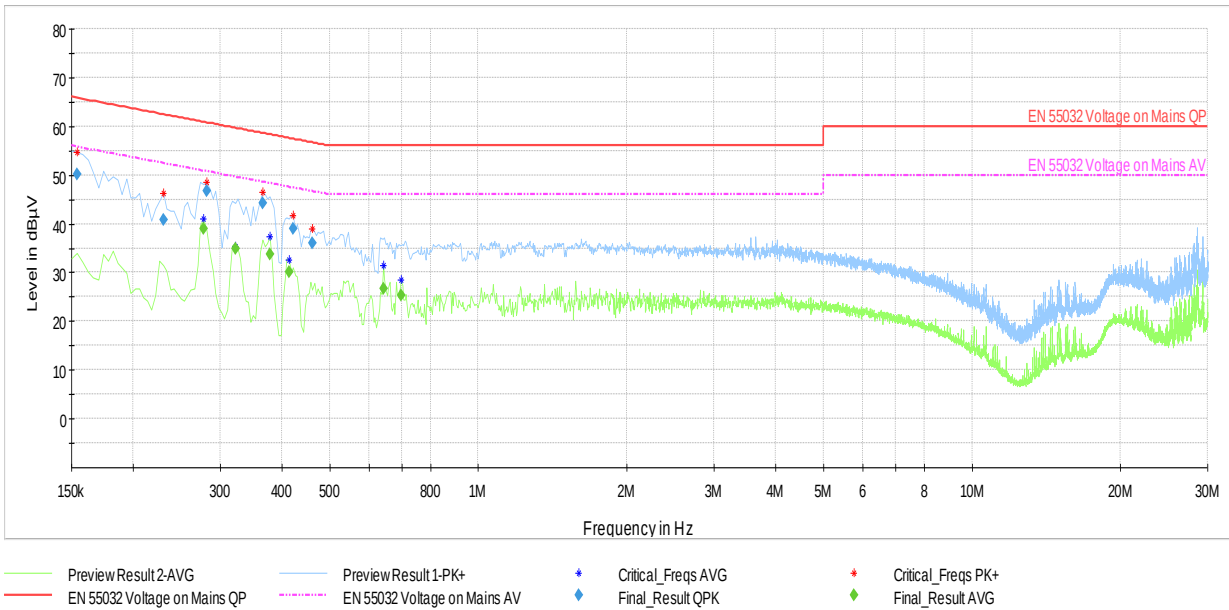
| Plot # | Port | EUT Set-Up #: | EUT operating mode | Scan Frequency | Limit | Result |
|--------|----------|---------------|--------------------|------------------|-------------------|--------|
| 1 | AC Mains | 2 | 802.11b Max Power | 150 kHz – 30 MHz | See section 8.7.2 | Pass |

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

8.7.5 Measurement Plots:

| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) | Frequency (MHz) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|-----|------------|-----------------|
| 0.154000 | 50.14 | --- | 65.78 | 15.64 | 500.0 | 9.000 | L1 | GND | 10.7 | 0.15400 |
| 0.230000 | 40.75 | --- | 62.45 | 21.69 | 500.0 | 9.000 | L1 | GND | 10.5 | 0.23000 |
| 0.278000 | --- | 38.92 | 50.88 | 11.96 | 500.0 | 9.000 | L1 | GND | 10.4 | 0.27800 |
| 0.282000 | 46.70 | --- | 60.76 | 14.05 | 500.0 | 9.000 | N | GND | 10.4 | 0.28200 |
| 0.322000 | --- | 34.81 | 49.66 | 14.85 | 500.0 | 9.000 | L1 | GND | 10.3 | 0.32200 |
| 0.366000 | 44.30 | --- | 58.59 | 14.29 | 500.0 | 9.000 | L1 | GND | 10.3 | 0.36600 |
| 0.378000 | --- | 33.70 | 48.32 | 14.63 | 500.0 | 9.000 | L1 | GND | 10.3 | 0.37800 |
| 0.414000 | --- | 30.18 | 47.57 | 17.39 | 500.0 | 9.000 | L1 | GND | 10.3 | 0.41400 |
| 0.422000 | 38.92 | --- | 57.41 | 18.49 | 500.0 | 9.000 | N | GND | 10.3 | 0.42200 |
| 0.462000 | 36.08 | --- | 56.66 | 20.57 | 500.0 | 9.000 | L1 | GND | 10.2 | 0.46200 |
| 0.642000 | --- | 26.64 | 46.00 | 19.36 | 500.0 | 9.000 | L1 | GND | 10.2 | 0.64200 |
| 0.698000 | --- | 25.27 | 46.00 | 20.73 | 500.0 | 9.000 | L1 | GND | 10.2 | 0.69800 |



Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

9 Test setup photos

Setup photos are included in supporting file name: "EMC_A2ZDE-048-18001_15.247_Setup_Photos.pdf"

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

10 Test Equipment and Ancillaries Used For Testing

| Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|---------------------------|---------------------|--------------|-----------------|--------------------------|------------------------------|
| Biconlog Antenna | EMCO | 3142E | 166067 | 3 years | 6/28/2017 |
| Loop Antenna | ETS Lindgren | 6507 | 161344 | 3 years | 10/26/2017 |
| Horn Antenna | EMCO | 3115 | 35114 | 3 years | 7/31/2017 |
| Horn Antenna | ETS Lindgren | 3117 PA | 169547 | 3 years | 8/8/2017 |
| Compact Digital Barometer | Control Company | 35519-055 | 91119547 | 2 Years | 6/20/2017 |
| Spectrum Analyzer | R&S | FSU26 | 200302 | 3 years | 7/5/2017 |
| Spectrum Analyzer | R&S | FSV40 | 101022 | 3 years | 7/5/2017 |
| RF Power Sensor | ETS Lindgren | 7002-006 | 160436 | 3 Years | 8/15/2016 |

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.

Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

11 Revision History

| Date | Report Name | Changes to report | Prepared by |
|------------|--------------------------------------|---|-----------------|
| 2019/2/28 | EMC_A2ZDE-048-18001_15.247_WLAN | Initial Version | James Donnellan |
| 2019/03/08 | EMC_A2ZDE-048-18001_15.247_WLAN-Rev1 | Updated Mfg. Address. | James Donnellan |
| 2019/05/23 | EMC_A2ZDE-048-18001_15.247_WLAN-Rev2 | (S) Section 3.5 Corrected setting value for 11n.
S 8.2.5. Changed wording from antenna # to chain # and clarified MIMO antenna gain.
Added comment to S 8.2.6
S 8.3.5 Clarified results for Chain 0 and added a table to show MIMO PSD
Fixed Typo S 8.4.5 | James Donnellan |