



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

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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)	
Date	Section	Name	Signature

Responsible for the Report:

2019-05-23	Compliance	James Donnellan (Compliance)	
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.

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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

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:	<input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production

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

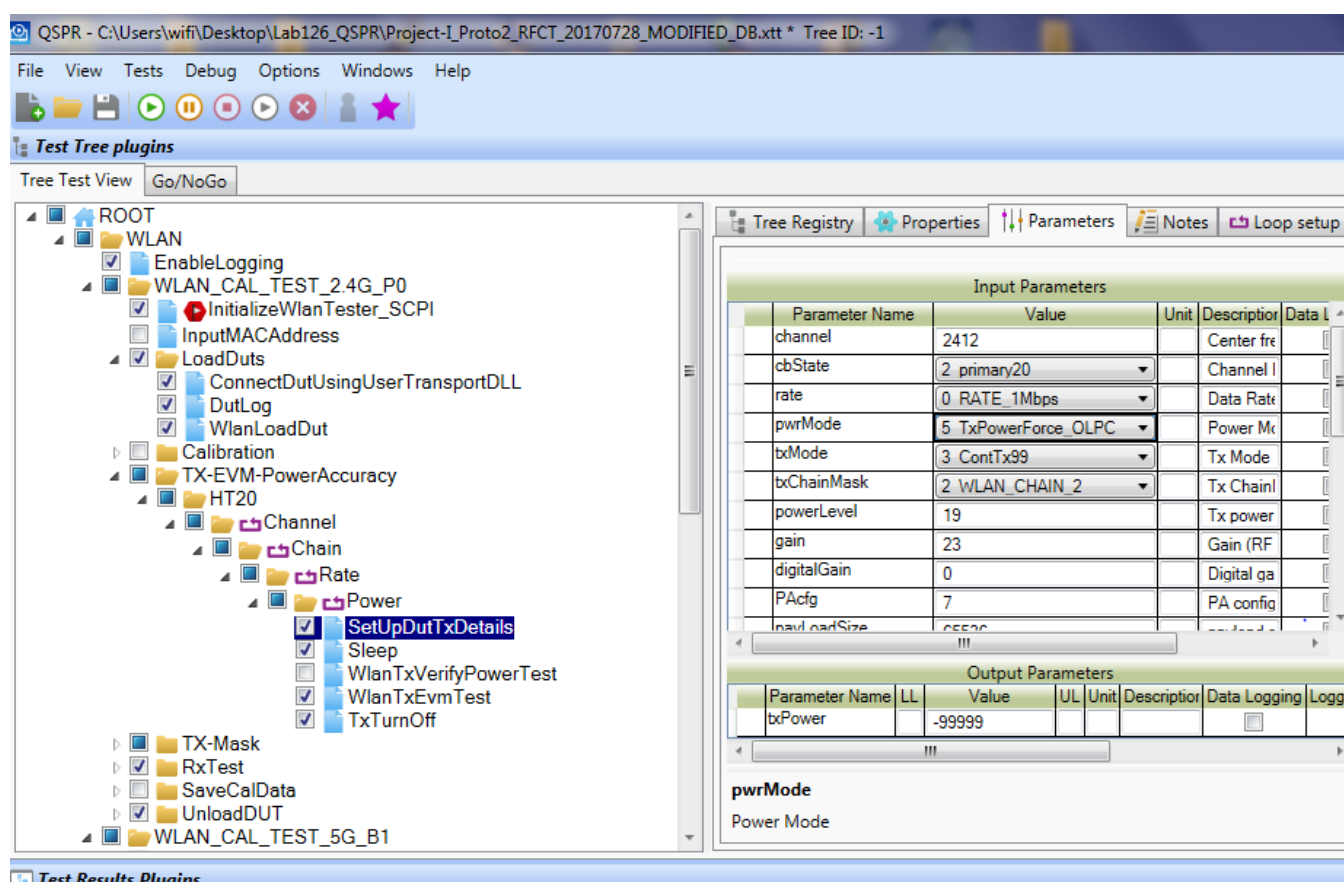
EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2 + AE#1 + AE#2	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software "QSPR" provided by client that is not available to the end user. The measurement equipment was connected 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.

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:



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 device is included in supporting file “EMC_A2ZDE-048-18001_CO-TX.pdf”

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)
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RF conducted measurement	±0.5 dB
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According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: <http://physics.nist.gov/cuu/Uncertainty/typeb.html>.

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:

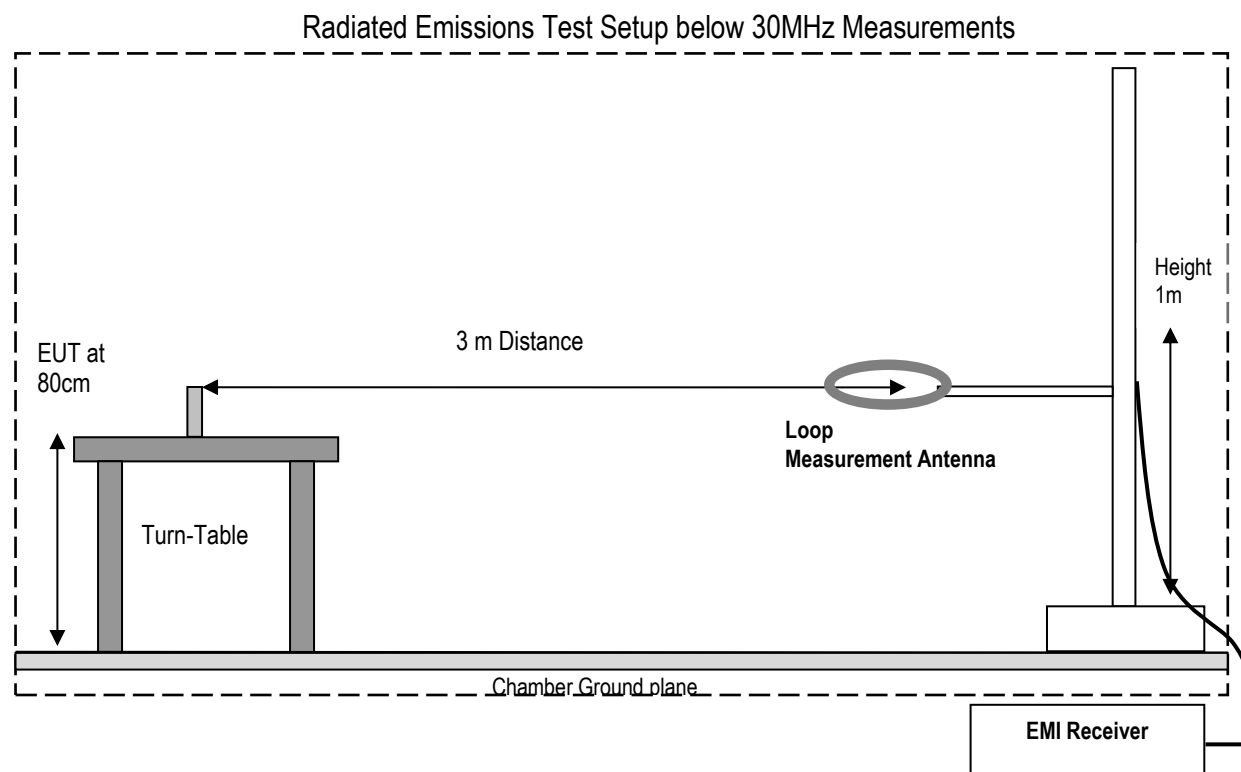
Nov 28, 2018 – Jan 18, 2019

7 Measurement Procedures

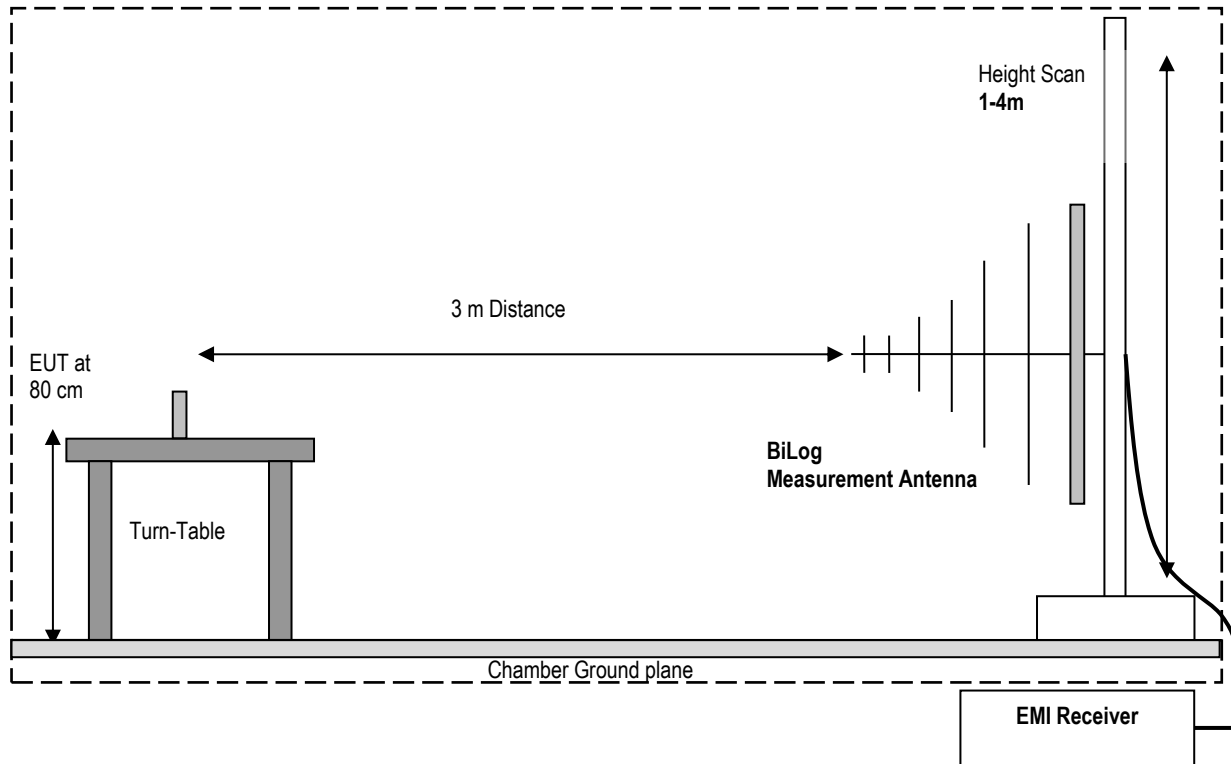
7.1 Radiated Measurement

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

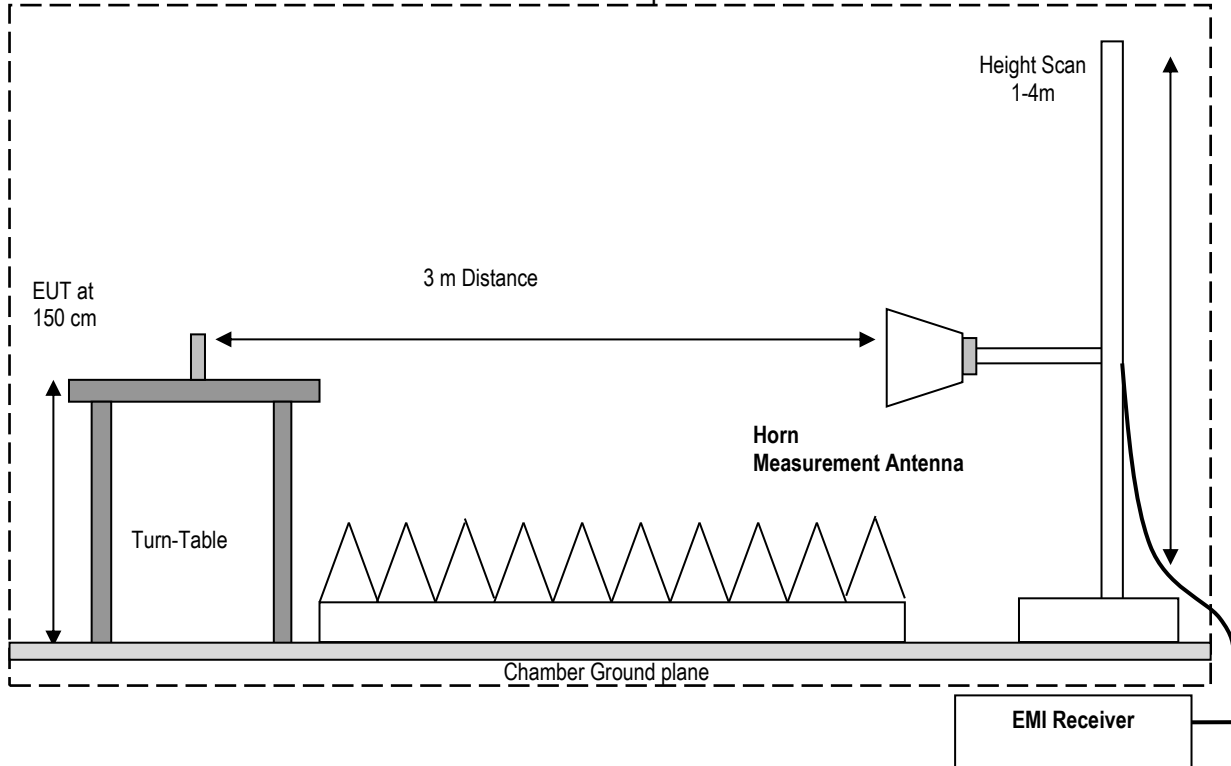
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to 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.



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

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

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

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

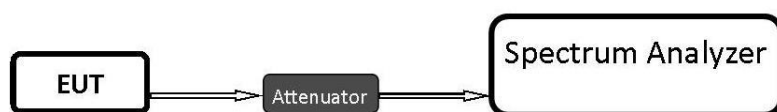
$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

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

7.2 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

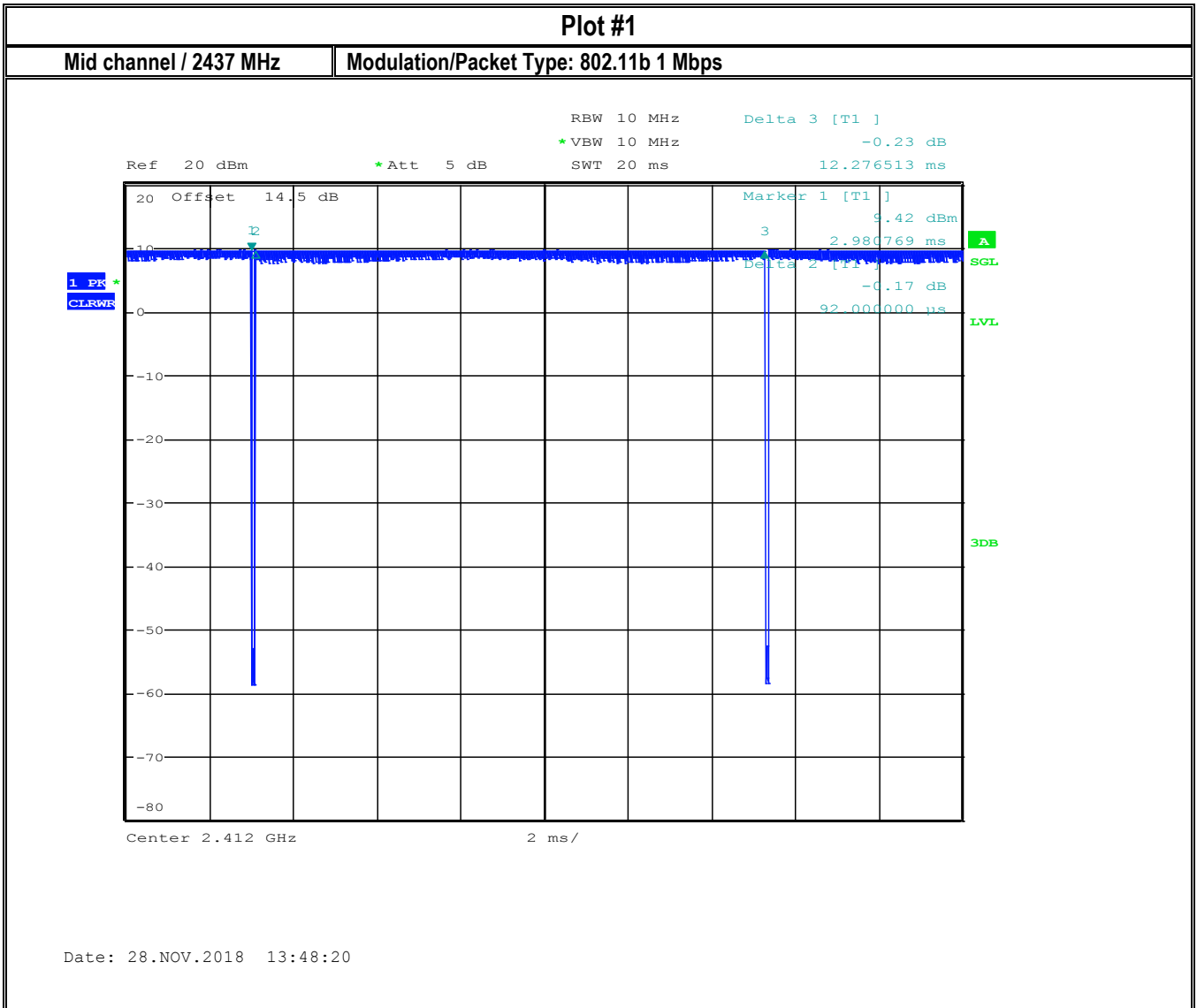
8.1.1 Measurement according to FCC 558074 D01 DTS Meas Guidance v05

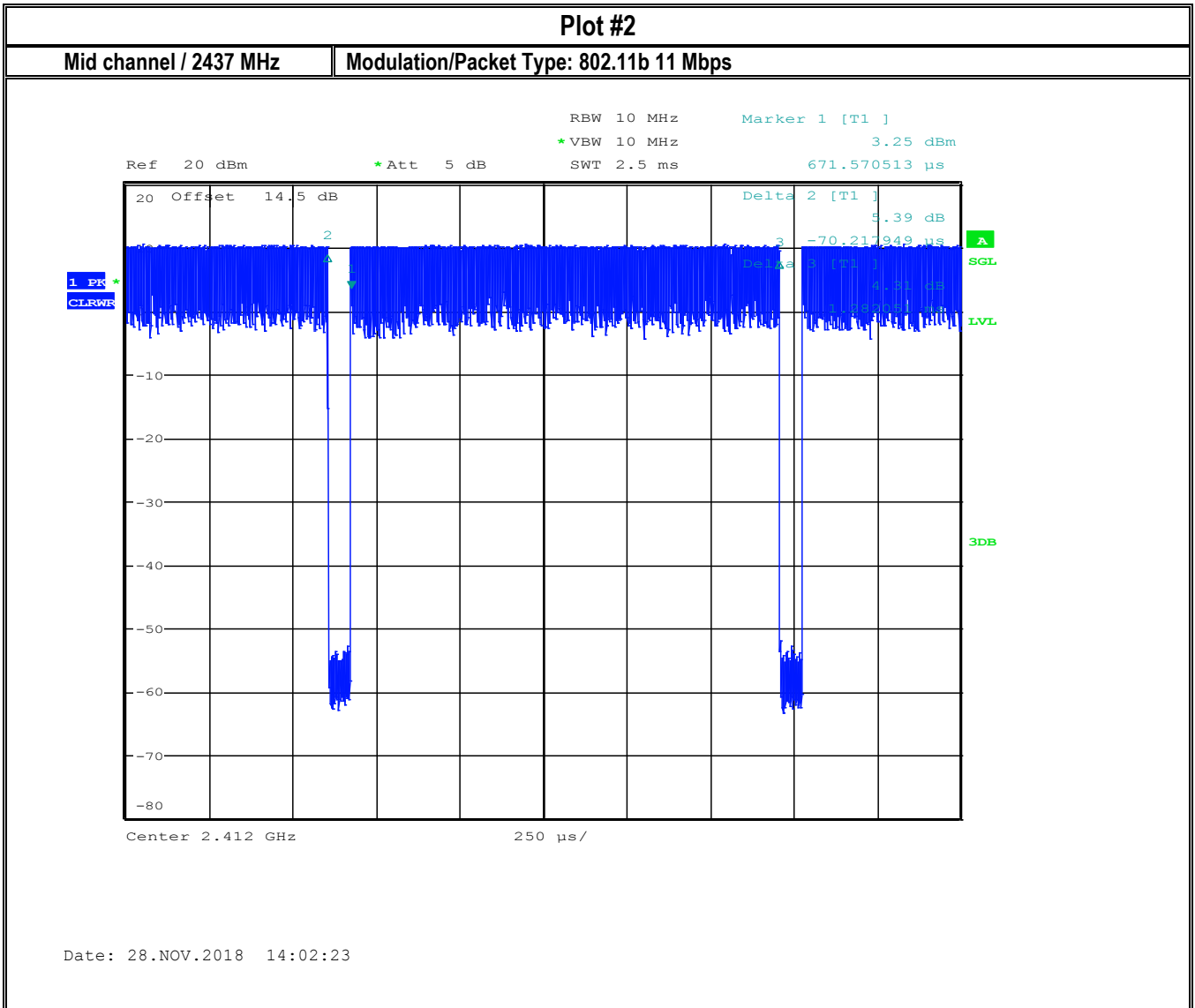
Spectrum Analyzer settings:

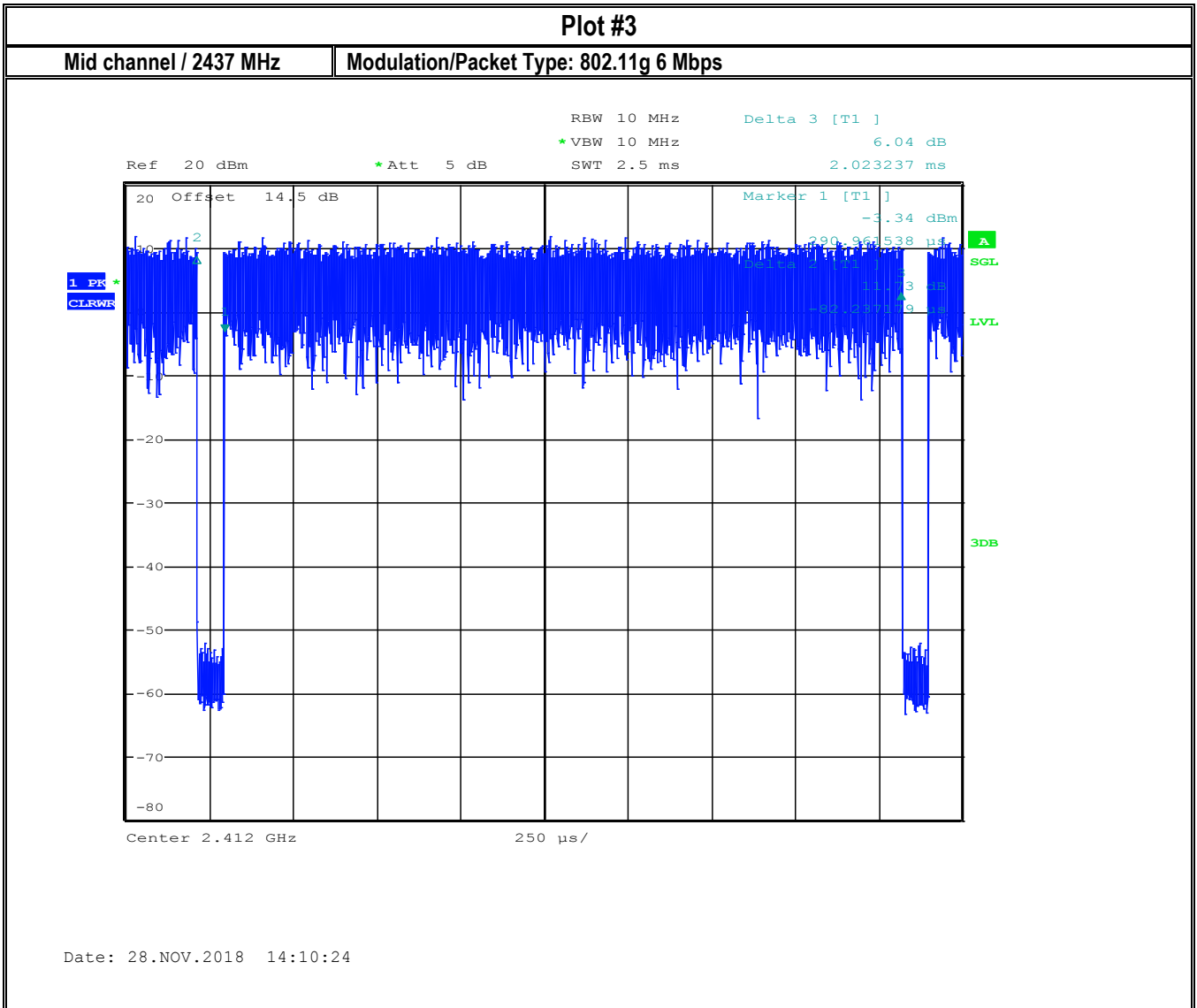
- Set the center frequency and of the instrument to the center frequency of the transmission
- Zero span
- Set RBW >=OBW if possible; otherwise, set RBW to the largest available value
- Detector = Peak or average

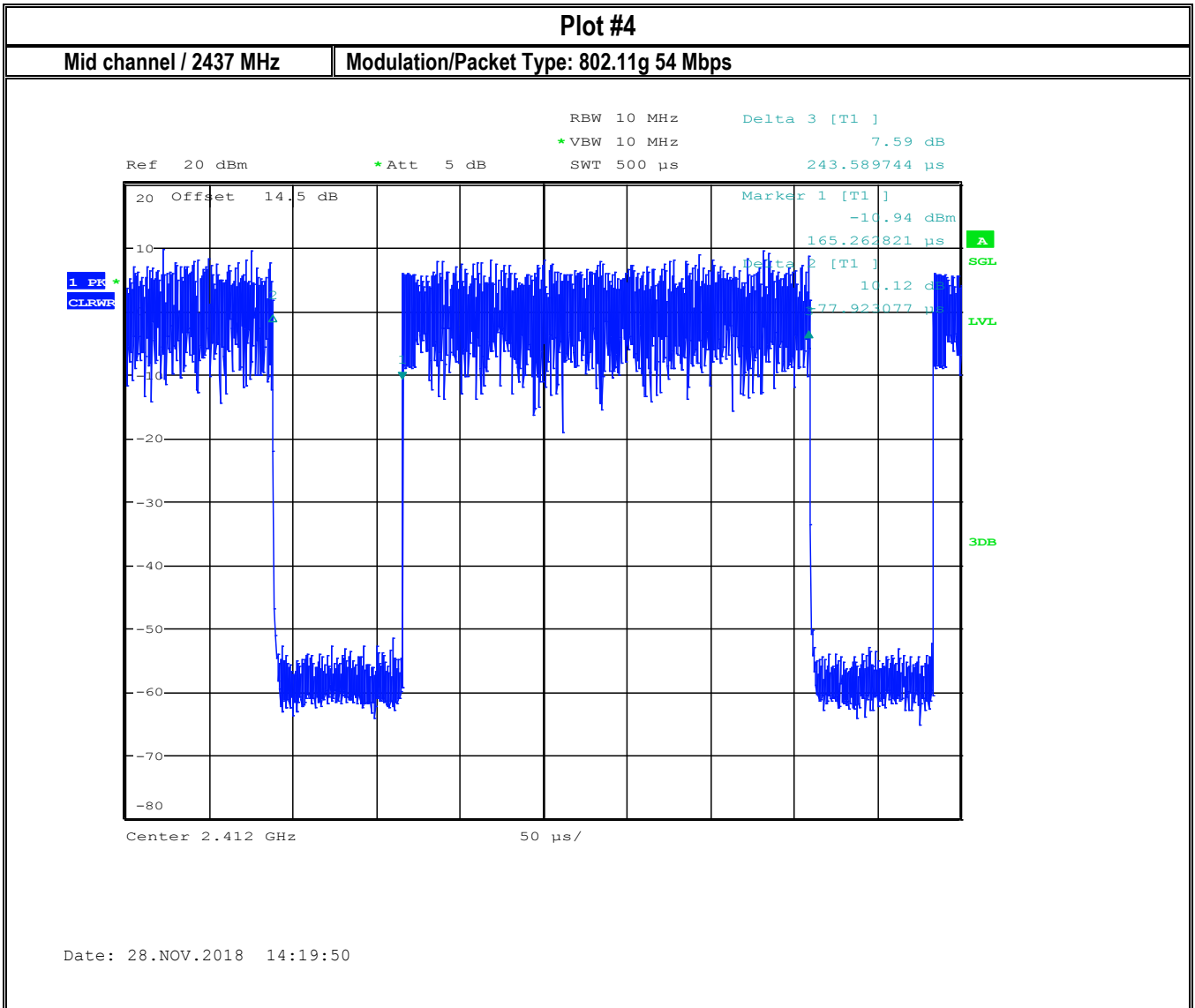
8.1.2 Measurement result

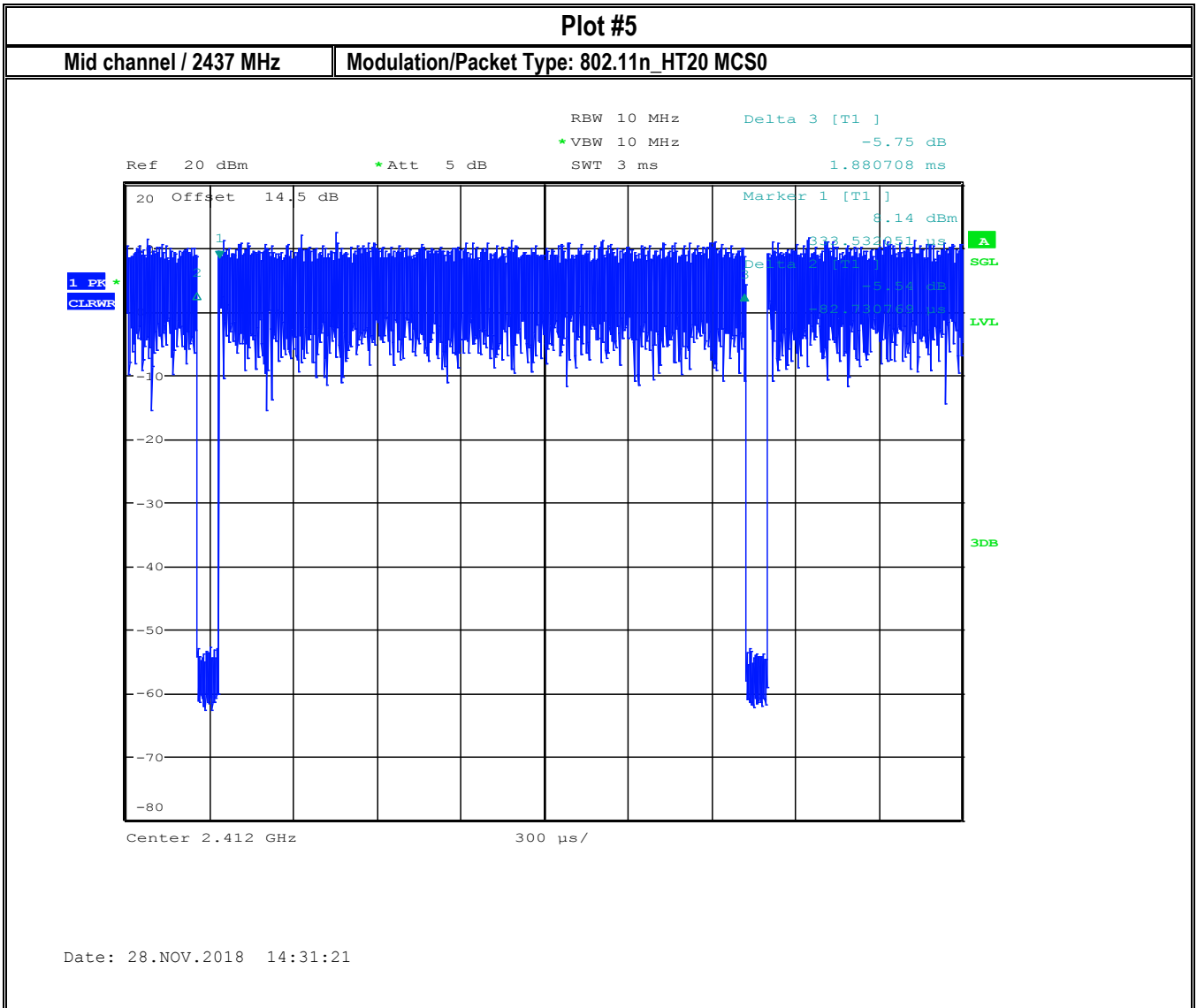
Plot #	Mode	Data Rate	Duty Cycle	Duty Cycle Correction Factor (dB)
1	802.11b	1Mbps	99.25%	0.03
2	802.11b	11Mbps	94.81%	0.23
3	802.11g	6Mbps	96.09%	0.17
4	802.11g	54Mbps	75.76%	1.21
5	802.11n_HT20	MCS0	95.79%	0.19
6	802.11n_HT20	MCS7	75.14%	1.24
7	802.11n_HT40	MCS0	92.15%	0.35
8	802.11n_HT40	MCS7	64.31%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





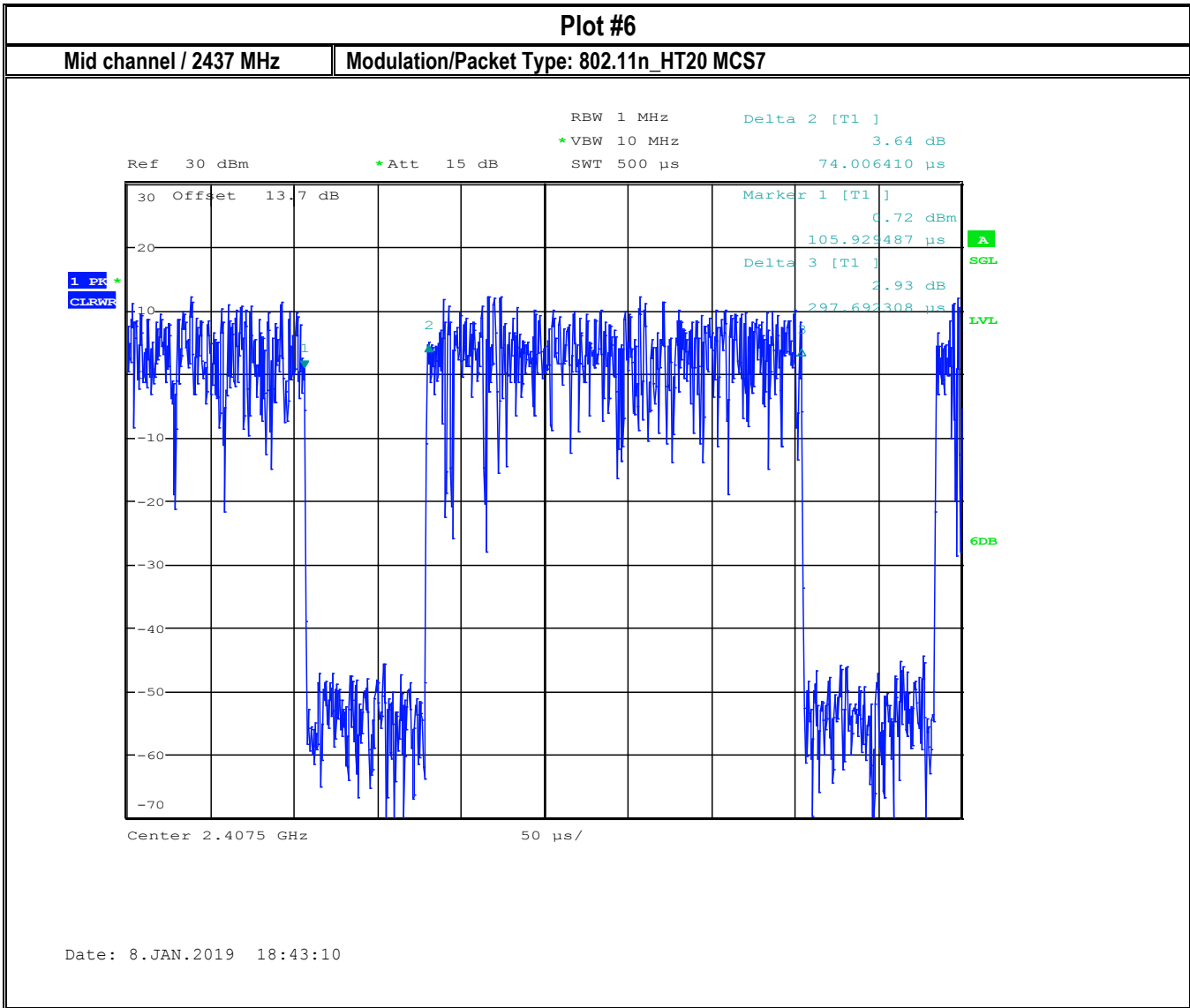


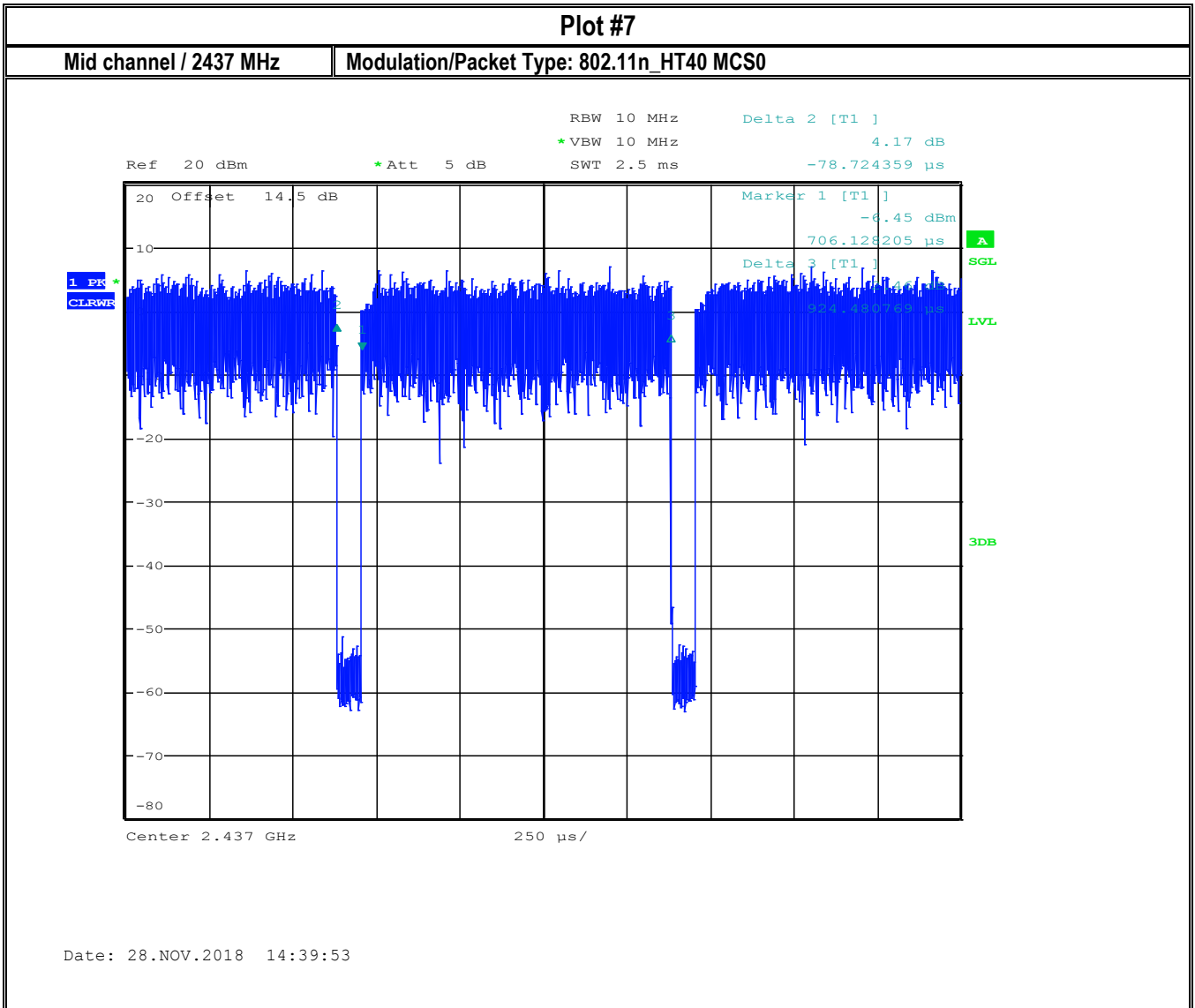




Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

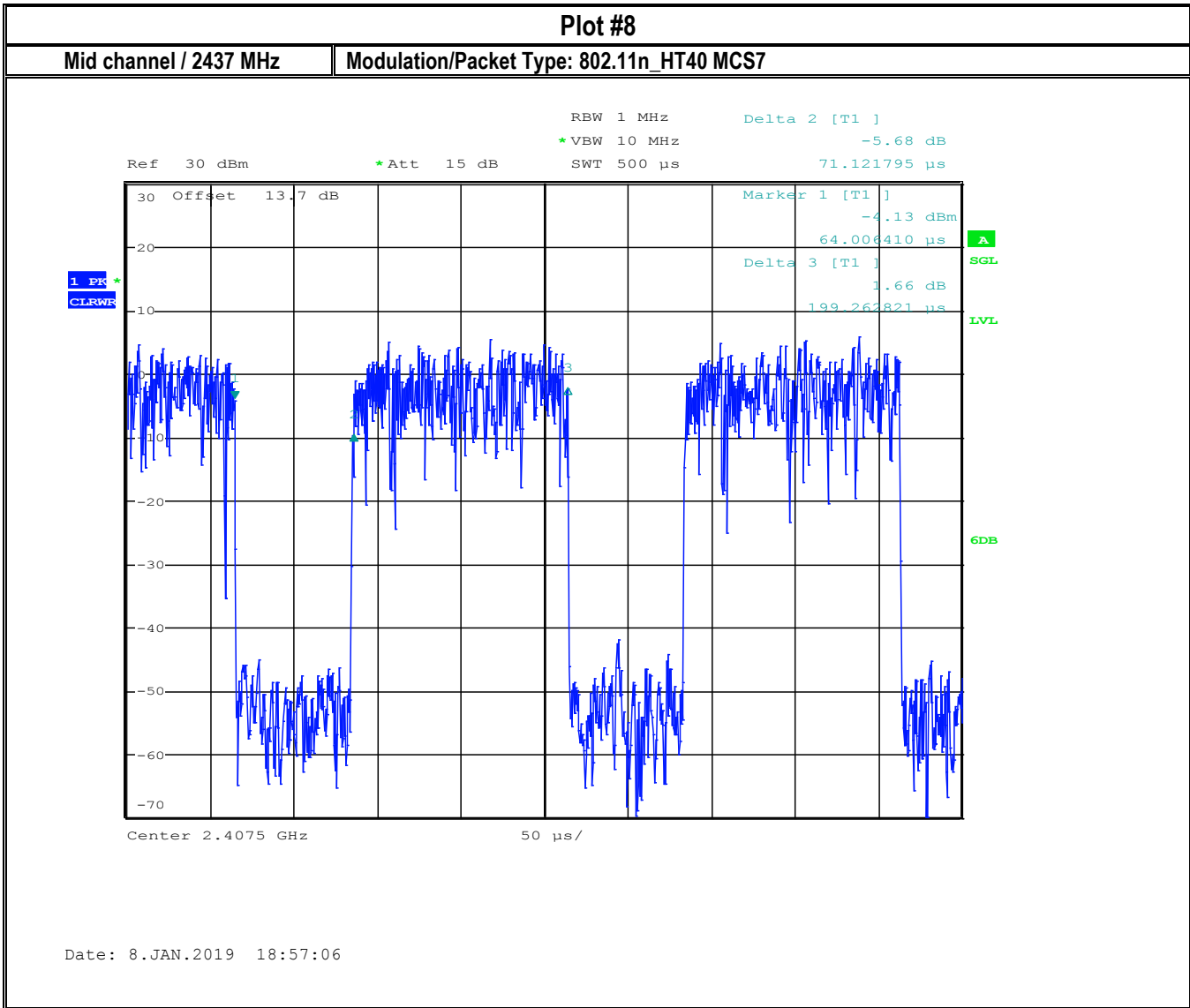
FCC ID: UUU-5411





Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
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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

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.

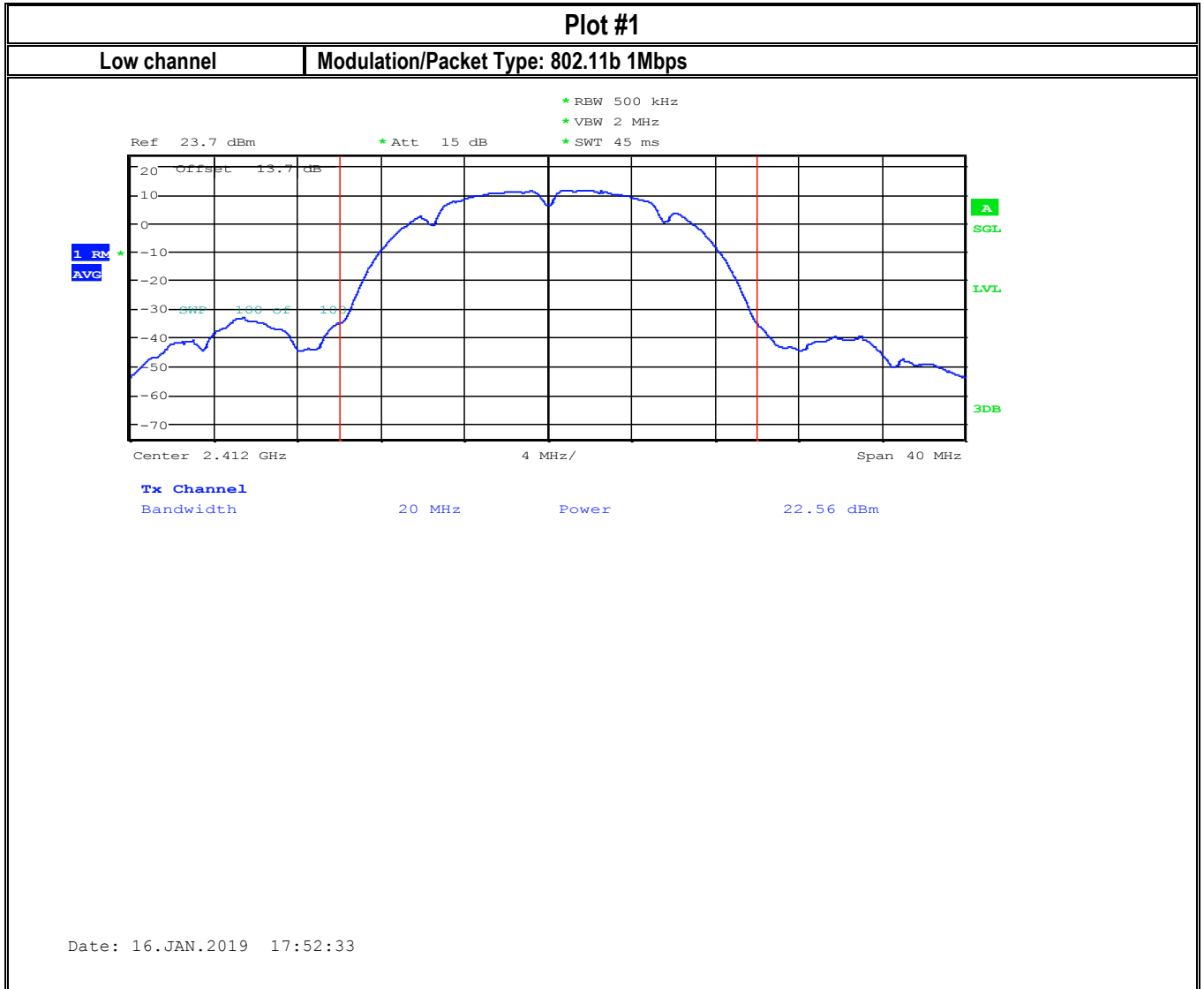
Maximum conducted output is used to compute the Power for MIMO below.
MIMO Mode Power Table

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.

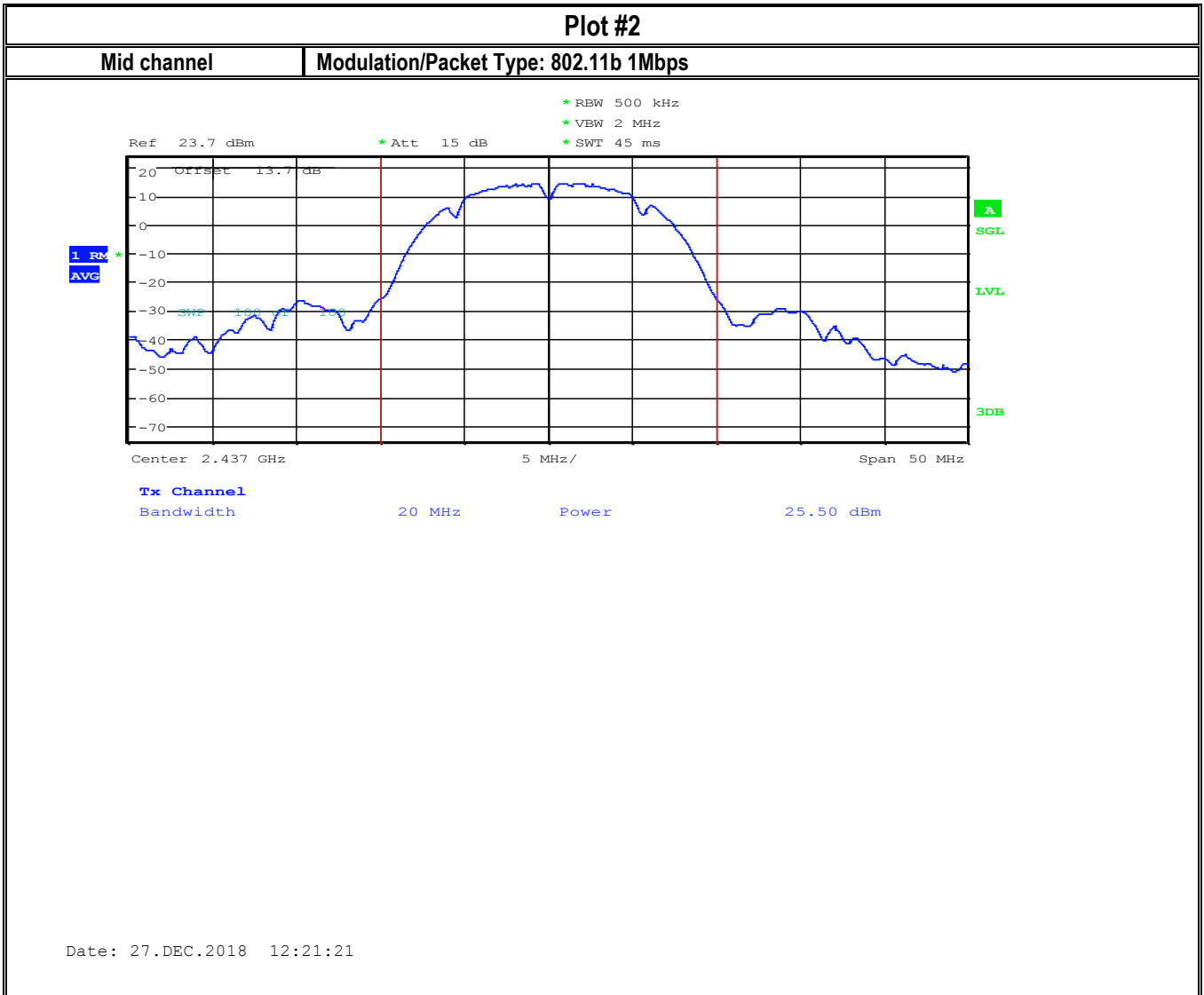
8.2.6 Plots

Power Plots for Antenna Chain 0



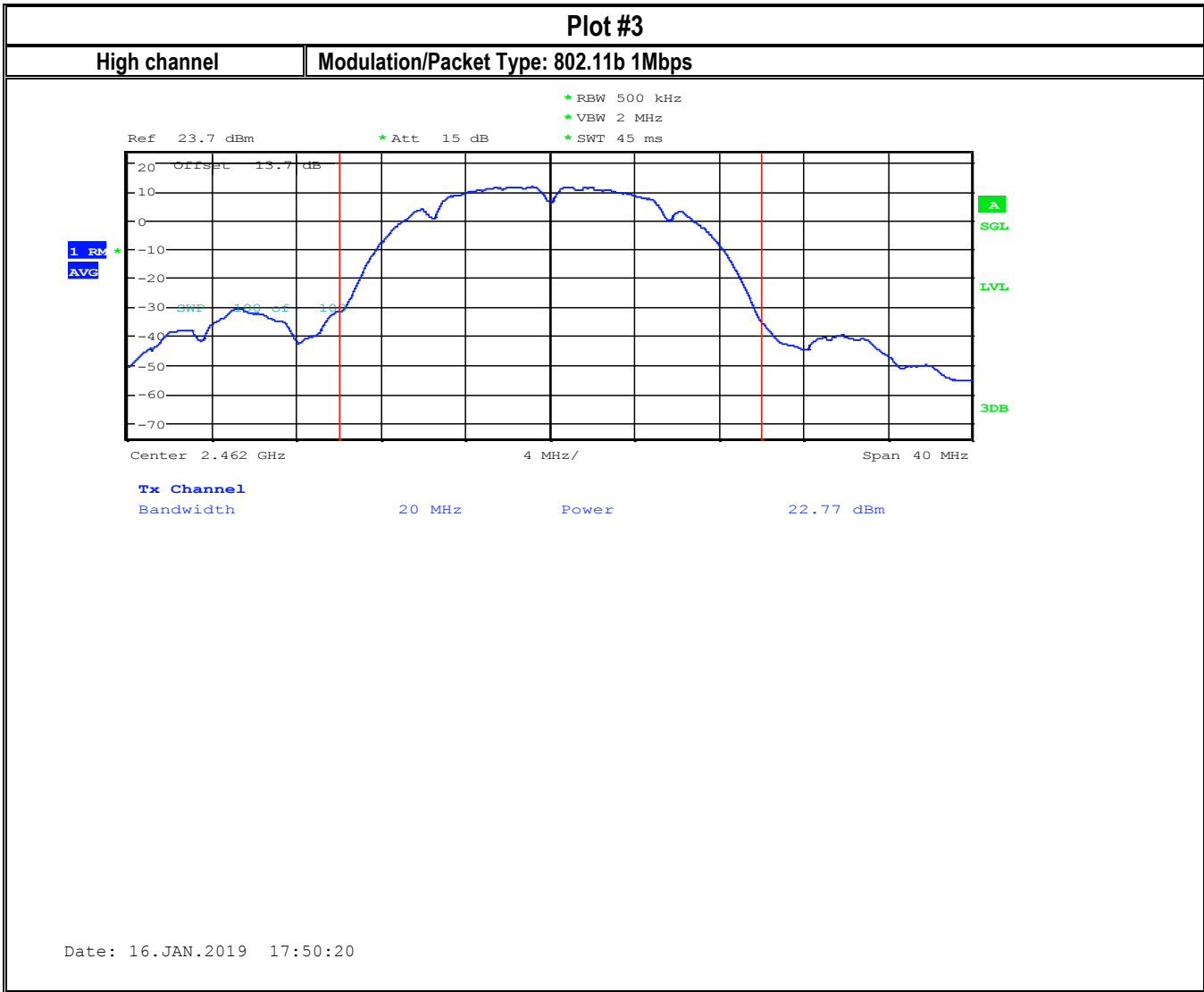
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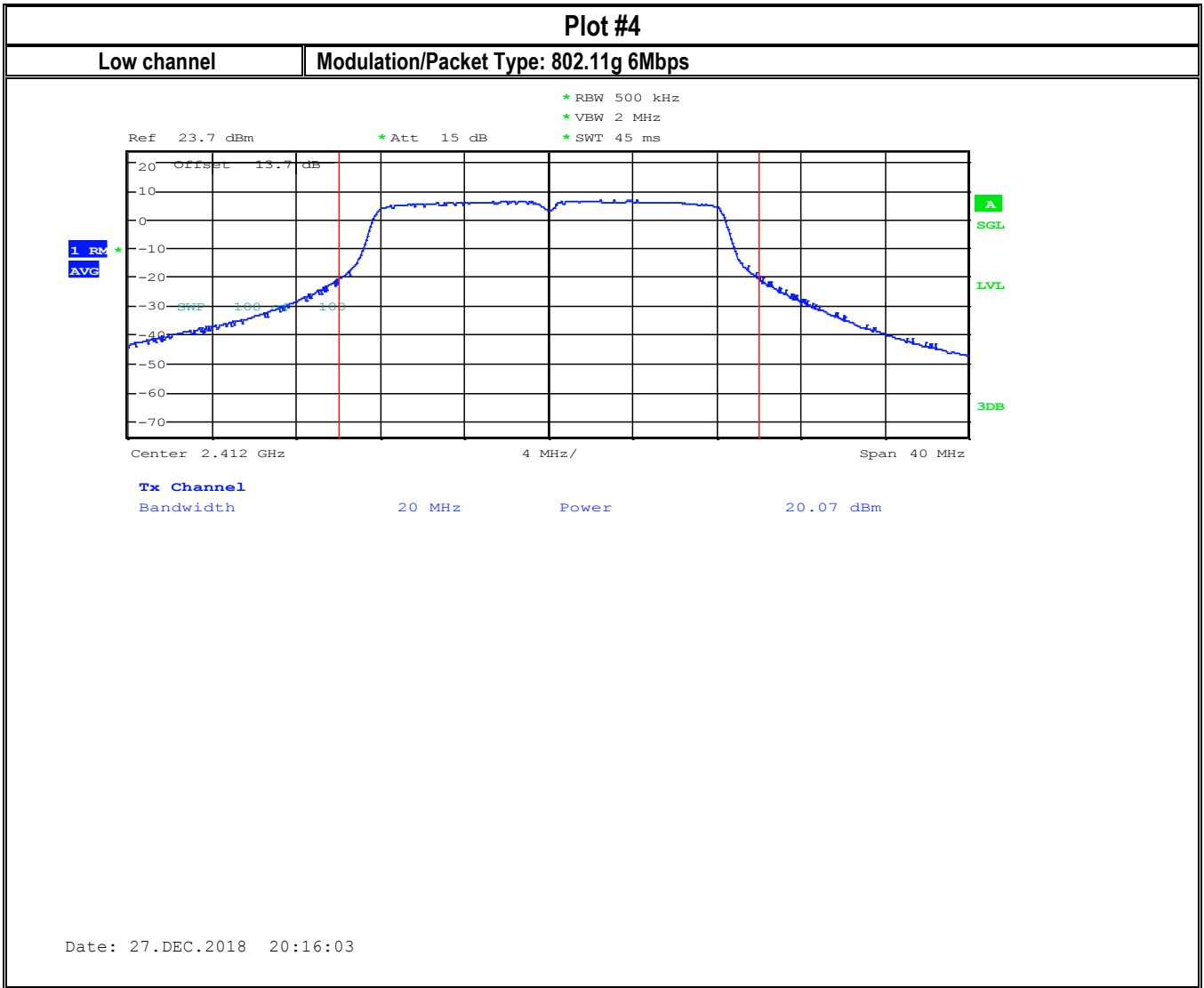
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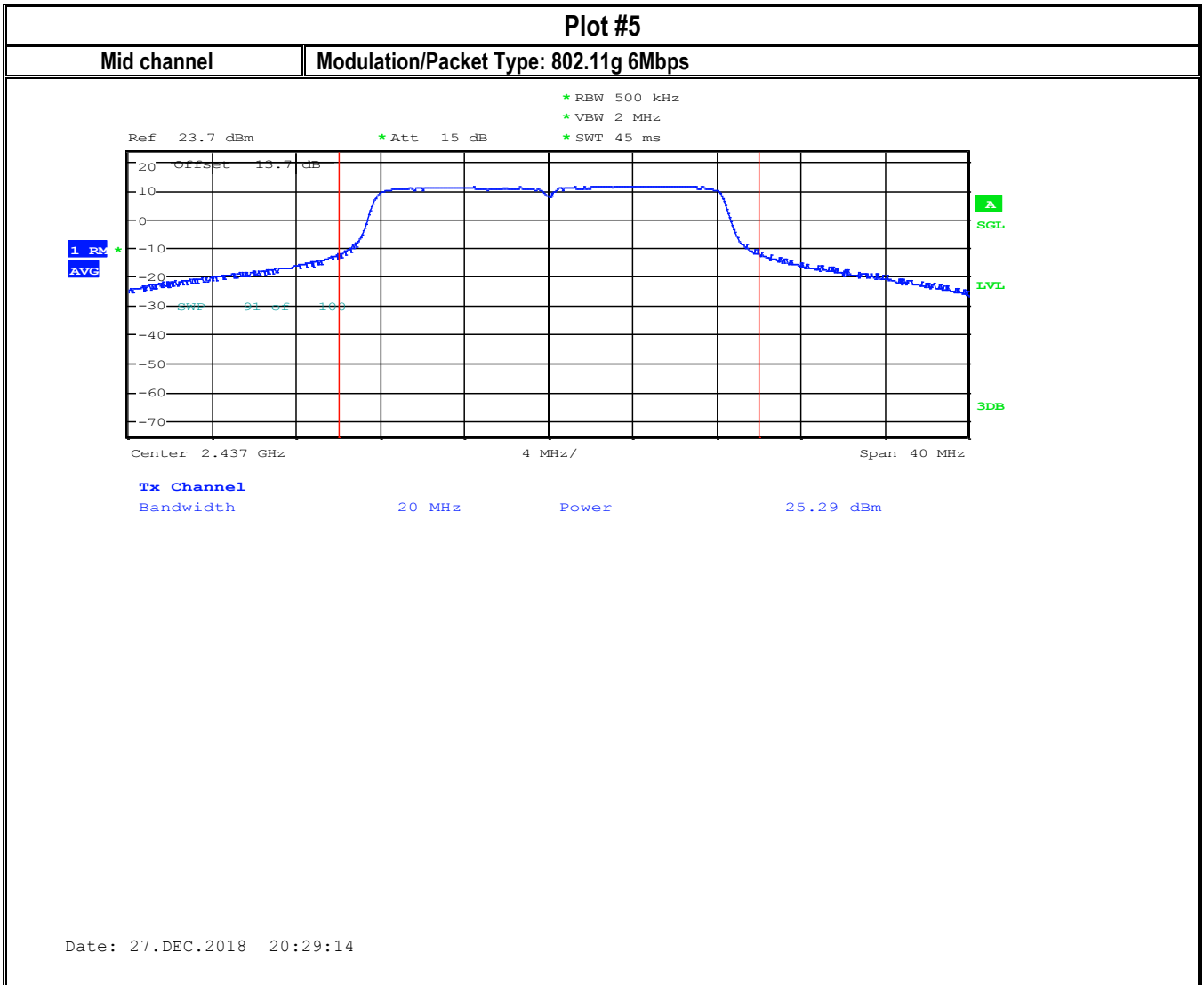
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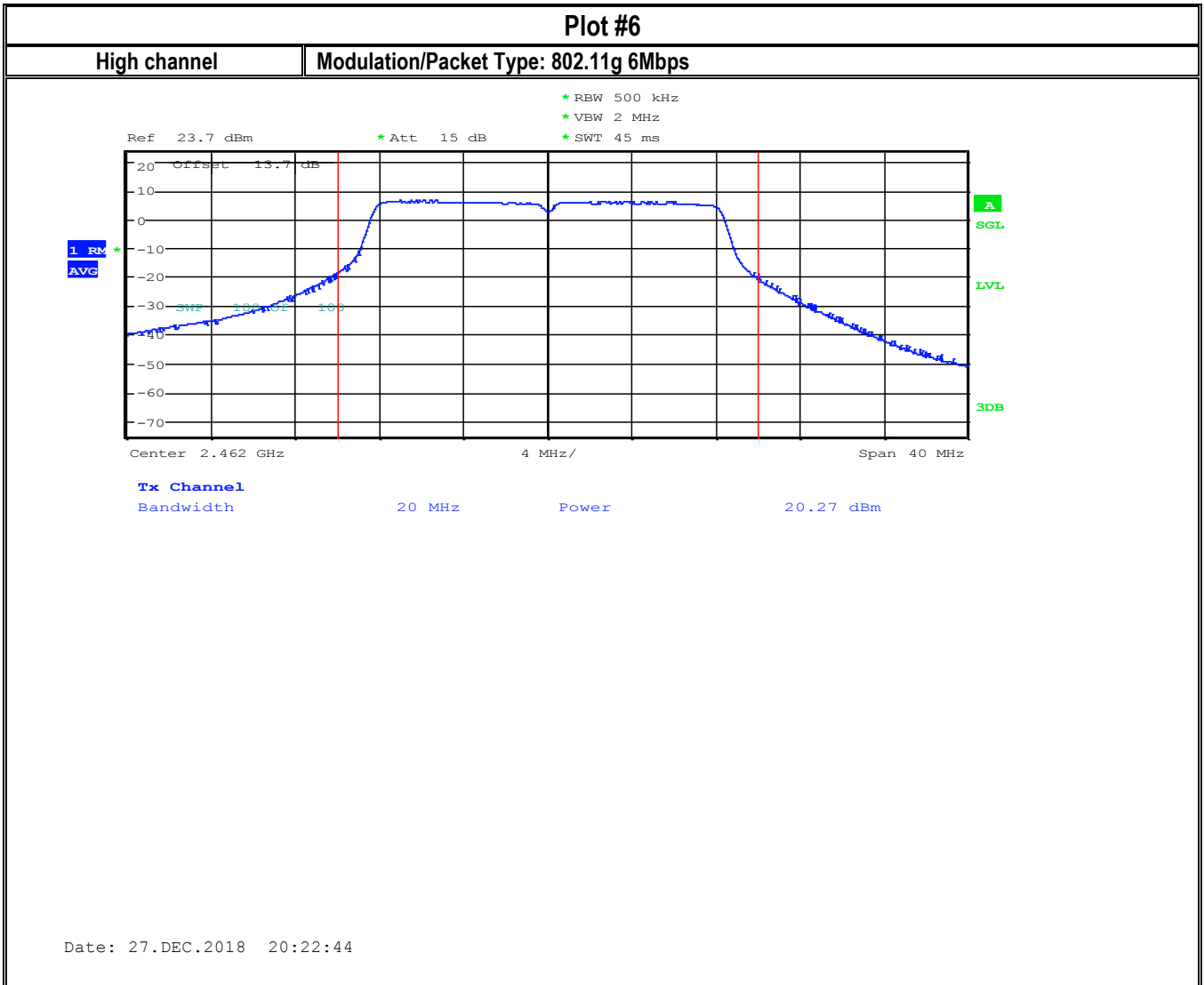
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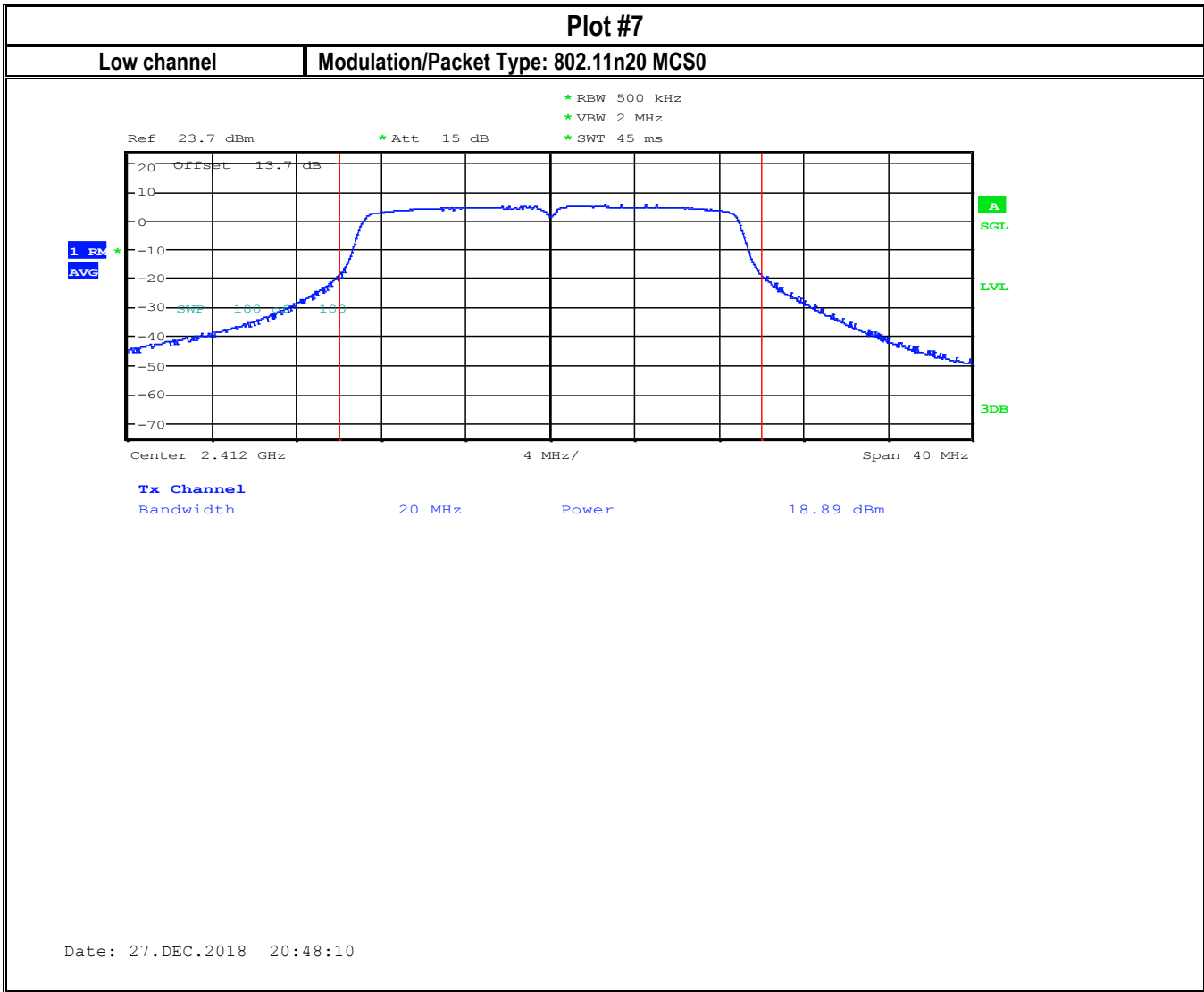
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Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

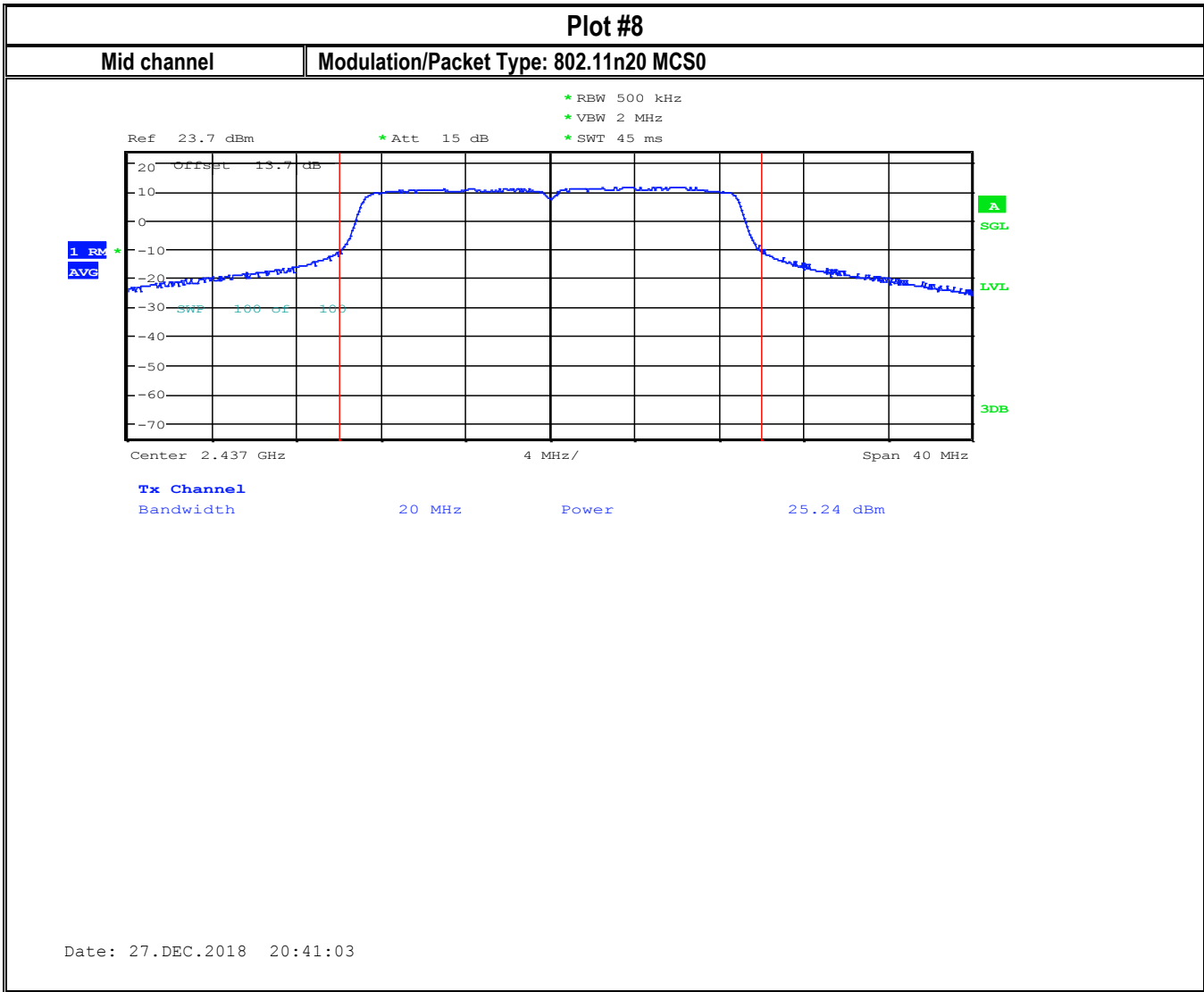
FCC ID: UUU-5411





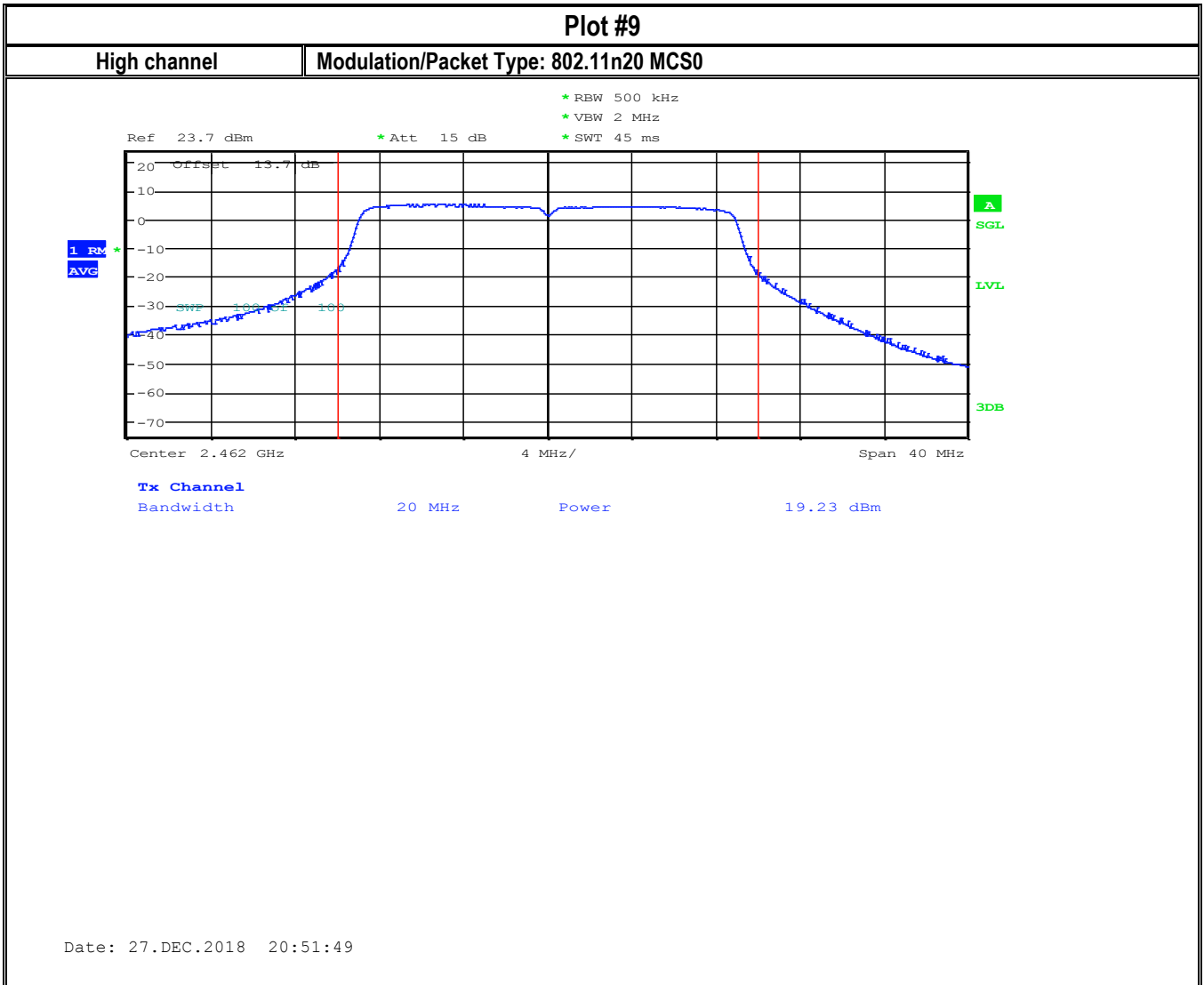
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



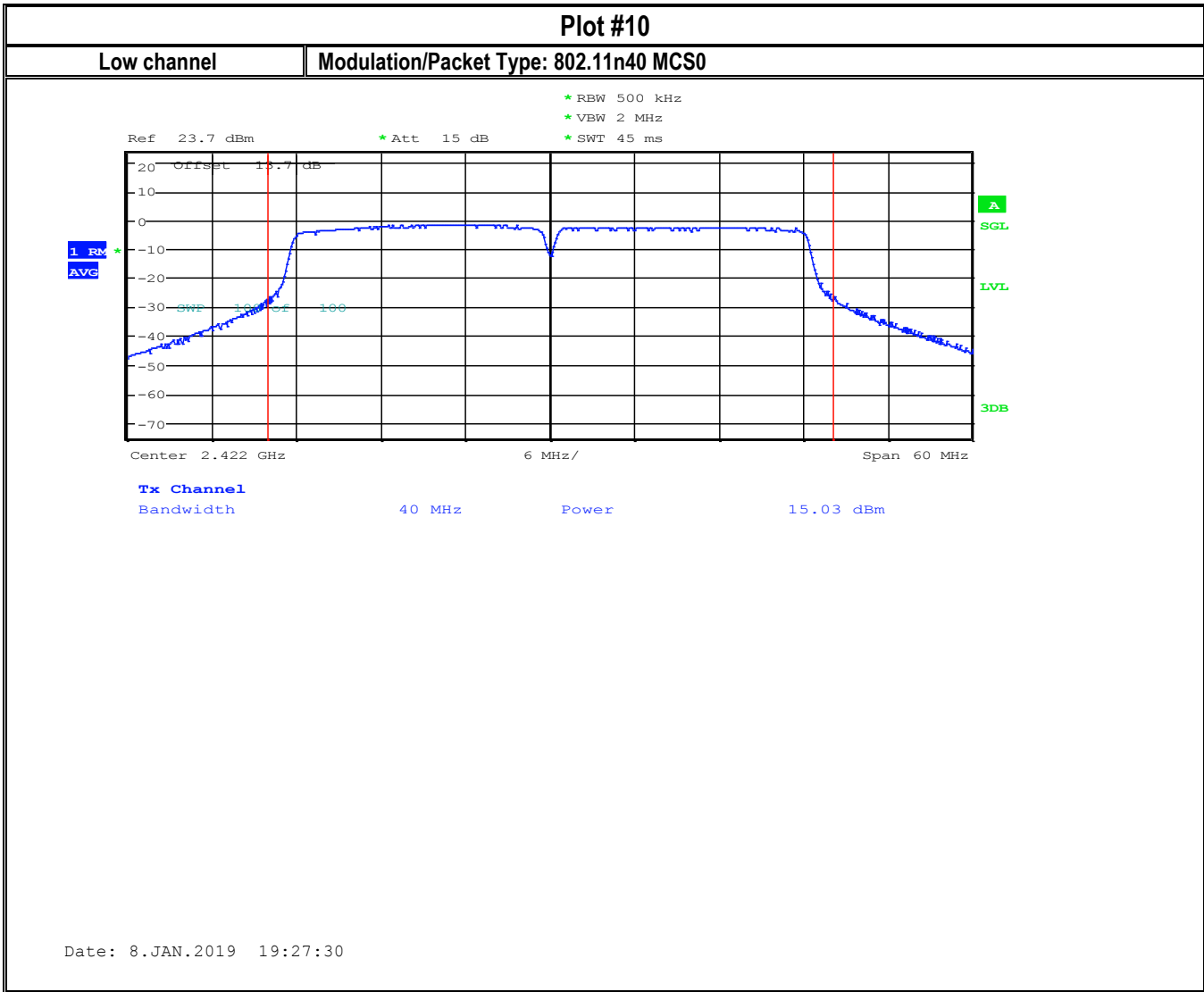
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

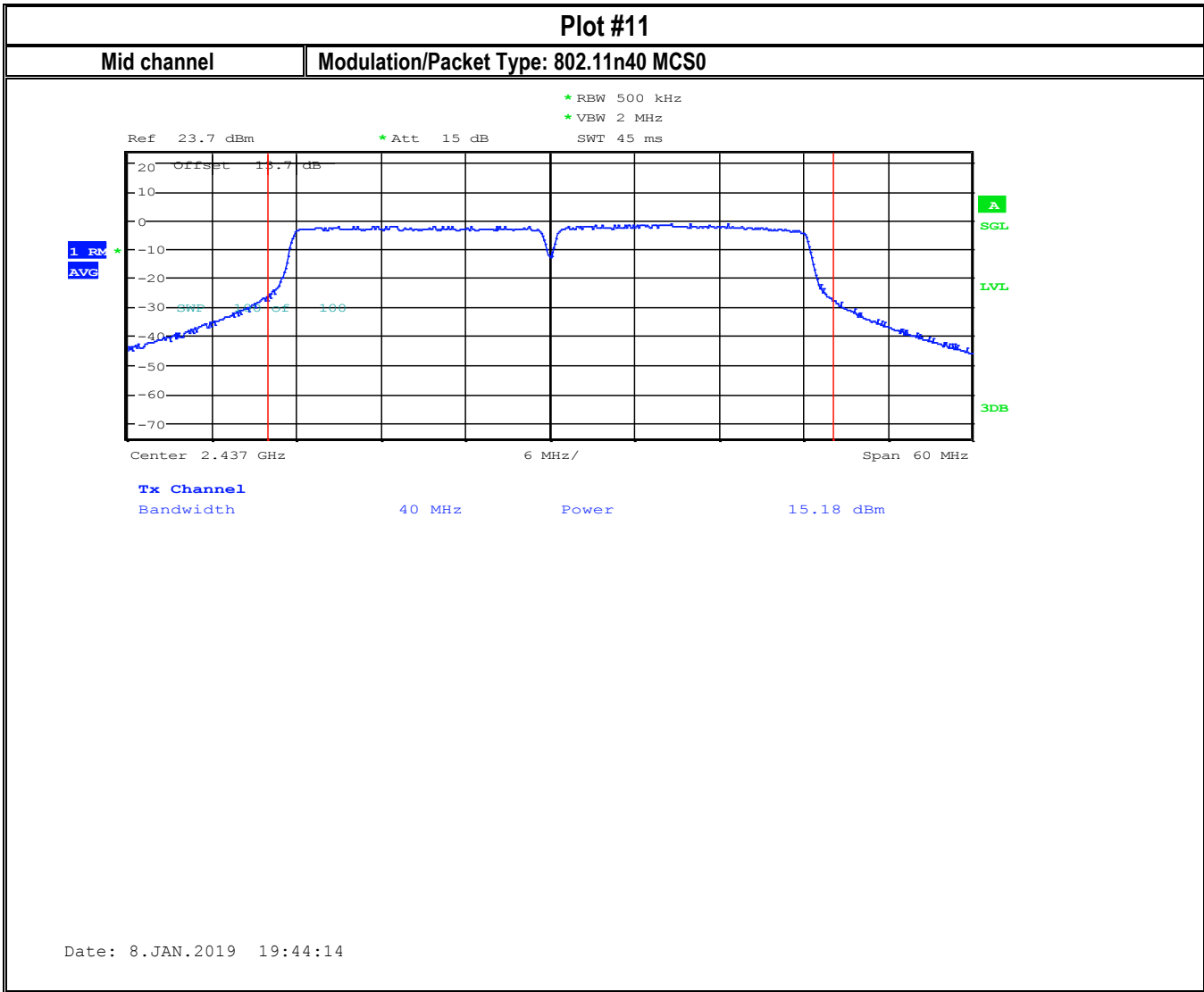
FCC ID: UUU-5411



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

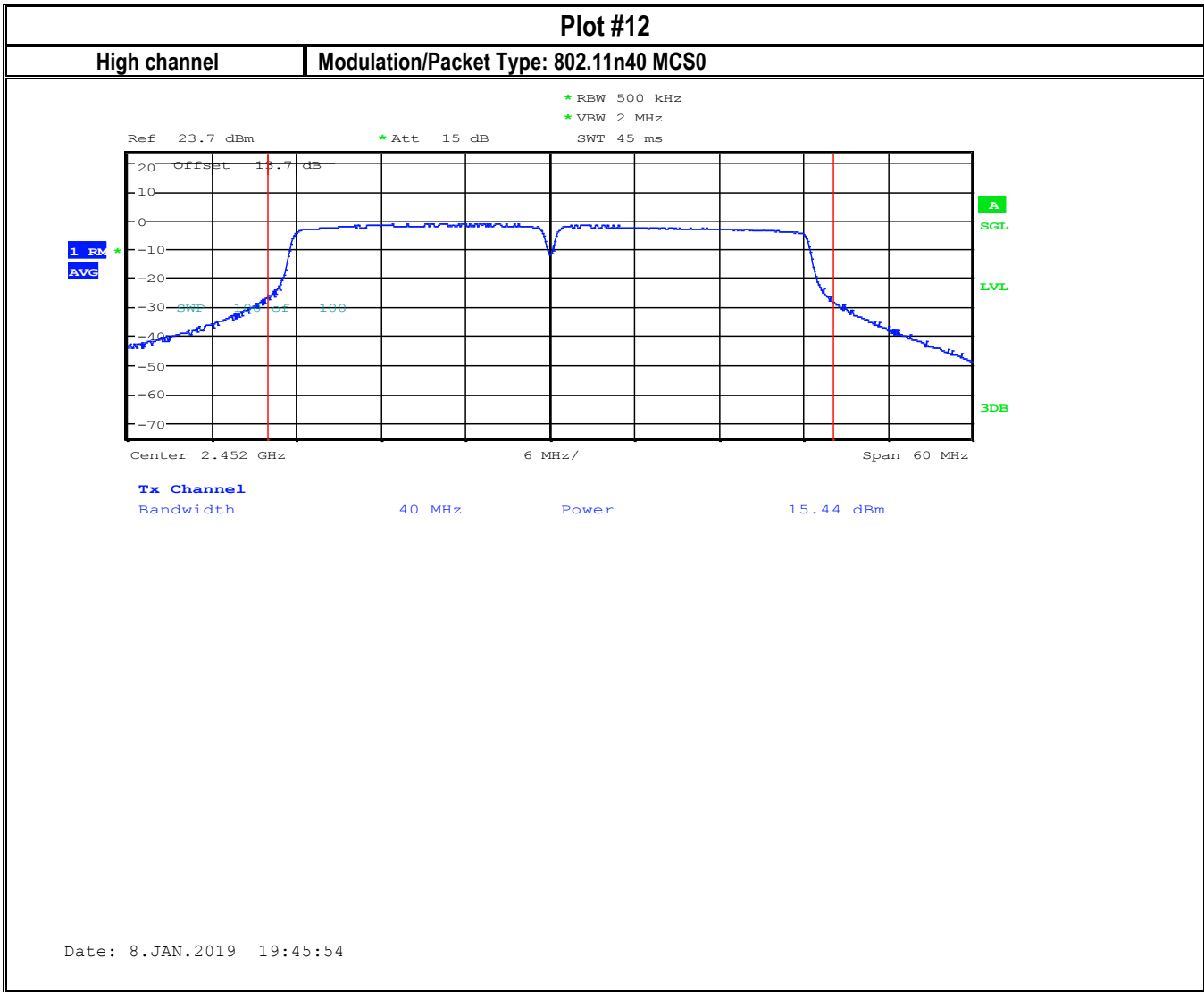
FCC ID: UUU-5411





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

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

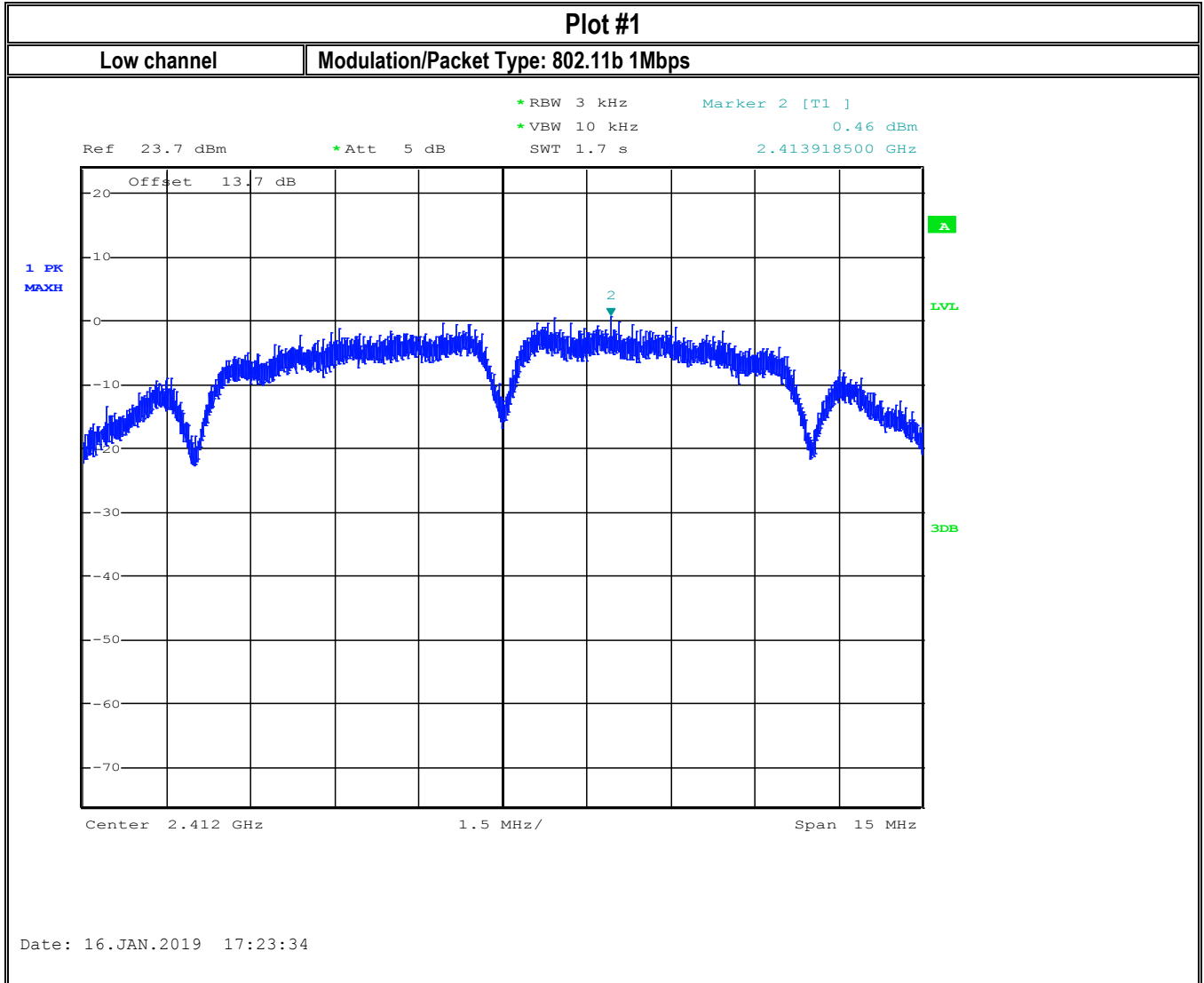
Chain 1 demonstrated same levels to Chain 0.

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

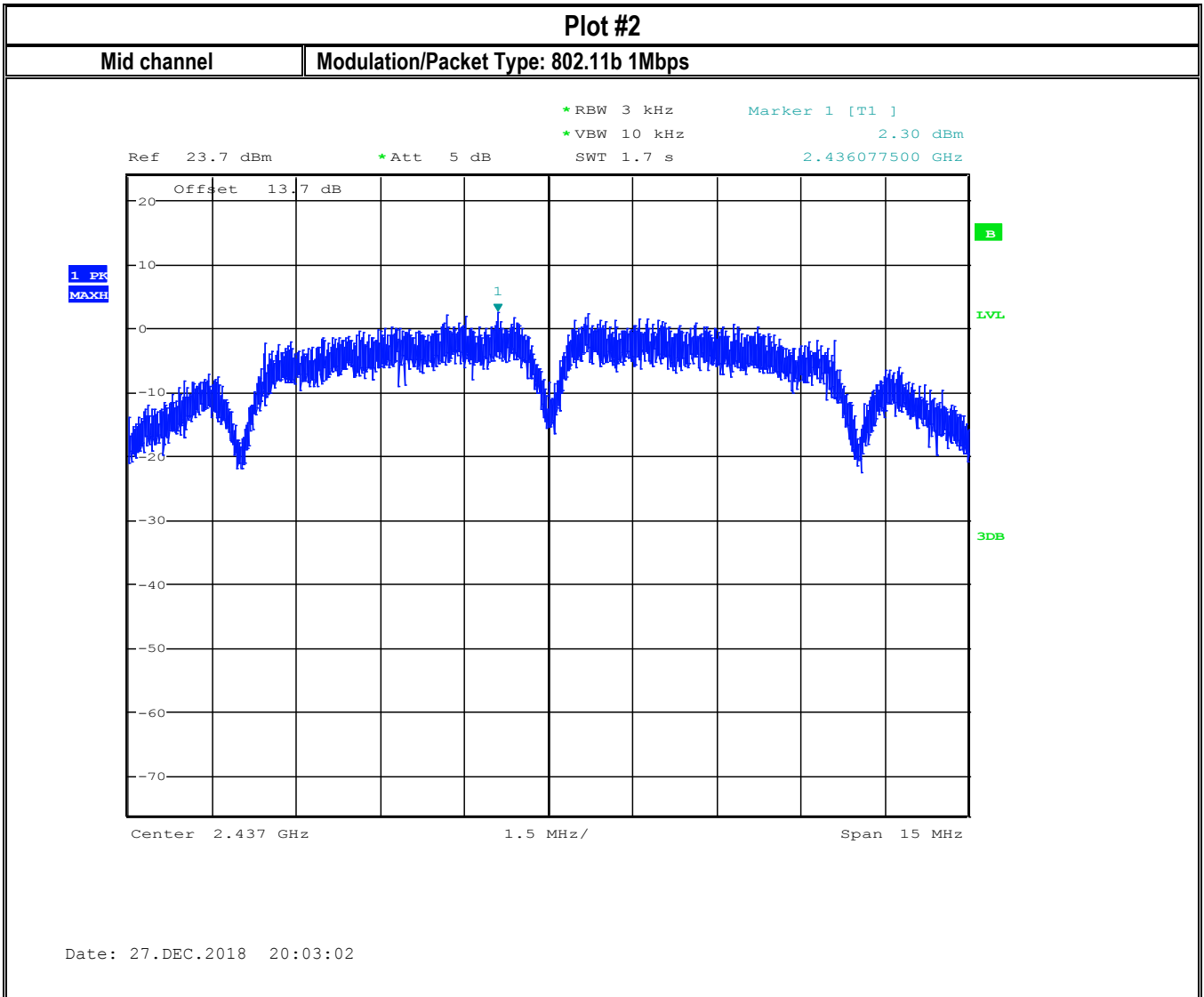
MIMO Directional Gain = GANT. No correlation between Spatial Streams for MIMO.

8.3.6 Measurement Plots:



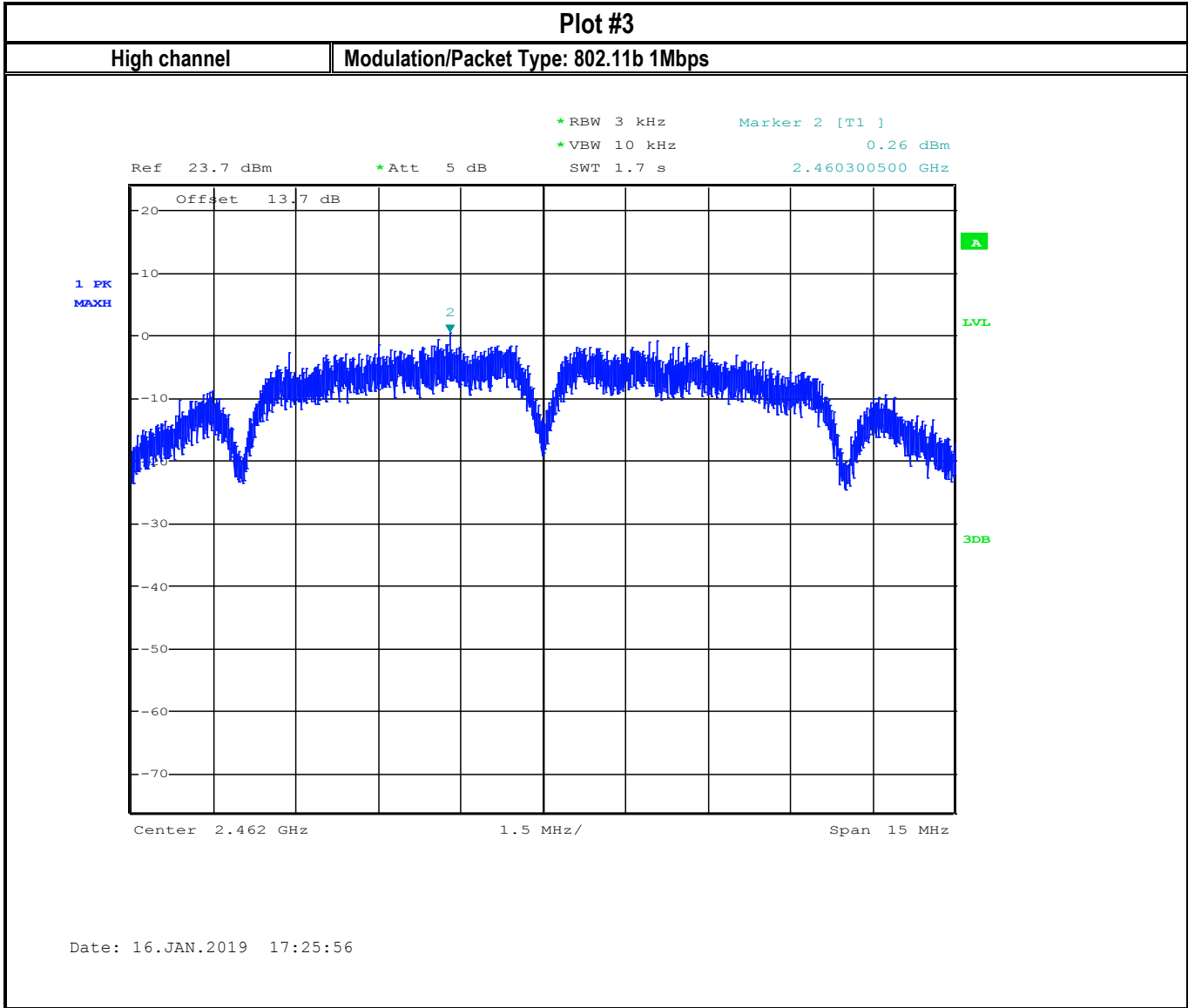
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report: 2019-05-23

FCC ID: UUU-5411



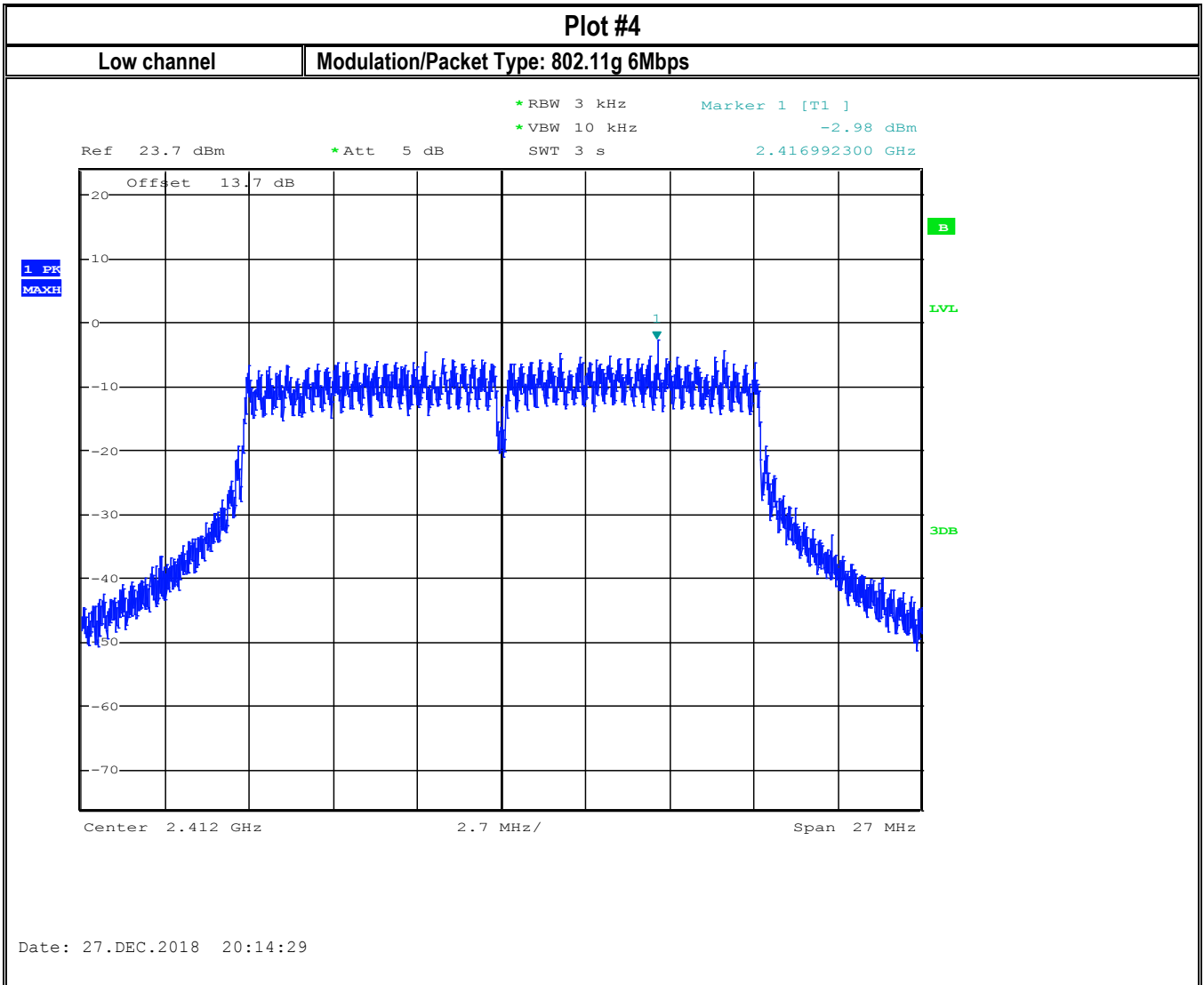
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

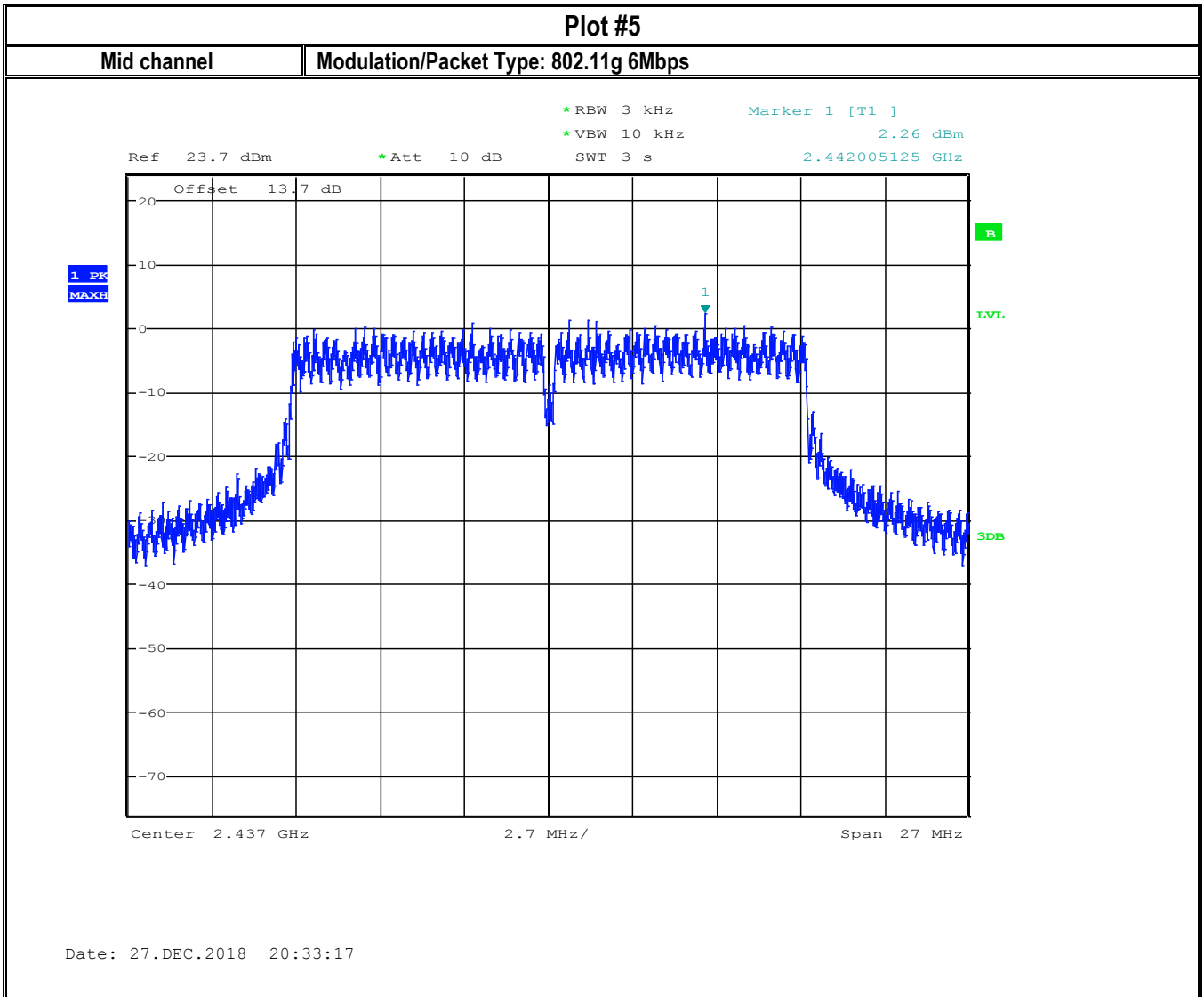
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Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411





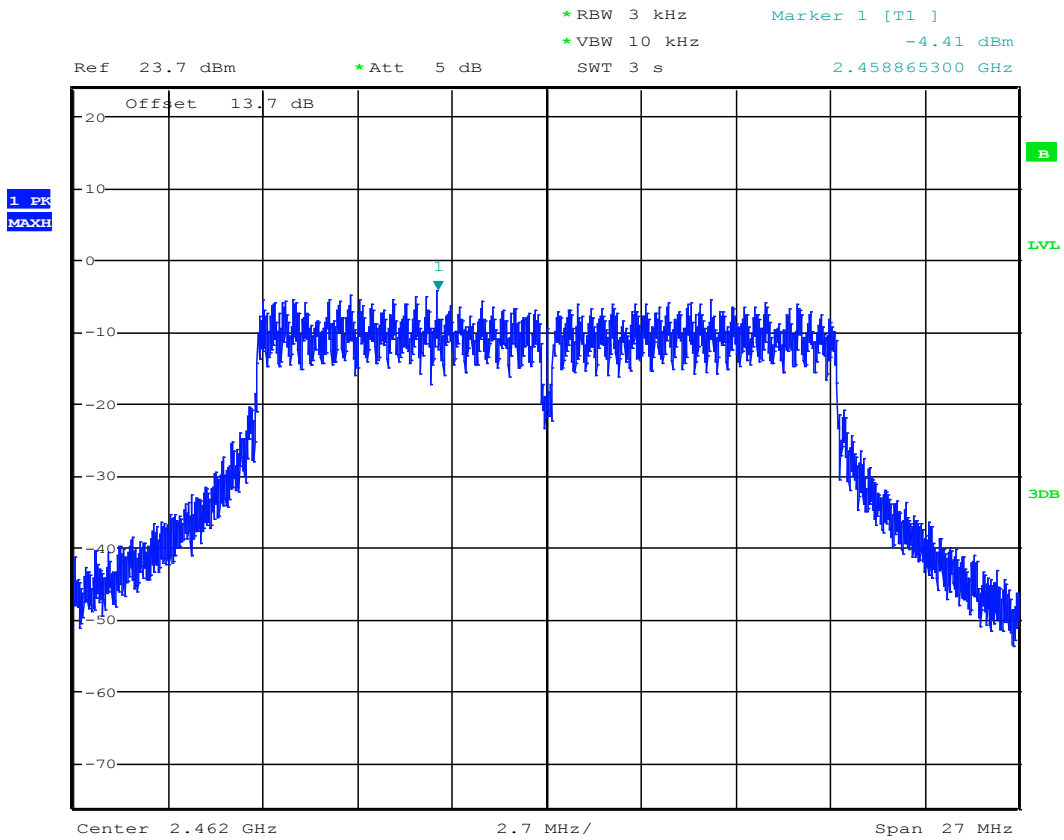
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Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #6

High channel

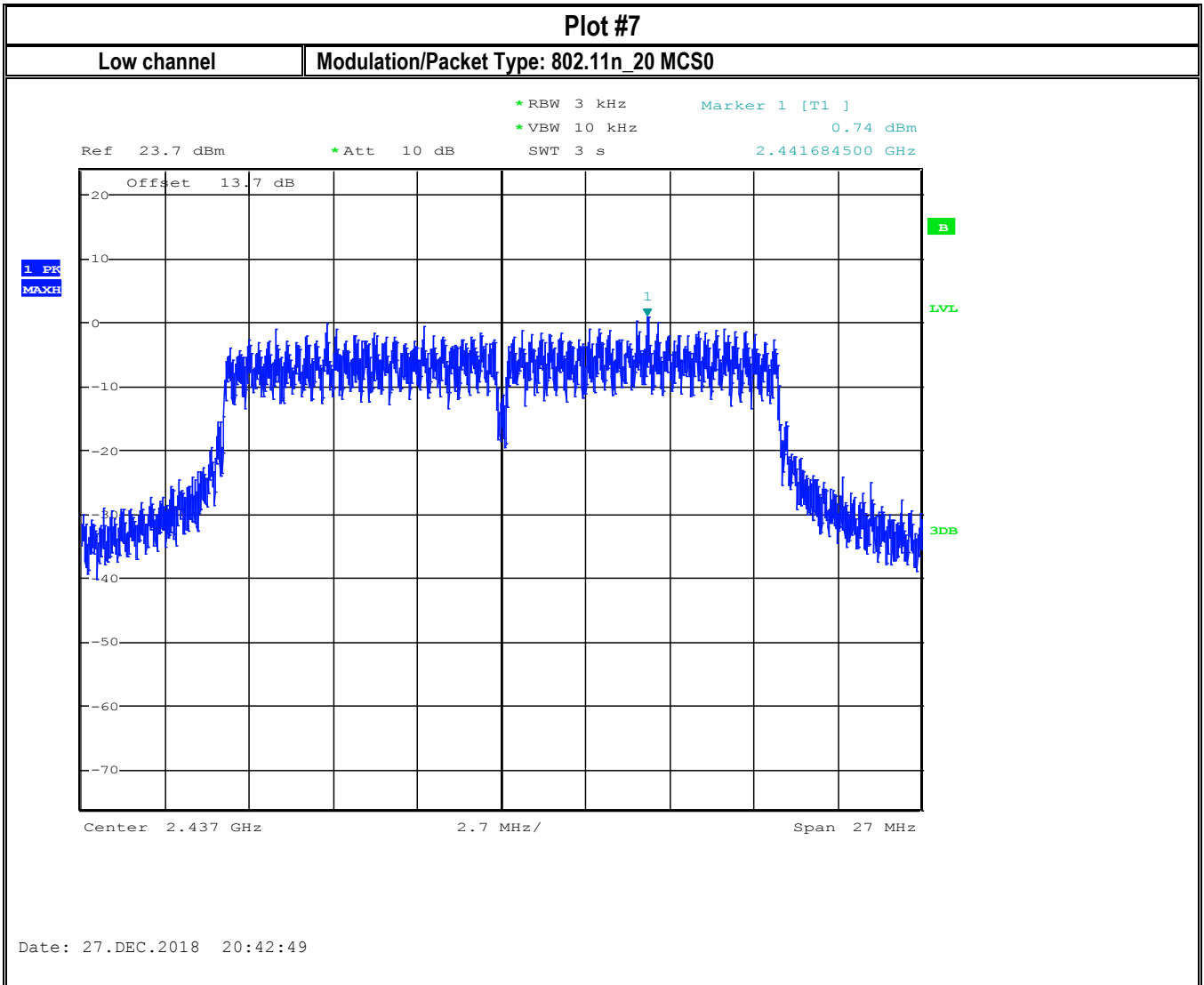
Modulation/Packet Type: 802.11g 6Mbps

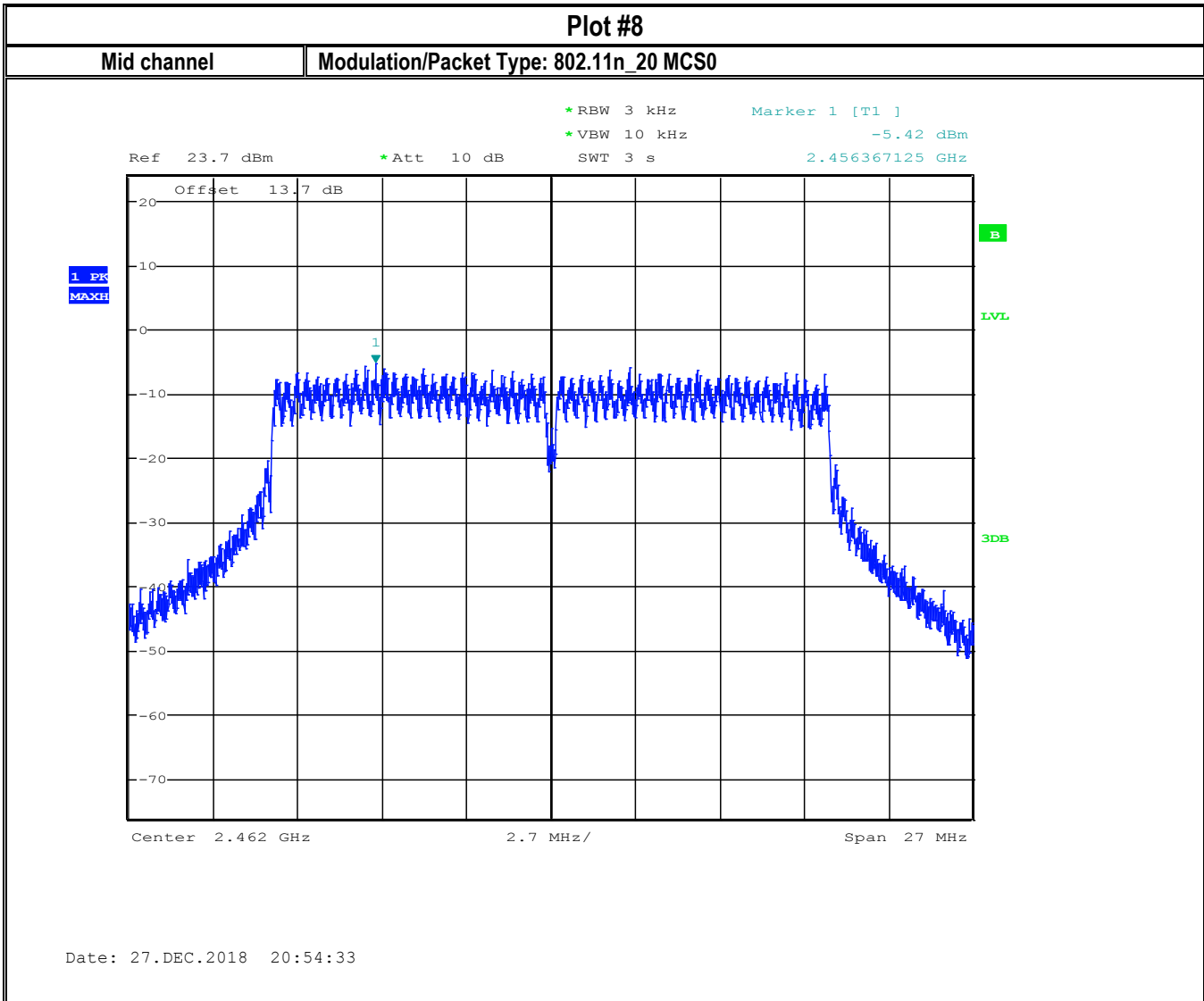


Date: 27.DEC.2018 20:20:19

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

FCC ID: UUU-5411





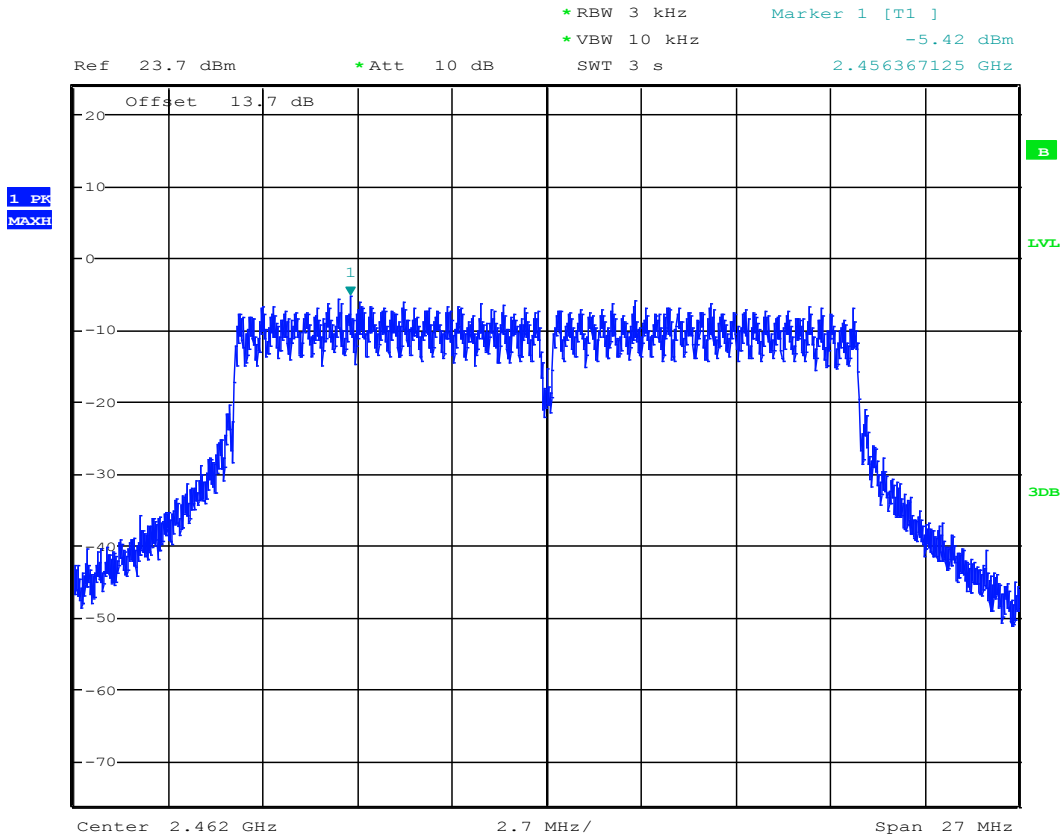
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411

Plot #9

High channel

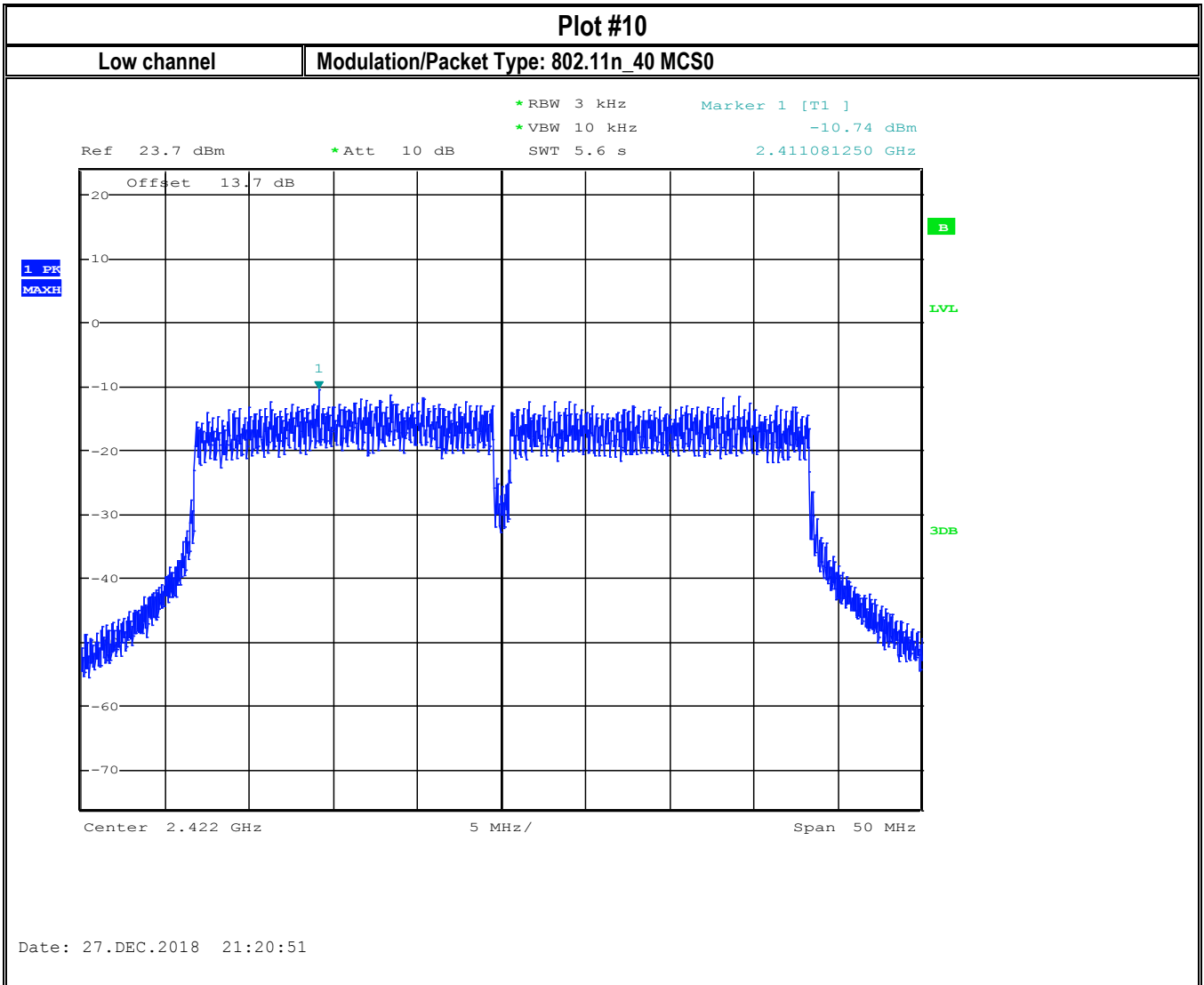
Modulation/Packet Type: 802.11n_20 MCS0

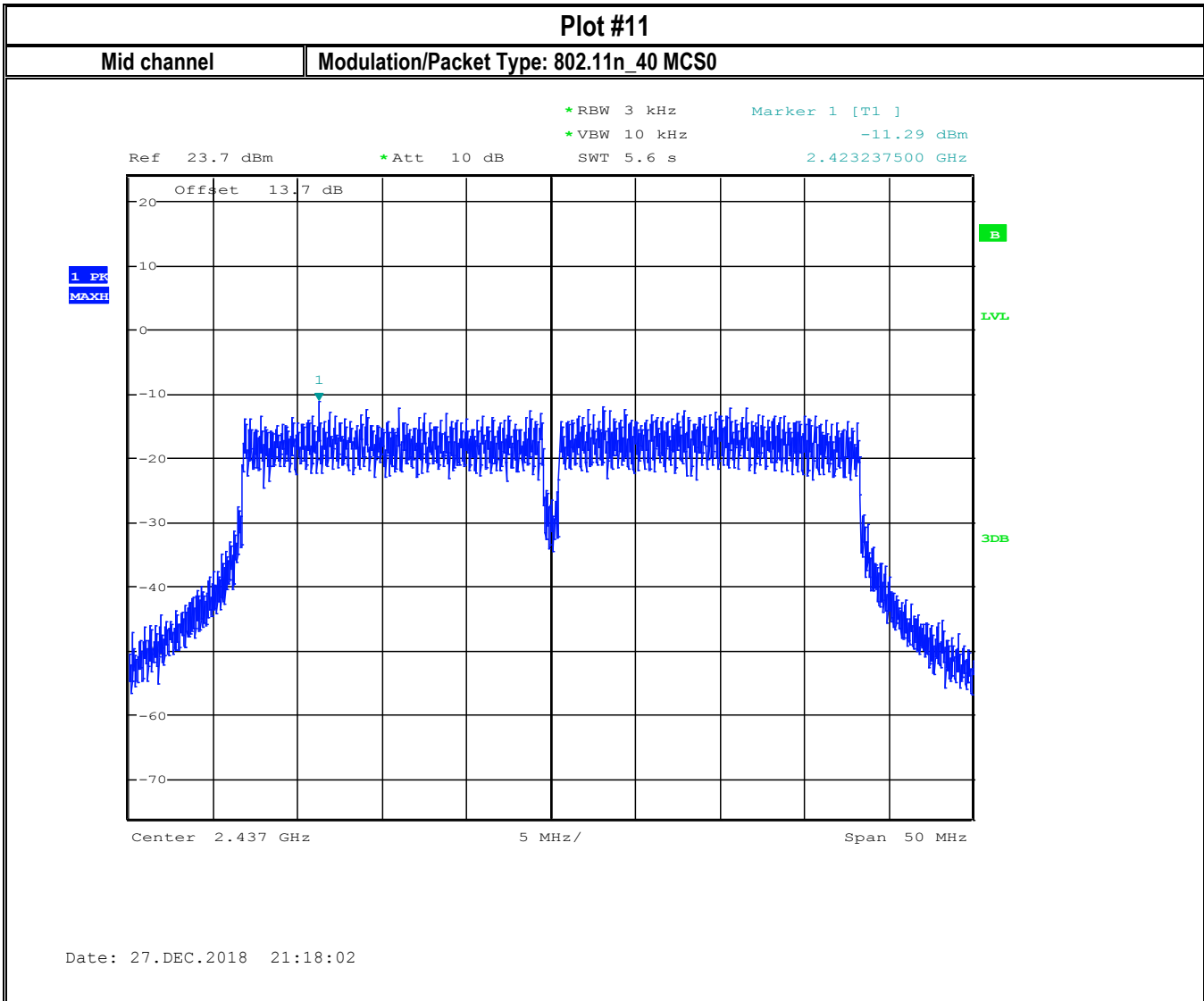


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Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

FCC ID: UUU-5411





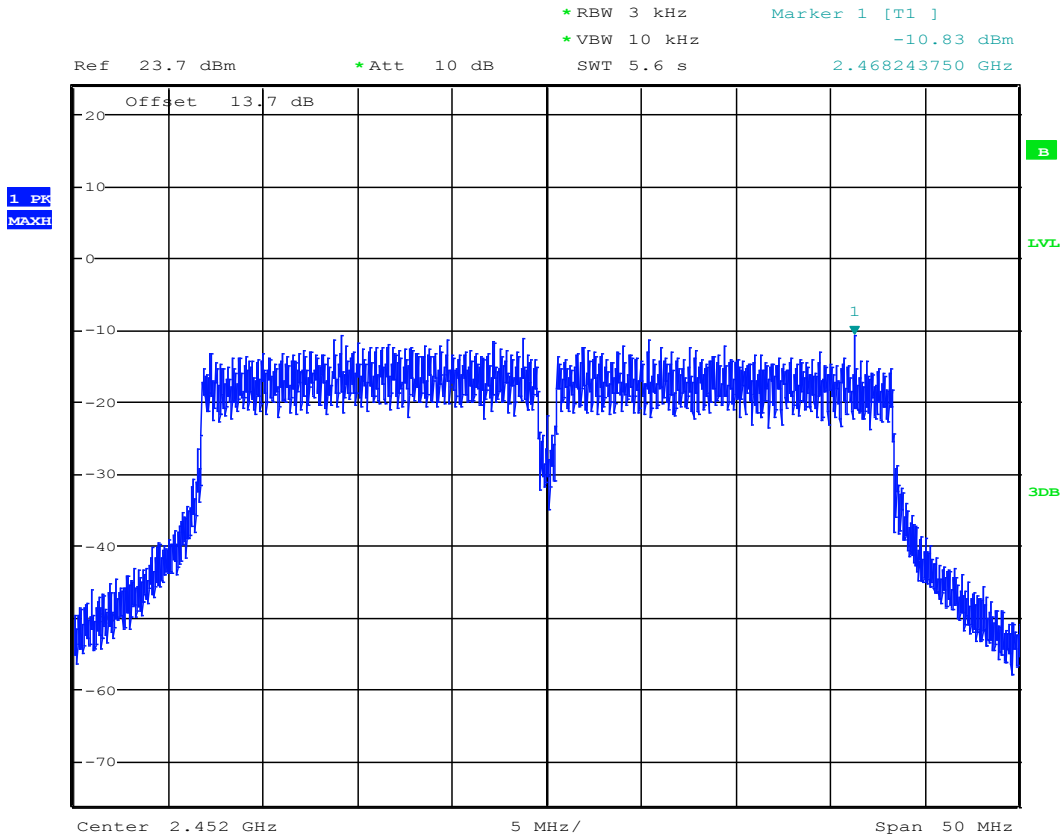
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
Date of Report 2019-05-23

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

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

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

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

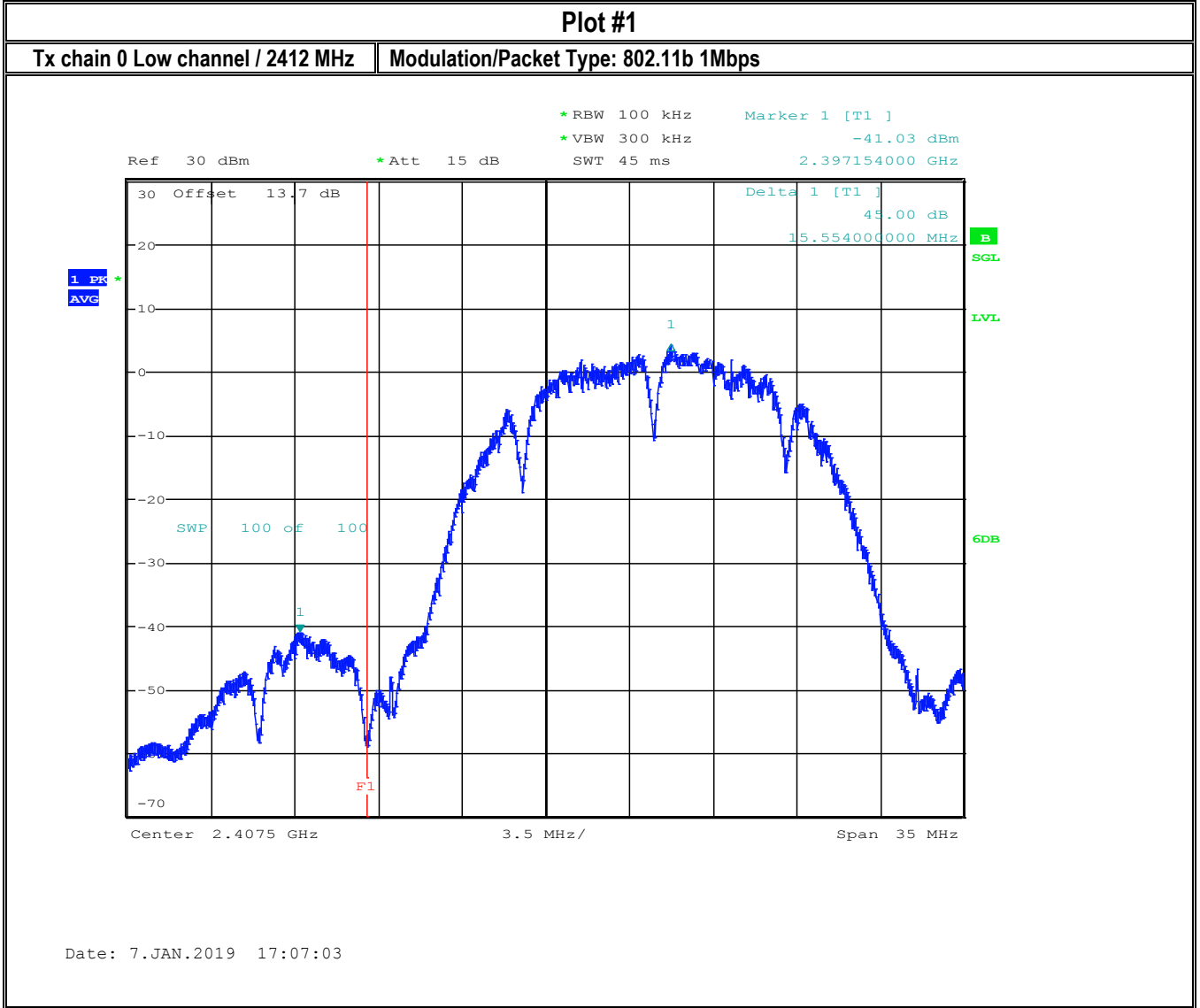
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

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

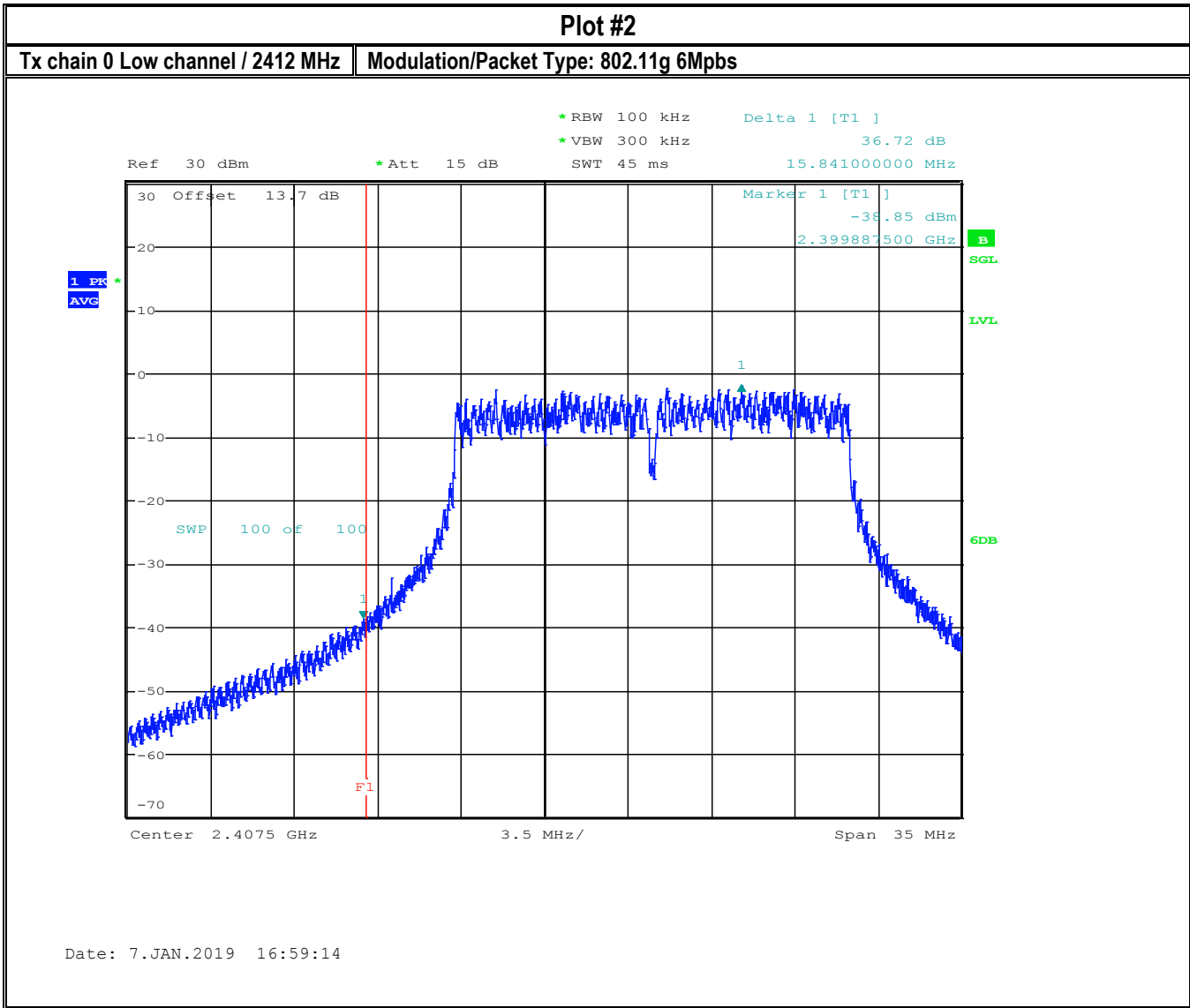
21	1	802.11b	Upper Restricted Peak	2483.5	-41.72	N/A	-38.72	-21.23 Peak	Pass
21	1	802.11b	Upper Restricted Average	2483.5	-49.85	0.03	-46.82	-41.23 AVG	Pass
22	1	802.11g	Upper Restricted Peak	2484	-28.66	N/A	-25.66	-21.23 Peak	Pass
22	1	802.11g	Upper Restricted Average	2483.5	-50.07	0.17	-46.90	-41.23 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

8.4.6 Measurement Plots:



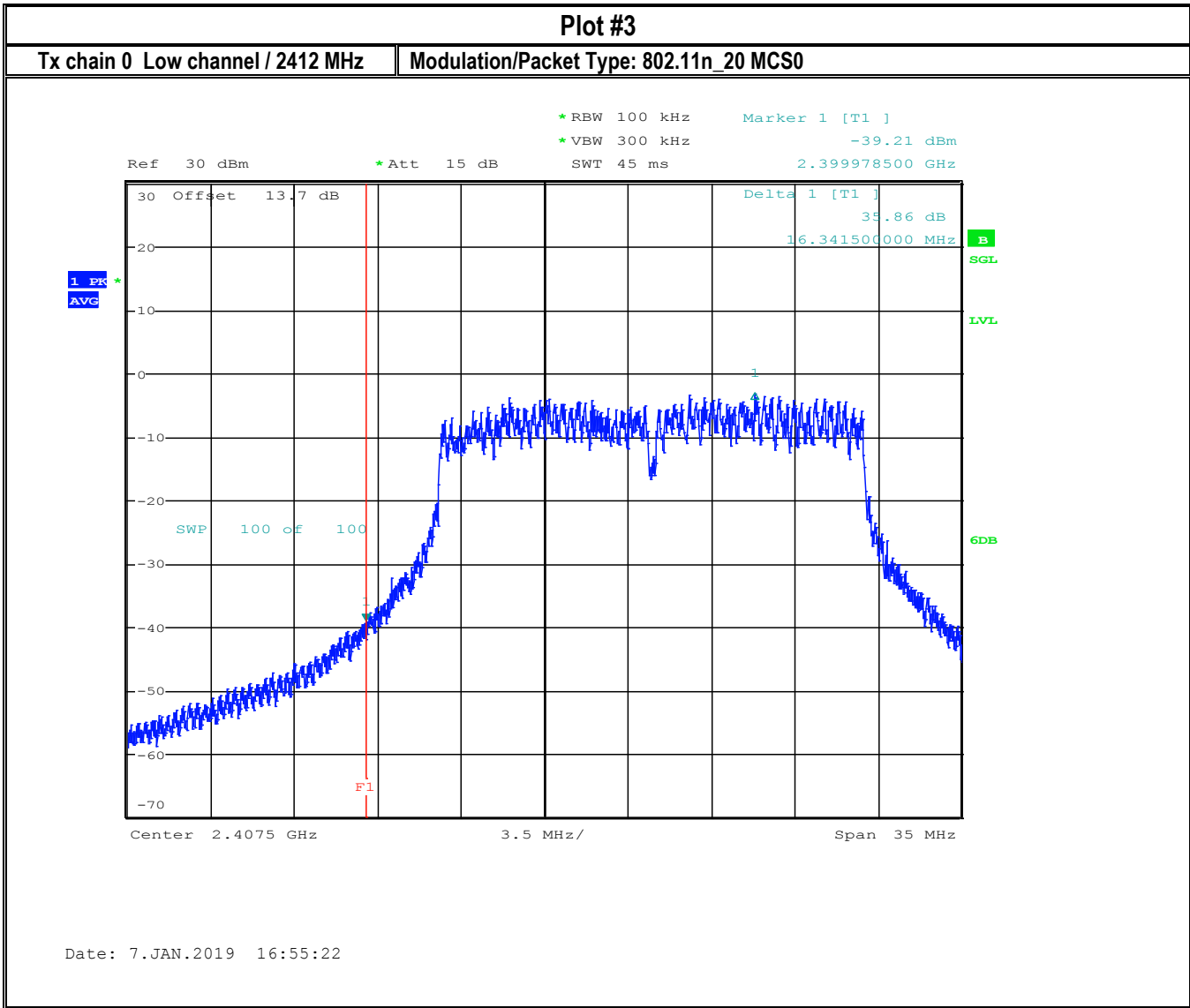
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

FCC ID: UUU-5411



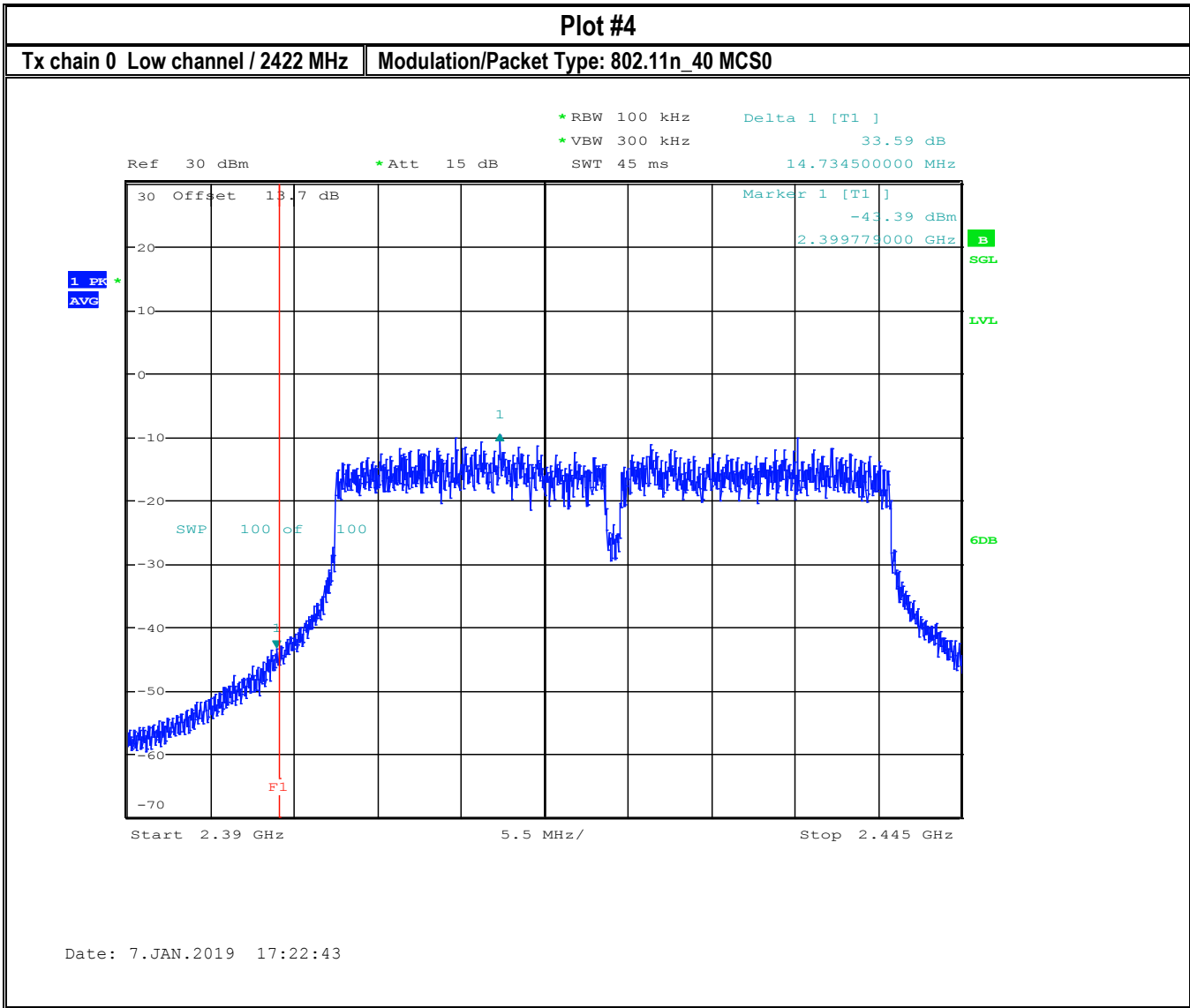
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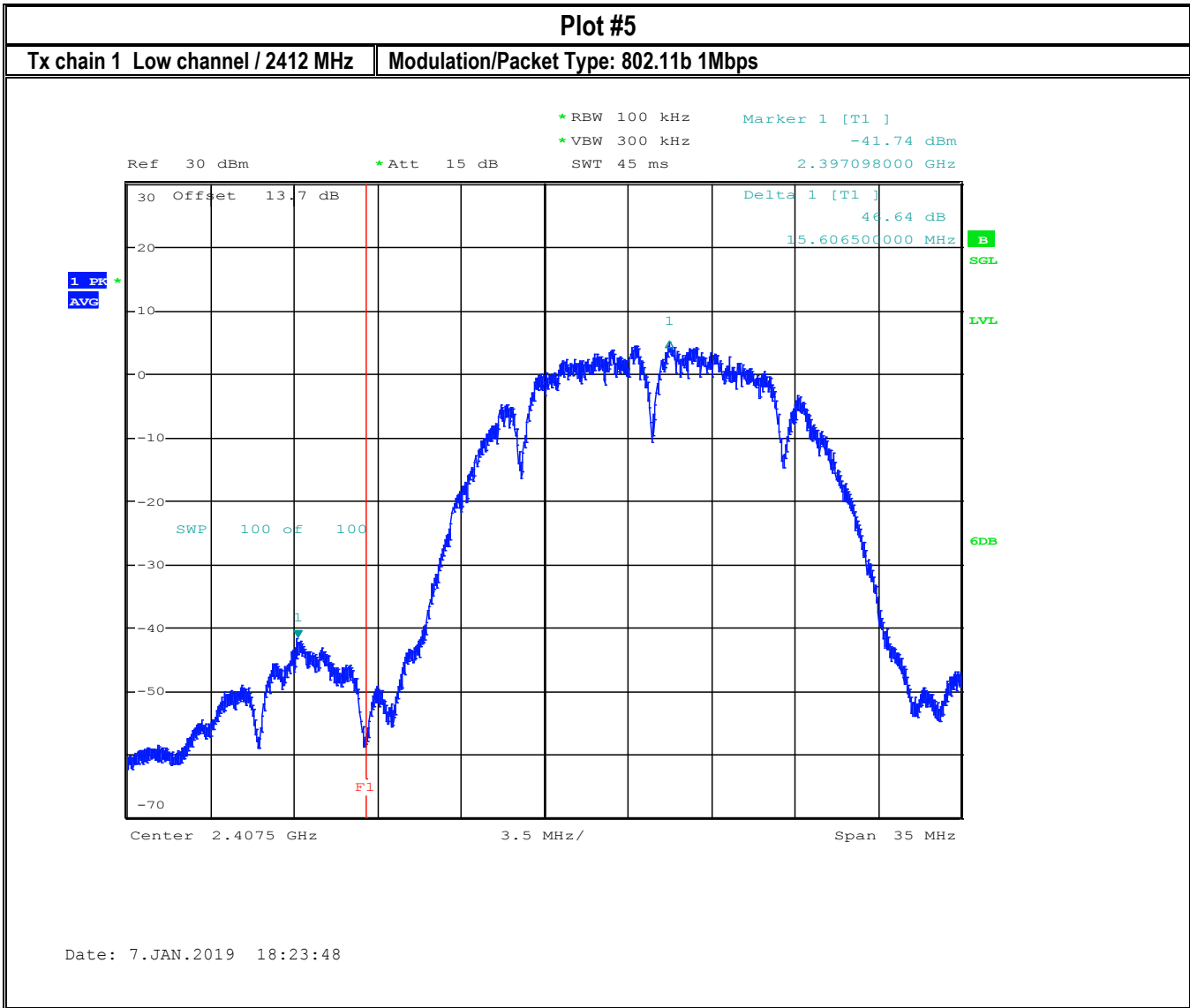
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 Date of Report: 2019-05-23

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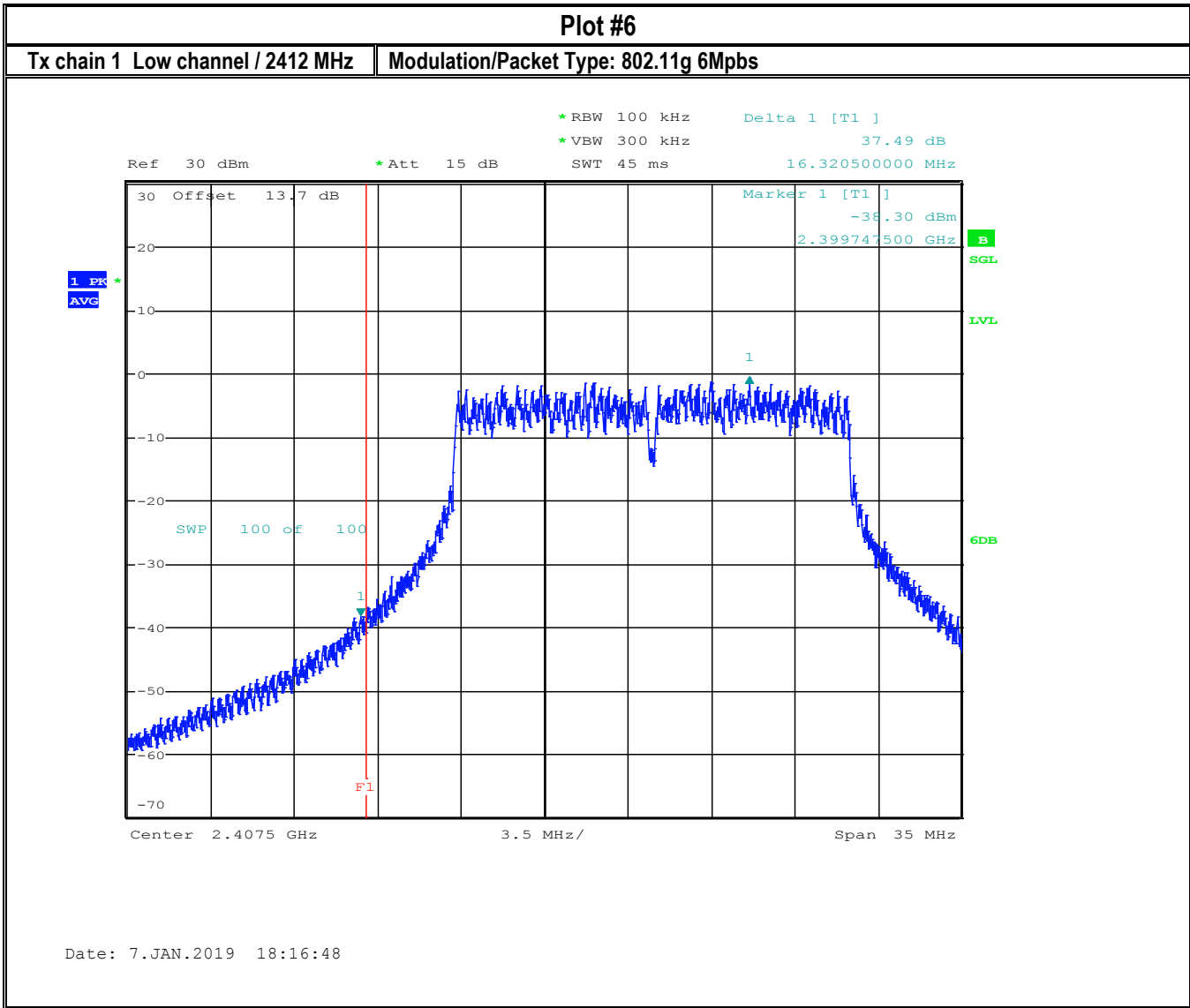
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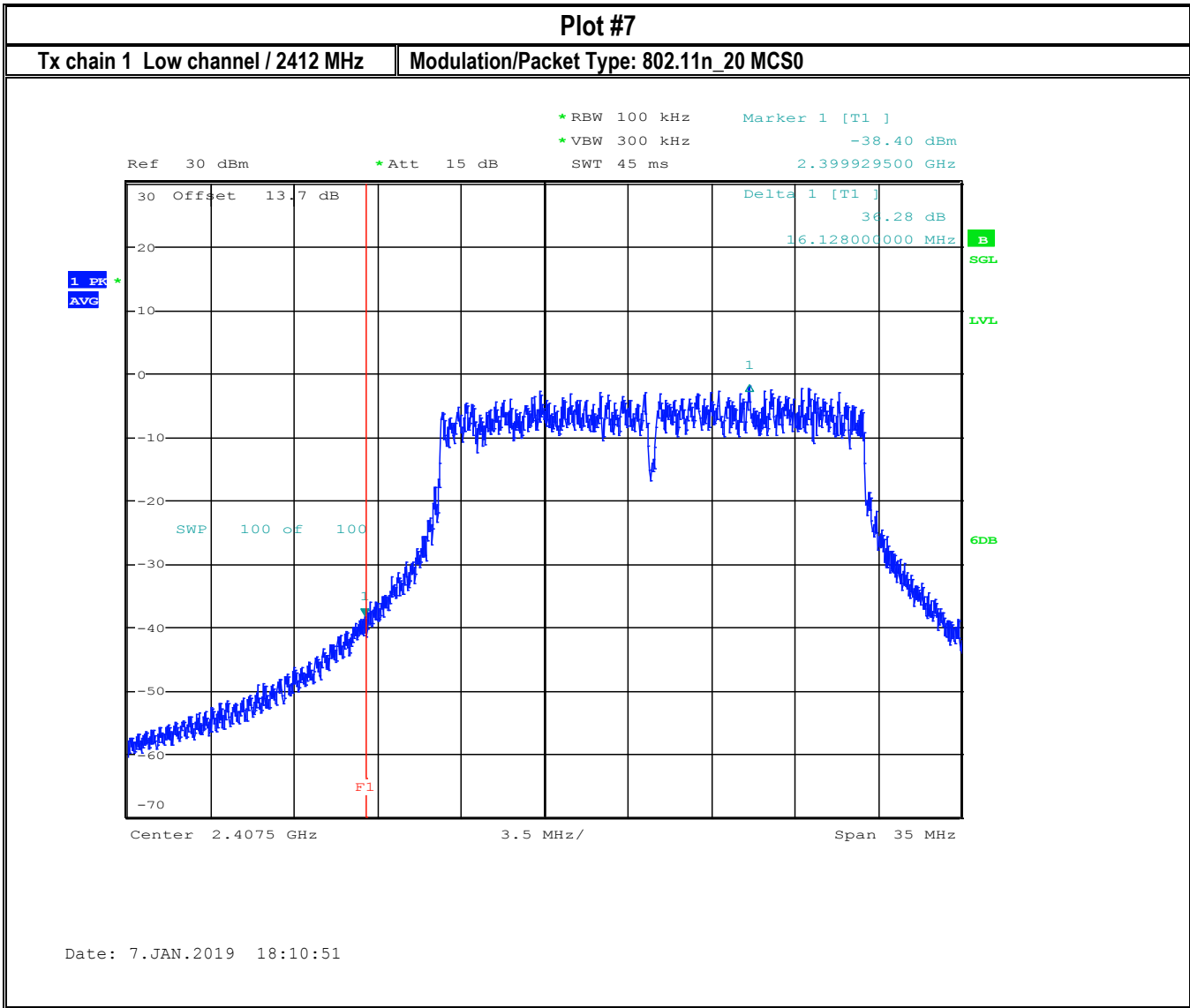
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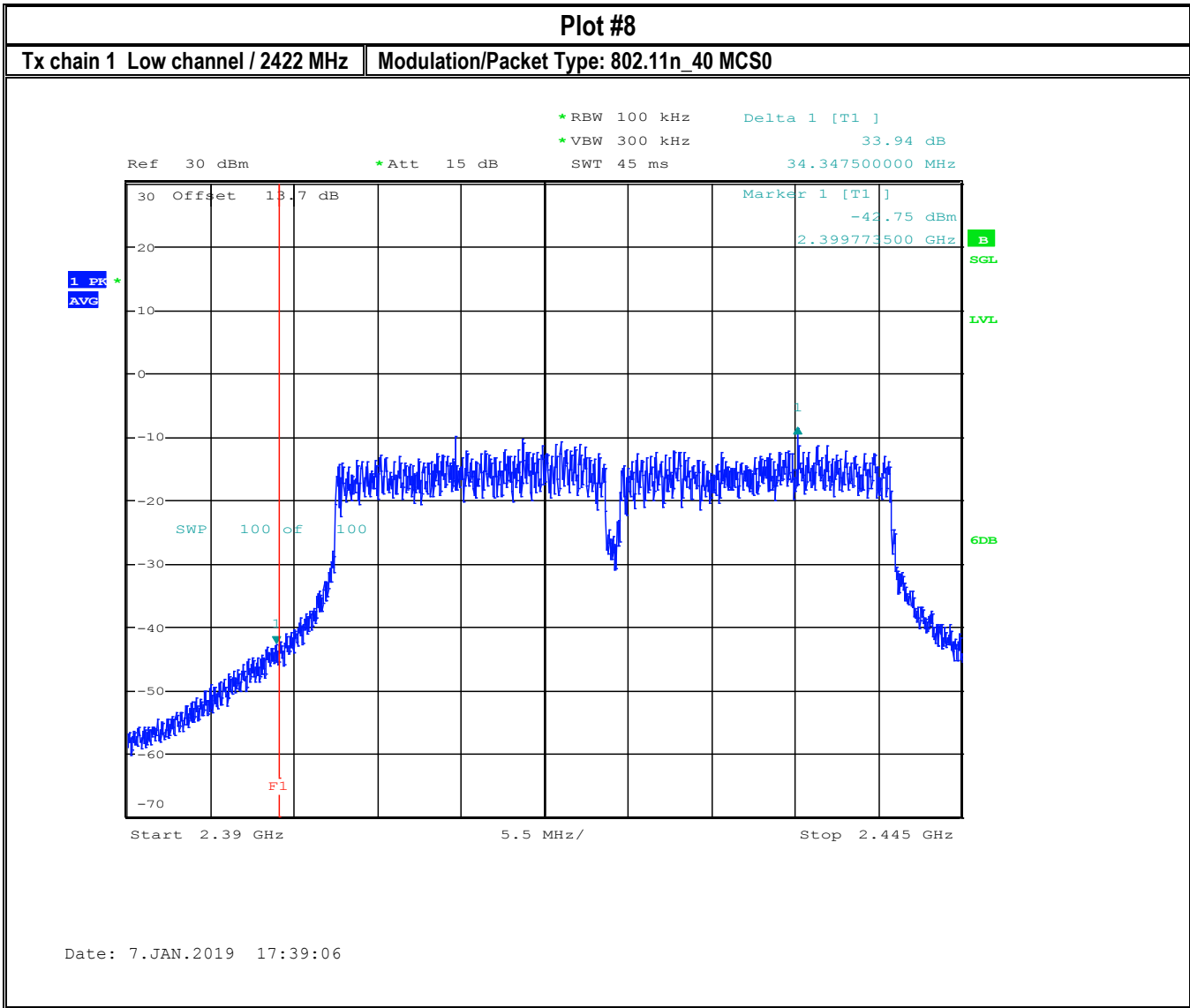
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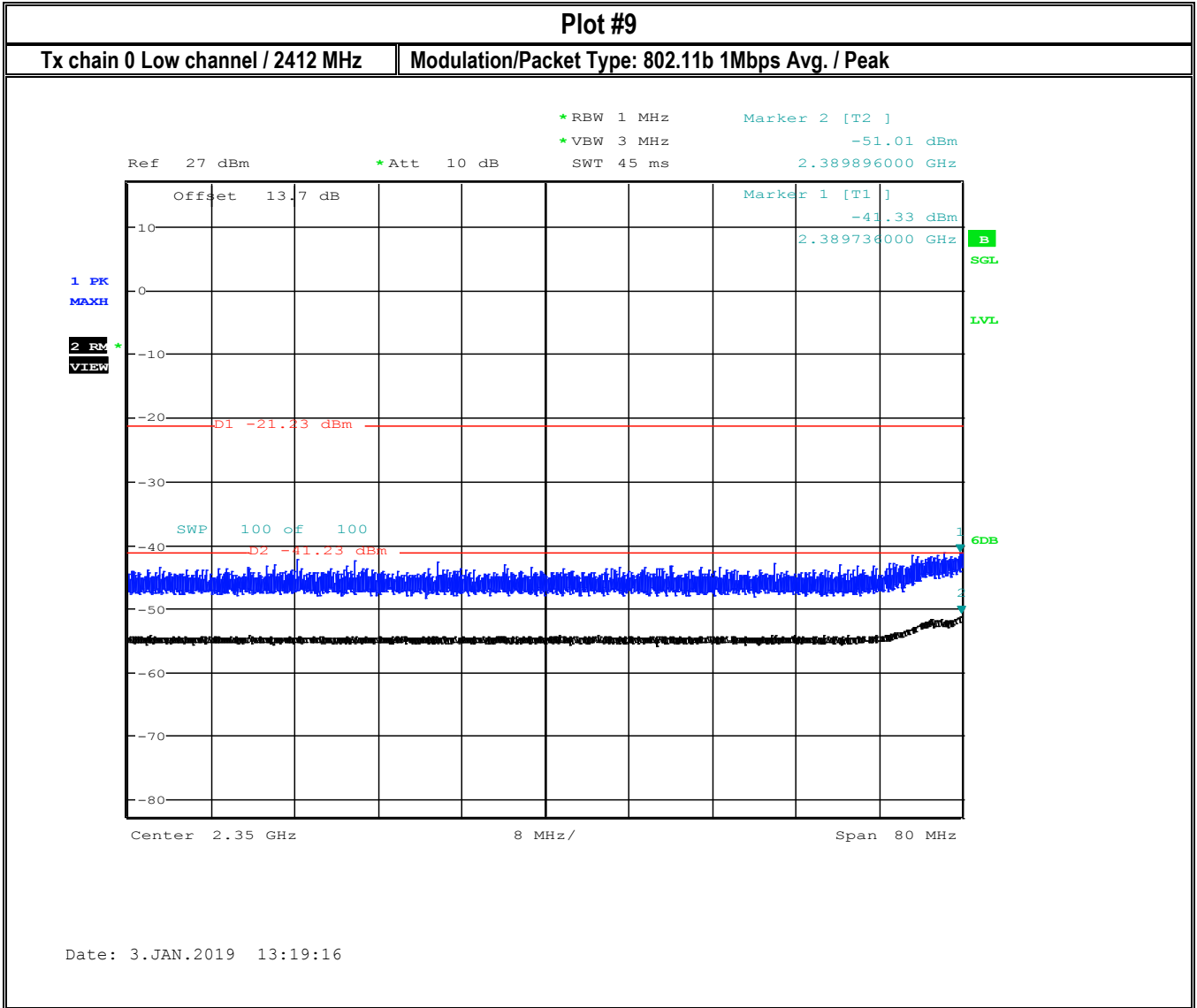


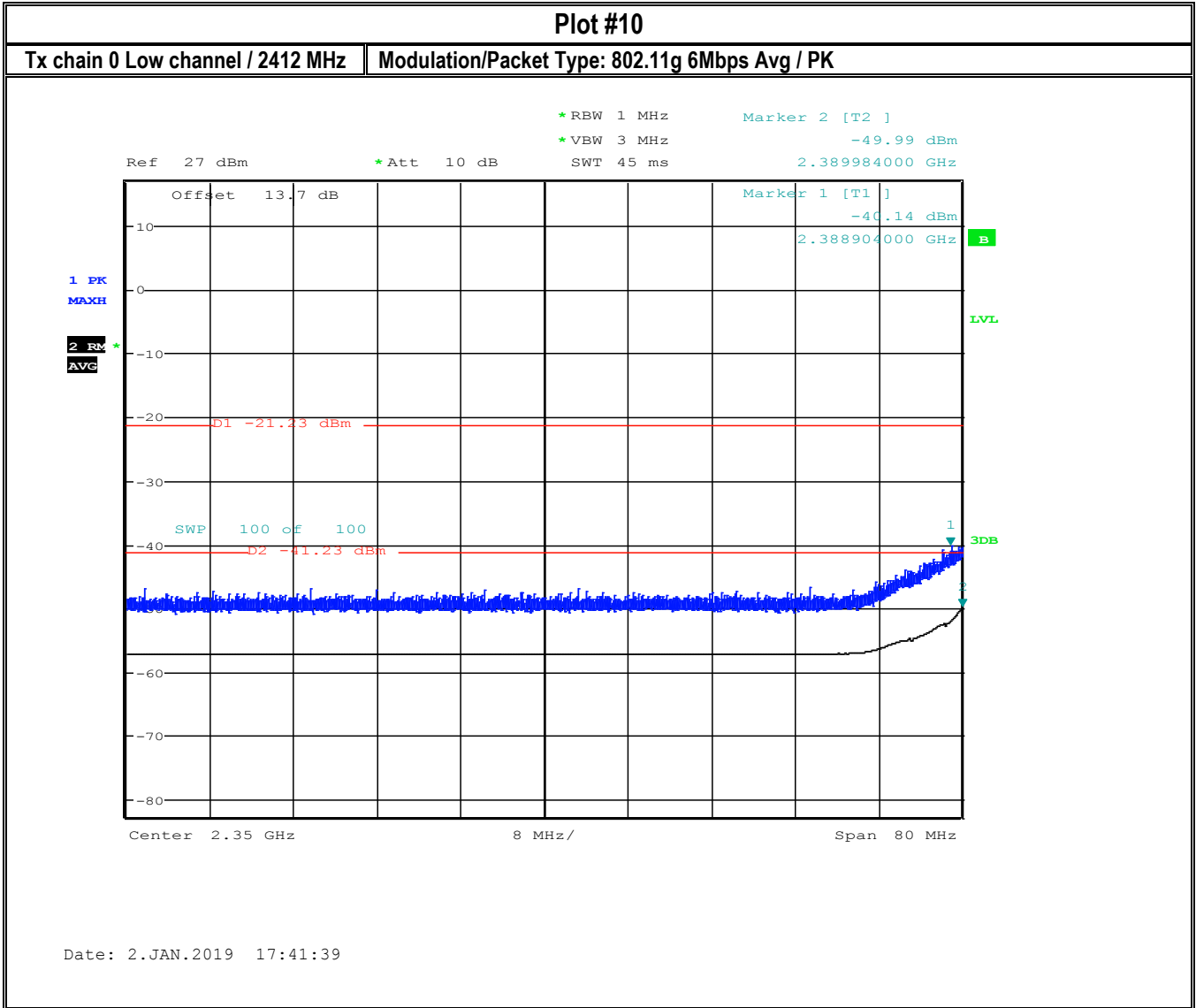


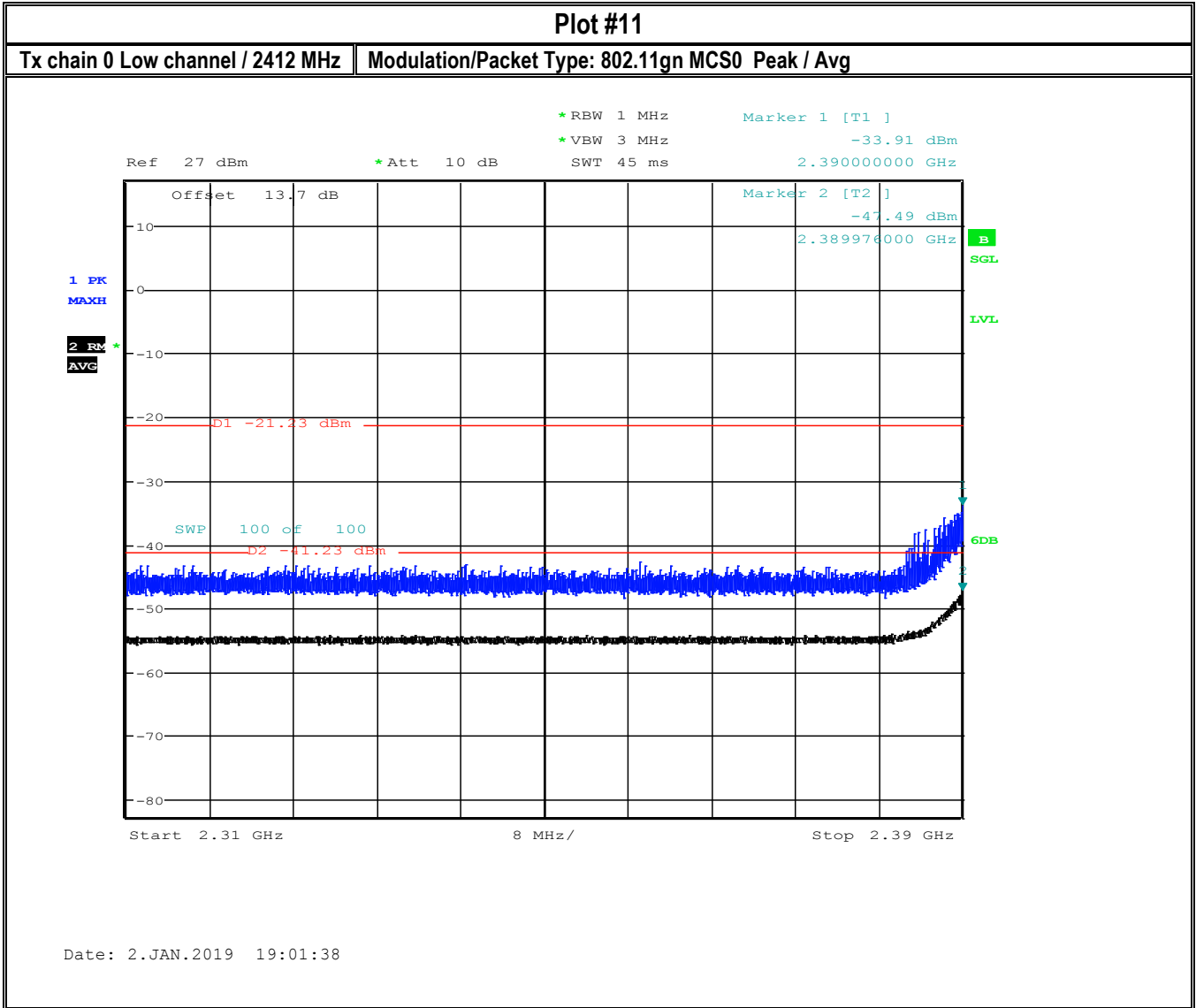
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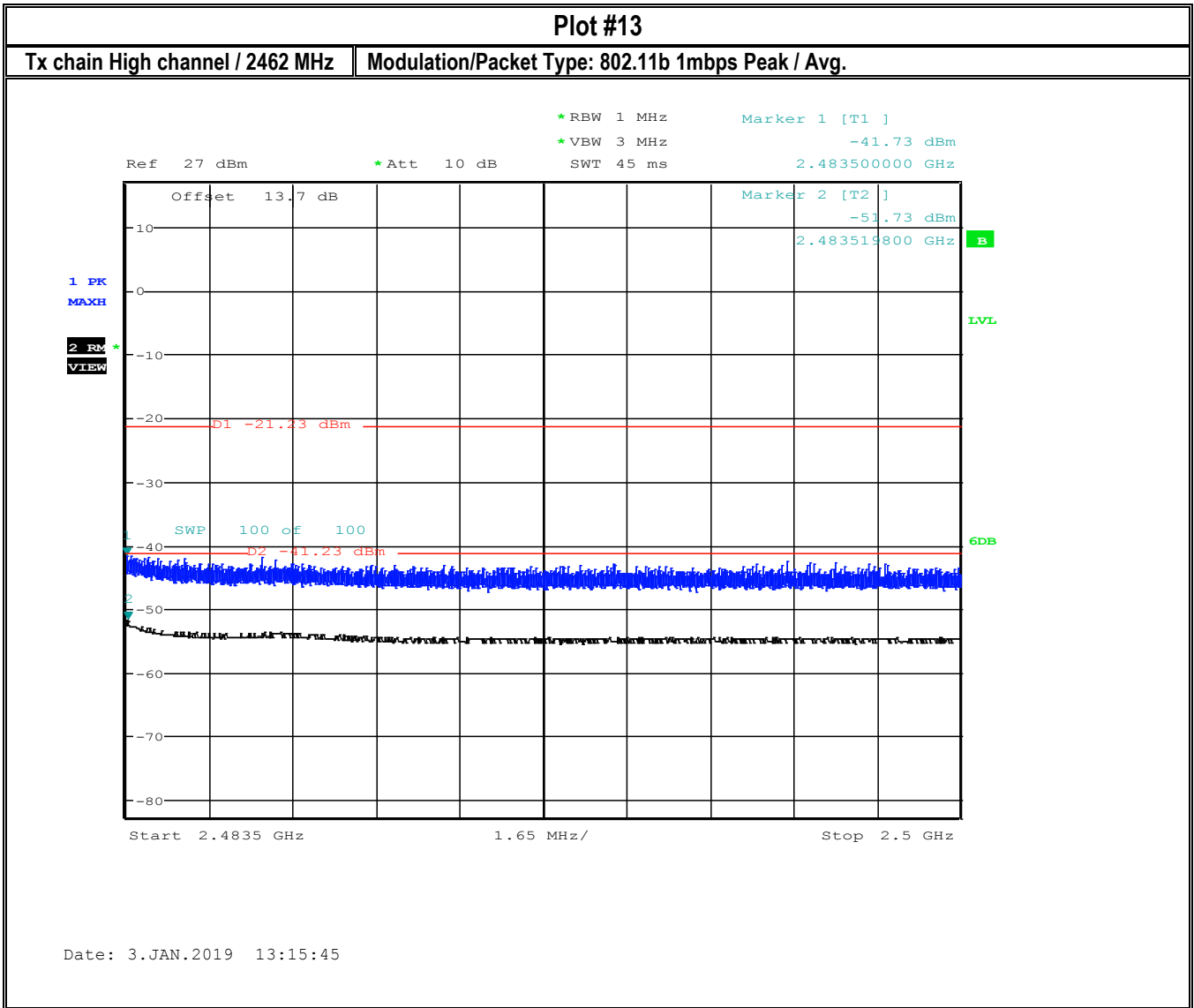
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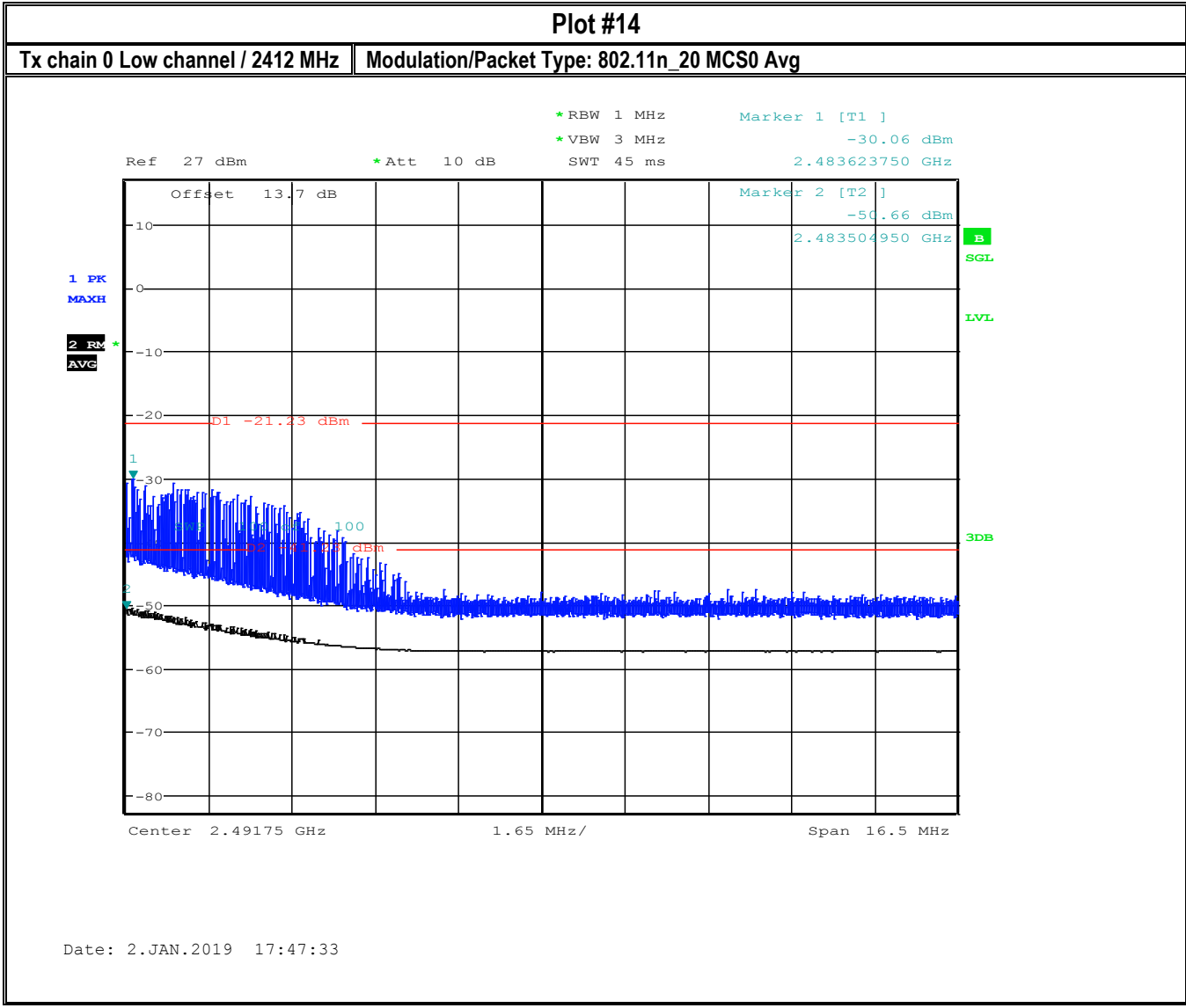


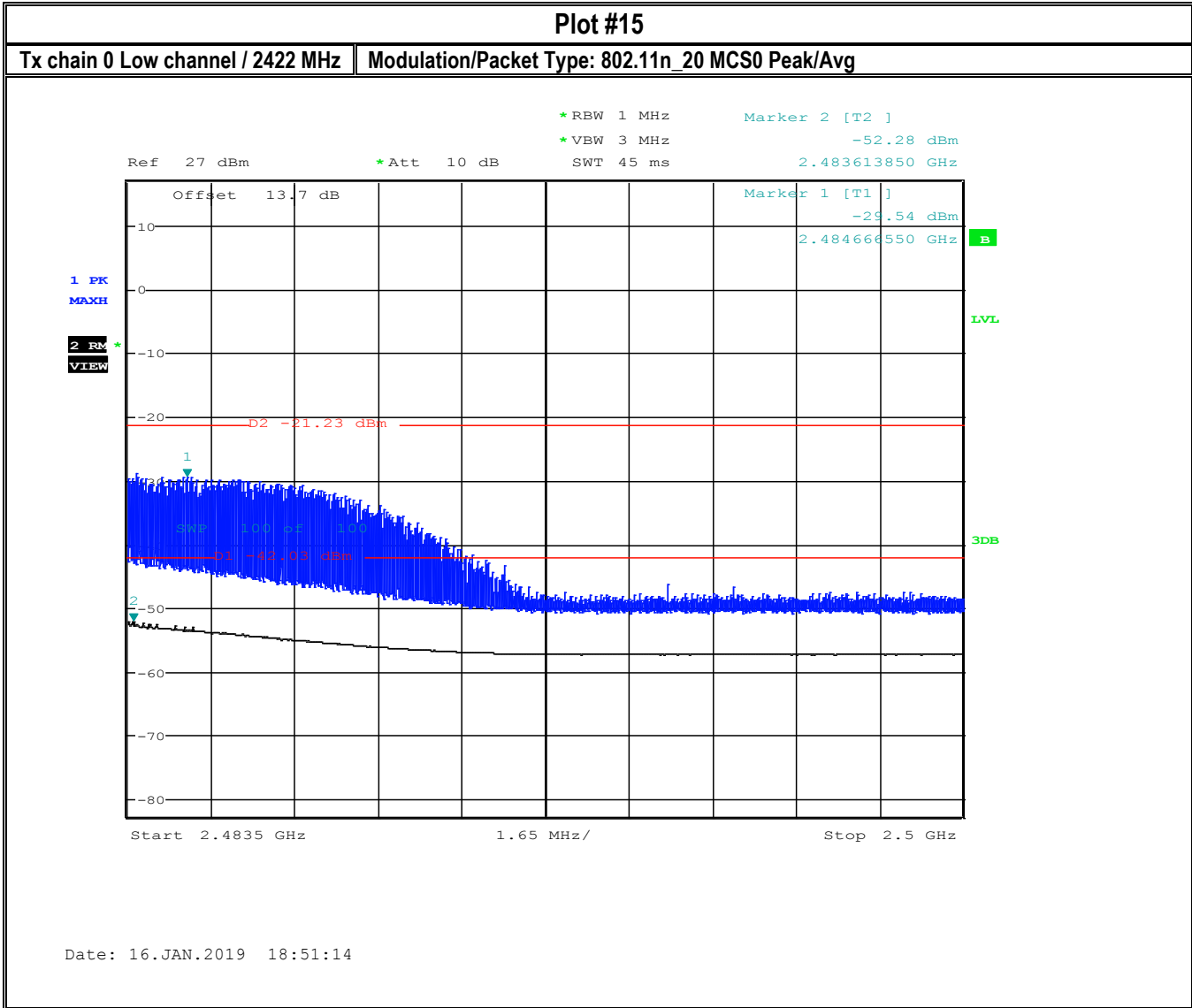


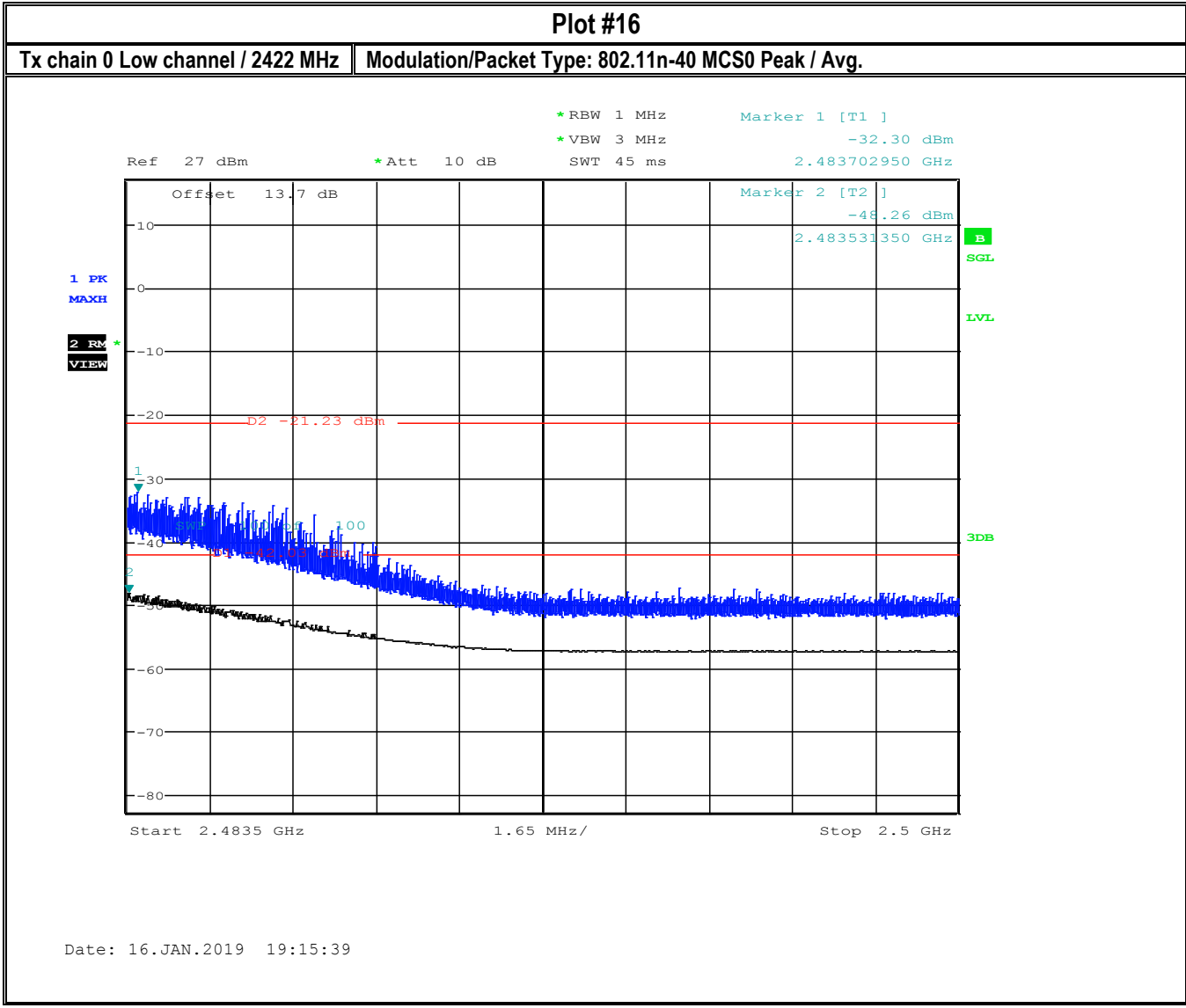


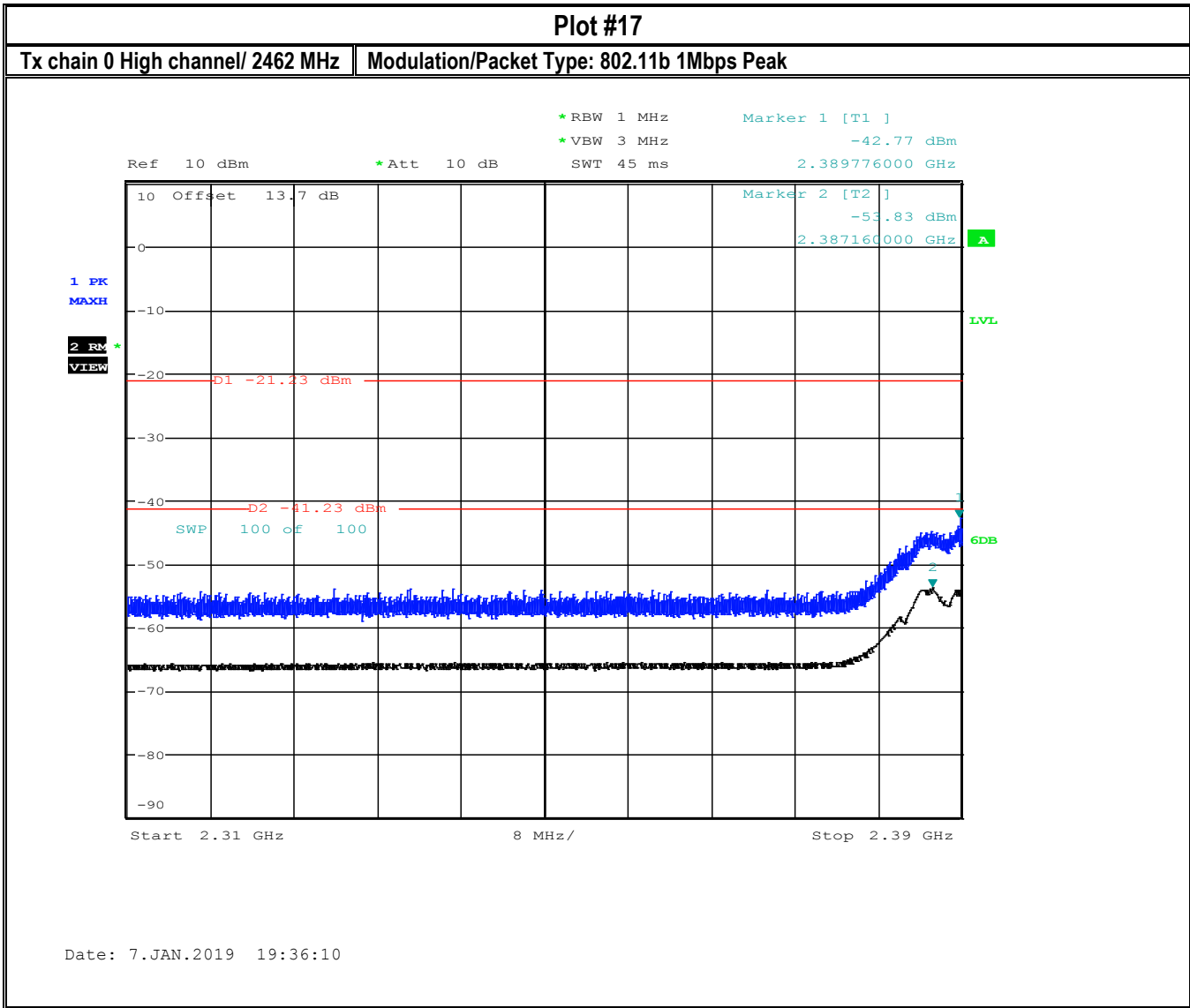






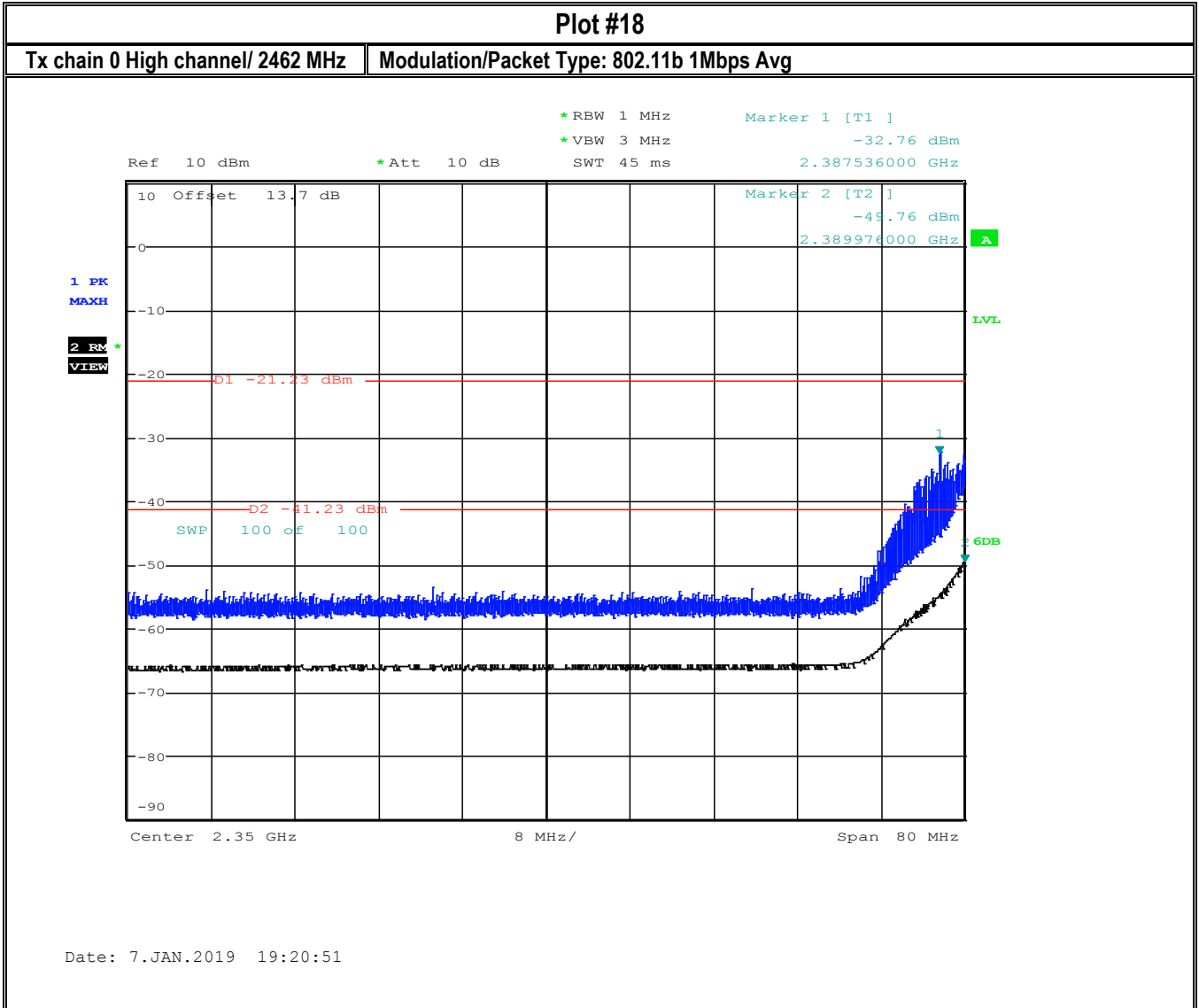


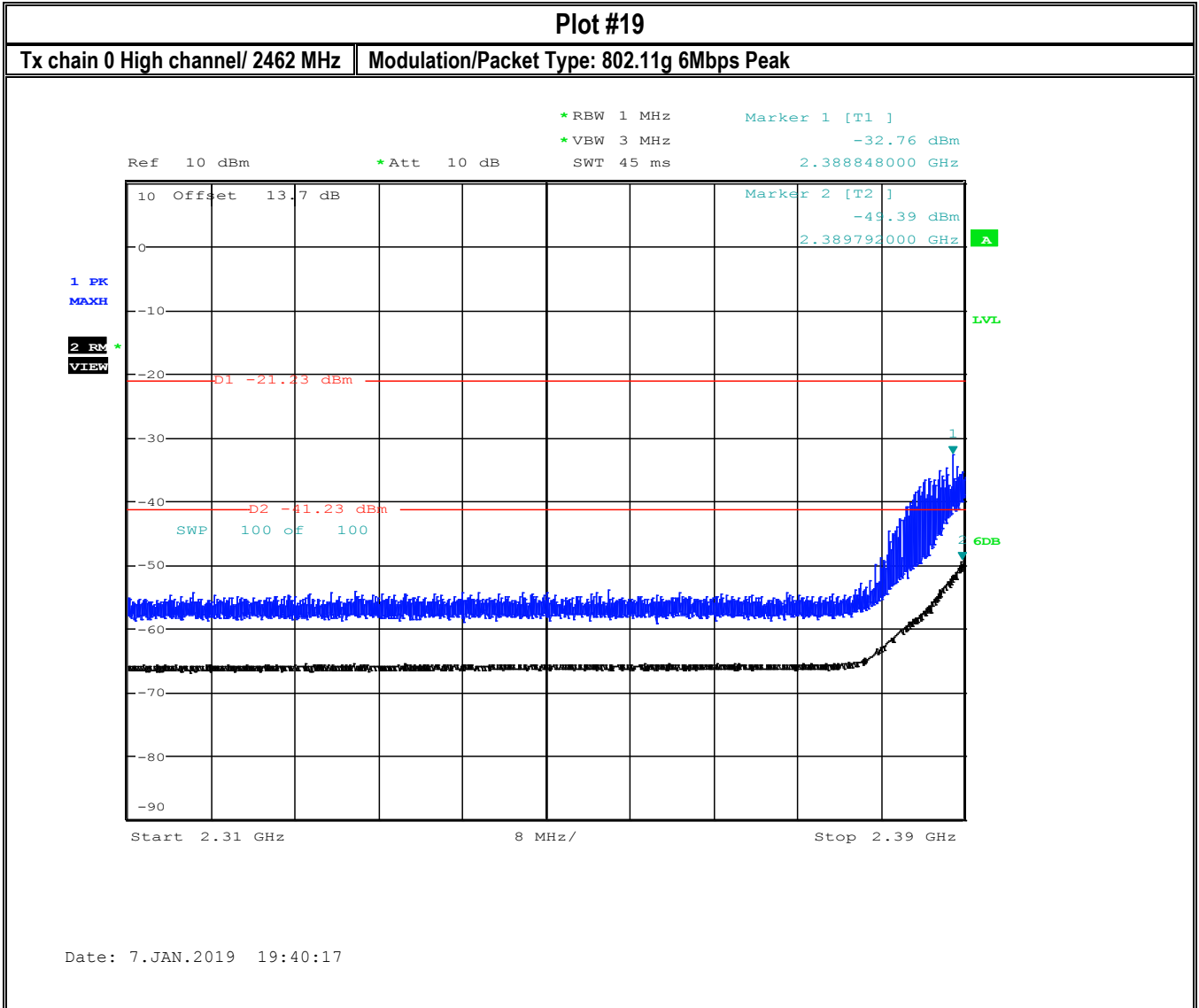


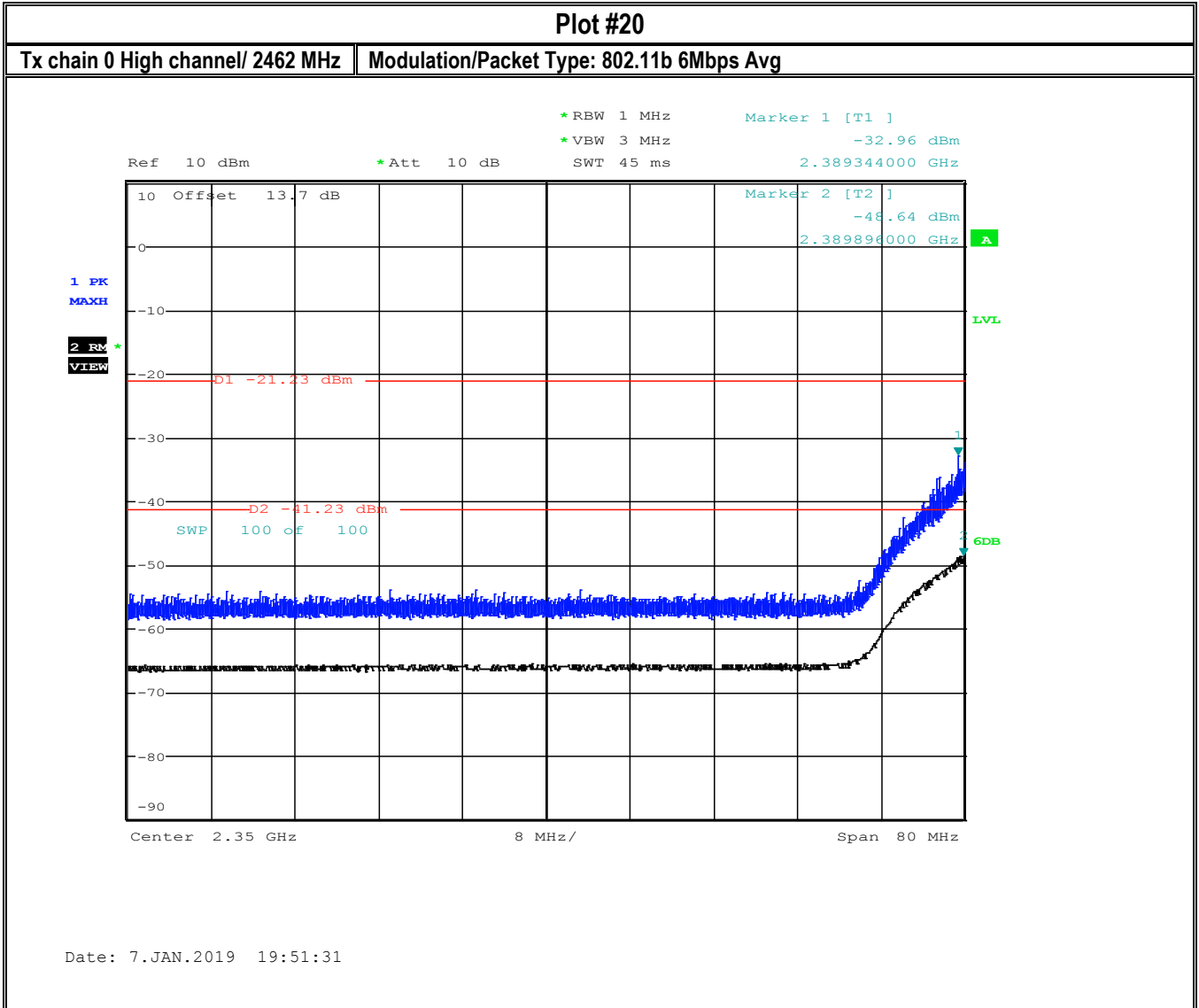


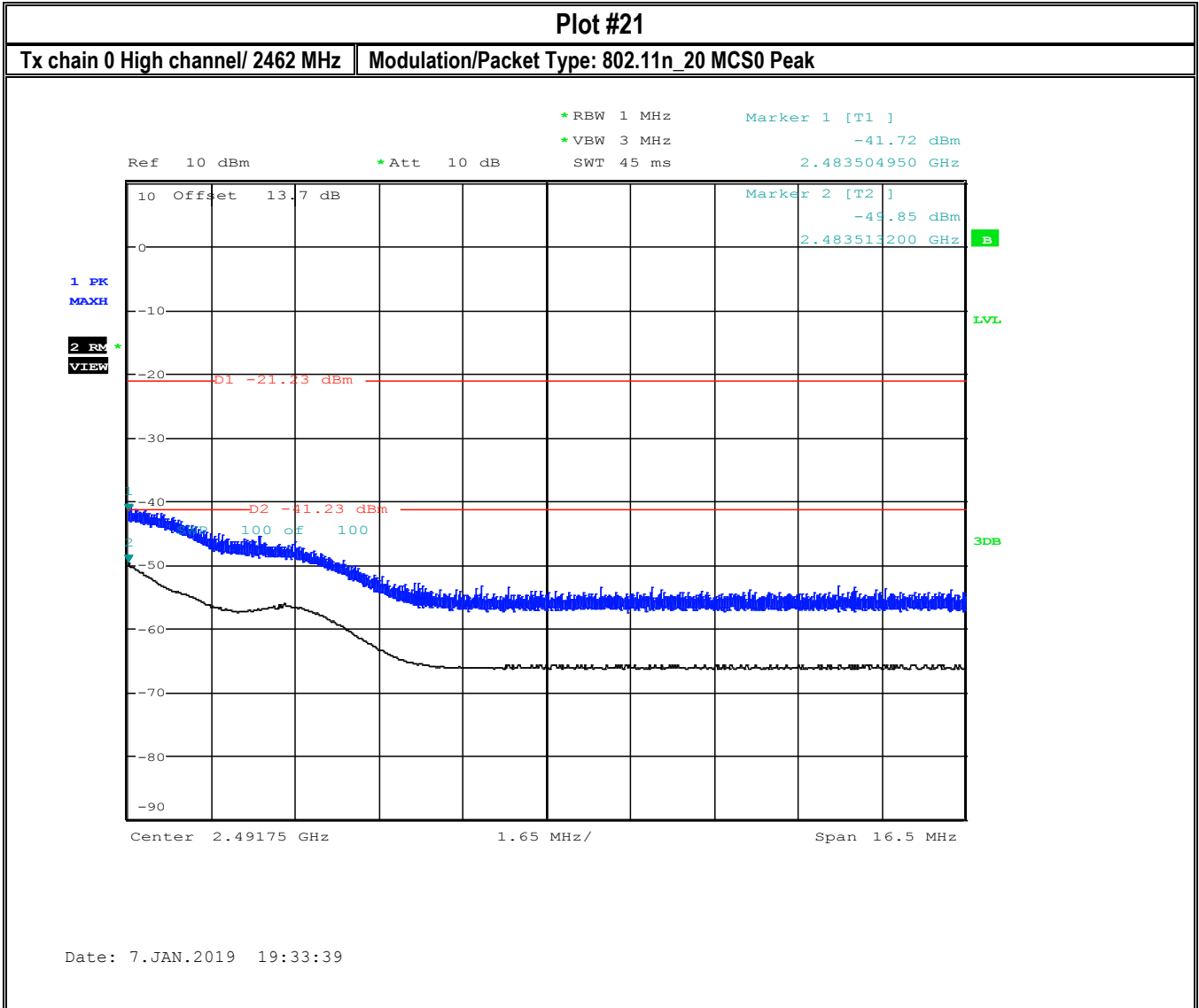
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report 2019-05-23

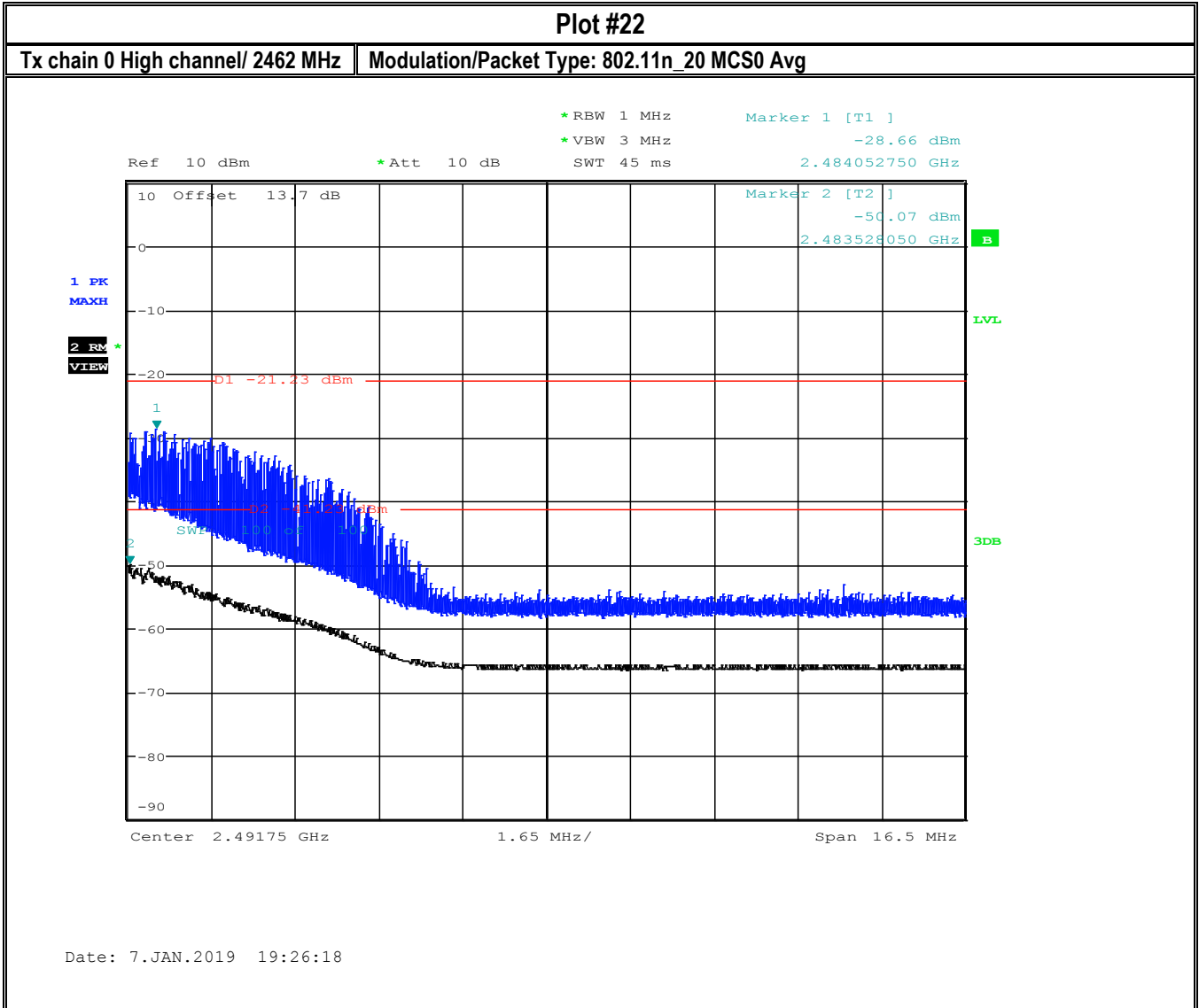
FCC ID: UUU-5411

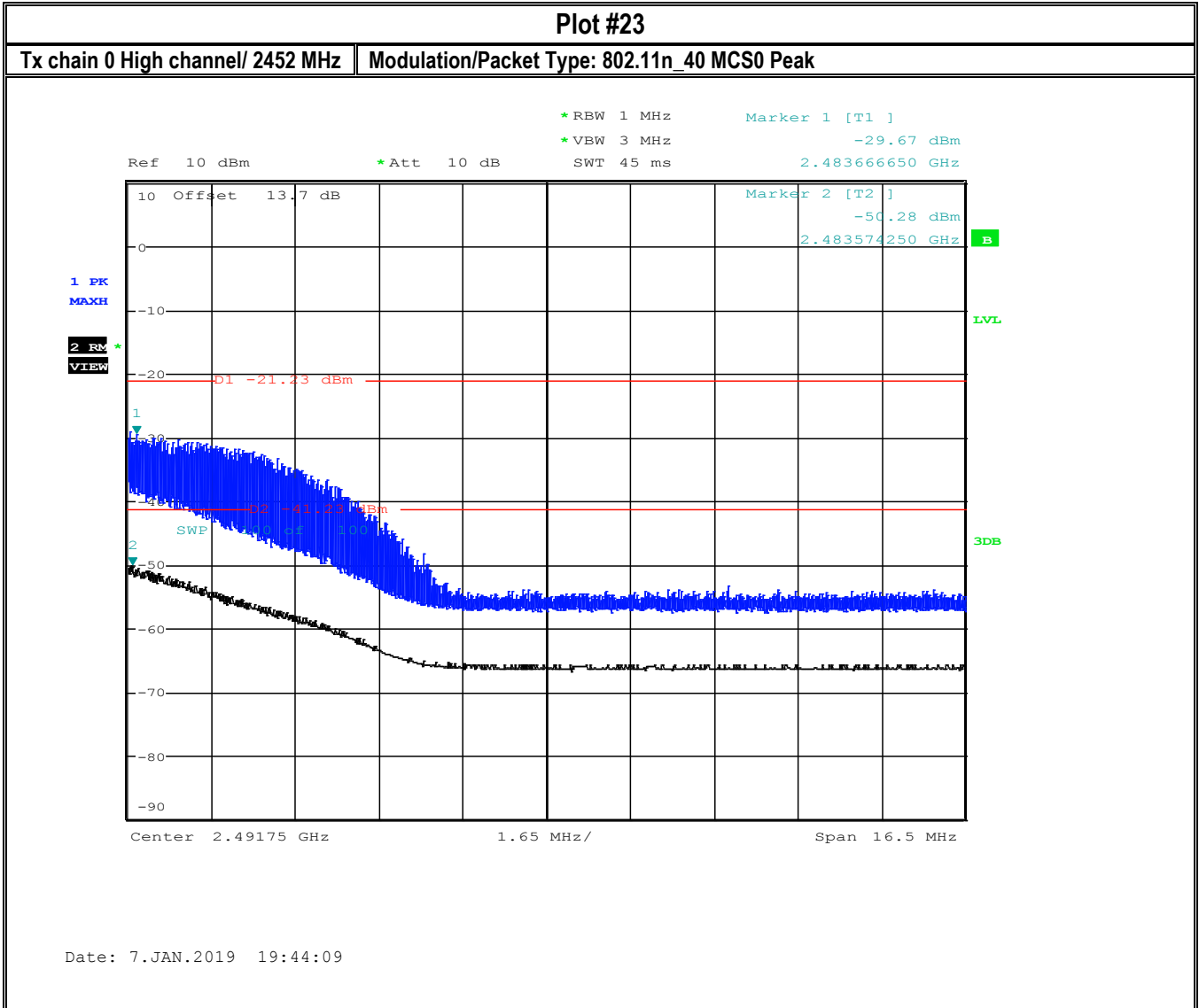


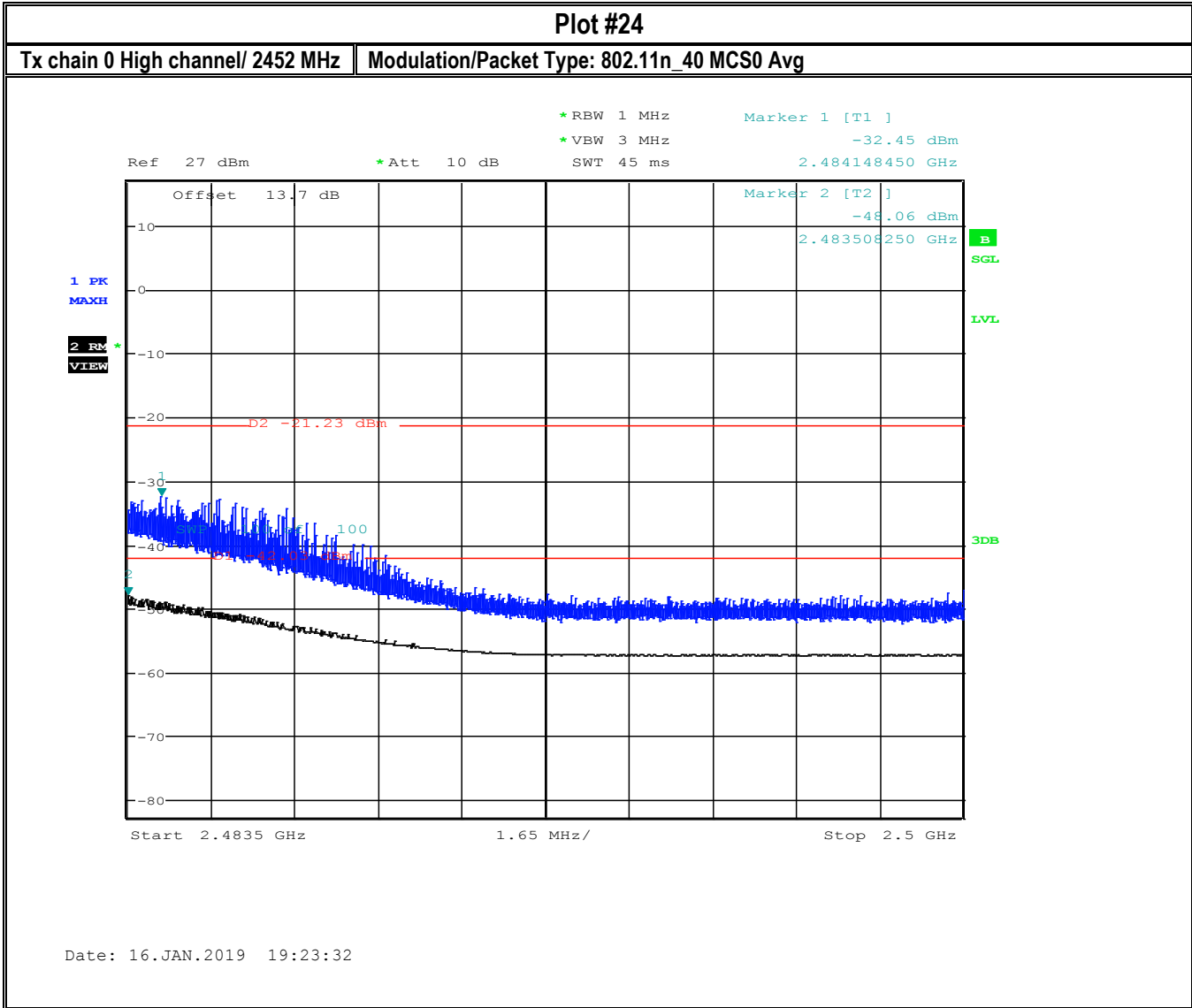












8.5 Emission Bandwidth 6 dB and 99% Occupied Bandwidth

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:

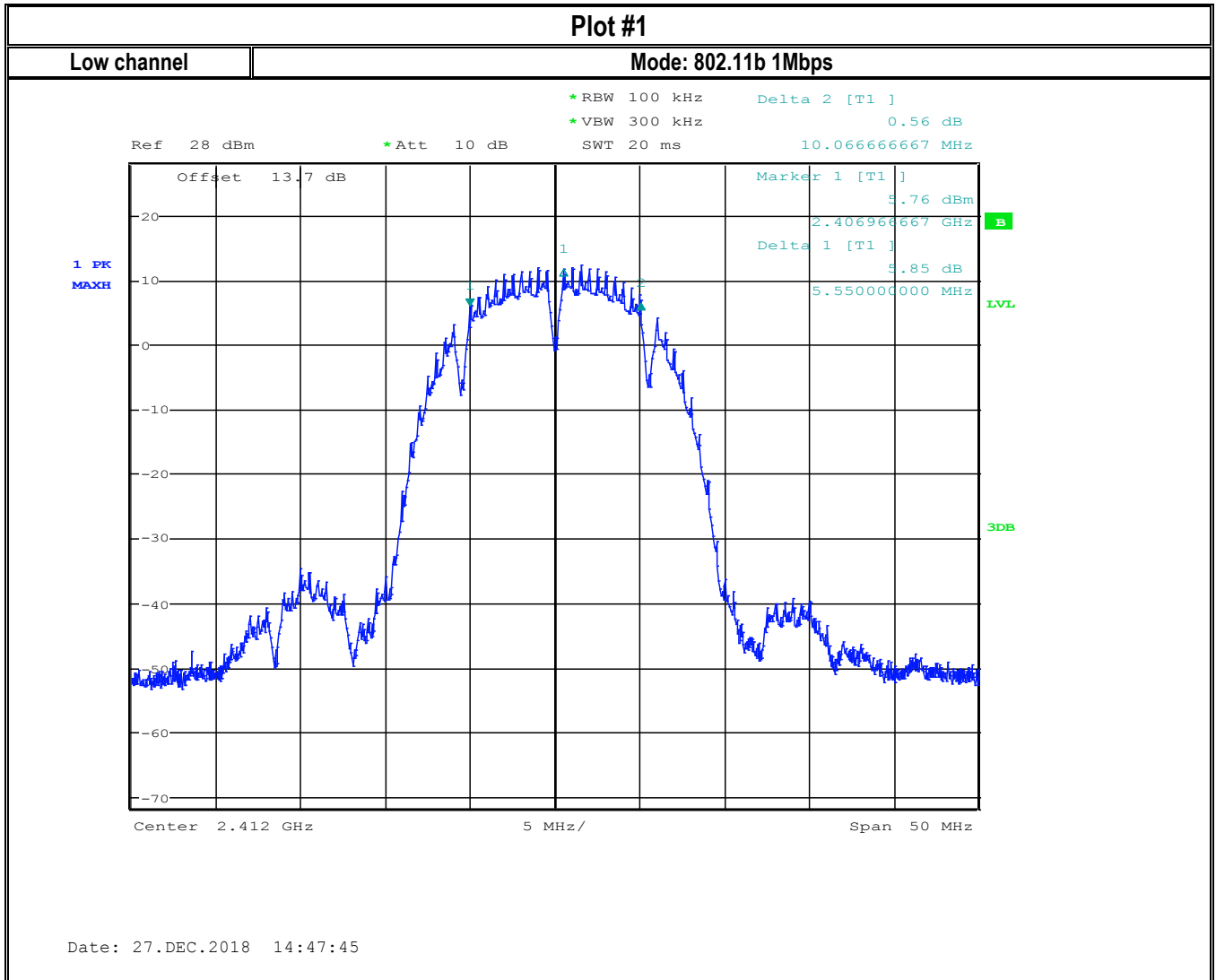
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
22° C	1	802.11 b/g/n	AC/DC Adapter

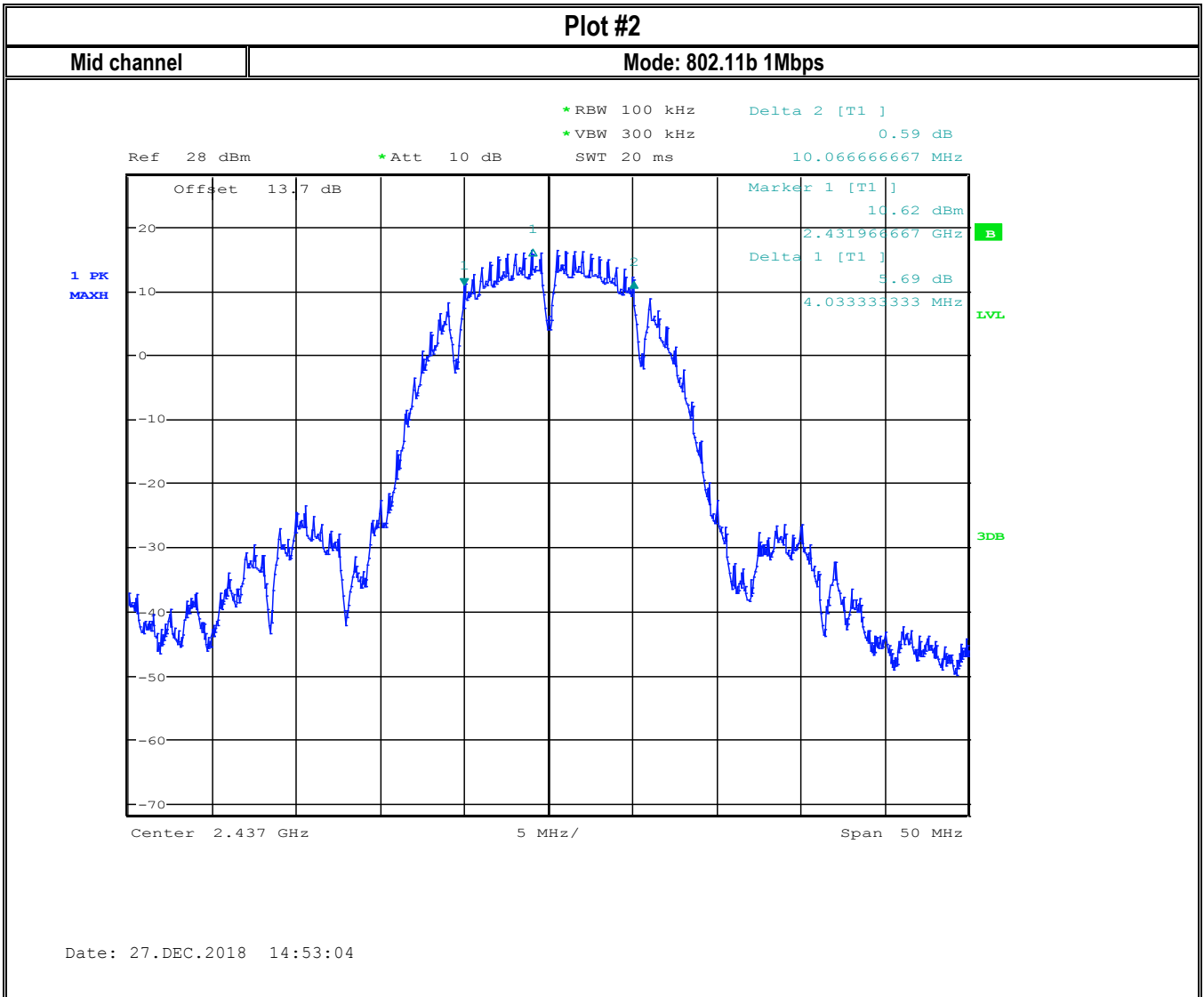
8.5.4 Measurement result:

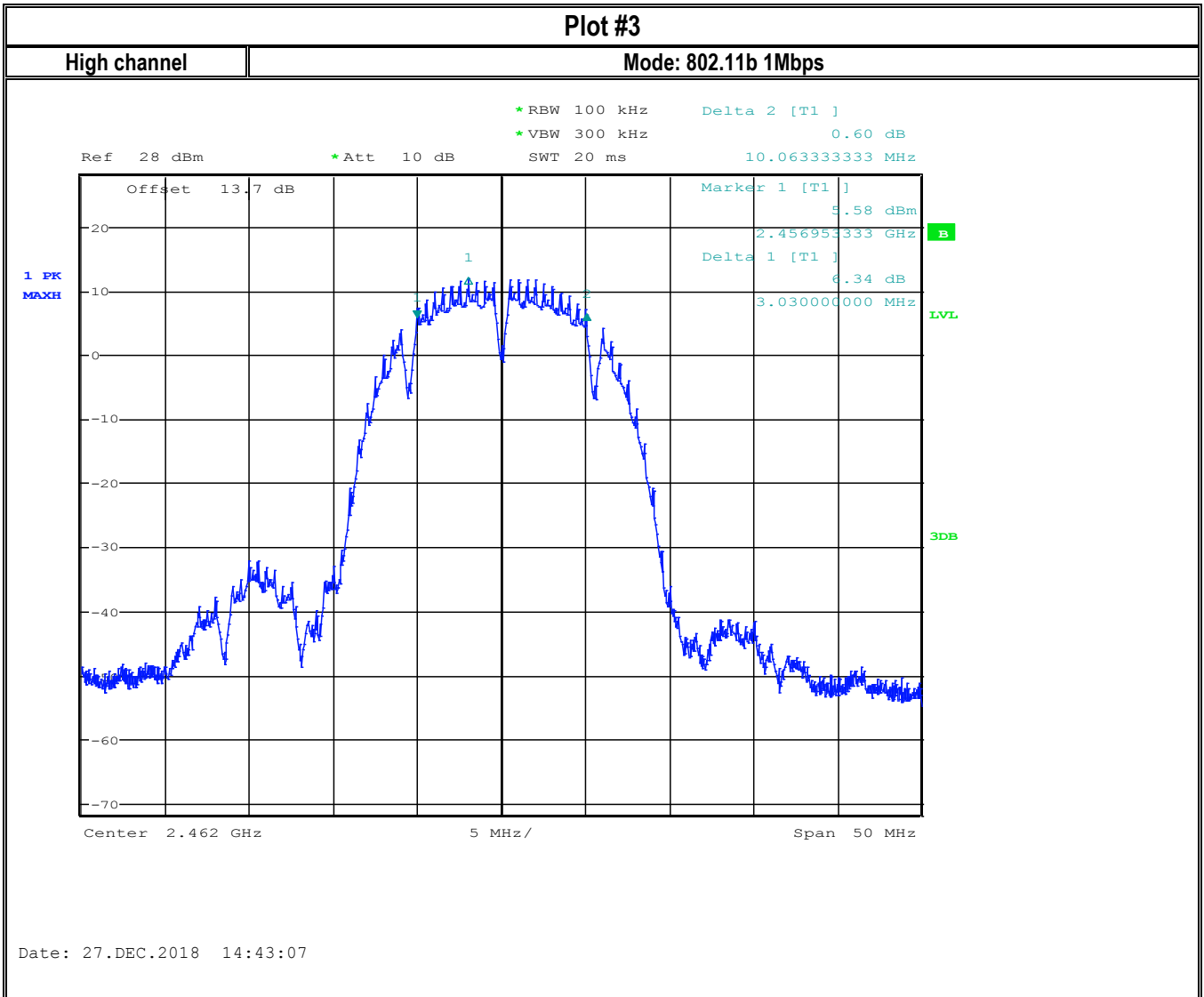
Plot #	Mode	Channel	6 dB Emissions Bandwidth (MHz)	Limit (MHz)	Result
1	802.11b	1	10.06	> 0.5	Pass
2	802.11b	6	10.06	> 0.5	Pass
3	802.11b	11	10.06	> 0.5	Pass
4	802.11g	1	16.28	> 0.5	Pass
5	802.11g	6	16.17	> 0.5	Pass
6	802.11g	11	17.31	> 0.5	Pass
7	802.11n_20	1	16.43	> 0.5	Pass
8	802.11n_20	6	17.28	> 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

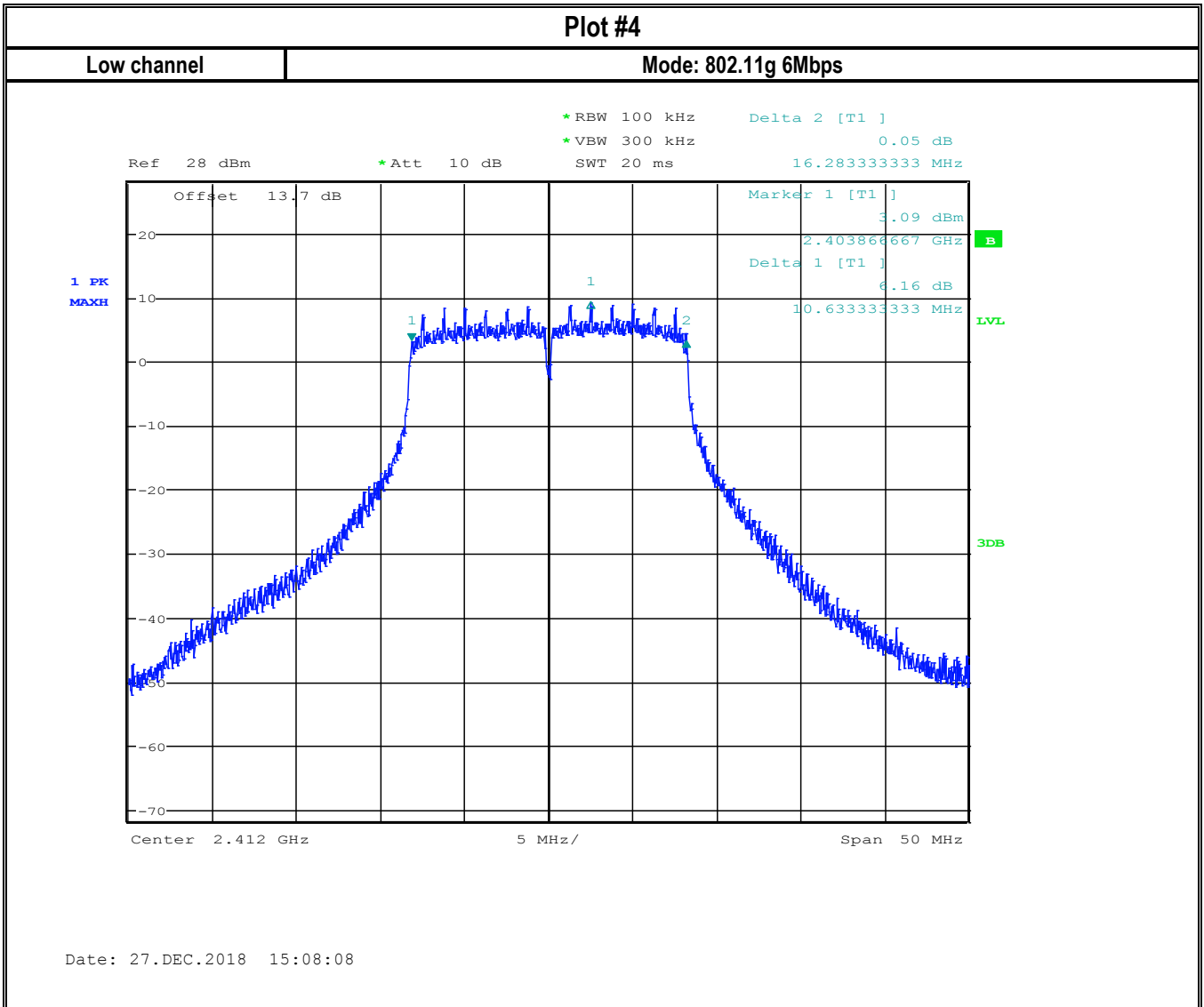
Plot #	Mode	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
13	802.11b	1	13.6	> 0.5	Pass
14	802.11b	6	13.93	> 0.5	Pass
15	802.11b	11	13.86	> 0.5	Pass
16	802.11g	1	16.62	> 0.5	Pass
17	802.11g	6	17.02	> 0.5	Pass
18	802.11g	11	16.8	> 0.5	Pass
19	802.11n_20	1	17.79	> 0.5	Pass
20	802.11n_20	6	18.05	> 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

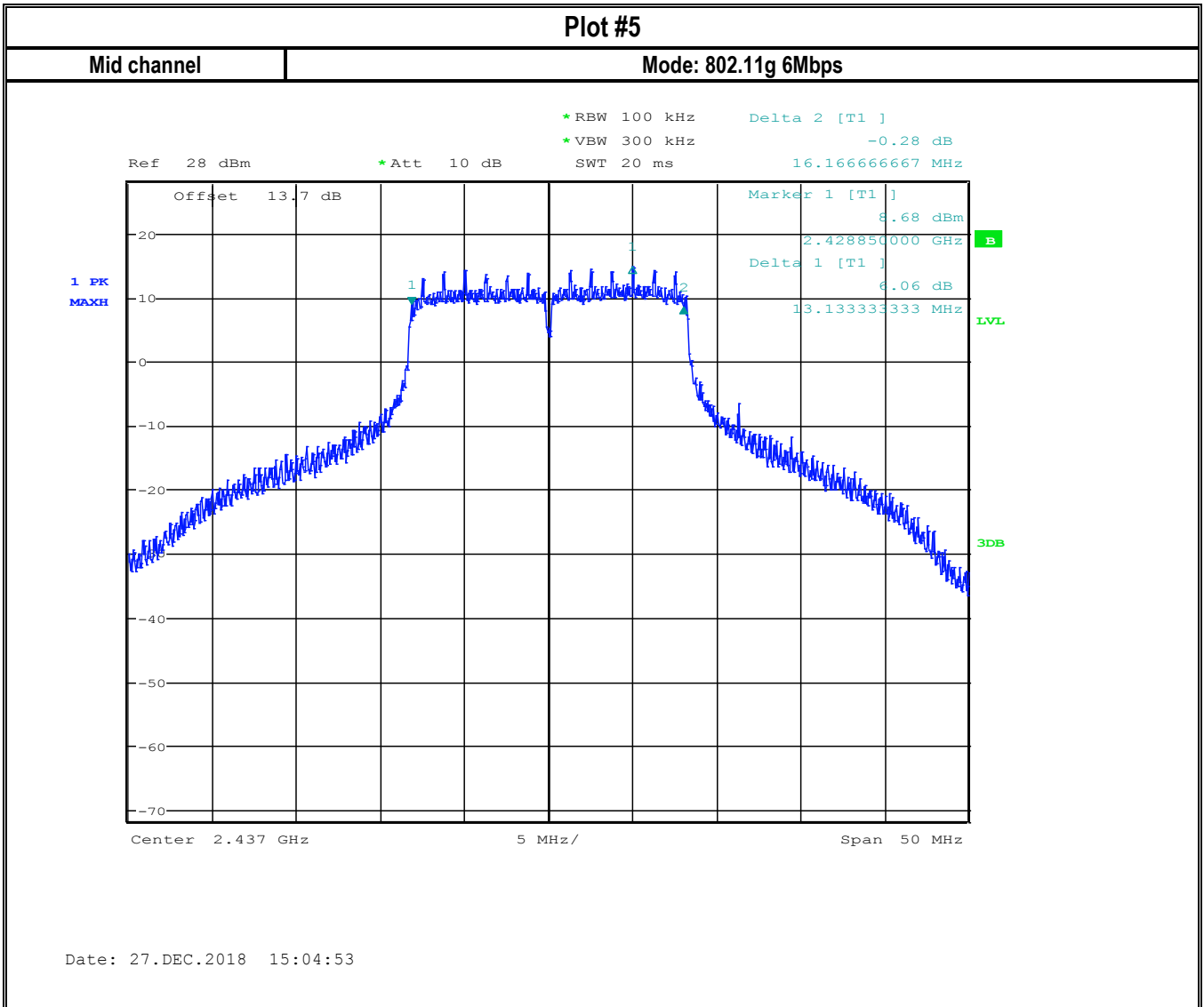
8.5.5 Measurement Plots:

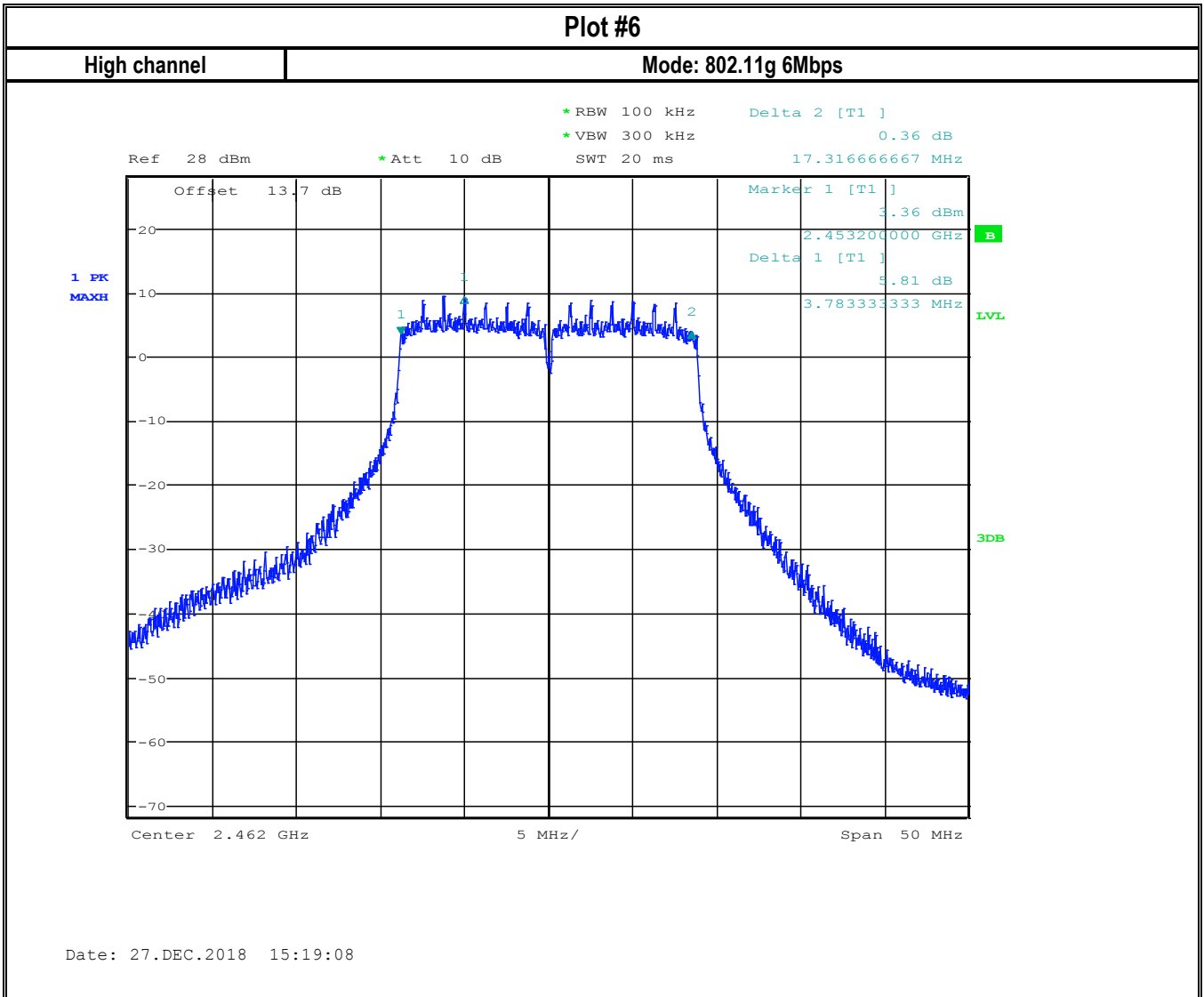


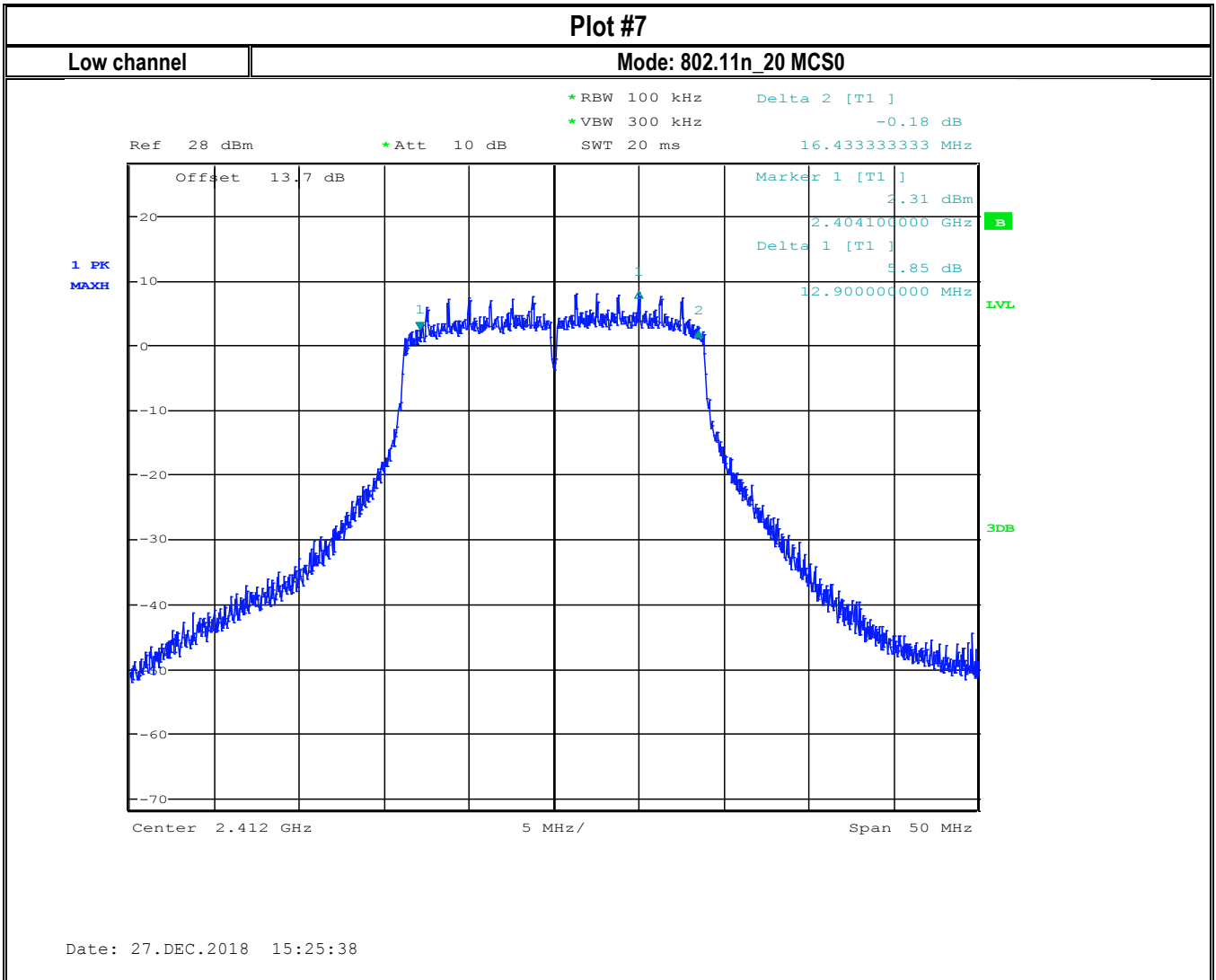


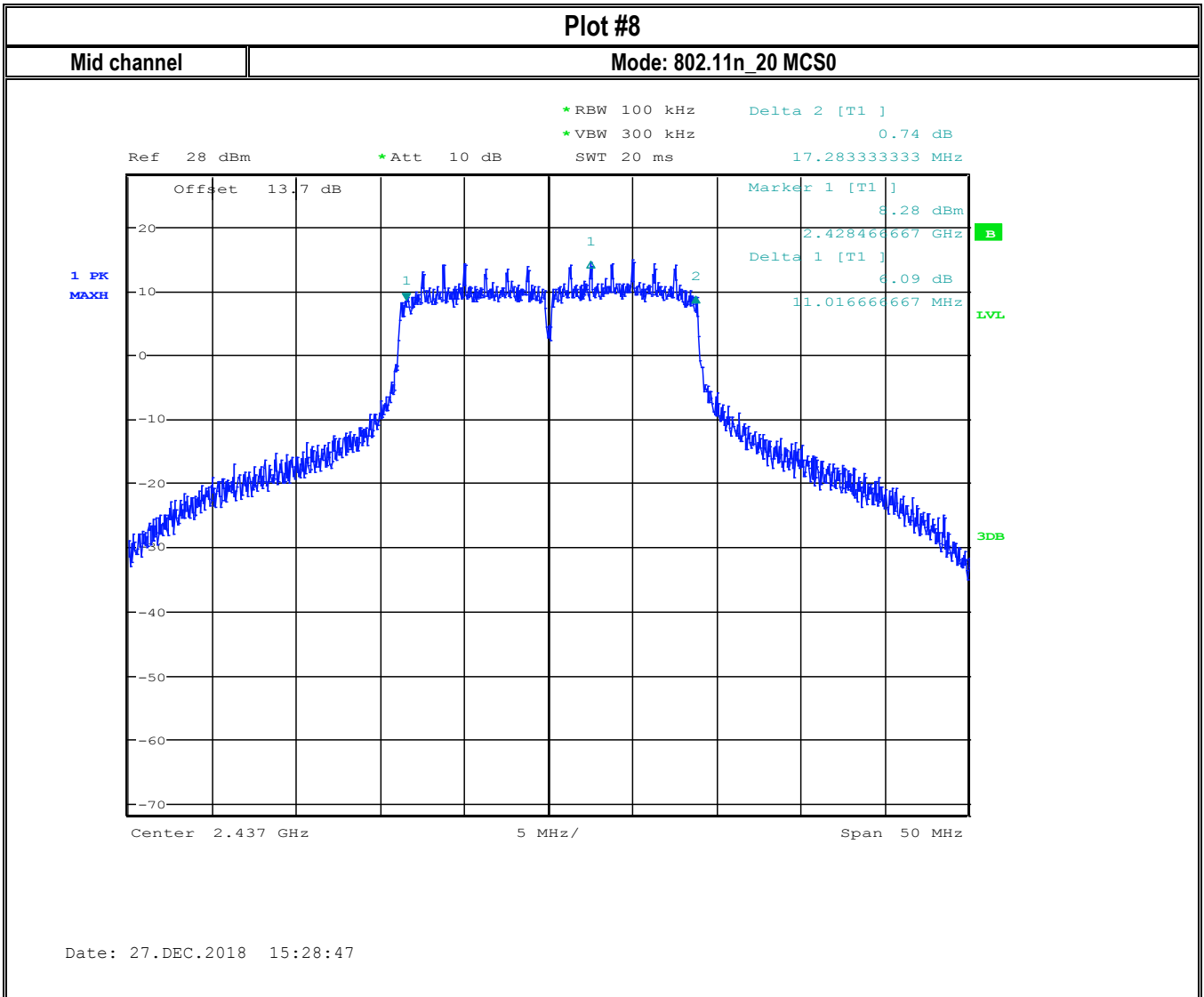


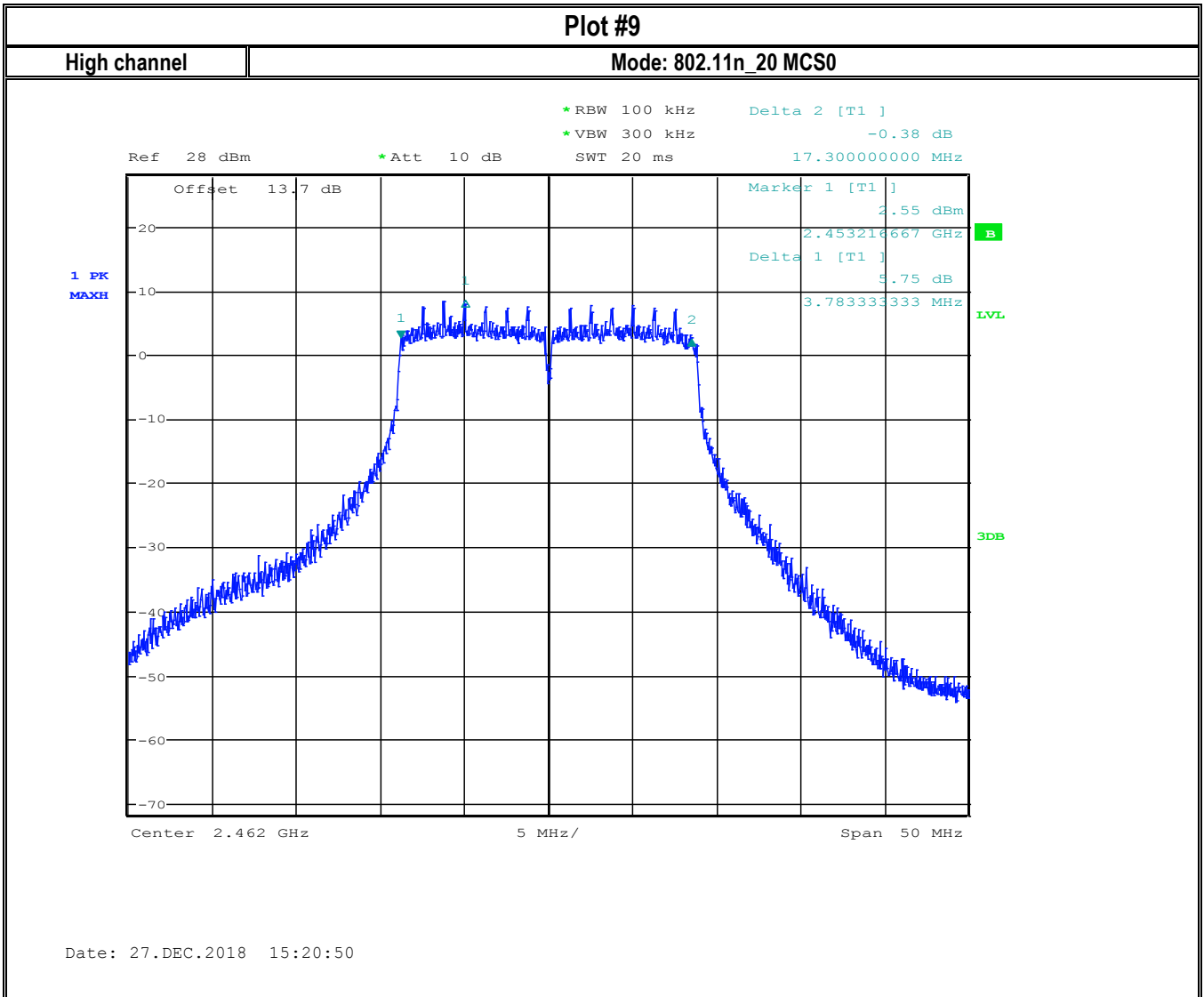


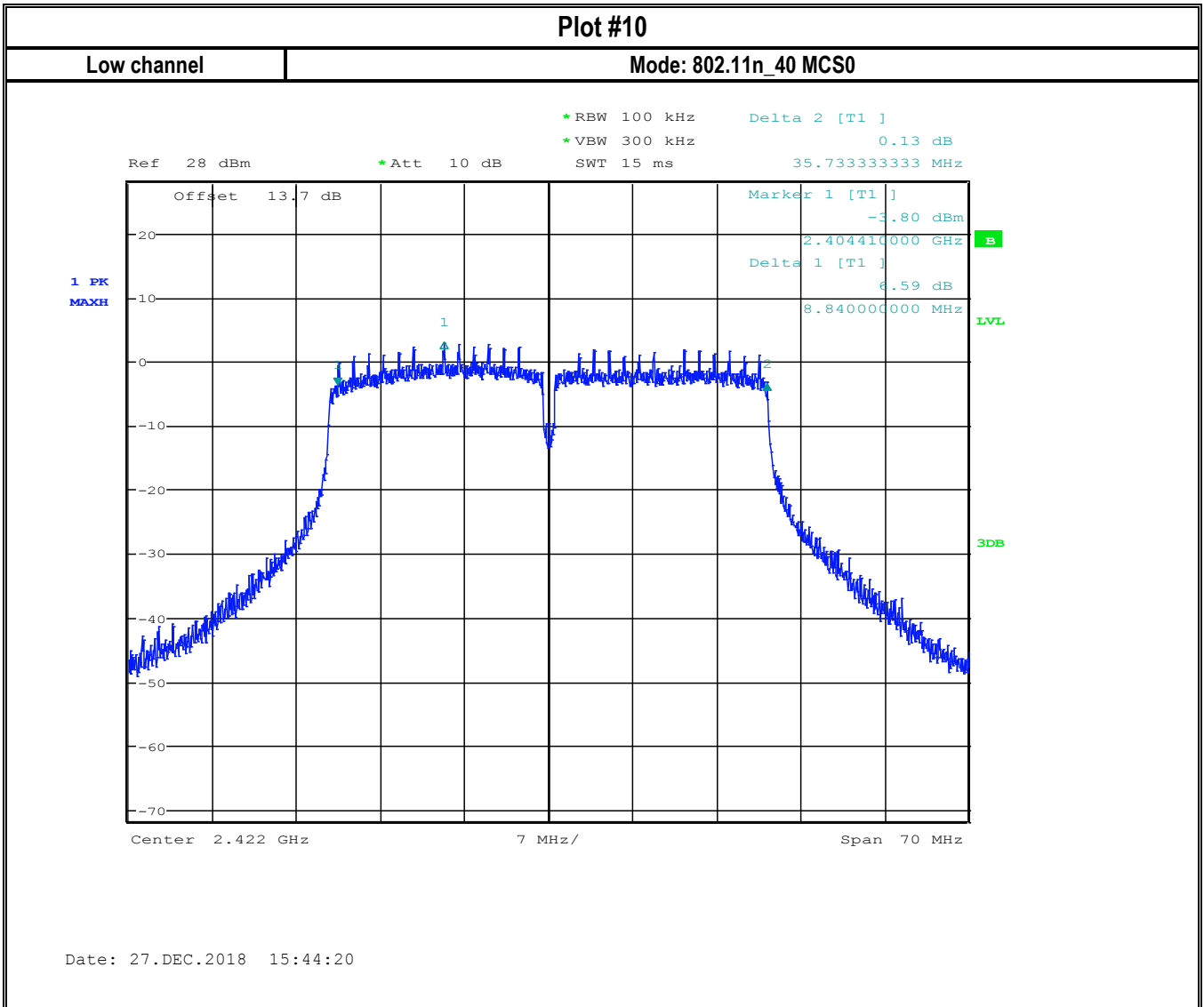


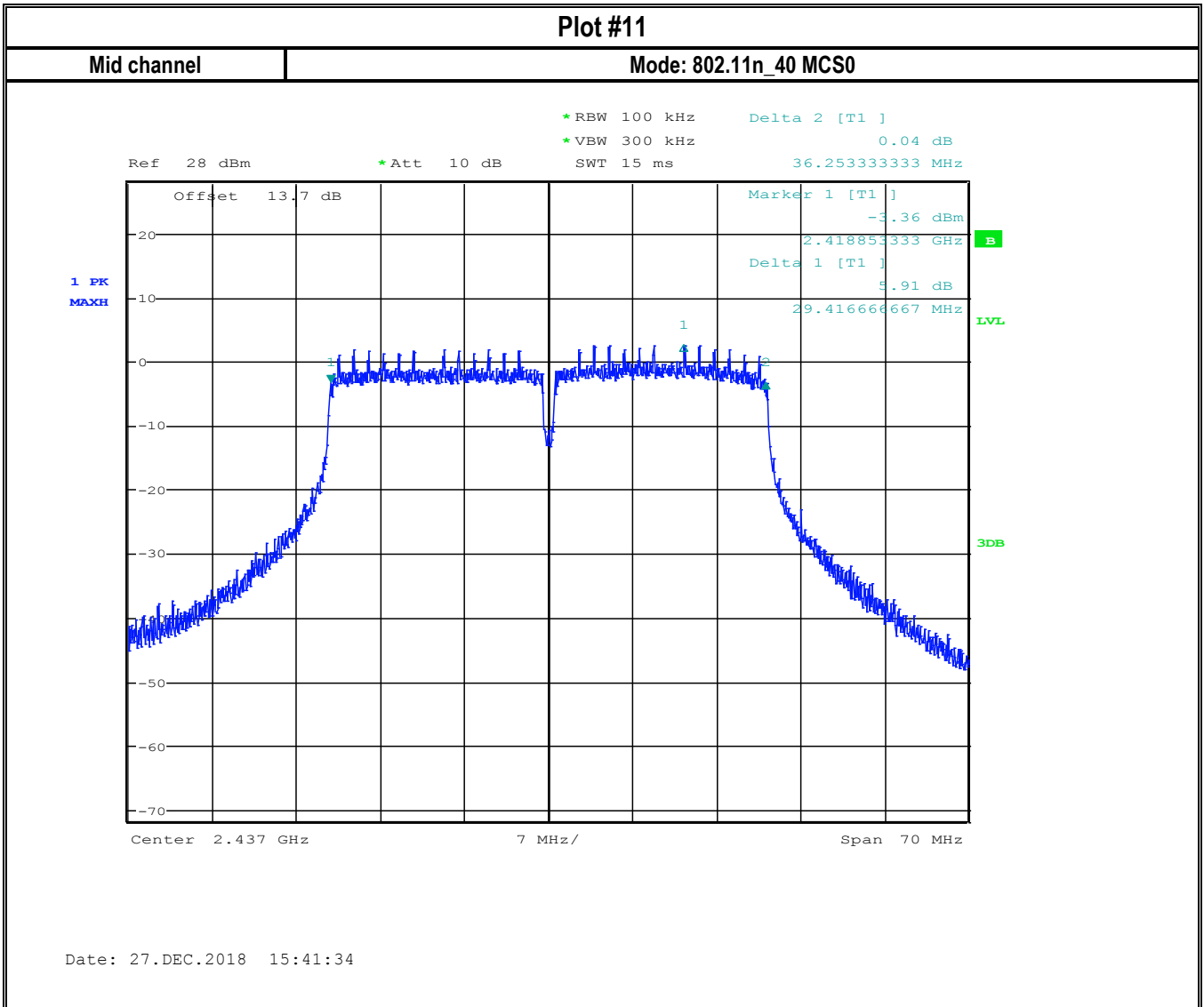


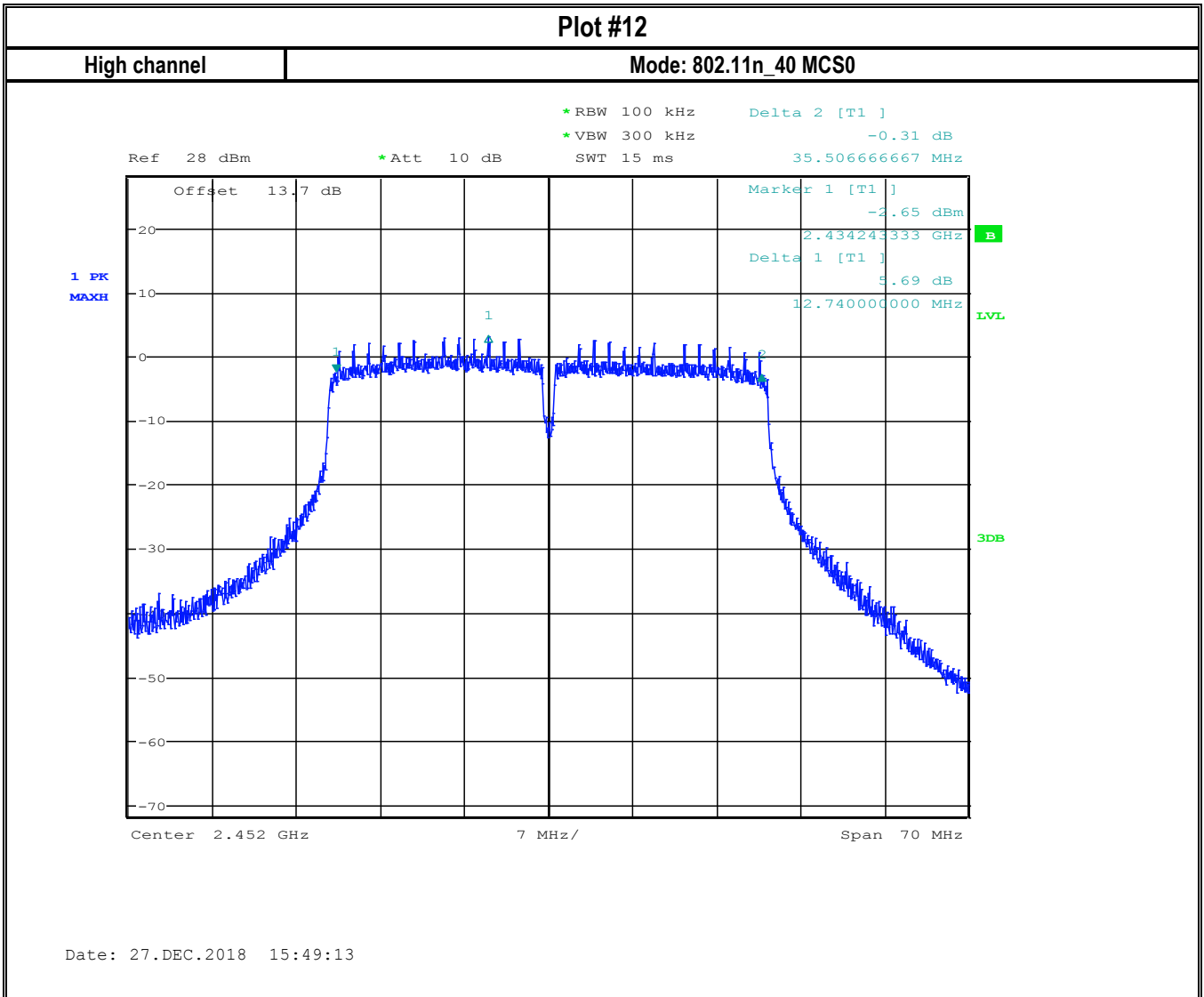


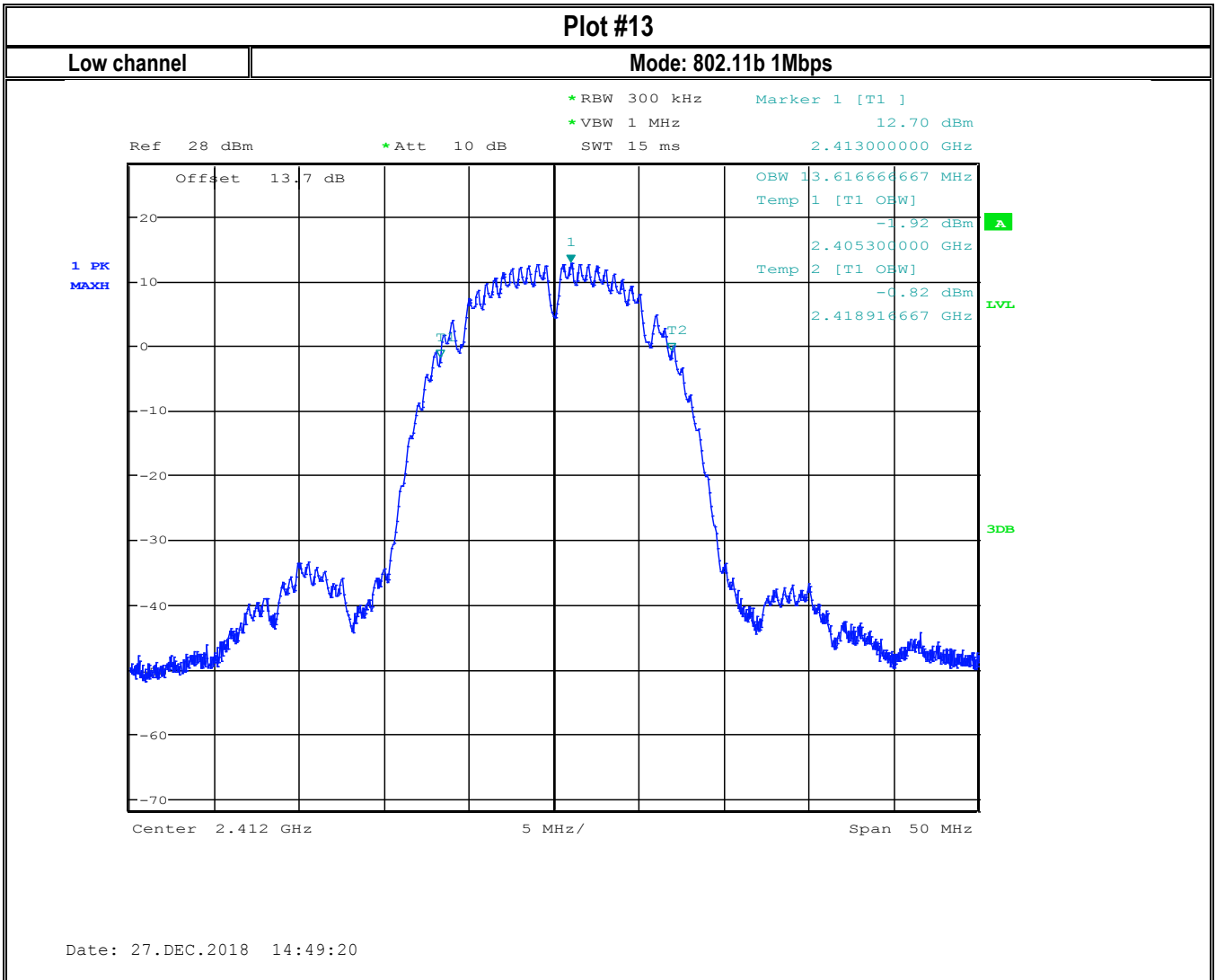


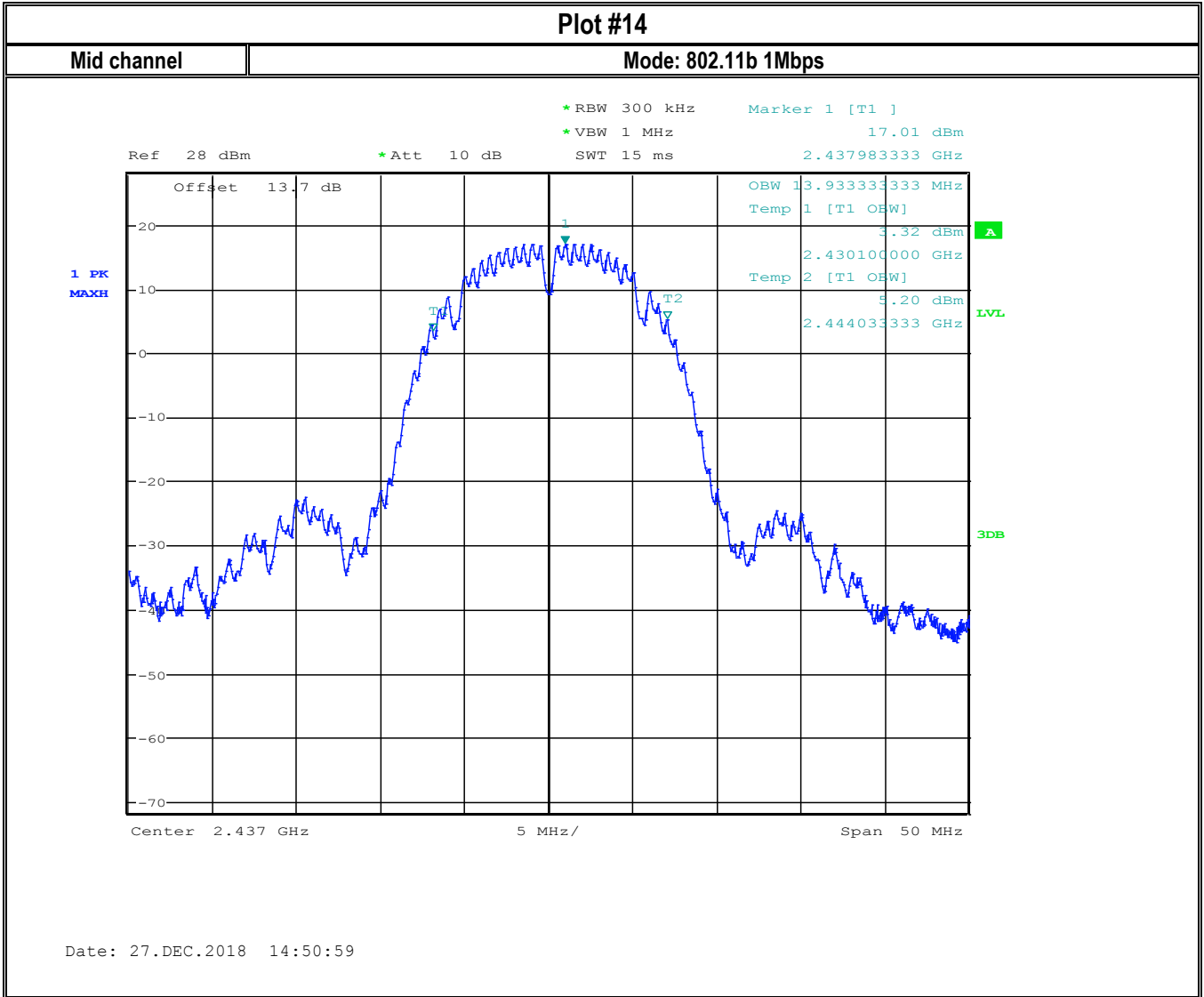


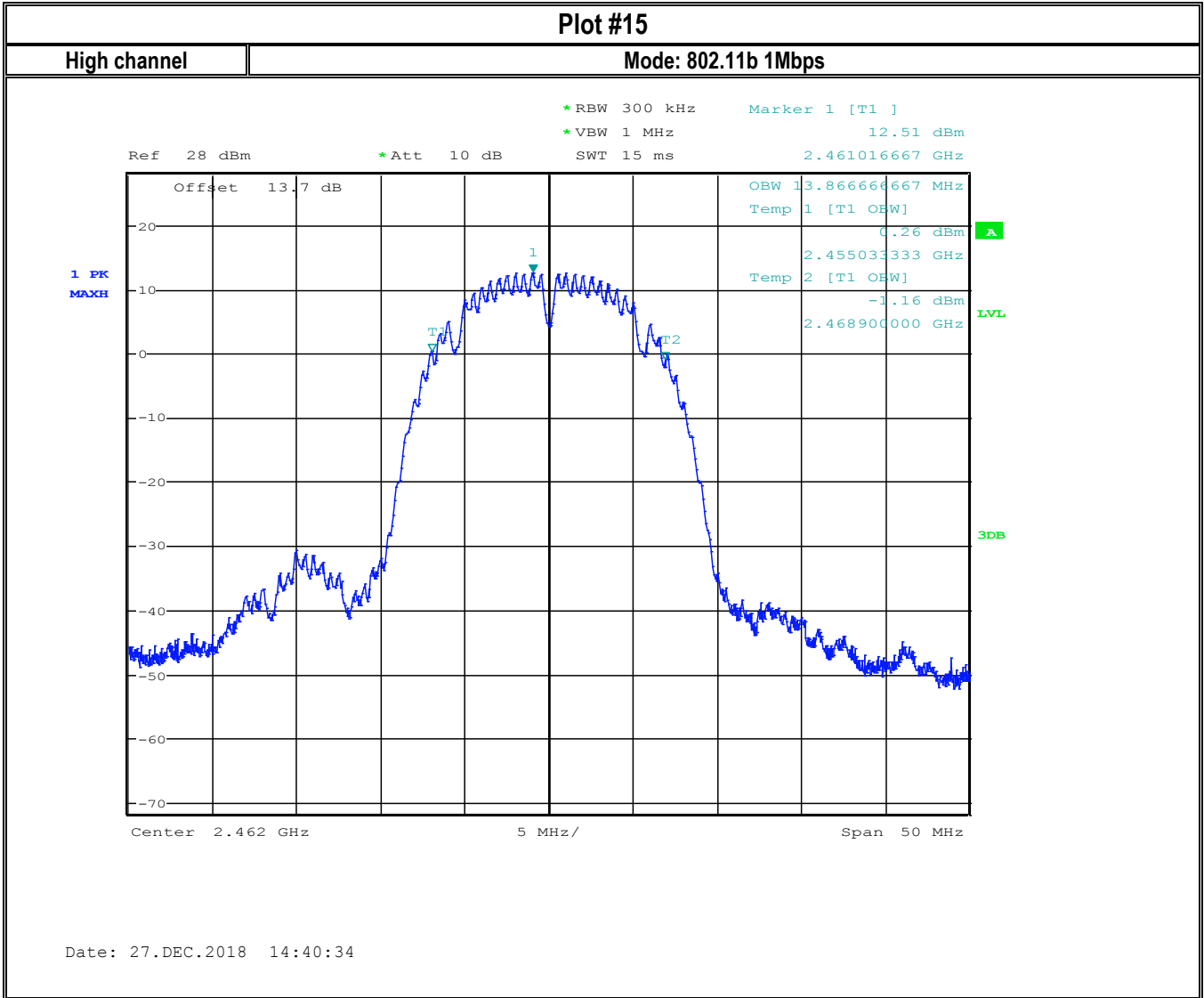






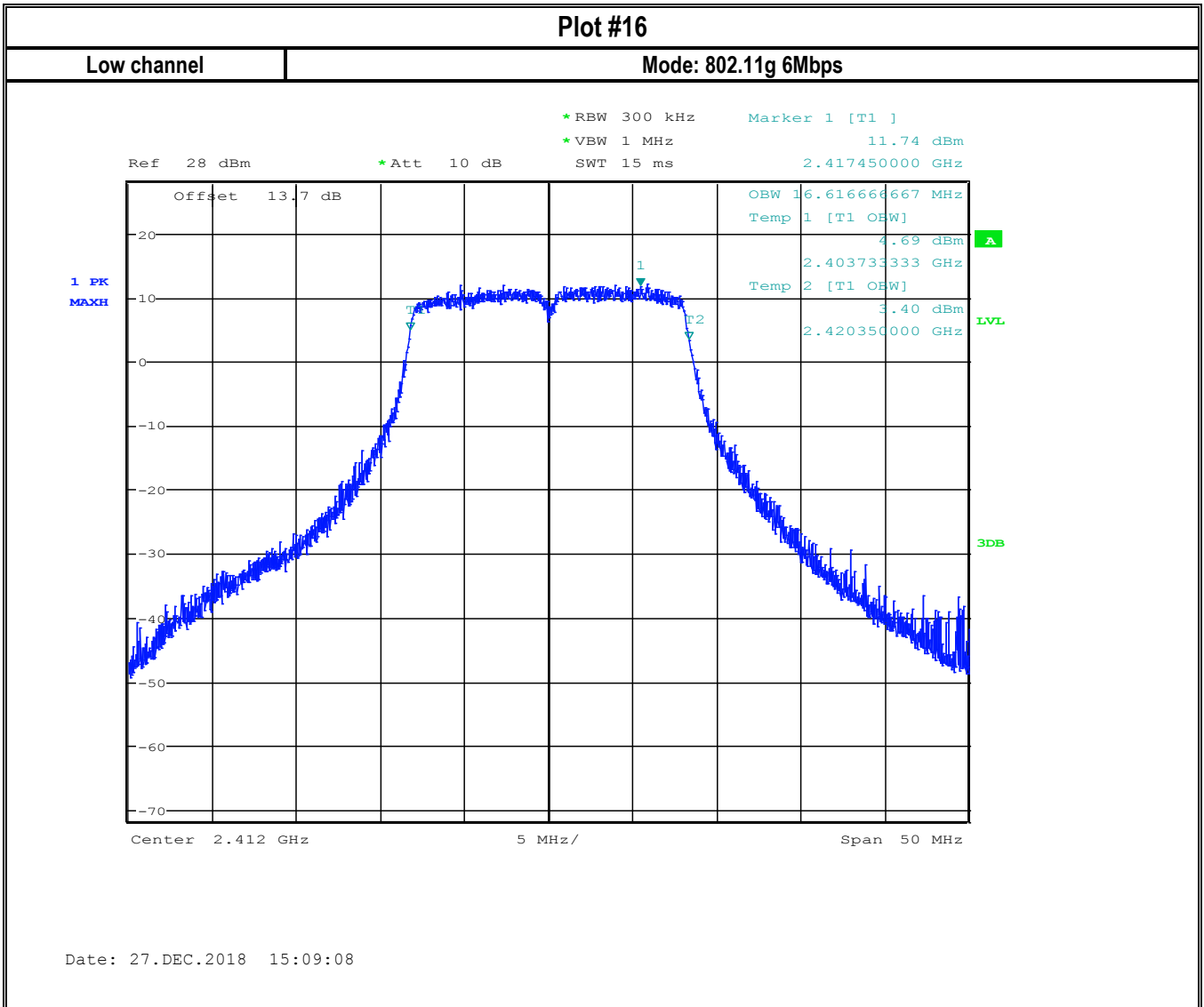


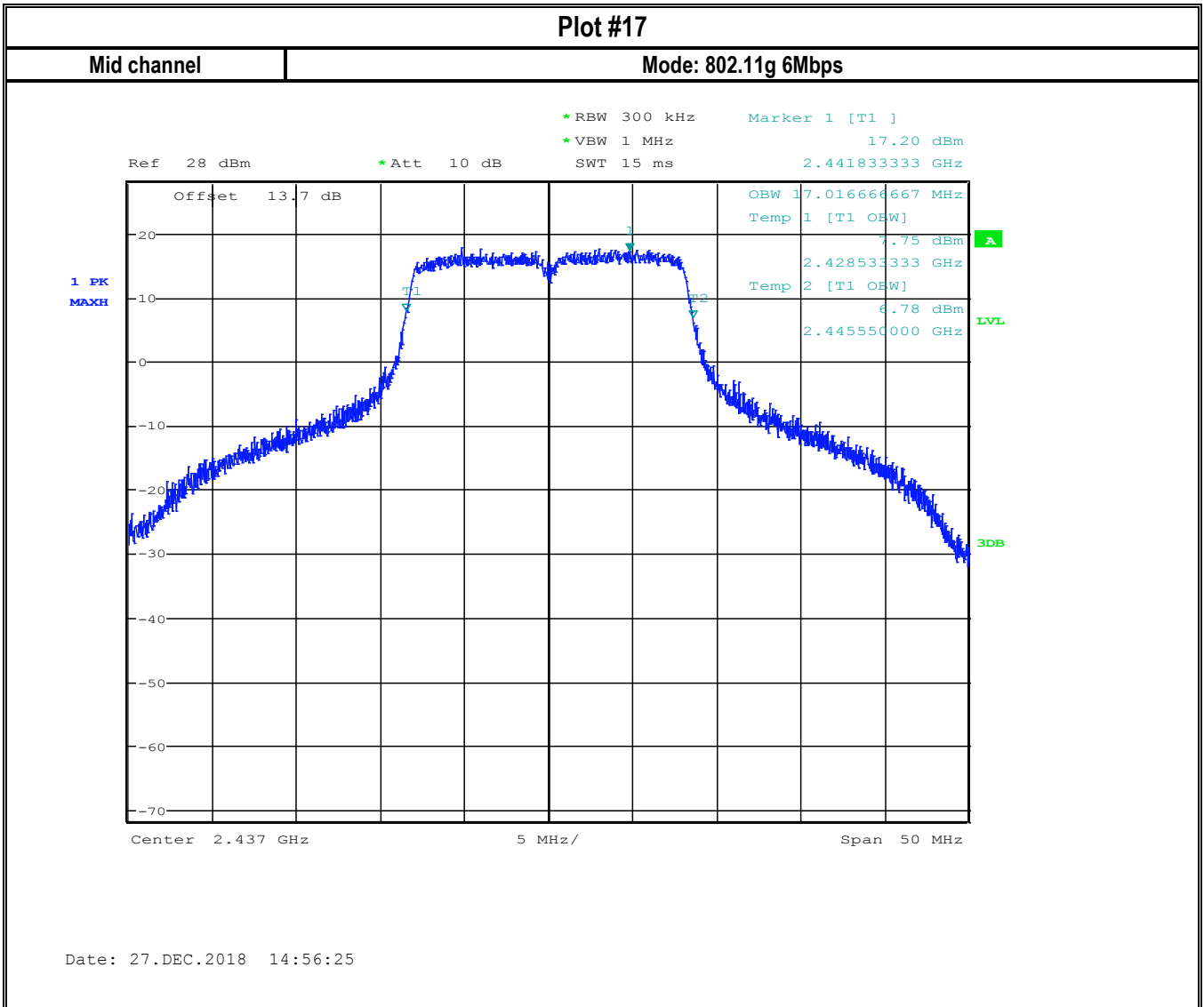


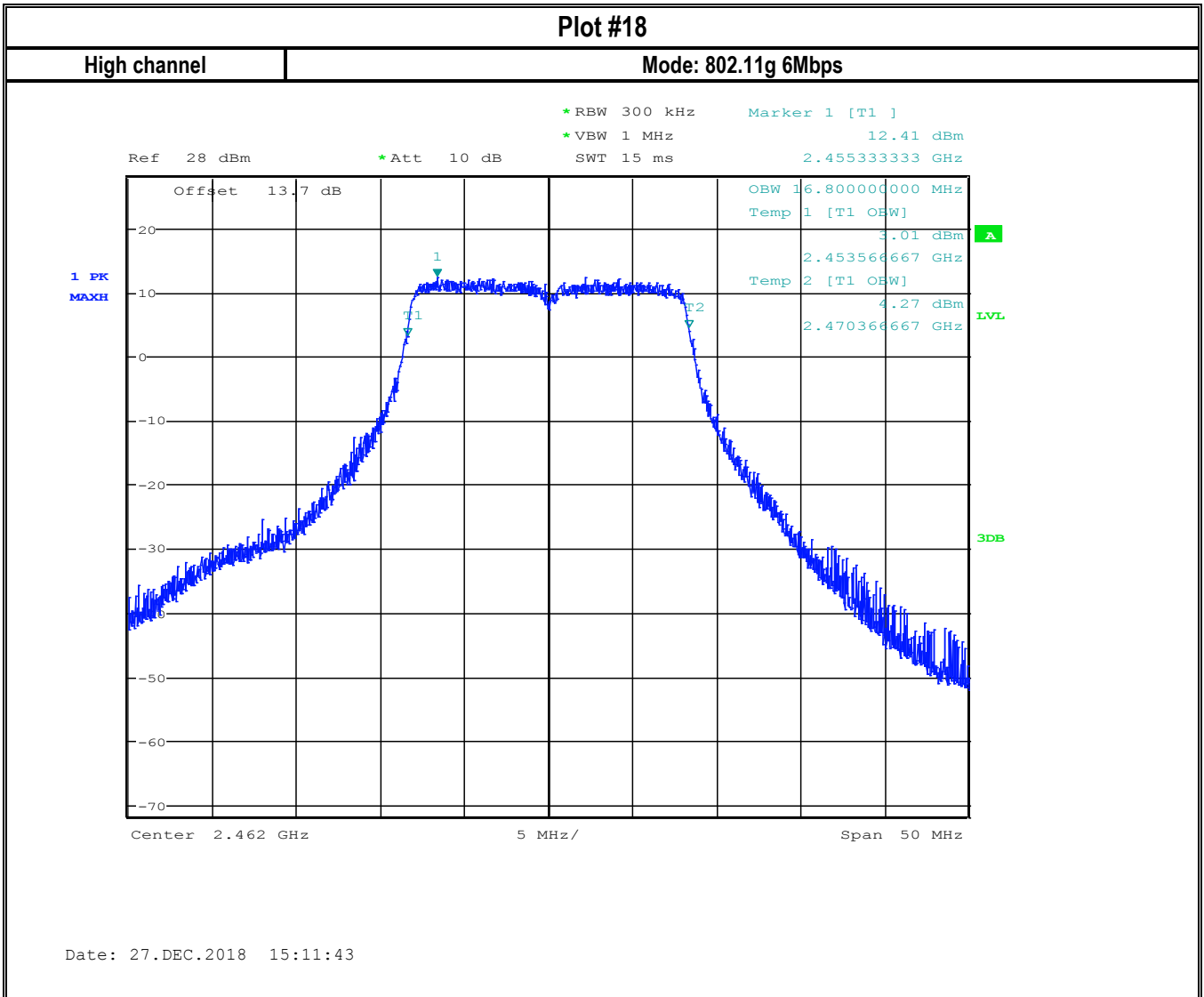


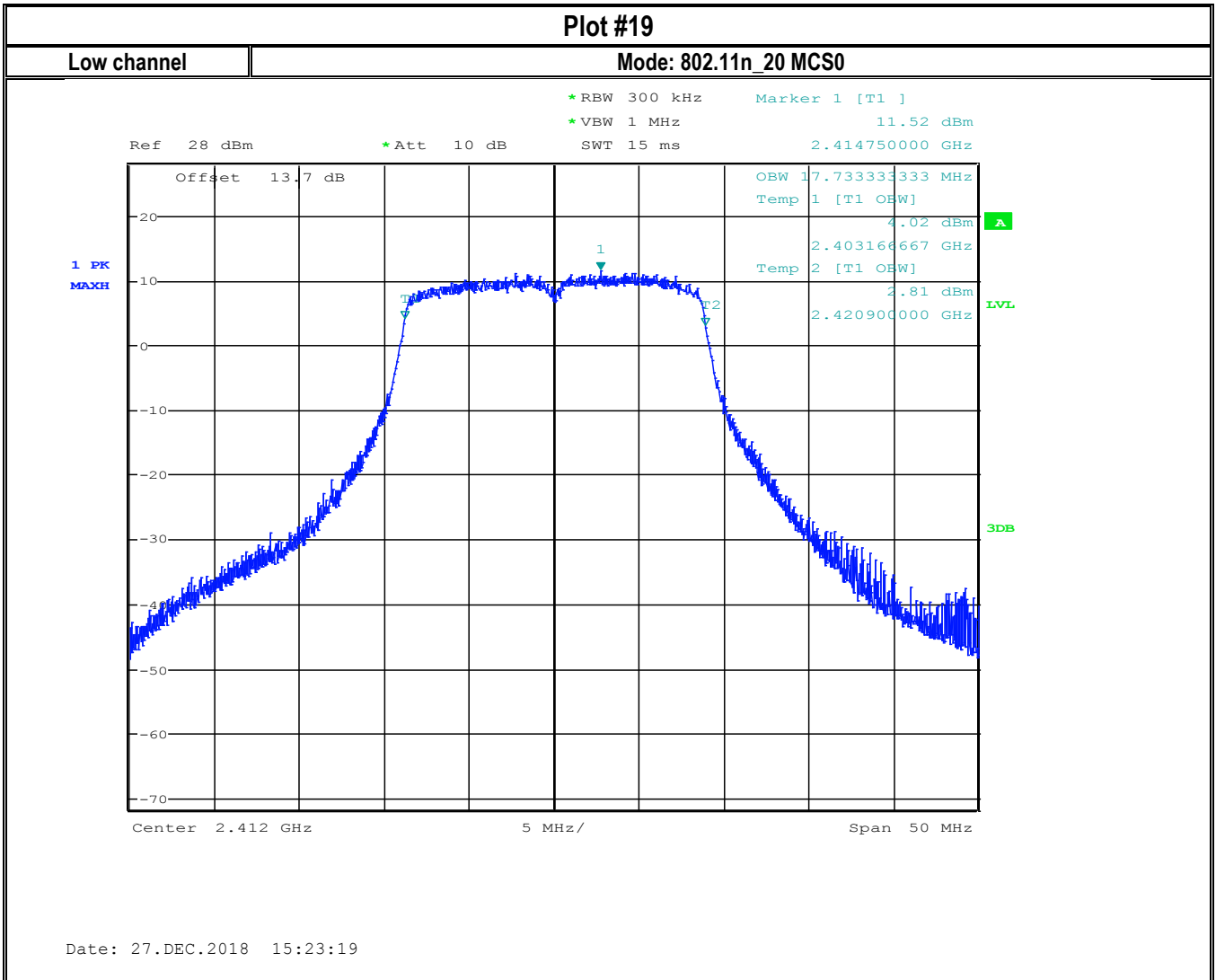
Test Report #: EMC_A2ZDE-048-18001_15.247_WLAN-Rev2
 Date of Report: 2019-05-23

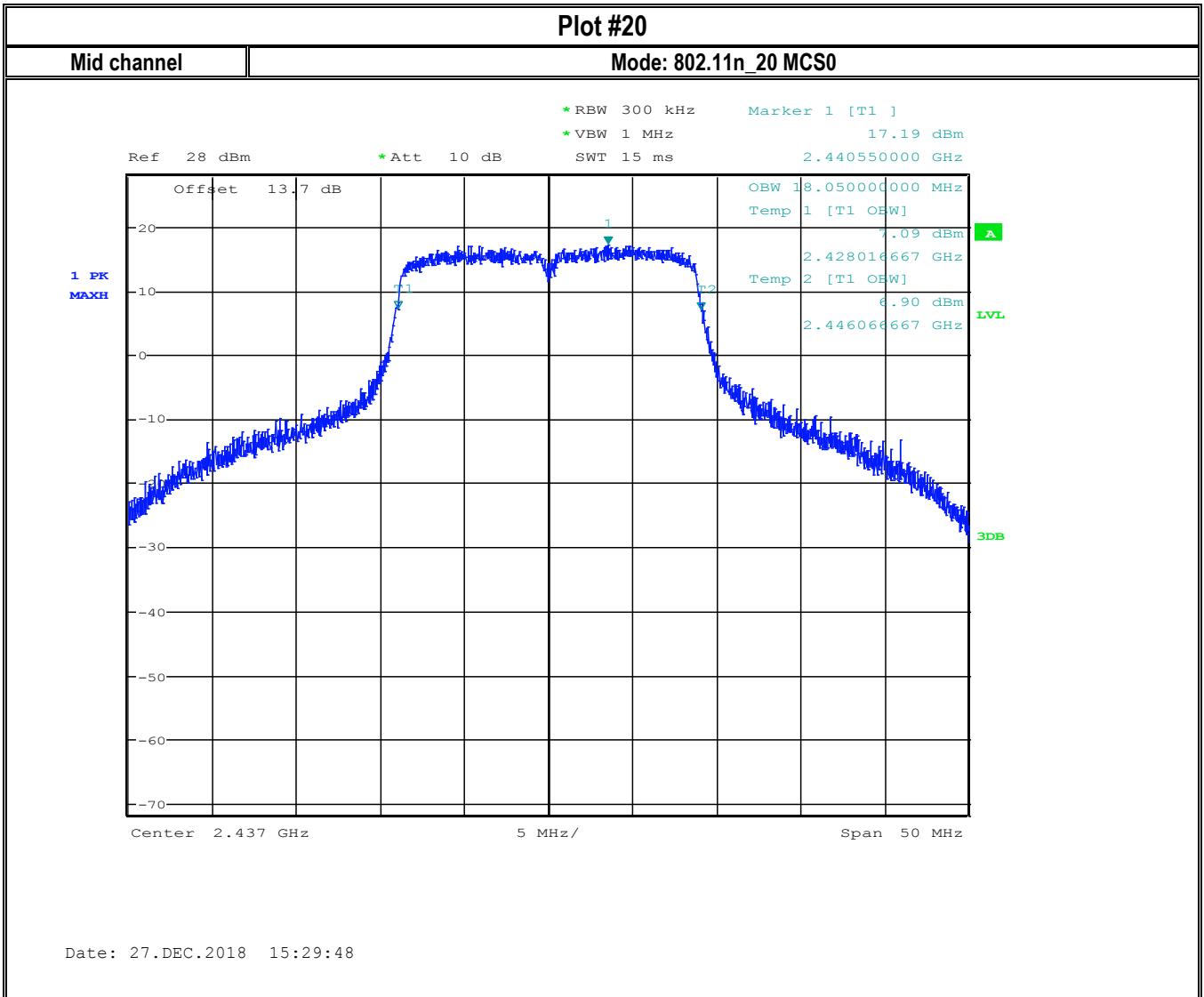
FCC ID: UUU-5411

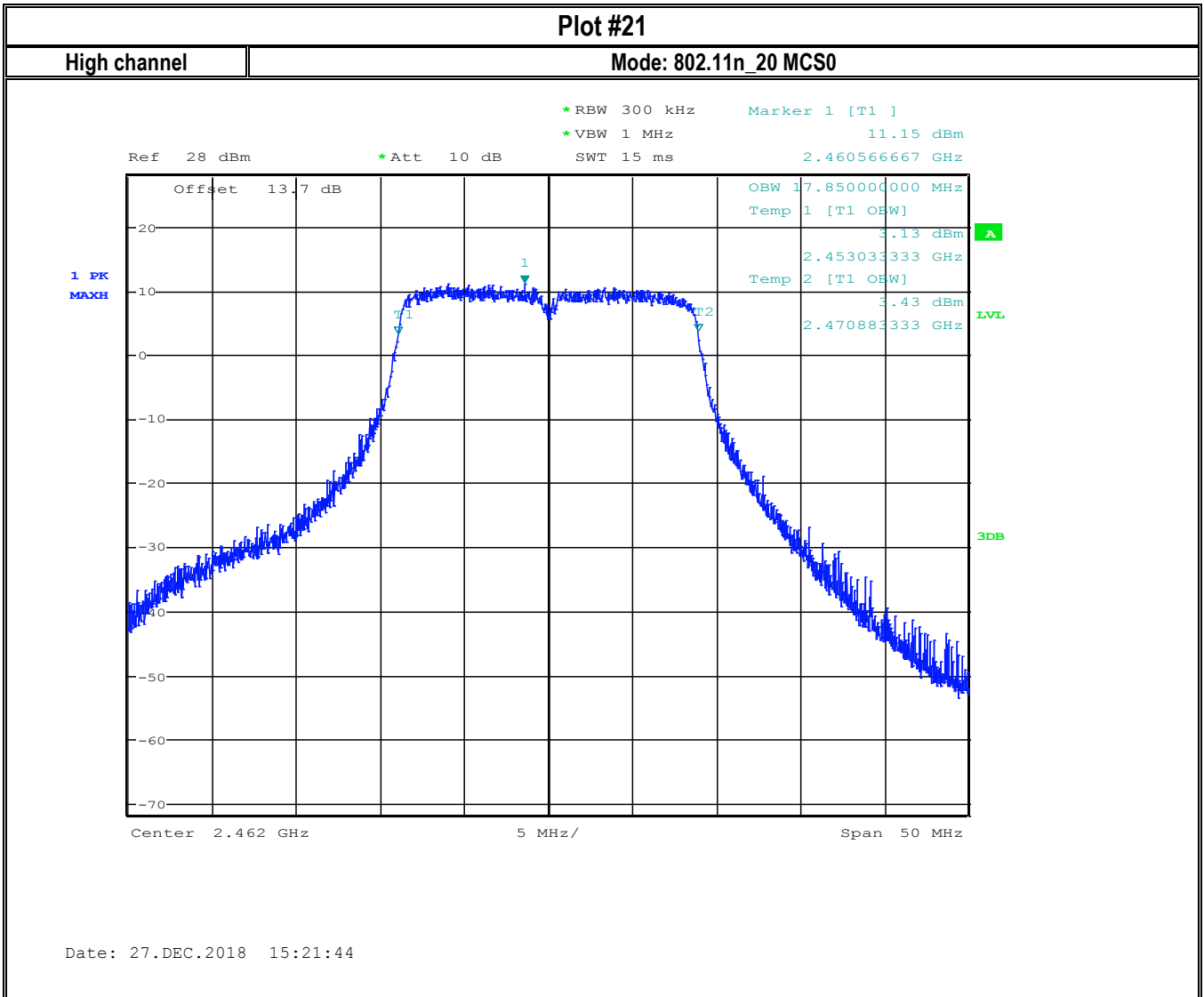


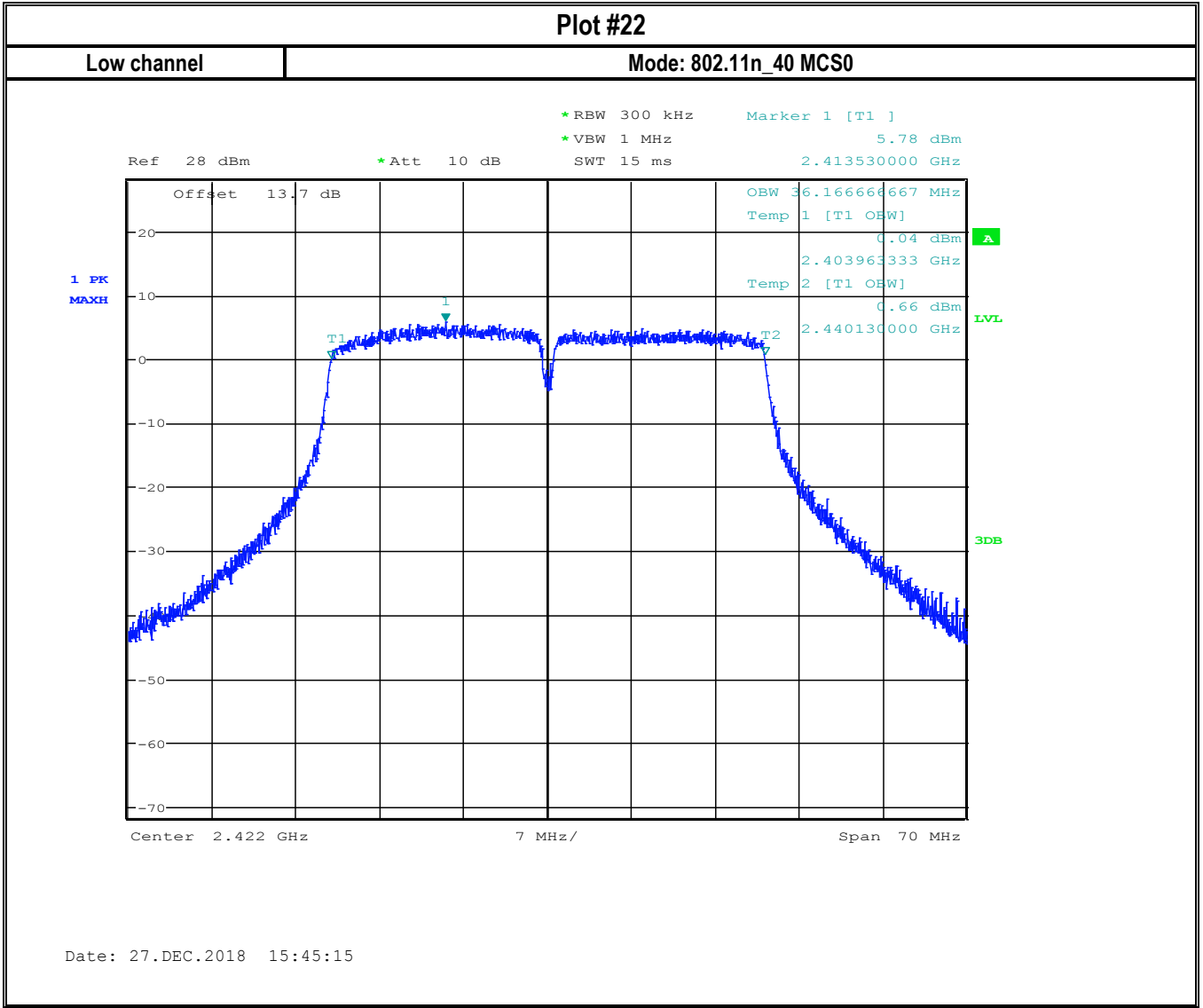








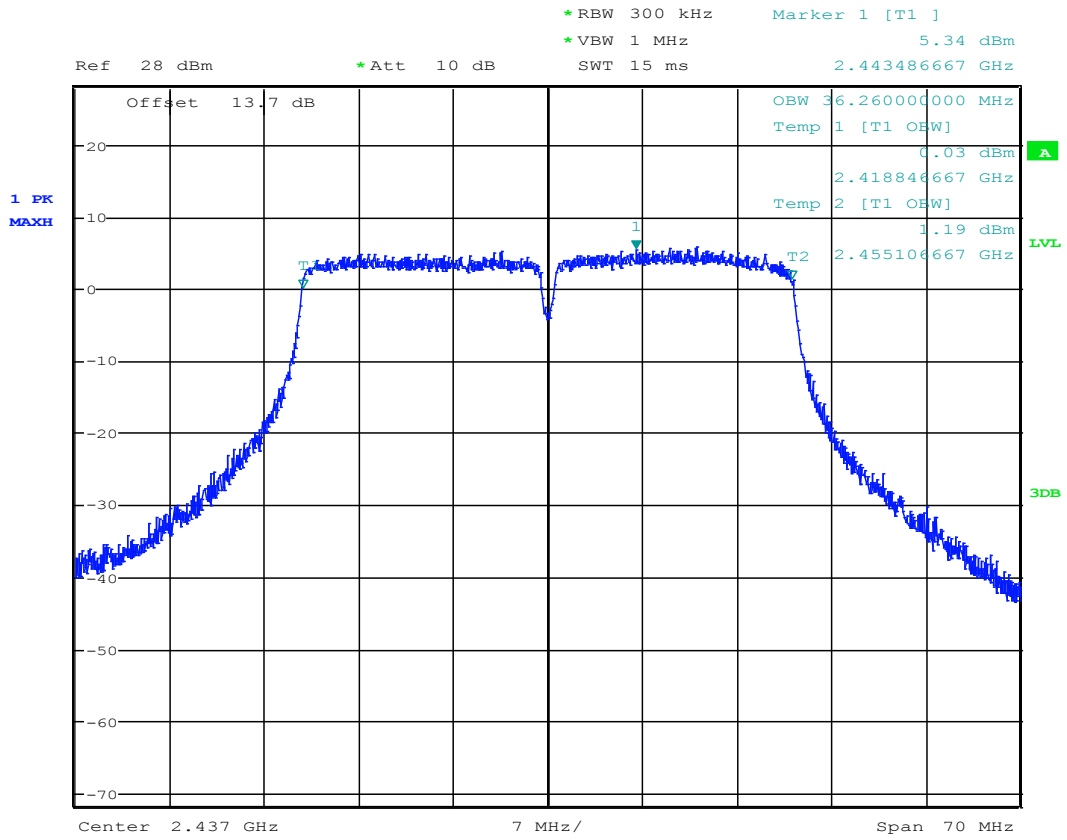




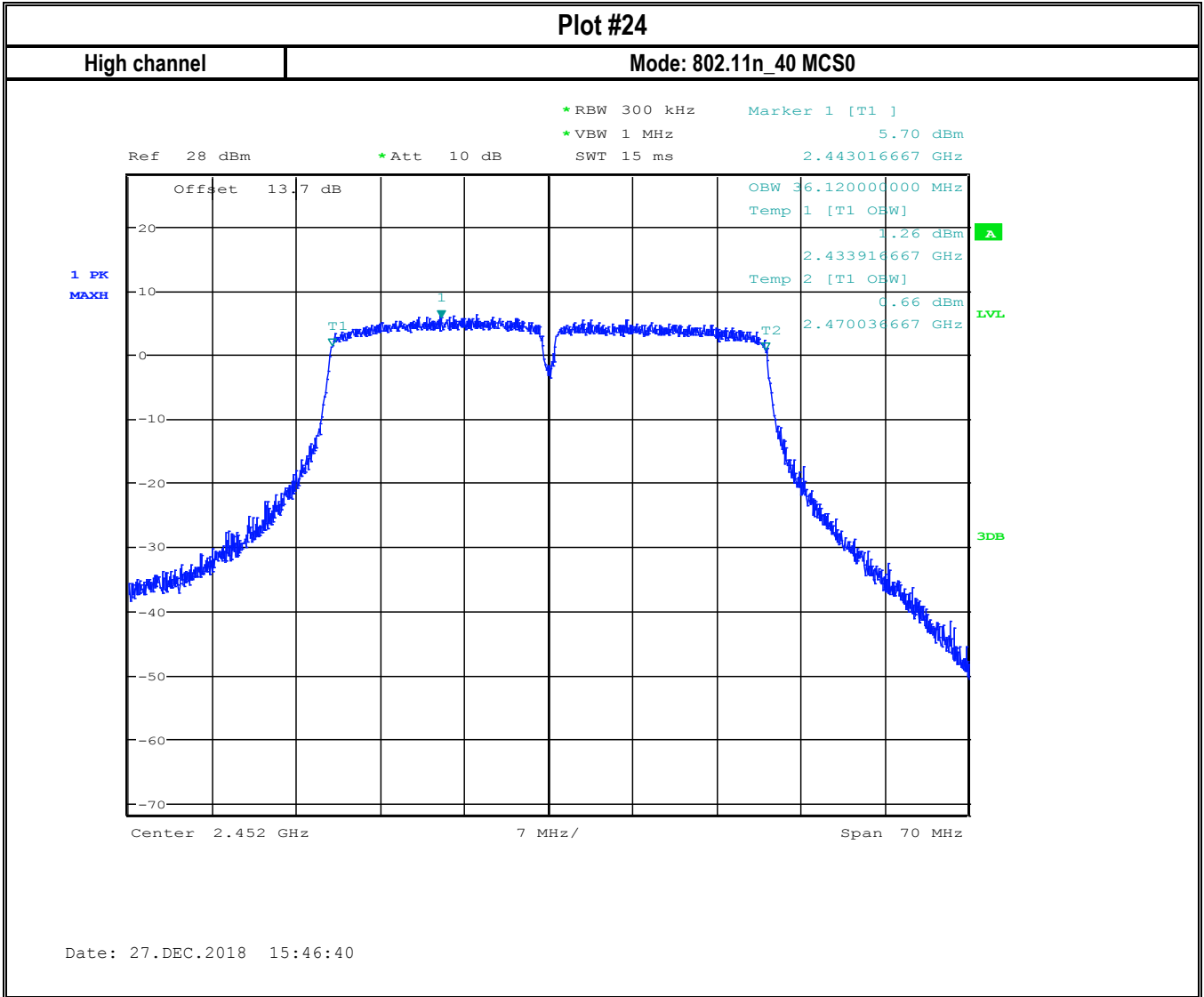
Plot #23

Mid channel

Mode: 802.11n_40 MCS0



Date: 27.DEC.2018 15:37:45



8.6 Radiated Transmitter Spurious Emissions and Restricted Bands

8.6.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

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

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

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

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

8.6.2 Limits:

FCC §15.247

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

FCC §15.209

- 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

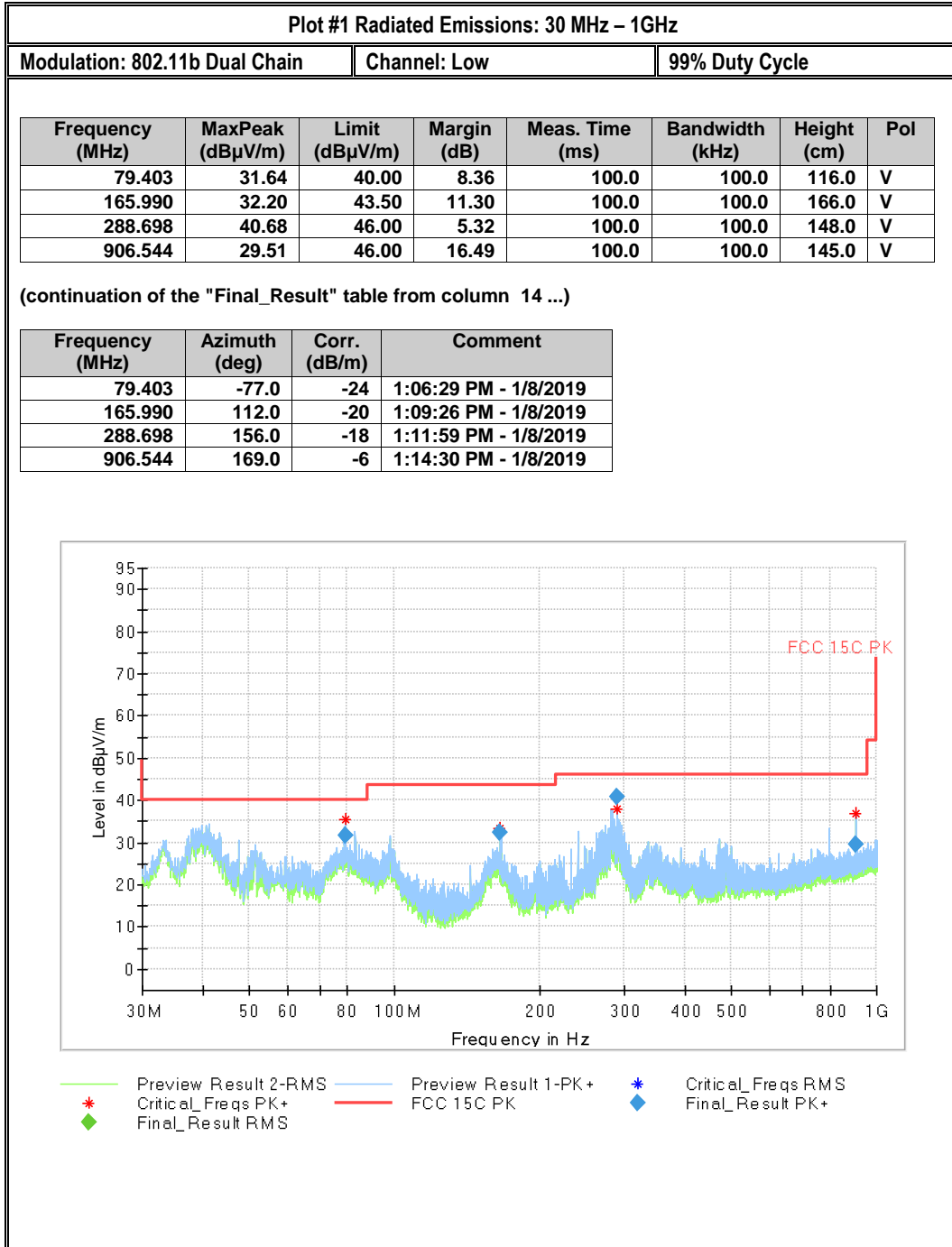
8.6.3 Test conditions and setup:

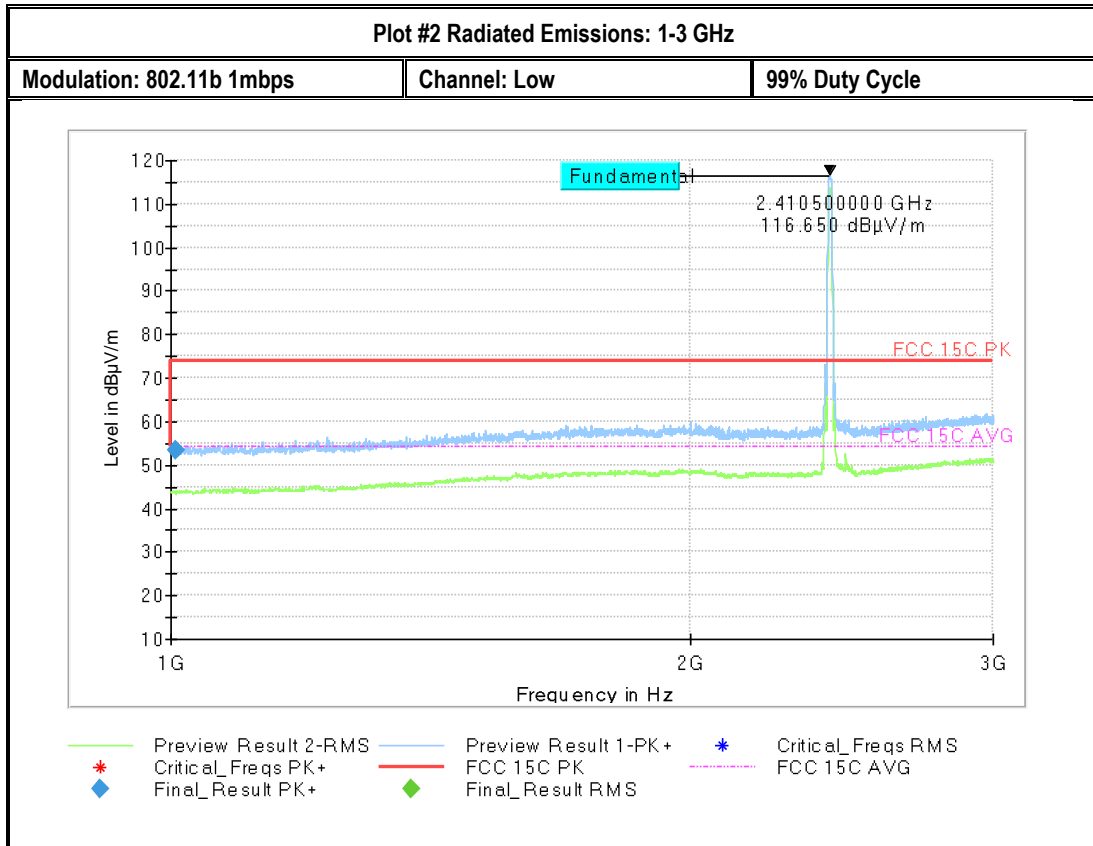
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	2	802.11n_20 MIMO	AC/DC Adapter

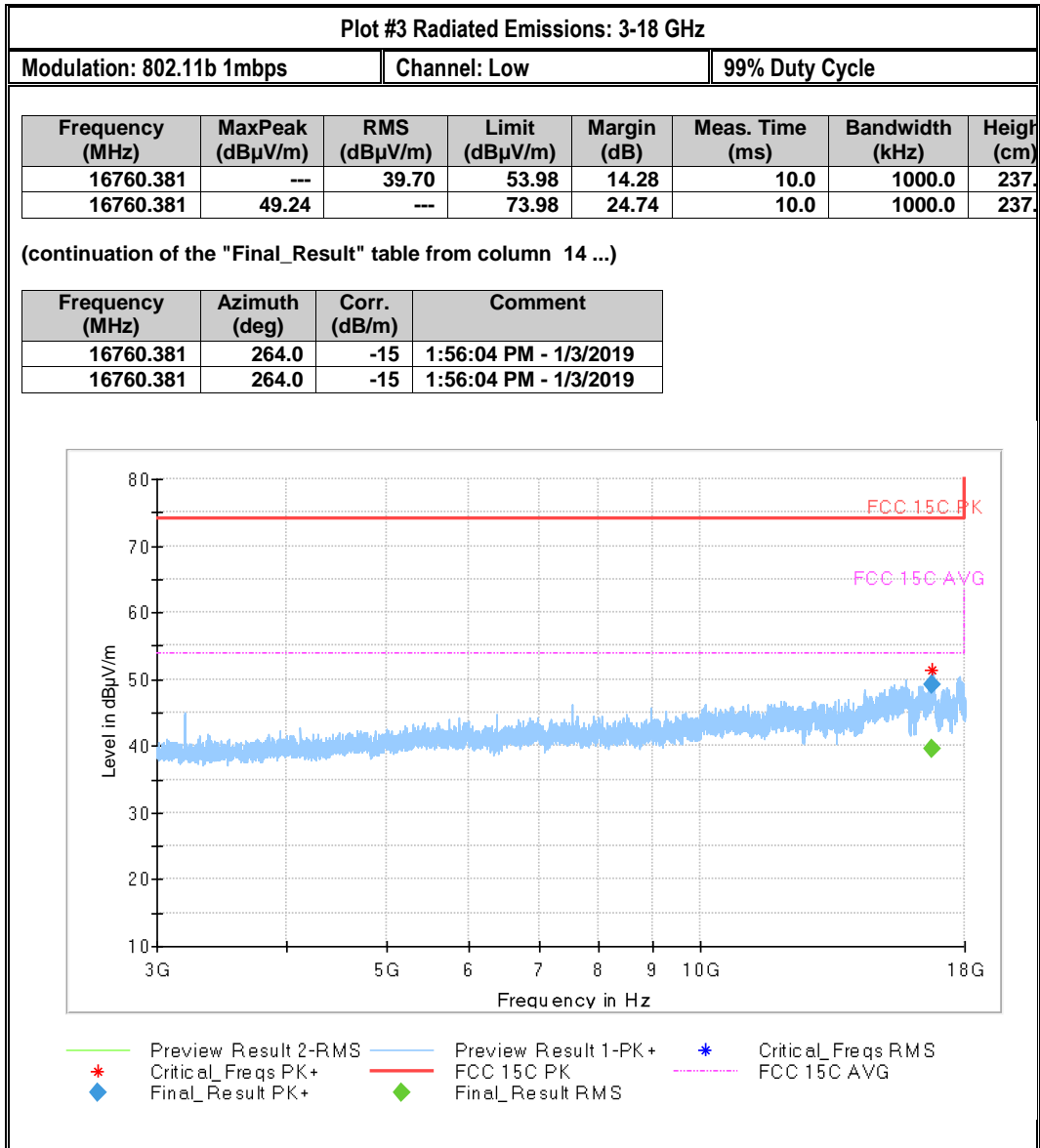
8.6.4 Measurement result:

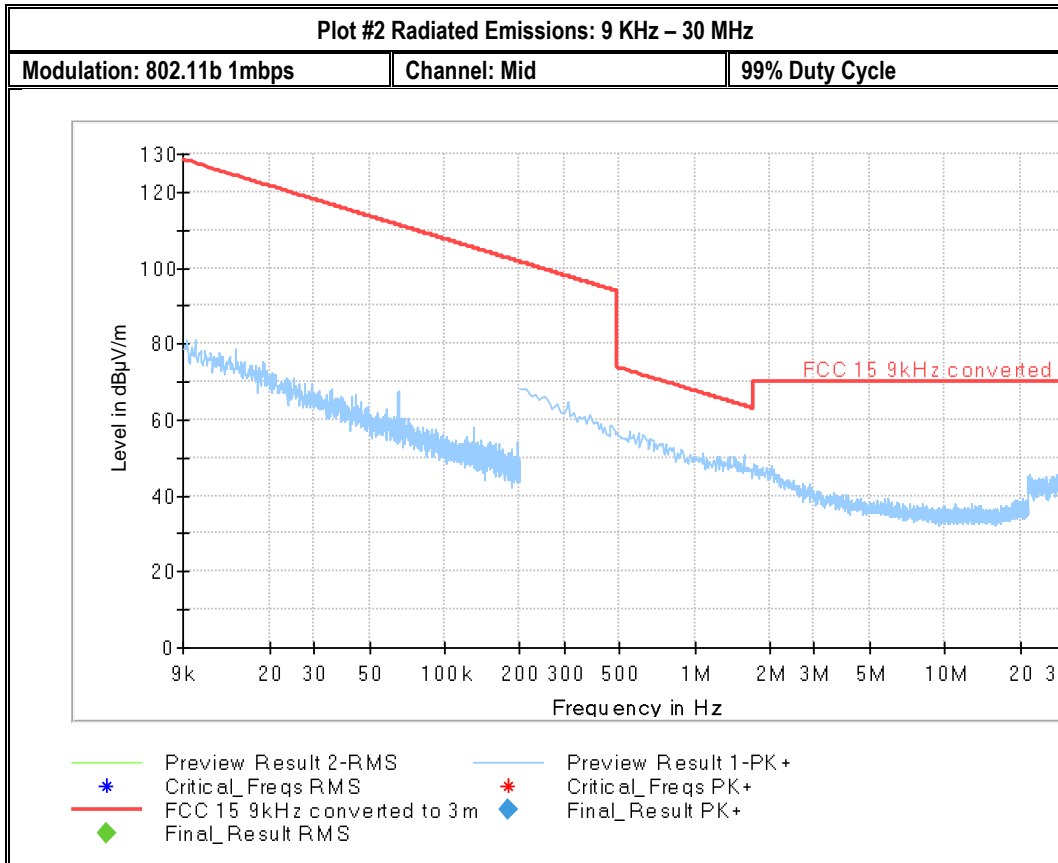
Plot #	Channel #	Scan Frequency	Limit	Result
1-3	11b Low	30 MHz – 18 GHz	See section 8.6.2	Pass
4-8	11b Mid	9 kHz – 26 GHz	See section 8.6.2	Pass
9-11	11b High	30 MHz – 18 GHz	See section 8.6.2	Pass
12-16	11g mid	9 KHz – 26 GHz	See section 8.6.2	Pass
17-19	11n 20 mi	30 MHz – 18 GHz	See section 8.6.2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

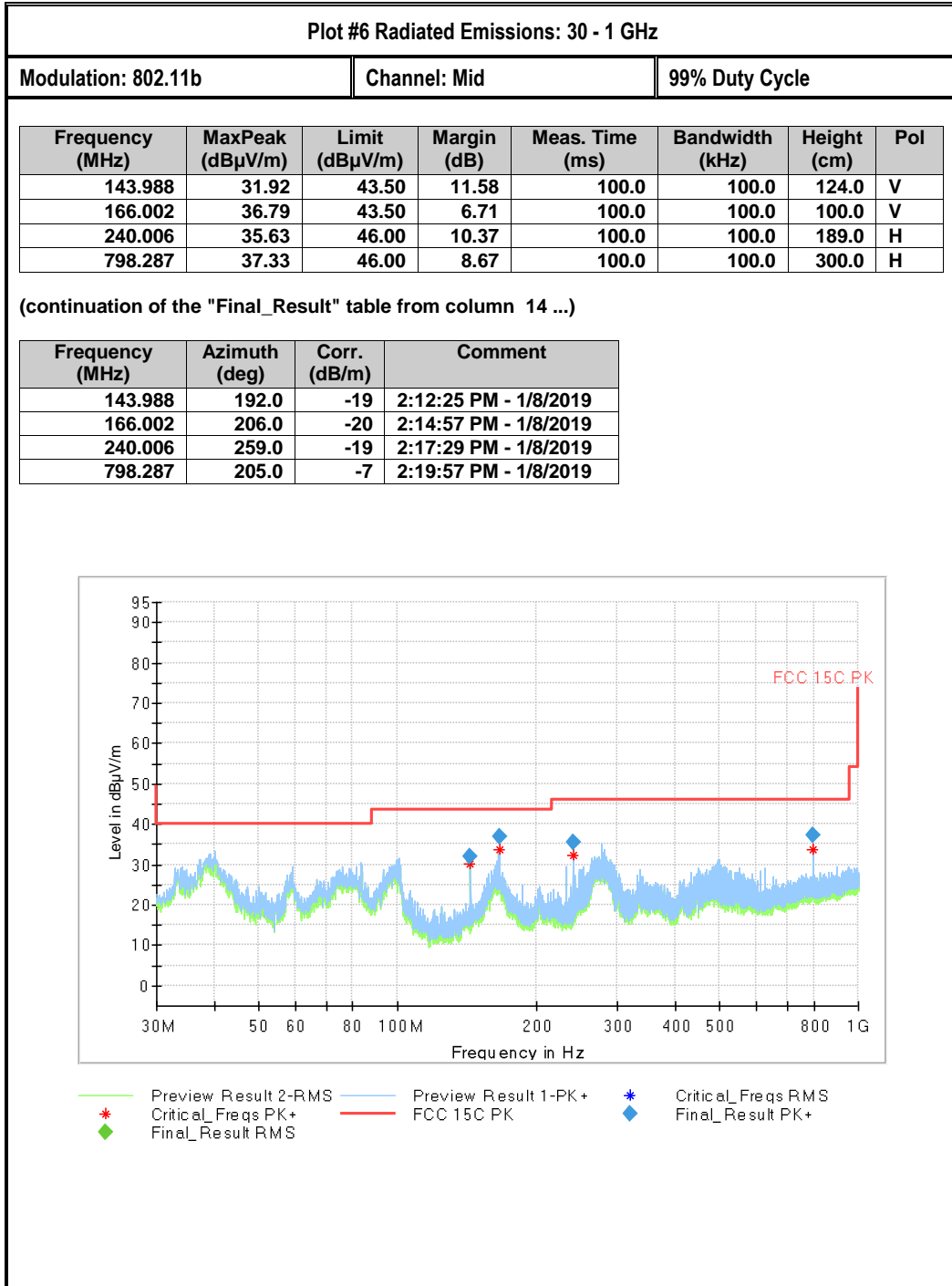
8.6.5 Measurement Plots:

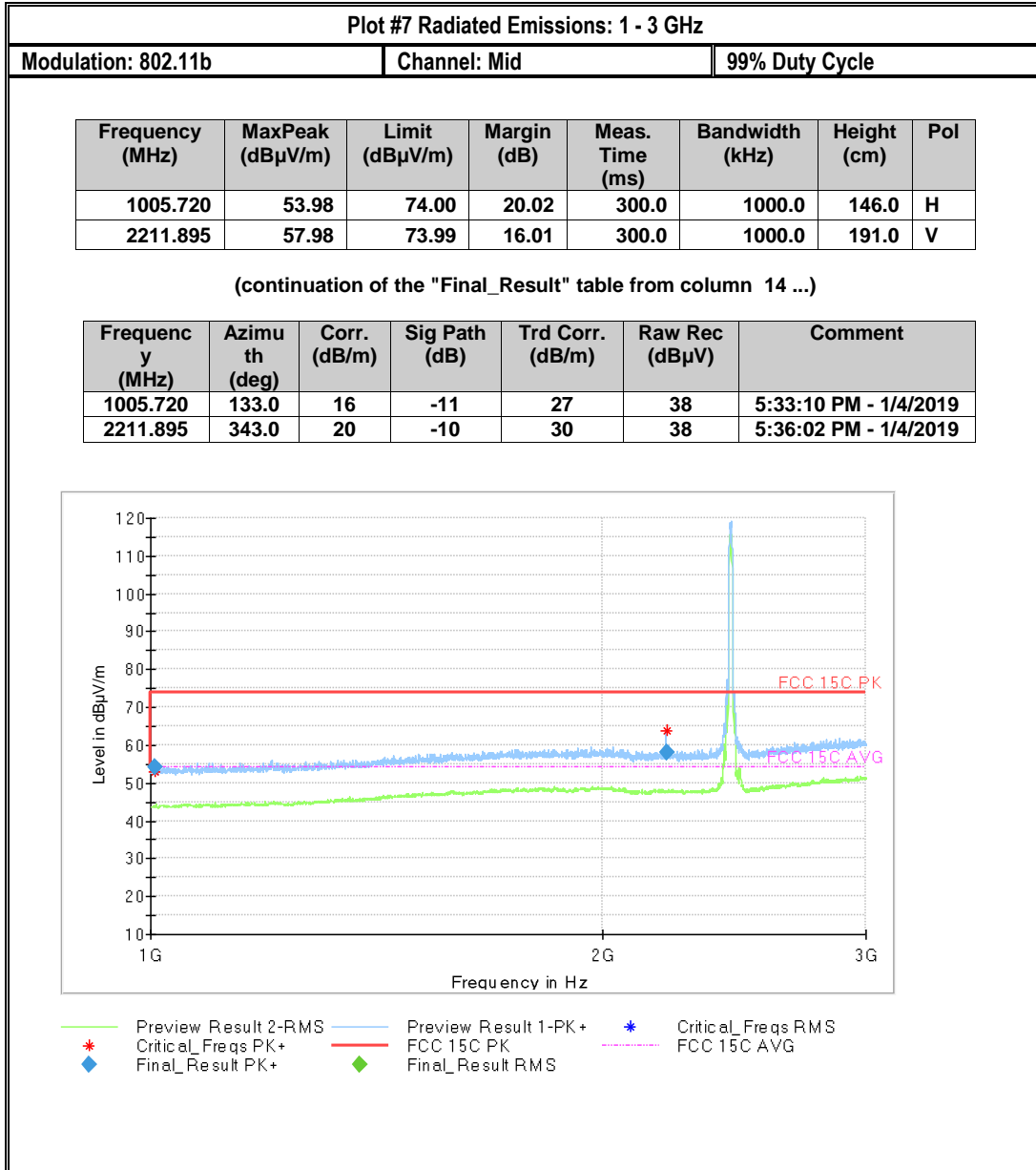


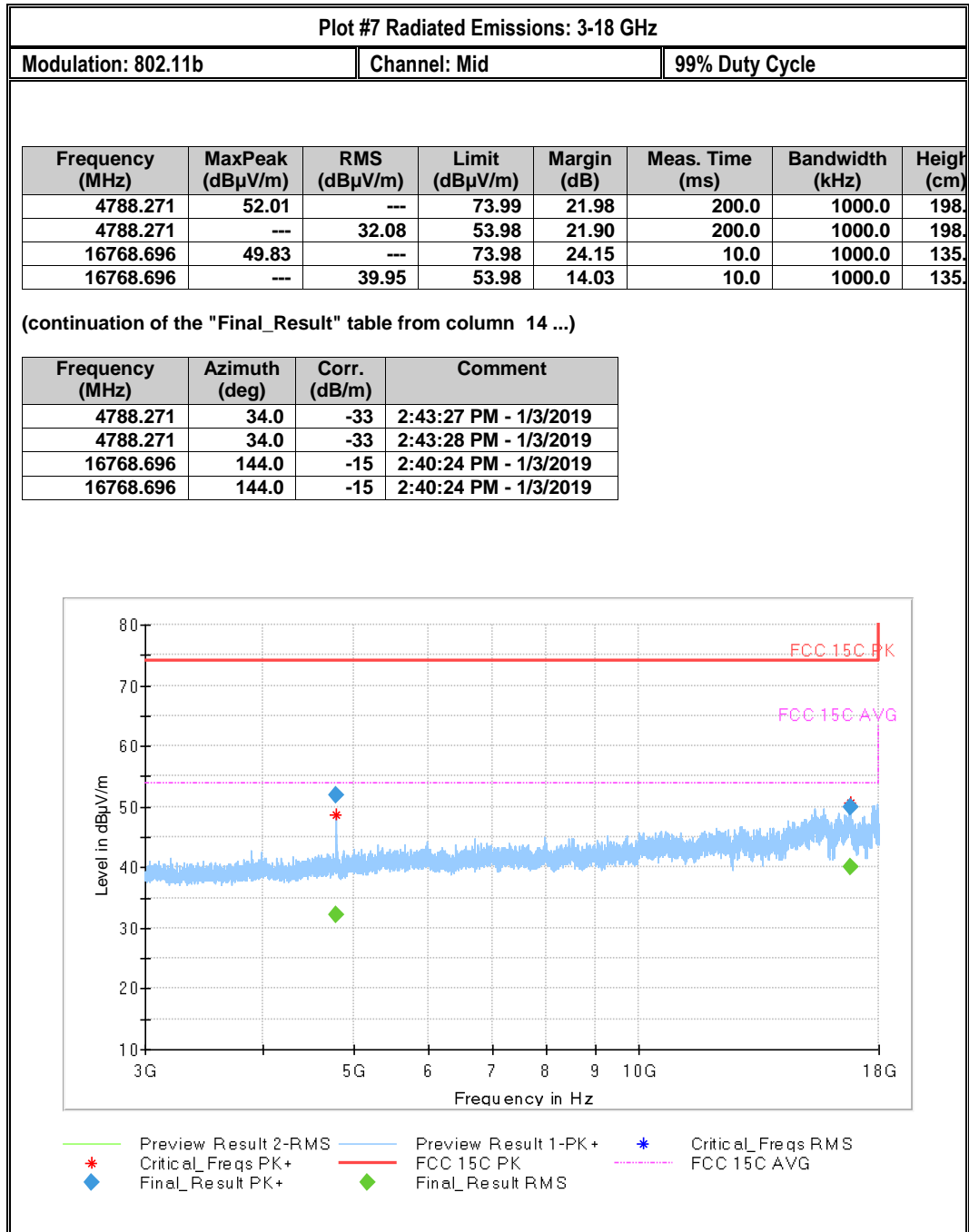


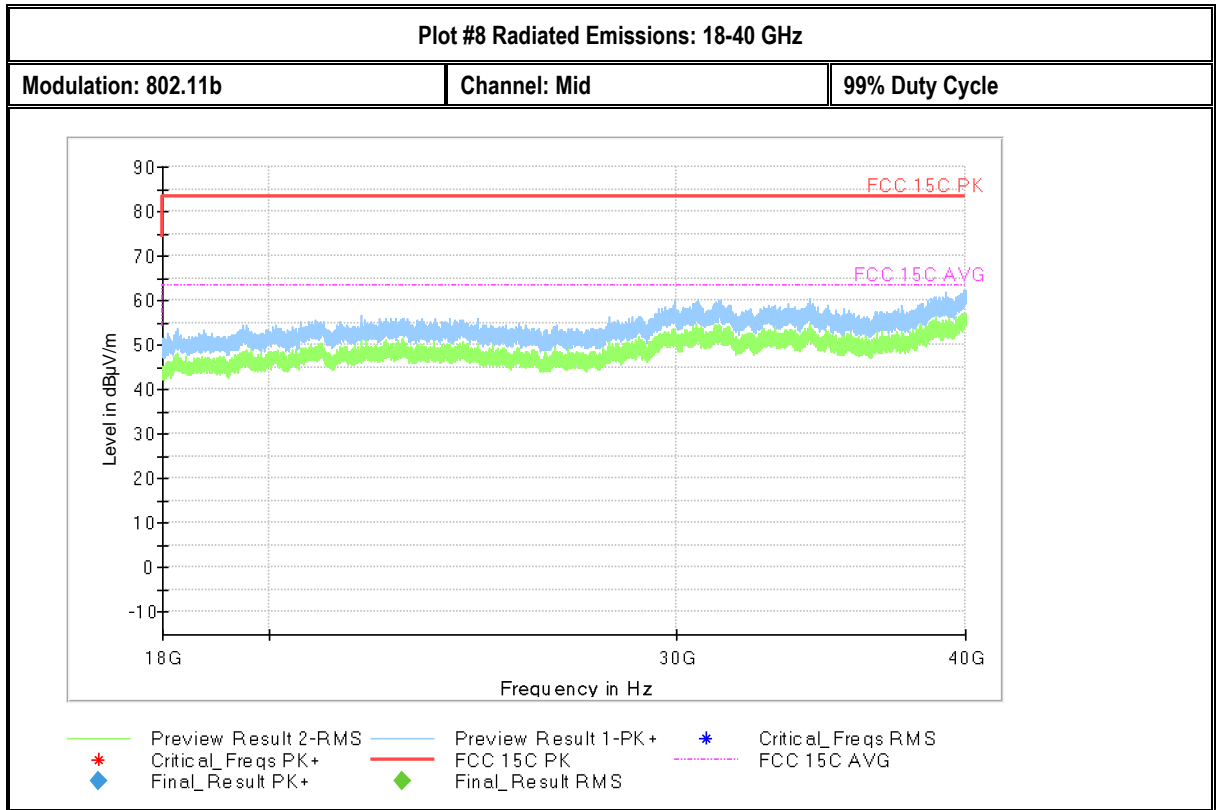


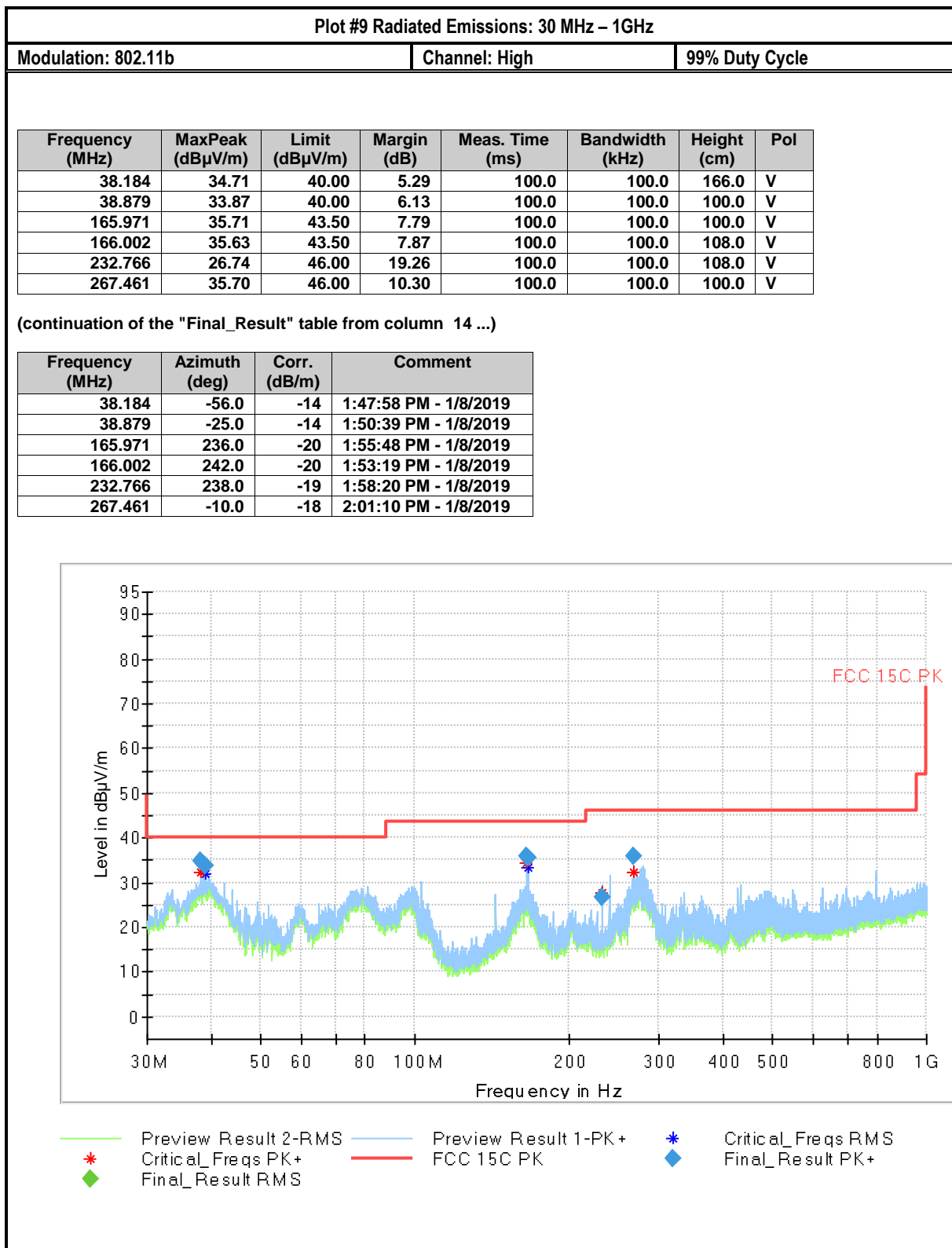


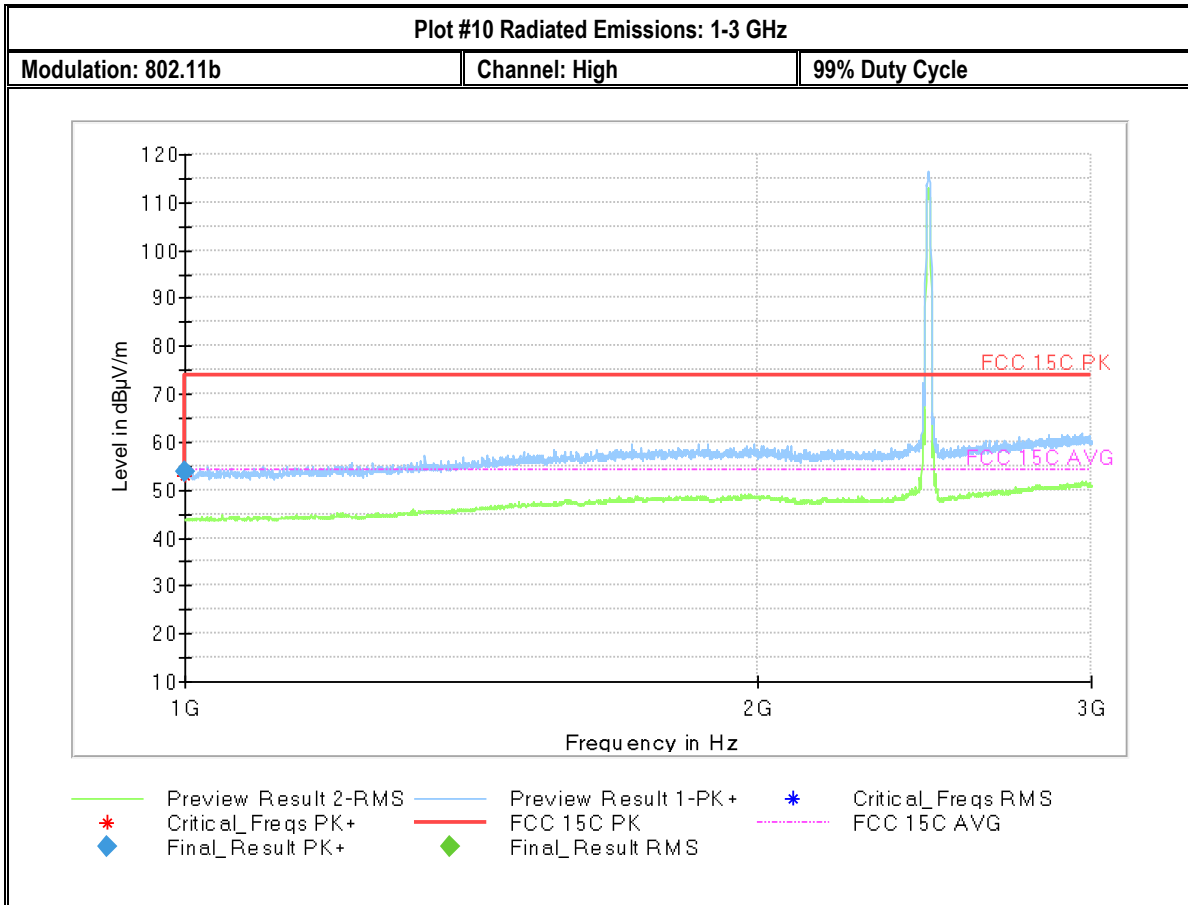


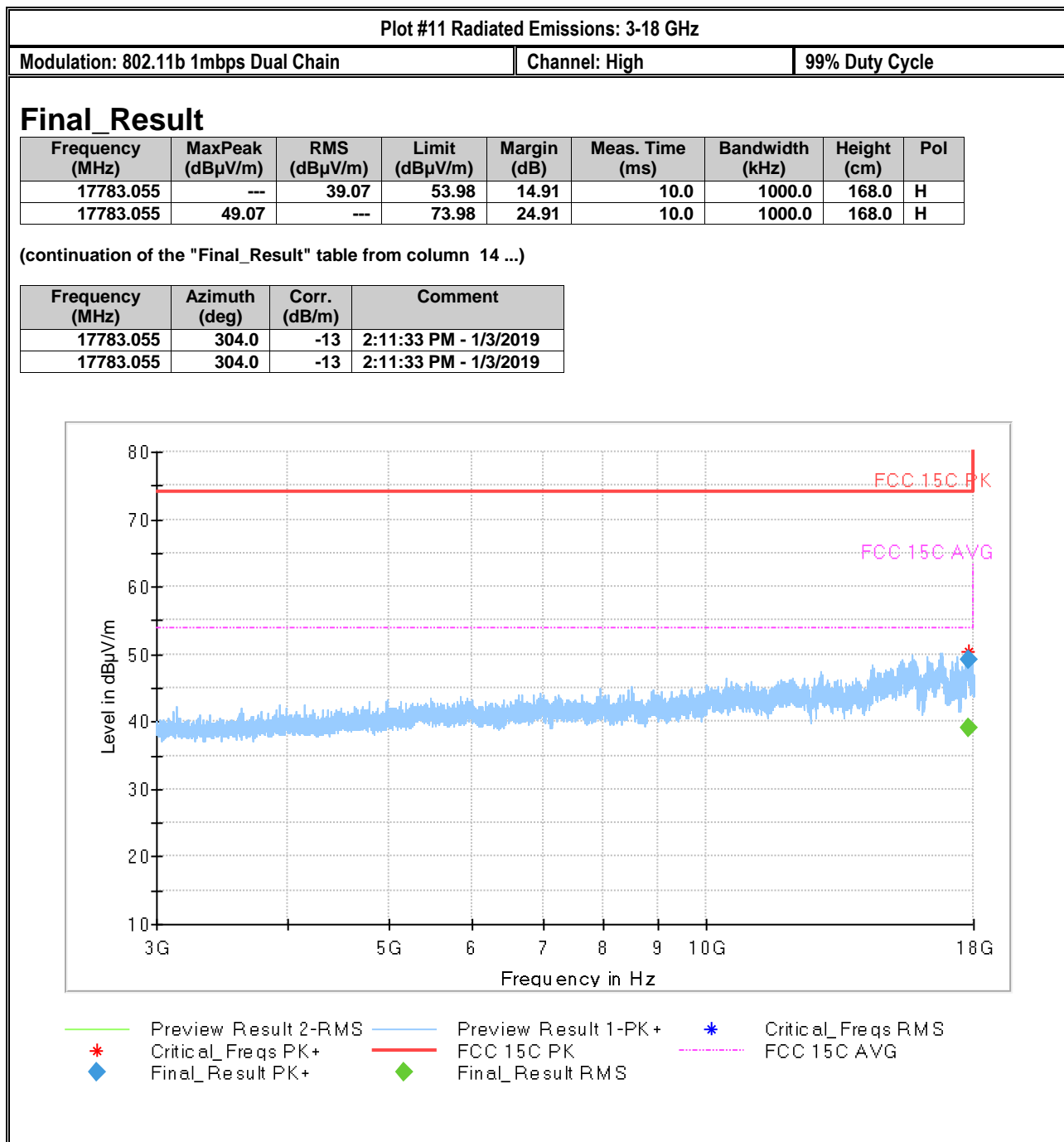


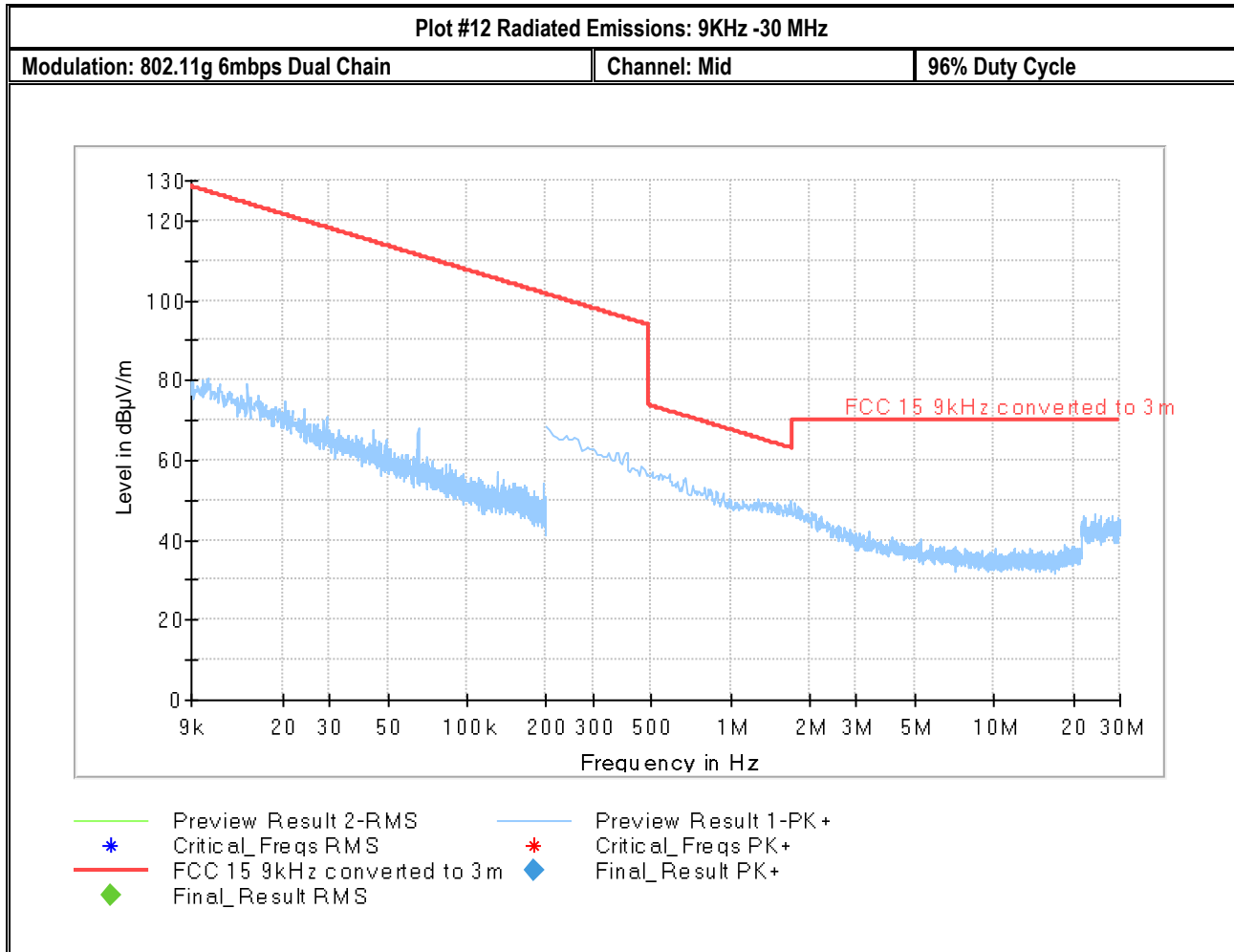


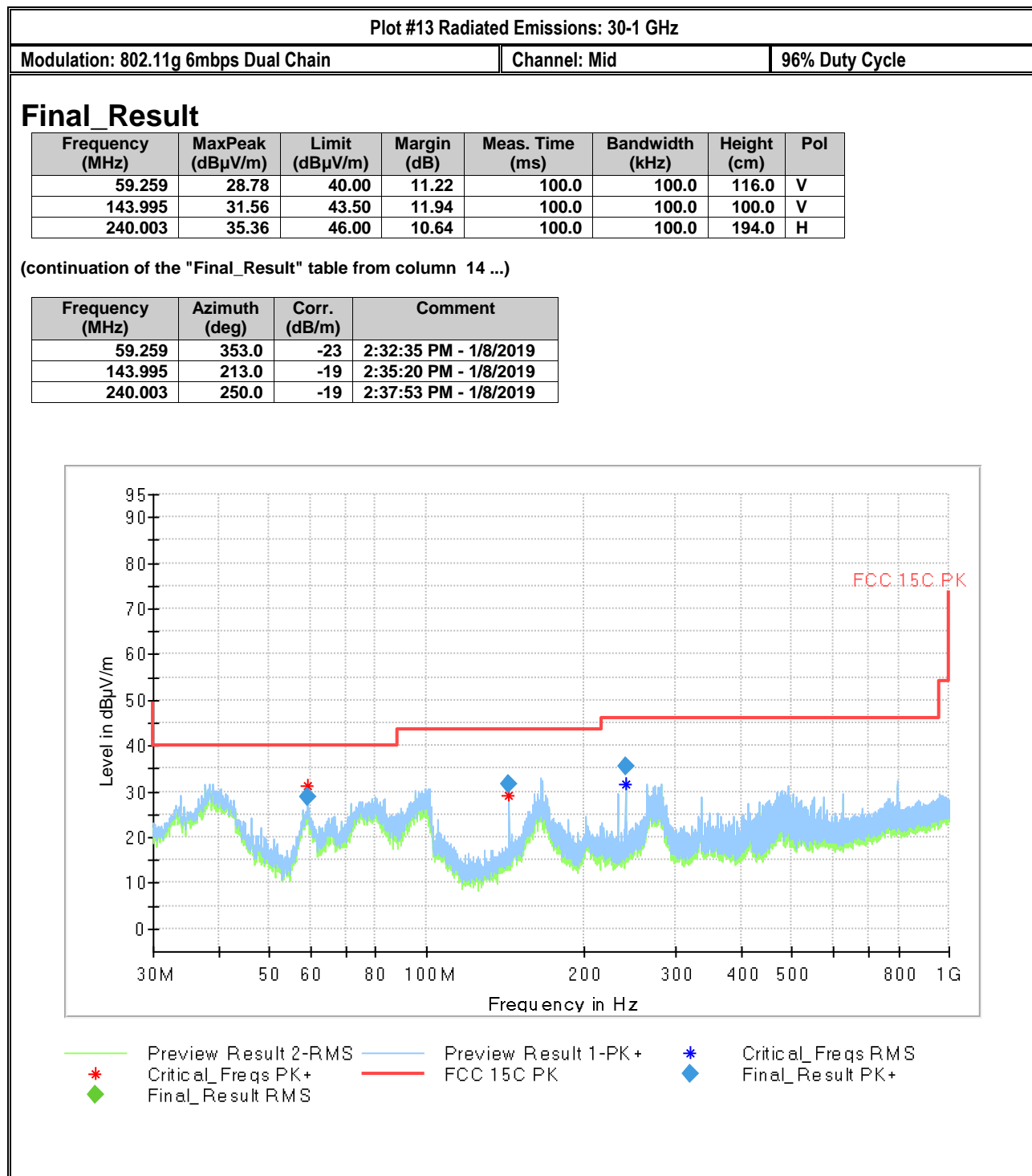


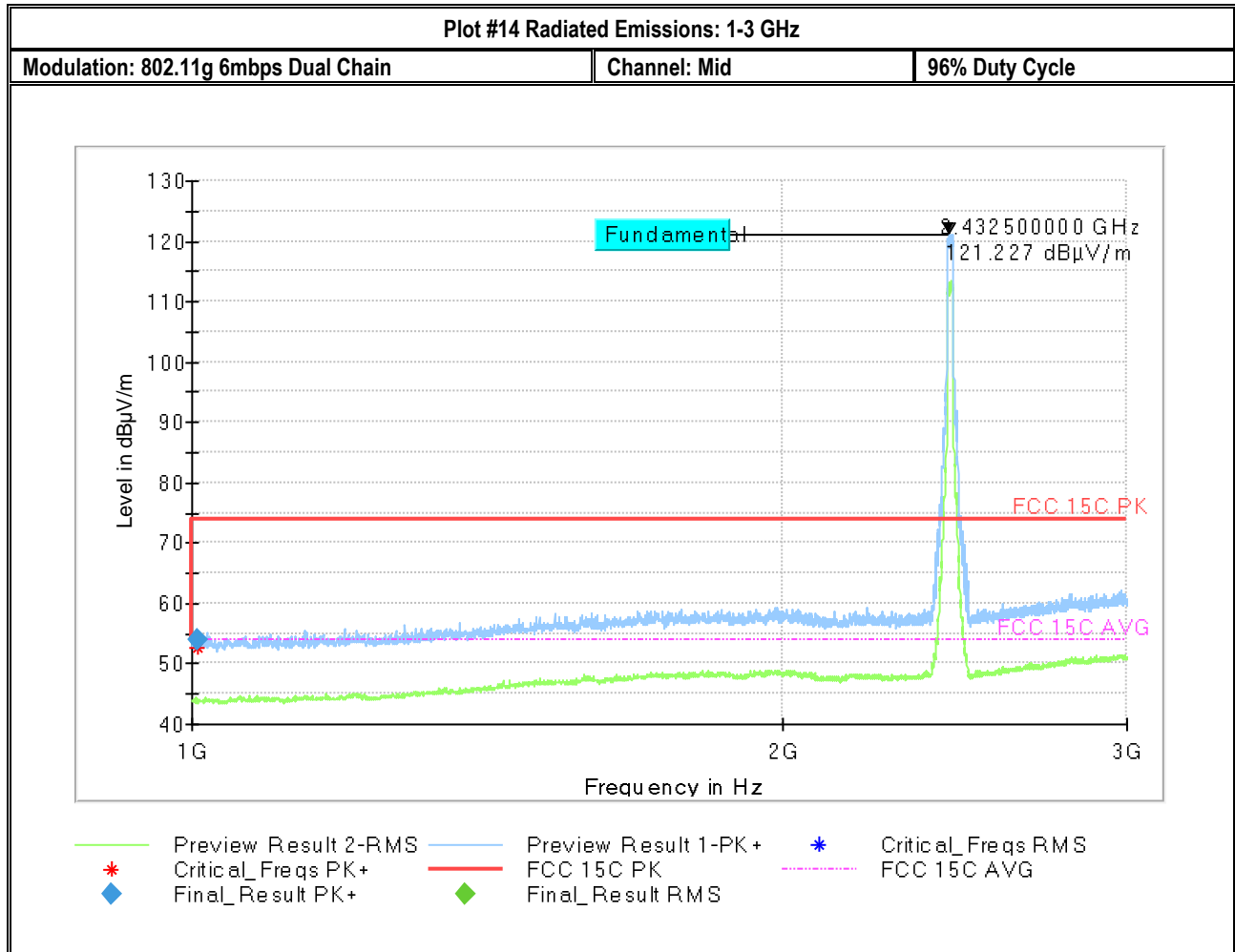












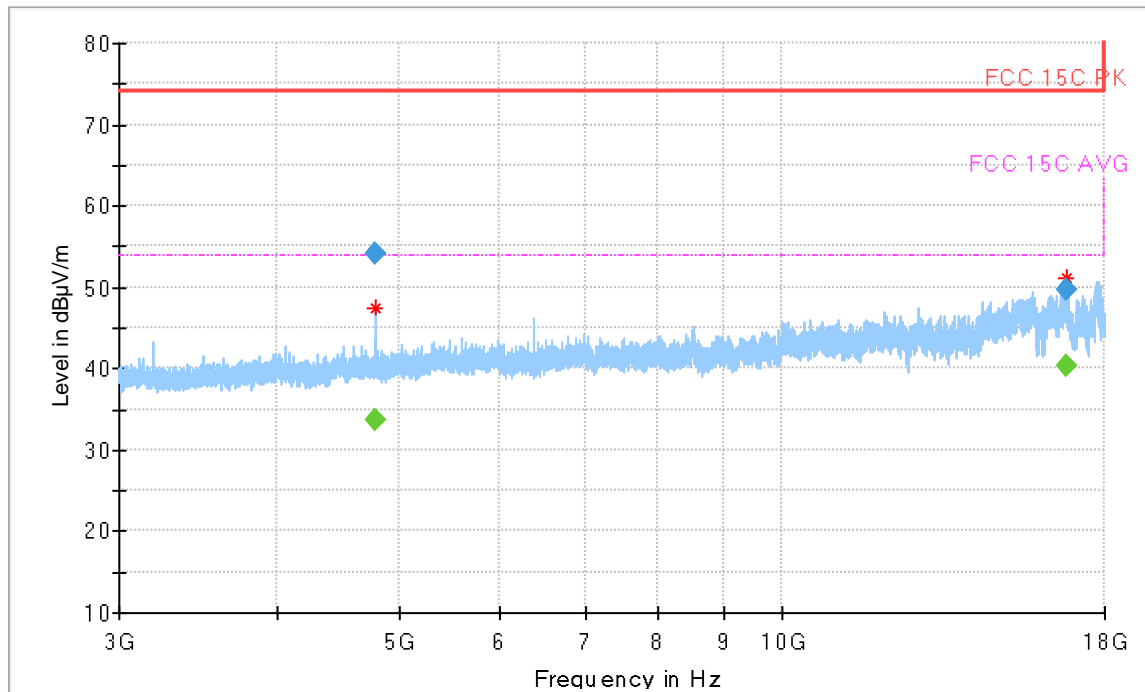
Plot #15 Radiated Emissions: 3-18 GHz

Modulation: 802.11g 6Mbps Dual Chain Channel: Mid 96% Duty Cycle

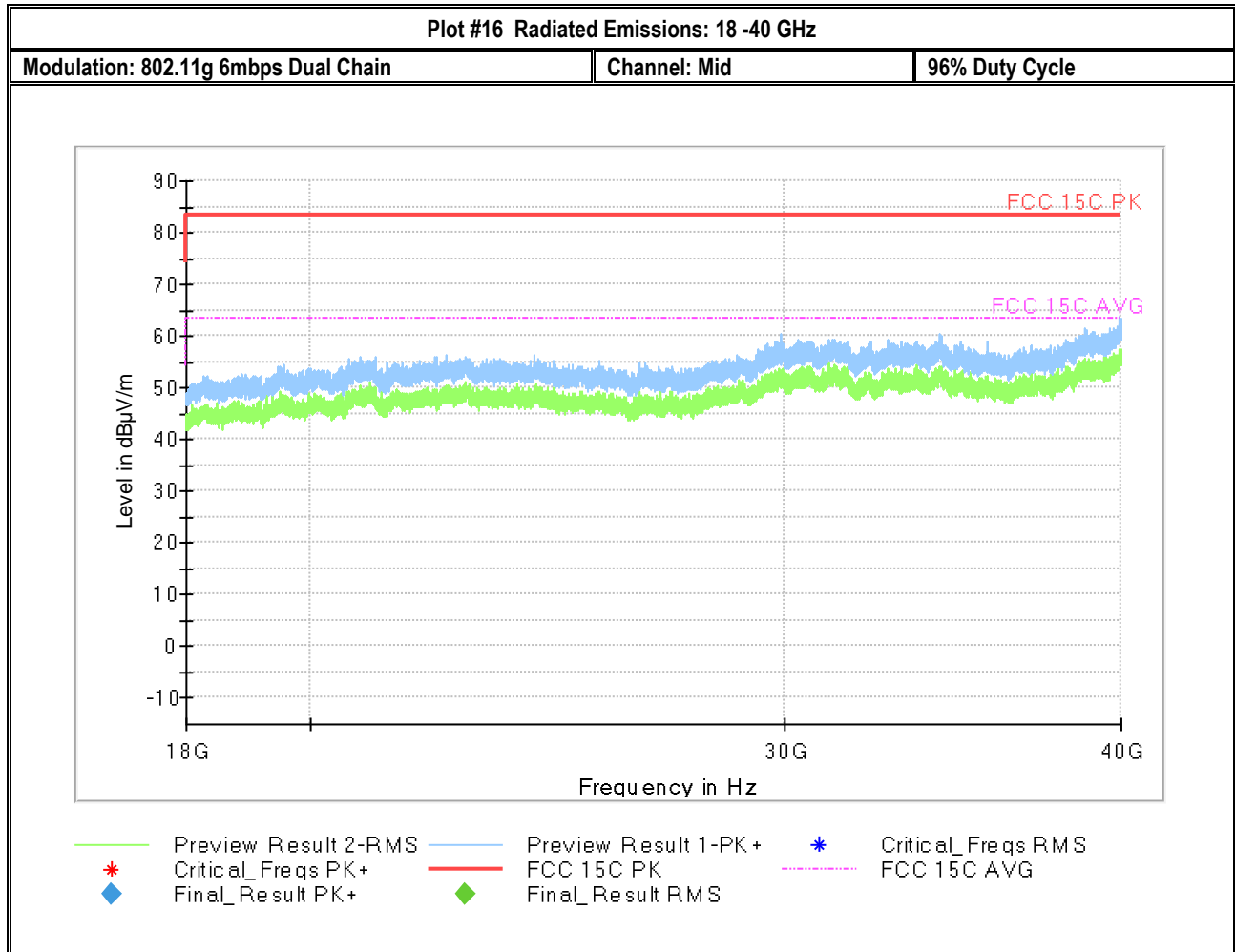
Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
4782.661	54.02	---	73.99	19.97	200.0	1000.0	182.0	V
4782.661	---	33.61	53.98	20.37	200.0	1000.0	182.0	V
16773.012	49.70	---	73.98	24.28	10.0	1000.0	304.0	V
16773.012	---	40.22	53.98	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 PK+
- FCC 15C PK
- Critical_Freqs RMS
- FCC 15C AVG
- Final_Result PK+
- Final_Result RMS



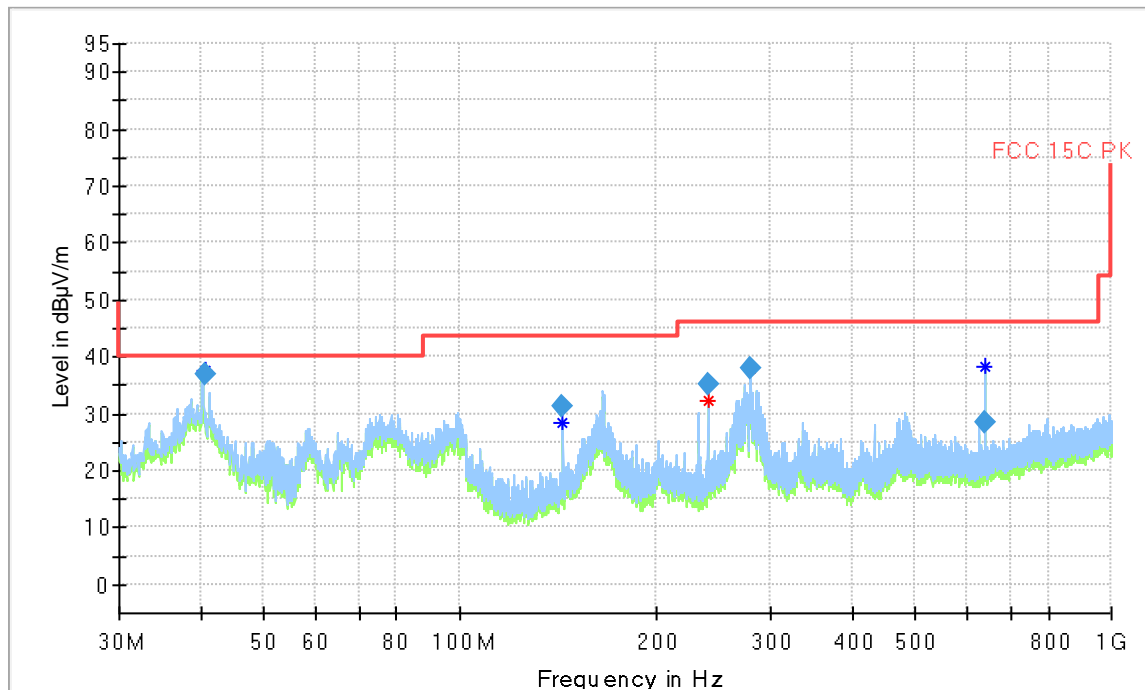
Plot #17 Radiated Emissions: 30-1 GHz

Modulation: 802.11n 20 MSC0 Dual Chain Channel: Mid 95% Duty Cycle

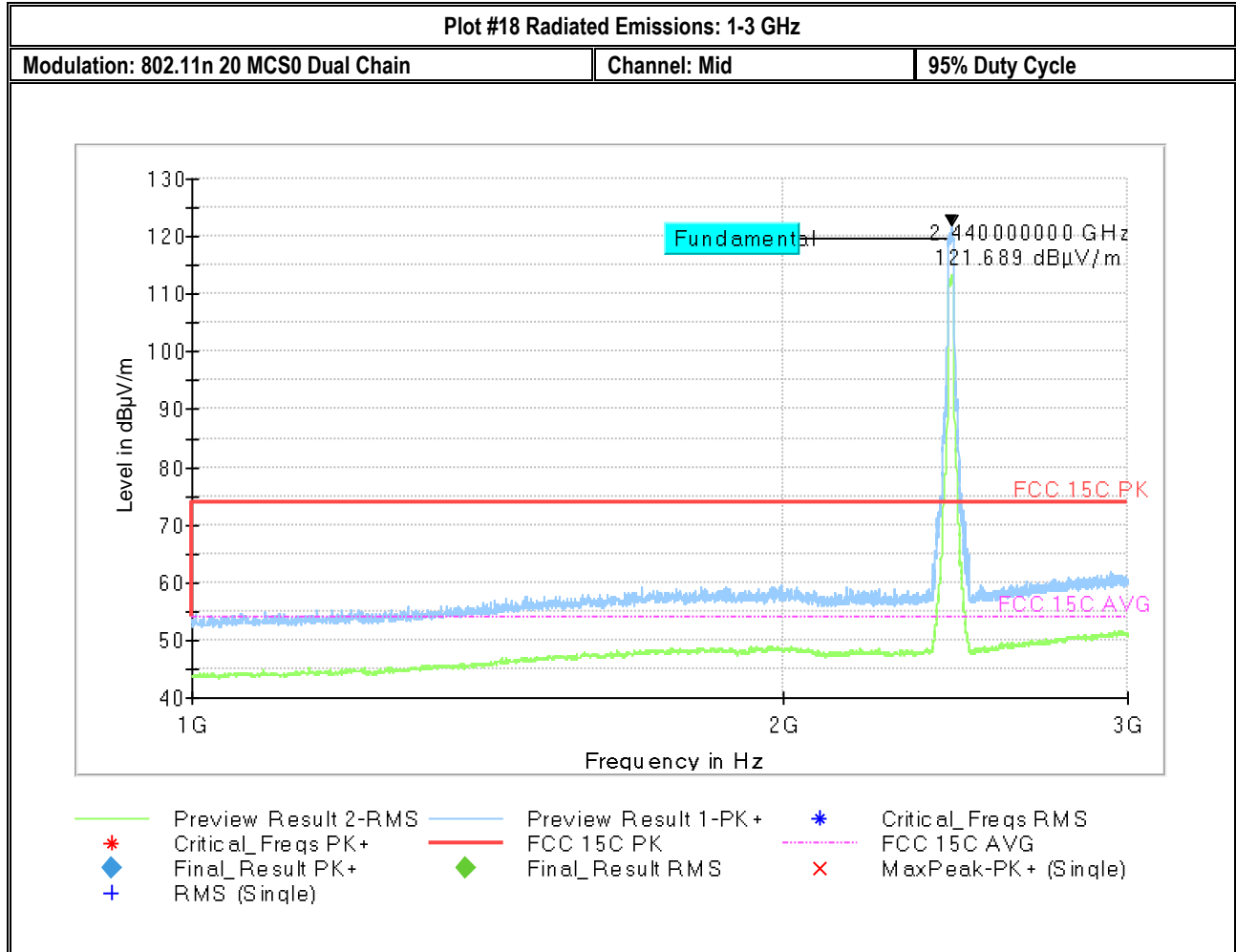
Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
40.653	36.88	---	40.00	3.12	100.0	100.0	145.0	V
144.005	31.17	---	43.50	12.33	100.0	100.0	109.0	V
240.001	35.26	---	46.00	10.74	100.0	100.0	186.0	H
279.706	37.88	---	46.00	8.12	100.0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



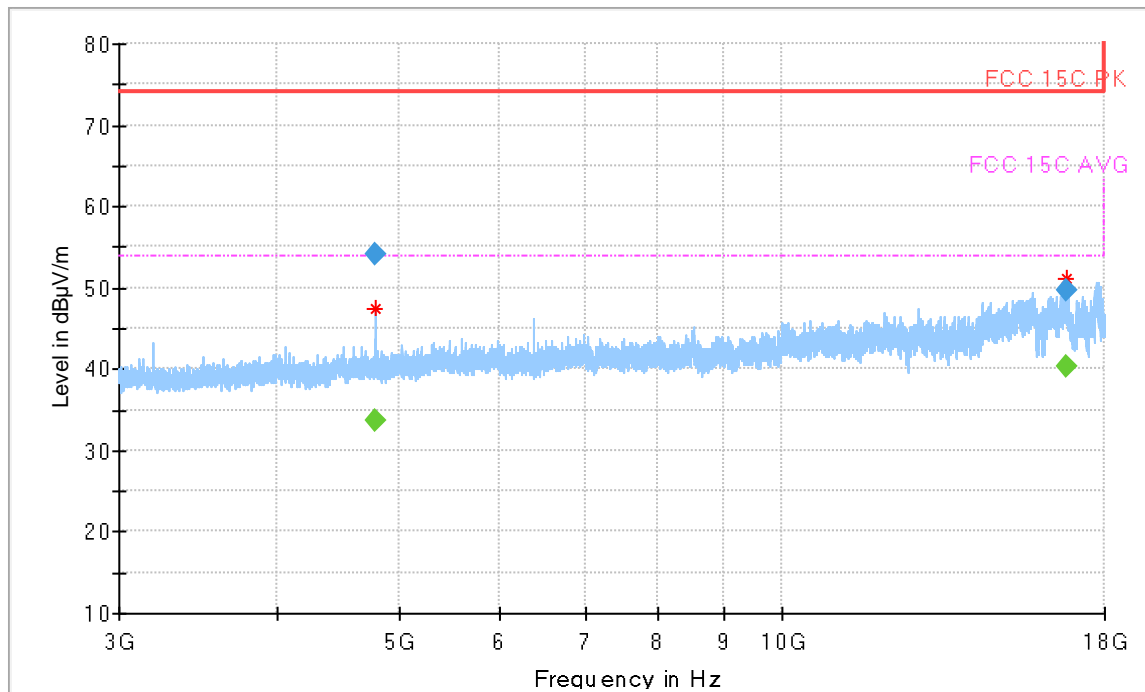
Plot #19 Radiated Emissions: 3-18 GHz

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

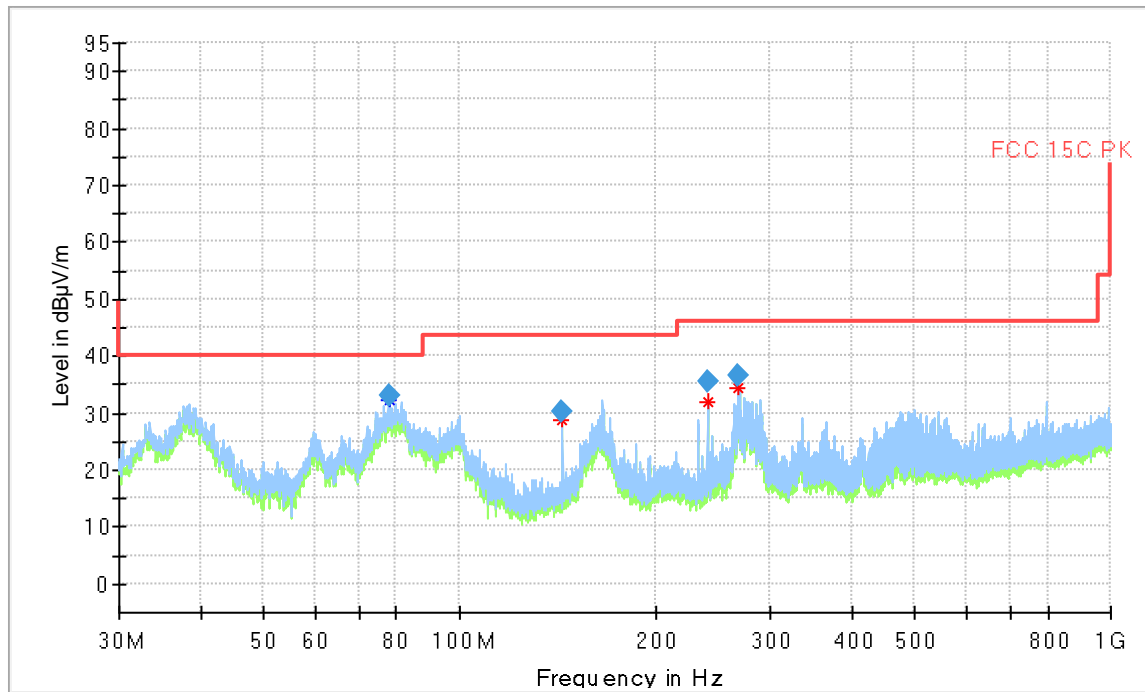
Plot #20 Radiated Emissions: 30-1 GHz

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

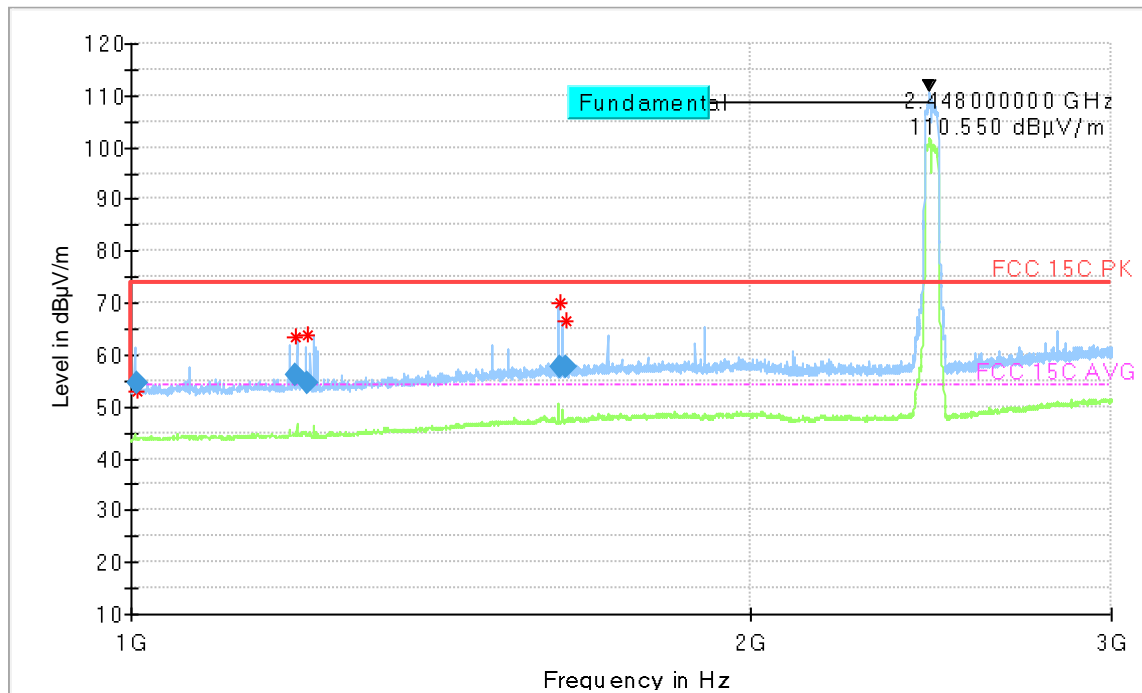
Plot #21 Radiated Emissions: 1-3 GHz

Modulation: 802.11n 40 MCS0 Dual Chain Channel: Mid 92% Duty Cycle

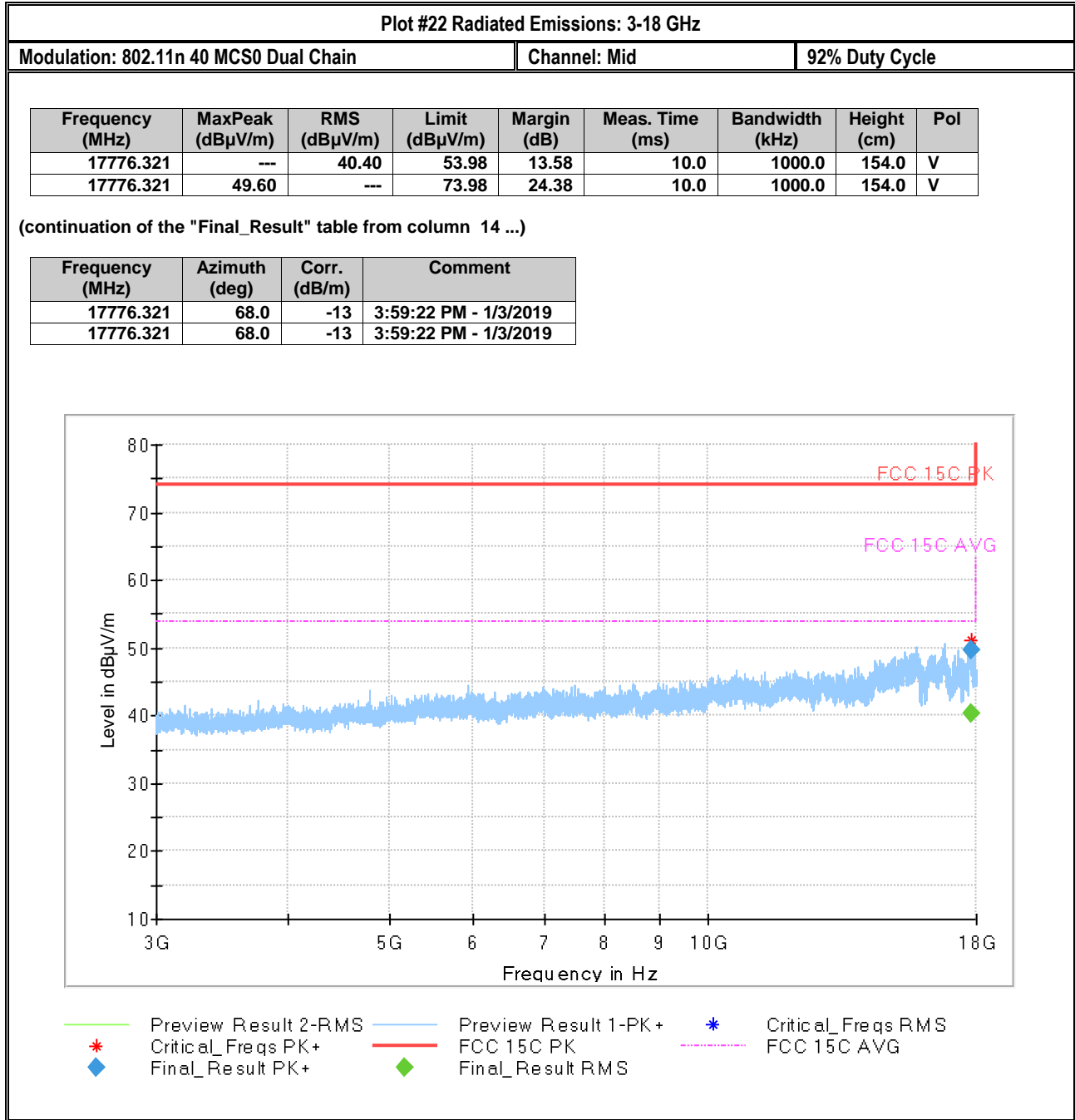
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
1007.675	54.56	74.00	19.44	300.0	1000.0	108.0	V
1202.280	55.98	74.00	18.01	300.0	1000.0	185.0	H
1219.015	54.67	74.00	19.33	300.0	1000.0	291.0	V
1619.155	57.52	74.00	16.48	300.0	1000.0	203.0	H
1627.310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



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:

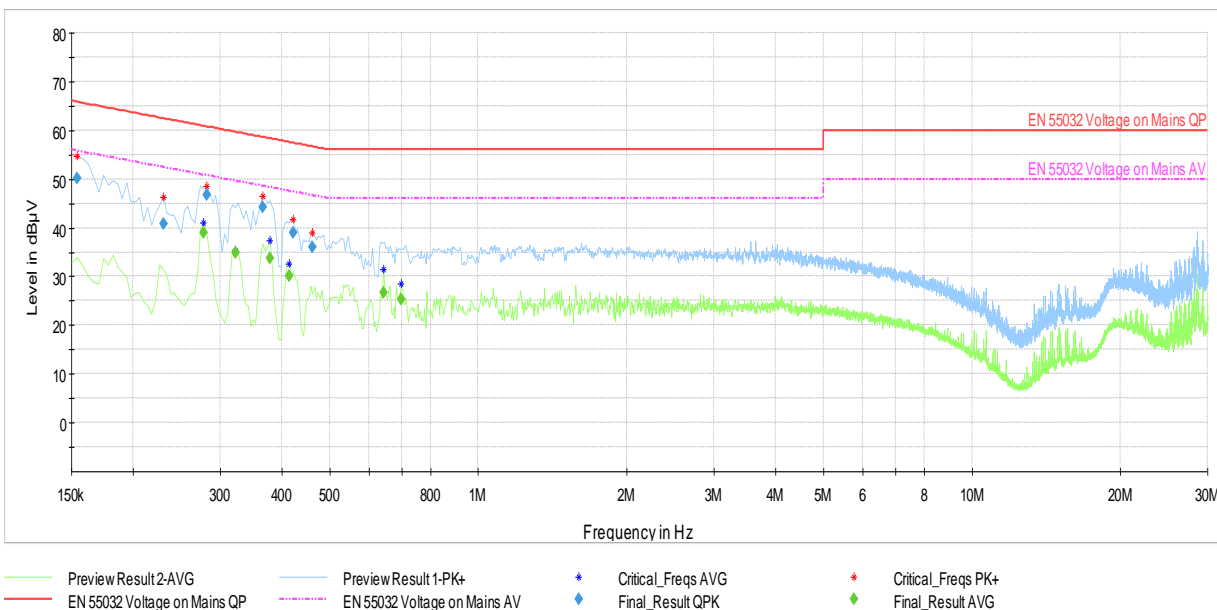
Ambient Temperature ©	EUT Set-Up #	EUT operating mode	Power line (L1, L2, L3, N)	Power Input
22° C	2	Mid channel 80211b	Line & Neutral	110V / 60Hz

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

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"

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.

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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