RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Certification Application Report
FCC Part 15.247 & ISED RSS-247

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Honeywell International Inc. 9680 Old Bailes Road Fort Mill, SC 29707	
FCC ID/ IC	HD5-TAP1000-01/ 1693B-TAP100001	**Test Report Date**	June 15, 2018
Platform	N/A	**RTL Work Order #**	2018064
Model Model #/HVINs	A700x TAP1010-01, TAP1020-01, TAP1030-01	**RTL Quote #**	QRTL18-064A

American National Standard Institute	ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC Classification:	DTS – Part 15 Digital Transmission System (Wi-Fi, BLE)
FCC Rule Part(s)	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10-01-17)
ISED Standards	RSS-247 Issue 2: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
2412-2462 (Wi-Fi)	0.129	N/A	19M6F1D
2402-2480 (BLE)	0.003	N/A	1M40F1D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.10, and ISED RSS-247 and RSS-Gen.

Signature:  Date: June 15, 2018

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

Table of Contents

Figure Index

Table Index

Plot Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

Applicable Standards:

- FCC Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- ISED RSS-247: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
- ISED RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

1.2 Description of EUT

Equipment Under Test	Body-worn transmitter
Model	A700x
Power Supply	Internal rechargeable 3.7VDC Li-Ion Battery
Modulation Type	Wi-Fi: CCK, DSSS; OFDM BLE: GFSK
Frequency Range	Wi-Fi: 2412–2462 MHz BLE: 2402-2480 MHz
Antenna Connector	Internal 3.2 dBi

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10-2013).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for Honeywell International Inc. Model A700x, FCC ID: HD5-TAP1000-01, IC: 1693B-TAP100001. The ISED application includes a family certification for three HVINs: TAP1010-01, TAP1020-01, and TAP1030-01. These 3 HVINs are electrically identical.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested.

Table 2-1: Channels Tested for Wi-Fi – 802.11b (11 Mbps); 802.11g (54 Mbps); 802.11n (6.5 Mbps)

Channel	Frequency (MHz)
1	2412
6	2437
11	2462

Table 2-2: Channels Tested for BLE

Channel	Frequency (MHz)
0	2402
19	2440
39	2480

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted, and all modes were investigated and the worst-case mode was used for final testing. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-3: Test Result Summary – FCC Part 15, Subpart C (Section 15.247); ISED RSS-247, RSS-Gen

Test	FCC Reference	ISED Reference	Result
AC Power Conducted Emissions	FCC 15.207	RSS-Gen 8.8	N/A
Radiated Emissions	FCC 15.209	RSS-247 5.5; RSS-Gen 8.9, 8.10	Pass
Maximum Peak Power Output	FCC 15.247(b)(3)	RSS-247 5.4(d), RSS-Gen 6.12	Pass
Antenna Conducted Spurious Emissions	FCC 15.247(d)	RSS-247 5.5, RSS-Gen 6.13	Pass
Band Edge Measurement	FCC 15.247(d)	RSS-247 5.5	Pass
Power Spectral Density	FCC 15.247(e)	RSS-247 5.2(b)	Pass
6 dB Bandwidth	FCC 15.247(a)(2)	RSS-247 5.2(a)	Pass
99% Bandwidth	N/A	RSS-Gen 6.7	N/A

2.4 Test System Details

The test samples were received on June 5, 2018. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables. The BT transceiver models are electrically identical.

Table 2-4: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
BT Transceiver (conducted)	Honeywell International Inc.	TAP1020-01	7518200122	HD5-TAP1000-01	N/A	22944
BT Transceiver	Honeywell International Inc.	TAP1020-01	7518200106	HD5-TAP1000-01	N/A	22942
BT Transceiver	Honeywell International Inc.	TAP1010-01	7418200070	HD5-TAP1000-01	N/A	22940
3.7V Lithium Ion Battery	Honeywell International Inc.	BT-901	351747034705	N/A	N/A	22950
3.7V Lithium Ion Battery	Honeywell International Inc.	TBA901-01	351747030105	N/A	N/A	22955
3.7V Lithium Ion Battery	Honeywell International Inc.	BT-902	351741029405	N/A	N/A	22952

Table 2-5: Support Equipment

Part	Manufacturer	Model #	Serial Number	FCC ID	Cable Description	RTL Bar Code
Laptop	Samsung	NP300E5A-A01UB	HJVF93EB 903201D	N/A	N/A	901550

2.5 Configuration of Tested System

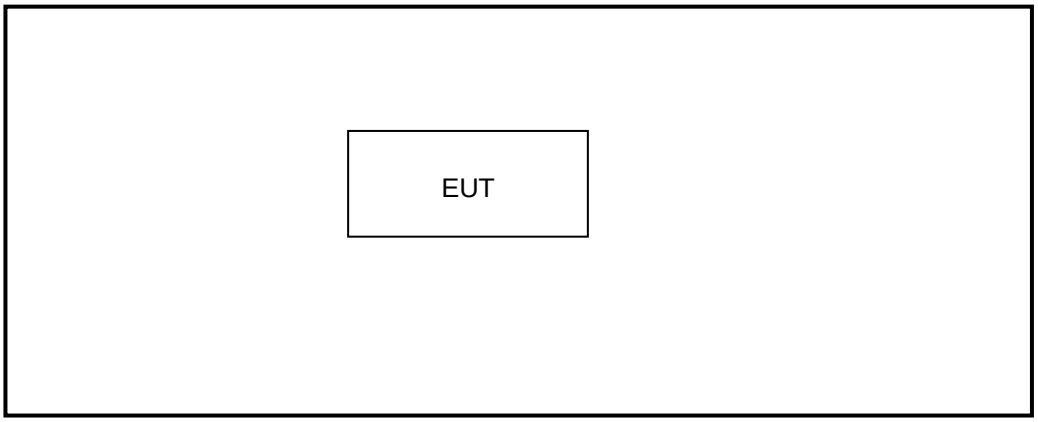


Figure 2-1: Configuration of System Under Test

3 Peak Output Power – FCC 15.247(b)(3); ISED RSS-247 5.4(d), RSS-Gen 6.12

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using a Rhode & Schwarz Analyzer. The following settings were used:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel (5 MHz used)
2) RBW >20 dB bandwidth of the emission being measured (2 MHz used)
3) VBW ≥RBW (3 MHz used)
4) Sweep: Auto
5) Detector function: Peak
6) Trace: Max hold. The trace was allowed to stabilize, and the marker-to-peak function was used to set the marker to the peak of the emission.

3.2 Power Output Test Data

Table 3-1: Power Output Test Data – BLE

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
0	2402	4.6
19	2440	4.4
39	2480	4.2

Table 3-2: Power Output Test Data – 802.11b (11 Mbps)

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	21.1
6	2437	21.1
11	2462	19.9

Table 3-3: Power Output Test Data – 802.11g (54 Mbps)

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	19.0
6	2437	20.1
11	2462	19.0

Table 3-4: Power Output Test Data – 802.11n (MCS7)

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
1	2412	20.5
6	2437	19.2
11	2462	18.6

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty: ±0.5 dB.

RESULTS: PASS

Table 3-5: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19

Test Personnel:

Khue Do		June 6, 2018
Test Engineer	Signature	Date of Test

4 Compliance with the Band Edge – FCC 15.247(d); ISED RSS-247 5.5

4.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. 1 MHz integrated peak (100 kHz RBW/300 kHz VBW) and 1 MHz integrated average (100 MHz RBW/300 kHz VBW) corrected measurements were taken within the restricted band to show compliance.

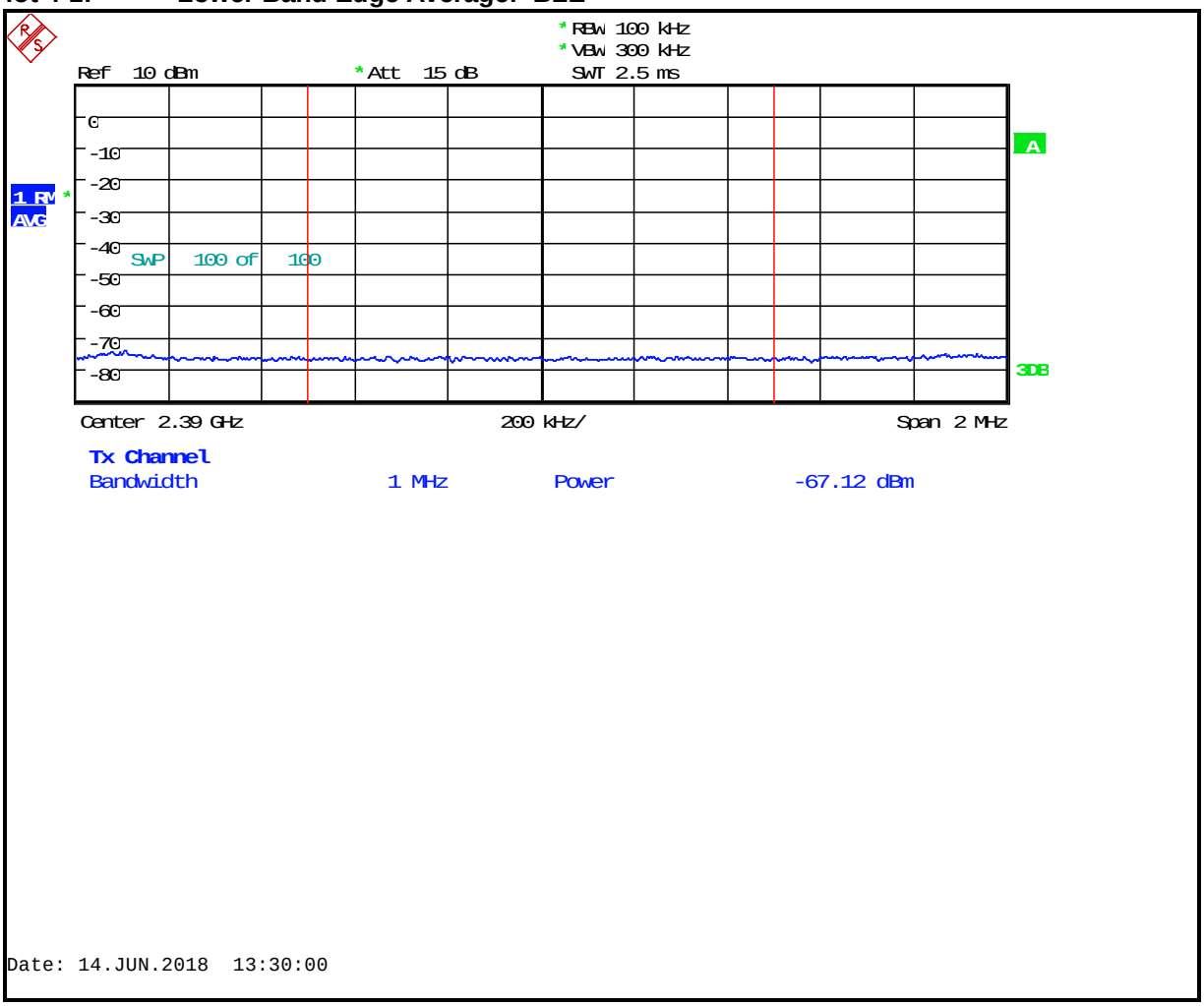
Conversion of dBm to dBuV/m at 3m distance is:

dBuV/m = dBm + 95.2 derived from P=E·d^2/30 and 20log 3m.

4.2 Restricted Band Edge Test Results

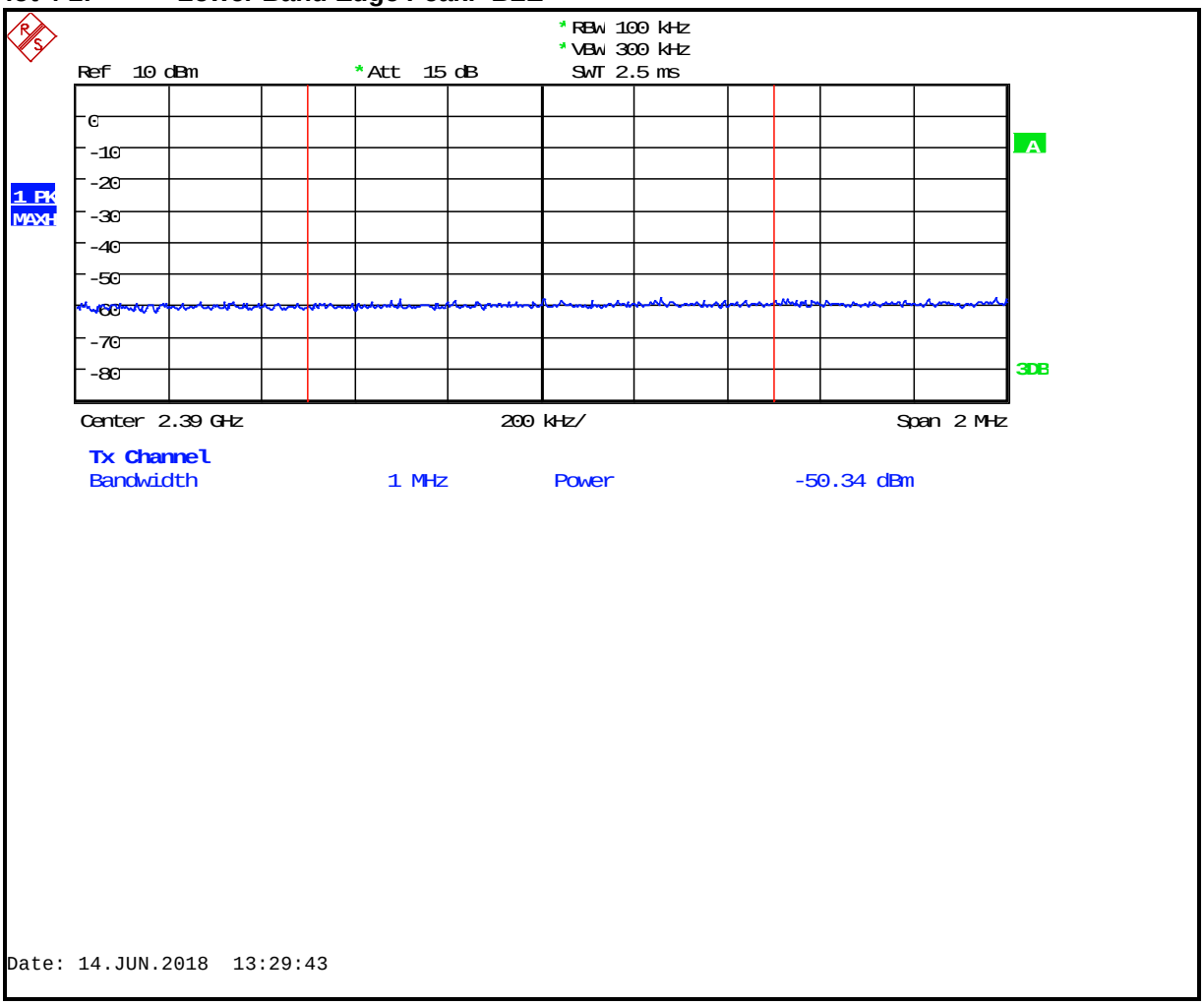
4.2.1 Lower Band Edge

Plot 4-1: Lower Band Edge Average: BLE



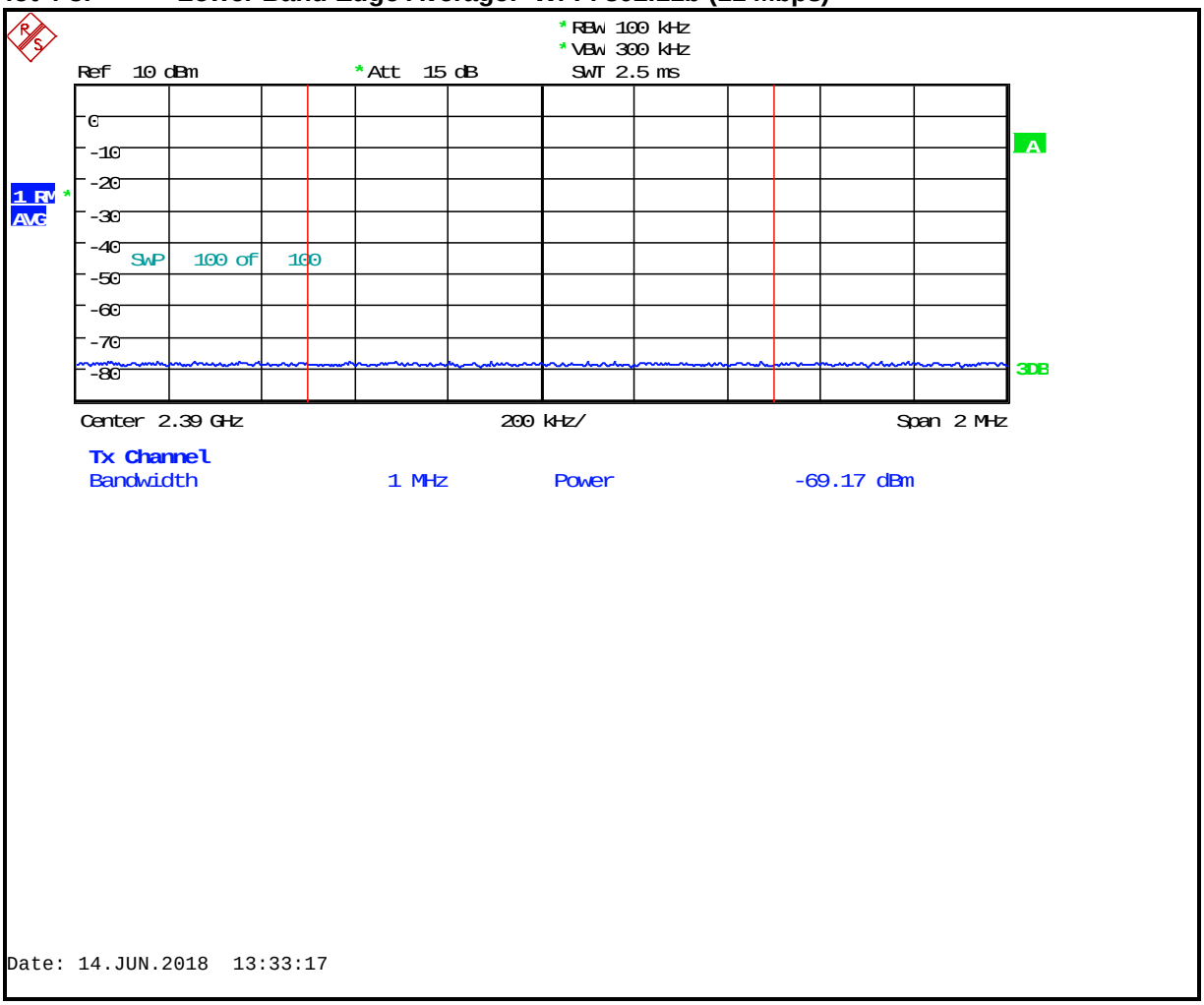
-67.1 + 95.2 = 28.1 dBuV/m – 54 dBuV/m (limit) = -25.9 dB margin

Plot 4-2: Lower Band Edge Peak: BLE



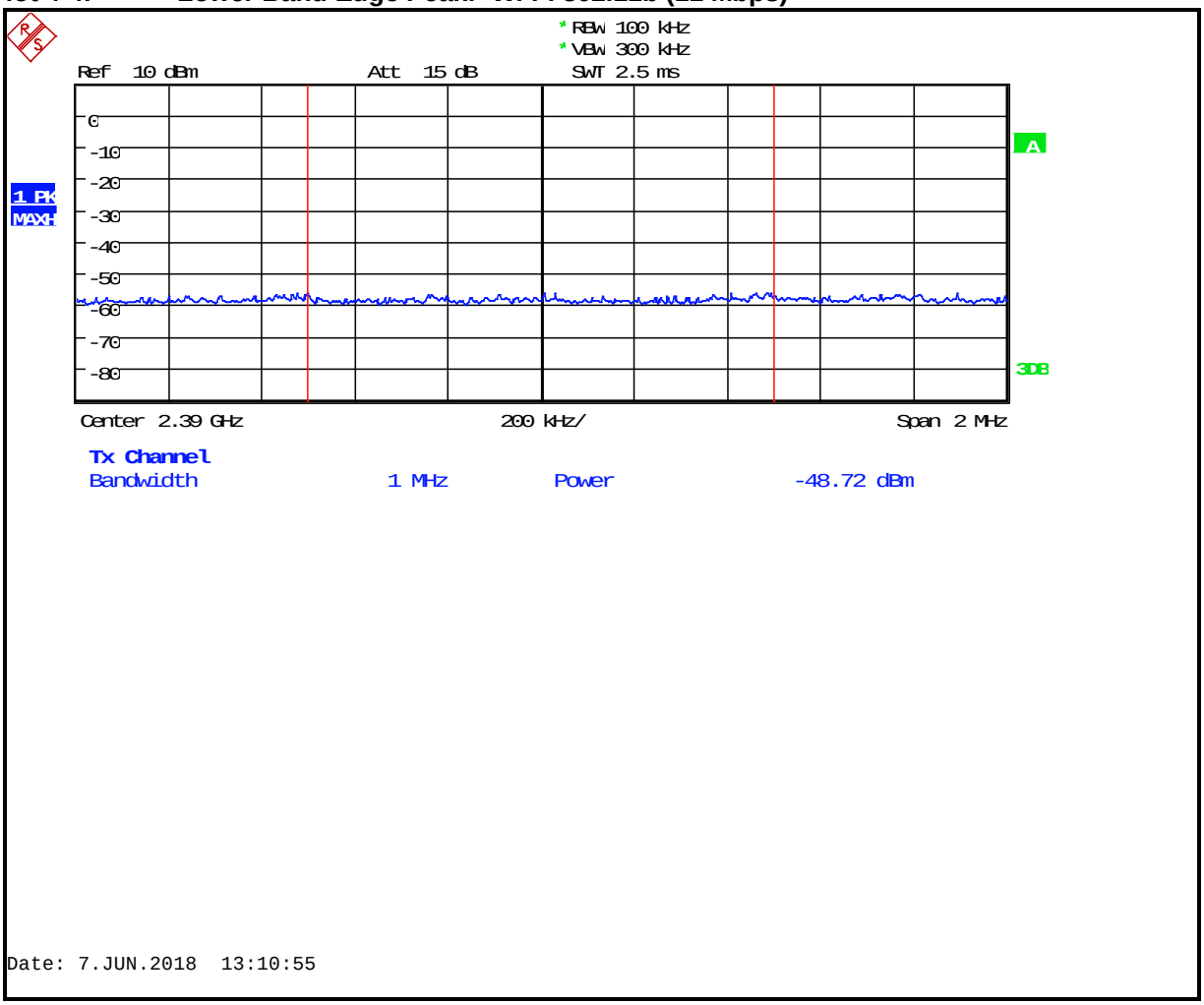
-50.3 + 95.2 = 44.9 dBuV/m – 74 dBuV/m (limit) = -29.1 dB margin

Plot 4-3: Lower Band Edge Average: Wi-Fi 802.11b (11 Mbps)



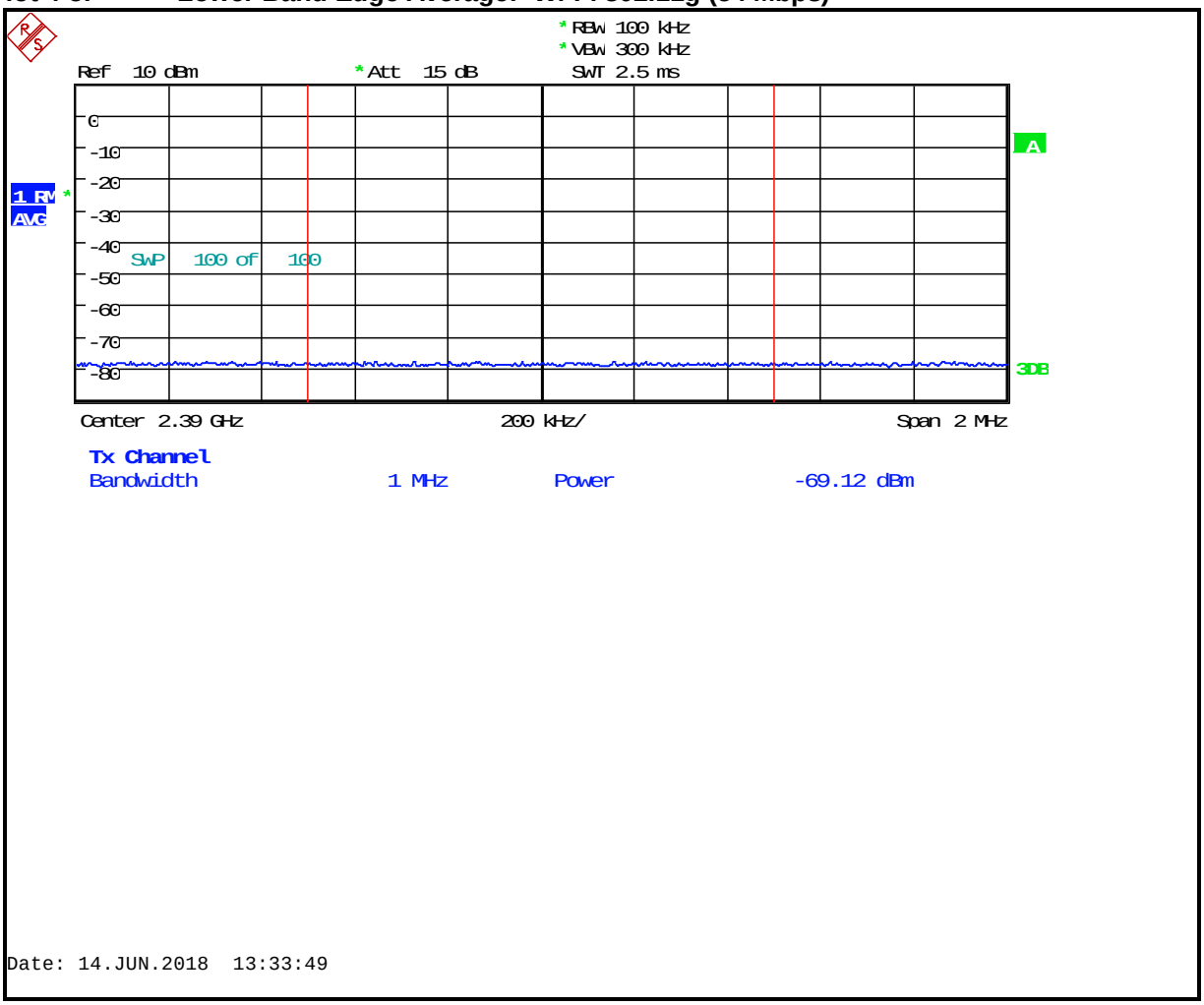
-69.2 + 95.2 = 26 dBuV/m – 54 dBuV/m (limit) = -28 dB margin

Plot 4-4: Lower Band Edge Peak: Wi-Fi 802.11b (11 Mbps)



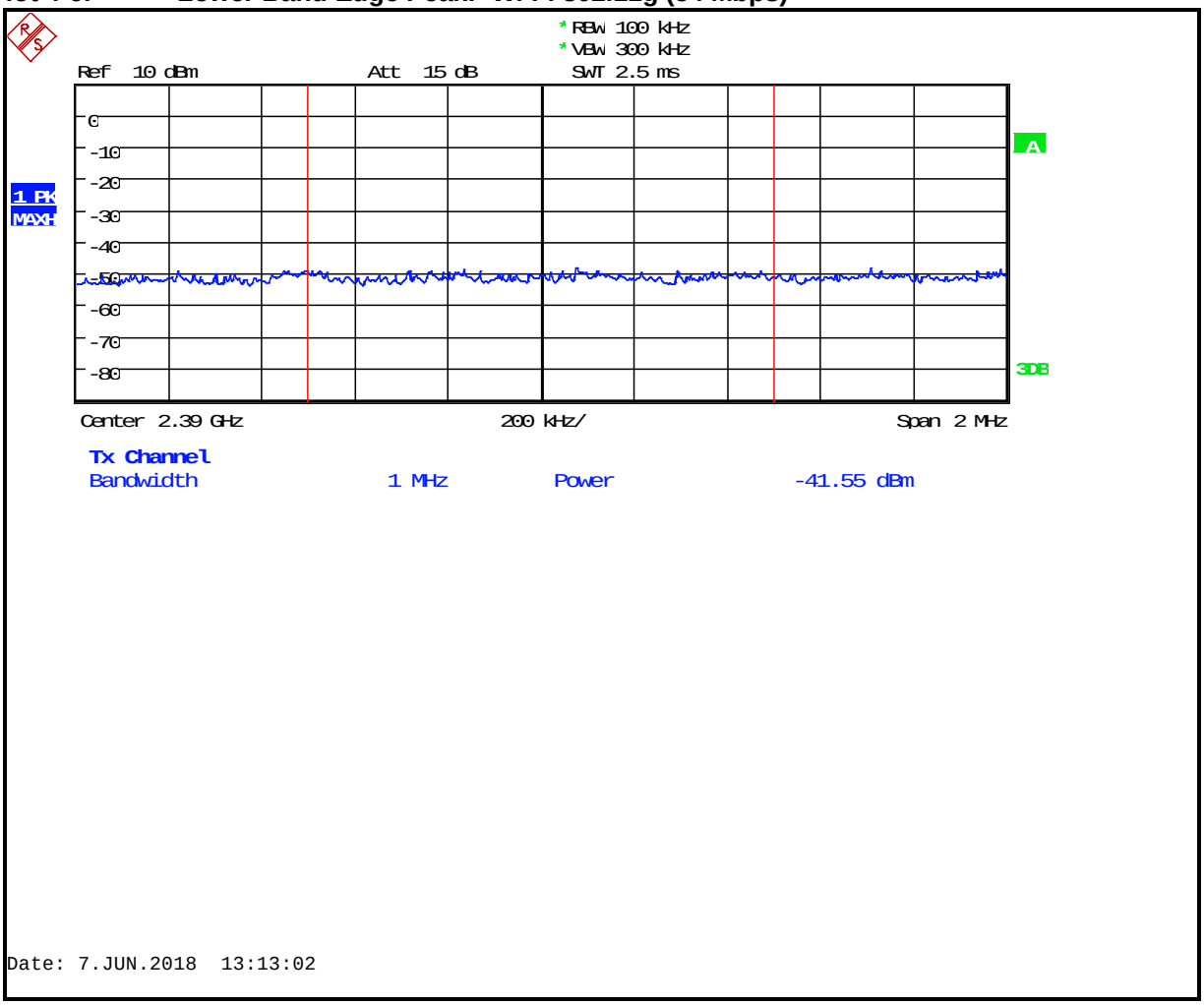
-48.7 + 95.2 = 46.5 dBuV/m – 74 dBuV/m (limit) = -27.5 dB margin

Plot 4-5: Lower Band Edge Average: Wi-Fi 802.11g (54 Mbps)



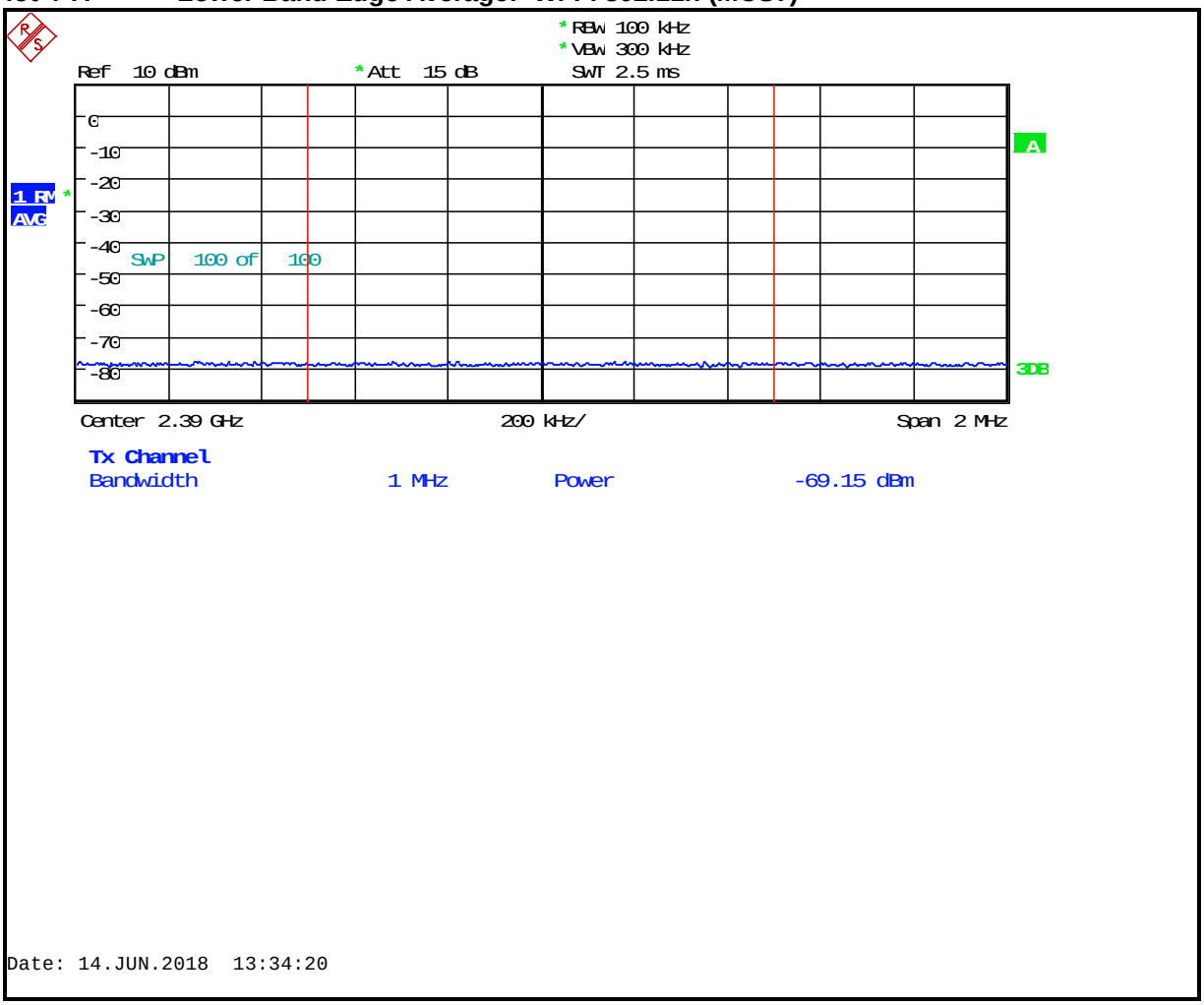
-69.1 + 95.2 = 26.1 dBuV/m – 54 dBuV/m (limit) = -27.9 dB margin

Plot 4-6: Lower Band Edge Peak: Wi-Fi 802.11g (54 Mbps)



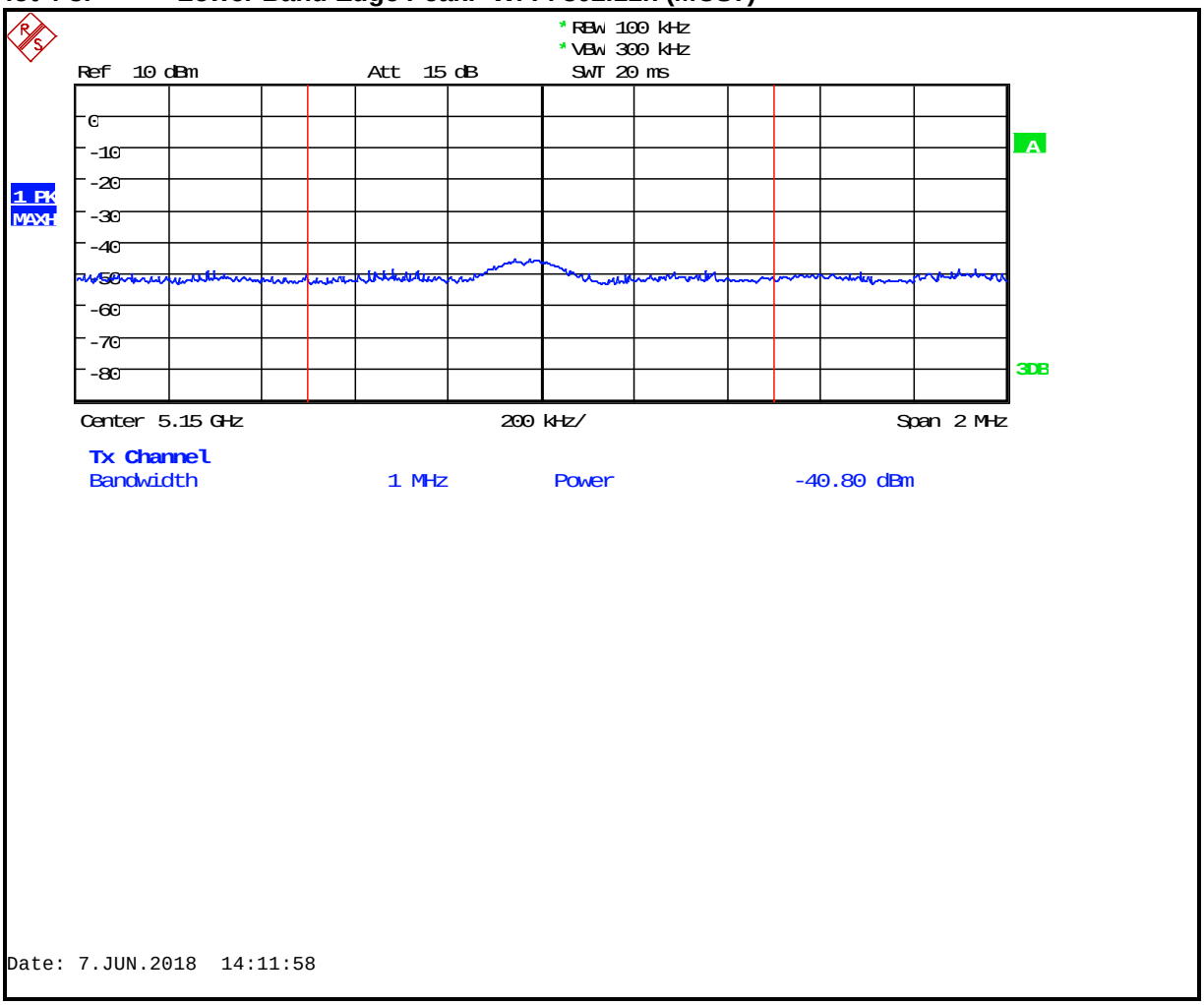
-41.6 + 95.2 = 53.6 dBuV/m – 74 dBuV/m (limit) = -20.4 dB margin

Plot 4-7: Lower Band Edge Average: Wi-Fi 802.11n (MCS7)



-69.2 + 95.2 = 26dBuV/m – 54 dBuV/m (limit) = -28 dB margin

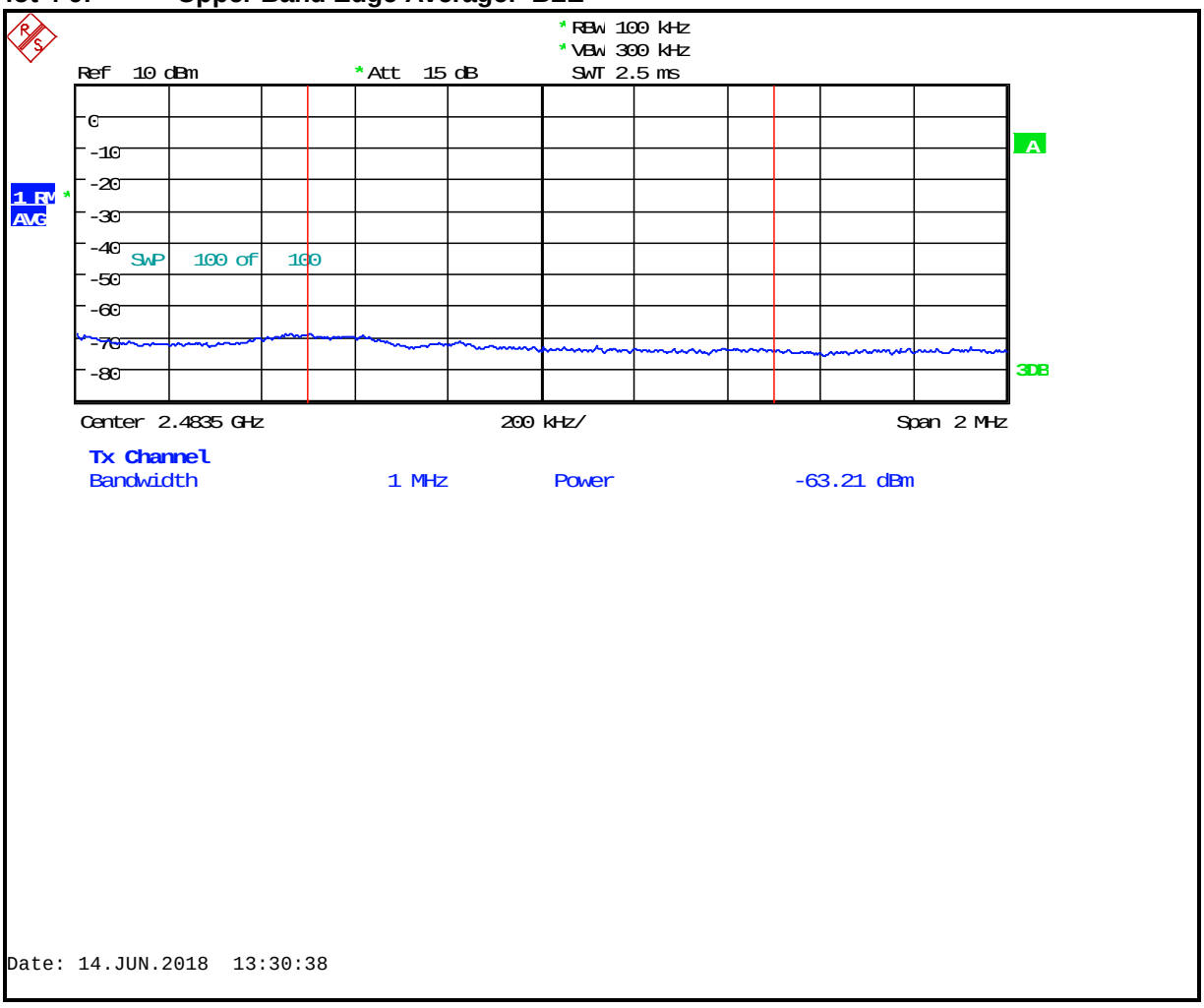
Plot 4-8: Lower Band Edge Peak: Wi-Fi 802.11n (MCS7)



-40.8 + 95.2 = 54.4 dBuV/m – 74 dBuV/m (limit) = -19.6 dB margin

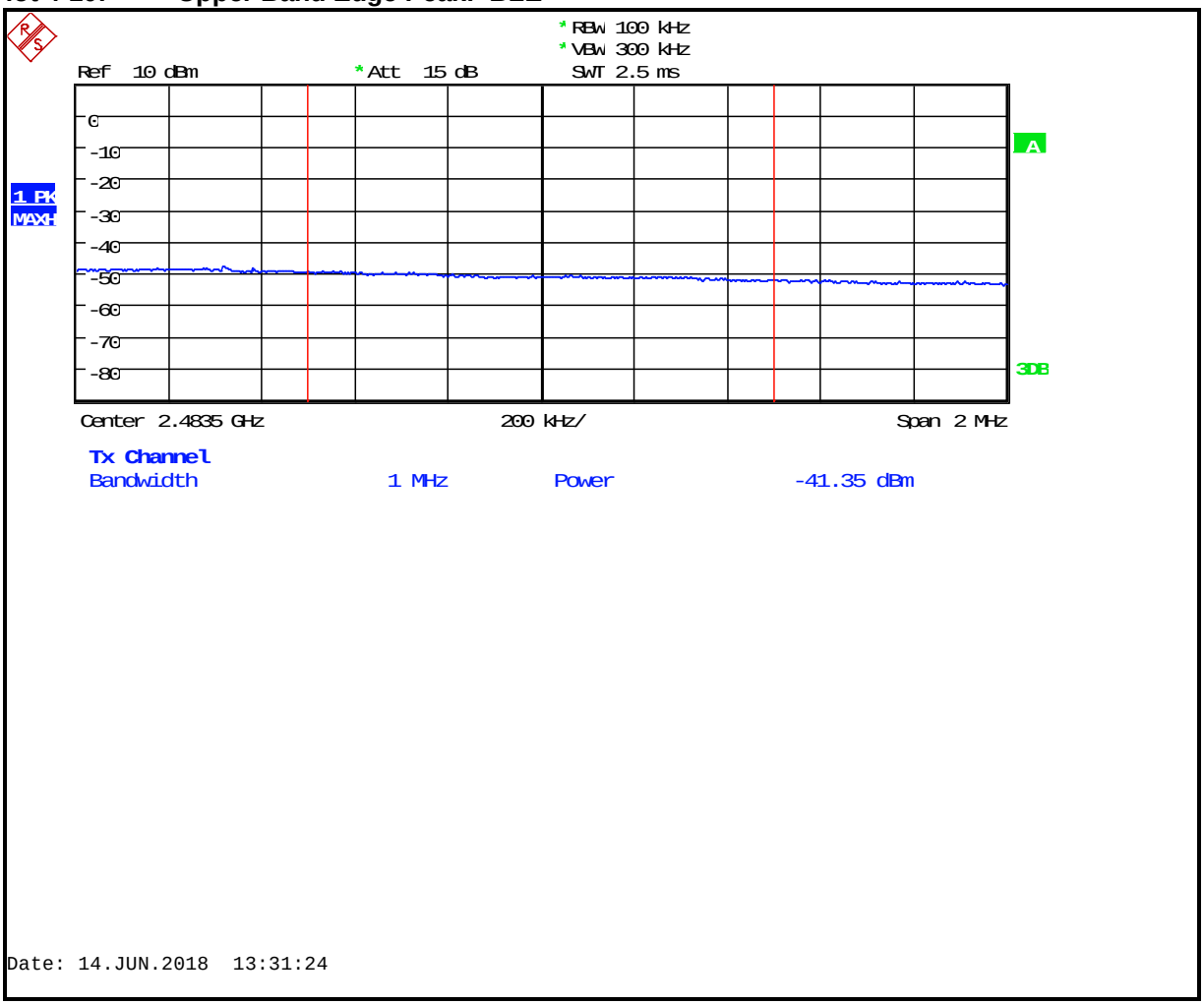
4.2.2 Upper Band Edge

Plot 4-9: Upper Band Edge Average: BLE



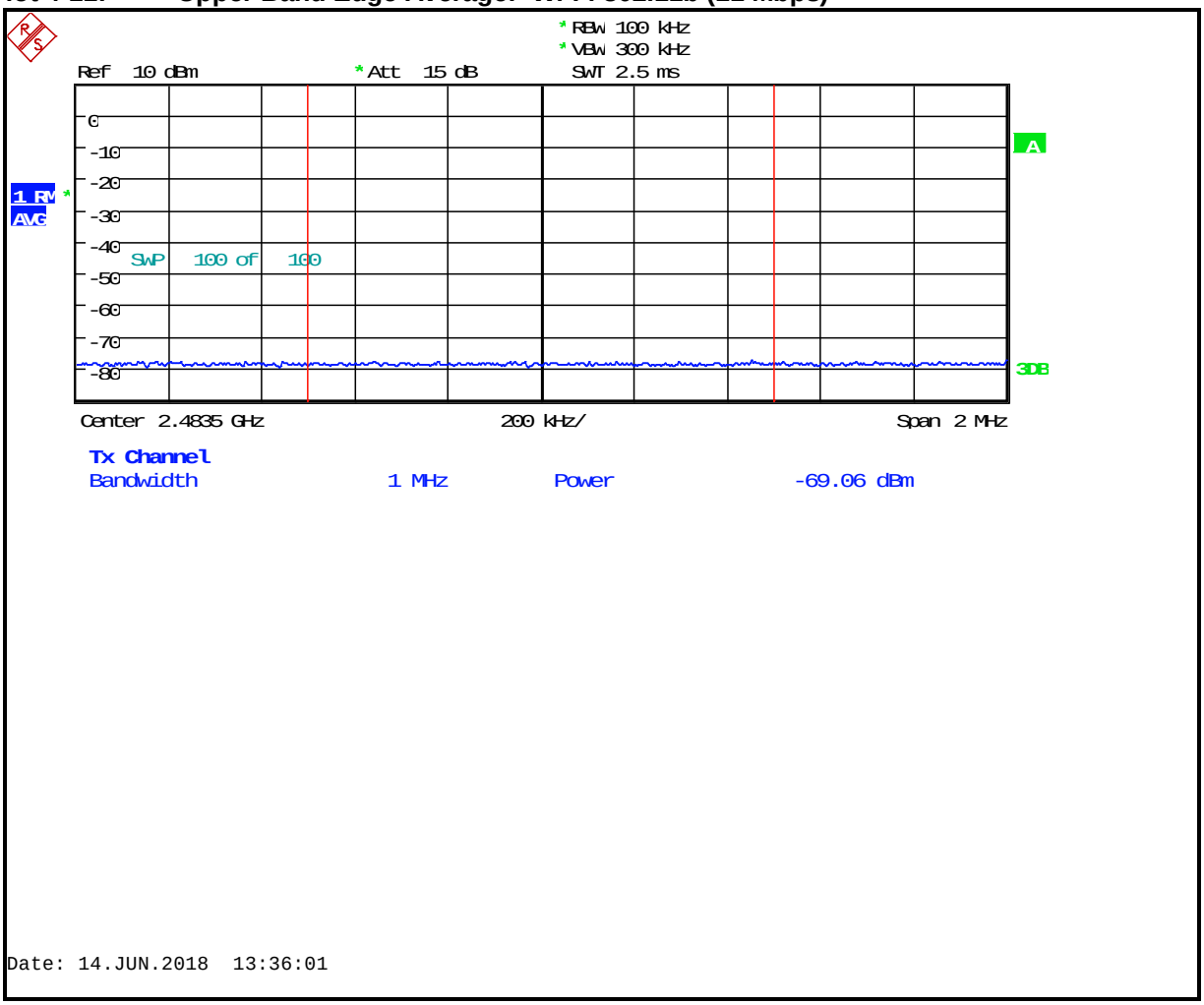
-63.2 + 95.2 = 32 dBuV/m – 54 dBuV/m (limit) = -22 dB margin

Plot 4-10: Upper Band Edge Peak: BLE



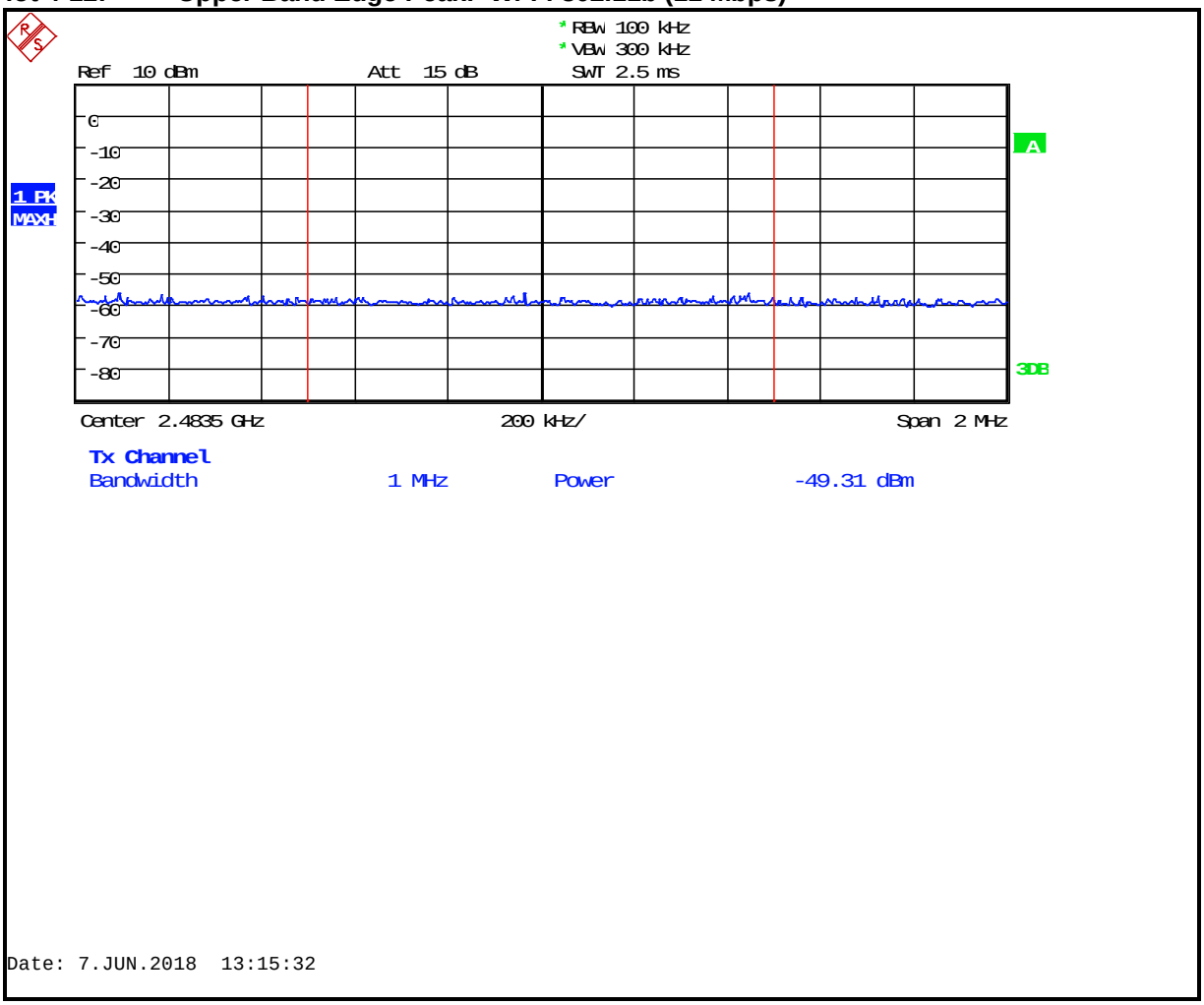
-41.4 + 95.2 = 53.8 dBuV/m – 74 dBuV/m (limit) = -20.2 dB margin

Plot 4-11: Upper Band Edge Average: Wi-Fi 802.11b (11 Mbps)



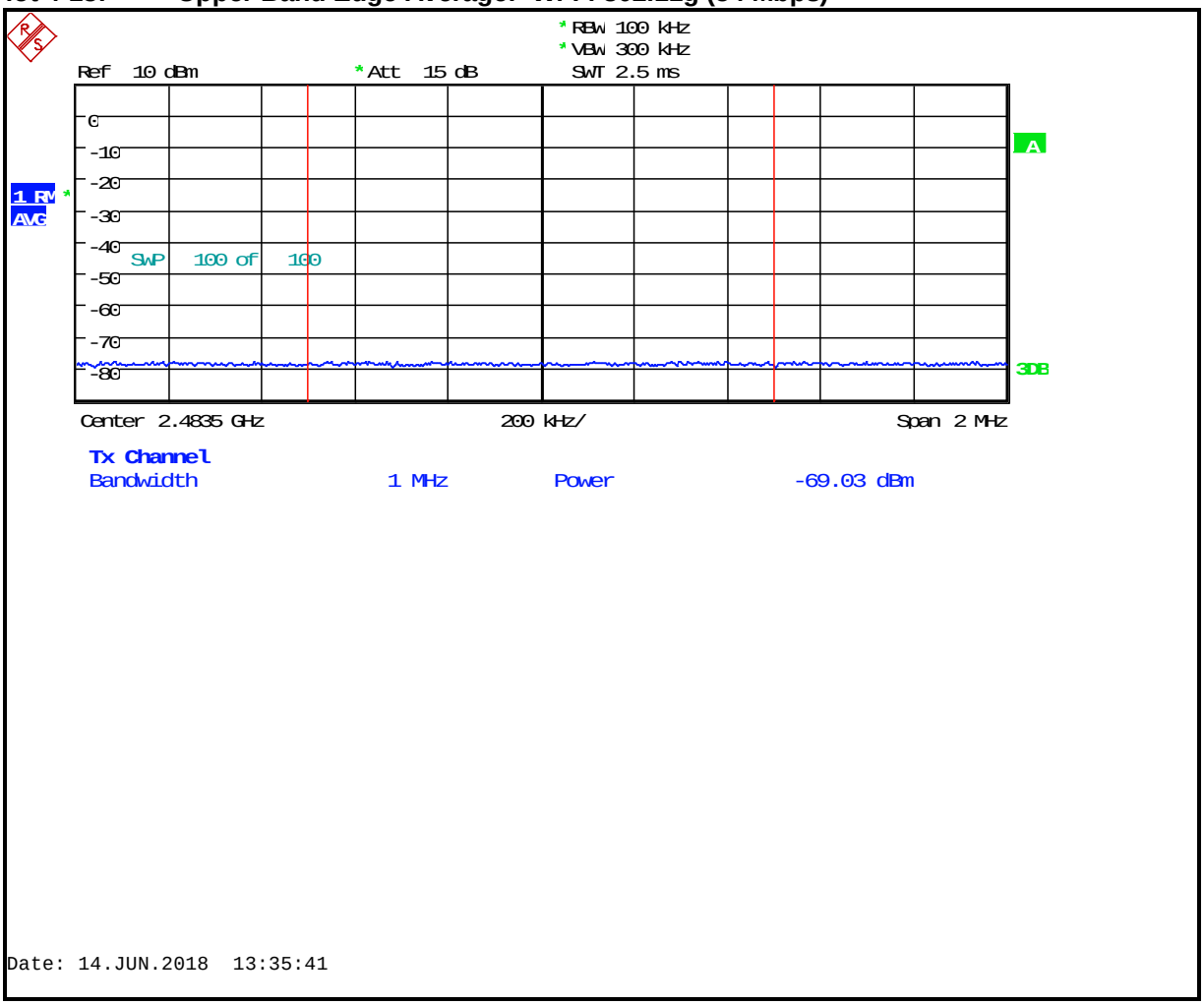
-69.1 + 95.2 = 26.1 dBuV/m – 54 dBuV/m (limit) = -27.9 dB margin

Plot 4-12: Upper Band Edge Peak: Wi-Fi 802.11b (11 Mbps)



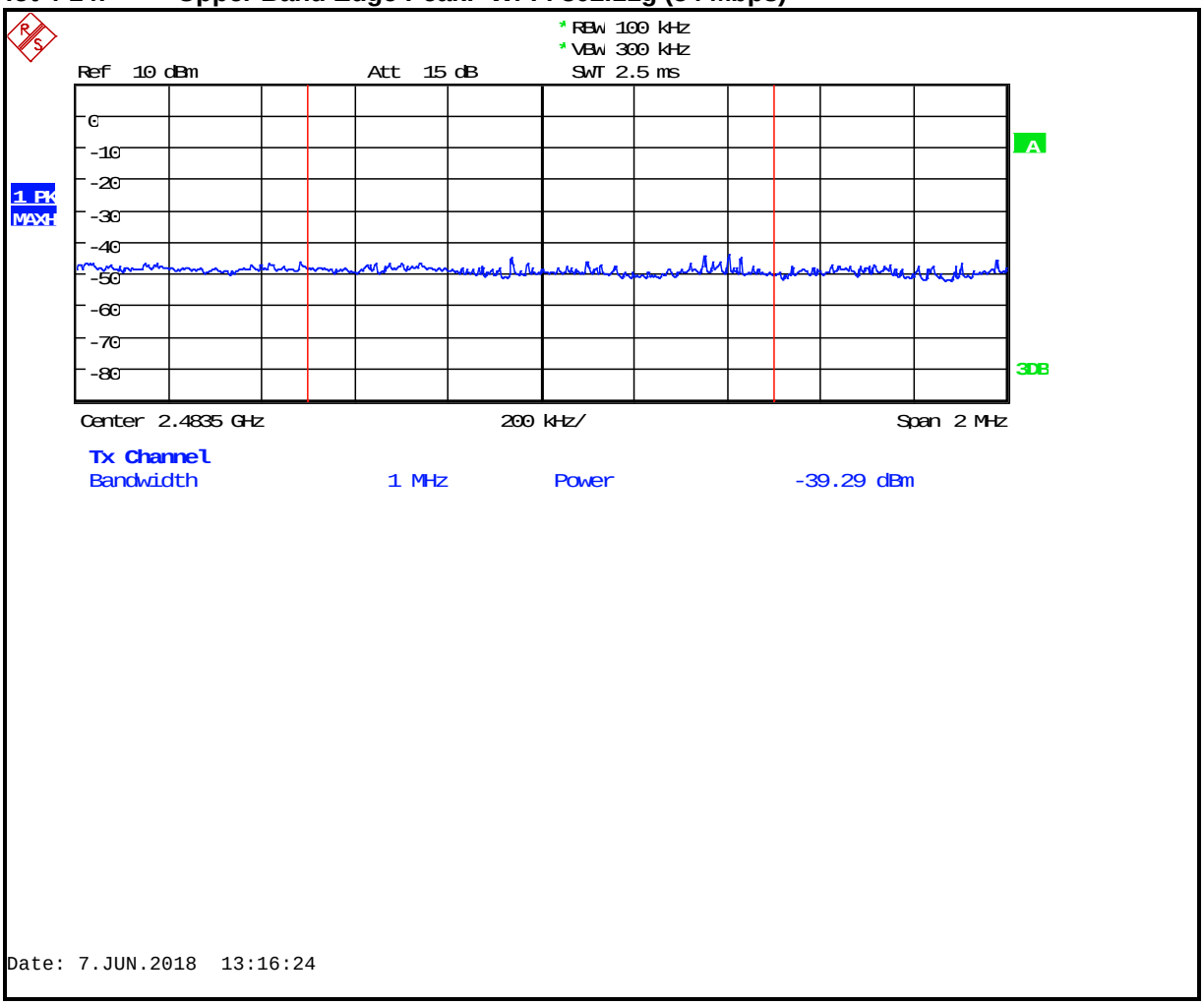
-49.3 + 95.2 = 45.9 dBuV/m – 74 dBuV/m (limit) = -28.1 dB margin

Plot 4-13: Upper Band Edge Average: Wi-Fi 802.11g (54 Mbps)



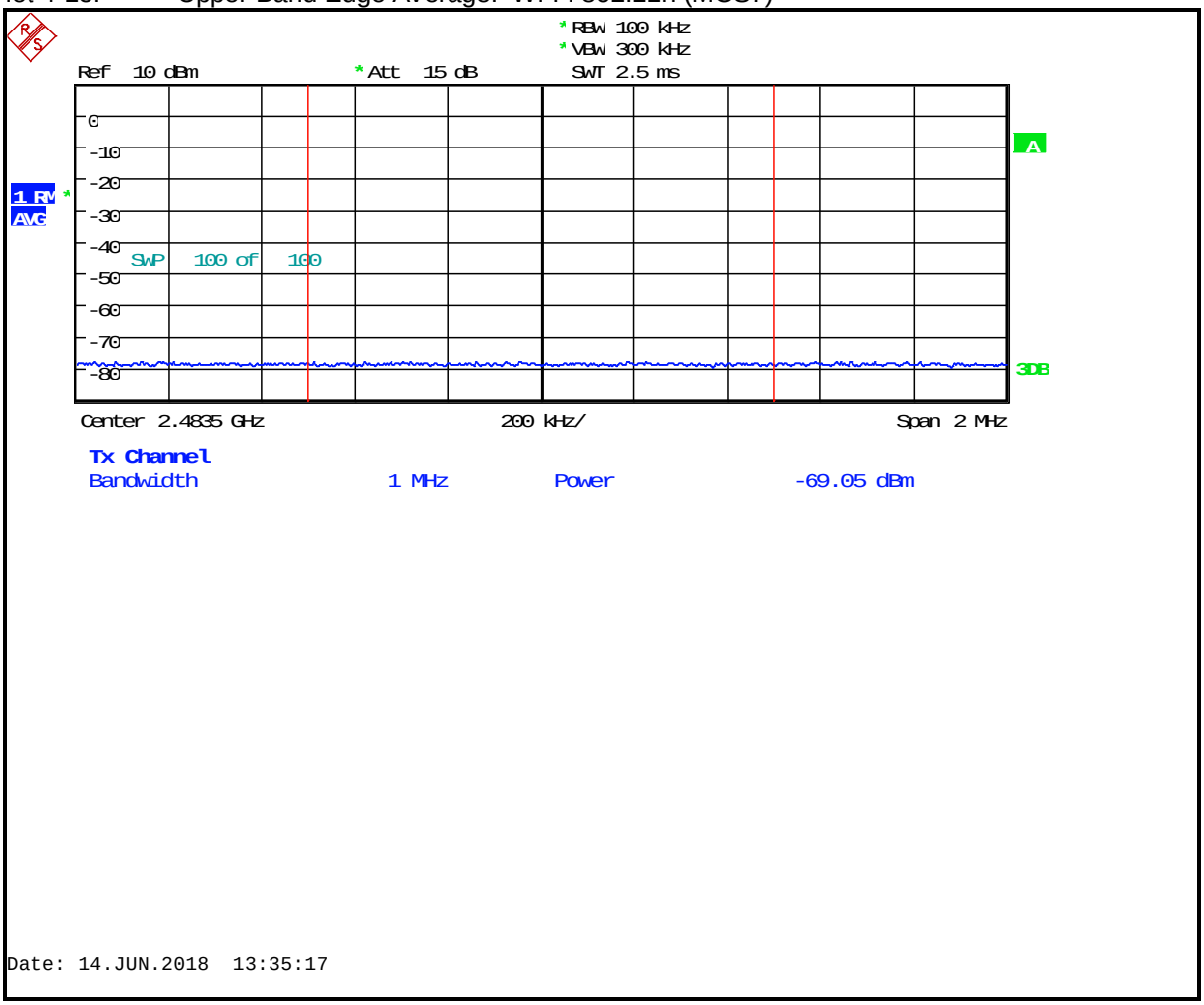
-69 + 95.2 = 26.2 dBuV/m – 54 dBuV/m (limit) = -27.8dB margin

Plot 4-14: Upper Band Edge Peak: Wi-Fi 802.11g (54 Mbps)



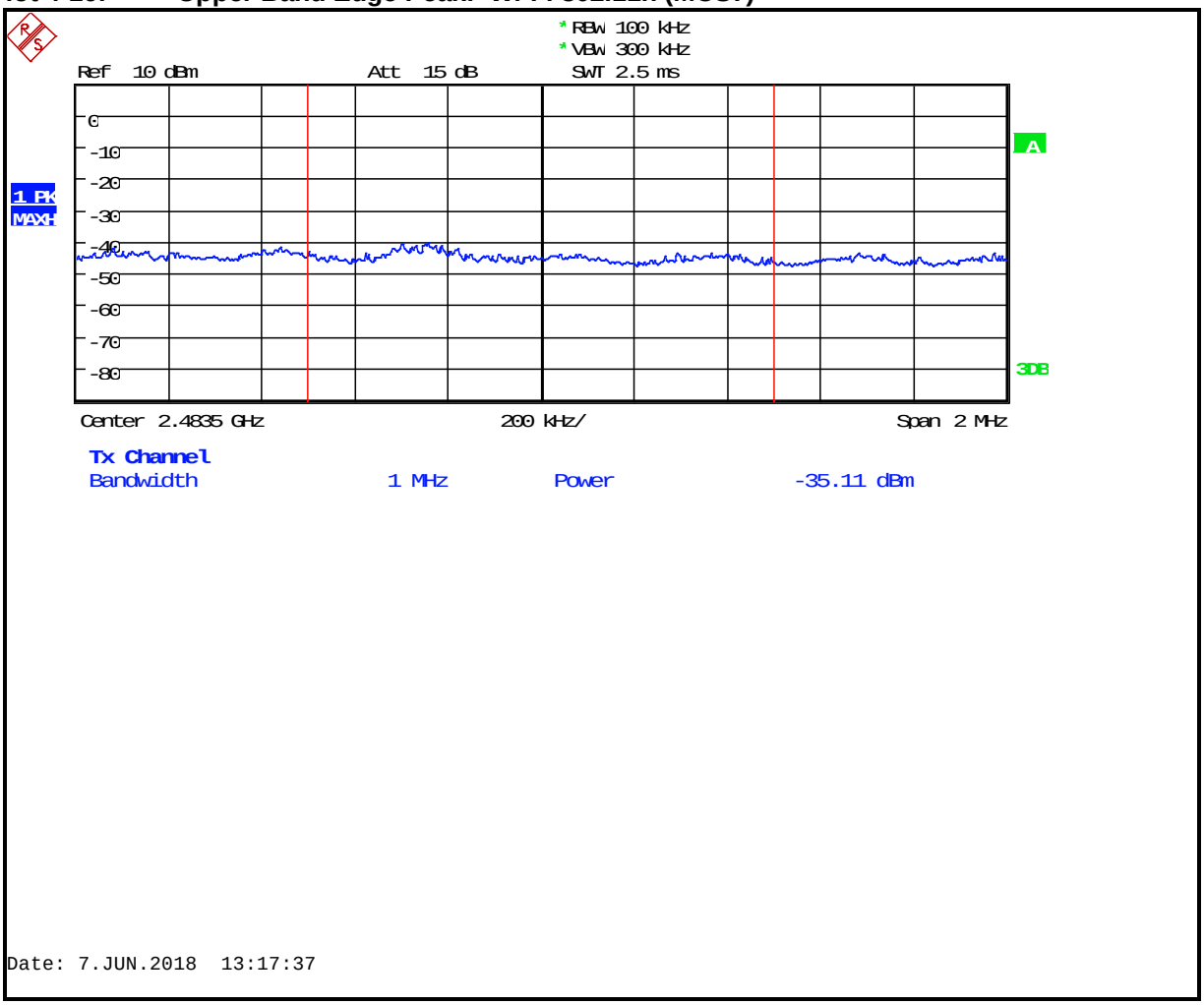
-39.3 + 95.2 = 55.9 dBuV/m – 74 dBuV/m (limit) = -18.1 dB margin

Plot 4-15: Upper Band Edge Average: Wi-Fi 802.11n (MCS7)



-69.1 + 95.2 = 26.1 dBuV/m – 54 dBuV/m (limit) = -27.9 dB margin

Plot 4-16: Upper Band Edge Peak: Wi-Fi 802.11n (MCS7)



-35.1 + 95.2 = 60.1 dBuV/m – 74 dBuV/m (limit) = -13.9 dB margin

Measurement uncertainty: ±1.4%. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19

PASS

Test Personnel:

Khue Do		June 7 & 14 2018
Test Engineer	Signature	Dates of Test

5 Antenna Conducted Spurious Emissions – FCC 15.247(d); ISED RSS-247 5.5, RSS-Gen 6.13

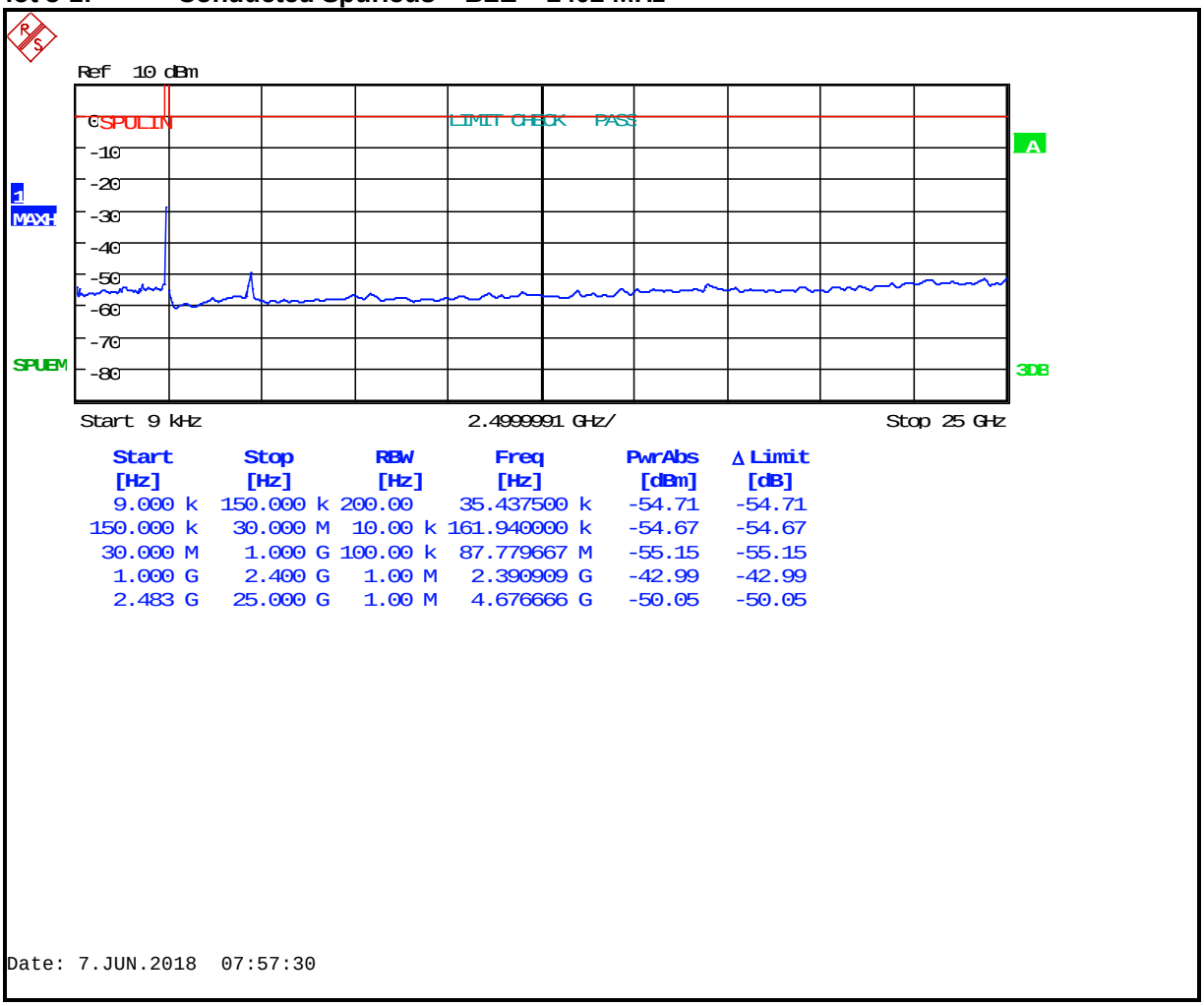
5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna conducted spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at the following frequencies: 2412 MHz, 2437 MHz and 2462 MHz for Wi-Fi; and 2402 MHz, 2440 MHz, and 2480 MHz for BLE.

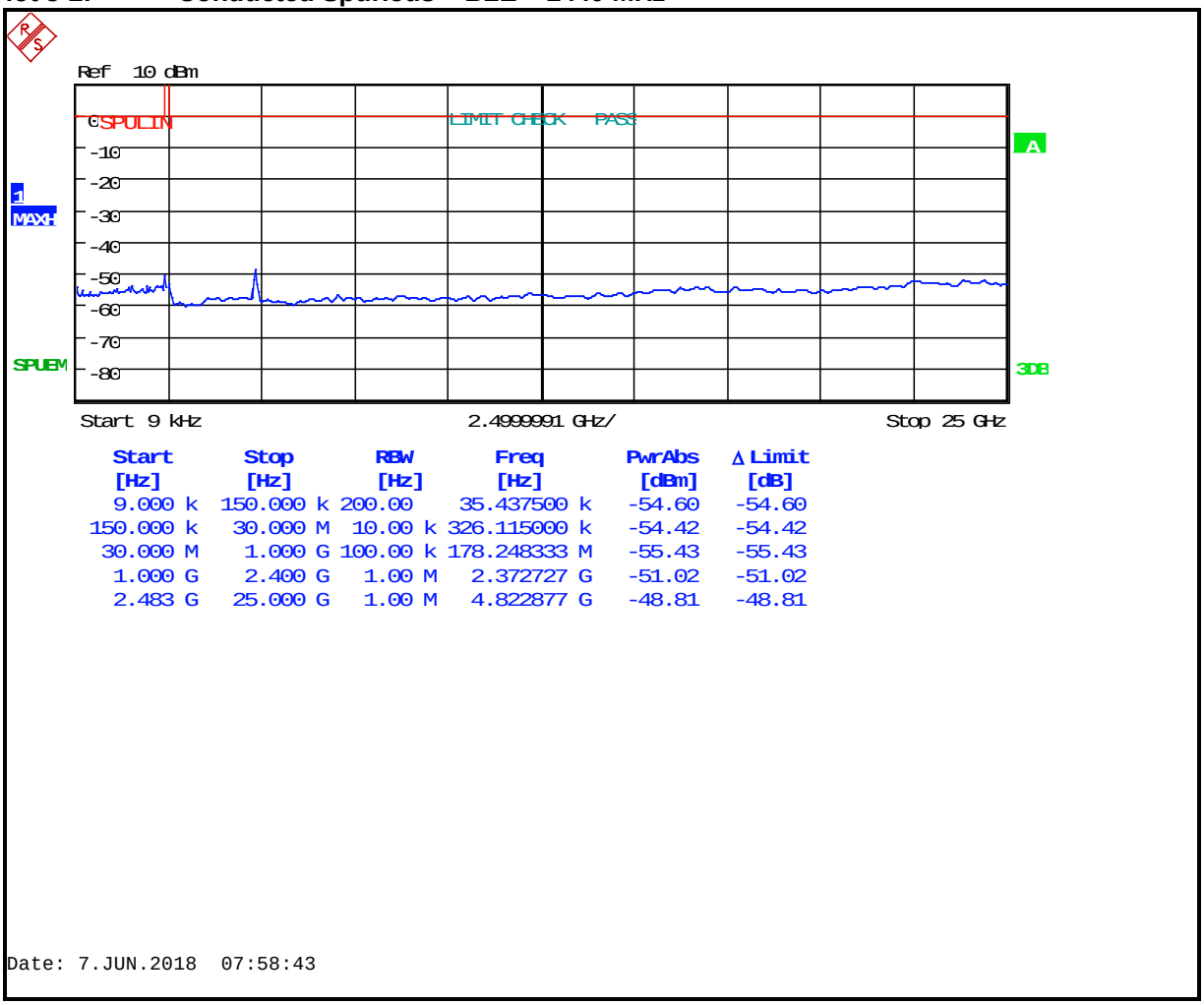
5.2 Antenna Conducted Spurious Emissions Test Results

No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the carrier level from the carrier to the 10th harmonic of the carrier frequency. The below plots were taken to show compliance.

Plot 5-1: Conducted Spurious – BLE – 2402 MHz



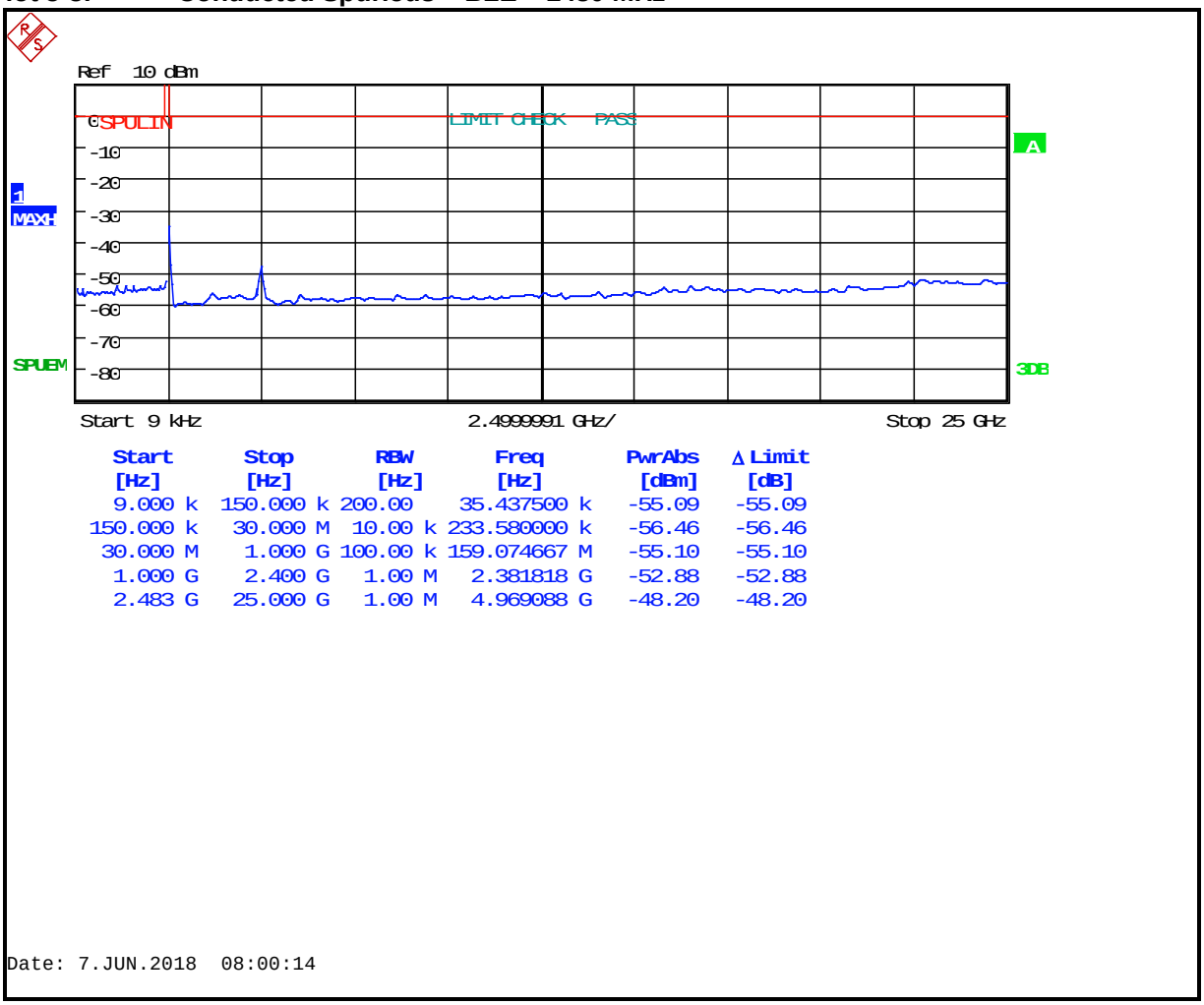
Plot 5-2: Conducted Spurious – BLE – 2440 MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	200.00	35.437500 k	-54.60	-54.60
150.000 k	30.000 M	10.00 k	326.115000 k	-54.42	-54.42
30.000 M	1.000 G	100.00 k	178.248333 M	-55.43	-55.43
1.000 G	2.400 G	1.00 M	2.372727 G	-51.02	-51.02
2.483 G	25.000 G	1.00 M	4.822877 G	-48.81	-48.81

Date: 7.JUN.2018 07:58:43

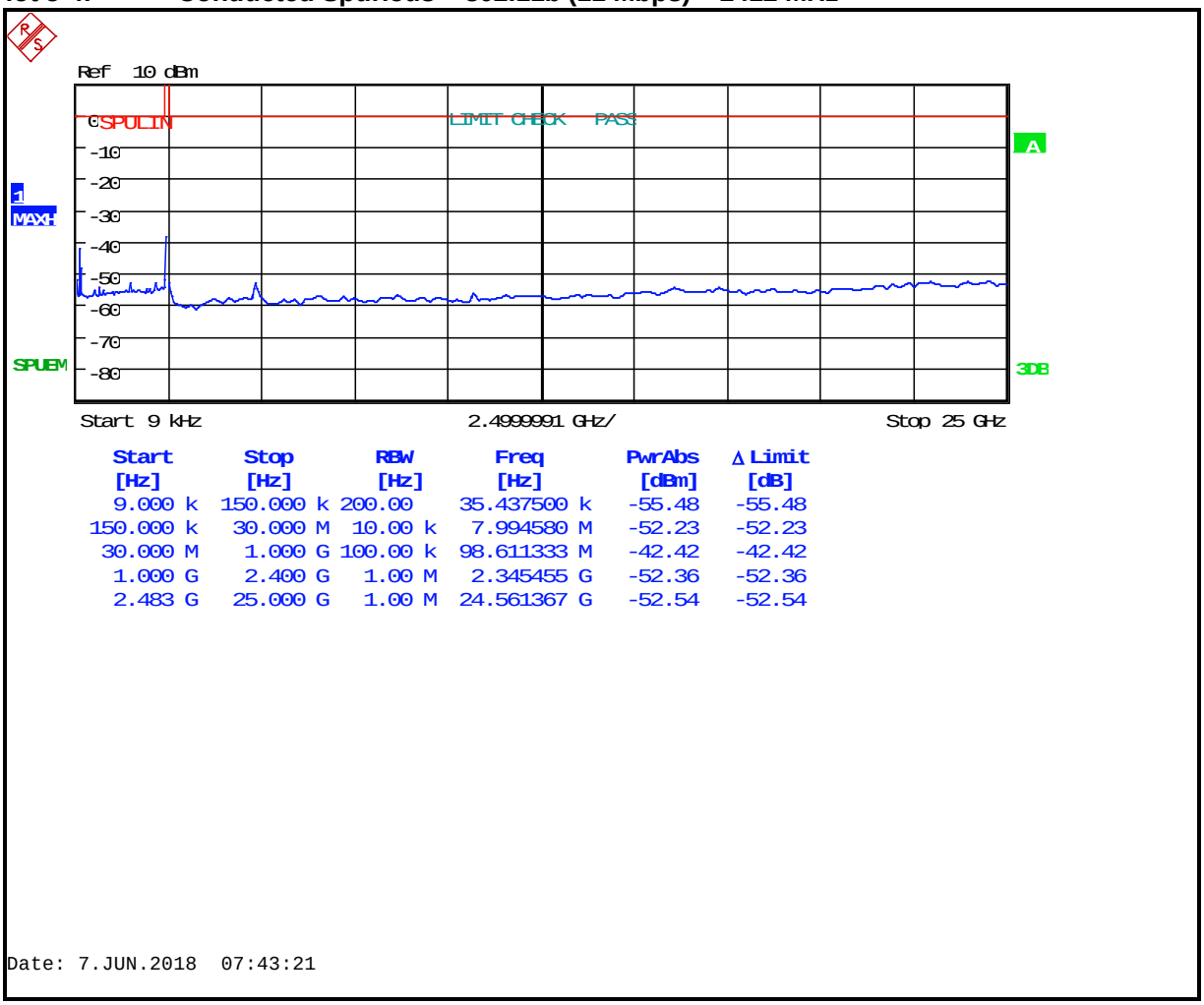
Plot 5-3: Conducted Spurious – BLE – 2480 MHz



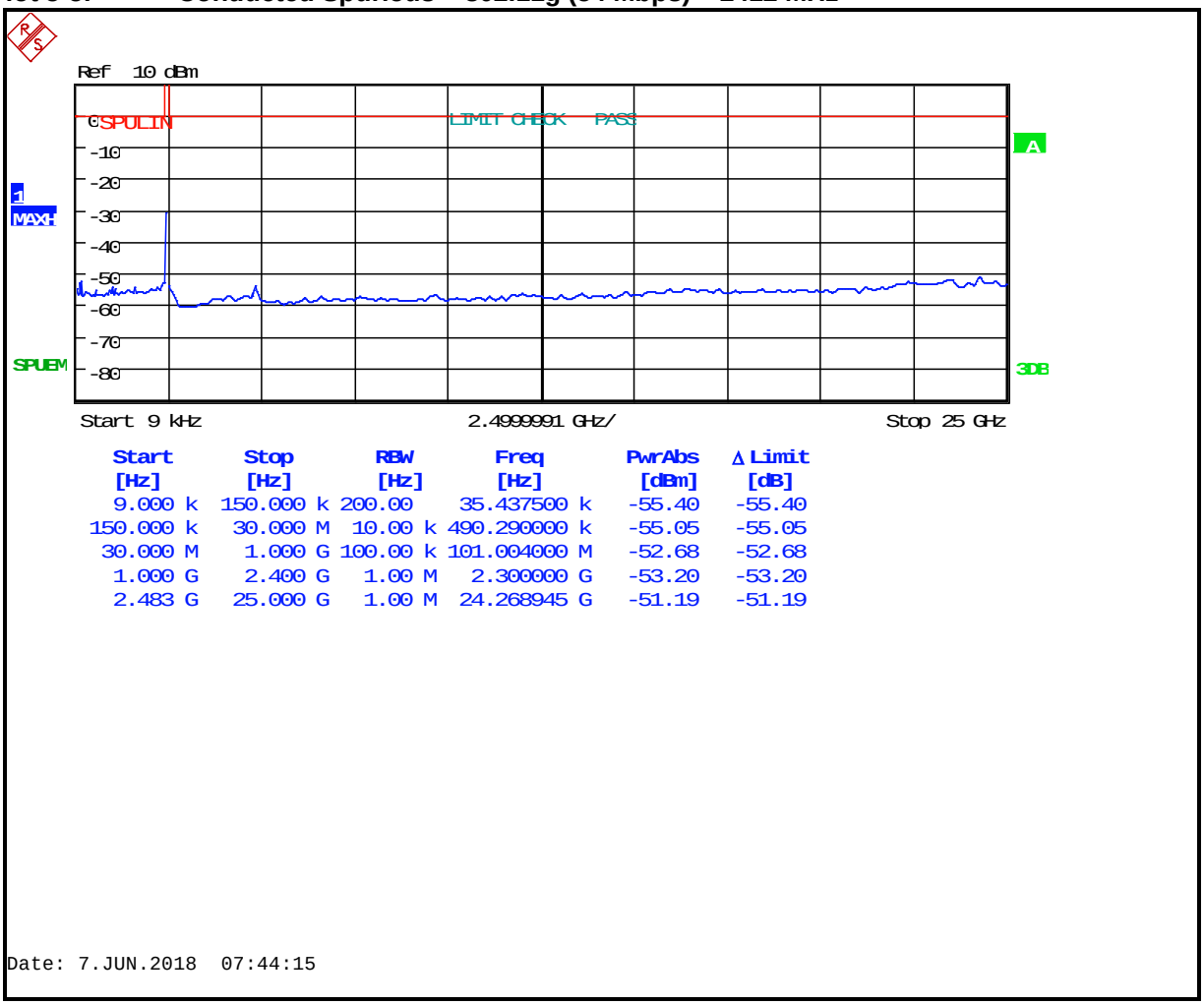
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	200.00	35.437500 k	-55.09	-55.09
150.000 k	30.000 M	10.00 k	233.580000 k	-56.46	-56.46
30.000 M	1.000 G	100.00 k	159.074667 M	-55.10	-55.10
1.000 G	2.400 G	1.00 M	2.381818 G	-52.88	-52.88
2.483 G	25.000 G	1.00 M	4.969088 G	-48.20	-48.20

Date: 7.JUN.2018 08:00:14

Plot 5-4: Conducted Spurious – 802.11b (11 Mbps) – 2412 MHz



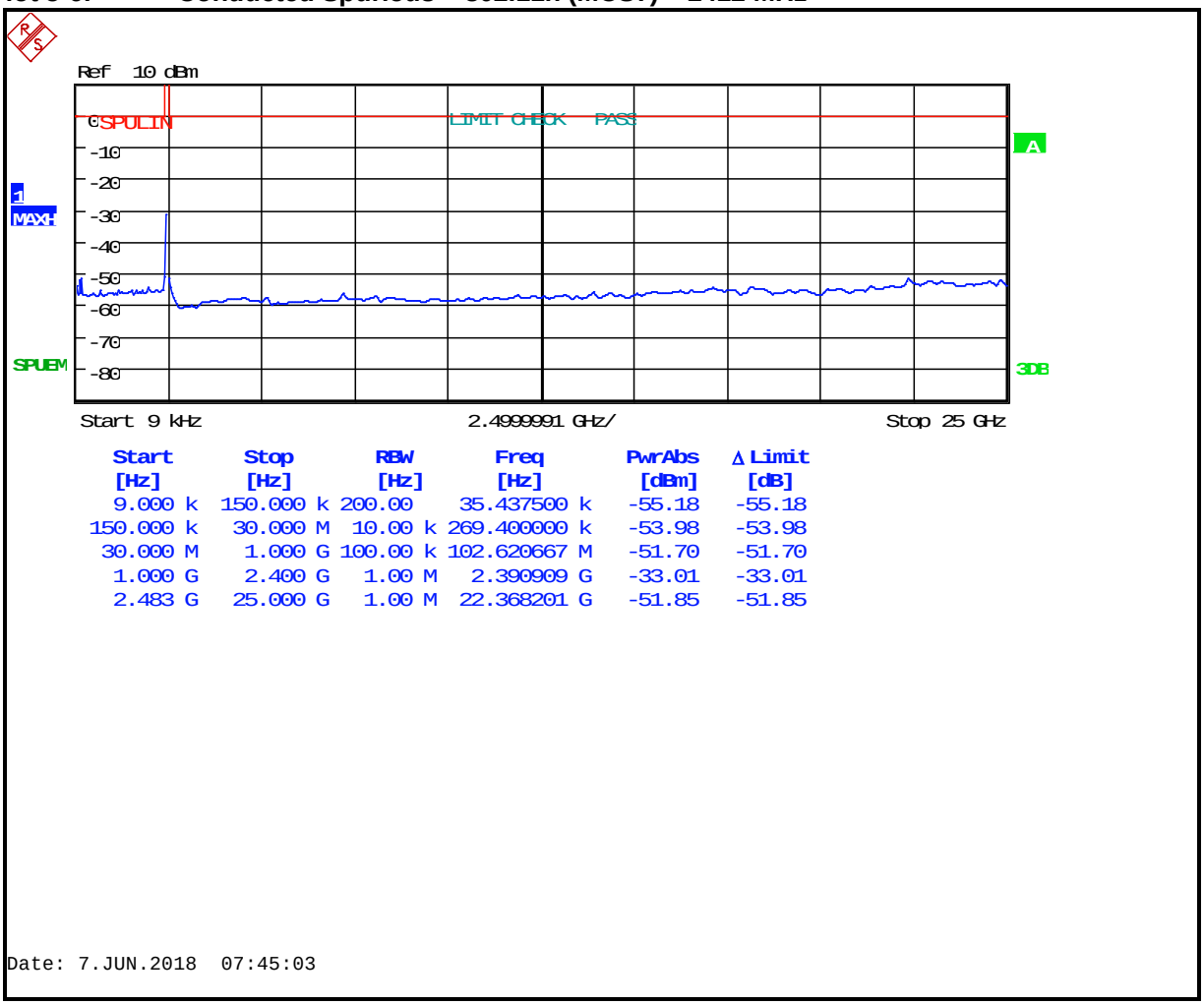
Plot 5-5: Conducted Spurious – 802.11g (54 Mbps) – 2412 MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	200.00	35.437500 k	-55.40	-55.40
150.000 k	30.000 M	10.00 k	490.290000 k	-55.05	-55.05
30.000 M	1.000 G	100.00 k	101.004000 M	-52.68	-52.68
1.000 G	2.400 G	1.00 M	2.300000 G	-53.20	-53.20
2.483 G	25.000 G	1.00 M	24.268945 G	-51.19	-51.19

Date: 7.JUN.2018 07:44:15

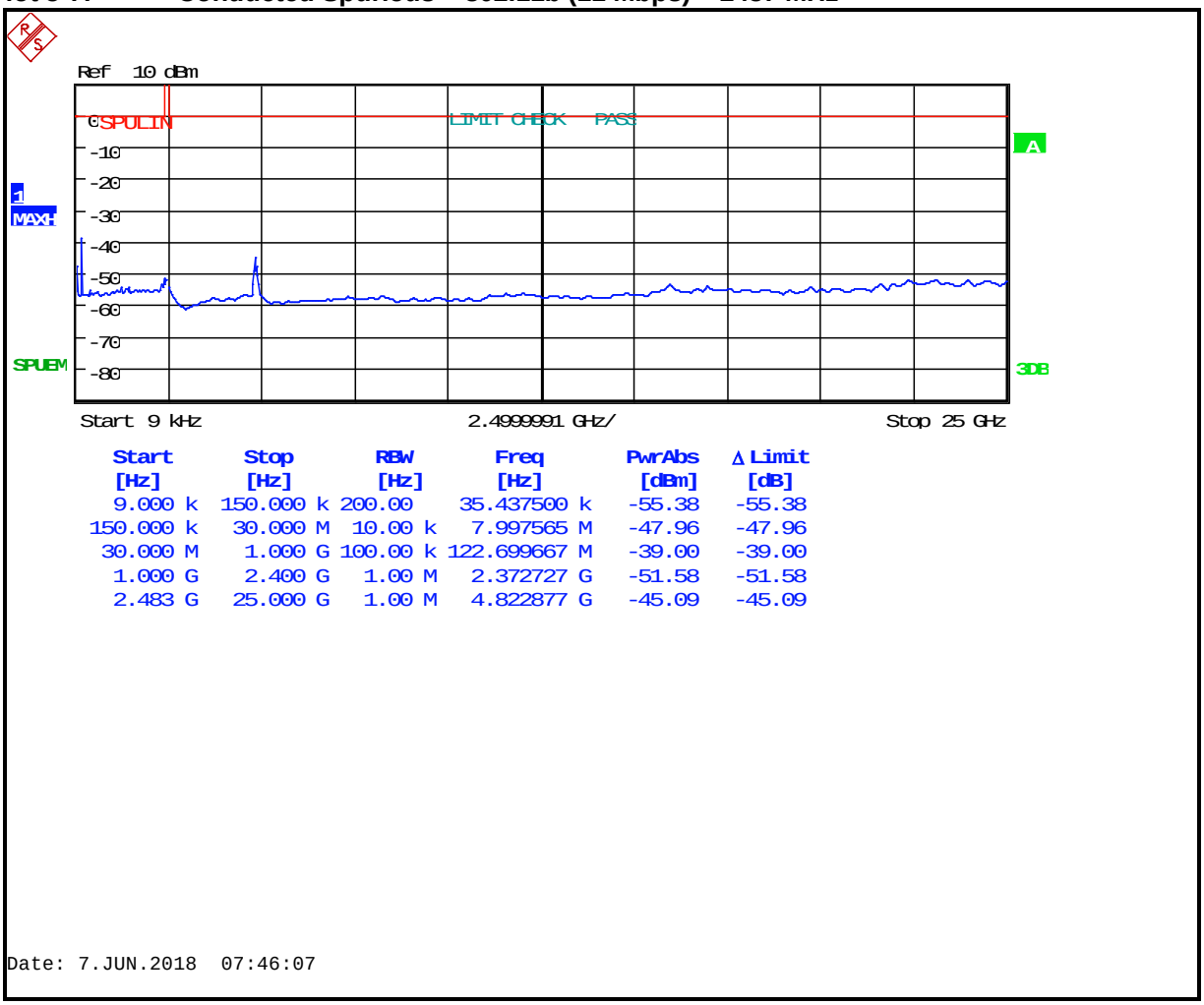
Plot 5-6: Conducted Spurious – 802.11n (MCS7) – 2412 MHz



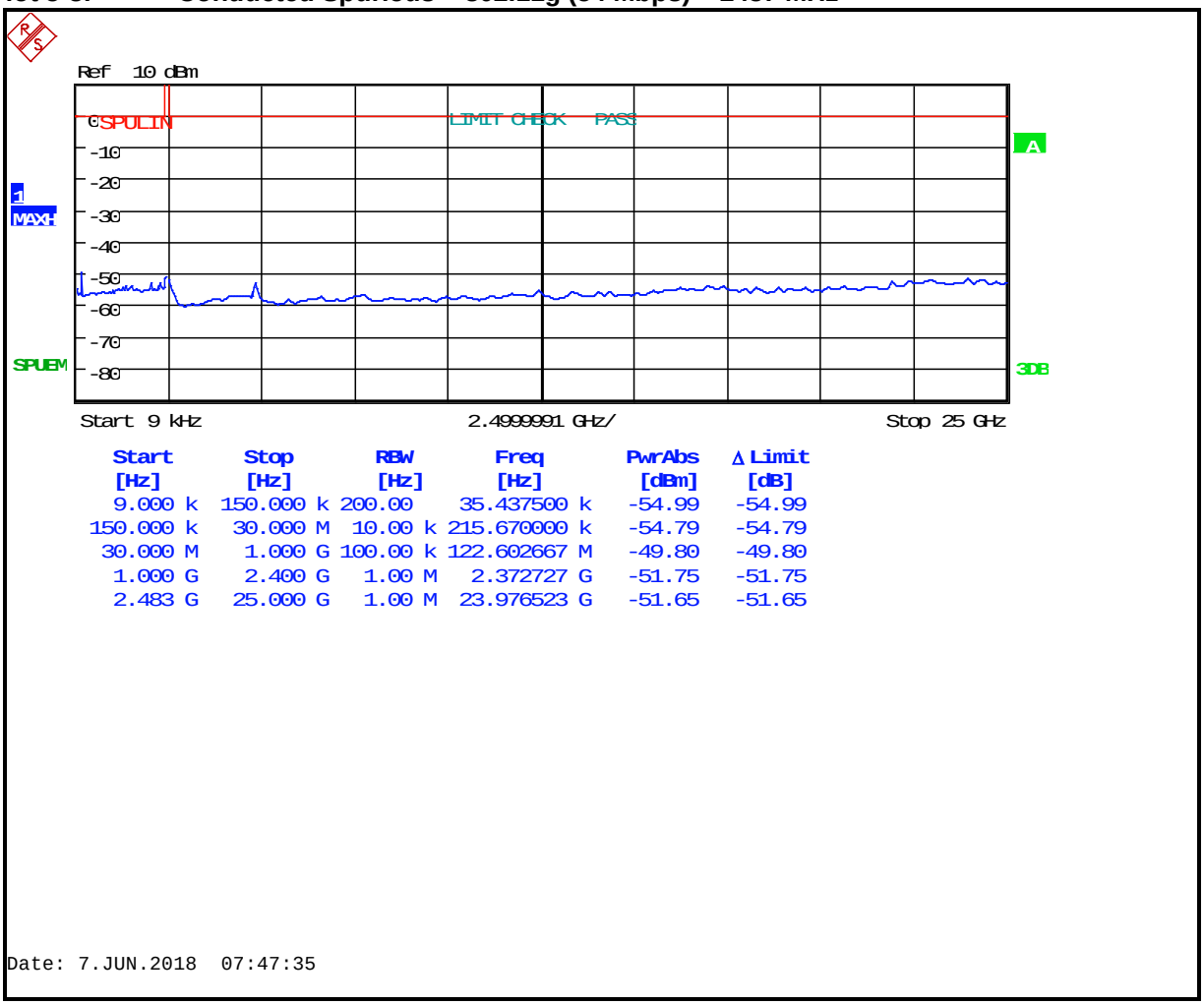
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	200.00	35.437500 k	-55.18	-55.18
150.000 k	30.000 M	10.00 k	269.400000 k	-53.98	-53.98
30.000 M	1.000 G	100.00 k	102.620667 M	-51.70	-51.70
1.000 G	2.400 G	1.00 M	2.390909 G	-33.01	-33.01
2.483 G	25.000 G	1.00 M	22.368201 G	-51.85	-51.85

Date: 7.JUN.2018 07:45:03

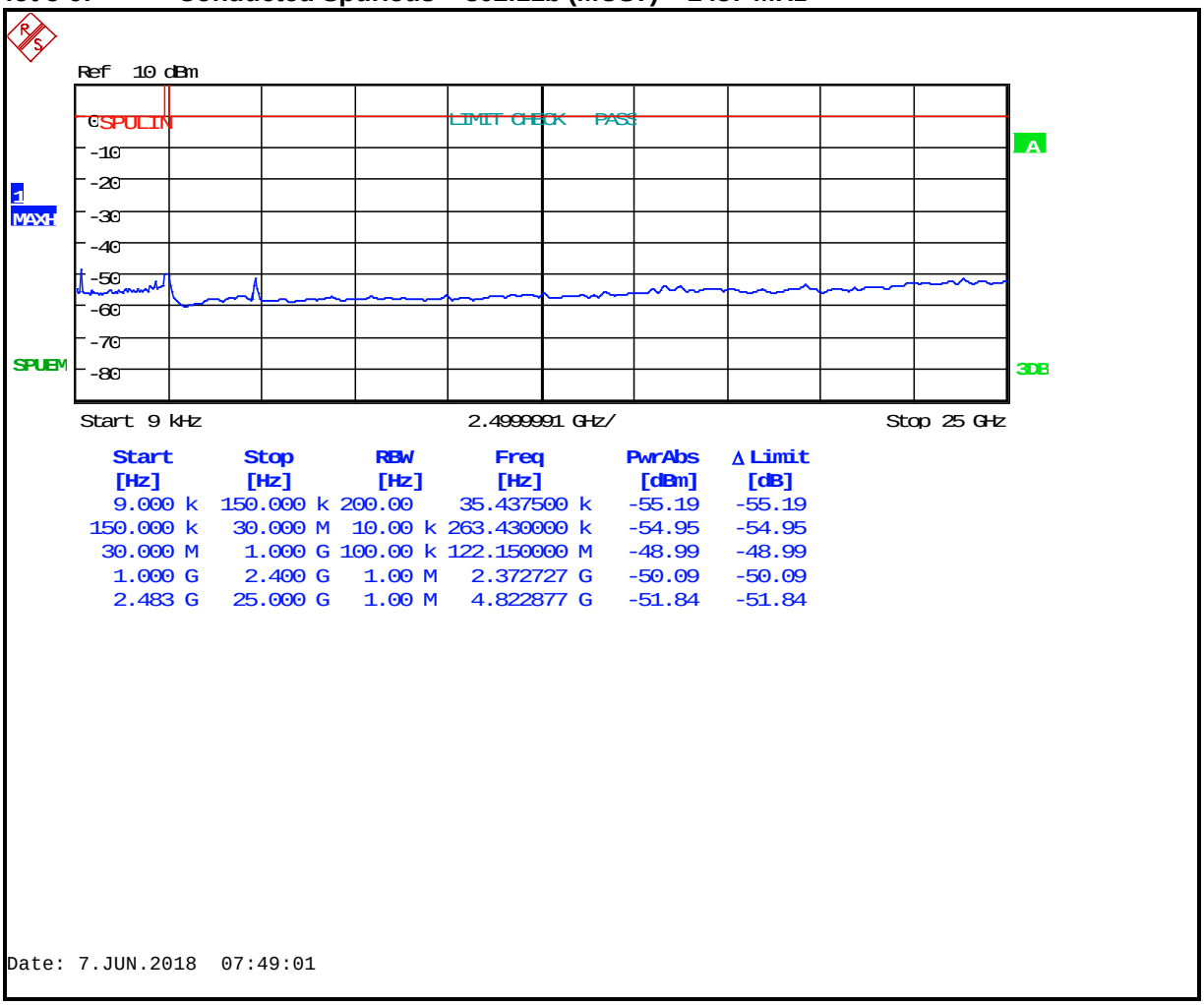
Plot 5-7: Conducted Spurious – 802.11b (11 Mbps) – 2437 MHz



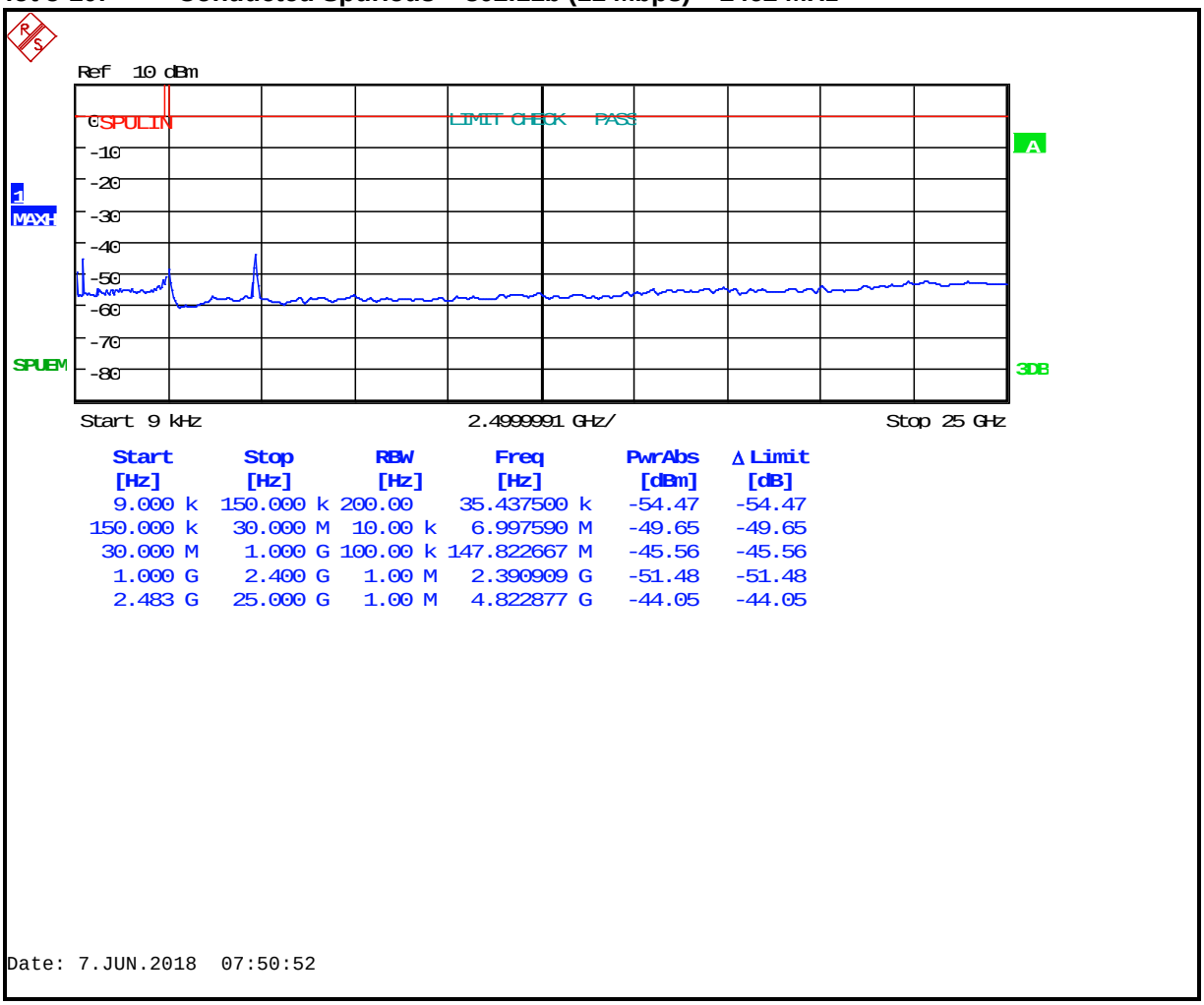
Plot 5-8: Conducted Spurious – 802.11g (54 Mbps) – 2437 MHz



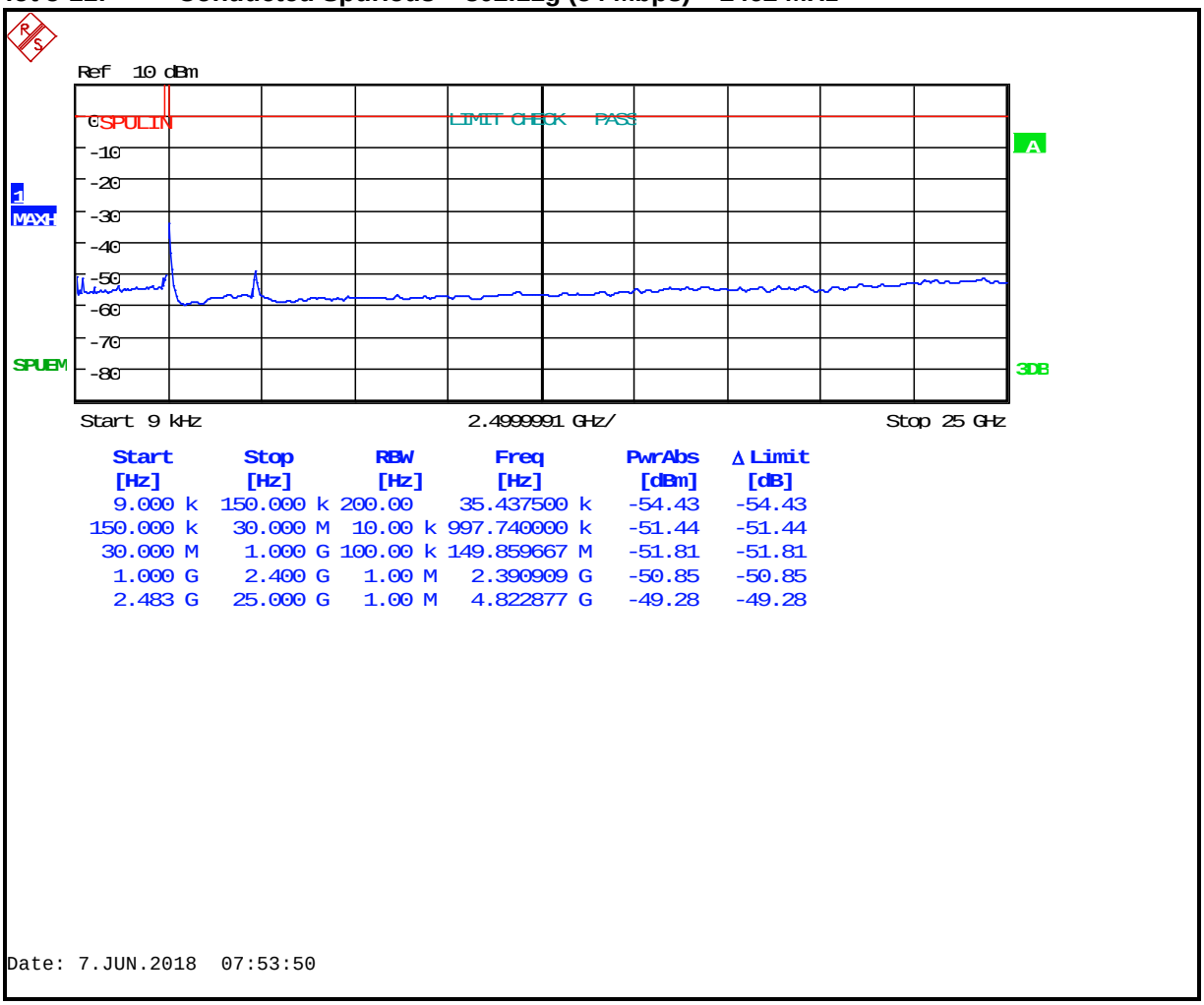
Plot 5-9: Conducted Spurious – 802.11b (MCS7) – 2437 MHz



Plot 5-10: Conducted Spurious – 802.11b (11 Mbps) – 2462 MHz



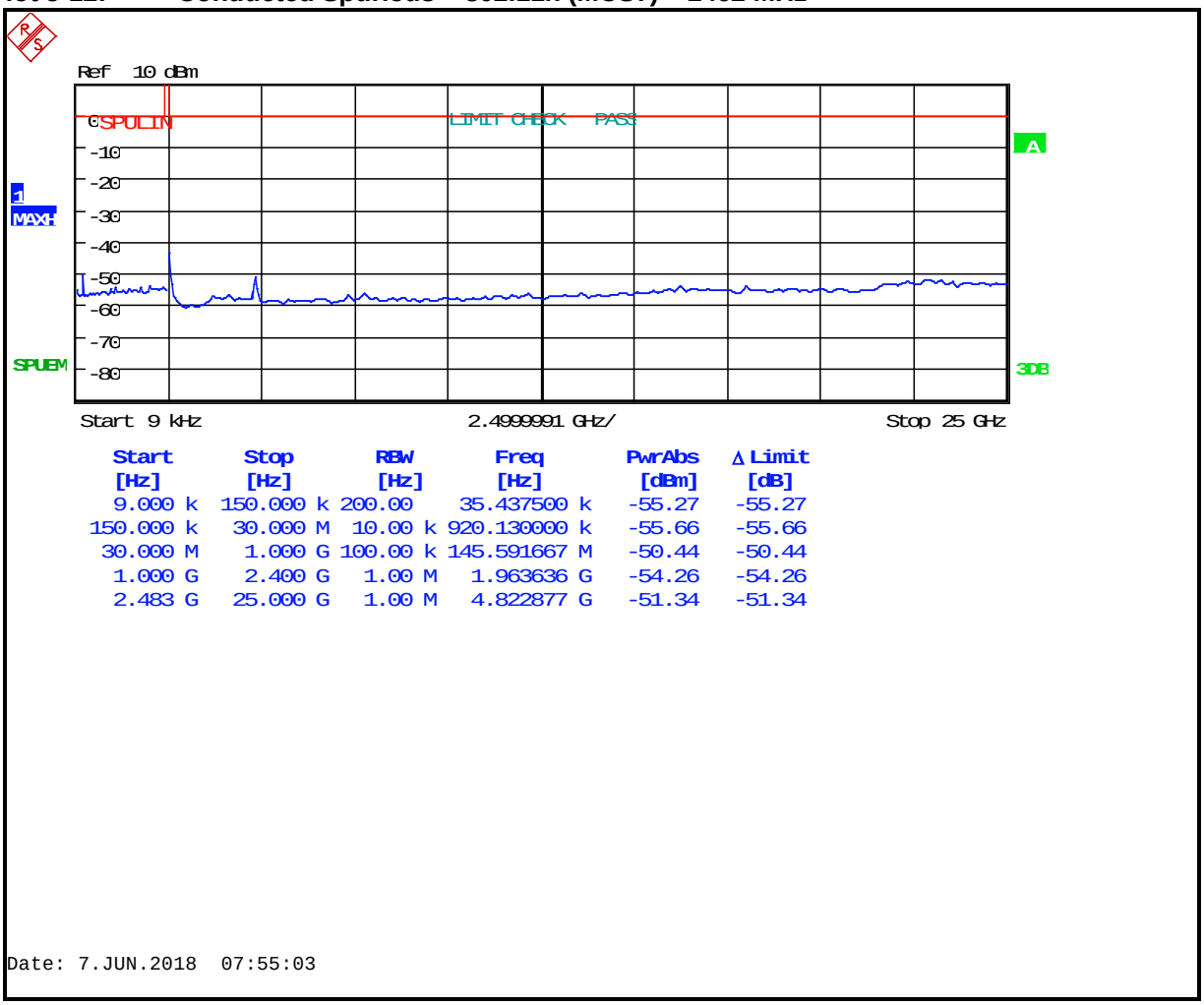
Plot 5-11: Conducted Spurious – 802.11g (54 Mbps) – 2462 MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	200.00	35.437500 k	-54.43	-54.43
150.000 k	30.000 M	10.00 k	997.740000 k	-51.44	-51.44
30.000 M	1.000 G	100.00 k	149.859667 M	-51.81	-51.81
1.000 G	2.400 G	1.00 M	2.390909 G	-50.85	-50.85
2.483 G	25.000 G	1.00 M	4.822877 G	-49.28	-49.28

Date: 7.JUN.2018 07:53:50

Plot 5-12: Conducted Spurious – 802.11n (MCS7) – 2462 MHz



Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty: ±2 dB.

RESULTS: PASS

Table 5-1: Antenna Conducted Spurious Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19

Test Personnel:

Khue Do		June 7, 2018
Test Engineer	Signature	Date of Test

6 6 dB Bandwidth – FCC 15.247(a)(2); ISED RSS-247 5.2(a)

6.1 6 dB Bandwidth Test Procedure

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at ≥3xRBW. The device was modulated. The 6 dB bandwidths are presented below.

6.2 6 dB Bandwidth Test Data

Table 6-1: 6 dB Bandwidth Test Data – BLE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
2	2402	1.23
40	2440	1.23
80	2480	1.24

Table 6-2: 6 dB Bandwidth Test Data – 802.11b (11 mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
1	2412	9.8
6	2437	9.9
11	2462	9.9

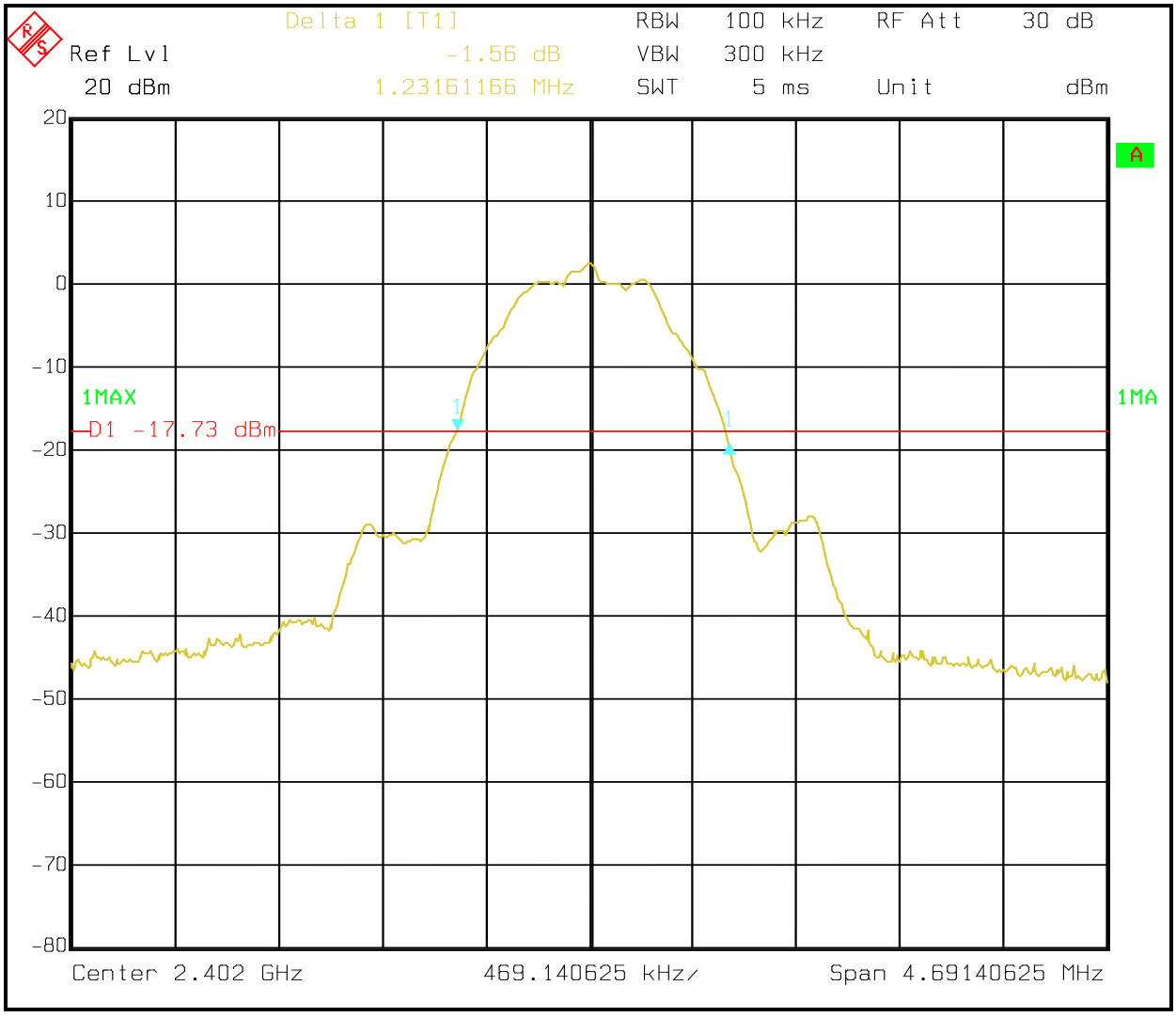
Table 6-3: 6 dB Bandwidth Test Data – 802.11g (54 mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
1	2412	16.7
6	2437	16.7
11	2462	16.6

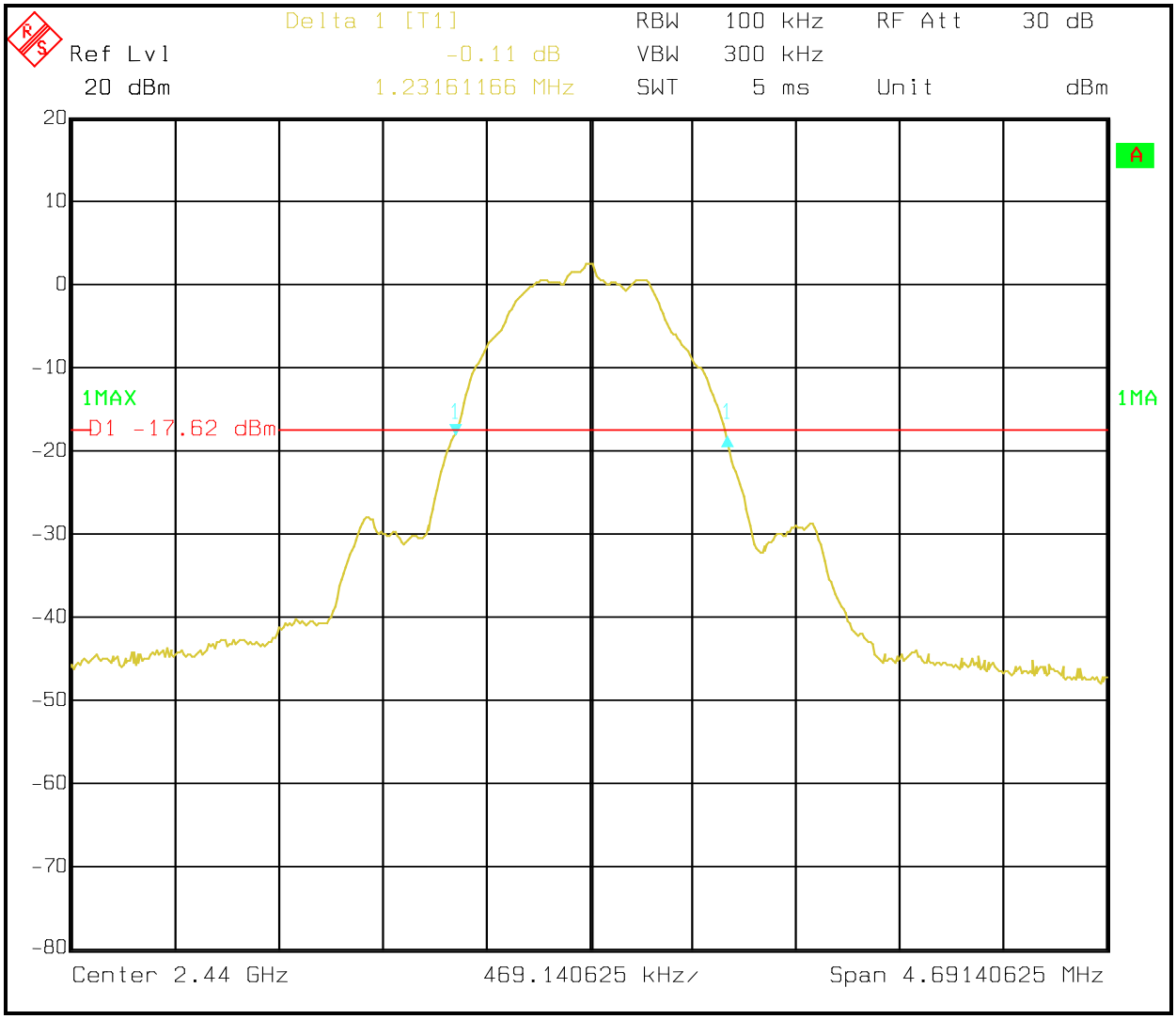
Table 6-4: 6 dB Bandwidth Test Data – 802.11n (MCS7)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
1	2412	17.7
6	2437	17.9
11	2462	16.7

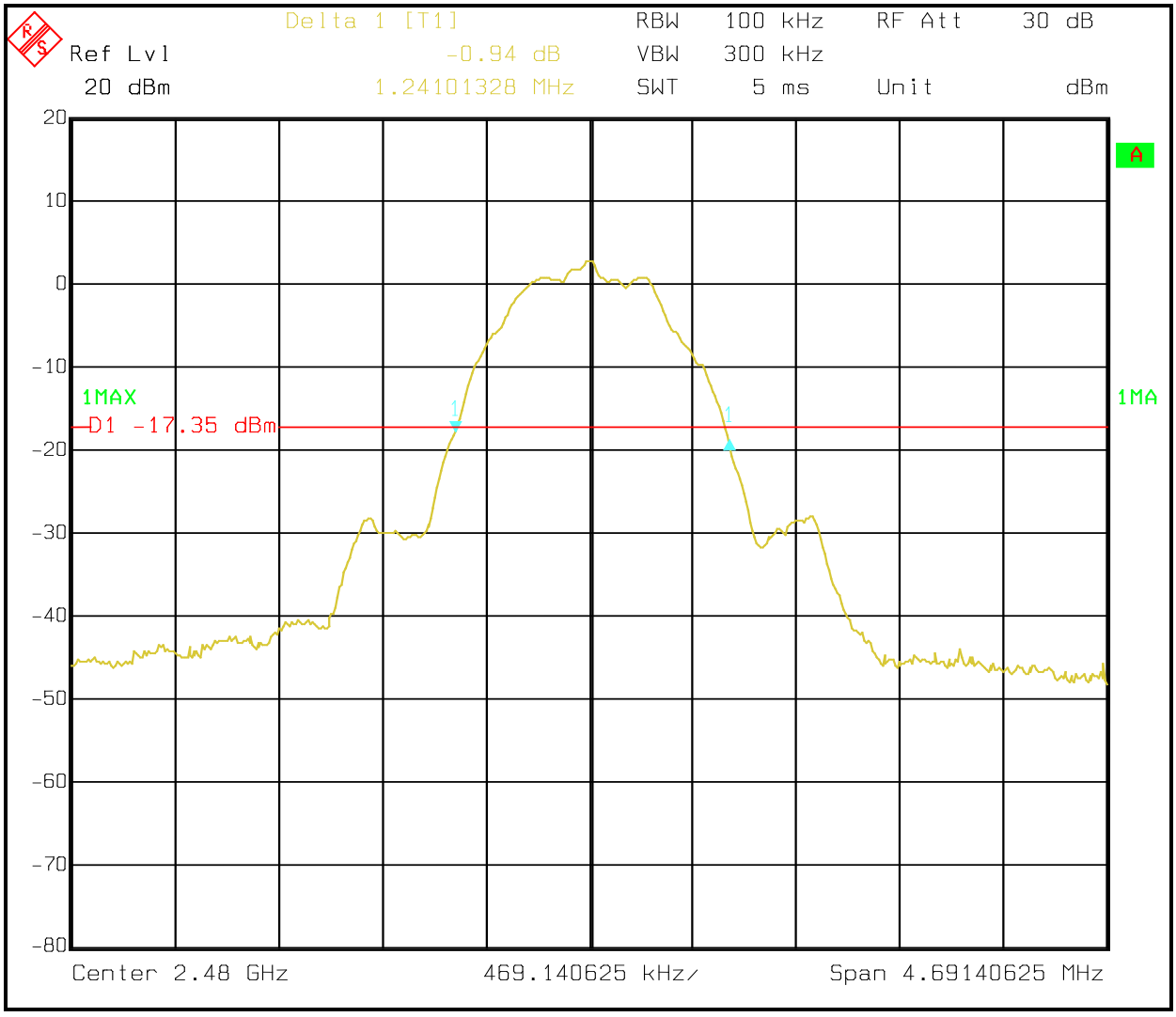
Plot 6-1: 6 dB Bandwidth – BLE – 2402 MHz



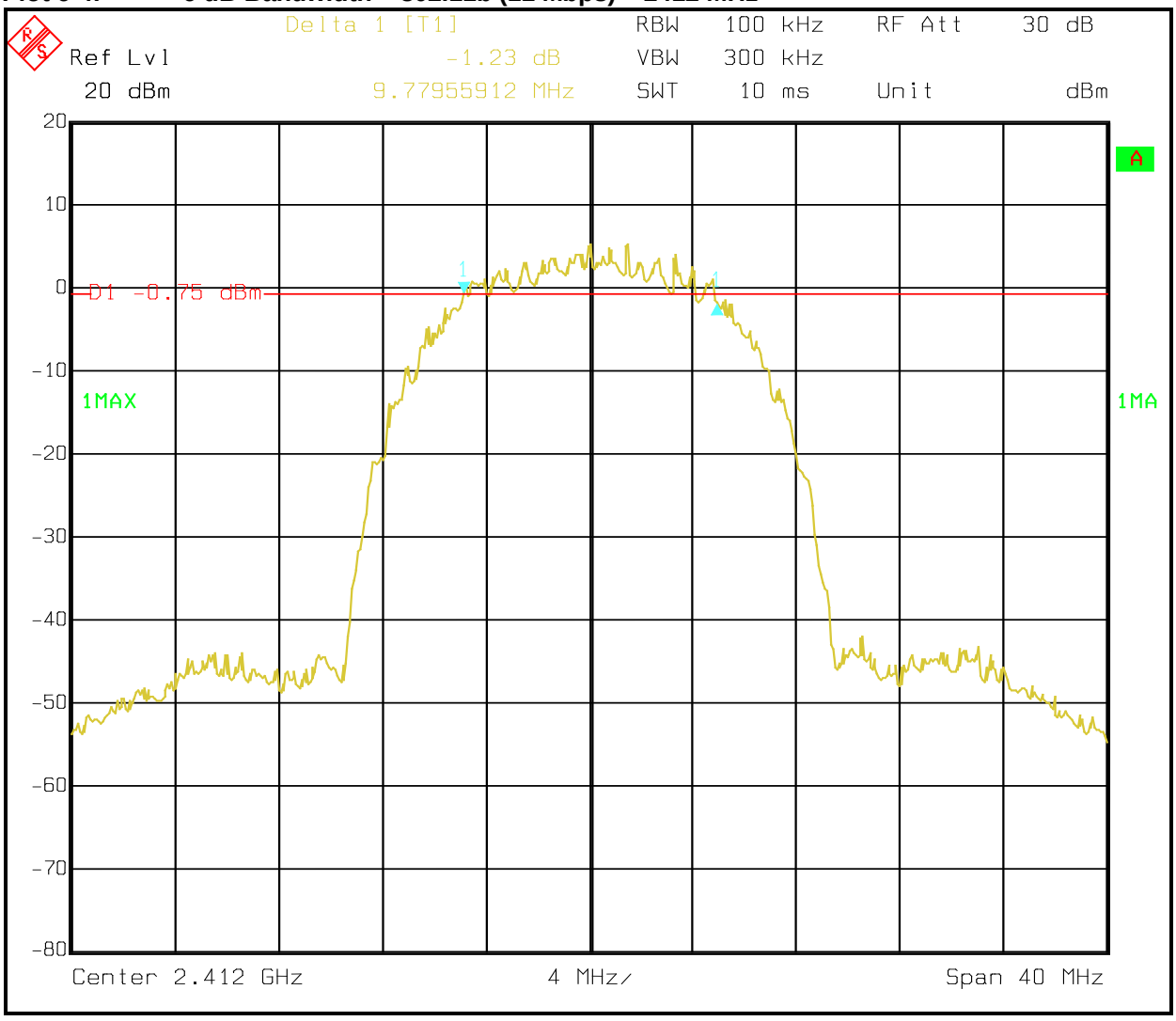
Plot 6-2: 6 dB Bandwidth – BLE – 2440 MHz



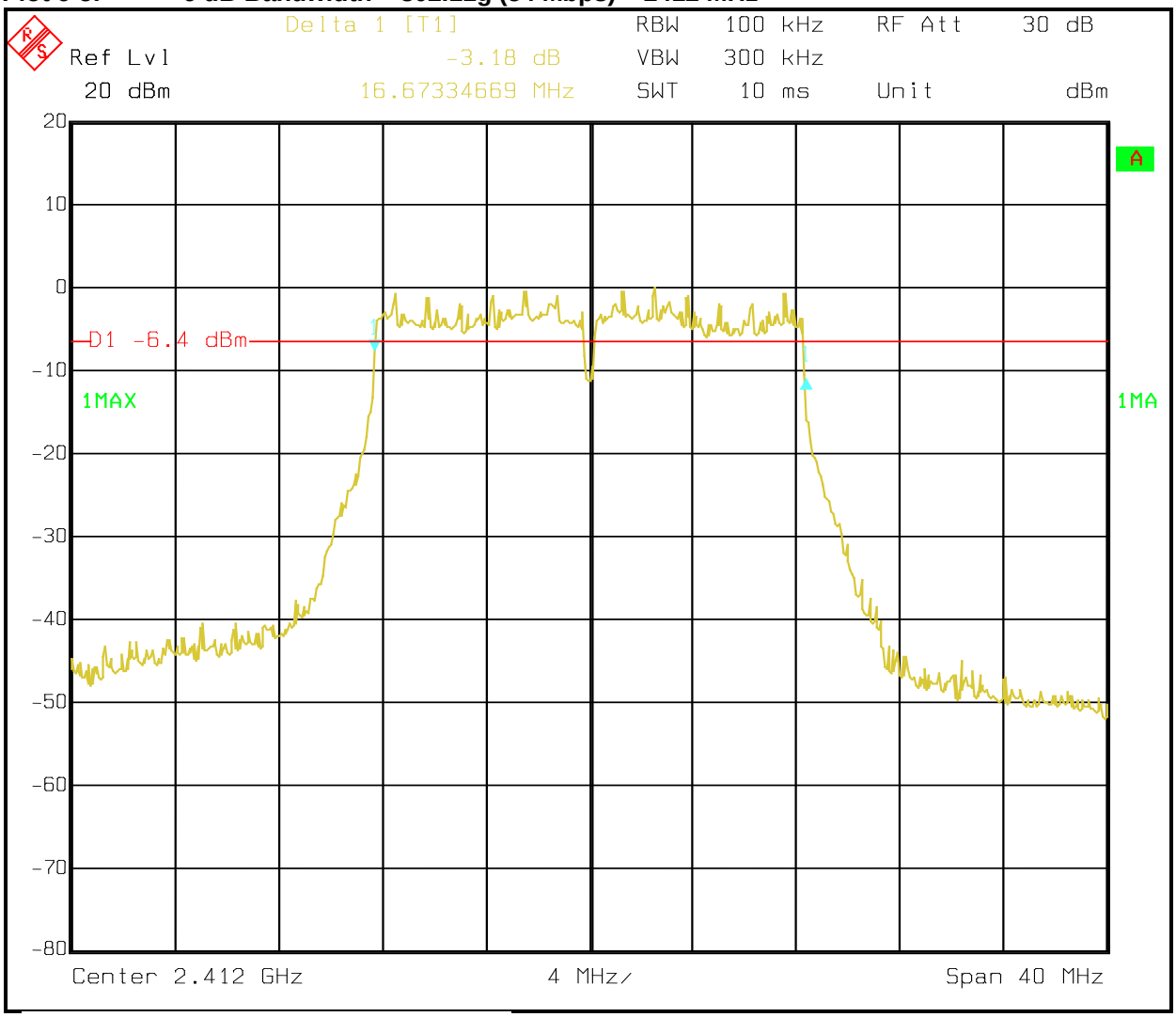
Plot 6-3: 6 dB Bandwidth – BLE – 2480 MHz



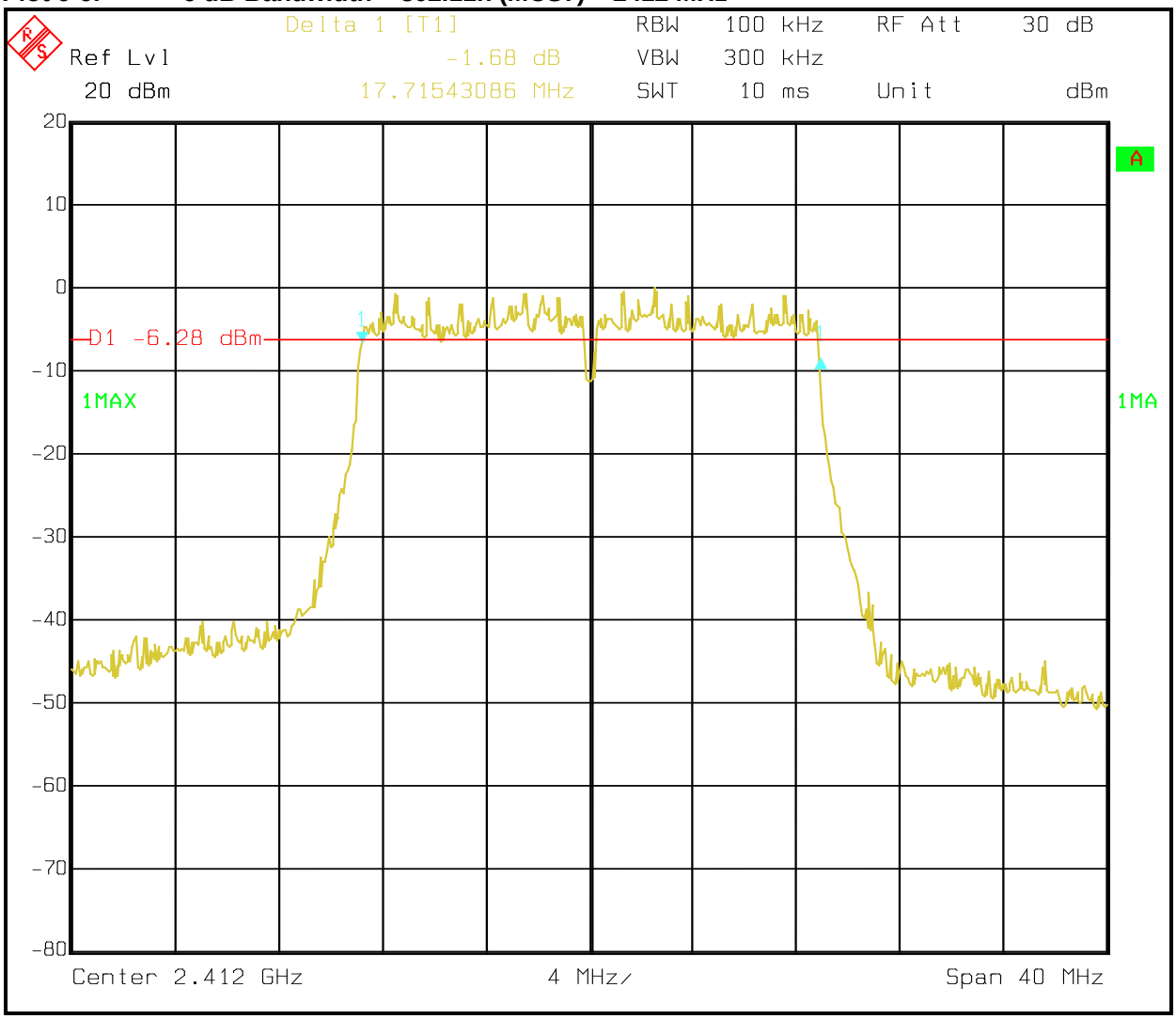
Plot 6-4: 6 dB Bandwidth – 802.11b (11 Mbps) – 2412 MHz



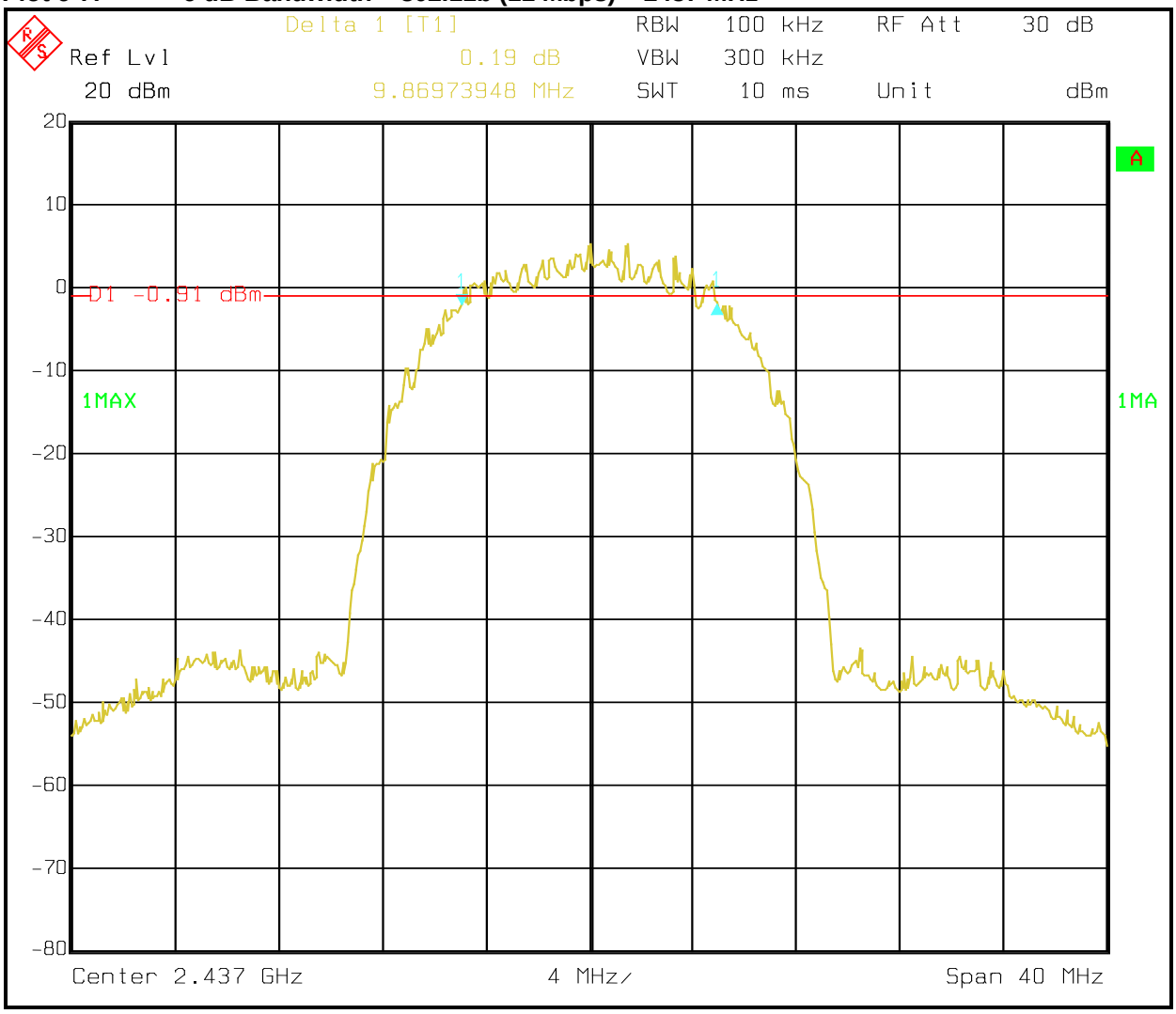
Plot 6-5: 6 dB Bandwidth – 802.11g (54 Mbps) – 2412 MHz



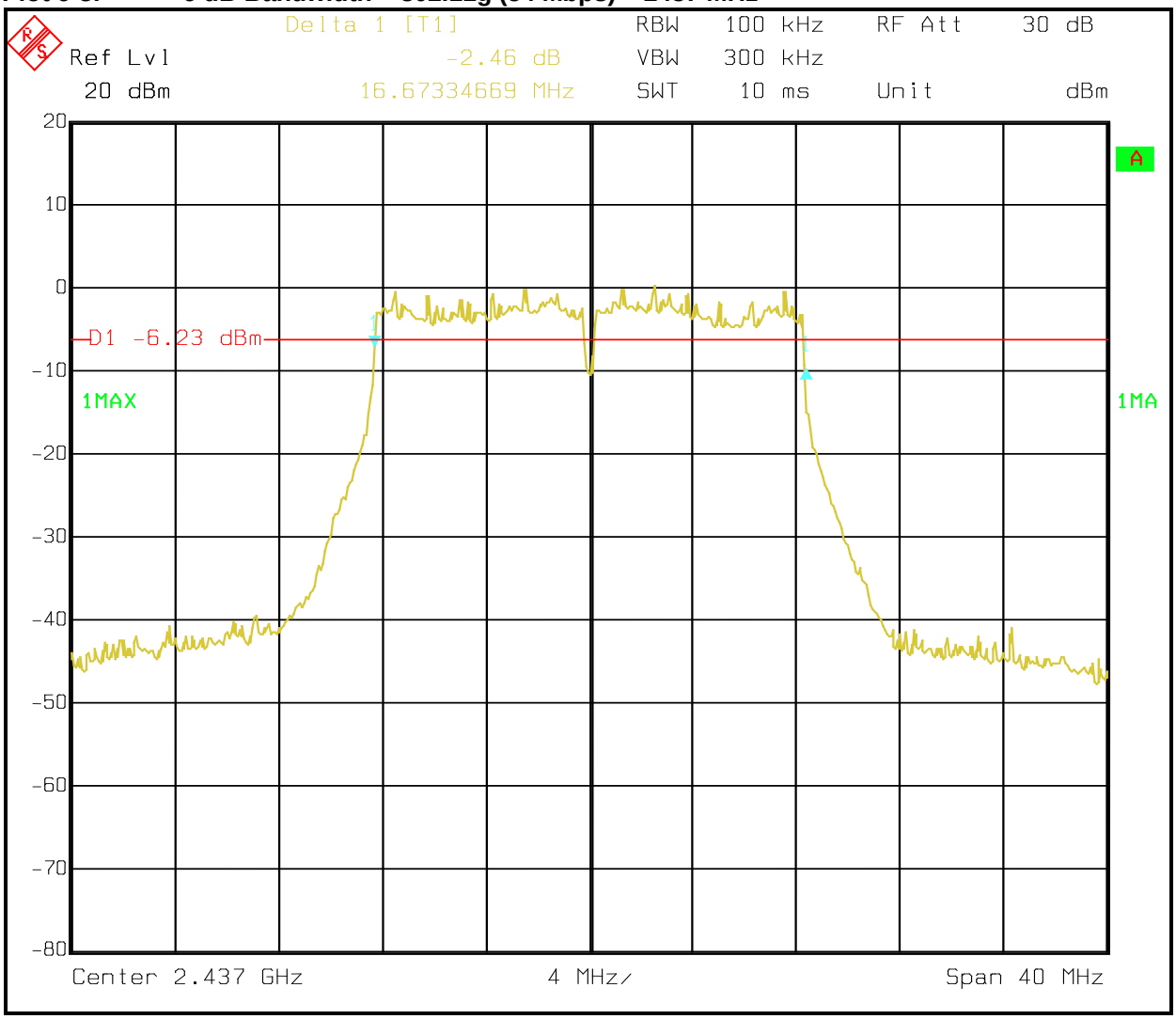
Plot 6-6: 6 dB Bandwidth – 802.11n (MCS7) – 2412 MHz



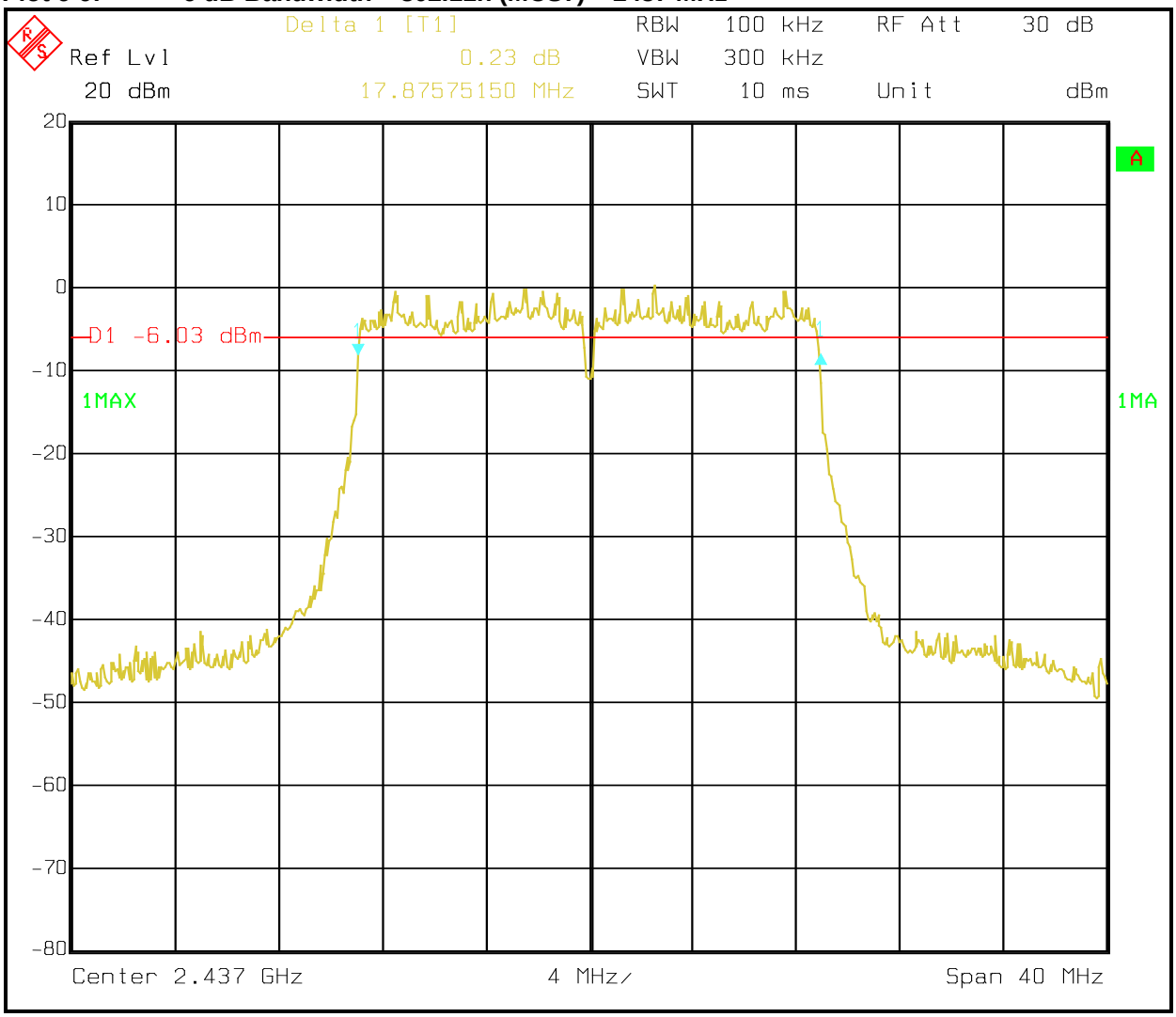
Plot 6-7: 6 dB Bandwidth – 802.11b (11 Mbps) – 2437 MHz



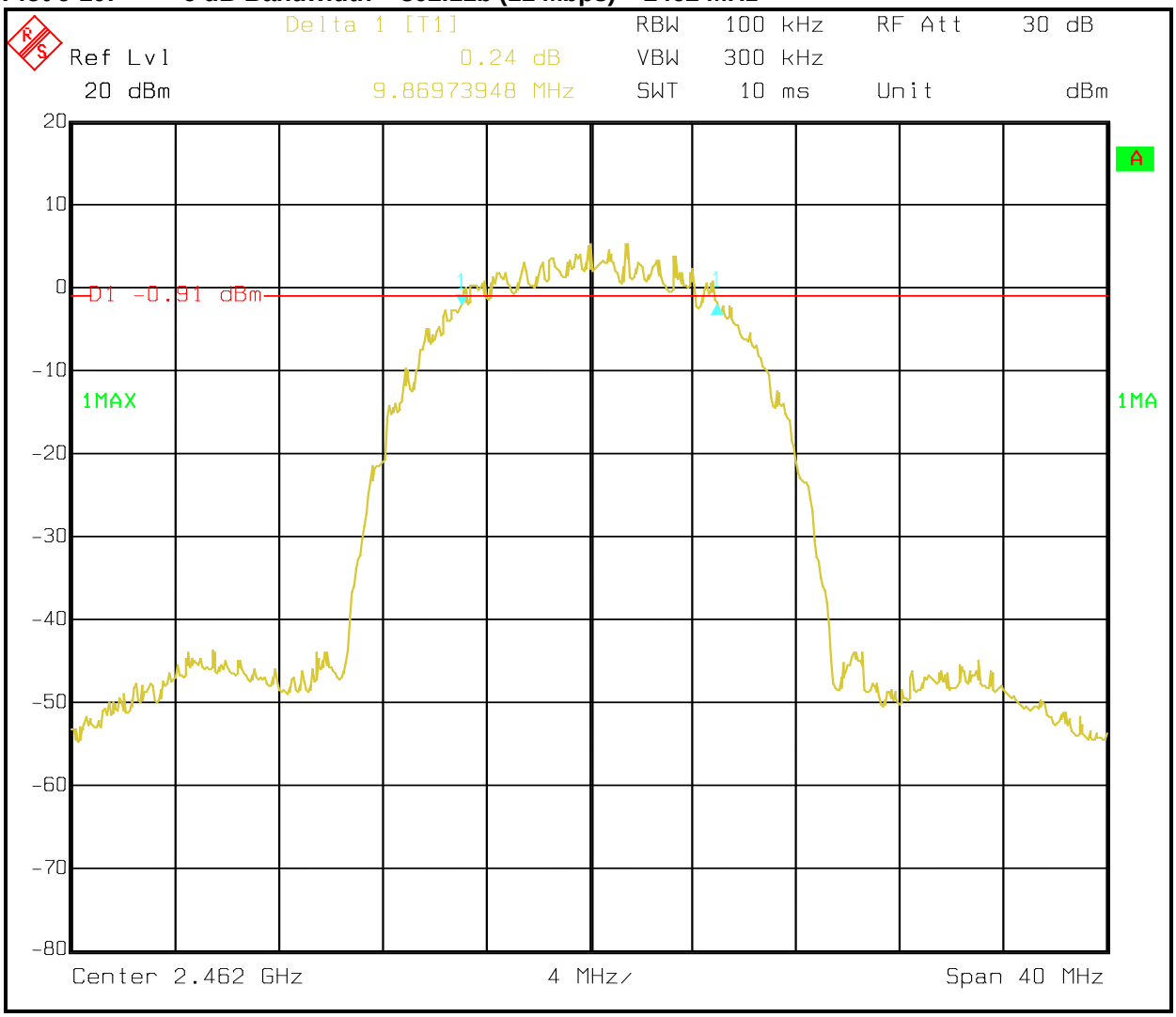
Plot 6-8: 6 dB Bandwidth – 802.11g (54 Mbps) – 2437 MHz



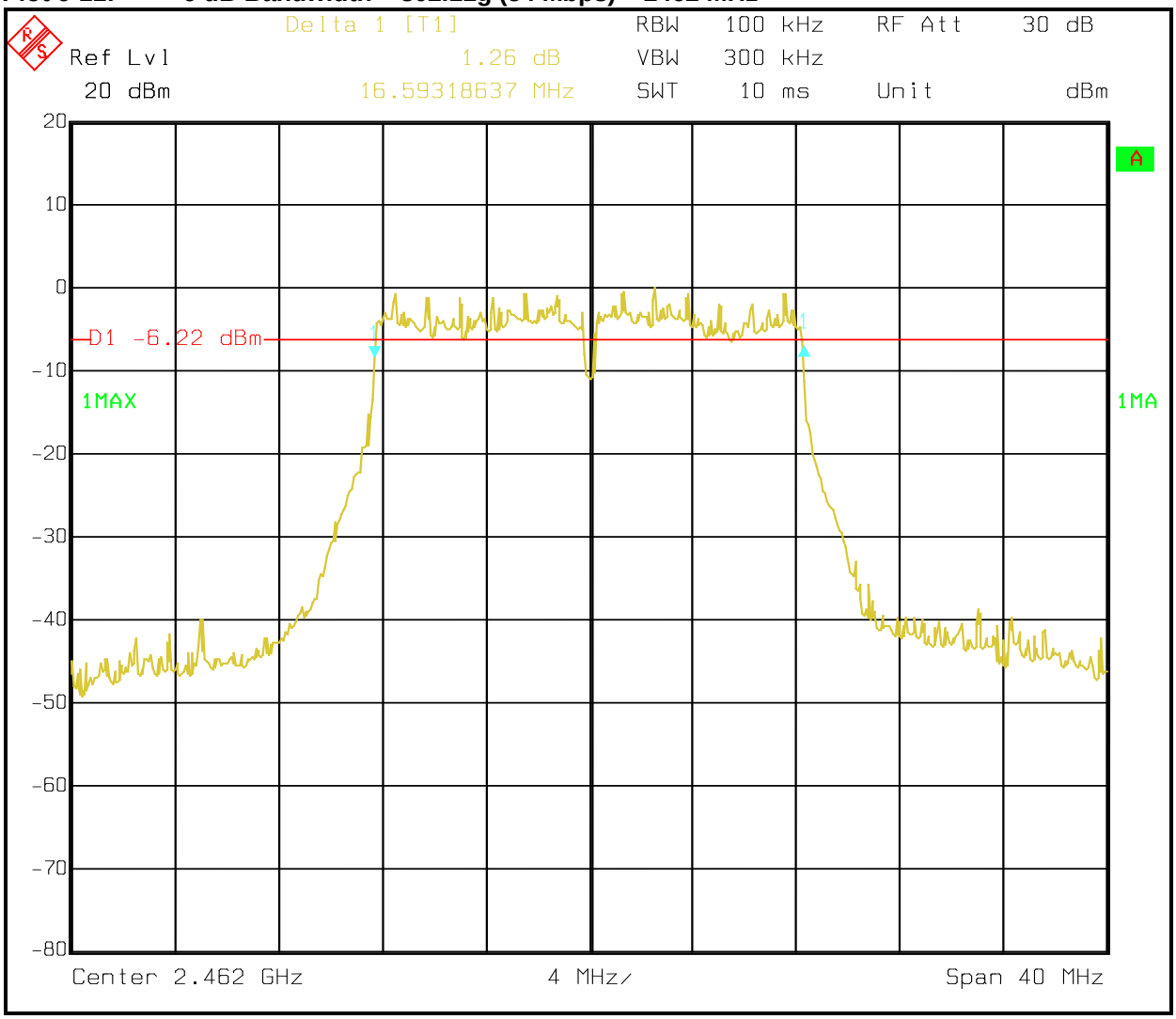
Plot 6-9: 6 dB Bandwidth – 802.11n (MCS7) – 2437 MHz



Plot 6-10: 6 dB Bandwidth – 802.11b (11 Mbps) – 2462 MHz



Plot 6-11: 6 dB Bandwidth – 802.11g (54 Mbps) – 2462 MHz



Plot 6-12: 6 dB Bandwidth – 802.11n (MCS7) – 2462 MHz

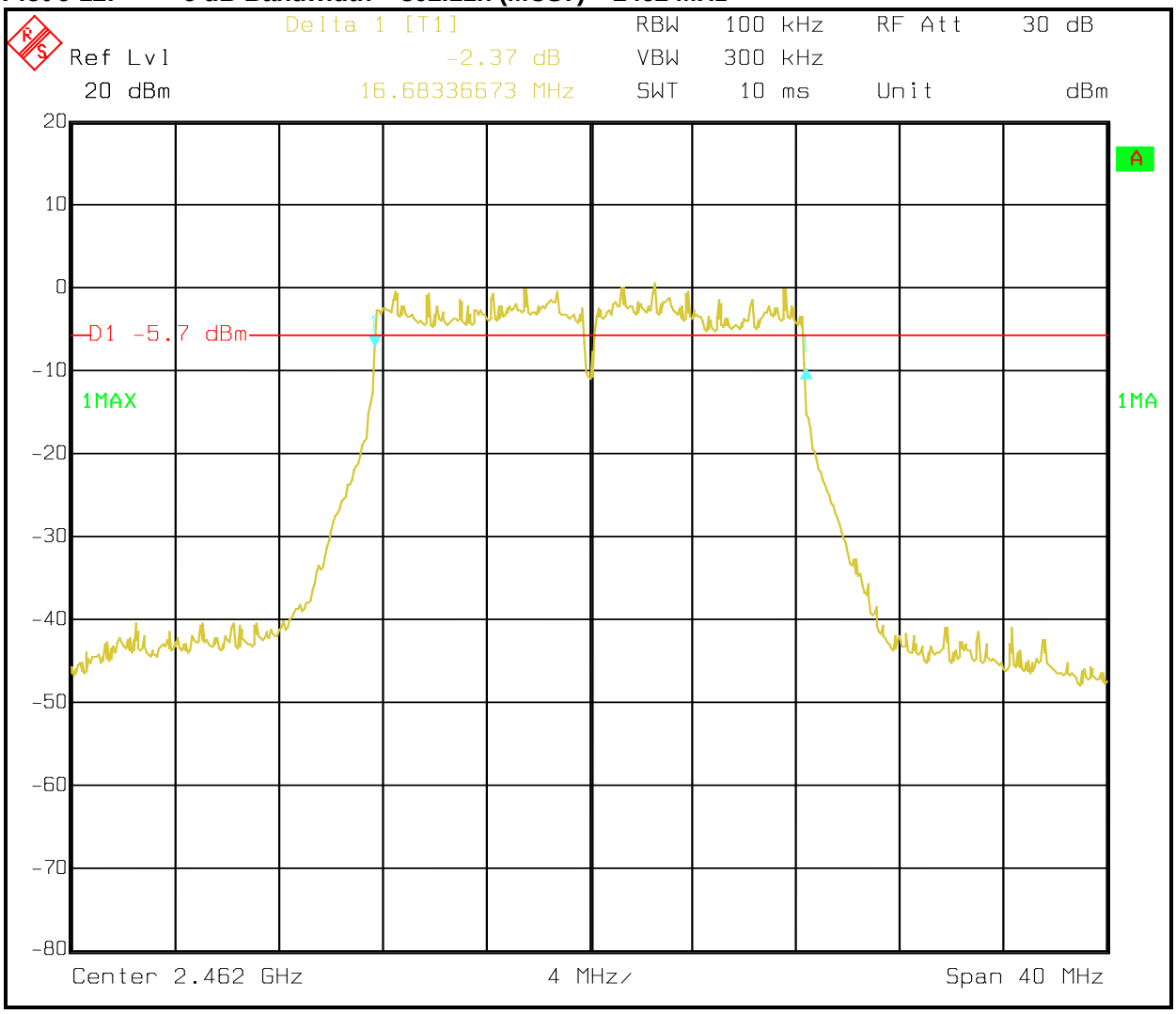


Table 6-5: 6 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	4/17/19

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty= ±2 dB.

RESULTS: PASS

Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	June 8, 2018
Test Engineer	Signature	Date of Test

7 Occupied Bandwidth – ISED RSS-Gen 6.7

7.1 99% Bandwidth Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

7.2 99% Bandwidth Test Data

Table 7-1: 99% Bandwidth Test Data – BLE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
0	2402	1.4
19	2440	1.4
39	2480	1.4

Table 7-2: 99% Bandwidth Test Data – 802.11b (11 Mbps)

Channel	Frequency (MHz)	99% Bandwidth (MHz)
1	2412	16.0
6	2437	16.2
11	2462	16.0

Table 7-3: 99% Bandwidth Test Data – 802.11g (54 Mbps)

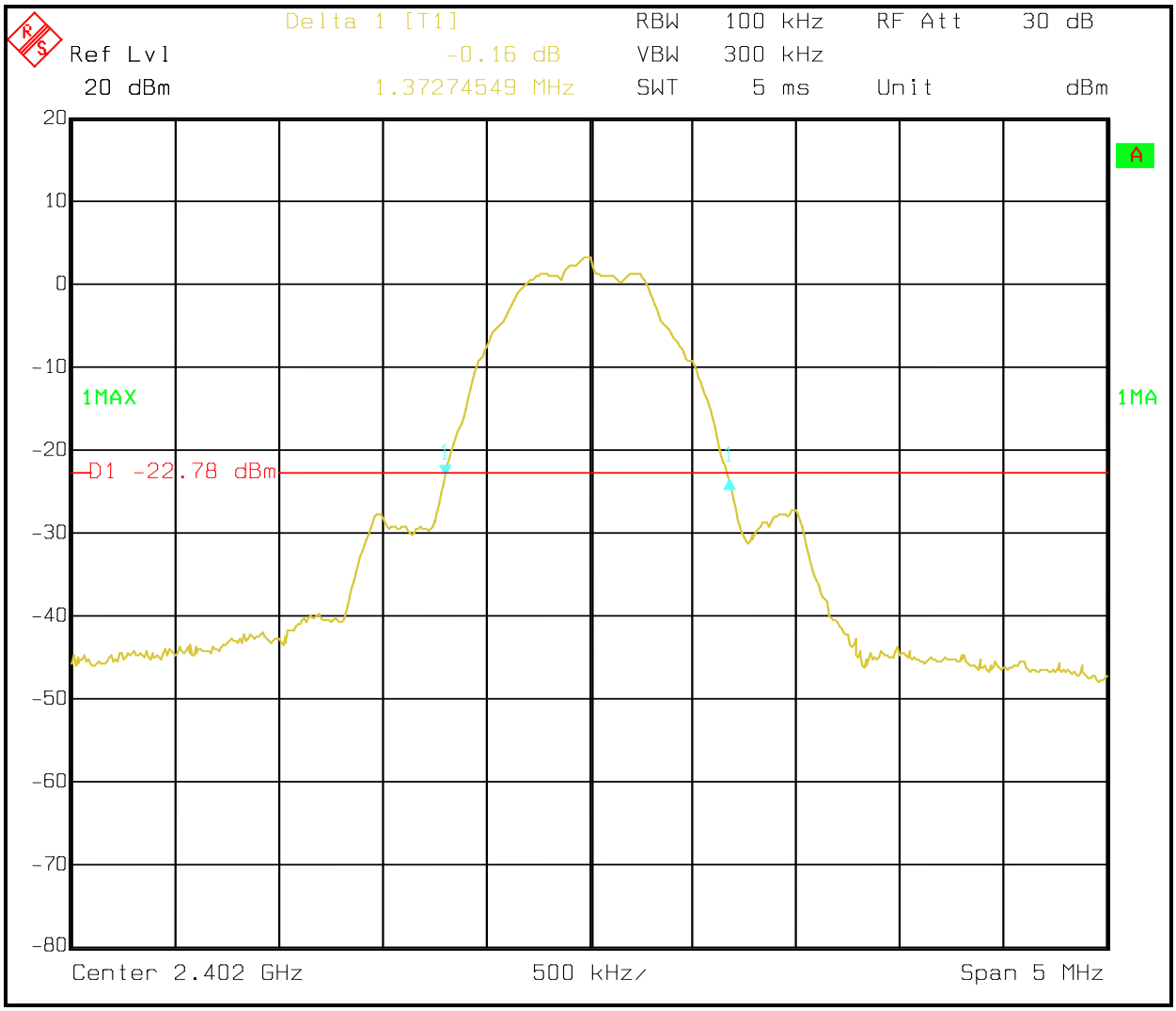
Channel	Frequency (MHz)	99% Bandwidth (MHz)
1	2412	18.9
6	2437	19.1
11	2462	18.9

Table 7-4: 99% Bandwidth Test Data – 802.11n (MCS7)

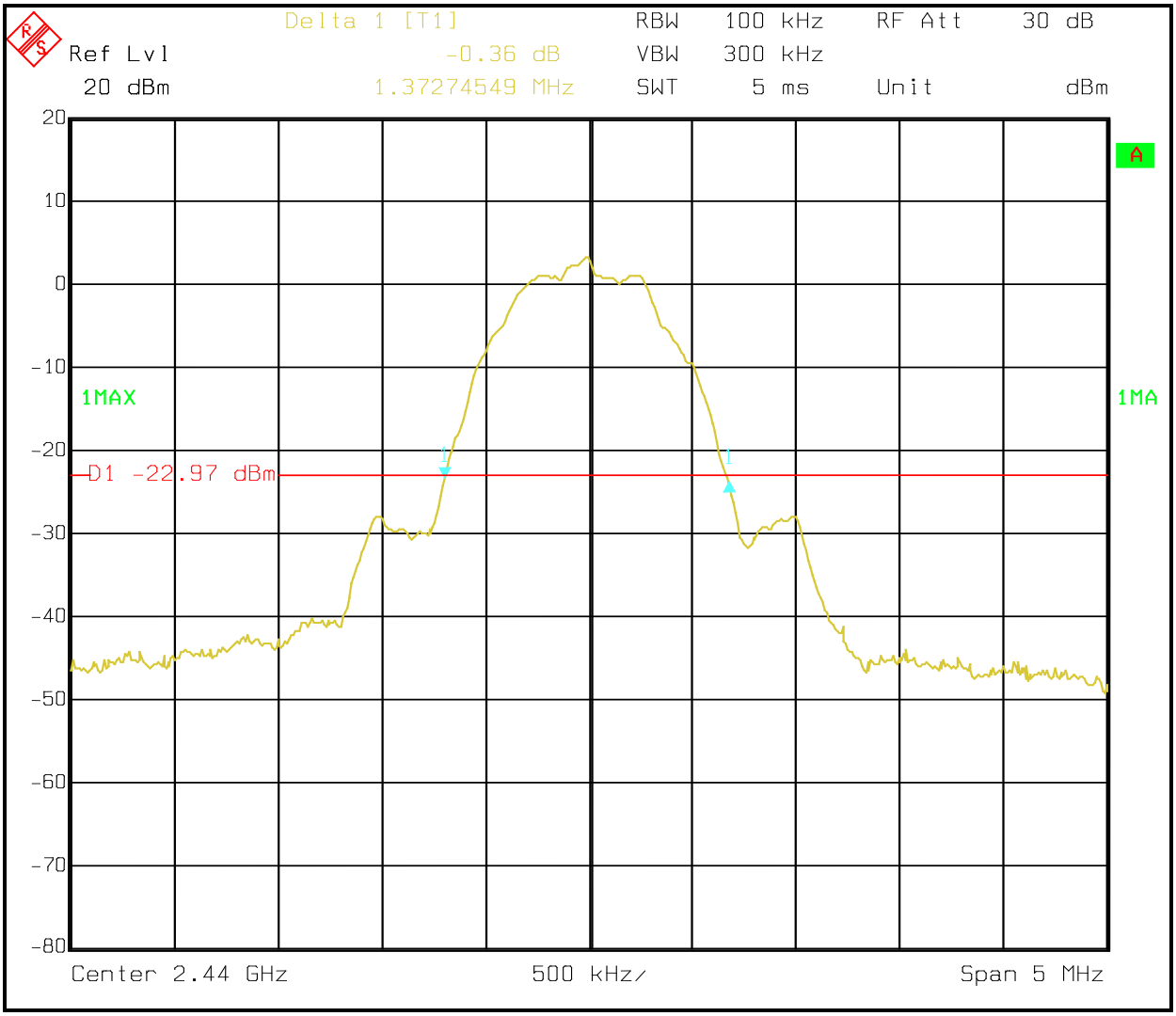
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
1	2412	19.6
6	2437	19.6
11	2462	19.5

7.3 99% Bandwidth Plots

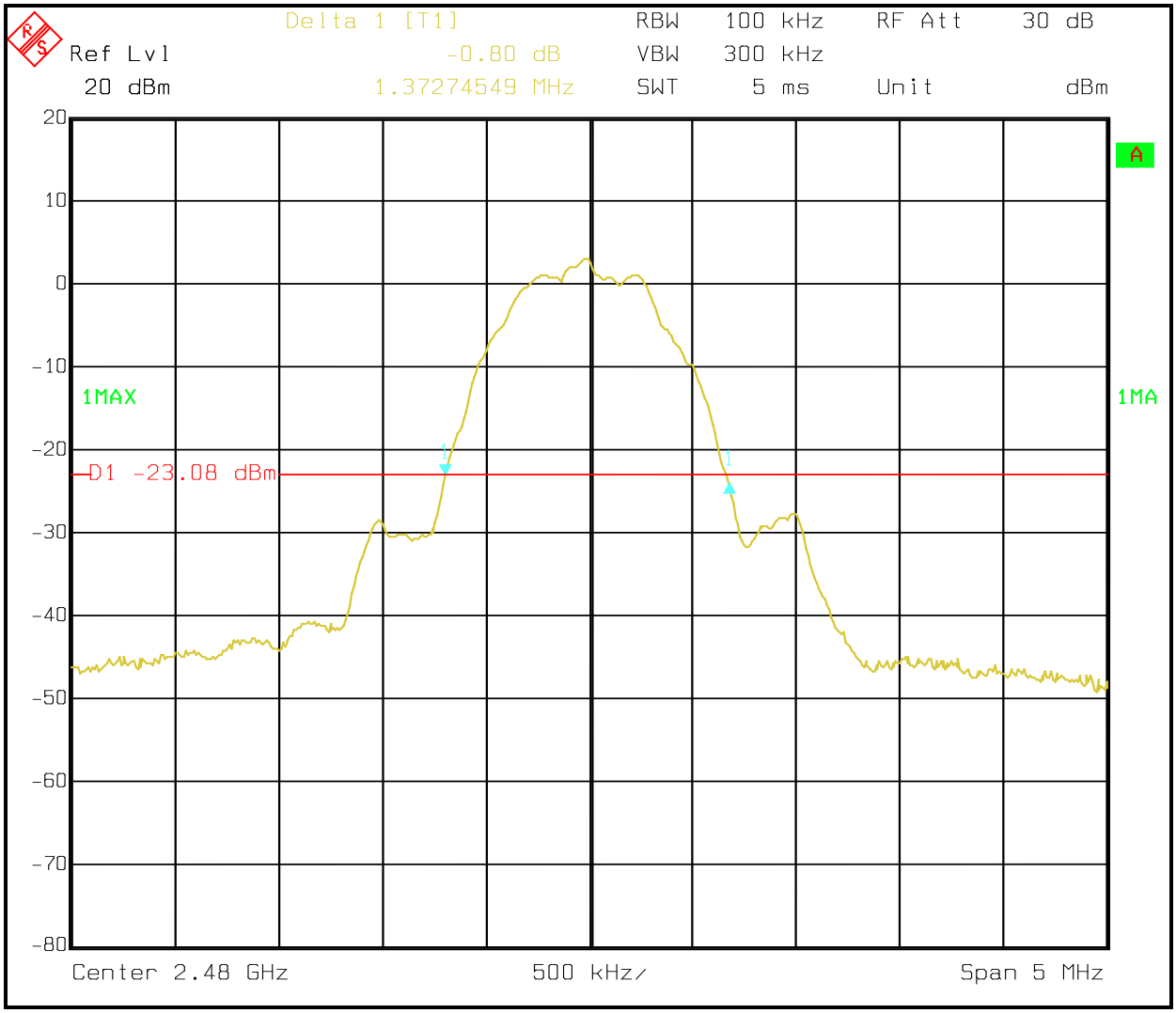
Plot 7-1: 99% Bandwidth – BLE – 2402 MHz



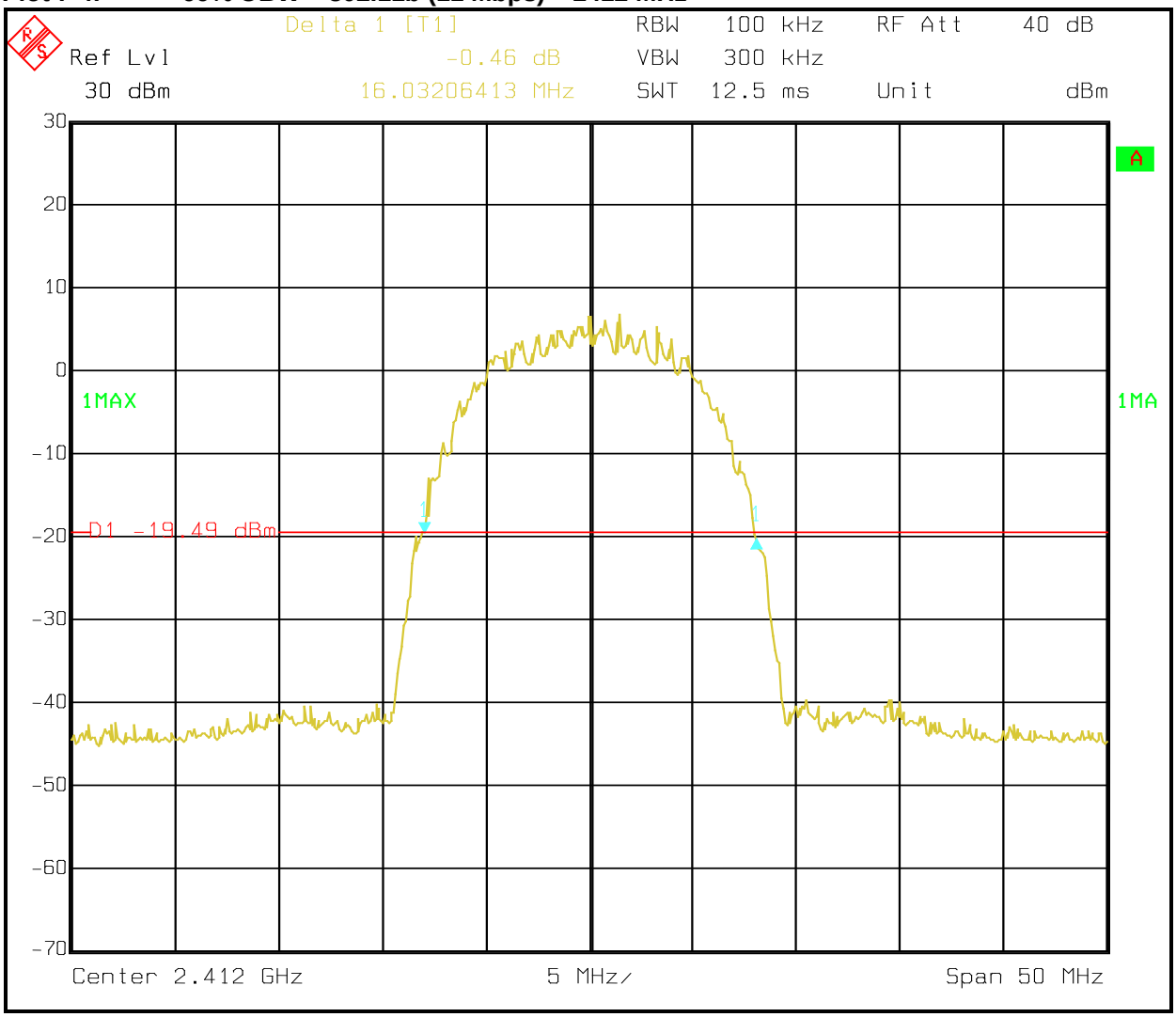
Plot 7-2: 99% OBW – BLE – 2440 MHz



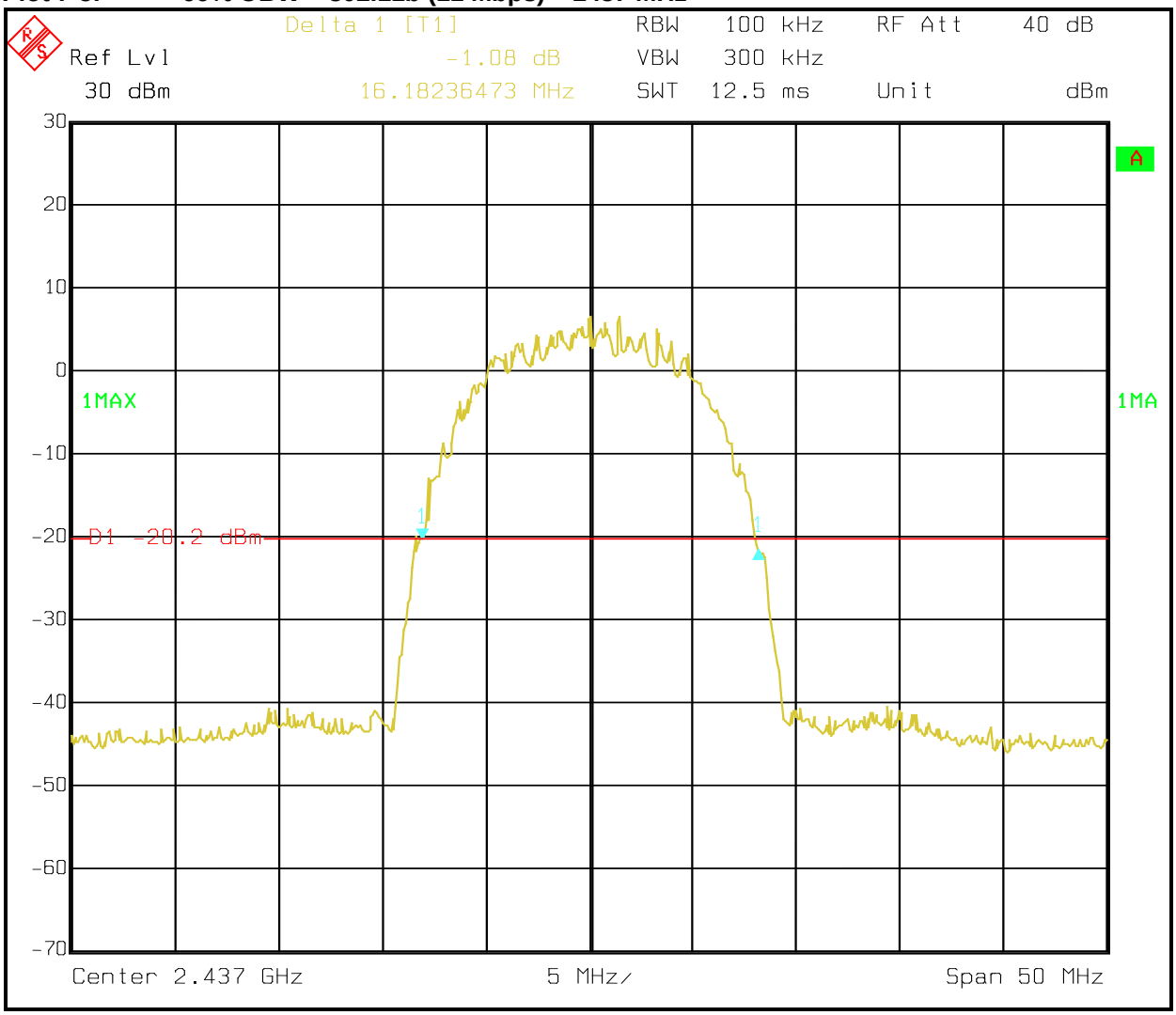
Plot 7-3: 99% OBW – BLE – 2480 MHz



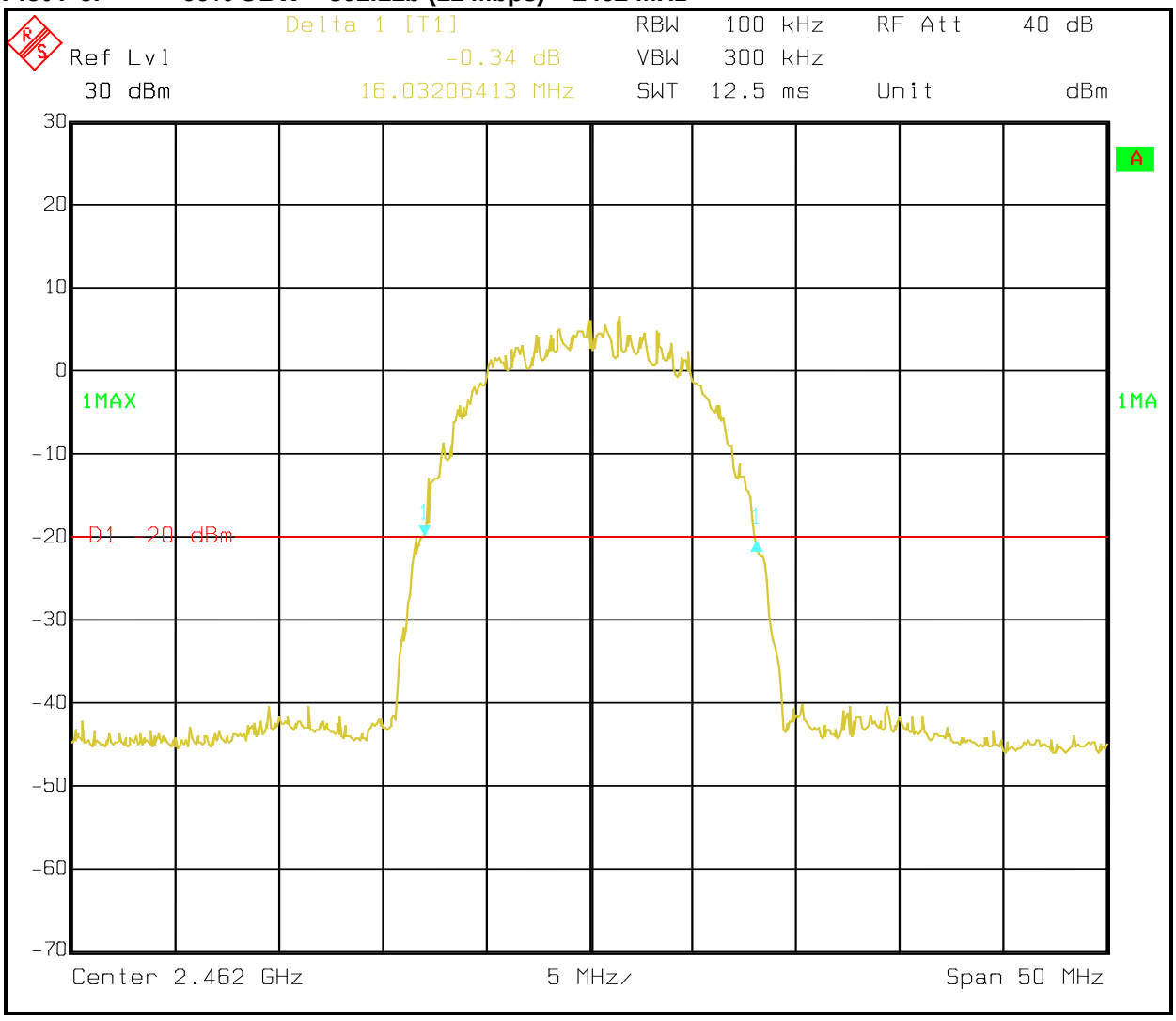
Plot 7-4: 99% OBW – 802.11b (11 Mbps) – 2412 MHz



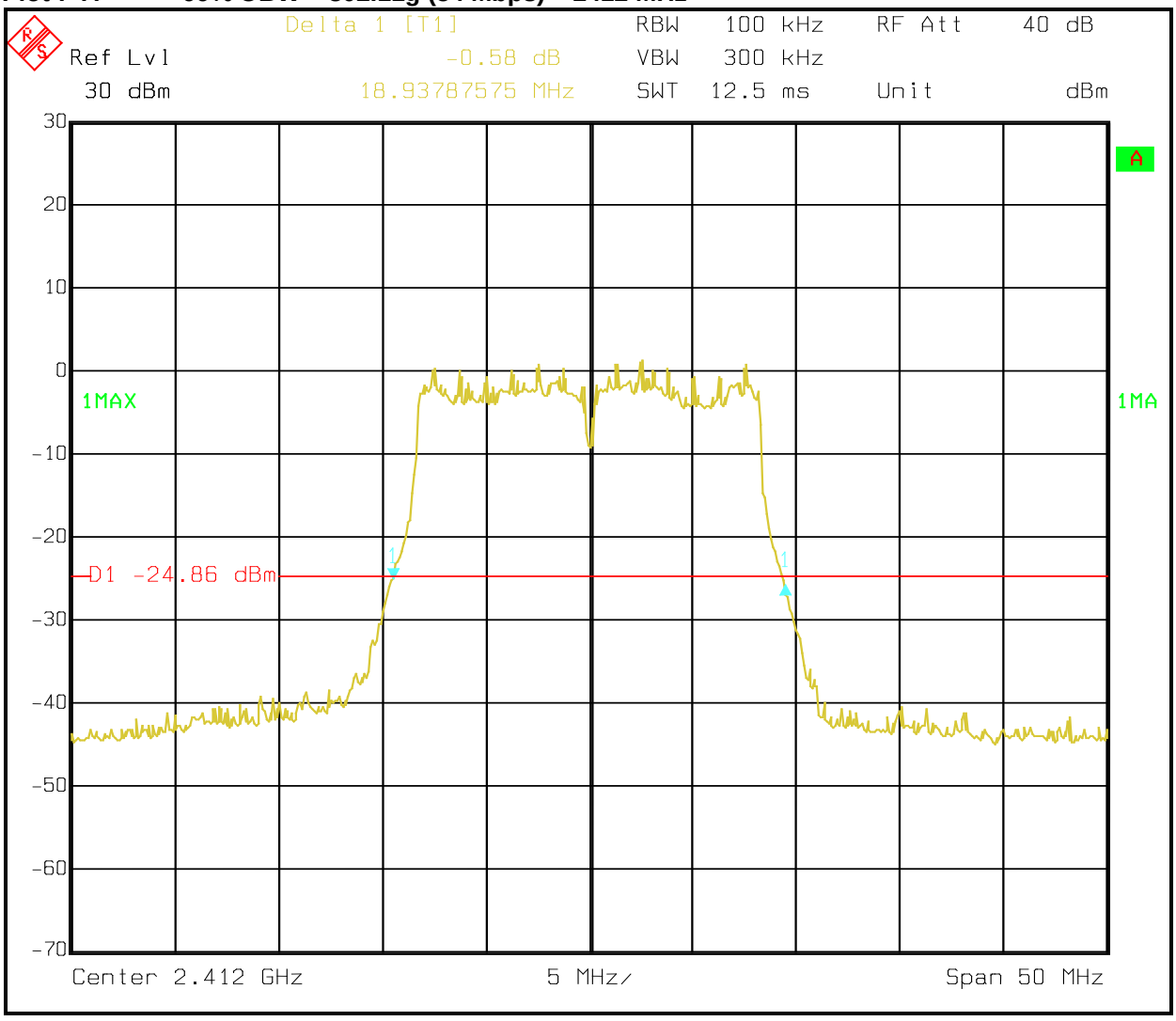
Plot 7-5: 99% OBW – 802.11b (11 Mbps) – 2437 MHz



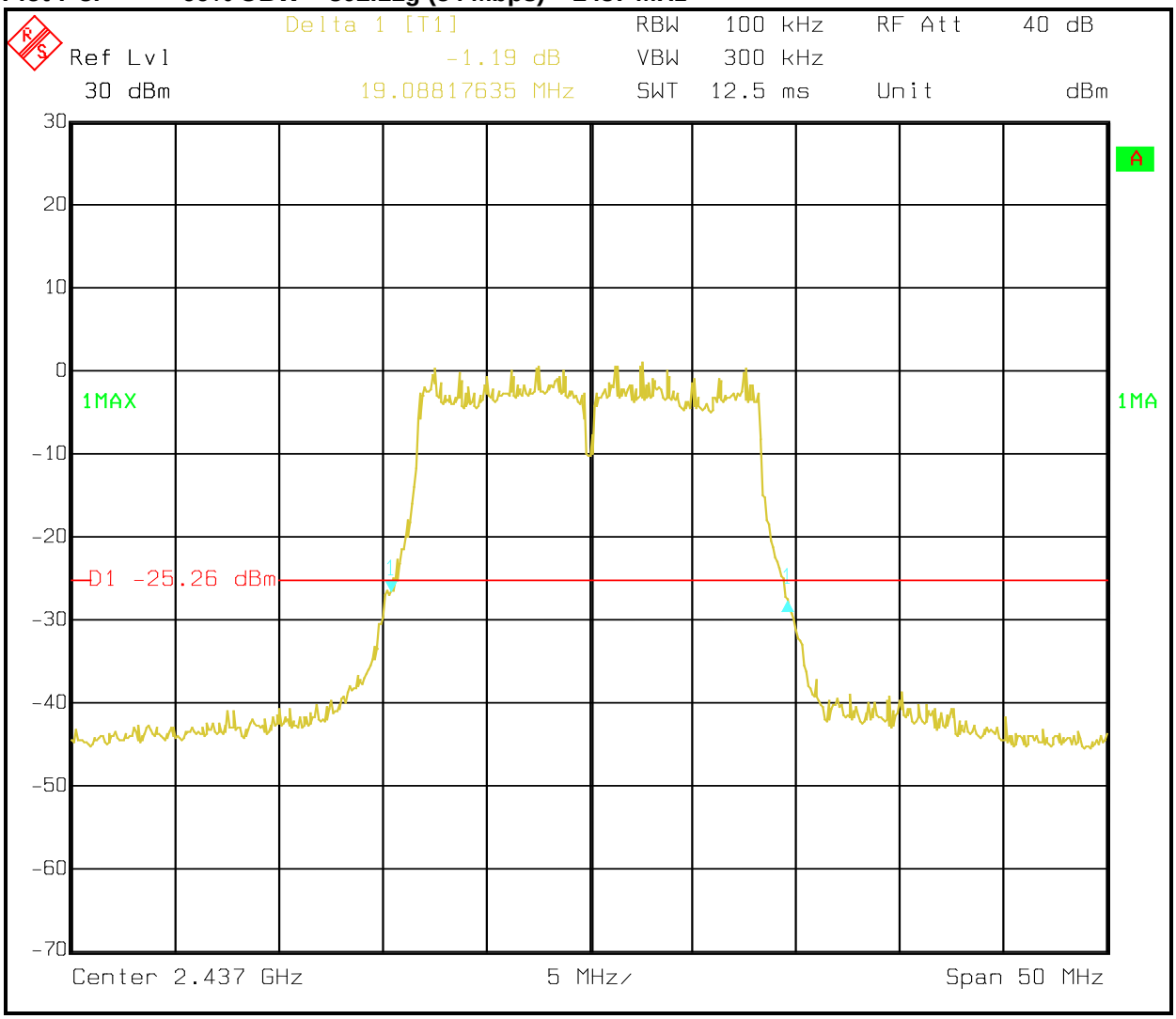
Plot 7-6: 99% OBW – 802.11b (11 Mbps) – 2462 MHz



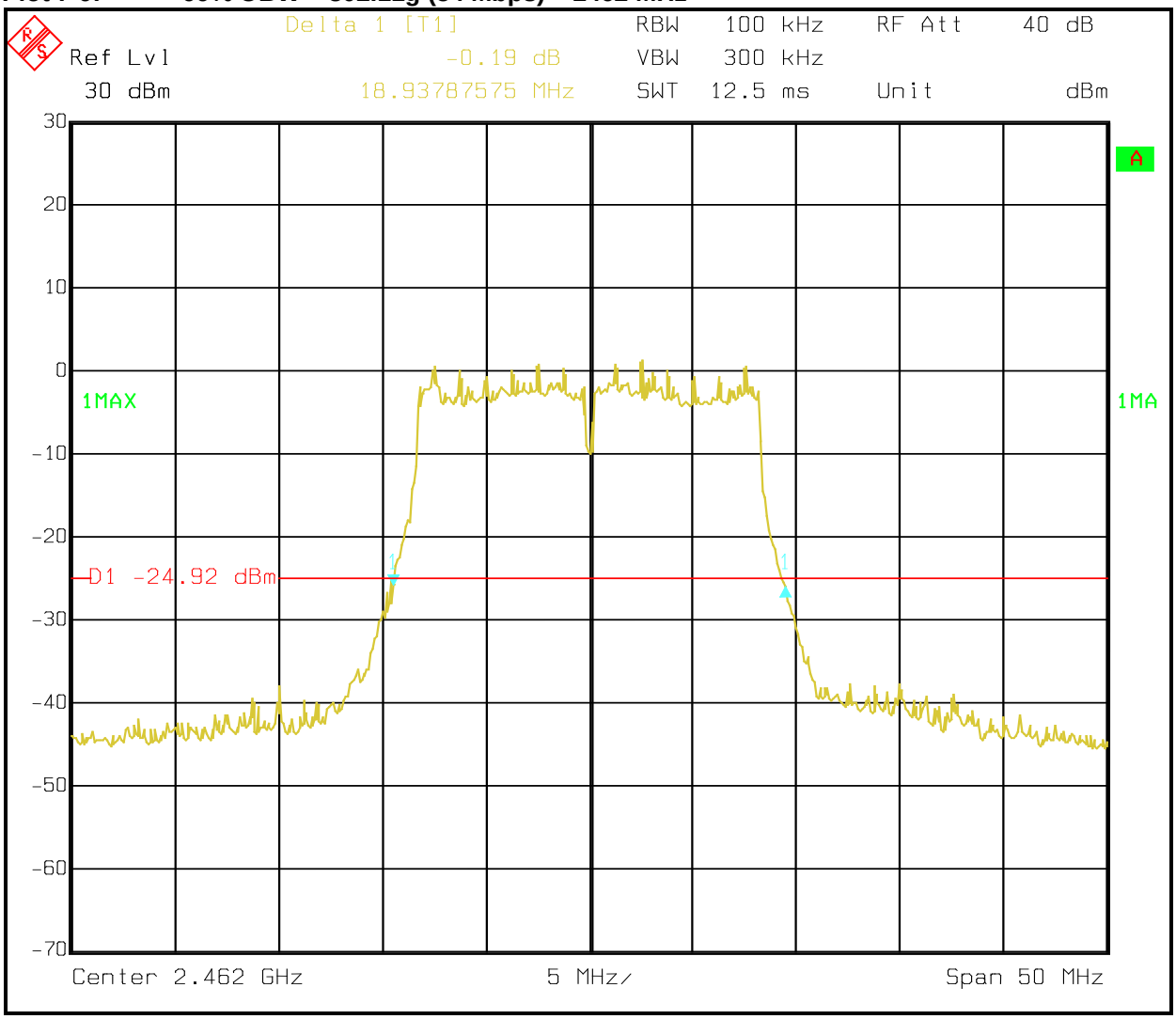
Plot 7-7: 99% OBW – 802.11g (54 Mbps) – 2412 MHz



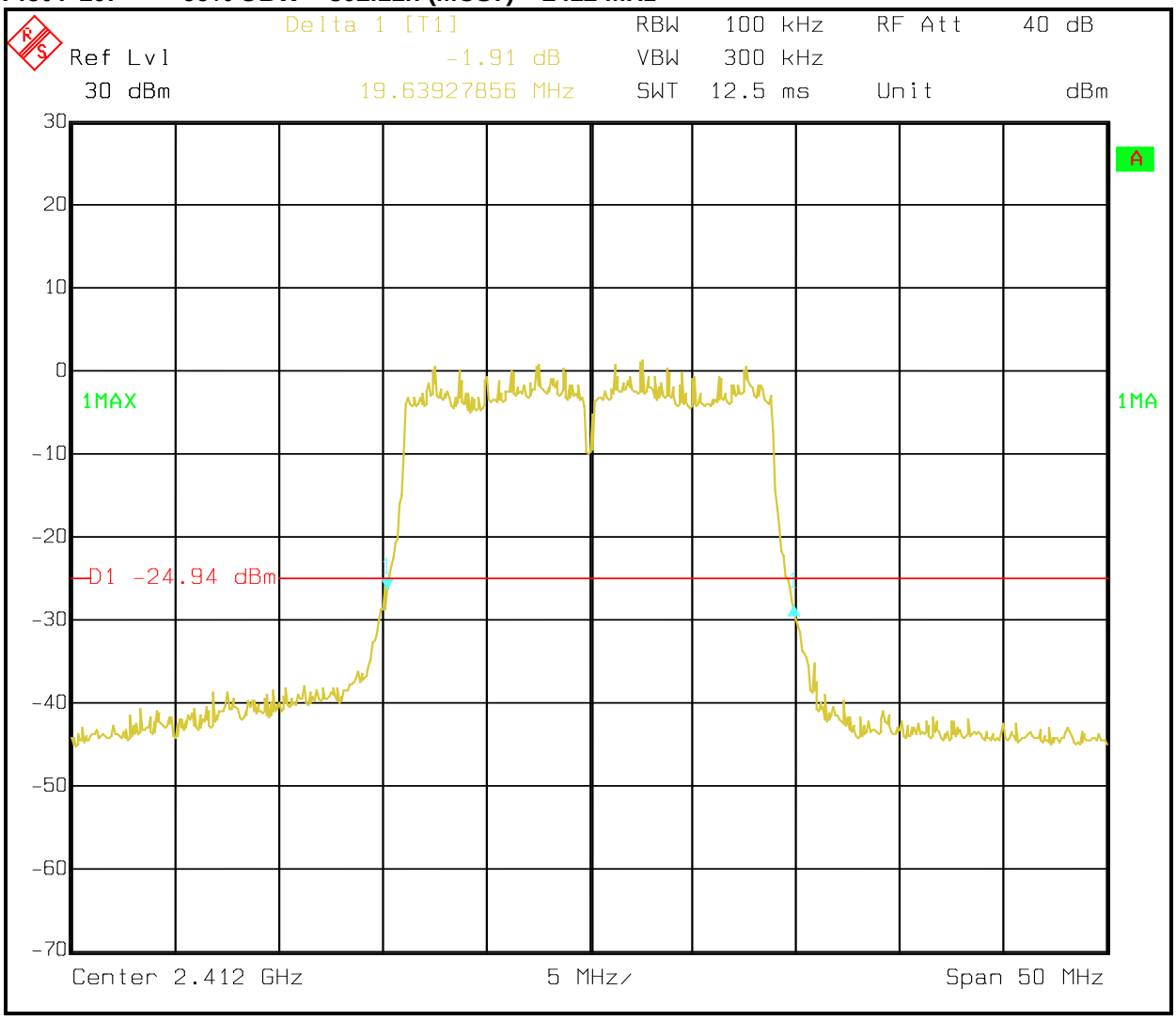
Plot 7-8: 99% OBW – 802.11g (54 Mbps) – 2437 MHz



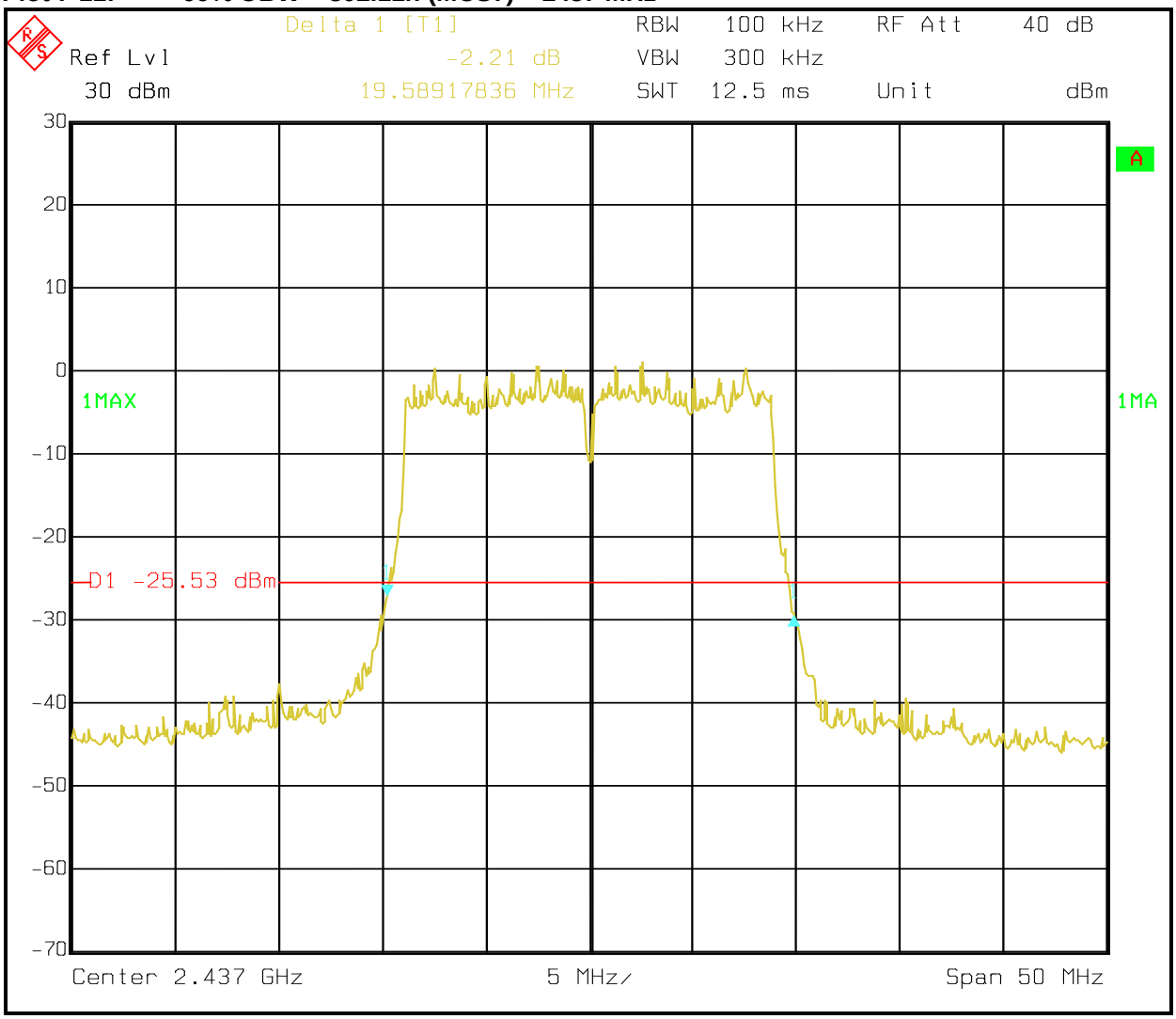
Plot 7-9: 99% OBW – 802.11g (54 Mbps) – 2462 MHz



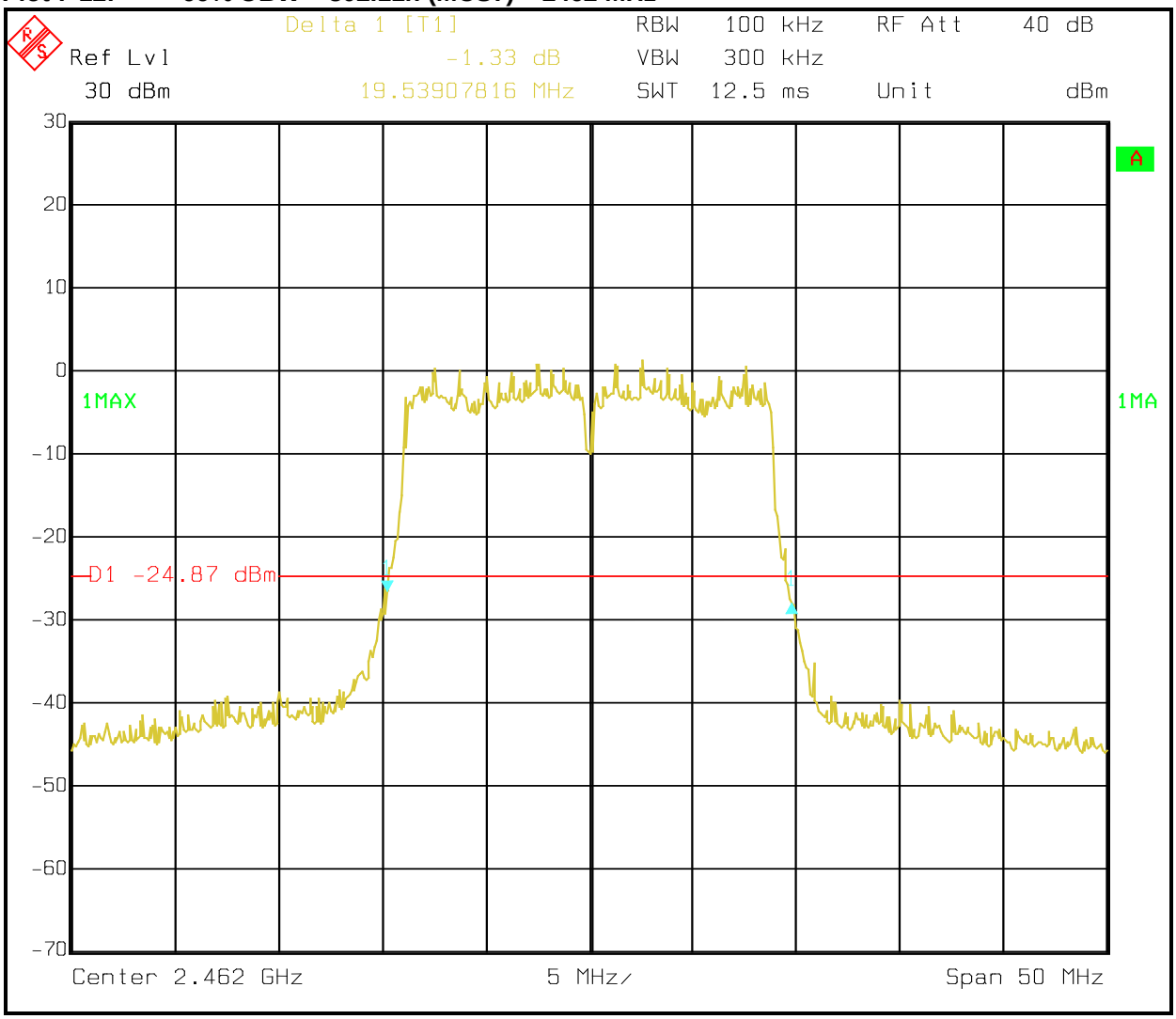
Plot 7-10: 99% OBW – 802.11n (MCS7) – 2412 MHz



Plot 7-11: 99% OBW – 802.11n (MCS7) – 2437 MHz



Plot 7-12: 99% OBW – 802.11n (MCS7) – 2462 MHz



Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty: ±2 dB.

Table 7-5: 99% OBW Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19

Test Personnel:

Daniel W. Baltzell		June 14, 2018
Test Engineer	Signature	Date of Test

8 Power Spectral Density – FCC 15.247(e); ISED RSS-247 5.2(b)

8.1 Power Spectral Density Test Procedure

The power spectral density per FCC 15.247(e) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz, the video bandwidth set at 30 kHz, and the auto sweep time. The spectral lines were resolved for the modulated carriers at 2412 MHz, 2437 MHz, and 2462 MHz for Wi-Fi, and 2402, 2440, and 2480 for BLE. These levels are below the +8 dBm limit. See the power spectral density table and plots.

8.2 Power Spectral Density Test Data

Table 8-1: Power Spectral Density Test Data – BLE

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
0	2402	-3.0	8	Pass
19	2440	-3.1	8	Pass
39	2480	-3.0	8	Pass

Table 8-2: Power Spectral Density Test Data – 802.11b (11 Mbps)

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-6.8	8	Pass
6	2437	-6.9	8	Pass
11	2462	-6.8	8	Pass

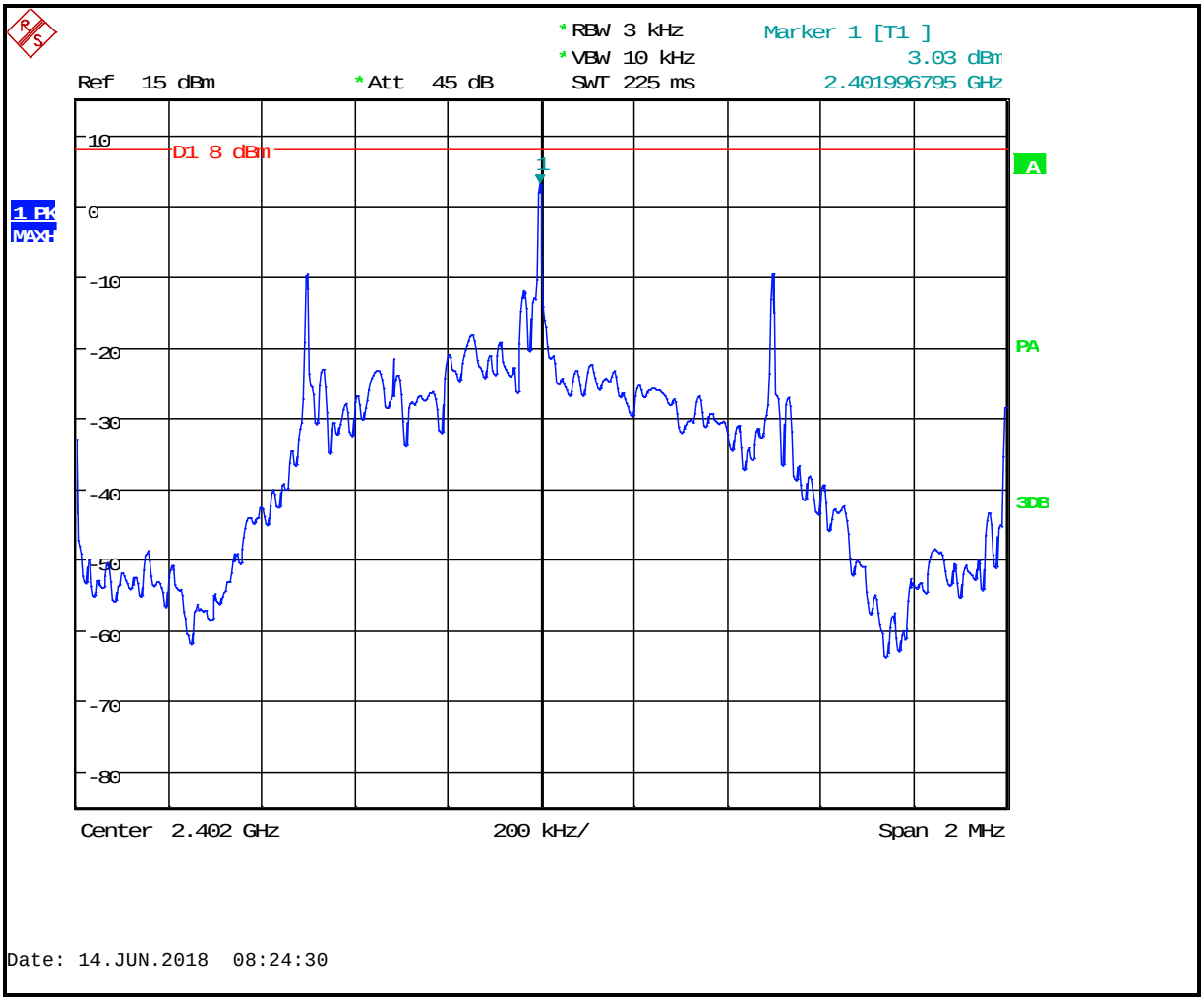
Table 8-3: Power Spectral Density Test Data – 802.11g (54 Mbps)

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-14.7	8	Pass
6	2437	-14.5	8	Pass
11	2462	-15.4	8	Pass

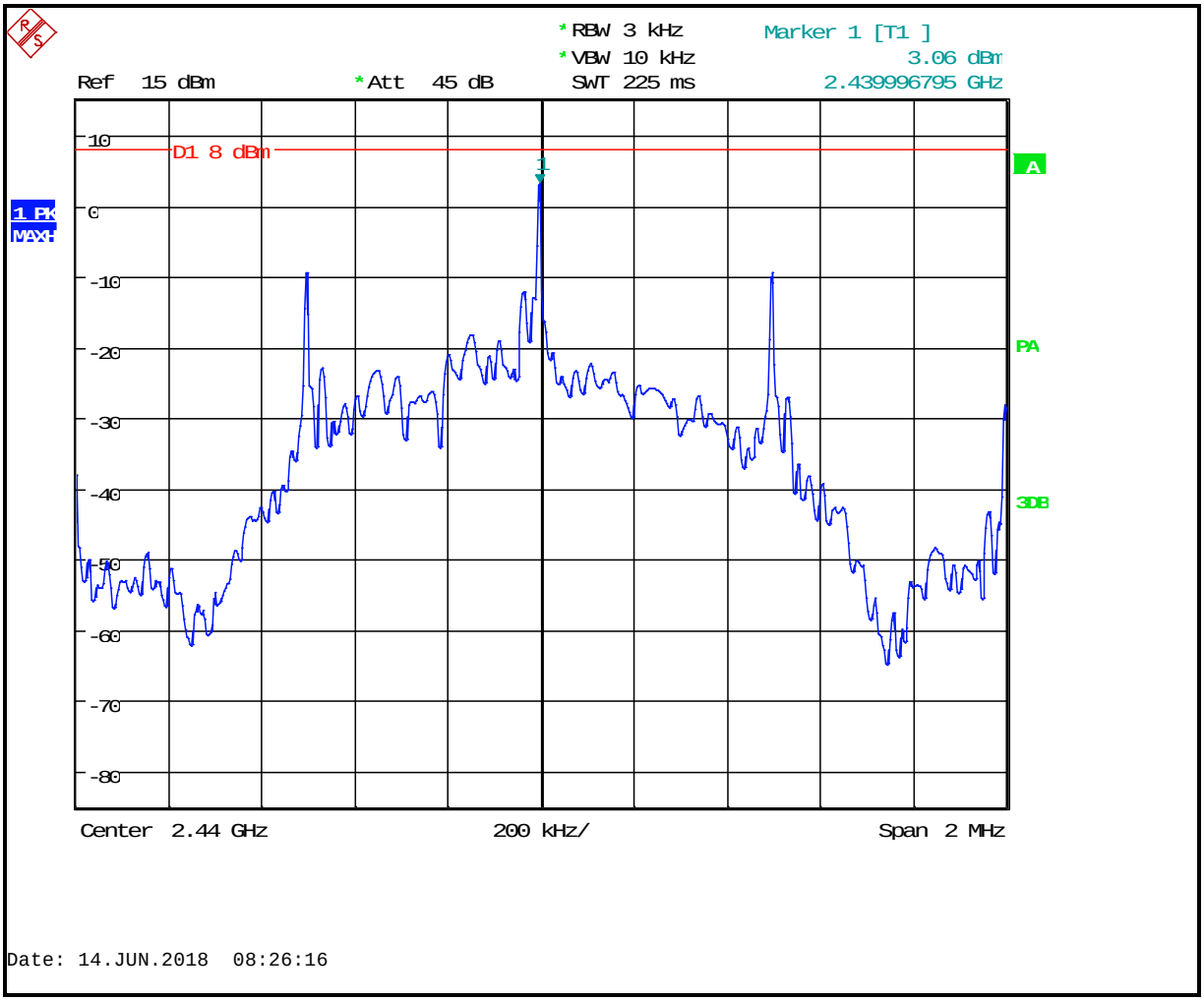
Table 8-4: Power Spectral Density Test Data – 802.11n (MCS7)

Channel	Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8dBm	Pass/Fail
1	2412	-16.0	8	Pass
6	2437	-15.7	8	Pass
11	2462	-14.1	8	Pass

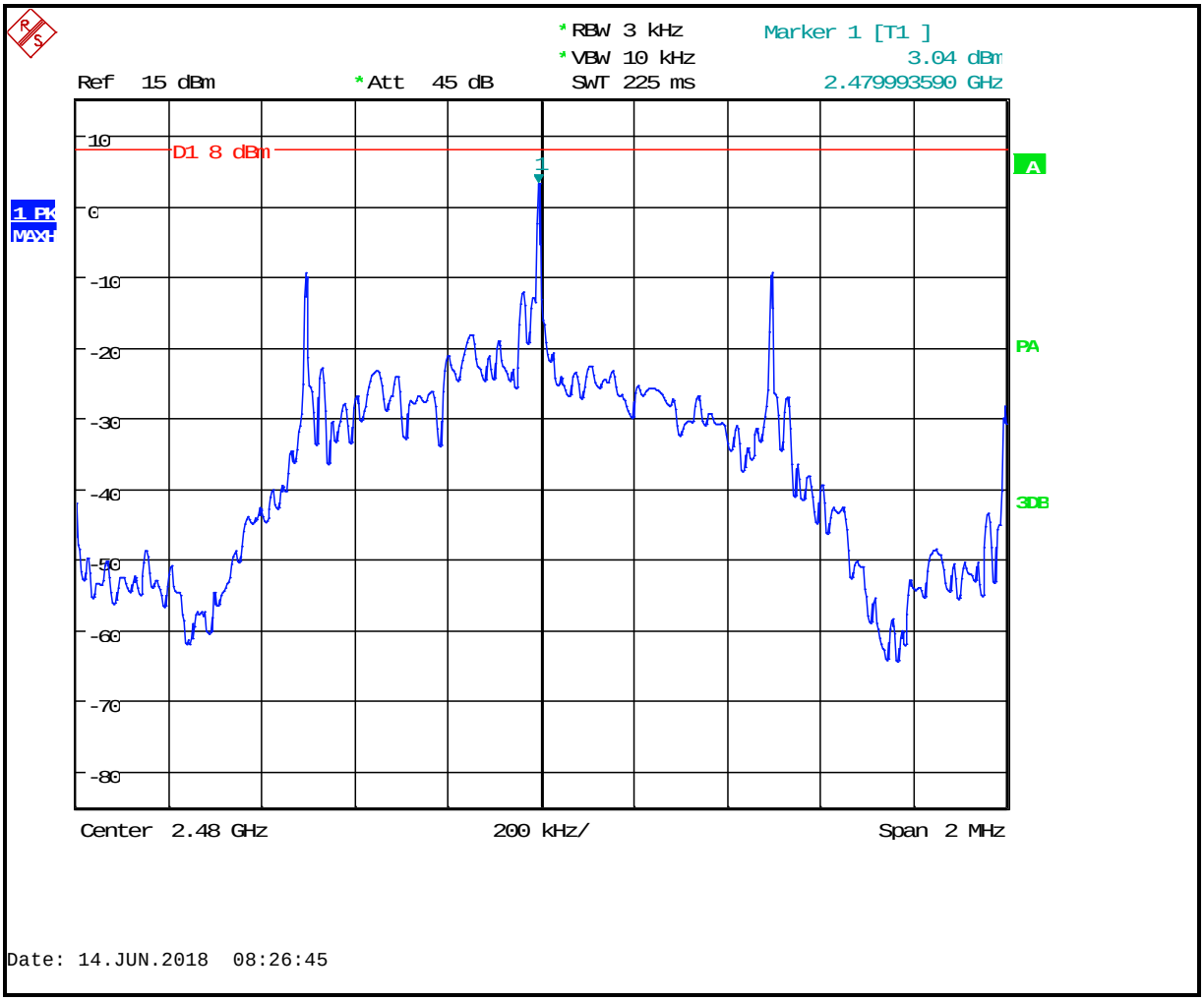
Plot 8-1: PSD – BLE – 2402 MHz



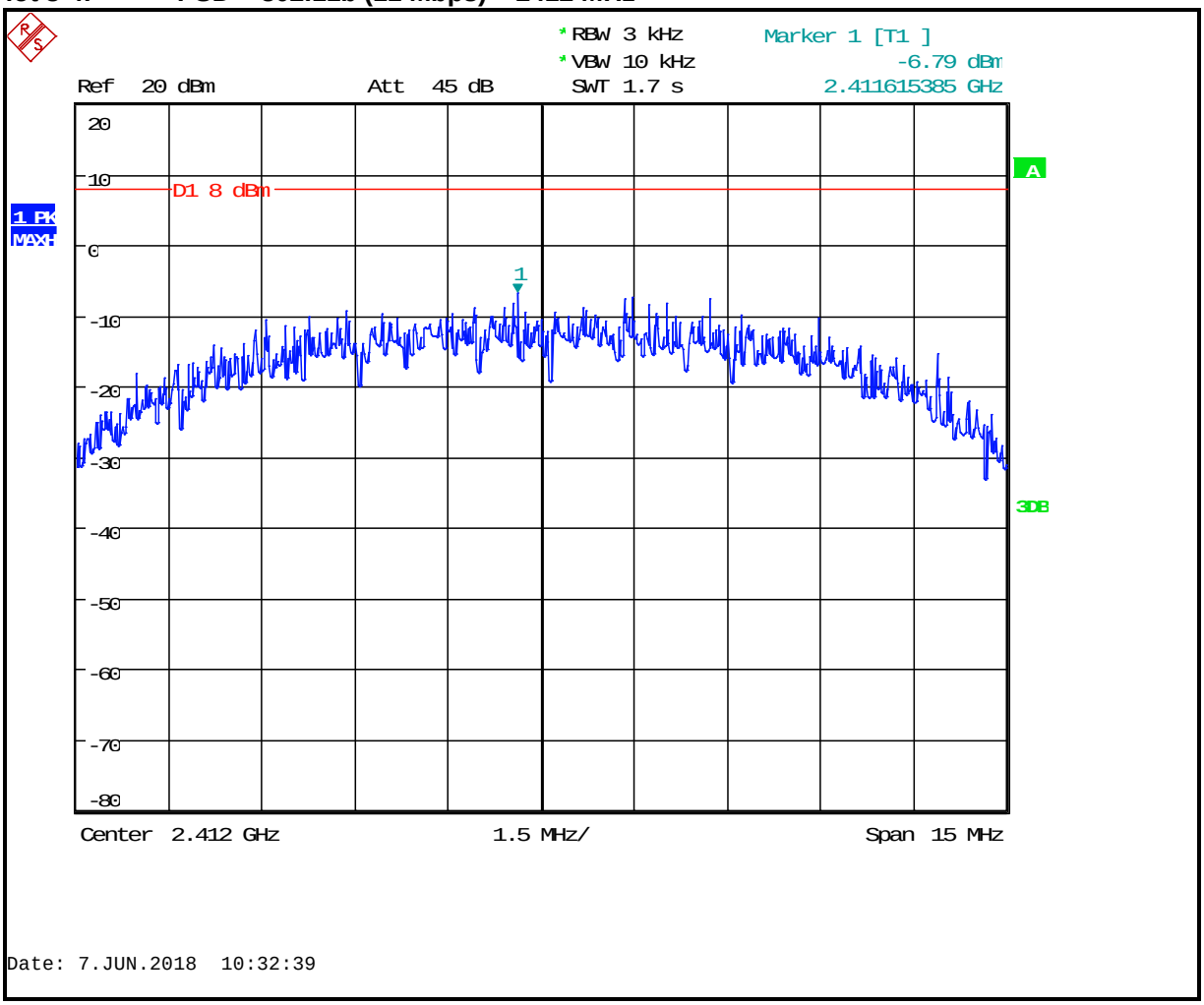
Plot 8-2: PSD – BLE – 2440 MHz



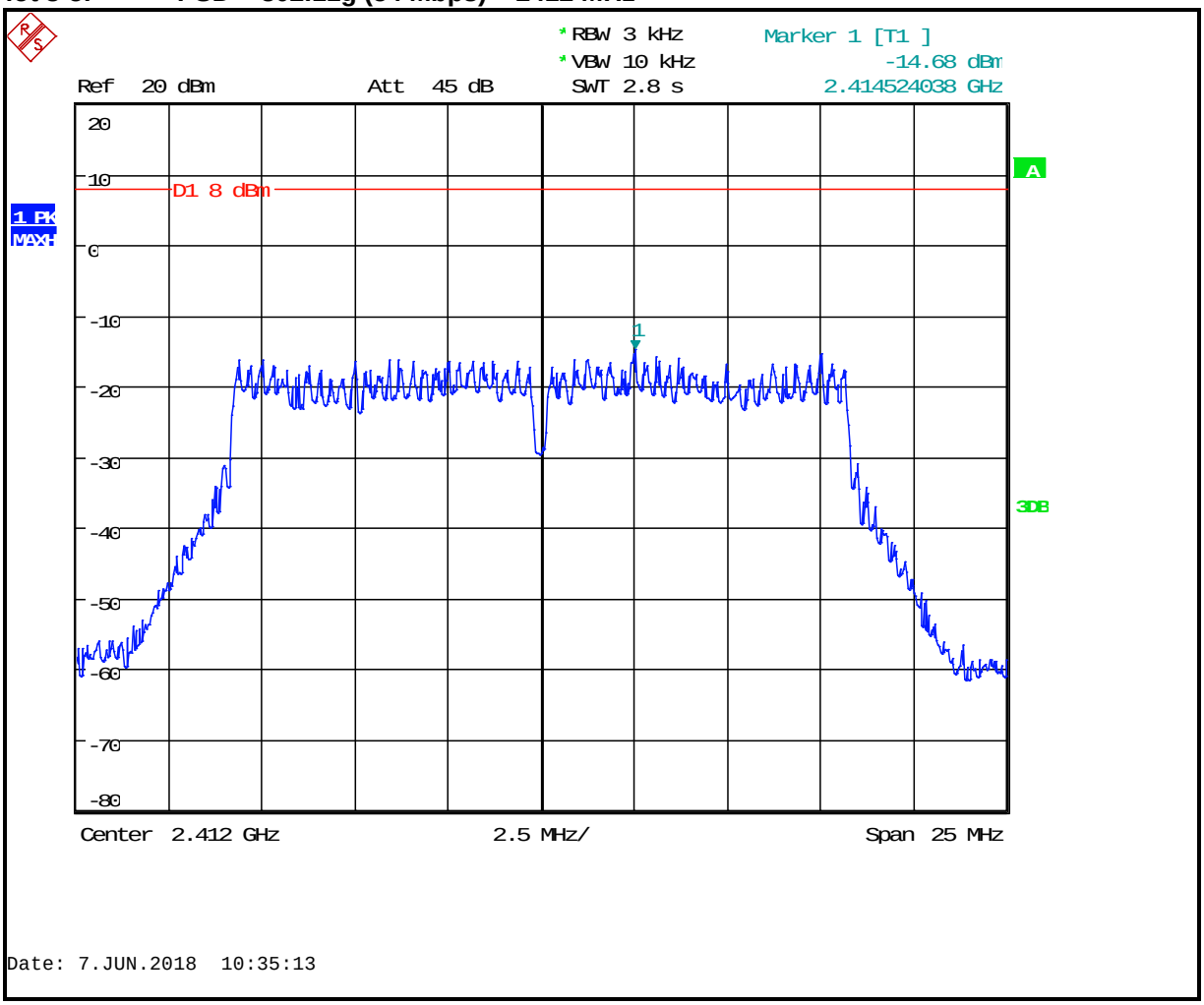
Plot 8-3: PSD – BLE – 2480 MHz



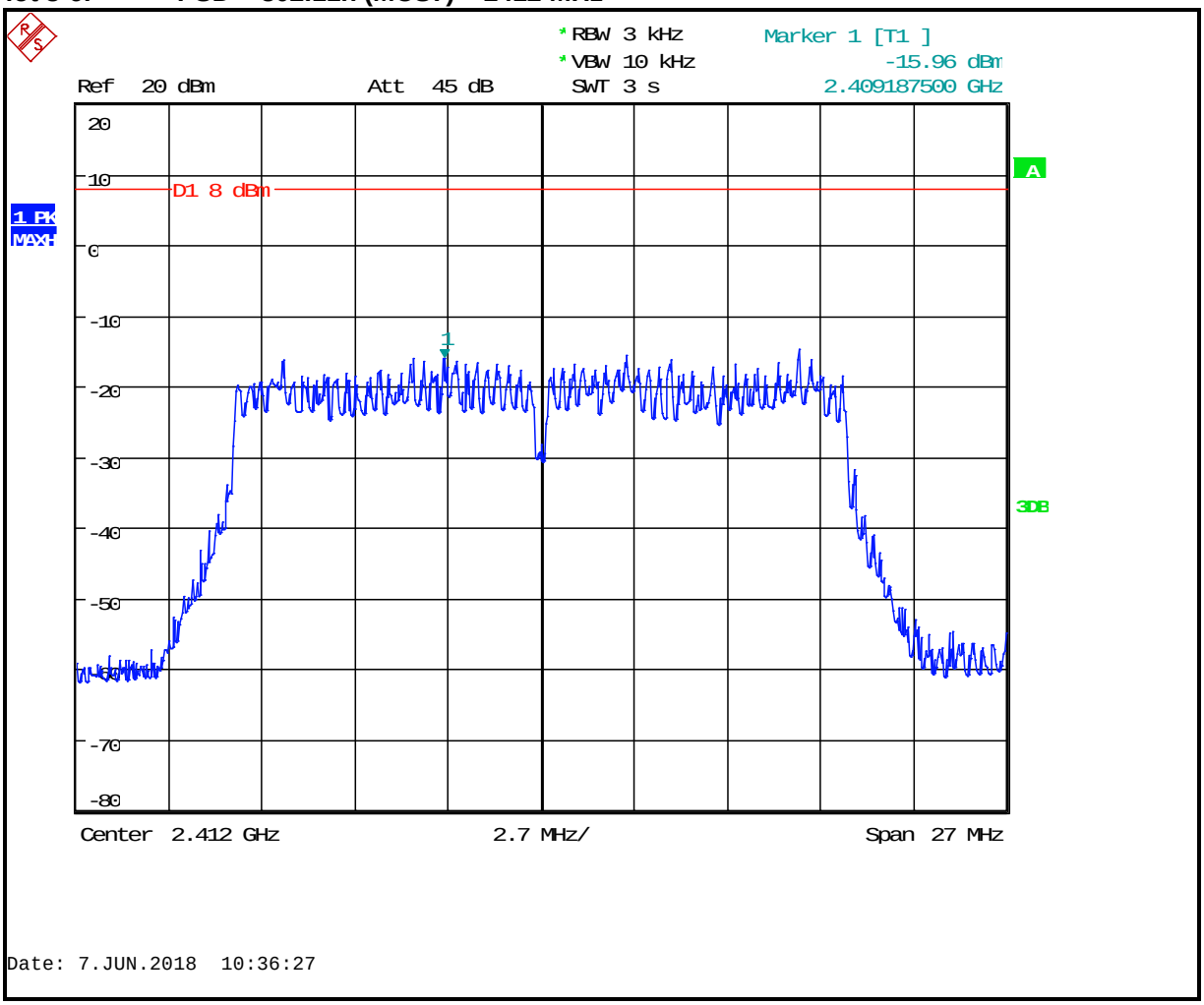
Plot 8-4: PSD – 802.11b (11 Mbps) – 2412 MHz



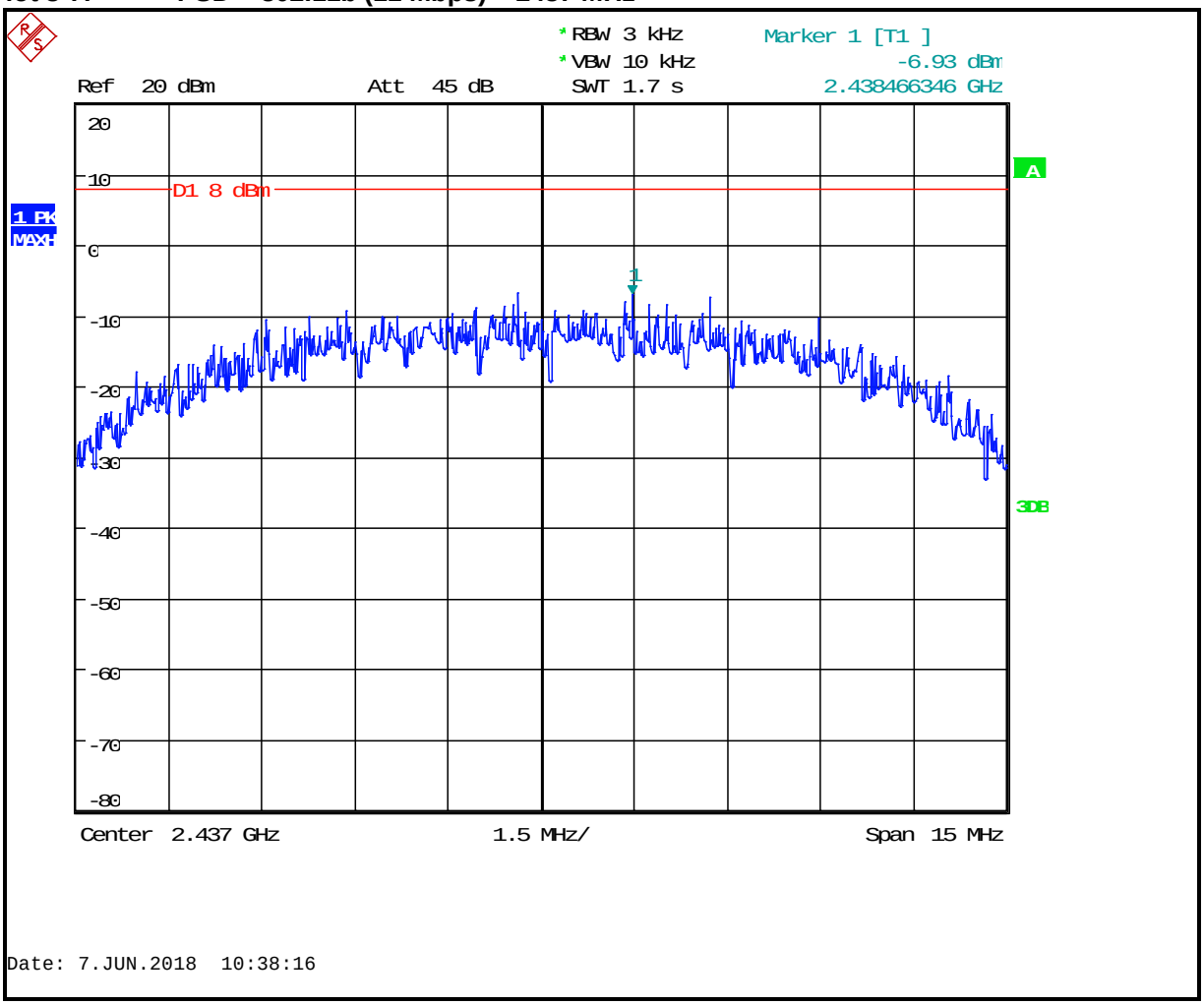
Plot 8-5: PSD – 802.11g (54 Mbps) – 2412 MHz



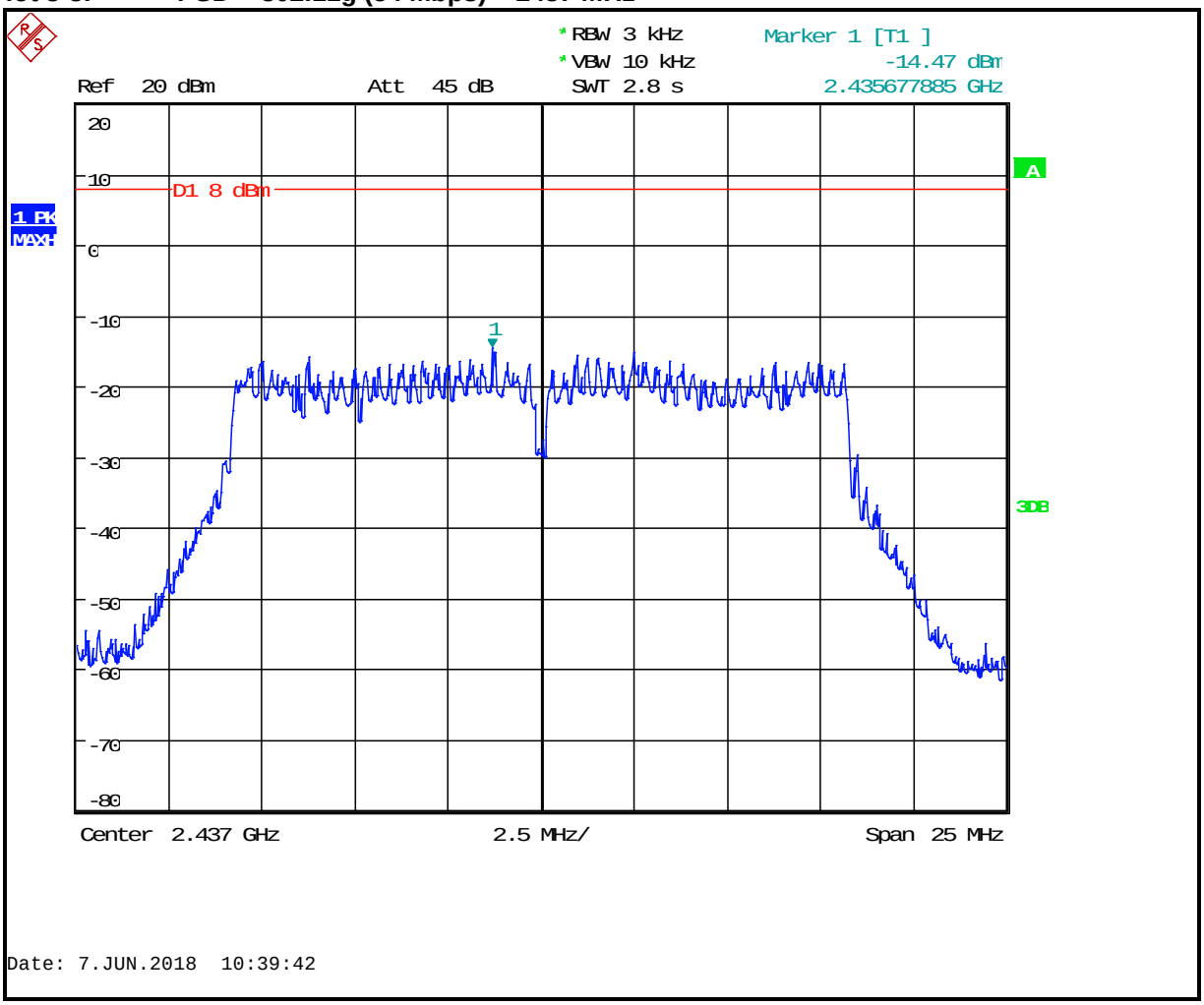
Plot 8-6: PSD – 802.11n (MCS7) – 2412 MHz



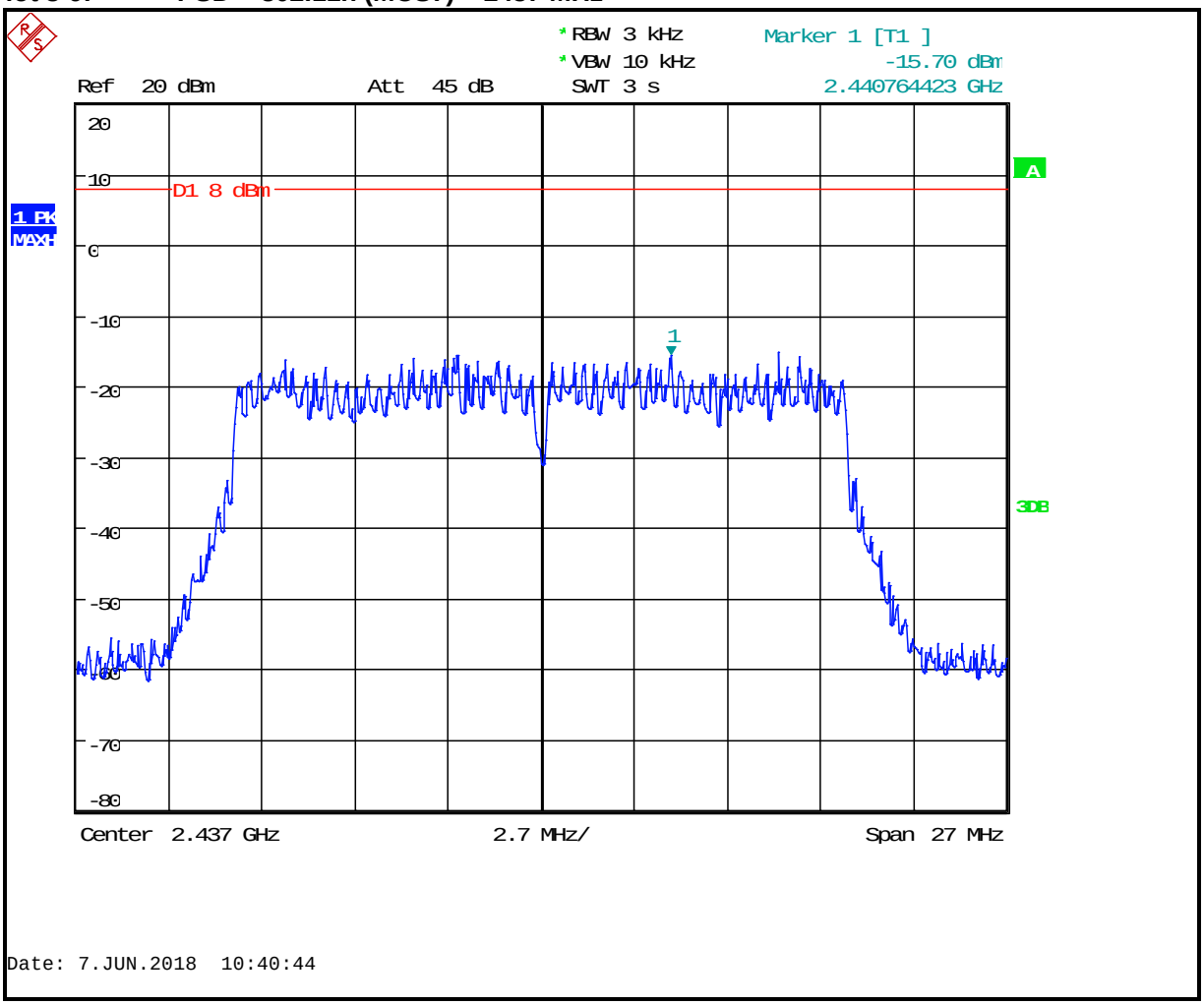
Plot 8-7: PSD – 802.11b (11 Mbps) – 2437 MHz



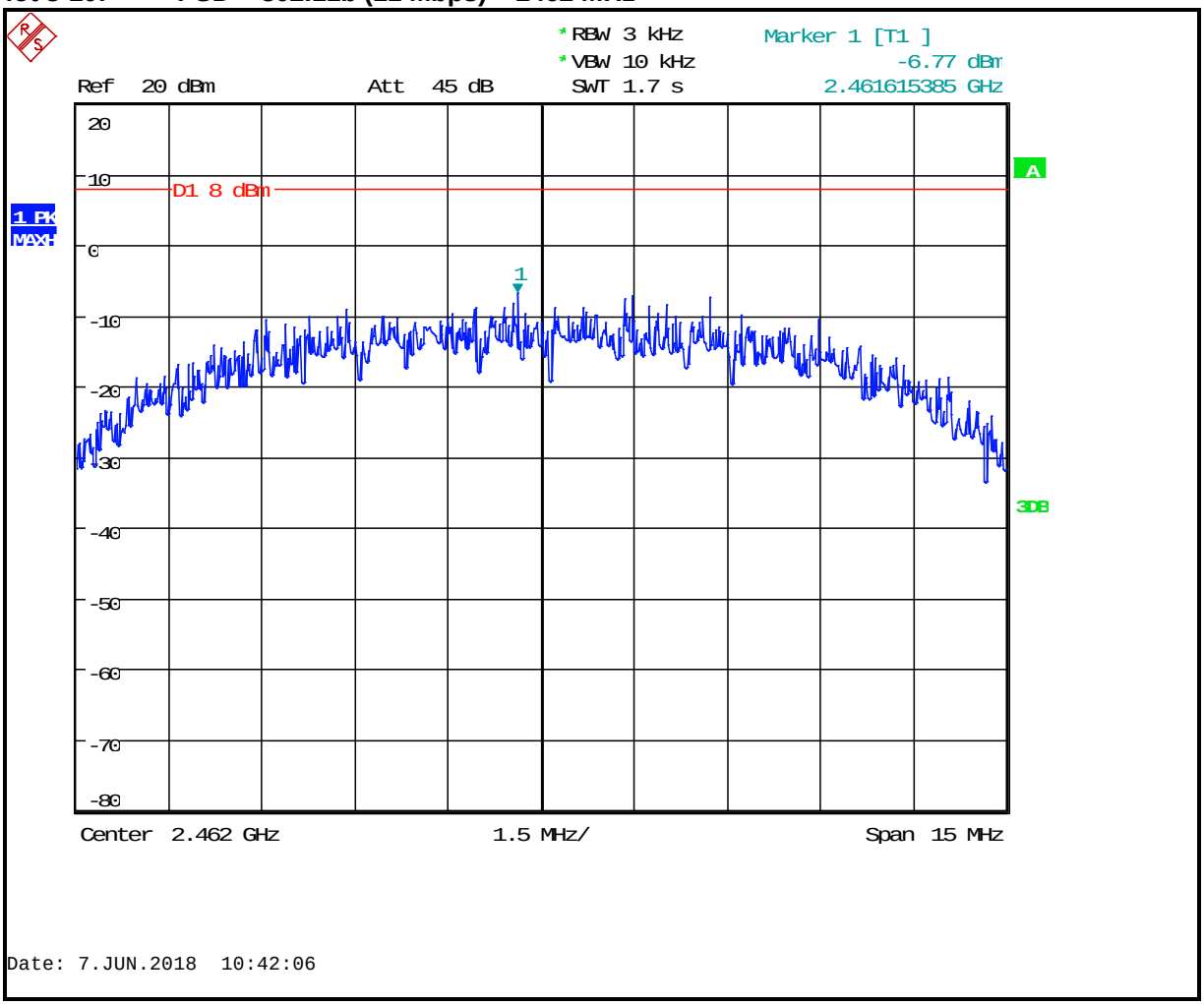
Plot 8-8: PSD – 802.11g (54 Mbps) – 2437 MHz



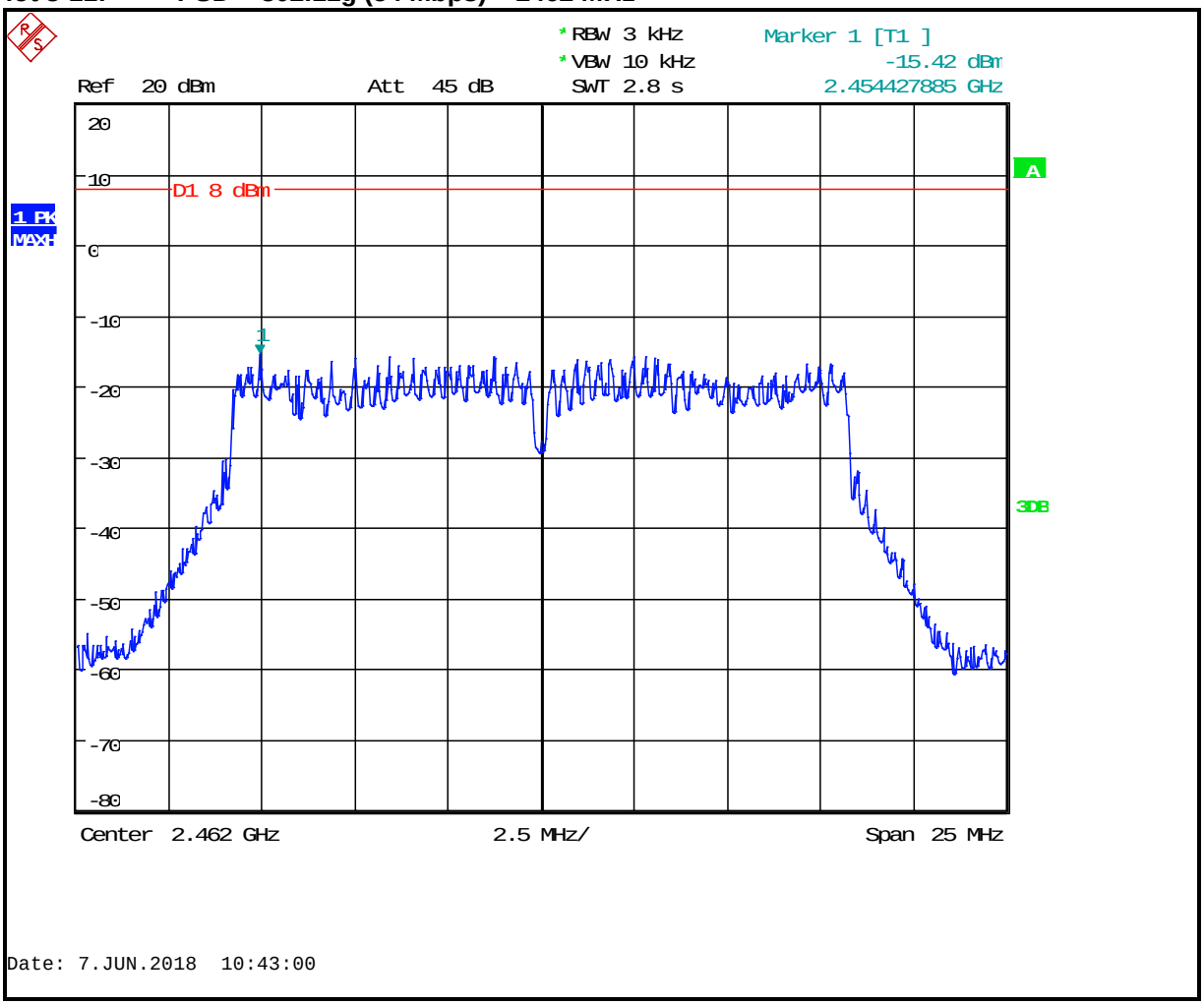
Plot 8-9: PSD – 802.11n (MCS7) – 2437 MHz



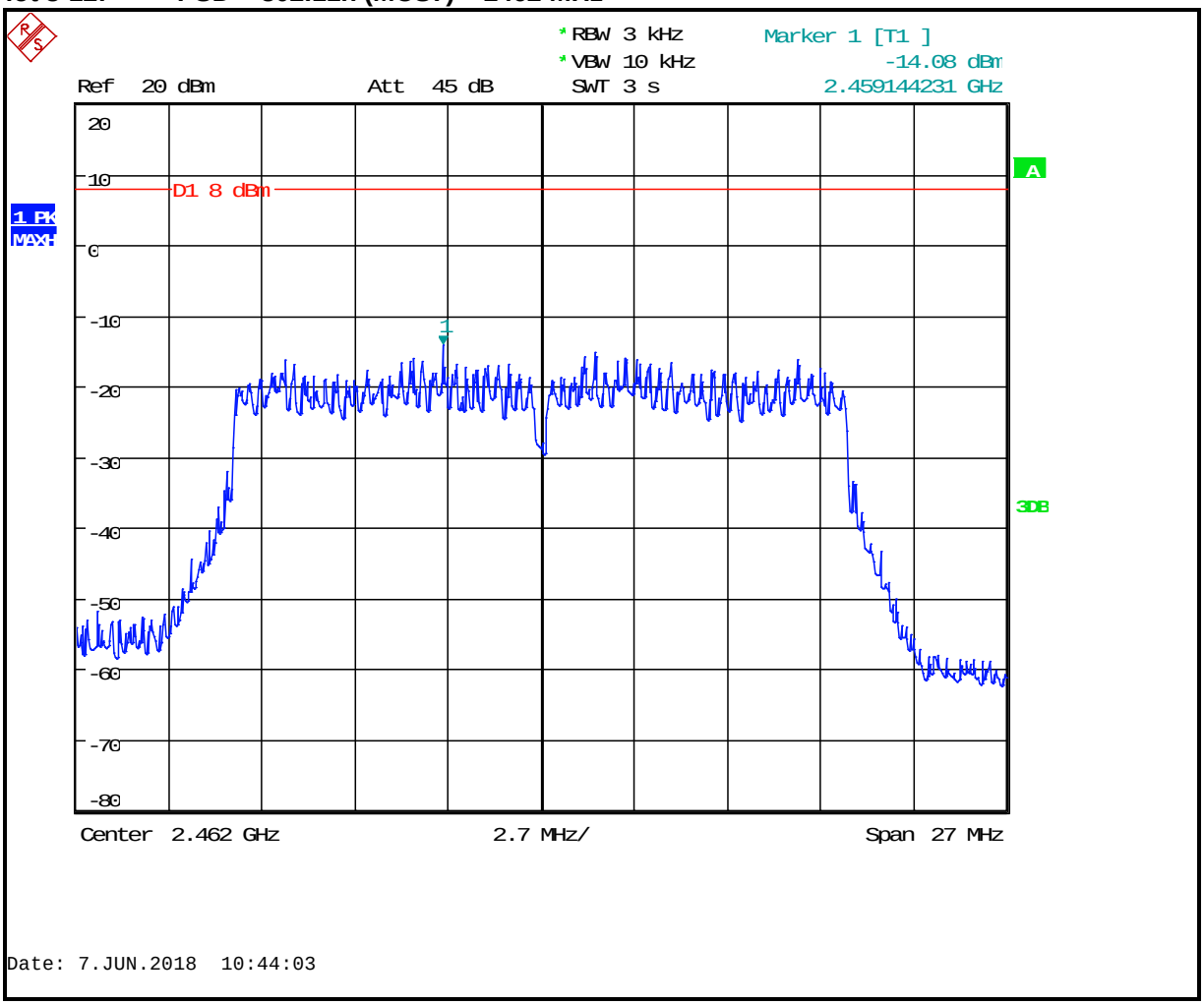
Plot 8-10: PSD – 802.11b (11 Mbps) – 2462 MHz



Plot 8-11: PSD – 802.11g (54 Mbps) – 2462 MHz



Plot 8-12: PSD – 802.11n (MCS7) – 2462 MHz



Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty: ±0.5 dB.

RESULTS: PASS

Table 8-5: Power Spectral Density Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	4/17/19

Test Personnel:

Khue Do		June 7-8 & 14, 2018
Test Engineer	Signature	Dates of Test

9 Radiated Emissions – FCC 15.209; ISED RSS-247 5.5, RSS-Gen 8.9, 8.10

9.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

9.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10^{th} harmonic of the highest fundamental transmitter frequency (24.8 GHz) for the 2.4 GHz band.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

9.3 Radiated Emissions Test Results

Table 9-1: Radiated Emissions Harmonics/Spurious - 2402 MHz, BLE, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4804	22.8	33.4	56.2	74.0	-17.8
12010	-1.5	43.6	42.1	74.0	-31.9
19216	-0.5	52.9	52.4	74.0	-21.6

Table 9-2: Radiated Emissions Harmonics/Spurious - 2402 MHz, BLE, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4804	12.3	33.4	45.7	54.0	-8.3
12010	-11.4	43.6	32.2	54.0	-21.8
19216	-9.0	52.9	43.9	54.0	-10.1

Table 9-3: Radiated Emissions Harmonics/Spurious - 2440 MHz, BLE, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4880	17.6	33.4	51.0	74.0	-23.0
7320	13.7	35.7	49.4	74.0	-24.7
12200	-0.9	43.6	42.7	74.0	-31.3
19520	0.4	53.0	53.4	74.0	-20.6

Table 9-4: Radiated Emissions Harmonics/Spurious - 2440 MHz, BLE, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4880	6.9	33.4	40.3	54.0	-13.7
7320	2.2	35.7	37.9	54.0	-16.2
12200	-10.3	43.6	33.3	54.0	-20.7
19520	-11.9	53.0	41.2	54.0	-12.9

Table 9-5: Radiated Emissions Harmonics/Spurious - 2480 MHz, BLE, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4960	15.5	33.6	49.1	74.0	-24.9
7440	13.6	35.8	49.4	74.0	-24.6
12400	-2.8	43.7	40.9	74.0	-33.1
19840	-0.3	53.2	52.9	74.0	-21.1
22320	0.4	54.2	54.6	74.0	-19.4

Table 9-6: Radiated Emissions Harmonics/Spurious - 2480 MHz, BLE, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4960	6.4	33.6	40.0	54.0	-14.0
7440	2.7	35.8	38.5	54.0	-15.5
12400	-12.0	43.7	31.7	54.0	-22.3
19840	-12.9	53.2	40.3	54.0	-13.7
22320	-11.9	54.2	42.3	54.0	-11.7

Table 9-7: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11b, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4824	23.5	33.4	56.9	74.0	-17.1
12060	-1.6	43.6	42.0	74.0	-32.0
14472	-0.3	48.1	47.8	74.0	-26.2
19296	-0.8	52.9	52.1	74.0	-21.9

Table 9-8: Radiated Emissions Harmonics/Spurious - 2412 MHz, 802.11b, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4824	20.1	33.4	53.5	54.0	-0.5
12060	-11.2	43.6	32.4	54.0	-21.6
14472	-10.8	48.1	37.3	54.0	-16.7
19296	-10.8	52.9	42.1	54.0	-11.9

Table 9-9: Radiated Emissions Harmonics/Spurious- 2437 MHz, 802.11n, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction	Peak Corrected	Peak Limit	Peak Margin

		Factor (dB/m)	(dBuV/m)	(dBuV/m)	(dB)
4874	24.1	33.4	57.5	74.0	-16.5
7311	15.8	35.7	51.5	74.0	-22.5
12185	-0.8	43.6	42.8	74.0	-31.2
19496	-0.4	53.0	52.6	74.0	-21.4

Table 9-10: Radiated Emissions Harmonics/Spurious - 2437 MHz, 802.11n, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4874	19.6	33.4	53.0	54.0	-1.0
7311	5.9	35.7	41.6	54.0	-12.4
12185	-11.6	43.6	32.0	54.0	-22.0
19496	-10.9	53.0	42.1	54.0	-11.9

Table 9-11: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11n, Peak Detector

Frequency (MHz)	Peak Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
4924	25.1	33.5	58.6	74.0	-15.4
7386	15.9	35.9	51.8	74.0	-22.2
12310	-1.5	43.7	42.2	74.0	-31.8
19696	-1.5	53.1	51.6	74.0	-22.4
22158	-0.7	54.1	53.4	74.0	-20.6

Table 9-12: Radiated Emissions Harmonics/Spurious - 2462 MHz, 802.11n, Average Detector

Frequency (MHz)	Average Analyzer (dBuV/m)	Site Correction Factor (dB/m)	Average Corrected (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
4924	20.1	33.5	53.6	54.0	-0.4
7386	8.4	35.9	44.3	54.0	-9.7
12310	-11.5	43.7	32.2	54.0	-21.8
19696	-12.1	53.1	41.0	54.0	-13.0
22158	-9.7	54.1	44.4	54.0	-9.6

Measurement uncertainty: ±4.7 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Table 9-13: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date

901663	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz-30 MHz)	827525/019	5/1/19
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505	8/18/18
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz–2 GHz)	1006	8/18/18
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter Antenna mast, polarizing	Outdoor Range 1	Not Required
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20'	NA	8/21/18
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	8/18/18
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz–6.5 GHz)	3325A00159	4/4/19
900914	Hewlett Packard	8546OA	RF Filter Section (100 kHz-6.5 GHz)	3330A00107	4/4/19
900772	EMCO	3161-02	Horn Antenna (2-4 GHz)	9804-1044	4/9/19
900321	EMCO	3161-03	Horn Antenna (4.0-8.2 GHz)	9508-1020	4/9/19
900323	EMCO	3160-07	Horn Antenna (8.2-12.4 GHz)	9605-1054	4/9/19
900356	EMCO	3160-08	Horn Antenna (12.4-18 GHz)	9607-1044	4/9/19
901218	EMCO	3160-09	Horn Antenna (18-26.5 GHz)	960281-003	4/9/19
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	4/26/19
900791	Antenna Research Associates, Inc.	LPB-2520	BiLog Antenna (25-1000 MHz)	1037	10/4/20

RESULTS: PASS

Test Personnel:

Khue N. Do		June 11-12, 2018
Test Engineer	Signature	Dates of Test

10 Conclusion

The data in this measurement report shows that the EUT as tested, Honeywell International Inc. Model A700x, FCC ID: HD5-TAP1000-01, IC: 1693B-TAP100001, complies with all the applicable requirements of FCC Parts 2 and 15 and ISED RSS-247 and RSS-Gen.