Report on the FCC and ISED Testing of the

Flextronics America LLC
FCL5324

In accordance with FCC Rule Part 15.247 & ISED Radio Standard RSS-247

Prepared for: Flextronics America LLC
1180.W Peachtree.Street.NW.Suite 1500
Atlanta, GA 30309

FCC ID: 2AG9G-FCL5324

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FCC Accreditation
Designation Number US1063 Tampa, FL Test Laboratory

Innovation, Science, and Economic Development Canada Accreditation
Main Site Number 2087A-2 Tampa, FL Test Laboratory
Satellite Site Number: 4175C Boca Raton, FL Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC Rule Part 15.247, ISED Radio Standard RSS-247

A2LA Cert. No. 2955.15

ACCREDITATION
Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

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TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

1.2 Applicant Information

Flextronics America LLC
1180.W Peachtree.Street.NW.Suite 1500
Atlanta, GA 30309

1.3 Product Description

The AMS-1 LoRa model # FCL5324 product defines a smart home gateway which acts as a wireless router. It provides Wi-Fi where computers, smartphones and other terminals can communicate freely. Also, its Lora technology provides an environment where smart living appliances, metering, etc. can communicate through the wireless. What's more, PCs, laptops and smartphones can control electric devices in the house through the Smart Home Gateway.

This document reports the compliance of the Wi-Fi Transceiver.

Technical Details

Mode of Operation:	IEEE 802.11b/g/n
Frequency Range:	802.11b/g/n 20 MHz: 2412 MHz - 2462 MHz
	802.11n 40 MHz: 2422 MHz - 2452 MHz
Number of Channels:	802.11b/g/n 20 MHz: 11
	802.11n 40 MHz: 7
Channel Separation:	5 MHz
Modulations:	802.11b: CCK, DSSS
	802.11g/n: OFDM
Antenna Type/Gain:	PlFA, 1.0 dBi
Input Power:	120V/60Hz

Model Number: FCL5324

Test Sample Serial Number(s): N/A

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.4 Test Methodology and Considerations

All modes of operation, including all data rates were evaluated. The data presented in this document corresponds to the worst case where applicable.

For radiated emissions the EUT was evaluated in three orthogonal orientations. The worst case orientations correspond to the EUT in the vertical position (X-Orientation) for spurious emissions and the EUT flat for radiated emissions at the band-edges. The EUT was also investigated for radiated intermodulation products between the 802.11b/g/n radio and the LoRa when transmitting simultaneously. All intermodulation products were attenuated below the limits of FCC 15.209 and RSS-Gen.

For the RF conducted emissions evaluation, the EUT was configured with temporary connectors a the antenna ports. Each antenna port was evaluated in full.

The EUT was also evaluated for unintentional emissions and for the LoRa radio. The test results are documented in separate test reports.

Table 1.4-1: IEEE 802.11b/g/n Radio Power Settings

Mode	Channels	Software Setting
802.11b	1 2 -11	8 16
802.11g/n 20 MHz	1 2-10 11	13 17 7
802.11n 40 MHz	3 & 9 4 & 8 5 & 6 7	0 5 8 6

Notes:
A full evaluation was performed in full for the low, middle and high channels.
Limited measurements were performed to the channels adjacent to channels operating at reduced power. These channels were also found to be compliant.

Table 1.4-2: IEEE 802.11b/g/n Radio Test Configuration

Mode of Operation	Frequency (MHz)	Channel	Test Software Power Setting	Data Rate Configuration (Mbps)
802.11b	2412	1	8	MCS0, MCS10
	2437	6	16	
	2462	11	16	
802.11g	2412	1	13	MCS0, MCS4
	2437	6	17	
	2462	11	7	
802.11n 20 MHz	2412	1	13	MCS0, MCS10
	2437	6	17	
	2462	11	7	
802.11n 40 MHz	2422	3	0	MCS0, MCS8, MCS9
	2437	6	8	
	2452	9	0	

Notes:
All radiated emissions measurements reported were performed using the MCS0 modulation index, which led to the highest emissions with respect to the limits.
Limited measurements were performed to the channels adjacent to channels operating at reduced power. These channels were also found to be compliant.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
http://www.tuv-sud-america.com

Innovation, Science and Economic Development Canada Lab Code: 4175C

1.1 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by American Association for Laboratory Accreditation (A2LA) and has been issued certificate number 2955.15 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

Main Site Information:

TÜV SÜD America, Inc.
5610 West Sligh Ave., Suite 100
Tampa, FL 33634
Phone: 813-284-2715
www.tuv-sud-america.com

FCC Designation Number US1063
FCC Test Firm Registration #: 160606
Innovation, Science, and Economic Development Canada Lab Code: 2087A-2

2.2 Radiated & Conducted Emissions Test Site Description

2.2.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

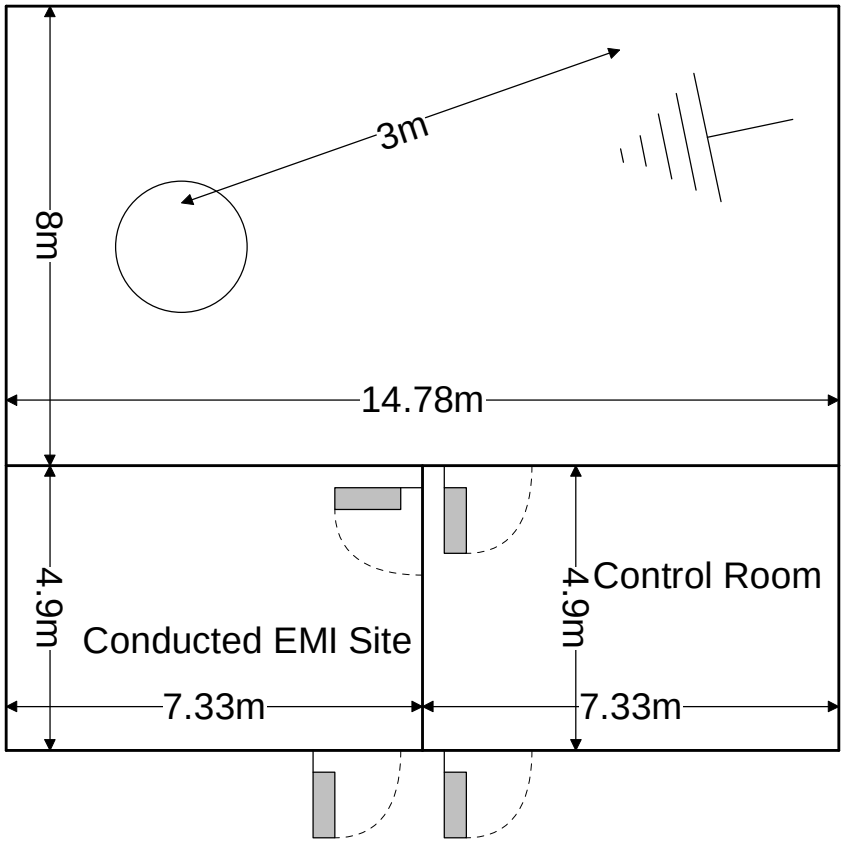


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.2.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

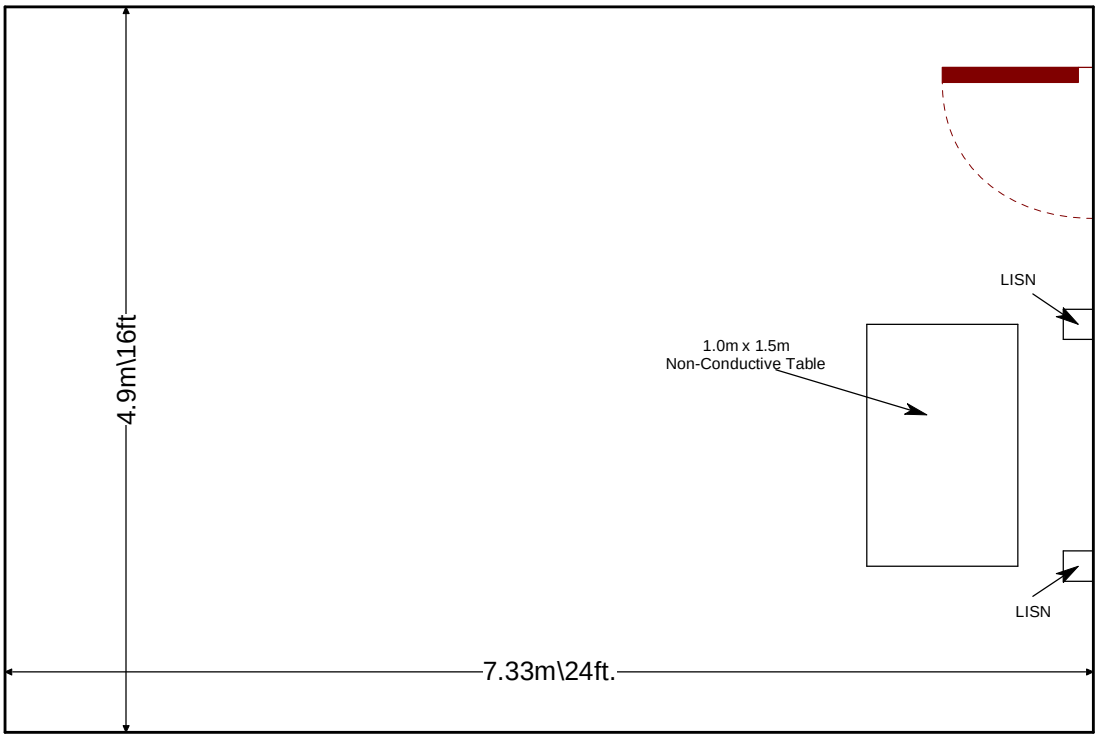


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2018.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2018
- FCC KDB 558074 D01 DTS Meas Guidance v05 - Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.257 of the FCC Rules, August 24, 2018.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01 – Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc), October 31, 2013.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, Amendment 1, March 2018.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
267	Hewlett Packard	N1911A	Power Meter	MY45100129	8/22/2017	8/22/2019
268	Hewlett Packard	N1921A	Power Sensor	MY45240184	8/22/2017	8/22/2019
BEMC00078	EMCO	6502	Active Loop Antenna	9104-2608	5/11/2016	5/11/2018
BEMC00282	Microwave Circuits	H2G020G4	2-20GHz Band Pass Filter	74541	5/23/2017	5/23/2018
BEMC00283	Rohde & Schwarz	FSP40	Spectrum Analyzer	1000033	7/21/2016	7/21/2018
BEMC00523	Agilent	E7405	9kHz-26.5GHz EMC analyzer/HYZ	MY45103293	12/9/2016	12/9/2018
BEMC00653	Suhner	SF-102A	Cable (40GHz)	0944/2A	9/5/2017	9/5/2018
BEMC02002	EMCO	3108	30 MHz to 200 MHz Biconical Antenna	2147	11/28/2017	11/30/2019
BEMC02004	EMCO	3146	200 MHz to 1 GHz Log Periodic Antenna	1385	12/27/2017	12/27/2019
BEMC02006	EMCO	3115	Linear Polarized Horn antenna, 1-18 GHz	2573	4/7/2017	4/7/2019
BEMC02008	COM-power	AH-826	Horn Antenna (18 GHz to 26.5 GHz)	81009	NCR	NCR
BEMC02011	Hewlett-Packard	HP 8447D	100 kHz to 1.3 GHz low-noise, high gain amplifier	2443A03952	10/27/2017	10/27/2018
BEMC02045	ACS Boca	Conducted Cable Set	Consisits of cables 2046, 2047, 2062, 2063 and 2065	2045	10/26/2017	10/27/2018
BEMC02082	Teledyne Storm Products	90-010-048	High Frequency Cable	2082	4/6/2018	4/6/2019
BEMC02086	Merrimac	FAN-6-10K	10dB Attenuator	23148-83-1	10/27/2017	10/27/2018
BEMC02095	ETS Lindgren	TILE4! - Version 4.2.A	Tile Automation Software	85242	NCR	NCR
BEMC02110	Aeroflex Inmet	40AH2W-10	Attenuator 10dB, 2.9 mm-M/F, DC-40GHz 2 W	2110	7/20/2017	7/20/2018
BEMC02111	Aeroflex Inmet	40AH2W-20	Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W	2111	7/20/2017	7/20/2018
BEMC02112	Teledyne Storm Products	921-0101-036	Duratest High Frequency Cable Max. frequency 26.5GHz	12-06-698	10/27/2017	10/27/2018
BEMC02121	Teledyne Storm Products	A81-0303	Radiated Cable Set	2121	7/31/2017	7/31/2018
BEMC02138	Hewlett Packard	8449B	Pre-Amplifier	3008A00320	12/1/2017	12/1/2018
BEMC03004	Teseq	CFL 9206A	Transient Filter Limiter 9kHz - 30MHz	34720	8/29/2017	8/29/2018
TEMC00153	Rhode & Schwarz Vertrieb München	ESH3-Z5	Voltage Network	894785/012	9/27/2017	9/27/2018

Notes:

- **NCR=No Calibration Required**
- **The assets were only used during the active period of the calibration cycle.**

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment Description – Radiated and Power Line Emissions

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Flextronics, Inc.	FCL5324	N/A

Table 5-2: Cable Description – Radiated Emissions

Cable #	Cable Type	Length	Shield	Termination
A	Power	2.7 m	No	EUT to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

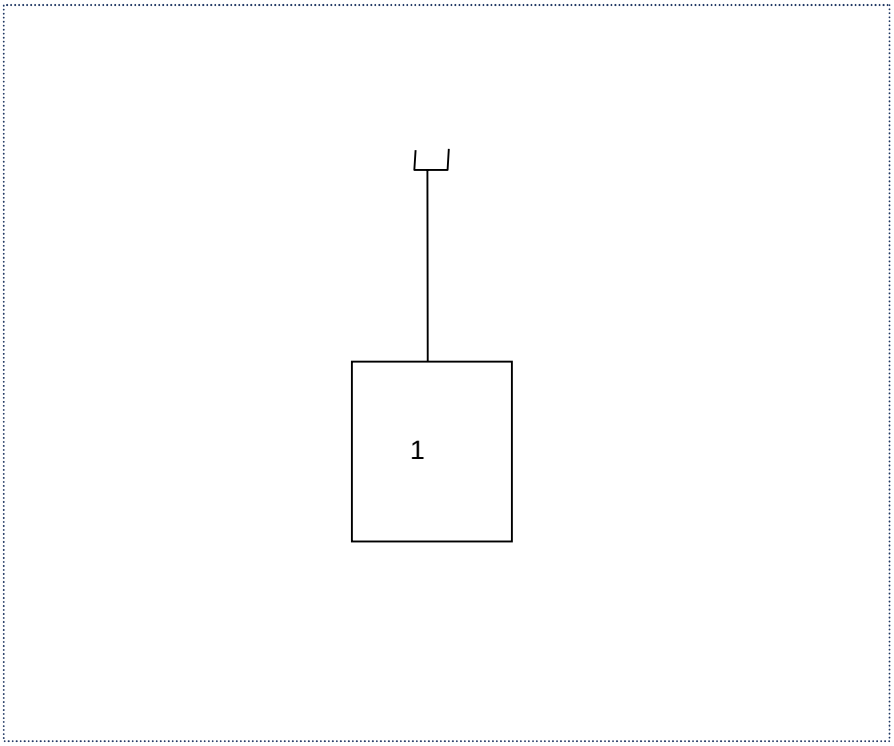


Figure 6-1: EUT and Support Equipment Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

Test Begin Date: March 27, 2018
Test End Date: May 1, 2018

Table 7-1: Result Summary

Requirements	FCC Rule Part	ISED Canada	Test Results
Antenna Requirement	FCC: Section 15.203		Pass
6 dB Bandwidth	FCC: Section 15.247(a)(2)	ISED Canada: RSS-247 5.2(a)	Pass
99% Bandwidth		ISED Canada: RSS-GEN 6.6	Pass
Peak Output Power	FCC: Section 15.247(b)(3)	ISED Canada: RSS-247 5.4(d)	Pass
Band-Edge Compliance of RF Conducted Emissions	FCC: Section 15.247(d)	ISED Canada: RSS-247 5.5	Pass
RF Conducted Spurious Emissions	FCC: Section 15.247(d)	ISED Canada: RSS-247 5.5	Pass
Radiated Spurious Emissions into Restricted Frequency Bands	FCC: Sections 15.205, 15.209	ISED Canada: RSS-Gen 8.9, 8.10	Pass
Power Spectral Density	FCC: Section 15.247(e)	ISED Canada: RSS-247 5.2(b)	Pass
Power Line Conducted Emissions	FCC: Section 15.207	ISED Canada: RSS-Gen 8.8	Pass

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses a 1.0 dBi PIFA LDS antenna that is printed on the top enclosure of the device. The antenna connects to the PCB through SMD spring contact. The antenna is not replaceable and therefore meets the requirements of FCC Section 15.203.

7.2 6 dB Bandwidth - FCC: Section 15.247(a)(2); ISED Canada: RSS-247 5.2(a); 99% Bandwidth ISED Canada: RSS-GEN 6.6

7.2.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the ANSI C63.10 Section 11.8.1 Option 1. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the emissions and >> RBW. A peak detector was used for the measurements.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using 99% bandwidth equipment function of the spectrum analyzer using a peak detector.

7.2.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.2.2-1: 6dB / 99% Bandwidth – 802.11b (MCS0)

Frequency (MHz)	Antenna Port	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	1	10.075	12.369
2437		10.078	12.475
2462		10.088	12.500
2412	2	10.075	12.631
2437		10.080	12.594
2462		10.085	13.181

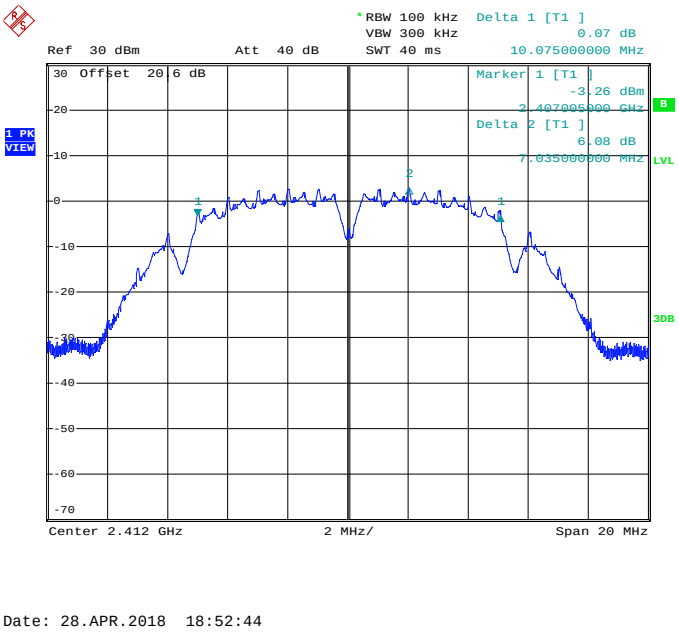


Figure 7.2.2-1: 6dB BW - Low Channel – 802.11b – Antenna Port 1 (MCS0)

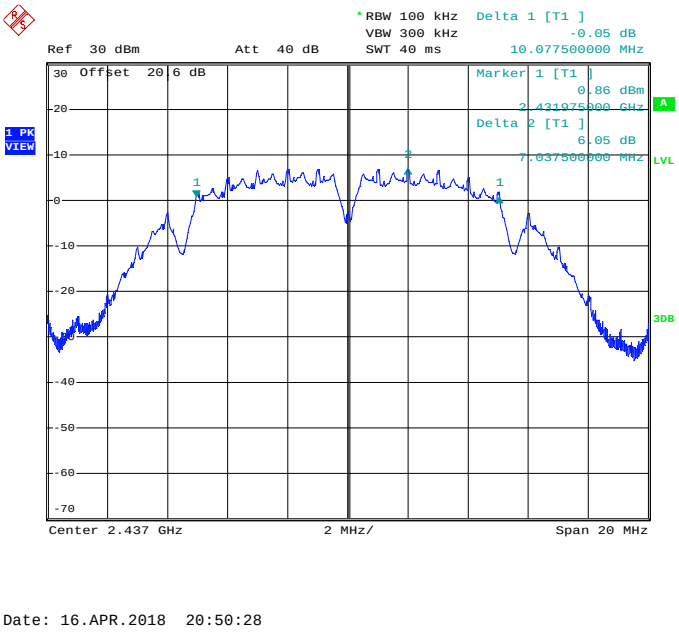


Figure 7.2.2-2: 6dB BW - Middle Channel – 802.11b – Antenna Port 1 (MCS0)

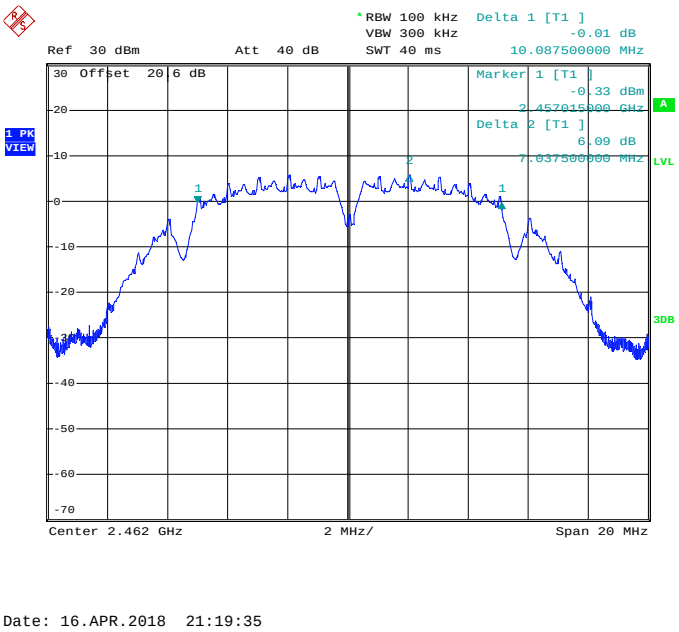


Figure 7.2.2-3: 6dB BW - High Channel – 802.11b – Antenna Port 1 (MCS0)

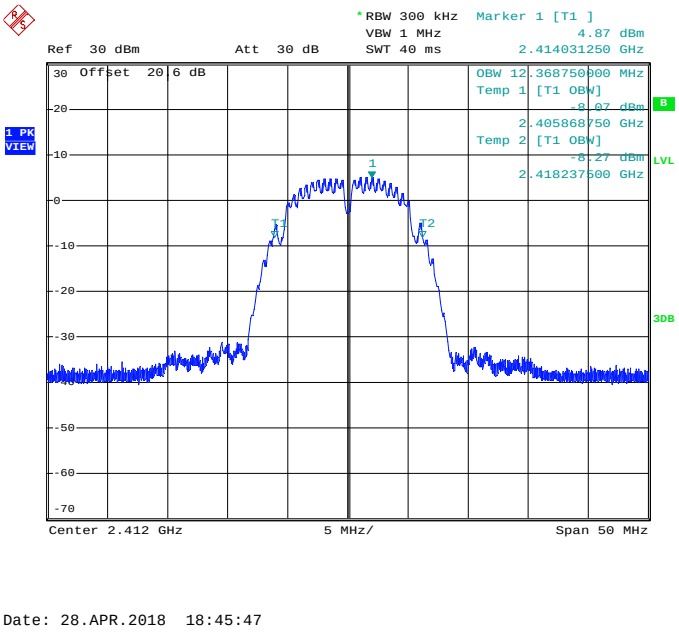


Figure 7.2.2-4: 99% OBW - Low Channel – 802.11b – Antenna Port 1 (MCS0)

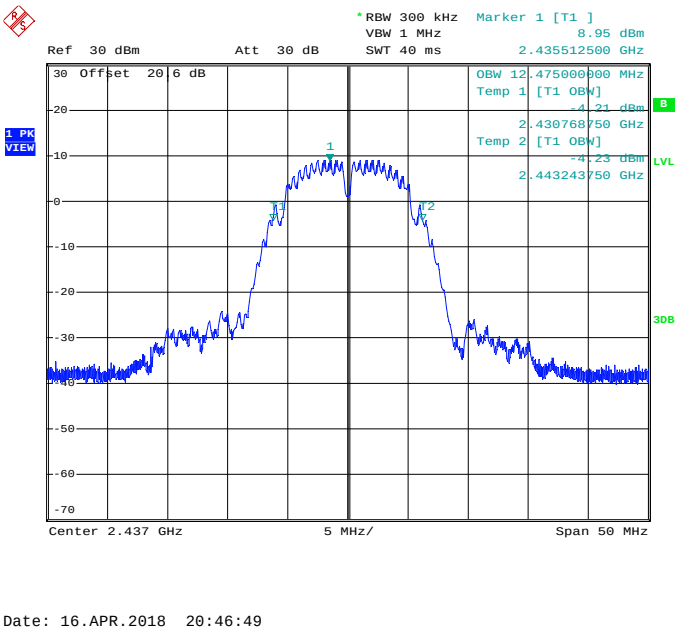


Figure 7.2.2-5: 99% OBW - Middle Channel – 802.11b – Antenna Port 1 (MCS0)

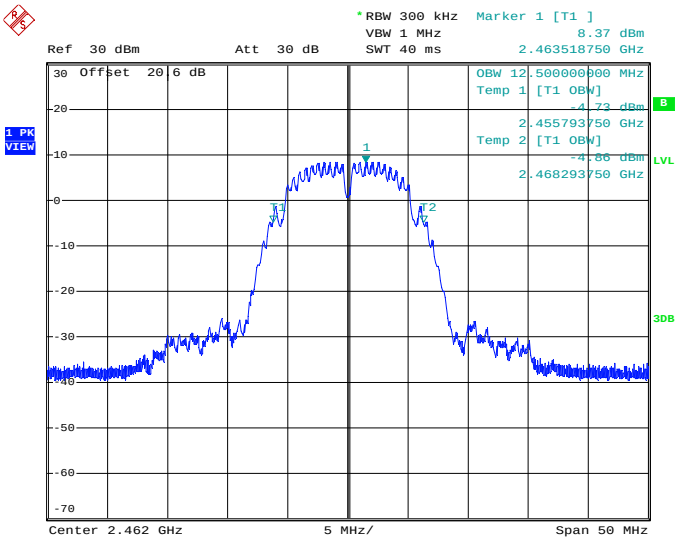


Figure 7.2.2-6: 99% OBW - High Channel – 802.11b – Antenna Port 1 (MCS0)

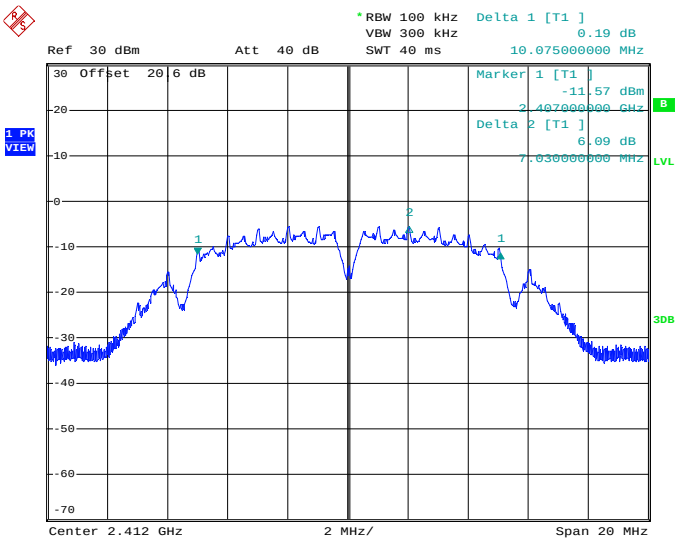


Figure 7.2.2-7: 6dB BW - Low Channel – 802.11b – Antenna Port 2 (MCS0)

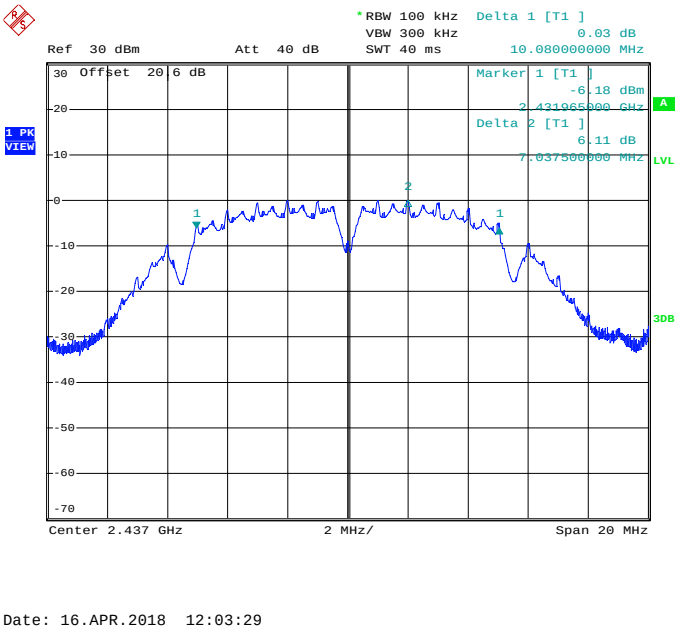


Figure 7.2.2-8: 6dB BW - Middle Channel – 802.11b – Antenna Port 2 (MCS0)

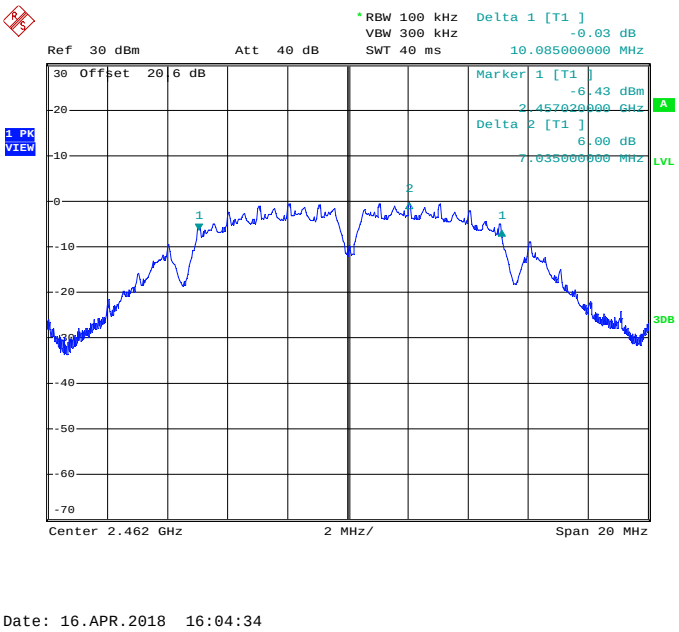


Figure 7.2.2-9: 6dB BW - High Channel – 802.11b – Antenna Port 2 (MCS0)

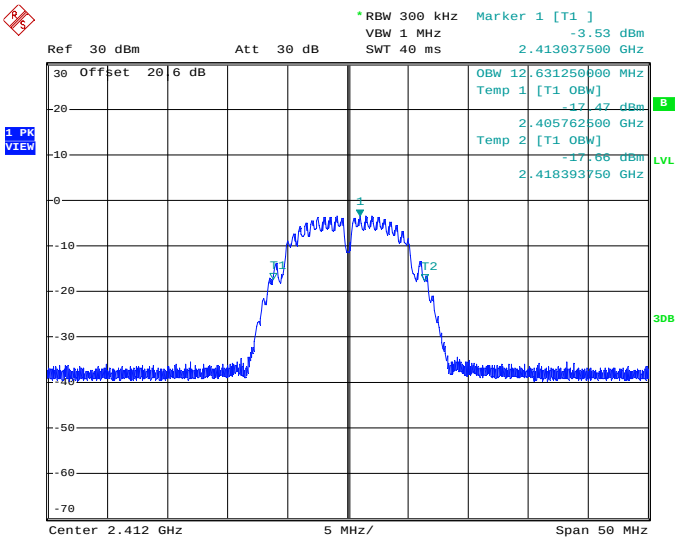


Figure 7.2.2-10: 99% OBW - Low Channel – 802.11b – Antenna Port 2 (MCS0)

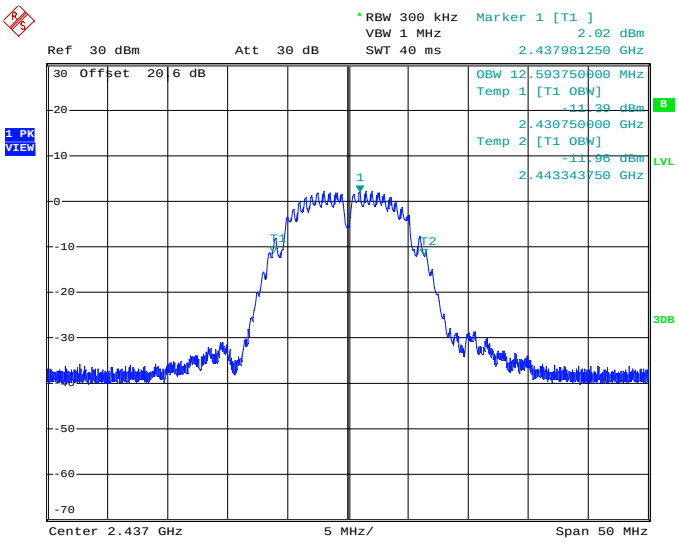


Figure 7.2.2-11: 99% OBW - Middle Channel – 802.11b – Antenna Port 2 (MCS0)

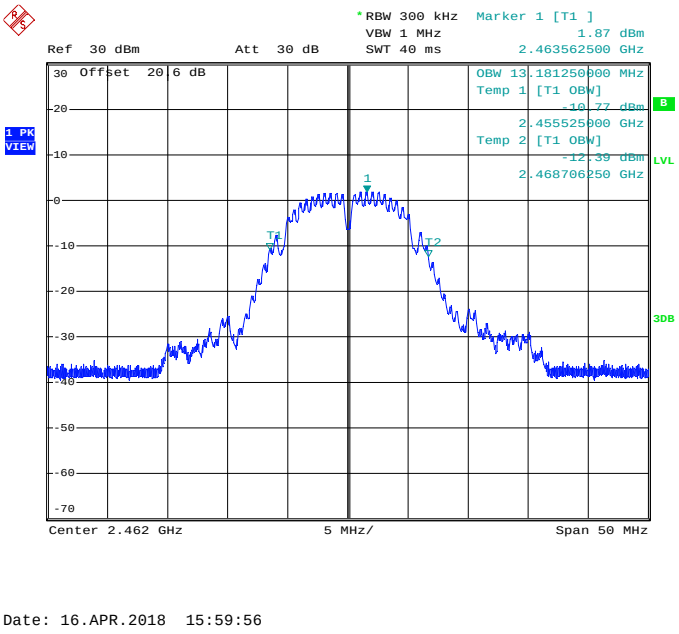


Figure 7.2.2-12: 99% OBW - High Channel – 802.11b – Antenna Port 2 (MCS0)

Table 7.2.2-2: 6dB / 99% Bandwidth – 802.11g (MCS0)

Frequency (MHz)	Antenna Port	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	1	16.588	17.175
2437		16.590	17.400
2462		16.569	17.006
2412	2	16.590	17.147
2437		16.583	18.563
2462		16.585	17.334

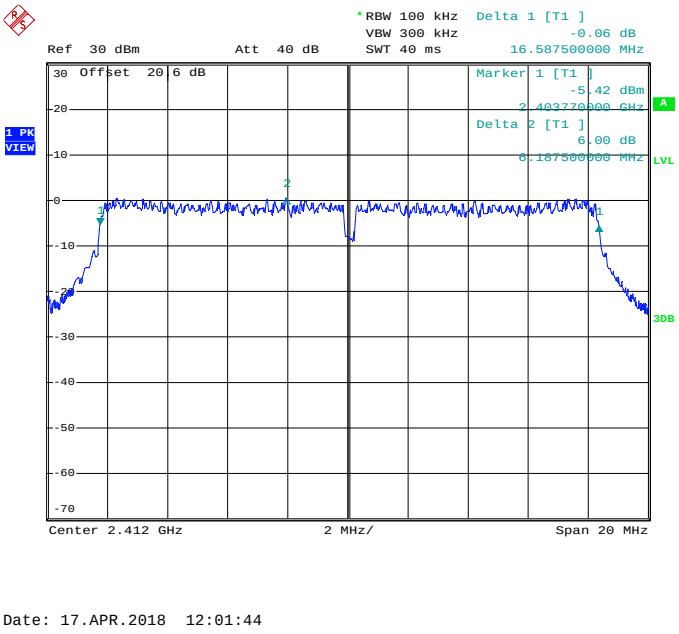


Figure 7.2.2-13: 6dB BW - Low Channel – 802.11g – Antenna Port 1 (MCS0)

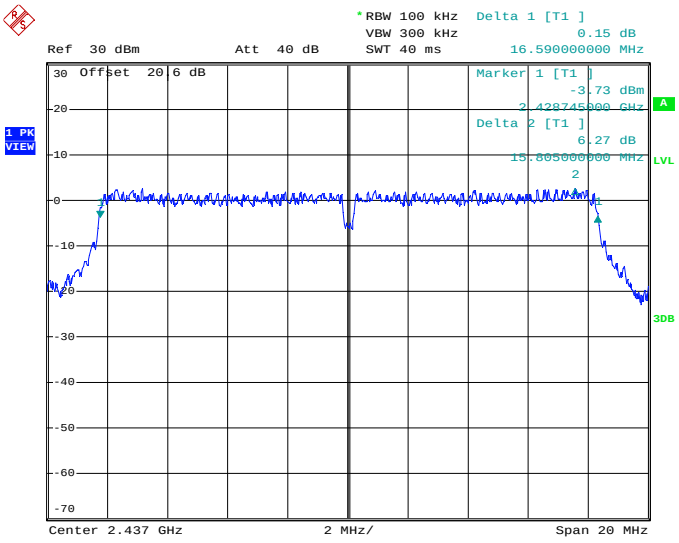


Figure 7.2.2-14: 6dB BW - Middle Channel – 802.11g – Antenna Port 1 (MCS0)

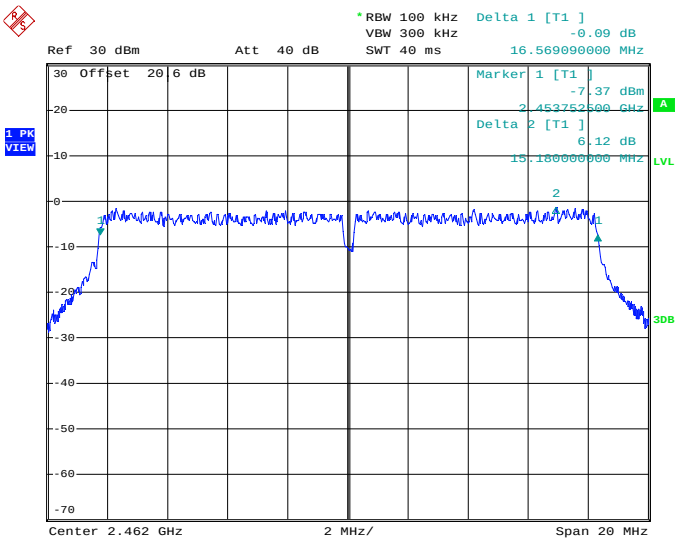


Figure 7.2.2-15: 6dB BW - High Channel – 802.11g – Antenna Port 1 (MCS0)

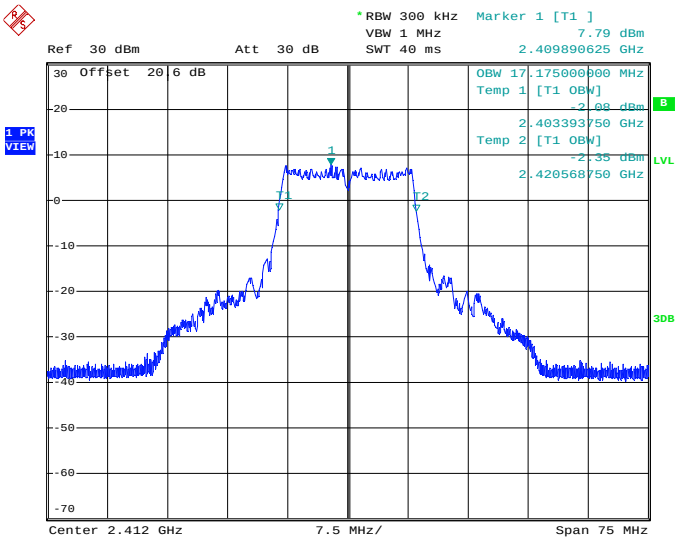


Figure 7.2.2-16: 99% OBW - Low Channel – 802.11g – Antenna Port 1 (MCS0)

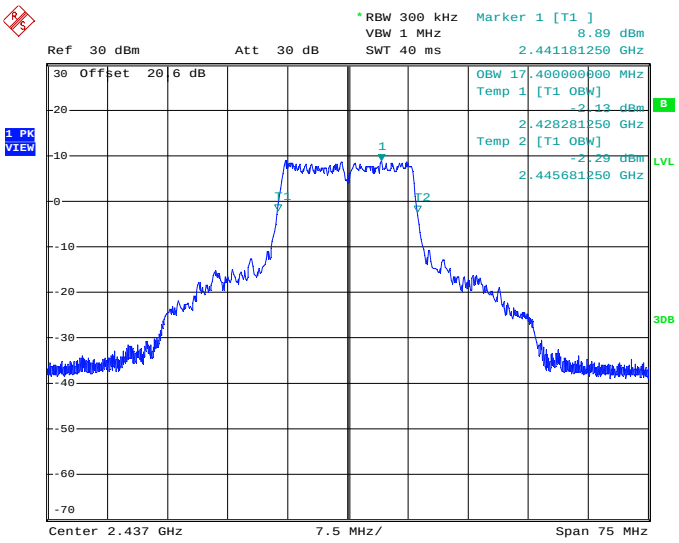


Figure 7.2.2-17: 99% OBW - Middle Channel – 802.11g – Antenna Port 1 (MCS0)

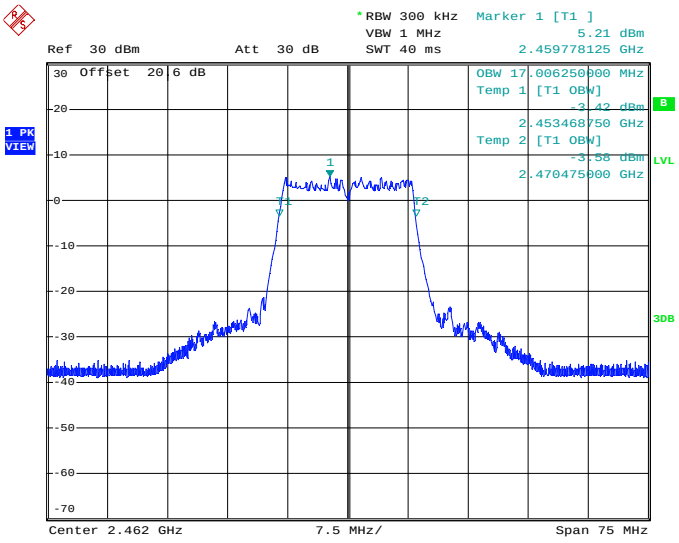


Figure 7.2.2-18: 99% OBW - High Channel – 802.11g – Antenna Port 1 (MCS0)

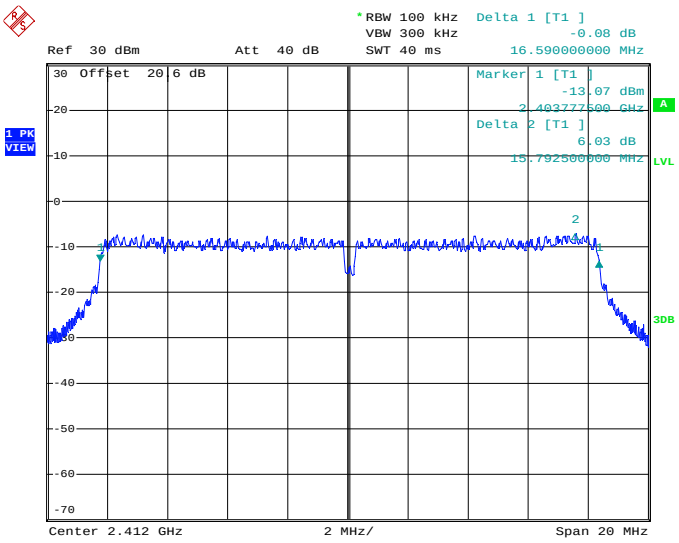


Figure 7.2.2-19: 6dB BW - Low Channel – 802.11g – Antenna Port 2 (MCS0)

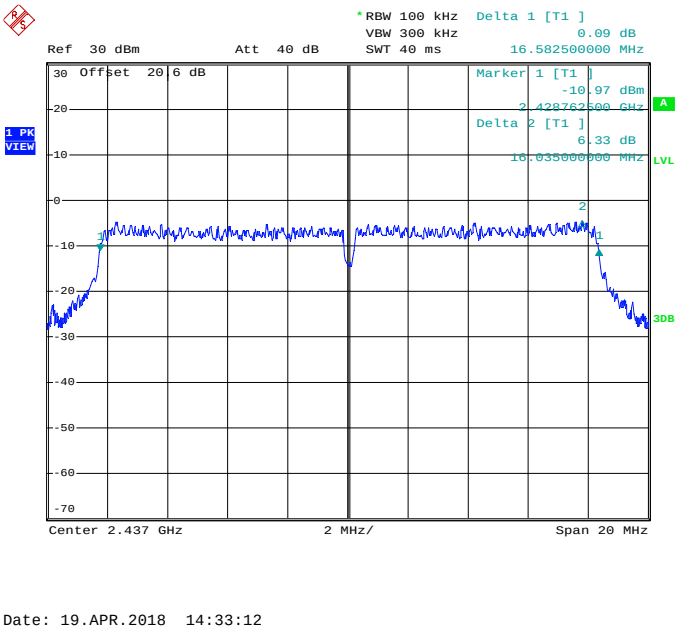


Figure 7.2.2-20: 6dB BW - Middle Channel – 802.11g – Antenna Port 2 (MCS0)

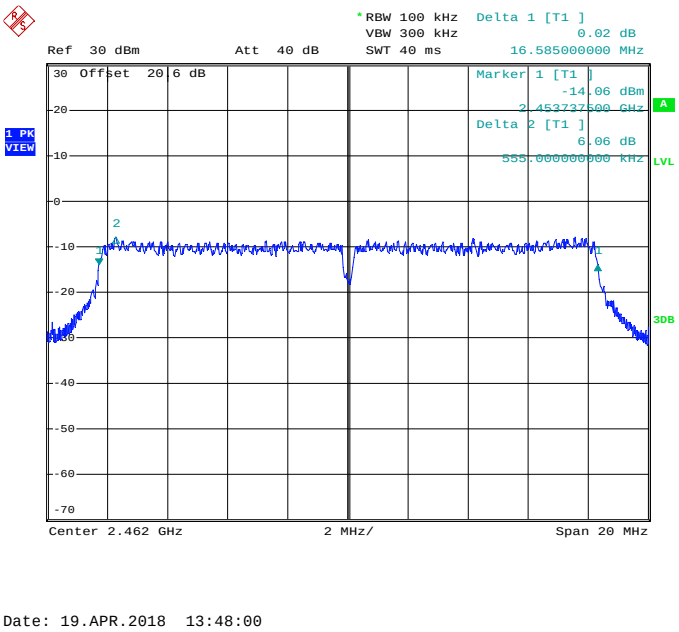


Figure 7.2.2-21: 6dB BW - High Channel – 802.11g – Antenna Port 2 (MCS0)

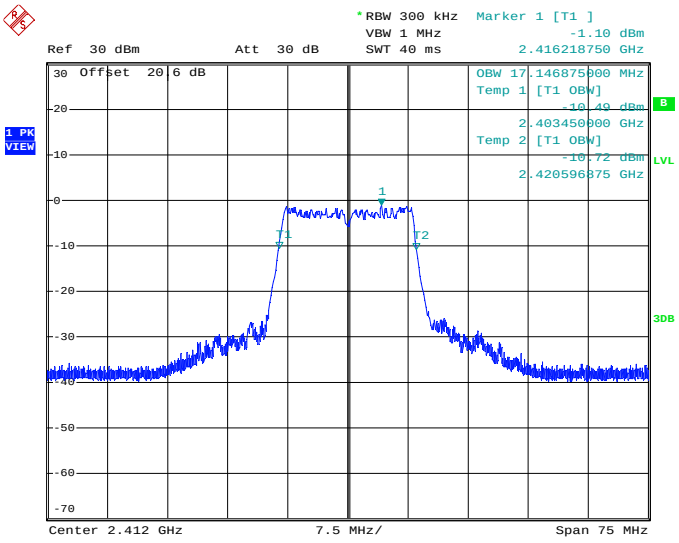


Figure 7.2.2-22: 99% OBW - Low Channel – 802.11g – Antenna Port 2 (MCS0)

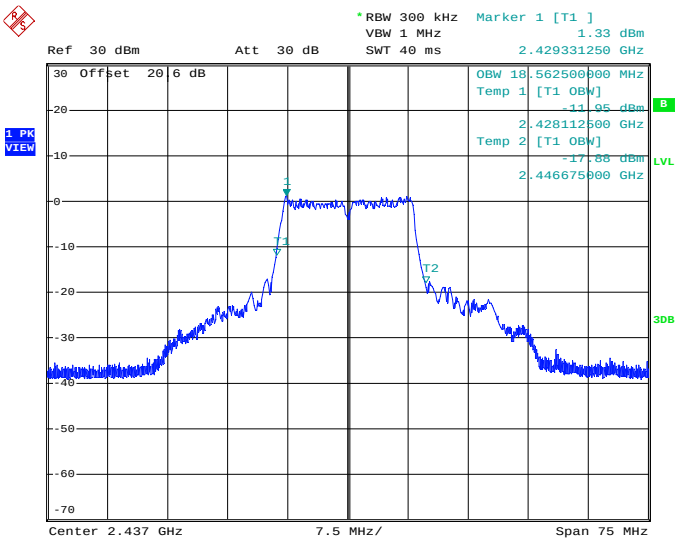


Figure 7.2.2-23: 99% OBW - Middle Channel – 802.11g – Antenna Port 2 (MCS0)

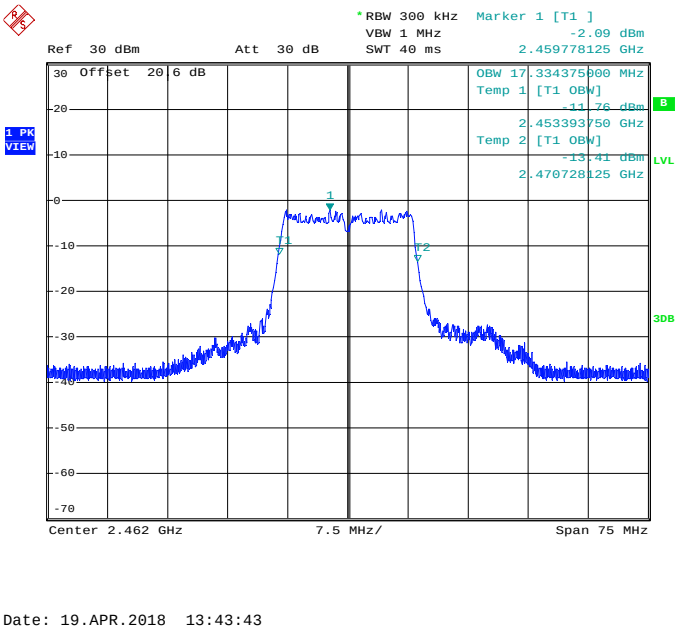


Figure 7.2.2-24: 99% OBW - High Channel – 802.11g – Antenna Port 2 (MCS0)

Table 7.2.2-3: 6dB / 99% Bandwidth – 802.11n 20 MHz (MCS0)

Frequency (MHz)	Antenna Port	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	1	17.773	17.766
2437		17.775	17.963
2462		17.773	17.766
2412	2	17.715	17.897
2437		17.780	18.141
2462		17.763	17.934

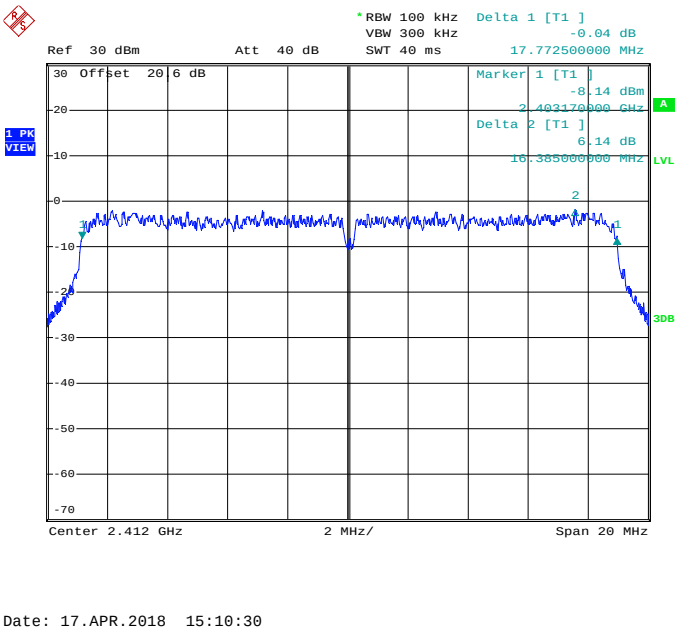


Figure 7.2.2-25: 6dB BW - Low Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

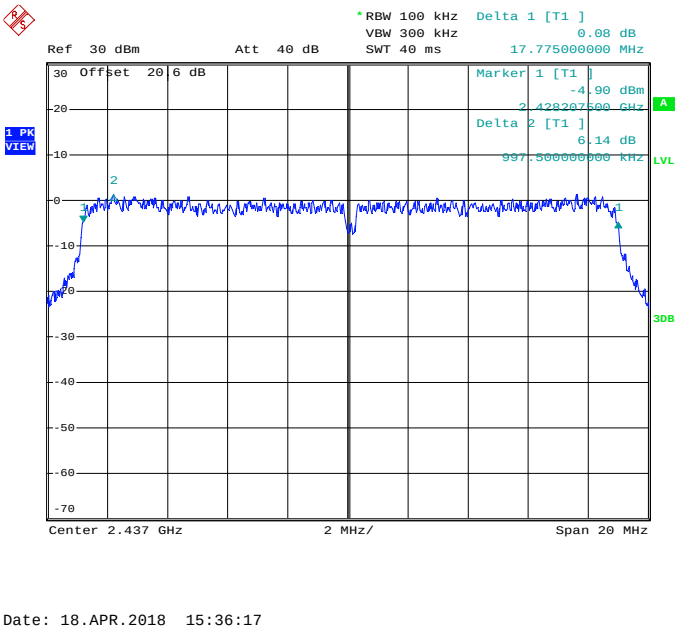


Figure 7.2.2-26: 6dB BW - Middle Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

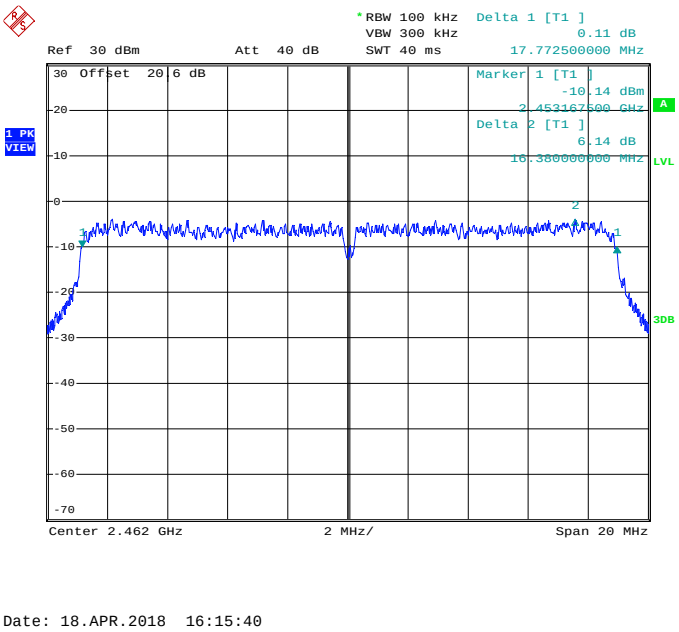


Figure 7.2.2-27: 6dB BW - High Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

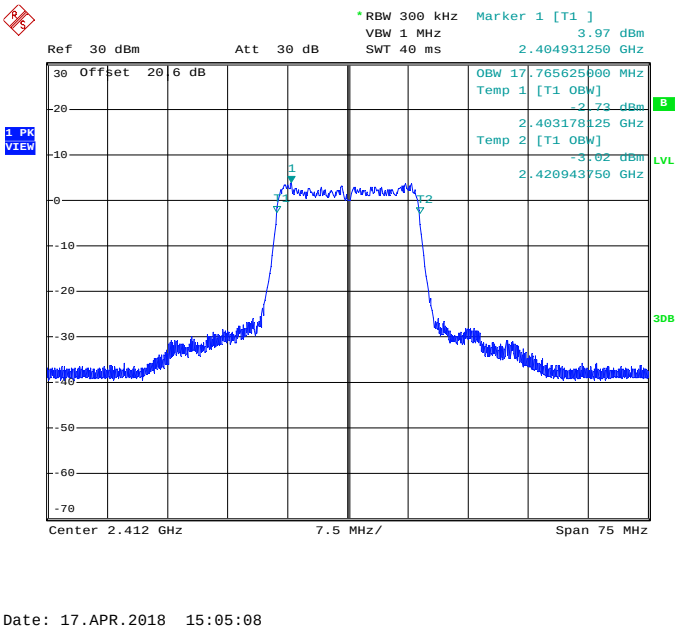


Figure 7.2.2-28: 99% OBW - Low Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

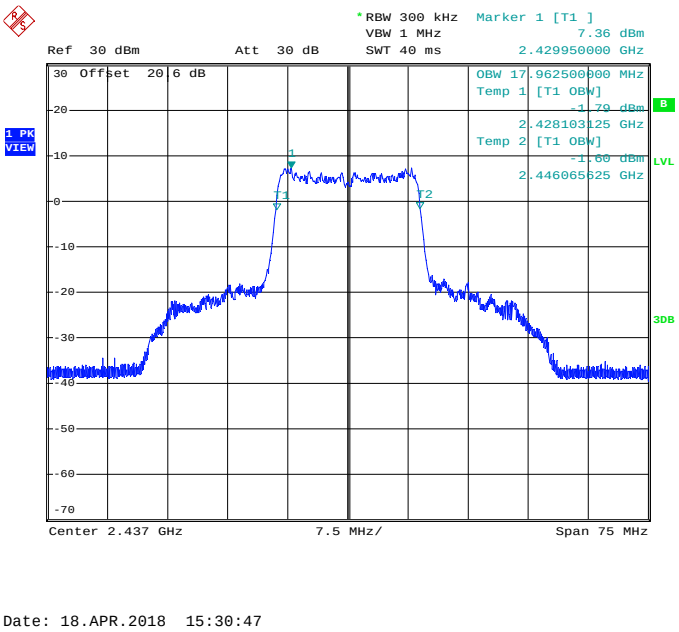


Figure 7.2.2-29: 99% OBW - Middle Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

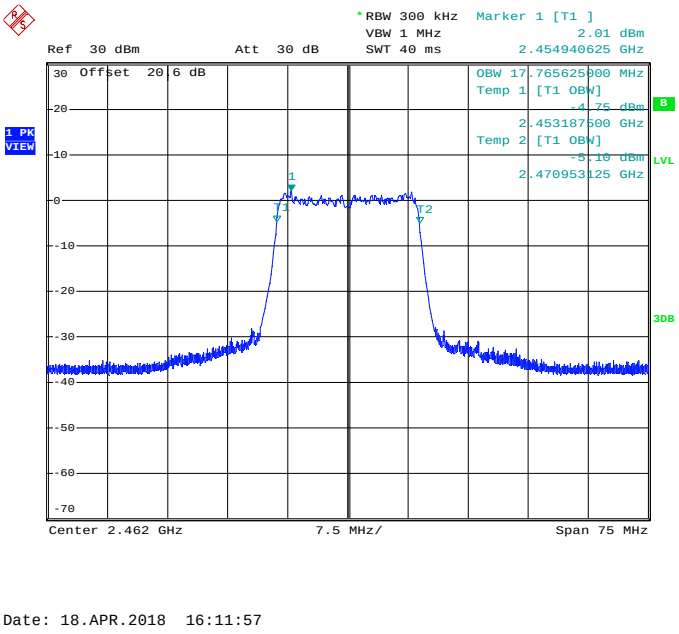


Figure 7.2.2-30: 99% OBW - High Channel – 802.11n 20 MHz – Antenna Port 1 (MCS0)

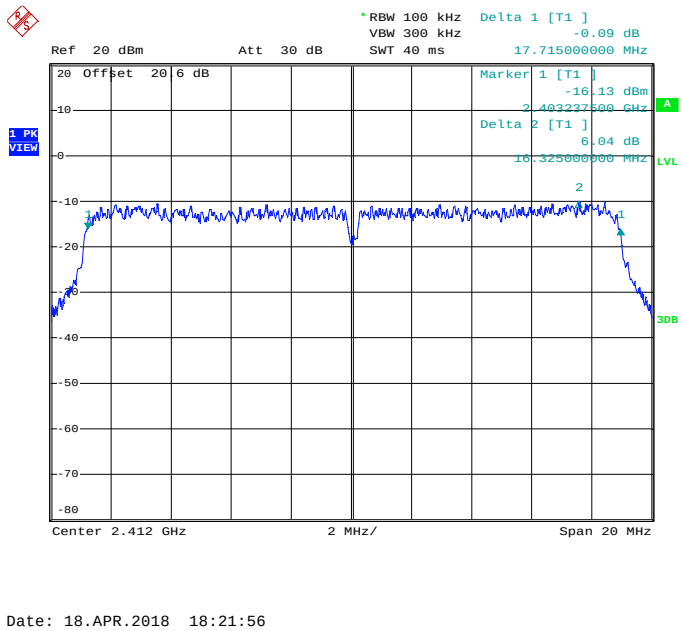


Figure 7.2.2-31: 6dB BW - Low Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

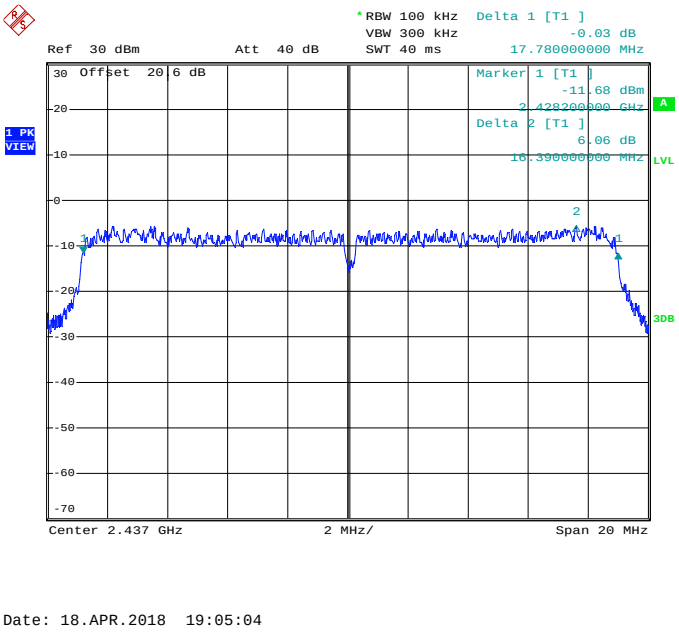


Figure 7.2.2-32: 6dB BW - Middle Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

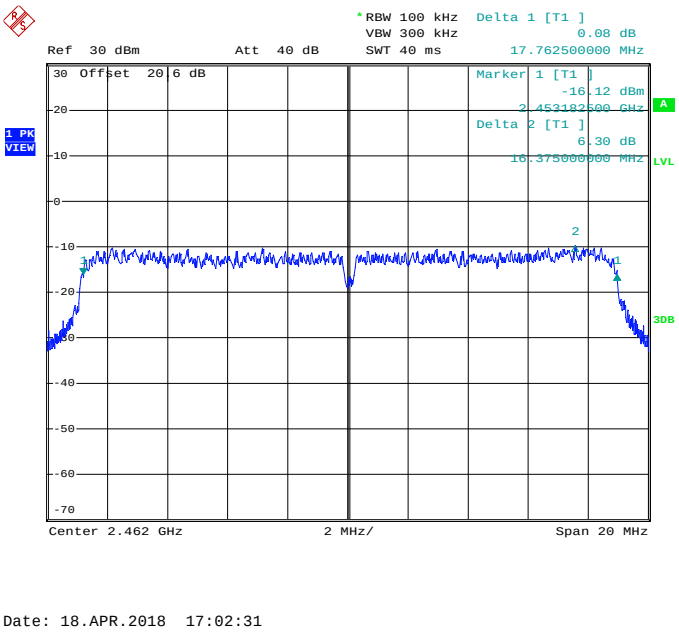


Figure 7.2.2-33: 6dB BW - High Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

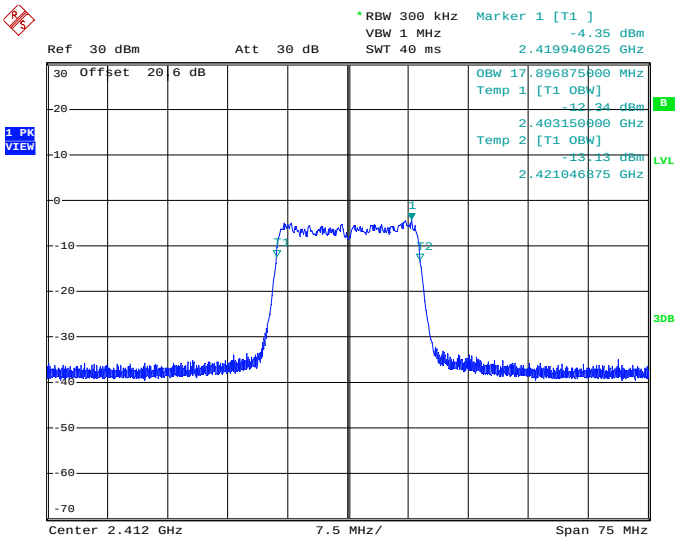


Figure 7.2.2-34: 99% OBW - Low Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

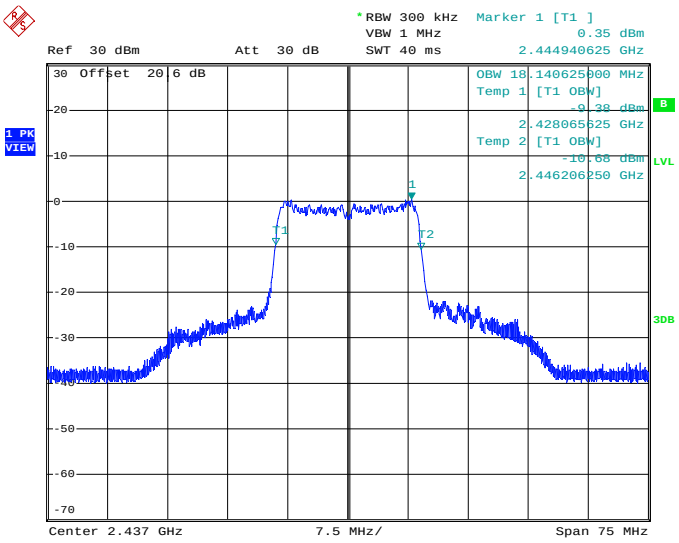


Figure 7.2.2-35: 99% OBW - Middle Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

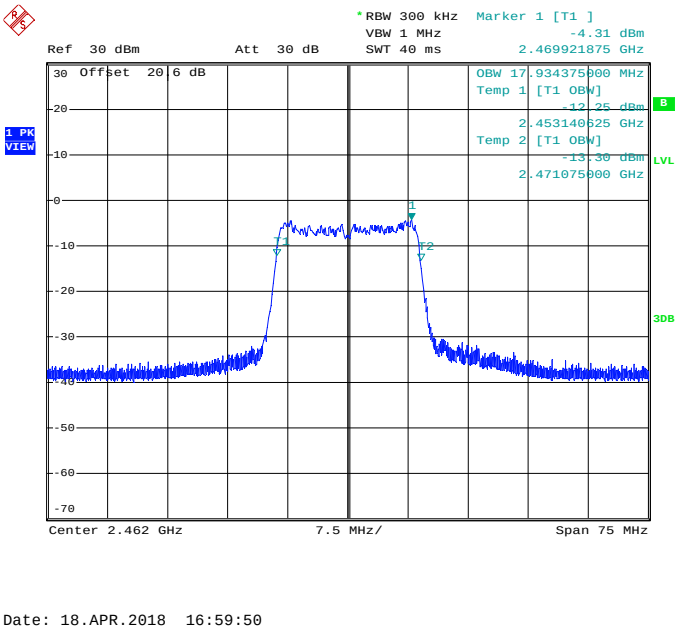


Figure 7.2.2-36: 99% OBW - High Channel – 802.11n 20 MHz – Antenna Port 2 (MCS0)

Table 7.2.2-4: 6dB / 99% Bandwidth – 802.11n 40 MHz (MCS8)

Frequency (MHz)	Antenna Port	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2422	1	36.550	37.275
2437		36.569	37.350
2452		36.569	37.245
2422	2	36.463	37.350
2437		36.456	37.170
2452		36.456	37.440

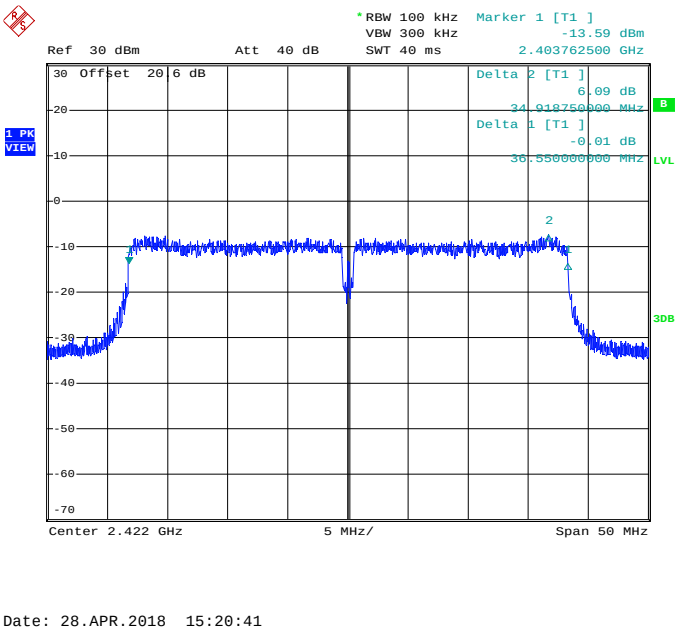


Figure 7.2.2-37: 6dB BW - Low Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

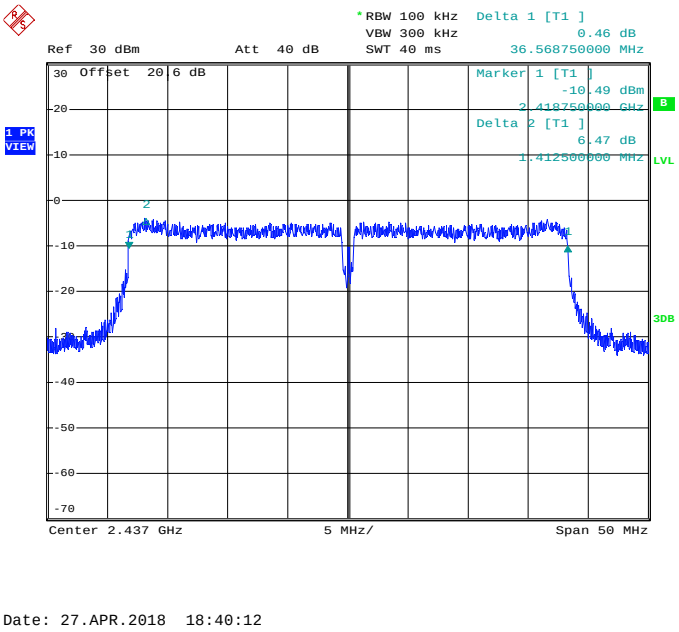


Figure 7.2.2-38: 6dB BW - Middle Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

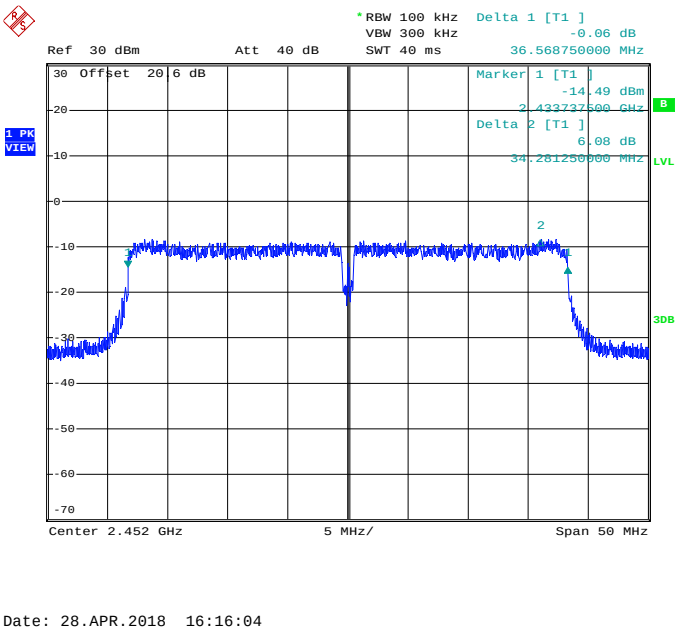


Figure 7.2.2-39: 6dB BW - High Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

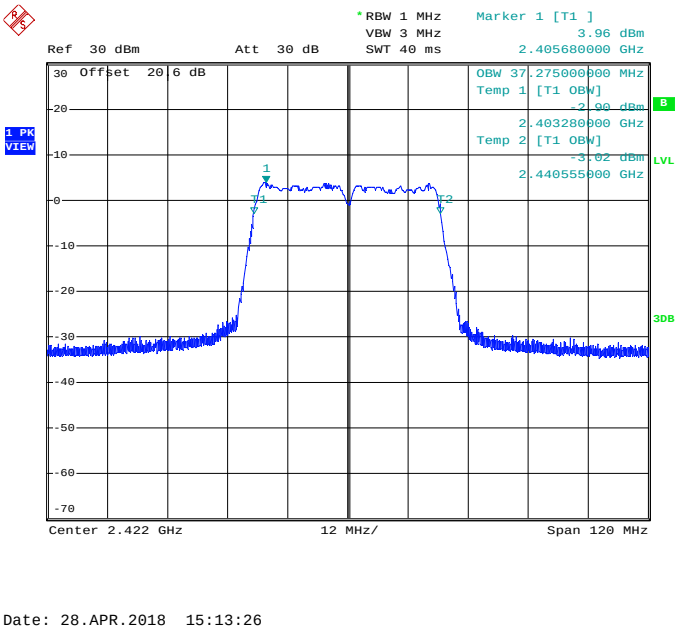


Figure 7.2.2-40: 99% OBW - Low Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

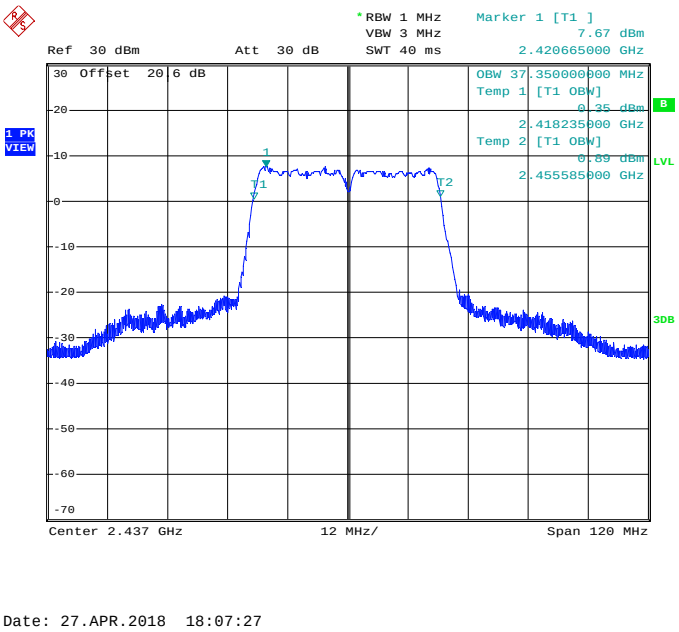


Figure 7.2.2-41: 99% OBW - Middle Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

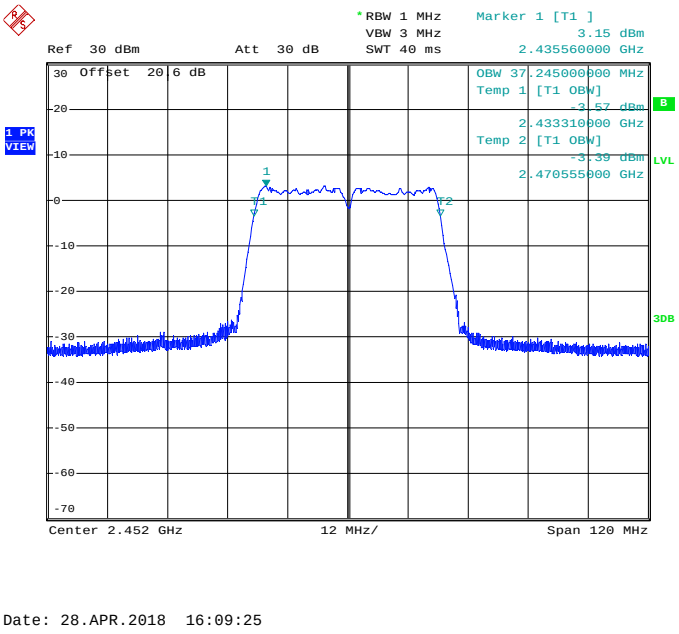


Figure 7.2.2-42: 99% OBW - High Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

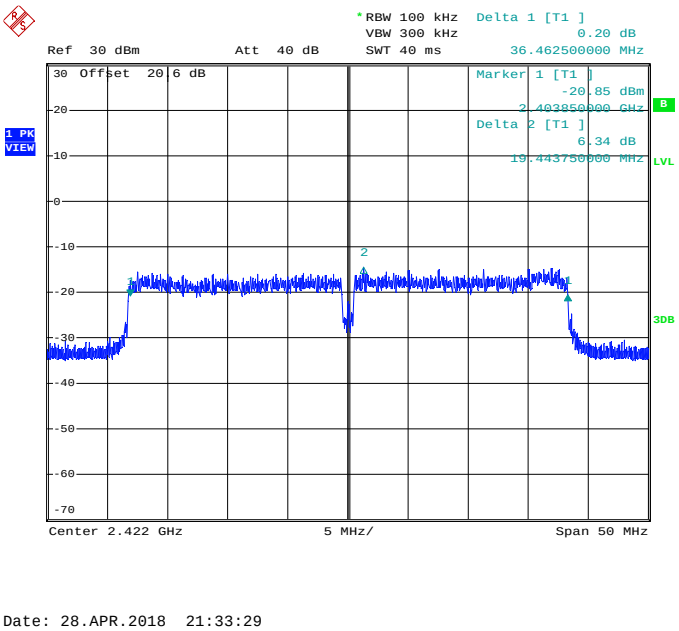


Figure 7.2.2-43: 6dB BW - Low Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

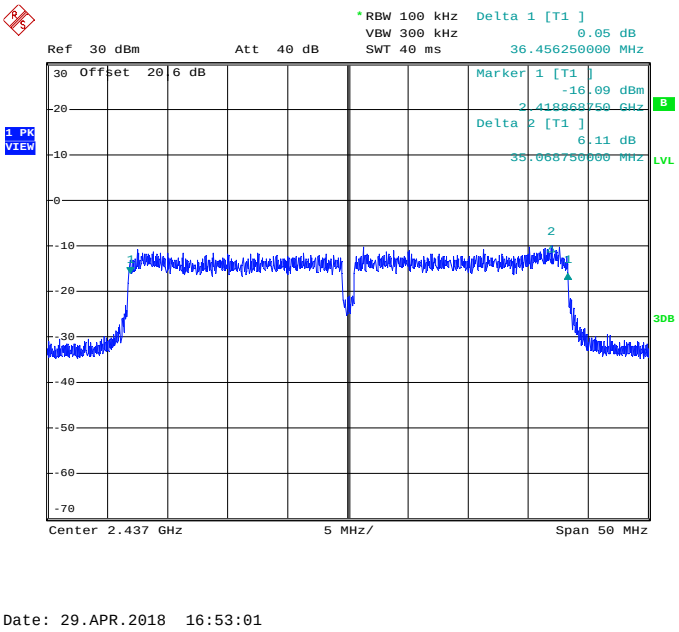


Figure 7.2.2-44: 6dB BW - Middle Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

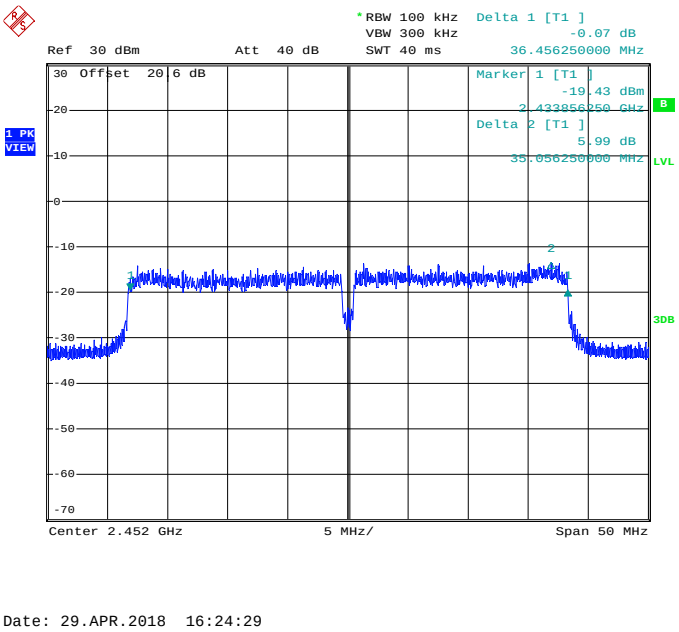


Figure 7.2.2-45: 6dB BW - High Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

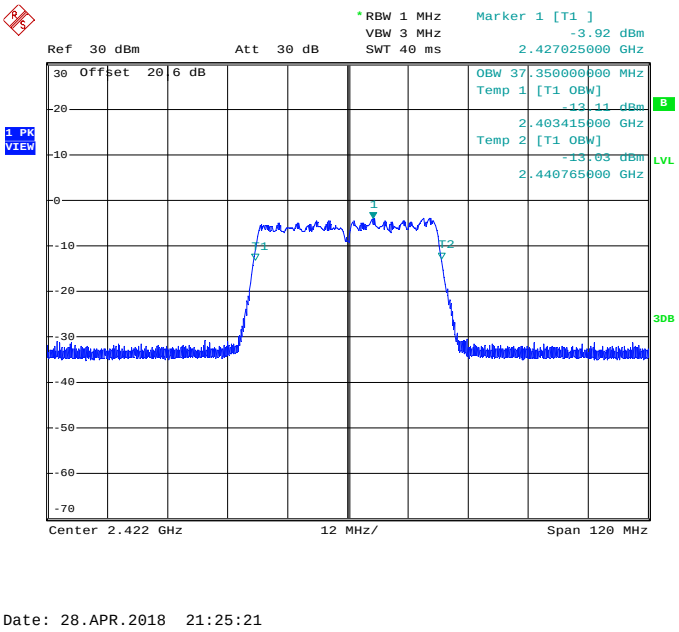


Figure 7.2.2-46: 99% OBW - Low Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

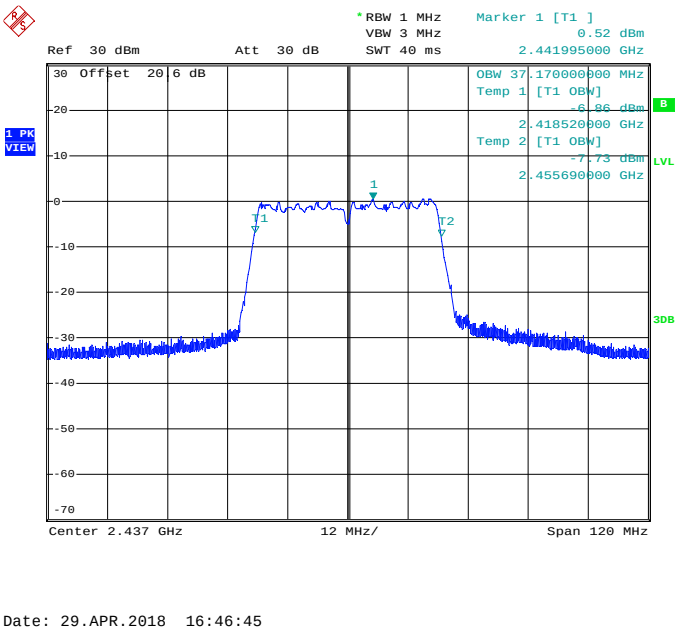


Figure 7.2.2-47: 99% OBW - Middle Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

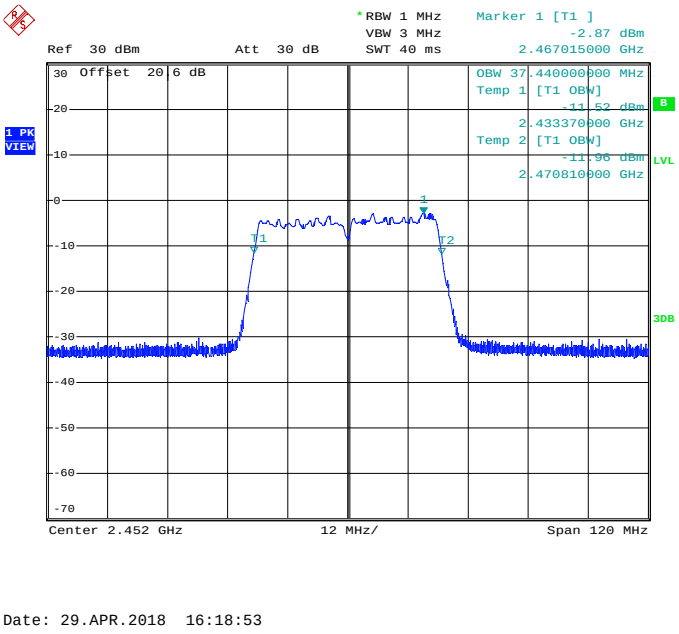


Figure 7.2.2-48: 99% OBW - High Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

7.3 Peak Output Power – FCC: Section 15.247(b)(3); ISED Canada: RSS-247 5.4(d)

7.3.1 Measurement Procedure (Conducted Method)

The fundamental emission output power was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v05.

ANSI C63.10 Section 11.9.1.3 PKPM1 (Peak power meter method) was used for the 802.11b/g/20 MHz modes.

ANSI C63.10 Section 11.9.2.2.2 Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep) was used for the 802.11n 40 MHz mode.

The RF output of the equipment under test was directly connected to the input of the measuring equipment through suitable attenuation.

7.3.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.3.2-1: RF Output Power – 802.11b (Peak) (MCS10)

Frequency (MHz)	Antenna Port 1 Level (dBm)	Antenna Port 2 Level (dBm)	Total Power (dBm)
2412	16.78	8.36	17.364
2437	20.25	12.64	20.944
2462	19.68	12.8	20.490

Table 7.3.2-2: RF Output Power – 802.11g (Peak) (MCS0)

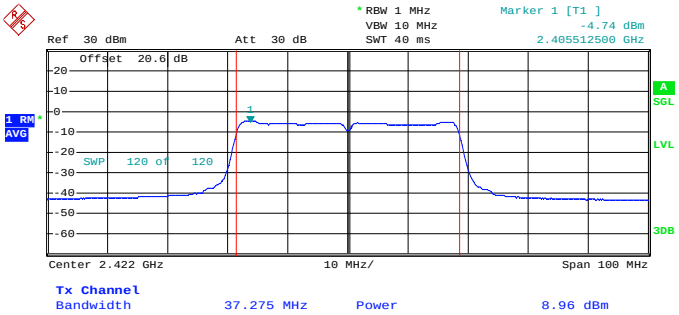
Frequency (MHz)	Antenna Port 1 Level (dBm)	Antenna Port 2 Level (dBm)	Total Power (dBm)
2412	22.79	15.14	23.479
2437	23.11	15.50	23.804
2462	21.37	13.51	22.028

Table 7.3.2-3: RF Output Power – 802.11n 20 MHz (Peak) (MCS0)

Frequency (MHz)	Antenna Port 1 Level (dBm)	Antenna Port 2 Level (dBm)	Total Power (dBm)
2412	20.3	12.95	21.034
2437	23.02	15.43	23.717
2462	19.41	12.08	20.147

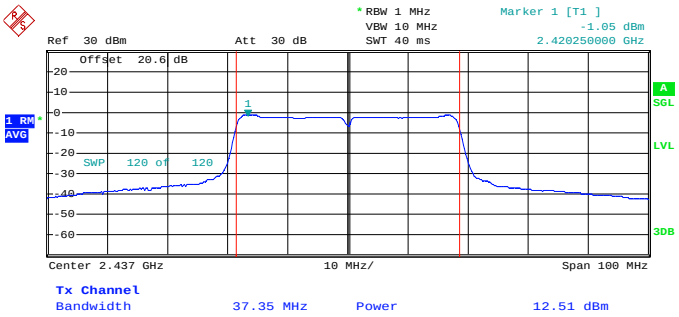
Table 7.3.2-4: RF Output Power – 802.11n 40 MHz (Average) (MCS8)

Frequency (MHz)	Antenna Port 1 Level (dBm)	Antenna Port 2 Level (dBm)	Total Power (dBm)
2422	8.96	0.63	9.555
2437	12.51	5.1	13.235
2452	8.2	1.57	9.054



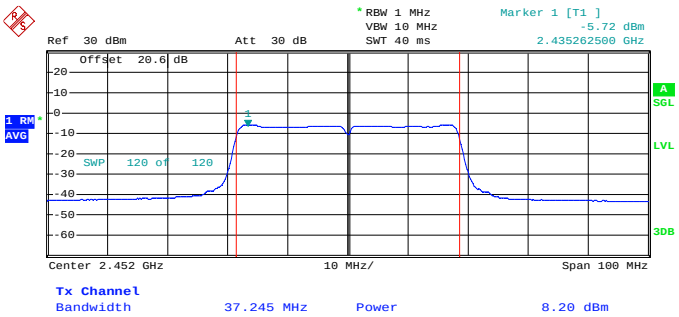
Date: 28.APR.2018 15:15:09

Figure 7.3.2-1: RF Output Power - Low Channel – 802.11n 40 MHz – Antenna Port 1



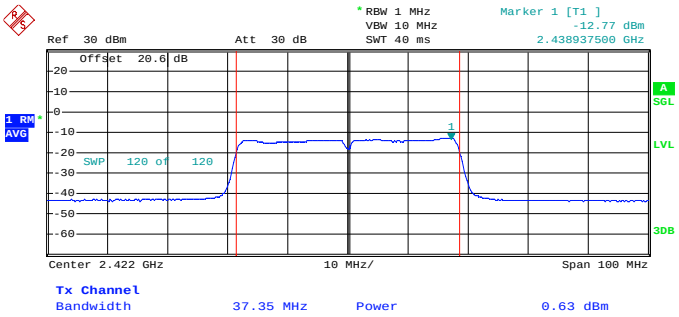
Date: 27.APR.2018 18:10:54

Figure 7.3.2-2: RF Output Power - Middle Channel – 802.11n 40 MHz – Antenna Port 1



Date: 28.APR.2018 16:10:59

Figure 7.3.2-3: RF Output Power - High Channel – 802.11n 40 MHz – Antenna Port 1



Date: 28.APR.2018 21:29:36

Figure 7.3.2-4: RF Output Power - Low Channel – 802.11n 40 MHz – Antenna Port 2

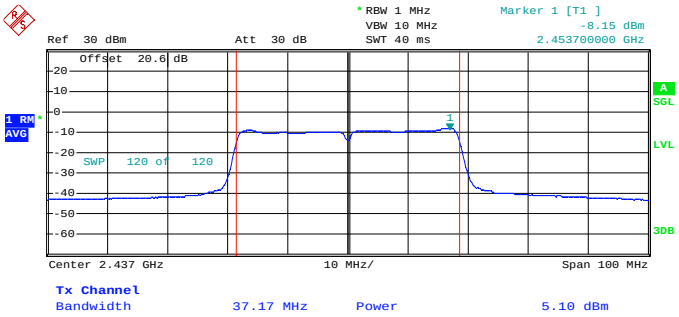


Figure 7.3.2-5: RF Output Power - Middle Channel – 802.11n 40 MHz – Antenna Port 2

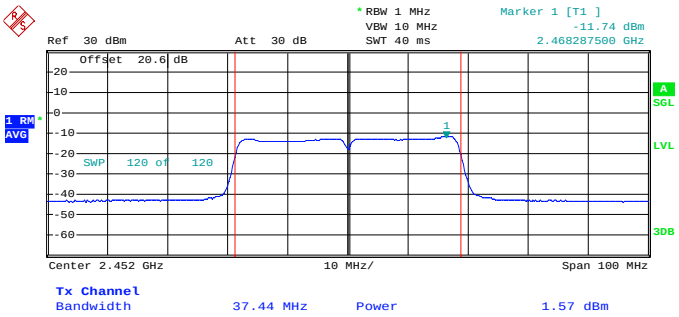


Figure 7.3.2-6: RF Output Power - High Channel – 802.11n 40 MHz – Antenna Port 2

7.4 Band-Edge and Spurious Emissions

7.4.1 Band-Edge Compliance of RF Conducted Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer via suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement, the spectrum analyzer's RBW was set to 100 kHz, and the VBW was set to 300 kHz.

7.4.1.2 Measurement Results

Performed by: Thierry Jean-Charles

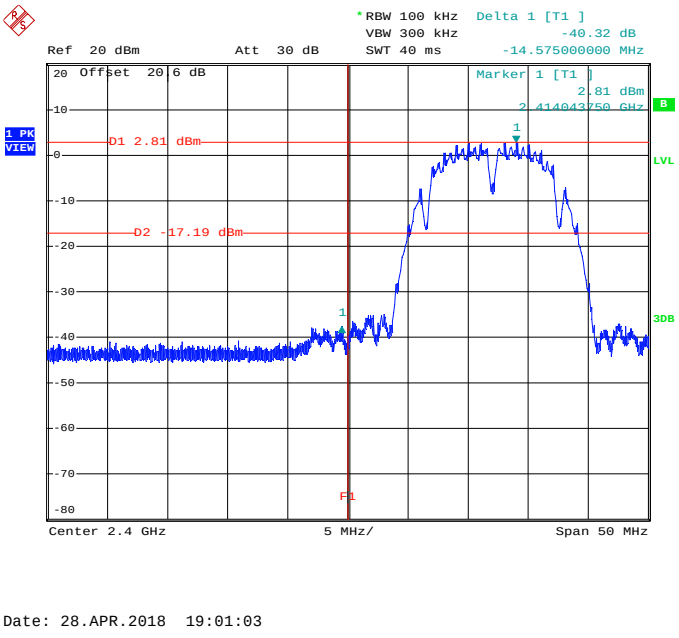


Figure 7.4.1.2-1: Lower Band-edge – 802.11b – Antenna Port 1 (MCS0)

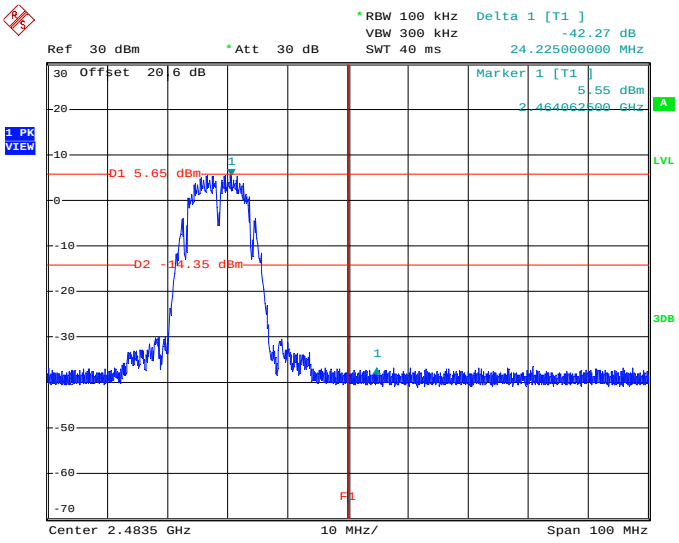


Figure 7.4.1.2-2: Upper Band-edge – 802.11b – Antenna Port 1 (MCS0)

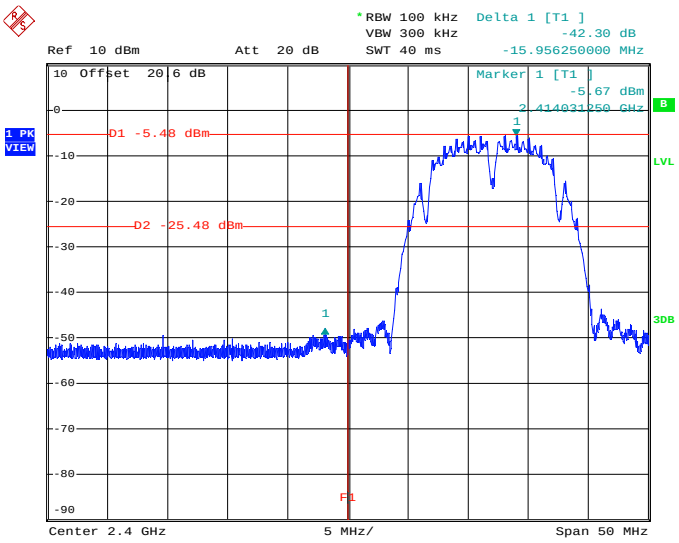


Figure 7.4.1.2-3: Lower Band-edge – 802.11b – Antenna Port 2 (MCS0)

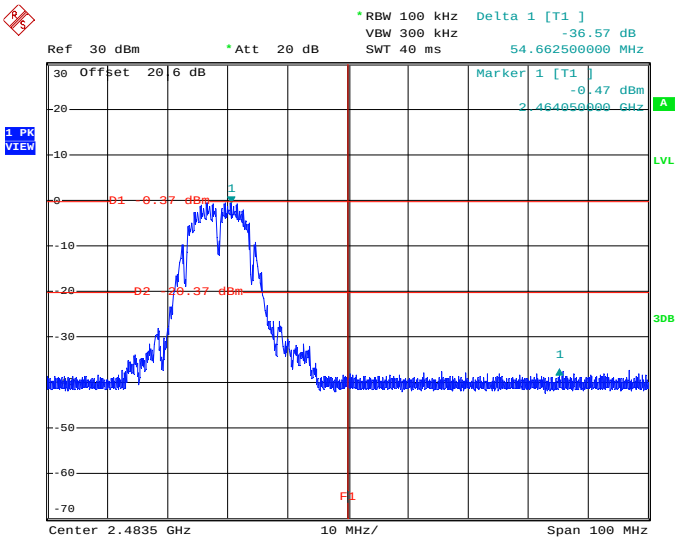


Figure 7.4.1.2-4: Upper Band-edge – 802.11b – Antenna Port 2 (MCS0)

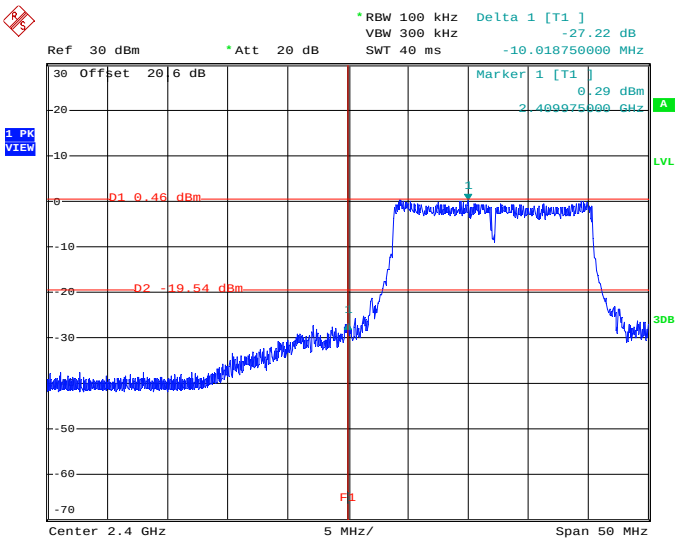


Figure 7.4.1.2-5: Lower Band-edge – 802.11g – Antenna Port 1 (MCS0)

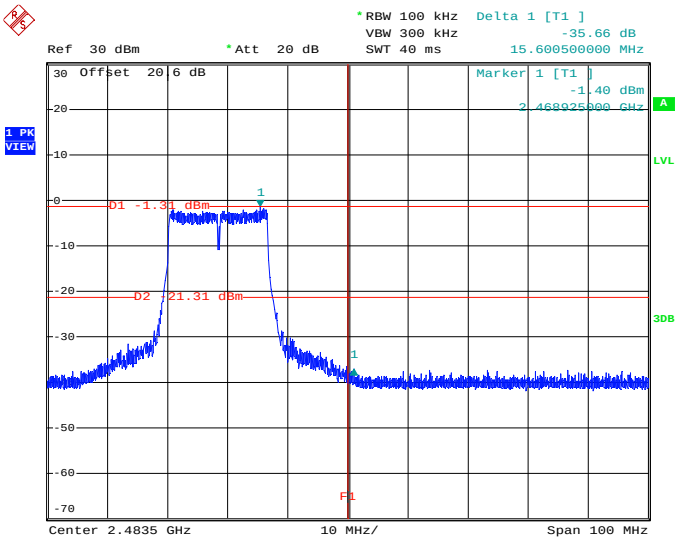


Figure 7.4.1.2-6: Upper Band-edge – 802.11g – Antenna Port 1 (MCS0)

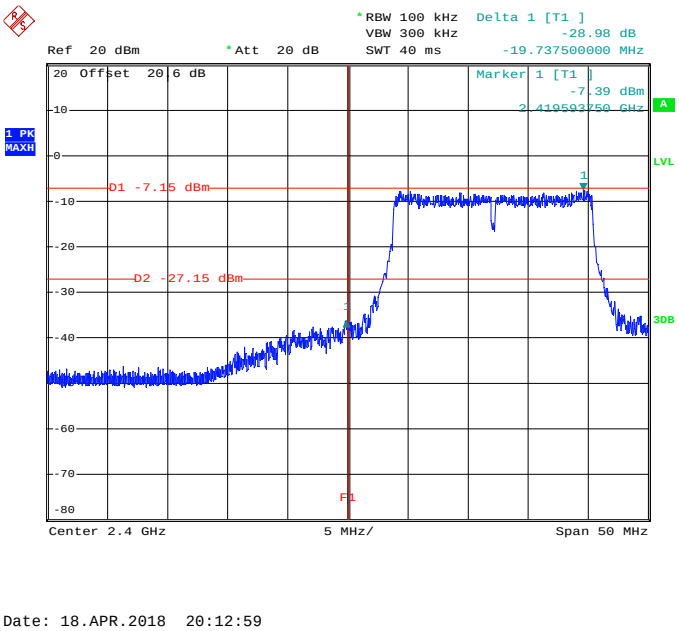


Figure 7.4.1.2-7: Lower Band-edge – 802.11g – Antenna Port 2 (MCS0)

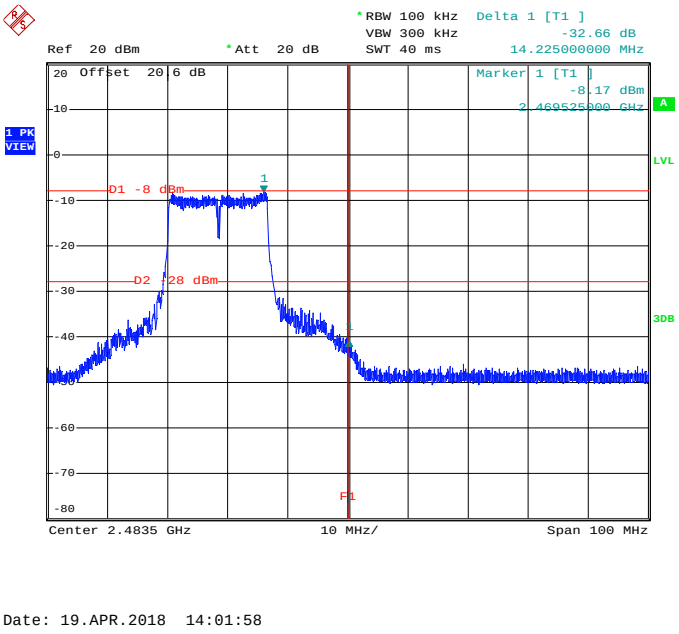


Figure 7.4.1.2-8: Upper Band-edge – 802.11g – Antenna Port 2 (MCS0)

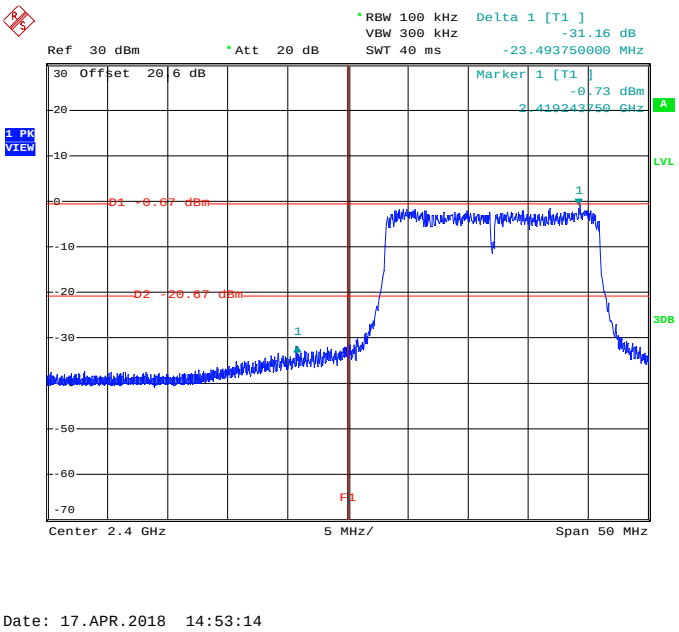
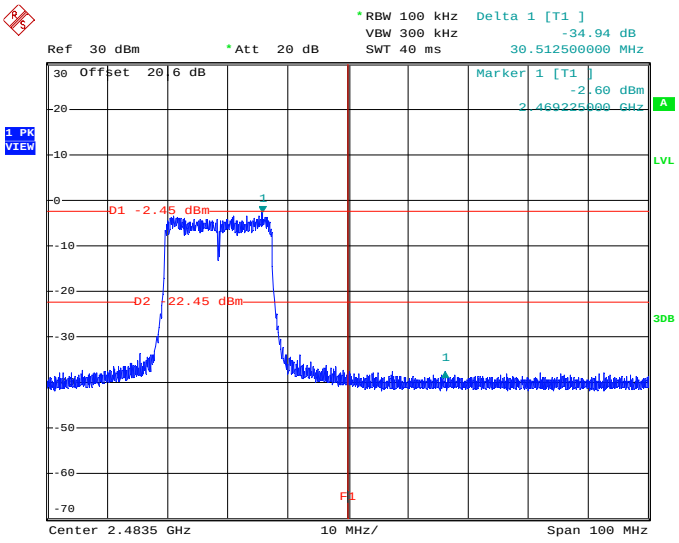
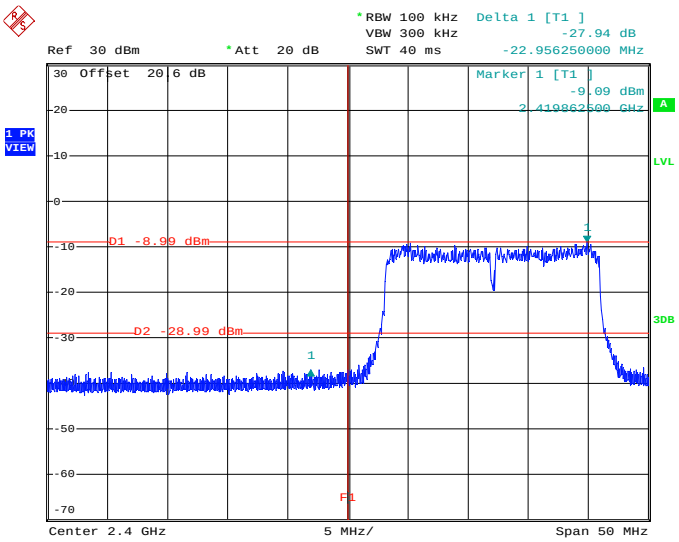


Figure 7.4.1.2-9: Lower Band-edge – 802.11n 20 MHz – Antenna Port 1 (MCS10)



Date: 17.APR.2018 16:10:15

Figure 7.4.1.2-10: Upper Band-edge – 802.11n 20 MHz – Antenna Port 1 (MCS10)



Date: 17.APR.2018 17:58:59

Figure 7.4.1.2-11: Lower Band-edge – 802.11n 20 MHz – Antenna Port 2 (MCS10)

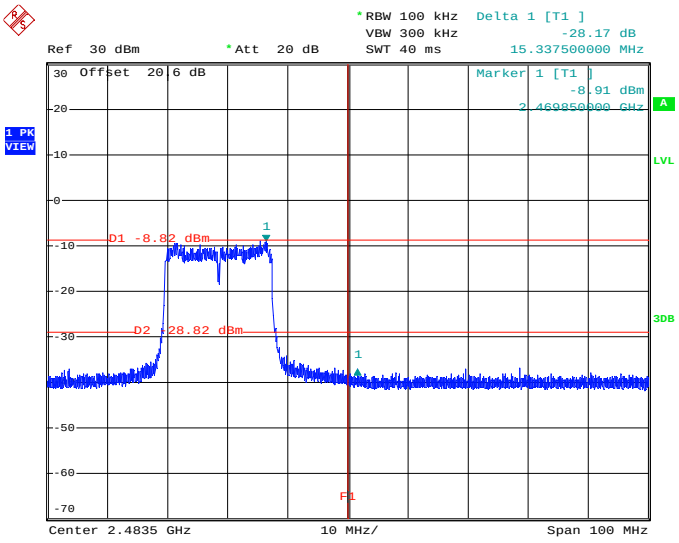


Figure 7.4.1.2-12: Upper Band-edge – 802.11n 20 MHz – Antenna Port 2 (MCS10)

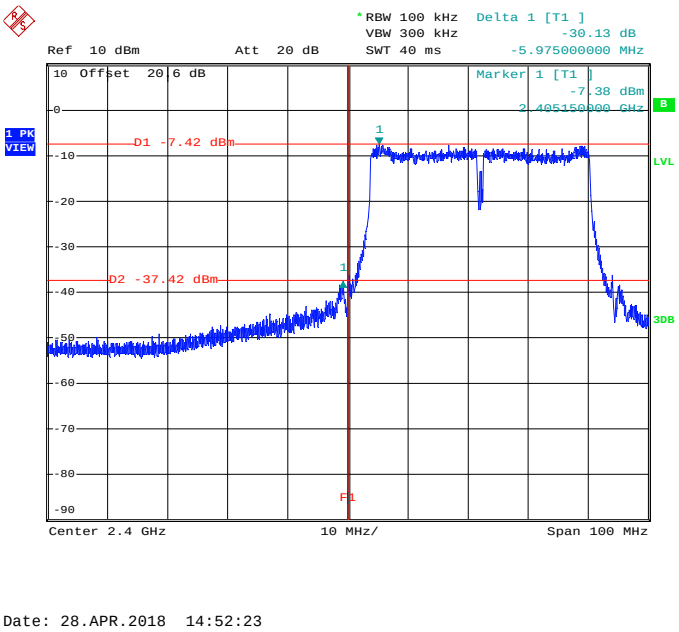


Figure 7.4.1.2-13: Lower Band-edge – 802.11n 40 MHz – Antenna Port 1 (MCS9)

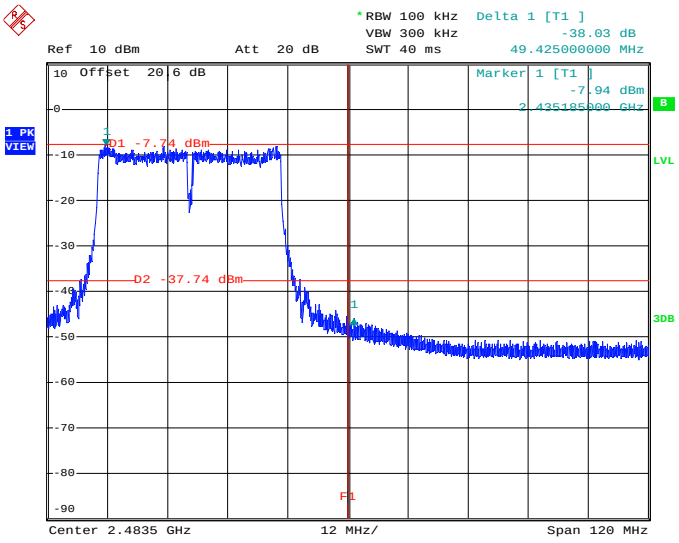


Figure 7.4.1.2-14: Upper Band-edge – 802.11n 40 MHz – Antenna Port 1 (MCS9)

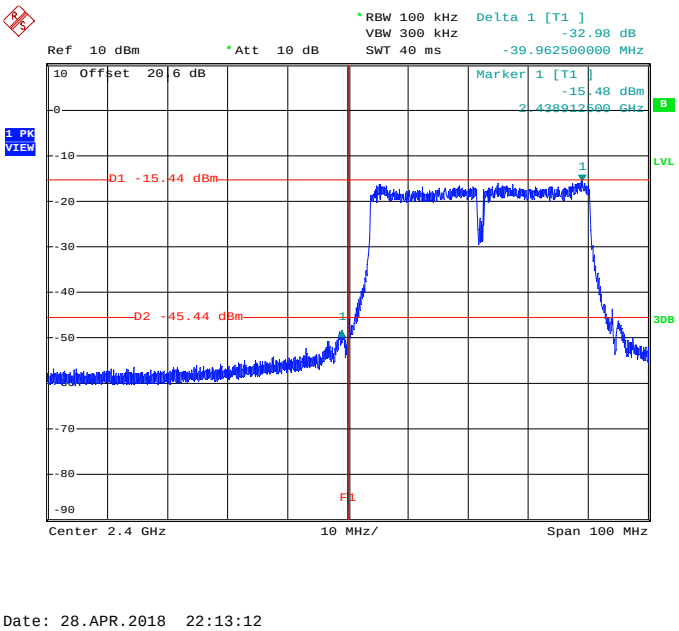


Figure 7.4.1.2-15: Lower Band-edge – 802.11n 40 MHz – Antenna Port 2 (MCS9)

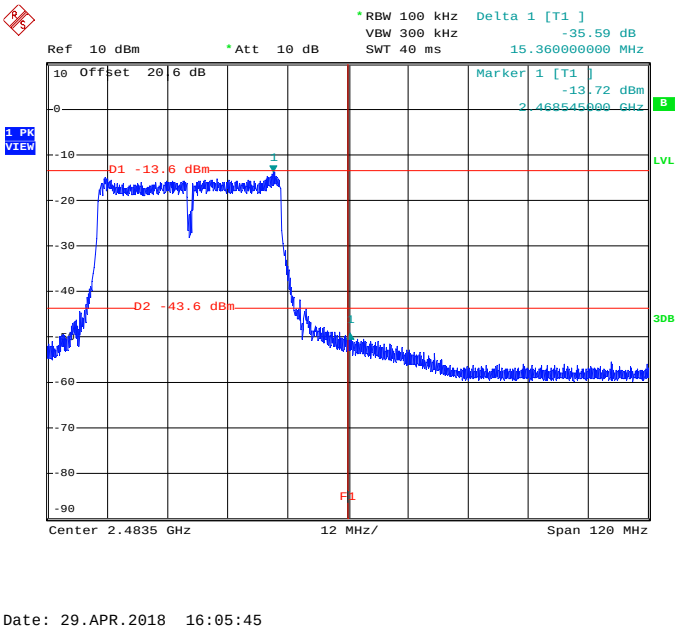


Figure 7.4.1.2-16: Upper Band-edge – 802.11n 40 MHz – Antenna Port 2 (MCS9)

7.4.2 RF Conducted Spurious Emissions – FCC: Section 15.247(d); ISED Canada: RSS-247 5.5

7.4.2.1 Measurement Procedure

The RF Conducted Spurious Emissions were measured in accordance with ANSI C63.10 Section 11.11. The RF output port of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30 MHz to 26 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak Max Hold function of the analyzer was utilized. The reference level was determined by measuring the Peak PSD level in any 100-kHz bandwidth within the DTS channel bandwidth.

7.4.2.2 Measurement Results

Performed by: Thierry Jean-Charles

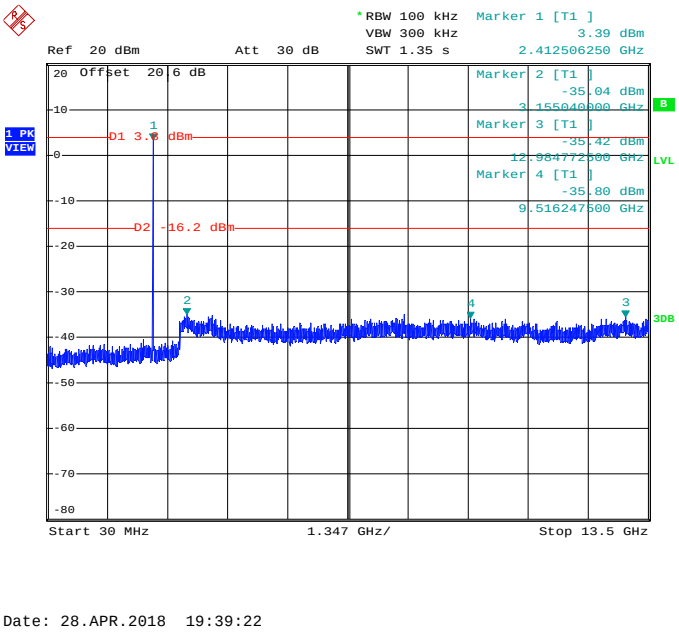


Figure 7.4.2.2-1: 30 MHz – 13.5 GHz – Low Channel – 802.11b – Antenna Port 1 (MCS10)

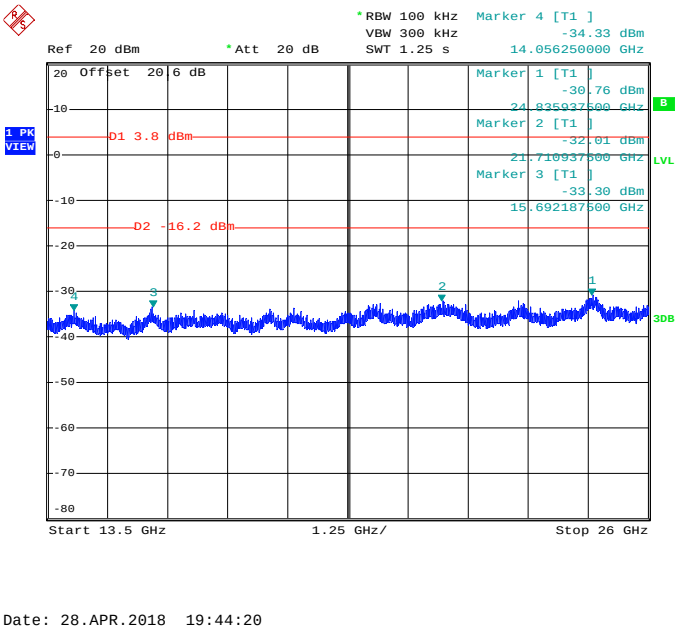


Figure 7.4.2.2-2: 13.5 GHz – 26 GHz – Low Channel – 802.11b – Antenna Port 1 (MCS10)

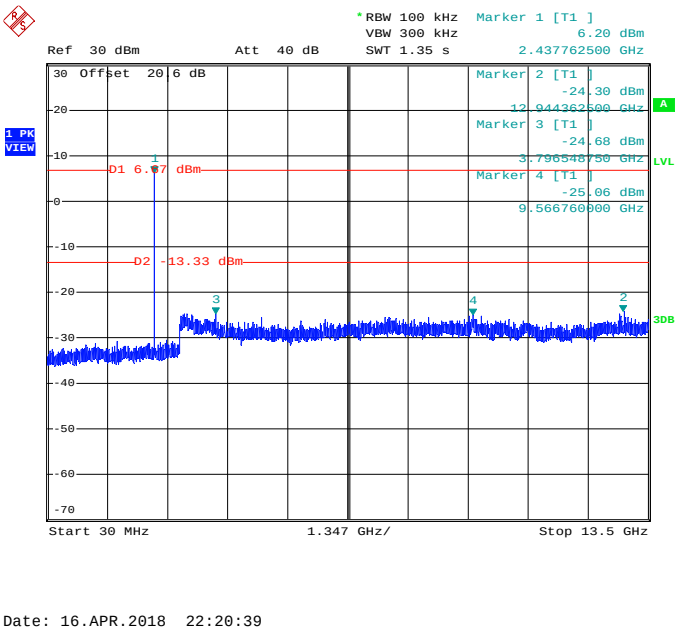


Figure 7.4.2.2-3: 30 MHz – 13.5 GHz – Middle Channel – 802.11b – Antenna Port 1 (MCS10)

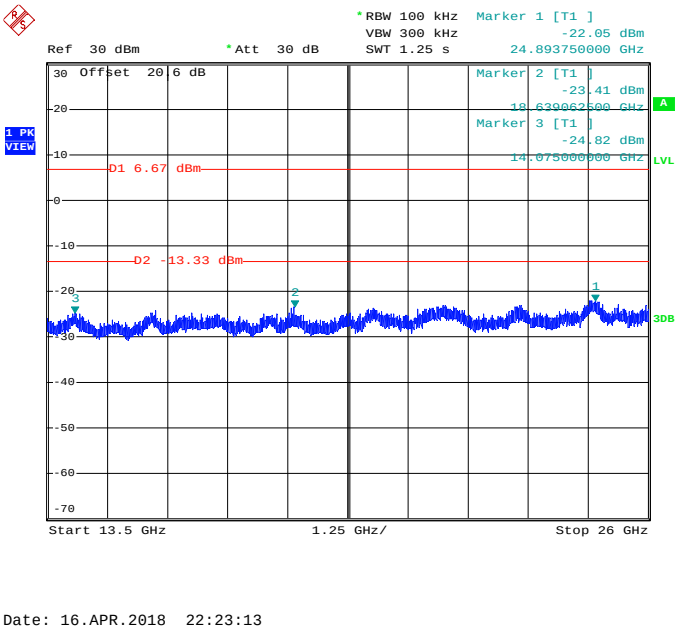


Figure 7.4.2.2-4: 13.5 GHz – 26 GHz – Middle Channel – 802.11b – Antenna Port 1 (MCS10)

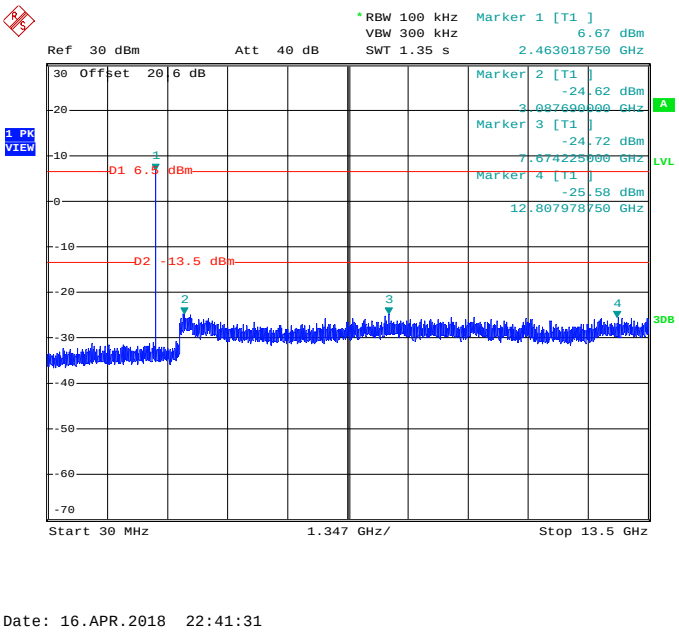


Figure 7.4.2.2-5: 30 MHz – 13.5 GHz – High Channel – 802.11b – Antenna Port 1 (MCS10)

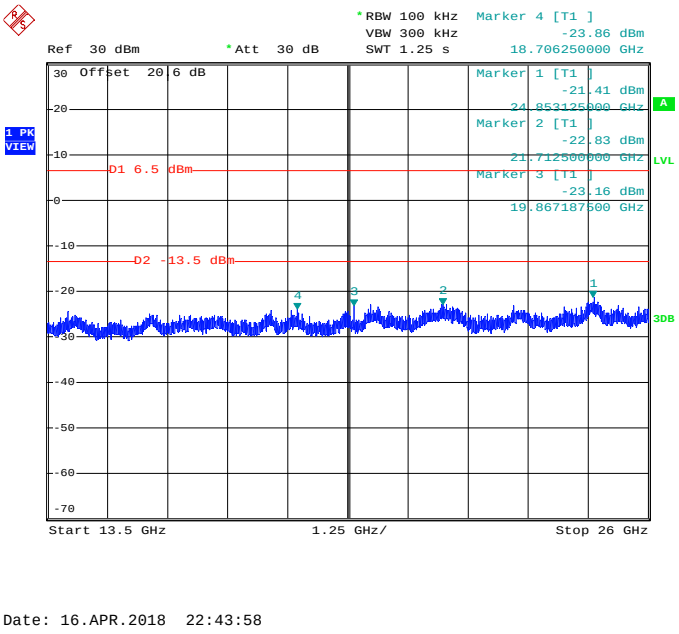


Figure 7.4.2.2-6: 13.5 GHz – 26 GHz – High Channel – 802.11b – Antenna Port 1 (MCS10)

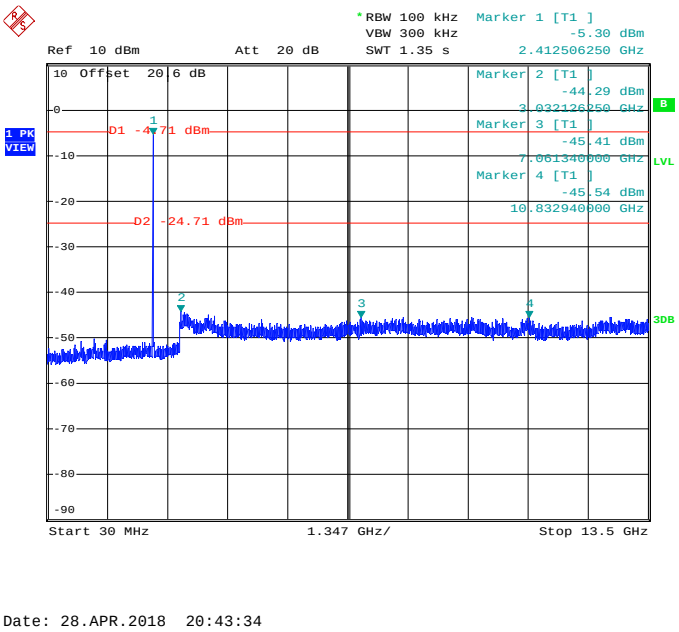


Figure 7.4.2.2-7: 30 MHz – 13.5 GHz – Low Channel – 802.11b – Antenna Port 2 (MCS10)

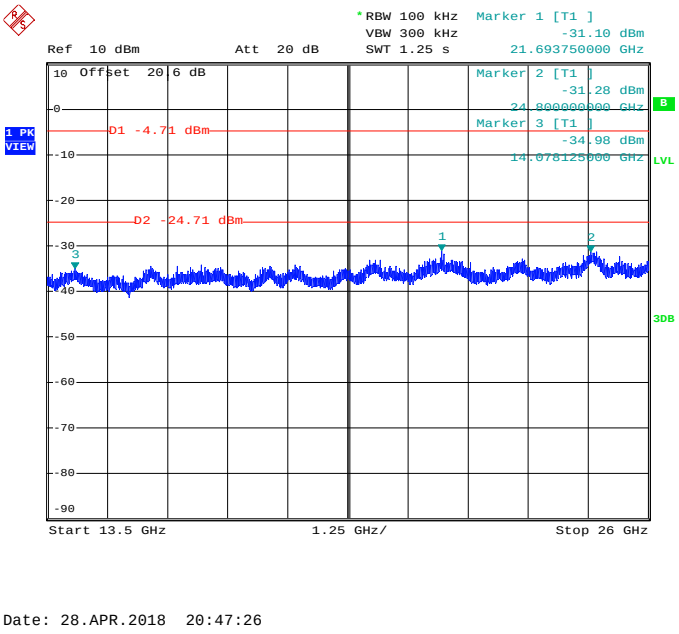


Figure 7.4.2.2-8: 13.5 GHz – 26 GHz – Low Channel – 802.11b – Antenna Port 2 (MCS10)

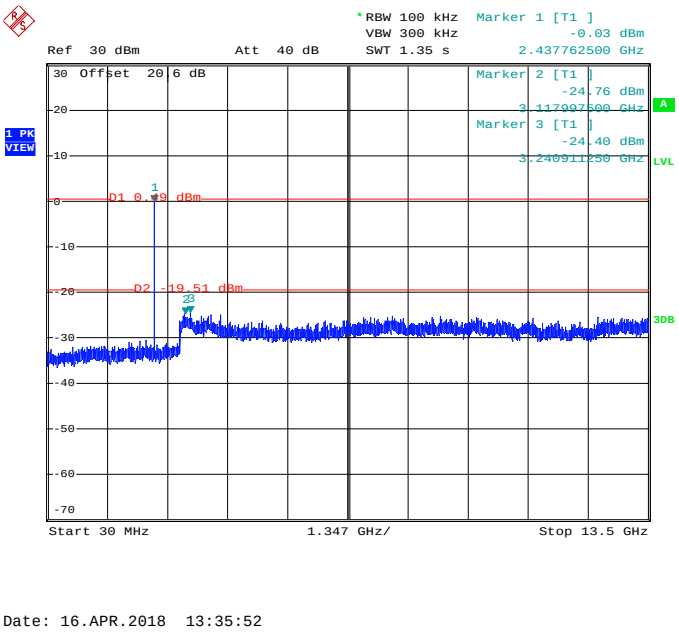


Figure 7.4.2.2-9: 30 MHz – 13.5 GHz – Middle Channel – 802.11b – Antenna Port 2 (MCS10)

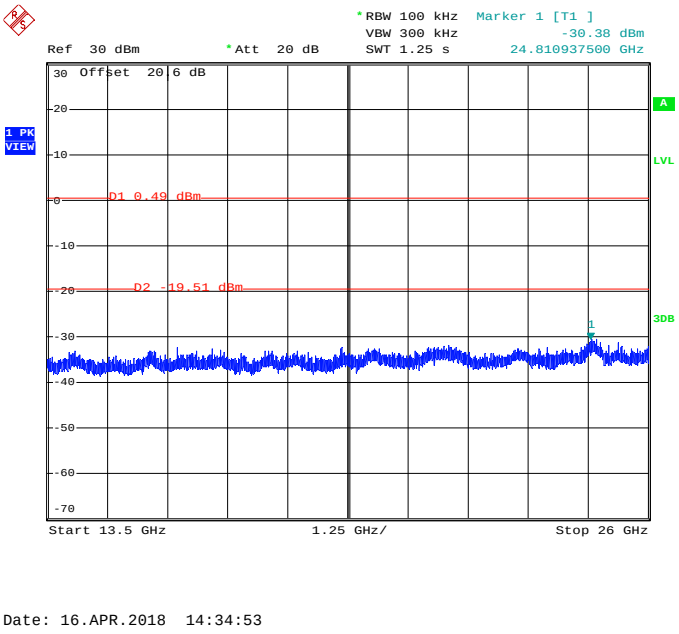


Figure 7.4.2.2-10: 13.5 GHz – 26 GHz – Middle Channel – 802.11b – Antenna Port 2 (MCS10)

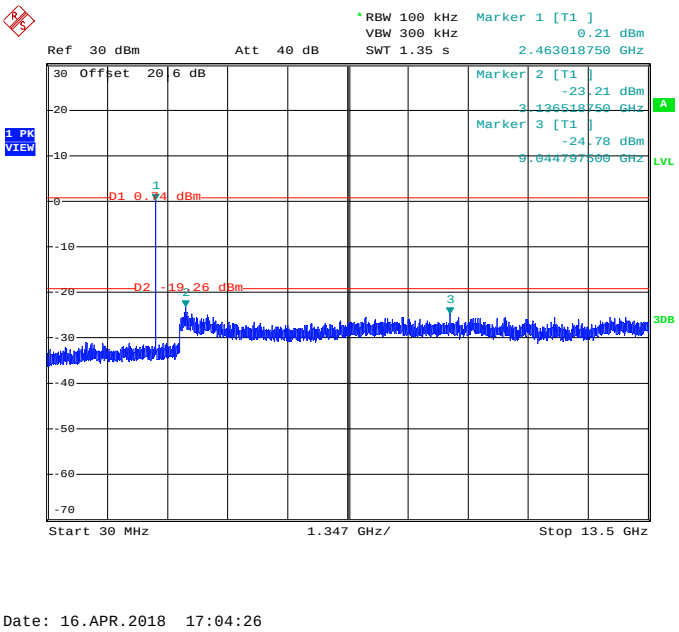


Figure 7.4.2.2-11: 30 MHz – 13.5 GHz – High Channel – 802.11b – Antenna Port 2 (MCS10)

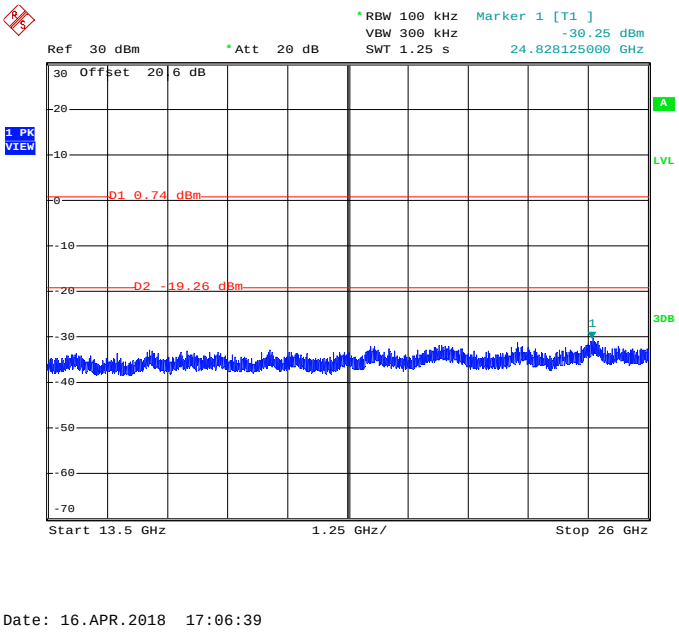


Figure 7.4.2.2-12: 13.5 GHz – 26 GHz – High Channel – 802.11b – Antenna Port 2 (MCS10)

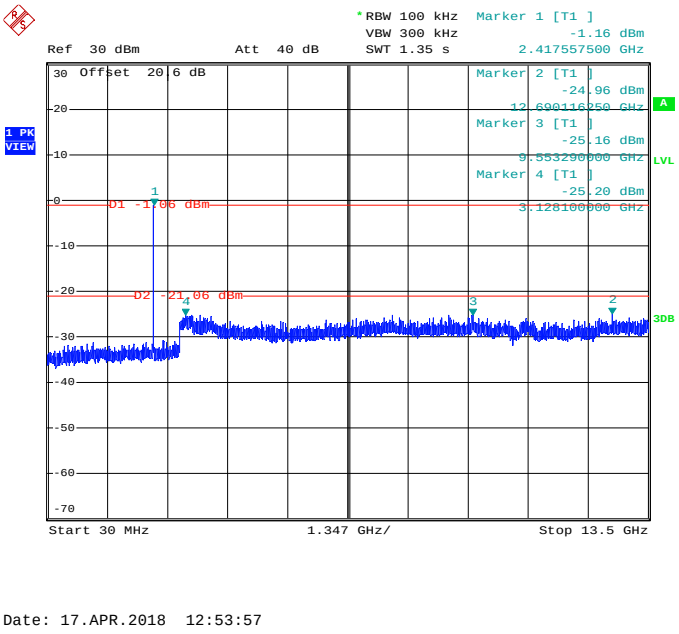


Figure 7.4.2.2-13: 30 MHz – 13.5 GHz – Low Channel – 802.11g – Antenna Port 1 (MCS4)

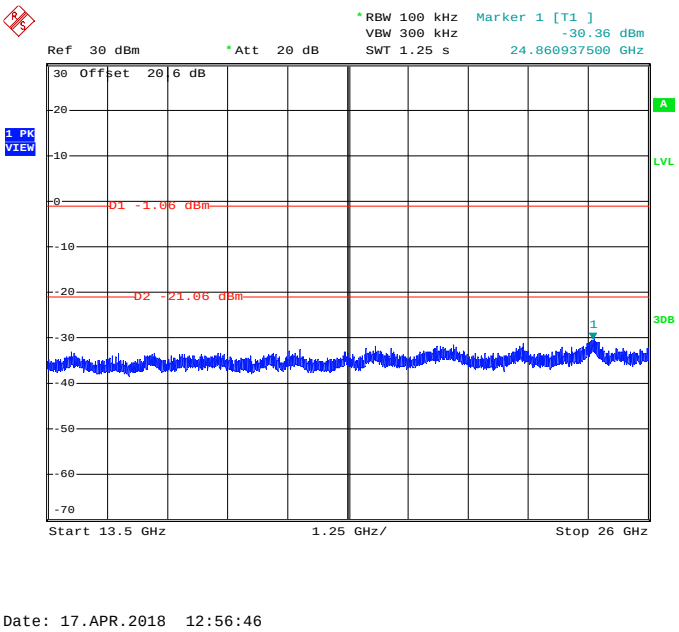


Figure 7.4.2.2-14: 13.5 GHz – 26 GHz – Low Channel – 802.11g – Antenna Port 1 (MCS4)

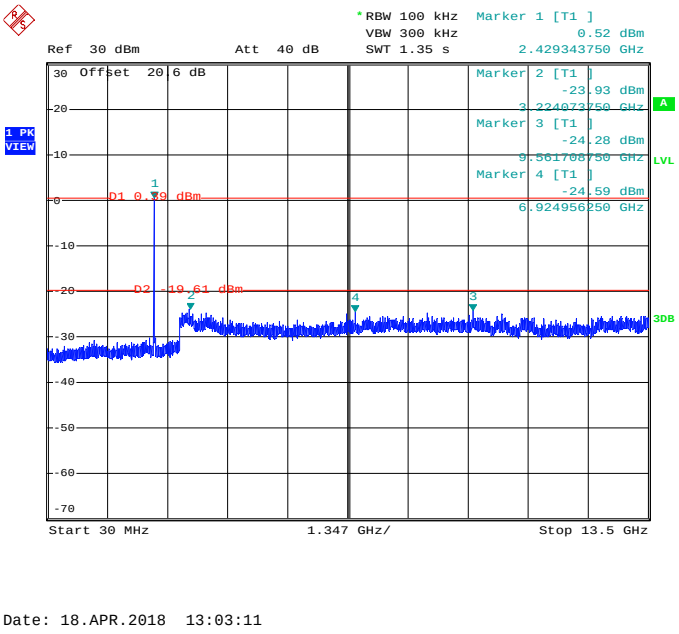


Figure 7.4.2.2-15: 30 MHz – 13.5 GHz – Middle Channel – 802.11g – Antenna Port 1 (MCS4)

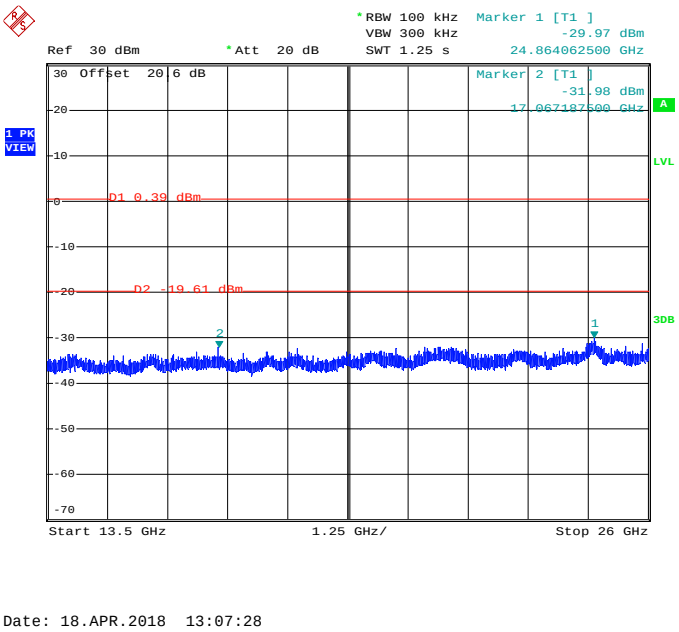


Figure 7.4.2.2-16: 13.5 GHz – 26 GHz – Middle Channel – 802.11g – Antenna Port 1 (MCS4)

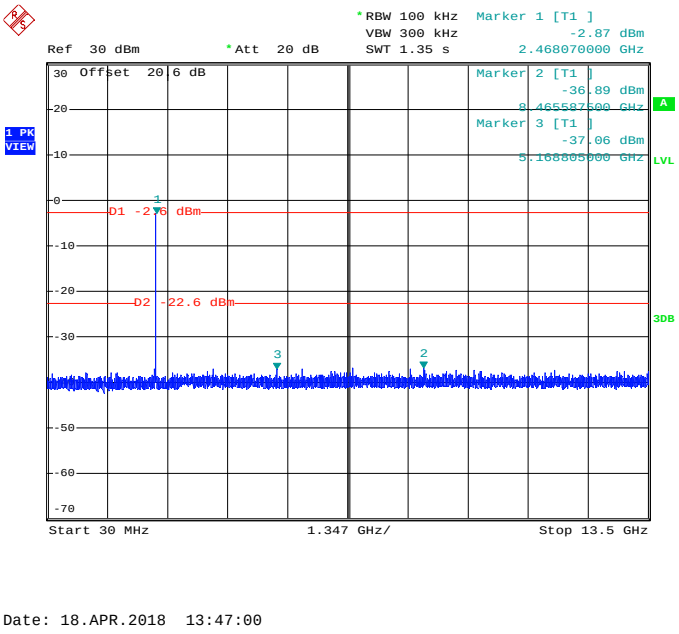


Figure 7.4.2.2-17: 30 MHz – 13.5 GHz – High Channel – 802.11g – Antenna Port 1 (MCS4)

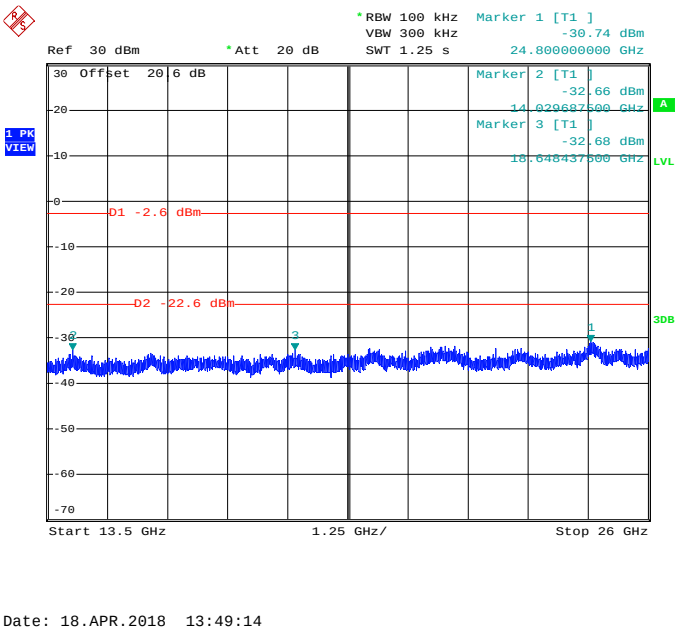


Figure 7.4.2.2-18: 13.5 GHz – 26 GHz – High Channel – 802.11g – Antenna Port 1 (MCS4)

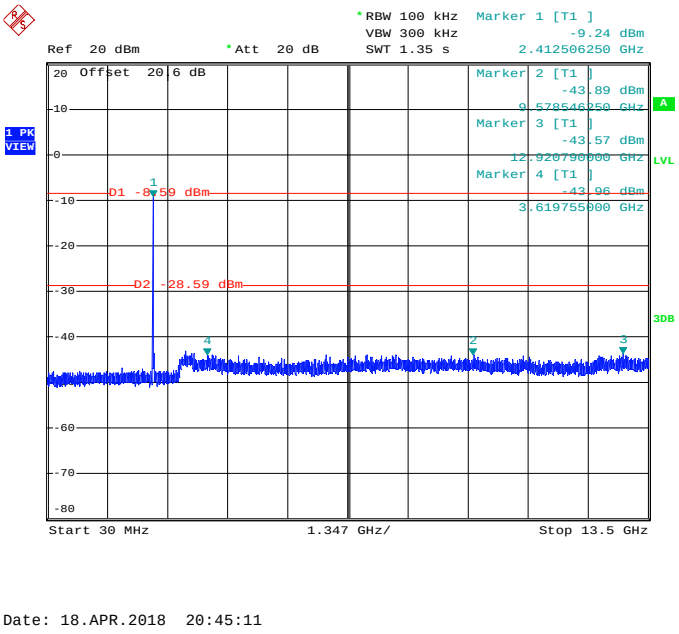


Figure 7.4.2.2-19: 30 MHz – 13.5 GHz – Low Channel – 802.11g – Antenna Port 2 (MCS4)

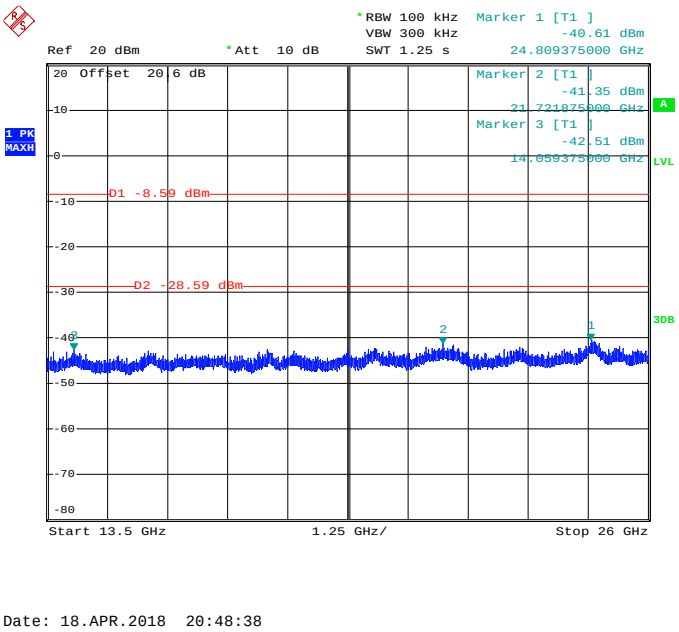


Figure 7.4.2.2-20: 13.5 GHz – 26 GHz – Low Channel – 802.11g – Antenna Port 2 (MCS4)

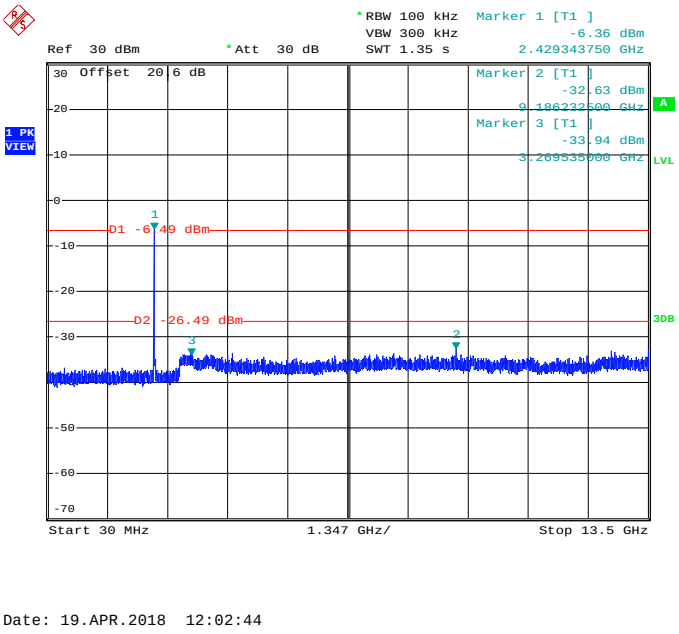


Figure 7.4.2.2-21: 30 MHz – 13.5 GHz – Middle Channel – 802.11g – Antenna Port 2 (MCS4)

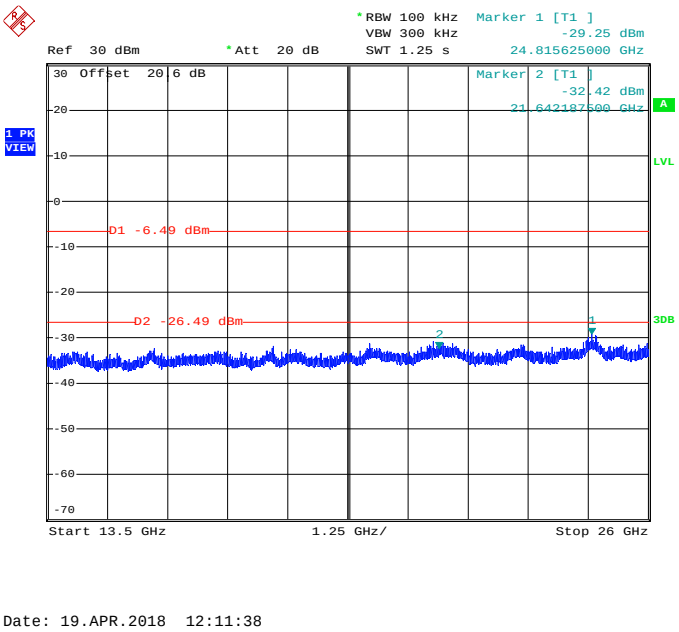


Figure 7.4.2.2-22: 13.5 GHz – 26 GHz – Middle Channel – 802.11g – Antenna Port 2 (MCS4)

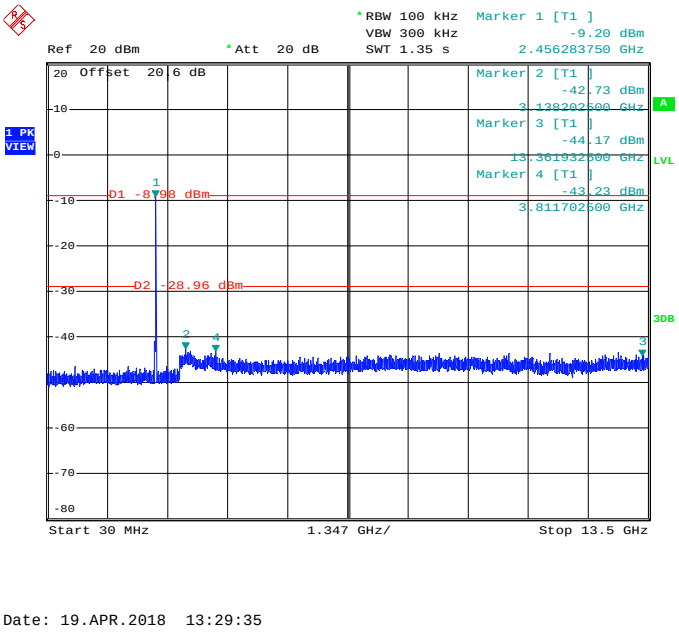


Figure 7.4.2.2-23: 30 MHz – 13.5 GHz – High Channel – 802.11g – Antenna Port 2 (MCS4)

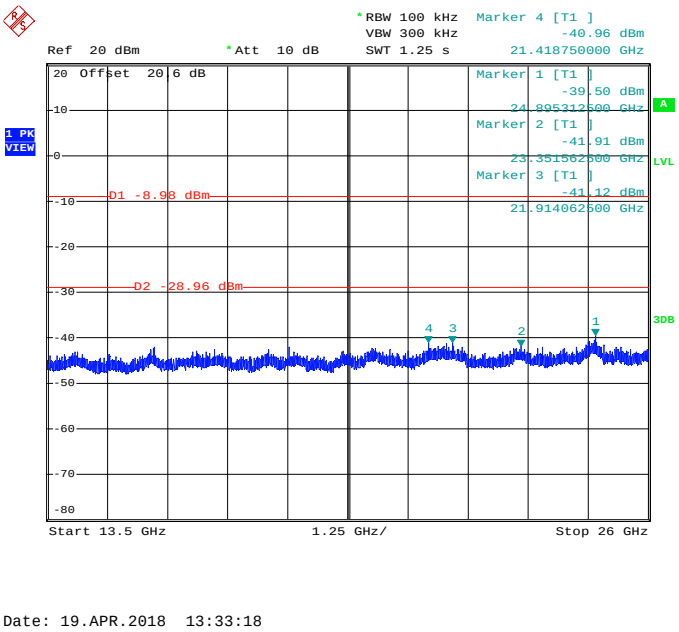


Figure 7.4.2.2-24: 13.5 GHz – 26 GHz – High Channel – 802.11g – Antenna Port 2 (MCS4)

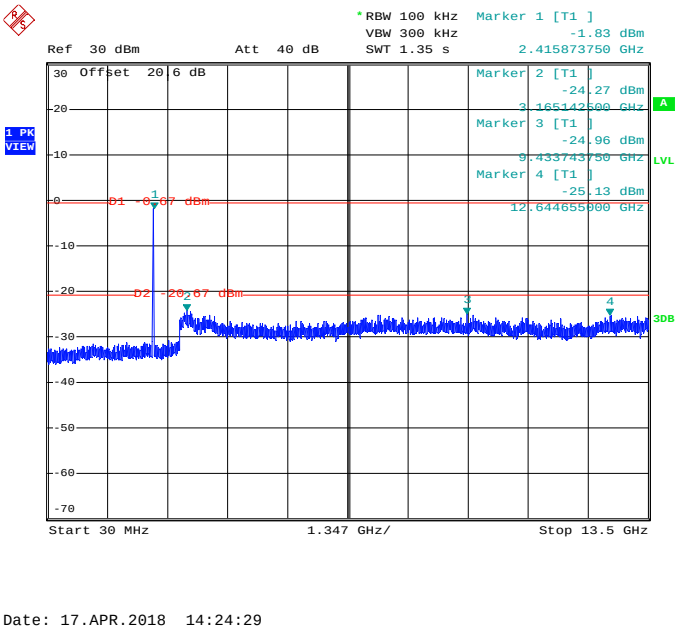


Figure 7.4.2.2-25: 30 MHz – 13.5 GHz – Low Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

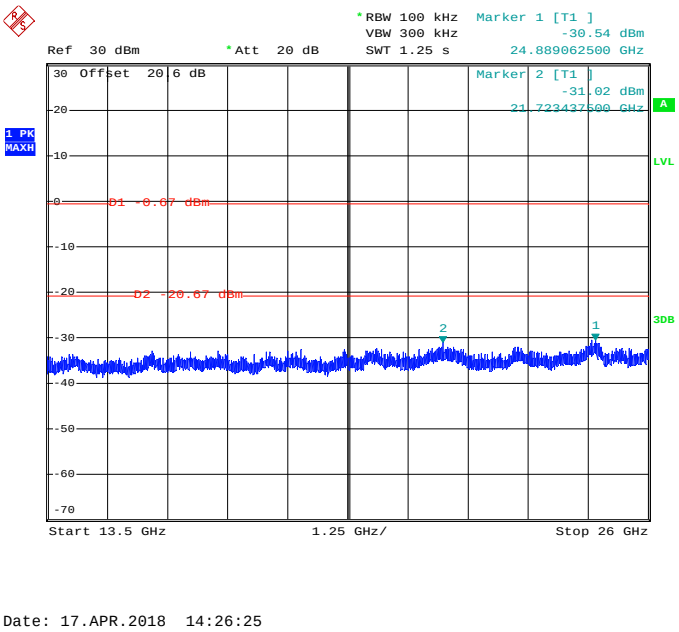


Figure 7.4.2.2-26: 13.5 GHz – 26 GHz – Low Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

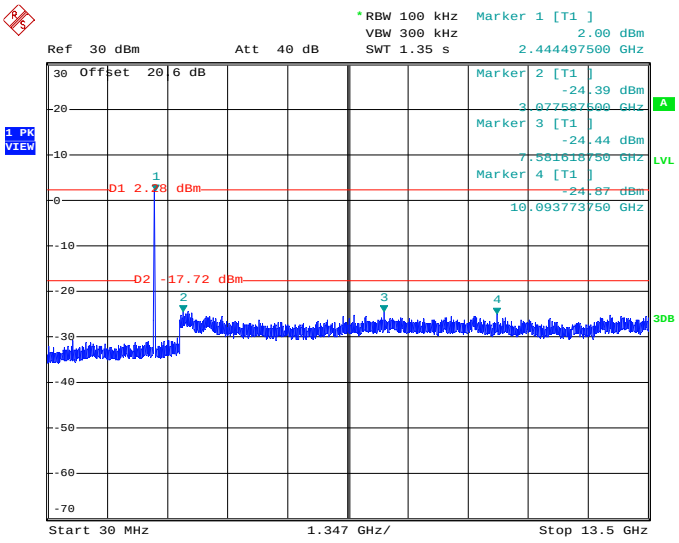


Figure 7.4.2.2-27: 30 MHz – 13.5 GHz – Middle Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

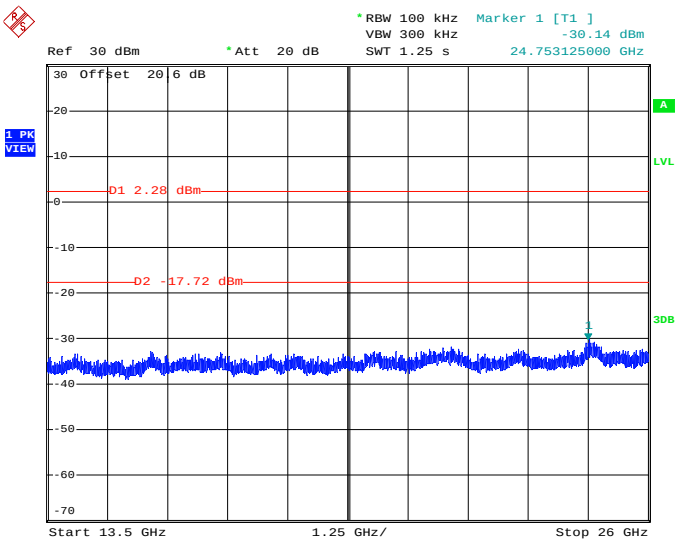


Figure 7.4.2.2-28: 13.5 GHz – 26 GHz – Middle Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

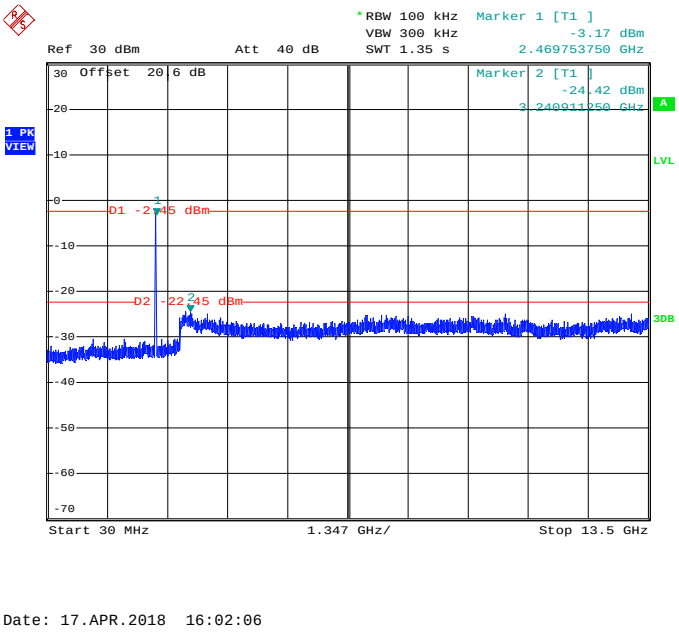


Figure 7.4.2.2-29: 30 MHz – 13.5 GHz – High Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

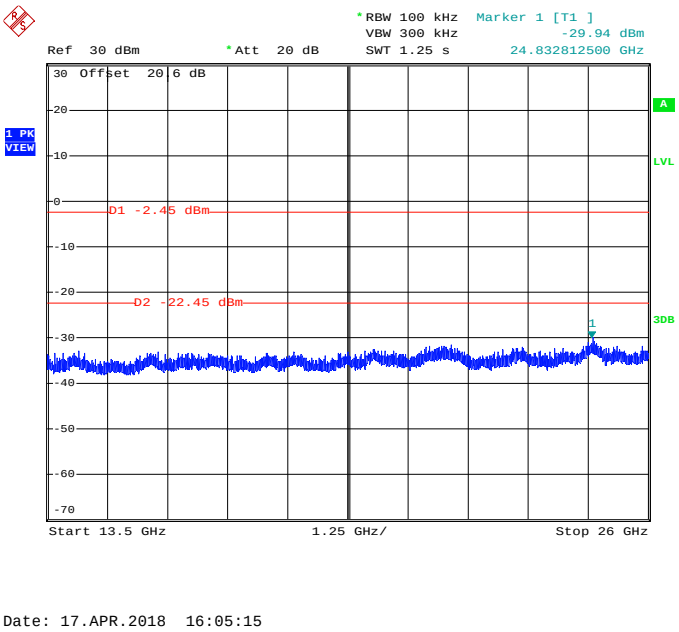


Figure 7.4.2.2-30: 13.5 GHz – 26 GHz – High Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

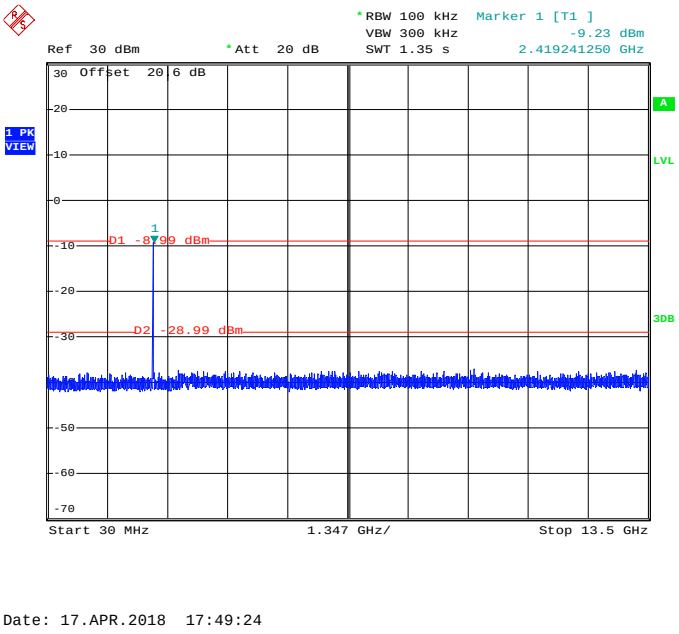


Figure 7.4.2.2-31: 30 MHz – 13.5 GHz – Low Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

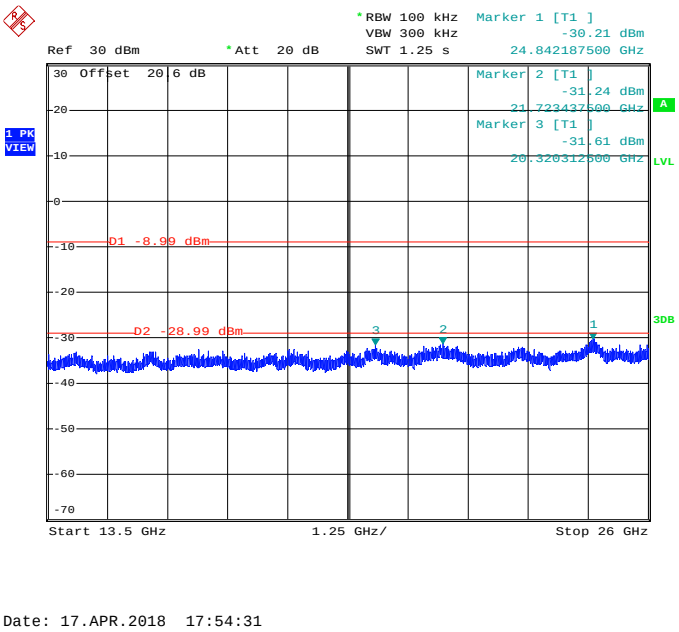


Figure 7.4.2.2-32: 13.5 GHz – 26 GHz – Low Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

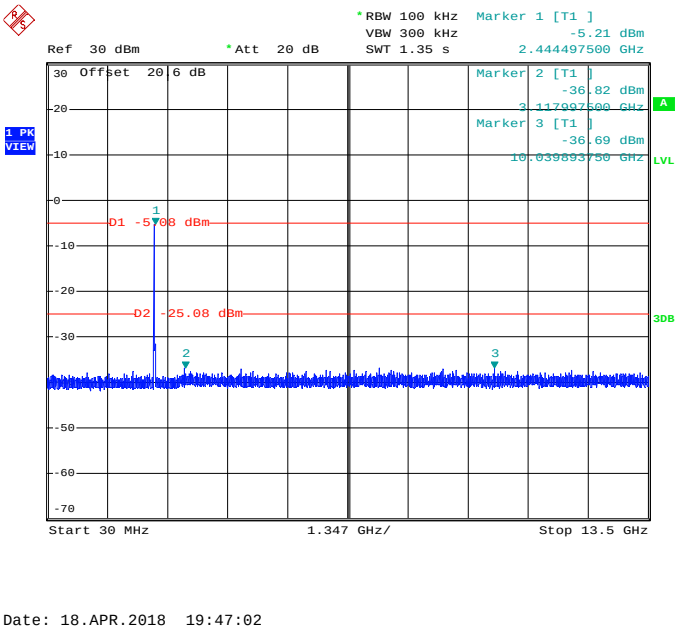


Figure 7.4.2.2-33: 30 MHz – 13.5 GHz – Middle Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

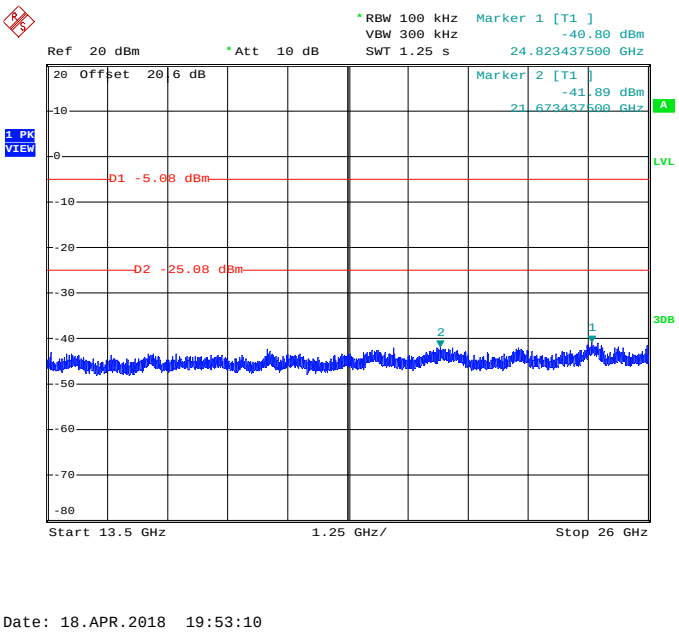


Figure 7.4.2.2-34: 13.5 GHz – 26 GHz – Middle Channel – 802.11n 20 MHz – Antenna Port 2 (MCs10)

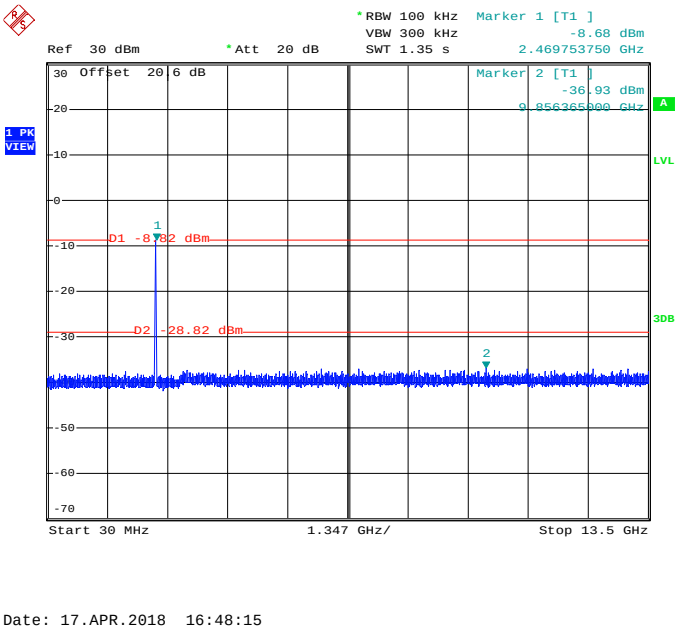


Figure 7.4.2.2-35: 30 MHz – 13.5 GHz – High Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

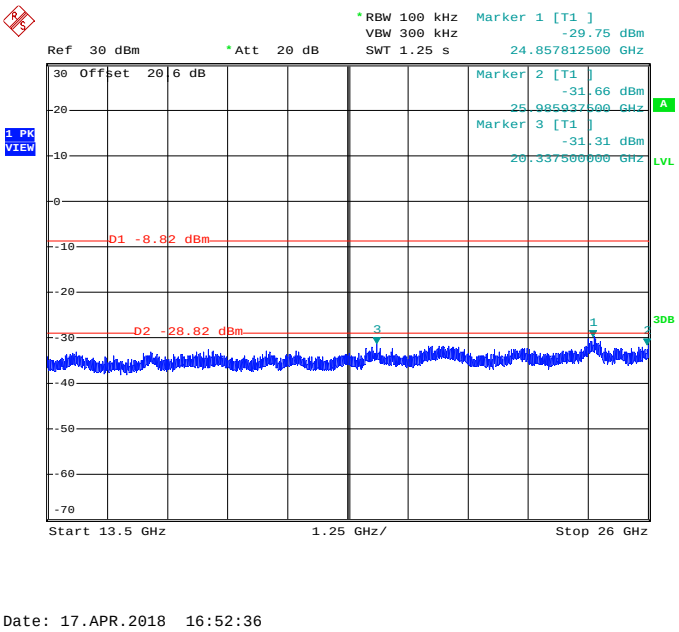


Figure 7.4.2.2-36: 13.5 GHz – 26 GHz – High Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

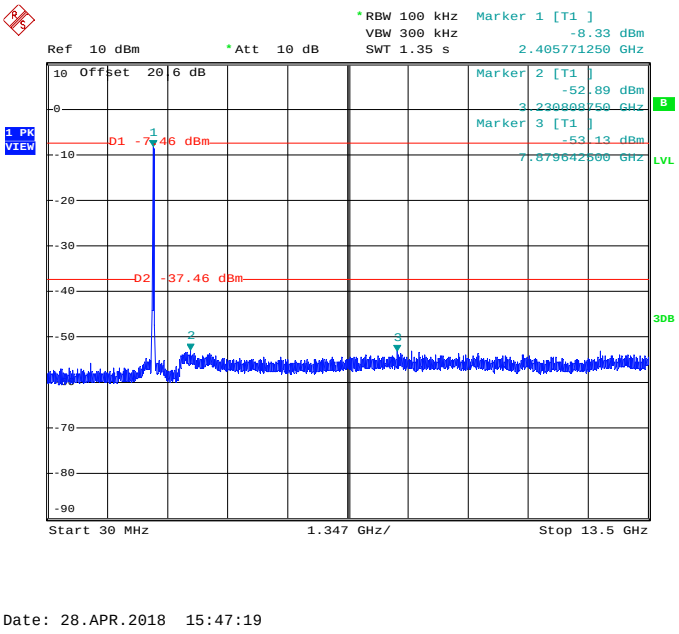


Figure 7.4.2.2-37: 30 MHz – 13.5 GHz – Low Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

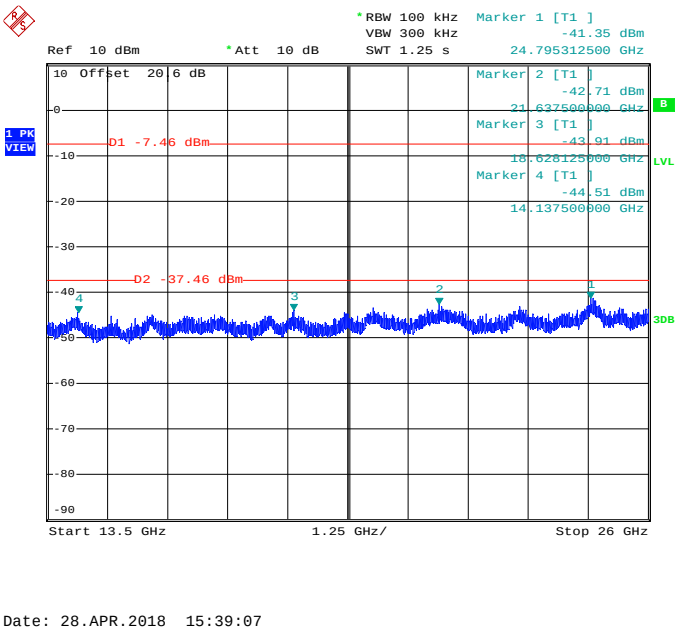


Figure 7.4.2.2-38: 13.5 GHz – 26 GHz – Low Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

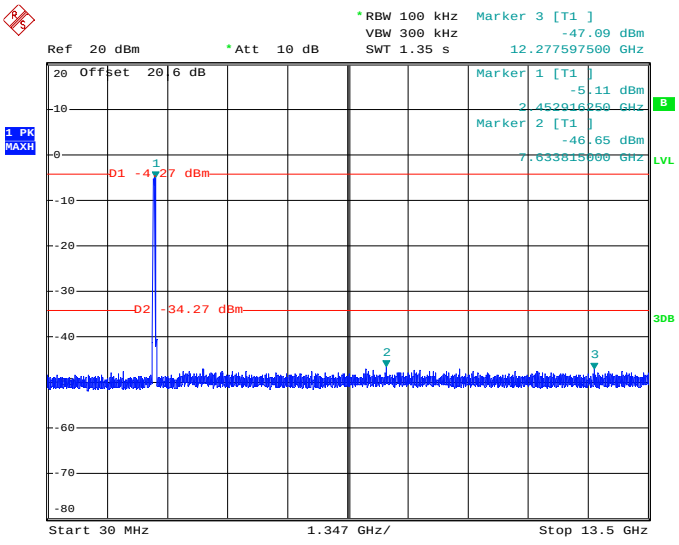


Figure 7.4.2.2-39: 30 MHz – 13.5 GHz – Middle Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

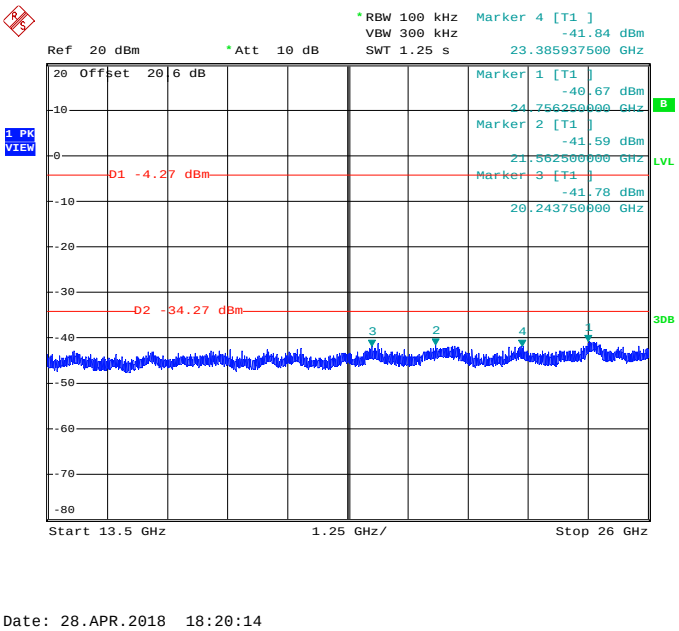


Figure 7.4.2.2-40: 13.5 GHz – 26 GHz – Middle Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

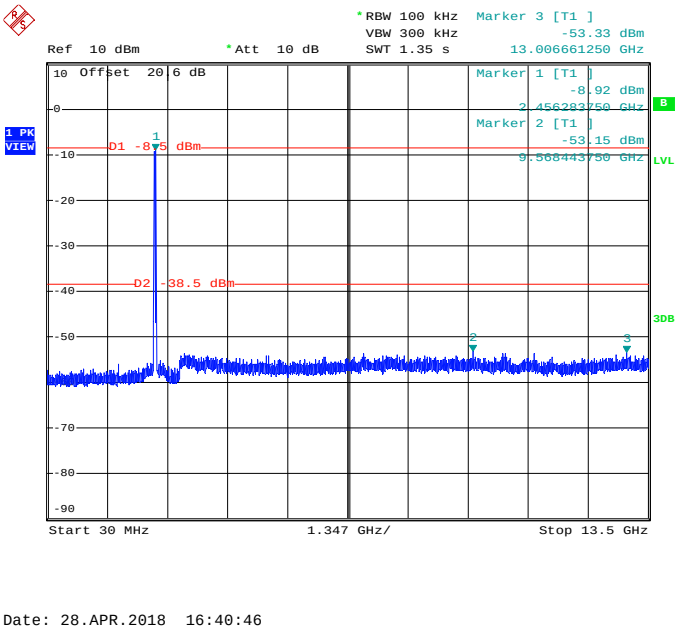


Figure 7.4.2.2-41: 30 MHz – 13.5 GHz – High Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

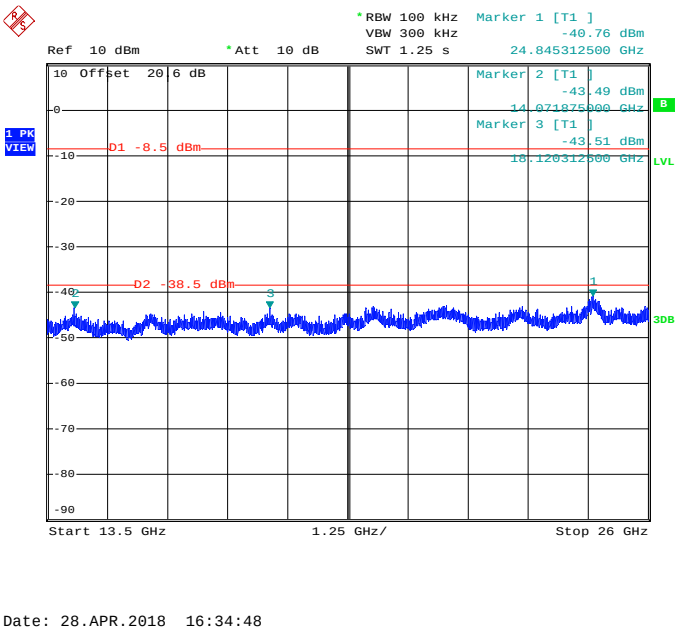


Figure 7.4.2.2-42: 13.5 GHz – 26 GHz – High Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

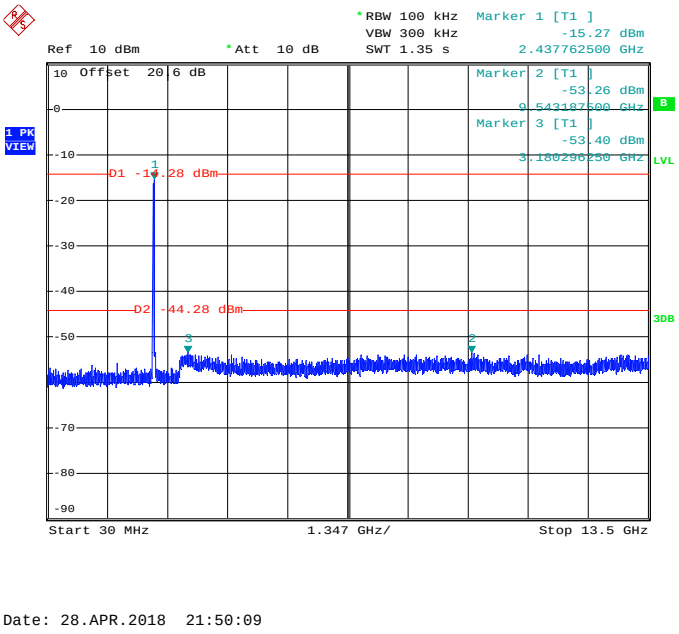


Figure 7.4.2.2-43: 30 MHz – 13.5 GHz – Low Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

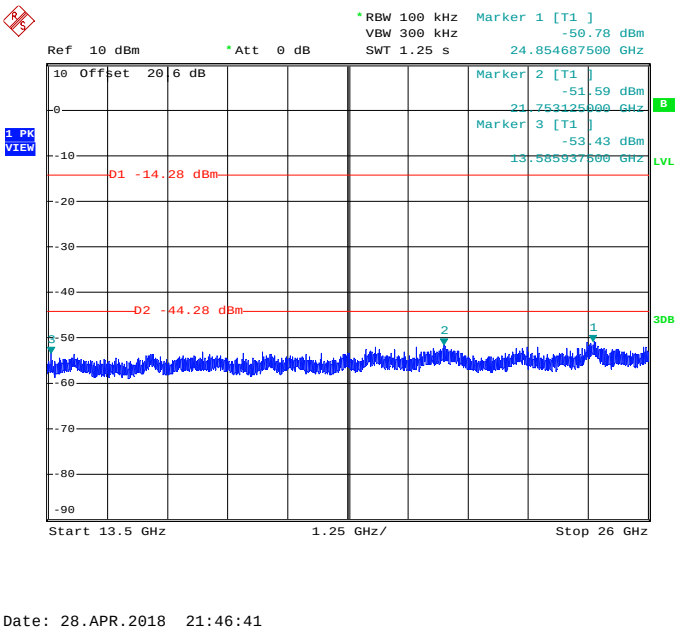


Figure 7.4.2.2-44: 13.5 GHz – 26 GHz – Low Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

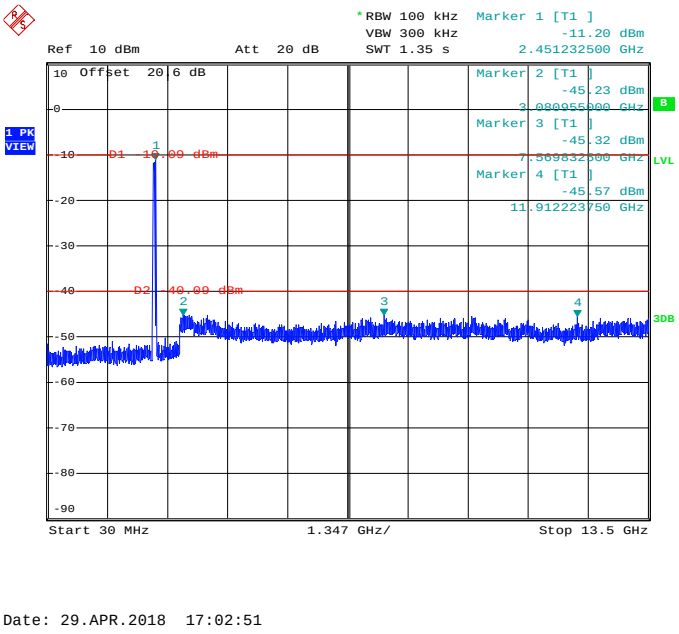


Figure 7.4.2.2-45: 30 MHz – 13.5 GHz – Middle Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

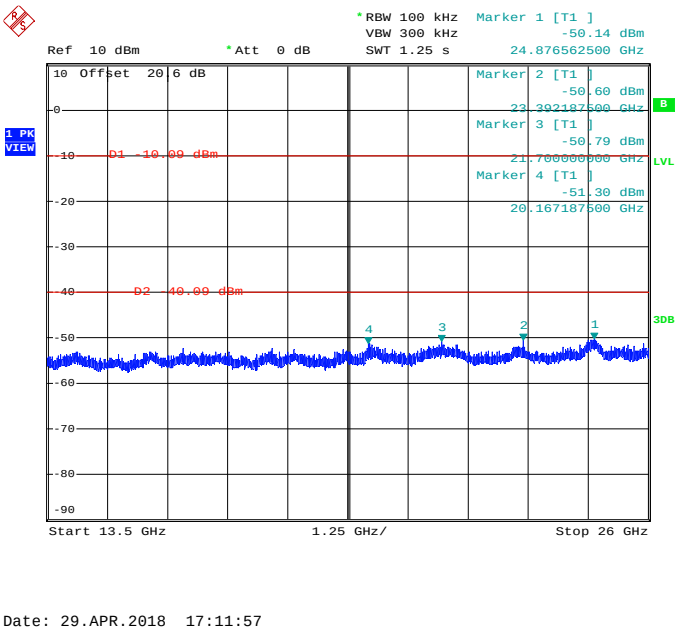
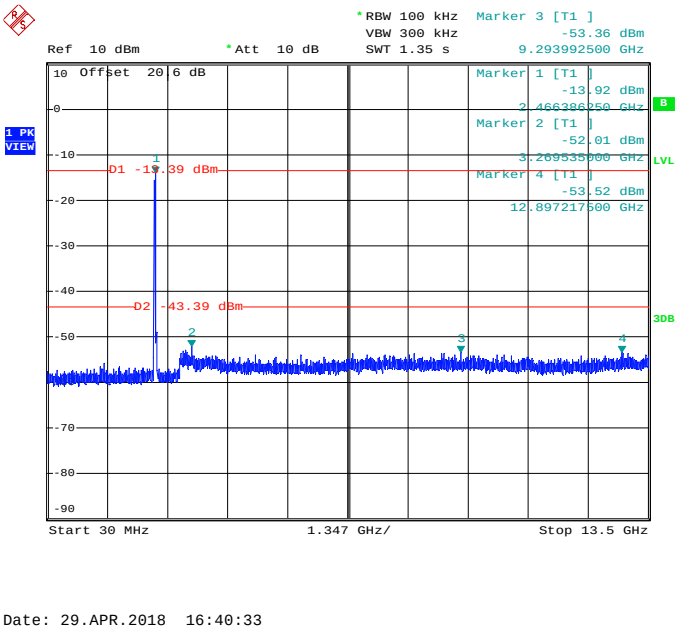
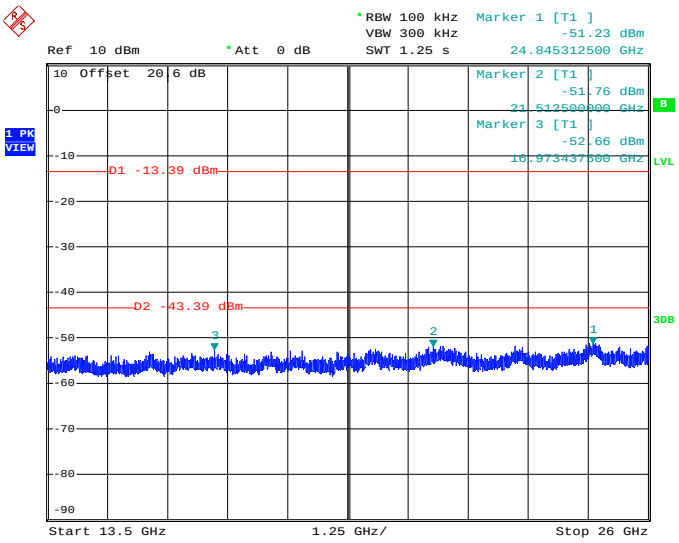


Figure 7.4.2.2-46: 13.5 GHz – 26 GHz – Middle Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)



Date: 29.APR.2018 16:40:33

Figure 7.4.2.2-47: 30 MHz – 13.5 GHz – High Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)



Date: 29.APR.2018 16:42:50

Figure 7.4.2.2-48: 13.5 GHz – 26 GHz – High Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

7.4.3 Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9, 8.10

7.4.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in Section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1 m to 4 m so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

7.4.3.2 Measurement Results

Performed by: Jean Rene

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 26 GHz are reported in the tables below.

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data – 802.11b

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2412 MHz										
2390	54.23	41.20	H	0.63	54.86	41.83	74.0	54.0	19.1	12.2
2390	52.32	39.34	V	0.63	52.95	39.97	74.0	54.0	21.1	14.0
4824	45.99	42.30	H	9.19	55.18	51.49	74.0	54.0	18.8	2.5
4824	45.72	42.13	V	9.19	54.91	51.32	74.0	54.0	19.1	2.7
Middle Channel = 2437 MHz										
4874	45.74	41.62	H	9.38	55.12	51.00	74.0	54.0	18.9	3.0
4874	44.70	40.73	V	9.38	54.08	50.11	74.0	54.0	19.9	3.9
7311	41.45	28.21	H	14.05	55.50	42.26	74.0	54.0	18.5	11.7
7311	40.63	26.04	V	14.05	54.68	40.09	74.0	54.0	19.3	13.9
High Channel = 2462 MHz										
2483.5	56.24	46.28	H	0.99	57.23	47.27	74.0	54.0	16.8	6.7
2483.5	53.67	43.18	V	0.99	54.66	44.17	74.0	54.0	19.3	9.8
4924	44.02	39.56	H	9.56	53.58	49.12	74.0	54.0	20.4	4.9
4924	42.06	35.90	V	9.56	51.62	45.46	74.0	54.0	22.4	8.5
7386	41.28	27.38	H	14.23	55.51	41.61	74.0	54.0	18.5	12.4
7386	40.38	26.22	V	14.23	54.61	40.45	74.0	54.0	19.4	13.6

Notes:
All emissions above 7.39 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.4.3.2-2: Radiated Spurious Emissions Tabulated Data – 802.11g

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2412 MHz										
2390	66.07	49.60	H	0.63	66.70	50.23	74.0	54.0	7.3	3.8
2390	64.70	47.00	V	0.63	65.33	47.63	74.0	54.0	8.7	6.4
4824	45.69	32.68	H	9.19	54.88	41.87	74.0	54.0	19.1	12.1
4824	42.76	29.71	V	9.19	51.95	38.90	74.0	54.0	22.1	15.1
Middle Channel = 2437 MHz										
4874	45.01	31.88	H	9.38	54.39	41.26	74.0	54.0	19.6	12.7
4874	41.64	28.00	V	9.38	51.02	37.38	74.0	54.0	23.0	16.6
7311	40.72	26.00	H	14.05	54.77	40.05	74.0	54.0	19.2	13.9
7311	40.98	25.70	V	14.05	55.03	39.75	74.0	54.0	19.0	14.2
High Channel = 2462 MHz										
2483.5	67.68	50.21	H	0.99	68.67	51.20	74.0	54.0	5.3	2.8
2483.5	65.79	48.66	V	0.99	66.78	49.65	74.0	54.0	7.2	4.4
4924	39.74	26.64	H	9.56	49.30	36.20	74.0	54.0	24.7	17.8
4924	39.20	25.72	V	9.56	48.76	35.28	74.0	54.0	25.2	18.7

Notes:
All emissions above 7.31 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.4.3.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2412 MHz										
2390	62.50	50.15	H	0.63	63.13	50.78	74.0	54.0	10.9	3.2
2390	58.66	44.68	V	0.63	59.29	45.31	74.0	54.0	14.7	8.7
4824	42.04	28.11	H	9.19	51.23	37.30	74.0	54.0	22.8	16.7
4824	41.01	27.19	V	9.19	50.20	36.38	74.0	54.0	23.8	17.6
Middle Channel = 2437 MHz										
4874	45.65	32.01	H	9.38	55.03	41.39	74.0	54.0	19.0	12.6
4874	42.40	27.69	V	9.38	51.78	37.07	74.0	54.0	22.2	16.9
7311	40.48	25.88	H	14.05	54.53	39.93	74.0	54.0	19.5	14.1
7311	40.59	25.82	V	14.05	54.64	39.87	74.0	54.0	19.4	14.1
High Channel = 2462 MHz										
2483.5	65.18	50.74	H	0.99	66.17	51.73	74.0	54.0	7.8	2.3
2483.5	58.48	44.12	V	0.99	59.47	45.11	74.0	54.0	14.5	8.9
4924	38.72	25.13	H	9.56	48.28	34.69	74.0	54.0	25.7	19.3
4924	38.05	24.65	V	9.56	47.61	34.21	74.0	54.0	26.4	19.8

Notes:
All emissions above 7.31 GHz were attenuated below the limits and the noise floor of the measurement equipment.

Table 7.4.3.2-4: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel = 2422 MHz										
2390	63.41	48.20	H	0.63	64.04	48.83	74.0	54.0	10.0	5.2
2390	57.81	42.46	V	0.63	58.44	43.09	74.0	54.0	15.6	10.9
4844	39.80	26.14	H	9.26	49.06	35.40	74.0	54.0	24.9	18.6
4844	38.76	25.70	V	9.26	48.02	34.96	74.0	54.0	26.0	19.0
Middle Channel = 2437 MHz										
4874	41.56	27.67	H	9.38	50.94	37.05	74.0	54.0	23.1	17.0
4874	40.71	26.26	V	9.38	50.09	35.64	74.0	54.0	23.9	18.4
High Channel = 2452 MHz										
2483.5	64.02	50.58	H	0.99	65.01	51.57	74.0	54.0	9.0	2.4
2483.5	58.72	42.88	V	0.99	59.71	43.87	74.0	54.0	14.3	10.1
4904	38.59	24.76	H	9.49	48.08	34.25	74.0	54.0	25.9	19.8

Notes:

All emissions above 4.904 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.4.4 Sample Calculation

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 54.23+ 0.63 = 54.86 dBµV/m
Margin: 74 dBµV/m – 54.86 dBµV/m = 19.14 dB

Example Calculation: Average
Corrected Level: 41.2 + 0.63 = 41.83 dBµV/m
Margin: 54 dBµV/m – 41.83 dBµV/m = 12.17dB

7.5 Power Spectral Density – FCC: Section 15.247(e); ISED Canada: RSS-247 5.2(b)

7.5.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v04 Section 10.2 Method PKPSD (peak PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 1.5 times the DTS bandwidth and the sweep time was set to auto.

7.5.2 Measurement Results

Performed by: Thierry Jean-Charles

Results are shown below.

Table 7.5.2-1: Power Spectral Density – 802.11b (MCS10)

Frequency (MHz)	Antenna Port 1 PSD (dBm)	Antenna Port 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-10.09	-18.77	-9.54	8	17.54
2437	-7.19	-13.54	-6.28	8	14.28
2462	-7.21	-13.16	-6.23	8	14.23

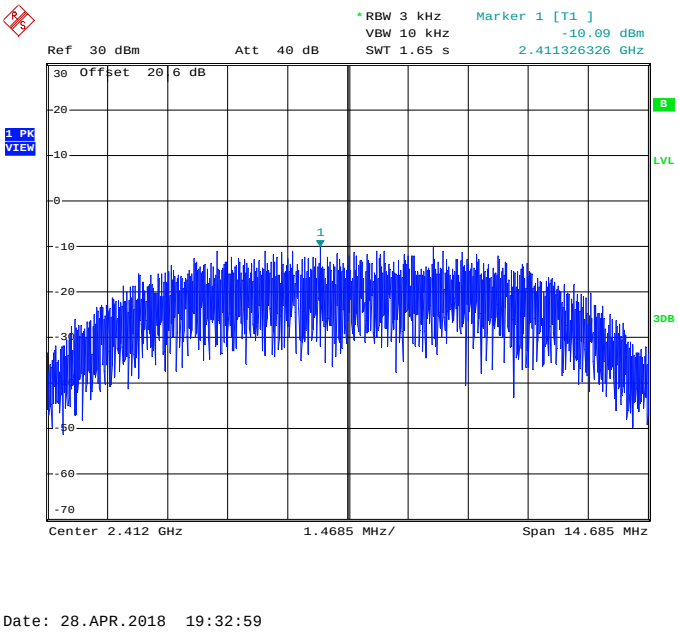


Figure 7.5.2-1: Power Spectral Density - Low Channel – 802.11b – Antenna Port 1 (MCS10)

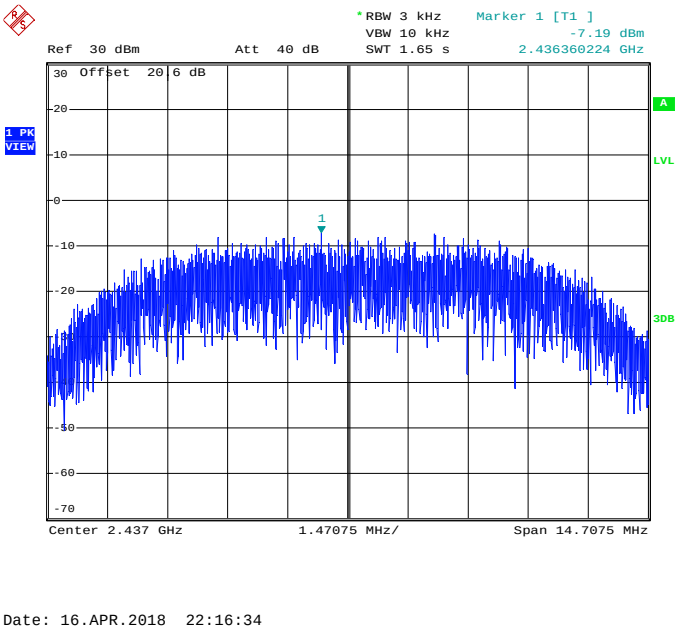


Figure 7.5.2-2: Power Spectral Density - Middle Channel – 802.11b – Antenna Port 1 (MCS10)

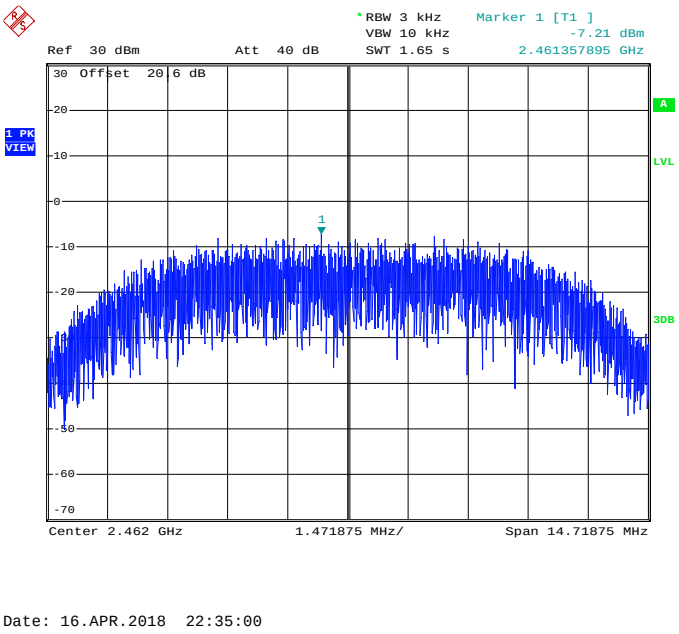


Figure 7.5.2-3: Power Spectral Density – High Channel – 802.11b – Antenna Port 1 (MCS10)

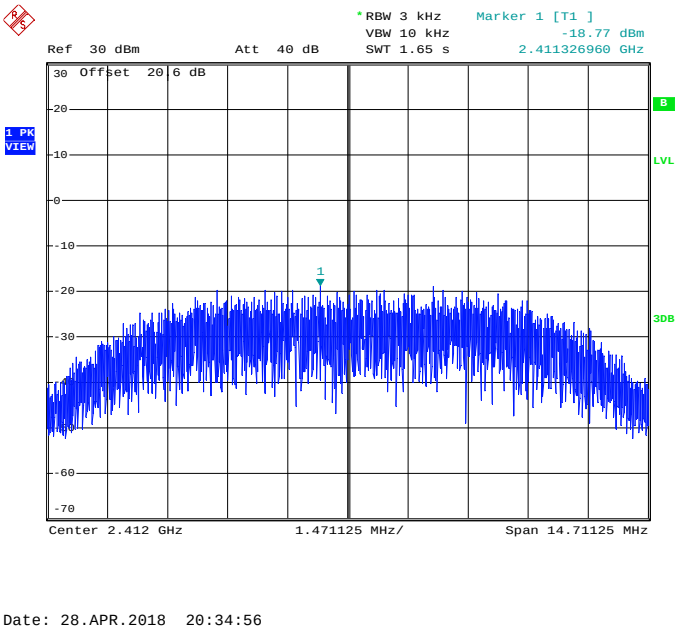


Figure 7.5.2-4: Power Spectral Density - Low Channel – 802.11b – Antenna Port 2 (MCS10)

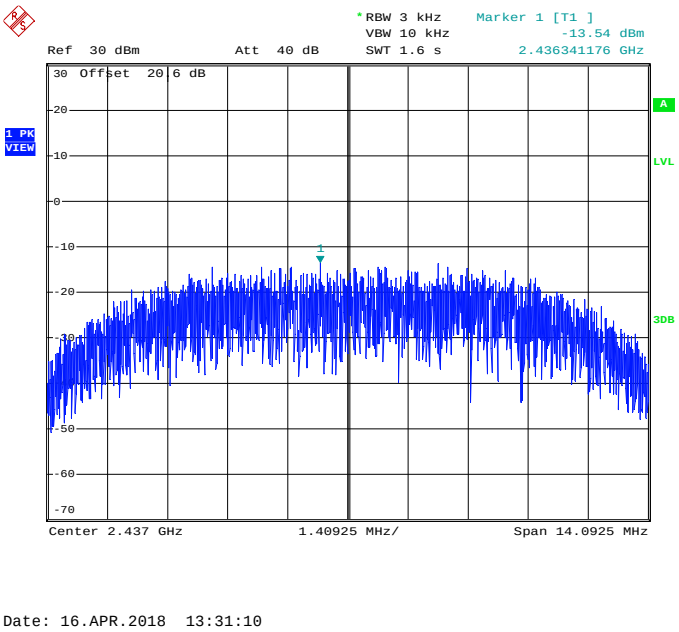


Figure 7.5.2-5: Power Spectral Density - Middle Channel – 802.11b – Antenna Port 2 (MCS10)

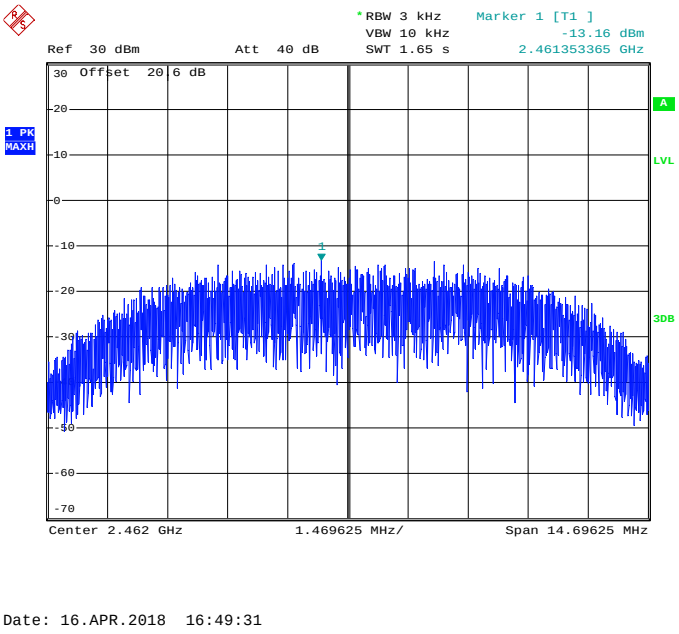


Figure 7.5.2-6: Power Spectral Density – High Channel – 802.11b – Antenna Port 2 (MCS10)

Table 7.5.2-2: Power Spectral Density – 802.11g (MCS4)

Frequency (MHz)	Antenna Port 1 PSD (dBm)	Antenna Port 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-12.73	-20.61	-12.07	8	20.07
2437	-11.27	-18.29	-10.48	8	18.48
2462	-14.81	-20.96	-13.87	8	21.87

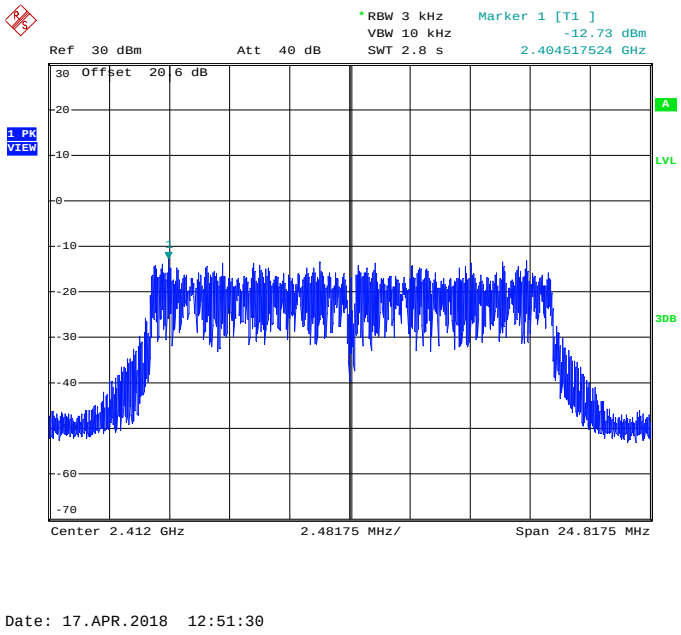


Figure 7.5.2-7: Power Spectral Density - Low Channel – 802.11g – Antenna Port 1 (MCS4)

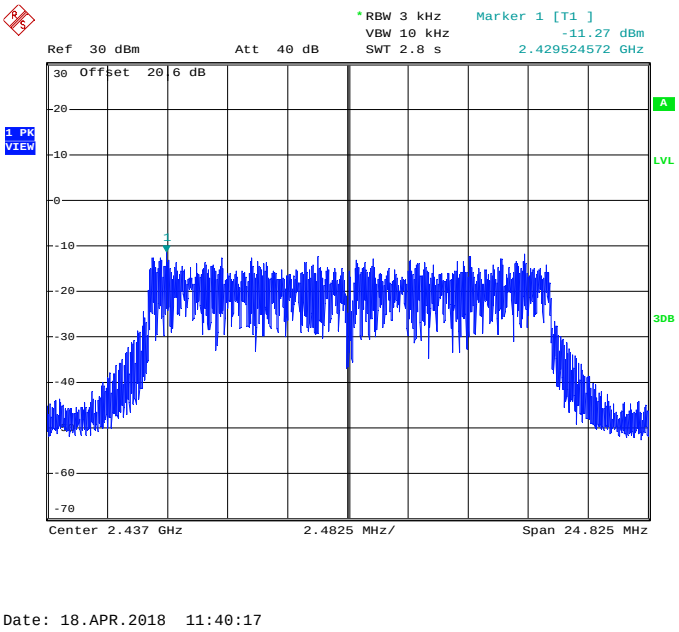


Figure 7.5.2-8: Power Spectral Density - Middle Channel – 802.11g – Antenna Port 1 (MCS4)

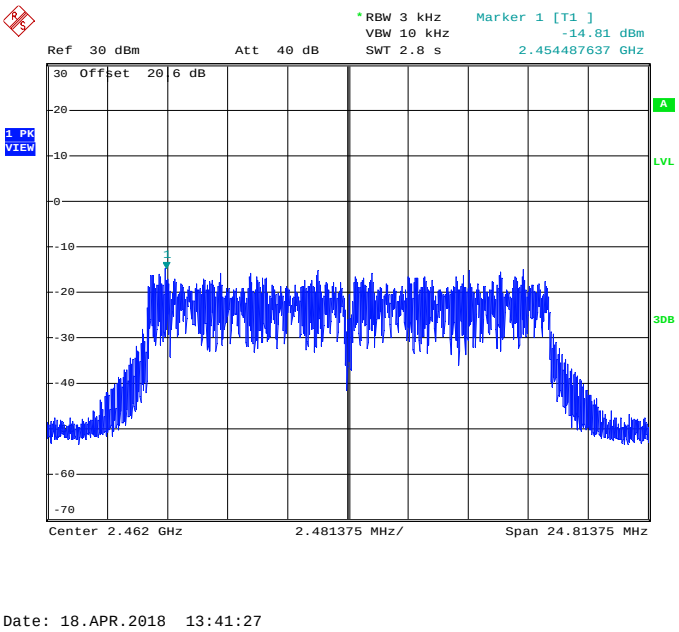


Figure 7.5.2-9: Power Spectral Density – High Channel – 802.11g – Antenna Port 1 (MCS4)

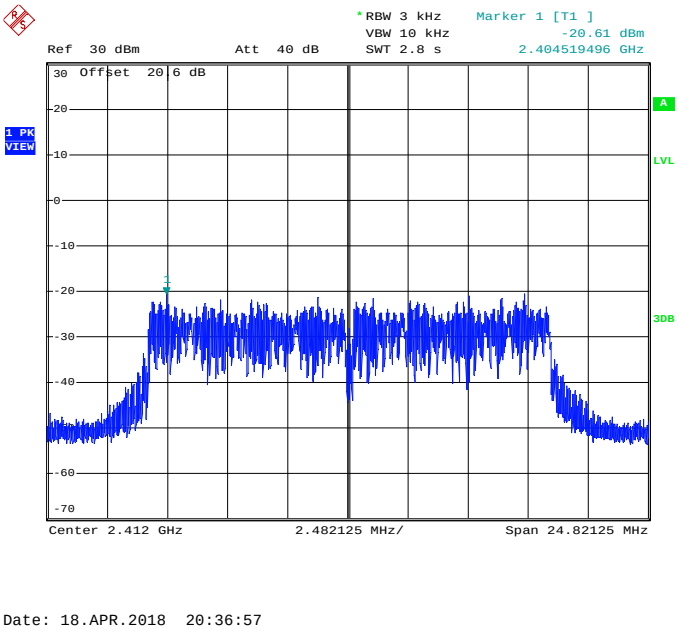


Figure 7.5.2-10: Power Spectral Density - Low Channel – 802.11g – Antenna Port 2 (MCS4)

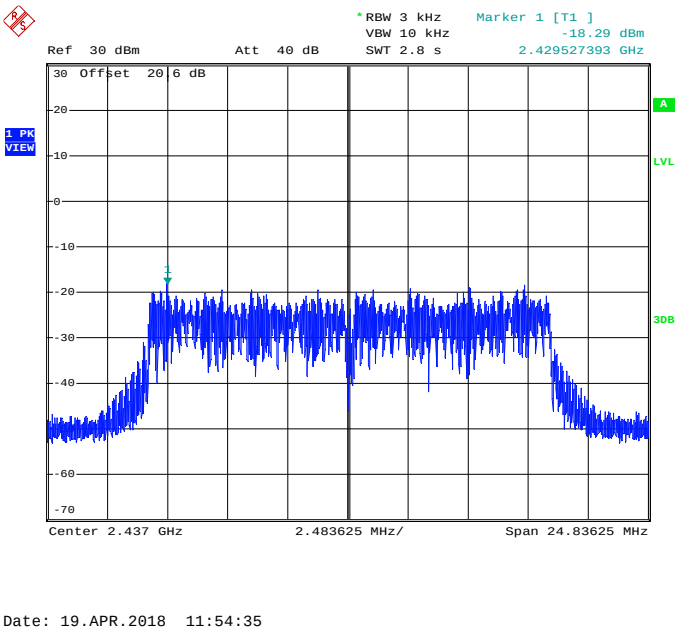


Figure 7.5.2-11: Power Spectral Density - Middle Channel – 802.11g – Antenna Port 2 (MCS4)

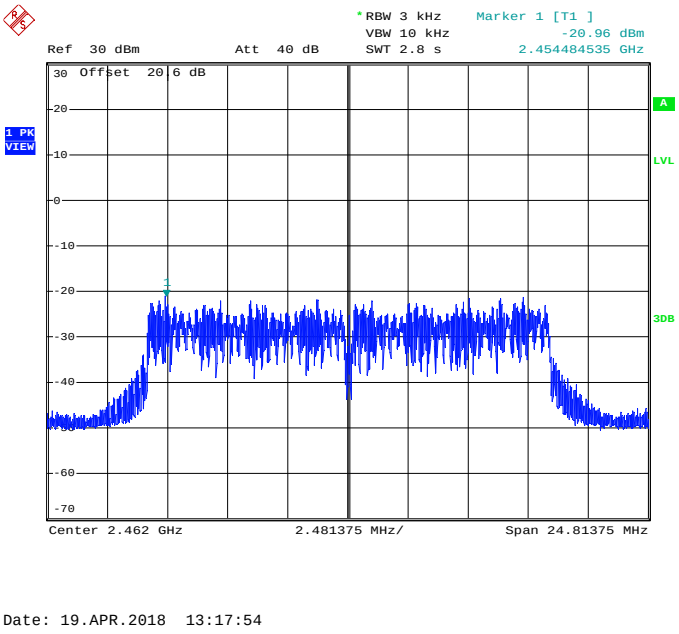


Figure 7.5.2-12: Power Spectral Density – High Channel – 802.11g – Antenna Port 2 (MCS4)

Table 7.5.2-3: Power Spectral Density – 802.11n 20 MHz (MCS10)

Frequency (MHz)	Antenna Port 1 PSD (dBm)	Antenna Port 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-14.74	-22.88	-14.12	8	22.12
2437	-11.34	-18.76	-10.62	8	18.62
2462	-15.96	-22.29	-15.05	8	23.05

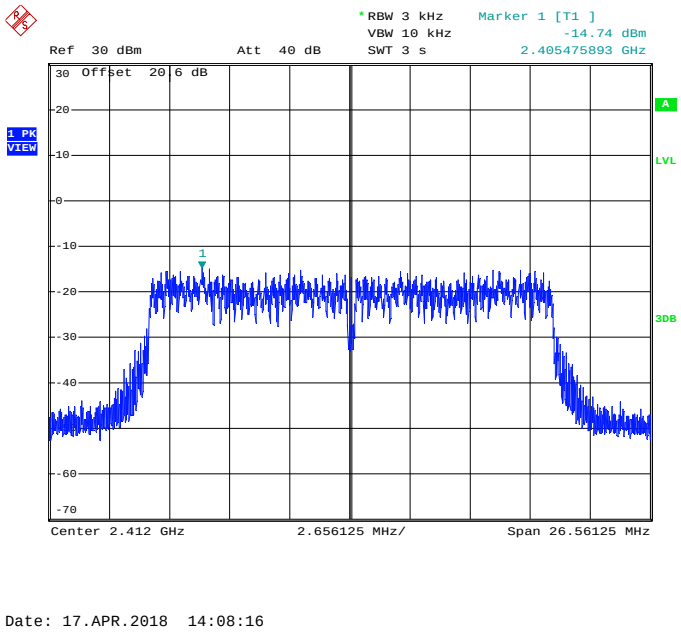


Figure 7.5.2-13: Power Spectral Density - Low Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

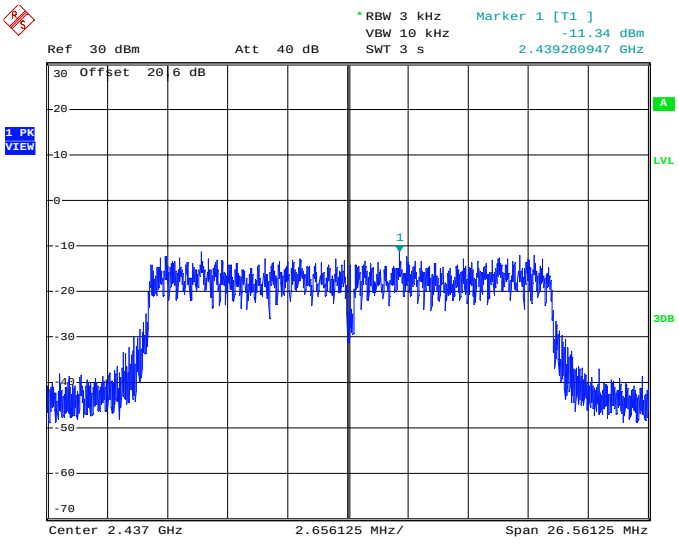


Figure 7.5.2-14: Power Spectral Density - Middle Channel – 802.11n 20 MHz – Antenna Port 1 (MCS10)

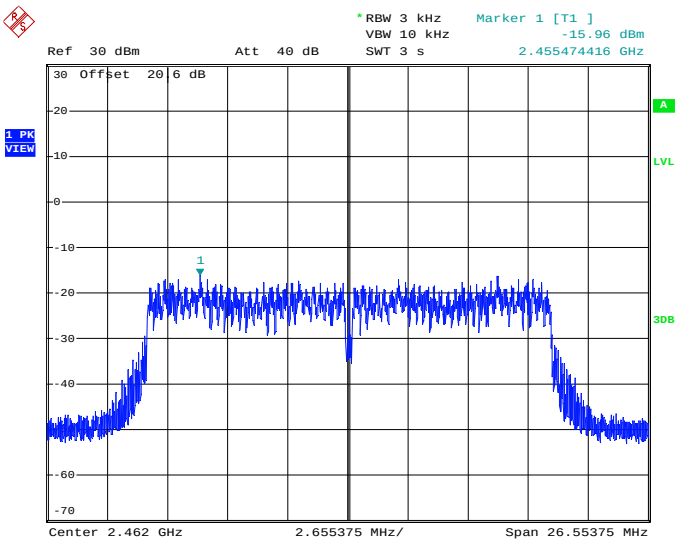


Figure 7.5.2-15: Power Spectral Density – High Channel – 802.11n 20 MHz– Antenna Port 1 (MCS10)

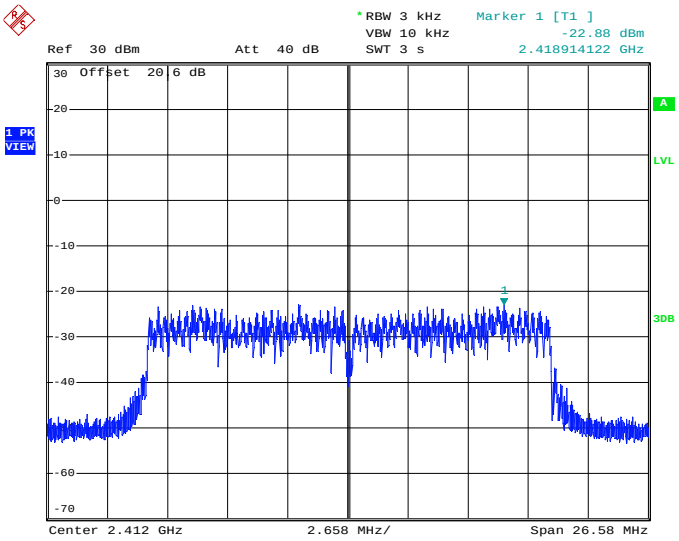


Figure 7.5.2-16: Power Spectral Density - Low Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

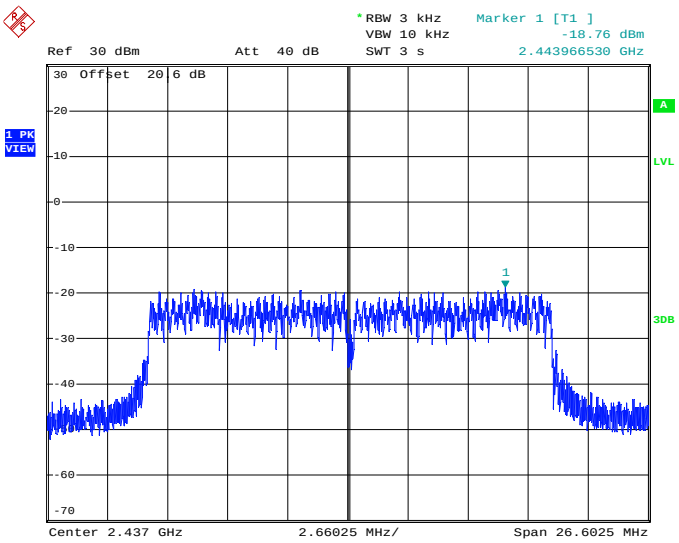


Figure 7.5.2-17: Power Spectral Density - Middle Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

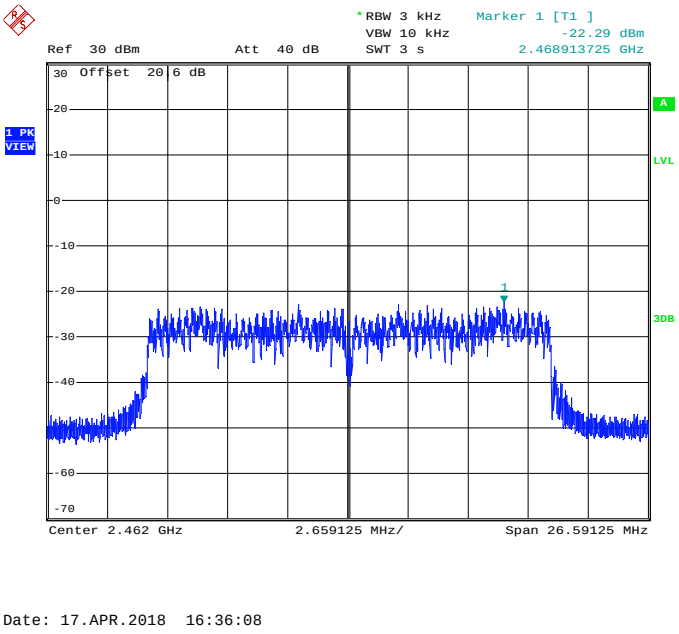


Figure 7.5.2-18: Power Spectral Density – High Channel – 802.11n 20 MHz – Antenna Port 2 (MCS10)

Table 7.5.2-3: Power Spectral Density – 802.11n 40 MHz (MCS8)

Frequency (MHz)	Antenna Port 1 PSD (dBm)	Antenna Port 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
2422	-18.72	-28.40	-18.28	8	26.28
2437	-15.47	-24.08	-14.91	8	22.91
2452	-19.47	-27.73	-18.87	8	26.87

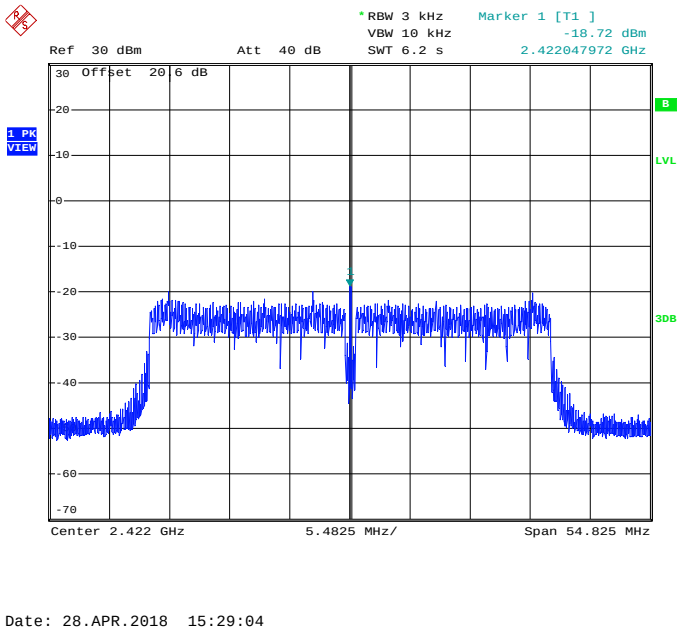


Figure 7.5.2-19: Power Spectral Density - Low Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

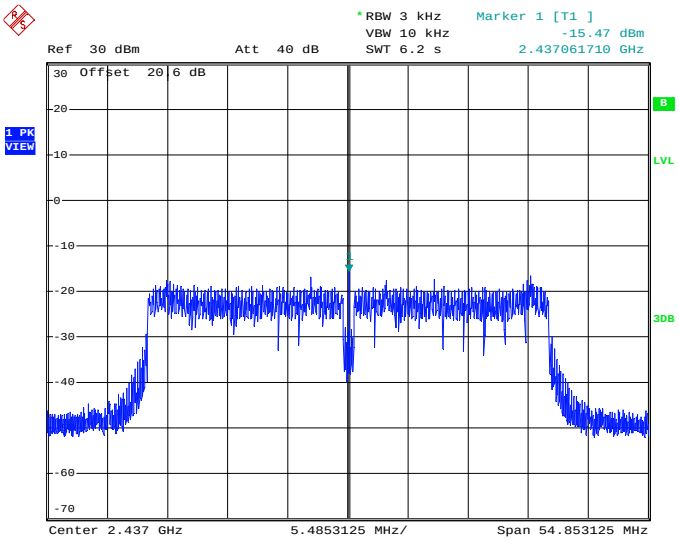


Figure 7.5.2-20: Power Spectral Density - Middle Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

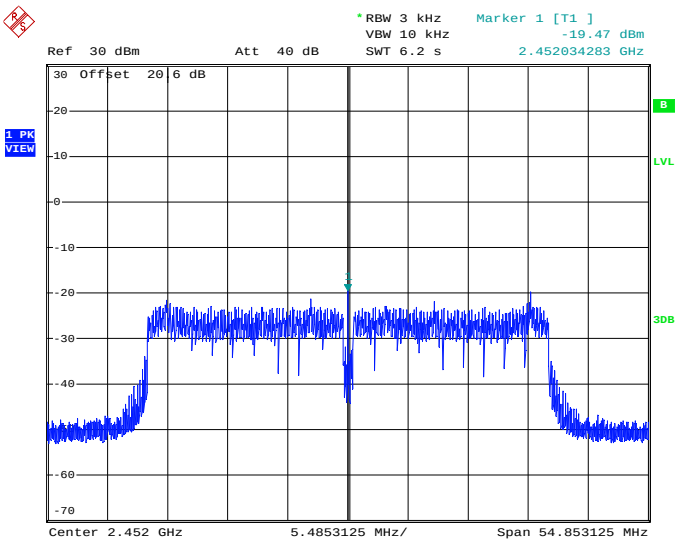


Figure 7.5.2-21: Power Spectral Density – High Channel – 802.11n 40 MHz – Antenna Port 1 (MCS8)

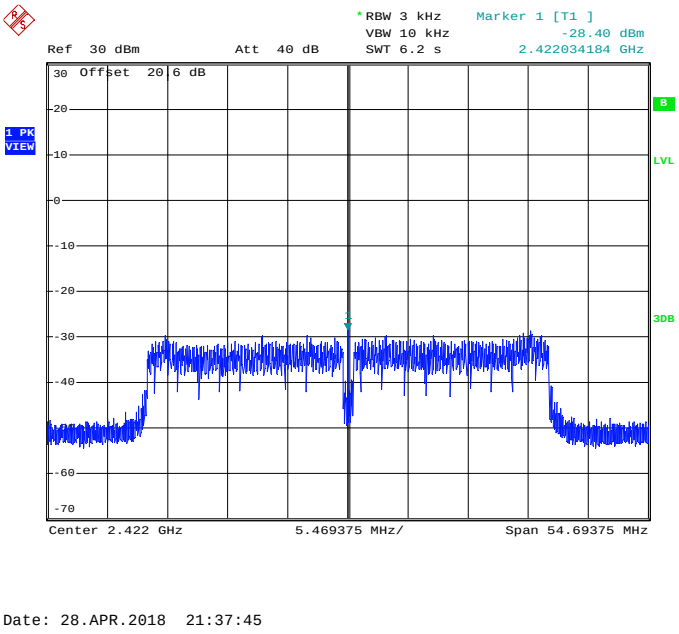


Figure 7.5.2-22: Power Spectral Density - Low Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

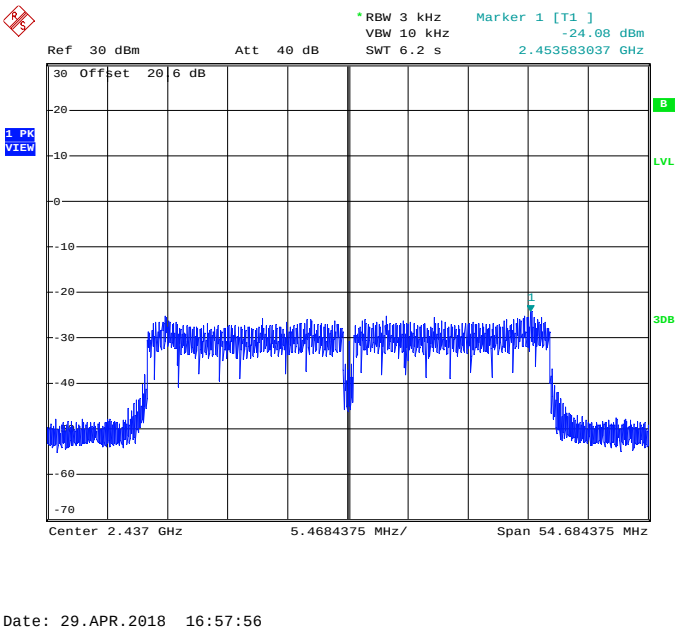


Figure 7.5.2-23: Power Spectral Density - Middle Channel – 802.11n 40 MHz– Antenna Port 2 (MCS8)

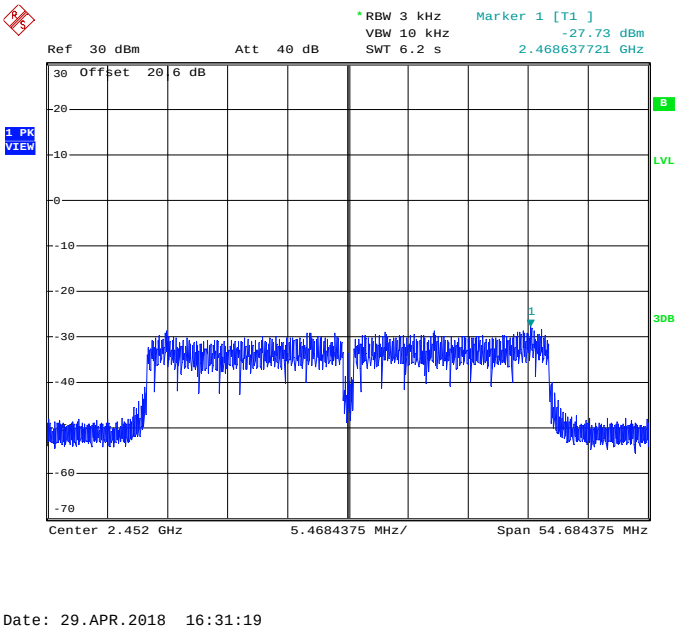


Figure 7.5.2-24: Power Spectral Density – High Channel – 802.11n 40 MHz – Antenna Port 2 (MCS8)

7.6 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.6.1 Measurement Procedure

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.6.2 Measurement Results

Performed by: Thierry Jean-Charles

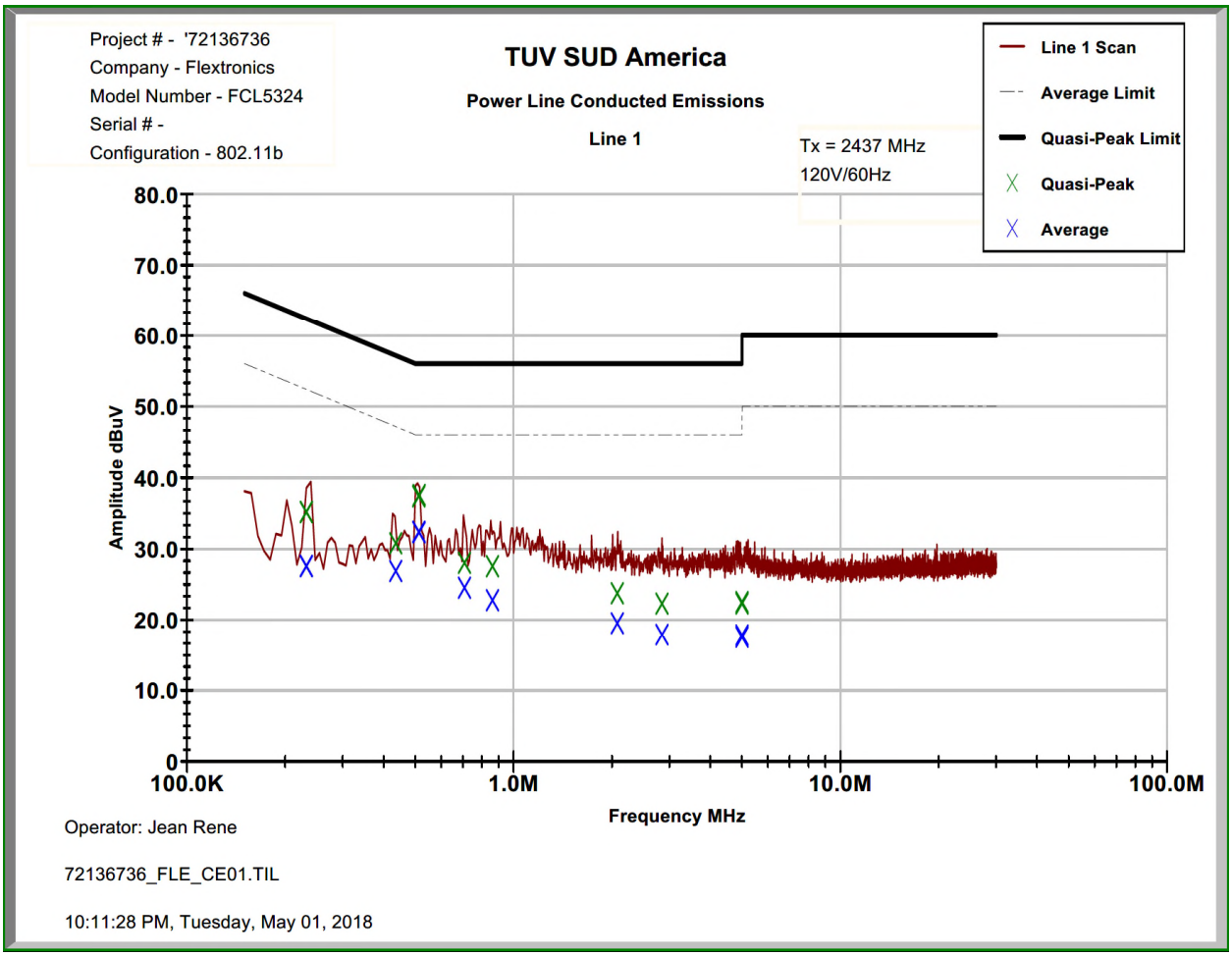


Figure 7.6.2-1: Conducted Emissions Results – Line 1

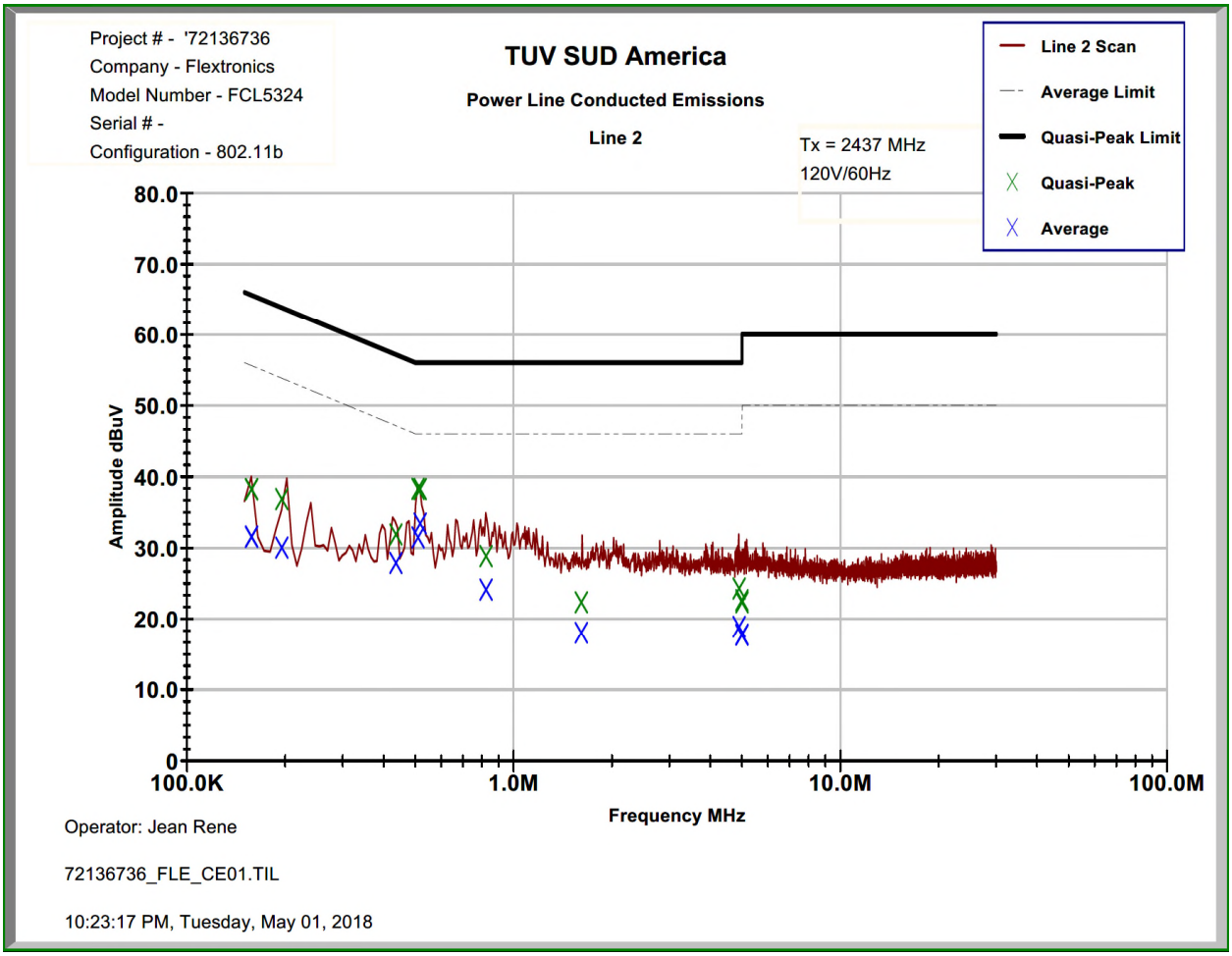


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Plot Number: _____
Power Supply Description: N/A

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.23215	25.146	17.568	10.01	35.16	27.58	62.37	52.37	27.2	24.8
0.435613	20.744	16.858	10.04	30.78	26.90	57.14	47.14	26.4	20.2
0.5127	27.332	22.345	10.03	37.36	32.38	56.00	46.00	18.6	13.6
0.514	27.5	22.296	10.03	37.53	32.33	56.00	46.00	18.5	13.7
0.707325	17.957	14.467	10.06	28.02	24.53	56.00	46.00	28.0	21.5
0.861225	17.478	12.691	10.06	27.54	22.76	56.00	46.00	28.5	23.2
2.07564	13.551	9.306	10.20	23.75	19.51	56.00	46.00	32.3	26.5
2.84531	11.998	7.596	10.20	22.20	17.80	56.00	46.00	33.8	28.2
4.99755	11.823	7.321	10.41	22.23	17.73	56.00	46.00	33.8	28.3
4.99905	12.022	7.035	10.41	22.43	17.44	56.00	46.00	33.6	28.6
Line 2									
0.15773	28.174	21.496	10.06	38.24	31.56	65.58	55.58	27.3	24.0
0.195138	26.768	19.954	10.06	36.83	30.02	63.81	53.81	27.0	23.8
0.436063	21.789	17.79	10.08	31.87	27.87	57.14	47.14	25.3	19.3
0.5098	28.199	21.369	10.08	38.28	31.45	56.00	46.00	17.7	14.6
0.5176	28.17	23.313	10.08	38.25	33.39	56.00	46.00	17.7	12.6
0.822874	18.724	13.999	10.11	28.84	24.11	56.00	46.00	27.2	21.9
1.61101	12.139	7.822	10.13	22.27	17.95	56.00	46.00	33.7	28.0
4.90069	13.784	8.375	10.42	24.20	18.79	56.00	46.00	31.8	27.2
4.99535	12.125	7.19	10.42	22.54	17.61	56.00	46.00	33.5	28.4
4.99825	11.838	7.266	10.42	22.26	17.68	56.00	46.00	33.7	28.3

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Measurement Uncertainties

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 1.15 dB
Power Spectral Density	± 1.15 dB
Antenna Port Conducted Emissions	± 1.15 dB
Radiated Emissions ≤ 1GHz	± 5.86 dB
Radiated Emissions > 1GHz	± 4.65 dB
Temperature	± 0.860 °C
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	±3.72 dB

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model FCL5324, manufactured by Flextronics America LLC, meets the requirements of FCC Part 15.247 and Industry Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT