



# TEST REPORT

**Test Report No. :** UL-RPT-RP12505086JD09C

**Customer** : Apple Inc.  
**Model No.** : A2116  
**FCC ID** : BCGA2116  
**Technology** : WLAN  
**Test Standard(s)** : FCC Parts 15.209(a) & 15.247

**Test Laboratory** : UL VS LTD, Basingstoke, Hampshire, RG24 8AH, United Kingdom

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

**Date of Issue:** 18 January 2019

**Checked by:**

Ian Watch  
Senior Test Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams  
Senior Test Engineer, Radio Laboratory  
UL VS LTD

---

**UL VS LTD**

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK  
Telephone: +44 (0)1256 312000  
Facsimile: +44 (0)1256 312001

**Customer Information**

<b>Company Name:</b>	Apple Inc.
<b>Address:</b>	One Apple Park Way Cupertino, California 95014 U.S.A.
<b>Contact Name:</b>	Stuart Thomas

**Report Revision History**

<b>Version Number</b>	<b>Issue Date</b>	<b>Revision Details</b>	<b>Revised By</b>
1.0	18/01/2019	Initial Version	Ian Watch

## **Table of Contents**

<b>Customer Information</b> .....	<b>2</b>
<b>Report Revision History</b> .....	<b>2</b>
<b>Table of Contents</b> .....	<b>3</b>
<b>1. Attestation of Test Results</b> .....	<b>4</b>
1.1. Description of EUT	4
1.2. General Information	4
1.3. Summary of Test Results	4
1.4. Deviations from the Test Specification	4
<b>2. Summary of Testing</b> .....	<b>5</b>
2.1. Facilities and Accreditation	5
2.2. Methods and Procedures	5
2.3. Calibration and Uncertainty	6
2.4. Test and Measurement Equipment	7
<b>3. Equipment Under Test (EUT)</b> .....	<b>9</b>
3.1. Identification of Equipment Under Test (EUT)	9
3.2. Modifications Incorporated in the EUT	9
3.3. Additional Information Related to Testing	10
3.4. Description of Available Antennas	10
3.5. Description of Test Setup	11
<b>4. Antenna Port Test Results</b> .....	<b>16</b>
4.1. Transmitter Minimum 6 dB Bandwidth	16
4.2. Transmitter Power Spectral Density	26
4.3. Transmitter Maximum (Average) Output Power	36
<b>5. Radiated Test Results</b> .....	<b>46</b>
5.1. Transmitter Radiated Emissions <1 GHz	46
5.2. Transmitter Radiated Emissions >1 GHz	48
5.3. Transmitter Band Edge Radiated Emissions	51

## **1. Attestation of Test Results**

### **1.1. Description of EUT**

The equipment under test was a desktop computer with WLAN and BT radios.

### **1.2. General Information**

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
<b>Site Registration:</b>	621311
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	22 October 2018 to 29 November 2018

### **1.3. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	Complied
Part 15.247(e)	Transmitter Power Spectral Density	Complied
Part 15.247(b)(3)	Transmitter Maximum (Average) Output Power	Complied
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	Complied
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	Complied

#### **Note(s):**

- For the data rates declared as worst case and reported in this test report, duty cycle was measured to be greater than 98%. Plots for these measurements are archived on the UL VS LTD IT server and available for inspection upon request.
- There are two vendors of the WiFi/*Bluetooth* radio modules, Vendor 1 and Vendor 2.

The WiFi/*Bluetooth* radio modules have the same mechanical outline (i.e. the same packaging dimension and pin layout), use the same on-board antenna matching circuit, have an identical antenna structure and are built and tested to conform to the same specification and to operate within the same tolerances.

Baseline testing was performed on the two vendors to determine the worst case.

### **1.4. Deviations from the Test Specification**

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

## **2. Summary of Testing**

### **2.1. Facilities and Accreditation**

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	X

UL VS LTD is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

### **2.2. Methods and Procedures**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018
<b>Title:</b>	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules

## **2.3. Calibration and Uncertainty**

### **Measuring Instrument Calibration**

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

### **Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Conducted Maximum Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±4.65 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## 2.4. Test and Measurement Equipment

### Test Equipment Used for Transmitter Conducted Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2042	Thermohygrometer	Testo	608-H1	458046425	26 Feb 2019	12
A3027	Attenuator	Broadwave Technologies	351-311-006	#1	Calibrated before use	-
A3028	Attenuator	Broadwave Technologies	351-311-006	#2	Calibrated before use	-
A3029	Attenuator	Broadwave Technologies	351-311-006	#3	Calibrated before use	-
A3004	RF Switch	Pickering Interfaces	64-102-002	XZ363230	Calibrated before use	-
M2033	Signal Analyser	Rohde & Schwarz	FSV13	101667	31 May 2019	12
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36
A3005	Replay Test Rack	N/A	N/A	N/A	Calibration not required	-

### Test Measurement Software/Firmware Used for Transmitter Conducted Tests

Name	Version	Release Date
UL VS LTD Replay	v.10	22 Nov 2018

### Test Equipment Used for Transmitter Radiated Emissions

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	27 Feb 2019	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	20 Feb 2019	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	10 Aug 2019	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	19 Feb 2019	12
A490	Antenna	Chase	CBL6111A	1590	03 Apr 2019	12
A2148	Attenuator	AtlanTecRF	AN18-06	090202-06	03 Apr 2019	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	21 Feb 2019	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	22 Feb 2019	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	19 Feb 2019	12
A2891	Pre-Amplifier	Schwarzbeck	BBV 9718	9718-306	20 Feb 2019	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	22 Feb 2019	12
A2131	Low Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	22 Feb 2019	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	21 Feb 2019	12
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	26 Apr 2019	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	19 Feb 2019	12

**Test and Measurement Equipment (continued)****Test Equipment Used for Transmitter Band Edge Radiated Emissions**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M2040	Thermohygrometer	JM Handelspunkt	608-H1	45124934	27 Mar 2019	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
A3155	Pre Amplifier	Com-Power	PAM-118A	18040037	14 Sep 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3138	Antenna	Schwarzbeck	BBHA 9120B	00702	03 Oct 2019	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	8328727#1	23 Feb 2019	12



### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A2116
<b>Test Sample Serial Number:</b>	C02WW00PKFMM ( <i>Radiated sample #1</i> )
<b>Hardware Version:</b>	EVT
<b>Software Version:</b>	18E110z
<b>FCC ID:</b>	BCGA2116

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A2116
<b>Test Sample Serial Number:</b>	C02X200XKFLX ( <i>Radiated sample #2</i> )
<b>Hardware Version:</b>	EVT
<b>Software Version:</b>	18E110z
<b>FCC ID:</b>	BCGA2116

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A2116
<b>Test Sample Serial Number:</b>	C02X2007KFLX ( <i>Conducted sample #1</i> )
<b>Hardware Version:</b>	EVT
<b>Software Version:</b>	18A334
<b>FCC ID:</b>	BCGA2116

#### **3.2. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

### 3.3. Additional Information Related to Testing

<b>Technology Tested:</b>	WLAN (IEEE 802.11b,g,n) / Digital Transmission System	
<b>Type of Unit:</b>	Transceiver	
<b>Modulation Type:</b>	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM	
<b>Data Rates:</b>	802.11b	1, 2, 5.5 & 11 Mbps (SISO)
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbps (SISO)
	802.11n HT20	MCS0 to MCS7 (SISO)
<b>Power Supply Requirement(s):</b>	Nominal	120 VAC 60 Hz
<b>Maximum Conducted Output Power:</b>	23.2 dBm	
<b>Channel Spacing:</b>	20 MHz	
<b>Transmit Frequency Range:</b>	2412 MHz to 2472 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	1	2412
	2	2417
	3	2422
	6	2437
	7	2442
	11	2462
	12	2467
	13	2472

### 3.4. Description of Available Antennas

The radio utilizes one integrated antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2400 - 2480	4.3

### **3.5. Description of Test Setup**

#### **Support Equipment**

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	PHF (Personal Hands Free)
<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	Apple EarPods
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB Mouse
<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1152
<b>Serial Number:</b>	CC2446203PNDNYPAJ

<b>Description:</b>	USB Keyboard
<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1243
<b>Serial Number:</b>	CC2438202G4DQW0AC

<b>Description:</b>	USB Hub
<b>Brand Name:</b>	Hama
<b>Model Name or Number:</b>	00078498
<b>Serial Number:</b>	09825891600

<b>Description:</b>	Ethernet Router
<b>Brand Name:</b>	Netgear
<b>Model Name or Number:</b>	DG834G
<b>Serial Number:</b>	1JX167B008C4A

<b>Description:</b>	Ethernet cable. Quantity 1. Length 1.0 metres
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB cables. Quantity 4. Length 3.0 metres
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

## **Operating Modes**

The EUT was tested in the following operating mode(s):

- Continuously transmitting with a modulated carrier at maximum power on the relevant channels as required using the supported data rates/modulation types.

## **Configuration and Peripherals**

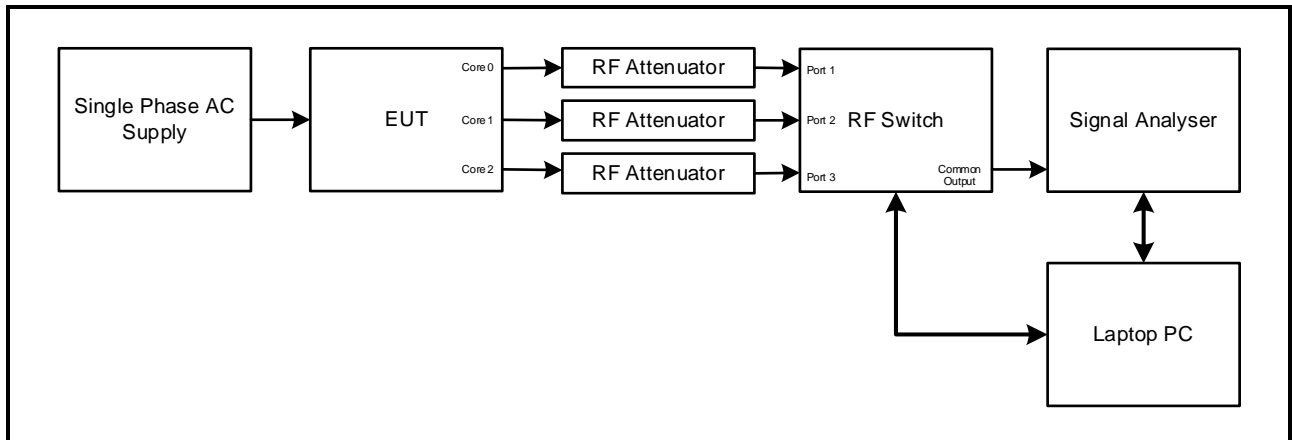
The EUT was tested in the following configuration(s):

- Controlled in test mode using a software application on the EUT supplied by the customer. The application was used to enable a continuous transmission and to select the test channels as required. The customer supplied scripts 'MAC\_WIFI.sh' to control the EUT.
- The customer declared the following data rates to be used for all measurements as:
  - 802.11b / SISO – DBPSK / 1 Mbps
  - 802.11g / SISO – BPSK / 6 Mbps
  - 802.11n HT20 / SISO – BPSK / MCS0
- The customer supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.
- Transmitter spurious emissions were performed with the EUT transmitting 802.11b / SISO - DBPSK / 1 Mbps. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest output power level, it was deemed to be the worst case.
- Transmitter radiated spurious emissions tests were performed with all active ports terminated using the appropriate termination.
- Additional testing on channels near the lower and upper band edges was requested.
- The EUT was powered from a 120 VAC 60 Hz single phase mains supply.

**Test Setup Diagrams**

**Conducted Tests:**

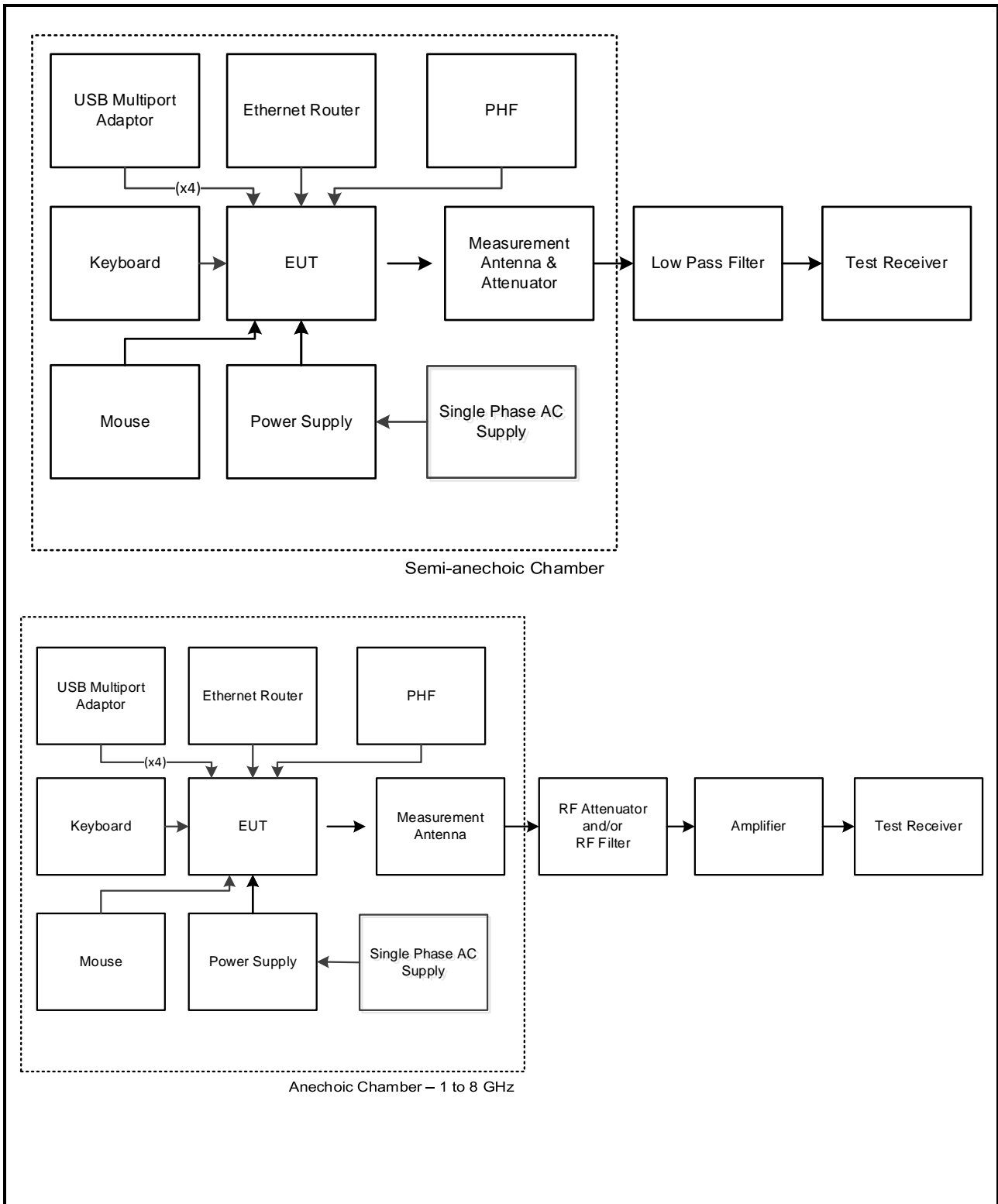
**Test Setup for Transmitter Conducted Tests**



**Test Setup Diagrams (continued)**

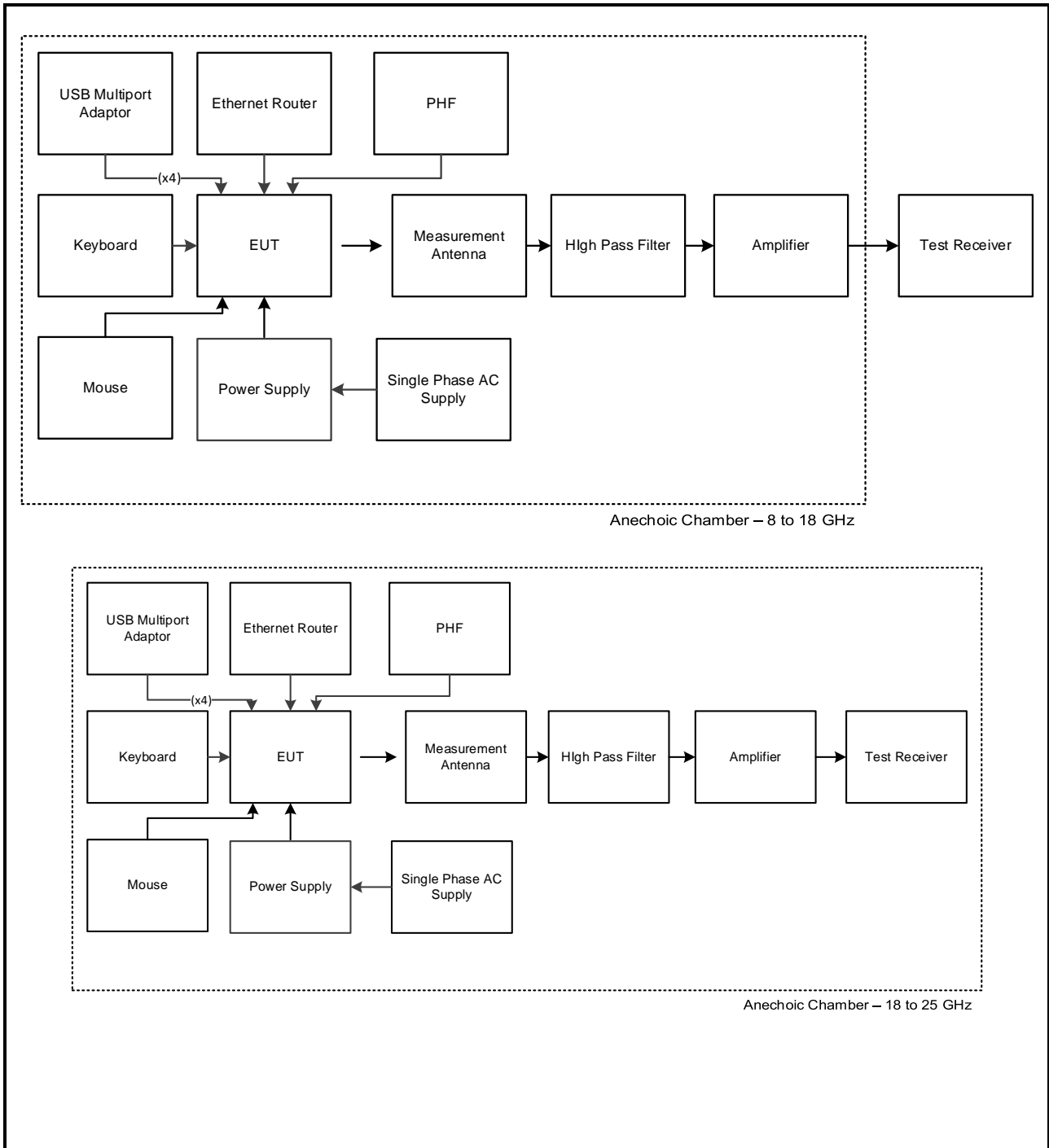
**Radiated Tests:**

**Test Setup for Transmitter Radiated Emissions**



**Test Setup Diagrams (continued)**

**Test Setup for Transmitter Radiated Emissions (continued)**



## **4. Antenna Port Test Results**

### **4.1. Transmitter Minimum 6 dB Bandwidth**

#### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	29 November 2018
<b>Test Sample Serial Number:</b>	C02X2007KFLX		

<b>FCC Reference:</b>	Part 15.247(a)(2)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Subclause 11.8.1 and Notes below

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	53

#### **Note(s):**

1. The customer requested the following configurations to be used for all measurements:
  - 802.11b – DBPSK / 1 Mbps / Core 2
  - 802.11g – BPSK / 6 Mbps / Core 2
  - 802.11n HT20 – BPSK / MCS0 / Core 2
2. Final measurements were performed using the above configurations on the relevant channels in accordance with ANSI C63.10 Subclause 11.8.1 measurement procedure. Additional channels were tested as requested by the customer. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 40 MHz. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
3. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF offset was entered on the signal analyser to compensate for the loss of the switch, attenuator and RF cables.

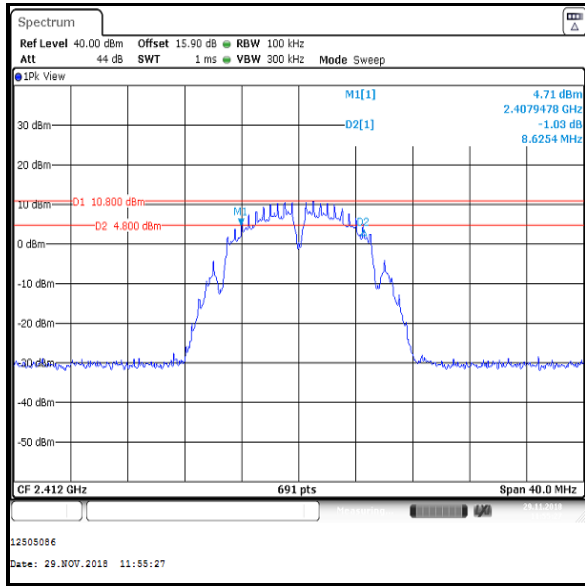


**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**

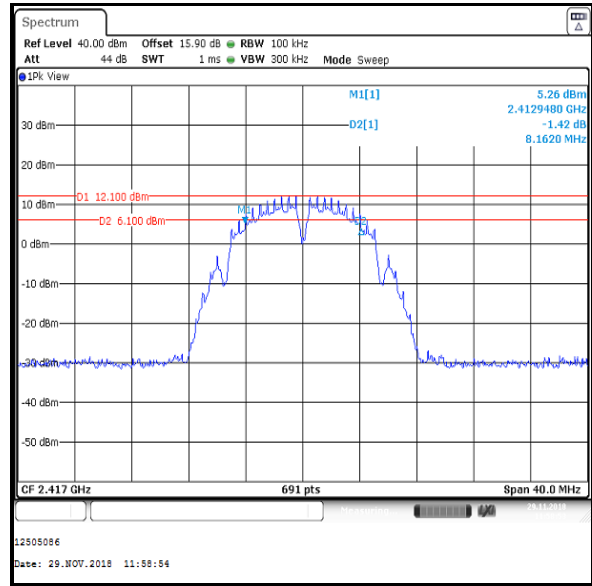
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	8625	≥500	8125	Complied
2	8162	≥500	7662	Complied
3	8220	≥500	7720	Complied
6	9146	≥500	8646	Complied
7	9088	≥500	8588	Complied
11	8683	≥500	8183	Complied
12	8625	≥500	8125	Complied
13	8683	≥500	8183	Complied

**Transmitter Minimum 6 dB Bandwidth (continued)**

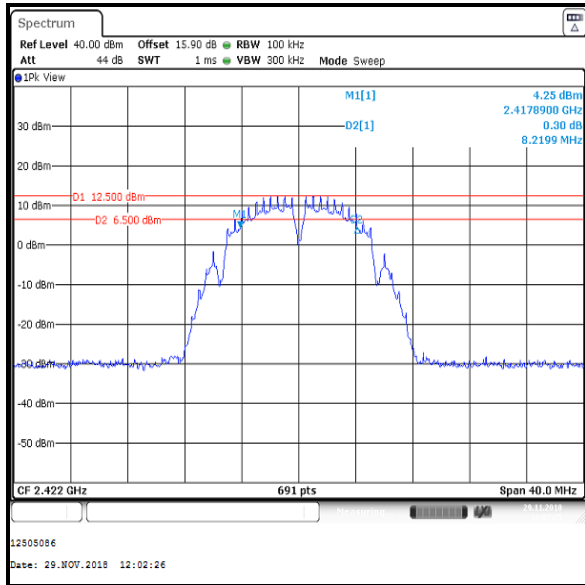
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



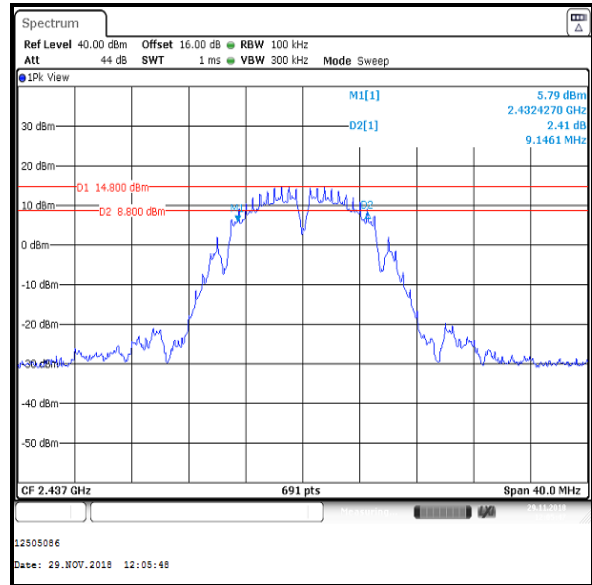
Channel 1



Channel 2



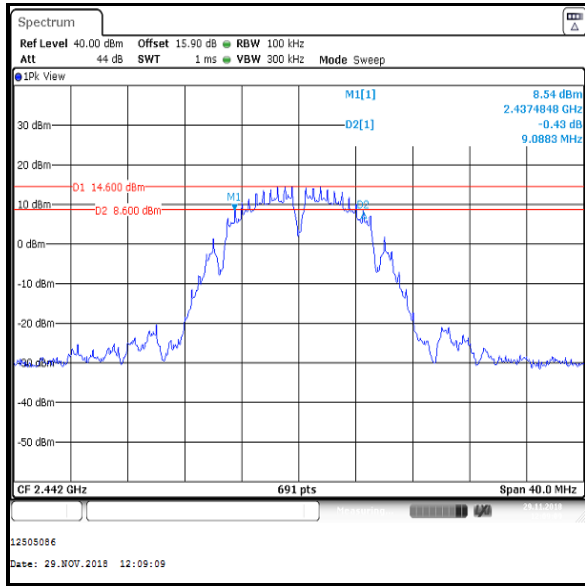
Channel 3



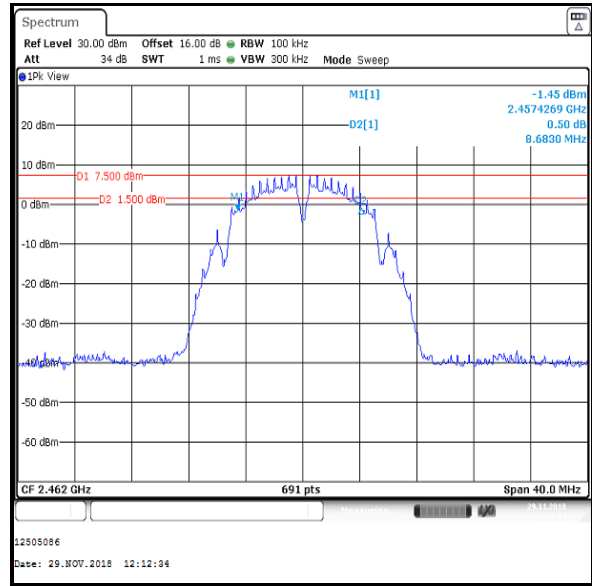
Channel 6

**Transmitter Minimum 6 dB Bandwidth (continued)**

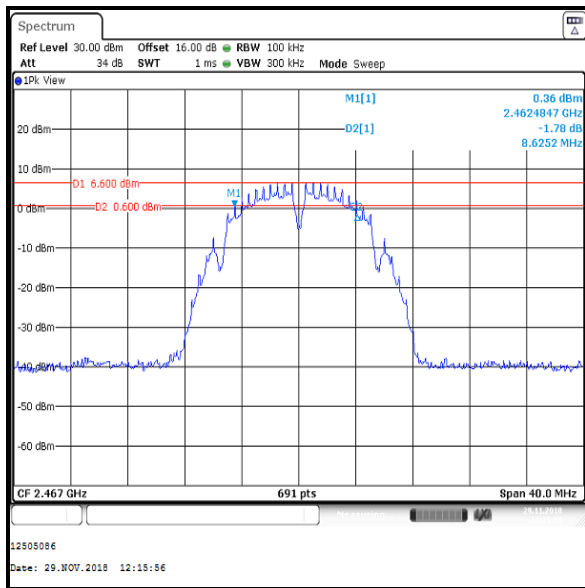
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



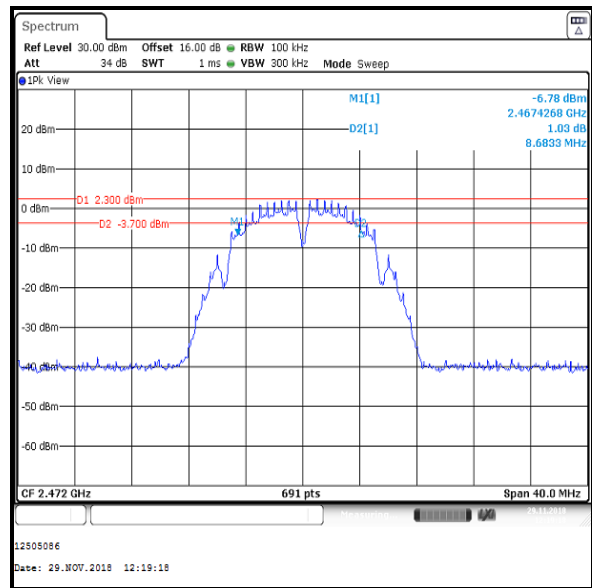
Channel 7



Channel 11



Channel 12



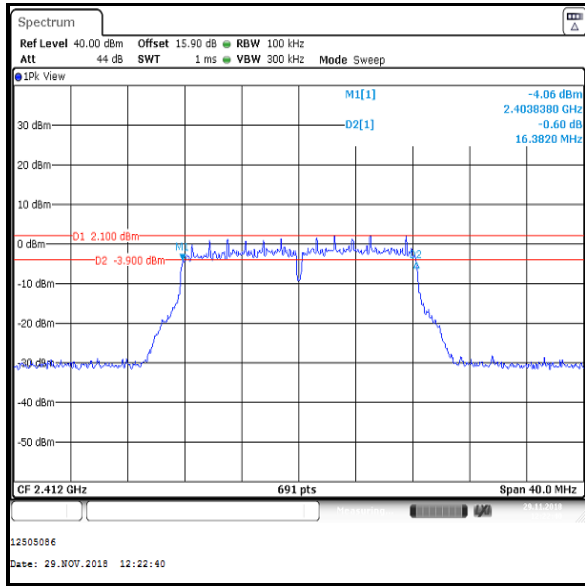
Channel 13

**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**

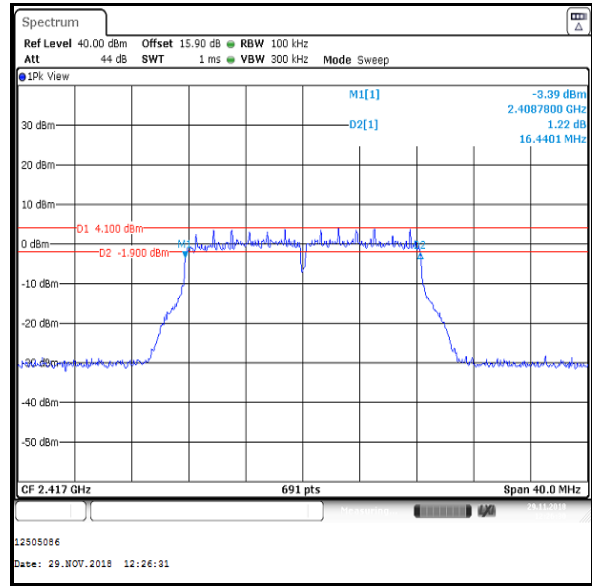
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	16382	≥500	15882	Complied
2	16440	≥500	15940	Complied
3	16440	≥500	15940	Complied
6	16440	≥500	15940	Complied
7	16440	≥500	15940	Complied
11	16440	≥500	15940	Complied
12	16440	≥500	15940	Complied
13	16440	≥500	15940	Complied

**Transmitter Minimum 6 dB Bandwidth (continued)**

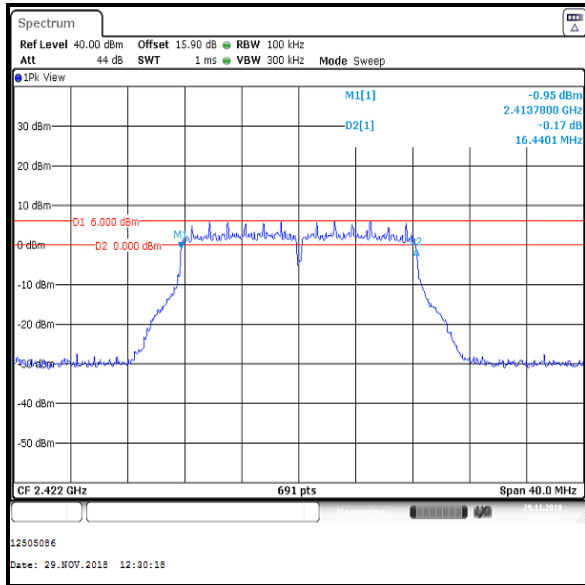
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



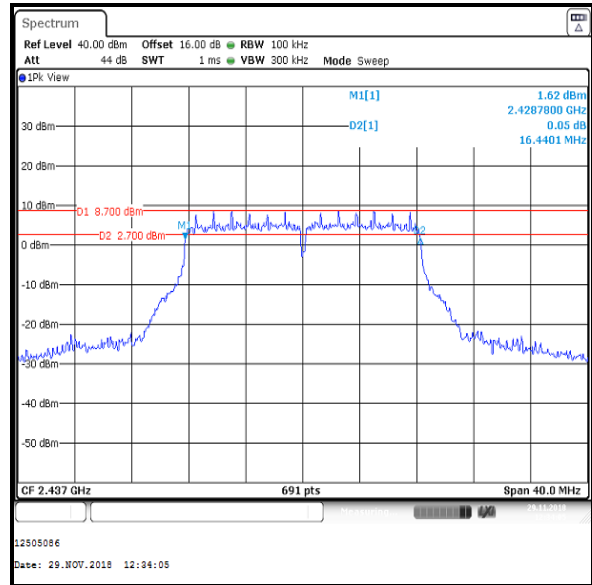
Channel 1



Channel 2



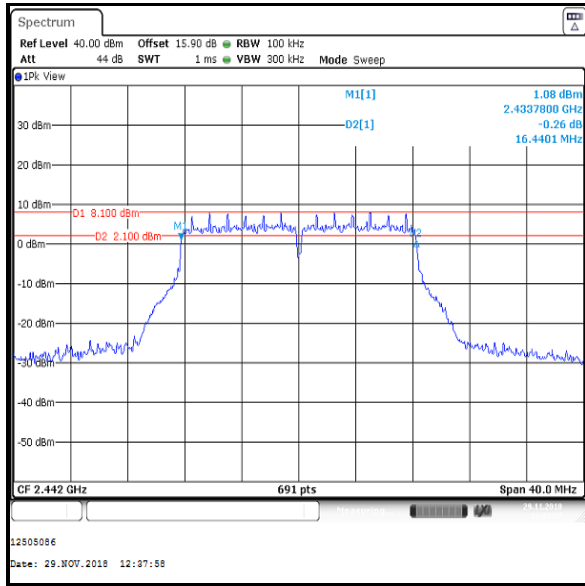
Channel 3



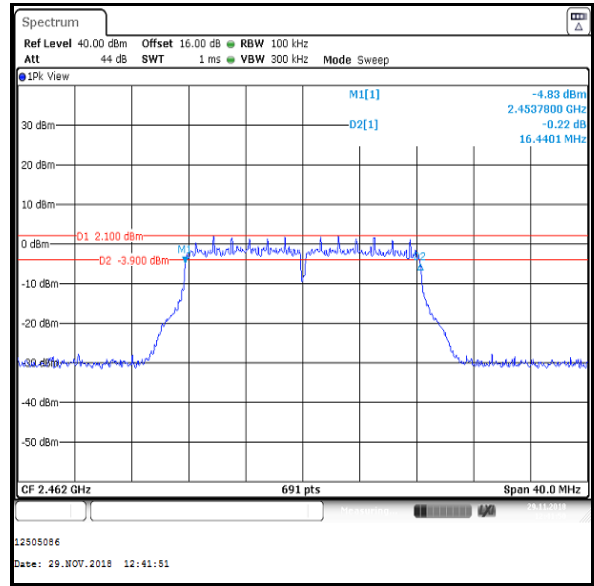
Channel 6

**Transmitter Minimum 6 dB Bandwidth (continued)**

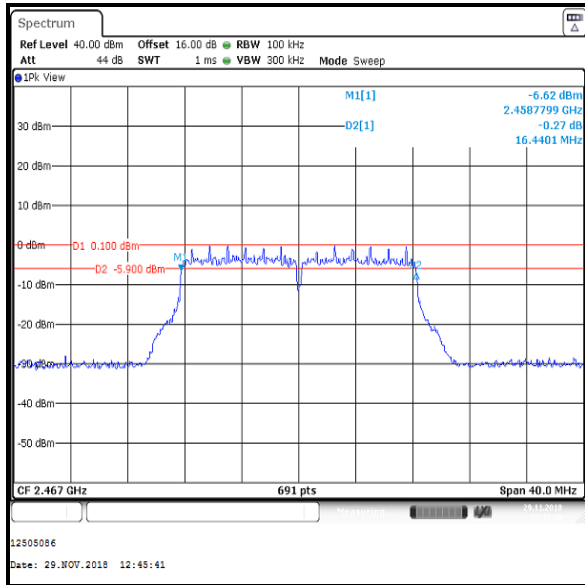
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



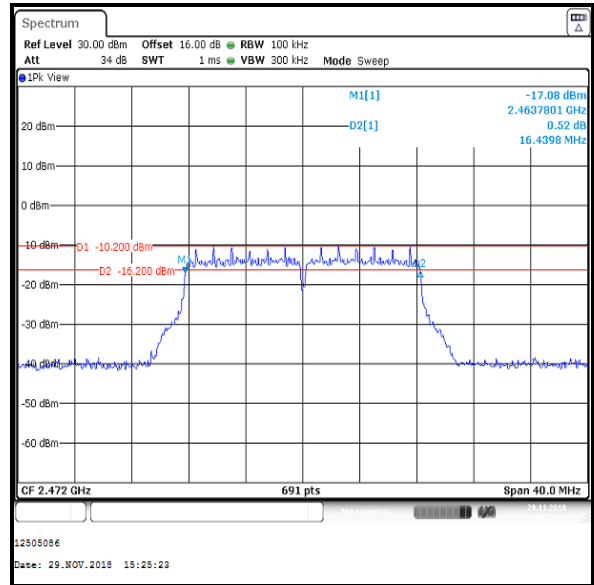
Channel 7



Channel 11



Channel 12



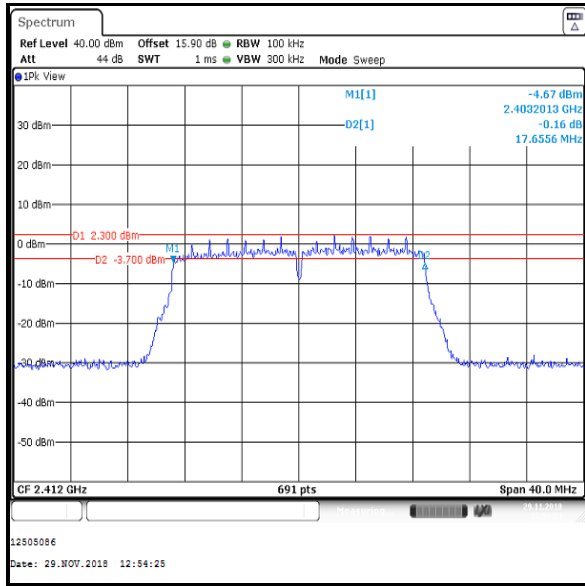
Channel 13

**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**

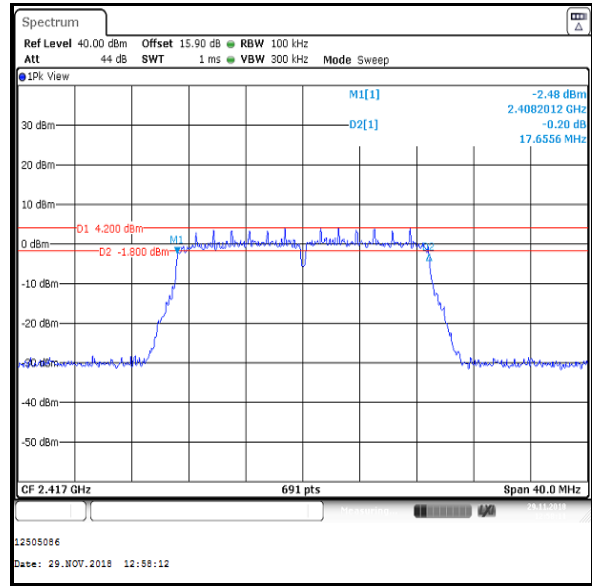
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	17656	≥500	17156	Complied
2	17656	≥500	17156	Complied
3	17656	≥500	17156	Complied
6	17713	≥500	17213	Complied
7	17656	≥500	17156	Complied
11	17713	≥500	17213	Complied
12	17656	≥500	17156	Complied
13	17656	≥500	17156	Complied

**Transmitter Minimum 6 dB Bandwidth (continued)**

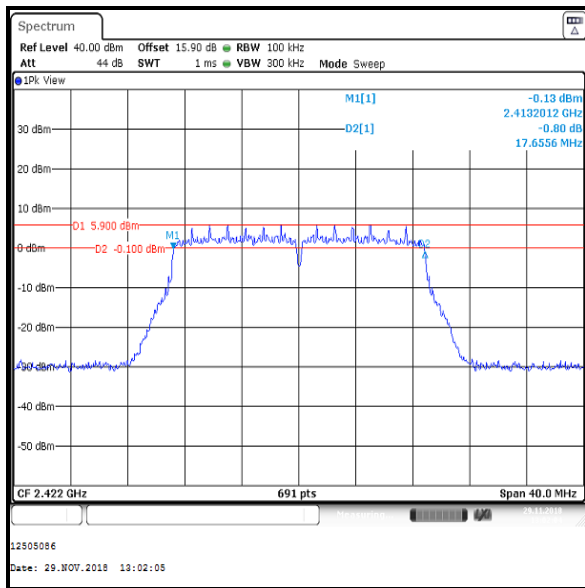
**Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**



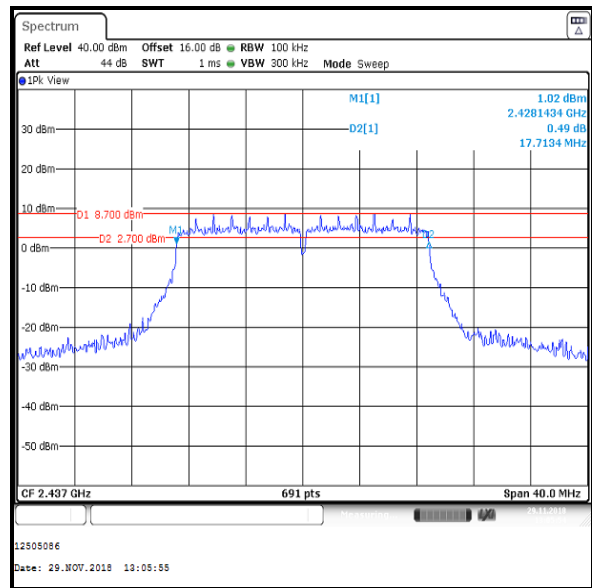
Channel 1



Channel 2



Channel 3

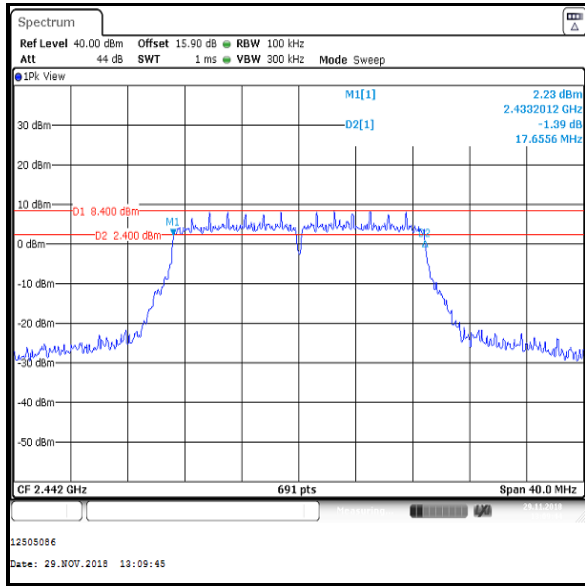


Channel 6

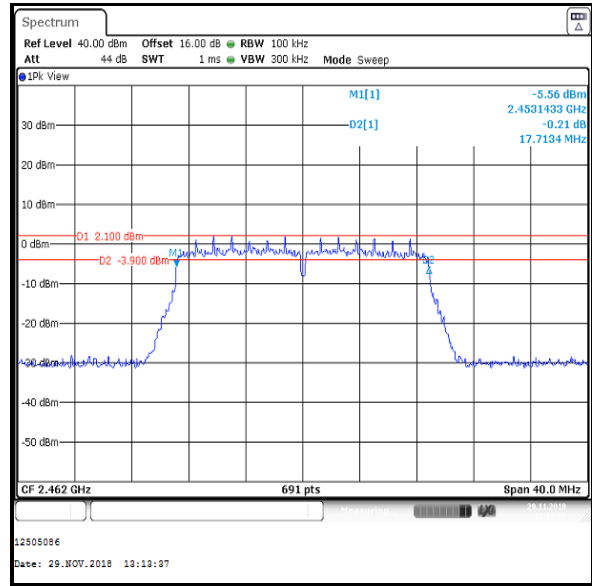


**Transmitter Minimum 6 dB Bandwidth (continued)**

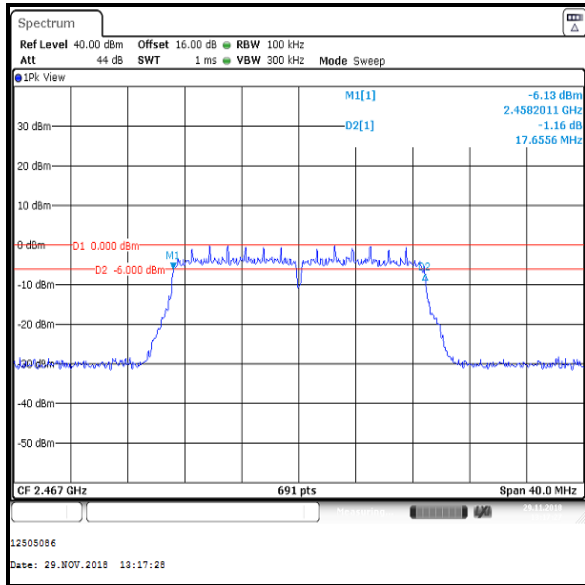
**Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**



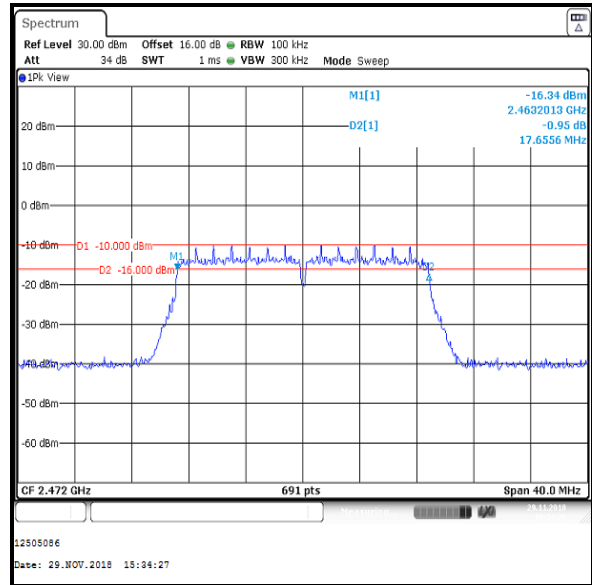
Channel 7



Channel 11



Channel 12



Channel 13

## **4.2. Transmitter Power Spectral Density**

### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Dates:</b>	29 November 2018
<b>Test Sample Serial Number:</b>	C02X2007KFLX		

<b>FCC Reference:</b>	Part 15.247(e)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.4 referencing ANSI C63.10 Subclause 11.10 and Notes below

### **Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	53

### **Note(s):**

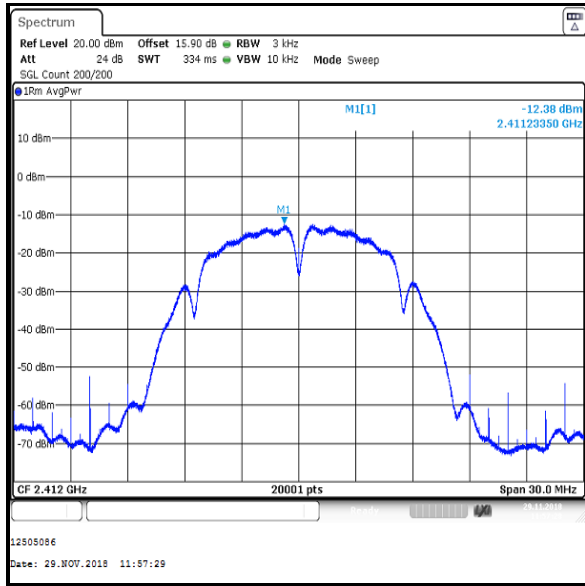
1. The customer declared the following data rates to be used for all measurements as:
  - 802.11b – DBPSK / 1 Mbps / Core 2
  - 802.11g – BPSK / 6 Mbps / Core 2
  - 802.11n HT20 – BPSK / MCS0 / Core 2
2. Final measurements were performed using the above configurations on the relevant channels. Additional channels were tested as requested by the customer.
3. The EUT was transmitting at >98% duty cycle and testing was performed in accordance with ANSI C63.10 Subclause 11.10.3 Method AVGPSD-1. The signal analyser resolution bandwidth was set to 3 kHz and video bandwidth 10 kHz. An RMS detector was used and sweep time set manually to perform trace averaging over 200 traces. The span was set greater than 1.5 times the 99% emission bandwidth. The highest peak of the measured signal was recorded.
4. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF offset was entered on the signal analyser to compensate for the loss of the switch, attenuator and RF cables.

**Transmitter Power Spectral Density (continued)****Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**

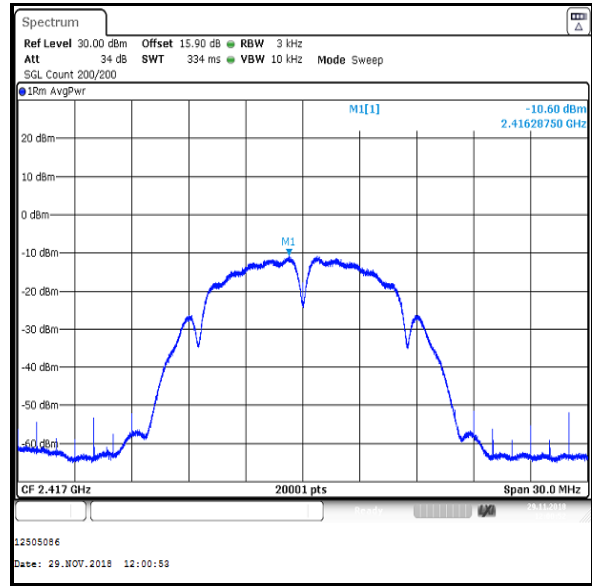
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
1	-12.4	8.0	20.4	Complied
2	-10.6	8.0	18.6	Complied
3	-11.0	8.0	19.0	Complied
6	-8.5	8.0	16.5	Complied
7	-8.7	8.0	16.7	Complied
11	-15.6	8.0	23.6	Complied
12	-16.6	8.0	24.6	Complied
13	-20.7	8.0	28.7	Complied

**Transmitter Power Spectral Density (continued)**

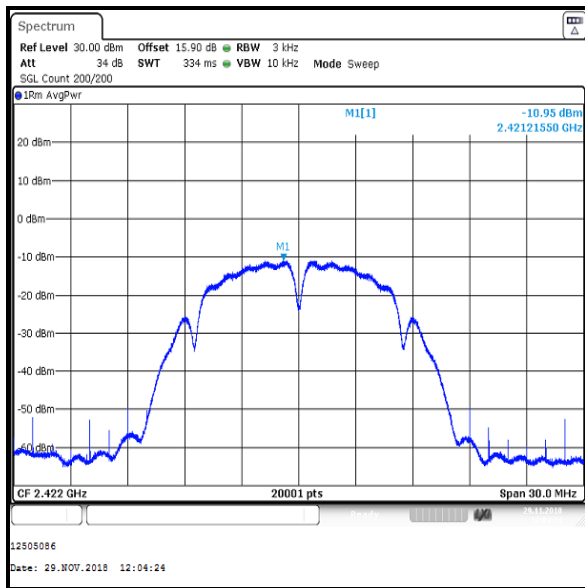
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



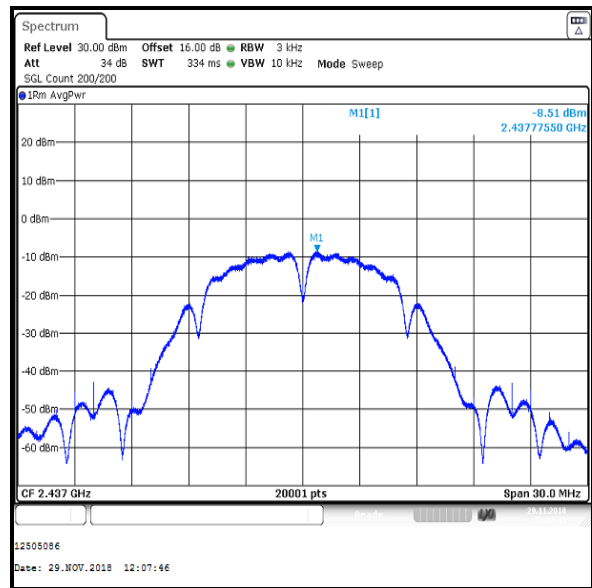
Channel 1



Channel 2



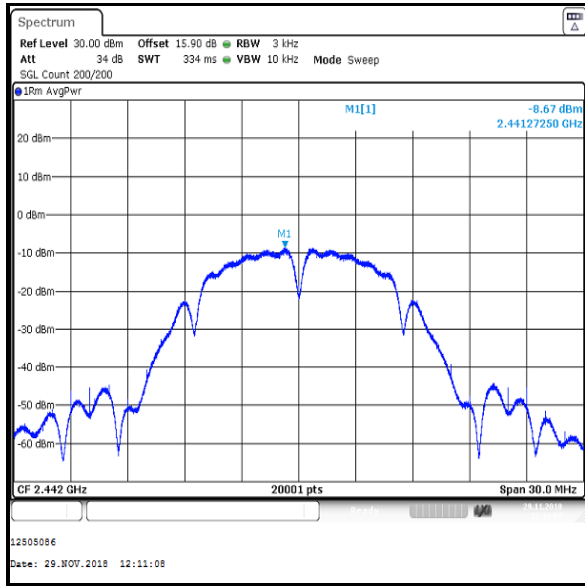
Channel 3



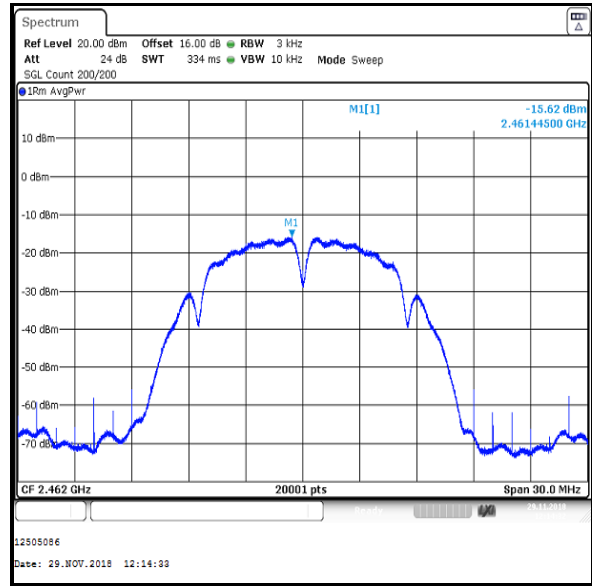
Channel 6

**Transmitter Power Spectral Density (continued)**

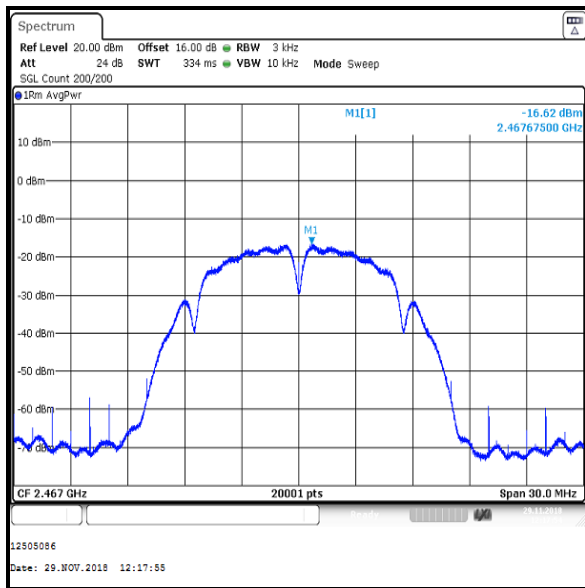
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



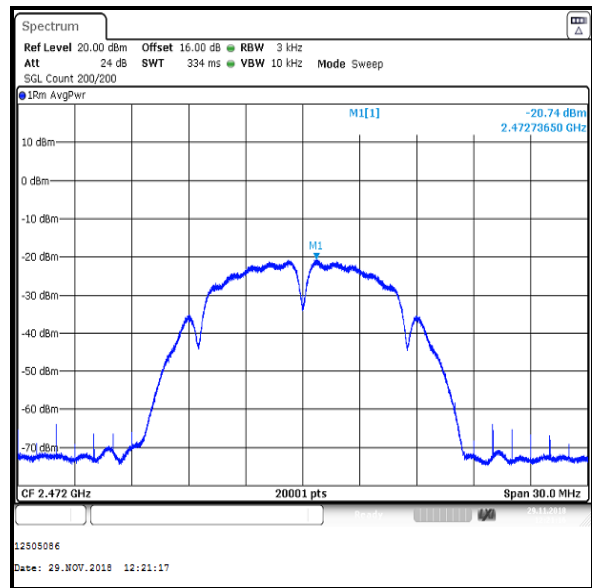
**Channel 7**



**Channel 11**



**Channel 12**



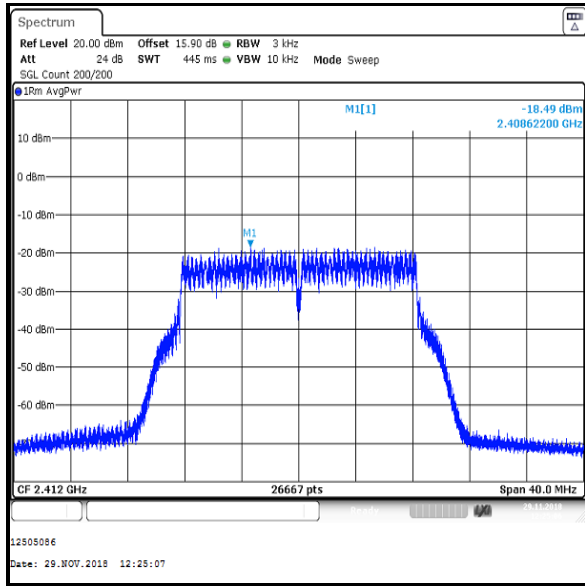
**Channel 13**

**Transmitter Power Spectral Density (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**

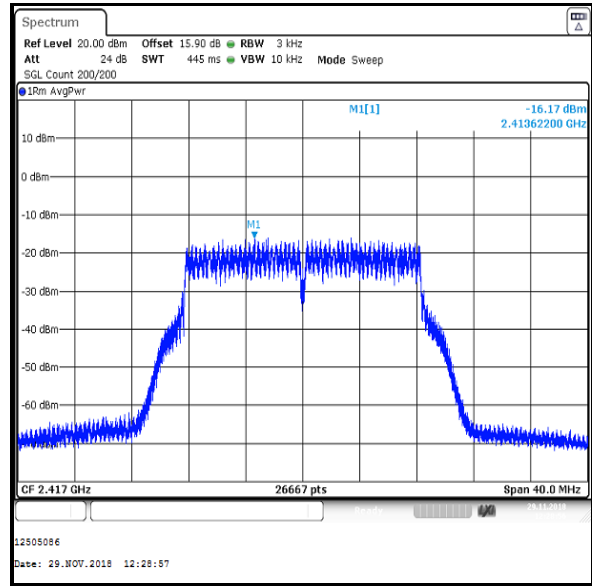
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
1	-18.5	8.0	26.5	Complied
2	-16.2	8.0	24.2	Complied
3	-13.9	8.0	21.9	Complied
6	-11.9	8.0	19.9	Complied
7	-12.6	8.0	20.6	Complied
11	-18.5	8.0	26.5	Complied
12	-19.9	8.0	27.9	Complied
13	-30.3	8.0	38.3	Complied

**Transmitter Power Spectral Density (continued)**

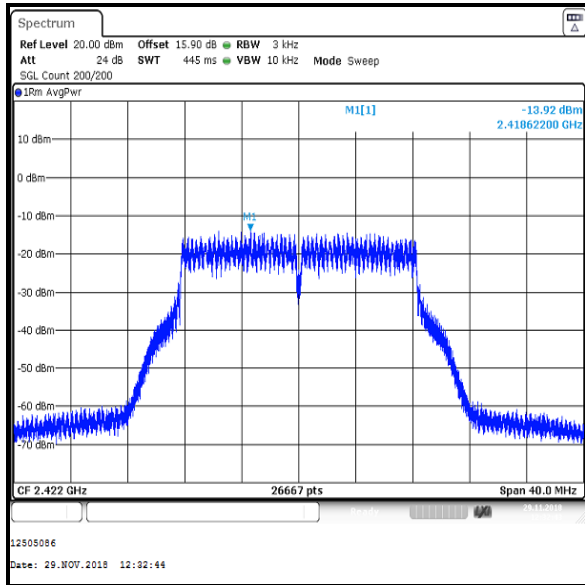
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



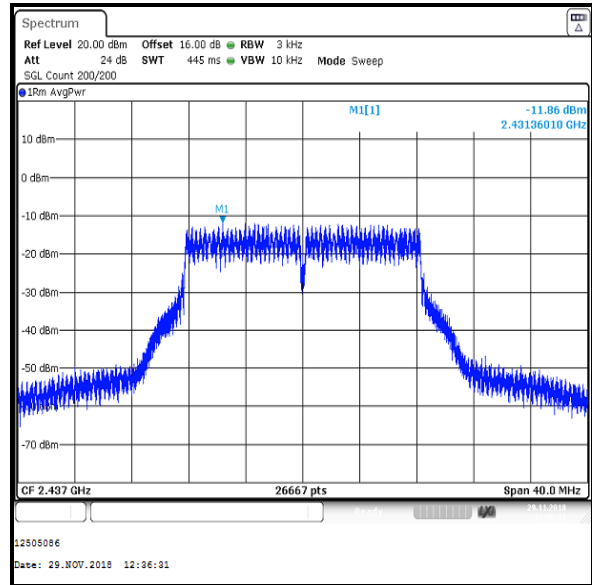
Channel 1



Channel 2



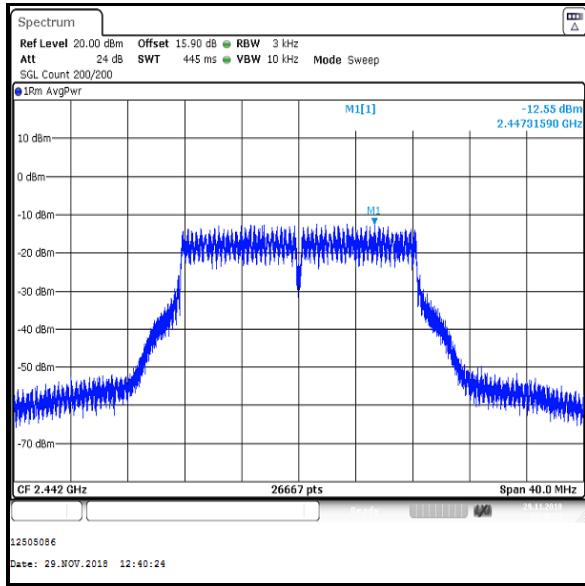
Channel 3



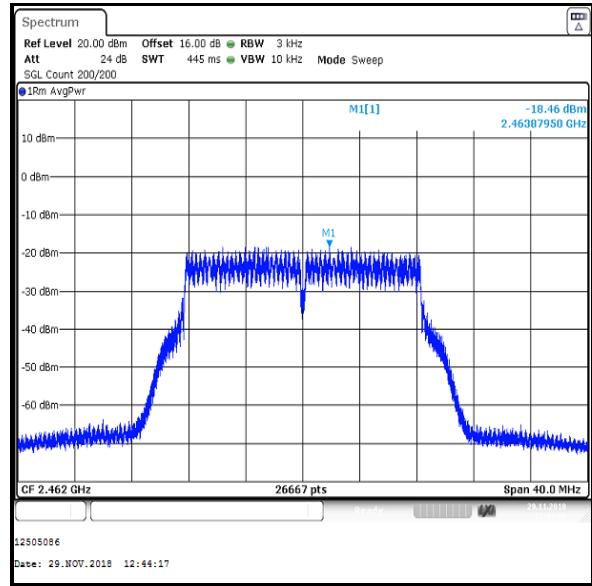
Channel 6

**Transmitter Power Spectral Density (continued)**

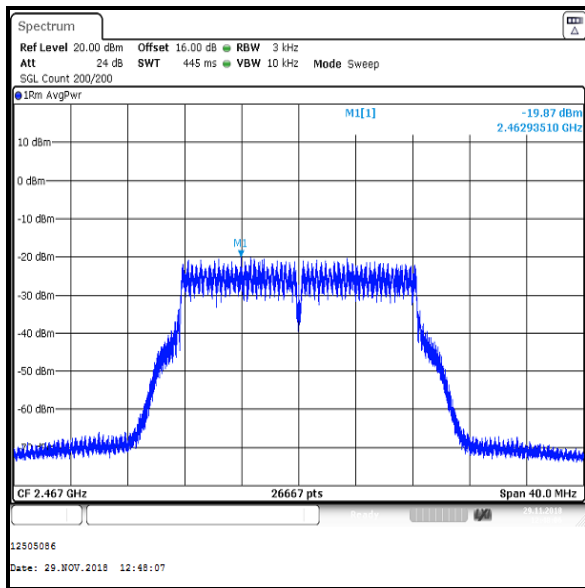
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



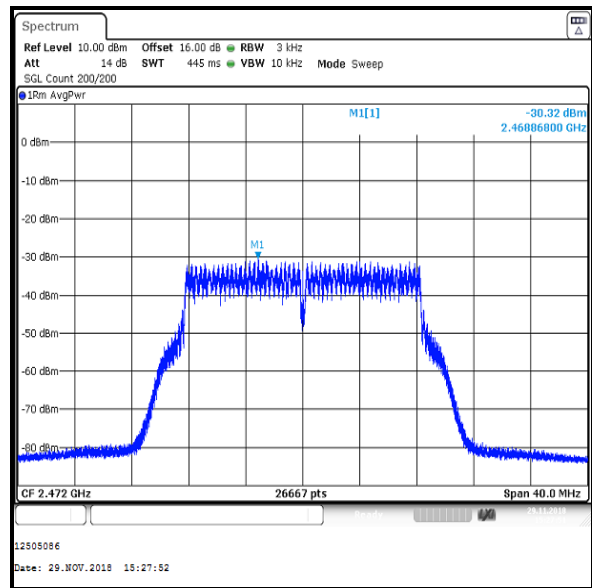
Channel 7



Channel 11



Channel 12



Channel 13

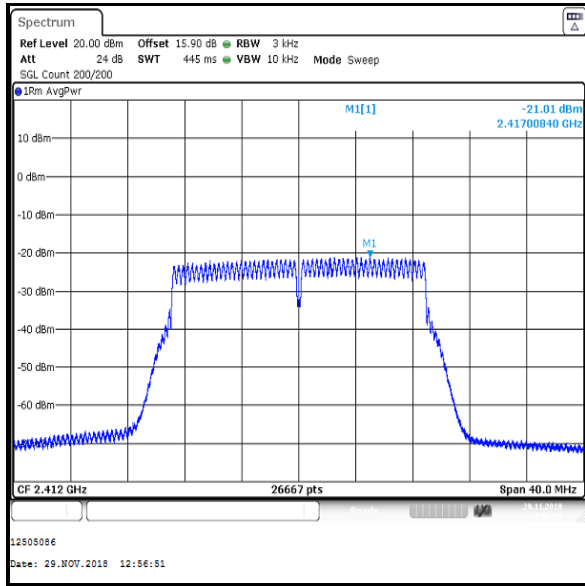


**Transmitter Power Spectral Density (continued)****Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**

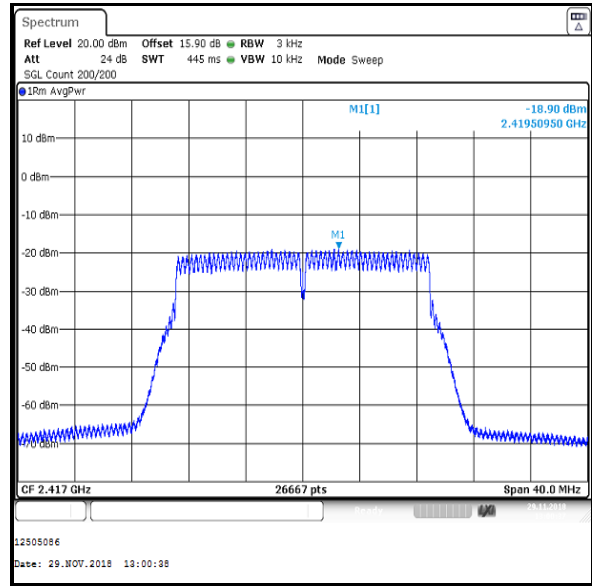
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
1	-21.0	8.0	29.0	Complied
2	-18.9	8.0	26.9	Complied
3	-17.2	8.0	25.2	Complied
6	-14.3	8.0	22.3	Complied
7	-14.9	8.0	22.9	Complied
11	-21.0	8.0	29.0	Complied
12	-23.2	8.0	31.2	Complied
13	-33.3	8.0	41.3	Complied

**Transmitter Power Spectral Density (continued)**

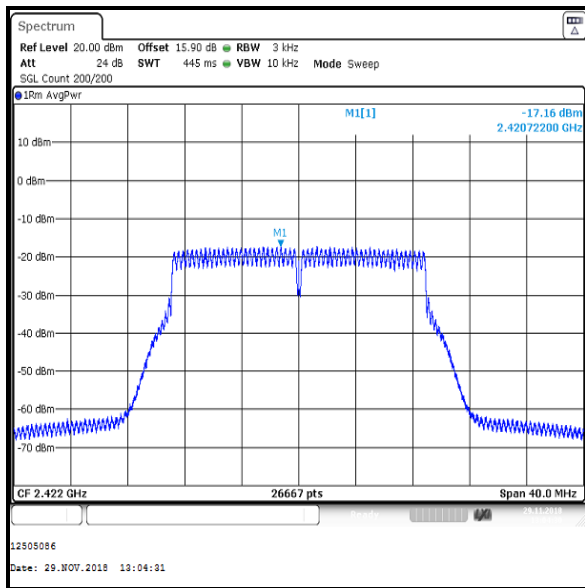
**Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**



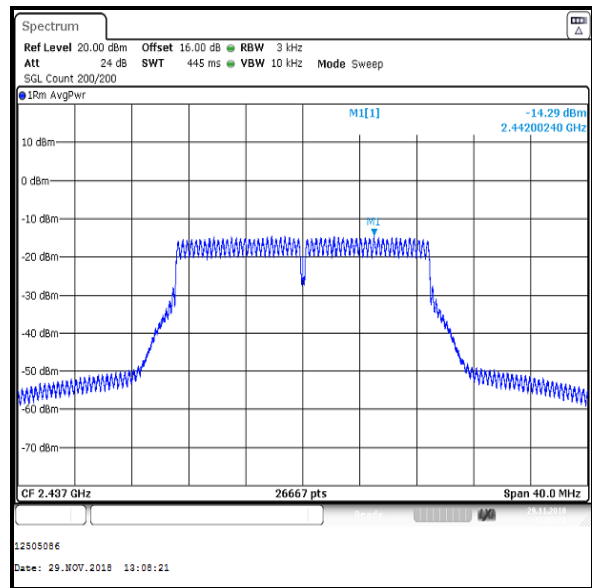
Channel 1



Channel 2



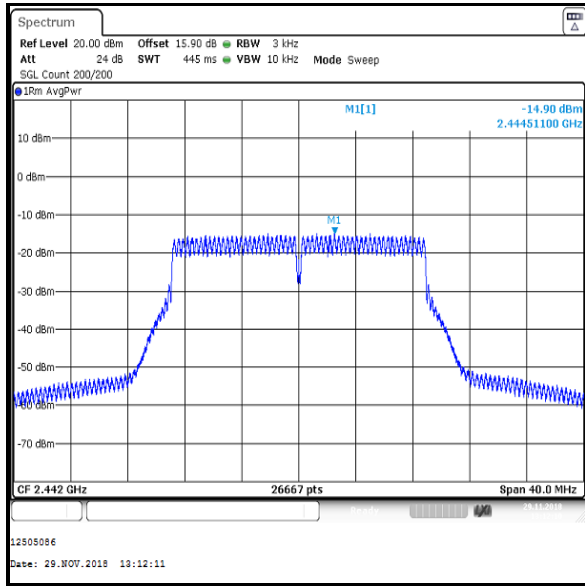
Channel 3



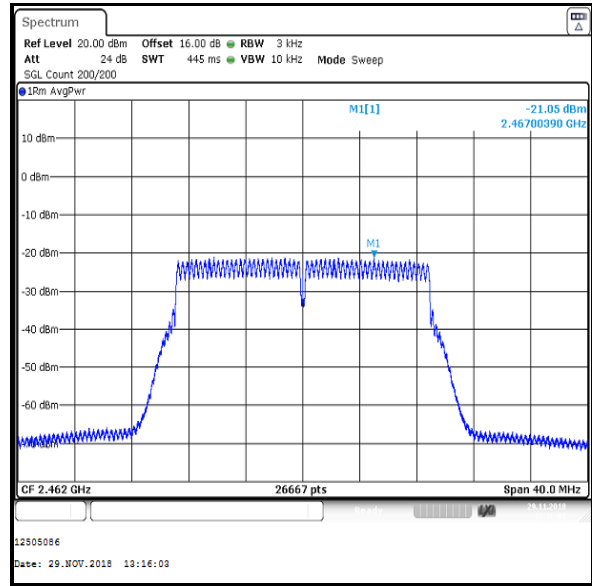
Channel 6

**Transmitter Power Spectral Density (continued)**

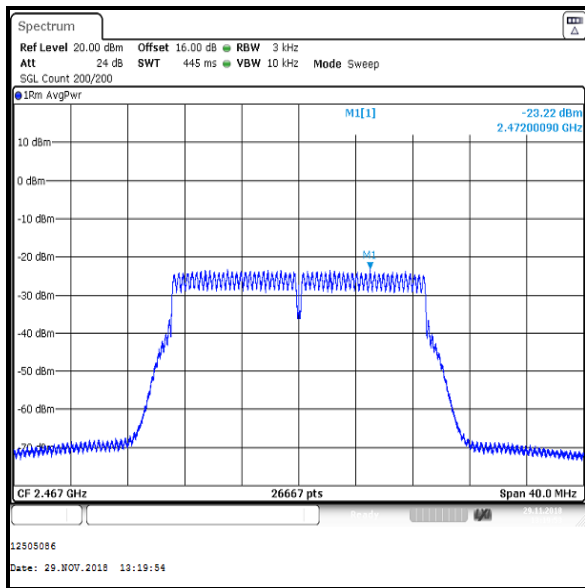
**Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**



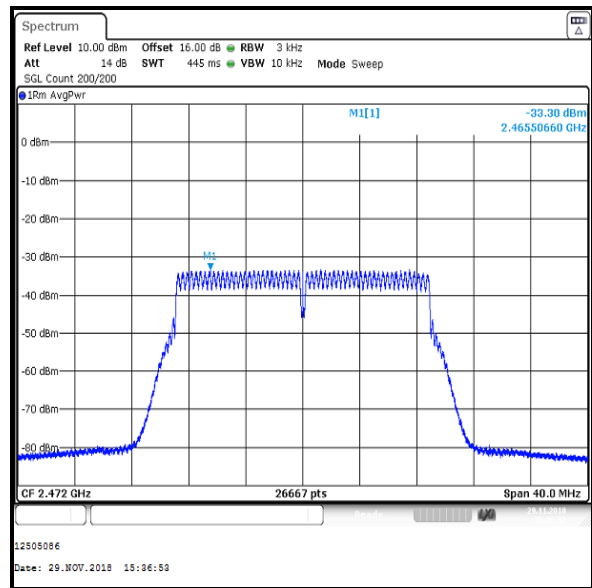
Channel 7



Channel 11



Channel 12



Channel 13

### **4.3. Transmitter Maximum (Average) Output Power**

#### **Test Summary:**

<b>Test Engineer:</b>	Max Passell	<b>Test Date:</b>	29 November 2018
<b>Test Sample Serial Number:</b>	C02X2007KFLX		

<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.3.2.2 referencing ANSI C63.10 Sections 11.9.2.2.2

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	53

#### **Note(s):**

1. The customer declared the following data rates to be used for all measurements as:
  - 802.11b – DBPSK / 1 Mbps / SISO / Core 2
  - 802.11g – BPSK / 6 Mbps / SISO / Core 2
  - 802.11n HT20 – BPSK / MCS0 / SISO / Core 2
2. Final measurements were performed using the above configurations on the relevant channels. Additional channels were tested as requested by the customer.
3. The power has been integrated over the 99% emission bandwidth. Plots for the occupied bandwidth are archived on the UL VS LTD IT server and available for inspection upon request.
4. The EUT was transmitting at >98% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.9.2.2.2 Method AVGSA-1. The signal analyser's integration function was used to integrate across the 99% occupied bandwidth. For 802.11b, the signal analyser resolution bandwidth was set to 300 kHz and video bandwidth 1 MHz. For 802.11g and 802.11n, the signal analyser resolution bandwidth was set to 500 kHz and video bandwidth 2 MHz. An RMS detector was used and sweep time set manually to perform trace averaging over 200 traces. The span was set to at least 1.5 times the 99% emission bandwidth.
5. The signal analyser was connected to the RF port on the EUT using an RF switch, suitable attenuation and RF cables. An RF offset was entered on the signal analyser to compensate for the loss of the switch, attenuator and RF cables.

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / SISO / Core 2****Conducted Limit Comparison**

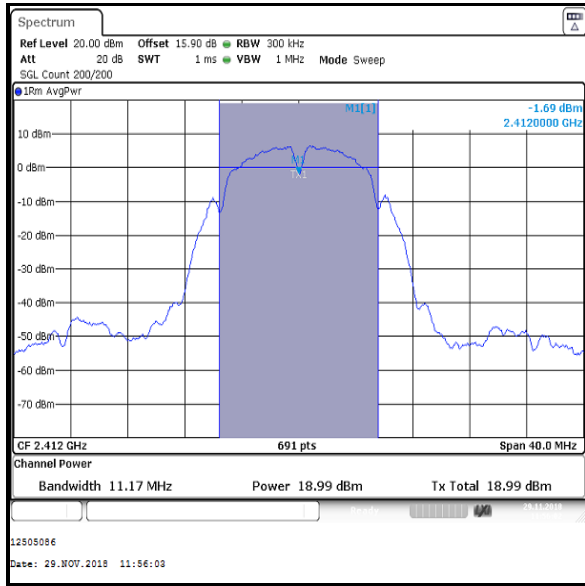
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	19.0	30.0	11.0	Complied
2	20.7	30.0	9.3	Complied
3	21.0	30.0	9.0	Complied
6	23.2	30.0	6.8	Complied
7	23.1	30.0	6.9	Complied
11	15.9	30.0	14.1	Complied
12	15.0	30.0	15.0	Complied
13	10.9	30.0	19.1	Complied

**EIRP Limit Comparison**

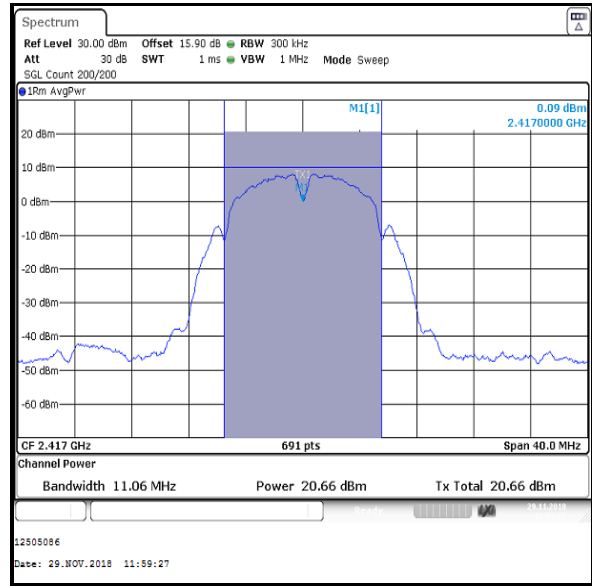
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	19.0	4.3	23.3	36.0	12.7	Complied
2	20.7	4.3	25.0	36.0	11.0	Complied
3	21.0	4.3	25.3	36.0	10.7	Complied
6	23.2	4.3	27.5	36.0	8.5	Complied
7	23.1	4.3	27.4	36.0	8.6	Complied
11	15.9	4.3	20.2	36.0	15.8	Complied
12	15.0	4.3	19.3	36.0	16.7	Complied
13	10.9	4.3	15.2	36.0	20.8	Complied

**Transmitter Maximum (Average) Output Power (continued)**

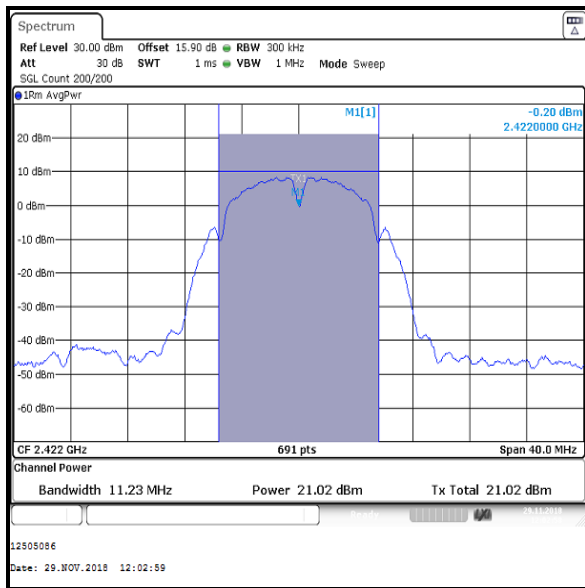
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



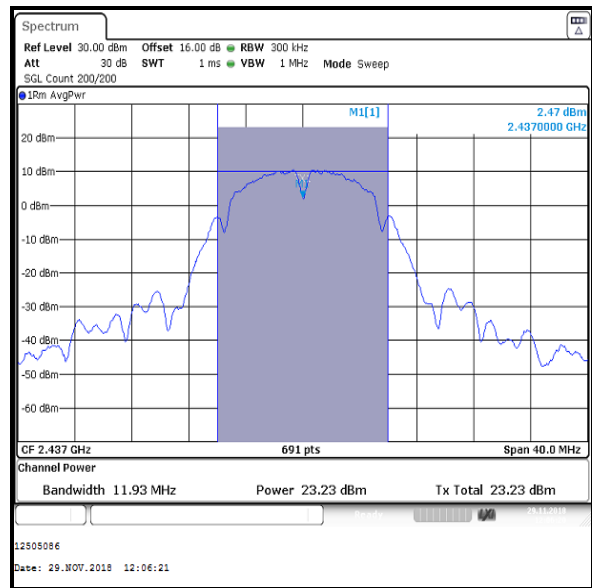
Channel 1



Channel 2



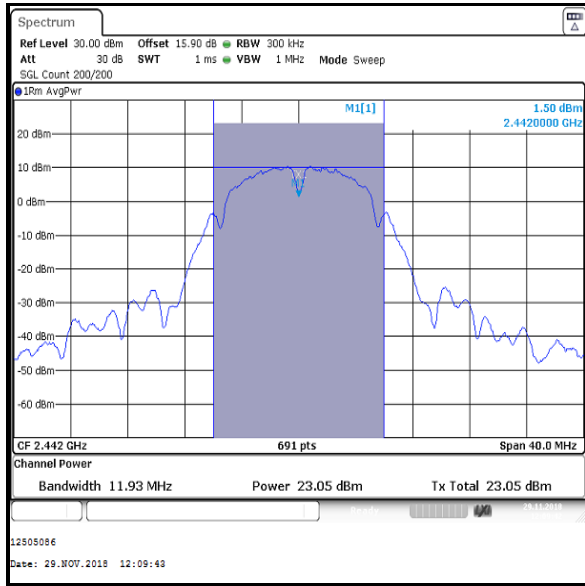
Channel 3



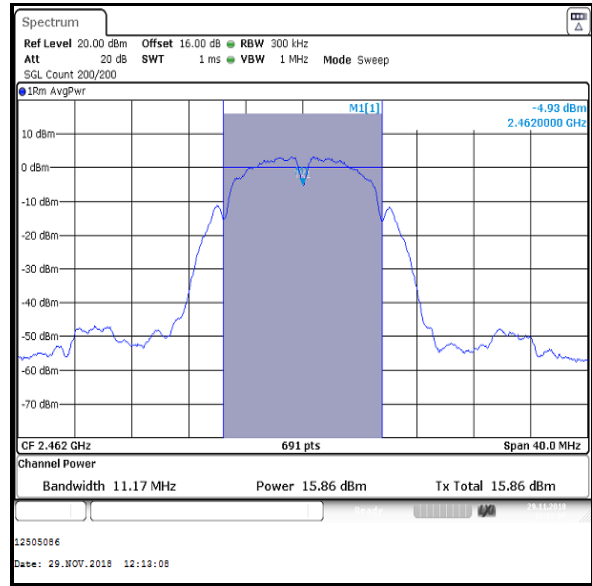
Channel 6

**Transmitter Maximum (Average) Output Power (continued)**

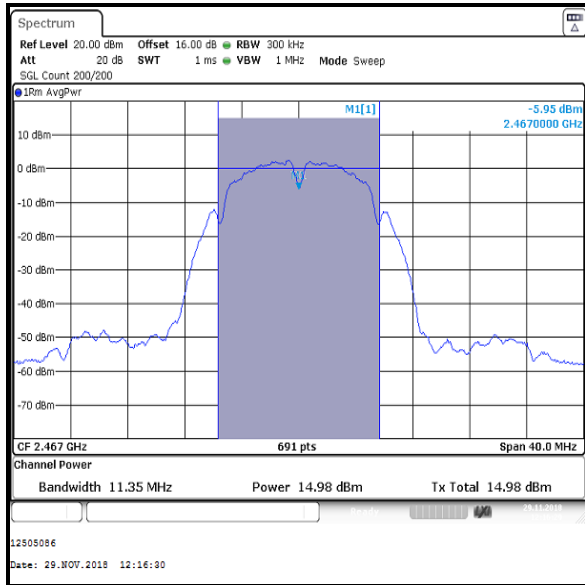
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2**



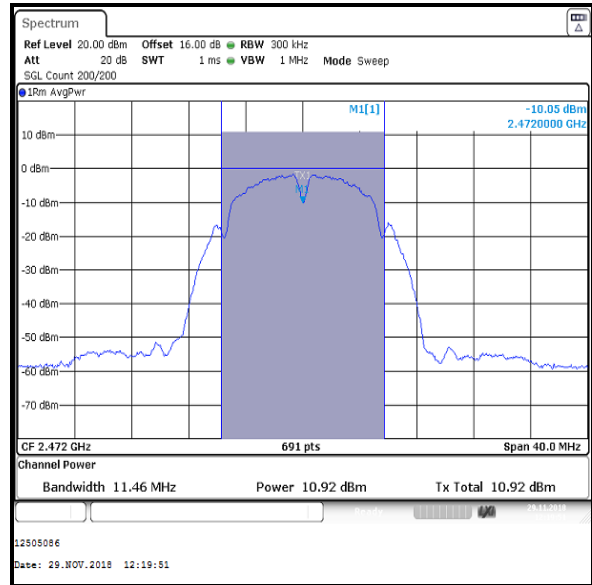
Channel 7



Channel 11



Channel 12



Channel 13

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2****Conducted Limit Comparison**

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	13.3	30.0	16.7	Complied
2	15.6	30.0	14.4	Complied
3	17.5	30.0	12.5	Complied
6	20.0	30.0	10.0	Complied
7	19.4	30.0	10.6	Complied
11	13.3	30.0	16.7	Complied
12	11.4	30.0	18.6	Complied
13	1.2	30.0	28.8	Complied

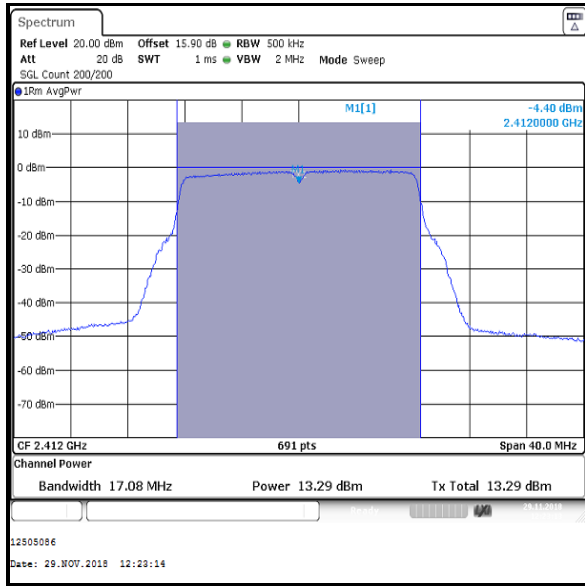
**EIRP Limit Comparison**

Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	13.3	4.3	17.6	36.0	18.4	Complied
2	15.6	4.3	19.9	36.0	16.1	Complied
3	17.5	4.3	21.8	36.0	14.2	Complied
6	20.0	4.3	24.3	36.0	11.7	Complied
7	19.4	4.3	23.7	36.0	12.3	Complied
11	13.3	4.3	17.6	36.0	18.4	Complied
12	11.4	4.3	15.7	36.0	20.3	Complied
13	1.2	4.3	5.5	36.0	30.5	Complied

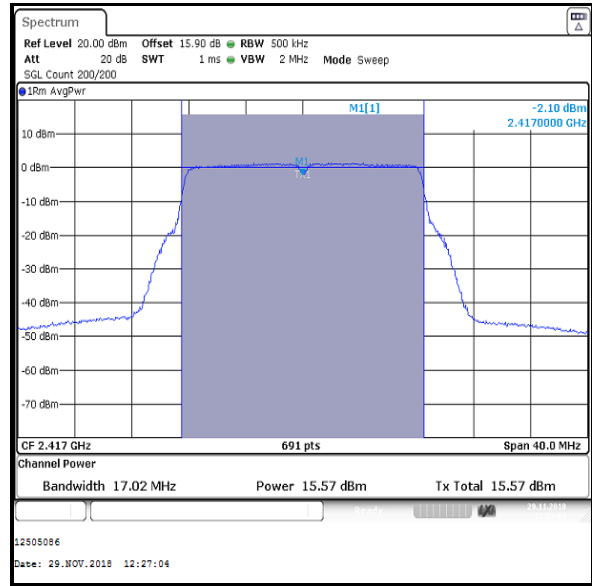


**Transmitter Maximum (Average) Output Power (continued)**

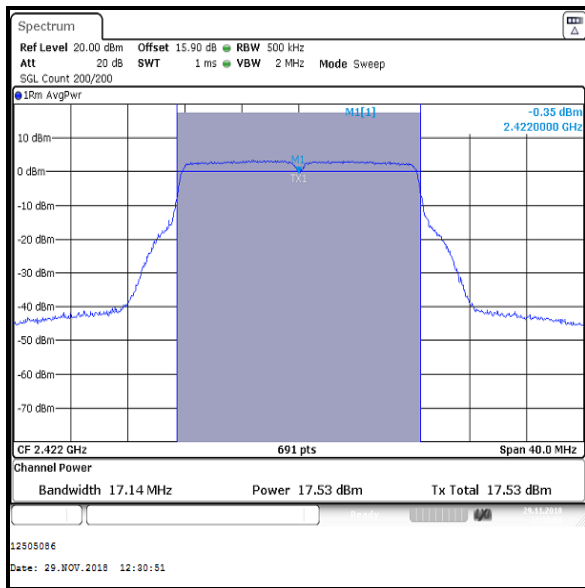
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



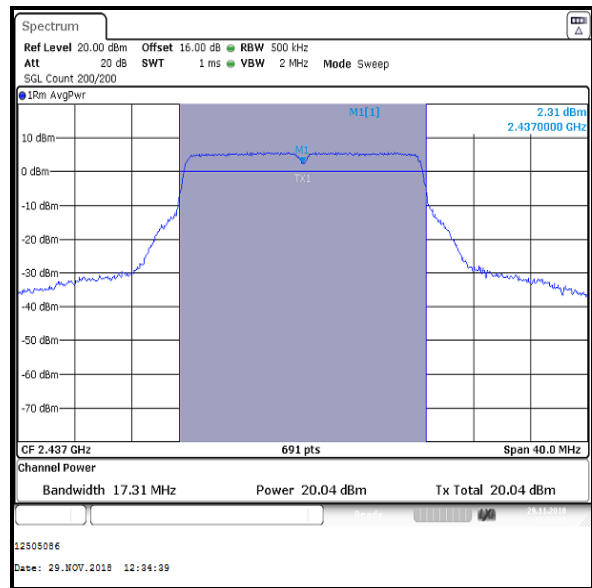
Channel 1



Channel 2



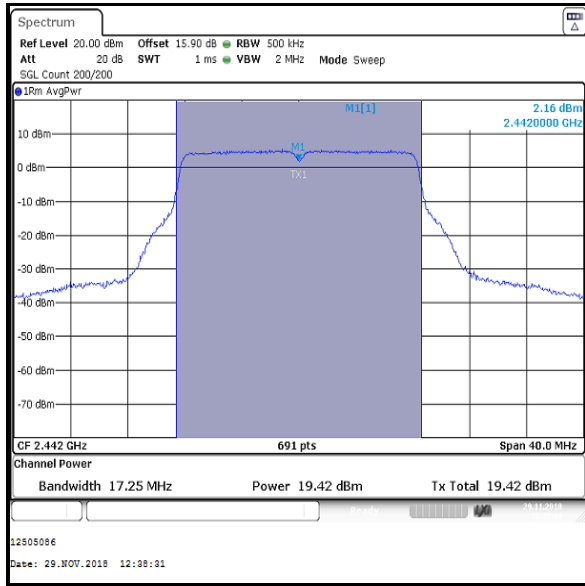
Channel 3



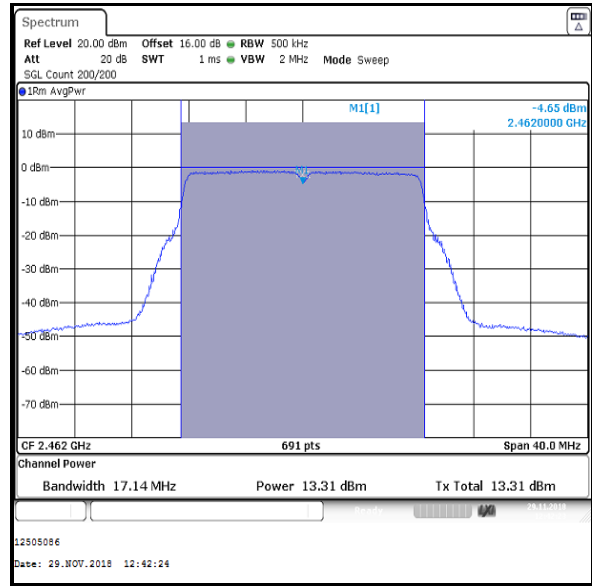
Channel 6

**Transmitter Maximum (Average) Output Power (continued)**

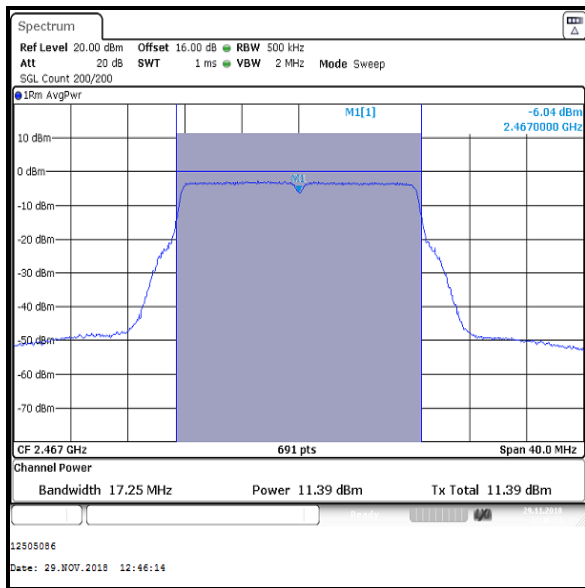
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2**



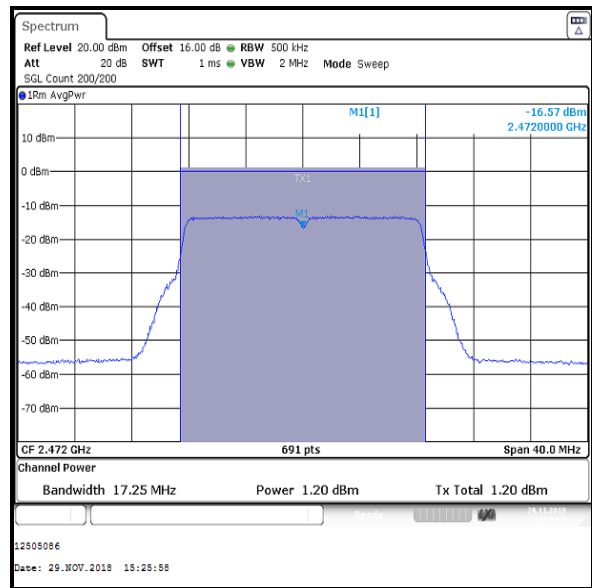
Channel 7



Channel 11



Channel 12



Channel 13

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2****Conducted Limit Comparison**

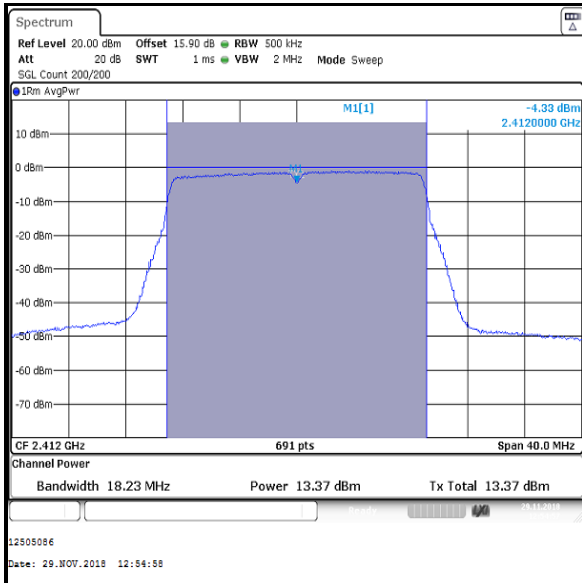
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	13.4	30.0	16.6	Complied
2	15.5	30.0	14.5	Complied
3	17.4	30.0	12.6	Complied
6	20.1	30.0	9.9	Complied
7	19.7	30.0	10.3	Complied
11	13.4	30.0	16.6	Complied
12	11.2	30.0	18.8	Complied
13	1.5	30.0	28.5	Complied

**EIRP Limit Comparison**

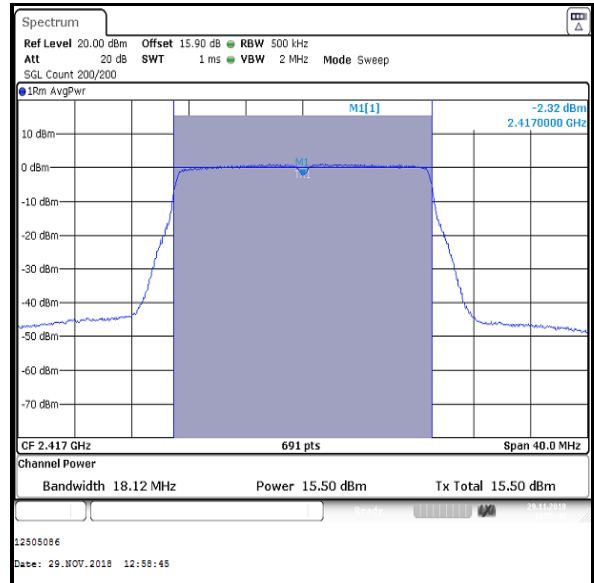
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	13.4	4.3	17.7	36.0	18.3	Complied
2	15.5	4.3	19.8	36.0	16.2	Complied
3	17.4	4.3	21.7	36.0	14.3	Complied
6	20.1	4.3	24.4	36.0	11.6	Complied
7	19.7	4.3	24.0	36.0	12.0	Complied
11	13.3	4.3	17.6	36.0	18.4	Complied
12	11.2	4.3	15.5	36.0	20.5	Complied
13	1.5	4.3	5.8	36.0	30.2	Complied

### Transmitter Maximum (Average) Output Power (continued)

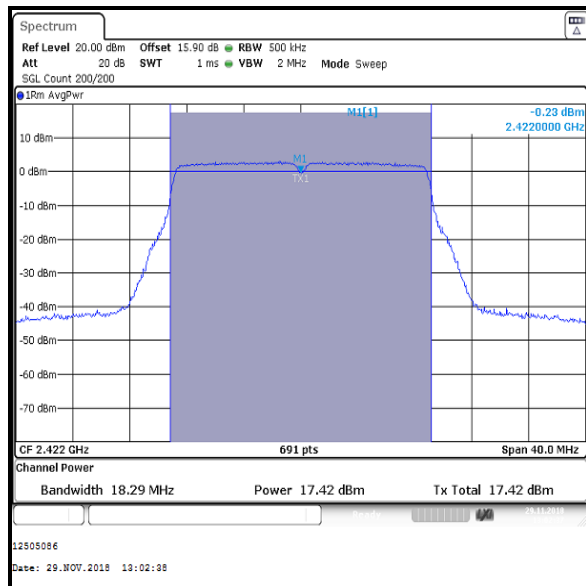
#### Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2



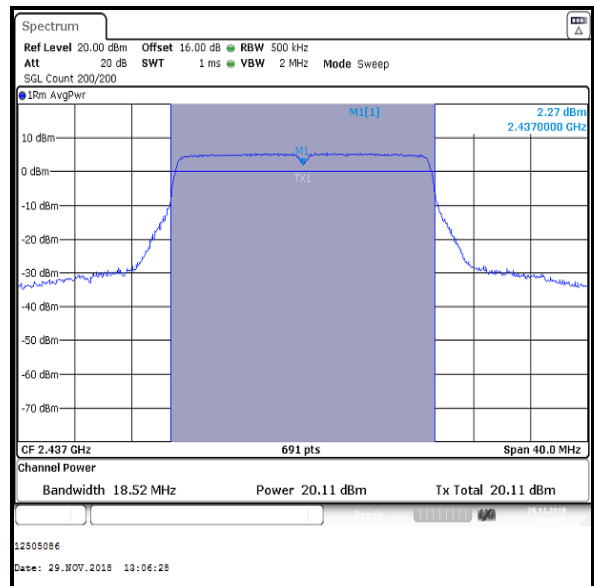
Channel 1



Channel 2



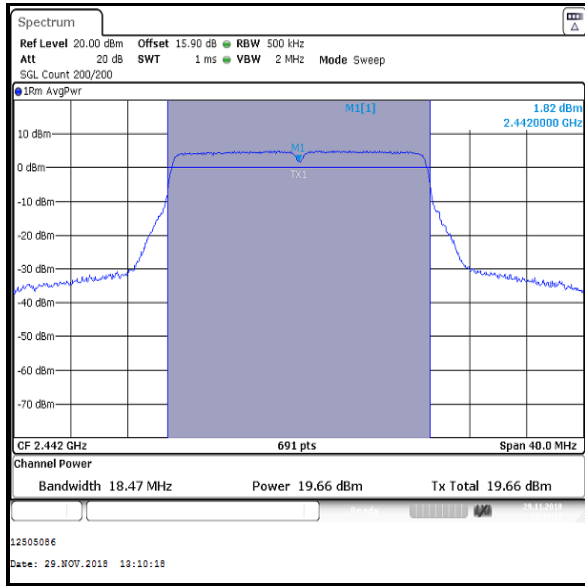
Channel 3



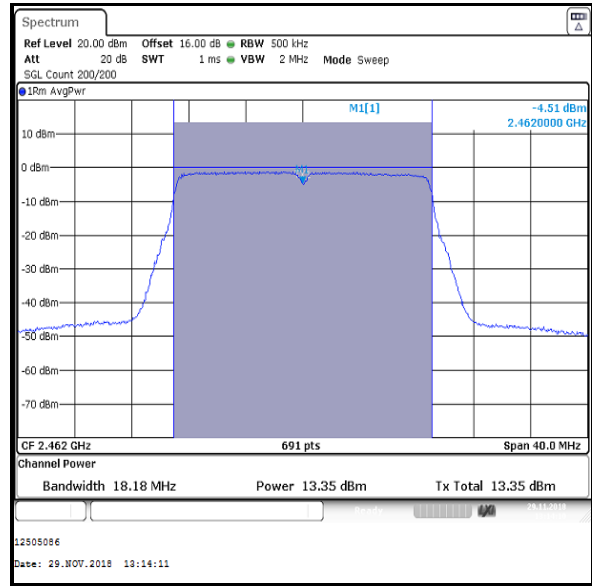
Channel 6

**Transmitter Maximum (Average) Output Power (continued)**

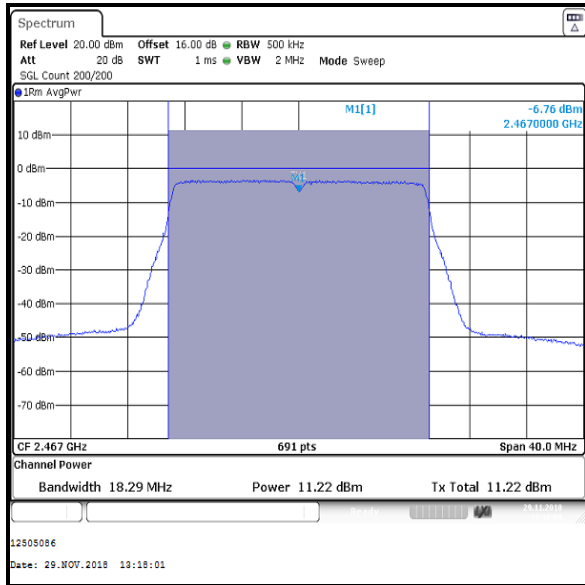
**Results: 802.11n / HT20 / SISO / BPSK / MCS0 / Core 2**



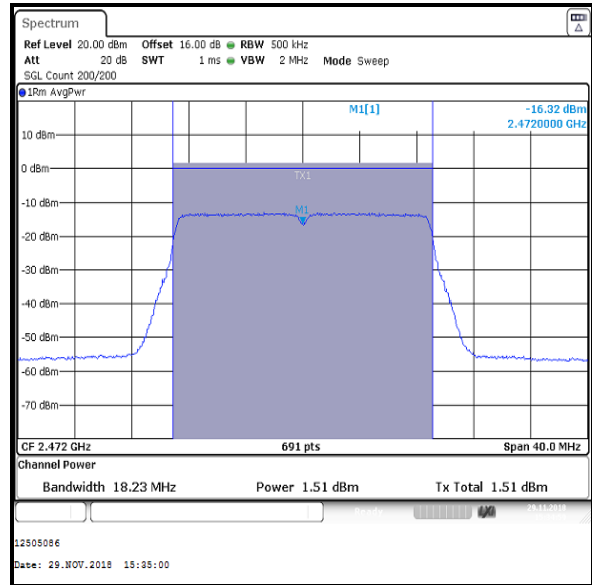
Channel 7



Channel 11



Channel 12



Channel 13

## **5. Radiated Test Results**

### **5.1. Transmitter Radiated Emissions <1 GHz**

#### **Test Summary:**

<b>Test Engineer:</b>	Mark Perry	<b>Test Dates:</b>	17 November 2018 & 23 November 2018
<b>Test Sample Serial Number:</b>	C02X200XKFLX		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	22 to 23
<b>Relative Humidity (%):</b>	40 to 46

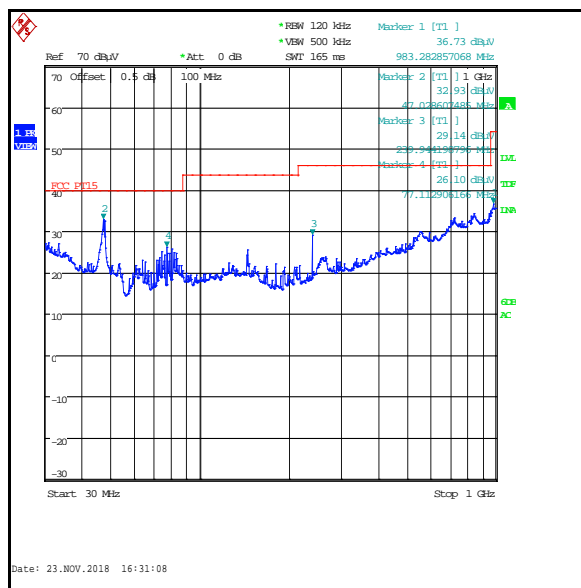
#### **Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. All other emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor and therefore not recorded.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.
6. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

**Transmitter Radiated Emissions (continued)**

**Results: Middle Channel / 802.11b / SISO - DBPSK / 1 Mbps**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
47.215	Vertical	26.5	40.0	13.5	Complied
63.776	Vertical	19.7	40.0	20.3	Complied
77.267	Vertical	24.7	40.0	15.3	Complied
144.627	Vertical	22.1	43.5	21.4	Complied
180.058	Vertical	14.0	43.5	29.5	Complied
240.037	Horizontal	27.6	46.0	18.4	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

**5.2. Transmitter Radiated Emissions >1 GHz****Test Summary:**

<b>Test Engineer:</b>	Mark Perry	<b>Test Date:</b>	17 November 2018
<b>Test Sample Serial Number:</b>	C02X200XKFLX		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Subclauses 11.11 & 11.12 and Notes below
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	42 to 46

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
3. The emission shown approximately at 2442 MHz on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.



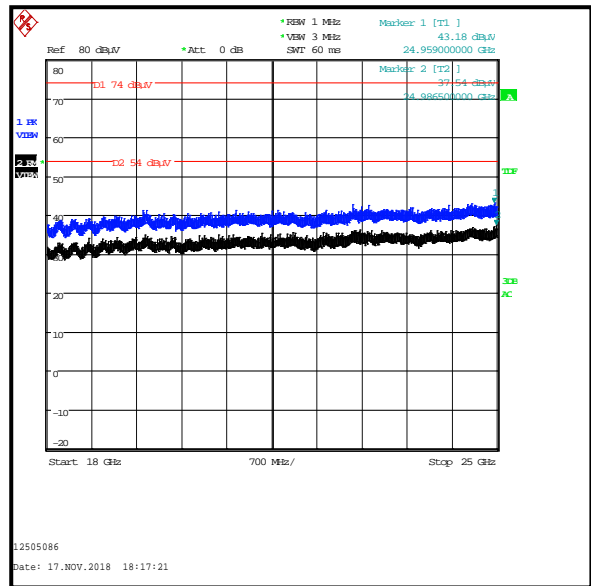
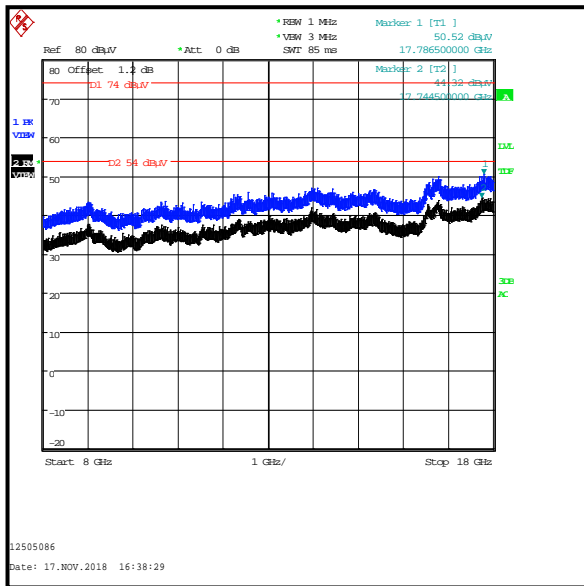
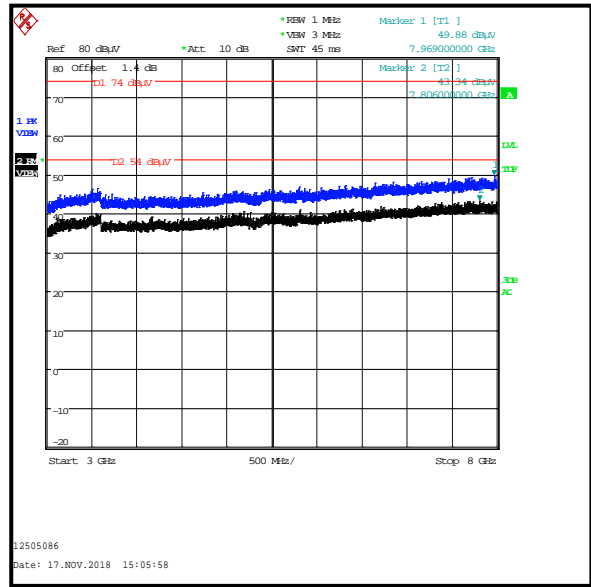
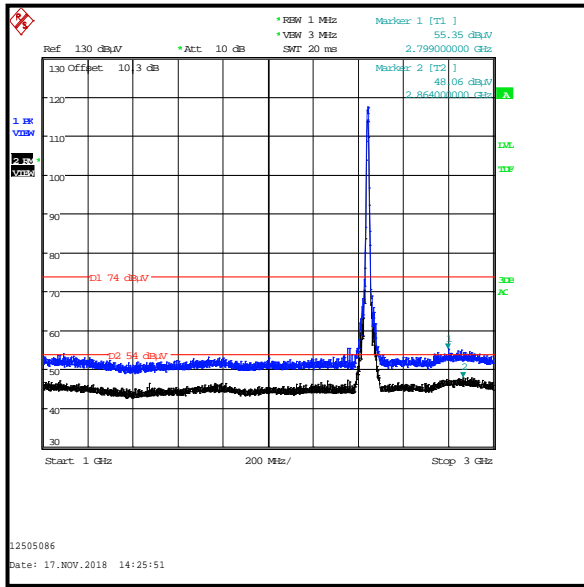
**Transmitter Radiated Emissions (continued)****Results: Peak/Middle Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
2799.000	Vertical	55.4	74.0	18.6	Complied

**Results: Average/Middle Channel**

Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
2864.000	Vertical	48.1	54.0	5.9	Complied

**Transmitter Radiated Emissions (continued)**



### **5.3. Transmitter Band Edge Radiated Emissions**

#### **Test Summary:**

<b>Test Engineers:</b>	Marco Zunarella & John Ferdinand	<b>Test Dates:</b>	22 October 2018 & 23 October 2018
<b>Test Sample Serial Number:</b>	C02WW00PKFMM		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	KDB 558074 Section 8.7 ANSI C63.10 Sections 6.10, 11.11 & 11.12 & 11.13 and Notes below

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	21 to 25
<b>Relative Humidity (%):</b>	39 to 56

#### **Note(s):**

1. The customer requested the following configuration to be used for all measurements:
  - 802.11b – DBPSK / 1 Mbps / SISO / Core Aux
  - 802.11g – BPSK / 6 Mbps / SISO / Core Aux
  - 802.11n HT20 – BPSK / MCS0 / SISO / Core Aux
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The maximum conducted (average) output power was previously measured. In accordance with ANSI C63.10 Section 11.11.1(b), the lower band edge measurement should be performed with a peak detector and the -30 dBc limit applied.
4. As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with ANSI C63.10 Section 11.11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. As the maximum conducted (average) output power was measured using an RMS detector in accordance with ANSI C63.10 Section 11.9.2.2.2, an out-of-band limit line was placed 30 dB (ANSI C63.10 Section 11.11.1(b)) below the peak level. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
5. As the upper band edge is adjacent to a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
6. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11b / 20 MHz / DBPSK / 1 Mbps****Results: Lower Band Edge / Channel 1**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	-30 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
2397.997	Horizontal	62.0	78.9	16.9	Complied
2400.000	Horizontal	57.6	78.9	21.3	Complied

**Results: Upper Band Edge / Peak / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	59.3	74.0	14.7	Complied
2487.763	Horizontal	61.5	74.0	12.5	Complied

**Results: Upper Band Edge / Average / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	48.3	54.0	5.7	Complied

**Results: Upper Band Edge / Peak / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	60.1	74.0	13.9	Complied
2485.327	Horizontal	61.6	74.0	12.4	Complied

**Results: Upper Band Edge / Average / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	48.5	54.0	5.5	Complied

**Results: Upper Band Edge / Peak / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	60.8	74.0	13.2	Complied
2483.580	Horizontal	61.9	74.0	12.1	Complied

**Results: Upper Band Edge / Average / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	49.4	54.0	4.6	Complied
2483.740	Horizontal	49.7	54.0	4.3	Complied

**Transmitter Band Edge Radiated Emissions (continued)**

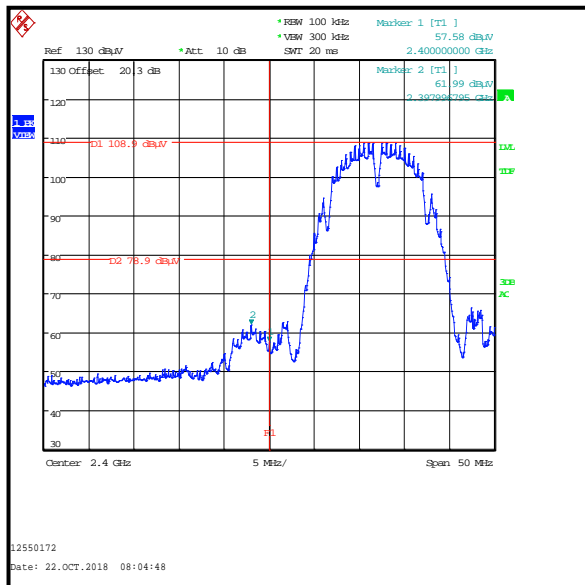
**Results: 802.11b / 20 MHz / DBPSK / 1 Mbps**

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

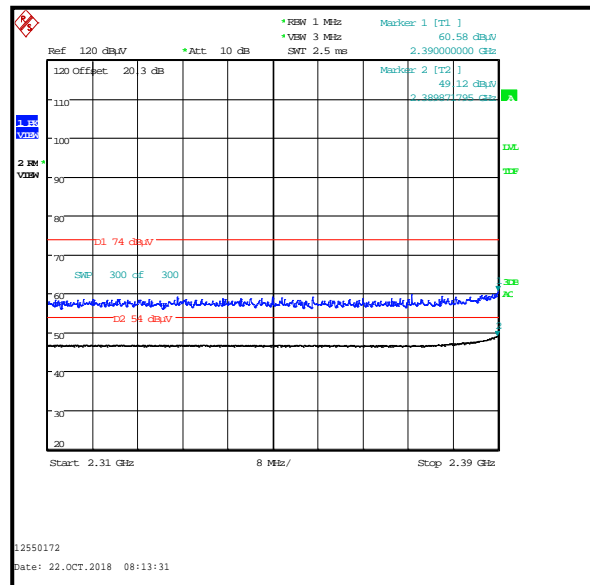
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Horizontal	60.6	74.0	13.4	Complied

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.872	Horizontal	49.1	54.0	4.9	Complied



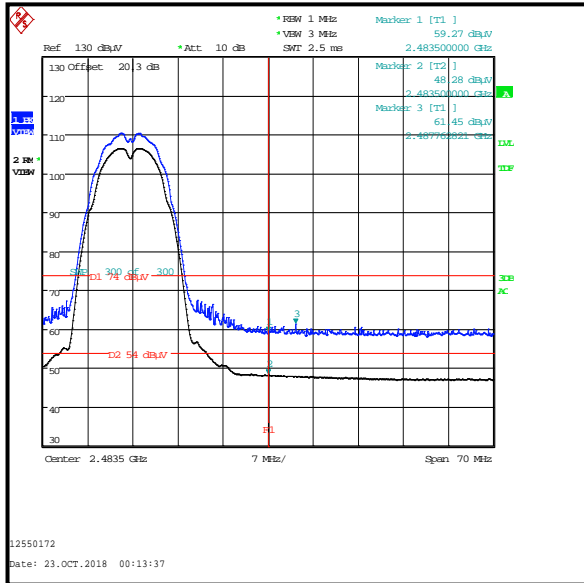
**Lower Band Edge Channel 1**



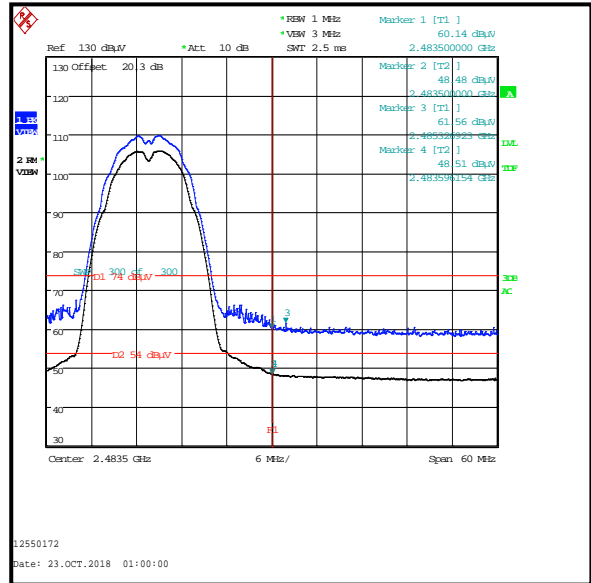
**2310 MHz to 2390 MHz Restricted Band**

### Transmitter Band Edge Radiated Emissions (continued)

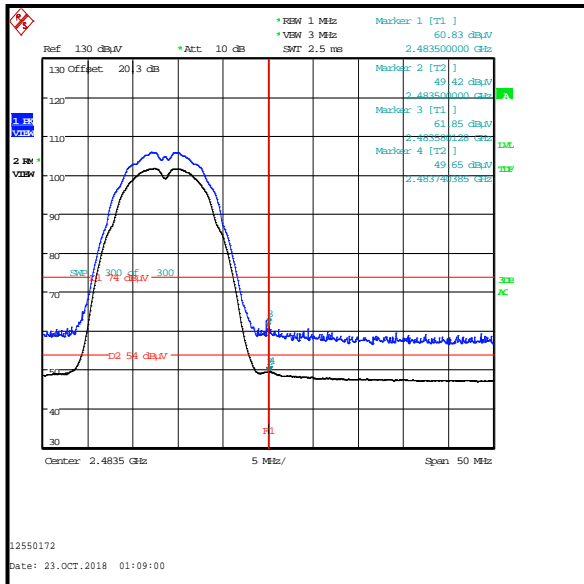
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps



Upper Band Edge  
Channel 11



Upper Band Edge  
Channel 12



Upper Band Edge  
Channel 13

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbps****Results: Lower Band Edge / Channel 1**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	-30 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
2399.519	Horizontal	61.5	70.9	9.4	Complied
2400.000	Horizontal	58.2	70.9	12.7	Complied

**Results: Upper Band Edge / Peak / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	65.1	74.0	8.9	Complied
2483.612	Horizontal	65.6	74.0	8.4	Complied

**Results: Upper Band Edge / Average / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	51.3	54.0	2.7	Complied

**Results: Upper Band Edge / Peak / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	63.9	74.0	10.1	Complied
2484.942	Horizontal	66.2	74.0	7.8	Complied

**Results: Upper Band Edge / Average / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	51.6	54.0	2.4	Complied
2483.596	Horizontal	51.7	54.0	2.3	Complied

**Results: Upper Band Edge / Peak / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	60.2	74.0	13.8	Complied

**Results: Upper Band Edge / Average / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	48.2	54.0	5.8	Complied

**Transmitter Band Edge Radiated Emissions (continued)**

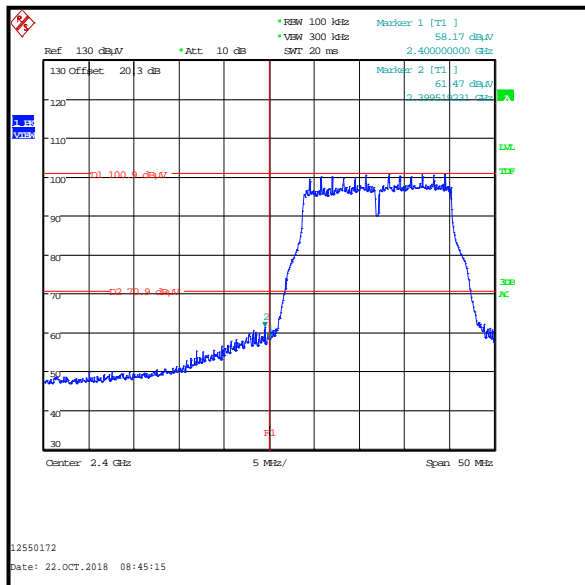
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps**

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

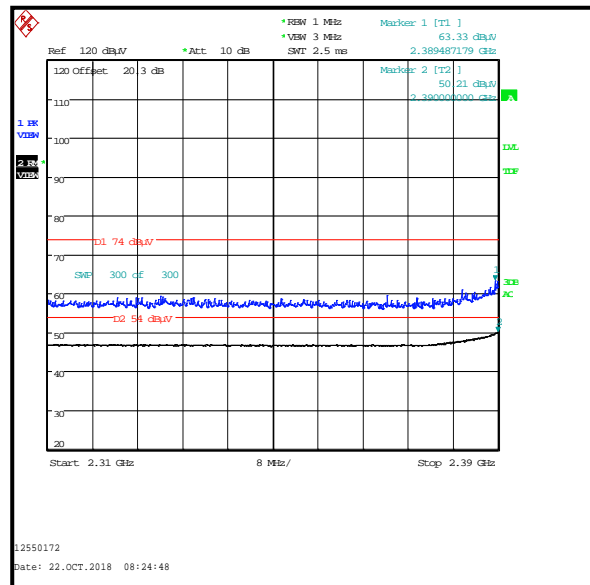
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	Horizontal	63.3	74.0	10.7	Complied

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Horizontal	50.2	54.0	3.8	Complied



**Lower Band Edge Channel 1**

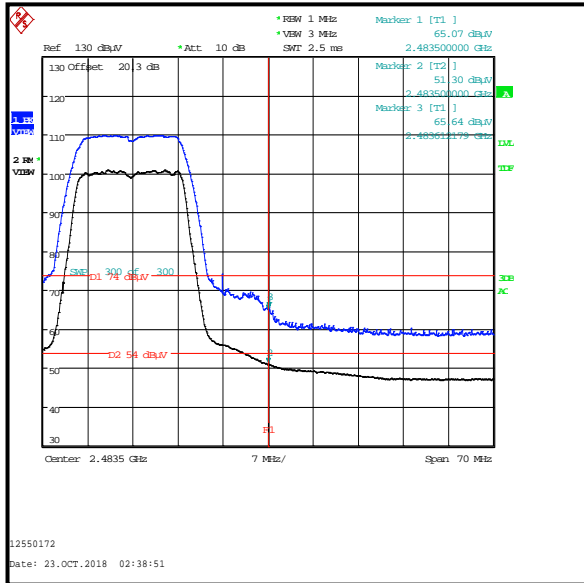


**2310 MHz to 2390 MHz Restricted Band**

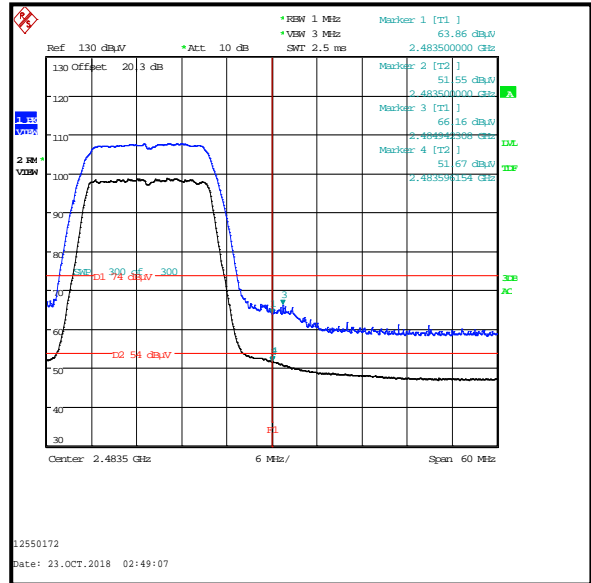


### Transmitter Band Edge Radiated Emissions (continued)

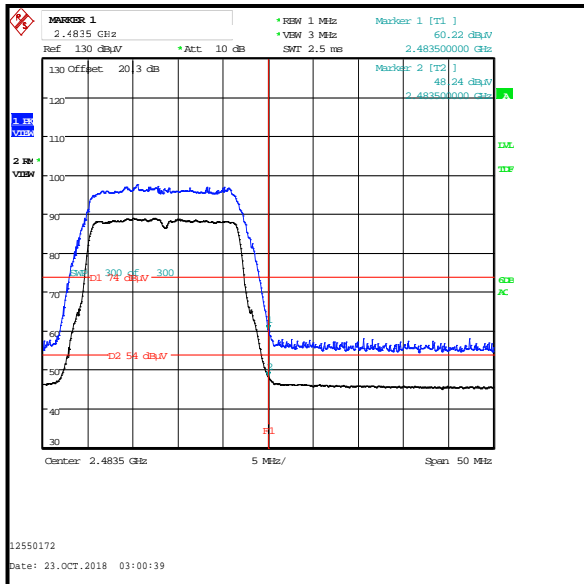
**Results: 802.11g / 20 MHz / BPSK / 6 Mbps**



**Upper Band Edge  
Channel 11**



**Upper Band Edge  
Channel 12**



**Upper Band Edge  
Channel 13**

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n HT20 / SISO / BPSK / MCS0****Results: Lower Band Edge / Channel 1**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	-30 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
2398.478	Horizontal	60.9	71.2	10.3	Complied
2400.000	Horizontal	59.5	71.2	11.7	Complied

**Results: Upper Band Edge / Peak / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	70.3	74.0	3.7	Complied

**Results: Upper Band Edge / Average / Channel 11**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	52.0	54.0	2.0	Complied

**Results: Upper Band Edge / Peak / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	68.6	74.0	5.4	Complied

**Results: Upper Band Edge / Average / Channel 12**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	51.7	54.0	2.3	Complied

**Results: Upper Band Edge / Peak / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	62.2	74.0	11.8	Complied
2483.580	Horizontal	62.5	74.0	11.5	Complied

**Results: Upper Band Edge / Average / Channel 13**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	Horizontal	48.1	54.0	5.9	Complied

**Transmitter Band Edge Radiated Emissions (continued)**

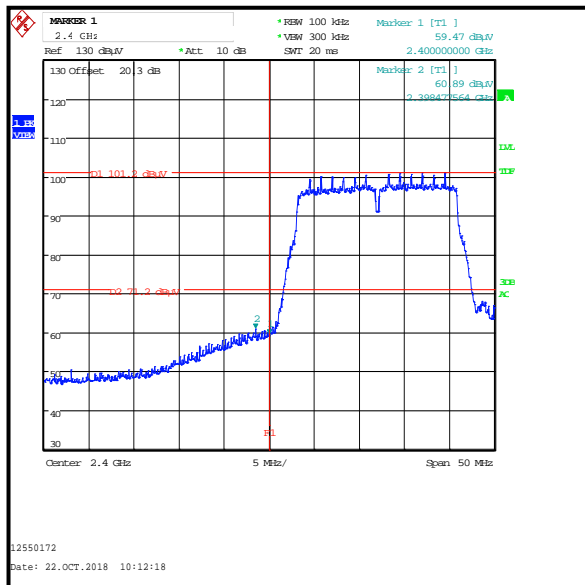
**Results: 802.11n HT20 / SISO / BPSK / MCS0**

**Results: 2310 MHz to 2390 MHz Restricted Band / Peak**

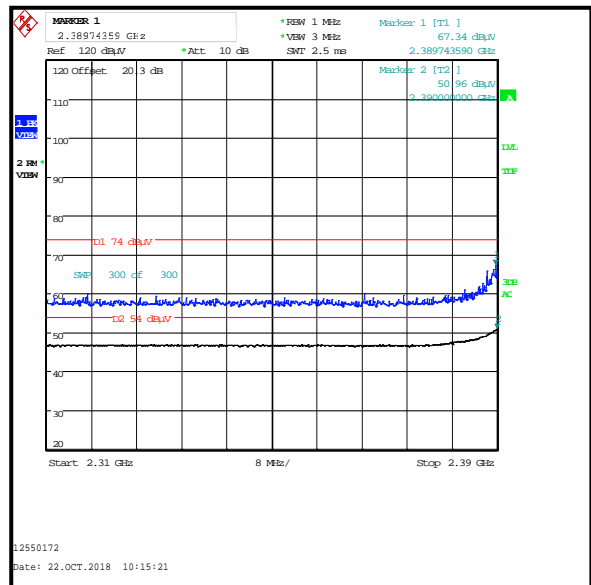
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2389.744	Horizontal	67.3	74.0	6.7	Complied

**Results: 2310 MHz to 2390 MHz Restricted Band / Average**

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2390.000	Horizontal	51.0	54.0	3.0	Complied



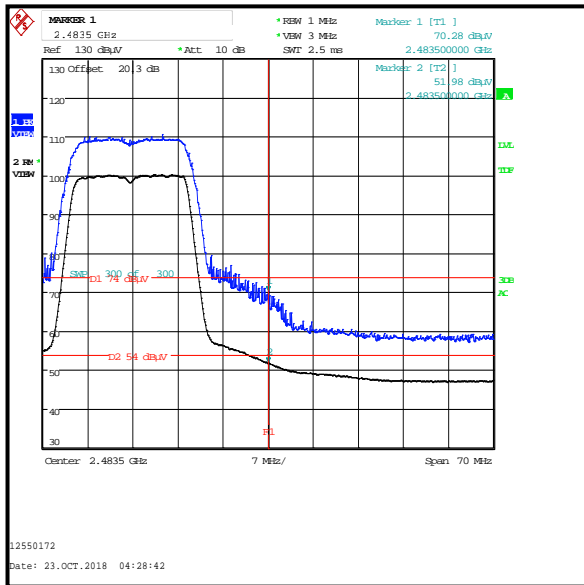
**Lower Band Edge Channel 1**



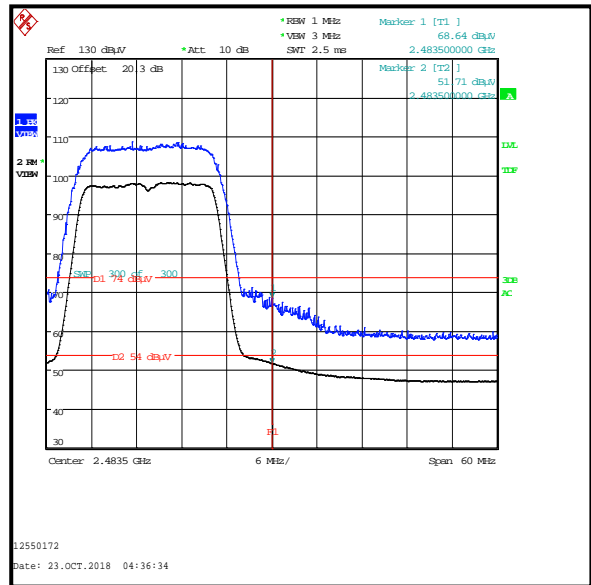
**2310 MHz to 2390 MHz Restricted Band**

**Transmitter Band Edge Radiated Emissions (continued)**

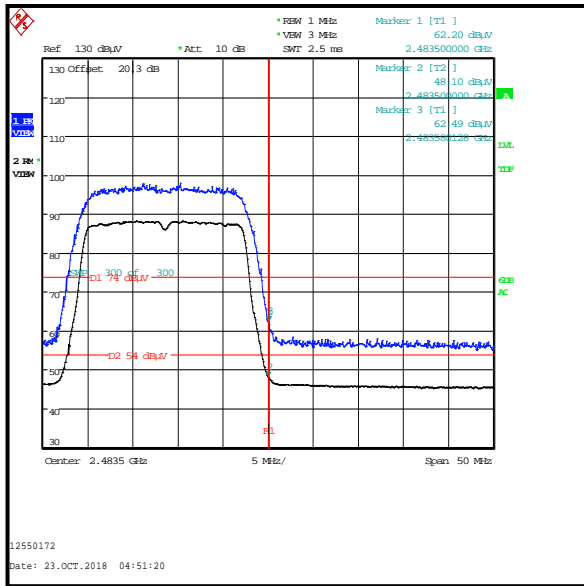
**Results: 802.11n HT20 / SISO / BPSK / MCS0**



**Upper Band Edge  
Channel 11**



**Upper Band Edge  
Channel 12**



**Upper Band Edge  
Channel 13**

--- END OF REPORT ---