TEST REPORT

Test Report No. : UL-RPT-RP12718494JD09C V2.0

Customer	:	Apple Inc.
Model No.	:	A1991
FCC ID	:	BCGA1991
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 except in full, 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 2.0 supersedes all previous versions.

Date of Issue: 17 September 2019

Checked by:

Sarah Williams
Senior Test Engineer, Radio Laboratory

Company Signatory:

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Senior Test Engineer, Radio Laboratory
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Customer Information

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

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	15/07/2019	Initial Version	Sarah Williams
2.0	17/09/2019	Address TCB questions	Sarah Williams

Table of Contents

1. Attestation of Test Results

1.1. Description of EUT

The Equipment Under Test (EUT) was a Desktop computer with *Bluetooth*, *Bluetooth* Low Energy and 802.11 a/b/g/n/ac capabilities in the 2.4 GHz and 5.0 GHz bands.

1.2. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
Site Registration:	621311
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	03 May 2019 to 03 June 2019

1.3. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
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):

1. 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.
2. 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

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019
Title:	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”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
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)
M2004	Thermohygrometer	Testo	608-H1	45046425	06 Jan 2020	12
M2033	Signal Analyser	Rohde & Schwarz	FSV13	101667	29 Jan 2020	12
M2024	Power Sensor	Boonton	55006	9824	11 Jan 2020	12
A3027	Attenuator	Broadwave Technologies Inc.	351-311-006	#1	Calibrated before use	-
A3004	RF Switch	Pickering Interfaces	64-102-002	XZ363230	Calibrated before use	-
A3180	Attenuator	Pasternack	PE7047-3	Not stated	Calibrated before use	-
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	08 May 2020	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	20190208	08 February 2019

Test and Measurement Equipment (continued)

Test Equipment Used for Transmitter Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	20 Sep 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	01 Apr 2020	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	14 Sep 2019	12
A3141	Pre-Amplifier	Schwarzbeck	BBV 9718 B	00021	21 Nov 2019	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721 - 023	08 Feb 2020	12
A553	Antenna	Chase	CBL6111A	1593	08 Oct 2019	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	08 Feb 2020	12
A3139	Antenna	Schwarzbeck	HWRD 750	00027	04 Oct 2019	12
A3112	Attenuator	AtlanTecRF	AN18-06	219706#2	08 Oct 2019	12
A3085	Low Pass Filter	AtlanTecRF	AFL-02000	18051600014	09 Apr 2020	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	16 Feb 2020	12
M2003	Thermohygrometer	Testo	608-H1	45046641	06 Jan 2020	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	16 Feb 2020	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	08 May 2020	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	12 Feb 2020	12
A3142	Pre-Amplifier	Schwarzbeck	BBV 9718 B	00020	12 Feb 2020	12
A2889	Antenna	Schwarzbeck	BBHA 9120B	BBHA 9120 B 653	12 Feb 2020	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	12 Feb 2020	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	20 Feb 2020	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	20 Feb 2020	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	20 Feb 2020	12

Test and Measurement Equipment (continued)

Test Equipment Used for Transmitter Band Edge Radiated Emissions

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	01 Apr 2020	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	04 Apr 2020	12
A3138	Antenna	Schwarzbeck	BBHA 9120B	00702	03 Oct 2019	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	832827#1	04 Mar 2020	12
M2003	Thermohygrometer	Testo	608-H1	45046641	06 Jan 2020	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	16 Feb 2020	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	08 May 2020	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	20 Sep 2019	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	12 Feb 2020	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	12 Feb 2020	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	20 Feb 2020	12

Test Measurement Software/Firmware Used

Name	Version	Release Date
UL VS LTD Replay	1	29 November 2018

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Apple
Model Name or Number:	A1991
Test Sample Serial Number:	C02YF007MFLF *(Conducted sample)*
Hardware Version:	REV 1.0
Software Version:	18F98
FCC ID:	BCGA1991

Brand Name:	Apple
Model Name or Number:	A1991
Test Sample Serial Number:	C02YF00CMFLF *(Radiated sample #1)*
Hardware Version:	REV 1.0
Software Version:	18F98
FCC ID:	BCGA1991

Brand Name:	Apple
Model Name or Number:	A1991
Test Sample Serial Number:	C02YD006MFLQ *(Radiated sample #2)*
Hardware Version:	REV 1.0
Software Version:	18F98
FCC ID:	BCGA1991

3.2. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3. Additional Information Related to Testing

Technology Tested:	WLAN (IEEE 802.11b,g,n) / Digital Transmission System	
Type of Unit:	Transceiver	
Modulation Type:	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM	
Data Rates:	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)
Power Supply Requirement(s):	Nominal	Constant 3.8 VDC via 120 VAC 60 Hz AC/DC supply
Maximum Conducted Output Power:	22.8 dBm	
Channel Spacing:	20 MHz	
Transmit Frequency Range:	2412 MHz to 2472 MHz	

Transmit Channels Tested:	**Channel Number**	**Channel Frequency (MHz)**
	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 an integrated antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2400 to 2438.5	4.5

3.5. Description of Test Setup

Support Equipment

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

Description:	Test Laptop
Brand Name:	Apple
Model Name or Number:	MacBook Pro
Serial Number:	C02Q81PFG3QD

Description:	USB Keyboard
Brand Name:	Apple
Model Name or Number:	A1243
Serial Number:	C02T300BHXOX

Description:	USB Mouse
Brand Name:	Apple
Model Name or Number:	A1152
Serial Number:	Not marked or stated

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

Description:	USB-C to USB Adapter. Quantity 4
Brand Name:	Apple
Model Name or Number:	A1632
Serial Number:	Not marked or stated

Description:	HDMI Monitor
Brand Name:	Dell
Model Name or Number:	S2218H
Serial Number:	Not marked or stated

Description:	USB Hub
Brand Name:	Hama
Model Name or Number:	0078498
Serial Number:	09825891600

Support Equipment (continued)

Description:	Ethernet Router
Brand Name:	Netgear
Model Name or Number:	GS605v3
Serial Number:	1YG194390218E

Description:	Ethernet Cable. Length 3.0 metres. Quantity 2
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	HDMI Cable. Length 3.0 metres. Quantity 2
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	USB Cable. Length 3.0 metres. Quantity 3
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Test Laptop
Brand Name:	Apple
Model Name or Number:	MacBook Pro
Serial Number:	C02VT0AUHX87

Description:	HDMI Hub
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	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

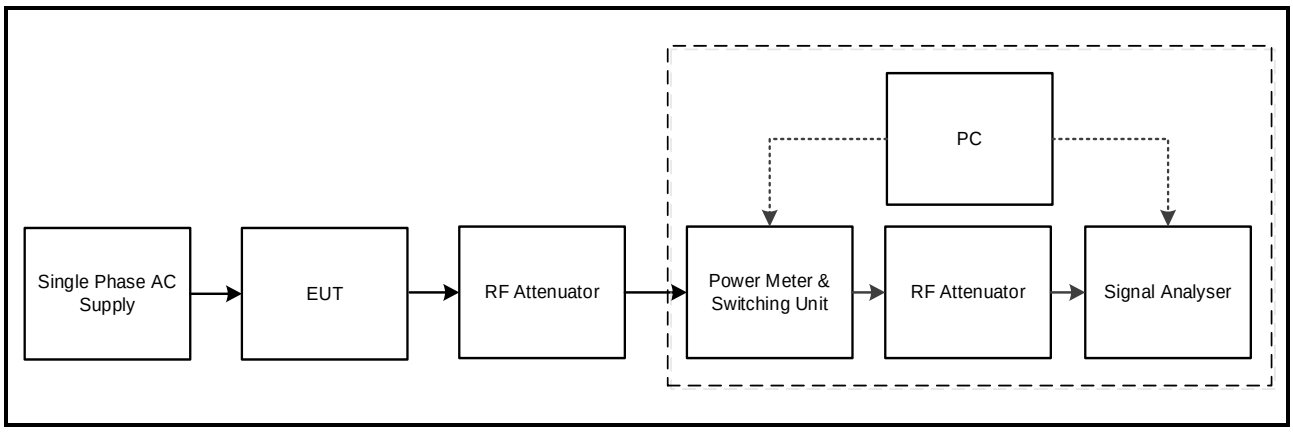
The EUT was tested in the following configuration(s):

- 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 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 with a data rate of 802.11b / SISO / 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 the USB Keyboard, USB Mouse and PHF connected to the EUT. The remaining USB ports were connected with a USB cable to a hub. The USB-C ports were connected via a USB C-A adaptor and USB cable to a hub. The ethernet ports were terminated into a router. The HDMI ports were terminated into a hub. The router and hubs were placed under the floor inside the chamber.
- 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:

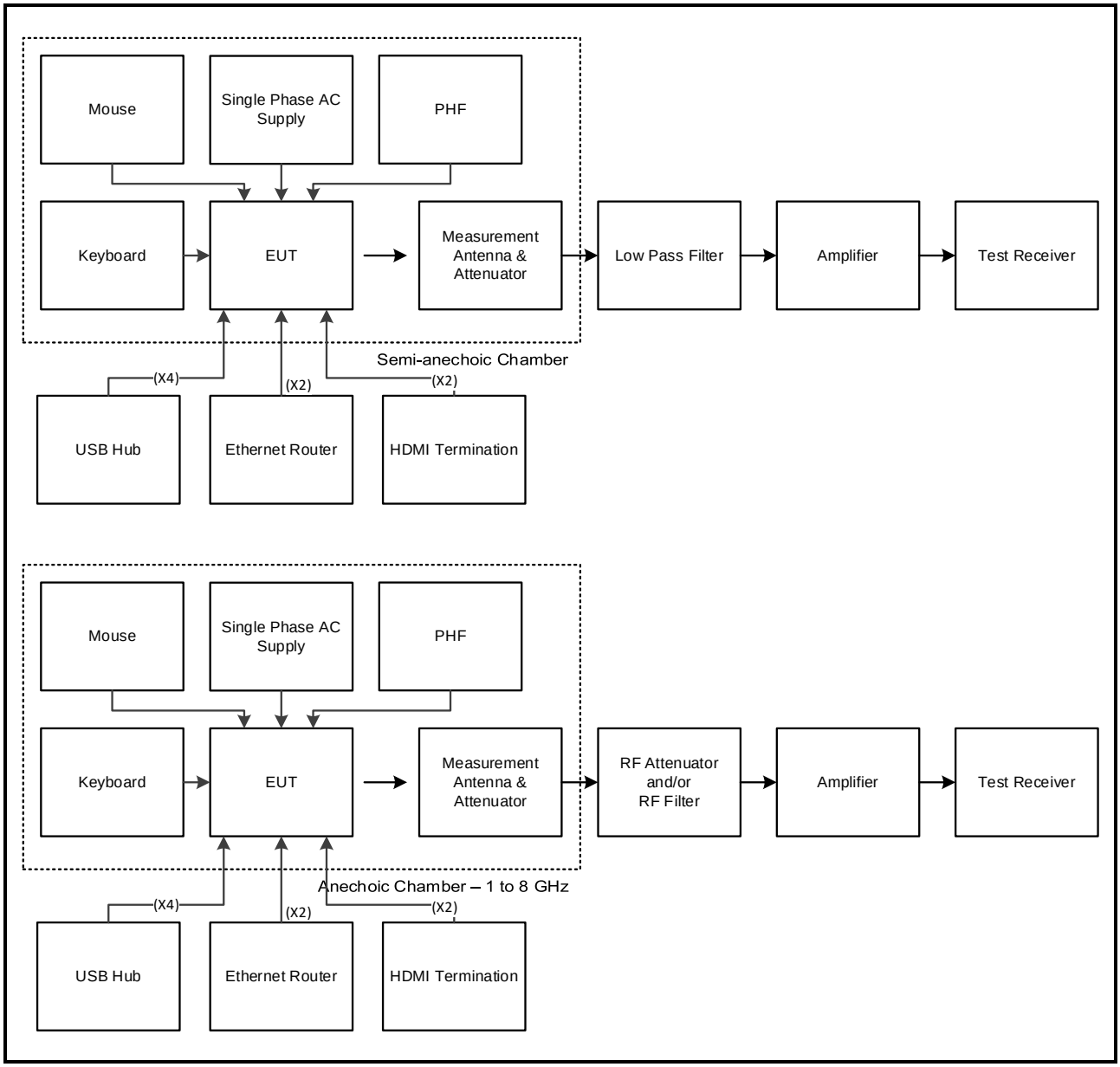
Test Setup for Transmitter Conducted Tests



Test Setup Diagrams (continued)

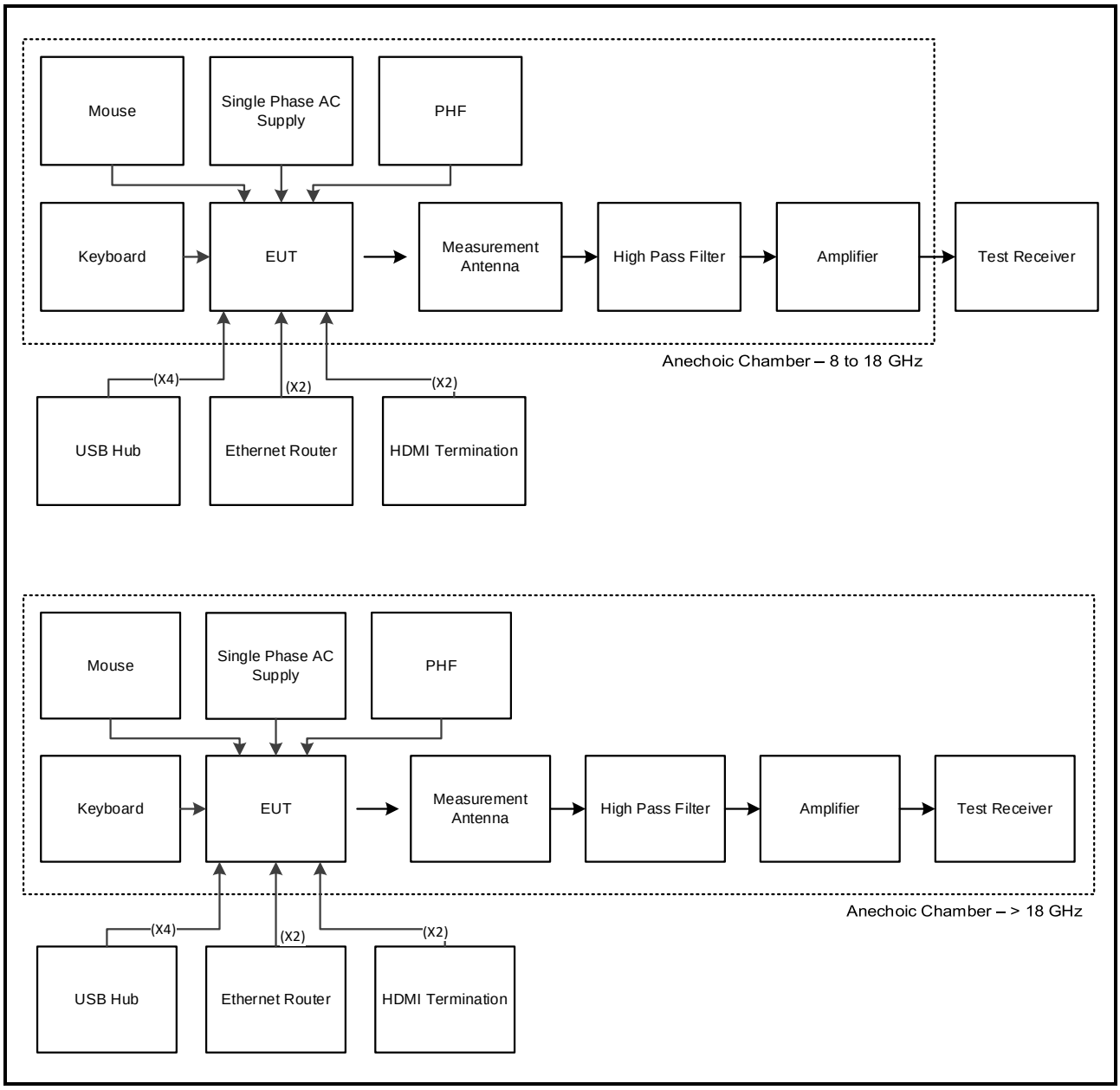
Radiated Tests:

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:

Test Engineer:	Max Passell	**Test Dates:**	30 May 2019 & 03 June 2019
Test Sample Serial Number:	C02YF007MFLF		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Section 11.8.1

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	44 to 50

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 in accordance with ANSI C63.10 Section 11.8.1 Option 1 measurement procedure. 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.

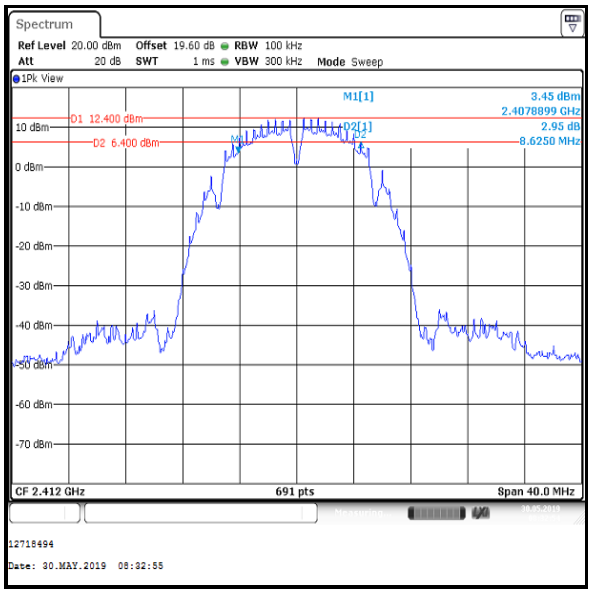
Transmitter Minimum 6 dB Bandwidth (continued)

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

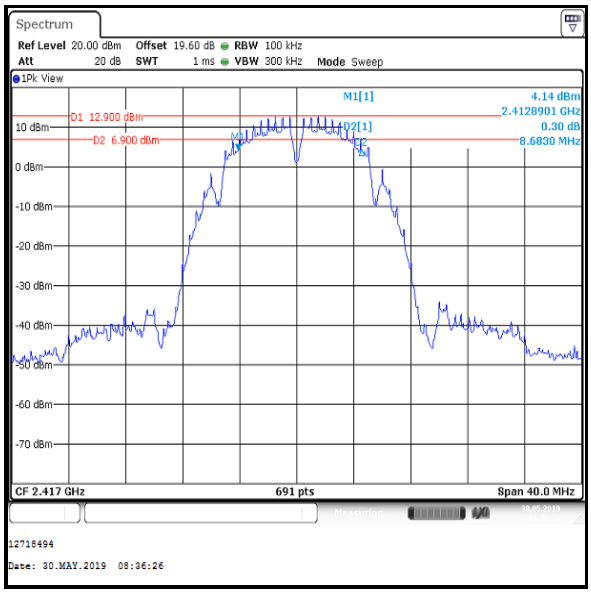
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	8625	≥500	8125	Complied
2	8683	≥500	8183	Complied
3	8683	≥500	8183	Complied
6	9146	≥500	8646	Complied
7	9146	≥500	8646	Complied
11	8683	≥500	8183	Complied
12	8683	≥500	8183	Complied
13	8683	≥500	8183	Complied

Transmitter Minimum 6 dB Bandwidth (continued)

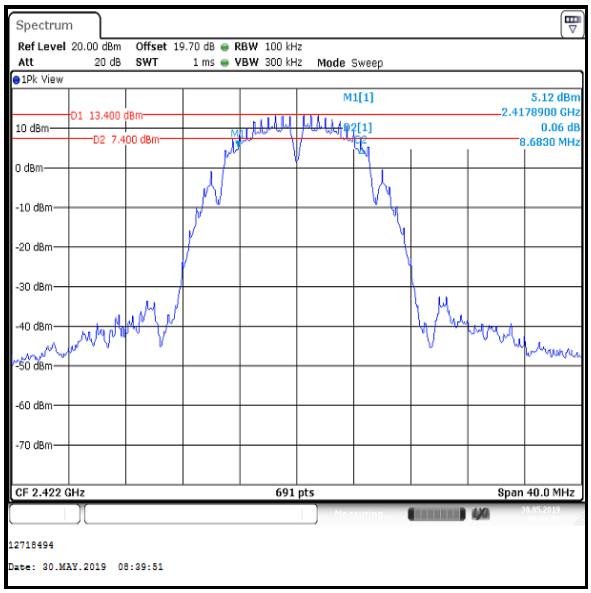
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



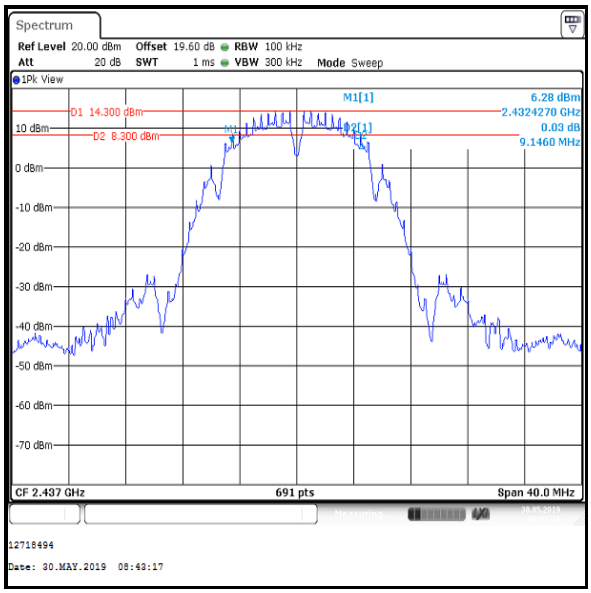
Channel 1



Channel 2



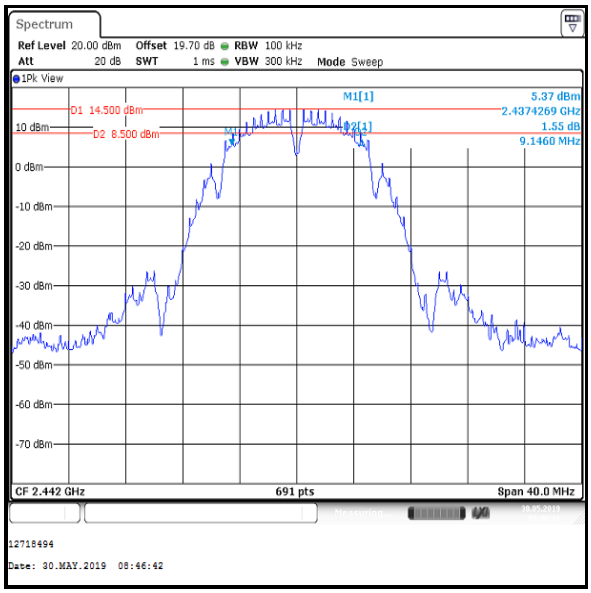
Channel 3



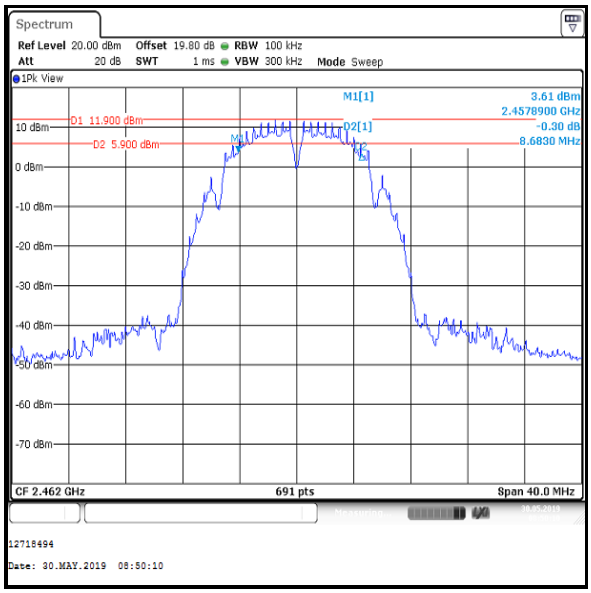
Channel 6

Transmitter Minimum 6 dB Bandwidth (continued)

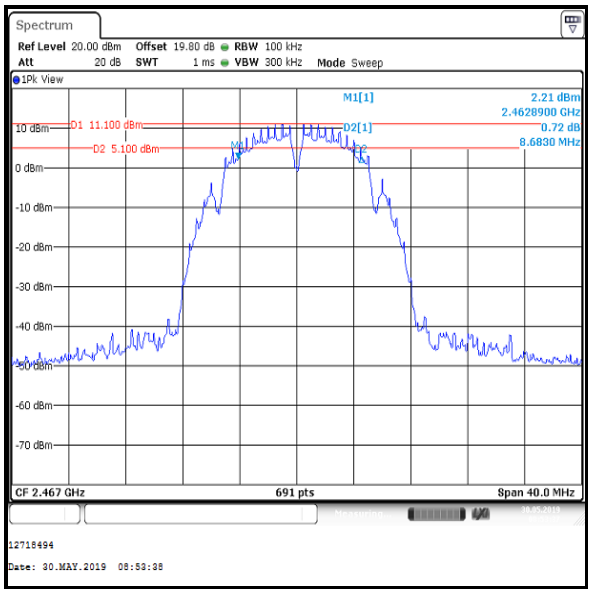
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



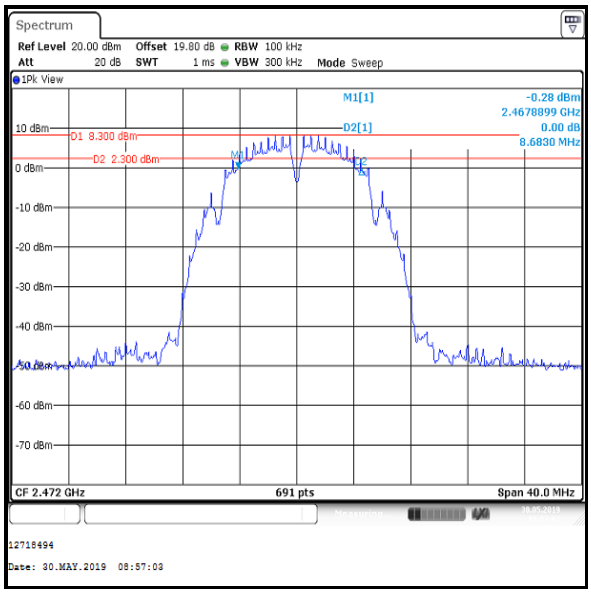
Channel 7



Channel 11



Channel 12



Channel 13

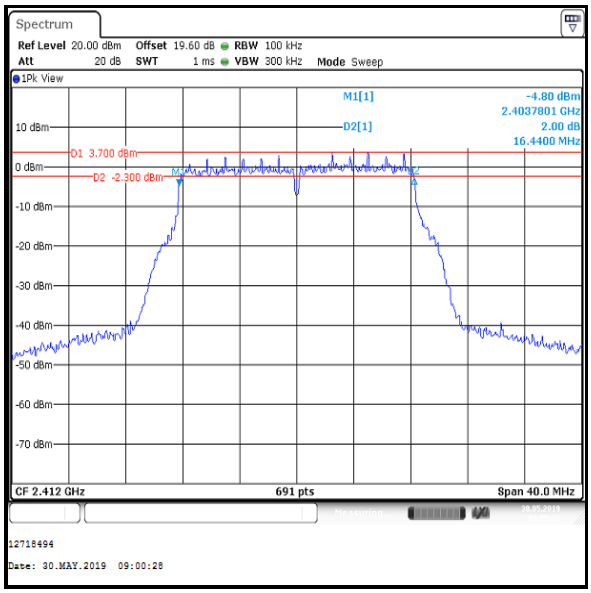
Transmitter Minimum 6 dB Bandwidth (continued)

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

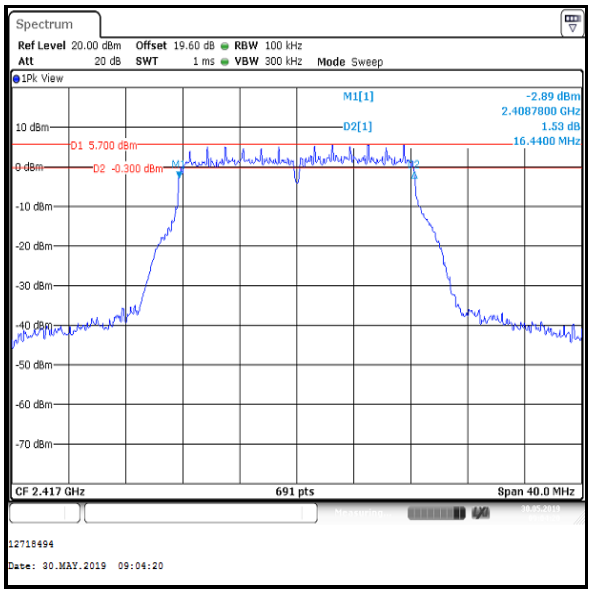
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	16440	≥500	15940	Complied
2	16440	≥500	15940	Complied
3	16440	≥500	15940	Complied
6	16440	≥500	15940	Complied
7	16440	≥500	15940	Complied
11	16440	≥500	15940	Complied
12	16440	≥500	15940	Complied
13	16440	≥500	15940	Complied

Transmitter Minimum 6 dB Bandwidth (continued)

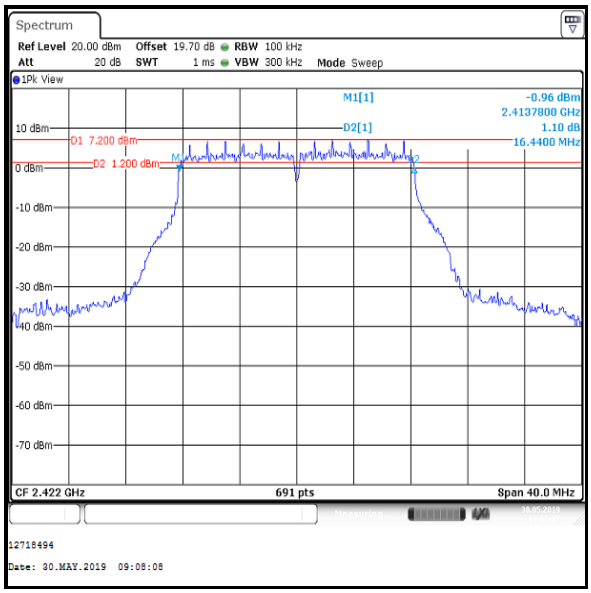
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



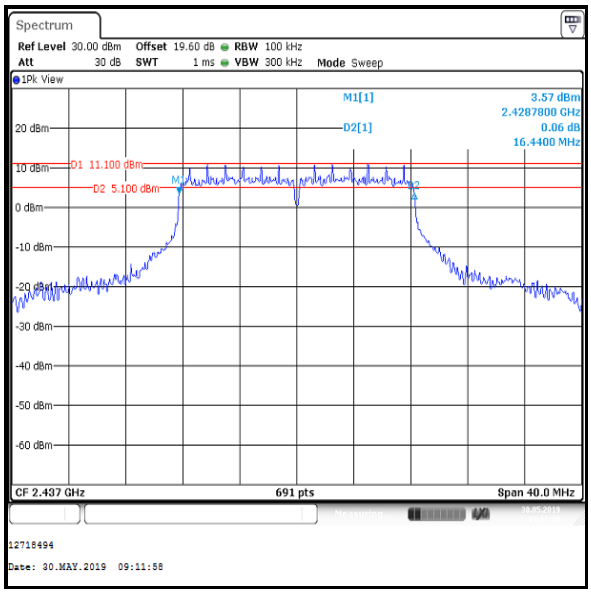
Channel 1



Channel 2



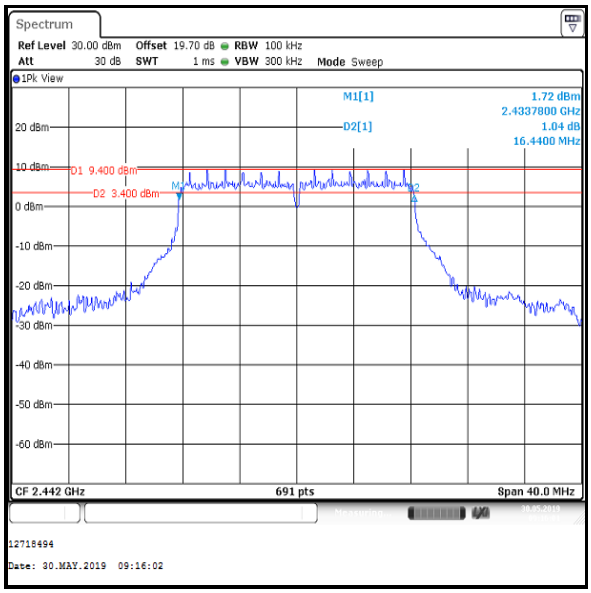
Channel 3



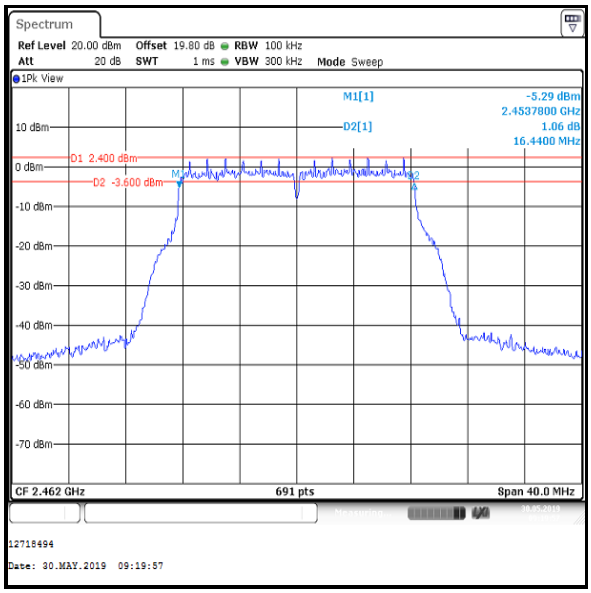
Channel 6

Transmitter Minimum 6 dB Bandwidth (continued)

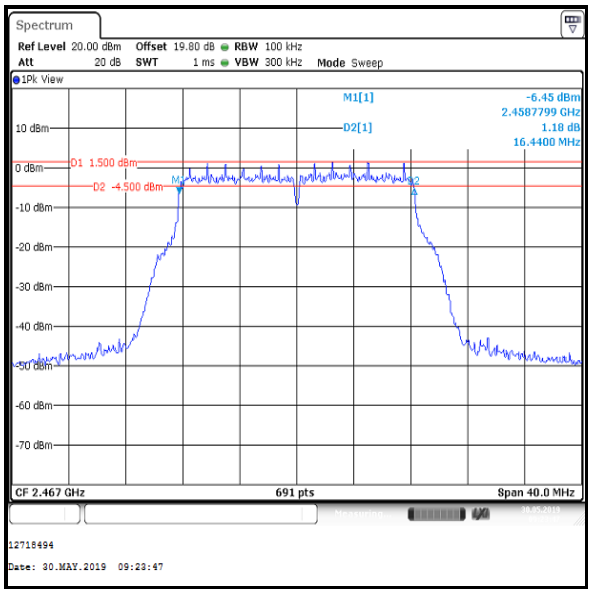
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



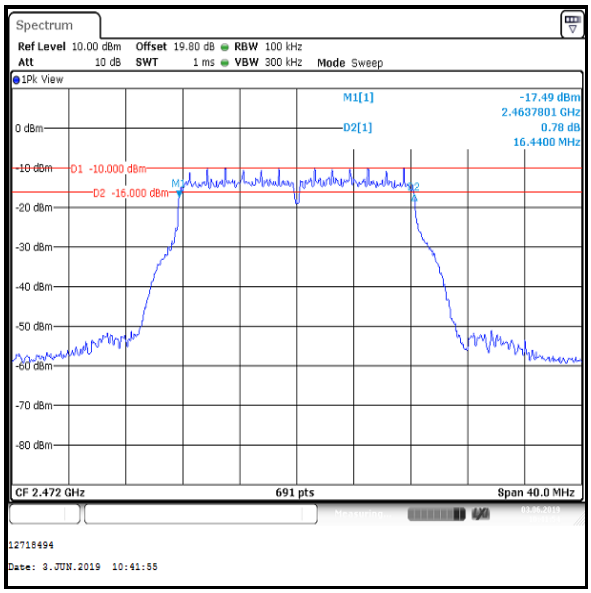
Channel 7



Channel 11



Channel 12



Channel 13

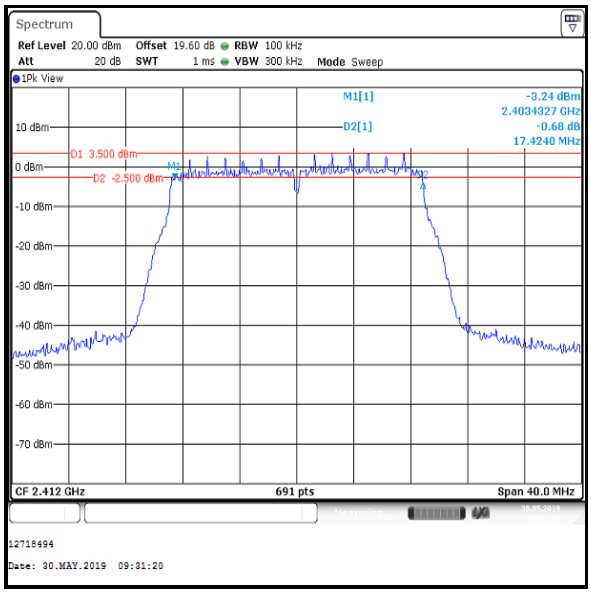
Transmitter Minimum 6 dB Bandwidth (continued)

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

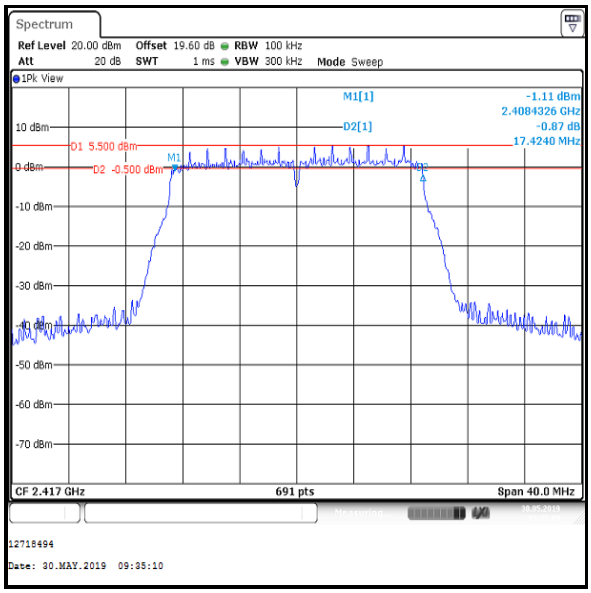
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
1	17424	≥500	16924	Complied
2	17424	≥500	16924	Complied
3	17656	≥500	17156	Complied
6	17713	≥500	17213	Complied
7	17713	≥500	17213	Complied
11	17713	≥500	17213	Complied
12	17656	≥500	17156	Complied
13	17656	≥500	17156	Complied

Transmitter Minimum 6 dB Bandwidth (continued)

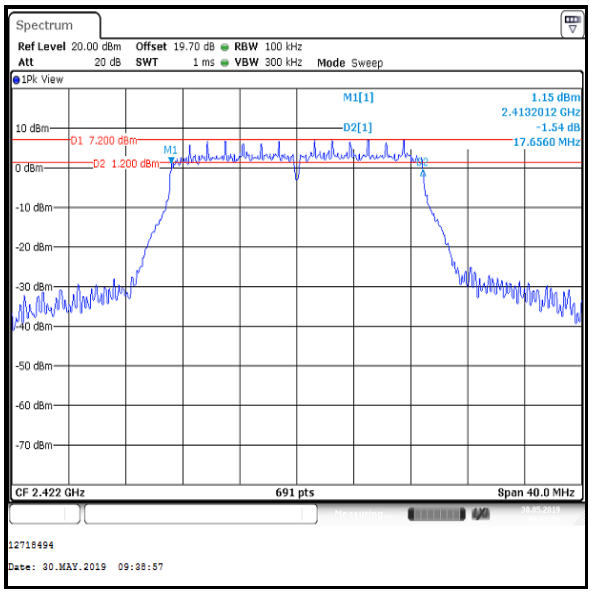
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



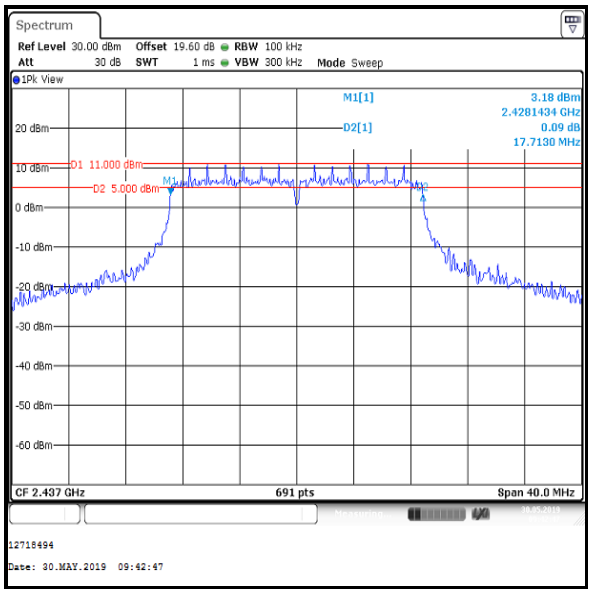
Channel 1



Channel 2



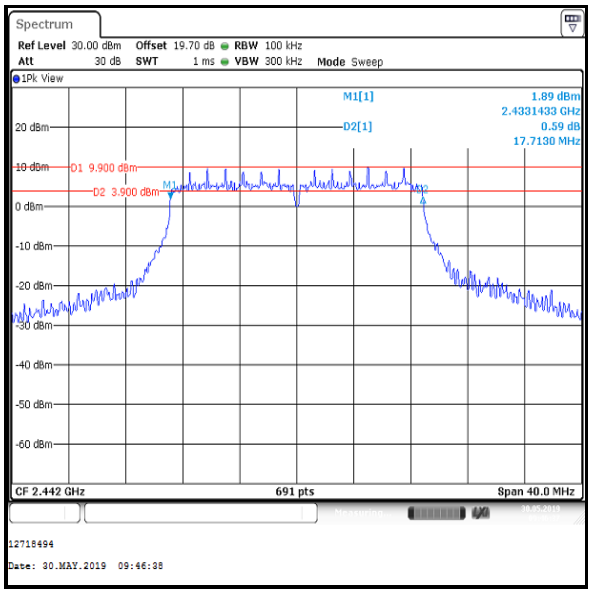
Channel 3



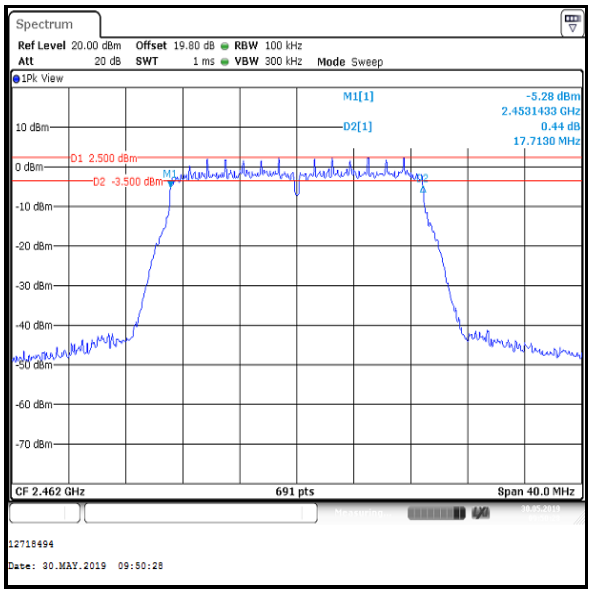
Channel 6

Transmitter Minimum 6 dB Bandwidth (continued)

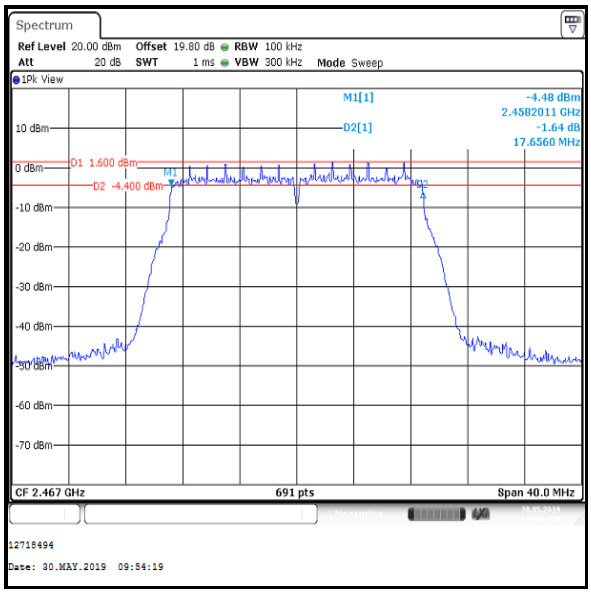
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



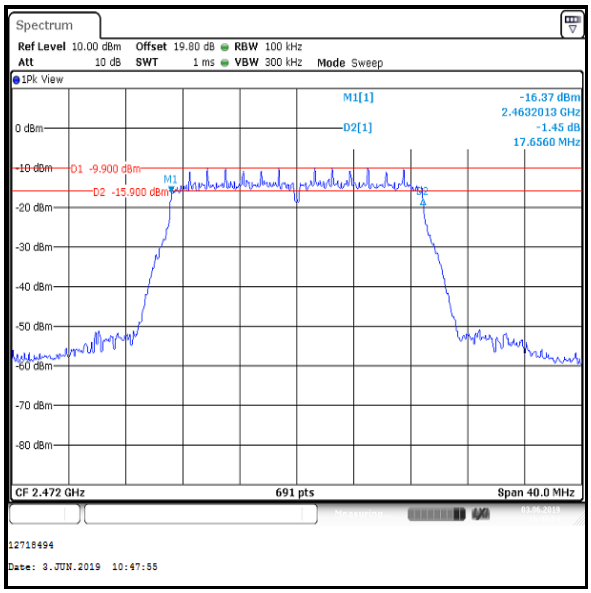
Channel 7



Channel 11



Channel 12



Channel 13

4.2. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Max Passell	**Test Dates:**	30 May 2019 & 03 June 2019
Test Sample Serial Number:	C02YF007MFLF		

FCC Reference:	Part 15.247(e)
Test Method Used:	FCC KDB 558074 Section 8.4 referencing ANSI C63.10 Section 11.10.3

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	44 to 50

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 Section 11.10.3 Method AVGPSD-1. The signal analyser resolution bandwidth was set to 3 kHz or 100 kHz and video bandwidth 10 kHz or 300 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.

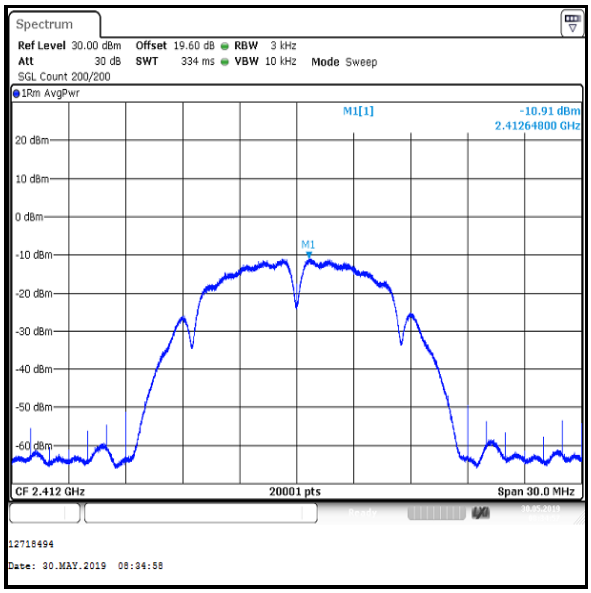
Transmitter Power Spectral Density (continued)

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

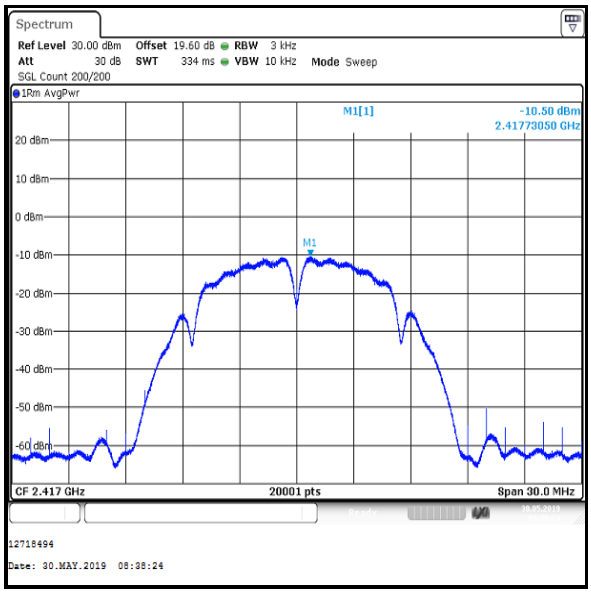
Channel	PSD (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
1	-10.9	8.0	18.9	Complied
2	-10.5	8.0	18.5	Complied
3	-9.8	8.0	17.8	Complied
6	-8.9	8.0	16.9	Complied
7	-8.8	8.0	16.8	Complied
11	-11.4	8.0	19.4	Complied
12	-12.2	8.0	20.2	Complied
13	-15.0	8.0	23.0	Complied

Transmitter Power Spectral Density (continued)

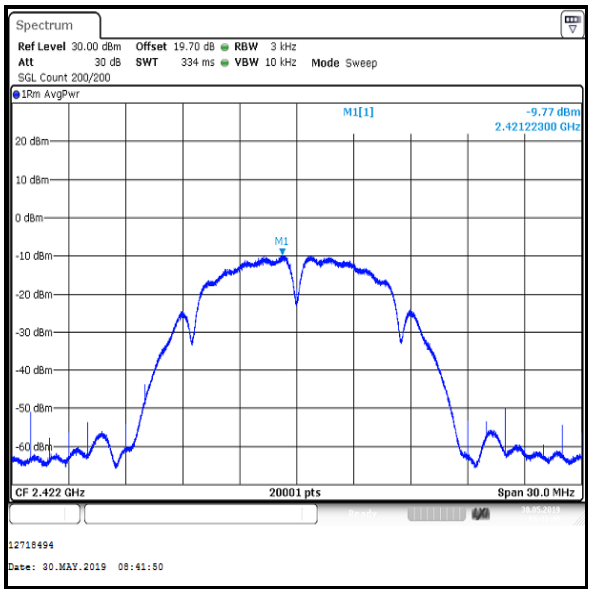
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



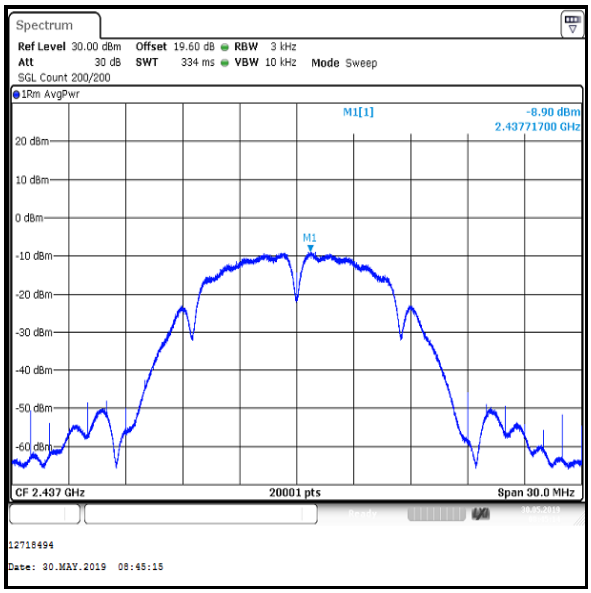
Channel 1



Channel 2



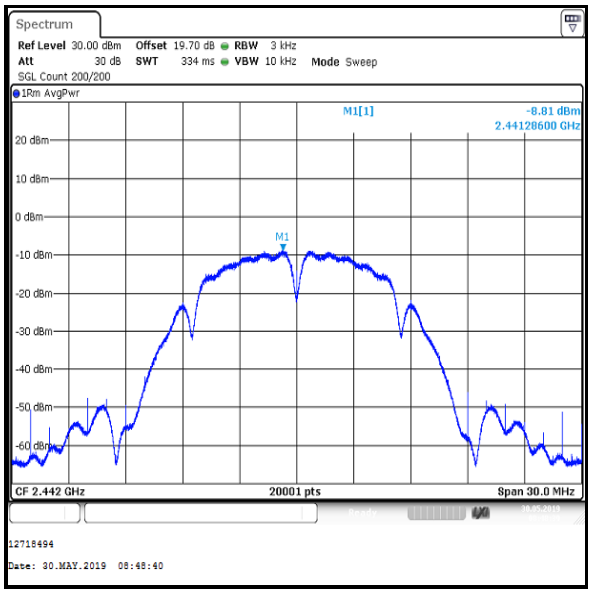
Channel 3



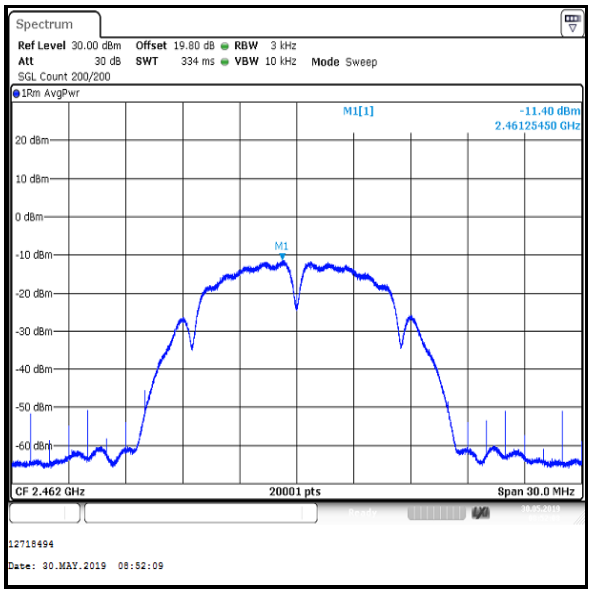
Channel 6

Transmitter Power Spectral Density (continued)

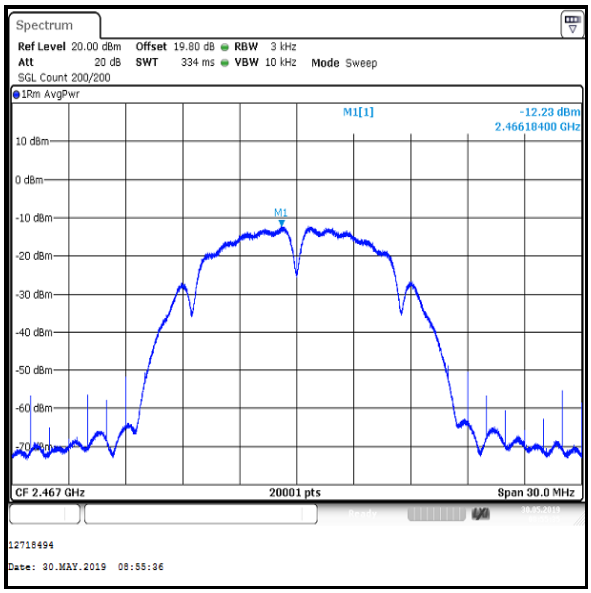
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



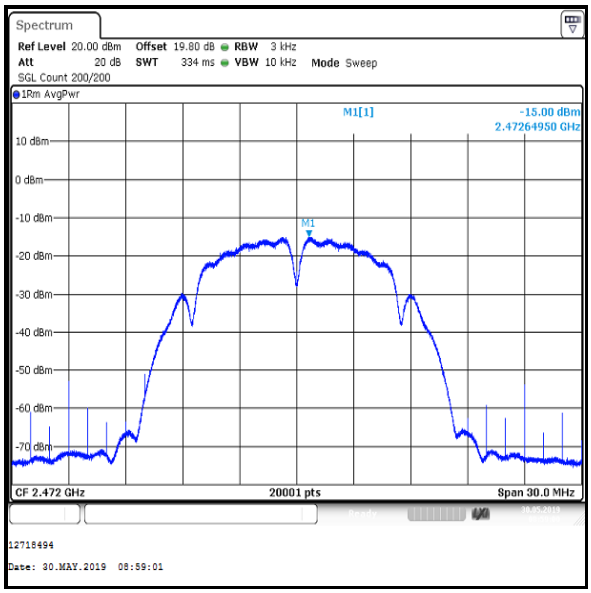
Channel 7



Channel 11



Channel 12



Channel 13

Transmitter Power Spectral Density (continued)

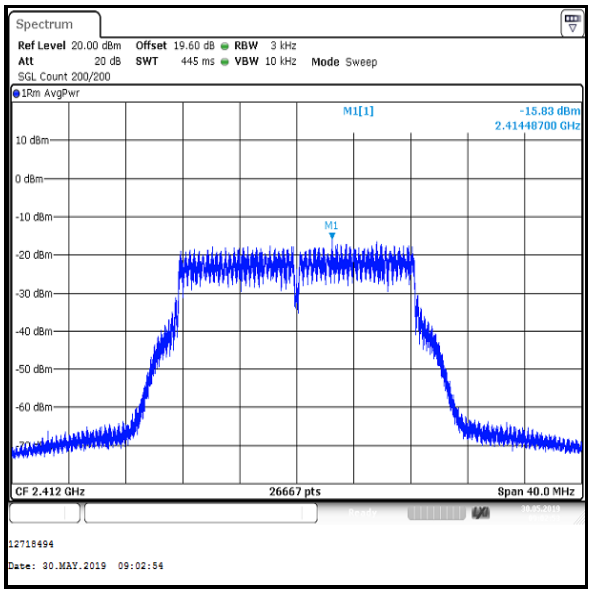
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2

Channel	PSD (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
1	-15.8	8.0	23.8	Complied
2	-14.0	8.0	22.0	Complied
3	-12.2	8.0	20.2	Complied
6	-8.9	8.0	16.9	Complied
7	-10.2	8.0	18.2	Complied
11	-17.2	8.0	25.2	Complied
12	-18.1	8.0	26.1	Complied

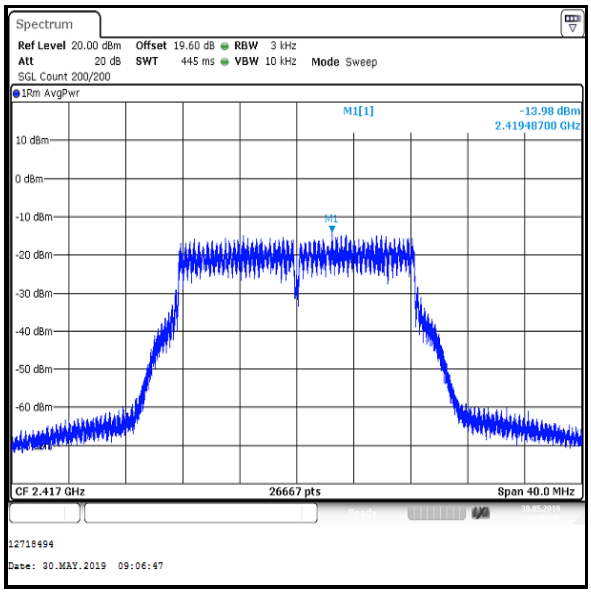
Channel	PSD (dBm/100 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
13	-18.6	8.0	26.6	Complied

Transmitter Power Spectral Density (continued)

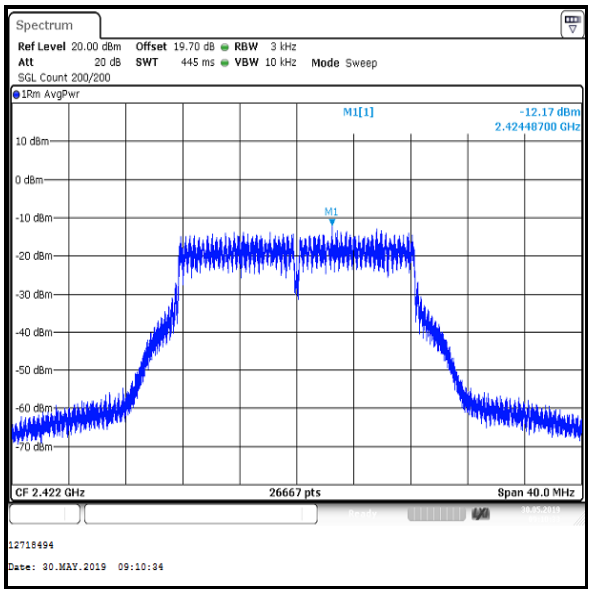
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



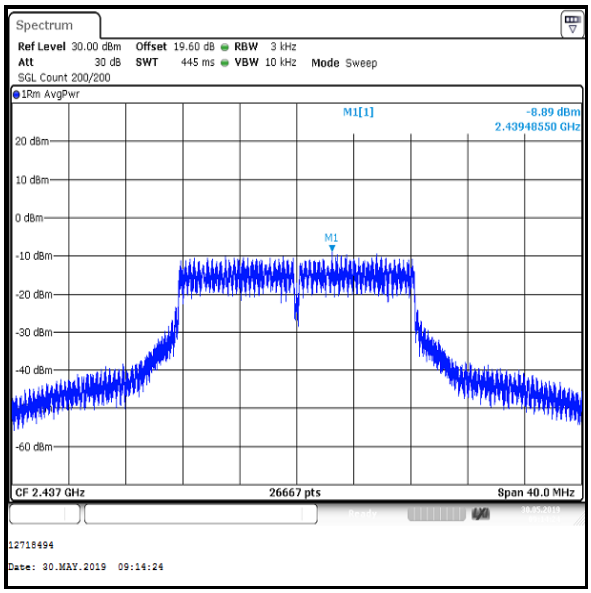
Channel 1



Channel 2



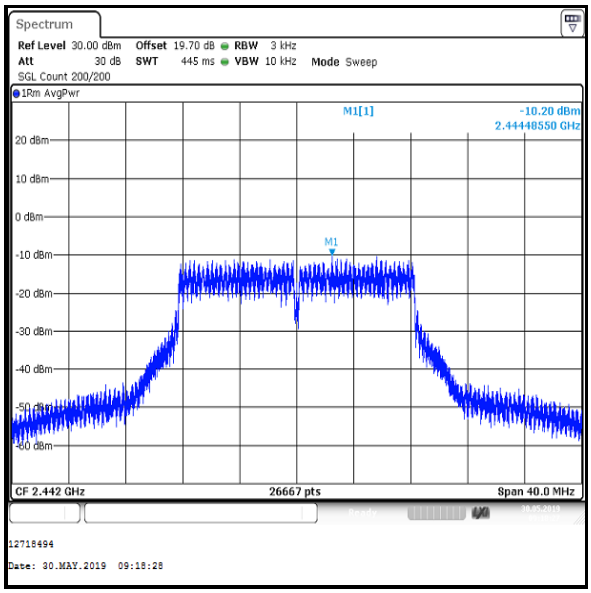
Channel 3



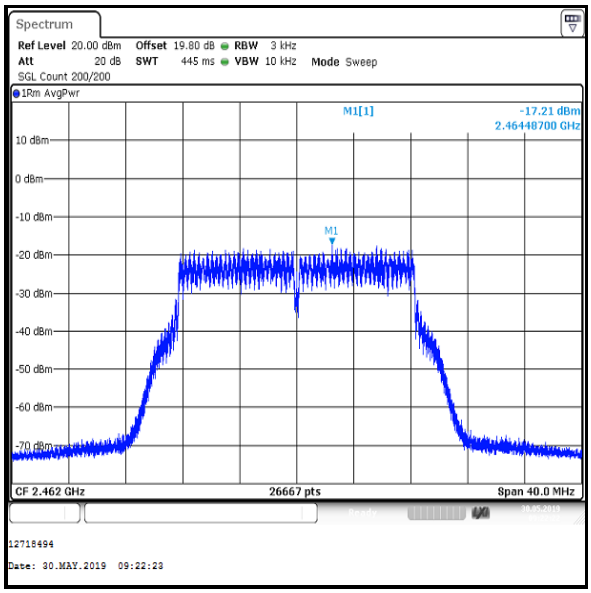
Channel 6

Transmitter Power Spectral Density (continued)

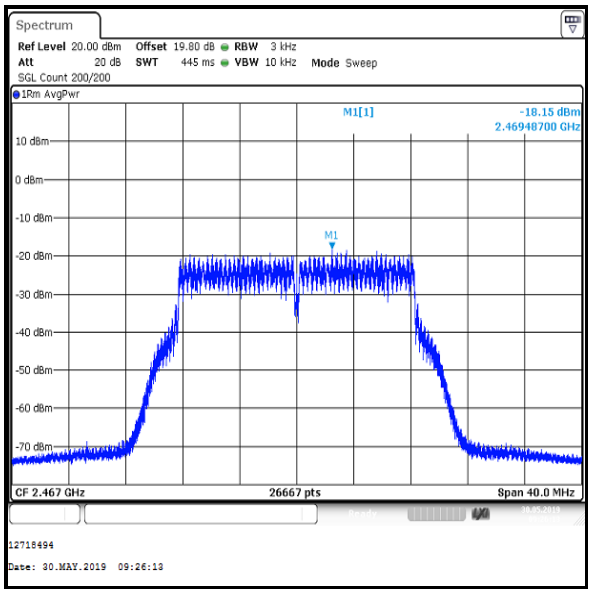
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



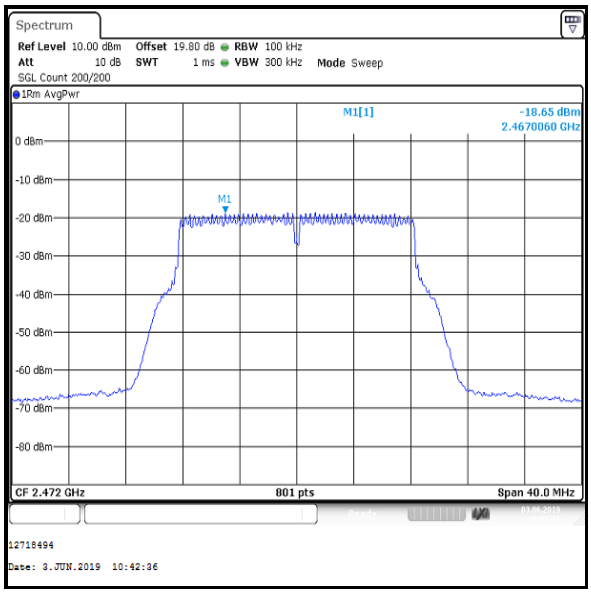
Channel 7



Channel 11



Channel 12



Channel 13

Transmitter Power Spectral Density (continued)

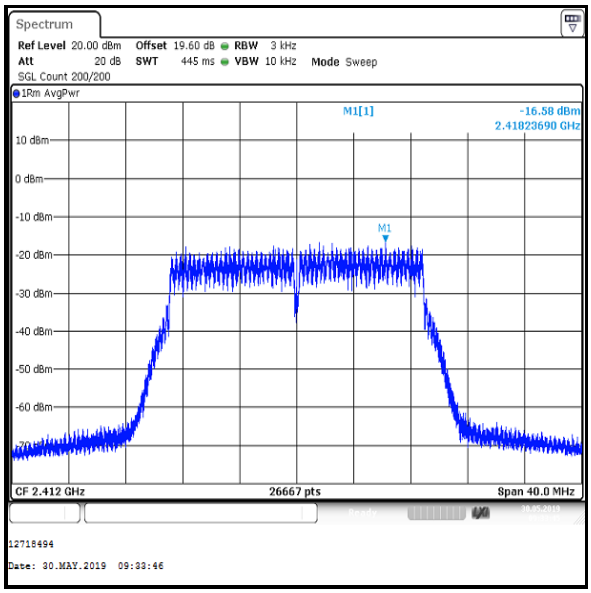
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2

Channel	PSD (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
1	-16.6	8.0	24.6	Complied
2	-14.7	8.0	22.7	Complied
3	-12.9	8.0	20.9	Complied
6	-8.9	8.0	16.9	Complied
7	-10.3	8.0	18.3	Complied
11	-17.3	8.0	25.3	Complied
12	-18.8	8.0	26.8	Complied

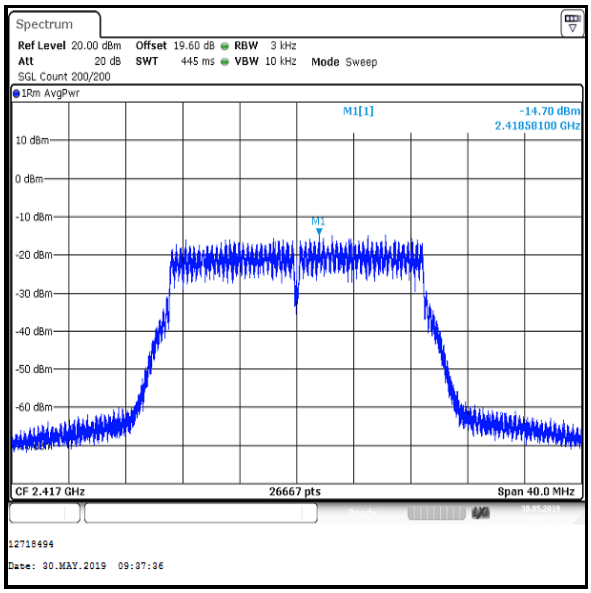
Channel	PSD (dBm/100 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
13	-18.9	8.0	26.9	Complied

Transmitter Power Spectral Density (continued)

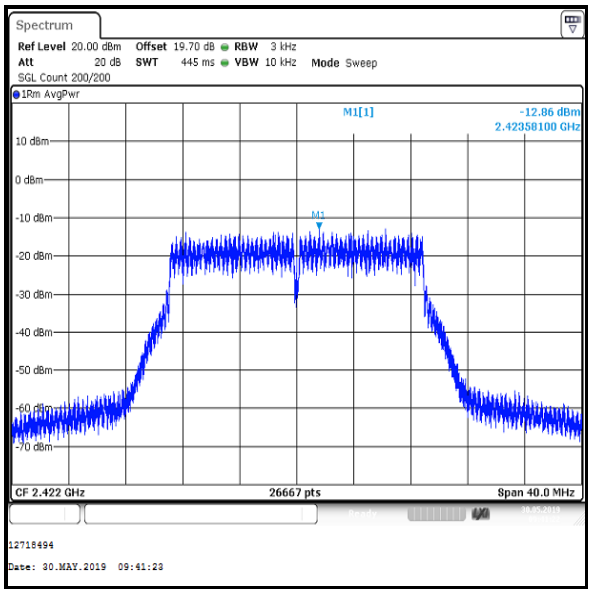
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



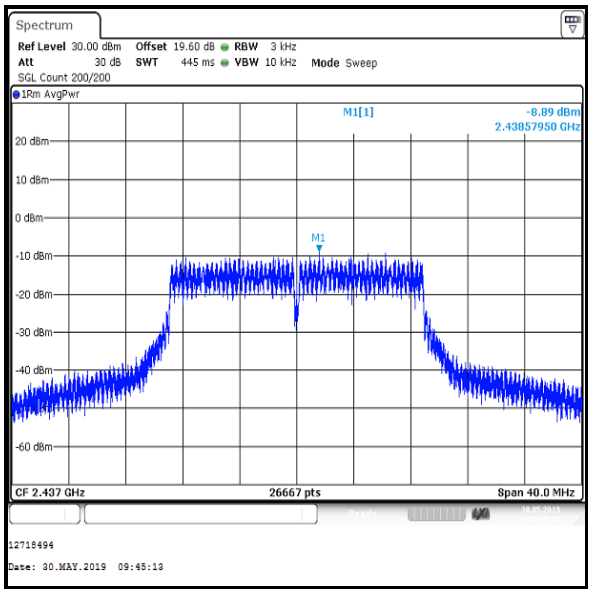
Channel 1



Channel 2



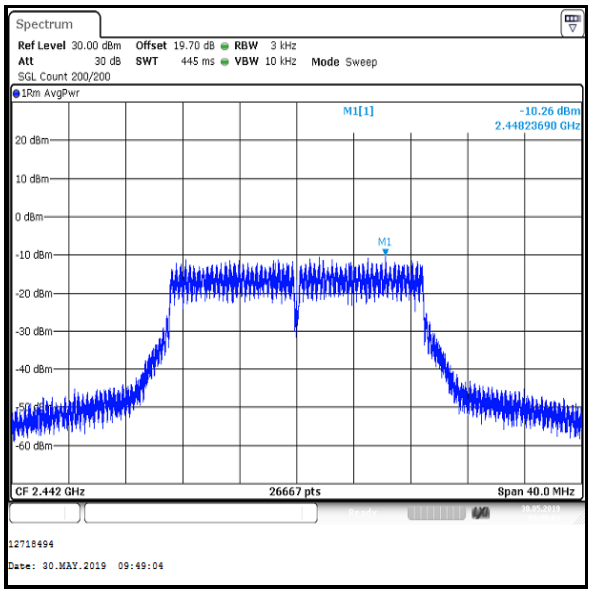
Channel 3



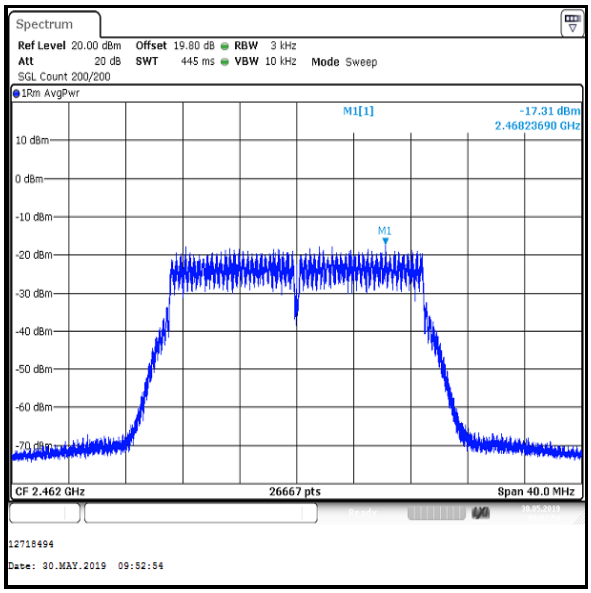
Channel 6

Transmitter Power Spectral Density (continued)

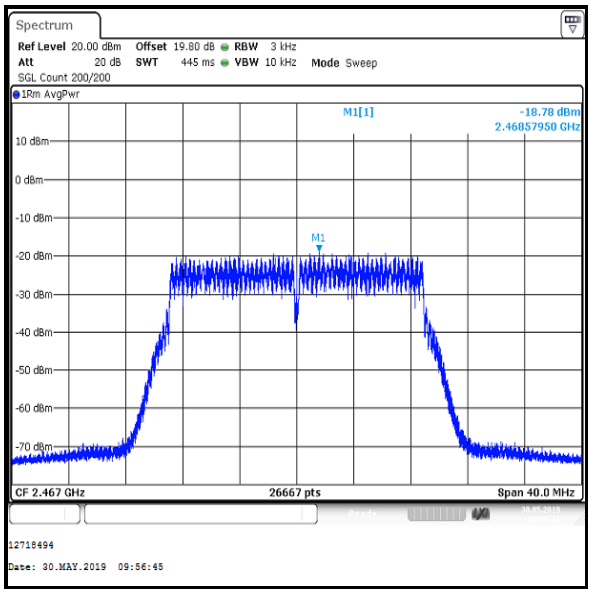
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



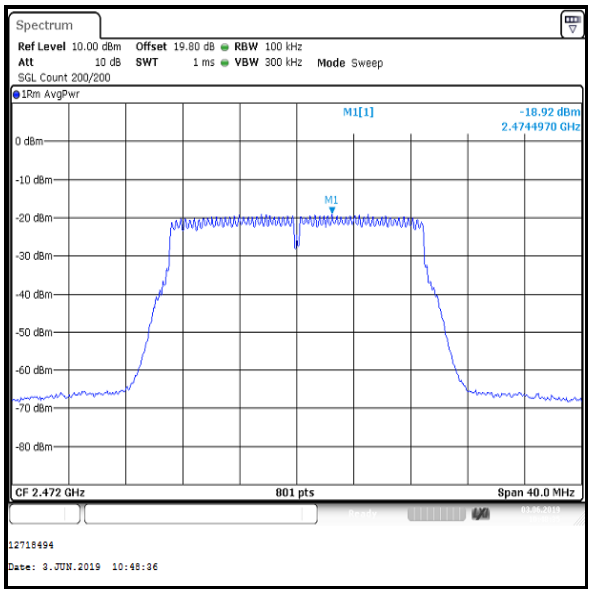
Channel 7



Channel 11



Channel 12



Channel 13

4.3. Transmitter Maximum (Average) Output Power

Test Summary:

Test Engineer:	Max Passell	**Test Dates:**	30 May 2019 & 03 June 2019
Test Sample Serial Number:	C02YF007MFLF		

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

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	44 to 50

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 power has been integrated over the 99% emission bandwidth. Plots for the occupied bandwidth are archived on the company server and available for inspection upon request.
4. The EUT was transmitting at >98% duty cycle and testing was performed in accordance with KDB 558074 Section 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% occupied 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 / Core 2

Conducted Peak Limit Comparison

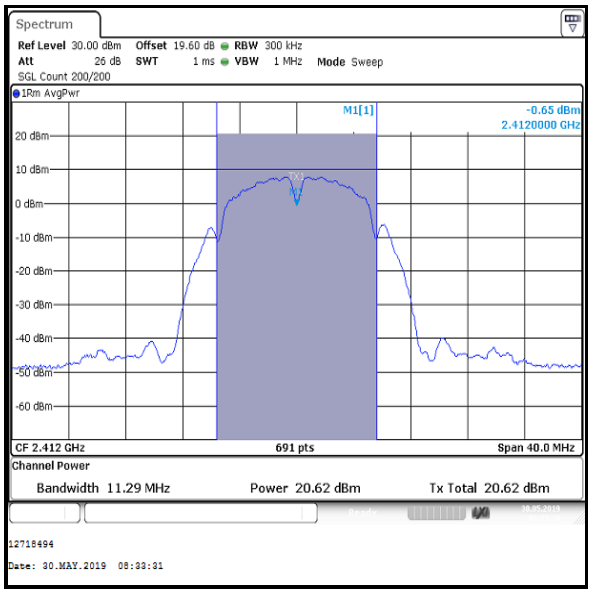
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	20.6	30.0	9.4	Complied
2	21.1	30.0	8.9	Complied
3	21.7	30.0	8.3	Complied
6	22.7	30.0	7.3	Complied
7	22.8	30.0	7.2	Complied
11	20.1	30.0	9.9	Complied
12	19.3	30.0	10.7	Complied
13	16.6	30.0	13.4	Complied

EIRP Limit Comparison

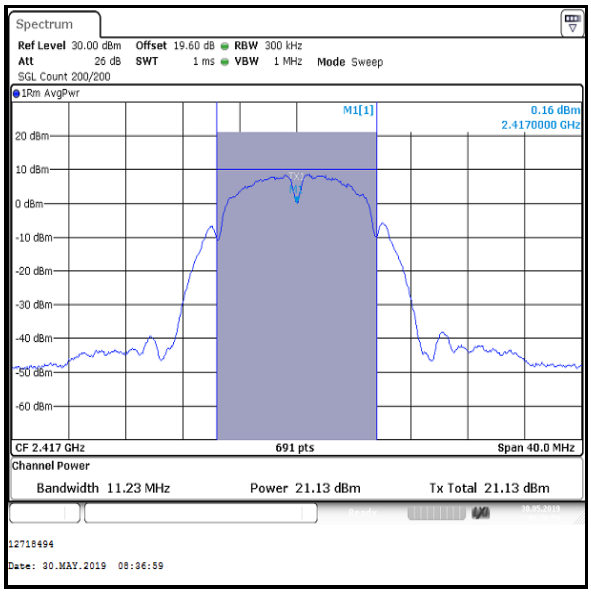
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	20.6	4.5	25.1	36.0	10.9	Complied
2	21.1	4.5	25.6	36.0	10.4	Complied
3	21.7	4.5	26.2	36.0	9.8	Complied
6	22.7	4.5	27.2	36.0	8.8	Complied
7	22.8	4.5	27.3	36.0	8.7	Complied
11	20.1	4.5	24.6	36.0	11.4	Complied
12	19.3	4.5	23.8	36.0	12.2	Complied
13	16.6	4.5	21.1	36.0	14.9	Complied

Transmitter Output Power (continued)

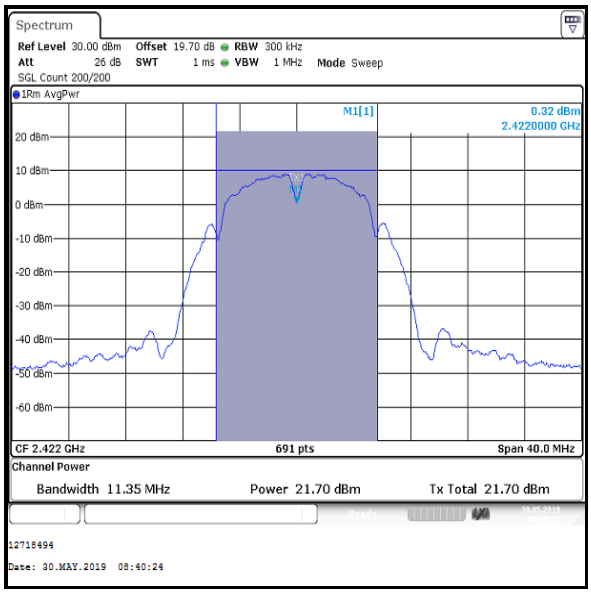
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



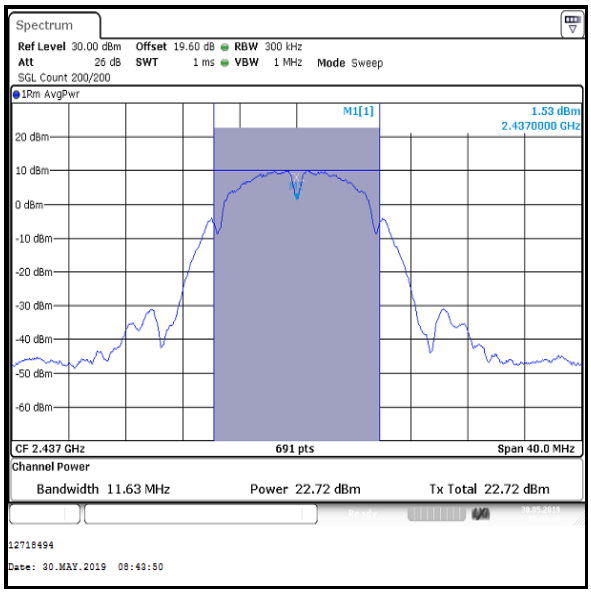
Channel 1



Channel 2



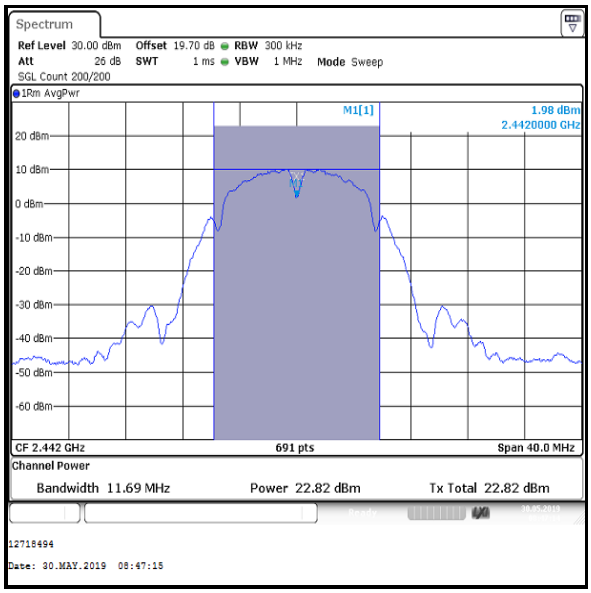
Channel 3



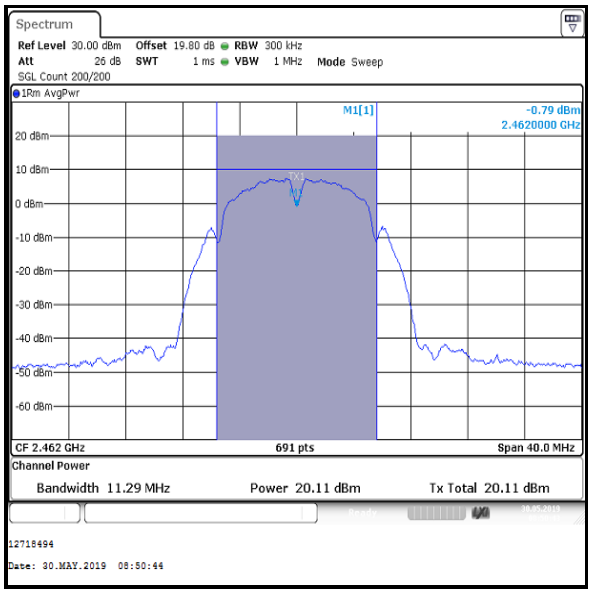
Channel 6

Transmitter Output Power (continued)

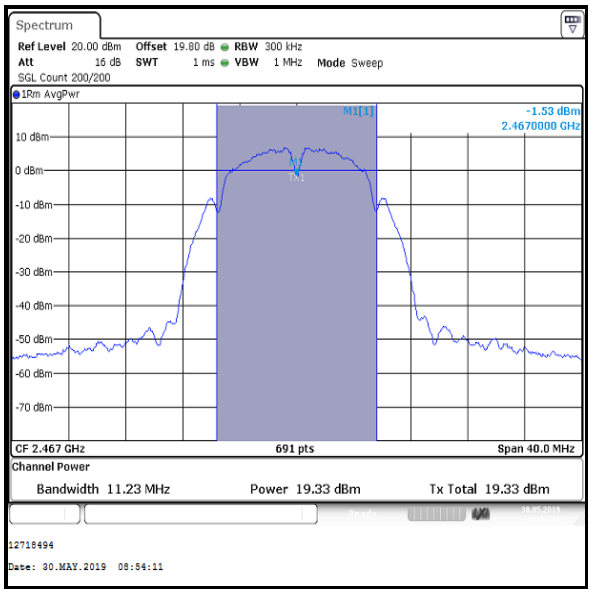
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps / Core 2



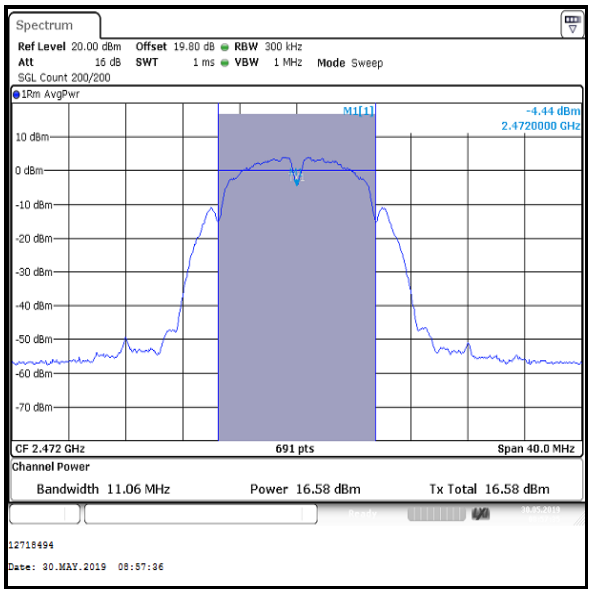
Channel 7



Channel 11



Channel 12



Channel 13

Transmitter Output Power (continued)

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

Conducted Peak Limit Comparison

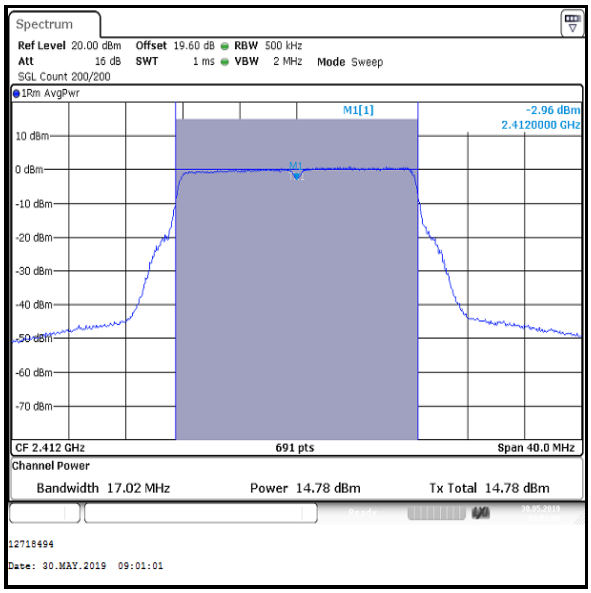
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	14.8	30.0	15.2	Complied
2	16.9	30.0	13.1	Complied
3	18.4	30.0	11.6	Complied
6	22.1	30.0	7.9	Complied
7	20.9	30.0	9.1	Complied
11	13.7	30.0	16.3	Complied
12	12.7	30.0	17.3	Complied
13	1.5	30.0	28.5	Complied

EIRP Limit Comparison

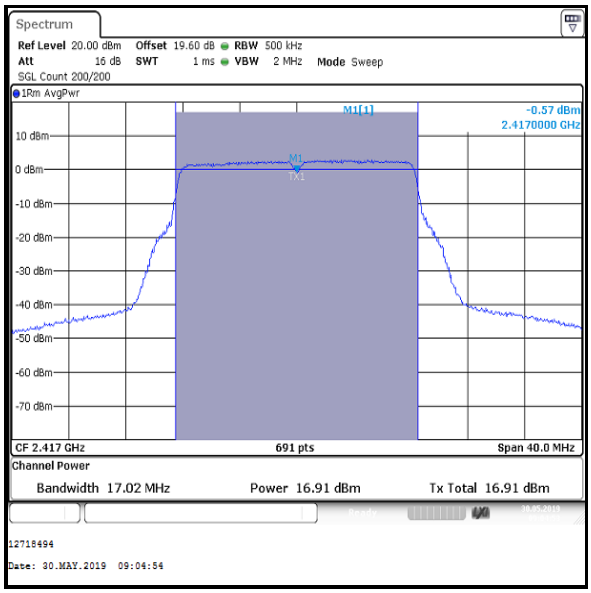
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	14.8	4.5	19.3	36.0	16.7	Complied
2	16.9	4.5	21.4	36.0	14.6	Complied
3	18.4	4.5	22.9	36.0	13.1	Complied
6	22.1	4.5	26.6	36.0	9.4	Complied
7	20.9	4.5	25.4	36.0	10.6	Complied
11	13.7	4.5	18.2	36.0	17.8	Complied
12	12.7	4.5	17.2	36.0	18.8	Complied
13	1.5	4.5	6.0	36.0	30.0	Complied

Transmitter Output Power (continued)

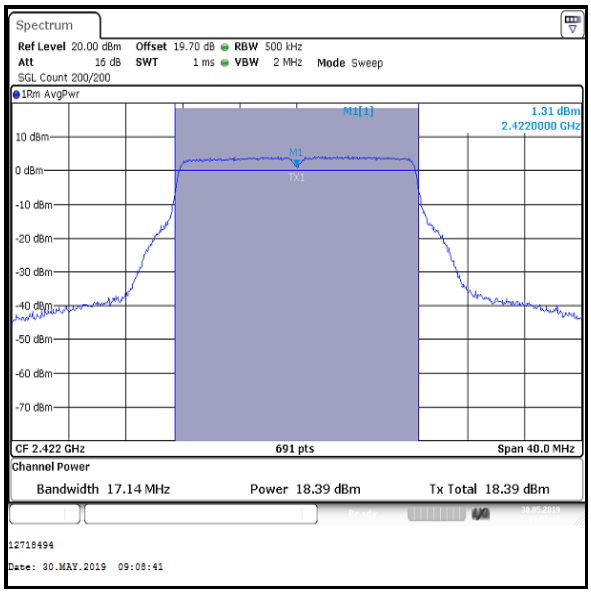
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



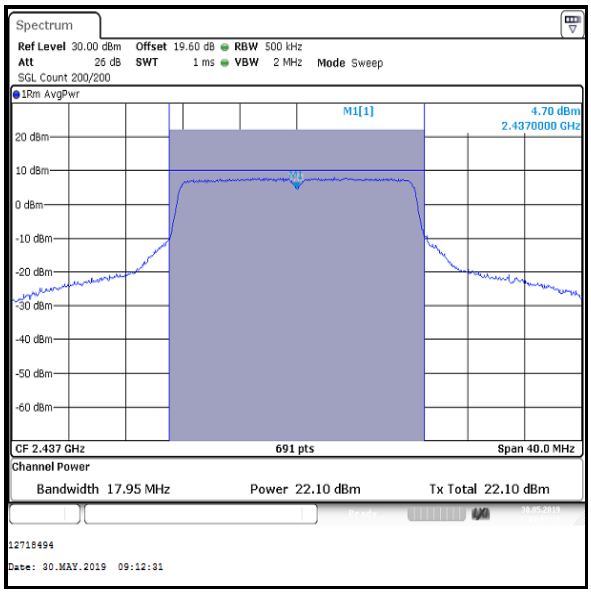
Channel 1



Channel 2



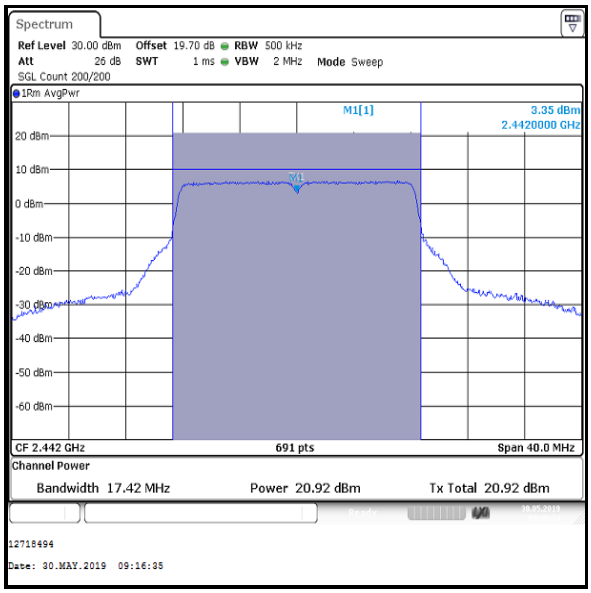
Channel 3



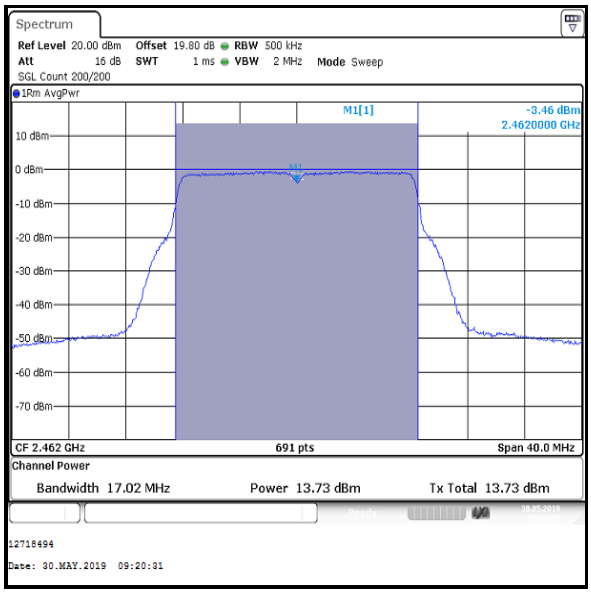
Channel 6

Transmitter Output Power (continued)

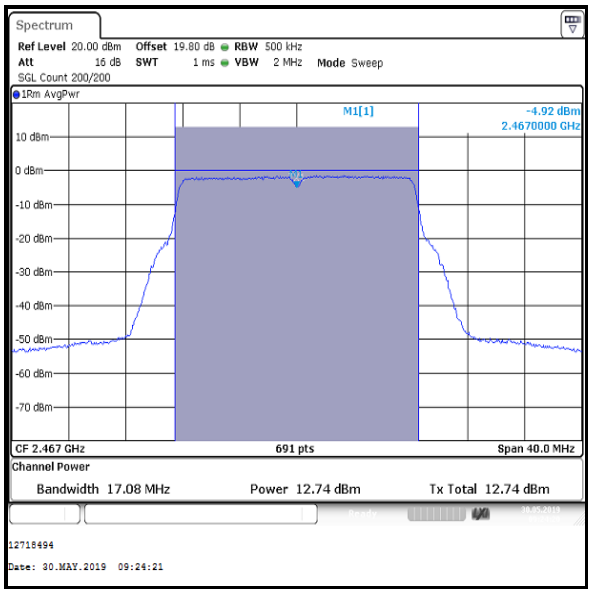
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



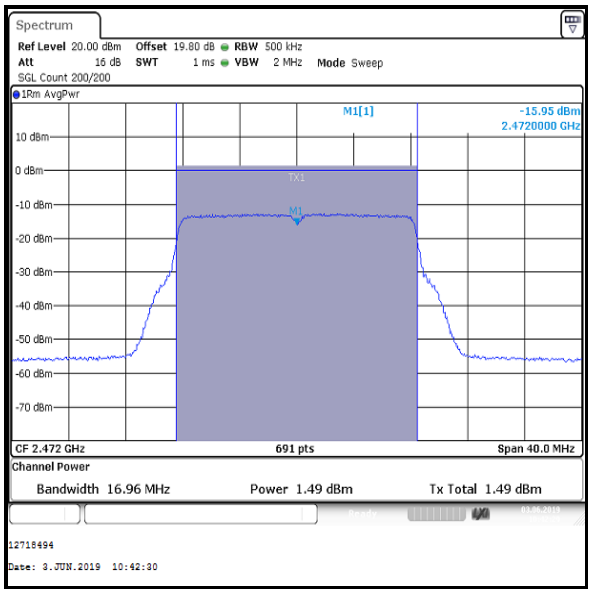
Channel 7



Channel 11



Channel 12



Channel 13

Transmitter Output Power (continued)

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

Conducted Peak Limit Comparison

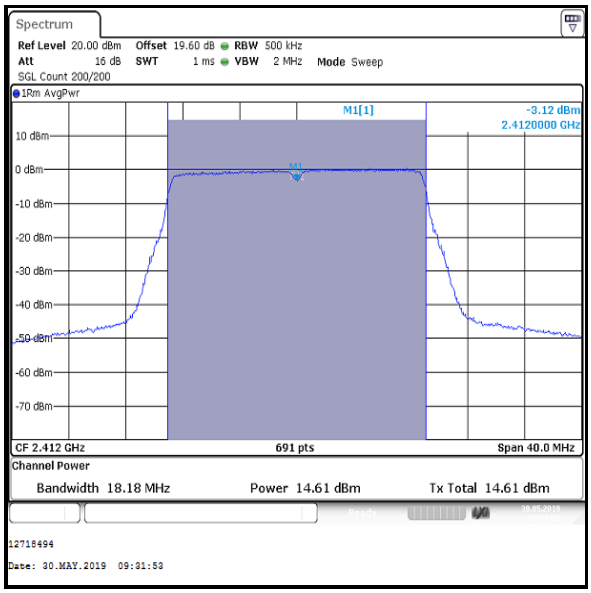
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
1	14.6	30.0	15.4	Complied
2	16.6	30.0	13.4	Complied
3	18.5	30.0	11.5	Complied
6	22.1	30.0	7.9	Complied
7	20.9	30.0	9.1	Complied
11	13.8	30.0	16.2	Complied
12	12.7	30.0	17.3	Complied
13	1.3	30.0	28.7	Complied

EIRP Limit Comparison

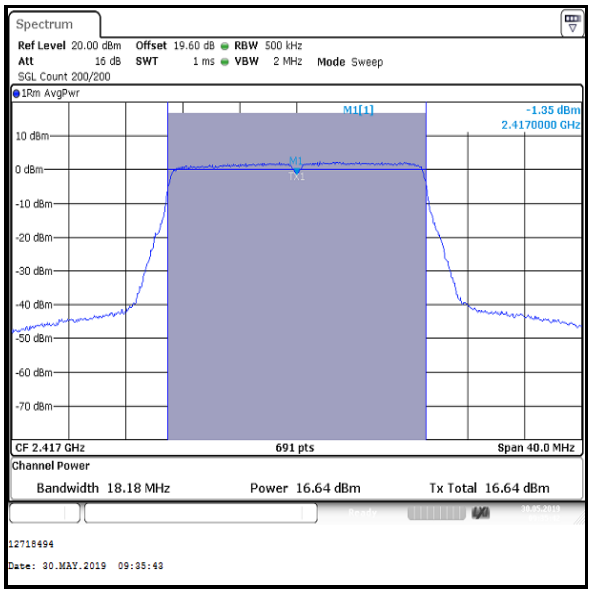
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
1	14.6	4.5	19.1	36.0	16.9	Complied
2	16.6	4.5	21.1	36.0	14.9	Complied
3	18.5	4.5	23.0	36.0	13.0	Complied
6	22.1	4.5	26.6	36.0	9.4	Complied
7	20.9	4.5	25.4	36.0	10.6	Complied
11	13.8	4.5	18.3	36.0	17.7	Complied
12	12.7	4.5	17.2	36.0	18.8	Complied
13	1.3	4.5	5.8	36.0	30.2	Complied

Transmitter Output Power (continued)

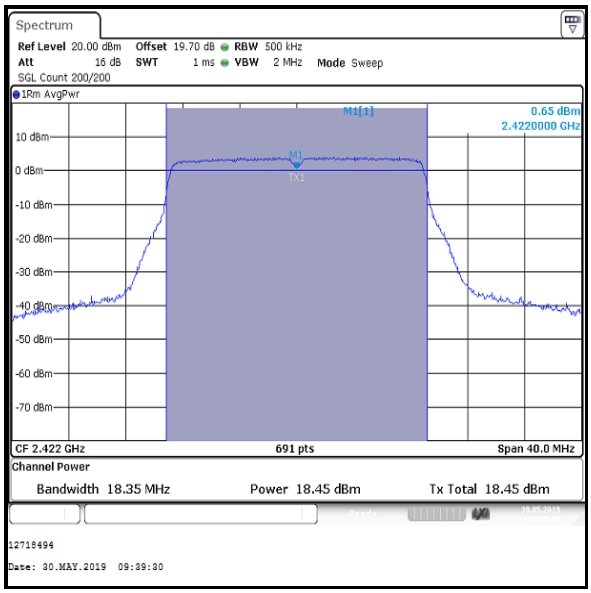
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



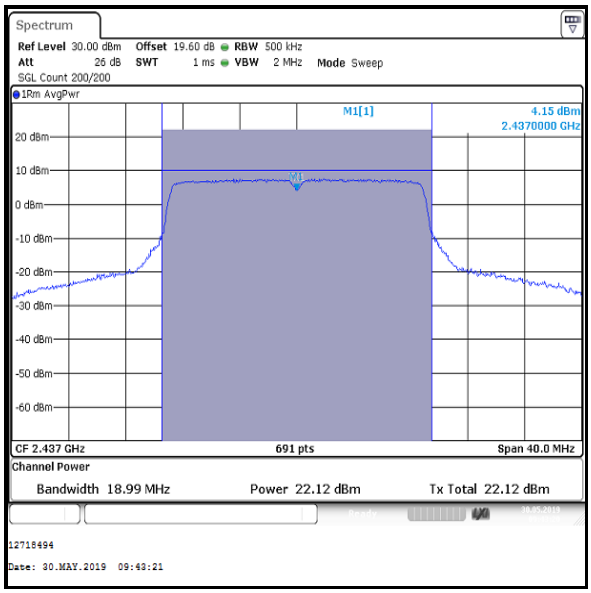
Channel 1



Channel 2



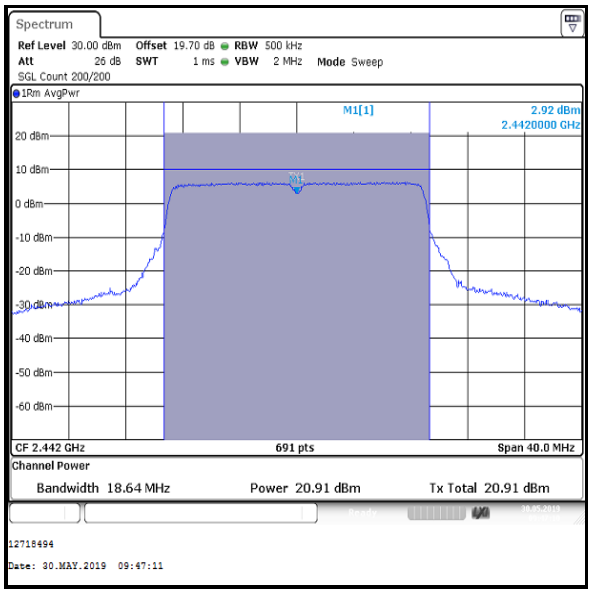
Channel 3



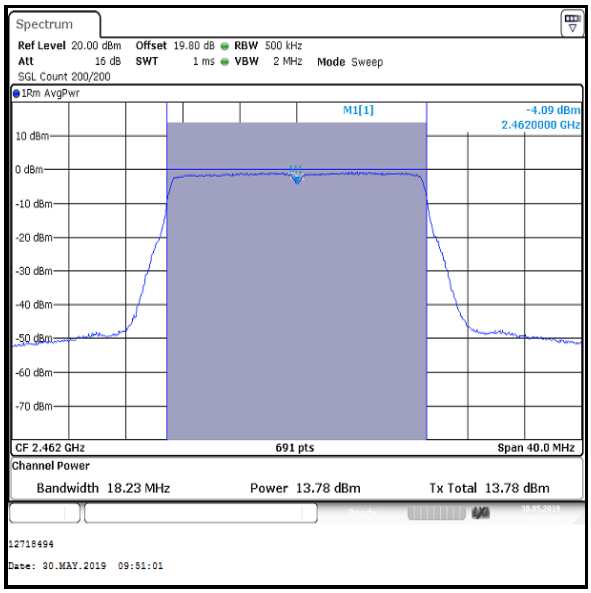
Channel 6

Transmitter Output Power (continued)

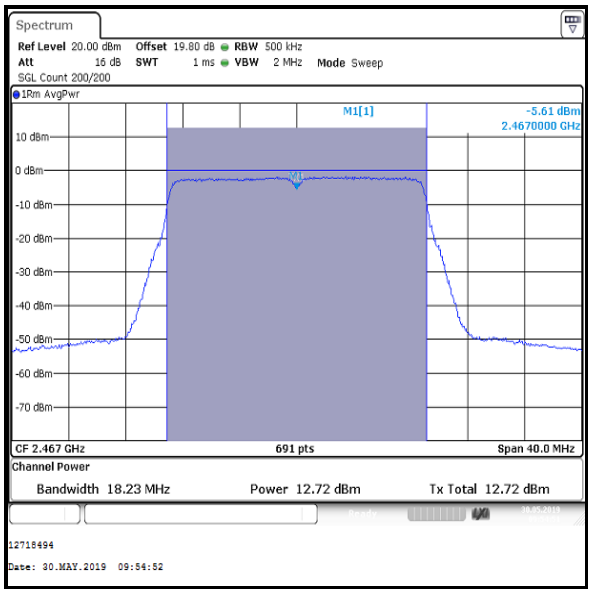
Results: 802.11n / HT20 / BPSK / MCS0 / Core 2



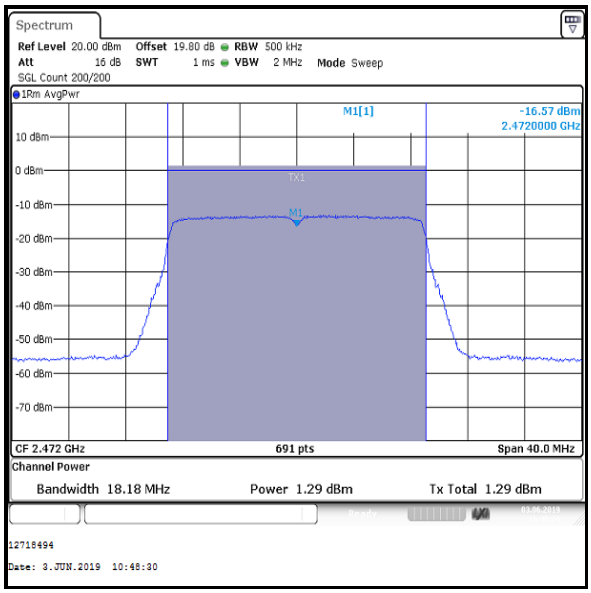
Channel 7



Channel 11



Channel 12



Channel 13

5. Radiated Test Results

5.1. Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineers:	Mohamed Toubella & Andrew Harding	**Test Date:**	24 May 2019
Test Sample Serial Number:	C02YD006MFLQ		

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

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	38

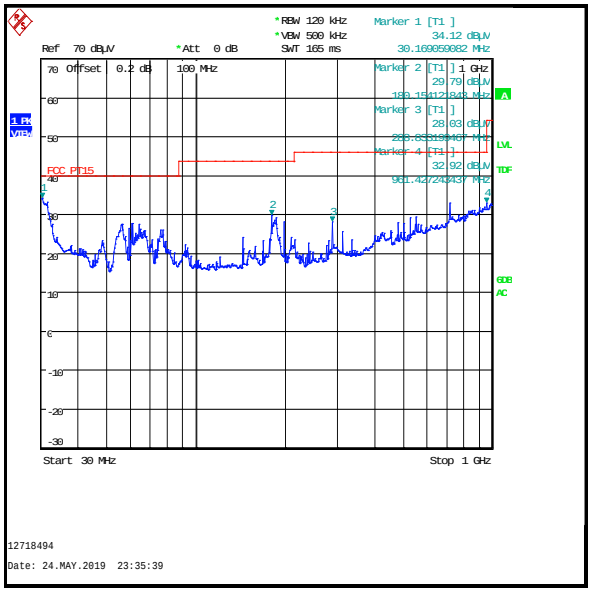
Note(s):

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. The emissions stated below were found to be independent of wireless technology.
4. 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.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) 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.
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.
7. 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 peak detector with max hold enabled. Span was wide enough to see the whole emission.

Transmitter Radiated Emissions (continued)

Results: Peak / Middle Channel / 802.11b / 1 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
74.390	Horizontal	28.4	40.0	11.6	Complied
167.981	Horizontal	26.1	43.5	17.4	Complied
240.005	Horizontal	31.0	46.0	15.0	Complied
263.949	Horizontal	26.6	46.0	19.4	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:

Test Engineers:	Nick Steele, James O'Reilly & Mohamed Toubella	**Test Dates:**	10 May 2019 to 21 May 2019
Test Sample Serial Number:	C02YD006MFLQ		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11, 11.12.2.4 & 11.12.2.5.1
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	21 to 24
Relative Humidity (%):	35 to 47

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the appropriate limit or below the measurement system noise floor.
3. The emission shown approximately at 2442 MHz on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. *In accordance with ANSI C63.10 Section 6.6.4.3 (Note 1), if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001 or 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 K0001) 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.
6. 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: Bottom Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15923.462	Vertical	57.2	74.0	16.8	Complied
23819.000	Vertical	51.5*	54.0	2.5	Complied

Results: Bottom Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15997.500	Vertical	38.6	54.0	15.4	Complied

Results: Middle Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15923.462	Vertical	57.2	74.0	16.8	Complied
23819.000	Vertical	51.5*	54.0	2.5	Complied

Results: Middle Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15997.500	Vertical	38.6	54.0	15.4	Complied

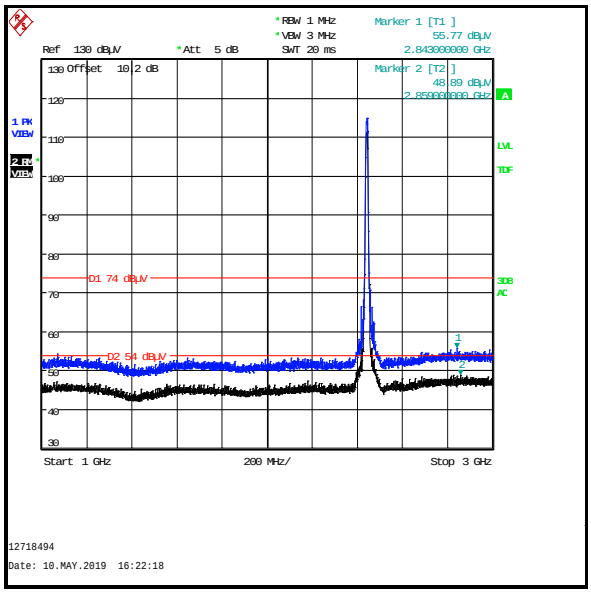
Results: Top Channel / Field Strength / Peak

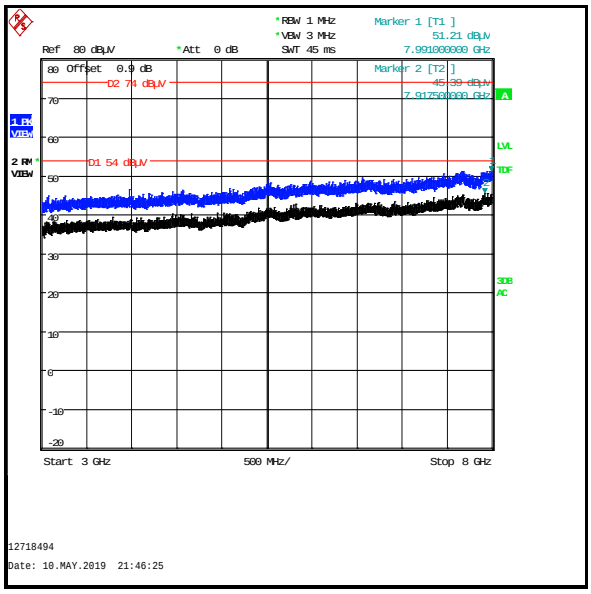
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15923.462	Vertical	57.2	74.0	16.8	Complied
23819.000	Vertical	51.5*	54.0	2.5	Complied

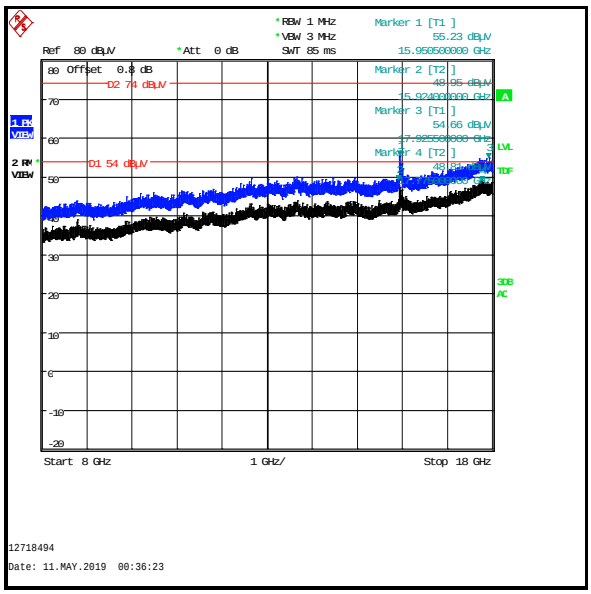
Results: Top Channel / Field Strength / Average

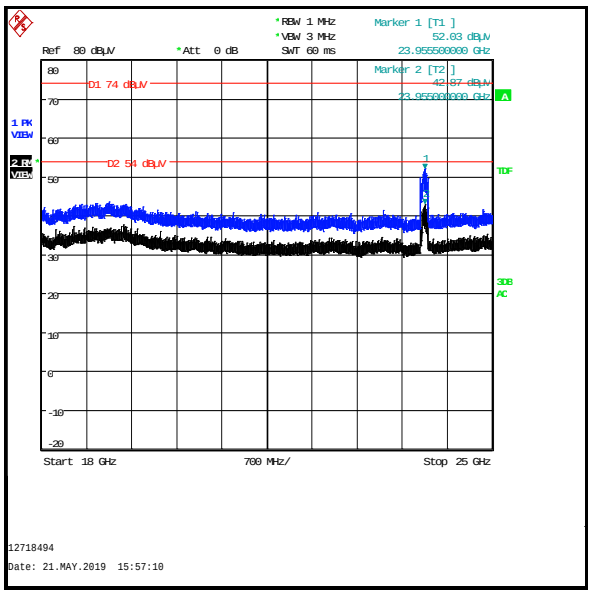
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
15997.500	Vertical	38.6	54.0	15.4	Complied

Transmitter Radiated Emissions (continued)









Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.3. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineers:	James O'Reilly, Tom Sleigh, Andrew Harding & Marco Zunarelli	**Test Dates:**	03 May 2019 to 07 May 2019
Test Sample Serial Numbers:	C02YF00CMFLF & C02YD006MFLQ		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	KDB 558074 Section 8.7 referencing ANSI C63.10 Sections 6.10, 11.11, 11.12 & 11.13

Environmental Conditions:

Temperature (°C):	20 to 24
Relative Humidity (%):	36 to 42

Transmitter Band Edge Radiated Emissions (continued)

Note(s):

1. The customer declared the following data rates to be used for all measurements as:
    - 802.11b / DPSK / 1 Mbps / SISO / Core 2
    - 802.11g / BPSK / 6 Mbps / SISO / Core 2
    - 802.11n HT20 / BPSK / MCS0 / SISO / Core 2
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 / DPSK / 1 Mbps / Core 2

Results: Lower Band Edge / Channel 1

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.958	Vertical	61.0	76.8	15.8	Complied
2400	Vertical	57.3	76.8	19.5	Complied

Results: Upper Band Edge / Peak / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	61.1	74.0	12.9	Complied
2485.071	Vertical	62.2	74.0	11.8	Complied

Results: Upper Band Edge / Average / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	47.4	54.0	6.6	Complied
2486.753	Vertical	50.8	54.0	3.2	Complied

Results: Upper Band Edge / Peak / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	61.8	74.0	12.2	Complied
2484.173	Vertical	63.0	74.0	11.0	Complied

Results: Upper Band Edge / Average / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	49.4	54.0	4.6	Complied
2484.269	Vertical	50.3	54.0	3.7	Complied

Results: Upper Band Edge / Peak / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	60.8	74.0	13.2	Complied
2484.381	Vertical	68.0	74.0	6.0	Complied

Results: Upper Band Edge / Average / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	51.3	54.0	2.7	Complied
2483.660	Vertical	51.4	54.0	2.6	Complied

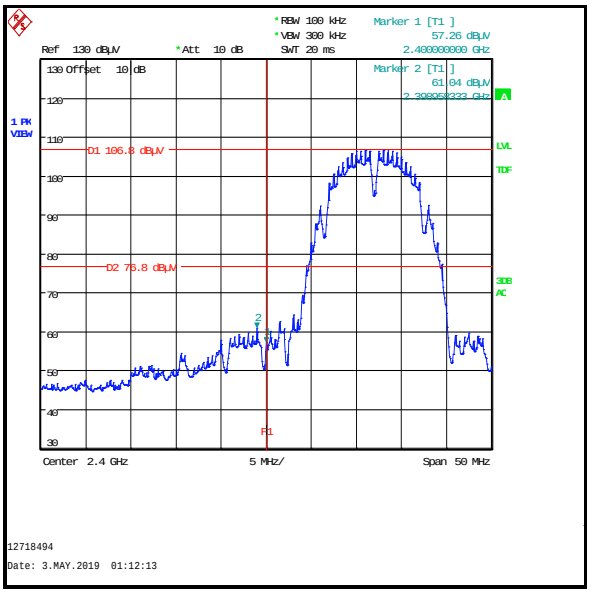
Transmitter Band Edge Radiated Emissions (continued)

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

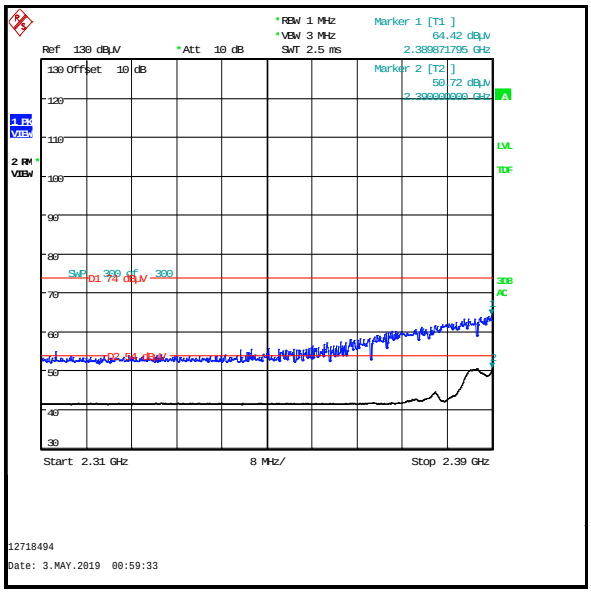
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.872	Vertical	64.4	74.0	9.6	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Vertical	50.7	54.0	3.3	Complied



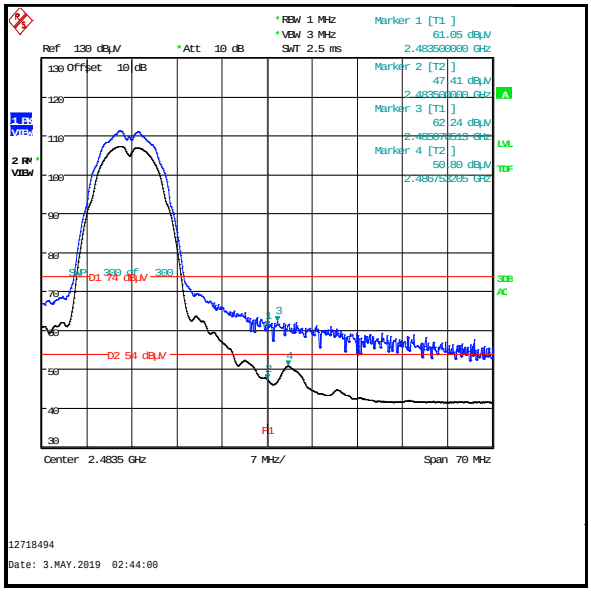
Lower Band Edge
Channel 1



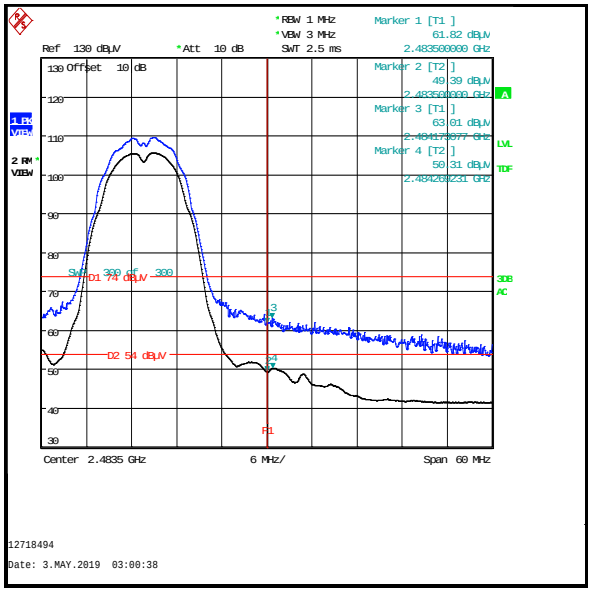
2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)

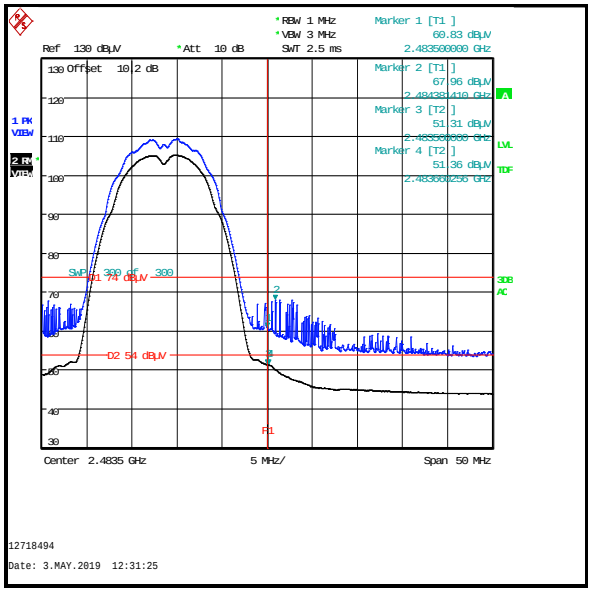
Results: 802.11b / 20 MHz / DPSK / 1 Mbps / Core 2



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 / Core 2

Results: Lower Band Edge / Channel 1

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.920	Vertical	59.7	68.9	9.2	Complied
2400	Vertical	57.3	68.9	11.6	Complied

Results: Upper Band Edge / Peak / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	69.2	74.0	4.8	Complied

Results: Upper Band Edge / Average / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	50.9	54.0	3.1	Complied

Results: Upper Band Edge / Peak / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	68.6	74.0	5.4	Complied
2483.596	Vertical	69.1	74.0	4.9	Complied

Results: Upper Band Edge / Average / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	51.4	54.0	2.6	Complied

Results: Upper Band Edge / Peak / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	69.5	74.0	4.5	Complied

Results: Upper Band Edge / Average / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	50.8	54.0	3.2	Complied

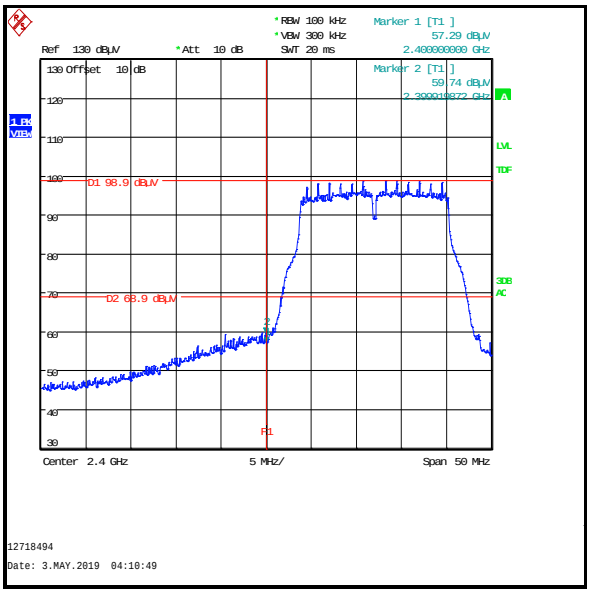
Transmitter Band Edge Radiated Emissions (continued)

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

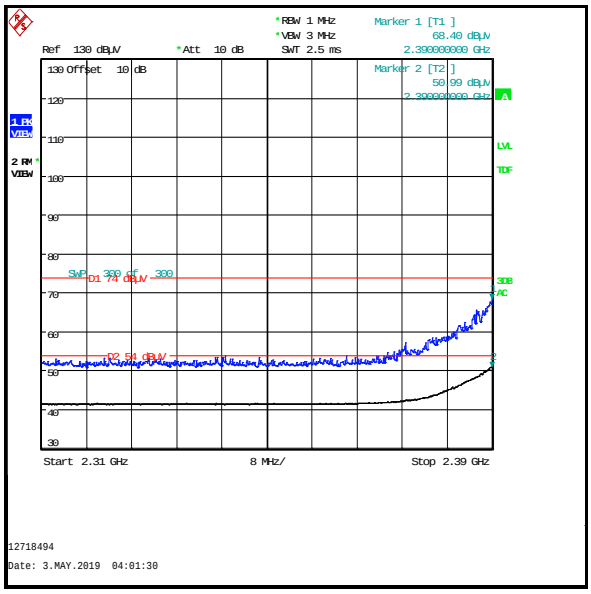
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Vertical	68.4	74.0	5.6	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

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



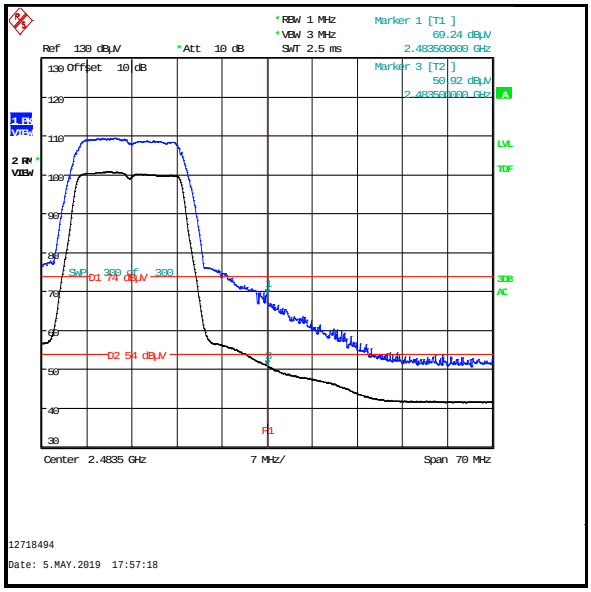
Lower Band Edge
Channel 1



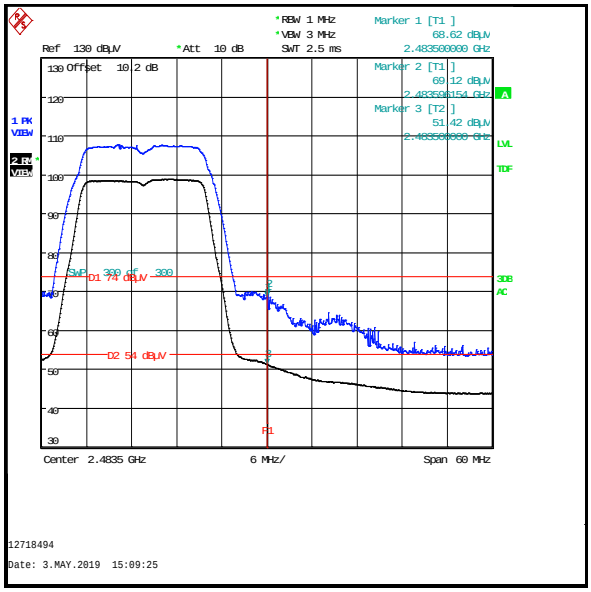
2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)

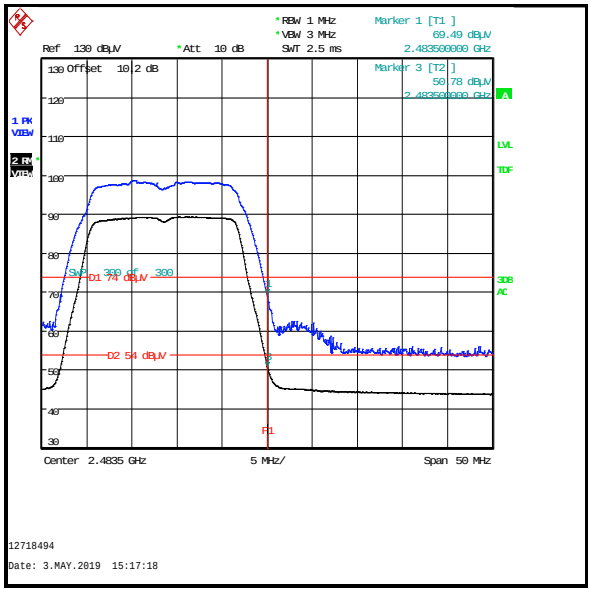
Results: 802.11g / 20 MHz / BPSK / 6 Mbps / Core 2



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 / BPSK / MCS0 / Core 2

Results: Lower Band Edge / Channel 1

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.199	Vertical	61.2	71.2	10.0	Complied
2400	Vertical	57.2	71.2	14.0	Complied

Results: Upper Band Edge / Peak / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	66.5	74.0	7.5	Complied

Results: Upper Band Edge / Average / Channel 11

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	51.4	54.0	2.6	Complied

Results: Upper Band Edge / Peak / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	67.8	74.0	6.2	Complied
2483.596	Vertical	68.3	74.0	5.7	Complied

Results: Upper Band Edge / Average / Channel 12

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	51.2	54.0	2.8	Complied
2483.596	Vertical	51.3	54.0	2.7	Complied

Results: Upper Band Edge / Peak / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	69.1	74.0	4.9	Complied

Results: Upper Band Edge / Average / Channel 13

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Vertical	51.5	54.0	2.5	Complied

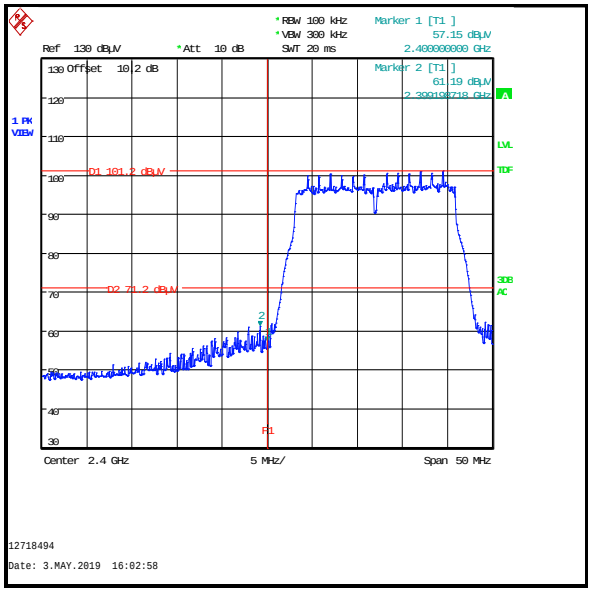
Transmitter Band Edge Radiated Emissions (continued)

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

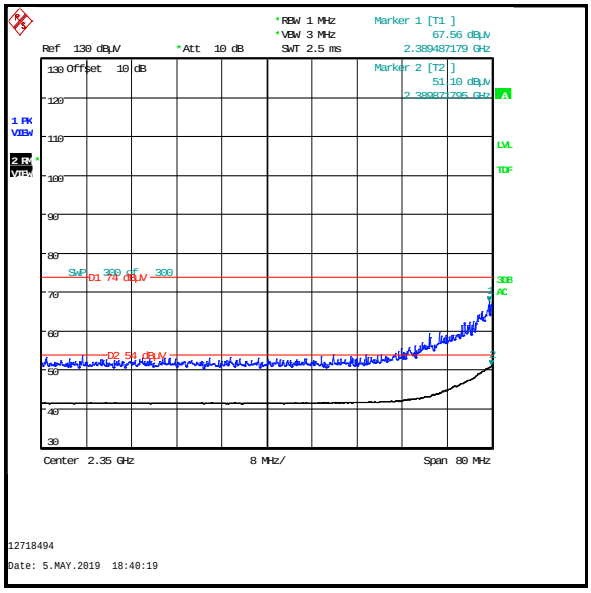
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.487	Vertical	67.6	74.0	6.4	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.872	Vertical	51.1	54.0	2.9	Complied



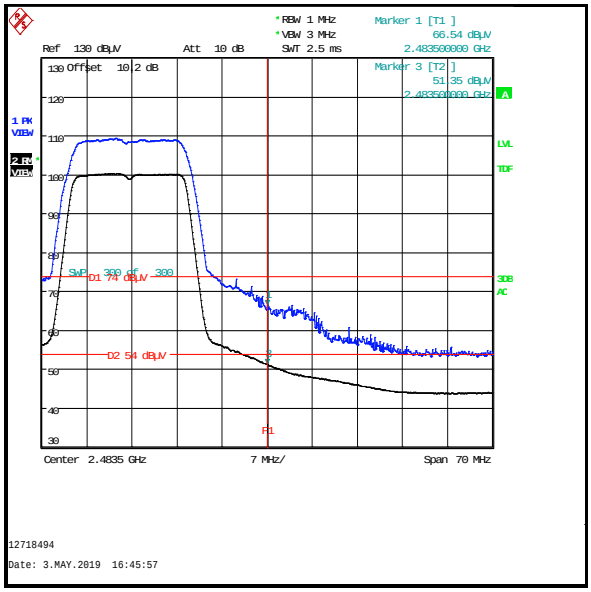
Lower Band Edge
Channel 1



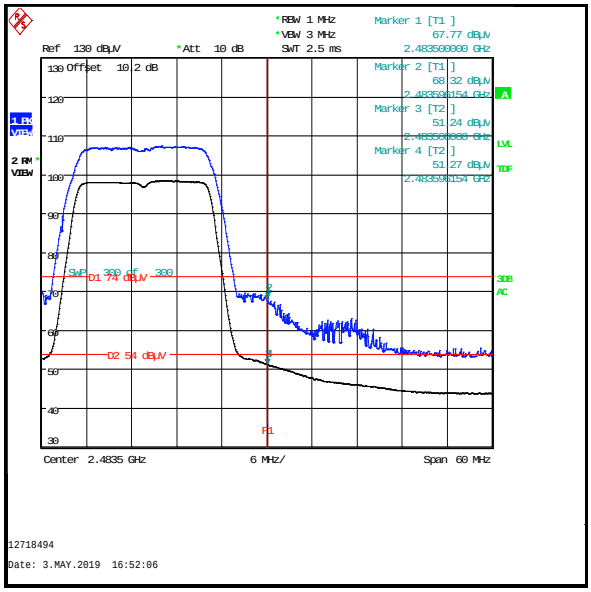
2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)

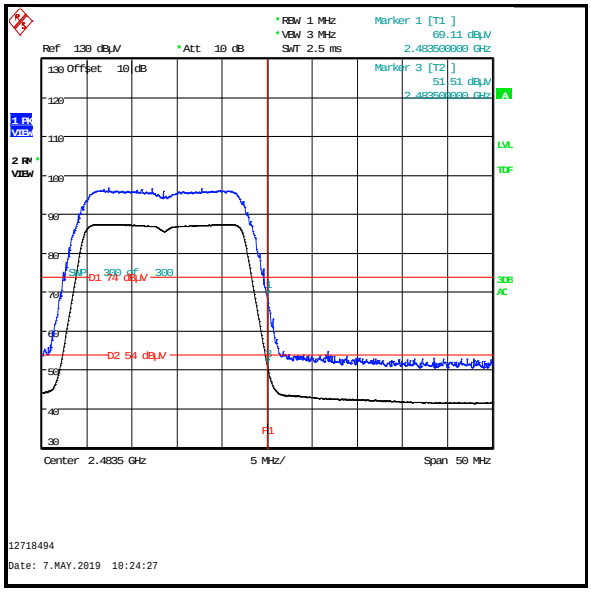
Results: 802.11n HT20 / BPSK / MCS0 / Core 2



Upper Band Edge
Channel 11



Upper Band Edge
Channel 12



Upper Band Edge
Channel 13

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