TEST REPORT

Test Report No. : UL-RPT-RP13946797-316A V2.0

Customer	:	Buddi Limited
Model No. / HVIN	:	3430013
PMN	:	Smart Tag 4
FCC ID	:	ZDLST6
ISED Certification No.	:	20371-ST6
Technology	:	2.4 GHz WLAN
Test Standard(s)	:	FCC Parts 15.209(a) & 15.247 Innovation, Science and Economic Development Canada RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 February 2021
Test Laboratory	:	UL International (UK) LTD, Basingstoke, Hampshire, RG24 8AH, United Kingdom

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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: 01 December 2021

Checked by:

Ben Mercer
Lead Project Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
Operations Leader, Radio Laboratory

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Customer Information

Company Name:	Buddi Limited
Address:	Talbot House 17 Chruch Street Rickmansworth Hertfordshire WD3 1DE United Kingdom

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	07/10/2021	Initial Version	Ben Mercer
2.0	01/12/2021	Hardware Version updated	Sarah Williams

Table of Contents

1 Attestation of Test Results

1.1 Description of EUT

The equipment under test was an Electronic Monitoring (EM) device which communicates to a server-based monitoring platform providing data such as: event time, GPS location, geo-fence data, position type, speed of motion, battery level, signal strength, strap on/off, alerts. It contains a 2G and 4G cellular module (FCC ID: XPYUBX18ZO01, IC: 8595A-UBX18ZO01), a 2.4 GHz WLAN transceiver and a 915 MHz ISM transceiver.

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
Specification Reference:	RSS-Gen Issue 5 February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 2 February 2017
Specification Title:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs), and Licence-Exempt Local Area Network (LE-LAN) Devices
Site Registration:	FCC: 685609, ISEDC: 20903
FCC Lab. Designation No:	UK2011
ISEDC CABID:	UK0001
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	13 September 2021 to 21 September 2021

1.3 Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
Part 15.35(c)	RSS-Gen 8.2	Transmitter Duty Cycle	Note 1
N/A	RSS-Gen 6.7	Transmitter 99% Occupied Bandwidth	✓
Part 15.247(a)(2)	RSS-Gen 6.7 / RSS-247 5.2(a)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.247(e)	RSS-247 5.2(b)	Transmitter Power Spectral Density	✓
Part 15.247(b)(3)	RSS-Gen 6.12 / RSS-247 5.4(d)	Transmitter Maximum (Average) Output Power	✓
Part 15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Radiated Emissions	✓
Part 15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Band Edge Radiated Emissions	✓
Key to Results ✓ = Complied ✗ = Did not comply			

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 company IT server and available for inspection upon request.

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 International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. 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 & Decision Rule

Overview

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 of the measurand (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.

Decision Rule

The decision rule applied is based upon the accuracy method criteria. The measurement uncertainty is met and the result is considered in conformance with the requirement criteria if the observed value is within the prescribed limit.

Measurement Uncertainty

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 %
99% Emission Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92 %
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	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 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 Minimum 6 dB Bandwidth, 99% Emission Bandwidth, Maximum (Average) Output Power & Power Spectral Density

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2042	Thermohygrometer	Testo	608-H1	45124926	10 Dec 2021	12
M1883	Spectral Analyser	Rohde & Schwarz	FSV30	103084	24 Mar 2022	12
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	12 Jun 2022	36
A3118	Attenuator	AtlanTecRF	AN18-10	237378#2	Calibrated before use	-

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	10 Dec 2021	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	21 Oct 2021	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	19 May 2022	12
A2948	Pre Amplifier	Com-Power	PAM-103	551087	21 Oct 2021	12
A3265	Pre Amplifier	Schwarzbeck	BBV 9721	9721-069	16 Feb 2022	12
A3142	Pre Amplifier	Schwarzbeck	BBV 9718 B	00020	21 Oct 2021	12
A2951	Pre Amplifier	Com-Power	PAM-103	441141	25 Jan 2022	12
A3161	Antenna	Teseq	CBL6111D	50859	04 May 2022	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120B653	23 Oct 2021	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	27 Oct 2021	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	30 Oct 2021	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	01 Feb 2022	12
A3036	Low Pass Filter	AtlanTecRF	AFL-02000	15062902848	01 Feb 2022	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	01 Feb 2022	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	01 Feb 2022	12
M2040	Thermohygrometer	Testo	608-H1	451224934	10 Dec 2021	12
K0001	5m RSE Chamber	Rainford	N/A	N/A	06 Sep 2022	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2022	12
A3198	Magnetic Loop Antenna	ETS Lindgren	6502	00221887	12 Aug 2022	12

Test and Measurement Equipment (continued)

Test Equipment Used for Transmitter Band Edge Radiated Emissions Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	10 Dec 2021	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	21 Oct 2021	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	19 May 2022	12
A2948	Pre Amplifier	Com-Power	PAM-103	551087	21 Oct 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120B653	23 Oct 2021	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	01 Feb 2022	12

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	Buddi
Model Name or Number / HVIN:	3430013
PMN:	Smart Tag 4
Test Sample Serial Number:	STV00004 *(Conducted sample)*
Hardware Version:	3430013
Firmware Version:	1.40.12
FCC ID:	ZDLST6
ISED Canada Certification Number:	20371-ST6

Brand Name:	Buddi
Model Name or Number / HVIN:	3430013
PMN:	Smart Tag 4
Test Sample Serial Number:	STV00003 *(Radiated sample)*
Hardware Version:	3430013
Software Version:	1.40.12
FCC ID:	ZDLST6
ISED Canada Certification Number:	20371-ST6

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, BPSK		
Data Rates:	802.11b	1 Mbps	
	802.11g	6 Mbps	
	802.11n HT20	MCS0	
Power Supply Requirement(s):	Nominal	3.7 VDC	
Maximum Conducted Output Power:	13.9 dBm		
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2400 MHz to 2483.5 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462

3.4 Description of Available Antenna

The WLAN radio module contains an integral antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2400 to 2483.5	-1.5

3.5 Description of Test Setup

Support Equipment

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

Brand Name:	Buddi
Description:	On Body Charger (Battery pack)
Model Name or Number:	OBC v2
Serial Number:	OBX00885

Brand Name:	Buddi
Description:	Switching Adapter
Model Name or Number:	N/A
Serial Number:	N/A

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.

Configuration and Peripherals

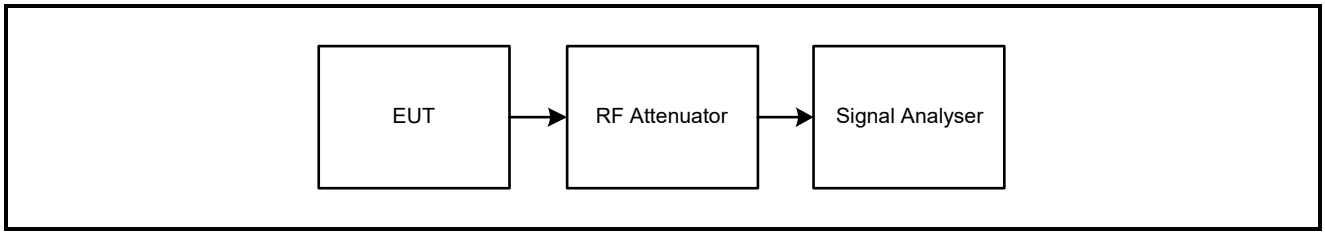
The EUT was tested in the following configuration(s):

- The EUT was controlled in test mode using a switching adapter supplied by the customer. The adapter was attached to the EUT and a predetermined number of user configurable modes were selected by pressing the red button on the adapter. The adapter was used to enable continuous transmission and to select the test channels and modes as required. The customer supplied a document containing the setup instructions 'SmartTAG 4G – WLAN TEST - v1.1.pdf.
- The customer declared the following data rates to be used for all measurements as:
    - 802.11b – 1 Mbps
    - 802.11g – 6 Mbps
    - 802.11n – MCS0
- The customer supplied an RF cable 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 1 Mbps. This was deemed to be the worst case as this mode emits the highest output power level.
- All radiated tests were performed with the EUT placed in the worst case orientation/position for the applicable test.

Test Setup Diagrams

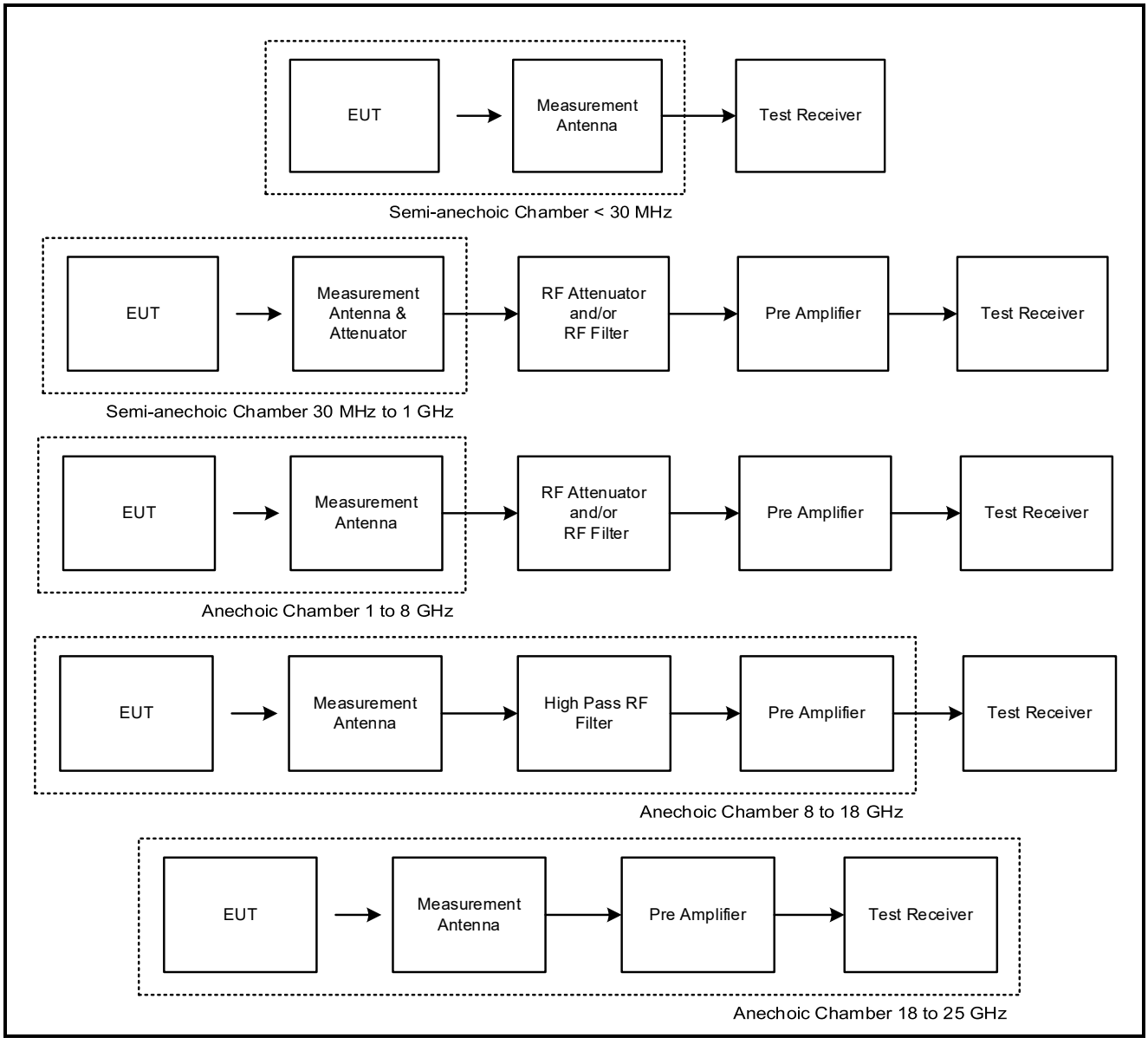
Conducted Tests:

Test Setup for Transmitter Conducted Tests



Radiated Tests:

Test Setup for Transmitter Radiated Emissions



4 Antenna Port Test Results

4.1 Transmitter 99% Emission Bandwidth

Test Summary:

Test Engineers:	Max Passell & Kieran Highton	**Test Date:**	13 September 2021
Test Sample Serial Number:	STV00004		

FCC Reference:	FCC Part 15.247 (a)(2)
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	RSS-Gen 6.7 and Notes below

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	47

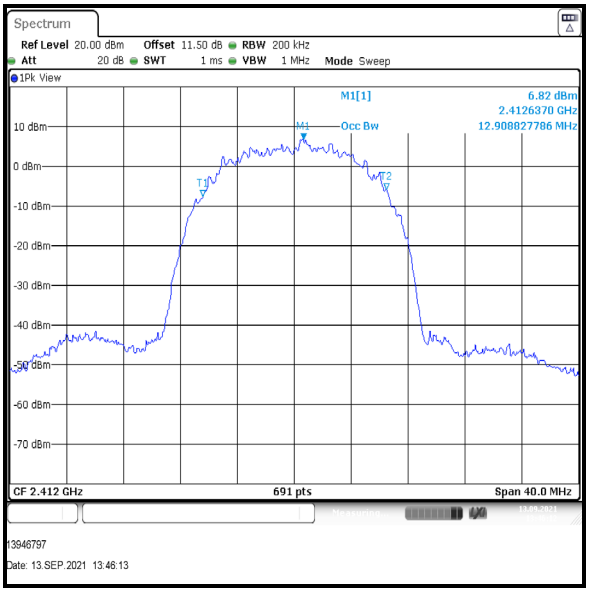
Note(s):

1. The 99% emission bandwidth was measured using the signal analyser occupied bandwidth function. The resolution bandwidth was set in the range of 1% to 5% of the occupied bandwidth and the video bandwidth set to 3 times the resolution bandwidth as the signal analyser allowed without being below 3 times RBW. The span was set to capture all products of the modulation process including emission skirts.
2. The signal analyser resolution bandwidth was set to 200 kHz and video bandwidth 1 MHz. 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 signal analyser function set the measurements to be made at 99% of the emission bandwidth. The results are given in the tables below.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

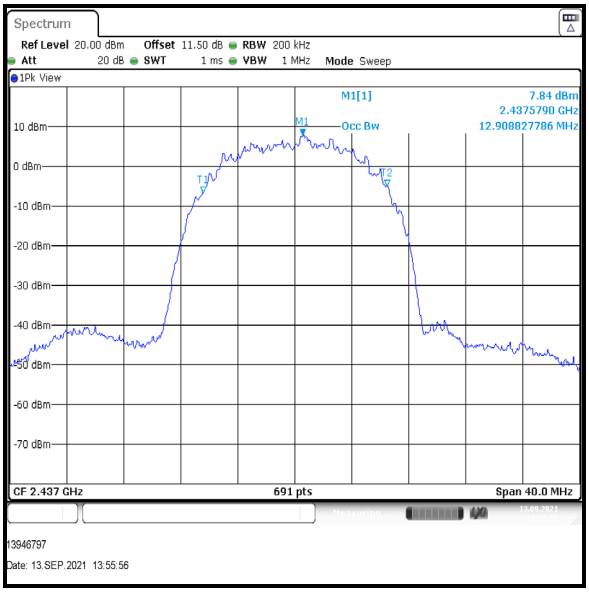
Transmitter 99% Emision Bandwidth (continued)

Results: 802.11b / 20 MHz / 1 Mbps

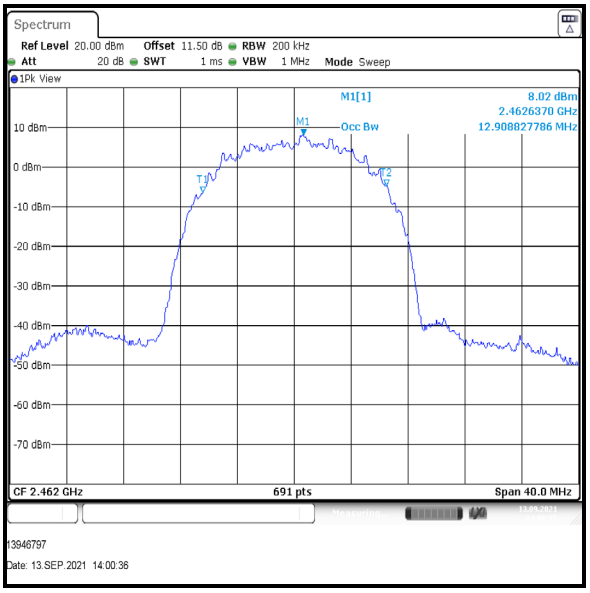
Channel	99% Emission Bandwidth (MHz)
Bottom	12.909
Middle	12.909
Top	12.909



Bottom Channel



Middle Channel

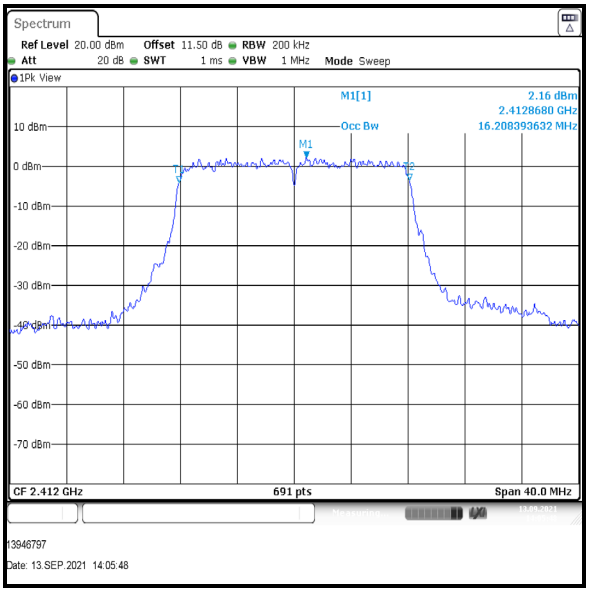


Top Channel

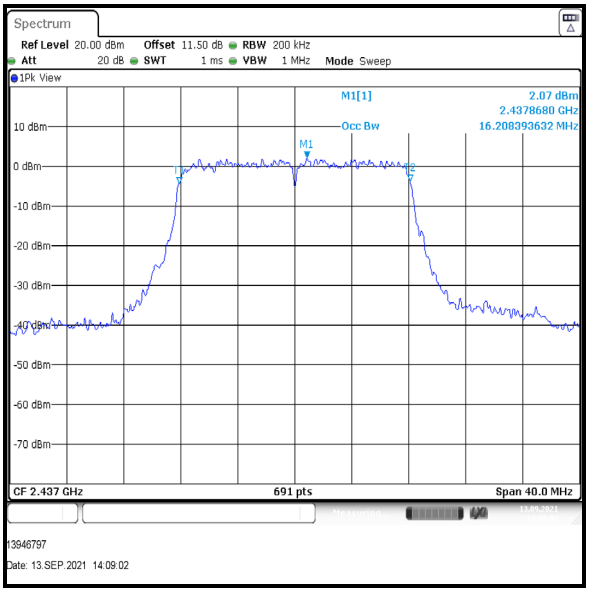
Transmitter 99% Emision Bandwidth (continued)

Results: 802.11g / 20 MHz / 6 Mbps

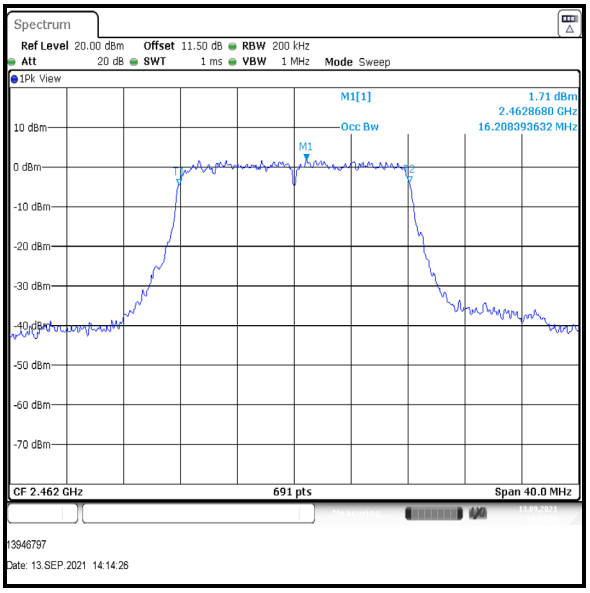
Channel	99% Emission Bandwidth (MHz)
Bottom	16.208
Middle	16.208
Top	16.208



Bottom Channel



Middle Channel

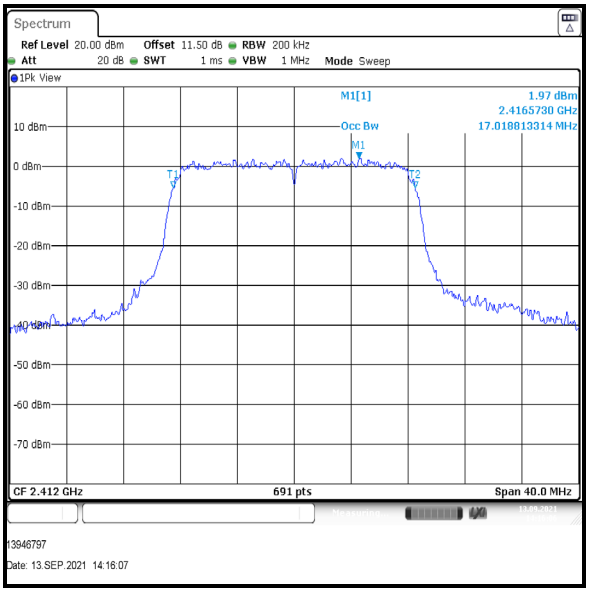


Top Channel

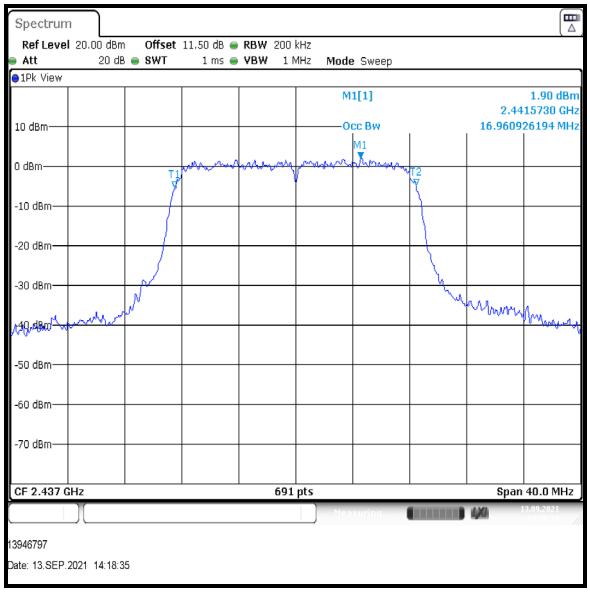
Transmitter 99% Emision Bandwidth (continued)

Results: 802.11n / HT20 / 20 Mbps

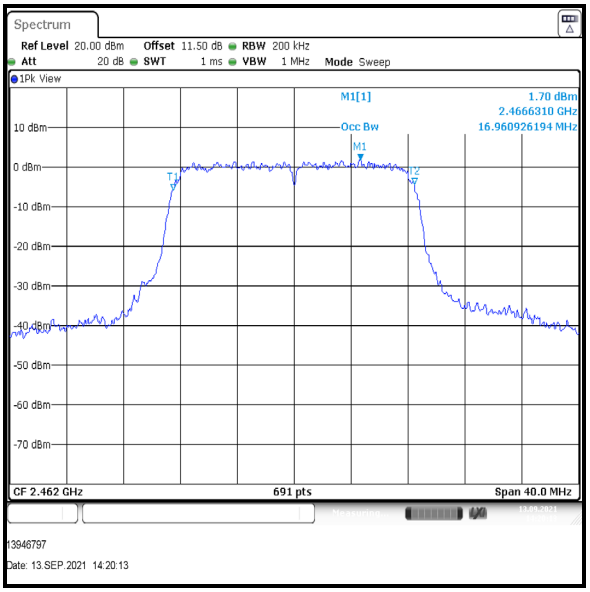
Channel	99% Emission Bandwidth (MHz)
Bottom	17.019
Middle	16.961
Top	16.961



Bottom Channel



Middle Channel



Top Channel

4.2 Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineers:	Max Passell & Kieran Highton	**Test Dates:**	13 September 2021 & 14 September 2021
Test Sample Serial Number:	STV00004		

FCC Reference:	Part 15.247(a)(2)
ISED Canada Reference:	RSS-Gen 6.7 / RSS-247 5.2(a)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Section 11.8.1

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	47 to 57

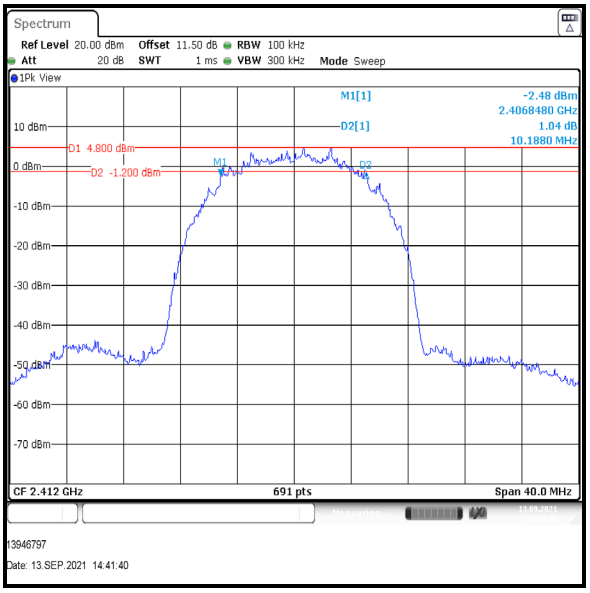
Note(s):

1. The customer declared the following data rates to be used for all measurements:
    - 802.11b – DBPSK / 1 Mbps
    - 802.11g – BPSK / 6 Mbps
    - 802.11n HT20 – BPSK / MCS0
2. Final measurements were performed using the above configurations on bottom, middle and top channels in accordance with ANSI C63.10 Section 11.8.1 Option 1 measurement procedure. 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 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 suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

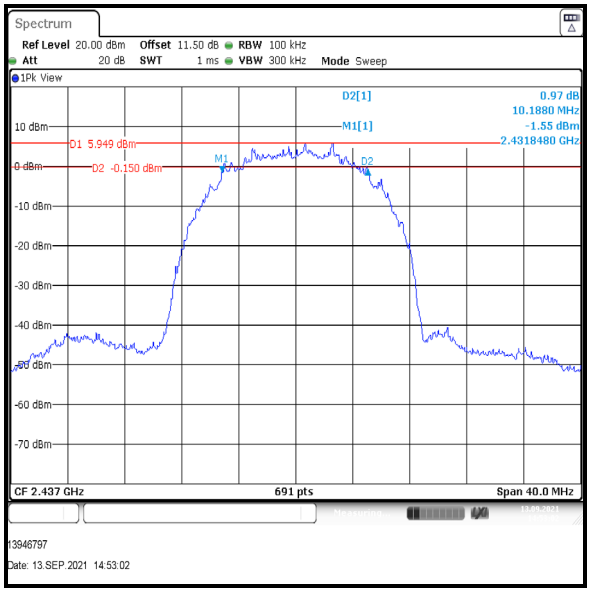
Transmitter Minimum 6 dB Bandwidth (continued)

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

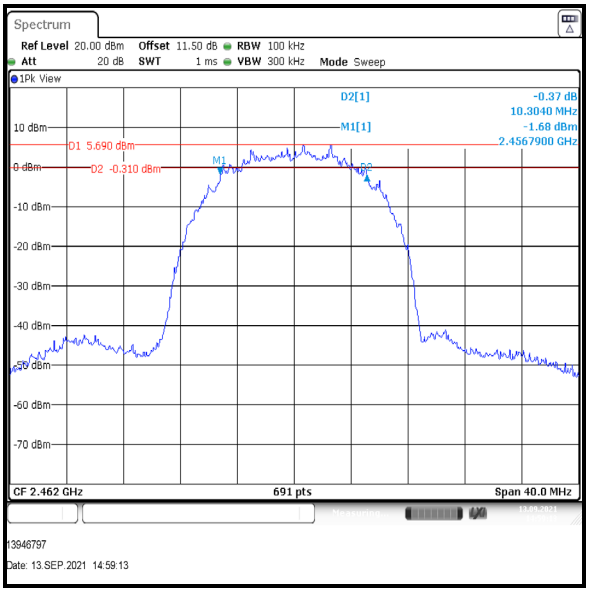
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	10188	≥500	9688	Complied
Middle	10188	≥500	9688	Complied
Top	10304	≥500	9804	Complied



Bottom Channel



Middle Channel

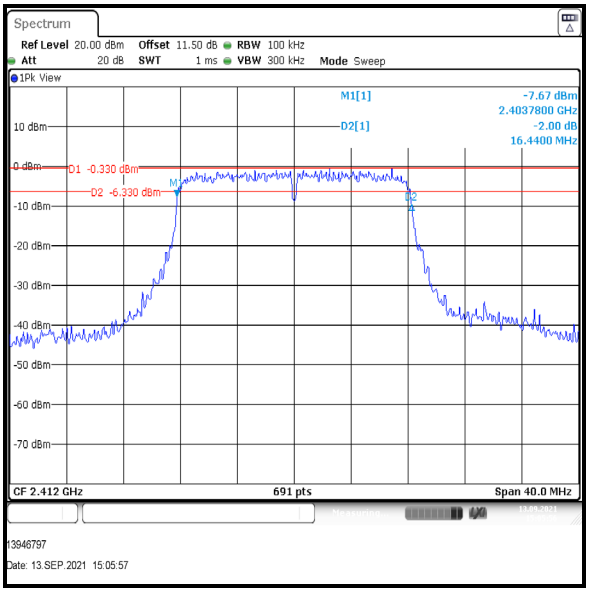


Top Channel

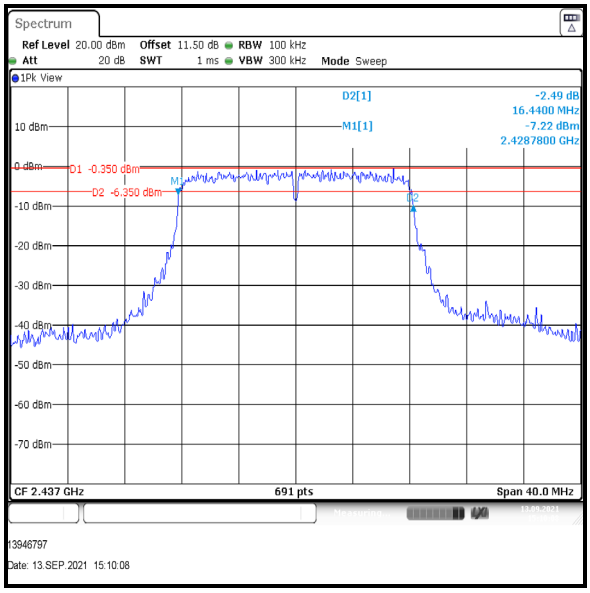
Transmitter Minimum 6 dB Bandwidth (continued)

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

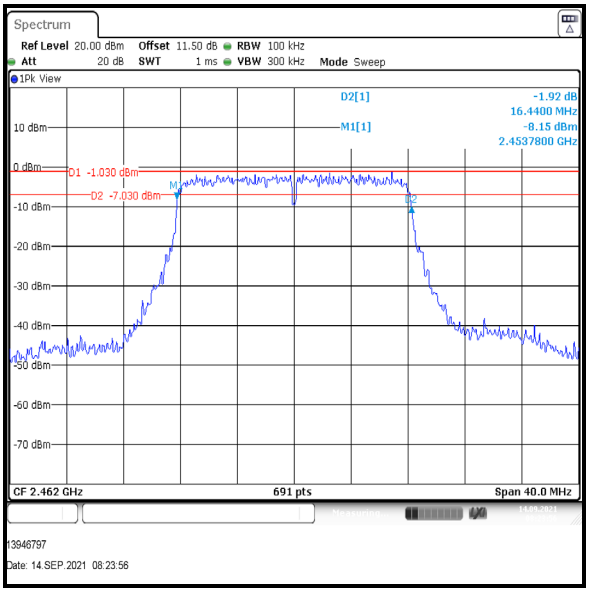
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16440	≥500	15940	Complied
Middle	16440	≥500	15940	Complied
Top	16440	≥500	15940	Complied



Bottom Channel



Middle Channel

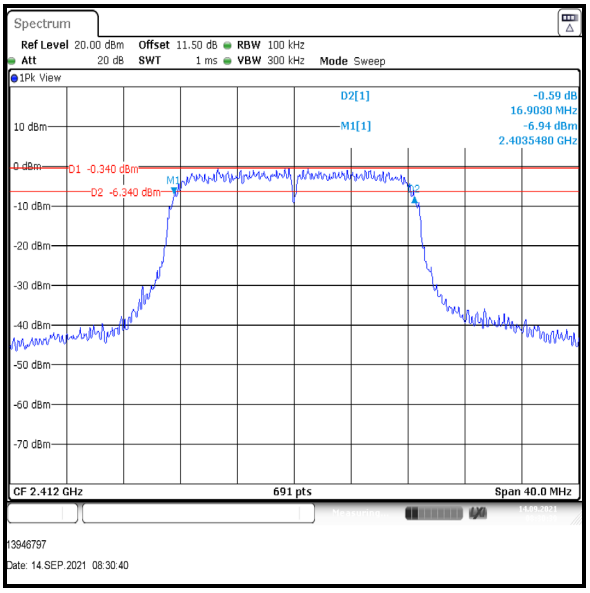


Top Channel

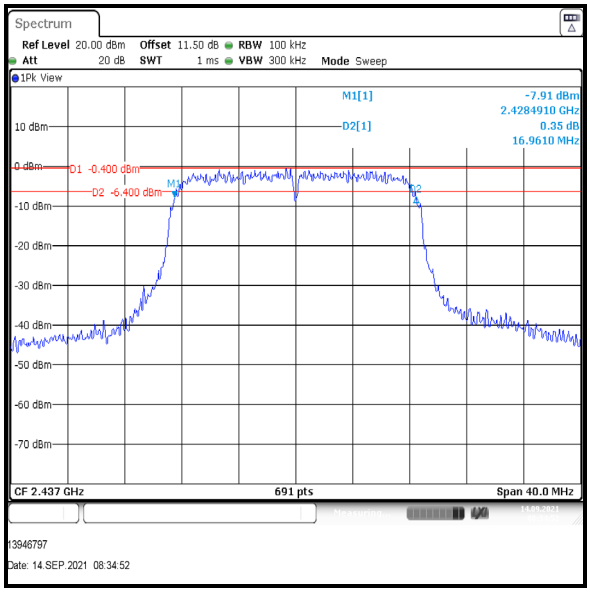
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / HT20 / MCS0

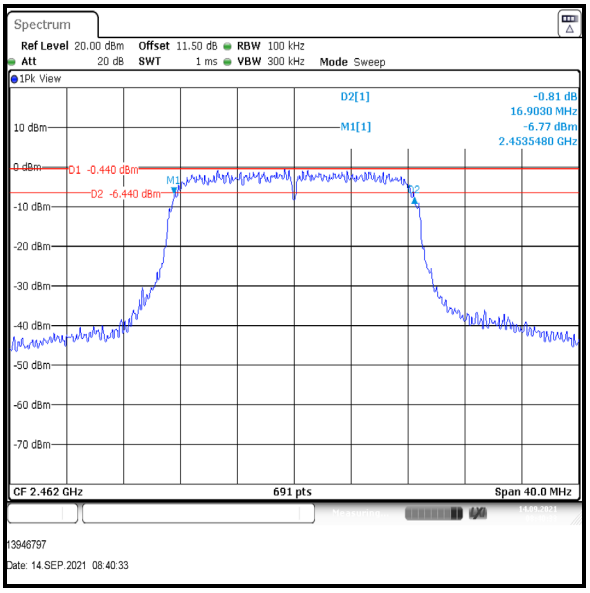
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16903	≥500	16403	Complied
Middle	16961	≥500	16461	Complied
Top	16903	≥500	16403	Complied



Bottom Channel



Middle Channel



Top Channel

4.3 Transmitter Power Spectral Density

Test Summary:

Test Engineers:	Max Passell & Kieran Highton	**Test Date:**	14 September 2021
Test Sample Serial Number:	STV00004		

FCC Reference:	Part 15.247(e)
ISED Canada Reference:	RSS-247 5.2(b)
Test Method Used:	FCC KDB 558074 Section 8.4 referencing ANSI C63.10 Section 11.10.3

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	57

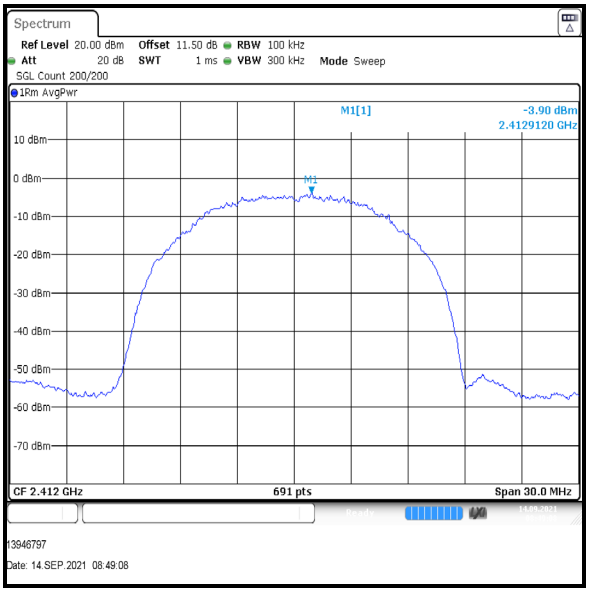
Note(s):

1. The customer declared the following data rates to be used for all measurements as:
    - 802.11b / DBPSK / 1 Mbps
    - 802.11g / BPSK / 6 Mbps
    - 802.11n HT20 / BPSK / MCS0
2. Final measurements were performed using the above configurations on bottom, middle and top channels.
3. The EUT was transmitting at 100% 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 100 kHz and video bandwidth 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 suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

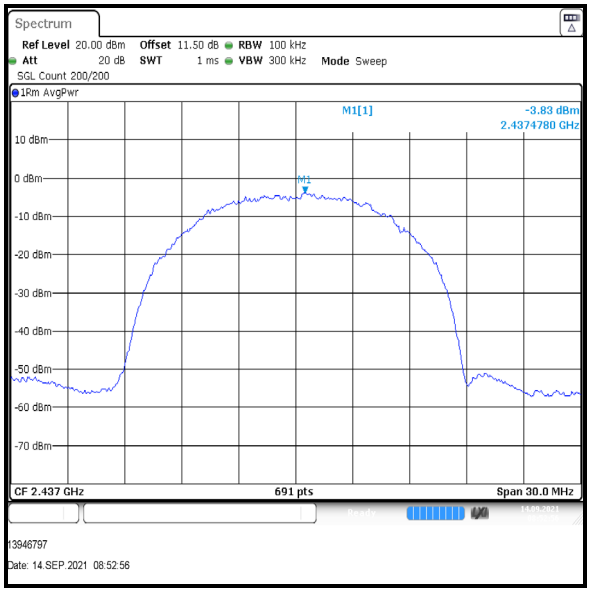
Transmitter Power Spectral Density (continued)

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

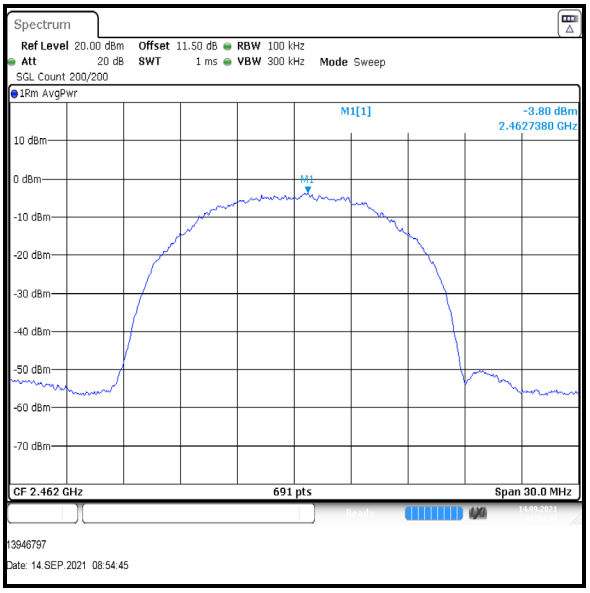
Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-3.9	8.0	11.9	Complied
Middle	-3.8	8.0	11.8	Complied
Top	-3.8	8.0	11.8	Complied



Bottom Channel



Middle Channel

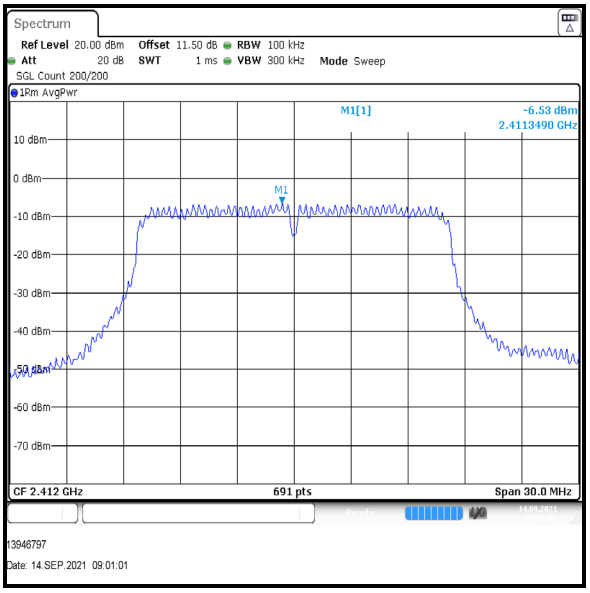


Top Channel

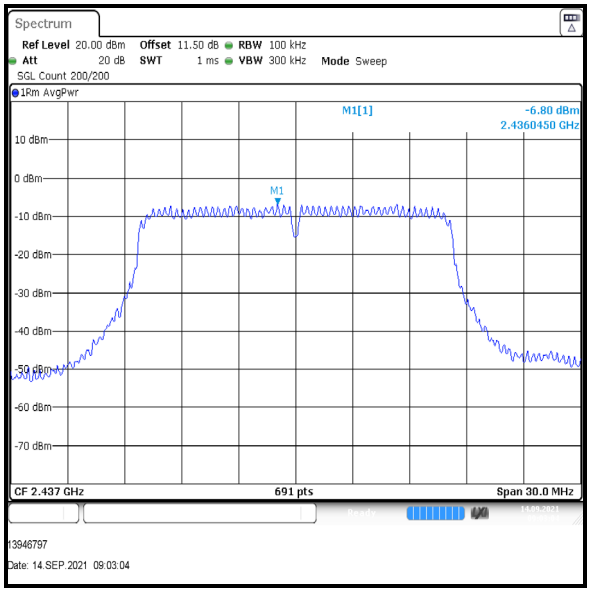
Transmitter Power Spectral Density (continued)

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

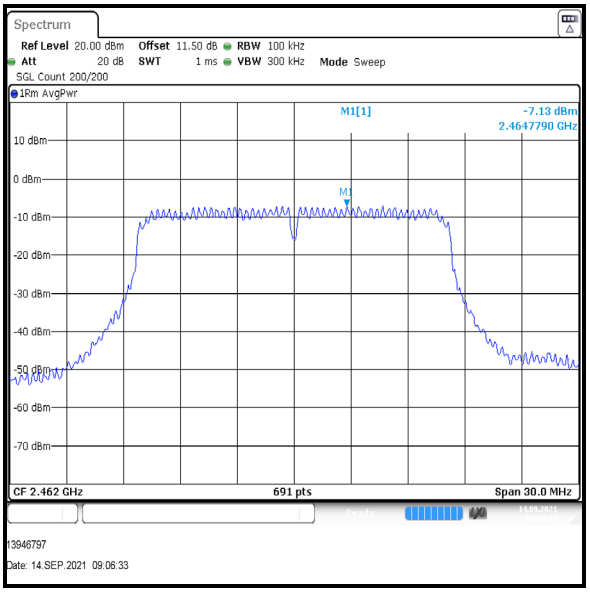
Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-6.5	8.0	14.5	Complied
Middle	-6.8	8.0	14.8	Complied
Top	-7.1	8.0	15.1	Complied



Bottom Channel



Middle Channel

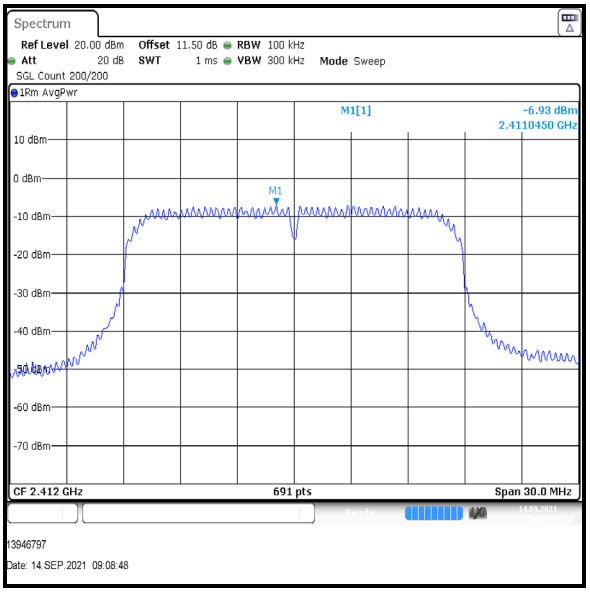


Top Channel

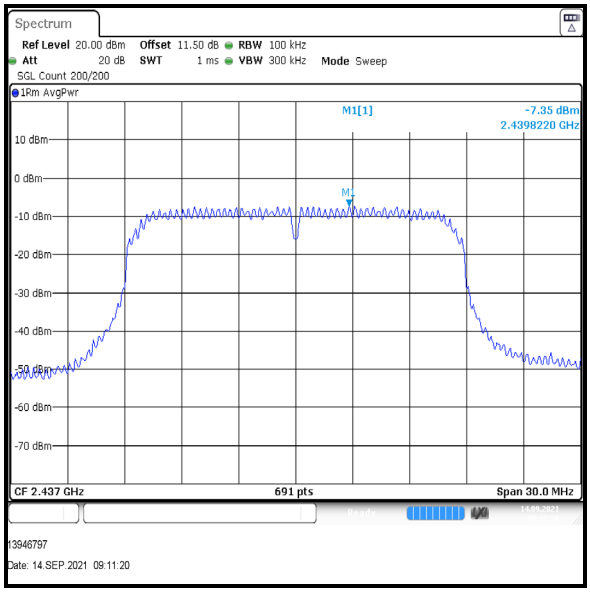
Transmitter Power Spectral Density (continued)

Results: 802.11n / HT20 / BPSK / MCS0

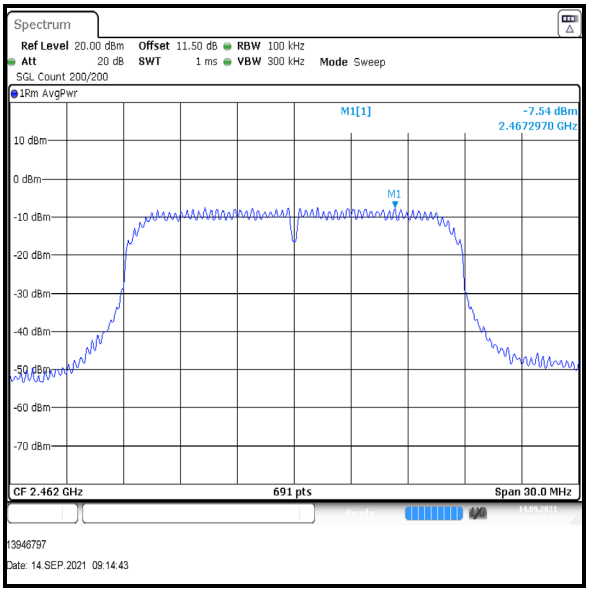
Channel	PSD (dBm/100 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-6.9	8.0	14.9	Complied
Middle	-7.3	8.0	15.3	Complied
Top	-7.5	8.0	15.5	Complied



Bottom Channel



Middle Channel



Top Channel

4.4 Transmitter Maximum (Average) Output Power

Test Summary:

Test Engineers:	Max Passell & Kieran Highton	**Test Date:**	14 September 2021
Test Sample Serial Number:	STV00004		

FCC Reference:	Part 15.247(b)(3)
ISED Canada Reference:	RSS-Gen 6.12 / RSS-247 5.4(d)
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):	23
Relative Humidity (%):	57

Note(s):

1. The customer declared the following data rates to be used for all measurements:
    - 802.11b / DBPSK / 1 Mbps
    - 802.11g / BPSK / 6 Mbps
    - 802.11n HT20 / BPSK / MCS0
2. Final measurements were performed using the above configurations on bottom, middle and top channels.
3. The EUT was transmitting at 100% 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. The signal analyser resolution bandwidth was set to 200 kHz and video bandwidth 1 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.
4. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

Transmitter Maximum (Average) Output Power (continued)

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

Conducted Peak Limit Comparison

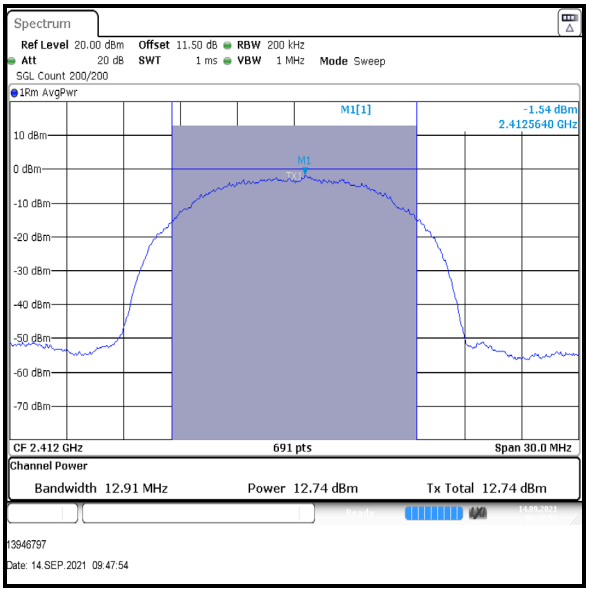
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	12.7	30.0	17.3	Complied
Middle	13.9	30.0	16.1	Complied
Top	13.8	30.0	16.2	Complied

EIRP Limit Comparison

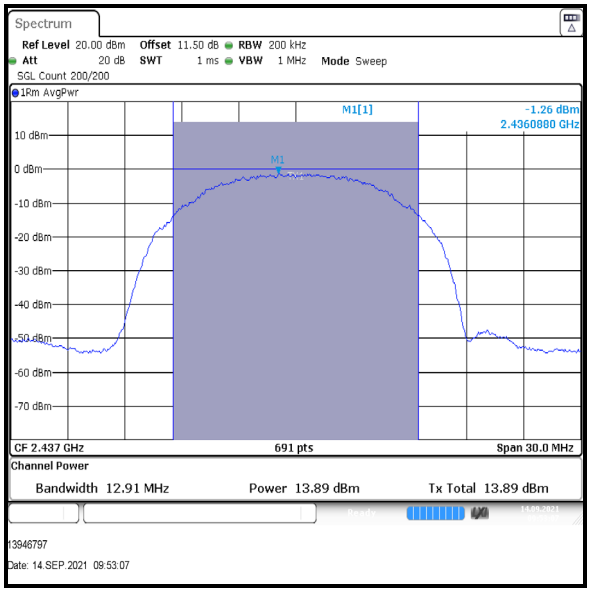
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	12.7	-1.5	11.2	36.0	24.8	Complied
Middle	13.9	-1.5	12.4	36.0	23.6	Complied
Top	13.8	-1.5	12.3	36.0	23.7	Complied

Transmitter Maximum (Average) Output Power (continued)

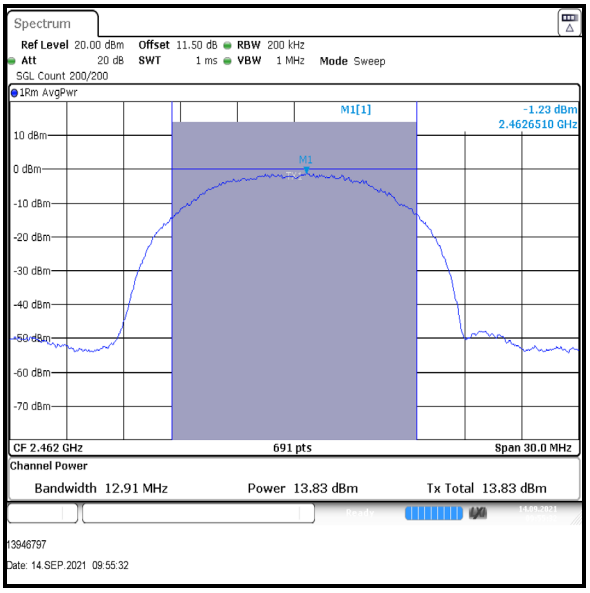
Results: 802.11b / 20 MHz / DBPSK / 1 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum (Average) Output Power (continued)

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

Conducted Peak Limit Comparison

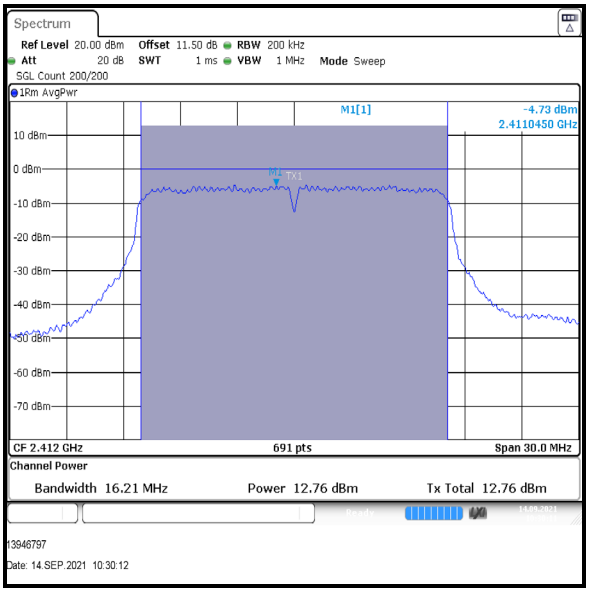
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	12.8	30.0	17.2	Complied
Middle	12.7	30.0	17.3	Complied
Top	12.5	30.0	17.5	Complied

EIRP Limit Comparison

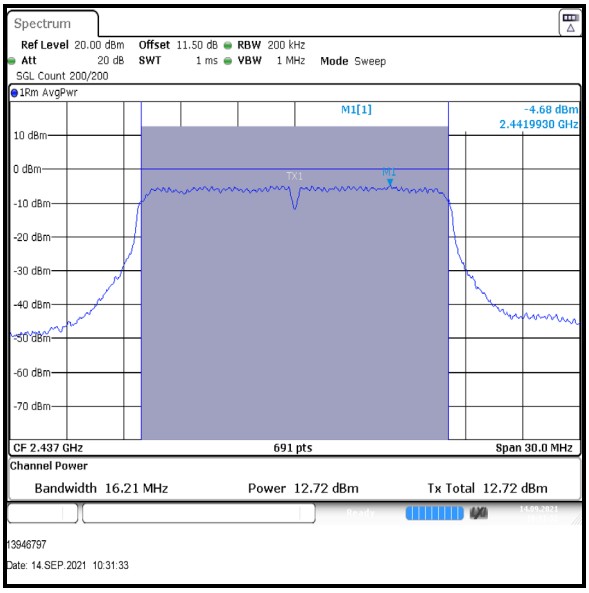
Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	12.8	-1.5	11.3	36.0	24.7	Complied
Middle	12.7	-1.5	11.2	36.0	24.8	Complied
Top	12.5	-1.5	11.0	36.0	25.0	Complied

Transmitter Maximum (Average) Output Power (continued)

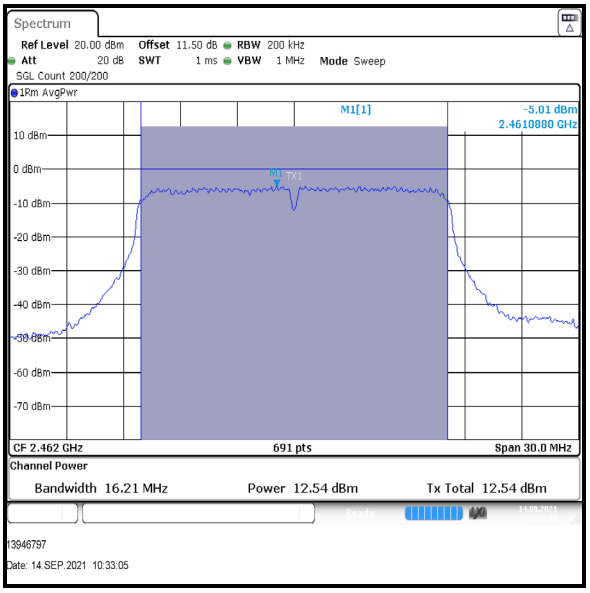
Results: 802.11g / 20 MHz / BPSK / 6 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum (Average) Output Power (continued)

Results: 802.11n / HT20 / BPSK / MSC0

Conducted Peak Limit Comparison

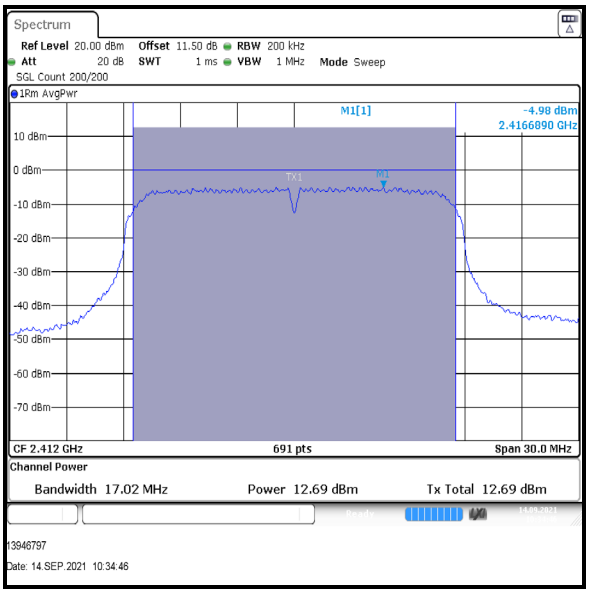
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	12.7	30.0	17.3	Complied
Middle	12.5	30.0	17.5	Complied
Top	12.3	30.0	17.7	Complied

EIRP Limit Comparison

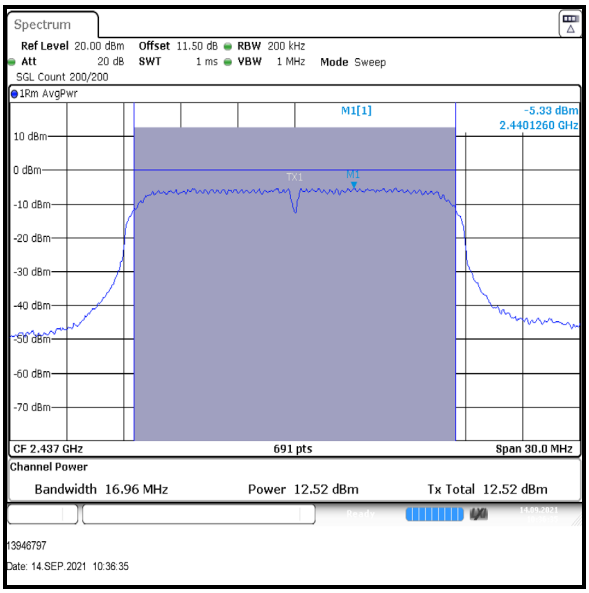
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	12.7	-1.5	11.2	36.0	24.8	Complied
Middle	12.5	-1.5	11.0	36.0	25.0	Complied
Top	12.3	-1.5	10.8	36.0	25.2	Complied

Transmitter Maximum (Average) Output Power (continued)

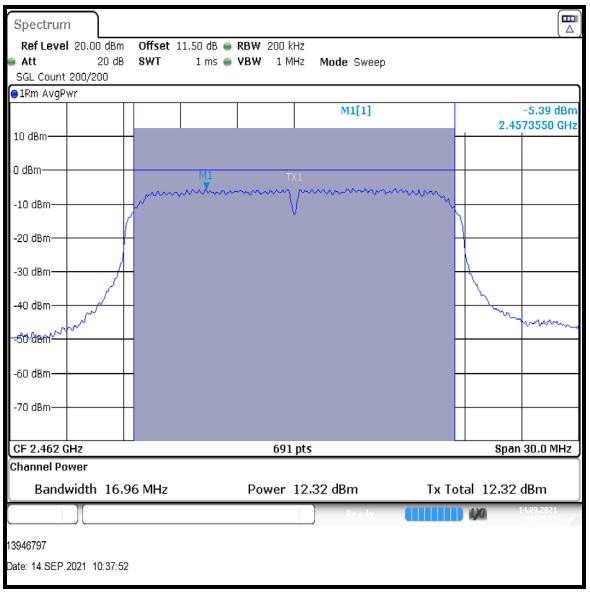
Results: 802.11n / HT20 / BPSK / MSC0



Bottom Channel



Middle Channel



Top Channel

5 Radiated Test Results

5.1 Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineers:	Nick Steele & Andrew Harding	**Test Dates:**	16 September 2021 & 21 September 2021
Test Sample Serial Number:	STV00003		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 / RSS-247 5.5
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5
Frequency Range	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	45 to 50

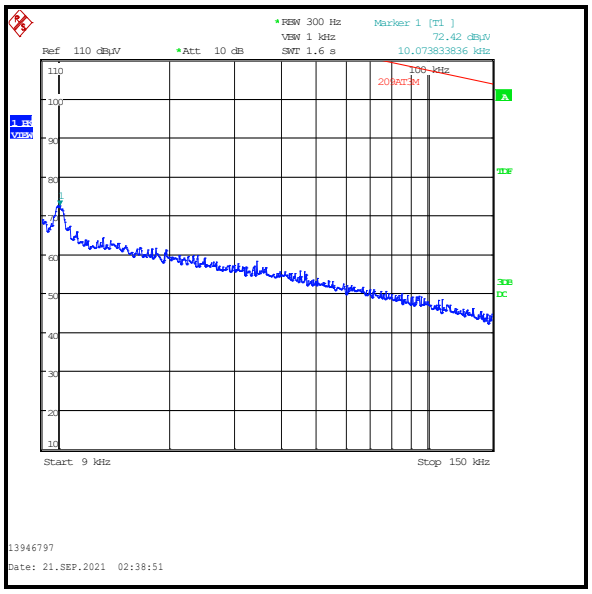
Note(s):

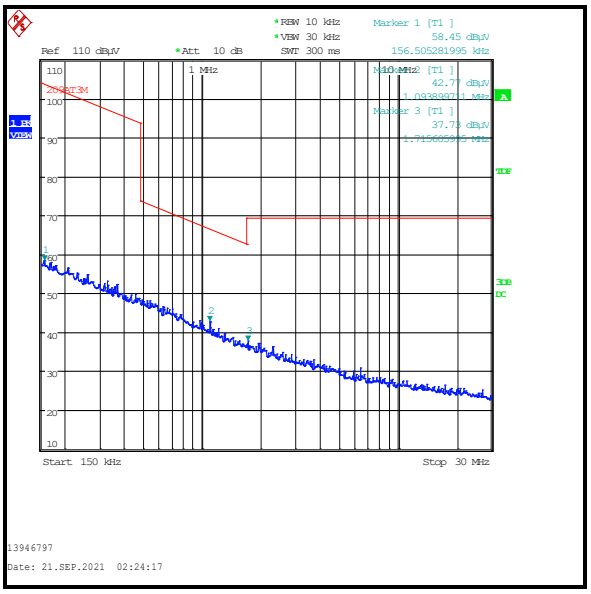
1. The EUT was transmitting with a data rate of 802.11b 1Mbps, as it was found to have the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The preliminary scans showed 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.
4. All emissions shown on the pre-scans were investigated and found to be ambient, > 20 dB below the appropriate limit or below the noise floor of the measurement system. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
5. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The limit was extrapolated to 3 metres in accordance with ANSI C63.10 Section 6.4.4.2. Correlation data between the semi-anechoic chamber and an open-field test site is available upon request.
6. Measurements between 30 MHz to 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.
7. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: During 9 kHz to 150 kHz tests, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used and trace mode was Max Hold. For 30 MHz to 1 GHz, the 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.

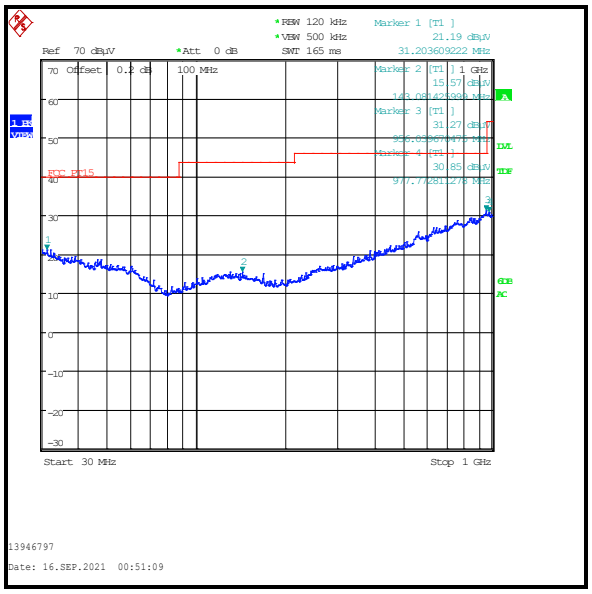
Transmitter Radiated Emissions (continued)

Results: Middle Channel / 802.11b / 1Mbps

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
856.030	Horizontal	31.3	46.0	14.7	Complied







5.2 Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	15 September
Test Sample Serial Number:	STV00003		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	50

Note(s):

1. The EUT was transmitting with a data rate of 802.11b 1Mbps, as it was found to have the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. All other emissions shown on the pre-scan plot were investigated and found to be ambient, >20 dB below the appropriate limit or below the measurement system noise floor.
4. The emission shown approximately at 2441 MHz on the 1 GHz to 3 GHz plot is the EUT fundamental.
5. 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.
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 / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4824.240	Horizontal	56.8	74.0	17.2	Complied

Results: Bottom Channel / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4824.641	Horizontal	47.8	54.0	6.2	Complied

Results: Middle Channel / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4874.099	Horizontal	56.4	74.0	17.6	Complied

Results: Middle Channel / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
48732.981	Horizontal	47.3	54.0	6.7	Complied

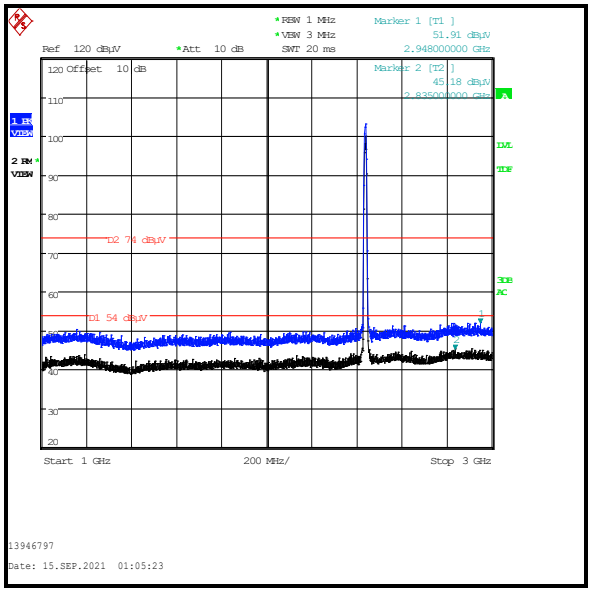
Results: Top Channel / Peak

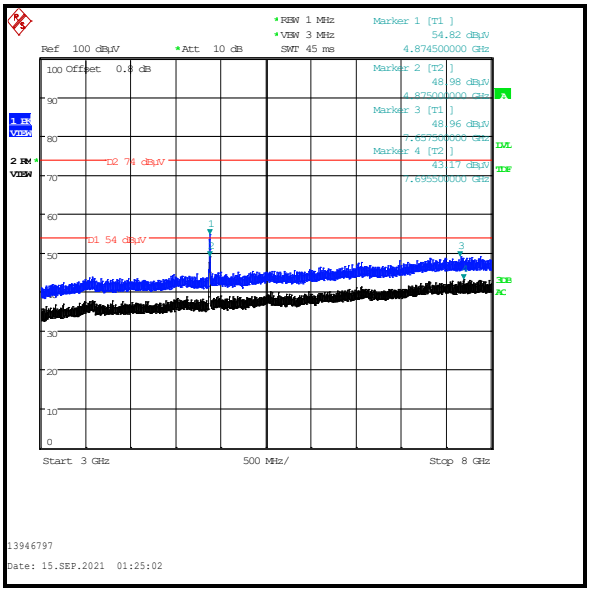
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4932.424	Horizontal	55.2	74.0	18.8	Complied

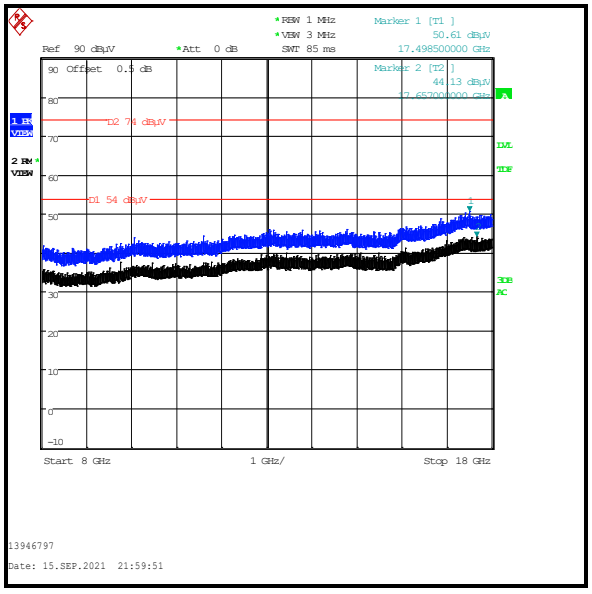
Results: Top Channel / Average

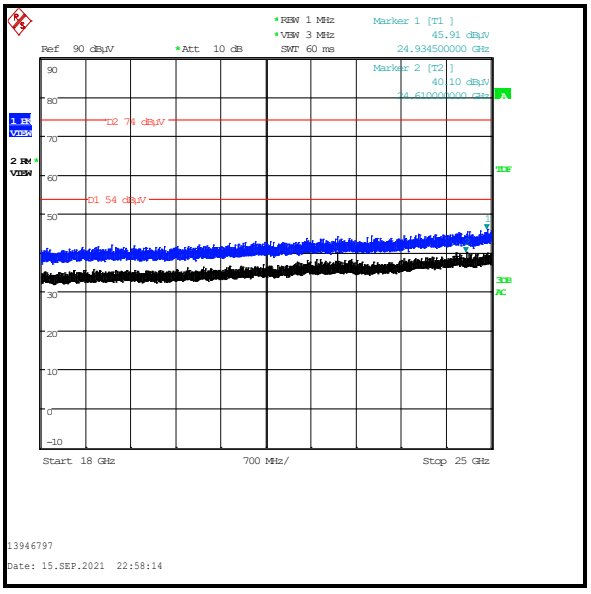
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4924.561	Horizontal	46.1	54.0	7.9	Complied

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 Engineer:	Nick Steele	**Test Date:**	15 September 2021
Test Sample Serial Number:	STV00003		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 / RSS-247 5.5
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):	23
Relative Humidity (%):	46

Note(s):

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

    Final measurements were performed with the above configurations.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. 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 or 11.9.2.2.4 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.
4. 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.
5. 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 / 1 Mbps

Results: Lower Band Edge

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.718	Horizontal	42.0	64.4	22.4	Complied
2400	Horizontal	41.6	64.4	22.8	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	51.4	74.0	22.6	Complied
2486.064	Horizontal	52.1	74.0	21.9	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	40.1	54.0	13.9	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

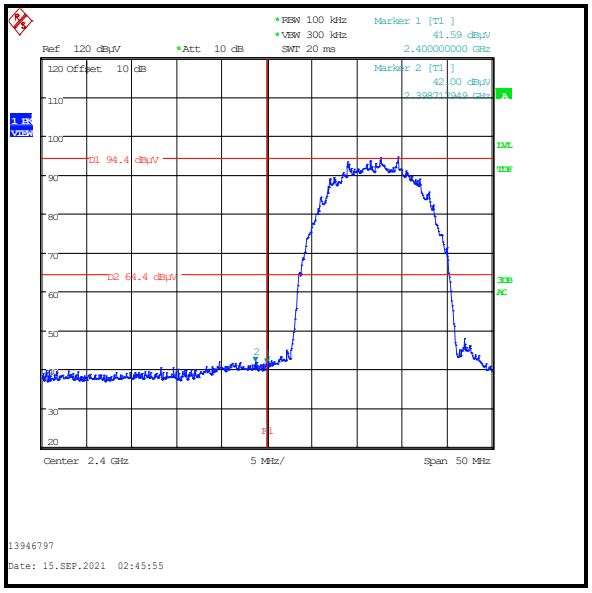
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2371.282	Horizontal	50.5	74.0	23.5	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

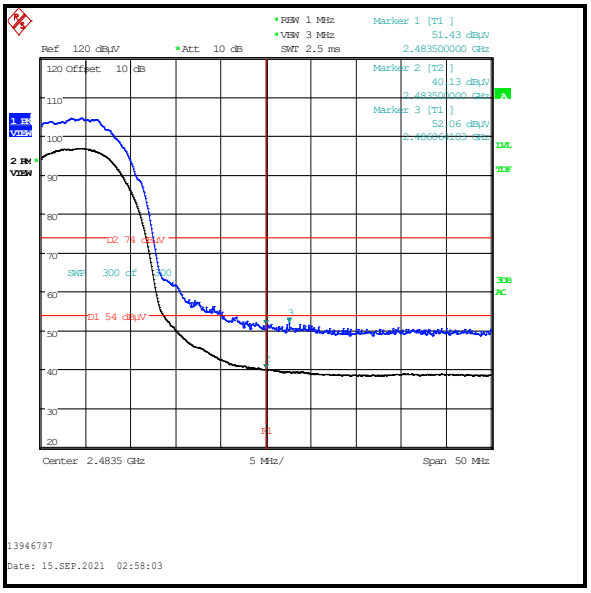
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2388.974	Horizontal	38.4	54.0	15.6	Complied

Transmitter Band Edge Radiated Emissions (continued)

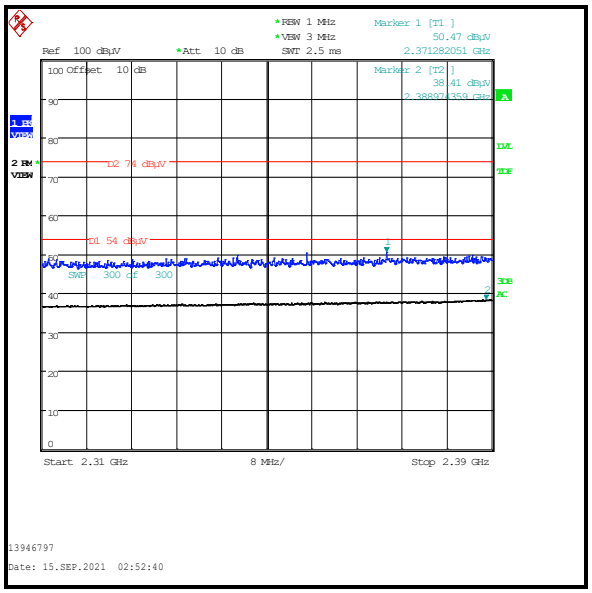
Results: 802.11b / 20 MHz / 1 Mbps



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11g / 20 MHz / 6 Mbps

Results: Lower Band Edge

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.237	Horizontal	55.3	58.8	3.5	Complied
2400	Horizontal	53.4	58.8	5.4	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	60.3	74.0	13.7	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	48.6	54.0	5.4	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

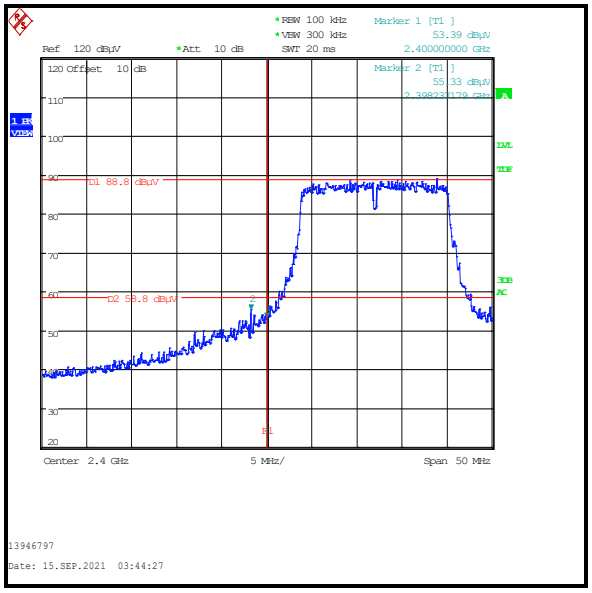
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.231	Horizontal	56.3	74.0	17.7	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

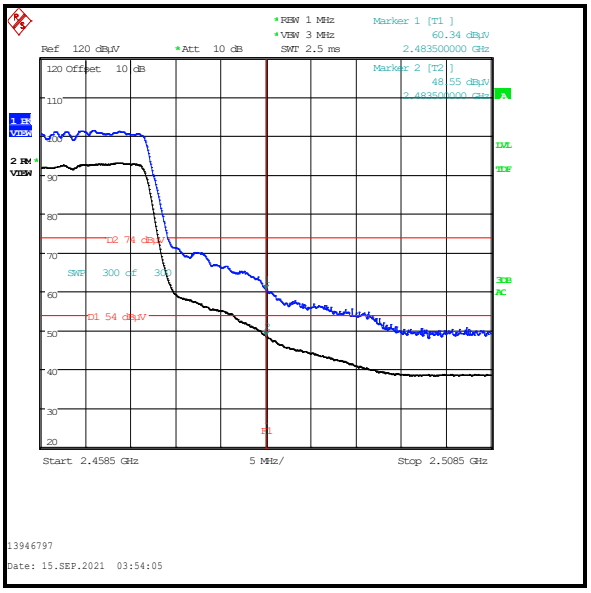
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Horizontal	43.5	54.0	10.5	Complied

Transmitter Band Edge Radiated Emissions (continued)

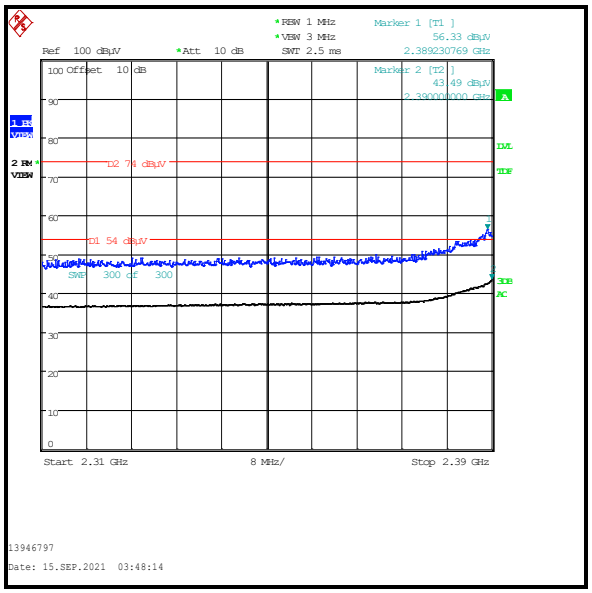
Results: 802.11g / 20 MHz / 6 Mbps



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)

Results: 802.11n HT20 / 20 MHz / MCS0

Results: Lower Band Edge

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.840	Horizontal	56.8	59.6	2.8	Complied
2400	Horizontal	54.9	59.6	4.7	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	63.1	74.0	10.9	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	49.5	54.0	4.5	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

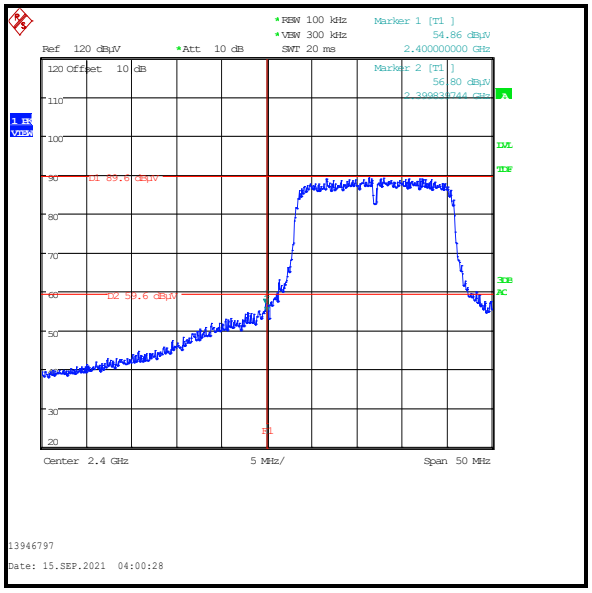
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.744	Horizontal	58.5	74.0	15.5	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

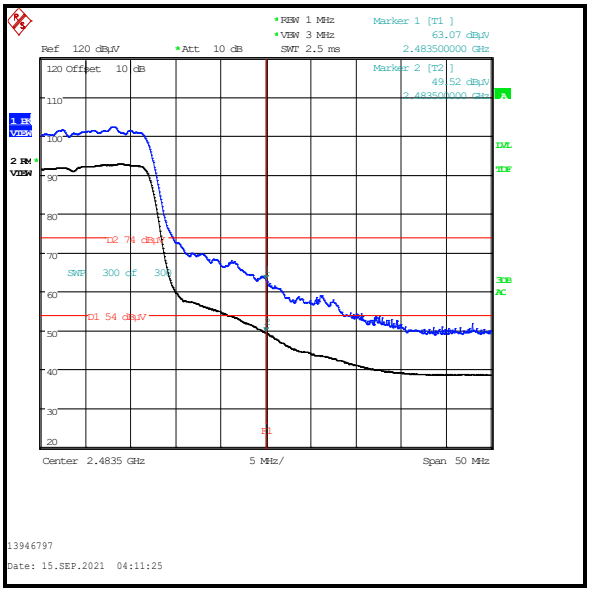
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2390.000	Horizontal	46.1	54.0	7.9	Complied

Transmitter Band Edge Radiated Emissions (continued)

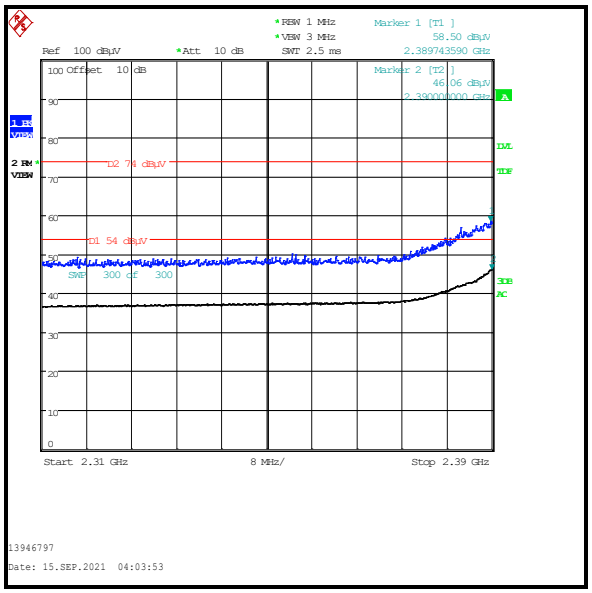
Results: 802.11n HT20 / 20 MHz / MCS0



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

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