



TEST REPORT

Test Report No. : UL-RPT-RP13627946-616A

Customer : Ubisense
Model No. / HVIN : D4UWBBLB
PMN : UB-Tag
FCC ID : SEAUWBBLB
ISED Certification No. : IC: 8673A-UWBBLB
Technology : 2.4 GHz Proprietary-based on protocol
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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3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 04 June 2021

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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	04/06/2021	Initial Version	Sarah Williams

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1 Attestation of Test Results

1.1 Description of EUT

The equipment under test was a location-tracking tag containing a proprietary BLE based transmitter and an Ultra Wide Band (UWB) transmitter operating in the 5925 MHz to 7250 MHz band. The unit has an integral antenna and is normally powered by battery from a nominal 3.0 VDC supply.

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, G24 8AH, United Kingdom
Test Dates:	17 February 2021 to 19 May 2021

1.3 Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
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(b)(3)	RSS-Gen 6.12 / RSS-247 5.4(d)	Transmitter Maximum Peak Output Power	✓
Part 15.247(e)	RSS-247 5.4(b)	Transmitter Power Spectral Density	Note 1
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. In accordance with ANSI C63.10 Section 11.10.1, PSD measurements are not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured output power.

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
99% Occupied 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 %
Conducted Maximum Peak 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 Conducted Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2001	Thermohygrometer	Testo	608-H1	45041824	10 Dec 2021	12
M2033	Signal Analyser	Rohde & Schwarz	FSV13	101667	24 Jul 2021	12
G0615	Signal Generator	Rohde & Schwarz	SMBV100A	260473	19 Mar 2023	36
A2525	Attenuator	AtlanTecRF	AN18W5-10	832827#3	Calibrated before use	-

Test Equipment Used for Transmitter Radiated Emissions

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Oct 2021	12
M2040	Thermohygrometer	Testo	608-H1	45124934	10 Dec 2021	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	14 Apr 2021	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	29 Sep 2021	12
A553	Antenna	Chase	CBL6111A	1593	15 Sep 2021	12
A3083	Low Pass Filter	AtlanTecRF	AFL-01000	18010900076	03 Feb 2022	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	16 Feb 2022	12
A2896	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-023	16 Feb 2022	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	21 Sep 2022	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2022	12
M2003	Thermohygrometer	Testo	608-H1	45046641	10 Dec 2021	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	21 Oct 2021	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	07 Dec 2021	12
A2948	Pre-Amplifier	Com Power	PAM-118A	551087	21 Oct 2021	12
A3142	Pre-Amplifier	Schwarzbeck	BBV 9718 B	00020	21 Oct 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	00653	23 Oct 2021	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	26 Oct 2021	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

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
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	07 Dec 2021	12
A2948	Pre-Amplifier	Com Power	PAM-118A	551087	21 Oct 2021	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	00653	23 Oct 2021	12

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	Ubisense
Model Name or Number / HVIN:	D4UWBBLE
PMN:	UB-Tag
Test Sample Serial Number:	0011ce00000061ab (<i>Conducted sample</i>)
Hardware Version:	RevD
Firmware Version:	0.1
FCC ID:	SEAUWBBLE
ISED Canada Certification Number:	IC: 8673A-UWBBLE

Brand Name:	Ubisense
Model Name or Number / HVIN:	D4UWBBLE
PMN:	UB-Tag
Test Sample Serial Number:	0011ce00000061b1 (<i>Radiated sample #1</i>)
Hardware Version:	RevD
Firmware Version:	0.1
FCC ID:	SEAUWBBLE
ISED Canada Certification Number:	IC: 8673A-UWBBLE

Brand Name:	Ubisense
Model Name or Number / HVIN:	D4UWBBLE
PMN:	UB-Tag
Test Sample Serial Number:	0011ce0000006284 (<i>Radiated sample #2</i>)
Hardware Version:	RevD
Firmware Version:	0.1
FCC ID:	SEAUWBBLE
ISED Canada Certification Number:	IC: 8673A-UWBBLE

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:	Proprietary 2.4 GHz Radio (Digital Transmission System)	
Type of Unit:	Transceiver	
Channel Spacing:	2 MHz	
Modulation:	GFSK	
Data Rate:	1 Mbps	
Power Supply Requirement(s):	Nominal	3.0 VDC
Maximum Conducted Output Power:	-1.5 dBm	
Transmit Frequency Range:	2401 MHz to 2481.750 MHz	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	2401.000
	Middle	2441.375
	Top	2481.750

3.4 Description of Available Antennas

The radio utilizes two integrated antennas, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2400-2483.5	3.6

3.5 Description of Test Setup

Support Equipment

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

Description:	Bar Magnet
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):

- Transmitting in test mode at maximum power on bottom, middle or top channel as required.

Configuration and Peripherals

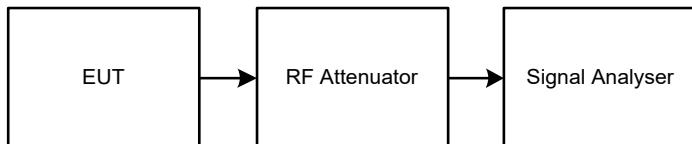
The EUT was tested in the following configuration(s):

- The customer pre-loaded test software/firmware prior to testing. A bar magnet was used to activate the magnetic sensor on the EUT to switch between the relevant pre-loaded test modes. This enabled selection of transmit mode and channel selection.
- For conducted transmit tests, the EUT was powered via a bench DC power supply.
- For all other tests, the EUT was powered by a 3.0 V lithium battery. The battery was soldered on the PCB. The battery voltage was monitored throughout testing.

Test Setup Diagrams

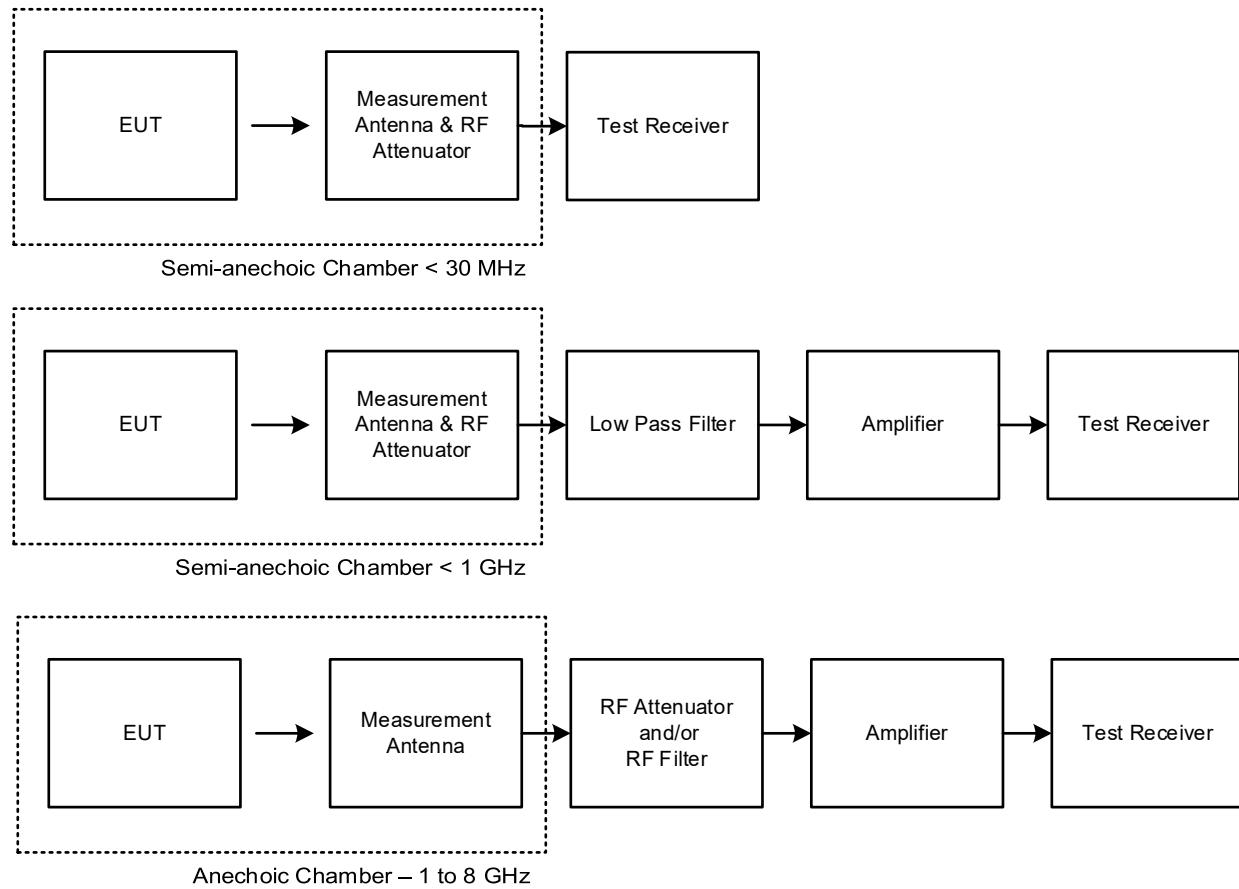
Conducted Tests:

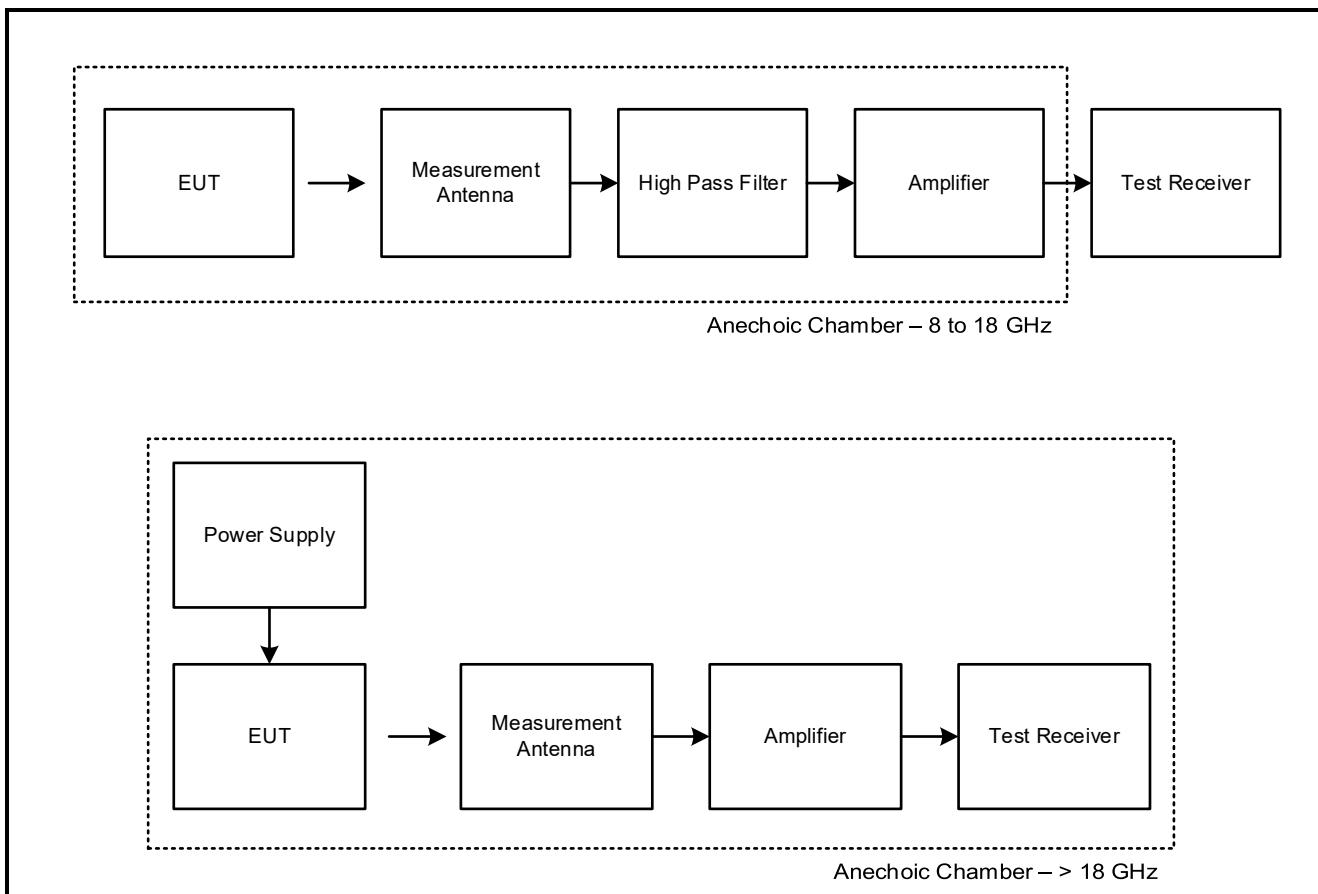
Test Setup for Transmitter Conducted Tests



Radiated Tests:

Test Setup for Transmitter Radiated Emissions



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

4 Antenna Port Test Results

4.1 Transmitter 99% Occupied Bandwidth

Test Summary:

Test Engineer:	Matthew Botfield	Test Date:	17 February 2021
Test Sample Serial Number:	0011ce00000061ab		

FCC Reference:	N/A
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	RSS-Gen 6.7

Environmental Conditions:

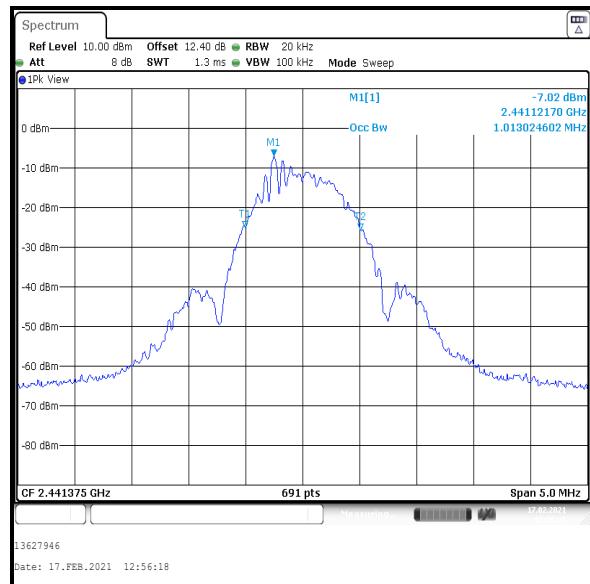
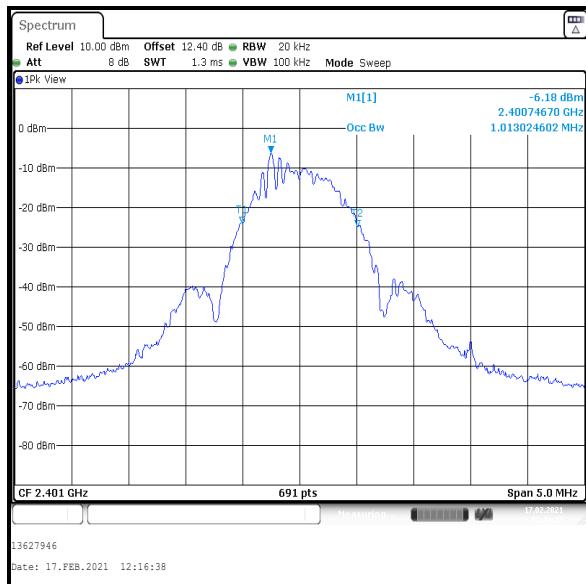
Temperature (°C):	23
Relative Humidity (%):	38

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. The span was set to capture all the products of the modulation process including emission skirts.
2. The signal analyser resolution bandwidth was set to 20 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 5 MHz. The signal analyser occupied bandwidth function measured the 99% emission bandwidth.
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.

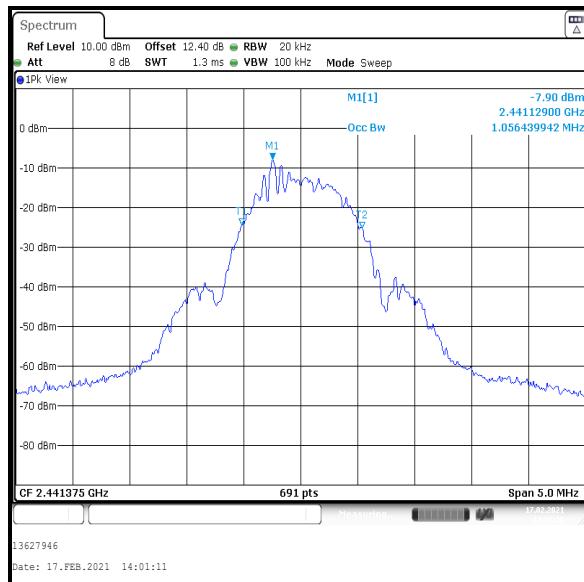
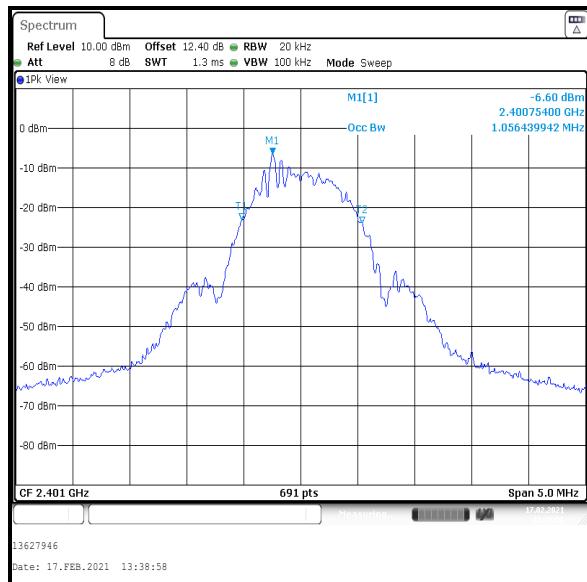
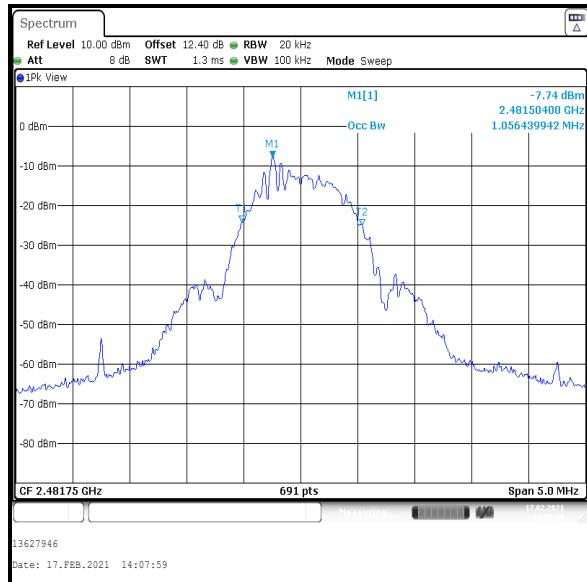
Transmitter 99% Emission Bandwidth (continued)**Results: Port 1**

Channel	99% Emission Bandwidth (kHz)
Bottom	1013.025
Middle	1013.025
Top	1056.440

**Bottom Channel****Top Channel**

Transmitter 99% Emission Bandwidth (continued)**Results: Port 2**

Channel	99% Emission Bandwidth (kHz)
Bottom	1056.440
Middle	1056.440
Top	1056.440

**Bottom Channel****Middle Channel****Top Channel**

4.2 Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Matthew Botfield	Test Date:	17 February 2021
Test Sample Serial Number:	0011ce00000061ab		

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:

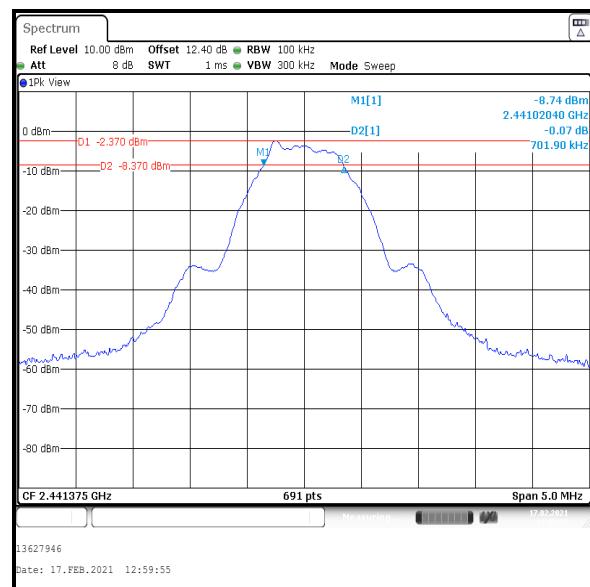
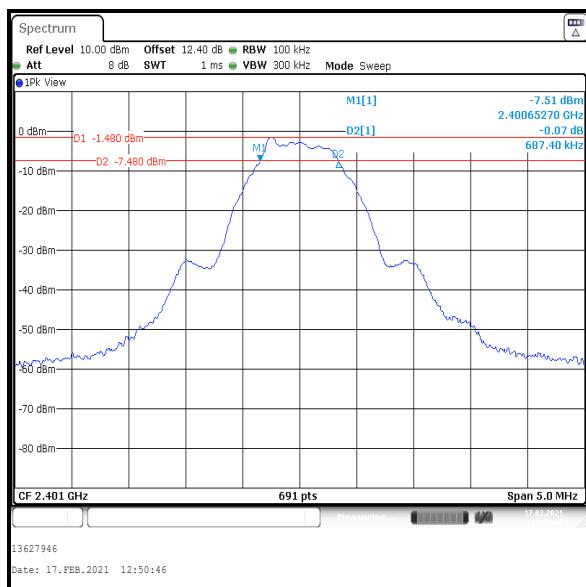
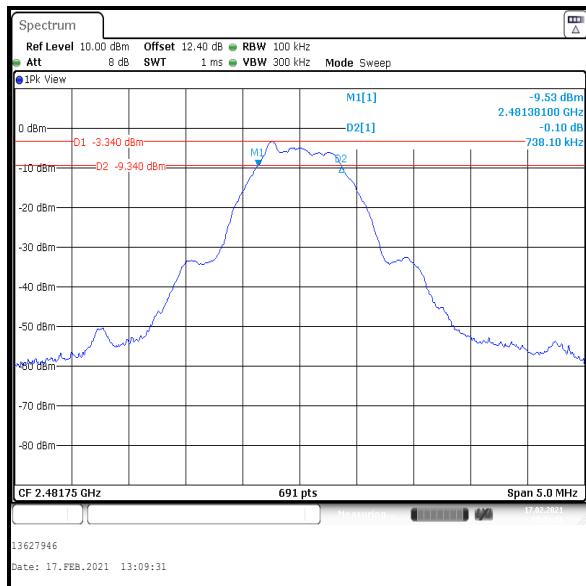
Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with ANSI C63.10 section 11.8.1 Option 1 measurements 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 DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. 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.

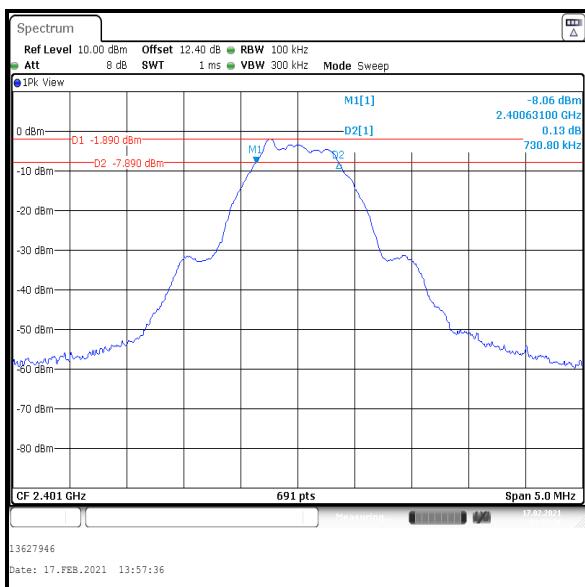
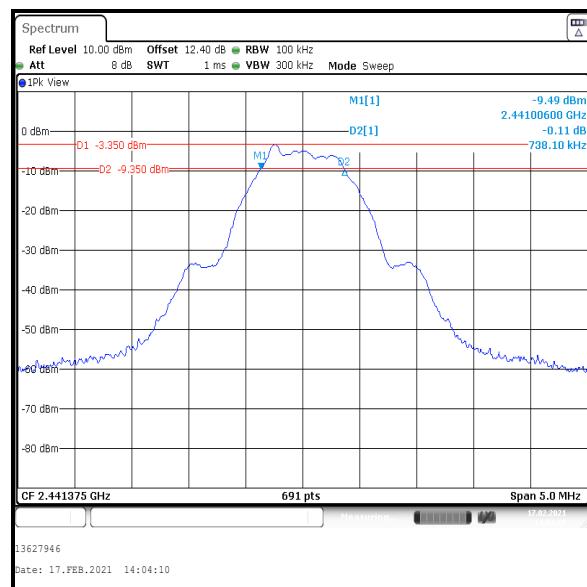
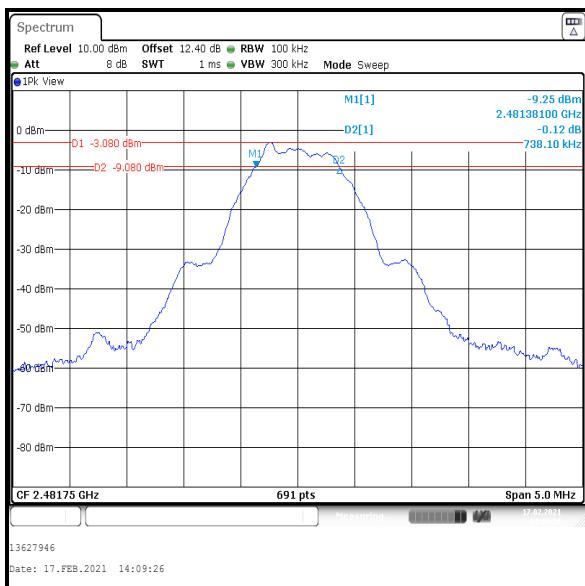
Transmitter 6 dB Bandwidth (continued)**Results: Port 1**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	687.400	≥500	187.400	Complied
Middle	701.900	≥500	201.900	Complied
Top	738.100	≥500	238.100	Complied

**Bottom Channel****Top Channel****Middle Channel**

Transmitter 6 dB Bandwidth (continued)**Results: Port 2**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	730.800	≥500	230.800	Complied
Middle	738.100	≥500	238.100	Complied
Top	738.100	≥500	238.100	Complied

**Bottom Channel****Middle Channel****Top Channel**

4.3 Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Matthew Botfield	Test Date:	17 February 2021
Test Sample Serial Number:	0011ce00000061ab		

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 8.3.1.1 referencing ANSI C63.10 Section 11.9.1.1 and Notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

1. Conducted power tests were performed using a signal analyser in accordance with ANSI C63.10 section 11.9.1.1. with the $RBW \geq DTS$ bandwidth procedure.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. a peak detector was used, sweep time was set to auto and the trace was Max Hold. The span was set to 3 MHz. A marker was placed at the peak of the signal and the results recorded 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.
4. The conducted power was added to the declared antenna gain to obtain the EIRP.

Transmitter Maximum Peak Output Power (continued)**Results: Port 1**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.5	30.0	31.5	Complied
Middle	-2.4	30.0	32.4	Complied
Top	-3.4	30.0	34.4	Complied

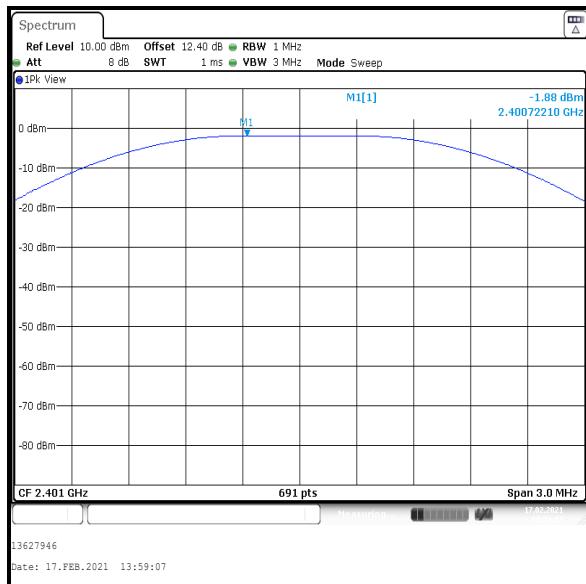
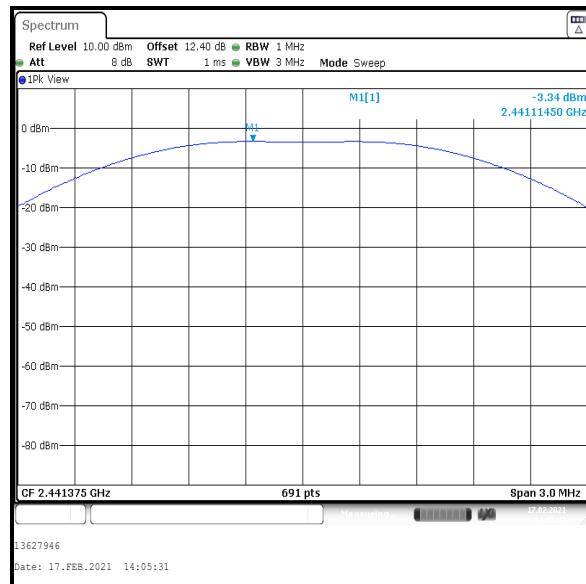
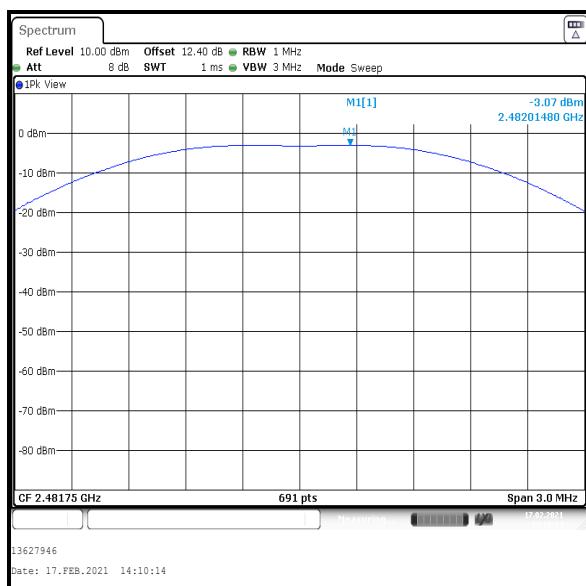
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.5	3.6	2.1	36.0	33.9	Complied
Middle	-2.4	3.6	1.2	36.0	34.8	Complied
Top	-3.4	3.6	0.2	36.0	35.8	Complied

Transmitter Maximum Peak Output Power (continued)**Results: Port 1****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: Port 2**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.9	30.0	31.9	Complied
Middle	-3.3	30.0	33.3	Complied
Top	-3.1	30.0	33.1	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.9	3.6	1.7	36.0	34.3	Complied
Middle	-3.3	3.6	0.3	36.0	35.7	Complied
Top	-3.1	3.6	0.5	36.0	35.5	Complied

Transmitter Maximum Peak Output Power (continued)**Results: Port 2****Bottom Channel****Middle Channel****Top Channel**

5 Radiated Test Results

5.1 Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Jose Bayona	Test Dates:	24 February 2021 & 19 May 2021
Test Sample Serial Numbers:	0011ce00000061b1 & 0011ce0000006284		

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:	ANSI C63.10 Sections 6.3, 6.4 and 6.5
Frequency Range	9 kHz to 1000 MHz

Environmental Conditions:

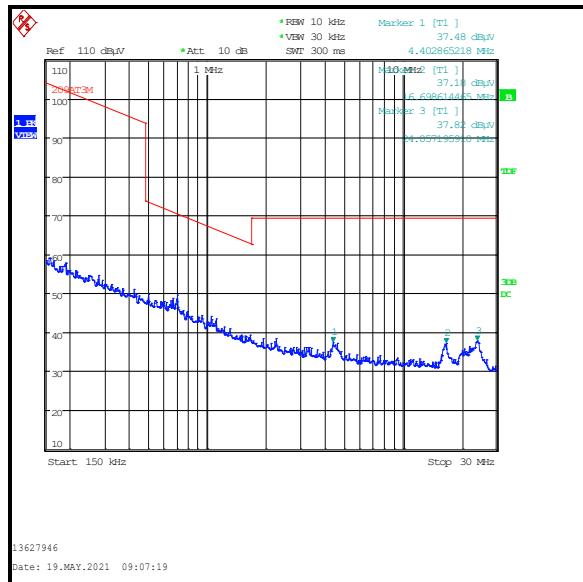
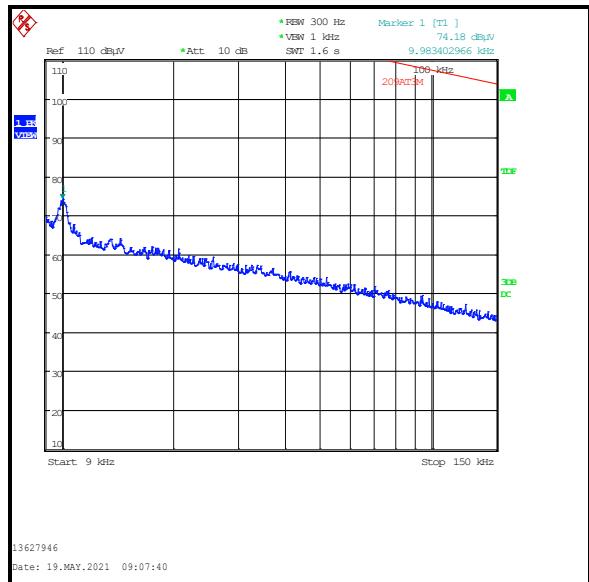
Temperature (°C):	22 to 23
Relative Humidity (%):	34 to 35

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
3. 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.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: For 9 kHz to 150 kHz, 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, 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: Peak / Port 1**

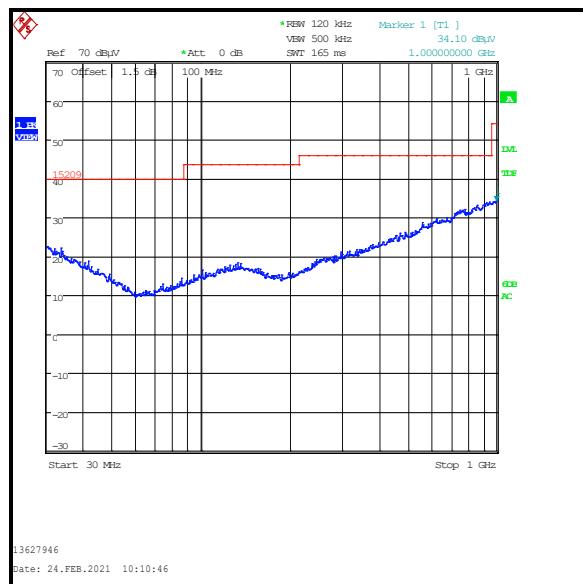
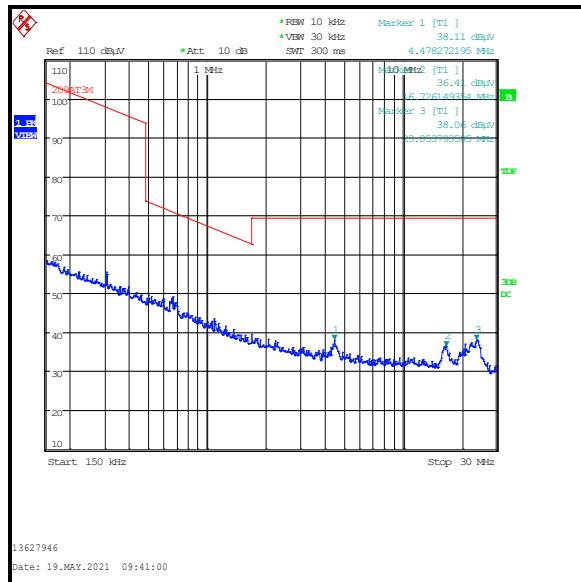
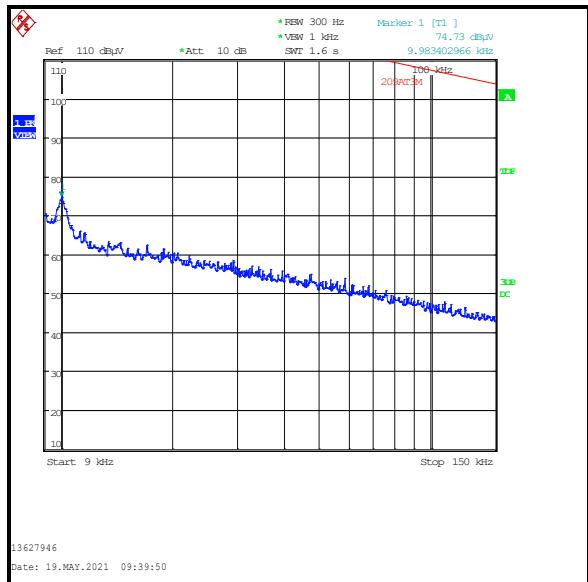
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
972.294	Vertical	34.6	54.0	19.4	Complied



Transmitter Radiated Emissions (continued)

Results: Peak / Port 2

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1000.000	Vertical	34.1	54.0	19.9	Complied



5.2 Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineer:	Jose Bayona	Test Dates:	22 February 2021 to 24 February 2021
Test Sample Serial Numbers:	0011ce00000061b1 & 0011ce0000006284		

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):	22 to 23
Relative Humidity (%):	36 to 40

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-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The emission shown 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.
6. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001 or 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.
7. 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. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.

Transmitter Radiated Emissions (continued)**Results: Peak / Bottom Channel / Port 1**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12003.622	Horizontal	49.5	54.0*	4.5	Complied

Results: Peak / Middle Channel / Port 1

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2328.718	Vertical	39.1	54.0*	14.9	Complied
2345.769	Vertical	40.8	54.0*	13.2	Complied
2361.564	Vertical	40.6	54.0*	13.4	Complied
2377.436	Vertical	40.6	54.0*	13.4	Complied
7323.500	Vertical	50.5	54.0*	3.5	Complied
12205.513	Horizontal	53.6	54.0*	0.4	Complied

Results: Peak / Top Channel / Port 1

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2321.960	Vertical	39.1	54.0*	14.9	Complied
2369.909	Vertical	37.9	54.0*	16.1	Complied
2385.140	Vertical	41.5	54.0*	12.5	Complied
7444.547	Vertical	41.4	54.0*	12.6	Complied
12410.064	Horizontal	55.5	74.0	18.5	Complied
22337.978	Vertical	47.5	54.0*	6.5	Complied

Results: Average / Top Channel / Port 1

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12407.564	Horizontal	49.2	54.0	4.8	Complied

Transmitter Radiated Emissions (continued)**Results: Peak / Bottom Channel / Port 2**

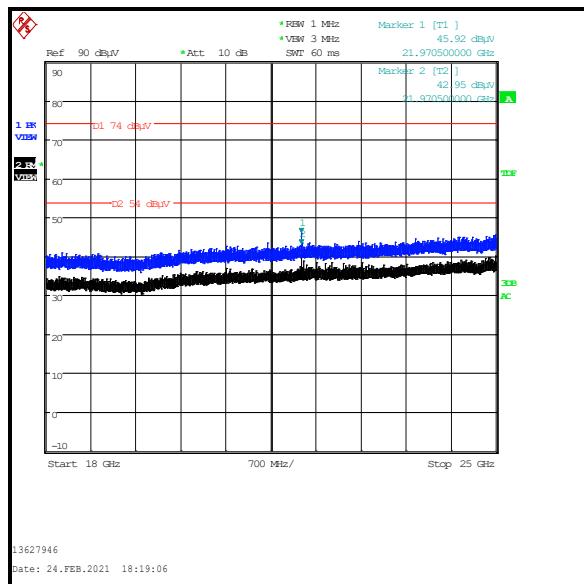
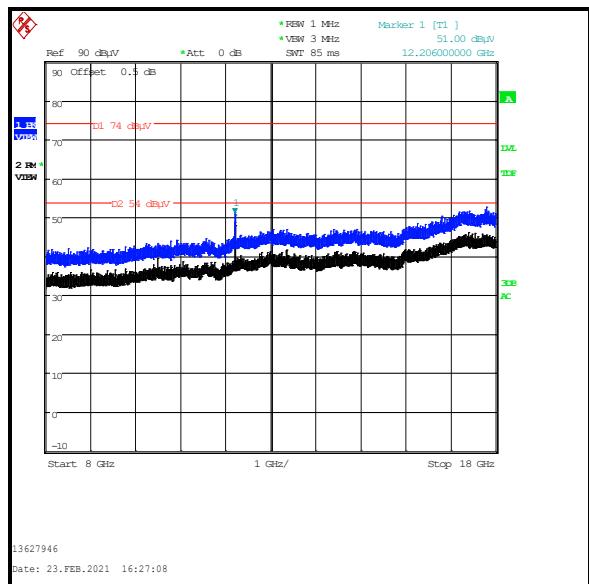
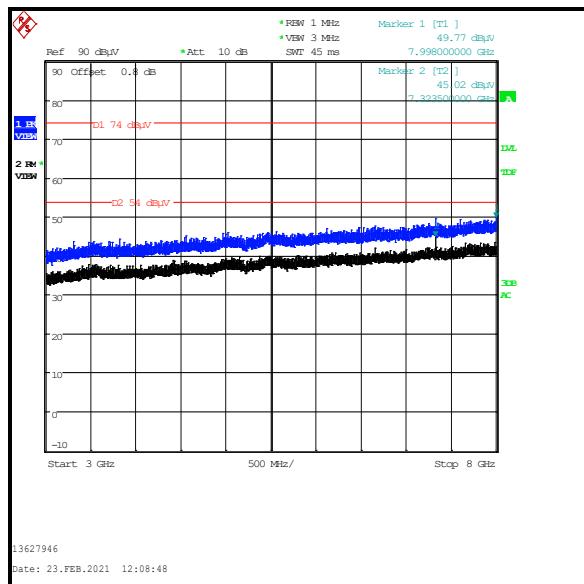
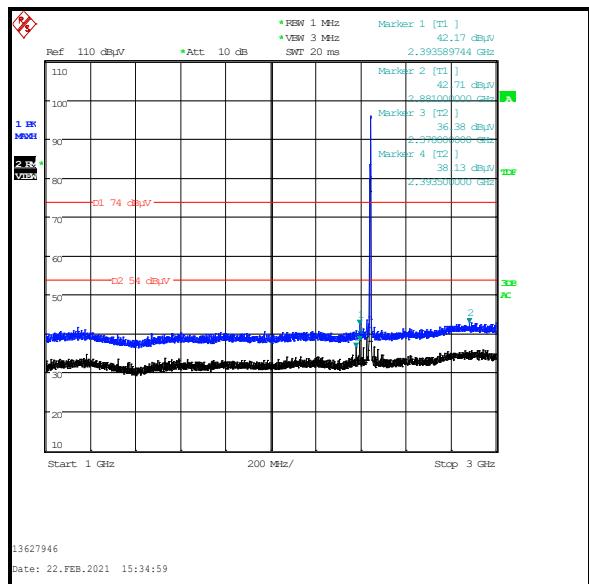
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12003.734	Vertical	48.2	54.0*	5.8	Complied

Results: Peak / Middle Channel / Port 2

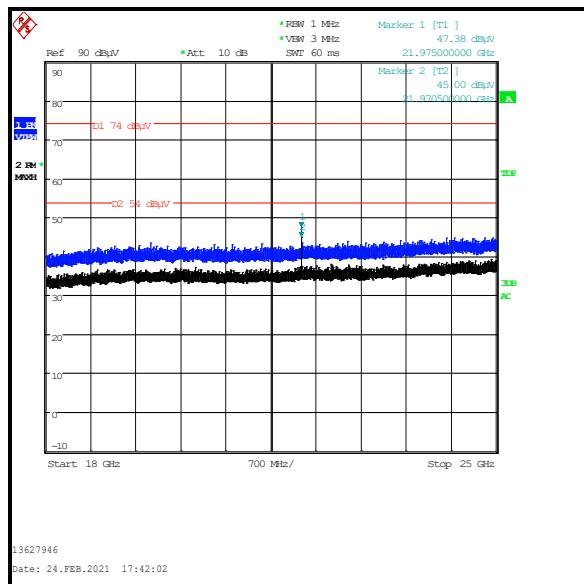
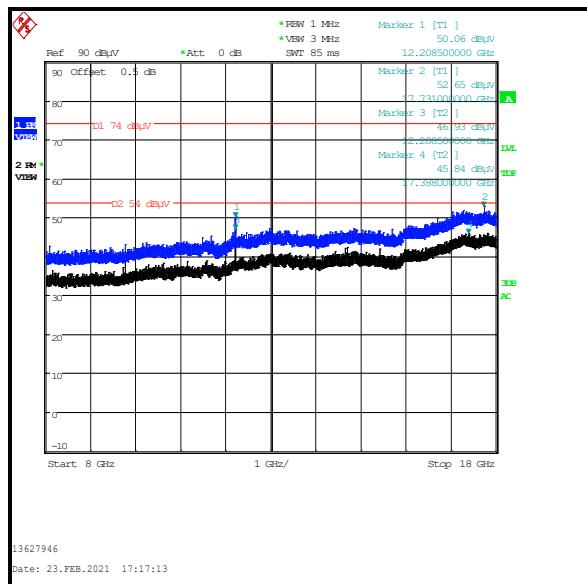
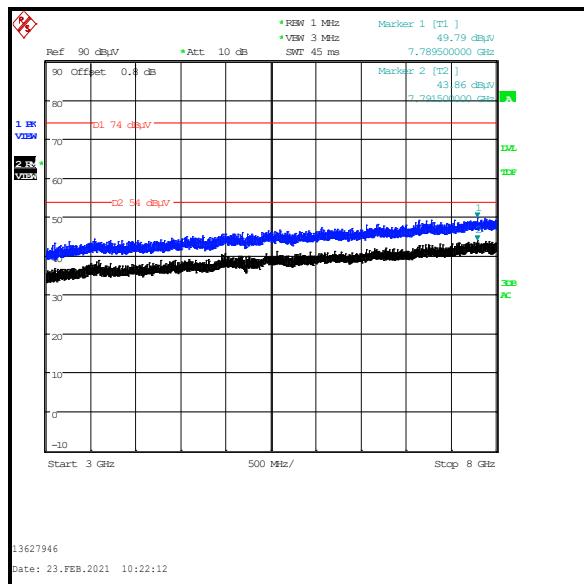
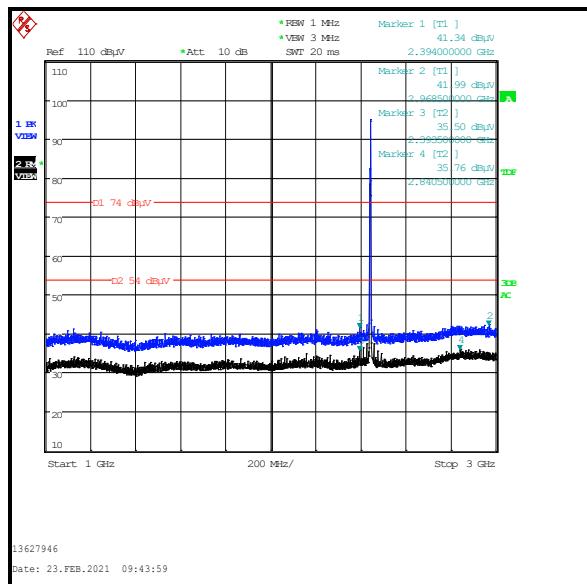
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12205.545	Vertical	51.3	54.0*	2.7	Complied

Results: Peak / Top Channel / Port 2

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12407.64	Vertical	51.7	54.0*	2.3	Complied
22333.27	Horizontal	49.3	54.0*	4.7	Complied

Transmitter Radiated Emissions (continued)**Pre-scans / Port 1**

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

Transmitter Radiated Emissions (continued)**Pre-scans / Port 2**

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:	Jose Bayona	Test Dates:	23 February 2021 to 11 March 2021
Test Sample Serial Numbers:	0011ce00000061b1 & 0011ce0000006284		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13, 8.9 & 8.10 / RSS-247 5.5
Test Method Used:	KDB 558074 Section 8.7 referencing ANSI C63.10 Sections 11.11, 11.12 & 11.13

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	36 to 40

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. 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 11.11.3 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 peak conducted output power was measured using an peak detector in accordance with ANSI C63.10 Section 11.9.1.1 an out-of-band limit line was placed 20 dB (ANSI C63.10 Section 11.11.1(a)) below the peak level. A marker was placed on the band edge spot frequencies. Marker frequency and levels were recorded.
3. 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.
4. 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 peak and RMS detectors respectively. Markers were placed on the highest point on each trace.
5. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)**Results: Port 1****Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Vertical	67.1	76.9*	9.8	Complied
2483.5	Vertical	54.3	74.0	19.7	Complied
2497.362	Vertical	39.3	74.0	34.7	Complied

Results: Average

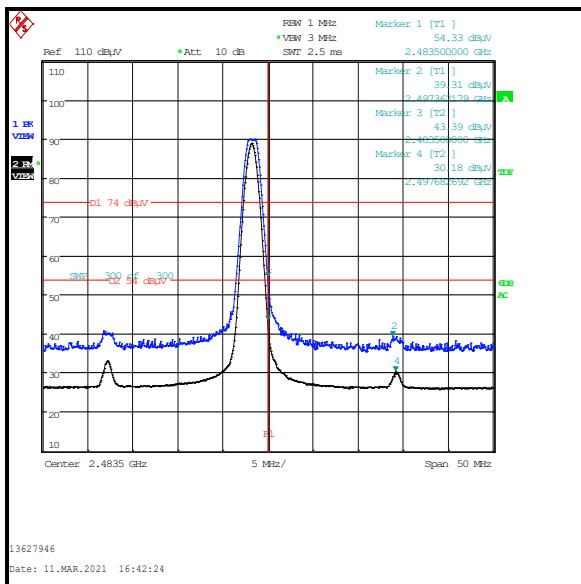
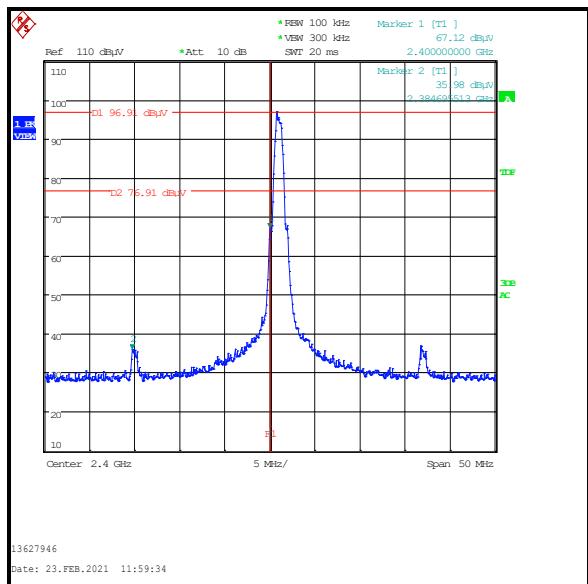
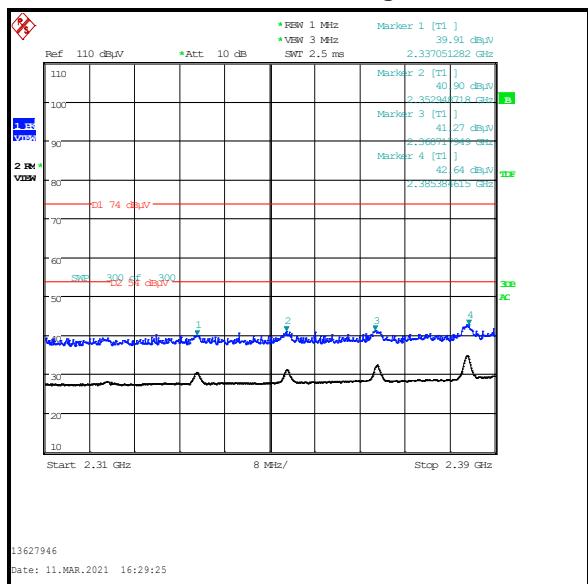
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Vertical	43.4	54.0	10.6	Complied
2497.683	Vertical	30.2	54.0	23.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2337.051	Vertical	39.9	74.0	34.1	Complied
2352.949	Vertical	40.9	74.0	33.1	Complied
2368.718	Vertical	41.3	74.0	32.7	Complied
2385.385	Vertical	42.6	74.0	31.4	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2336.923	Vertical	30.4	54.0	23.6	Complied
2353.769	Vertical	31.1	54.0	22.9	Complied
2369.103	Vertical	32.3	54.0	21.7	Complied
2385.000	Vertical	34.8	54.0	19.2	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Port 1****Lower Band Edge****Upper Band Edge****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Port 2****Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Vertical	62.9	73.3*	10.4	Complied
2483.5	Vertical	53.6	74.0	20.4	Complied
2497.683	Vertical	40.0	74.0	34.0	Complied

Results: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Vertical	42.8	54.0	11.2	Complied
2497.763	Vertical	30.0	54.0	24.0	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

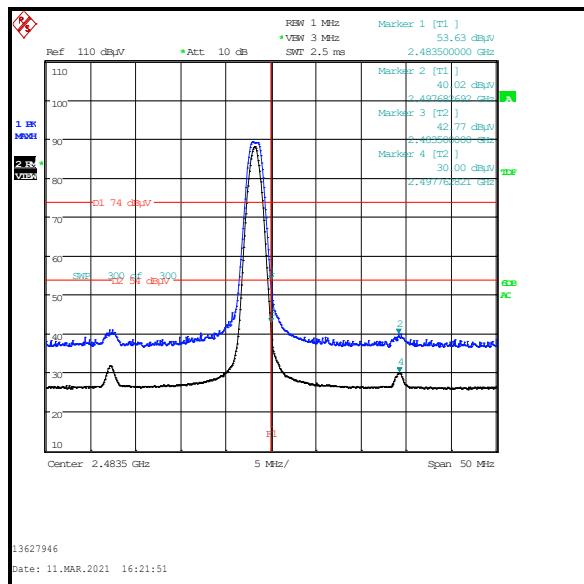
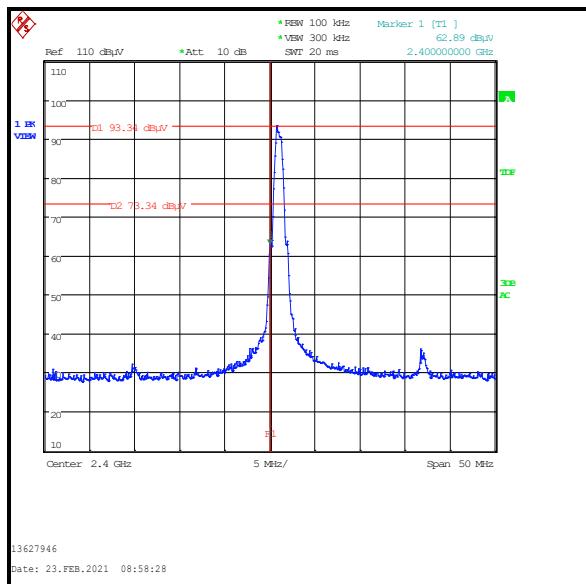
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2337.308	Vertical	36.9	74.0	37.1	Complied
2385.256	Vertical	38.3	74.0	35.7	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2336.923	Vertical	26.4	54.0	27.6	Complied
2385.000	Vertical	28.7	54.0	25.3	Complied

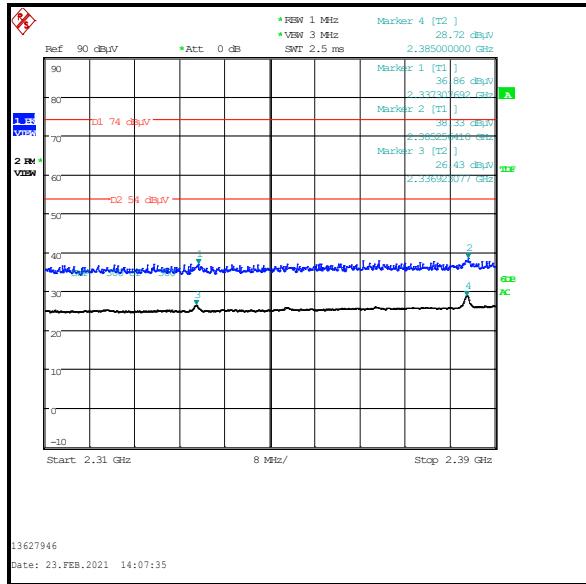
Transmitter Band Edge Radiated Emissions (continued)

Results: Port 2



Lower Band Edge

Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

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