

# TEST REPORT

**Test Report No. :** UL-RPT-RP14415455-816A

**Customer** : VEGA Grieshaber KG

**Model No. / HVIN** : PS40WM / PS40WE

**PMN** : VEGAPULS 42

**FCC ID** : O6QPS40W

**ISED Certification No.** : IC: 3892A-PS40W

**Technology** : *Bluetooth* – Low Energy

**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 4.0 supersedes all previous versions.

**Date of Issue:** 24 April 2023

**Checked by:**



Ben Mercer  
Lead Project Engineer, Radio Laboratory

**Company Signatory:**



Sarah Williams  
RF Operations Leader, Radio Laboratory



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## **Customer Information & Manufacturer Information**

### **Customer**

<b>Company Name:</b>	VEGA Grieshaber KG
<b>Address:</b>	Am Hohenstein 113 D-77761 Schiltach Germany

### **Manufacturer**

<b>Company Name:</b>	VEGA Americas, Inc.
<b>Address:</b>	3877 Mason Research Parkway Ohio Mason 45036 United States of America

<b>Company Name:</b>	VEGA India Level and Pressure Measurement Pvt. Ltd
<b>Address:</b>	Plot No. 1, Gat No. 181, Village – Phulgaon Tal. Haveli Pune 412216 India

## **Report Revision History**

<b>Version Number</b>	<b>Issue Date</b>	<b>Revision Details</b>	<b>Revised By</b>
1.0	02/03/2023	Initial Version	Ben Mercer
2.0	05/04/2023	HVIN, FCC ID, IC Certification No & antenna gain updated.	Ben Mercer
3.0	17/04/2023	HVIN updated	Ben Mercer
4.0	24/04/2023	HVIN updated	Ben Mercer

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## **1 Attestation of Test Results**








### **1.1 Description of EUT**

The equipment under test was a radar sensor for the continuous level measurement of liquids, operating in the 75 GHz to 85 GHz band using FMCW. It contains a *Bluetooth* LE transceiver for commissioning and monitoring.

### **1.2 General Information**

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.247
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.209
<b>Specification Reference:</b>	RSS-Gen Issue 5 February 2021
<b>Specification Title:</b>	General Requirements for Compliance of Radio Apparatus
<b>Specification Reference:</b>	RSS-247 Issue 2 February 2017
<b>Specification Title:</b>	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
<b>Site Registration:</b>	FCC: 685609, ISEDC: 20903
<b>FCC Lab. Designation No.:</b>	UK2011
<b>ISEDC CABID:</b>	UK0001
<b>Location of Testing:</b>	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
<b>Test Dates:</b>	30 November 2022 to 08 December 2022

### 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(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 2
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	
<b>Key to Results</b>  = Complied  = Did not comply			

#### Note(s):

1. The measurement was performed to assist in the calculation of the level of the emissions. The EUT cannot transmit continuously and sweep triggering/signal gating cannot be implemented.
2. 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 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	X
Site 17	-

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**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
<b>Title:</b>	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules

## **2.3 Calibration and Uncertainty**

### **Measuring Instrument Calibration**

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

### **Measurement Uncertainty & 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% 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%	±3.16 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)
M2037	Thermohygrometer	Testo	608-H1	45124925	08 Dec 2022	12
A213953	Attenuator	Atlantic Microwave	ATT10KXP-483082-N4N5	21415050	Calibrated before use	-
M2033	Signal Analyser	Rohde & Schwarz	FSV13	101667	11 Aug 2023	12
G0614	Signal Generator	Rohde & Schwarz	SMB100A	177687	19 May 2023	36

### 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	09 Dec 2022	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2023	12
K0001	3m RSE Chamber	Rainford Solutions	N/A	N/A	05 Sep 2023	12
A221643	Attenuator	AtlanTecRF	ATT06KXP-483034-N4N5	ATT06KXP-483034-N4N5_1	19 Jul 2023	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	22 Aug 2023	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	14 Sep 2023	12
A3139	Antenna	Schwarzbeck	HWRD750	00027	22 Aug 2023	12
A3085	Low Pass Filter	AtlanTecRF	AFL-02000	18051600014	27 Jan 2023	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	27 Jan 2023	12
A3095	High Pass Filter	AtlanTecRF	AFH-07000	18051600012	27 Jan 2023	12
A222867	Pre-Amplifier	Atlantic Microwave	A-LNAKX-380116-S5S5	210865001	26 Aug 2023	12
A3154	Pre-Amplifier	Com Power Corp	PAM-103	18020012	18 Aug 2023	12
A3161	Antenna	Teseq Inc	CBL6111D	50859	03 May 2023	12
A3265	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-069	31 Oct 2023	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	31 Oct 2023	12
A3165	Antenna	ETS-Lindgren	6502	00224383	05 May 2023	12

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

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M2040	Thermohygrometer	Testo	608-H1	45124934	09 Dec 2022	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	29 Apr 2023	12
K0001	3m RSE Chamber	Rainford Solutions	N/A	N/A	05 Sep 2023	12
A221643	Attenuator	AtlanTecRF	ATT06KXP-483034-N4N5	ATT06KXP-483034-N4N5_1	19 Jul 2023	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	22 Aug 2023	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	14 Sep 2023	12

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

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

<b>Brand Name:</b>	VEGAPULS
<b>Model Name or Number / HVIN:</b>	PS40WM
<b>PMN:</b>	VEGAPULS 42 (Plastic Lid)
<b>Test Sample Serial Number:</b>	60481420 / 5225104-1 ( <i>Conducted sample #1</i> )
<b>Hardware Version:</b>	1.0.0
<b>Software Version:</b>	1.0.0
<b>FCC ID:</b>	O6QPS40W
<b>ISED Canada Certification Number:</b>	IC: 3892A-PS40W

<b>Brand Name:</b>	VEGAPULS
<b>Model Name or Number / HVIN:</b>	PS40WM
<b>PMN:</b>	VEGAPULS 42 (Plastic Lid)
<b>Test Sample Serial Number:</b>	60481413 / 5225102-1 ( <i>Radiated sample #1</i> )
<b>Hardware Version:</b>	1.0.0
<b>Software Version:</b>	1.0.0
<b>FCC ID:</b>	O6QPS40W
<b>ISED Canada Certification Number:</b>	IC: 3892A-PS40W

<b>Brand Name:</b>	VEGAPULS
<b>Model Name or Number / HVIN:</b>	PS40WE
<b>PMN:</b>	VEGAPULS 42 (Metal Lid)
<b>Test Sample Serial Number:</b>	60481423 / 5225100-2 ( <i>Radiated sample #2</i> )
<b>Hardware Version:</b>	1.0.0
<b>Software Version:</b>	1.0.0
<b>FCC ID:</b>	O6QPS40W
<b>ISED Canada Certification Number:</b>	IC: 3892A-PS40W

#### **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:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rates:	LE: 1 Mbit/s		
	LE2M: 2 Mbit/s		
	Coded S2: 500 kbit/s		
	Coded S8: 125 kbit/s		
Power Supply Requirement(s):	Nominal	24.0 VDC	
Maximum Conducted Output Power:	4.3 dBm		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

### 3.4 Description of Available Antennas

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

Frequency Range (MHz)	Antenna Gain (dBi)
2400-2480	-2.0

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

#### **Support Equipment**

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

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	L470
<b>Serial Number:</b>	PF10T3JS

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	L480
<b>Serial Number:</b>	PF1EJ3BY

<b>Description:</b>	DC Power Supply (UL Asset S0537)
<b>Brand Name:</b>	TTI
<b>Model Name or Number:</b>	EL302D
<b>Serial Number:</b>	249928

## **Operating Modes**

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

- Transmitting in *Bluetooth* LE, LE2M, Coded S2 and Coded S8 test modes at maximum power on bottom, middle or top channel as required.
- The radar was disabled by the customer prior to receiving the samples.

## **Configuration and Peripherals**

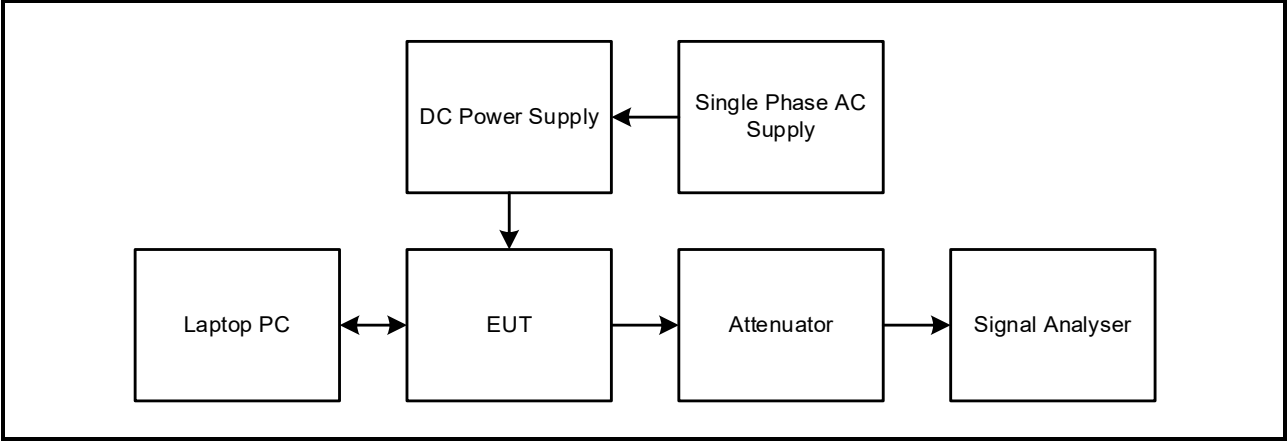
The EUT was tested in the following configuration(s):

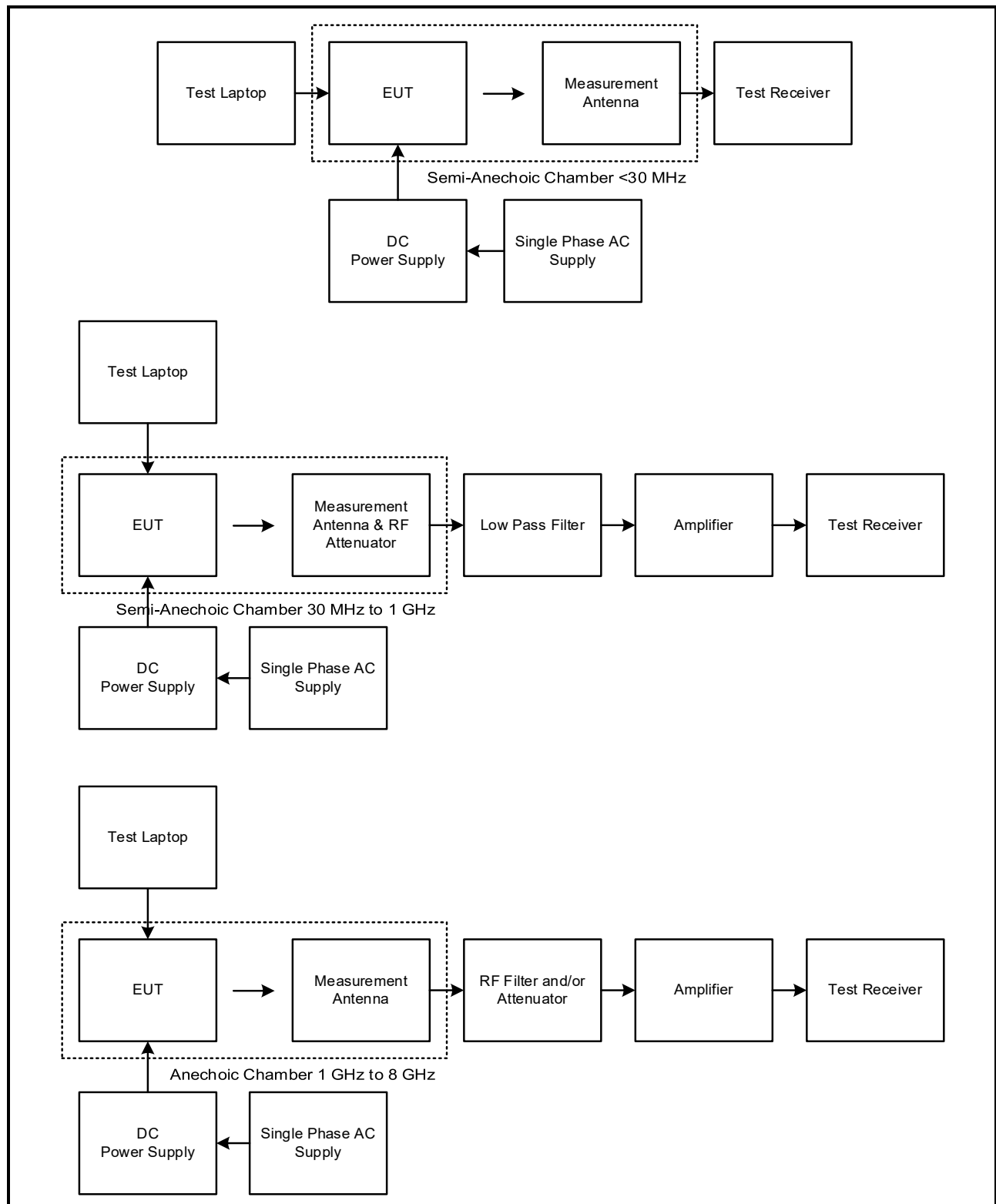
- A test laptop with 'nRF Connect' test application was used to place the EUT into *Bluetooth* LE, LE2M, Coded S2 and Coded S8 test modes via a TTL232 test cable. The application was used to enable continuous transmission and to select the test channels & packet types as required. The customer supplied instructions to configure the EUT into test modes "VEGAPULS42\_Prüfmuster\_Bluetooth\_V00.pdf".
- The Transmit Power setting was set to 4 dBm.
- The EUT was powered via a 24 VDC bench power supply connected to a 120 VAC 60 Hz mains supply.
- Transmitter radiated spurious emissions tests were performed with the EUT transmitting in LE2M mode, as this was found to transmit the highest power and had the widest bandwidth.
- Radiated tests were performed with the EUT in the worst-case orientation/position. There were no ports to terminate.
- The EUT can be supplied with a plastic or metal lid. Radiated tests were performed on both variants.

**Test Setup Diagrams**

**Conducted Tests:**

**Test Setup for Transmitter Conducted Tests**

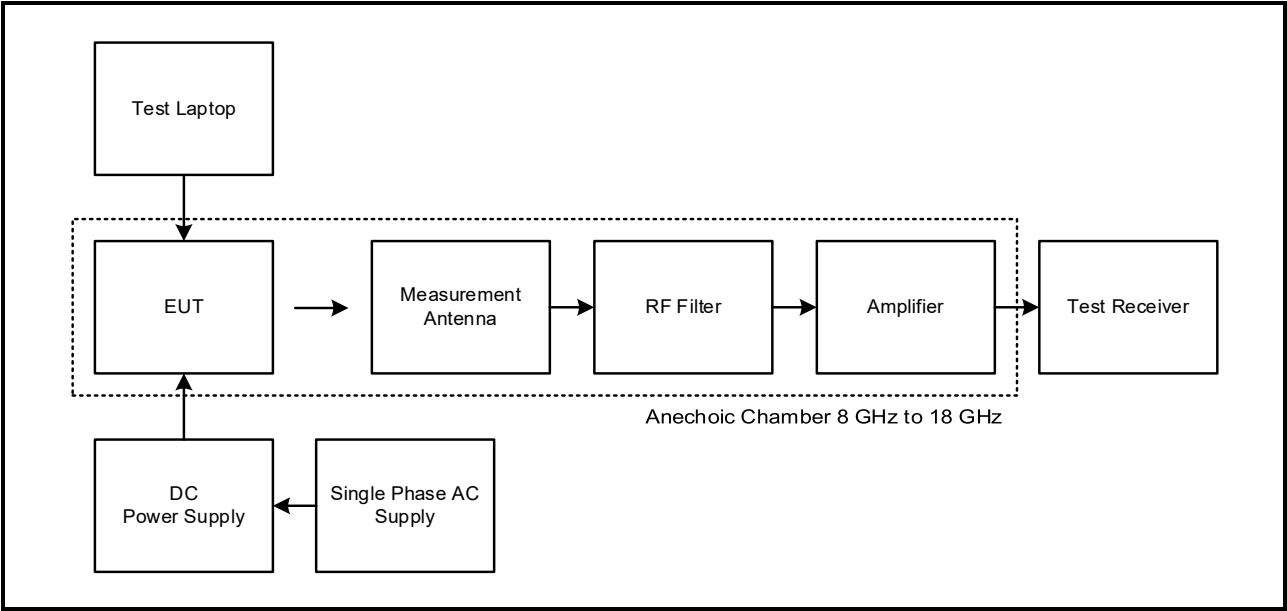


**Test Setup Diagrams (continued)****Radiated Tests:****Test Setup for Transmitter Radiated Tests**

**Test Setup Diagrams (continued)**

**Radiated Tests:**

**Test Setup for Transmitter Radiated Emissions**



## 4 Antenna Port Test Results

### 4.1 Transmitter Duty Cycle

#### Test Summary:

Test Engineer:	Jose Bayona	Test Date:	30 November 2022
Test Sample Serial Number:	60481420 / 5225104-1		

FCC Reference:	Part 15.35(c)
ISED Canada Reference:	RSS-Gen 8.2
Test Method Used:	FCC KDB 558074 Section 6 referencing ANSI C63.10 Section 11.6

#### Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	51

#### Note(s):

- In order to assist with the determination of the average level of spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum/signal analyser in the time domain and calculated by using the following calculation:

$$10 \log (1 / (\text{On Time} / [\text{Period or } 100 \text{ ms whichever is the lesser}])).$$

$$LE \text{ duty cycle: } 10 \log (1 / (392.20 \text{ ms} / 625.31 \text{ ms})) = 2.0 \text{ dB}$$

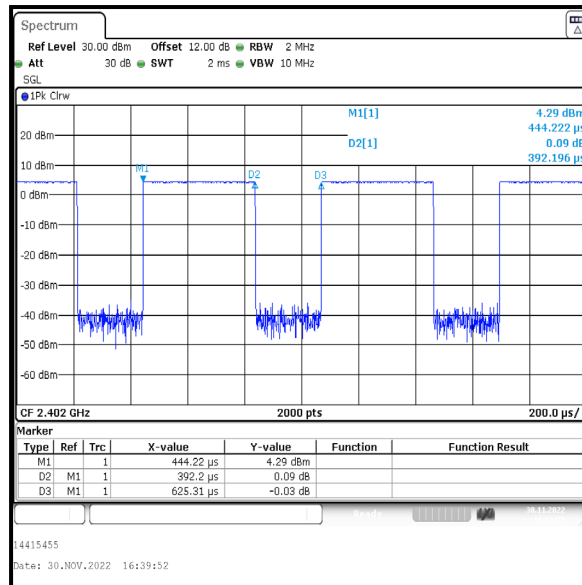
$$LE2M \text{ duty cycle: } 10 \log (1 / (205.10 \text{ ms} / 625.31 \text{ ms})) = 4.8 \text{ dB}$$

$$\text{Coded S2 duty cycle: } 10 \log (1 / (392.20 \text{ ms} / 625.31 \text{ ms})) = 2.0 \text{ dB}$$

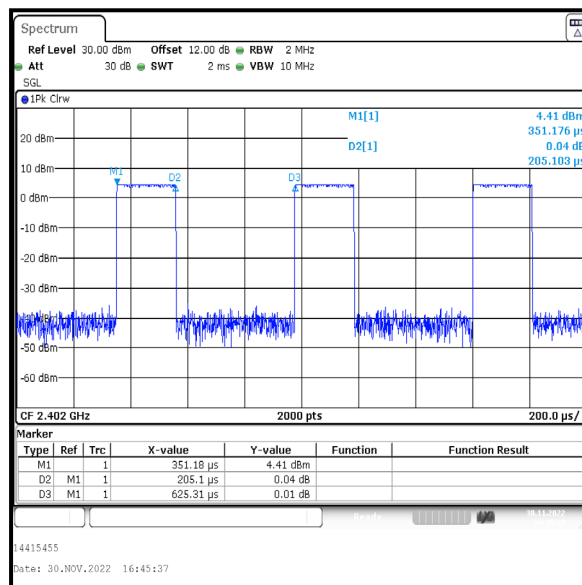
$$\text{Coded S8 duty cycle: } 10 \log 10 \log (1 / (392.20 \text{ ms} / 625.31 \text{ ms})) = 2.0 \text{ dB}$$

**Transmitter Duty Cycle (continued)****Results: LE**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
392.20	625.31	2.0

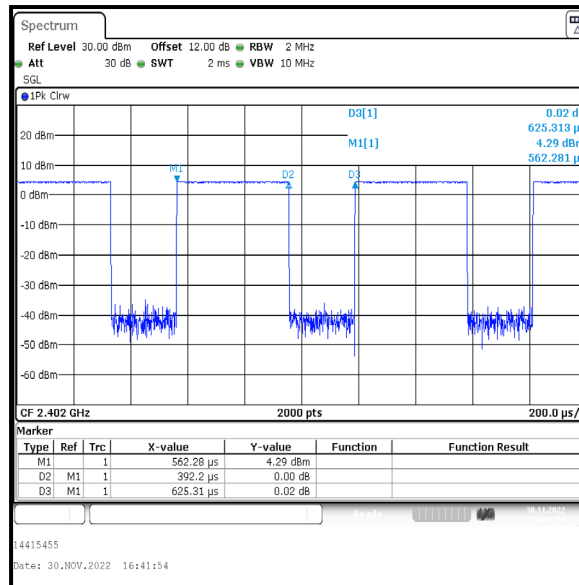
**Results: LE2M**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
205.10	625.31	4.8

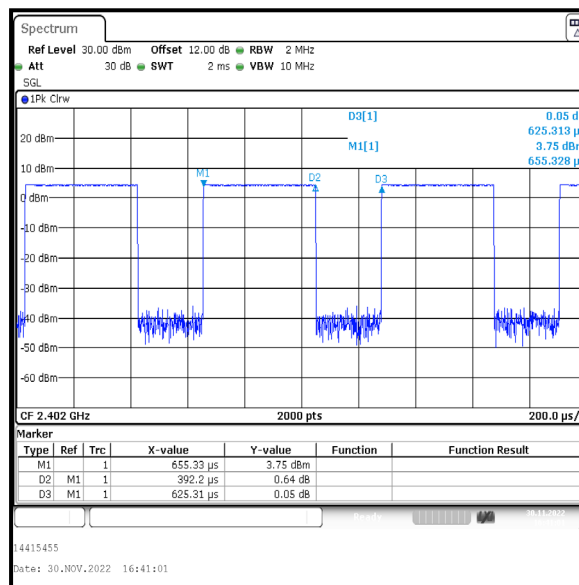


**Transmitter Duty Cycle (continued)****Results: Coded S2**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
392.20	625.31	2.0

**Results: Coded S8**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
392.20	625.31	2.0



## **4.2 Transmitter 99% Occupied Bandwidth**

### **Test Summary:**

<b>Test Engineer:</b>	Jose Bayona	<b>Test Date:</b>	30 November 2022
<b>Test Sample Serial Number:</b>	60481420 / 5225104-1		

<b>FCC Reference:</b>	N/A
<b>ISED Canada Reference:</b>	RSS-Gen 6.7
<b>Test Method Used:</b>	RSS-Gen 6.7 and Notes below

### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	37

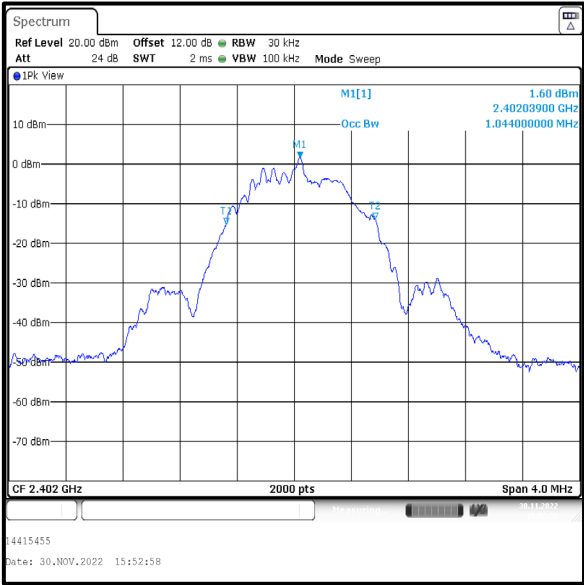
### **Note(s):**

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 products of the modulation process including emission skirts.
2. For LE, Coded S2 and Coded S8 modes, the signal analyser resolution bandwidth was set to 30 kHz, video bandwidth to 100 kHz and span to 4 MHz. For LE2M, the signal analyser resolution bandwidth was set to 50 kHz, video bandwidth to 200 kHz and span to 6 MHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and coaxial cable.

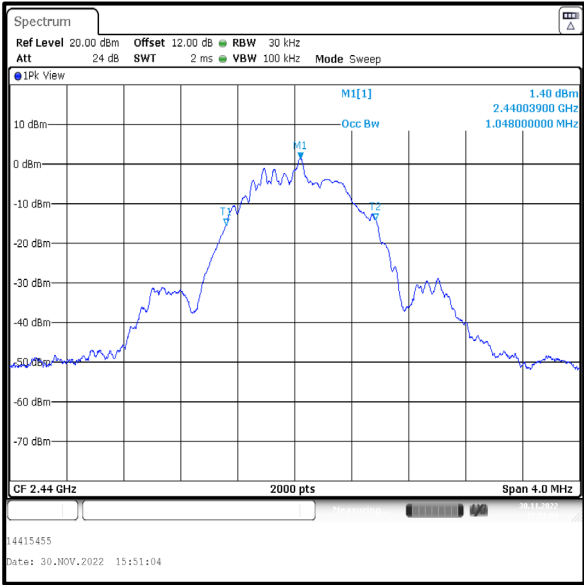
Transmitter 99% Occupied Bandwidth (continued)

Results: LE

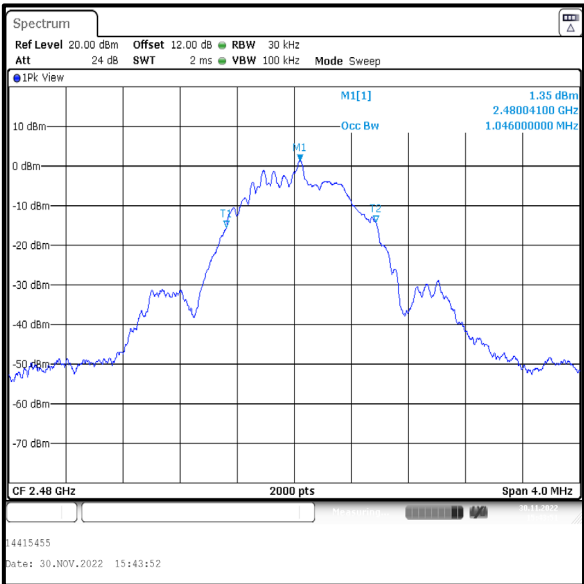
Channel	99% Occupied Bandwidth (kHz)
Bottom	1044.000
Middle	1048.000
Top	1046.000



Bottom Channel



Middle Channel

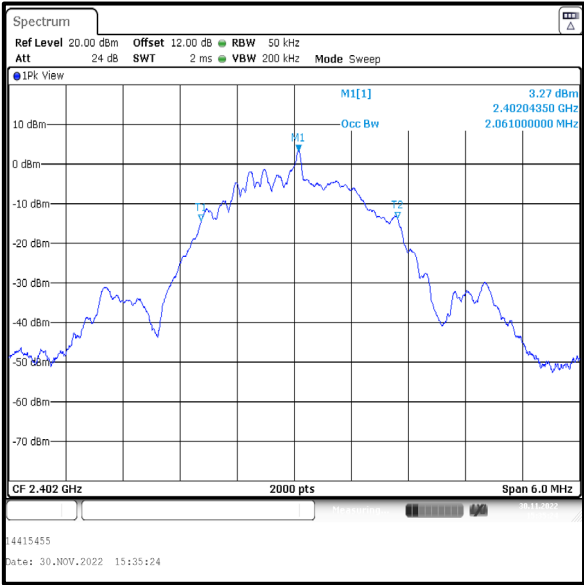


Top Channel

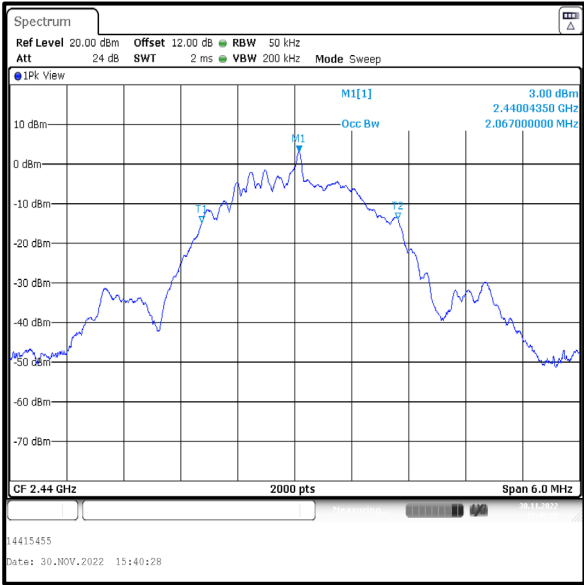
Transmitter 99% Occupied Bandwidth (continued)

Results: LE2M

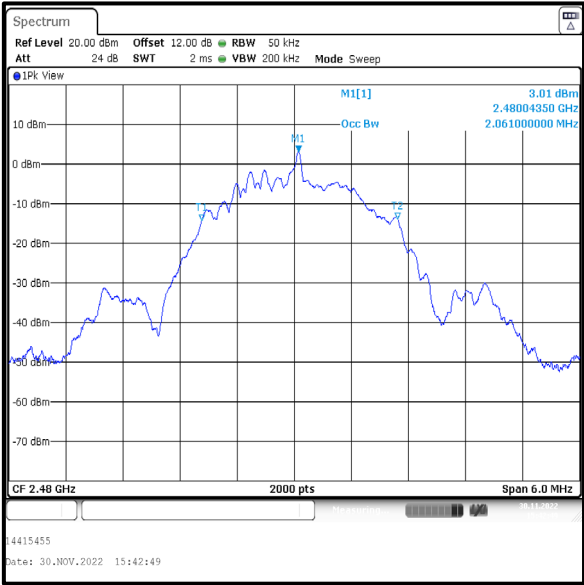
Channel	99% Occupied Bandwidth (kHz)
Bottom	2061.000
Middle	2067.000
Top	2061.000



Bottom Channel



Middle Channel

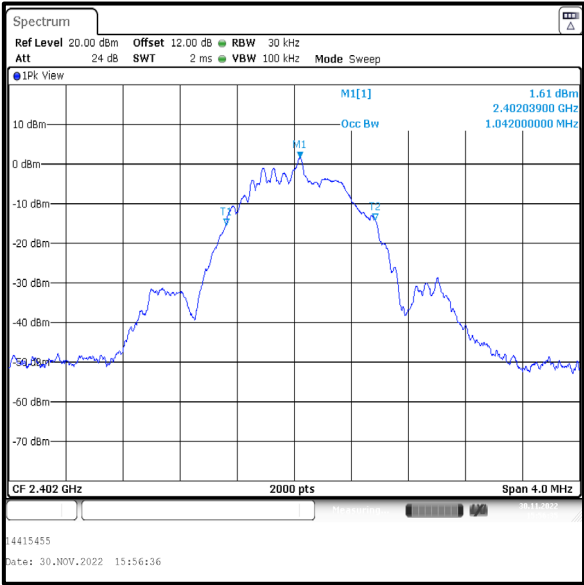


Top Channel

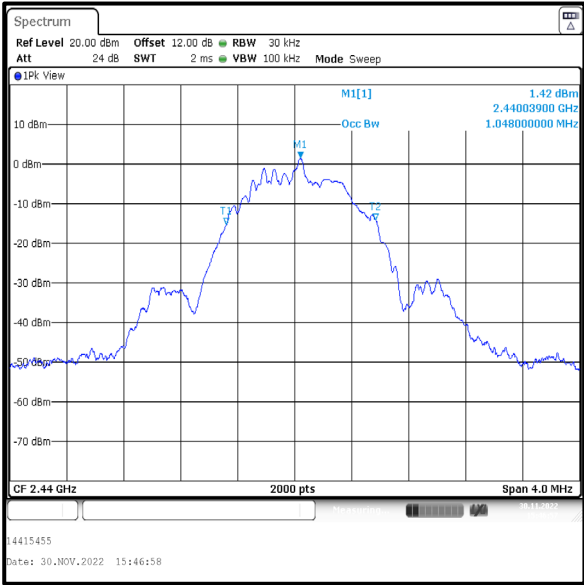
Transmitter 99% Occupied Bandwidth (continued)

Results: Coded S2

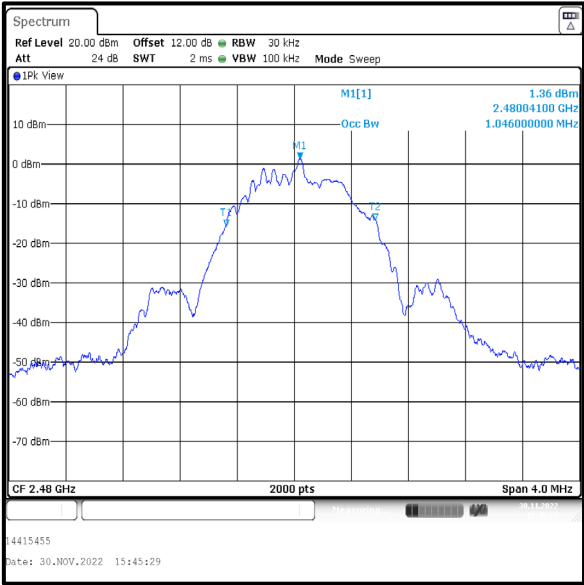
Channel	99% Occupied Bandwidth (kHz)
Bottom	1042.000
Middle	1048.000
Top	1046.000



Bottom Channel



Middle Channel

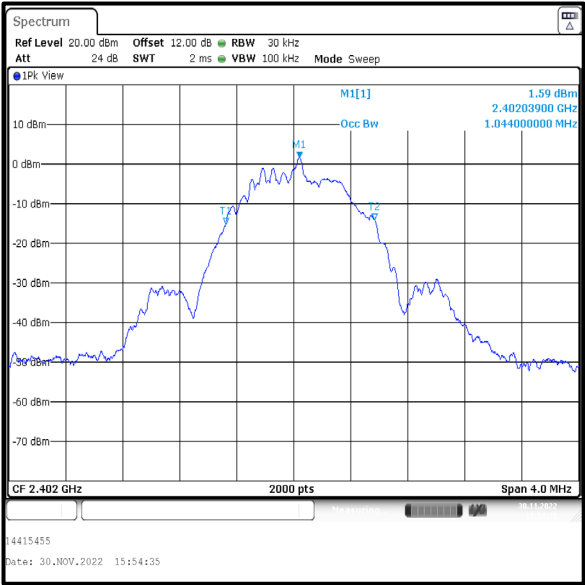


Top Channel

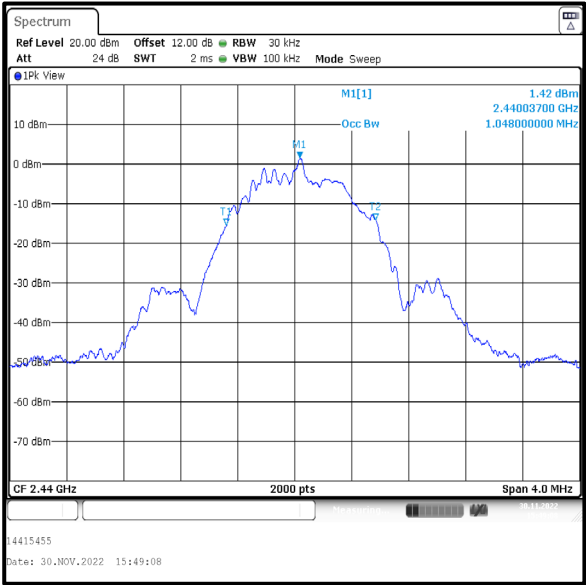
Transmitter 99% Occupied Bandwidth (continued)

Results: Coded S8

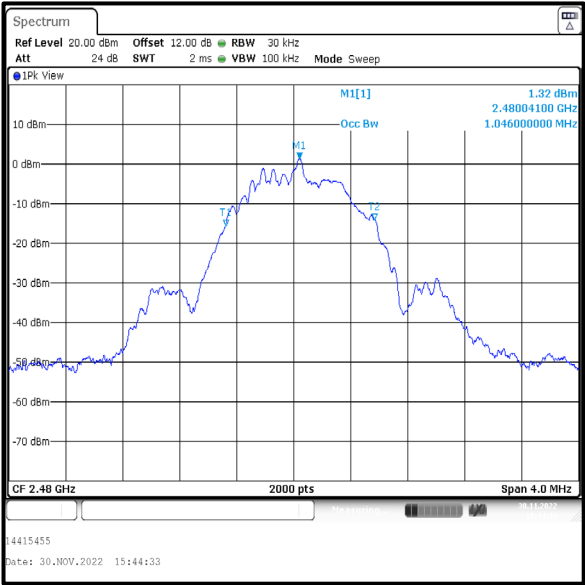
Channel	99% Occupied Bandwidth (kHz)
Bottom	1044.000
Middle	1048.000
Top	1046.000



Bottom Channel



Middle Channel



Top Channel

### **4.3 Transmitter Minimum 6 dB Bandwidth**

#### **Test Summary:**

<b>Test Engineer:</b>	Jose Bayona	<b>Test Dates:</b>	30 November 2022 & 01 December 2022
<b>Test Sample Serial Number:</b>	60481420 / 5225104-1		

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

#### **Environmental Conditions:**

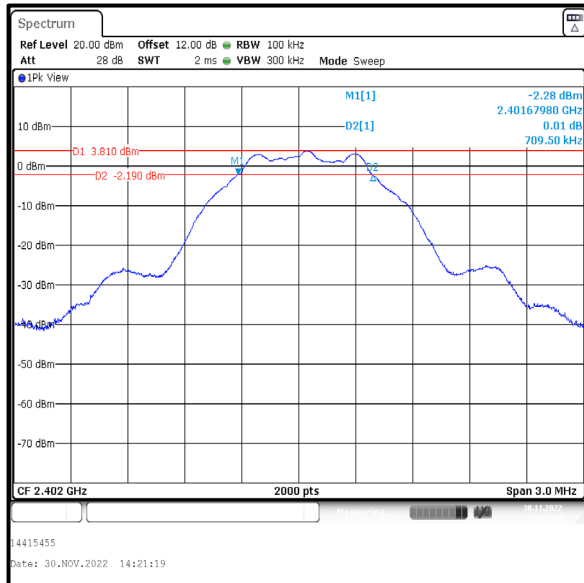
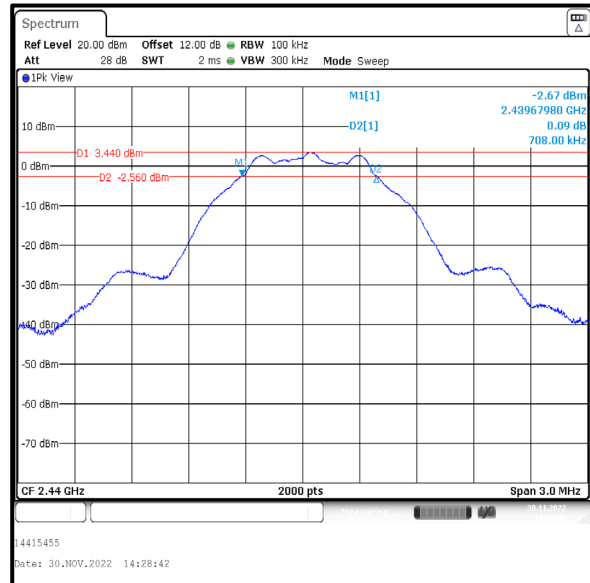
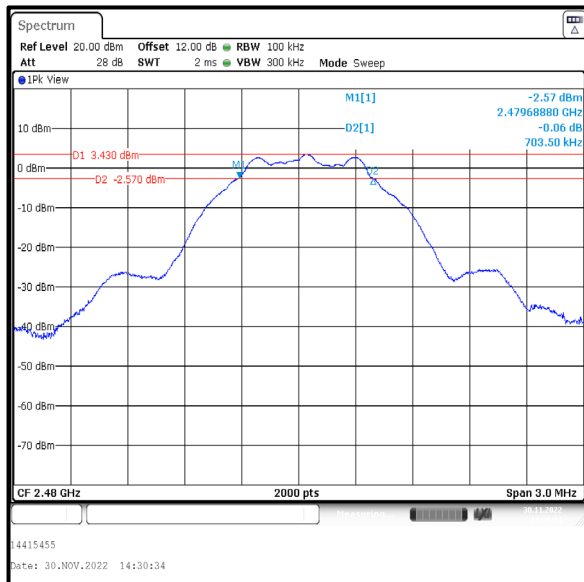
<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	37 to 41

#### **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 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 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 coaxial cable.

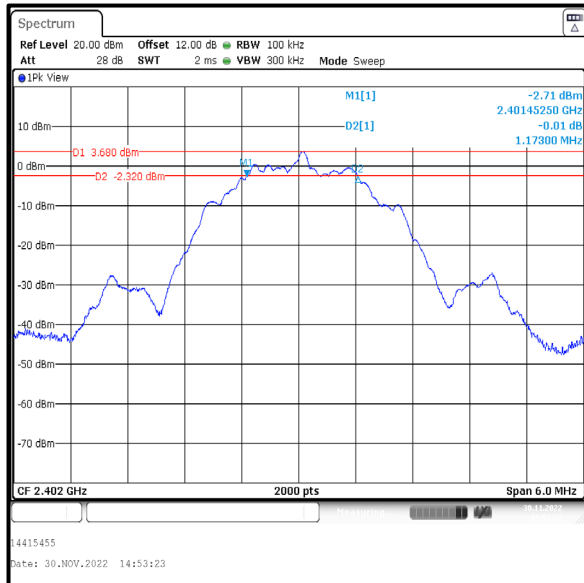
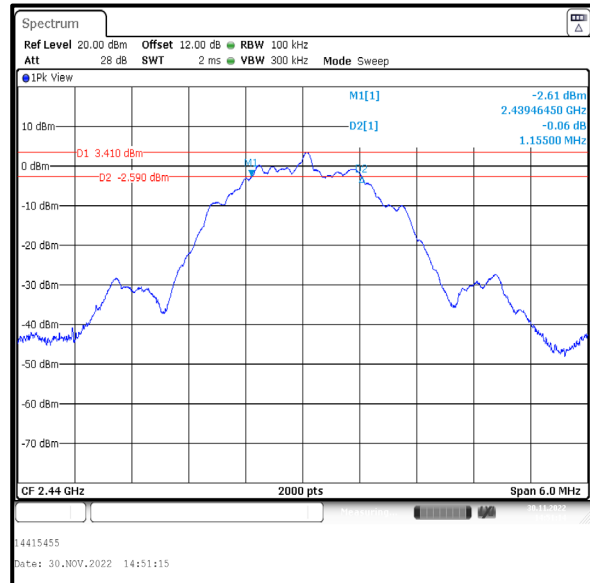
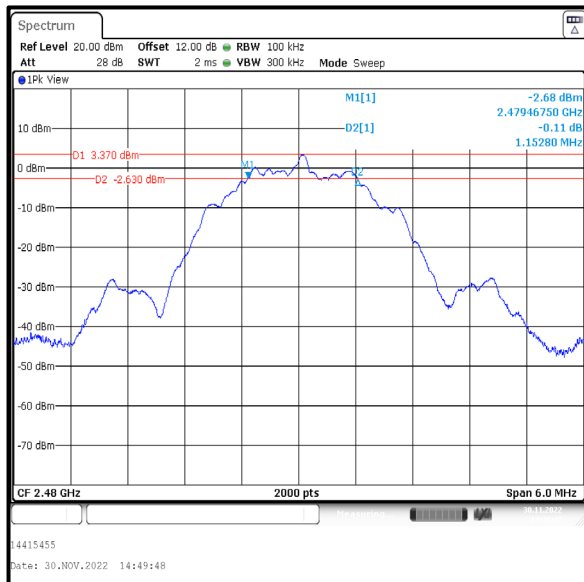
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: LE**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	709.500	≥500	209.500	Complied
Middle	708.000	≥500	208.000	Complied
Top	703.500	≥500	203.500	Complied

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

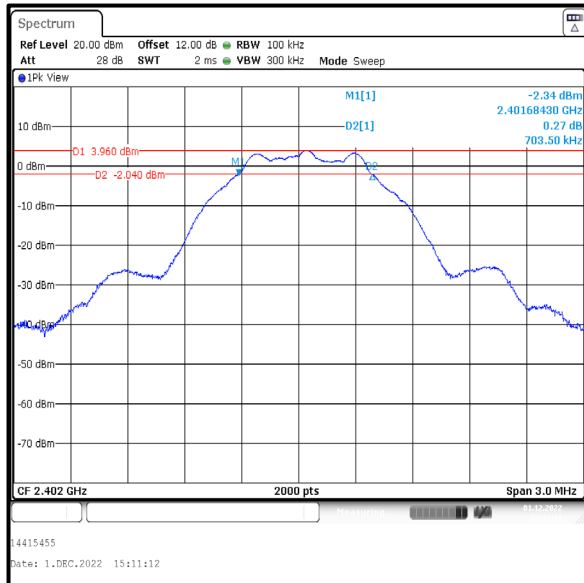
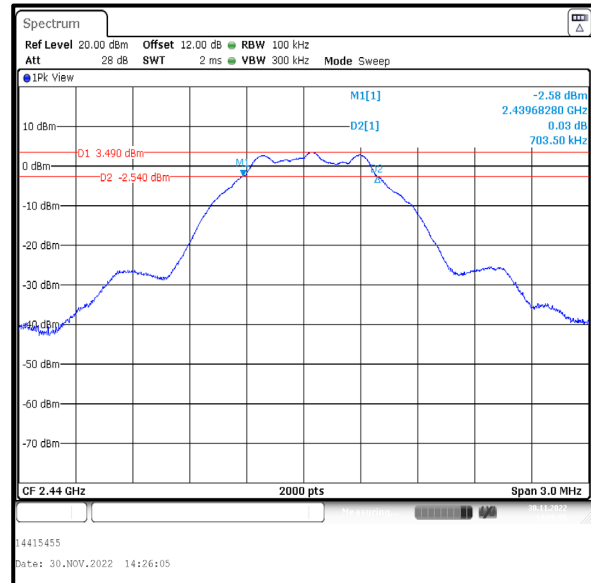
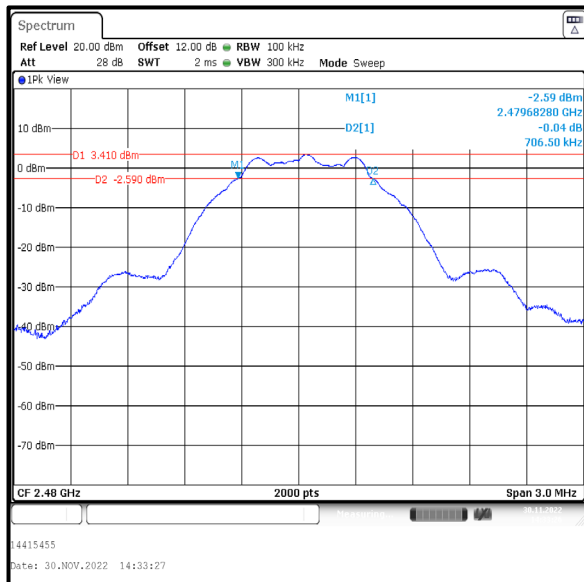
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: LE2M**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1173.000	≥500	673.000	Complied
Middle	1155.000	≥500	655.000	Complied
Top	1152.800	≥500	652.800	Complied

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

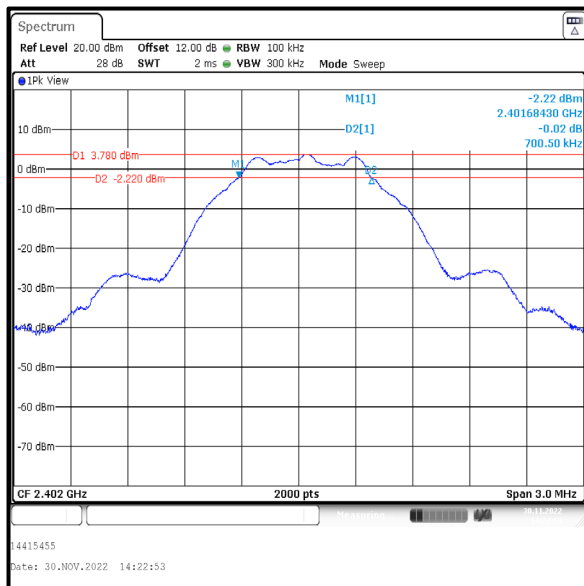
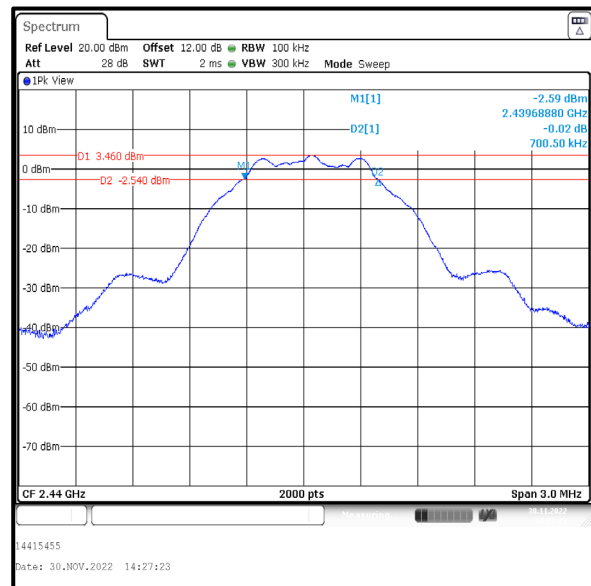
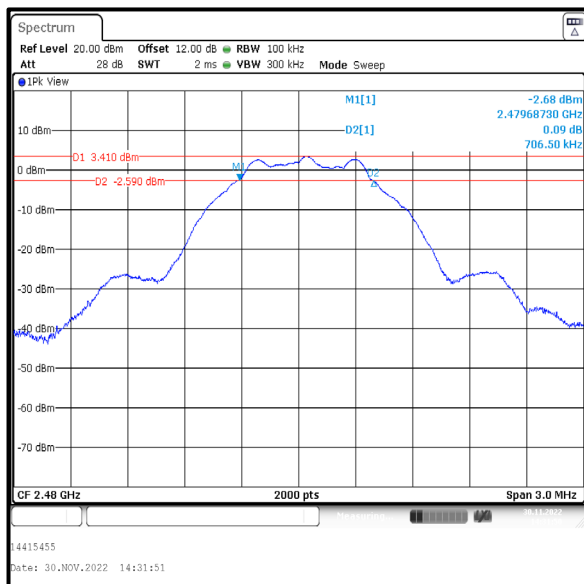
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: Coded S2**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	703.500	≥500	203.500	Complied
Middle	703.500	≥500	203.500	Complied
Top	706.500	≥500	206.500	Complied

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

**Transmitter Minimum 6 dB Bandwidth (continued)****Results: Coded S8**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	700.500	≥500	200.500	Complied
Middle	700.500	≥500	200.500	Complied
Top	706.500	≥500	206.500	Complied

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

#### **4.4 Transmitter Maximum Peak Output Power**

##### **Test Summary:**

<b>Test Engineer:</b>	Jose Bayona	<b>Test Date:</b>	30 November 2022
<b>Test Sample Serial Number:</b>	60481420 / 5225104-1		

<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>ISED Canada Reference:</b>	RSS-Gen 6.12 / RSS-247 5.4(d)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.3.1.1 referencing ANSI C63.10 Section 11.9.1.1 and Notes below

##### **Environmental Conditions:**

<b>Ambient Temperature (°C):</b>	24
<b>Ambient Relative Humidity (%):</b>	37

##### **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 or 2 MHz and video bandwidth of 3 MHz or 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 5 MHz or 8 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 coaxial cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and cable.
4. The conducted power was added to the declared antenna gain to obtain the EIRP.

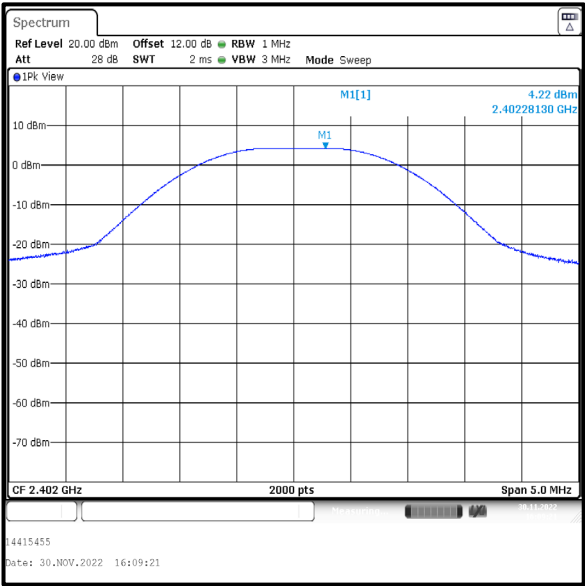
**Transmitter Maximum Peak Output Power (continued)****Results: LE**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.2	30.0	25.8	Complied
Middle	4.1	30.0	25.9	Complied
Top	4.1	30.0	25.9	Complied

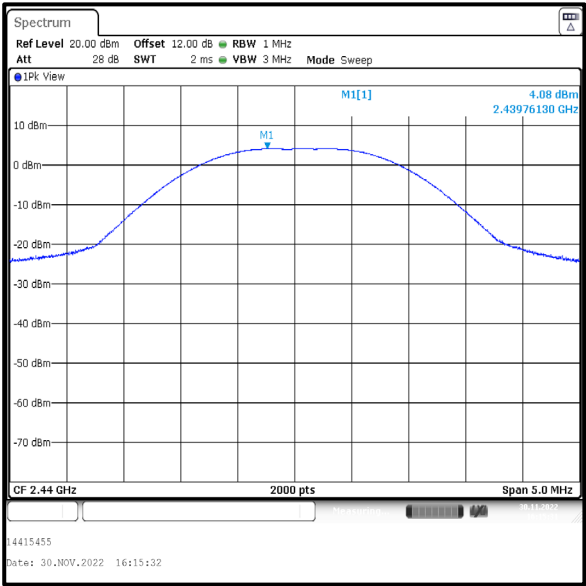
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.2	-2.0	2.2	36.0	33.8	Complied
Middle	4.1	-2.0	2.1	36.0	33.9	Complied
Top	4.1	-2.0	2.1	36.0	33.9	Complied

Transmitter Maximum Peak Output Power (continued)

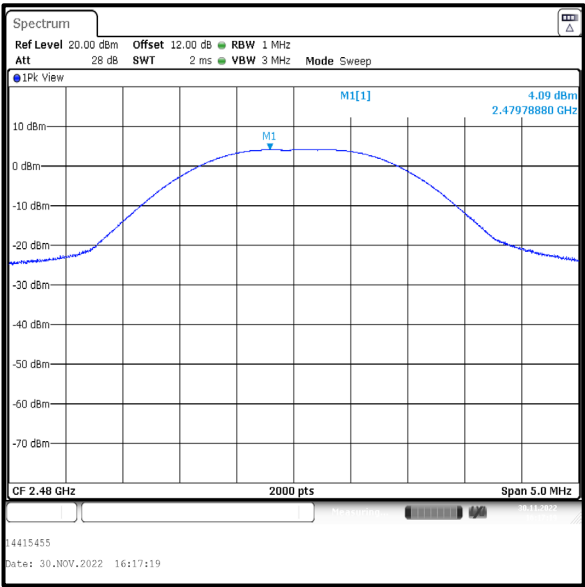
Results: LE



Bottom Channel



Middle Channel



Top Channel

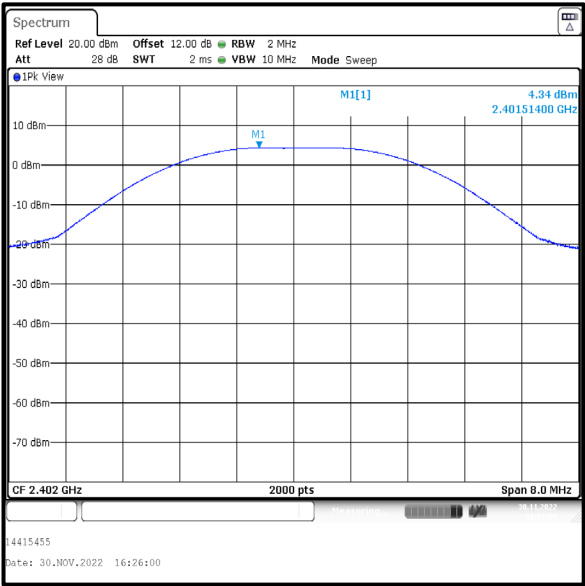
**Transmitter Maximum Peak Output Power (continued)****Results: LE2M**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.3	30.0	25.7	Complied
Middle	4.1	30.0	25.9	Complied
Top	4.1	30.0	25.9	Complied

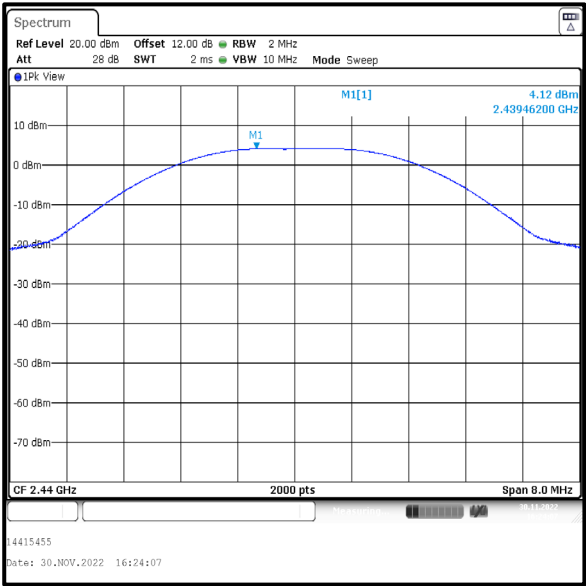
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.3	-2.0	2.3	36.0	33.7	Complied
Middle	4.1	-2.0	2.1	36.0	33.9	Complied
Top	4.1	-2.0	2.1	36.0	33.9	Complied

Transmitter Maximum Peak Output Power (continued)

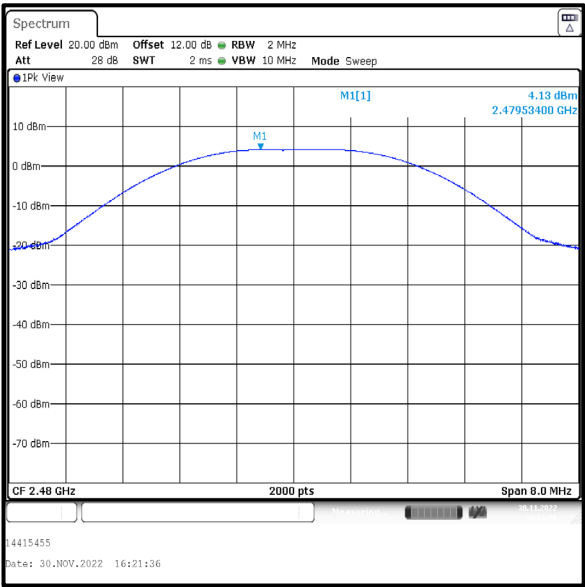
Results: LE2M



Bottom Channel



Middle Channel



Top Channel

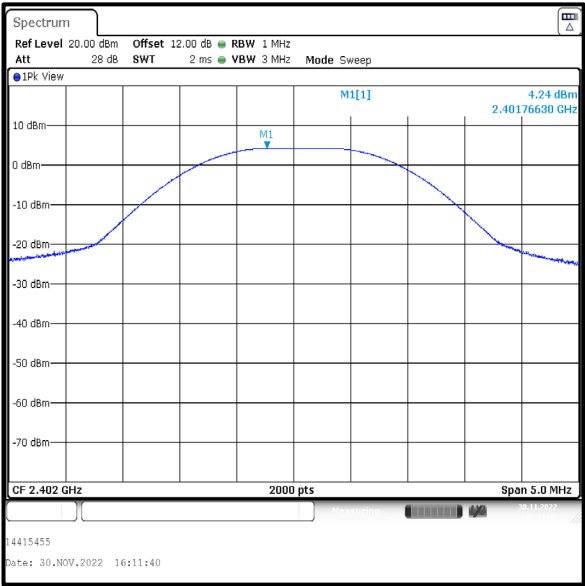
**Transmitter Maximum Peak Output Power (continued)****Results: Coded S2**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.2	30.0	25.8	Complied
Middle	4.1	30.0	25.9	Complied
Top	4.1	30.0	25.9	Complied

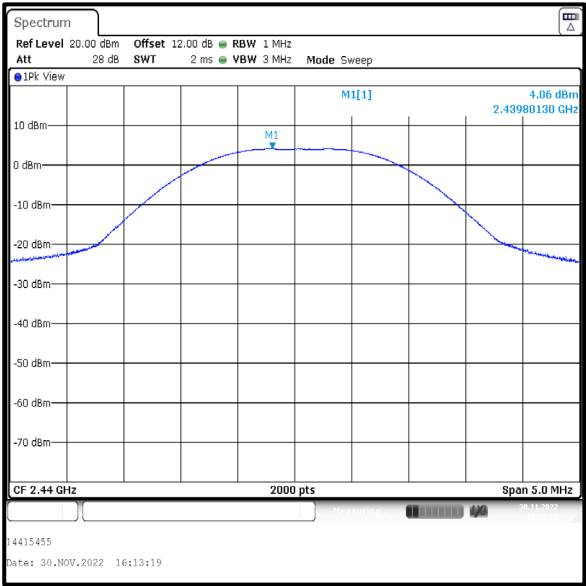
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.2	-2.0	2.2	36.0	33.8	Complied
Middle	4.1	-2.0	2.1	36.0	33.9	Complied
Top	4.1	-2.0	2.1	36.0	33.9	Complied

Transmitter Maximum Peak Output Power (continued)

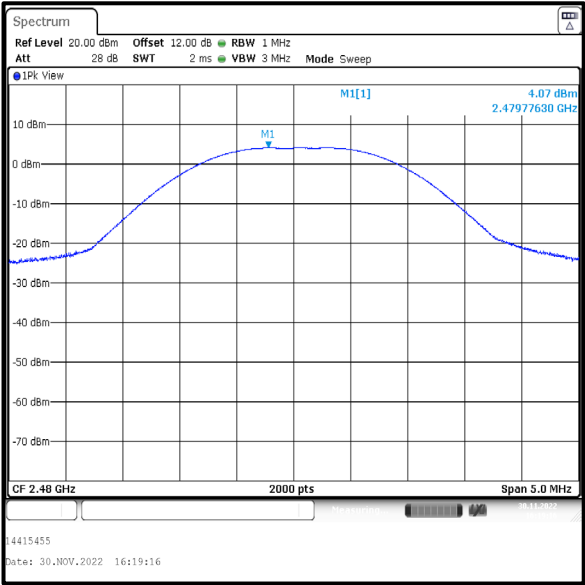
Results: Coded S2



Bottom Channel



Middle Channel



Top Channel

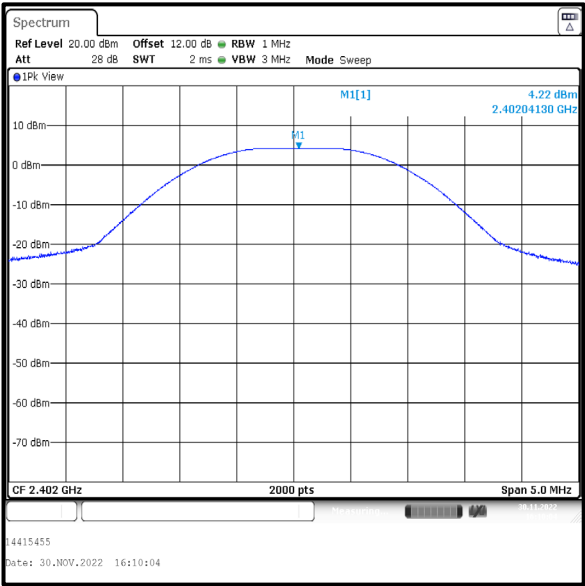
**Transmitter Maximum Peak Output Power (continued)****Results: Coded S8**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.2	30.0	25.8	Complied
Middle	4.1	30.0	25.9	Complied
Top	4.1	30.0	25.9	Complied

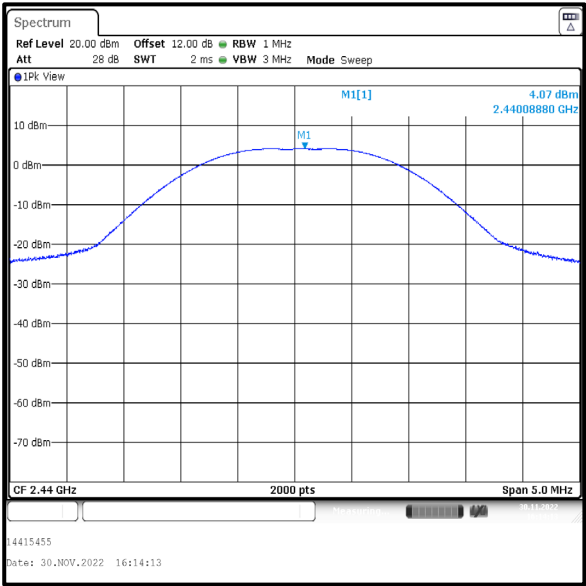
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.2	-2.0	2.2	36.0	33.8	Complied
Middle	4.1	-2.0	2.1	36.0	33.9	Complied
Top	4.1	-2.0	2.1	36.0	33.9	Complied

Transmitter Maximum Peak Output Power (continued)

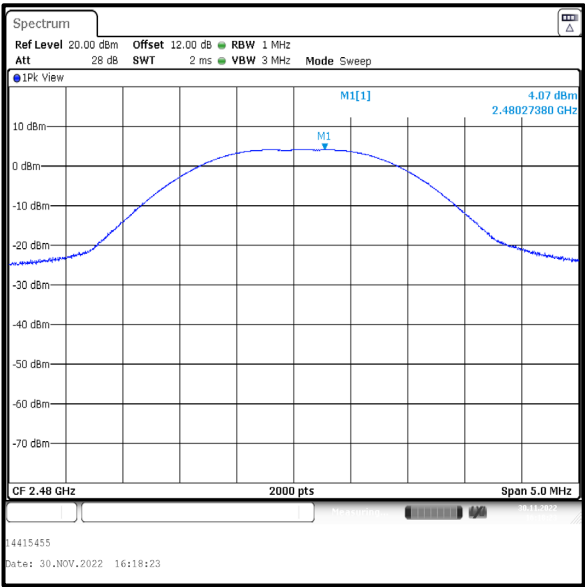
Results: Coded S8



Bottom Channel



Middle Channel



Top Channel

## 5 Radiated Test Results

### 5.1 Transmitter Radiated Emissions <1 GHz

#### Test Summary:

Test Engineer:	Nick Steele	Test Dates:	07 December 2022 & 08 December 2022
Test Sample Serial Number:	60481413 / 5225102-1 & 60481423 / 5225100-2		

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:

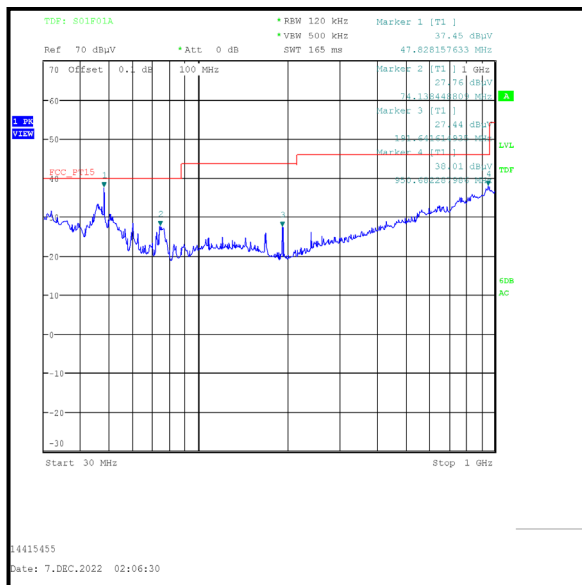
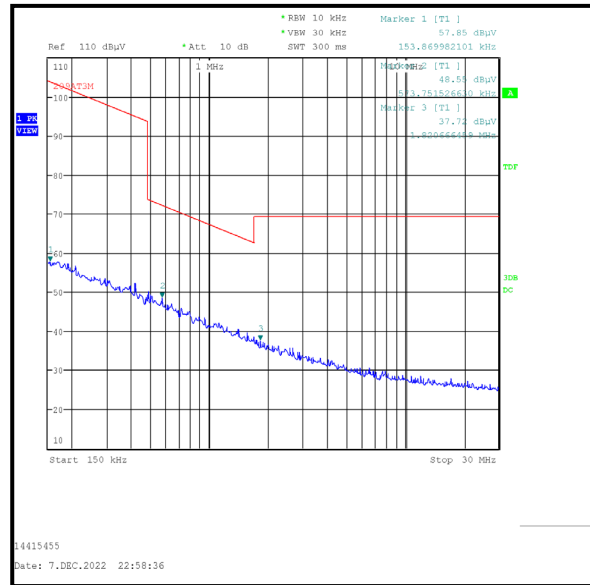
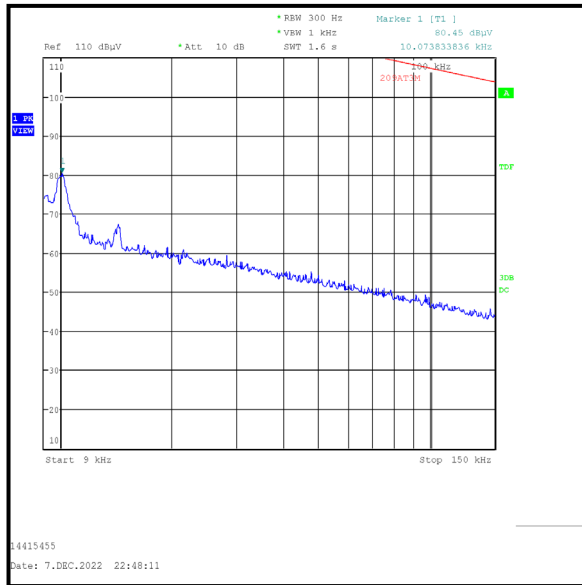
Temperature (°C):	20 to 22
Relative Humidity (%):	34 to 38

#### Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other 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.
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. 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 ANSI C63.10 clause 6.4.3 & 6.4.4.2. As allowed by ANSI C63.10 clause 5.2; an alternative test site that can demonstrate equivalence to an open area test site may be used for measurements below 30 MHz. Therefore, measurements were performed in a semi-anechoic chamber. The correlation data between semi-anechoic chamber and an open field test site is available upon request.
5. Measurements between 30 MHz and 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. 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.
8. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.

**Transmitter Radiated Emissions (continued)****Results: Quasi-Peak / Middle Channel / LE2M / Plastic Lid**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
72.023	Horizontal	23.9	40.0	16.1	Complied
168.053	Horizontal	22.3	43.5	21.2	Complied



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