



Solutions

TEST REPORT

Test Report No.: UL-RPT-RP-15628132-316

Customer : Schaeffler Technologies AG & Co. KG
Model No. / PMN : OPTIME-LW-C4-R1
HVIN : OPTIME-LW-C4-R1
FCC ID : 2BNQKSMPLLC4
ISED Certification No. : 33623-SMPLC4
Technology : Bluetooth – Low Energy
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247
ISED RSS-247 ISSUE 3
ISED RSS-GEN ISSUE 5+A1+A2

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. **Test Report Version 1.1 supersede Version 1.0 with immediate effect**
Test Report No. UL-RPT-RP-15628132-316 Version 1.1, Issue Date 08 May 2025 replaces
Test Report No. UL-RPT-RP-15628132-316 Version 1.0, Issue Date 10 April 2025, which is no longer valid.
5. Result of the tested sample: **Pass**
6. All information marked with a (*) were provided by customer / applicant or authorized representative

Yixiang Lin

Prepared by: Yixiang Lin
Title: Project Engineer
Date: 08 May 2025

Faiq

Approved by: Muhammad Faiq Khan
Title: Project Engineer
Date: 08 May 2025



This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

Customer Information

Company Name:	Schaeffler Technologies AG & Co. KG
Address:	Georg-Schäfer-Straße 30 97421 Schweinfurt, Germany

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	10/04/2025	Initial Version	Muhammad Faiq Khan
1.1	08/05/2025	Page 1, correction of PMN Page 10, correction of HVIN and Hardware version	Muhammad Faiq Khan

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1 Attestation of Test Results

1.1 Description of EUT









The Equipment is an automatic lubrication pump, which can be commissioned/initiated through NFC and can communicate data to a mesh network over a Bluetooth based RF technology. The operator can remotely activate any of the 4 outlets of his choice (but only one at a time) by sending wirelessly a corresponding signal to the Equipment.

The Equipment in turn send back wirelessly different information to the operator, informing him for example about the state of the cartridge through mesh network over a Bluetooth based RF technology.

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:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209
Specification Reference:	RSS-Gen Issue 5 February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 3 August 2023
Specification Title:	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Site Registration:	FCC: 399704, ISEDC: 22511
FCC Lab. Designation No.:	DE0019
ISEDC CABID:	DE0008
Location of Testing:	Hedelfinger Strasse. 61,70327 Stuttgart, GERMANY
Test Dates:	5 March 2025 to 8 March 2025

1.3 Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
Part 15.35(c)	-	Transmitter Duty Cycle ⁽¹⁾	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 5.2(b)	Transmitter Power Spectral Density ⁽²⁾	Note 2
Part 15.247(d)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Conducted Emissions ⁽³⁾	Note 3
Part 15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Band Edge Conducted Emissions ⁽³⁾	Note 3
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	
Part 15.207	RSS-Gen 8.8	Transmitter AC Conducted Emissions	
Key to Results  = Complied  = Did not comply N.P. = Not Performed N/A = Not Applicable			

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 to be equal to the measured output power.
3. The Spurious emission measurements were performed Radiated and therefore conducted emissions were required.

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 Hedelfinger Strasse. 61,70327 Stuttgart, GERMANY. 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.

SR1	X
SR9	X
SR7/8	X

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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
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.3 Calibration and Uncertainty

Measuring Instrument Calibration

In accordance with DAkkS 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

Measurement system instrumentation shall be used with an accuracy specification meeting the accuracy specification limits according to IEC/IECEE OD-5014.

As applicable, unless specified otherwise in this quotation, the compliance "Decision Rule" is based on Simple Acceptance. If the measured value is on the limit, the result is defined as a pass. In this case the risk of a false positive is 50%. For further information regarding risk assessment refer to ILAC G8:09/2019.

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	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	95%	±2.49 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Transmitter Duty Cycle	95%	±3.4%
Minimum 6 dB Bandwidth	95%	±0.87 %
Spectral Power Density	95%	±0.59 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 site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	18/07/2023	36
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
495	Schwarzbeck	Antenna, Trilog Broadband	VULB 9163	01691	30/11/2023	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	36
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	12/07/2024	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	12/01/2024	36
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
637	Rohde & Schwarz	Spectrum Analyser	FSV40	101587	12/07/2023	36
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a
-	Huber+Suhner	RF Cable -OSP120-DUT1	ST18/SMQm/S MAm/72	605505	lab verification	n/a
	Huber+Suhner	Attenuator	10 dB SMA	0047	lab verification	n/a

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
22	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/014	09/07/2024	12
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	09/07/2024	12
215	Rohde & Schwarz	Artificial Mains Network	ESH2-Z5	879675/002	09/07/2024	24
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	18/07/2024	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	09/07/2024	12

Test Measurement Software/Firmware Used:

Name	Manufacturer	Version
EMI Software; CE measurement software	Toyo	EP9/CE Ver 4.4.010
EMC32	Rohde & Schwarz	11.30.00

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	FAG
Model Name or Number / HVIN:	OPTIME-LW-C4-R1
PMN:	OPTIME-LW-C4-R1
Test Sample Serial Number:	LW4-243340002310
Hardware Version:	R1
Software Version:	0.5-0_17
FCC ID:	2BNQKSMPLLC4
ISED Canada Certification Number:	33623-SMPLC4
Date of Receipt:	26 February 2025

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:	<i>Bluetooth</i> Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate: LE	1 Mbps		
Data Rate: LE2M	2 Mbps		
Power Supply Requirement(s):	24 VDC		
Maximum Conducted Output Power:	6.65 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	2.26

3.5 Description of Test Setup

Support Equipment

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

Description:	Laptop
Brand Name:	LENOVO
Model Name or Number:	20NYS1GL1U
Serial Number:	PC1G3R7Y

Description:	AC/DC Adaptor
Brand Name:	CoolPower
Model Name or Number:	CPS-24008EU/3630+
Serial Number:	-

Operating Modes

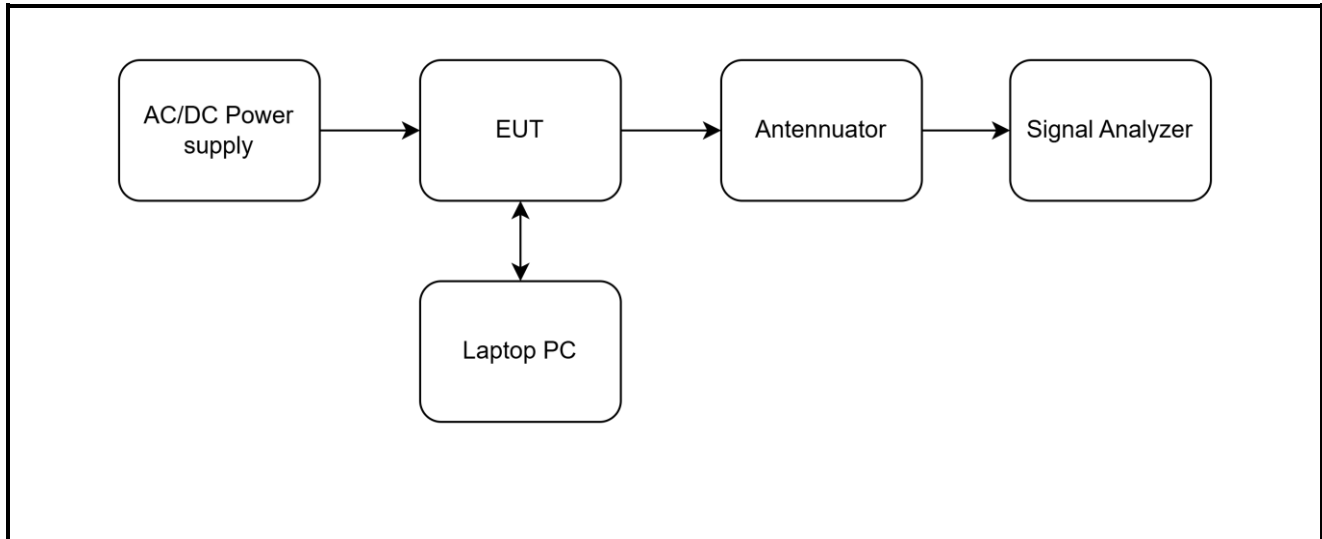
The EUT was tested in the following operating mode(s):

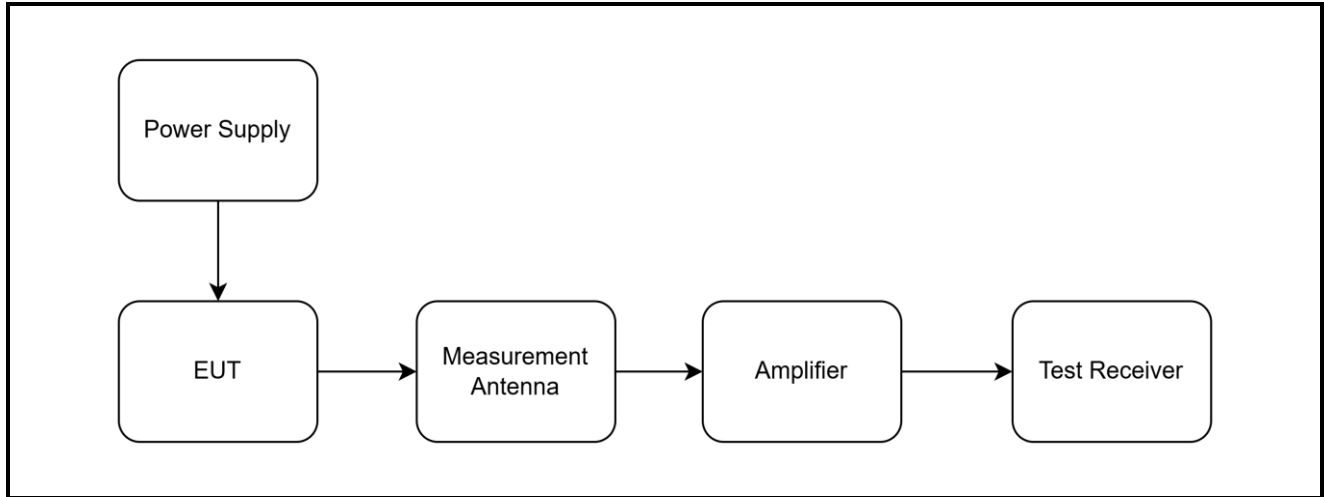
- Transmitting at maximum power in *Bluetooth* LE 1M mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.
- Transmitting at maximum power in *Bluetooth* LE 2M mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

Configuration and Peripherals

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

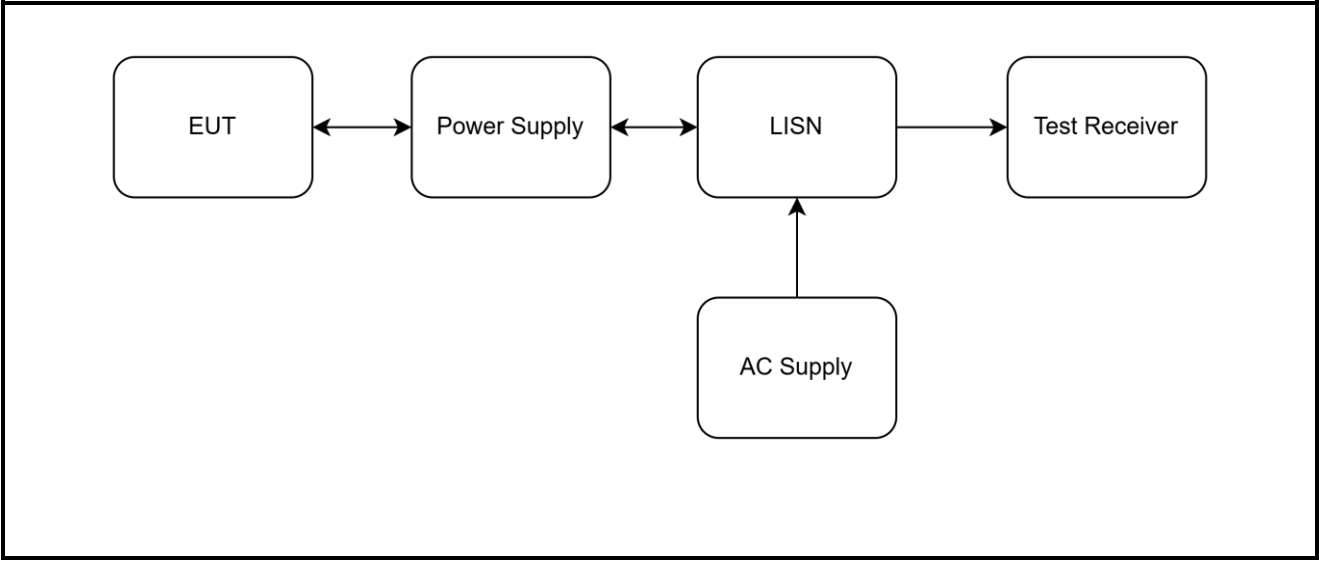
- Controlled in test mode using a software application on the laptop PC. The application nRF Connect Desktop was used to enable a continuous transmission and to select the test channels as required. The laptop PC was connected to the EUT via a USB to serial adaptor.
- The EUT was powered via an AC/DC switch mode power supply.
- Transmitter antenna port conducted measurements were performed with the transmitter PCB disassembled from the enclosure and converted to a conducted sample.
- Transmitter radiated spurious emissions tests were performed with the EUT transmitting in LE1M mode as this was found to transmit the highest power.
- Transmitter radiated spurious emissions tests were performed with the AC Charger connected to the EUT.
- Transmitter radiated spurious emissions tests were performed with the EUT in its normal orientation. There were no active ports to terminate.

Test Setup Diagrams**Conducted Tests:****Test Setup for Transmitter Minimum 6 dB Bandwidth, Duty Cycle, Power Spectral Density & Maximum Peak Output Power**

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

Test Setup Diagrams (continued)

Test Setup for Transmitter AC Conducted Spurious Emissions



4 Antenna Port Test Results

4.1 Transmitter Duty Cycle

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	5 March 2025
Test Sample Serial Number:	243340002310		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6 referencing ANSI C63.10 Section 11.6

Environmental Conditions:

Temperature (°C):	21.0
Relative Humidity (%):	30

Note(s):

- In order to assist with the determination of the average level of spurious emissions field strength in LE2M mode, 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:

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

$$LE \text{ duty cycle: } 20 \log (1 / (\text{XXX.XXX ms} / \text{XXX.XXX ms})) = X.X \text{ dB}$$

$$LE1M \text{ duty cycle: } 20 \log (1 / (2.1449 \text{ ms} / 2.5072 \text{ ms})) = 1.36 \text{ dB}$$

Results: LE1M

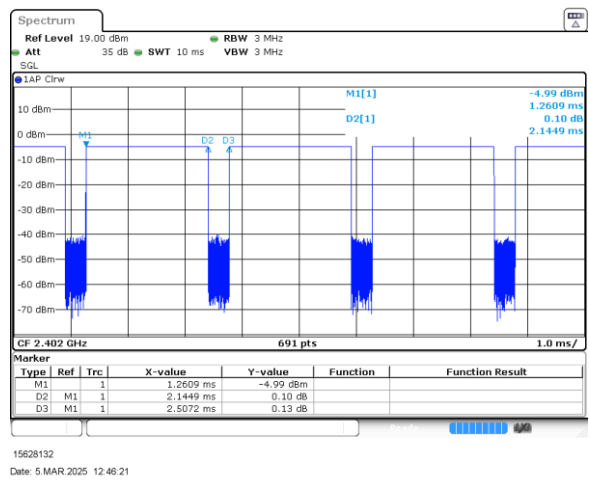
Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
2.1449	2.5072	1.36

Results: LE2M

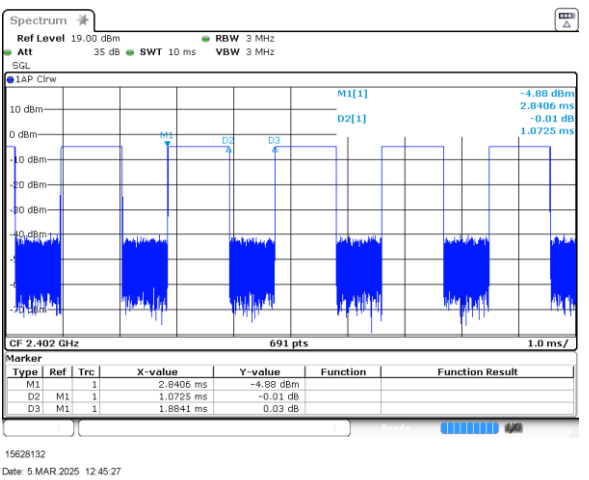
Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
1.0725	1.8841	4.89

Transmitter Duty Cycle (continued)

Results:



LE1M



LE2M

4.2 Transmitter 99% Occupied Bandwidth

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	5 March 2025
Test Sample Serial Number:	243340002310		

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

Environmental Conditions:

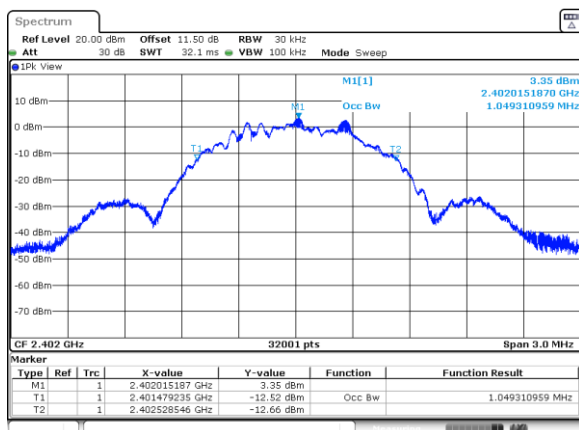
Temperature (°C):	21
Relative Humidity (%):	30

Note(s):

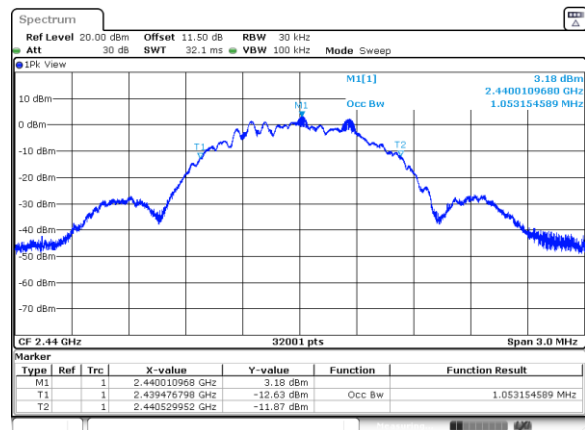
1. The 99% emission bandwidth was measured using the signal analyser occupied bandwidth function. The resolution bandwidth was set in the range of 1% to 5% of the occupied bandwidth and the video bandwidth set to 3 times the resolution bandwidth. The span was set to capture all products of the modulation process including emission skirts.

Transmitter 99% Occupied Bandwidth (continued)**Results: LE1M**

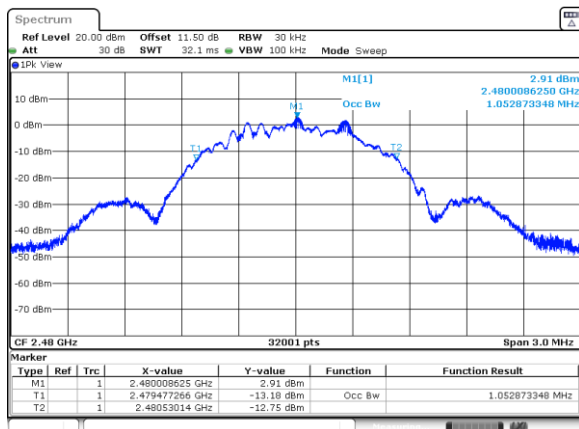
Channel	99% Occupied Bandwidth (kHz)
Bottom	1049.311
Middle	1053.155
Top	1052.873



15628132
Date: 5 MAR 2025 12:21:17

Bottom Channel

15628132
Date: 5 MAR 2025 12:23:17

Middle Channel

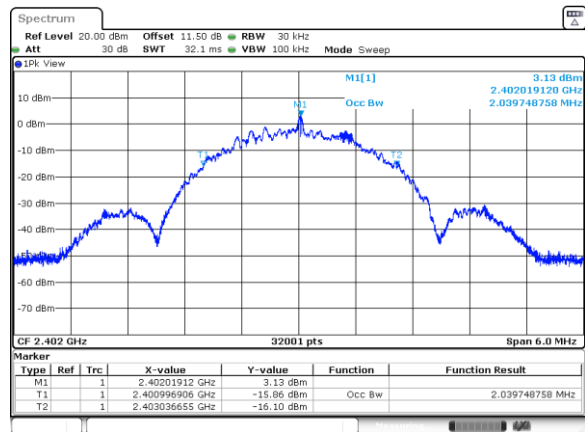
15628132
Date: 5 MAR 2025 12:19:01

Top Channel

Transmitter 99% Occupied Bandwidth (continued)

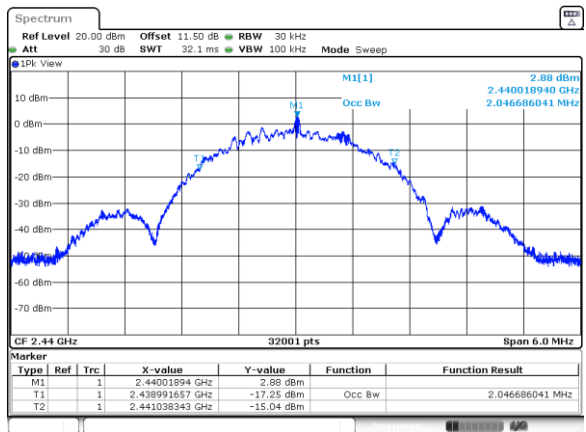
Results: LE2M

Channel	99% Occupied Bandwidth (kHz)
Bottom	2039.748
Middle	2046.686
Top	2048.373



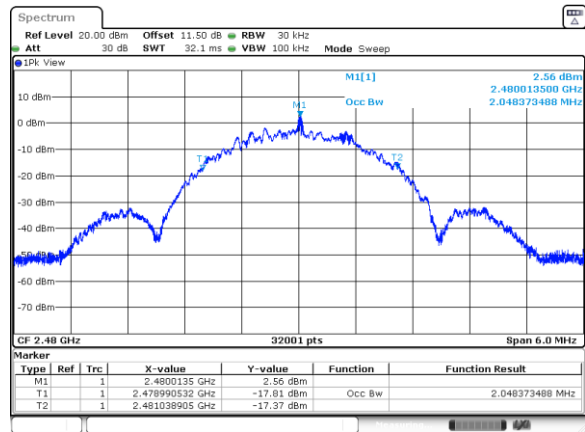
15628132_2Mbps
Date: 5.MAR.2025 12:31:52

Bottom Channel



15628132_2Mbps
Date: 5.MAR.2025 12:27:56

Middle Channel



15628132_2Mbps
Date: 5.MAR.2025 12:30:15

Top Channel

4.3 Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	5 March 2025
Test Sample Serial Number:	243340002310		

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):	21
Relative Humidity (%):	30

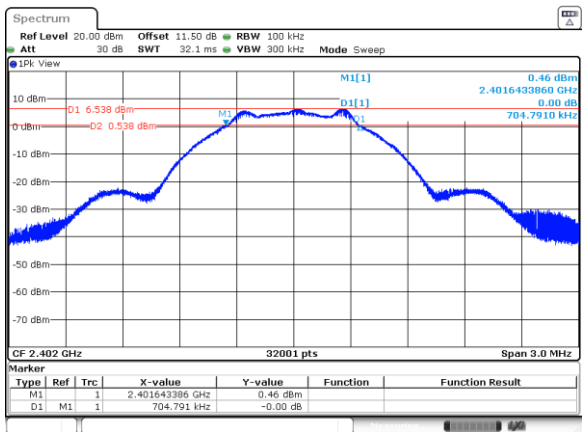
Note(s):

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.

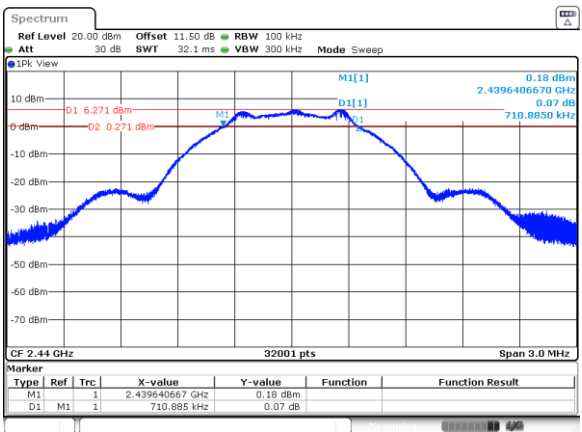
Transmitter Minimum 6 dB Bandwidth (continued)

Results: LE1M

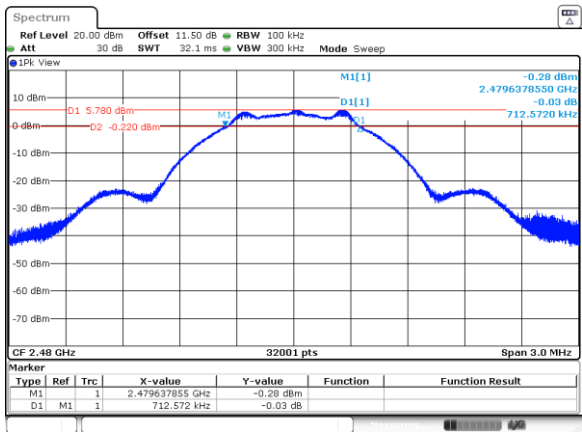
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	704.791	≥500	204.79	Complied
Middle	710.885	≥500	210.89	Complied
Top	712.572	≥500	212.57	Complied



Bottom Channel



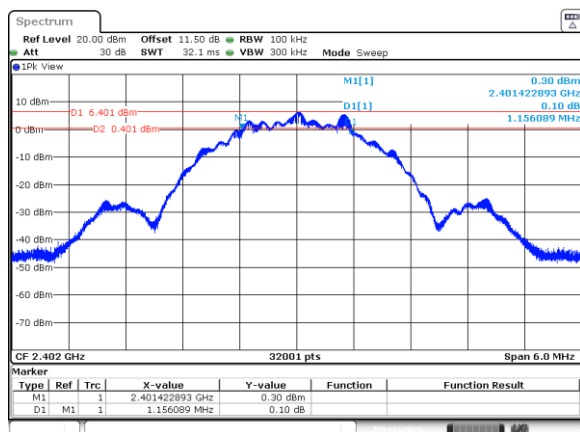
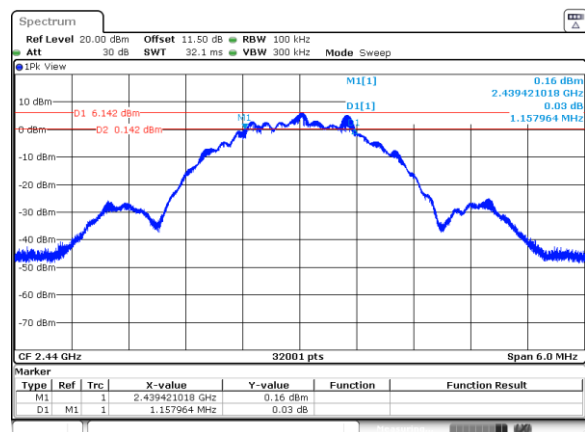
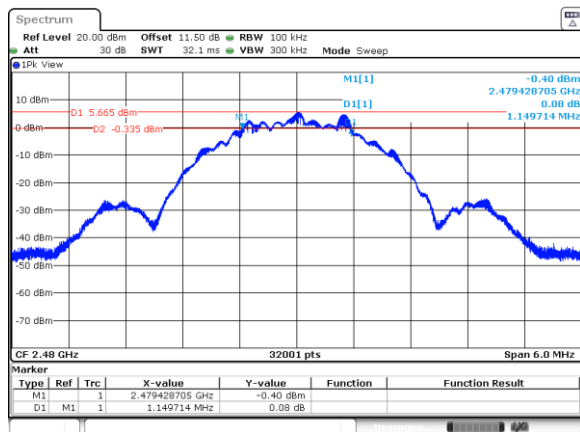
Middle Channel



Top Channel

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

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1156.089	≥500	656.09	Complied
Middle	1157.964	≥500	657.96	Complied
Top	1149.714	≥500	649.71	Complied

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

4.4 Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	5 March 2025
Test Sample Serial Number:	243340002310		

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):	21
Relative Humidity (%):	30

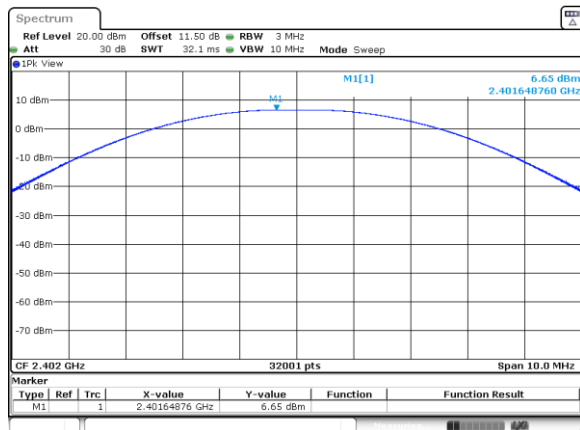
Note(s):

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 3 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set $\geq 3 \times$ RBW. 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.

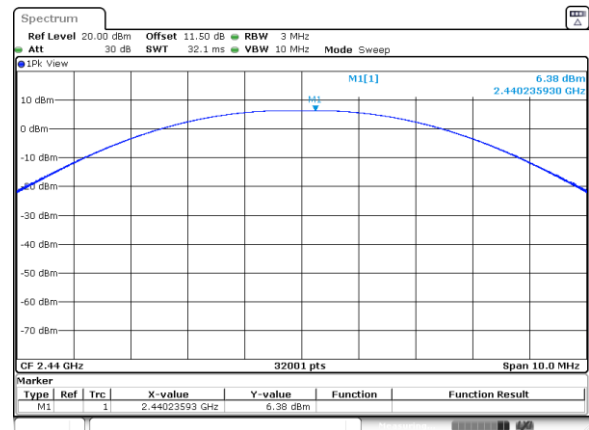
Transmitter Maximum Peak Output Power (continued)**Results: LE1M**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.65	30.0	23.35	Complied
Middle	6.38	30.0	23.62	Complied
Top	5.89	30.0	24.11	Complied

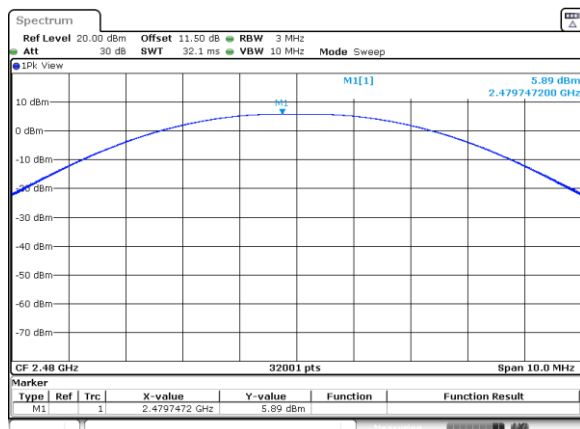
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.65	2.26	8.91	36.0	27.09	Complied
Middle	6.38	2.26	8.64	36.0	27.36	Complied
Top	5.89	2.26	8.15	36.0	27.85	Complied



15628132
Date: 5 MAR 2025 12:21:56

Bottom Channel

15628132
Date: 5 MAR 2025 12:23:56

Middle Channel

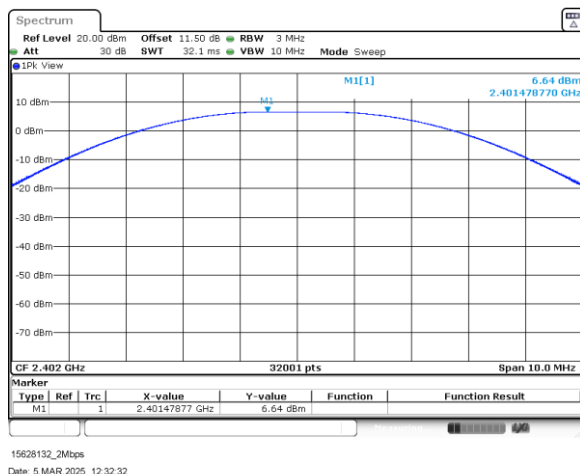
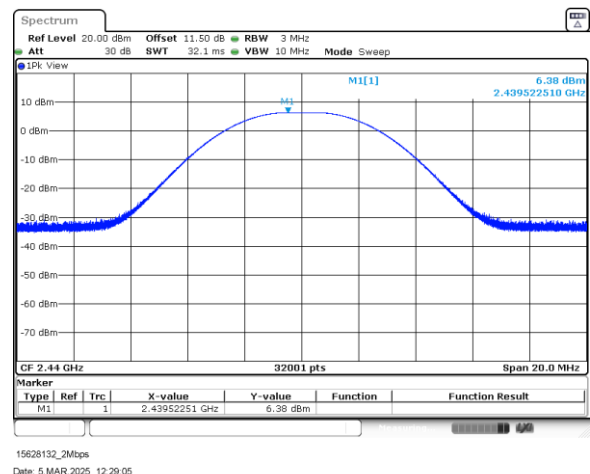
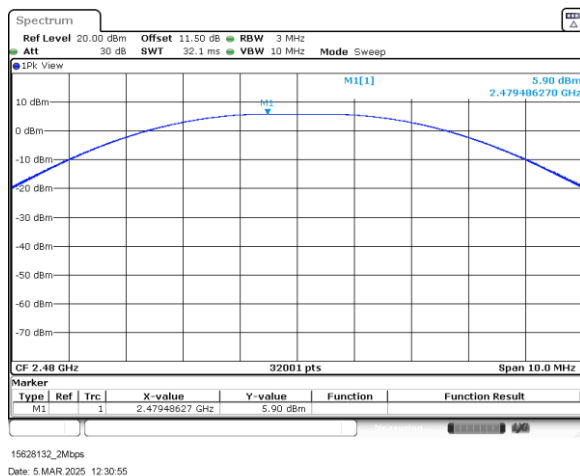
15628132
Date: 5 MAR 2025 12:19:40

Top Channel

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

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.64	30.0	23.36	Complied
Middle	6.38	30.0	23.62	Complied
Top	5.90	30.0	24.10	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.64	2.26	8.90	36.0	27.10	Complied
Middle	6.38	2.26	8.64	36.0	27.36	Complied
Top	5.90	2.26	8.16	36.0	27.84	Complied

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

5 Radiated Test Results

5.1 Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	6 March 2025
Test Sample Serial Number:	243340002310		

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):	21.4
Relative Humidity (%):	30.2

Note(s):

- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- The preliminary scans showed similar emission levels below 1 GHz, for LE1M and LE2M each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to LE 1M the bottom channel only.
- 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.
- Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number 1603665) 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 measurement level was extrapolated in accordance with ANSI C63.10 clause 6.4.3 using the method described in clause 6.4.4.2. ANSI C63.10 clause 5.2 states 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.
- FCC rule part 15.209(a) specifies limits at 300 m / 30 m in $\mu\text{V/m}$ but RSS GEN specifies limits at 300 m / 30 m in $\mu\text{A/m}$. The relevant limits are the same after accounting for E-field to H-field correction. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table). According to Notice 2020-DRS0023 converting the magnetic field strength into electrical field strength using the following equation while considering free space impedance of 377Ω results in a factor of 51.5 dB Ω .

$$AF^E [\text{dB}(\text{m}^{-1})] = AF^H [\text{dB}(\Omega^{-1}\text{m}^{-1})] + Z_0[\text{dB}\Omega]$$

For example, the measurement frequency X KHz resulted in a level of Y dB $\mu\text{V/m}$, which is equivalent to Y -51.5 = Z dB $\mu\text{A/m}$, which has the same margin, W dB, to the corresponding RSS-GEN Section 8.9, Table 6 limit as it has to the 15.209(a) limit.

- The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in

clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade.

Therefore, measurements were performed at a measurement distance of 3 m.

7. The measured values at 3 m were extrapolated to the required measurement distances of 300 m and 30 m and compared the specified limits at those distances as follows:
 - 9 kHz- 490 kHz: measured value extrapolated from 3 m to 300 m by subtracting 80 dB at 40 dB /decade.
 - 490 kHz-30 MHz: measured value extrapolated from 3 m to 30 m by subtracting 40 dB at 40 dB /decade.
8. Measurements from 30 MHz to 1 GHz were performed in a semi-anechoic chamber (Asset Number 1603665) 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.
9. 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.
10. 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.
11. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 9kHz / 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 / LE1M****9kHz to 30MHz**

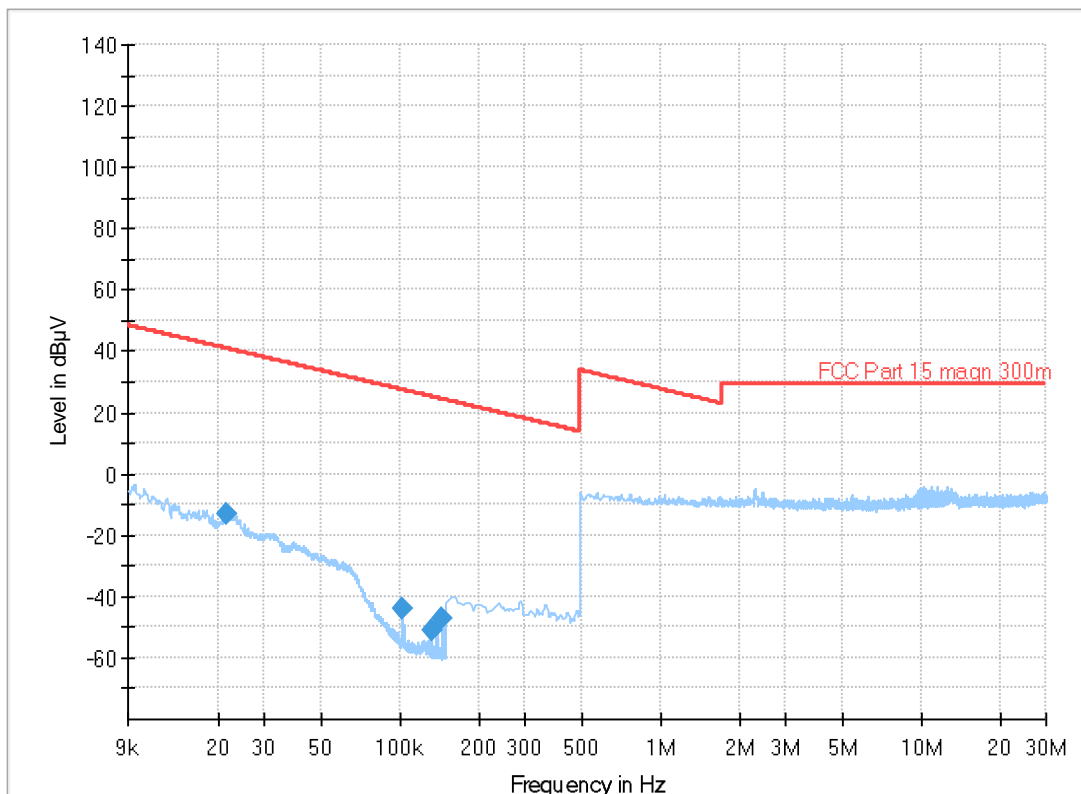
Frequency (MHz)	Antenna Polarity	Level extrapolated (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
-	-	-	-	-	-

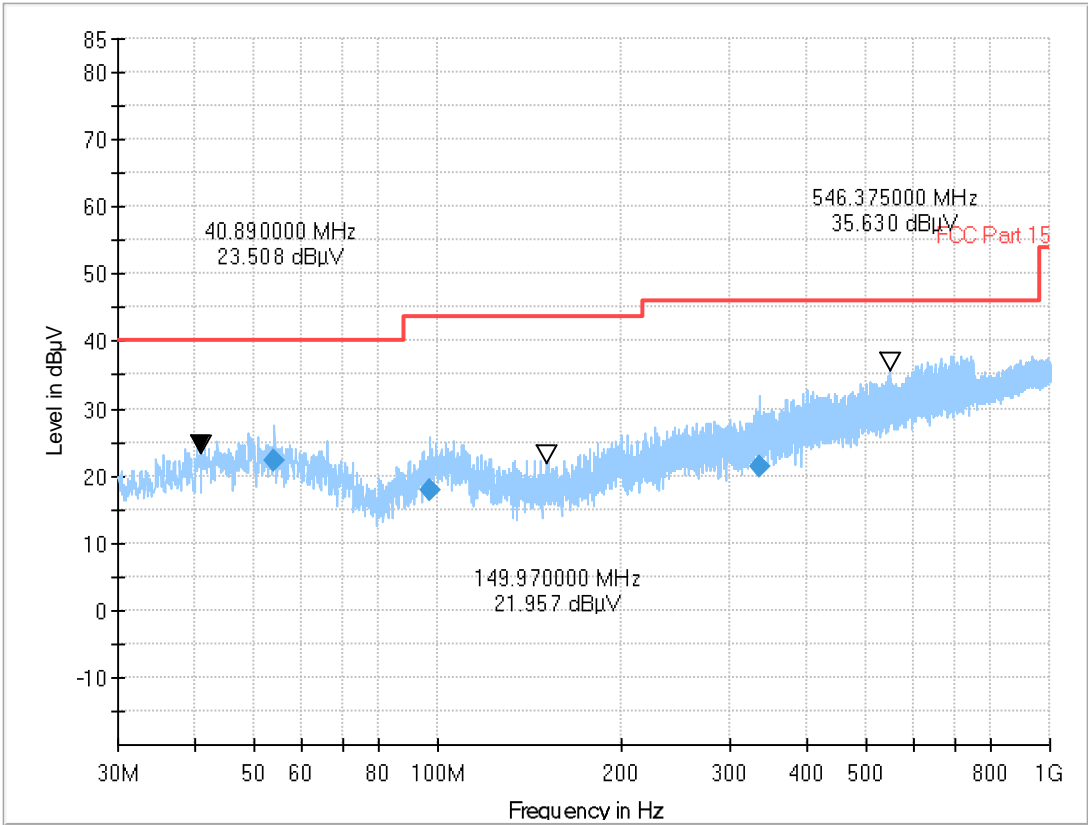
No critical emissions were detected

30MHz to 1 GHz

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
54.120000	Vertical	22.20	40.00	17.80	Complied
96.960000	Vertical	17.95	43.50	25.55	Complied
334.500000	Horizontal	21.45	46.00	24.55	Complied

Full Spectrum





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

5.2 Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	6 March 2025
Test Sample Serial Number:	243340002310		

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 8.1 c)3), 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:

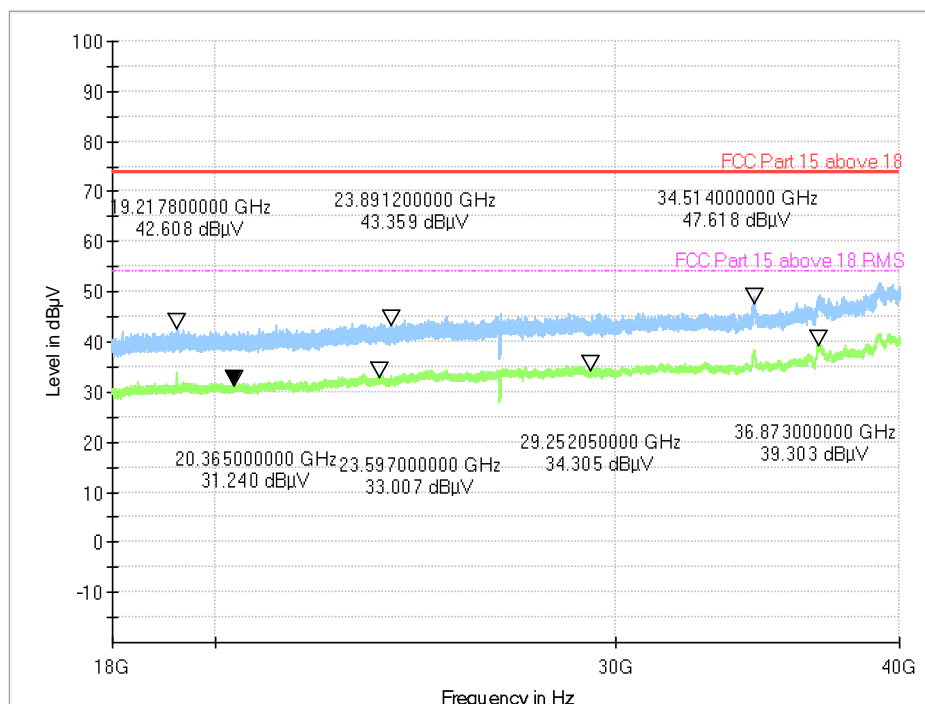
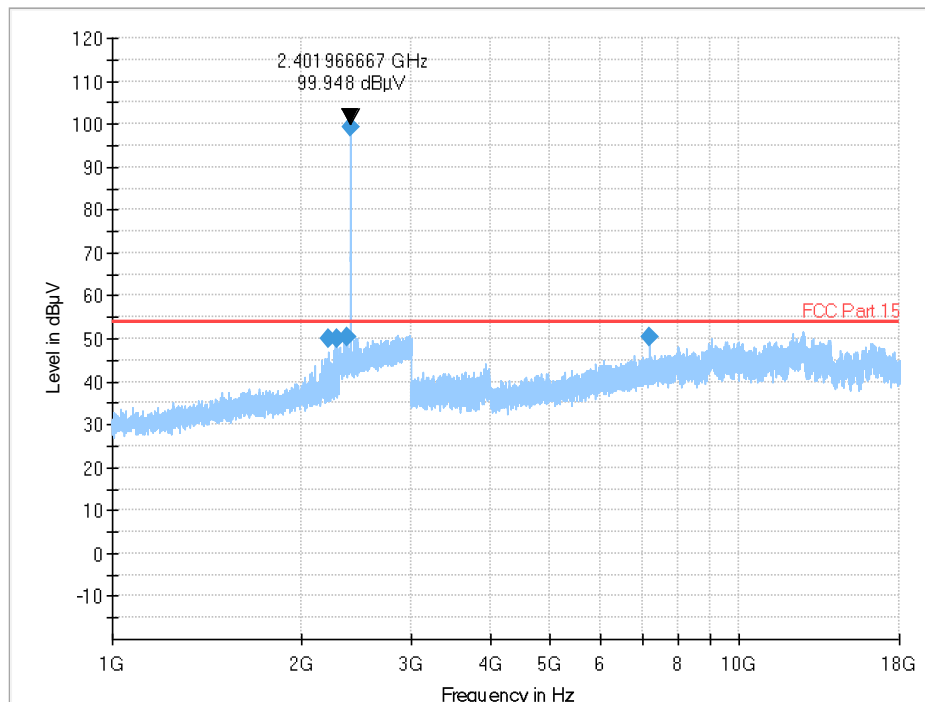
Temperature (°C):	21.4
Relative Humidity (%):	30.2

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
3. 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.
4. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
5. *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.
6. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number 1603665) 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.
7. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number 1603665) 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.
8. 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.
9. The reference level for the emission in the non-restricted band was established by following ANSI C63.10 Section 11.11.2 procedure.
10. The preliminary scans showed similar emission levels for LE1M and LE2M each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to LE 1M the bottom channel only.

Results: Bottom Channel / Peak / LE1M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2210.300000	Vertical	50.01	54.00	3.99	Complied
2288.083333	Vertical	50.11	54.00	3.89	Complied
2366.500000	Vertical	50.45	54.00	3.55	Complied
7205.333333	Horizontal	50.28	54.00	3.72	Complied

Transmitter Radiated Emissions (continued)

Note: The 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:	Yixiang Lin	Test Date:	6 March 2025
Test Sample Serial Number:	243340002310		

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 11.11, 11.12 & 11.13

Environmental Conditions:

Temperature (°C):	21.4
Relative Humidity (%):	30.2

Transmitter Band Edge Radiated Emissions (continued)**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 a 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. 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 Max Hold. 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 peak and RMS detectors respectively. Markers were placed on the highest point on each trace.
6. * -20 dBc limit.
7. **As the EUT had a duty cycle < 98% the duty cycle correction factor has been applied to the LE 1M and LE2M upper band edge average result. The corrected level is shown below:

Upper Band Average result + duty cycle = Corrected band edge level

Corrected band edge level at 2483.5 MHz : XX.X + X.X = XX.X dB μ V/m

Transmitter Band Edge Radiated Emissions (continued)**Results: LE1M****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dB μ V/m)	Limit (dB μ V/m)*	Margin (dB)	Result
2399.65	48.87	82.956	34.09	Complied
2400.00	51.76	82.956	31.20	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2366.224	54.21	74.00	19.79	Complied

Results: Lower Band Edge / 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Level (dB μ V/m) **	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	50.52	1.36	51.88	54.0	2.12	Complied

Results: Upper Band Edge / Peak

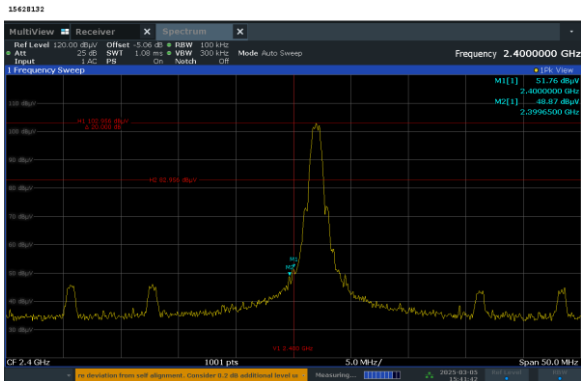
Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	52.95	74.00	21.05	Complied
2483.58	59.38	74.00	14.62	Complied

Results: Upper Band Edge / Average

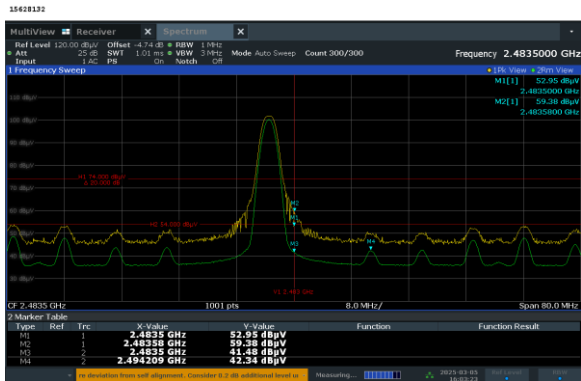
Frequency (MHz)	Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.50	41.48	1.36	42.84	54.0	11.16	Complied
2494.209	42.34	1.36	43.70	54.0	10.30	Complied

Transmitter Band Edge Radiated Emissions (continued)

Results: LE1M



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)**Results: LE2M****Results: Lower Band Edge Peak**

Frequency (MHz)	Level (dB μ V/m)	Limit* (dB μ V/m)	Margin (dB)	Result
2387.762	45.94	82.609	36.67	Complied
2400.000	69.14	82.609	13.47	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2352.797	53.74	74.0	20.26	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average

Frequency (MHz)	Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Level (dB μ V/m)**	Limit (dB μ V/m)	Margin (dB)	Result
2352.158	47.86	4.89	52.75	54.0	1.25	Complied

Results: Upper Band Edge / Peak

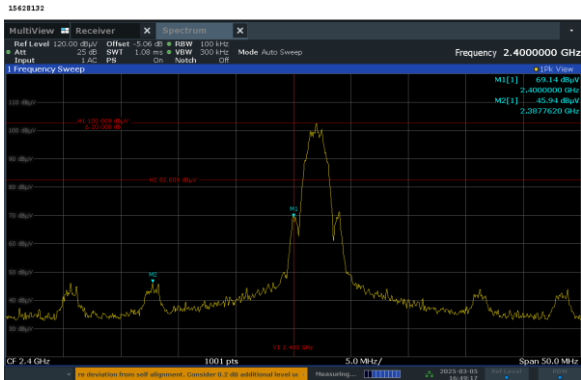
Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	58.38	74.00	15.62	Complied
2483.58	58.99	74.00	15.01	Complied

Results: Upper Band Edge / Average

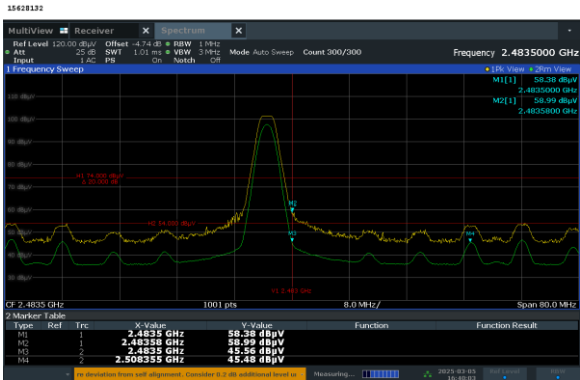
Frequency (MHz)	Level (dB μ V/m)	Duty cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.50	45.56	4.89	50.45	54.0	3.55	Complied
2508.355	45.48	4.89	50.37	54.0	3.63	Complied

Transmitter Band Edge Radiated Emissions (continued)

Results: LE2M



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

6 AC Power Line Conducted Emissions Test Results

6.1 Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Yixiang Lin	Test Date:	8 March 2025
Test Sample Serial Number:	243340002310		

FCC Reference:	Part 15.207
ISED Canada Reference:	RSS-Gen 8.8
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	24

Note(s):

1. The EUT was connected to the power supply input which was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the AC/DC power supply.
3. The preliminary scans showed similar emission levels for LE1M and LE2M each channel of operation. Therefore final measurements were performed with the EUT set to LE 1M the bottom channel only.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.520	Live	21.30	56.00	34.70	Complied
2.481	Live	11.80	56.00	44.20	Complied
0.158	Live	39.90	65.60	25.70	Complied
10.496	Live	14.90	60.00	45.10	Complied
22.005	Live	12.70	60.00	47.30	Complied
3.402	Live	11.90	56.00	44.10	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.520	Live	9.30	46.00	36.70	Complied
2.481	Live	4.60	46.00	41.40	Complied
0.158	Live	16.50	55.60	39.10	Complied
10.496	Live	6.80	50.00	43.20	Complied
22.005	Live	6.40	50.00	43.60	Complied
3.402	Live	5.00	46.00	41.00	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

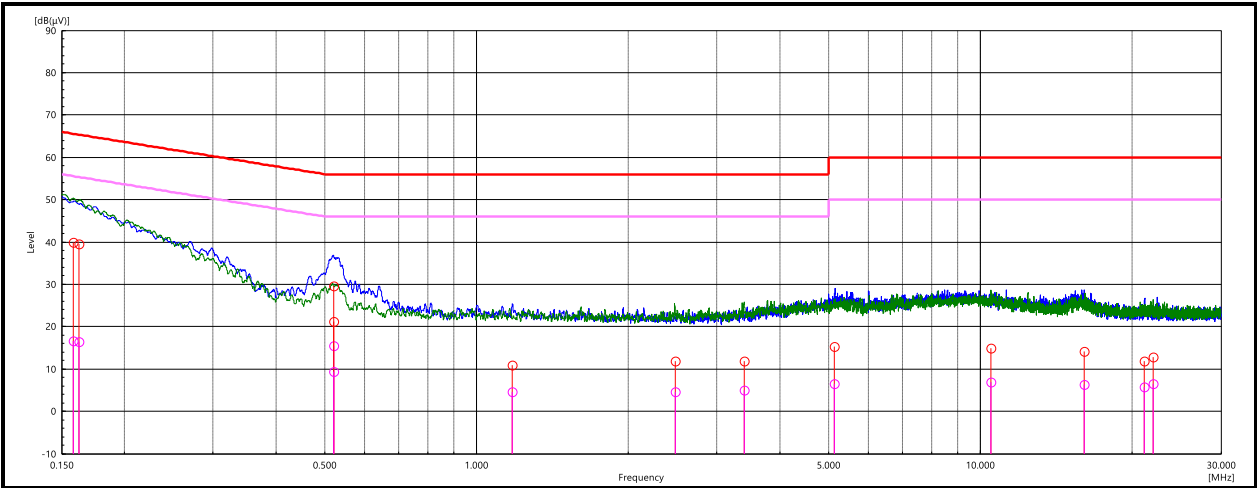
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.163	Neutral	39.40	65.30	25.90	Complied
0.521	Neutral	29.70	56.00	26.30	Complied
1.175	Neutral	10.90	56.00	45.10	Complied
5.135	Neutral	15.40	60.00	44.60	Complied
16.077	Neutral	14.20	60.00	45.80	Complied
21.158	Neutral	11.90	60.00	48.10	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.163	Neutral	16.40	55.30	38.90	Complied
0.521	Neutral	15.50	46.00	30.50	Complied
1.175	Neutral	4.60	46.00	41.40	Complied
5.135	Neutral	6.60	50.00	43.40	Complied
16.077	Neutral	6.30	50.00	43.70	Complied
21.158	Neutral	5.70	50.00	44.30	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



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

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.160	Live	35.00	65.50	30.50	Complied
0.544	Live	22.40	56.00	33.60	Complied
1.294	Live	10.70	56.00	45.30	Complied
2.882	Live	11.00	56.00	45.00	Complied
4.461	Live	15.60	56.00	40.40	Complied
18.879	Live	15.60	60.00	44.40	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.160	Live	14.60	55.50	40.90	Complied
0.544	Live	10.20	46.00	35.80	Complied
1.294	Live	4.40	46.00	41.60	Complied
2.882	Live	4.50	46.00	41.50	Complied
4.461	Live	6.90	46.00	39.10	Complied
18.879	Live	6.70	50.00	43.30	Complied

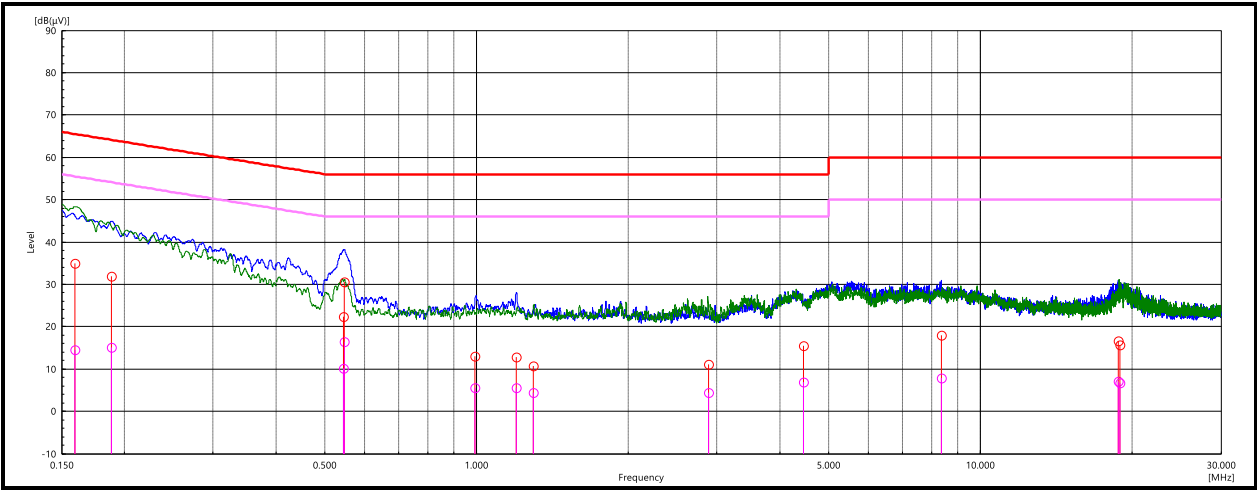
Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.188	Neutral	31.80	64.10	32.30	Complied
0.546	Neutral	30.60	56.00	25.40	Complied
0.993	Neutral	12.90	56.00	43.10	Complied
1.197	Neutral	12.80	56.00	43.20	Complied
8.366	Neutral	18.00	60.00	42.00	Complied
18.736	Neutral	16.60	60.00	43.40	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.188	Neutral	15.10	54.10	39.00	Complied
0.546	Neutral	16.40	46.00	29.60	Complied
0.993	Neutral	5.60	46.00	40.40	Complied
1.197	Neutral	5.60	46.00	40.40	Complied
8.366	Neutral	7.90	50.00	42.10	Complied
18.736	Neutral	7.10	50.00	42.90	Complied

Transmitter AC Conducted Spurious Emissions (continued)
Results: 240 VAC 60 Hz



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

--- END OF REPORT ---