TEST REPORT

Test Report No.: UL-RPT-RP-15782998-116

Customer	:	RFbeam Microwave GmbH
Model No. / PMN	:	V-LD1
HVIN	:	V-LD1
FCC ID	:	2ASYV-V-LD1
ISED Certification No.	:	IC: 24358-VLD1
Technology	:	60 GHz Radar
Test Standard(s)	:	**FCC Parts 15.207, 15.209, 15.215 & 15.255** **ISED Canada RSS-210 Issue 11, June 2024, Annex J &** **RSS-Gen Issue 5, February 2021** 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-15782998-116-FCC Version 1.1, Issue Date 18 JULY 2025 replaces
   Test Report No. UL-RPT-RP-15782998-116-FCC Version 1.0, Issue Date 18 JUNE 2025, which is no longer valid.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

Prepared by: Yixiang Lin
Title: Project Engineer
Date: 18 July 2025

Approved by: Muhammad Faiq Khan
Title: Project Engineer
Date: 18 July 2025

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

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Customer Information

Company Name:	RFbeam Microwave GmbH
Address:	Schuppisstrasse 7, 9016 St. Gallen, Switzerland

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	18/06/2025	Initial Version	Yixiang Lin
1.1	18/07/2025	Pages 1: modification of FCC ID Page 9: correction of Test equipment list Page 11: modification of FCC ID Page 12: Antenna information and note updated Page 13: Operating Modes updated Page 18, 20,22,28,30,35,37: Correction of test method reference Page 30: Correction of test plot	Yixiang Lin

Table of Contents

1 Attestation of Test Results

1.1 Description of EUT

The equipment under test (EUT) was a distance measurement sensor operating at 60GHz band.

1.2 General Information

Specification Reference:	47CFR15.255
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Section 15.255
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-210 Issue 11 June 2024
Specification Title:	License-Exempt Radio Apparatus: Category I Equipment
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:	8 May 2025 to 18 June 2025

1.3 Summary of Test Results

FCC Reference (47CFR)	ISED Canada Reference	Measurement	Result
Part 15.255(c)(2)	RSS-Gen 8.2	Transmitter Duty Cycle	✓
Part 15.255(c)(2)	RSS-210 J.3.2b.	Transmitter EIRP	✓
Part 15.215(c)	N/A	Transmitter 20 dB Bandwidth	✓
N/A	RSS-Gen 6.7	Transmitter 99% Emission Bandwidth	✓
Part 15.255(d) / 15.209	RSS-Gen 6.13 &8.9 / RSS-210 J.4	Transmitter Spurious Emissions	✓
Part 15.255(f)	RSS-Gen 6.11 / RSS-210 J.6	Transmitter Frequency Stability (Temperature & Voltage Variation)	✓
Part 15.207	RSS-Gen 8.8	AC Conducted Emissions	✓

Key to Results
✓ = Complied ✗ = Did not comply

Decision rule:
Where not otherwise specified or communicated in writing, statements of conformity (e.g. Pass/Fail) are established according to the following decision rule: considering the ILAC G8:2019 chapter 4.2.1 (simple acceptance rule). This leads to a maximum 50% of false accept or false reject when the measured value equals the tolerance limit. See ILAC-G8:09/2019 for further details.

Note(s):

-/-

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
SR4/5	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 364244 D01 Meas 15.255 Radars v01r01 March 31, 2025
Title:	RADAR DEVICES CERTIFYING UNDER THE PROVISIONS OF §15.255
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

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.

Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Operating Bandwidth	95%	±0.87 %
Radiated Peak EIRP	95%	±4.98 dB
Transmitter Duty Cycle	95%	±3.4%
Radiated Spurious Emissions below 40 GHz	95%	±3.10 dB
Radiated Spurious Emissions above 40 GHz	95%	±4.98 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
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	36
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	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
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	21/12/2023	24
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	13/05/2024	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
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 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
207474	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	9-Jul-2024	12
207509	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	18-Jul-2024	12

Test site: SR 9 and SR 4/5

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
239944	Rohde & Schwarz	Analyzer Spectrum	FSW50	101847	9/05/2023	24
239964	Rohde & Schwarz	Power Meter	NRP110T	101328	10/05/2023	24
239963	Rohde & Schwarz	Frequency Multiplier	SMZ110	101418	4/07/2023	Internal Verification
239962	Rohde & Schwarz	Frequency Multiplier	SMZ75	101368	24/07/2023	Internal Verification
239956	Rohde & Schwarz	Harmonic Mixer	FS-Z110	102122	5/06/2023	Internal Verification
239957	Rohde & Schwarz	Harmonic Mixer	FS-Z170	101065	25/04/2023	Internal Verification
239958	Rohde & Schwarz	Harmonic Mixer	FS-Z220	101093	16/03/2023	Internal Verification
239959	Rohde & Schwarz	Harmonic Mixer	FS-Z325	101050	23/05/2023	Internal Verification
239945	Rohde & Schwarz	Harmonic Mixer	FS-Z60	101376	5/06/2023	Internal Verification
239955	Rohde & Schwarz	Harmonic Mixer	FS-Z90	102303	5/06/2023	Internal Verification
239946	Rohde & Schwarz	Standard Horn Antenna	TC-HORN60	101259	17/05/2023	Internal Verification
239947	Rohde & Schwarz	Standard Horn Antenna	TC-HORN60	101258	17/05/2023	Internal Verification
239948	Rohde & Schwarz	Standard Horn Antenna	TC-HORN90	100997	21/11/2023	Internal Verification
239949	Rohde & Schwarz	Standard Horn Antenna	TC-HORN90	100998	21/11/2023	Internal Verification
239950	Rohde & Schwarz	Standard Horn Antenna	TC-HORN110	101141	21/11/2023	Internal Verification
239951	Rohde & Schwarz	Standard Horn Antenna	TC-HORN110	101142	21/11/2023	Internal Verification
239952	Rohde & Schwarz	Standard Horn Antenna	SGH170G20	101352	21/11/2023	Internal Verification
239953	Rohde & Schwarz	Standard Horn Antenna	TC-HORN220	101244	21/11/2023	Internal Verification
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
645	Weiss Umwelttechnik	Climatic Chamber	LabEvent T/110/70/3	58226197940010	lab verification	n/a
-	SAGE	RF Detector	SFD-503753-15SF-P1	18199-01	lab verification	n/a
246763	Rohde & Schwarz	Oszilloscope, digital	RTO64	111391	18-Jul-2023	24

Test Measurement Software/Firmware Used:

Name	Manufacturer	Version
EMI Software; CE measurement software	Toyo	EP5/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:	RFbeam
Model Name or Number / HVIN:	V-LD1
PMN:	V-LD1
Test Sample Serial Number:	L2333n00830 (normal sample), L2333n00829 (DC input sample)
Hardware Version:	B
Software Version:	-
HVIN:	V-LD1
FVIN:	-
FCC ID:	2ASYV-V-LD1
ISED Canada Certification Number:	IC: 24358-VLD1
Date of Receipt:	25 April 2025

3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3 Additional Information Related to Testing

Category of Equipment	Transceiver	
Modulation Type:	FMCW	
Power Supply Requirement:	5VDC USB, Nominal 1.8VDC to tranceiver	
Antenna Type:	Microstrip	
Transmit Frequency Range	57.4 GHz to 61.4 GHz	
Transmit Channels Tested:	**Channel ID**	**Frequency (GHz)**
	Single	59.3

Note: Preliminary measurements were performed with two different range settings (20m and 50m). The 20m range setting turned out to be the worst-case scenario. Final testing was performed with the 20m.

3.4 Description of Test Setup

Support Equipment

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

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Power Supply	Good Will Instrument Co., LTD.	-	7662217
2	Laptop	Lenovo	20NYS1GL1U	PC1D101H

B. Support Equipment (Manufacturer supplied) *

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Control Cable	RFbeam	-	-

Operating Modes

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

☒ Continuous Transmit mode: FMCW modulation | Single channel | MAX PWR |

- Below parameters were used during the test:

  TX Power Setting = 31

  Chirp Integration = 100

  Range Setting = 20m

  Lens Gain = 12dBi

Configuration and Peripherals

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

EUT Power Supply:

- The EUT was powered by USB 5V DC. For frequency stability test, a dedicated test port of 1.8 V DC to the RF circuit of radar was provided by the customer to enable adjustment of input voltage. The 1.8V DC was provided by an external AC/DC power supply.

Test Mode Activation:

- The test mode was by enabled by the test software via the USB cable provided by the customer.

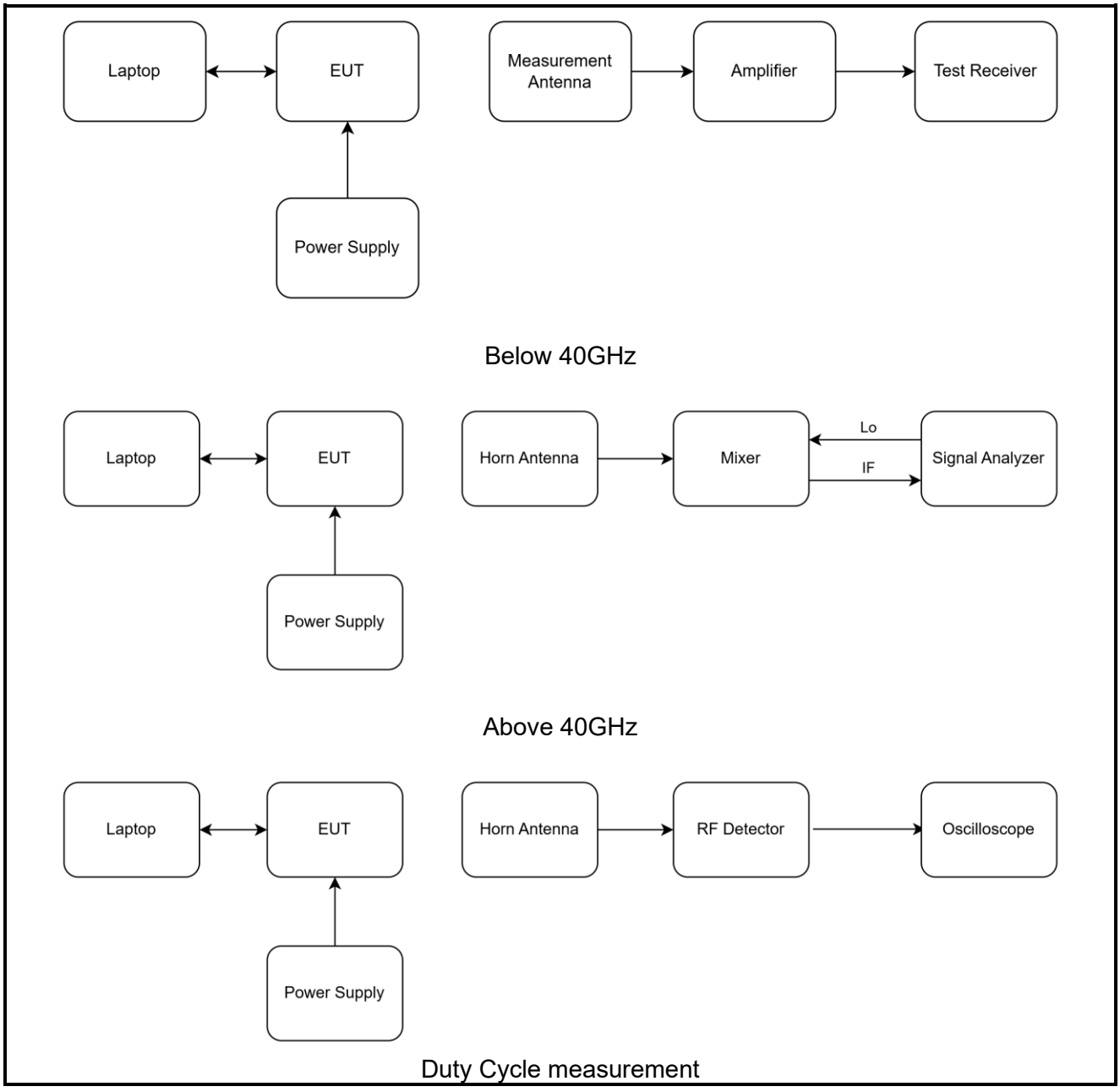
Radiated Measurements:

- The EUT RF sample with antenna was used for radiated spurious emissions measurements.
- The EUT has a lens cover which will enhance the directivity of the radar signal emission, the Transmitter Peak EIRP was performed under condition with and without the lens cover. The configuration with lens cover was found to have highest emission, thus other test items were performed with lens cover.
- Radiated measurements between 30 MHz to 1 GHz were performed with the EUT positioned on the turn table at a height of 0.8m and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range.
- Radiated measurements between 1GHz to 18 GHz were performed with the EUT positioned on the turn table at a height of 1.5m and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range.
- Radiated measurements above 18 GHz were performed with the EUT positioned on the turn table at a height of 1.5m and rotating 360° the antenna height was also fixed to 1.5m over the measurement frequency range.
- R&S® EMC32 V11.30.00 Software was used for the Radiated spurious emission measurements till 40 GHz.

Test Setup Diagrams

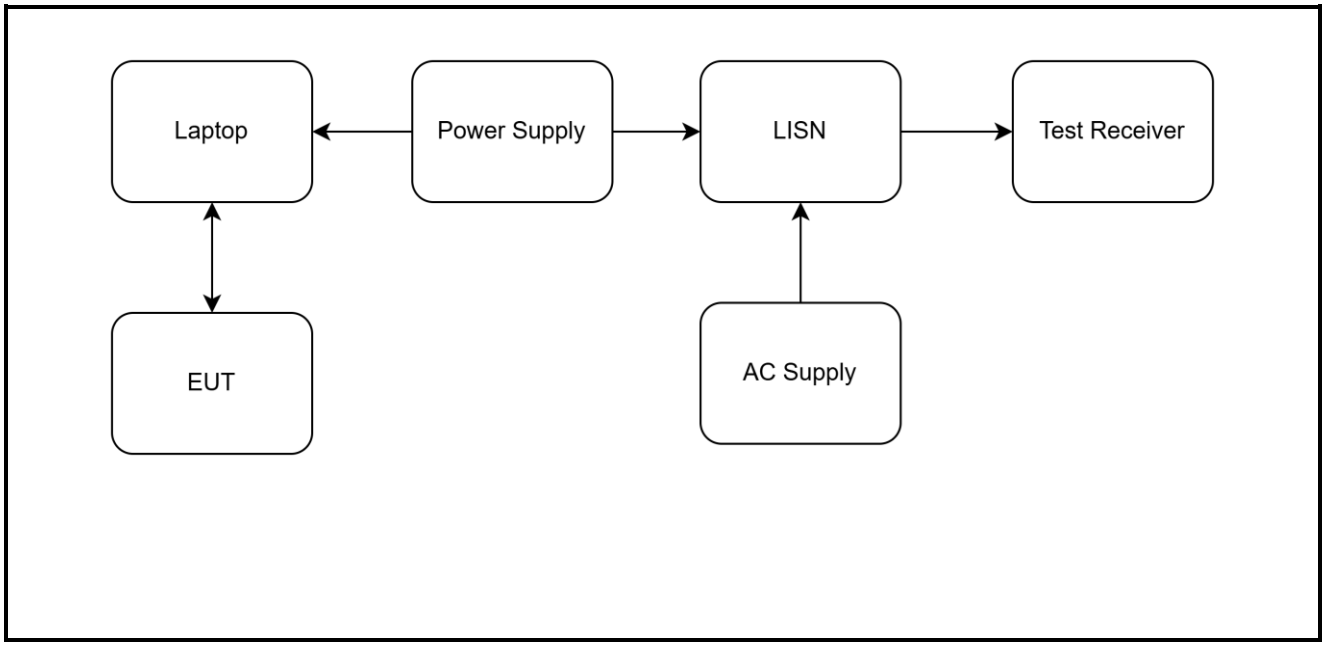
Radiated Tests:

Test Setup for Transmitter Radiated Emissions



Test Setup Diagrams (continued)

Test Setup for Transmitter AC Conducted Spurious Emissions



4 Test Results

4.1 Transmitter Duty Cycle

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	18 June 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Part 15.255(c)(2)(ii)
ISED Reference:	RSS-Gen 8.2
Test Method Used:	ANSI C63.10 Section 7.5 and notes below

Environmental Conditions:

Temperature (°C):	22.0
Relative Humidity (%):	42.5

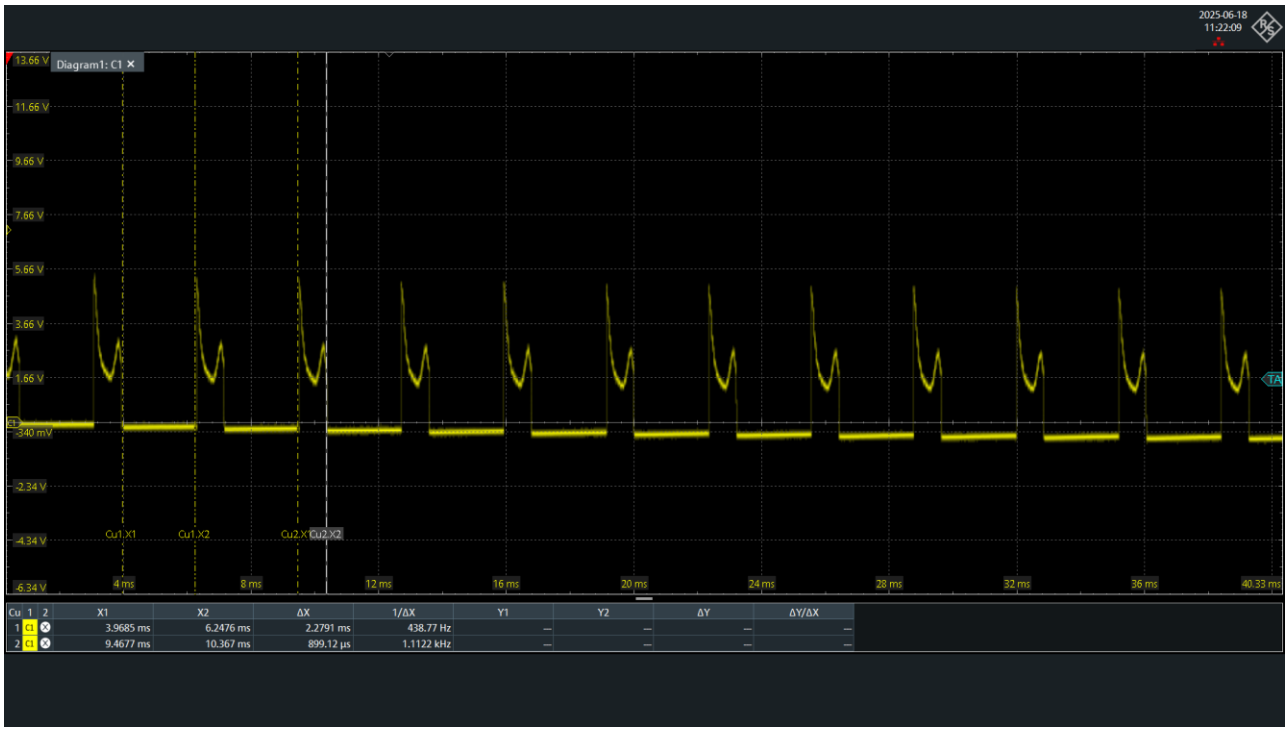
Note(s):

1. Transmitter duty cycle was measured using a spectrum analyzer. The raw data was captured and analysed to calculate the duty cycle:
2. Transmitter off times exceeding 2 ms were summed over a rolling 33 ms period. The minimum combined off time in any 33 ms period was recorded below.

Results:

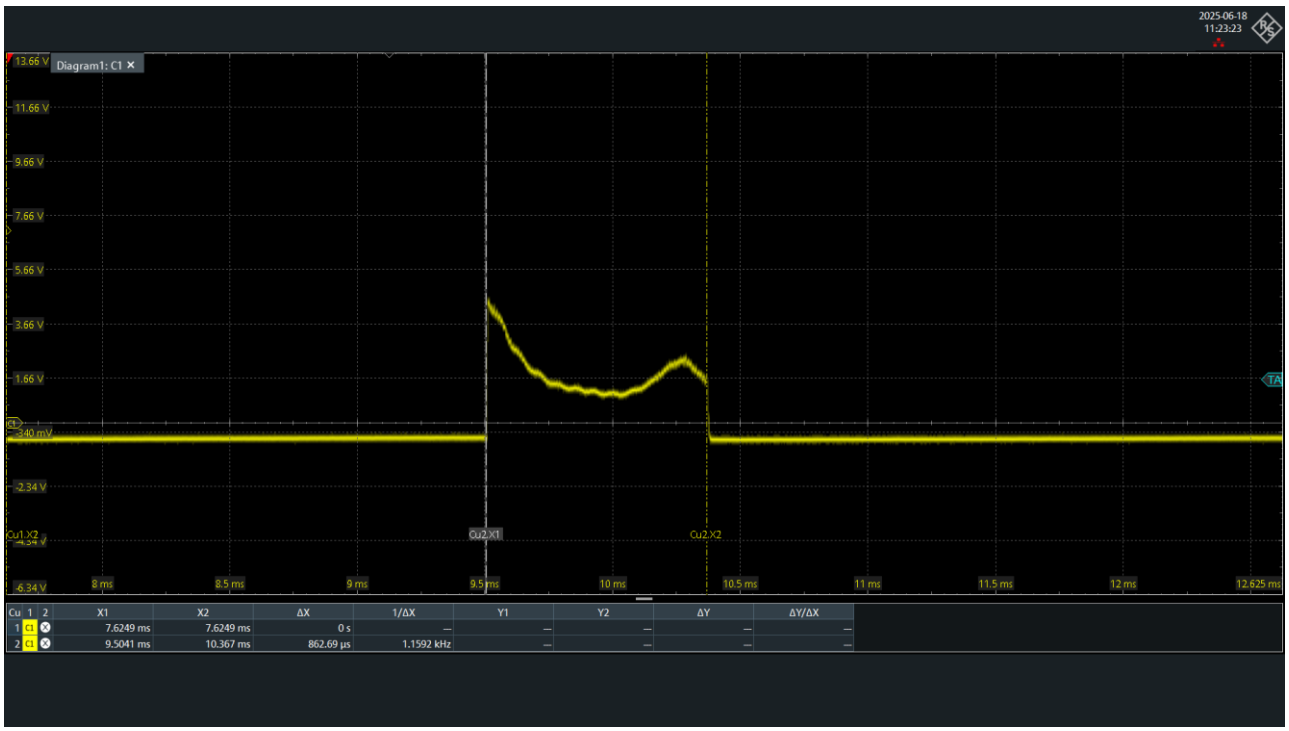
Pulse Period (T_{ON} +T_{OFF}) (ms)	Minimum Tx Off Duration (ms) ms	Tx Off Limit (ms) ms	Result
33	22.79	>16.5	Complied

Trasnmitter Duty cycle (continued)



Tx off time 2.2791ms, 10 counts within 33ms

Plot



Tx on time 862.69 µs

Plot

4.2 Transmitter Peak EIRP

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	16 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Part 15.255(c)(2)(ii)
ISED Canada Reference:	RSS-210 J.3.2b(ii)
Test Method Used:	FCC KDB 364244 Section 6 referencing ANSI C63.10 Section 9.10

Environmental Conditions:

Temperature (°C):	22.0
Relative Humidity (%):	42.3

Note(s):

1. All measurements were taken at 1 meter distance from EUT, correction factors of the mixers and cables were loaded to the signal analyser prior to testing. Free space loss were used to compensate the measurement distance. [FSL] = 10 log (4πr/λ)2.
2. According to FCC Part 15.35(b), the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

   The desensitization correction factor was applied to the Fundamental Emission results.

   The derivation of the Pulse Desensitization Factor is given in the Keysight Technologies Application Note 5952-1039.

   Desensitization factor was calculated from follow equation.

   PDF = 20 log(α)

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2\ln(2)}{\pi}\right)^2 \left(\frac{BW_{\text{Chirp}}}{T_{\text{Chirp}} B^2}\right)^2}}$$

   Where

   α is the reduction in amplitude

   BW_{Chirp} is the FMCW Chirp Bandwidth, which is 3840MHz according to manufacturer

   T_{Chirp} is the FMCW Chirp Time, which is 862.69 µs

   B is the 3 dB IF Bandwidth = RBW, 1MHz was used during test

   PDF = -3.43 dB

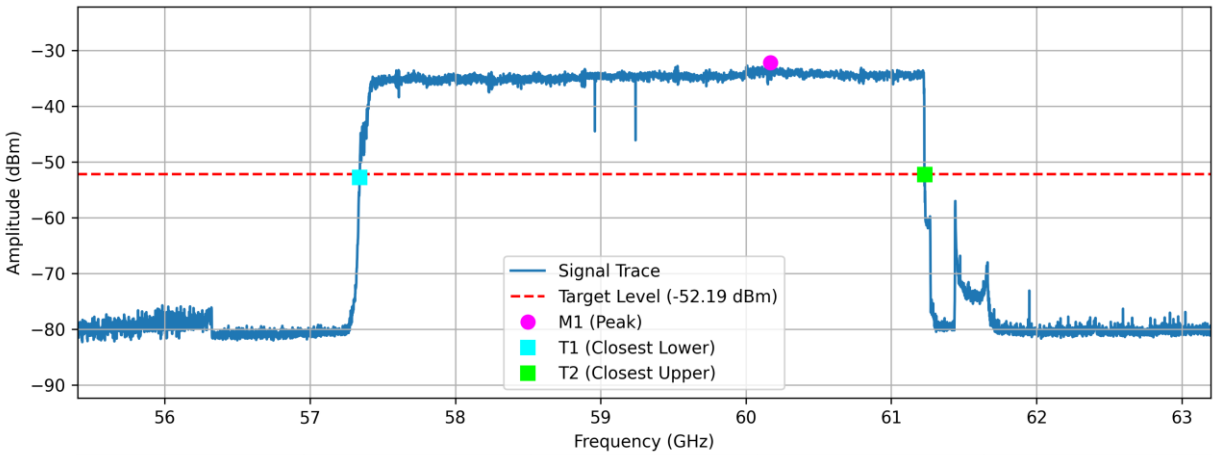
Transmitter Peak EIRP (continued)

Results:

Peak frequency (GHz)	Measured Value (dBm)	Free space loss (dB)	Receiving Antenna Gain (dBi)	Cable loss (dB)	Pulse Desensitization Factor (dB)	Substituted EIRP Level (dBm)	Limit (dBm)	Margin (dB)	Notes
59.300	-32.19	67.909	25	1.294	-3.43	15.44	20	4.56	With lens peak
59.300	-43.94	67.909	25	1.294	-3.43	3.69	20	16.31	Without lens peak

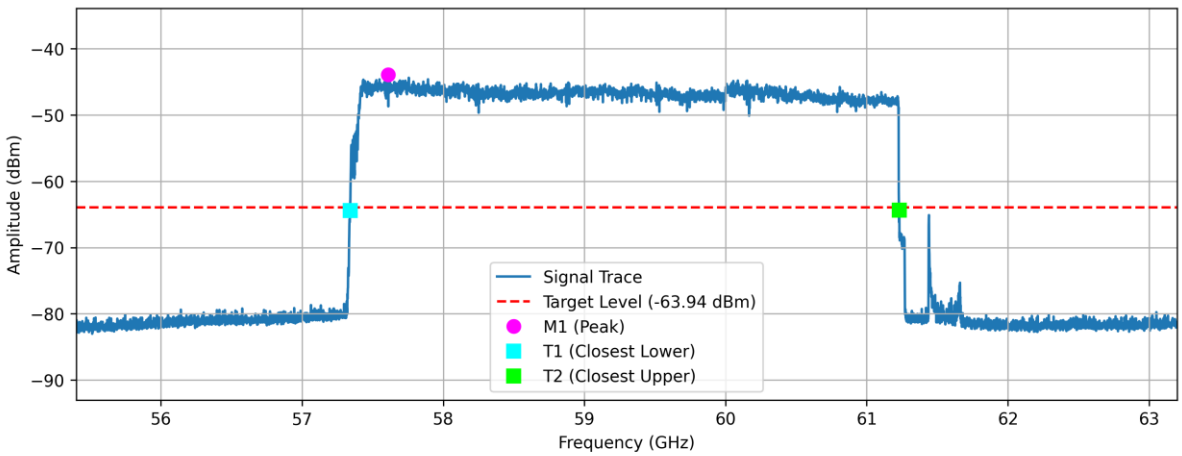
RF output power = Measured Value + Free space loss + Cable loss + - Receiving Antenna Gain - PDF

Plot: Peak power with lens



Type	X-Value	Y-Value	Function	Function Result
M1	60.169GHz	-32.19dBm	ndB	20dB
T1	57.342GHz	-52.82dBm	ndB down BW	3888.000MHz
T2	61.230GHz	-52.30dBm		

Plot: Peak power without lens



Type	X-Value	Y-Value	Function	Function Result
M1	57.609GHz	-43.94dBm	ndB	20dB
T1	57.340GHz	-64.45dBm	ndB down BW	3890.000MHz
T2	61.230GHz	-64.38dBm		

4.3 Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	8 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Part 15.215(c)
ISED Canada Reference:	N/A
Test Method Used:	FCC KDB 364244 Section 5 referencing ANSI C63.10 Section 9.3

Environmental Conditions:

Temperature (°C):	21.0
Relative Humidity (%):	41.5

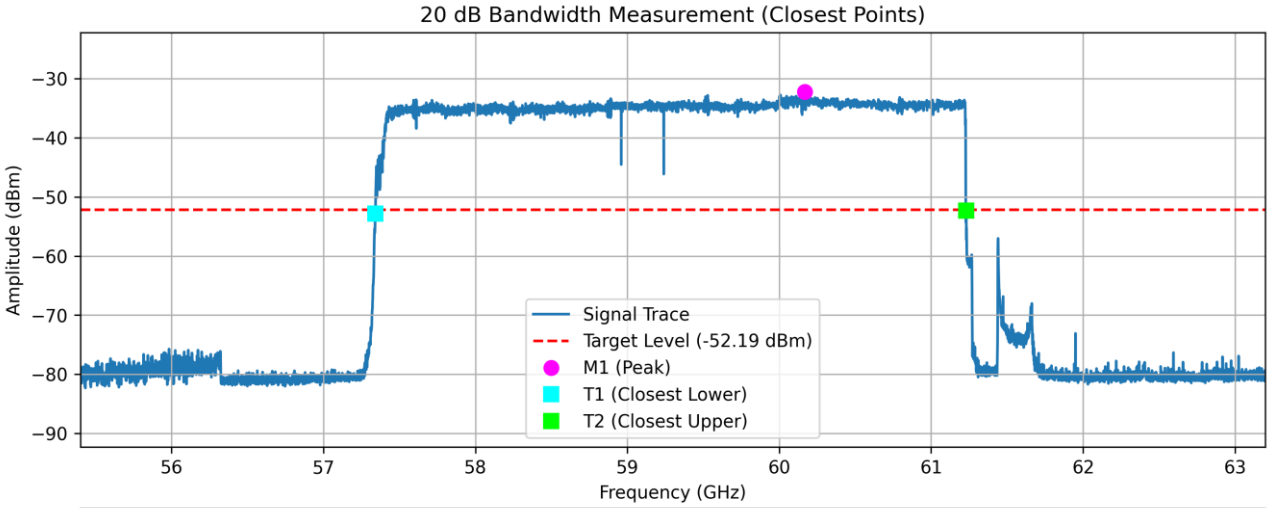
Note(s):

1. 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 trace mode was Max Hold. The span was set to 3 GHz. The 20dB bandwidth was measured at 20 dB down from the peak of the signal.

Transmitter 20 dB Bandwidth (continued)

Results:

Channel	RBW (MHz)	VBW (MHz)	20dB Bandwidth (MHz)
Single	1	3	3888



Type	X-Value	Y-Value	Function	Function Result
M1	60.169GHz	-32.19dBm	ndB	20dB
T1	57.342GHz	-52.82dBm	ndB down BW	3888.000MHz
T2	61.230GHz	-52.30dBm		

4.4 Transmitter 99% Emission Bandwidth

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	8 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	N/A
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	FCC KDB 364244 Section 5 referencing ANSI C63.10 Section 9.3

Environmental Conditions:

Temperature (°C):	21.0
Relative Humidity (%):	41.5

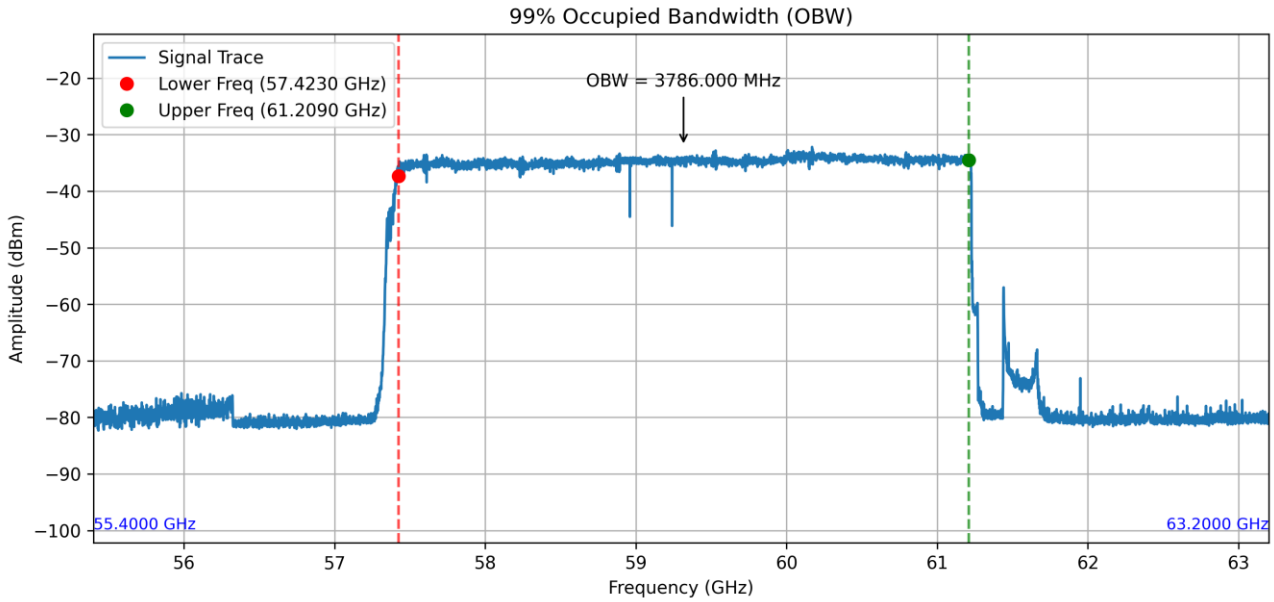
Note(s):

1. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth 3MHz. A Peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 3GHz. The analyzer occupied bandwidth function was used to measure the 99% emission bandwidth.

Transmitter 99% Emission Bandwidth (continued)

Results:

Channel	RBW (MHz)	VBW (MHz)	99% Occupied Bandwidth (MHz)
Single	1	3	3786



4.5 Transmitter Radiated Spurious Emissions

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	9 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Parts 15.255(d) & 15.209
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-210 J.4
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):	21.7
Relative Humidity (%):	31.4

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore, final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. 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. 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. 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.
5. FCC rule part 15.209(a) specifies limits at 300 m / 30 m in µV/m but RSS GEN specifies limits at 300 m / 30 m in µA/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 377 Ω results in a factor of 51.5 dBΩ.

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

For example, the measurement frequency X KHz resulted in a level of Y dBµV/m, which is equivalent to Y -51.5 = Z dBµA/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.

Transmitter Radiated Emissions (continued)

Note(s):

6. 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 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.
10. 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)

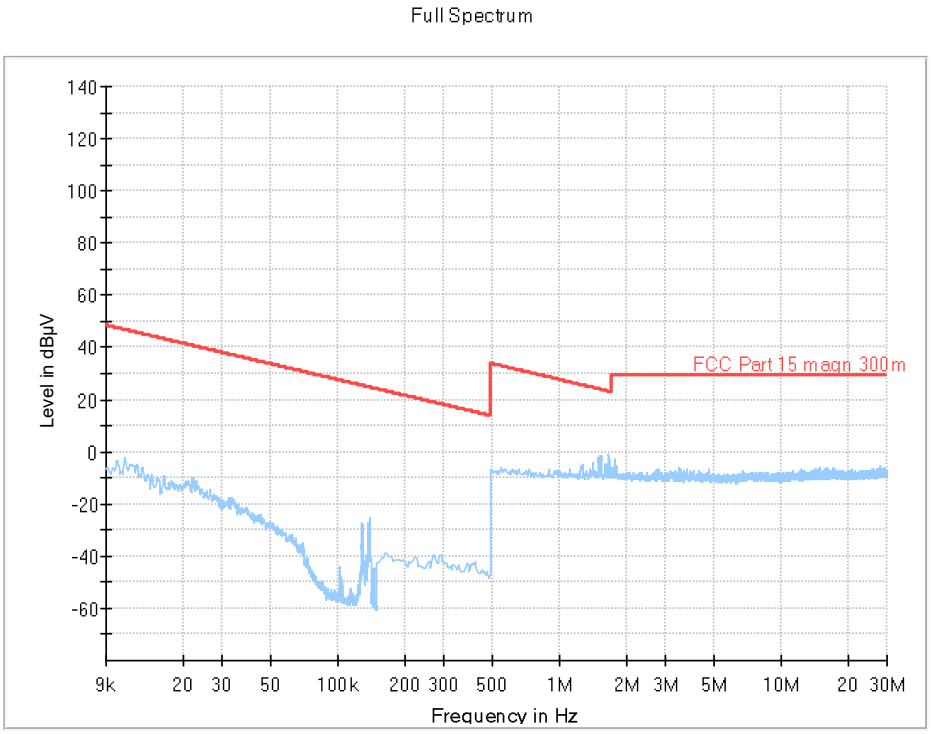
Results:

9kHz to 30MHz

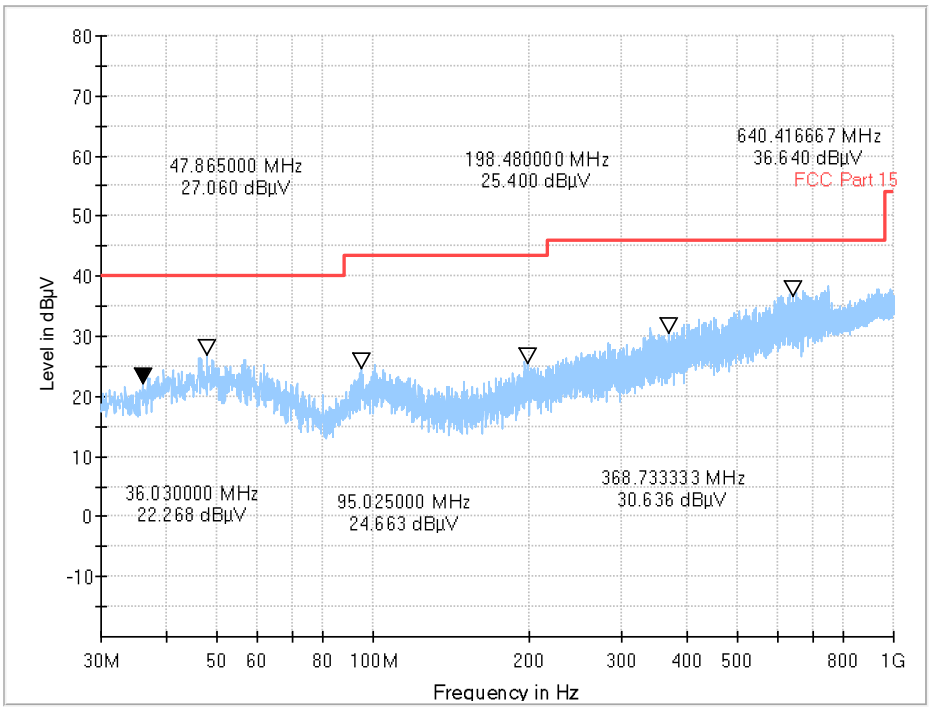
Frequency (MHz)	Antenna Polarity	Level@3m (dBµV/m)	Level extrapolated (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical emissions were detected						

30MHz to 1 GHz

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical emissions were detected					



Transmitter Radiated Emissions (continued)



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

4.6 Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	9 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Parts 15.255(d) & 15.209
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-210 J.4
Test Method Used:	FCC KDB 364244 Sections 7 referencing ANSI C63.10 Sections 9.12 & 9.13
Frequency Range	1 GHz to 200 GHz

Environmental Conditions:

Temperature (°C):	21.7
Relative Humidity (%):	31.4

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 at approximately 62GHz is the EUT fundamental.
5. Measurements 1 GHz to 18GHz 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 metres above the test chamber floor in the centre of the chamber turntable. The antenna height varies from 1 to 4 m over the measurement frequency range.
6. Measurements 18 GHz to 40GHz were performed in a semi-anechoic chamber (Asset Number 1603665) at a distance of 1 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable.
7. Part 15.255(d)(3) defines a power density limit of 90 pW/cm^2 at 3 meters for spurious emissions between 40 GHz and 200 GHz. This was converted to a field strength limit of 85.31 dBuV/m using equation provided in the section 9.6 of ANSI C63.10.
8. Measurement distance above 40 GHz were determined using the procedure defined in section 9.8 of ANSI C63.10. Measurements were made at the following distances:

   40GHz to 200 GHz 1 meter

9. *In accordance with ANSI C63.10 Section 6.6.4.3 Note 1, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

Transmitter Radiated Emissions (continued)

Note(s):

Calculation of the boundary near/far field:

Rayleigh far filed distance calculation using formular $R = 2D^2/\lambda$, where D is the dimension of the antenna used during test, .λ is the free space wave length in m at the frequency of measurement.

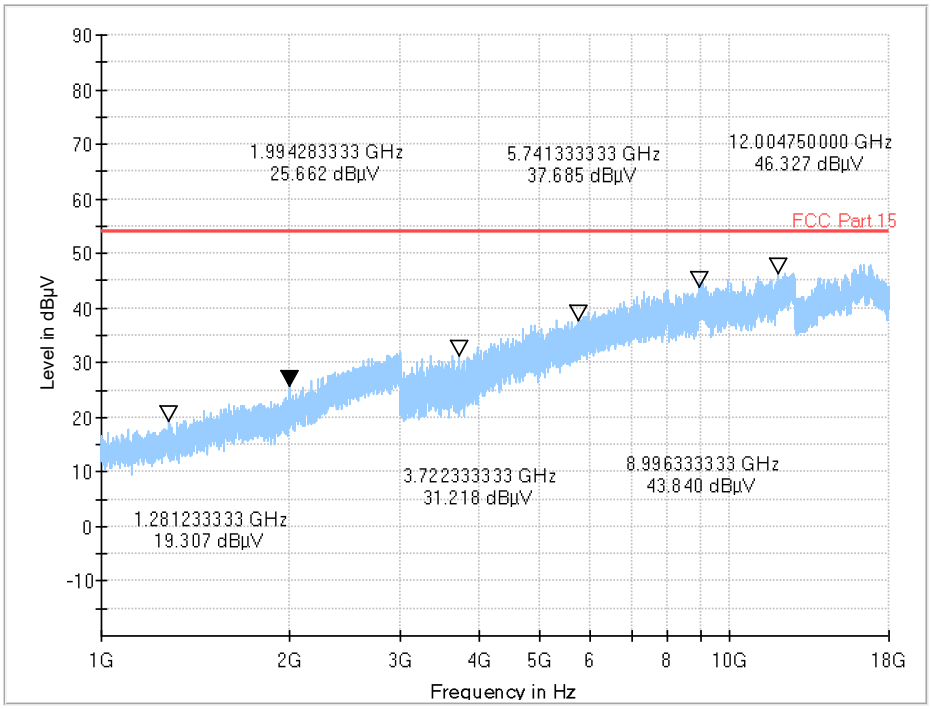
Antenna Range (GHz)	D (m)	Highest frequency (GHz)	Wavelength λ (m)	Near/far field boundary
40-60	0.050	60	0.00499654	1.00
60-90	0.031	90	0.00333103	0.58
90-110	0.028	110	0.00272539	0.58
110-140	0.007	140	0.00214137	0.05
140-220	0.0207	220	0.00136269	0.63

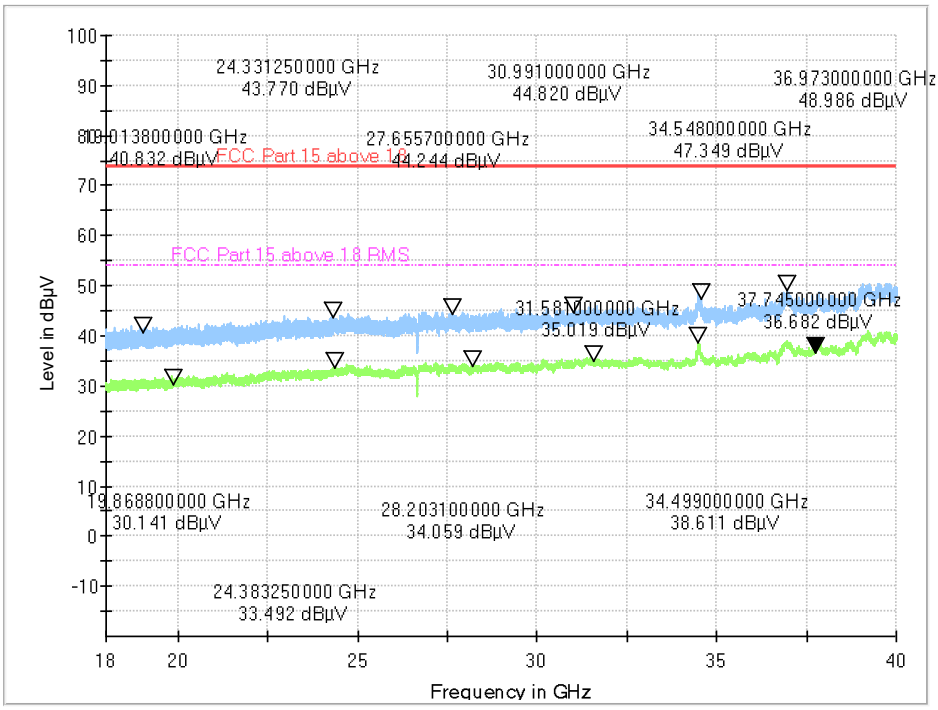
10. Where measurements were performed at a distance other than that specified by the limit, a correction factor was calculated using the equation provided in section 9.4 of ANSI C63.10.

Results:

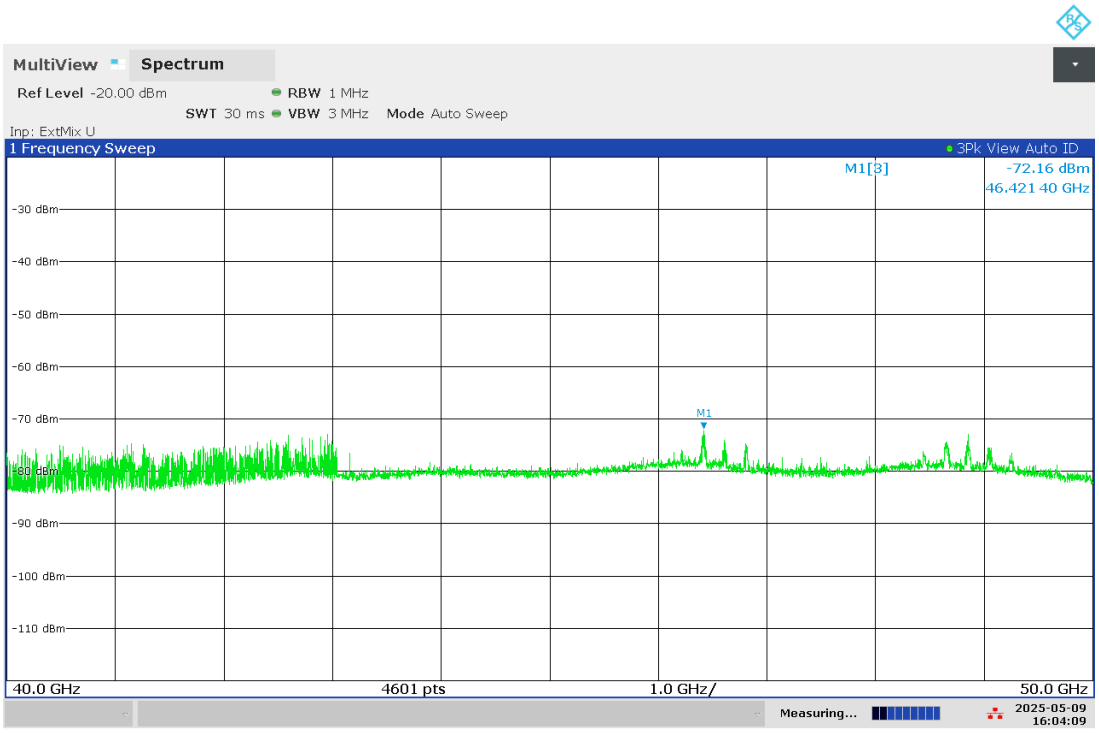
Peak frequency(GHz)	Measured Value (dBm)	Free space loss (dB)	Receiving Antenna Gain(dBi)	Cable loss (dB)	Duty Cycle Correction Factor (dB)	Substituted EIRP Level (dBm)	Power Flux Density pW/cm2	Limit (pW/cm2)	Limt Margin (pW/cm2)
89.353	-72.42	71.470	25	1.294	0.00	-24.66	3.03	90	86.97
144.000	-69.37	75.615	25	1.294	0.00	-17.46	15.87	90	74.13

Transmitter Radiated Emissions (continued)





Transmitter Radiated Emissions (continued)



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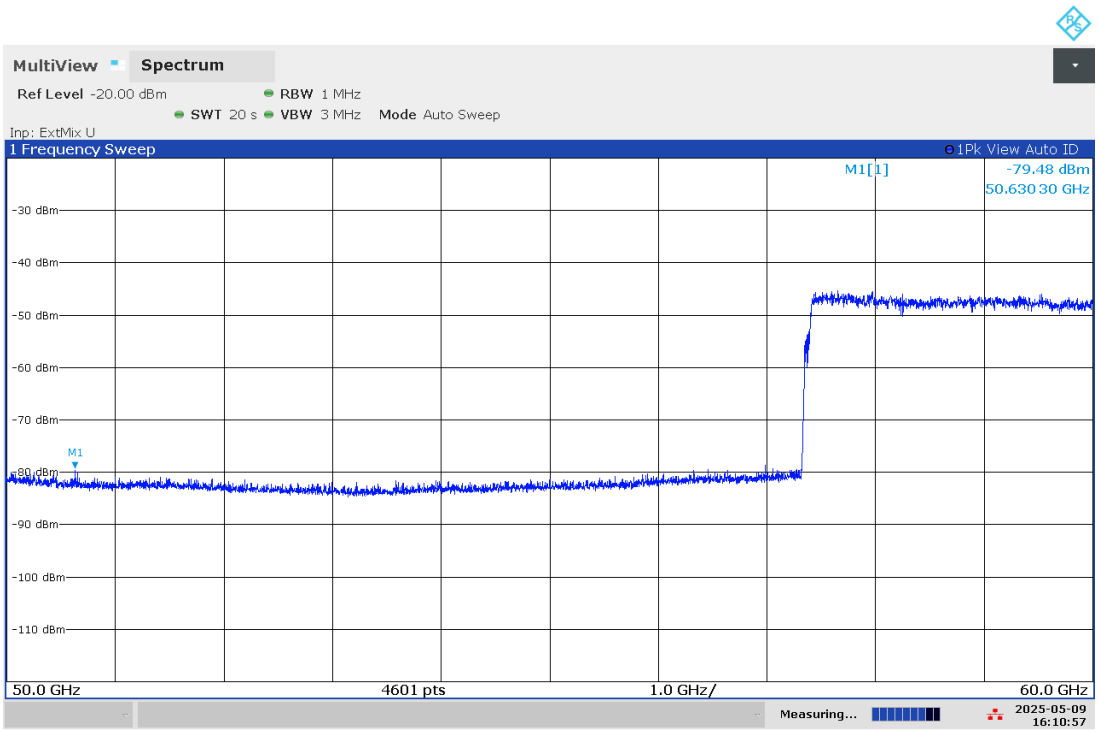

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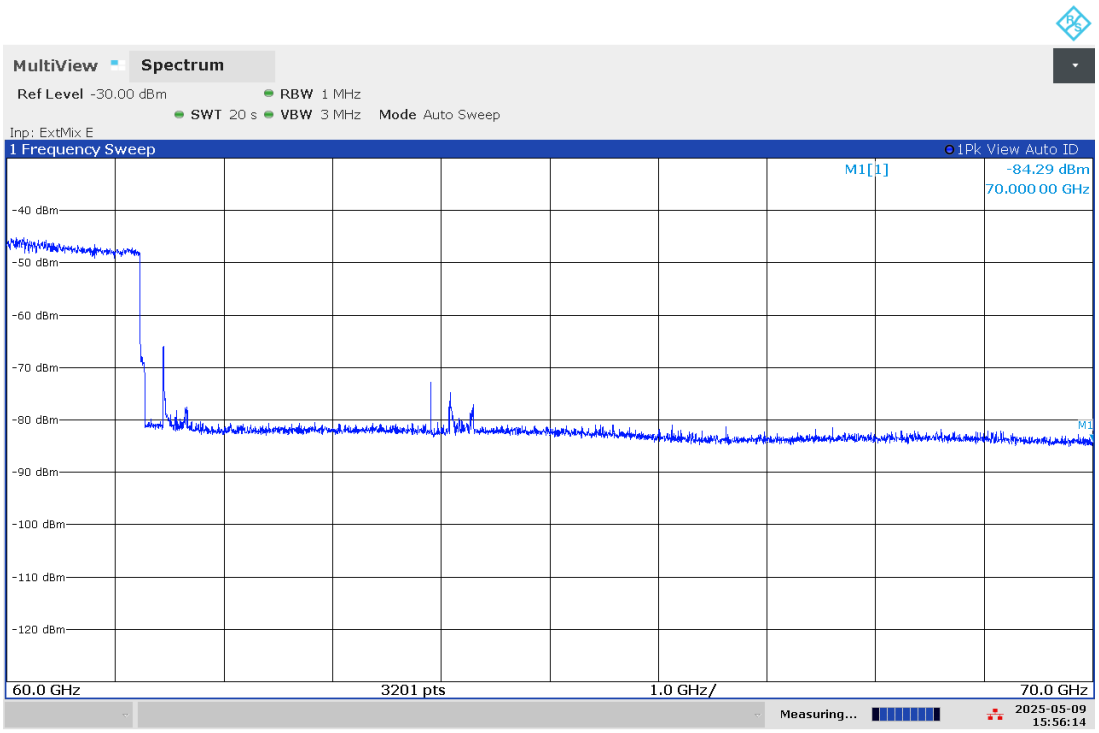
Transmitter Radiated Emissions (continued)



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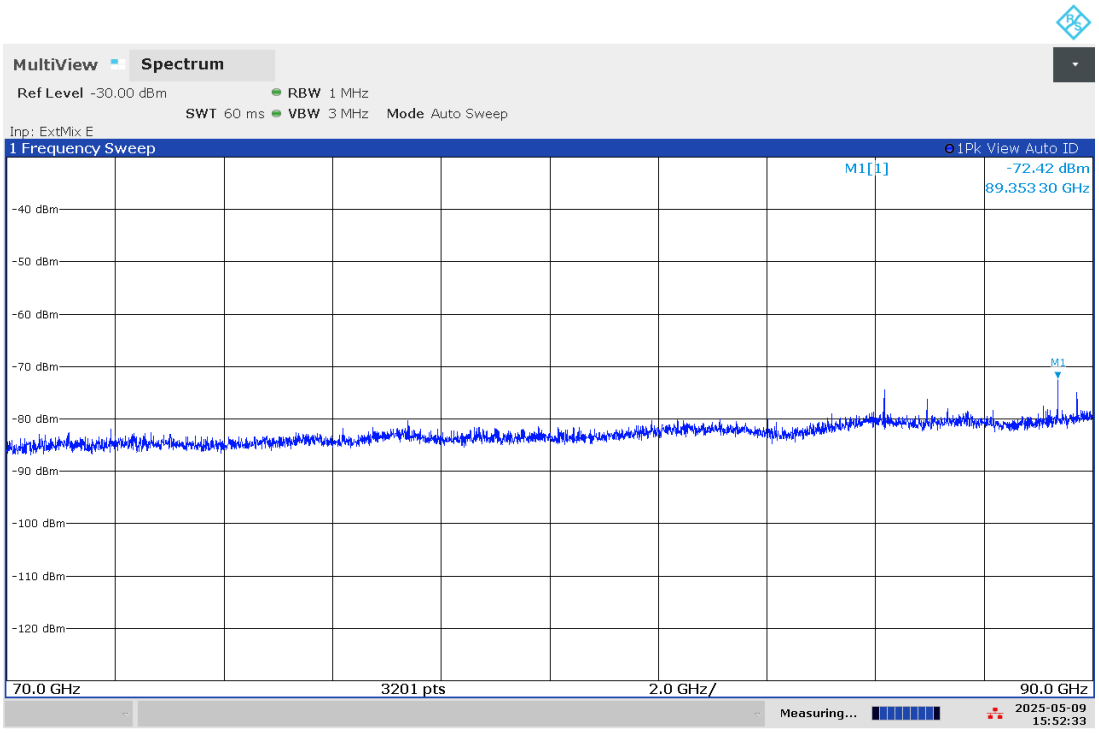

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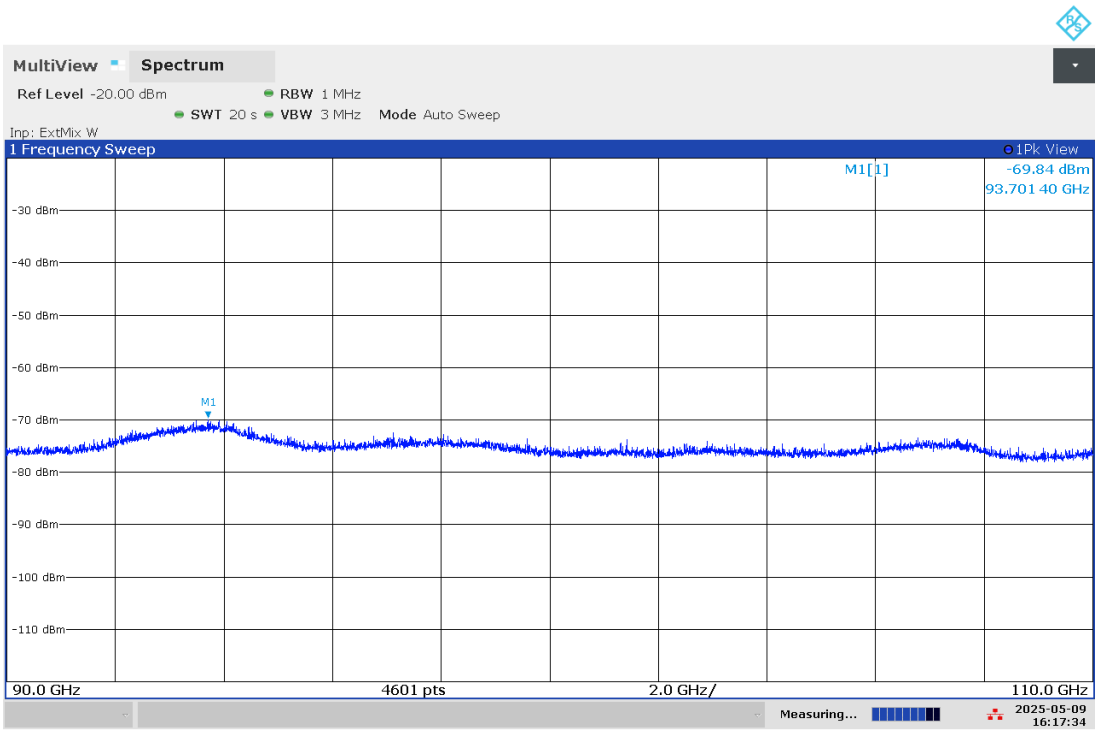
Transmitter Radiated Emissions (continued)



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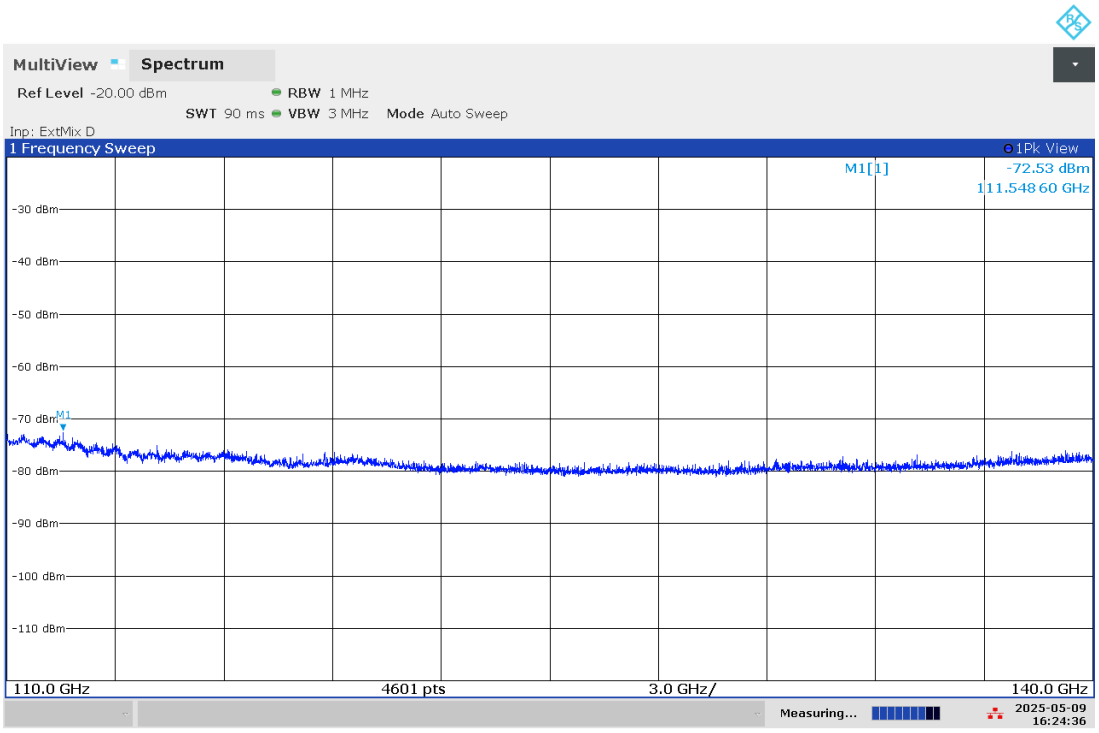

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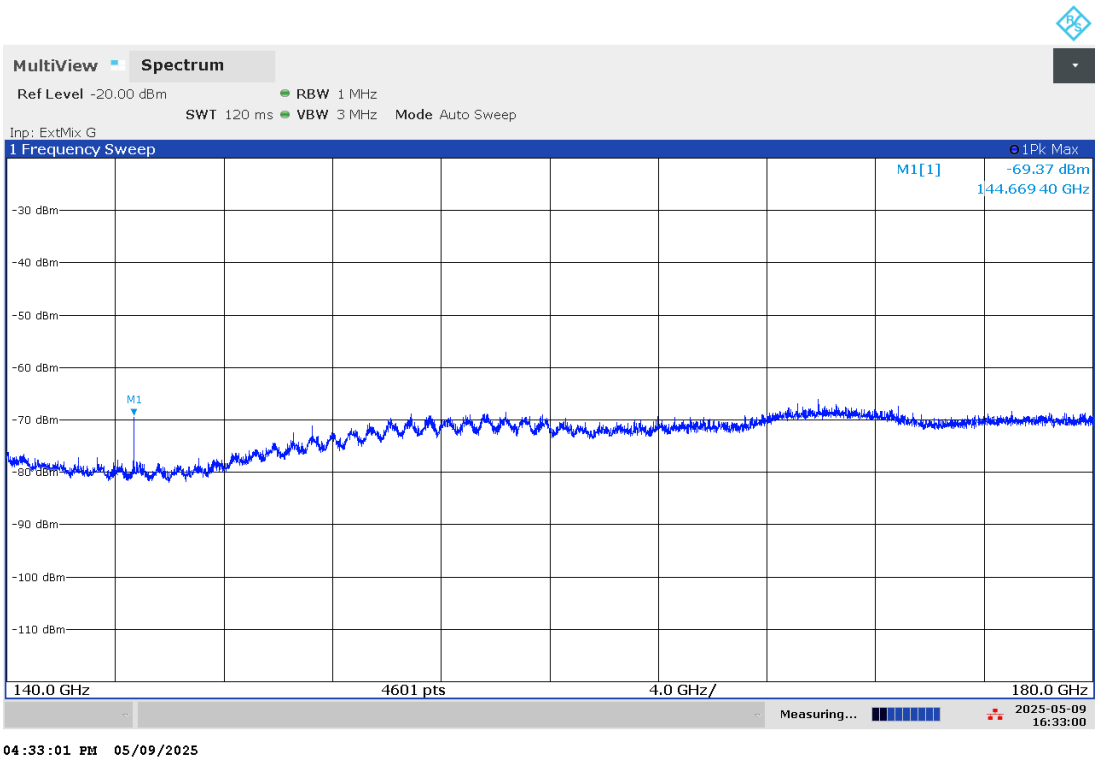
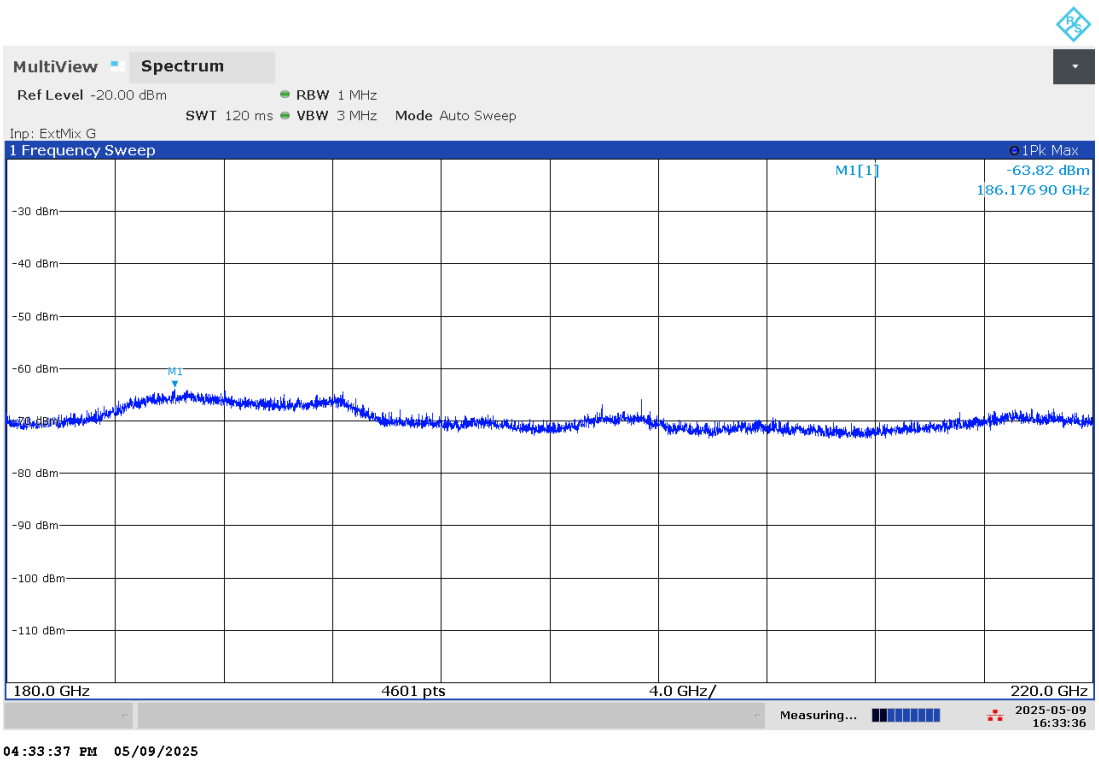
Transmitter Radiated Emissions (continued)





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

4.7 Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	16 May 2025
Test Sample Serial Number:	L2333n00830		

FCC Reference:	Part 15.255(f)
ISED Canada Reference:	RSS-Gen 6.11 / RSS-210 J.6
Test Method Used:	FCC KDB 364244 Sections 8 referencing ANSI C63.10 Section 9.14

Environmental Conditions:

Temperature (°C):	22.3
Relative Humidity (%):	42.0

Note(s):

1. The 20 dB emission bandwidth and 99% occupied bandwidth was recorded on a signal analyser and compared to the lower and upper emission edges.
2. Temperature was monitored throughout the test with a calibrated digital thermometer.

Transmitter Frequency Stability (Temperature Variation)

Results: Lower Band Edge

Temperature (°C)	Lower Band Edge Frequency (MHz)	Lower 20 dB Emission Bandwidth Frequency (MHz)	Lower 99% Occupied Bandwidth Frequency (MHz)	Result
-20	57000	57338	57416	Complied
-10	57000	57339	57416	Complied
0	57000	57338	57416	Complied
10	57000	57338	57416	Complied
20	57000	57338	57421	Complied
30	57000	57339	57416	Complied
40	57000	57338	57416	Complied
50	57000	57338	57416	Complied
Worst-case Margin (MHz)		338		

Results: Upper Band Edge

Temperature (°C)	Upper Band Edge Frequency (MHz)	Upper 20 dB Emission Bandwidth Frequency (MHz)	Upper 99% Occupied Bandwidth Frequency (MHz)	Result
-20	61560	61227	61197	Complied
-10	61560	61227	61197	Complied
0	61560	61227	61197	Complied
10	61560	61227	61198	Complied
20	61560	61230	61198	Complied
30	61560	61227	61198	Complied
40	61560	61230	61198	Complied
50	61560	61230	61198	Complied
Worst-case Margin (MHz)		330		

4.8 Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	16 May 2025
Test Sample Serial Number:	L2333n00829		

FCC Reference:	Part 15.255(f)
ISED Canada Reference:	RSS-Gen 6.11 / RSS-210 J.6
Test Method Used:	FCC KDB 364244 Sections 8 referencing ANSI C63.10 Section 9.14

Environmental Conditions:

Temperature (°C):	22.3
Relative Humidity (%):	42.0

Note(s):

1. The 20 dB emission bandwidth and 99% occupied bandwidth was recorded on a signal analyser and compared to the lower and upper emission edges.
2. The DC power supply voltage was set to 85% and 115% of the stated Control Unit input voltage of 1.8 VDC.
3. Voltage was monitored throughout the test with a calibrated digital voltmeter.

Transmitter Frequency Stability (Voltage Variation)

Results: Lower Band Edge

Supply Voltage (V)	Lower Band Edge Frequency (MHz)	Lower 20 dB Emission Bandwidth Frequency (MHz)	Lower 99% Occupied Bandwidth Frequency (MHz)	Result
1.53	57000	57337	57415	Complied
1.80	57000	57338	57421	Complied
2.07	57000	57337	57415	Complied
Worst-case Margin (MHz)		337		

Results: Upper Band Edge

Supply Voltage (V)	Upper Band Edge Frequency (MHz)	Upper 20 dB Emission Bandwidth Frequency (MHz)	Upper 99% Occupied Bandwidth Frequency (MHz)	Result
1.53	61560	61227	61191	Complied
1.80	61560	61230	61198	Complied
2.07	61560	61227	61191	Complied
Worst-case Margin (MHz)		330		

4.9 Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Yixiang Lin	**Test Date:**	11 June 2025
Test Sample Serial Number:	L2333n00830		

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):	22.3
Relative Humidity (%):	42.0

Note(s):

1. The EUT was powered by a USB cable which was connected to a laptop. The AC/DC charger of the laptop was connected to single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed also with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
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.
5. Preliminary measurements were performed at both 50 Hz and 60 Hz supply frequencies. There was no change to the observed emissions.

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.164	Live	31.60	65.30	33.70	Complied
0.436	Live	23.80	57.10	33.30	Complied
8.475	Live	19.10	60.00	40.90	Complied
29.131	Live	13.10	60.00	46.90	Complied
19.007	Live	12.80	60.00	47.20	Complied
1.287	Live	14.30	56.00	41.70	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.164	Live	9.10	55.30	46.20	Complied
0.436	Live	10.80	47.10	36.30	Complied
8.475	Live	8.40	50.00	41.60	Complied
29.131	Live	6.90	50.00	43.10	Complied
19.007	Live	6.10	50.00	43.90	Complied
1.287	Live	6.10	46.00	39.90	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

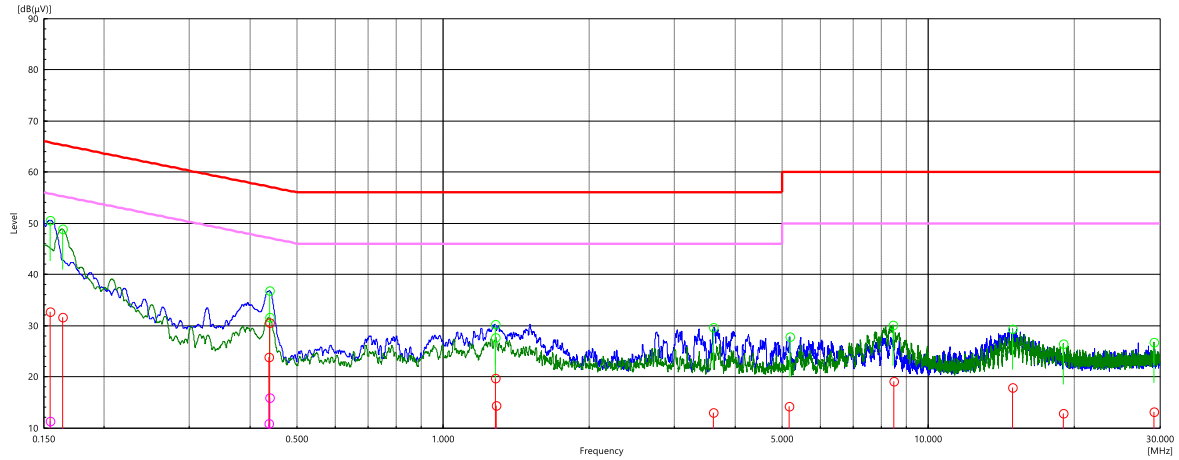
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Neutral	32.60	65.70	33.10	Complied
0.439	Neutral	30.50	57.10	26.60	Complied
1.283	Neutral	19.70	56.00	36.30	Complied
3.602	Neutral	13.00	56.00	43.00	Complied
14.937	Neutral	17.80	60.00	42.20	Complied
5.163	Neutral	14.10	60.00	45.90	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Neutral	11.30	55.70	44.40	Complied
0.439	Neutral	15.80	47.10	31.30	Complied
1.283	Neutral	8.30	46.00	37.70	Complied
3.602	Neutral	4.90	46.00	41.10	Complied
14.937	Neutral	7.70	50.00	42.30	Complied
5.163	Neutral	6.10	50.00	43.90	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



Note: 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 (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Live	39.30	65.50	26.20	Complied
0.350	Live	16.80	59.00	42.20	Complied
0.716	Live	17.20	56.00	38.80	Complied
1.672	Live	16.70	56.00	39.30	Complied
7.836	Live	18.40	60.00	41.60	Complied
15.816	Live	12.00	60.00	48.00	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Live	22.30	55.50	33.20	Complied
0.350	Live	6.70	49.00	42.30	Complied
0.716	Live	13.60	46.00	32.40	Complied
1.672	Live	12.80	46.00	33.20	Complied
7.836	Live	12.20	50.00	37.80	Complied
15.816	Live	5.20	50.00	44.80	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

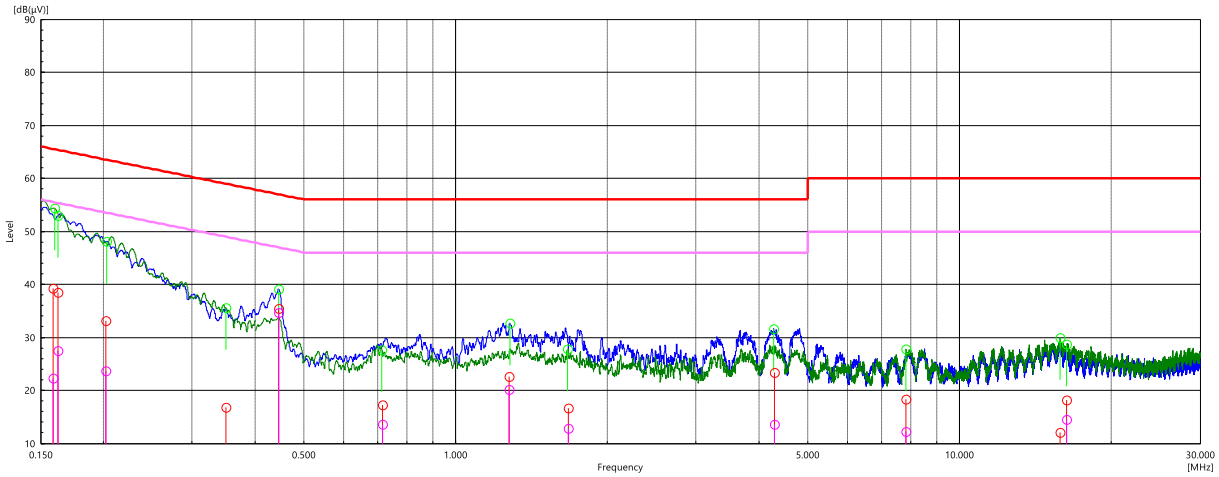
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.163	Neutral	38.50	65.30	26.80	Complied
0.202	Neutral	33.20	63.50	30.30	Complied
0.445	Neutral	35.40	57.00	21.60	Complied
1.277	Neutral	22.70	56.00	33.30	Complied
4.294	Neutral	23.40	56.00	32.60	Complied
16.314	Neutral	18.20	60.00	41.80	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.163	Neutral	27.40	55.30	27.90	Complied
0.202	Neutral	23.60	53.50	29.90	Complied
0.445	Neutral	34.70	47.00	12.30	Complied
1.277	Neutral	20.10	46.00	25.90	Complied
4.294	Neutral	13.50	46.00	32.50	Complied
16.314	Neutral	14.40	50.00	35.60	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.

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