TEST REPORT

Test Report No. : UL-RPT-RP14415455-416B

Customer	:	VEGA Grieshaber KG
HVIN	:	PS40WM
PMN	:	VEGAPULS 42
ISED Certification No.	:	IC: 3892A-PS40W
Technology	:	Level Probing Radar
Test Standard(s)	:	Innovation, Science and Economic Development Canada RSS-211 Issue 1 March 2015 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
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Company Signatory:

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Customer Information & Manufacturer Information

Customer

Company Name:	VEGA Grieshaber KG
Address:	Am Hohenstein 113 D-77761 Schiltach Germany

Manufacturer

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

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

Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	02/03/2023	Initial Version	Ben Mercer
2.0	05/04/2023	HVIN & IC number updated	Ben Mercer
3.0	17/04/2023	HVIN updated	Ben Mercer
4.0	24/04/2023	HVIN updated	Ben Mercer

Table of Contents

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.

1.2 General Information

Specification Reference:	RSS-Gen Issue 5 February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-211 Issue 1 March 2015
Specification Title:	Level Probing Radar Equipment
Site Registration:	20903
CABID:	UK0001
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
Test Dates:	06 December 2022 to 22 February 2023

1.3 Summary of Test Results

ISED Canada Reference	Measurement	Result
RSS-Gen 8.2	Transmitter Duty Cycle	Note 1
RSS-Gen 6.7	Transmitter 99% Occupied Bandwidth	✓
RSS-211 5.1(a)&(b)	Transmitter Fundamental Emission Bandwidth	✓
RSS-211 5.3(b)	Transmitter Maximum Average EIRP	Note 2
RSS-Gen 6.13 / RSS-211 5.1(d)	Transmitter Unwanted Emissions	✓
RSS-Gen 8.8	Transmitter AC Conducted Emissions	✓
Key to Results ✓ = Complied ✗ = Did not comply		

Note(s):

1. The measurement was performed to assist in the calculation of the level of the emissions.
2. The Maximum Average EIRP was measured during the Transmitter Unwanted Emissions test.

1.4 Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

2 Summary of Testing

2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	-

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

2.2 Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	ETSI EN 302 729
Title:	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SDR); Level Probing Radar (LPR) equipment operating in the frequency ranges 6 GHz to 8,5 GHz, 24,05 GHz to 26,5 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz; Part 1: Technical characteristics and test methods
Reference:	ETSI EN 302 372
Title:	Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SDR); Equipment for Detection and Movement; Tanks Level Probing Radar (TLPR) operating in the frequency bands 5,8 GHz, 10 GHz, 25 GHz, 61 GHz and 77 GHz; Part 1: Technical characteristics and test methods

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	75 GHz to 85 GHz	95%	±1.14 %
99% Occupied Bandwidth	75 GHz to 85 GHz	95%	±3.92 %
Fundamental Emission Bandwidth	75 GHz to 85 GHz	95%	±4.59 %
Maximum Peak EIRP	75 GHz to 85 GHz	95%	±5.12 dB
Maximum Average EIRP	75 GHz to 85 GHz	95%	±5.12 dB
Radiated Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Emissions	1 GHz to 40 GHz	95%	±3.16 dB
Radiated Emissions	40 GHz to 200 GHz	95%	±5.12 dB
Transmitter AC Conducted Emissions	0.15 MHz to 30 MHz	95%	±1.96 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 Bandwidth and Duty Cycle Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	09 Dec 2023	12
M2064	Downconverter	Virginia Diodes	WR12SAX	SAX 325	29 Jul 2023	24
A3194	Attenuator	AtlanTecRF	AS8167	J510060687	Calibrated before use	-
M1832	Signal Analyser	Keysight	N9010A	MY53470303	18 May 2024	24
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	04 Feb 2024	24
G0555	Source Module	Hewlett Packard	83558A	2948A00189	Calibrated before use	-

Test Equipment Used for Transmitter Frequency Stability Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	09 Dec 2023	12
M2064	Downconverter	Virginia Diodes	WR12SAX	SAX 325	29 Jul 2023	24
A3194	Attenuator	AtlanTecRF	AS8167	J510060687	Calibrated before use	-
M1832	Signal Analyser	Keysight	N9010A	MY53470303	18 May 2024	24
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	04 Feb 2024	24
G0555	Source Module	Hewlett Packard	83558A	2948A00189	Calibrated before use	-
E0518	Environmental Chamber	TAS	LTCL	24000107	Calibrated before use	-
M1642	Thermometer	Fluke	52II	18890119	21 May 2022	12
M122	Digital Multimeter	Fluke	77	64910017	27 Apr 2023	12

Test and Measurement Equipment (continued)

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 2023	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	05 Sep 2023	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	02 Nov 2023	12
M2077	Test Receiver	Rohde & Schwarz	ESW44	102026	15 Feb 2023	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	05 May 2023	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	18 Aug 2023	12
A3161	Antenna	Chase	CBL6111A	50859	03 May 2023	12
A3113	6dB Attenuator	AtlanTecRF	AN18-06	219706#3	03 May 2023	12
A3085	Low Pass Filter	AtlanTecRF	AFL-02000	18051600014	26 Jan 2024	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	22 Aug 2023	12
A3139	Antenna	Schwarzbeck	HWRD750	00027	22 Aug 2023	12
A222867	Pre-Amplifier	Atlantic Microwave	A-LNAKX-380116-S5S5	210865001	26 Aug 2023	12
A2523	10dB Attenuator	AtlanTecRF	AN18W5-10	832827#1	26 Jan 2024	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	26 Jan 2024	12
A212041	High Pass Filter	Micro-Tronics	HPS20723	001	26 Jan 2024	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	31 Oct 2023	12
A3265	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-069	31 Oct 2023	12
M1832	Signal Analyser	Keysight	N9010A	MY53470303	18 May 2024	24
A219915	Downconverter	Virginia Diodes	WR19SAX	SAX 897	14 Apr 2023	12
M2069	Downconverter	Virginia Diodes	WR15SAX	SAX 394	09 Jul 2023	24
M2064	Downconverter	Virginia Diodes	WR12SAX	SAX 325	29 Jul 2023	24
M2065	Downconverter	Virginia Diodes	WR10SAX	SAX 393	30 Jul 2023	24
M2066	Downconverter	Virginia Diodes	WR6.5SAX	SAX 392	31 May 2024	24
M2067	Downconverter	Virginia Diodes	WR4.3SAX	SAX 391	31 May 2024	24
A2963	Antenna	Link Microtek	AM19HA-ULV1	14929	20 Jun 2023	12
A2964	Antenna	Link Microtek	AM15HA-ULV1	14930	24 Jun 2023	12
A2967	Antenna	Link Microtek	AM10HA-ULV1	14933	13 Jul 2023	12
A2968	Antenna	Link Microtek	AM7HA-ULV1	14934	04 Feb 2023	12
A2969	Antenna	Link Microtek	AM4HA-ULV1	14935	04 Feb 2023	12

Test and Measurement Equipment (continued)

Test Equipment Used for Transmitter AC Conducted Spurious Emissions:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2037	Thermohygrometer	Testo	608-H1	45124925	08 Dec 2023	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	01 Sep 2023	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	31 May 2023	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	06 Oct 2023	12
A215746	Variable DC Power Supply	Rohde & Schwarz	NGSM 32/10	192.0810.31	Cal before use	-
M1251	Digital Voltmeter	Fluke	175	89170179	19 May 2023	12

Test Measurement Software/Firmware Used:

Name	Version	Release Date
Rohde & Schwarz EMC32	6.30.0	2018

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	VEGAPULS
HVIN:	PS40WM
PMN:	VEGAPULS 42
Test Sample Serial Number:	60337826 *(Conducted sample #1)*
Hardware Version:	1.0.0
Software Version:	1.0.0
ISED Canada Certification Number:	IC: 3892A-PS40W
Date of Receipt:	28 November 2022

Brand Name:	VEGAPULS
HVIN:	PS40WM
PMN:	VEGAPULS 42 (Antenna 1)
Test Sample Serial Number:	61489212 *(Radiated sample #1)*
Hardware Version:	1.0.0
Software Version:	1.0.0
ISED Canada Certification Number:	IC: 3892A-PS40W
Date of Receipt:	20 January 2023

Brand Name:	VEGAPULS
HVIN:	PS40WM
PMN:	VEGAPULS 42 (Antenna 3)
Test Sample Serial Number:	61489166 *(Radiated sample #2)*
Hardware Version:	1.0.0
Software Version:	1.0.0
ISED Canada Certification Number:	IC: 3892A-PS40W
Date of Receipt:	20 January 2023

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:	Level Probing Radar	
Type of Unit:	Transceiver	
Modulation:	FMCW	
Power Supply Requirement(s):	Nominal	24.0 VDC
Maximum Conducted Output Power:	4.2 dBm	
Transmit Frequency Range:	75 GHz to 85 GHz	
Transmit Channels Tested:	**Channel Bandwidth (GHz)**	**Channel Frequency (GHz)**
	8	80.000

3.4 Description of Available Antennas

The radio utilizes various integrated antennas, with the following maximum gains:

ID	Type	HPBW	Frequency Range (MHz)	Gain (dBi)
1	1” Thread	13.2°	75000 to 85000	22.2
2	¾” Thread	14.2°	75000 to 85000	18.2
3	1” Thread with Hygiene Adapter	14.1°	75000 to 85000	20.8

3.5 Description of Test Setup

Support Equipment

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

Description:	240 Litre Tank
Brand Name:	Speidel
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Test Laptop
Brand Name:	Lenovo
Model Name or Number:	L480
Serial Number:	PF1EJ3BY

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

Description:	Waveguide Adapter
Brand Name:	MI-WAVE
Model Name or Number:	284E-102/387
Serial Number:	2051

Operating Modes

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

- Transmitting at maximum power with FMCW modulation.

Configuration and Peripherals

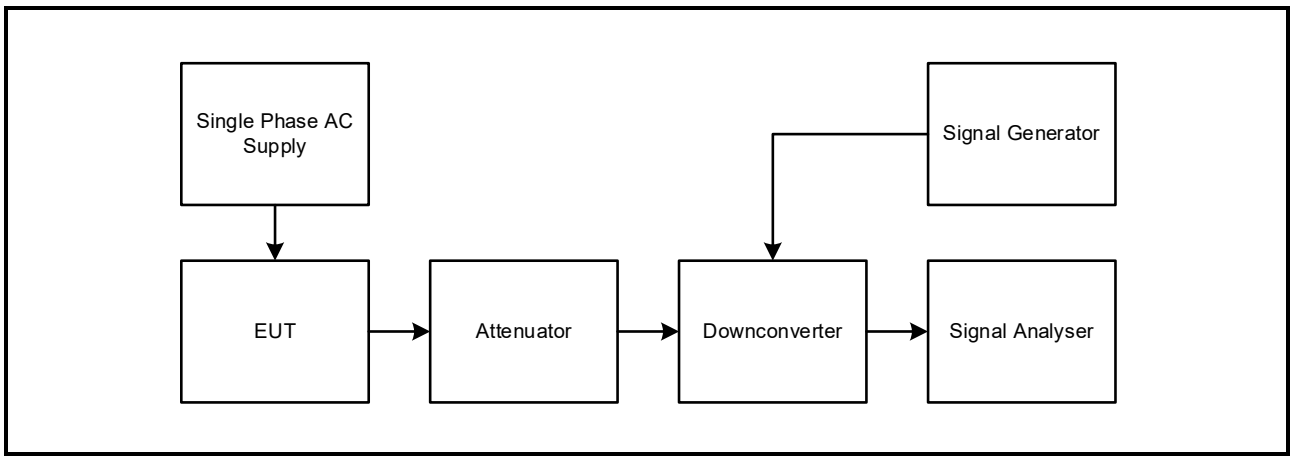
The EUT was tested in the following configuration(s):

- The EUT was pre-configured to transmit when powered on.
- The EUT was powered via a 24 VDC bench power supply connected to a 120 VAC 60 Hz mains supply.
- The customer supplied a waveguide adapter to transition from the proprietary connector to rectangular waveguide. The adapter loss is considered negligible and has therefore not been included in path loss calculations.
- Transmitter Unwanted Emissions testing was performed with the EUT installed in a representative metal tank. No accessories/peripherals were emnployed during test as there were no ports on the EUT to populate.
- For AC Conducted Emissions tests, the *Bluetooth* LE transciever was also active and sending data to a test laptop running VEGA PACTware 5.0 software.
- The EUT can be supplied with a range of antennas. Testing was performed on the highest gain antenna of each type.

Test Setup Diagrams

Conducted Tests:

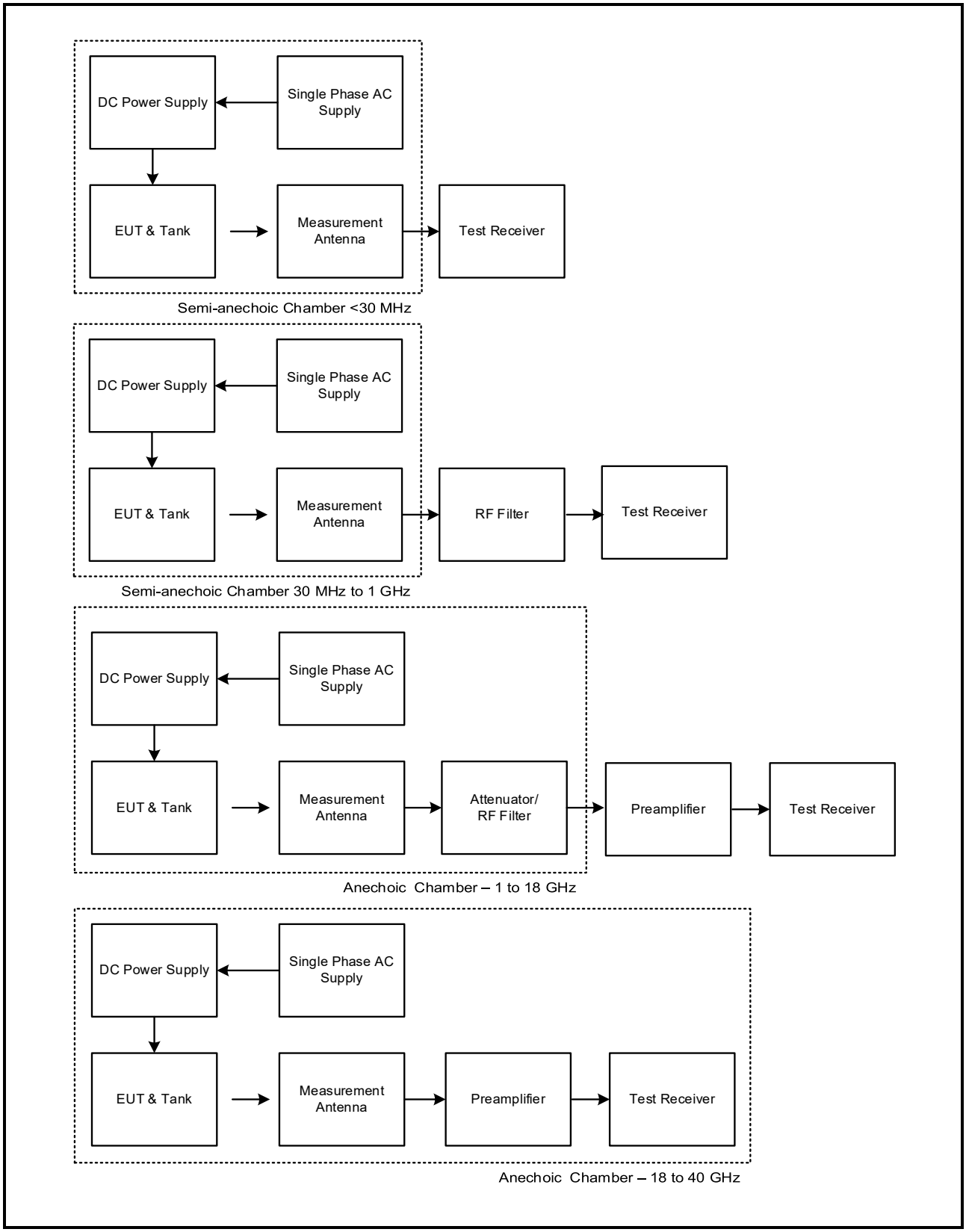
Test Setup for Transmitter Bandwidth, Duty Cycle and EIRP



Test Setup Diagrams (continued)

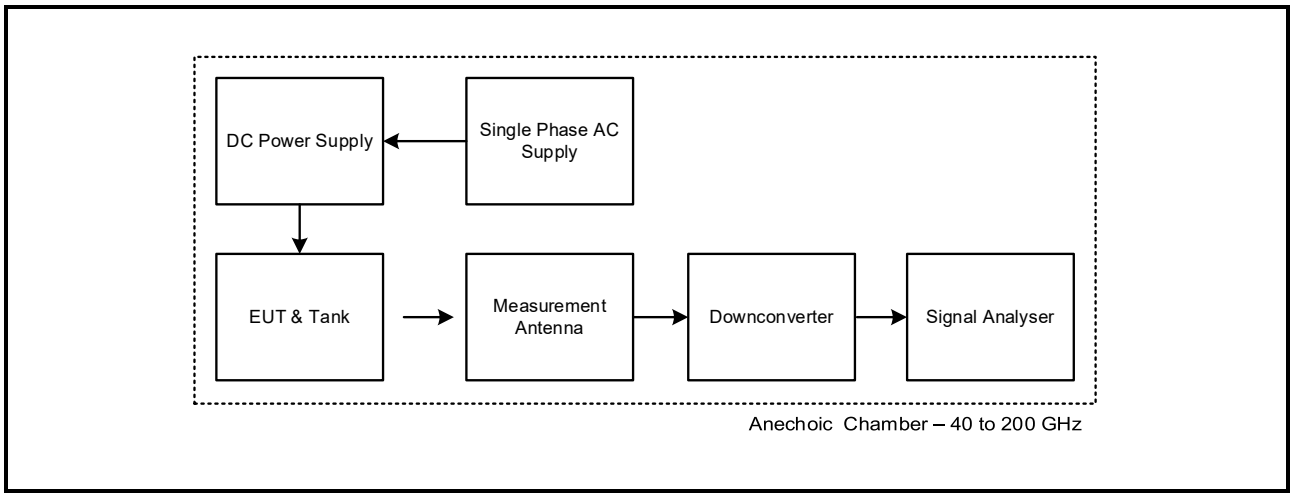
Radiated Tests:

Test Setup for Transmitter Radiated Emissions

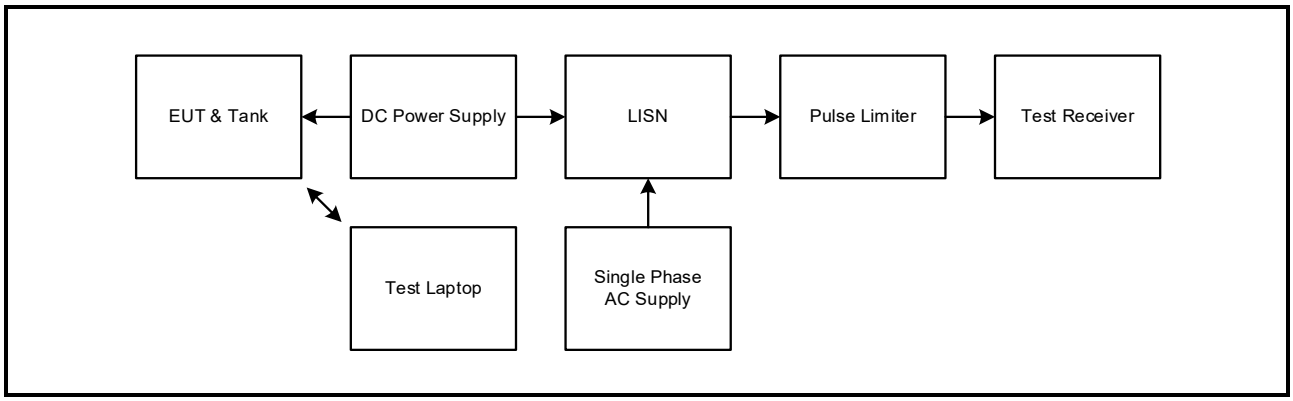


Test Setup Diagrams (continued)

Test Setup for Transmitter Radiated Emissions (continued)



Test Setup for Transmitter AC Conducted Spurious Emissions



4 Antenna Port Test Results

4.1 Transmitter Duty Cycle

Test Summary:

Test Engineer:	Shamraiz Ashiq	**Test Date:**	06 December 2022
Test Sample Serial Number:	60337826		

ISED Canada Reference:	RSS-Gen 8.2
Test Method Used:	RSS-Gen 8.2 and notes below

Environmental Conditions:

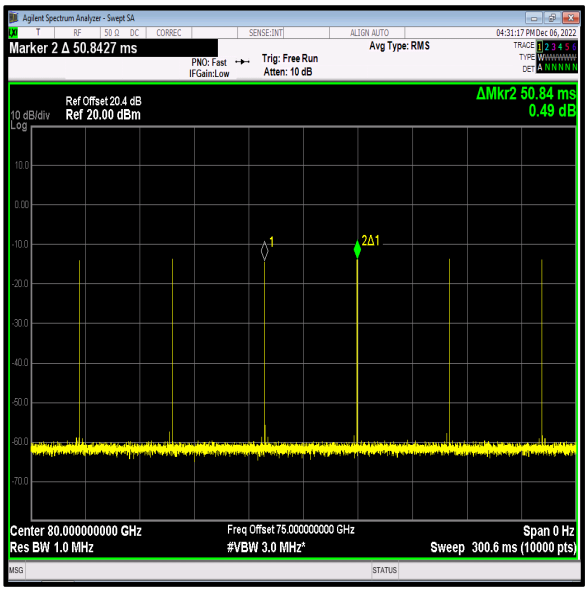
Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

1. In order to assist with the determination of the average level of spurious emissions field strength, measurements were made of the duty cycle / chirp duration to determine the dwell time per MHz. The transmitter duty cycle / chirp duration was measured using a spectrum/signal analyser in the time domain.

Results:

Channel Bandwidth (GHz)	Chirp Duration (t_{meas} + t_G) (ms)
8	50.840



4.2 Transmitter 99% Occupied Bandwidth

Test Summary:

Test Engineer:	Shamraiz Ashiq	**Test Date:**	06 December 2022
Test Sample Serial Number:	60337826		

ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	RSS-Gen 6.7 and Notes below

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

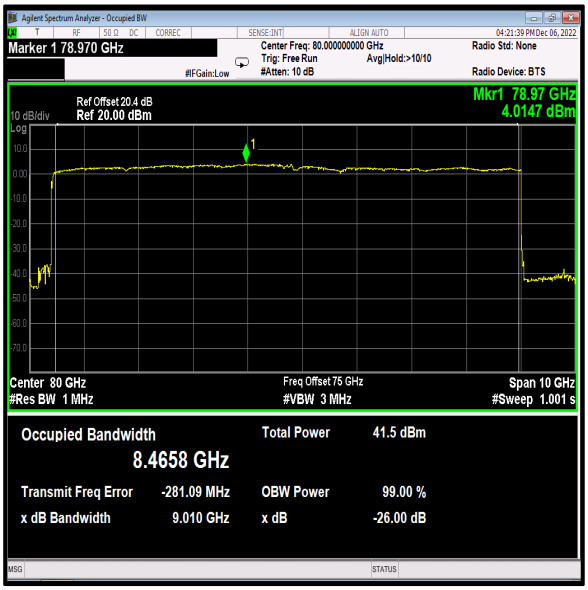
Note(s):

1. The 99% emission bandwidth was measured using the signal analyser occupied bandwidth function. It was not possible to set the resolution bandwidth in the range of 1% to 5% of the occupied bandwidth, due to the large chirp bandwidth and limited RBW values available on the spectrum analyser. Therefore, the RBW was to 1 MHz and the VBW to 3 MHz. An enquiry was made to the ISEDC Certification Bureau and this method was deemed acceptable. The span was set to capture all products of the modulation process including emission skirts.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The signal analyser function set the measurements to be made at 99% of the emission bandwidth. The results are given in the tables below.
3. The downconverter was connected to the RF port on the EUT using suitable attenuation and waveguide.

Transmitter 99% Occupied Bandwidth (continued)

Results:

Channel Bandwidth (GHz)	99% Occupied Bandwidth (GHz)
8	8.466



4.3 Transmitter Fundamental Emission Bandwidth

Test Summary:

Test Engineer:	Shamraiz Ashiq	**Test Date:**	06 December 2022
Test Sample Serial Number:	60337826		

ISED Canada Reference:	RSS-211 5.1(a)
Test Method Used:	RSS-Gen 6.7 / EN 302 729 6.5.4 / EN 302 372 6.5.4

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

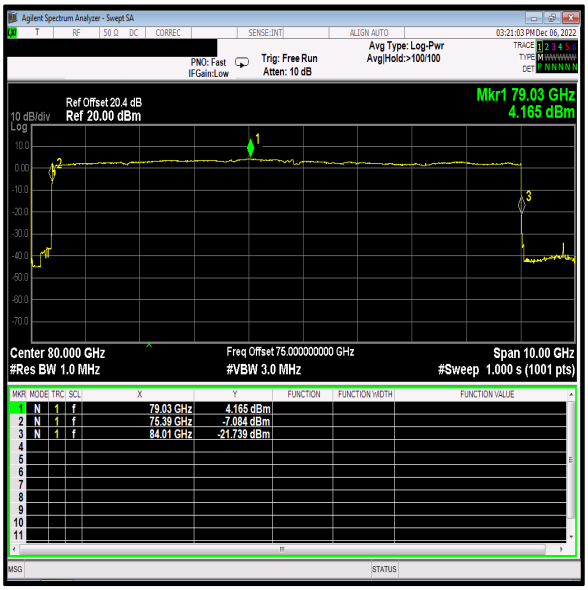
Note(s):

1. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth to 3 MHz. A peak detector was used, with Max Hold trace mode, and with sweep time set to ensure coincidence with the FMCW signal. The emission bandwidth was measured at 10 dB down from the peak of the signal.
2. The downconverter was connected to the antenna port on the EUT using suitable attenuation and waveguide.

Transmitter Fundamental Emission Bandwidth (continued)

Results:

Channel Bandwidth (GHz)	10 dB Bandwidth (GHz)	Limit (MHz)	Margin (GHz)	Result
8	8.620	≥50	8.570	Complied



4.4 Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineer:	Shamraiz Ashiq	**Test Date:**	08 December 2022
Test Sample Serial Number:	60337826		

ISED Canada Reference:	RSS-211 5.1(a)
Test Method Used:	RSS-Gen 6.7 / EN 302 729 6.5.4 / EN 302 372 6.5.4

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	32

Note(s):

1. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth to 3 MHz. A peak detector was used, with Max Hold trace mode, and with sweep time set to ensure coincidence with the FMCW signal. The emission bandwidth was measured at 10 dB down from the peak of the signal.
2. The downconverter was connected to the antenna port on the EUT using suitable attenuation and waveguide.
3. Temperature was monitored throughout the test using a calibrated digital thermometer.

Transmitter Frequency Stability (Temperature Variation) (continued)

Results: Lower Band Edge

Temperature (°C)	Measured Frequency (MHz)	Band Edge (MHz)	Margin (MHz)	Result
-30	75400.000	75000.000	400.000	Complied
-20	75410.000	75000.000	410.000	Complied
-10	75410.000	75000.000	410.000	Complied
0	75410.000	75000.000	410.000	Complied
10	75410.000	75000.000	410.000	Complied
20	75410.000	75000.000	410.000	Complied
30	75410.000	75000.000	410.000	Complied
40	75400.000	75000.000	400.000	Complied
50	75400.000	75000.000	400.000	Complied

Results: Upper Band Edge

Temperature (°C)	Measured Frequency (MHz)	Band Edge (MHz)	Margin (MHz)	Result
-30	84010.000	85000.000	990.000	Complied
-20	84010.000	85000.000	990.000	Complied
-10	84010.000	85000.000	990.000	Complied
0	84010.000	85000.000	990.000	Complied
10	84010.000	85000.000	990.000	Complied
20	84010.000	85000.000	990.000	Complied
30	84010.000	85000.000	990.000	Complied
40	84010.000	85000.000	990.000	Complied
50	84010.000	85000.000	990.000	Complied

4.5 Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Shamraiz Ashiq	**Test Dates:**	06 December 2022 & 07 December 2022
Test Sample Serial Number:	60337826		

ISED Canada Reference:	RSS-Gen 6.11 & RSS-211 5.1(b)
Test Method Used:	RSS-Gen 6.7, 6.11 & EN 302 372 6.5.4

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

1. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth to 3 MHz. A peak detector was used, with Max Hold trace mode, and with sweep time set to ensure coincidence with the FMCW signal. The emission bandwidth was measured at 10 dB down from the peak of the signal.
2. The downconverter was connected to the antenna port on the EUT using suitable attenuation and waveguide.
3. Voltage was monitored throughout the test using a calibrated digital voltmeter.

Results: Lower Band Edge

Voltage (VDC)	Measured Frequency (MHz)	Band Edge (MHz)	Margin (MHz)	Result
20.4	75400.000	75000.000	400.000	Complied
24.0	75390.000	75000.000	390.000	Complied
27.6	75390.000	75000.000	390.000	Complied

Results: Upper Band Edge

Voltage (VDC)	Measured Frequency (MHz)	Band Edge (MHz)	Margin (MHz)	Result
20.4	84010.000	85000.000	990.000	Complied
24.0	84010.000	85000.000	990.000	Complied
27.6	84010.000	85000.000	990.000	Complied

5 Radiated Test Results

5.1 Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Vi Van	**Test Date:**	03 February 2023 & 04 February 2023
Test Sample Serial Number:	61489212 & 61489166		

ISED Canada Reference:	RSS-211 5.1(d) / RSS-Gen 6.13 & 8.9
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
Relative Humidity (%):	38 to 39

Note(s):

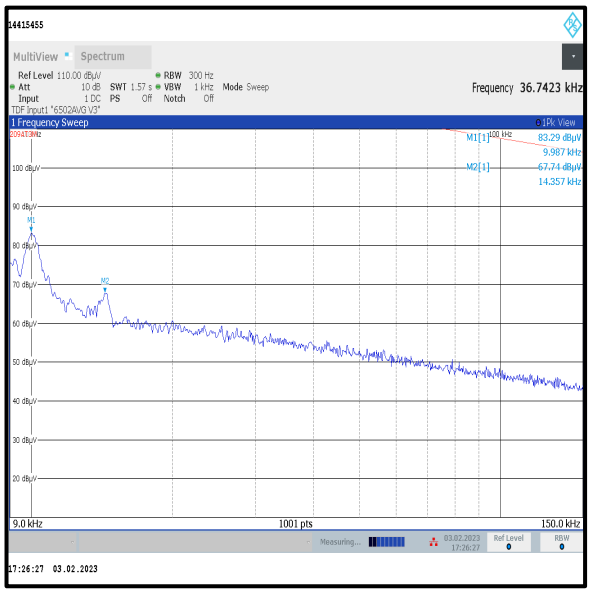
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. Radiated Transmitter Unwanted Emissions were performed with the EUT installed in a representative tank. The tank was placed on the turntable using non-conductive supports. No other accessories/peripherals were employed during test as there were no ports on the EUT to populate.
4. Between 30 MHz and 1 GHz, maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. 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.
6. 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.

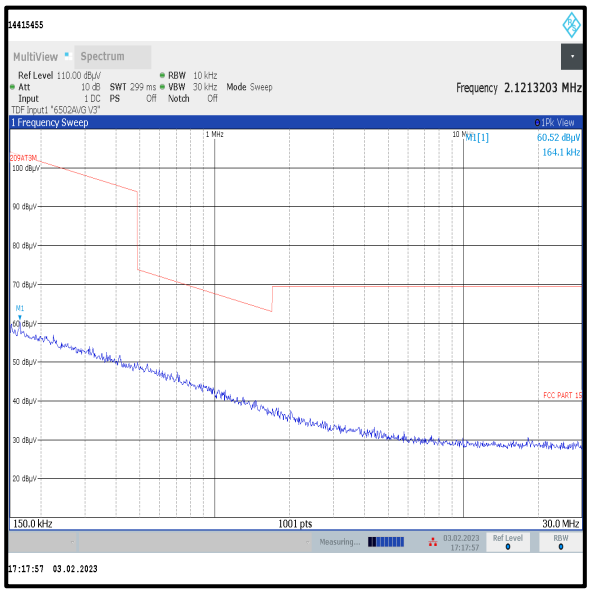
Transmitter Radiated Emissions (continued)

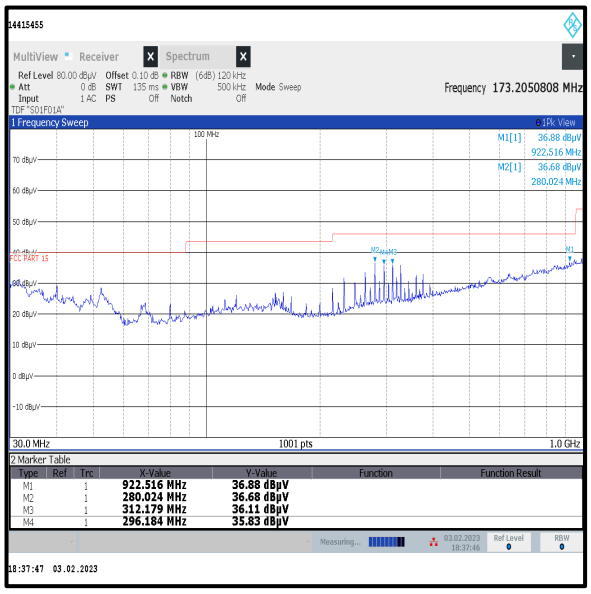
Results: Antenna 1 / Quasi-Peak

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
40.007	Vertical	26.6	40.0	13.4	Complied
160.008	Vertical	25.8	43.0	17.2	Complied
216.006	Vertical	28.1	43.0	14.9	Complied
231.993	Vertical	31.2	46.0	14.8	Complied
248.004	Vertical	30.5	46.0	15.5	Complied
263.992	Vertical	33.5	46.0	12.5	Complied
280.007	Vertical	36.3	46.0	9.7	Complied
296.009	Vertical	35.4	46.0	10.6	Complied
312.006	Vertical	35.3	46.0	10.7	Complied
328.013	Vertical	34.6	46.0	11.4	Complied
344.005	Vertical	30.2	46.0	15.8	Complied
360.008	Vertical	30.8	46.0	15.2	Complied
376.021	Vertical	30.3	46.0	15.7	Complied

Transmitter Radiated Emissions (continued)







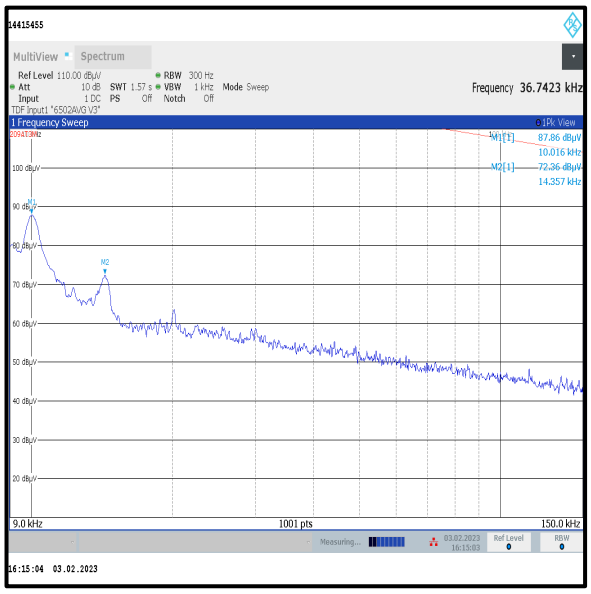
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

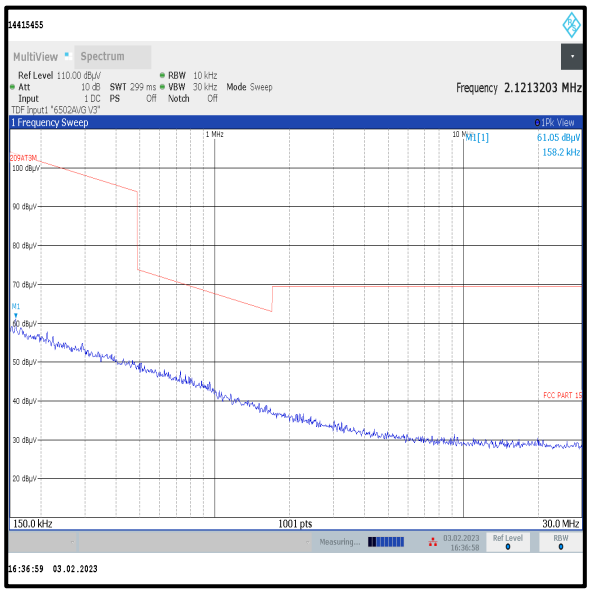
Transmitter Radiated Emissions (continued)

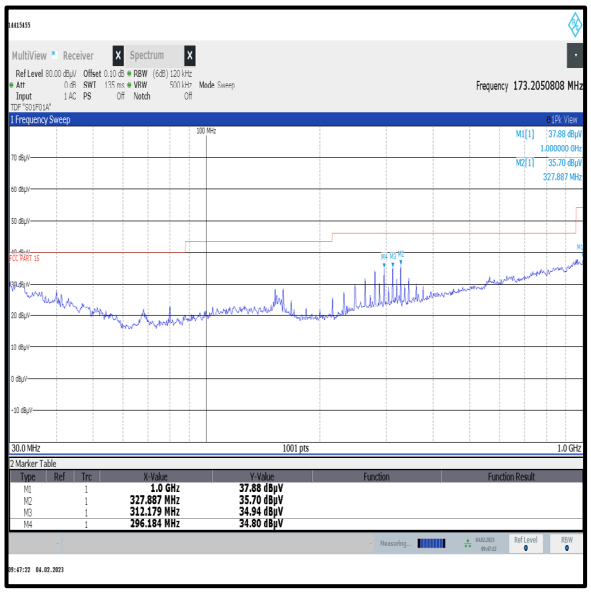
Results: Antenna 3 / Quasi-Peak

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
79.987	Vertical	21.5	40.0	18.5	Complied
152.006	Vertical	26.7	43.0	16.3	Complied
160.005	Vertical	27.9	43.0	15.1	Complied
215.994	Vertical	23.8	43.0	19.2	Complied
232.015	Vertical	26.6	46.0	19.4	Complied
247.989	Vertical	30.2	46.0	15.8	Complied
263.999	Vertical	32.0	46.0	14.0	Complied
280.003	Vertical	34.7	46.0	11.3	Complied
288.006	Vertical	28.0	46.0	18.0	Complied
295.992	Vertical	34.4	46.0	11.6	Complied
312.017	Vertical	34.0	46.0	12.0	Complied
319.996	Vertical	29.6	46.0	16.4	Complied
328.006	Vertical	35.0	46.0	11.0	Complied
336.000	Vertical	27.8	46.0	18.2	Complied
343.993	Vertical	30.1	46.0	15.9	Complied

Transmitter Radiated Emissions (continued)







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:	Vi Van	**Test Dates:**	27 January 2023 to 03 February 2023
Test Sample Serial Number:	61489212 & 61489166		

ISED Canada Reference:	RSS-211 5.1(d) / RSS-Gen 6.13 & 8.9
Test Method Used:	ANSI C63.10 Sections 6.3, 6.6, 9.8 and 9.12 / EN 302 372 6.5.5
Frequency Range	1 GHz to 200 GHz

Environmental Conditions:

Temperature (°C):	19 to 21
Relative Humidity (%):	33 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. The emissions seen on the 1 GHz to 3 GHz plots are advertising signals from the Bluetooth radio. These could not be disabled.
3. 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.
4. *The average in-band EIRP was below the noise floor of the measuring receiver, therefore the highest average noise floor reading of the measuring receiver was recorded in the table below.
5. Pre-scans between 1GHz and 18GHz were performed in fully anechoic chambers (Asset Numbers K0001) at a distance of 3 metres; pre-scans between 18GHz and 40GHz were performed at measurement distance of 1 metre.
6. Radiated Transmitter Unwanted Emissions were performed with the EUT installed in a representative tank. The tank was placed on the turntable using non-conductive supports, the EUT is at 1.5m above the ground plance. No other accessories/peripherals were employed during test as there were no ports on the EUT to populate.
7. Final measurements between 1 GHz and 40 GHz were performed in fully anechoic chambers (Asset Numbers K0001). The tank was placed placed on the turntable using non-conductive supports 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. Measurements above 40 GHz were performed in accordance with ANSI C63.10 Clause 9.12.
9. Measurement distances above 40 GHz were determined according to ANSI C63.10 Clause 9.8. Measurement distances were reduced until 6 dB noise floor clearance was achieved:

40-110 GHz – 0.5 metres
110-150 GHz – 0.3 metres
150-200 GHz – 0.2 metres

Transmitter Radiated Emissions (continued)

Results: Antenna 1 / Peak

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4738.200	Vertical	57.5	74.0	16.5	Complied
5211.200	Vertical	65.9	74.0	8.1	Complied
15079.300	Vertical	54.5	74.0	19.5	Complied
22750.688	Vertical	42.2	74.0	31.8	Complied

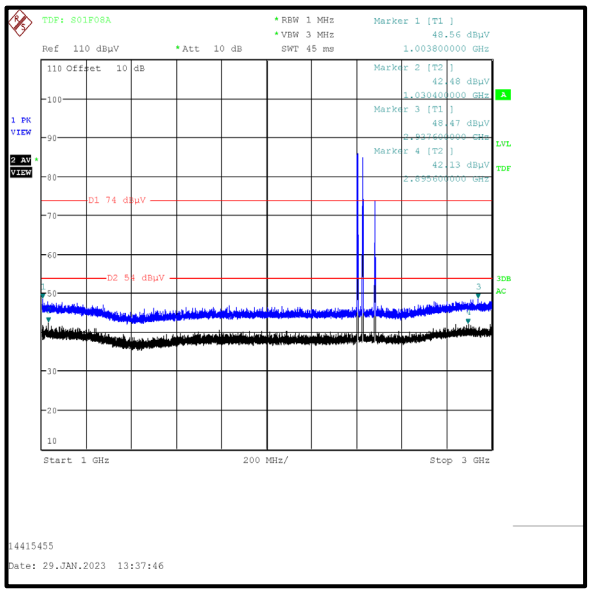
Results: Antenna 1 / Average

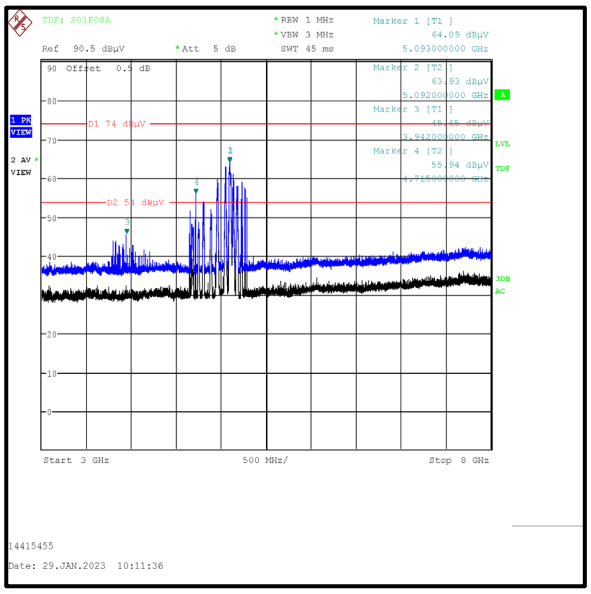
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
4250.400	Vertical	30.9	54.0	23.1	Complied
4878.100	Vertical	31.1	54.0	22.9	Complied
14144.602	Vertical	38.2	54.0	15.8	Complied
22750.688	Vertical	41.5	54.0	12.5	Complied

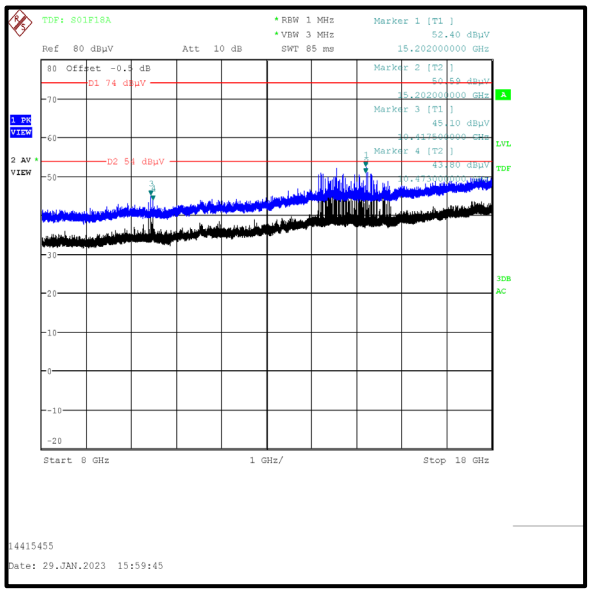
Results: Antenna 1 / Maximum Average Fundamental EIRP (75-85 GHz)

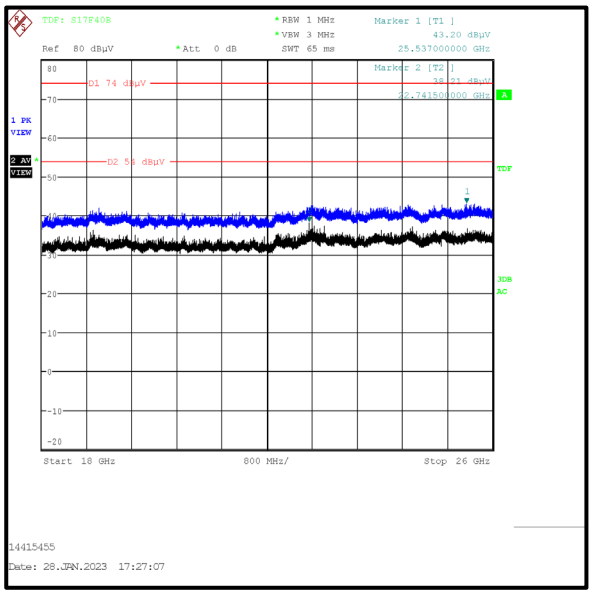
Frequency (MHz)	Antenna Polarity	Field Strength (dBμV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
77036.796	Vertical	43.7	-51.5	-41.3	10.2	Complied

Transmitter Radiated Emissions (continued)



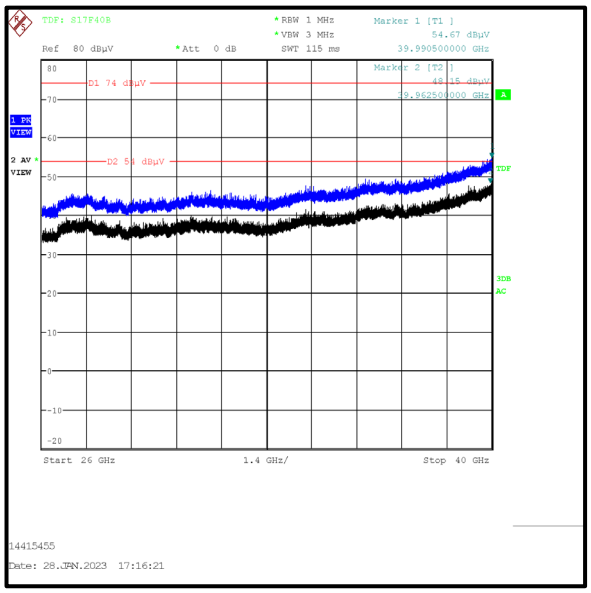


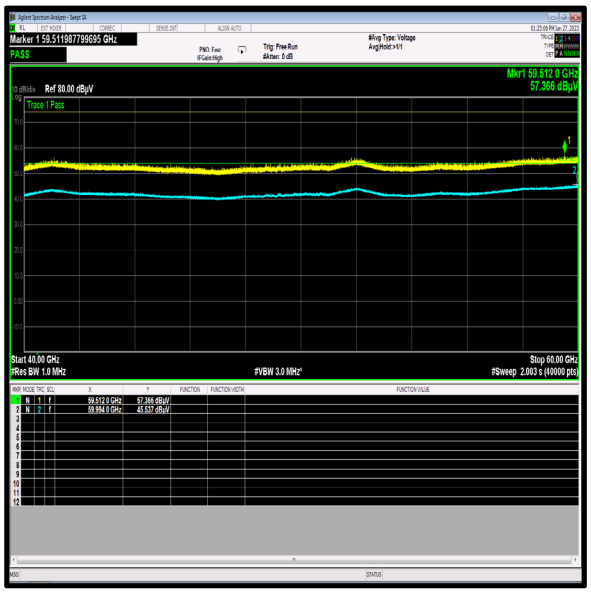




Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

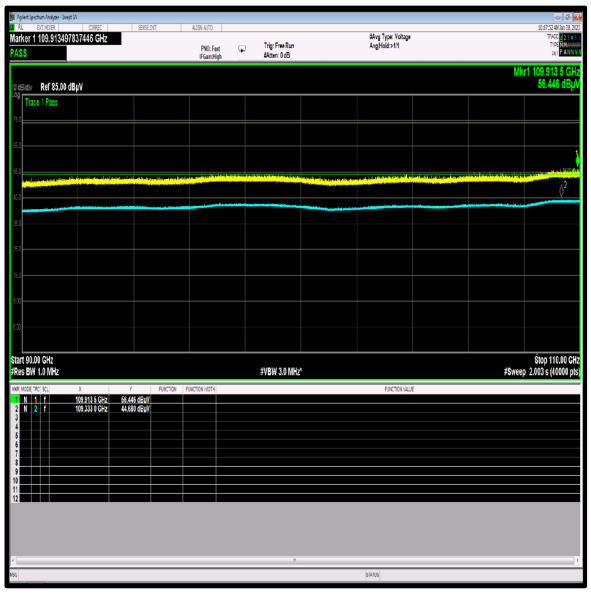
Transmitter Radiated Emissions (continued)

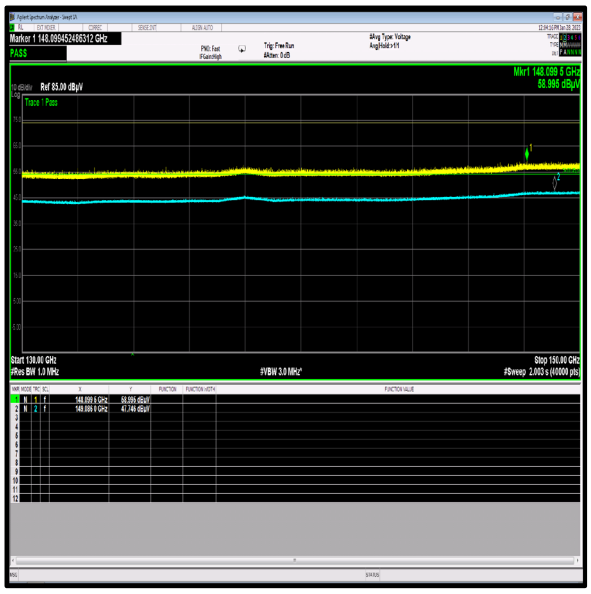


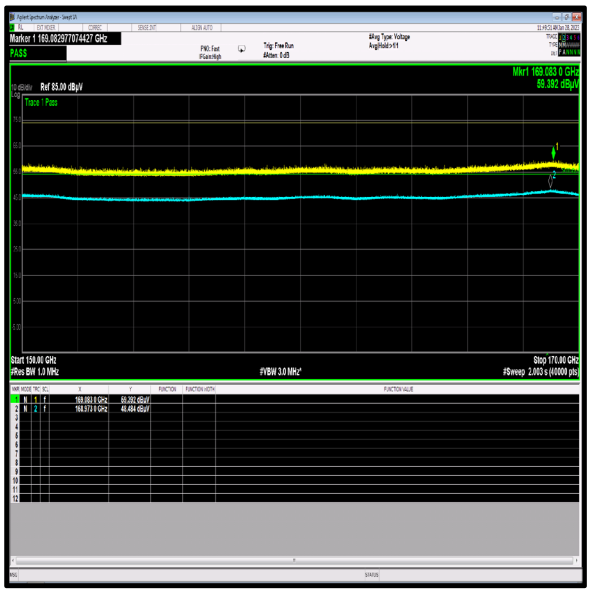


Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Transmitter Radiated Emissions (continued)

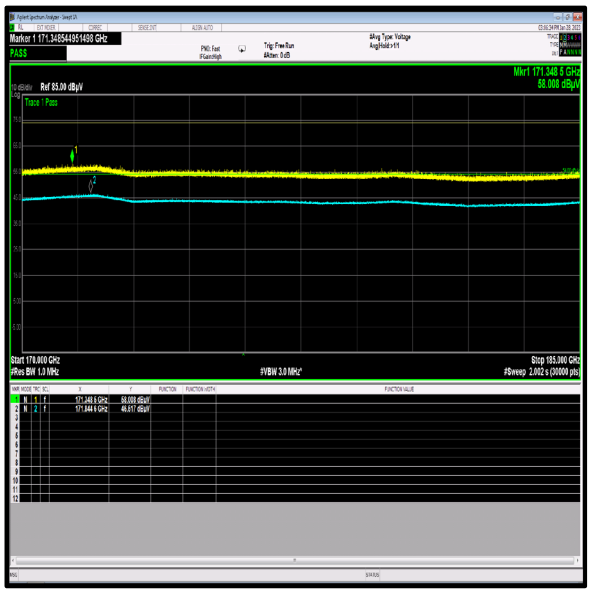


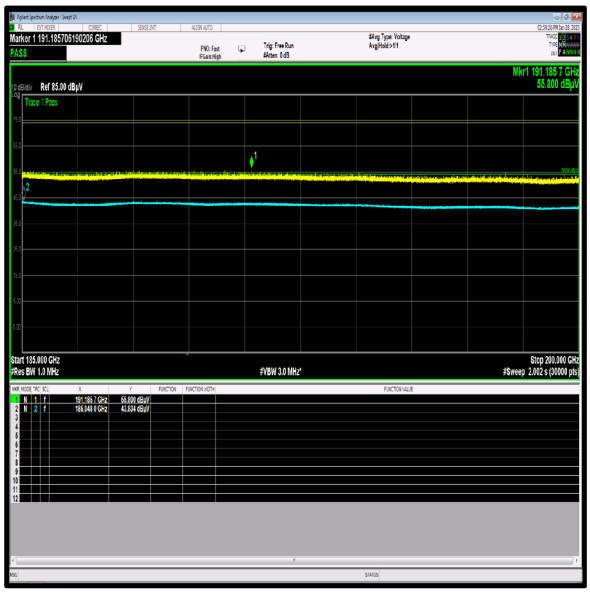




Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Transmitter Radiated Emissions (continued)





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

Transmitter Radiated Emissions (continued)

Results: Antenna 3 / Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5102.000	Vertical	63.5	74.0	10.5	Complied
14153.200	Vertical	52.7	74.0	21.3	Complied

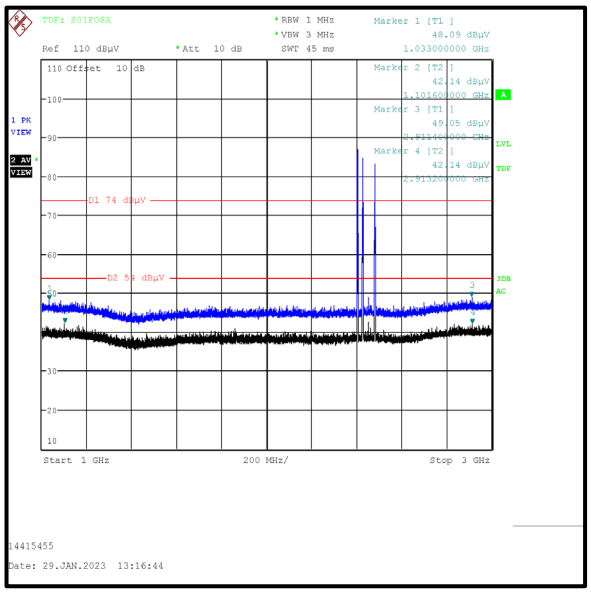
Results: Antenna 3 / Average

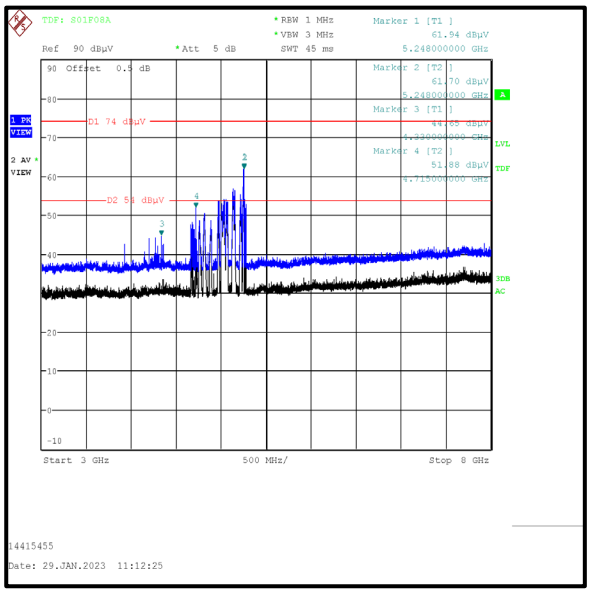
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4889.400	Vertical	34.8	54.0	19.2	Complied
14144.700	Vertical	35.0	54.0	19.0	Complied

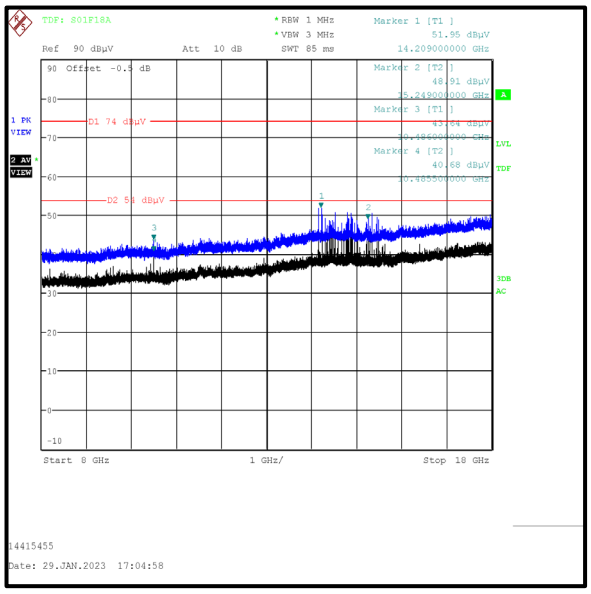
Results: Antenna 3 / Maximum Average Fundamental EIRP (75-85 GHz)

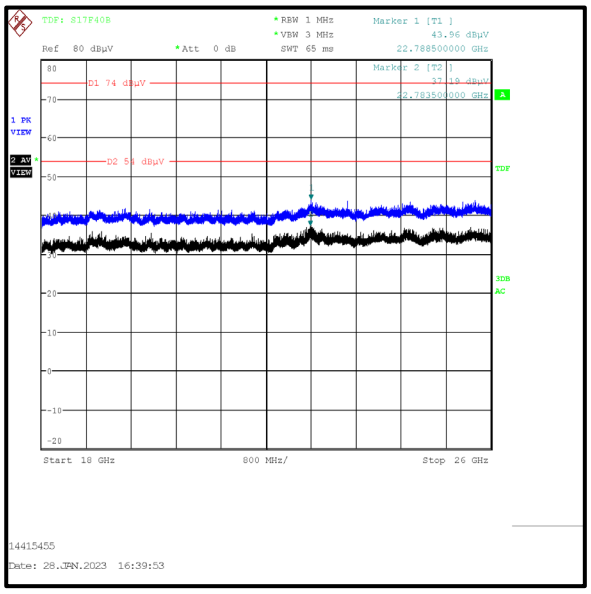
Frequency (MHz)	Antenna Polarity	Field Strength (dBµV/m)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
81432.205	Vertical	44.8	-50.4	-41.3	9.1	Complied

Transmitter Radiated Emissions (continued)



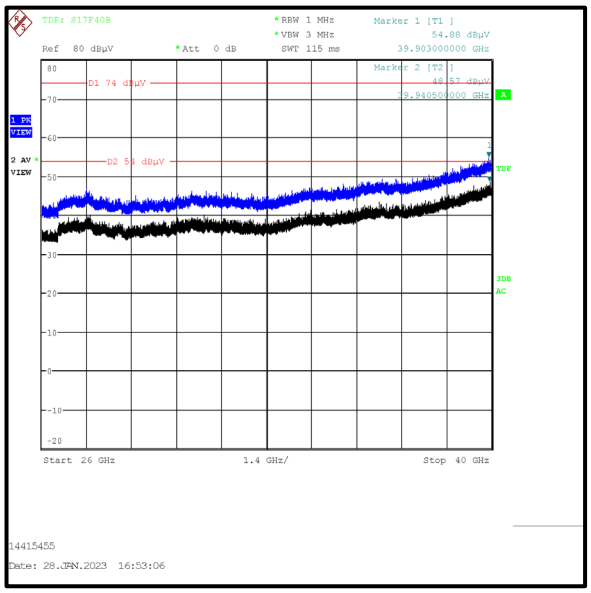


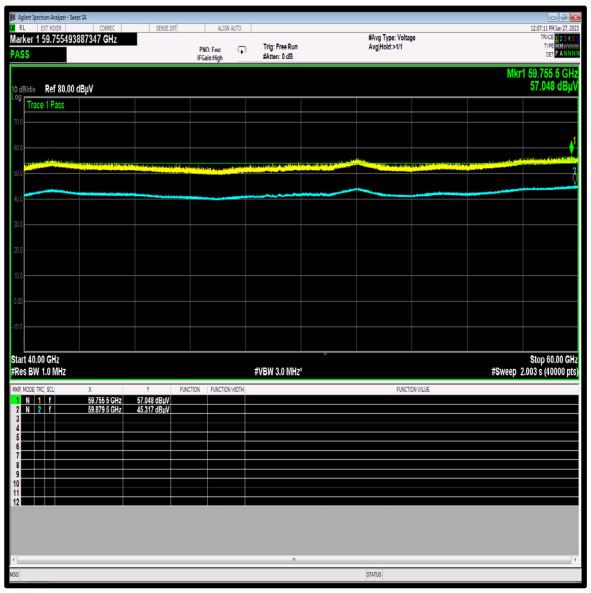




Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

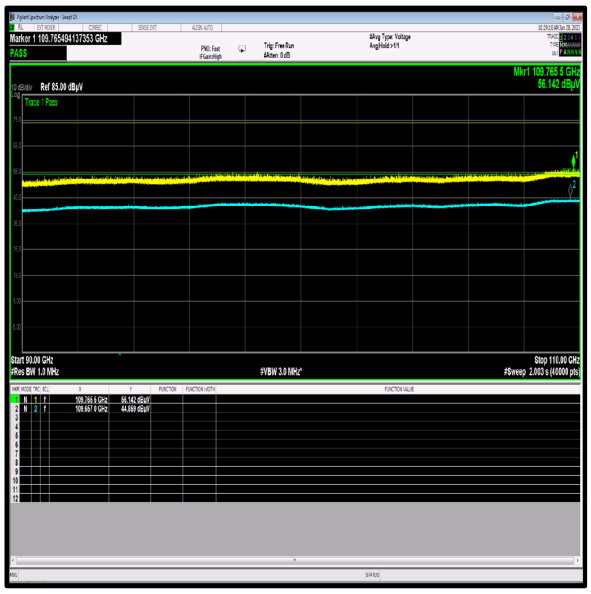
Transmitter Radiated Emissions (continued)

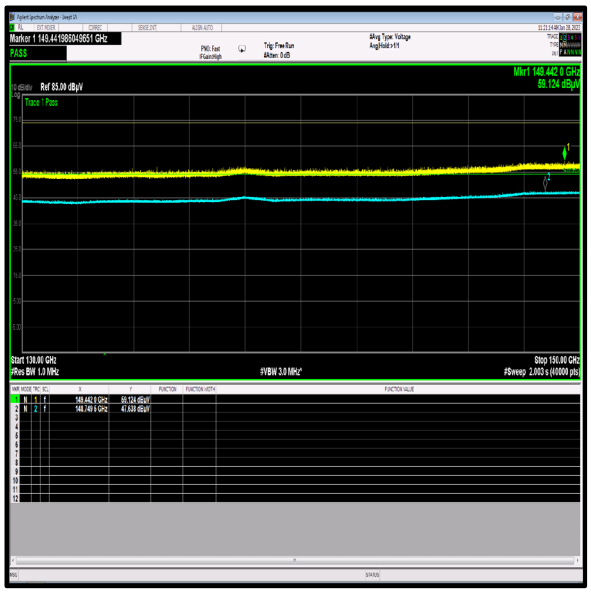


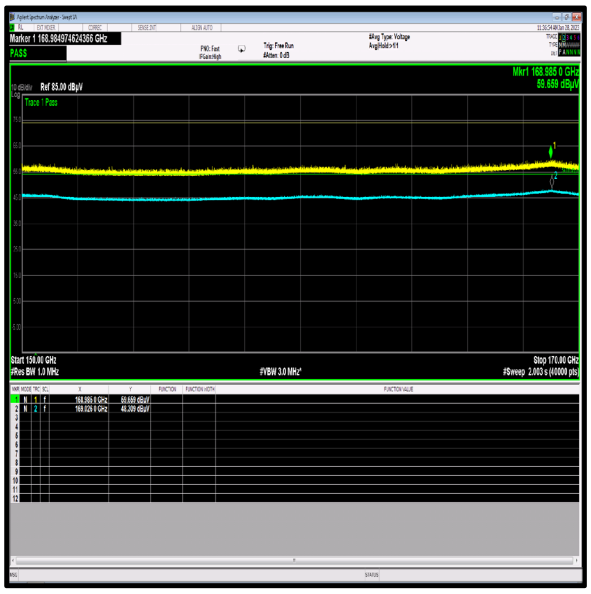


Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Transmitter Radiated Emissions (continued)

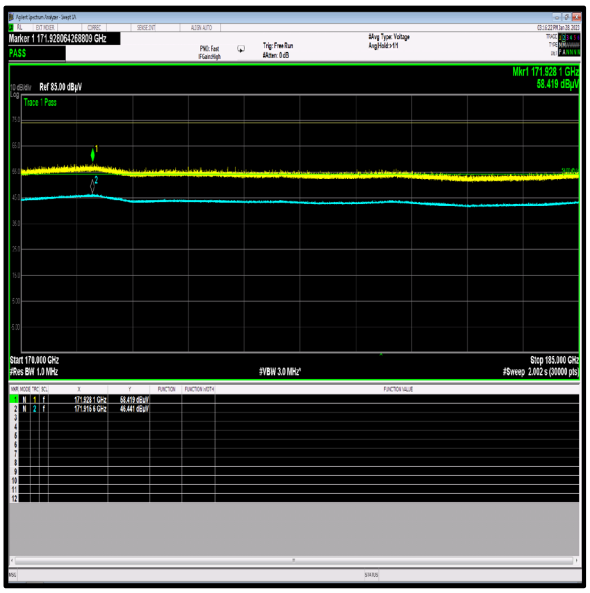


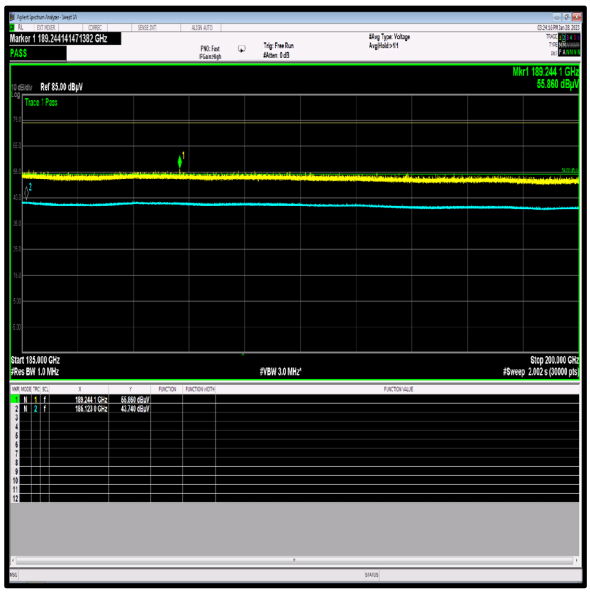




Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

Transmitter Radiated Emissions (continued)





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

6 AC Power Line Conducted Emissions Test Results

6.1 Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Alison Johnston	**Test Dates:**	21 February 2023 & 22 February 2023
Test Sample Serial Number:	61489212 & 61489166		

ISED Canada Reference:	RSS-Gen 8.8
Test Method Used:	ANSI C63.10 Section 6.2 and notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	46

Note(s):

1. The EUT was connected to a benchtop DC power supply which supplied the unit with 24 VDC. The DC power supply was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. A pulse limiter was fitted between the LISN and the test receiver.
3. 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: Antenna 1 / Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.154500	Live	17.1	65.8	48.7	Complied
0.190500	Live	15.3	64.0	48.7	Complied
10.855500	Live	14.1	60.0	45.9	Complied
12.003000	Live	17.9	60.0	42.1	Complied
14.280000	Live	29.3	60.0	30.7	Complied
24.000000	Live	30.7	60.0	29.3	Complied

Results: Antenna 1 / Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
7.998000	Live	12.0	50.0	38.0	Complied
10.860000	Live	7.1	50.0	42.9	Complied
11.427000	Live	31.3	50.0	18.7	Complied
12.853500	Live	30.5	50.0	19.5	Complied
18.001500	Live	20.3	50.0	29.7	Complied
22.848000	Live	21.7	50.0	28.3	Complied

Results: Antenna 1 / Neutral / Quasi Peak / 120 VAC 60 Hz

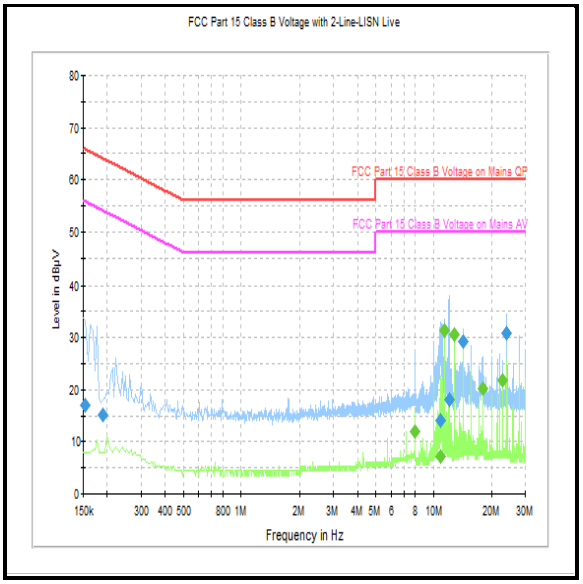
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150000	Neutral	17.5	66.0	48.5	Complied
7.998000	Neutral	24.2	60.0	35.8	Complied
11.004000	Neutral	16.5	60.0	43.5	Complied
12.003000	Neutral	20.8	60.0	39.2	Complied
14.280000	Neutral	29.6	60.0	30.4	Complied
24.000000	Neutral	29.0	60.0	31.0	Complied

Results: Antenna 1 / Neutral / Average / 120 VAC 60 Hz

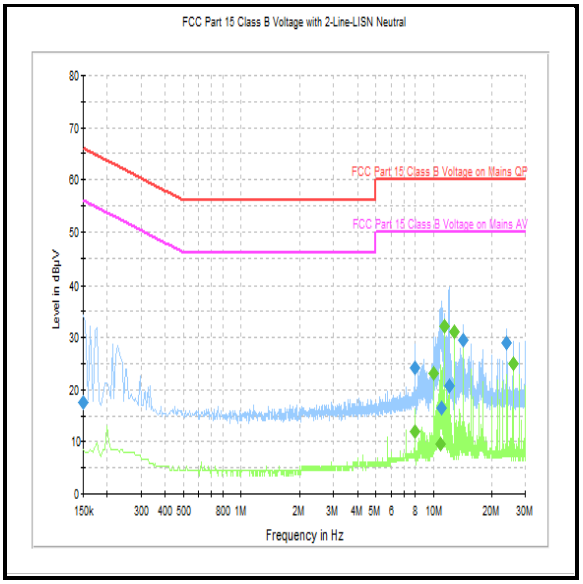
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
7.998000	Neutral	12.0	50.0	38.0	Complied
9.996000	Neutral	23.2	50.0	26.8	Complied
10.851000	Neutral	9.5	50.0	40.5	Complied
11.427000	Neutral	32.1	50.0	17.9	Complied
12.853500	Neutral	31.2	50.0	18.8	Complied
26.002500	Neutral	25.0	50.0	25.0	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: Antenna 1 / 120 VAC 60 Hz



Live



Neutral

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

Transmitter AC Conducted Spurious Emissions (continued)

Results: Antenna 3 / Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.172500	Live	17.0	64.8	47.8	Complied
10.927500	Live	13.8	60.0	46.2	Complied
11.998500	Live	19.8	60.0	40.2	Complied
14.230500	Live	30.5	60.0	29.5	Complied
24.000000	Live	30.7	60.0	29.3	Complied
28.000500	Live	28.3	60.0	31.7	Complied

Results: Antenna 3 / Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
9.960000	Live	21.4	50.0	28.6	Complied
11.386500	Live	34.1	50.0	15.9	Complied
12.808500	Live	32.5	50.0	17.5	Complied
15.657000	Live	29.1	50.0	20.9	Complied
24.000000	Live	24.1	50.0	25.9	Complied
28.000500	Live	25.2	50.0	24.8	Complied

Results: Antenna 3 / Neutral / Quasi Peak / 120 VAC 60 Hz

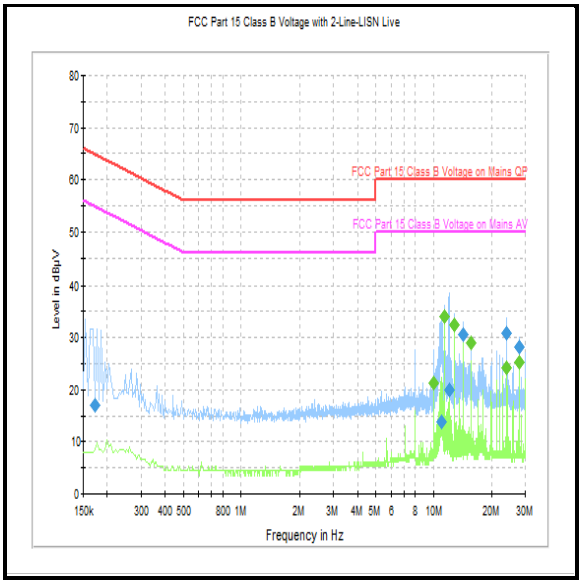
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.154500	Neutral	17.3	65.8	48.5	Complied
7.998000	Neutral	24.3	60.0	35.7	Complied
10.851000	Neutral	17.0	60.0	43.0	Complied
11.998500	Neutral	22.3	60.0	37.7	Complied
14.230500	Neutral	30.5	60.0	29.5	Complied
24.000000	Neutral	29.2	60.0	30.8	Complied

Results: Antenna 3 / Neutral / Average / 120 VAC 60 Hz

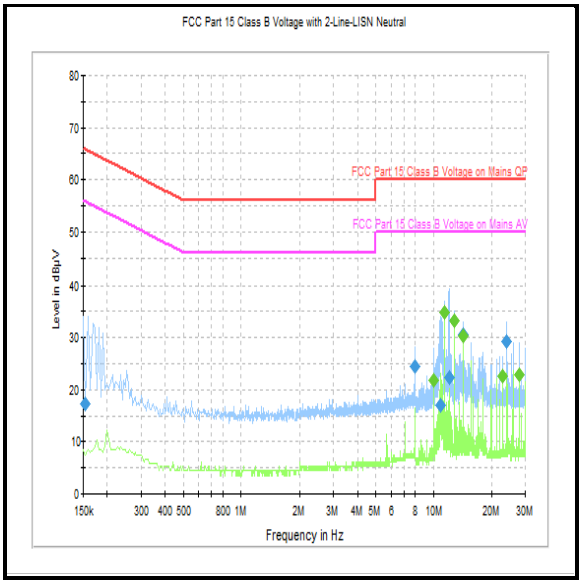
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
9.964500	Neutral	21.7	50.0	28.3	Complied
11.386500	Neutral	34.8	50.0	15.2	Complied
12.808500	Neutral	33.2	50.0	16.8	Complied
14.230500	Neutral	30.2	50.0	19.8	Complied
22.771500	Neutral	22.6	50.0	27.4	Complied
28.000500	Neutral	22.8	50.0	27.2	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: Antenna 3 / 120 VAC 60 Hz



Live



Neutral

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

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