Test Report

FCC ID: R7PEG1R1X8
IC: 5294A-EG1R1X8

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

Report Number: AT72162781-1C0

Manufacturer: Landis+Gyr Technology, Inc.
Model/HVIN: Gridstream RF, Series 5, I210+c

Test Begin Date: November 24, 2020
Test End Date: June 28, 2021

Report Issue Date: Nov 9, 2021

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared By:

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This report contains 34 pages

TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein for single modular approval.

1.2 Applicant Information

Landis + Gyr Technology, Inc.
30000 Mill Creek Ave., Suite 100
Alpharetta, GA 30022

1.3 Product Description

The DUT is a communication module used to remotely read an electric meter and send metrology data to the power company for billing and other monitoring functions. It can also communicate with a home area network and provide metrology data to in-home ZigBee-enabled devices such as thermostats.
The module also contains a separate integrated on-board pre-approved radio module (Model No: S5-MCMO, FCC ID: R7PNG0R1S7 & IC: 5294A-NG0R1S7) which can transmit simultaneously. Simultaneous transmission is addressed in a separate report.

Technical Details:

Detail	Description
Frequency Range (MHz)	2405 – 2475
Number of Channels	15
Channel Spacing	5 MHz
Modulation Format	O-QPSK
Data Rates	250kbps
Operating Voltage	3.6 - 5 VDC
Antenna Type(s) / Gain(s)	Printed-F onboard Antenna / 0dBi

Test Sample Serial Number(s): 930082F1 (conducted sample)
92008A92 (radiated sample)

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

All modes of operation, including all data rates, were evaluated and the data presented in this report represents the worst case where applicable.

For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was the X-orientation for spurious harmonics.

For antenna port conducted emissions, a temporary antenna connector soldered on the board was used to directly connect the DUT to the measuring equipment through suitable attenuation. The DUT was programmed to generate a continuously modulated signal on a single channel.

For power line conducted emissions, the EUT was evaluated with a commercially available off the shelf power supply provided by the applicant.

Power setting during test: DAC Value: 25

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following addresses:

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Designation Accreditation Number:	US1233
FCC Test Site Registration Number:	967699
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site – Chamber A

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 5' in diameter and is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted EMCO Model 1060 installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chase from the turntable to the pit that allows for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

The chamber rear wall is covered with a mixture of Siepel pyramidal absorber. The side walls of the chamber are partially covered with Siepel pyramidal absorber.

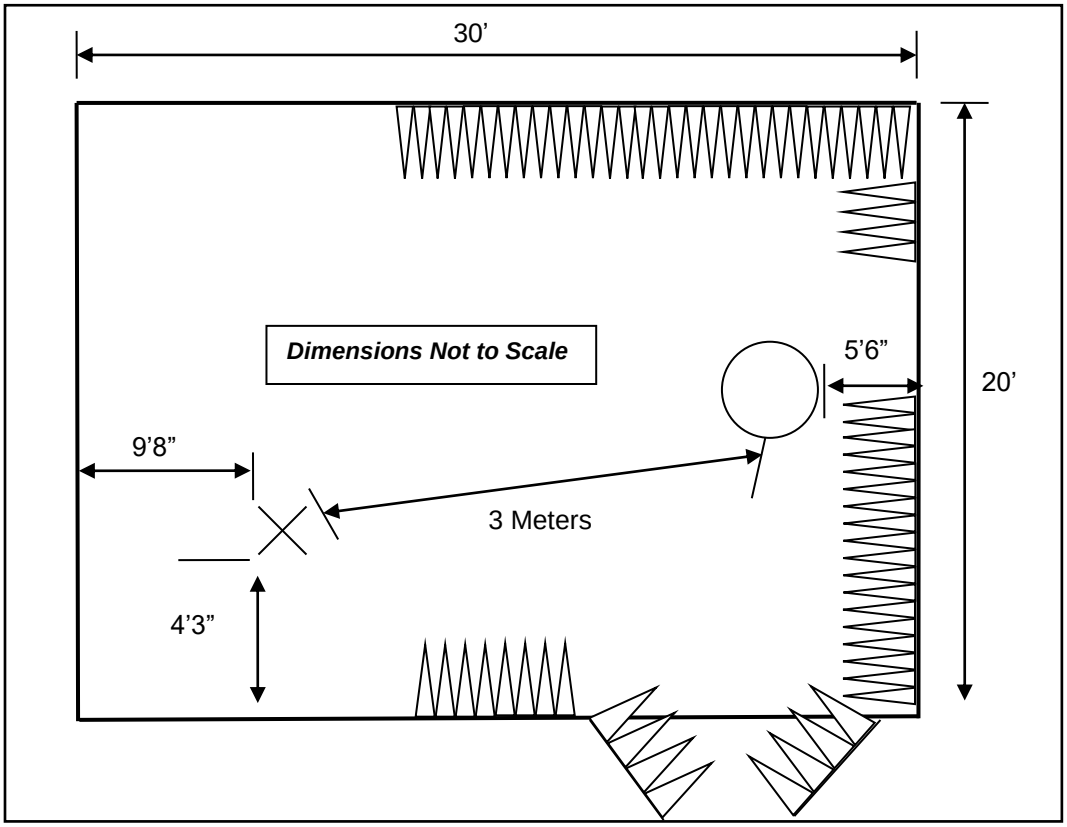


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

2.3.2 Semi-Anechoic Chamber Test Site – Chamber B

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

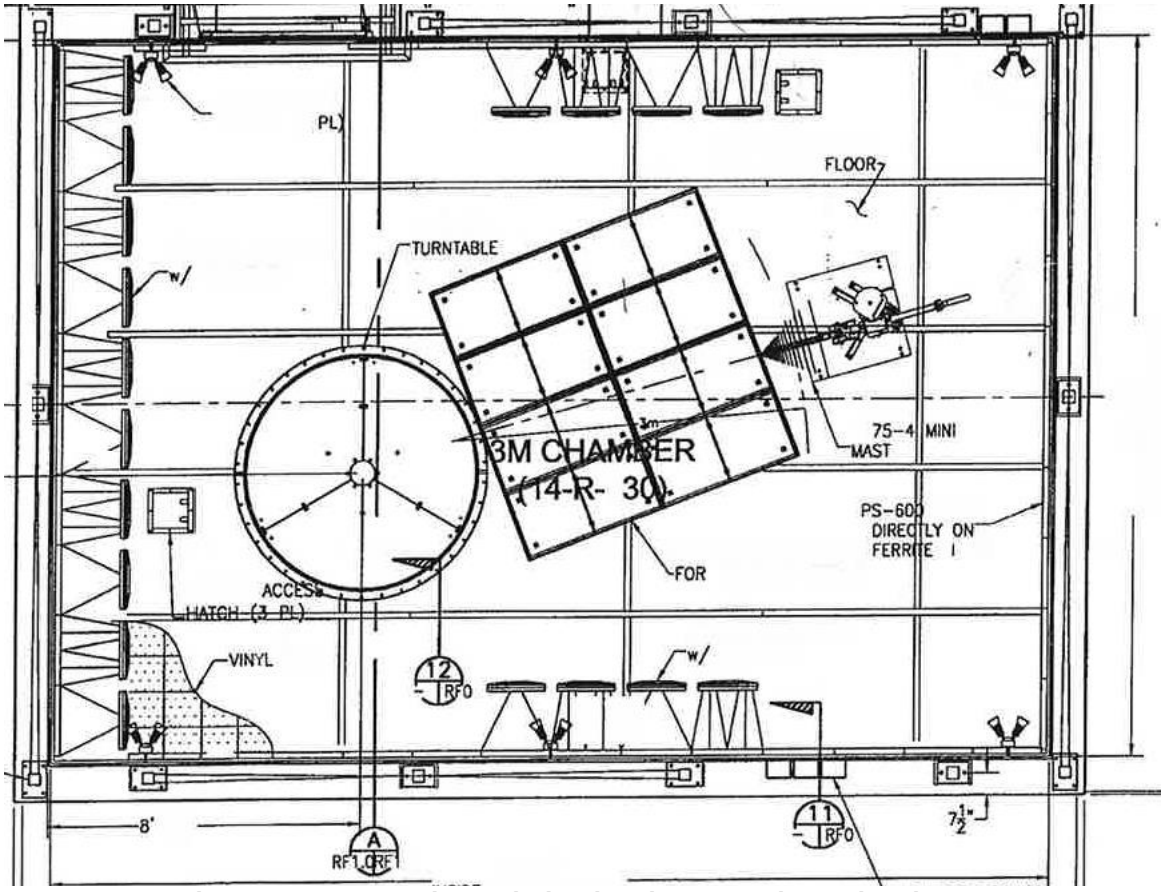


Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane (VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test tabletop and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

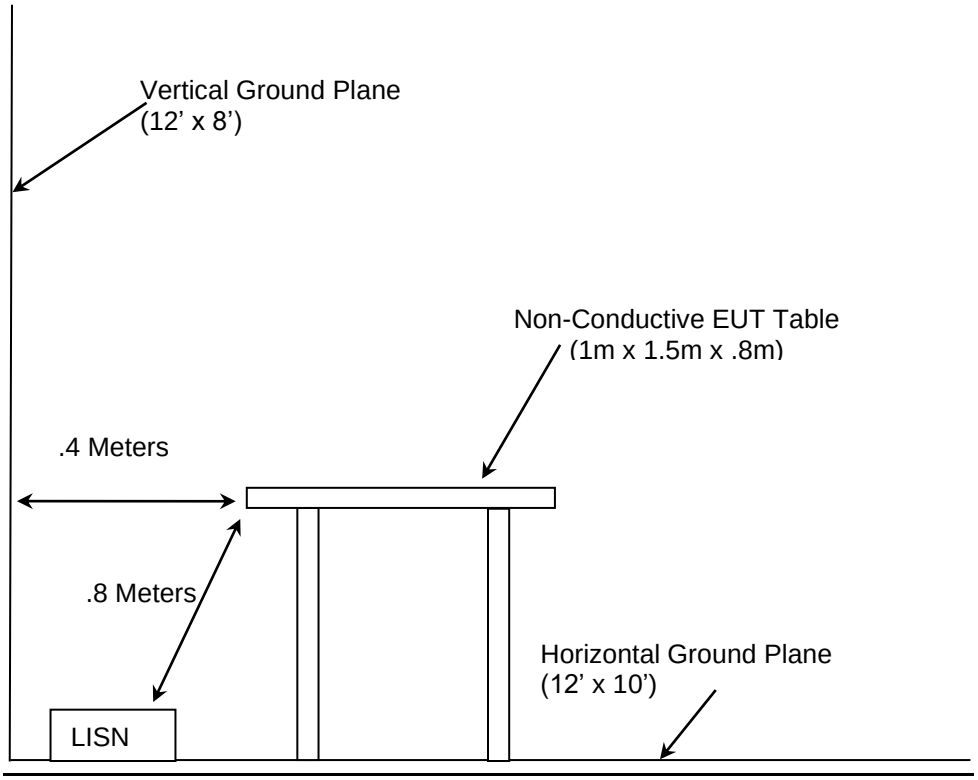


Figure 2.4.1-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2021
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2021
- FCC KDB 558074 D01 DTS Meas Guidance v05r02 - Guidance for Compliance Measurements on Digital Transmission Systems (DTS), Frequency Hopping Spread Spectrum System (FHSS), and Hybrid system devices Operating Under §15.247, April 2, 2019
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, April 2018 + Amendment 1, March 2019, Amendment 2 February 2021.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	08/24/2020	08/24/2021
346	Aeroflex/Weinschel	54A-10	Attennuator	T1362	06/23/2020	06/23/2021
346	Aeroflex/Weinschel	54A-10	Attennuator	T1362	6/24/2021	6/24/2022
638	Rohde & Schwarz	OSP 120	Open Switch and Control Unit	101229	06/11/2019	06/11/2021
827	Rohde & Schwarz	TS8997 Rack Cable Set	TS8997 Rack Cable Set	N/A	09/04/2020	09/04/2021
857	ETS Lindgren	3117	Horn Antenna 1-18GHz	00153608	11/12/2019	11/12/2021
432	Microwave Circuits	H3G020G4	Highpass Filter	264066	06/09/2020	06/09/2021
432	Microwave Circuits	H3G020G4	Highpass Filter	264066	6/9/2021	6/9/2022
3161	Teseq; Huber+Suhner	CBL6112D;6804-17-A	Bilog Antenna; Attenuator	51323;01252019A	2/18/2020	2/18/2021
3161	Teseq; Huber+Suhner	CBL6112D;6804-17-A	Bilog Antenna; Attenuator	51323;01252019A	3/19/2021	3/19/2022
22	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A00526	10/19/2020	10/19/2021
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2019	05/11/2021
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	6/8/2021	6/8/2023
335	Suhner	SF-102A	Cable (40GHZ)	882/2A	06/23/2020	06/23/2021
345	Suhner Sucoflex	102A	Cable 42(GHZ)	1077/2A	06/23/2020	06/23/2021
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	07/28/2020	7/28/2021
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	6/24/2021	6/24/2022
334	Rohde & Schwarz	3160-09	HF 18 - 26.5GHz	49404	4/25/2020	4/25/2022
872	Agilent	E7402A	EMC Spectrum Analyzer	US40240258	6/4/2020	6/4/2021
872	Agilent	E7402A	EMC Spectrum Analyzer	US40240258	6/22/2021	6/22/2022
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	6/23/2020	6/23/2021
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	6/23/2021	6/23/2022
324	ACS	Belden	Conducted EMI Cable	8214	4/2/2021	4/2/2022
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/11/2020	05/11/2021
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	5/11/2021	5/11/2022

NOTE: All test equipment was used only during active calibration cycles as reported above.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Landis & Gyr	1210C ISM	930082F1 (1) 92008A92 (2)
2	DC Power Supply	Hewlett Packard	6622A	3448A03980
3	AC Power Adapter	Radio Shack	N/A	N/A

1) Conducted measurements
2) Radiated measurements

Table 5-2: Cable Description

Item	Cable Type	Length	Shield
A	DC Power Cable	2m	No
B	AC Power Cable	2m	Yes

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

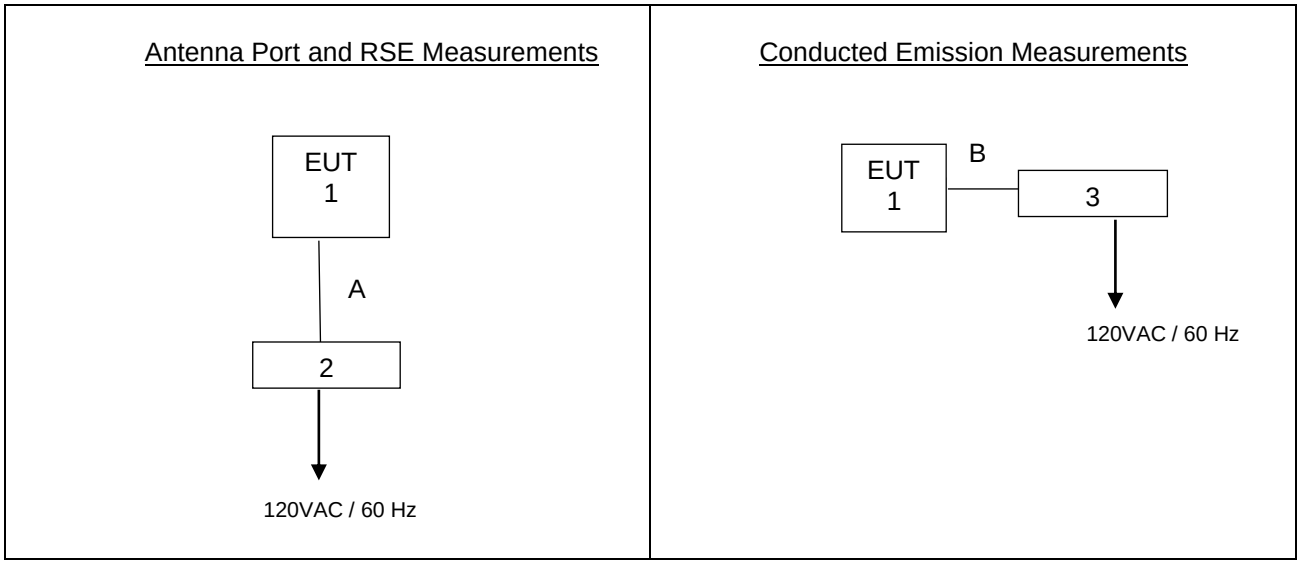


Figure 6-1: Test Setup Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC 15.203

The EUT utilizes an integral onboard printed F (PIFA) antenna with 0 dBi gain, therefore satisfying the requirements of Section 15.203.

7.2 Power Line Conducted Emissions – FCC 15.207, ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Corrected Reading – Applicable Limit

7.2.2 Measurement Results

Performed by: Sean Vick

Table 7.2.2-1: Conducted EMI AVG Results – Line 1

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
0.17	55.5	45.3	35.6	9.68	-10.2	PASS
5.73	50	47.4	37.7	9.715	-2.6	PASS
5.9	50	46	36.3	9.712	-4	PASS
6.17	50	38.7	29	9.71	-11.3	PASS
6.26	50	37.6	27.9	9.71	-12.4	PASS
6.28	50	37.8	28.1	9.71	-12.2	PASS

Table 7.2.2-2: Conducted EMI Peak Results – Line 1

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
0.17	65.5	51.9	42.2	9.68	-13.6	PASS
5.73	60	49.8	40.1	9.715	-10.2	PASS
5.9	60	48.9	39.1	9.712	-11.1	PASS
6.17	60	41.6	31.9	9.71	-18.4	PASS
6.26	60	40.6	30.9	9.71	-19.4	PASS
6.28	60	41.7	32	9.71	-18.3	PASS

Table 7.2.2-3: Conducted EMI AVG Results – Line 2

Frequency (MHz)	Avg Limit	Avg Level Corr	Avg Level	Corr Fact.	Avg Margin	Result
0.17	55.5	48.8	39.1	9.673	-6.7	PASS
5.77	50	39.9	30.2	9.715	-10.1	PASS
5.77	50	40	30.3	9.715	-10	PASS
5.81	50	41.1	31.3	9.716	-8.9	PASS
5.9	50	42.2	32.4	9.718	-7.8	PASS
7.04	50	38.3	28.6	9.731	-11.7	PASS

Table 7.2.2-4: Conducted EMI Peak Results – Line 2

Frequency (MHz)	QP Limit	QP Level Corr	QP Level	Corr Fact.	QP Margin	Result
0.17	65.5	52.2	42.5	9.673	-13.3	PASS
5.77	60	45.7	36	9.715	-14.3	PASS
5.77	60	44.2	34.5	9.715	-15.8	PASS
5.81	60	43.2	33.5	9.716	-16.8	PASS
5.9	60	48	38.2	9.718	-12	PASS
7.04	60	41.6	31.8	9.731	-18.4	PASS

7.3 6dB / 99% Bandwidth – FCC 15.247(a)(2), ISED Canada: RSS-247 5.2(a), RSS-GEN 6.7

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the ANSI C63.10 Section 11.8. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set from 1% to 5% of the occupied bandwidth and the video bandwidth set to at least 3 times the resolution bandwidth. A peak detector was used.

7.3.2 Measurement Results

Performed by: Divya Adusumilli

Table 7.3.2-1: 6dB / 99% Bandwidth

Modulation	Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
O-QPSK	2405	1.700	2.275
	2445	1.700	2.275
	2475	1.750	2.275

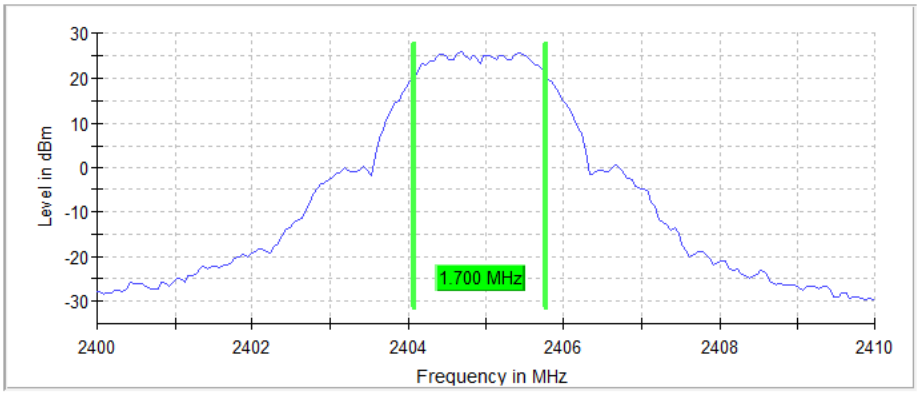


Figure 7.3.2-1: 6dB BW – LCH

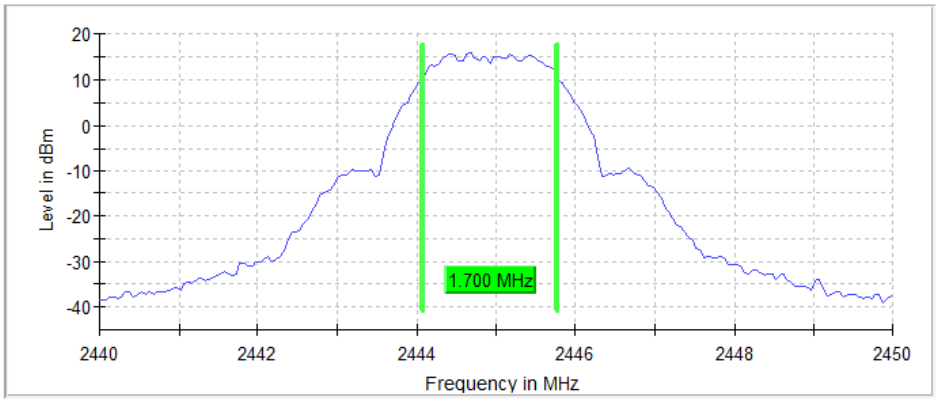


Figure 7.3.2-2: 6dB BW – MCH

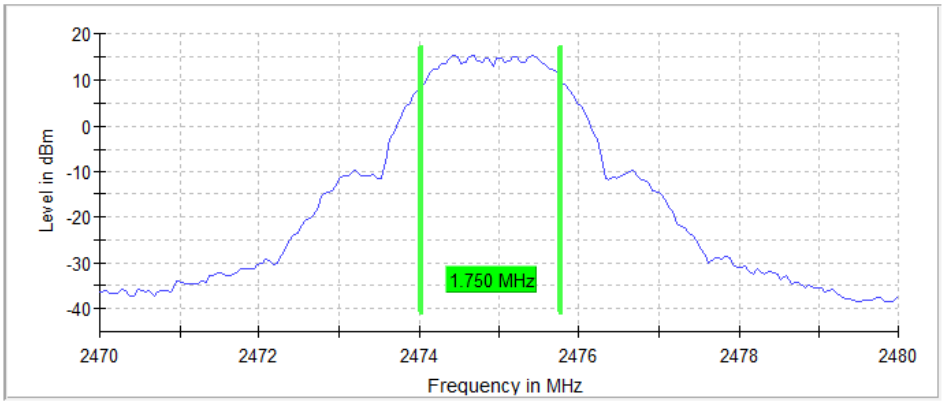


Figure 7.3.2-3: 6dB BW – HCH

Table 7.3.2-2: Sample Measurement Settings (6dB BW)

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.41000 GHz	2.41000 GHz
Span	10.000 MHz	10.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
Sweep Points	200	~ 200
Sweep time	18.945 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	15.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	25 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.00 dB	0.50 dB

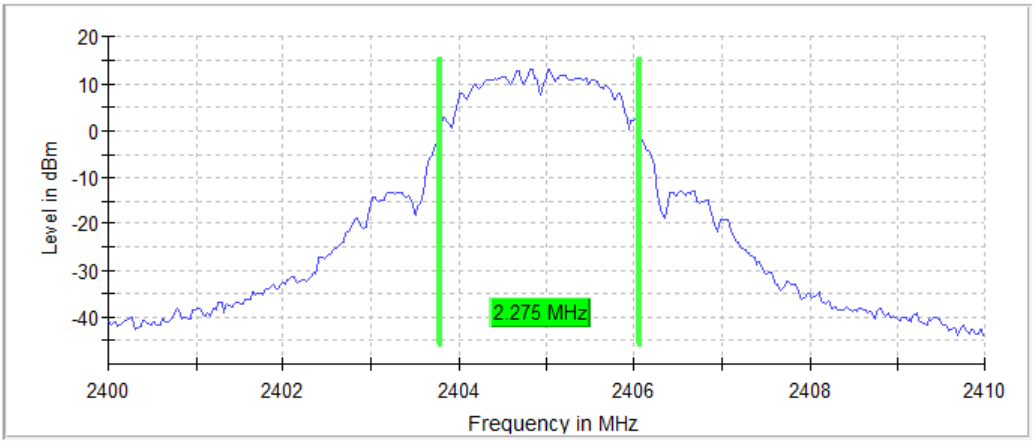


Figure 7.3.2-4: 99% OBW – LCH

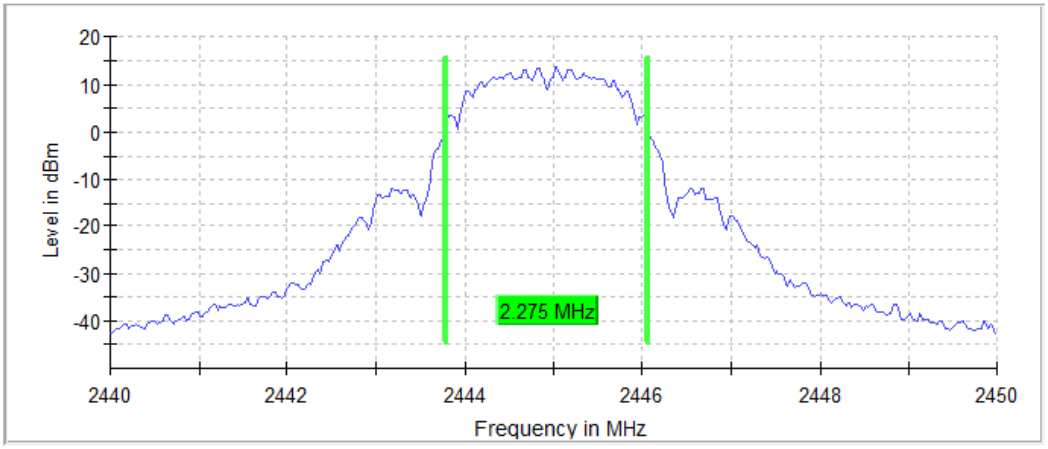


Figure 7.3.2-5: 99% OBW – MCH

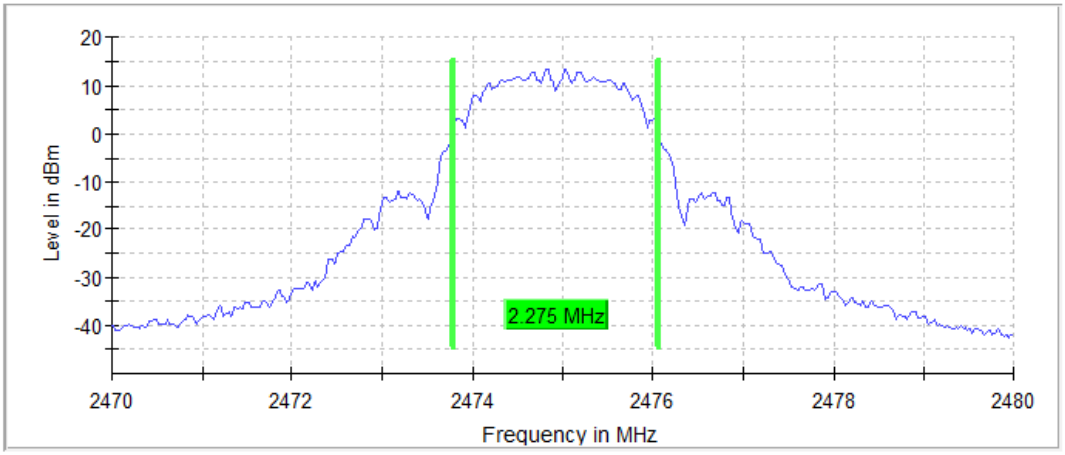


Figure 7.3.2-6: 99% OBW – HCH

Table 7.3.2-3: Sample Measurement Settings (OBW)

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.41000 GHz	2.41000 GHz
Span	10.000 MHz	10.000 MHz
RBW	50.000 kHz	>= 50.000 kHz
VBW	200.000 kHz	>= 150.000 kHz
Sweep Points	400	~ 400
Sweep time	37.930 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.30 dB	0.30 dB
Run	15 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.25 dB	0.30 dB

7.4 Fundamental Emission Output Power – FCC 15.247(b)(3), ISED Canada: RSS-247 5.4(d)

7.4.1 Measurement Procedure

The maximum conducted output power was measured in accordance with ANSI C63.10 Section 11.9.1.1 utilizing the RBW ≥ DTS Bandwidth method. The RF output of the equipment under test was directly connected to the input of the analyzer applying suitable attenuation.

7.4.2 Measurement Results

Performed by: Divya Adusumilli

Table 7.4.2-1: Conducted Output Power

Modulation	Frequency (MHz)	Peak Power (dBm)
O-QPSK	2405	19.1
	2445	19.6
	2475	19.3

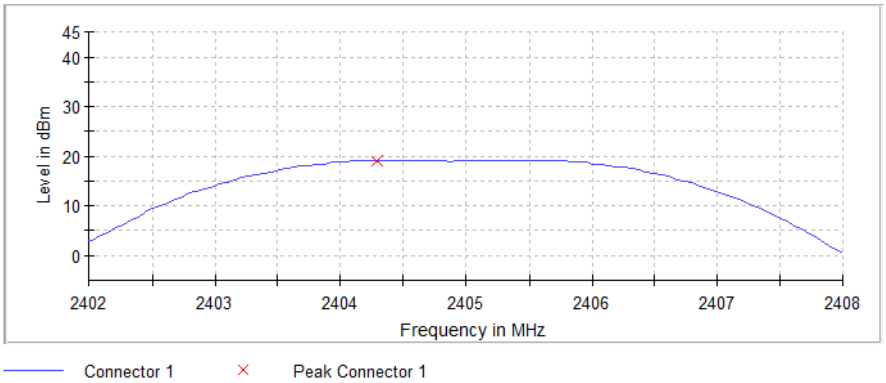


Figure 7.4.2-1: Output Power – LCH

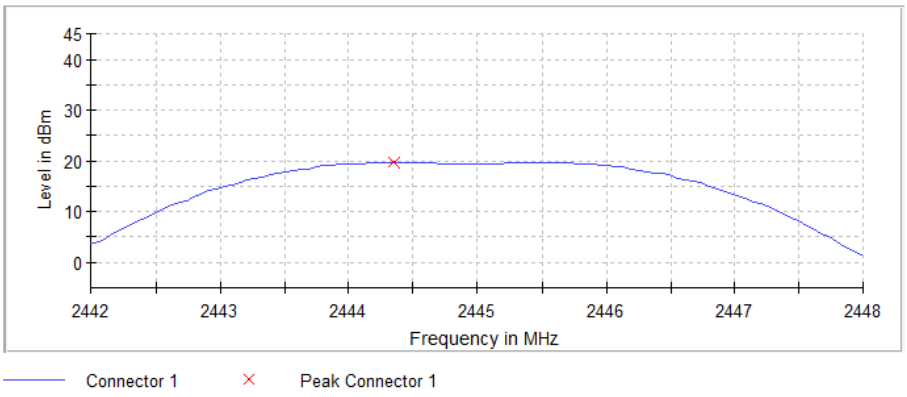


Figure 7.4.2-2: Output Power – MCH

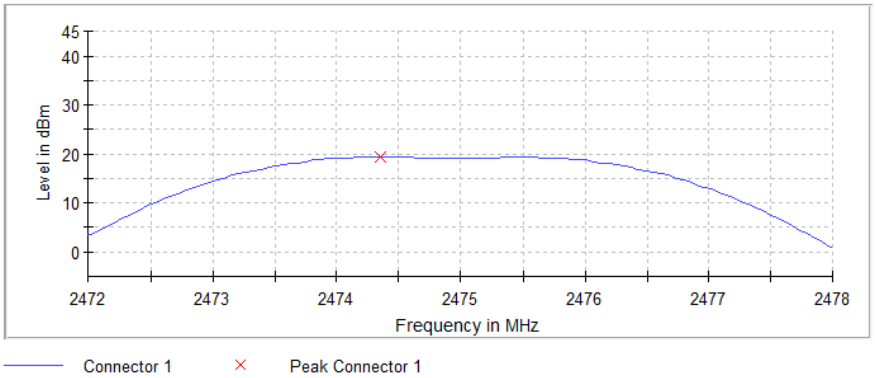


Figure 7.4.2-3: Output Power – HCH

Table 7.4.2-2: Sample Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	2.40200 GHz	2.40200 GHz
Stop Frequency	2.40800 GHz	2.40800 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.700 MHz
VBW	10.000 MHz	>= 6.000 MHz
Sweep Points	101	~ 101
Sweep time	953.450 ns	AUTO
Reference Level	20.000 dBm	20.000 dBm
Attenuation	40.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	FFT	AUTO
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.02 dB	0.50 dB

7.5 Emission Levels

7.5.1 Emissions into Non-restricted Frequency Bands – FCC 15.247(d); ISED Canada: RSS-247 5.5

7.5.1.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with ANSI C63.10 Section 11.11. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit at the band edges. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. The worst-case for each modulation was investigated at the lower and upper band edges.

7.5.1.2 Measurement Results

Performed by: Divya Adusumilli

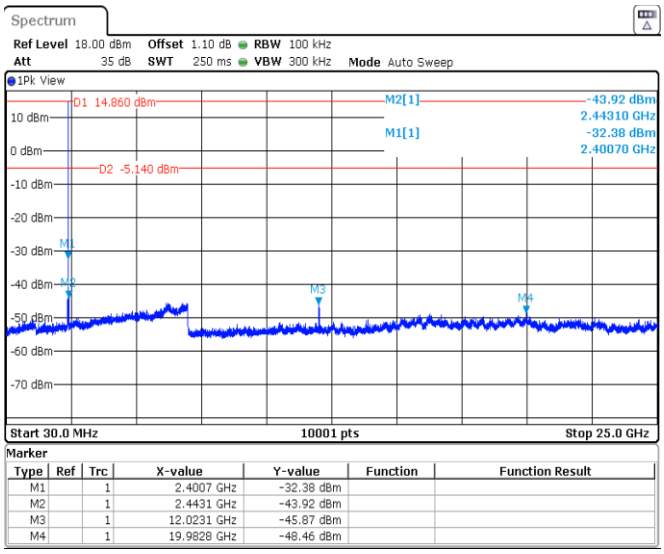


Figure 7.5.1.2-1: LCH (2405MHz) – 30MHz–25GHz

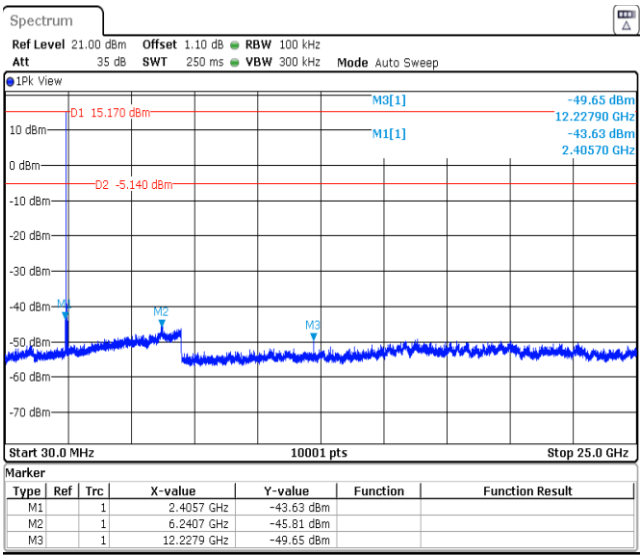


Figure 7.5.1.2-2: MCH (2445MHz) – 30MHz–25GHz

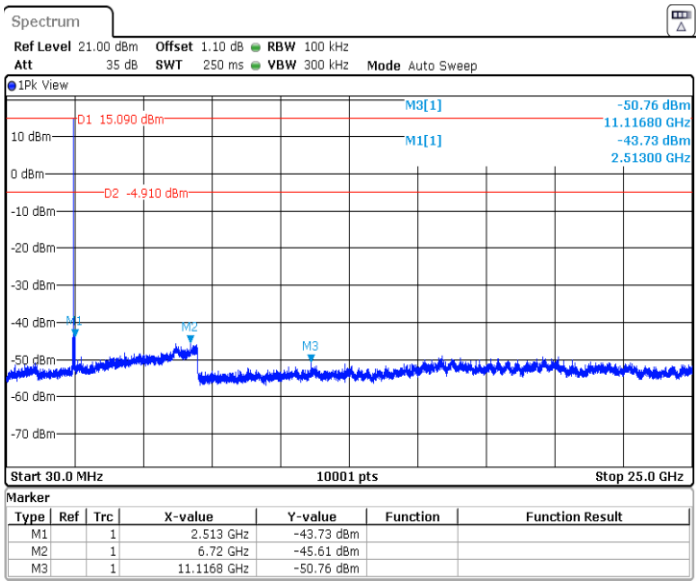


Figure 7.5.1.2-3: HCH (2475MHz) – 30MHz–25GHz

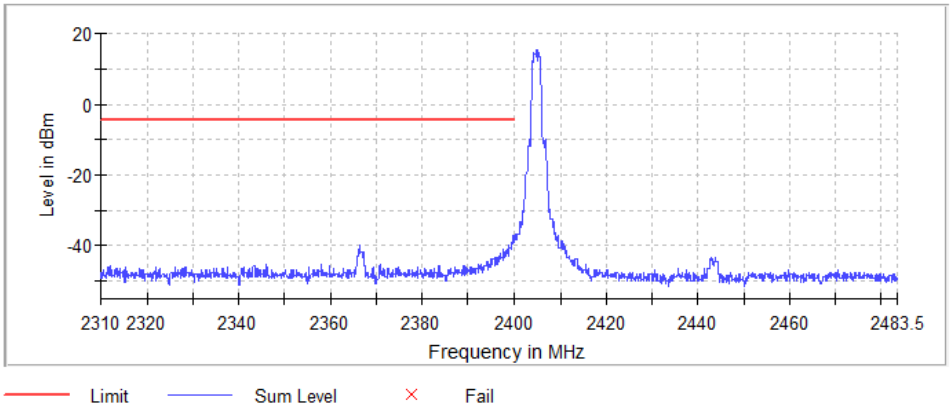


Figure 7.5.1.2-4: Lower Band-edge – 2405MHz

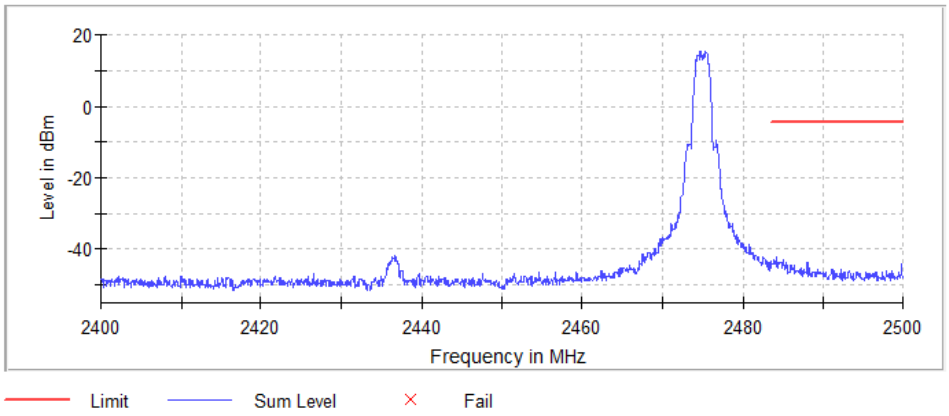


Figure 7.5.1.2-5: Upper Band-edge – 2475MHz

Table 7.5.1.2-1: Lower Band-edge – Low Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.675000	-37.0	32.5	-4.5	PASS
2399.875000	-37.3	32.7	-4.5	PASS
2399.725000	-37.4	32.9	-4.5	PASS
2399.925000	-37.7	33.2	-4.5	PASS
2399.825000	-37.9	33.4	-4.5	PASS
2399.975000	-38.1	33.6	-4.5	PASS
2399.625000	-38.2	33.7	-4.5	PASS
2399.775000	-38.6	34.1	-4.5	PASS
2399.425000	-38.9	34.4	-4.5	PASS
2399.475000	-39.0	34.5	-4.5	PASS
2399.325000	-39.3	34.8	-4.5	PASS
2399.375000	-39.4	34.9	-4.5	PASS
2399.525000	-39.6	35.1	-4.5	PASS
2399.575000	-39.7	35.2	-4.5	PASS
2399.025000	-39.8	35.3	-4.5	PASS

Table 7.5.1.2-2: Upper Band-edge – High Channel

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.175000	-42.2	37.7	-4.5	PASS
2484.225000	-42.5	38.0	-4.5	PASS
2483.825000	-42.7	38.2	-4.5	PASS
2483.775000	-42.8	38.3	-4.5	PASS
2485.025000	-42.9	38.4	-4.5	PASS
2485.075000	-43.2	38.8	-4.5	PASS
2483.925000	-43.3	38.8	-4.5	PASS
2483.575000	-43.4	38.9	-4.5	PASS
2483.875000	-43.4	38.9	-4.5	PASS
2484.125000	-43.5	39.0	-4.5	PASS
2483.625000	-43.5	39.0	-4.5	PASS
2484.975000	-43.6	39.1	-4.5	PASS
2484.475000	-43.6	39.1	-4.5	PASS
2483.975000	-43.7	39.3	-4.5	PASS
2485.375000	-43.8	39.4	-4.5	PASS

7.5.2 Emissions into Restricted Frequency Bands – FCC: 15.205, 15.209; ISED Canada: RSS-Gen 8.9 / 8.10

7.5.2.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 9kHz to 25GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.5.2.2 Measurement Results

Performed by: Tyler Leeson / Paul Villarreal

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
LCH - 2405 MHz										
2390	50.5	36.1	H	-0.11	50.39	35.99	74.0	54.0	23.6	18.0
2390	50.3	36.1	V	-0.11	50.19	35.99	74.0	54.0	23.8	18.0
4810	46.60	32.80	H	4.67	51.27	37.47	74.0	54.0	22.7	16.5
4810	47.60	37.10	V	4.67	52.27	41.77	74.0	54.0	21.7	12.2
12025	52.60	46.90	H	13.98	66.58	60.88	83.5	63.5	16.9	2.7
12025	52.80	47.60	V	13.98	66.78	61.58	83.5	63.5	16.7	2.0
MCH - 2445 MHz										
4890	47.10	33.80	H	4.80	51.90	38.60	74.0	54.0	22.1	15.4
4890	46.50	33.90	V	4.80	51.30	38.70	74.0	54.0	22.7	15.3
7335	51.10	45.10	H	8.31	59.41	53.41	74.0	54.0	14.6	0.6
7335	48.40	38.80	V	8.31	56.71	47.11	74.0	54.0	17.3	6.9
12225	51.10	42.90	H	14.62	65.72	57.52	83.5	63.5	17.8	6.0
12225	50.70	42.90	V	14.62	65.32	57.52	83.5	63.5	18.2	6.0
HCH - 2475 MHz										
2483.5	64.1	49.6	H	-0.02	64.08	49.58	74.0	54.0	9.9	4.4
2483.5	59.1	44.1	V	-0.02	59.08	44.08	74.0	54.0	14.9	9.9
4950	46.7	32.8	H	4.89	51.59	37.69	74.0	54.0	22.4	16.3
4950	46.3	32.8	V	4.89	51.19	37.69	74.0	54.0	22.8	16.3
7425	49.1	40.7	H	8.37	57.47	49.07	74.0	54.0	16.5	4.9
7425	46.5	34.1	V	8.37	54.87	42.47	74.0	54.0	19.1	11.5
12375	51.8	45.4	H	15.11	66.91	60.51	83.5	63.5	16.6	3.0
12375	49.9	40.7	V	15.11	65.01	55.81	83.5	63.5	18.5	7.7

7.5.2.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 64.10+ -0.02 = 64.08dBµV/m
Margin: 74dBµV/m – 64.08dBµV/m = 9.9 dB

Example Calculation: Average

Distance Correction Factor for above 10GHz @ 1m:
dBuV/m @ 3m + 20log (3m/1m)
54+9.5 =63.5dBuv/m@1m

Corrected Level: 47.60 + 13.98 - 0 = 61.58 dBµV
Margin: 63.5dBµV – 61.58dBµV = 2.0 dB

7.6 Maximum Power Spectral Density in the Fundamental Emission – FCC 15.247(e) ISED Canada: RSS-247 5.2(b)

7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the ANSI C63.10 Section 11.10. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. Initial measurements were recorded with the Resolution Bandwidth (RBW) of the spectrum analyzer set to 10 kHz, and the Video Bandwidth (VBW) set to 30 kHz. Span was set to 1.5 times the channel bandwidth. The trace was set to max hold with the peak detector active. Since the limit was exceeded, the RBW was reduced to 3kHz and the VBW was reduced to 10kHz.

7.6.2 Measurement Results

Performed by: Divya Adusumilli

Table 7.6.2-1: Power Spectral Density

Modulation	Frequency [MHz]	PSD [dBm]
O-QPSK	2405	3.677
	2445	4.352
	2475	3.778

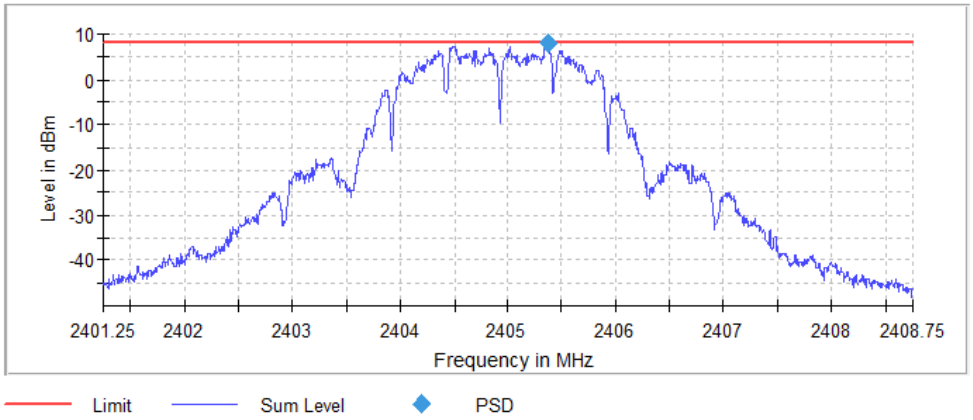


Figure 7.6.2-1: PSD Plot (10kHz RBW) - LCH

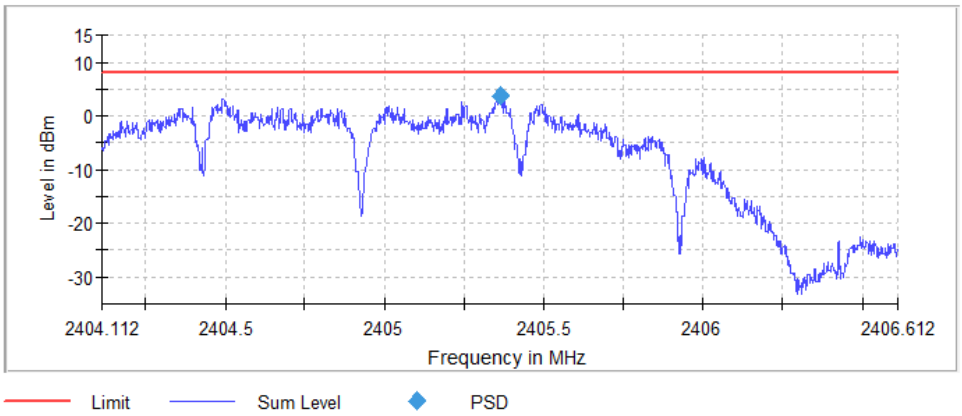


Figure 7.6.2-2: PSD Plot (3kHz RBW) – LCH

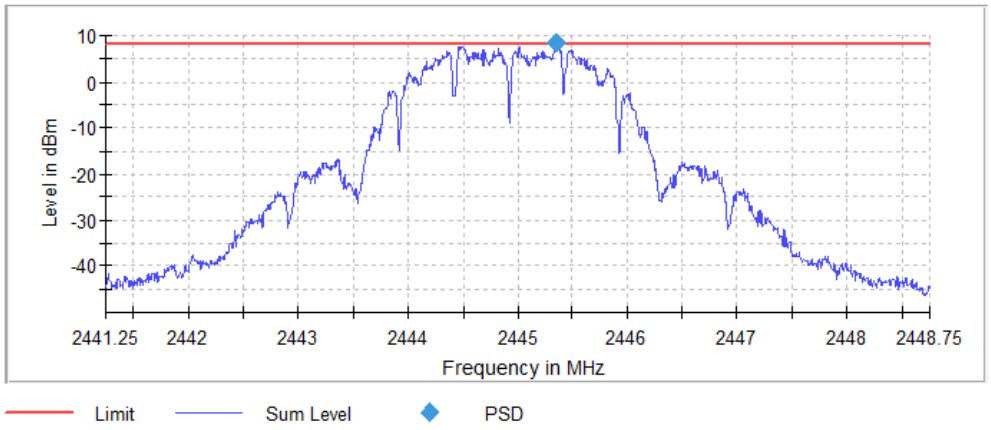


Figure 7.6.2-3: PSD Plot (10kHz RBW) – MCH

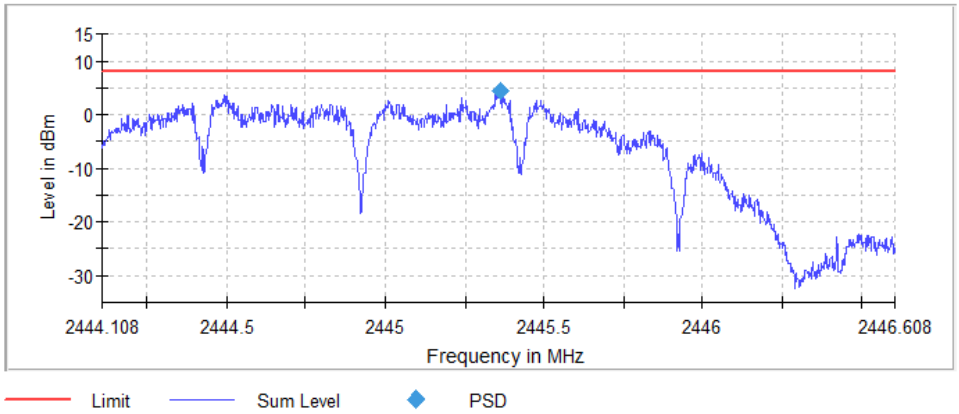


Figure 7.6.2-4: PSD Plot (3kHz RBW) – MCH

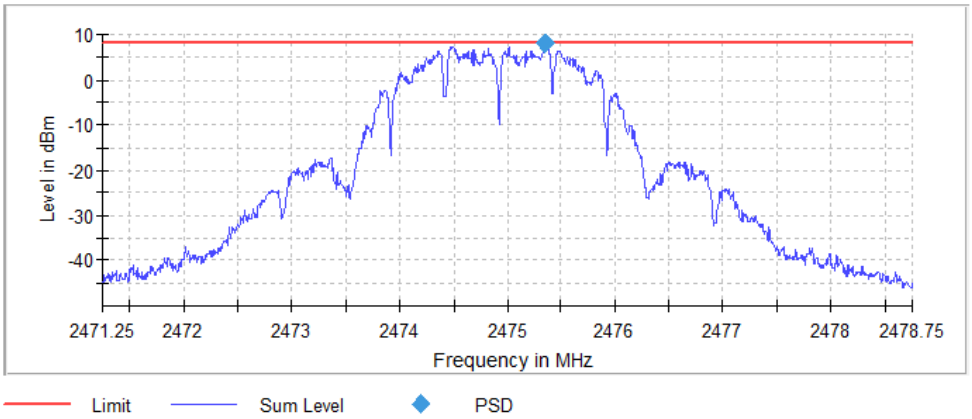


Figure 7.6.2-5: PSD Plot (10kHz RBW) - HCH

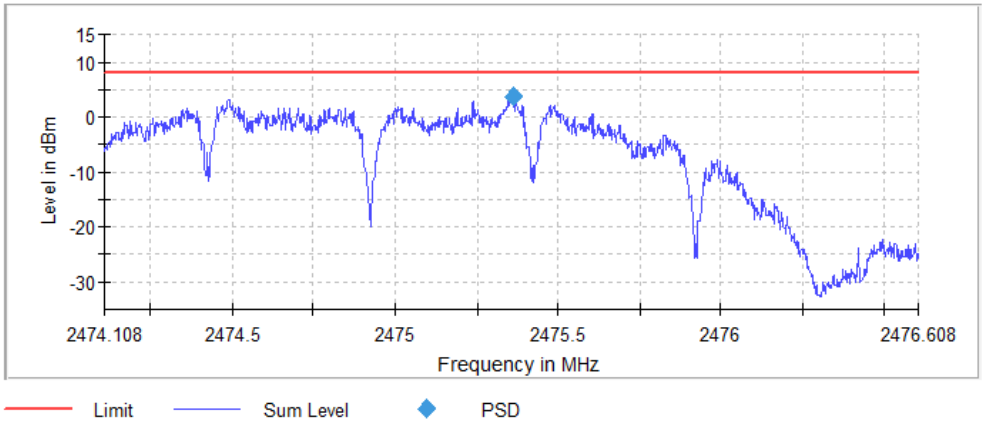


Figure 7.6.2-6: PSD Plot (3kHz RBW) – HCH

Table 7.6.2-2: Sample Measurement Settings (PSD) – 10kHz RBW

Setting	Instrument Value	Target Value
Start Frequency	2.40125 GHz	2.40125 GHz
Stop Frequency	2.40875 GHz	2.40875 GHz
Span	7.500 MHz	7.500 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
Sweep Points	1500	~ 1500
Sweep time	7.500 ms	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	Sweep	Sweep
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	11 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.45 dB	0.50 dB

Table 7.6.2-3: Sample Measurement Settings (PSD) – 3kHz RBW

Setting	Instrument Value	Target Value
Start Frequency	2.40411 GHz	2.40411 GHz
Stop Frequency	2.40661 GHz	2.40661 GHz
Span	2.500 MHz	2.500 MHz
RBW	3.000 kHz	<= 3.000 kHz
VBW	10.000 kHz	>= 9.000 kHz
Sweep Points	1667	~ 1667
Sweep time	27.800 ms	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
Sweep Count	10	10
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweep type	Sweep	Sweep
Preamp	off	off
Stable mode	Trace	Trace
Stable value	0.50 dB	0.50 dB
Run	22 / max. 150	max. 150
Stable	1 / 1	1
Max Stable Difference	0.27 dB	0.50 dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Table 8-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

In the opinion of TUV SUD the 1210C ISM, manufactured by Landis & Gyr meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247 for the tests documented herein.

Appendix A: Plots

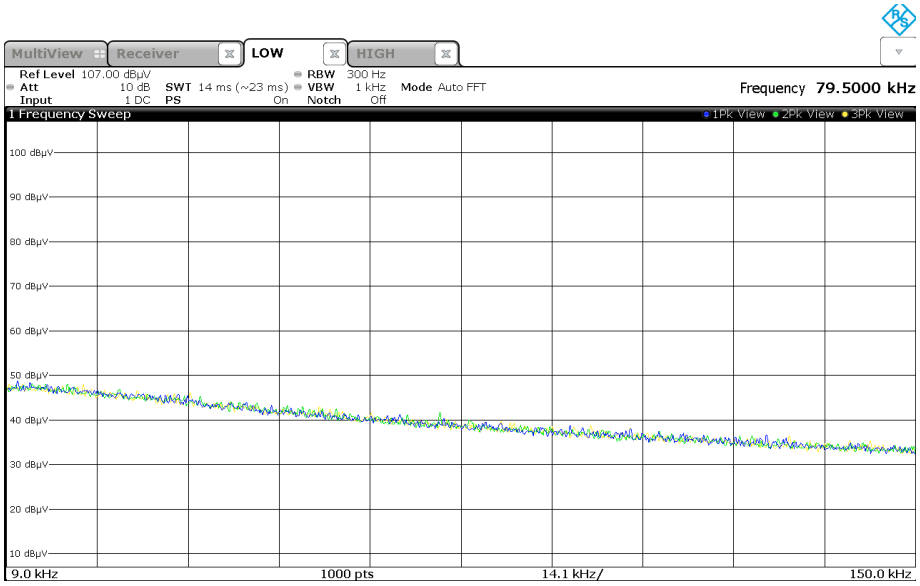


Figure A-1: 9kHz-150kHz

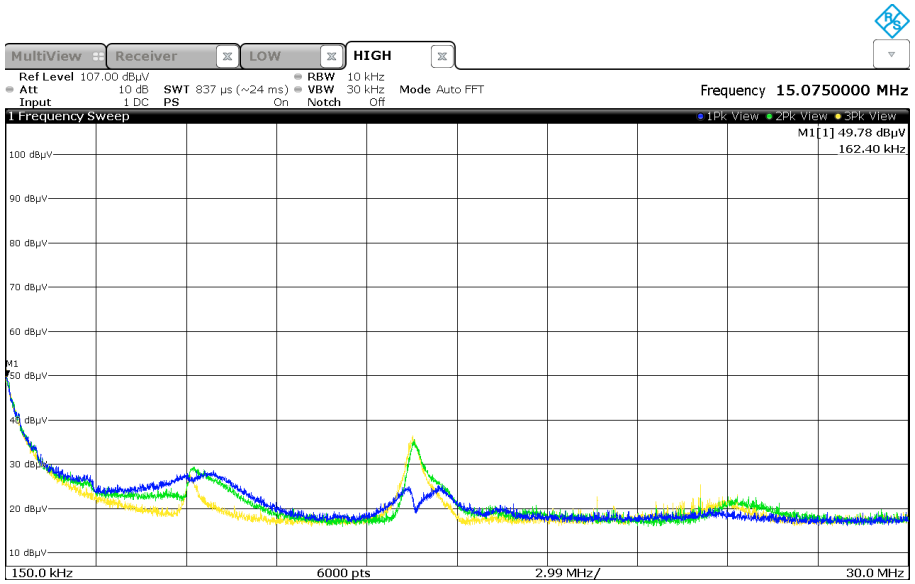
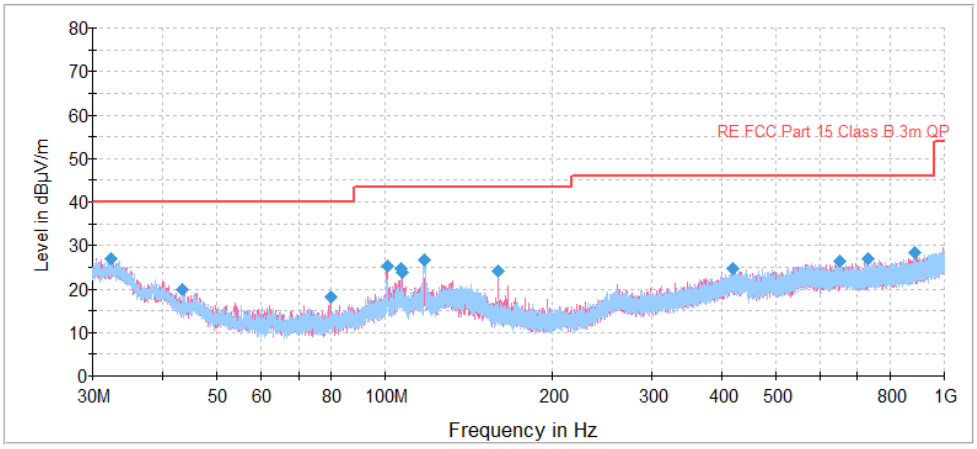


Figure A-2: 150kHz-30MHz

Note: Emissions above the noise floor are ambient not associated with the EUT.



Note: Emissions above the noise floor are from the digital sections of the DUT and not associated with the radio.

Figure A-3: 30MHz-1GHz

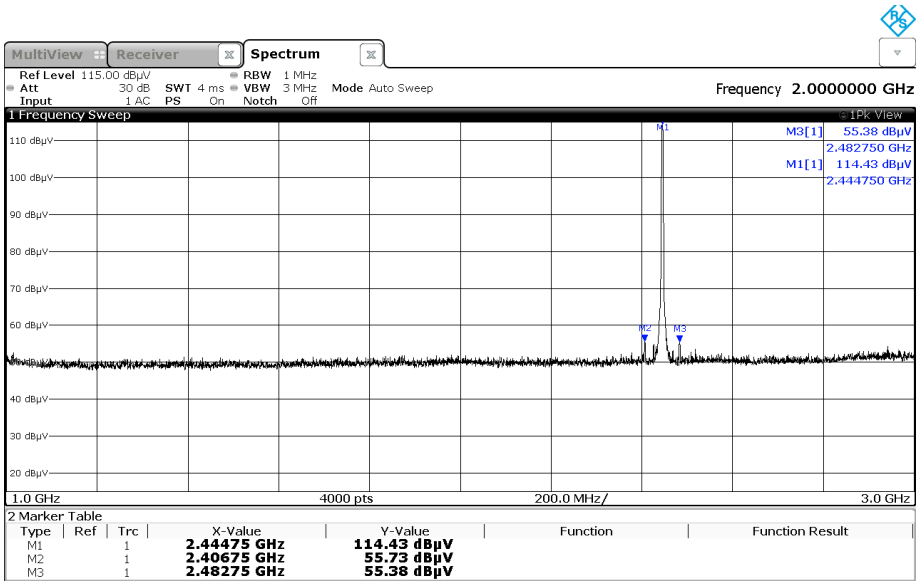


Figure A-4: 1GHz-3GHz

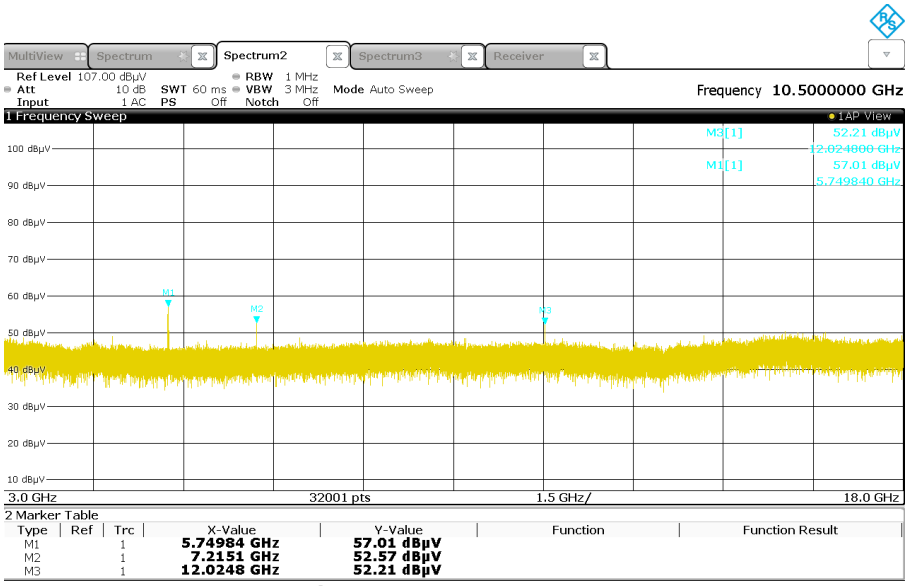


Figure A-5: 3GHz-18GHz

Note: Emissions in and around 5GHz are ambient noise and not associated with the DUT.

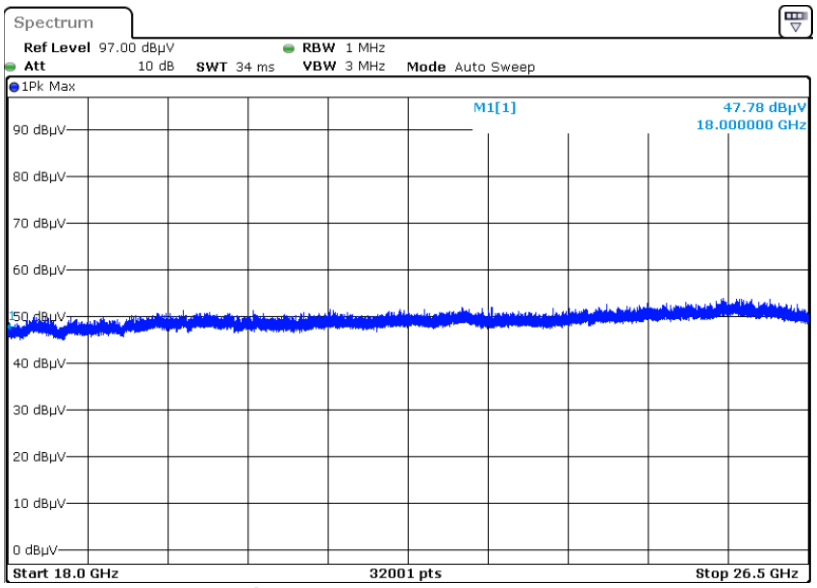


Figure A-6: 18GHz-26.5GHz

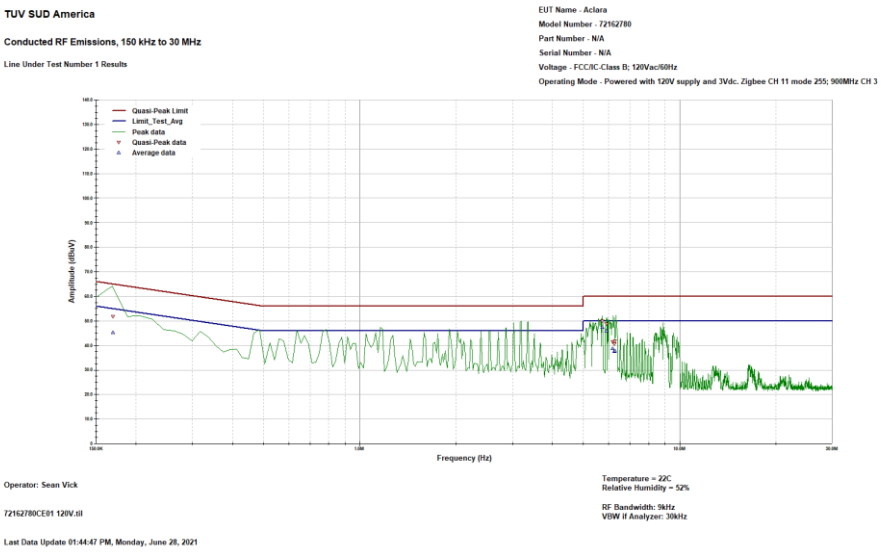


Figure A-7: Conducted Emissions – Line 1

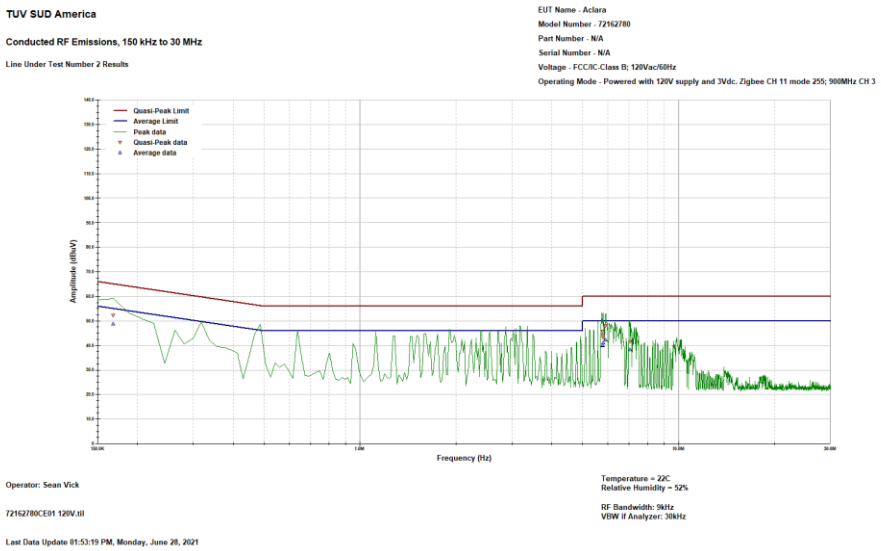


Figure A-8: Conducted Emissions – Line 2

END REPORT