Certification Test Report

FCC ID: R7PNG1R1S1
IC: 5294A-NG1R1S1

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

Report Number: AT72157008-1P1

Manufacturer: Landis+Gyr Technology, Inc.
Model: NIC AM

Test Begin Date: February 13, 2020
Test End Date: March 5, 2020

Report Issue Date: March 30, 2019

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 22 pages

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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 Class II Permissive Change for the tests documented herein.

1.2 Applicant Information

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

1.3 Product Description

The Landis+Gyr Network Bridge provides the basis for a powerful RF wireless mesh network for remote data collection and end device monitoring and control in the 900 MHz ISM Band. The Network Bridge supports full two-way peer-to-peer communication to all devices within the network. The product offers advanced functionality, such as individual message prioritization, additional memory for localized intelligence, and it is based on the Linux operating system. The N2200/N2250 provides interface and control to distribution equipment and critical devices that require low latency.

Technical Details
The model NIC AM provides 4 distinct frequency hopping modes of operation as outlined below.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
1	902.3 - 927.8	86	300	9.6, 19.2, 38.4, 115.2
2	904.0 - 927.9	240	100	9.6, 19.2, 38.4
3	902.2 - 927.8	129	200	50.0
4	902.4 - 927.6	64	400	50, 150, 200

Modulations: FSK/GFSK
Antenna Type/Gain: Airgain Panel / +9.0 dBi
Input Power: 5.0 VDC

Model Number: NIC AM

Test Sample Serial Number(s): Not Labeled

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

1.4 Test Methodology and Considerations

This is a Class 2 Permissive Change to add antenna Airgain ET900SLGADB to the original filing.

For radiated emissions, the EUT was evaluated in 3 orthogonal orientations. The worst-case orientation was the Z-orientation. See test setup photos for more information.

For power line conducted emissions, the EUT was evaluated with a representative wall wart power supply.

For RF conducted measurements, the output power was reduced due to the directional gain of the antenna being 9dBi.

Power setting during test: 35

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 tests 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
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.

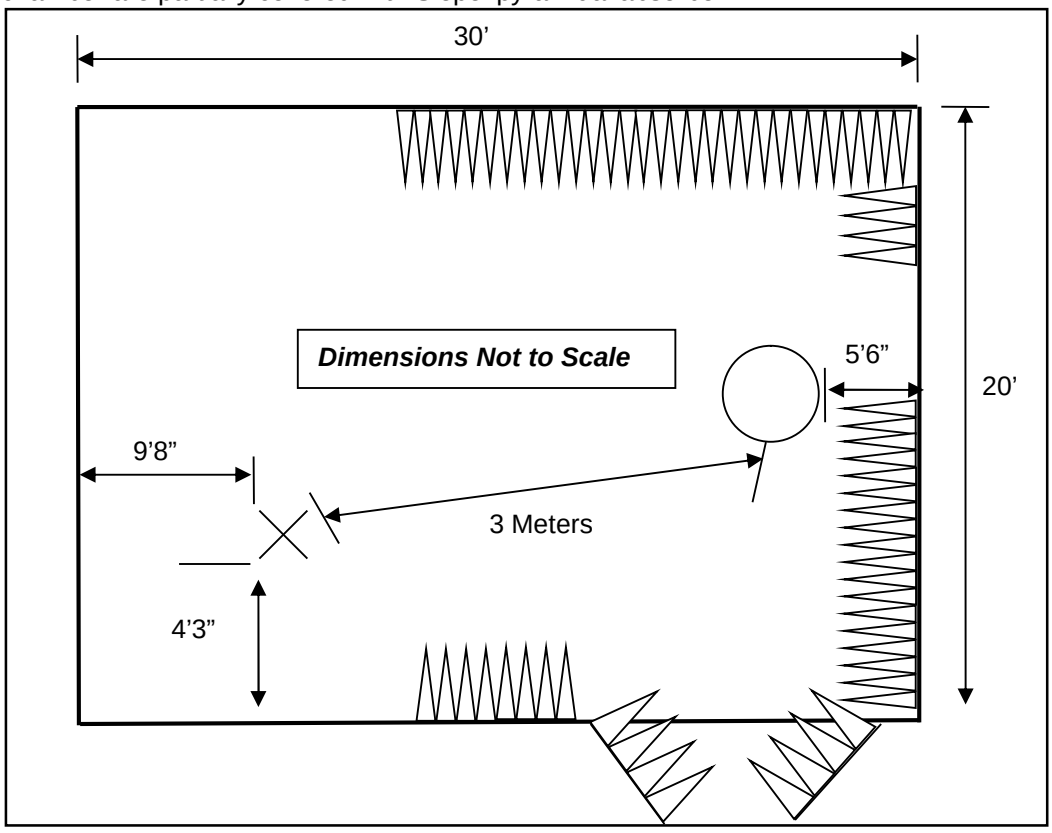

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

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.

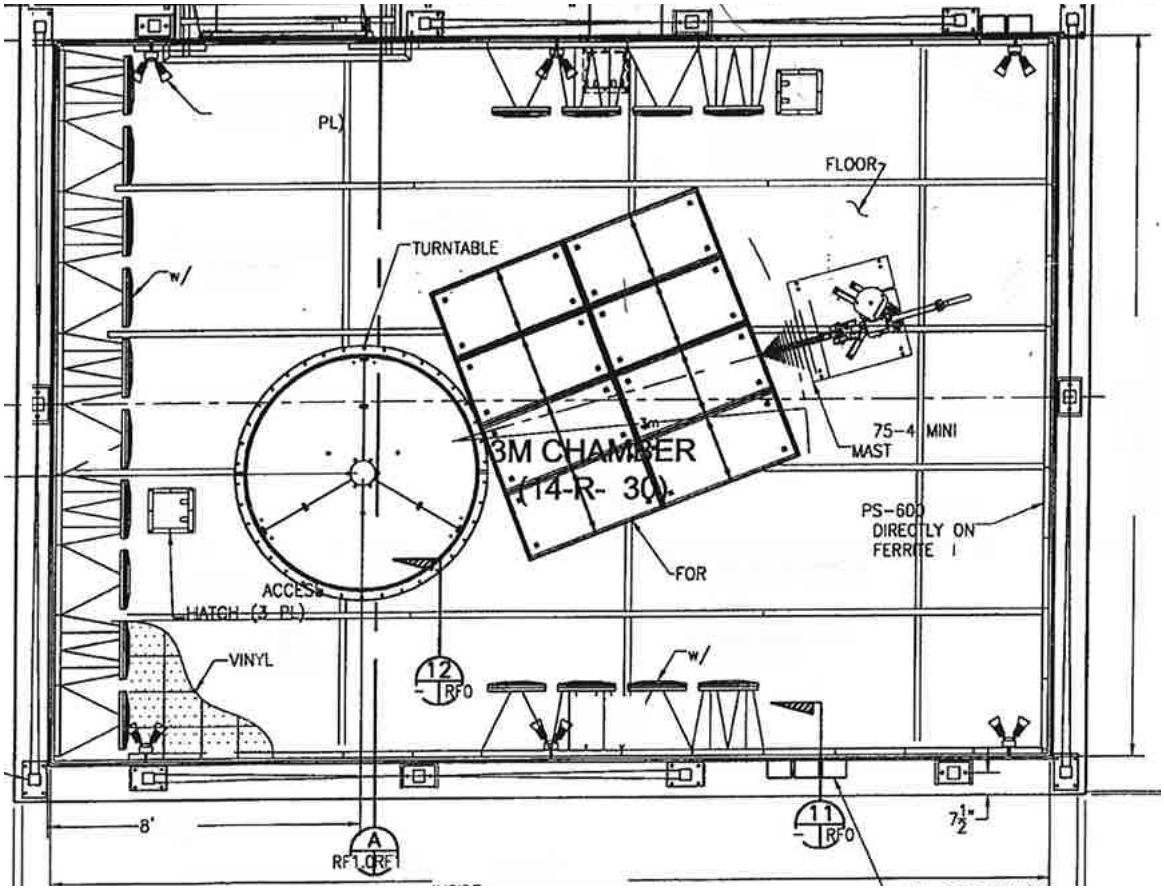

Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

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 table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

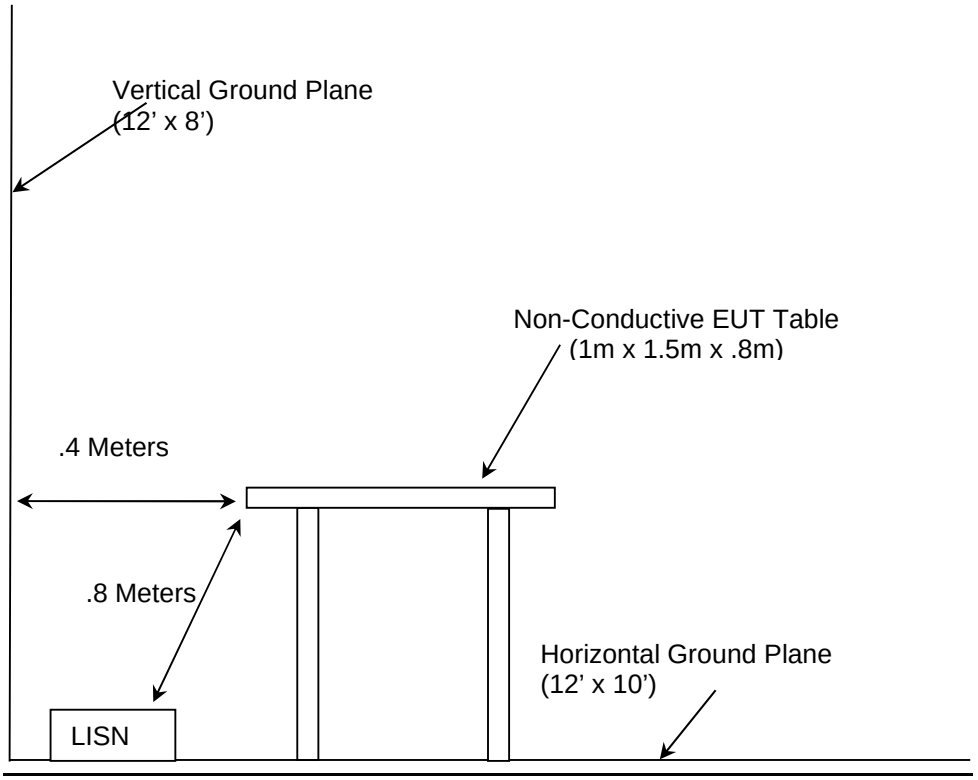

Figure 2.4.1-1: AC Mains Conducted EMI Site

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, 2020
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2020
- FCC KDB 558074 D01 DTS Meas Guidance v05r02 - Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules, April 2, 2019
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-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, March 2019, Amendment 1

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
22	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A00526	07/11/2018	07/11/2020
213	TEC	PA 102	Amplifier	44927	7/22/2019	7/22/2020
267	Hewlett Packard	N1911A	Power Meter	MY45100129	7/26/2019	7/26/2021
268	Hewlett Packard	N1921A	Power Sensor	MY45240184	7/26/2019	7/26/2021
324	ACS	Belden	Conducted EMI Cable	8214	3/19/2019	3/19/2020
329	A.H.Systems	SAS-571	Horn Antenna	721	8/27/2019	8/27/2021
331	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	31417	5/31/2019	5/31/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	2/11/2019	2/11/2021
813	PMM	9010	EMI Receiver; RF Input 50ohm; 10Hz-50MHz; 10Hz-30MHz	697WW30606	02/25/2019	02/25/2020
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/1/2018	5/1/2020
851	TUV ATLANTA	FMC0101951-100CM	ASAC Cable Set Consisting of 566, 619, and 564	N/A	10/1/2019	10/1/2020
852	Teseq	CBL 6112D	Bilog Antenna; Attenuator	51617	10/15/2018	10/15/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	2/11/2019	2/11/2021
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	7/10/2019	7/10/2020

NCR = No Calibration Required
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	Evaluation Board	Landis + Gyr	N/A	N/A
2	Antenna	Airgain	ET900SLGADB	N/A
3	DC Power Supply	Tekpower	TP3005T	483279

Table 5-2: Cable Description

Item	Cable Type	Length	Shield	Termination
A	U.FL Cable/RF cable	93cm	Yes	1 - 2
B	DC Wires	180cm	No	1 - 3
C	AC input	180cm	Yes	3 - AC

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

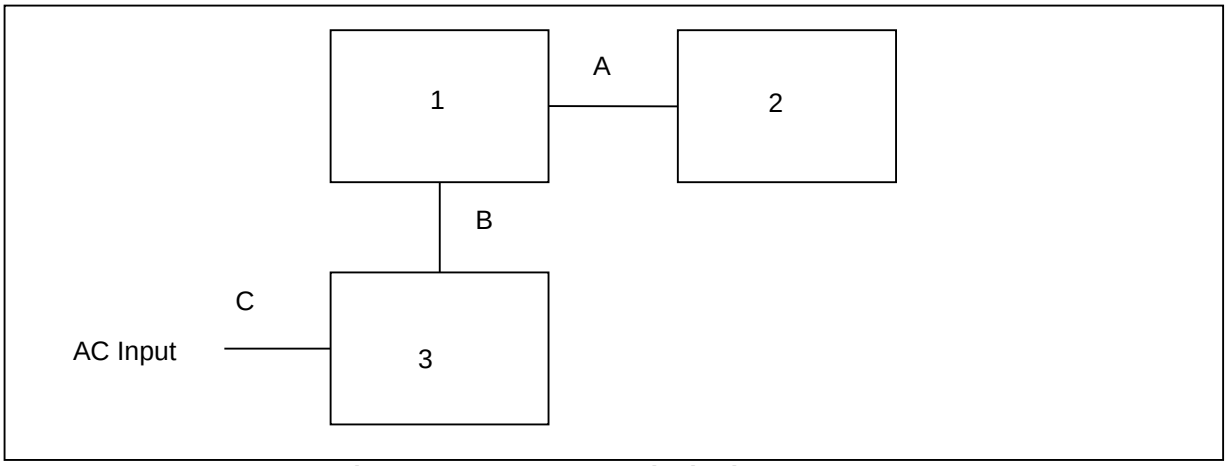

Figure 6-1: Test Setup Block Diagram

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 a panel antenna. The antenna is coupled to the device through a U.FL connector, thereby satisfying the requirements of Section 15.203. The gain of the antenna is +9.0dBi.

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

7.2.1 Measurement Procedure

ANSI C63.10 section 6 was the guiding documents for this evaluation. 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: Tyler Leeson

Table 7.2.2-1: Conducted EMI Results Line 1

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.15	54.32	36.01	66	56	-11.68	-19.99	19.39
0.165	50.99	32.53	65.21	55.21	-14.22	-22.68	19.4
0.195	50.68	32.07	63.82	53.82	-13.14	-21.75	19.39
0.22	47.44	29.89	62.82	52.82	-15.38	-22.93	19.4
0.235	43.87	22.33	62.27	52.27	-18.4	-29.94	19.43
0.25	40.86	23.94	61.76	51.76	-20.9	-27.82	19.43
0.275	40.46	22.29	60.97	50.97	-20.51	-28.68	19.47
0.445	41.32	28.49	56.97	46.97	-15.65	-18.48	19.5
0.46	40.97	24.9	56.69	46.69	-15.72	-21.79	19.51
0.5	41.72	35.71	56	46	-14.28	-10.29	19.58

Table 7.2.2-2: Conducted EMI Results Line 2

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.165	49.47	29.93	65.21	55.21	-15.74	-25.28	19.37
0.175	49.27	29.94	64.72	54.72	-15.45	-24.78	19.37
0.195	48.01	29.43	63.82	53.82	-15.81	-24.39	19.36
0.215	45.81	26.74	63.01	53.01	-17.2	-26.27	19.36
0.245	42.55	24.1	61.92	51.92	-19.37	-27.82	19.39
0.27	40.66	22.24	61.12	51.12	-20.46	-28.88	19.4
0.285	39.18	22.24	60.67	50.67	-21.49	-28.43	19.43
0.5	41.71	33.85	56	46	-14.29	-12.15	19.47
0.775	38.67	22.29	56	46	-17.33	-23.71	19.52
1.375	38.02	22.31	56	46	-17.98	-23.69	19.64

7.3 Fundamental Emission Output Power – FCC: Section 15.247(b)(2), ISED Canada: RSS-247 Section 5.4(1)

7.3.1 Measurement Procedure

The maximum conducted output power was measured in accordance with FCC KDB 558074 D01. The RF output of the equipment under test was directly connected to the input of the power meter applying suitable attenuation. The device employs >50 channels therefore the power is limited to 1 Watt. All data rates were evaluated and the worst-case is reported. The worst-case data rate was 50kbps for 902.2 MHz, 9.6kbps for 902.3 MHz and 927.9MHz, and 38.4kbps for 915 MHz.

7.3.2 Measurement Results

Performed by: Tyler Leeson

Table 7.3.2-1: Conducted Output Power

Frequency [MHz]	Level [dBm]
902.2	25.11
902.3	25.08
915.0	25.17
927.0	24.74

7.4 Emission Levels

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

7.4.1.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 10GHz, 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.

7.4.1.2 Measurement Results

Performed by: Tyler Leeson

Table 7.4.1.2-1: Radiated Spurious Emissions Tabulated Data – ZPOS

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
902.2 MHz										
2706.6	44.40	33.90	H	3.65	48.05	37.55	74.0	54.0	25.9	16.4
2706.6	44.10	33.80	V	3.65	47.75	37.45	74.0	54.0	26.2	16.5
3608.8	44.20	33.70	H	5.56	49.76	39.26	74.0	54.0	24.2	14.7
3608.8	43.80	32.00	V	5.56	49.36	37.56	74.0	54.0	24.6	16.4
915 MHz										
2745	44.90	33.50	H	3.90	48.80	37.40	74.0	54.0	25.2	16.6
2745	44.00	31.70	V	3.90	47.90	35.60	74.0	54.0	26.1	18.4
3660	44.10	31.10	H	5.82	49.92	36.92	74.0	54.0	24.1	17.1
3660	42.6	29.3	V	5.82	48.42	35.12	74.0	54.0	25.6	18.9
7320	45.7	32.8	H	15.25	60.95	48.05	74.0	54.0	13.1	6.0
8235	44.8	31.9	H	17.21	62.01	49.11	74.0	54.0	12.0	4.9
8235	45.9	33	V	17.21	63.11	50.21	74.0	54.0	10.9	3.8
927.9 MHz										
2783.4	45.20	35.30	H	4.15	49.35	39.45	74.0	54.0	24.7	14.6
2783.4	44.20	31.80	V	4.15	48.35	35.95	74.0	54.0	25.7	18.1
3711.2	43.10	30.00	H	6.07	49.17	36.07	74.0	54.0	24.8	17.9
3711.2	42.90	30.00	V	6.07	48.97	36.07	74.0	54.0	25.0	17.9

7.4.1.3 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 – ZPOS – Vertical Polarity – 8235 MHz

Corrected Level: 45.9 + 17.21 = 63.11dBuV/m
Margin: 74dBuV/m – 63.11dBuV/m = 10.9dB

Example Calculation: Average – ZPOS – Vertical Polarity – 8235 MHz

Corrected Level: 33 + 17.21 - 0 = 50.21dBuV
Margin: 54dBuV – 50.21dBuV = 3.8dB

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 NIC AM, manufactured by Landis+Gyr Technology, Inc. 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

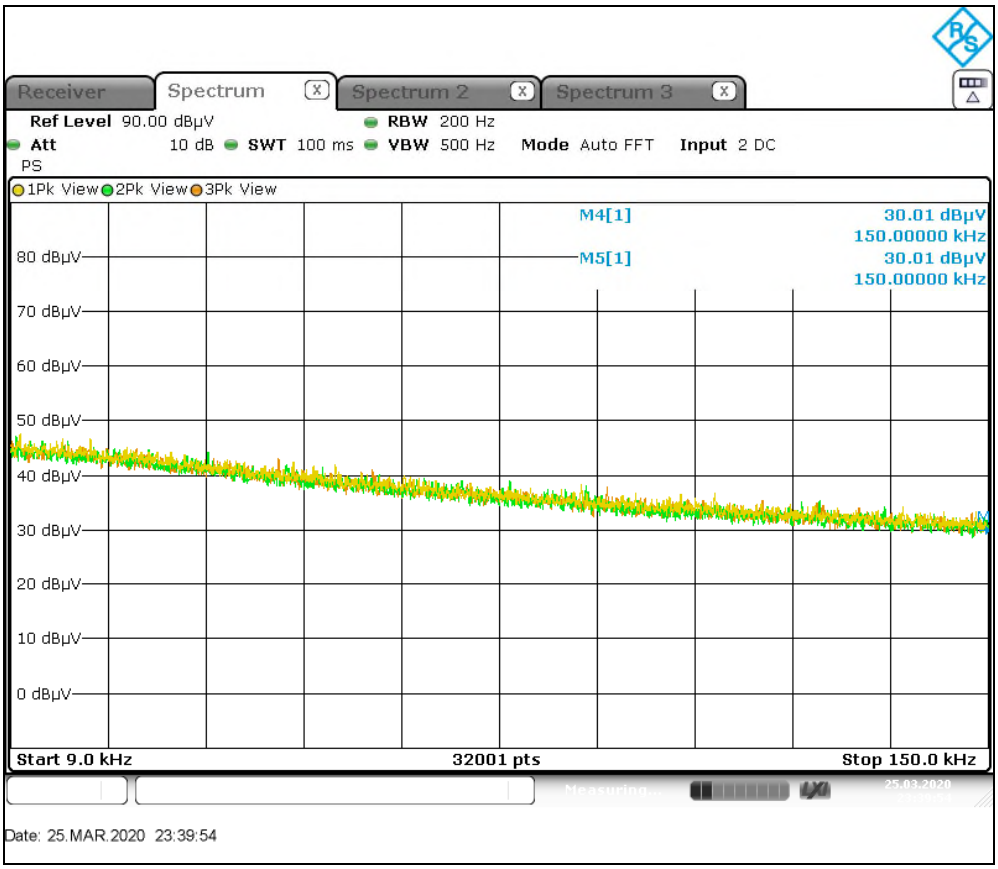

Figure A-1: 9 kHz – 150 kHz

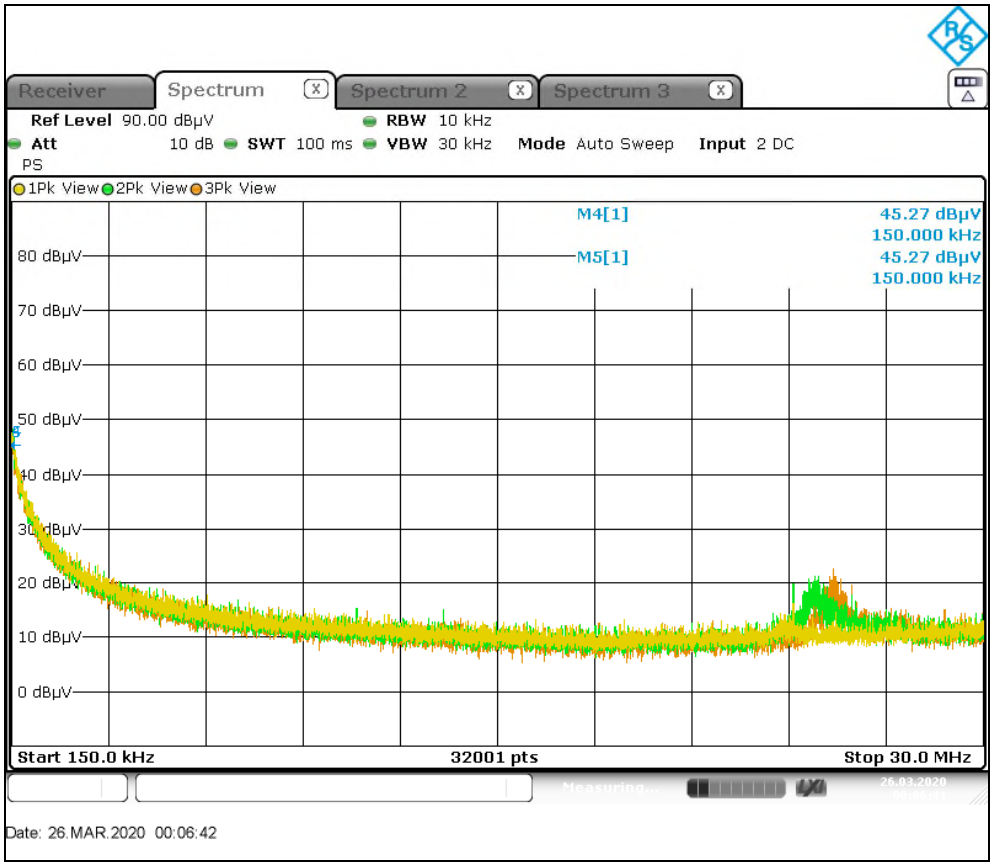

Figure A-2: 150 kHz to 30 MHz

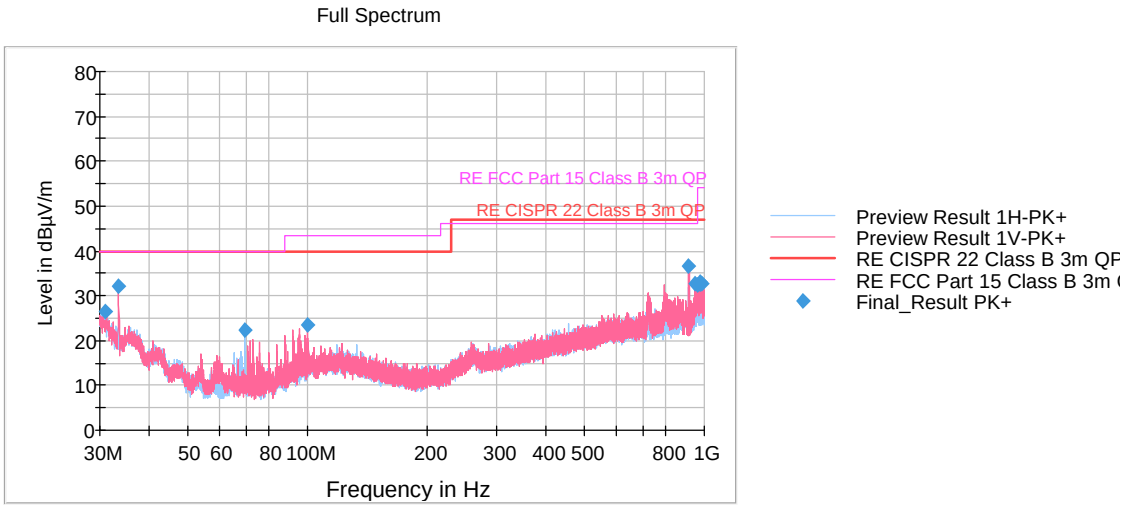

Figure A-3: 30 MHz – 1GHz (Mid Channel)

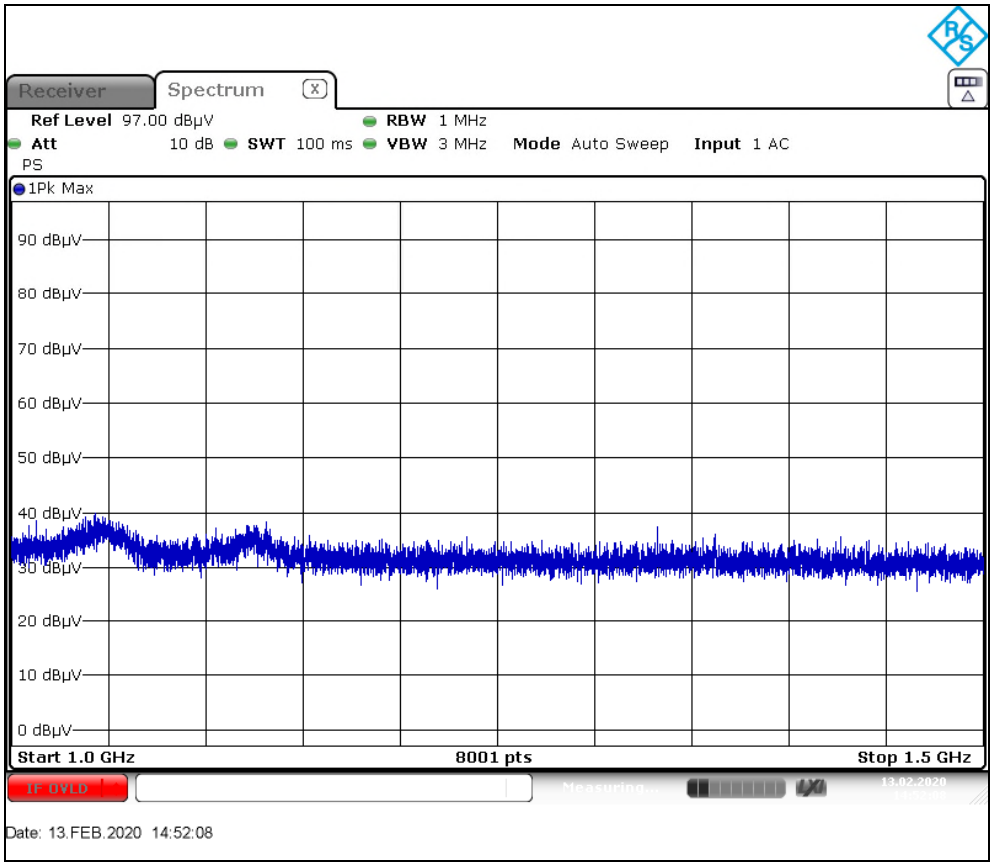

Figure A-4: 1 GHz – 1.5 GHz (No filter)

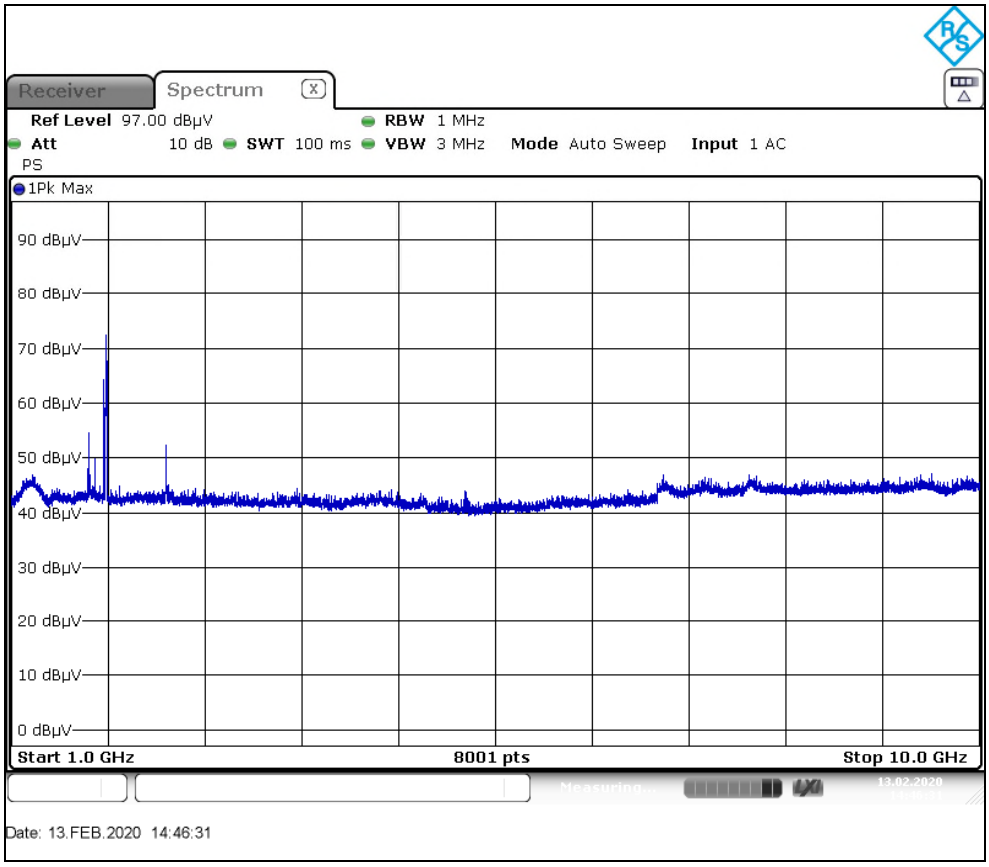

Figure A-5: 1 GHz – 10 GHz (Filter included)

END REPORT