Certification Test Report

FCC ID: R7PNG1R1S1
IC: 5294A-NG1R1S1

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

Report Number: AT72146019-1P1

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

Test Begin Date: January 22, 2019
Test End Date: January 25, 2019

Report Issue Date: March 1, 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.

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This report contains 16 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 a Class II Permissive Change.

The purpose of this change is to add two (2) new antennas to the original filing.

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 5 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	902.5 - 927.5	51	500	300
4	902.2 - 927.8	129	200	50.0
5	902.4 - 927.6	64	400	150, 200

Modulations: FSK/GFSK
Antenna Type/Gain: Omnidirectional Whip / +5.5dBi (Original)
Skywave Omnidirectional PCB / +2.15 dBi (New)
Laird Omnidirectional Whip / +5.15 dBi (New)
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 antennas Laird FG9023 and Skywave 11-1106E to the original filing. Due to the addition of two (2) new antennas and no other changes performed on the module, this evaluation was limited to Radiated Spurious Emissions and AC Power Line Conducted Emissions only.

For radiated emissions, the EUT was evaluated in X-orientation due to it being worst case from original filing.

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

Power setting during test: 51

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 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.

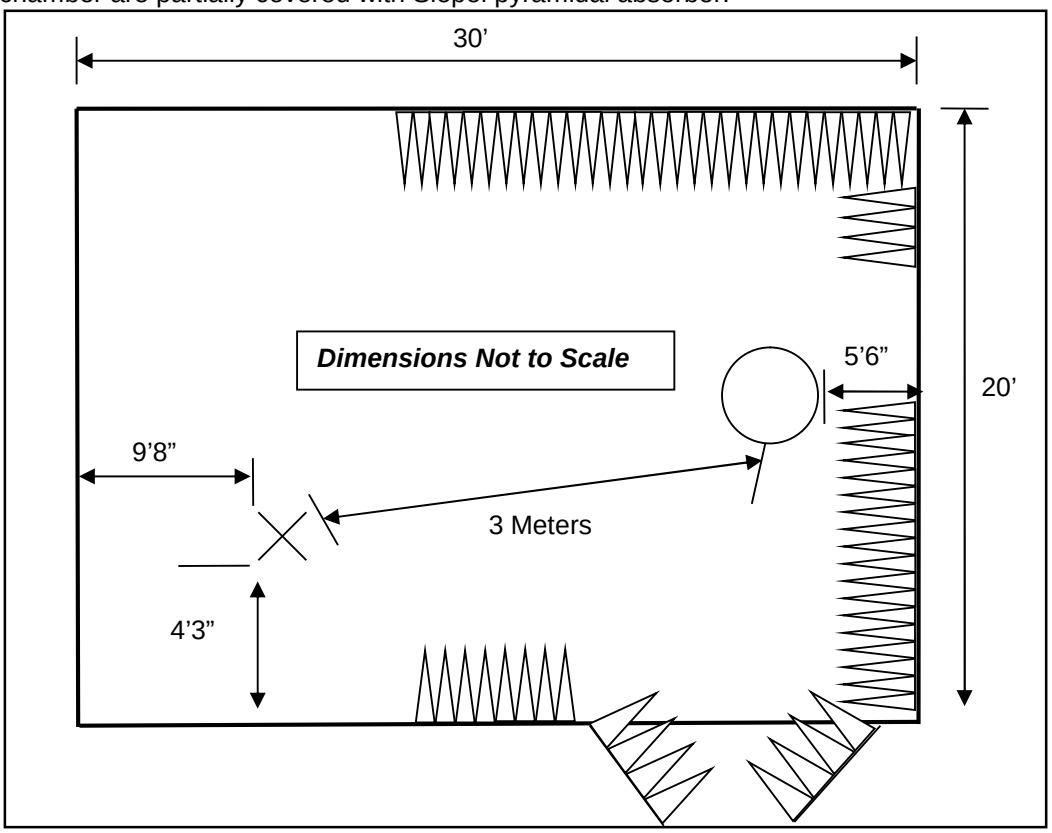

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

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.

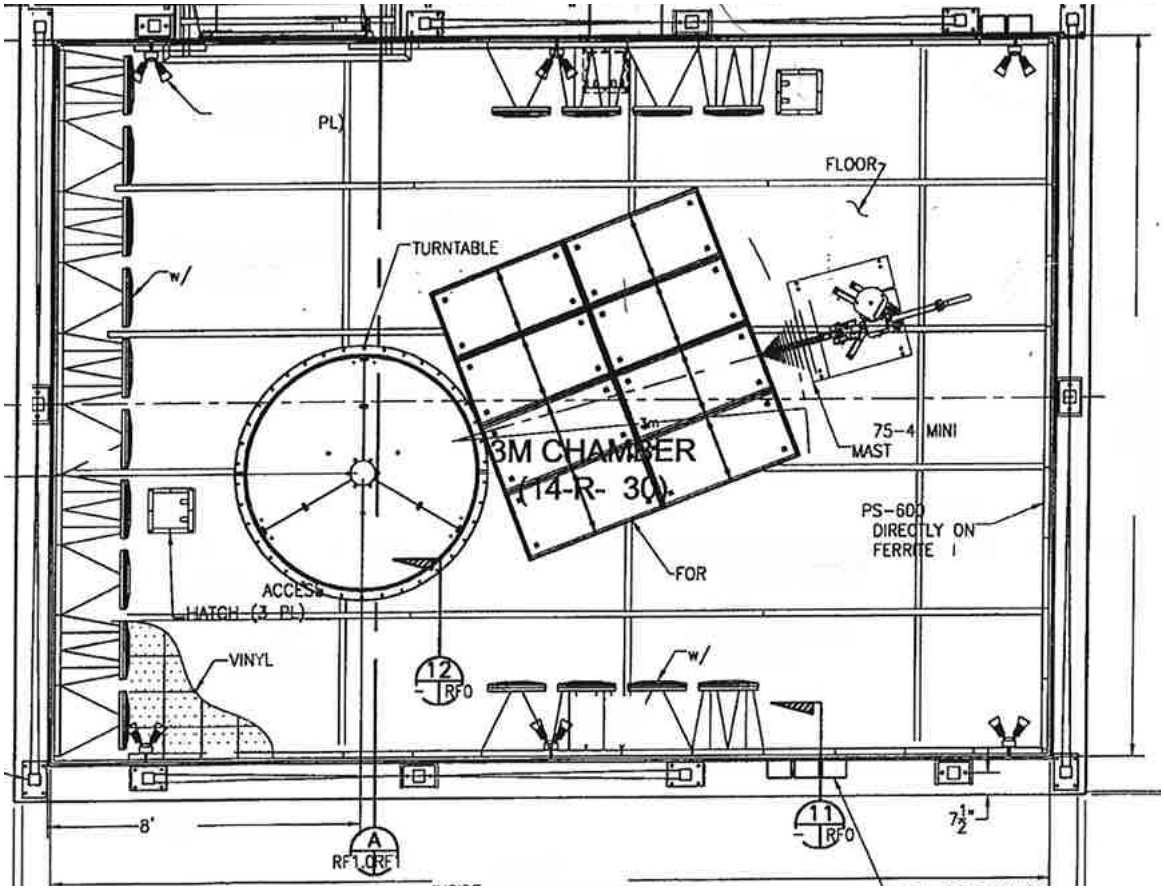

Figure 2.3.2-1: Semi-Anechoic Chamber Test Site – Chamber B

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

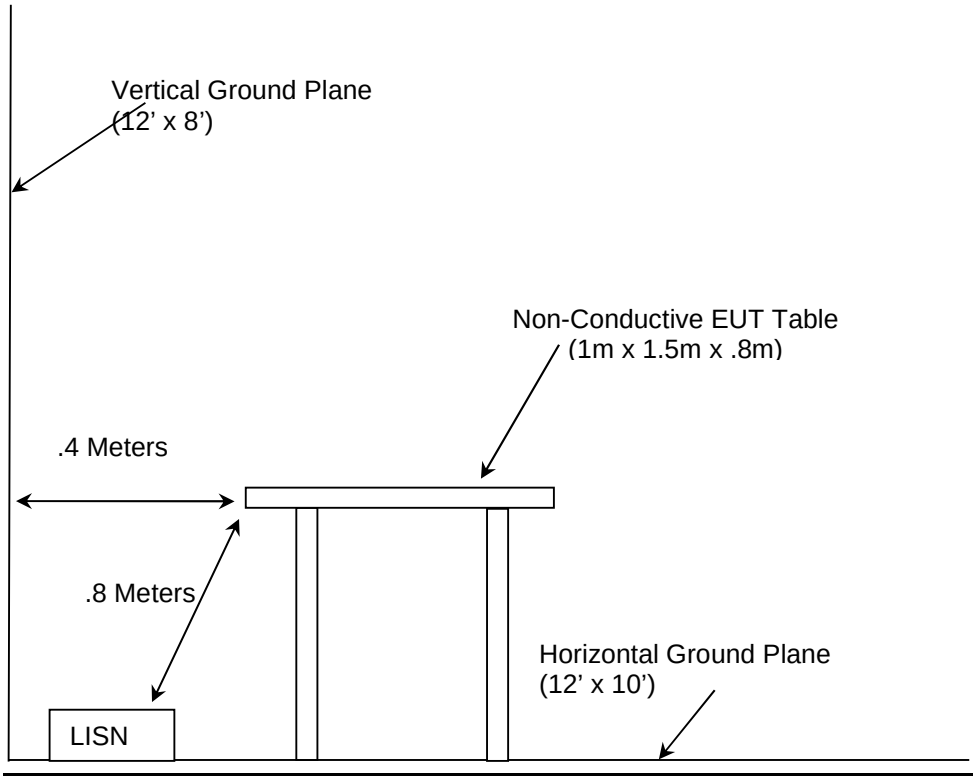

Figure 2.4.1-1: AC Mains Conducted EMI Site

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, 2019
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2019
- FCC KDB 558074 D01 DTS Meas Guidance v05r01 - Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules, February 11, 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, April 2018.

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
30	Spectrum Technologies	DRH-0118	1-18GHz Horn Antenna	970102	05/09/2017	05/09/2019
213	TEC	PA 102	Amplifier	44927	07/19/2018	07/19/2019
324	ACS	Belden	Conducted EMI Cable	8214	04/05/2018	04/05/2019
337	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	282706	05/16/2018	05/16/2019
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	07/30/2018	07/30/2020
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	02/11/2016	02/11/2019
813	PMM	9010	EMI Receiver; RF Input 50ohm; 10Hz-50MHz; 10Hz-30MHz	697WW30606	02/12/2018	02/12/2019
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2018	05/01/2019
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2019
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	07/11/2018	07/11/2019

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	Wall Wart Power Supply	XP Power	VEL05US050-US-JA	N/A
3	PCB Antenna	Skywave	11-1106E	N/A
4	Whip Antenna	Laird	FG9023	39376

Table 5-2: Cable Description

Item	Cable Type	Length	Shield	Termination
A	Power Cable	1.5 m	No	2 – 1
B	U.FL Cable	22cm	No	1 - 3/4

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

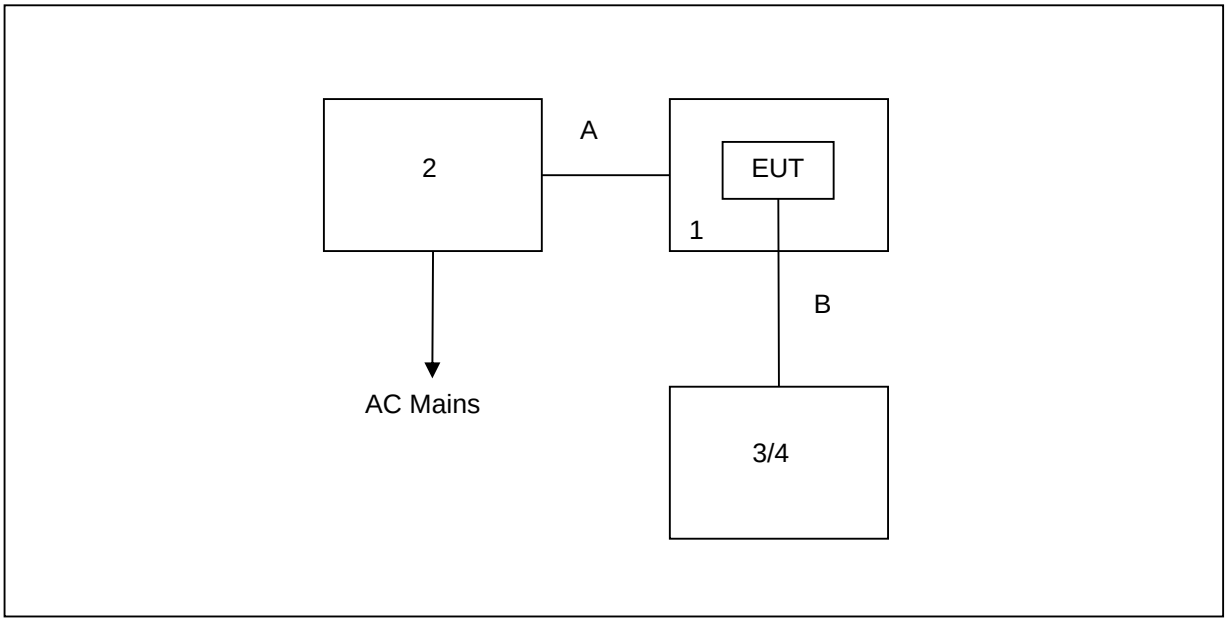

Figure 6-1: Test Setup Block Diagram

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 omnidirectional PCB antenna and an omnidirectional whip antenna. The antennas are coupled to the device with a U.FL connector. The gain of the antenna is +2.15dBi and +5.15dBi respectively.

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 = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Performed by: Tyler Leeson

Table 7.2.2-1: Conducted EMI Results Line 1 – PCB Antenna

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.154	38.86	27.86	65.78	55.78	-26.92	-27.92	9.58
0.186	37.46	24.28	64.21	54.21	-26.75	-29.93	9.58
0.598	34.85	25.73	56	46	-21.15	-20.27	9.59
0.634	34.63	21.51	56	46	-21.37	-24.49	9.59
0.722	35.19	29.24	56	46	-20.81	-16.76	9.59
0.974	38.52	25.4	56	46	-17.48	-20.6	9.6
3.586	30.46	19.05	56	46	-25.54	-26.95	9.63
3.738	34.94	25.21	56	46	-21.06	-20.79	9.63
3.91	39.43	27.9	56	46	-16.57	-18.1	9.63
15.386	35.12	25.88	60	50	-24.88	-24.12	9.82

Table 7.2.2-2: Conducted EMI Results Line 2 – PCB Antenna

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	36.31	30.03	66	56	-29.69	-25.97	9.59
0.186	30.44	26.5	64.21	54.21	-33.77	-27.71	9.58
0.814	25.77	19.61	56	46	-30.23	-26.39	9.59
0.83	31.27	27.53	56	46	-24.73	-18.47	9.59
0.87	31.24	26.49	56	46	-24.76	-19.51	9.59
3.17	27.11	20.54	56	46	-28.89	-25.46	9.62
3.766	30.19	21.71	56	46	-25.81	-24.29	9.63
3.934	34.86	23.58	56	46	-21.14	-22.42	9.63
13.854	28.8	21.71	60	50	-31.2	-28.29	9.81
16.838	31.51	22.51	60	50	-28.49	-27.49	9.85

Table 7.2.2-3: Conducted EMI Results Line 1 – Whip Antenna

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.646	34.66	30.95	56	46	-21.34	-15.05	9.59
0.678	34.9	31.19	56	46	-21.1	-14.81	9.59
0.746	36.88	30.67	56	46	-19.12	-15.33	9.59
0.882	36.82	29.81	56	46	-19.18	-16.19	9.6
3.622	35.83	23.32	56	46	-20.17	-22.68	9.63
3.822	36.69	26.05	56	46	-19.31	-19.95	9.63
3.894	36.88	24.37	56	46	-19.12	-21.63	9.63
4.03	37.24	25.59	56	46	-18.76	-20.41	9.63
13.002	28	20.9	60	50	-32	-29.1	9.77
14.738	33.85	24.99	60	50	-26.15	-25.01	9.81

Table 7.2.2-4: Conducted EMI Results Line 2 – Whip Antenna

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.574	25.85	20.94	56	46	-30.15	-25.06	9.59
0.606	25.22	14.73	56	46	-30.78	-31.27	9.59
0.822	31.99	29.74	56	46	-24.01	-16.26	9.59
1.898	29.68	14.12	56	46	-26.32	-31.88	9.61
2.998	26.87	22.39	56	46	-29.13	-23.61	9.62
3.394	25.69	18.75	56	46	-30.31	-27.25	9.62
3.622	27.36	16.19	56	46	-28.64	-29.81	9.63
3.75	33.71	23.48	56	46	-22.29	-22.52	9.63
13.906	30.24	21.52	60	50	-29.76	-28.48	9.81
16.11	32.85	23.57	60	50	-27.15	-26.43	9.84

7.3 Emission Levels

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

7.3.1.1 Measurement Procedure

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

7.3.1.2 Measurement Results

Performed by: Tyler Leeson

Table 7.3.1.2-1: Radiated Spurious Emissions Tabulated Data – PCB Antenna

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
Lowest Channel										
2706.6	47.90	41.80	H	1.99	49.89	43.79	74.0	54.0	24.1	10.2
2706.6	47.50	41.50	V	1.99	49.49	43.49	74.0	54.0	24.5	10.5
3608.8	44.10	33.20	H	5.19	49.29	38.39	74.0	54.0	24.7	15.6
3608.8	43.30	31.40	V	5.19	48.49	36.59	74.0	54.0	25.5	17.4
4511	43.80	33.10	H	6.73	50.53	39.83	74.0	54.0	23.5	14.2
5413.2	42.10	29.40	H	9.78	51.88	39.18	74.0	54.0	22.1	14.8
5413.2	41.80	30.10	V	9.78	51.58	39.88	74.0	54.0	22.4	14.1
Middle Channel										
2745	45.70	38.10	H	2.13	47.83	40.23	74.0	54.0	26.2	13.8
2745	47.40	41.10	V	2.13	49.53	43.23	74.0	54.0	24.5	10.8
3660	44.60	34.10	H	5.28	49.88	39.38	74.0	54.0	24.1	14.6
3660	43.60	32.60	V	5.28	48.88	37.88	74.0	54.0	25.1	16.1
4575	44.10	32.70	H	7.00	51.10	39.70	74.0	54.0	22.9	14.3
Highest Channel										
2782.8	49.10	43.60	H	2.27	51.37	45.87	74.0	54.0	22.6	8.1
2782.8	47.10	40.40	V	2.27	49.37	42.67	74.0	54.0	24.6	11.3
3710.4	45.90	36.40	H	5.36	51.26	41.76	74.0	54.0	22.7	12.2
3710.4	45.30	35.70	V	5.36	50.66	41.06	74.0	54.0	23.3	12.9
4638	43.30	31.90	H	7.27	50.57	39.17	74.0	54.0	23.4	14.8

Table 7.3.1.2-2: Radiated Spurious Emissions Tabulated Data – Whip Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Lowest Channel										
2706.6	46.40	38.10	H	1.99	48.39	40.09	74.0	54.0	25.6	13.9
2706.6	47.60	40.90	V	1.99	49.59	42.89	74.0	54.0	24.4	11.1
3608.8	43.10	30.50	H	5.19	48.29	35.69	74.0	54.0	25.7	18.3
3608.8	43.70	31.10	V	5.19	48.89	36.29	74.0	54.0	25.1	17.7
4511	43.30	30.40	H	6.73	50.03	37.13	74.0	54.0	24.0	16.9
Middle Channel										
2745	45.60	35.40	H	2.13	47.73	37.53	74.0	54.0	26.3	16.5
2745	46.60	39.10	V	2.13	48.73	41.23	74.0	54.0	25.3	12.8
4575	43.30	30.20	H	7.00	50.30	37.20	74.0	54.0	23.7	16.8
Highest Channel										
2782.8	45.90	37.10	H	2.27	48.17	39.37	74.0	54.0	25.8	14.6
2782.8	46.90	40.30	V	2.27	49.17	42.57	74.0	54.0	24.8	11.4
4638	43.30	32.10	H	7.27	50.57	39.37	74.0	54.0	23.4	14.6

7.3.1.3 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 – PCB Antenna – Horizontal Polarity – 2706.6 MHz

Corrected Level: 47.9 + 1.99 = 49.89dBuV/m
Margin: 74dBuV/m – 49.89dBuV/m = 24.1dB

Example Calculation: Average – PCB Antenna – Horizontal Polarity – 2706.6 MHz

Corrected Level: 41.8 + 1.99 - 0 = 43.79dBuV
Margin: 54dBuV – 43.79dBuV = 10.2dB

8 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.

END REPORT