Certification Test Report

FCC ID: R7PNG0R1S3
IC: 5294A-NG0R1S3

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

Report Number: AT72128631-1P1

Manufacturer: Landis+Gyr Technology, Inc.
Model: S5 SBR

Test Begin Date: July 10, 2017
Test End Date: July 12, 2017

Report Issue Date: August 31, 2017

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: AT-2021

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

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This report contains 15 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 Certification for Class II Permissive Change.

The purpose of this evaluation for Class II Permissive Change is to address the addition of a new antenna and host combination. No RF output power or hardware changes were made to the device for this evaluation.

1.2 Product description

The S5 SBR contains (1) 900 MHz LAN frequency hopping spread spectrum radio.

Technical Information:
The model S5 SBR 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 - 927.8	239	100	9.6, 19.2, 38.4
3	902.5 - 927.5	51	500	300.0
4	902.2 - 927.8	129	200	50.0
5	902.4 - 927.6	64	400	150, 200

Modulation Format: FSK/GFSK
Antenna Type / Gain: Planar Inverted F Antenna / -3.0dBi
Operating Voltage: 120Vac / 60Hz

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

EUT Serial Numbers: 915A03D3

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated for each mode. The data presented in this report represents the worst case where applicable.

For radiated emissions, the EUT was evaluated in an orientation typical of the host device installation. See test setup photos for more information. The worst case data rate was evaluated based on the original certification. The worst-case data rates evaluated was 9.6kbps for the Middle and Highest Channel and 50kbps for the Lowest Channel.

For AC power line conducted emissions the EUT was evaluated with a host device connected directly to the AC Mains.

This evaluation is for the addition of an antenna and host combination, therefore RF Conducted measurements were not performed.

Power setting during test: 42

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program, and has been issued certificate number AT-2021 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Innovation, Science, and Economic Development Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 391271
Innovation, Science, and Economic Development Canada Lab Code: IC 4175A
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

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 150cm in diameter and is located 160cm 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 table 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 chases from the turntable to the pit that allow 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.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

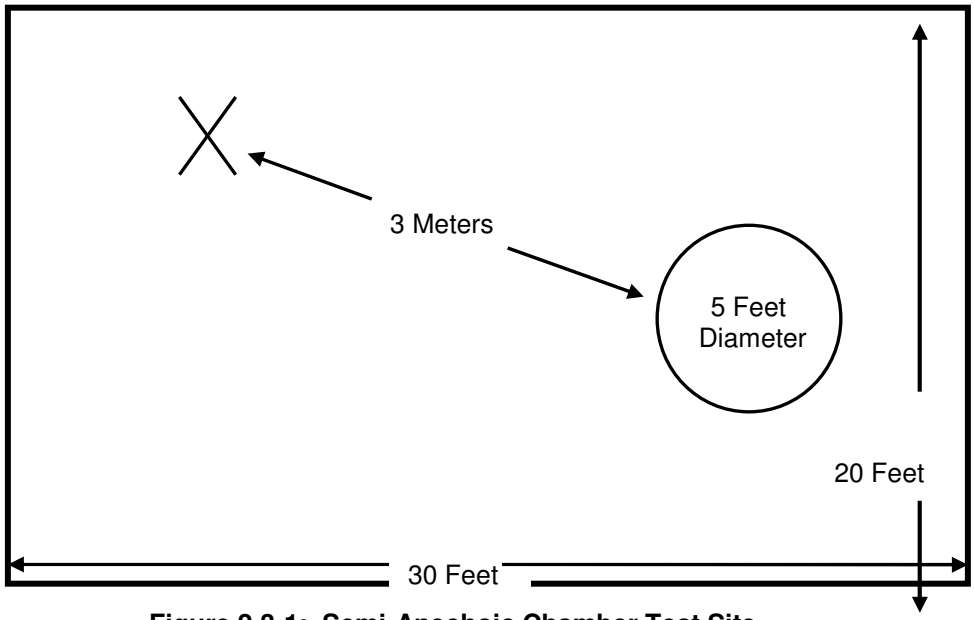

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 – 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' 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.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 – 4" PVC chases from the pit to the control room that allow 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 pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.10.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

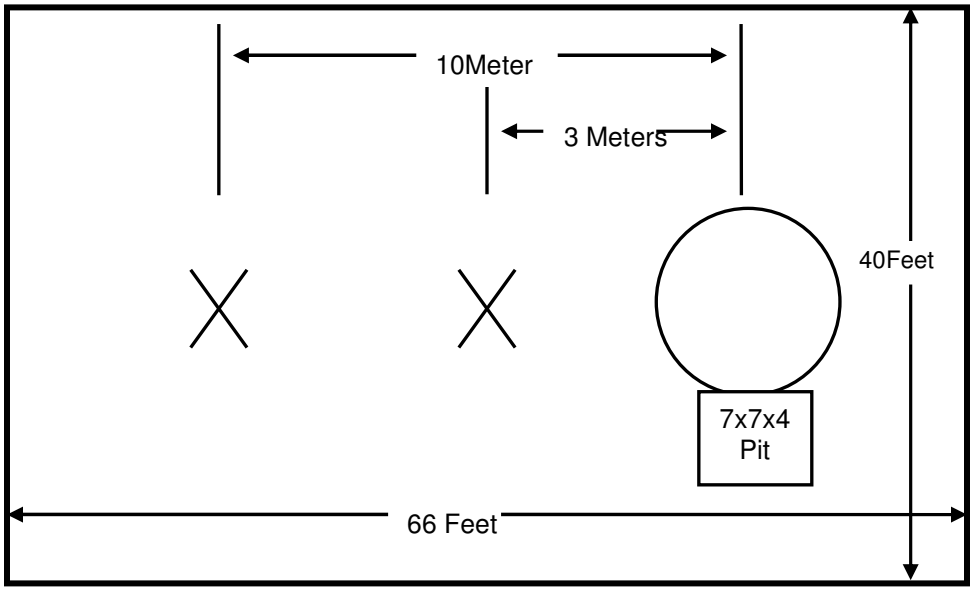

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with ANSI C63.10.

A diagram of the room is shown below in figure 2.4-1:

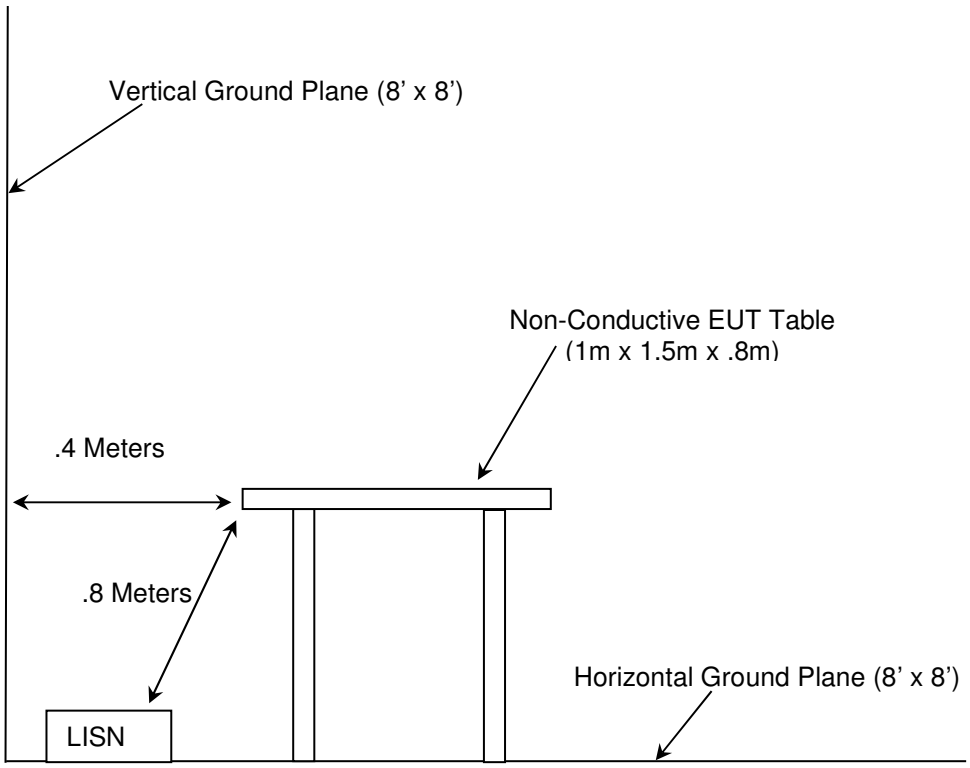

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2017
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- 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, Feb 2017
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 4, Nov 2014.

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

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/9/2017	5/9/2019
40	EMCO	3104	Antennas	3211	6/8/2016	6/8/2018
73	Agilent	8447D	Amplifiers	2727A05624	7/21/2016	7/21/2017
167	ACS	Chamber EMI Cable Set	Cable Set	167	9/30/2016	9/30/2017
324	ACS	Belden	Cables	8214	3/21/2017	3/21/2018
331	Microwave Circuits	H1G513G1	Filters	31417	5/13/2017	5/13/2018
338	Hewlett Packard	8449B	Amplifiers	3008A01111	8/21/2015	8/21/2017
412	Electro Metrics	LPA-25	Antennas	1241	8/8/2016	8/8/2018
422	Florida RF	SMS-200AW-72.0-SMR	Cables	805	10/27/2016	10/27/2017
616	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	9/2/2016	9/2/2017
676	Florida RF Labs	SMS-290AW-480.0-SMS	Cables	MFR2Y194	11/4/2016	11/4/2017
812	PMM	9030	Receiver	121WW30401	2/6/2017	2/6/2018
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2016	7/11/2017
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2017	7/11/2018
RE135	Rohde & Schwarz	FSP30	Spectrum Analyzers	835618/031	10/31/2016	10/31/2017

NCR = No Calibration Required
NOTE: All test equipment was used only during active calibration cycles.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model/Part Number	Serial Number
1	Host Device	Landis + Gyr	Streetlight Controller	N/A
2	Junction Box	Landis + Gyr	N/A	N/A

Table 5-2: Cable Description

Cable	Cable Type	Length	Shield	Termination
A	AC Power Cable	1.75 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

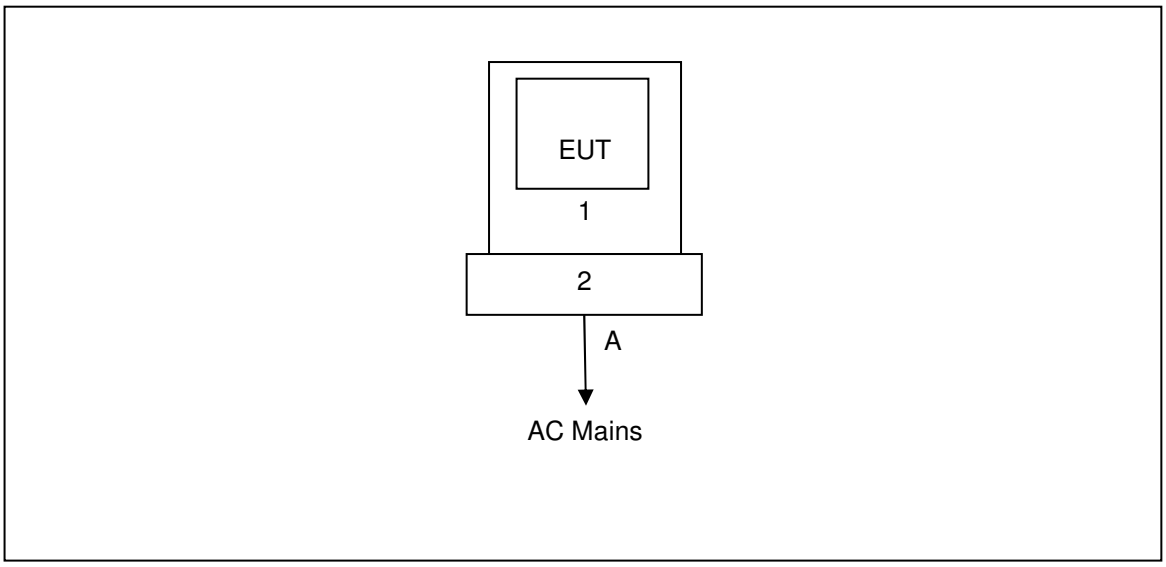

Figure 6-1: Test Setup Block Diagram

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: Section 15.203

The EUT utilizes a Planar Inverted F Antenna with -3.0dBi gain. The antenna is mounted directly to the device and cannot be removed without damaging the device, therefore meeting the requirements of 15.203.

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

7.2.1 Measurement Procedure

Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. 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: Sean Vick

Table 7.2.2-1: Conducted EMI Results Line 1

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	36.84	22.24	66	56	-29.16	-33.76	9.59
0.154	32.4	29.81	65.78	55.78	-33.38	-25.97	9.58
0.178	34.87	29.54	64.58	54.58	-29.71	-25.04	9.58
0.266	34.15	30.89	61.24	51.24	-27.09	-20.35	9.58
0.35	34.45	29.17	58.96	48.96	-24.51	-19.79	9.58
0.422	32.74	28.62	57.41	47.41	-24.67	-18.79	9.59
0.442	37.19	32.89	57.02	47.02	-19.83	-14.13	9.59
2.374	27.18	25.45	56	46	-28.82	-20.55	9.71
3.814	20.65	10.46	56	46	-35.35	-35.54	9.73
29.974	21.67	13.33	60	50	-38.33	-36.67	9.91

Table 7.2.2-2: Conducted EMI Results Line 2

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	
0.15	31.62	28.39	66	56	-34.38	-27.61	9.59
0.154	32.5	29.78	65.78	55.78	-33.28	-26	9.58
0.178	35.01	31.08	64.58	54.58	-29.57	-23.5	9.58
0.262	33.19	30.99	61.37	51.37	-28.18	-20.38	9.59
0.35	32.84	28.63	58.96	48.96	-26.12	-20.33	9.59
0.438	37	31.85	57.1	47.1	-20.1	-15.25	9.59
2.522	27.17	25.37	56	46	-28.83	-20.63	9.72
3.682	18.81	10.47	56	46	-37.19	-35.53	9.73
3.818	18.8	10.46	56	46	-37.2	-35.54	9.73
20.766	26.92	24.54	60	50	-33.08	-25.46	9.91

7.3 Radiated Spurious Emissions – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9/8.10

7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 10 GHz, 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.

The EUT was caused to generate a continuous modulated carrier on the hopping channel.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

7.3.2 Measurement Results

Performed by: Arthur Sumner

Table 7.3.2-1: 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
Low Channel										
2706.6	58.04	50.19	H	-4.00	54.04	46.19	74.0	54.0	20.0	7.8
2706.6	57.17	50.30	V	-4.00	53.17	46.30	74.0	54.0	20.8	7.7
3608.8	50.07	38.64	H	-1.01	49.06	37.63	74.0	54.0	24.9	16.4
3608.8	50.54	42.26	V	-1.01	49.53	41.25	74.0	54.0	24.5	12.7
4511	46.81	35.98	H	0.60	47.41	36.58	74.0	54.0	26.6	17.4
4511	48.18	37.87	V	0.60	48.78	38.47	74.0	54.0	25.2	15.5
5413.2	47.45	38.70	H	3.49	50.94	42.19	74.0	54.0	23.1	11.8
5413.2	48.59	41.55	V	3.49	52.08	45.04	74.0	54.0	21.9	9.0
Middle Channel										
2745	53.87	49.14	H	-3.89	49.98	45.25	74.0	54.0	24.0	8.7
2745	52.77	48.32	V	-3.89	48.88	44.43	74.0	54.0	25.1	9.6
3660	48.77	36.78	H	-0.83	47.94	35.95	74.0	54.0	26.1	18.0
3660	49.13	39.50	V	-0.83	48.30	38.67	74.0	54.0	25.7	15.3
4575	46.15	34.39	H	0.83	46.98	35.22	74.0	54.0	27.0	18.8
4575	47.27	35.93	V	0.83	48.10	36.76	74.0	54.0	25.9	17.2
High Channel										
2783.4	52.42	47.84	H	-3.77	48.65	44.07	74.0	54.0	25.3	9.9
2783.4	54.10	49.39	V	-3.77	50.33	45.62	74.0	54.0	23.7	8.4
3711.2	50.04	40.11	H	-0.65	49.39	39.46	74.0	54.0	24.6	14.5
3711.2	50.74	42.22	V	-0.65	50.09	41.57	74.0	54.0	23.9	12.4
4639	46.35	34.40	H	1.06	47.41	35.46	74.0	54.0	26.6	18.5
4639	47.30	36.47	V	1.06	48.36	37.53	74.0	54.0	25.6	16.5

7.3.3 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: 58.04 - 4.00 = 54.04dBuV/m
Margin: 74dBuV/m – 54.04dBuV/m = 20.0dB

Example Calculation: Average

Corrected Level: 50.19 - 4.00 - 0 = 46.19dBuV
Margin: 54dBuV – 46.19dBuV = 7.8dB

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%.

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 TÜV SÜD America, Inc. the S5 SBR, manufactured by Landis+Gyr Technology, Inc. meets the requirements of FCC Part 15 subpart C and Innovation, Science, and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented in this test report.

END REPORT