Certification Test Report

FCC ID: R7PNG0R1S3
IC: 5294A-NG0R1S3

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

Report Number: AT72142812-1P2

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

Test Begin Date: October 5, 2018
Test End Date: October 9, 2018

Report Issue Date: December 5, 2018

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 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 Certification for a Class II Permissive Change. The permissive change is to address a change in antenna type and gain.

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: Whip / 5.0 dBi (original)
Planar Inverted F Antenna / -3.0 dBi (original)
3D PIFA / 3.0 dBi **(new antenna)**
Operating Voltage: 4.2Vdc

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

Test Sample Serial Number: 915A16C6

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

1.3 Test Methodology and Considerations

This Class II Permissive Change is to address the addition of a new antenna type, therefore this evaluation was limited to radiated spurious emissions and power line conducted emissions only. 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 Y-position. The worst-case data rate was evaluated based on the original certification. The worst-case data rates evaluated were 9.6kbps for the Middle and Highest Channel and 50kbps for the Lowest Channel.

For power line conducted emissions, the EUT was powered by a representative wall wart power supply.

Software power setting during test: 42

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.

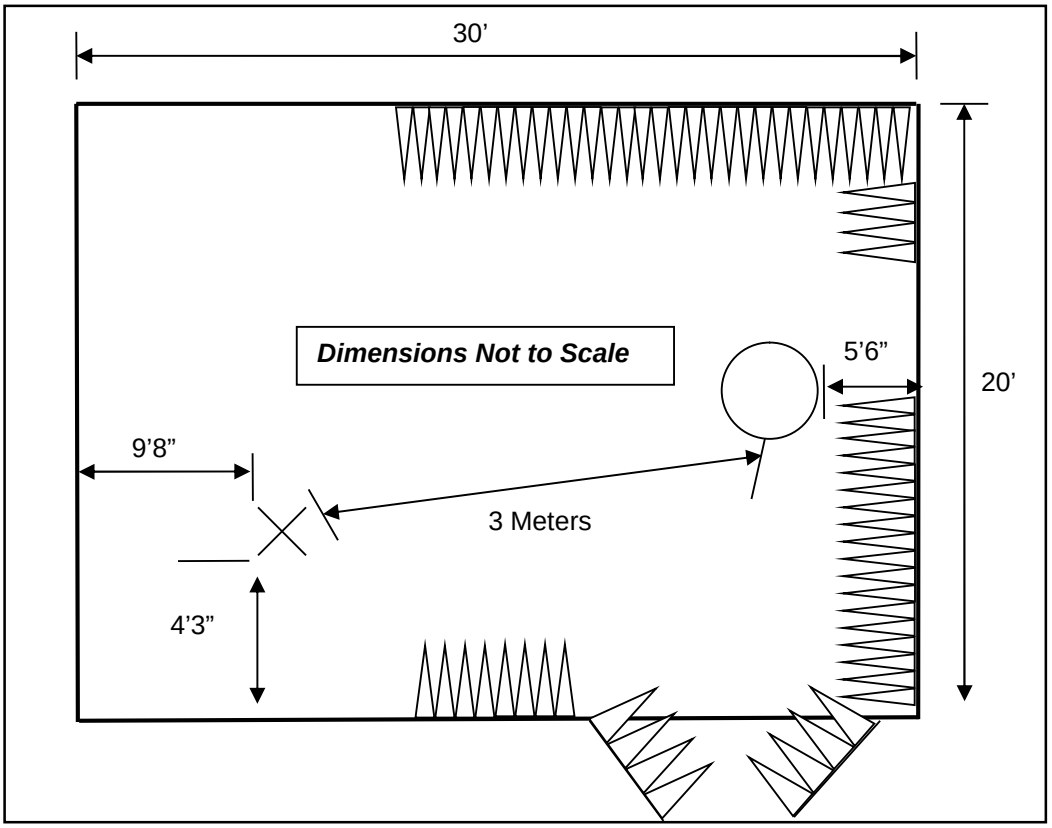

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

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.

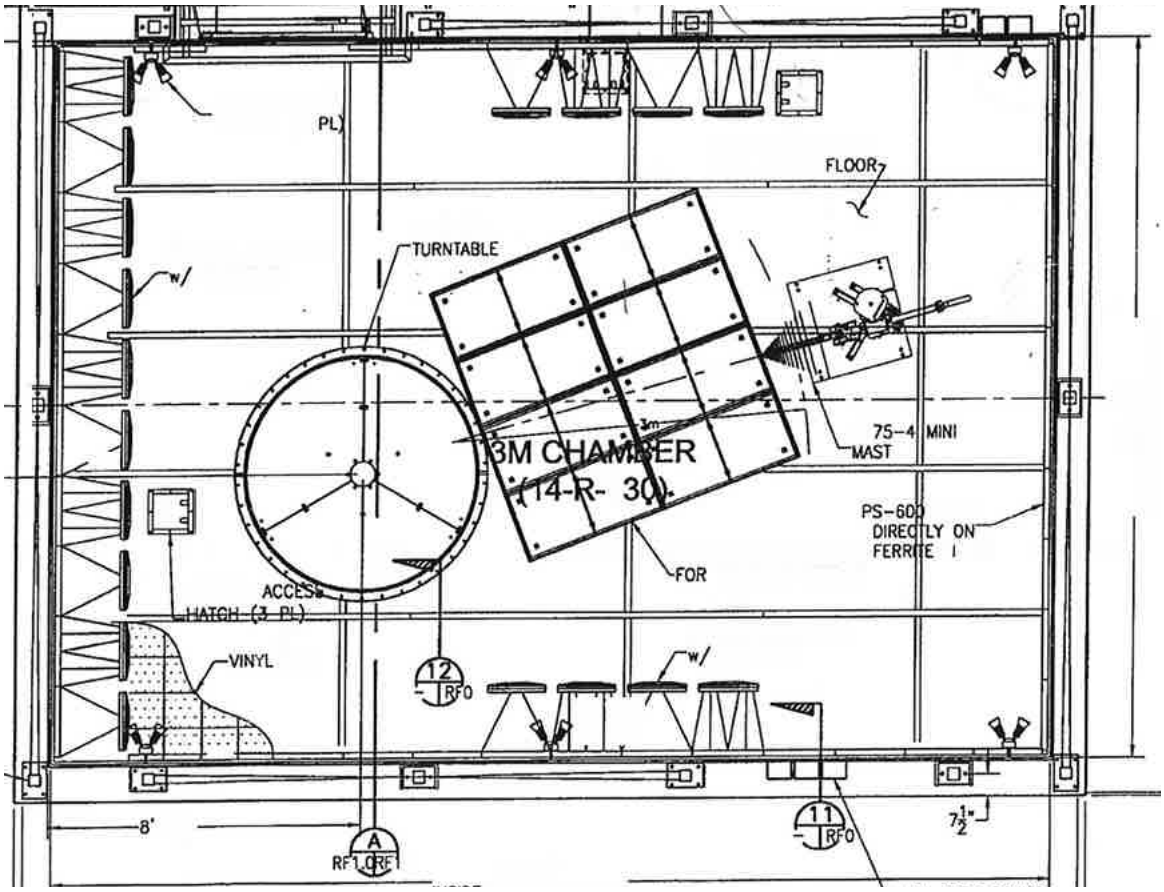

Figure 2.3.1-2: Semi-Anechoic Chamber Test Site – Chamber B

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.

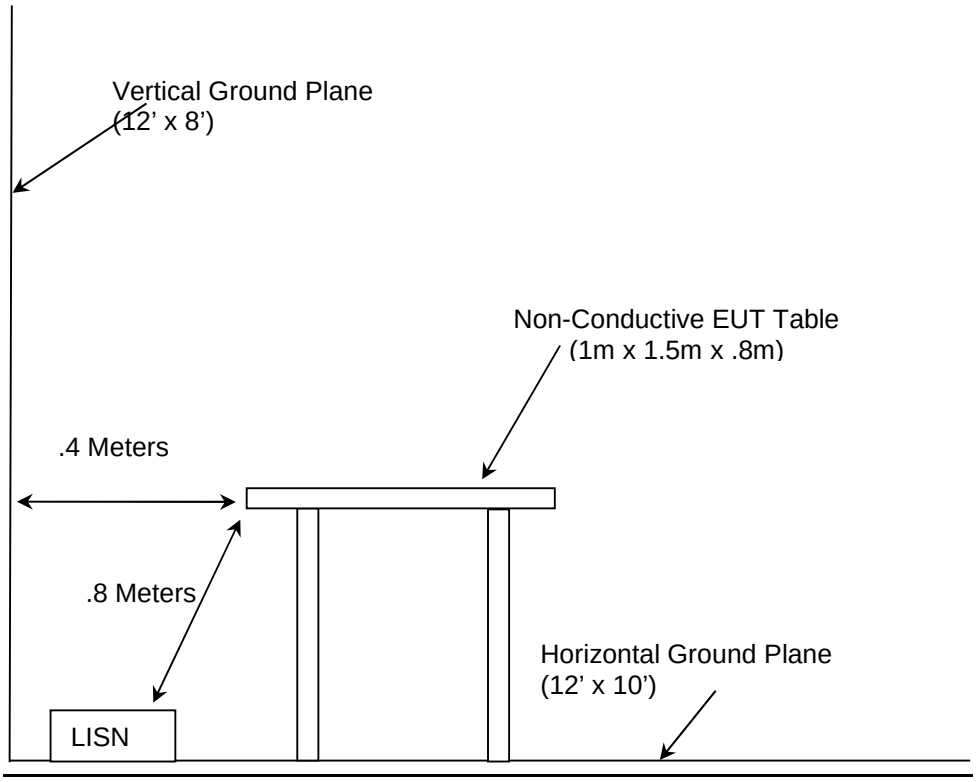

Figure 2.4.1-1: AC Mains Conducted EMI Site

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, 2018
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2018
- FCC KDB 558074 D01 DTS Meas Guidance v05 - 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, August 24, 2018
- 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
30	Spectrum Technologies	DRH-0118	1-18GHz Horn Antenna	970102	05/09/2017	05/09/2019
90	Electro-metrics	LPA25	LPA Antenna	1476	01/03/2018	01/03/2020
213	TEC	PA 102	Amplifier	44927	07/19/2018	07/19/2019
331	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	31417	05/16/2018	05/16/2019
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/11/2017	07/11/2019
731	EMCO	3104	Bicon Antenna	2659	11/09/2016	11/09/2018
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	10/31/2017	10/31/2018
831	Rohde & Schwarz	FSP38	Spectrum Analyzer 9kHz-40GHz	0	04/26/2018	04/26/2019
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2018	05/01/2019
851	TUV ATLANTA	FMC0101951-100CM	ASAC Cable Set Consisting of 566, 619, and 643	N/A	09/26/2018	09/26/2019

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	AC/DC Adapter	Blackberry	PSM04A-050RIMO	N/A

Table 5-2: Cable Description

Cable	Cable Type	Length	Shield	Termination
A	DC Power Cable	1.8 m	No	EUT to Power Supply

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

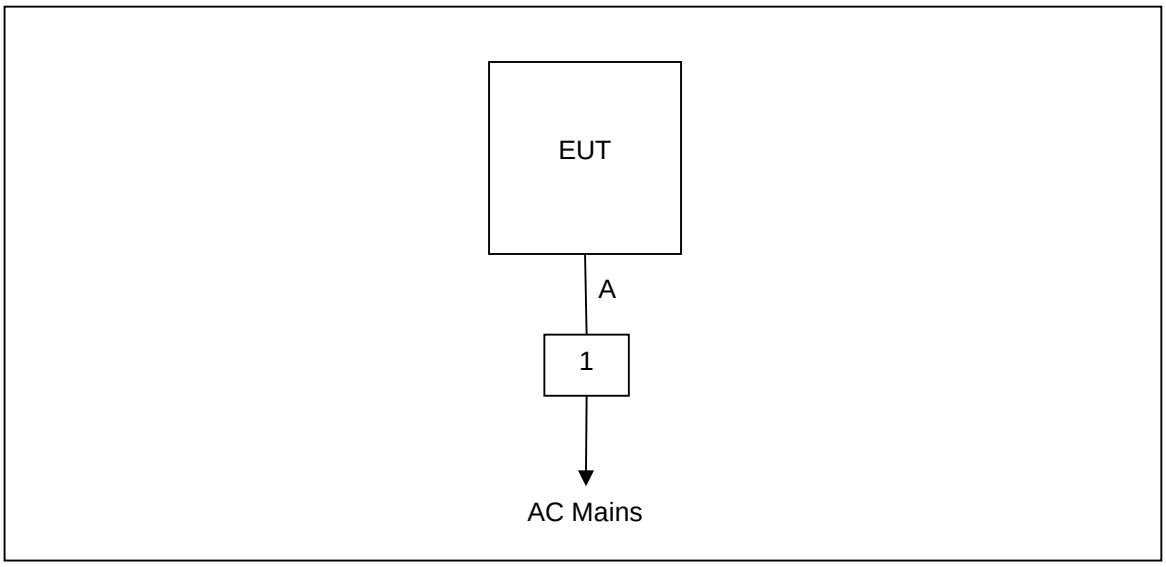

Figure 6-1: Test Setup Block Diagram

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 3-D Printed Inverted F Antenna. The antenna is integral to the device and cannot be removed or replaced by the end user. The gain of the antenna is 3.0 dBi.

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 = Corrected Reading – Applicable Limit

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	38.83	19.9	66	56	-27.17	-36.1	9.59
0.158	44.29	26.85	65.57	55.57	-21.28	-28.72	9.58
0.178	43.9	23.82	64.58	54.58	-20.68	-30.76	9.58
0.19	40.23	20.1	64.04	54.04	-23.81	-33.94	9.58
0.21	36.07	18.44	63.21	53.21	-27.14	-34.77	9.58
0.346	31.98	21.3	59.06	49.06	-27.08	-27.76	9.58
0.354	34.28	22.68	58.87	48.87	-24.59	-26.19	9.59
0.382	35.04	23.73	58.24	48.24	-23.2	-24.51	9.59
0.482	33.41	22.23	56.3	46.3	-22.89	-24.07	9.59
0.662	32.18	21.11	56	46	-23.82	-24.89	9.59

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	38.83	19.9	66	56	-27.17	-36.1	9.59
0.158	44.29	26.85	65.57	55.57	-21.28	-28.72	9.58
0.178	43.9	23.82	64.58	54.58	-20.68	-30.76	9.58
0.19	40.23	20.1	64.04	54.04	-23.81	-33.94	9.58
0.21	36.07	18.44	63.21	53.21	-27.14	-34.77	9.58
0.346	31.98	21.3	59.06	49.06	-27.08	-27.76	9.58
0.354	34.28	22.68	58.87	48.87	-24.59	-26.19	9.59
0.382	35.04	23.73	58.24	48.24	-23.2	-24.51	9.59
0.482	33.41	22.23	56.3	46.3	-22.89	-24.07	9.59
0.662	32.18	21.11	56	46	-23.82	-24.89	9.59

7.3 Radiated Spurious Emissions – FCC: Section 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 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.

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.

7.3.1.1 Measurement Results

Performed by: Jeremy Pickens

Table 7.3.1.1-1: Radiated Spurious Emissions Tabulated Data

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
Low Channel										
2706.6	49.99	40.12	H	-2.26	47.73	37.86	74.0	54.0	26.3	16.1
2706.6	49.69	39.29	V	-2.26	47.43	37.03	74.0	54.0	26.6	17.0
3808.8	51.46	42.98	H	2.29	53.75	45.27	74.0	54.0	20.2	8.7
3808.8	51.15	41.49	V	2.29	53.44	43.78	74.0	54.0	20.6	10.2
4511	49.99	40.11	H	3.21	53.20	43.32	74.0	54.0	20.8	10.7
Middle Channel										
2745	50.79	42.38	H	-2.12	48.67	40.26	74.0	54.0	25.3	13.7
2745	50.40	39.20	V	-2.12	48.28	37.08	74.0	54.0	25.7	16.9
3660	53.11	45.35	H	1.47	54.58	46.82	74.0	54.0	19.4	7.2
3660	51.31	41.22	V	1.47	52.78	42.69	74.0	54.0	21.2	11.3
4575	49.57	39.88	H	3.49	53.06	43.37	74.0	54.0	20.9	10.6
High Channel										
2783.4	50.69	41.93	H	-1.97	48.72	39.96	74.0	54.0	25.3	14.0
2783.4	50.69	41.96	V	-1.97	48.72	39.99	74.0	54.0	25.3	14.0
3711.2	50.6	41.24	H	1.75	52.35	42.99	74.0	54.0	21.6	11.0
3711.2	50.97	41.58	V	1.75	52.72	43.33	74.0	54.0	21.3	10.7
4511	50.48	40.8	H	3.21	53.69	44.01	74.0	54.0	20.3	10.0

7.3.1.2 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: 53.11 + 1.47 = 54.58dBuV/m
Margin: 74dBuV/m – 54.58dBuV/m = 19.4dB

Example Calculation: Average

Corrected Level: 45.35 + 1.47 - 0 = 46.82dBuV
Margin: 54dBuV – 46.82dBuV = 7.2dB

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	± 2.832×10^{-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 herein.

END REPORT