Certification Test Report

FCC ID: R7PNG0R1S3
IC: 5294A-NG0R1S3

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

Report Number: AT72157435-1P1

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

Test Begin Date: July 17, 2020
Test End Date: July 30, 2020

Report Issue Date: November 12, 2020

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 20 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 Manufacturer Information

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

1.3 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
Slot Antenna / 0.0 dBi **(new antenna)**
Operating Voltage: 4.2Vdc

Test Sample Serial Number: 915A16C6

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

1.4 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: Power setting preconfigured prior to testing

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
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.

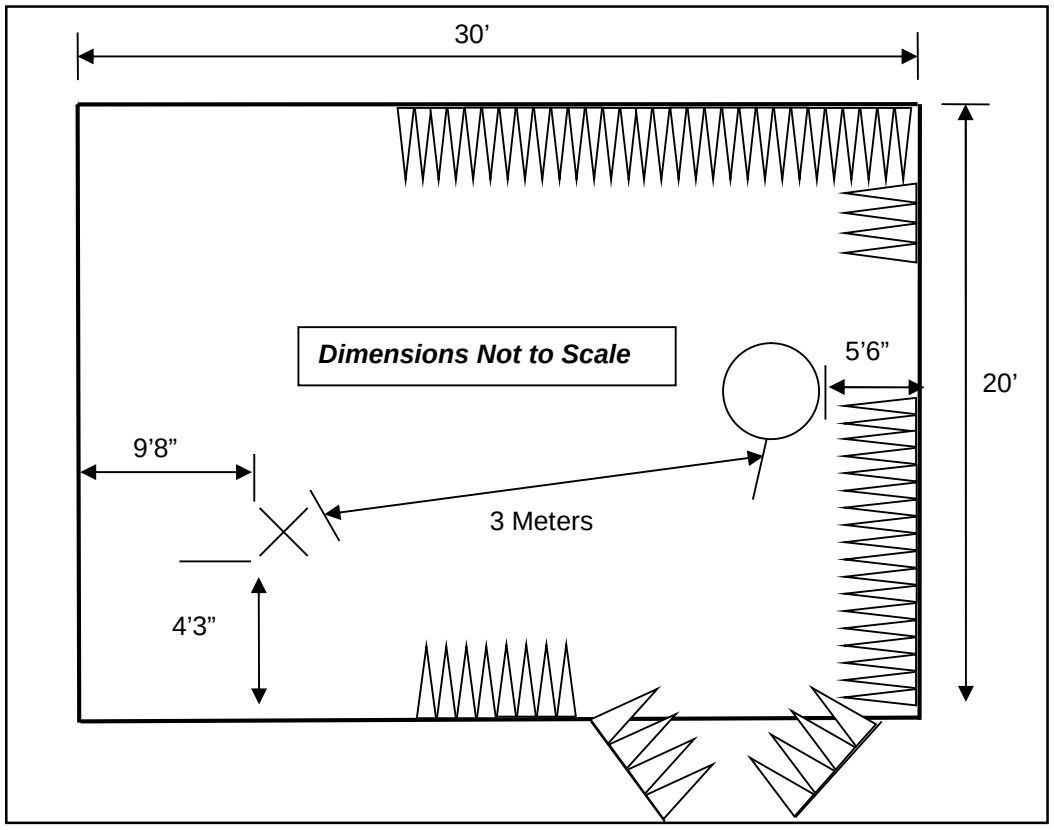

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site – Chamber A

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.

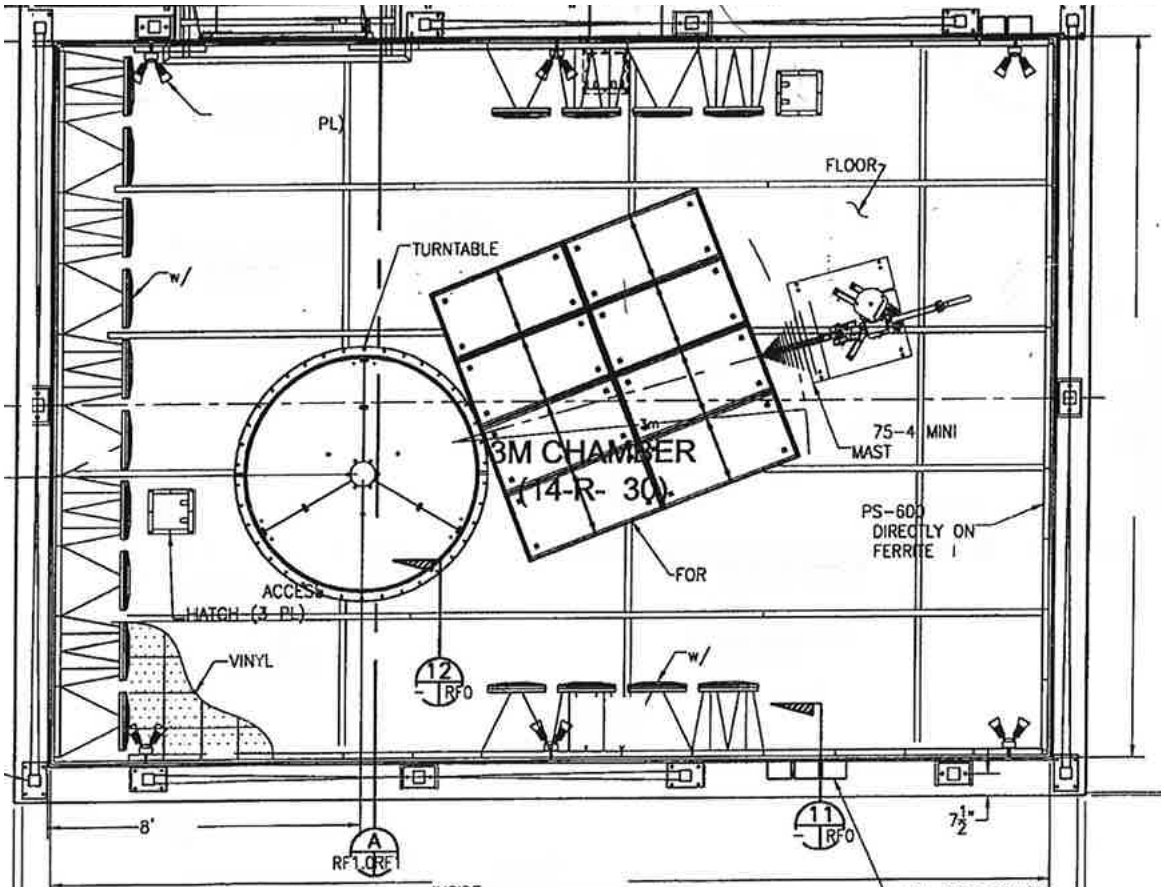

Figure 2.3.1-2: Semi-Anechoic Chamber Test Site – Chamber B

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.

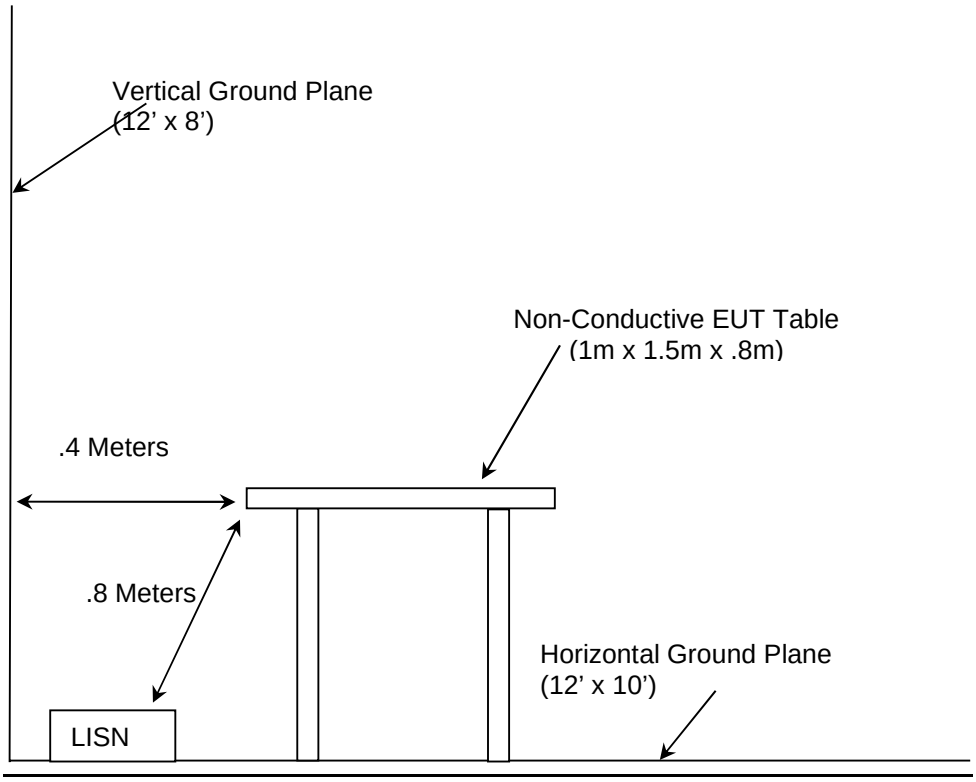

Figure 2.4.1-1: AC Mains Conducted EMI Site

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 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, 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
213	TEC	PA 102	Amplifier	44927	7/22/2019	7/22/2020
324	ACS	Belden	Conducted EMI Cable	8214	4/3/2020	4/3/2021
337	Microwave Circuits	H1G513G1	Microwave Bandpass Filter	282706	6/9/2020	6/9/2021
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/15/2019	07/15/2021
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	4/23/2019	10/23/2020
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	3/3/2020	3/3/2021
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	5/11/2020	5/11/2021
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2020
857	ETS Lindgren	3117	Horn Antenna 1-18GHz	00153608	11/12/2019	11/12/2021
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	7/10/2019	7/10/2020
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	6/23/2020	6/23/2021
RE880	Rhode & Schwarz USA	ESW44	Test Receiver	1206247	11/6/2019	11/6/2020

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	Evaluation Board	Landis+Gyr	N/A	N/A
2	DC Power Supply (Radiated)	Hewlett Packard	E3630A	KR64308603
	Wall Wart Power Supply (AC Conducted)	XP Power	VEL05US050-US-JA	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

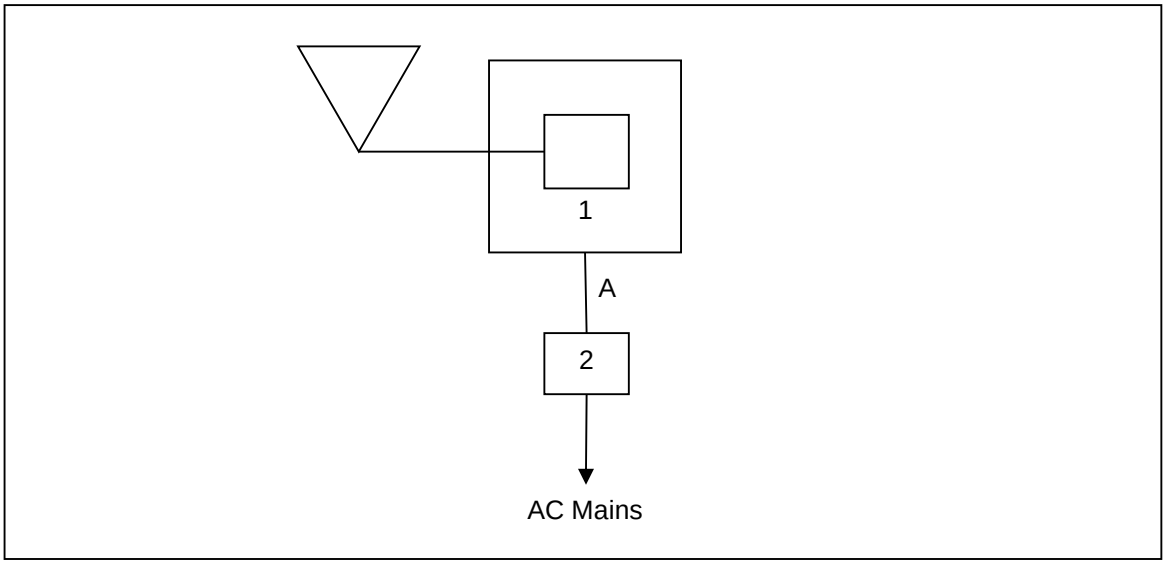

Figure 6-1: Test Setup Block Diagram

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 Slot Antenna. The antenna is connected to the device via u.FL connector, therefore satisfying the requirements of Section 15.203. The gain of the antenna is 0.0 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	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBµV)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dB)	
0.154	37.39	30.82	65.78	55.78	-28.39	-24.96	9.43
0.19	35.87	25.3	64.04	54.04	-28.17	-28.74	9.45
0.302	35.81	24.75	60.19	50.19	-24.38	-25.44	9.48
0.346	38.72	34.71	59.06	49.06	-20.34	-14.35	9.47
3.49	34.51	23.02	56	46	-21.49	-22.98	9.56
3.582	32.76	21.99	56	46	-23.24	-24.01	9.55
3.822	31.66	23.53	56	46	-24.34	-22.47	9.55
3.954	35.22	24.84	56	46	-20.78	-21.16	9.55
4.186	35.01	23.79	56	46	-20.99	-22.21	9.58
4.458	34.3	21.82	56	46	-21.7	-24.18	9.62

Table 7.2.2-2: Conducted EMI Results Line 2

Frequency (MHz)	Corrected Reading		Limit		Margin		Correction (dB)
	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
	(dBµV)	(dBµV)	(dBµV)	(dBµV)	(dB)	(dB)	
0.154	37.54	27.33	65.78	55.78	-28.24	-28.45	9.41
0.306	37.02	33.18	60.08	50.08	-23.06	-16.9	9.43
3.154	26.1	20.54	56	46	-29.9	-25.46	9.51
3.198	30.92	21.71	56	46	-25.08	-24.29	9.51
3.338	28.25	19.06	56	46	-27.75	-26.94	9.51
3.746	32.12	20.69	56	46	-23.88	-25.31	9.51
3.966	34.84	24.74	56	46	-21.16	-21.26	9.51
4.434	34.47	23.86	56	46	-21.53	-22.14	9.56
15.382	27.59	20.04	60	50	-32.41	-29.96	9.79
16.362	32.61	22.57	60	50	-27.39	-27.43	9.81

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 9kHz 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: Arthur Sumner

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	51.10	44.90	H	0.97	52.07	45.87	74.0	54.0	21.9	8.1
2706.6	53.20	46.90	V	0.97	54.17	47.87	74.0	54.0	19.8	6.1
3608.8	48.80	35.60	H	2.55	51.35	38.15	74.0	54.0	22.6	15.8
3608.8	48.40	35.60	V	2.55	50.95	38.15	74.0	54.0	23.0	15.8
4511	49.40	40.50	H	4.54	53.94	45.04	74.0	54.0	20.1	9.0
4511	48.50	36.60	V	4.54	53.04	41.14	74.0	54.0	21.0	12.9
5413.2	46.90	34.40	H	6.22	53.12	40.62	74.0	54.0	20.9	13.4
5413.2	47.30	35.40	V	6.22	53.52	41.62	74.0	54.0	20.5	12.4
8119.8	46.70	32.80	H	8.85	55.55	41.65	74.0	54.0	18.4	12.3
8119.8	47.00	32.90	V	8.85	55.85	41.75	74.0	54.0	18.1	12.2
9022	47.50	33.30	H	9.64	57.14	42.94	74.0	54.0	16.9	11.1
9022	47.80	33.30	V	9.64	57.44	42.94	74.0	54.0	16.6	11.1
Middle Channel										
2745	50.70	43.40	H	1.05	51.75	44.45	74.0	54.0	22.3	9.6
2745	53.40	48.20	V	1.05	54.45	49.25	74.0	54.0	19.6	4.8
3660	48.80	35.80	H	2.72	51.52	38.52	74.0	54.0	22.5	15.5
3660	48.20	35.60	V	2.72	50.92	38.32	74.0	54.0	23.1	15.7
4575	49.70	41.10	H	4.58	54.28	45.68	74.0	54.0	19.7	8.3
4575	47.80	36.50	V	4.58	52.38	41.08	74.0	54.0	21.6	12.9
7320	46.90	33.50	H	8.40	55.30	41.90	74.0	54.0	18.7	12.1
7320	47.10	32.90	V	8.40	55.50	41.30	74.0	54.0	18.5	12.7
8235	46.40	33.00	H	8.98	55.38	41.98	74.0	54.0	18.6	12.0
8235	46.00	32.70	V	8.98	54.98	41.68	74.0	54.0	19.0	12.3
9150	47.50	33.40	H	9.84	57.34	43.24	74.0	54.0	16.7	10.8
9150	47.30	33.30	V	9.84	57.14	43.14	74.0	54.0	16.9	10.9
High Channel										
2783.4	50.60	42.80	H	1.12	51.72	43.92	74.0	54.0	22.3	10.1
2783.4	51.40	44.50	V	1.12	52.52	45.62	74.0	54.0	21.5	8.4
3711.2	51.90	44.50	H	2.89	54.79	47.39	74.0	54.0	19.2	6.6
3711.2	50.40	42.00	V	2.89	53.29	44.89	74.0	54.0	20.7	9.1
4639	51.50	44.90	H	4.62	56.12	49.52	74.0	54.0	17.9	4.5
4639	50.10	42.50	V	4.62	54.72	47.12	74.0	54.0	19.3	6.9
7422.4	47.30	33.70	H	8.46	55.76	42.16	74.0	54.0	18.2	11.8
7422.4	47.10	34.50	V	8.46	55.56	42.96	74.0	54.0	18.4	11.0
8350.2	46.80	32.90	H	9.10	55.90	42.00	74.0	54.0	18.1	12.0
8350.2	47.10	33.00	V	9.10	56.20	42.10	74.0	54.0	17.8	11.9

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 High Channel

Corrected Level: 51.50 + 4.62 = 56.12dBuV/m
Margin: 74dBuV/m – 56.12dBuV/m = 17.9dB

Example Calculation: Average High Channel

Corrected Level: 44.90 + 4.62 - 0 = 49.52dBuV
Margin: 54dBuV – 49.52dBuV = 4.5dB

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 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.

Appendix A: Plots

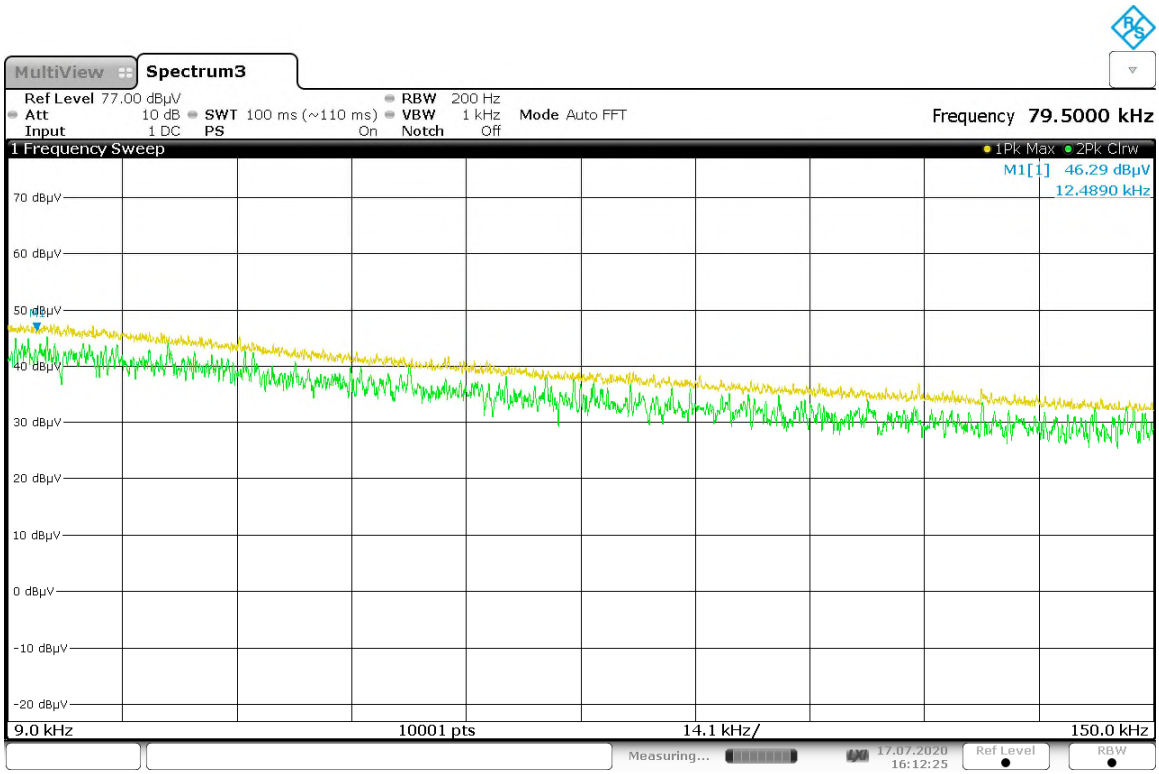

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Figure A-1: Radiated Emissions – 9 kHz – 150 kHz

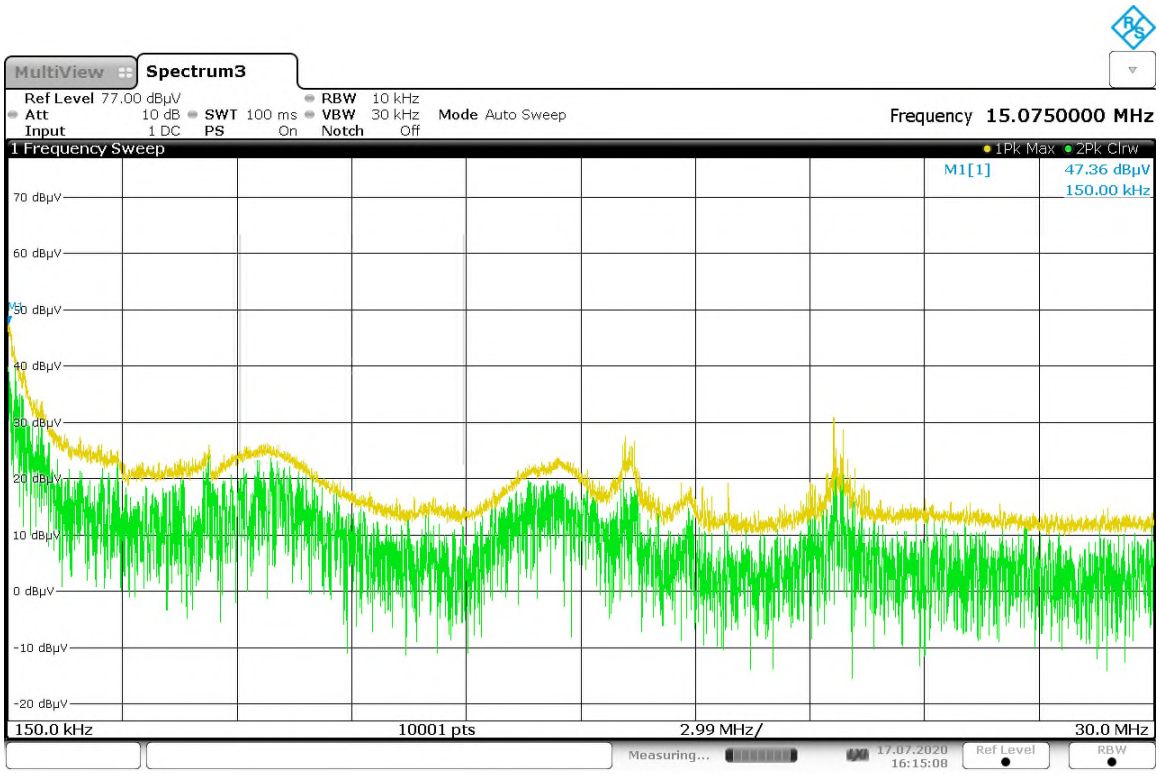

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Figure A-2: Radiated Emissions – 150 kHz to 30 MHz

Full Spectrum

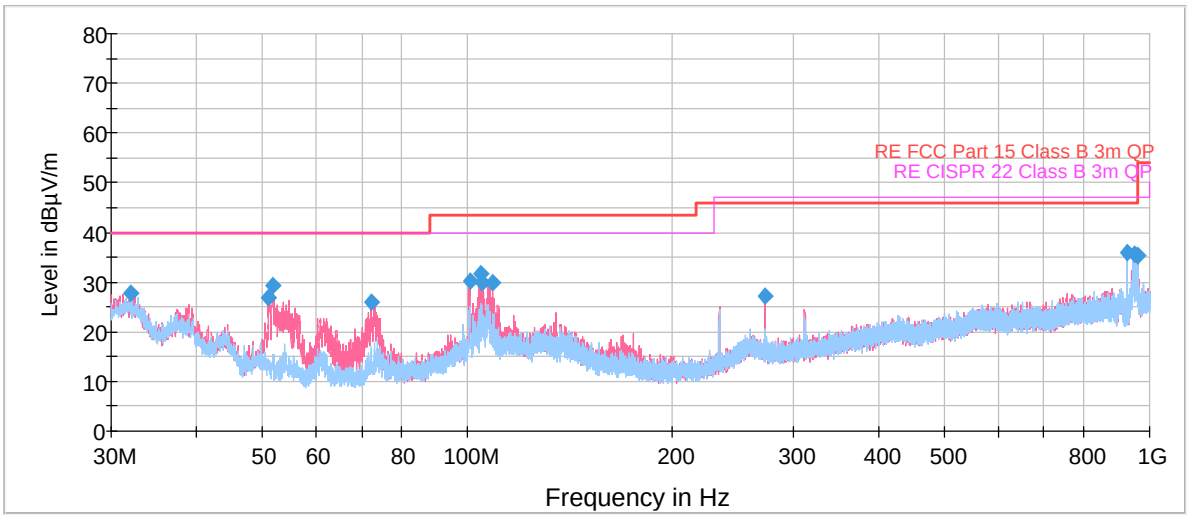

Figure A-3: Radiated Emissions – 30 MHz – 1GHz

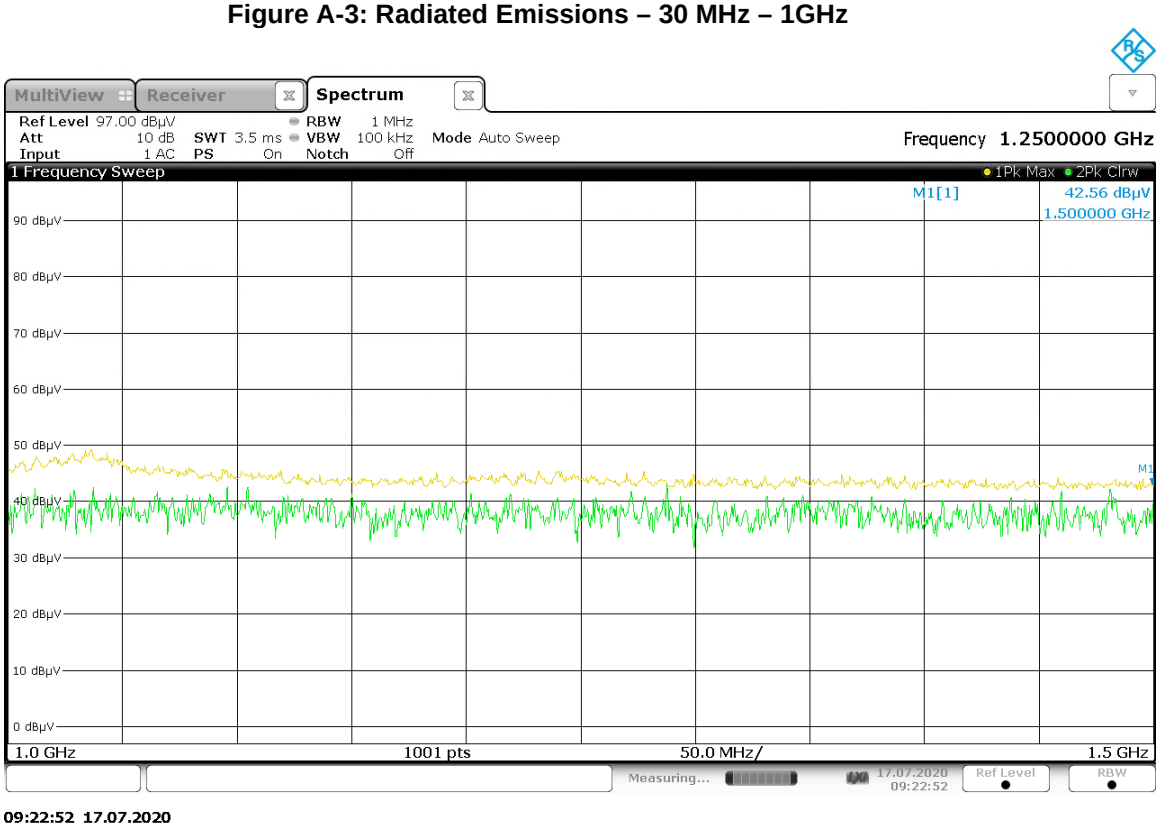

Figure A-4: Radiated Emissions – 1 GHz – 1.5 GHz

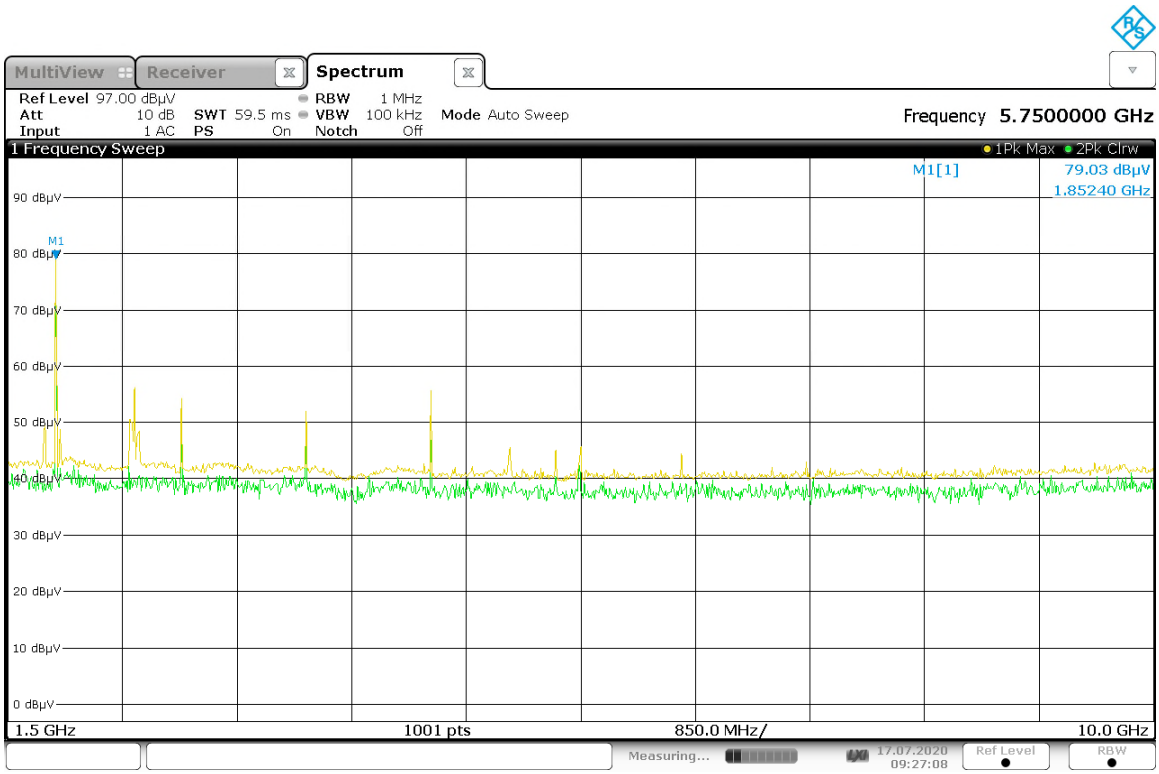

Figure A-5: Radiated Emissions – 1.5 GHz – 10 GHz

END REPORT