Report on the Testing of the

Landis + Gyr Technology, Inc.
Series-6 RF Mesh mSBR Card

In accordance with:
FCC 47 CFR part 15.247
ISED RSS-247 Issue 2, February 2017

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

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Thierry Jean-Charles	**Team Lead** **TUV SUD America Inc.**	**Authorized Signatory**	12/08/2023

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FCC Accreditation Designation Number US1233
FCC Test Site Registration Number 967699
Innovation, Science, and Economic Development Canada Lab Code 23932

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the standards listed above.

A2LA Cert. No. 2955.09

DISCLAIMER AND COPYRIGHT

ACCREDITATION

Our A2LA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our A2LA Accreditation.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Table 1.1-1 – Modification Record

Issue	Description of Change	Date of Issue
0	First Issue	12/08/2023

1.2 Introduction

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.247 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein to add a new dipole antenna to the 900 MHz radio on pre-approved module FCC ID: R7PNG0R1S4 / IC: 5294A-NG0R1S4.

The Series-6 RF Mesh mSBR Card radio module contains both 900 MHz and 2.4 GHz radios. The data addressed in this report are only applicable to the 900 MHz radio.

Applicant	Mr. Raghav Goteti
Manufacturer	Landis + Gyr Technology, Inc.
Applicant's Email Address	Raghav.Goteti@landisgyr.com
Model Name(s)	Series 6 RF Mesh mSBR Card
Model Number(s)	N651
Serial Number(s)	LAN ID: 612946CA
FCC ID	R7PNG0R1S4
ISED Certification Number	5294A-NG0R1S4
Hardware Version(s)	40-2060
Software Version(s)	Wi-SUN: 26.56 Mesh IP: 24.21
Number of Samples Tested	2
Test Specification/Issue/Date	US Code of Federal Regulation (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2022 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, February 2017.

Order Number	72194622
Date of Receipt of EUT	11/7/2023
Start of Test	11/8/2023
Finish of Test	11/13/2023
Related Document(s)	ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device. FCC OET KDB 558074 D01 15.247 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 US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2022. ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, Amendment 1 (March 2019), Amendment 2 (February 2021)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC Part 15.247 and ISED Canada's RSS-247 is shown below.

Table 1.3-1: Test Result Summary

Test Parameter	Test Plan (Yes/No)	Test Result	FCC 47 CFR Rule Part	ISED Canada's RSS	Test Report Page No
Antenna Requirement	Yes	Pass	15.203, 15.204	-------	12
6 dB Bandwidth	No	Not Tested	15.247(a)(2)	RSS-247 5.2(a)	-------
99% Bandwidth	No	Not Tested	-------	RSS-GEN 6.7	-------
Average Output Power	No	Not Tested	15.247(b)(3)	RSS-247 5.4(d)	-------
Band-Edge Compliance of RF Conducted Emissions	No	Not Tested	15.247(d)	RSS-247 5.5	-------
RF Conducted Spurious Emissions	No	Not Tested	15.247(d)	RSS-247 5.5	-------
Radiated Spurious Emissions into Restricted Frequency Bands	Yes	Pass	15.205, 15.209	RSS-GEN 8.9, 8.10	16
Power Spectral Density	No	Not Tested	15.247(e)	RSS-247 5.2(b)	-------
Power Line Conducted Emissions	Yes	Pass	15.207	RSS-GEN 8.8	13
Duty Cycle	No	--------			-------

1.4 Product Information

1.4.1 Technical Description

The Series-6 RF Mesh platform supports half-duplex operation in both the Sub-GHz and 2.4-GHz bands. There are 2 types of RF Mesh Communication Stacks supported by the Series-6 platform: Mesh IP (SBS) and Wi-SUN (WSN).

Table 1.4-1 – Wireless Technical Information

Detail	Description
FCC ID	R7PNG0R1S4
ISED Certification Number	5294A-NG0R1S4
Model(s) / HVIN(s)	Series 6 RF Mesh mSBR Card
PMN(s)	N651
Frequency Range	902.2 – 927.8 MHz
Modulation Format	FSK, OFDM
Antenna Type / Description:	Dipole Antenna / 5.7 dBi Gain

A full description and detailed product specification details are available from the manufacturer.

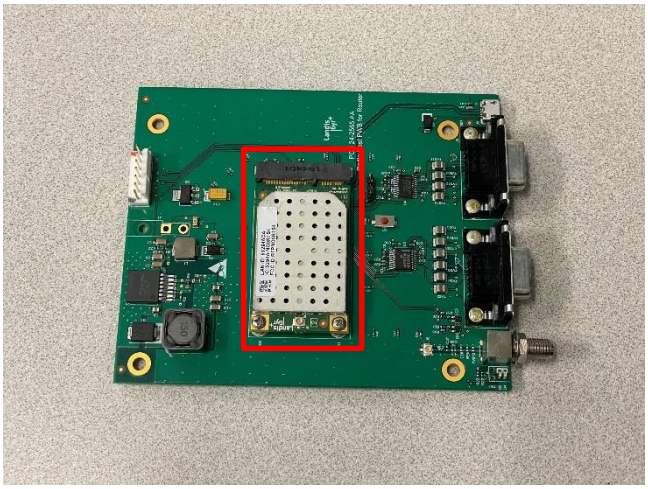

Figure 1.4.1-1 –Front view of the AC Power Line CE module with evaluation board

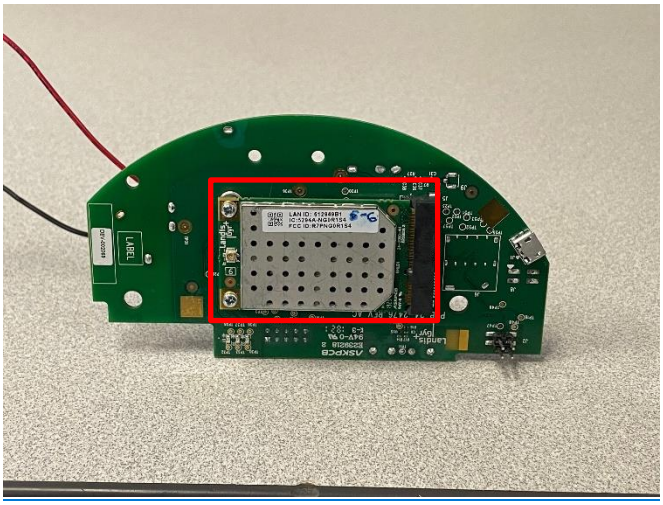

Figure 1.4.1-2 –Front view of the Radiated EUT module with evaluation board

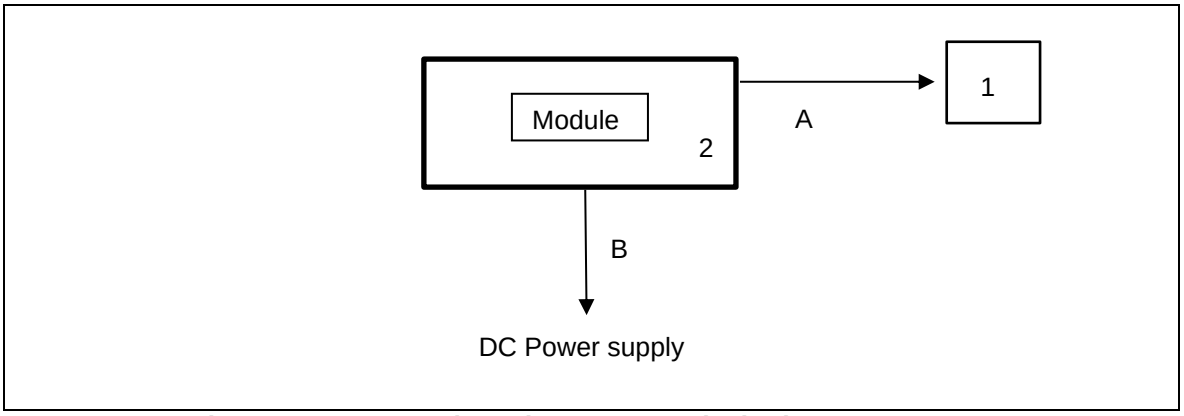

Figure 1.4.1-3 – Conducted Test Setup Block Diagram

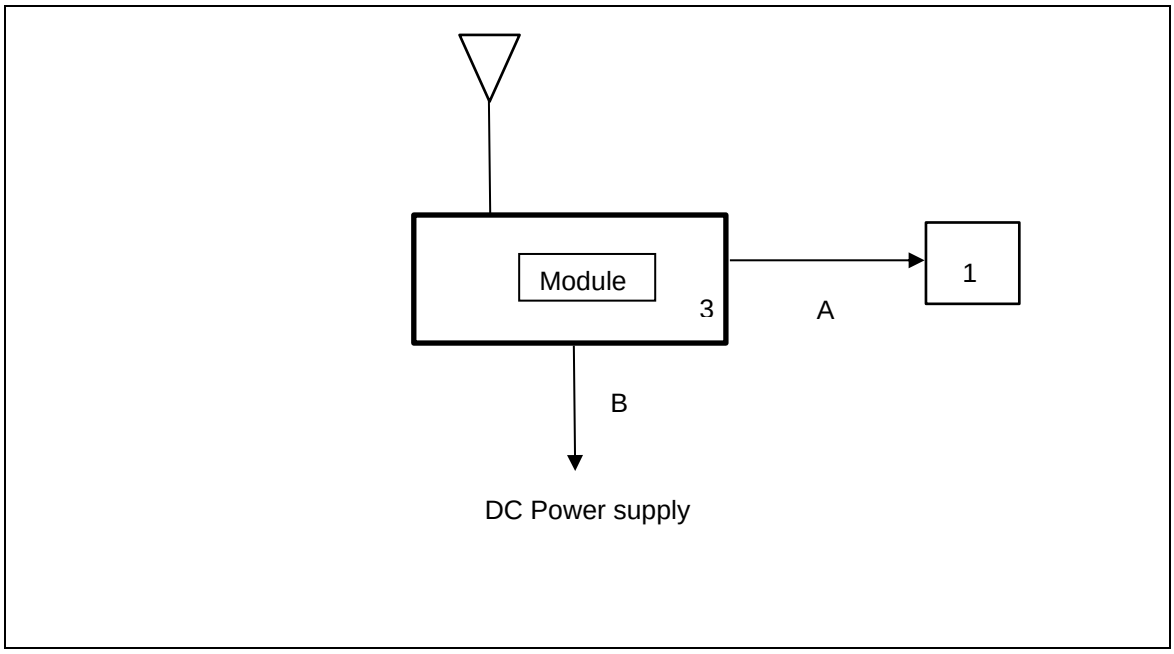

Figure 1.4.1-4 – Radiated Test Setup Block Diagram

Table 1.4.1-1 – Cable Descriptions

Item	Cable/Port	Description
A	USB Serial cable	Programming cable connected to laptop
B	DC Power Supply Cable	Power Supply DC power supply

Table 1.4.1-2 – Support Equipment Descriptions

Item	Make/Model	Description
1	Thinkpad	Laptop for configuration
2	Landis & Gyr	Evaluation Board
3	Landis & Gyr	Evaluation Board

Two different evaluation boards were used for AC Power Line CE and radiated measurements is to stay consistent with the original FCC unit setup photos.

1.4.2 Modes of Operation

The Landis + Gyr Series-6 RF Mesh mSBR Card radio is an electricity metering module which includes a 900 MHz ISM transmitter as well as a 2.4 GHz OFDM transmitter.

This test report documents the compliance of the 900 MHz Digital transmission systems mode of operation. This model provides distinct proprietary modes of operation using DTS classification as outlined below. The following mode only was evaluated considering a wide frequency range for this purpose of evaluation where adding a new antenna and the other modes were covered in the original certification.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Stack / Mode	Data Rates Supported (kbps)	Classification
1	902.8 – 926.8	31	800	WiSUN	MCS3 – MCS5	DTS

1.4.3 Monitoring of Performance

For radiated emissions and AC Power Line conducted emissions, the EUT was evaluated with external dipole antenna. For radiated emissions, the EUT was evaluated in three orthogonal orientations. The worst-case orientation was Y-position. See test setup photos for more information. The EUT was programmed to generate a continuously modulated signal on each channel evaluated.

The worst-case data rate for the RSE into Restricted Frequency Bands measured is listed below:

Mode of Operation	Classification	Data Rate (kbps)
1	DTS	MCS3

Power setting during test: Mode of operation 1: Index: 21 dBm

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test program. The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	Initial State		

The equipment was tested as provided without any modifications.

1.7 Test Location

TÜV SÜD conducted the following tests at our Alpharetta, GA test laboratory.

Test Name	Name of Engineer(s)	Accreditation
Antenna Requirement	Divya Adusumilli	A2LA
Power Line Conducted Emissions	Divya Adusumilli	A2LA
Radiated Spurious Emissions into Restricted Frequency Bands	Divya Adusumilli	A2LA

Office address:
TÜV SÜD America
5945 Cabot Parkway, Suite 100
Alpharetta, GA 30005, USA

2 Test Details

2.1 Antenna Requirement

2.1.1 Specification Reference

FCC Section: 15.203, 15.204

2.1.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.1.3 Date of Observation

11/8/2023

2.1.4 Test Method

N/A

2.1.5 Environmental Conditions

N/A

2.1.6 Observation

The EUT utilizes one additional external antenna, a dipole antenna with peak gain 5.7 dBi. Connection to the module is via U.fl to SMA adapter cable, therefore satisfying the requirements of Section 15.203.

2.2 Power Line Conducted Emissions

2.2.1 Specification Reference

FCC Section: 15.207
ISED Canada: RSS-Gen 8.8

2.2.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.2.3 Date of Test

11/10/2023

2.2.4 Test Method

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

2.2.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	22.3 °C
Relative Humidity	53.8 %
Atmospheric Pressure	972.2 mbar

2.2.6 Test Results

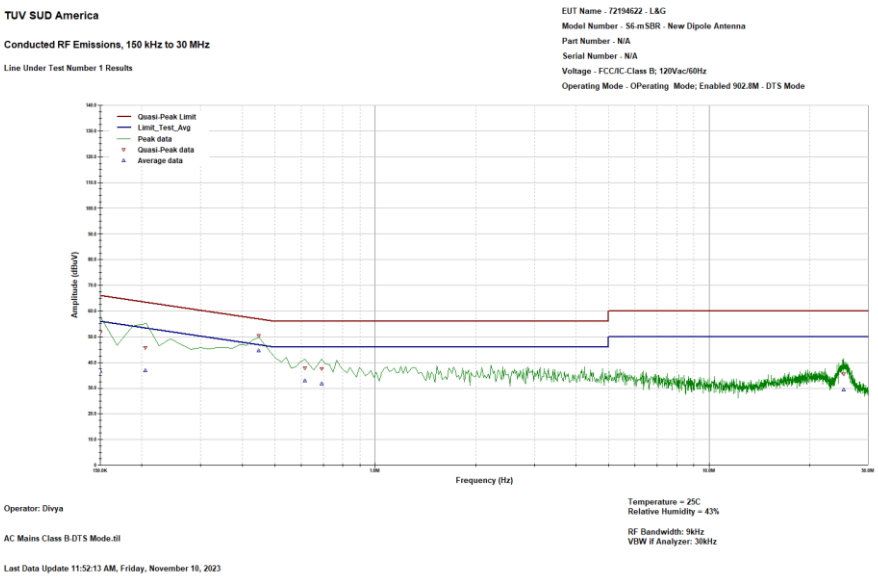

Figure 1: Conducted Emission Plot – Line 1

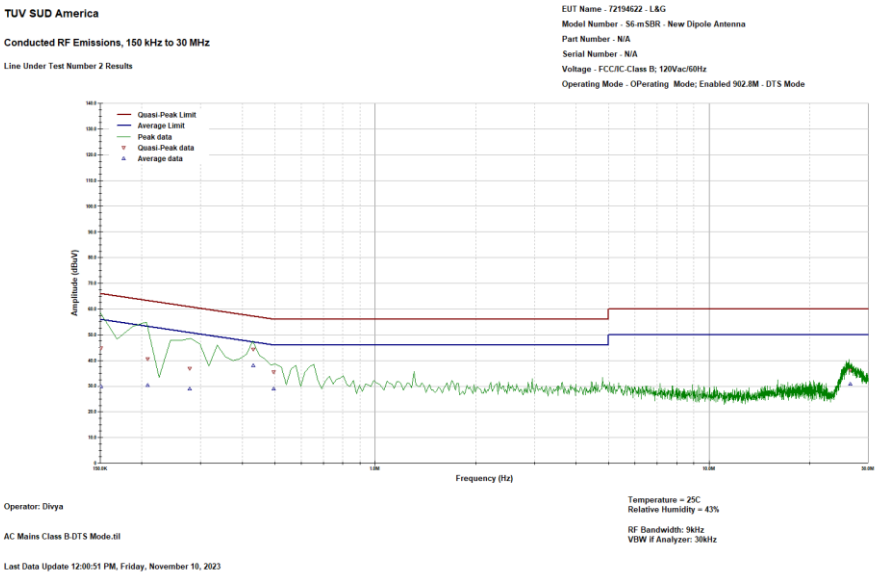

Figure 2: Conducted Emission Plot – Neutral

Table 2.2.6-1: Conducted EMI Results-Avg – Line 1

Frequency	Avg Limit	Avg Level Corr	Avg Level	CF	Avg Margin	Result
MHz	dBuV	dBuV	dBuV	dB	dB	
0.15	56	36.6	26.9	9.682	-19.4	PASS
0.21	54.4	36.9	27.2	9.674	-17.5	PASS
0.45	47.5	44.5	34.9	9.653	-3	PASS
0.61	46	32.9	23.3	9.657	-13.1	PASS
0.69	46	31.6	22	9.662	-14.4	PASS
25.32	50	29.5	19.4	10.02	-20.5	PASS

Table 2.2.6-2: Conducted EMI Results-QP – Line 1

Frequency	QP Limit	QP Level Corr	QP Level	CF	QP Margin	Result
MHz	dBuV	dBuV	dBuV	dB	dB	
0.15	66	51.5	41.8	9.682	-14.5	PASS
0.21	64.4	45.7	36.1	9.674	-18.7	PASS
0.45	57.5	50.5	40.8	9.653	-7	PASS
0.61	56	37.8	28.1	9.657	-18.2	PASS
0.69	56	37.4	27.8	9.662	-18.6	PASS
25.32	60	35.4	25.4	10.02	-24.6	PASS

Table 2.2.6-3: Conducted EMI Results-Avg – Neutral

Frequency	Avg Limit	Avg Level Corr	Avg Level	CF	Avg Margin	Result
MHz	dBuV	dBuV	dBuV	dB	dB	
0.15	56	29.7	20.1	9.675	-26.2	PASS
0.21	54.3	30.3	20.7	9.669	-24	PASS
0.28	52.3	28.9	19.3	9.662	-23.4	PASS
0.43	48	38.1	28.4	9.64	-9.9	PASS
0.5	46.1	29	19.4	9.631	-17.1	PASS
26.48	50	30.8	20.6	10.134	-19.2	PASS

Table 2.2.6-4: Conducted EMI Results-QP – Neutral

Frequency	QP Limit	QP Level Corr	QP Level	CF	QP Margin	Result
MHz	dBuV	dBuV	dBuV	dB	dB	
0.15	66	44.8	35.2	9.675	-21.1	PASS
0.21	64.3	40.7	31	9.669	-23.7	PASS
0.28	62.3	36.8	27.2	9.662	-25.5	PASS
0.43	58	44.3	34.7	9.64	-13.6	PASS
0.5	56.1	35.4	25.8	9.631	-20.7	PASS
26.48	60	36.2	26.1	10.134	-23.8	PASS

2.3 Radiated Spurious Emissions into Restricted Frequency Bands

2.3.1 Specification Reference

FCC Sections: 15.205, 15.209.
ISED Canada: RSS – Gen 8.9/8.10

2.3.2 Equipment Under Test and Modification State

As shown in §1.4 with modification state “0”, as noted in §1.6.

2.3.3 Date of Test

11/08/2023 to 11/13/2023

2.3.4 Test Method

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, 10 times the highest fundamental frequency of 900 MHz 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.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 150 kHz, quasi-peak measurements were made using a resolution bandwidth RBW of 300 Hz and a video bandwidth VBW of 1 kHz and frequencies between 150 kHz and 30MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 10 kHz and a video bandwidth VBW of 30 kHz. For frequencies between 30 MHz and 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 100 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW of 1 MHz and VBW of 3 MHz.

2.3.5 Environmental Conditions

The EUT was evaluated within the temperature, humidity and pressure range of the EUT as specified by the standard. The laboratory shall have an ambient temperature range of 15°C to 35°C, relative humidity range of 30% to 60% and atmospheric pressure range of 86 kPa to 106 kPa.

Ambient Temperature	22.3 °C
Relative Humidity	53.8 %
Atmospheric Pressure	972.2 mbar

2.3.5 Test Results

Test Summary: EUT was set to transmit mode as per sections 1.4.2 / 1.4.3.

Test Results: Pass

See data below for detailed results.

Table 2.8.6-1: Radiated Spurious Emissions Tabulated Data – Mode 1 – MCS3

Frequency	Peak Value	QP/Avg Value	Peak Limit	QP/Avg Limit	Peak Margin	QP/Avg Margin	Polarity	Peak Limit Results	QP/Avg Limit Results
MHz	dBµV/m	dBµV/m	dBµV/m	dBµV/m	dB	dB	H/V	Pass/Fail	Pass/Fail
LCH - 902.8MHz									
343.308	-----	25.708	-----	46	-----	-20.29	H	-----	PASS
703.568	-----	18.89	-----	46	-----	-27.11	H	-----	PASS
35.975	-----	33.927	-----	40	-----	-6.07	V	-----	PASS
96.01	-----	31.568	-----	43.5	-----	-11.93	V	-----	PASS
119.993	-----	32.039	-----	43.5	-----	-11.46	V	-----	PASS
156	-----	30.763	-----	43.5	-----	-12.74	V	-----	PASS
1805.55	43.099	28.228	74	54	-30.9	-25.77	H	PASS	PASS
2708.45	44.938	30.704	74	54	-29.06	-23.3	H	PASS	PASS
4513.875	47.976	33.279	74	54	-26.02	-20.72	H	PASS	PASS
9028	53.798	39.661	74	54	-20.2	-14.34	H	PASS	PASS
1805.625	47.726	30.924	74	54	-26.27	-23.08	V	PASS	PASS
2708.4	45.501	30.822	74	54	-28.5	-23.18	V	PASS	PASS
4513.875	47.816	33.298	74	54	-26.18	-20.7	V	PASS	PASS
9028.025	53.847	39.686	74	54	-20.15	-14.31	V	PASS	PASS
MCH – 914.8 MHz									
176.251	-----	26.416	-----	43.5	-----	-17.08	H	-----	PASS
332.983	-----	21.375	-----	46	-----	-24.62	H	-----	PASS
699.837	-----	15.141	-----	46	-----	-30.86	H	-----	PASS
35.992	-----	32.193	-----	40	-----	-7.81	V	-----	PASS
96.01	-----	30.616	-----	43.5	-----	-12.88	V	-----	PASS
119.993	-----	30.648	-----	43.5	-----	-12.85	V	-----	PASS
700.563	-----	15.302	-----	46	-----	-30.7	V	-----	PASS
1829.5	44.812	29.153	74	54	-29.19	-24.85	H	PASS	PASS
6403.55	52.989	36.757	74	54	-21.01	-17.24	H	PASS	PASS
1829.625	43.86	28.363	74	54	-30.14	-25.64	V	PASS	PASS
6402.4	53.983	36.458	74	54	-20.02	-17.54	V	PASS	PASS
HCH – 926.8 MHz									
173.411	-----	24.189	-----	43.5	-----	-19.31	H	-----	PASS

337.154	-----	22.942	-----	46	-----	-23.06	H	-----	PASS
36.016	-----	34.651	-----	40	-----	-5.35	V	-----	PASS
96.01	-----	31.346	-----	43.5	-----	-12.15	V	-----	PASS
119.993	-----	31.158	-----	43.5	-----	-12.34	V	-----	PASS
156	-----	26.231	-----	43.5	-----	-17.27	V	-----	PASS
1853.6	43.861	28.859	74	54	-30.14	-25.14	H	PASS	PASS
2780.45	44.705	30.229	74	54	-29.3	-23.77	H	PASS	PASS
6487.6	49.699	35.893	74	54	-24.3	-18.11	H	PASS	PASS
1853.45	43.258	28.939	74	54	-30.74	-25.06	V	PASS	PASS
2780.3	44.945	30.282	74	54	-29.05	-23.72	V	PASS	PASS
6487.55	53.795	36.646	74	54	-20.2	-17.35	V	PASS	PASS

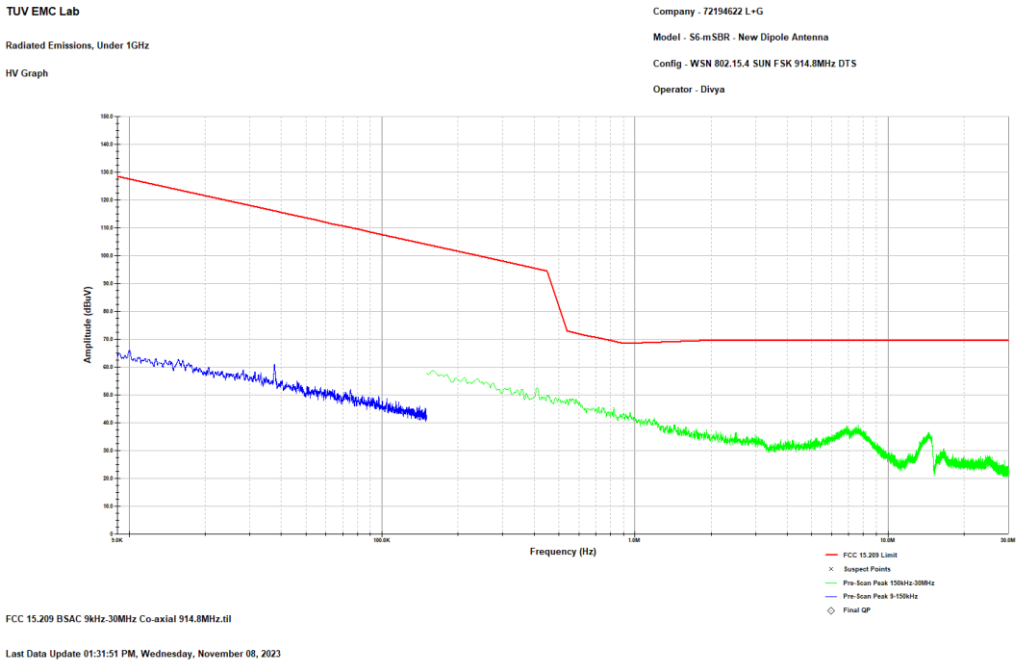

Figure 1: Reference plot for Radiated Spurious Emissions – 9 kHz – 30 MHz – Mode 1 – LCH
Note: Emissions above the noise floor are ambient not associated with the EUT.

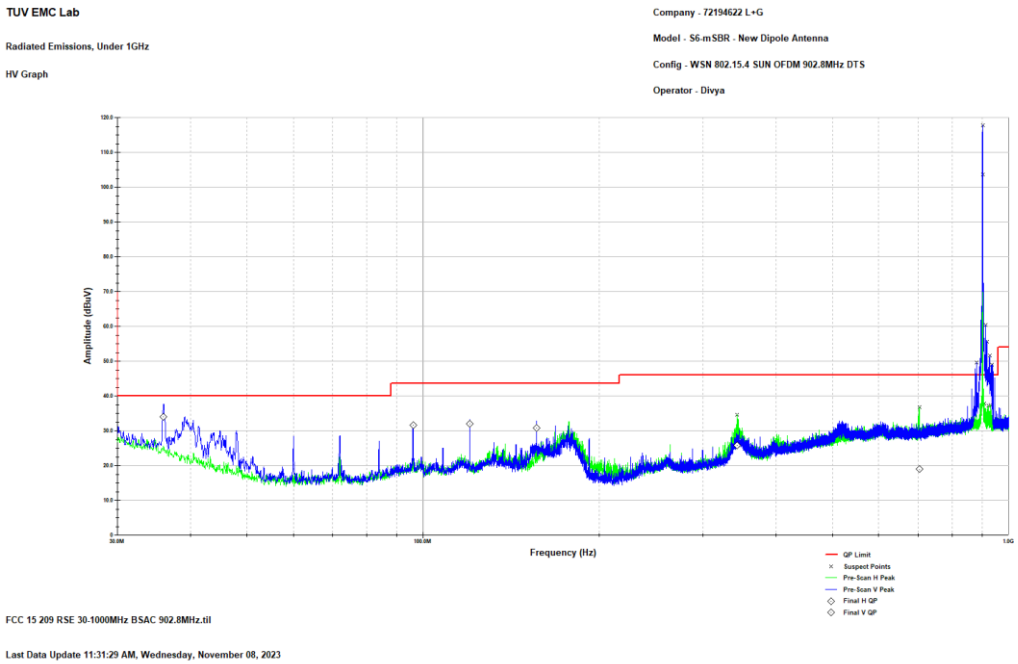

Figure 2: Reference plot for Radiated Spurious Emissions – 30 MHz – 1 GHz – Mode 1 – LCH
Note: Emissions within restricted bands were evaluated.

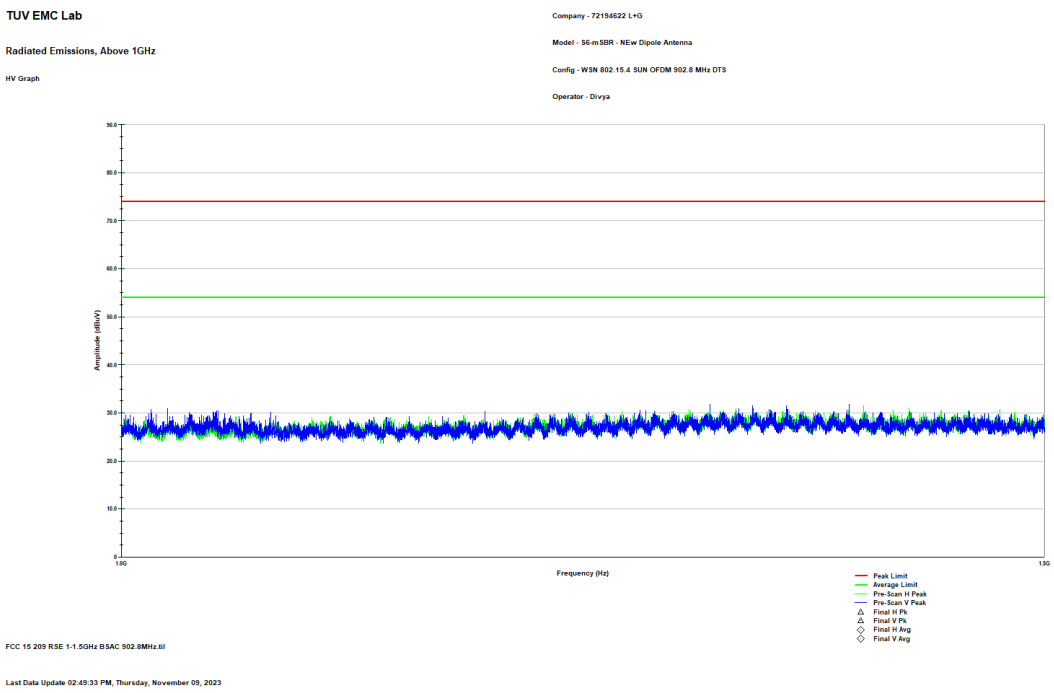

Figure 3: Reference plot for Radiated Spurious Emissions – 1 GHz – 1.5 GHz – Mode 1 – LCH

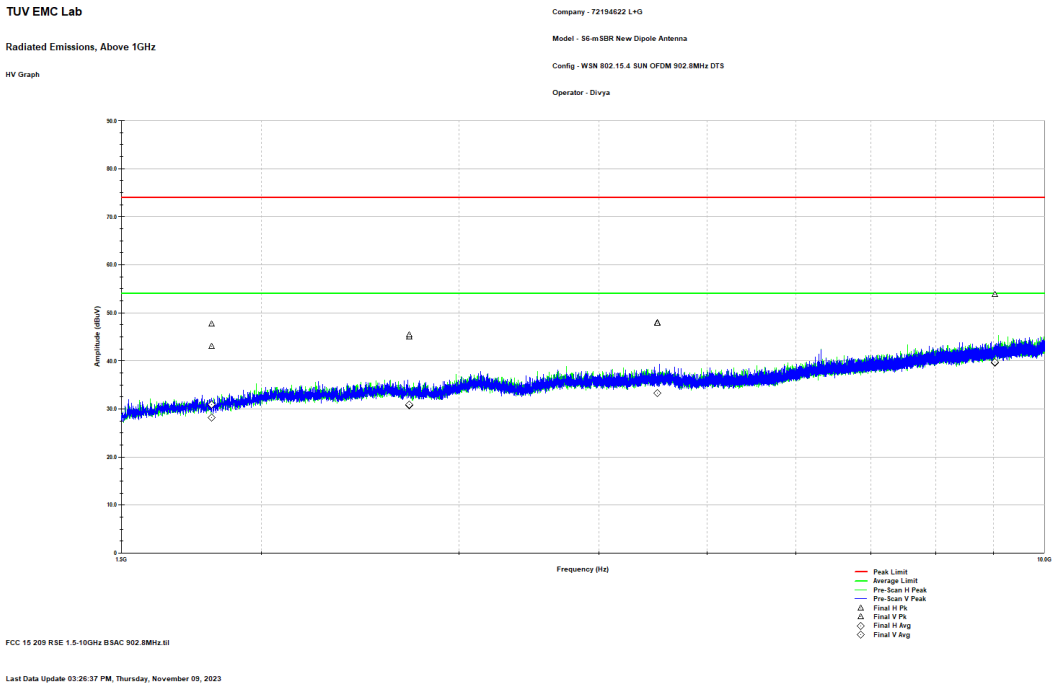

Figure 4: Reference plot for Radiated Spurious Emissions – 1.5 GHz – 10 GHz – Mode 1 – LCH

Note: Emissions within restricted bands were evaluated.

2.4 Test Equipment Used

Table 2.4-1 –Equipment List

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
628	EMCO	6502	Active Loop Antenna 10kHz-30MHz	9407-2877	06/20/2023	06/20/2024
853	Teseq	CBL6112D	BiLog Antenna	51616	11/01/2022	11/01/2024
884	ETS Lindgren (EMCO)	3117	DOUBLE-RIDGED GUIDE ANTENNA	240106	05/16/2023	05/16/2025
889	Com Power	PAM 103	Pre-amplifier	18020215	10/02/2023	10/02/2024
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	6/22/2023	6/22/2025
882	Rohde & Schwarz	ESW44	ESW44 EMI TEST RECEIVER	101961	06/21/2023	06/21/2024
22	Teledyne Storm Microwave	90-195-456	BSAC Cable	N/A	10/02/2023	10/02/2024
20	Teledyne Storm Microwave	R-90-195-036	BSAC Cable	N/A	07/13/2023	07/13/2024
21	Teledyne Storm Microwave	R-90-195-072	BSAC Cable	N/A	07/13/2023	07/13/2024
337	Microwave Circuits	H1G513G1	Microwave filter	282706	05/31/2023	05/31/2024
872	HP	E7402A	EMI Receiver	US40240258	6/22/2023	6/22/2024
871	ACS	n/a	Conducted EMI Cable	871	3/24/2023	3/24/2024
3010	Rohde & Schwarz	ENV216	Two-Line V-Network	3010	6/21/2023	6/21/2024

N/A – Not Applicable

3 Diagram of Test Set-ups

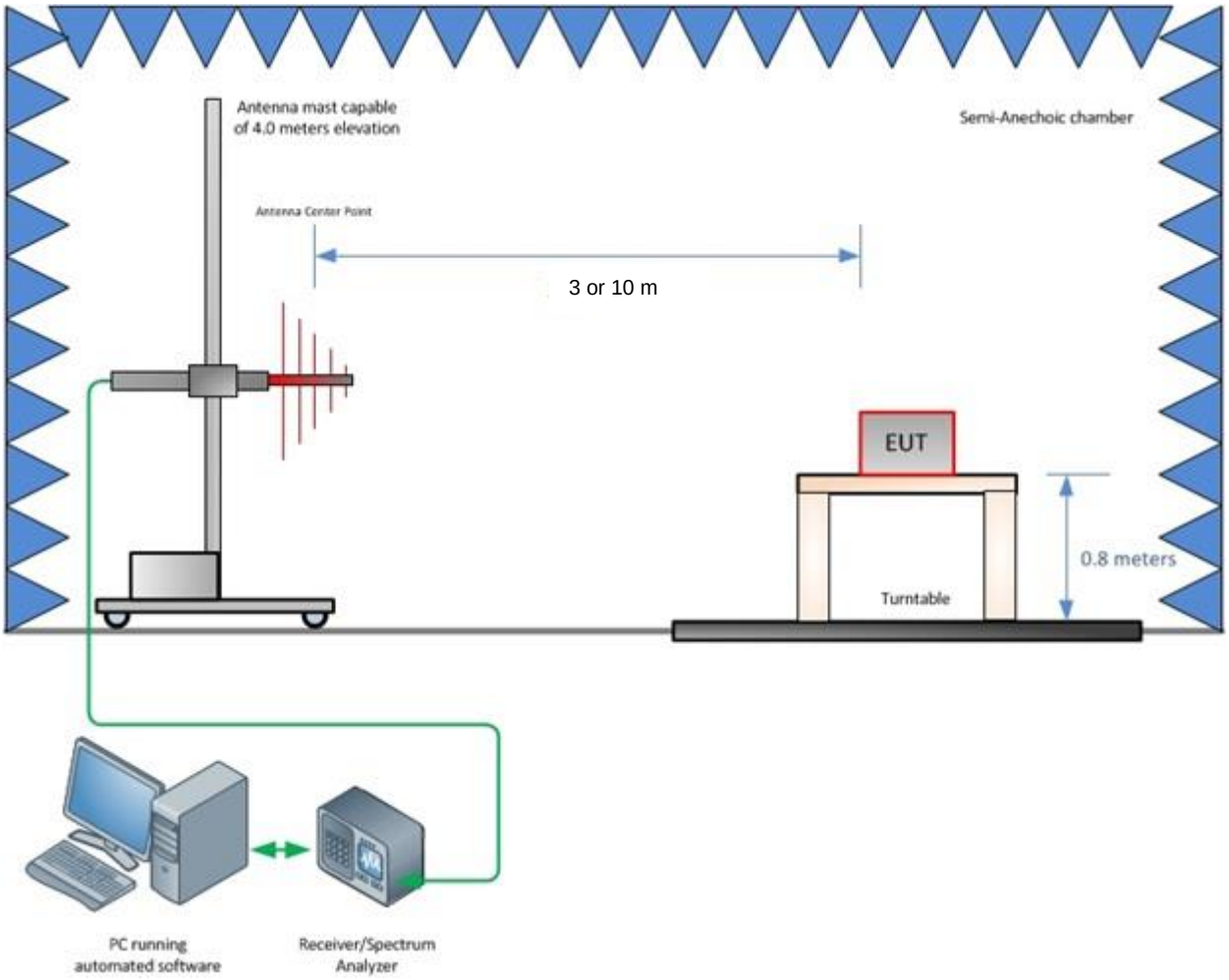

Figure 3-1 – Radiated Emissions Test Setup up to 1 GHz

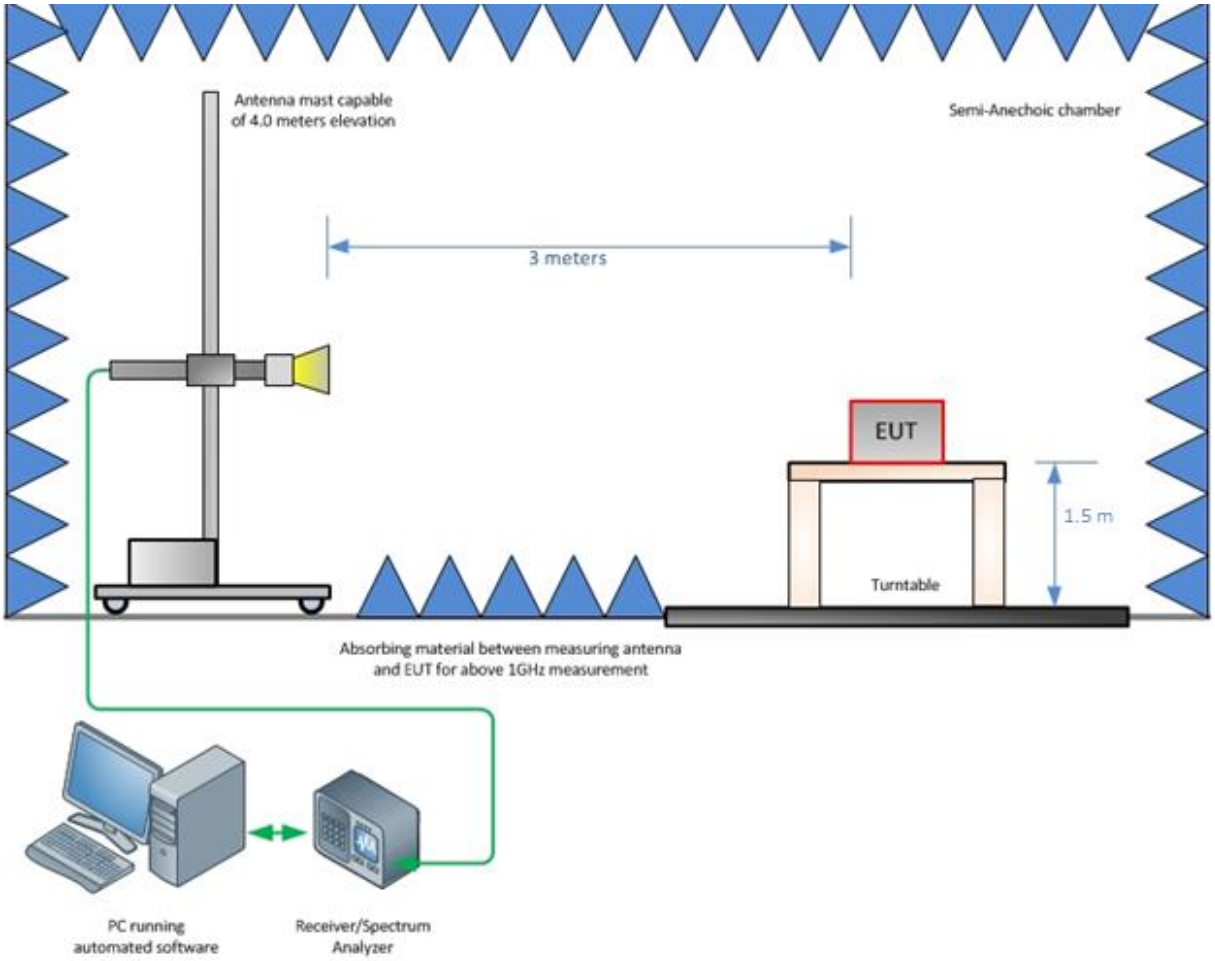

Figure 3-2 – Radiated Emissions Test Setup above 1 GHz

4 Accreditation, Disclaimers and Copyright

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STATEMENT 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 4-1: Estimation of Measurement Uncertainty

Parameter	U_{lab}
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

TEST EQUIPMENT

All measurement instrumentation is traceable to the National Institute of Standards and Technology and is calibrated to meet test method standard requirements and/or manufacturer's specifications.