Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15 Subpart B:2019, ICES-003 Issue 6

On

Flexco Elevate i3 Device, US 91600

Prepared for:

Flexible Steel Lacing Company
2525 Wisconsin Avenue
Downers Grove, IL 60515 USA

Prepared by:

TUV Rheinland of North America, Inc.
1279 Quarry Lane, Ste. A
Pleasanton, CA 94566 U.S.A.

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Revisions

Revision No.	Date	Reason for Change	Author
0	09.19.2019	Original Document	BMJ
1	12/02/2019	Model Name Change	JEN

Note: Latest revision report will replace all previous reports.

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ATTESTATION OF TEST RESULTS

Client:	Flexible Steel Lacing Company 2525 Wisconsin Avenue Downers Grove, IL 60515 USA U.S.A.	Timothy A Gunter Jr Tel. +1 616-242-1714 tgunter@flexco.com	
Model Name:	Flexco Elevate i3 Device, US	***Serial Number:***	Crypto IC unique ID = 0x01235D394FF5C7F4EE
Model Numbers:	91600	***Date(s) Tested:***	August 22nd, 2019 to September 17, 2019
Test Location:	TUV Rheinland of North America 1279 Quarry Lane, Ste. A Pleasanton, CA 94566 U.S.A. Tel. (925) 249-9123		
Test Specifications:	Emissions:	FCC Part 15 Subpart B:2019, ICES-003 Issue 6	
	Immunity:	N/A	
Test Result:	**The above product was found to be Compliant to the above test standard(s)**		

Prepared by: Bernd Jungbluth	***Reviewed by:*** Richard Decker
February 7, 2020 *Date* *Name* *Signature*	February 7, 2020 *Date* *Name* *Signature*
Other aspects: **None**	

PLEASANTON

US1131	**Testing Cert #3331.02**	**INDUSTRY CANADA 2932M-1**	**1097 (A-0326)**

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General Information

1.1 Scope

This report is intended to document the status of conformance with the listed standards based on the results of testing performed between August 22nd, 2019 to September 17, 2019 on the Flexco Elevate i3 Device, US, Model No.: 91600, manufactured by Flexible Steel Lacing Company. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

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1.3 Summary of Test Results

Applicant	Flexible Steel Lacing Company 2525 Wisconsin Avenue Downers Grove, IL 60515 USA U.S.A.
Contact	Timothy A Gunter Jr
Tel.	+1 616-242-1714
E-mail	tgunter@flexco.com
Description	EUT short description: Sensor for monitoring conveyor belt cleaners
Model Name	Flexco Elevate i3 Device, US
Model Number	91600
Serial Number	Crypto IC unique ID = 0x01235D394FF5C7F4EE
Input Power	3V Battery operated
Test Date(s)	August 22nd, 2019

Standards	Description	Severity Level or Limit	Criteria	Test Result
FCC Part 15 Subpart B:2019, ICES-003 Issue 6	Radiated Emissions	Class A 30 MHz - 30 GHz	Limit	Compliant

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2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA. 94538, are recognized by the Commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Pleasanton Registration No. US1131, Fremont Registration No. US1131). The laboratory Scopes of Accreditation include Title 47 CFR Parts 15, 18 and 90. The accreditations are updated every three years.

2.1.2 A2LA

TUV Rheinland of North America EMC test facilities are accredited by the American Association for Laboratory Accreditation (A2LA). The laboratories have been assessed and accredited by A2LA in accordance with ISO Standard 17025:2017 (Testing Certificate #3331.02). The Scope of Laboratory Accreditation includes emission and immunity testing. The accreditations are updated annually.

2.1.3 Industry Canada

The Pleasanton 5-meter Semi-Anechoic Chamber, Registration No. 2932M-1, has been accepted by Industry Canada to perform testing to 3 and 5 meters based on the test procedures described in ANSI C63.4-2014. The Fremont 10-meter Semi-Anechoic Chamber, Registration No. 2932D-1, has been accepted by Industry Canada to perform testing to 3 and 10 meters based on the test procedures described in ANSI C63.4-2014.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA. 94538, have been assessed and approved in accordance with the Regulations for Voluntary Control Measures.
VCCI Registration No. for Pleasanton: A-0326
VCCI Registration No. for Fremont: A-0327

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

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2.2 Test Facilities and EMC Software

Test facilities are located at 1279 Quarry Lane, Ste. A, Pleasanton, California 94566, U.S.A. and 5015 Brandin Ct, Fremont, CA. 94538, U.S.A. (Fremont is the Pleasanton Annex).

2.2.1 Emission Test Facility

The Semi-Anechoic Chambers and AC Line Conducted measurement facilities used to collect radiated and conducted emissions data have been constructed in accordance with ANSI C63.7:1992. The Fremont 10 meter semi-anechoic chamber has been measured in accordance with and verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4-2014 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04), at test distances of 3 and 10 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02). The Pleasanton 5 meter semi-anechoic chamber has been verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4-2014 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04) at a test distance of 3 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02).

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 3.7 m x 3.175 mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 10m semi-anechoic chamber with absorber added to floor.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9 m x 3.7 m x 3.175 mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

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2.2.3 EMC Software – Fremont

Manufacturer	Name	Version	Test Type
Rohde & Schwarz	EMC32	10.40.10	Radiated Emissions
EMISoft	Vasona	5.0	Radiated & Conducted Emissions
ETS-Lindgren	TILE	4.2.A	Radiated Emissions > 1 GHz
ETS-Lindgren	TILE	V.3.4.K.22	Radiated & Conducted Immunity

2.2.4 EMC Software - Pleasanton

Manufacturer	Name	Version	Test Type
Rohde & Schwarz	EMC32	10.40.10	Radiated Emissions
EMISoft	Vasona	5.0	Radiated & Conducted Emissions
ETS-Lindgren	TILE	3.4.K.14	Radiated & Conducted Immunity

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2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurement. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable Loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

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2.3.2 Measurement Uncertainty Emissions

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 5.0%.	Per CISPR 16-4-2

2.3.3 Measurement Uncertainty Immunity

The estimated expanded uncertainty for ESD immunity measurements is ± 8.2%.	Per IEC 61000-4-2
The estimated expanded uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated expanded uncertainty for EFT fast transient immunity measurements is ± 5.84%.	Per IEC 61000-4-4
The estimated expanded uncertainty for surge immunity measurements is ± 5.84 %.	Per IEC 61000-4-4
The estimated expanded uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated expanded uncertainty for power frequency magnetic field immunity is ± 11.6%.	Per IEC 61000-4-8
The estimated expanded uncertainty for voltage variation and interruption measurements is ± 3.48%.	Per IEC 61000-4-11

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2017. Equipment calibration records are kept on file at the test facility.

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2.5 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yy	Next Cal mm/dd/yy	Test
EMI Receiver	Rohde & Schwarz	ESIB	5000-309092304	02/28/2019	02/28/2020	RE
Preamplifier	Miteq	TTA1180	1842452	01/15/2019	01/15/2020	RE
Preamplifier	Sonoma Instruments	310	185516	01/16/2019	01/16/2020	RE
Bilog Antenna	Sunol Sciences	JB3	A102606	08/01/2018	08/01/2020	RE
Horn Ant. (1-18GHz)	Sunol Sciences	3115	9211-4676	05/03/2019	05/03/2021	RE
Horn Antenna w pre-amp	Com-Power	AHA-840	105005	09/03/2019	09/03/2021	RE

Note: CE=Conducted Emissions, CI=Conducted Immunity, DP=Disturbance Power, EFT=Electrical Fast Transients, ESD=Electrostatic Discharge, FLI=Flicker, HAR=Harmonics, MF=Magnetic Field Immunity, NCR=No Calibration Required, RE=Radiated Emissions, RI=Radiated Immunity, SI=Surge Immunity, VDSI=Voltage Dips and Short Interruptions

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3 Product Information

3.1 Product Description

Client provided Information:

The EUT is a remote monitoring device for components on a conveyor belt system. The device includes sensors to monitor the equipment and it communicates with the cloud via cellular or Wi-Fi and can remotely provide service teams with insights regarding the state of the equipment. The device is battery powered, and has no external connections. The battery is a custom primary cell pack (non-rechargeable, lithium thionyl chloride). The device also has Bluetooth for interfacing with a mobile phone. The Bluetooth interface supports both Bluetooth LE and Bluetooth Classic (SPP profile).

The device has two primary operating modes – scheduled and continuous. By default, the device operates in scheduled mode whereby it shuts down the majority of the circuitry for 60 minutes, and then after 60 minutes elapses, wakes the main applications processor, collects data, and optionally communicates with the cloud for 1 minute. The 60 minute sleep duration and 1 minute operating duration are remotely configurable. In continuous mode the device does not go to sleep and continuously collects data and uploads it via the cellular or Wi-Fi interface.

The device has the ability to perform remote software updates of all of the software in the applications processor as well as the cellular module.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

3.3 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in Appendix A of this report.

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3.4 Product Photos

Figure 1: EUT Picture - Front view

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Figure 2: EUT Picture - Side view

Figure 3: EUT Picture - Top view

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Figure 4: EUT Picture - Bottom view

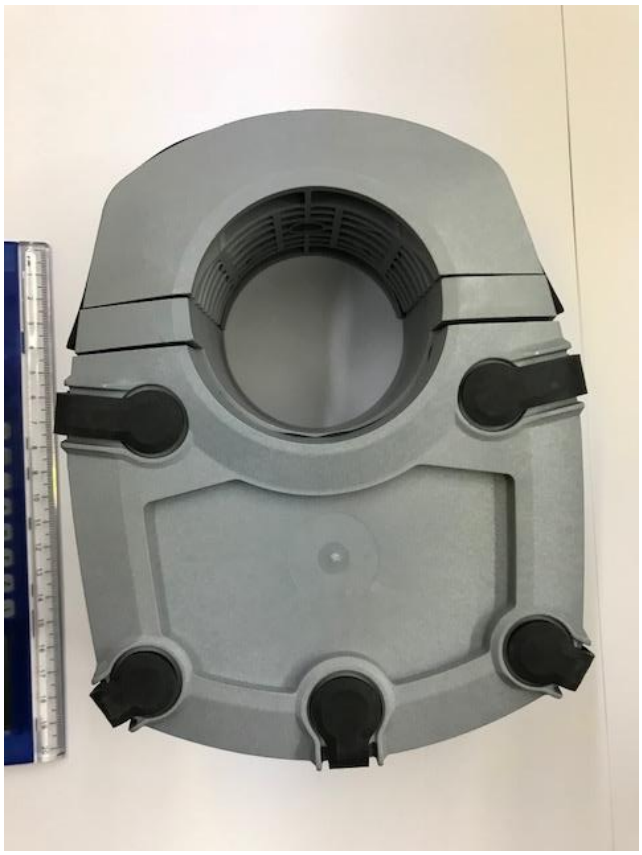

Figure 5: EUT Picture - Rear view

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Figure 6: EUT Picture – Rear View - Housing

Figure 7: EUT Picture – Rear View – Battery compartment

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Figure 8: EUT Picture – Rear View – Housing

Figure 9: EUT Picture – Rear View – Battery compartment

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Figure 10: EUT Picture – Rear View – temporary serial programmer access
(Not present in final design)

Figure 11: EUT Picture – side view – power capacitor and On\Off button

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Figure 12: EUT Picture – Rear View – PCB ribbon cable connection

Figure 13: EUT Picture – PCB Front (Note: Cellular antenna PA.710.A – left side)

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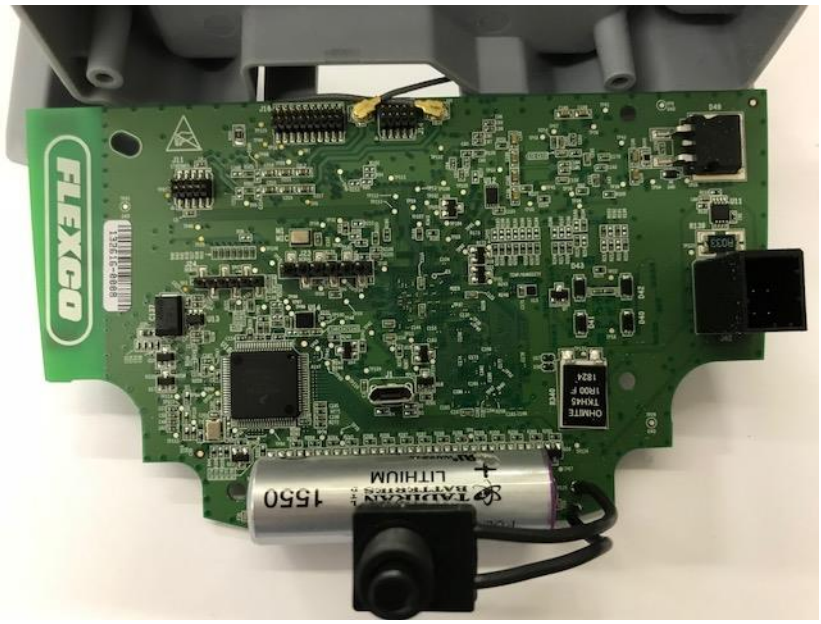

Figure 14: EUT Picture – PCB Rear

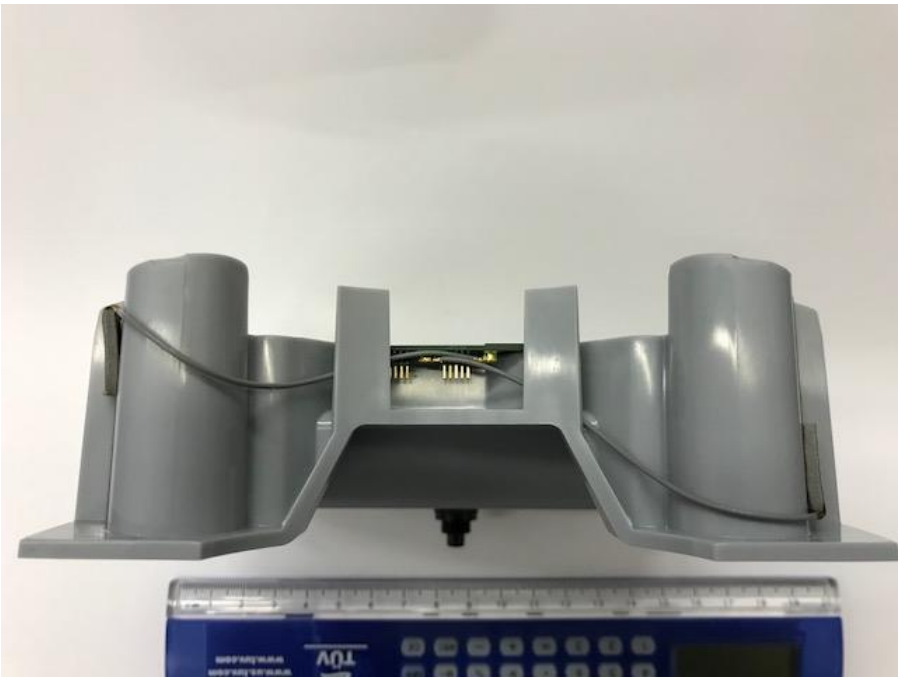

Figure 15: EUT Picture – U.FL connection and WiFi\BT antenna cabling

(Note: BT\WiFi antenna visible left and right side)

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Figure 16: EUT Picture – WiFi\BT antenna 1 - Detail

Figure 17: EUT Picture – WiFi\BT antenna 2 (right side) – Cellular antenna (upper side)

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4 Emissions

4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.1 Overview of Test

Results	**Compliant** (as tested per this report)			**Test Date(s)**		August 22nd, 2019 September 17th, 2019	
Standard	FCC Part 15 Subpart B:2019, ICES-003 Issue 6						
Model Number	91600			**Serial #**		Crypto IC unique ID = 0x01235D394FF5C7F4EE	
Configuration	See test plan for details.						
Test Setup	Tested in the 5-meter chamber, placed on turntable: see test plan for details.						
EUT Powered By	3 VDC (Battery operated)						
Environmental Conditions	August 22nd, 2019	**Temp**	21º C	**Humidity**	37%	**Pressure**	1016 mbar
	September 17th, 2019	**Temp**	20º C	**Humidity**	40%	**Pressure**	1014 mbar
Frequency Range	30 MHz - 30 GHz						
Perf. Criteria	A			**Perf. Verification**		Readings Under Limit	
Mod. to EUT	None			**Test Performed By**		Bernd Jungbluth	

4.1.2 Test Procedure

Radiated emissions tests were performed using the procedures of ANSI C63.4:2014 including methods for signal maximizations and EUT configuration.

The frequency range from 30 MHz - 30 GHz was investigated for radiated emissions.

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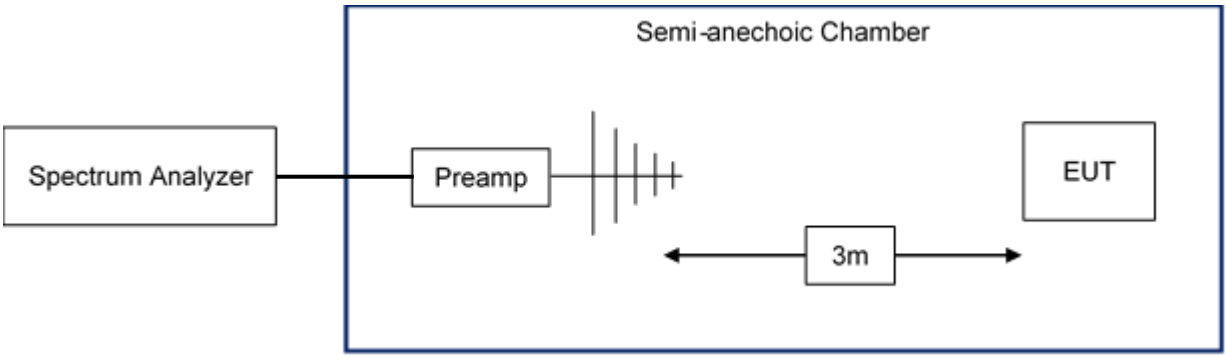
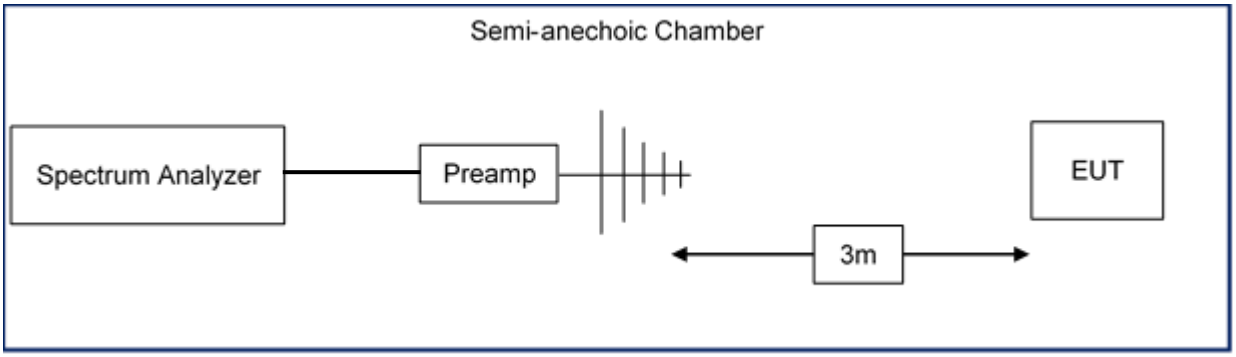
4.1.3 Test Setup:

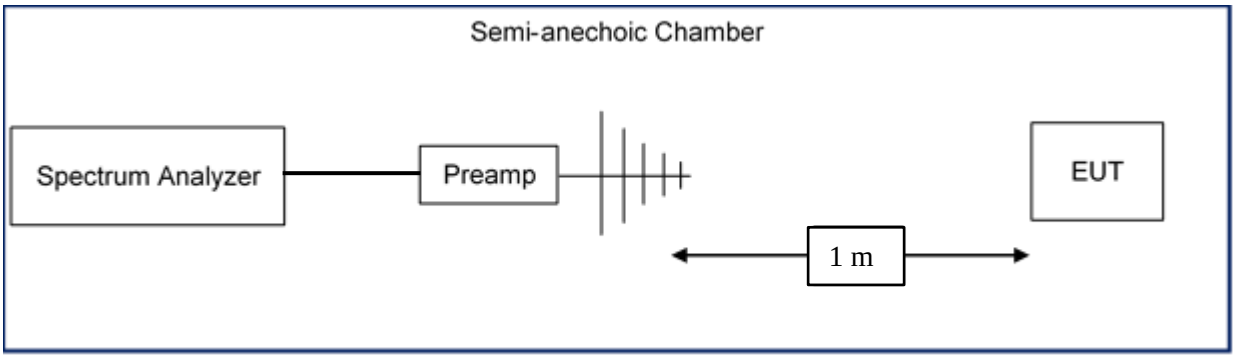
Scan Range: 30MHz to 1GHz



Scan Range: 1 to 18GHz



Scan Range: 18 to 30 GHz



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4.1.4 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.1.5 Final Test

All final radiated emissions measurements were below the specification limits.

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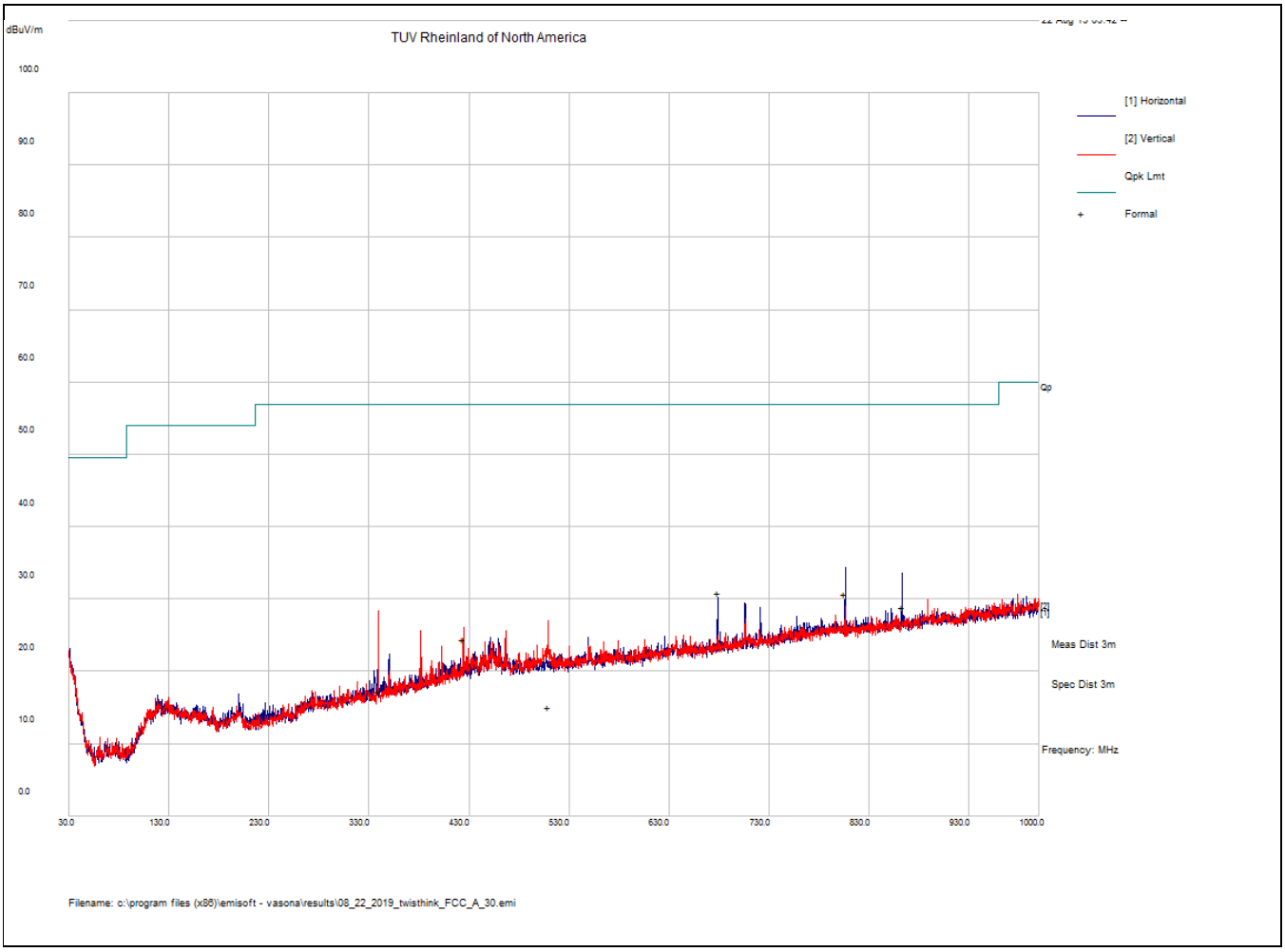
4.1.6 Plots – 30 MHz to 1 GHz

30 – 1000 MHz ; FCC 15B Class A

Radiated Emissions
EUT in Vertical Orientation



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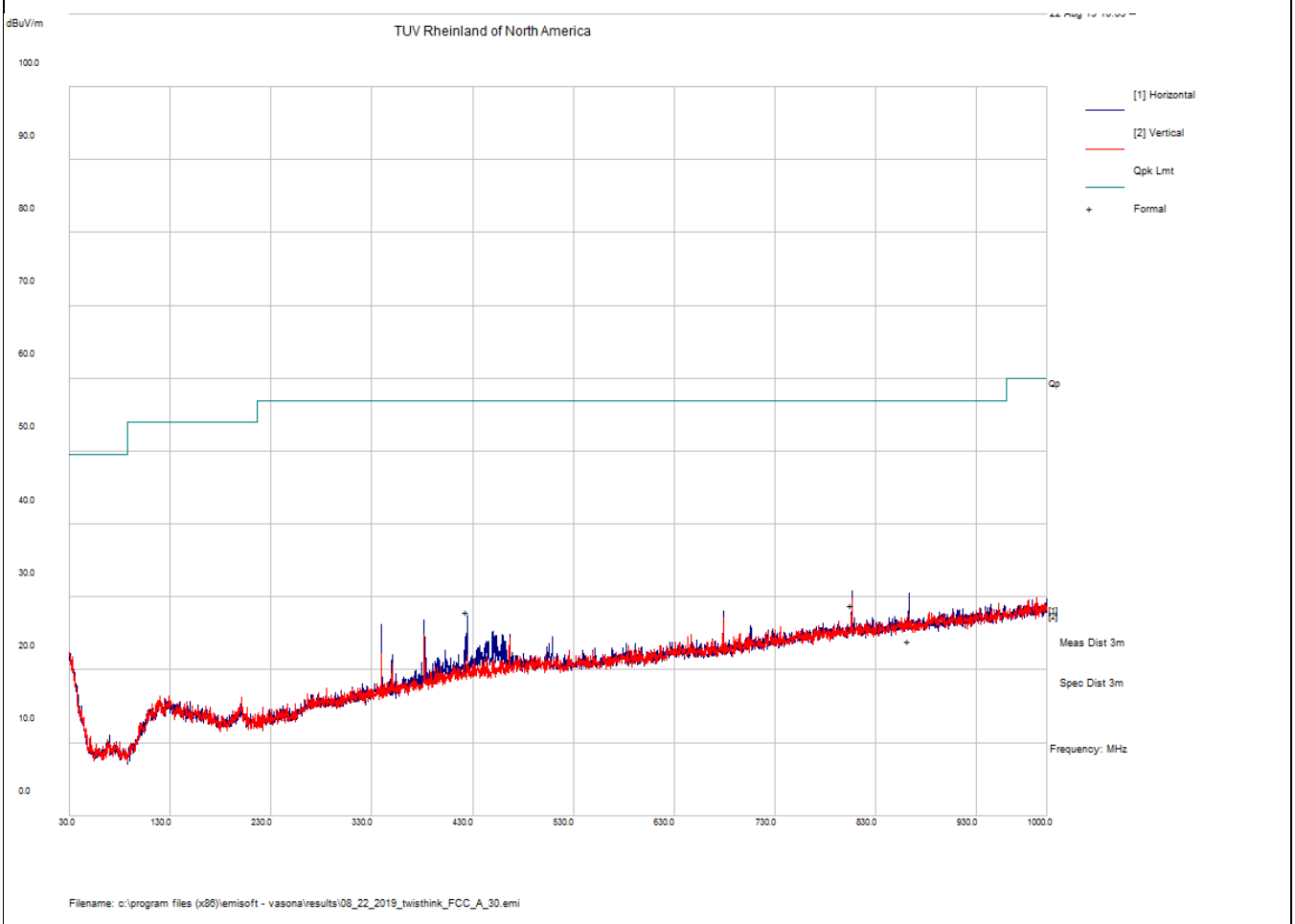
30 – 1000 MHz ; FCC 15B Class A

Radiated Emissions
EUT in Horizontal Orientation



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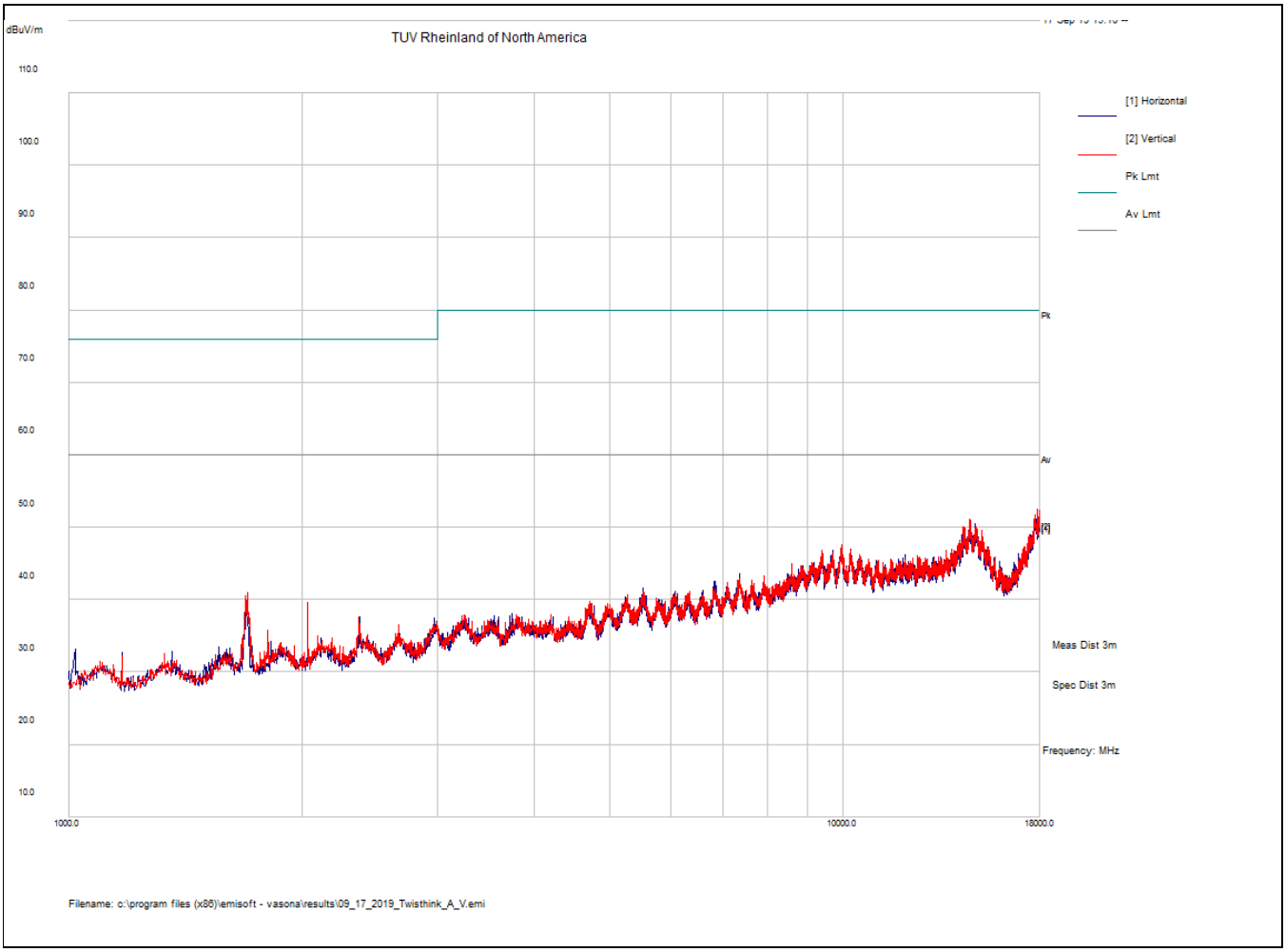
4.1.1 Plots – 1 GHz to 18 GHz

1 GHz to 18 GHz; FCC 15B Class A

Radiated Emissions
EUT in Vertical Orientation



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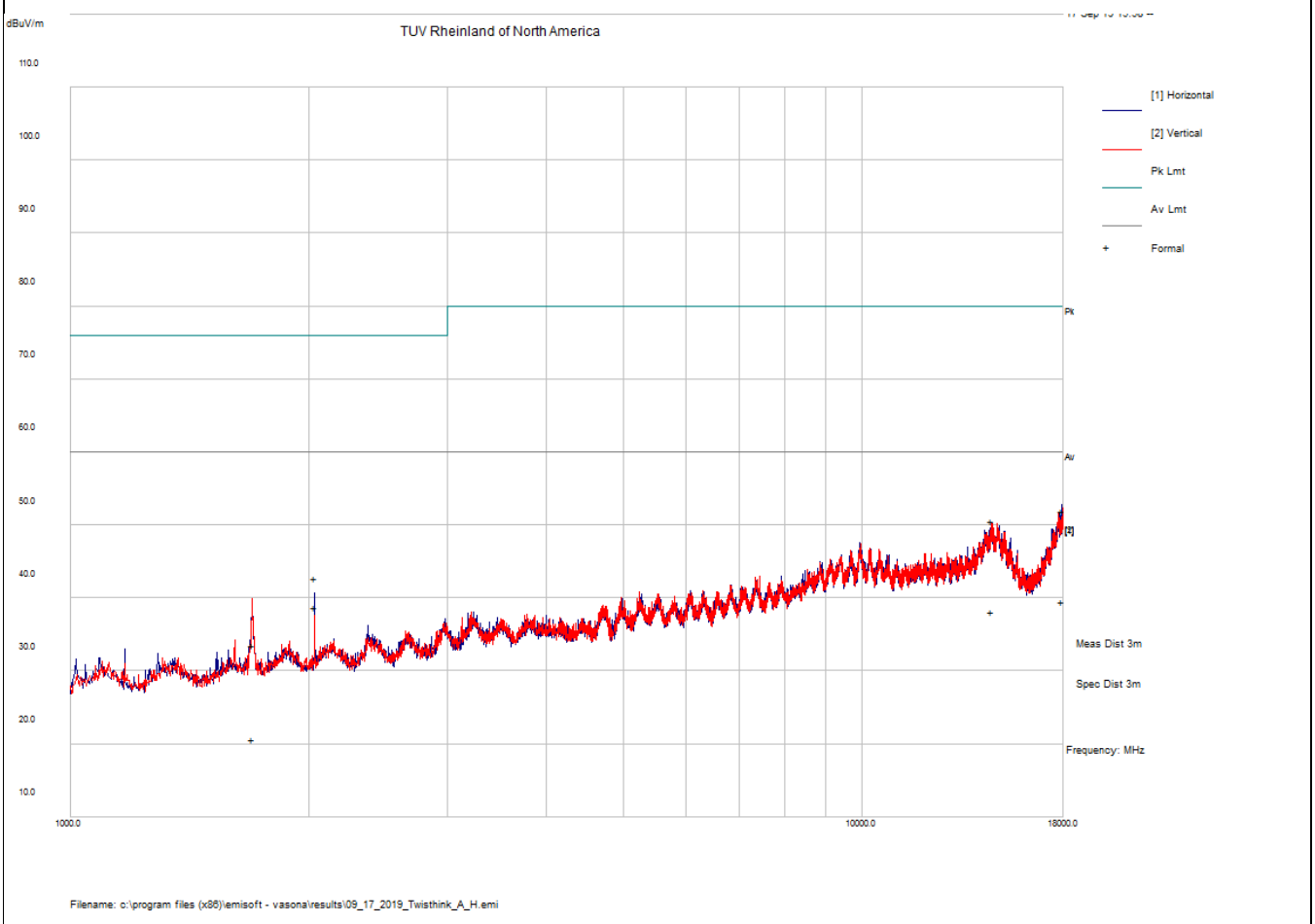
1 GHz to 18 GHz; FCC 15B Class A

Radiated Emissions
EUT in Horizontal Orientation



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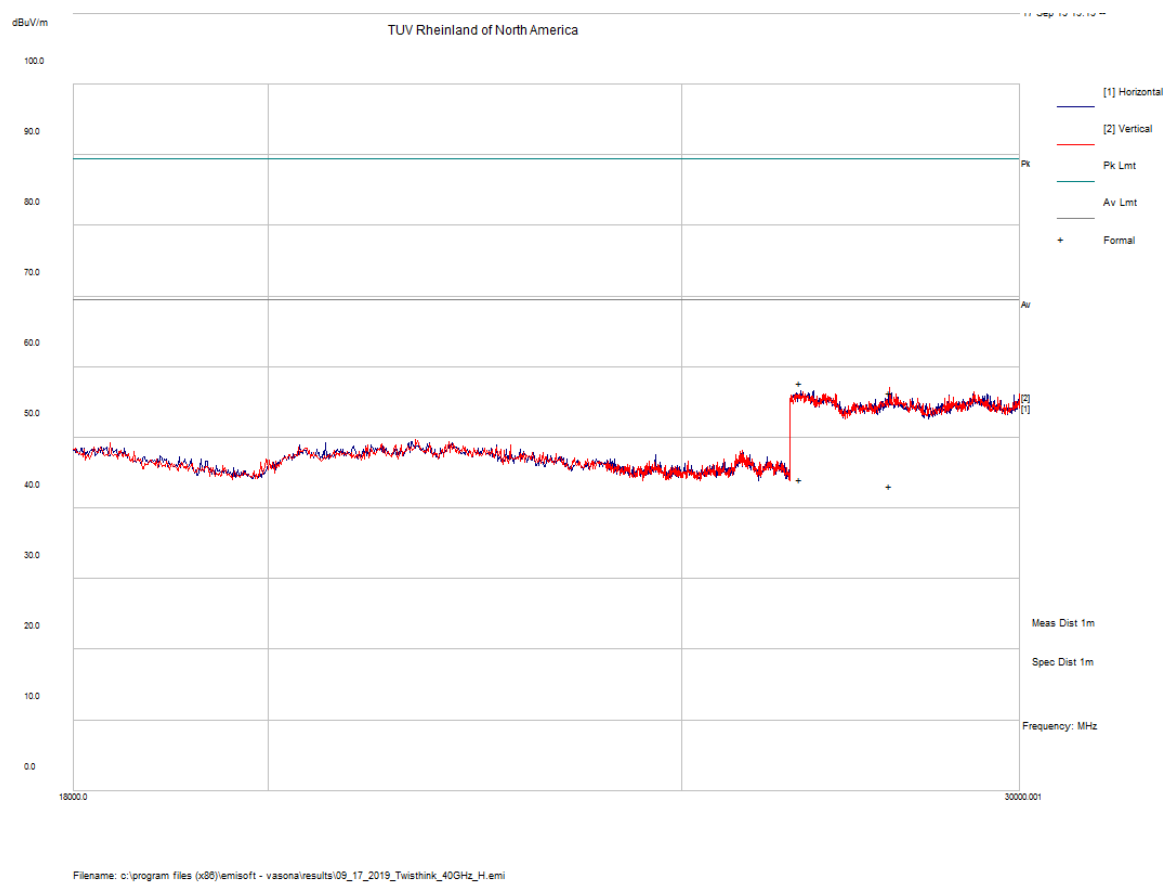
4.1.1 Plots – 18 GHz to 30 GHz

18GHz to 30 GHz; FCC 15B Class A

Radiated Emissions
EUT in Vertical Orientation



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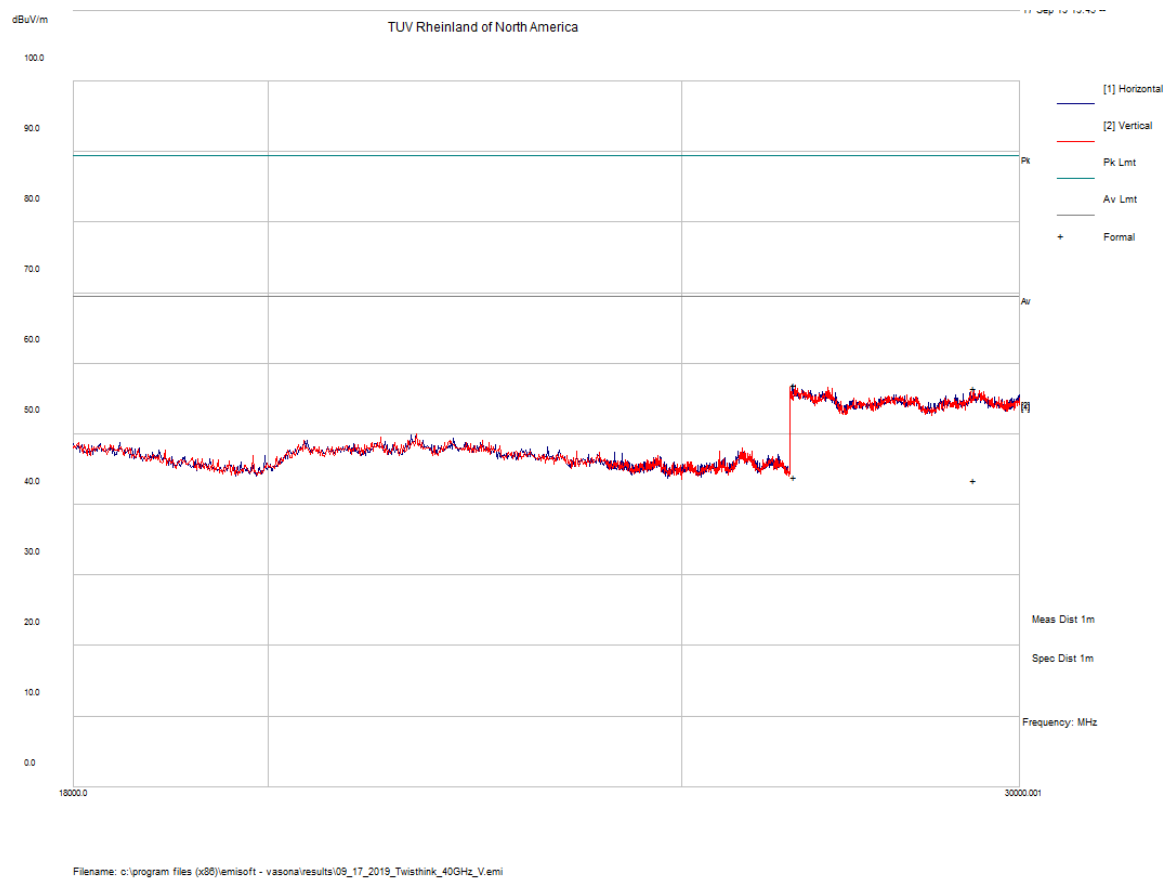
18GHz to 30 GHz; FCC 15B Class A

Radiated Emissions
EUT in Horizontal Orientation



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4.1.2 Final Tabulated Data – 30 MHz to 1 GHz

EUT in Vertical Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
339.37	28.76	1.71	-13.31	17.16	QP	V	185	338	56.90	-39.74	Pass
424.30	33.79	1.93	-11.22	24.50	QP	V	128	66	56.90	-32.40	Pass
509.35	22.98	2.15	-10.01	15.12	QP	V	204	280	56.90	-41.78	Pass
678.87	35.94	2.54	-7.63	30.85	QP	H	128	22	56.90	-26.05	Pass
806.15	33.63	2.77	-5.70	30.71	QP	H	102	112	56.90	-26.20	Pass
863.14	31.00	2.89	-4.95	28.94	QP	H	181	0	56.90	-27.96	Pass

EUT in Horizontal Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
424.28	37.25	1.93	-11.22	27.96	QP	H	237	164	56.90	-28.94	Pass
806.11	31.89	2.77	-5.70	28.96	QP	H	221	0	56.90	-27.94	Pass
862.75	25.98	2.89	-4.95	23.92	QP	H	277	246	56.90	-32.98	Pass

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4.1.1 Final Tabulated Data – 1 GHz to 18 GHz

EUT in Vertical Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
1696.84	62.70	2.10	-31.21	33.59	Peak Max	H	116	360	76.00	-42.41	Pass
1696.84	49.72	2.10	-31.21	20.61	Average Max	H	116	360	60.00	-39.39	Pass
2036.50	70.14	2.30	-29.67	42.77	Peak Max	H	217	76	76.00	-33.23	Pass
2036.50	66.06	2.30	-29.67	38.69	Average Max	H	217	76	60.00	-21.31	Pass
17944.06	52.79	6.98	-7.89	51.87	Peak Max	H	196	334	80.00	-28.13	Pass
17944.06	40.40	6.98	-7.89	39.49	Average Max	H	196	334	60.00	-20.51	Pass
14595.82	57.54	6.12	-13.04	50.62	Peak Max	V	237	338	80.00	-29.38	Pass
14595.82	44.99	6.12	-13.04	38.07	Average Max	V	237	338	60.00	-21.93	Pass

EUT in Horizontal Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
1696.84	62.70	2.10	-31.21	33.59	Peak Max	H	116	360	76.00	-42.41	Pass
1696.84	49.72	2.10	-31.21	20.61	Average Max	H	116	360	60.00	-39.39	Pass
2036.50	70.14	2.30	-29.67	42.77	Peak Max	H	217	76	76.00	-33.23	Pass
2036.50	66.06	2.30	-29.67	38.69	Average Max	H	217	76	60.00	-21.31	Pass
17944.06	52.79	6.98	-7.89	51.87	Peak Max	H	196	334	80.00	-28.13	Pass
17944.06	40.40	6.98	-7.89	39.49	Average Max	H	196	334	60.00	-20.51	Pass
14595.82	57.54	6.12	-13.04	50.62	Peak Max	V	237	338	80.00	-29.38	Pass
14595.82	44.99	6.12	-13.04	38.07	Average Max	V	237	338	60.00	-21.93	Pass

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4.1.1 Final Tabulated Data – 18 GHz to 30 GHz

EUT in Vertical Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
26650.46	53.34	8.38	-3.91	57.82	Peak Max	H	240	78	89.50	-31.68	Pass
26650.46	39.57	8.38	-3.91	44.05	Average Max	H	240	78	69.50	-25.45	Pass
27964.64	52.50	8.56	-4.64	56.42	Peak Max	V	243	210	89.50	-33.08	Pass
27964.64	39.20	8.56	-4.64	43.12	Average Max	V	243	210	69.50	-26.38	Pass

EUT in Horizontal Orientation:

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	Result
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
29275.07	52.08	8.86	-4.49	56.45	Peak Max	H	230	276	89.50	-33.05	Pass
29275.07	39.03	8.86	-4.49	43.40	Average Max	H	230	276	69.50	-26.10	Pass
26572.00	52.52	8.36	-3.91	56.98	Peak Max	V	136	52	89.50	-32.52	Pass
26572.00	39.40	8.36	-3.91	43.86	Average Max	V	136	52	69.50	-25.64	Pass

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4.1.2 Photos

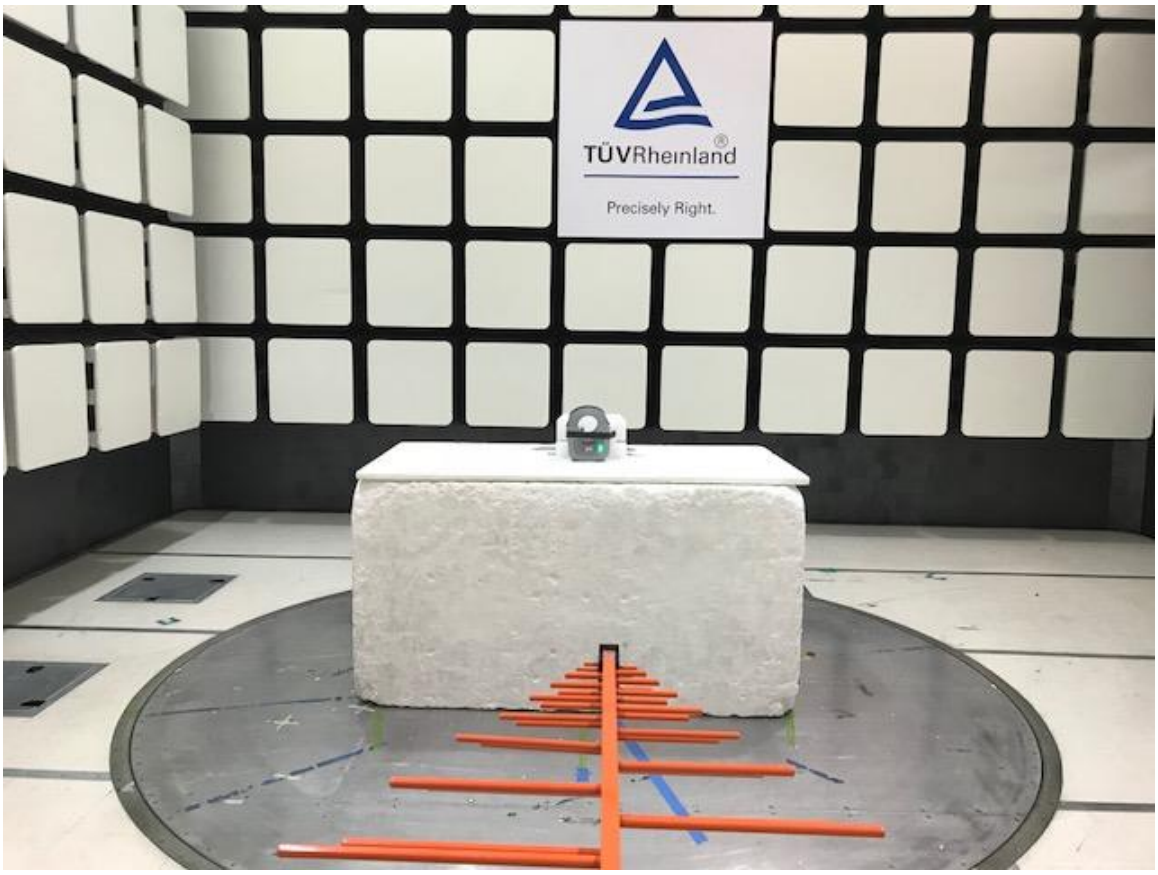

Figure 18: 30 - 1000 MHz Radiated Emission Test Setup – Front View – EUT Vertical

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Figure 19: 30 - 1000 MHz Radiated Emission Test Setup – Front View – EUT Horizontal

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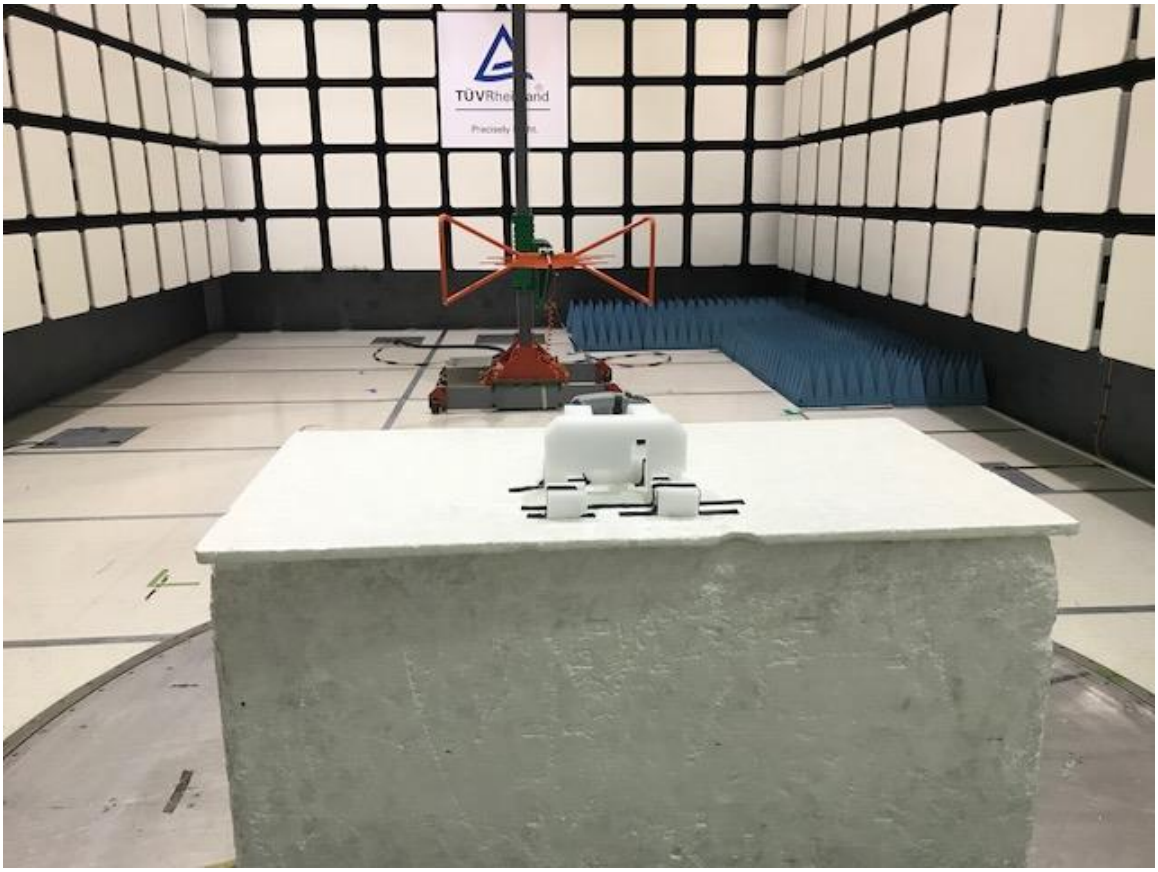

Figure 20: 30 - 1000 MHz Radiated Emission Test Setup – Rear View

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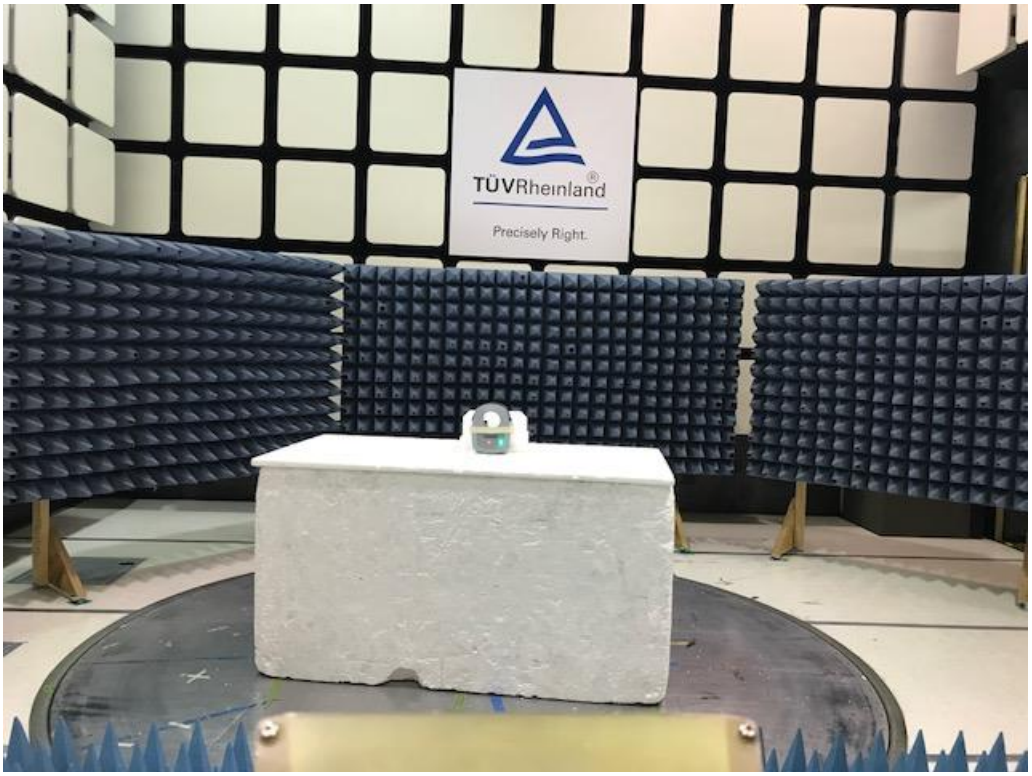

Figure 21: 1 – 18 GHz Radiated Emission Test Setup – Front View – EUT Vertical

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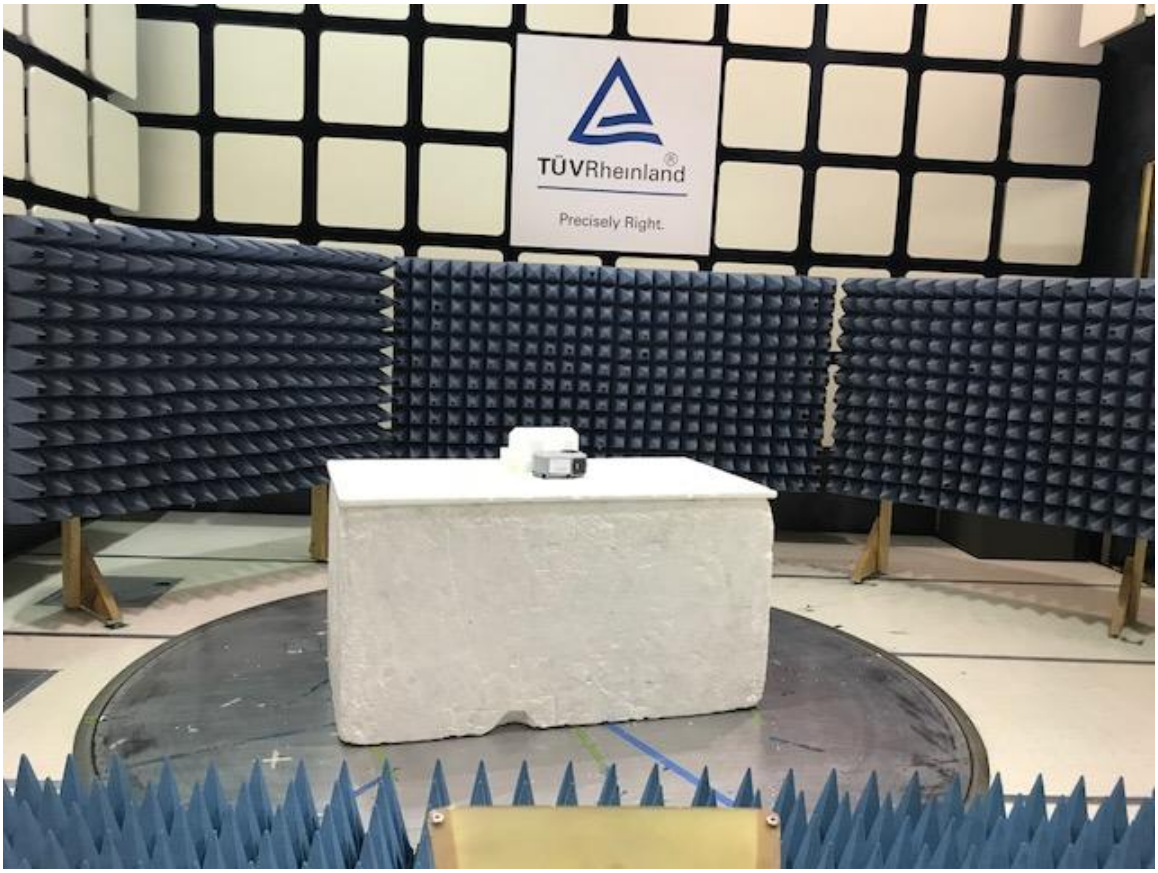

Figure 22: 1 – 18 GHz Radiated Emission Test Setup – Front View – EUT Horizonatl

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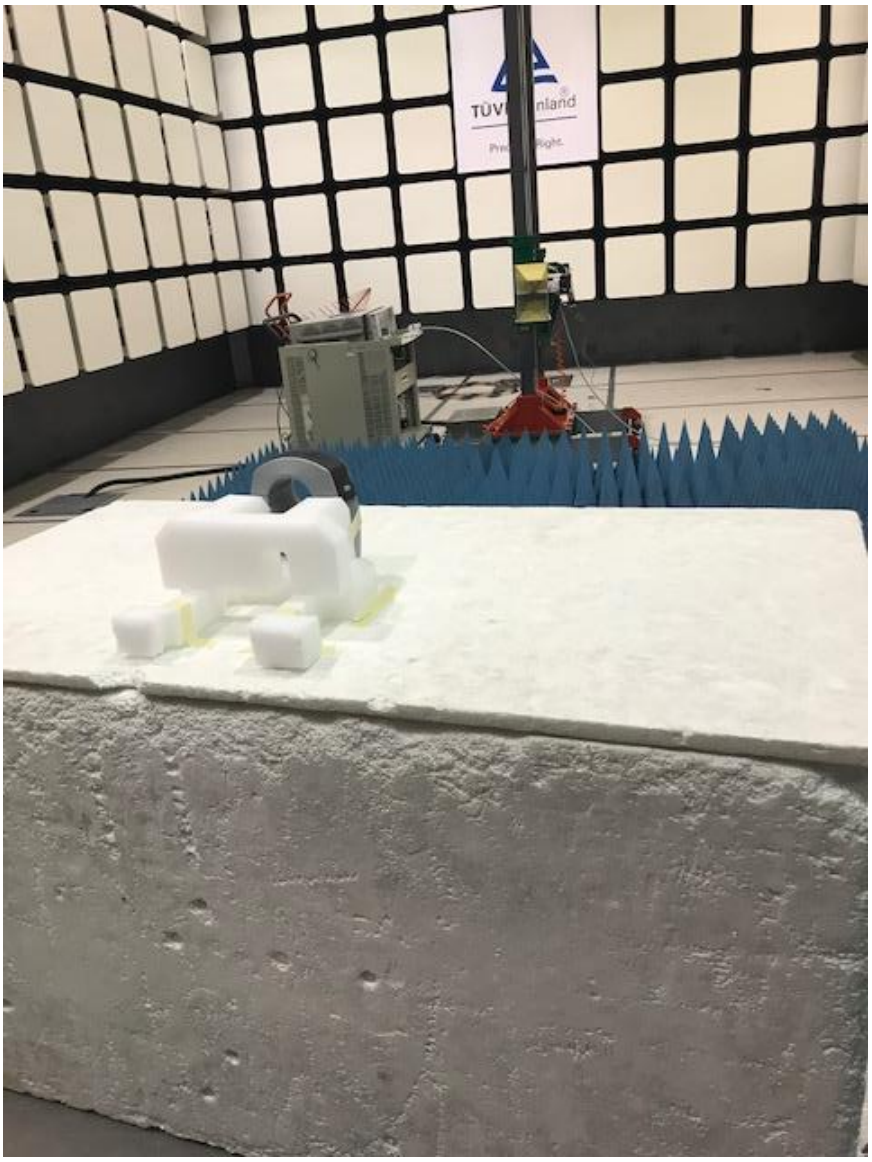

Figure 23: 1 – 18 GHz Radiated Emission Test Setup – Rear View

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Figure 24: 18 - 30 GHz Radiated Emission Test Setup – Front View

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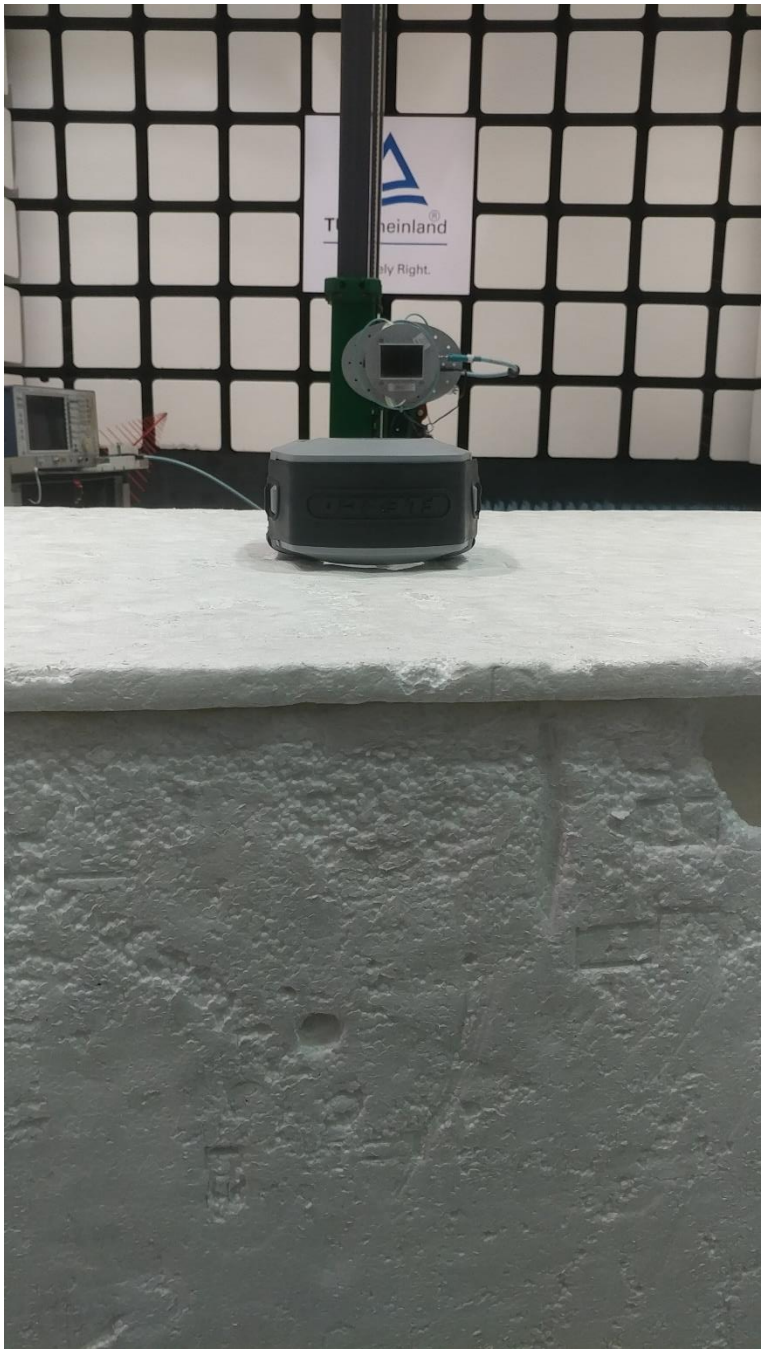

Figure 25: 18 - 30 GHz Radiated Emission Test Setup – Rear View

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Appendix A

5 Test Plan

This test report is intended to follow the test plan outlined herein unless otherwise stated. The test plan provides product information, reference standards, and testing details. The product information was provided by the client. Test procedure information will reference standards or internal TUV Rheinland NA procedures.

5.1 General Information

Client	Flexible Steel Lacing Company
Address	2525 Wisconsin Avenue
	Downers Grove, IL 60515 USA
Contact Person	Timothy A Gunter Jr
Telephone	+1 616-242-1714
e-mail	tgunter@flexco.com

5.2 EUT Designation

Model Name	Flexco Elevate i3 Device, US
Model Number(s)	91600

5.3 EUT Description

Sensor for monitoring conveyor belt cleaners

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5.4 Equipment Under Test (EUT) Description

The EUT is a remote monitoring device for components on a conveyor belt system.

5.5 Product Environment(s)

☐	**Domestic/Residential**	☐	**Hospital**
☒	**Light Industrial/Commercial**	☐	**Small Clinic**
☒	**Industrial**	☐	**Doctor's office**
☐	**Telecommunications Center**	☒	**Other than Telecommunications Center**
☐	**Other**		

*Check all that apply

5.6 Applicable Documents

Standards	Description
FCC Part 15 Subpart B:2019, ICES-003 Issue 6	Radiated Emissions

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5.7 EUT Electrical Power Information

Name	# of Phases	Type	Input Voltage		AC Voltage Frequency	Current Max.
			Min	Max		
Battery	1 ☐ 3 ☐ None ☒	AC ☐ DC ☐ Host ☐ Batteries ☒	2.5 V	3.6 V	DC	3 A
Notes	None					

5.7.1 Radiated Emissions, Upper Frequency

☐	**Less than 108 MHz**	**Scan to 1 GHz**
☐	**Less than 500 MHz**	**Scan to 2 GHz**
☐	**Less than 1000 MHz**	**Scan to 5 GHz**
☒	**Greater than 1000 MHz**	**Scan to 5th Harmonic or 40 GHz (whichever is lower)**

Note: EUT tested up to 6 GHz for informational purposes.

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5.8 Electrical Support Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Lenovo	Thinkpad	N/A	EUT Configuration for regulatory test mode operation. Laptop not present during testing.
Diagnostic cable (3.3V I/O)	Sparkfun	DEV-09717	N/A	EUT Configuration for regulatory test mode operation via Laptop. Not present during testing. EUT in standalone operation after configuration.
Note: None.				

5.9 Non - Electrical Support Equipment

Reference Designation	Manufacturer	Model	Serial Number or Description (e.g., Type of Gas or Liquid)
None	-	-	-

5.10 EUT Equipment/Cabling Information

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Serial	USB to serial	☐ Yes	N/A	☒ M
Note: Serial Connector for diagnostic and maintenance purpose only. Serial connector located on PCB. Not accessible to end user.				

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5.11 EUT Test Program

Internal test routine operation for a continuous sensor logging operational during test execution.
Sensor mode operation declared by the manufacturer as worst case operational mode with regards to EMC emission assessment.

5.12 Monitoring of EUT during Testing

Device will be continuously logging to files during tests. Log files are evaluated after the test to verify correct behavior(s).

5.13 EUT Configuration

5.13.1 Description

Configuration	Description
Flexco application running	Device continuously sampling sensors and logging data locally.
Notes	None

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5.13.2 Block Diagram

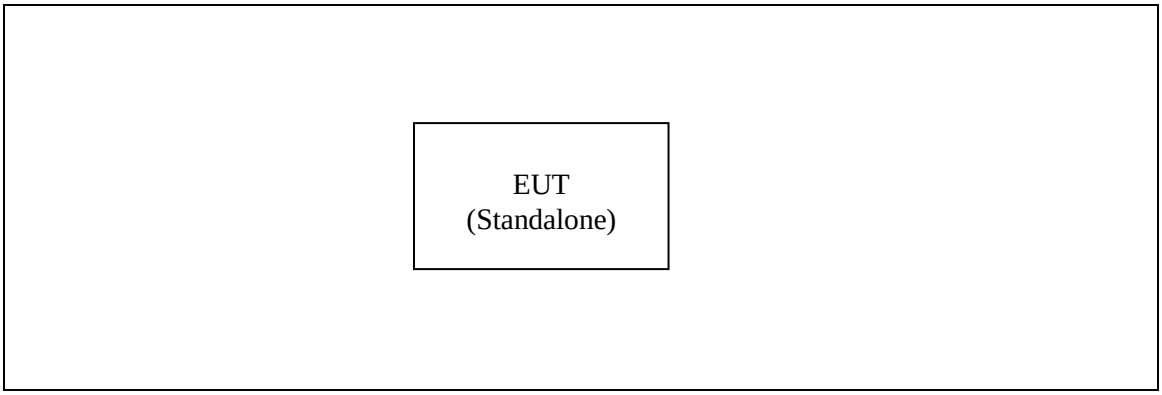

Figure 22: Block Diagram of EUT Setup

5.14 Emissions

5.14.1 Radiated Emissions

5.14.1.1 Preliminary Radiated Emissions Test Setup

Standard	FCC Part 15 Subpart B:2019, ICES-003 Issue 6			**TUV Test Procedure**	MS-0005192
Limit	Class A	**Emissions Verification**		Emissions Under Limit	
Frequency Range	30MHz – 6 GHz				
Scan #1	Pre-scan 30 – 1000 MHz	**Antenna Distance**	3m	**Detector**	Peak
Scan #2	Pre-scan 1– 18 GHz	**Antenna Distance**	3m	**Detector**	Peak
Scan #2	Pre-scan 18 - 30 GHz	**Antenna Distance**	1m	**Detector**	Peak
Configuration	See Section 6.15				
Notes	None				

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5.14.1.2 Final Radiated Emissions Test Setup

Standard	FCC Part 15 Subpart B:2019, ICES-003 Issue 6			**TUV Test Procedure**	MS-0005192
Limit	Class A	**Emissions Verification**		Emissions Under Limit	
Frequency Range	30MHz – 30 GHz				
Scan #1	Final Scan 30 – 1000 MHz	**Antenna Distance**	3m	**Detector**	Quasi Peak
Scan #2	Final Scan 1 – 18 GHz	**Antenna Distance**	3m	**Detector**	Peak Average
Scan #2	Final Scan 18 - 30 GHz	**Antenna Distance**	1m	**Detector**	Peak Average
Configuration	See Section 6.15				
Notes	None				

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END OF REPORT

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