

Report on the FCC and ISED Testing of the ValidFill, LLC ISC.MU02.02-AD

In accordance with FCC 47 CFR Part 15.247

Prepared for: ValidFill, LLC
4914 Lena Road Suite 106
Bradenton, FL 34211

FCC ID: ODB-BB000SA003 IC: N/A



Add value.
Inspire trust.

COMMERCIAL-IN-CONFIDENCE

Document Number: BO72144038.100 | Issue: 01

SIGNATURE

A handwritten signature of Pete Walsh in blue ink.

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Pete Walsh	Service Line Manager	Authorized Signatory	2019-Nov-06

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD America, Inc. document control rules.

FCC Accreditation
Designation Number US1063 Tampa, FL Test Laboratory
Innovation, Science, and Economic Development Canada
Accreditation
Main Site Number 2087A-2 Tampa, FL Test Laboratory
Satellite Site Number: 4175C Boca Raton, FL Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC Part 15.247.



DISCLAIMER AND COPYRIGHT

This non-binding report has been prepared by TÜV SÜD America with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD America. No part of this document may be reproduced without the prior written approval of TÜV SÜD America.
© TÜV SÜD.

ACCREDITATION

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

TÜV SÜD America
5610 West Sligh Ave., Suite 100
Tampa, FL 33634

Phone: 813-284-2715
www.tuv-sud-america.com

TÜV SÜD

TÜV®

TABLE OF CONTENTS

1	GENERAL	3
1.1	Purpose	3
1.2	Applicant Information.....	3
1.3	Product Description	3
1.4	Test Methodology and Considerations	3
2	TEST FACILITIES	4
2.1	Location.....	4
2.2	Laboratory Accreditations/Recognitions/Certifications.....	4
2.3	Radiated & Conducted Emissions Test Site Description	5
2.3.1	Semi-Anechoic Chamber Test Site	5
2.3.2	Conducted Emissions Test Site Description.....	6
3	APPLICABLE STANDARD REFERENCES	7
4	LIST OF TEST EQUIPMENT	8
5	SUPPORT EQUIPMENT	9
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM.....	9
7	SUMMARY OF TESTS.....	10
7.1	Antenna Requirement – FCC: Section 15.203.....	10
7.2	Band-Edge Compliance and Spurious Emissions	10
7.2.1	Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209	10
7.2.2	Sample Calculation:	11
8	MEASUREMENT UNCERTAINTIES	12
9	CONCLUSION.....	13

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 Section 15.247 for the tests documented herein for a Class 2 Permissive Change.

The purpose of the Class 2 Permissive Change is to add a new antenna configuration on the module while integrated into a new host device.

There are no hardware changes on the module.

1.2 Applicant Information

ValidFill, LLC
4914 Lena Road Suite 106
Bradenton, FL 34211

1.3 Product Description

The EUT is a 900 MHz limited modular approved transceiver. The device was evaluated while integrated within a soda dispenser.

Technical Details

Mode of Operation: 900 MHz RFID
Frequency Range: 902.75 - 927.25 MHz
Number of Channels: 50
Channel Separation: 500 kHz
Modulations: ASK
Antenna Type/Gain: PCB Loop Antenna, 0.55 dBi
Input Power: 120V/60Hz (Dispenser)

Model Number: ISC.MU02.02-AD

Test Sample Serial Number(s): N/A

Test Sample Condition: The test samples were in good operating condition without any physical damages.

1.4 Test Methodology and Considerations

The evaluation on the module was performed while integrated within the soda dispenser.

The module was set to transmit at the maximum RF output power.

The module is used in conjunction with a multiplexer. Per the manufacturer, only one RF port of the module is used. The device was tested accordingly.

Preliminary measurements were performed on all the multiplexer output. The overall worst case from the pre-scans was tested in full.

Compliance to the power line conducted emissions and unintentional radiated emissions is documented in the Supplier's Declaration of Conformity (SDOC) test report.

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
<http://www.tuv-sud-america.com>

Innovation, Science and Economic Development Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by American Association for Laboratory Accreditation (A2LA) and has been issued certificate number 2955.15 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

Main Site Information:

TÜV SÜD America, Inc.
5610 West Sligh Ave., Suite 100
Tampa, FL 33634
Phone: 813-284-2715
www.tuv-sud-america.com

FCC Designation Number US1063
FCC Test Firm Registration #: 160606
Innovation, Science, and Economic Development Canada Lab Code: 2087A-2

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized, and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

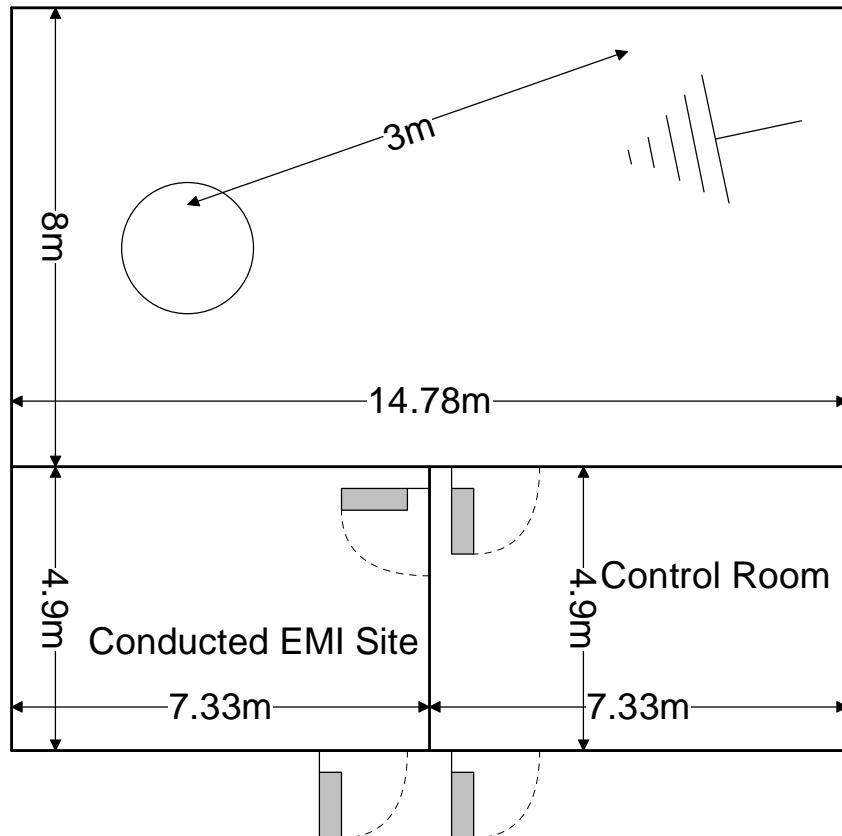


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are $7.3 \times 4.9 \times 3 \text{ m}^3$. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 $50 \Omega/50 \mu\text{H}$ and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

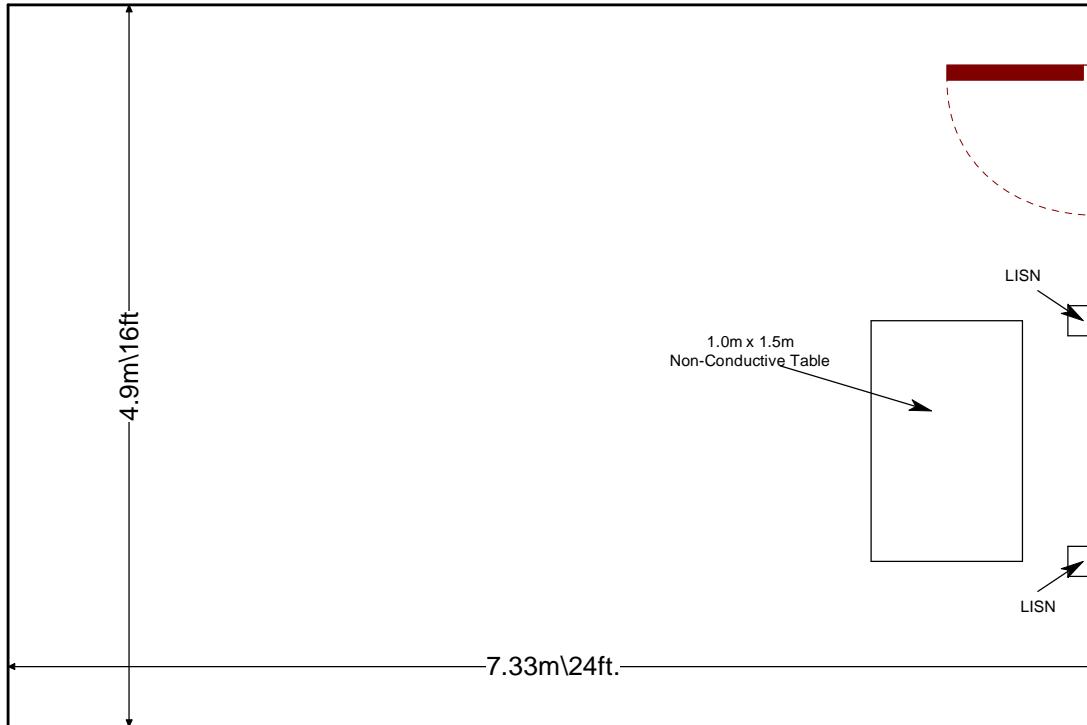


Figure 2.3.2-1: AC Mains Conducted EMI Site

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 15.247 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 14, 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 List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
BEMC00078	EMCO	6502	Active Loop Antenna	9104-2608	5/9/2018	5/9/2020
BEMC00523	Agilent	E7405A	9kHz-26.5GHz EMC analyzer/HYZ	MY45103293	11/27/2018	11/27/2020
BEMC02002	EMCO	3108	30 MHz to 200 MHz Biconical Antenna	2147	11/28/2017	11/30/2019
BEMC02004	EMCO	3146	200 MHz to 1 GHz Log Periodic Antenna	1385	12/27/2017	12/27/2019
BEMC02006	EMCO	3115	Linear Polarized Horn antenna, 1-18 GHz	2573	4/7/2017	4/7/2019
BEMC02011	Hewlett-Packard	HP 8447D	100 kHz to 1.3 GHz low-noise, high gain amplifier	2443A03952	10/18/2018	10/18/2019
BEMC02045	ACS Boca	Conducted Cable Set	Consists of cables 2046, 2047, 2062, 2063 and 2065	2045	10/22/2018	10/22/2019
BEMC02071	Trilithic, Inc.	4HC1400-1-KK	High Pass Filter	9643263	10/17/2018	10/17/2019
BEMC02095	ETS Lindgren	TILE4! - Version 4.2.A	Tile Automation Software	85242	NCR	NCR
BEMC02121	Teledyne Storm Products	A81-0303	Radiated Cable Set	2121	7/26/2018	7/26/2019
BEMC02138	Hewlett Packard	8449B	Pre-Amplifier	3008A00320	11/26/2018	11/26/2019

Notes:

- **NCR=No Calibration Required**
- **The assets were only used during the active period of the calibration cycle.**

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	ValidFill, LLC	ISC.MU02.02-AD	N/A
2	Soda Dispenser	ValidFill, LLC	4100 FireStorm	N/A
3	Ethernet Switch	LINKSYS	BEFSR41 ver 4.2	C2171G508151
4	9 VAC Power Supply	LINKSYS	AM-91000A	2102-10091000R

Table 5-2: Cable Description – Radiated Emissions

Cable #	Cable Type	Length	Shield	Termination
A	Power	2 m	No	EUT to AC Mains
B	Ethernet	10 m	No	EUT to Ethernet Switch
C	Power	0.85 m	No	Power Supply to Ethernet Switch

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

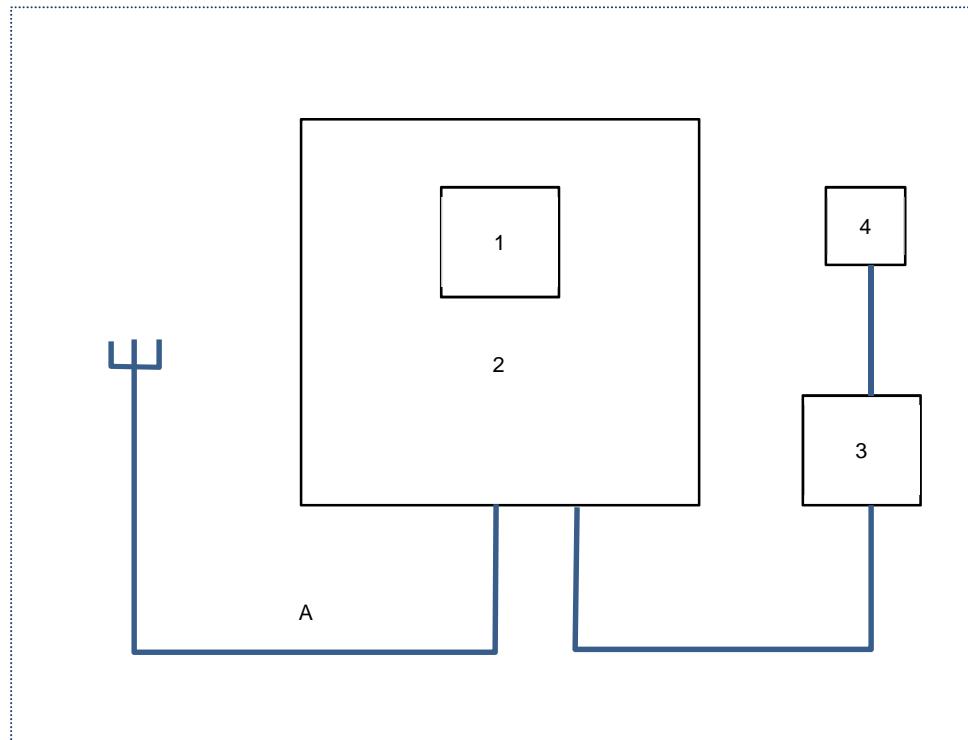


Figure 6-1: EUT and Support Equipment Block Diagram

Note: The Ethernet Switch was set up outside of the test environment.

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

Test Begin Date: December 4, 2018
Test End Date: December 6, 2018

Table 7-1: Summary of Tests

Requirements	FCC Rule Part	ISED Canada	Test Results
Antenna Requirement	FCC: Section 15.203		Pass
Radiated Spurious Emissions into Restricted Frequency Bands	FCC: Sections 15.205, 15.209	ISED Canada: RSS-Gen 8.9, 8.10	Pass

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses 0.55 dBi loop antennas provided by the host device. The antennas are not easily accessible nor replaceable. The EUT meets the requirements of FCC Section 15.203.

7.2 Band-Edge Compliance and Spurious Emissions

7.2.1 Radiated Spurious Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209

7.2.1.1 Measurement Procedure

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

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

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 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 measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

7.2.1.2 Measurement Results

Performed by: Jean Rene, Thierry Jean-Charles

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 10 GHz are reported in the tables below.

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dB μ V)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dB μ V/m)		Limit (dB μ V/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 902.75 MHz										
2708.25	39.73	27.55	H	2.01	41.74	29.56	74.0	54.0	32.3	24.4
2708.25	39.92	27.89	V	2.01	41.93	29.90	74.0	54.0	32.1	24.1
3611	42.20	28.55	H	5.16	47.36	33.71	74.0	54.0	26.6	20.3
3611	41.55	28.26	V	5.16	46.71	33.42	74.0	54.0	27.3	20.6
5416.5	36.95	24.42	H	9.22	46.17	33.64	74.0	54.0	27.8	20.4
5416.5	37.21	24.92	V	9.22	46.43	34.14	74.0	54.0	27.6	19.9
Middle Channel 915.25 MHz										
2745.75	42.36	33.92	H	2.12	44.48	36.04	74.0	54.0	29.5	18.0
2745.75	42.37	34.59	V	2.12	44.49	36.71	74.0	54.0	29.5	17.3
3661	37.95	25.50	H	5.36	43.31	30.86	74.0	54.0	30.7	23.1
3661	39.48	29.47	V	5.36	44.84	34.83	74.0	54.0	29.2	19.2
High Channel 927.25 MHz										
2781.75	40.61	30.90	H	2.23	42.84	33.13	74.0	54.0	31.2	20.9
2781.75	41.07	32.06	V	2.23	43.30	34.29	74.0	54.0	30.7	19.7
3709	42.43	30.06	H	5.56	47.99	35.62	74.0	54.0	26.0	18.4
3709	45.06	33.67	V	5.56	50.62	39.23	74.0	54.0	23.4	14.8
4636.25	37.22	24.19	H	7.25	44.47	31.44	74.0	54.0	29.5	22.6
4636.25	36.90	24.49	V	7.25	44.15	31.74	74.0	54.0	29.9	22.3

Notes:

All emissions above 5.42 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.2.2 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: $39.73 + 2.01 = 41.74 \text{ dB}\mu\text{V/m}$

Margin: $74 \text{ dB}\mu\text{V/m} - 41.74 \text{ dB}\mu\text{V/m} = 32.26 \text{ dB}$

Example Calculation: Average

Corrected Level: $27.55 + 2.01 = 29.56 \text{ dB}\mu\text{V/m}$

Margin: $54 \text{ dB}\mu\text{V/m} - 29.56 \text{ dB}\mu\text{V/m} = 24.44 \text{ dB}$

8 MEASUREMENT UNCERTAINTIES

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: Measurement Uncertainties

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 1.15 \text{ dB}$
Power Spectral Density	$\pm 1.15 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.15 \text{ dB}$
Radiated Emissions $\leq 1\text{GHz}$	$\pm 5.86 \text{ dB}$
Radiated Emissions $> 1\text{GHz}$	$\pm 4.65 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 3.72 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model ISC.MU02.02-AD, manufactured by ValidFill, LLC, meets the requirements of FCC Part 15.247 for the tests documented herein.

END REPORT