HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

August 10, 2020

HID Global Corporation
6533 Flying Cloud Drive
Eden Prairie, MN 55344

Dear Robert Cresswell,

Enclosed is the EMC test report for compliance testing of the HID Global Corporation, Fargo HDP6600 Lamination Module, tested to the requirements of Title 47 of the CFR, Part 15.225, Subpart C for Certification as an Intentional Radiator.

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if we can be of further service to you, please feel free to contact me.

Sincerely yours,
EUROFINS E&E NORTH AMERICA

Joel Huna
Documentation Department

Reference: (\HID Global Corporation\EMCA103010-FCC225 Rev. 2)

Electromagnetic Compatibility Criteria
Test Report

for the

HID Global Corporation
Fargo HDP6600 Lamination Module
Model: X002200LAM

Tested under
the FCC Certification Rules
contained in
15.225 Subpart C
for Intentional Radiators

Report: EMCA103010-FCC225 Rev. 2

August 10, 2020

Prepared For:

HID Global Corporation
6533 Flying Cloud Drive
Eden Prairie, MN 55344

Prepared By:
Eurofins E&E North America
13501 McCallen Pass,
Austin, TX 78753

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Giuliano Messina, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Part 15.225 under normal use and maintenance.

Jonathan Tavira,
Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 15, 2020	Initial Issue.
1	August 4, 2020	TCB modifications
2	August 10, 2020	TCB modifications

Table of Contents

List of Figures

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**er**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. *Executive Summary*

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the HID Global Corporation Fargo HDP6600 Lamination Module with the requirements of Part 15, §15.225. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Fargo HDP6600 Lamination Module. HID Global Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Fargo HDP6600 Lamination Module, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.225, in accordance with HID Global Corporation, purchase order number 1110967802. All tests were conducted using measurement procedures ANSI C63.10-2013.

FCC Reference 47 CFR Part 15.225	Description	Compliance
Part 15 §15.203	Antenna Requirement	Compliant
Part 15 §15.207(a)	Conducted Emission Limits	Compliant
Part 15 §15.215	20dB Occupied Bandwidth	Compliant
Part 15 §15.225(a)	Field Strength emissions within the band 13.553 – 13.567 MHz	Compliant
Part 15 §15.225(b)	Field Strength emissions within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	Compliant
Part 15 §15.225(c)	Field Strength emissions within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	Compliant
Part 15 §15.225(d)	Outside-Band Field Strength emissions per 15.209 - 13.110 – 14.010 MHz	Compliant
Part 15 §15.225(e)	Frequency Tolerance of the Carrier	Compliant

Figure 1. Executive Summary of EMC Part 15.225 Compliance Testing

Eurofins MET Laboratories Inc. (Eurofins E&E North America) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

II. *Equipment Configuration*

A. Overview

Eurofins E&E North America was contracted by HID Global Corporation to perform testing on the Laminator Accessory, under HID Global Corporation's purchase order number 1110967802.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the HID Global Corporation, Laminator Accessory.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	X002200LAM	
Model(s) Covered:	X002200LAM	
EUT Specifications:	Primary Power: 100-240 VAC 50/60 Hz	
	FCC ID: JQ6-X002200LAM	
	Type of Modulations:	ASK
	Equipment Code:	DXX
	Peak Field Strength:	27.49 dBµV/m @30m
	EUT Frequency Ranges:	13.56MHz
	Antenna Type:	Inductive Loop
	Antenna Gain:	1 dBi
	Power Setting:	Factory Default
	Firmware Version:	TP5K_R2.exe
	Support Software:	HostControl_Lite
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Giuliano Messina	
Report Date(s):	August 10, 2020	

Figure 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Figure 3. References

C. Test Site

Eurofins MET Laboratories Inc. (Eurofins E&E North America) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.
All testing was performed at Eurofins E&E North America, 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.97 dB	2	95%
RF Power Radiated Emissions	±2.95 dB	2	95%

Figure 4. Uncertainty Calculations Summary

E. Description of Test Sample

The Fargo HDP6600 Lamination Module, Equipment Under Test (EUT), is a lamination module optional accessory that can apply a protective patch over the surface of an identification card. This module is designed to connect to an X002200 printer or to the printer's optional flipper module.
The laminator has its own internal power supply that outputs 24 V dc to power the laminator control board, motors, and lamination hot roller. It utilizes small DC and stepper motors in conjunction with several optical sensors to move a card throughout its mechanism. Cards are feed into the laminator from the printer or flipper and then a hot roller is used in the laminator to transfer a protective patch onto the card surface. The card then exits the laminator and drops into an output hopper.

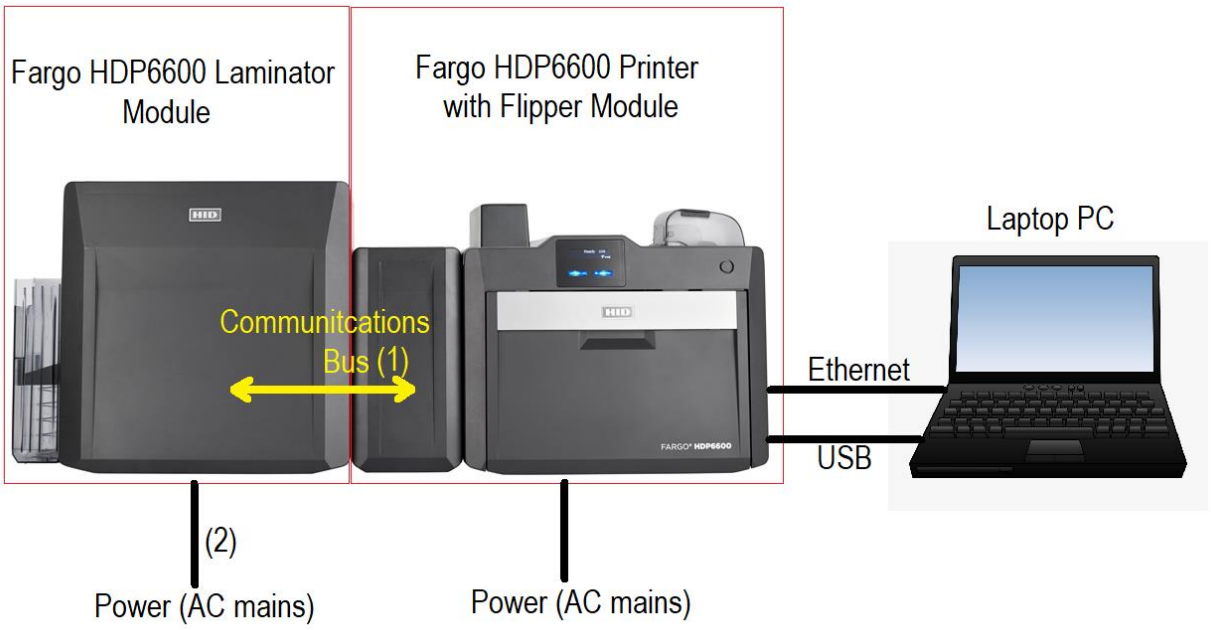

Figure 5. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part of the EUT is included in the following list.

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
1	N/A	Fargo HDP6600 Lamination Module	X002200LAM	N/A	N/A	N/A

Figure 6. Equipment Configuration

G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
1	Printer (with flipper & dual input hopper)	HID Global	X002200	N/A
2	Dell Laptop	Dell	Inspiron	N/A
The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.				

Figure 7. Support Equipment

H. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	USB	Print Job communication	1	1	< 3	N	USB
2	Ethernet	Alternate Print Job communication	1	1	100	N	Ethernet
3	Power	Power cable	1	2	2	N	AC Mains
4	Communications Bus	Data	1	0.3	< 3	N	Flipper Module and Ribbon Cable
5	Ribbon Cable	Data	1	0.3	<3	N	Comm. Bus

Figure 8. Ports and Cabling Information

I. Mode of Operation

The EUT was operating in a normal operating as it was printing cards on both side and Laminate cards. Data was transferred from GUI. HF radio turns ON when needed in order to operate in normal operation.

J. Method of Monitoring EUT Operation

The EUT was monitored by the screen on the front of the unit, and by transferring the cards out to the print cardholder.

K. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

The test standard of measuring 20 dB Occupied Bandwidth is deviated. The radiated measurement is used for test instead of conducted measurement as standard dictates. An active loop antenna is used to capture the measurement.

L. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to HID Global Corporation upon completion of testing.

III. *Electromagnetic Compatibility Criteria for Intentional Radiators*

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Test Results: The EUT as tested is compliant the criteria A of §15.203. The antenna is not accessible by the end user.

Test Engineer(s): Giuliano Messina

Test Date(s): April 23, 2019

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

Figure 9. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Note: *Decreases with the logarithm of the frequency.

Test Procedure: The EUT was placed on a 0.8 m-high wooden table above a ground plane. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2013*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMI receiver. For the purpose of this testing, the transmitter was turned on.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Giuliano Messina

Test Date(s): March 19, 2019

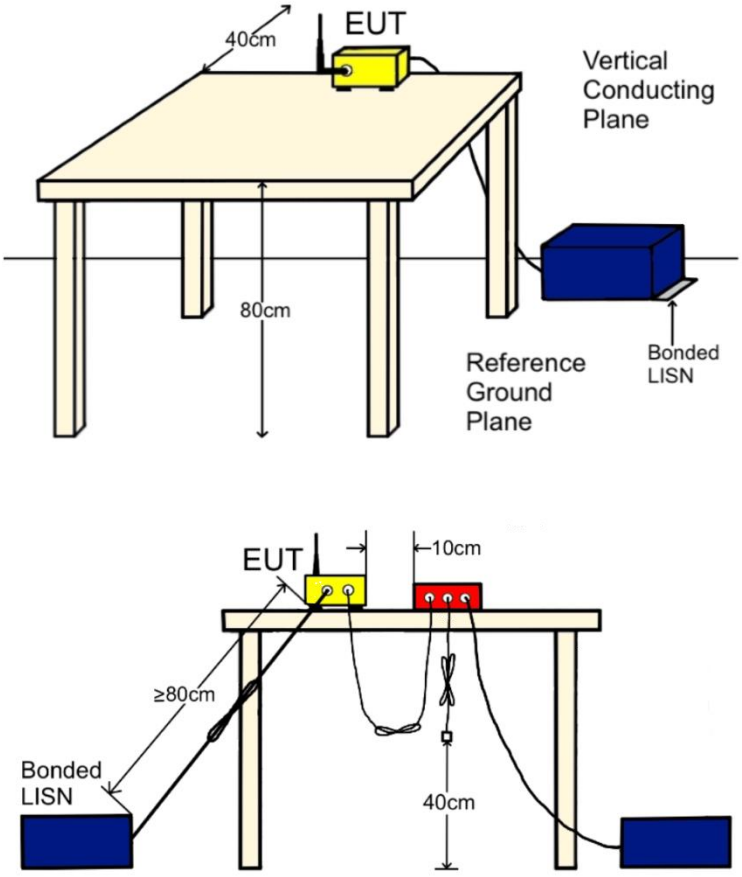

Figure 10. CEV Test Setup

Meas. Location	Meas. m	Limit	Pass/Fail
Bonding measurement from LISN ground to ground plane	0.708 mΩ	< 2.5 mΩ	Pass

Line	Freq (MHz)	QP Amplitude (dBµV)	QP Limit (dBµV)	Margin (dB)	Pass	Average Amplitude (dBµV)	Average Limit (dBµV)	Margin (dB)	Pass	Notes
Line_120VAC 60 Hz	13.562	64.2	60	4.2	Pass	58.3	50	8.3	Pass	See note
Line_120VAC 60 Hz	0.178	45.6	64.582	-18.982	Pass	33.5	54.582	-21.082	Pass	
Line_120VAC 60 Hz	0.214	49.1	63.057	-13.957	Pass	40.7	53.057	-12.357	Pass	
Line_120VAC 60 Hz	0.282	55.2	60.771	-5.571	Pass	40.7	50.771	-10.071	Pass	
Line_120VAC 60 Hz	11.014	34.9	60	-25.1	Pass	28.6	50	-21.4	Pass	
Line_120VAC 60 Hz	0.322	46.3	59.672	-13.372	Pass	36.6	49.672	-13.072	Pass	
Line_120VAC 60 Hz	15.966	48.3	60	-11.7	Pass	36.6	50	-13.4	Pass	
Neutral_120VAC 60 Hz	0.206	53.5	63.372	-9.872	Pass	41.4	53.372	-11.972	Pass	
Neutral_120VAC 60 Hz	0.314	44.5	59.881	-15.381	Pass	37.2	49.881	-12.681	Pass	
Neutral_120VAC 60 Hz	0.430	44.8	57.277	-12.477	Pass	37.2	47.277	-10.077	Pass	
Neutral_120VAC 60 Hz	0.890	37.4	56	-18.6	Pass	34.6	46	-11.4	Pass	
Neutral_120VAC 60 Hz	16.146	44.4	60	-15.6	Pass	37.9	50	-12.1	Pass	
Neutral_120VAC 60 Hz	0.534	33.18	56	-22.82	Pass	30.57	46	-15.43	Pass	

Note: 13.562 MHz is omitted from formal measurements because it is the intentional radiator.

Figure 11. Conducted Emissions, Test Results

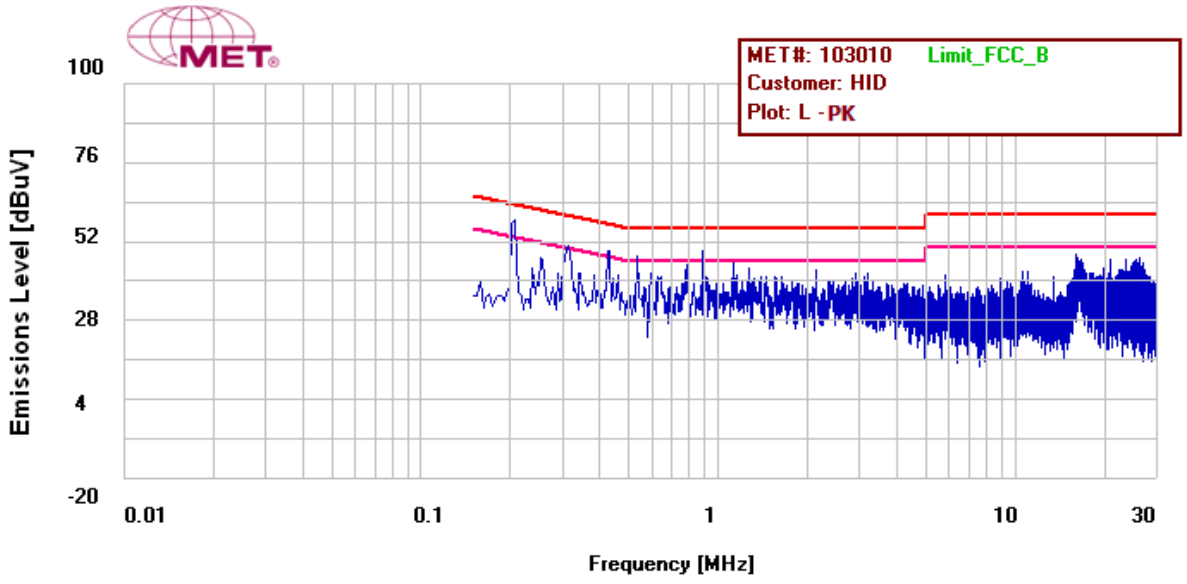

Figure 12. Conducted Emissions, Line

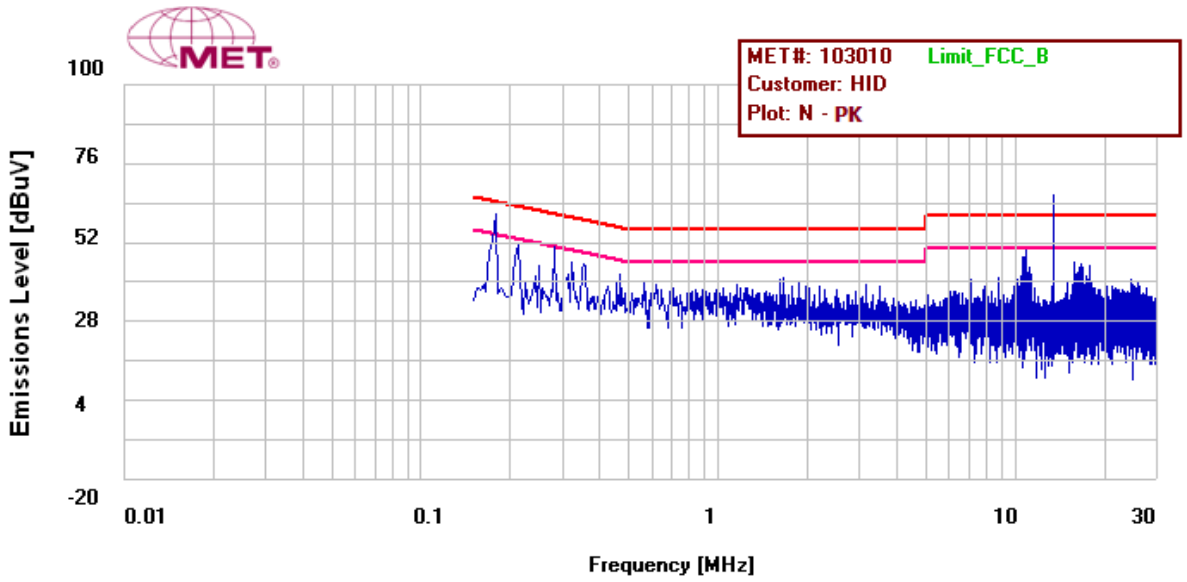

Figure 13. Conducted Emissions, Neutral

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.215(c) 20 dB Occupied Bandwidth

Test Requirement(s): **§ 15.215 (c)** Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Procedure: The transmitter was on and transmitting at the highest output power. The test standard is deviated, and radiated measurement was used. The bandwidth of the fundamental frequency was measured with an active loop antenna and spectrum analyzer using an RBW approximately 1% of the total emission bandwidth. The 20 dB Bandwidth was measured and recorded.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Giuliano Messina

Test Date(s): April 29, 2019

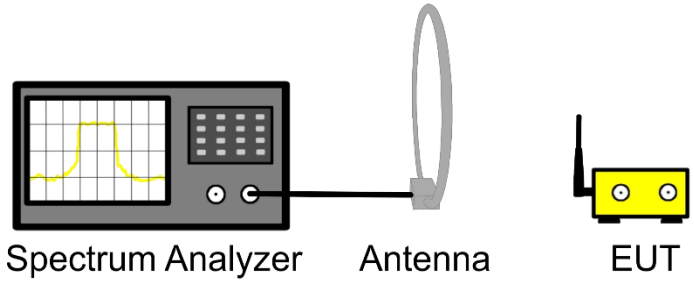

Figure 14. 20 dB Bandwidth Test Setup

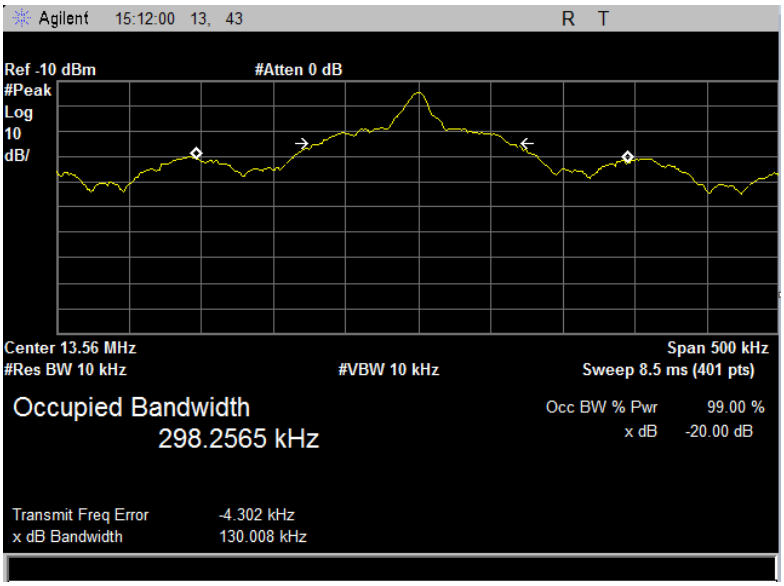

Figure 15. 20 dB Occupied Bandwidth, 130 kHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(a) Spurious Emission Limits, within the band 13.553 – 13.567 MHz

Test Requirement(s): **15.225 (a)** The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Test Procedure: The EUT was set to transmit and placed on a 0.8m-high wooden table above a turntable inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used.
The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

40log(3/30) = -40 dB

Test Results: The EUT was compliant with the requirements of **§15.225(a)**.

Test Engineer(s): Giuliano Messina

Test Date(s): April 23, 2019

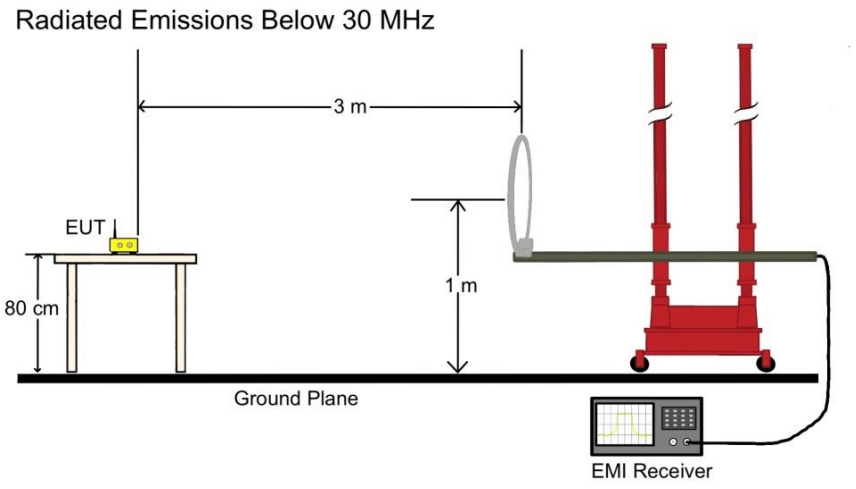

Figure 16. Radiated Emissions, Test Setup

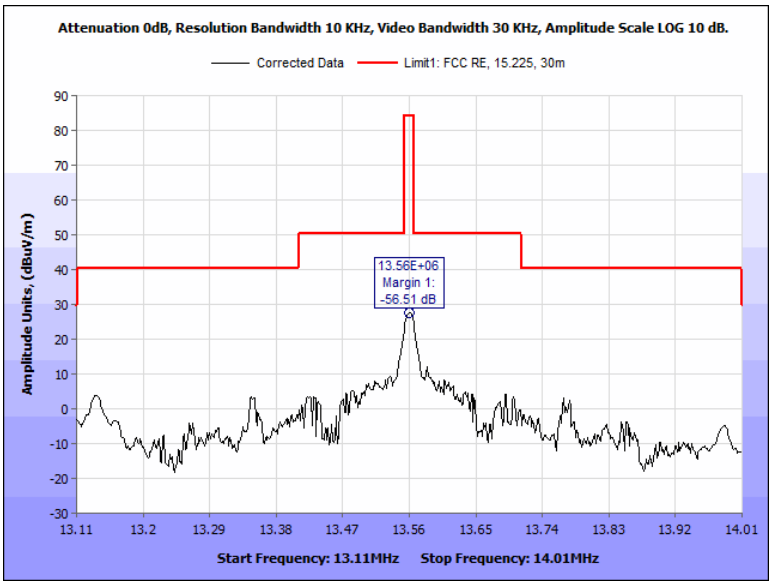

Figure 17. Spurious Emissions Within the Bands 13.110 – 14.010 MHz, 0 degrees

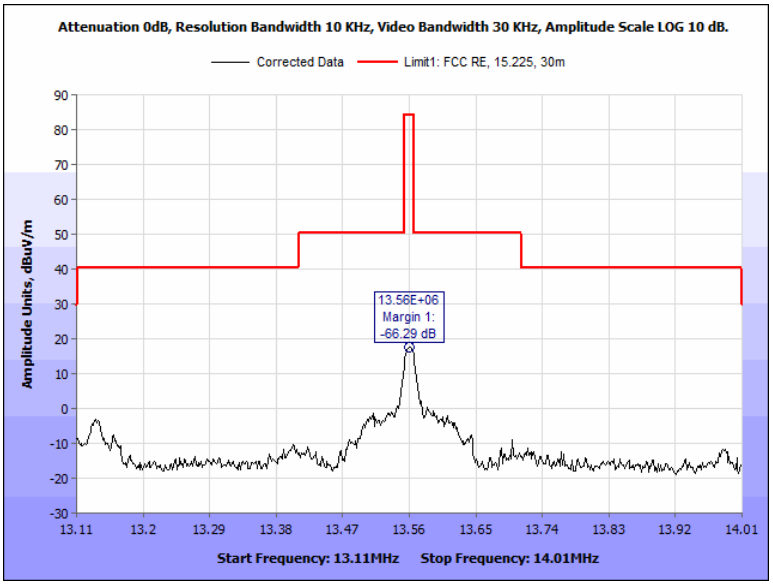

Figure 18. Spurious Emissions Within the Bands 13.110 – 14.010 MHz, 90 degrees

Frequency (MHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (kHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, FCC RE, 15.225, 30m (dBuV/m)	Margin (dB)
13.56	56.79	0	10	-40	10.7	0	27.49	84	-56.51
13.56	47.01	90	10	-40	10.7	0	17.71	84	-66.29

Figure 19. Spurious Emissions, Within the Bands, 13.110 – 14.010 MHz, Peak Marker Data

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(b) Spurious Emission Limits, within the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz

Test Requirement(s): **15.225 (b)** Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden table above a turntable inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used.
The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

40log(3/30) = -40 dB

Test Results: The EUT was compliant with the requirements of **§ 15.225(b)**. See above section, for 15.225(a).

Test Engineer(s): Giuliano Messina

Test Date(s): May 22, 2019

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(c) Spurious Emission Limits, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz

Test Requirement(s): **15.225 (c)** Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength
of any emissions shall not exceed 106 microvolts/meter at 30 meters.

.

Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden table above a turntable inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. The loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used.
The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

40log(3/30) = -40 dB

Test Results: The EUT was compliant with the requirements of **§15.225(c)**. See above section, for 15.225(a).

Test Engineer(s): Giuliano Messina

Test Date(s): May 22, 2019

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(d) Spurious Emission Limits, outside the bands 13.110 – 14.010 MHz

Test Requirement(s): 15.225 (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Test Procedures: The EUT was set to transmit and placed on a 0.8m-high wooden table above a turntable inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. For measurements below 30 MHz, the loop antenna was located 3 m from the EUT. Measurements were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. The Spectrum analyzer RBW was set to 10 kHz and VBW was set to 30 kHz. A peak detector was used.
The measurements were made at 3m and then extrapolated to 30m using the following correction factor.

40log(3/30) = -40 dB
40log(3/300) = -80 dB

The measurements made at 10m with the biconilog antenna were then extrapolated to the 3m using the following correction factor.

20log(10/3) = +10.46 dB

Test Results: The EUT was compliant with requirements of **§ 15.225 (d)**.

Test Engineer: Giuliano Messina

Test Date: May 23, 2019

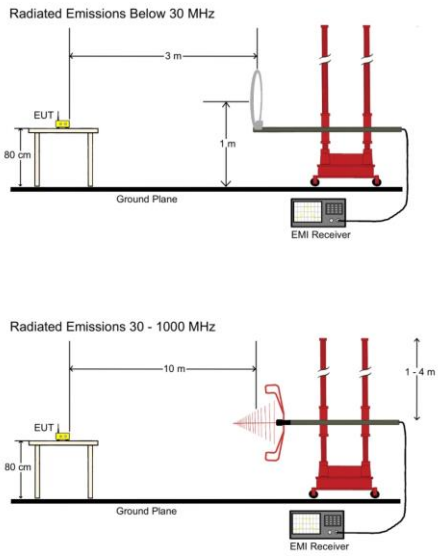

Figure 20. Radiated Spurious Emissions Test Setup

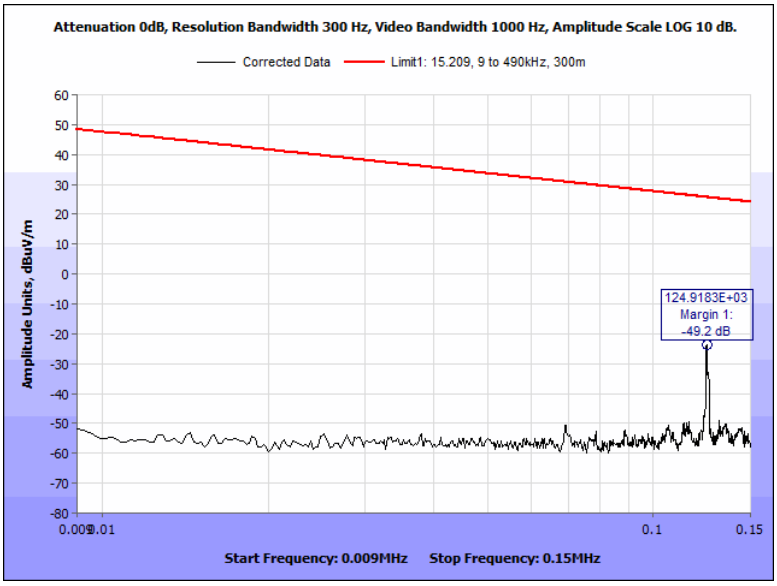

Figure 21. Spurious Emissions, Outside the Bands 13.110 - 14.010 MHz, 0.009 – 0.150 MHz, 0 degrees

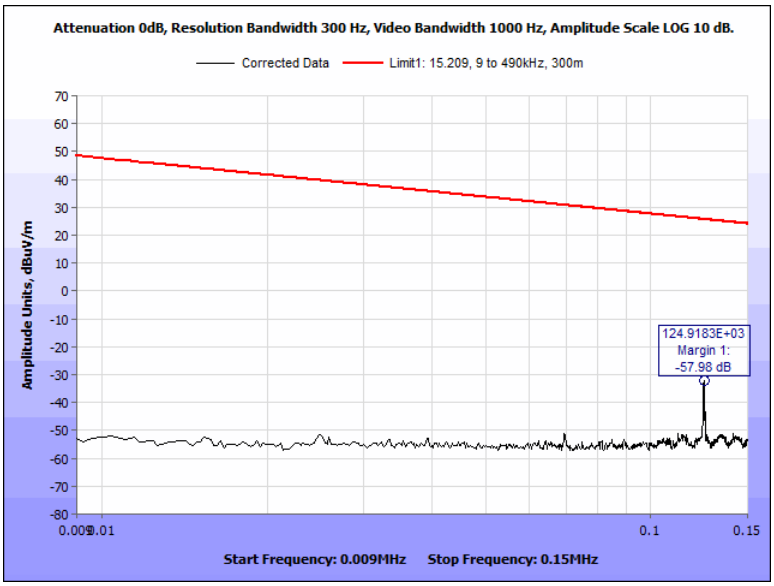

Figure 22. Spurious Emissions, Outside the Bands 13.110 - 14.010 MHz, 0.009 – 0.150 MHz, 90 degrees

Frequency (KHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (Hz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209, 9 to 490kHz, 300m (dBuV/m)	Margin (dB)
124.9183	45.2	0	300	-80	11.28	0	-23.53	25.67	-49.2
124.9183	36.41	90	300	-80	11.28	0	-32.31	25.67	-57.98

Figure 23. Spurious Emissions, Outside the Bands, 13.110 – 14.010 MHz, 0.009-0.150 MHz - Peak Marker Data

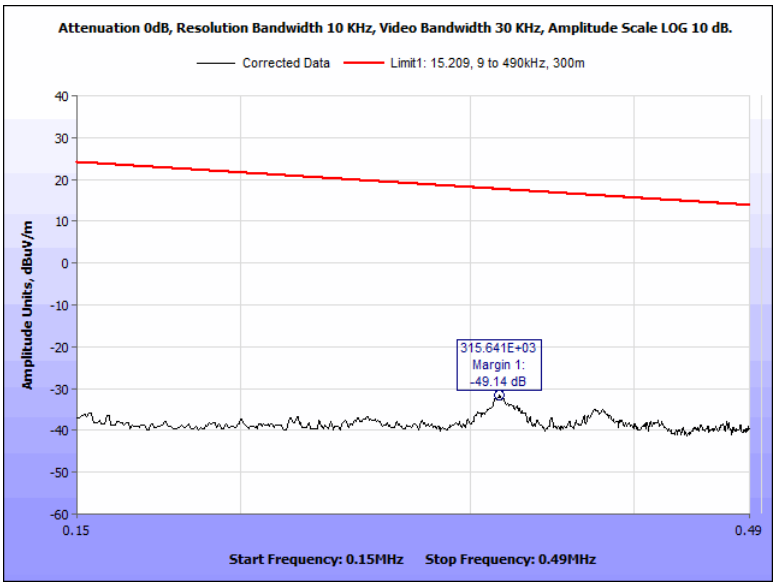

Figure 24. Spurious Emissions, Outside the Bands 13.110 - 14.010 MHz, 0.150 – 0.490 MHz, 0 degrees

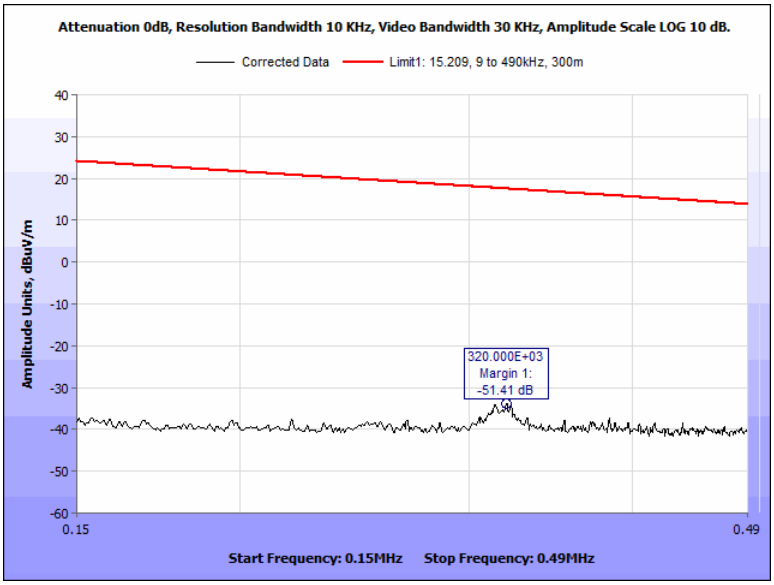

Figure 25. Spurious Emissions, Outside the Bands 13.110 - 14.010 MHz, 0.150 – 0.490 MHz, 90 degrees

Frequency (KHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209, 9 to 490kHz, 300m (dBuV/m)	Margin (dB)
315.6410	37.39	0	10	-80	11.08	0	-31.52	17.62	-49.14

320.0000	35.01	90	10	-80	11.08	0	-33.91	17.5	-51.41

Figure 26. Spurious Emissions, outside the Bands, 13.110 – 14.010 MHz, 0.150-490 MHz - Peak Marker Data

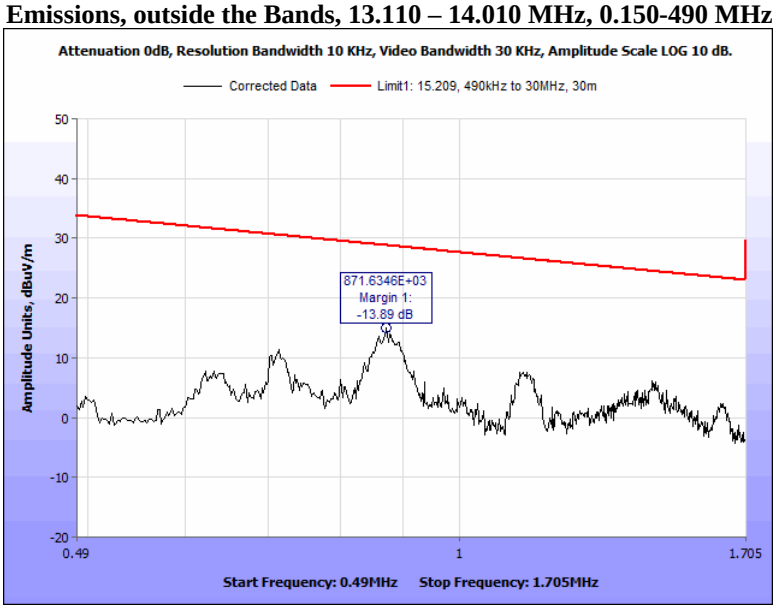

Figure 27. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 0.490 – 1.705 MHz, 0 degrees

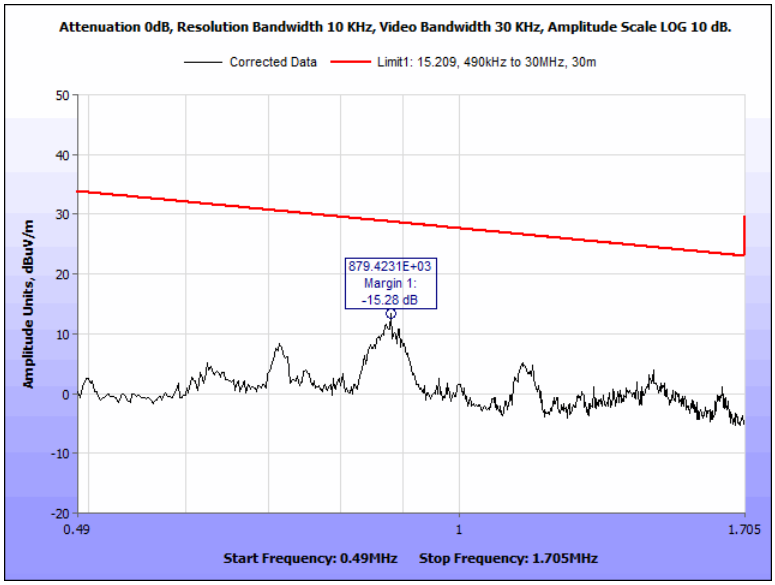

Figure 28. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 0.490 – 1.705 MHz, 90 degrees

Frequency (KHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209, 490kHz to 30MHz, 30m (dBuV/m)	Margin (dB)
871.6346	43.64	0	10	-40	11.27	0	14.91	28.8	-13.89

879.4231	42.16	90	10	-40	11.28	0	13.44	28.72	-15.28

Figure 29. Spurious Emissions, outside the Bands, 13.110 – 14.010 MHz, 490-1.705 MHz - Peak Marker Data

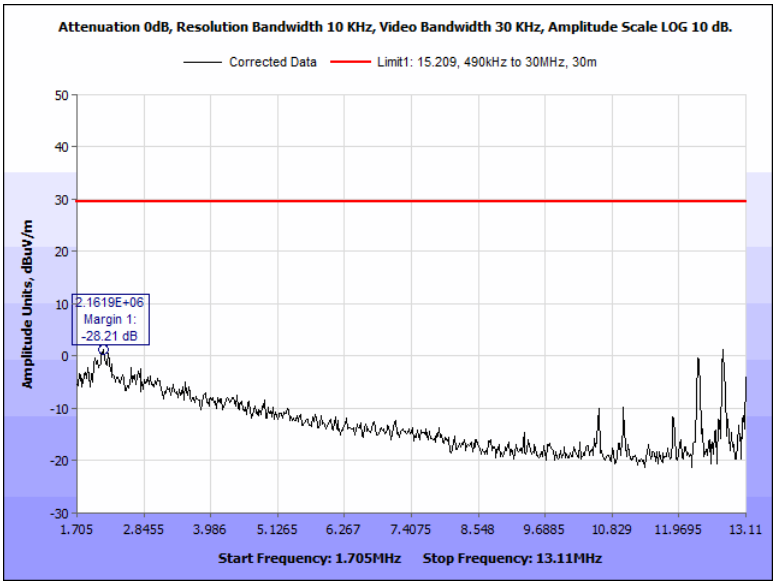

Figure 30. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 1.705 – 13.110 MHz, 0 degrees

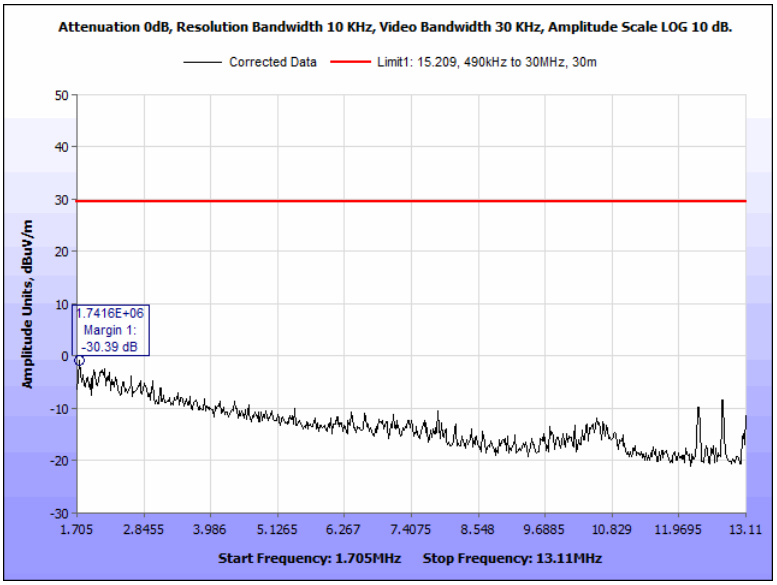

Figure 31. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 1.705 – 13.110 MHz, 90 degrees

Frequency (MHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209, 490kHz to 30MHz, 30m (dBuV/m)	Margin (dB)
2.1619	29.85	0	10	-40	11.48	0	1.33	29.54	-28.21

1.7416	27.65	90	10	-40	11.5	0	-0.85	29.54	-30.39

Figure 32. Spurious Emissions, outside the Bands, 13.110 – 14.010 MHz, 1.705-13.110 MHz - Peak Marker Data

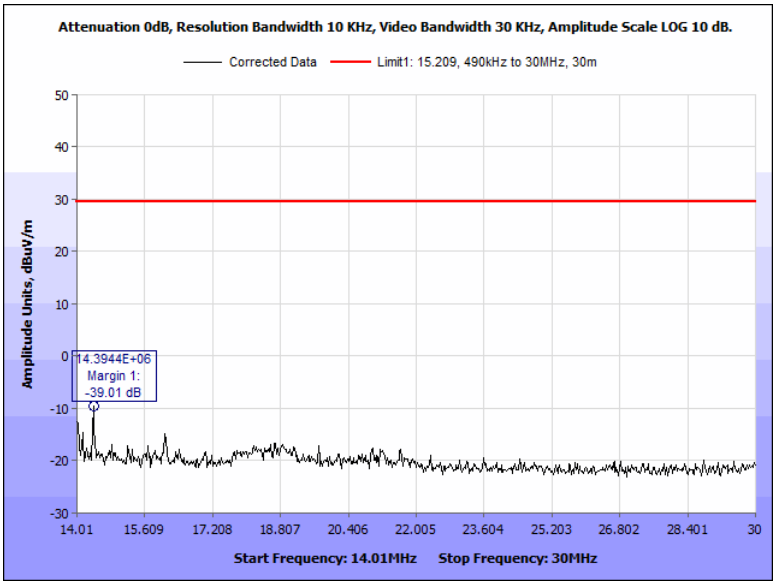

Figure 33. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 14.010 – 30 MHz, 0 degrees

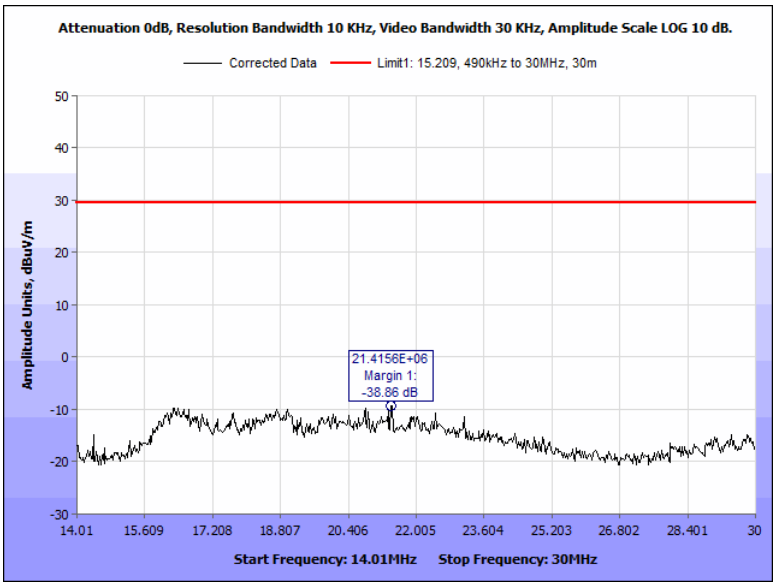

Figure 34. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 14.010 – 30 MHz, 90 degrees

Frequency (MHz)	Uncorrected Amplitude (dBuV)	Antenna Orientation (Degrees)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209, 490kHz to	Margin (dB)

								30MHz, 30m (dBuV/m)	
14.3944	19.86	0	10	-40	10.66	0	-9.47	29.54	-39.01
21.4156	20.66	90	10	-40	10.02	0	-9.32	29.54	-38.86

Figure 35. Spurious Emissions, outside the Bands, 13.110 – 14.010 MHz, 14.010-30 MHz - Peak Marker Data

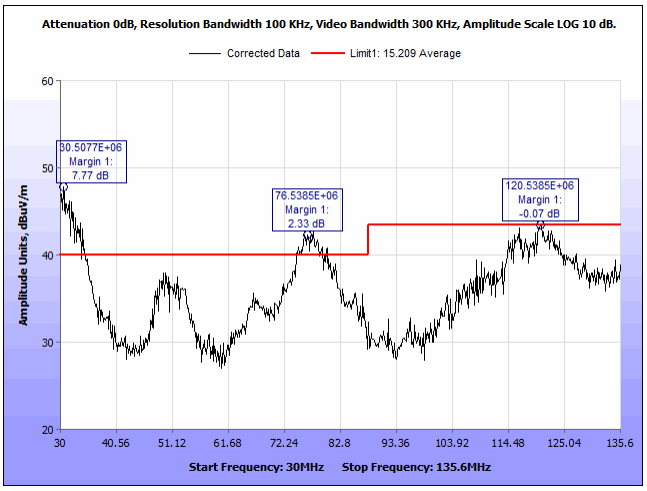

Figure 36. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 30MHz – 1GHz TX off – Vertical

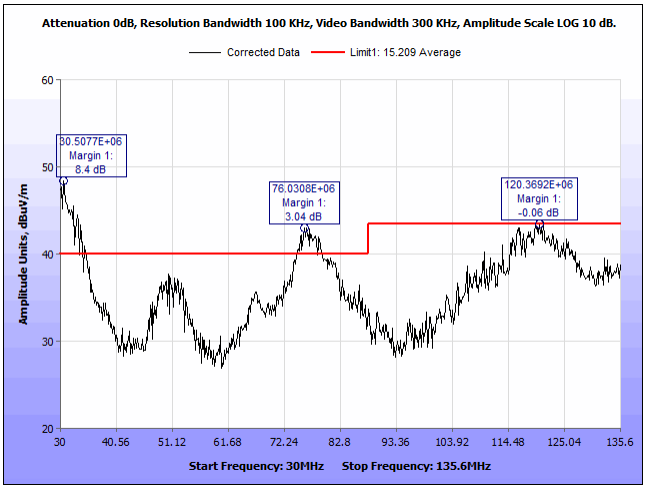

Figure 37. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 30MHz – 1GHz TX on – Vertical

Frequency (MHz)	Uncorrected Amplitude (dBuV)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209 Average (dBuV/m)	Margin (dB)
30.5077	37.72	100	10.46	22	-21.78	48.4	40	8.4
76.0308	42.88	100	10.46	10.51	-20.81	43.04	40	3.04
120.3692	37.41	100	10.46	15.94	-20.37	43.44	43.5	-0.06

Figure 38. Spurious Emissions, Outside the Bands, 30 - 1000 MHz, TX on, Peak Marker Data - Vertical

Frequency (MHz)	Uncorrected Amplitude (dBuV)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209 Average (dBuV/m)	Margin (dB)
30.5077	21.2	100	10.46	22	-21.78	31.88	40	-8.12
76.0308	33.7	100	10.46	10.51	-20.81	33.86	40	-6.14
120.3692	28.4	100	10.46	15.94	-20.37	34.43	43.5	-9.07

Figure 39. Spurious Emissions, Outside the Bands, 30 - 1000 MHz, TX on, Quasi-Peak Marker Data - Vertical

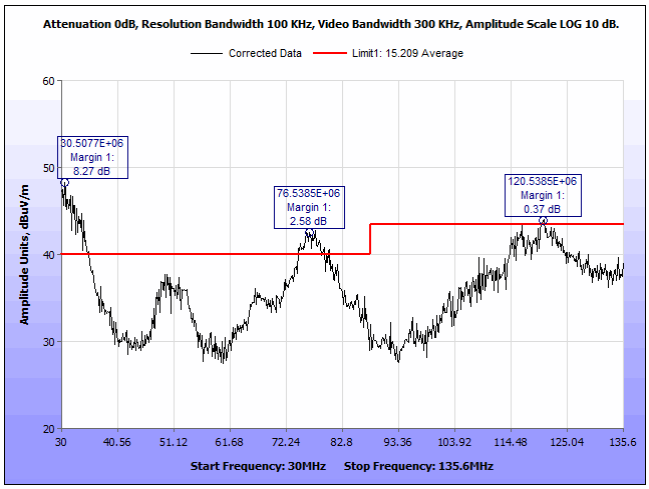

Figure 40. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 30MHz – 1GHz TX off - Horizontal

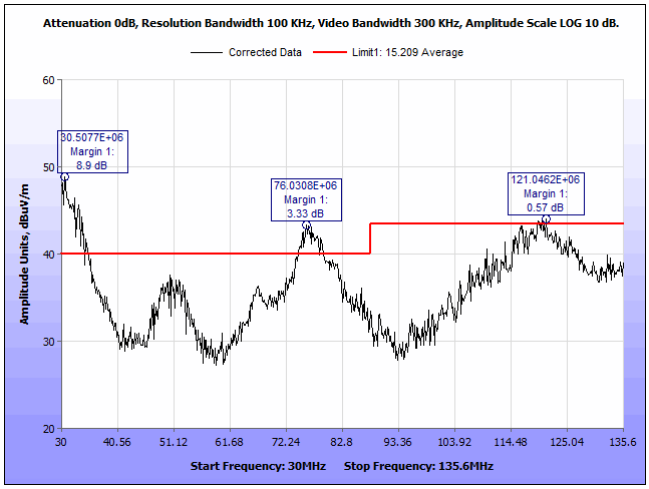

Figure 41. Spurious Emissions, Outside the Bands, 13.110 - 14. 010 MHz, 30MHz – 1GHz TX on – Horizontal

Frequency (MHz)	Uncorrected Amplitude (dBuV)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209 Average (dBuV/m)	Margin (dB)
30.5077	37.72	100	10.46	22.5	-21.78	48.9	40	8.9
76.0308	42.88	100	10.46	10.8	-20.81	43.33	40	3.33
121.0462	37.56	100	10.46	16.4	-20.35	44.07	43.5	0.57

Figure 42. Spurious Emissions, Outside the Bands, 30 - 1000 MHz, TX on, Peak Marker Data – Horizontal

Frequency (MHz)	Uncorrected Amplitude (dBuV)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Corrected Amplitude (dBuV/m)	Limit, 15.209 Average (dBuV/m)	Margin (dB)
30.5077	22.37	100	10.46	22.5	-21.78	33.55	40	-6.45
76.0308	32.54	100	10.46	10.8	-20.81	32.99	40	-7.01
121.0462	27.22	100	10.46	16.4	-20.35	33.73	43.5	-9.77

Figure 43. Spurious Emissions, Outside the Bands, 30 - 1000 MHz, TX on, Quasi-Peak Marker Data - Horizontal

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(e) Frequency Stability

Test Requirement(s): **15.225(e)** The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure: Measurements are in accordance with Part 2.1055. The EUT was placed in the Environmental Chamber and allowed to reach desired temperature. A spectrum analyzer was used to measure the frequency drift. The EUT was set to transmit in the operating frequency range. Frequency drift was investigated for the extreme temperatures and nominal temperature, until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20º to 50ºC.

Test Results: The EUT was found compliant with Part 15.225 (e) requirement(s) of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): April 29, 2019

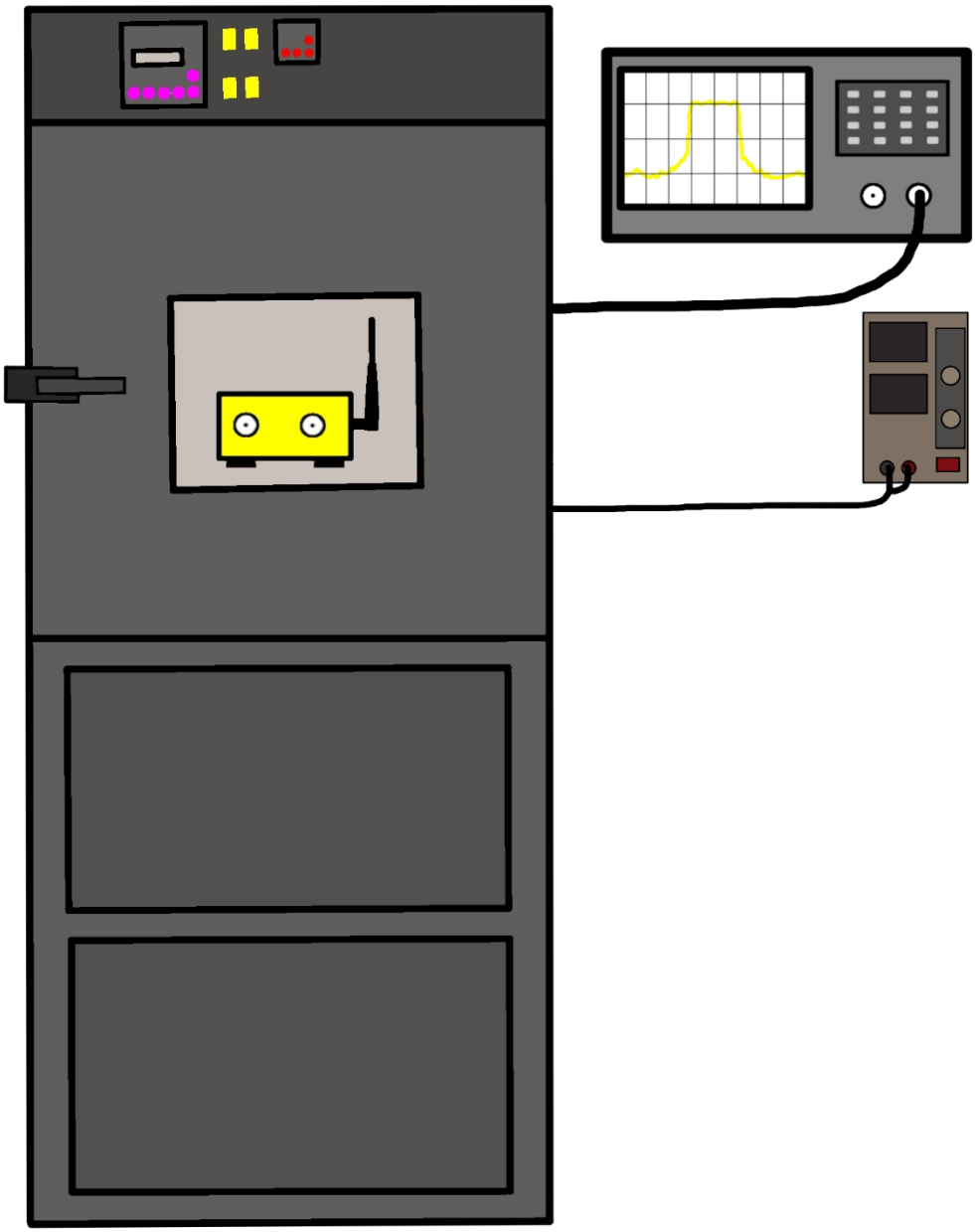

Figure 44. Temperature Stability Test Setup

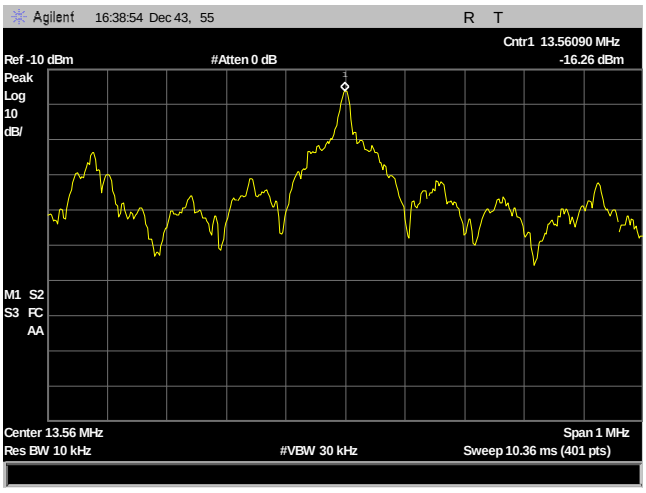

Figure 45. Frequency Stability, 115% Vnorm – 20°C

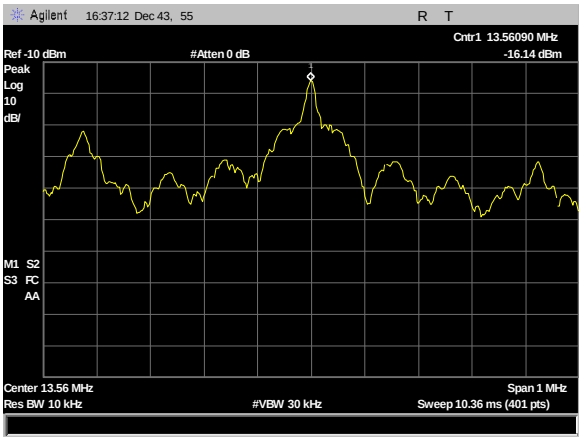

Figure 46. Frequency Stability, 85% Vnorm _– 20°C

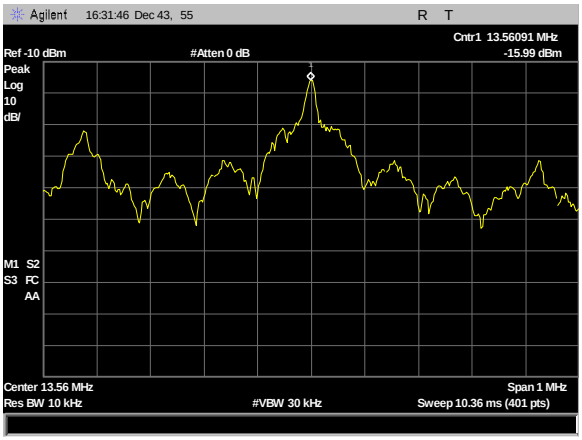

Figure 47. Frequency Stability, Vnom_– 20°C

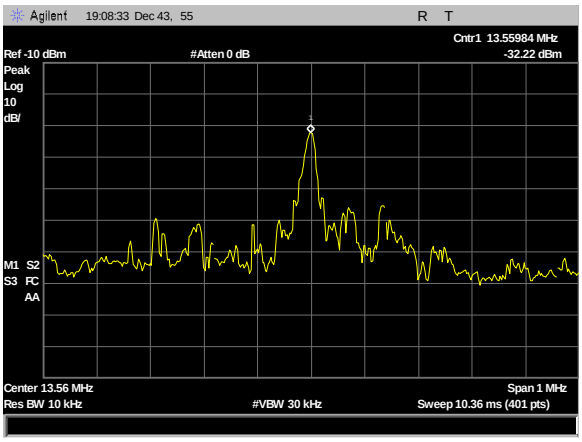

Figure 48. Frequency Stability,Vnorm _20°C

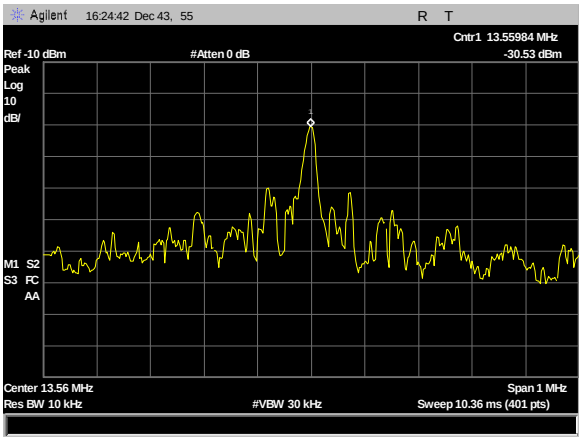

Figure 49. Frequency Stability, Vnorm _50°C

FCC 15.225	120VAC 60Hz				
Voltage Variation (%)	**Temperature (°C)**	**Nominal Freq (MHz)**	**Result (MHz)**	**% Difference**	**Limit**
Vnorm (120VAC 60Hz)	50	13.56	13.55984	-0.0011799	**±0.01%**
	20	13.56	13.55984	-0.0011799	
	-20	13.56	13.56091	0.0067109	
115% Vnom	-20	13.56	13.5609	0.0066372	
85% Vnorm	-20	13.56	13.5609	0.0066372	

Figure 50. Frequency Stability, Test Result

IV. *Test Equipment*

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1184	Spectrum Analyzer	Agilent	E4407B	6/20/2018	6/25/2019
1A1225	Temperature Chamber	Espec	EXP-2H	2/21/2019	2/21/2020
1A1176	Active Loop Antenna	ETS-Lindgren	6502	1/31/2018	7/31/2019
1A1083	EMI Test Receiver	Rohde & Schwarz	ESU40	10/17/2018	10/17/2019
1A1106	10m Chamber (FCC)	ETS	Semi-Anechoic	12/2/2016	12/2/2019
1A1050	Bilog Antenna (30MHz to 1GHz)	Schaffner	CBL 6112D	8/29/2018	2/29/2020
1A1050 -A	Attenuator	Fairview Microwave	SA6N5WA-04	8/29/2018	2/29/2020
1A1099	Generator	COM-Power Corp	CGO-51000	See Note	
1A1088	Pre-Amp	Rohde & Schwarz	TS-PR1	See Note	
1A1044	Generator	COM-Power Corp	CG-520	See Note	
1A1073	Multi Device Controller	ETS EMCO	2090	See Note	
1A1074	System Controller	Panasonic	WV-CU101	See Note	
1A1080	Multi Device Controller	ETS EMCO	2090	See Note	
1A1119	Test Area	Custom Made	N/A	See Note	
1A1177	Pulse Limiter	Rohde & Schwarz	ESH3Z2	11/30/2018	11/30/2019
1A1123	LISN	Teseq	NNB 51	7/18/2018	7/18/2019
1A1149	Milliohm Meter	GW Instek	GOM-802	4/18/2019	4/19/2020
1A1079	Conducted Comb Generator	COM-Power Corp	CGC-255	See Note	

Figure 51. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

v. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

1. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

End of Report