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07/30/2020

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, Model: X002500, 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 Eurofins 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\EMCA106135-FCC225 Rev. 2)

Electromagnetic Compatibility Criteria
Test Report

for the

HID Global Corporation
ELEMENT
Model: X002500

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

Report: EMCA106135-FCC225 Rev. 2

07/07/2020

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

Electromagnetic Compatibility Criteria
Test Report

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ELEMENT
Model: X002500

Tested under
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15.225 Subpart C
for Intentional Radiators

Adan Arab, 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
∅	04/14/2020	Initial Issue.
1	07/07/2020	TCB Review.
2	07/30/2020	Customer Comments.

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List of Figures

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the HID Global Corporation Model: X002500, 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 Model: X002500. 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 Model: X002500, 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 1110971959. All tests were conducted using measurement procedure 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 ComplianceTesting

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 Model X002500, under HID Global Corporation's purchase order number 1110971959.

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, Model: X002500.

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

Model(s) Tested:	X002500	
Model(s) Covered:	X002500	
EUT Specifications:	Primary Power: 120 VAC 60 Hz	
	Encoder Module FCC ID: JQ6-MSX002500	
	Prime Input Module FCC ID: JQ6-OK5127CKMINI	
	Type of Modulation(s):	ASK
	Equipment Code:	DXX
	Peak Field Strength:	14.32 dBµV/m @30m
	EUT Frequency Ranges:	13.56 MHz
	Antenna Type:	Inductive Loop
	Antenna Gain:	1 dBi
	Power Setting:	Factory Default
	Firmware Version:	1.0.0.1031
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:	Adan Arab	
Report Date(s):	07/30/2020	

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 Eurofins E&E North America.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Figure 4. Uncertainty Calculations Summary

E. Description of Test Sample

The Model: X002500, Equipment Under Test (EUT), prints on plastic identification cards. It can also encode data on a card's magnetic stripe and can encode e-cards using RFID or a direct contact encoder.
A flipper module is used for duplex printing and for mounting a contact encoder and a mag encoder module
An output hoper module is used for holding cards after printing.

AC power feeds an internal power supply that outputs 24 V dc to power the printers main control board along with motors, print head and heaters.

The printer utilizes small DC and stepper motors in conjunction with several optical sensors to move the card throughout the printer modules.

Printing uses an Ink Jet print head that cures with UV light and prints directly to the card surface.

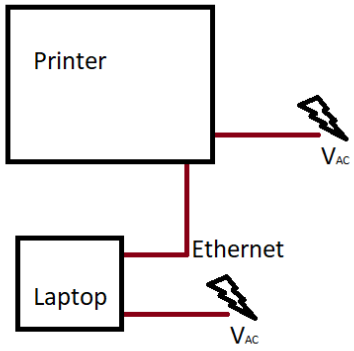


Figure 5. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 5. 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. #
--	--	Prime Input Module (display, input hopper)	--	--	--	--
--	--	Encoder Module (optional)	--	--	--	--
--	--	Printer Module	--	--	--	--
--	--	Stacker Module (output hopper).	--	--	--	--

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.	Laptop	Dell	Inspiron 15	N/A
2.	Ethernet Cable	--	--	N/A
3.	Power cord	--	--	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	AC Input	3 Conductor, 18 awg	1	2		No	--
2	Ethernet	Ethernet	1	2	--	No	--

Figure 8. Ports and Cabling Information

I. Mode of Operation During Testing

A host computer sends data to the printer using Ethernet connection (10/100/1G) and uses a TFT LCD graphical touchscreen display. The prime Input module uses single FCC/IC approved module (13.56 MHz OMNIKEY 5127CK Mini) uses it optional contactless RFID encoding and the encoder uses RFID (13.56 MHz Smartview) radio for receiving card from the prime input module or encode a card (Contactless RFID). The radio under is the encoder module (Smartview) radio.

The test software used during testing was the following:

EUT Software (internal to EUT): 1.0.0.1031
RF Support Software (used by support PC to exercise EUT): Smartwave USN1se-1M

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. 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 was 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.

Results: The EUT is compliant with the requirement of §15.203.

Results: The EUT as tested is compliant to 15.203. The antenna is integrated into the EUT (permanently attached) and is unable to be modified by the end-user.

Test Engineer(s): Adan Arab

Test Date(s): 11/18/2019

Name/Description	Type	Manufacturer	Model	Gain (dBi)	Impedance (Ω)
Encoder Module Antenna	Shielded 50Ω PCB trace loop	SmartWare	SmartWare T73X42X2 antenna	1dBi	--

Figure 9. EUT Antenna Description

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

Note: *Decreases with the logarithm of the frequency.

Sample Calculation:

Rr – S = M

where:

Rr = Receiver Reading in dBμV
S = Specification Limit in dBμV
M = Margin to Specification in +/- dB

Sample formula for calculating the Corrected Data for the Conducted Emissions Measurements:

Line	Freq (MHz)	Uncorrected QP** Amplitude (dBμV)	LISN IL (dB)	CBL (dB)	Corrected QP** Amplitude (dBμV)	QP** Limit (dBμV)	Margin (dB)	Results
XYZ	0.18	42.65	10	0.58	53.23	79	-25.77	Pass

*Corrected QP** Amplitude (dBμV) = Uncorrected Amplitude (dBμV) +LISN IL (dB) + CBL (dB)=42.65+10+0.58=53.23*
*** Same Calculation applies to Corrected Avg. amplitude as well.*

Test Procedure: The EUT was placed on a 0.8 m-high non-conducting 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 C63.10-2013 "Procedures for Compliance Testing of Unlicensed Wireless Devices"*. 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 at full power during scans.

Test Results: The EUT was compliant with this requirement.

Test Engineer(s): Adan Arab

Test Date(s): 11/14/2019

Conducted Emissions Voltage Test Setup

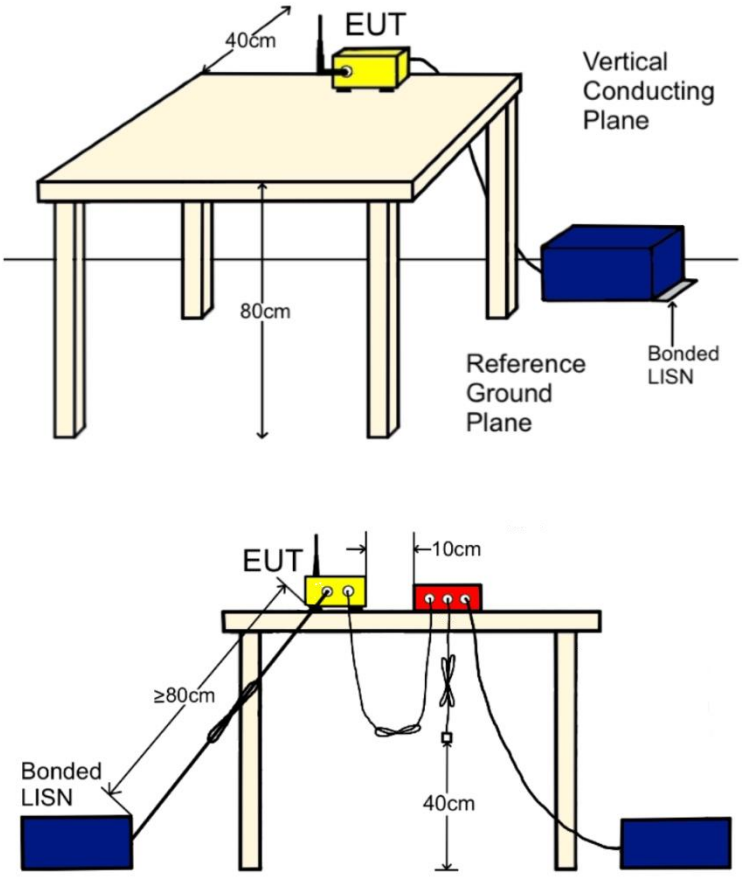


Figure 11. CEV Test Setup

Meas. Location	Meas. m	Limit	Pass/Fail
Bonding measurement from LISN ground to ground plane	0.557 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/Fail
Line1_120 VAC 60 Hz	0.150	62.9	66	-3.1	Pass	46.6	56	-9.4	Pass
Line1_120 VAC 60 Hz	0.158	60.7	65.57	-4.87	Pass	45.5	55.57	-10.07	Pass
Line1_120 VAC 60 Hz	0.542	50.2	56	-5.8	Pass	38.4	46	-7.6	Pass
Line1_120 VAC 60 Hz	0.182	56.8	64.398	-7.598	Pass	40.2	54.398	-14.198	Pass
Line1_120 VAC 60 Hz	2.110	44.8	56	-11.2	Pass	33.5	46	-12.5	Pass
Line1_120 VAC 60 Hz	0.890	44.8	56	-11.2	Pass	31.7	46	-14.3	Pass

Figure 12. Conducted Emissions, Line, Test Results

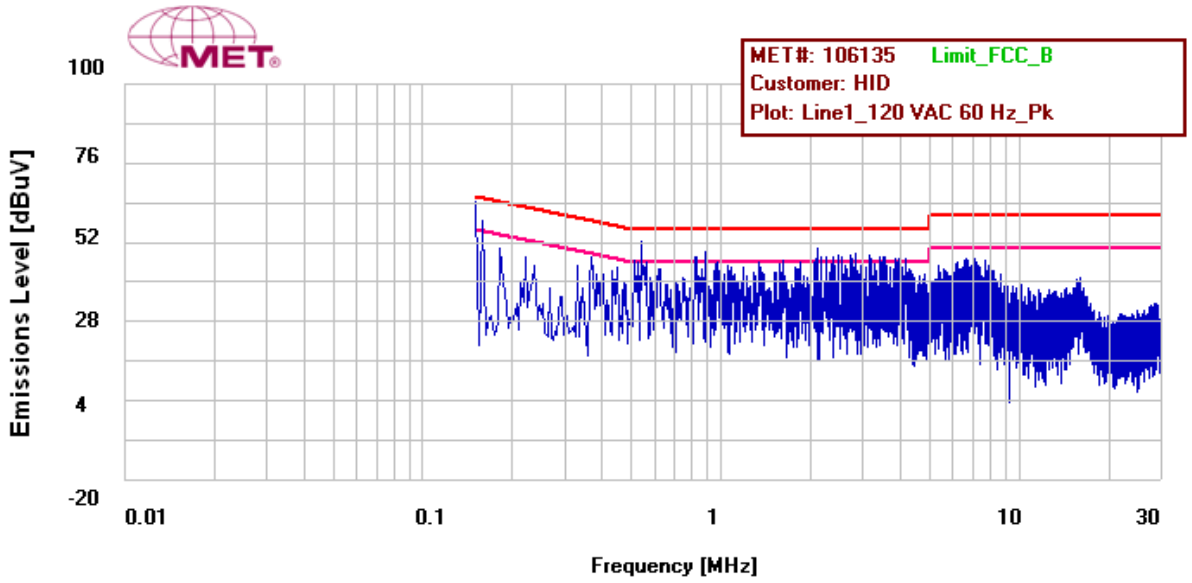


Figure 13. Conducted Emissions, Line Plot

Line	Freq (MHz)	QP Amplitude (dBµV)	QP Limit (dBµV)	Margin (dB)	Pass	Average Amplitude (dBµV)	Average Limit (dBµV)	Margin (dB)	Pass/Fail
Neutral_120 VAC 60 Hz	0.158	60.5	65.57	-5.07	Pass	45.3	55.57	-10.27	Pass
Neutral_120 VAC 60 Hz	0.174	55.4	64.771	-9.371	Pass	39.5	54.771	-15.271	Pass
Neutral_120 VAC 60 Hz	0.190	54.2	64.042	-9.842	Pass	38.3	54.042	-15.742	Pass
Neutral_120 VAC 60 Hz	0.554	50.4	56	-5.6	Pass	34.4	46	-11.6	Pass
Neutral_120 VAC 60 Hz	0.166	58.5	65.16	-6.66	Pass	45.6	55.16	-9.56	Pass
Neutral_120 VAC 60 Hz	0.214	52.6	63.057	-10.457	Pass	37.5	53.057	-15.557	Pass

Figure 14. Conducted Emissions, Neutral, Test Results

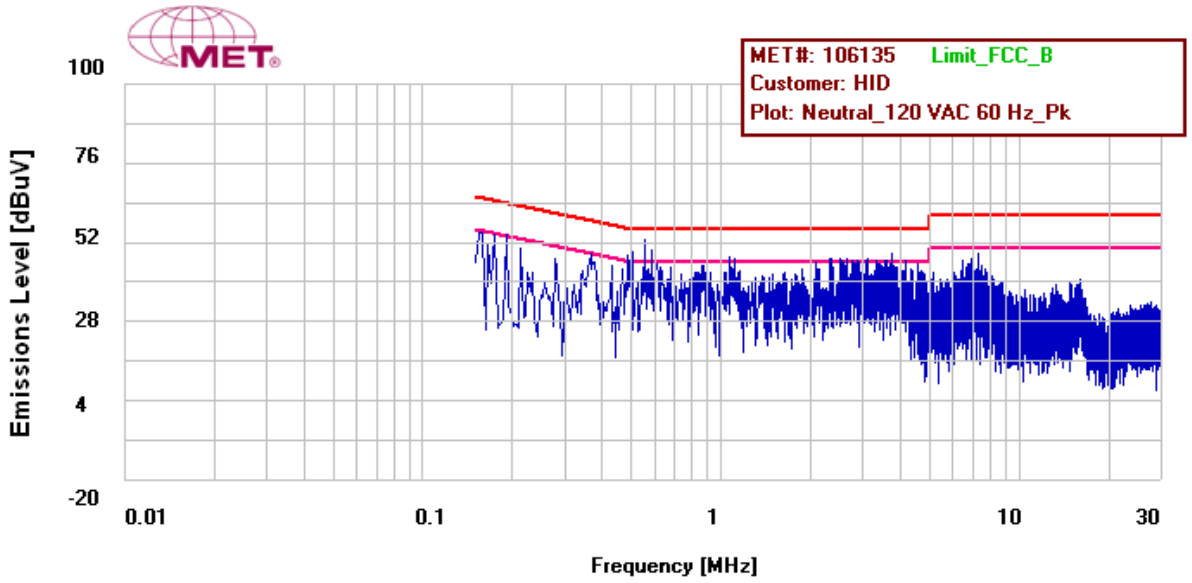


Figure 15. Conducted Emissions, Neutral Plot

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.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measure with the spectrum analyzer using an RBW approximately 1% of the total emission bandwidth. The 20 dB Bandwidth was measured and recorded.

Test Results: The measured 20 dB Bandwidth is 4.075 KHz.

Test Engineer(s): Adan Arab

Test Date(s): 11/18/2018

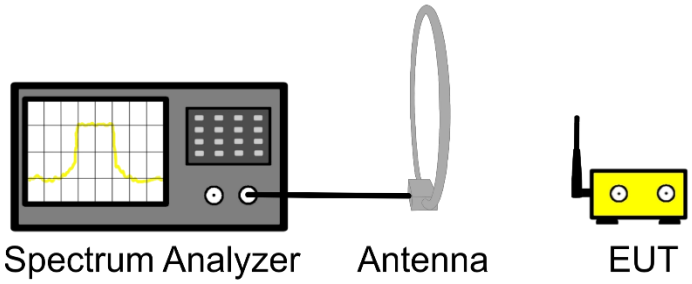


Figure 16. 20 dB Bandwidth Test Setup

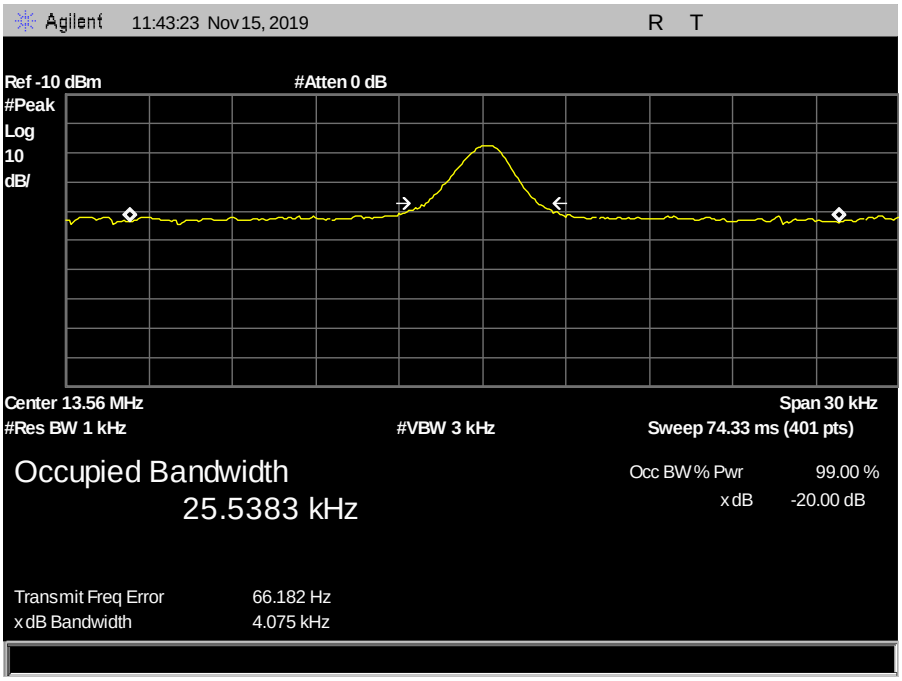


Figure 17. 20 dB Occupied Bandwidth, 4.075 kHz

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 non-conductive table 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.

The EUT was set to transmit on a factory default setting.

40log(3/30) = -40 dB

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

Test Engineer(s): Adan Arab

Test Date(s): 11/18/2019

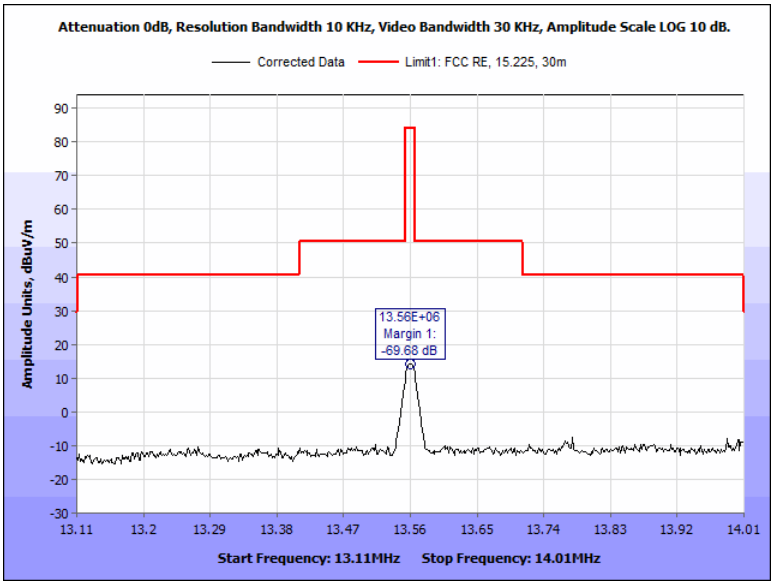


Figure 18. Spurious Emissions Within the Band 13.110 – 14.010 MHz , 90 degrees

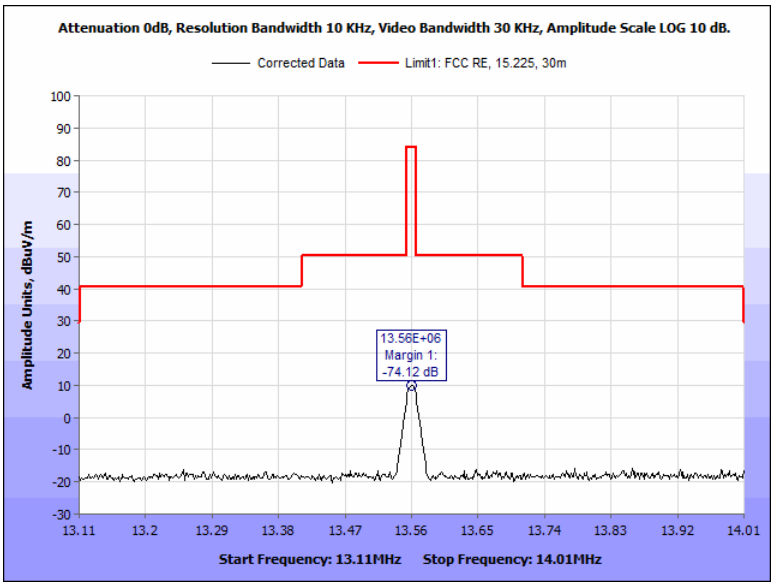


Figure 19. Spurious Emissions Within the Band 13.110 – 14.010 MHz, 0 degrees

Frequency (MHz)	Uncorrected Amplitude (dBuV @ 3m)	Loop Antenna Orientation (Degree)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m @ 30m)	Limit, FCC 15.225, 30m (dBuV/m)	Margin (dB)
13.5600	39.18	0	10	-40	10.7	0	9.88	84	-74.12
13.5600	43.62	90	10	-40	10.7	0	14.32	84	-69.68

Figure 20. Spurious Emissions Within the Band 13.110 – 14.010 MHz, Test Results

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 non-conductive table 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)**. Please see **§15.225(a)** data plots.

Test Engineer(s): Adan Arab

Test Date(s): 11/18/2019

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 non-conductive table 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)**. Please see **§15.225(a)** data plots.

Test Engineer(s): Adan Arab

Test Date(s): 11/18/2019

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 non-conductive table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10-2013 were used. For measurements below 30 MHz a loop antenna placed 3m away from the unit was used. For measurements above 30 MHz a biconalog antenna placed 10m away from the unit was used. 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 below 30 MHz and a Quasi-peak detector was used for measurements for above 30 MHz.

The measurements made at 3m with the loop antenna were then extrapolated to 30m or 300 M using the following correction factor.

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

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

20log (10/3) = +10.46 dB

Sample Calculation for Distance Correction factor (DCF) measurement:

$F_d = 20*LOG_{10}(D_m/D_s)$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

Sample formula for calculating the Corrected Data for the Radiated Emissions Measurements:

Frequency (MHz)	Antenna Polarity	EUT Azimuth (Degrees)	Antenna Height (cm)	Uncorrected Amplitude (dBµV/m)	ACF (dB/m) (+)	Pre Amp Gain + CBL (dB)(-)	DCF (dB) (+)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
249.99	V	359.9	240.7	55.46	11.4	28.335	10.46	***38.525***	47	-8.475

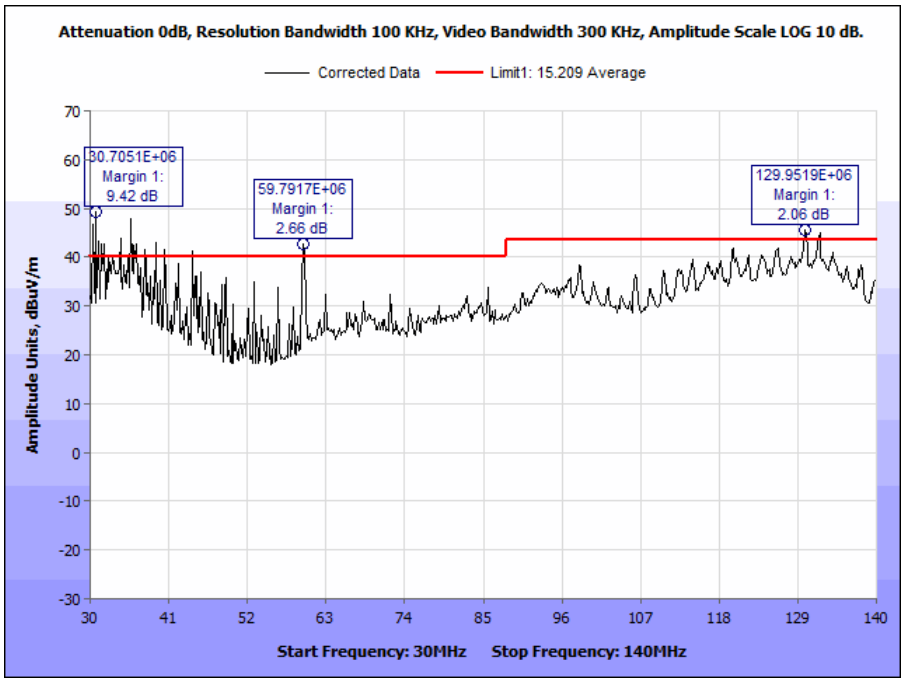
*Corrected Amplitude (dBµV/m) = Uncorrected Amplitude (dBµV/m) +ACF (dB/m) – (Preamp Gain (dB) + CBL (dB) +DCF (dB) ** = 55.46 + 11.4 – 28.355 + 10.46 =* ***38.525***

*** DCF Column represents the appropriate correction factor used when the measurement distance differs from the specification distance.*

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

Test Engineer: Adan Arab

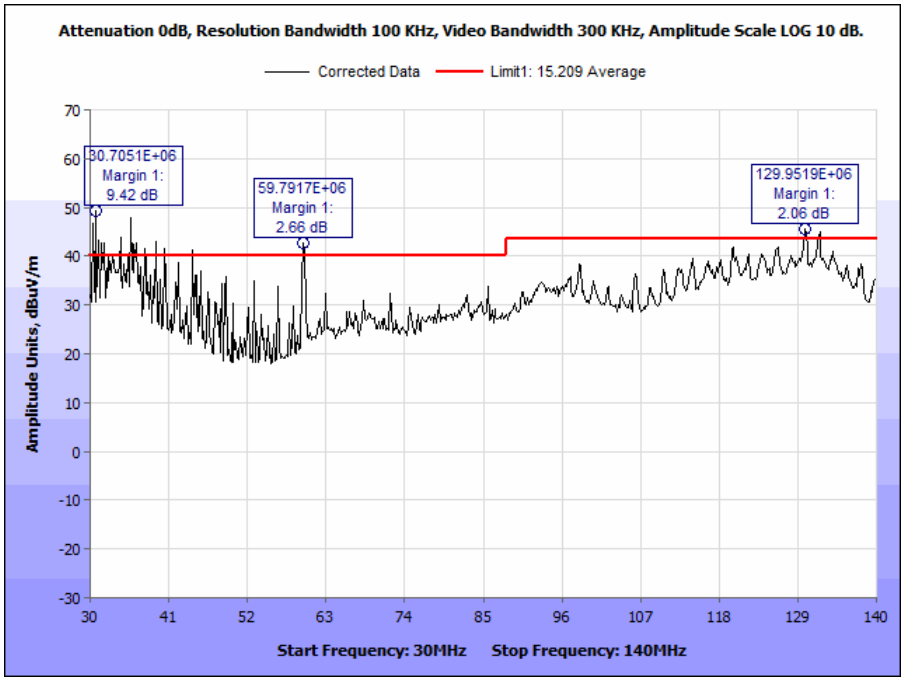
Test Date: 11/18/2019



Frequency (MHz)	Uncorrected Amplitude (dBuV)	Antenna Polarity	Antenna Height (cm)	EUT Azimuth (Deg)	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)	Comments
35.2885	29.6	V	100	0	100	10.46	19.9	-24.61	35.35	40	-4.65	
30.7051	19	V	100	70	100	10.46	22.38	-24.77	27.07	40	-12.93	
37.5801	18.3	V	200	26	100	10.46	18.55	-24.59	22.72	40	-17.28	
41.4583	18.2	V	145	134	100	10.46	16.37	-24.51	20.52	40	-19.48	
59.9679	44.2	V	100	78	100	10.46	10.4	-24.23	40.83	40	0.83	See Note
129.9519	39.7	V	137	48	100	10.46	16.1	-23.49	42.77	43.5	-0.73	
132.0673	35	V	100	112	100	10.46	15.99	-23.47	37.97	43.5	-5.53	

Note: Measurements listed above represent quasi-peak results for spurious Emissions. Spurious emissions above the limit were determined to be sourced from digital devices unrelated to the transmitter. Therefore, are not subject to the requirements of FCC15.209 but shall meet the requirements of FCC 15.109.

Figure 20. Spurious Emissions, 30 – 140 MHz, Outside the Band 13.110 – 13.410 MHz band, Vertical Test Results



Frequency (MHz)	Uncorrected Amplitude (dBuV @10m)	Antenna Polarity	Antenna Height (cm)	EUT Azimuth (Deg)	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)	Comments
30.7051	18.8	H	220	78	100	10.46	22.38	-24.77	26.87	40	-13.13	
35.6410	21	H	154	186	100	10.46	19.65	-24.61	26.5	40	-13.5	
59.7917	45.4	H	204	165	100	10.46	10.4	-24.23	42.03	40	2.03	See Note
129.9519	40.1	H	300	86	100	10.46	16.1	-23.49	43.17	43.5	-0.33	
39.1667	32	H	260	30.7	100	10.46	17.62	-24.51	35.57	40	-4.43	
31.9391	25	H	400	167	100	10.46	21.73	-24.7	32.49	40	-7.51	

Note: Measurements listed above represent quasi-peak results for spurious Emissions. Spurious emissions above the limit were determined to be sourced from digital devices unrelated to the transmitter. Therefore, are not subject to the requirements of FCC15.209 but shall meet the requirements of FCC 15.109.

Figure 21. Spurious Emissions, 30 – 140 MHz, Outside the Band 13.110 – 13.410 MHz band, Horizontal Test Results

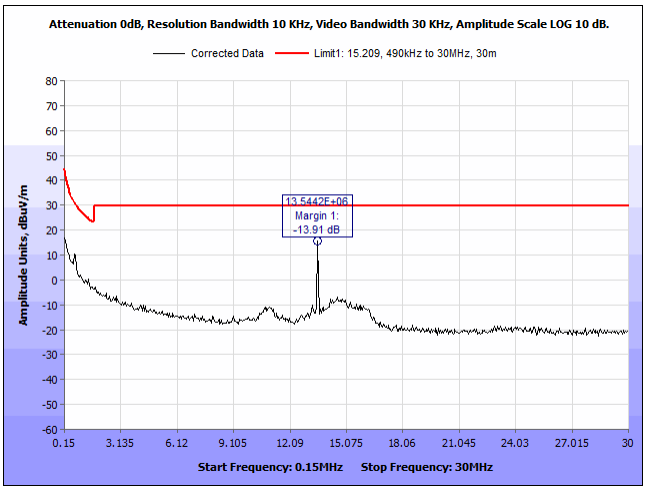


Figure 22. Spurious Emissions Outside the Band 13.110 – 13.410 MHz band, 0.150 – 30 MHz, 90 degrees

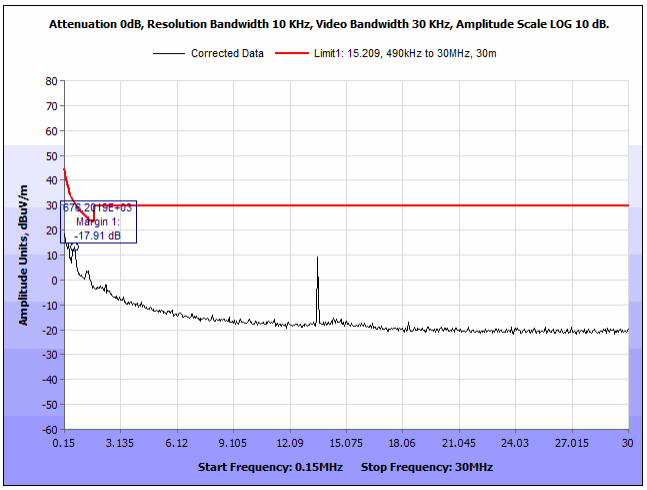


Figure 23. Spurious Emissions Outside the Band 13.110 – 14.010 MHz band, 0.150 – 30 MHz, 0 degrees

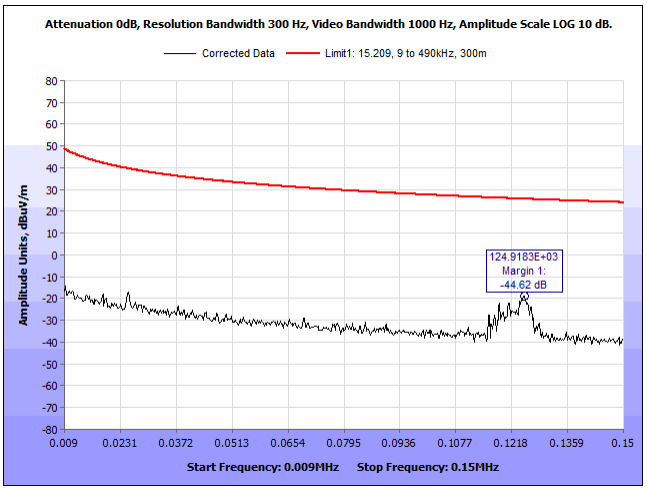


Figure 24. Spurious Emissions Outside the Band 13.110 – 13.410 MHz band, 0.009 – 0.150 MHz, 90 degrees

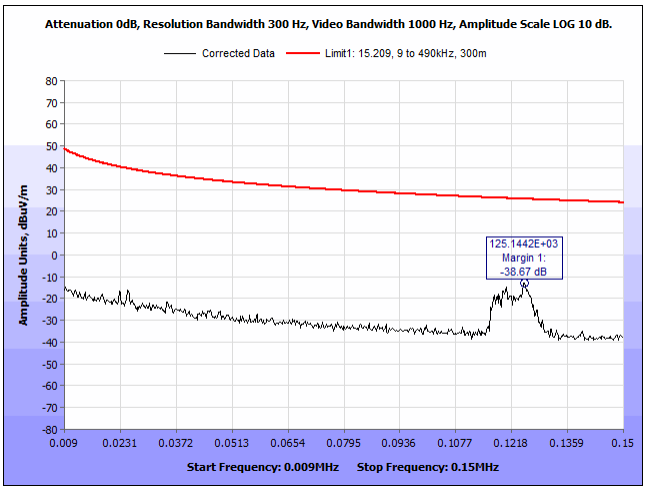


Figure 25. Spurious Emissions Outside the Band 13.110 – 14.010 MHz band, 0.009 – 0.150 MHz, 0 degrees

Frequency (MHz)	Uncorrected Amplitude (dBuV @ 3m)	Loop Antenna Orientation (Degree)	RBW (KHz)	Distance Correction Factor (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Corrected Amplitude (dBuV/m @ 300m, 30m)	Limit, FCC 15.225, 300m, 30m (dBuV/m)	Margin (dB)
0.1251	55.72	0	0.3	-80	11.27	0	-13.01	25.66	-38.67
0.1249	49.78	90	0.3	-80	11.28	0	-18.95	25.67	-44.62
676.2019	41.89	0	10	-40	11.2	0	13.09	31	-17.91
13.5442	44.93	90	10	-40	10.7	0	15.63	29.54	-13.91

Figure 20. Spurious Emissions outside 13.110 – 14.010 MHz band, 0.009-30 MHz Test Results

Spurious Emissions Limits Test Setup

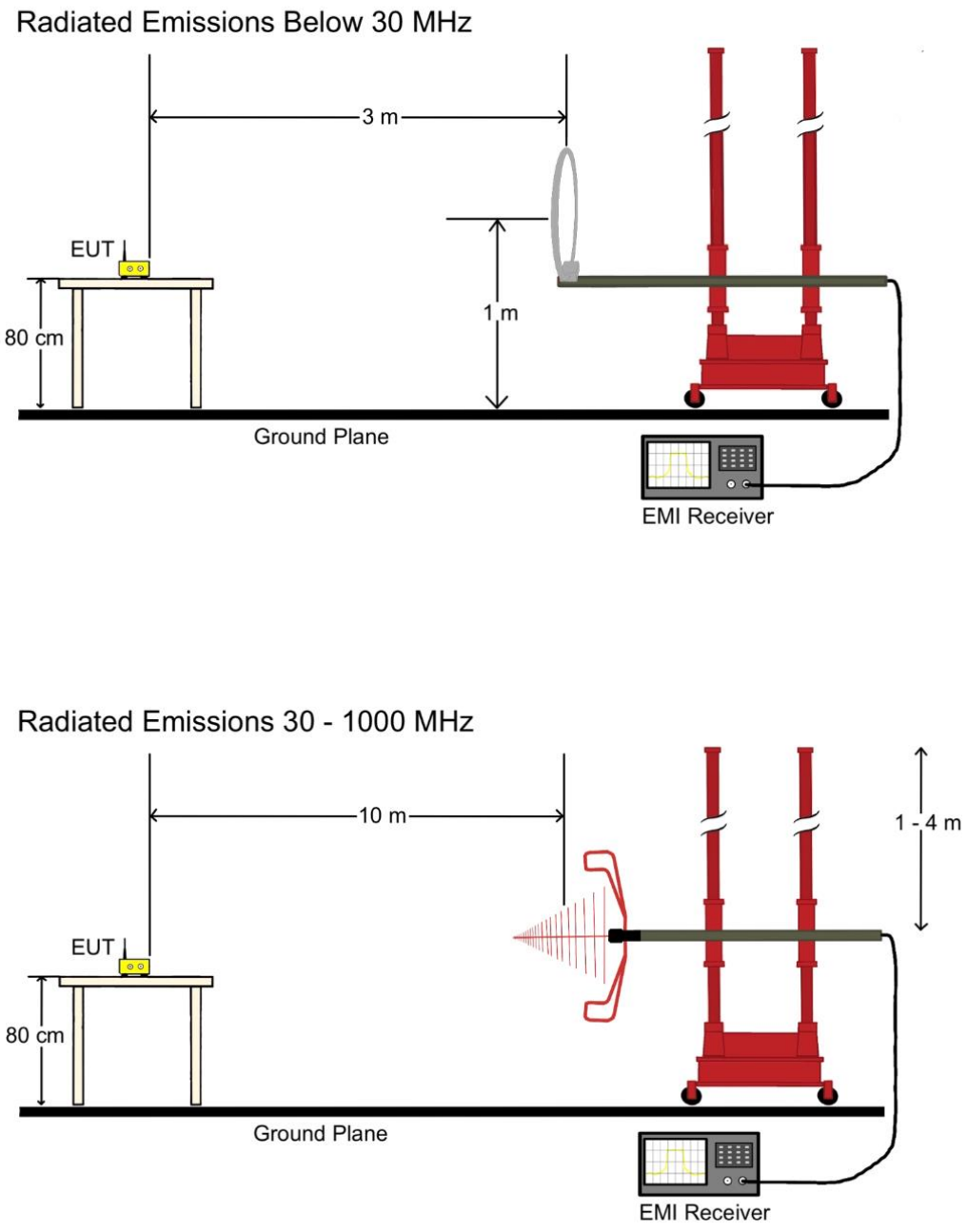


Figure 26. Radiated Emissions Test Setup

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° C degrees to +50° C 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 °C 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 Cto 50º C.

Test Results: The EUT was found compliant with the frequency stability requirements of this section.

Test Engineer(s): Adan Arab

Test Date(s): 11/19/2019

FCC 15.225 (e)	120VAC 60Hz				
Voltage Variation (%)	Temperature (°C)	Nominal Freq (MHz)	Result (MHz)	% Difference	Limit
Vnom	50	13.56	13.560136	0.0010029	±0.01%
	40	13.56	13.560137	0.0010103	
	30	13.56	13.560157	0.0011578	
	20	13.56	13.55956	-0.0032448	
	10	13.56	13.560177	0.0013053	
	0	13.56	13.560187	0.0013791	
	-10	13.56	13.560198	0.0014602	
	-20	13.56	13.56025	0.0018437	
15	20	13.56	13.560137	0.0010103	
-15	20	13.56	13.560136	0.0010029	

Figure 27. Frequency Stability, Test Results

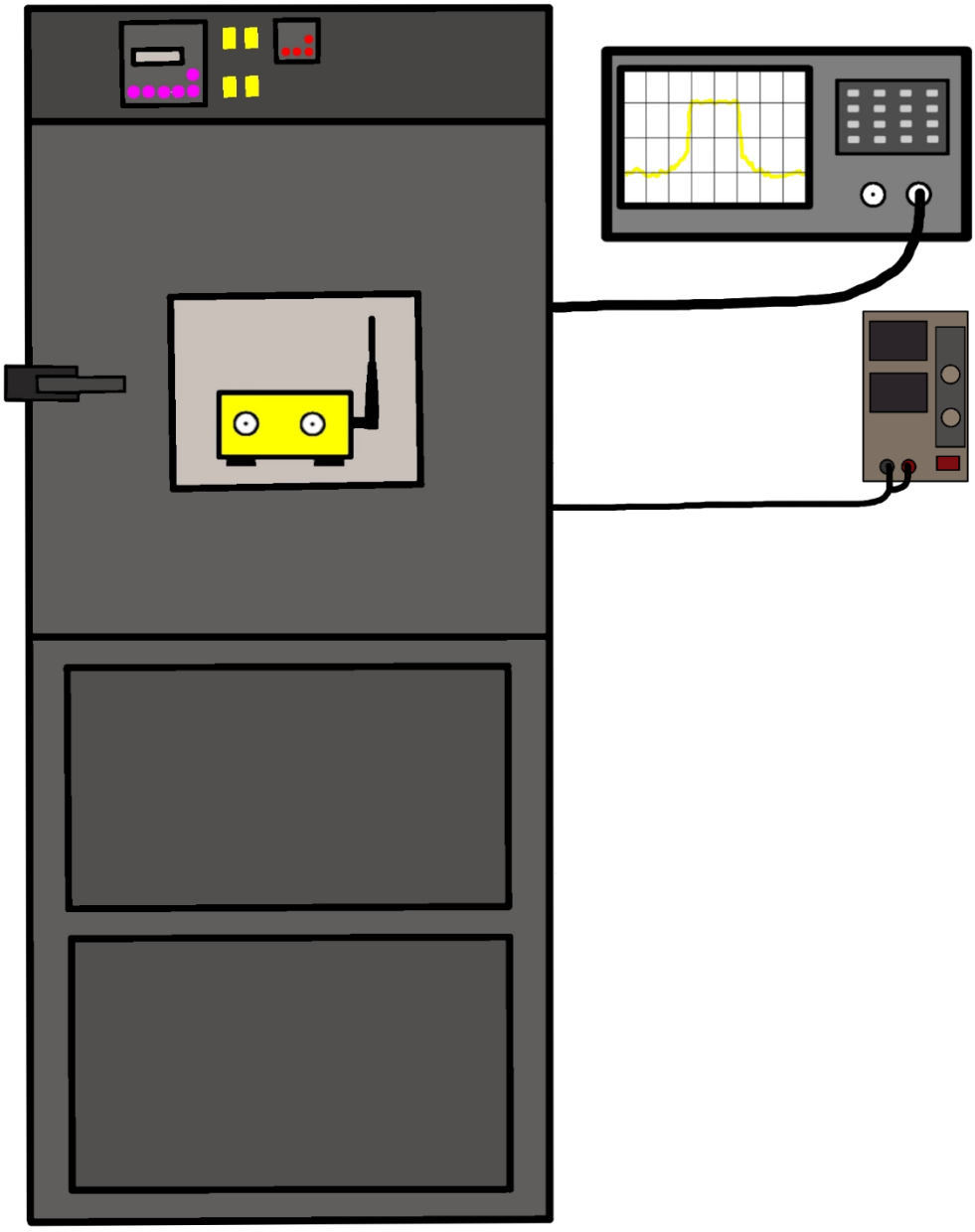


Figure 28. Temperature Stability Test Setup

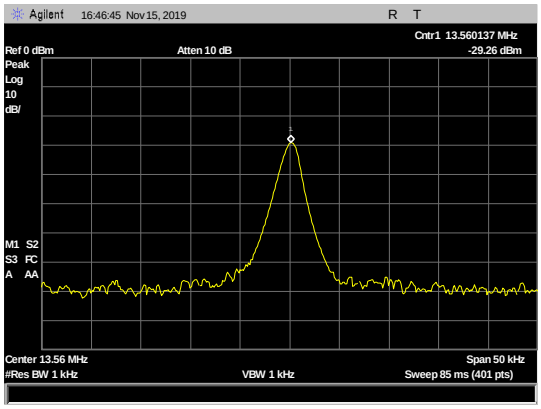


Figure 29: Frequency Tolerance, Vnorm+15, 20C

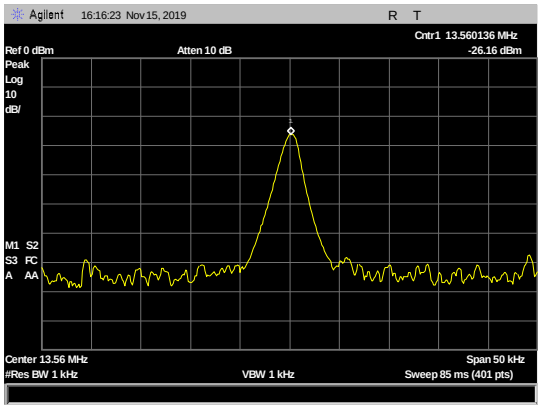


Figure 30: Frequency Tolerance, Vnorm-15, 20C

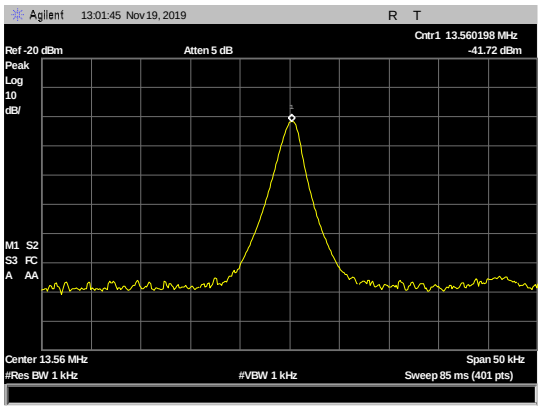


Figure 31: Frequency Tolerance, Vnorm, -10C

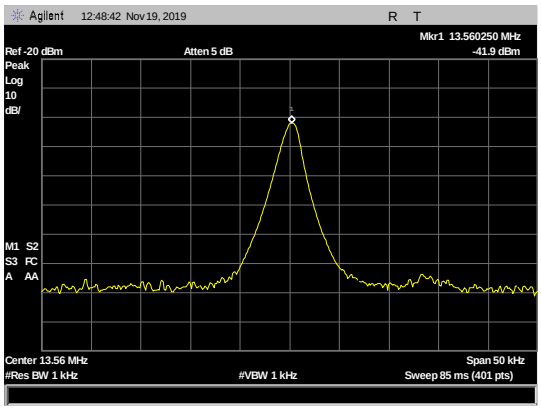


Figure 32: Frequency Tolerance, Vnorm, -20C

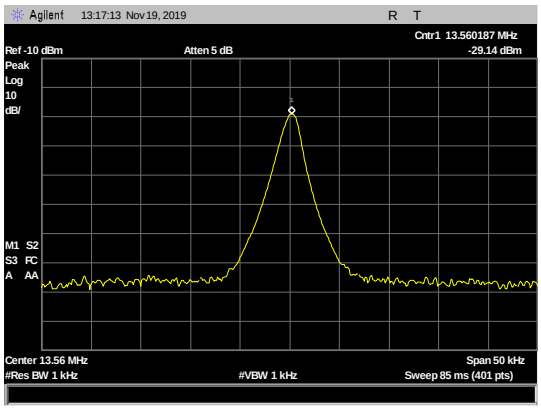


Figure 33: Frequency Tolerance, Vnorm, 0C

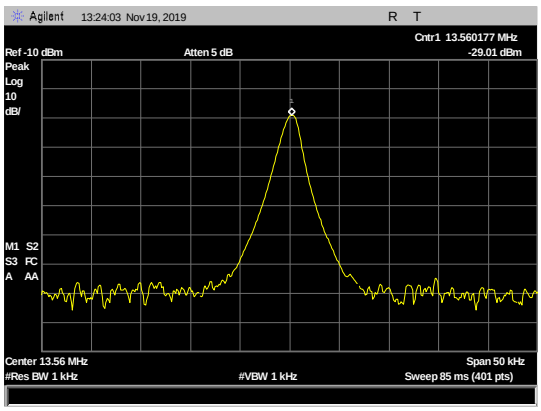


Figure 34: Frequency Tolerance, Vnorm, 10C

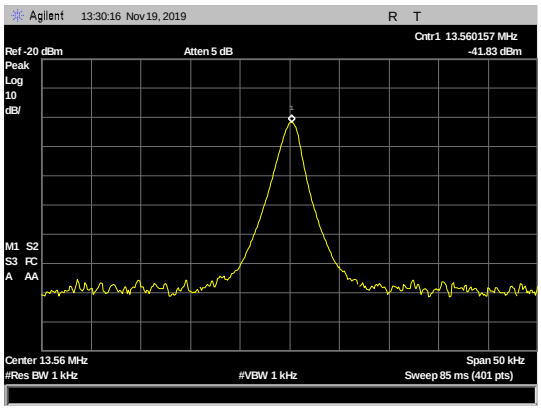


Figure 35: Frequency Tolerance, Vnorm, 30C

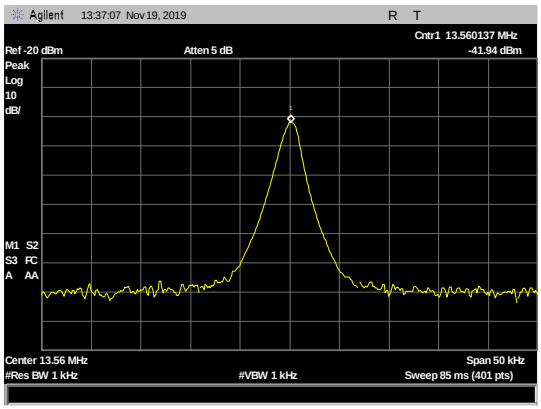


Figure 36: Frequency Tolerance, Vnorm, 40C

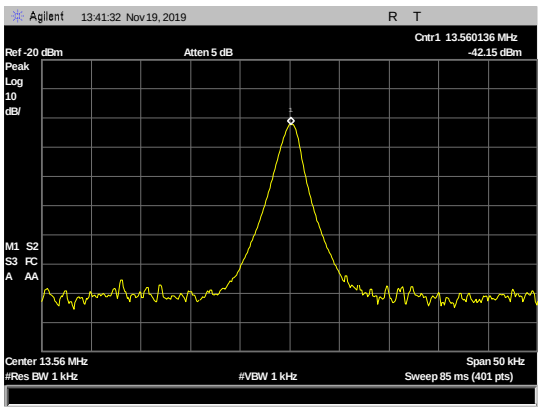


Figure 37: Frequency Tolerance, Vnorm, 50C

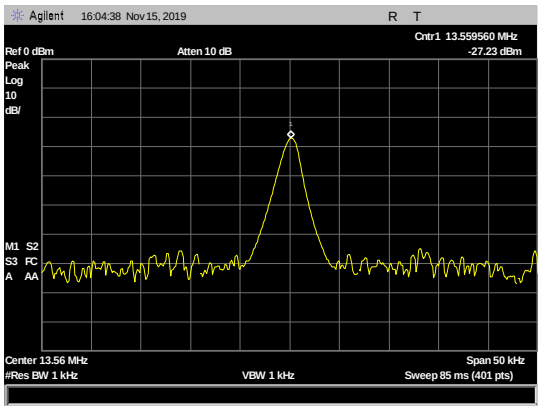


Figure 38: Frequency Tolerance, Vnorm 20C

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 #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1044	Generator	COM-Power Corp	CG-520	See Note	See Note
1A1099	Generator	COM-Power Corp	CG-51000	See Note	See Note
1A1079	Conducted Comb Generator	COM-Power Corp	CGC-255	See Note	See Note
1A1050	Bilog Antenna (30 MHz to 1 GHz)	Schaffner	CBL 6112D	08/29/2018	02/19/2020
1A1183	Double Ridged waveguide Antenna (1 GHz to 18 GHz)	ETS Lindgren	3117	10/10/2018	04/10/2020
1A1050-A	4 dB Fixed Attenuator	Fairview Microwave	SA6N5WA-04	08/29/2018	02/29/2020
1A1088	Pre-Amp	Rhode & Schwarz	TS-PR1	See Note	
1A1073	Multi Device Controller	ETS Lindgren	2090		
1A1195	Preamplifier	A.H. Systems	PAM-0018P		
1A1074	System Camera Controller	Panasonic	WV-CU101		
1A1075	System Camera Controller	Panasonic	WV-CU101		
1A1080	Multi Device Controller	ETS Lindgren	2090		
1A1176	Active Loop Antenna	ETS-Lindgren	6502	04/03/2019	04/03/2020
1A1122	LISN	Teseq	NNB 51	8/09/2019	08/09/2020
1A1065	EMI Receiver	Rohde & Schwarz	ESCI	5/1/2019	5/1/2020
1A1149	Milliohm Meter	GW Instek	GOM-802	18.04/2019	18/04/2020
1A1184	Spectrum Analyzer	Agilent Technologies	E4407B	6/25/2019	6/25/2020
1A1225	Environmental Chamber	Aspec	EXP-2H/New	2/21/2019	2/21/2020
1A1119	Test Area	Custom Made	N/A	See Note	
1A1177	Pulse Limiter / Attenuator	Rohde & Schwarz	ESH3Z2	11/30/2018	5/30/2020
1A1083	Test Receiver	Rohde & Schwarz	ESU40	10/10/2019	10/10/2020
1A1106	10 m Chamber (NSA)	ETS Lindgren	Semi-Anechoic	See Note	

Figure 39. Test Equipment List

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

End of Report

