Project 20267-15

Hubbell Control Solutions

NXOFM-1R1D-UNV

Wireless Certification Report

Prepared for:

Hubbell Control Solutions 1812 Centre Creek Dr Suite 240 Austin, TX 78754

By

Professional Testing (EMI), Inc. 1601 North A.W. Grimes Blvd., Suite B Round Rock, Texas 78665

18 Sep 2018

Reviewed by

Larry Finn Chief Technical Officer Written by

Eric Lifsey EMC Engineer

Revision History

Revision Number	Description	Date
DRAFT 01	Draft for review.	18 Sep 2018
Final	Final, no changes.	21 Sep 2018

Е	r	٠-	ta	•
L	1 1	а	ια	

None.

Table of Contents

Revisio	n History	2
Compl	iance Certificate	5
1.0 I	ntroduction	6
1.1		
1.2	- I	
1.3		6
1.4	Modifications to Equipment	
1.5	Test Site	
1.6	Radiated Measurements	
1.7	Applicable Documents and Clauses	
	Fundamental Power and Duty Cycle	
2.1	Test Procedure	
2.2	Test Possite Possite Possite	
2.3	,,	
2.4	Test Results, Duty Cycle	
	Power Spectral Density	
3.1	Test Procedure	
3.1		
3.3		
	Occupied Bandwidth	
4.1	1	
4.2		
4.3		
	13.1 Bandwidth Plots, 6 dB	
	1.3.2 Bandwidth Plots, 20 dB	
	1.3.3 Bandwidth Plots, OBW 99%	
	Band Edge	
5.1		
5.2		
5.3		
5	5.3.1 Low Channel Band Edge	
5	5.3.2 High Channel Band Edge	. 18
6.0 F	Radiated Spurious Emissions, Receive Mode	
6.1	Test Procedure	. 19
6.2	Test Criteria	. 19
6.3	Test Results	. 19
	5.3.1 Above 1 GHz	
7.0 F	Radiated Spurious Emissions, Transmit Mode	
7.1	Test Procedure	
7.2	Test Criteria	
7.3		
	V.3.1 Up to 1 GHz, Middle Channel	
	7.3.2 1 GHz to 18 GHz, Middle Channel	
	7.3.3 1 GHz to 18 GHz, Bottom Channel	
	7.3.4 1 GHz to 18 GHz, Top Channel	
	7.3.5 18 GHz to 25 GHz, Middle Channel	
	7.3.6 18 GHz to 25 GHz, Bottom Channel	
	7.3.7 18 GHz to 25 GHz, Top Channel	
	Antenna Construction	
8.1	Procedure	
8.2	Criteria	
8.3	Results	
9.0 (Conducted Emissions, Mains	
9.1	Test Procedure	
9.2	Test Criteria Test Results	
	1 est Results	
>	7.5.1 IVIAIII5, INCUITAL	. 50

9.3.2 Mains, Phase	37
10.0 Equipment	38
10.1 Spurious Radiated Emissions 30 MHz to 25 GHz	
10.2 Bandwidth and Duty Cycle	
10.3 Mains Conducted Emissions	
11.0 Measurement Bandwidths	
Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty	42
End of Report	

NOTICE: (1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST. (2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc. (3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



Compliance Certificate

Applicant Device & Test Identification		tion
Hubbell Control Solutions	FCC ID:	YH9NXOFM1R1D
1812 Centre Creek Dr	Industry Canada ID:	9044A-NXOFM1R1D
Suite 240	Model(s):	NXOFM-1R1D-UNV
Austin, TX 78754-3962		
Certificate Date: 18 Sep 2018	Laboratory Project ID:	20267-15

The device named above was tested utilizing the following documents and found to be in compliance with the required criteria:

Requirement	Reference	Detail
FCC 47 CFR Part 15 C	15.247	Operation within the bands 902-928 MHz, <u>2400-2483.5 MHz</u> , and 5725-5850 MHz.
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements.
FCC 47 CFR Part 15 C	15.107, 15.207	Conducted emission limits.
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
KDB 558074 D01	DR01	DTS Measurement Guidance v03r02
KDB 412172	D01	Guidelines for Determining the ERP and EIRP of an RF Transmitting System
OET Bulletin 65*	Edition 97-01, and Supplement C, Ed. 01-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
RSS-247	Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence- Exempt Local Area Network (LE-LAN) Devices
RSS-Gen	Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-102	Issue 5	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

^{*}MPE is reported separately from this document. **Corresponding RSS references are listed in the body of the report.

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above requirements and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.



This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the requirements listed above.

Representative of Applicant	

1.0 Introduction

1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of the United States and Canada.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing.

1.2 EUT Description

Table 1.2.1: Equipment Under Test				
Manufacturer / Model Serial # Description				
Hubbell Building Automation / NXOFM-1R1D-UNV	None	2400-2483.5 MHz FHSS transceiver; using Bluetooth Low Energy radio protocols.		

Table 1.2.2: Support Equipment				
Manufacturer / Model	Serial #	Description		
none		none		

The EUT is a sensor board in support of a lighting control system. It is cylindrical and measures approximately 13.5 cm x 8 cm.

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations.

The EUT was tested as a DTS device as its bandwidth satisfies the DTS minimum bandwidth requirements. In the final application it will be also hopping per the Bluetooth Low Energy protocol.

1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

1.6 Radiated Measurements

Radiated levels are determined as follows:

Raw Measured Level + Antenna Factor + Cable Losses – Amplifier Gain = Corrected Level

Conducted RF levels are determined as follows:

Conducted mains levels are determined as follows:

Raw Measured Level + LISN Factor + Cable/Filter/Limiter Losses = Corrected Level

Additionally, measurement distance extrapolation factors are applied and documented where used.

1.7 Applicable Documents and Clauses

Table 1.7.1: Applicable Documents		
Document	Title	
47 CFR	Part 15 – Radio Frequency Devices	
47 CFK	Subpart C -Intentional Radiators	
RSS-247 Issue 1	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-	
N33-247 ISSUE 1	Exempt Local Area Network (LE-LAN) Devices	
RSS-Gen Issue 4	General Requirements and Information for the Certification of Radio Apparatus	
ANSI C63.10 2013	American National Standard of Procedures for Compliance Testing of Unlicensed	
ANSI C03.10 2013	Wireless Devices	

Table 1.7.2: Applicable Clauses					
Parameter	FCC Part 15	IC RSS References			
raiailletei	Rule Paragraphs				
Transmitter Characteristics	15.247	RSS-247 5.2 (DTS) & 5.4, RSS-Gen			
Bandwidth	15.247(a)(1), 2.1049, KDB 558074 D01	RSS-Gen 4.6			
Spurious Emission	15.247, 15.209, 15.205	RSS-247 5.5, RSS-GEN 4.9, 4.10			
Band Edge	15.247, 15.205	RSS-247 5.5, RSS-Gen 4.9			
Antenna Requirement	15.203	RSS-Gen 8.3			
Conducted Emissions, Mains	15.207	RSS-Gen 8.8			

2.0 Fundamental Power and Duty Cycle

2.1 Test Procedure

Peak power is measured using radiated means. The transmitter hopping sequence is disabled to operate on a single channel for the measurement.

Duty cycle measurement is taken based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)					
Section Reference	Date				
	Fundamental Power				
15.247(a)(3) //	Conducted Limits	31 Jul 2018			
RSS-247 5.2	1 W	3 Aug 2018			
	Limit Restated as Field: 125.23 dBμV/m @ 3 m				

2.3 Test Results, Peak Power

The EUT was measured for radiated power in normal upright orientation. It is not operated hand-held.

Table 2.3.1 Power, Pea	ak, Radiated		
Frequency MHz	Measured Peak Power dBμV/m @ 3 m Vertical Polarity	Measured Peak Power dBμV/m @ 3 m Horizontal Polarity	Maximum Measured Peak Power Restated as EIRP dBm
2402	92.6	92.5	-2.63
2440	91.9	93.8	-1.43
2480	89.1	92.2	-3.03

Measured in 1 MHz RBW, 3 MHz VBW.

The EUT was found to be in compliance with the applicable criteria.

2.4 Test Results, Duty Cycle

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

The EUT was set into normal operation and using the manufacturer's mobile smart phone application a constant query of light level was used as maximum activity. A sense antenna was placed next to the EUT and the mobile phone was located 2 meters away to minimize effect on measurement. The spectrum analyzer was set to the center channel in time domain mode and triggered on video. The time base was set to 100 ms to count the number of events, then the transmit time itself was measured.

Events in 100 ms: 4

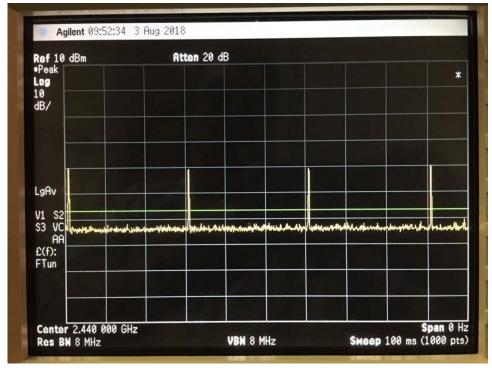
Transmit time: 0.095 ms * 4 = 0.38 ms

Duty cycle: 0.38 / 100 = 0.38 %

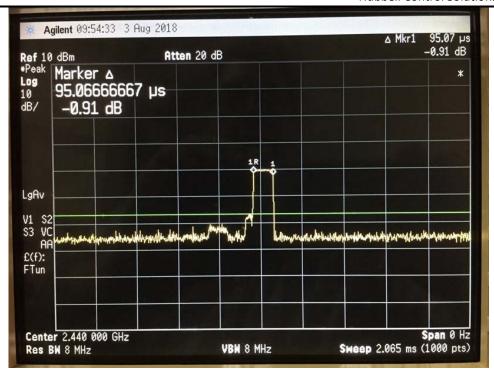
Duty cycle factor: $20 \log (0.0038) = -48 \text{ dB}$; allowed -20 dB

Factor for exposure = -24 dB

2.4.1 Timings, Duty Cycle



Transmit events in 100 ms



Transmit event

3.0 Power Spectral Density

3.1 Test Procedure

A spectrum analyzer is either connected directly to the EUT or used by radiated means to measure the fundamental emission. It is adjusted to measure the power spectral density in the prescribed resolution bandwidth.

3.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date
15.247(e) // RSS-247, 5.2	Power Spectral Density, Conducted Limit: 8 dBm / 3 kHz	31 Jul 2018

3.3 Test Results

The fundamental peak power measured below the 8 dBm limit for this test; the EUT satisfies the criteria without additional measurement.

4.0 Occupied Bandwidth

4.1 Test Procedure

Bandwidth is measured by radiated means. A recording of the results is included.

4.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
14.247(a)(2), 2.1049, KDB 558074 D01 // RSS-Gen 4.6	Bandwidth, 6 dB, 20 dB, 99%	19 Jun 2017

4.3 Test Results

The bandwidth measurement is used to verify DTS characteristics and/or for general reporting for agency application.

The EUT was found to be in compliance with applicable requirements.

Table 4.3.1 Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW							
Low Channel Mid Channel High Channel Reported							
Measured BW	Measured BW	Measured BW	Minimum BW				
(kHz)	(kHz)	(kHz)	(kHz)				
630	628	624	624				

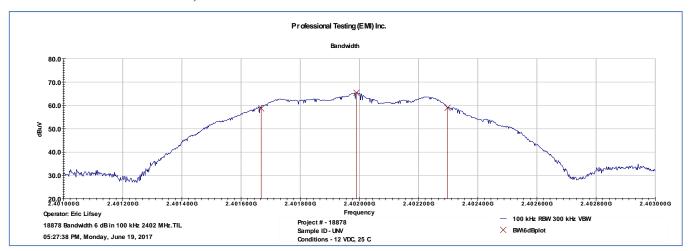
Table 4.3.2 Bandwidth 20 dB, Measure and Report								
Low Channel Mid Channel High Channel Reported								
Measured BW	Measured BW	Measured BW	Maximum BW					
(kHz)	(kHz)	(kHz)	(kHz)					
972	1076	1088	1088					

Table 4.3.3 Bandwidth OBW 99%, Measure and Report							
Low Channel Mid Channel High Channel Reported							
Measured BW	Measured BW	Measured BW	Maximum BW				
(kHz)	(kHz)	(kHz)	(kHz)				
1018	1019	1015	1019				

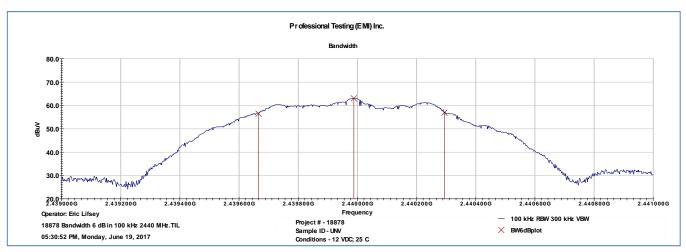
Plotted measurements appear on the following pages.

Note that the test results for a previous certification apply in that the transmitter is the same sample with only an antenna change involved.

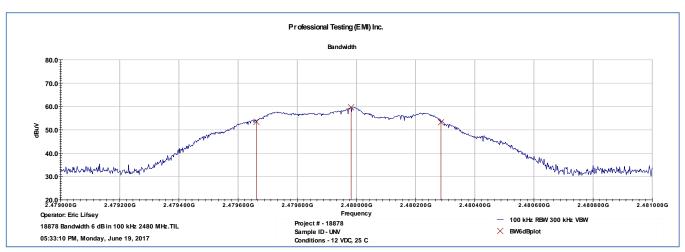
4.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

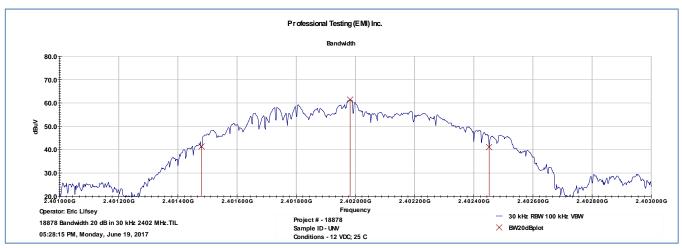


6 dB, Middle Channel

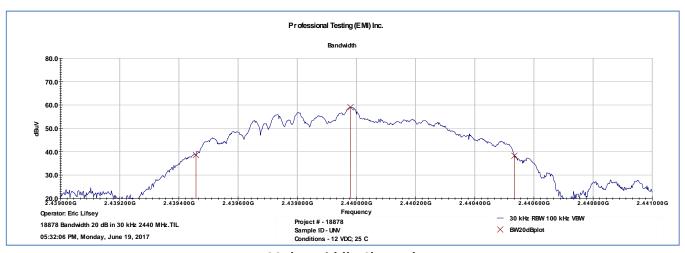


6 dB, High Channel

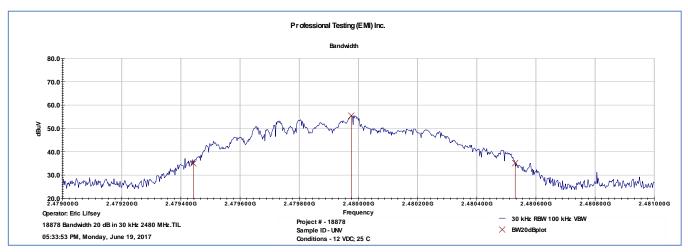
4.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel

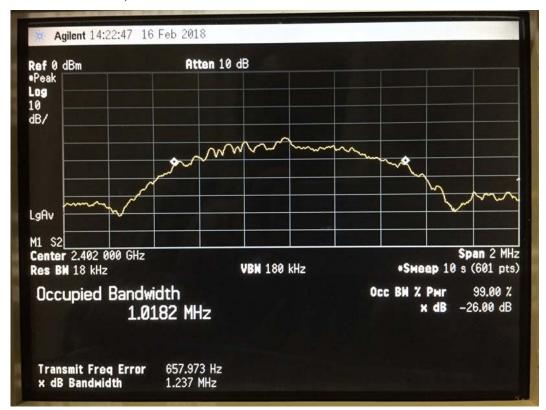


20 dB, Middle Channel

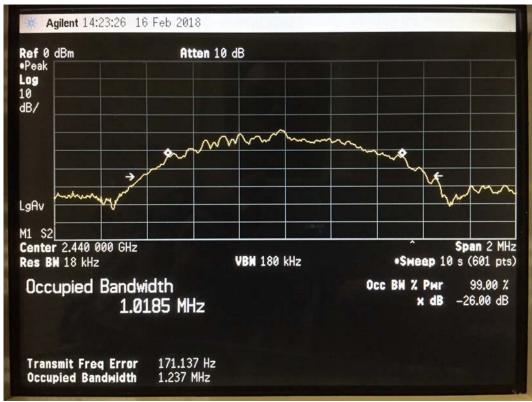


20 dB, High Channel

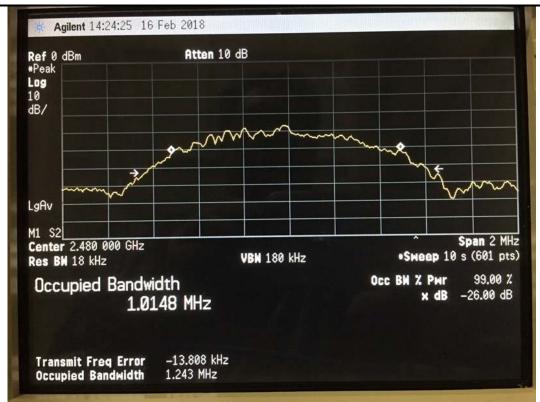
4.3.3 Bandwidth Plots, OBW 99%



Low Channel



Low Channel



High Channel

5.0 Band Edge

5.1 Test Procedure

EUT is placed into normal transmit operation on the nearest band edge channel. The spectrum analyzer is approximately centered on the band edge frequency with span sufficient to include the peak of the adjacent fundamental signal. Measurement includes at least two standard bandwidths from the respective band edge. If required, the band-edge marker-delta method of C63.4 is utilized.

5.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.205 //	Unwanted Emissions Adjacent to Authorized	2 Aug 2019
RSS-247 5.5, RSS-Gen 4.9	Band, Radiated	2 Aug 2018

5.3 Test Results

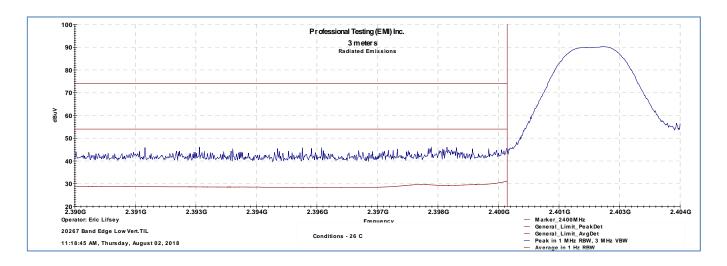
Measurements included more than 2 standard bandwidths (standard bandwidth 1 MHz) from the band edges to provide a clear view of the fundamental and the declining emission levels. Peak detection and average detection with max-hold was employed.

Peak detection of emissions at both band edges were below the general emission average limit levels.

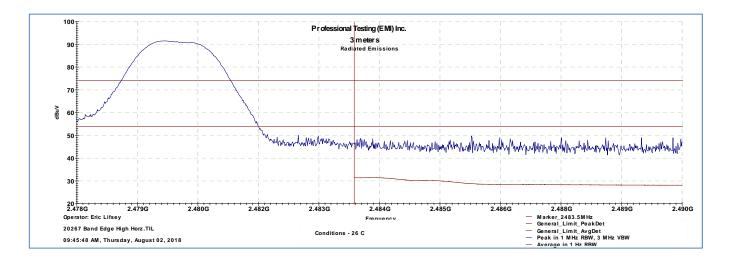
The polarity with highest recorded output power is presented for the given edge.

The EUT satisfied the criteria. Plotted results appears on the following pages.

5.3.1 Low Channel Band Edge



5.3.2 High Channel Band Edge

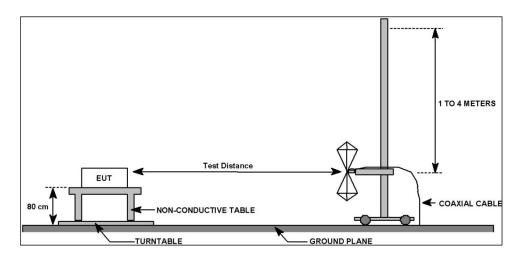


6.0 Radiated Spurious Emissions, Receive Mode

6.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate and 1 MHz resolution bandwidth. A diagram showing the test setup appears below.



6.2 Test Criteria

47 CFR (USA) // IC (Canada)					
Section Reference	Parameter	Date(s)			
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode	22 Aug 2018			

6.3 Test Results

The EUT was tuned to the middle channel and placed in receive mode.

The EUT satisfied the criteria. Recorded data is presented below.

Emissions below 1 GHz in transmit mode satisfied the receive mode limits.

6.3.1 Above 1 GHz

Purchase Order #: 0 Supervisor: Lisa A	0 GHz ntional Radiators, Rad ne	
Section: 15.109	e	liated
Test Date(s):		
Customer: Hubble Control Solutions EUT Part #: None Project Number: 20267 Test Technician: Eric L Purchase Order #: 0 Supervisor: Lisa A Equip. Under Test: NXOFM-UNV Witness' Name: None Radiated Emissions Test Results Data Sheet EUT Line Voltage: 120 VAC EUT Power Frequency: Antenna Orientation: Vertical Frequency Range: EUT Mode of Operation: Recorded Amplitude (dBμV) Corrected (dBμV/m) Limit (dBμ (dBμV/m) 1127.92 3 123 2.1 Average 42.1 29.58 54 1283.95 3 76 1.83 Average 39.6 27.831 54 1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 37.3 27.625 54 1800.29 3 47 1.92 Average 37.3		
Project Number: 20267	Δ	
Name		
Equip. Under Test: NXOFM-UNV Witness' Name: None Radiated Emissions Test Results Data Sheet EUT Line Voltage: 120 VAC EUT Power Frequency: Frequency: Range: Antenna Orientation: Vertical Recorded Amplitude (dBμV) Corrected Level (dBμV/m) Limit (dBμ Measured (MHz) Distance (Meters) Limit (dBμV) Limit (dBμV/m)	Lifsey	
Radiated Emissions Test Results Data Sheet	Arndt	
EUT Line Voltage: 120 VAC EUT Power Frequency: Antenna Orientation: Vertical Frequency Range: EUT Mode of Operation: Antenna Height (Meters) Detector Function Recorded Amplitude (dBμV/m) Limit (dBμV/m) 1127.92 3 123 2.1 Average 42.1 29.58 54 1283.95 3 76 1.83 Average 39.6 27.831 54 1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 36.4 28.718 54 2761.13 3 311 1.49 Average 36.4 28.718 54	ie	
Receive & Receive & Receive & Receive & Receive &	Page: 1	of 1
Frequency Test Distance (Meters) Direction (Meters) Detector Eurition Eurition Detector (Meters) Direction (Meters) Detector Corrected Level (dBμV/m) Detector (Meters) Detector Direction Detector Corrected Direction Detector Detector Direction Detector Direction Detector Detector Direction Detector Direction Detector Detector Direction Detector Detector Direction Detector Detector Direction Detector Direction Detector Detector Detector Direction Detector Direction Detector Detector Detector Direction Detector Dete	60 Hz	
Frequency Measured (MHz) Test Distance (Meters) EUT Direction (Degrees) Antenna Height (Meters) Detector Function Recorded Amplitude (dBμV) Corrected Level (dBμV/m) Limit (dBμ (dBμV/m) 1127.92 3 123 2.1 Average 42.1 29.58 54 1283.95 3 76 1.83 Average 39.6 27.831 54 1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 36.4 28.718 54 2761.13 3 311 1.49 Average 36.4 28.718 54	Above 1	.GHz
Measured (MHz) Distance (Meters) Direction (Degrees) Height (Meters) Detector Function Amplitude (dBμV) Level (dBμV/m) Limit (dBμ 1127.92 3 123 2.1 Average 42.1 29.58 54 1283.95 3 76 1.83 Average 39.6 27.831 54 1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 36.4 28.718 54 2761.13 3 311 1.49 Average 36.4 28.718 54	advertising	
1283.95 3 76 1.83 Average 39.6 27.831 54 1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 37.3 28.017 54 2761.13 3 311 1.49 Average 36.4 28.718 54	it Level Margin μV/m) (dB)	Test Results
1332.08 3 47 1.79 Average 40.1 28.245 54 1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 37.3 28.017 54 2761.13 3 311 1.49 Average 36.4 28.718 54	54.0 -24.4	Pass
1404.09 3 77 2.86 Average 38.2 26.326 54 1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 37.3 28.017 54 2761.13 3 311 1.49 Average 36.4 28.718 54	54.0 -26.1	Pass
1800.29 3 47 1.92 Average 37.3 27.625 54 1939.75 3 86 2.83 Average 37.3 28.017 54 2761.13 3 311 1.49 Average 36.4 28.718 54	54.0 -25.7	Pass
1939.75 3 86 2.83 Average 37.3 28.017 54 2761.13 3 311 1.49 Average 36.4 28.718 54	54.0 -27.6	Pass
2761.13 3 311 1.49 Average 36.4 28.718 54	54.0 -26.3	Pass
	54.0 -25.9	Pass
3479.49 3 52 1.56 Average 36.9 30.003 54	54.0 -25.2	Pass
The rest of the rest of the second	54.0 -24.0	Pass
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-60Hz Vertical Polarity Measured Emissions	— Average Limit ▽ Average Reading — Peak Limit — Pre-scan Emissions △ Peak Reading	
Frequency But: NXOFM Mode: Receive & advertising Project Num Project Num	FM -UNV	larga wiji salahi qab
Current Time -09:09:15 AM, Wednesday, August 22, 2018 > 1GHz Vertical Antenna Polarity Measured Emissions	bble	

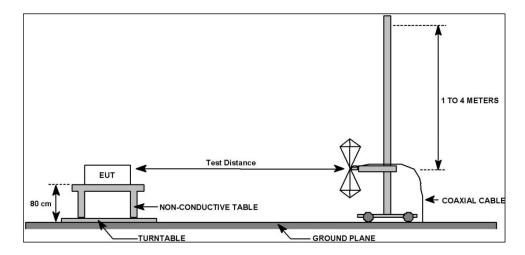
						Hubb	oell Control S	Solutions – N	NXOFM-1R1D
			Profes	sional Te	sting, El	VII, Inc.			
Test Metho	d:		: 2014, America e Electrical and					adio-Noise Em	nissions from
In accordan	ce with:	FCC Part 15 Emissions	i.109 - Code of Limits	Federal Regulat	tions Part 47, S	Subpart B - Ur	nintentional R	adiators, Radi	iated
Section:		15.109							
Test Date(s):	8/22/201	8		EUT Serial	#:	None		
Customer:		_	ontrol Solution	ons	EUT Part #:		None		
Project Nur	nber:	20267			Test Techn	ician:	Eric Lifsey		
Purchase O	rder #:	0			Supervisor:		Lisa Arndt		
Equip. Und	er Test:	NXOFM-	UNV		Witness' N	ame:	None		
	F	Radiated E	missions Test	Results Data	a Sheet		Pa	ge: 1	of 1
EUT Li	ne Voltage	•	120 VAC		EUT Pow	ver Frequen	cy: 6	60 Hz	
Antenna	Antenna Orientation: Horizontal Frequency Range:				Above 1	GHz			
	EUT N	lode of O	peration:			Rece	ive & adver	tising	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees	- 0	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1122.95	3	56	3.72	Average	40	27.453	54.0	-26.5	Pass
1287.59	3	4	1.55	Average	40.9	29.133	54.0	-24.8	Pass
1327.54	3	114	1.84			27.025	54.0	-26.9	Pass
2539.46	3	77	1.61	_		27.436	54.0	-26.5	Pass
3473.19	3	102	3.46	Average	37.1	30.198	54.0	-23.8	Pass
Radiated En	al Testing, EMI, Inc nissions, 3m Distance izontal Polarity Meast	red Emissions					— Pre-so	ge Limit can Emissions	
80									
19 60 Hall (19 19 19 19 19 19 19 19 19 19 19 19 19 1				 			***************************************		and the state of t
30 20 IG								100	136
				Fre q	uency		EUT: NXOFM-UNV		
Operator: Eri Current Time	c Lifsey 09:09:15 AM, Wedne	esday, August 22, 2	Power: 120	eive & advertising		ı	Project Number: 20267 Client: Hubble		
		> 1	GHz Horizont	al Antenna F	Polarity Mea	sured Emis	sions		

7.0 Radiated Spurious Emissions, Transmit Mode

7.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The EUT was centered on a rotating turntable. Measurements below 1 GHz were taken at a test distance of 10 meters from the measurement antenna. Above 1 GHz the measurement distance was 3 meters.

Spurious emissions below 1 GHz were measured with quasi-peak detection with a resolution bandwidth of 120 kHz. Above 1 GHz peak measurements were taken and average measured where appropriate using 1 MHz resolution bandwidth. A diagram showing the test setup appears below.



7.2 Test Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.247, 15.209 // RSS-247 5.5, RSS-Gen 4.9 & 4.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode	31 Jul 2018 1 Aug 2018

7.3 Test Results

Below 1 GHz measurements were taken for the middle channel. Above 1 GHz measurements were taken for the three standard channels of the band.

All measurements used peak detection.

The applicable averaging factor for harmonic spurious emissions is -20 dB and can be applied to any harmonic peaks appearing above the average limit.

7.3.1 Up to 1 GHz, Middle Channel

			Profes	sional Te	sting, EN	VII, Inc.				
Test Metho	od:	ANSI C63.10: Devices	2013: Ameri	can National Sta	andard of Proc	edures for Co	mplianc	e Testii	ng of Unlice	nsed Wirele
In accordar	nce with:	Limits	209 - Code of	Federal Regulat	ions Part 47, S	Subpart C - In	tentiona	l Radiat	tors, Radiate	ed Emissions
Section:	,	15.209					,			
Test Date(s	s):	7/31/2018	Cal		EUT Serial		none	A D4D	.4	
Customer: Project Nui	mhori	20267	ntrol Soluti	ons	EUT Part #: Test Techni		NXOFI Eric Lif		1	
Purchase C		0			Supervisor:		Lisa Ar			
Equip. Und		NXOFM-R1	D1		Witness' Na		none	iiut		
	F	Radiated Em	issions Test	t Results Data	Sheet			Pag	e: 1	of 1
EUT L	ne Voltage	: 23	30 VAC		EUT Pow	er Frequen	icy:	50	Hz	
Antenna	a Orientatio	n:	Vertic	al	Freque	ency Range	:	:	30MHz to	1GHz
	EUT N	Node of Ope	eration:			Trai	nsmit 2	440 M	lHz	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit L (dBμV		Margin (dB)	Test Resul
41.583	10	80	1.28	Quasi-peak	39.452	23.585	29.	5	-5.9	Pass
42.907	10	139	1.56	Quasi-peak	39.287	22.954	29.		-6.5	Pass
257.959	10	92	1.27	Quasi-peak	39.553	28.105	35.		-7.5	Pass
514.672	10	131	3.67	Quasi-peak	39.304	34.657	35.		-0.9	Pass
562.113 771.791	10 10	234 102	2.95 4.06	Quasi-peak Quasi-peak	31.696 30.203	27.471 30.892	35. 35.		-8.1 -4.7	Pass Pass
, , , , , , , , , , , , , , , , , , , ,	10	102	4.00	Quasi peak	30.203	30.032	33.		4.7	1 433
Prof Radia 30MHz 60 50 40 40 10	essiona ted Emissi - 1GHz Vertical	I Testing ons, 10m D Polarity Measur	J, EMI, Ir istance red Emissions	1C				— An — Pre ∇ Qu × LP	X	ions ading
0 30M Operate	or: Eric Lifsey	RE'Spur'TX'Mid'2	100M 30-50'BoxChai	Made: T	quency ansmit Middle C	hannal	EUT: NXC			1G

						Hubl	oell Coi	ntrol So	lutions – N	IXOFM-1R1	
			Profess	sional Te	sting, El	VII, Inc.					
Test Metho	d:	ANSI C63. Devices	10: 2013: Americ	can National Sta	andard of Proc	edures for Co	mplian	ce Testir	ng of Unlice	nsed Wireles	
In accordar	nce with:	FCC Part 1 Limits	.5.209 - Code of F	ederal Regulat	ions Part 47, S	Subpart C - Int	tentiona	al Radiat	ors, Radiate	d Emissions	
Section:		15.209									
Test Date(s	<u>):</u>	7/31/20			EUT Serial :		none	24 040			
Customer: Hubbell Control Solutions EUT Par Project Number: 20267 Test Te							Eric Li	M-R1D	1		
Purchase O		0			Supervisor		Lisa A				
Equip. Und		NXOFM-	R1D1		Witness' N		none				
Radiated Emissions Test Results Data Sheet Page: 1 of 1											
EUT Li	ne Voltage	:	230 VAC		EUT Pov	ver Frequen	су:	50	Hz		
Antenna	Orientation	on:	Horizon	ıtal	Frequ	ency Range			30MHz to	1GHz	
	EUT N	/lode of C	Operation:			Trai	nsmit 2	2440 M	lHz		
Frequency Test EUT Antenna Detector Recorded Corrected Limit Level Margin								Test Result:			
210.524	10	86	3.89	Quasi-peak	39.05	25.236	33	.1	-7.9	Pass	
210.559	10	88	3.9	Quasi-peak	38.821	25.009	33	.1	-8.1	Pass	
257.661	10	233	3.58	Quasi-peak	41.453	30.008	35		-5.6	Pass	
386.048	10	28	2.49	Quasi-peak	33.051	24.845	35		-10.8	Pass	
515.111 771.741	10 10	54 306	1.68 3.22	Quasi-peak Quasi-peak	33.197 24.453	28.56 25.142	35 35		-7.0 -10.5	Pass Pass	
//1./41	10	300	3.22	Quasi-peak	24.433	23.142	33	.0	-10.5	rass	
Professional Testing, EMI, Inc Radiated Emissions, 10m Distance 30MHz - 1GHz Horizontal Polarity Measured Emissions 60 T Verified Low-PRF QP Reading											
Field Strength (dByWm)	Anni partina de la como de la com	Manage Manage Control			×		×		×		
0 ± 30M 100M 1G Frequency Operator: Eric Lifsey											
	:18'Run03'RE'Spur'TX'l e -03:53:17 PM, Tuesd		-	Power: 230/5	mit Middle Channel 0 Antenna, wMetal Box Un		Project Numb	er: 20267	utions		
		≤ 1GHz Horizontal Antenna Polarity Measured Emissions									

7.3.2 1 GHz to 18 GHz, Middle Channel

			Profess	sional Te	sting, EN	VII, Inc.			
Test Metho	od:	ANSI C63.10 Devices	: 2013: Americ	can National St	andard of Proc	edures for Co	mpliance T	esting of Unlice	ensed Wireless
In accordar	nce with:	FCC Part 15.2 Limits	209 - Code of F	ederal Regula	tions Part 47, S	Subpart C - Int	entional R	adiators, Radia	ted Emissions
Section:		15.209			1		_		
Test Date(s	s):	7/31/2018			EUT Serial		none		
Customer:			ntrol Soluti	ons	EUT Part #:		NXOFM-		
	ject Number: 20267 Test Technician: Er							•	
Purchase O		0			Supervisor:		Lisa Arno	dt	
Equip. Under Test: NXOFM-R1D1 Witness' Name: none									
Radiated Emissions Test Results Data Sheet Page: 1 of 1									
EUT L	ine Voltage:	: 2	30 VAC		EUT Pow	ver Frequen	cy:	50 Hz	
Antenna	orientation	n:	Vertic	al	Freque	ency Range:		Above :	1GHz
EUT Mode of Operation: Transmit 2440 MHz									
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Lev (dBµV/n		Test Results
1320.16	3	210	1.61	Average	40.3	28.448	54.0	-25.5	Pass
1343.87	3	237	1.01	Average	39.7	27.822	54.0	-26.1	Pass
2440.01	3	267	3.46	Peak	100.9	91.902			Funamenta
3537.91	3	107	2.22	Average	36.4	29.536	54.0	-24.4	Pass
4879.93	3	301	2.58	Peak	61.7	57.758	74.0	-16.2	Pass
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions 100 100 100 100 100 100 100 1									
40									

						Hubl	oell Control S	Solutions – N	NXOFM-1R1D
			Profess	sional Te	sting, El	VII, Inc.			
Test Metho	d:	ANSI C63.10 Devices	: 2013: Americ	can National St	andard of Prod	edures for Co	mpliance Tes	ting of Unlice	nsed Wireless
In accordar	ice with:	FCC Part 15.2 Limits	209 - Code of I	ederal Regula	tions Part 47,	Subpart C - Int	tentional Radi	ators, Radiate	ed Emissions
Section:		15.209							
Test Date(s):	7/31/2018			EUT Serial	#:	none		
Customer:		_	ntrol Soluti	ons	EUT Part #:		NXOFM-R1	D1	
Project Nur		20267			Test Techn		Eric Lifsey		
Purchase O		0			Supervisor		Lisa Arndt		
Equip. Und	er Test:	NXOFM-R1	.D1		Witness' N	ame:	none		
Radiated Emissions Test Results Data Sheet Page: 1 of 1								of 1	
EUT Li	ne Voltage:	: 2	30 VAC		EUT Pov	ver Frequen	cy: 5	0 Hz	
Antenna	Orientatio	n:	Horizor	ıtal	Frequ	ency Range		Above 1	GHz
	EUT N	Node of Op	eration:			Trai	nsmit 2440	MHz	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1312.57	3	312	2.85	Average	40.7	28.95	54.0	-25.0	Pass
1329.73	3	310	2.1	Average	38.5	26.686	54.0	-27.3	Pass
1407.61	3	115	3.36	Average	36.7	24.847	54.0	-29.1	Pass
2439.99	3	54	3.08	Peak	102.2	93.278			Fundamental
3468.07	3	133	1.51	Average	36.8	29.863	54.0	-24.1	Pass
4879.96	3	11	1.85	Peak	66.2	62.202	74.0	-11.8	Pass
Radiated E	ional Testing, E missions, 3m Distar izontal Polarity Measu	nce			•		— Ave — Pre- △ Pea	k Limit rage Limit scan Emissions k Reading rage Reading	18G
				Frequ	iency		EUT: NXOFM-1R1D-UNV		
Operator: Eri	c Lifsey		Mode: Trai Power: 230	nsmit Middle Channel /50		1	Project Number: 20267		
Current Time	Current Time -04:36:54 PM, Tuesday, July 31, 2018 Notes: Linx Antenna, wMetal E					•	Client: Hubbell Control	Solutions	

> 1GHz Horizontal Antenna Polarity Measured Emissions

7.3.3 1 GHz to 18 GHz, Bottom Channel

Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Test Direction Height Punction (Meters) (Meters) (Degrees) (Meters) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Met					Profess	sional Te	sting, EN	VII, Inc.					
Limits Section: 15.209 Test Date(s): 7/31/2018 EUT Serial #: none NXOFM-R1D1	Test Metho	od:			2013: Americ	an National Sta	andard of Proc	edures for Co	mpliance	Testing	of Unlice	nsed W	ireless
Test Date(s): 7/31/2018 EUT Serial #: none Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Test EUT Antenna Direction (Meters) (Direction (Meters) (Direction (Meters)) (Direction (Meters)) (Meters) (Direction (Meters)) (Degrees) (Meters) (Meters) (Direction (Meters)) (Degrees) (Meters) (In accordar	nce with:		rt 15.2	09 - Code of F	ederal Regulat	tions Part 47, S	Subpart C - Int	entional	Radiator	s, Radiat	ed Emis	sions
Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Test EUT Antenna Direction (Meters) Direction (Meters) (Direction (Meters) (Meter	Section:		_										
Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Test Direction Height Punction (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Meters) (Degrees) (Meters) (Mete	Test Date(s	s):	7/31/	2018			EUT Serial	# :	none				
Purchase Order #: 0 Equip. Under Test: NXOFM-R1D1 Radiated Emissions Test Results Data Sheet Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Measured Distance Direction Height (Meters) (Degrees) (Meters) (MHz) (Meters) (Degrees) (Meters) Possional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions. 3m Distance 1-148Gtk Vertical Polarity Measured Emissions Professional Testing, EMI, Inc Radiated Emissions 1-148Gtk Vertical Polarity Measured Emissions 1-148Gtk	Customer:		_		ntrol Solution	ons	EUT Part #:		NXOFN	/I-R1D1			
Radiated Emissions Test Results Data Sheet Page: 1 of 1	Project Nu	mber:	20267	7			Test Techni	ician:	Eric Life	sey			
Radiated Emissions Test Results Data Sheet Page: 1 of 1 EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Test EUT Antenna Detector (MHz) Distance (Image) (Ima	Purchase C	Order #:					•		Lisa Arı	ndt			
EUT Line Voltage: 230 VAC Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2402 MHz Frequency Distance (Meters) Direction (Degrees) (Meters) 2401.98 3 259 3.48 Peak 101.6 92.632 Fundamenta 4803.95 3 263 3.29 Peak 65.3 61.347 74.0 -12.6 Pass Professional Testing, EMI, Inc Radated Emissions 3 Detactor Professional Testing, EMI, Inc Radated Emissions, 3 m Distance 1186 trends and Distance 1186 tre	Equip. Under Test: NXOFM-R1D1 Witness' Name: none												
Antenna Orientation: EUT Mode of Operation: Transmit 2402 MHz Frequency Test Distance (MHz) (Meters) Direction (Meters) (Mete													
EUT Mode of Operation: Transmit 2402 MHz Frequency Test Distance (MHz) (Meters) Direction (Meters) Detector (Meters) (Meters) (Meters) (Meters) (Meters) Detector (Meters)	EUT L	ine Voltage	:	23	0 VAC		EUT Pow	er Frequen	су:	50	Hz		
Frequency Measured (MHz) Distance (Meters) Direction (Degrees) (Meters) Direction (Meters) Direction (Degrees) (Meters) Direction (Meters) Direc	Antenna	a Orientatio	n:		Vertica	al	Freque	ency Range:		,	Above 1	GHz	
Measured (MHz) Distance (Direction (Degrees) (Meters) Punction (Meters) (Meters) (Meters) Punction (Meters) (EUT N	/lode c	of Ope	eration:			Trar	smit 24	102 MH	Z		
4803.95 3 263 3.29 Peak 65.3 61.347 74.0 -12.6 Pass Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions 100 100 Peak Eading Peak Average Reading Peak Limit Pre-scan Emissions △ Peak Reading	Measured	Distance	Direc	tion	Height		Amplitude	Level			_	Test F	lesults
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18 GHz. Vertical Polarity Measured Emissions 100 90 Peak Reading Peak Reading	2401.98	3	25	59	3.48	Peak	101.6	92.632				Funda	mental
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions → Pre-scan Emissions → Peak Reading Peak Reading	4803.95	3	26	53	3.29	Peak	65.3	61.347	74.0		-12.6	Pa	iss
Frequency EUT: NXCFM-1R1D-UNV Mode: Transmit Bottom Channel	Radiated E 1-18 GHz Ve 1000	Emissions, 3m Distantical Polarity Measure	nce		Mode: Tran		ency		1 EUT: NXOFM-1R:	7 Average R Peak Limi Pre-scan E A Peak Read	eading t Emissions	1	
Operator: Eric Lifsey Mode: Iransmit tootom Channel Project Number: 20267 Current Time -05:00:21 PM, Tuesday, July 31, 2018 Notes: Linx Antenna, wMetal Box Under Client: Hubbell Control Solutions			ay, July 31,	2018	Power: 230/	50	dor				ns		

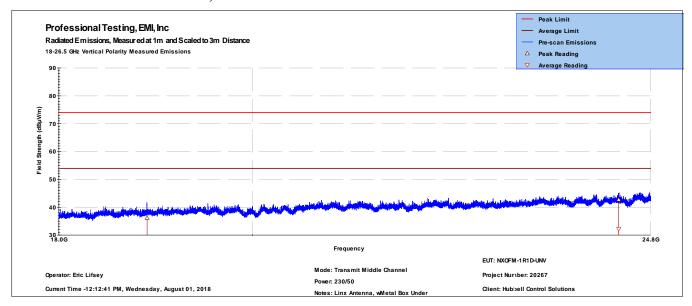
							Hubl	bell Co	ntrol Sol	utions – I	NXOFM	I-1R10
				Profess	ional Te	sting, El	VII, Inc.					
Test Metho	d:	ANSI Co		2013: Americ	an National St	andard of Proc	edures for Co	mplian	ce Testin	g of Unlice	nsed W	ireless
In accordar	ce with:	FCC Par	rt 15.2	09 - Code of F	ederal Regulat	ions Part 47,	Subpart C - Int	tentiona	al Radiato	ors, Radiato	ed Emis	sions
Section:		15.209										
Test Date(s):	7/31/	2018			EUT Serial	#:	none				
Customer:								_	M-R1D	1		
Project Nur		20267	'			Test Techn	ician:	Eric Li				
Purchase O		0				Supervisor:		Lisa A	rndt			
Equip. Und	er Test:	NXOF	M-R1	D1		Witness' N	ame:	none				
Radiated Emissions Test Results Data Sheet Page: 1 of 1												
EUT Li	ne Voltage:		23	0 VAC		EUT Pow	ver Frequen	су:	50	Hz		
Antenna	Orientatio	n:		Horizon	tal	Frequ	ency Range:			Above 1	GHz	
	EUT Mode of Operation:						Trar	nsmit 2	2402 MI	Hz		
Frequency Measured (MHz)	Test Distance (Meters)	EU Direct (Degr	tion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit (dBµ\		Margin (dB)	Test R	Results
2401.97	3	19	2	1.48	Peak	101.5	92.478				Funda	mental
4804.09	3	17	9	2.04	Peak	65.2	61.263	74	.0	-12.7	Pa	ess
Radiated E	ional Testing, E missions, 3m Distar izontal Polarity Measu	nce	ns						— Peak Lir — Average — Pre-scar △ Peak Re ▽ Average	Limit Emissions ading		
100 H												
40 30 20 1G							Monta Judd Ha		10G			
					Freque	ency		EUT: NXOFM-1	IR1D-UNV			
Operator: Eri	c Lifsey				smit Bottom Channel							
Current Time	e -05:00:21 PM, Tuesd	ay, July 31, 2	2018	Power: 230/ Notes: Linx	50 Antenna, wMetal Box Un	der		Client: Hubbe	II Control Solut	ions		
	> 1GHz Horizontal Antenna Polarity Measured Emissions											

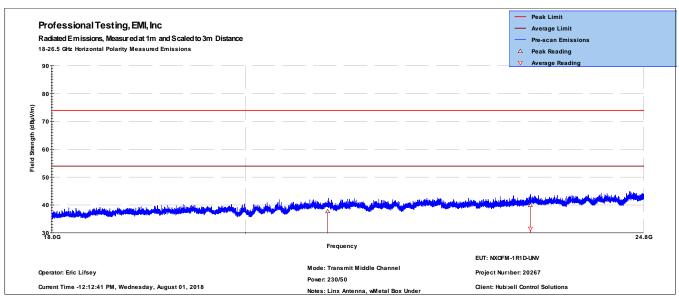
7.3.4 1 GHz to 18 GHz, Top Channel

Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt				Profess	ional Te	sting, EN	VII, Inc.					
In accordance with: Limits Section: 15.209 Test Date(s): 7/31/2018 EUT Serial #: none Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test Direction Height Function Amplitude Level Limit Level (dBuV/m) (dB) Test Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Amplitude Level (dBuV/m) (dB)	Test Method:			2013: Americ	an National St	andard of Proc	edures for Co	mpliance	Testing of	f Unlice	nsed W	ireless
Test Date(s): 7/31/2018 EUT Serial #: none Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB)	n accordance with:		rt 15.20	09 - Code of F	ederal Regula	tions Part 47, S	Subpart C - Int	entional F	Radiators,	Radiat	ed Emis	sions
Customer: Hubbell Control Solutions EUT Part #: NXOFM-R1D1 Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Level (dBuV/m) (dB) Test Recorded Corrected Level (dBuV/m) (dB)	Section:							_				
Project Number: 20267 Test Technician: Eric Lifsey Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Test Technician: Eric Lifsey Lisa Arndt Page: 1 of EUT Power Frequency: 50 Hz Frequency Corrected Amplitude Level (dBuV/m) (dB) Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded (dBuV/m) (dB)	Γest Date(s):					EUT Serial	‡ :	none				
Purchase Order #: 0 Supervisor: Lisa Arndt Equip. Under Test: NXOFM-R1D1 Witness' Name: none Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Correcte				ntrol Solutio	ons	EUT Part #:						
Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Radiated Emissions Test Results Data Sheet Page: 1 of EUT Power Frequency: 50 Hz Frequency Range: Above 1GHz Corrected Amplitude Corrected Limit Level (dBuV/m) (dB) Test Results Data Sheet Page: 1 of EUT Power Frequency: 50 Hz EUT Mode of Operation: Transmit 2480 MHz	•	20267			Test Techni	ician:		•				
Radiated Emissions Test Results Data Sheet Page: 1 of EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Detector Measured Distance Direction Height Function Recorded Amplitude Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dB) Test Recorded Corrected Corr						•		Lisa Arn	dt			
EUT Line Voltage: 230 VAC EUT Power Frequency: 50 Hz Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test Distance Direction Height Detector Measured Distance Direction Height Function Function (dBuV/m) (dB) EUT Power Frequency: 50 Hz Above 1GHz Corrected Limit Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dBuV/m) (dB)	Equip. Under Test: NXOFM-R1D1 Witness' Name: none											
Antenna Orientation: Vertical Frequency Range: Above 1GHz EUT Mode of Operation: Transmit 2480 MHz Frequency Test EUT Antenna Measured Distance Direction Height Function Detector Function Recorded Amplitude Level (dBuV/m) (dB) Test Recorded (dB) Test												
EUT Mode of Operation: Frequency Test EUT Antenna Measured Distance Direction Height Function Transmit 2480 MHz Recorded Amplitude Corrected Limit Level (dBuV/m) (dB) Test Recorded Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dB) Test Recorded Corrected Corrected Limit Level (dB) Test Recor	EUT Line Voltag	ge:	23	0 VAC		EUT Pow	er Frequen	су:	50	Hz		
Frequency Test EUT Antenna Detector Amplitude Level Limit Level (dBuV/m) (dB) Test Recorded Corrected Amplitude Level (dBuV/m) (dB) Test Recorded Corrected Limit Level (dB) Test Recorded Corrected Corrected Limit Level (dB) Test Recorded Corrected Corrected Corrected Corrected Corrected Corrected Corrected Correcte	Antenna Orienta	tion:		Vertica	al	Freque	ency Range:		Al	ove 1	GHz	
Measured Distance Direction Height Detector Amplitude Level Limit Level Margin (dBuV/m) (dB)	EUT	Mode o	of Ope	ration:			Trar	nsmit 24	80 MHz			
	Measured Distance	Direc	tion	Height		Amplitude	Level			_	Test R	Results
2480 3 318 2.46 Peak 98.1 89.141 Fundam	2480 3	31	8	2.46	Peak	98.1	89.141				Funda	mental
4960.03 3 310 2.37 Peak 57.6 53.644 74.0 -20.3 Pas	4960.03 3	31	.0	2.37	Peak	57.6	53.644	74.0	-2	20.3	Pa	SS
Professional Testing, EMI, Inc Radated Emissions, 3m Distance 1-18Gtz Vertical Polarity Measured Emissions 100 90 880 40 100 100 100 100 100 100 100 100 100	Radiated Emissions, 3m Di 1-18GHz Vertical Polarity Meas 100 90 80 70 40 40	istance			Frequ	ency			Average Read Peak Limit Pre-scan Emi Peak Reading	ling	1	- -
Curent Time -05:25:51 PM, Tuesday, July 31, 2018 Mode: Transmit Top Channel Project Number: 20267 Power: 230/50 Curent Time -05:25:51 PM, Tuesday, July 31, 2018 Notes: Linx Antenna, wMetal Box Under EUT: NXOFM-1R1 D-UNV Project Number: 20267 Client: Hubbell Control Solutions												

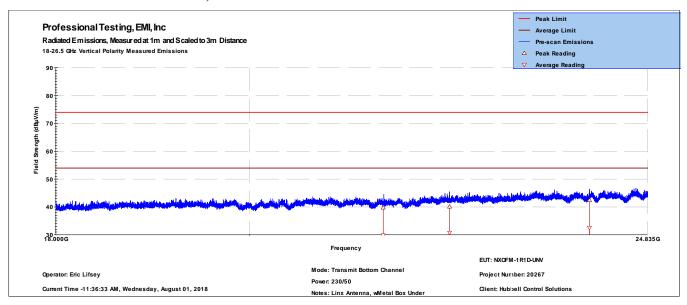
	Hubbell Control Solutions – NXOFM-1R1D																			
				Profess	sional Te	sting, El	VII, Inc	•												
Test Metho	d:	ANSI Co		2013: Americ	an National St	andard of Prod	edures for	Complian	ce Testing	g of Unlice	nsed W	ireless								
In accordar	nce with:	FCC Par	t 15.2	09 - Code of I	ederal Regulat	tions Part 47,	Subpart C -	Intention	al Radiato	ors, Radiat	ed Emis	sions								
Section:		15.209																		
Test Date(s):	7/31/	2018			EUT Serial	#:	none												
Customer:	,								M-R1D1											
Project Nui		20267				Test Techn	ician:	Eric L												
Purchase O		0				Supervisor		Lisa A	Arndt											
Equip. Und	er Test:	NXOF	M-R1	D1		Witness' N	ame:	none												
Radiated Emissions Test Results Data Sheet Page: 1 of 1																				
EUT Li	ne Voltage		23	0 VAC		EUT Pov	ver Frequ	ency:	50	Hz										
Antenna	orientation	n:		Horizor	tal	Frequ	ency Ran	ge:		Above 1	GHz									
	EUT N	/lode o	f Ope	ration:			Ti	ransmit	2480 MH	łz										
Frequency Measured (MHz)	Test Distance (Meters)	EU Direct	tion	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Correcte Level (dBµV/m	Limit (dBu	Level V/m)	Margin (dB)	Test R	esults								
2479.99	3	66	5	3.03	Peak	101.1	92.158				Fundai	mental								
4959.91	3	54		2.83	Peak	62.5	58.589	74	1.0	-15.4	Pa	SS								
Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Horizontal Polarity Measured Emissions						<u> </u>		— Peak Lin — Average — Pre-scan △ Peak Rea ▼ Average	Limit Emissions ading											
90 (m) 70																				
40 40 40 40 40 40 40 40 40 40 40 40 40 4											dellate adea e y a									
20 <u>±</u> 1G			-		Frequ	ency	-	+	10G		18	3G								
				=		-		EUT: NXOFM	-1 R1 D-UNV											
Operator: Er				Mode: Trai Power: 230	smit Top Channel /50	Project Number: 20267														
Current Time	e -05:25:51 PM, Tuesd	ay, July 31, 2	018	Notes: Linz	Antenna, wM etal Box Un	der		Client: Hubb	ell Control Soluti	ons										
			> 1GI				sured Em	nissions				Current Time -05:25:51 PM, Tuesday, July 31, 2018 Notes: Linx Antenna, wMetal Box Under Client: Hubbell Control Solutions > 1GHz Horizontal Antenna Polarity Measured Emissions								

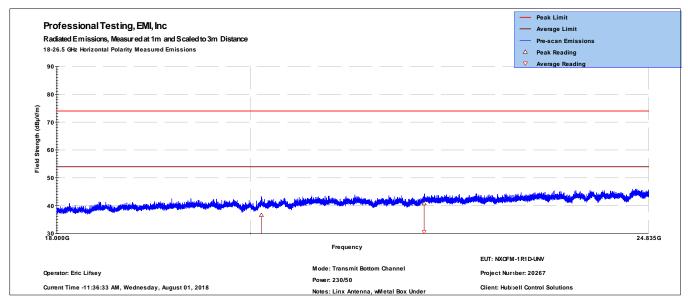
7.3.5 18 GHz to 25 GHz, Middle Channel



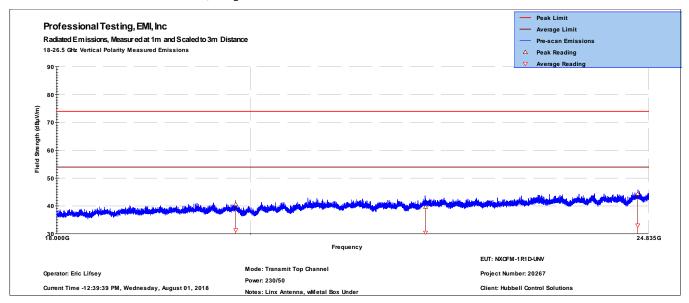


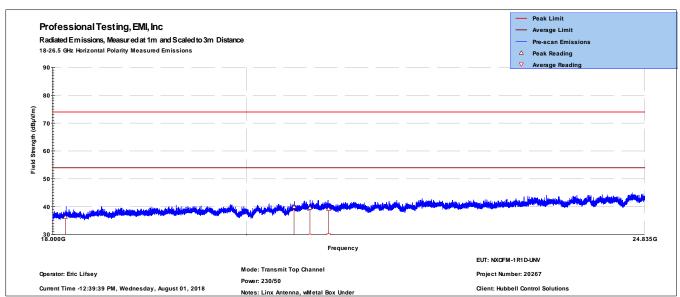
7.3.6 18 GHz to 25 GHz, Bottom Channel





7.3.7 18 GHz to 25 GHz, Top Channel





8.0 Antenna Construction

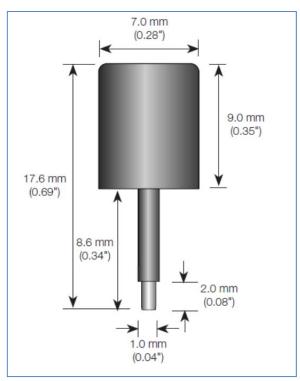
8.1 Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevent wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

8.2 Criteria

47 CFR (USA) // IC (Canada)		
Section Reference	Parameter	Date(s)
15.203 // RSS-Gen 8.3	Antenna Construction	18 Sep 2018

8.3 Results



Antenna Appearance and Dimensions

- Manufacturer: Linx
- Manufacturer Part Number: ANT-2.4-JJB
- Antenna Type: ¹/₄ wave monopole
- Manufacturer Reported Antenna Gain: 3.3 dBi (This is the highest reported gain of the two supported mounting schemes.)
- Antenna is an upright monopole component soldered to the circuit board.
- There is no external antenna connector.

The antenna design satisfies the requirements of the rules.

9.0 Conducted Emissions, Mains

9.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and the measurement is taken.

9.2 Test Criteria

47 CFR (USA) // IC (Canada)								
Section Reference	Parameter	Date(s)						
15.107, 15.207 // RSS-Gen	Mains conducted emissions	18 May 2017						

9.3 Test Results

The EUT satisfied the criteria.

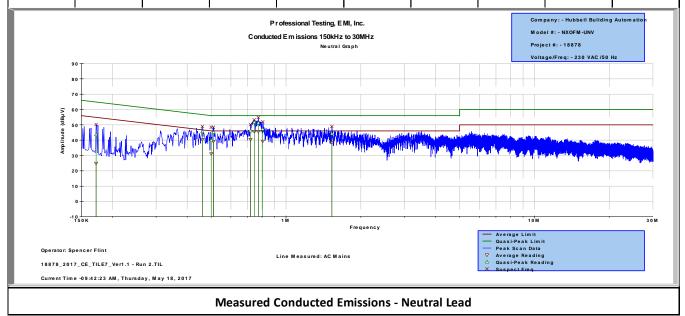
Measurements from previous certification project are applicable as the 2.4 GHz antenna change has no impact on mains conducted emissions.

Tabular and plotted measurements appear on the following pages.

9.3.1 Mains, Neutral

Professional Testing, EMI, Inc.									
ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz									
In accordance with: FCC Part 15.107 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Conducted Limits									
Section:	15.107								
Test Date(s):	5/18/2017	EUT Serial #:	0						
Customer:	Hubbell Building Automation	EUT Part #:	NXOFM-UNV						
Project Number:	18878	Test Technician:	Spencer Flint						
Purchase Order #:	0	Supervisor:	Lisa Arndt						
Equip. Under Test:	NXOFM-UNV	Witness' Name:	Tom Hartnagel						

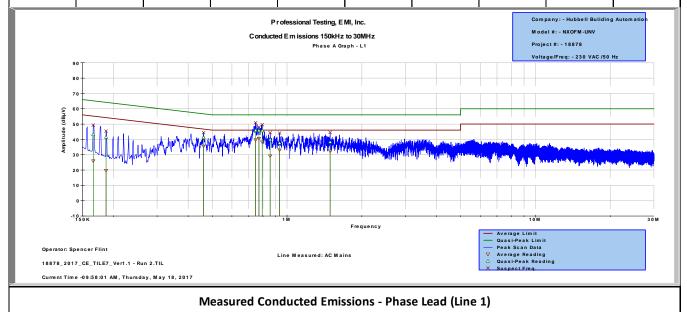
	Conduct	ed Emissions	ad	Pa	ge: 1	of 2			
EU	EUT Line Voltage: 230 VAC EUT Line Fre				Line Freque	ncy:	50	Hz	
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.1719	50.3	43.6	64.9	-21.2	PASS	24.9	54.9	-30	PASS
0.4604	50.4	45.6	56.7	-11.1	PASS	40.3	46.7	-6.4	PASS
0.5	49.6	39.9	56	-16.1	PASS	31.1	46	-14.9	PASS
0.5102	49.4	45.1	56	-10.9	PASS	39.2	46	-6.8	PASS
0.7201	52.5	46	56	-10	PASS	40.5	46	-5.5	PASS
0.745	55.7	51.6	56	-4.4	PASS	45.6	46	-0.4	PASS
0.7739	56.1	51.3	56	-4.7	PASS	45.6	46	-0.4	PASS
0.8057	55	47.1	56	-8.9	PASS	39.3	46	-6.7	PASS
1.5291	49.3	44.1	56	-11.9	PASS	38.2	46	-7.8	PASS
I	I	1	I	1					



9.3.2 Mains, Phase

Professional Testing, EMI, Inc.									
ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz									
In accordance with: FCC Part 15.107 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Conducted Limits									
Section:	15.107								
Test Date(s):	5/18/2017	EUT Serial #:	0						
Customer:	Hubbell Building Automation	EUT Part #:	NXOFM-UNV						
Project Number:	18878	Test Technician:	Spencer Flint						
Purchase Order #:	0	Supervisor:	Lisa Arndt						
Equip. Under Test:	NXOFM-UNV	Witness' Name:	Tom Hartnagel						

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) Page 1							ge: 2	of 2	
EUT Line Voltage:		230	VAC	EUT Line Frequency:		50	Hz		
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.1659	51.3	43.2	65.2	-22	PASS	26	55.2	-29.2	PASS
0.1868	50	41.4	64.2	-22.7	PASS	19.7	54.2	-34.5	PASS
0.4614	44.9	41.1	56.7	-15.5	PASS	35.6	46.7	-11.1	PASS
0.747	51.1	45.8	56	-10.2	PASS	39.7	46	-6.3	PASS
0.7709	51.9	45.8	56	-10.2	PASS	40.6	46	-5.4	PASS
0.7948	52.1	45.6	56	-10.4	PASS	38.3	46	-7.7	PASS
0.8555	45.6	39.9	56	-16.1	PASS	29.2	46	-16.8	PASS
0.9331	43.9	37.6	56	-18.4	PASS	33	46	-13	PASS
1.4913	44.9	38.2	56	-17.8	PASS	32.3	46	-13.7	PASS



10.0 Equipment

10.1 Spurious Radiated Emissions 30 MHz to 25 GHz

	Radiated Emissions Test Equipment List								
Til	Tile! Software Version: Version: 7.1.2.17 (Jan 08, 2016 - 02:12:48 PM) or 4.1.A.0, April 14, 2009, 11:01:00PM								
Test Profile: Asset # Manufacturer		2018_ Model	Radiated Emissions_TILE7_v1EL.til Equipment Nomenclature	Serial Number	Calibration Due Date				
1509A	Braden	TDK 10M	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/10/2019				
1890	НР	8447F-H64	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/10/2020				
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	11/7/2018				
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	3/7/2019				
C027D	NAD	NAD 2400	Amplifier, 100W, 3Hz-100kHz	11524464	N/A				
1327	EMCO	1050	Controller, Antenna Mast	none	N/A				
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A				
1969	HP 11713A Attenuator/Switch Driver		3748A04113	N/A					
1509B	Braden	TDK 10M	TDK 10M Chamber,sVSWR > 1 GHz	DAC-012915-005	11/16/2019				
2004	Miteq	AFS44-00101800- 2S-10P-44	Amplifier, 40dB, .1-18GHz	0	1/10/2020				
C030	none	none	Cable Coax, N-N, 30m, 30 MHz - 18GHz	none	9/28/2018				
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A				
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	3/15/2019				
1973	Agilent	83017A	Amplifier, Microwave 0.5-26.5 GHz	MY39500497	11/17/2018				
1735	Pasternack	PE9850-20	Antenna, horn, WR28	N/A	N/A				

10.2 Bandwidth and Duty Cycle

Asset #	Manufacturer	Model #	Description	Calibration Due
2295	Agilent	E4440A Spectrum Analyzer		18 Sep 2018
1831	HP 6622A Power Supply		Power Supply	CIU
C241	Pasternack PE300-120 RG type		RG type cable	CNR
None	ne ETS 5211 Shielded Enclo		Shielded Enclosure	CIU
None PTI I		None	2 GHz Sleeve Sense Antenna	CIU
0463 Fluke 77 DMN		DMM	10 Jul 2019	

10.3 Mains Conducted Emissions

		Profes	sional Testing, EMI, Inc.			
Test Metho	ų.	•	ican National Standard for Methods of Itage Electrical and Electronic Equipm			
n accordan	ce with:	art 15.107 - Code ucted Limits	of Federal Regulations Part 47, Subpa	rt B - Unintention	al Radiators,	
Section:	15.10	7				
Test Date(s): 5/18/	2017	EUT Serial #:	0		
Customer:		ell Building Auton		NXOFM-UNV		
Project Nun		3	Test Technician:	Spencer Flint		
Purchase O			Supervisor:	Lisa Arndt		
quip. Und	er lest: NXOF	M-UNV	Witness' Name:	Tom Hartnagel		
		Conduct	ed Emissions Test Equipment List			
Ti	le! Software Version	on: Versio	n: 7.1.2.17 (Jan 08, 2016 - 02:12:48 PM)	or 4.1.A.0, April 14, 2	2009, 11:01:00PM	
	Test Profile:	2017	_CE_TILE7_Ver1.1.TIL or CE_Marine_1	.00616.TIL		
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date	
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	2517A01821	7/20/2017	
1834	НР	85662A	Spec Anal Dsply, use with A/N 1145	2349A06182	N/A	
0990	НР	85685A	RF Preselector	3010A01119	7/20/2017	
0085	НР	85650A	Quasi-Peak Adapter CISPR	3033A01458	7/20/2017	
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	2/2/2018	
1088	PTI	PTI-ALF4	Attenuator Limiter Filter	none	10/6/2017	
C171	HP	08444-60018	Cable, RF, BNC-BNC, 18", Grey	none	6/13/2018	
C303	Coleman Cable	RG-58A/U	Cable, BNC-BNC, 36" Black	None	3/25/2018	
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/4/2018	
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	8/1/2017	
1132	AilTech	91550-1M	Probe, Current, 10kHz-100MHz	1856	2/9/2018	
1683	Teseq	ISN T800	ISN-T8, Impedance Stabilization Network	27091	6/15/2017	
	1	1	LISN, 10kHz-100MHz	9010-1708	10/5/2017	
0027	EMCO	3825/2	LISIN, TORTIZ-TOOIVITIZ	3010-1708	10/ 5/ 2017	

11.0 Measurement Bandwidths

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan							
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range			
0.009	0.15	0.3	2	Multiple Sweeps			
0.15	30	9	6	Multiple Sweeps			
30	1000	120	2	Multiple 800 mS Sweeps			
1000	6000	1000	2	Multiple Sweeps			
6000	18000	1000	2	Multiple Sweeps			
18000	26500	1000	2	Multiple Sweeps			

*Notes:

- 1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.
- 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.
- 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.
- 4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.
- 5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

	Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time							
Fr	equency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range			
	0.01	0.15	0.3	7	Five 1 second sweeps			
	0.15	30	9	20	Five 1 second sweeps			

*Notes

- 1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
- 2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz.
- 3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
Radiated Emissions	1 to 18 GHz	3 m	5.7

End of Report