
Project 17666-15

**Hubbell Building Automation
NXBTR**

Wireless Certification Report

Prepared for:

Eric Weber
Hubbell Building Automation
9601 Dessau Road
Building 1
Austin, TX 78754

By

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

30 Nov 2015

Reviewed by



Larry Finn
Chief Technical Officer

Written by



Eric Lifsey
EMC Engineer

Revision History

Revision Number	Description	Date
00	Draft for client and internal review.	23 Nov 2015
01	Revised per reviewer comments, revised address.	30 Nov 2015

Corrections:

None.

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Compliance Certificate

Applicant	Device & Test Identification
Hubbell Building Automation (Eric Weber) 9601 Dessau Road Building 1 Austin, TX 78754-3962 Certificate Date: 23 Nov 2015	FCC ID: YH9NXBTR Industry Canada ID: 9044A-NXBTR Model(s): NXBTR Laboratory Project ID: 17666-15

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, 2400-2483.5 MHz, 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 1	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 4	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.

Eric Lifsey
EMC Engineer

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 / NXBTR	77B275	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 designed as a pluggable wireless bridge from the building control system to a wireless personal device with software to monitor/adjust the building control system.

The EUT measures approximately 48 mm x 12 mm x 18 mm. It includes a permanently embedded cable/connector of length 90 mm of modular RJ style. It plugs into a service port of the host system where it exchanges serial data by RS-485 and receives power. Power is 16 to 30 VDC and requires a peak current of 16 mA in operation.

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 protocol.

1.4 Modifications to Equipment

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

A 2nd cable connector, like the original, was added to allow operating DC voltage to be applied since it could not be provided by the programmer card used to exercise the EUT. Once the EUT was placed into a given operating mode, the programmer card was disconnected and removed from test.

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:

$$\text{Raw Measured Level} + \text{Antenna Factor} + \text{Cable Losses} - \text{Amplifier Gain} = \text{Corrected Level}$$

Conducted RF levels are determined as follows:

$$\text{Raw Measured Level} + \text{Attenuator Factor} + \text{Cable Losses} = \text{Corrected Level}$$

Conducted mains levels are determined as follows:

$$\text{Raw Measured Level} + \text{LISN Factor} + \text{Cable/Filter/Limiter Losses} = \text{Corrected Level}$$

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 Subpart C -Intentional Radiators
RSS-247 Issue 1	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
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment

Table 1.7.2: Applicable Clauses

Parameter	FCC Part 15 Rule Paragraphs	IC RSS References
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

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

Modulation is enabled and 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	Parameter	Date
15.247(a)(3) // RSS-247 5.2	Fundamental Power Conducted Limits 1 W Limit Restated as Field: 125.23 dB μ V/m @ 3 m	15 Nov 2015

2.3 Test Results, Peak Power

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

Table 2.3.1 Power, Peak, Radiated			
Frequency MHz	Measured Peak Power dB μ V/m @ 10 m Vertical Polarity	Measured Peak Power dB μ V/m @ 10 m Horizontal Polarity	Maximum Measured Peak Power Restated as EIRP dBm
2402	86.9	89.4	4.6
2440	87.6	88.2	3.4
2480	86.8	84.3	2.0

Measured in 1 MHz RBW, 3 MHz VBW.

The EUT was found to be in compliance with the applicable criteria. Fundamental field strength was extracted from measurements during spurious tests with an unmodulated carrier.

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.

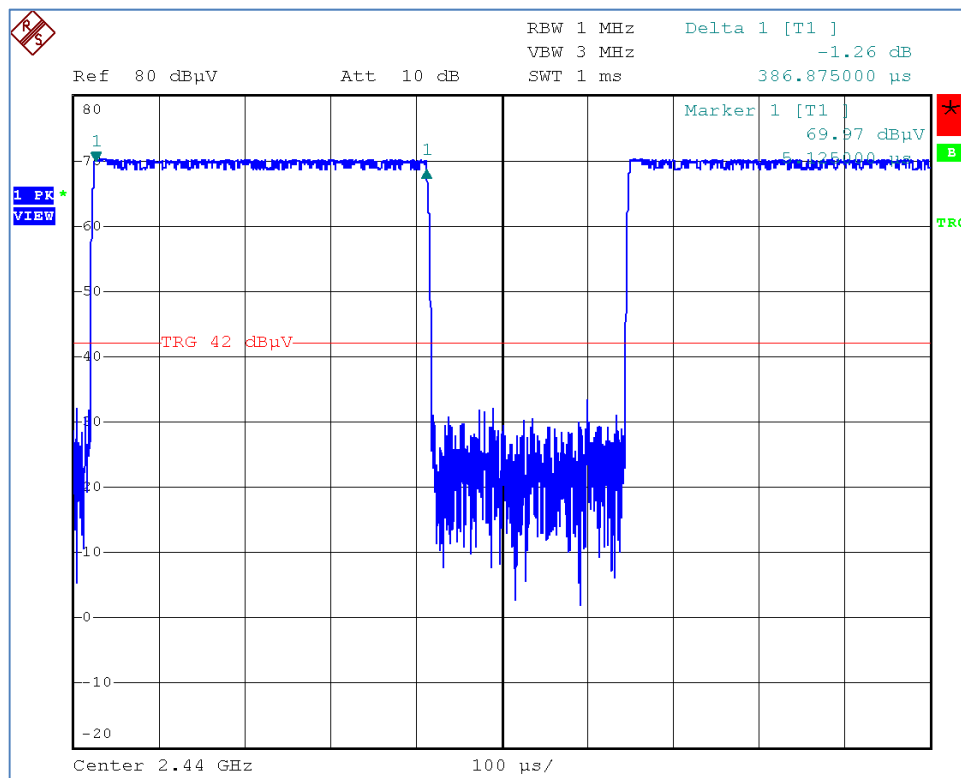
The EUT was placed in the packet transmit mode representing a high transmit duty cycle that likely exceeds that of normal operation but provides a conservative result.

Table 2.4.1 Duty Cycle Factor Result				
Measured On Time (msec)	Measured Time Period (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
0.3869	0.624	$= 20 * \text{Log}_{10} (0.3869 \text{ msec} / 0.624 \text{ msec})$	-4.15	-4.15

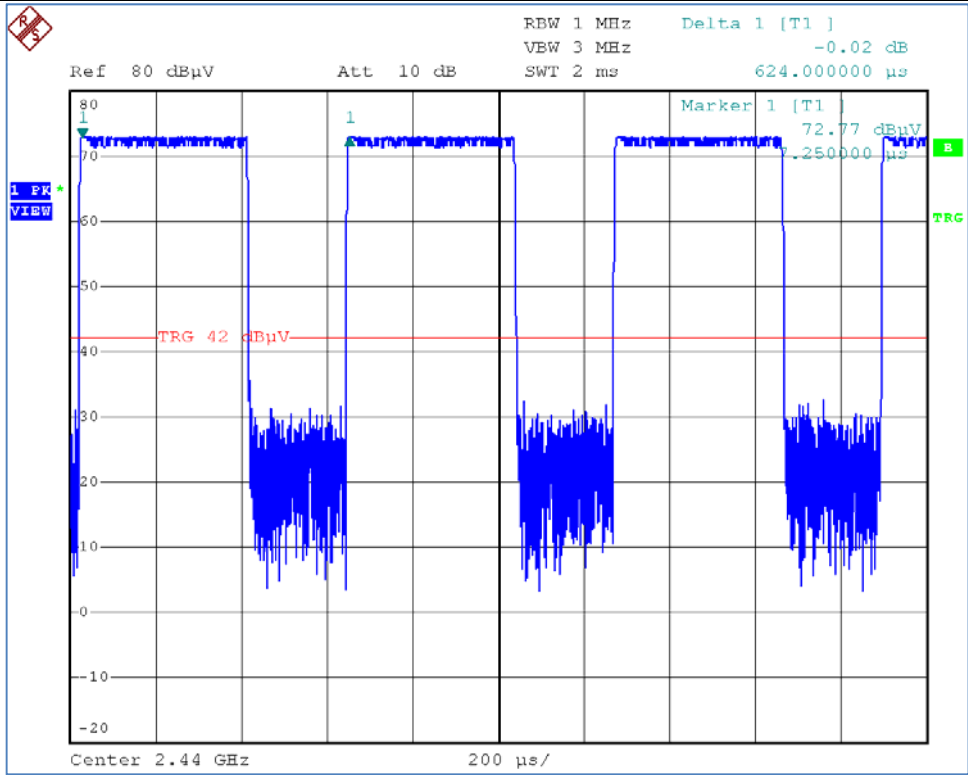
The allowed duty cycle factor is applied to peak measured harmonic signals to find average levels.

The source based factor for exposure is half of the above or: -2.08 dB

Plotted results appear below.



Transmit On Time



Transmit Period

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	23 Nov 2015

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	16 Nov 2015

4.3 Test Results

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

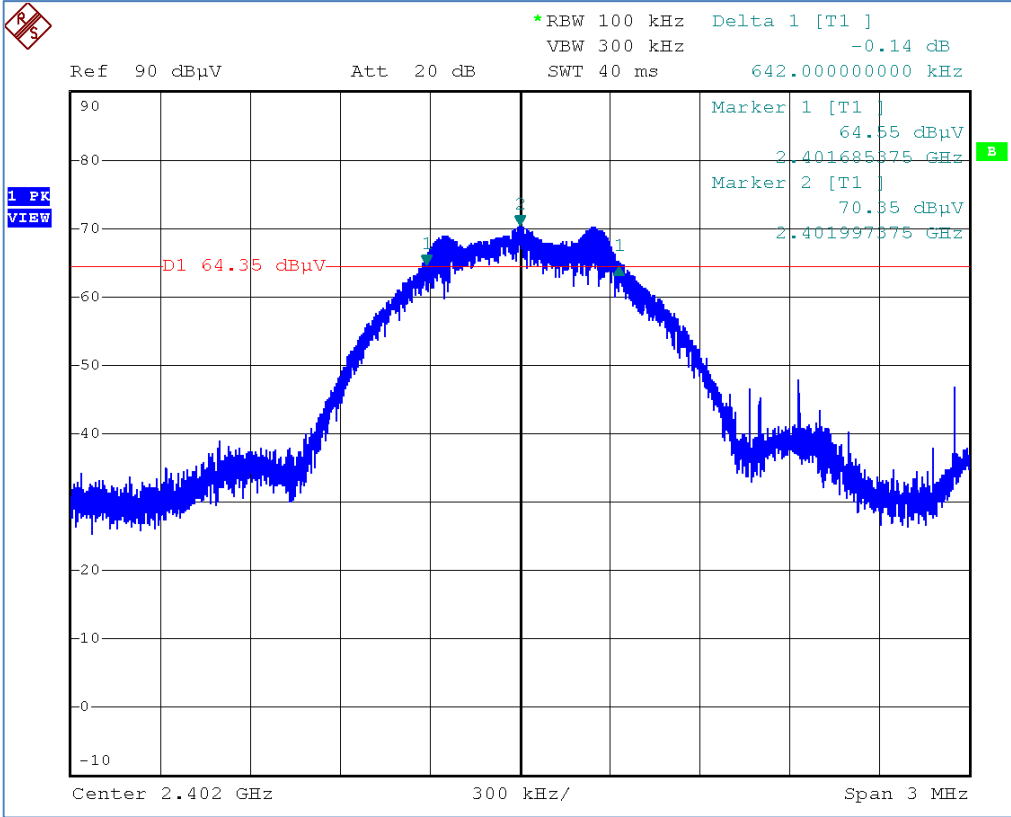
The EUT was found to be in compliance with applicable requirements.

Table 5.3.1 Bandwidth 6 dB, Minimum 500 kHz in 100 kHz RBW			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Minimum BW (kHz)
642	666	654	642

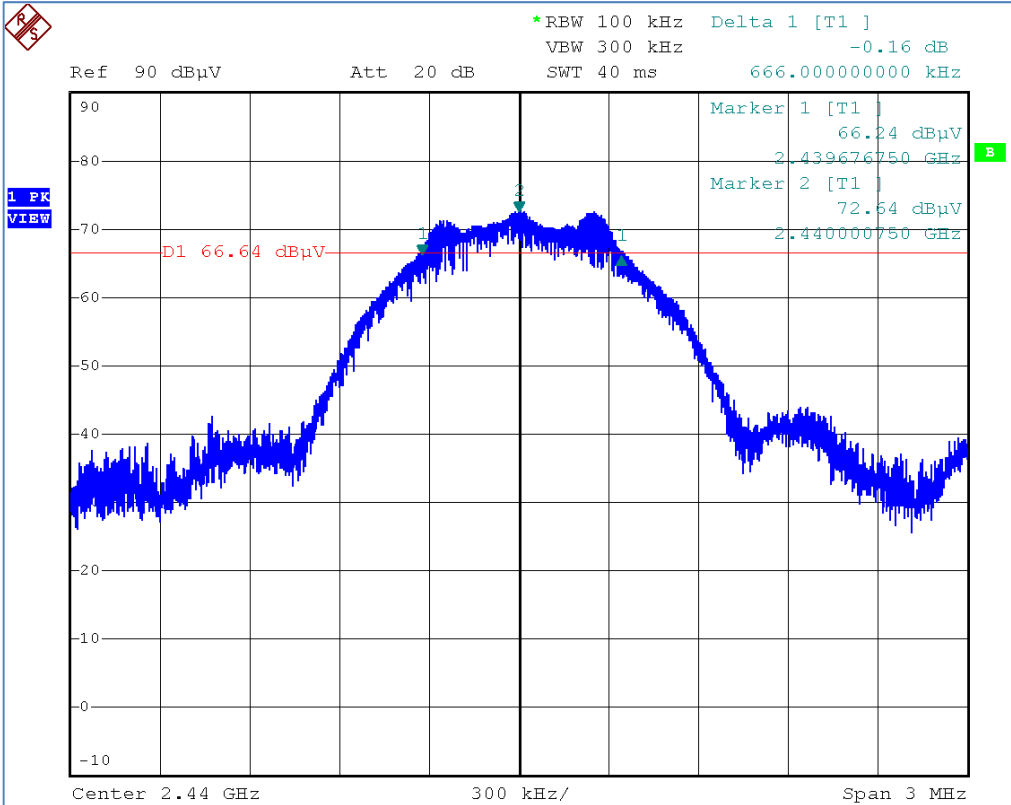
Table 5.3.2 Bandwidth 20 dB, Measure and Report			
Low Channel Measured BW (kHz)	Mid Channel Measured BW (kHz)	High Channel Measured BW (kHz)	Reported Maximum BW (kHz)
1080	1062	1086	1086

Plotted measurements appear on the following pages.

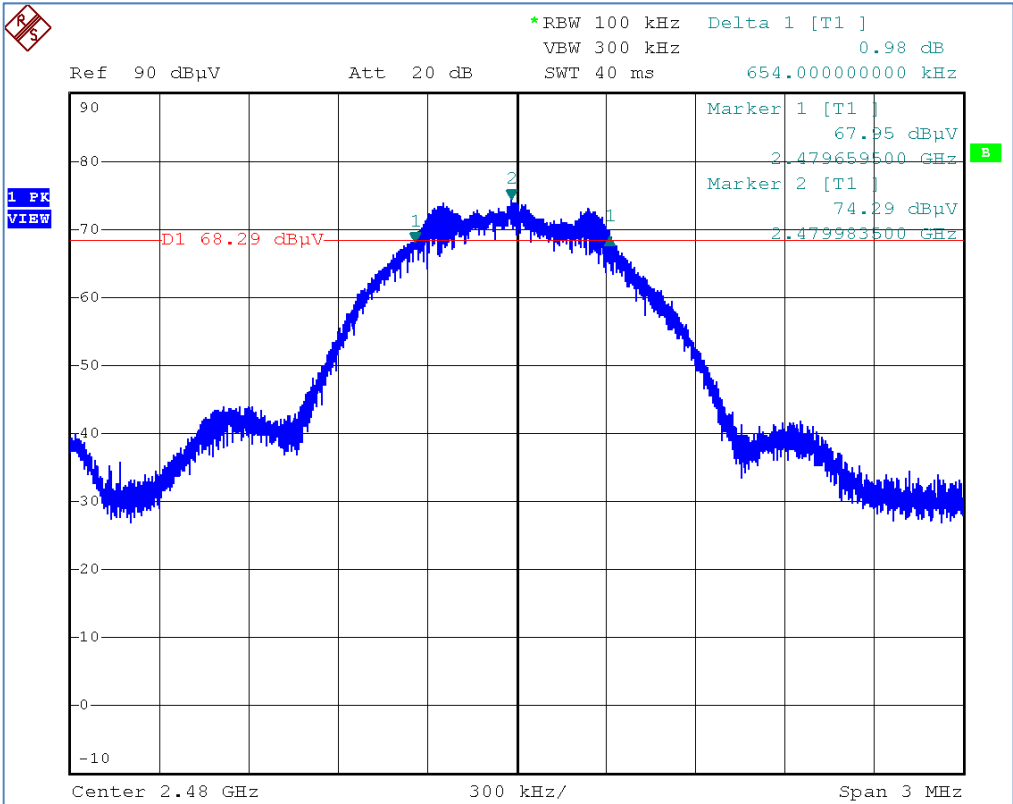
4.3.1 Bandwidth Plots, 6 dB



6 dB, Low Channel

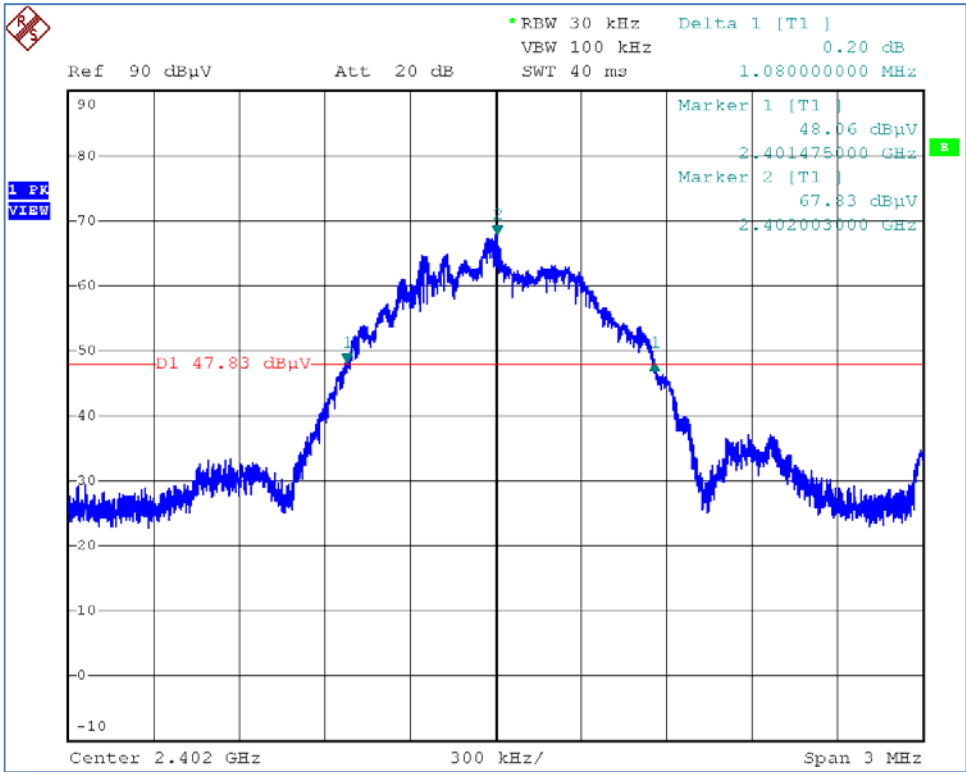


6 dB, Middle Channel

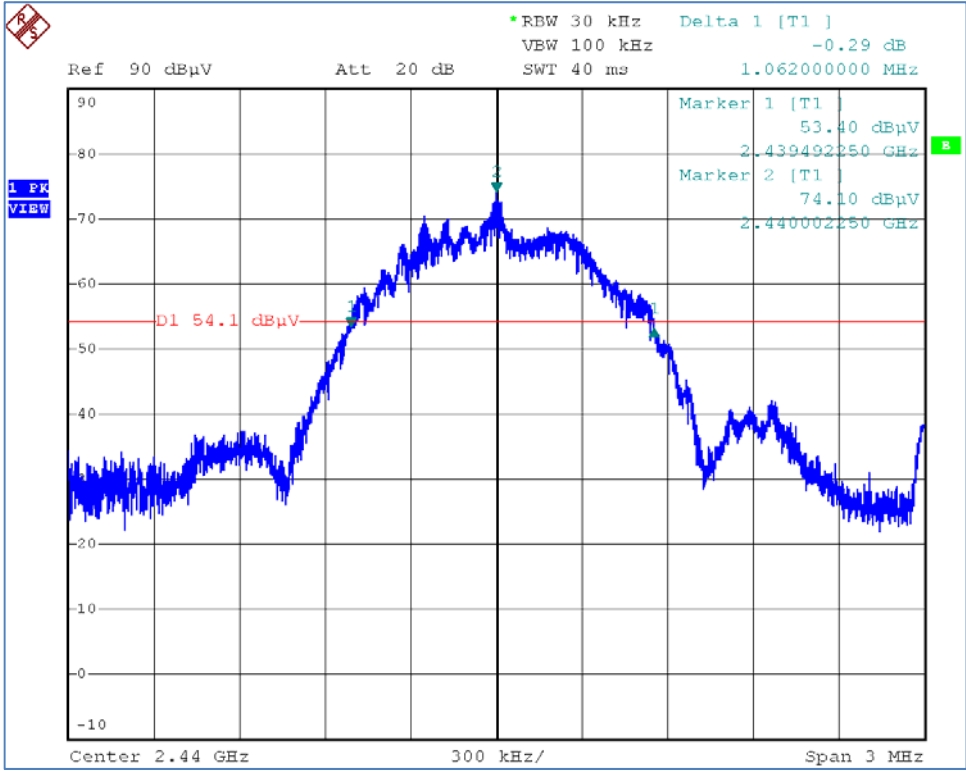


6 dB, High Channel

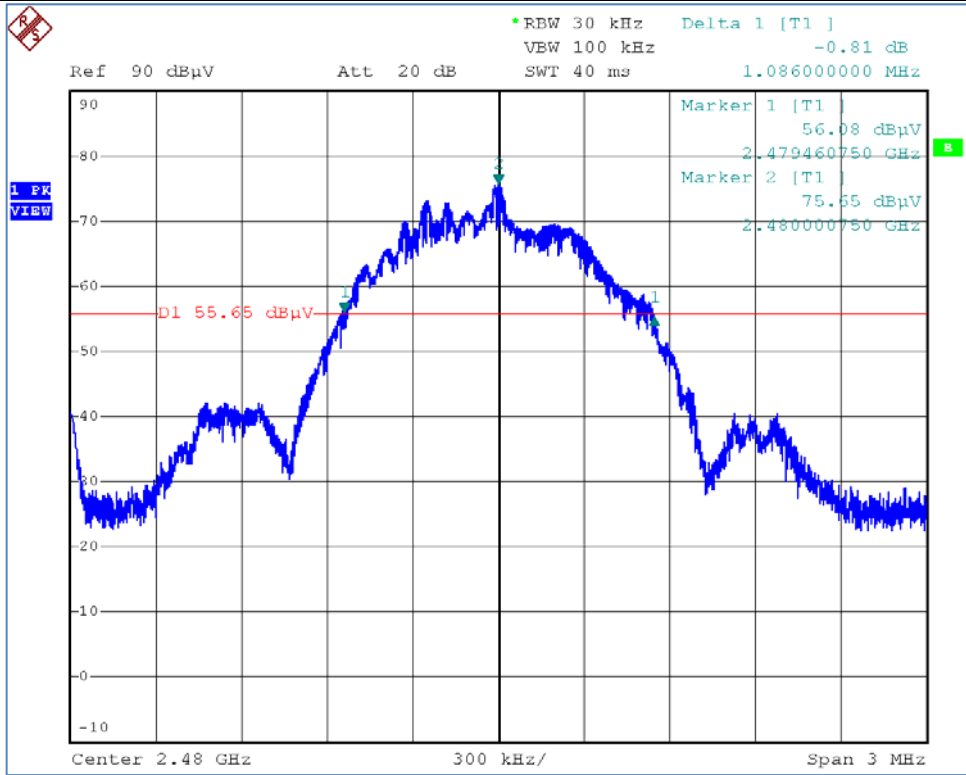
4.3.2 Bandwidth Plots, 20 dB



20 dB, Low Channel



20 dB, Middle Channel



20 dB, High Channel

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 // RSS-247 5.5, RSS-Gen 4.9	Unwanted Emissions Adjacent to Authorized Band, Radiated	16 Nov 2015

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 with max-hold was employed.

Peak detection of emissions at both band edges were below the general emission limits for average limit levels. Also, the duty cycle averaging factor applies -4.15 dB to the peaks recorded.

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

5.3.1 Low Channel Band Edge

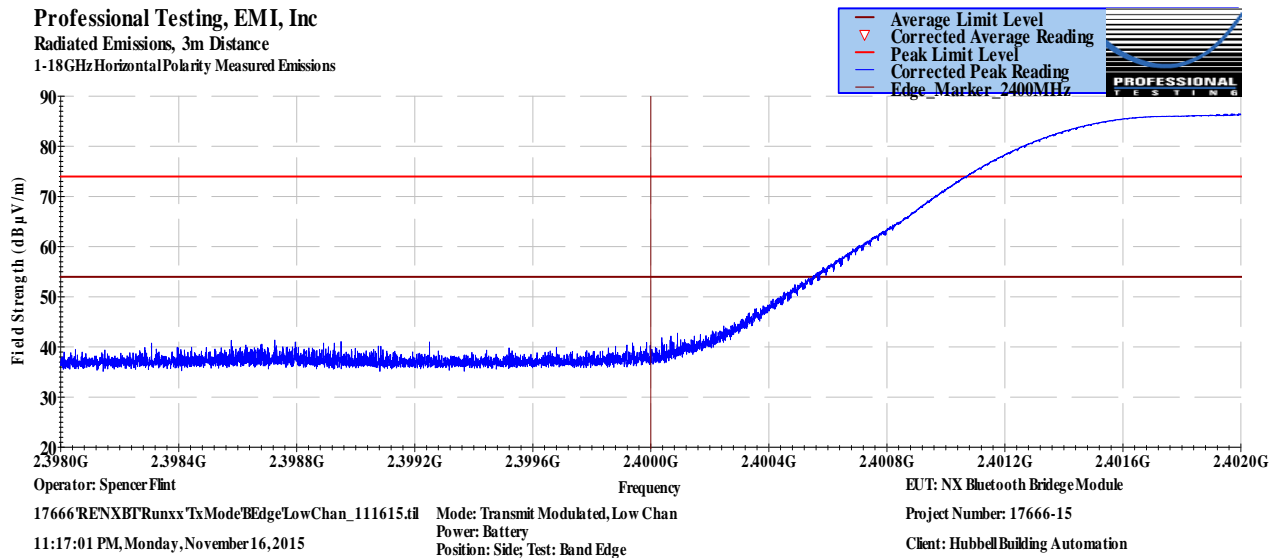
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None
Radiated Emissions Test Results Data Sheet: Band Edge			Page: 1 of 1
EUT Line Voltage:	28 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode Low Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>PROFESSIONAL TESTING</p> </div> </div>			
Operator: Spencer Flint		EUT: NX Bluetooth Bridge Module	
17666\RENXBTRunxxTxModeBEEdgeLowChan_111615.tif		Project Number: 17666-15	
11:15:06 PM, Monday, November 16, 2015		Client: Hubbell Building Automation	
Mode: Transmit Modulated, Low Chan			
Power: Battery			
Position: Side; Test: Band Edge			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet: Band Edge Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Transmit Mode Low Channel		



> 1GHz Horizontal Antenna Polarity Measured Emissions

5.3.2 High Channel Band Edge

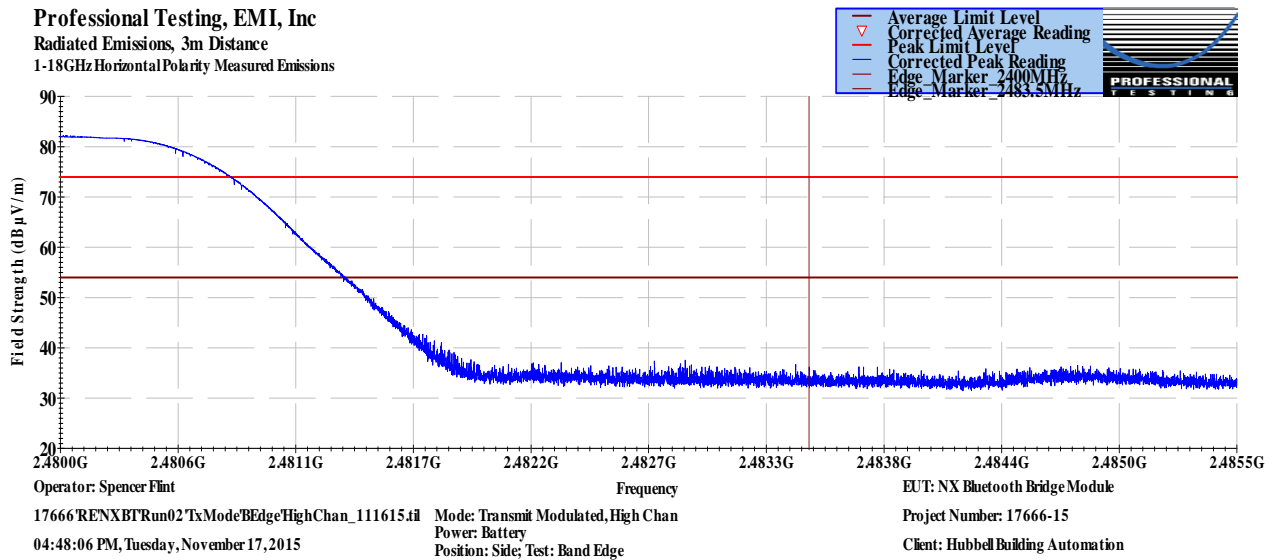
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None
Radiated Emissions Test Results Data Sheet: Band Edge		Page: 1 of 1	
EUT Line Voltage:	28 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
EUT Mode of Operation:		Transmit Mode High Channel	
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p>Professional Testing, EMI, Inc Radiated Emissions, 3m Distance 1-18GHz Vertical Polarity Measured Emissions</p> </div> <div style="width: 35%; text-align: right;"> <p>PROFESSIONAL TESTING, INC.</p> </div> </div>			
Operator: Spencer Flint		EUT: NX Bluetooth Bridge Module	
17666\RENXBTR\run02\TxMode\BEdge\HighChan_111615.tif		Project Number: 17666-15	
04:46:04 PM, Tuesday, November 17, 2015		Client: Hubbell Building Automation	
Mode: Transmit Modulated, High Chan			
Power: Battery			
Position: Side; Test: Band Edge			
> 1GHz Vertical Antenna Polarity Measured Emissions			

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet: Band Edge Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Transmit Mode High Channel		



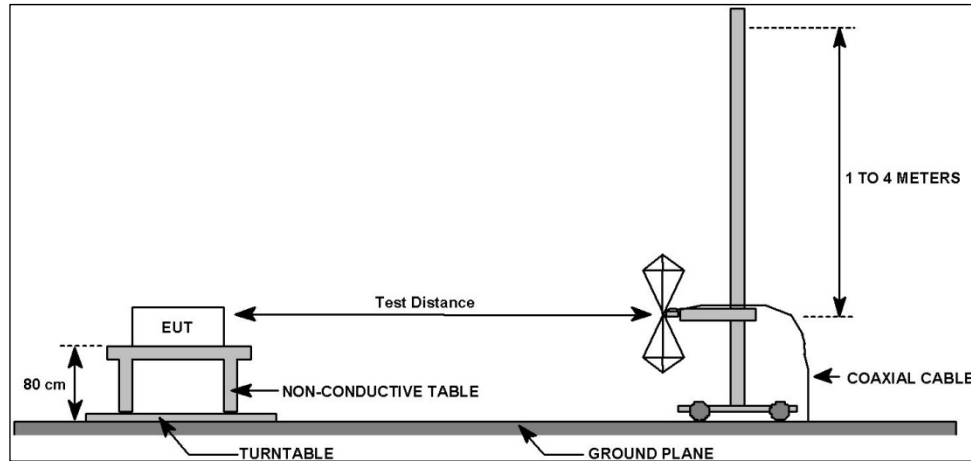
> 1GHz Horizontal Antenna Polarity Measured Emissions

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	15 Nov 2015

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.

Table 6.3.1: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

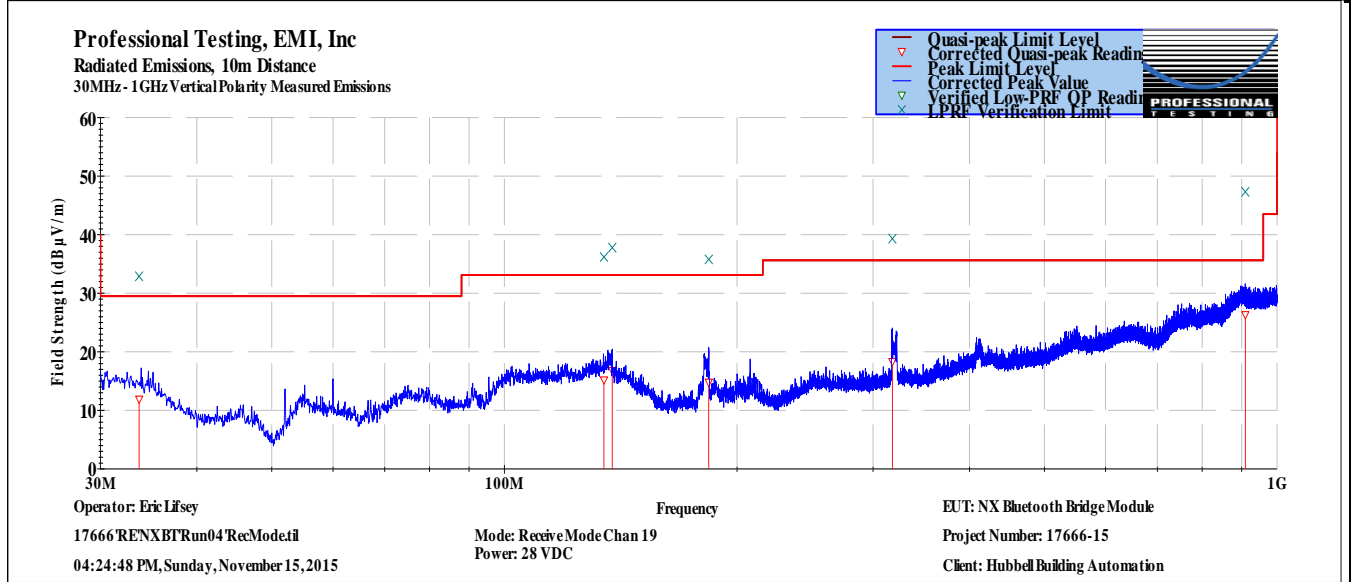
Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
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Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
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EUT Mode of Operation: Receive Mode Center Channel

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
33.6724	10	43	2.36	Quasi-peak	23.4	11.887	29.5	-17.6	Pass
134.548	10	197	1.68	Quasi-peak	32.4	15.167	33.1	-17.9	Pass
137.944	10	299	1.33	Quasi-peak	34	16.771	33.1	-16.3	Pass
183.909	10	284	1.23	Quasi-peak	29.9	14.775	33.1	-18.3	Pass
317.837	10	100	3.07	Quasi-peak	28	18.305	35.6	-17.3	Pass
909.923	10	323	3.87	Quasi-peak	21.2	26.312	35.6	-9.3	Pass

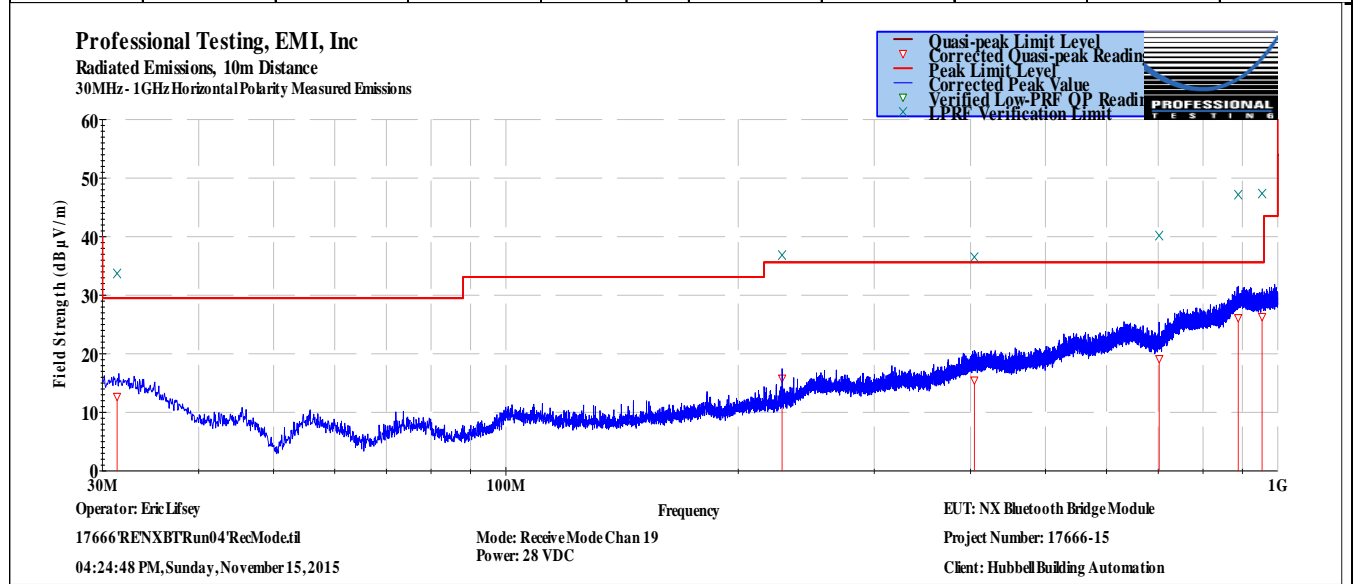


≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 6.3.2: Radiated Spurious Emissions, Receive Mode, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet						Page: 1 of 1			
EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal			Frequency Range:	30MHz to 1GHz				
EUT Mode of Operation:				Receive Mode Center Channel					
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
31.3469	10	286	1.32	Quasi-peak	24.2	12.715	29.5	-16.8	Pass
227.989	10	97	3.8	Quasi-peak	29.6	15.835	35.6	-19.8	Pass
404.584	10	48	2.79	Quasi-peak	22.2	15.509	35.6	-20.1	Pass
702.221	10	191	3.62	Quasi-peak	21.7	19.161	35.6	-16.4	Pass
888.857	10	168	3.41	Quasi-peak	21.4	26.173	35.6	-9.4	Pass
954.761	10	146	2.87	Quasi-peak	21.1	26.35	35.6	-9.3	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 6.3.3: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity

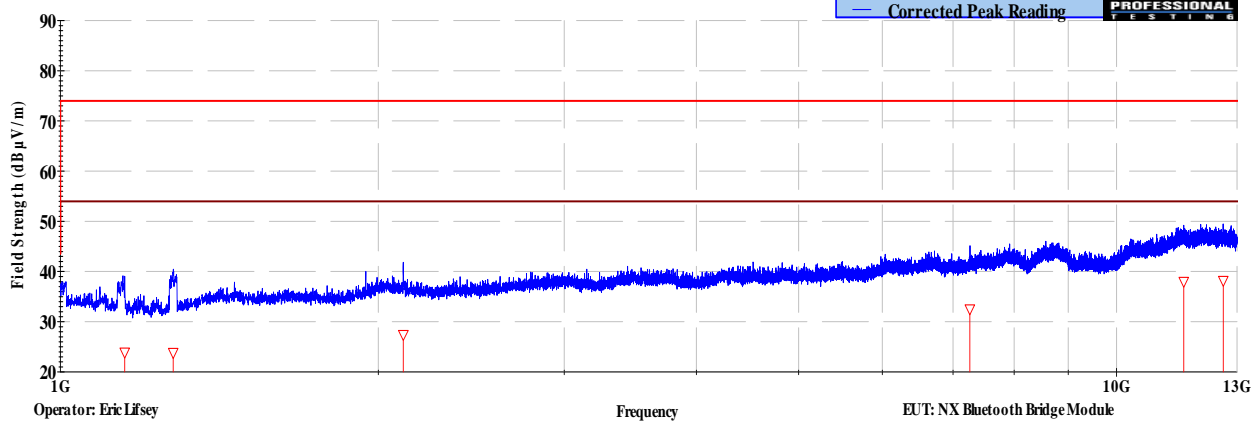
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: **1** of **1**

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Receive Mode Center Channel						
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
1150.54	3	122	0	Average	35.8	23.9	54.0	-30.1	Pass
1278.6	3	160	0	Average	35.9	23.819	54.0	-30.1	Pass
2111.85	3	244	0	Average	36.3	27.415	54.0	-26.5	Pass
7261.42	3	295	0	Average	29.3	32.518	54.0	-21.4	Pass
11576.5	3	96	0	Average	27.4	37.993	54.0	-16.0	Pass
12619.7	3	163	0	Average	27.7	38.194	54.0	-15.8	Pass

Professional Testing, EMI, Inc
 Radiated Emissions, 3m Distance
 1-18GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey
 17666 RENXBTRun04 RecMode.tif
 03:53:57 PM, Sunday, November 15, 2015

Mode: Receive Mode Chan 19
 Power: 28 VDC

EUT: NX Bluetooth Bridge Module
 Project Number: 17666-15
 Client: Hubbell Building Automation

> 1GHz Vertical Antenna Polarity Measured Emissions

Table 6.3.4: Radiated Spurious Emissions, Receive Mode, Above 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

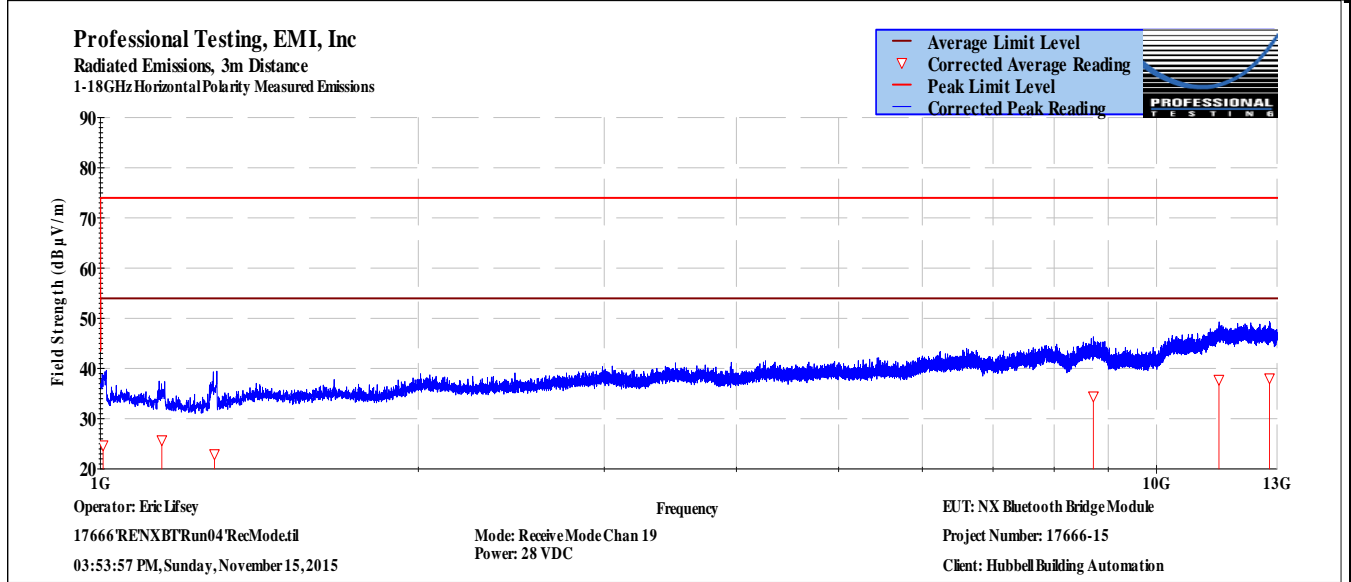
Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
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Antenna Orientation:	Horizontal	Frequency Range:	Above 1GHz
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EUT Mode of Operation: Receive Mode Center Channel

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
1005.86	3	37	0	Average	36.3	24.732	54.0	-29.2	Pass
1143.27	3	130	0	Average	37.7	25.76	54.0	-28.2	Pass
1282.53	3	70	0	Average	35	22.97	54.0	-31.0	Pass
8712.97	3	333	0	Average	27.1	34.475	54.0	-19.5	Pass
11453.5	3	107	0	Average	27.1	37.793	54.0	-16.2	Pass
12789	3	303	0	Average	27.6	38.087	54.0	-15.9	Pass



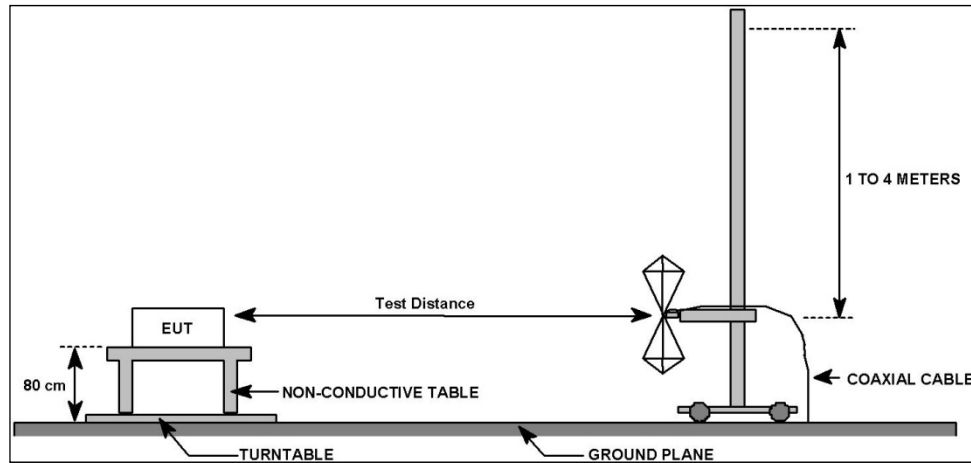
> 1GHz Horizontal Antenna Polarity Measured Emissions

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	15 Nov 2015

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.

Modulation was disabled for this test and the transmitter was placed into continuous transmit mode.

The duty cycle averaging factor applies -4.15 dB to the peaks recorded for the harmonics.

All measurements used peak detection.

Table 7.3.1: TX Mode, Below 1 GHz, Vertical Polarity, Mid. Channel

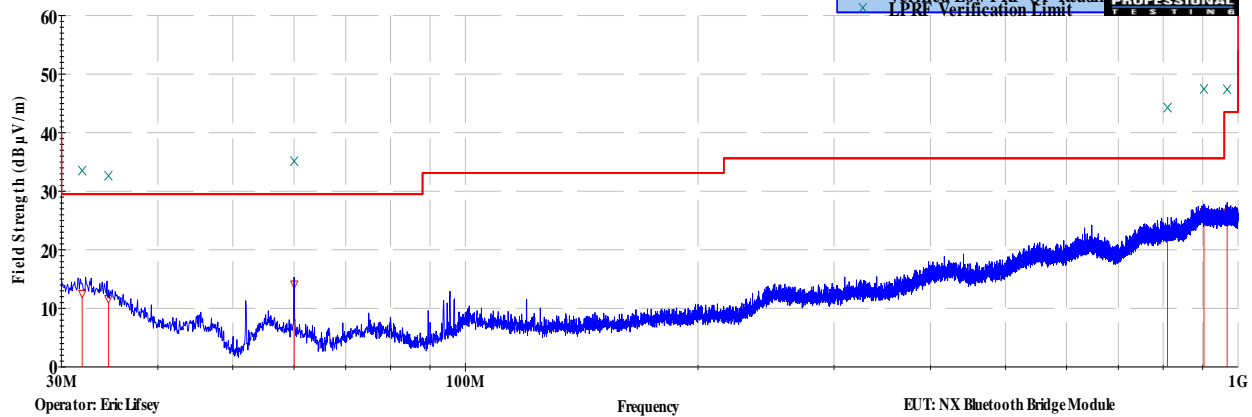
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: **1** of **1**

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit Mode Center Channel						
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
31.9229	10	219	3.14	Quasi-peak	24	12.514	29.5	-17.0	Pass
34.505	10	181	3.89	Quasi-peak	23.2	11.638	29.5	-17.9	Pass
60.0452	10	101	3.9	Quasi-peak	32.4	14.114	29.5	-15.4	Pass
810.788	10	152	4.05	Quasi-peak	21.5	23.285	35.6	-12.3	Pass
903.769	10	218	2.31	Quasi-peak	21.2	26.455	35.6	-9.1	Pass
968.58	10	263	1.28	Quasi-peak	21	26.401	43.5	-17.1	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

17666\RENXBTR\Run01\TxMode\ChanMid\Spurious.tif

12:54:48 PM, Sunday, November 15, 2015

Frequency

Mode: Transmit Unmod. Mid Channel

Power: 28 VDC

EUT: NX Bluetooth Bridge Module

Project Number: 17666-15

Client: Hubbell Building Automation

≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.2: TX Mode, Below 1 GHz, Horizontal Polarity, Mid. Channel

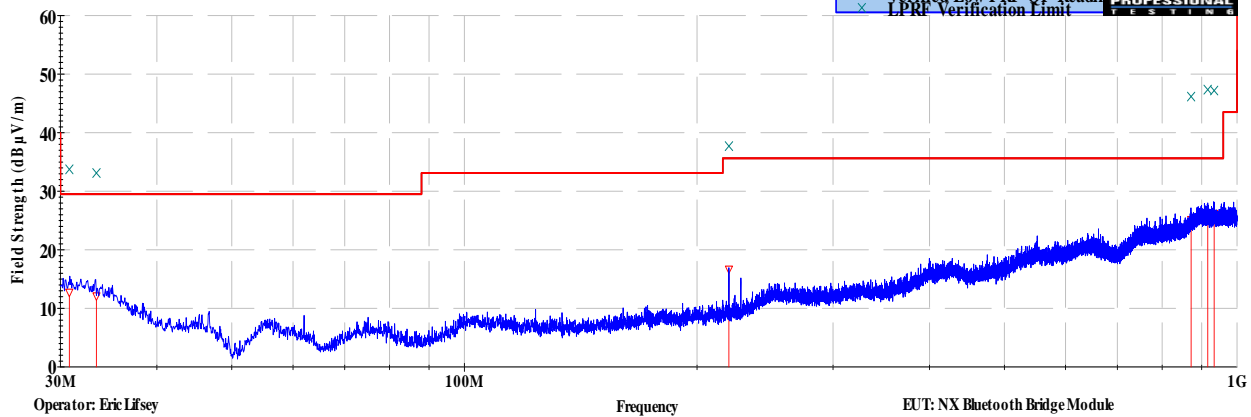
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	30MHz to 1GHz					
EUT Mode of Operation:			Transmit Mode Center Channel						
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
30.8054	10	181	1.92	Quasi-peak	24.2	12.734	29.5	-16.8	Pass
33.4052	10	247	2.91	Quasi-peak	23.6	12.096	29.5	-17.4	Pass
220.025	10	309	3.25	Quasi-peak	30.9	16.678	35.6	-18.9	Pass
872.336	10	257	1.91	Quasi-peak	21.4	25.146	35.6	-10.5	Pass
916.579	10	3	3.36	Quasi-peak	21.3	26.322	35.6	-9.3	Pass
934.242	10	111	1.06	Quasi-peak	21.2	26.193	35.6	-9.4	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 10m Distance
30MHz - 1GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey
17666 RENXBTRun01 TxModeChanMidSpurious.tif
12:54:48 PM, Sunday, November 15, 2015

Mode: Transmit Unmod. Mid Channel
Power: 28 VDC

EUT: NX Bluetooth Bridge Module
Project Number: 17666-15
Client: Hubbell Building Automation

≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.3: TX Mode, Above 1 GHz, Vertical Polarity, Low Channel

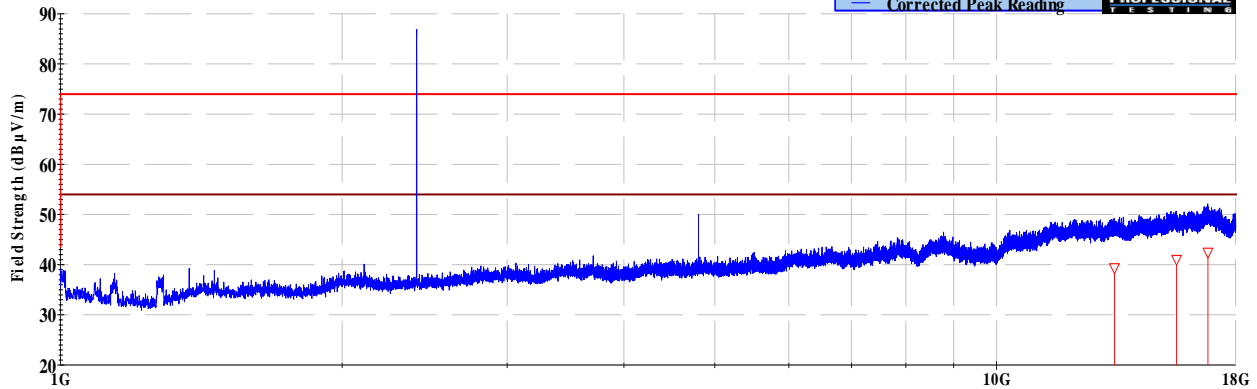
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit Mode Bottom Channel						
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
4804	3	0	1	Peak	49.9	49.9	74.0	-24.1	Pass
13360.5	3	162	1	Average	28.5	39.331	54.0	-14.6	Pass
15567.3	3	19	1	Average	27.7	41.002	54.0	-13.0	Pass
16819.5	3	114	1	Average	27.7	42.451	54.0	-11.5	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Vertical Polarity Measured Emissions



Operator: Eric Lifsey

Frequency

EUT: NX Bluetooth Bridge Module

17666 RENXBTRun02TxModeChanLowSpuriousGHZfil

Mode: Transmit Unmod.Low Channel

Project Number: 17666-15

02:01:58 PM, Sunday, November 15, 2015

Power: 28 VDC

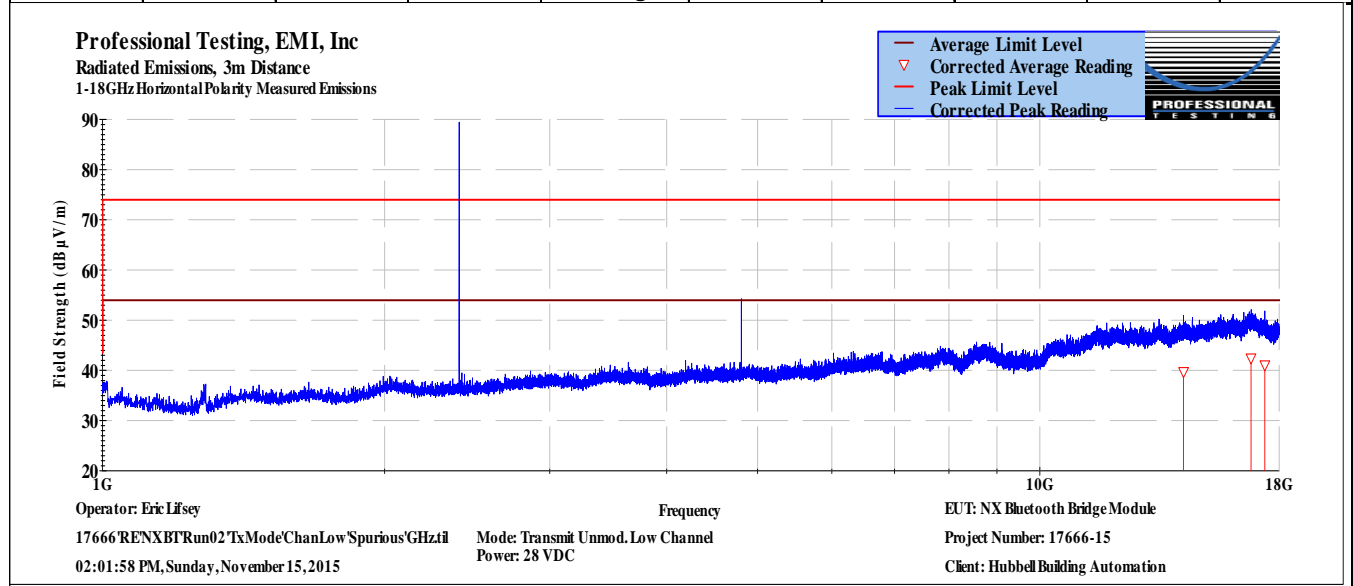
Client: Hubbell Building Automation

> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.4: TX Mode, Above 1 GHz, Horizontal Polarity, Low Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet						Page: 1 of 1			
EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal			Frequency Range:	Above 1GHz				
EUT Mode of Operation:					Transmit Mode Bottom Channel				
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
4804	3	0	1	Average	54.1	50.05	54.0	-3.9	Pass
14235.8	3	103	1	Average	28.5	39.681	54.0	-14.3	Pass
16796.2	3	116	1	Average	27.7	42.431	54.0	-11.5	Pass
17382.1	3	171	1	Average	26.9	41.048	54.0	-12.9	Pass



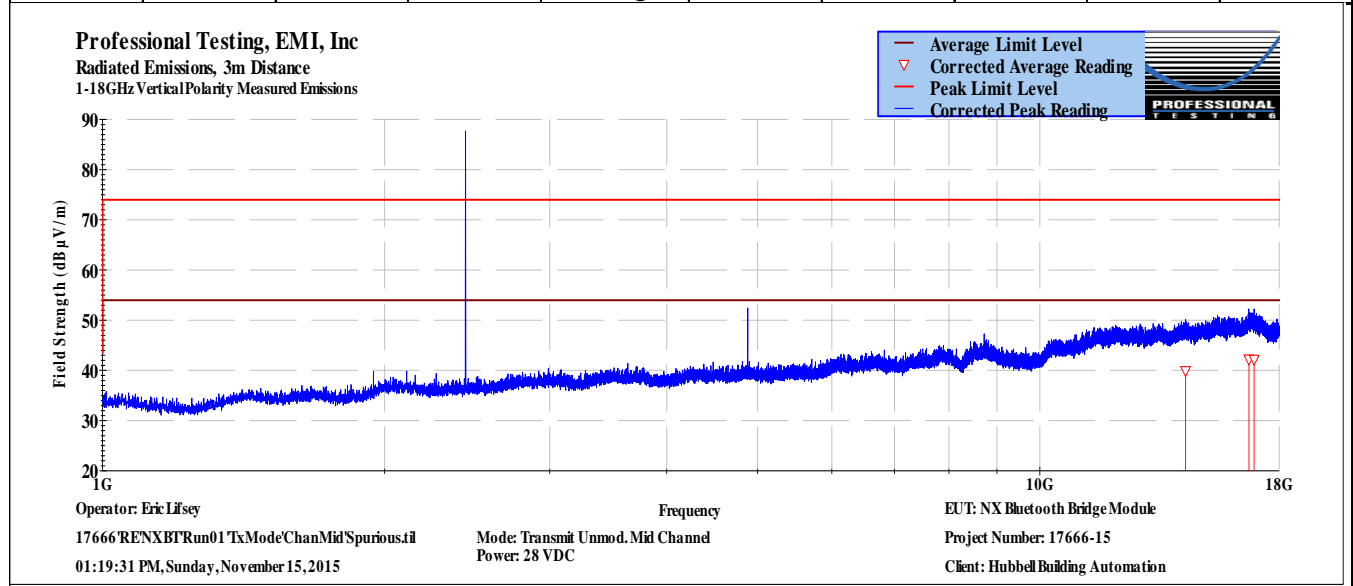
> 1GHz Horizontal Antenna Polarity Measured Emissions

The duty cycle averaging factor was -4.15 dB and applied to the 4804 MHz harmonic.

Table 7.3.5: TX Mode, Above 1 GHz, Vertical Polarity, Middle Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet						Page: 1 of 1			
EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit Middle Channel						
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
4880	3	0	1	Peak	52.5	52.5	74.0	-21.5	Pass
14306.1	3	221	1	Average	28.6	39.917	54.0	-14.0	Pass
16712.3	3	266	1	Average	27.5	42.232	54.0	-11.7	Pass
16929	3	99	1	Average	27.5	42.169	54.0	-11.8	Pass

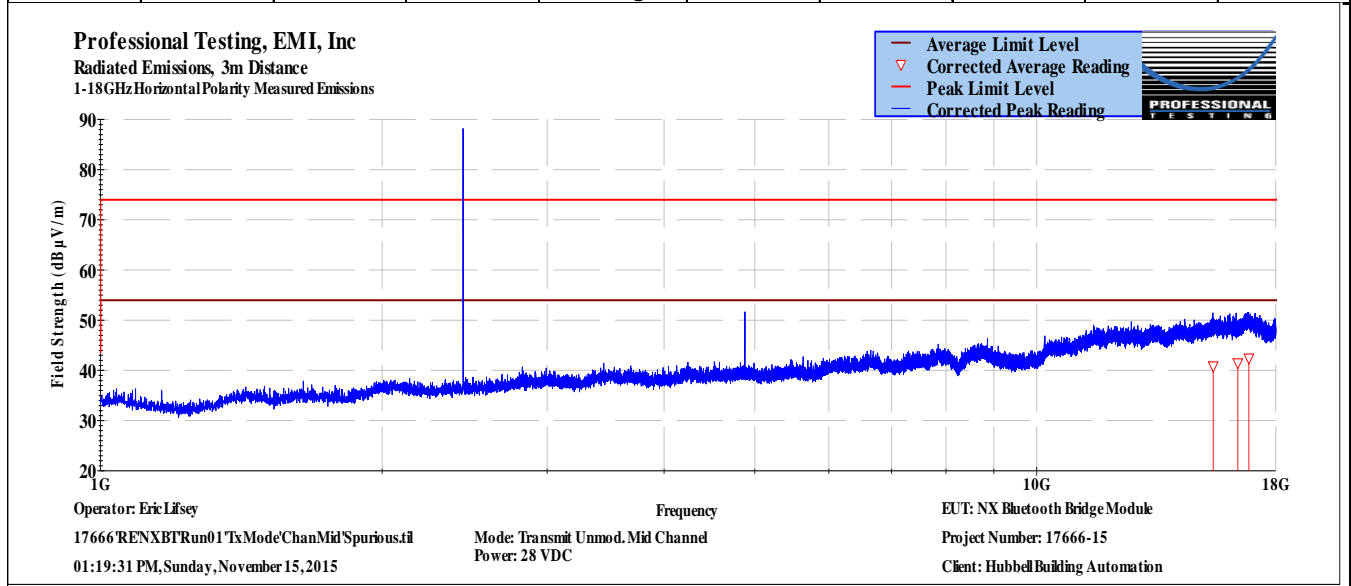


> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.6: TX Mode, Above 1 GHz, Horizontal Polarity, Middle Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet						Page: 1 of 1			
EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal			Frequency Range:	Above 1GHz				
EUT Mode of Operation:					Transmit Middle Channel				
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
4880	3	0	1	Peak	51.5	51.5	74.0	-22.5	Pass
15435.7	3	269	1	Average	27.9	40.846	54.0	-13.1	Pass
16395.6	3	206	1	Average	27.1	41.451	54.0	-12.5	Pass
16848.7	3	243	1	Average	27.7	42.41	54.0	-11.5	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.7: TX Mode, Above 1 GHz, Vertical Polarity, High Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

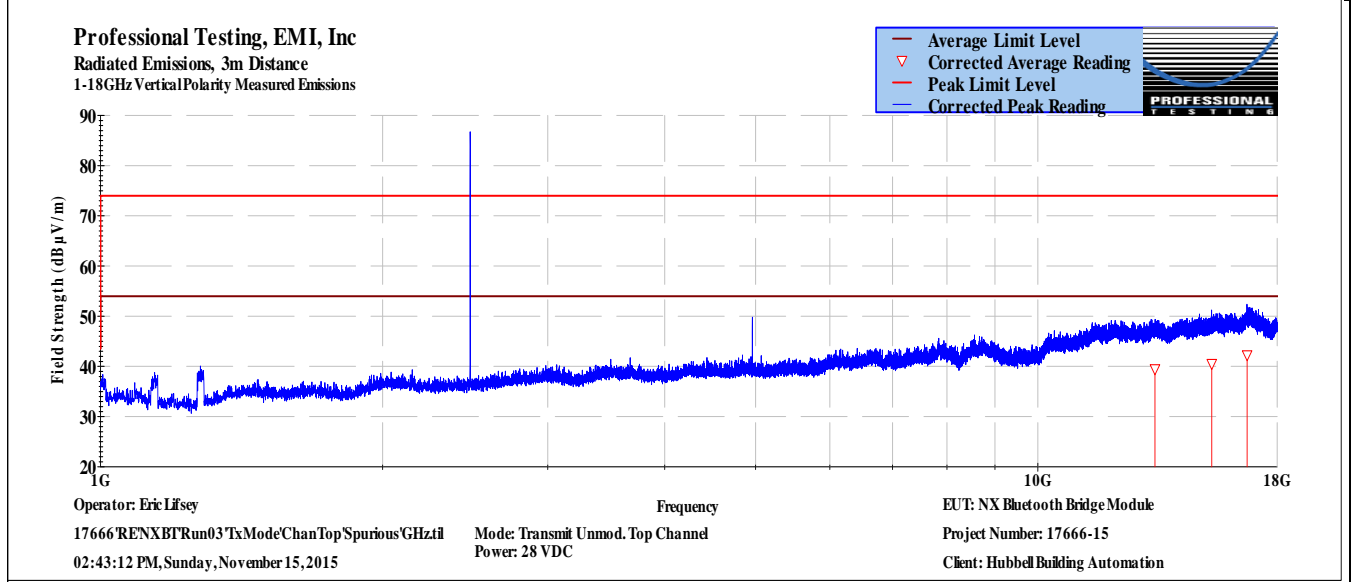
Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
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Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
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EUT Mode of Operation: Transmit Middle Top Channel

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
4960	3	0	1	Peak	49.8	49.8	74.0	-24.2	Pass
13334.2	3	128	1	Average	28.5	39.479	54.0	-14.5	Pass
15330.3	3	93	1	Average	28.1	40.535	54.0	-13.4	Pass
16724	3	179	1	Average	27.5	42.268	54.0	-11.7	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Table 7.3.8: TX Mode, Above 1 GHz, Horizontal Polarity, High Channel

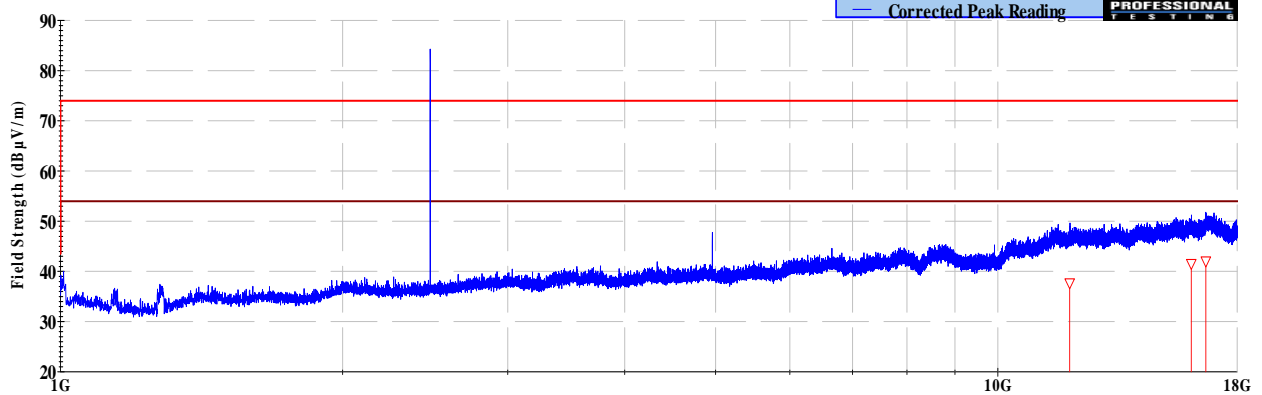
Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit Middle Top Channel						
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
4960	3	0	1	Peak	47.8	47.8	74.0	-26.2	Pass
11932.8	3	299	1	Average	27.4	37.685	54.0	-16.3	Pass
16085.6	3	304	1	Average	27.4	41.532	54.0	-12.4	Pass
16671.9	3	43	1	Average	27.4	42.034	54.0	-11.9	Pass

Professional Testing, EMI, Inc
Radiated Emissions, 3m Distance
1-18GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey
17666 RENXBTRun03TxModeChanTopSpurious/GHztil
02:43:12 PM, Sunday, November 15, 2015
Mode: Transmit Unmod. Top Channel
Power: 28 VDC
EUT: NX Bluetooth Bridge Module
Project Number: 17666-15
Client: Hubbell Building Automation

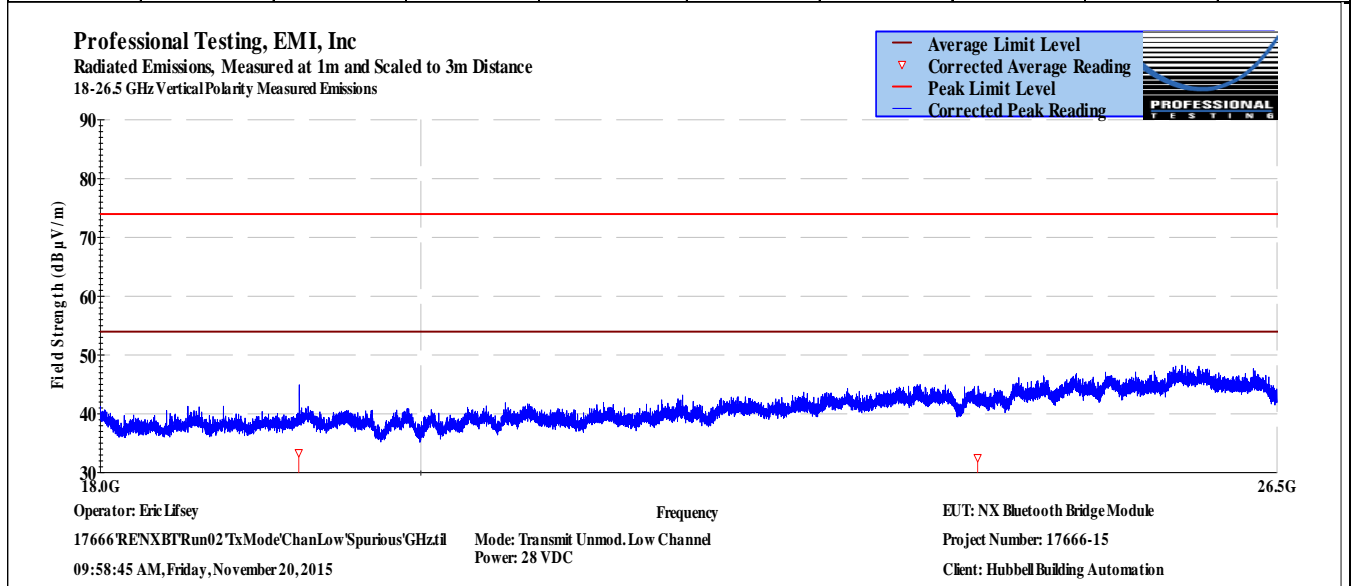
> 1GHz Horizontal Antenna Polarity Measured Emissions

7.3.9 TX Mode, 18 GHz to 25 GHz, Low Channel

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit Mode Bottom Channel						
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
19212.8	3	290	1	Average	37.2	33.372	54.0	-20.6	Pass
24016.8	3	147	1	Average	34.1	32.521	54.0	-21.4	Pass
19212.8	3	290	1	Peak	42	38.153	74.0	-35.8	Pass
24016.8	3	147	1	Peak	43.3	41.74	74.0	-32.2	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

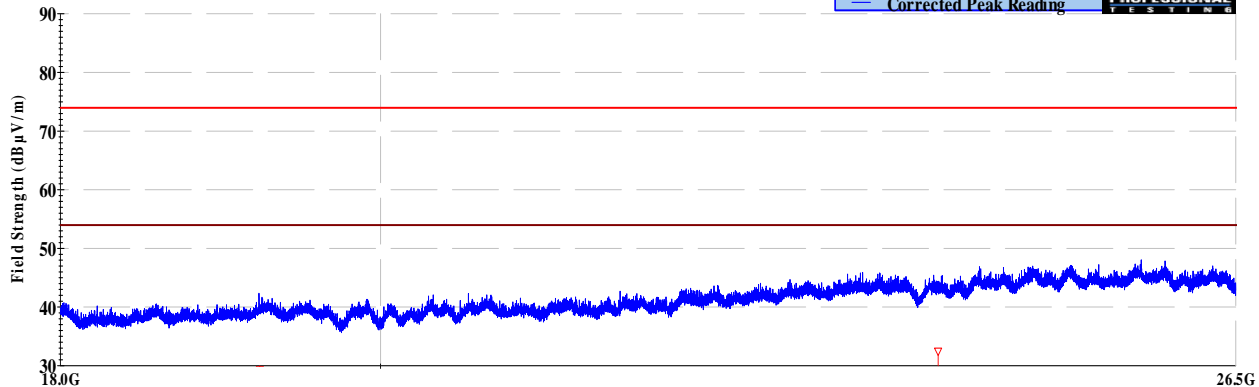
Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		28	VDC	EUT Power Frequency:		0	N/A			
Antenna Orientation:				Horizontal		Frequency Range:		Above 1GHz		
EUT Mode of Operation:						Transmit Mode Bottom Channel				
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	
19221.4	3	119	1	Average	33.1	29.279	54.0	-24.7	Pass	
24028.3	3	207	1	Average	34	32.478	54.0	-21.5	Pass	
19221.4	3	119	1	Peak	42.9	39.072	74.0	-34.9	Pass	
24028.3	3	207	1	Peak	42.5	40.937	74.0	-33.0	Pass	

Professional Testing, EMI, Inc
 Radiated Emissions, Measured at 1m and Scaled to 3m Distance
 18-26.5 GHz Horizontal Polarity Measured Emissions

- Average Limit Level
- ▽ Corrected Average Reading
- Peak Limit Level
- Corrected Peak Reading



Operator: Eric Lifsey
 17666 RENXBTRun02TxModeChanLowSpuriousGHzfil Mode: Transmit Unmod.Low Channel Power: 28 VDC
 09:58:45 AM, Friday, November 20, 2015
 EUT: NX Bluetooth Bridge Module
 Project Number: 17666-15
 Client: Hubbell Building Automation

> 1GHz Horizontal Antenna Polarity Measured Emissions

7.3.10 TX Mode, 18 GHz to 25 GHz, Middle Channel

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

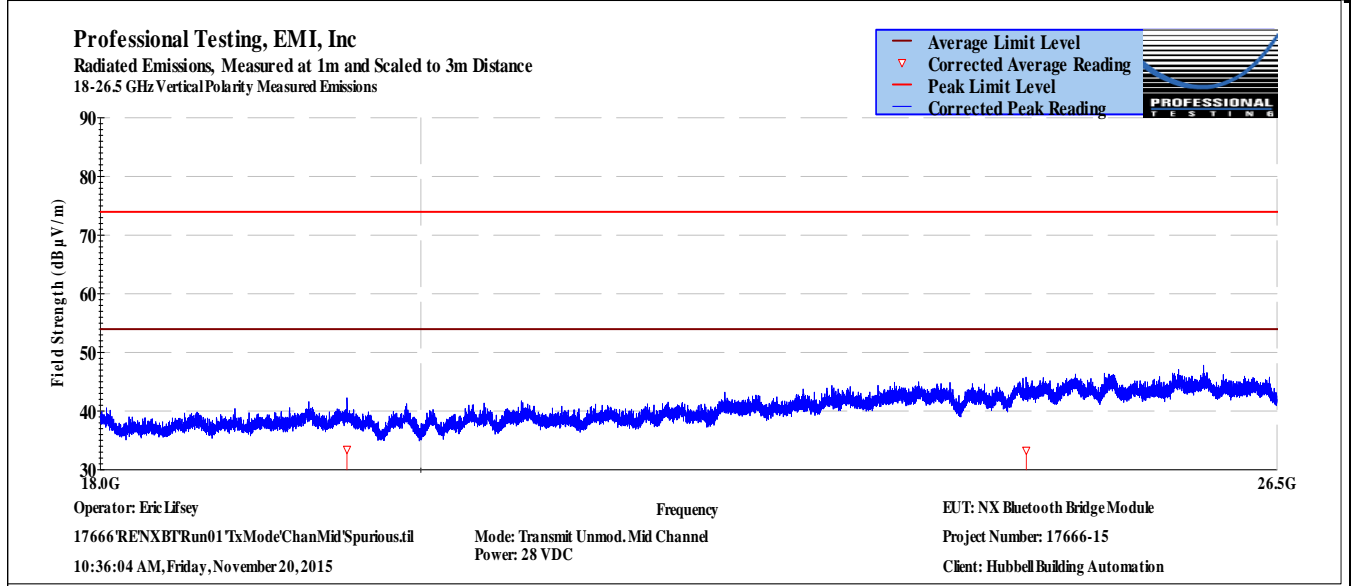
Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A
--------------------------	----	-----	-----------------------------	---	-----

Antenna Orientation:	Vertical	Frequency Range:	Above 1GHz
-----------------------------	----------	-------------------------	------------

EUT Mode of Operation: Transmit Middle Channel

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
19519.9	3	313	1	Average	37.3	33.462	54.0	-20.5	Pass
24403.3	3	215	1	Average	33.9	33.314	54.0	-20.6	Pass
19519.9	3	313	1	Peak	46.4	42.501	74.0	-31.5	Pass
24403.3	3	215	1	Peak	43.5	42.958	74.0	-31.0	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

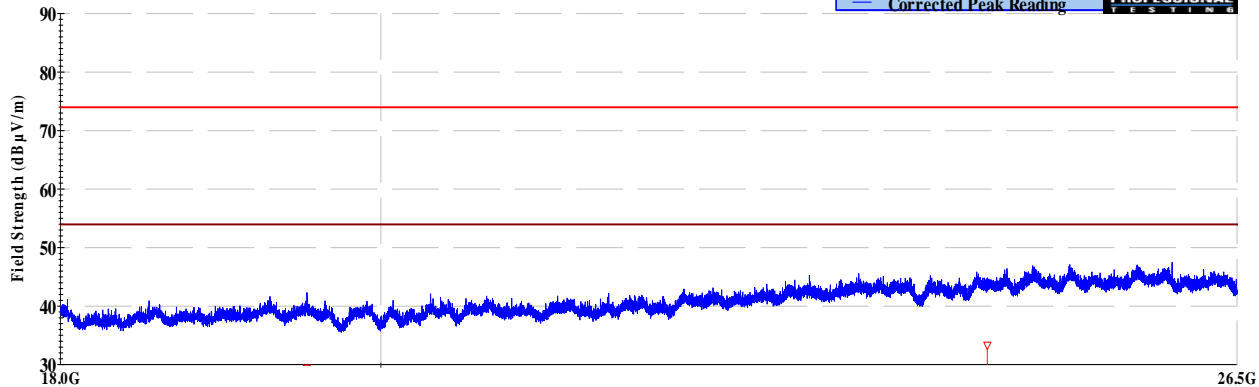
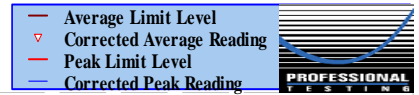
Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		28	VDC	EUT Power Frequency:		0	N/A			
Antenna Orientation:				Horizontal		Frequency Range:		Above 1GHz		
EUT Mode of Operation:						Transmit Middle Channel				
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	
19520.3	3	154	1	Average	33.2	29.363	54.0	-24.6	Pass	
24412.1	3	184	1	Average	33.9	33.282	54.0	-20.7	Pass	
19520.3	3	154	1	Peak	45.6	41.745	74.0	-32.2	Pass	
24412.1	3	184	1	Peak	43	42.417	74.0	-31.5	Pass	

Professional Testing, EMI, Inc
 Radiated Emissions, Measured at 1m and Scaled to 3m Distance
 18-26.5 GHz Horizontal Polarity Measured Emissions



Operator: Eric Lifsey
 17666 RENXBTRun01 TxModeChanMidSpurious.fil
 10:36:04 AM, Friday, November 20, 2015

Frequency
 Mode: Transmit Unmod. Mid Channel
 Power: 28 VDC

EUT: NX Bluetooth Bridge Module
 Project Number: 17666-15
 Client: Hubbell Building Automation

> 1GHz Horizontal Antenna Polarity Measured Emissions

7.3.11 TX Mode, 18 GHz to 25 GHz, High Channel

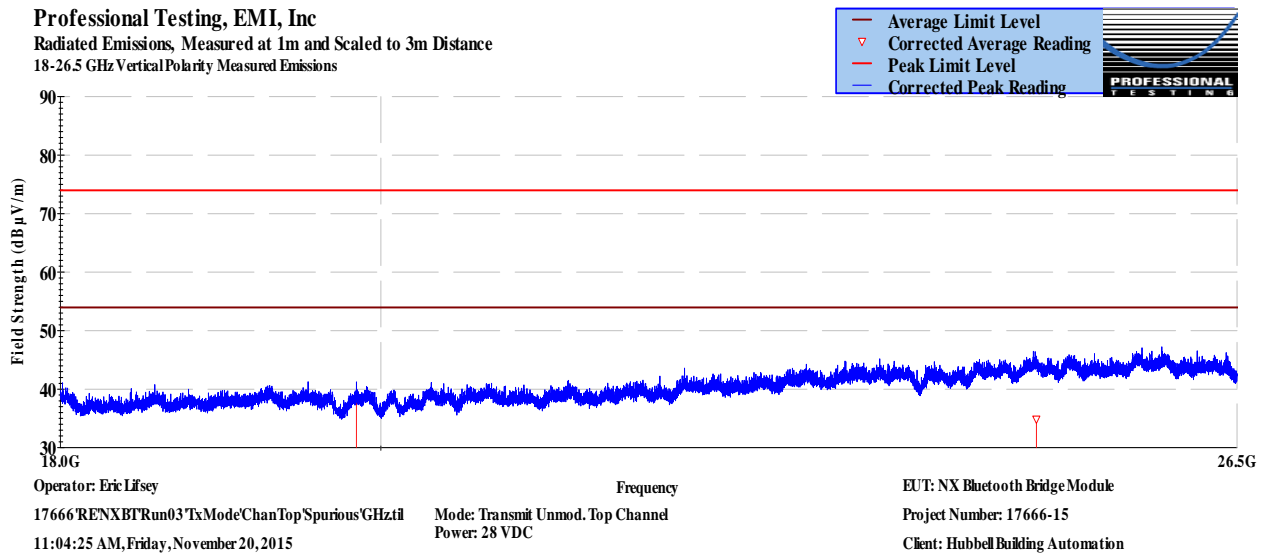
Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Radiated Emissions Test Results Data Sheet Page: 1 of 1

EUT Line Voltage:	28	VDC	EUT Power Frequency:	0	N/A				
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz					
EUT Mode of Operation:			Transmit Top Channel						
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
19839.9	3	258	1	Average	42.5	38.145	54.0	-15.8	Pass
24808.6	3	122	1	Average	34.5	34.852	54.0	-19.1	Pass
19839.9	3	258	1	Peak	47.2	42.837	74.0	-31.1	Pass
24808.6	3	122	1	Peak	45	45.296	74.0	-28.7	Pass

Professional Testing, EMI, Inc
Radiated Emissions, Measured at 1m and Scaled to 3m Distance
18-26.5 GHz Vertical Polarity Measured Emissions



> 1GHz Vertical Antenna Polarity Measured Emissions

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	11/15/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

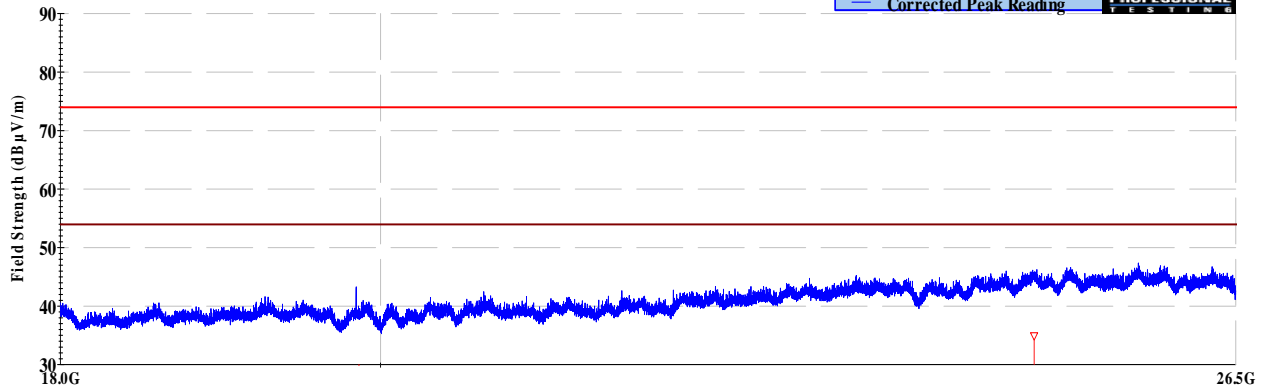
Radiated Emissions Test Results Data Sheet

Page: 1 of 1

EUT Line Voltage:		28	VDC	EUT Power Frequency:		0	N/A			
Antenna Orientation:				Horizontal		Frequency Range:		Above 1GHz		
EUT Mode of Operation:						Transmit Top Channel				
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	
19858.6	3	295	1	Average	32.9	28.68	54.0	-25.3	Pass	
24798.6	3	327	1	Average	34.5	34.902	54.0	-19.1	Pass	
19858.6	3	295	1	Peak	42.9	38.694	74.0	-35.3	Pass	
24798.6	3	327	1	Peak	44	44.409	74.0	-29.5	Pass	

Professional Testing, EMI, Inc
 Radiated Emissions, Measured at 1m and Scaled to 3m Distance
 18-26.5 GHz Horizontal Polarity Measured Emissions

- Average Limit Level
- ▽ Corrected Average Reading
- Peak Limit Level
- Corrected Peak Reading



Operator: Eric Lifsey Frequency EUT: NX Bluetooth Bridge Module
 17666 RENXBTRun03TxModeChanTopSpuriousGHzfil Mode: Transmit Unmod. Top Channel Project Number: 17666-15
 11:04:25 AM, Friday, November 20, 2015 Power: 28 VDC Client: Hubbell Building Automation

> 1GHz Horizontal Antenna Polarity Measured Emissions

8.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

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	30 Nov 2015

8.3 Results

Table 8.3.1 Antenna Construction Details					
Antenna Manufacturer and Model			Specifications		
Manufacturer: Advanced Ceramic X Corp.					
Part Number: AT8010-E2R9HAA_					
Part Number	Frequency Range (MHz)	Peak Gain (dBi typ.)	Average Gain (dBi typ.)	VSWR	Impedance
AT8010-E2R9HAA_	2400~2500	2.5 (XZ-V)	0.5 (XZ-V)	2 max.	50 Ω

- Antenna is chip style component.
- There is no external antenna connector.

The antenna design above 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	Nov 2015

9.3 Test Results

The EUT satisfied the criteria.

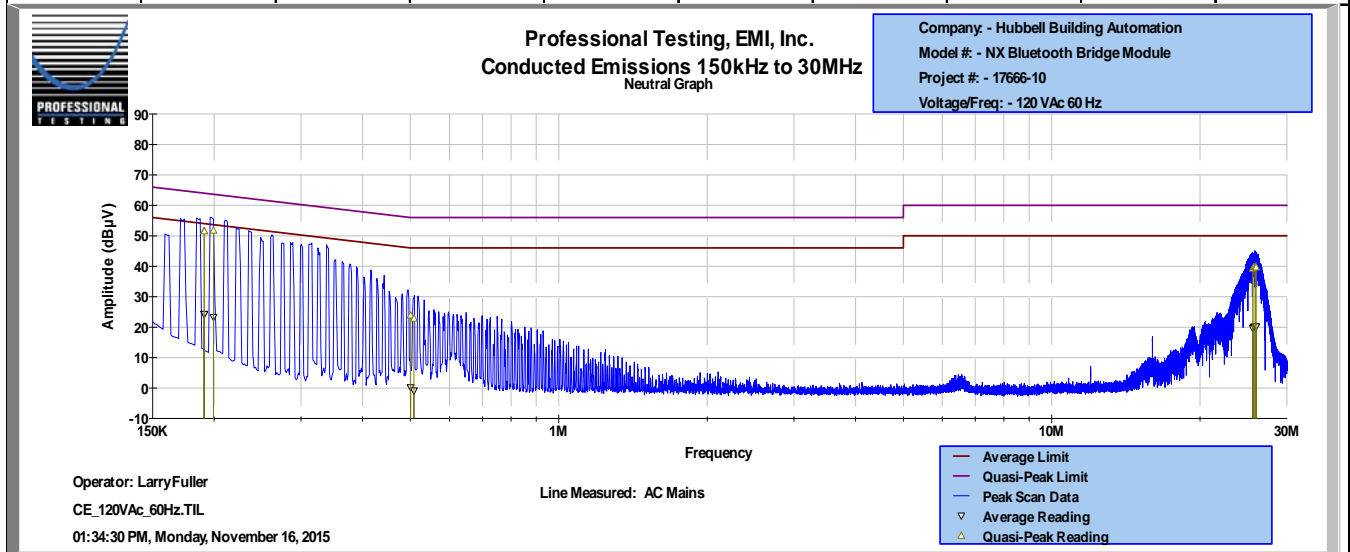
Tabular and plotted measurements appear on the following pages.

9.3.1 Mains, Neutral

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.107 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Conducted Emissions Limits		
Section:	15.107		
Test Date(s):	11/16/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Larry Fuller
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Neutral Lead Page: 1 of 2

EUT Line Voltage:		120		VAC		EUT Line Frequency:		60		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	
0.19073	58.8	51.6	64	-12.4	PASS	24.3	54	-29.7	PASS	
0.19102	57.5	51.5	64	-12.5	PASS	24.2	54	-29.8	PASS	
0.19933	57.4	51.7	63.6	-11.9	PASS	23.3	53.6	-30.3	PASS	
0.50062	34.6	23.9	56	-32.1	PASS	0.2	46	-45.8	PASS	
0.5083	31.9	22.8	56	-33.2	PASS	-0.8	46	-46.8	PASS	
25.5849	44.8	39.2	60	-20.8	PASS	19.7	50	-30.3	PASS	
25.7236	45.3	39.8	60	-20.2	PASS	20.2	50	-29.8	PASS	
25.9158	45.5	39.8	60	-20.2	PASS	20.4	50	-29.6	PASS	
25.9947	45.6	39.6	60	-20.4	PASS	20.2	50	-29.8	PASS	



Measured Conducted Emissions - Neutral Lead

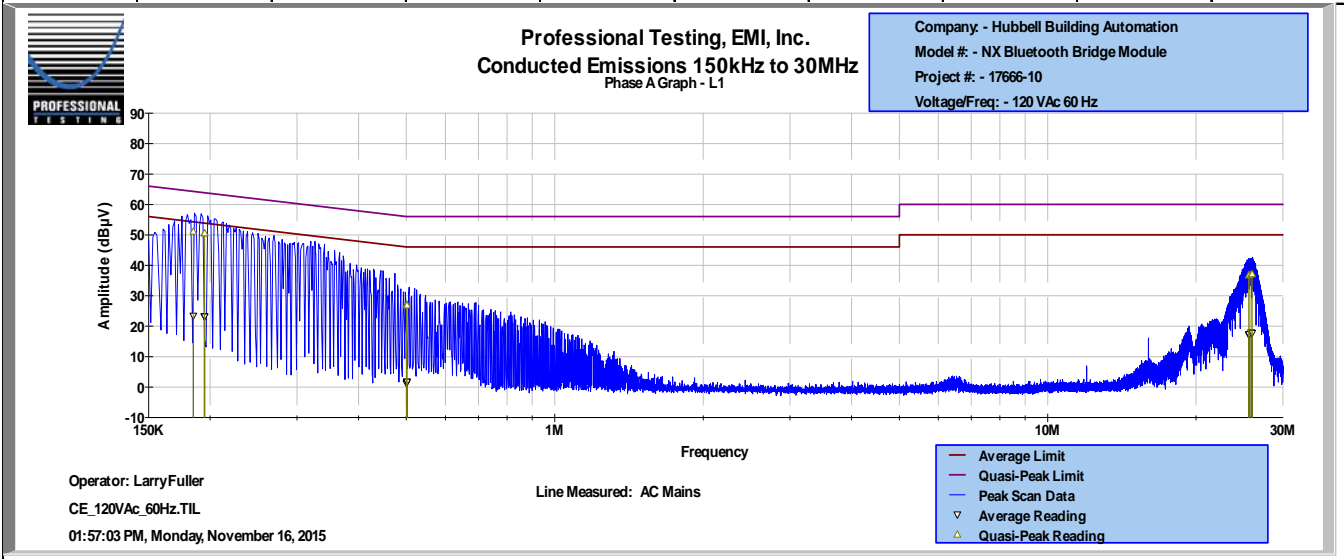
9.3.2 Mains, Phase

Professional Testing, EMI, Inc.

Test Method:	ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.107 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Conducted Emissions Limits		
Section:	15.107		
Test Date(s):	11/16/2015	EUT Serial #:	None
Customer:	Hubbell Building Automation	EUT Part #:	None
Project Number:	17666-15	Test Technician:	Larry Fuller
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	NX Bluetooth Bridge Module	Witness' Name:	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) Page: 2 of 2

EUT Line Voltage:		120 VAC		EUT Line Frequency:		60 Hz			
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.1848	57.6	51.1	64.3	-13.2	PASS	23.4	54.3	-30.8	PASS
0.19452	57.2	50.5	63.8	-13.3	PASS	23.2	53.8	-30.6	PASS
0.19494	56.9	50.6	63.8	-13.2	PASS	23.2	53.8	-30.7	PASS
0.50031	34.7	26.9	56	-29.1	PASS	1.2	46	-44.8	PASS
0.50096	34.7	27.1	56	-28.9	PASS	1.7	46	-44.3	PASS
0.50185	34.5	26.8	56	-29.2	PASS	1.7	46	-44.3	PASS
25.594	42	36.7	60	-23.3	PASS	17.1	50	-32.9	PASS
25.6213	42.9	36.7	60	-23.3	PASS	17.3	50	-32.7	PASS
25.8631	42.8	37	60	-23	PASS	17.9	50	-32.1	PASS
26.0023	42.8	37.1	60	-22.9	PASS	17.8	50	-32.2	PASS



Measured Conducted Emissions - Phase Lead (Line 1)

10.0 Equipment

10.1 Spurious Radiated Emissions 30 MHz to 25 GHz

Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.4–2003: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators,			
In accordance with:		Radiated Emissions Limits			
Section:		15.209			
Test Date(s):		11/15/2015	EUT Serial #:	None	
Customer:		Hubbell Building Automation	EUT Part #:	None	
Project Number:		17666-15	Test Technician:	Eric Lifsey	
Purchase Order #:		NA	Supervisor:	Lisa Arndt	
Equip. Under Test:		NX Bluetooth Bridge Module	Witness' Name:	None	
Radiated Emissions Test Equipment List					
Title! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		2015 Rad Emissions_ClassA - LowPRF_072715.til or 2015 Rad Emissions_ClassB - LowPRF_072715.til			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	2/5/2016
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	2/6/2016
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	12/2/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	1/25/2017
C027D	none	RG214	Cable Coax, N-N, 25m	none	10/1/2016
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	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	3/13/2016
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	12/29/2015
C030	none	none	Cable Coax, N-N, 30m	none	10/1/2016
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	2/25/2017
1973	Agilent	83017A	Amplifier, Microwave 0.5-26.5 GHz	MY39500497	2/4/2016
1542	A.H. Systems	SAS-572	Antenna, Horn 18-26.5GHz, 20dB gain	225	N/A

10.2 Bandwidth and Duty Cycle

Asset #	Manufacturer	Model #	Description	Calibration Due
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	29 Jan 2016

10.3 Mains Conducted Emissions

Professional Testing, EMI, Inc.					
Test Method:		ANSI C63.4–2009: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (incorporated by reference, see §15.38).			
In accordance with:		FCC Part 15.107 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Conducted Emissions Limits			
Section:		15.107			
Test Date(s):		11/16/2015	EUT Serial #:	None	
Customer:		Hubbell Building Automation	EUT Part #:	None	
Project Number:		17666-15	Test Technician:	Larry Fuller	
Purchase Order #:		NA	Supervisor:	Lisa Arndt	
Equip. Under Test:		NX Bluetooth Bridge Module	Witness' Name:	None	
Conducted Emissions Test Equipment List					
Title! Software Version:		4.1.A.0, April 14, 2009, 11:01:00PM			
Test Profile:		CE_2014_R3_091615.TIL or CE_Marine_091615.TIL			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1145	HP	8568B	Spectrum Analyzer 100Hz-1.5GHz	2517A01821	10/18/2016
1834	HP	85662A	Spec Anal Dsply, use with A/N 1145	2349A06182	N/A
0990	HP	85685A	RF Preselector	3010A01119	12/1/2015
0085	HP	85650A	Quasi-Peak Adapter CISPR	3033A01458	10/18/2016
1173	PTI	100k HPF	Filter, High Pass, 100kHz	none	1/15/2016
1087	PTI	PTI-ALF3	Attenuator Limiter Filter	none	4/28/2016
C109	HP	none	Cable 19 inch BNC (grey)	none	8/6/2016
C108	HP	11170 C	Cable 5 ft BNC (Grey)	none	8/6/2016
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/6/2016
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	11/12/2016

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				
Frequency 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
	1 to 18 GHz	3 m	5.7

End of Report

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