Project #: 23094-15

Company: Hubbell Control Solutions

EUT: NXSMDT-OMNI

FCC and Industry Canada

Wireless Test Report

Prepared for:

Hubbell Control Solutions
710 Hesters Crossing Rd, Suite 100
Round Rock, TX 78681

By

Nemko PTI, Inc.
1601 North A.W. Grimes Blvd., Suite B
Round Rock, Texas 78665

May 9, 2022

Written by

Shakil Murad
Wireless Engineer

Table of Contents

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Compliance Certificate

FCC MRA Designation Number: US5270
NVLAP Accreditation Number: 200062-0

Applicant	Device & Test Identification
Hubbell Control Solutions 710 Hesters Crossing Rd, Suite 100 Round Rock, TX 78681	Model(s): NXSMDT-OMNI FCC ID: YH9NXSMDT-OMNI IC: 9044A-NXSMDT-OMNI Laboratory Project ID: 23094-15

The device named above was tested utilizing the following standards 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 2400-2483.5 MHz
FCC 47 CFR Part 15 C	15.209	Radiated emission limits; general requirements
FCC 47 CFR Part 15 C	15.205	Restricted Bands of Operation
FCC 47 CFR Part 15 C	15.203	Antenna requirement
FCC 47 CFR Part 1 I*	1.1310	Radiofrequency radiation exposure limits
RSS-247	Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-Gen	Issue 5	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, Shakil Murad, for Nemko PTI, 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.

NVLAP
TESTING
NVLAP LAB CODE 200062-0

Shakil Murad
Wireless 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

Test Result Summary

Test	FCC Part 15 Rule Paragraphs	IC RSS References	Test Results
Antenna Requirement	15.203	RSS-Gen 6.8	Pass
Fundamental Power	15.247 (b)(3)	RSS-247 5.4 (d)	Pass
Duty Cycle	15.247 (f)	RSS-247 5.3 (a)	Pass
Power Spectral Density	15.247 (e)	RSS-247 5.2 (b)	Pass
Occupied Bandwidth	15.247 (a)(2), 2.1049	RSS-247 5.2 (a)	Pass
Band Edge	15.247 (d); 15.205 (a)	RSS-247 5.5;	Pass
Conducted Spurious Emissions	15.247 (d); 15.209 (a)	RSS-247 5.5; RSS-GEN 6.13	Pass
Transmitter Radiated Spurious Emissions	15.247 (d); 15.209 (a)	RSS-247 5.5; RSS-Gen 6.13 & 8.10	Pass
Receiver Radiated Spurious Emissions	15.109	RSS-Gen 7.3	Pass

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.

Nemko PTI, Inc., 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

Manufacturer / Model	Serial #	Description
Hubbell Control Solutions Model: NXSMDT-OMNI	N/A	2.4GHz Bluetooth Low Energy Wireless Transmitter

1.3 EUT Test Mode

EUT has the capability to operate in BLE and Wirepas modes. Wirepas has the similar characteristics and the power levels as the BLE as observed during evaluation. Therefore, test data for BLE mode is reported in this report.

1.4 EUT Test Configuration

The EUT was exercised in a manner consistent with normal operations. The EUT is powered by +12 VDC via an external DC power supply.

1.5 Modifications to Equipment

The PCB mounted chip antenna was removed, and a small coaxial cable was soldered in its place to facilitate conducted RF measurements.

1.6 Test Site

Measurements were made at the Nemko PTI semi-anechoic facility designated Site 45 (FCC 776781, 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. CAB Identifier: US 0123.

1.7 Measurement Corrections

Parameter	From Sums Of
Radiated Field Strength	Raw Measured Level + Antenna Factor + Cable Losses – Amplifier Gain
Conducted Antenna Port	Raw Measured Level + Attenuator Factor + Cable Losses
Conducted Mains Port	Raw Measured Level + LISN Factor + Cable/Filter/Limiter Losses

Additionally, measurement distance extrapolation factors (such as 1/d above 30 MHz) are applied and documented where used.

1.8 Applicable Documents

Table 1.8.1: Applicable Documents

Document	Title
47 CFR	Part 15 – Radio Frequency Devices Subpart C -Intentional Radiators
RSS-247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-102 Issue 5	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
RSS-Gen Issue 5	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 558074 D01	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
KDB 412172 D01	GUIDELINES FOR DETERMINING THE EFFECTIVE RADIATED POWER (ERP) AND EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP) OF AN RF TRANSMITTING SYSTEM
KDB 447498 D01	RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES
OET Bulletin 65 Edition 97-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

2.0 Fundamental Power

2.1 Test Procedure

The radio was connected directly to the spectrum analyzer for measurement. Low, mid, and high channel output power was measured.

2.2 Test Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Conducted Power Limit
15.247(b)(3) // RSS-247 (d)	1 W peak (+30dBm)

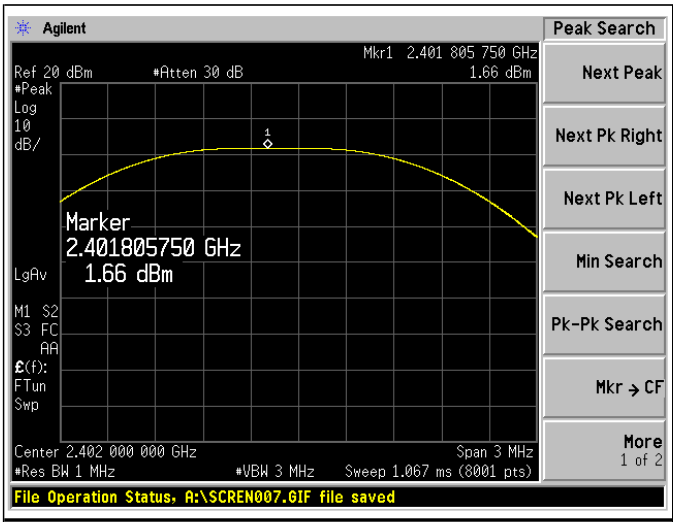
2.3 Test Results, Peak Power

Peak Output Power - Conducted Test Data														
Project Number:	22094-15					Test Date(s):	4/20/2022							
Environmental Conditions:	Temperature	22.8	°C			Humidity	55	RH		Barometric Pressure	29.86	in Hg		
EUT (6 dB) Bandwidth:	0.684	MHz												
Measurement Parameters:	RBW	1	MHz	VBW	3	MHz	Span	3	MHz	Detector	Peak			

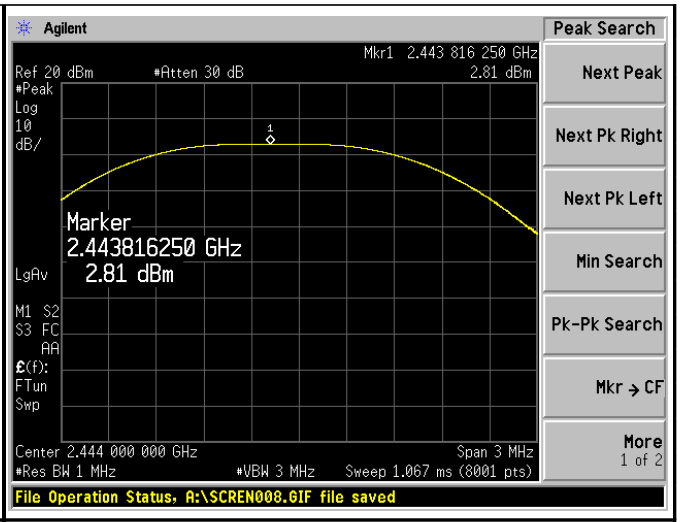
Channel	Frequency (MHz)	Measured Power (dBm)	Attenuator Factor (dB)	Corrected Power (dBm)	Limit (dBm)	Test Result
Bottom	2402	1.66	0	1.66	30	Pass
Middle	2444	2.81	0	2.81	30	Pass
Top	2480	3.39	0	3.39	30	Pass

The requirements were satisfied.

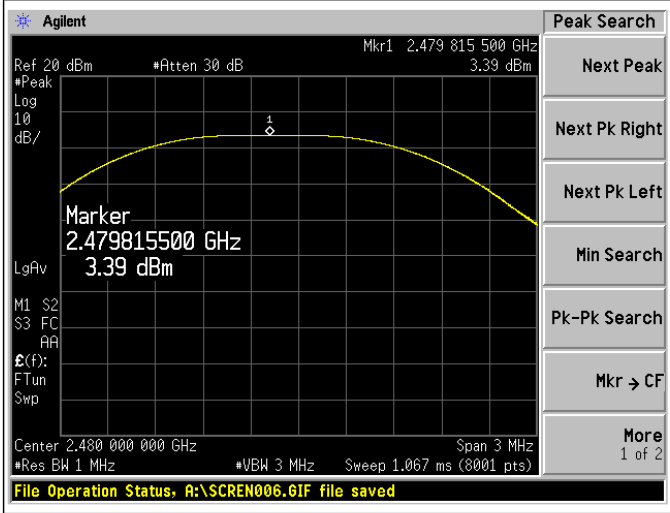
Peak output power test plots:



Low Channel



Mid Channel



High Channel

3.0 Occupied Bandwidth

3.1 Test Procedure

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

3.2 Test Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Bandwidth
15.247(a)(2), 2.1049 // RSS-247 5.2(a)	6 dB 500 kHz minimum 99% (all methods)

In cases where the software function fails to find/mark the correct edge of the modulated envelope, a manual measurement (marker-delta over display line) is taken with the same spectrum analyzer settings.

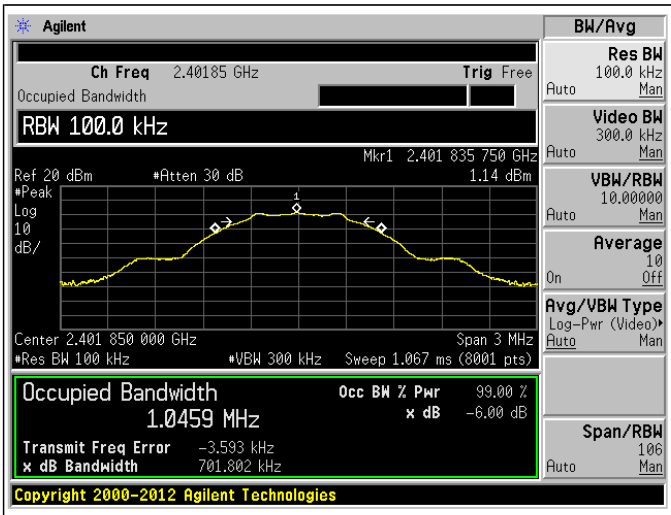
3.3 Test Results, Occupied Bandwidth

Occupied Bandwidth - Conducted Test Data														
Project Number:	22094-15				Test Date(s):	4/20/2022								
Environmental Conditions:	Temperature	22.8	°C		Humidity	55	RH		Barometric Pressure	29.86	in Hg			
Measurement Parameters:	RBW	100	kHz		VBW	300	kHz		Span	3	MHz		Detector	Peak
Measurement Bandwidth:		6	dB											

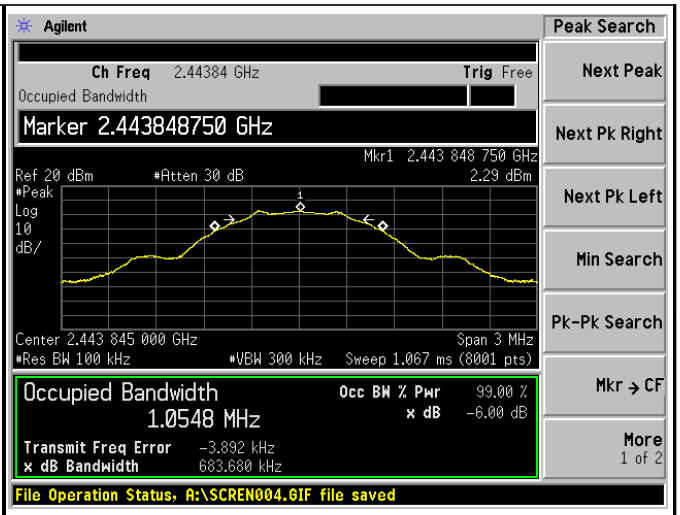
Channel	Frequency (MHz)	Measured Bandwidth (kHz)	Reported Minimum Bandwidth (kHz)
Bottom	2402	701.802	683.68
Middle	2444	683.68	
Top	2480	687.596	

The EUT met the requirements.

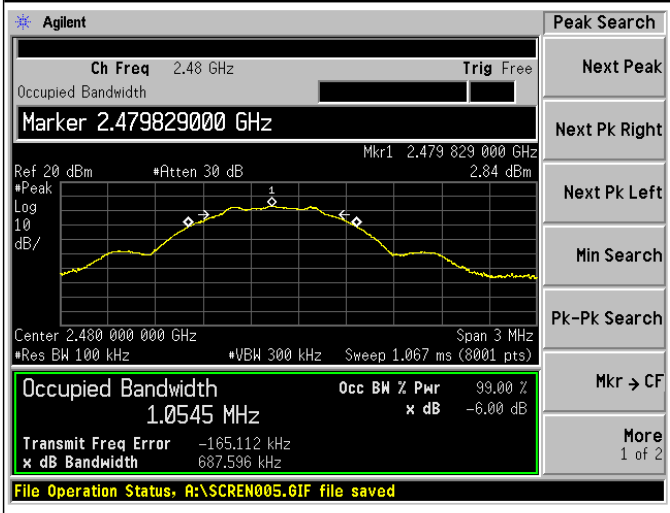
Occupied Bandwidth data plots, Recorded: 6 dB, 99% BW



Low Channel



Mid Channel

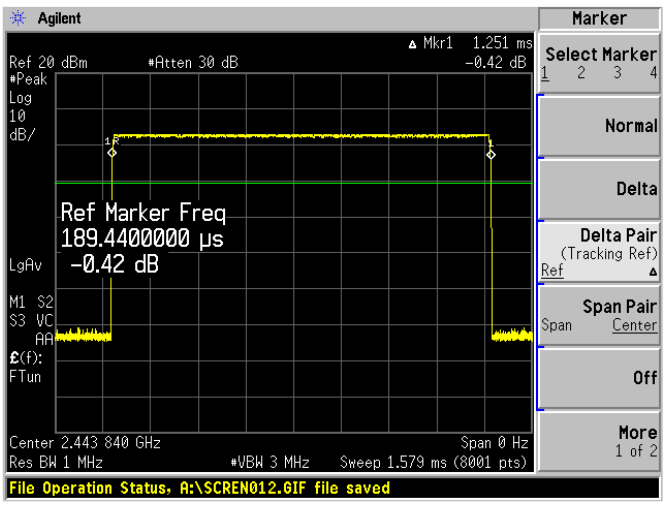


High Channel

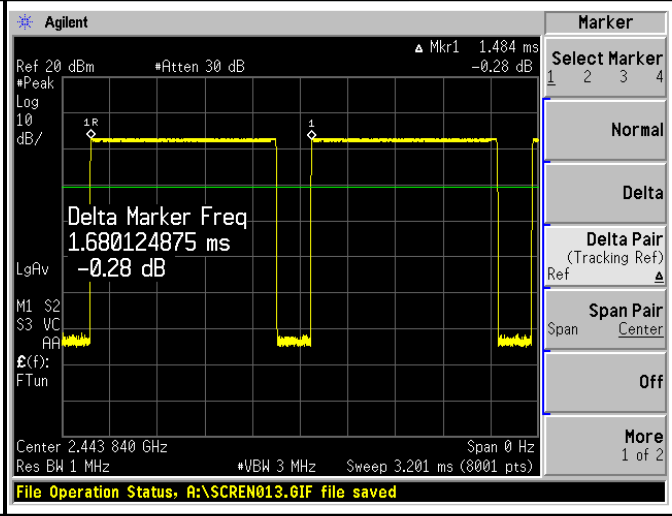
4.0 Duty Cycle

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.

Dyty Cycle - Conducted Test Data														
Project Number:	**22094-15**				**Test Date(s):**	**4/20/2022**								
Environmental Conditions:	**Temperature**	**22.8**	**°C**		**Humidity**	**55**	**RH**		**Barometric Pressure**	**29.86**	**in Hg**			
Measurement Parameters:	**RBW**	**1**	**MHz**	**VBW**	**3**	**MHz**	**Span**	**0**	**MHz**	**Detector**	**Peak**			
Measured On Time (ms)	**Max On Time Allowed (ms)**	**On Time Result**	**Measured Time Interval (ms)**		**Duty Cycle Factor (dB) (20 * Log(On time/Interval)**					**Duty Cycle Factor Allowed (dB)**				
1.251	**400**	**Pass**	**1.484**		**1.48**					**20**				
RF Exposure Duty Cycle Reduction Factor (10 * Log(On Time/Period), (dB)										**0.7**				



Transmit Event Time



Time Interval (Return to channel time)

Duty Cycle Measurement

5.0 Power Spectral Density

5.1 Test Procedure

The radio was connected directly to the spectrum analyzer for measurement. Low, mid, and high channel was measured.

5.2 Test Criteria

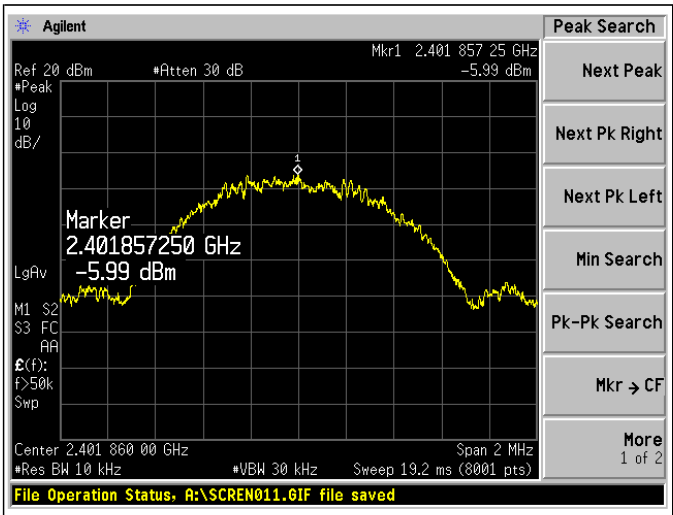
47 CFR (USA) // IC (Canada)	
Section Reference	Power Spectral Density, Conducted Limit
15.247(e) // RSS-247 5.2 (b)	8 dBm / 3 kHz

5.3 Test Results, Power Spectral Density

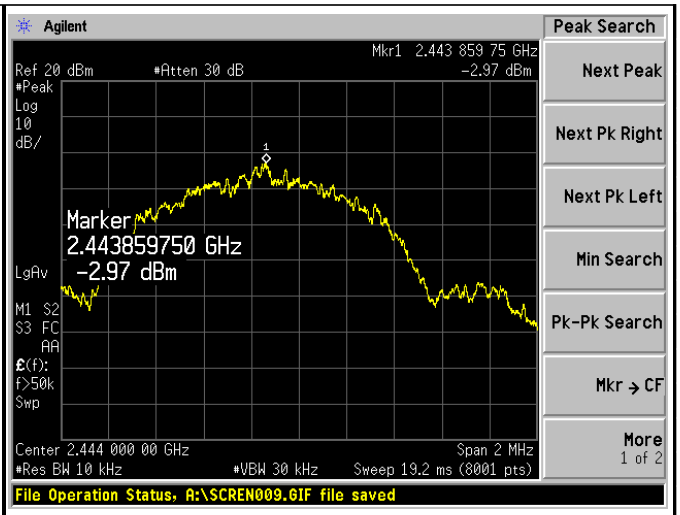
Power Spectral Density - Conducted Test Data																	
Project Number:	22094-15						Test Date(s):	4/20/2022									
Environmental Conditions:	Temperature	22.8	°C		Humidity	55	RH		Barometric Pressure	29.86	in Hg						
EUT Channel Bandwidth:	0.70	MHz															
Measurement Parameters:	RBW	10	kHz	VBW	30	kHz	Span	2	MHz	Detector	Peak						
Channel	Frequency (MHz)	Measured Power (dBm)		Attenuator Factor (dB)			Corrected Power (dBm)			Limit (dBm)			Test Result				
Bottom	2402	-5.99		0			-5.99			8			Pass				
Middle	2444	-2.97		0			-2.97			8			Pass				
Top	2480	-3.22		0			-3.22			8			Pass				

The requirements were satisfied.

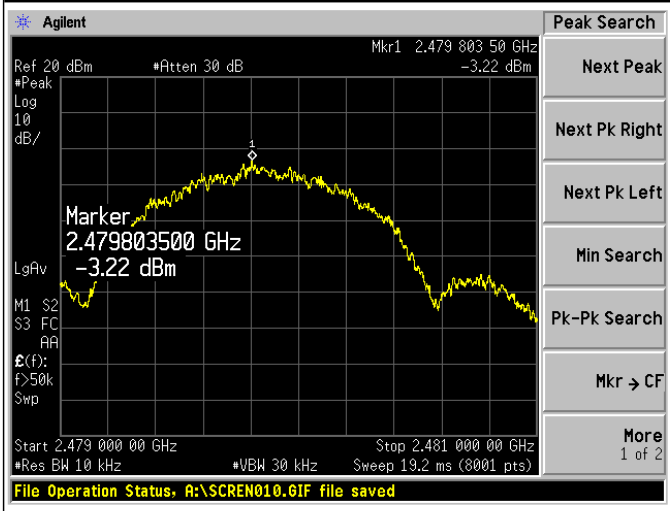
Power Spectral Density test plots:



Low Channel



Mid Channel



High Channel

6.0 Band Edge

6.1 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 is utilized. The radio was connected directly to the spectrum analyzer for measurement.

6.2 Test Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Unwanted Emissions
15.247 (d), 15.205 (a) // RSS-247 5.5, RSS-Gen 6.13	Emissions Adjacent to Authorized Band

6.3 Test Results

Measurements included fundamental and more than 2 standard bandwidths (standard bandwidth 1 MHz) beyond the band edges to provide a clear view of the fundamental and the declining emission levels. Beyond this point, the general emission limits are applied in the radiated emission tests reported elsewhere in the report.

This is a conducted measurement with limits derived from the general emission field strength limits. The far field path loss equation is utilized to convert the field strength limits to EIRP limits in dBm as follows:

Given EIRP = $E_{dB\mu V/m}$ + $20Log_{10}(d)$ – 104.8

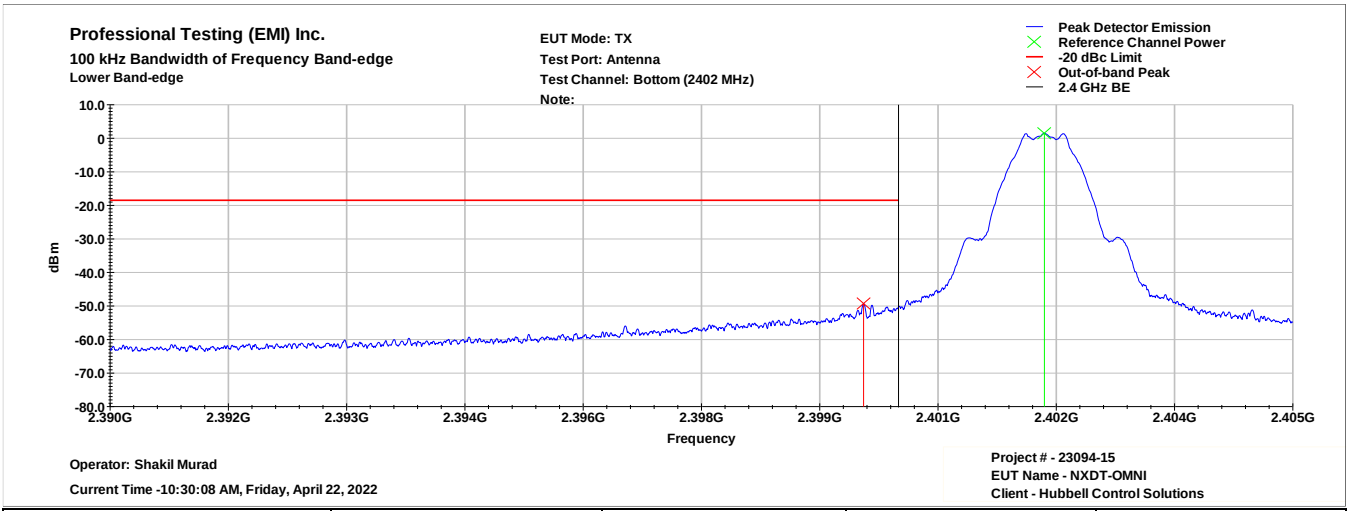
EIRP = 54 dBµV/m + $20Log_{10}$(3 m) – 104.8 dB = -41.25 dBm (commonly -41 dBm is applied)

Emissions below band were measured with peak detection in 100 kHz RBW.

Emissions above band measured with peak detection and 1 Hz video average in 1 MHz RBW if the peak emission exceeds the average limit.

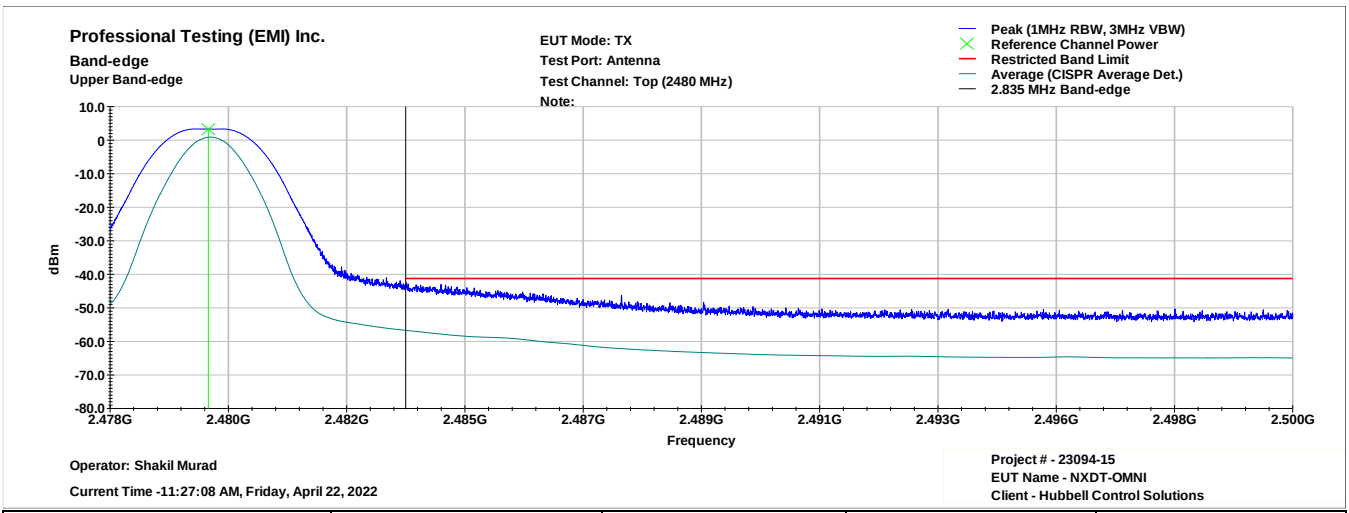
The requirement was satisfied. Plotted results appear on the following page.

Lower Band-edge



Frequency (MHz)	Corrected Reading (dBm)	Limit -20 dBc (dBm)	Margin (dB)	Results
2399.557	-49.352	-18.505	-30.847	PASS

Upper Band-edge



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
2483.500	-56.728	-41.250	-15.478	PASS

7.0 Conducted Antenna Port Spurious Emissions, Transmit Mode

7.1 Test Procedure

Conducted antenna port emissions are measured with the EUT transmitting on the required frequencies.

Table 7.1.1: Test Parameters

30 MHz to 1 GHz	1 GHz to 18 GHz	18 GHz to 25 GHz
120kHz RBW / 300kHz VBW	1MHz RBW / 3MHz VBW	1MHz RBW / 3MHz VBW
Quasi-peak	Peak & Average	Peak & Average

7.2 Test Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Unwanted Emissions
15.247 (d), 15.209 (a) // RSS-247 5.5, RSS-Gen 6.13	Antenna Port Conducted Spurious/Harmonic Emissions Transmit Mode

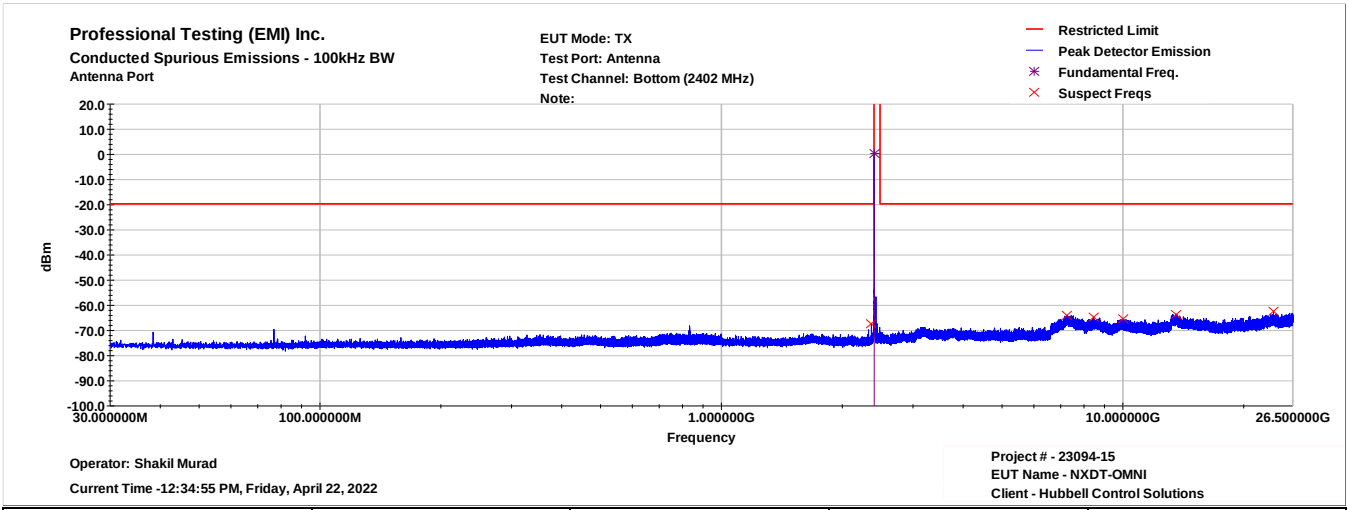
7.3 Test Results

Three channels were tested. EUT was transmitting continuously and modulated.

The top, middle and bottom channels were tested. 15.209 limits were applied to entire band for worst-case limits. The EUT satisfied the requirements.

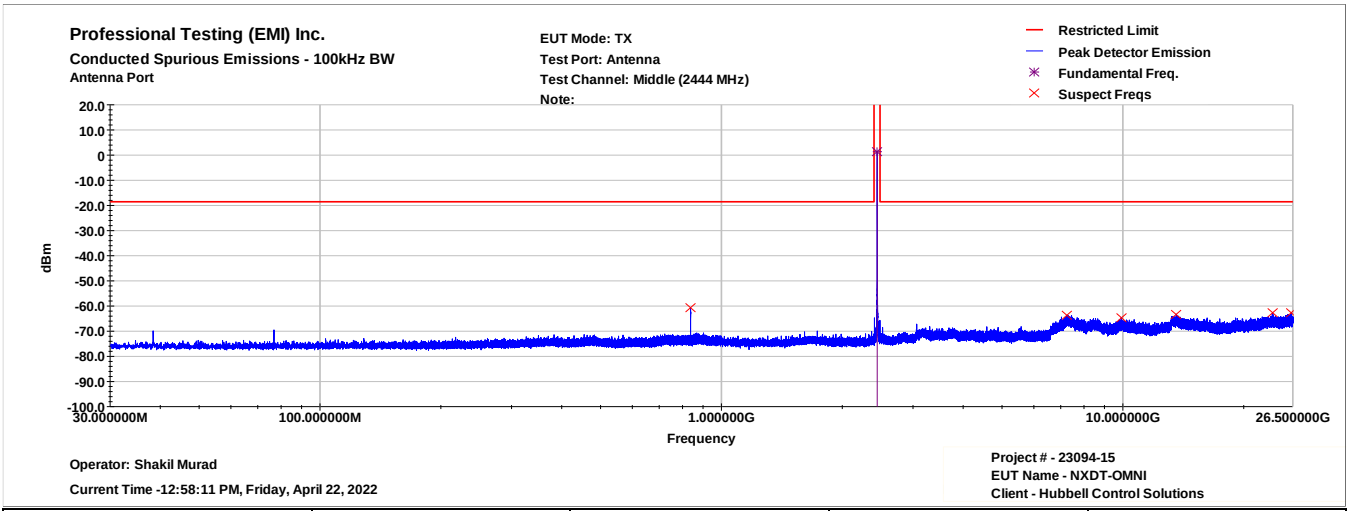
7.3.1 100 kHz Bandwidth Test data

Bottom Channel: 100 kHz Bandwidth



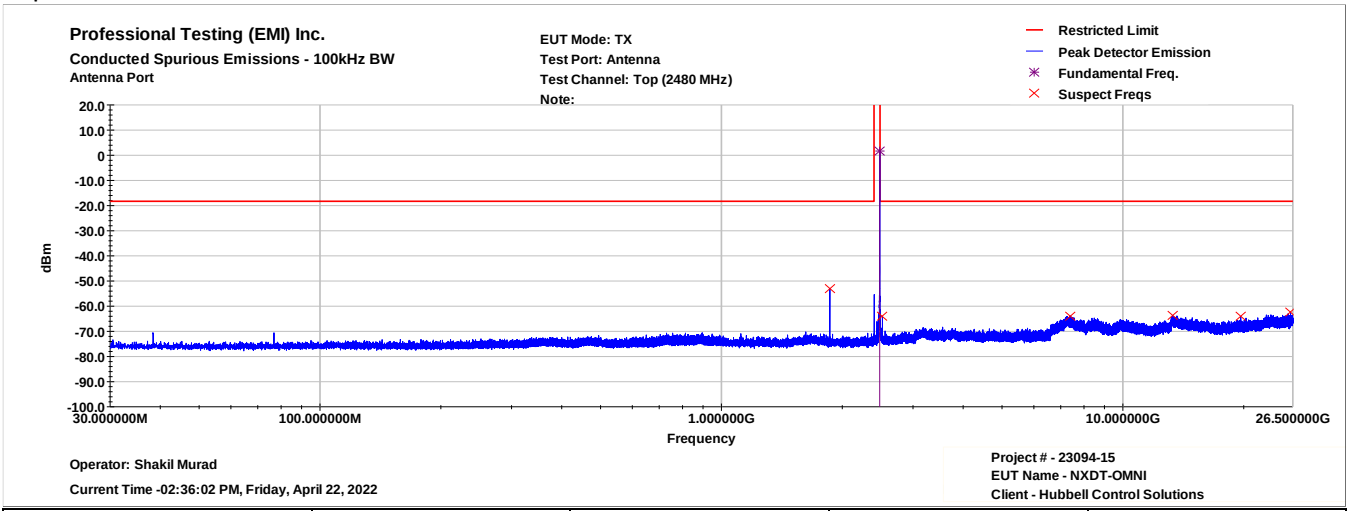
Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
2363.450	-67.411	-19.675	47.736	PASS
7253.775	-63.995	-19.675	44.320	PASS
8459.925	-64.824	-19.675	45.149	PASS
10019.175	-65.507	-19.675	45.832	PASS
13552.104	-63.535	-19.675	43.860	PASS
23721.438	-62.440	-19.675	42.765	PASS

Middle Channel: 100 kHz Bandwidth



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
837.646	-60.739	-18.567	42.172	PASS
7248.000	-63.730	-18.567	45.163	PASS
9904.500	-64.564	-18.567	45.997	PASS
13591.375	-63.271	-18.567	44.704	PASS
23596.979	-62.711	-18.567	44.144	PASS
26252.896	-62.756	-18.567	44.189	PASS

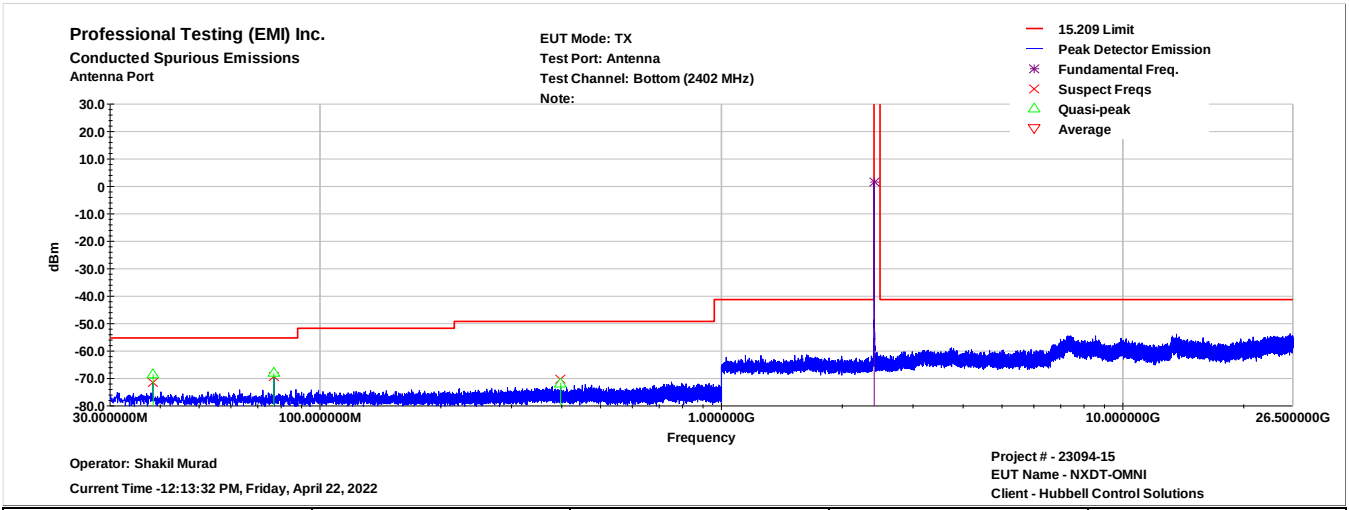
Top Channel: 100 kHz Bandwidth



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
1862.400	-52.971	-18.320	34.651	PASS
2518.275	-63.969	-18.320	45.649	PASS
7403.100	-63.954	-18.320	45.634	PASS
13316.479	-63.761	-18.320	45.441	PASS
19656.604	-64.156	-18.320	45.836	PASS
26169.521	-62.362	-18.320	44.042	PASS

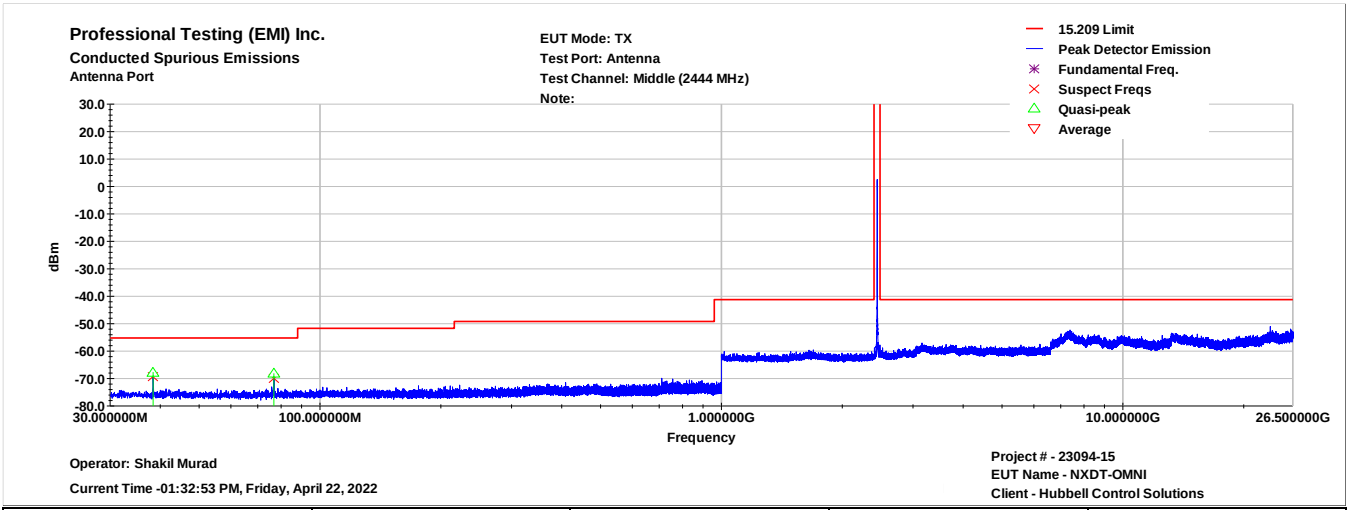
7.3.2 1 MHz Bandwidth Test data

Bottom Channel: 1 MHz Bandwidth



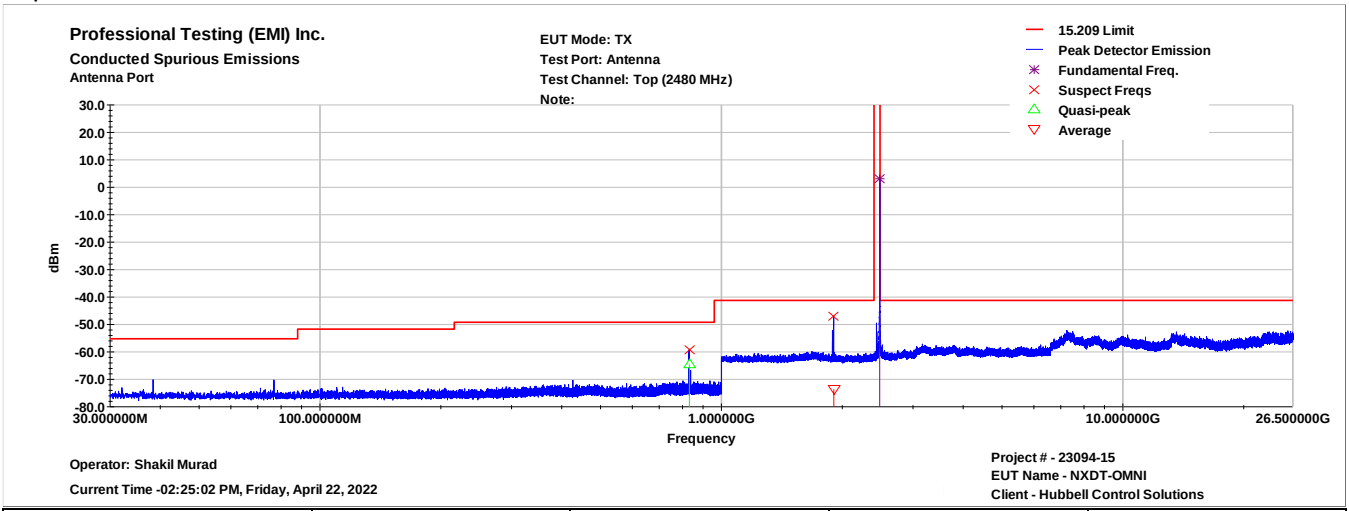
Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
38.420	-68.417	-55.230	13.187	PASS
76.781	-67.873	-55.230	12.643	PASS
397.638	-71.627	-49.210	22.417	PASS

Middle Channel: 1 MHz Bandwidth



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
38.394	-67.646	-55.230	12.416	PASS
76.769	-68.109	-55.230	12.879	PASS

Top Channel: 1 MHz Bandwidth



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
832.073	-64.567	-49.210	15.357	PASS
1905.109	-73.634	-41.250	32.384	PASS

8.0 Transmitter Radiated Spurious Emissions

8.1 Test Procedure

Radiated emissions are measured with the EUT transmitting on the required frequencies.

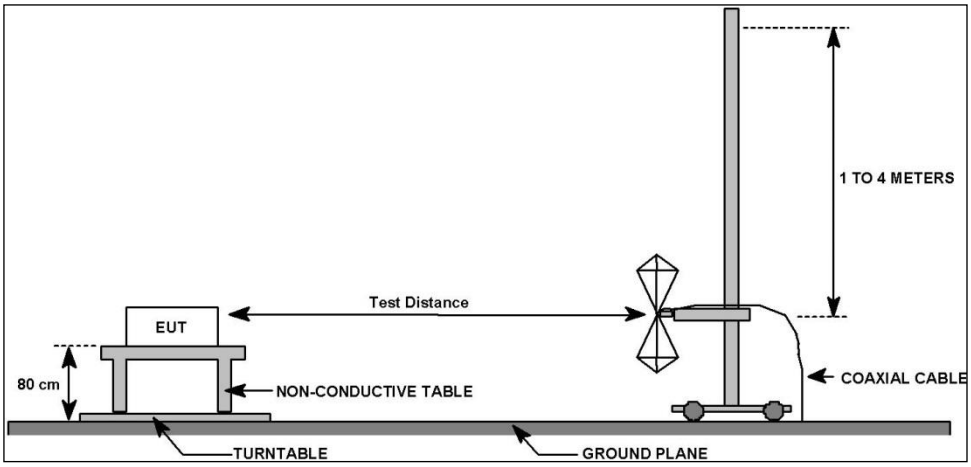


Table 8.1.1: Test Distance, Table Height, and Detection Method

30 MHz to 1 GHz	1 GHz to 18 GHz	18 GHz to 26.5 GHz
10 m, 80 cm	3 m, 1.5 m	1 m, 1.5 m
Quasi-peak	Peak & Average	Peak & Average

8.2 Test Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Parameter
15.247(d), 15.209 (a) // RSS-247 5.5, RSS-Gen 6.13 & 8.10	Field Strength of Radiated Spurious/Harmonic Emissions Transmit Mode

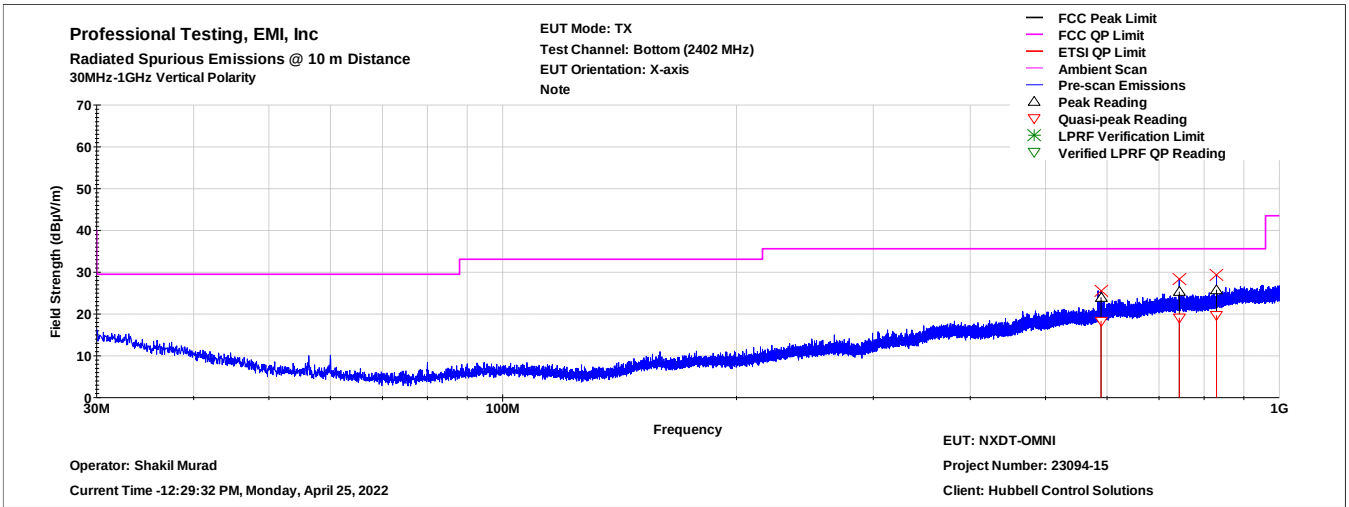
8.3 Test Results

Three channels were tested. EUT was transmitting continuously and modulated. Device tested in normal operational orientation.

The EUT satisfied the requirement. Graphical and tabular data appears below.

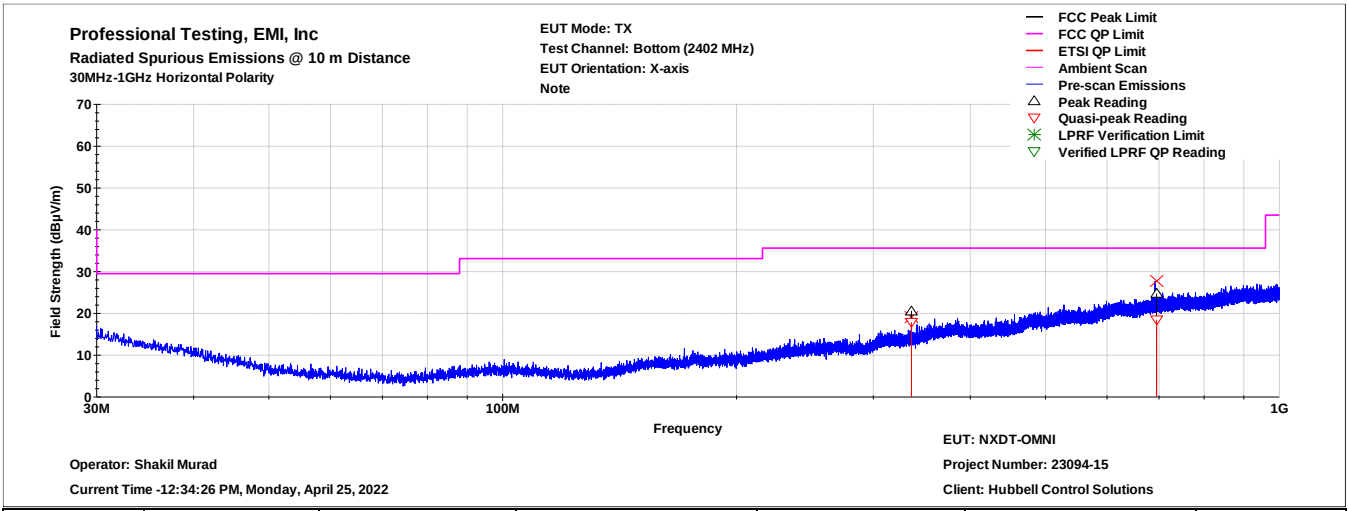
8.3.1 Middle Channel, 30 MHz to 26.5 GHz

30MHz - 1GHz Vertical Polarity Emissions Data



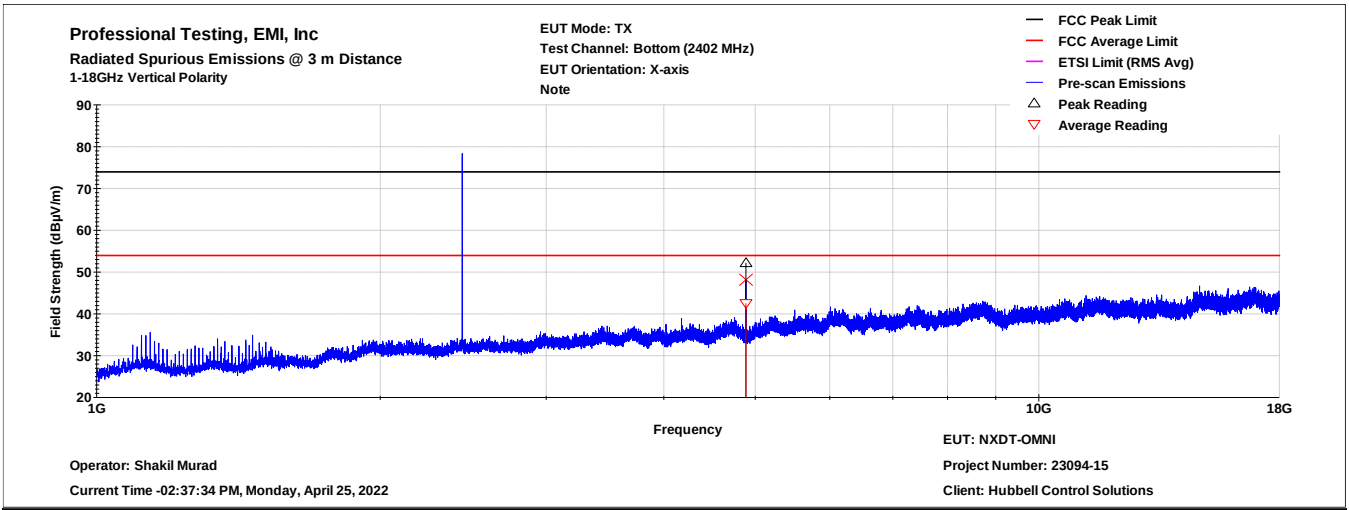
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Margin (dB)	Quasi-peak Results
589.414	89.000	363.000	18.355	35.600	-17.245	PASS
743.295	336.000	189.000	19.120	35.600	-16.480	PASS
830.086	246.000	306.000	19.692	35.600	-15.908	PASS

30MHz - 1GHz Horizontal Polarity Emissions Data



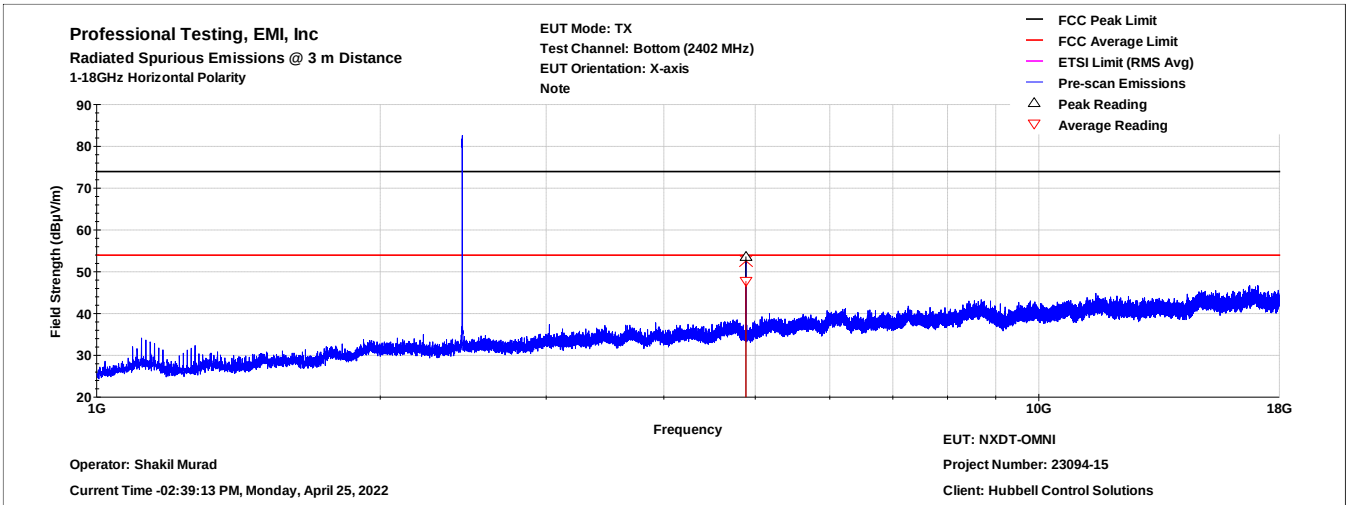
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Margin (dB)	Quasi-peak Results
336.014	107.000	257.000	17.880	35.600	-17.720	PASS
694.832	-2.000	101.000	18.483	35.600	-17.117	PASS

1GHz - 18GHz Vertical Polarity Emissions Data



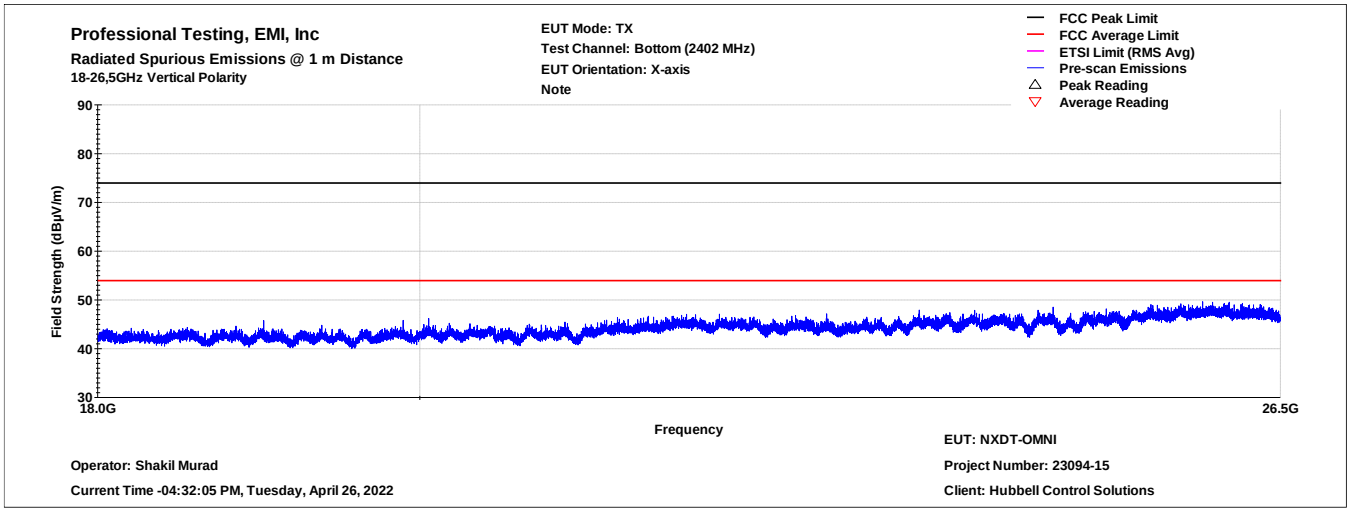
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4888.02	52	134	52.199	73.958	-21.759	PASS	42.525	53.958	-11.433	PASS

1GHz - 18GHz Horizontal Polarity Emissions Data



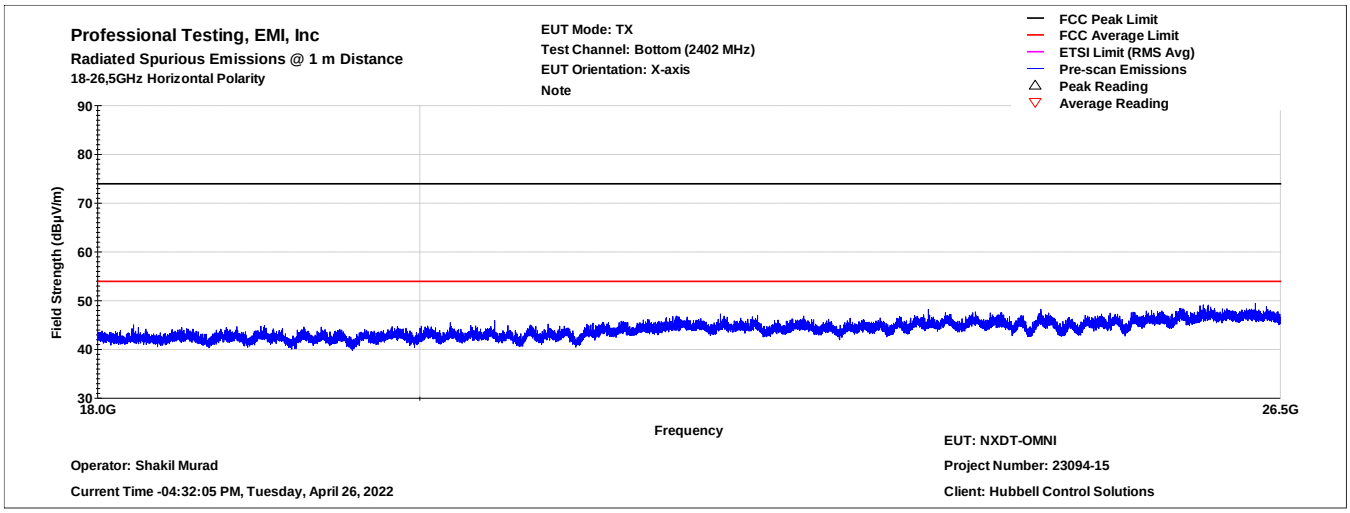
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4887.99	18	370	53.647	73.958	-20.311	PASS	47.754	53.958	-6.204	PASS

18GHz - 26.5GHz Vertical Polarity Emissions Data



Note: No emissions were observed.

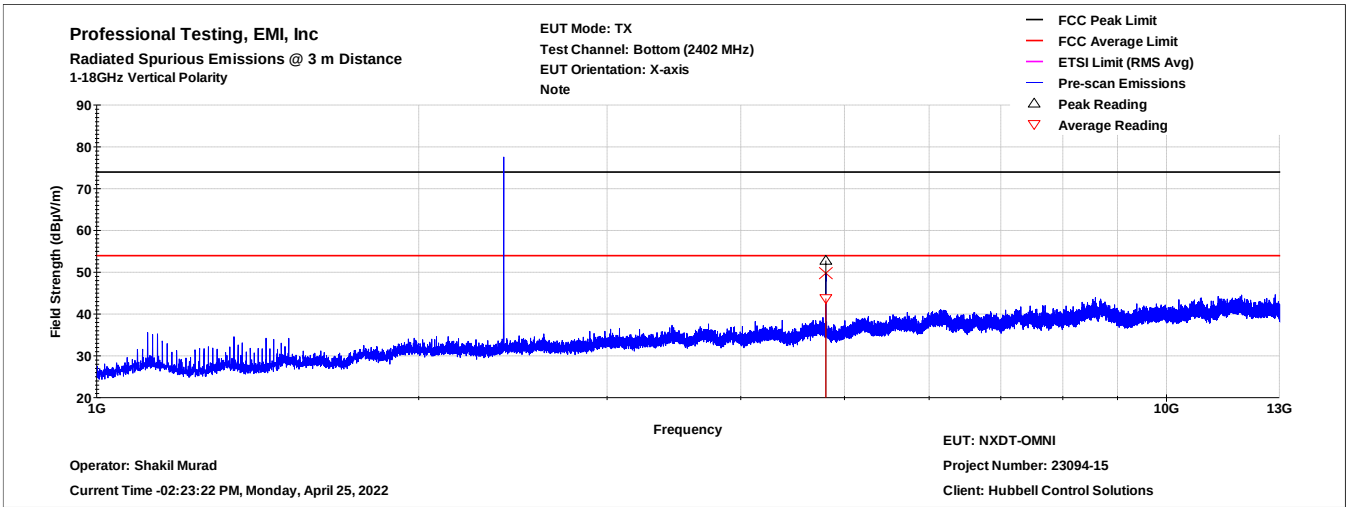
18GHz - 26.5GHz Horizontal Polarity Emissions Data



Note: No emissions were observed.

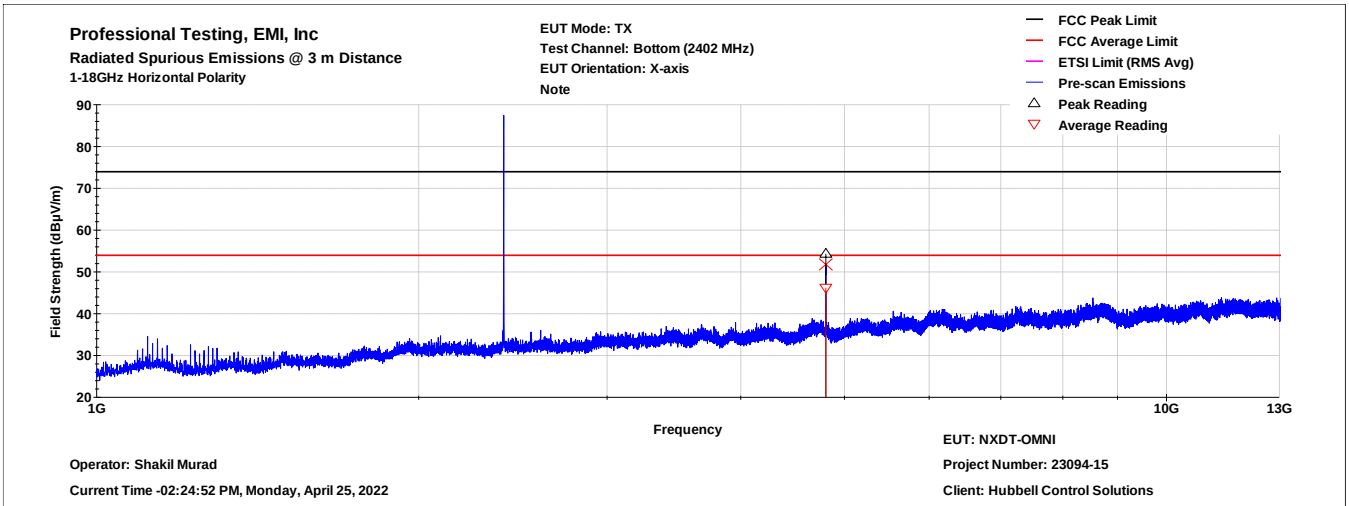
8.3.1 Bottom Channel, 1 GHz to 26.5 GHz

1GHz - 18GHz Vertical Polarity Emissions Data



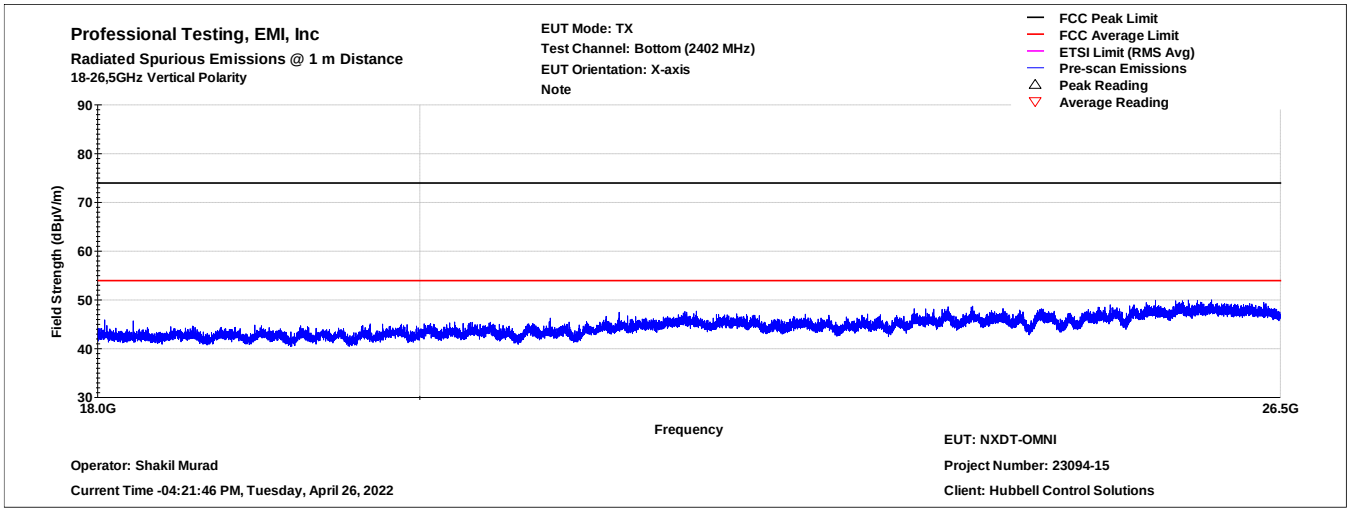
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4804.27	52	156	52.775	73.958	-21.183	PASS	43.708	53.958	-10.250	PASS

1GHz - 18GHz Horizontal Polarity Emissions Data



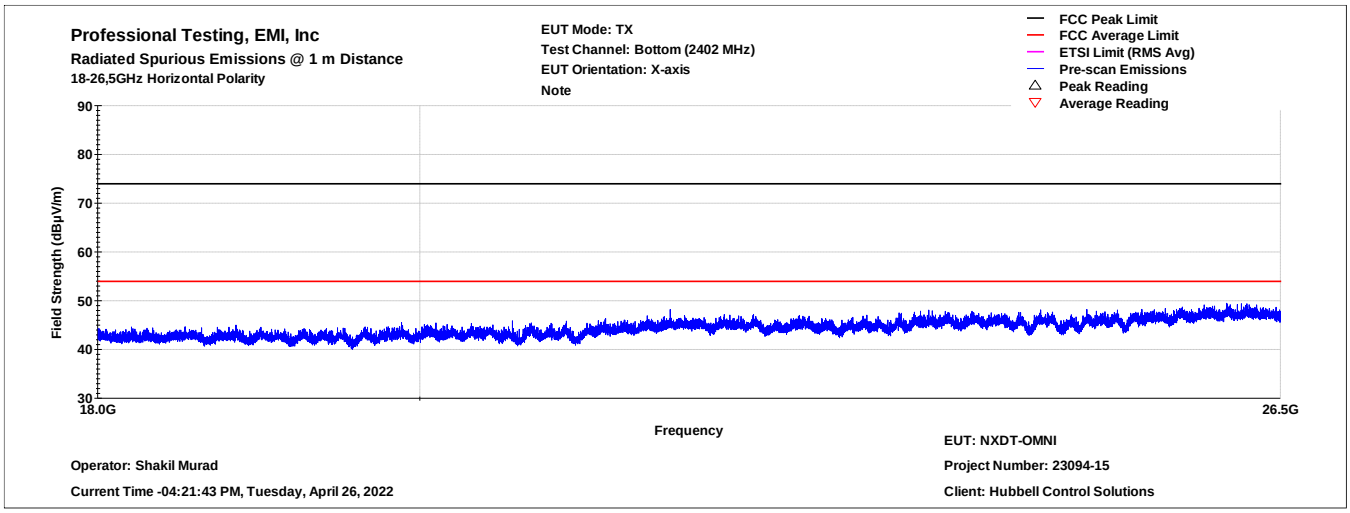
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4803.99	16	374	54.324	73.958	-19.634	PASS	46.212	53.958	-7.746	PASS

18GHz - 26.5GHz Vertical Polarity Emissions Data



Note: No emissions were observed.

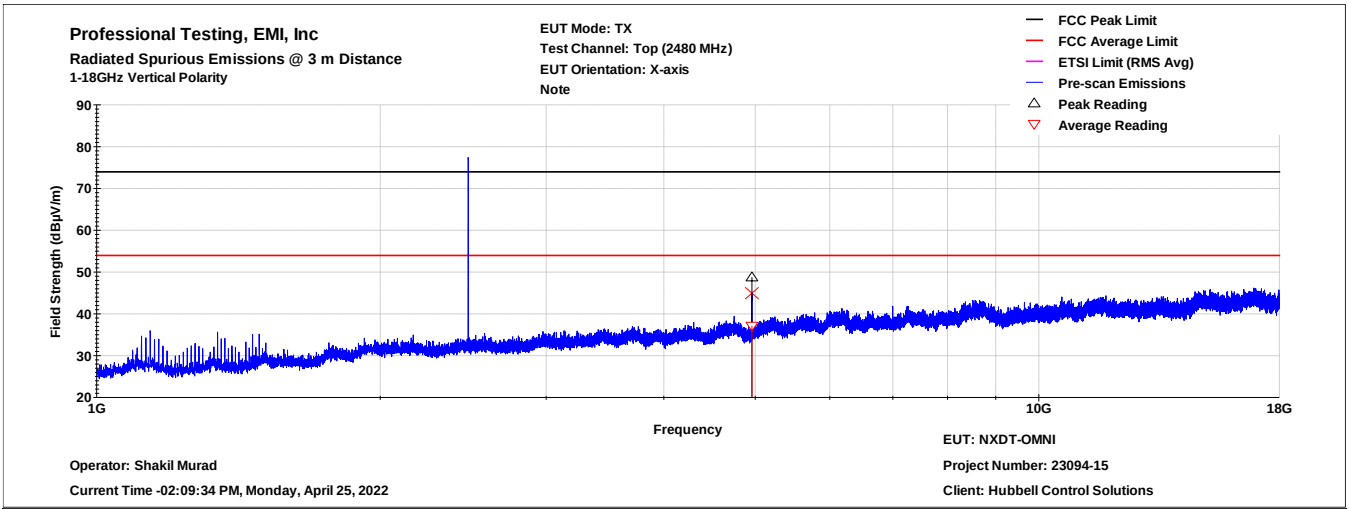
18GHz - 26.5GHz Horizontal Polarity Emissions Data



Note: No emissions were observed.

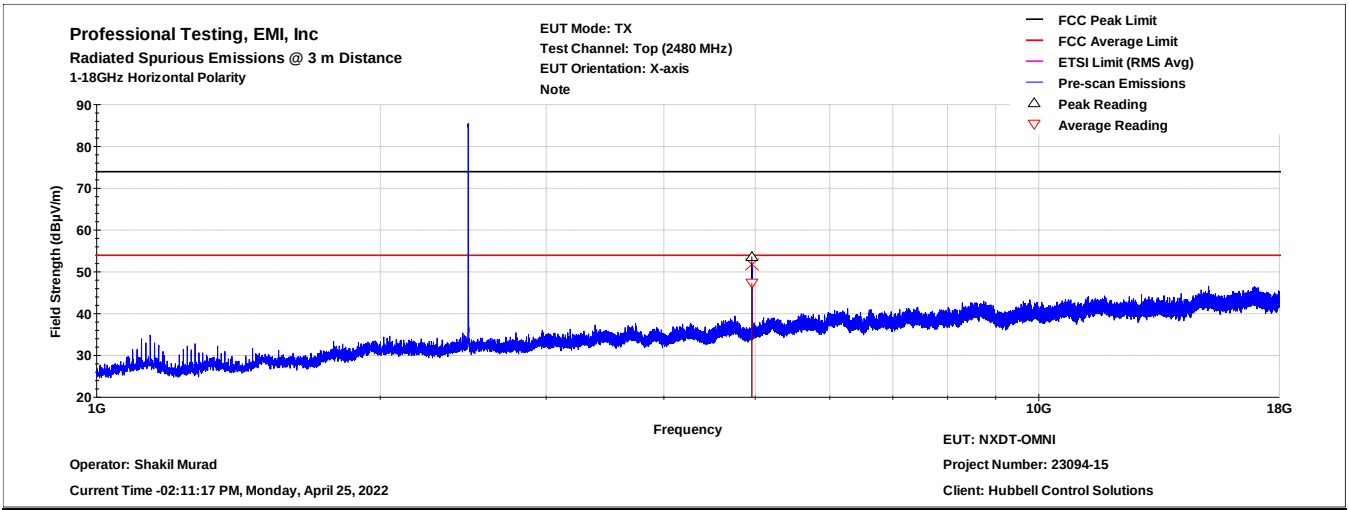
8.3.2 Top Channel, 1GHz to 26.5 GHz

1GHz - 18GHz Vertical Polarity Emissions Data



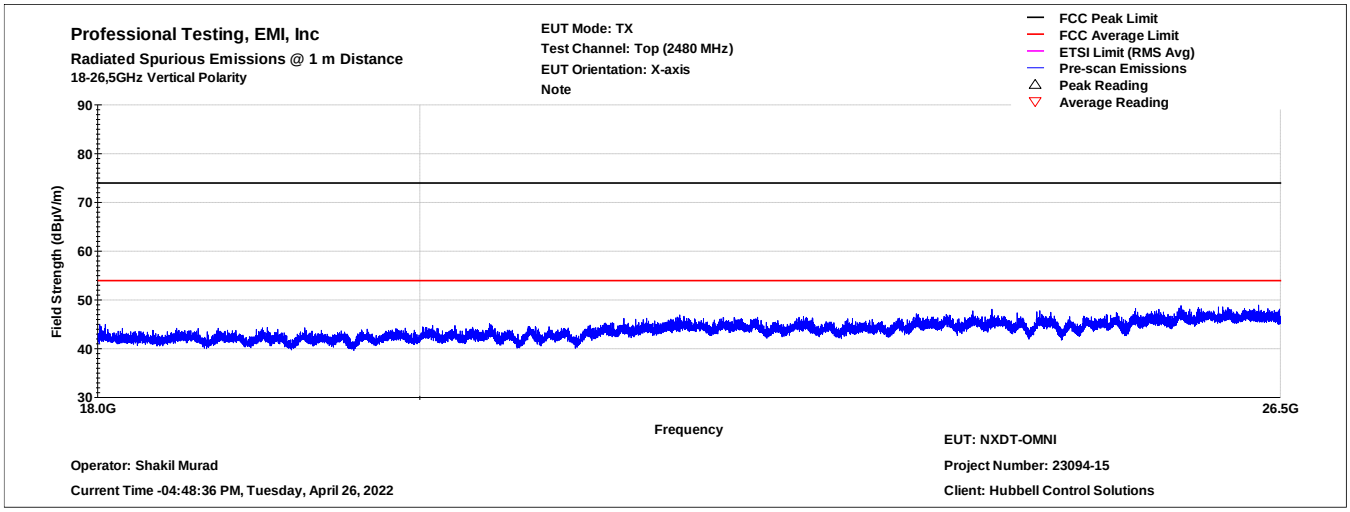
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4959.83	48	132	48.771	73.958	-25.187	PASS	37.168	53.958	-16.790	PASS

1GHz - 18GHz Horizontal Polarity Emissions Data



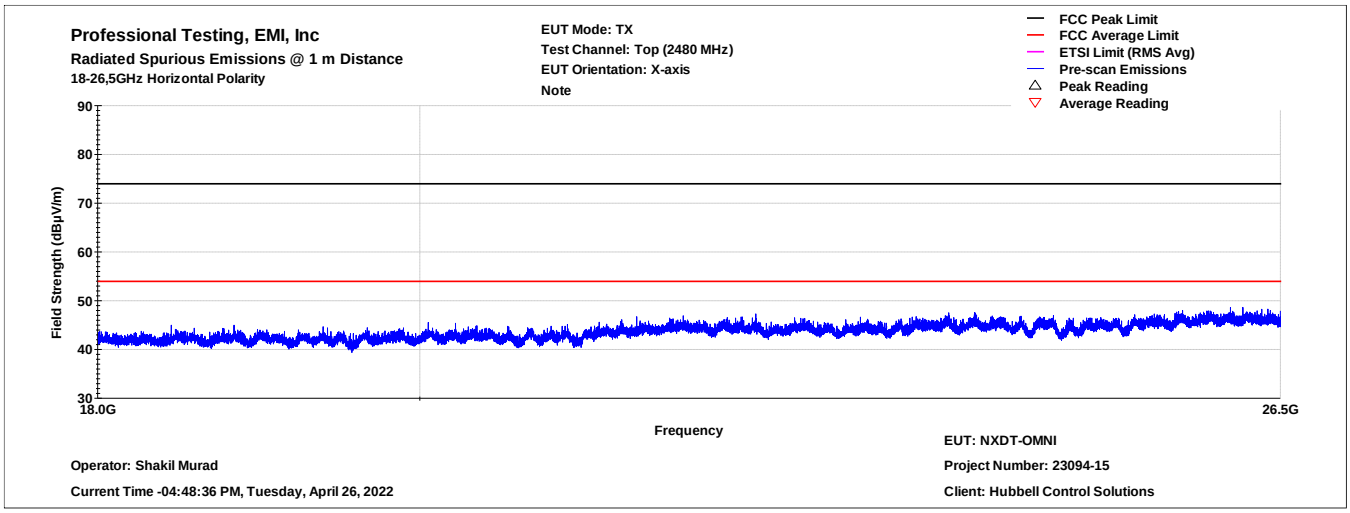
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Peak Limit (dBµV)	Peak Margin (dB)	Peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Margin (dB)	Average Results
4959.36	18	192	53.661	73.958	-20.297	PASS	47.356	53.958	-6.602	PASS

18GHz - 26.5GHz Vertical Polarity Emissions Data



Note: No emissions were observed.

18GHz - 26.5GHz Horizontal Polarity Emissions Data



Note: No emissions were observed.

9.0 Radiated Spurious Emissions, Receive Mode

9.1 Test Procedure

The EUT was in normal operating mode (Transmitting and Receiving) during this measurements.

Table 9.1.1: Test Distance, Table Height, and Detection Method

30 MHz to 1 GHz	1 GHz to 18 GHz	18 GHz to 25 GHz
10 m, 80 cm	3 m, 80 cm	1 m, 80 cm
Quasi-peak	Peak & Average	Peak & Average

9.2 Test Criteria

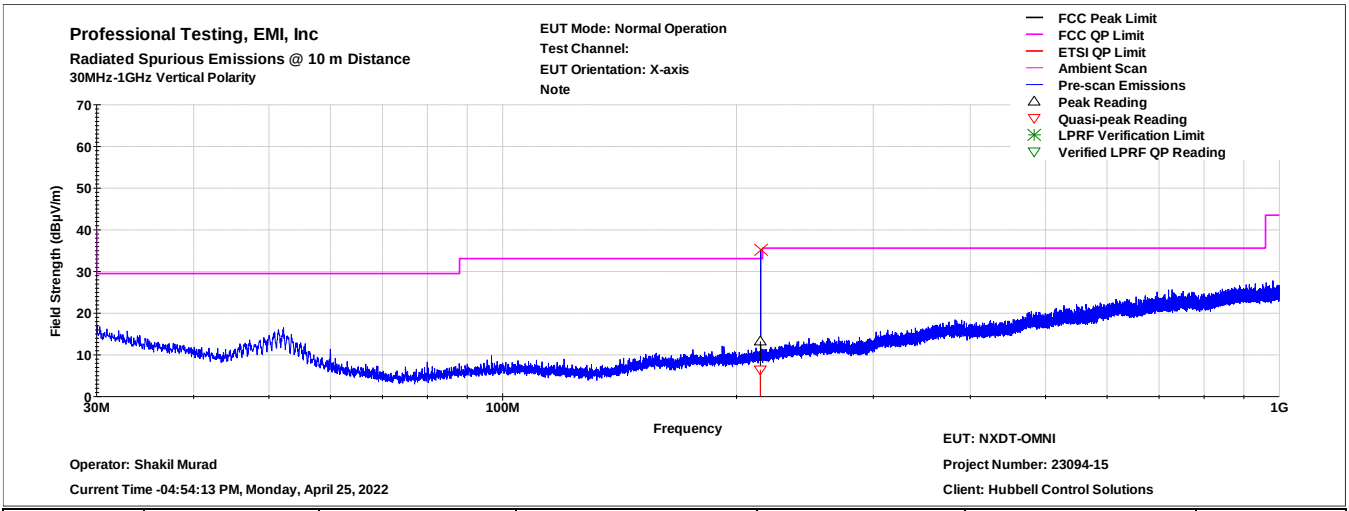
47 CFR (USA) // IC (Canada)	
Section Reference	Parameter
15.109 // RSS-Gen 7.3	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode

9.3 Test Results

The requirement was satisfied. Graphical and tabular data appears below.

9.3.1 Middle Channel 30 MHz to 14 GHz

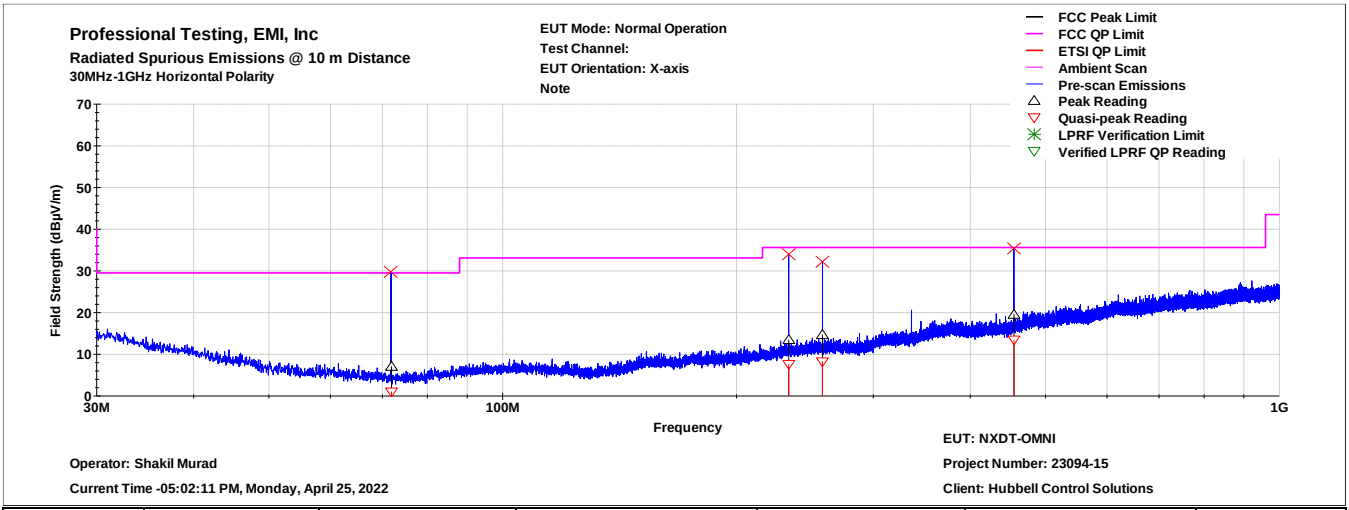
30MHz - 1GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Margin (dB)	Quasi-peak Results
214.665	335.000	144.000	6.480	33.100	-26.620	PASS

Note: above emissions are not from the ETU. This issue was investigated and was found to be spontaneous emissions from the turntable movement

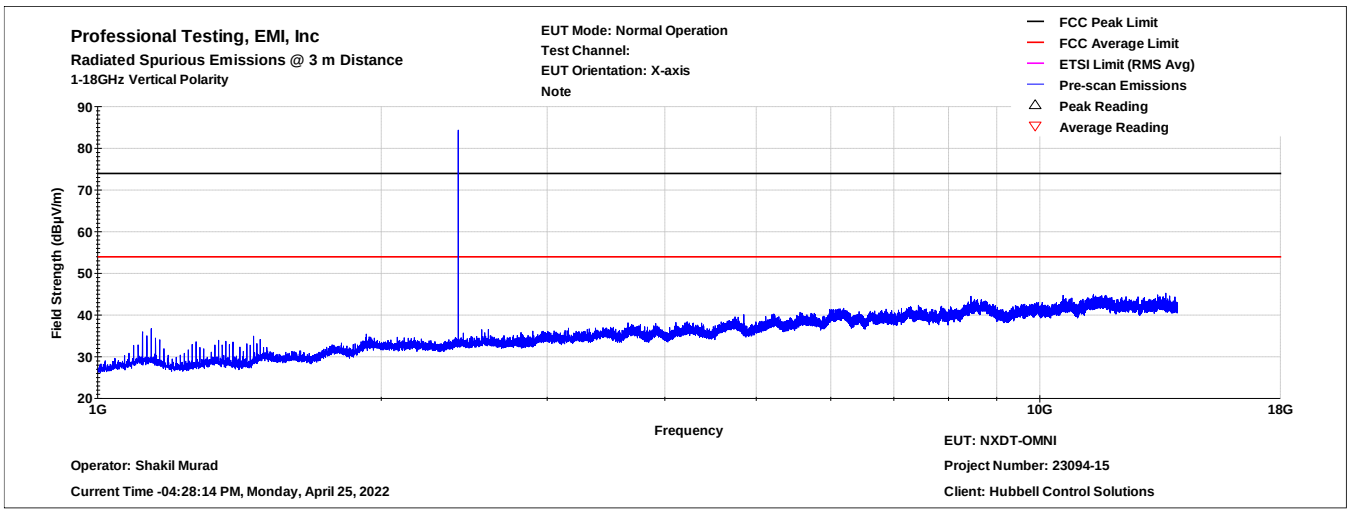
30MHz - 1GHz Horizontal Polarity Emissions Data



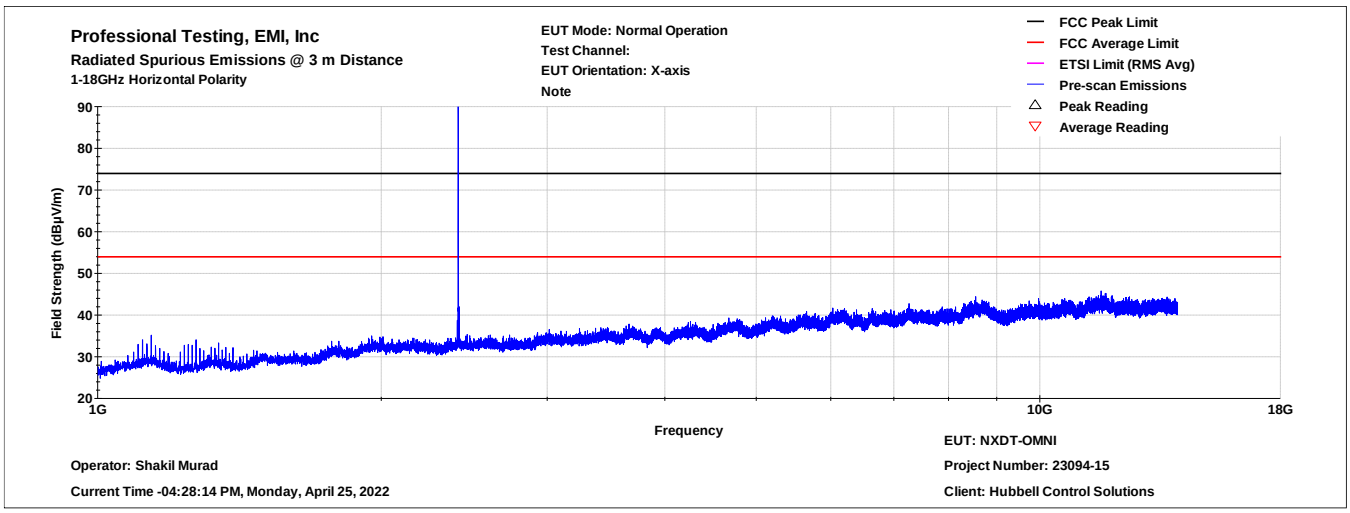
Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Margin (dB)	Quasi-peak Results
71.926	280.000	229.000	1.064	29.500	-28.436	PASS
233.518	294.000	180.000	7.612	35.600	-27.988	PASS
258.046	18.000	101.000	8.311	35.600	-27.289	PASS
455.287	224.000	324.000	13.388	35.600	-22.212	PASS

Note: above emissions are not from the ETU. This issue was investigated and was found to be spontaneous emissions from the turntable movement

1GHz - 18GHz Vertical Polarity Emissions Data



1GHz - 18GHz Horizontal Polarity Emissions Data



10.0 Antenna Construction

10.1 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.

10.2 Criteria

47 CFR (USA) // IC (Canada)	
Section Reference	Antenna Construction
15.203 // RSS-Gen 6.8	Type of Antenna(s) Type of Connector Gain

10.3 Results

Table 8.3.1 Antenna Construction Details
Chip Antenna
Manufacturer: Pulse Model/PN: W3001 Antenna peak gain: 1.5 dBi No connector. Chip is soldered to circuit board.

User cannot substitute antenna.

Gain is under maximum limit of 6 dBi.

The requirement was satisfied.

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.

12.0 Test Equipment

12.1 Conducted Measurements at the Antenna Port

Asset#	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
2295	Keysight	E4440A-AYZ	PSA Spectrum Analyzer	MY46186204	1/5/2023
1117	HP	6296A	Power Supply, DC, 60V 3A	1552A02489	N/A

12.2 Radiated Spurious Emissions

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:			2020_RE_Unintentional_TILE7_v4		
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
1509A	Braden	TDK 10M	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	4/9/2023
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1326	EMCO	1051-12	Controller, Antenna Mast	9101-1564	N/A
1244	EMCO	1050C	Controller, Antenna Mast	1100	N/A
C027	none	RG214	Cable Coax, N-N, 25m, 25MHz - 1GHz	None	9/14/2022
C233	Sucoflex	None	Cable, SMA-SMA, 7.62m, 9kHz - 1.5 GHz, Purple	None	10/22/2023
2172	ETS-Lindgren	3142C	Antenna, Biconilog, 26 MHz-3GHz	49383	3/11/2023
1457	HP	8447D	Preamp, .1-1300MHz	1937A02800	10/21/2022
C289	Pasternack	PE354-24	Cable, N-SMA, 0.610m Blue	1310	9/9/2022
C030	none	none	Cable Coax, N-N, 30m, 1 - 18GHz	None	9/15/2022
C038	none	LMR-400	Cable Coax, N-N, 0.15m	None	N/A
1780	Dytran	3032A	Accelerometer, Voltage Mode	2703	3/3/2024
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, 100MHz-18GHz	None	1/14/2024
745	0	ZKL1500-1	Amplifier, 40dB, 0.1-1500MHz	618-00180	N/A
1326	EMCO	1051-12	Controller, Antenna Mast	9101-1564	N/A
1542	A.H. Systems	SAS-572	Antenna, Horn 18-26.5GHz, 20dB gain	225	N/A
1973	Agilent	83017A	Amplifier, Microwave 0.5-26.5 GHz	MY39500497	11/10/2022
1937	Agilent	E4440A - AYZ	PSA , 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	11/12/2022

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 Nemko 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 Nemko 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