
Project #: 23494-15

Company: Hubbell Control Solutions

EUT Model(s): NXSMDT-LH and NXSMIR-LH

FCC and Industry Canada

Wireless Test Report

Prepared for:

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

By

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January 25, 2023

Written by

Shakil Murad
Wireless Engineer

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Compliance Certificate

FCC MRA Designation Number: US5270

ANAB Accreditation Number: AT-3165.01

Applicant	Device & Test Identification
Hubbell Control Solutions 710 Hesters Crossing Rd, Suite 100 Round Rock, TX 78681	Model(s): NXSMDT-LH and NXSMIR-LH FCC ID(s): YH9NXSMDT-LH ISED(s): 9044A-NXSMDTLH Laboratory Project ID: 23494-15

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 <u>2400-2483.5 MHz</u>
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 USA, 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.



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 USA, 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 NXSMMDT-LH and NXSMIR-LH	N/A	2.4GHz Bluetooth Low Energy Wireless Transmitter

NXSMMDT-LH and NXSMIR-LH represent a family of electrical identical variants. The following model numbers are represented by the data contained in this test report:

NXSMMDT-LH0-WH	NXSMIR-LH0-WH
NXSMMDT-LH1-WH	NXSMIR-LH1-WH
NXSMMDT-LH2-WH	NXSMIR-LH2-WH
NXSMMDT-LH0-BK	NXSMIR-LH0-BK
NXSMMDT-LH1-BK	NXSMIR-LH1-BK
NXSMMDT-LH2-BK	NXSMIR-LH2-BK
NXSMMDT-LH0-GY	NXSMIR-LH0-GY
NXSMMDT-LH1-GY	NXSMIR-LH1-GY
NXSMMDT-LH2-GY	NXSMIR-LH2-GY
NXSMMDT-LH0-RD	NXSMIR-LH0-RD
NXSMMDT-LH1-RD	NXSMIR-LH1-RD
NXSMMDT-LH2-RD	NXSMIR-LH2-RD
NXSMMDT-LH0-LA	NXSMIR-LH0-LA
NXSMMDT-LH1-LA	NXSMIR-LH1-LA
NXSMMDT-LH2-LA	NXSMIR-LH2-LA
NXSMMDT-LH0-IV	NXSMIR-LH0-IV
NXSMMDT-LH1-IV	NXSMIR-LH1-IV
NXSMMDT-LH2-IV	NXSMIR-LH2-IV

Note: References to NXSMMDT-LH-X in report data corresponds to model NXSMMDT-LH0-WH and references to NXSMIR-LH-X correspond to model NXSMMDT-LH0-WH.

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. This device consists of a single family comprised of 2 models. The difference between the models is the presence (or lack thereof) of IR components. All PCB and RF components are identical between both models, and all RF tests were conducted on both models to verify that they exhibited electrically identical performance. Data shown for NXSMMDT-LH0-WH model except for radiated spurious, in which data is presented for both models.

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 USA semi-anechoic facility designated Site 45 (FCC 905409, 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 (ANAB). 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

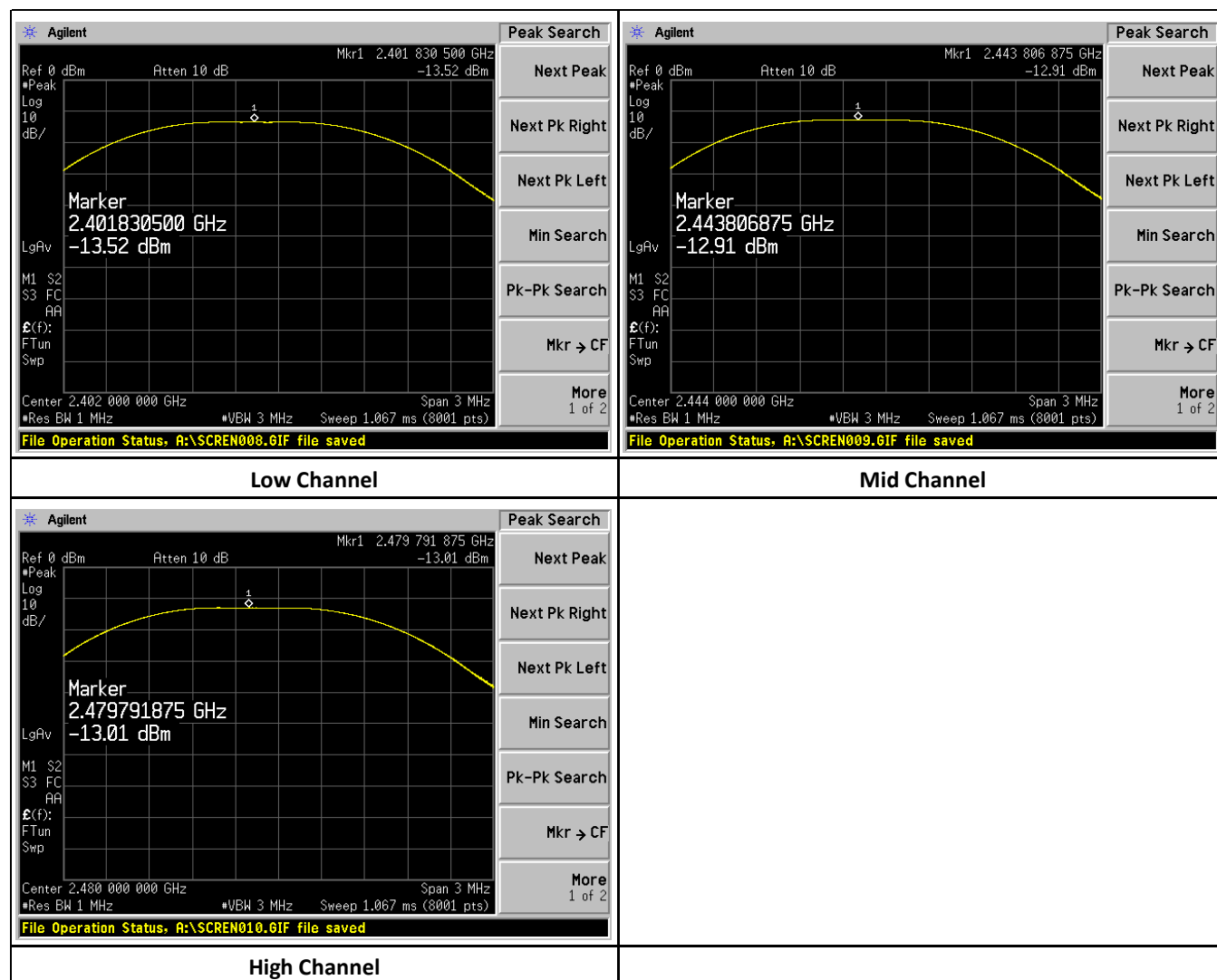
47 CFR (USA) // IC (Canada)	
Section Reference	Conducted Power Limit
15.247(b)(3) // RSS-247 (d)	1 W peak (+30dBm)

2.3 Test Results, Peak Power – Model: NXSMDT-LH0-WH

Peak Output Power - Conducted Test Data																			
Project Number:		23494-15				Test Date(s):		9/13/2022											
Environmental Conditions:		Temperature		21	°C		Humidity		39	RH		Barometric Pressure		29.99	in Hg				
EUT (6 or 20 dB) Bandwidth:		0.660		MHz															
Measurement Parameters:		RBW		1	MHz		VBW		3	MHz		Span		3	MHz		Detector		Peak
Channel	Frequency	Measured Power		Attenuator Factor			Corrected Power				Limit			Test Result					
	(MHz)	(dBm)		(dB)			(dBm)				(dBm)								
Low	2402	-13.52		20.12			6.6				30			Pass					
Mid	2444	-12.91		20.12			7.21				30			Pass					
High	2480	-13.01		20.12			7.11				30			Pass					

The requirements were satisfied.

Peak output power test plots:



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 – Model: NXSM-DT-LH0-WH

Occupied Bandwidth - Conducted Test Data													
Project Number:		23494-15				Test Date(s):		9/13/2022					
Environmental Conditions:		Temperature		21	°C	Humidity		39	RH	Barometric Pressure		29.99	in Hg
Measurement Parameters:		RBW	100	kHz	VBW	300	kHz	Span	3	MHz	Detector	Peak	
Measurement Bandwidth:				6	dB								
Channel	Frequency		Measured Bandwidth				Reported Minimum Bandwidth						
	(MHz)		(kHz)				(kHz)						
Low	2402		688.919				659.668						
Mid	2444		692.547										
High	2480		659.668										
Measurement Bandwidth:				99	%								
Channel	Frequency		Measured Bandwidth				Reported Maximum Bandwidth						
	(MHz)		(kHz)				(kHz)						
Low	2402		1049				1055.9						
Mid	2444		1055.9										
High	2480		1053										

The EUT met the requirements.

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

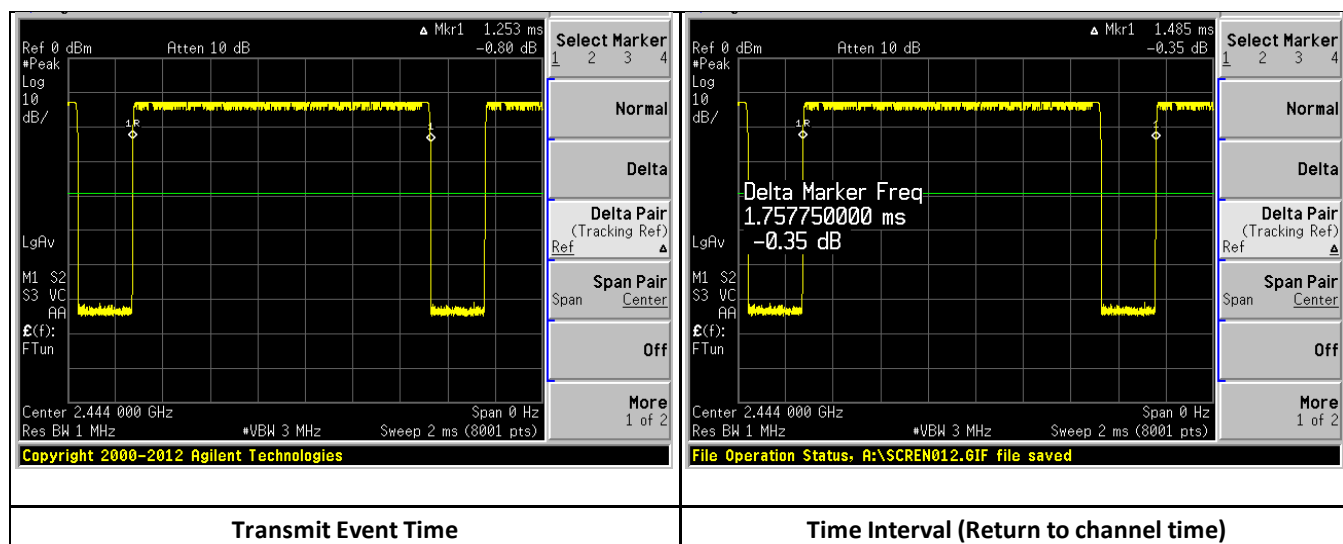


4.0 Duty Cycle

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.

4.1 Test Results, Duty Cycle – Model: NXSMDT-LH0-WH

Dyty Cycle - Conducted Test Data														
Project Number:		23494-15				Test Date(s):		9/13/2022						
Environmental Conditions:		Temperature		21	°C	Humidity		39	RH		Barometric Pressure		29.99	in Hg
Measurement Parameters:			RBW	1	MHz	VBW	3	MHz	Span	0	MHz	Detector	Peak	
On Time (ms)		Max On Time Allowed (ms)		On Time Result	Time Interval (ms)		Duty Cycle Factor (dB) (20 * Log(On time/Interval)				Duty Cycle Factor Allowed (dB)			
1.253		400		Pass	1.485		-1.48				-20			
RF Exposure Duty Cycle Reduction Factor (10 * Log(On Time/Period), (dB)											-0.7			



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

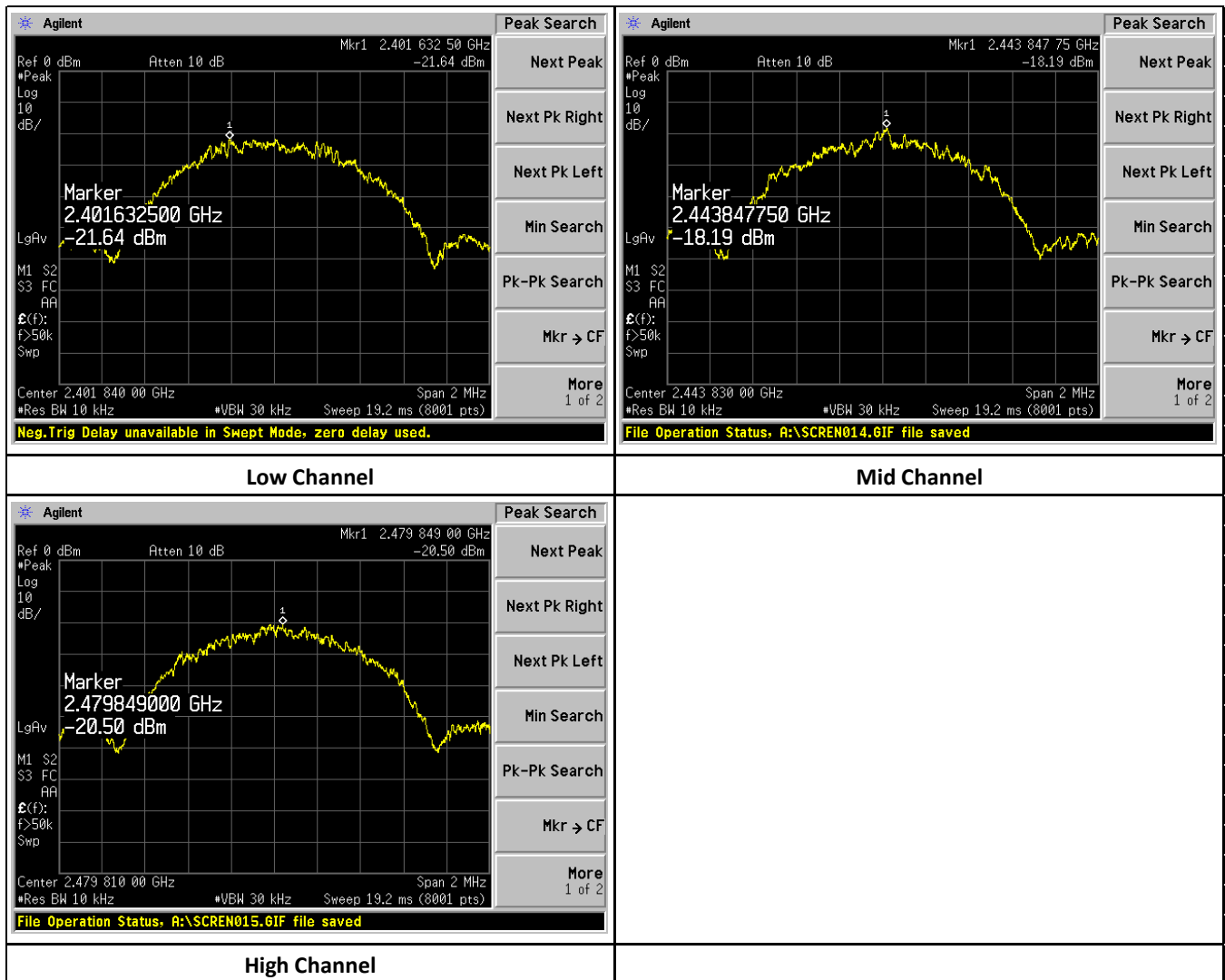
47 CFR (USA) // IC (Canada)	
Section Reference	Power Spectral Density, Conducted Limit
15.247(e) // RSS-247 5.2 (b)	8 dBm / 3 kHz

5.3 Test Results, Power Spectral Density – Model: NXSMMDT-LH0-WH

Power Spectral Density - Conducted Test Data															
Project Number:		23494-15				Test Date(s):		9/13/2022							
Environmental Conditions:		Temperature		21	°C	Humidity		39	RH		Barometric Pressure		29.99	in Hg	
EUT Channel Bandwidth:		0.66		MHz											
Measurement Parameters:		RBW		10	kHz	VBW		30	kHz	Span		2	MHz	Detector	Peak
Channel	Frequency	Measured Power	Attenuator Factor		Corrected Power			Limit		Test Result					
	(MHz)	(dBm)	(dB)		(dBm)			(dBm)							
Low	2402	-21.64	20.12		-1.52			8		Pass					
Mid	2444	-18.19	20.12		1.93			8		Pass					
High	2480	-20.5	20.12		-0.38			8		Pass					

The requirements were satisfied.

Power Spectral Density test plots:



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:

$$\text{Given EIRP} = E_{\text{dB}\mu\text{V/m}} + 20\text{Log}_{10}(d) - 104.8$$

$$\text{EIRP} = 54 \text{ dB}\mu\text{V/m} + 20\text{Log}_{10}(3 \text{ m}) - 104.8 \text{ dB} = -41.25 \text{ dBm} \text{ (commonly -41 dBm is applied)}$$

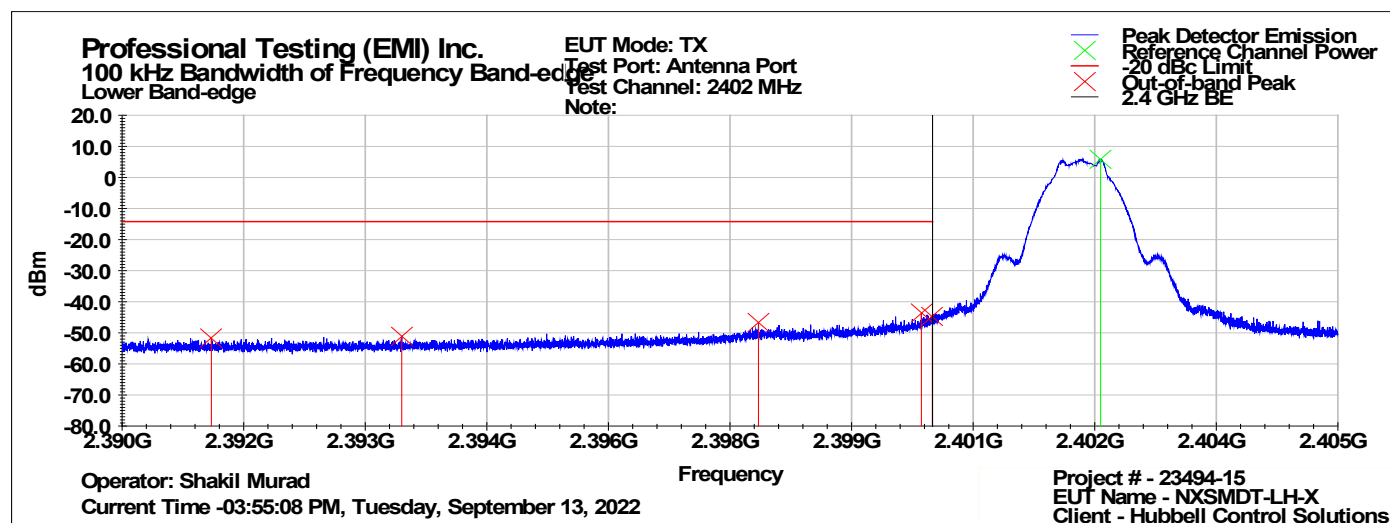
Emissions below band were measured with peak detection in 100 kHz RBW.

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.

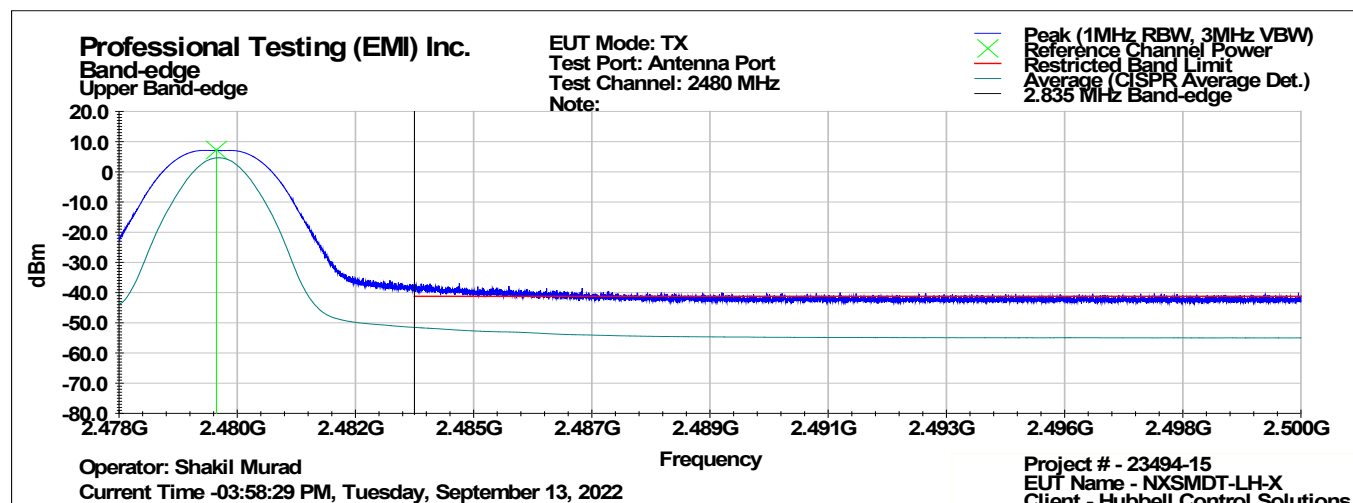
6.3.1 Test data – Model: NXSMMDT-LH0-WH

Lower Band-edge



Frequency (MHz)	Corrected Reading (dBm)	Limit -20 dBc (dBm)	Margin (dB)	Results
2391.103	-51.692	-14.246	-37.446	PASS
2393.450	-51.266	-14.246	-37.020	PASS
2397.853	-46.802	-14.246	-32.556	PASS
2399.863	-43.750	-14.246	-29.504	PASS
2399.997	-44.685	-14.246	-30.439	PASS

Upper Band-edge



Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
2483.500	-51.540	-41.250	-10.290	PASS
2483.709	-51.769	-41.250	-10.519	PASS
2484.718	-52.800	-41.250	-11.550	PASS
2485.788	-53.435	-41.250	-12.185	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

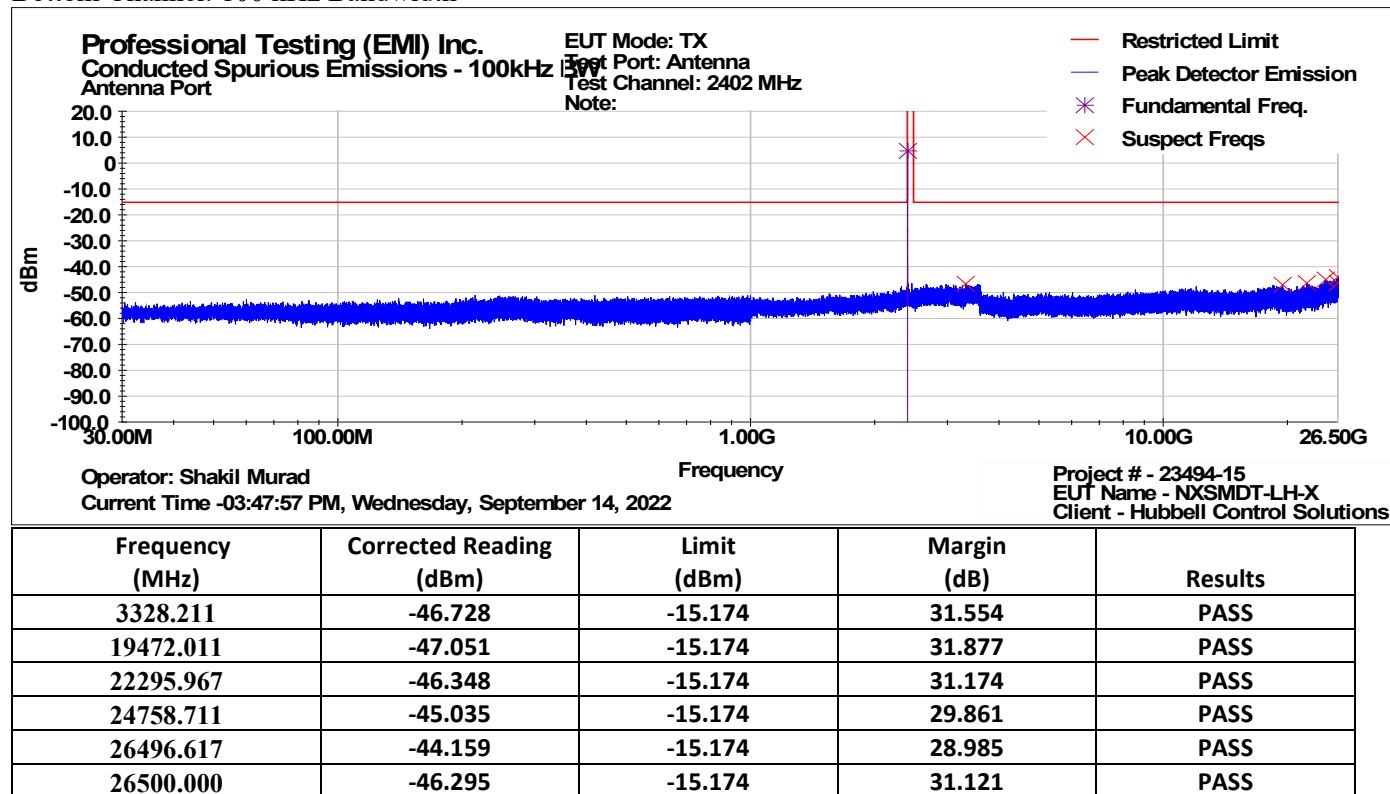
7.3 Test Results

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

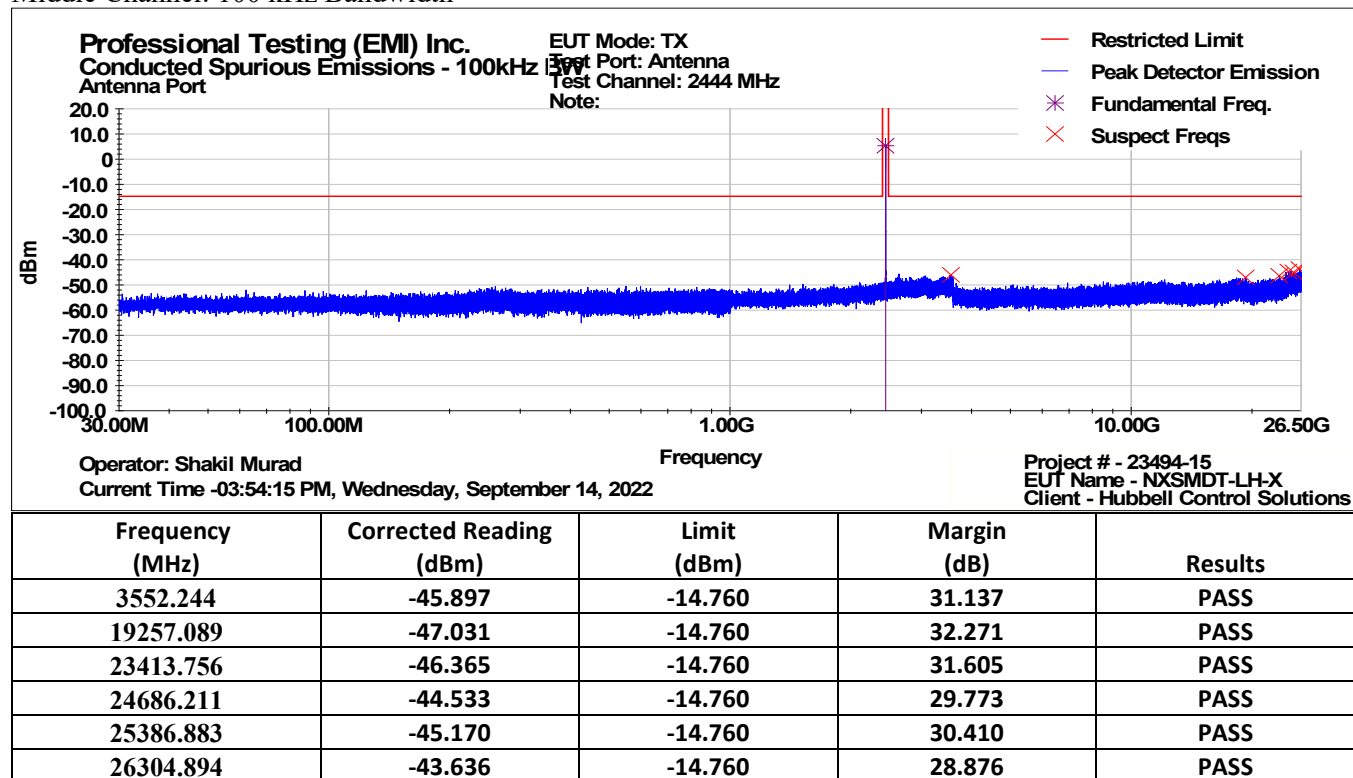
The top, middle and bottom channels were tested. 15.209 limits were applied to entire band for worst-case limits. The EUT satisfied the requirements.

7.3.1 100 kHz Bandwidth Test data – Model: NXSM-DT-LH0-WH

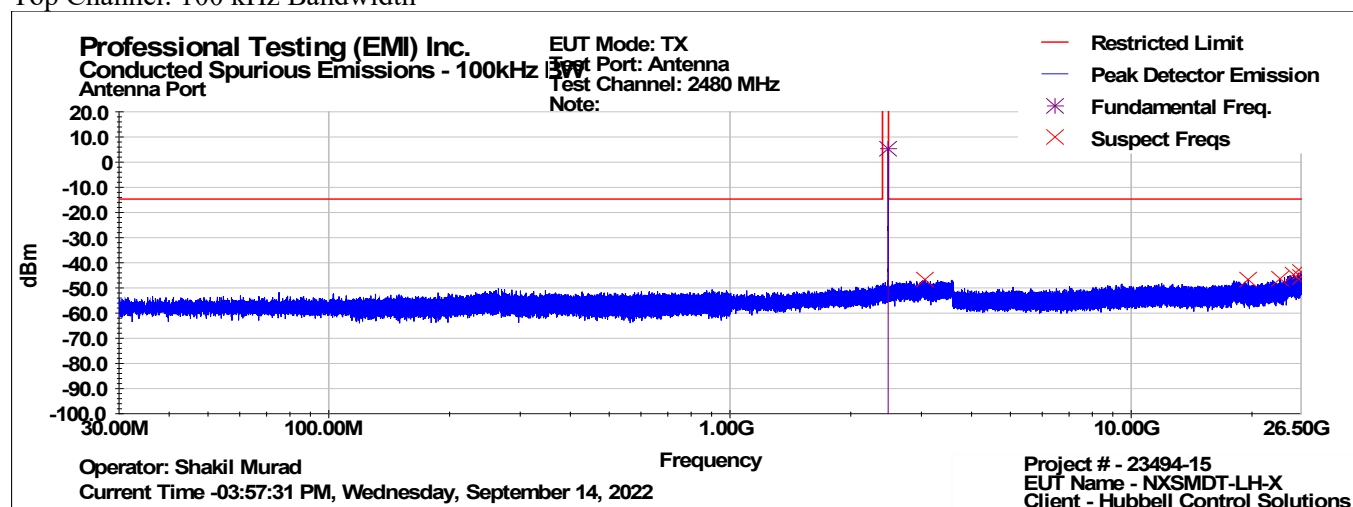
Bottom Channel: 100 kHz Bandwidth



Middle Channel: 100 kHz Bandwidth



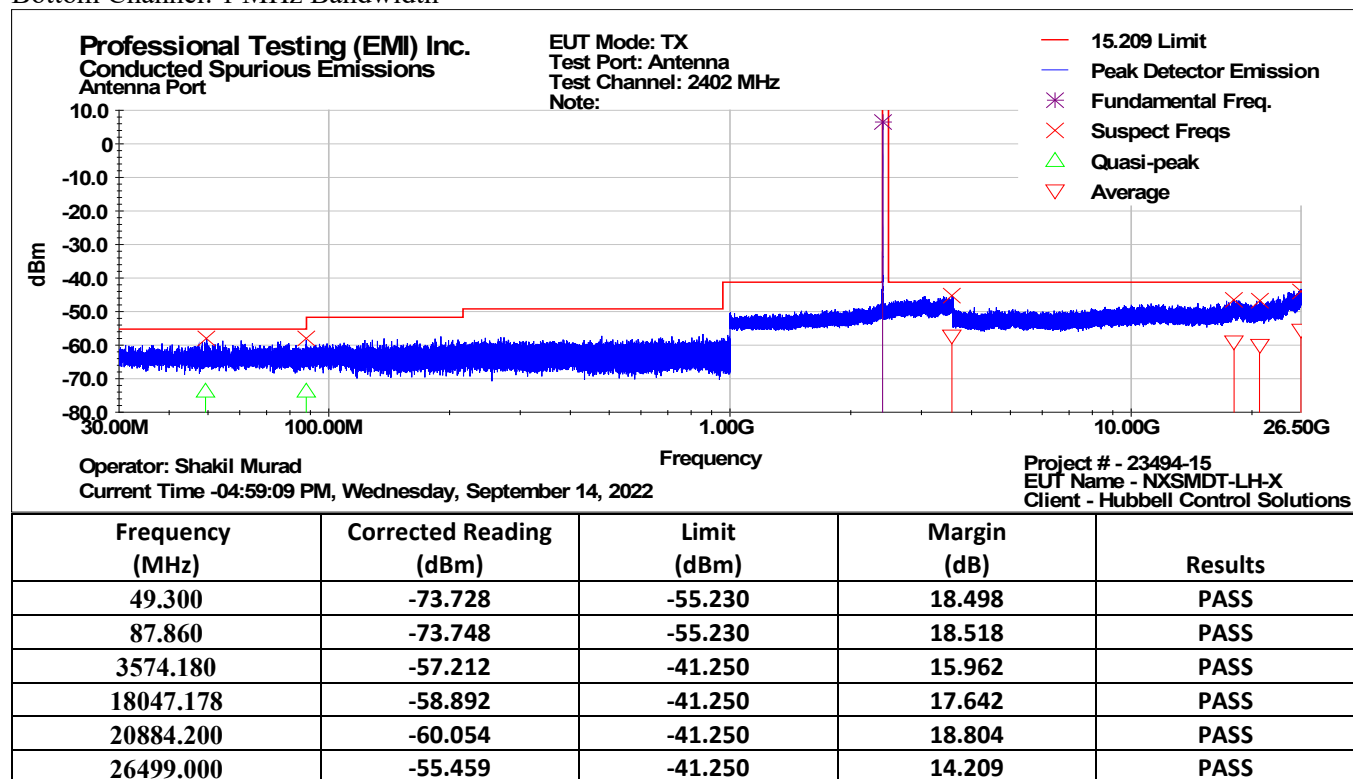
Top Channel: 100 kHz Bandwidth



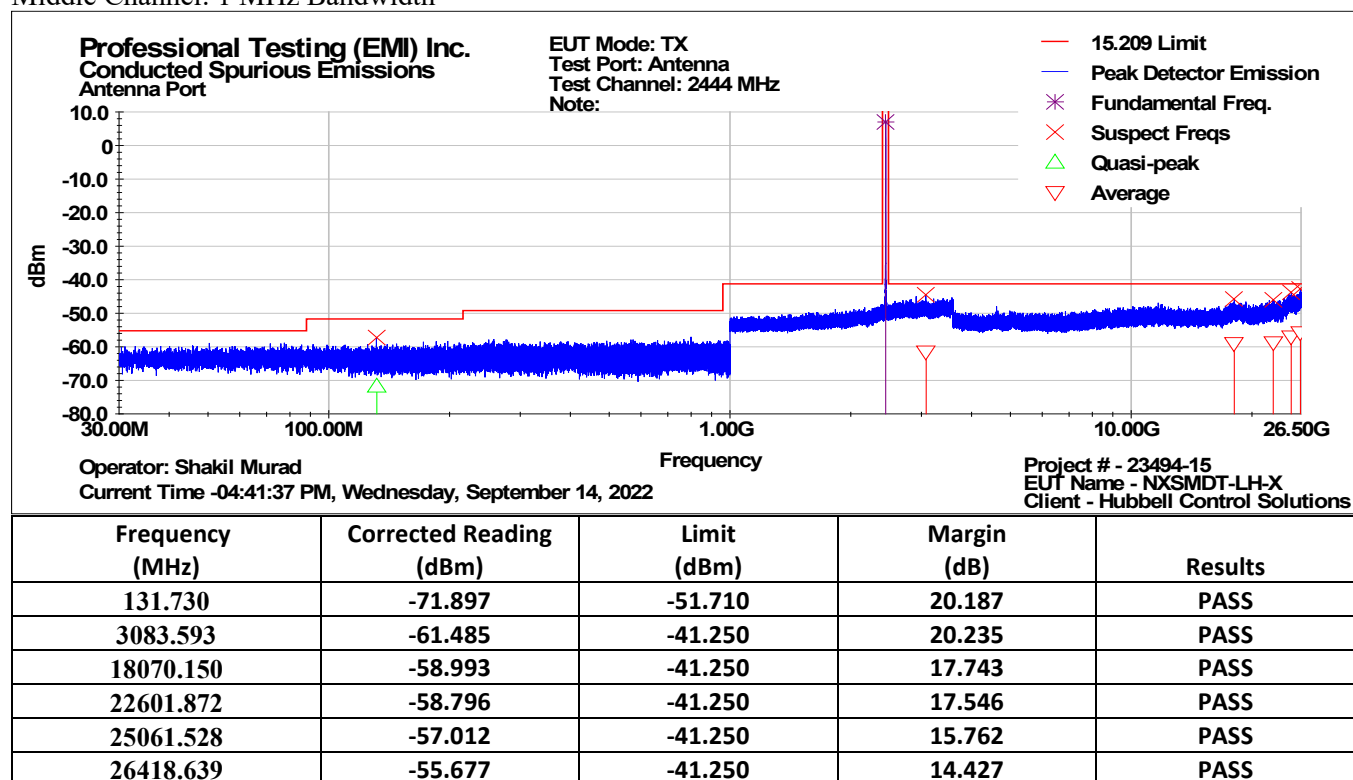
Frequency (MHz)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)	Results
3060.789	-46.577	-14.709	31.868	PASS
19577.861	-46.653	-14.709	31.944	PASS
23458.061	-46.357	-14.709	31.648	PASS
25433.606	-44.603	-14.709	29.894	PASS
26467.456	-43.831	-14.709	29.122	PASS
26499.678	-45.714	-14.709	31.005	PASS

7.3.2 1 MHz Bandwidth Test data – Model: NXSMDT-LH0-WH

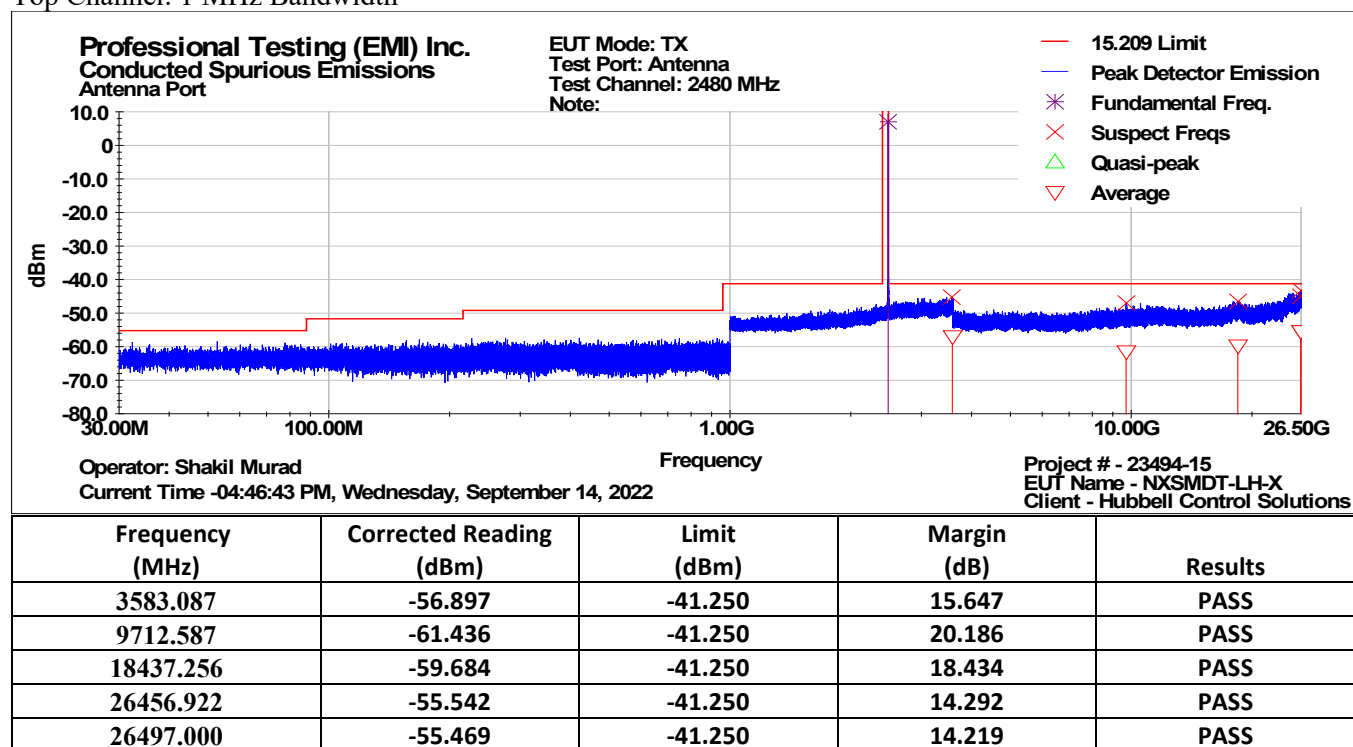
Bottom Channel: 1 MHz Bandwidth



Middle Channel: 1 MHz Bandwidth



Top Channel: 1 MHz Bandwidth



8.0 Transmitter Radiated Spurious Emissions

8.1 Test Procedure

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

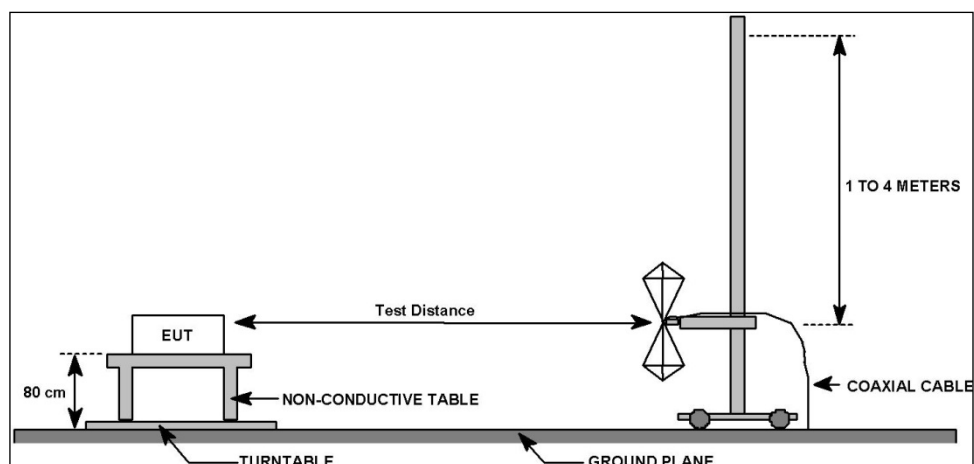


Table 8.1.1: Test Distance, Table Height, and Detection Method

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

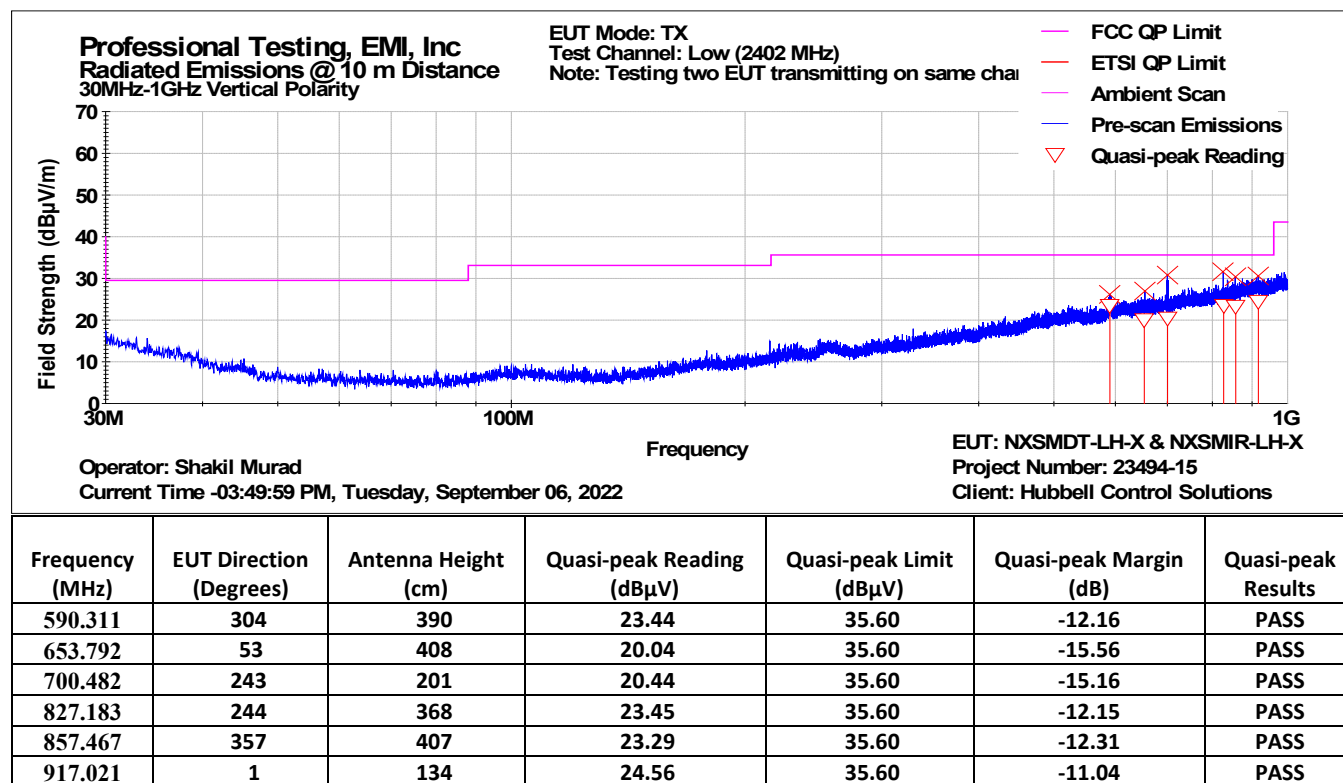
8.3 Test Results

Three channels were tested. EUT was transmitting continuously and modulated. Device tested in normal operational orientation. Both EUT models, NXSMDT-LH and NXSMIR-LH, were tested together transmitter set to transmit on same channel.

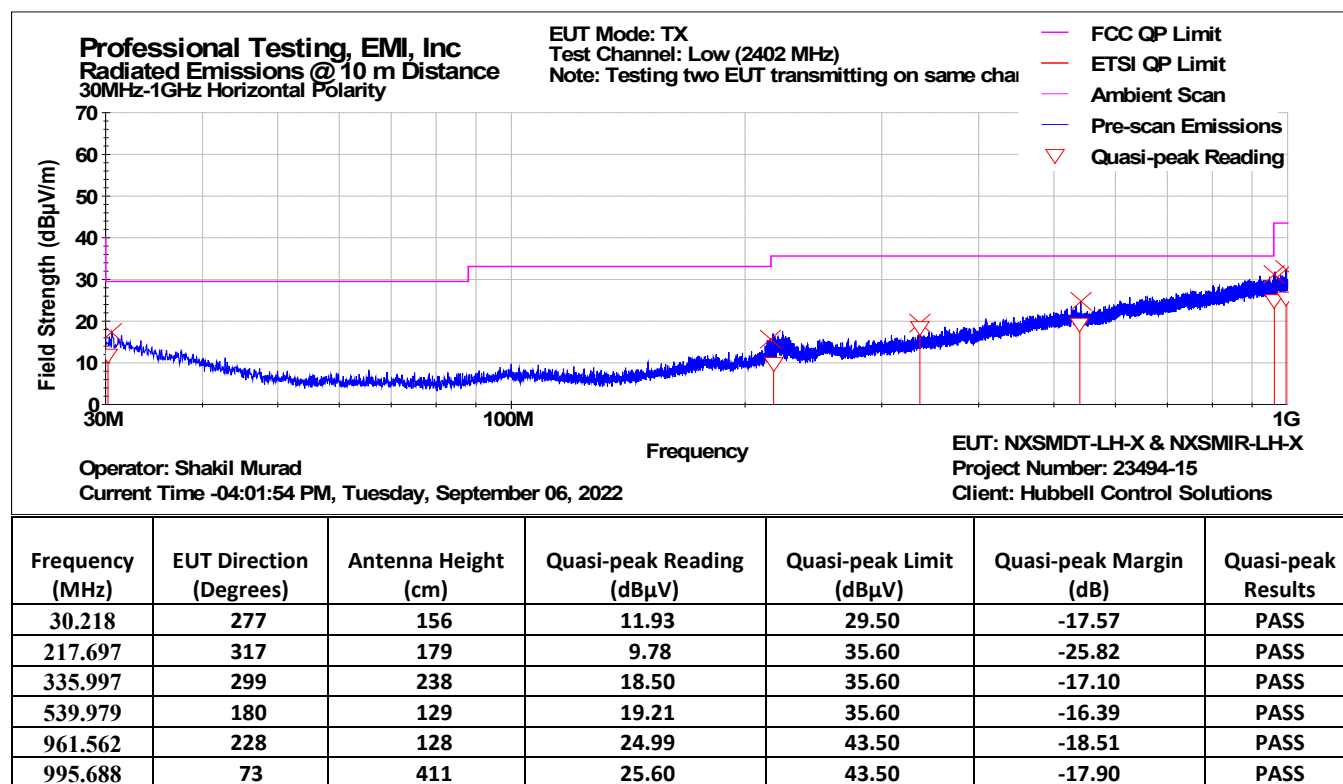
The EUT satisfied the requirement. Graphical and tabular data appears below.

8.3.1 Bottom Channel, 30 MHz to 26.5 GHz

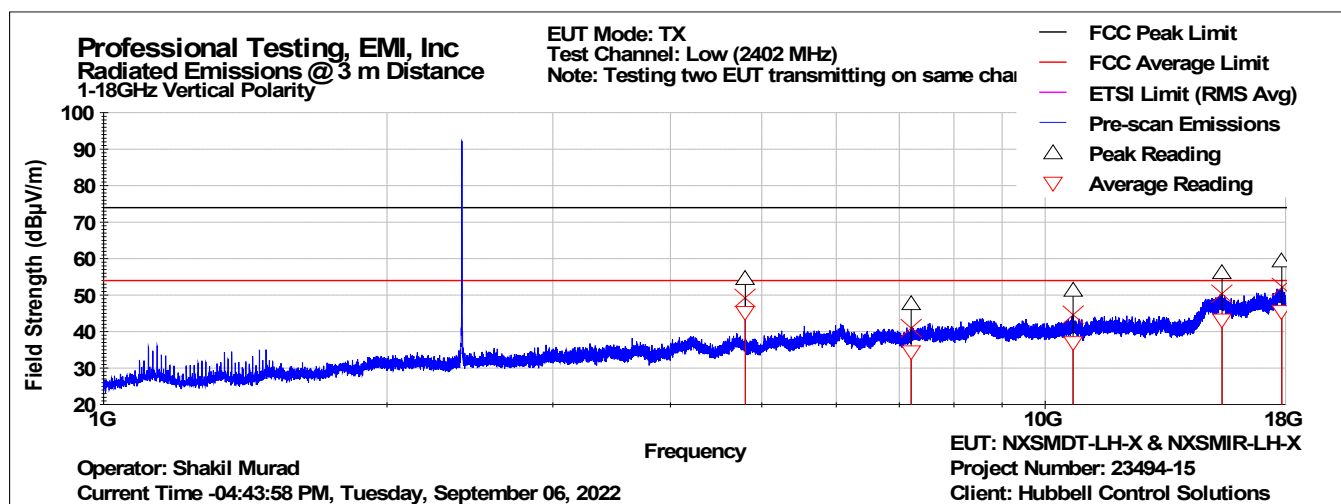
30MHz - 1GHz Vertical Polarity Emissions Data



30MHz - 1GHz Horizontal Polarity Emissions Data

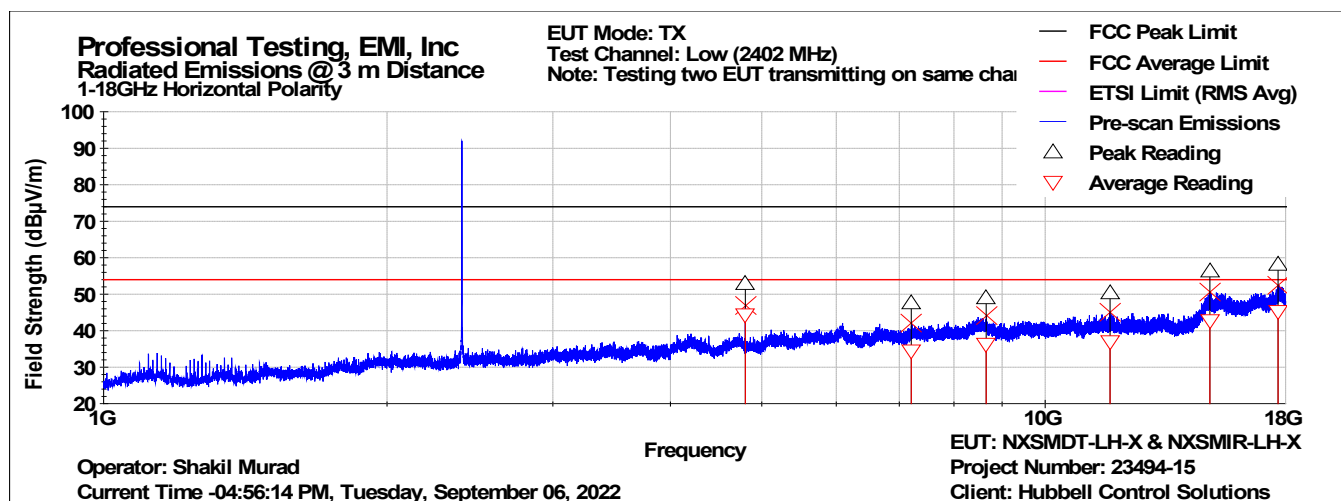


1GHz - 18GHz Vertical Polarity Emissions Data



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
4803.92	271	231	54.40	73.96	-19.56	PASS	45.19	53.96	-8.77	PASS
7204.87	282	107	47.50	73.96	-26.45	PASS	34.40	53.96	-19.55	PASS
10704.65	297	345	51.14	73.96	-22.82	PASS	36.91	53.96	-17.04	PASS
15412.67	108	293	56.01	73.96	-17.95	PASS	43.24	53.96	-10.72	PASS
17834.70	246	263	59.22	73.96	-14.73	PASS	45.54	53.96	-8.41	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
4803.28	116	243	52.97	73.96	-20.99	PASS	44.40	53.96	-9.55	PASS
7207.72	69	108	47.57	73.96	-26.38	PASS	34.39	53.96	-19.57	PASS
8657.41	162	126	49.02	73.96	-24.93	PASS	36.33	53.96	-17.63	PASS
11719.79	43	293	50.37	73.96	-23.59	PASS	36.92	53.96	-17.04	PASS
14959.87	30	376	56.25	73.96	-17.70	PASS	42.84	53.96	-11.12	PASS
17672.74	121	329	58.09	73.96	-15.87	PASS	45.19	53.96	-8.77	PASS