Project #: 22343-15

Company: FlexRadio Systems

EUT Name: Skyline 5000-watt RF Power Amplifier
EUT Model: C5K-PA

FCC CFR 47 Part 2 and Part 87

Wireless Test Report

Prepared for:

FlexRadio Systems
4616 W. Howard Lane, Suite 8-860
Austin, TX 78728

By

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

May 3, 2023

Written by

Shakil Murad
Wireless Engineer

Revision History

Revision Number	Description	Date
Draft01	Initial release for review	10/24/2022
Draft02	Made update from customer review	11/08/2022
Final	Final Report	11/8/2022
Final01	Added modulation data for mask/power/spurious	5/3/2023

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Compliance Certificate

FCC MRA Designation Number: US3166
ANAB Accreditation Number: AT-3165.01

Applicant	Device & Test Identification
FlexRadio Systems **4616 W. Howard Lane, Suite 8-860** **Austin, TX 78728**	**Model(s): C5K-PA** **FCC ID: ZD8C5K-PA** **Laboratory Project ID: 22343-15**

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

Test Requirements:

Requirement	Reference	Test Description
FCC 47 CFR Part 2 and Part 87 C	2.1046 (b)(3),(c) and 87.131	RF Output Power
	87.139 (c)(1)/(2)/(3)	Emission Limitations
	2.1051 and 87.139 (c)(3)	Conducted Spurious Emissions
	2.1053 and 87.139 (c)(3)	Field Strength of Radiated Spurious Emissions

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

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
FlexRadio Systems Model: C5K-PA	5021-0011-0000-6812	Skyline 5000-watt RF Power Amplifier

1.3 Support Equipment

Manufacturer	Model #	Description
Bird Electronic Corp.	4273-020	5000 Watt RF Sampler
N/A	LP-500	Power Meter
Bird Electronic Corp.	8931-115	10000 Watt Load Resistor

EUT Essential Specifications	
Power Output to Antenna	Approximately 5000 Watt
Frequency Range	2.7 MHz to 23 MHz
Channel Bandwidths Supported (kHz)	N/A
Modulation Methods Supported	N/A
Antenna	N/A
Operating Voltage and Power Required	208 VAC 60 Hz
Environment	Indoor

1.4 EUT Test Configuration

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

1.5 Modifications to Equipment

None

1.6 Test Site

Measurements were made at the Nemko USA, Inc. 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

Document	Title
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
47 CFR	FCC Part 87 – Subpart D – Technical requirements FCC Part 2 – Subpart J – Equipment authorization procedures

2.0 RF Output Power - 87.139 (c)(1)/(2)/(3)

2.1 Test Procedure

The EUT was connected directly to the spectrum analyzer with directional coupler and attenuator for the measurements. Low, mid, and high channel were measured. ANSI C63.26-2015, section 5.2, procedure is used for the measurements. J3E modulation used for power measurements.

2.2 Test Criteria

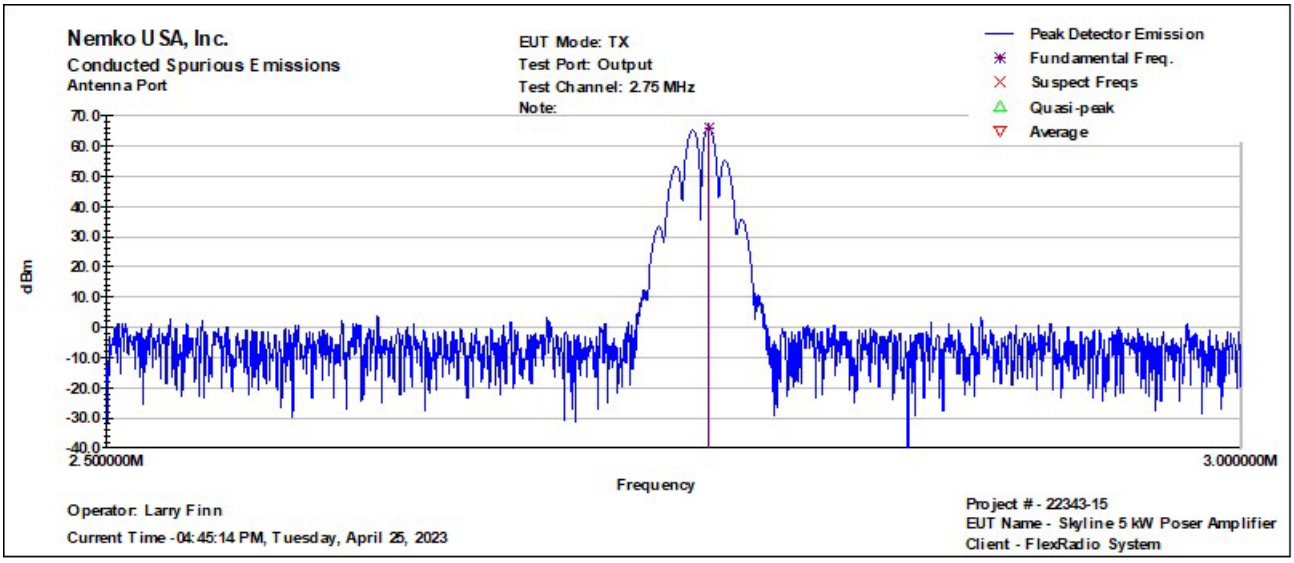
Class of Station	Frequency Band/Frequency	Authorized Emission(s)	Maximum Power
Aeronautical enroute and aeronautical fixed	HF	R3E, H3E, J3E, J7B, H2B, J2D HF	6 kW

2.3 Test Results

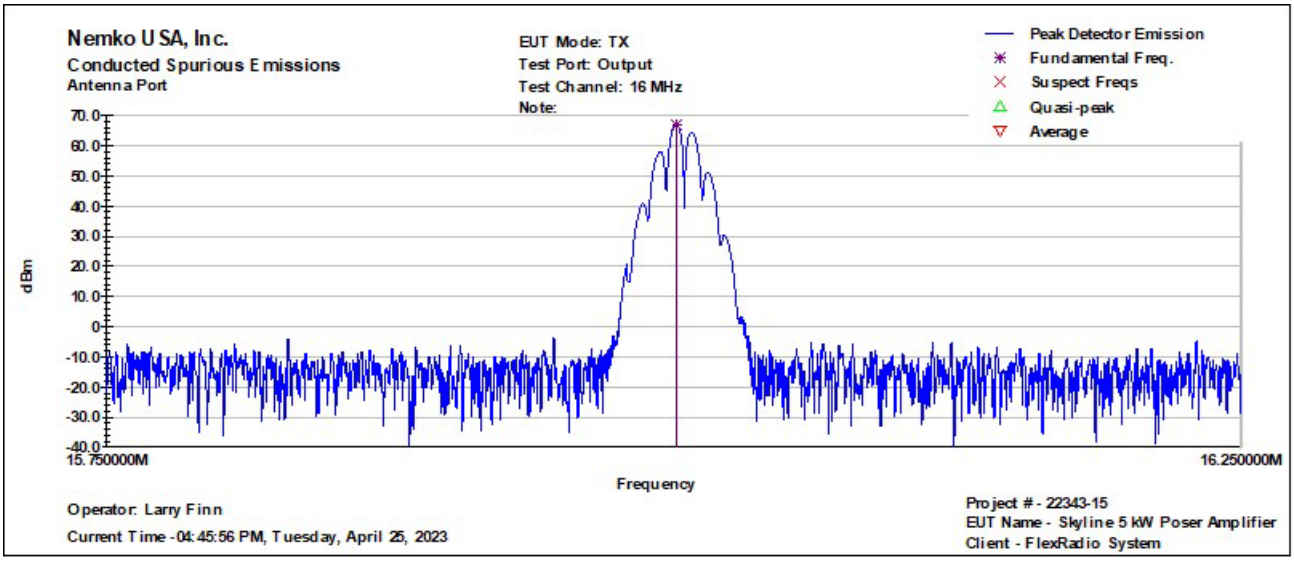
Peak Output Power - Conducted Test Data													
Project Number:	22343-15				Test Date(s):	4/25/2023							
Environmental Conditions:	Temperature	24.2	°C		Humidity	32	RH		Barometric Pressure	29.94	in Hg		
Measurement Parameters:	RBW	10	kHz	VBW	30	kHz	Span	200	kHz	Detector	Peak		

Channel	Frequency (MHz)	Measured Power (dBm)	Correction Factor (dB)	Corrected Power (dBm)	Corrected Power (Watt)
Low	2.75	66.03	-	66.03	4008.67
Mid	16	67.00	-	67.00	5011.87
High	23	66.55	-	66.55	4518.56

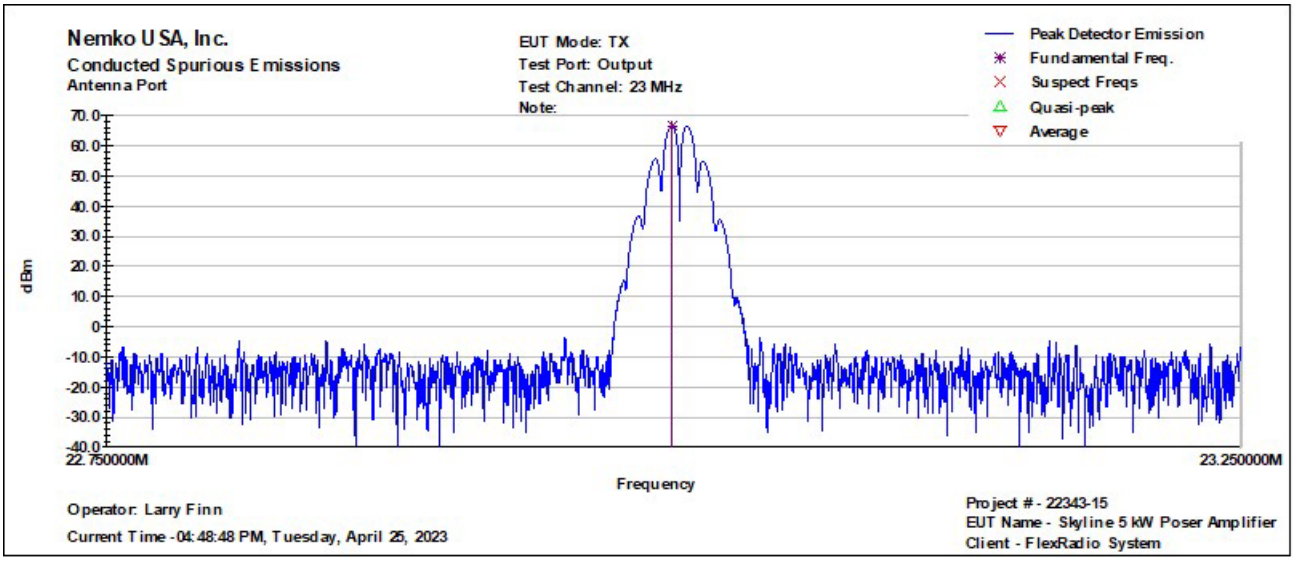
Bottom Channel (2.75MHz), J3E Modulation



Middle Channel (16MHz), J3E Modulation



Top Channel (23MHz), J3E Modulation



3.0 Conducted Spurious Emissions - 2.1051 and 87.139 (c)(3)

3.1 Test Procedure

The EUT was connected directly to the spectrum analyzer with directional coupler and attenuator for the measurements.
Conducted antenna port emissions are measured with the EUT transmitting on Low, Mid, and High channels. ANSI C63.26-2015, section 5.7, procedure is used for the measurements.

3.2 Test Criteria

When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least 43 + 10 log10 pX dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

3.3 Test Results

Three channels were tested. EUT was transmitting continuously using J3E modulation.

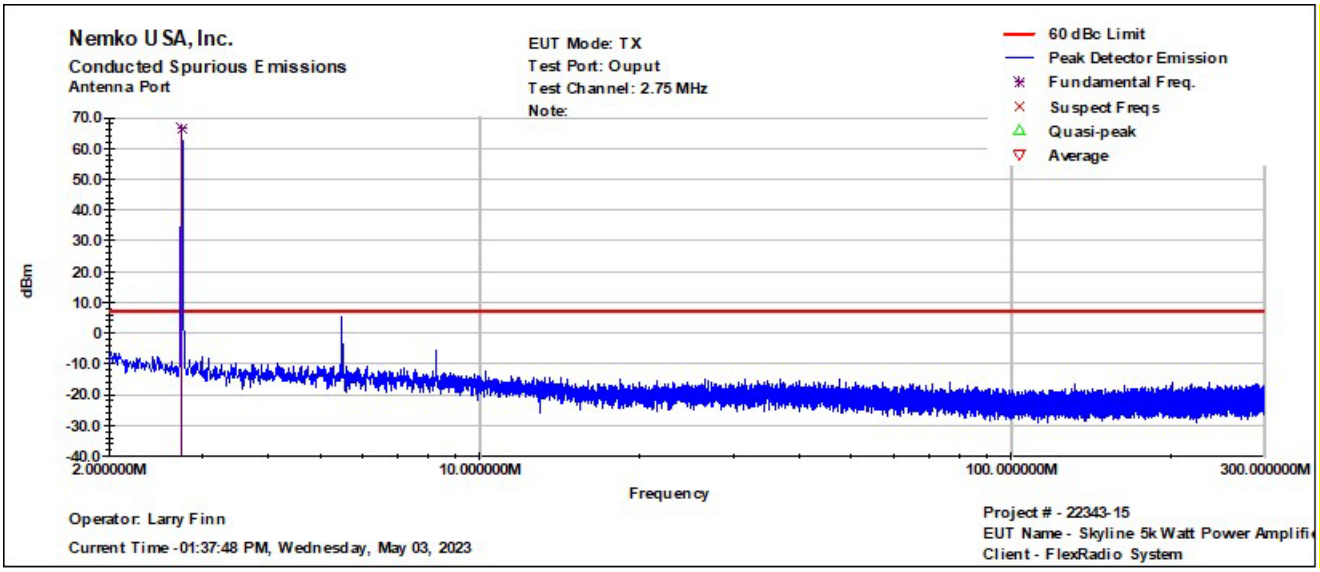
The top, middle, and bottom channels were tested. Testing was conducted with 9 kHz RBW.

There were no emissions observed within 60 dBc of the transmitter rated output power.

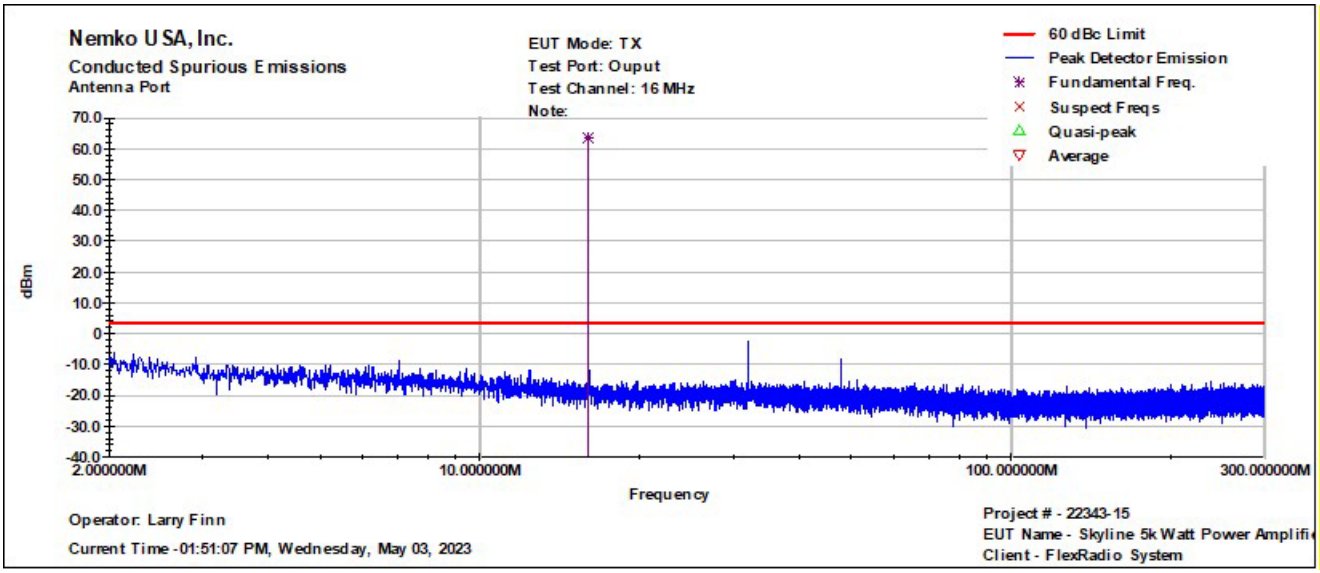
The EUT satisfied the requirements. Test plots are presented on the following page.

3.3.1 Test data

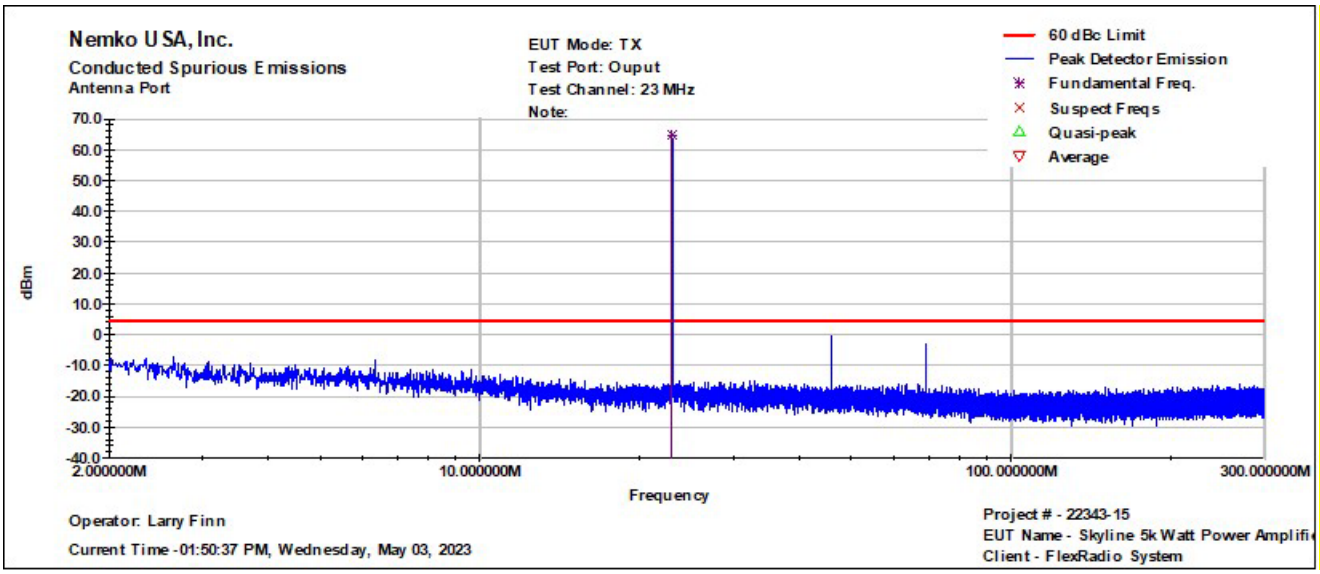
Bottom Channel (2.75MHz), J3E Modulation



Middle Channel (16MHz), J3E Modulation



Top Channel (23MHz), J3E Modulation



4.0 Emission Limitations - 2.1051 and 87.139 (c)(3)

4.1 Test Procedure

The EUT was connected directly to the spectrum analyzer with directional coupler and attenuator for the measurements.
Conducted antenna port emissions are measured with the EUT transmitting on Low, Mid, and High channels. ANSI C63.26-2015, section 5.7, procedure is used for the measurements.

4.2 Test Criteria

When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least 43 + 10 log10 pX dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

4.3 Test Results

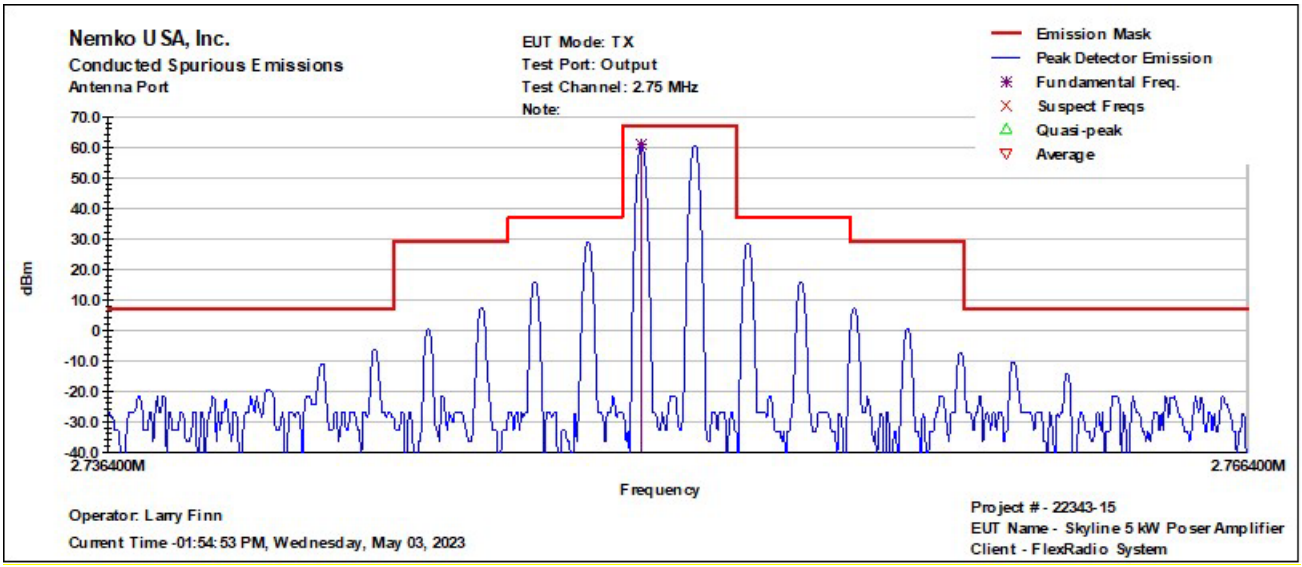
Three channels were tested. EUT was transmitting continuously using H3E and J3E modulation.

The top, middle, and bottom channels were tested. Testing was conducted with 100 Hz RBW with Emission Mask Limits.

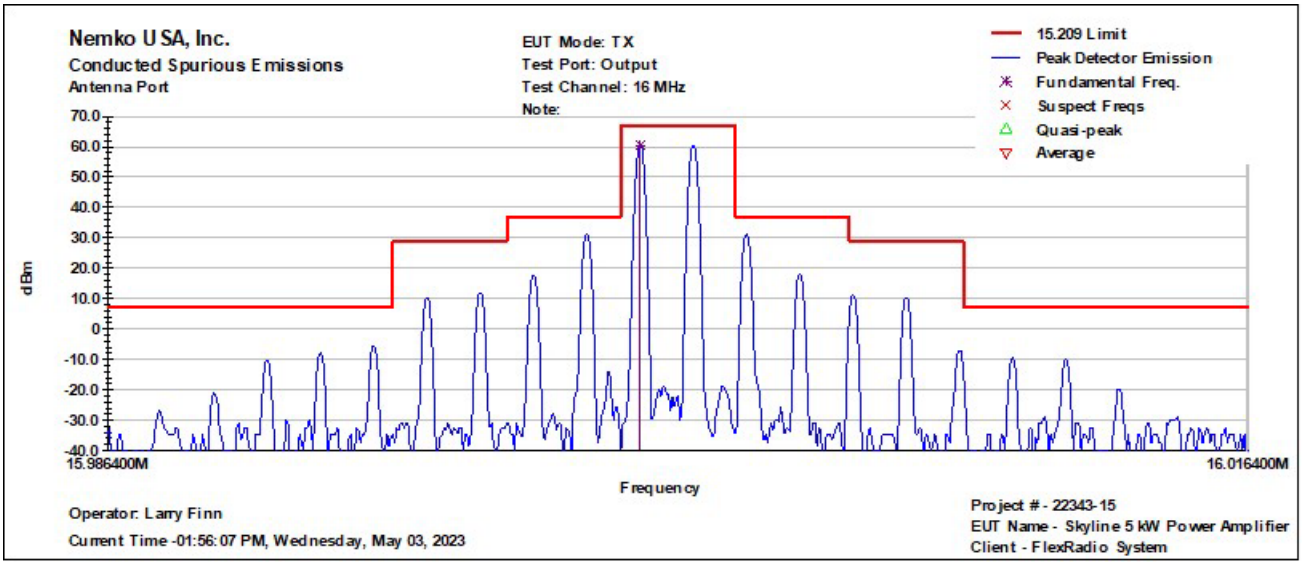
The EUT satisfied the requirements. Test plots are presented below.

4.3.1 Test data

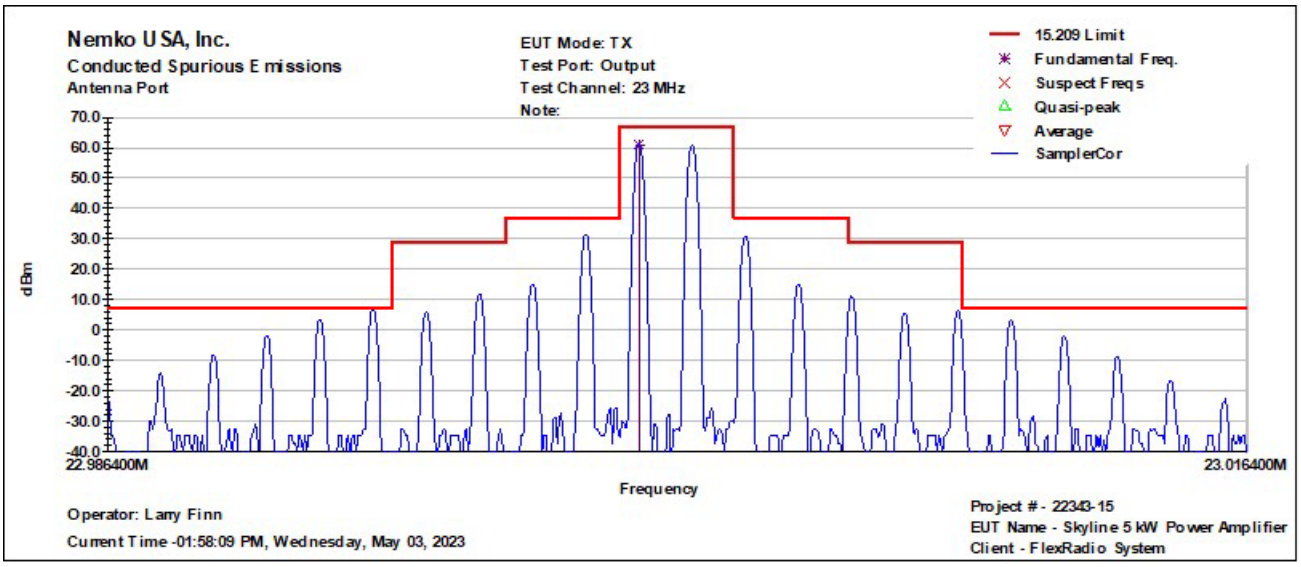
Bottom Channel (2.75MHz), J3E Modulation



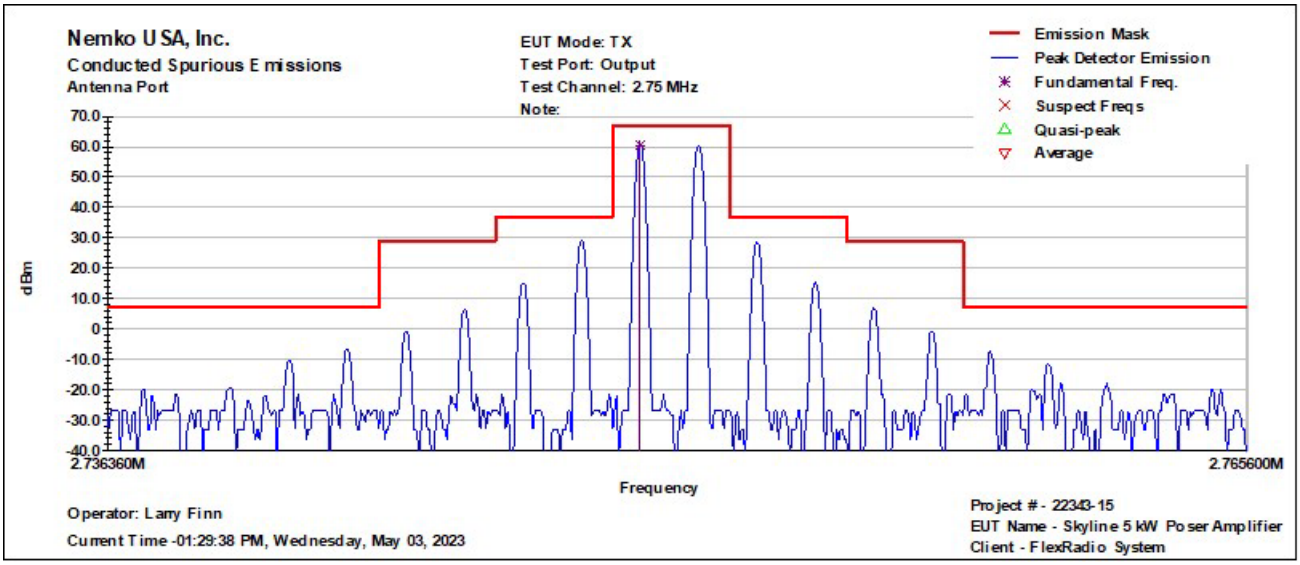
Middle Channel (16MHz), J3E Modulation



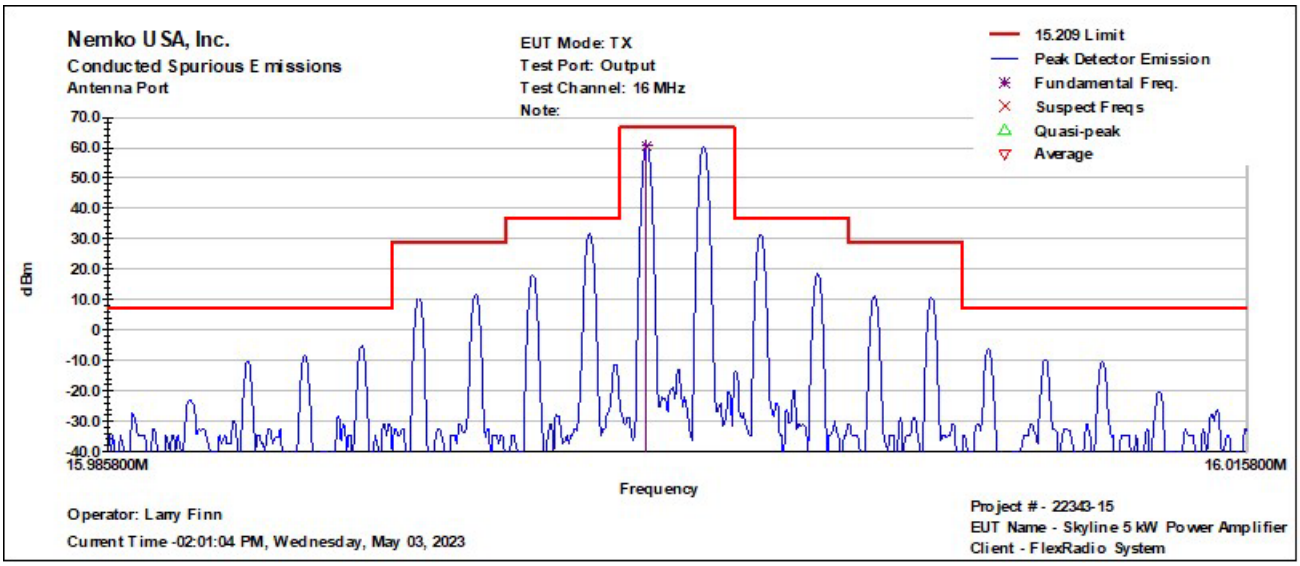
Top Channel (23MHz), J3E Modulation



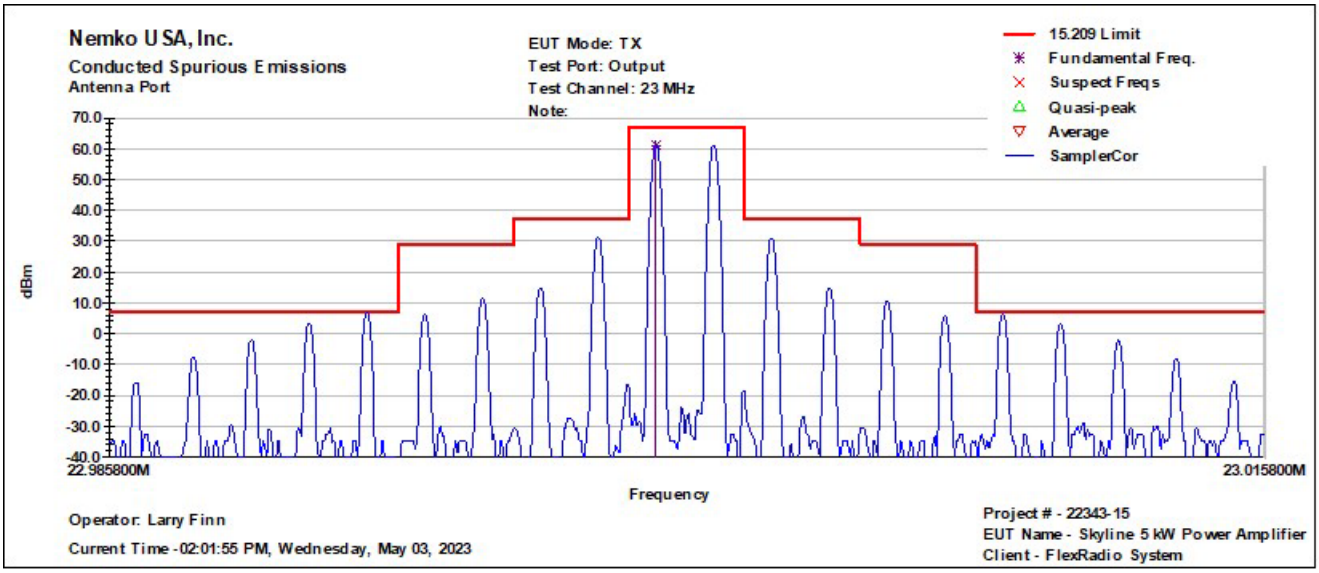
Bottom Channel (2.75MHz), H3E Modulation



Middle Channel (16MHz), H3E Modulation



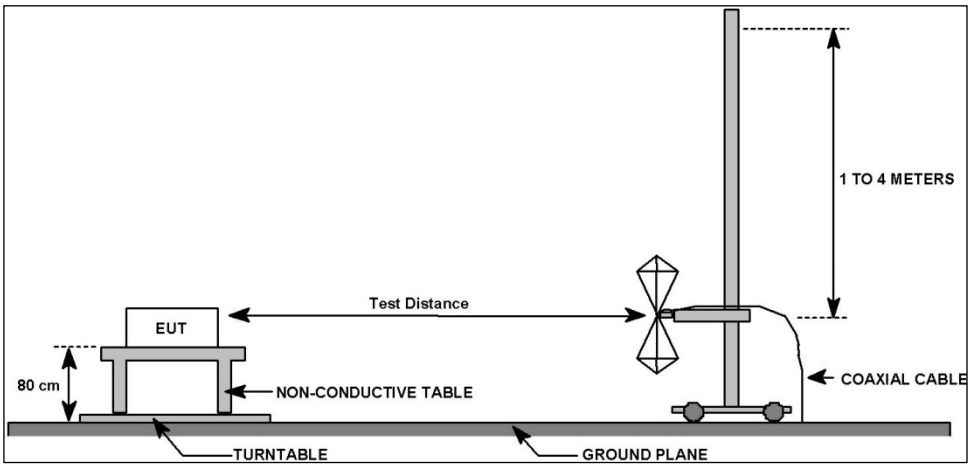
Top Channel (23MHz), H3E Modulation



5.0 Field Strength of Radiated Spurious Emissions - 2.1053 and 87.139 (c)(3)

5.1 Test Procedure

Radiated emissions are measured with the EUT in normal operation transmitting on normal hopping channels. ANSI C63.26-2015, section 5.7, procedure is used for the measurements.



Radiated Spurious Emissions Test Setup

Table 5.1.1: 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

5.2 Test Criteria

When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least 43 + 10 log10 pX dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

5.3 Test Results

EUT was tested in normal operation and transmitting continuously unmodulated. Device tested in normal operational orientation.

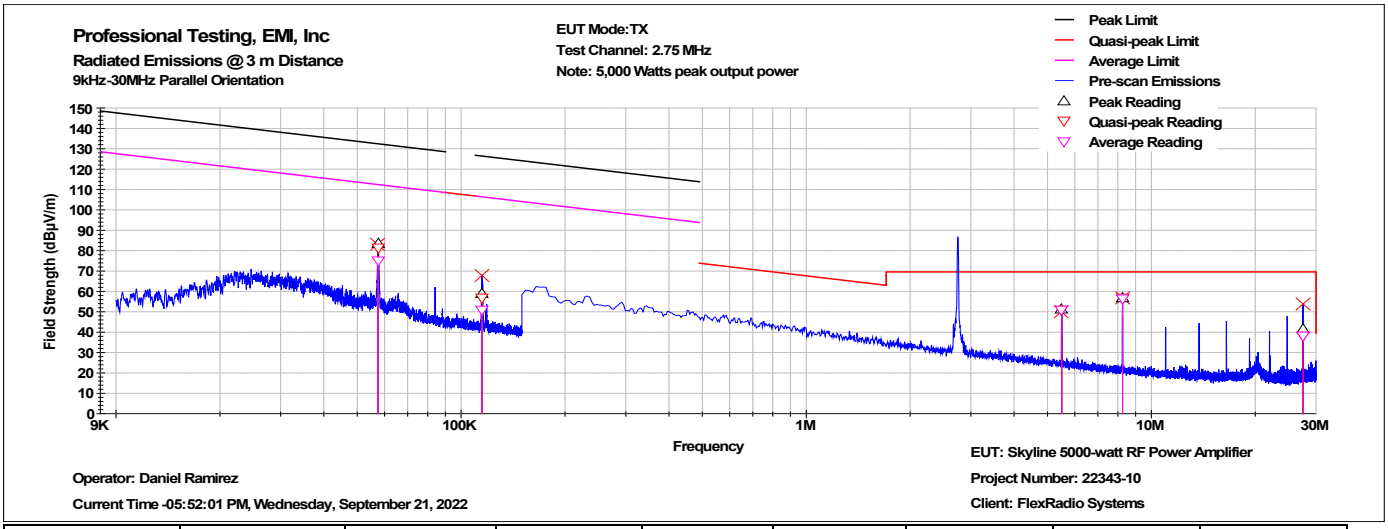
There were no emissions observed within 60 dBc of the transmitter rated output power.

The EUT satisfied the requirement. Test plots and tabular data are presented on the following page.

5.3.1 Test data

Bottom Channel

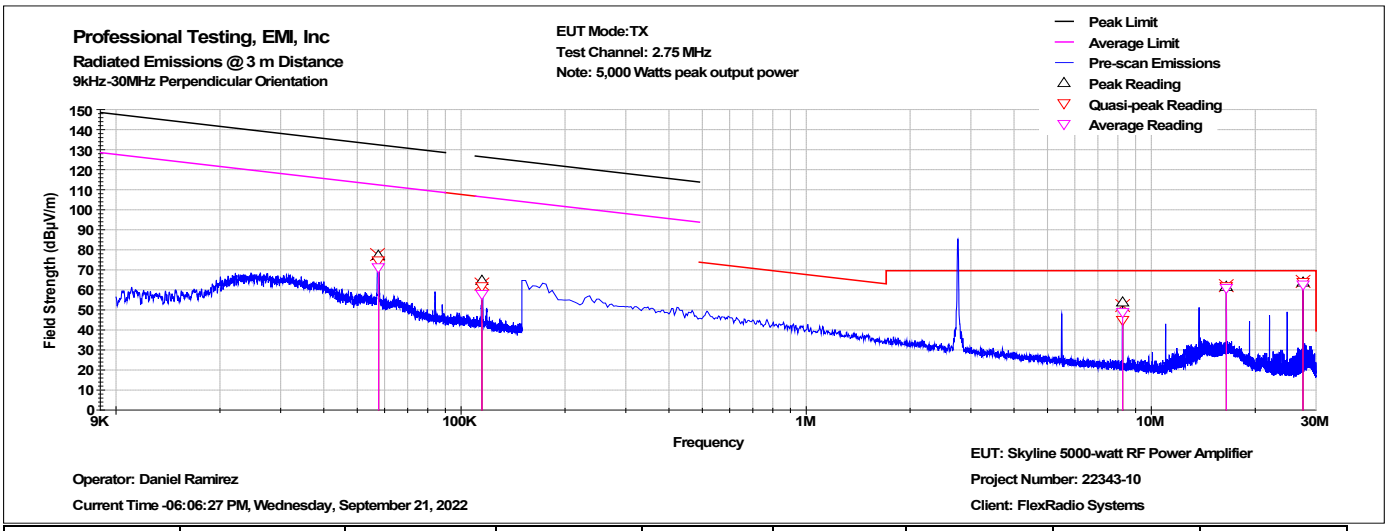
9kHz – 30MHz Parallel Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.057	44	100				74.98	112.43	PASS
0.115	31	100				50.92	106.40	PASS
5.501	35	100	50.822	69.54	PASS			
8.251	34	100	56.714	69.54	PASS			
27.499	276	100	38.247	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

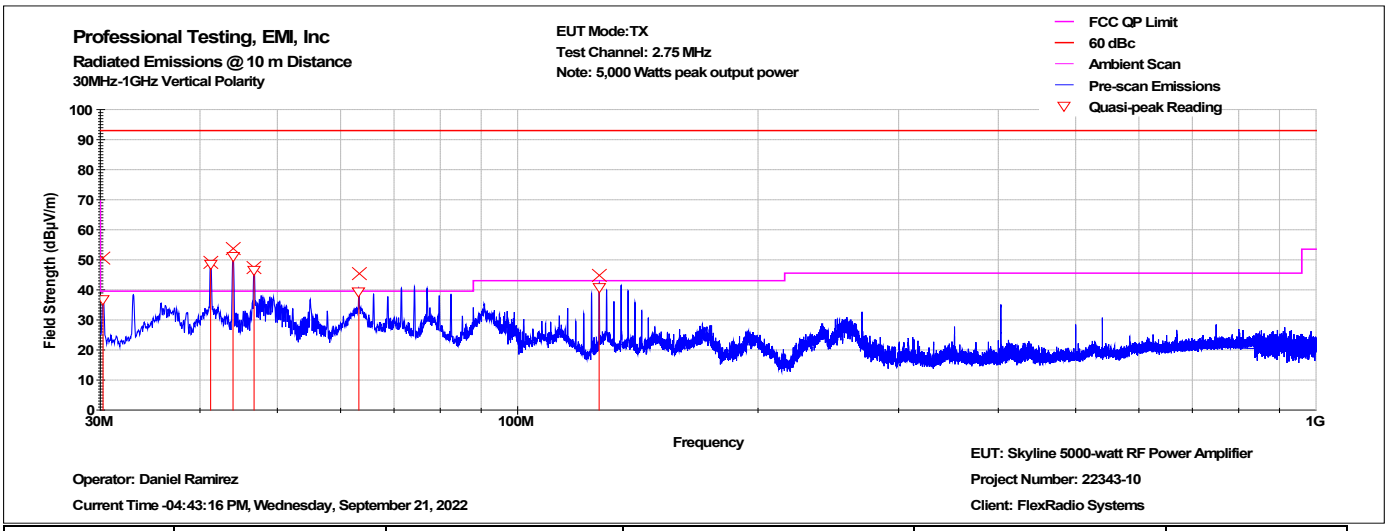
9kHz – 30MHz Perpendicular Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.058	79	100				70.924	112.39	PASS
0.115	115	100				57.623	106.40	PASS
8.254	246	100	44.925	69.54	PASS			
16.500	83	100	61.424	69.54	PASS			
27.501	256	100	63.715	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

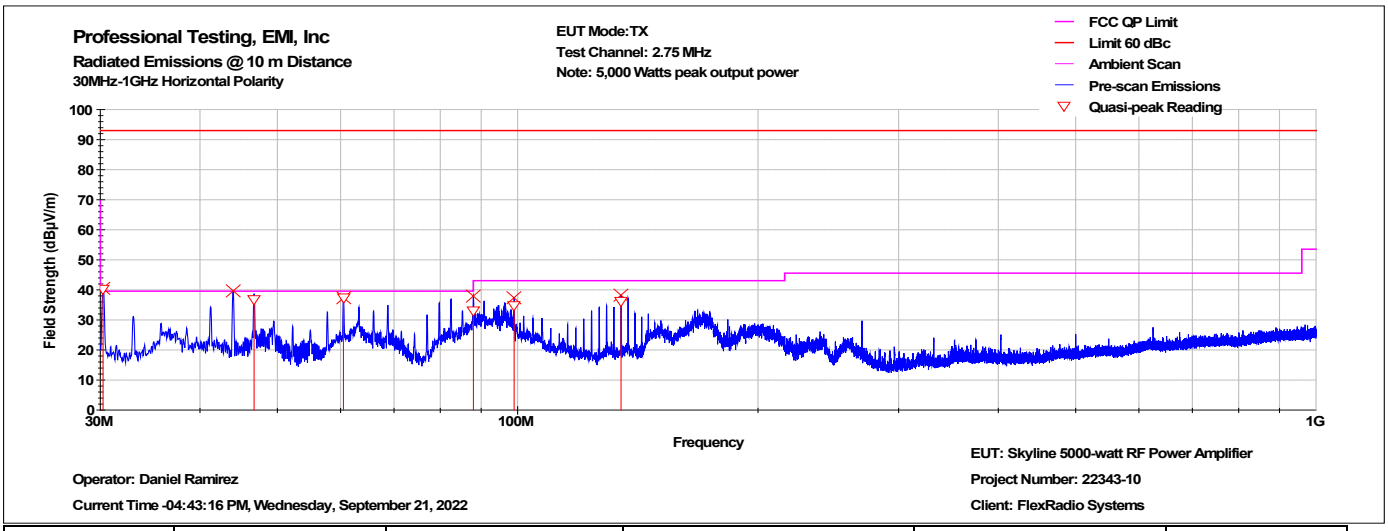
30MHz - 1GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
30.243	325	182	36.70	91.76	PASS
41.250	78	104	48.47	91.76	PASS
44.003	44	128	51.15	91.76	PASS
46.750	99	104	46.41	91.76	PASS
63.256	297	270	39.33	91.76	PASS
126.505	280	134	40.90	91.76	PASS

Note: FCC part 15.209 limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

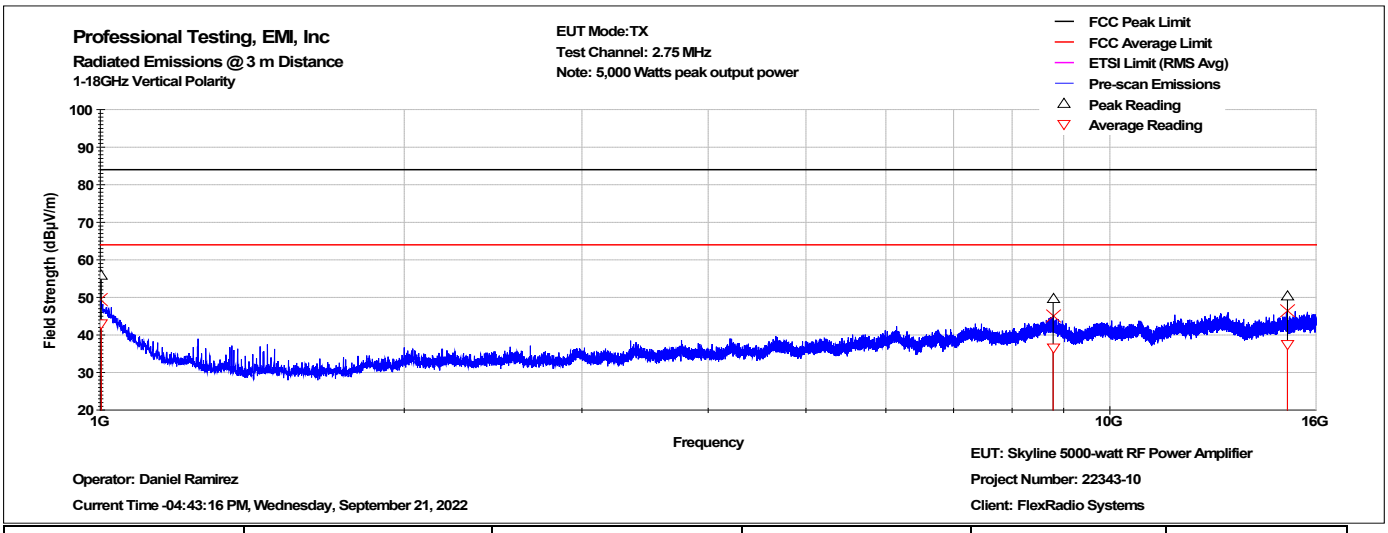
30MHz - 1GHz Horizontal Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
30.246	315	412	40.14	91.76	PASS
46.756	23	128	36.86	91.76	PASS
60.505	229	387	37.39	91.76	PASS
88.024	350	409	32.93	91.76	PASS
98.978	198	381	34.74	91.76	PASS
134.751	191	367	36.29	91.76	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

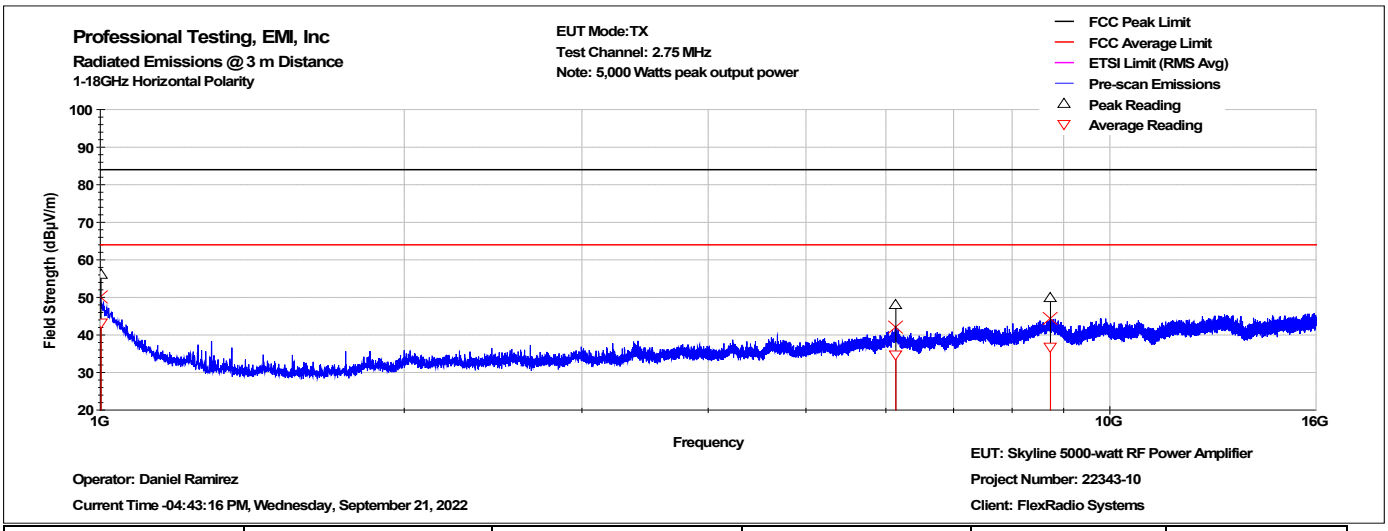
1GHz - 18GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1002.40	154	375	55.89	102.22	PASS
8785.54	289	182	49.58	102.22	PASS
14992.61	26	329	50.38	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

1GHz - 18GHz Horizontal Polarity Emissions Data

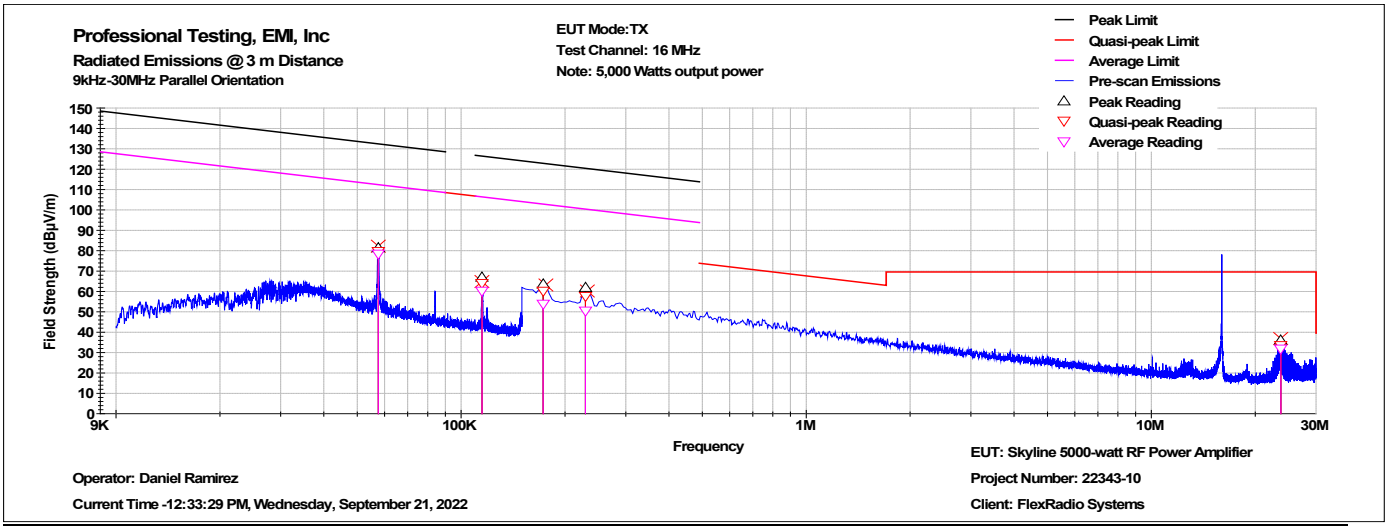


Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1001.79	32	257	56.09	102.22	PASS
6137.32	207	174	47.97	102.22	PASS
8732.29	252	151	49.90	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

Middle Channel

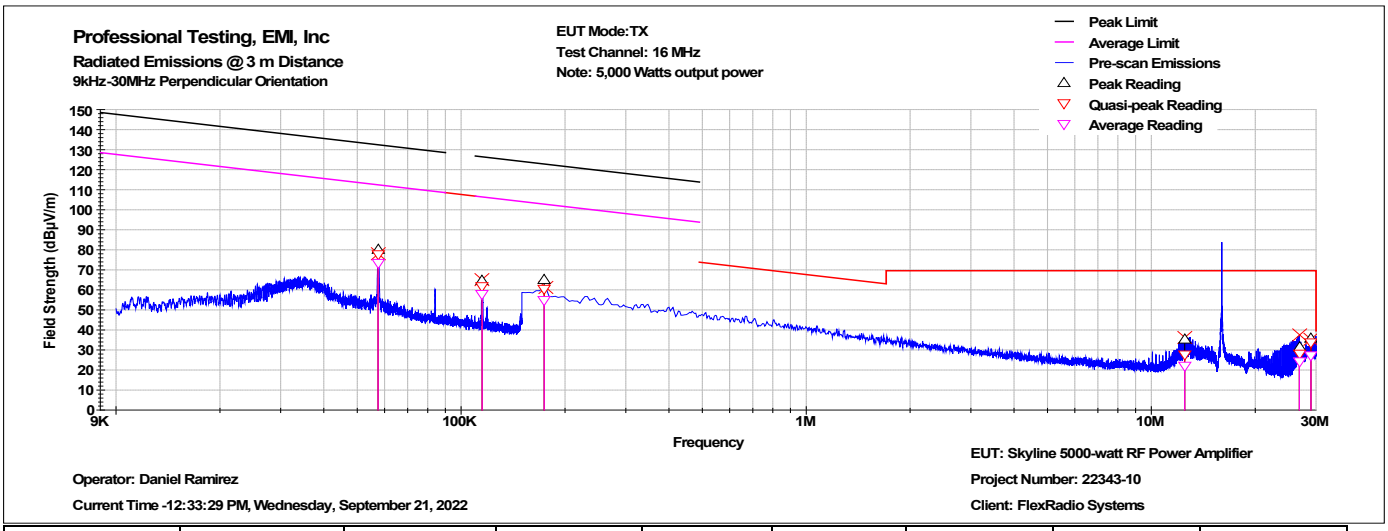
9kHz – 30MHz Parallel Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.058	241	100				78.29	112.40	PASS
0.115	220	100				60.39	106.40	PASS
0.173	190	100				53.82	102.86	PASS
0.229	241	100				50.25	100.40	PASS
23.737	350	100	33.500	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

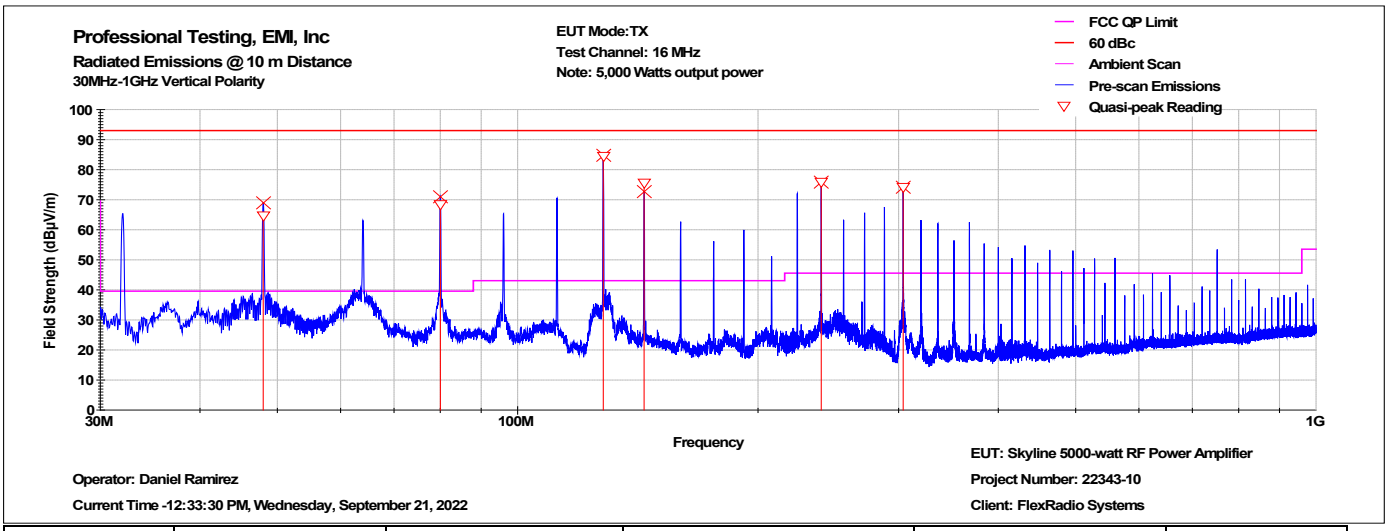
9kHz – 30MHz Perpendicular Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.057	299	100				73.414	112.42	PASS
0.115	303	100				57.738	106.39	PASS
0.174	300	100				54.827	102.79	PASS
12.492	350	100	27.431	69.54	PASS			
26.855	294	100	27.808	69.54	PASS			
29.013	125	100	33.430	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

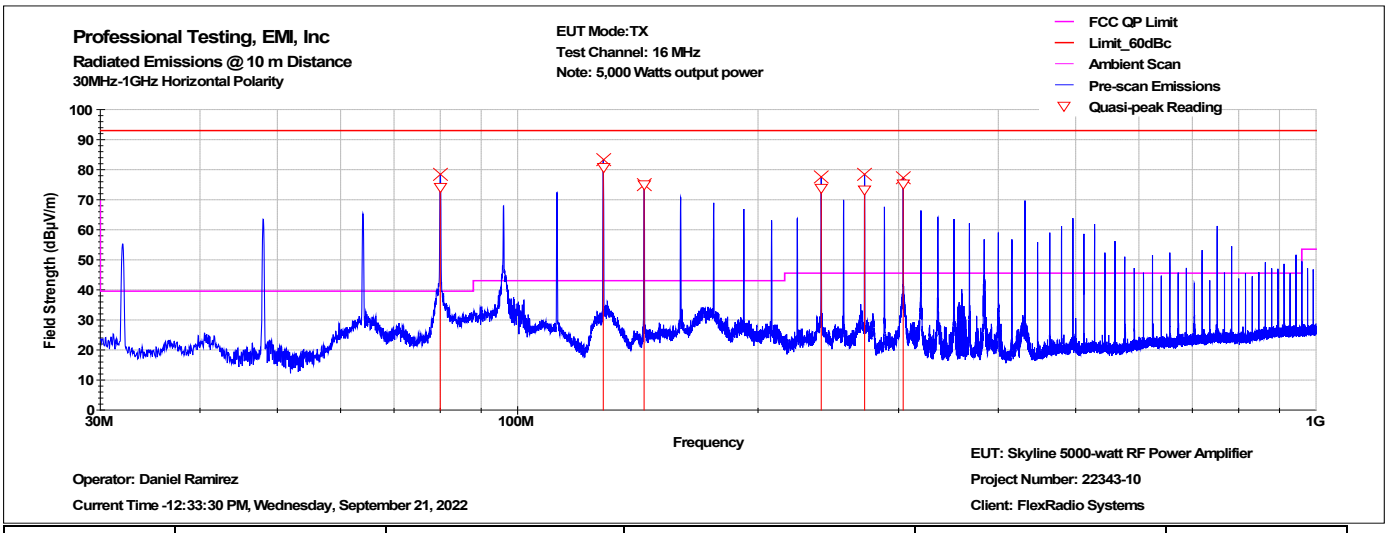
30MHz - 1GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
47.995	99	105	64.64	91.76	PASS
80.006	94	214	68.44	91.76	PASS
128.003	100	185	84.51	91.76	PASS
144.011	15	106	75.66	91.76	PASS
240.005	105	236	75.95	91.76	PASS
304.005	34	277	74.16	91.76	PASS

Note: FCC part 15.209 limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

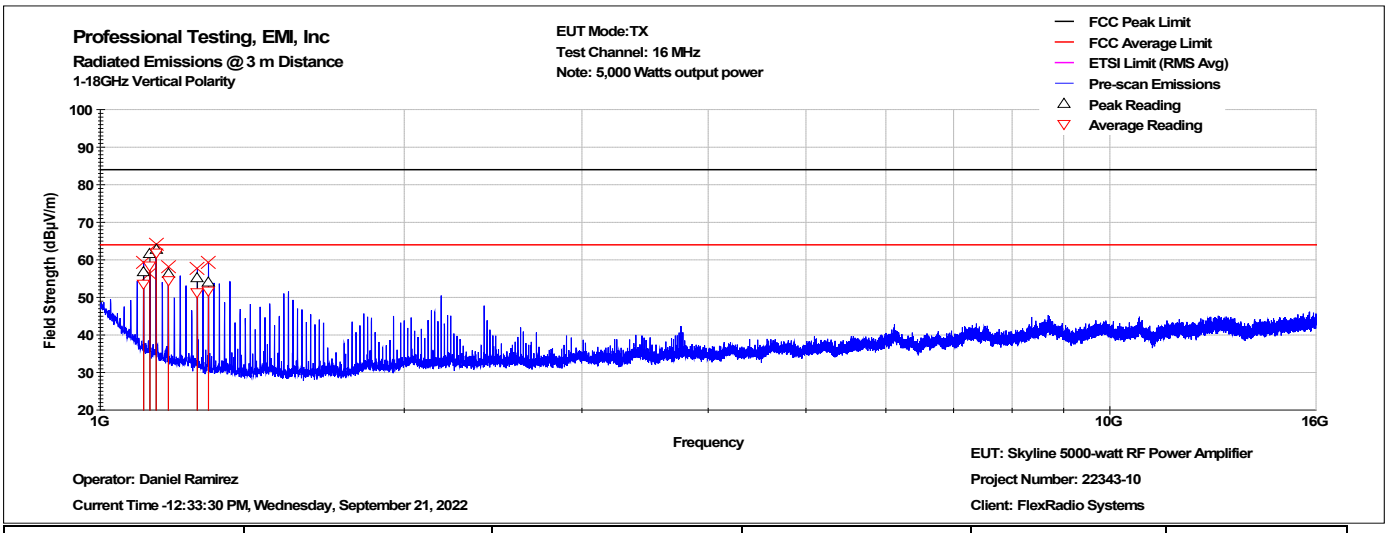
30MHz - 1GHz Horizontal Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Quasi-peak Results
79.998	68	387	74.24	91.76	Pass
128.001	203	413	80.73	91.76	Pass
144.004	108	371	74.91	91.76	Pass
240.002	125	213	73.97	91.76	Pass
272.003	23	186	73.38	91.76	Pass
303.998	293	262	75.36	91.76	Pass

Note: FCC part 15.209 limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

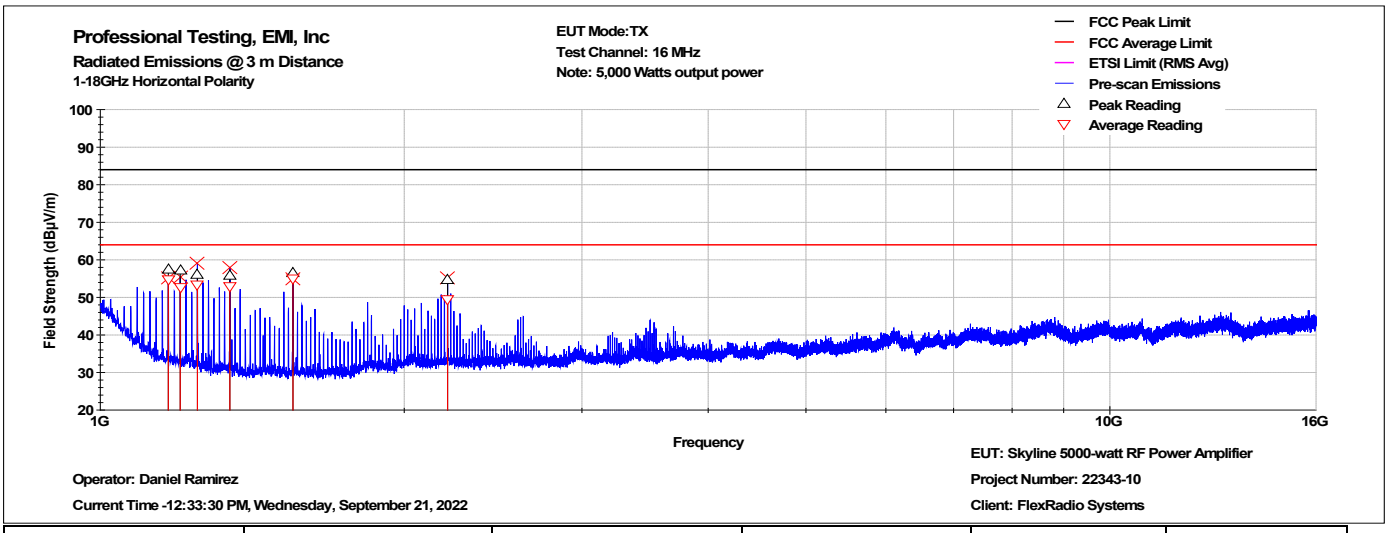
1GHz - 18GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1104.10	289	253	56.76	102.22	PASS
1120.02	317	132	61.69	102.22	PASS
1136.03	288	178	62.83	102.22	PASS
1168.10	277	190	56.36	102.22	PASS
1247.92	274	168	55.15	102.22	PASS
1280.02	263	179	54.00	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

1GHz - 18GHz Horizontal Polarity Emissions Data

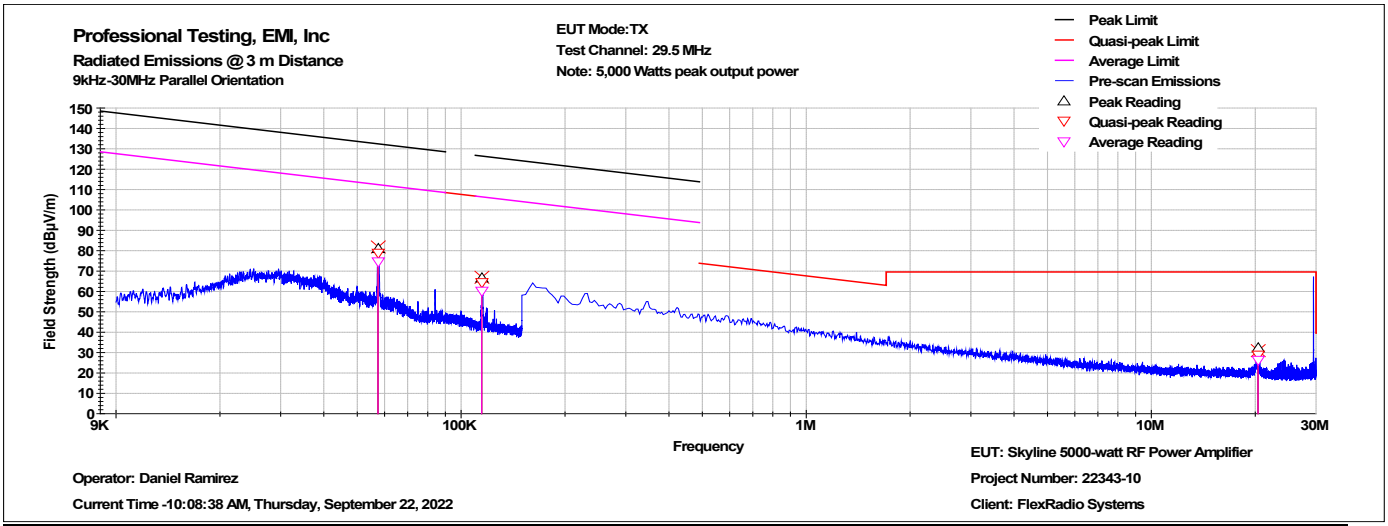


Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1167.99	293	293	57.54	102.22	PASS
1199.99	251	247	57.33	102.22	PASS
1248.06	293	229	55.98	102.22	PASS
1343.98	288	180	55.74	102.22	PASS
1552.00	330	138	56.63	102.22	PASS
2208.03	296	151	54.60	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

Top Channel

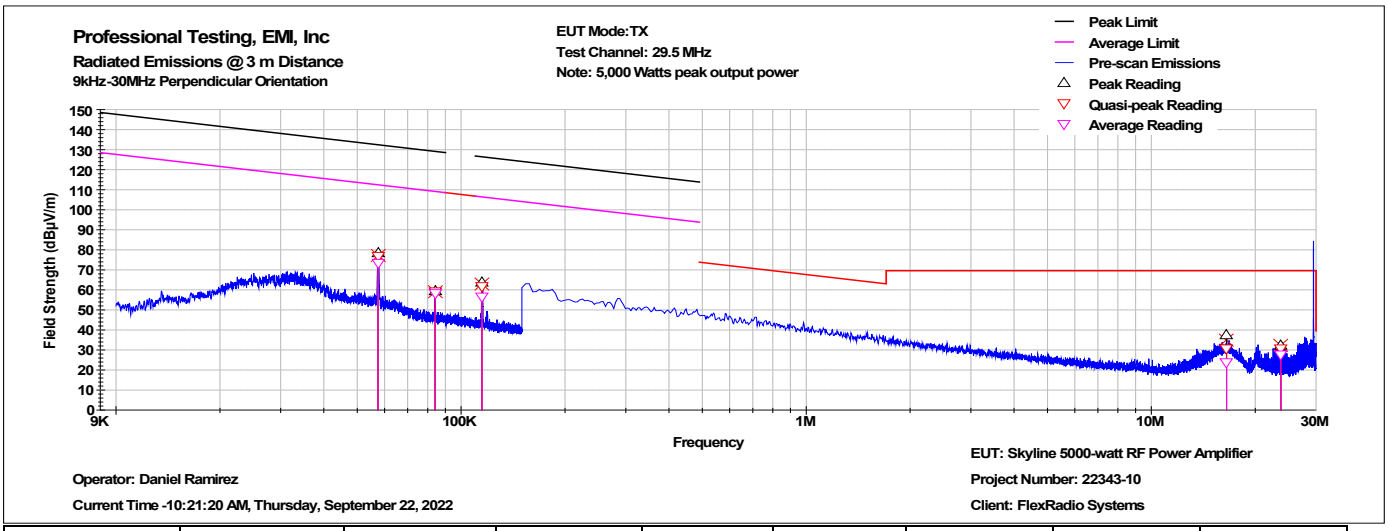
9kHz – 30MHz Parallel Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.057	87	100				74.48	112.42	PASS
0.115	39	100				60.2	106.41	PASS
20.377	273	100	28.759	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

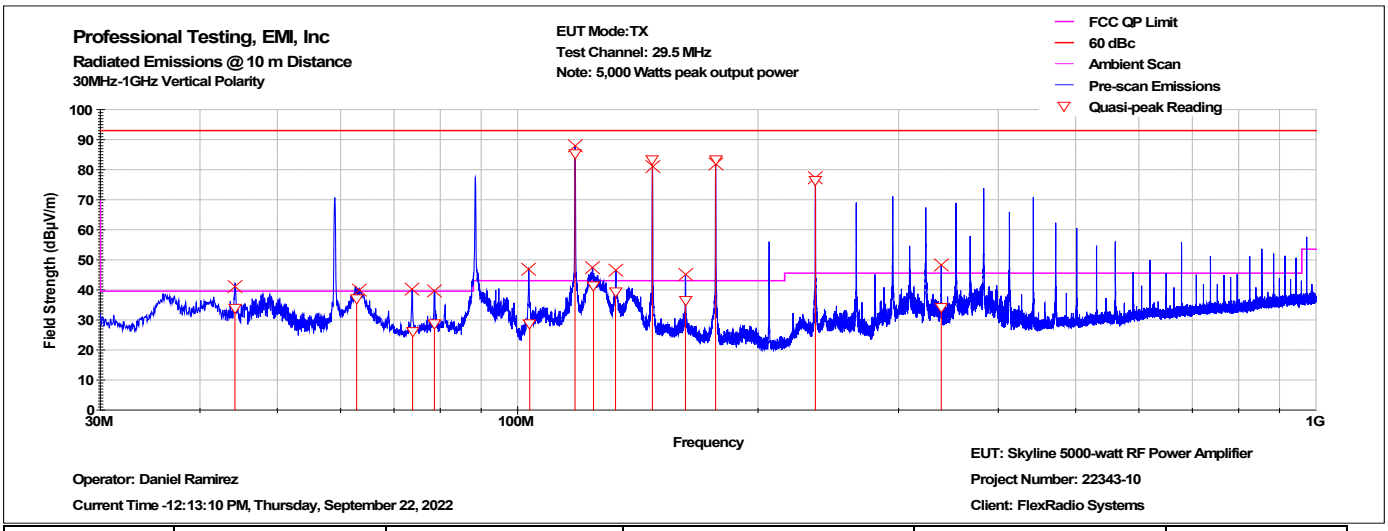
9kHz – 30MHz Perpendicular Orientation Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Quasi-peak Limit (dBµV)	Quasi-peak Results	Average Reading (dBµV)	Average Limit (dBµV)	Average Results
0.057	95	100				73.032	112.42	PASS
0.084	81	100				58.190	109.12	PASS
0.115	120	100				56.474	106.40	PASS
16.524	340	100	30.524	69.54	PASS			
23.734	22	100	30.603	69.54	PASS			

Note: FCC part 15.209 limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

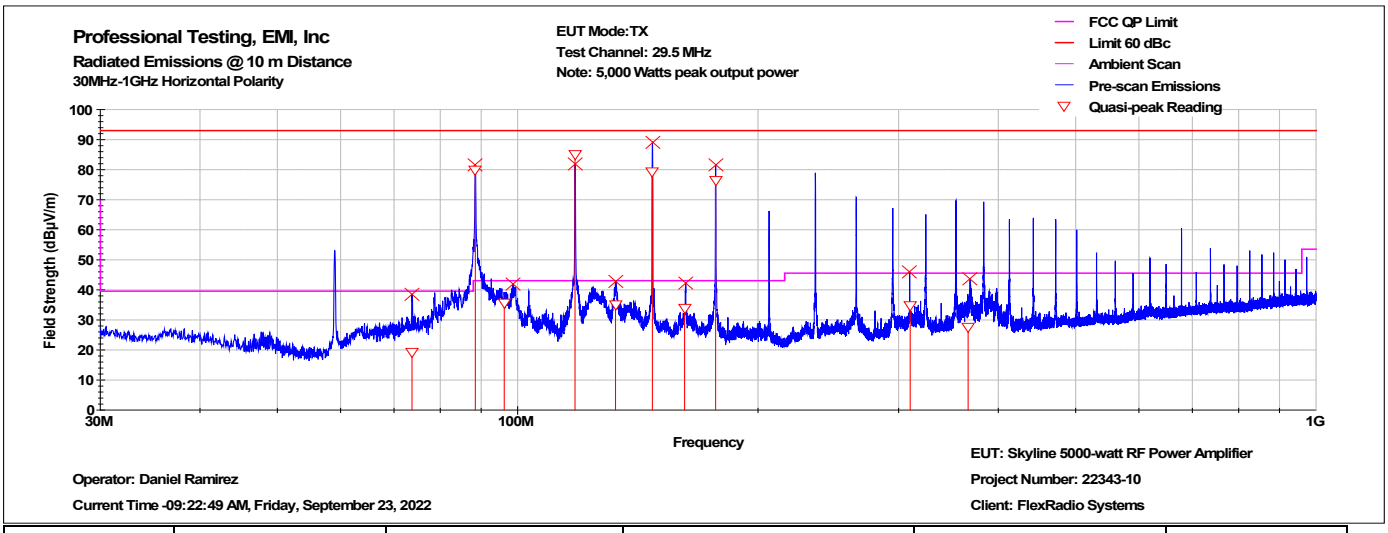
30MHz - 1GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
44.239	323	135	34.03	91.76	PASS
62.837	61	237	37.21	91.76	PASS
73.829	5	171	26.06	91.76	PASS
78.657	85	247	28.84	91.76	PASS
103.550	72	304	28.71	91.76	PASS
117.999	244	137	85.34	91.76	PASS
124.461	265	116	41.46	91.76	PASS
132.612	10	119	39.36	91.76	PASS
147.502	117	345	83.43	91.76	PASS
162.229	61	333	36.44	91.76	PASS
177.001	23	105	83.36	91.76	PASS
236.003	252	105	76.36	91.76	PASS
339.330	94	274	34.13	91.76	PASS

Note: FCC part 15.209 limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

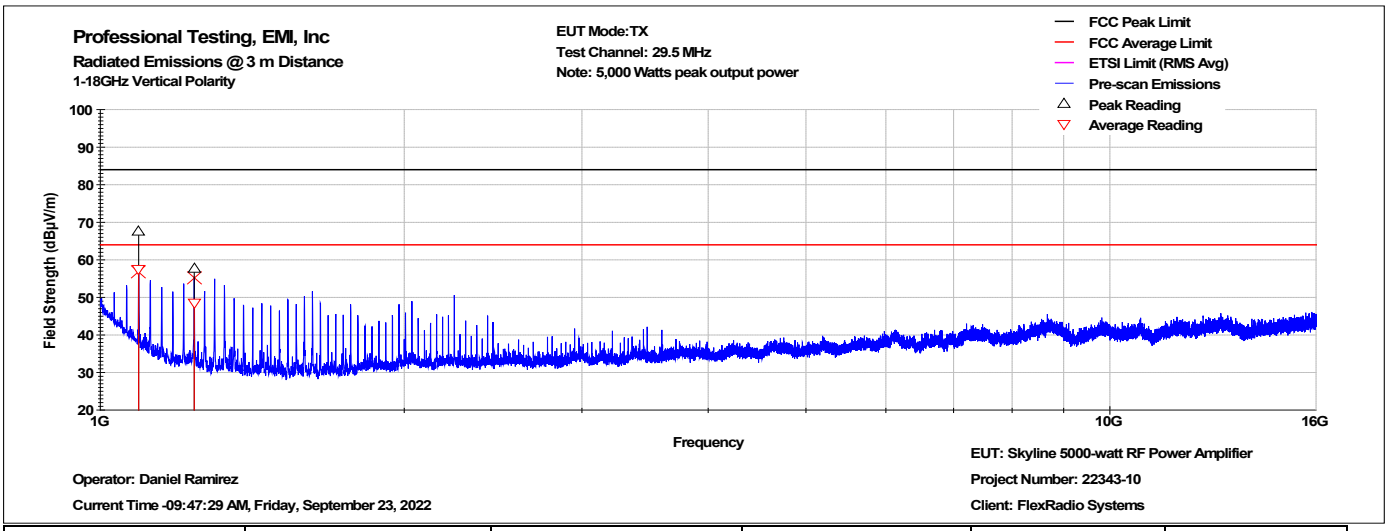
30MHz - 1GHz Horizontal Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Quasi-peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
73.738	350	127	19.13	92.76	PASS
88.518	236	412	79.73	92.76	PASS
96.197	350	381	35.50	92.76	PASS
117.998	210	378	84.98	92.76	PASS
132.584	350	375	35.04	92.76	PASS
147.500	147	338	79.41	92.76	PASS
161.858	209	392	33.99	92.76	PASS
177.007	38	338	76.41	92.76	PASS
310.220	316	392	34.68	92.76	PASS
366.628	350	147	27.71	92.76	PASS

Note: FCC part 15.209 limit used in this range is for reference only at 10 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

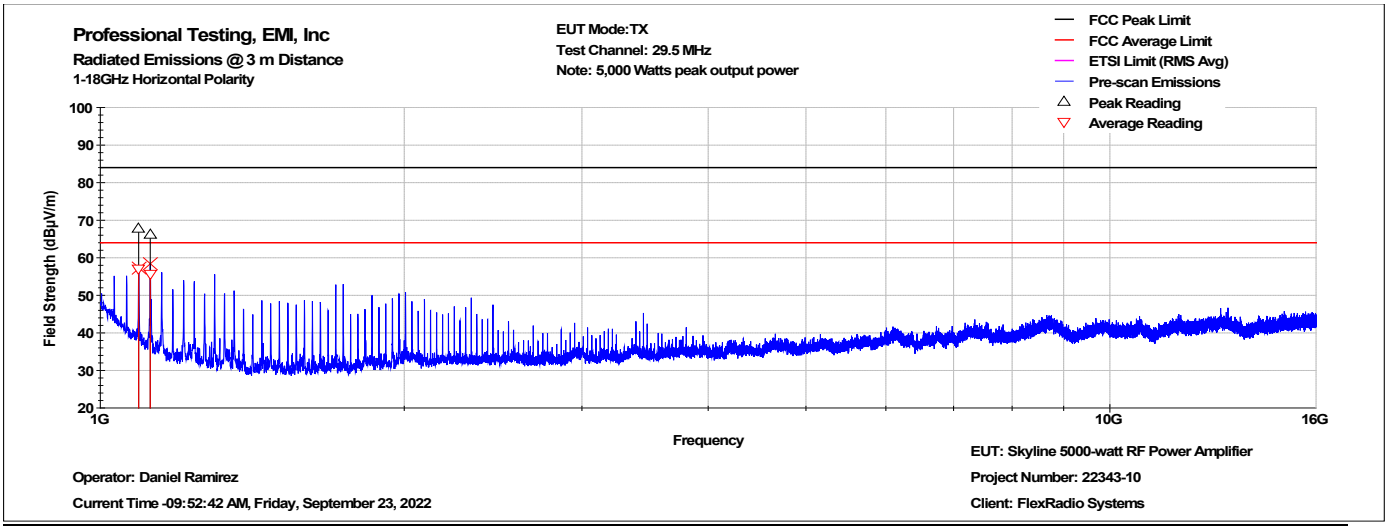
1GHz - 18GHz Vertical Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1091.59	9	175	67.60	102.22	PASS
1239.19	16	162	57.78	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

1GHz - 18GHz Horizontal Polarity Emissions Data



Frequency (MHz)	EUT Direction (Degrees)	Antenna Height (cm)	Peak Reading (dBµV)	Limit 60 dBc (dBµV)	Results
1091.59	28	265	67.84	102.22	PASS
1120.92	318	265	66.15	102.22	PASS

Note: FCC part 15.109 Class A limit used in this range is for reference only at 3 meters distance. There were no emissions observed within 60 dBc of the transmitter rated output power.

6.0 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.

7.0 Test Equipment

7.1 Conducted Measurements at the Antenna Port

	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
308	ENI	440LA	Amplifier, 35W, .15-300MHz, 45dB	104	N/A
A105	Narda	768A-20	20 dB 20 W Attenuator	None	10/21/2024
A122	JFW	50HF-030-25/18	Attenuator, N, 30dB 25W, DC-18GHz	None	6/20/2024
C355	Pasternack	PE300-120	Cable, RF, SMA-SMA, 3.048m	None	10/24/2024
N/A	Bird Electronic	4273-020	Coupler	N/A	N/A
2431	Rohde & Schwarz	132.6005K26	Test Receiver, ESU / EMI Test Receiver 20 Hz - 26.5 GHz	100027	8/31/2023
2211	Fluke	6060B	Synthesized RF Signal Generator, 10kHz - 1050MHz	5400211	12/6/2023
2431	Rohde & Schwarz	ESU	20Hz to 26.5GHz EMI Receiver	100027	8/31/2023
N/A	Keysight	N5181B	9kHz to 6GHz Signal Generator	MY59100371	5/15/2023
N/A	Keysight	N5181B	9kHz to 3GHz Signal Generator	MY59100385	12/10/2024

7.2 Radiated 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
1457	HP	8447D	Preamp, .1-1300MHz	1937A02800	10/21/2022
1937	Agilent	E4440A - AYZ	PSA , 3 Hz - 26.5 GHz, Opt. AYZ	MY44808298	11/12/2022
2172	ETS-Lindgren	3142C	Antenna, Biconilog, 26 MHz-3GHz	49383	3/11/2023
C027	none	RG214	Cable Coax, N-N, 25m, 25MHz - 1GHz	None	9/9/2023
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1293	EMCO	6502	Antenna, Loop, Active, .01-30MHz	2040	9/14/2022
1509B	Braden	TDK 10M	TDK 10M Chamber,sVSWR > 1 GHz	DAC-012915-005	4/9/2023
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, 100MHz-18GHz	None	1/14/2024
C030	none	none	Cable Coax, N-N, 30m, 1 - 18GHz	None	9/9/2023
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	110313	4/16/2023
C137	Belden	M17/164	Cable, RF, N-N, 9.14m, Black, 9 kHz - 1 GHz	None	9/15/2023
C289	Pasternack	PE354-24	Cable, N-SMA, 0.610m Blue	1310	9/9/2024

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

All uncertainty calculations, estimates and expressions thereof shall be in accordance with ANAB policy. Since Nemko USA, Inc. operates in accordance with ANAB Document Number AR 2250: 2021/06/16, 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 ANAB Document Number AR 2250.

1. Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at Nemko USA 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 USA's 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	2.82
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	3.48
Radiated Emissions	30 to 1,000 MHz	10 m	3.88
	1 to 18 GHz	3 m	4.31

End of Report