

Test Report C-3596B

Equipment Under Test: Lasair Pro

Requirement(s): FCC eCFR 47 Part 15: 207, 209, 225
KDB 996369 D04
ISED: RSS-210, RSS-GEN

Test Date(s): 07/18/2023-08/17/2023

Prepared for: Particle Measuring Systems
Attn: Joan Legerski
5475 Airport Blvd
Boulder, CO 80301

Report Issued by: Adam Hauke, EMC Engineer

Signature: 

Date: 10/11/2023

Report Reviewed by: Adam Alger, Laboratory Manger

Signature: 

Date: 08/22/2023

Report Constructed by: Adam Hauke, EMC Engineer

Signature: 

Date: 07/25/2023

This test report may not be reproduced, except in full, without approval of Laird Connectivity LLC

CONTENTS

Contents	2
Laird Connectivity Test Services in Review	3
1 Test Report Summary	4
2 Client Information	5
2.1 Equipment Under Test (EUT) Information	5
2.2 Product Description	5
2.3 Modifications Incorporated for Compliance.....	5
2.4 Deviations and Exclusions from Test Specifications	5
2.5 Test Channels	6
2.6 Firmware Versions	6
2.7 Programming Information	6
2.8 Antenna Information	6
3 References	7
4 Uncertainty Summary	8
5 Test Data	9
5.1 Radiated Emissions	9
5.2 AC Mains Conducted Emissions	27
6 Revision History	30

Laird Connectivity Test Services in Review

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

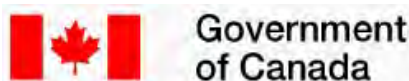
Scope of accreditation includes all test methods listed herein unless otherwise noted



Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers



Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

Company: Particle Measuring Systems	Page 3 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

1 TEST REPORT SUMMARY

During **07/18/2023-08/17/2023** the Equipment Under Test (EUT), **Lasair Pro**, as provided by **Particle Measuring Systems** was tested to the following requirements:

47 CFR Part 15 & ISED Canada – Class A

Requirements	Description	Method	Compliant
15.207 RSS-GEN	Conducted AC Emissions 0.15-30 MHz	ANSI C63.10	Yes
15.225(d) RSS-GEN	Radiated Emissions 30-40000 GHz	ANSI C63.10	Yes
15.225 RSS-210	Operation within the band 13.11-14.01 MHz	ANSI C63.10	Yes
15.31(k) RSS-247	Simultaneous Transmission NFC and 2.4, 5 GHz WLAN	ANSI C63.10	Yes
RSS-GEN	99% OBW	ANSI C63.10	Yes

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Particle Measuring Systems
Contact Person	Joan Legerski
Address	5475 Airport Blvd Boulder, CO 80301

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Lasair Pro
Model Number	5100, 310, 360
Serial Number	163810
FCC ID	2BCDH-LPRO
IC ID	31142-LPRO
Contains FCC ID	SQG-60SIPT
Contains IC ID	3147A-60SIPT

2.2 Product Description

Airborne particle counter implementing 2.4 GHz and 5 GHZ WLAN and NFC.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Test Channels

Radio	Channel	Frequency (MHz)	Bandwidth (MHz)	Modulation
2.4 GHz WLAN	1	2412	20	1 Mbps
	6	2437	20	1 Mbps
	11	2452	20	1 Mbps
5 GHz WLAN	36	5180	20	6 Mbps
	44	5220	20	6 Mbps
	60	5300	20	6 Mbps
	64	5320	20	6 Mbps
	100	5500	20	6 Mbps
	120	5600	20	6 Mbps
	157	5785	20	6 Mbps

2.6 Firmware Versions

Lasair Pro FW: 01.02.03wi

Labtool Version: 1.1.0.188

Labtool Wireless Device Firmware Version: 88w8997.16.80.205.p208

Dut labtool Version: 1.0.0.164

2.7 Programming Information

EUT device was programmed via ethernet connected to a wireless network hub. VxWorks.bin firmware was loaded onto the EUT in order to operate Labtool to control the radio module. Putty command “debug set net 1” enabled the EUT to communicate with Labtool via the ethernet port. Labtool interface as accessed using clariFi debugger software by inputting the following commands in the Lua Command Line window:

```
“dofile “c:/ClariFi/labToolBridge.luac””
```

```
“labToolBridge()”
```

The following commands were then entered into windows cmd window:

```
“cd c:\labtool”
```

```
“DutApiSisoACDualif.exe”
```

The windows cmd window was then used to program the radio module Tx modes for testing.

2.8 Antenna Information

Antenna data sheet not required. Only radiated measurements are used to show compliance with limits for fundamental and spurious emissions for operation under part 15.255 / RSS-210 B.6.

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR 47 Part 15	-	2023	-	-
ICES-003	7	2020	-	-
RSS-GEN	5	2018	2019	2021
RSS-247	2	2017	-	-
RSS-210	10	2019	-	-
ANSI C63.4	-	2014	2017	-
ANSI C63.10	-	2020	-	-
KDB 996369 D04	02	2020	-	-
KDB 174176 D01	01	2015	-	-

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

References

CISPR 16-4-1

CISPR 16-4-2

CISPR 32

ANSI C63.23

A2LA P103

A2LA P103c

ETSI TR 100-028

Measurement Type	Configuration	Uncertainty $\pm$
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m) Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m) Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB

Block Diagram



5.1.1 Radiated Emissions

Operator	Jon Dilley Adam Hauke	QA	Adam Hauke Dylan Rosenfeldt
Temperature	22.3°C 21.7°C	R.H. %	45.10% 53.60%
Test Date	07/10/2023 07/11/2023	Location	Chamber 5
Requirement	FCC 15.209 RSS-GEN	Method	ANSI C63.4

FCC 15.209 Limits:

Frequency (MHz)	Quasi-Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-40000	-	54.0	74.0

Test Parameters

Frequency	30-40000 MHz	Distance	3 m
Detector(s)	Peak Reading Peak, QP, Avg - Final	Table height	80 cm
RBW	120 kHz 1 MHz	VBW	1.2 MHz 3 MHz
Note	No emissions above 30 MHz associated with NFC radio transmission. Device is a Class A unintentional transmitter.		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna – Double Ridge Horn	ETS Lindgren	3117	109300	01/30/2023	01/30/2024	Active Calibration
AA 960162	Cable	MegaPhase	EM2-S1S1- 120	51503501001	03/22/2022	03/22/2023	Active Verification
AA 960174	Antenna – Small Horn	ETS Lindgren	3116C-PA	00206880	09/27/2022	09/27/2023	Active Calibration
AA 960211	Antenna – Low Noise Amplifier	Mini-Circuits	ZVA-213X- S+	977711030	01/30/2023	01/30/2024	Active Calibration
AA 960194	Antenna – Biconical	A.H. Systems, Inc.	SAS-540	780	09/29/2022	09/29/2023	Active Calibration

Company: Particle Measuring Systems	Page 10 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

Instrumentation (continued)

AA 960195	Antenna – Log Periodic	A.H. Systems, Inc.	SAS-512-2	557	09/29/2022	09/29/2023	Active Calibration
EE 960085	Analyzer – EMI Receiver	Agilent	85033E	MY39204103	07/07/2022	07/07/2024	Active Calibration
LSC-500	Cable	Chamber 5 Emissions	-	-	04/25/2022	04/25/2023	Active Verification

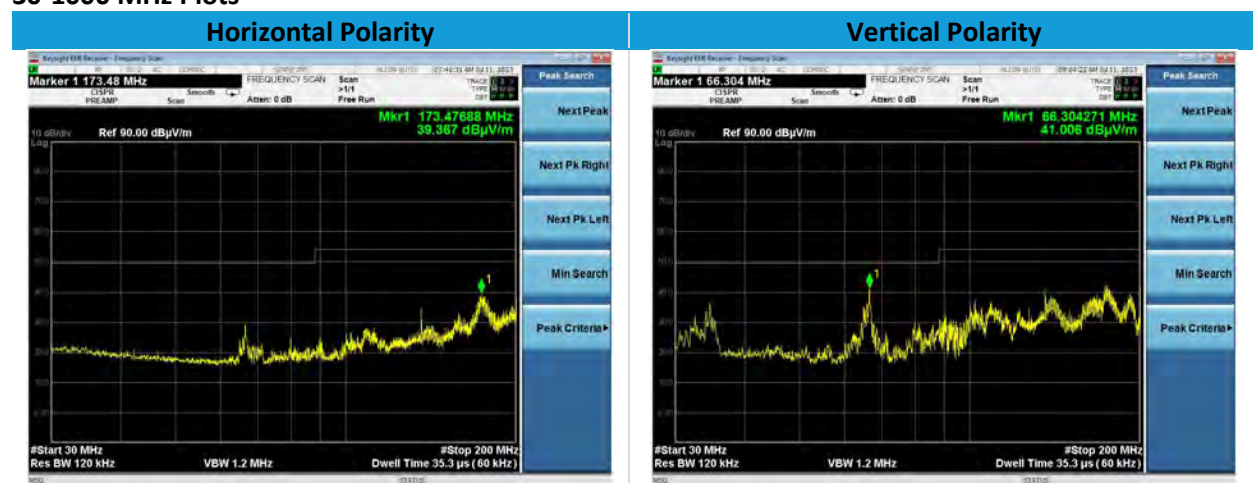
EUT Parameters

Input Power	120 VAC @ 60 Hz	Mode	Batteries Charging, Test Cycling, WLAN Rx
--------------------	-----------------	-------------	---

30-1000 MHz Measurements

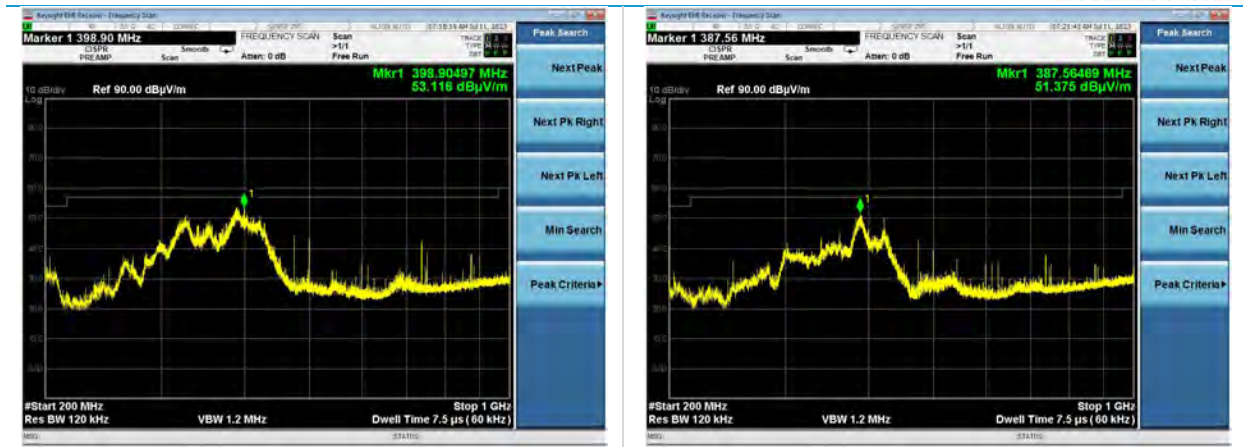
Frequency (MHz)	Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)
66.3	Vertical	100	0	38.7	49.5	10.8
66.3	Horizontal	200	0	28.2	49.5	21.3
135.8	Horizontal	225	275	35.0	54.0	19.0
135.8	Vertical	100	115	36.6	54.0	17.4
173.7	Horizontal	100	220	36.1	54.0	17.9
327.3	Horizontal	100	24	46.2	57.0	10.8
390.6	Horizontal	100	65	47.6	57.0	9.4
391.5	Vertical	140	225	43.4	57.0	13.6
736.7	Vertical	100	75	38.7	57.0	18.3
736.8	Horizontal	113	95	43.6	57.0	13.4

30-1000 MHz Plots



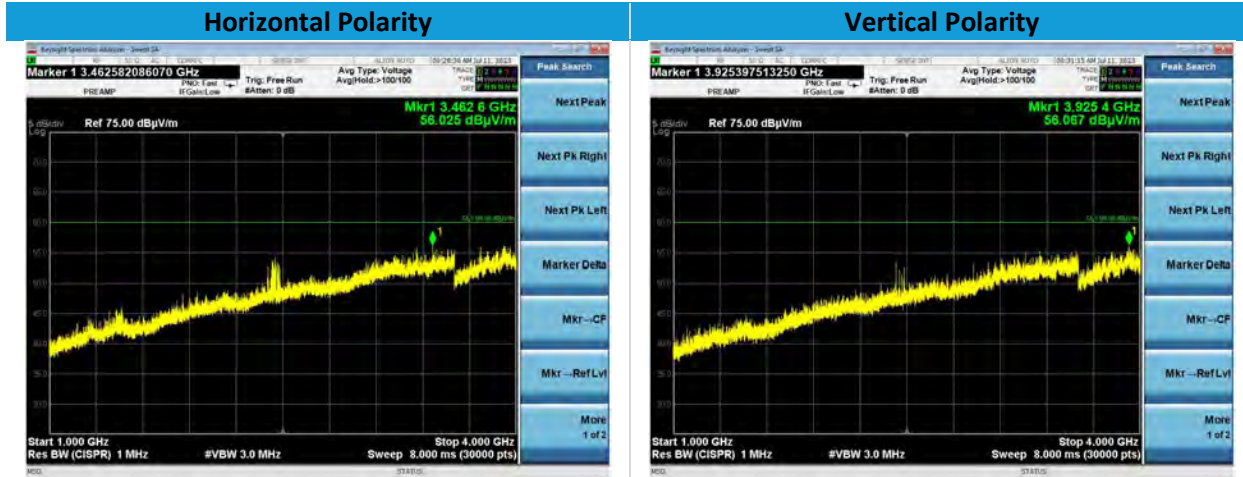
30-200 MHz

Company: Particle Measuring Systems		Name: Lasair Pro
Report: C-3596B	Page 11 of 30	Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810



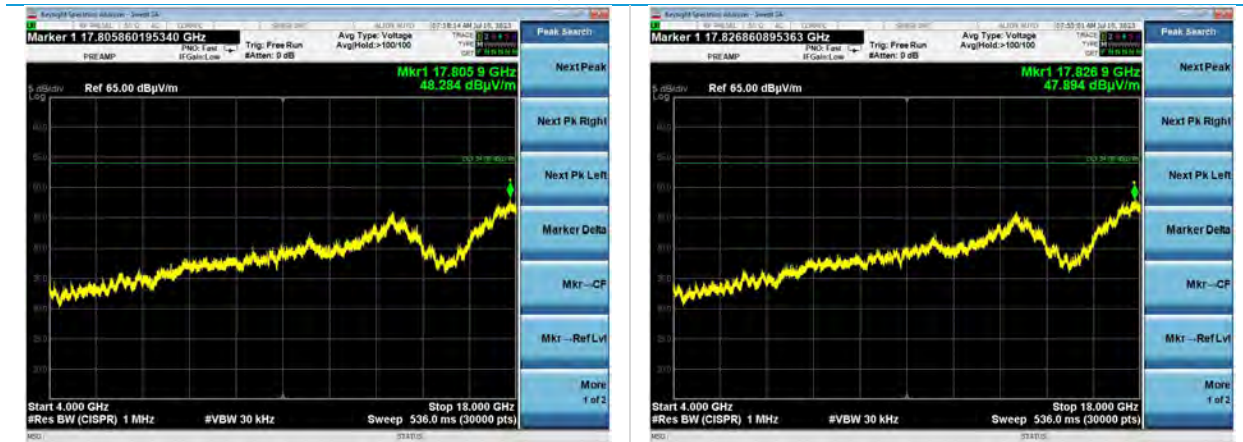
200-1000 MHz

1000-40000 MHz Plots



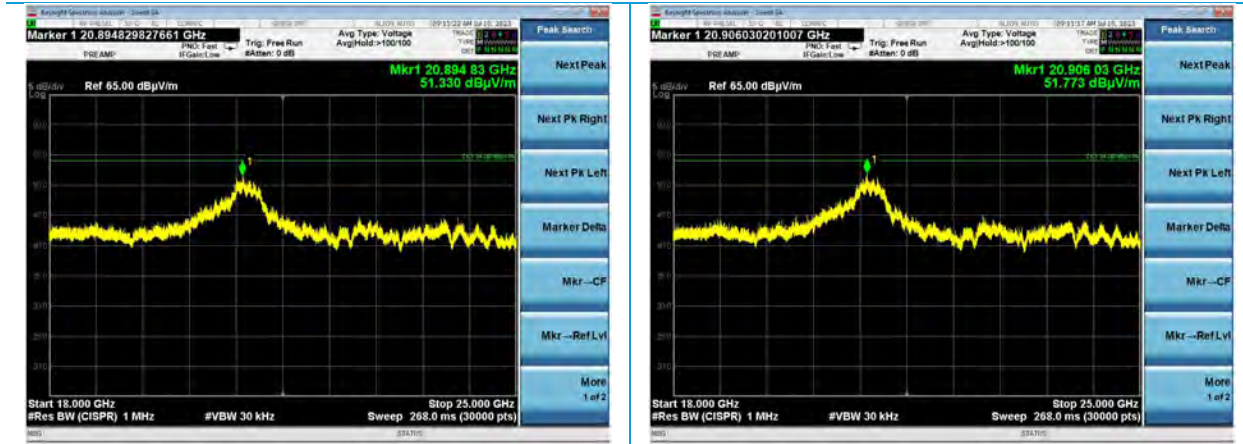
1000-4000 MHz

No Emissions, 2.4 GHz Radio Observed

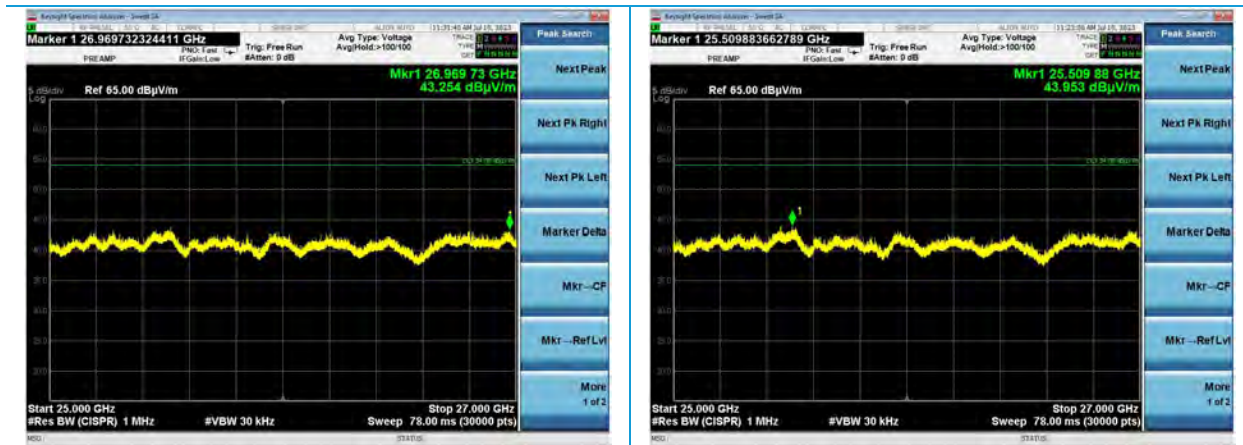


4000-18000 MHz

No Emissions Observed



18000-25000 MHz
No Emissions Observed



25000-40000 MHz
No Emissions Observed

5.1.2 Operation within the band 13.11-14.01 MHz

Operator	Adam Hauke	QA	Anthony Smith
Temperature	21.8°C	R.H. %	58.00%
Test Date	07/18/2023	Location	Chamber 3
Requirement	FCC 15.225 RSS-210	Method	ANSI C63.10

FCC 15.225 | RSS-247 Limits:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
13.553-13.567	15,848	30
13.410-13.553 13.567-13.710	334	30
13.110-13.410 13.710-14.010	106	30

FCC 15.209 | RSS-247 Limits:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

Test Parameters

Frequency	9 kHz-30 MHz	Distance	3 m
Detector(s)	Peak Trace Quasi-Peak, Average – Final	Table height	80 cm
RBW	200 Hz – 9-150 kHz 9 kHz – 0.15-30 MHz	VBW	2 kHz – 9-150 kHz 90 kHz – 0.15-30 MHz
Example Calculations	See ANSI C63.10 § 6.4 for converting field strength measurement to limit distance		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960206	Antenna – Loop	A.H. Systems, Inc.	SAS-565-H	2758	09/03/2021	09/03/2023	Active Calibration
EE 960203	Analyzer – EMI Receiver	Keysight	N9038A	MY56400072	04/11/2023	04/11/2024	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	04/26/2022	04/26/2024	Active Verification

Company: Particle Measuring Systems	Page 14 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

EUT Parameters

Input Power	120 VAC @ 60 Hz	Mode	Battery Operated NFC Active
--------------------	-----------------	-------------	-------------------------------

Measurements

Frequency (MHz)	Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Reading @ Limit Distance (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Note
0.325	Parallel	100	89	57.8	-16.0	17.4	33.4	Ambient
0.325	Perpendicular	100	4	57.8	-16.0	17.4	33.4	Ambient
0.155	Flat	100	242	48.2	-31.8	23.8	55.6	Ambient
13.56	Parallel	100	89	60.5	39.1	84.0	44.9	
13.55	Parallel	100	89	46.2	24.8	50.5	25.7	
13.57	Parallel	100	89	50.3	28.9	50.5	21.6	
13.41	Parallel	100	89	22.9	1.4	40.5	39.1	
13.84	Parallel	100	89	22.2	1.0	40.5	39.5	
0.652	Parallel	100	89	53.8	13.8	31.3	17.5	Ambient
1.96	Parallel	100	89	37.4	-0.8	30.0	30.8	Ambient

Frequency (MHz)	Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Reading @ Limit Distance (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)	Note
13.56	Perpendicular	100	4	55.8	34.4	84.0	49.6	
13.55	Perpendicular	100	4	41.5	20.1	50.5	30.4	
13.57	Perpendicular	100	4	45.6	24.2	50.5	26.3	
13.29	Perpendicular	100	4	22.3	0.7	40.5	39.8	
14.01	Perpendicular	100	4	22.3	1.2	40.5	39.3	
0.652	Perpendicular	100	4	53.8	13.8	31.3	17.5	Ambient
1.96	Perpendicular	100	4	37.1	-1.1	30.0	31.1	Ambient
13.56	Flat	100	242	45.7	24.3	84.0	59.7	
13.55	Flat	100	242	31.7	10.3	50.5	40.2	
13.57	Flat	100	242	35.7	14.3	50.5	36.2	
13.35	Flat	100	242	22.3	0.8	40.5	39.7	
13.71	Flat	100	242	22.6	1.3	40.5	39.2	
0.652	Flat	100	242	53.8	13.8	31.3	17.5	Ambient
1.96	Flat	100	242	35.1	-3.1	30.0	33.1	Ambient
0.009	Flat	100	0	93.5	13.5	48.5	35.0	Ambient
0.118	Flat	100	0	46.6	-33.4	26.2	59.6	Ambient
0.009	Parallel	100	0	97.3	17.3	48.5	31.2	Ambient
0.009	Perpendicular	100	0	94.9	14.9	48.5	33.6	Ambient

Noise Floor (Ambient) Plots



9-150 kHz Parallel



0.15-30 MHz Parallel

Company: Particle Measuring Systems		Name: Lasair Pro
Report: C-3596B	Page 15 of 30	Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810



9-150 kHz Perpendicular



0.15-30 MHz Perpendicular



9-150 kHz Flat



0.15-30 MHz Flat

Measurement Plots



9-150 kHz Parallel



0.15-30 MHz Parallel



9-150 kHz Perpendicular



0.15-30 MHz Perpendicular



9-150 kHz Flat



0.15-30 MHz Flat

Operator	Adam Hauke	QA	Adam Alger
Temperature	21.4°C	R.H. %	56.00%
Test Date	09/12/2023	Location	Conducted Bench
Requirement	FCC 15.225 RSS-210	Method	ANSI C63.10

Test Parameters

Frequency	13.56 MHz	Distance	20 cm
Detector(s)	99% OBW	Table height	N/A
RBW	10 Hz	VBW	30 Hz

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960206	Antenna – Loop	A.H. Systems, Inc.	SAS-565-H	2758	08/31/2023	08/31/2025	Active Calibration
EE 960088	Analyzer – EMI Receiver	Agilent	N9038A	MY51210138	04/10/2023	04/10/2024	Active Calibration
LSC-211	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-002	04/25/2023	04/25/2024	Active Verification

EUT Parameters

Input Power	120 VAC @ 60 Hz	Mode	Battery Operated NFC Active
--------------------	-----------------	-------------	-------------------------------

99% OBW



99% OBW – 22 Hz

Company: Particle Measuring Systems	Page 18 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

Company: Particle Measuring Systems	Page 19 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

5.1.3 Simultaneous Transmission

Operator	Adam Hauke	QA	Jon Dilley
Temperature	22.0°C	R.H. %	60.00%
Test Date	07/17/2023	Location	Chamber 3
Requirement	FCC 15.31 RSS-247	Method	ANSI C63.10

FCC 15.209 | RSS-247 Limits:

Frequency (MHz)	Quasi-Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-40000	-	54.0	74.0

Test Parameters

Frequency	2310-40000 MHz	Distance	3 m
Detector(s)	Peak Trace Peak, Average -Final	Table height	150 cm
RBW	1 MHz	VBW	3 MHz Peak 10 Hz Average

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960153	Filter – High Pass 2.4 GHz	KWM	HPF-L-14186	7272-04	04/11/2023	04/11/2024	Active Calibration
AA 960158	Antenna – Double Ridge Horn	ETS Lindgren	3117	109300	01/30/2023	01/30/2024	Active Calibration
AA 960161	Filter – Highpass 5 GHz	K&L Microwave	11SH10-8000	2	04/11/2023	04/11/2024	Active Calibration
AA 960162	Cable	MegaPhase	EM2-S1S1-120	51503501 001	06/13/2023	06/13/2024	Active Verification
AA 960174	Antenna – Small Horn	ETS Lindgren	3116C-PA	00206880	09/27/2022	09/27/2023	Active Calibration

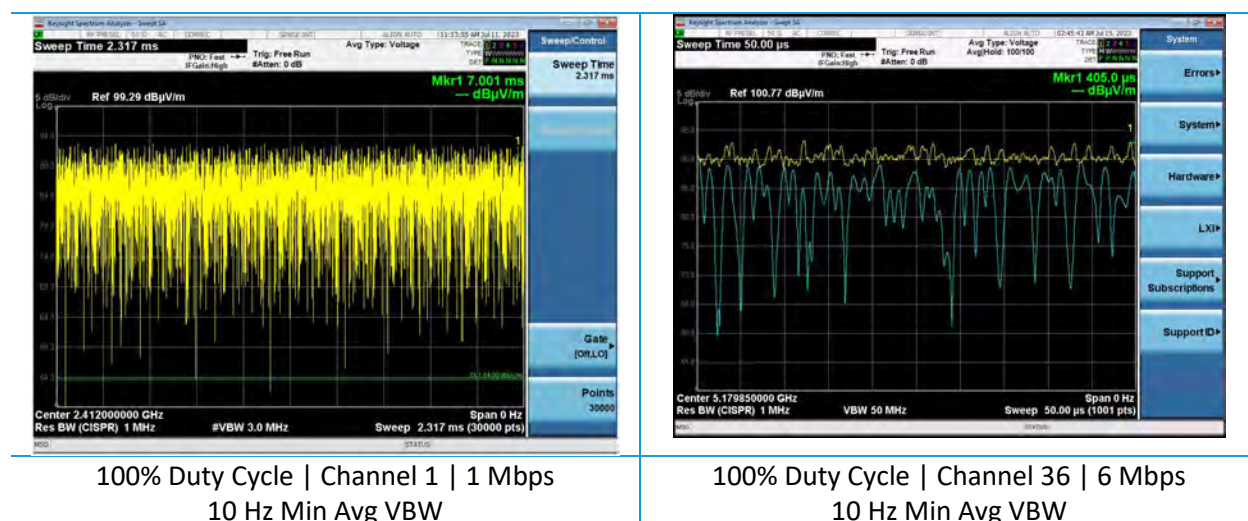
Instrumentation (continued)

AA 960221	Cable	A.H. Systems, Inc.	SAC-26G-6	524	06/13/2022	06/13/2024	Active Verification
EE 960087	Analyzer – Spectrum	Agilent	N9010A	MY53400296	04/11/2023	04/11/2024	Active Calibration
EE 960203	Analyzer – EMI Receiver	Keysight	N9038A	MY56400072	04/11/2023	04/11/2024	Active Calibration

EUT Parameters

Input Power	120 VAC @ 60 Hz	Mode	Charging AMPDU DutyCycle TX Constant Tx NFC Active
--------------------	-----------------	-------------	---

Duty Cycle Plots

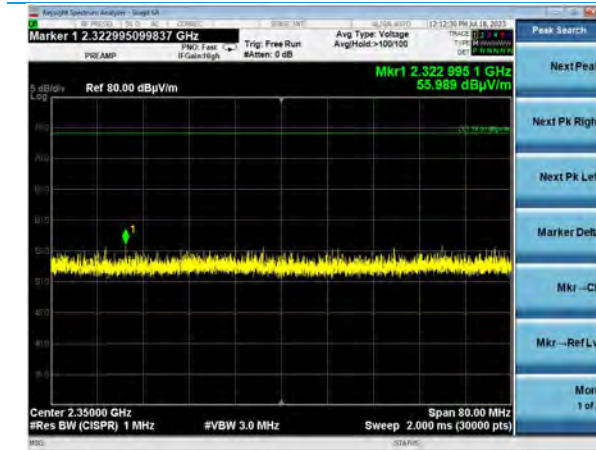


Measurements

Frequency (MHz)	Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Channel	Data Rate (Mbps)
2375.6	Horizontal	150	0	43.5	54.0	10.5	56.0	74.0	18.0	1	1
2486.3	Horizontal	150	0	44.7	54.0	9.3	56.7	74.0	17.3	11	1
4881.4	Vertical	100	9	46.8	54.0	7.2	58.2	74.0	15.8	36	6
5384.8	Horizontal	187	190	48.2	54.0	5.8	58.1	74.0	15.9	64	6
5448.7	Horizontal	190	190	45.1	54.0	8.9	57.9	74.0	16.1	100	6
7305.3	Horizontal	150	323	41.8	54.0	12.2	46.0	74.0	28.0	6	1

Band Edge Plots

Company: Particle Measuring Systems	Page 21 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

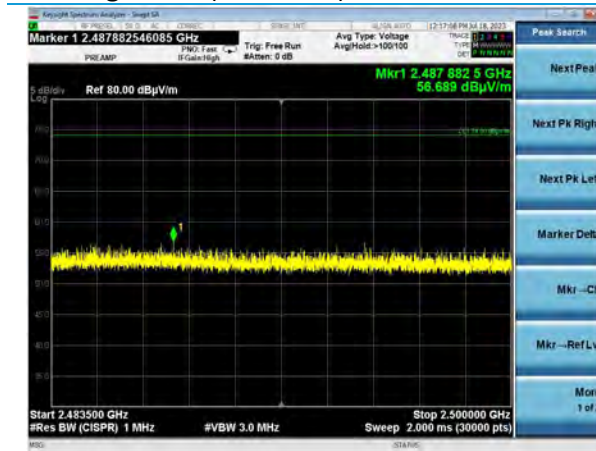


2310-2390 MHz | Peak Trace | Horizontal
Channel 1 | 1 Mbps



2310-2390 MHz | Average Trace | Horizontal
Channel 1 | 1 Mbps

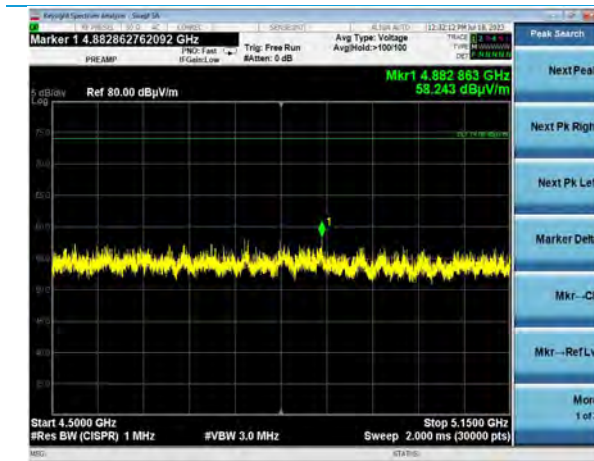
Band Edge Plots (continued)



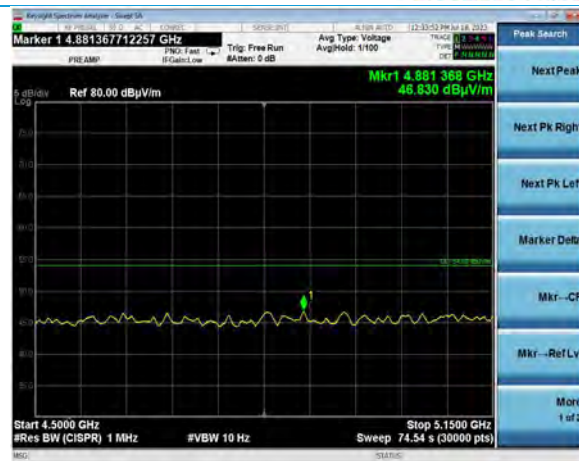
2483.5-2500 MHz | Peak Trace | Horizontal
Channel 11 | 1 Mbps



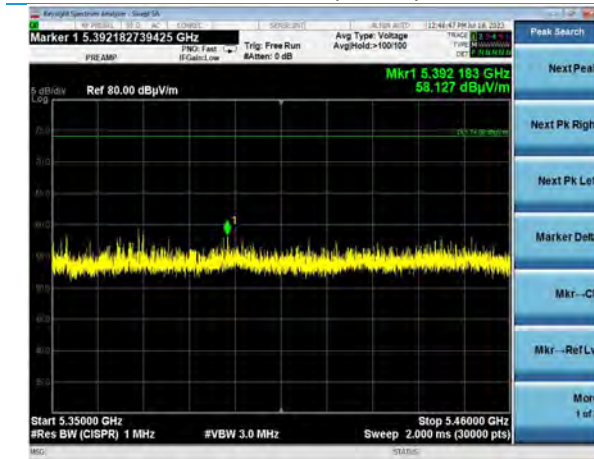
2483.5-2500 MHz | Average Trace | Horizontal
Channel 11 | 1 Mbps



4500-5150 MHz | Peak Trace | Vertical
Channel 36 | 6 Mbps



4500-5150 MHz | Average Trace | Vertical
Channel 36 | 6 Mbps

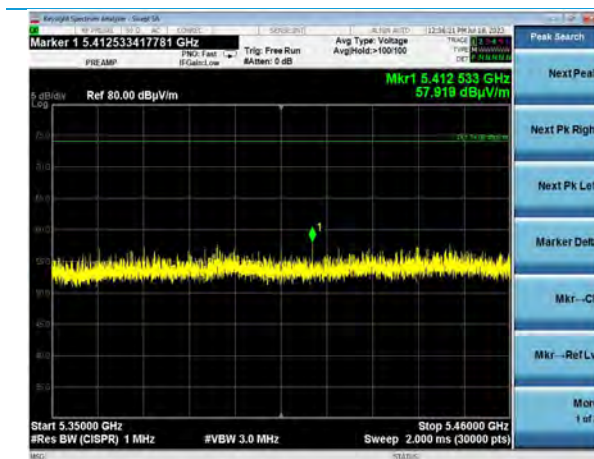


5350-5460 MHz | Peak Trace | Horizontal
Channel 64 | 6 Mbps



5350-5460 MHz | Average Trace | Horizontal
Channel 64 | 6 Mbps

Band Edge Plots (continued)

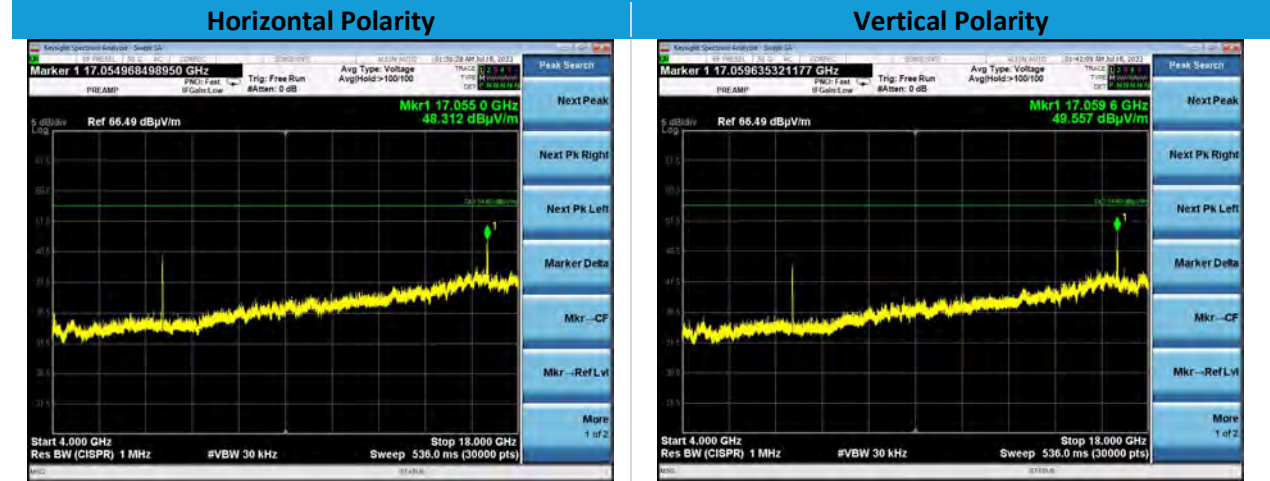


5350-5460 MHz | Peak Trace | Horizontal
Channel 100 | 6 Mbps

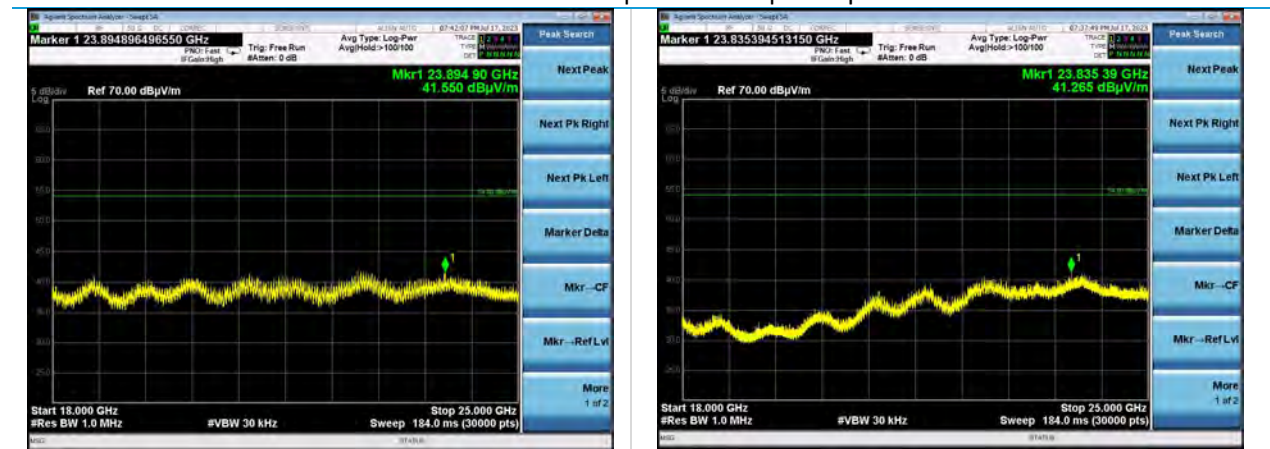


5350-5460 MHz | Average Trace | Horizontal
Channel 100 | 6 Mbps

Spurious Plots

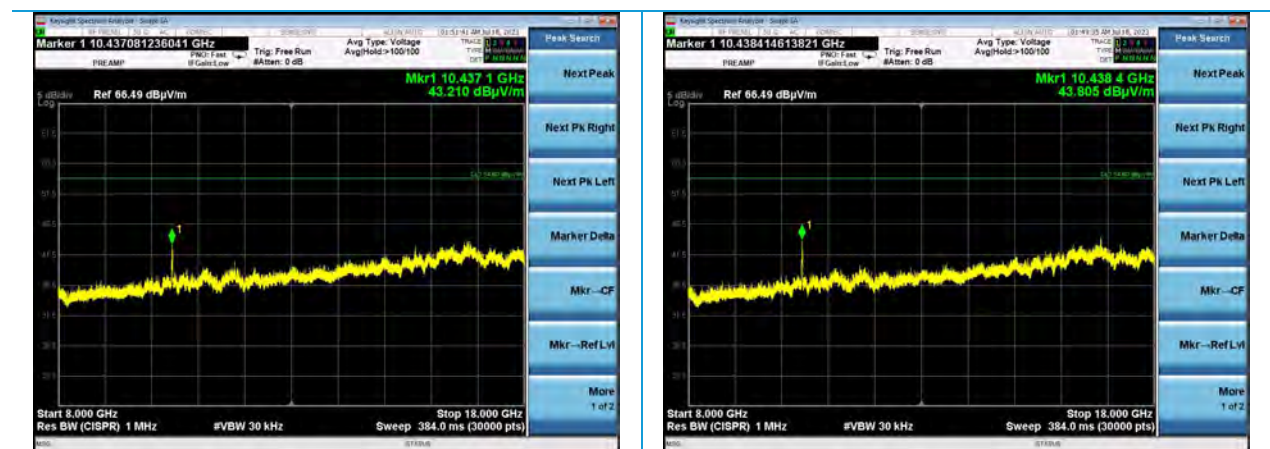


4000-18000 MHz | Channel 6 | 1 Mbps



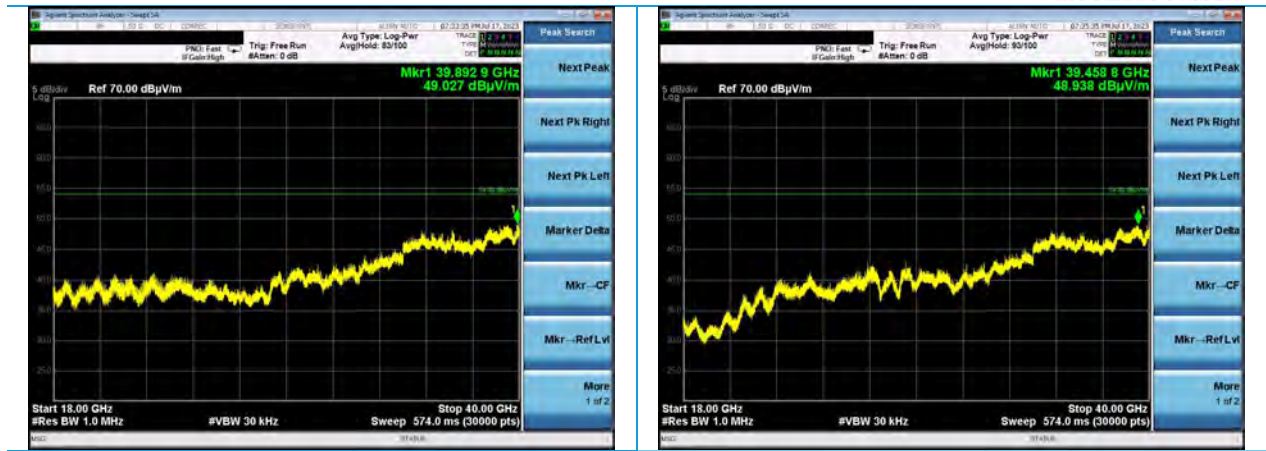
18000-25000 MHz | Channel 6 | 1 Mbps

Spurious Plots (continued)



8000-18000 MHz | Channel 44 | 6 Mbps

Company: Particle Measuring Systems		Name: Lasair Pro
Report: C-3596B	Page 24 of 30	Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810



18000-40000 MHz | Channel 44 | 6 Mbps

Company: Particle Measuring Systems	Page 25 of 30	Name: Lasair Pro
Report: C-3596B		Model: 5100
Quote: NBO-11-2018-001705		Serial: 163810

5.1.4 Frequency Stability

Operator	Adam Hauke	QA	Anthony Smith
Temperature	22.5°C	R.H. %	64.30%
Test Date	07/18/2023	Location	Chamber 3
Requirement	FCC 15.225 RSS-210	Method	ANSI C63.10

Limit: The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test Parameters

Frequency	13.56 MHz	Distance	3 m
Detector(s)	Peak	Table height	80 cm

Results

Voltage	Center Frequency (Hz)
Nominal	13560822.5
85%	13560804.3
115%	13560837.1

Test Parameters

Temperature	-20° to 50°C	Distance	3 m
Detector(s)	Peak	Table height	80 cm

Results

Temperature	Center Frequency (Hz)
20.0°C	13560616.7
-20.0°C	13560656.3
50.0°C	13560651.9

5.2 AC Mains Conducted Emissions

A line impedance stabilization network (LISN) or artificial mains network (AMN) allows the emissions of the power supply conductors to be measured while isolating the EUT from the supply mains.

Description of Measurement

The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

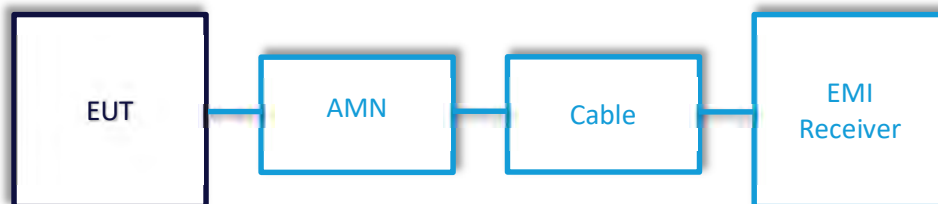
Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)

Example Calculations

Measurement (dBμV) + Cable factor (dB) + Other (dB) = Corrected Reading (dBμV)

Margin (dB) = Limit (dBμV) - Corrected Reading (dBμV)

Block Diagram



5.2.1 AC Mains Conducted Emissions

Operator	Adam Hauke	QA	Adam Alger
Temperature	22.7°C	R.H. %	44.60%
Test Date	08/17/2023	Location	Conducted Bench
Requirement	FCC 15.207 RSS-GEN	Method	ANSI C63.10

Limits:

Frequency (MHz)	Quasi-Peak Limit (dBμV/m)	Average Limit (dBμV/m)
0.15-0.5	66.0-56.0*	56.0-46.0*
0.5-5	56.0	46.0
5-30	60.0	50.0

*Decreases with the logarithm of the frequency.

Test Parameters

Frequency	0.15-30 MHz	Distance	40 cm from wall 80 cm from LISN
Detector(s)	Peak Trace Quasi-Peak, Average Final	Table height	80 cm
RBW	9 kHz	VBW	62 kHz

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960088	Analyzer – EMI Receiver	Agilent	N9038A	MY51210138	04/10/2023	04/10/2024	Active Calibration
EE 960089	LISN	COM-POWER	LI-215A	191943	04/10/2023	04/10/2024	Active Calibration
EE 960162	LISN	COM-POWER	LI-215A	191969	04/10/2023	04/10/2024	Active Calibration
LSC-212	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-001	04/25/2022	04/25/2024	Active Verification

EUT Parameters

Input Power	120 VAC @ 60 Hz	Mode	NFC Read Active Antenna port shunted with 47Ω Resistor per KDB 174176
--------------------	-----------------	-------------	--

Measurements

Line	Frequency (MHz)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Mode
1	0.295	50.4	60.4	10.0	45.2	50.4	5.2	
1	0.439	47.8	57.1	9.3	39.2	47.1	7.9	
1	21.5	30.2	60.0	29.8	23.6	50.0	26.4	
2	0.294	50.8	60.4	9.6	44.8	50.4	5.6	
2	0.448	49.5	56.9	7.4	39.2	46.9	7.7	
2	21.7	33.8	60.0	26.2	30.7	50.0	19.3	

Plots



6 REVISION HISTORY

Version	Date	Notes	Person
0.0	07/25/2023	Initial Draft	Adam Hauke
1.0	08/22/2023	Final Draft	Adam Hauke
1.1	09/12/2023	Added 99% OBW	Adam Hauke
1.2	10/11/2023	Updated 99% OBW Section	Adam Hauke

END OF REPORT