

C-3680 TR3680B

Equipment Under Test: Sera NX040 - 802.15.4z HRP UWB

Requirement(s): FCC 15.519
RSS-220

Test Date(s): 6/13/2023 – 12/1/2023

Prepared for: Laird Connectivity, LLC.
Attn: Jonathan Kaye
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Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/08/2023

Report Reviewed by: Adam Alger, Laboratory Manager

Signature:  Date: 12/08/2023

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature:  Date: 12/02/2023

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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

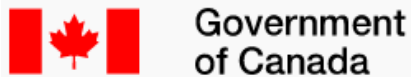
Scope of accreditation includes all test methods listed herein unless otherwise noted



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: Laird Connectivity	Page 3 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

1 TEST REPORT SUMMARY

During **6/13/2023 – 12/1/2023** the Equipment Under Test (EUT), **Sera NX040**, as provided by **Laird Connectivity** was tested to the following requirements:

FCC 15.519 / RSS-220

Requirements	Description	Specification	Method	Compliant
FCC 15.519 (a)(1) RSS-220 §5.3.1(b)	Shutdown Timing Requirements	10 Seconds	ANSI C63.10	Yes
FCC 15.521 (e) RSS-220 §5.1(a)	UWB Bandwidth 10 dB	Highest Emissions contained within UWB BW	ANSI C63.10	Yes
FCC 15.519 (c)(d)(e) RSS-220 §5.3.1(c)(d)(e)(g)	Transmitter Radiated Emissions	Limits listed per test in each section	ANSI C63.10	Yes
FCC 15.207 RSS-GEN 8.8	AC Mains Conducted Emissions	FCC 15.207	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	0.5 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	Laird Connectivity
Contact Person	Jonathan Kaye
Address	W66 N220 Commerce Ct. Cedarburg, WI 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Sera NX040
Model Number	Sera NX040
Serial Number	Trace Antenna Version: 00016 External Antenna Version: 00029
FCC ID	SQG-SERANX040
IC ID	3147A-SERANX040

2.2 Product Description

802.15.4z HRP UWB + Bluetooth LE v5.4 Module

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 Modes

Radio test modes were set using provided Python scripts run via Windows Powershell on a laptop connected to the EUT using USB. Channels are 5 and 9, respective center frequencies of 6489.6 MHz and 7987.2 MHz. EUT uses pulse rates BPRF and HPRF.

2.6 EUT Configurations

Two variants of EUT tested:

Config 1 utilizes a trace antenna.

Config 2 utilizes an external antenna (tested with UWB antenna connected).

Company: Laird Connectivity	Page 6 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
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3 REFERENCES

Publication	Edition	Date	AMD 1
ANSI C63.10	-	2013	-
FCC eCFR	-	2023	-
RSS-220	1	2009	2018

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

<p>Description of Measurement</p>	<p>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.</p> <p>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.</p> <p>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.</p>
<p>Example Calculations</p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>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</p>

Block Diagram



5.1.1 Radiated Emissions – 10 dB Bandwidth

Operator	Anthony Smith	QA	Jon Dilley
Temperature	22.0°C	R.H. %	43.7%
Test Date	10/2/2023	Location	Chamber 5
Requirement	FCC 15.521(e) RSS-220 5.1(a)	Method	ANSI C63.10

Limits: >500 MHz

Test Parameters

Frequency	6000-8500 MHz	Distance	3m
Detector(s)	Peak Max Hold	Table height	150cm
RBW	1 MHz	VBW	3 MHz

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	1/30/2023	1/30/2024	Active Calibration
AA 960222	Cable	A.H. Systems, Inc.	SAC-26G-6	525	6/13/2023	6/13/2024	Active Verification
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/11/2023	4/11/2024	Active Calibration

EUT Parameters

Input Power	USB	Mode	UWB Tx
Channel	5, 9		

Data

Table

Config 1

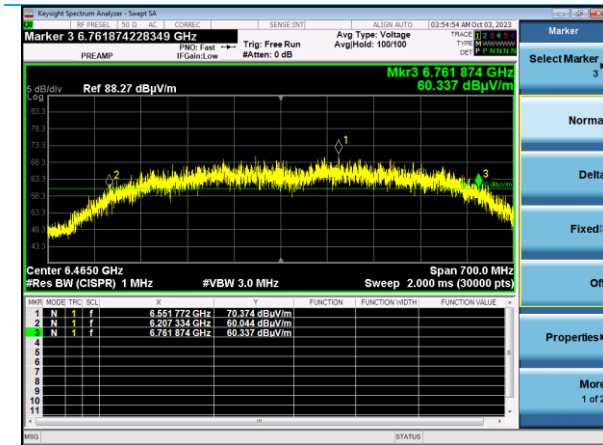
Radio	Peak Frequency (MHz)	10dB Fl Frequency (MHz)	10dB Fh Frequency (MHz)	10dB Bandwidth	Limit (MHz)	Margin (MHz)
Ch 5 HPRF	6551.8	6207.3	6761.9	554.6	500.0	54.6
Ch 5 BPRF	6537.8	6201.5	6779.6	578.1	500.0	78.1
Ch 9 HPRF	7924.2	7689.1	8263.2	574.1	500.0	74.1
Ch 9 BPRF	7893.6	7683.2	8268.6	585.4	500.0	85.4

Config 2

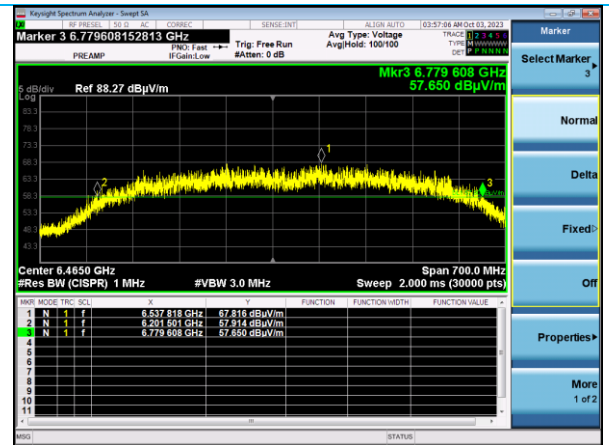
Radio	Peak Frequency (MHz)	10dB Fl Frequency (MHz)	10dB Fh Frequency (MHz)	10dB Bandwidth	Limit (MHz)	Margin (MHz)
Ch 5 HPRF	6552.9	6206.1	6776.4	570.3	500.0	70.3
Ch 5 BPRF	6559.4	6217.1	6769.8	552.7	500.0	52.7
Ch 9 HPRF	8049.3	7688.0	8265.0	577.0	500.0	77.0
Ch 9 BPRF	8080.9	7685.9	8269.6	583.7	500.0	83.7

Plots

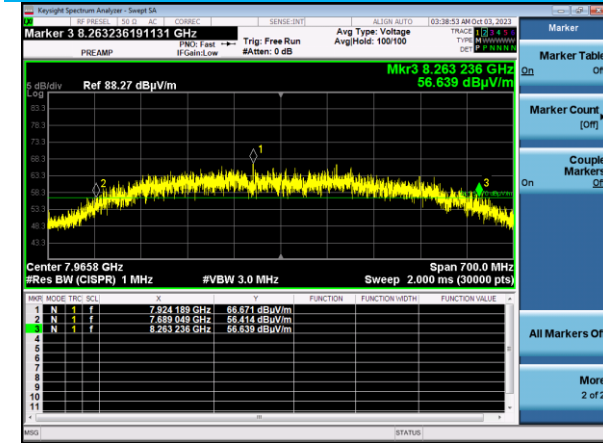
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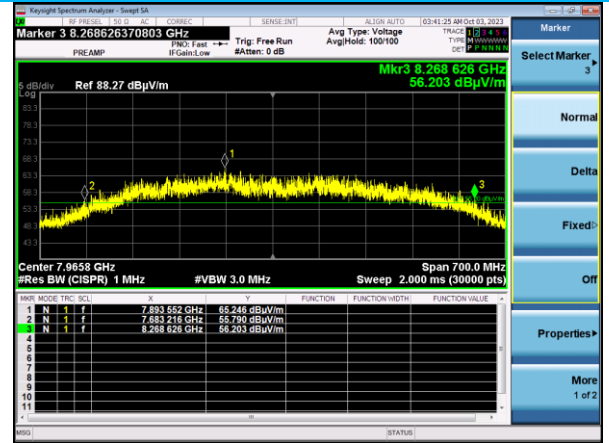
Ch 5 HPRF



Ch 5 BPRF

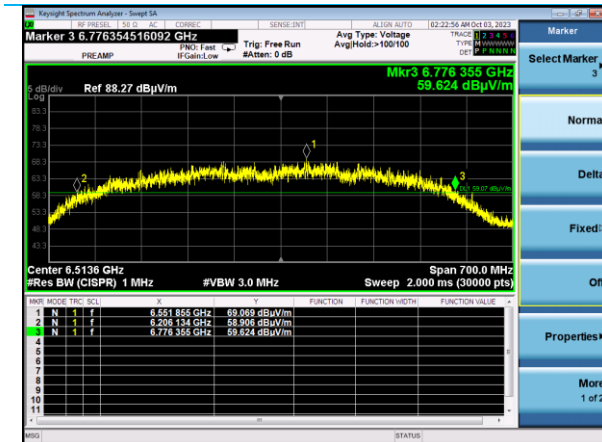


Ch 9 HPRF

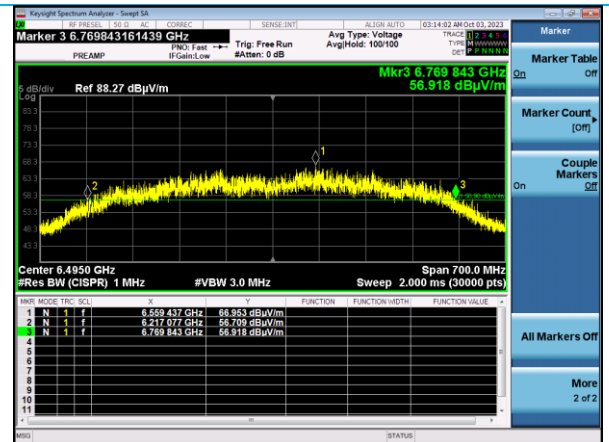


Ch 9 BPRF

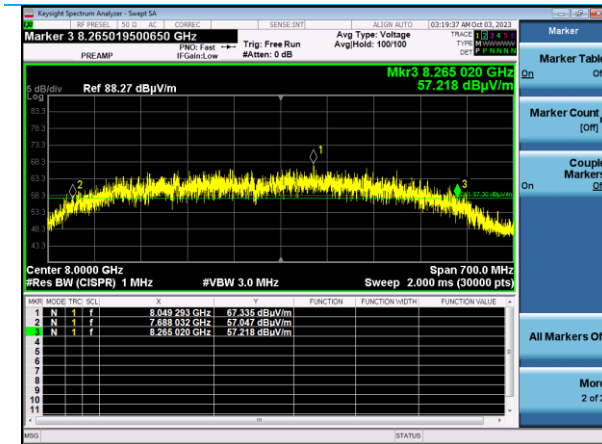
Config 2



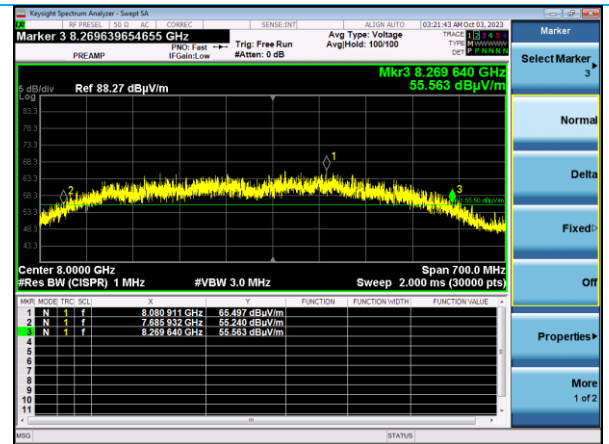
Ch 5 HPRF



Ch 5 BPRF



Ch 9 HPRF



Ch 9 BPRF

5.1.2 Radiated Emissions – Transmitter Emissions

Operator	Anthony Smith	QA	Jon Dilley
Temperature	22.0-23.9°C	R.H. %	20.6-58.2%
Test Date	6/13/2023-11/29/2023	Location	Chamber 5, Chamber 3
Requirement	FCC 15.209, 15.519 (c)(d)(e)	Method	ANSI C63.10

Limits:

15.519(c)

Frequency (MHz)	EIRP in dBm
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

15.519(d)

Frequency (MHz)	EIRP in dBm
1164-1240	-85.3
1559-1610	-85.3

15.209

Frequency (MHz)	Quasi-Peak Limit (dBµV/m) @ 3m	Average Limit (dBµV/m) @ 3m	Peak Limit (dBµV/m) @ 3m
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
Above 1000	-	54.0	74.0

RSS-220

Hand-held (Outdoor) Communication, Measurement, Location Sensing, and Tracking Devices

Frequency	E.i.r.p. in a Resolution Bandwidth of 1 MHz
960-1 610 MHz	-75.3 dBm
1.61-4.75 GHz	-70.0 dBm
4.75-10.6 GHz	-41.3 dBm
Above 10.6 GHz	-61.3 dBm

Test Parameters

Frequency	30-40000 MHz	Distance	3m – Fundamental Emission, Spurious Below 1 GHz 1m – Transmitter Spurious Above 1 GHz
Detector(s)	Peak, QP, Avg	Table height	80cm Below 1 GHz 150cm Above 1 GHz
RBW	10 MHz – Fundamental Emission 1 MHz – Spurious Above 1 GHz 9 kHz – 15.519(d)	VBW	50 MHz – Fundamental Emission 3 MHz – Above 1 GHz Spurious 30 kHz – 15.519(d)
Notes	<p>Antenna at 1m test distance for specified tests due to noise floor. Noted in relevant plots that spurious emissions seen in 1-4 GHz range are a result of active USB connection necessary to program EUT, not from EUT/radio. Reduced VBW used in some plots to identify emissions where limit is close/below normal noise floor. EUT brought close to antenna and rotated manually in 25-40 GHz range where noise floor is above limit to identify any spurious emissions.</p>		
Example Calculations	<p>Peak Power Conversion: $EIRP_{10\text{ MHz}} = EIRP_{50\text{ MHz}} + 20\log(10\text{ MHz}/50\text{ MHz}) = 0\text{ dBm} + (-13.98\text{ dB}) = -13.98\text{ dBm}$ EIRP to Field Strength: $E\text{ (dB}\mu\text{V/m)} = EIRP\text{ (dBm)} + 95.3$ Measurement Distance Adjustment From 3m to 1m: $20\log(3/1) = 9.54\text{ dB}$</p>		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960081	Antenna - Double Ridge Horn	EMCO	3115	6907	1/11/2023	1/11/2024	Active Calibration
AA 960162	Cable	MegaPhase	EM2-S1S1-120	51503501001	6/13/2023	6/13/2024	Active Verification
AA 960163	Antenna - Log Periodic	A.H. Systems, Inc.	SAS-512-2	500	8/10/2023	8/10/2024	Active Calibration
AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	8/30/2023	8/30/2024	Active Calibration
AA 960210	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	1/11/2023	1/11/2024	Active Calibration
AA 960218	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	853	7/17/2023	7/17/2024	Active Calibration
AA 960222	Cable	A.H. Systems, Inc.	SAC-26G-6	525	6/13/2023	6/13/2024	Active Verification
AA 960223	Filter - High Pass UWB	Mini-Circuits	ZHSS-K15G+	3 2304	8/8/2023	8/8/2024	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/27/2023	4/27/2024	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/11/2023	4/11/2024	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	8/22/2023	8/22/2024	Active Verification
AA 960215	Antenna - LPDA	A.H. Systems, Inc.	SAS-512-2	706	7/18/2023	7/18/2024	Active Calibration

EUT Parameters

Input Power	USB	Mode	UWB Transmit
Channel	5, 9	Packet Type	HPRF, BPRF

Data

Table

Fundamental Emission - Peak

Config 1

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Radio	EUT Orientation
6582.3	V	180	93	79.1	81.3	2.2	Ch 5 BPRF	Vertical
7893.9	V	100	270	75.7	81.3	5.6	Ch 9 BPRF	Vertical
6550.8	V	180	93	80.8	81.3	0.6	Ch 5 HPRF	Vertical
7924.7	V	100	270	77.2	81.3	4.1	Ch 9 HPRF	Vertical

Config 2

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Radio	EUT Orientation
6583.0	V	150	220	77.4	81.3	3.9	Ch 5 BPRF	Vertical
8018.3	H	100	160	76.4	81.3	4.9	Ch 9 BPRF	Flat
6552.2	V	150	220	80.1	81.3	1.2	Ch 5 HPRF	Vertical
8050.2	H	100	160	78.0	81.3	3.3	Ch 9 HPRF	Flat

Fundamental Emission - Average

Config 1

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Radio	EUT Orientation
8069.6	V	100	270	50.8	53.9	3.1	Ch 9 BPRF	Vertical
6572.6	V	180	93	51.5	53.9	2.4	Ch 5 BPRF	Vertical
6564.6	V	180	93	52.7	53.9	1.2	Ch 5 HPRF	Vertical
8062.6	V	100	270	51.6	53.9	2.4	Ch 9 HPRF	Vertical

Config 2

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Radio	EUT Orientation
8078.7	H	100	160	51.3	53.9	2.6	Ch 9 BPRF	Flat
6562.6	V	150	220	50.8	53.9	3.1	Ch 5 BPRF	Vertical
6548.6	V	150	220	51.8	53.9	2.1	Ch 5 HPRF	Vertical
8071.6	H	100	160	52.4	53.9	1.5	Ch 9 HPRF	Flat

Below 1 GHz Spurious Emissions

Config 1

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)	Quasi-Peak Margin (dB)	EUT Orientation	Radio
194.1	V	100	0	30.3	43.5	13.2	Vertical	Ch 9 HPRF
59.4	V	100	270	33.7	40.0	6.3	Vertical	Ch 9 HPRF
59.4	V	100	270	33.5	40.0	6.5	Vertical	Ch 5 HPRF
394.2	H	100	223	28.1	46.0	17.9	Vertical	Ch 5 HPRF
801.3	V	109	265	32.6	46.0	13.4	Vertical	Ch 5 HPRF

Config 2

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)	Quasi-Peak Margin (dB)	EUT Orientation	Radio
191.3	V	100	0	28.7	43.5	14.8	Vertical	Ch 9 HPRF
59.4	V	100	272	34.1	40.0	5.9	Vertical	Ch 9 HPRF
59.4	V	100	271	30.6	40.0	9.4	Vertical	Ch 5 HPRF
394.2	H	100	0	28.1	46.0	17.9	Vertical	Ch 5 HPRF
992.5	V	100	294	28.9	54.0	25.1	Vertical	Ch 5 HPRF

15.519(d) 1164 to 1240 MHz and 1559 to 1610 MHz

Both Horizontal and Vertical Polarizations were investigated with Vertical being worst case

Config 1

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Channel	EUT Orientation
1199.4	V	150	68	8.6	19.4	10.8	Ch 5 HPRF	Vertical
1591.5	V	150	180	1.8	19.4	17.6	Ch 9 HPRF	Vertical
1196.6	V	150	270	5.2	19.4	14.2	Ch 9 HPRF	Vertical

Config 2

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Channel	EUT Orientation
1207.5	V	150	180	11.7	19.4	7.7	Ch 5 HPRF	Vertical
1560.0	V	150	215	7.3	19.4	12.1	Ch 9 HPRF	Vertical

Above 1 GHz Spurious Emissions – Peak

Config 1

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Radio	EUT Orientation
16546.3	H	150	0	47.1	74.0	26.9	Ch 9 HPRF	Vert
16552.6	H	150	0	46.2	74.0	27.8	Ch 9 BPRF	Vert
12349.6	V	150	0	48.4	74.0	25.6	Ch 5 HPRF	Vert
12389.0	V	150	0	48.5	74.0	25.5	Ch 5 BPRF	Vert

Config 2

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Radio	EUT Orientation
12352.0	V	150	0	48.6	74.0	25.4	Ch 5 HPRF	Vertical
12371.9	V	150	0	47.9	74.0	26.1	Ch 5 BPRF	Vertical
16550.0	V	150	0	46.7	74.0	27.3	Ch 9 HPRF	Vertical
16526.5	V	150	0	47.2	74.0	26.8	Ch 9 BPRF	Vertical

Above 1 GHz Spurious Emissions – Average

Config 1

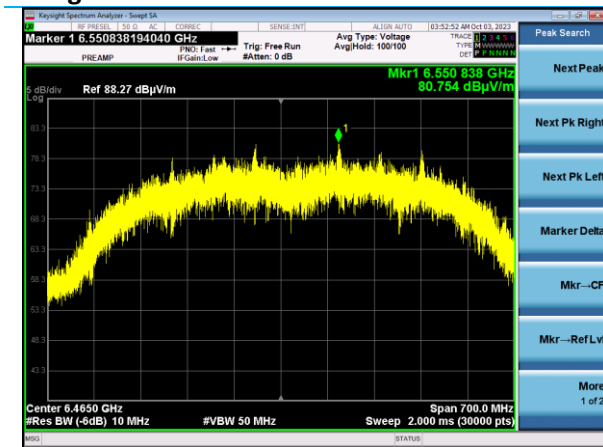
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dB μ V/m)	Average Limit (dB μ V/m)	Average Margin (dB)	Channel	EUT Orientation
16546.3	H	150	0	34.4	43.4	9.0	Ch 9 HPRF	Vertical
16552.6	H	150	0	34.4	43.4	9.0	Ch 9 BPRF	Vertical
12349.6	V	150	0	35.5	43.4	7.9	Ch 5 HPRF	Vertical
12389.0	V	150	0	35.2	43.4	8.2	Ch 5 BPRF	Vertical

Config 2

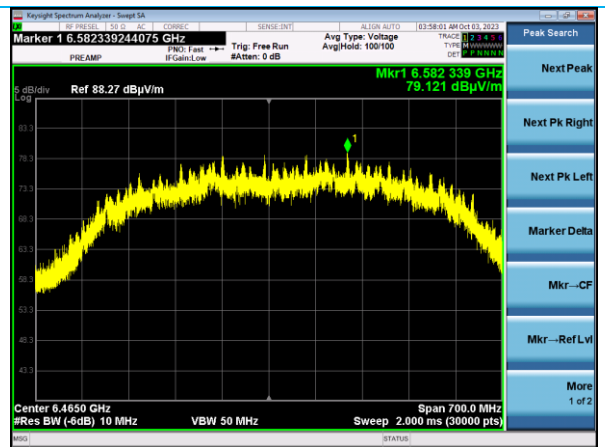
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dB μ V/m)	Average Limit (dB μ V/m)	Average Margin (dB)	Channel	EUT Orientation
12352.0	V	150	0	36.0	43.4	7.4	Ch 5 HPRF	Vertical
12371.9	V	150	0	35.4	43.4	8.0	Ch 5 BPRF	Vertical
16550.0	V	150	0	34.5	43.4	8.9	Ch 9 HPRF	Vertical
16526.5	V	150	0	34.2	43.4	9.2	Ch 9 BPRF	Vertical

Plots

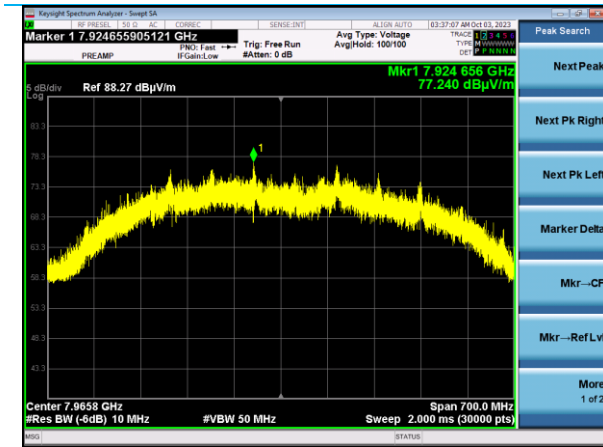
Fundamental Emission – Peak
Config 1



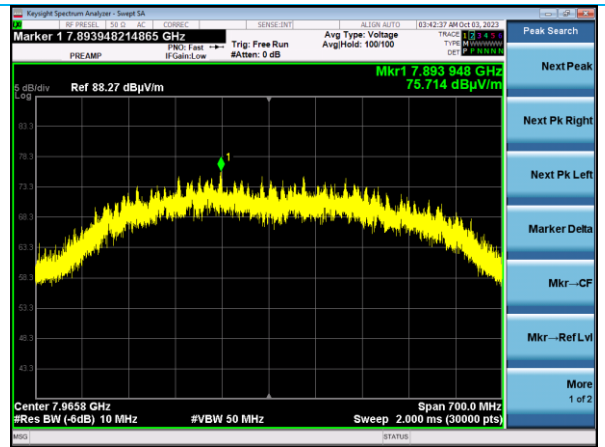
Ch 5 HPRF



Ch 5 BPRF



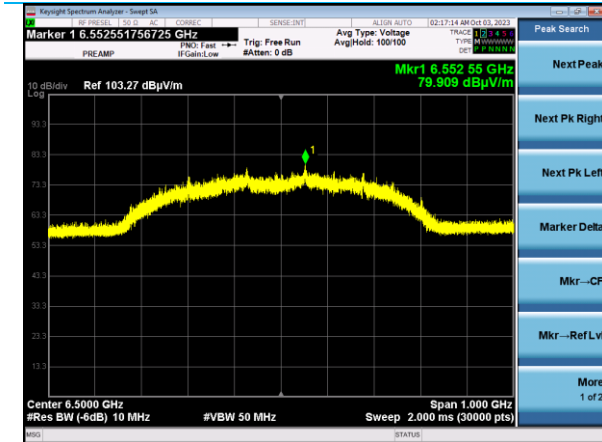
Ch 9 HPRF



Ch 5 BPRF

Company: Laird Connectivity	Page 20 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

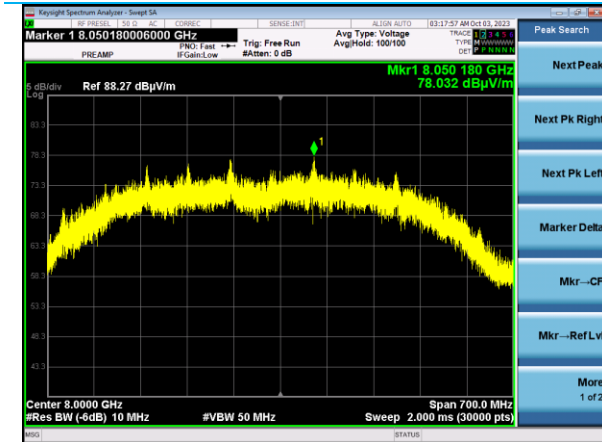
Config 2



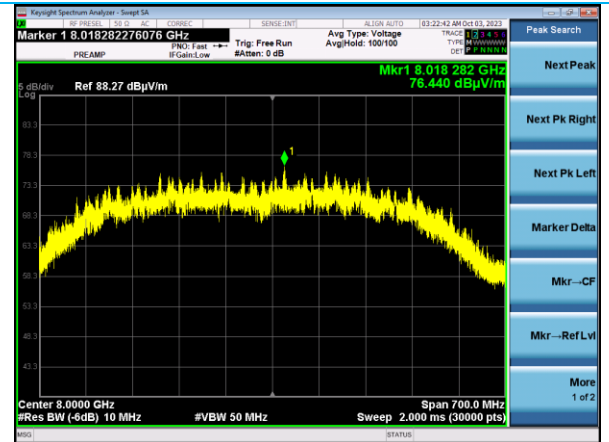
Ch 5 HPRF



Ch 5 BPRF



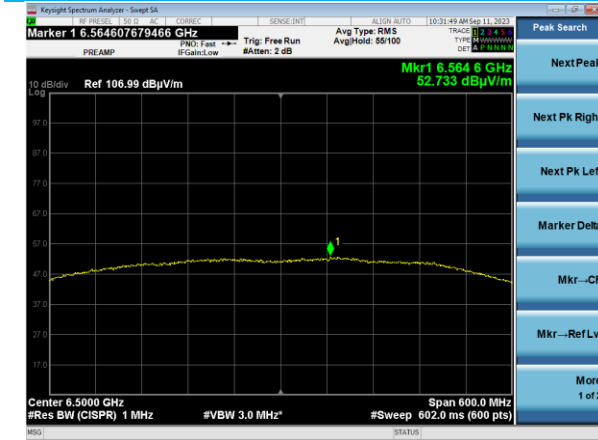
Ch 9 HPRF



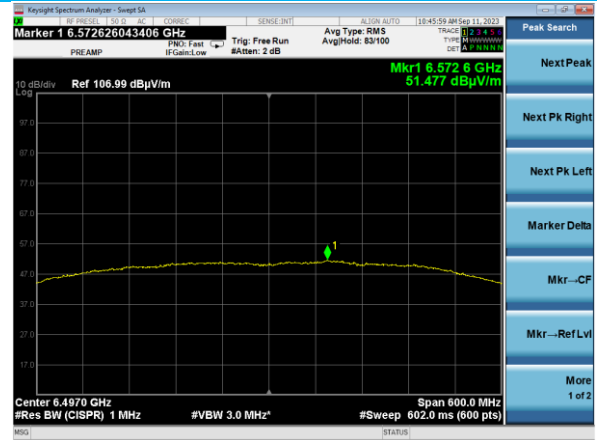
Ch 9 BPRF

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Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

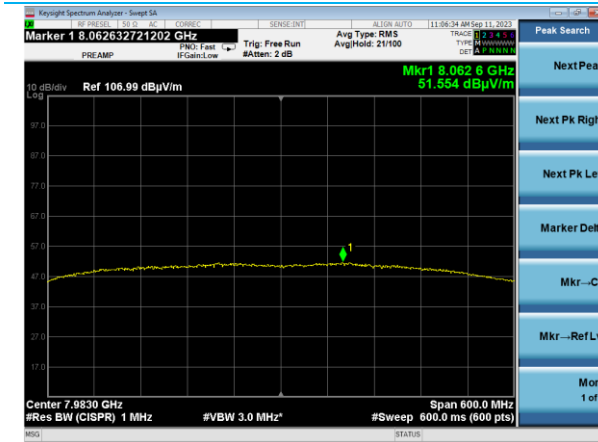
Fundamental Emission – Average
Config 1



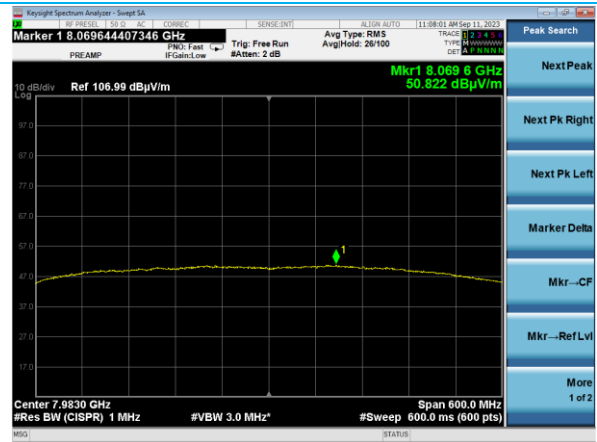
Ch 5 HPRF



Ch 5 BPRF



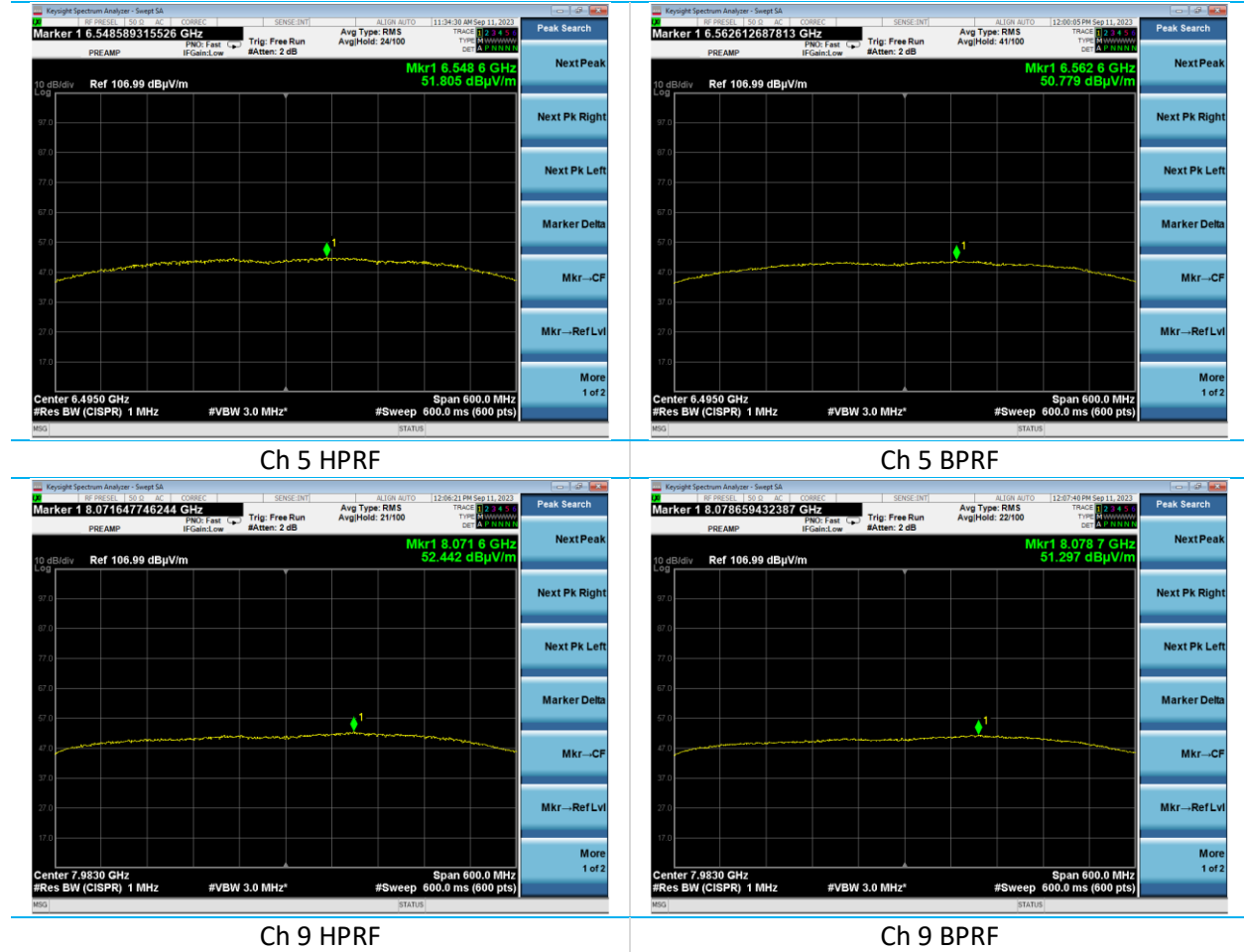
Ch 9 HPRF



Ch 9 BPRF

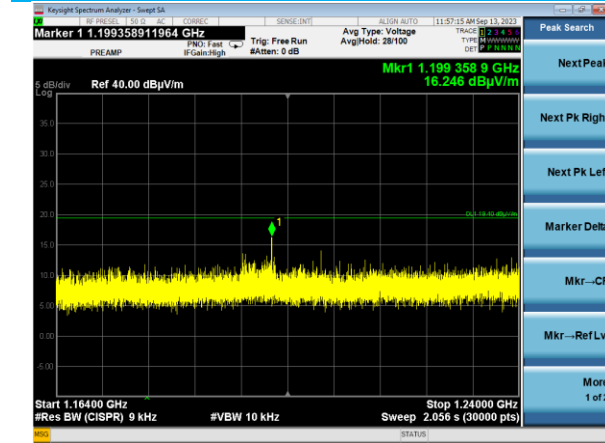
Company: Laird Connectivity	Page 22 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

Config 2

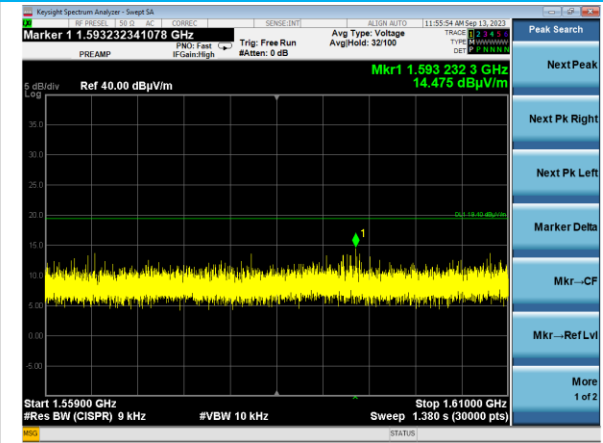


Company: Laird Connectivity	Page 23 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

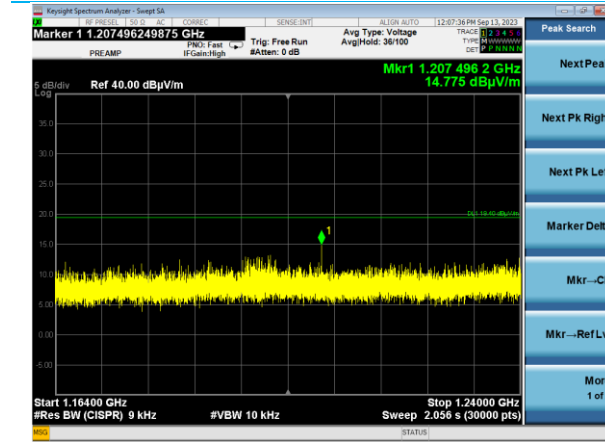
1164 to 1240 and 1559 to 1610 MHz
Config 1



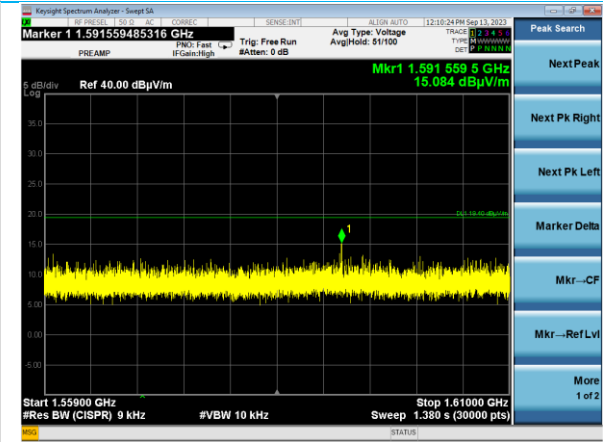
Ch 5 1164-1240



Ch 5 1559-1610



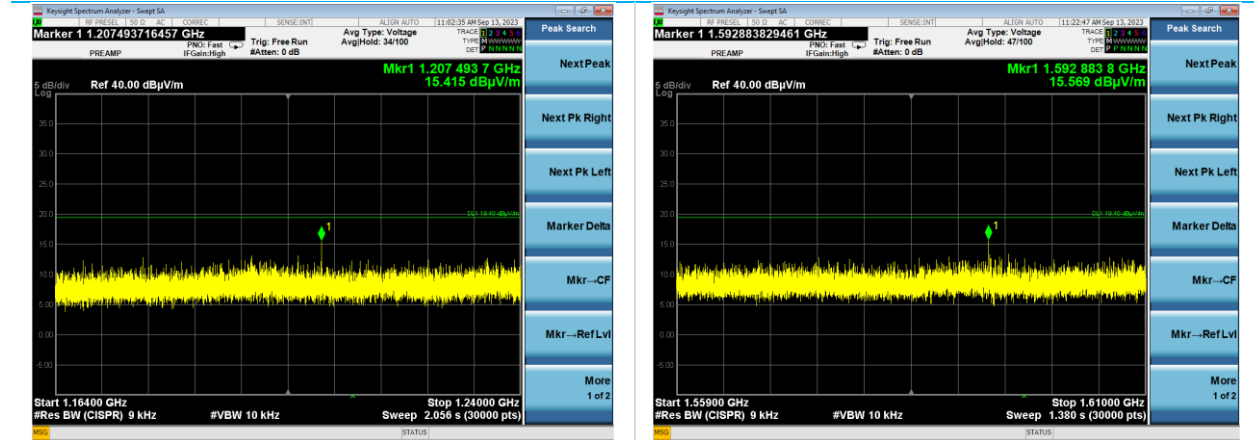
Ch 9 1164-1240



Ch 9 1559-1610

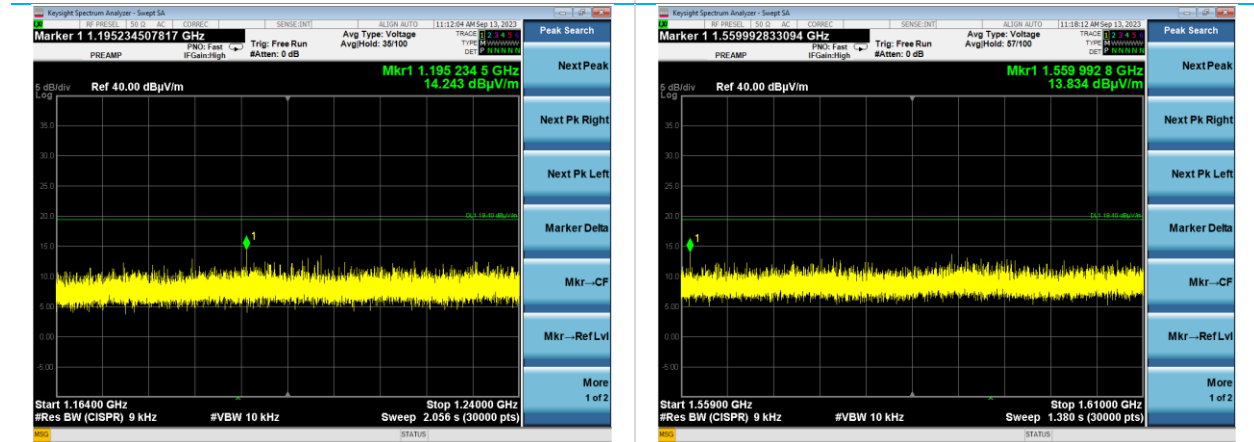
Company: Laird Connectivity	Page 24 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

Config 2



Ch 5 1164-1240

Ch 5 1559-1610

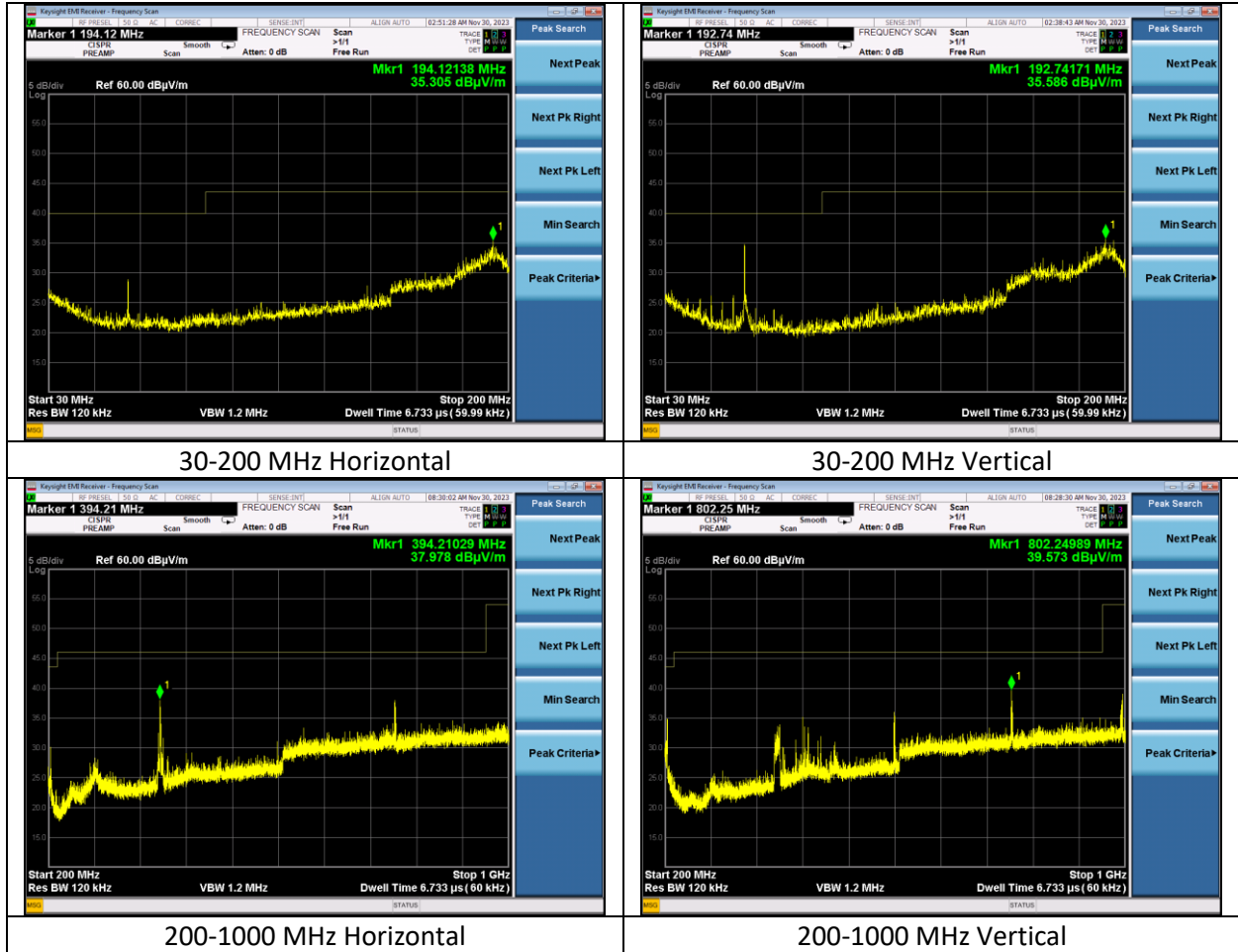


Ch 9 1164-1240

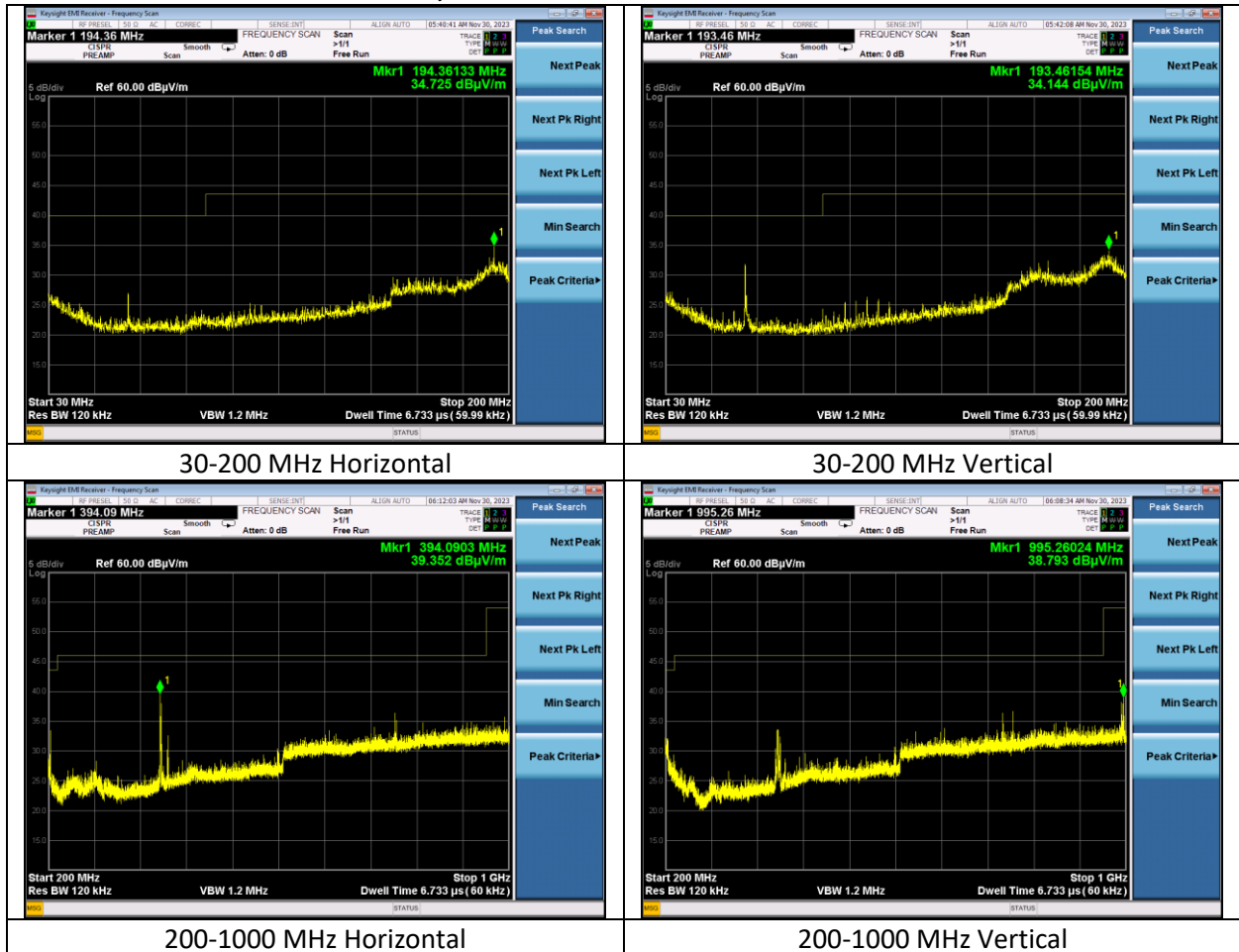
Ch 9 1559-1610

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Spurious Emissions Below 1 GHz
Config 1 – Channel 5 shown, no difference between channels
Emissions seen related to USB cable, not Radio

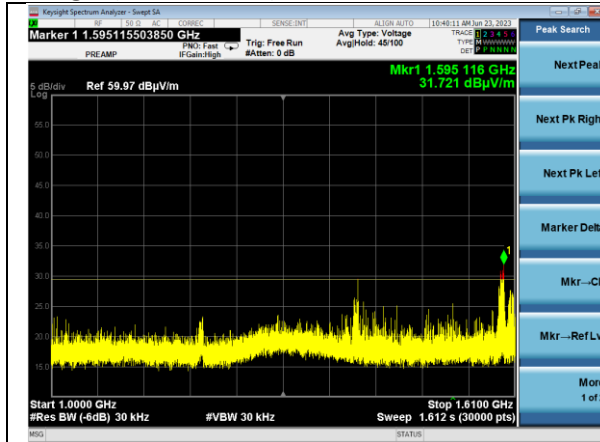


Config 2 – Channel 5 shown, no difference between channels
Emissions seen related to USB cable, not Radio

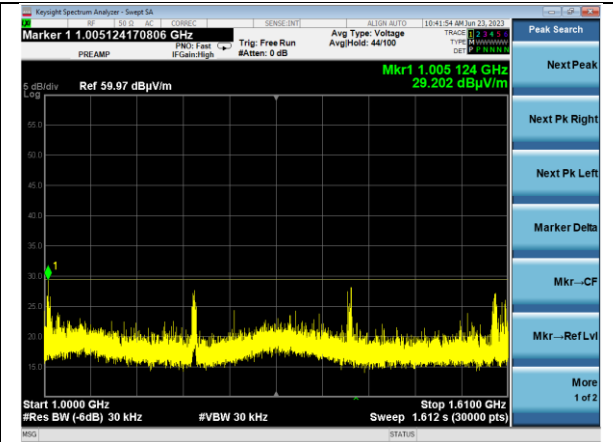


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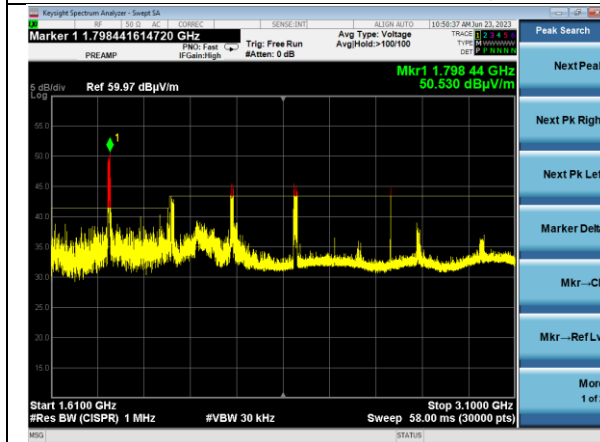
Spurious Emissions Above 1 GHz
Config 1 (EUT Vertical)



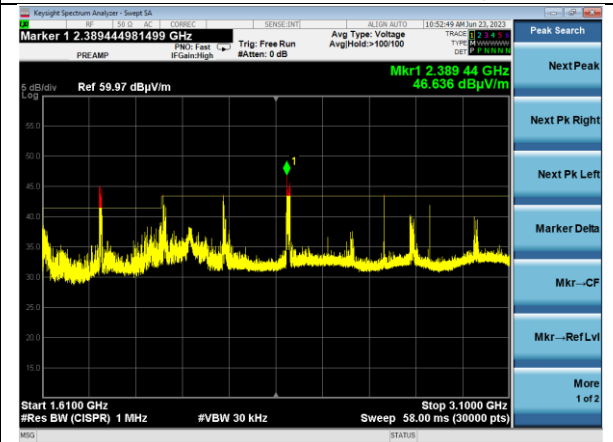
1-1.61 GHz Horizontal
Ch 9 - Emissions from USB connection, not EUT



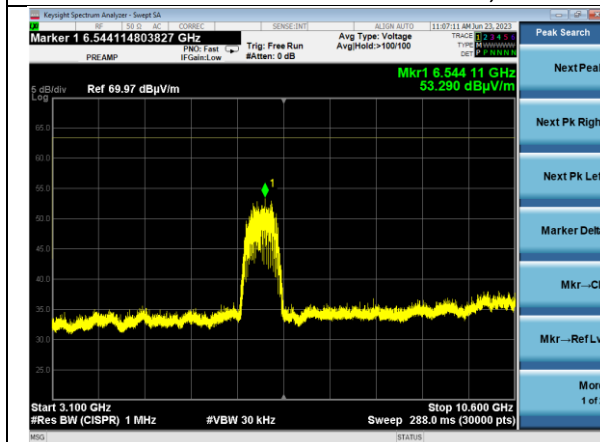
1-1.61 GHz Vertical
Ch 9 - Emissions from USB connection, not EUT



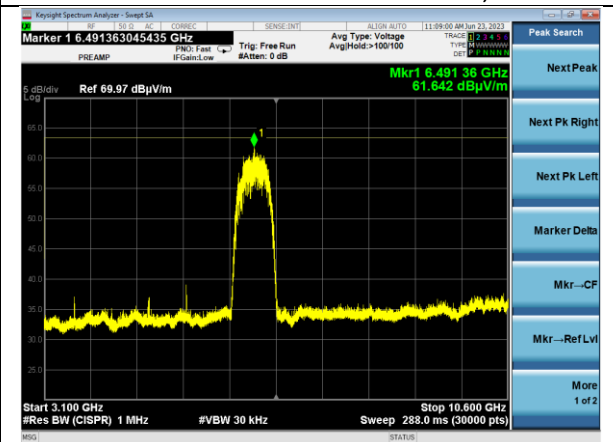
1.61-3.1 GHz Horizontal
Ch 9 - Emissions from USB connection, not EUT



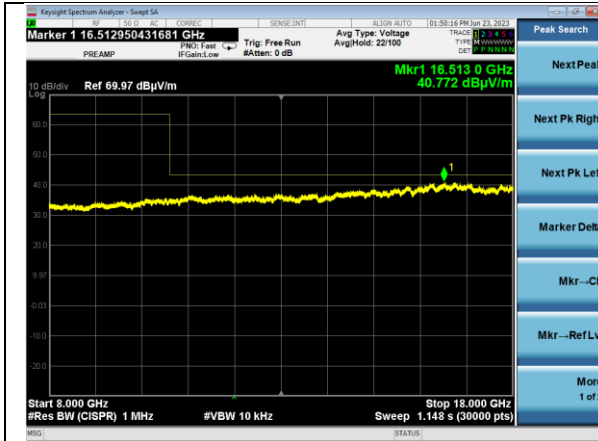
1.61-3.1 GHz Vertical
Ch 9 - Emissions from USB connection, not EUT



3.1-10.6 GHz Horizontal
Ch 5



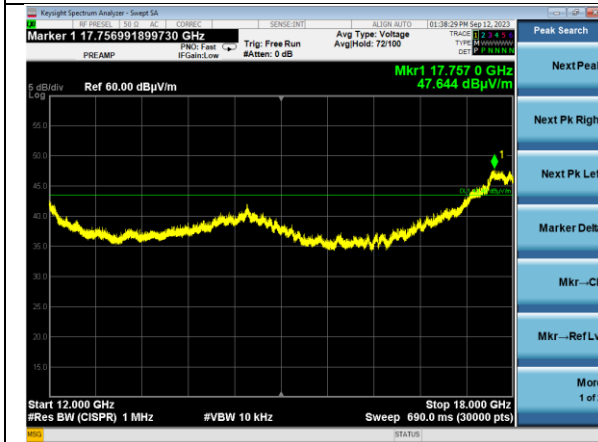
3.1-10.6 GHz Vertical
Ch 5



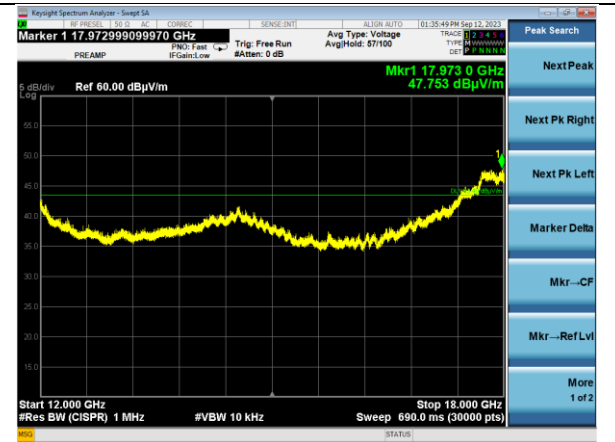
8-18 GHz Horizontal
Ch 5



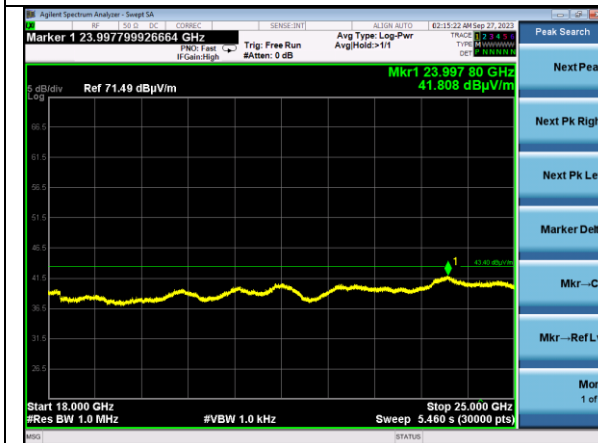
8-18 GHz Vertical
Ch 5



12-18 GHz Horizontal
Ch 5



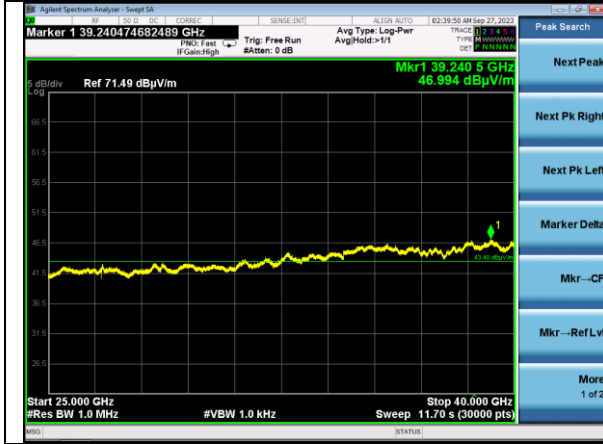
12-18 GHz Vertical
Ch 5



18-25 GHz Horizontal
Ch 5



18-25 GHz Vertical
Ch 5



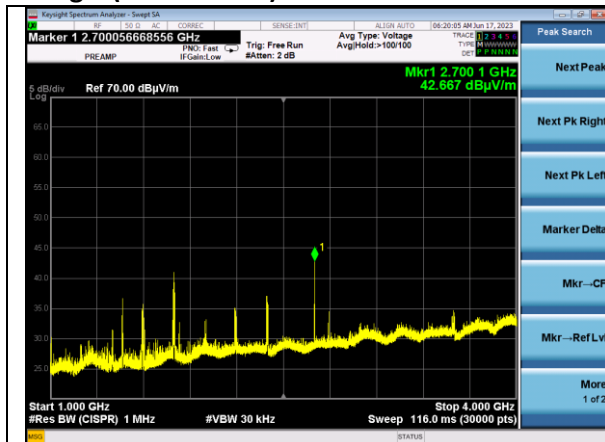
25-40 GHz Horizontal
Ch 5



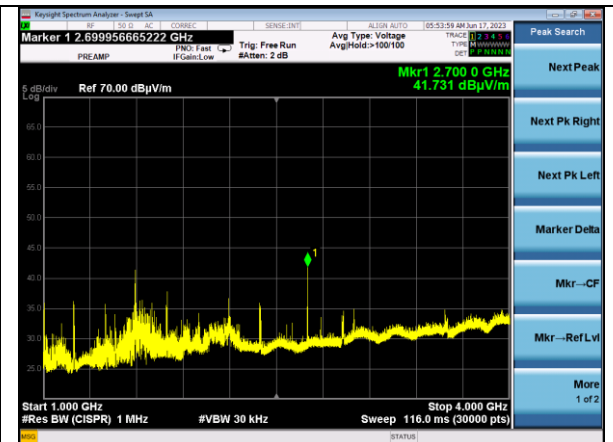
25-40 GHz Vertical
Ch 5

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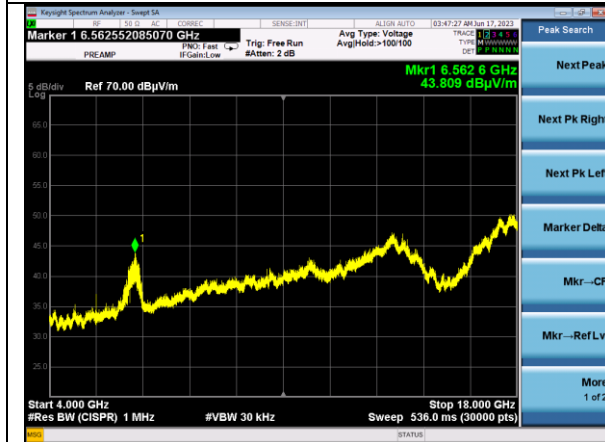
Config 2 (EUT Vertical)



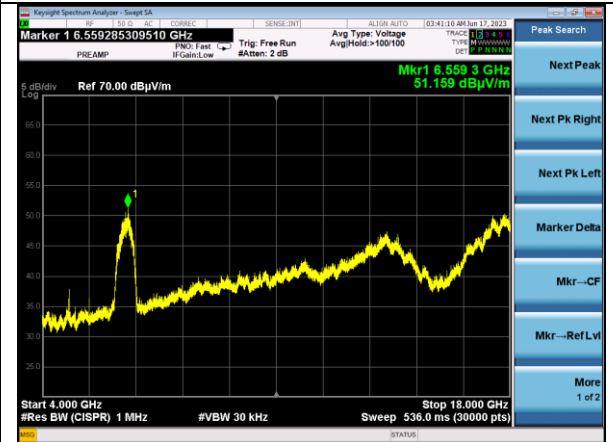
1-4 GHz Horizontal
Ch 5 – Emissions from USB connection, not EUT



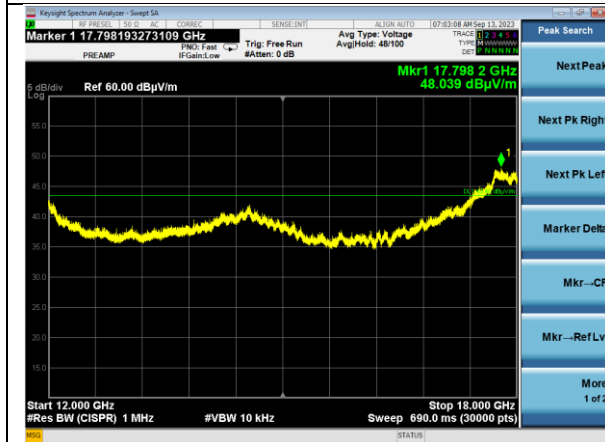
1-4 GHz Vertical
Ch 5 – Emissions from USB connection, not EUT



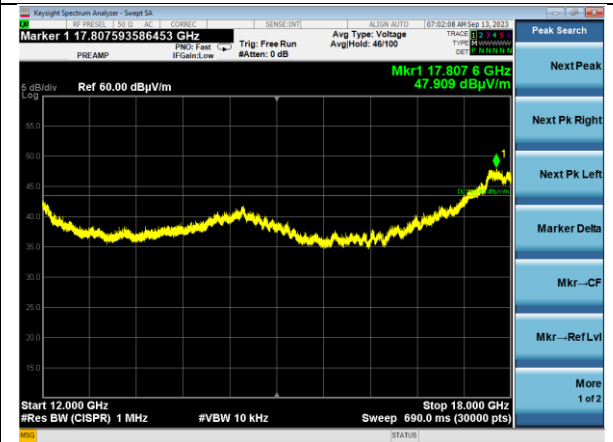
4-18 GHz Horizontal
Ch 5



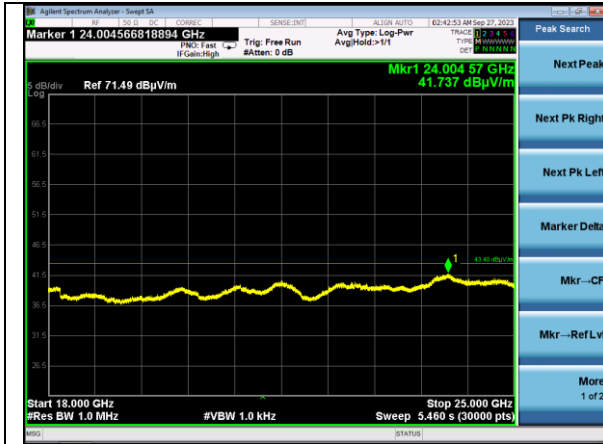
4-18 GHz Vertical
Ch 5



12-18 GHz Horizontal
Ch 5



12-18 GHz Vertical
Ch 5



18-25 GHz Horizontal
Ch 5



18-25 GHz Vertical
Ch 5



25-40 GHz Horizontal
Ch 5



25-40 GHz Vertical
Ch 5

5.1.3 Radiated Emissions – 10 Sec Shutoff

Operator	Anthony Smith	QA	Adam Alger
Temperature	22.3°C	R.H. %	42.6%
Test Date	9/26/2023	Location	Chamber 3
Requirement	FCC 15.519 (a)(1)	Method	ANSI C63.10

Limits: UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received.

Test Parameters

Frequency	6500, 8000 MHz	Distance	0.5m Antenna to EUT, 0.5m EUT to AE
Detector(s)	Peak	Table height	150cm
RBW	1 MHz	VBW	30 kHz
Notes	Zero Span monitoring Transmission between EUT and AE		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	1/30/2023	1/30/2024	Active Calibration
AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	2/16/2023	2/16/2024	Active Verification
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/11/2023	4/11/2024	Active Calibration

EUT Parameters

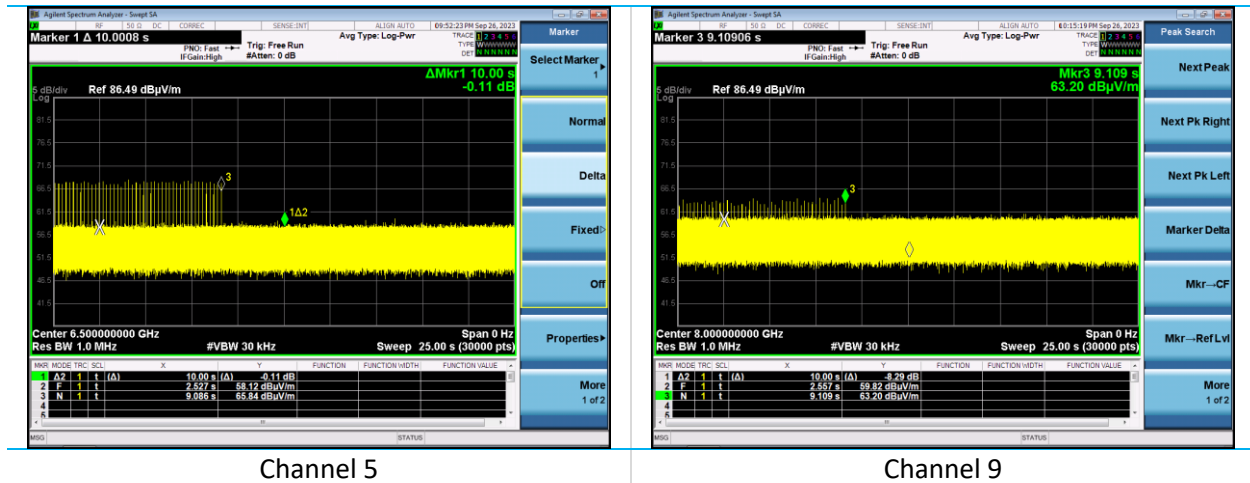
Input Power	USB	Mode	UWB
EUT	Using demo_ranging_initiator script for Transmitter	AE	Using demo_ranging_responder script for Receiver
Notes	USB removed from Receiver to trigger EUT Transmission shutoff		

Data

Table

Channel	AE Power Removed (sec)	EUT Transmission Stop (sec)	EUT Shutoff Time (sec)	Limit (sec)	Margin (sec)
5	2.527	9.086	6.559	10.000	3.441
9	2.557	9.109	6.552	10.000	3.448

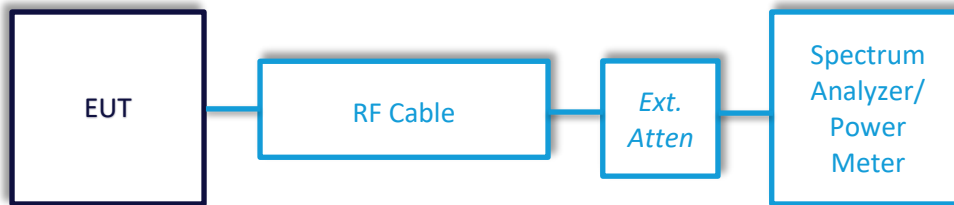
Plots



5.2 Antenna Port Conducted Emissions

<p>Description of Measurement</p>	<p>The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
<p>Example Calculations</p>	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

Block Diagram



5.2.1 Antenna Port Conducted Emissions

Operator	Anthony Smith	QA	Adam Alger
Temperature	21.8°C	R.H. %	29.5%
Test Date	12/1/2023	Location	Conducted RF Bench

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960172	Cable	A.H. Systems, Inc.	SAC-26G-1	387	6/13/2023	6/12/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration

Test Parameters

Frequency	6.5, 8 GHz	Setup	Conducted
RBW	8 MHz	VBW	50 MHz
Detector(s)	Peak	Sweep Time	3 ms

EUT Parameters

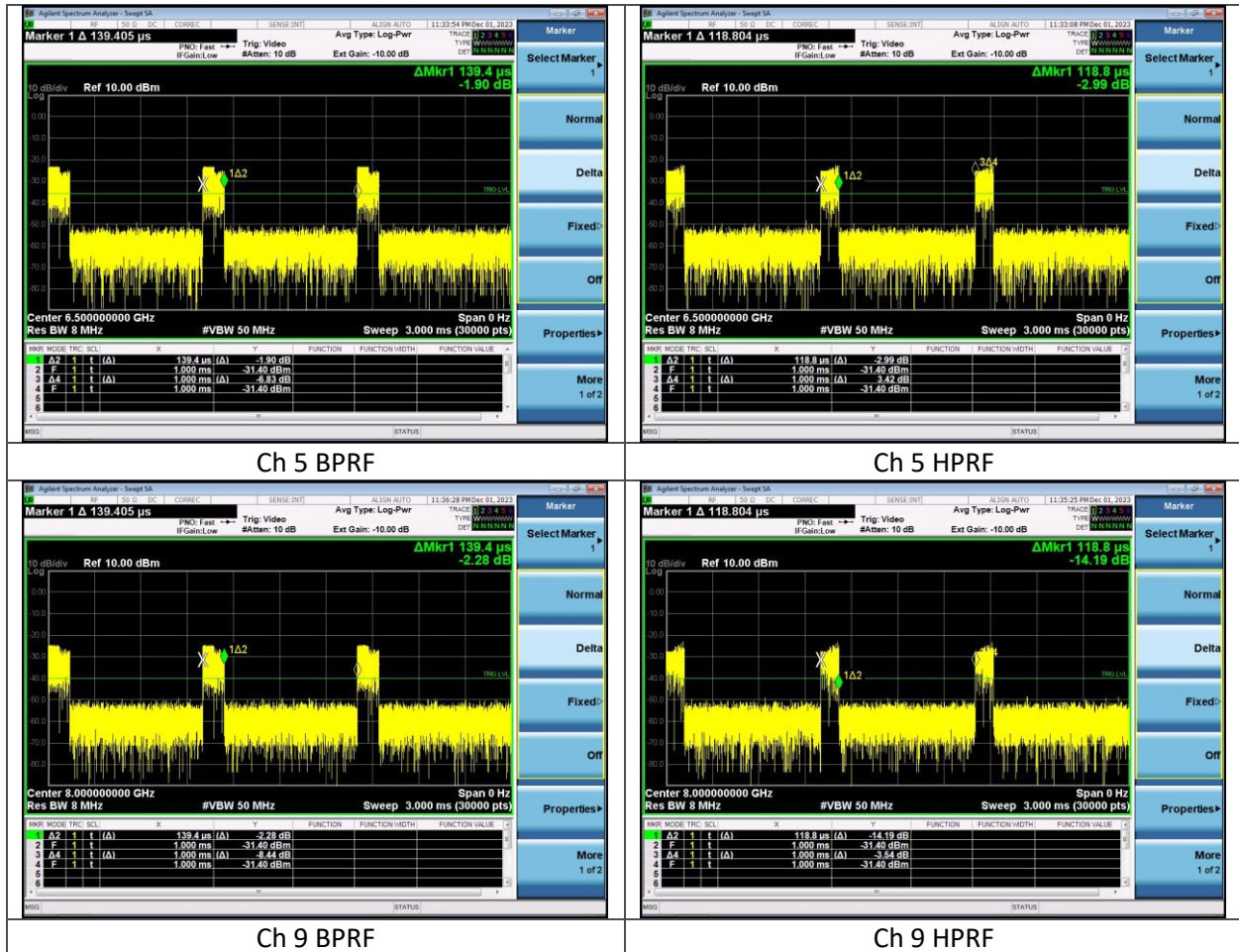
Input Power	USB	Mode	UWB Transmit
Data Rates	BPRF, HPRF	Channel	5, 9

Data

Table

Channel	Data Rate	On Time (µsec)	Period (µsec)	Duty Cycle
5	BPRF	139.4	1000.0	13.9
5	HPRF	118.8	1000.0	11.9
9	BPRF	139.4	1000.0	13.9
9	HPRF	118.8	1000.0	11.9

Plots



Company: Laird Connectivity	Page 37 of 41	Name: Sera NX040
Report: TR3680B		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

5.3 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

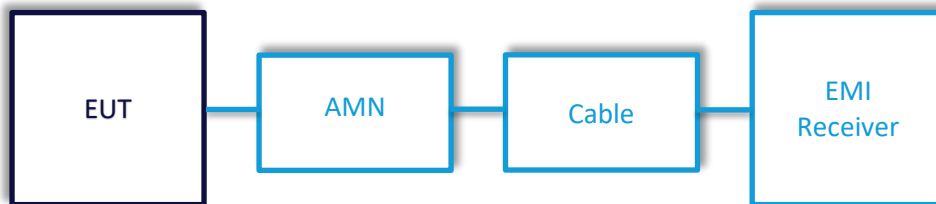
The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

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



5.3.1 AC Mains Conducted Emissions

Operator	Anthony Smith	QA	Jon Dille
Temperature	21.4°C	R.H. %	51.0
Test Date	9/28/2023	Location	Conducted Emissions
Requirement	FCC 15.207 RSS-GEN 8.8	Method	ANSI C63.10

Limits:

Frequency (MHz)	Quasi-Peak (dBμV)	Average (dBμV)
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency

Test Parameters

Frequency	150k-30M	Distance	80cm to LISN
Detector(s)	Peak, QP, Avg	Table height	80cm
RBW	9 kHz	VBW	62 kHz

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/10/2023	4/10/2024	Active Calibration
EE 960162	LISN	COM-POWER	LI-215A	191969	4/10/2023	4/10/2024	Active Calibration
LSC-211	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-002	4/25/2022	4/25/2024	Active Verification

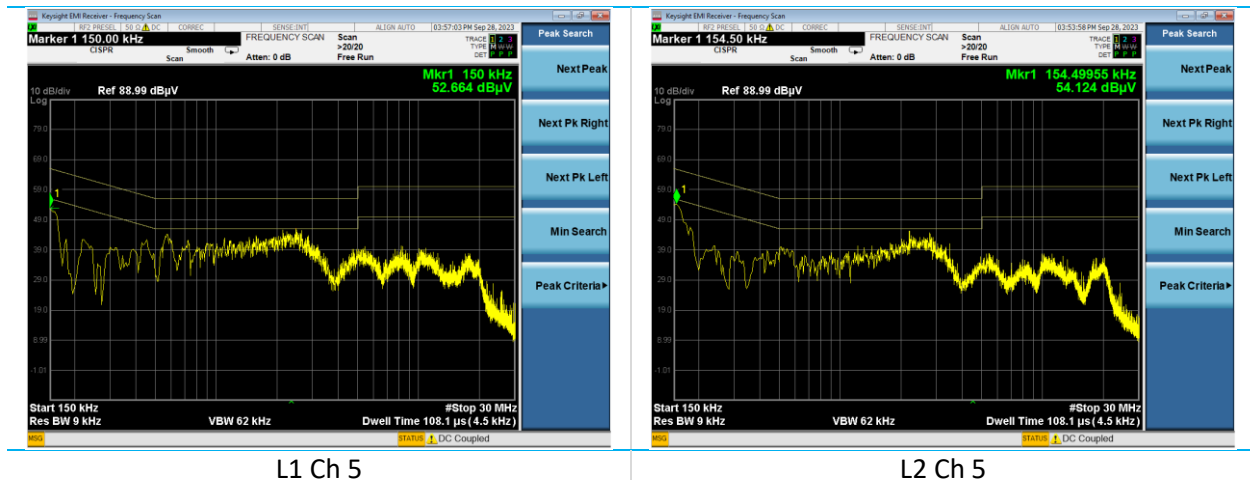
EUT Parameters

Input Power	120VAC 60Hz	Mode	UWB Tx
Notes	No difference seen between Channel 5 and 9. Channel 5 results reported.		

Data Table

Line	Frequency (MHz)	Quasi-Peak Reading (dBμV)	Average Reading (dBμV)	Quasi-Peak Limit (dBμV)	Average Limit (dBμV)	Quasi-Peak Margin (dB)	Average Margin (dB)	Note	Peak Reading (dBμV)
L2	0.2	52.4	38.3	65.8	55.8	13.4	17.5	UWB Ch 5	54.5
L2	2.5	40.3	30.7	56.0	46.0	15.7	15.3	UWB Ch 5	45.4
L2	5.4	32.8	25.1	60.0	50.0	27.2	24.9	UWB Ch 5	37.9
L1	0.2	51.1	39.0	66.0	56.0	14.9	17.0	UWB Ch 5	53.2
L1	2.8	39.7	29.9	56.0	46.0	16.3	16.1	UWB Ch 5	45.4
L1	0.6	41.7	28.1	56.0	46.0	14.3	17.9	UWB Ch 5	44.8

Plots



L1 Ch 5

L2 Ch 5

6 REVISION HISTORY

Version	Date	Notes	Person
1	10/3/2023	Initial Draft	Anthony Smith
2	10/10/2023	Revised Draft	Anthony Smith
3	10/12/2023	Revised Draft	Anthony Smith
4	11/22/2023	Revised Draft	Anthony Smith
5	11/29/2023	Revised Draft	Anthony Smith
6	12/2/2023	Revised Draft	Anthony Smith
7	12/8/2023	Revised Draft	Anthony Smith

END OF REPORT