

C-3680 TR3680A

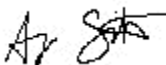
Equipment Under Test: Sera NX040 – Bluetooth LE v5.4 Module

Requirement(s): FCC 15.247
ISED RSS-247

Test Date(s): 9/6/2023 – 10/10/2023

Prepared for: Laird Connectivity, LLC.
Attn: Jonathan Kaye
W66 N220 Commerce Ct.
Cedarburg, WI 53012

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature: 


Date: 10/12/2023

Report Reviewed by: Adam Alger, Laboratory Manager

Signature: 

Date: 10/12/2023

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 10/12/2023

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Company: Laird Connectivity	Page 1 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: Engineering Sample

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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

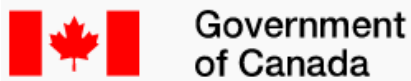
Scope of accreditation includes all test methods listed herein unless otherwise noted



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

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Quote: NBO-02-2023-005963		Serial: 00029, 00016

1 TEST REPORT SUMMARY

During **9/6/2023 – 10/10/2023** the Equipment Under Test (EUT), **Sera NX040**, as provided by **Laird Connectivity** was tested to the following requirements:

FCC 15.247 / RSS-247, DTS

Requirements	Description	Specification	Method	Compliant
FCC: 15.247 (a)(2) IC: RSS-247 5.2 (a)	Digital Modulation System 6 dB Bandwidth	500 kHz	ANSI C63.10	Yes
FCC: 2.1049 IC: RSS-GEN 6.7	Occupied Bandwidth	Reported	ANSI C63.10	Yes
FCC: 15.247 (b)(3) IC: RSS-247 5.4 (d)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Yes
FCC: 15.247 (e) IC: RSS-247 5.2 (b)	Digital Modulation System Power Spectral Density	8 dBm / 3 kHz	ANSI C63.10	Yes
FCC: 15.247 (d) IC: RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	20 dBc	ANSI C63.10	Yes
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Yes
FCC: 2.1055 (d) IC: RSS-GEN 6.11	Frequency Stability	Reported	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	1 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 Radio Information

Bluetooth Low Energy using Data Rates 125k, 500k, 1M, and 2M. All tested with 255 Packet Length configuration. Antenna Port terminated with 50Ω for radiated testing.

2.6 Programming Software

Nordic nRF Connect for Desktop v.4.2.0 mode used to program radio utilizing Direct Test Mode v.2.1.0.

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2.7 EUT Configuration

Device has two configurations: a trace antenna design and an external antenna design. Both were tested for radiated emissions. The external antenna design was tested with the BLE antenna port connected to a 50Ω terminator.

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3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR	-	2023	-	-
RSS-247	2	2017	-	-
RSS-GEN	5	2018	2019	2021
ANSI C63.10	-	2013	-	-

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

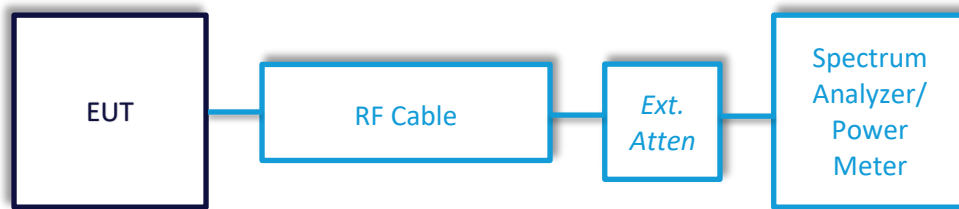
Parameter	ETSI U.C. \pm	U.C. \pm
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %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

5 TEST DATA

5.1 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



5.1.1 Antenna Port Conducted Emissions

Operator	Anthony Smith	QA	Adam Alger
Temperature	21.4°-22.6°C	R.H. %	48.9-52.3%
Test Date	9/21/2023, 10/9/2023, 10/10/2023	Location	Conducted RF Bench
Requirement	FCC 15.247 ISED RSS-247	Method	ANSI C63.10

Limits:

DTS 6dB BW: 500 kHz

OBW: Reported

Maximum Conducted Output Power: 30 dBm

PSD: 8dBm/3kHz

RF Spurious Emissions at the Transmitter Antenna Terminal: 20 dBc

Frequency Stability: Reported

RF Spurious Emissions in Restricted Bands:

Frequency (MHz)	Quasi-Peak Limit (dBm)	Average Limit (dBm)	Peak Limit (dBm)
30-88	-55.3	-	-
88-216	-51.8	-	-
216-960	-49.3	-	-
960-1000	-41.3	-	-
Above 1000	-	-41.3	-21.3

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	6/13/2023	6/12/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration

DTS 6dB BW

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	100 kHz	VBW	300 kHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

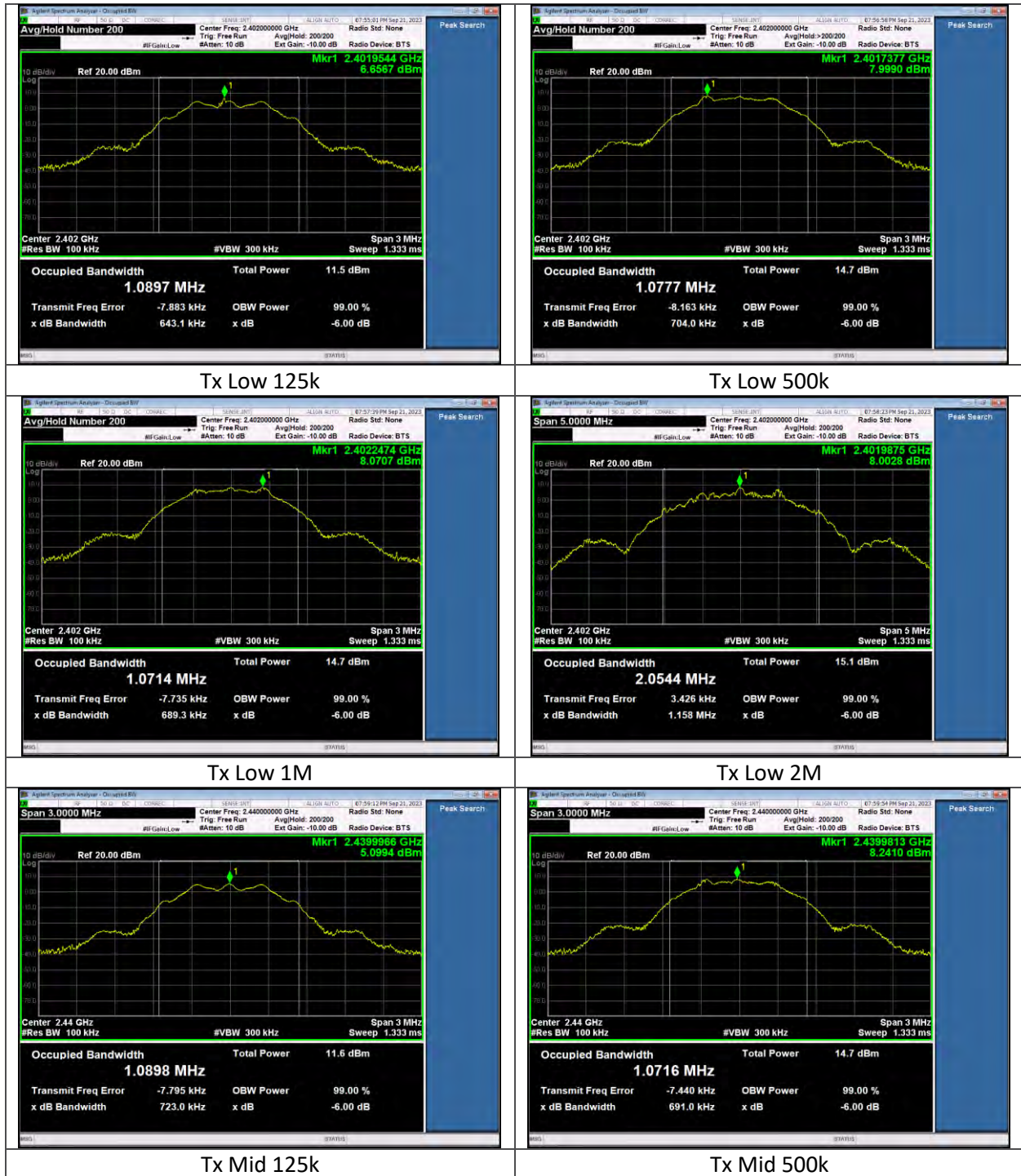
Input Power	5VDC	Mode	BLE
Data Rates	125k, 500k, 1M, 2M	Channel	Low, Mid, High

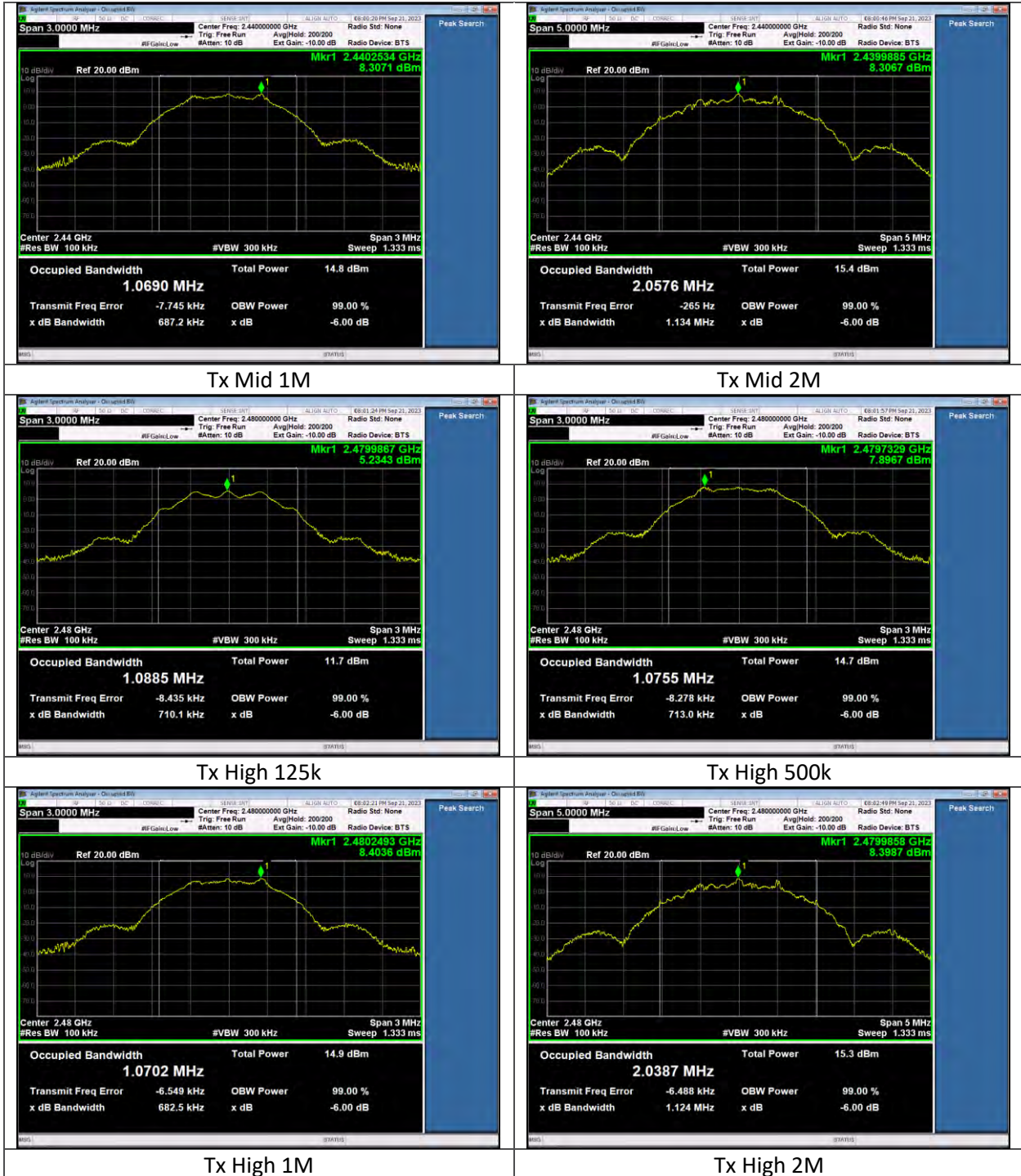
Data

Table

Channel	Data Rate	6dB DTS BW (kHz)	Limit (kHz)	Margin (kHz)
Low	125k	643.1	500.0	143.1
Mid	125k	723.0	500.0	223.0
High	125k	710.1	500.0	210.1
Low	500k	704.0	500.0	204.0
Mid	500k	691.0	500.0	191.0
High	500k	713.0	500.0	213.0
Low	1M	689.3	500.0	189.3
Mid	1M	687.2	500.0	187.2
High	1M	682.5	500.0	182.5
Low	2M	1158.0	500.0	658.0
Mid	2M	1134.0	500.0	634.0
High	2M	1124.0	500.0	624.0

Plots





Occupied Bandwidth

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	30 kHz	VBW	100 kHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

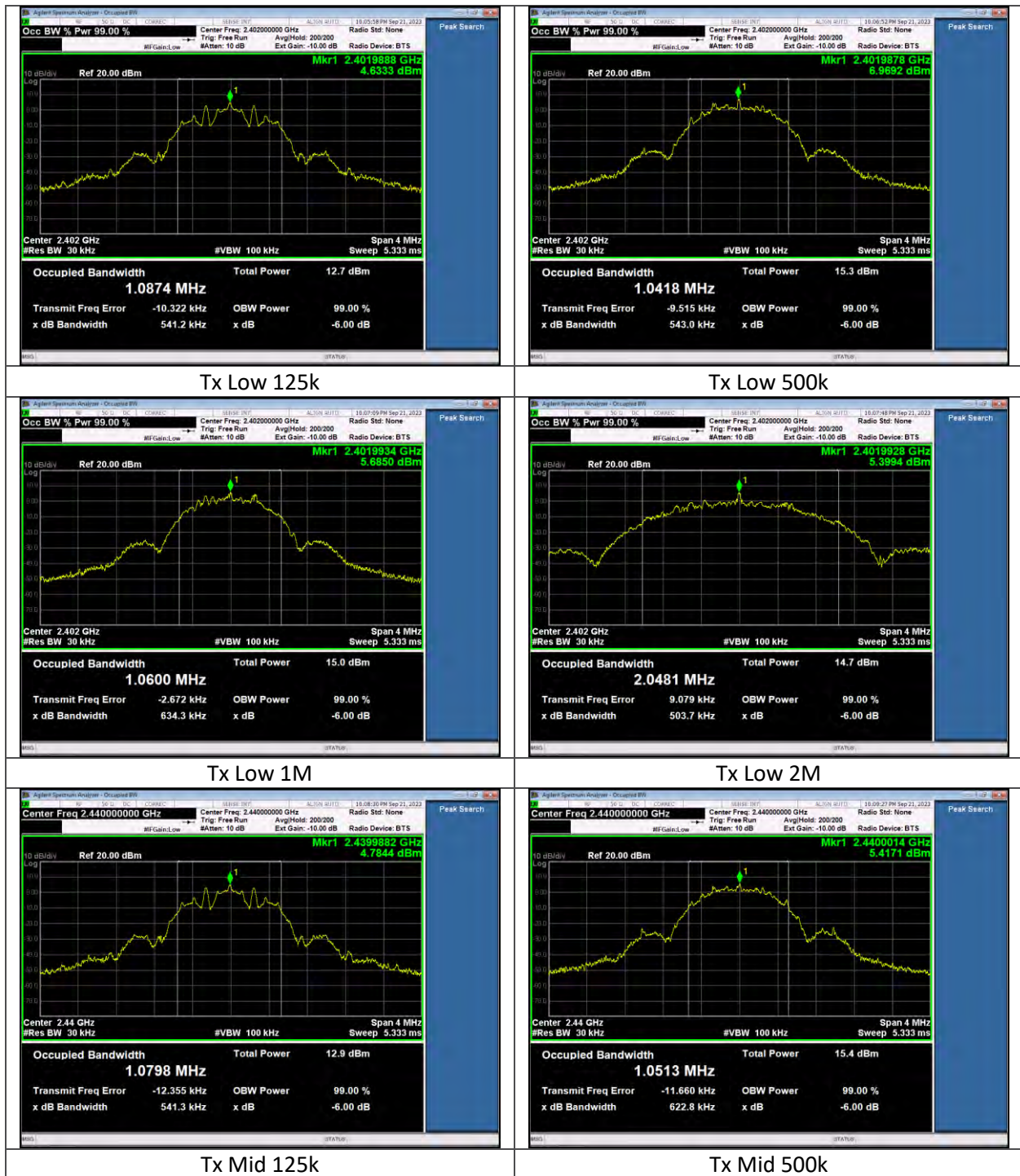
Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channel	Low, Mid, High

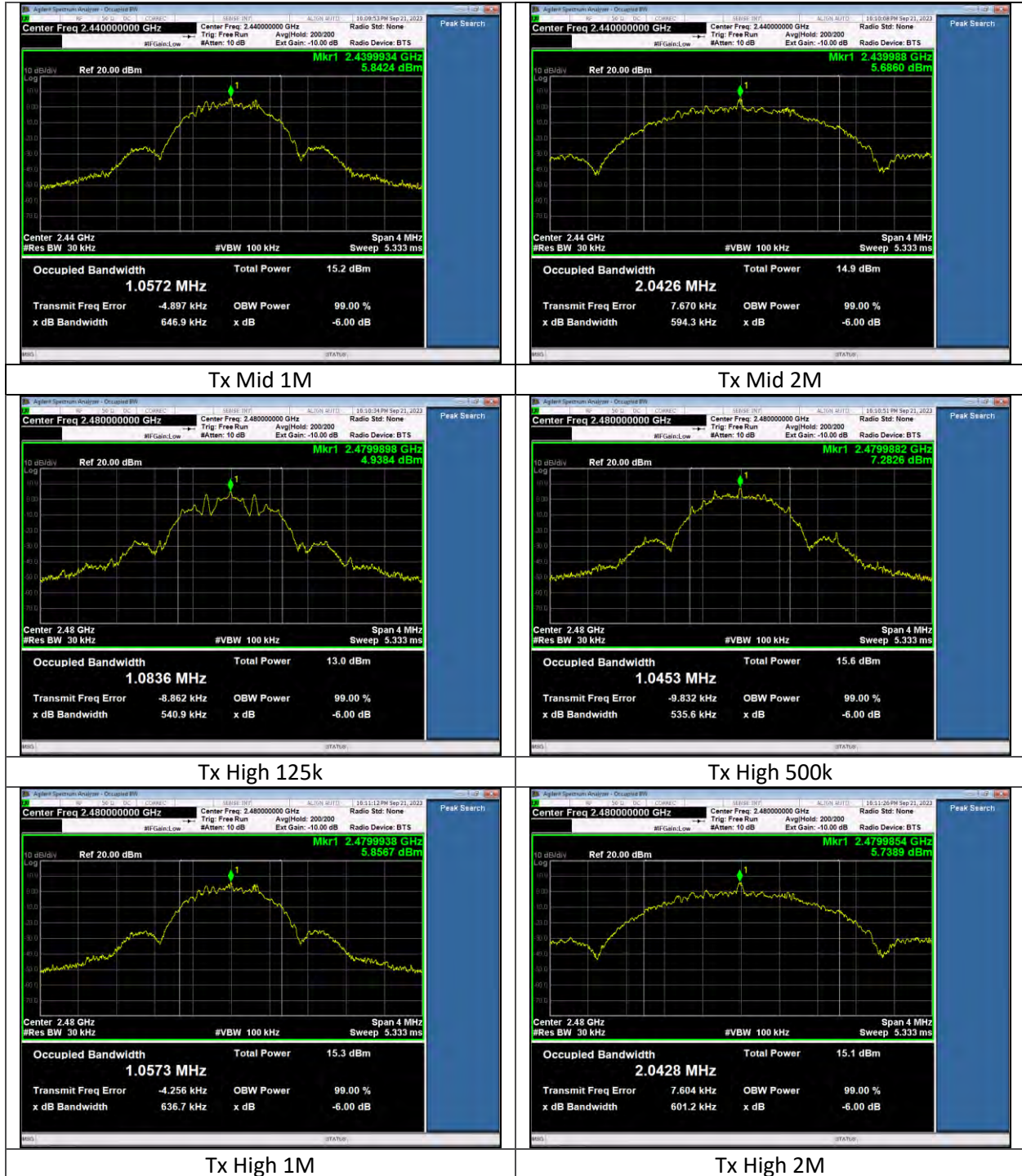
Data

Table

Channel	Data Rate	OBW (MHz)
Low	125k	1.0874
Mid	125k	1.0798
High	125k	1.0836
Low	500k	1.0418
Mid	500k	1.0513
High	500k	1.0453
Low	1M	1.0600
Mid	1M	1.0572
High	1M	1.0573
Low	2M	2.0481
Mid	2M	2.0426
High	2M	2.0428

Plots





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Maximum Conducted Output Power

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channel	Low, Mid, High
Transmit Power Setting	+8 -40		

Data

Table

Transmit Power Setting: +8

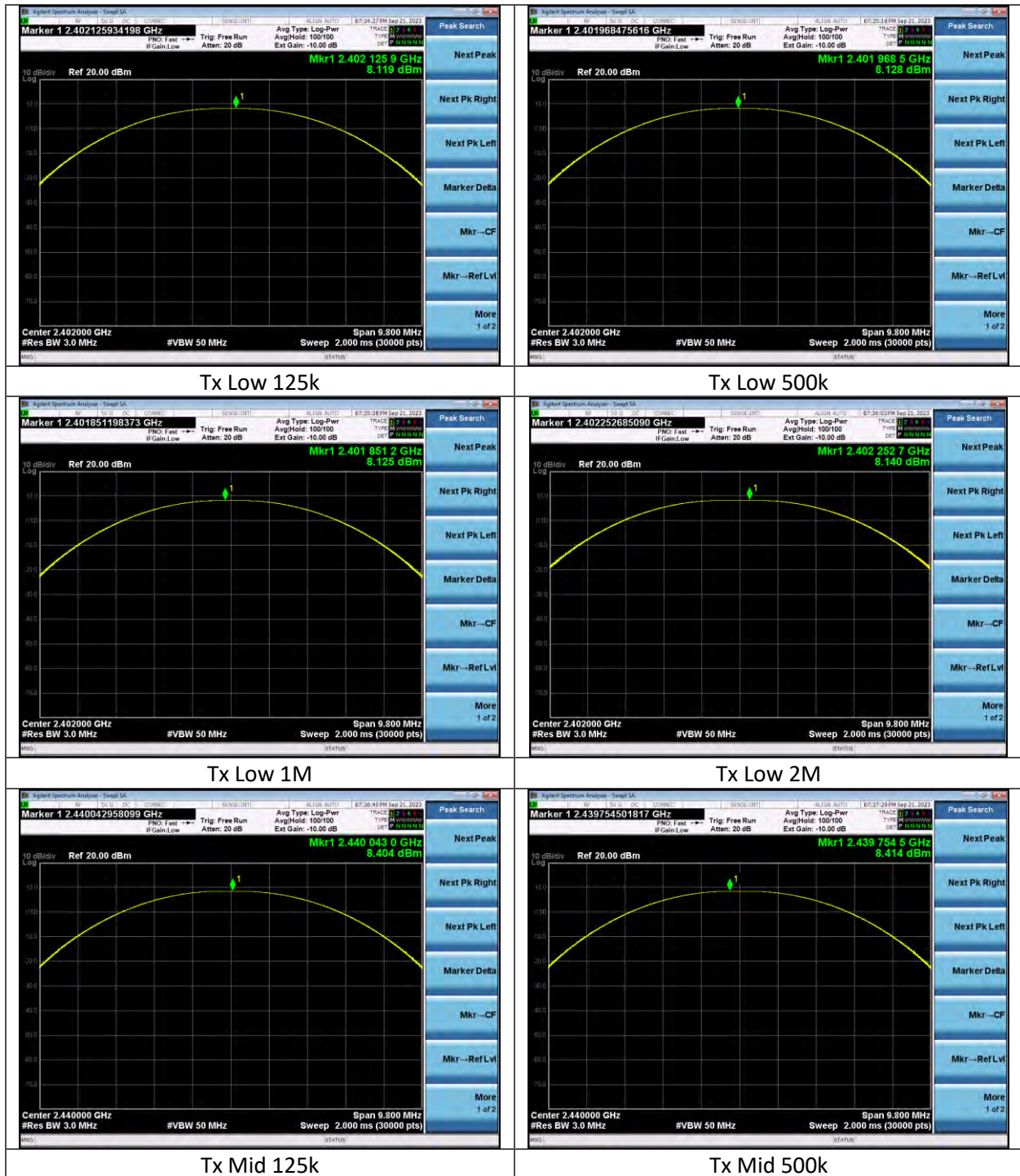
Channel	Data Rate	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	125k	8.1	30.0	21.9
Mid	125k	8.4	30.0	21.6
High	125k	8.4	30.0	21.6
Low	500k	8.1	30.0	21.9
Mid	500k	8.4	30.0	21.6
High	500k	8.4	30.0	21.6
Low	1M	8.1	30.0	21.9
Mid	1M	8.4	30.0	21.6
High	1M	8.4	30.0	21.6
Low	2M	8.1	30.0	21.9
Mid	2M	8.4	30.0	21.6
High	2M	8.4	30.0	21.6

Transmit Power Setting: -40

Channel	Data Rate	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	125k	-37.8	30.0	67.8
Mid	125k	-38.2	30.0	67.6
High	125k	-38.4	30.0	67.7
Low	500k	-37.6	30.0	67.6
Mid	500k	-38.2	30.0	68.2
High	500k	-38.4	30.0	68.4
Low	1M	-37.7	30.0	67.7
Mid	1M	-38.2	30.0	68.2
High	1M	-38.4	30.0	68.4
Low	2M	-37.8	30.0	67.8
Mid	2M	-38.2	30.0	68.2
High	2M	-38.5	30.0	68.5

Plots

Transmit Power Setting: +8

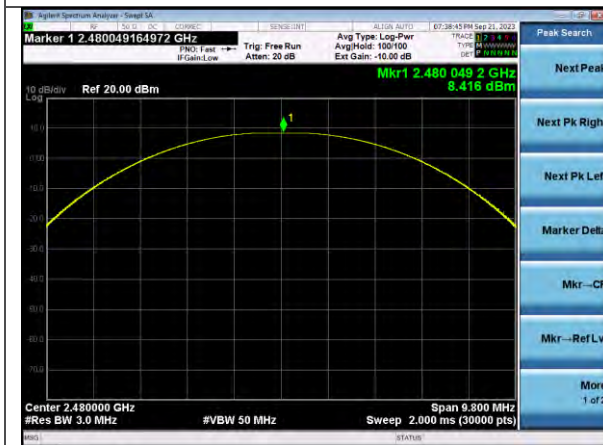




Tx Mid 1M



Tx Mid 2M



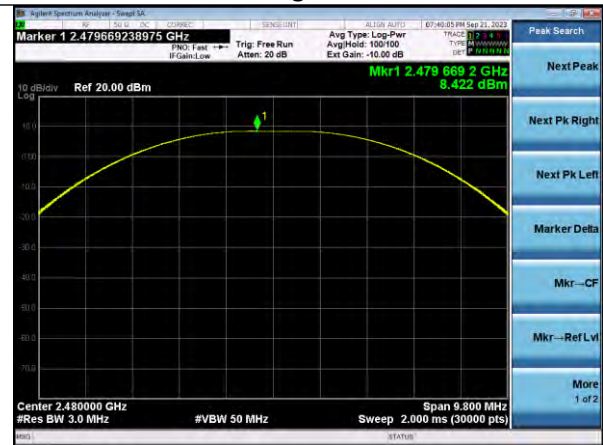
Tx High 125k



Tx High 500k

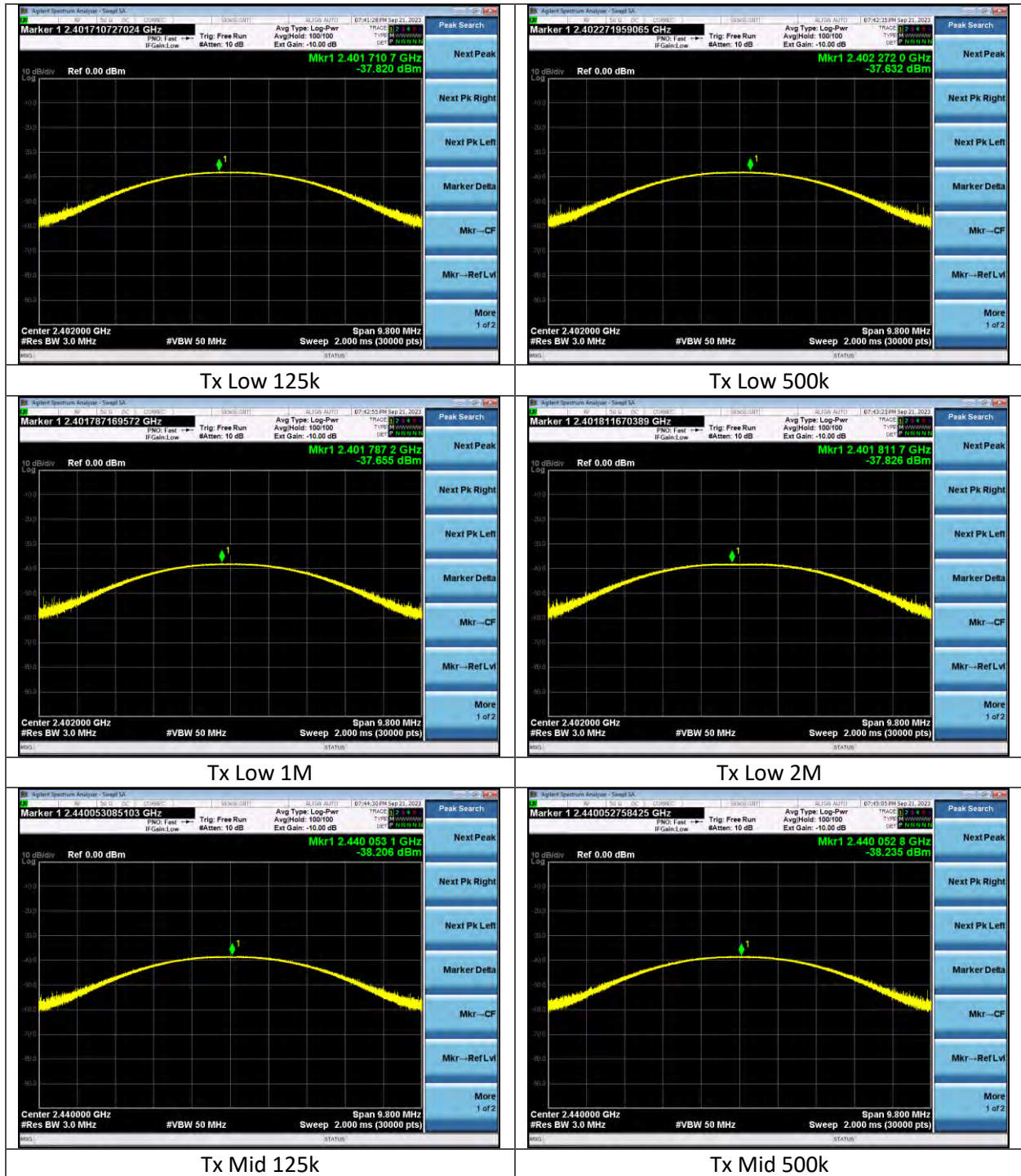


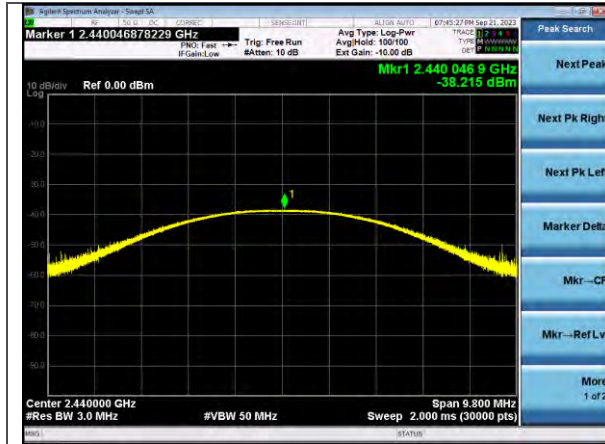
Tx High 1M



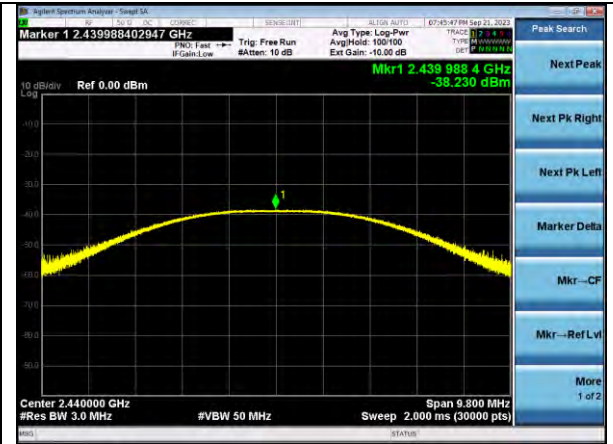
Tx High 2M

Transmit Power Setting: -40

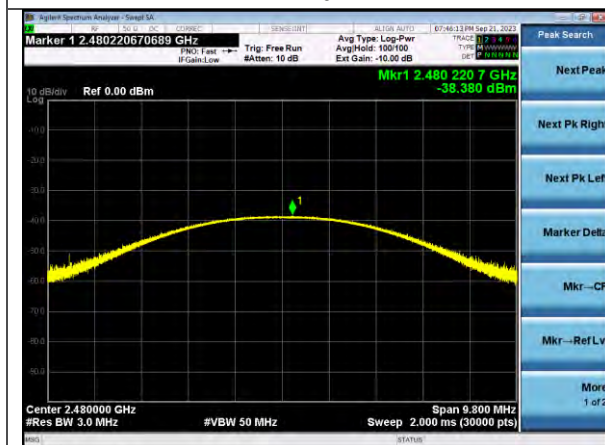




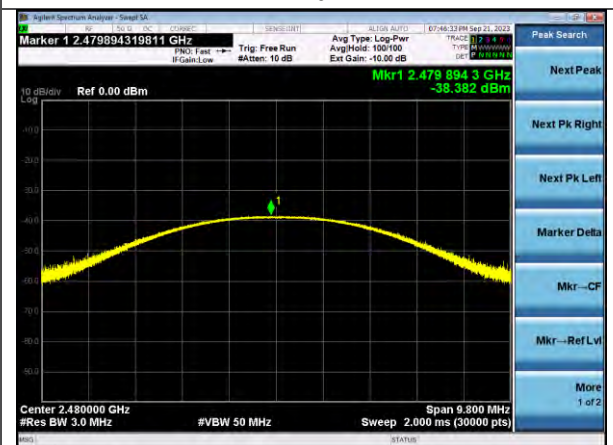
Tx Mid 1M



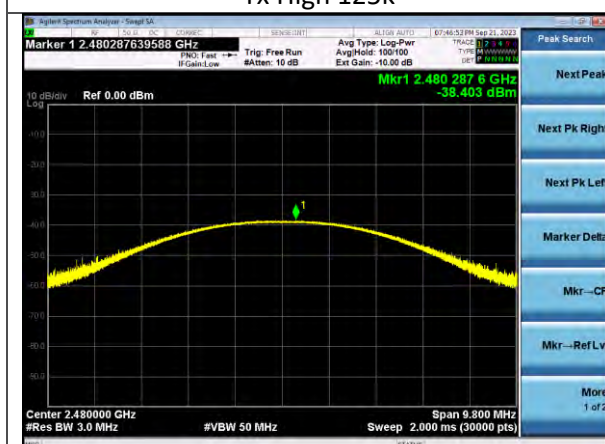
Tx Mid 2M



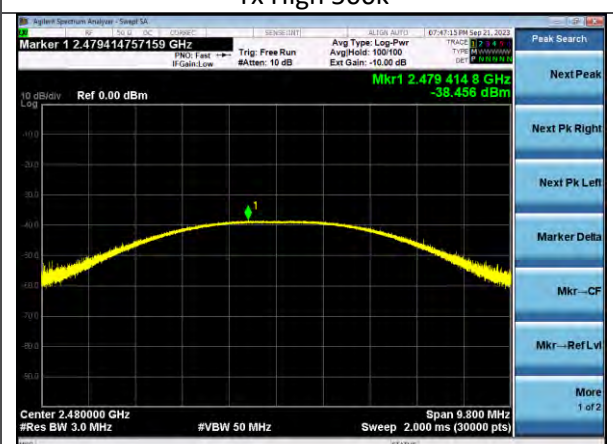
Tx High 125k



Tx High 500k



Tx High 1M



Tx High 2M

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Power Spectral Density

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	3 kHz	VBW	10 kHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channel	Low, Mid, High

Data

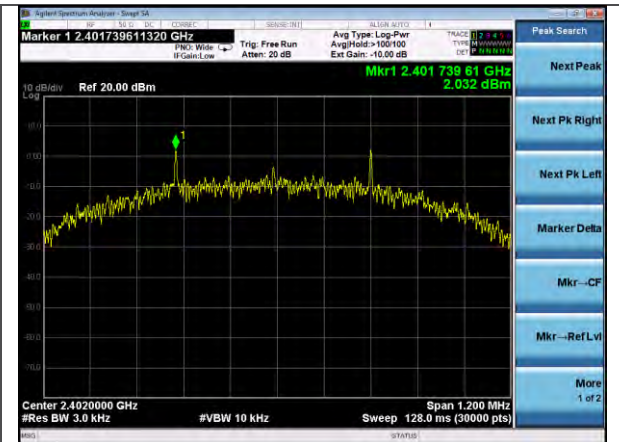
Table

Channel	Data Rate	Peak PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	125k	2.1	8.0	5.9
Mid	125k	2.4	8.0	6.0
High	125k	2.4	8.0	15.6
Low	500k	2.0	8.0	6.0
Mid	500k	2.2	8.0	5.8
High	500k	2.3	8.0	5.7
Low	1M	-7.6	8.0	15.6
Mid	1M	-7.2	8.0	15.2
High	1M	-7.1	8.0	15.1
Low	2M	-9.4	8.0	17.4
Mid	2M	-9.2	8.0	17.2
High	2M	-9.2	8.0	17.2

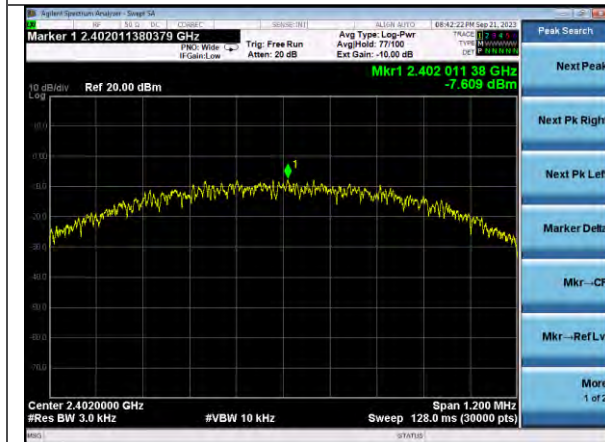
Plots



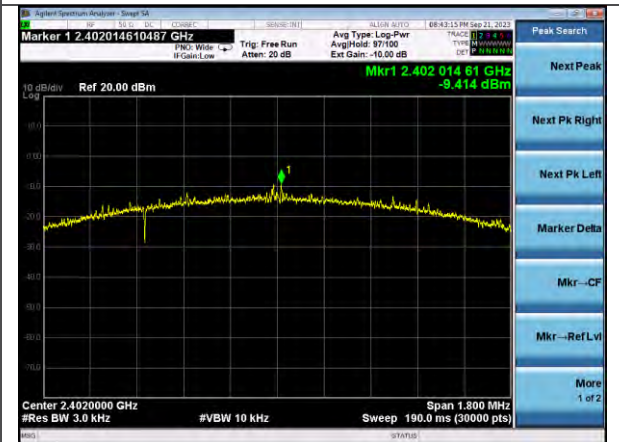
Tx Low 125k



Tx Low 500k



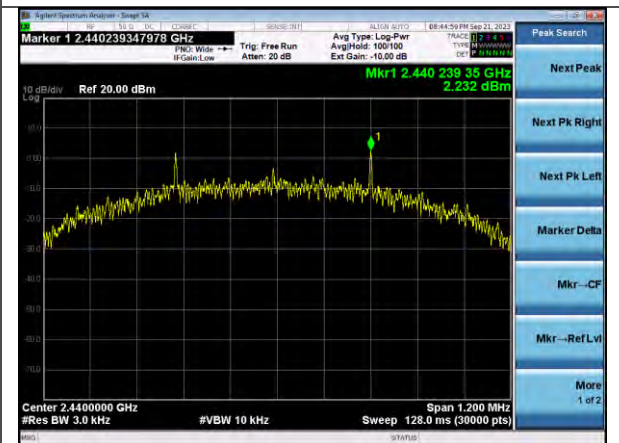
Tx Low 1M



Tx Low 2M

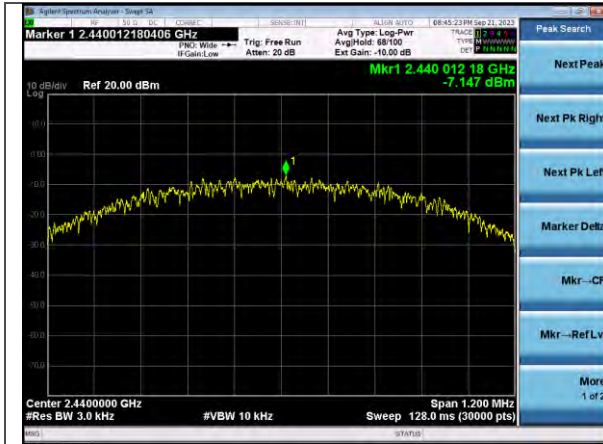


Tx Mid 125k

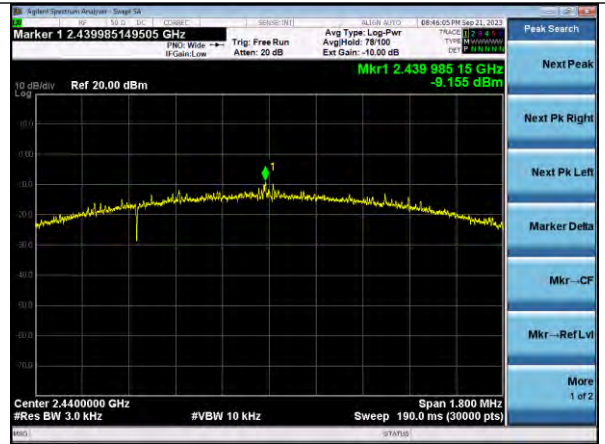


Tx Mid 500k

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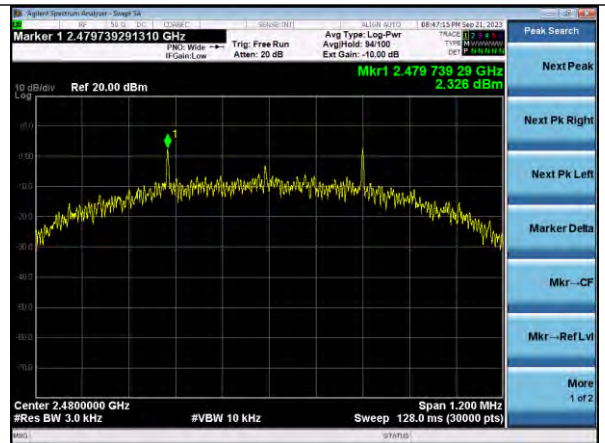
Tx Mid 1M



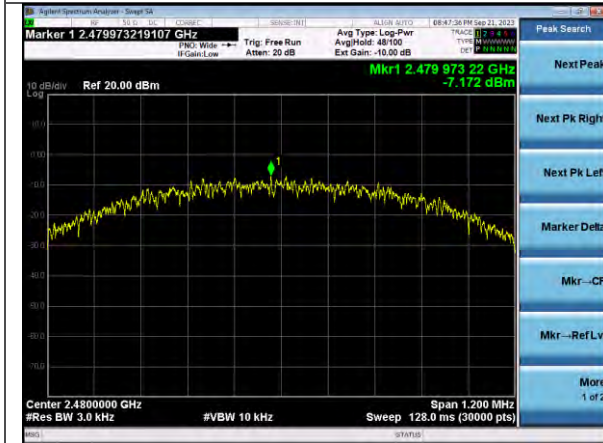
Tx Mid 2M



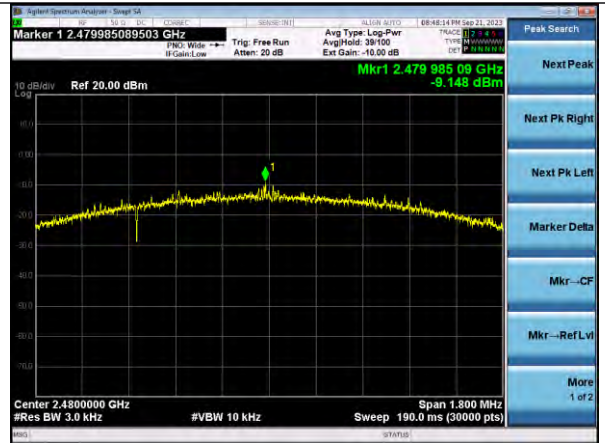
Tx High 125k



Tx High 500k



Tx High 1M



Tx High 2M

RF Spurious Emissions at the Transmitter Antenna Terminal

Test Parameters

Frequency	30-25000 MHz	Setup	Conducted
RBW	100 kHz	VBW	300 kHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channel	Low, Mid, High

Reference Level Plot (from Worst Case PSD channel/rate)



Tx Low 125k Rate

8 dBm – 20 dB = -12 dBm Limit

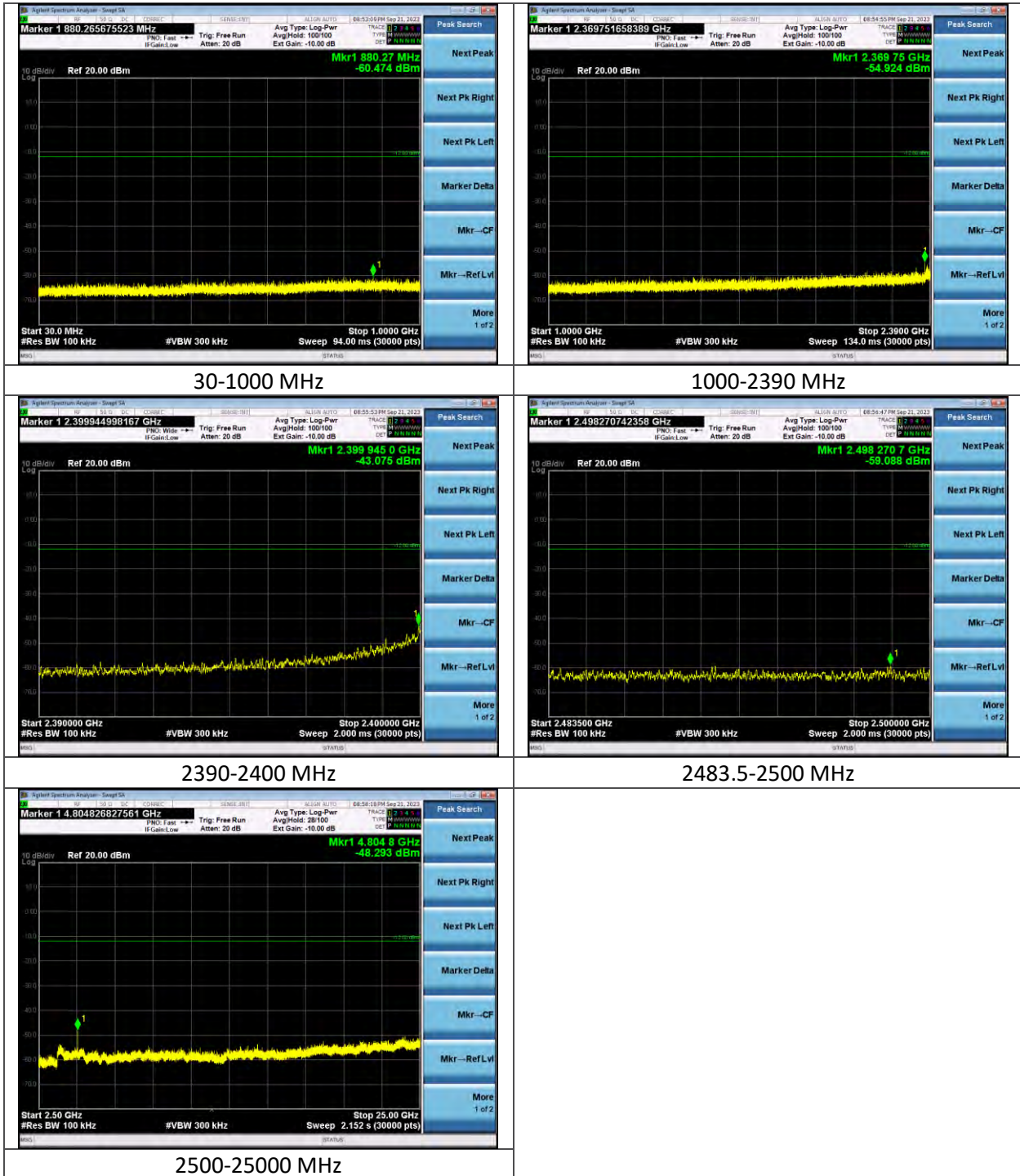
Data

Table

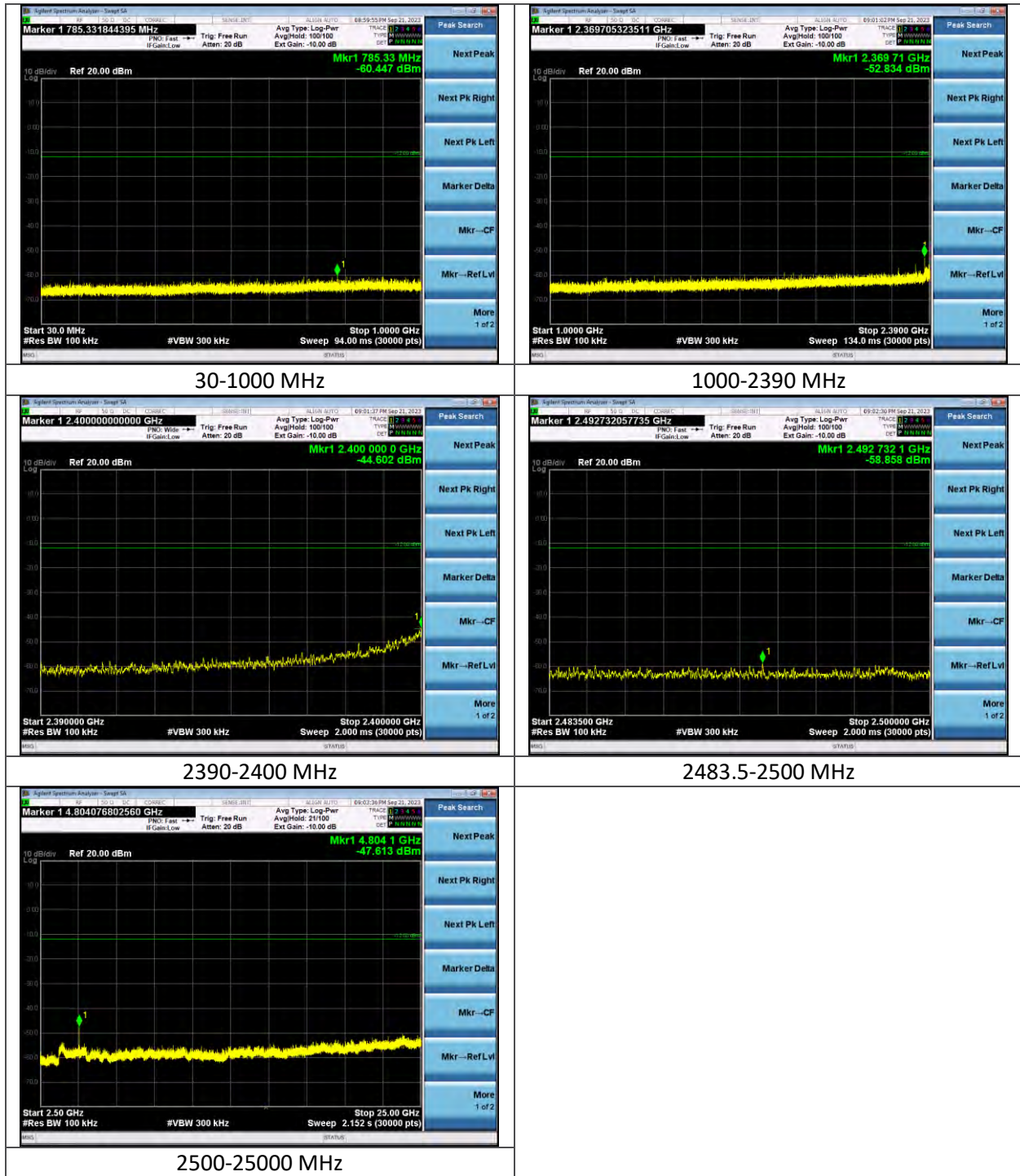
Channel	Data Rate	Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)
Low	125k	2400.0	-43.1	-12.0	31.1
Low	125k	4804.8	-48.3	-12.0	36.3
Low	500k	2400.0	-44.6	-12.0	32.6
Low	500k	4804.1	-47.6	-11.0	36.6
Low	1M	2400.0	-43.5	-12.0	31.5
Low	1M	4804.8	-48.2	-10.0	38.2
Low	2M	2400.0	-25.0	-12.0	13.0
Low	2M	4803.3	-50.4	-9.0	41.4
Mid	125k	2488.2	-60.5	-12.0	48.5
Mid	125k	4880.6	-52.4	-12.0	40.4
Mid	500k	2375.8	-57.0	-12.0	45.0
Mid	500k	4880.6	-49.9	-12.0	37.9
Mid	1M	2375.9	-57.6	-12.0	45.6
Mid	1M	4880.6	-50.2	-12.0	38.2
Mid	2M	2375.8	-59.7	-12.0	47.7
Mid	2M	4879.8	-50.1	-12.0	38.1
High	125k	2484.1	-53.2	-12.0	41.2
High	125k	4960.8	-53.4	-12.0	41.4
High	500k	2483.7	-52.3	-12.0	40.3
High	500k	4960.8	-50.6	-12.0	38.6
High	1M	2483.7	-53.3	-12.0	41.3
High	1M	4960.8	-51.6	-12.0	39.6
High	2M	2483.8	-46.4	-12.0	34.4
High	2M	4959.3	-52.5	-12.0	40.5

Plots

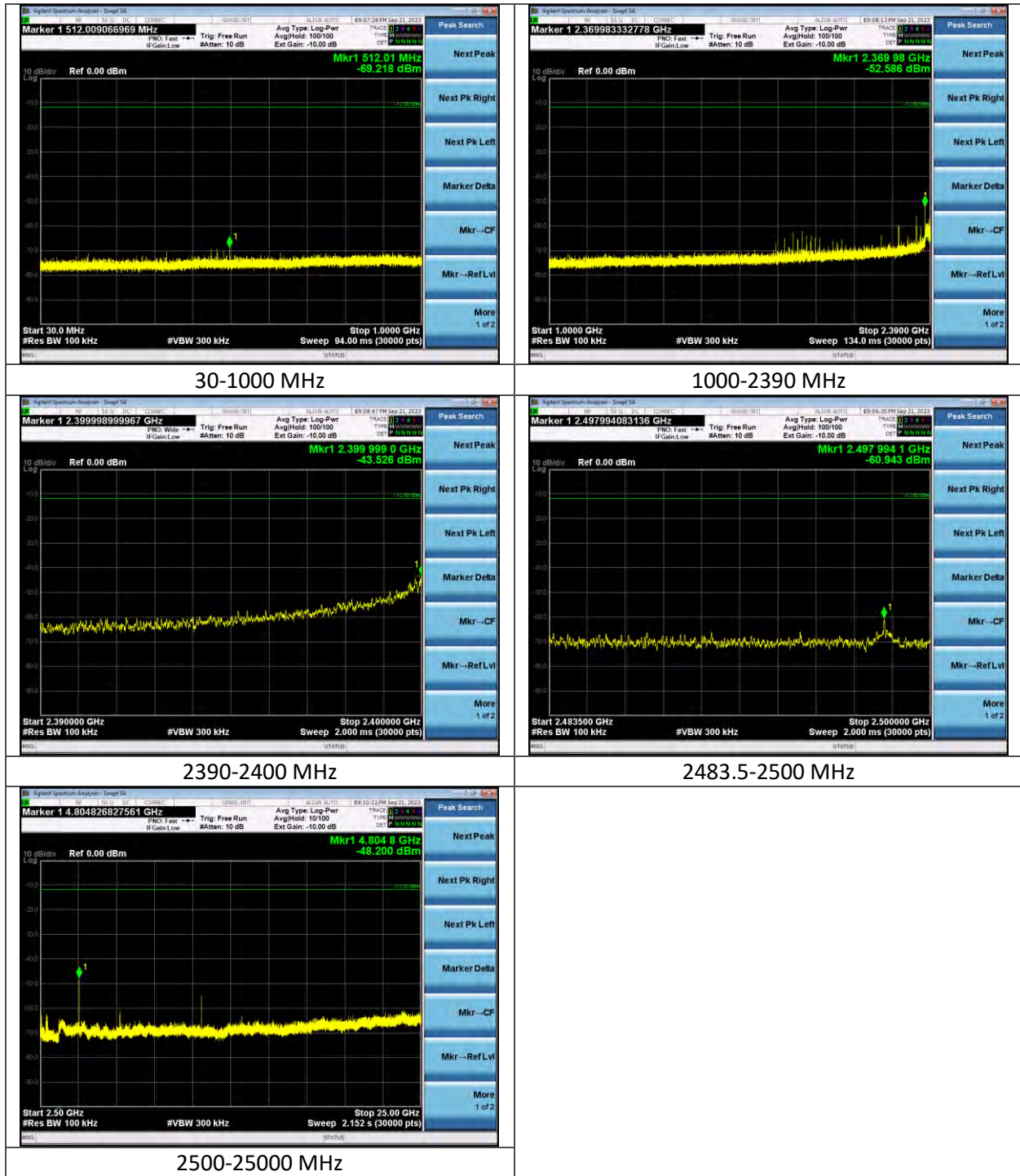
Tx Low 125k



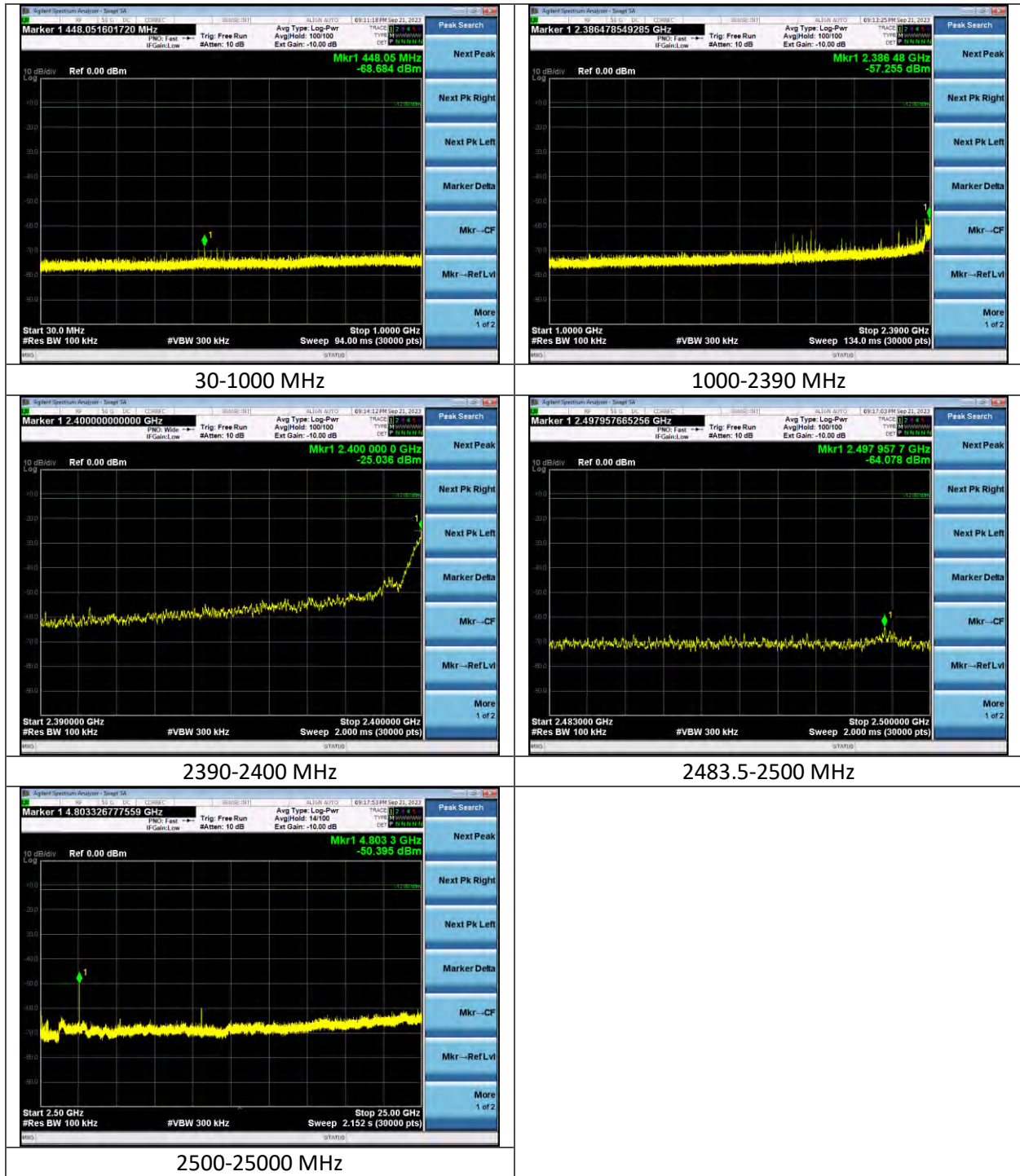
Tx Low 500k



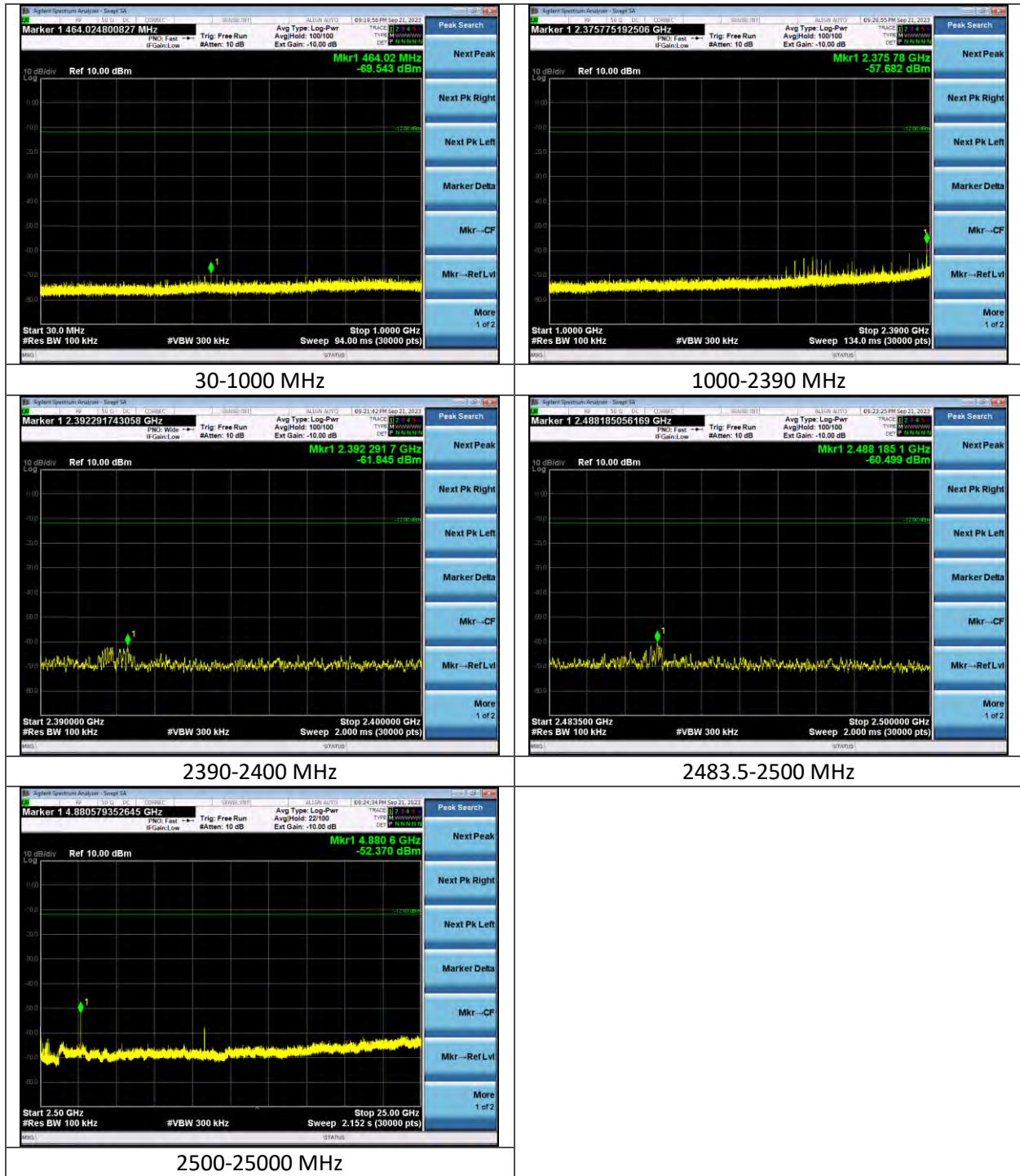
Tx Low 1M



Tx Low 2M

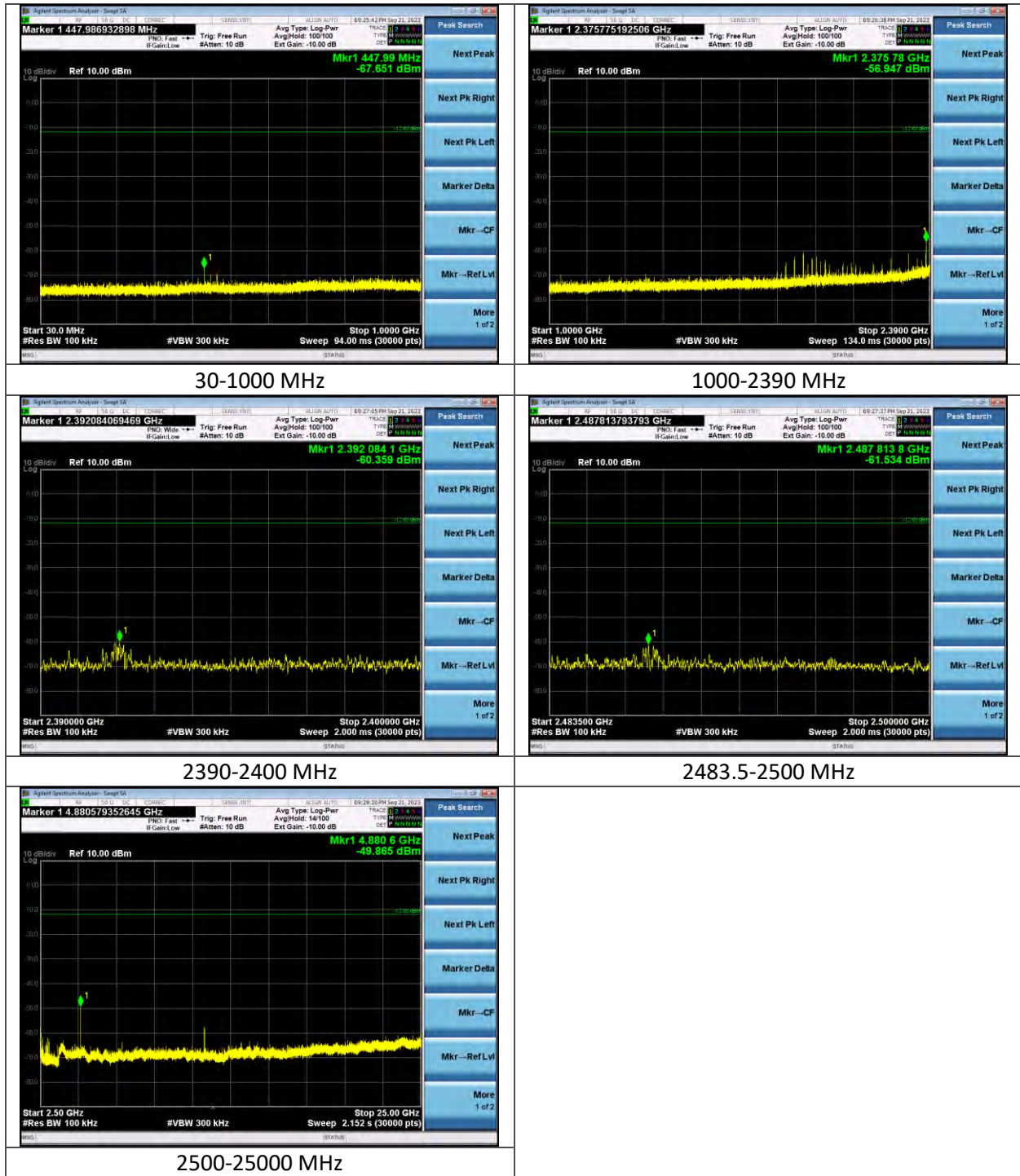


Tx Mid 125k



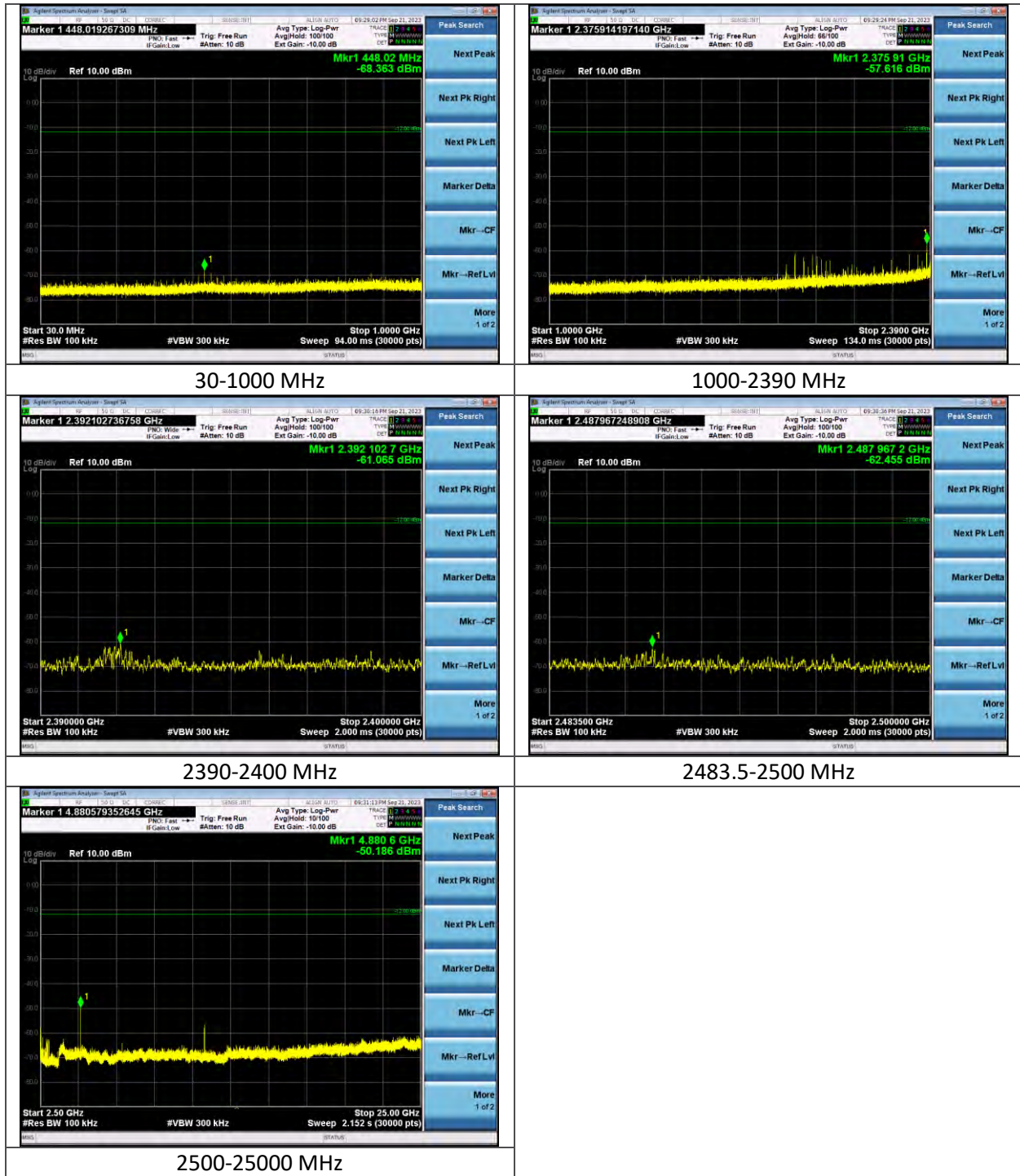
Company: Laird Connectivity	Page 32 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

Tx Mid 500k

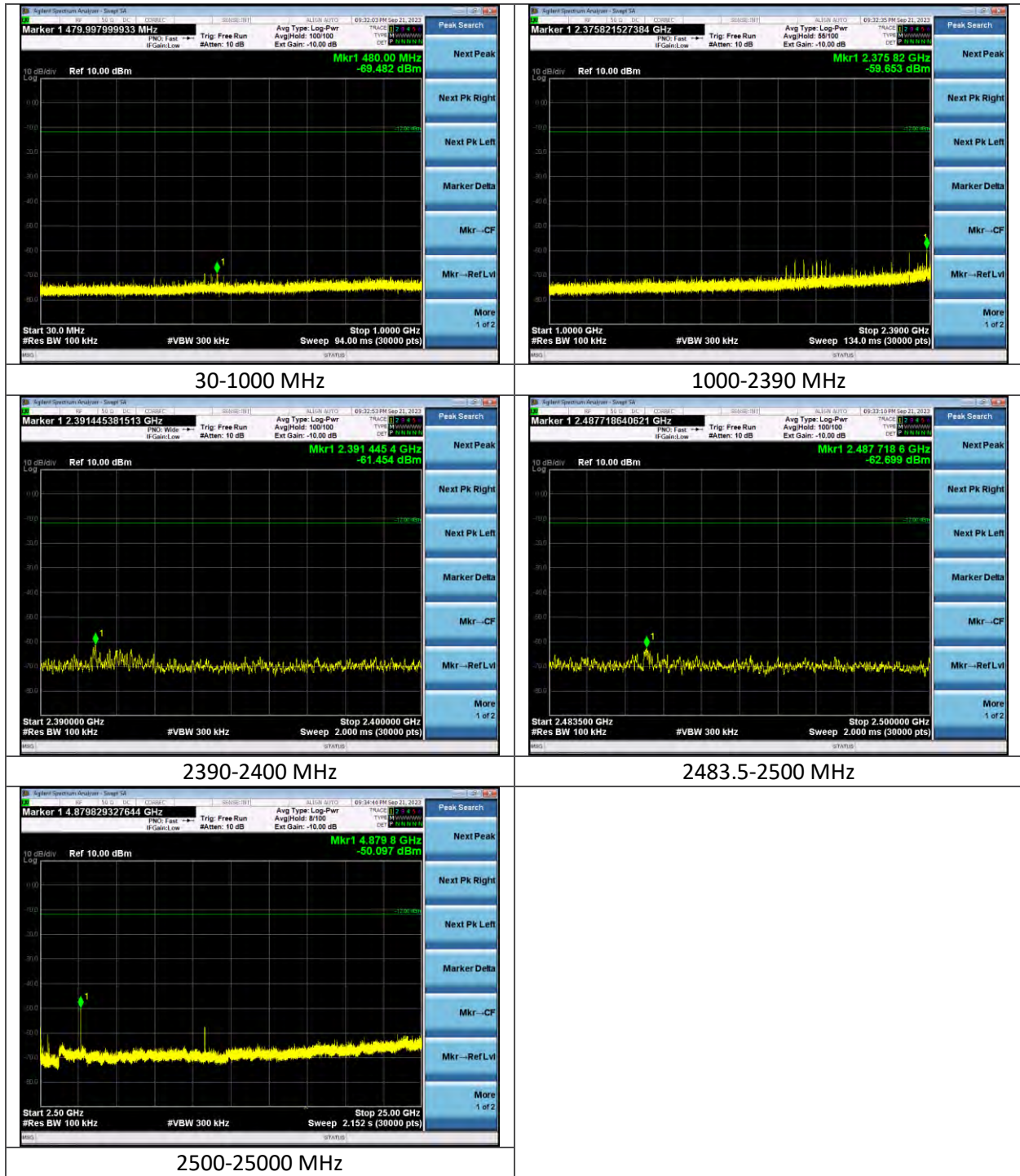


Company: Laird Connectivity	Page 33 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

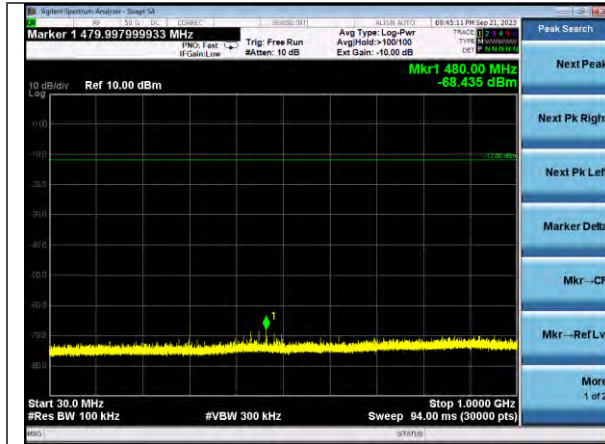
Tx Mid 1M



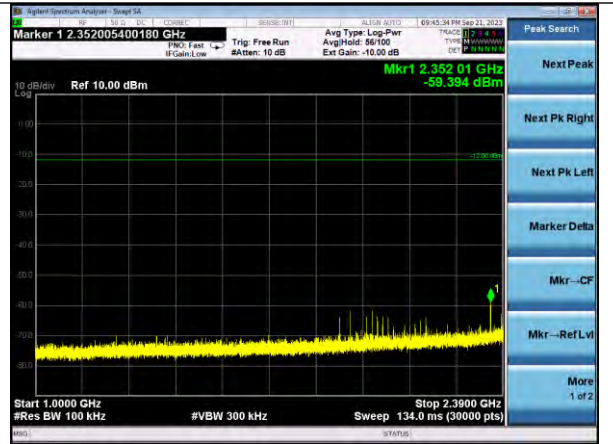
Tx Mid 2M



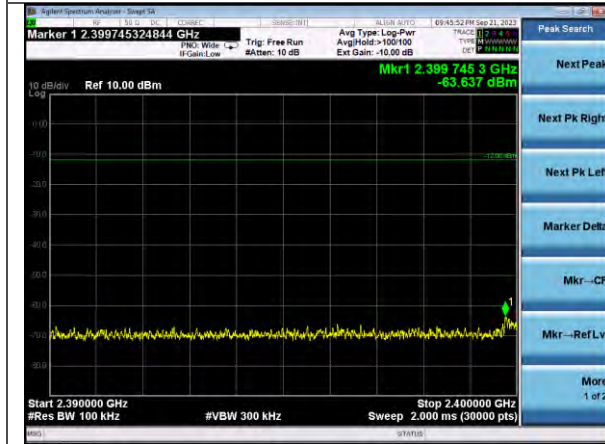
Tx High 125k



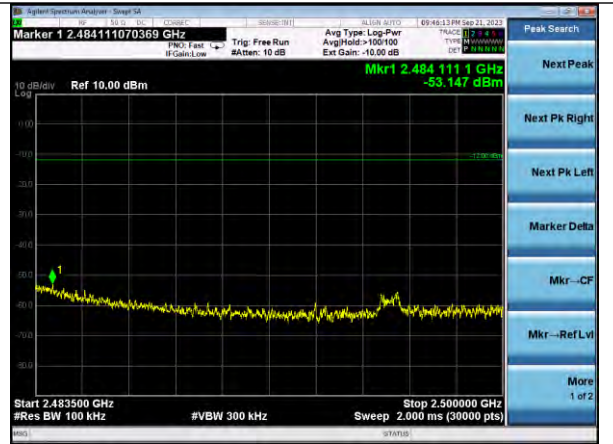
30-1000 MHz



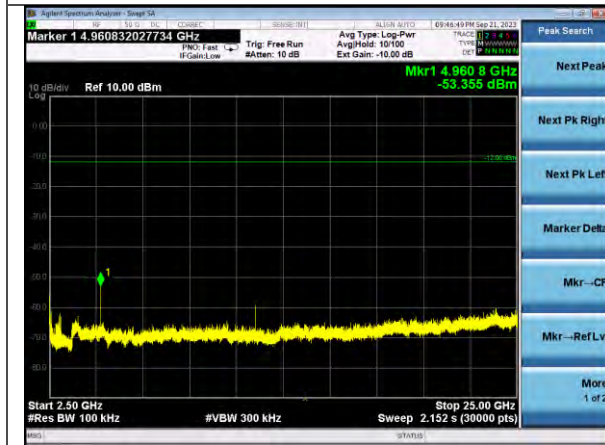
1000-2390 MHz



2390-2400 MHz



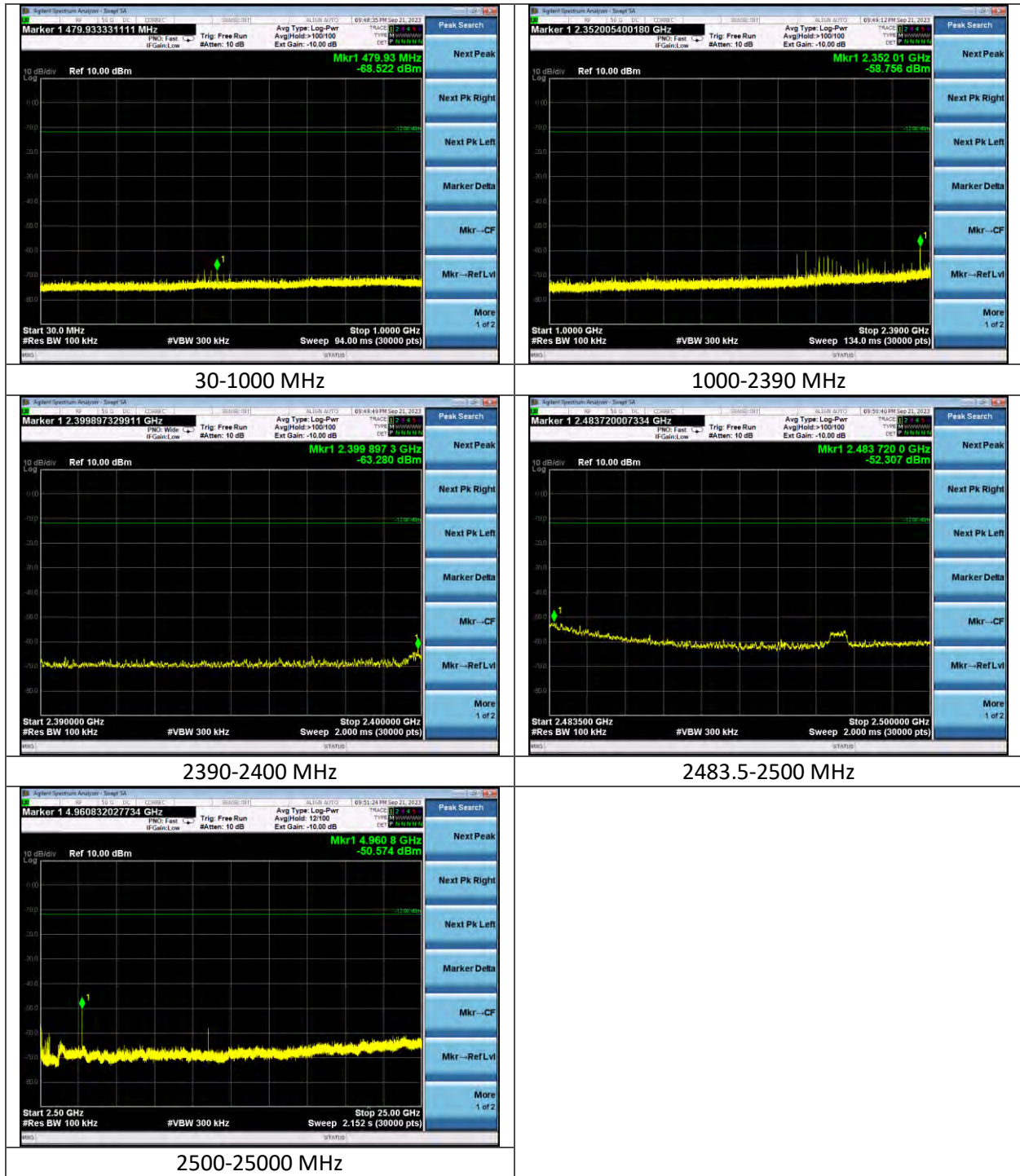
2483.5-2500 MHz



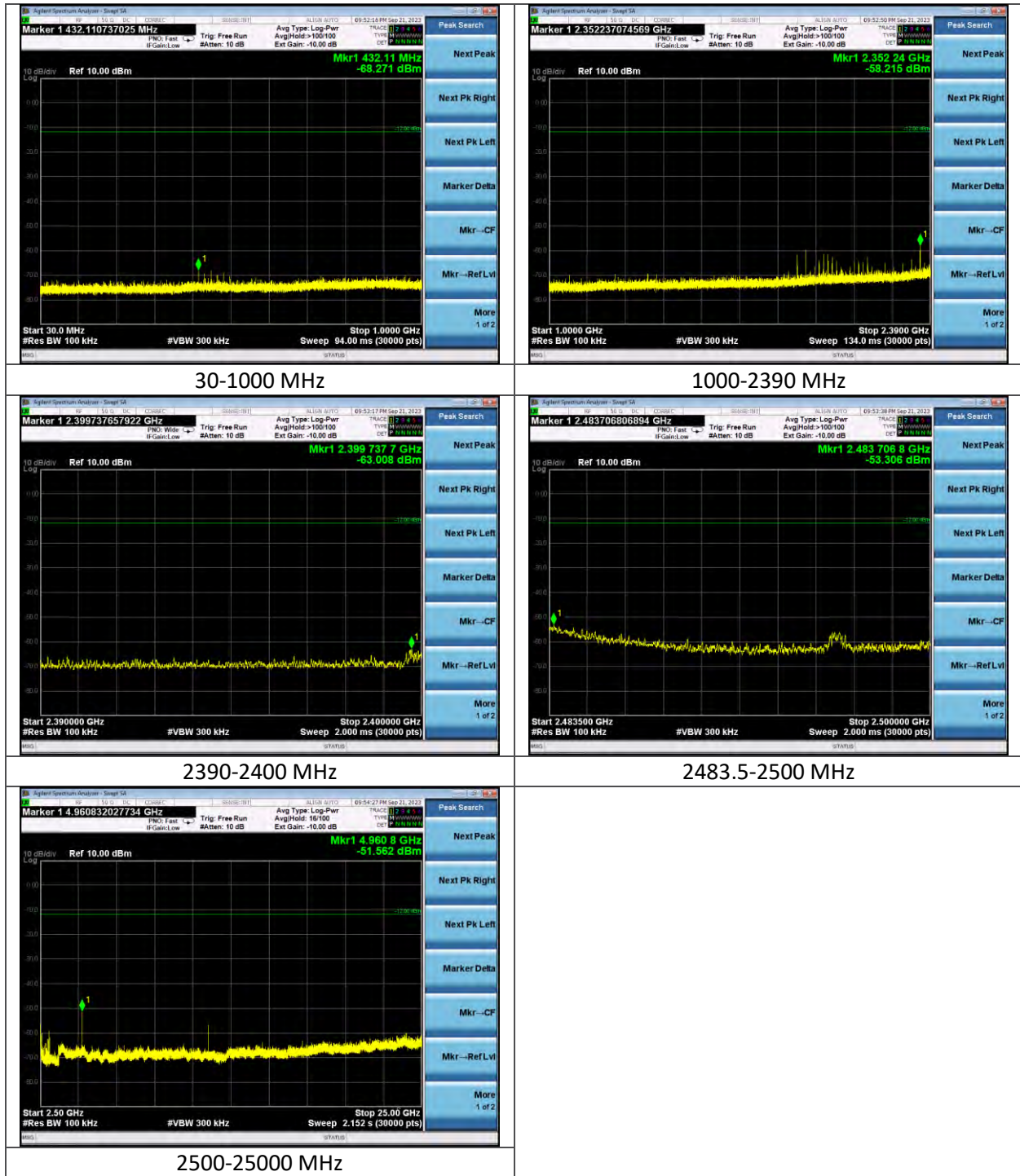
2500-25000 MHz

Company: Laird Connectivity	Page 36 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

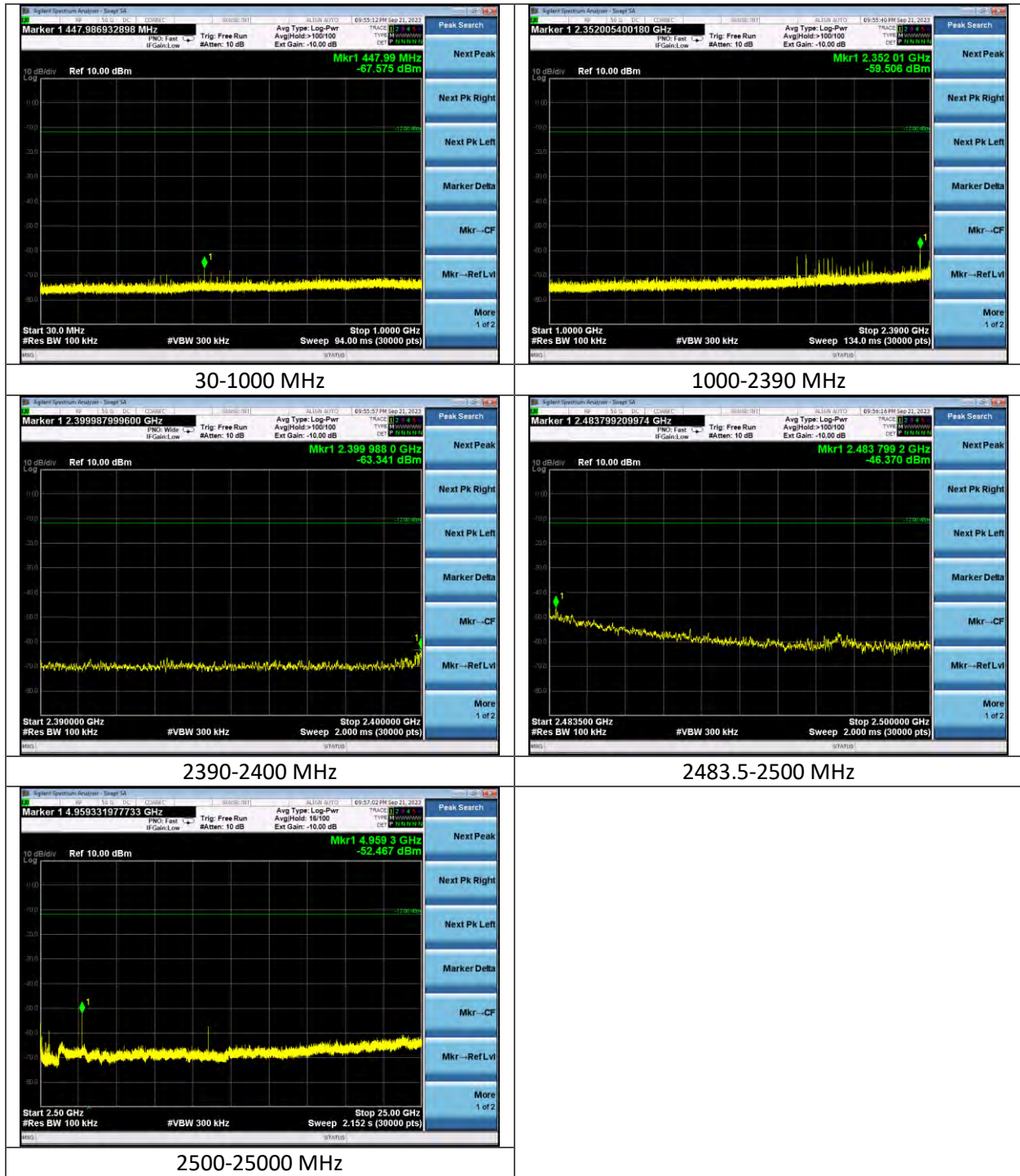
Tx High 500k



Tx High 1M



Tx High 2M



Company: Laird Connectivity	Page 39 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

Frequency Stability

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	1 kHz	VBW	3 kHz
Detector(s)	Max Peak Hold	Sweep Time	Auto

EUT Parameters

Input Power	4.25, 5.0, 5.75 VDC	Mode	BLE
Modulation	CW	Channel	Low, Mid, High

Data

Table

Channel	Frequency (Hz) 4.25VDC	Frequency (Hz) 5.0VDC	Frequency (Hz) 5.75VDC	Deviation (Hz)
Low	2401989228	2401989372	2401989175	197
Mid	2439989147	2439989210	2439989066	144
High	2479988941	2479989002	2479988856	146

RF Spurious Emissions in Restricted Bands

Test Parameters

Frequency	30-40000 MHz	Setup	Conducted
RBW	120 kHz (Below 1 GHz) 1 MHz (Above 1 GHz)	VBW	1.2 MHz (Below 1 GHz) 3 MHz (Above 1 GHz) Peak 470 Hz – 1M Avg 1 kHz – 2M Avg 100 Hz – 125k Avg 220 Hz – 500k Avg
Detector(s)	Peak	Sweep Time	Auto

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channel	Low, Mid, High

Data

Table

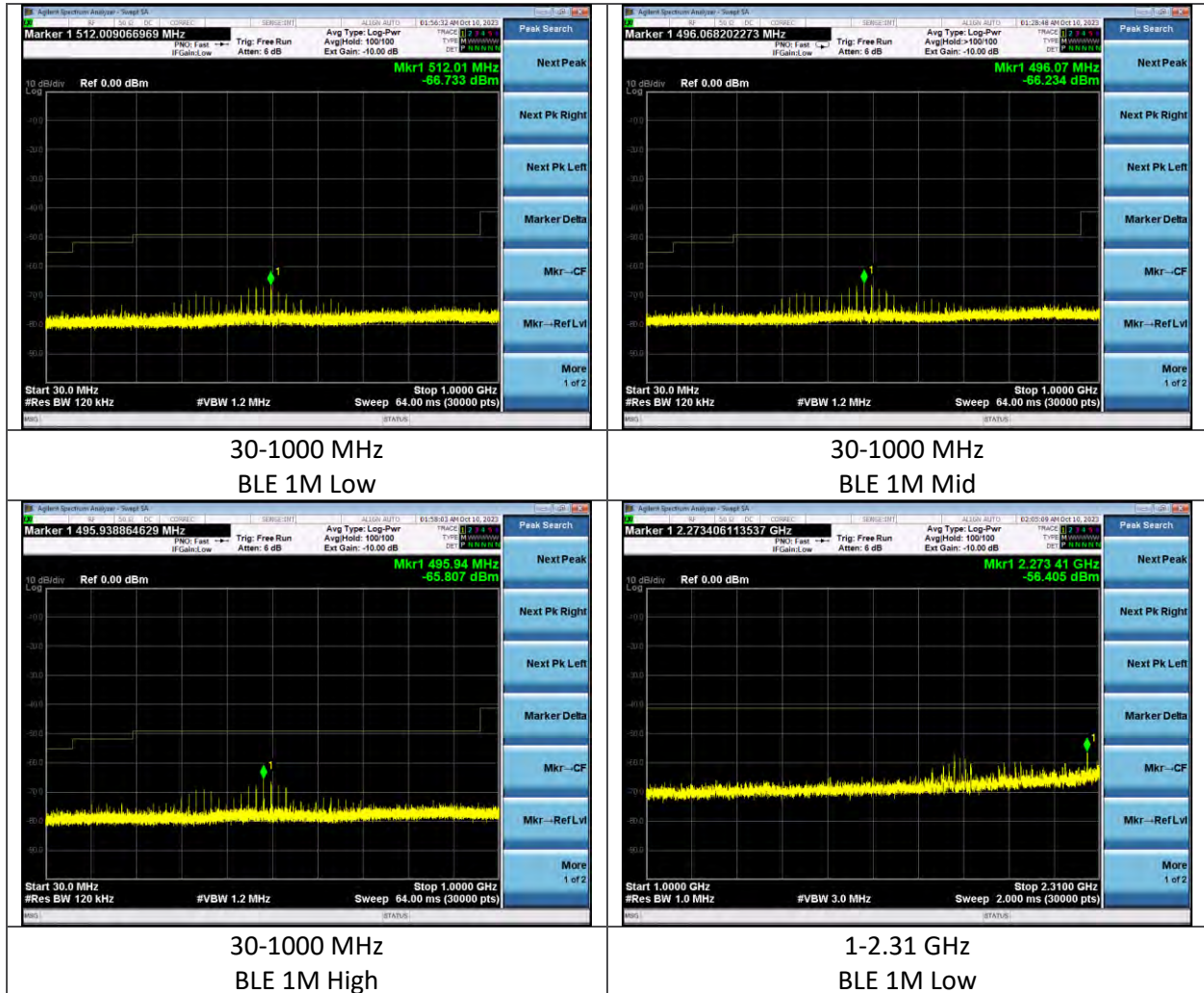
Below 1 GHZ

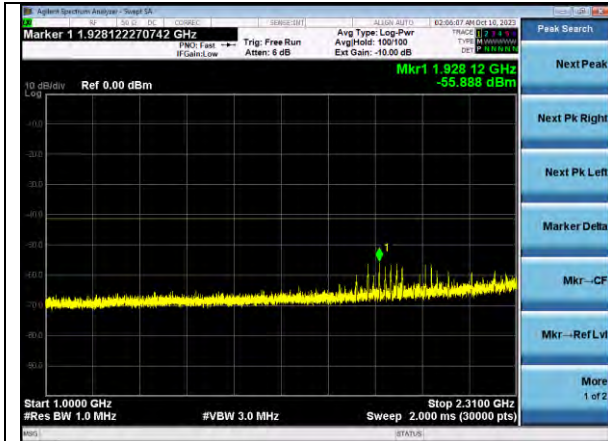
Channel	Data Rate	Frequency (MHz)	Spurious Emission (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Mid	1M	496.1	-66.3	3.1	4.7	-58.5	-49.3	9.2
Low	1M	512.0	-66.7	3.1	4.7	-58.9	-49.3	9.6
High	1M	495.9	-65.8	3.1	4.7	-58.0	-49.3	8.7

Above 1 GHz

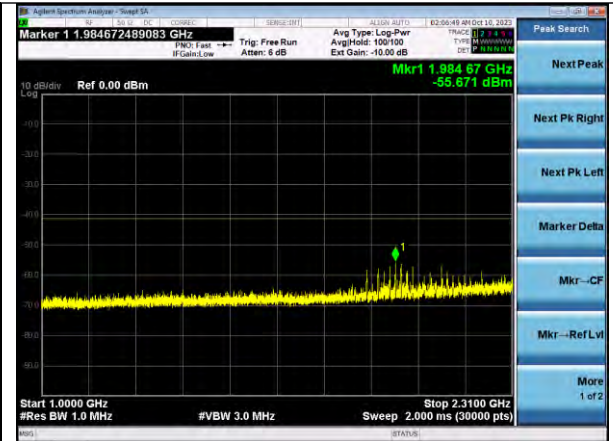
Channel	Data Rate	Frequency (MHz)	Spurious Emission (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Peak / Average
Low	1M	2273.4	-56.4	3.1	-53.3	-41.3	12.0	Avg
Mid	1M	1928.1	-55.9	3.1	-52.8	-41.3	11.5	Avg
High	1M	1984.7	-55.7	3.1	-52.6	-41.3	11.3	Avg
Low	1M	2375.1	-41.0	3.1	-37.9	-21.3	16.6	Peak
Low	1M	2370.1	-57.2	3.1	-54.1	-41.3	12.8	Avg
High	1M	2352.1	-61.1	3.1	-58.0	-41.3	16.7	Avg
High	1M	2351.8	-53.6	3.1	-50.5	-21.3	29.2	Peak
Mid	1M	2375.7	-53.3	3.1	-50.2	-21.3	28.9	Peak
Mid	1M	2376.1	-61.0	3.1	-57.9	-41.3	16.6	Avg
Low	2M	2370.0	-57.9	3.1	-54.8	-41.3	13.5	Avg
Low	2M	2376.5	-41.2	3.1	-38.1	-21.3	16.8	Peak
High	1M	2483.9	-36.1	3.1	-33.0	-21.3	11.7	Peak
High	1M	2483.5	-52.0	3.1	-48.9	-41.3	7.6	Avg
High	2M	2483.5	-46.9	3.1	-43.8	-41.3	2.5	Avg
High	2M	2483.6	-35.1	3.1	-32.0	-21.3	10.7	Peak
High	125k	2483.5	-52.1	3.1	-49.0	-41.3	7.7	Avg
High	125k	2483.9	-38.9	3.1	-35.8	-21.3	14.5	Peak
High	500k	2483.8	-37.2	3.1	-34.1	-21.3	12.8	Peak
High	500k	2483.5	-52.1	3.1	-49.0	-41.3	7.7	Avg
Mid	1M	4880.0	-48.2	3.1	-45.1	-41.3	3.8	Avg
High	1M	4960.0	-48.7	3.1	-45.6	-41.3	4.3	Avg
Low	1M	4804.0	-45.7	3.1	-42.6	-41.3	1.3	Avg
Mid	2M	4880.0	-51.7	3.1	-48.6	-41.3	7.3	Avg
High	2M	4960.0	-52.8	3.1	-49.7	-41.3	8.4	Avg
Low	2M	4804.1	-50.0	3.1	-46.9	-41.3	5.6	Avg
Low	125k	4804.0	-46.4	3.1	-43.3	-41.3	2.0	Avg
Low	500k	4804.0	-46.3	3.1	-43.2	-41.3	1.9	Avg
Mid	125k	4880.0	-47.7	3.1	-44.6	-41.3	3.3	Avg
Mid	500k	4880.0	-47.5	3.1	-44.4	-41.3	3.1	Avg
High	125k	4960.0	-49.0	3.1	-45.9	-41.3	4.6	Avg
High	500k	4960.0	-48.7	3.1	-45.6	-41.3	4.3	Avg
High	500k	4960.5	-45.3	3.1	-42.2	-21.3	20.9	Peak
Mid	500k	4879.5	-44.2	3.1	-41.1	-21.3	19.8	Peak
Low	500k	4803.4	-43.1	3.1	-40.0	-21.3	18.7	Peak

Plots

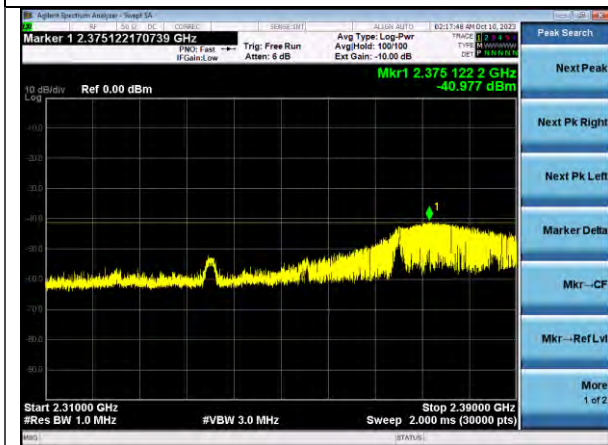




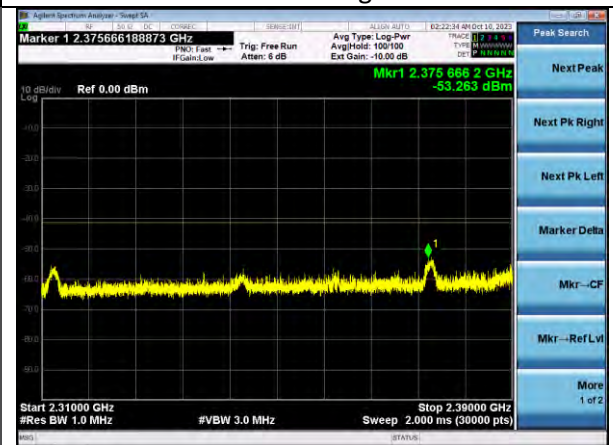
1-2.31 GHz
BLE 1M Mid



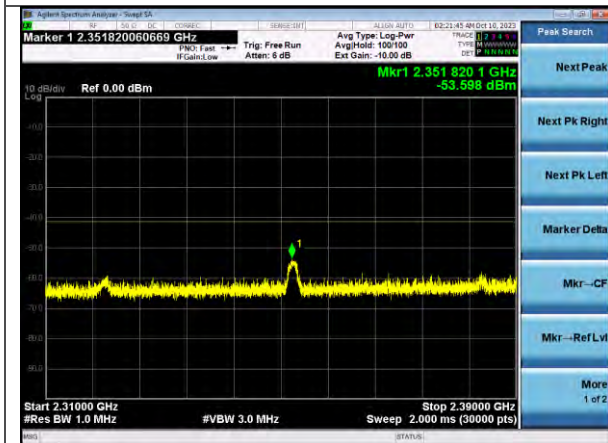
1-2.31 GHz
BLE 1M High



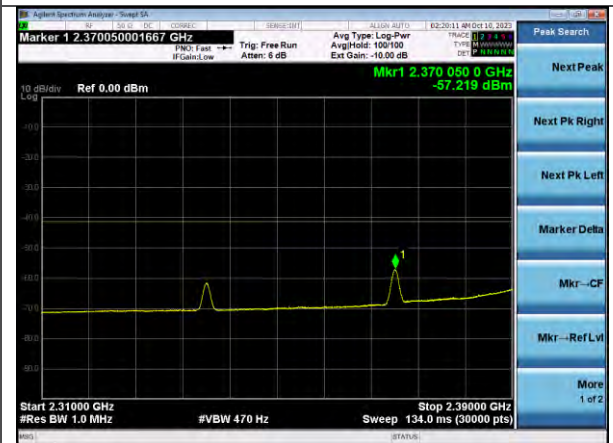
2.31-2.39 GHz
BLE 1M Low Peak



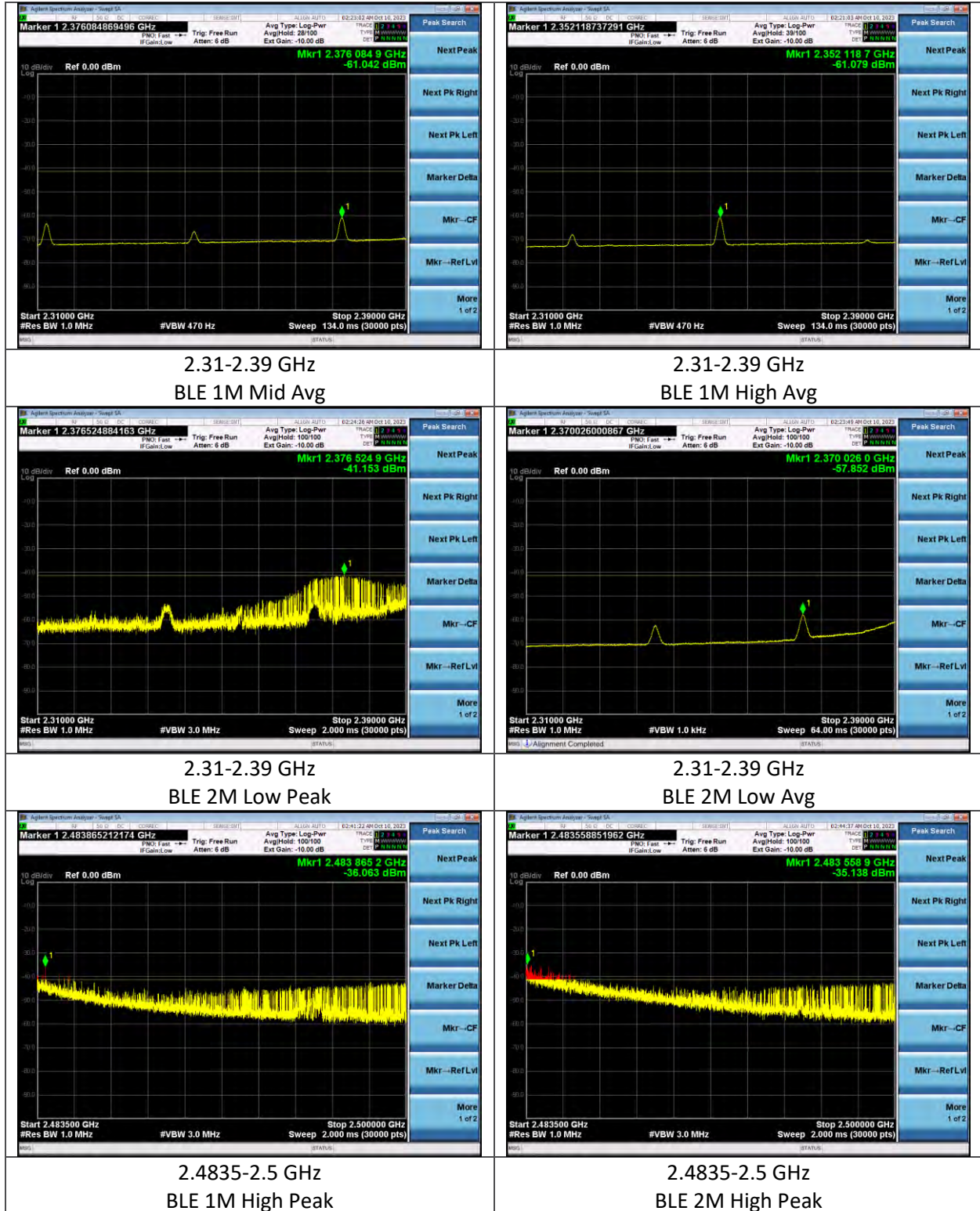
2.31-2.39 GHz
BLE 1M Mid Peak

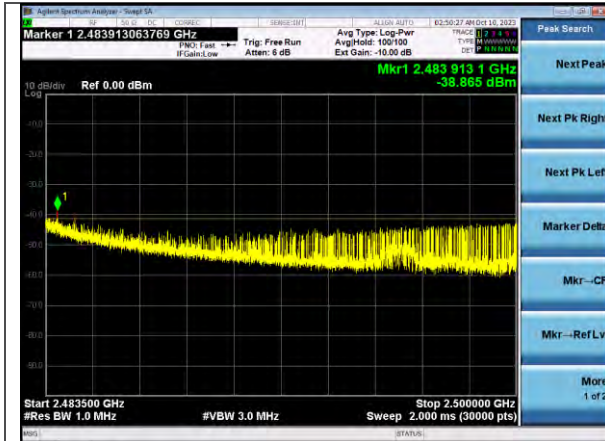


2.31-2.39 GHz
BLE 1M High Peak

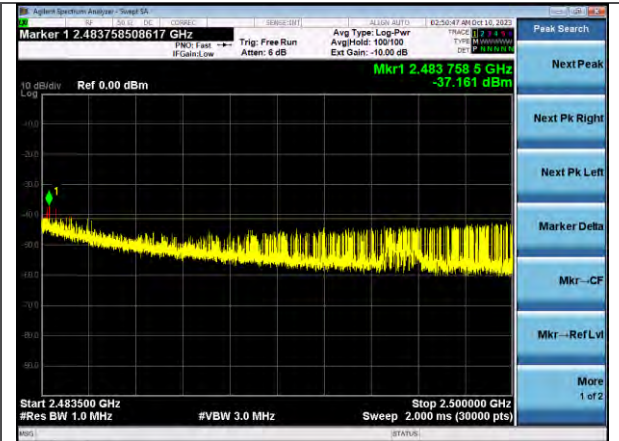


2.31-2.39 GHz
BLE 1M Low Avg





2.4835-2.5 GHz
BLE 125k High Peak



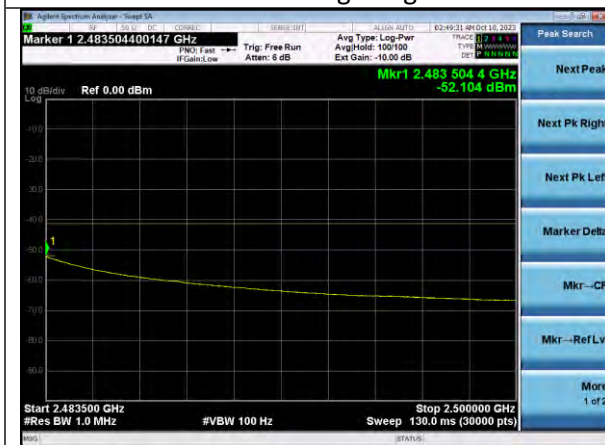
2.4835-2.5 GHz
BLE 500k High Peak



2.4835-2.5 GHz
BLE 1M High Avg



2.4835-2.5 GHz
BLE 2M High Avg



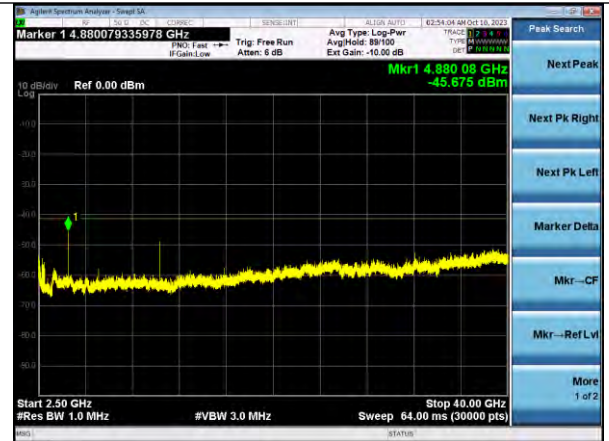
2.4835-2.5 GHz
BLE 125k High Avg



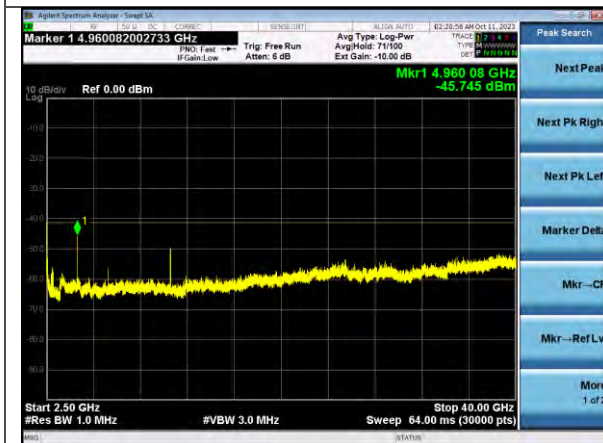
2.4835-2.5 GHz
BLE 500k High Avg



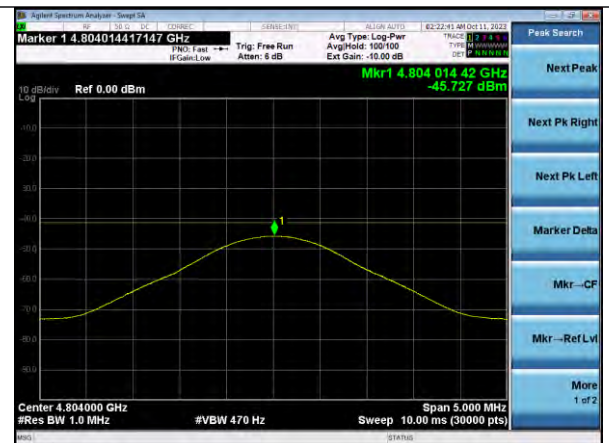
2.5-40 GHz
BLE 1M Low



2.5-40 GHz
BLE 1M Mid



2.5-40 GHz
BLE 1M High



4804 MHz
BLE 1M Low - Avg

5.2 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



5.2.1 Radiated Emissions – Trace Antenna

Operator	Anthony Smith	QA	Dylan Rosenfeldt
Temperature	23.8-24.2°C	R.H. %	47.4-51.7%
Test Date	9/6/2023-9/19/2023	Location	Chamber 3
Requirement	FCC 15.247 RSS-247	Method	ANSI C63.10

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	-	-
Above 1000	-	54.0	74.0

Test Parameters

Frequency	30-40000 MHz	Distance	3m
Detector(s)	Peak, QP, Avg	Table height	80cm Below 1 GHz 150cm Above 1 GHz
RBW	120 kHz Below 1 GHz 1 MHz Above 1 GHz	VBW	1.2 MHz Below 1 GHz 3 MHz Above 1 GHz Peak 470 Hz 1M Avg 1 kHz 2M Avg 100 Hz 125k Avg 220 Hz 500k Avg
Notes	VBW adjusted for On Time of each different data rate for average measurements		
Example Calculations	1/On Time = Average VBW (Hz)		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/11/2023	4/11/2024	Active Calibration
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	1/30/2023	1/30/2024	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 960211	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	977711030	1/30/2023	1/30/2024	Active Calibration
AA 960218	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	853	7/17/2023	7/17/2024	Active Calibration
AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	2/16/2023	2/16/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	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

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channels	Low, Mid, High
Notes	1M Rate used for plot captures		

Table

Fundamental Emission Peaking

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Data Rate	Channel	EUT Orientation
2402.0	H	238	188	97.5	1M	37	Vertical
2402.2	V	191	112	101.8	1M	37	Vertical
2402.2	V	150	249	101.7	1M	37	Horizontal
2402.0	H	185	226	99.4	1M	37	Horizontal
2402.2	H	131	303	102.6	1M	37	Flat
2402.0	V	154	13	94.3	1M	37	Flat
2402.4	H	131	303	102.6	2M	37	Flat
2402.2	H	131	303	102.4	125k	37	Flat
2402.3	H	131	303	102.4	500k	37	Flat
2479.8	H	111	302	103.2	1M	39	Flat
2480.0	H	111	302	103.2	2M	39	Flat
2479.7	H	111	302	103.2	125k	39	Flat
2479.9	H	111	302	103.2	500k	39	Flat

Band Edge – Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Channel	EUT Orientation
2389.5	H	131	303	53.7	74.0	20.3	37 2M	Flat
2379.1	H	131	303	53.6	74.0	20.4	37 125k	Flat
2375.4	H	131	303	53.4	74.0	20.6	37 500k	Flat
2376.1	H	131	303	54.0	74.0	20.0	37 1M	Flat
2483.7	H	111	302	57.4	74.0	16.6	39 1M	Flat
2483.5	H	111	302	57.2	74.0	16.9	39 2M	Flat
2483.8	H	111	302	55.2	74.0	18.8	39 125k	Flat
2483.6	H	111	302	55.7	74.0	18.3	39 500k	Flat

Band Edge – Average

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
2370.0	H	131	303	41.2	54.0	12.8	37 2M	Flat
2370.0	H	131	303	40.6	54.0	13.4	37 125k	Flat
2370.1	H	131	303	40.8	54.0	13.2	37 500k	Flat
2370.0	H	131	303	41.1	54.0	12.9	37 1M	Flat
2483.5	H	111	302	44.3	54.0	9.7	39 1M	Flat
2483.5	H	111	302	47.5	54.0	6.5	39 2M	Flat
2483.5	H	111	302	43.7	54.0	10.3	39 125k	Flat
2483.5	H	111	302	43.9	54.0	10.1	39 500k	Flat

Spurious Emissions – Average

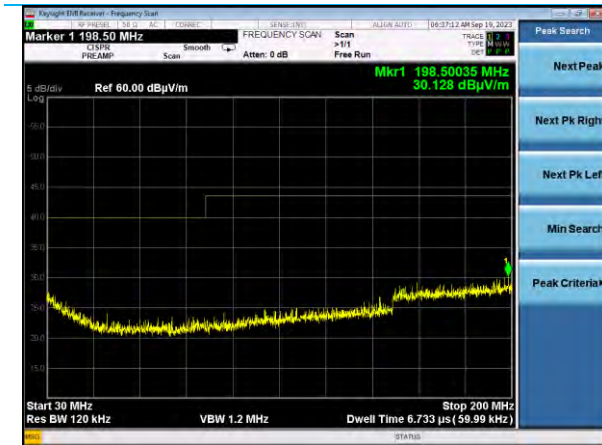
Frequency (MHz)	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Average Reading (dB μ V/m)	Average Limit (dB μ V/m)	Average Margin (dB)	Note
4880.1	Vertical	Flat	202	319	34.7	54.0	19.3	Mid
4880.2	Horizontal	Flat	135	286	30.8	54.0	23.2	Mid
4880.2	Horizontal	Vertical	144	53	33.1	54.0	20.9	Mid
4880.3	Vertical	Vertical	162	341	31.8	54.0	22.2	Mid
4880.2	Vertical	Horizontal	229	283	32.2	54.0	21.8	Mid
4879.7	Horizontal	Horizontal	208	0	29.7	54.0	24.3	Mid
4960.1	Vertical	Flat	220	47	35.6	54.0	18.4	High
4804.2	Vertical	Flat	240	48	35.8	54.0	18.2	Low
7320.6	Vertical	Flat	245	162	46.7	54.0	7.3	Mid
7319.4	Horizontal	Flat	259	113	41.3	54.0	12.7	Mid
7320.6	Horizontal	Vertical	230	33	46.5	54.0	7.5	Mid
7320.6	Vertical	Vertical	320	340	43.6	54.0	10.4	Mid
7320.6	Vertical	Horizontal	201	8	46.6	54.0	7.4	Mid
7320.6	Horizontal	Horizontal	151	311	42.0	54.0	12.0	Mid
7440.6	Vertical	Flat	238	236	47.4	54.0	6.6	High

Spurious Emissions – Peak

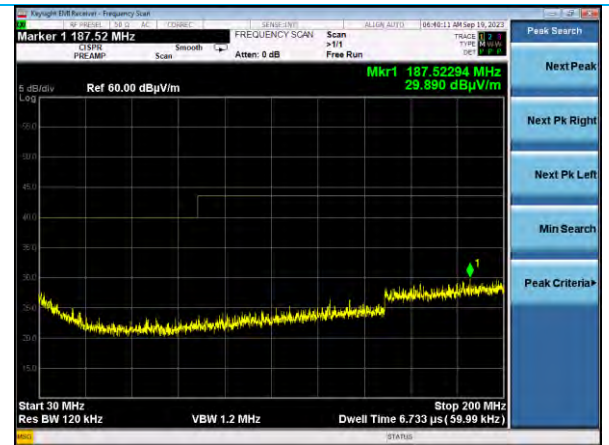
Frequency (MHz)	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Note
4880.1	Vertical	Flat	202	319	44.0	74.0	30.0	Mid
4880.2	Horizontal	Flat	135	286	40.2	74.0	33.8	Mid
4880.2	Horizontal	Vertical	144	53	42.1	74.0	31.9	Mid
4880.3	Vertical	Vertical	162	341	42.5	74.0	31.5	Mid
4880.2	Vertical	Horizontal	229	283	42.5	74.0	31.5	Mid
4879.7	Horizontal	Horizontal	208	0	39.3	74.0	34.7	Mid
4960.1	Vertical	Flat	220	47	44.2	74.0	29.8	High
4804.2	Vertical	Flat	240	48	44.7	74.0	29.3	Low
7320.6	Vertical	Flat	245	162	53.0	74.0	21.0	Mid
7319.4	Horizontal	Flat	259	113	48.7	74.0	25.3	Mid
7320.6	Horizontal	Vertical	230	33	53.1	74.0	20.9	Mid
7320.6	Vertical	Vertical	320	340	51.2	74.0	22.8	Mid
7320.6	Vertical	Horizontal	201	8	53.0	74.0	21.0	Mid
7320.6	Horizontal	Horizontal	151	311	49.5	74.0	24.5	Mid
7440.6	Vertical	Flat	238	236	54.2	74.0	19.8	High

Plots

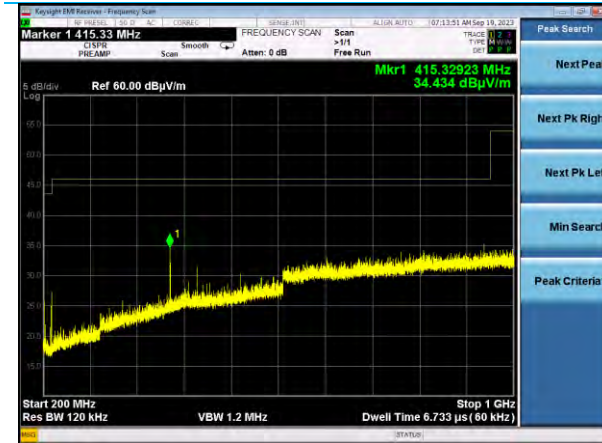
Spurious Emissions



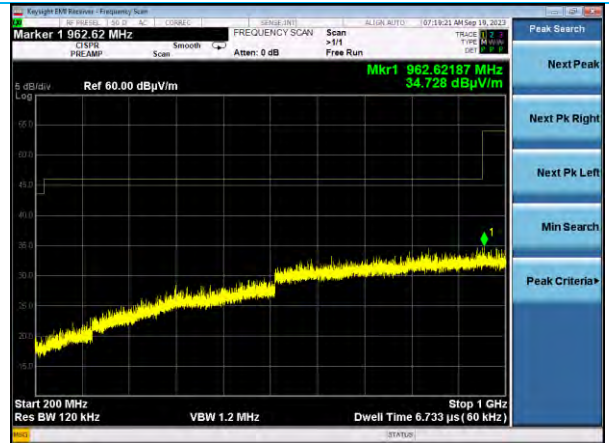
30-200 MHz Horizontal
EUT Vertical Tx Mid



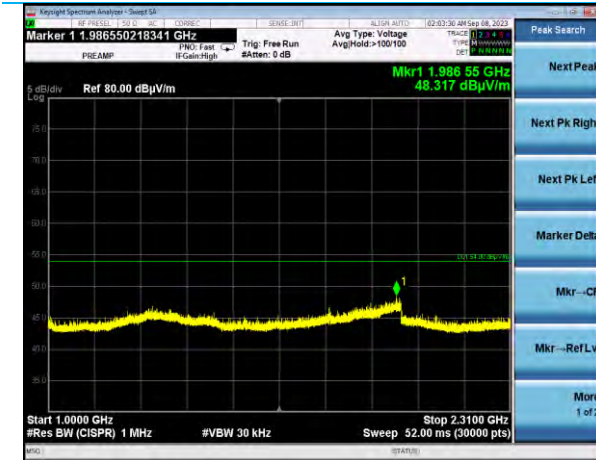
30-200 MHz Vertical
EUT Vertical Tx Mid



200-1000 MHz Horizontal
EUT Vertical Tx Mid
Emissions Related to Turntable, not EUT



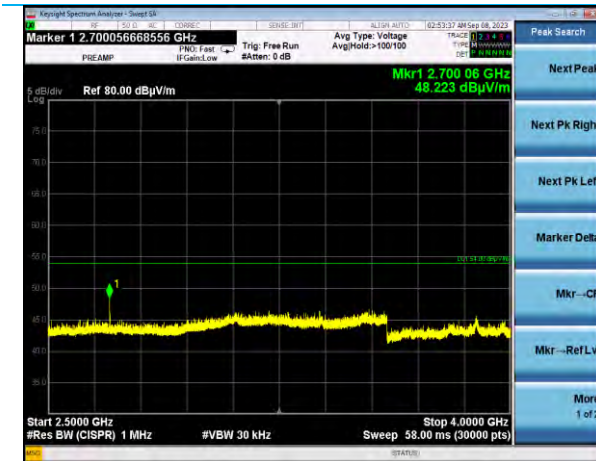
200-1000 MHz Vertical
EUT Vertical Tx Mid



1-2.31 GHz Horizontal
EUT Flat Tx Mid



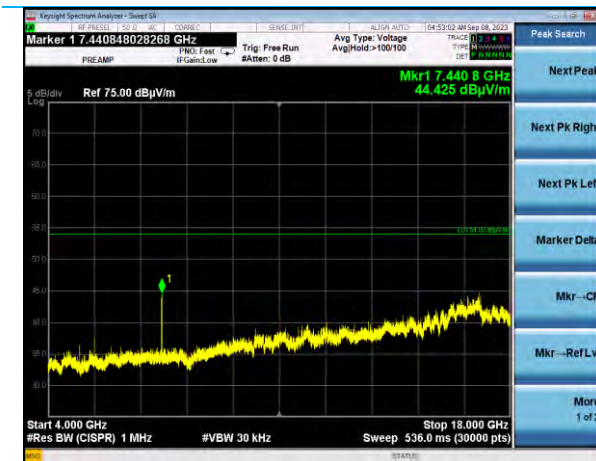
1-2.31 GHz Vertical
EUT Flat Tx Mid



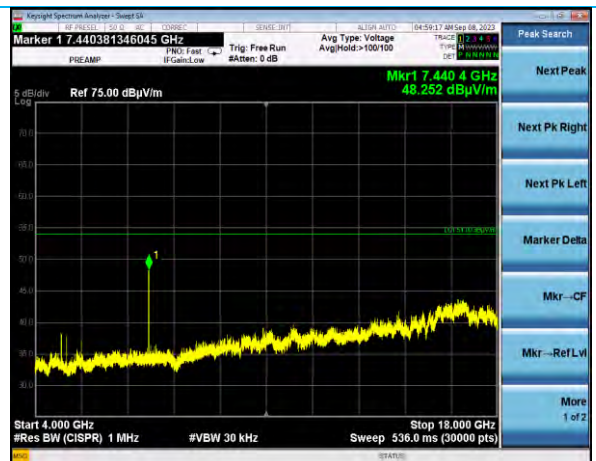
2.5-4 GHz Horizontal
EUT Flat Tx Mid



2.5-4 GHz Vertical
EUT Flat Tx Mid



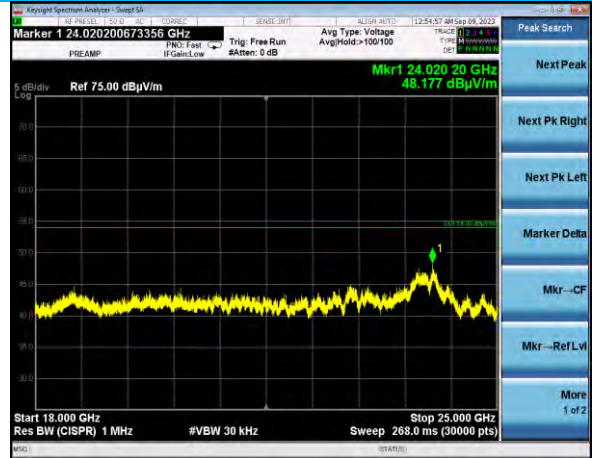
4-18 GHz Horizontal
EUT Flat Tx High



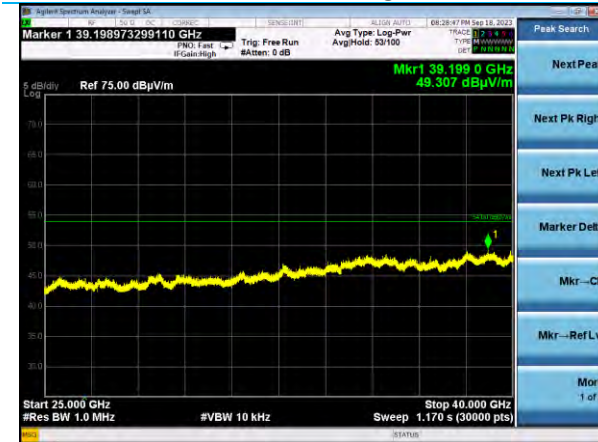
4-18 GHz Vertical
EUT Flat Tx High



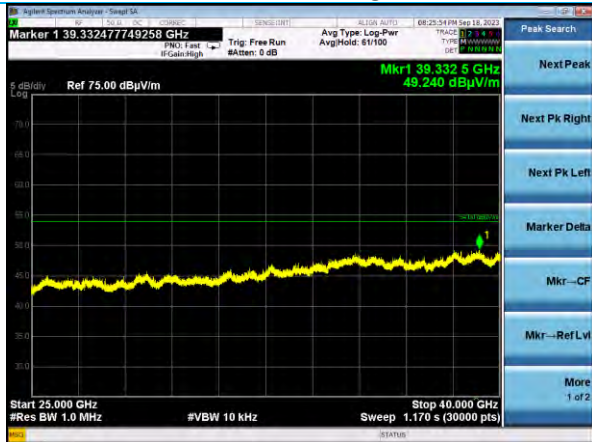
18-25 GHz Horizontal
EUT Flat Tx High



18-25 GHz Vertical
EUT Flat Tx High

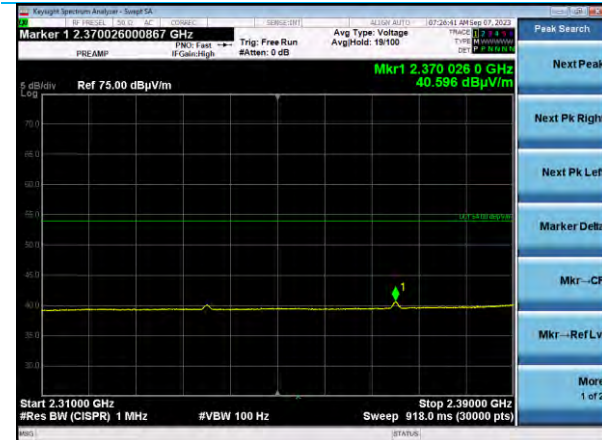


25-40 GHz Horizontal
EUT Vertical Tx Mid

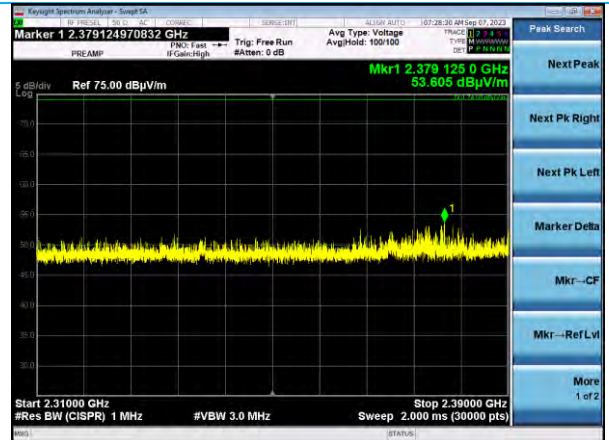


25-40 GHz Vertical
EUT Vertical Tx Mid

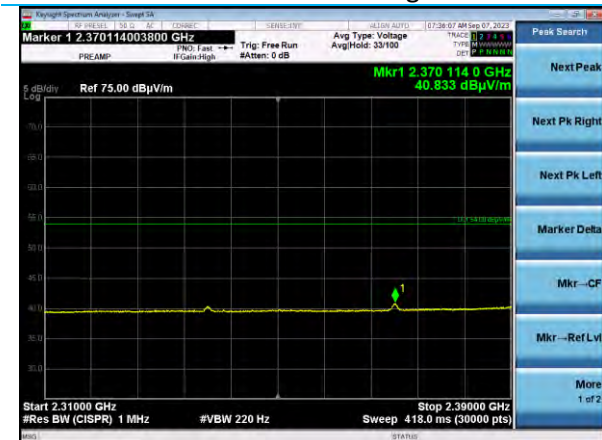
Band Edge



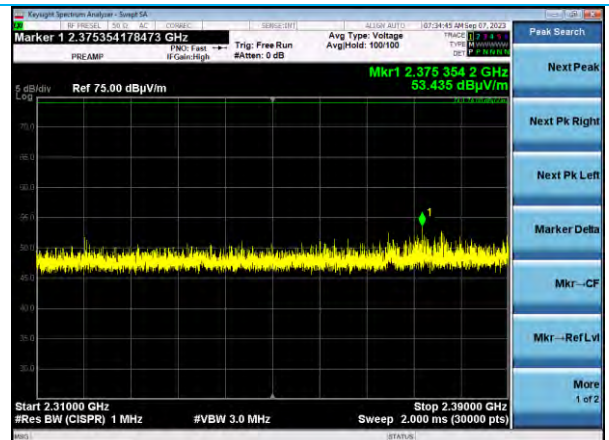
2310-2390 MHz Horizontal
EUT Flat 125k Avg



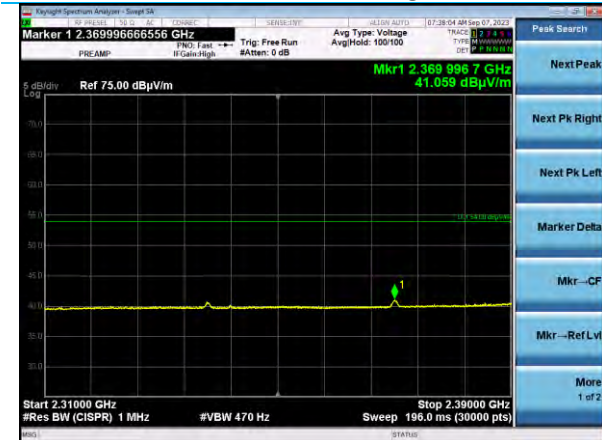
2310-2390 MHz Horizontal
EUT Flat 125k Peak



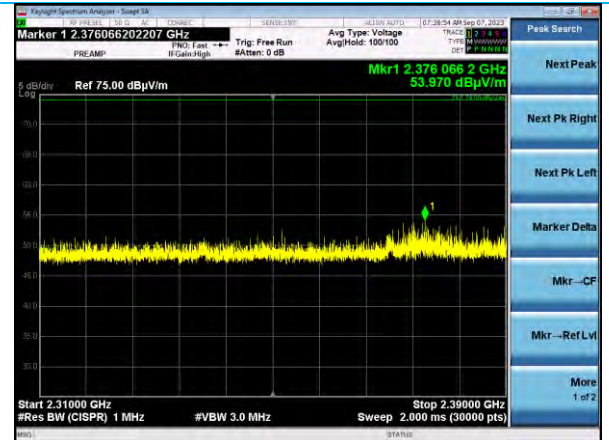
2310-2390 MHz Horizontal
EUT Flat 500k Avg



2310-2390 MHz Horizontal
EUT Flat 500k Peak

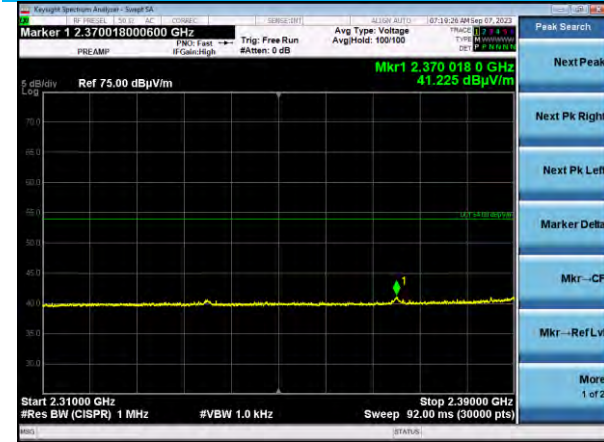


2310-2390 MHz Horizontal
EUT Flat 1M Avg

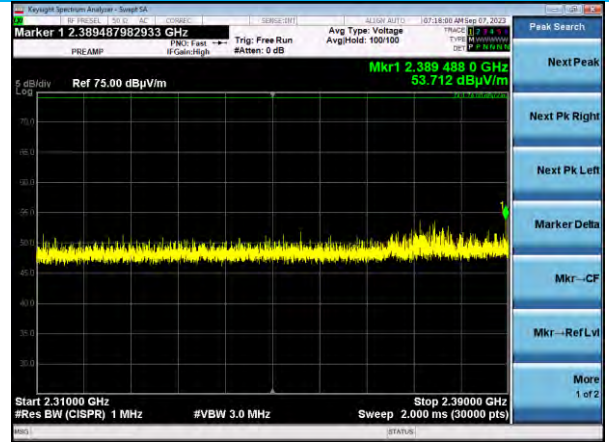


2310-2390 MHz Horizontal
EUT Flat 1M Peak

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2310-2390 MHz Horizontal
EUT Flat 2M Avg

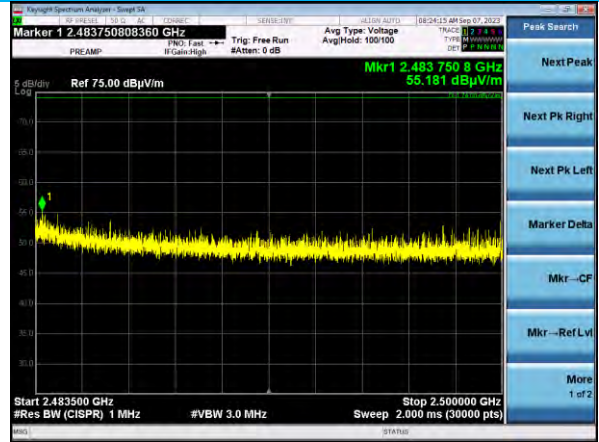


2310-2390 MHz Horizontal
EUT Flat 2M Peak

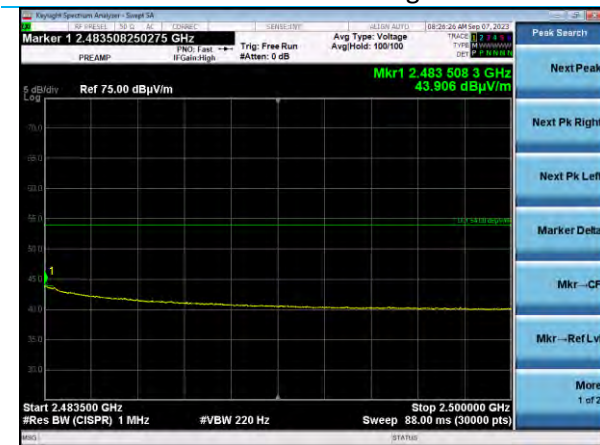
Company: Laird Connectivity	Page 58 of 74	Name: Sera NX040
Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016



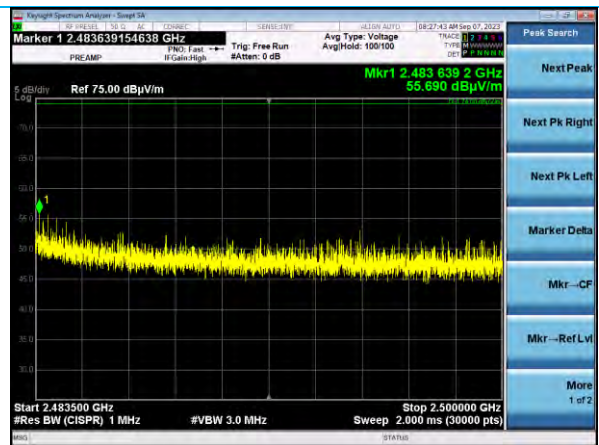
2483.5-2500 MHz Horizontal
EUT Flat 125k Avg



2483.5-2500 MHz Horizontal
EUT Flat 125k Peak



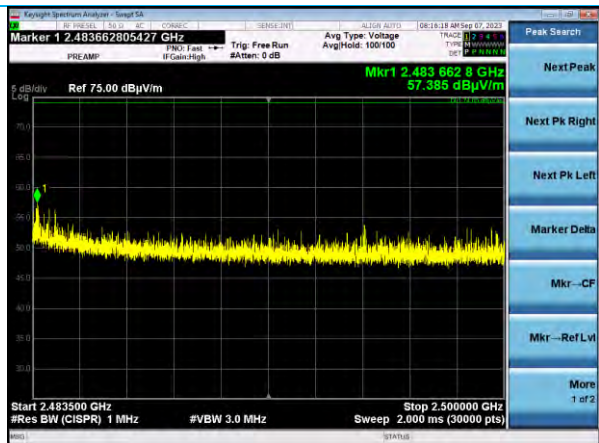
2483.5-2500 MHz Horizontal
EUT Flat 500k Avg



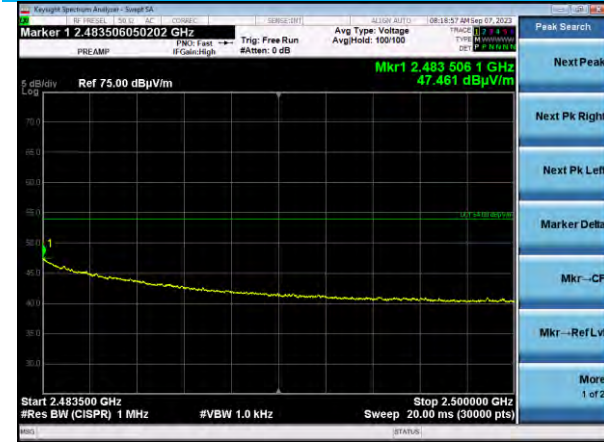
2483.5-2500 MHz Horizontal
EUT Flat 500k Peak



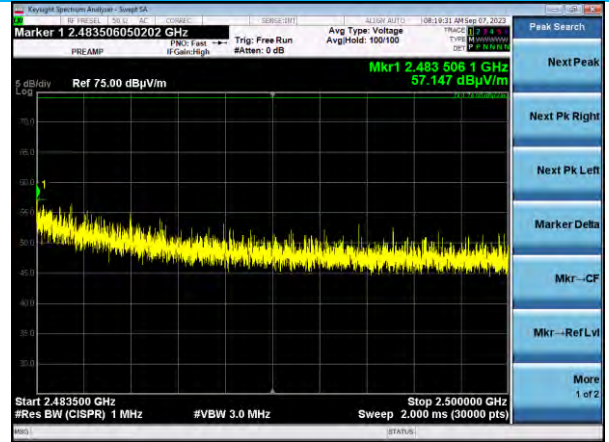
2483.5-2500 MHz Horizontal
EUT Flat 1M Avg



2483.5-2500 MHz Horizontal
EUT Flat 1M Peak



2483.5-2500 MHz Horizontal
EUT Flat 2M Avg



2483.5-2500 MHz Horizontal
EUT Flat 2M Peak

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Report: TR3680A		Model: Sera NX040
Quote: NBO-02-2023-005963		Serial: 00029, 00016

5.2.2 Radiated Emissions – External Antenna

Operator	Anthony Smith	QA	Jon Dilley
Temperature	22.3-24.0°C	R.H. %	47.6-50.5%
Test Date	9/14/2023 - 9/20/2023	Location	Chamber 3
Requirement	FCC 15.247 RSS-247	Method	ANSI C63.10

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	-	-
Above 1000	-	54.0	74.0

Test Parameters

Frequency	30-40000 MHz	Distance	3m
Detector(s)	Peak, QP, Avg	Table height	80cm Below 1 GHz 150cm Above 1 GHz
RBW	120 kHz Below 1 GHz 1 MHz Above 1 GHz	VBW	1.2 MHz Below 1 GHz 3 MHz Above 1 GHz Peak 470 Hz 1M Avg 1 kHz 2M Avg 100 Hz 125k Avg 220 Hz 500k Avg
Notes	VBW adjusted for On Time of each different data rate for average measurements		
Example Calculations	1/On Time = Average VBW (Hz)		

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/11/2023	4/11/2024	Active Calibration
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	1/30/2023	1/30/2024	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 960211	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	977711030	1/30/2023	1/30/2024	Active Calibration
AA 960218	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	853	7/17/2023	7/17/2024	Active Calibration
AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	2/16/2023	2/16/2024	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	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

EUT Parameters

Input Power	5VDC	Mode	BLE
Data Rate	125k, 500k, 1M, 2M	Channels	Low, Mid, High
Notes	Antenna port terminated with 50Ω Plots taken with 1M Data Rate unless otherwise noted		

Data

Table

Fundamental Emission Peaking

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Data Rate	Channel	EUT Orientation
2401.8	H	150	49	74.4	1M	Low	Vertical
2402.2	V	188	91	73.1	1M	Low	Vertical
2401.6	V	156	338	72.6	1M	Low	Horizontal
2402.0	H	171	60	76.3	1M	Low	Horizontal
2401.7	H	192	258	73.8	1M	Low	Flat
2402.5	V	263	97	77.2	1M	Low	Flat
2479.7	V	311	82	77.6	1M	High	Flat

Band Edge – Average

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Channel	EUT Orientation
2389.6	V	263	97	40.2	54.0	13.8	Low - 1M	Flat
2374.9	V	263	97	40.5	54.0	13.5	Low - 2M	Flat
2488.1	V	311	82	40.5	54.0	13.5	High - 1M	Flat
2484.5	V	311	82	40.8	54.0	13.3	High - 2M	Flat

Band Edge – Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Radio	EUT Orientation
2379.4	V	263	97	51.8	74.0	22.2	Low - 1M	Flat
2369.7	V	263	97	52.1	74.0	21.9	Low - 2M	Flat
2488.3	V	311	82	52.3	74.0	21.7	High - 1M	Flat
2496.7	V	311	82	52.0	74.0	22.0	High - 2M	Flat

Spurious Emissions – Average

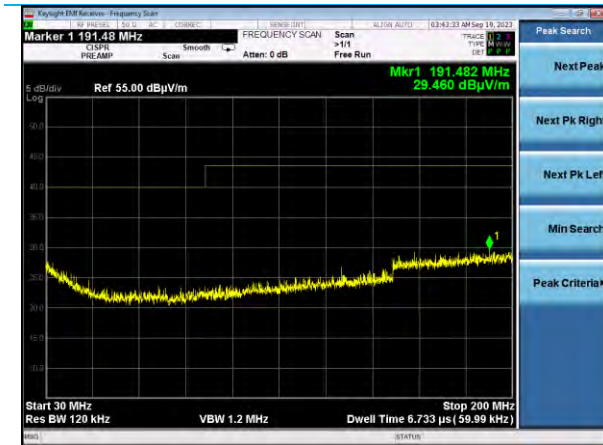
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Channel	EUT Orientation	Data Rate
7320.6	V	189	0	45.8	54.0	8.2	Mid	Vertical	1M
7320.6	H	245	29	49.4	54.0	4.7	Mid	Vertical	1M
4879.9	H	148	60	39.3	54.0	14.7	Mid	Vertical	1M
4879.9	V	184	340	34.5	54.0	19.5	Mid	Vertical	1M
4880.1	V	115	164	35.3	54.0	18.7	Mid	Horizontal	1M
7320.6	V	246	352	49.0	54.0	5.0	Mid	Horizontal	1M
7319.4	H	234	12	46.7	54.0	7.3	Mid	Horizontal	1M
4879.9	H	313	41	36.3	54.0	17.7	Mid	Horizontal	1M
4880.0	H	103	154	34.7	54.0	19.4	Mid	Flat	1M
7319.4	H	151	169	39.6	54.0	14.4	Mid	Flat	1M
7320.7	V	396	199	47.7	54.0	6.3	Mid	Flat	1M
4880.0	V	360	162	37.5	54.0	16.5	Mid	Flat	1M
7205.4	H	259	33	46.8	54.0	7.2	Low	Vertical	1M
4803.9	H	169	54	40.9	54.0	13.1	Low	Vertical	1M
7439.4	H	217	30	50.6	54.0	3.4	High	Vertical	1M
4959.9	H	156	58	37.9	54.0	16.2	High	Vertical	1M
7438.7	H	217	30	50.0	54.0	4.0	High	Vertical	2M
7439.3	H	217	30	50.4	54.0	3.6	High	Vertical	125k
7440.6	H	217	30	50.6	54.0	3.4	High	Vertical	500k
7321.2	H	245	29	48.7	54.0	5.3	Mid	Vertical	2M
7319.3	H	245	29	48.9	54.0	5.1	Mid	Vertical	125k
7319.4	H	245	29	49.1	54.0	4.9	Mid	Vertical	500k
7204.8	H	259	33	46.3	54.0	7.7	Low	Vertical	2M
7205.3	H	259	33	46.7	54.0	7.3	Low	Vertical	125k
7205.4	H	259	33	46.8	54.0	7.3	Low	Vertical	500k

Spurious Emissions – Peak

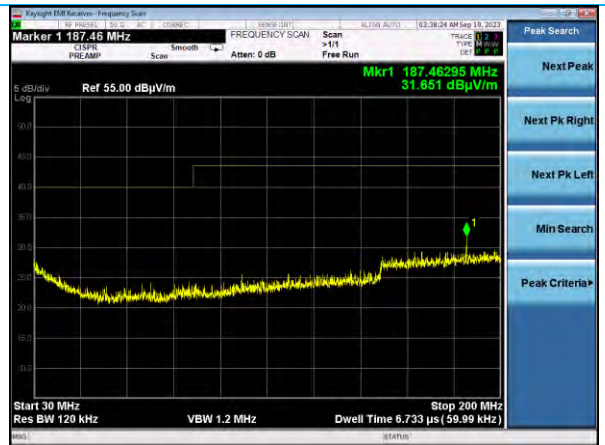
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Channel	EUT Orientation	Data Rate
7320.7	V	189	0	52.9	74.0	21.1	Mid	Vertical	1M
7320.6	H	245	29	55.8	74.0	18.2	Mid	Vertical	1M
4879.9	H	148	60	46.6	74.0	27.4	Mid	Vertical	1M
4880.6	V	184	340	43.8	74.0	30.2	Mid	Vertical	1M
4879.6	V	115	164	43.5	74.0	30.5	Mid	Horizontal	1M
7319.3	V	246	352	55.6	74.0	18.4	Mid	Horizontal	1M
7320.7	H	234	12	53.7	74.0	20.4	Mid	Horizontal	1M
4879.6	H	313	41	44.6	74.0	29.5	Mid	Horizontal	1M
4880.3	H	103	154	44.0	74.0	30.0	Mid	Flat	1M
7319.0	H	151	169	47.7	74.0	26.3	Mid	Flat	1M
7319.3	V	396	199	54.4	74.0	19.6	Mid	Flat	1M
4880.6	V	360	162	45.1	74.0	28.9	Mid	Flat	1M
7206.7	H	259	33	53.5	74.0	20.5	Low	Vertical	1M
4804.2	H	169	54	47.6	74.0	26.5	Low	Vertical	1M
7439.2	H	217	30	56.9	74.0	17.2	High	Vertical	1M
4959.6	H	156	58	45.3	74.0	28.7	High	Vertical	1M
7438.6	H	217	30	57.0	74.0	17.0	High	Vertical	2M
7439.2	H	217	30	57.3	74.0	16.7	High	Vertical	125k
7439.2	H	217	30	57.0	74.0	17.0	High	Vertical	500k
7321.4	H	245	29	55.4	74.0	18.6	Mid	Vertical	2M
7319.1	H	245	29	55.7	74.0	18.3	Mid	Vertical	125k
7320.7	H	245	29	55.6	74.0	18.4	Mid	Vertical	500k
7204.4	H	259	33	53.4	74.0	20.6	Low	Vertical	2M
7205.2	H	259	33	53.5	74.0	20.5	Low	Vertical	125k
7206.8	H	259	33	53.7	74.0	20.3	Low	Vertical	500k

Plots

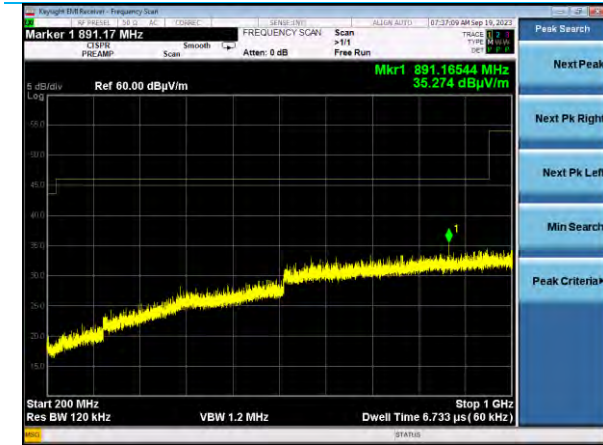
Spurious Emissions



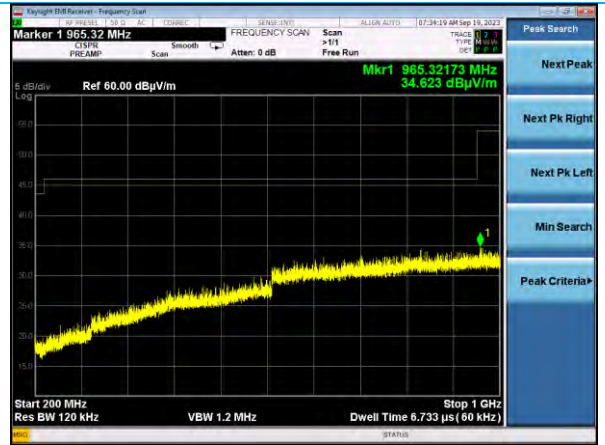
30-200 MHz Horizontal
EUT Vertical Tx Mid



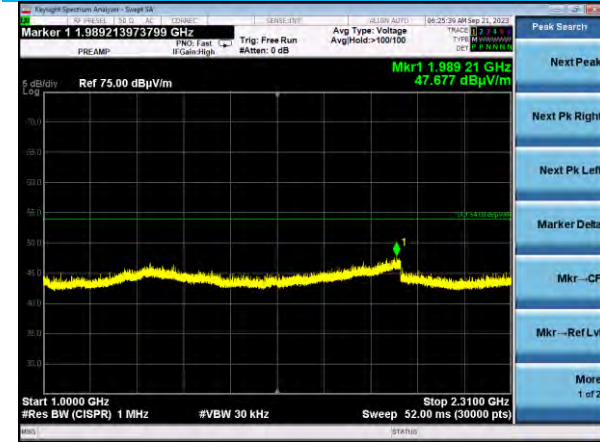
30-200 MHz Vertical
EUT Vertical Tx Mid



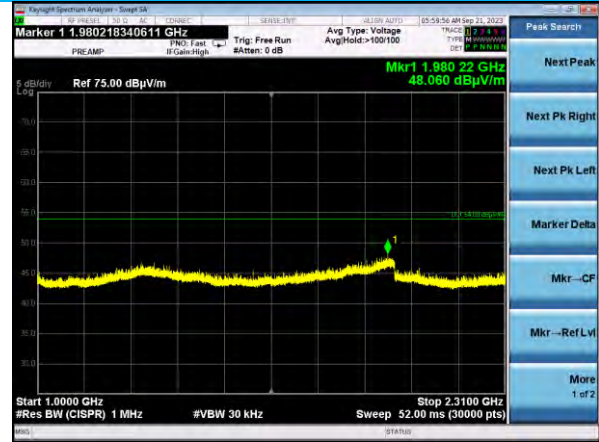
200-1000 MHz Horizontal
EUT Vertical Tx Mid



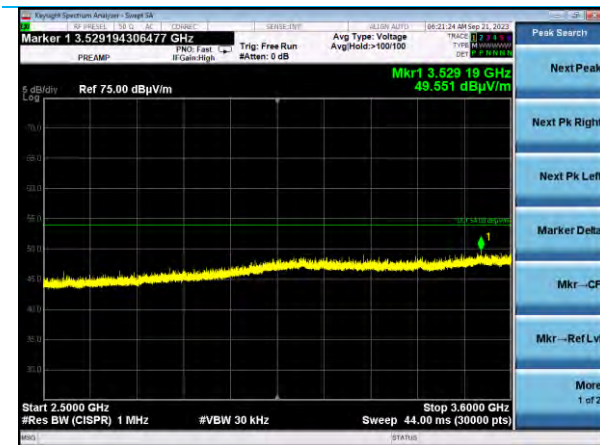
200-1000 MHz Vertical
EUT Vertical Tx Mid



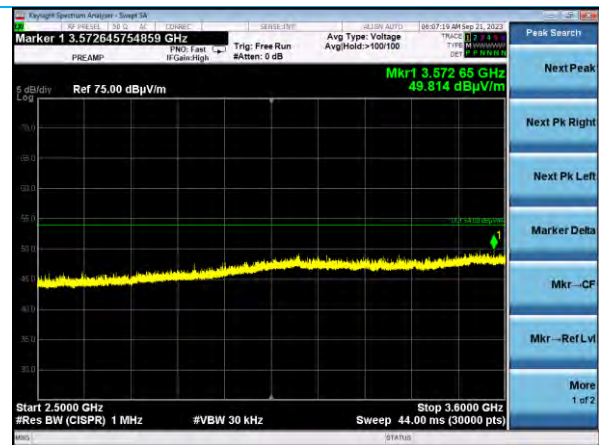
1-2.31 GHz Horizontal
EUT Flat Tx Mid



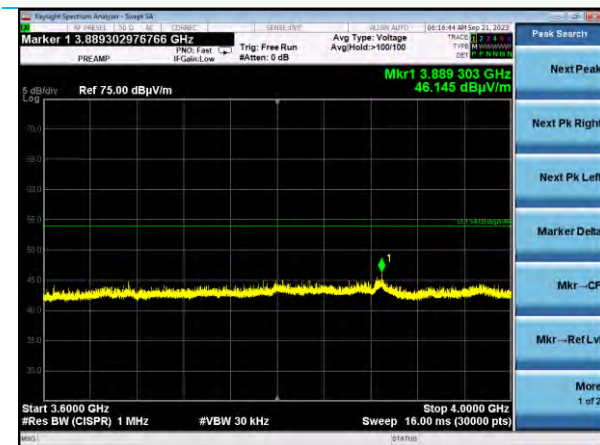
1-2.31 GHz Vertical
EUT Flat Tx Mid



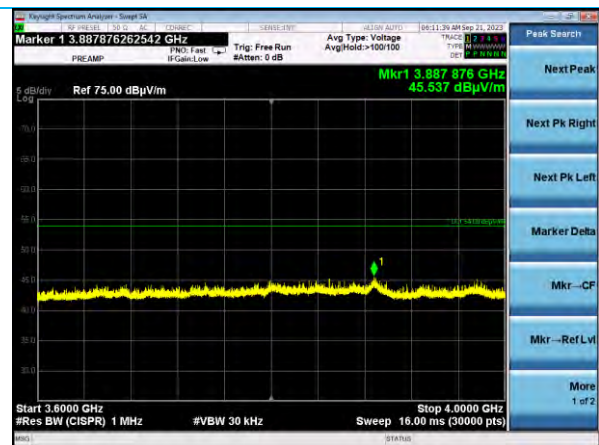
2.5-3.6 GHz Horizontal
EUT Flat Tx Mid



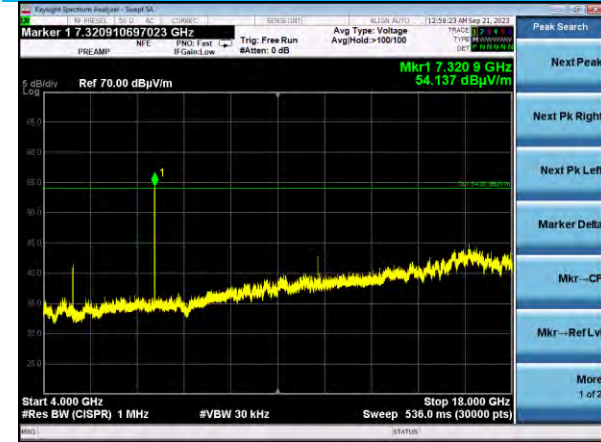
2.5-3.6 GHz Vertical
EUT Flat Tx Mid



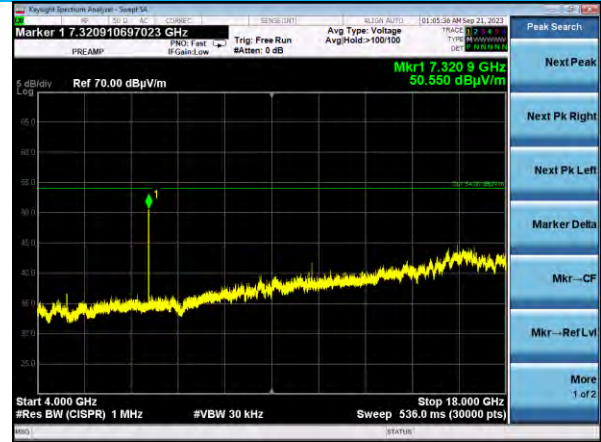
3.6-4 GHz Horizontal
EUT Flat Tx Mid



3.6-4 GHz Vertical
EUT Flat Tx Mid



4-18 GHz Horizontal
EUT Vertical Tx Mid



4-18 GHz Vertical
EUT Vertical Tx Mid



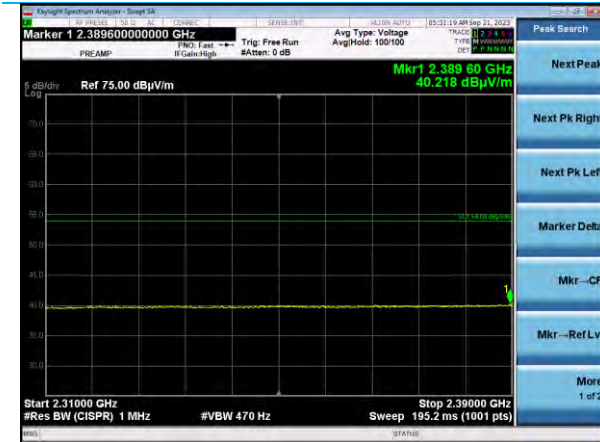
18-40 GHz Horizontal
EUT Vertical Tx Mid



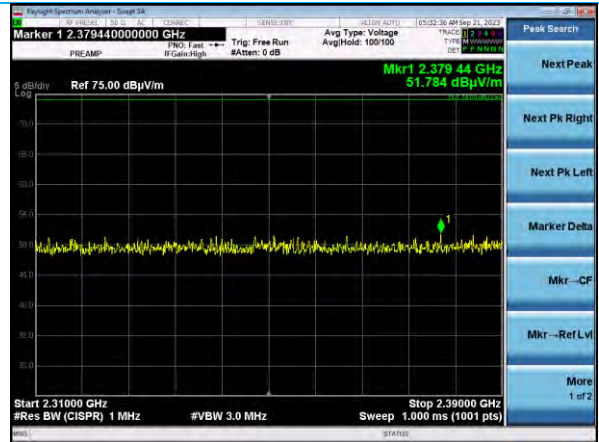
18-40 GHz Vertical
EUT Vertical Tx Mid

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Quote: NBO-02-2023-005963		Serial: 00029, 00016

Band Edge



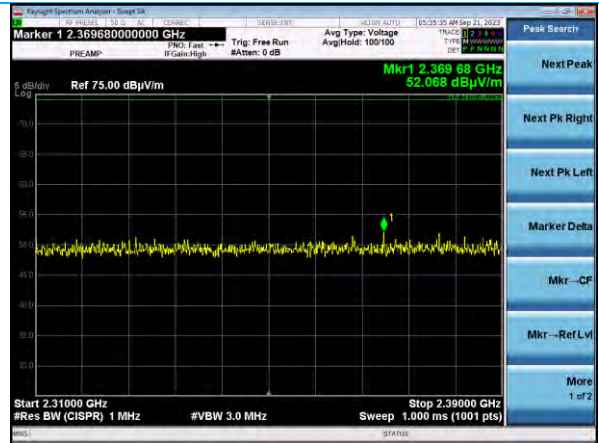
2310-2390 MHz Vertical
EUT Flat 1M Avg



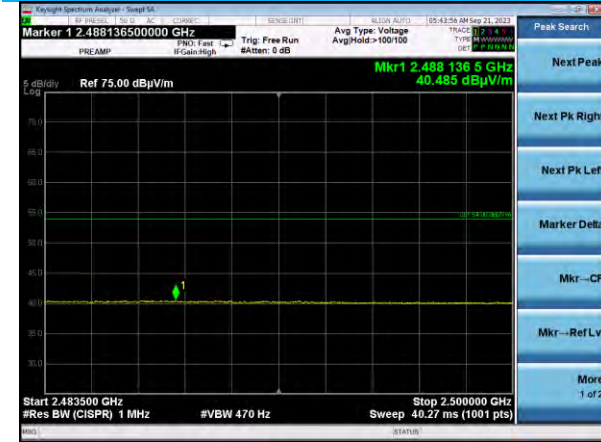
2310-2390 MHz Vertical
EUT Flat 1M Peak



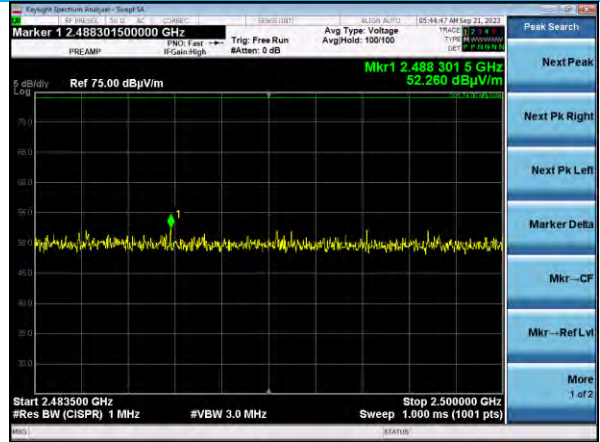
2310-2390 MHz Vertical
EUT Flat 2M Avg



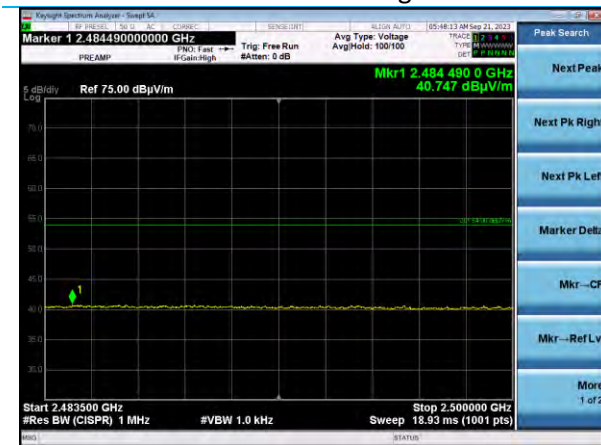
2310-2390 MHz Vertical
EUT Flat 2M Peak



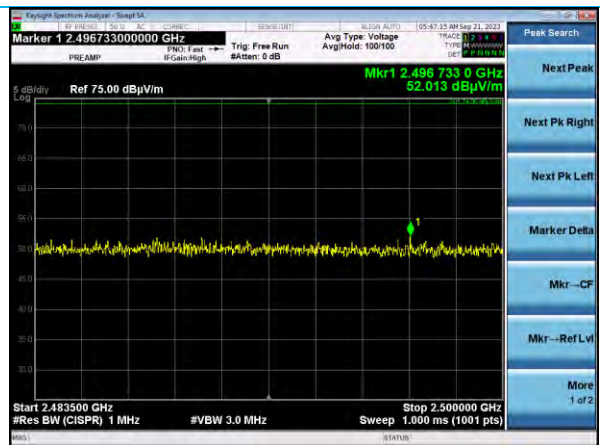
2483.5-2500 MHz Vertical
EUT Flat 1M Avg



2483.5-2500 MHz Vertical
EUT Flat 1M Peak



2483.5-2500 MHz Vertical
EUT Flat 2M Avg



2483.5-2500 MHz Vertical
EUT Flat 2M Peak

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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

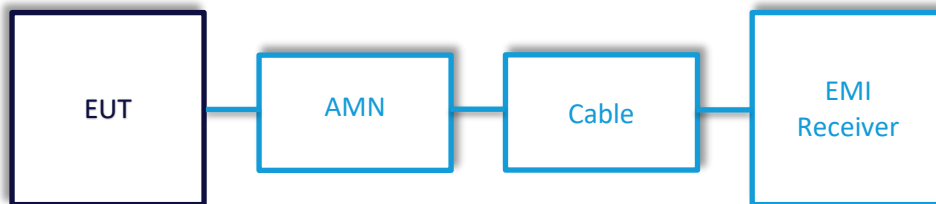
The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

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 15.247 RSS-247	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	0.15-30 MHz	Distance	40cm to VGP, 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	4/25/2023	4/25/2024	Active Verification

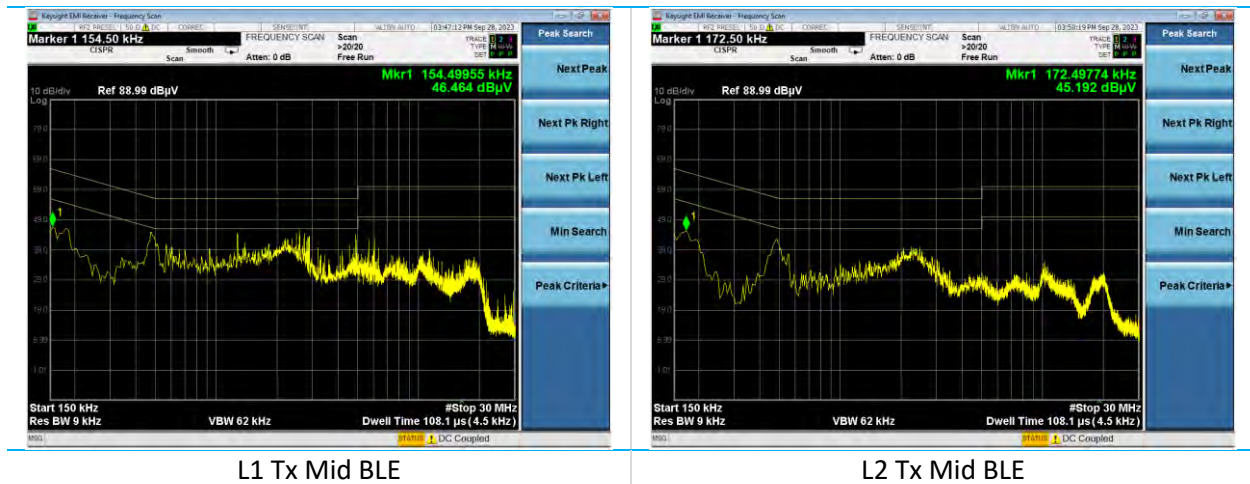
EUT Parameters

Input Power	120VAC 60Hz	Mode	BLE
Data Rate	1M	Channel	Mid

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)
L1	0.155	44.5	30.4	65.8	55.8	21.3	25.4
L1	0.474	41.0	33.5	56.4	46.4	15.4	12.9
L1	2.575	35.4	27.9	56.0	46.0	20.6	18.1
L2	0.173	43.9	28.7	64.8	54.8	20.9	26.1
L2	0.474	40.4	33.2	56.4	46.4	16.0	13.2
L2	2.278	36.9	30.2	56.0	46.0	19.1	15.8

Plots



6 REVISION HISTORY

Version	Date	Notes	Person
1	9/29/2023	Initial Draft	Anthony Smith
2	10/6/2023	Revised Draft	Anthony Smith
3	10/12/2023	Revised Draft	Anthony Smith

END OF REPORT