

Test Report C-3867 A

Equipment Under Test:	Lyra 24P
Requirement(s):	FCC Part 15.247, RSS-247
Test Date(s):	1/8/2025 – 1/10/2025
Prepared for:	Trimble Attn: Stefan Andersson Rinkebyvagen 17 182 36 Danderyd, Sweden

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 05/01/2025

Report Reviewed by: Adam Alger, Sr. Manager, EMC Laboratory

Signature: 

Date: 05/01/2025

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 01/14/2025

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Company: Trimble	Page 1 of 21	Name: Lyra 24P
Report: TR 3867 A		Model: Lyra 24P
Job: C-3867		Serial: Engineering Sample

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Ezurio Test Services in Review

The Ezurio 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: Trimble	Page 3 of 21	Name: Lyra 24P
Report: TR 3867 A		Model: Lyra 24P
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1 TEST REPORT SUMMARY

During **January 8th, 2025 through January 10th, 2025** the Equipment Under Test (EUT), **Lyra 24P**, as provided by **Trimble** was tested to the following requirements:

FCC 15.247 | RSS-247 – DTS Bluetooth Low Energy

Requirements	Description	Method	Compliant
15.247(d) 15.209 RSS-247 Clause 5.5 RSS-GEN Clause 8.10	Spurious Radiated Emissions in Restricted Bands 30-25000 MHz	ANSI C63.10	Yes
15.247(b)(3) RSS-247 Clause 5.4 (d)	RF Output Power	ANSI C63.10	Yes

Note: Class 2 permissive change testing to add an antenna.

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	Trimble
Contact Person	Stefan Andersson
Address	Rinkebyvagen 17 182 36 Danderyd, Sweden

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Lyra 24P
Model Number	Lyra 24P
Serial Number	Engineering Sample
FCC ID	S9E-LYRA24P
IC ID	5817A-LYRA24P

2.2 Product Description

Bluetooth Low Energy 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 Additional Information

EUT undergoing testing to add a 2.7 dBi Dipole antenna. Performed on Roubaix variant.

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR 47 Part 15	-	2025	-	-
ANSI C63.10	-	2020	-	-
RSS-247	3	2023	-	-
RSS-GEN	5	2018	2019	2021
KDB 558074 D01*	-	2019	-	-

**KDB 558074 D01 not on Scope of Accreditation*

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

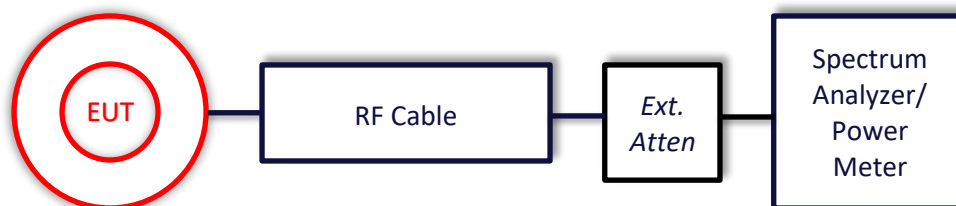
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9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

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	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. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 Antenna Port Conducted Emissions

Operator	Anthony Smith	QA	Dylan Rosenfeldt
Temperature	21.7°C	R.H. %	21.7
Test Date	1/10/2025	Location	Conducted RF Bench
Requirement	FCC 15.247, RSS-247	Method	ANSI C63.10

Limits: 30 dBm

Test Parameters

Frequency	2402, 2440, 2478, 2480 MHz	Setup	Antenna port
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak	Settings	Peak, max hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	1/28/2025	1/28/2026	Active Verification
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/10/2024	4/10/2025	Active Calibration

EUT Parameters

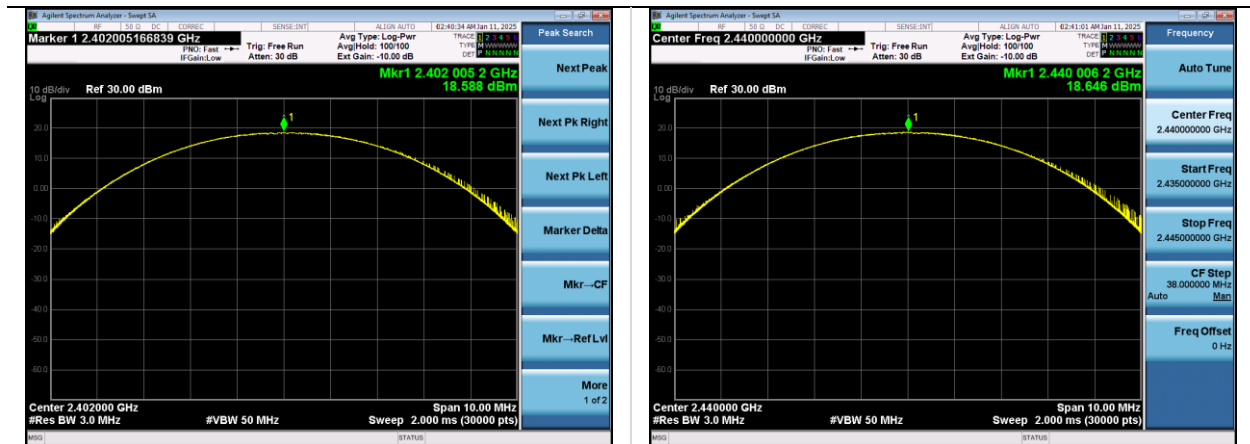
Input Power	USB – 5VDC	Mode	Continuous Transmit Modulated
Frequency	2402, 2440, 2478, 2480 MHz	Channel	Low, Mid, High

Table

Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate	Channel	Power Index Setting
2402.0	12.6	30.0	17.4	125k	0	12
2440.0	12.5	30.0	17.5	125k	19	12
2478.0	12.2	30.0	17.8	125k	38	12
2480.0	12.2	30.0	17.8	125k	39	12
2402.0	18.6	30.0	11.4	500k	0	20
2440.0	18.6	30.0	11.4	500k	19	20
2478.0	17.0	30.0	13.0	500k	38	18
2480.0	15.1	30.0	14.9	500k	39	15
2402.0	18.6	30.0	11.4	1M	0	20
2440.0	18.6	30.0	11.4	1M	19	20
2478.0	17.0	30.0	13.0	1M	38	18
2480.0	15.1	30.0	14.9	1M	39	15
2404.0	18.6	30.0	11.4	2M	1	20
2440.0	18.6	30.0	11.4	2M	38	20
2478.0	16.6	30.0	13.4	2M	38	17

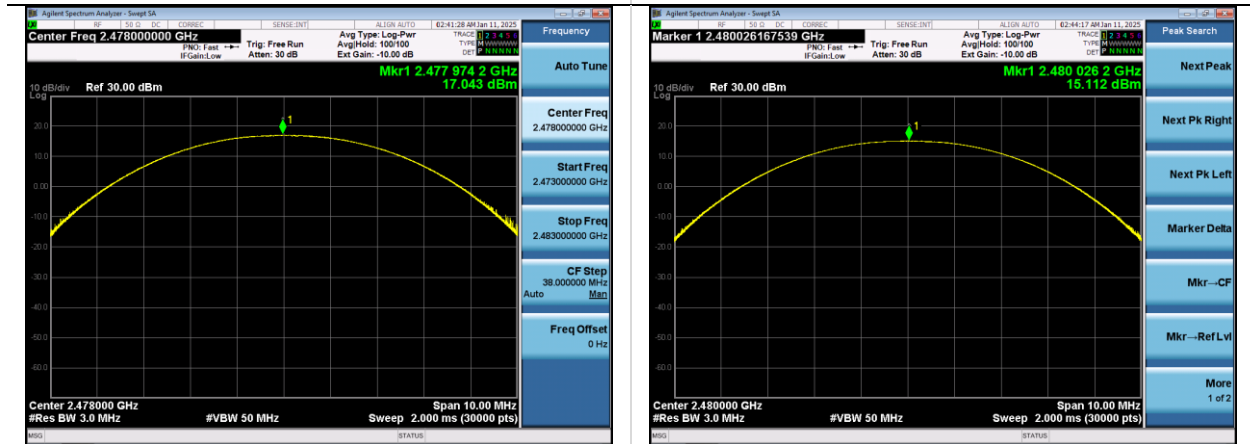
Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Data Rate	Channel	Power Index Setting
2402.0	10.3	30.0	19.7	125k	0	10
2440.0	10.1	30.0	19.9	125k	19	10
2478.0	9.9	30.0	20.1	125k	38	10
2480.0	9.9	30.0	20.1	125k	39	10
2402.0	10.3	30.0	19.7	500k	0	10
2440.0	10.2	30.0	19.8	500k	19	10
2478.0	9.9	30.0	20.1	500k	38	10
2480.0	9.9	30.0	20.1	500k	39	10
2402.0	10.3	30.0	19.7	1M	0	10
2440.0	10.2	30.0	19.8	1M	19	10
2478.0	9.9	30.0	20.1	1M	38	10
2480.0	9.9	30.0	20.1	1M	39	10
2404.0	10.3	30.0	19.7	2M	1	10
2440.0	10.2	30.0	19.8	2M	38	10
2478.0	10.0	30.0	20.0	2M	38	10

Plots (Worst Case)



2402 1M Power Set 20

2440 1M Power Set 20



2478 1M Power Set 17

2480 1M Power Set 15

5.2 Radiated Emissions

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

Block Diagram



5.2.1 Radiated Emissions

Operator	Anthony Smith	QA	Mitchell Freund
Temperature	23.7°C, 24.3°C	R.H. %	17.0, 16.9%
Test Date	1/8/2025, 1/9/2025	Location	Chamber 3
Requirement	FCC 15.247	Method	ANSI C63.10

Limits:

Frequency (MHz)	Peak Limit (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Average Limit (dBμV/m)
30-88	-	40.0	-
88-216	-	43.5	-
216-960	-	46.0	-
960-1000	-	54.0	-
1000-25000	74.0	-	54.0

Test Parameters

Frequency	2310-2390, 2483.5-2500, 4000-18000 MHz	Distance	3m
Detector(s)	Peak, Quasi-Peak, Average	Table height	150 cm
RBW	1 MHz	VBW	3 MHz (peak) 10 Hz (Average)

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	11/19/2024	11/19/2025	Active Calibration
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/10/2024	4/10/2025	Active Calibration
AA 960209	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	11/19/2024	11/19/2025	Active Calibration
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/9/2024	4/9/2025	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	1/24/2025	1/24/2026	Active Verification
LSC-546	Cable	A.H. Systems, Inc.	SAC-26G-6	546	1/28/2025	1/28/2026	Active Verification

EUT Parameters

Input Power	USB – 5V DC	Mode	Continuous transmit
Test Channel Frequencies	2402, 2404, 2440, 2478, 2480 MHz	Data Rates	1M, 2M (Power Index 20) 1M (Power Index 10)

Table

Restricted Band-Edge

Average

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	EUT Orientation	Radio Mode	Channel	Power Index
2483.5	H	100	185	51.6	54.0	2.4	Horizontal	1M	38 - 2478	20
2390.0	H	110	185	40.5	54.0	13.5	Horizontal	1M	0 - 2402	20
2390.0	H	110	185	32.1	54.0	21.9	Horizontal	1M	0 - 2402	10
2483.5	H	100	185	46.2	54.0	7.8	Horizontal	1M	39 - 2480	10
2365.6	H	110	185	40.8	54.0	13.2	Horizontal	2M	1 - 2404	20
2483.5	H	100	185	53.2	54.0	0.8	Horizontal	2M	38 - 2478	20

Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	EUT Orientation	Radio Mode	Channel	Power Index
2483.5	H	100	185	61.5	74.0	12.5	Horizontal	1M	38 - 2478	20
2389.7	H	110	185	51.0	74.0	23.0	Horizontal	1M	0 - 2402	20
2359.0	H	110	185	47.7	74.0	26.3	Horizontal	1M	0 - 2402	10
2483.5	H	100	185	58.8	74.0	15.2	Horizontal	1M	39 - 2480	10
2389.9	H	110	185	51.8	74.0	22.2	Horizontal	2M	1 - 2404	20
2483.7	H	100	185	63.6	74.0	10.4	Horizontal	2M	38 - 2478	20

Restricted Bands (Harmonics)

Average

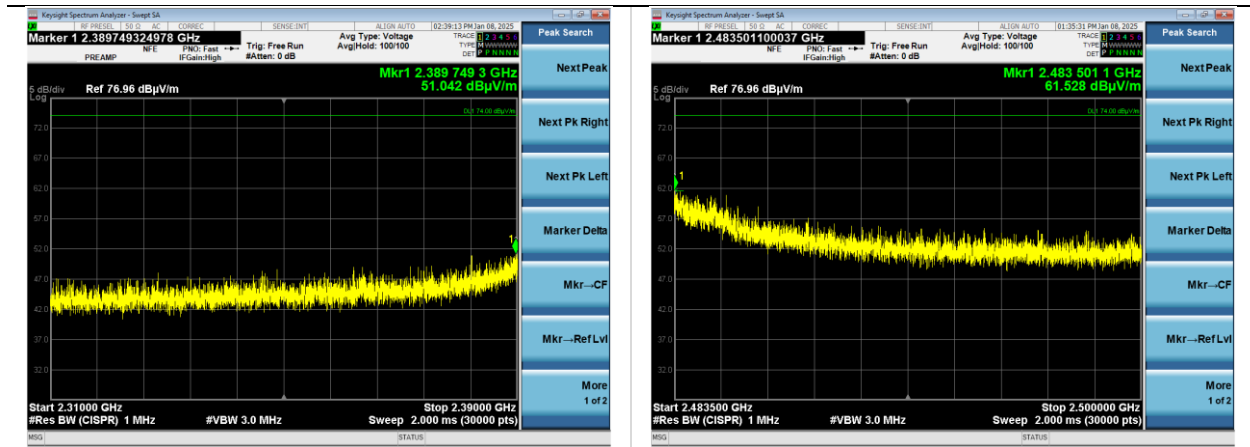
Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	EUT Orientation	Radio Mode	Channel	Power Index
4880.0	V	234	181	40.2	54.0	13.8	Horizontal	1M	19 - 2440	20
4880.1	H	100	135	35.5	54.0	18.5	Horizontal	1M	19 - 2440	20
7320.5	H	150	214	46.0	54.0	8.0	Horizontal	1M	19 - 2440	20
7320.6	V	279	180	42.4	54.0	11.6	Horizontal	1M	19 - 2440	20
12201.0	V	144	144	42.0	54.0	12.0	Horizontal	1M	19 - 2440	20
12201.0	H	187	157	42.4	54.0	11.6	Horizontal	1M	19 - 2440	20
4880.0	V	115	228	37.7	54.0	16.3	Flat	1M	19 - 2440	20
4880.0	H	202	119	35.1	54.0	18.9	Flat	1M	19 - 2440	20
7320.5	H	241	296	40.2	54.0	13.8	Flat	1M	19 - 2440	20
7320.6	V	241	69	39.2	54.0	14.8	Flat	1M	19 - 2440	20
12201.1	V	133	167	40.3	54.0	13.7	Flat	1M	19 - 2440	20
12201.0	H	347	241	35.8	54.0	18.2	Flat	1M	19 - 2440	20
4880.1	V	359	199	33.2	54.0	20.8	Vertical	1M	19 - 2440	20
4880.0	H	202	167	40.0	54.0	14.0	Vertical	1M	19 - 2440	20
7320.5	H	150	198	42.6	54.0	11.4	Vertical	1M	19 - 2440	20
7320.6	V	150	33	39.9	54.0	14.1	Vertical	1M	19 - 2440	20
12201.0	V	133	347	40.8	54.0	13.2	Vertical	1M	19 - 2440	20
12201.1	H	111	108	39.5	54.0	14.5	Vertical	1M	19 - 2440	20
4804.0	V	169	169	37.7	54.0	16.3	Horizontal	1M	0	20
4960.0	V	186	199	41.0	54.0	13.0	Horizontal	1M	38	20
7206.5	H	150	209	48.0	54.0	6.0	Horizontal	1M	0	20
7440.5	H	180	217	40.6	54.0	13.4	Horizontal	1M	38	20
12011.0	H	122	236	45.5	54.0	8.5	Horizontal	1M	0	20
12398.8	H	176	153	37.5	54.0	16.5	Horizontal	1M	38	20

Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	EUT Orientation	Radio Mode	Channel	Power Index
4879.5	V	234	181	46.8	74.0	27.2	Horizontal	1M	19 - 2440	20
4880.3	H	100	135	43.9	74.0	30.1	Horizontal	1M	19 - 2440	20
7320.6	H	150	214	53.8	74.0	20.2	Horizontal	1M	19 - 2440	20
7320.8	V	279	180	50.6	74.0	23.4	Horizontal	1M	19 - 2440	20
12198.9	V	144	144	51.3	74.0	22.7	Horizontal	1M	19 - 2440	20
12198.6	H	187	157	52.0	74.0	22.0	Horizontal	1M	19 - 2440	20
4879.6	V	115	228	45.3	74.0	28.7	Flat	1M	19 - 2440	20
4880.0	H	202	119	43.3	74.0	30.7	Flat	1M	19 - 2440	20
7319.2	H	241	296	49.4	74.0	24.6	Flat	1M	19 - 2440	20
7320.7	V	241	69	47.7	74.0	26.3	Flat	1M	19 - 2440	20
12201.3	V	133	167	50.2	74.0	23.8	Flat	1M	19 - 2440	20
12201.4	H	347	241	46.5	74.0	27.5	Flat	1M	19 - 2440	20
4880.0	V	359	199	42.7	74.0	31.3	Vertical	1M	19 - 2440	20
4880.5	H	202	167	46.5	74.0	27.5	Vertical	1M	19 - 2440	20
7320.7	H	150	198	50.2	74.0	23.8	Vertical	1M	19 - 2440	20
7320.7	V	150	33	48.8	74.0	25.2	Vertical	1M	19 - 2440	20
12201.3	V	133	347	50.5	74.0	23.5	Vertical	1M	19 - 2440	20
12201.0	H	111	108	49.5	74.0	24.5	Vertical	1M	19 - 2440	20
4803.4	V	169	169	45.5	74.0	28.5	Horizontal	1M	0	20
4960.4	V	186	199	47.7	74.0	26.3	Horizontal	1M	38	20
7205.2	H	150	209	55.3	74.0	18.7	Horizontal	1M	0	20
7440.7	H	180	217	48.9	74.0	25.1	Horizontal	1M	38	20
12008.7	H	122	236	54.1	74.0	19.9	Horizontal	1M	0	20
12398.4	H	176	153	48.1	74.0	25.9	Horizontal	1M	38	20

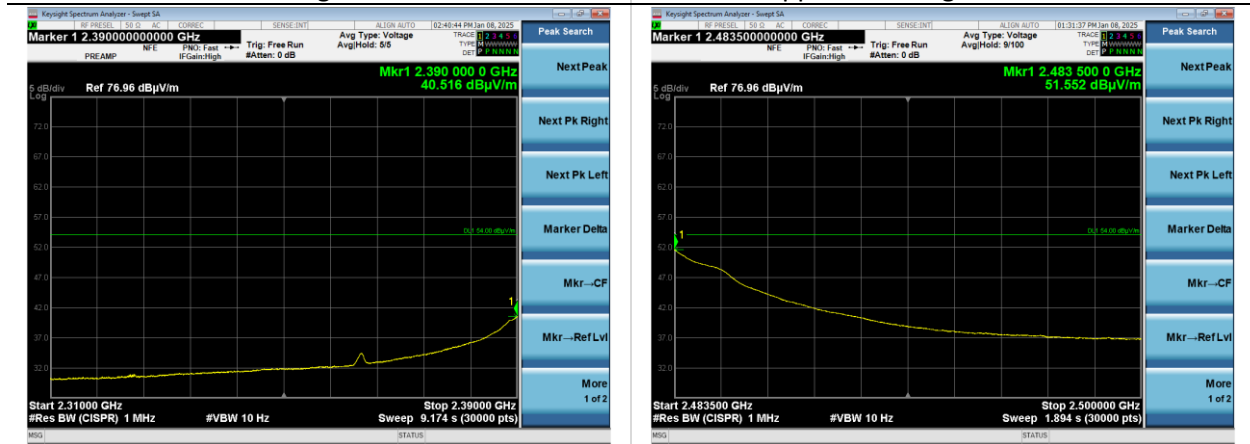
Plots (worst case)

Band Edge (1M – Power Index 20)



Lower Band Edge – Peak – 1M

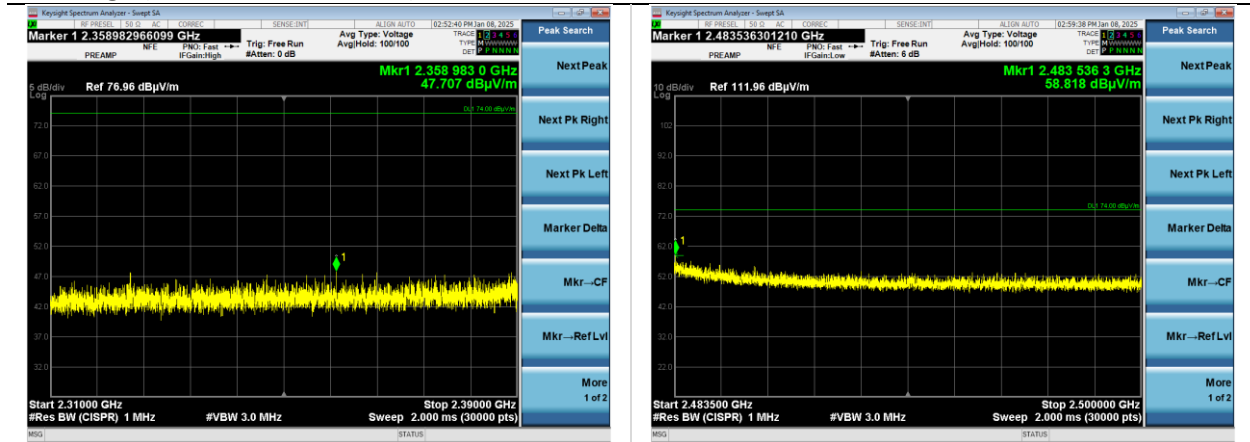
Upper Band Edge – Peak – 1M



Lower Band Edge – Average – 1M

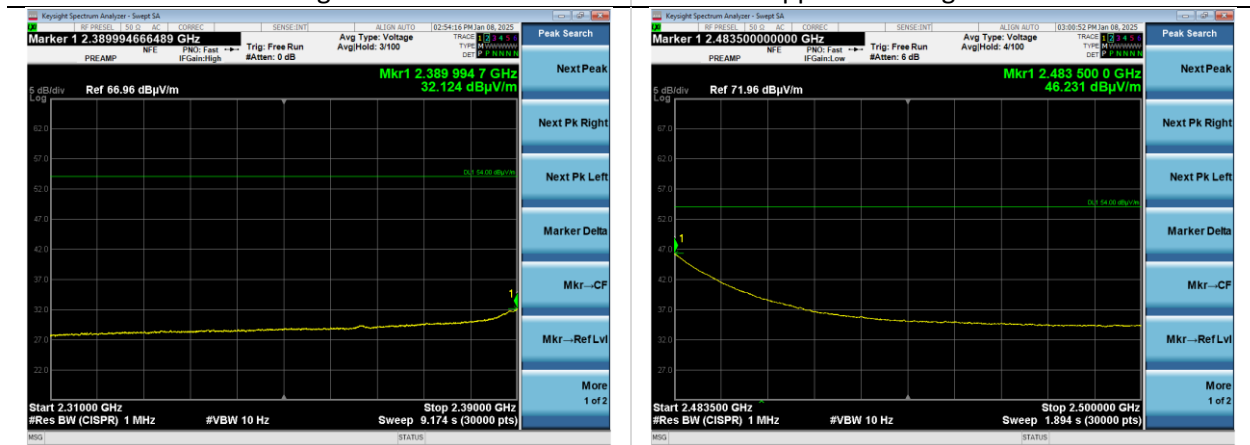
Upper Band Edge – Average – 1M

Band Edge (1M – Power Index 10)



Lower Band Edge – Peak – 1M

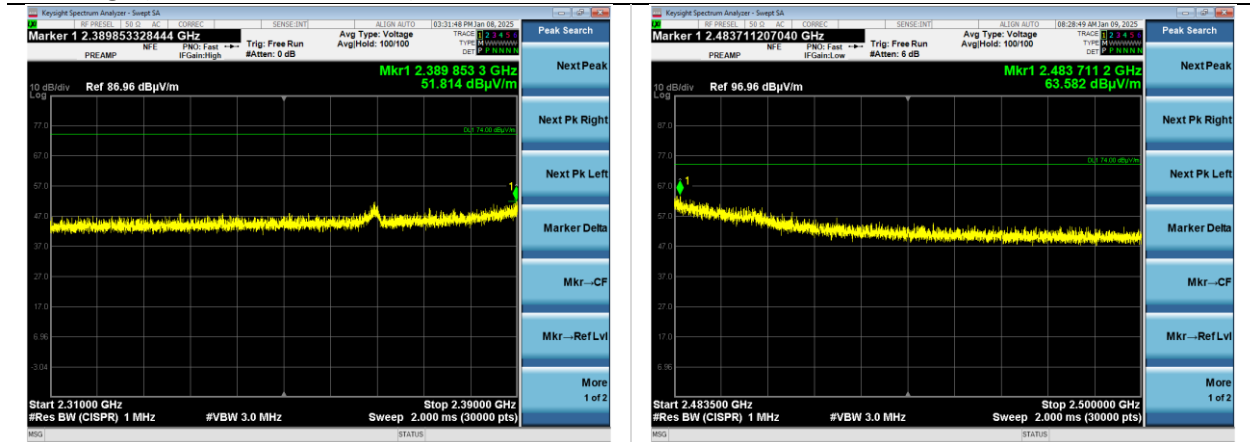
Upper Band Edge – Peak – 1M



Lower Band Edge – Average – 1M

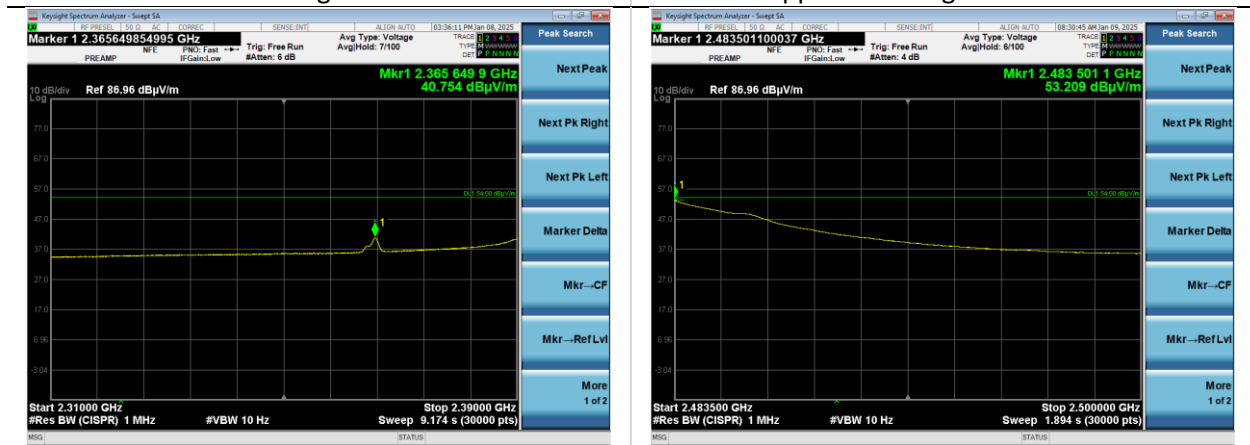
Upper Band Edge – Average – 1M

Band Edge (2M – Power Index 20)



Lower Band Edge – Peak – 2M

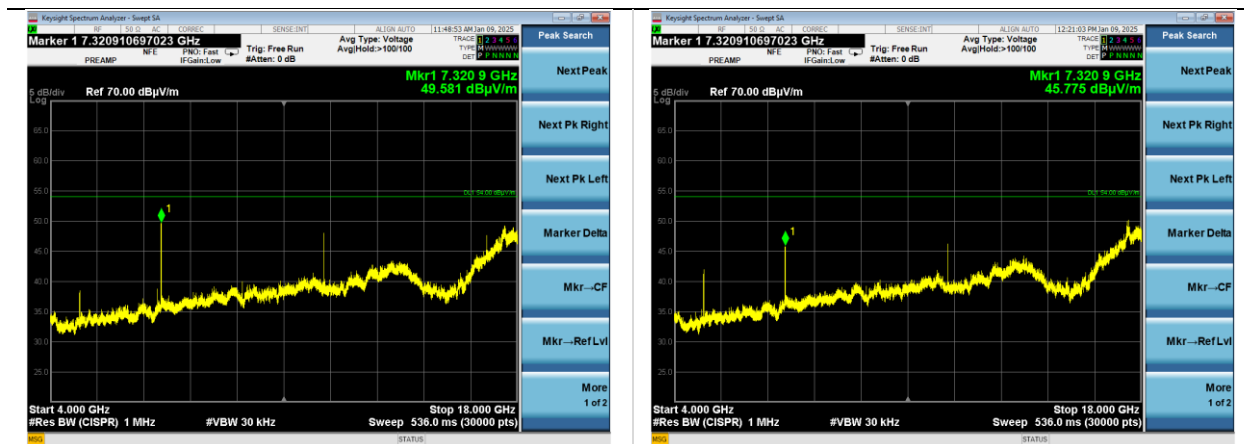
Upper Band Edge – Peak – 2M



Lower Band Edge – Average – 2M

Upper Band Edge – Average – 2M

Spurious Emissions in Restricted Bands (Harmonics)



4-18 GHz Horizontal Polarity
Ch 19 1M Power Index 20 | EUT Horizontal

4-18 GHz Vertical Polarity
Ch 19 1M Power Index 20 | EUT Horizontal

6 REVISION HISTORY

Version	Date	Notes	Person
0.0	1/14/2025	Initial Draft	Anthony Smith
0.1	5/1/2025	Comments addressed	Anthony Smith

END OF REPORT