

Test Report TR3703A

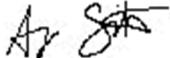
Equipment Under Test: 03ACCY0002

Requirement(s): FCC 15.247
ISED RSS-247

Test Date(s): 7/20/2023-2/23/2024

Prepared for: Enovation Controls LLC.
Attn: Jim Fox
5311 S. 122nd E. Ave
Tulsa, OK 74146

Report Issued by: Anthony Smith, EMC Engineering Specialist

Signature: 

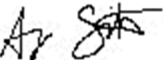
Date: 2/23/2024

Report Reviewed by: Adam Alger, Laboratory Manager

Signature: 

Date: 2/23/2024

Report Constructed by: Anthony Smith, EMC Engineering Specialist

Signature: 

Date: 2/23/2023

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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:



Certificate #1255.01

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



**Government
of Canada**

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

Company: Enovation Controls LLC	Page 3 of 48	Name: 03ACCY0002
Report: TR3703A		Model: 78060532K
Quote: NBO-10-2022-005468		Serial: Engineering Sample

1 TEST REPORT SUMMARY

During **July 20th, 2023 to February 23rd, 2024** the Equipment Under Test (EUT), **03ACCY0002**, as provided by **Enovation Controls LLC** was tested to the following requirements:

FCC 15.247 / RSS-247, FHSS

Requirements	Description	Specification	Method	Compliant
FCC: 15.247 (a)(1) IC: RSS-247 5.1	Channel Separation, Number of Hopping Frequencies, Time of Occupancy	FHS	ANSI C63.10	Yes
FCC: 2.1049 IC: RSS-GEN 6.7	Occupied Bandwidth	Reported	ANSI C63.10	Yes
FCC: 15.247 (b)(1) IC: RSS-247 5.4 (b)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Yes
FCC: 15.247 (d) IC: RSS-247 5.5	Emissions in Non-Restricted Frequency Bands	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 8.11	Frequency Stability	Reported	ANSI C63.10	Yes
FCC: 15.247 (a)(1)(iii) IC: RSS-247 5.1	20dB Bandwidth	500 kHz	ANSI C63.10	Yes
FCC: 15.207 IC: RSS-GEN 8.8	AC Power line Conducted Emissions	FCC 15.207 RSS-GEN 8.8	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	Enovation Controls LLC
Contact Person	Jim Fox
Address	5311 S. 122 nd E Ave Tulsa, OK 74146

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	03ACCY0002
Model Number	78060532K
Serial Number	Engineering Sample
FCC ID	2A3FV-ECB02
IC ID	28102-ECB02

2.2 Product Description

USB Based Dongle for BT Extensibility.

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 Programming Information

Device programmed using CyBluetool ver 0.1.97.1. Bluetooth Classic using Basic Rate and Enhanced Data Rate on channels 0 (2402 MHz), 39 (2440 MHz), 78 (2480 MHz), and Hopping.

2.6 Antenna Information

Ceramic antenna integrated on host PCBA. Peak gain of -2.7 dBi from “Enovation Antenna Summary”

Company: Enovation Controls LLC	Page 6 of 48	Name: 03ACCY0002
Report: TR3703A		Model: 78060532K
Quote: NBO-10-2022-005468		Serial: Engineering Sample

3 REFERENCES

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

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

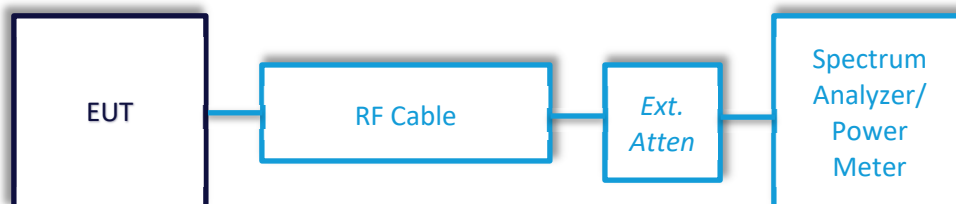
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
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	Adam Alger
Temperature	21.5°C, 21.6°C, 21.5°C, 22.0°C, 22.1°C	R.H. %	46.9, 45.9, 48.4, 47.4, 28.3%
Test Date	7/24/2023-7/31/2023, 2/23/2024	Location	Conducted Bench
Requirement	FCC 15.247	Method	ANSI C63.10

Limits:

Maximum Conducted Output Power: 30 dBm

RF Spurious Emissions at the Transmitter Antenna Terminal: 20 dBc

Occupied Bandwidth: Reported

20dB DSS Bandwidth: 500 kHz

Channel Separation, Number of Hopping Frequencies, Time of Occupancy: Channels separated by 2/3rds of the 20dB bandwidth of the hopping channel. Usage of at least 15 channels. Average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. In this case 79 channels * 0.4 seconds = 31.6 seconds.

Frequency Stability: Reported

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
EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/10/2023	4/10/2024	Active Calibration

99% Occupied Bandwidth / 20dB Bandwidth

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	30 kHz – OBW 100 kHz – 20 dB BW	VBW	100 kHz – OBW 300 kHz – 20 dB BW
Detector(s)	Peak Max Hold	Span	3 MHz

EUT Parameters

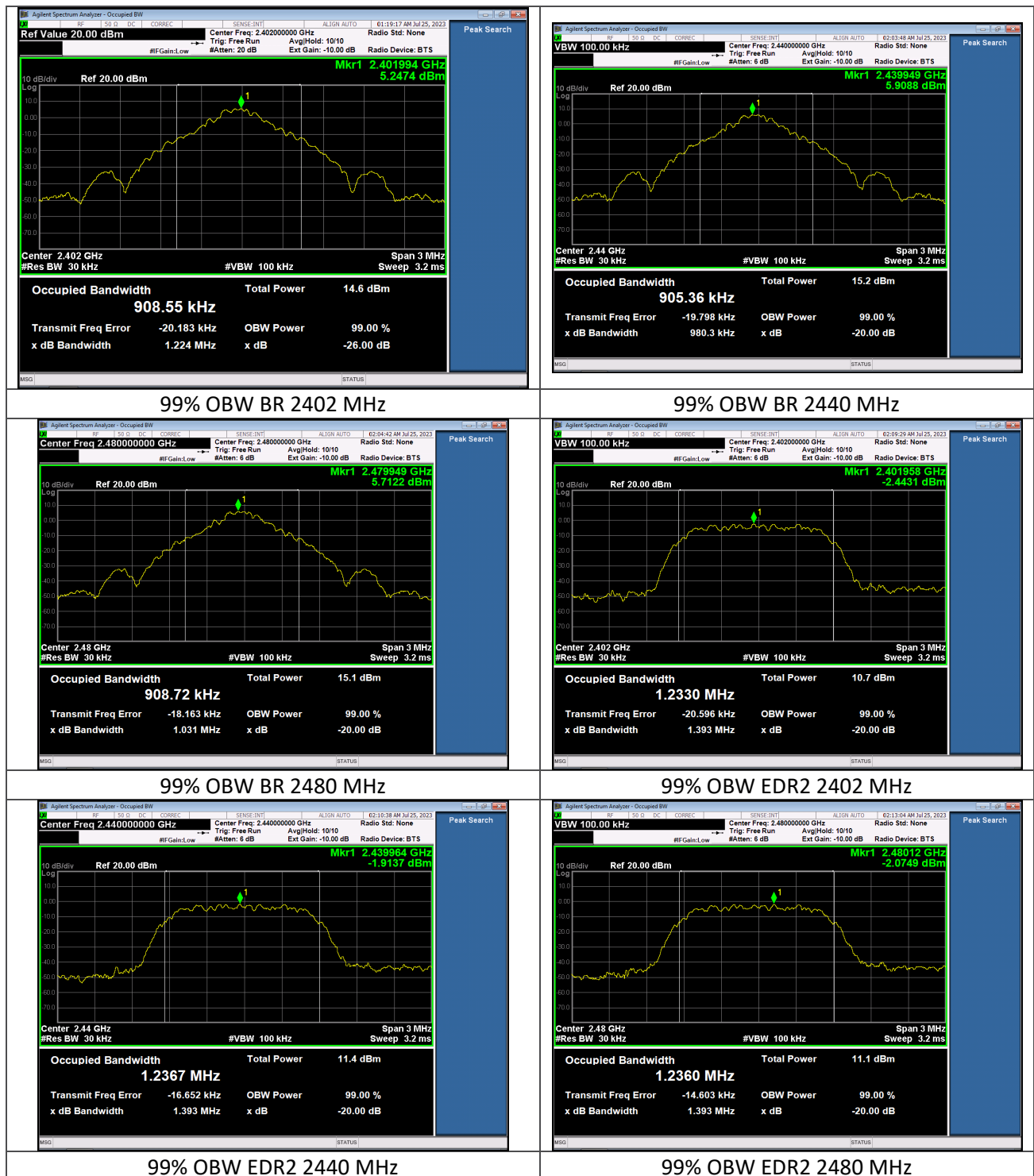
Input Power	USB	Mode	Bluetooth Classic Single Channel BR, EDR2, EDR3
Frequency	2402-2480 MHz	Channel	0, 39, 78

Data

Table

Frequency (MHz)	Data Rate	99% OBW (kHz)	20 dB BW (kHz)
2402	BR	908.6	1130.0
2440	BR	905.4	1134.0
2480	BR	908.7	1134.0
2402	EDR	1233.0	1437.0
2440	EDR	1236.7	1439.0
2480	EDR	1236.0	1439.0
2402	EDR3	1232.7	1438.0
2440	EDR3	1234.4	1428.0
2480	EDR3	1233.9	1437.0

Plots



Company: Enovation Controls LLC

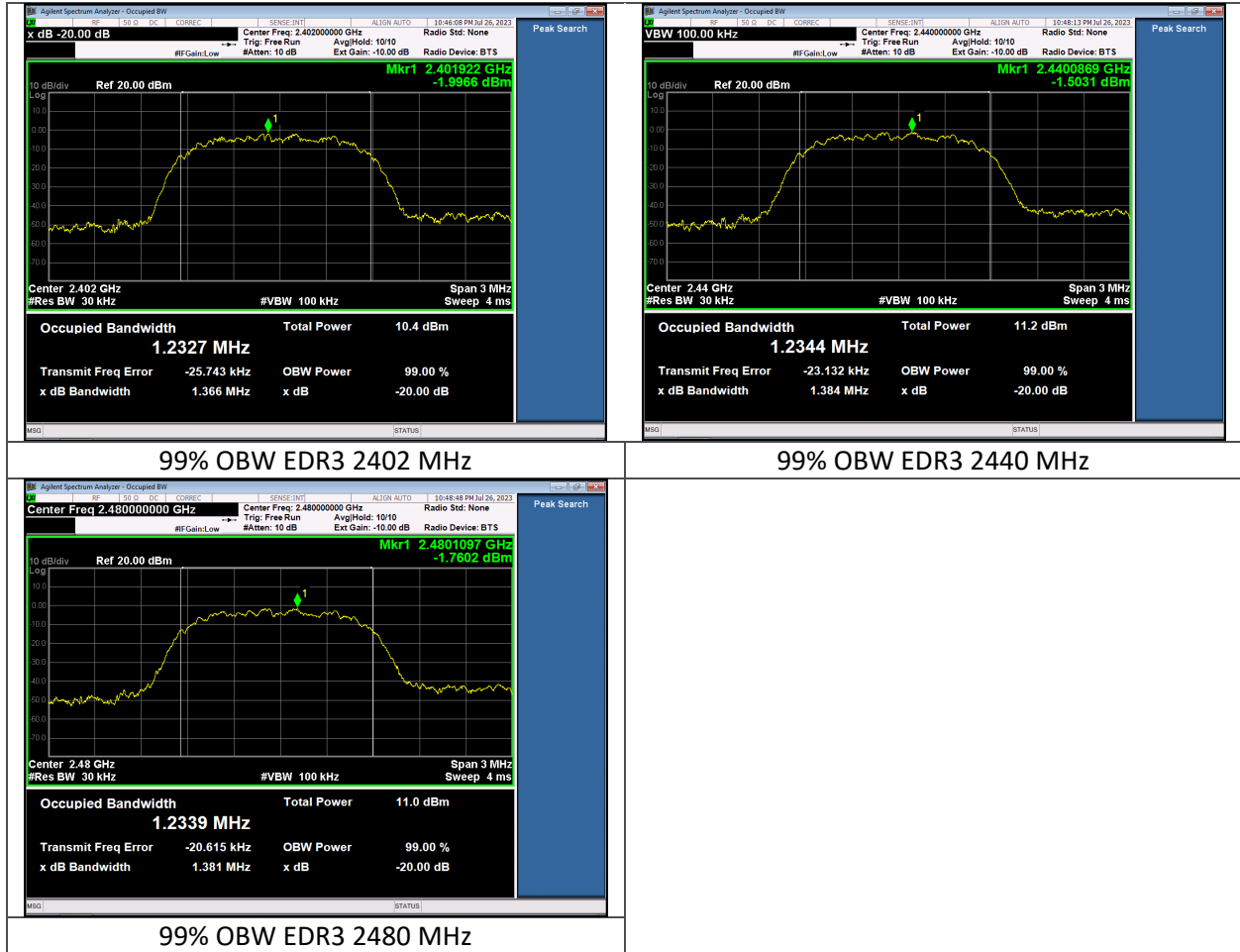
Report: TR3703A

Quote: NBO-10-2022-005468

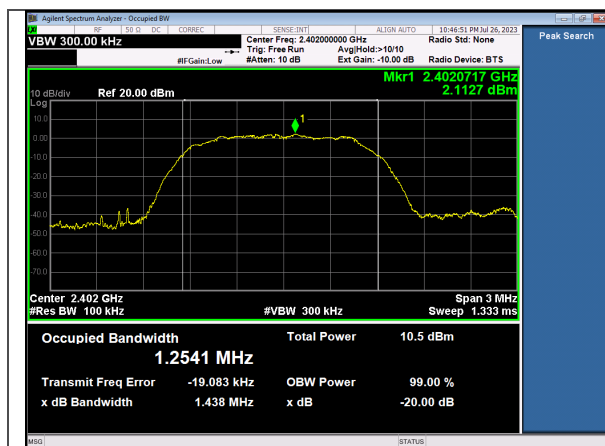
Name: 03ACCY0002

Model: 78060532K

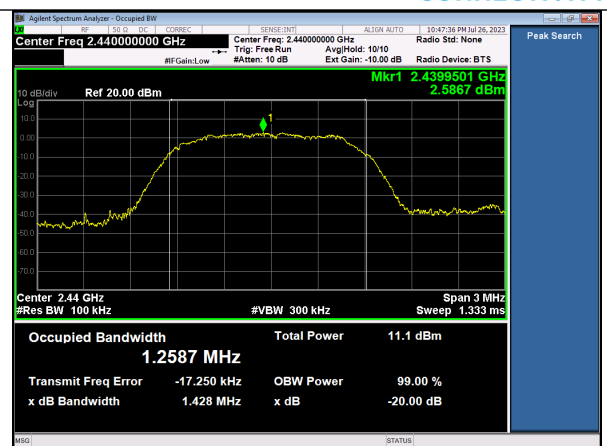
Serial: Engineering Sample



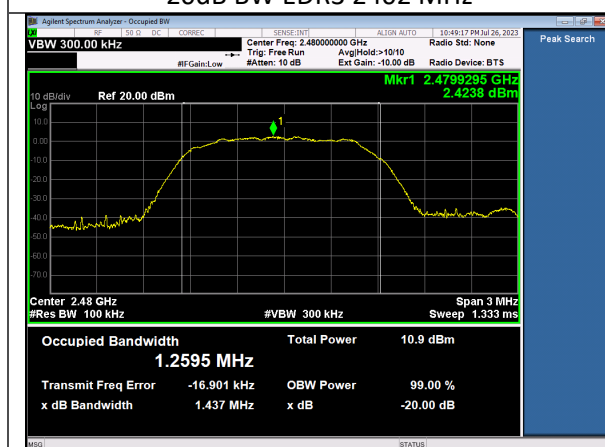




20dB BW EDR3 2402 MHz



20dB BW EDR3 2440 MHz



20dB BW EDR3 2480 MHz

Emissions in Non-restricted Frequency Bands

Test Parameters

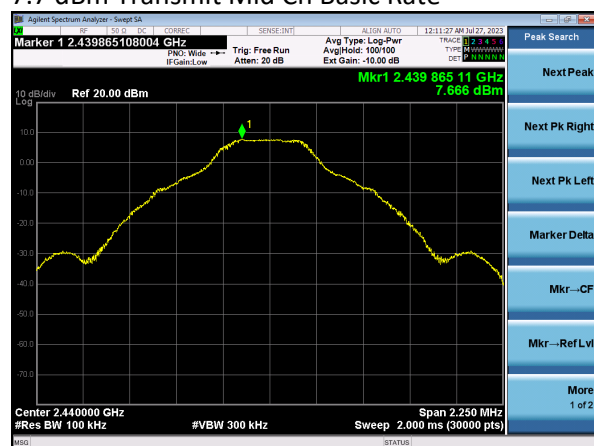
Frequency	30-25000 MHz	Setup	Conducted
RBW	100 kHz	VBW	300 kHz
Detector(s)	Peak Max Hold	Sweep Time	Auto

EUT Parameters

Input Power	USB	Mode	Bluetooth Classic Single Channel and Hopping BR, EDR2, EDR3
Frequency	2402-2480 MHz	Channel	0, 39, 78, Hopping

Reference Level

7.7 dBm Transmit Mid Ch Basic Rate

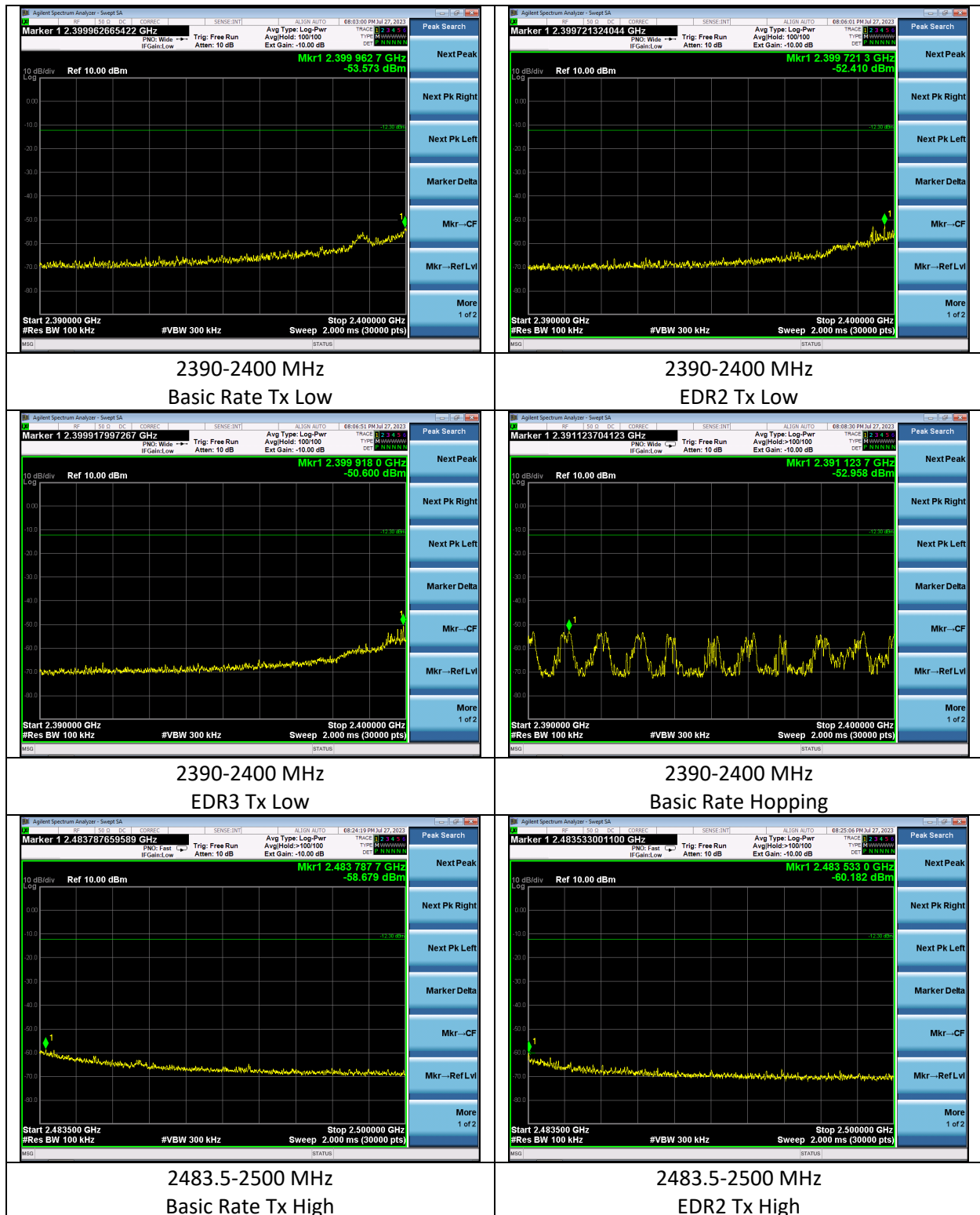


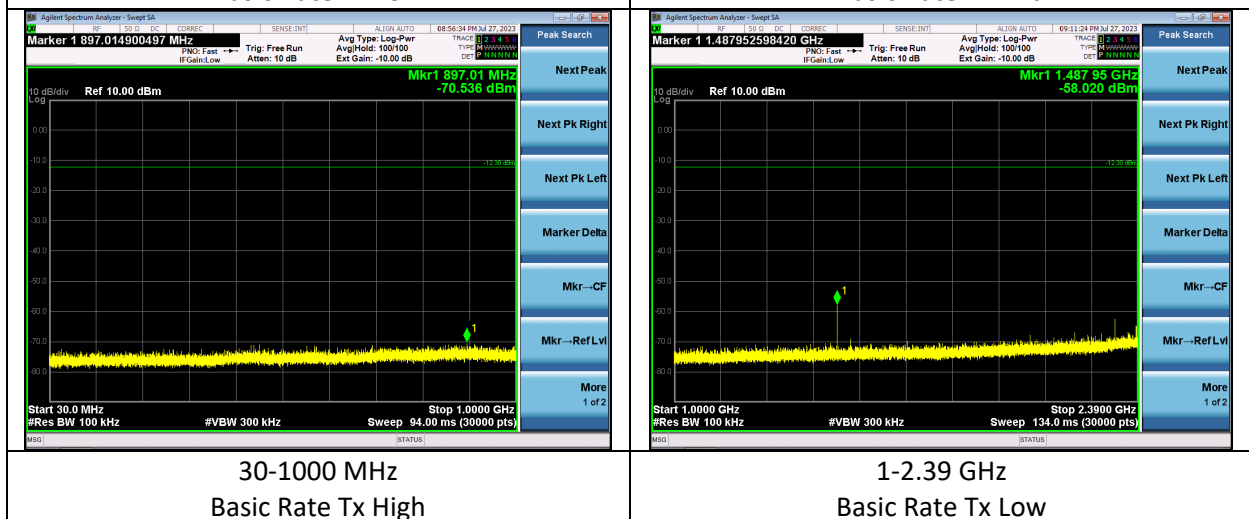
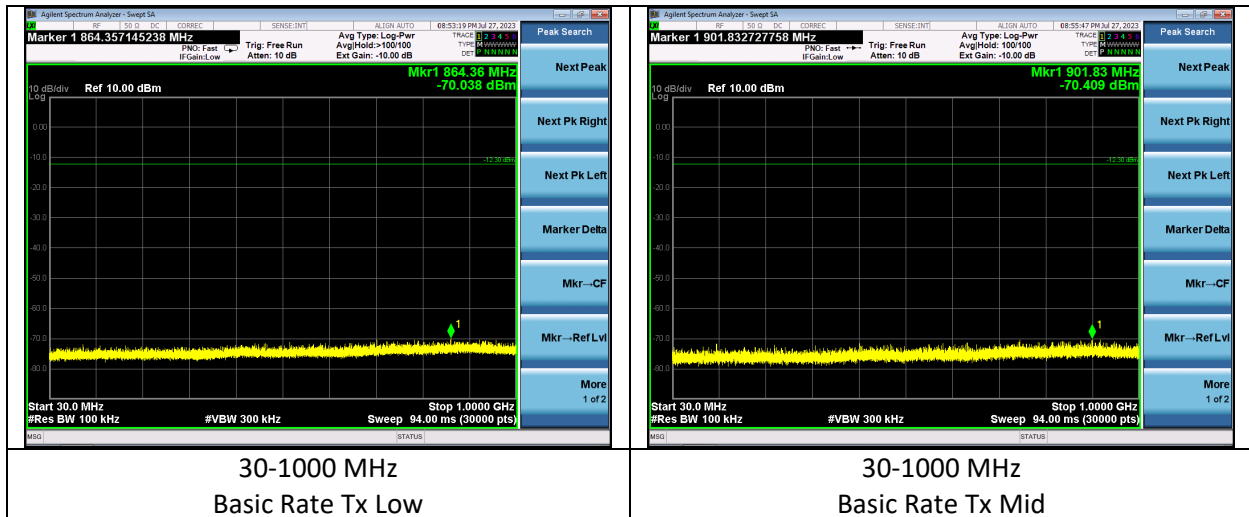
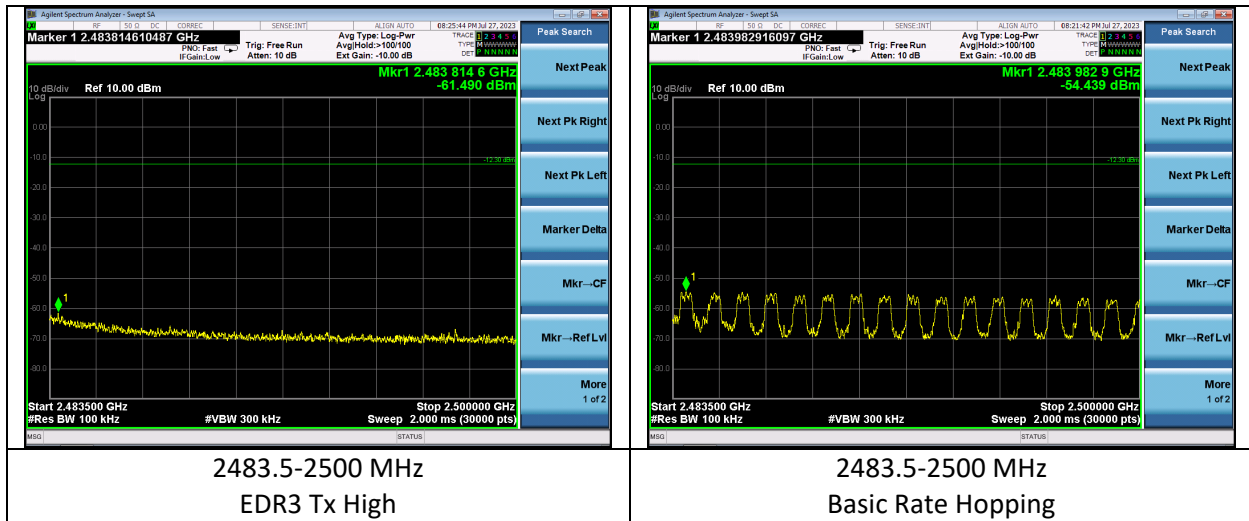
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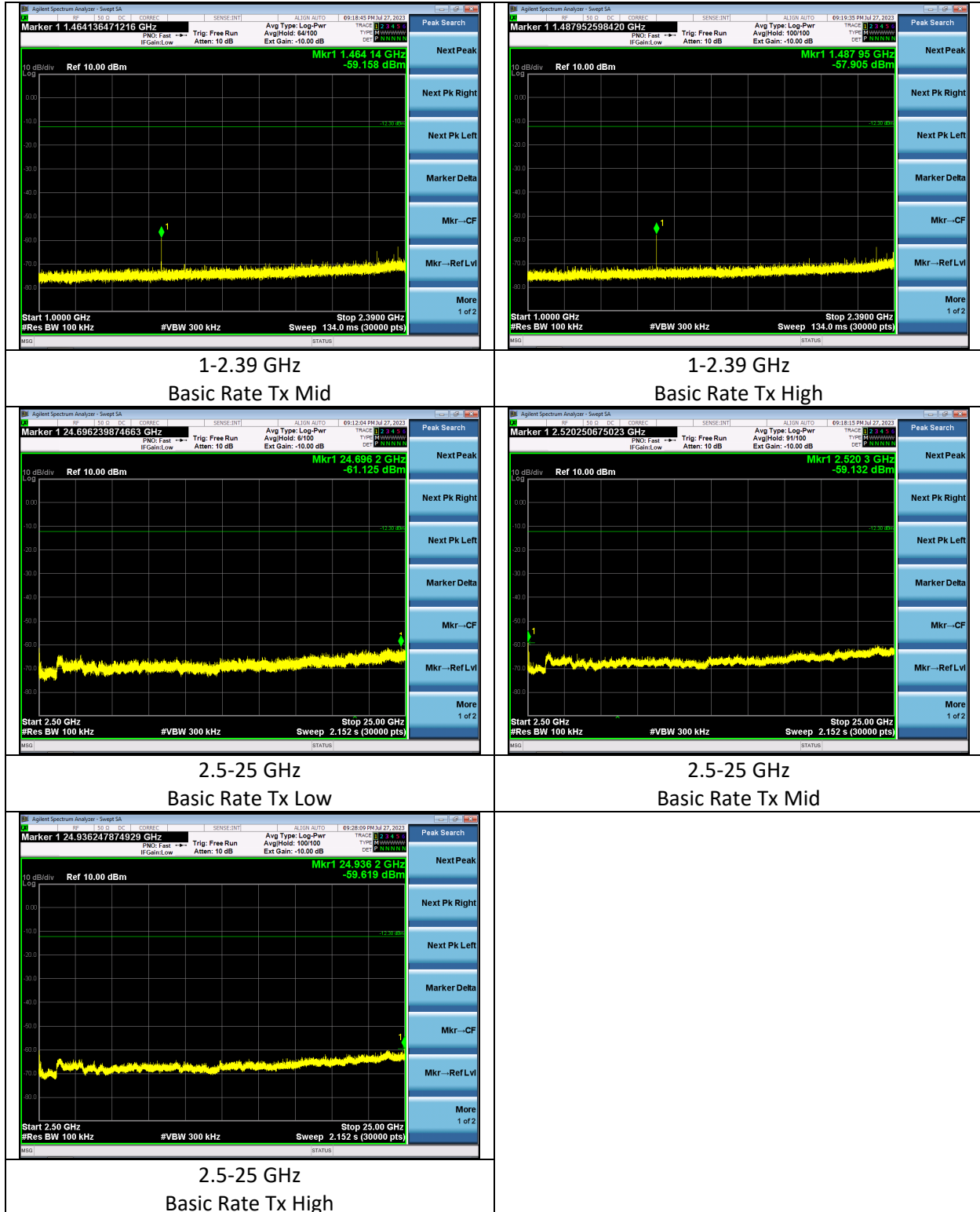
Table

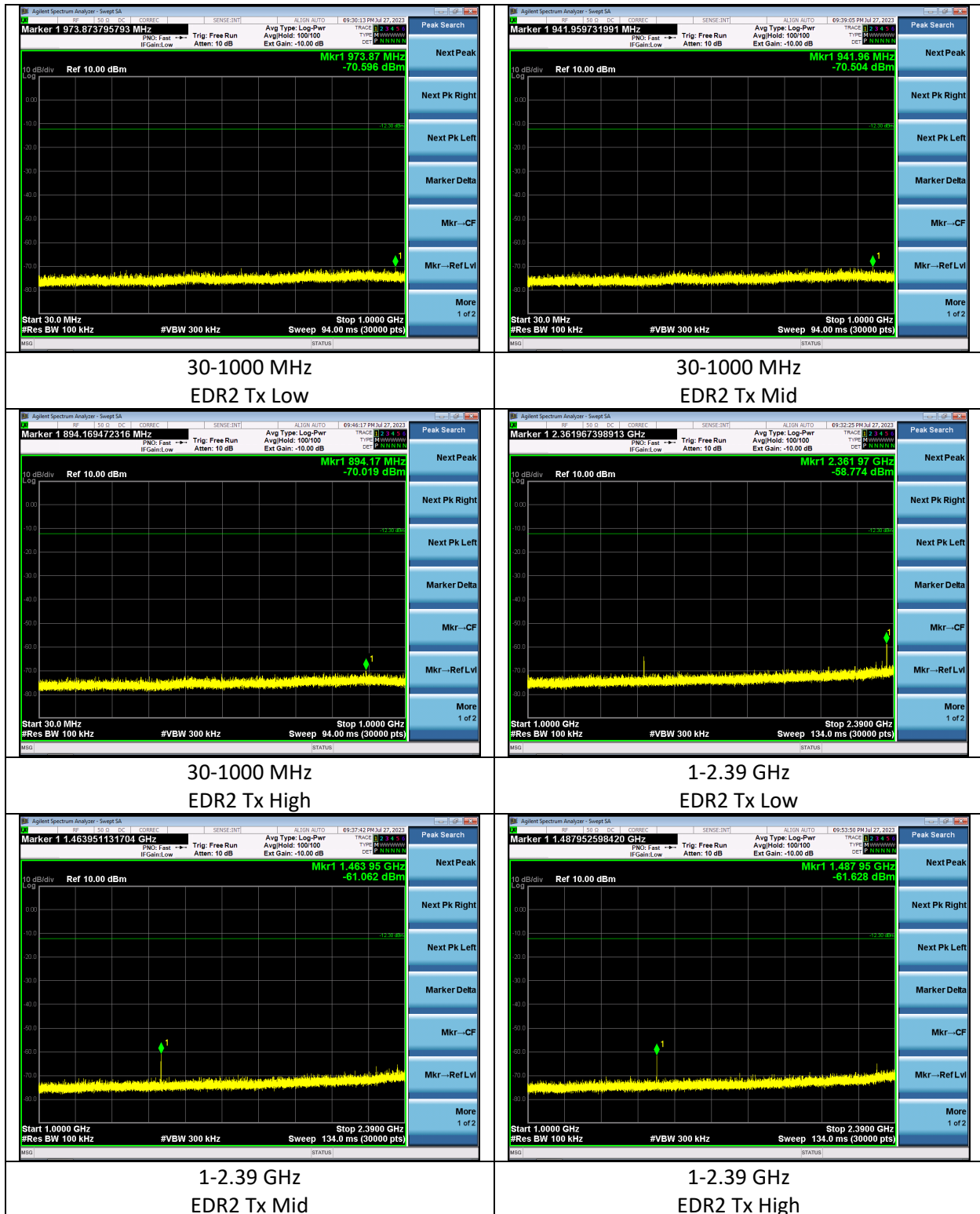
Frequency (MHz)	Data Rate	Measurement (dBm)	Limit (dBm)	Margin (dB)
2399.9	BR	-53.6	-12.3	41.3
2483.8	BR	-58.7	-12.3	46.4
2399.7	EDR	-52.4	-12.3	40.1
2483.5	EDR	-60.2	-12.3	47.9
2399.9	EDR3	-50.6	-12.3	38.3
2483.8	EDR3	-61.5	-12.3	49.2
2391.1	Hopping	-53.0	-12.3	40.7
2484.0	Hopping	-54.4	-12.3	42.1

Plots









30-1000 MHz
EDR2 Tx Low

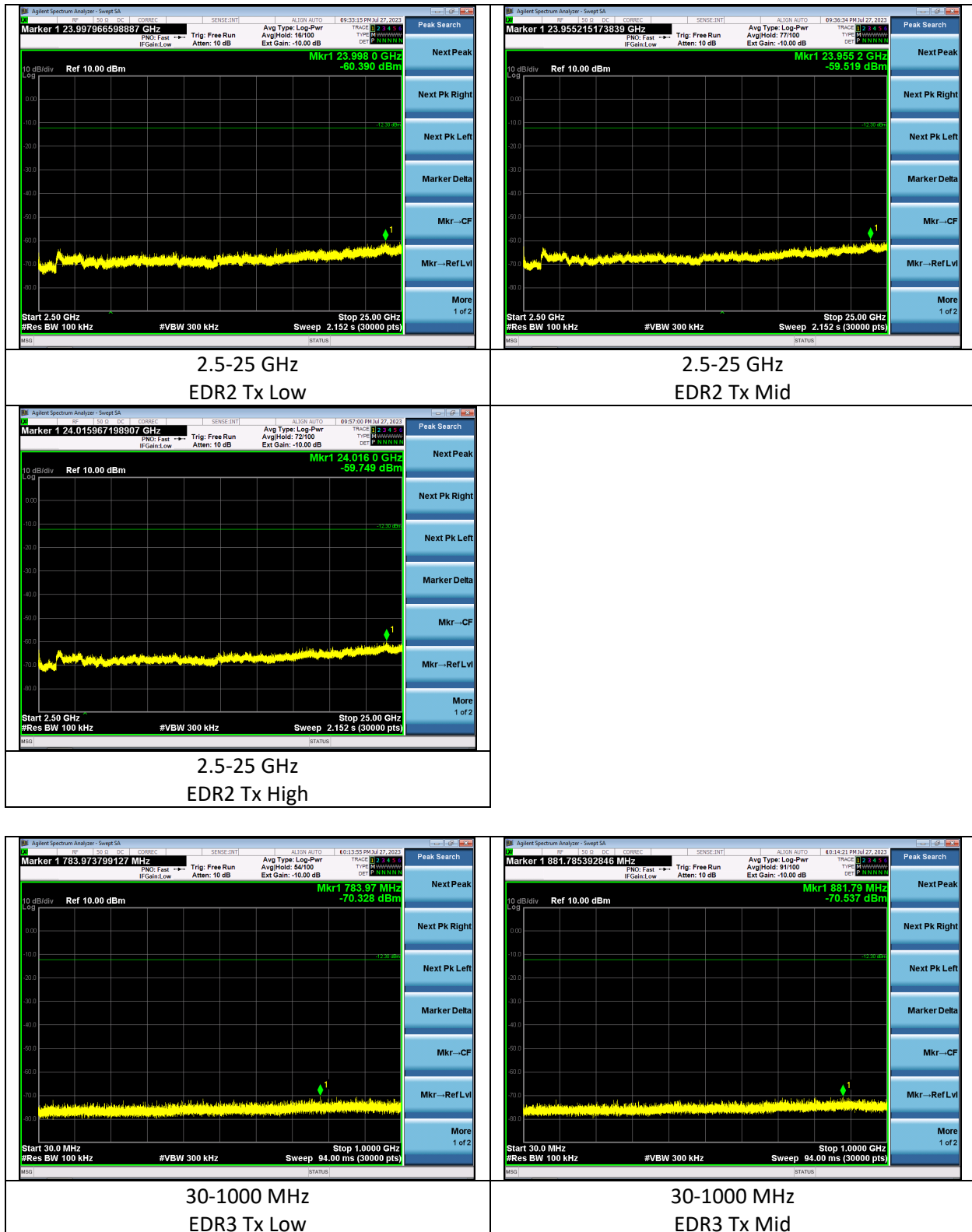
30-1000 MHz
EDR2 Tx Mid

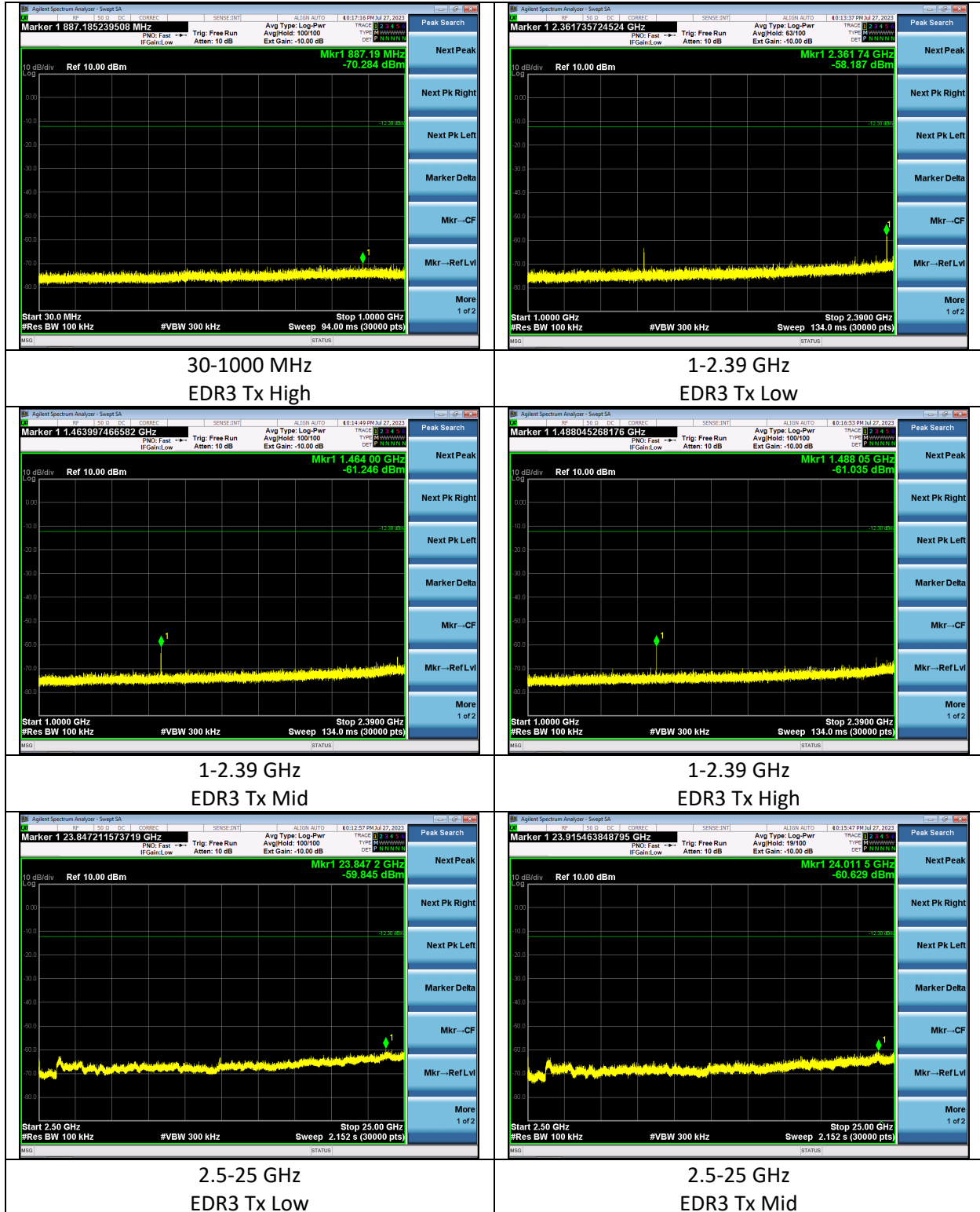
30-1000 MHz
EDR2 Tx High

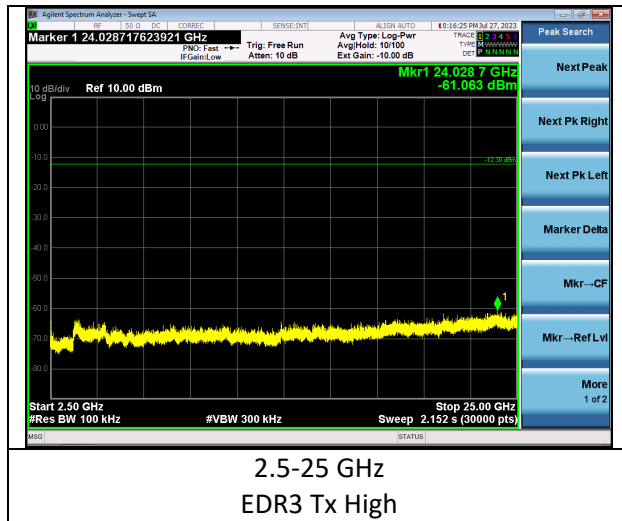
1-2.39 GHz
EDR2 Tx Low

1-2.39 GHz
EDR2 Tx Mid

1-2.39 GHz
EDR2 Tx High







Maximum Conducted Output Power

Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	3 MHz	VBW	50 MHz
Detector(s)	Peak Max Hold	Span	10 MHz

EUT Parameters

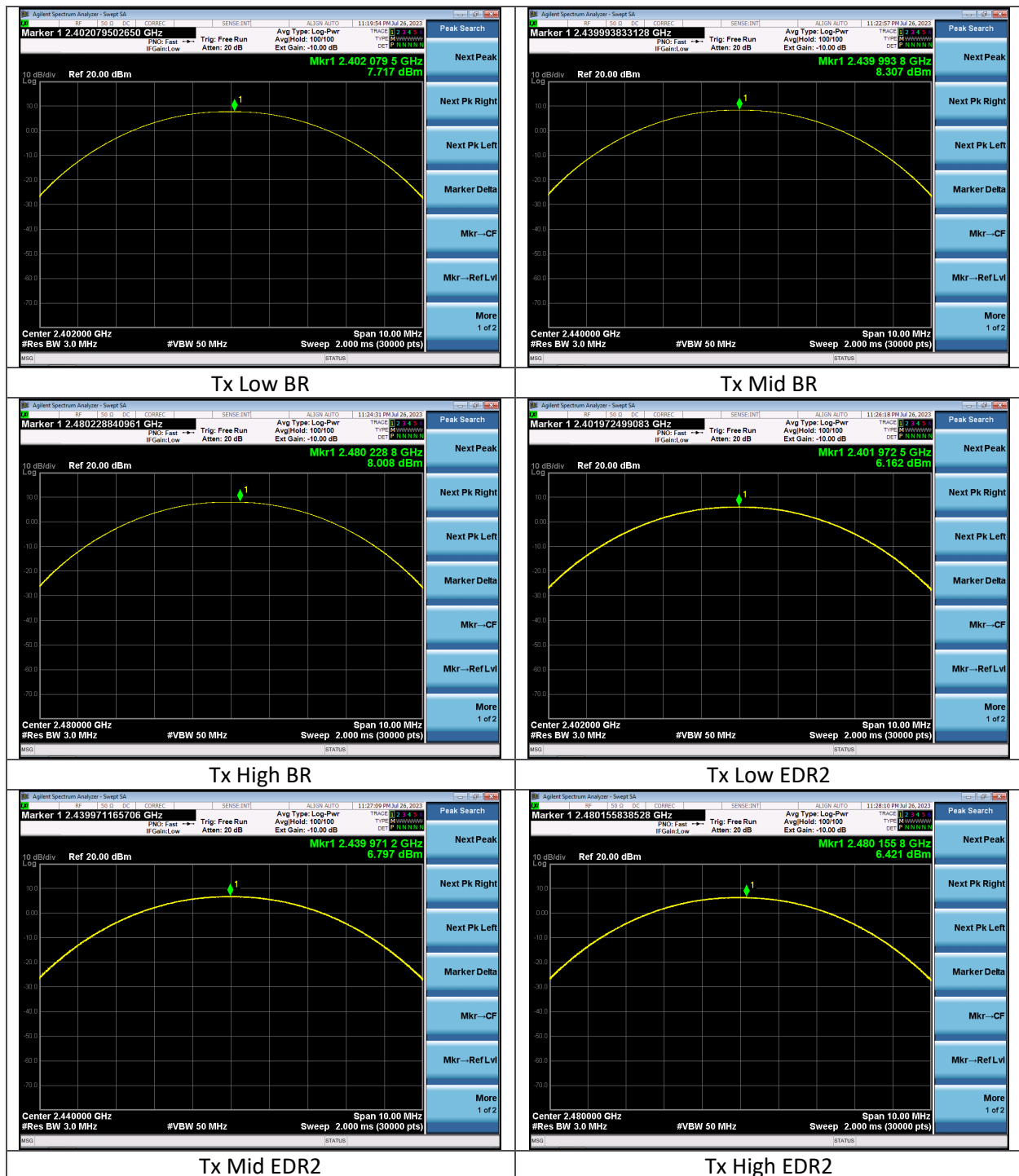
Input Power	USB	Mode	Bluetooth Classic Single Channel BR, EDR2, EDR3
Frequency	2402-2480 MHz	Channel	0, 39, 78

Data

Table

Frequency (MHz)	Data Rate	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
2402	BR	7.7	30.0	22.3
2440	BR	8.3	30.0	21.7
2480	BR	8.0	30.0	22.0
2402	EDR	6.2	30.0	23.8
2440	EDR	6.8	30.0	23.2
2480	EDR	6.4	30.0	23.6
2402	EDR3	6.8	30.0	23.2
2440	EDR3	7.3	30.0	22.7
2480	EDR3	6.8	30.0	23.2

Plots



Company: Enovation Controls LLC

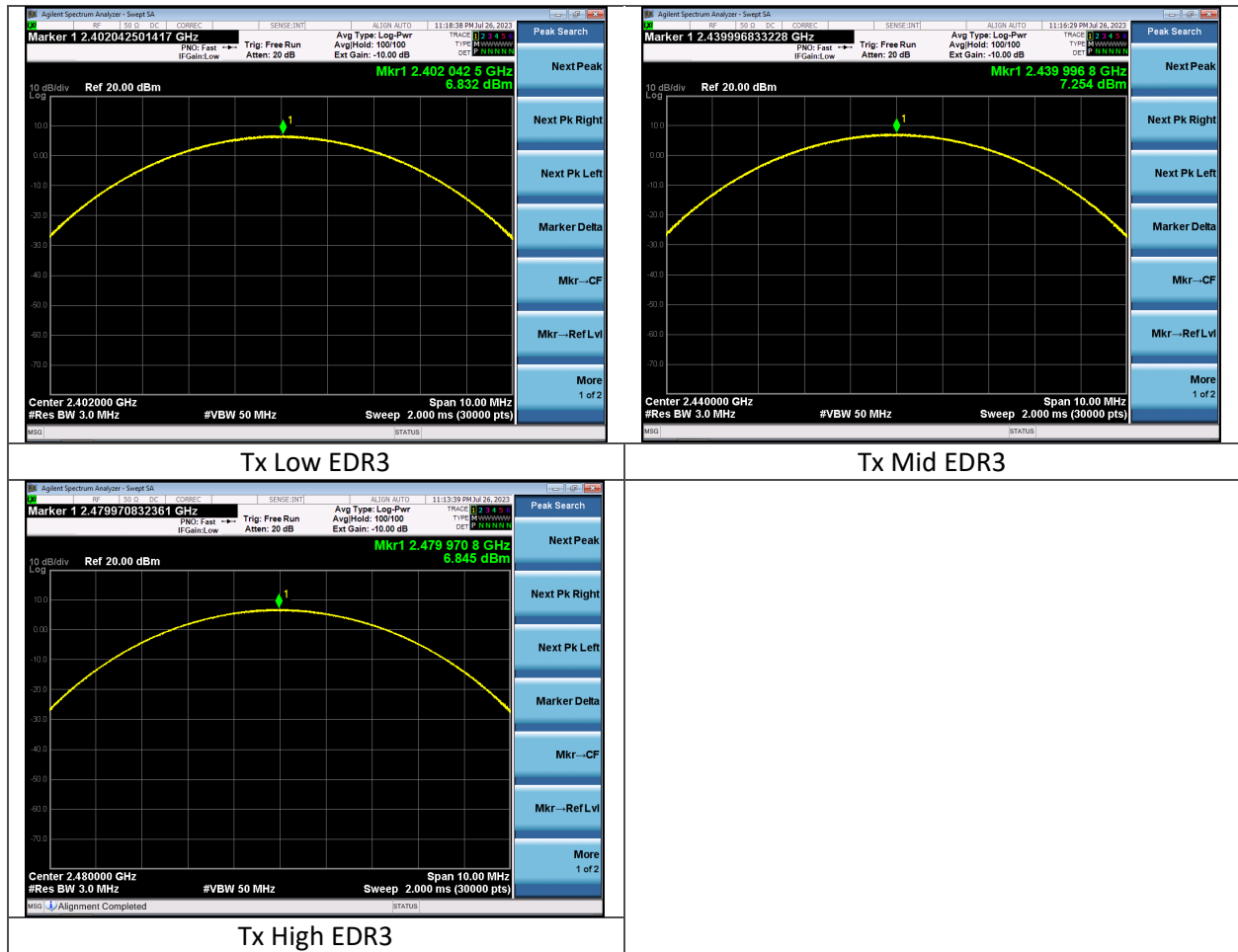
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Serial: Engineering Sample



Number of Hopping Frequencies

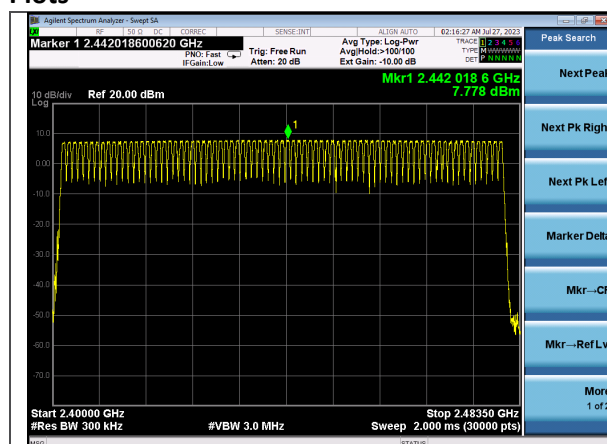
Test Parameters

Frequency	2400-2483.5 MHz	Setup	Conducted
RBW	300 kHz	VBW	1 MHz
Detector(s)	Peak Max Hold	Span	83.5 MHz

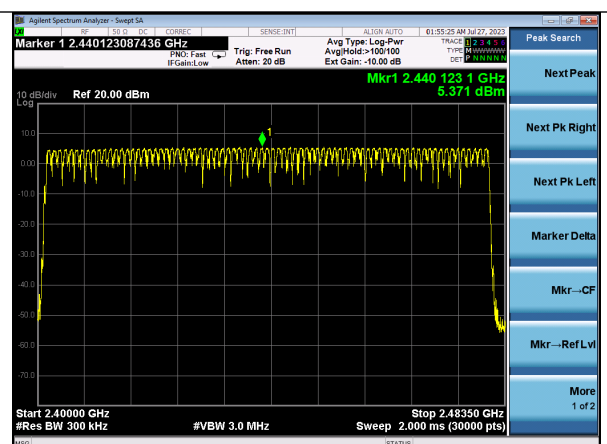
EUT Parameters

Input Power	USB	Mode	Bluetooth Classic BR, EDR2, EDR3
Frequency	2402-2480 MHz	Channel	Hopping

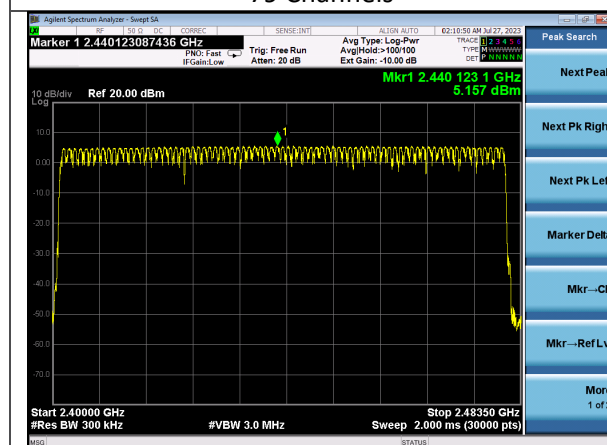
Data Plots



Tx Hopping Basic Rate
79 Channels



Tx Hopping EDR2
79 Channels



Tx Hopping EDR3
79 Channels

Carrier Frequency Separation

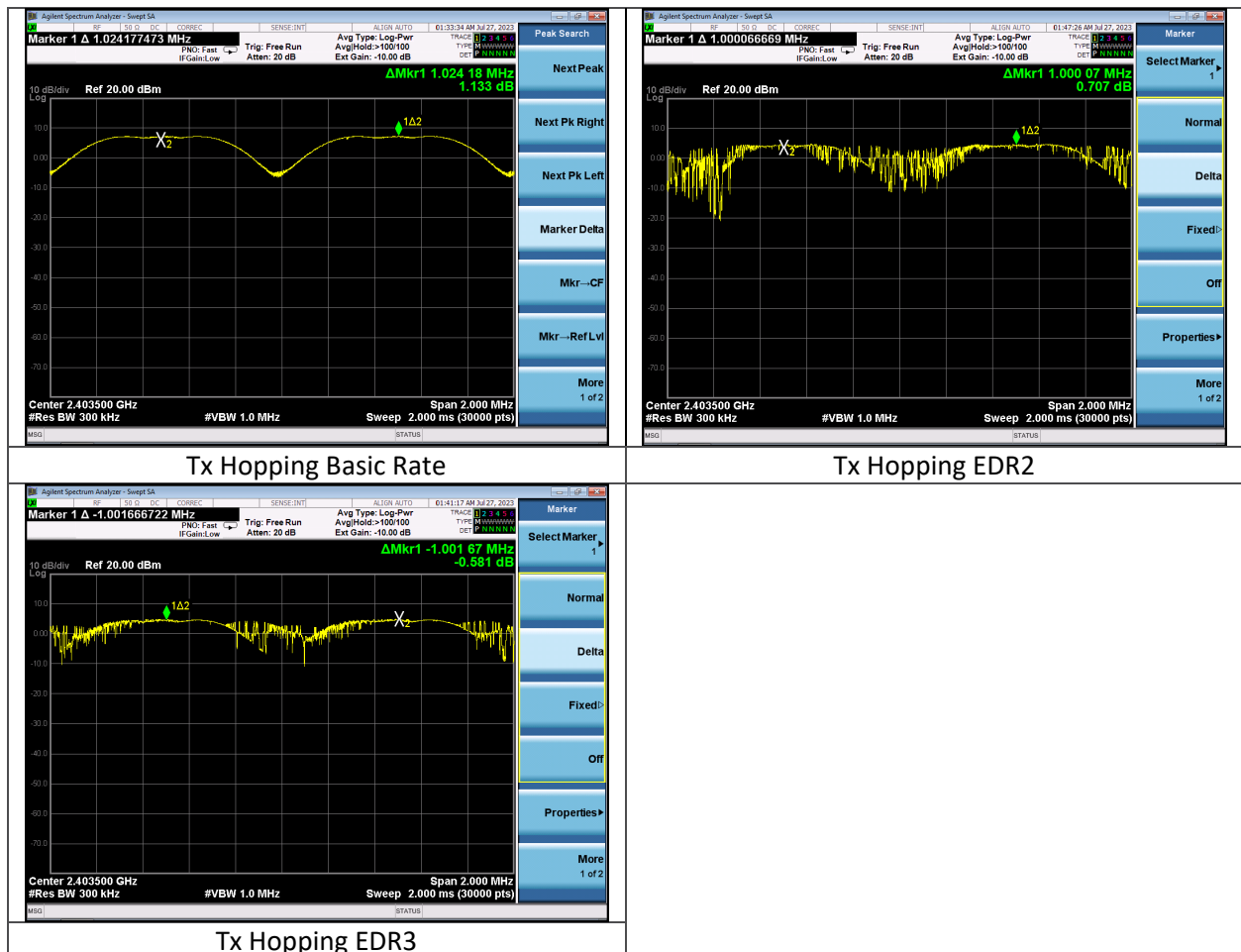
Test Parameters

Frequency	2402.5-2404.5 MHz	Setup	Conducted
RBW	300 kHz	VBW	1 MHz
Detector(s)	Peak Max Hold	Span	2 MHz

EUT Parameters

Input Power	USB	Mode	Bluetooth Classic BR, EDR2, EDR3
Frequency	2402-2480 MHz	Channel	Hopping

Data Plots



Time of Occupancy

Test Parameters

Frequency	2402 MHz	Setup	Conducted
RBW	100 kHz	VBW	300 kHz
Detector(s)	Peak Clear Write - Triggered	Span	Zero Span

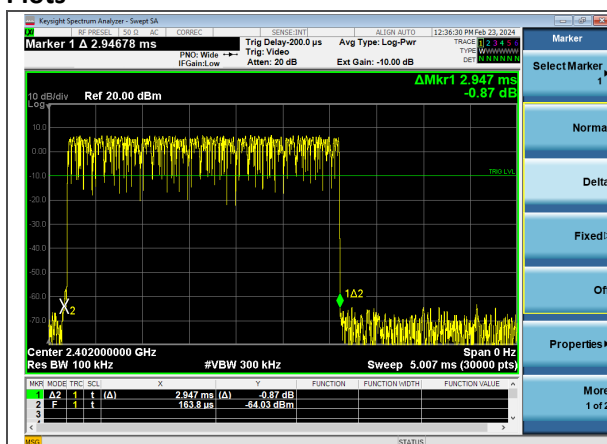
EUT Parameters

Input Power	USB	Mode	Bluetooth Classic BR, EDR 3mbps
Frequency	2402-2480 MHz	Channel	Hopping
Note	Hops measured over 10 and 5 second sweep times. Hops over time periods extrapolated to find total hops over 31.6 seconds (e.g. 33 hops over 10 seconds * 3.16 = 104.3 Hops in 31.6 seconds)		

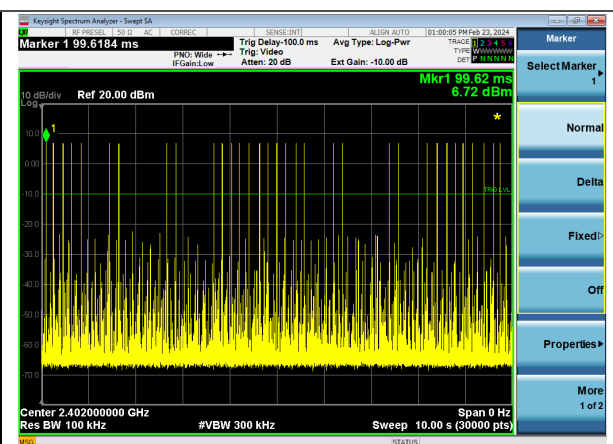
Data Table

Data Rate	Length of Transmission Time (ms)	Number of Transmissions in 31.6s (79 Hopping * 0.4)	Result (s)	Limit (s)	Margin (s)
DH5	2.95	104.3	0.308	0.400	0.092
3-DH5	2.92	116.9	0.341	0.400	0.059
DH1	0.41	322.3	0.133	0.400	0.267
3-DH1	0.42	322.3	0.135	0.400	0.265

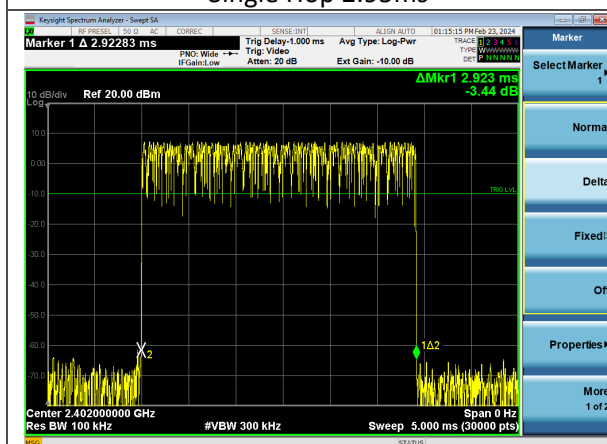
Plots



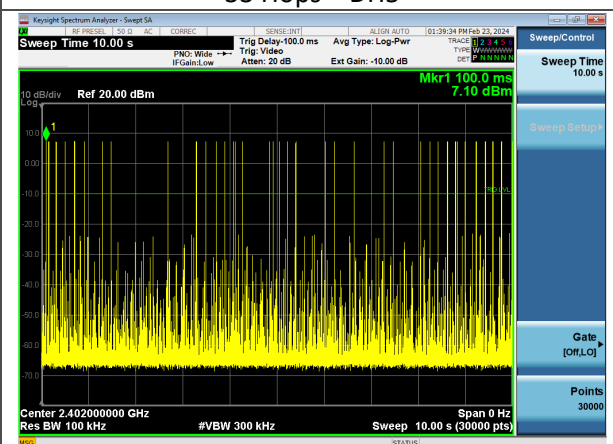
Tx Hopping Basic Rate DH5
Single Hop 2.95ms



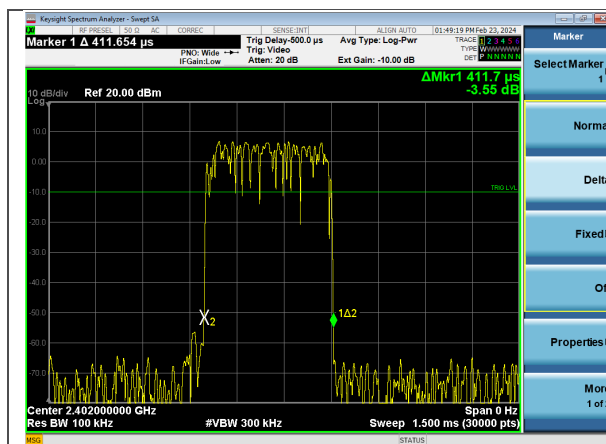
10 Second Sweep
33 Hops – DH5



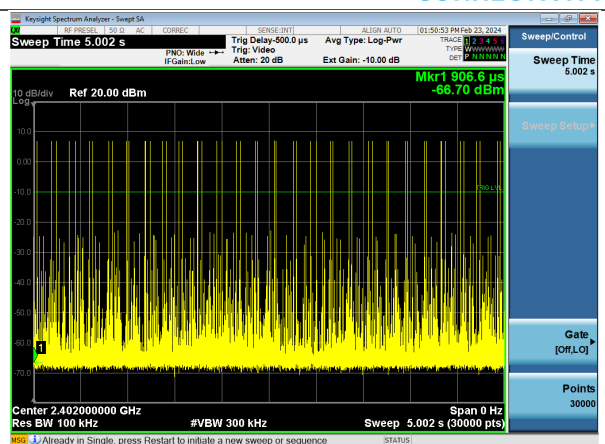
Tx Hopping 3-DH5 (EDR 3mbps)
Single Hop 2.92ms



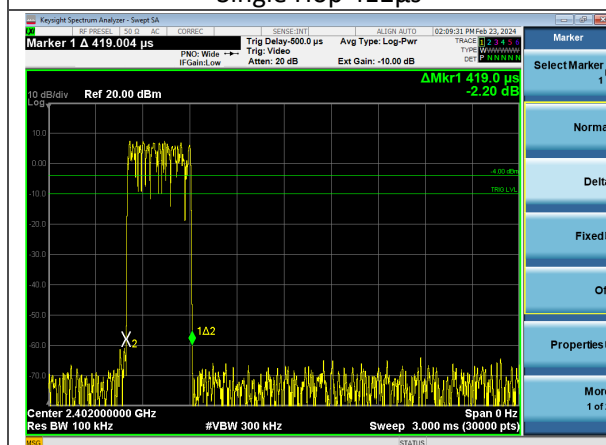
10 Second Sweep
37 Hops – 3-DH5



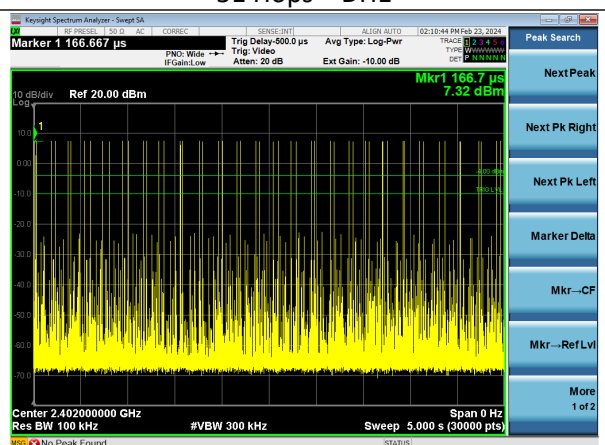
Tx Hopping Basic Rate DH1
Single Hop 412 μ s



5 Second Sweep
51 Hops – DH1



Tx Hopping 3-DH1 (EDR 3mbps)
Single Hop 419 μ s



5 Second Sweep
51 Hops – 3-DH1

Frequency Stability

Test Parameters

Frequency	2402, 2440, 2480 MHz	Setup	Conducted
RBW	1 kHz	VBW	3 kHz

EUT Parameters

Input Power	120VAC 60Hz (to laptop)	Mode	CW Transmit
Frequency	2402-2480 MHz	Channel	0, 39, 78

Data

Table

Channel	Frequency (Hz) 102VAC	Frequency (Hz) 120VAC	Frequency (Hz) 138VAC	Deviation (Hz)
0	2401977305	2401977422	2401977289	133
39	2439979264	2439979289	2439979132	157
78	2479981260	2479981376	2479981101	275

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	Jon Dilley
Temperature	21°C, 24°C	R.H. %	62%, 61%
Test Date	7/20/2023, 7/21/2023, 7/24/2023	Location	Chamber 3, Chamber 5
Requirement	FCC 15.247	Method	ANSI C63.10

Limits:

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	-	-
1000-25000	-	54.0	74.0

Test Parameters

Frequency	30-25000 MHz	Distance	3m
Detector(s)	Peak, Avg, QP	Table height	150cm Above 1 GHz 80cm Below 1 GHz
RBW	1 MHz Above 1 GHz 120 kHz Below 1 GHz	VBW	3 MHz Above 1 GHz Peak 1.2 MHz Below 1 GHz

EUT Parameters

Input Power	USB Powered	Mode	Transmit
Modulation	Basic Rate 1Mbps, Enhanced Data Rate 3Mbps	Channels	2402, 2440, 2480, Hopping

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	8/23/2022	8/23/2023	Active Calibration
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/11/2023	4/11/2024	Active Calibration
AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	9/27/2022	9/27/2023	Active Calibration
AA 960194	Antenna - Biconical	A.H. Systems, Inc.	SAS-540	780	9/29/2022	9/29/2023	Active Calibration
AA 960195	Antenna - Log Periodic	A.H. Systems, Inc.	SAS-512-2	557	9/29/2022	9/29/2023	Active Calibration
AA 960209	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	8/23/2022	8/23/2023	Active Calibration
AA 960222	Cable	A.H. Systems, Inc.	SAC-26G-6	525	6/13/2023	6/13/2024	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	-	-	4/26/2023	4/26/2024	Active Verification
LSC-500	Cable	Chamber 5 Emissions	-	-	4/25/2023	4/25/2024	Active Verification

Table

Fundamental Emission - Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	EUT Orientation	Channel	Data Rate
2401.8	V	150	66	99.3	Vertical	Low	BR
2402.1	H	352	199	95.1	Vertical	Low	BR
2401.9	H	150	181	99.1	Horizontal	Low	BR
2401.9	V	100	241	96.5	Horizontal	Low	BR
2401.9	V	284	304	93.2	Flat	Low	BR
2401.9	H	247	49	98.9	Flat	Low	BR
2479.8	V	150	89	98.4	Vertical	High	BR
2402.1	V	150	66	98.9	Vertical	Low	EDR
2480.1	V	150	89	98.4	Vertical	High	EDR

Band Edge – Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	EUT Orientation	Channel	Modulation
2494.2	V	150	89	51.4	74.0	22.6	Vertical	High	BR
2492.2	V	150	89	51.6	74.0	22.4	Vertical	Hopping	BR
2385.9	V	150	66	50.1	74.0	24.0	Vertical	Hopping	BR
2362.4	V	150	66	50.5	74.0	23.5	Vertical	Low	BR
2362.0	V	150	66	51.5	74.0	22.5	Vertical	Low	EDR
2491.2	V	150	89	51.1	74.0	22.9	Vertical	High	EDR
2378.0	V	150	66	50.9	74.0	23.1	Vertical	Hopping	EDR
2486.8	V	150	89	50.7	74.0	23.3	Vertical	Hopping	EDR

Band Edge – Average

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	EUT Orientation	Channel	Modulation
2483.7	V	150	89	38.9	54.0	15.1	Vertical	High	BR
2491.9	V	150	89	38.6	54.0	15.4	Vertical	Hopping	BR
2389.4	V	150	66	38.8	54.0	15.2	Vertical	Hopping	BR
2362.0	V	150	66	42.1	54.0	11.9	Vertical	Low	BR
2362.0	V	150	66	39.8	54.0	14.2	Vertical	Low	EDR
3483.5	V	150	89	38.8	54.0	15.2	Vertical	High	EDR
2390.0	V	150	66	38.9	54.0	15.1	Vertical	Hopping	EDR
2495.2	V	150	89	38.5	54.0	15.6	Vertical	Hopping	EDR

Spurious Emissions – Peak

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	EUT Orientation	Channel	Modulation
4879.9	H	238	0	42.6	74.0	31.4	Vertical	Mid	BR
4880.0	V	150	0	40.3	74.0	33.7	Vertical	Mid	BR
4880.0	V	251	0	41.6	74.0	32.4	Horizontal	Mid	BR
4879.8	H	150	0	40.8	74.0	33.2	Horizontal	Mid	BR
4879.7	H	150	0	40.8	74.0	33.2	Flat	Mid	BR
4879.9	V	305	97	41.2	74.0	32.8	Flat	Mid	BR
4803.9	H	254	0	40.7	74.0	33.3	Vertical	Low	BR
4960.0	H	238	0	41.7	74.0	32.3	Vertical	High	BR

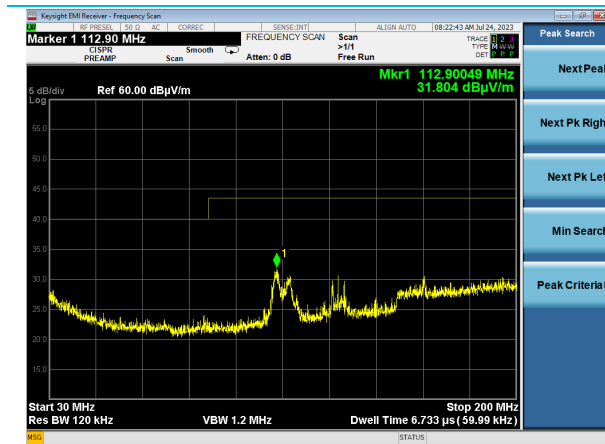
Spurious Emissions – Average

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	EUT Orientation	Channel	Modulation
4879.9	H	238	0	30.9	54.0	23.1	Vertical	Mid	BR
4880.0	V	150	0	28.4	54.0	25.6	Vertical	Mid	BR
4880.0	V	251	0	30.6	54.0	23.4	Horizontal	Mid	BR
4879.8	H	150	0	28.5	54.0	25.5	Horizontal	Mid	BR
4879.7	H	150	0	28.9	54.0	25.1	Flat	Mid	BR
4879.9	V	305	97	29.5	54.0	24.5	Flat	Mid	BR
4803.9	H	254	0	30.2	54.0	23.8	Vertical	Low	BR
4960.0	H	238	0	30.2	54.0	23.8	Vertical	High	BR

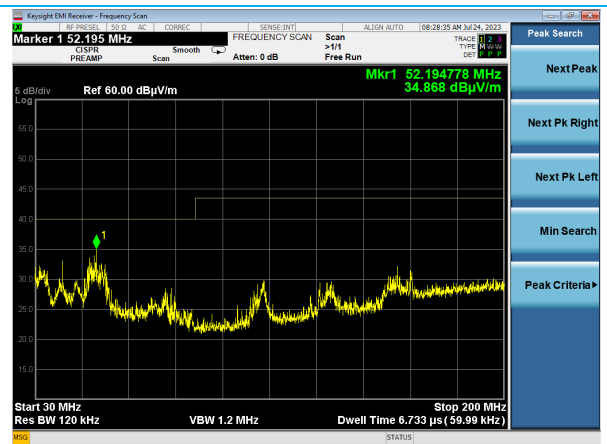
Spurious Emissions – Below 1 GHz

Frequency (MHz)	Antenna Polarity	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)	EUT Orientation	Channel	Modulation
49.9	V	100	0	29.0	40.0	11.0	Vertical	Mid	BR
110.8	H	295	60	24.3	43.5	19.2	Vertical	Mid	BR
333.8	H	100	20	23.7	46.0	22.3	Vertical	Mid	BR

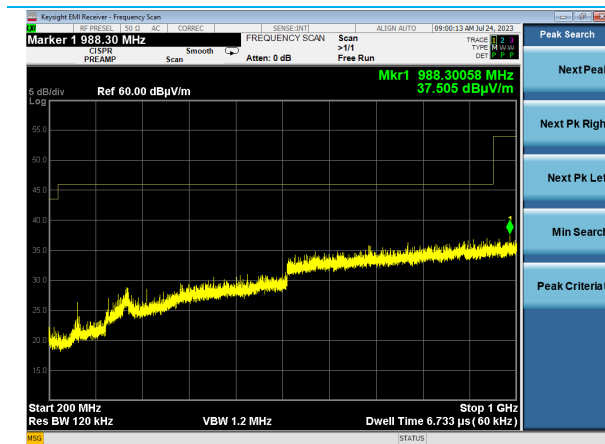
Plots



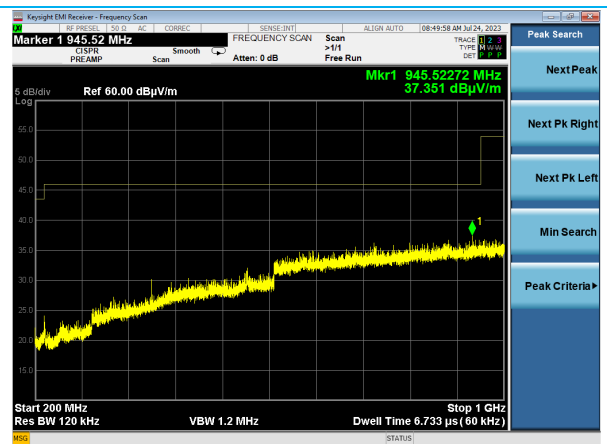
30-200 MHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



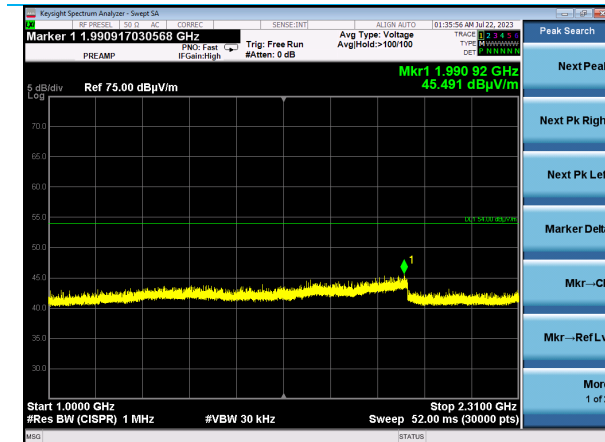
30-200 MHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



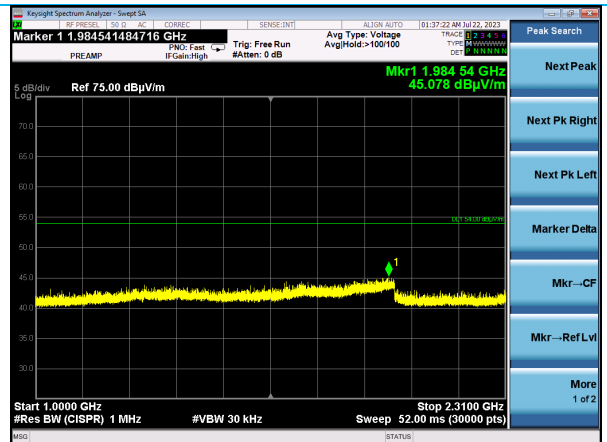
200-1000 MHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



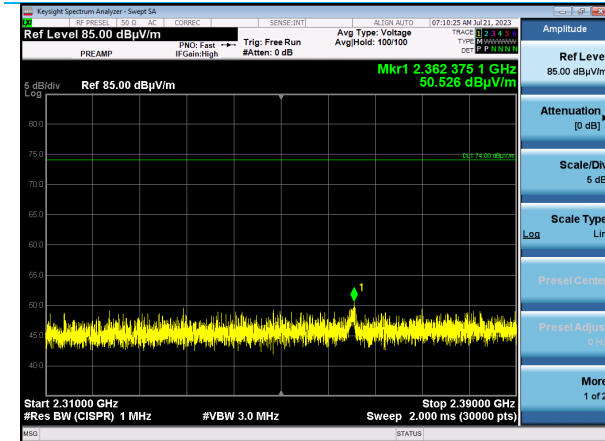
200-1000 MHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



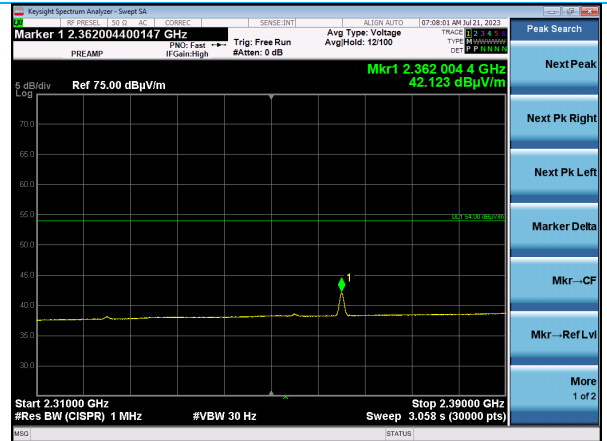
1-2.31 GHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



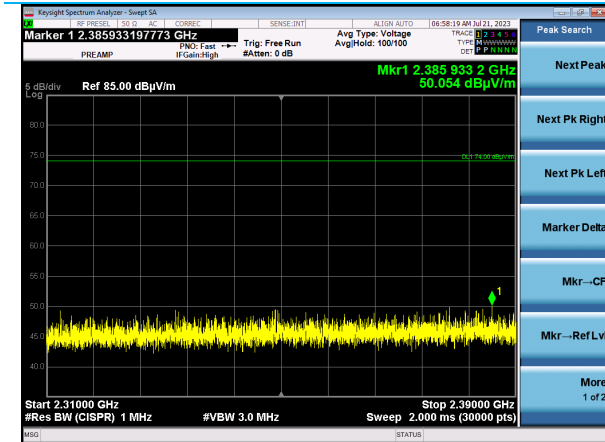
1-2.31 GHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



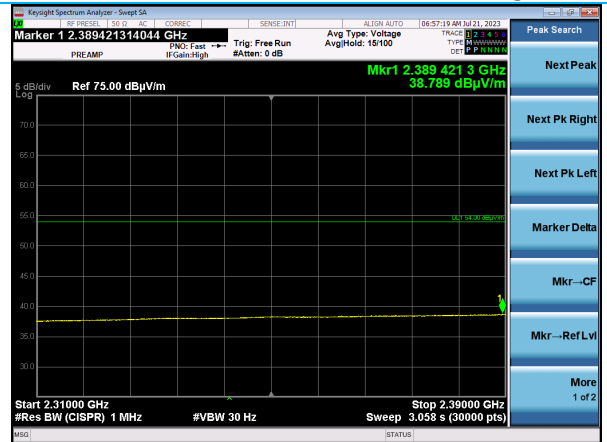
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Low Basic Rate Peak



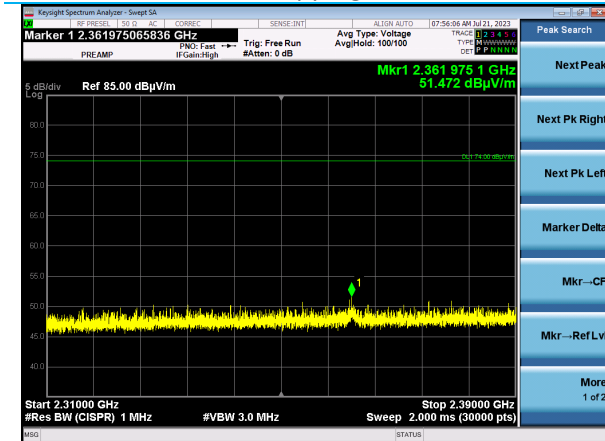
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Low Basic Rate Average



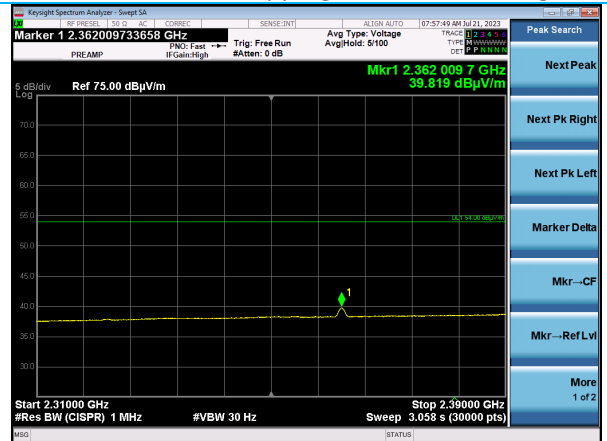
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Hopping Basic Rate Peak



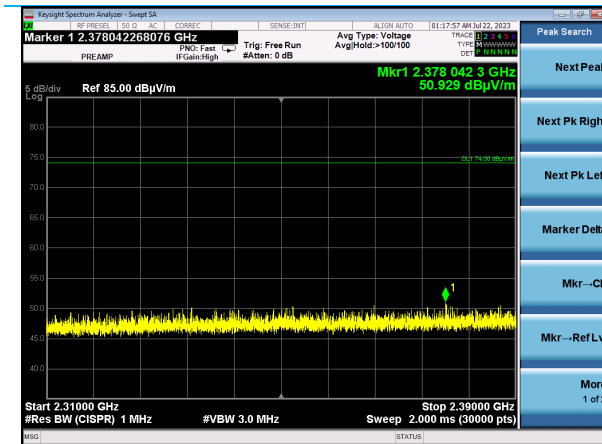
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Hopping Basic Rate Average



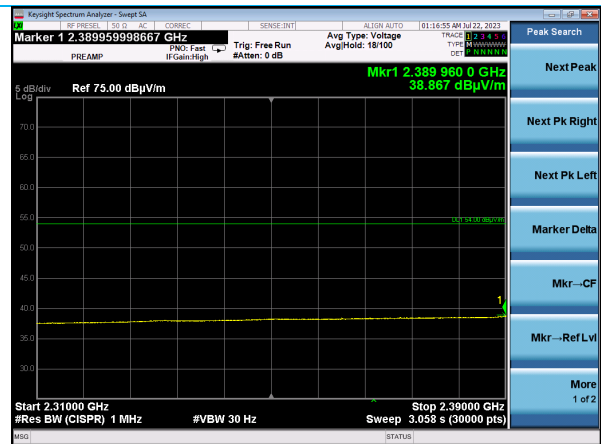
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Low EDR Peak



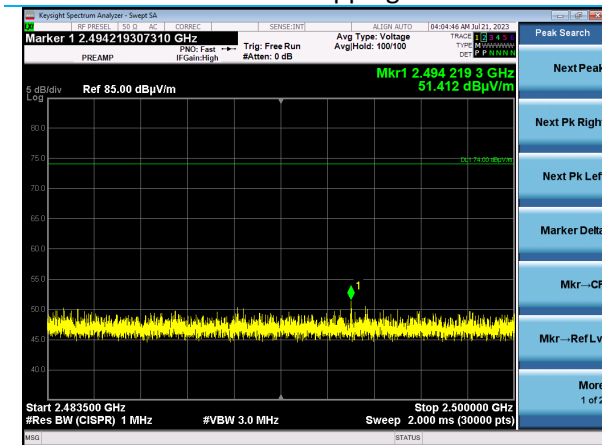
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Low EDR Average



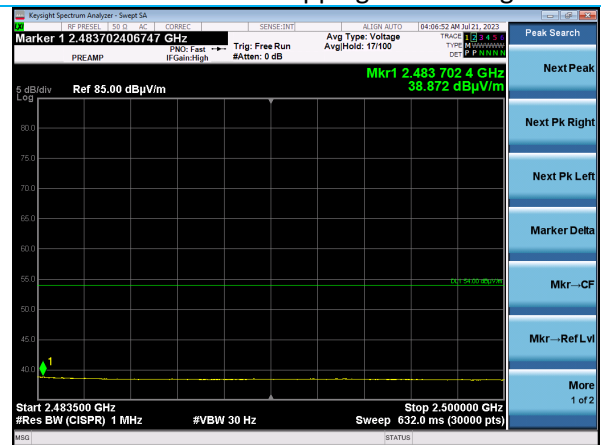
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Hopping EDR Peak



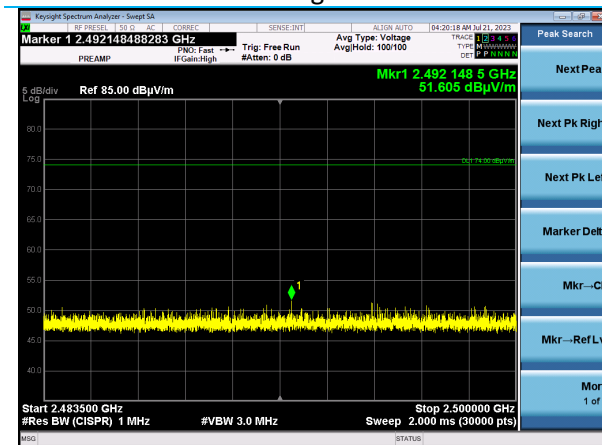
2310-2390 MHz Vertical Polarity
EUT Vertical Tx Hopping EDR Average



2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx High Basic Rate Peak



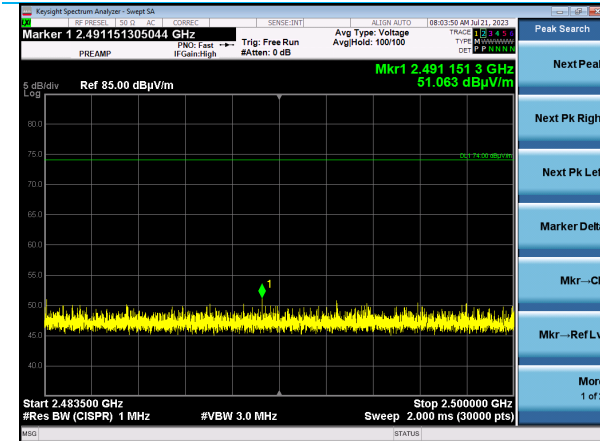
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx High Basic Rate Average



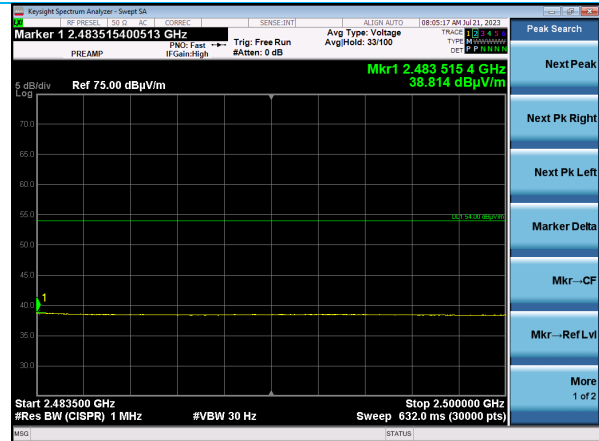
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx Hopping Basic Rate Peak



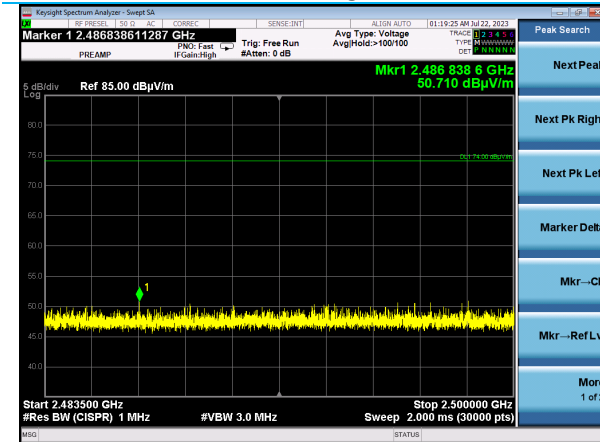
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx Hopping Basic Rate Average



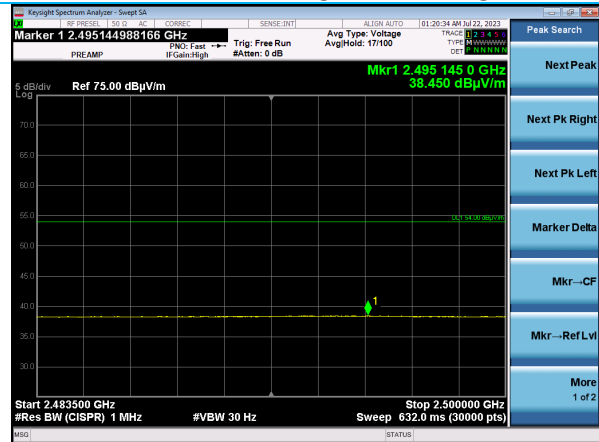
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx High EDR Peak



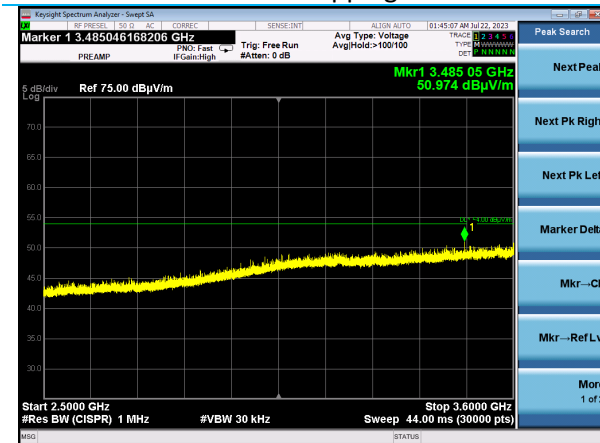
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx High EDR Average



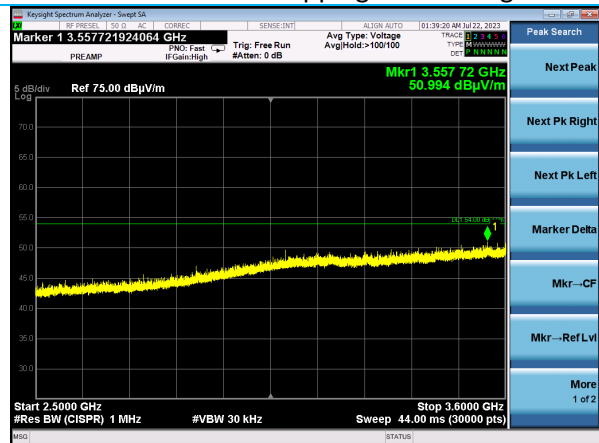
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx Hopping EDR Peak



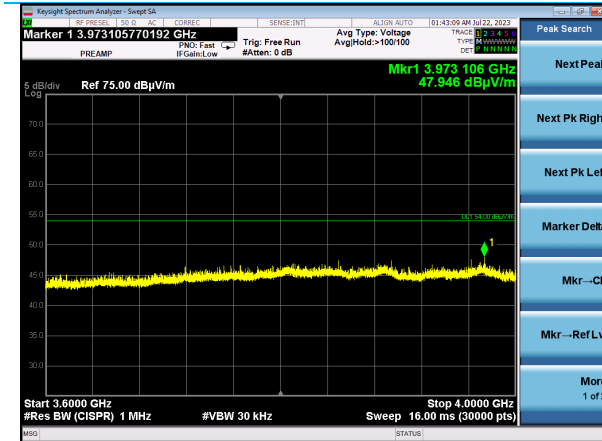
2483.5-2500 MHz Vertical Polarity
EUT Vertical Tx Hopping EDR Average



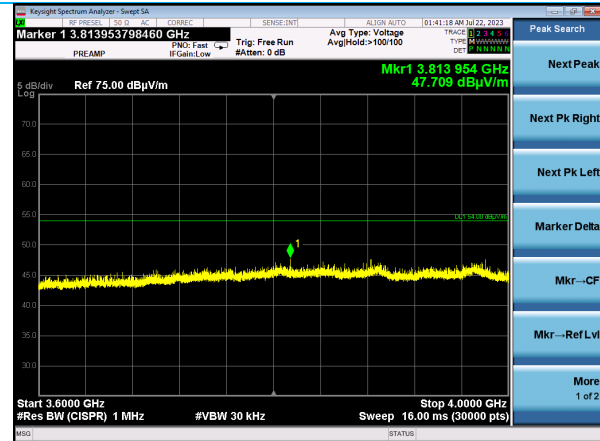
2.5-3.6 GHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



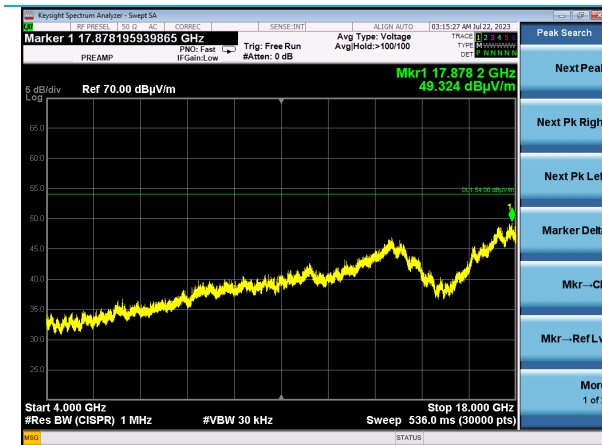
2.5-3.6 GHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



3.6-4.0 GHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



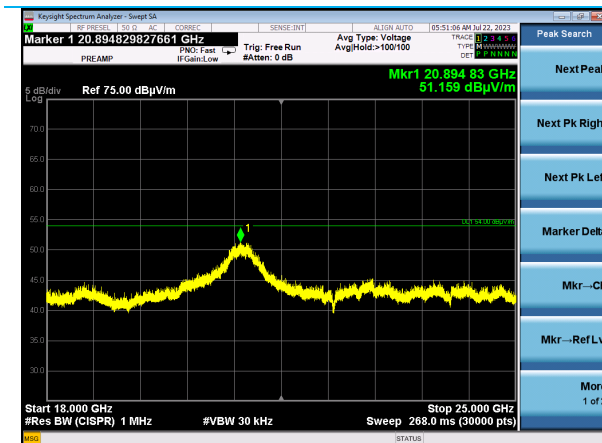
3.6-4.0 GHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



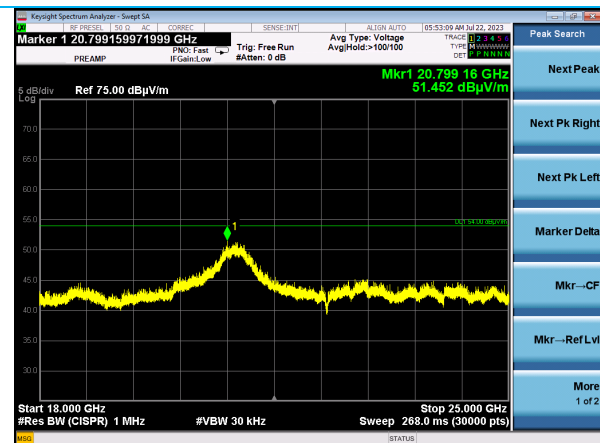
4-18 GHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



4-18 GHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate



18-25 GHz Horizontal Polarity
EUT Vertical Tx Mid Basic Rate



18-25 GHz Vertical Polarity
EUT Vertical Tx Mid Basic Rate

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.

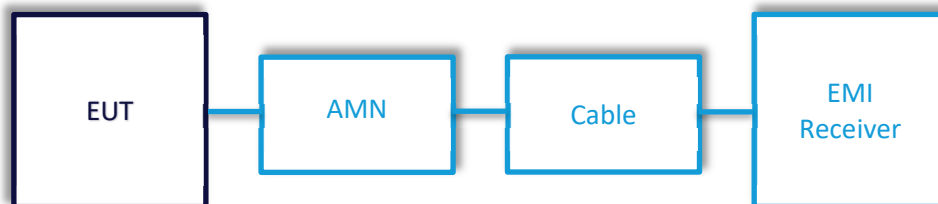
Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)

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	Adam Alger
Temperature	22.1°C	R.H. %	47.40%
Test Date	7/31/2023	Location	Bench
Requirement	FCC 15.207	Method	ANSI C63.10

Limits:

Frequency of emission (MHz)	Quasi-Peak Limit (dBµV)	Average Limit (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	150kHz-30MHz	Distance	80cm to LISN
Detector(s)	Peak, QP, Avg	Table height	80cm
RBW	9kHz	VBW	62kHz

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-212	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-001	4/25/2023	4/25/2024	Active Verification

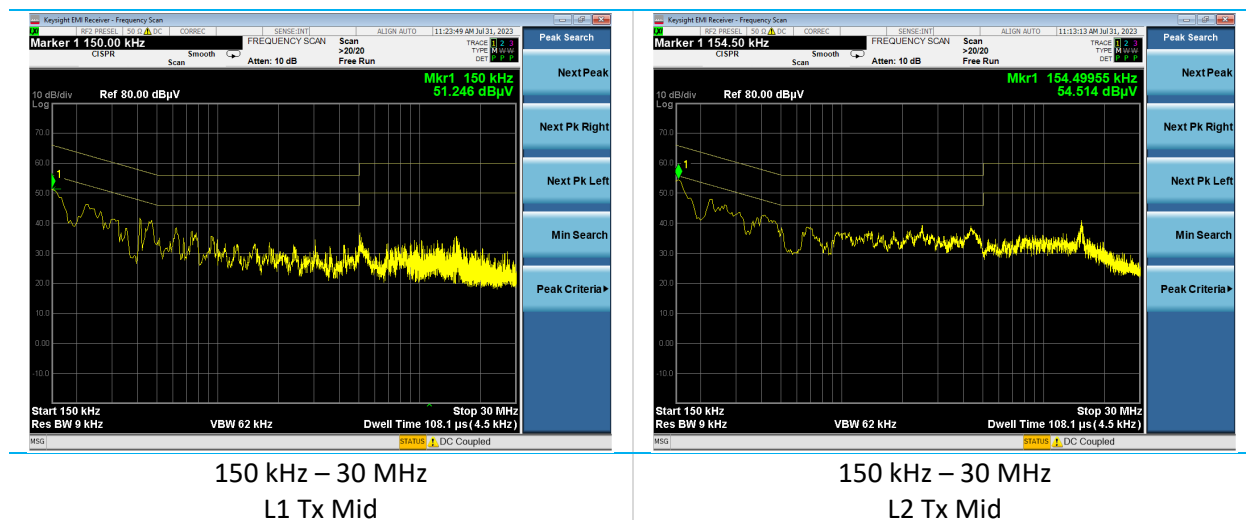
EUT Parameters

Input Power	120VAC 60Hz	Mode	Bluetooth Classic Transmit
EUT	Basic Rate Tx Mid Channel	EUT	EUT connected via USB to Laptop for Power and Programming, Laptop plugged into LISN

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)
L2	0.155	49.7	40.8	65.8	55.8	16.1	15.0
L2	0.667	27.7	18.9	56.0	46.0	28.3	27.1
L2	4.357	26.6	18.2	56.0	46.0	29.4	27.8
L1	0.150	50.5	41.6	66.0	56.0	15.5	14.4
L1	0.623	35.3	25.4	56.0	46.0	20.7	20.6
L1	3.021	29.7	18.5	56.0	46.0	26.3	27.5

Plots



6 REVISION HISTORY

Version	Date	Notes	Person
0	7/31/2023	Initial Draft	Anthony Smith
1	8/29/2023	Revised Draft	Anthony Smith
2	12/21/2023	EUT Name/Model # Revision	Anthony Smith
3	2/15/2024	Edits made to Time of Occupancy and DSS BW reporting	Anthony Smith
4	2/24/2024	Time of Occupancy section updated	Anthony Smith

END OF REPORT