

Test Report TR3747C

Equipment Under Test:	Trex Device Communicator
Requirement(s):	FCC: 15.247 ISED: RSS-247
Test Date(s):	11/6/2023-11/10/2023, 1/15/2024, 7/1/2025-7/3/2025, 7/23/2025
Prepared for:	R. Stahl HMI Systems Attn: Roman Cohnen Adolf-Grimme-Allee 8 Köln, Germany 50829

Report Issued by: Dylan Rosenfeldt, EMC Engineer	
Signature: 	Date: 7/31/2025
Report Reviewed by: Adam Alger, Sr. Manager, EMC Laboratory	
Signature: 	Date: 7/31/2025
Report Constructed by: Dylan Rosenfeldt, EMC Engineer	
Signature: 	Date: 7/31/2025

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Company: R. Stahl HMI Systems	Page 1 of 50	Name: Trex Device Communicator
Report: TR3747C		Model: TREX2-00NAW
Quote: NBO-04-2023-006145		Serial: EMC RF1, EMC RF2

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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: R. Stahl HMI Systems	Page 3 of 50	Name: Trex Device Communicator
Report: TR3747C		Model: TREX2-00NAW
Quote: NBO-04-2023-006145		Serial: EMC RF1, EMC RF2

1 TEST REPORT SUMMARY

During **11/6/2023-11/10/2023, 1/15/2024, 7/1/2025-7/3/2025, 7/23/2025**, the Equipment Under Test (EUT), **Trex Device Communicator**, provided by **R. Stahl HMI Systems**, was tested to the following requirements, for the purpose of a product filing:

FCC 15.247 / RSS-247

Requirements	Description	Method	Compliant
15.247(a)(2) RSS-247 Clause 5.2 (a)	6dB and 99% Occupied Bandwidth	ANSI C63.10 6.9.3, 11.8	Yes
15.247(b)(3) RSS-247 Clause 5.4 (d)	RF Output Power	ANSI C63.10 11.9	Yes
15.247(e) RSS-247 Clause 5.2 (b)	Power Spectral Density	ANSI C63.10 11.10	Yes
15.247(d) RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	ANSI C63.10 11.11	Yes
FCC: 15.247 (d) ISED: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	ANSI C63.10 11.12	Yes
2.1055(d) RSS-GEN 6.11	Frequency Stability	ANSI C63.10 6.8.2	Reported
FCC: 15.207 IC: RSS-GEN 8.8	AC Power Line Conducted Emissions	ANSI C63.10 6.2	Yes

Notice:

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

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

Measurement Type	Rule
Emissions – Amplitude	0.5 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

2 CLIENT INFORMATION

Company Name	R. Stahl HMI Systems
Contact Person	Roman Cohnen
Address	R. Stahl HMI Systems Adolf-Grimme-Allee 8 Köln, Germany 50829

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Trex Device Communicator
Model Number	TREX2-00NAW
Serial Number	EMC RF1, EMC RF2
Condition	Good
FCC ID	2AIM6-TREX2
IC ID	21553-TREX2

2.2 Product Description

Touchscreen tablet incorporating Bluetooth Classic, Bluetooth Low Energy, and 2.4GHz WLAN.

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 Data rates and channels

WLAN 2.4GHz 802.11b,g,n datarates: 1Mbps, 11Mbps, 6Mbps, 54Mbps, MCS0, MCS7. Channels tested: 1 (2412 MHz), 6 (2437 MHz), 11 (2462 MHz). 40MHz channels tested on channels 3 (2422 MHz), 6 (2437 MHz), 9 (2452 MHz).

2.6 Antenna Information

Manufacturer	Frequency Range (MHz)	Type	Peak Gain (dBi)
R.Stahl	2400-2483.5	PCB Dipole Antenna	4.03

3 REFERENCES

Publication	Edition	Date	AMD 1	AMD 2
FCC eCFR	-	2023	-	-
RSS-247	3	2023	-	-
RSS-GEN	5	2018	2019	2021
ANSI C63.10	-	2020	-	-

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

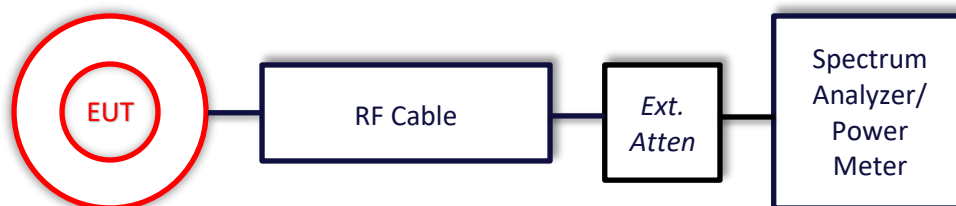
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
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 – 99% and 6dB Bandwidth

Operator	Dylan Rosenfeldt	QA	Adam Alger
Temperature	22.6°C, 19.5°C	R.H. %	48.9%, 21.9%
Test Date	11/6/2023, 1/15/2024	Location	RF Conducted Bench
Requirement	FCC: 15.247(a)(1) ICED: RSS-247 5.2	Method	ANSI C63.10 6.9.3, 11.8

Test Parameters

Frequency	2400 - 2483.5 MHz	Setup	Conducted RF
RBW	27 kHz, 56 kHz – 99% OBW 100kHz – DTS BW	VBW	270 kHz, 560 kHz – 99% OBW 1MHz – DTS BW
Detector(s)	Peak – Trace/Final	Settings	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration
EE 960197	Meter - Hygro- Thermometer	Control Company	90080-03	180045461	7/21/2023	7/21/2024	Active Calibration

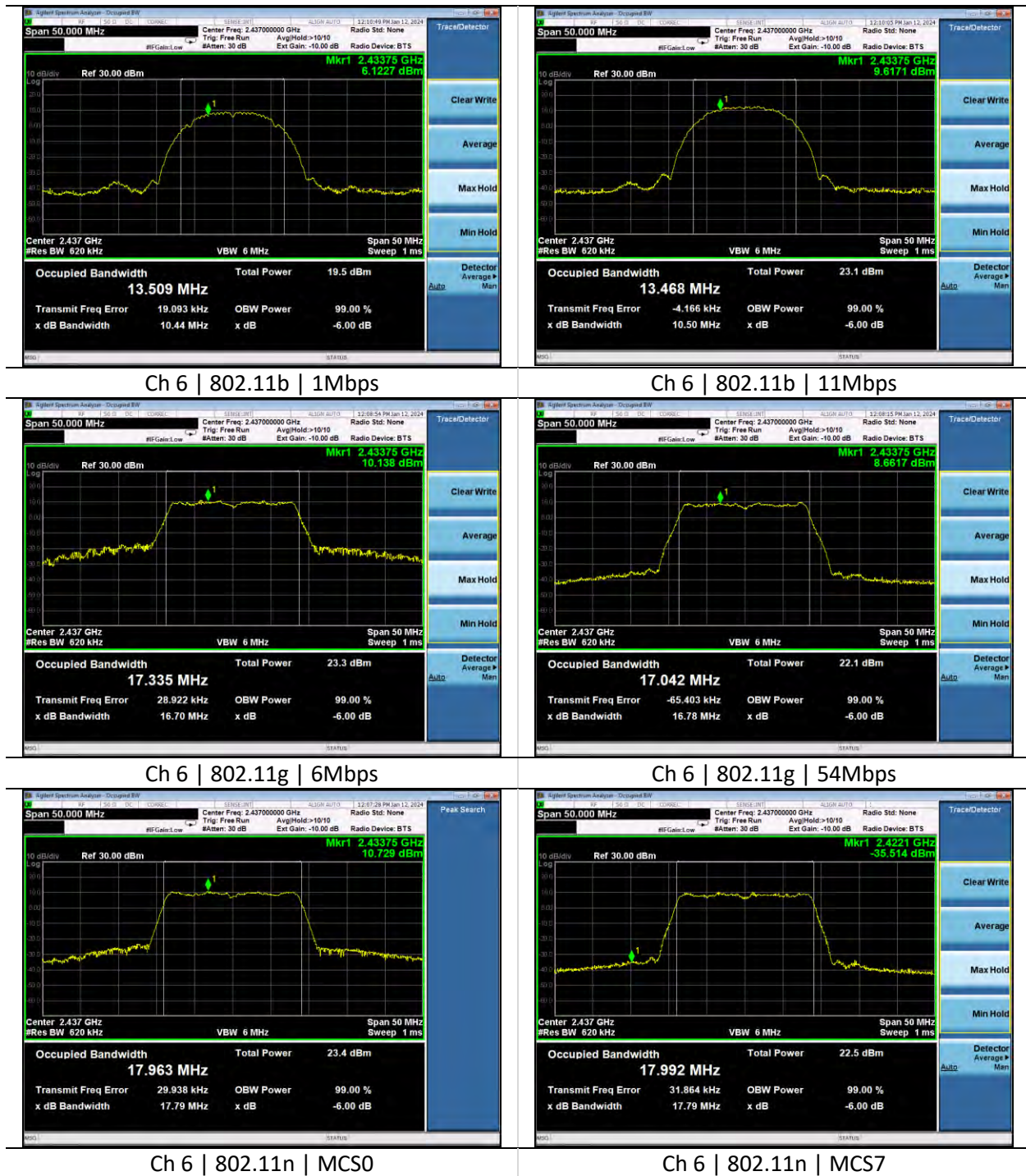
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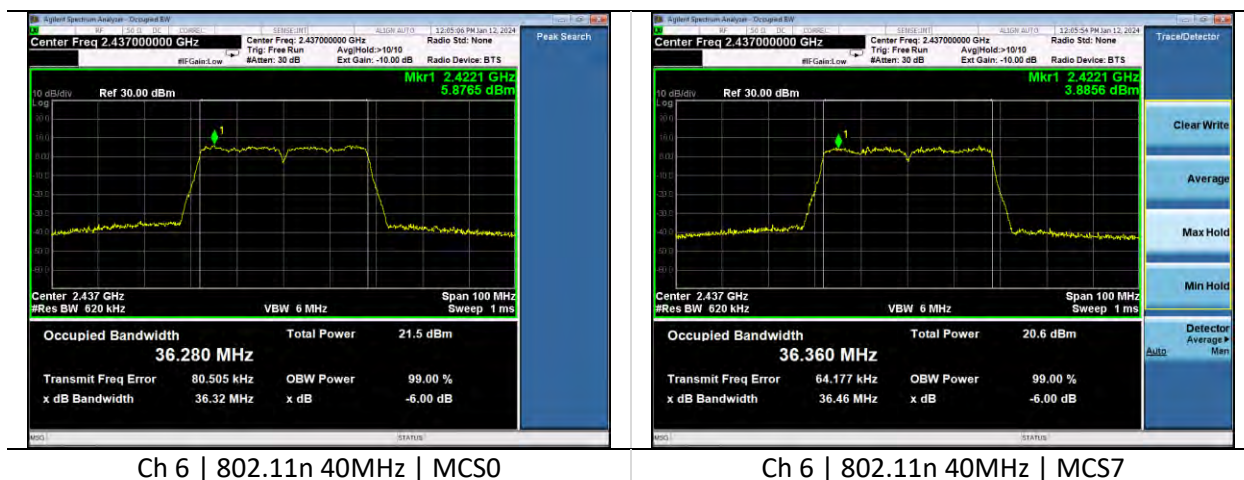
Input Power	15V Battery	Mode	2.4GHz TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	See 2.5		

Table

Frequency (MHz)	OBW (MHz)	DTS BW (MHz)	Limit (MHz)	Margin (<Hz)	Data rate
2412	13.51	10.45	0.50	9.95	ch 1 1M
2437	13.51	10.44	0.50	9.94	ch 6 1M
2462	13.53	10.43	0.50	9.93	ch 11 1M
2412	13.46	10.50	0.50	10.00	ch 1 11M
2437	13.47	10.50	0.50	10.00	ch 6 11M
2462	13.46	10.51	0.50	10.01	ch 11 11M
2412	17.27	16.71	0.50	16.21	ch 1 6M
2437	17.34	16.70	0.50	16.20	ch 6 6M
2462	17.24	16.71	0.50	16.21	ch 11 6M
2412	17.03	16.75	0.50	16.25	ch 1 54M
2437	17.04	16.78	0.50	16.28	ch 6 54M
2462	17.03	16.72	0.50	16.22	ch 11 54M
2412	17.96	17.79	0.50	17.29	ch 1 H0
2437	17.96	17.79	0.50	17.29	ch 6 H0
2462	17.96	17.81	0.50	17.31	ch 11 H0
2412	18.01	17.83	0.50	17.33	ch 1 H7
2437	17.99	17.79	0.50	17.29	ch 6 H7
2462	18.00	17.78	0.50	17.28	ch 11 H7
2422	36.28	36.29	0.50	35.79	ch 3 H0 40MHz
2437	36.28	36.32	0.50	35.82	ch 6 H0 40MHz
2452	36.28	36.30	0.50	35.80	ch 9 H0 40MHz
2422	36.39	36.52	0.50	36.02	ch 3 H7 40MHz
2437	36.36	36.46	0.50	35.96	ch 6 H7 40MHz
2452	36.37	36.47	0.50	35.97	ch 9 H7 40MHz

99% OBW & 6dB DTS BW Plots





5.1.2 Antenna Port Conducted Emissions – RF Output Power

Operator	Dylan Rosenfeldt	QA	Adam Alger
Temperature	22.6°C, 19.5°C	R.H. %	48.9%, 21.9%
Test Date	11/6/2023, 1/15/2024	Location	RF Conducted Bench
Requirement	FCC: 15.247(b)(3) ICED: RSS-247 5.4	Method	ANSI C63.10 11.9.2.2.4

Limits:

30dBm

Test Parameters

Frequency	2400 - 2483.5 MHz	Setup	Conducted RF
RBW	300 kHz, 1 MHz	VBW	1 MHz, 3 MHz
Detector(s)	RMS Average	Settings	Trace Average

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration
EE 960197	Meter - Hygro- Thermometer	Control Company	90080-03	180045461	7/21/2023	7/21/2024	Active Calibration

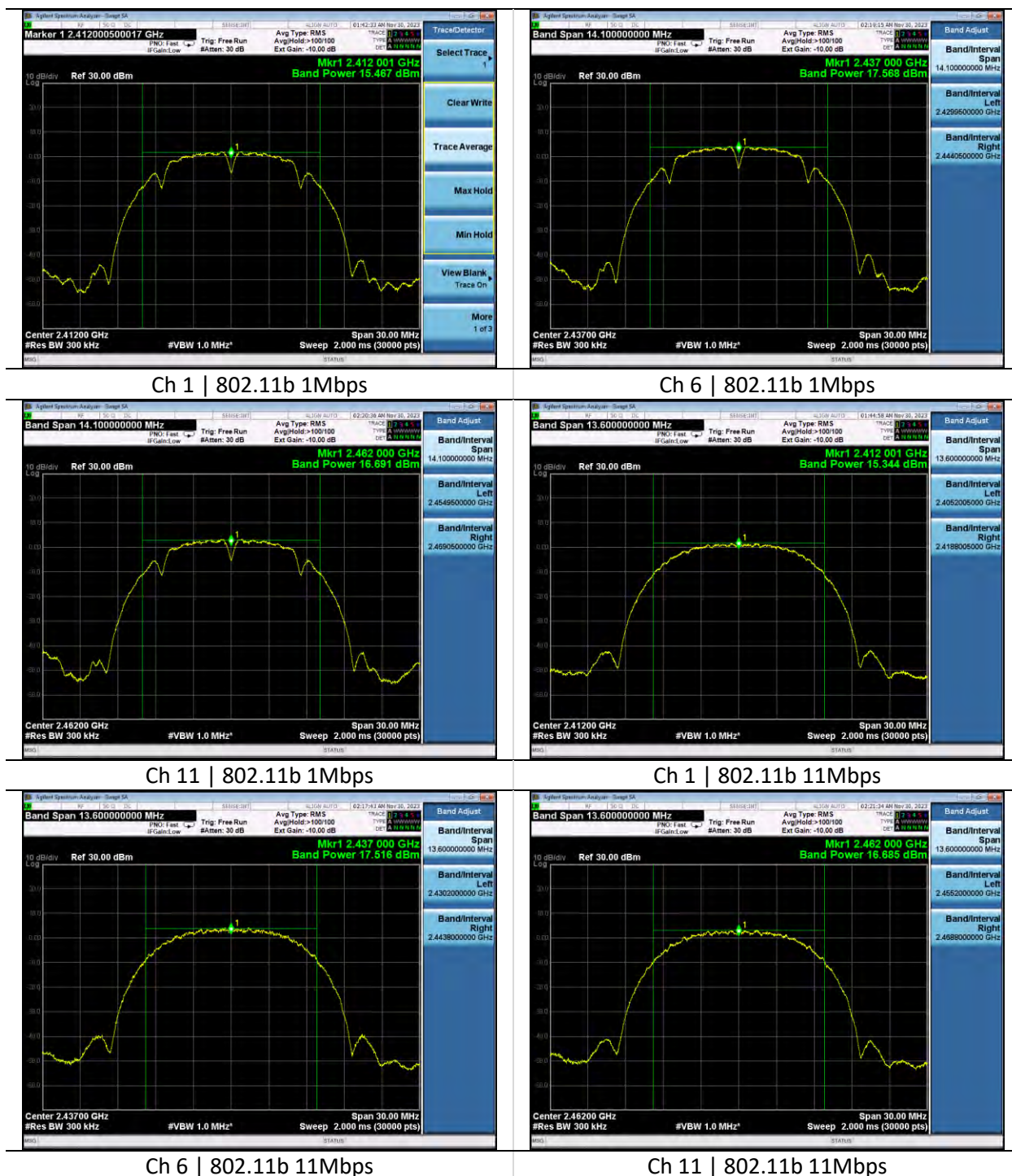
EUT Parameters

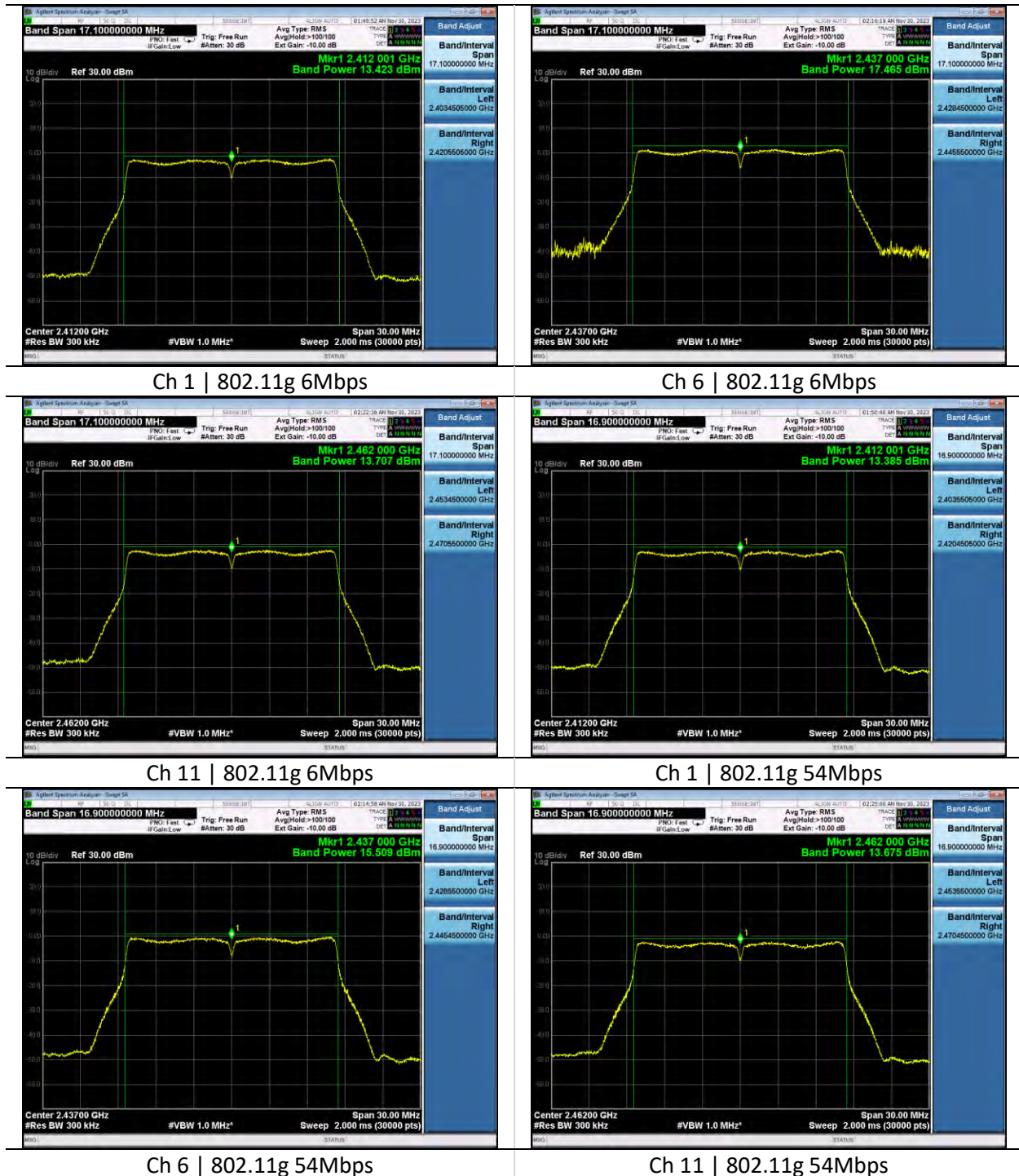
Input Power	15V Battery	Mode	2.4GHz TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	See 2.5		

Table

Frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	Margin (dB)	Data rate
2412	15.5	30	14.5	802.11b 1M
2437	17.6	30	12.4	802.11b 1M
2462	16.7	30	13.3	802.11b 1M
2412	15.3	30	14.7	802.11b 11M
2437	17.5	30	12.5	802.11b 11M
2462	16.7	30	13.3	802.11b 11M
2412	13.4	30	16.6	802.11g 6M
2437	17.5	30	12.5	802.11g 6M
2462	13.7	30	16.3	802.11g 6M
2412	13.4	30	16.6	802.11g 54M
2437	15.5	30	14.5	802.11g 54M
2462	13.7	30	16.3	802.11g 54M
2412	12.6	30	17.4	802.11n MCS0
2437	17.7	30	12.3	802.11n MCS0
2462	11.9	30	18.1	802.11n MCS0
2412	12.6	30	17.4	802.11n MCS7
2437	15.7	30	14.3	802.11n MCS7
2462	11.9	30	18.1	802.11n MCS7
2412	10.7	30	19.3	802.11n40 MCS0
2437	15.6	30	14.4	802.11n40 MCS0
2462	10.8	30	19.2	802.11n40 MCS0
2412	10.6	30	19.4	802.11n40 MCS7
2437	13.7	30	16.3	802.11n40 MCS7
2462	10.8	30	19.2	802.11n40 MCS7

Plots







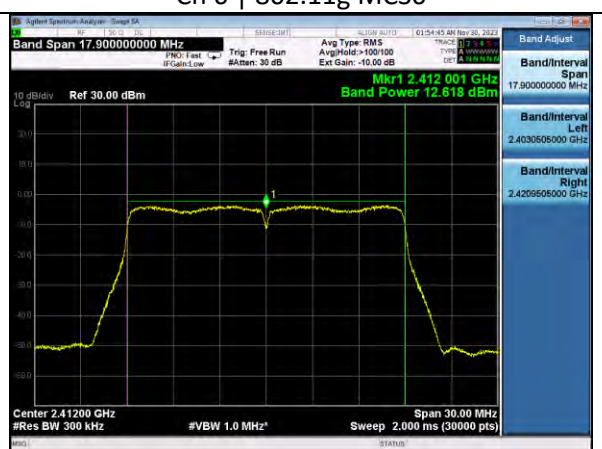
Ch 1 | 802.11n MCS0



Ch 6 | 802.11g MCS0



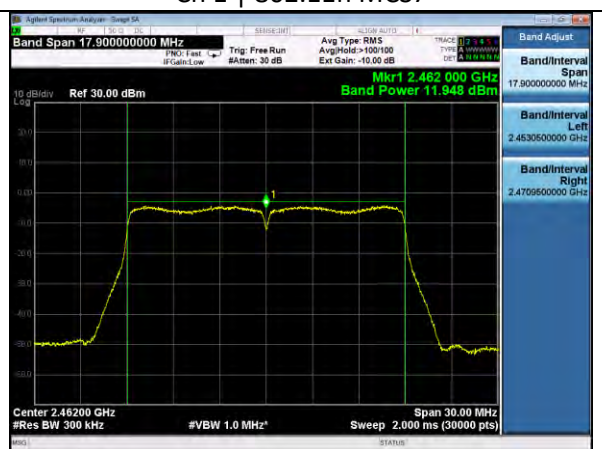
Ch 11 | 802.11n MCS0



Ch 1 | 802.11n MCS7



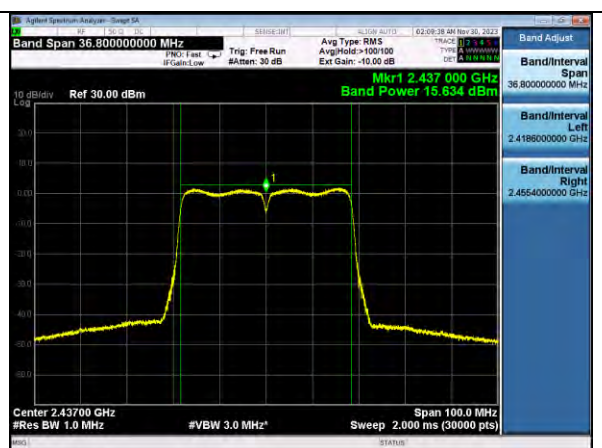
Ch 6 | 802.11n MCS7



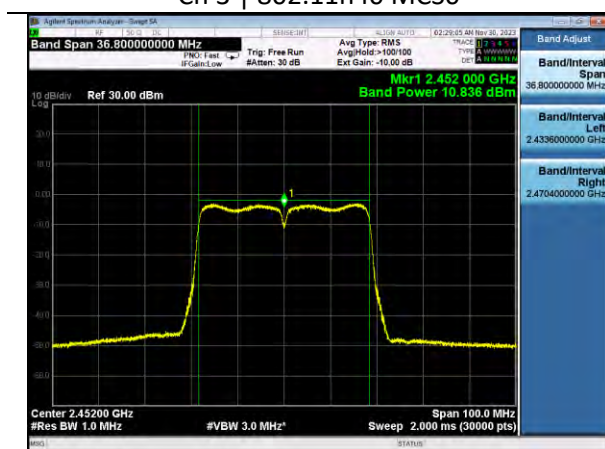
Ch 11 | 802.11n MCS7



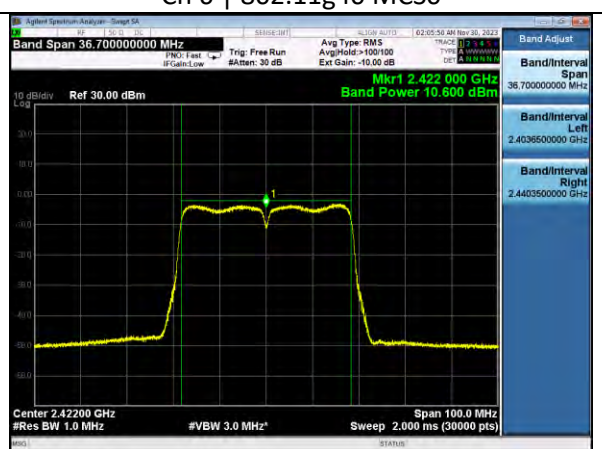
Ch 3 | 802.11n40 MCS0



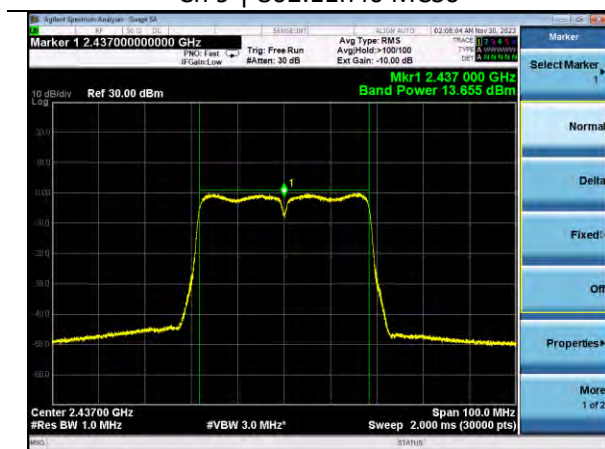
Ch 6 | 802.11g40 MCS0



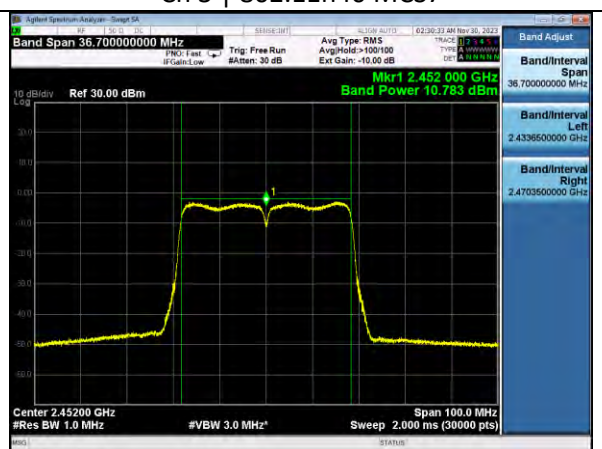
Ch 9 | 802.11n40 MCS0



Ch 3 | 802.11n40 MCS7



Ch 6 | 802.11n40 MCS7



Ch 9 | 802.11n40 MCS7

5.1.3 Antenna Port Conducted Emissions – Power Spectral Density

Operator	Dylan Rosenfeldt	QA	Adam Hauke
Temperature	22.6°C, 19.5°C	R.H. %	48.9%, 22.0%
Test Date	11/6/2023, 1/15/2024	Location	RF conducted Bench
Requirement	FCC: 15.247(e) ICED: RSS-247 5.2	Method	ANSI C63.10 11.10.5

Limits:

8dBm/3kHz

Test Parameters

Frequency	2400 - 2483.5 MHz	Setup	Conducted RF
RBW	100 kHz, 82kHz	VBW	300 kHz
Detector(s)	Peak – Trace/Final	Settings	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration
EE 960197	Meter - Hygro- Thermometer	Control Company	90080-03	180045461	7/21/2023	7/21/2024	Active Calibration

EUT Parameters

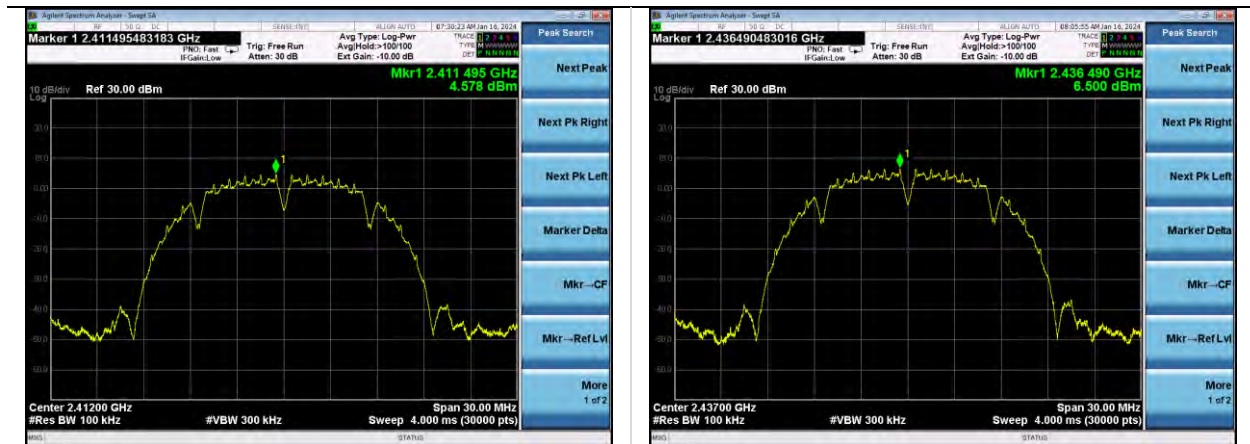
Input Power	15V Battery	Mode	2.4GHz TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	See 2.5		

Table

Frequency (MHz)	Average Output Power (dBm/100kHz)	Limit (dBm/3kHz)	Margin (dB)	Data rate
2412	4.6	8	3.4	802.11b 1M
2437	6.5	8	1.5	802.11b 1M
2462	5.6	8	2.4	802.11b 1M
2412	5.9	8	2.1	802.11b 11M
2437	7.3*	8	0.7	802.11b 11M
2462	7.2	8	0.8	802.11b 11M
2412	-0.6	8	8.6	802.11g 6M
2437	3.4	8	4.6	802.11g 6M
2462	-0.5	8	8.5	802.11g 6M
2412	0.9	8	7.1	802.11g 54M
2437	2.9	8	5.1	802.11g 54M
2462	1.1	8	6.9	802.11g 54M
2412	-1.1	8	9.1	802.11n MCS0
2437	3.9	8	4.1	802.11n MCS0
2462	-1.8	8	9.8	802.11n MCS0
2412	0.2	8	7.8	802.11n MCS7
2437	3.2	8	4.8	802.11n MCS7
2462	-0.6	8	8.6	802.11n MCS7
2412	-6.6	8	14.6	802.11n40 MCS0
2437	-1.6	8	9.6	802.11n40 MCS0
2462	-6.3	8	14.3	802.11n40 MCS0
2412	-4.3	8	12.3	802.11n40 MCS7
2437	-1.3	8	9.3	802.11n40 MCS7
2462	-4.5	8	12.5	802.11n40 MCS7

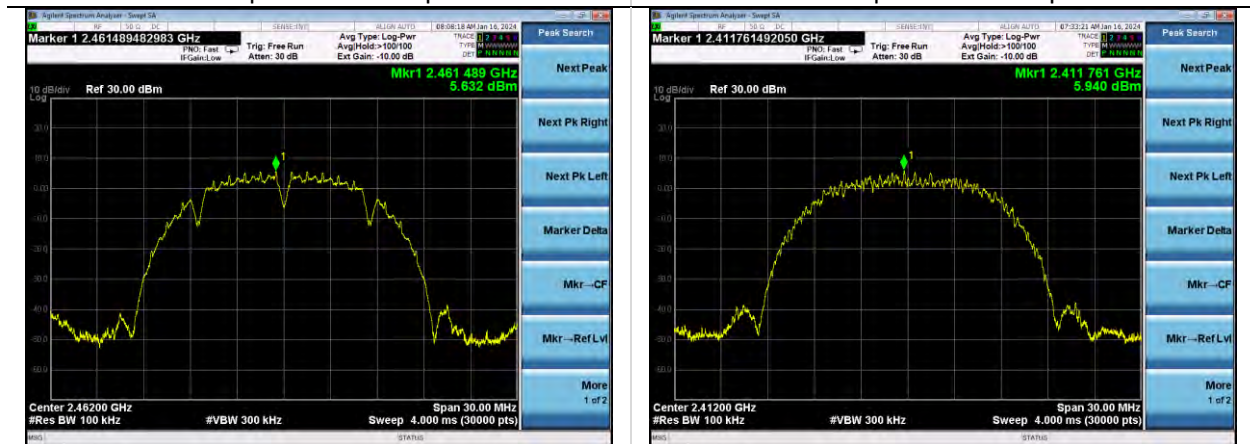
*Measurement RBW 82kHz

Plots



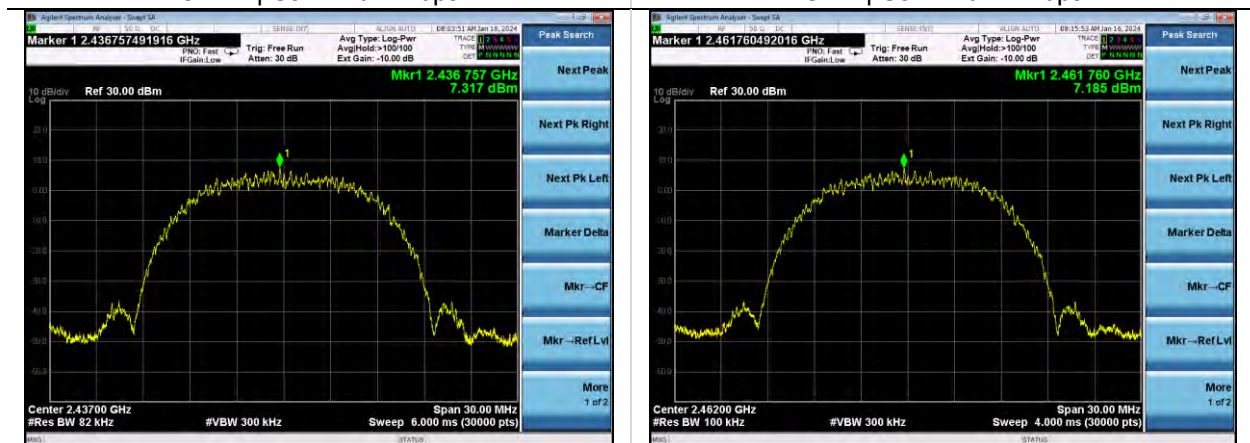
Ch 1 | 802.11b 1Mbps

Ch 6 | 802.11b 1Mbps



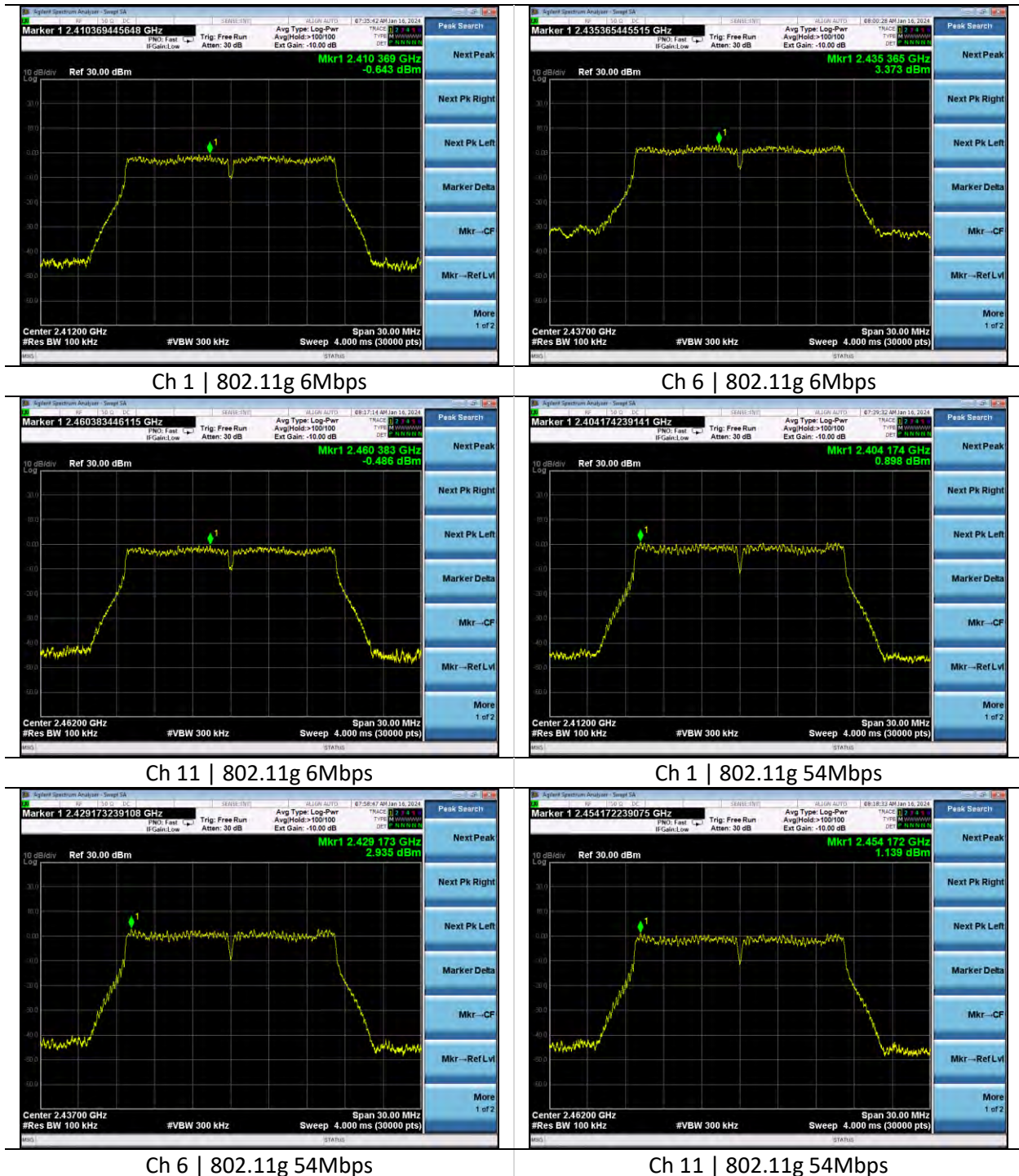
Ch 11 | 802.11b 1Mbps

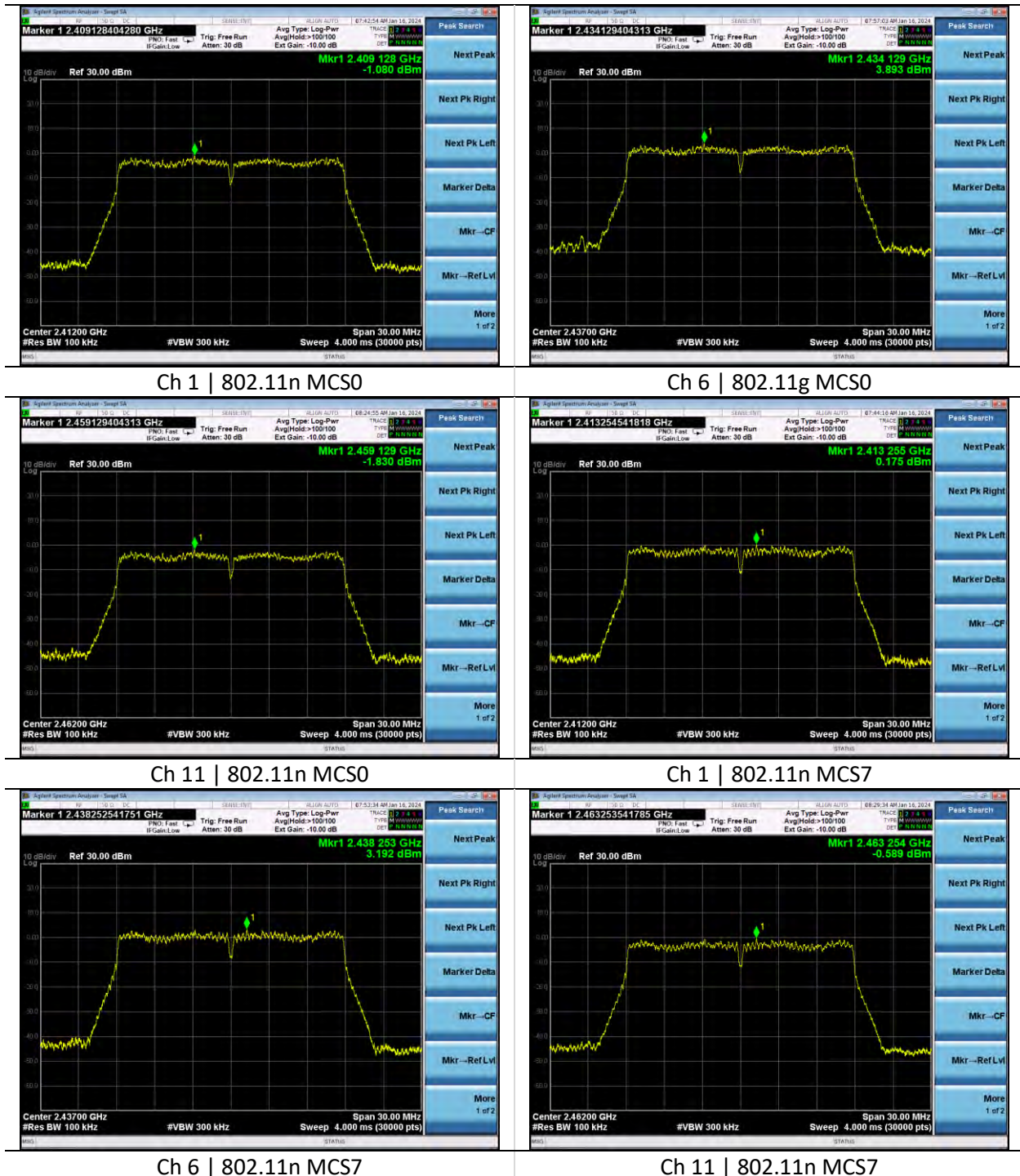
Ch 1 | 802.11b 11Mbps

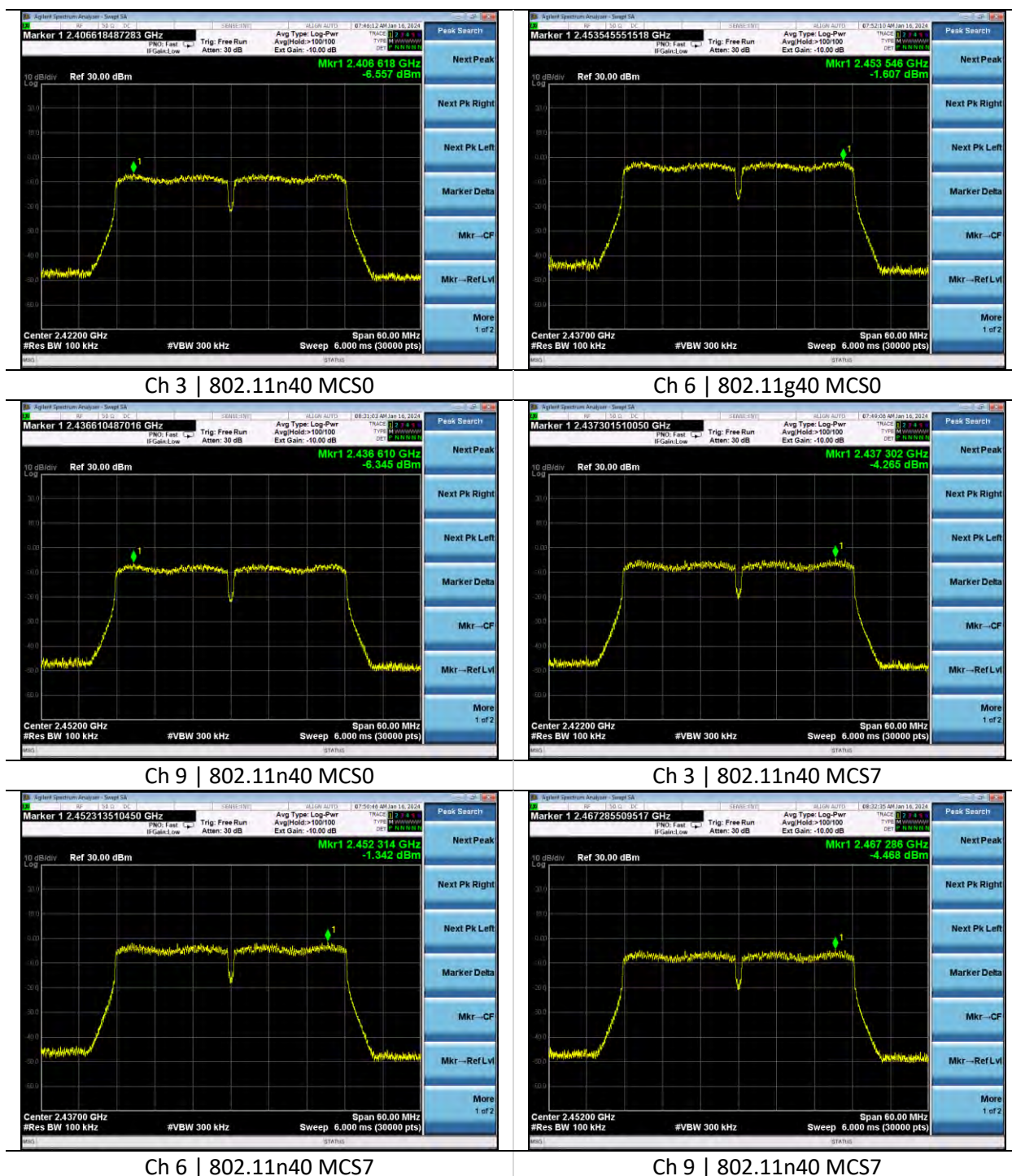


Ch 6 | 802.11b 11Mbps

Ch 11 | 802.11b 11Mbps







5.1.4 Antenna Port Conducted Emissions – Spurious Emissions

Operator	Dylan Rosenfeldt	QA	Anthony Smith
Temperature	23.3°C	R.H. %	49.9%
Test Date	7/23/2025	Location	RF conducted Bench
Requirement	FCC: 15.247d ICED: RSS-247 5.5	Method	ANSI C63.10 11.12

Limits:

-20dBc

Test Parameters

Frequency	30-25000 MHz	Setup	Conducted RF
RBW	100 kHz	VBW	300 kHz
Detector(s)	Peak – Trace/Final	Settings	Trace Max Hold

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	6/1/2025	6/1/2026	Active Calibration
EE 960197	Meter - Hygro- Thermometer	Control Company	90080-03	180045461	12/17/2024	12/17/2025	Active Calibration

EUT Parameters

Input Power	15V Battery	Mode	2.4GHz TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	See 2.5		

Reference Level Plot

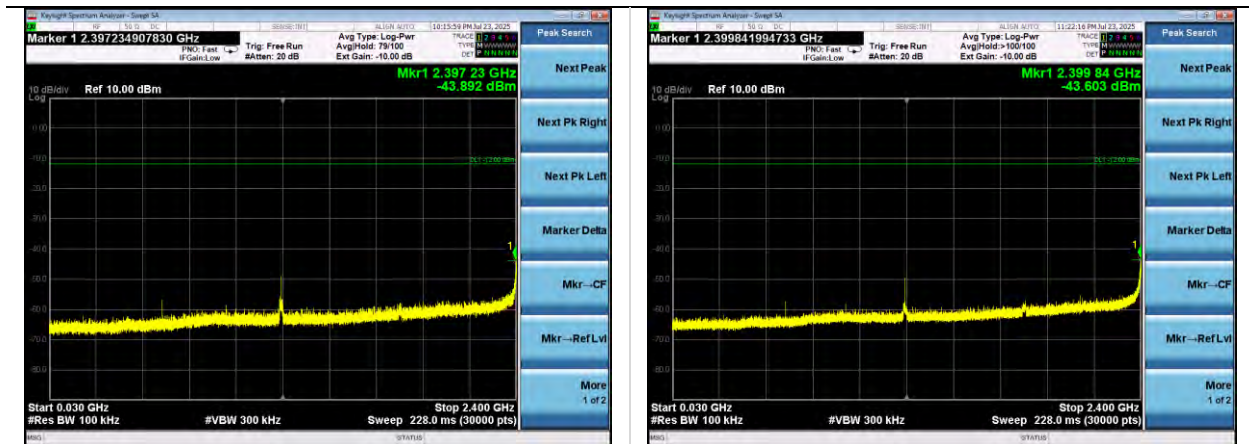


Ch 6 | 11Mbps | 8.0dBm

Table

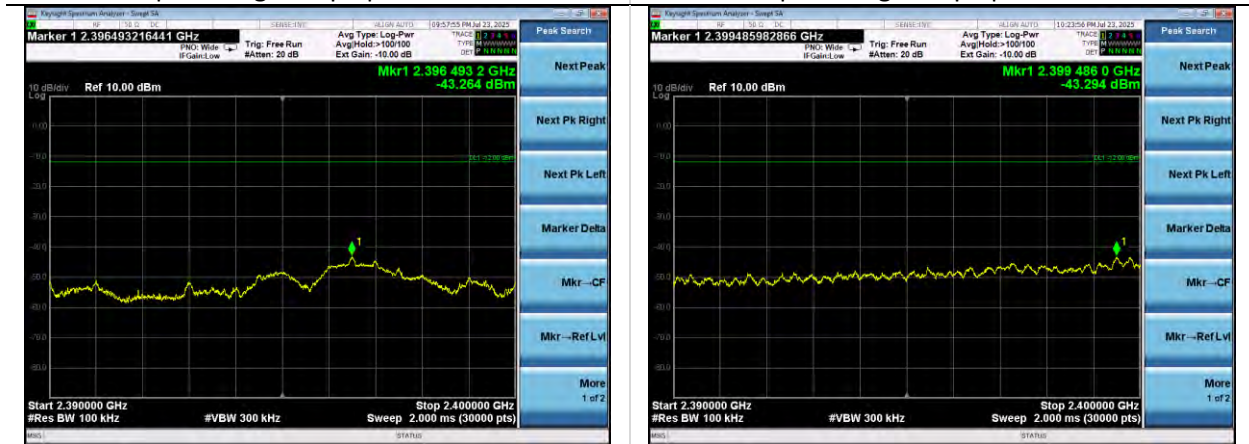
Channel	Mode	Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
1	1Mbps	2396.5	-43.3	-12.0	31.3
1	1Mbps	16884.4	-50.5	-12.0	38.5
1	11Mbps	1206.0	-45.6	-12.0	33.6
1	6Mbps	2399.1	-43.6	-12.0	31.6
1	54Mbps	2399.5	-43.3	-12.0	31.3
1	MCS0	2399.5	-45.7	-12.0	33.7
1	MCS7	2399.8	-44.7	-12.0	32.7
3	40MHz MCS0	2392.3	-46.0	-12.0	34.0
3	40MHz MCS7	2399.8	-45.4	-12.0	33.4
6	1Mbps	1218.5	-44.9	-12.0	32.9
6	6Mbps	1218.5	-44.4	-12.0	32.4
6	MCS0	1218.5	-45.0	-12.0	33.0
11	1Mbps	1231.0	-46.1	-12.0	34.1
11	11Mbps	1231.0	-43.9	-12.0	31.9

Worst Case Plots



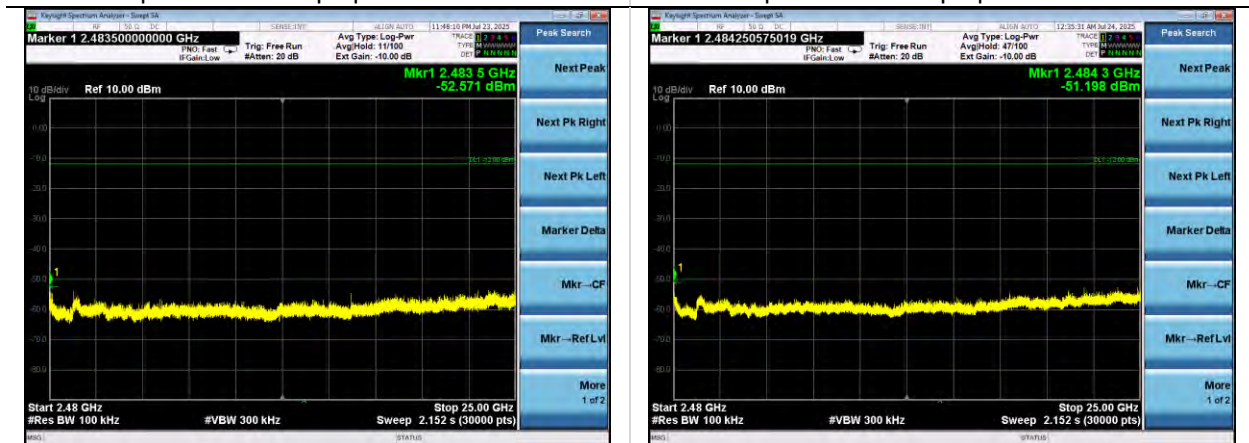
Ch 1 | 802.11g 6Mbps | 30-2400 MHz

Ch 1 | 802.11g 6Mbps | 30-2400 MHz



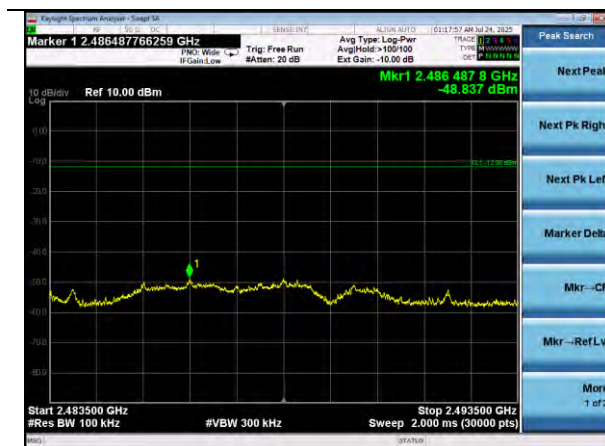
Ch 1 | 802.11b 1Mbps | 2390-2400 MHz

Ch 1 | 802.11b 1Mbps | 2390-2400 MHz

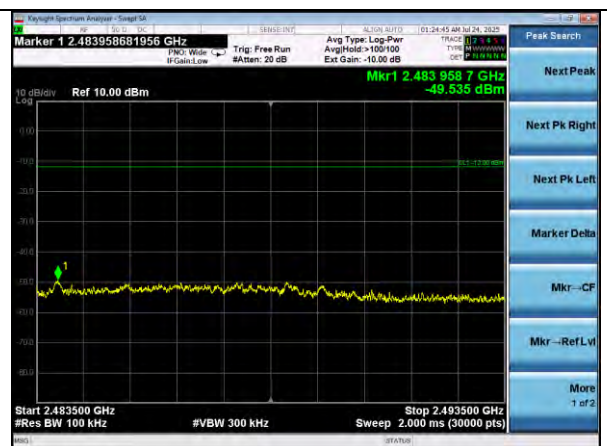


Ch 6 | 802.11b 1Mbps | 2483.5-25000 MHz

Ch 6 | 802.11n40 MCS7 | 2483.5-25000 MHz



Ch 11 | 802.11b 1Mbps | 2483.5-2493.5 MHz



Ch 11 | 802.11b 11Mbps | 2483.5-2493.5 MHz

5.1.5 Frequency Stability

Operator	Dylan Rosenfeldt	QA	Adam Hauke
Temperature	22.2°C	R.H. %	22.3%
Test Date	11/29/2023	Location	RF conducted Bench
Requirement	FCC: 2.1055(d) ISED: RSS-GEN 6.11	Method	ANSI C63.10 6.8.2

Test Parameters

Frequency	2402-2480 MHz	Voltage	102VAC, 120VAC, 138VAC 60Hz
Detector(s)	Peak	Settings	Max Hold
Notes	Tested on AC adapter		

Table

Channel	Voltage (V_{rms} 60Hz)	Center Frequency (Hz)
1	102	2111998692
	120	2411995442
	138	2411999242
6	102	2436998608
	120	2436997425
	138	2436998958
11	102	2461998125
	120	2461996458
	138	2461999692

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	Dylan Rosenfeldt	QA	Anthony Smith, Adam Alger, Jon Dilley
Temperature	20°C-25°C	R.H. %	25%-70%
Test Date	11/13/2023 – 11/17/2023, 6/30/2025	Location	Chamber 3, Chamber 5
Requirement	FCC: 15.247(d) ISED: RSS-GEN 8.10	Method	ANSI C63.10 11.12

15.209 Limits:

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

Test Parameters

Frequency	30-25000 MHz	Distance	3m
Detector(s)	Peak, Trace/Final Quasi-Peak, Final	Table height	80 cm (<1GHz) 150 cm (>1GHz)
RBW	120kHz (<1GHz) 1MHz (>1GHz)	VBW	1.2MHz (<1GHz) 3MHz (>1GHz)

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	2/21/2025	2/21/2026	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	1/24/2025	1/24/2026	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/3/2025	4/3/2026	Active Calibration
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	11/19/2024	11/19/2025	Active Calibration
AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	1/28/2025	1/28/2026	Active Verification
AA 960209	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	11/19/2024	11/19/2025	Active Calibration
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/3/2025	4/3/2026	Active Calibration
AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	12/2/2024	12/2/2025	Active Calibration
AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	12/9/2024	12/9/2025	Active Calibration
AA 960163	Antenna - Log Periodic	A.H. Systems, Inc.	SAS-512-2	500	12/11/2024	12/11/2025	Active Calibration

EUT Parameters

Input Power	15V Battery	Mode	2.4GHz TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	See 2.5		

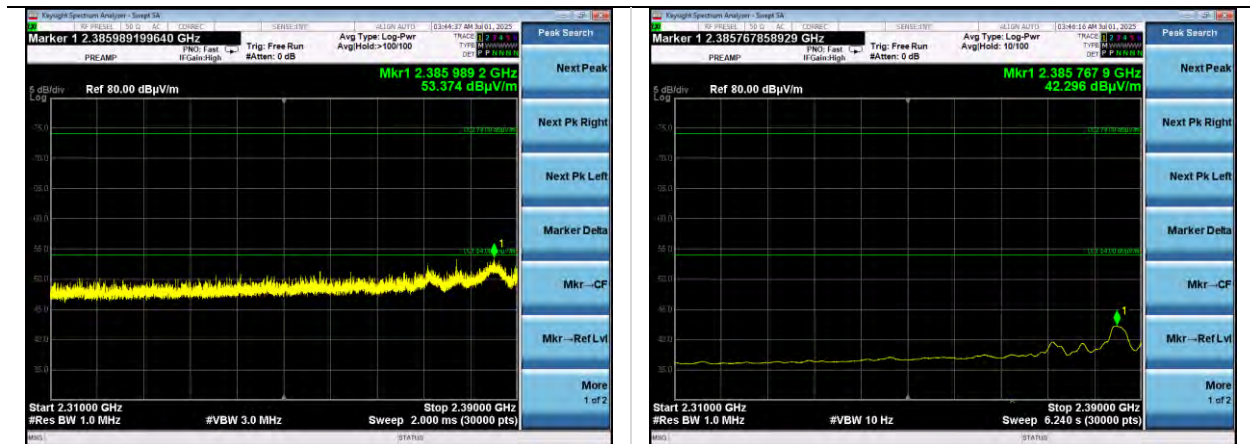
Lower Band Edge Emissions

Frequency (MHz)	EUT orientation	Polarity	Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Type	Power setting	Mode
2386.0	Z	V	53.4	74.0	20.6	pk	16	802.11b 1Mbps
2385.8	Z	V	42.3	54.0	11.7	avg	16	802.11b 1Mbps
2386.0	Z	V	53.0	74.0	21.0	pk	16	802.11b 11Mbps
2387.2	Z	V	40.9	54.0	13.1	avg	16	802.11b 11Mbps
2389.4	Z	V	53.4	74.0	20.6	pk	14	802.11g 6Mbps
2389.9	Z	V	39.6	54.0	14.4	avg	14	802.11g 6Mbps
2389.8	Z	V	53.8	74.0	20.2	pk	14	802.11g 54Mbps
2390.0	Z	V	39.5	54.0	14.5	avg	14	802.11g 54Mbps
2390.0	Z	V	54.8	74.0	19.2	pk	13	802.11n MCS0
2390.0	Z	V	39.6	54.0	14.4	avg	13	802.11n MCS0
2389.7	Z	V	52.4	74.0	21.6	pk	13	802.11n MCS7
2390.0	Z	V	39.6	54.0	14.4	avg	13	802.11n MCS7
2387.8	Z	V	53.2	74.0	20.8	pk	11	802.11n40 MCS0
2390.0	Z	V	40.1	54.0	13.9	avg	11	802.11n40 MCS0
2387.6	Z	V	53.2	74.0	20.8	pk	11	802.11n40 MCS7
2389.9	Z	V	40.2	54.0	13.8	avg	11	802.11n40 MCS7

Upper Band Edge Emissions

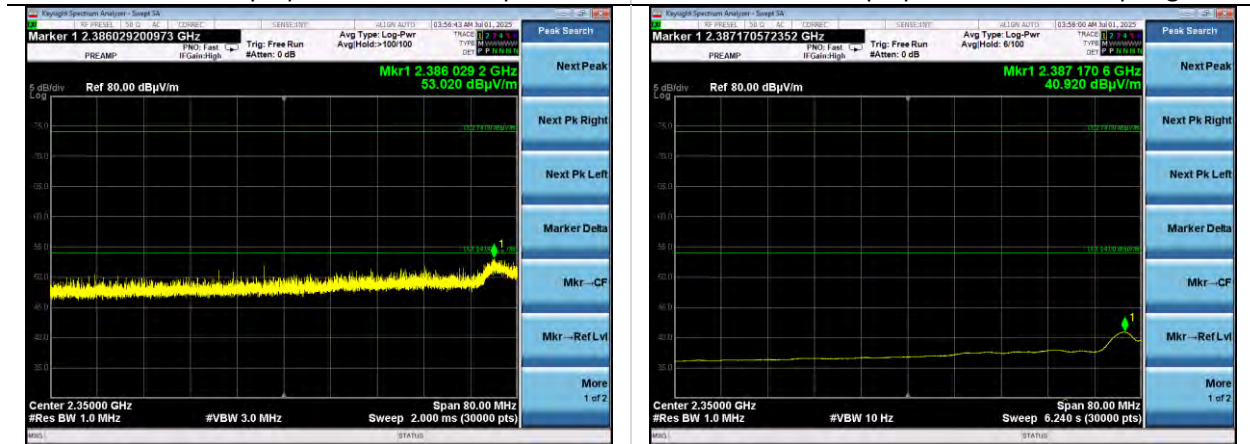
Frequency (MHz)	EUT orientation	Polarity	Reading (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Type	Power setting	Mode
2486.2	Z	V	53.3	74.0	20.7	pk	17	802.11b 1Mbps
2488.7	Z	V	41.2	54.0	12.8	avg	17	802.11b 1Mbps
2488.2	Z	V	54.3	74.0	19.7	pk	17	802.11b 11Mbps
2487.0	Z	V	41.3	54.0	12.7	avg	17	802.11b 11Mbps
2483.6	Z	V	55.4	74.0	18.6	pk	14	802.11g 6Mbps
2483.5	Z	V	39.8	54.0	14.2	avg	14	802.11g 6Mbps
2484.4	Z	V	54.1	74.0	19.9	pk	14	802.11g 54Mbps
2483.5	Z	V	39.9	54.0	14.1	avg	14	802.11g 54Mbps
2485.0	Z	V	53.8	74.0	20.2	pk	12	802.11n MCS0
2483.6	Z	V	39.8	54.0	14.2	avg	12	802.11n MCS0
2483.5	Z	V	54.5	74.0	19.5	pk	12	802.11n MCS7
2483.5	Z	V	39.9	54.0	14.1	avg	12	802.11n MCS7
2487.7	Z	V	54.6	74.0	19.4	pk	11	802.11n40 MCS0
2484.1	Z	V	40.6	54.0	13.4	avg	11	802.11n40 MCS0
2487.0	Z	V	54.3	74.0	19.7	pk	11	802.11n40 MCS7
2483.5	Z	V	40.4	54.0	13.6	avg	11	802.11n40 MCS7

Lower Band Edge Plots



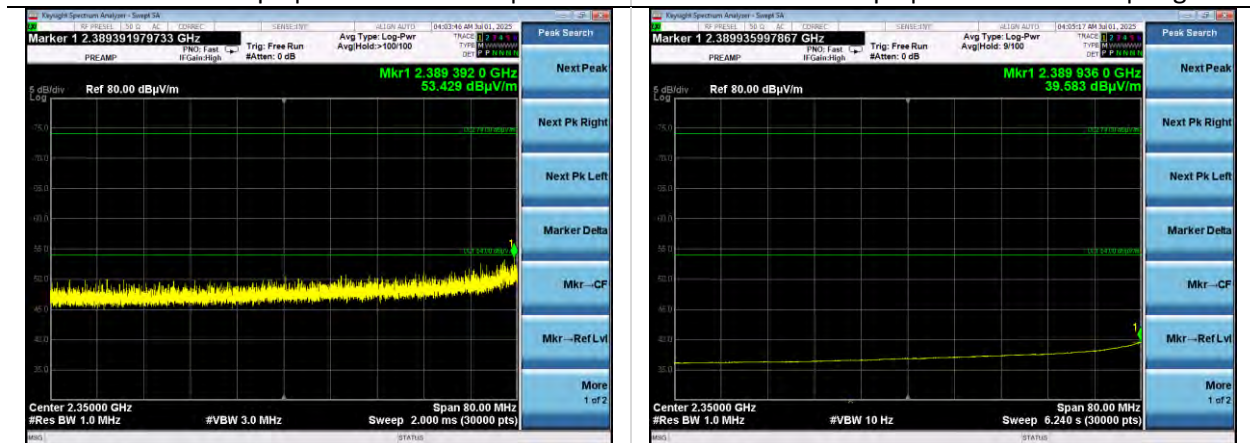
802.11b 1Mbps | 2310-2390 MHz | Pk

802.11b 1Mbps | 2310-2390 MHz | Avg



802.11b 11Mbps | 2310-2390 MHz | Pk

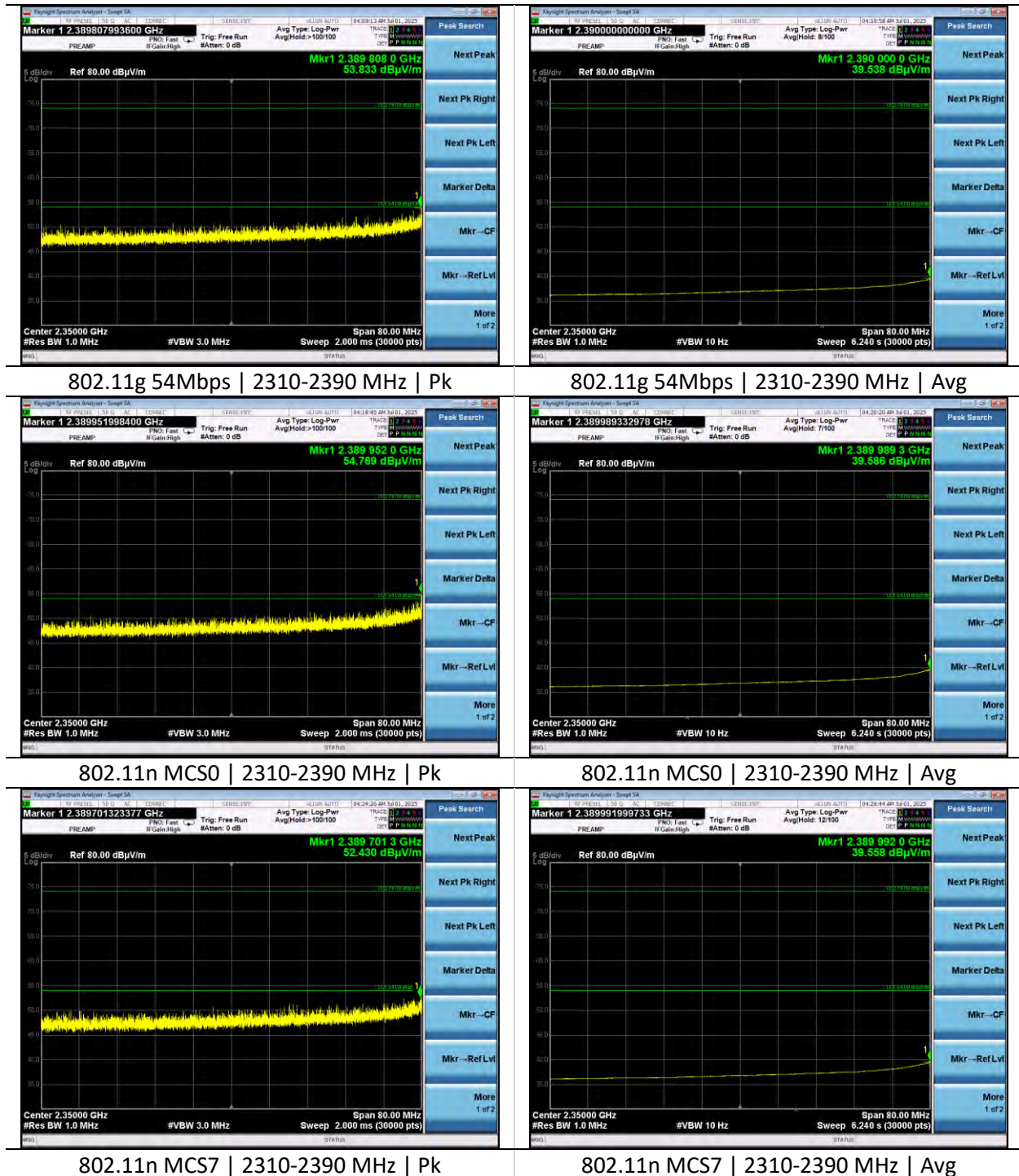
802.11b 11Mbps | 2310-2390 MHz | Avg

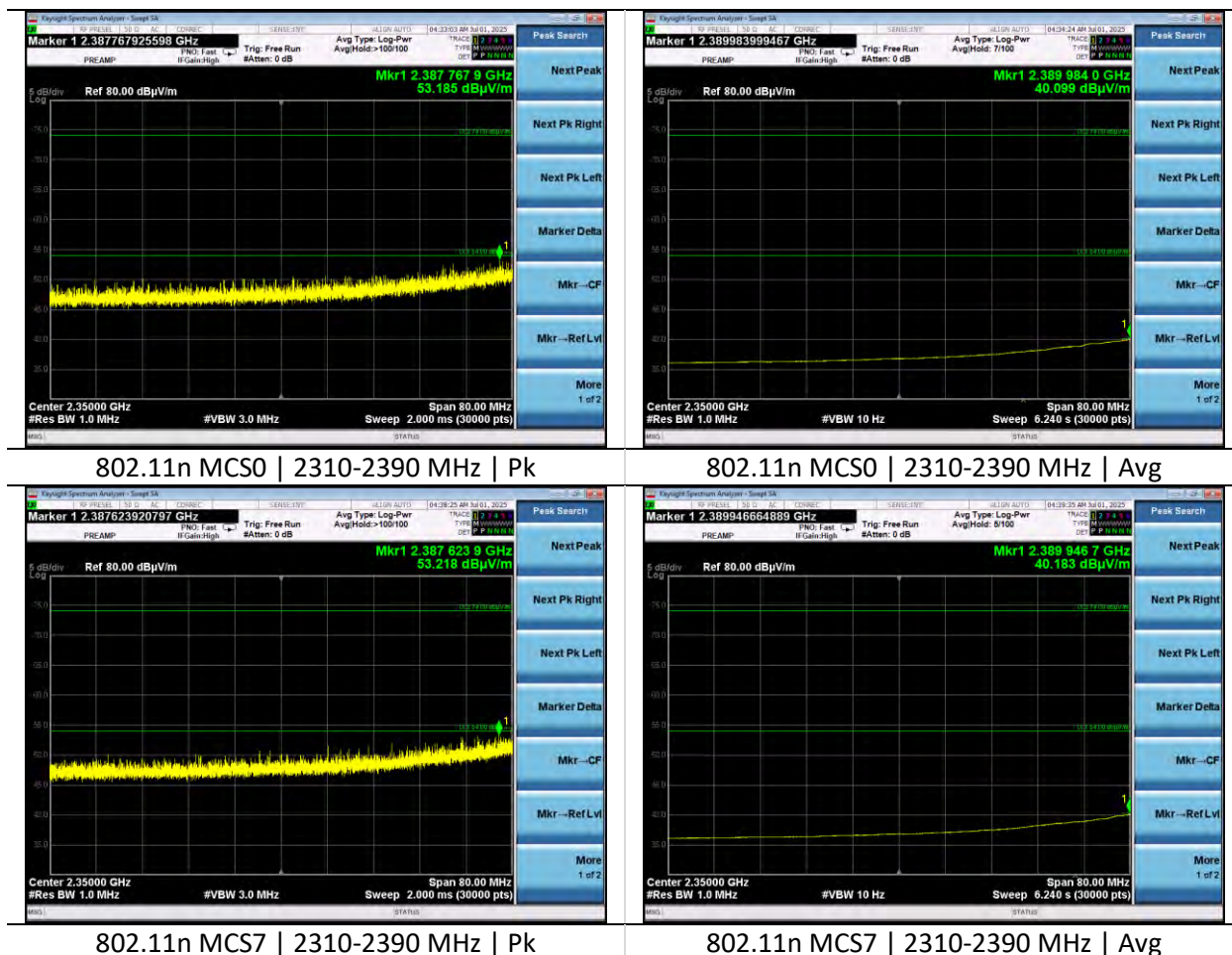


802.11g 6Mbps | 2310-2390 MHz | Pk

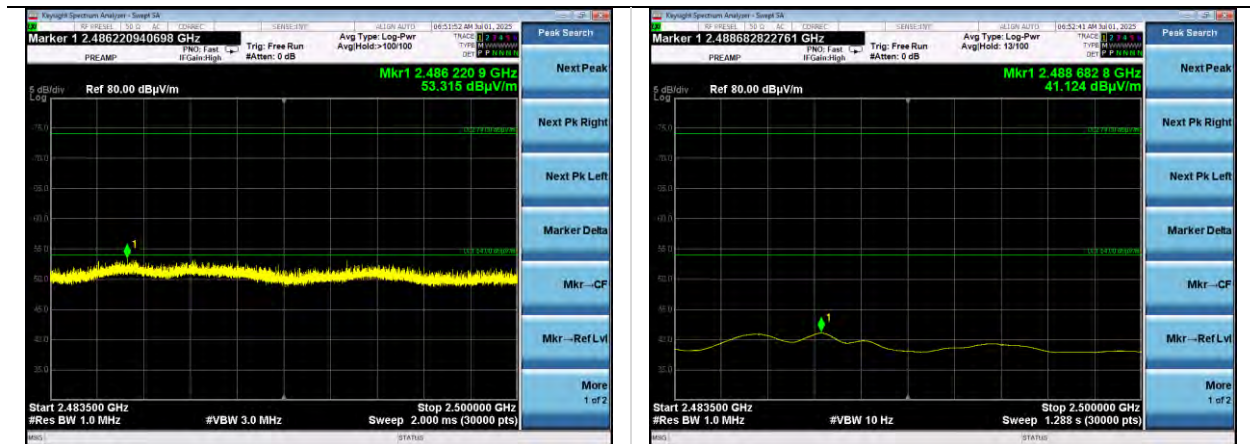
802.11g 6Mbps | 2310-2390 MHz | Avg

Company: R. Stahl HMI Systems	Page 36 of 50	Name: Trex Device Communicator
Report: TR3747C		Model: TREX2-00NAW
Quote: NBO-04-2023-006145		Serial: EMC RF1, EMC RF2



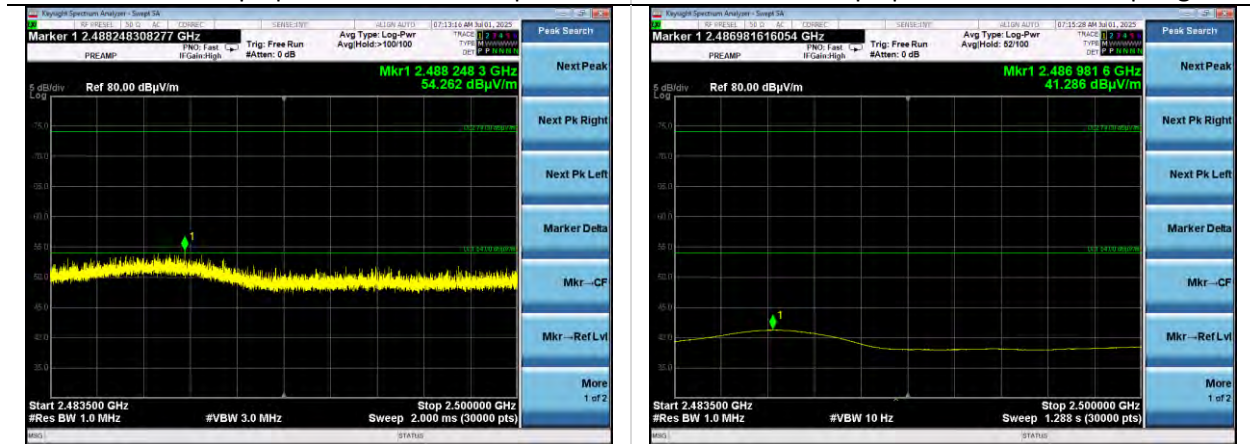


Lower Band Edge Plots



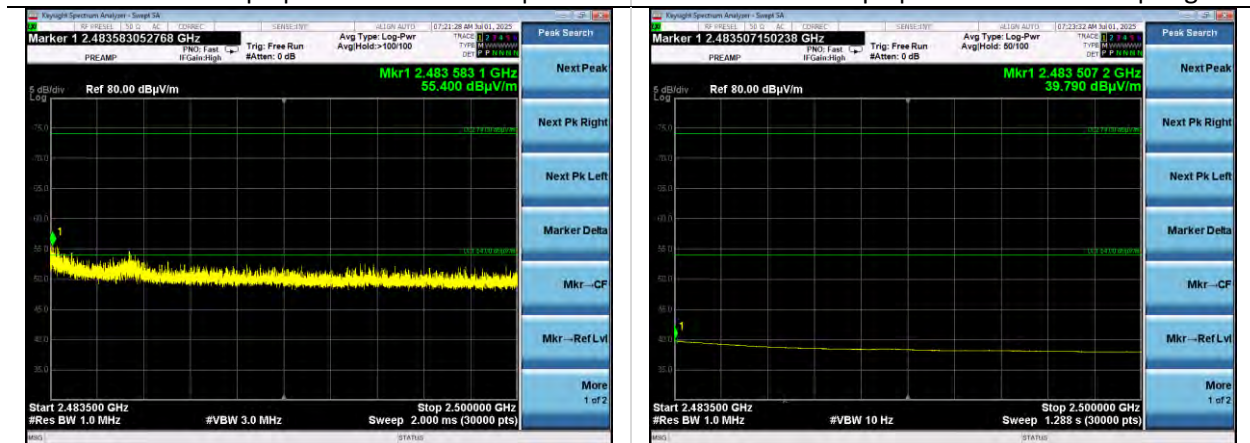
802.11b 1Mbps | 2483.5-2500 MHz | Pk

802.11b 1Mbps | 2483.5-2500 MHz | Avg



802.11b 11Mbps | 2483.5-2500 MHz | Pk

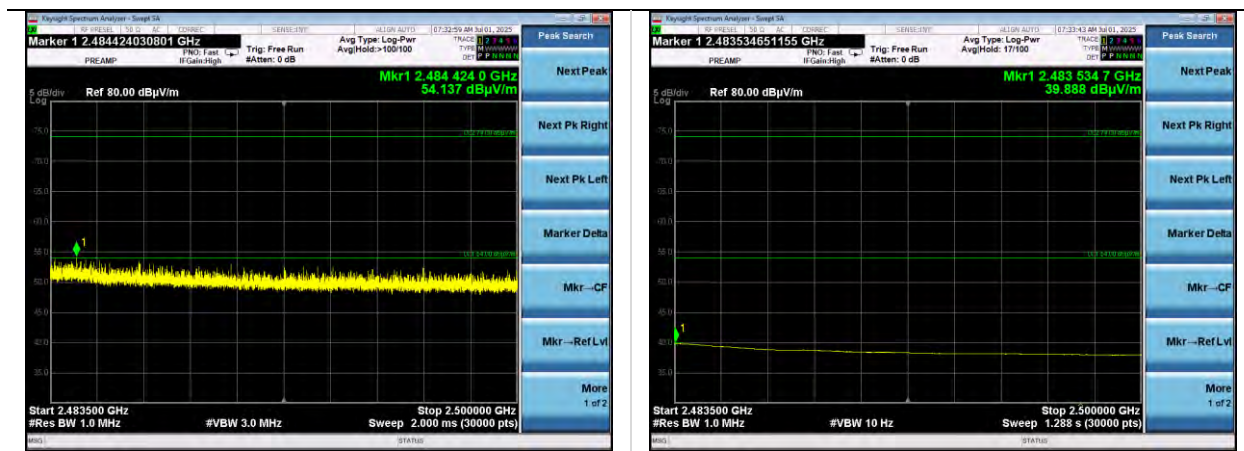
802.11b 11Mbps | 2483.5-2500 MHz | Avg



802.11g 6Mbps | 2483.5-2500 MHz | Pk

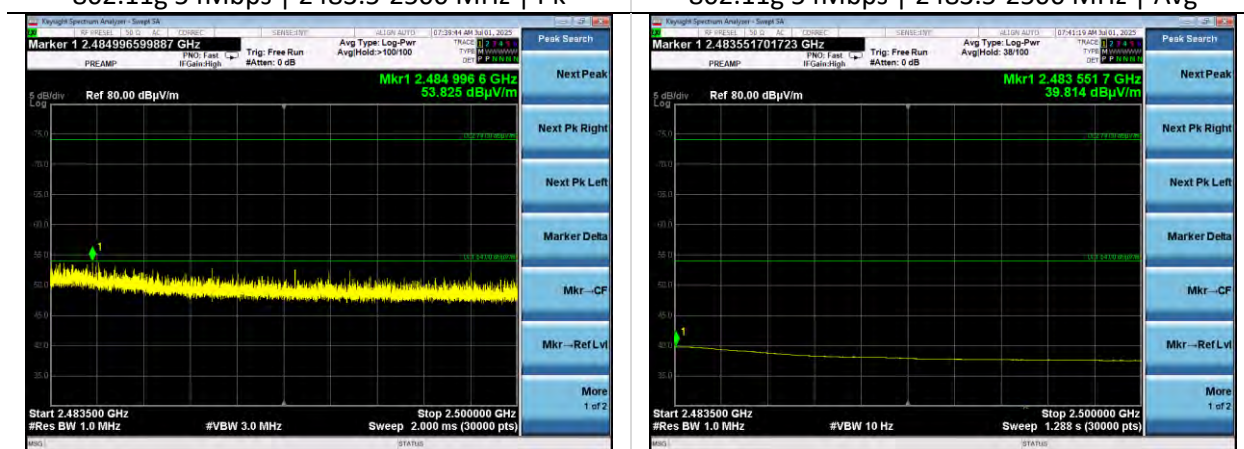
802.11g 6Mbps | 2483.5-2500 MHz | Avg

Company: R. Stahl HMI Systems	Page 39 of 50	Name: Trex Device Communicator
Report: TR3747C		Model: TREX2-00NAW
Quote: NBO-04-2023-006145		Serial: EMC RF1, EMC RF2



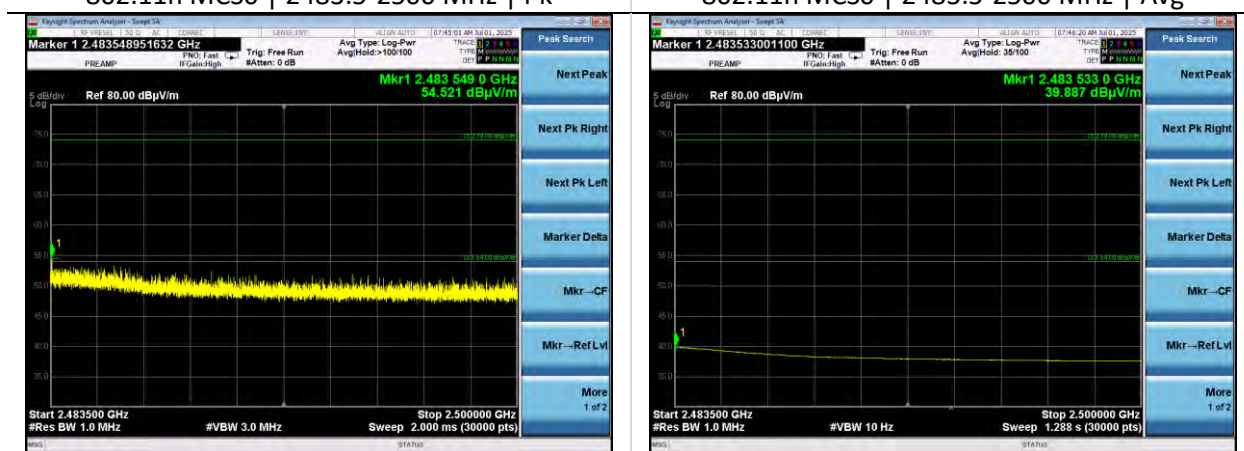
802.11g 54Mbps | 2483.5-2500 MHz | Pk

802.11g 54Mbps | 2483.5-2500 MHz | Avg



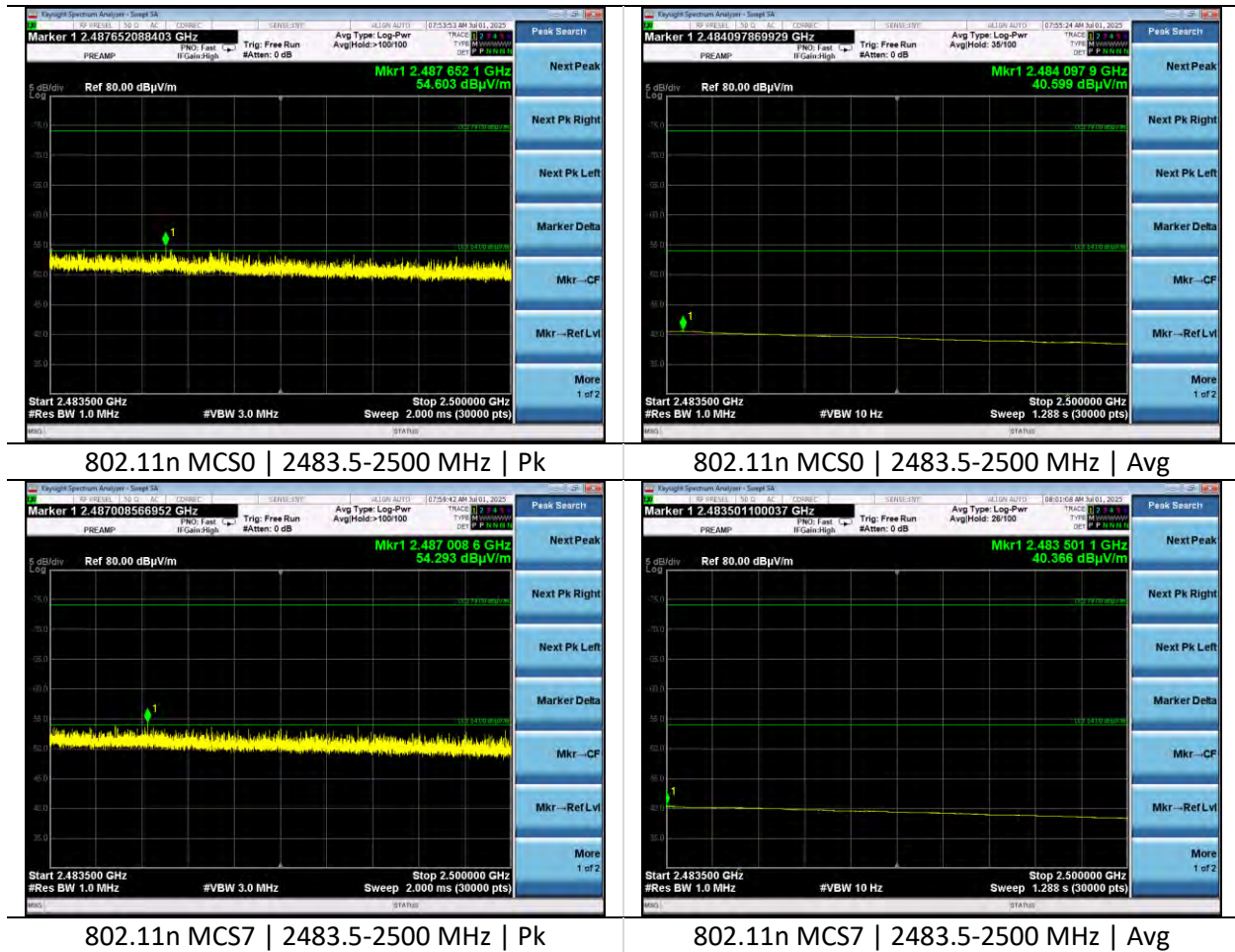
802.11n MCS0 | 2483.5-2500 MHz | Pk

802.11n MCS0 | 2483.5-2500 MHz | Avg



802.11n MCS7 | 2483.5-2500 MHz | Pk

802.11n MCS7 | 2483.5-2500 MHz | Avg

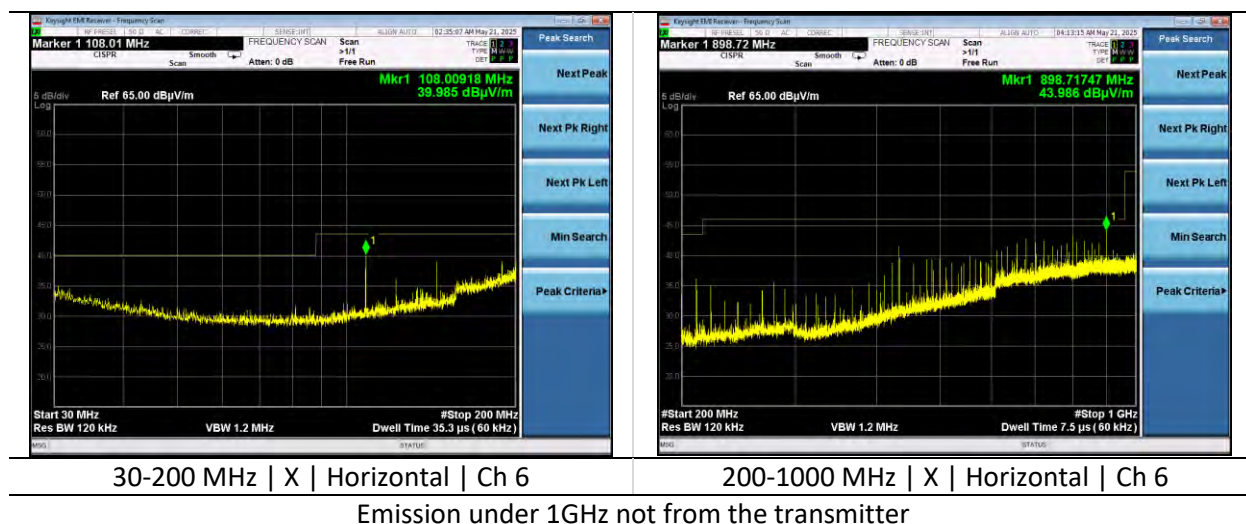


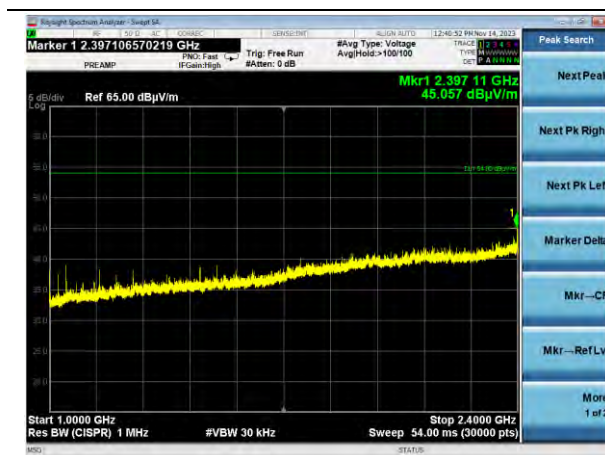
Spurious Emissions

Frequency (MHz)	EUT orientation	Antenna Polarity	Peak Reading (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)	Average Margin (dB)	Peak Margin (dB)	Channel
7311.9	Vertical	Vertical	44.9	54.0	74.0	9.1	29.1	6
4874.0	Vertical	Horizontal	42.8	54.0	74.0	11.2	31.2	6
4924.0	vertical	Horizontal	43.6	54.0	74.0	10.4	30.4	11
4924.0	flat	vertical	43.2	54.0	74.0	10.8	30.8	11
4874.0	Flat	Vertical	43.9	54.0	74.0	10.1	30.1	6
4824.0	flat	vertical	43.5	54.0	74.0	10.5	30.5	1
4824.0	Horizontal	Vertical	42.3	54.0	74.0	11.7	31.7	1
19296.0	Vertical	Vertical	47.8	54.0	74.0	6.2	26.2	1

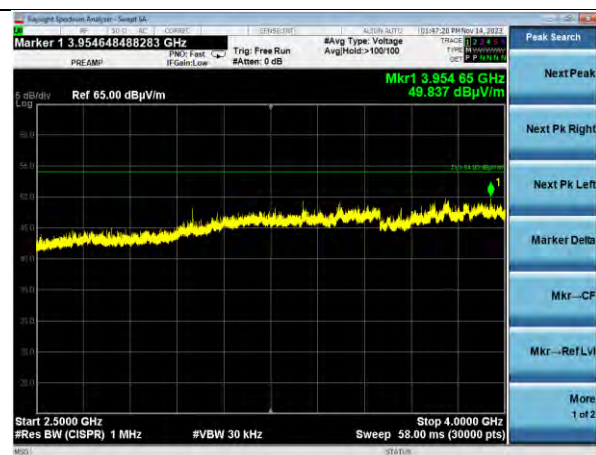
Note: Peak limit complies with average margin

Spurious Emissions Plots





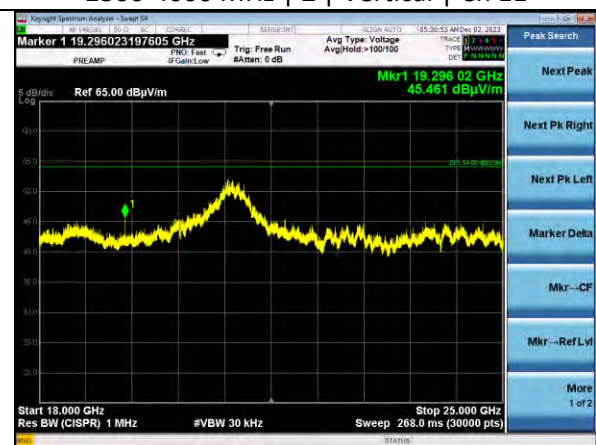
1000-2400 MHz | Y | Vertical | Ch 1



2500-4000 MHz | Z | Vertical | Ch 11



4-18 GHz | Y | Vertical | Ch 11



18-25 GHz | all orientations and polarities |
~20cm from antenna

5.2.2 Spurious Radiated Emissions – Spot Checks

Operator	Dylan Rosenfeldt	QA	Anthony Smith
Temperature	19.7°C	R.H. %	70.1%
Test Date	7/3/2025	Location	Chamber 3
Requirement	FCC: 15.247(d) ISED: RSS-GEN 8.10	Method	ANSI C63.10 11.12

15.209 Limits:

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

Test Parameters

Frequency	30-25000 MHz	Distance	3m
Detector(s)	Peak, Trace/Final Quasi-Peak, Final	Table height	80 cm (<1GHz) 150 cm (>1GHz)
RBW	120kHz (<1GHz) 1MHz (>1GHz)	VBW	1.2MHz (<1GHz) 3MHz (>1GHz)

Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960158	Antenna - Double Ridge Horn	ETS Lindgren	3117	109300	2/21/2025	2/21/2026	Active Calibration
LSC-300	Cable	Chamber 3 Emissions	-	-	1/24/2025	1/24/2026	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/3/2025	4/3/2026	Active Calibration
AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	11/19/2024	11/19/2025	Active Calibration
AA 960220	Cable	A.H. Systems, Inc.	SAC-26G-6	552	1/28/2025	1/28/2026	Active Verification
AA 960209	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	037101808	11/19/2024	11/19/2025	Active Calibration
AA 960154	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-02	4/3/2025	4/3/2026	Active Calibration
AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	12/2/2024	12/2/2025	Active Calibration
AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	12/9/2024	12/9/2025	Active Calibration
AA 960163	Antenna - Log Periodic	A.H. Systems, Inc.	SAS-512-2	500	12/11/2024	12/11/2025	Active Calibration

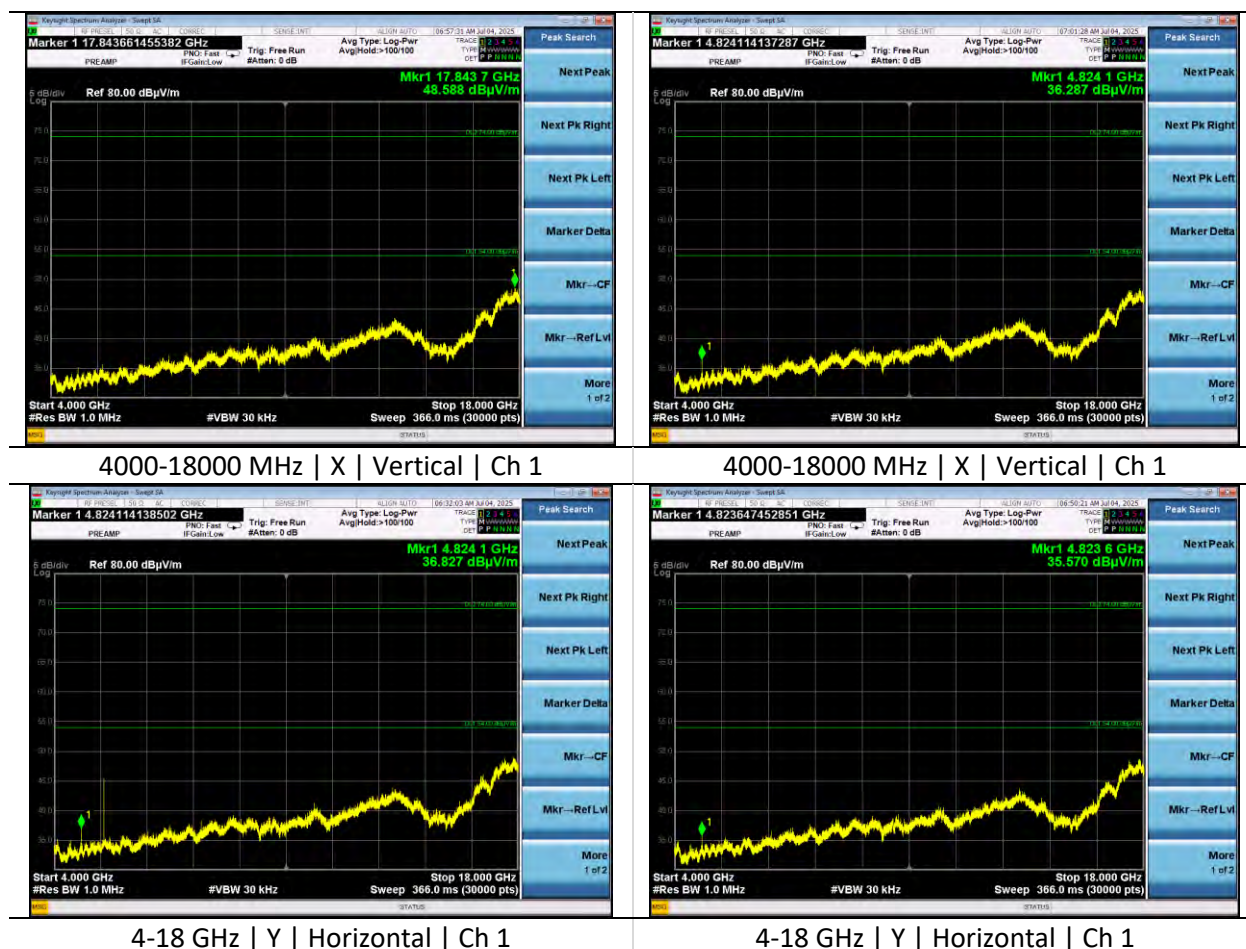
EUT Parameters

Input Power	15V Battery	Mode	2.4GHz WLAN TX
Frequency	2412MHz, 2437MHz, 2462MHz	Channel	1 (2412MHz), 6 (2437MHz), 11 (2462MHz)
Data Rates	802.11b 1Mbps		

Spurious Emissions

Frequency (MHz)	EUT orientation	Antenna Polarity	Limit (dBμV/m)	Margin (dB)	Measurement	Power Setting
4824.0	X	V	74.0	28.7	pk	16
4824.0	X	V	54.0	18.3	avg	16
4874.0	X	V	74.0	29.3	pk	18
4874.0	X	V	54.0	18.0	avg	18
4874.1	Y	H	74.0	29.8	pk	18
4874.0	Y	H	54.0	19.8	avg	18
4924.2	X	V	74.0	29.6	pk	17
4924.0	X	V	54.0	18.6	avg	17

Spurious Emissions Plots

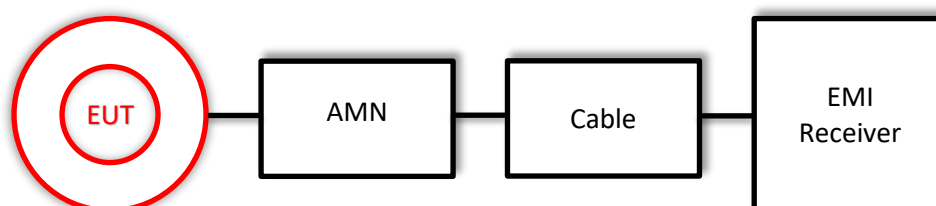


5.3 AC Mains Conducted Emissions

Description of Measurement	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. 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)
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Example Calculations	$\text{Measurement (dB}\mu\text{V)} + \text{Cable factor (dB)} + \text{Other (dB)} = \text{Corrected Reading (dB}\mu\text{V)}$ $\text{Margin (dB)} = \text{Limit (dB}\mu\text{V)} - \text{Corrected Reading (dB}\mu\text{V)}$
-----------------------------	---

Block Diagram



5.3.1 AC Mains Conducted Emissions

Operator	Dylan Rosenfeldt	QA	Adam Alger
Temperature	22.1°C	R.H. %	27.6%
Test Date	12/14/2023	Location	AC Conducted Emissions Bench
Requirement	FCC: 15.207 ISED: RSS-GEN 8.8	Method	ANSI C63.10 6.2

15.207 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	0.150-30 MHz	Distance	40cm from VCP >80cm from LISN
Detector(s)	Peak – Trace Quasi-Peak – Final Average – Final	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	12/10/2024	12/10/2025	Active Calibration
EE 960162	LISN	COM-POWER	LI-215A	191969	3/31/2025	3/31/2026	Active Calibration
EE 960197	Meter - Hygro-Thermometer	Control Company	90080-03	180045461	12/17/2024	12/17/2025	Active Calibration
LSC-211	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071-002	1/29/2025	1/29/2026	Active Verification

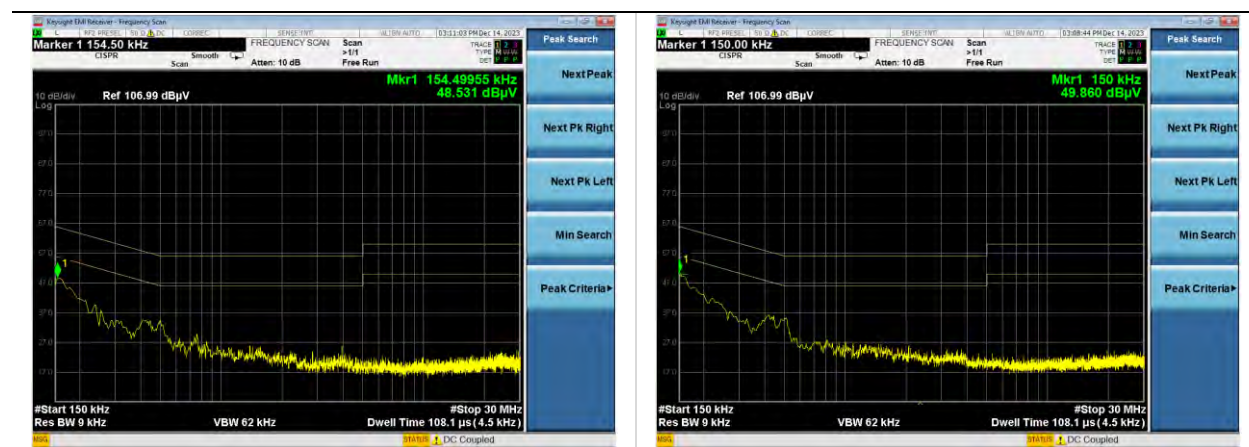
EUT Parameters

Input Power	15VDC battery charged on 120VAC adapter	Mode	2.4GHz WLAN Transmitting
EUT	Plugged in, charging		

Table

Line	Frequency (MHz)	Peak Reading (dBμV)	Quasi-Peak Reading (dBμV)	Average Reading (dBμV)	Quasi-Peak Limit (dBμV)	Average Limit (dBμV)	Quasi-Peak Margin (dB)	Average Margin (dB)
1	0.150	53.4	48.5	33.3	66.0	56.0	17.5	22.7
1	0.487	36.2	33.2	26.0	56.2	46.2	23.0	20.2
1	1.491	27.0	23.0	15.6	56.0	46.0	33.0	30.4
2	0.150	53.4	48.3	33.2	66.0	56.0	17.7	22.8
2	0.415	36.9	33.4	26.7	57.5	47.5	24.1	20.8
2	1.279	26.6	22.6	15.3	56.0	46.0	33.4	30.7

Plots



L1 | 802.11b 1Mbps | Ch 6

L2 | 802.11b 1Mbps | Ch 6

Emissions do not change with channel

6 REVISION HISTORY

Version	Date	Notes	Person
0	7/30/2025	Initial Draft	Dylan Rosenfeldt
1	7/31/2025	Updated Draft	Dylan Rosenfeldt
2	7/31/2025	Final Draft	Dylan Rosenfeldt
3	8/6/2025	Updated Model Name	Dylan Rosenfeldt
4	8/28/2025	Updated PSD plots	Dylan Rosenfeldt

END OF REPORT