

FCC/ISED Test Report

Prepared for: Garmin International, Inc.

Address: 1200 E. 151st Street
Olathe, Kansas, 66062, USA

Product: A04625

Test Report No: R20241202-70-E2 **Rev:** C

Approved by:



Fox Lane
EMC Test Engineer

DATE: June 25, 2025

Total Pages: 76

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Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

REVISION PAGE

Rev. No.	Date	Description
0	30 May 2025	Issued by FLane Prepared by FLane, ESchmidt
A	20 June 2025	Updated Model Name/FCC/IC ID – FL
B	20 June 2025	Updated Model Name/FCC/IC ID – FL
C	25 June 2025	Added emissions statement corrected plot labels – FL



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

CONTENTS

Revision Page 2

1.0 Summary of test results.....4

2.0 EUT Description5

2.1 Equipment under test5

2.2 Description of test modes5

2.3 Description of support units5

3.0 Laboratory and General Test Description6

3.1 Laboratory description.....6

3.2 Test personnel.....6

3.3 Test equipment.....7

3.4 General Test Procedure and Setup for Radio Measuremnts8

4.0 Results10

4.1 Output Power14

4.2 Bandwidth.....15

4.3 Duty Cycle16

4.4 Radiated emissions.....20

4.5 Conducted Spurious Emissions27

4.6 Band edges33

4.7 Power Spectral Density34

Appendix A: Sample Calculation35

Appendix B – Measurement Uncertainty36

Appendix C – Graphs and Tables37

REPORT END.....76

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. Summary of test results presented in this report correspond to the following standards/section(s):

- (1) US Code of Federal Regulations, Title 47, Part 15
- (2) ISED RSS-Gen, Issue 5
- (3) ISED RSS-247, Issue 3

APPLIED STANDARDS AND REGULATIONS		
Standard Section	Test Type	Result
FCC Part 15.35 RSS Gen, Issue 5, Section 6.10	Duty Cycle	Pass
FCC Part 15.247(b)(3) RSS-247 Issue 3 Section 5.4(d)	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 3 Section 5.2 (a)	Bandwidth	Pass
FCC Part 15.209 RSS-Gen Issue 5, Section 7.3	Receiver Radiated Emissions	Pass
FCC Part 15.209 (restricted bands), 15.247 (unrestricted) RSS-247 Issue 3 Section 5.5, RSS-Gen Issue 5, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 3 Section 5.2 (b)	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 3 Section 5.5	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	N/A*

*DC Battery Powered Device



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04625
FCC ID	IPH-04625
IC ID	1792A-04625
EUT Received	28 March 2025
EUT Tested	28 March 2025- 14 May 2025
Serial No.	K001 (Radiated Sample) (Lab Assigned Serial Number) K002 (Conducted Sample) (Lab Assigned Serial Number)
Operating Band	2400 – 2483.5 MHz
Device Type	☐ GMSK ☐ GFSK ☐ BT BR ☐ BT EDR 2MB ☐ BT EDR 3MB ☒ 802.11x
Power Supply / Voltage	External Battery Pack, 32VDC Pack

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 DESCRIPTION OF TEST MODES

The operating range of the EUT is dependent on the device type found in section 2.1:

Data Rates:

Modulation	Low/High Data rate
802.11b	1MB/11MB
802.11g	6MB/54MB
802.11n	MCS0/MCS7

For 802.11x Transmissions:

Channel	Frequency
Low	2412 MHz
Mid	2437 MHz
High	2462 MHz

These are the only representative channels tested in the frequency range according to FCC Part 15.31 and RSS-Gen Table A1. See the operational description for a list of all channel frequencies and designations.

2.3 DESCRIPTION OF SUPPORT UNITS

None

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

3.0 LABORATORY AND GENERAL TEST DESCRIPTION

3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
 4740 Discovery Drive
 Lincoln, NE 68521

A2LA Certificate Number: 1953.01
 FCC Accredited Test Site Designation No: US1060
 Industry Canada Test Site Registration No: 4294A
 NCC CAB Identification No: US0177

Environmental conditions varied slightly throughout the tests:

Relative humidity of $35 \pm 4\%$
 Temperature of $22 \pm 3^\circ$ Celsius



3.2 TEST PERSONNEL

No.	PERSONNEL	TITLE	ROLE
1	Fox Lane	Test Engineer	Testing, Review, and Report
2	Blake Winter	Test Engineer	Testing
3	Ethan Schmidt	Test Engineer	Testing and Report

Notes:

All personnel are permanent staff members of NCEE Labs. No testing or review was sub-contracted or performed by sub-contracted personnel.

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (44GHz)	N9038A	MY59050109	July 17, 2024	July 18, 2026
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	July 17, 2024	July 18, 2026
Keysight EXA Signal Analyzer	N9010A	MY56070862	July 18, 2023	July 17, 2025
SunAR RF Motion	JB1	A082918-1	July 17, 2024	July 17, 2025
EMCO Horn Antenna	3117	29616	June 12, 2024	June 12, 2025
Agilent Preamp*	87405A	3207A01475	May 2, 2024	May 2, 2026
ETS Red Preamplifier (Orange)*	3115-PA	00218576	January 22, 2024	January 22, 2026
Trilithic High Pass Filter*	6HC330	23042	June 5, 2023	June 5, 2025
Tektronix Average Power Meter	PSM3110	118674	July 17, 2024	July 18, 2026
ETS – Lindgren- VSWR on 10m Chamber	10m Semi-anechoic chamber-VSWR	4740 Discovery Drive	May 15, 2024	May 15, 2027
NCEE Labs-NSA on 10m Chamber*	10m Semi-anechoic chamber-NSA	NCEE-001	May 22, 2024	May 22, 2026
RF Cables (3m Ant. to Control room Bulkhead)	MFR-57500	1E3874	June 5, 2023	June 5, 2025
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	June 5, 2023	June 5, 2025
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	June 5, 2023	June 5, 2025
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	June 5, 2023	June 5, 2025
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	June 5, 2023	June 5, 2025
N connector bulkhead (control room)*	PE9128	NCEEBH2	June 5, 2023	June 5, 2025
TDK Emissions Lab Software	V11.25	700307	NA	NA

*Internal Characterization

Notes:

All equipment is owned by NCEE Labs and stored permanently at NCEE Labs facilities.



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMNTS

Measurement type presented in this report (Please see the checked box below):

Conducted ☒

The conducted measurements were performed by connecting the output of the transmitter directly into a spectrum analyzer using an impedance matched cable and connector soldered to the EUT in place of the antenna. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in Appendix C. All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

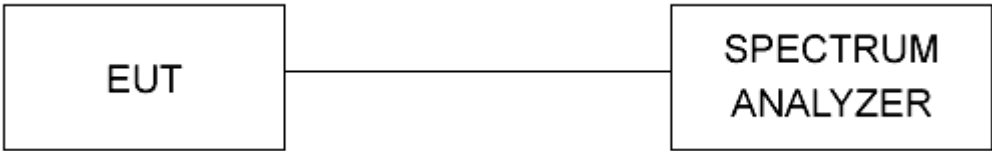


Figure 1 - Bandwidth Measurements Test Setup

Radiated ☒

All the radiated measurements were taken at a distance of 3m from the EUT. The information regarding resolution bandwidth, video bandwidth, span and the detector used can be found in the graphs provided in Appendix C. All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

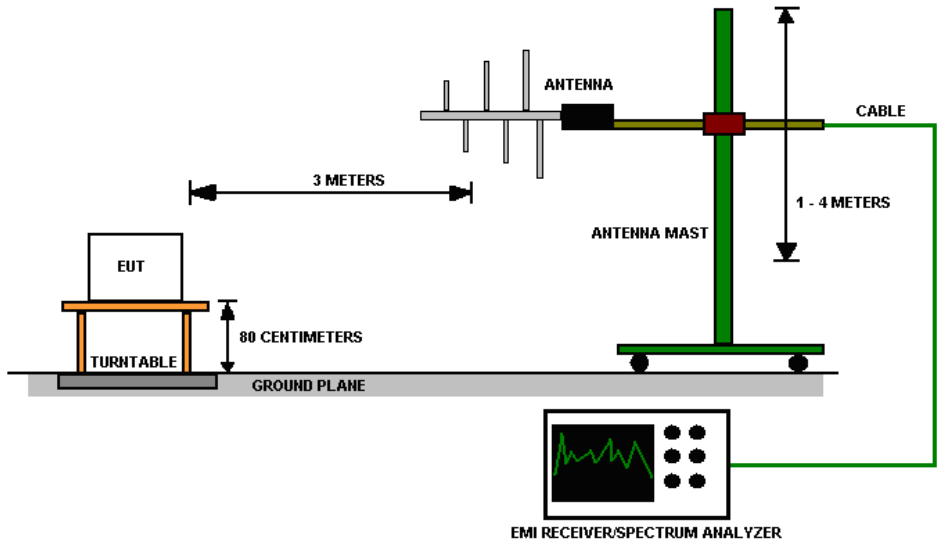


Figure 2 - Radiated Emissions Test Setup

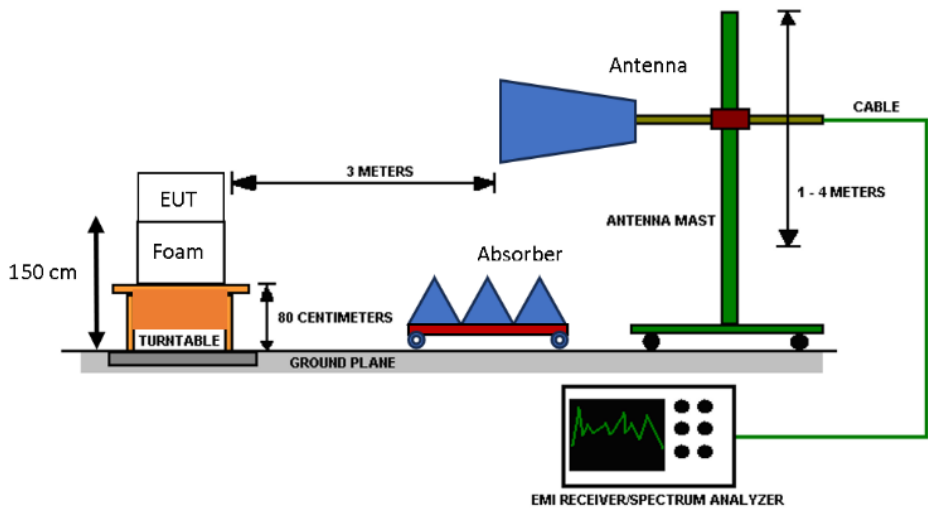


Figure 3 - Radiated Emissions Test Setup, >1GHz

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

4.0 RESULTS

DTS Radio Measurements Low Data Rate							
CHANNEL	Transmitter	Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)	PSD (dBm)	RESULT		
Low	802.11b	14028	8923	-11.825	PASS		
Mid	802.11b	13845	8143	-10.781	PASS		
High	802.11b	14064	8140	-10.471	PASS		
Low	802.11g	16436	16490	-16.565	PASS		
Mid	802.11g	16402	16490	-10.813	PASS		
High	802.11g	16459	16520	-12.293	PASS		
Low	802.11n	17617	17730	-12.061	PASS		
Mid	802.11n	17581	17680	-11.247	PASS		
High	802.11n	17642	17740	-17.02	PASS		
Occupied Bandwidth = N/A; 6 dB Bandwidth Limit =500 kHz				PSD Limit = 8 dBm			
Unrestricted Band-Edge Low Data Rate							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Delta (dB)	Min Delta (dB)	Result
Low	802.11b	2400.00	-49.771	1.588	51.36	30.00	PASS
Low	802.11g	2400.00	-36.001	-3.278	32.72	30.00	PASS
Low	802.11n	2400.00	-29.717	1.538	31.26	30.00	PASS
High	802.11b	2483.50	-62.194	0.902	63.10	30.00	PASS
High	802.11g	2483.50	-60.893	1.066	61.96	30.00	PASS
High	802.11n	2483.50	-60.257	-3.384	56.87	30.00	PASS
Radiated Peak Restricted Band-Edge Low Data Rate							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBμV/m @ 3m)	Measurement Type	Limit (dBμV/m @ 3m)	Margin	Result
Low	802.11b	2390.00	54.74	Peak	73.98	19.24	PASS
Low	802.11g	2390.00	54.578	Peak	73.98	19.40	PASS
Low	802.11n	2390.00	54.918	Peak	73.98	19.06	PASS
High	802.11b	2483.50	55.974	Peak	73.98	18.01	PASS
High	802.11g	2483.50	55.772	Peak	73.98	18.21	PASS
High	802.11n	2483.50	55.289	Peak	73.98	18.69	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

Average Restricted Band-Edge, Low Data Rate

Ch	Mode	Band edge /Measurement Frequency (MHz)	AVG Out of Band Level (dBuV/m @ 3m)	DCCF for Emissions (dB)	Corrected Out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	802.11b	2390.00	43.053	0.930	43.98	Average	53.98	10.00	PASS
Low	802.11g	2390.00	43.151	4.593	47.74	Average	53.98	6.24	PASS
Low	802.11n	2390.00	42.789	5.212	48.00	Average	53.98	5.98	PASS
High	802.11b	2483.50	43.778	0.930	44.71	Average	53.98	9.27	PASS
High	802.11g	2483.50	43.584	4.593	48.18	Average	53.98	5.80	PASS
High	802.11n	2483.50	43.569	5.212	48.78	Average	53.98	5.20	PASS

*Limit shown is the average limit taken from FCC Part 15.209 **Detector used was Avg, DCCF was added to Avg level to convert to average

DTS Power Measurements, Low Data Rate (Power Meter)

CHANNEL	Mode	Raw Average Output Power (dBm)	DCCF (For Power)	Corrected Average Power (dBm)	Corrected Average Power (mW)	RESULT
Low	802.11b	10.749	0.465	11.214	13.225	PASS
Mid	802.11b	10.724	0.465	11.189	13.150	PASS
High	802.11b	10.280	0.465	10.745	11.872	PASS
Low	802.11g	11.185	2.297	13.482	22.293	PASS
Mid	802.11g	11.614	2.297	13.911	24.607	PASS
High	802.11g	10.923	2.297	13.220	20.988	PASS
Low	802.11n	10.944	2.606	13.550	22.647	PASS
Mid	802.11n	11.363	2.606	13.969	24.940	PASS
High	802.11n	10.815	2.606	13.421	21.984	PASS

Limit = 30dBm



Report Number: R20241202-70-E2

Rev

C

Prepared for: Garmin International, Inc.

DTS Radio Measurements, High Data Rate

CHANNEL	Transmitter	Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)	PSD (dBm)	RESULT
Low	802.11b	13729	9539	-12.82	PASS
Mid	802.11b	13693	8133	-11.557	PASS
High	802.11b	13920	9629	-13.046	PASS
Low	802.11g	16399	16420	-13.461	PASS
Mid	802.11g	16319	16390	-18.876	PASS
High	802.11g	16420	16460	-14.648	PASS
Low	802.11n	17548	16730	-14.016	PASS
Mid	802.11n	17449	16910	-13.445	PASS
High	802.11n	17577	17270	-14.38	PASS

Occupied Bandwidth = N/A; 6 dB Bandwidth Limit = 500 kHz

PSD Limit = 8 dBm

Unrestricted Band-Edge, High Data Rate

CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Delta (dB)	Min Delta (dB)	Result
Low	802.11b	2400.00	-48.574	1.439	50.01	30.00	PASS
Low	802.11g	2400.00	-33.643	0.22	33.86	30.00	PASS
Low	802.11n	2400.00	-33.376	1.201	34.58	30.00	PASS
High	802.11b	2483.50	-61.699	1.817	63.52	30.00	PASS
High	802.11g	2483.50	-59.371	0.345	59.72	30.00	PASS
High	802.11n	2483.50	-61.591	0.841	62.43	30.00	PASS

Radiated Peak Restricted Band-Edge, High Data Rate

CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dB μ V/m @ 3m)	Measurement Type	Limit (dB μ V/m @ 3m)	Margin	Result
Low	802.11b	2390.00	55.524	Peak	73.98	18.46	PASS
Low	802.11g	2390.00	54.819	Peak	73.98	19.16	PASS
Low	802.11n	2390.00	55.053	Peak	73.98	18.93	PASS
High	802.11b	2483.50	55.561	Peak	73.98	18.42	PASS
High	802.11g	2483.50	55.928	Peak	73.98	18.05	PASS
High	802.11n	2483.50	55.349	Peak	73.98	18.63	PASS

*Limit shown is the peak limit taken from FCC Part 15.209



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

Average Restricted Band-Edge, High Data Rate

Ch	Mode	Band edge /Measurement Frequency (MHz)	Peak Out of Band Level (dBuV/m @ 3m)	DCCF for Emissions (dB)	Corrected Out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	802.11b	2390.00	55.524	6.655	48.87	Peak	53.98	5.11	PASS
Low	802.11g	2390.00	54.819	16.236	38.58	Peak	53.98	15.40	PASS
Low	802.11n	2390.00	55.053	16.710	38.34	Peak	53.98	15.64	PASS
High	802.11b	2483.50	55.561	6.655	48.91	Peak	53.98	5.07	PASS
High	802.11g	2483.50	55.928	16.236	39.69	Peak	53.98	14.29	PASS
High	802.11n	2483.50	55.349	16.710	38.639	Peak	53.98	15.34	PASS

*Limit shown is the average limit taken from FCC Part 15.209 **Detector used was Peak, DCCF was subtracted from Peak level to convert to average

DTS Power Measurements, High Data Rate (Power Meter)

CHANNEL	Mode	Raw Average Output Power (dBm)	DCCF (For Power)	Corrected Average Power (dBm)	Corrected Average Power (mW)	RESULT
Low	802.11b	7.515	3.328	10.843	12.141	PASS
Mid	802.11b	7.885	3.328	11.213	13.221	PASS
High	802.11b	7.223	3.328	10.551	11.352	PASS
Low	802.11g	4.134	8.118	12.252	16.796	PASS
Mid	802.11g	4.534	8.118	12.652	18.417	PASS
High	802.11g	3.867	8.118	11.985	15.795	PASS
Low	802.11n	4.676	8.355	13.031	20.096	PASS
Mid	802.11n	5.048	8.355	13.403	21.893	PASS
High	802.11n	4.353	8.355	12.708	18.655	PASS

Limit = 30dBm



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.1 OUTPUT POWER

Test Method:

Power measurements were performed using ANSI C63.10

Limits of power measurements:

For FCC Part 15.247 Device:

The maximum allowed output power is 30 dBm.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

The device was directly connected to a calibrated average power meter.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the output power plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. The measurements are listed in the tables in section 4.0.



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.2 BANDWIDTH

Test Method:

All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of bandwidth measurements:

For FCC Part 15.247 Device:

The 99% occupied bandwidth is for informational purposes only. The 6dB bandwidth of the signal must be greater than 500 kHz.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

Test setup details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the bandwidth plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. The measurements are listed in the tables in section 4.0.

4.3 DUTY CYCLE

Test Method:

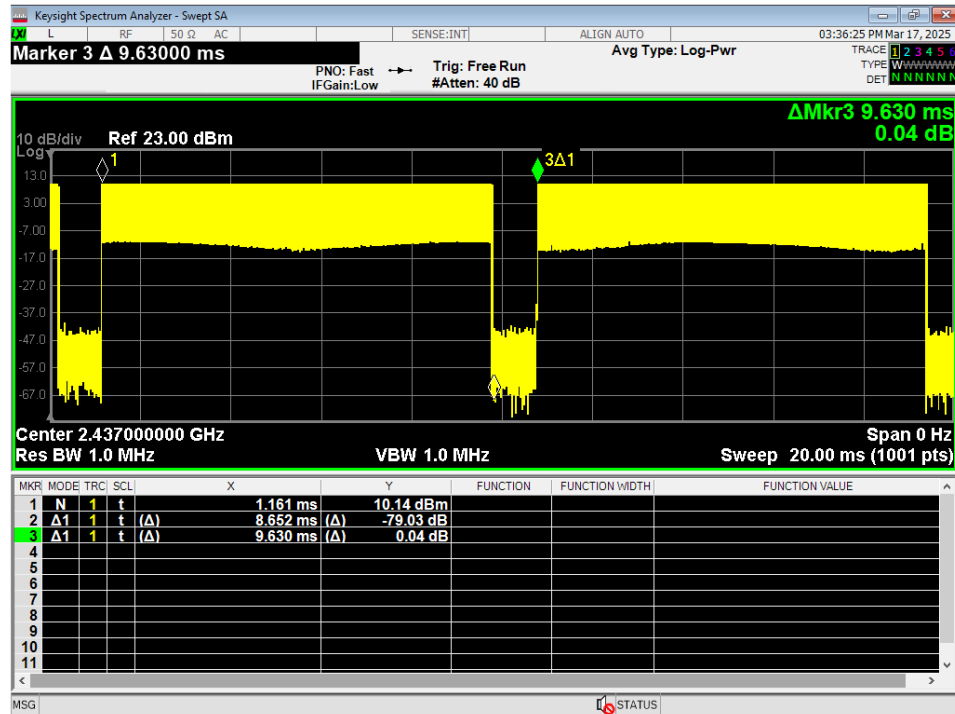


Figure 4 – Duty Cycle, 802.11b 1MB

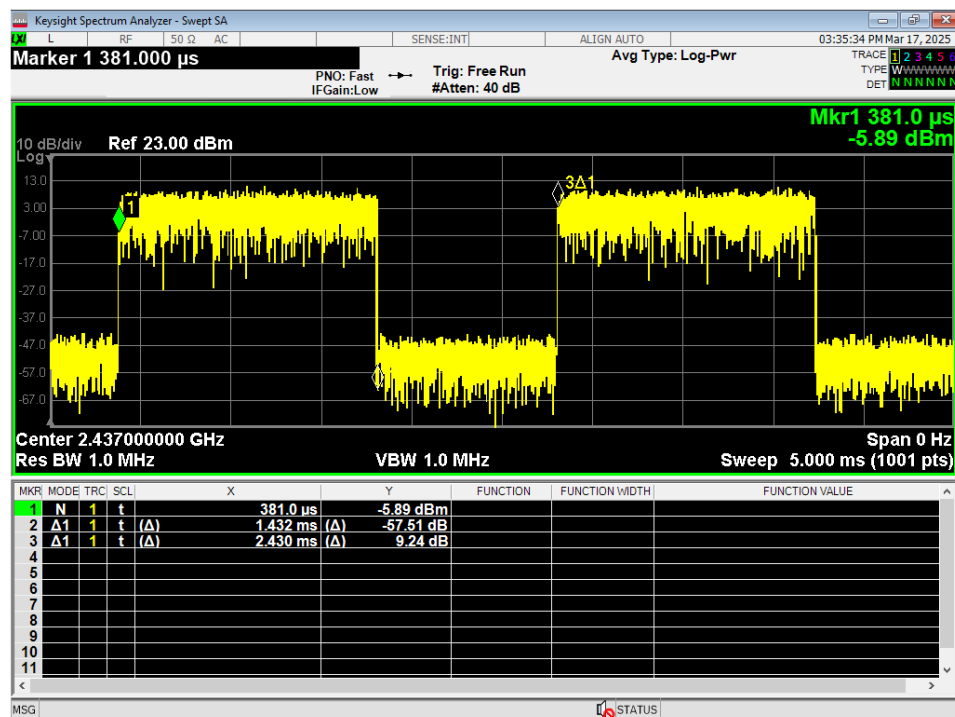


Figure 5 – Duty Cycle, 802.11G 6MB

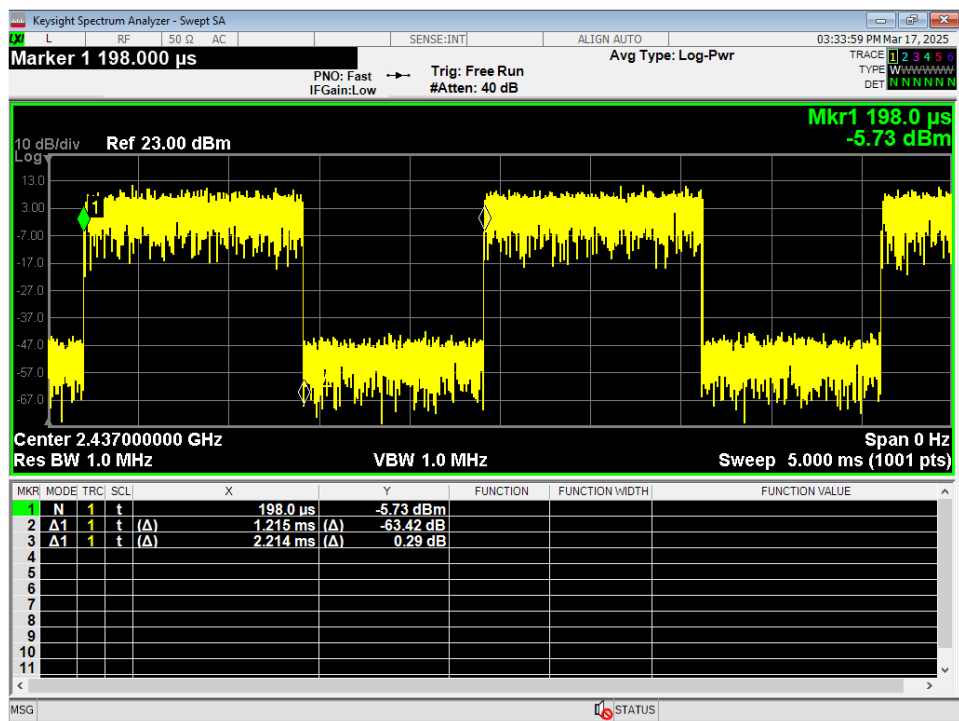


Figure 6 – Duty Cycle, 802.11N MCS0

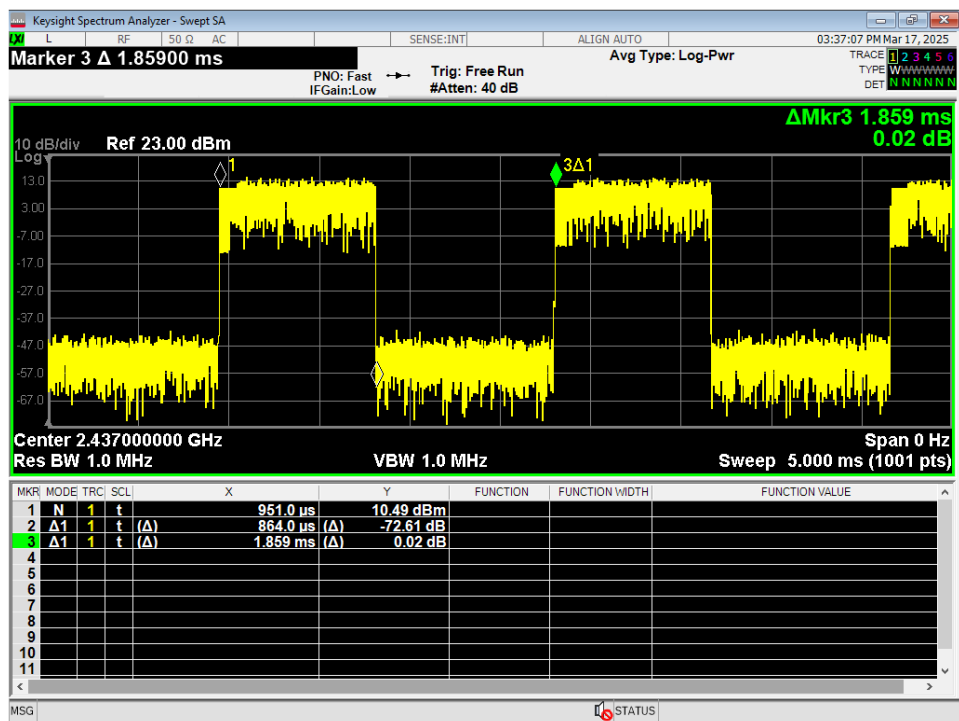


Figure 7 – Duty Cycle, 802.11b 11MB

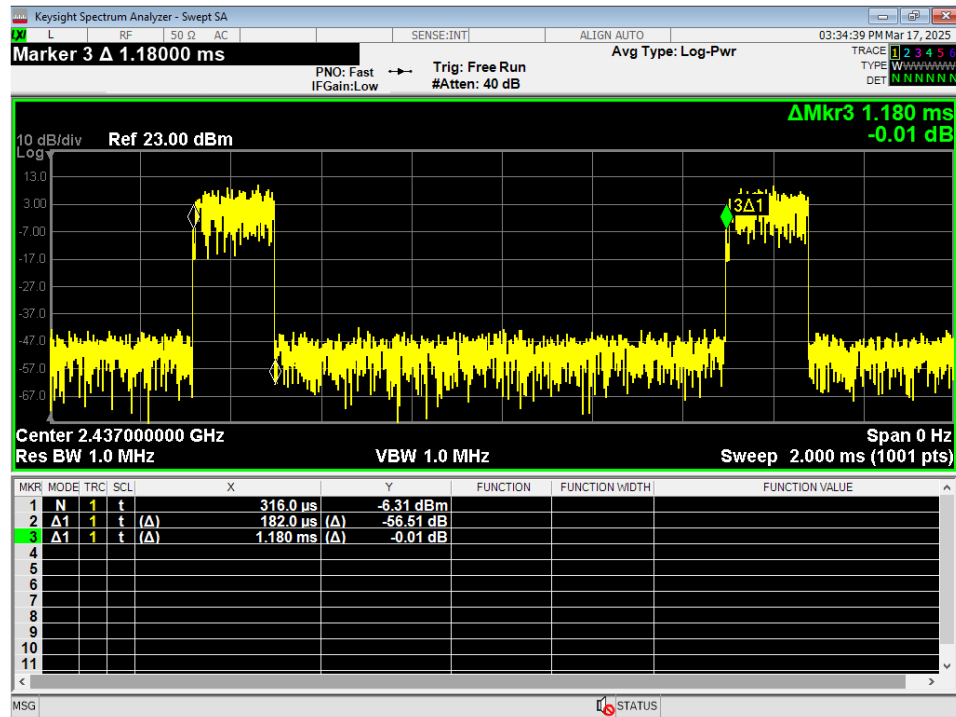


Figure 8 – Duty Cycle, 802.11G 54MB

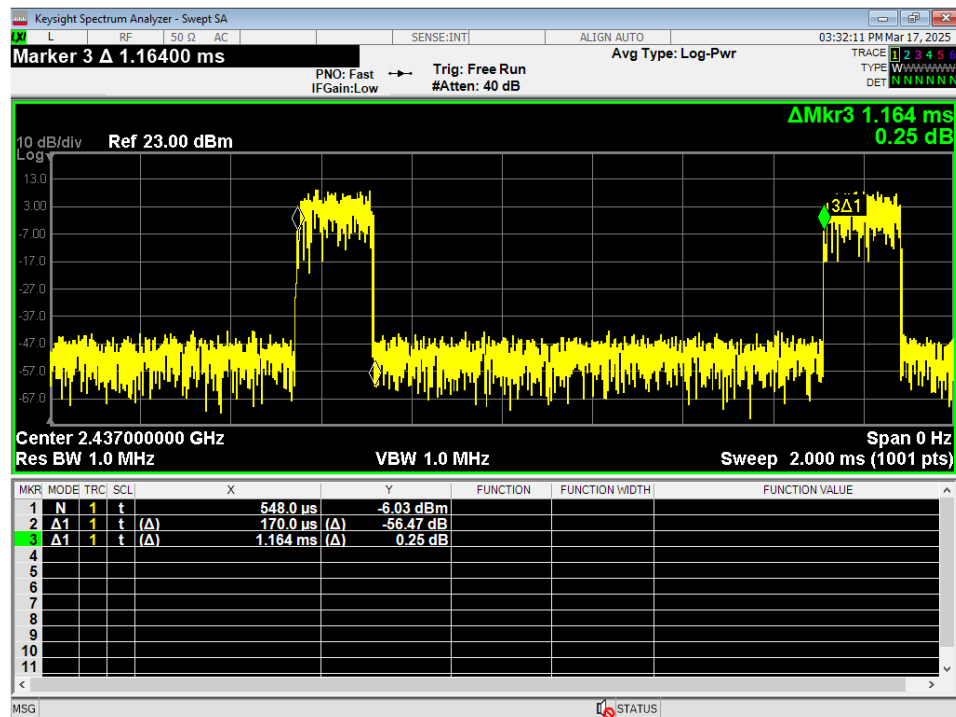


Figure 9 – Duty Cycle, 802.11N MCS7

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

The following duty cycle and duty cycle correction factors (DCCF) were used where applicable.

Duty Cycle correction factor (for emissions) = $20 \cdot \log(\text{Duty cycle})$

Duty Cycle correction factor (for power) = $10 \cdot \log(\text{Duty Cycle})$

Duty cycle for Wi-Fi B 1MB: 0.898

Duty cycle correction factor (for emissions) for Wi-Fi B 1MB: 0.930dB

Duty Cycle correction factor (for power) for Wi-Fi B 1MB: 0.465dB

Duty cycle for Wi-Fi G 6MB: 0.589

Duty cycle correction factor (for emissions) for Wi-Fi G 6MB: 4.593dB

Duty Cycle correction factor (for power) for Wi-Fi G 6MB: 2.297dB

Duty cycle for Wi-Fi N MCS0: 0.549

Duty cycle correction factor (for emissions) for Wi-Fi N MCS0: 5.212dB

Duty Cycle correction factor (for power) for Wi-Fi N MCS0: 2.606dB

Duty cycle for Wi-Fi B 11MB: 0.465

Duty cycle correction factor (for emissions) for Wi-Fi B 11MB: 6.655 dB

Duty Cycle correction factor (for power) for Wi-Fi B 11MB: 3.328dB

Duty cycle for Wi-Fi G 54MB: 0.154

Duty cycle correction factor (for emissions) for Wi-Fi G 54MB: 16.236dB

Duty Cycle correction factor (for power) for Wi-Fi G 54MB: 8.118dB

Duty cycle for Wi-Fi N MCS7: 0.146

Duty cycle correction factor (for emissions) for Wi-Fi N MCS7: 16.710dB

Duty Cycle correction factor (for power) for Wi-Fi N MCS7: 8.355dB



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.4 RADIATED EMISSIONS

Test Method:

ANSI C63.10-2020, Section 6.5, 6.6

Limits for radiated emissions measurements:

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH ($\mu\text{V/m}$)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = $20 * \log * \text{Emission level } (\mu\text{V/m})$.
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

Test procedures:

- a. The EUT was placed on the top of a rotating table above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The table was 0.8m high for measurements from 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.
- d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.
- e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise, the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. The EUT was maximized in all 3 orthogonal positions. The results are presented for the axis that had the highest emissions.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.
2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

Deviations from test standard:

No deviation.

EUT operating conditions

Details can be found in section 2.1 of this report.

Test results:

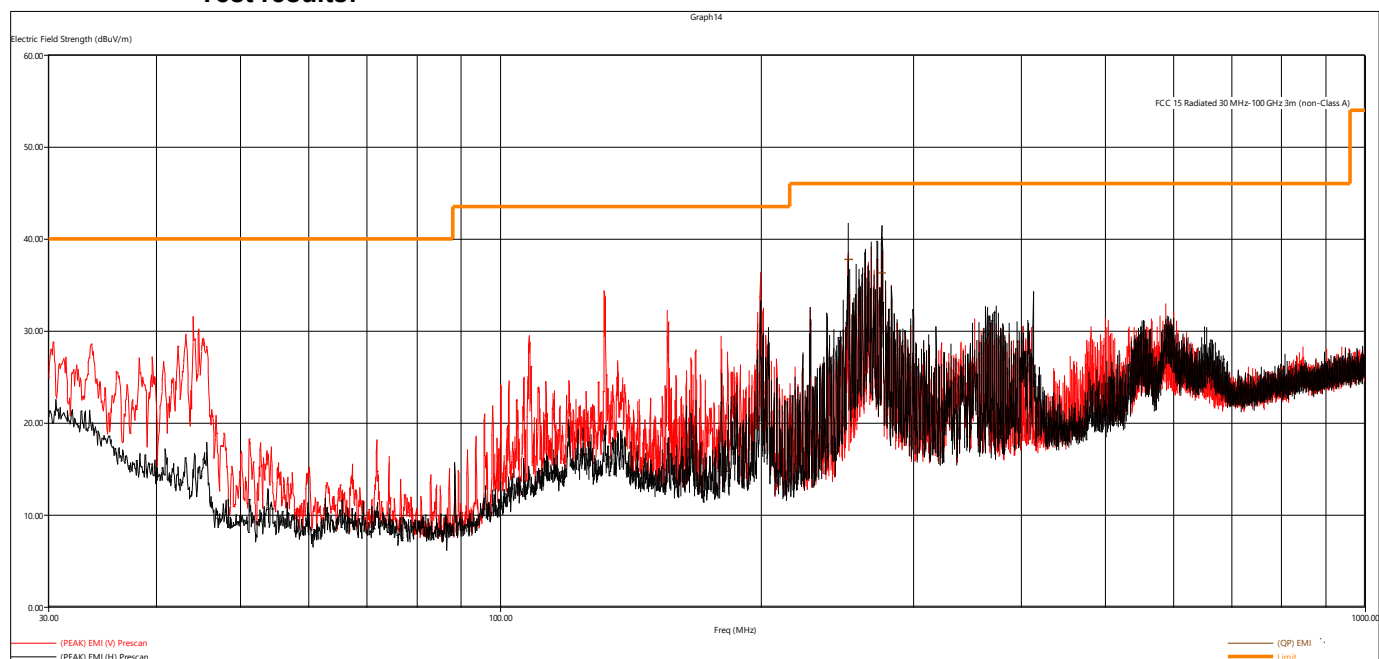


Figure 10 - Radiated Emissions Plot, Receive

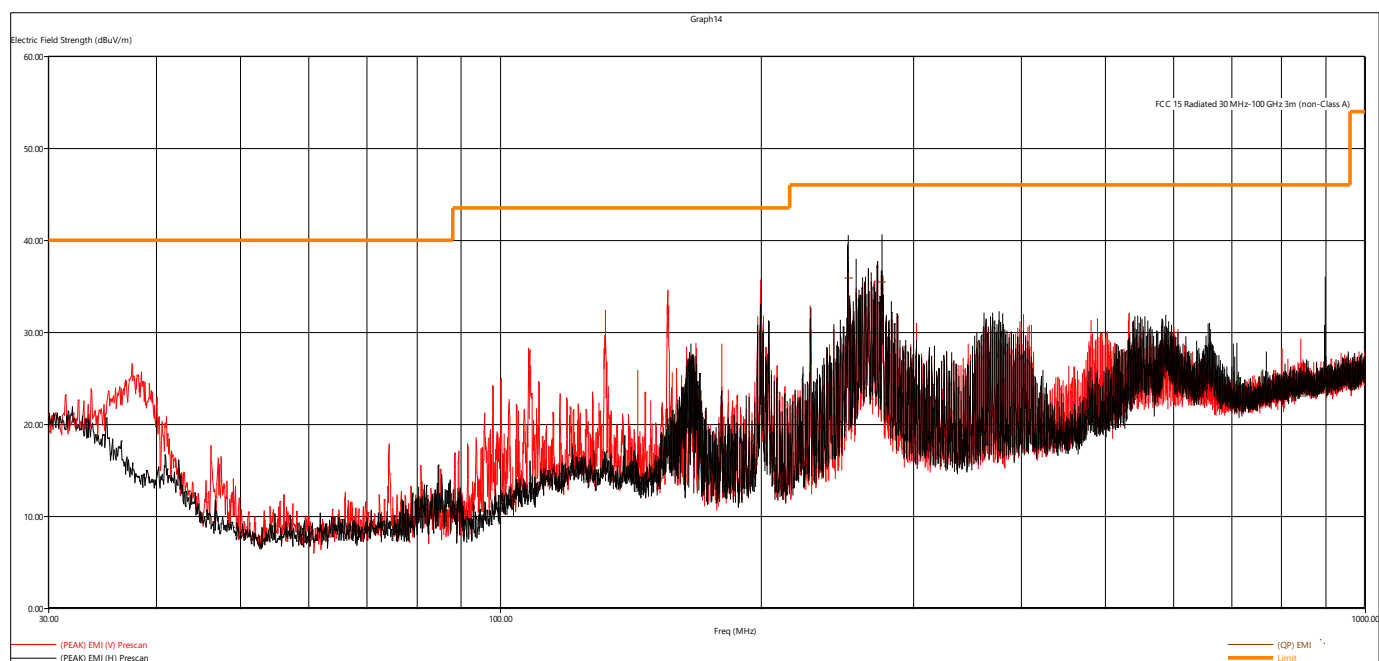


Figure 11 - Radiated Emissions Plot, 802.11b 1MB

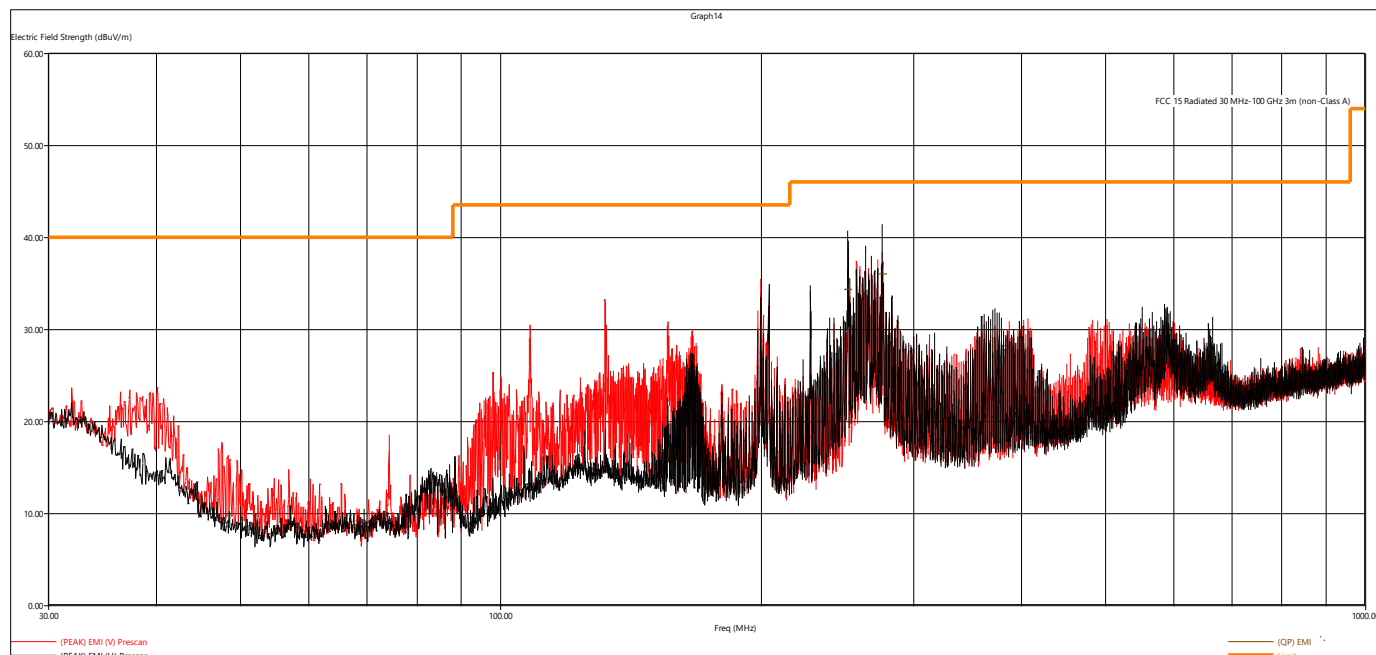


Figure 12 - Radiated Emissions Plot, 802.11b 11MB

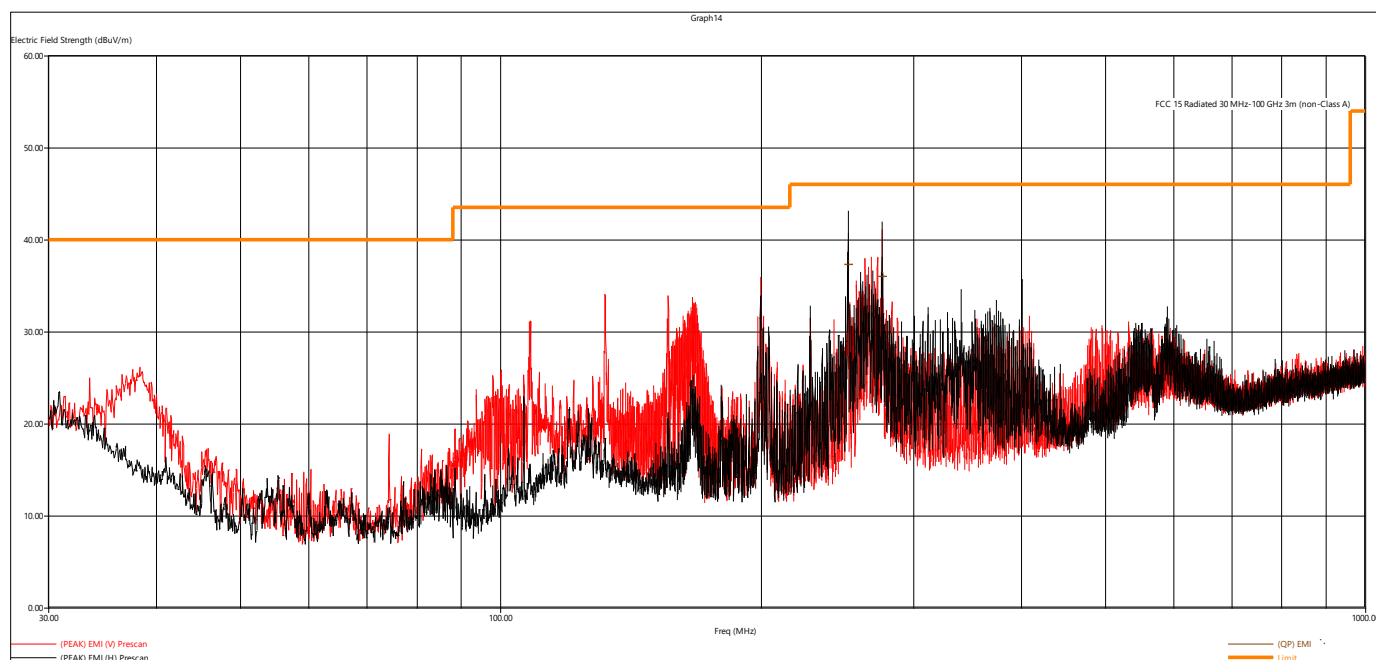


Figure 13 - Radiated Emissions Plot, 802.11g 6MB

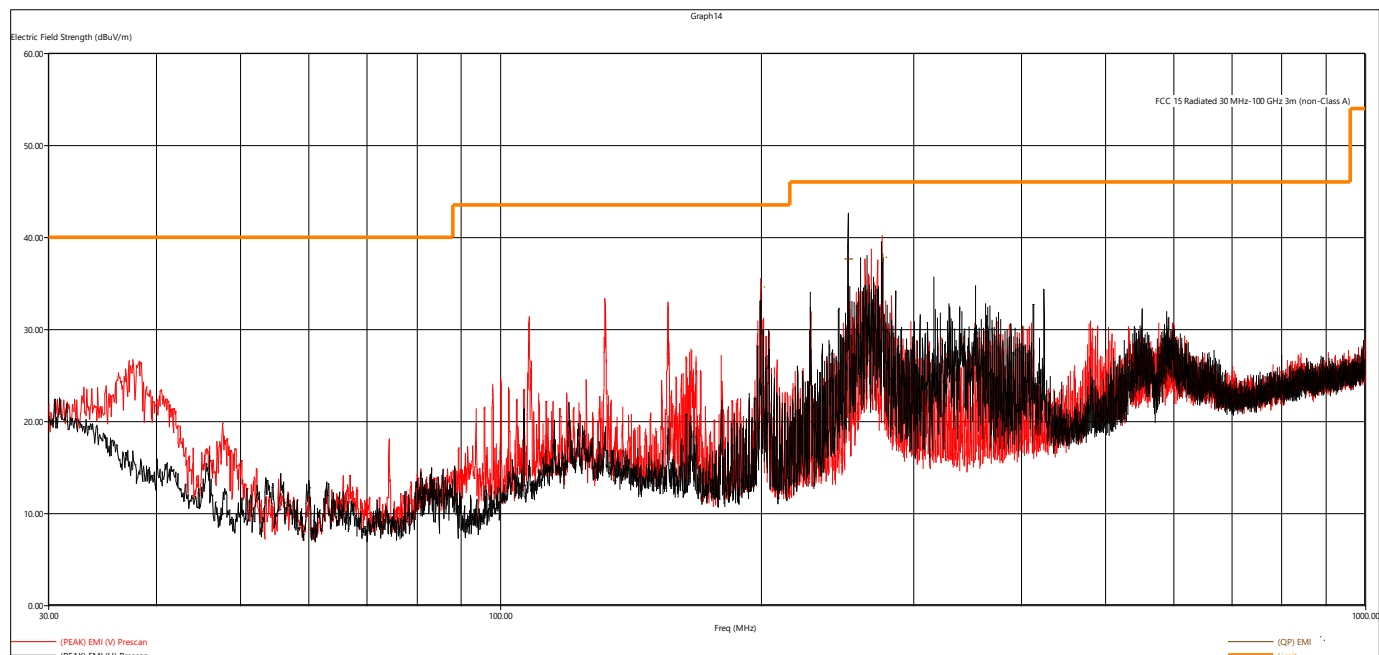


Figure 14 - Radiated Emissions Plot, 802.11g 54MB

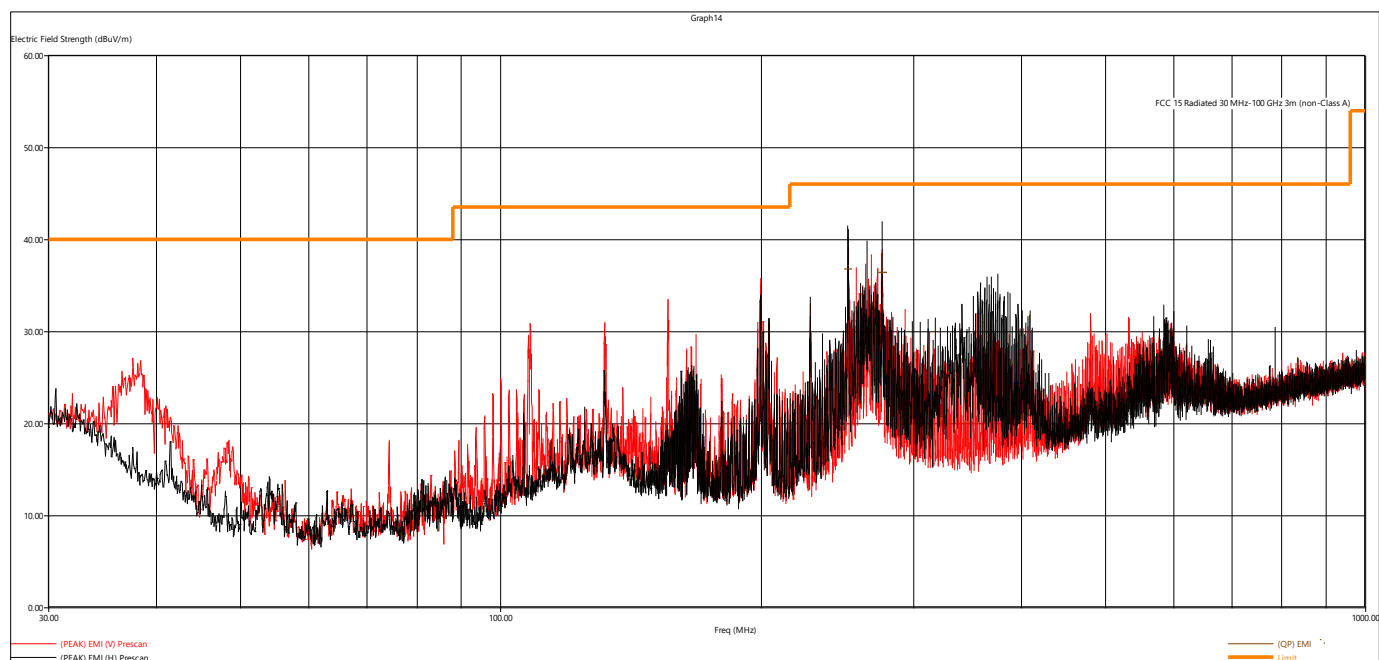


Figure 15 - Radiated Emissions Plot, 802.11n MCS0

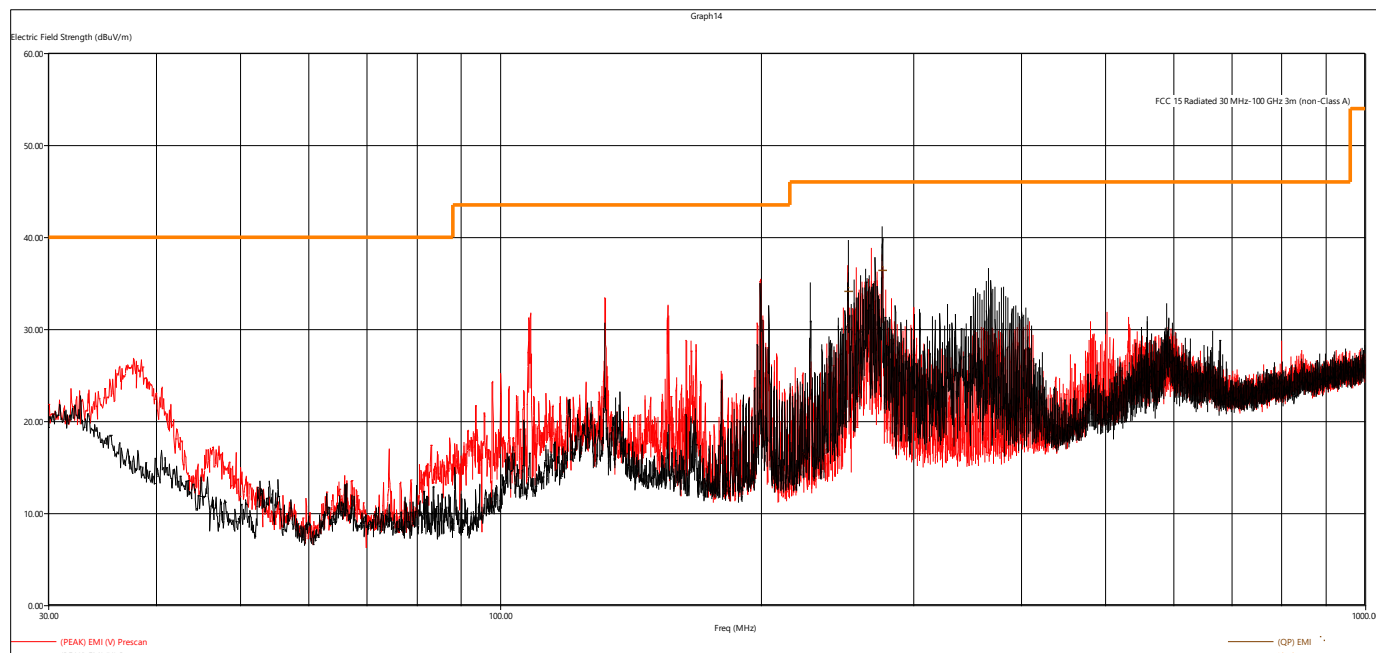


Figure 16 - Radiated Emissions Plot, 802.11n MCS7

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission level

Quasi-Peak Measurements, 802.11x							
Frequency	Level	Limit	Margin	Height	Angle	Pol	Modulation
MHz	dBμV/m	dBμV/m	dB	cm.	deg.		
252.102480	37.76	46.02	8.26	106.22	2.00	H	RX
275.824320	36.28	46.02	9.74	112.01	8.25	H	RX
252.190320	35.87	46.02	10.15	135.35	359.25	H	B 1MB
275.889120	35.40	46.02	10.62	104.49	12.00	H	B 1MB
251.665920	34.27	46.02	11.75	112.85	359.75	H	B 11MB
276.134880	35.96	46.02	10.06	103.77	1.00	H	B 11MB
252.150960	37.27	46.02	8.75	108.55	348.50	H	G 6MB
276.040080	35.90	46.02	10.12	107.83	6.50	H	G 6MB
251.831520	37.56	46.02	8.46	120.43	355.50	H	G 54MB
199.689360	34.49	43.52	9.03	176.49	85.50	V	G 54MB
275.805840	37.72	46.02	8.30	151.71	66.25	V	G 54MB
251.761200	36.70	46.02	9.32	109.62	355.50	H	N MCS0
275.898000	36.33	46.02	9.69	112.31	359.00	H	N MCS0
252.352320	34.04	46.02	11.98	113.80	359.25	H	N MCS7
276.017520	36.36	46.02	9.66	111.35	359.25	H	N MCS7

All other measurements were found to be at least 6 dB below the limit. Worst case emissions are reported.



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

Peak Measurements, 802.11x

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dBµV/m	dBµV/m	dB	cm.	deg.			
7250.732000	47.81	73.98	26.17	307.53	205.00	H	Low	Wifi N MCS0

The EUT was maximized on all 3 orthogonal axes. Emissions were investigated up to 25GHz, worst case was reported
All other measurements were found to be at least 6dB below the applicable limit line and were not tabulated.

Average Measurements, 802.11x

Freq.	Peak Level	DCCF	Average Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dBµV/m	dB	dBµV/m	dBµV/m	dB	cm.	deg.			
7250.732000	47.81	1.061	46.749	53.98	7.231	307.53	205.00	H	Low	Wifi N MCS0

The EUT was maximized on all 3 orthogonal axes. Emissions were investigated up to 25GHz, worst case was reported
All other measurements were found to be at least 6dB below the applicable limit line and were not tabulated.

Average Level = Peak level - DCCF



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.5 CONDUCTED SPURIOUS EMISSIONS

Test Method:

ANSI C63.10-2020, Section 6.7

Limits of spurious emissions:

From FCC Part 15.247:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Test procedures:

The highest emissions level was measured and recorded. All spurious measurements were evaluated to 30dB below the fundamental. More details can be found in section 3.4 of this report. The line shown in the plots is a reference line placed at -20dBm.

Deviations from test standard:

None.

Test setup:

Test setup details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Data rates and channels were investigated and worst case was reported. No emissions exceeded the limits.

There was no distinguishable difference between low and high data rate for purposes of Conducted spurious.

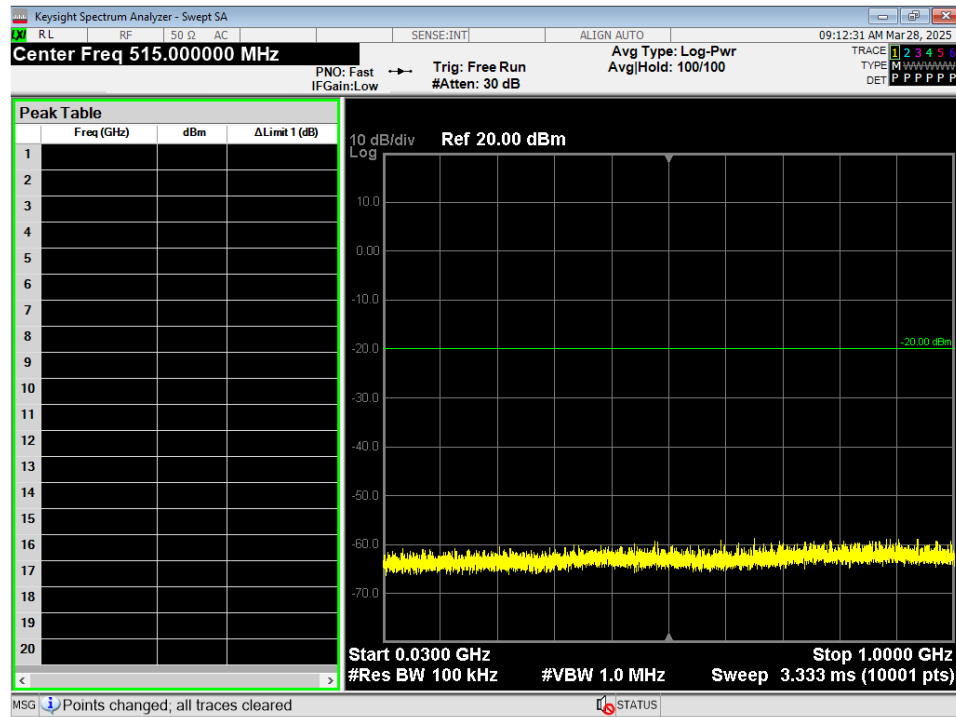


Figure 17 - Conducted Emissions Plot, WIFI 802.11b, 30M – 1G, Low

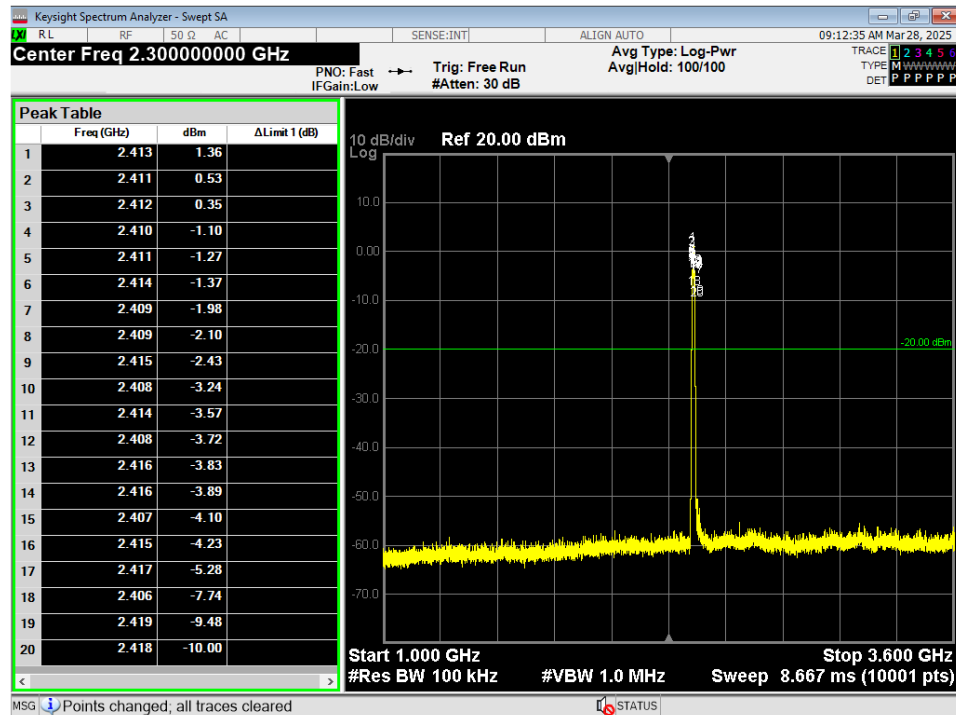


Figure 18 - Conducted Emissions Plot, WIFI 802.11b, 1G – 3.6G, Low

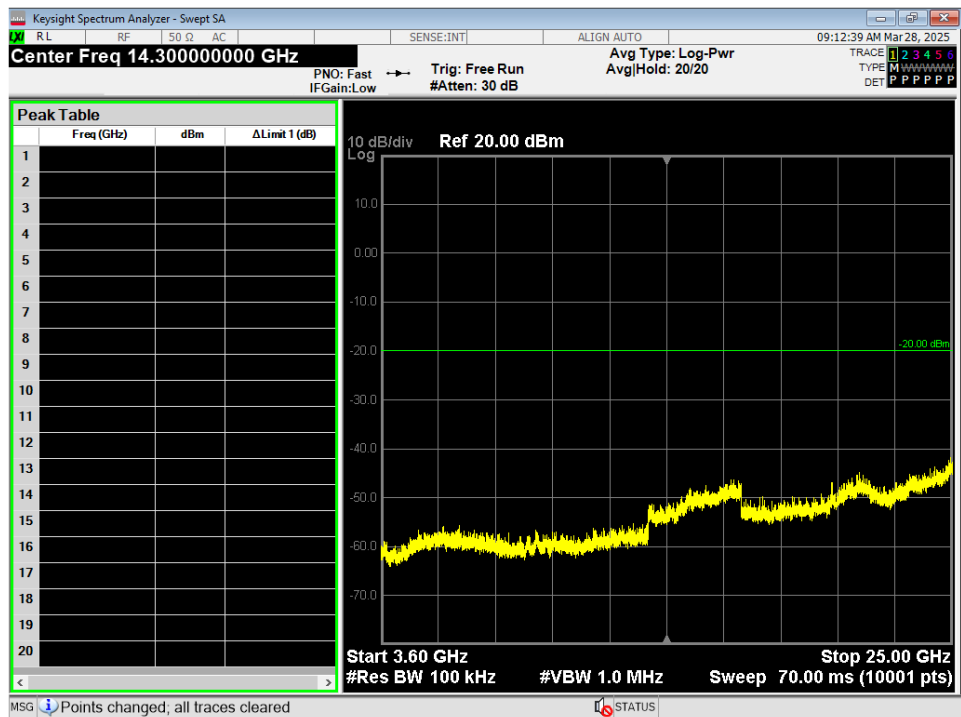


Figure 19 - Conducted Emissions Plot, WIFI 802.11b, 3.6G – 25G, Low

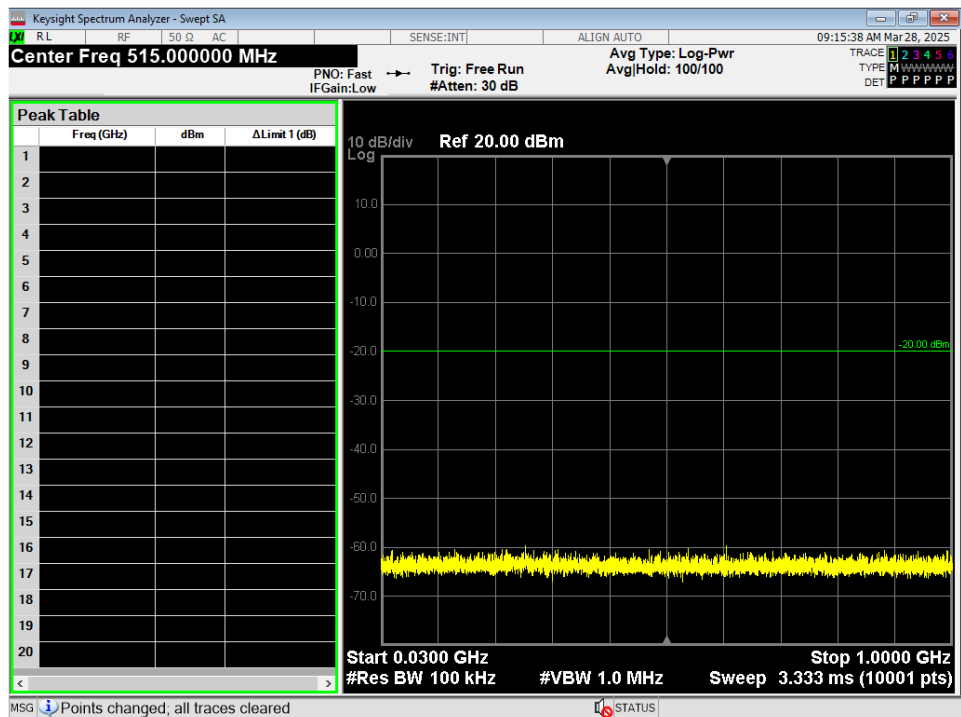


Figure 20 - Conducted Emissions Plot, WIFI 802.11g, 30M – 1G, Low

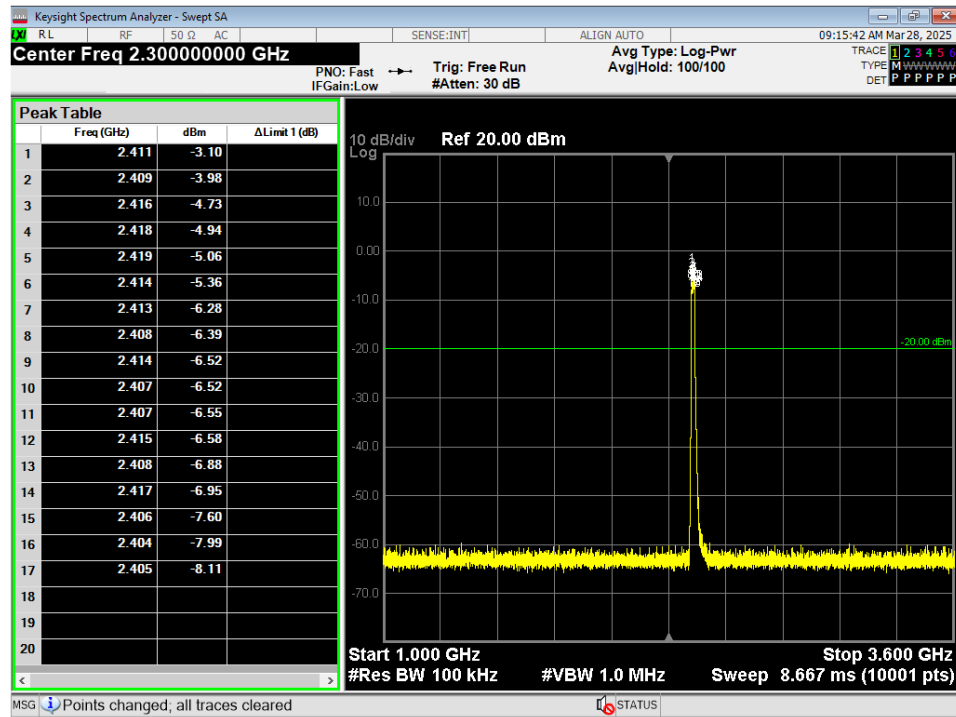


Figure 21 - Conducted Emissions Plot, WIFI 802.11g, 1G – 3.6G, Low

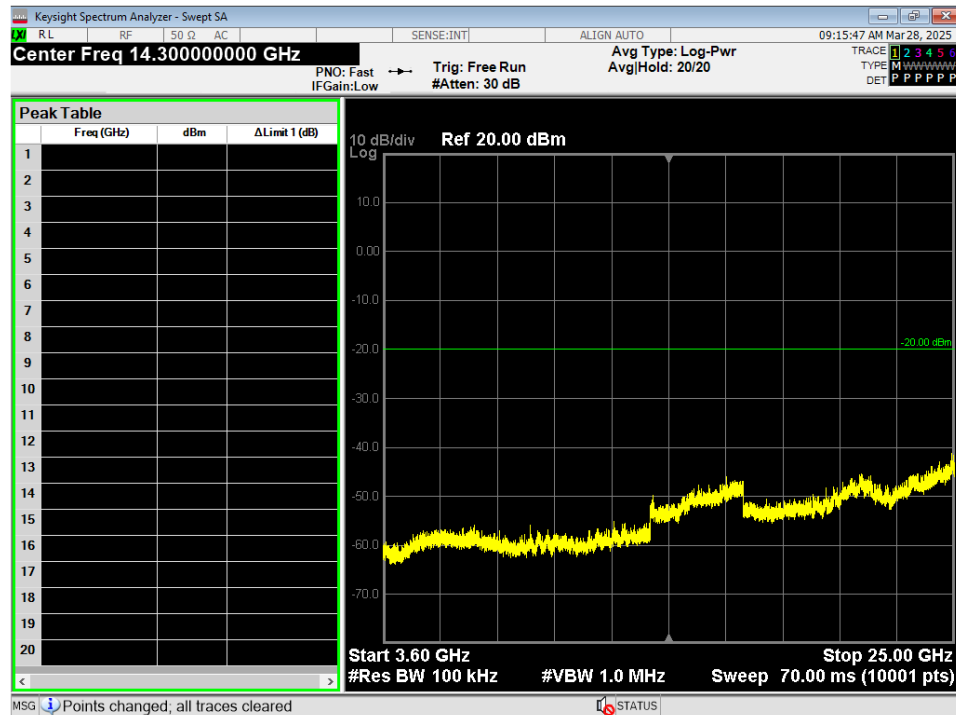


Figure 22 - Conducted Emissions Plot, WIFI 802.11g, 3.6G – 25G, Low

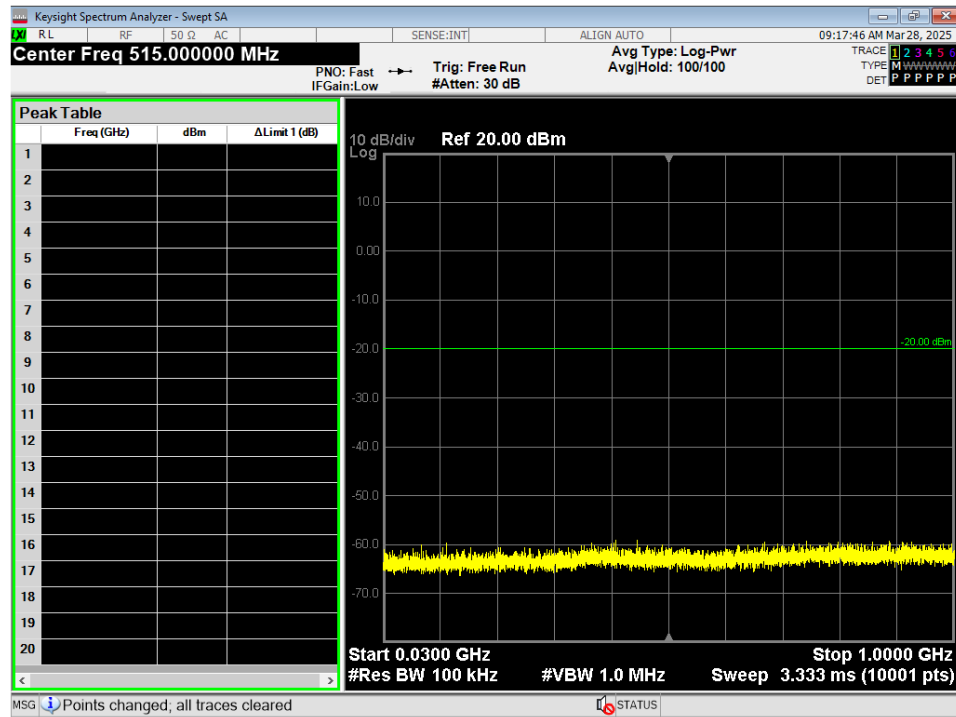


Figure 23 - Conducted Emissions Plot, WIFI 802.11n, 30M – 1G, Low

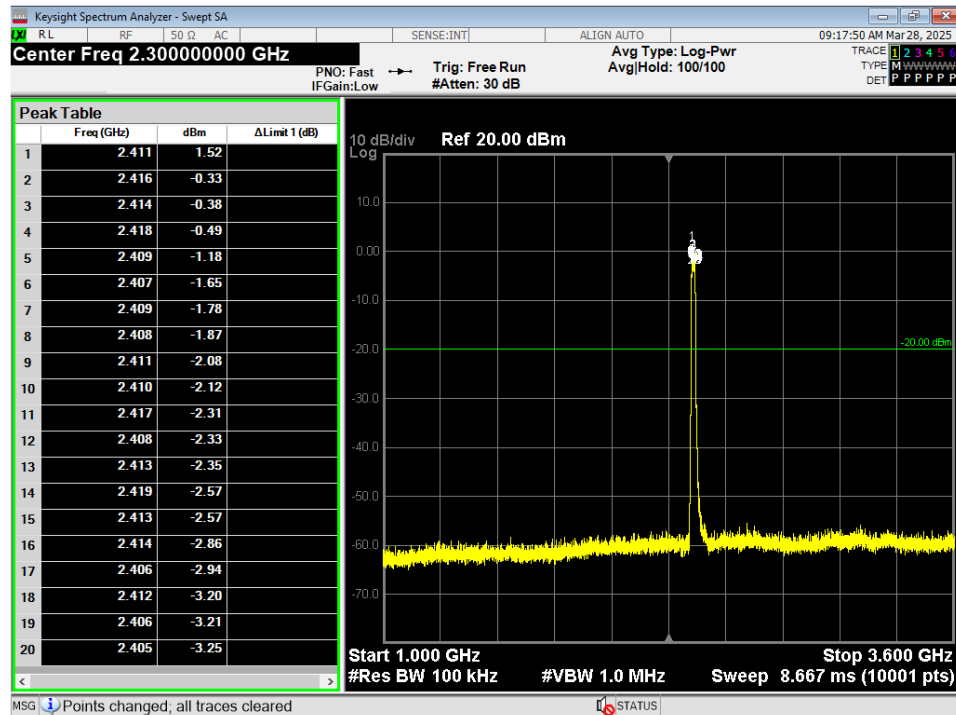


Figure 24 - Conducted Emissions Plot, WIFI 802.11n, 1G – 3.6G, Low

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.6 BAND EDGES

Test Method:

All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of band-edge measurements:

For FCC Part 15.247 Device:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test procedures:

The highest emissions level beyond the band-edge was measured and recorded. All band edge measurements were evaluated to the general limits in Part 15.209. More details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

Test setup details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the band edge plots can be found in Appendix C.
2. If the device falls under FCC Part 15.247 (Details can be found in summary of test results), compliance is shown in the unrestricted band edges by showing minimum delta of 20 dB between peak and the band edge.
3. The restricted band edge compliance is shown by comparing it to the general limit defined in Part 15.209. The limit shown in the graph accounts for the antenna gain of the device.



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

4.7 POWER SPECTRAL DENSITY

Test Method:

All the radio measurements were performed using the sections from ANSI C63.10, details about the section used can be found in the spectrum analyzer titles on the graph.

Limits of power measurements:

For FCC Part 15.247 Device:

The maximum PSD allowed is 8 dBm.

Test procedures:

Details can be found in section 3.4 of this report.

Deviations from test standard:

No deviation.

Test setup:

Details can be found in section 3.4 of this report.

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test results:

Pass

Comments:

1. All the Power Spectral Density (PSD) plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. The measurements are listed in the tables in section 4.0.



Report Number: R20241202-70-E2

Rev

C

Prepared for: Garmin International, Inc.

APPENDIX A: SAMPLE CALCULATION

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF - (-CF + AG) + AV$$

Where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dB μ V is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dB μ V/m.

$$FS = 55 + 12 - (-1.1 + 20) + 0 = 48.1 \text{ dB}\mu\text{V/m}$$

The 48.1 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(48.1 \text{ dB}\mu\text{V/m})/20] = 254.1 \mu\text{V/m}$$

AV is calculated by taking the $20 \cdot \log(T_{\text{on}}/100)$ where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

$$EIRP (\text{Watts}) = [\text{Field Strength (V/m)} \times \text{antenna distance (m)}]^2 / 30$$

$$\text{Power (watts)} = 10^{[\text{Power (dBm)}]/10} / 1000$$

$$\text{Voltage (dB}\mu\text{V)} = \text{Power (dBm)} + 107 \text{ (for } 50\Omega \text{ measurement systems)}$$

$$\text{Field Strength (V/m)} = 10^{[\text{Field Strength (dB}\mu\text{V/m)} / 20] / 10^6}$$

$$\text{Gain} = 1 \text{ (numeric gain for isotropic radiator)}$$

$$\text{Conversion from 3m field strength to EIRP (d=3):}$$

$$EIRP = [FS(\text{V/m}) \times d^2]/30 = FS [0.3] \quad \text{for } d = 3$$

$$EIRP(\text{dBm}) = FS(\text{dB}\mu\text{V/m}) - 10(\log 10^9) + 10\log[0.3] = FS(\text{dB}\mu\text{V/m}) - 95.23$$

$10\log(10^9)$ is the conversion from micro to milli

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

APPENDIX B – MEASUREMENT UNCERTAINTY

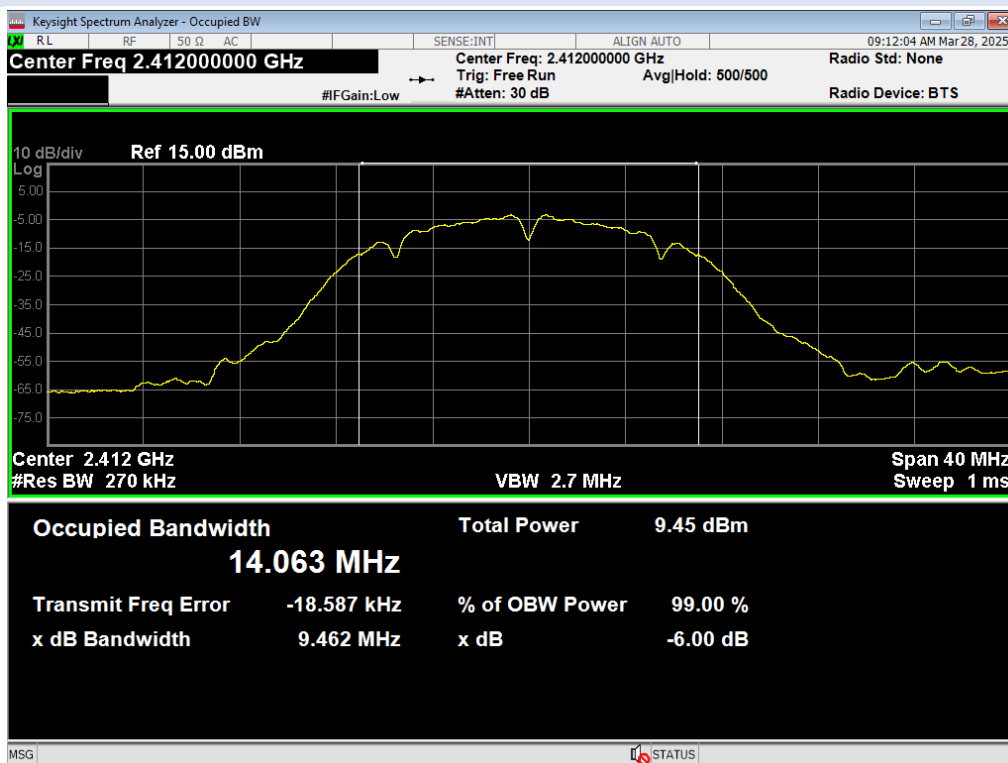
NCEE Labs does not add uncertainty levels to measurement levels

Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

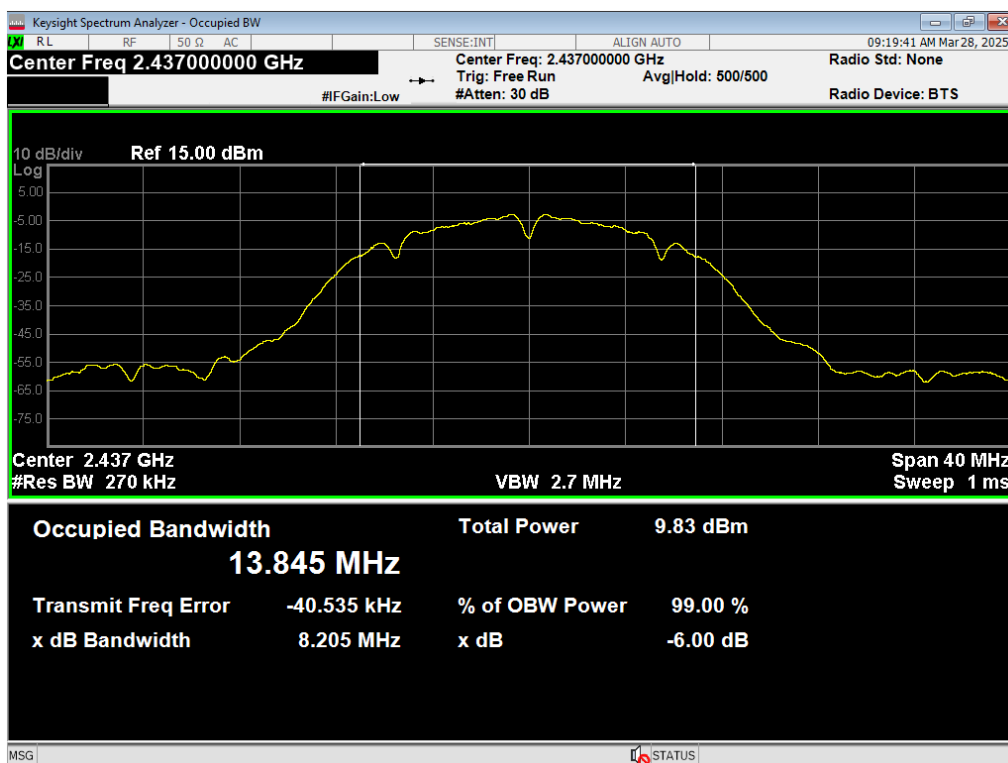
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08
Emissions limits, conducted	30MHz – 18GHz	±3.03

Expanded uncertainty values are calculated to a confidence level of 95%.

APPENDIX C – GRAPHS AND TABLES

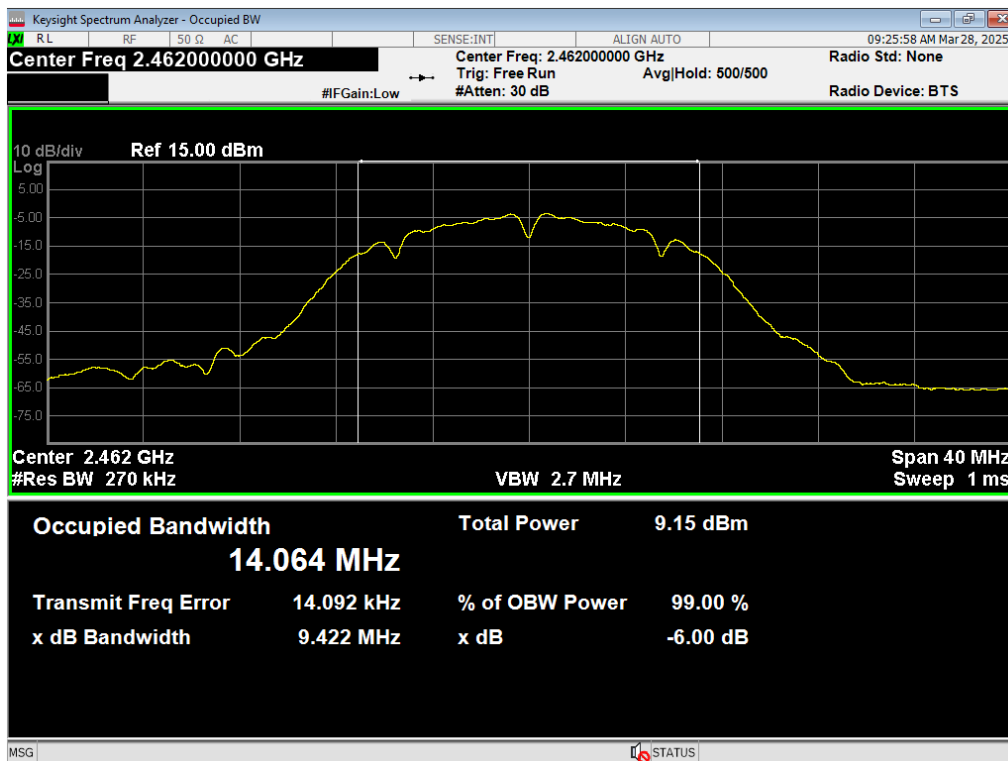


01 Occupied BW, WiFi B 1MB, 2412MHz

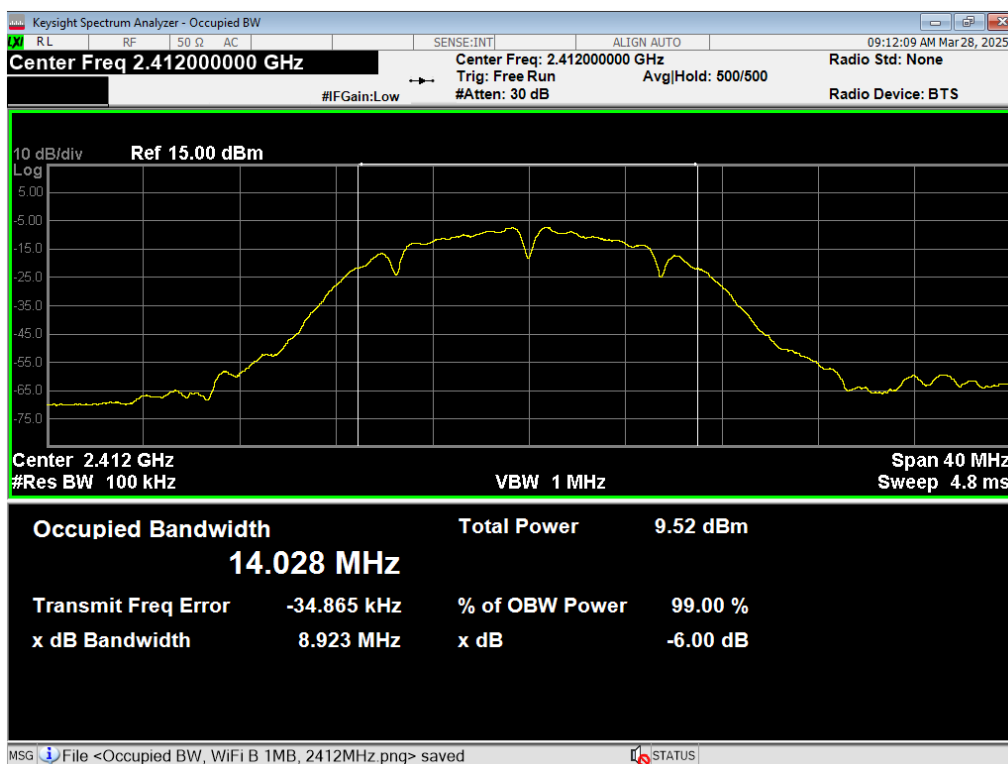


02 Occupied BW, WiFi B 1MB, 2437MHz

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

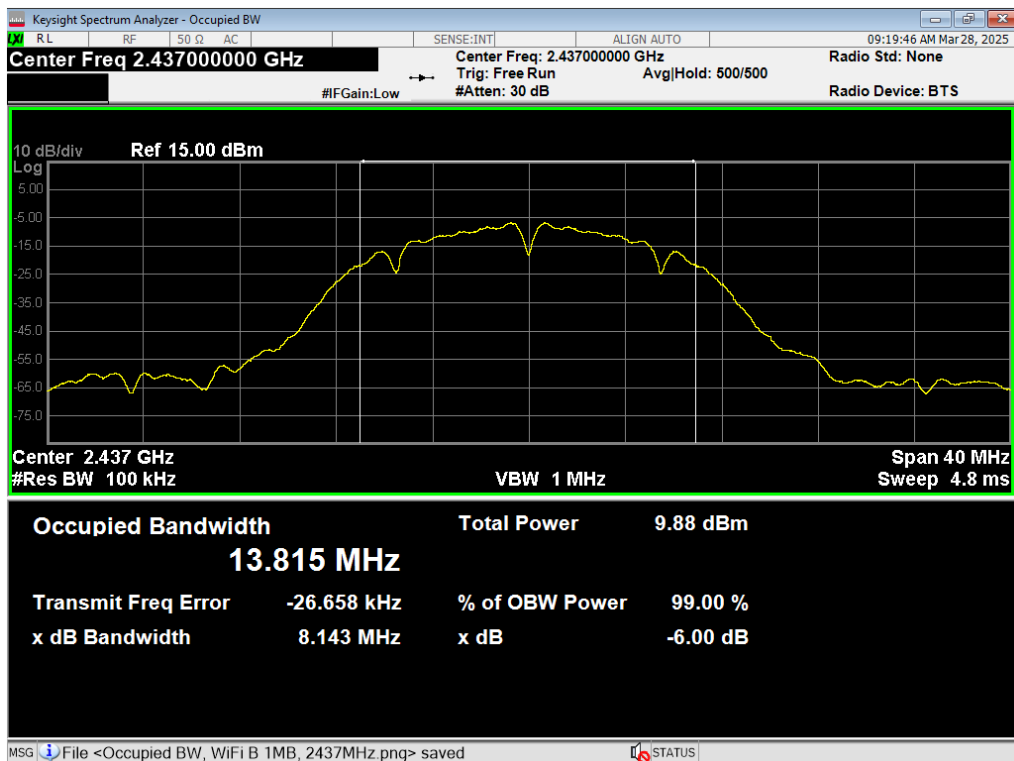


03 Occupied BW, WiFi B 1MB, 2462MHz

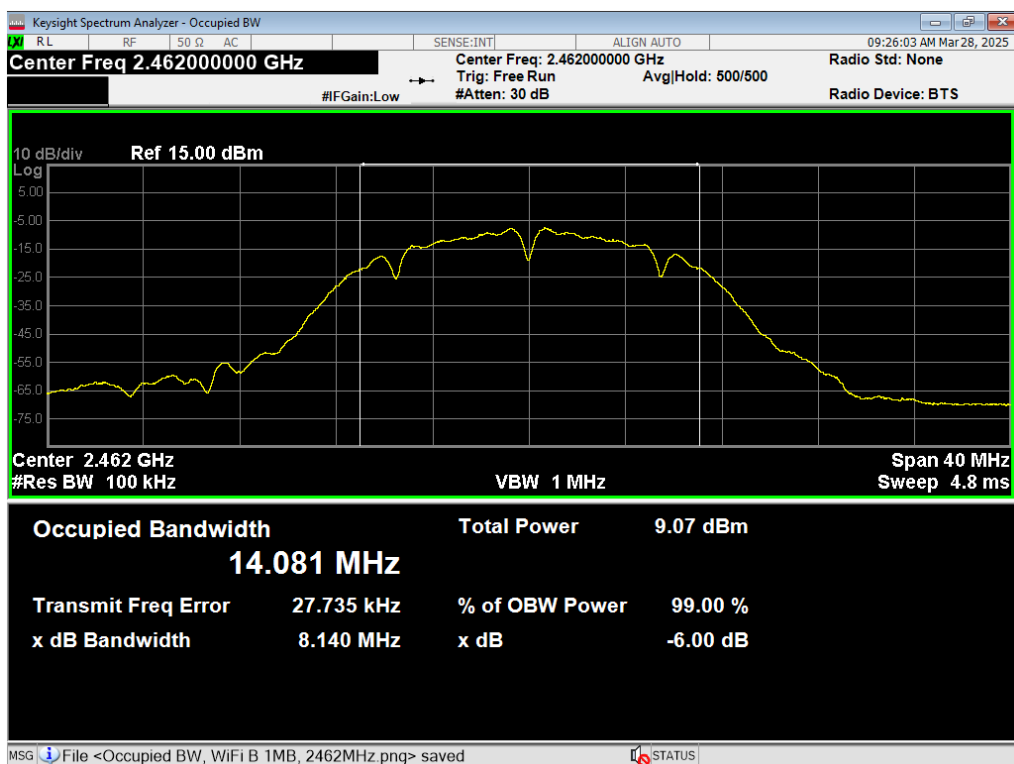


04 6dB BW, WiFi B 1MB, 2412MHz

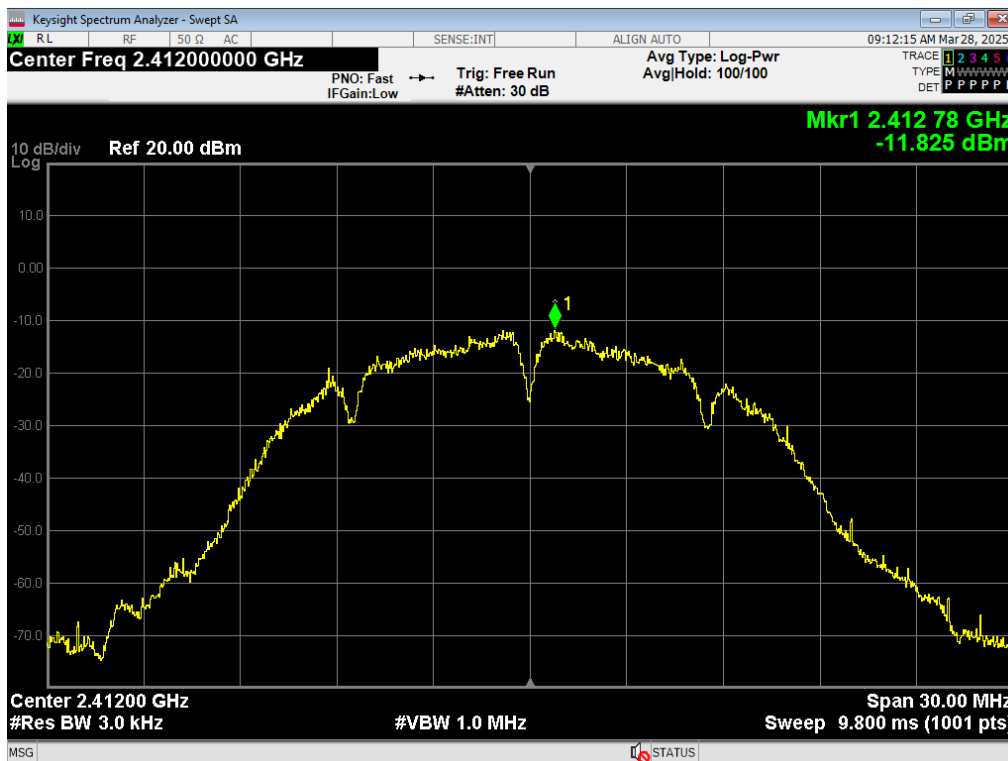
Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		



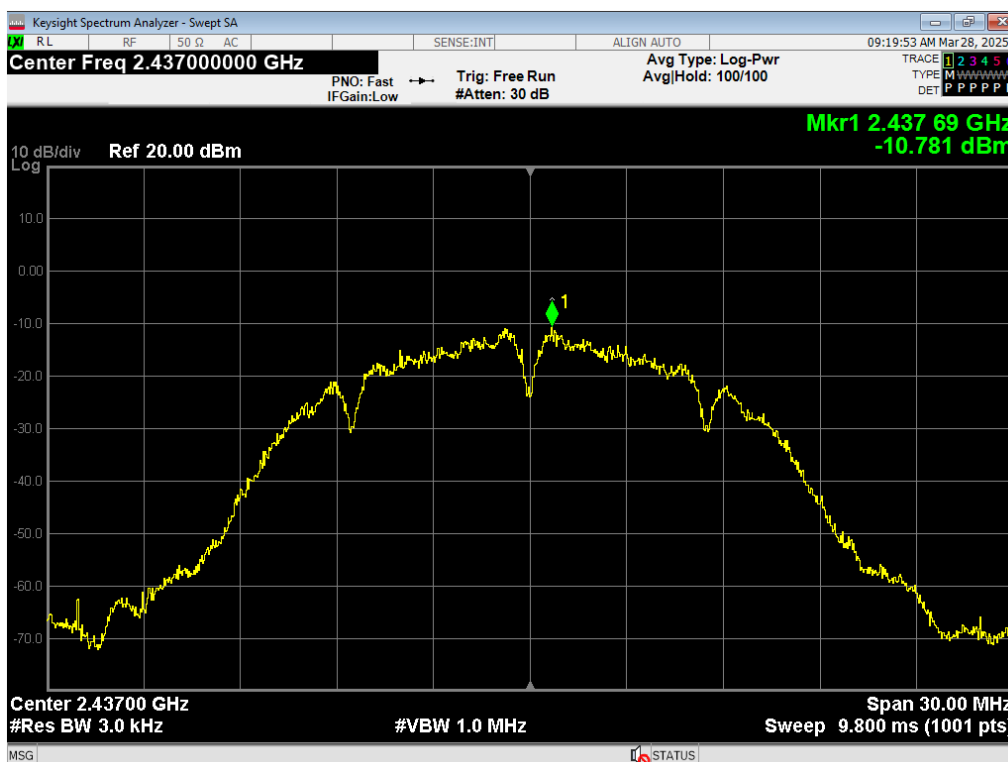
05 6dB BW, WiFi B 1MB, 2437MHz



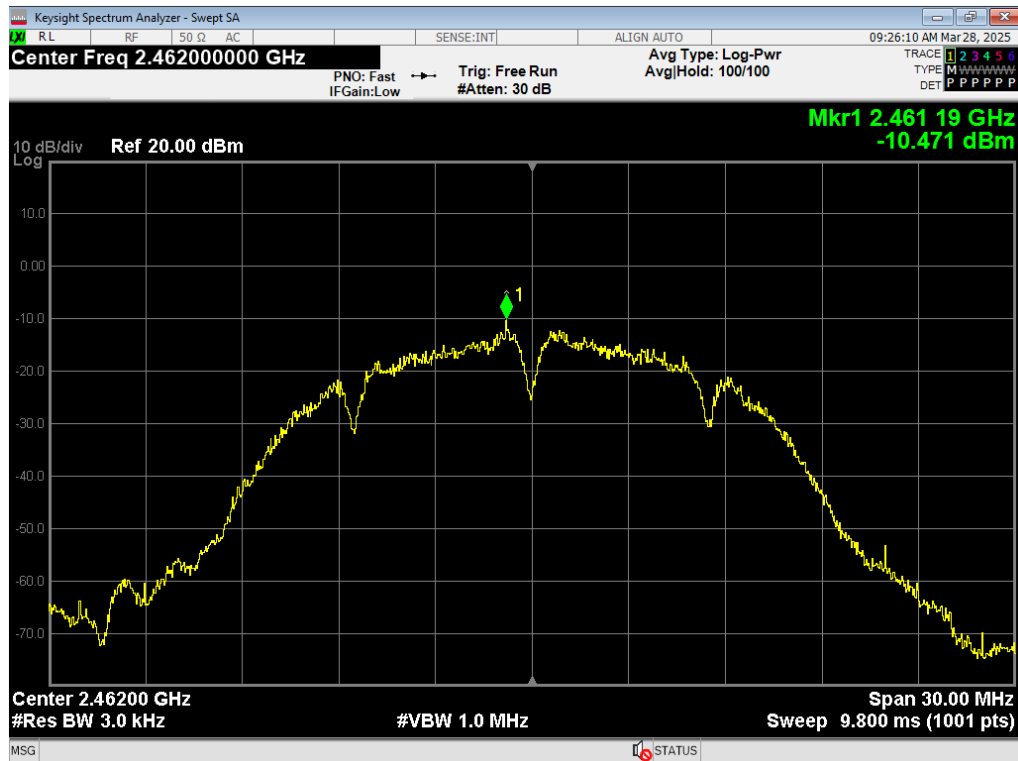
06 6dB BW, WiFi B 1MB, 2462MHz



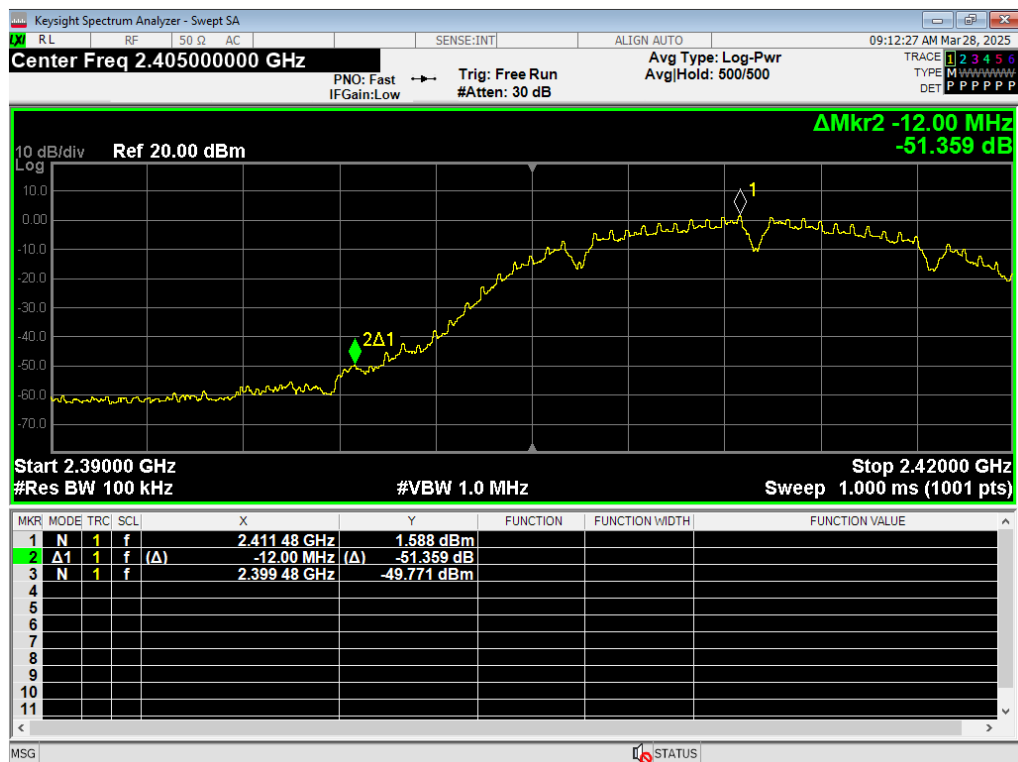
07 PSD, WiFi B 1MB, 2412MHz



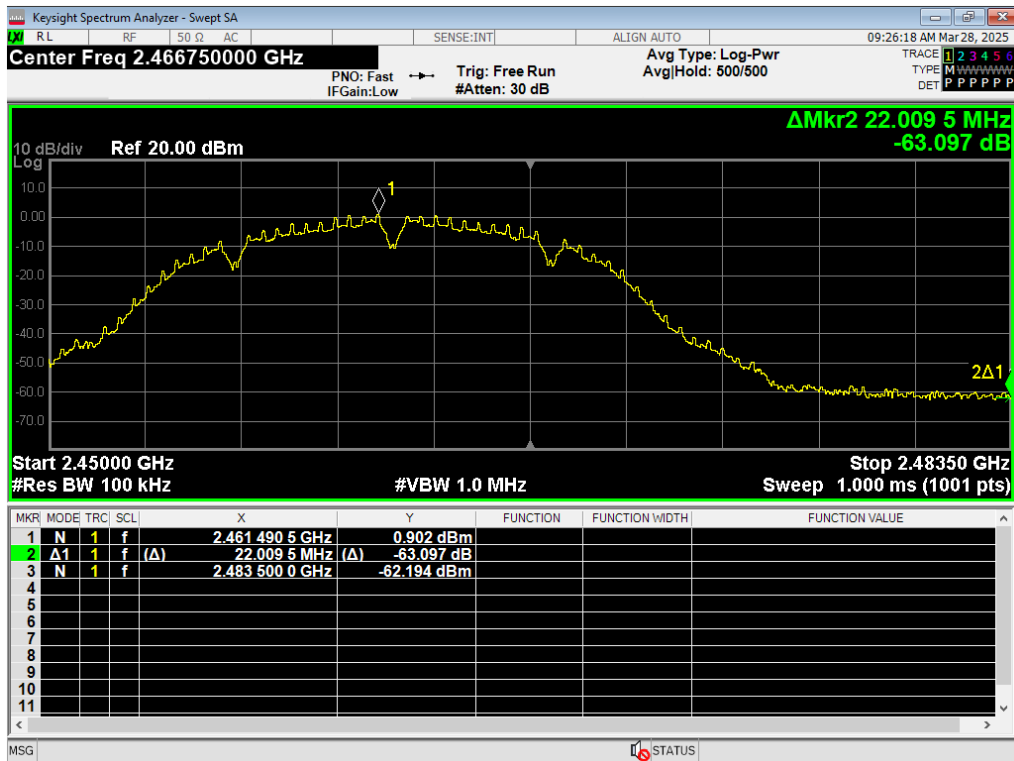
08 PSD, WiFi B 1MB, 2437MHz



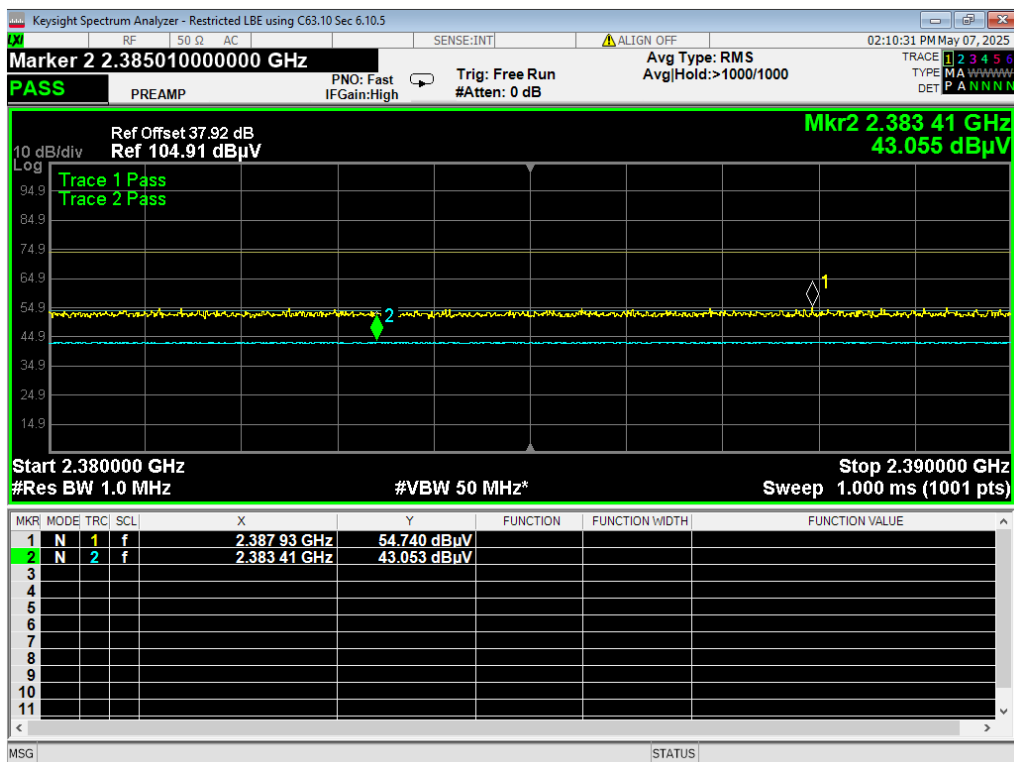
09 PSD, WiFi B 1MB, 2462MHz



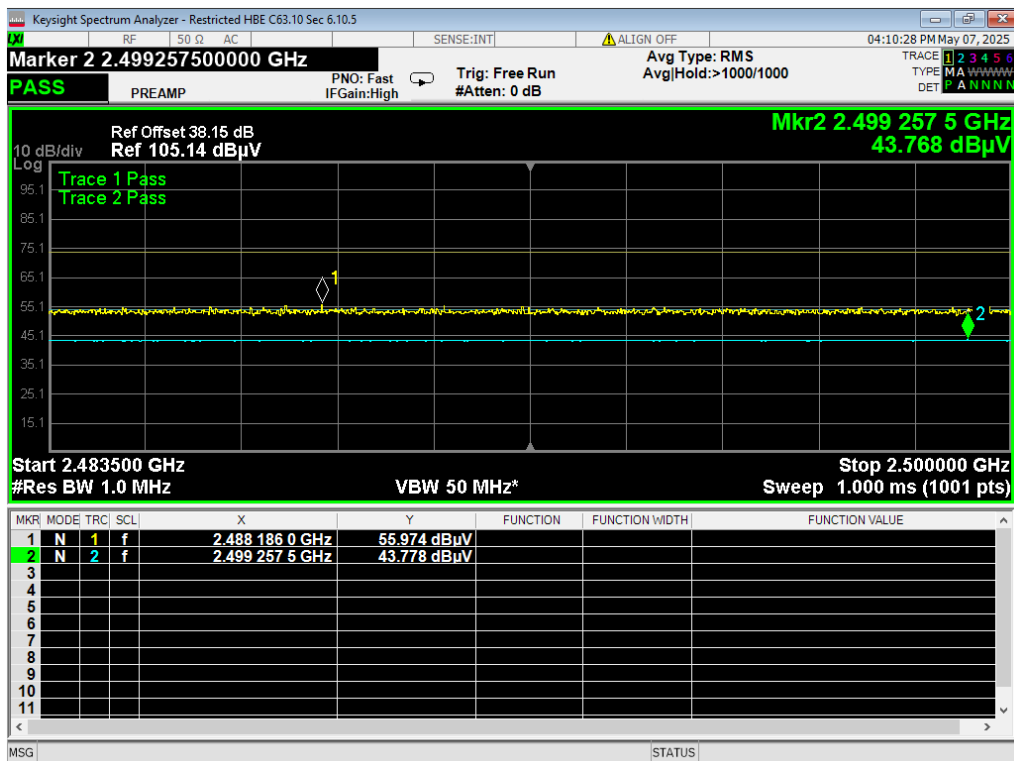
10 LBE Unrestricted, WiFi B 1MB



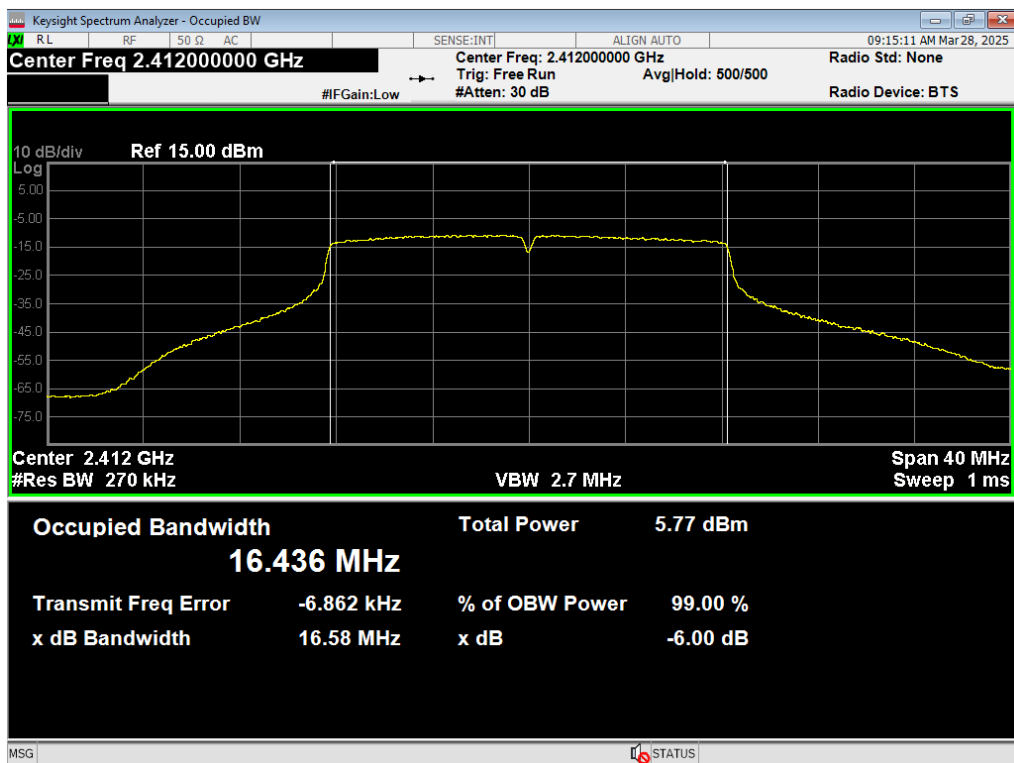
11 HBE Unrestricted, WiFi B 1MB



12 LBE Restricted, Wifi B 1MB

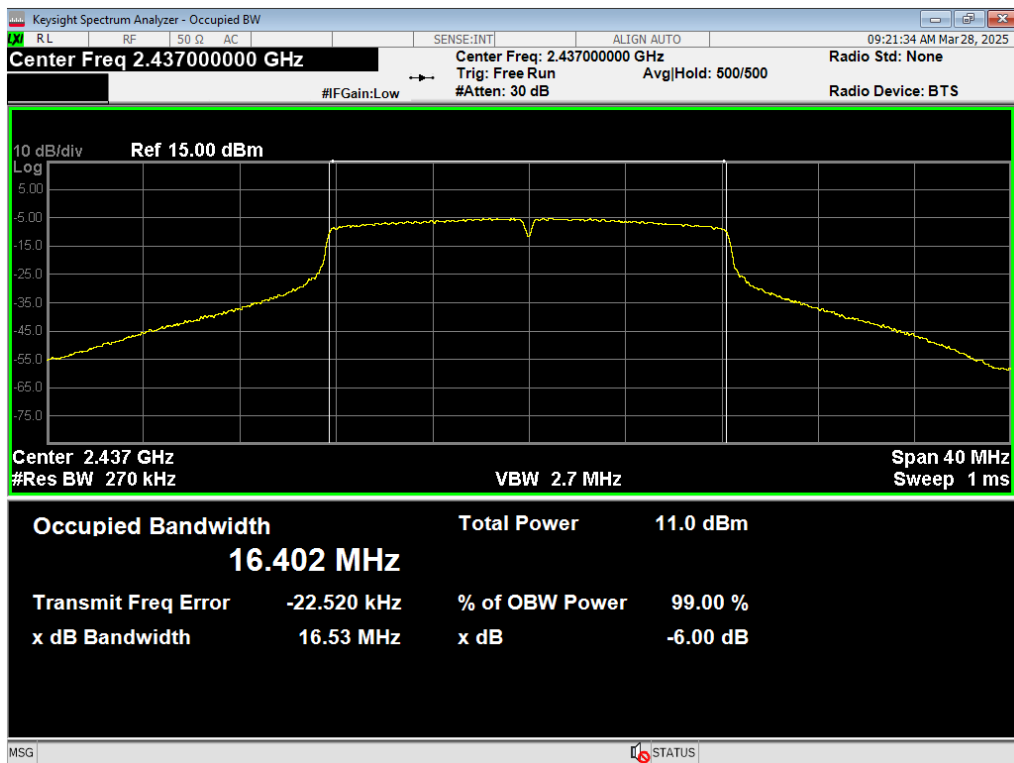


13 HBE Restricted, Wifi B 1MB, Ch11

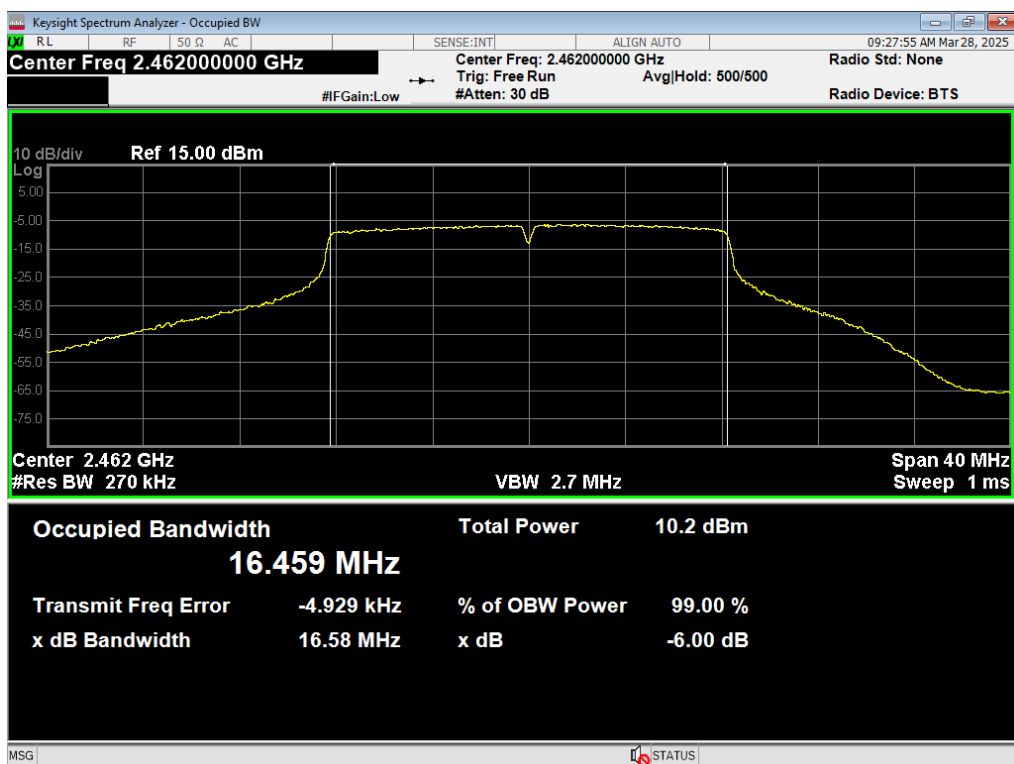


14 Occupied BW, WiFi G 6MB, 2412MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

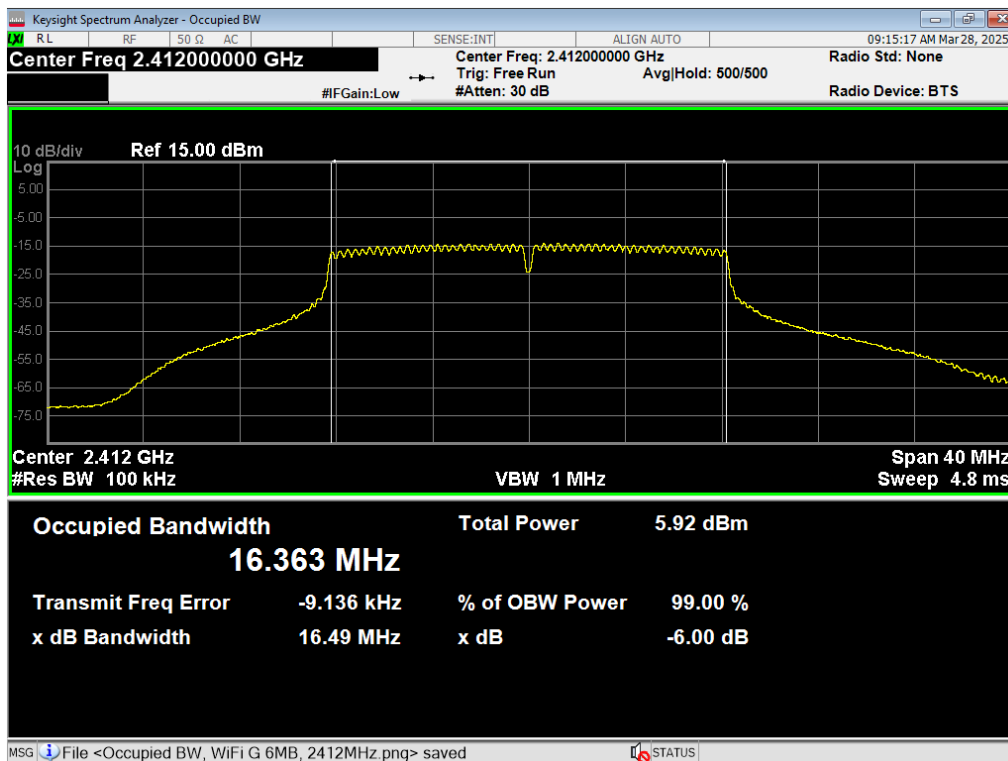


15 Occupied BW, WiFi G 6MB, 2437MHz

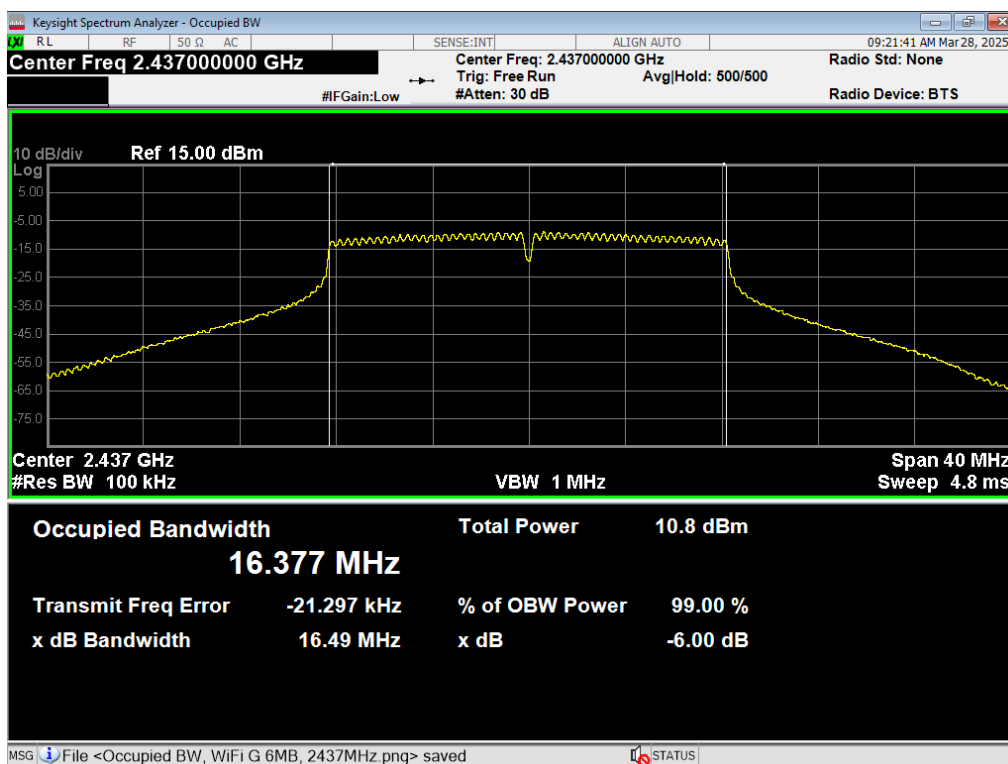


16 Occupied BW, WiFi G 6MB, 2462MHz

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

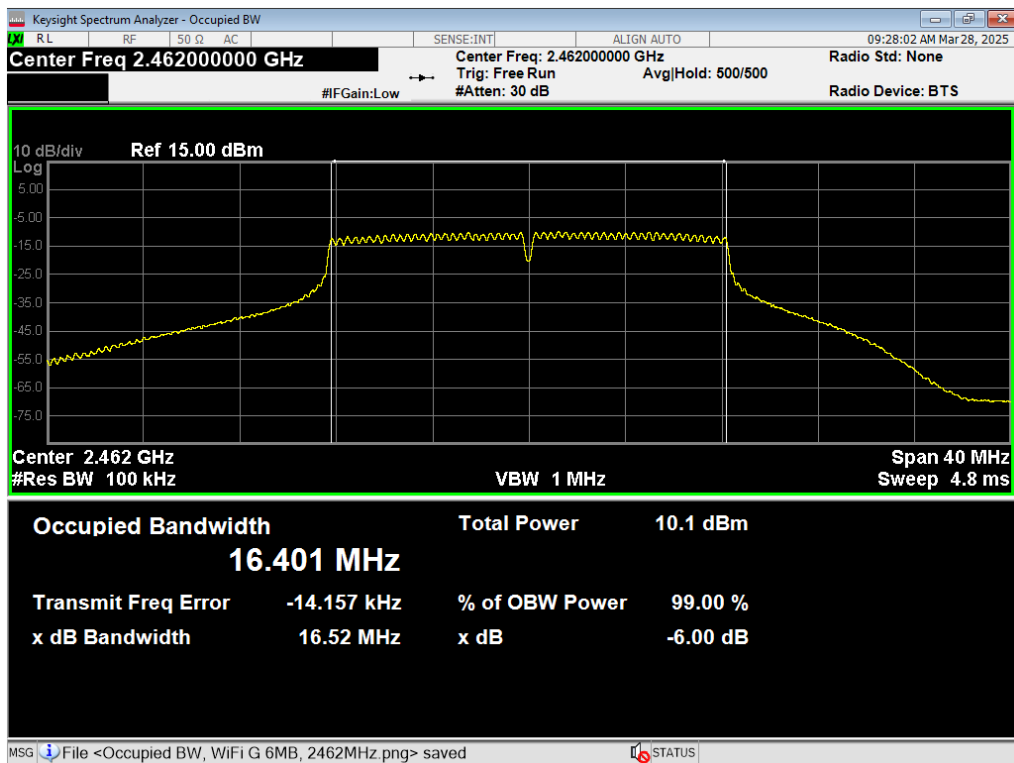


17 6dB BW, WiFi G 6MB, 2412MHz

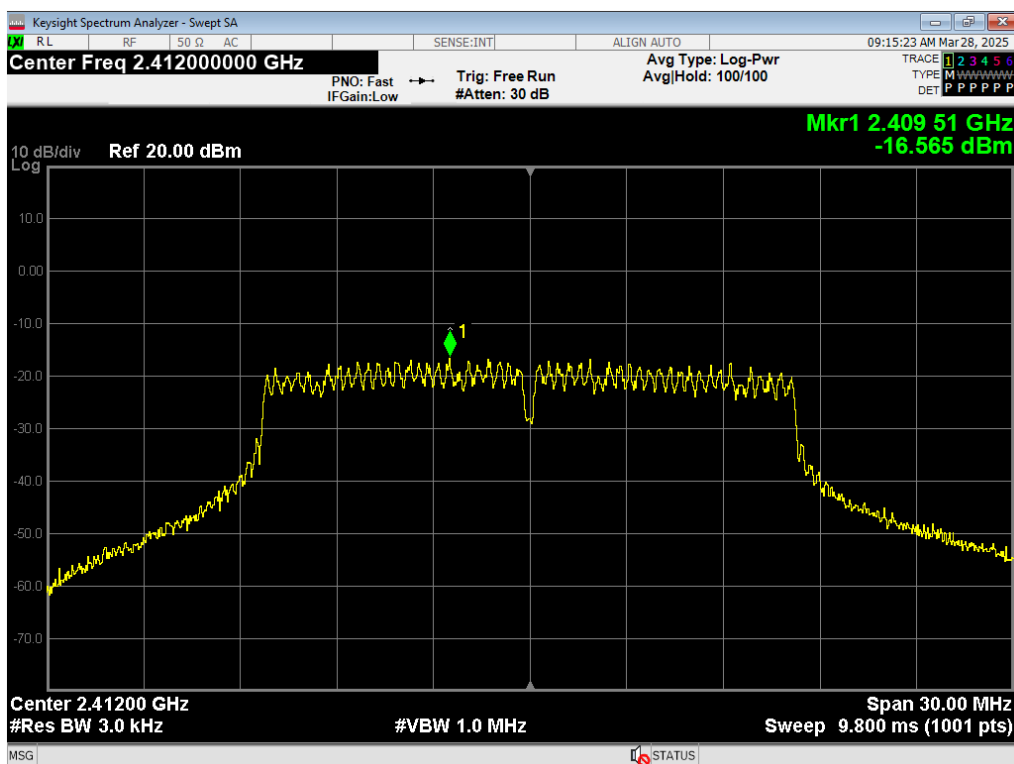


18 6dB BW, WiFi G 6MB, 2437MHz

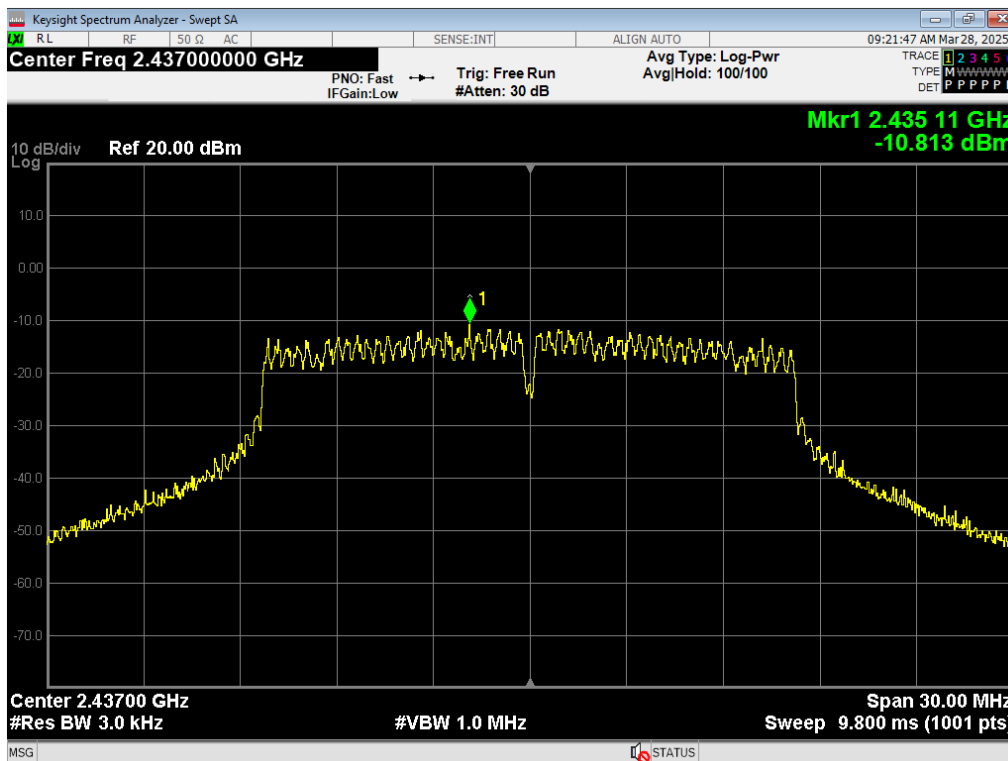
Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		



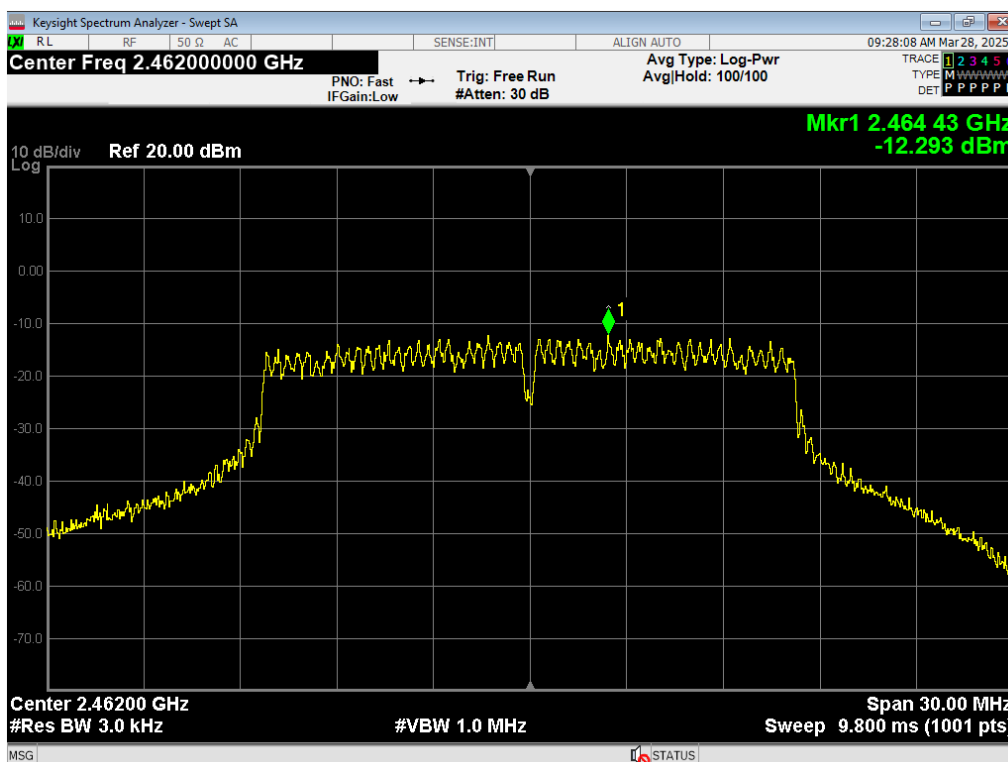
19 6dB BW, WiFi G 6MB, 2462MHz



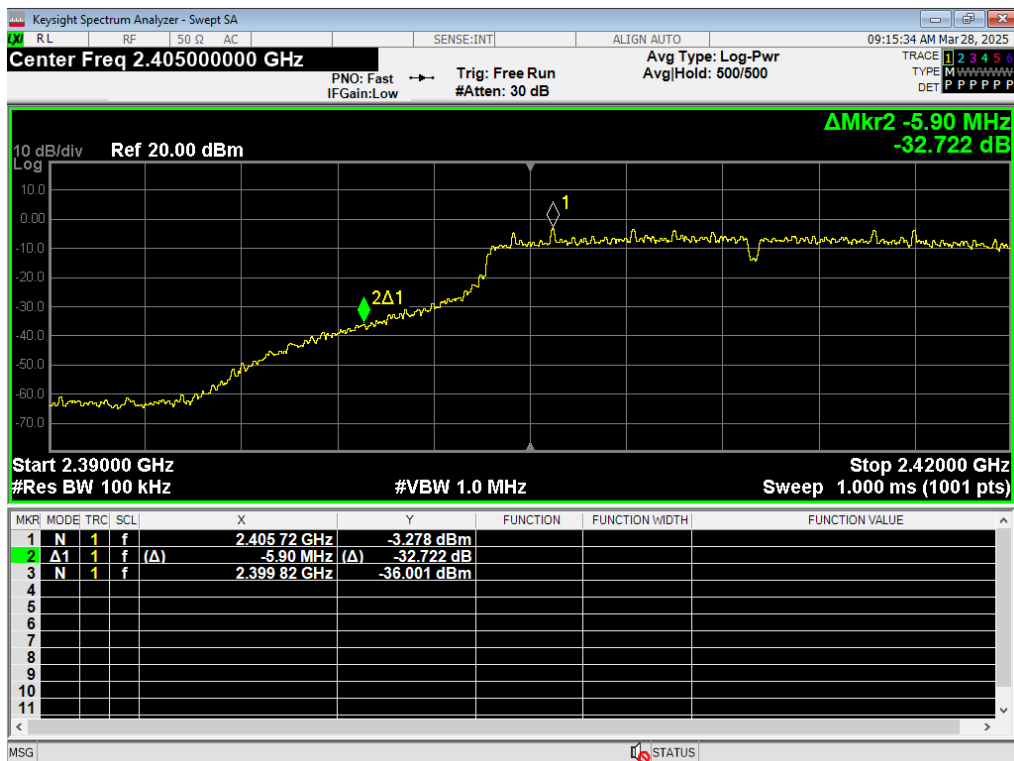
20 PSD, WiFi G 6MB, 2412MHz



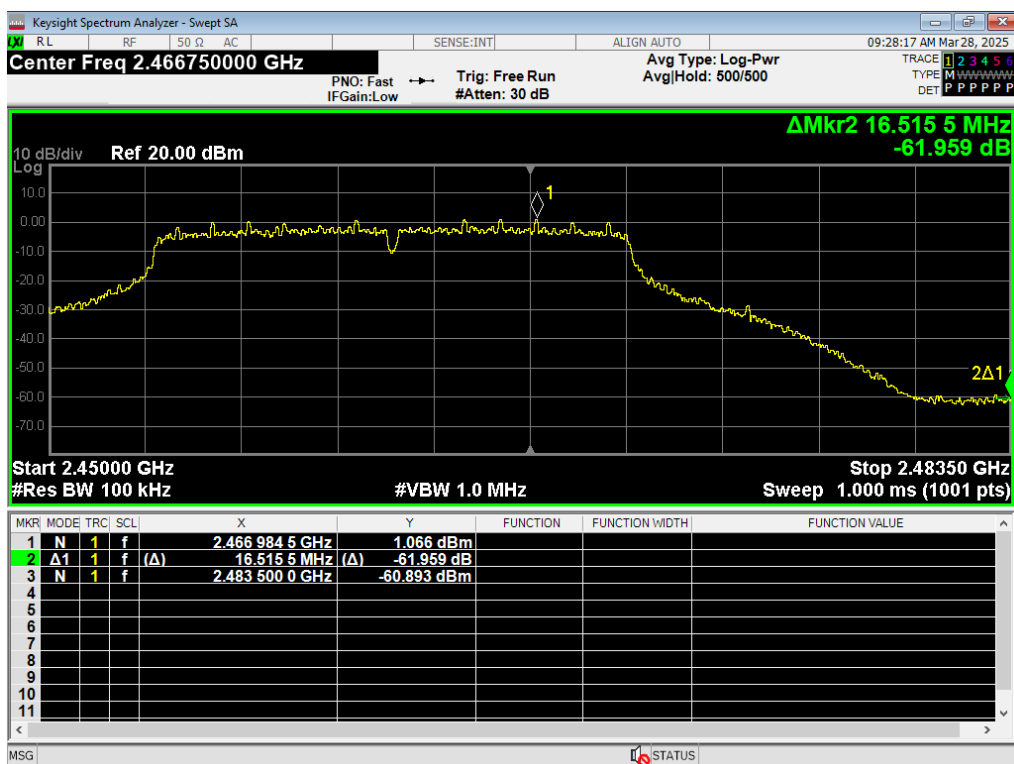
21 PSD, WiFi G 6MB, 2437MHz



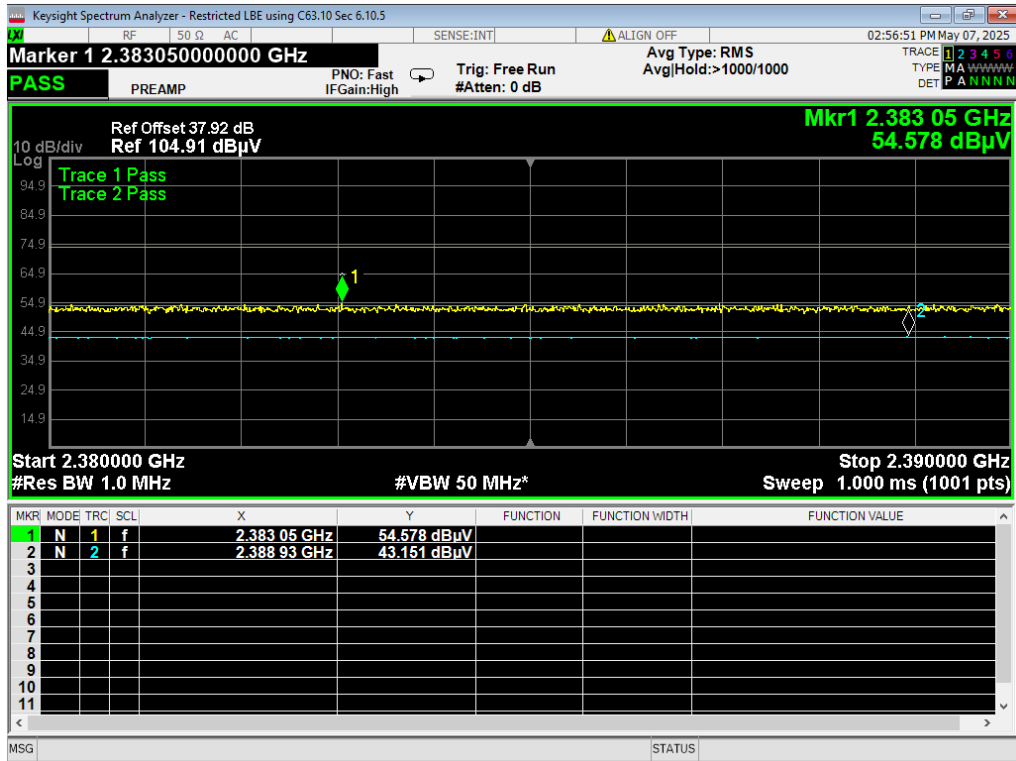
22 PSD, WiFi G 6MB, 2462MHz



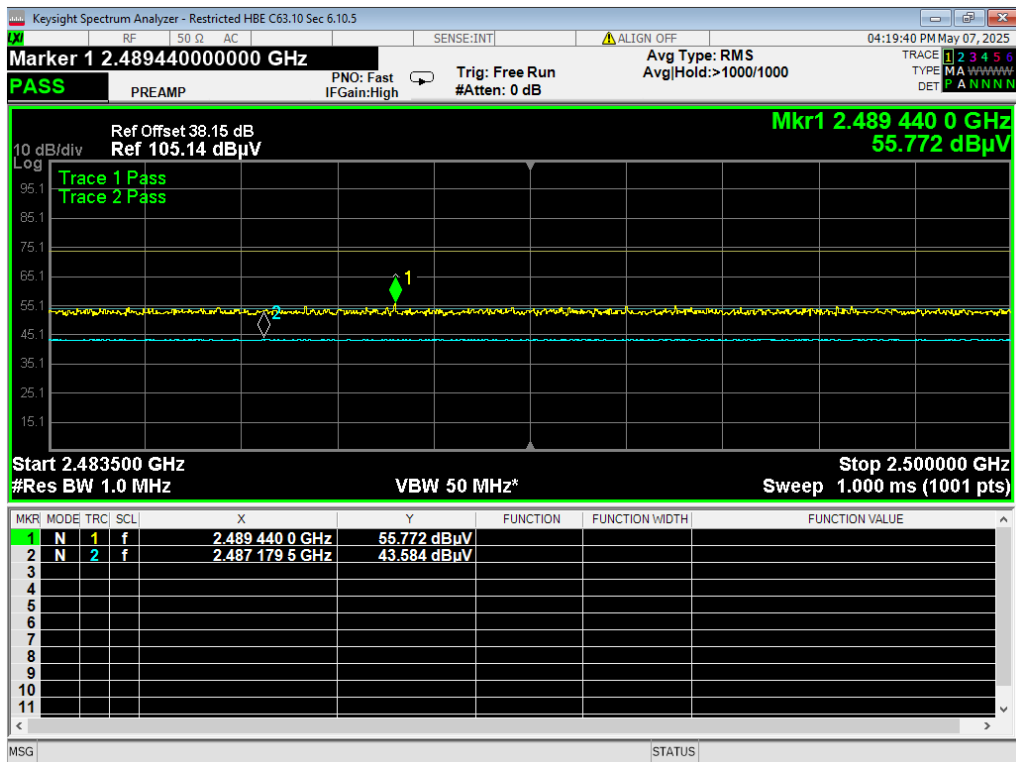
23 LBE Unrestricted, WiFi G 6MB



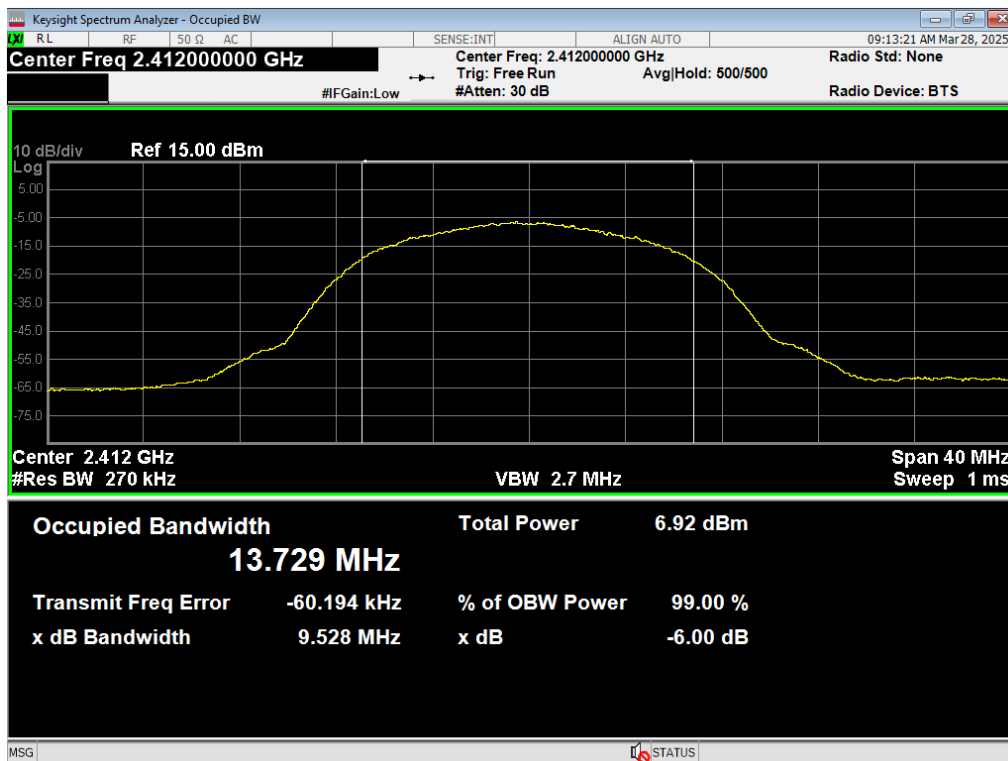
24 HBE Unrestricted, WiFi G 6MB



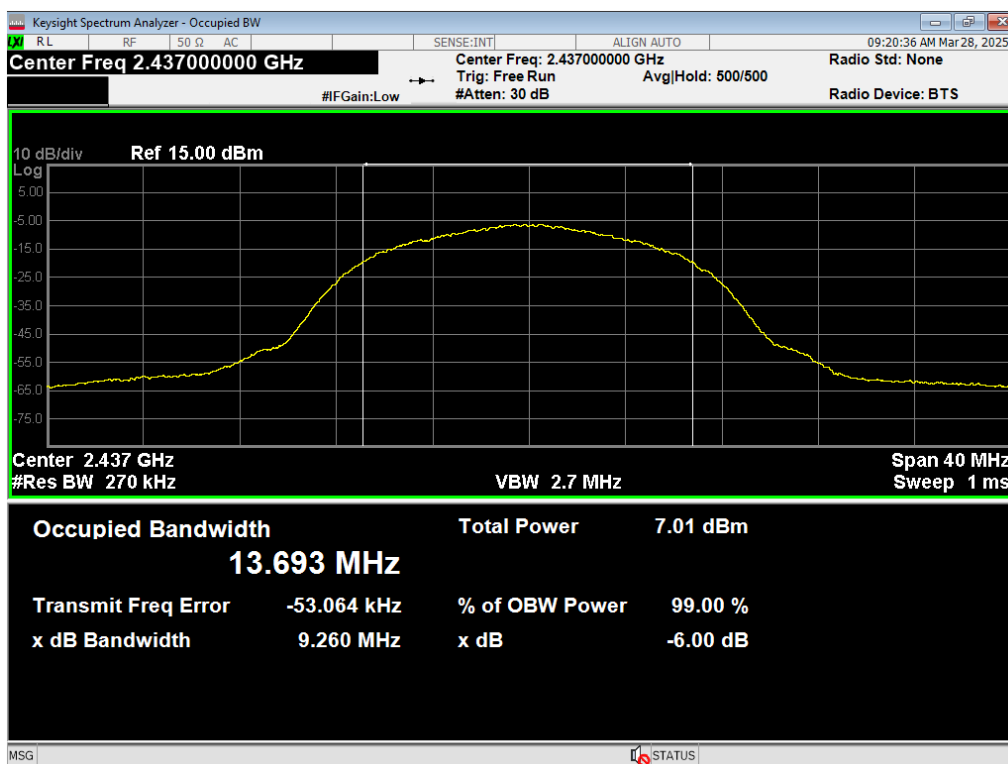
25 LBE Restricted, Wifi G 6MB



26 HBE Restricted, Wifi G 6MB, Ch11

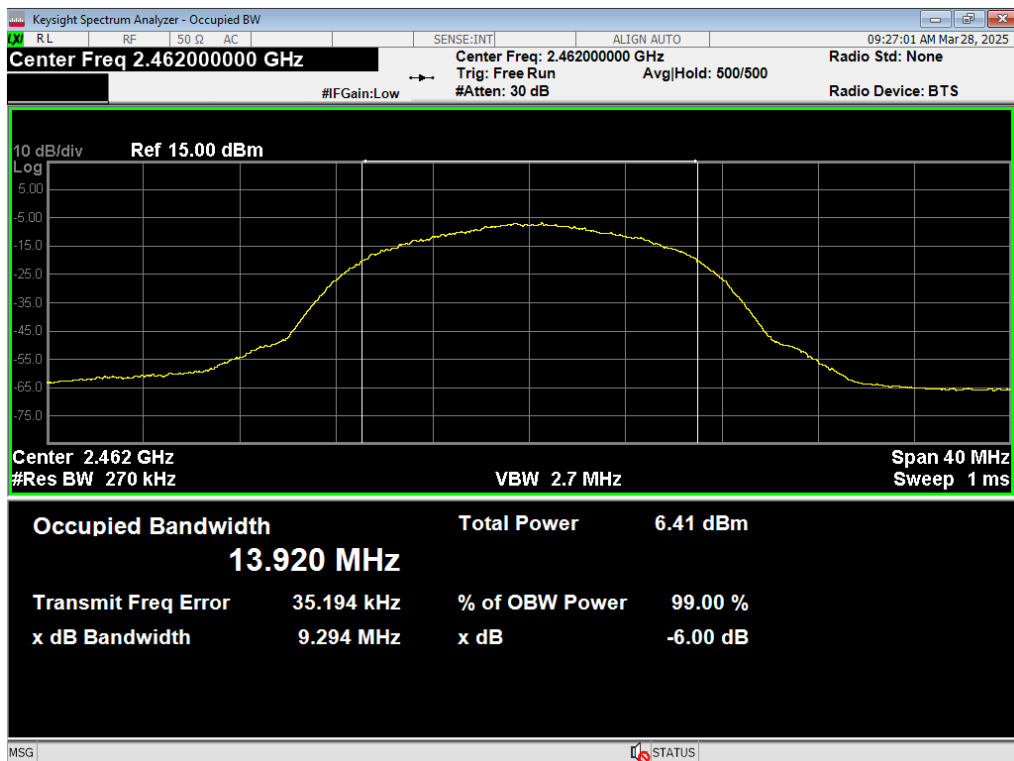


40 Occupied BW, WiFi B 11MB, 2412MHz27 Occupied BW, WiFi N MCS0, 2412MHz

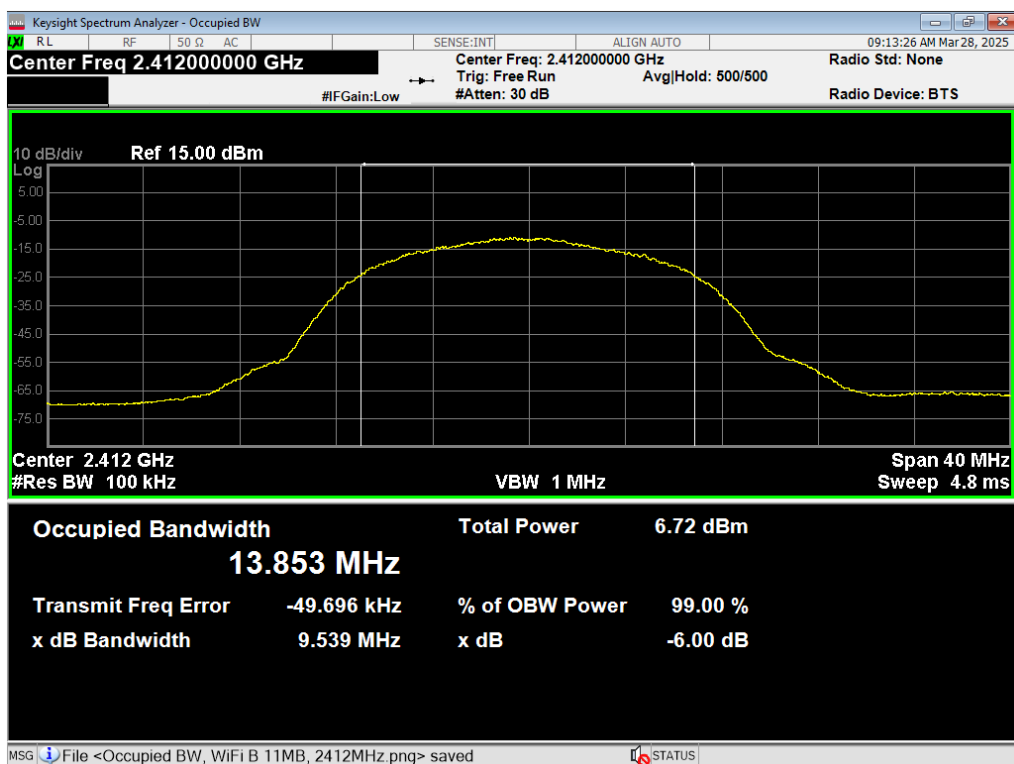


41 Occupied BW, WiFi B 11MB, 2437MHz28 Occupied BW, WiFi N MCS0, 2437MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

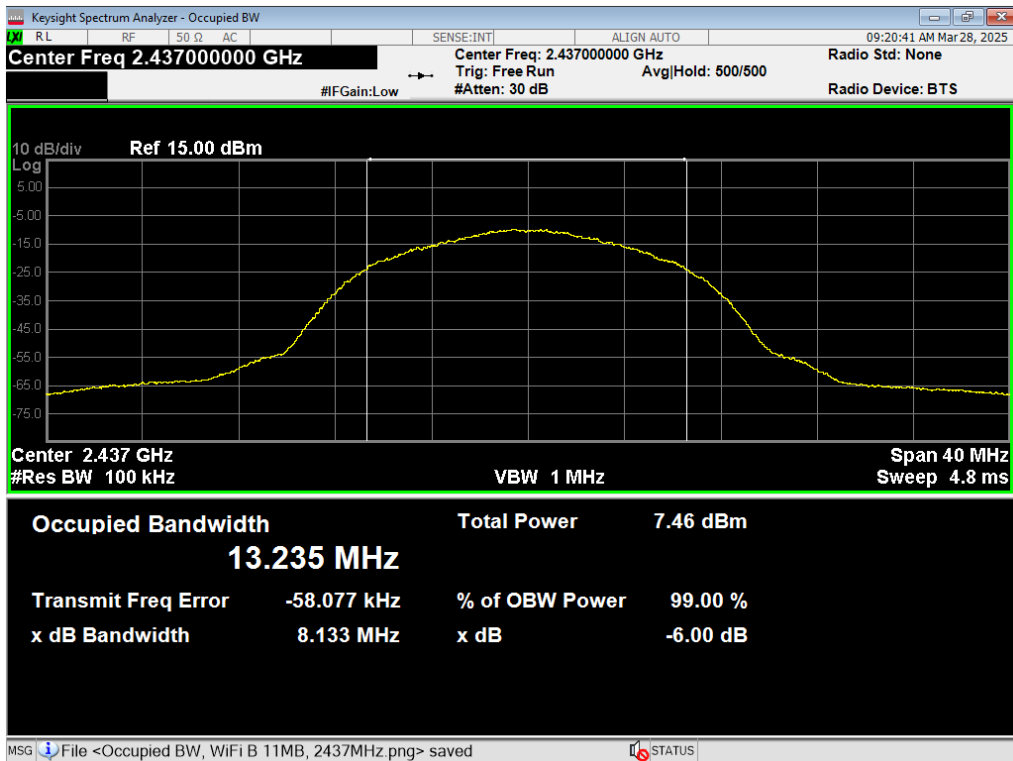


42 Occupied BW, WiFi B 11MB, 2462MHz29 Occupied BW, WiFi N MCS0, 2462MHz

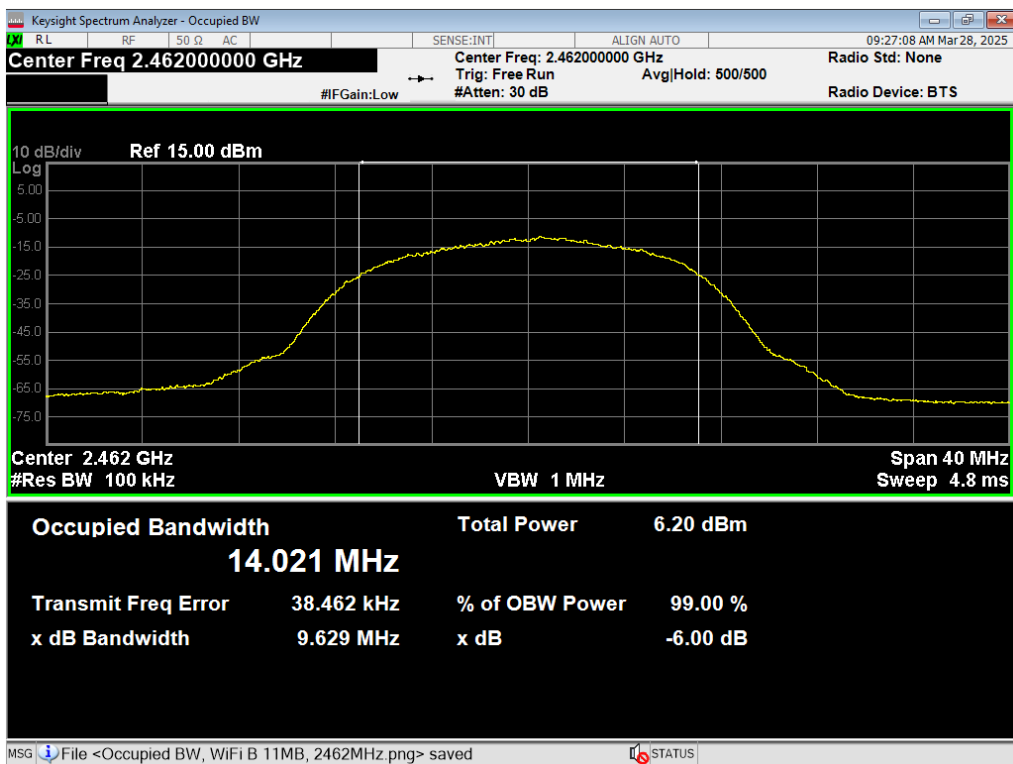


43 6dB BW, WiFi B 11MB, 2412MHz30 6dB BW, WiFi N MCS0, 2412MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

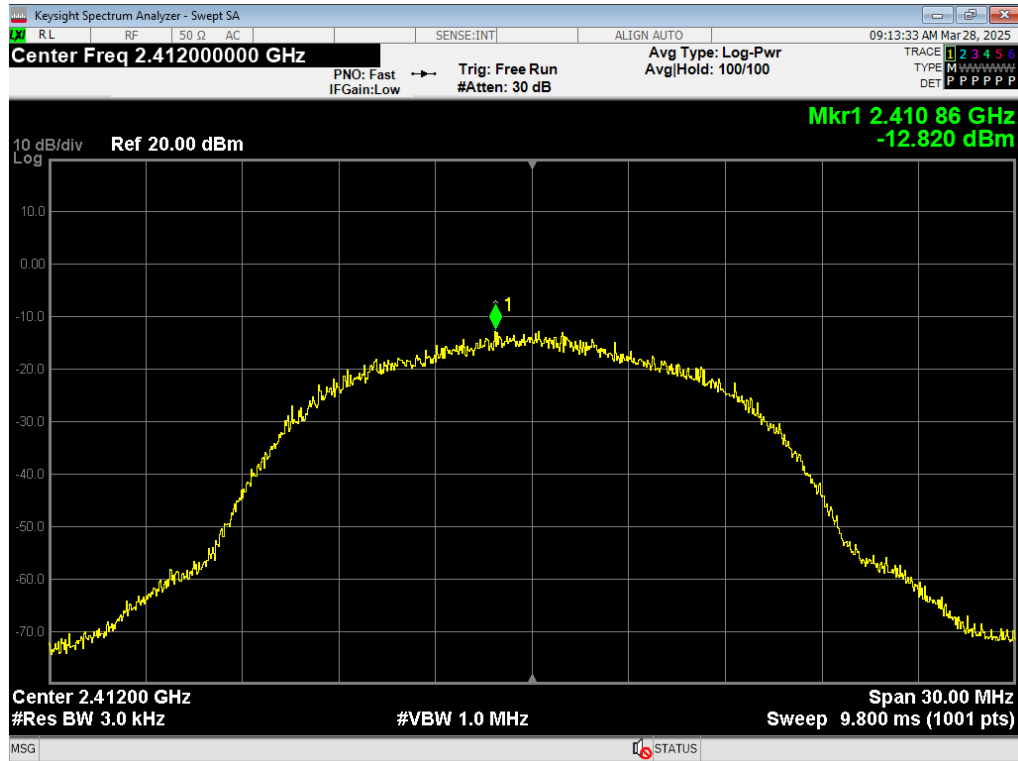


44 6dB BW, WiFi B 11MB, 2437MHz31 6dB BW, WiFi N MCS0, 2437MHz

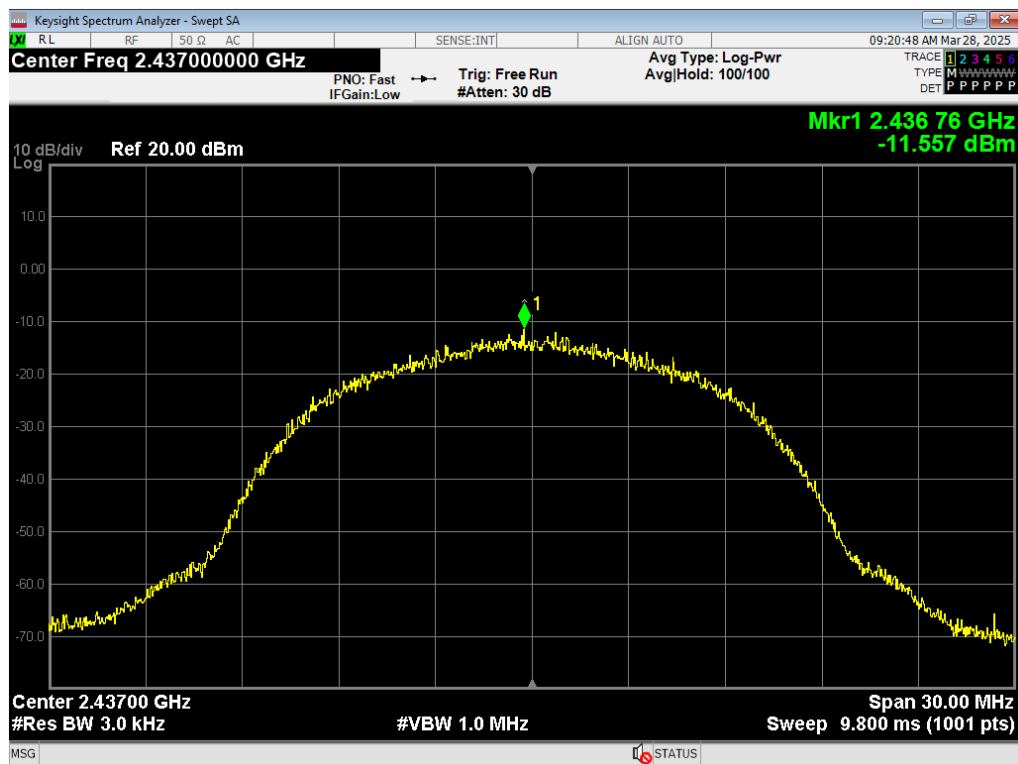


45 6dB BW, WiFi B 11MB, 2462MHz32 6dB BW, WiFi N MCS0, 2462MHz

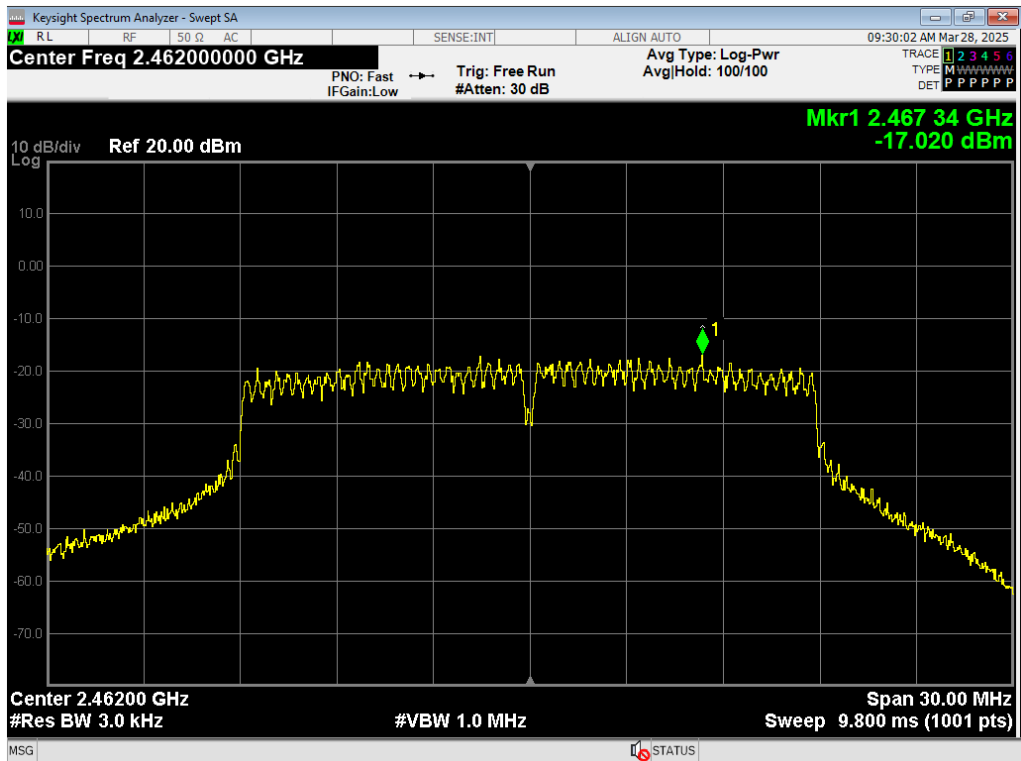
	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		



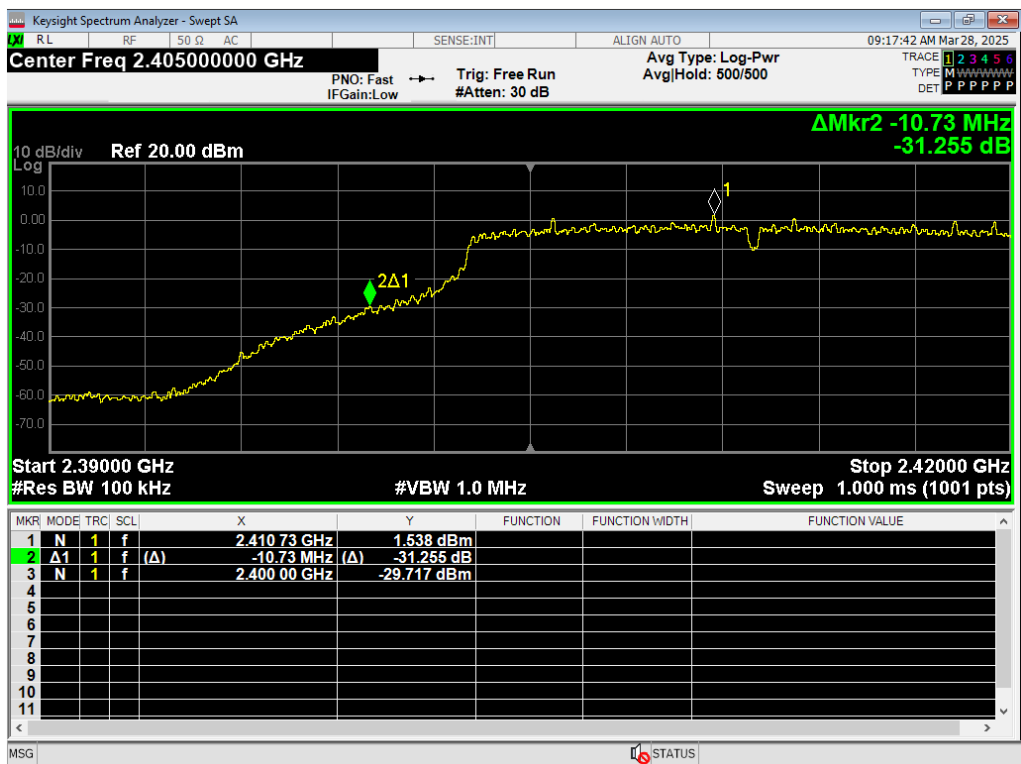
46 PSD, WiFi B 11MB, 2412MHz33 PSD, WiFi N MCS0, 2412MHz



47 PSD, WiFi B 11MB, 2437MHz34 PSD, WiFi N MCS0, 2437MHz



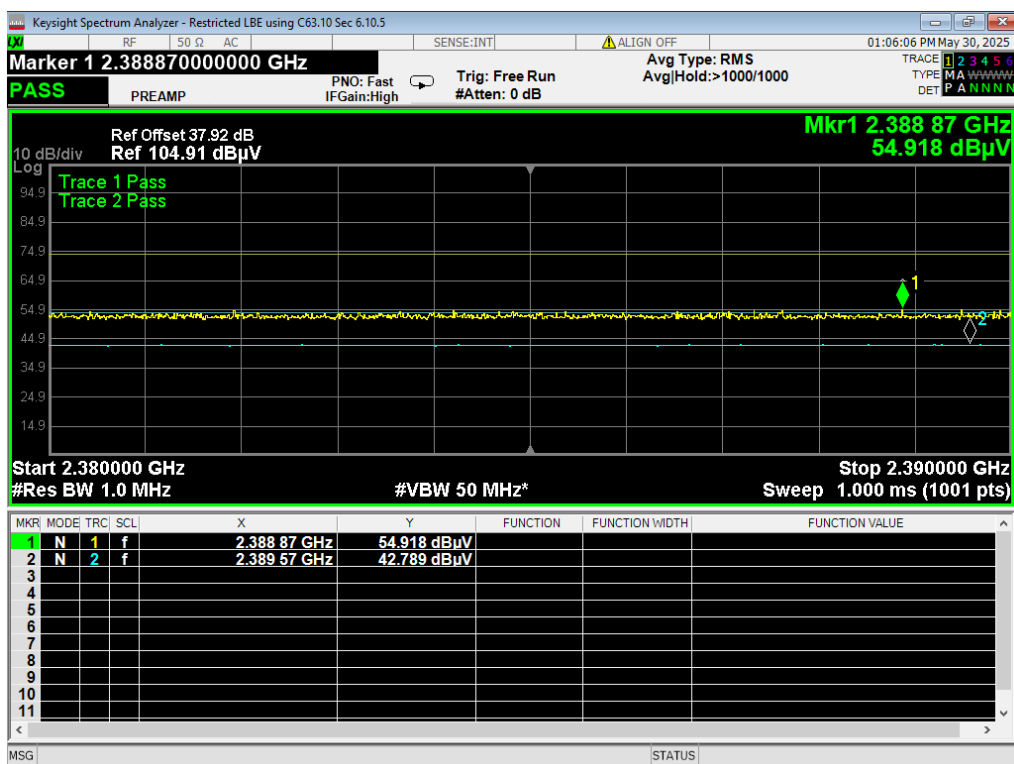
35 PSD, WiFi N MCS0, 2462MHz



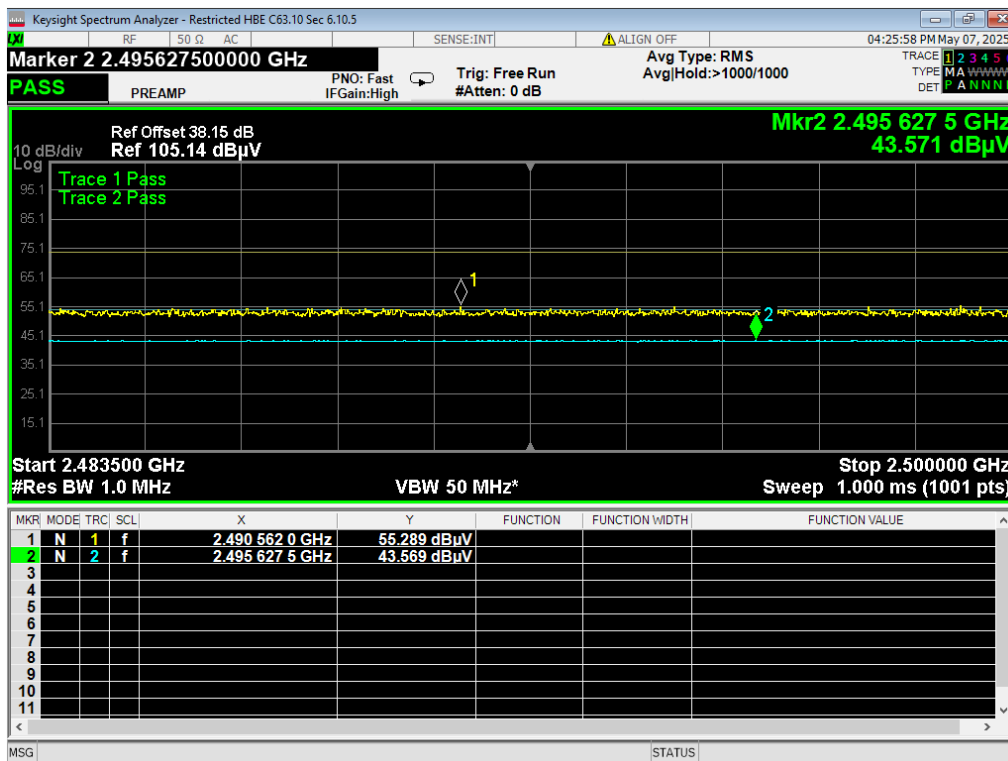
36 LBE Unrestricted, WiFi N MCS0



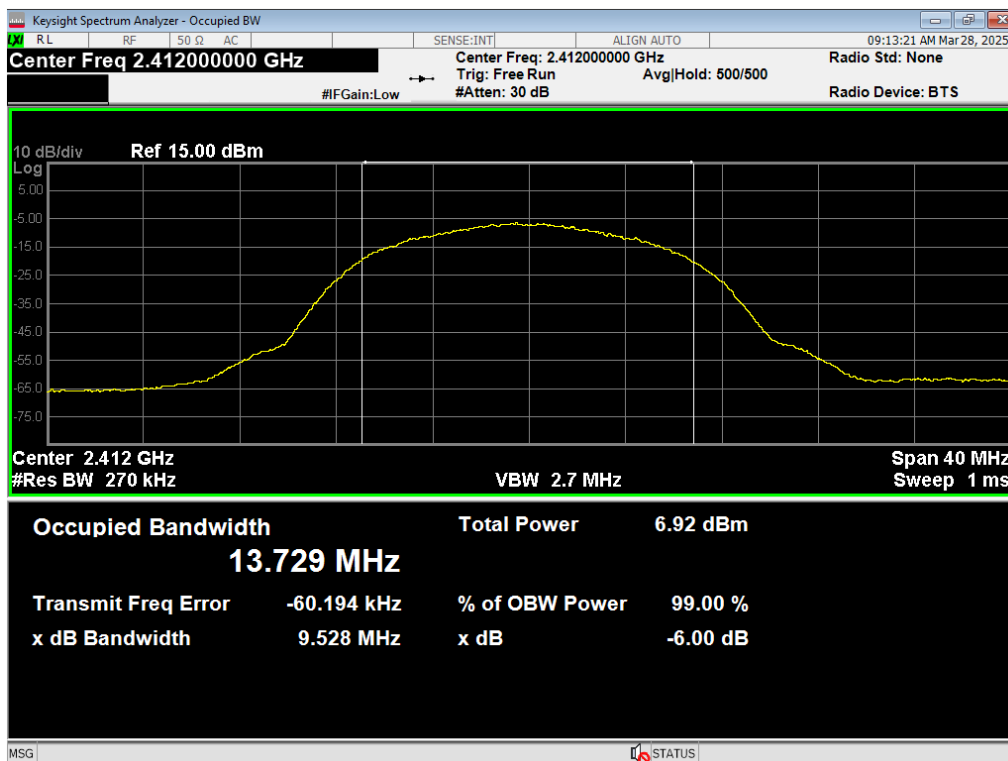
37 HBE Unrestricted, WiFi N MCS0



38 LBE Restricted, Wifi N MCS0

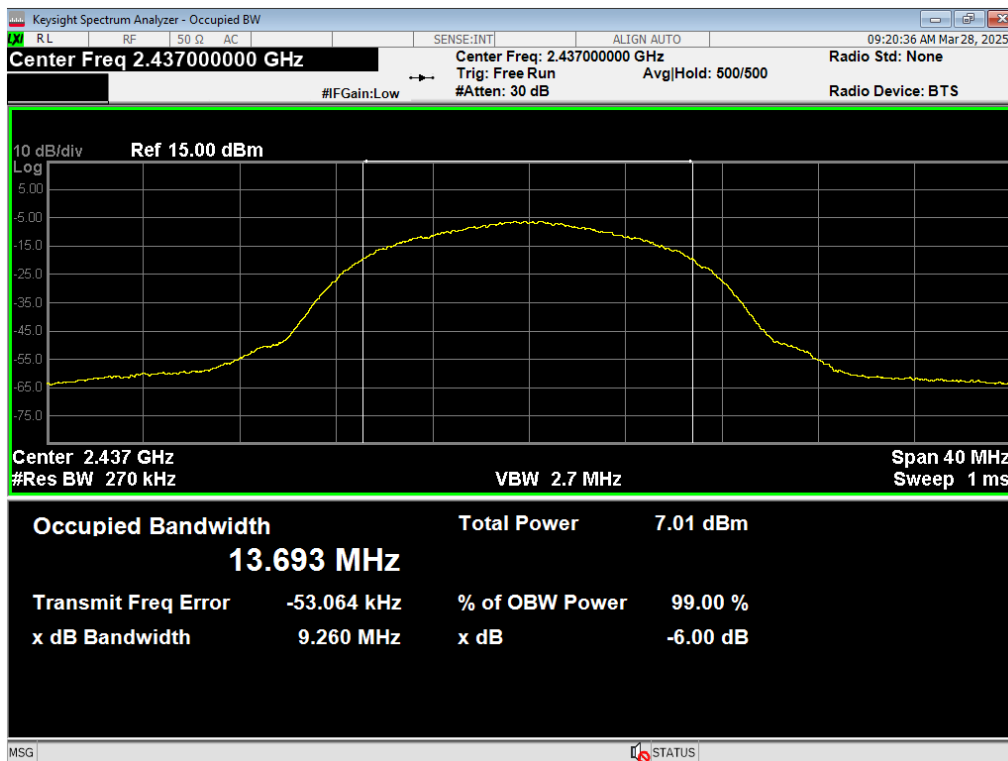


39 HBE Restricted, Wifi N MCS0, Ch11

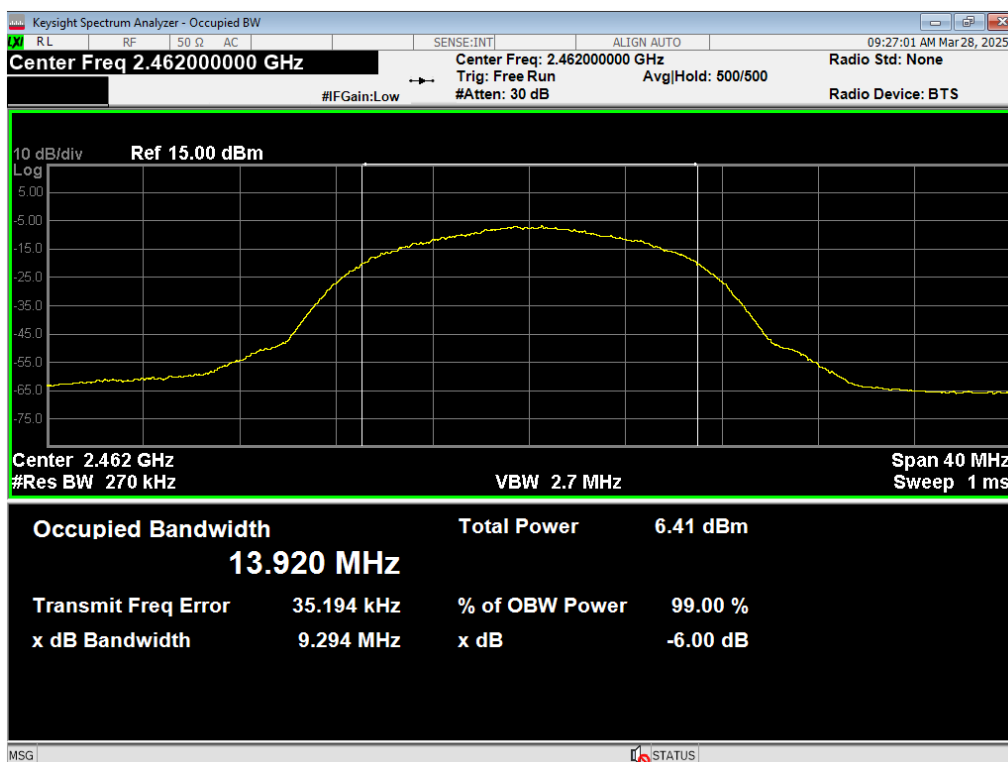


40 Occupied BW, WiFi B 11MB, 2412MHz

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

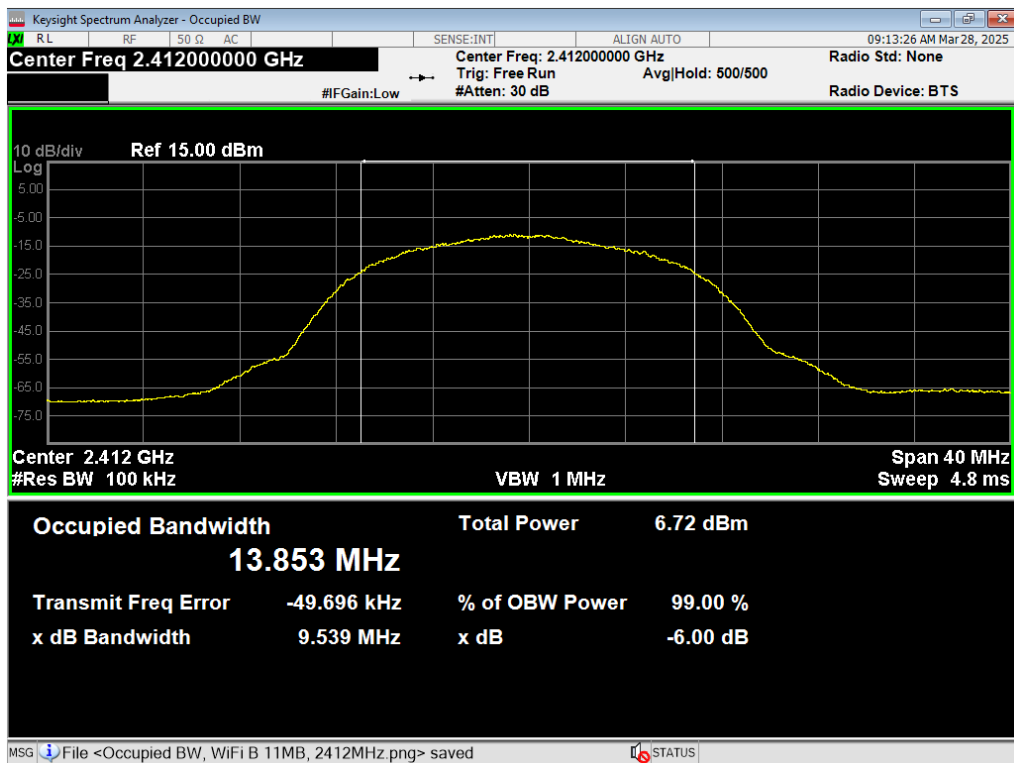


41 Occupied BW, WiFi B 11MB, 2437MHz

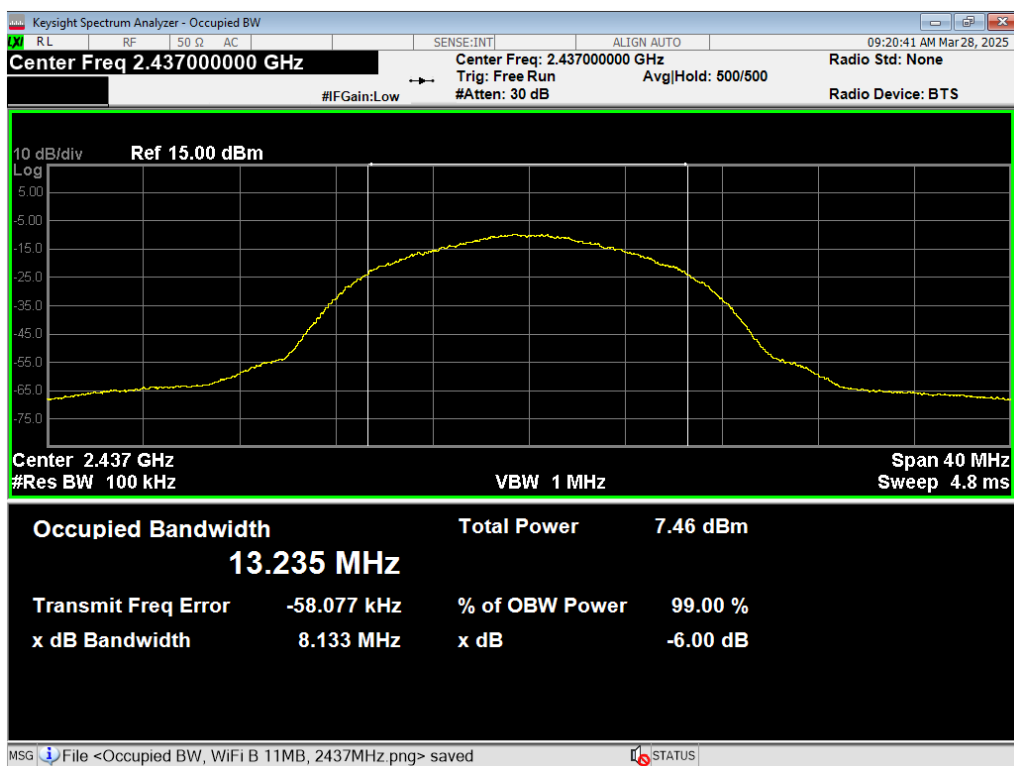


42 Occupied BW, WiFi B 11MB, 2462MHz

	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		

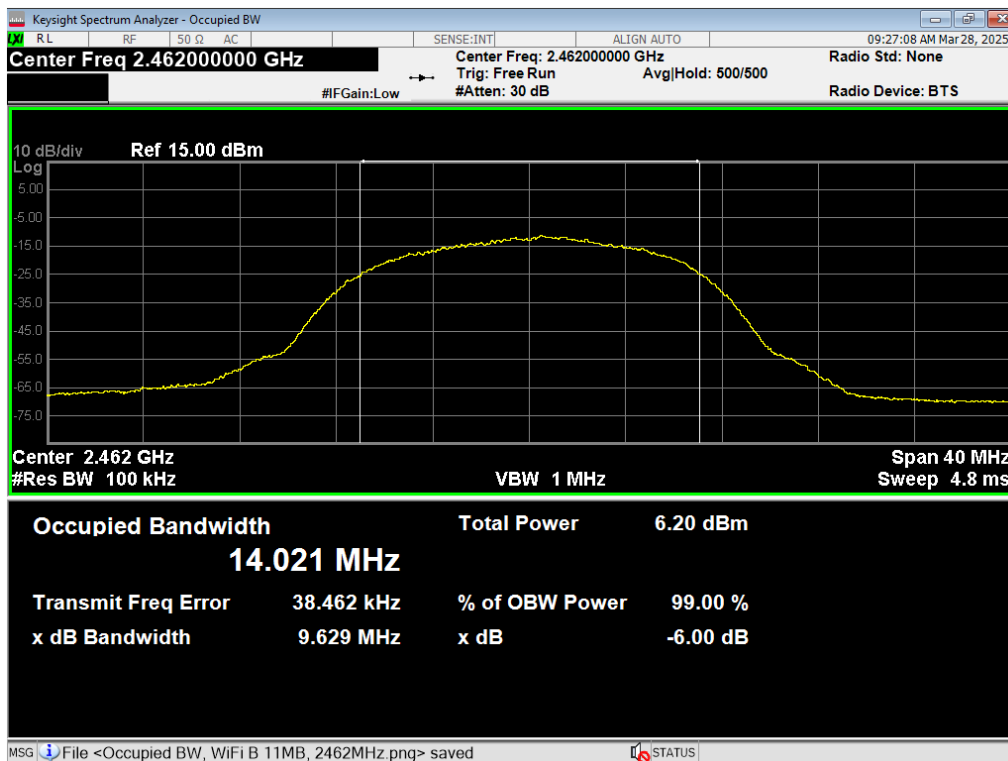


43 6dB BW, WiFi B 11MB, 2412MHz

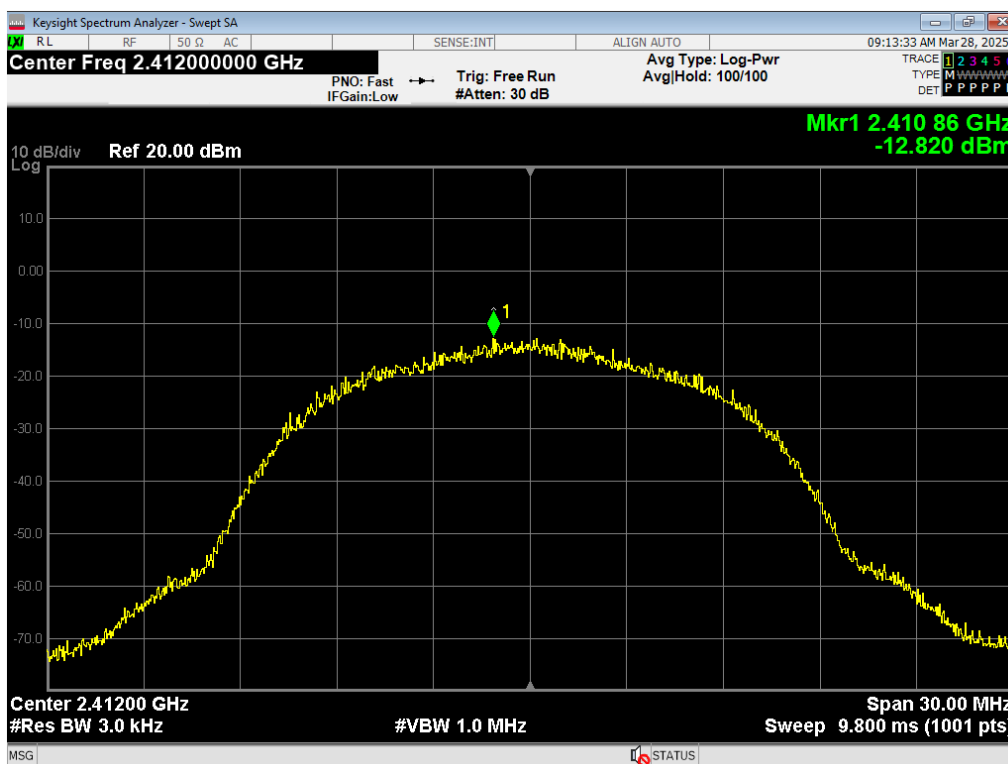


44 6dB BW, WiFi B 11MB, 2437MHz

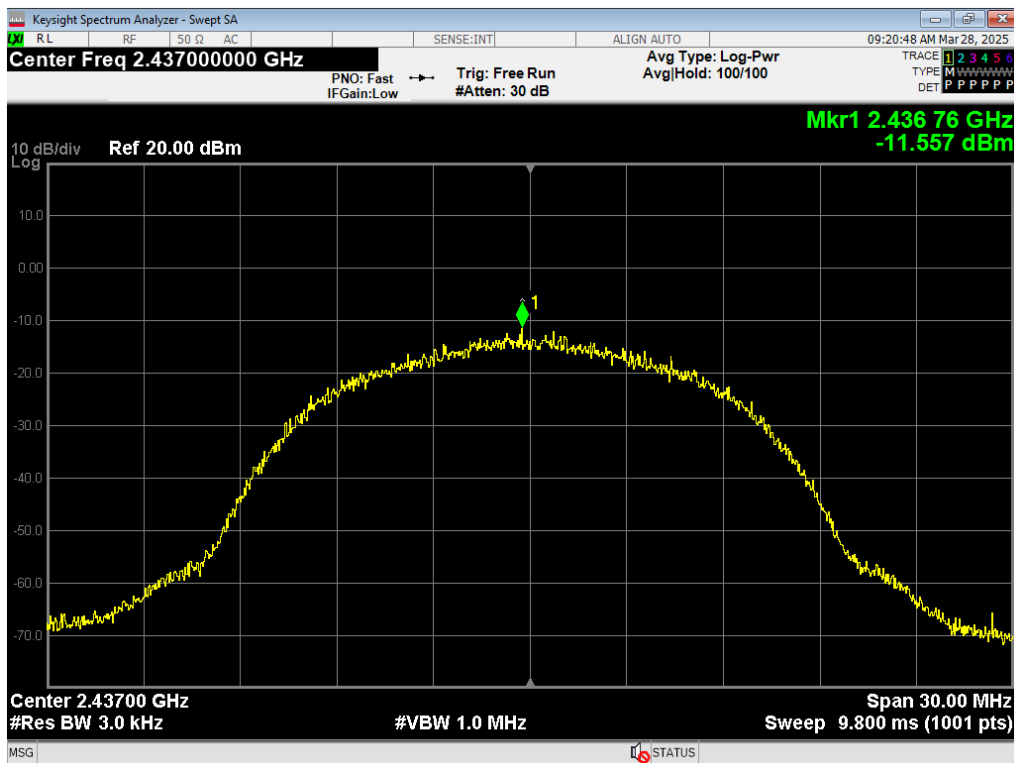
Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		



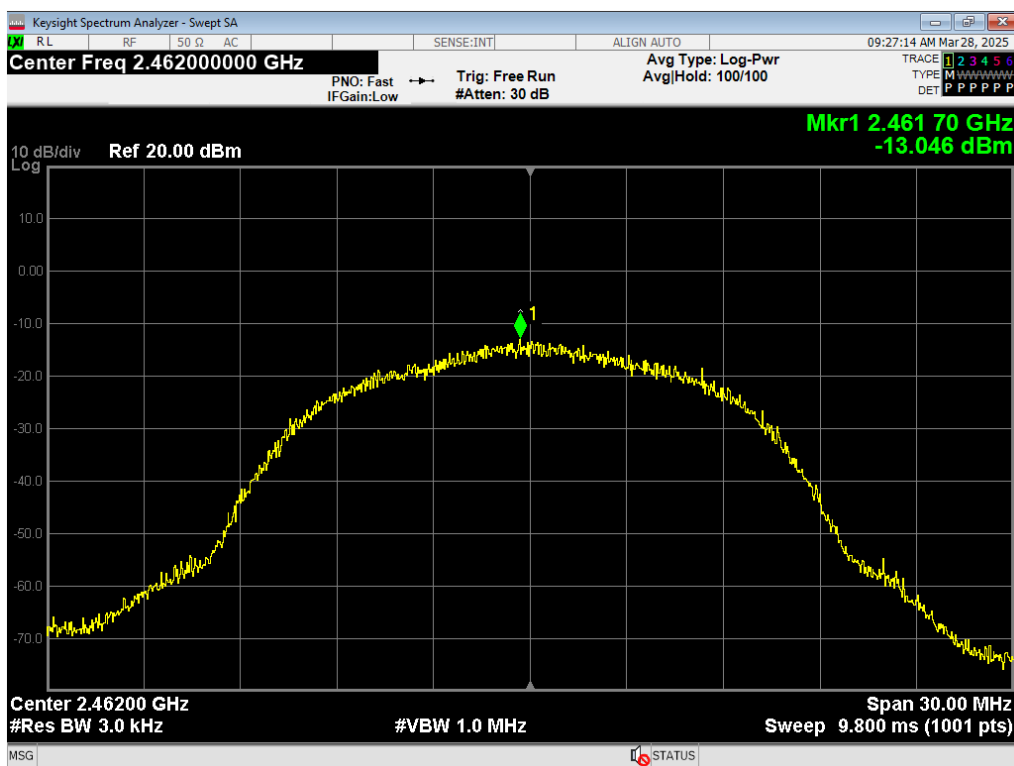
45 6dB BW, WiFi B 11MB, 2462MHz



46 PSD, WiFi B 11MB, 2412MHz



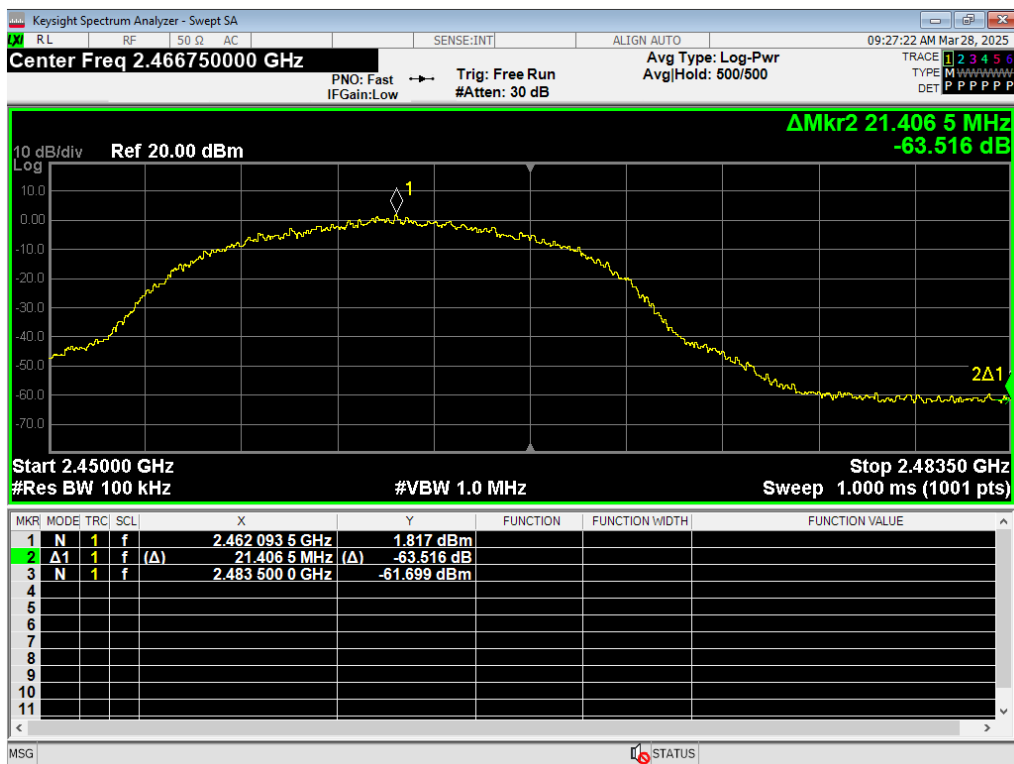
47 PSD, WiFi B 11MB, 2437MHz



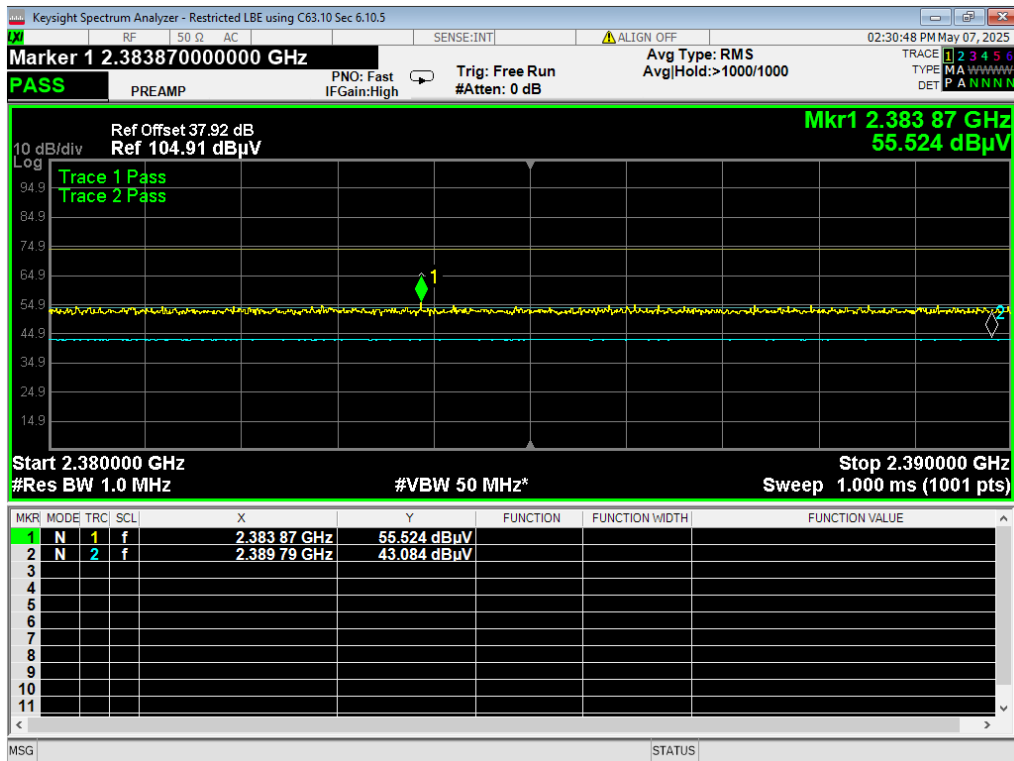
48 PSD, WiFi B 11MB, 2462MHz



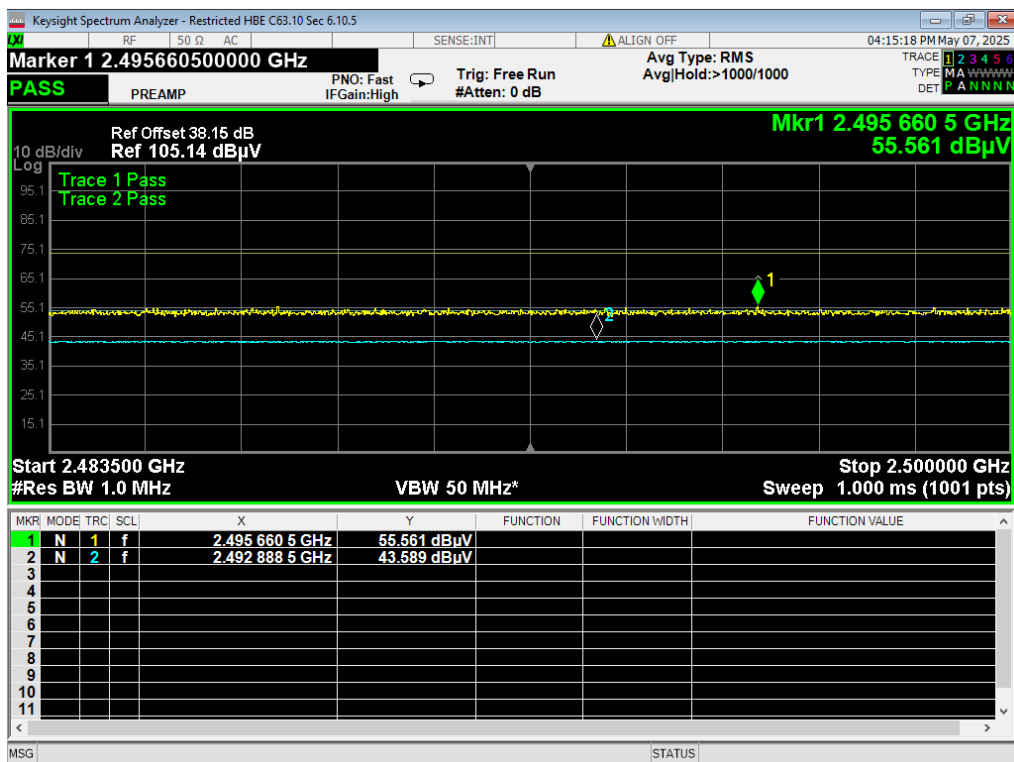
49 LBE Unrestricted, WiFi B 11MB



50 HBE Unrestricted, WiFi B 11MB

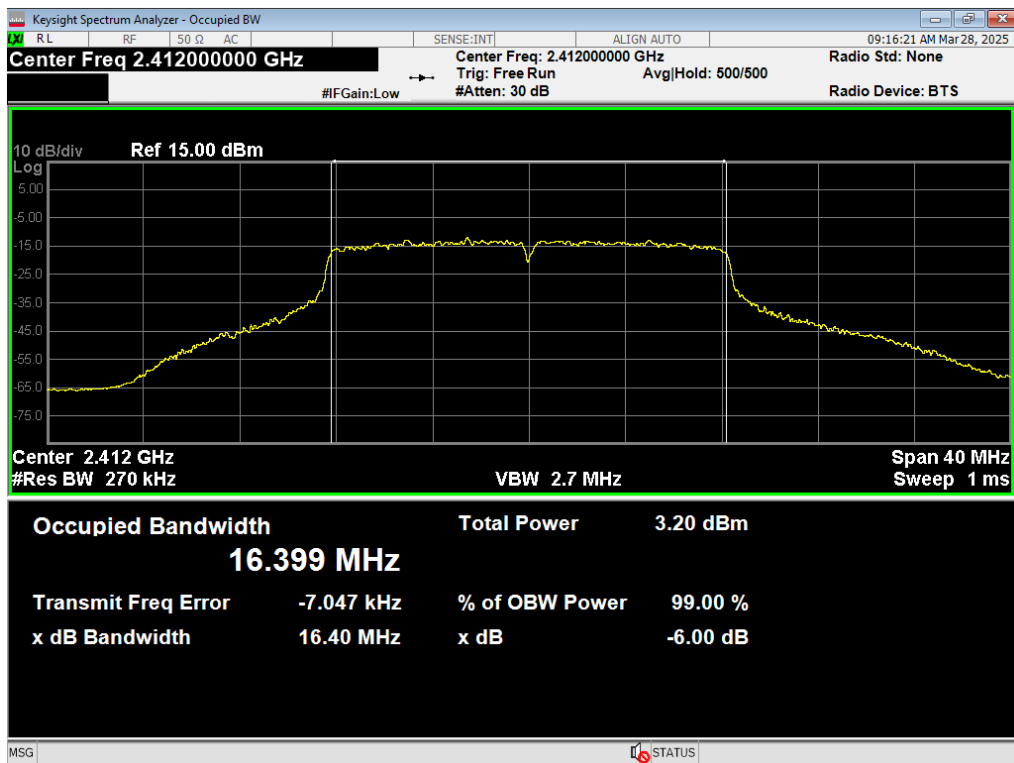


51 LBE Restricted, Wifi B 11MB

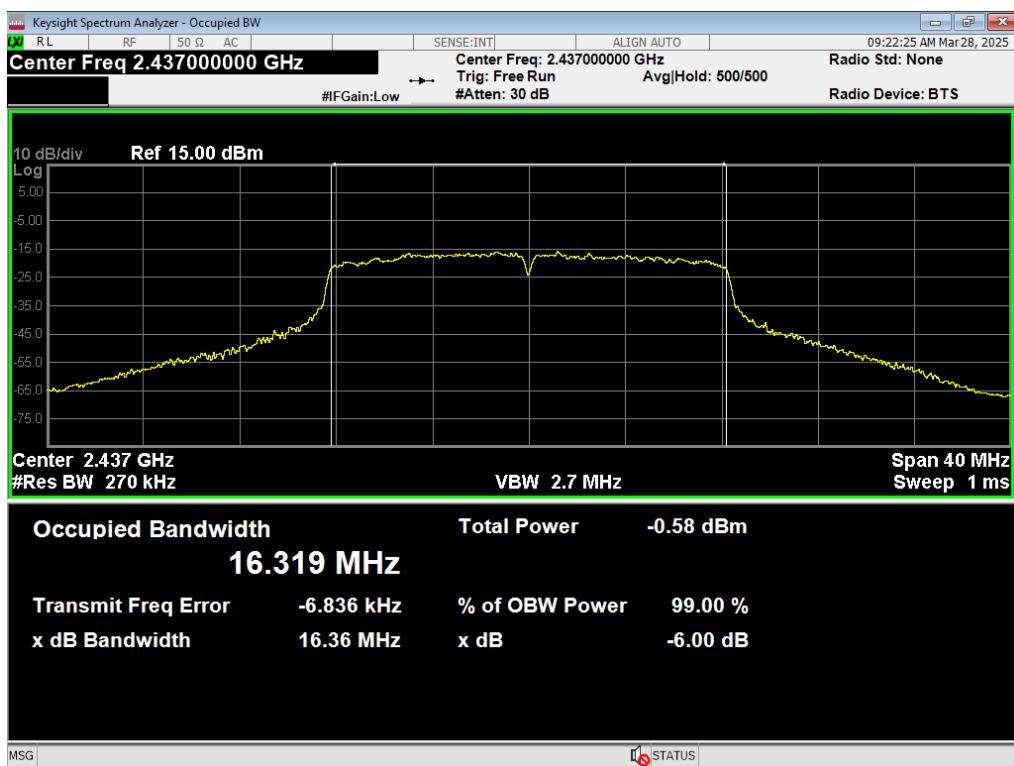


52 HBE Restricted, Wifi B 11MB, Ch11

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

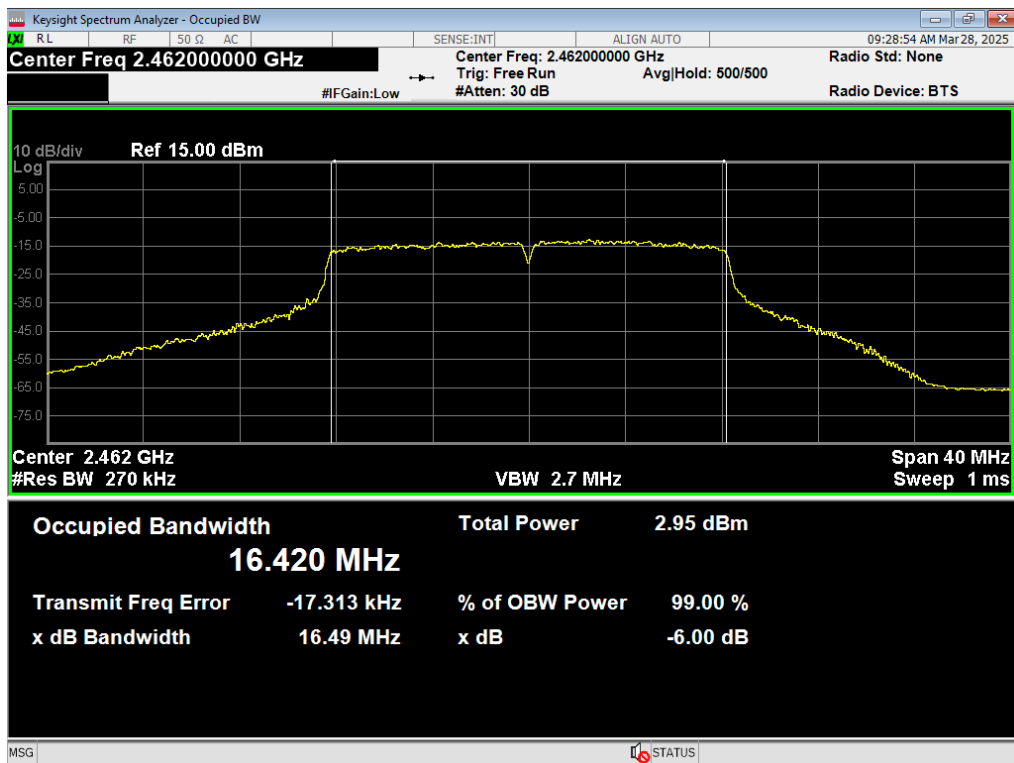


53 Occupied BW, WiFi G 54MB, 2412MHz

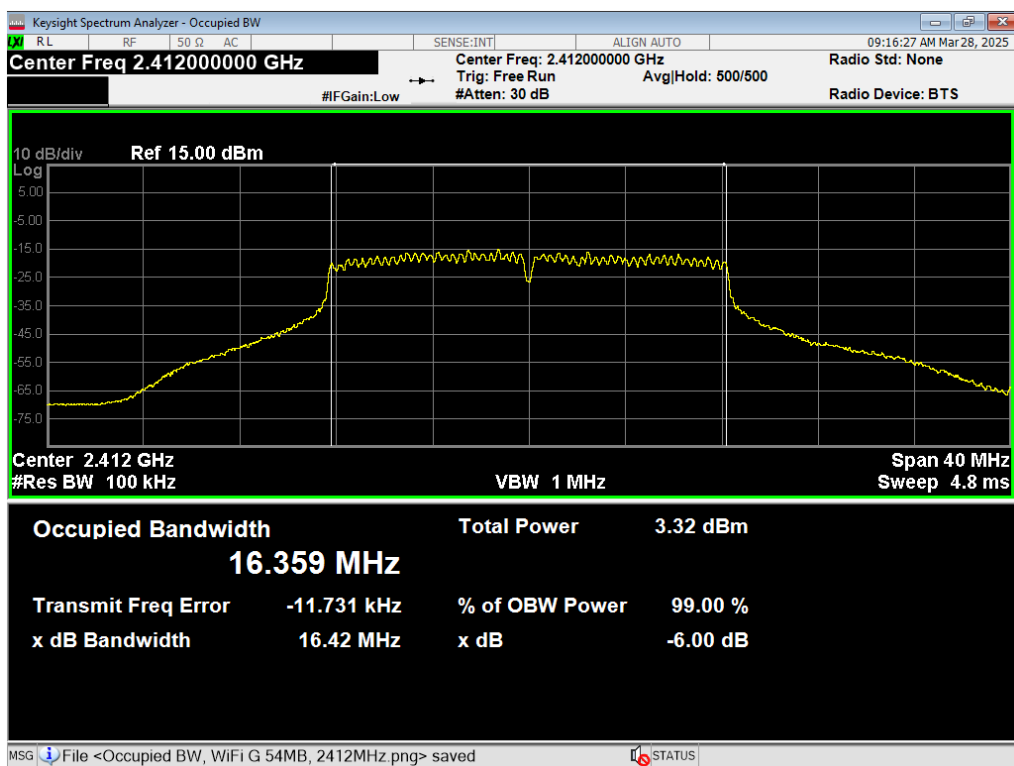


54 Occupied BW, WiFi G 54MB, 2437MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

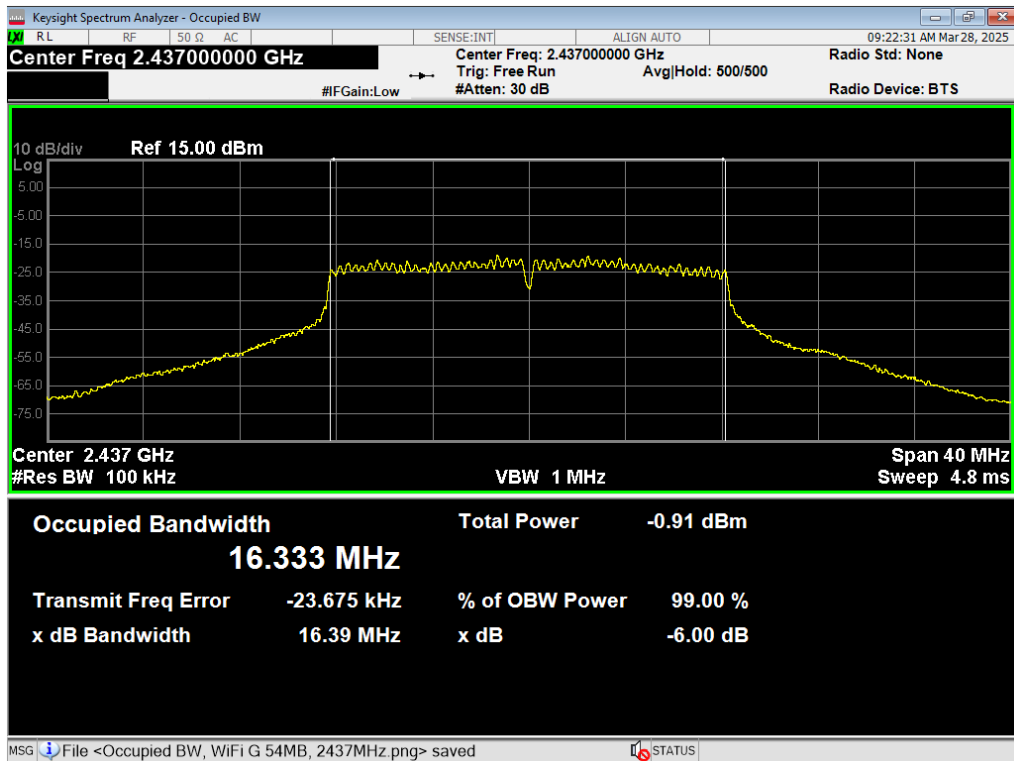


55 Occupied BW, WiFi G 54MB, 2462MHz

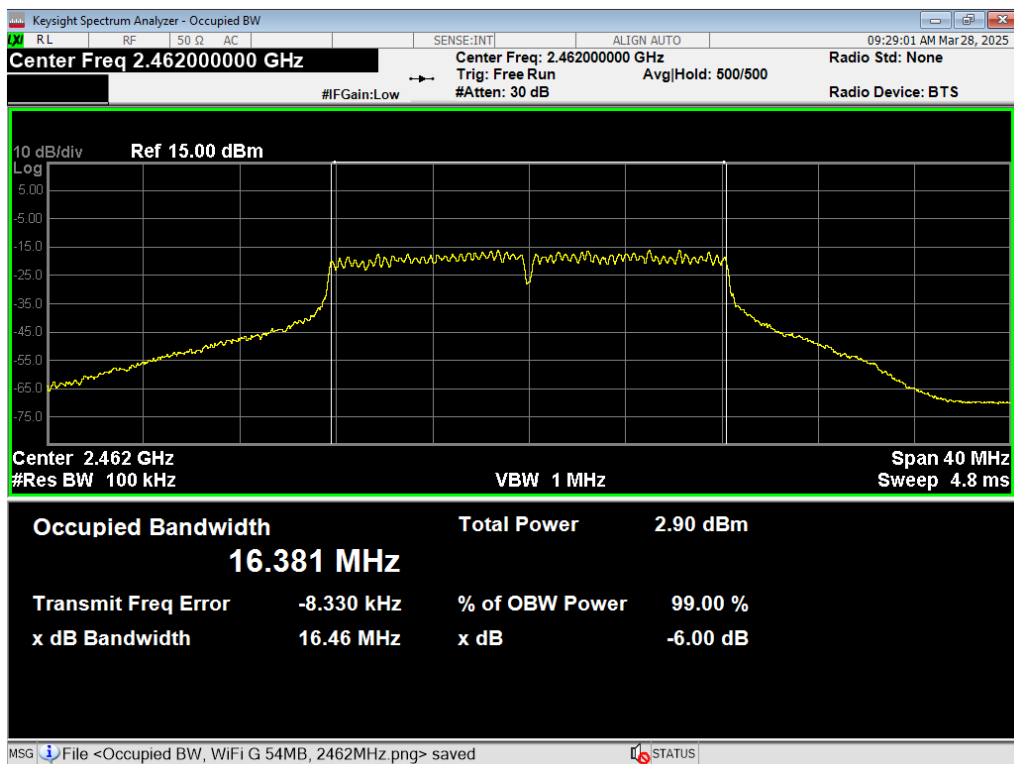


56 6dB BW, WiFi G 54MB, 2412MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

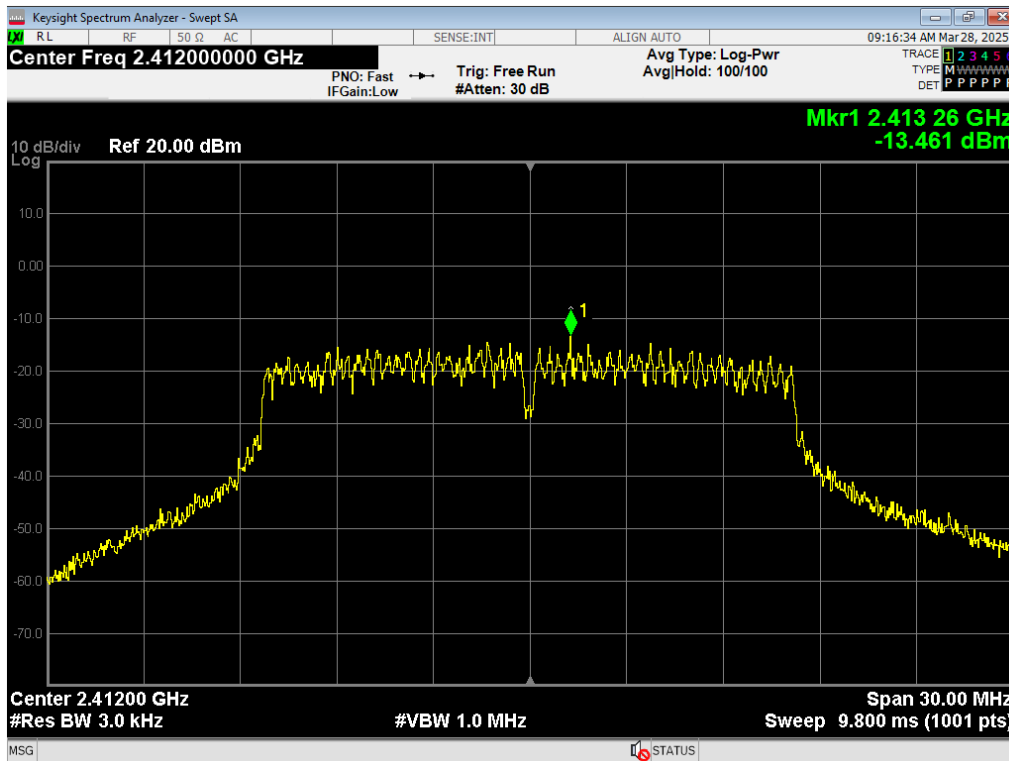


57 6dB BW, WiFi G 54MB, 2437MHz

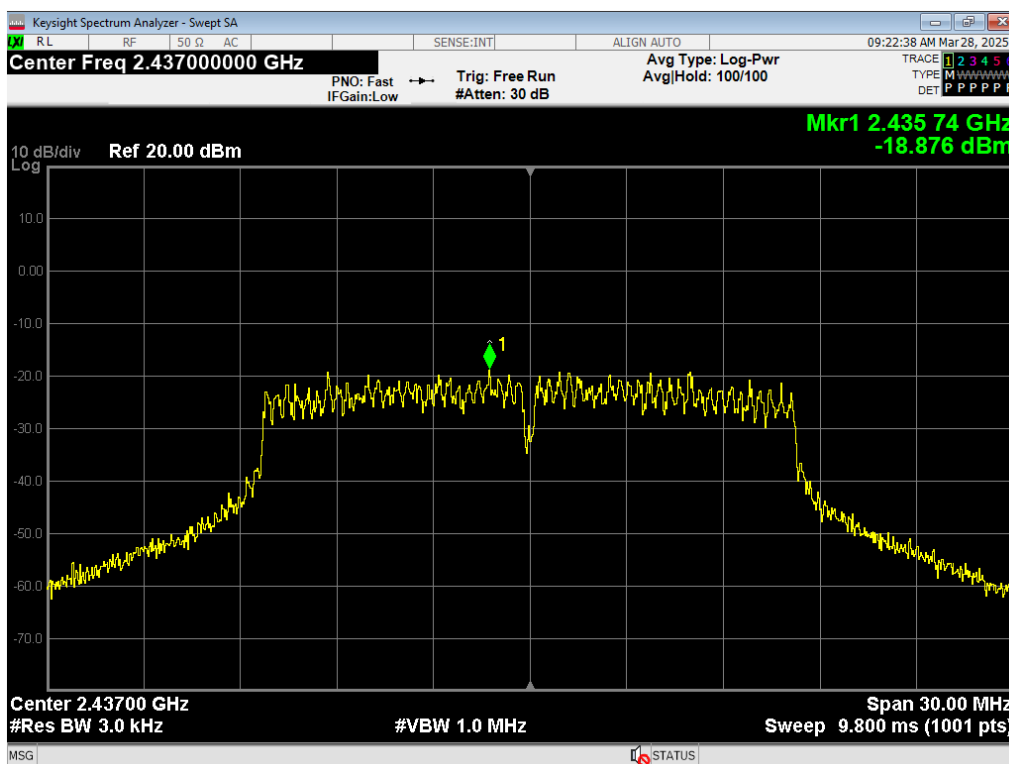


58 6dB BW, WiFi G 54MB, 2462MHz

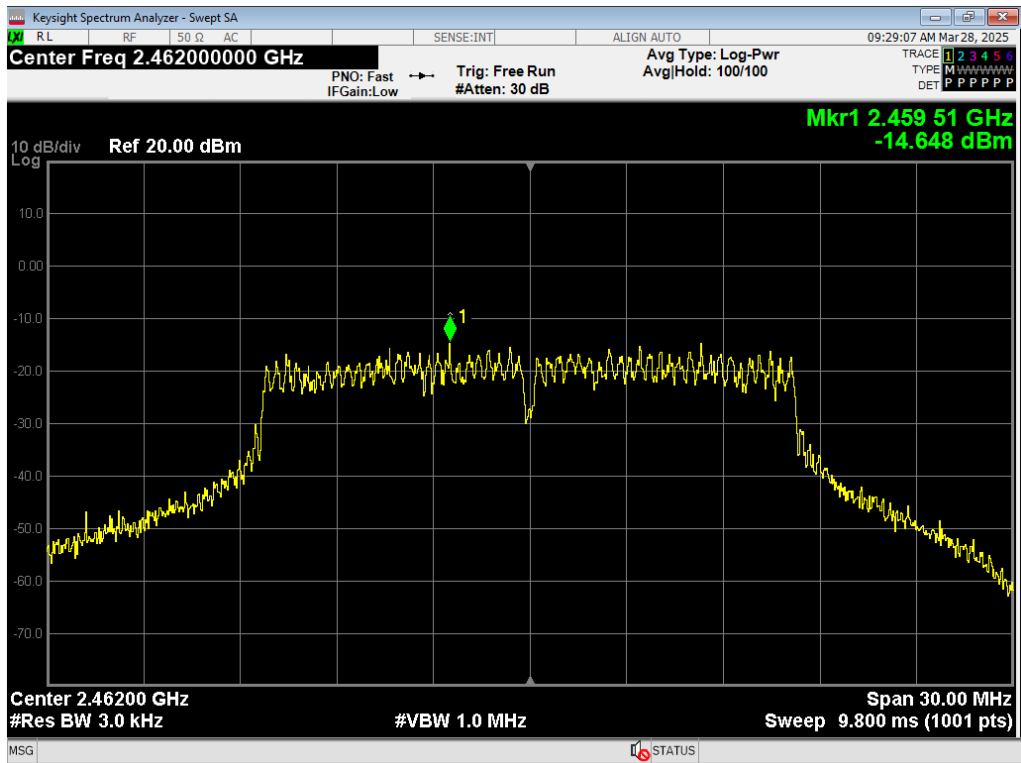
Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		



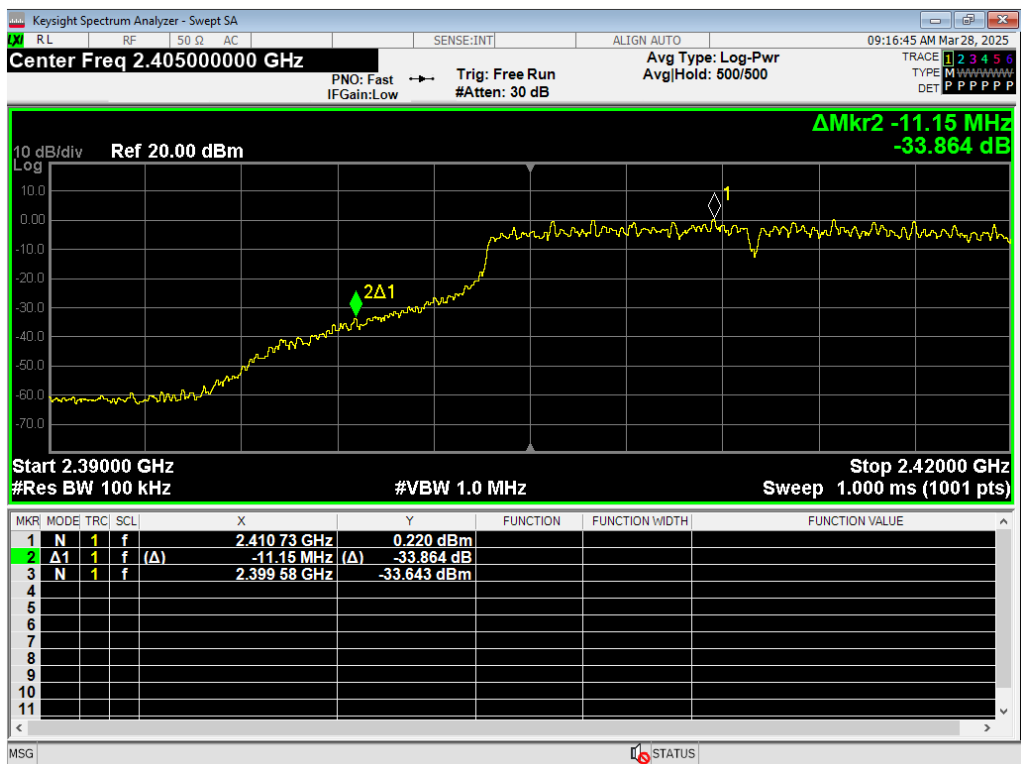
59 PSD, WiFi G 54MB, 2412MHz



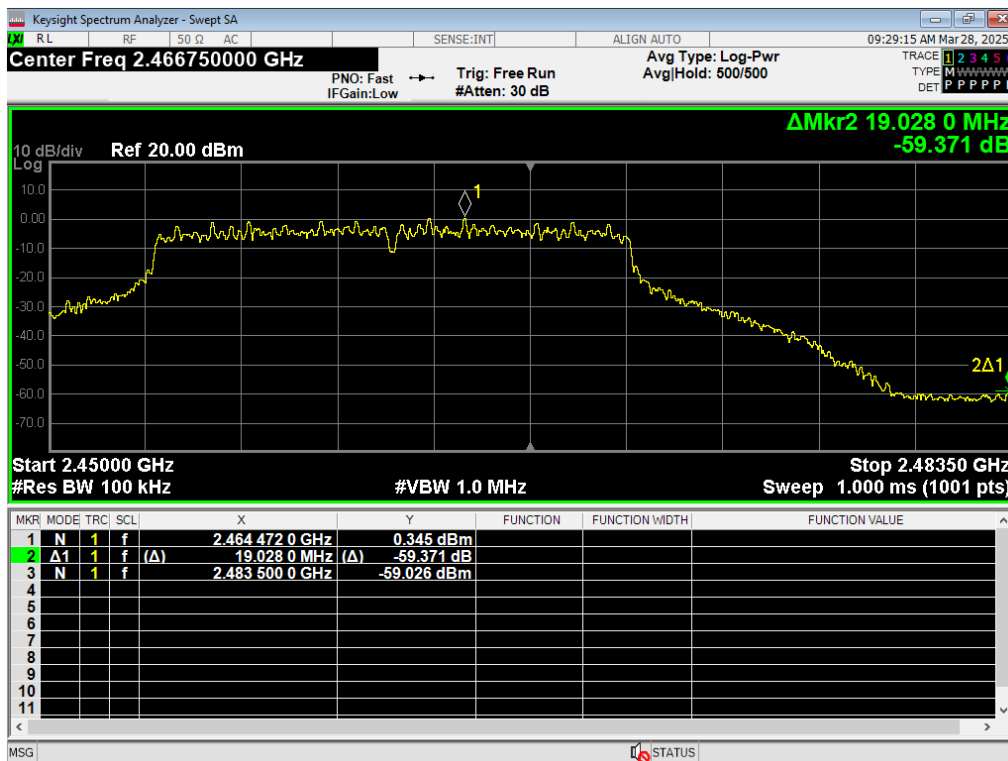
60 PSD, WiFi G 54MB, 2437MHz



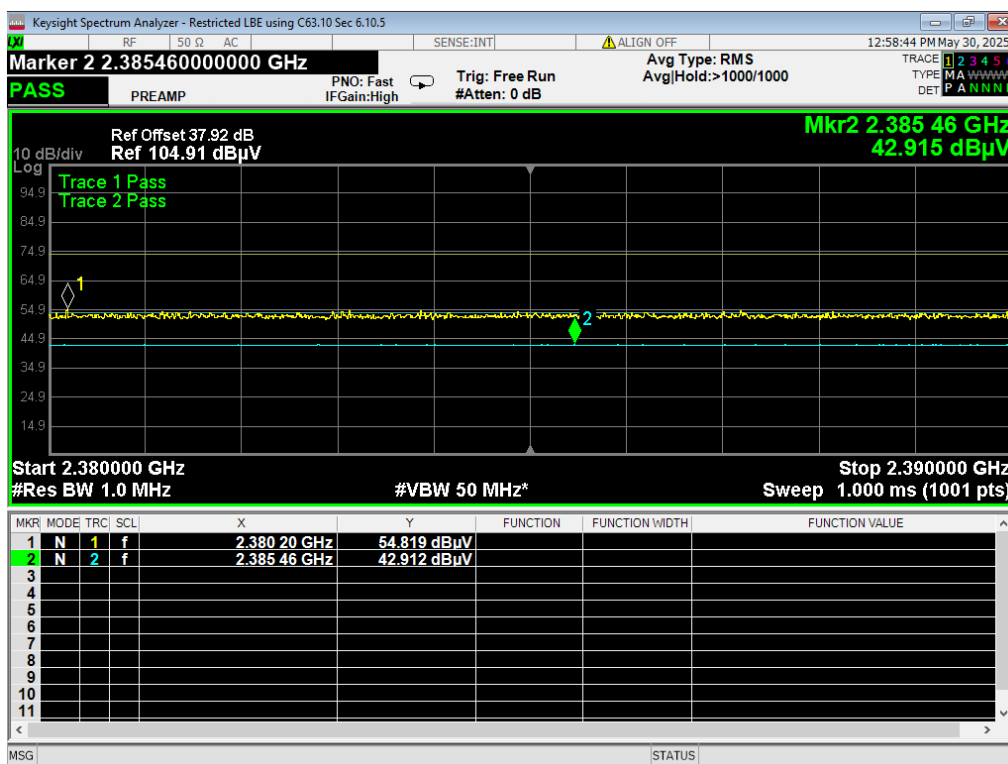
61 PSD, WiFi G 54MB, 2462MHz



62 LBE Unrestricted, WiFi G 54MB

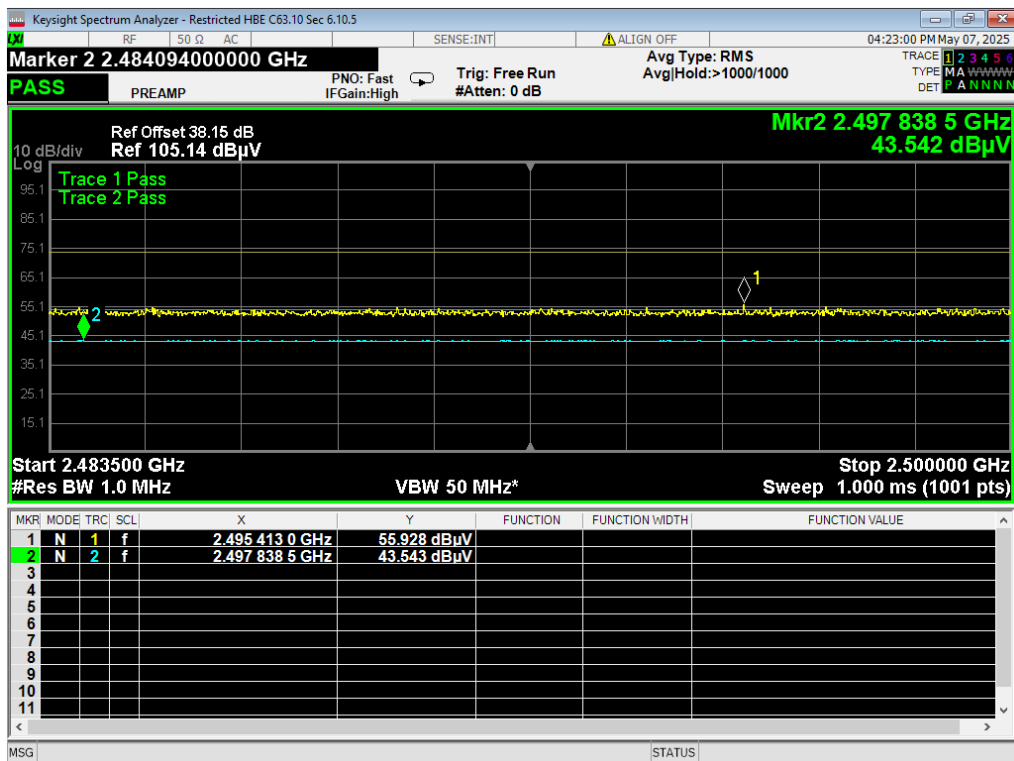


63 HBE Unrestricted, WiFi G 54MB

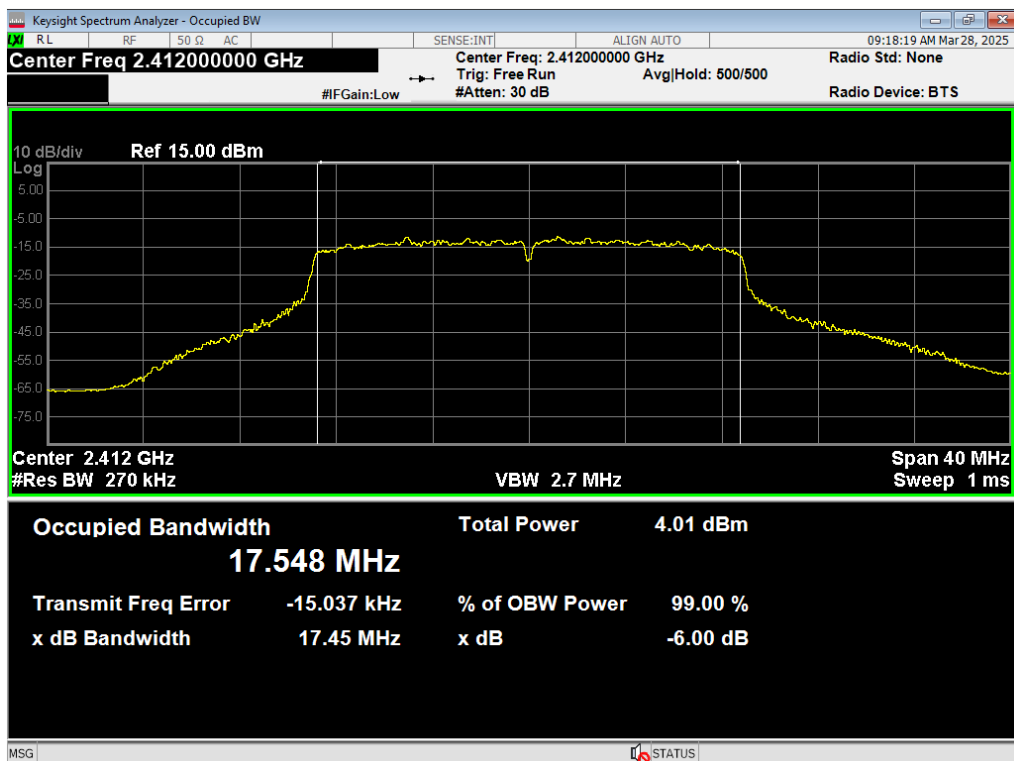


64 LBE Restricted, Wifi G 54MB

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

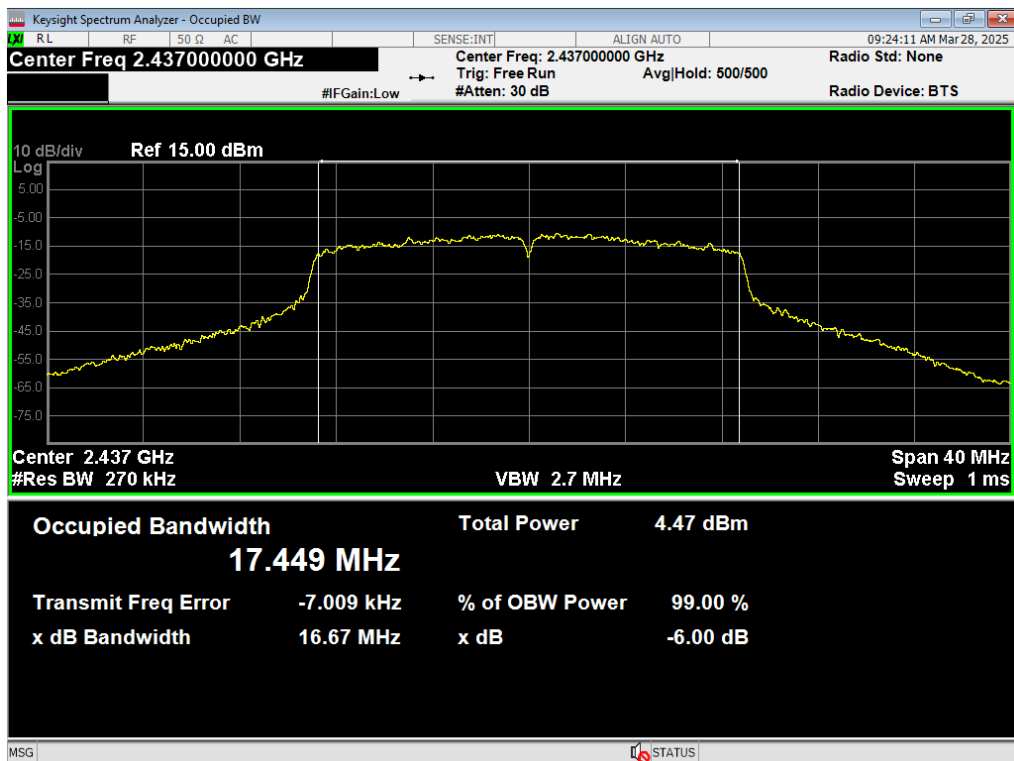


65 HBE Restricted, Wifi G 54MB, Ch11

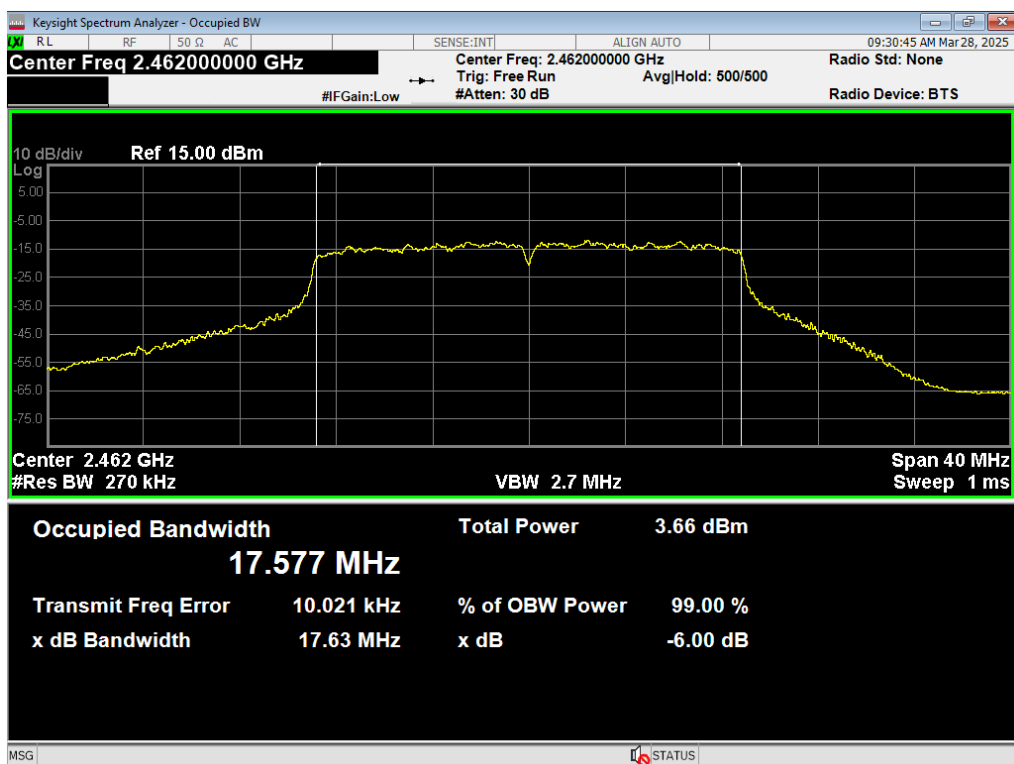


66 Occupied BW, WiFi N MCS7, 2412MHz

Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

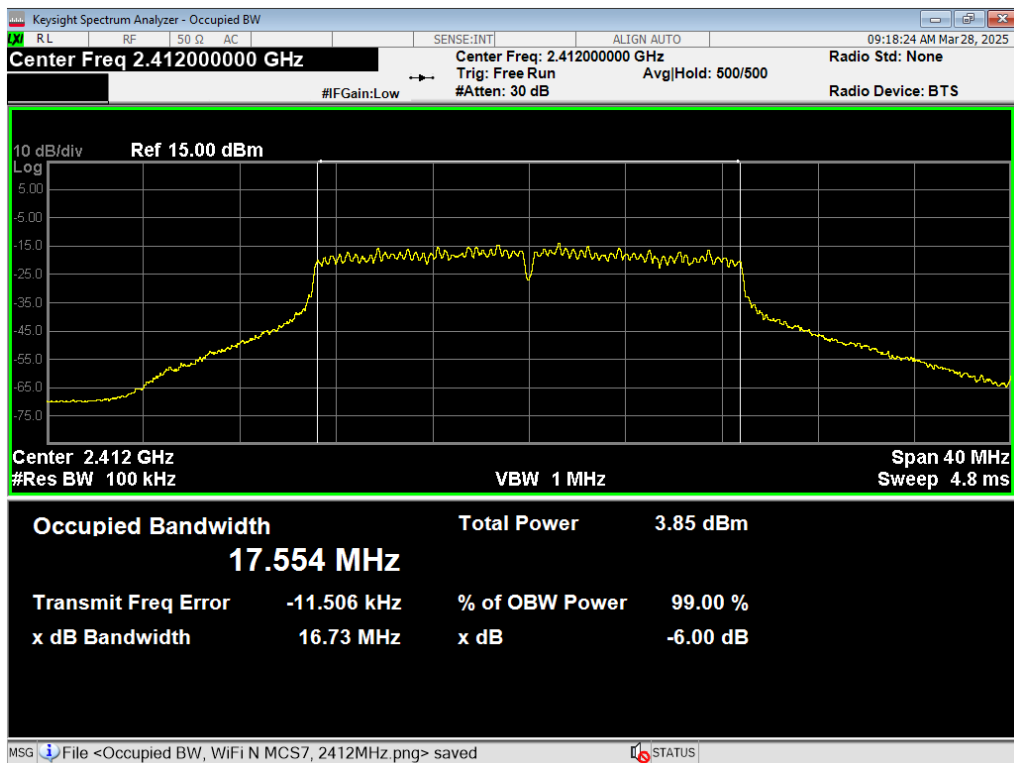


67 Occupied BW, WiFi N MCS7, 2437MHz

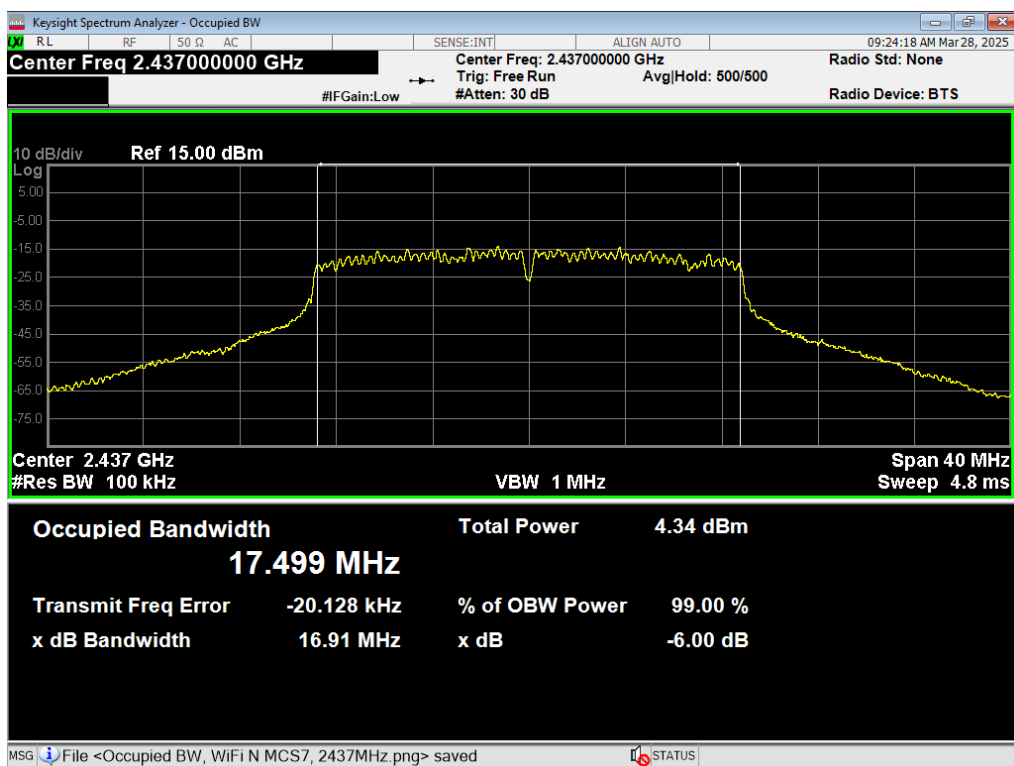


68 Occupied BW, WiFi N MCS7, 2462MHz

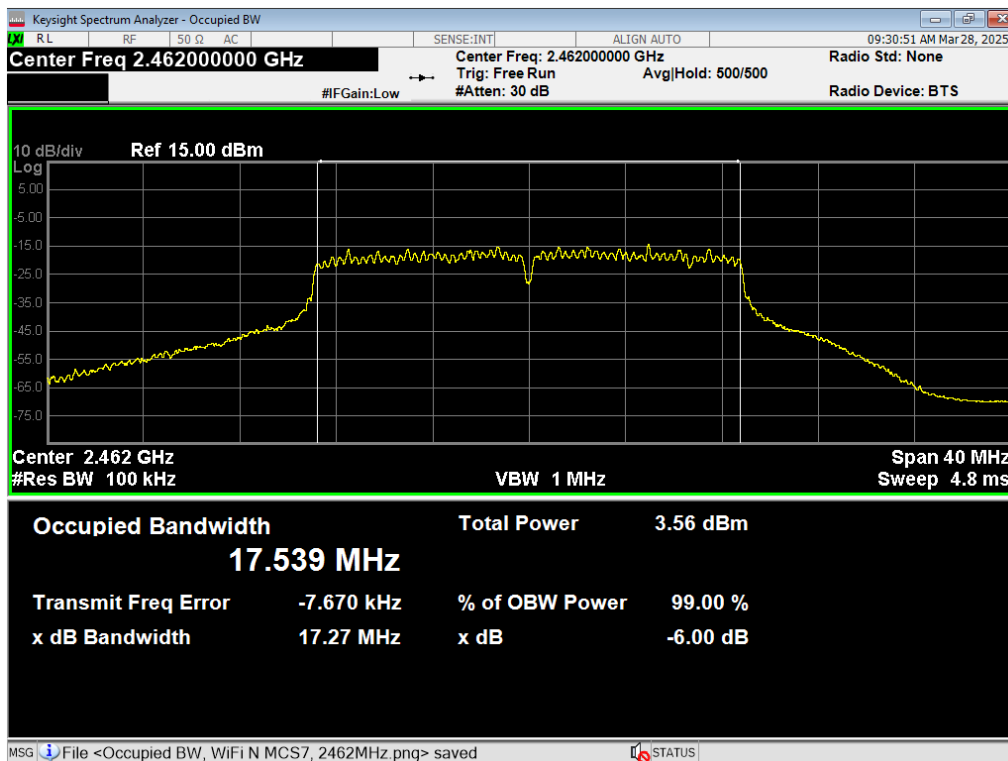
	Report Number:	R20241202-70-E2	Rev	C
	Prepared for:	Garmin International, Inc.		



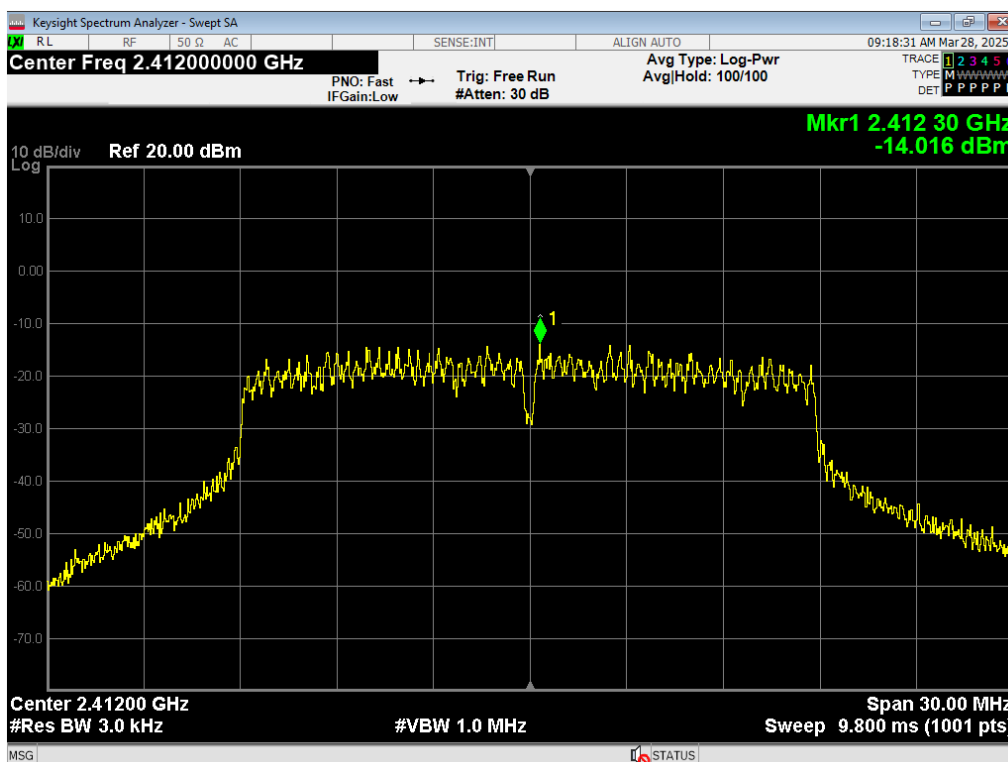
69 6dB BW, WiFi N MCS7, 2412MHz



70 6dB BW, WiFi N MCS7, 2437MHz

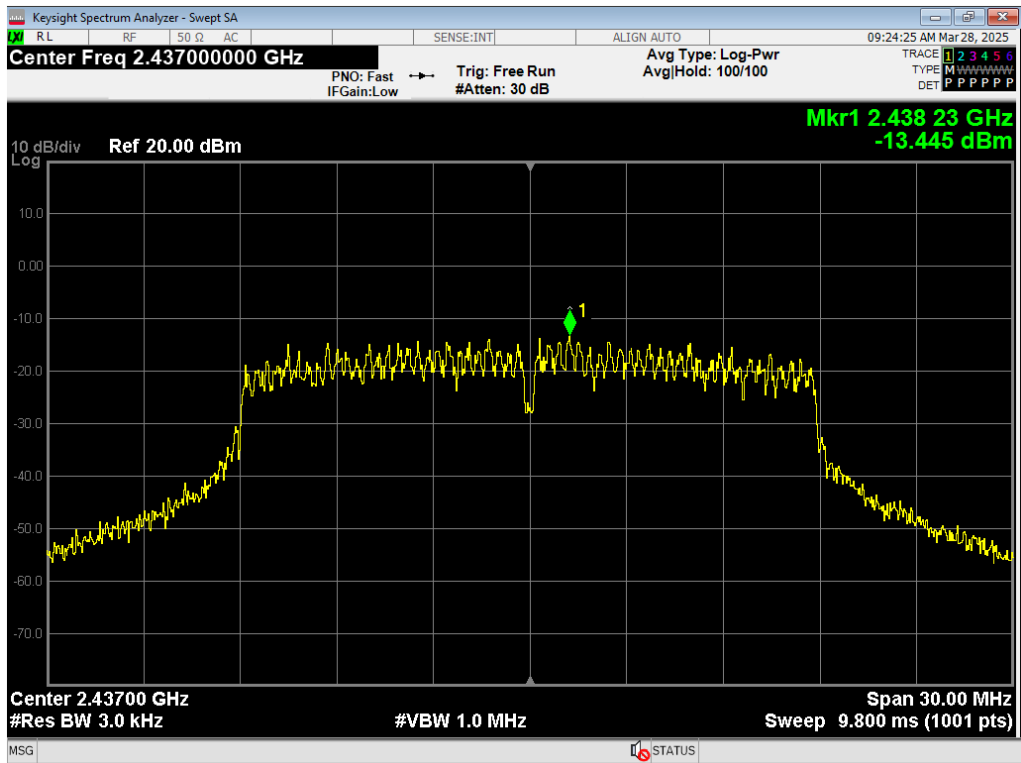


71 6dB BW, WiFi N MCS7, 2462MHz

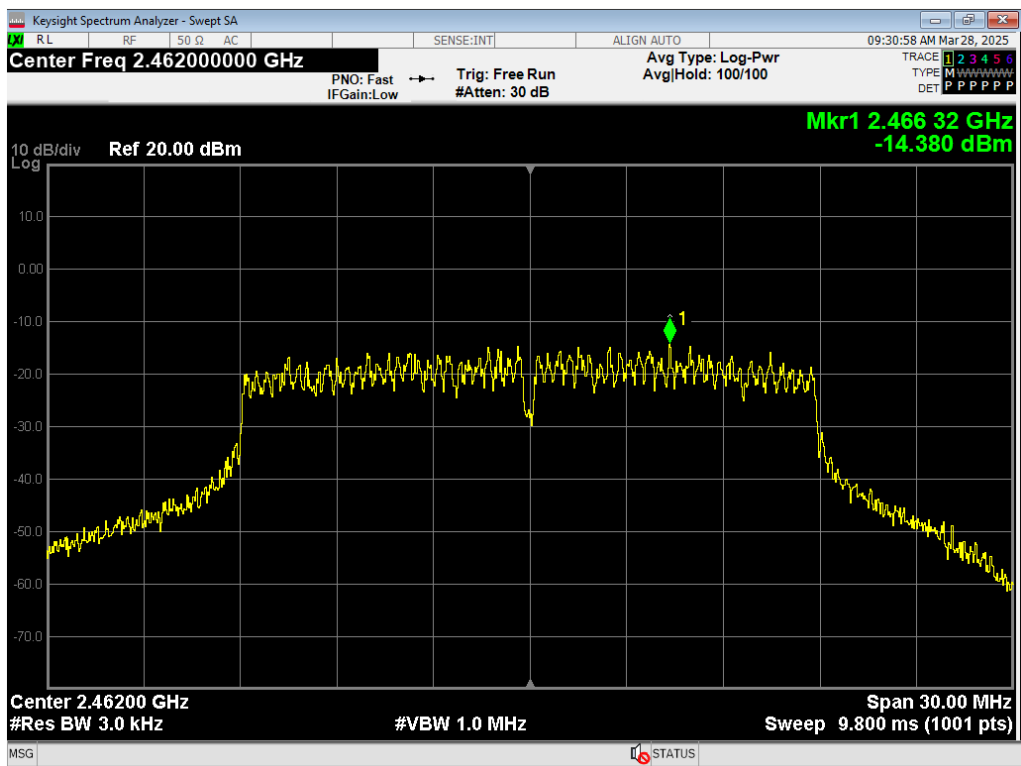


72 PSD, WiFi N MCS7, 2412MHz

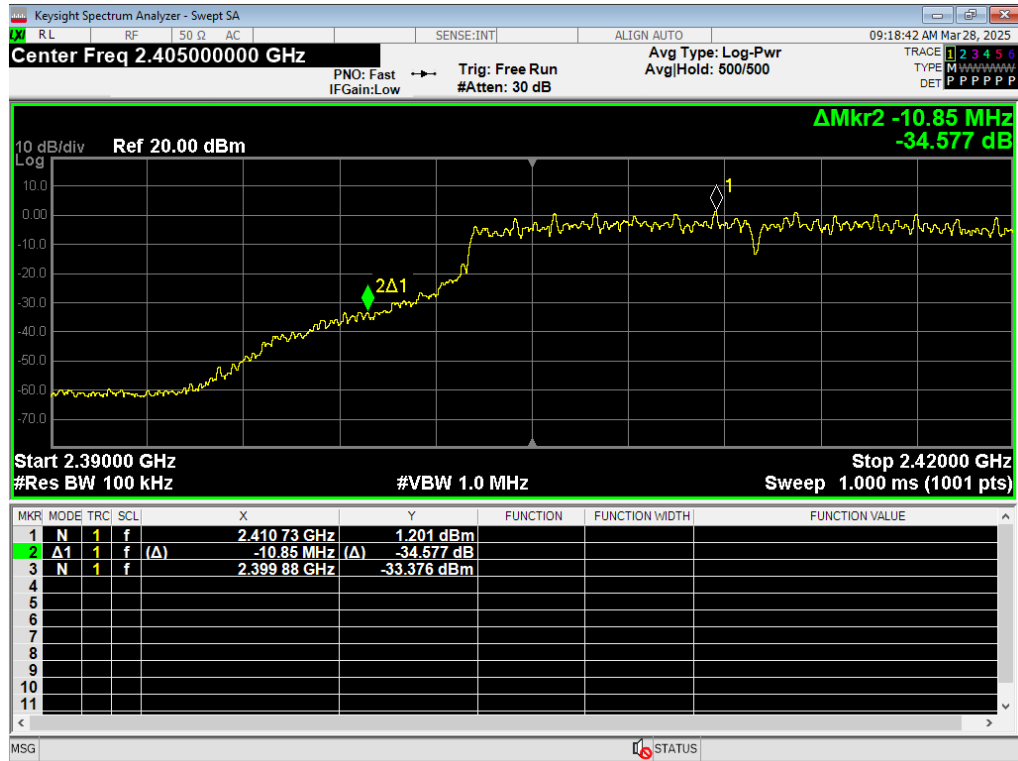
Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		



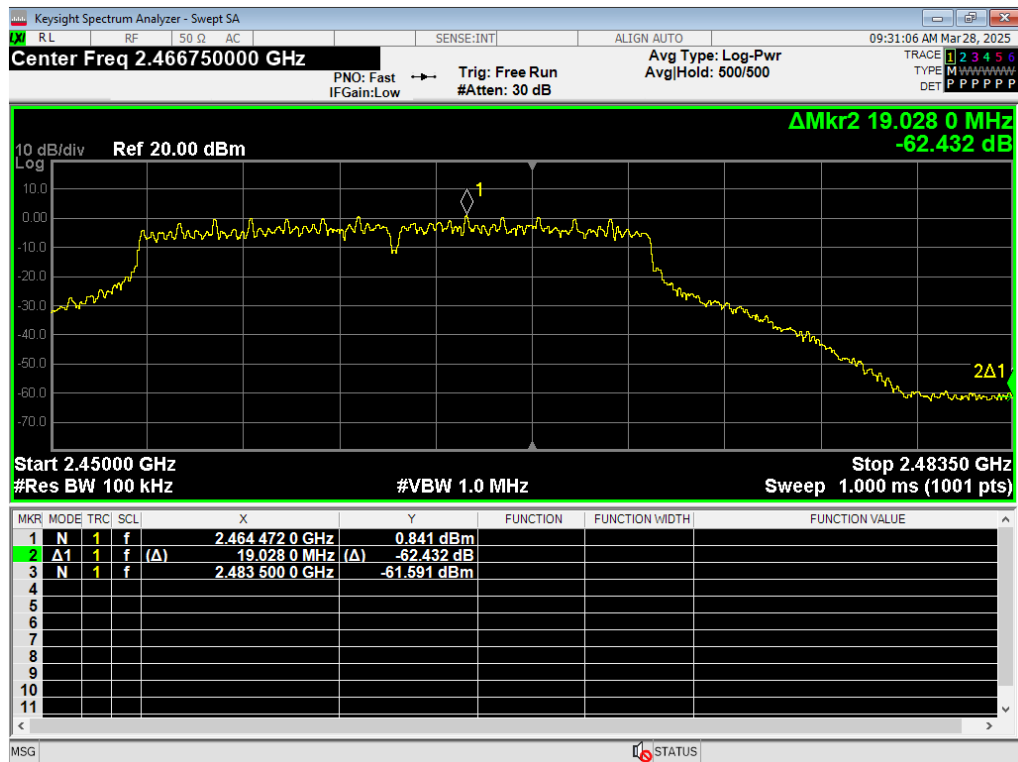
73 PSD, WiFi N MCS7, 2437MHz



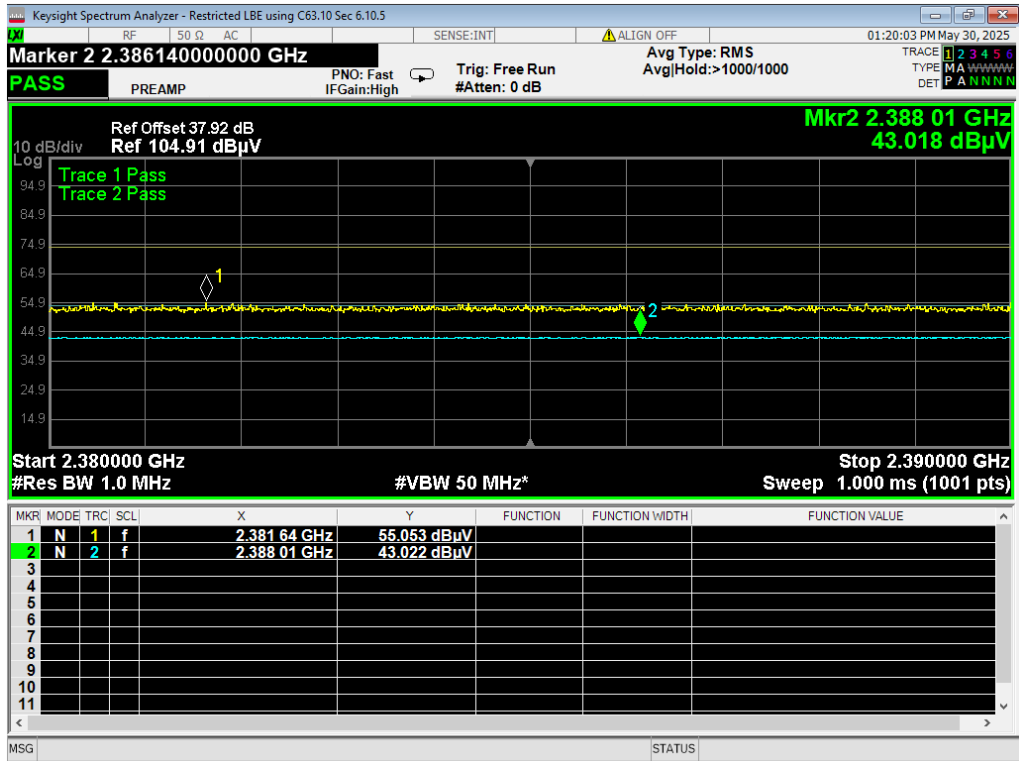
74 PSD, WiFi N MCS7, 2462MHz



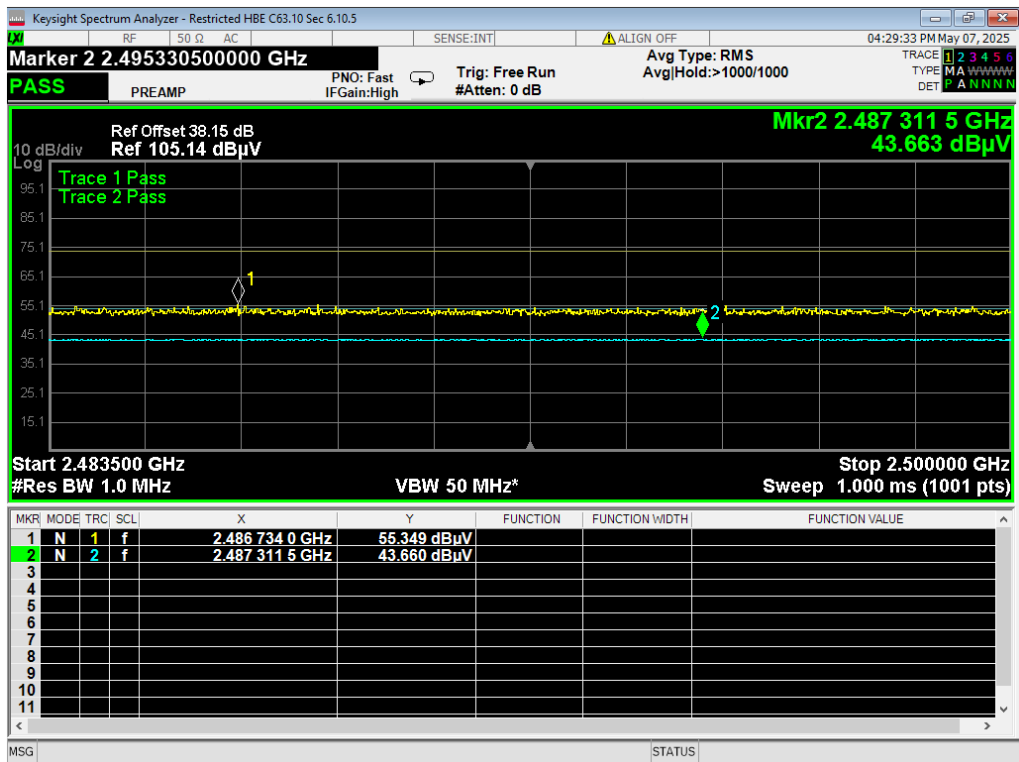
75 LBE Unrestricted, WiFi N MCS7



76 HBE Unrestricted, WiFi N MCS7



77 LBE Restricted, Wifi N MCS7



78 HBE Restricted, Wifi N MCS7, Ch11



Report Number:	R20241202-70-E2	Rev	C
Prepared for:	Garmin International, Inc.		

REPORT END