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16-Feb-26

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Subject: SUBTEL, Chile (Resolution 737) Certification Compliance 2026

Commercial Name: GPSMAP H1i

	Información (Information)
Tipo de equipo (Equipment type)	Portable Digital Transceiver
Marca (Brand)	Garmin 
Modelo (Model)	A04828
Tecnología o modulación (Technology or modulation)	BT (GFSK, $\pi/4$ DQPSK, 8DPSK), BLE (GMSK), WiFi 2.4GHz (802.11 b/g/n)
Frecuencias (Frequencies)	BT (2402MHz-2480MHz), BLE (2402MHz- 2480MHz), WiFi 2.4GHz (2412MHz – 2462MHz)
Ganancia de antena (dBi) (Antenna gain (dBi))	BT PIFA (4.03 dBi), BLE PIFA (4.03 dBi), WiFi 2.4GHz PIFA (4.03 dBi)
P.i.r.e. (E.I R P.)	BT (13.2 dBm, 20.89 mW), BLE (7.85 dBm, 6.09 mW), WiFi 2.4GHz (22.34 dBm, 171.39 mW)
Módulos (Modules)	BT , BLE, WiFi 2.4GHz

Declaration of Conformity Statement: the equipment previously identified complies with the provisions established in the Technical Standard for Small Range Equipment, approved by Exempt Resolution No.1,985 of 2017, of the Undersecretary of Telecommunications.

Declaración de conformidad: El equipo anteriormente identificado cumple con las disposiciones establecidas en la Norma Técnica para Equipos de Corto Alcance, aprobada mediante la Resolución Exenta N° 1.985 de 2017, de la Subsecretaría de Telecomunicaciones.

FCC/ISED Test Report

Prepared for: Garmin International, Inc.

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

Product: A04828

Test Report No: R20250124-00-E4 **Rev:** B

Approved by:



Fox Lane,
EMC Test Engineer

DATE: July 28, 2025

Total Pages: 43

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REVISION PAGE

Rev. No.	Date	Description
0	11 July 2025	Issued by FLane Prepared by FLane, ESchmidt
A	22 July 2025	Added FVIN in Section 2.1, Added plots for 1-25GHz scans in Section 4.4 – ES
B	28 July 2025	Updated to RSS-247 Issue 4



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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 standard(s)/section(s):

- (1) US Code of Federal Regulations, Title 47, Part 15
- (2) ISED RSS-Gen, Issue 5
- (3) ISED RSS-247, Issue 4

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 4 Section 6.3	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 4 Section 6.3	Bandwidth	Pass
FCC Part 15.209 RSS-Gen Issue 5, Section 7.3	Time of Occupancy	Pass
FCC Part 15.209 (restricted bands), 15.247 (unrestricted) RSS-247 Issue 4 Section 6.6, RSS-Gen Issue 5, Section 8.9	Receiver Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 4 Section 6.3	Transmitter Spurious Emissions	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 4 Section 6.6	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	Pass



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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04828
FCC ID	IPH-04828
IC ID	1792A-04828
FVIN	1.01
EUT Received	8 May 2025
EUT Tested	8 May 2025- 6 June 2025
Serial No.	3489571855 (Radiated Sample) 3489571782 (Conducted Sample)
Operating Band	2400 – 2483.5 MHz
Device Type	☐ GMSK ☐ GFSK ☒ BT BR ☐ BT EDR 2MB ☐ BT EDR 3MB ☐ 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: PSAI05R-0500 GPN: 362-00118-00 (Representative Power Supply)

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:

For BTBR Transmissions:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 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 frequency and designations.

2.3 DESCRIPTION OF SUPPORT UNITS

None

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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	Review/Testing and Report
2	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.

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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
EMCO Horn Antenna	3116	2576	July 31, 2023	July 30, 2025
Com-Power LISN, Single Phase	LI-220C	20070017	July 17, 2023	July 17, 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, 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	January 20, 2024	January 20, 2026
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	January 21, 2024	January 21, 2026
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	January 21, 2024	January 21, 2026
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	January 21, 2024	January 21, 2026
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	January 21, 2024	January 21, 2026
N connector bulkhead (control room)*	PE9128	NCEEBH2	January 21, 2024	January 21, 2026
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.

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3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMENTS

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.

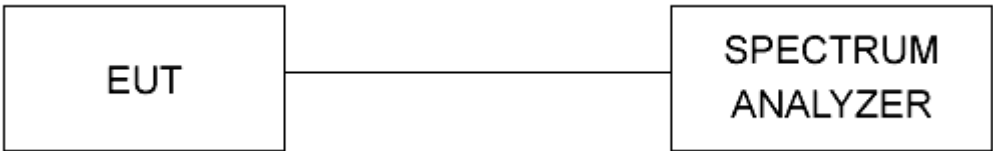


Figure 1 - Bandwidth Measurements Test Setup

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 the 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.

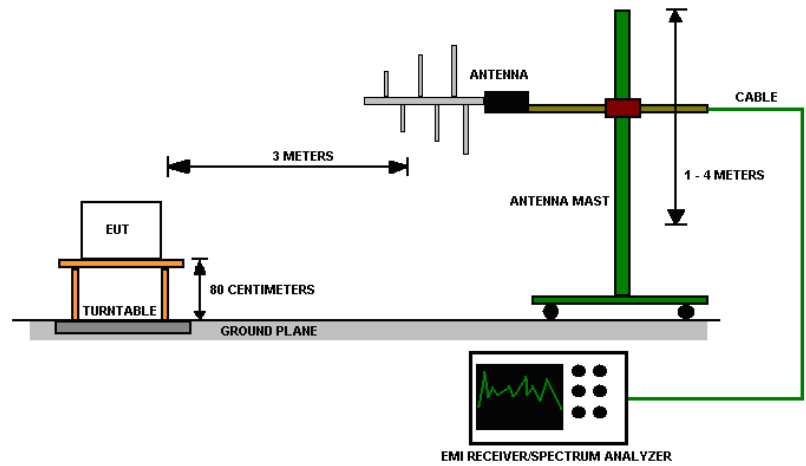


Figure 2 - Radiated Emissions Test Setup

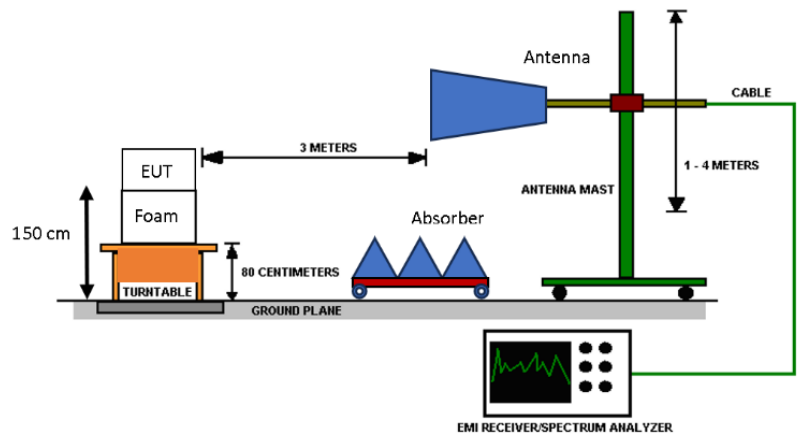


Figure 3 - Radiated Emissions Test Setup

4.0 RESULTS

DTS Radio Measurements								
CHANNEL	Mode	Occupied BW (kHz)	20dB BW (kHz)	Peak OUTPUT POWER (dBm)	Peak OUTPUT POWER (mW)	RESULT	# Of Hopping Channels	ON Time (μs)
Low	BTBR	903.65	1051.00	9.174	8.268	PASS	79	375
Mid	BTBR	986.16	1047.00	8.225	6.645	PASS	Channel Separation (MHz)	Time of Occupancy (ms)
High	BTBR	891.02	1052.00	7.688	5.872	PASS	1.006	120
Occupied Bandwidth = N/A; Channel Separation Limit: $> 2/3 * 20$ dB Bandwidth			Time of Occupancy Limit $< 0.4s$; Time of Occupancy = ON Time * # of transmissions over, period of time of occupancy = $0.000375 * 32 * 10 = 0.120s$ Period of Time of Occupancy = $0.4 * \# \text{ of Channels} = 0.4 * 79 = 31.6s$					

Unrestricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Delta (dB)	Min Delta (dB)	Result
Low	BTBR	2400.00	-39.20	7.59	46.79	30.00	PASS
High	BTBR	2483.50	-57.44*	6.07*	63.51	30.00	PASS
Low	BTBR Hopping	2400.00	-47.71	6.79	54.50	30.00	PASS
High	BTBR Hopping	2483.50	-58.54*	7.26*	65.79	30.00	PASS
*Converted to dBm using $\text{dBm} = \text{dBuV} - 107$							
Peak Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	BTBR	2390.00	55.25	Peak	73.98	18.73	PASS
High	BTBR	2483.50	56.86	Peak	73.98	17.12	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							
Average Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	BTBR	2390.00	43.60	Average	53.98	10.38	PASS
High	BTBR	2483.50	46.25	Average	53.98	7.73	PASS
*Limit shown is the average limit taken from FCC Part 15.209							

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4.1 OUTPUT POWER

Test Method:

All the radio measurements were performed using section ANSI C63.10 Section 11.

Limits of power measurements:

For FCC Part 15.247 Device:

The maximum allowed peak output power is 125mW.

Test procedures:

Details can be found in section 3.4 of this report. See section 4.3 for Duty cycle used.

Deviations from test standard:

No deviation.

Test setup:

Device was connected directly to 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 below.
4. Compiled values can be found in the Results section, 4.0.



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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:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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.



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4.3 DUTY CYCLE

Test Method:

All transmitter(s)/modulation(s) in this report are >98%, no duty cycle corrections were added.

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4.4 RADIATED EMISSIONS

Test Method:

ANSI C63.10-2013, 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.
4. The EUT was tested for spurious emissions while running off of battery power and external USB power. The worse-case emissions were produced while running off of USB power, so results from this mode are presented.



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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.

Test setup:

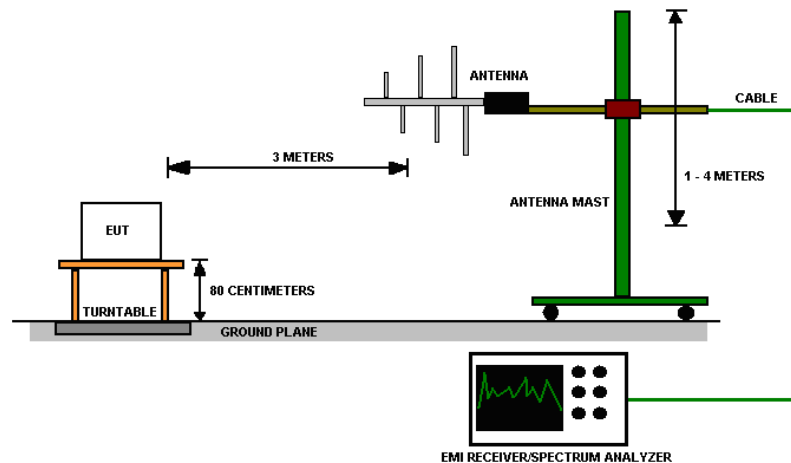


Figure 4 - Radiated Emissions Test Setup

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:

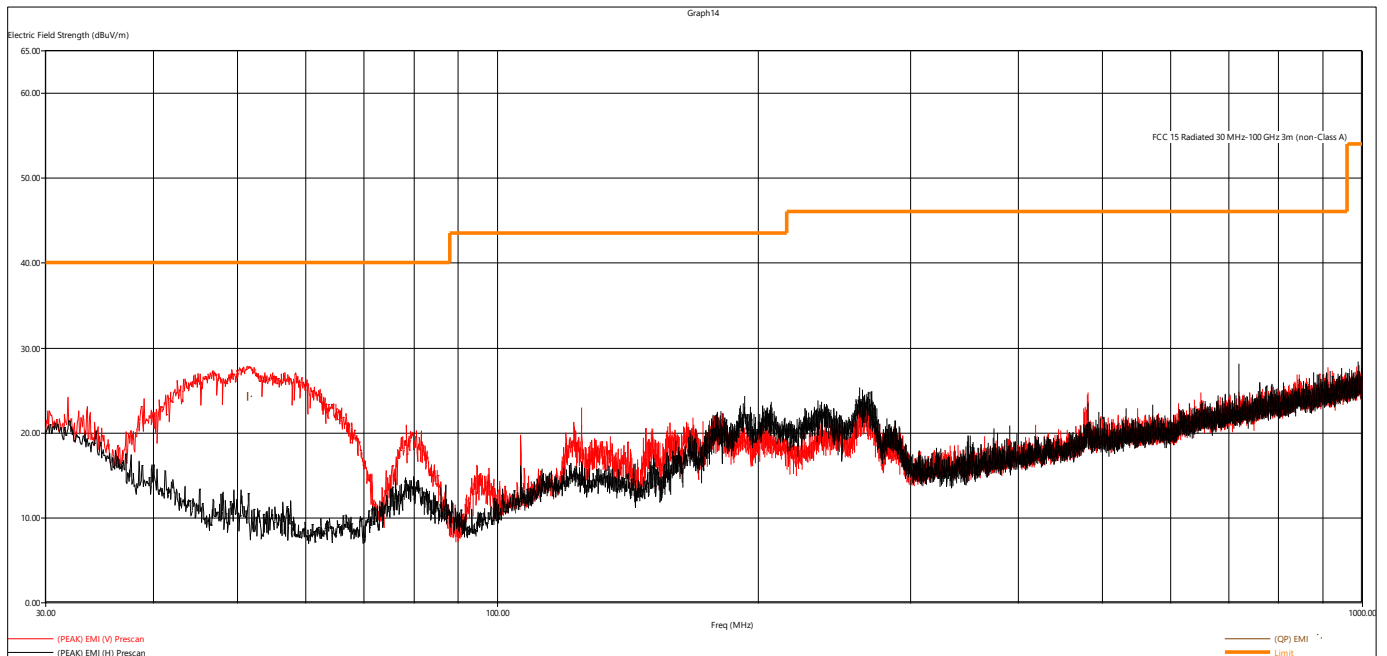


Figure 5 - Radiated Emissions Plot, Receive

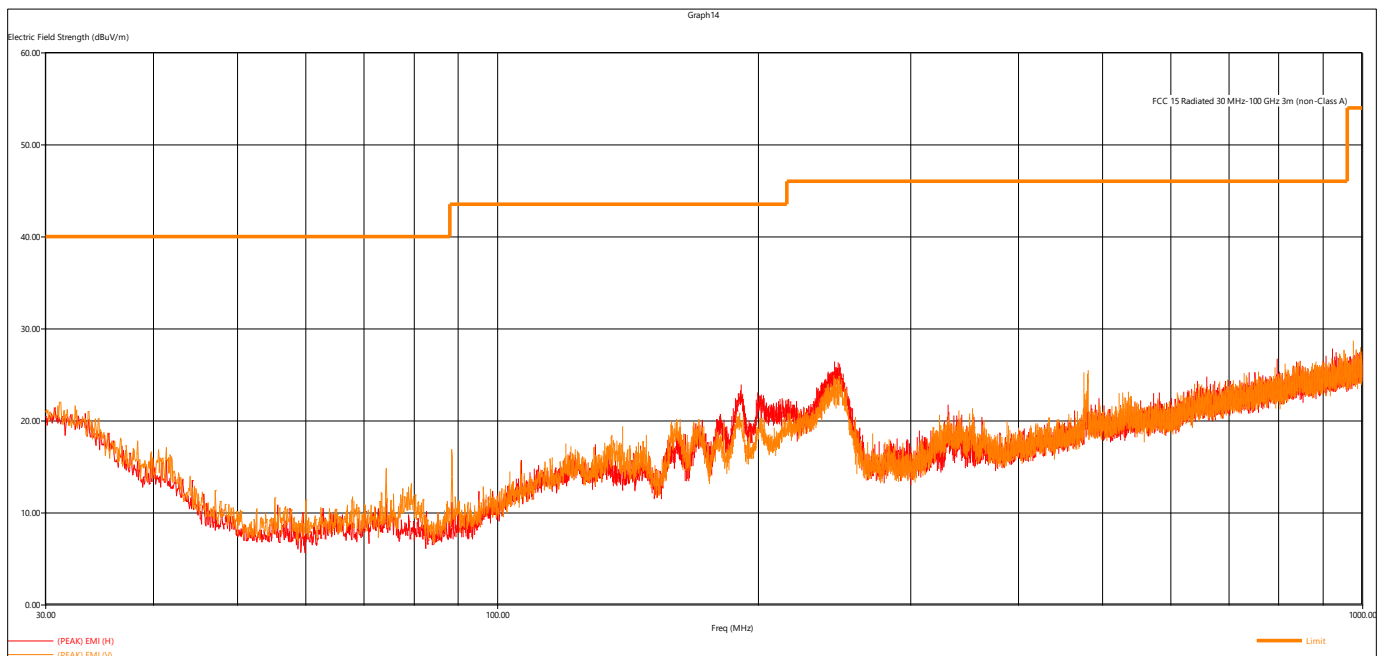


Figure 6 - Radiated Emissions Plot, BTBR, Low Channel

Quasi-Peak Measurements, BTBR

Freq (Max)	(QP) EMI	Limit	(QP) Margin	Twr Ht	Ttbl Ang	Pol	Channel	Modulation
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)			
51.349920	24.23	40.00	15.77	105.91	51.50	V		RX

All other emissions found to be at least 10dB below limit line

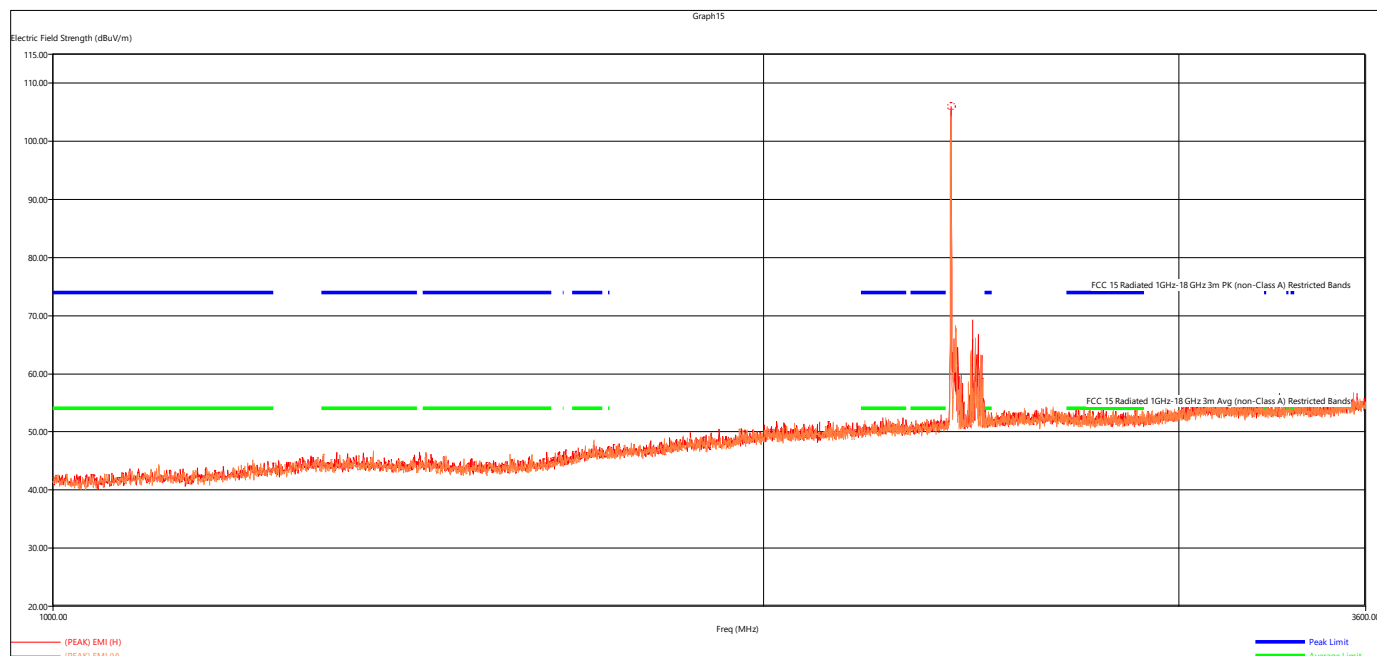


Figure 7 - Radiated Emissions Plot, 1-3.6GHz, BTBR Low

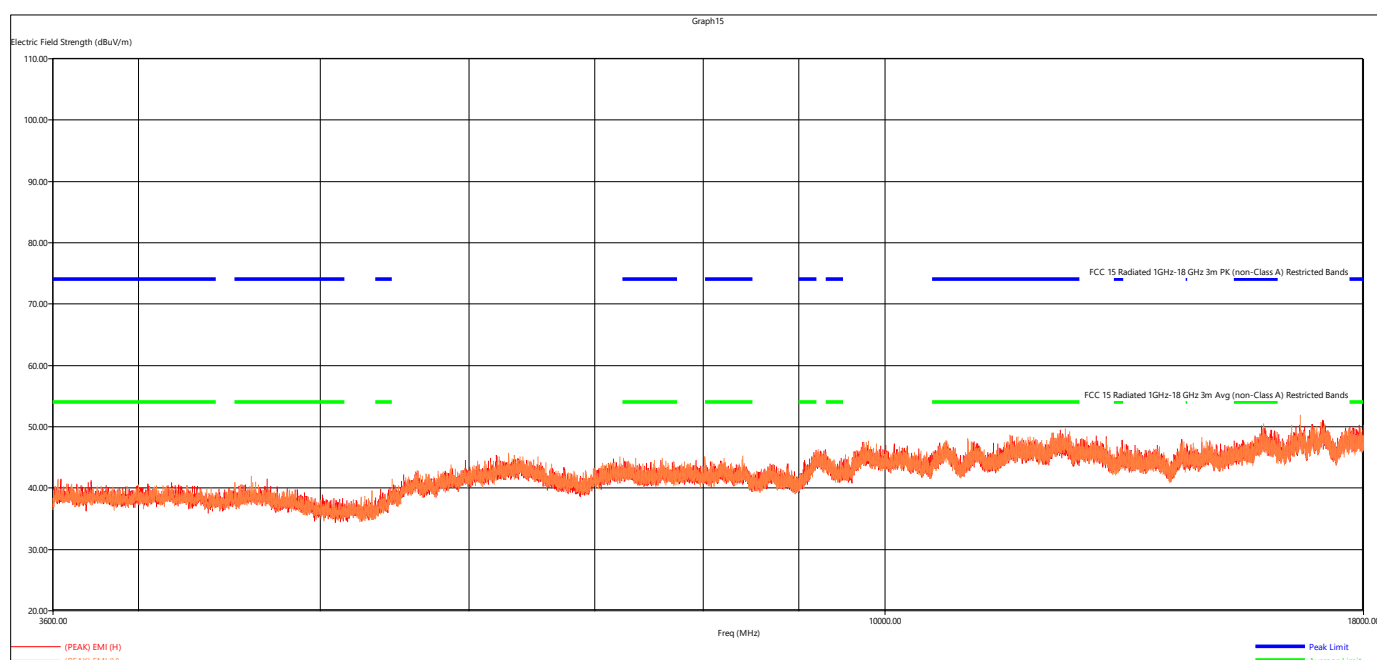


Figure 8 - Radiated Emissions Plot, 3.6-18GHz, BTBR Low

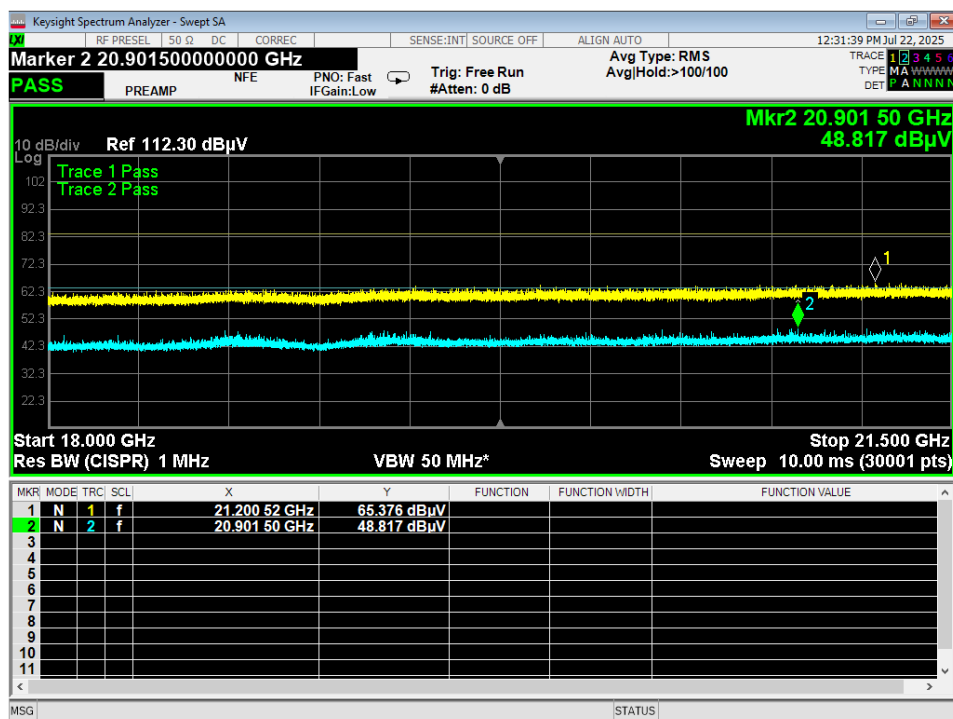


Figure 9 - Radiated Emissions Plot, 18-21.5GHz, BTBR Mid, 1m test distance

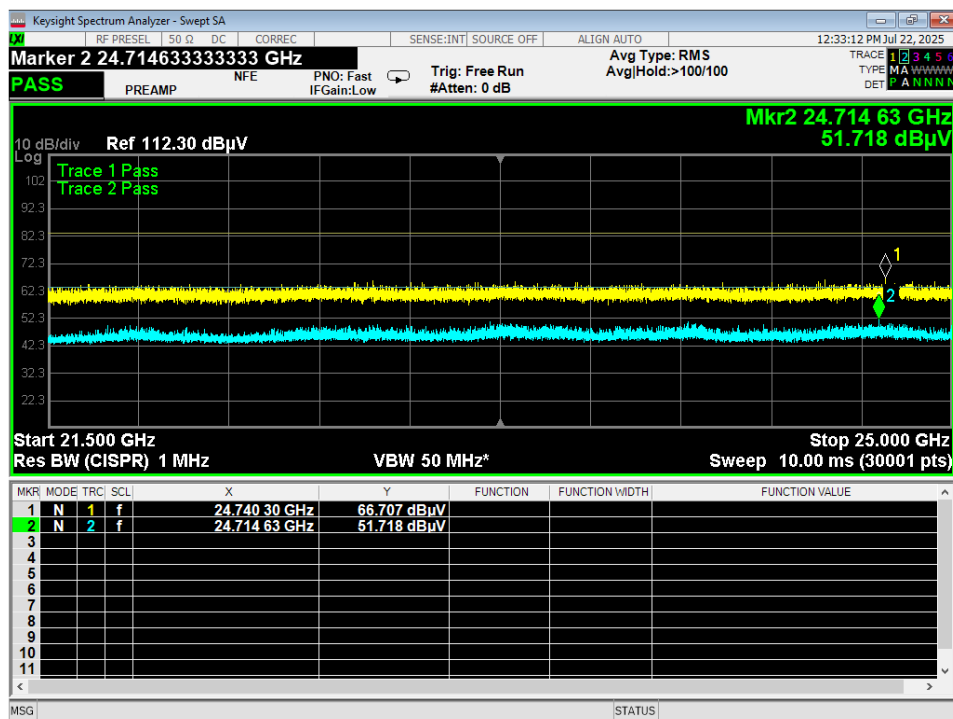


Figure 10 - Radiated Emissions Plot, 21.5-25GHz, BTBR Mid, 1m test distance



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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. Margin value = Limit value – Emission level
- 4. The worst-case plots from the 1-25GHz range are shown above. No measurements were found to be within 10dB of the applicable limits and therefore were not tabulated.



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4.5 CONDUCTED SPURIOUS EMISSIONS

Test Method:

ANSI C63.10-2020, Section 6.7

Limits of spurious emissions:

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 20dB below the fundamental. More details can be found in section 3.4 of this report.

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:

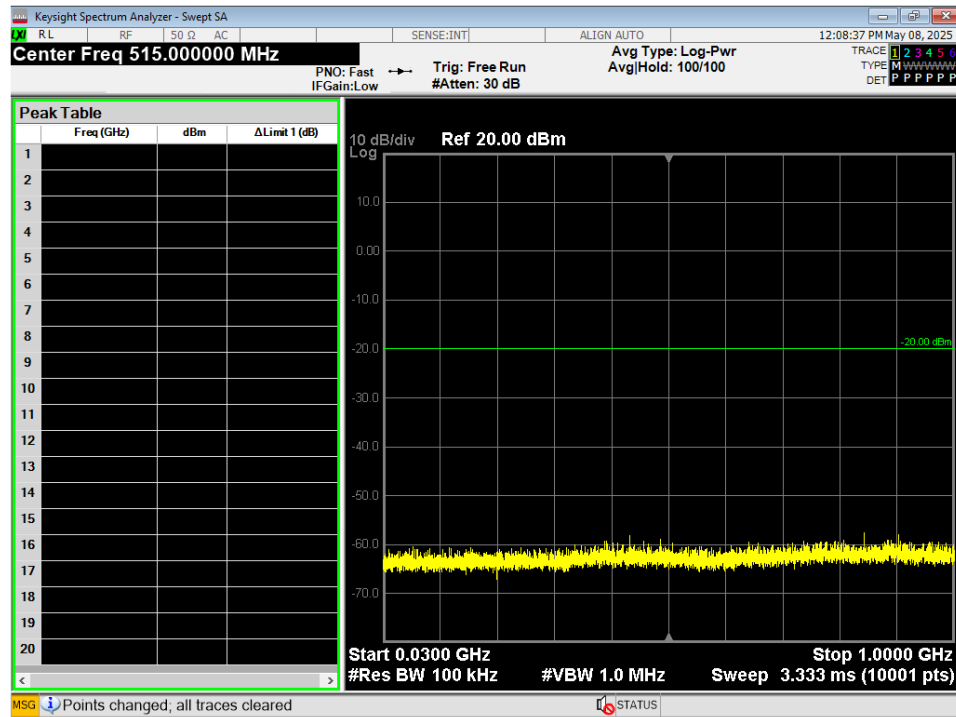


Figure 11 - Radiated Emissions Plot, BTBR, 30M – 1G

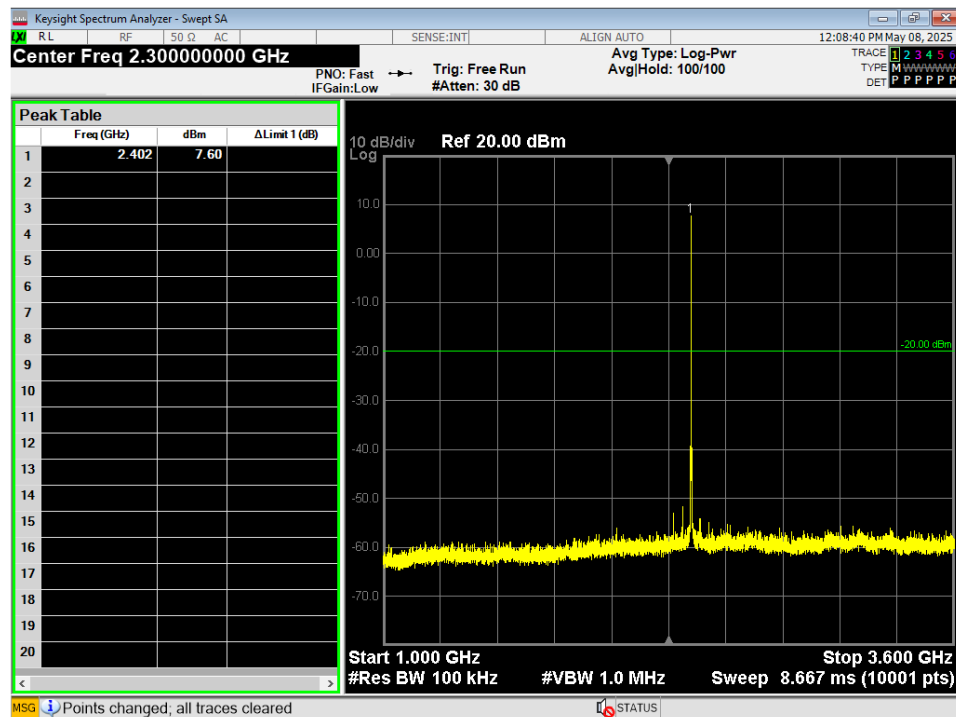


Figure 12 - Radiated Emissions Plot, BTBR, 1G – 3.6G



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4.6 BAND EDGES

Test Method:

All the radio measurements were performed using the sections from ANSI C63.10.
Restricted band edges are using Sec 6.10.5.

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.



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Test results:

Pass

Comments:

1. All the band edge plots can be found in the 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 to the general limit defined in Part 15.209. The limit shown in the graph accounts for the antenna gain of the device.

4.7 CONDUCTED AC MAINS EMISSIONS

Test Method:

ANSI C63.10-2020, Section(s) 6.2

Limits for conducted emissions measurements:

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Test Procedures:

- a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
- d. Results were compared to the 15.207 limits.

Deviation from the test standard:

No deviation

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test Results:

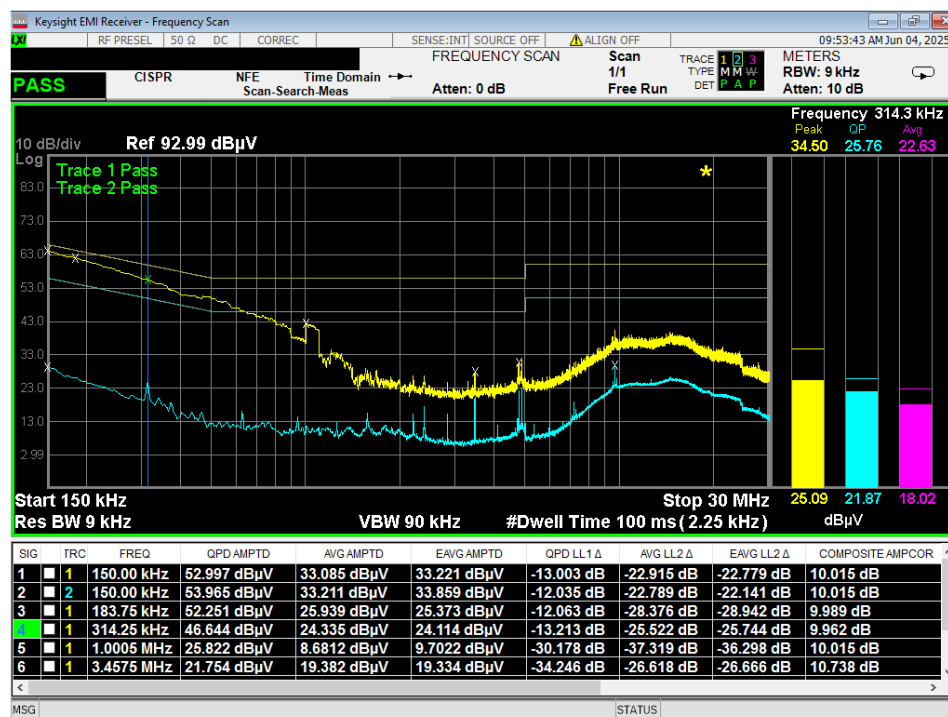


Figure 14 – Conducted Emissions Plot, charging on dock, TX, Line

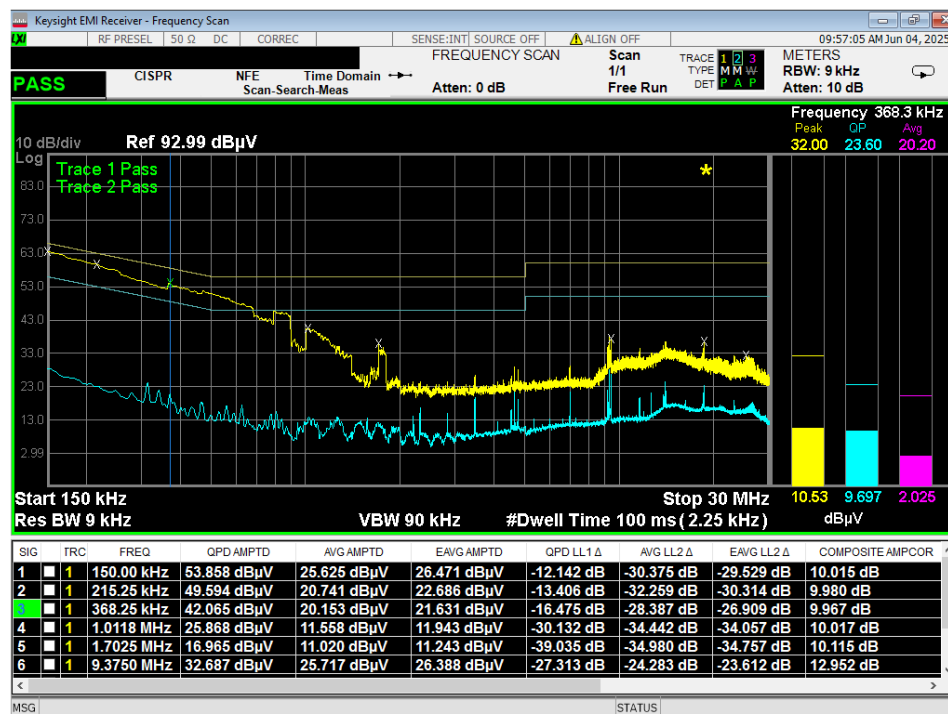


Figure 15 – Conducted Emissions Plot, charging on dock, TX, Neutral

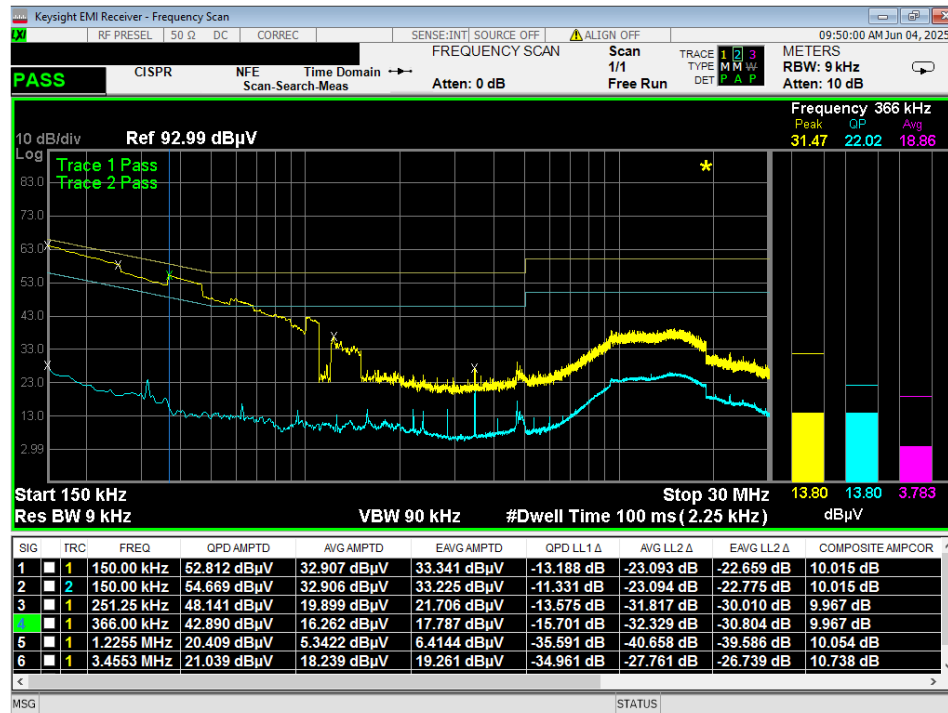


Figure 16 – Conducted Emissions Plot, charging on dock, IDLE, Line

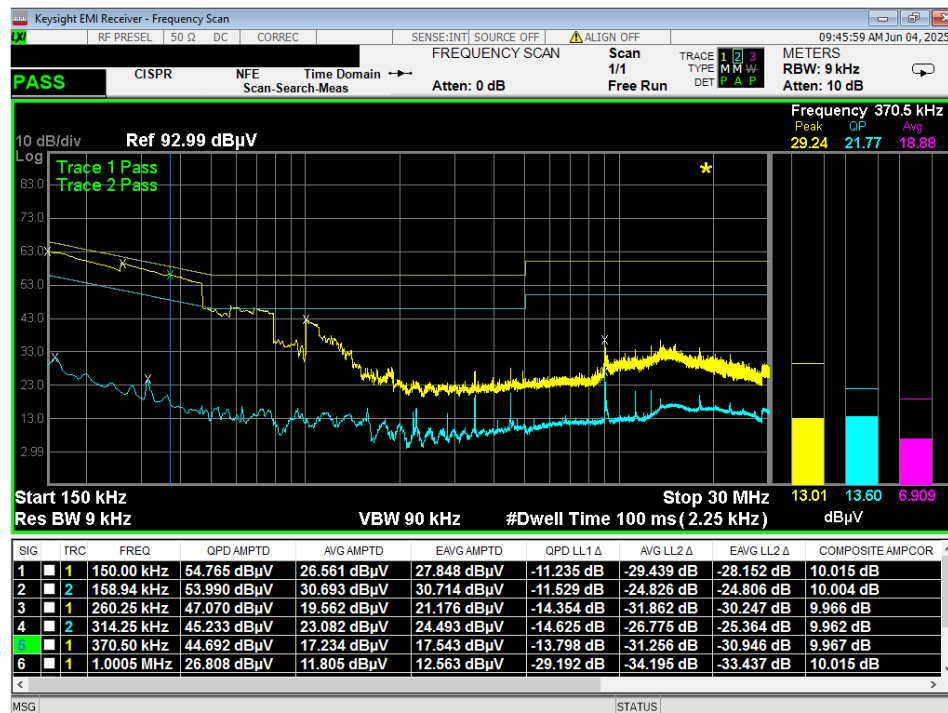


Figure 17 – Conducted Emissions Plot, charging on dock, IDLE, Neutral

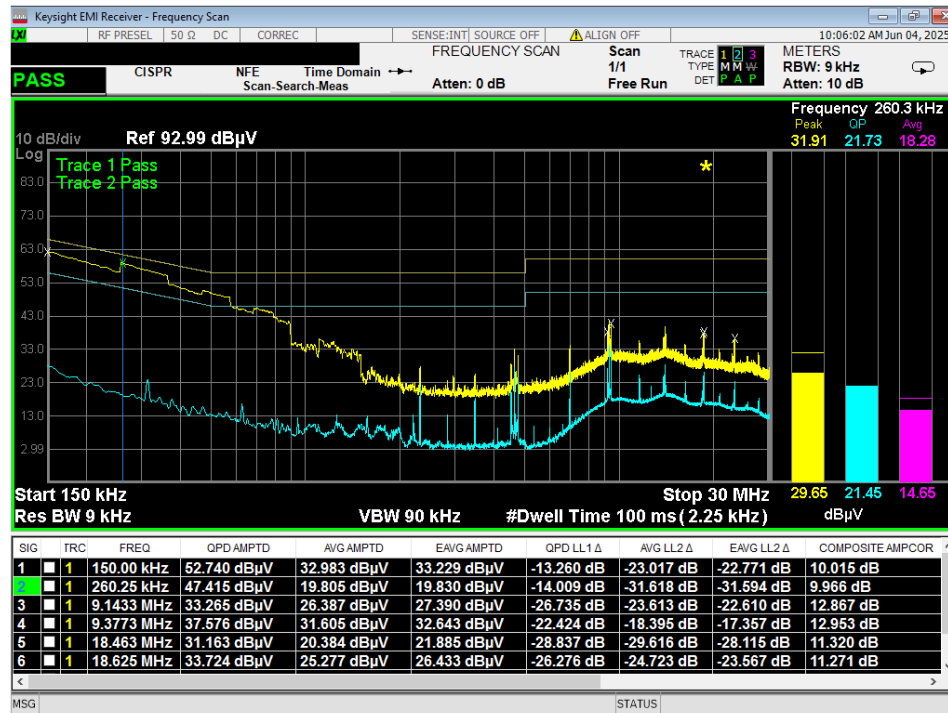


Figure 18 – Conducted Emissions Plot, charging via USB-C, TX, Line

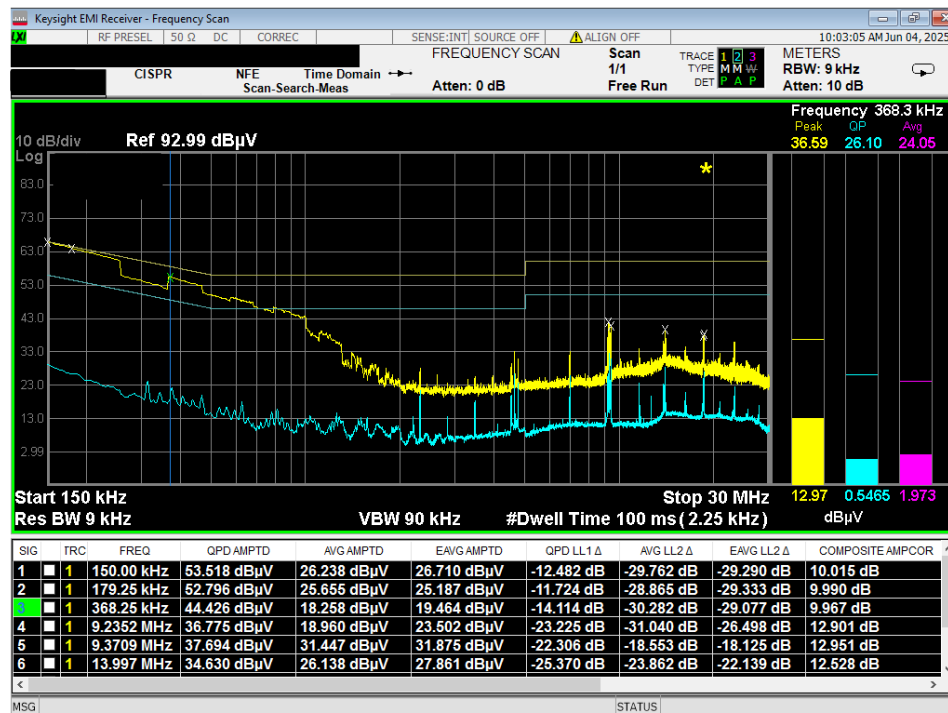


Figure 19 – Conducted Emissions Plot, charging via USB-C, TX, Neutral

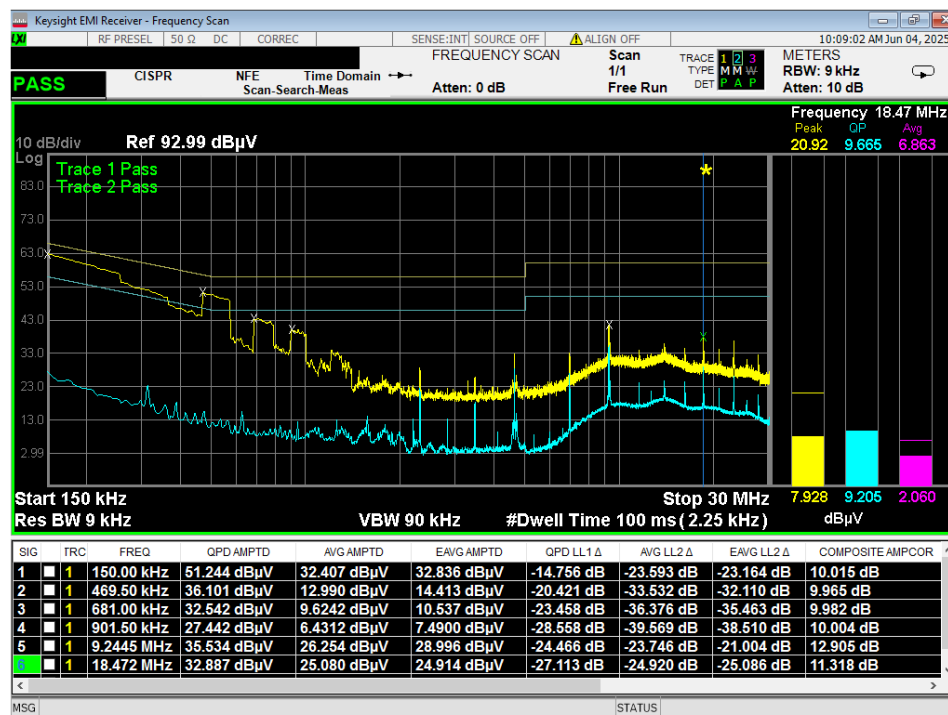


Figure 20 – Conducted Emissions Plot, charging via USB-C, IDLE, Line

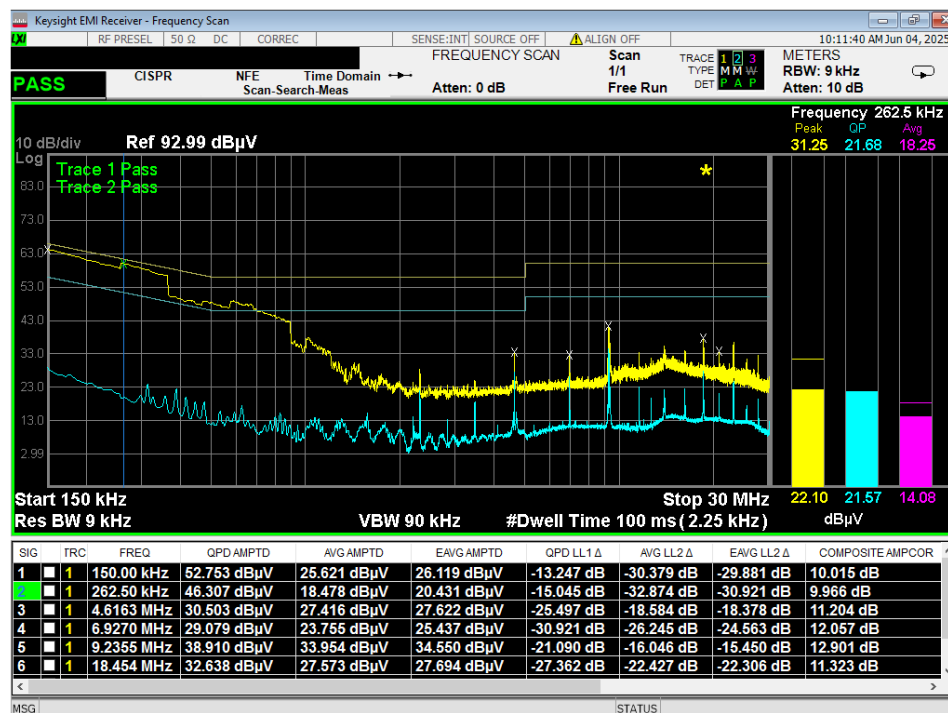


Figure 21 – Conducted Emissions Plot, charging via USB-C, IDLE, Neutral

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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;

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

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

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

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

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

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

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

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

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



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APPENDIX B – MEASUREMENT UNCERTAINTY

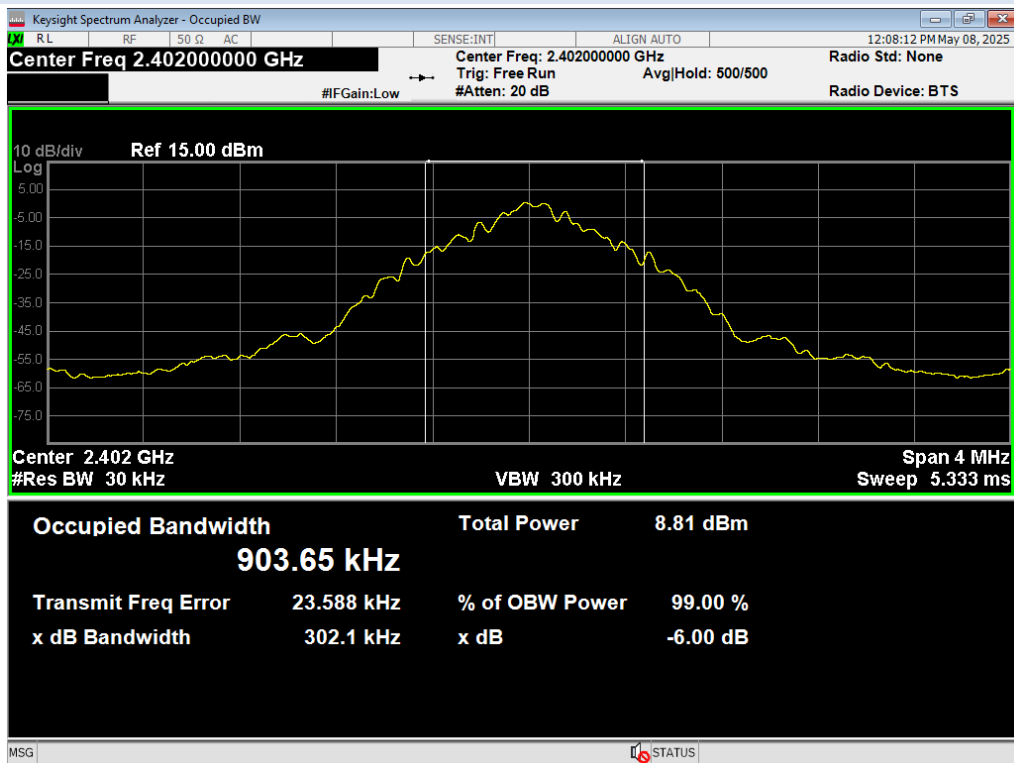
NCEE Labs does not add uncertainty values to measurement results

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

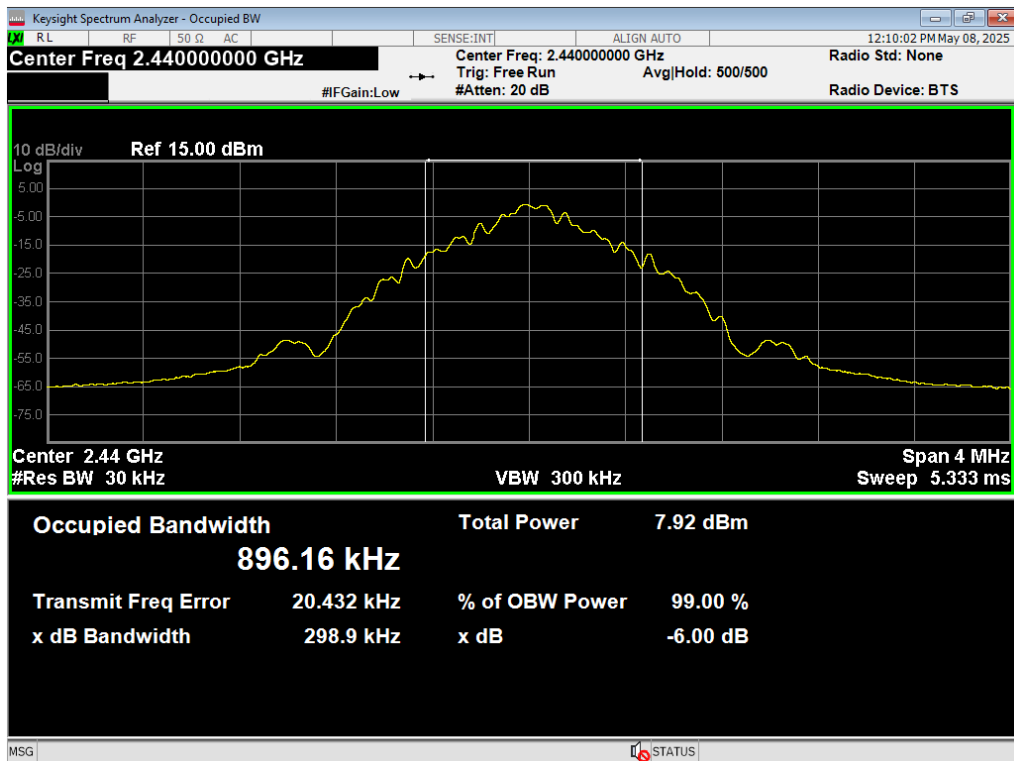
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08
Emissions limits, conducted	150kHz – 30MHz	±3.03

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

APPENDIX C – GRAPHS AND TABLES

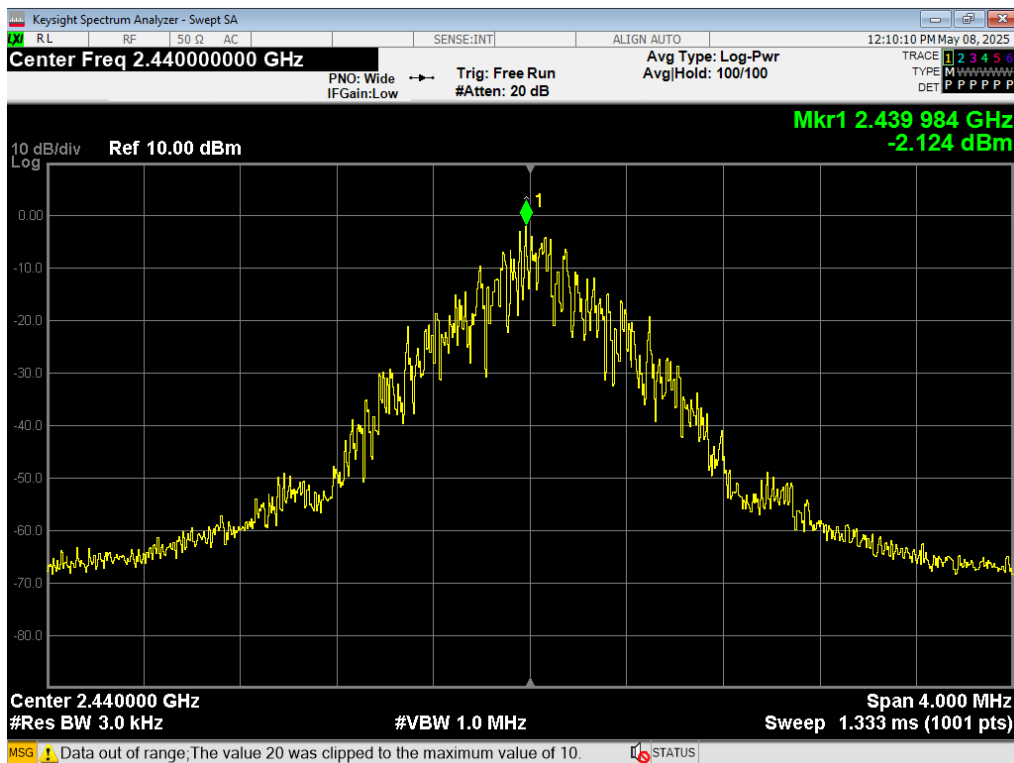


01 Occupied BW, BTBR, 2402MHz

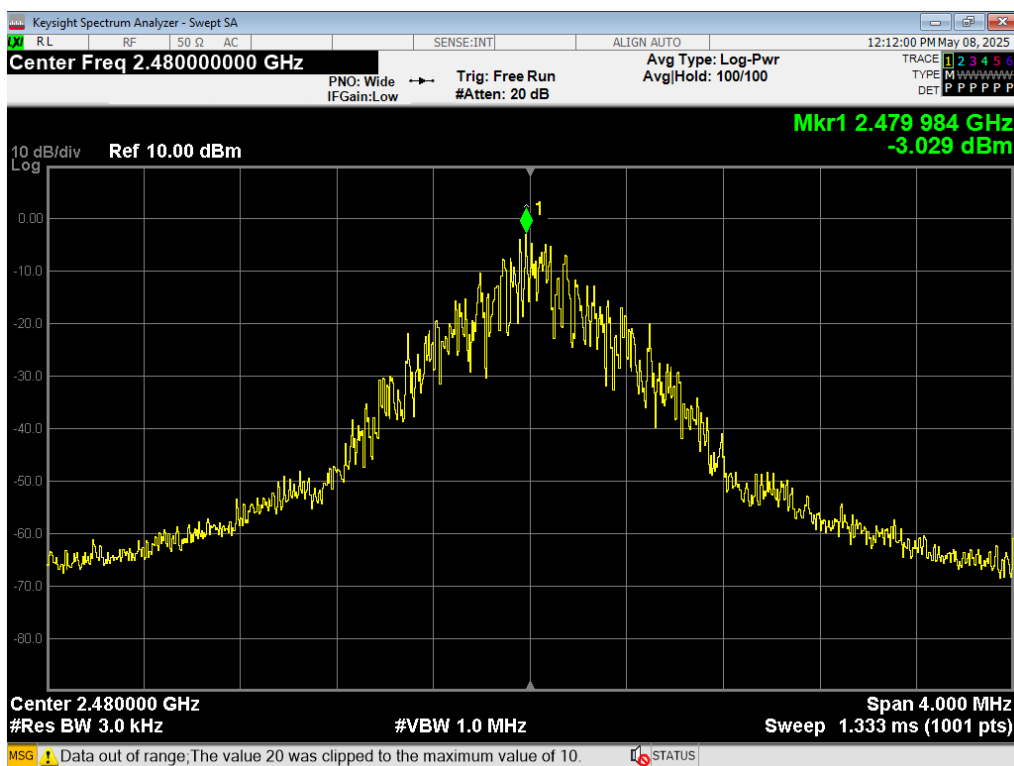


02 Occupied BW, BTBR, 2440MHz

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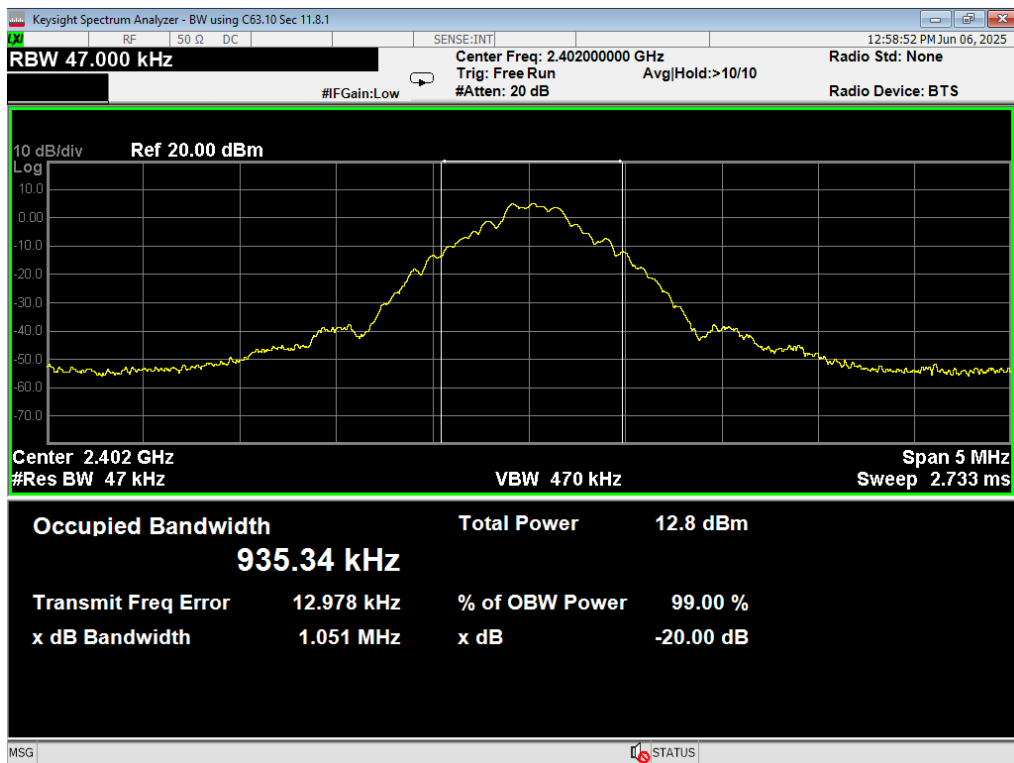


05 PSD, BTBR, 2440MHz

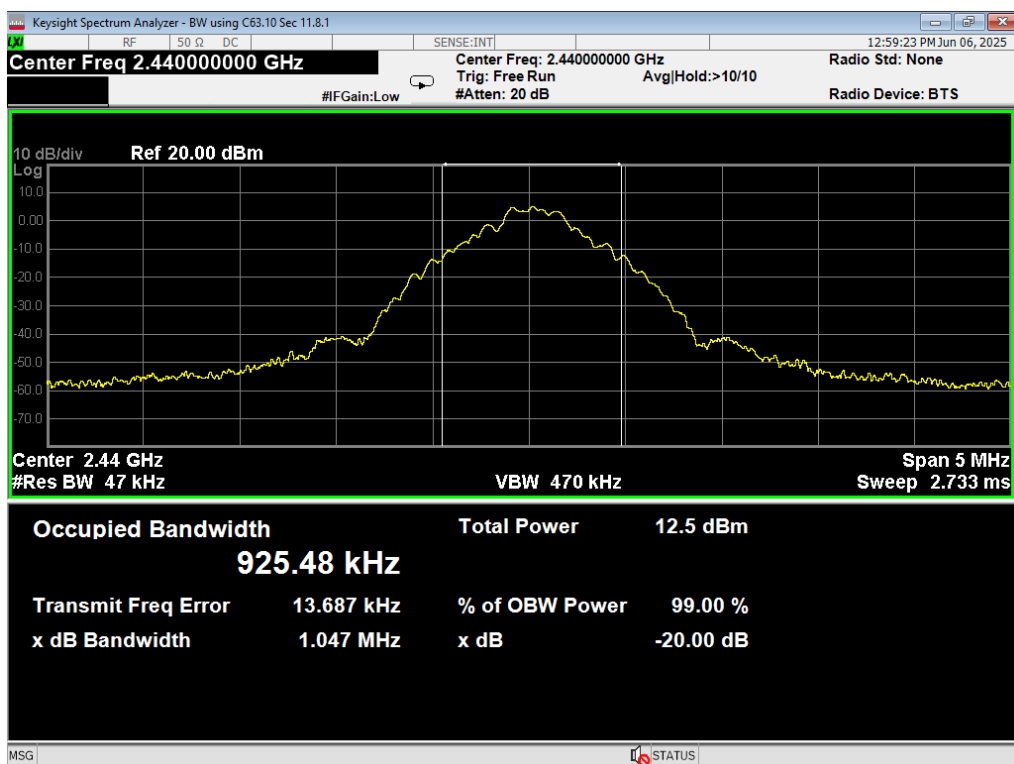


06 PSD, BTBR, 2480MHz

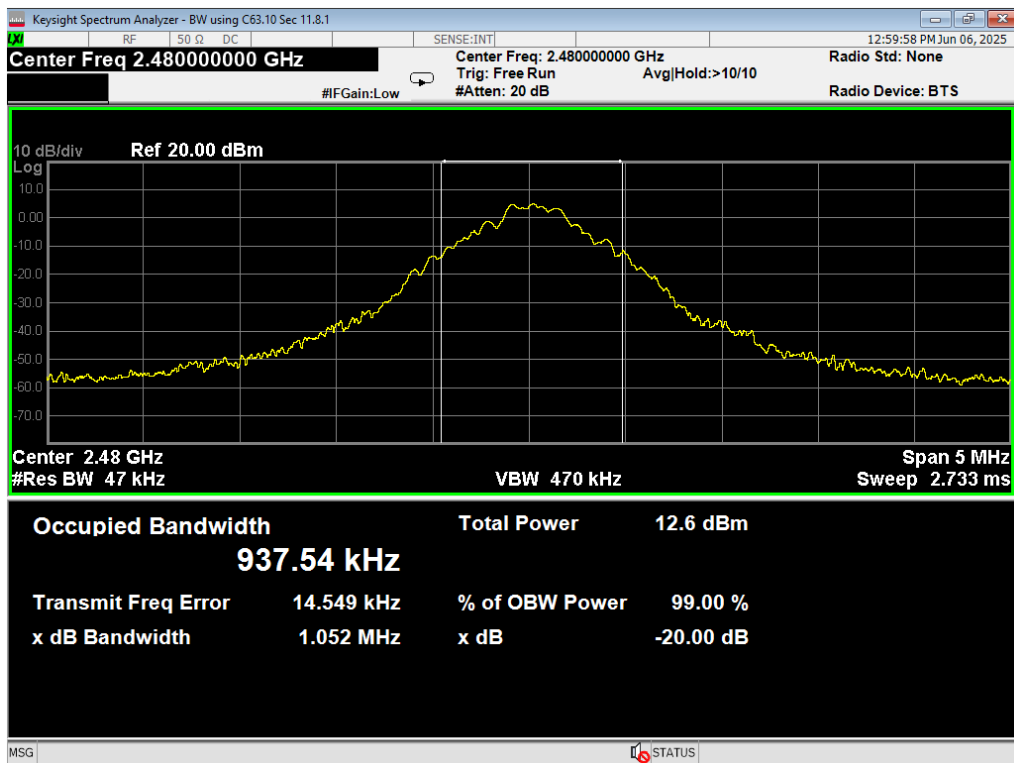
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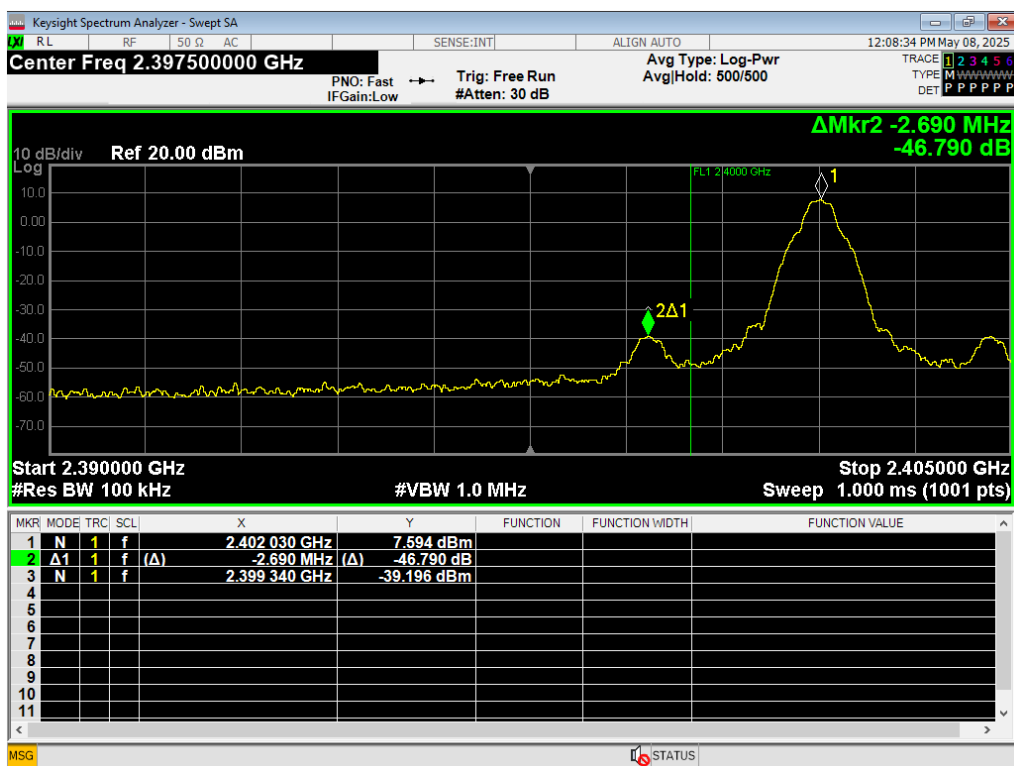
07 20dB BW, BTBR, 2402MHz



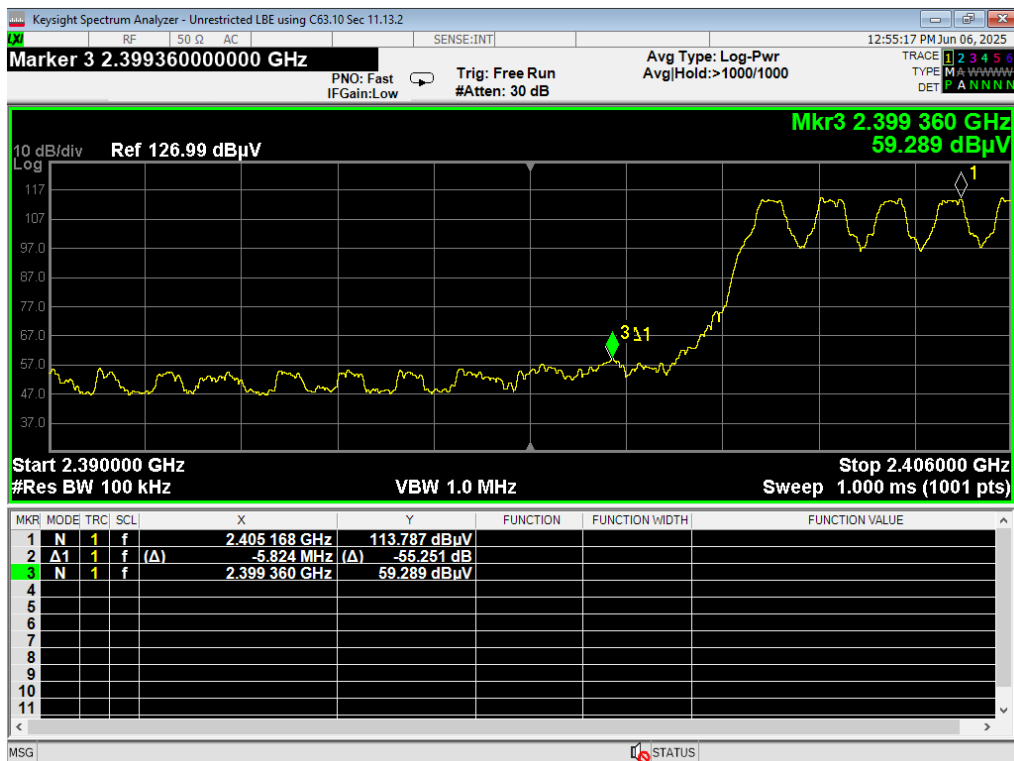
08 20dB BW, BTBR, 2440MHz



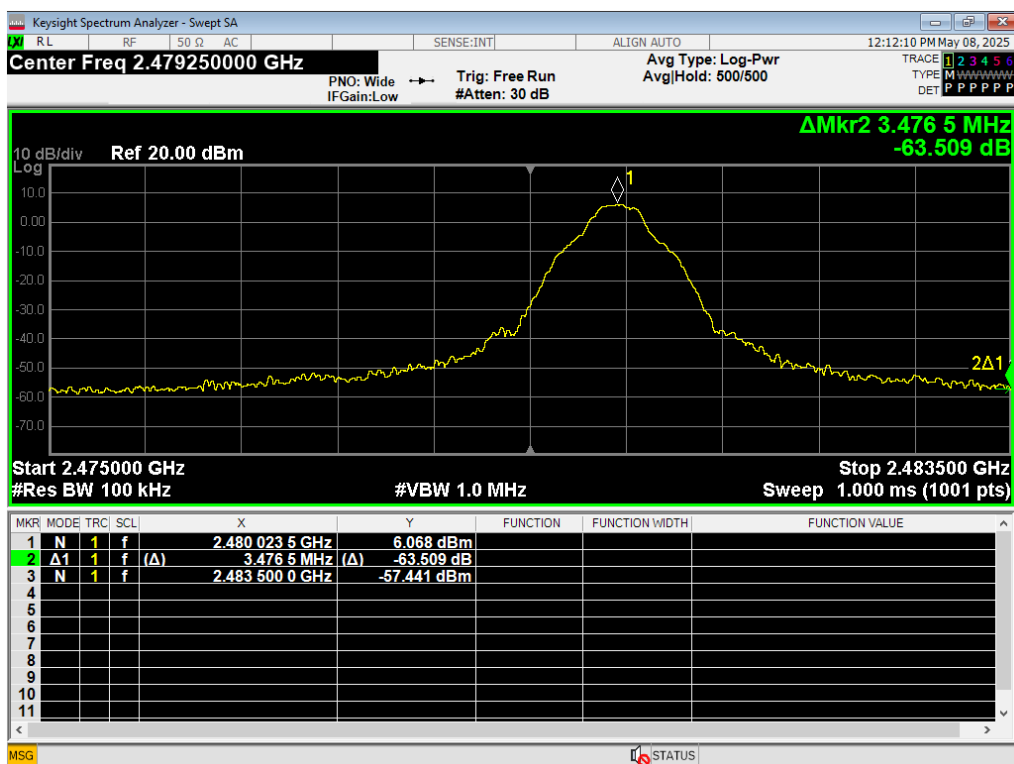
09 20dB BW, BTBR, 2480MHz



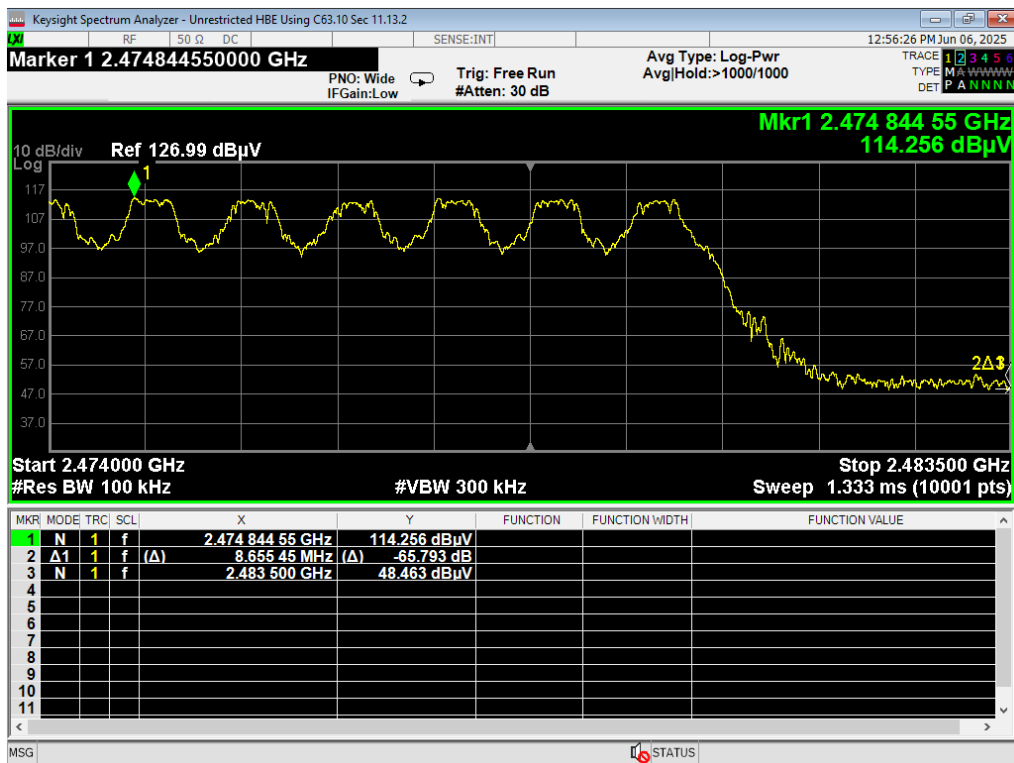
10 LBE Unrestricted, BTBR



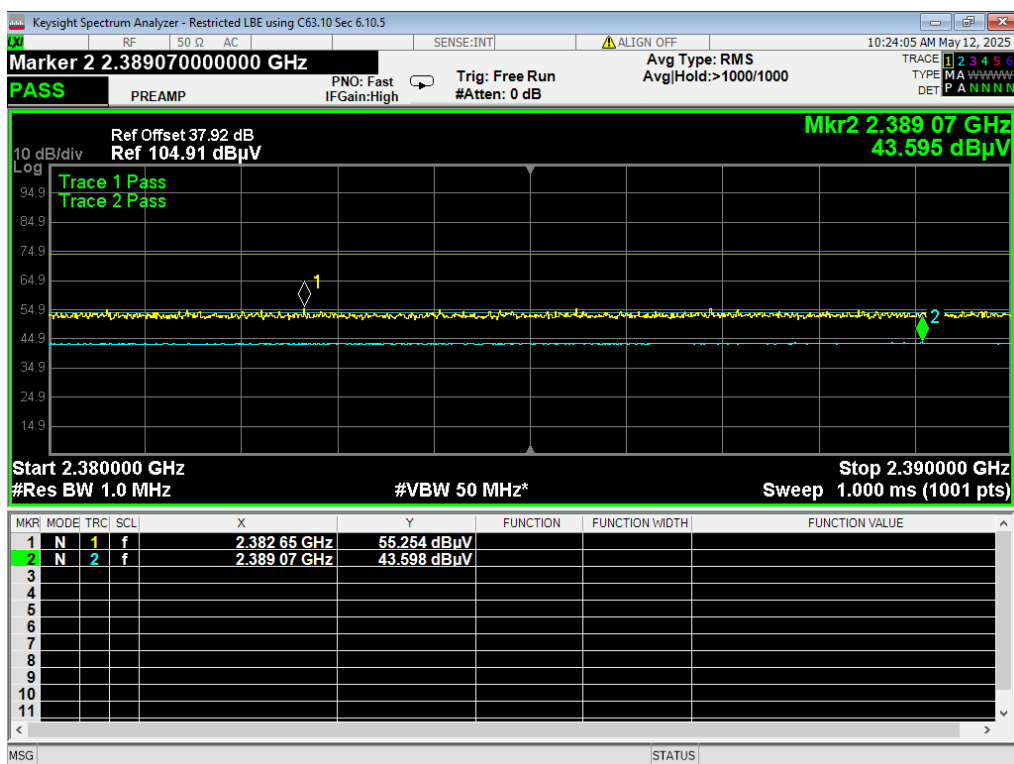
11 LBE Unrestricted, BTBR Hopping



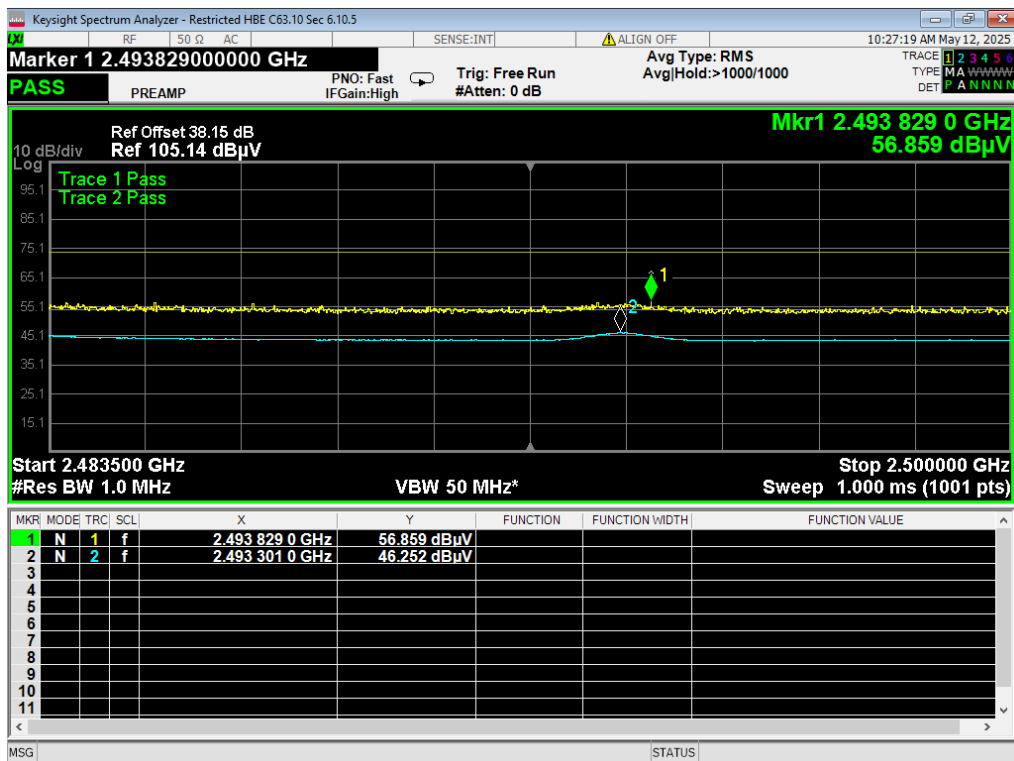
12 HBE Unrestricted, BTBR



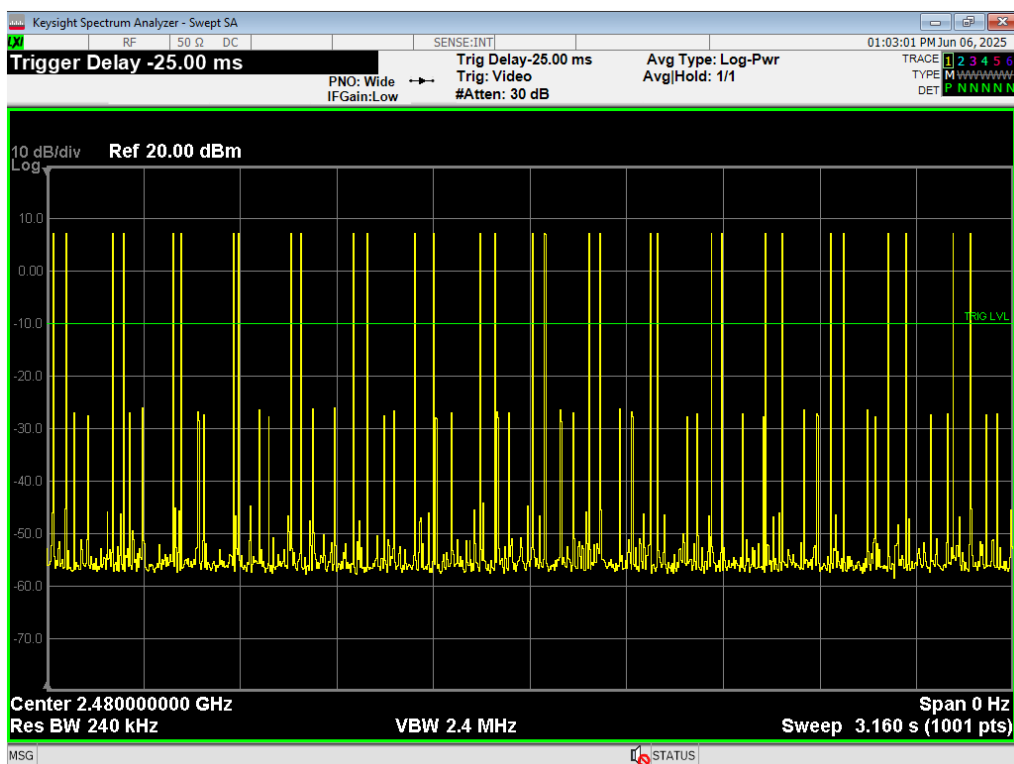
13 HBE Unrestricted, BTBR Hopping



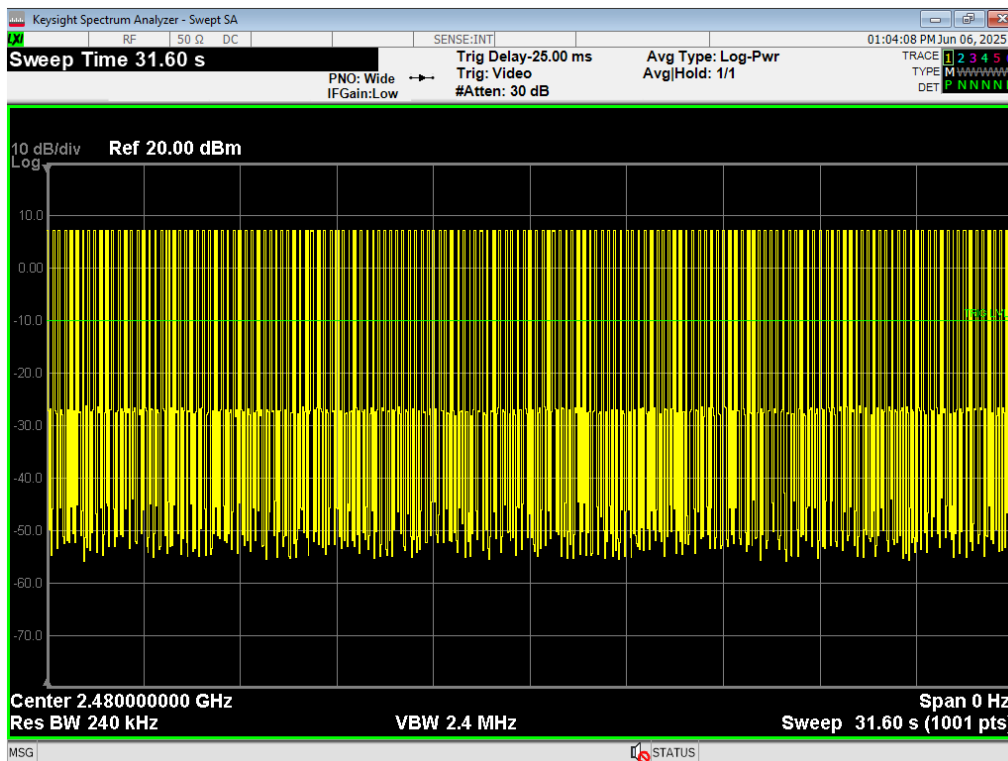
14 LBE Restricted, BTBR



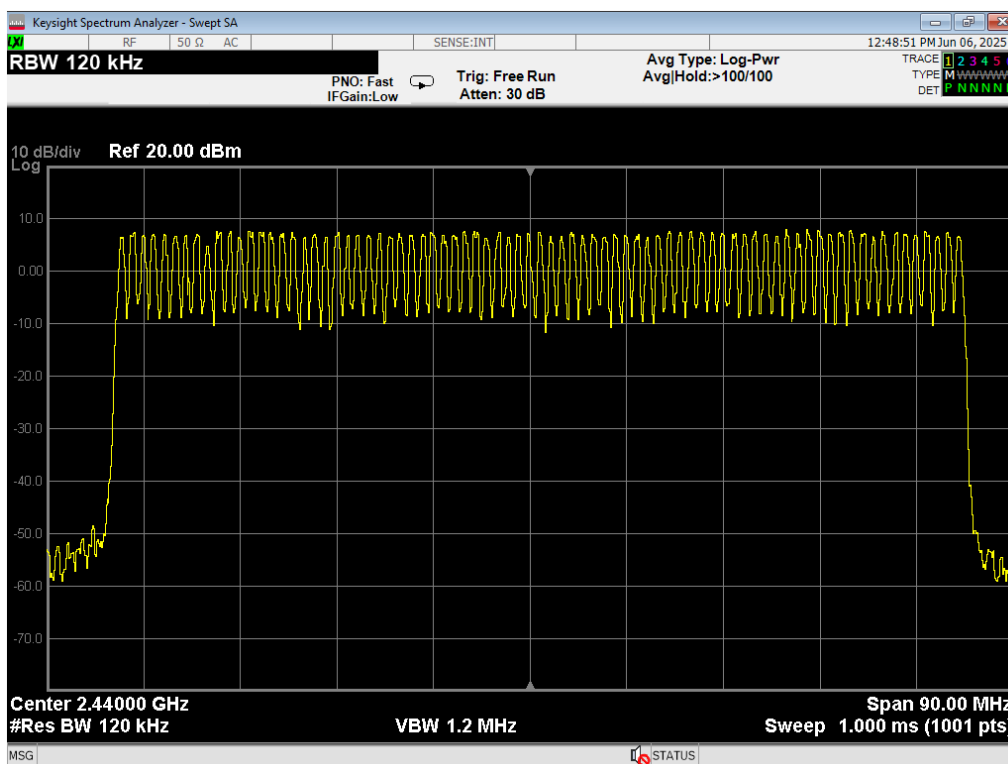
15 HBE Restricted, BTBR



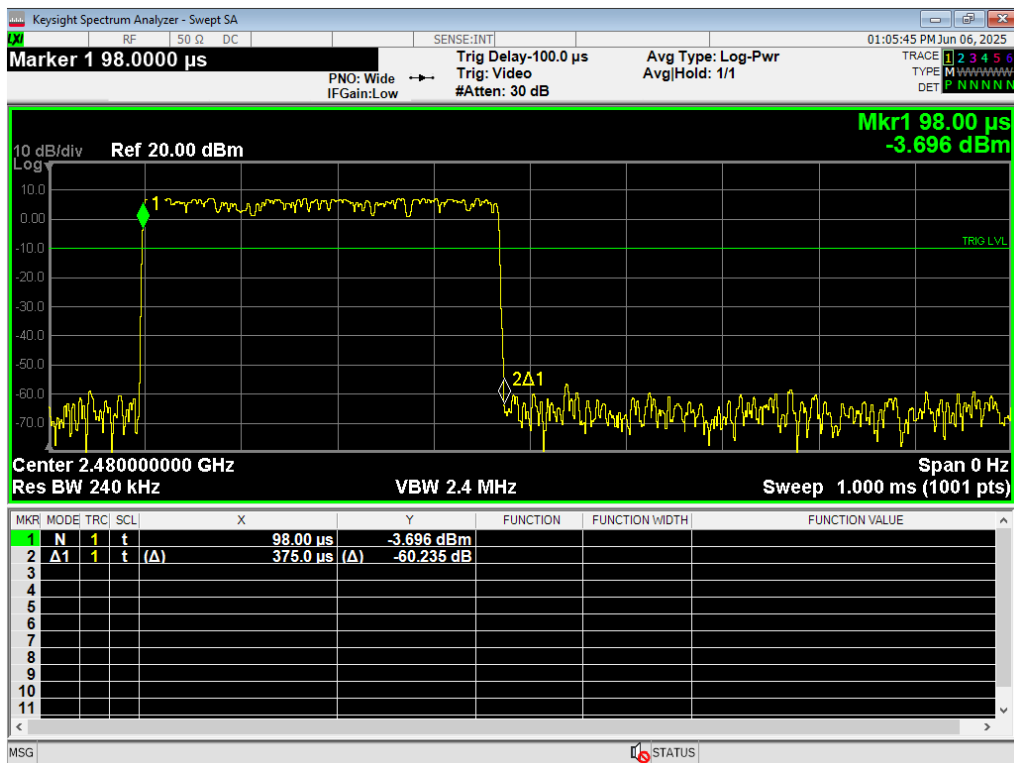
16 Dwell Time, 3



17 Dwell Time, 31



18 Hop Count



19 ON Time



20 Channel Separation



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Prepared for:	Garmin International, Inc.		

REPORT END

FCC/ISED Test Report

Prepared for: Garmin International, Inc.

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

Product: A04828

Test Report No: R20250124-00-E3 **Rev:** B

Approved by:


Fox Lane,
EMC Test Engineer

DATE: July 28, 2025

Total Pages: 46

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Prepared for:	Garmin International, Inc.		

REVISION PAGE

Rev. No.	Date	Description
0	11 July 2025	Issued by FLane Prepared by FLane, ESchmidt
A	22 July 2025	Added FVIN in Section 2.1, Added plots for 1-25GHz scans in Section 4.4 – ES
B	28 July 2025	Updated to RSS-247 Issue 4



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Prepared for: Garmin International, Inc.

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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 section:

The EUT has been tested according to the following specifications:

- (1) US Code of Federal Regulations, Title 47, Part 15
- (2) ISSED RSS-Gen, Issue 5
- (3) ISSED RSS-247, Issue 4

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 4 Section 6.3	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 4 Section 6.3	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 4 Section 6.6, RSS-Gen Issue 5, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 4 Section 6.3	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 4 Section 6.6	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	Pass



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Prepared for: Garmin International, Inc.

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04828
FCC ID	IPH-04828
IC ID	1792A-04828
FVIN	1.01
EUT Received	8 May 2025
EUT Tested	8 May 2025- 6 June 2025
Serial No.	3489571855 (Radiated Sample) 3489571782 (Conducted Sample)
Operating Band	2400 – 2483.5 MHz
Device Type	☐ GMSK ☐ GFSK ☐ BT BR ☒ BT EDR 2MB ☒ BT EDR 3MB ☐ 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: PSAl05R-0500 GPN: 362-00118-00 (Representative Power Supply)

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:

2EDR/3EDR Transmissions:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 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

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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 and Report
2	Blake Winter	Test Engineer	Testing
4	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.



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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
EMCO Horn Antenna	3116	2576	July 31, 2023	July 30, 2025
Com-Power LISN, Single Phase	LI-220C	20070017	July 17, 2023	July 17, 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
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	January 20, 2024	January 20, 2026
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	January 21, 2024	January 21, 2026
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	January 21, 2024	January 21, 2026
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	January 21, 2024	January 21, 2026
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	January 21, 2024	January 21, 2026
N connector bulkhead (control room)*	PE9128	NCEEBH2	January 21, 2024	January 21, 2026
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.

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	Prepared for:	Garmin International, Inc.		

3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMENTS

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.

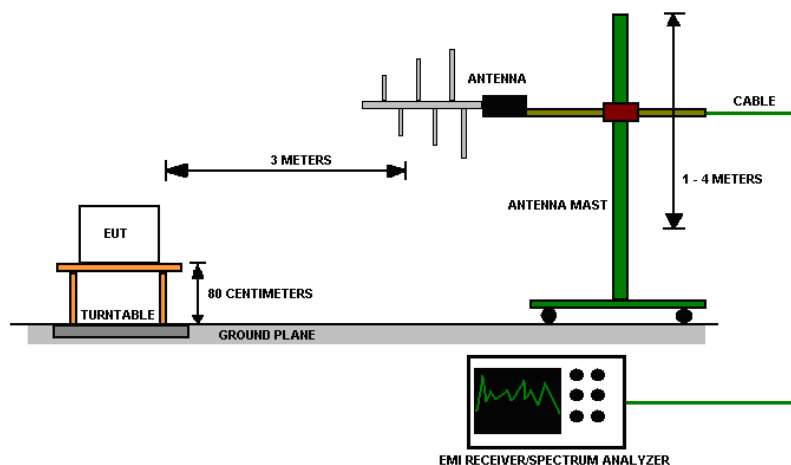


Figure 2 - Radiated Emissions Test Setup, <1GHz

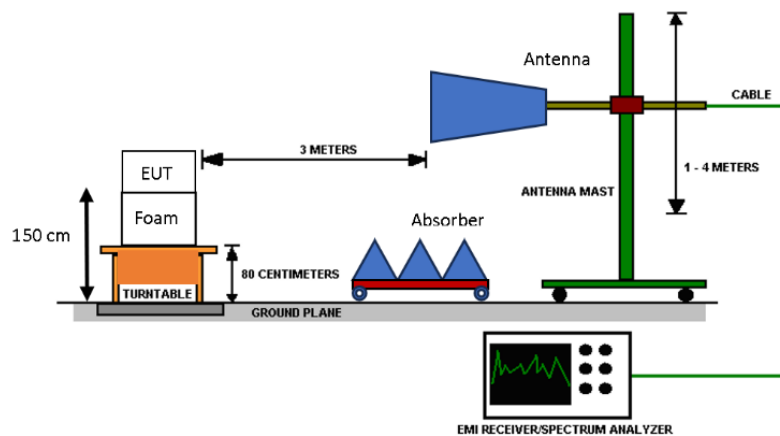


Figure 3 - Radiated Emissions Test Setup, >1GHz



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4.0 RESULTS**DTS Radio Measurements**

Ch.	Mode	Occupied BW (kHz)	6 dB BW (kHz)	PSD (dBm)	AVG OUTPUT POWER (dBm)	AVG OUTPUT POWER (mW)	RESULT
Low	2EDR	1189.60	1087.00	-5.471	9.168	8.257	PASS
Mid	2EDR	1189.60	1093.00	-6.206	8.265	6.707	PASS
High	2EDR	1189.00	1092.00	-7.089	7.721	5.917	PASS
Low	3EDR	1221.40	966.00	-6.041	6.823	4.812	PASS
Mid	3EDR	1219.00	954.40	-6.507	7.633	5.798	PASS
High	3EDR	1219.90	956.40	-7.514	6.729	4.709	PASS

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

Peak Output Power Limit = 30dBm; PSD Limit = 8dBm

Unrestricted Band-Edge

Ch.	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Delta (dB)	Min Delta (dB)	Result
Low	2EDR	2400.00	-40.77	5.20	45.98	30.00	PASS
Low	3EDR	2400.00	-39.82	4.54	44.36	30.00	PASS
High	2EDR	2483.50	-54.09	3.57	57.66	30.00	PASS
High	3EDR	2483.50	-57.69	3.00	60.70	30.00	PASS

Peak Restricted Band-Edge

Ch.	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	2EDR	2390.00	55.42	Peak	73.98	18.56	PASS
Low	3EDR	2390.00	55.19	Peak	73.98	18.79	PASS
High	2EDR	2483.50	56.66	Peak	73.98	17.32	PASS
High	3EDR	2483.50	55.90	Peak	73.98	18.08	PASS

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

Average Restricted Band-Edge

Ch.	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	2EDR	2390.00	43.54	Average	53.98	10.44	PASS
Low	3EDR	2390.00	43.40	Average	53.98	10.58	PASS
High	2EDR	2483.50	45.77	Average	53.98	8.21	PASS
High	3EDR	2483.50	45.65	Average	53.98	8.33	PASS

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



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4.1 OUTPUT POWER

Test Method:

All measurements were performed using section 11.9.1.1 from 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:

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 output power plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. Tabulated data is listed in section 4.0.



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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/documentation 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. Tabulated data is listed in section 4.0.



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4.3 DUTY CYCLE

Modulations in this report have a duty cycle of >98%. No DCCF used.

4.4 RADIATED EMISSIONS

Test Method:

ANSI C63.10-2013, 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.
4. The EUT was tested for spurious emissions while running off of battery power and external USB power. The worse-case emissions were produced while running off of USB power, so results from this mode are presented.



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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:

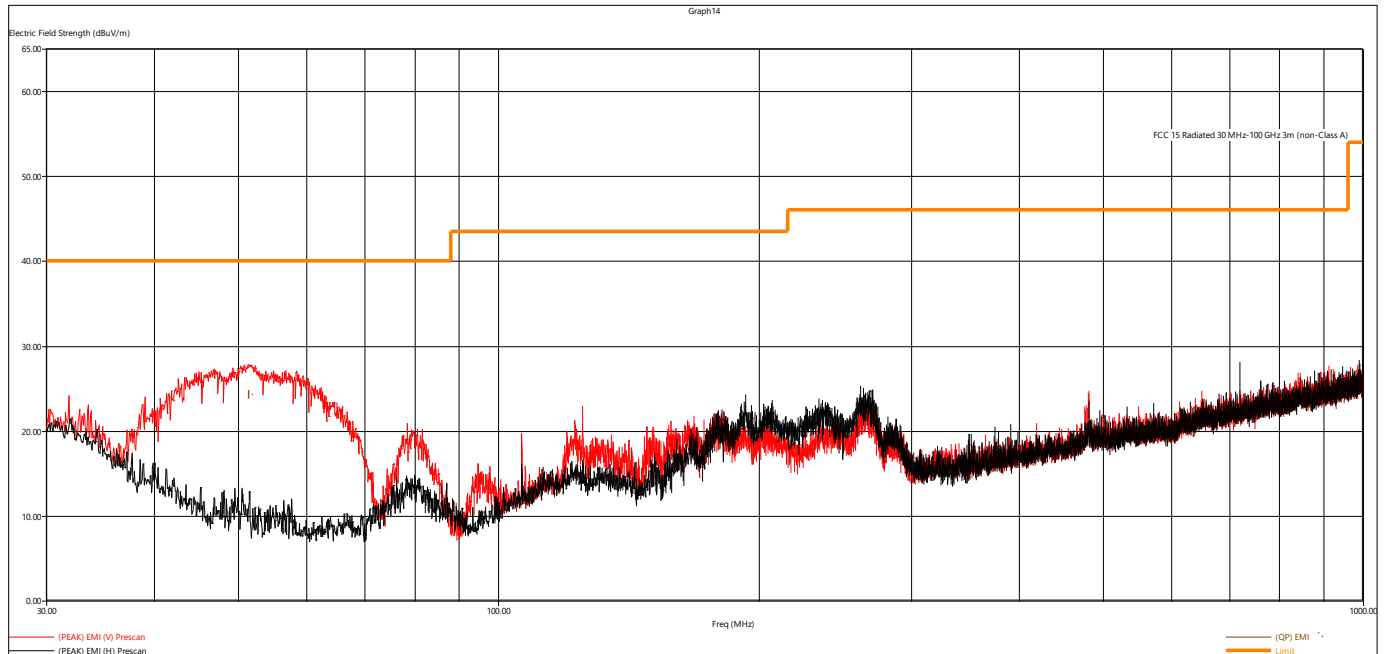


Figure 4 - Radiated Emissions Plot, Receive

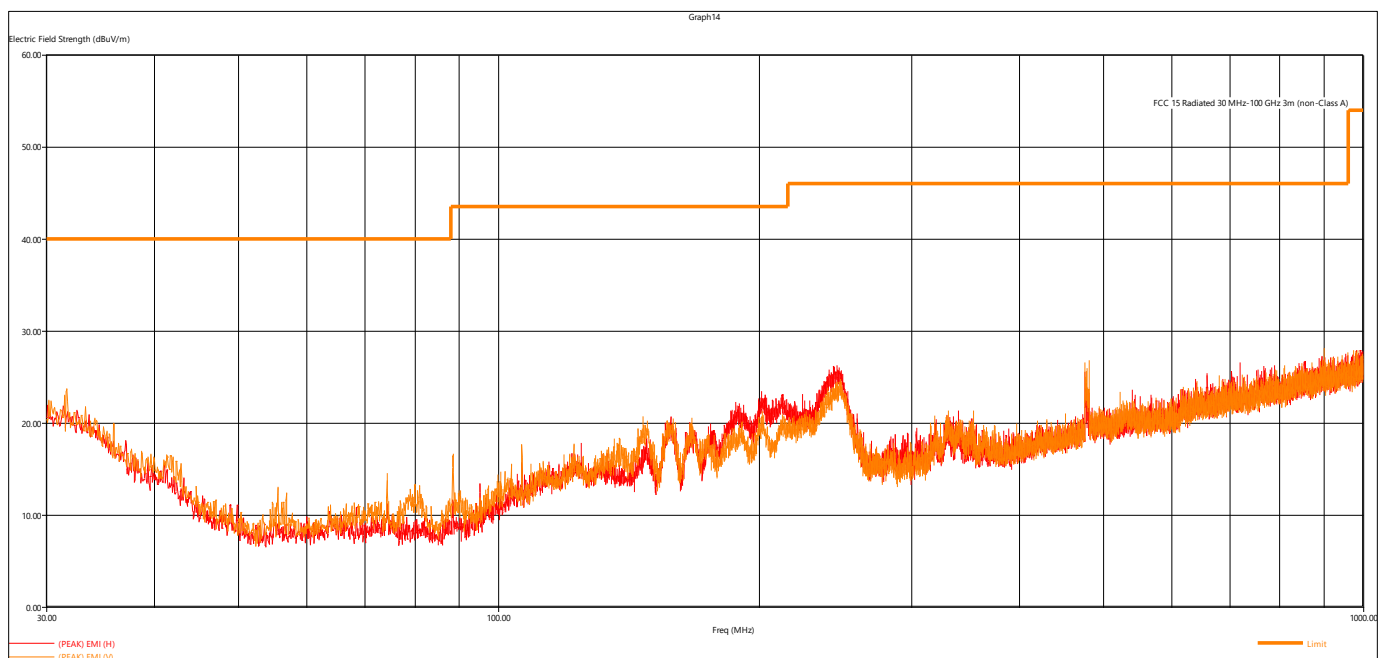


Figure 5 - Radiated Emissions Plot, 2EDR

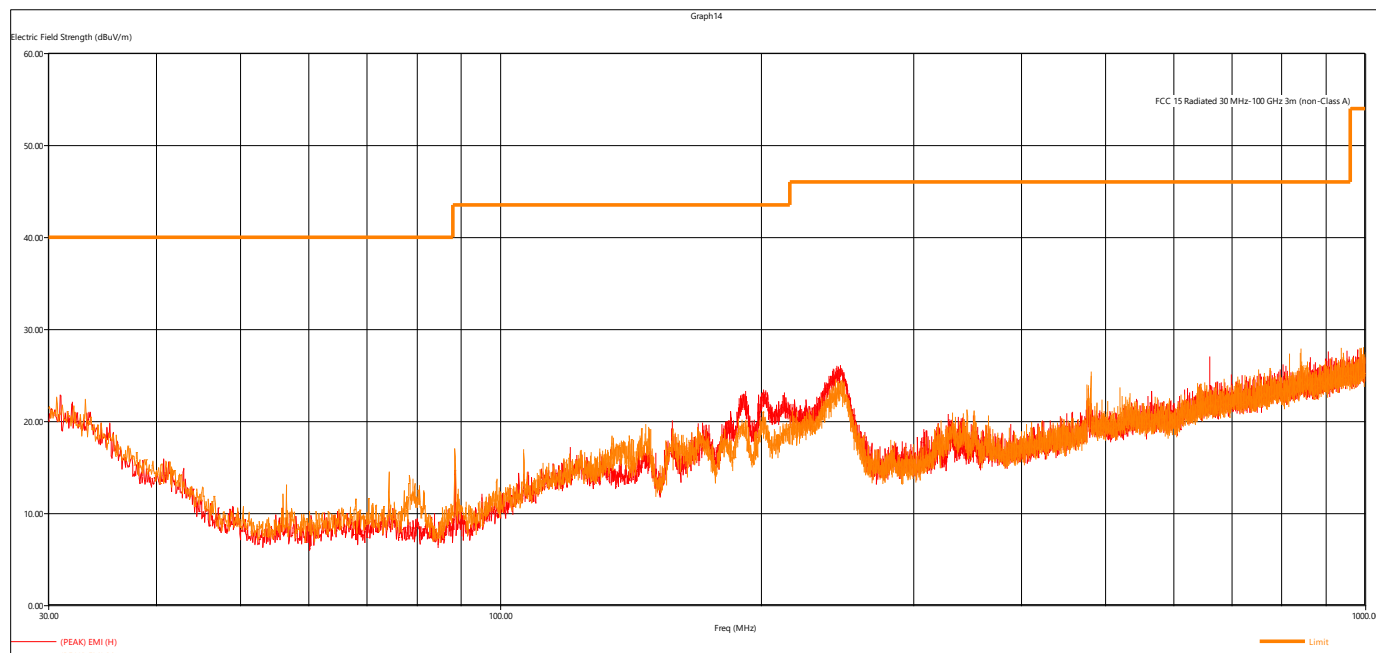


Figure 6 - Radiated Emissions Plot, 3EDR

Quasi-Peak Measurements, 30MHz – 1GHz

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dBμV/m	dBμV/m	dB	cm.	deg.			
51.349920	24.23	40.00	15.77	105.91	51.50	V		RX

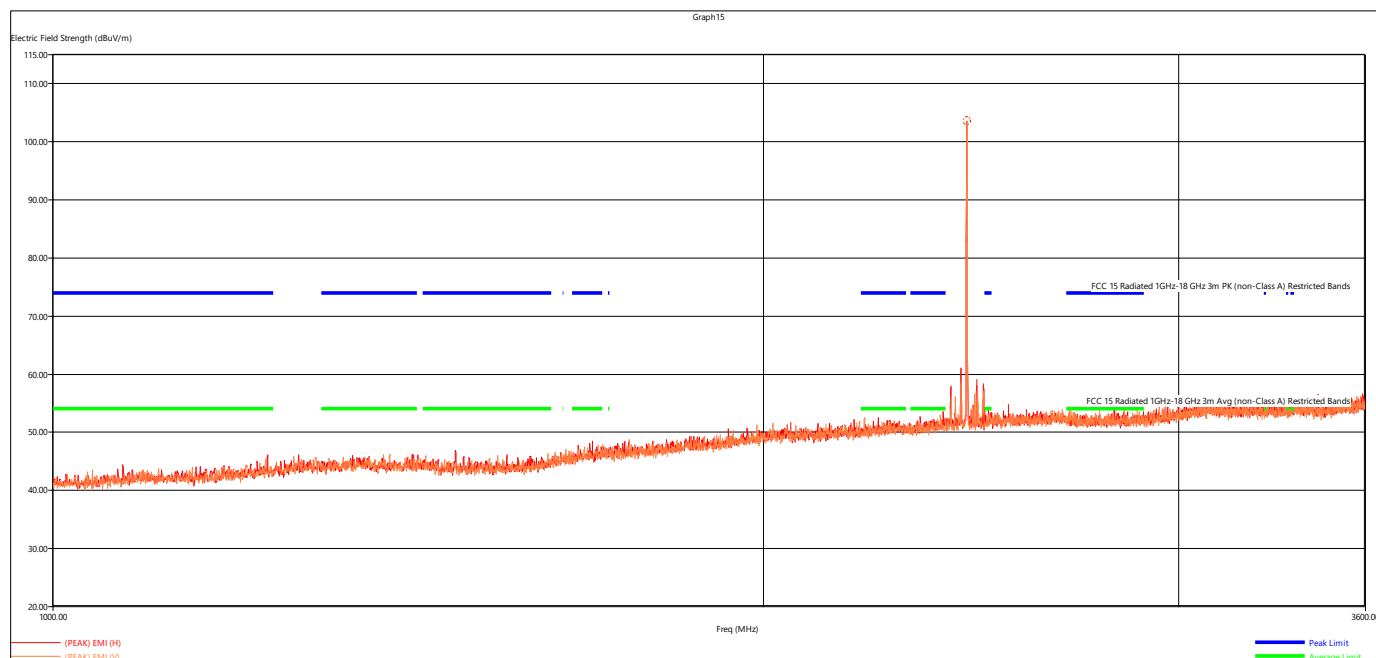


Figure 7 - Radiated Emissions Plot, 1-3.6GHz, 2EDR Mid

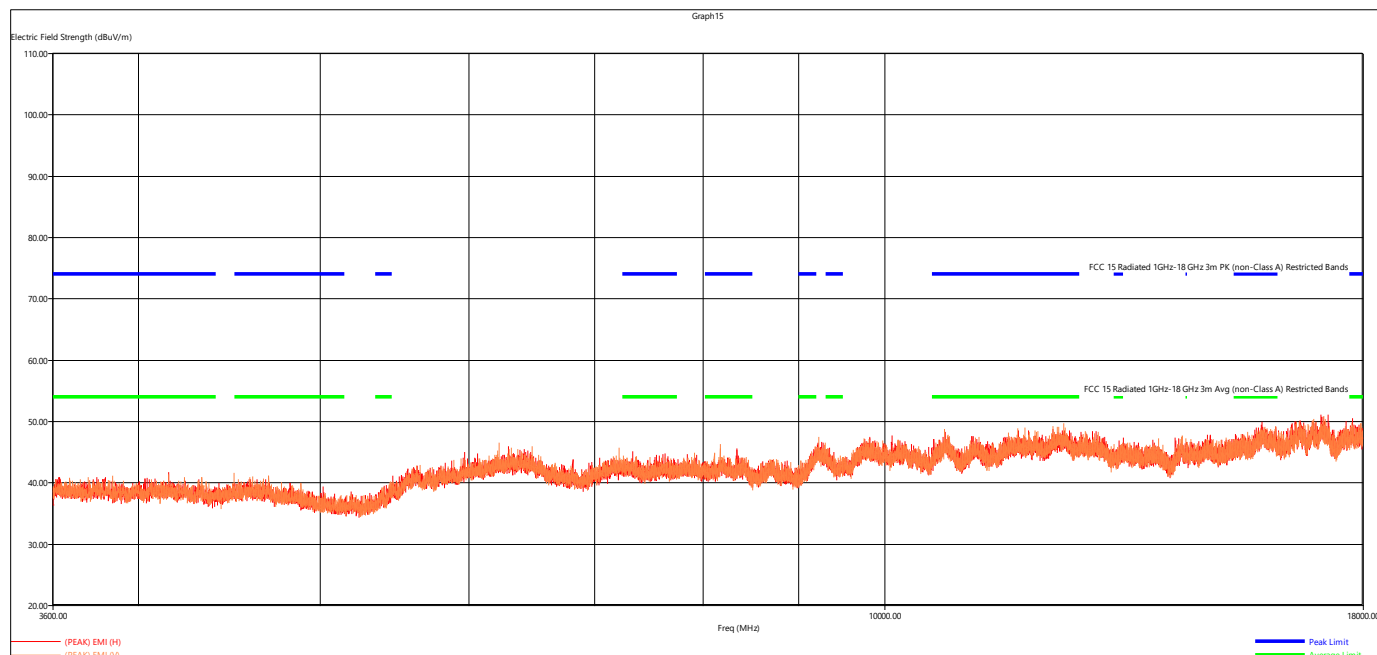


Figure 8 - Radiated Emissions Plot, 3.6-18GHz, 2EDR Mid

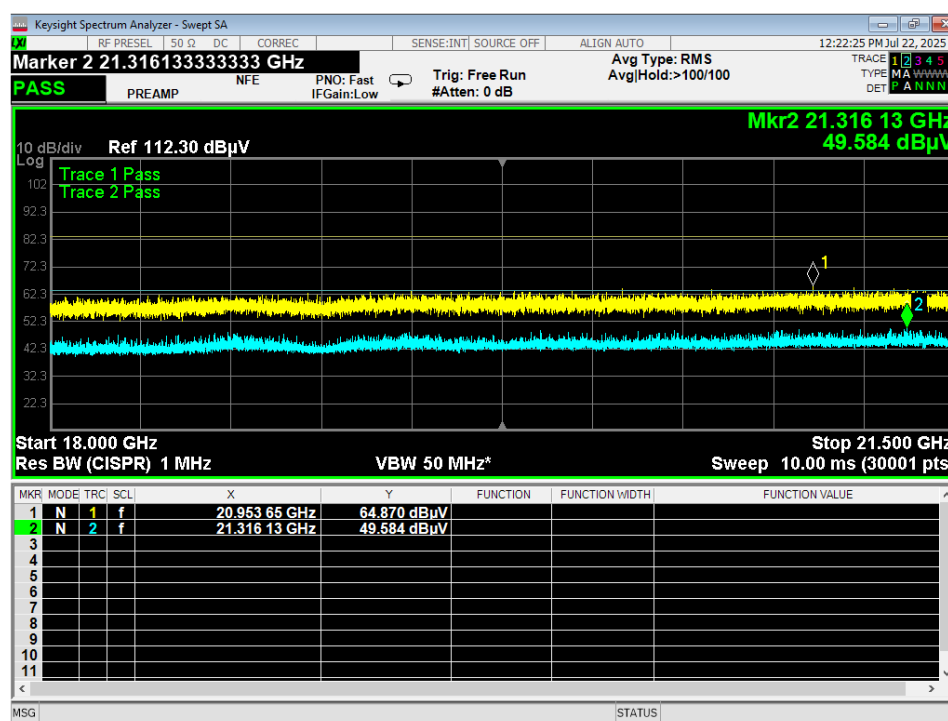


Figure 9 - Radiated Emissions Plot, 18-21.5GHz, 2EDR Mid, 1m test distance

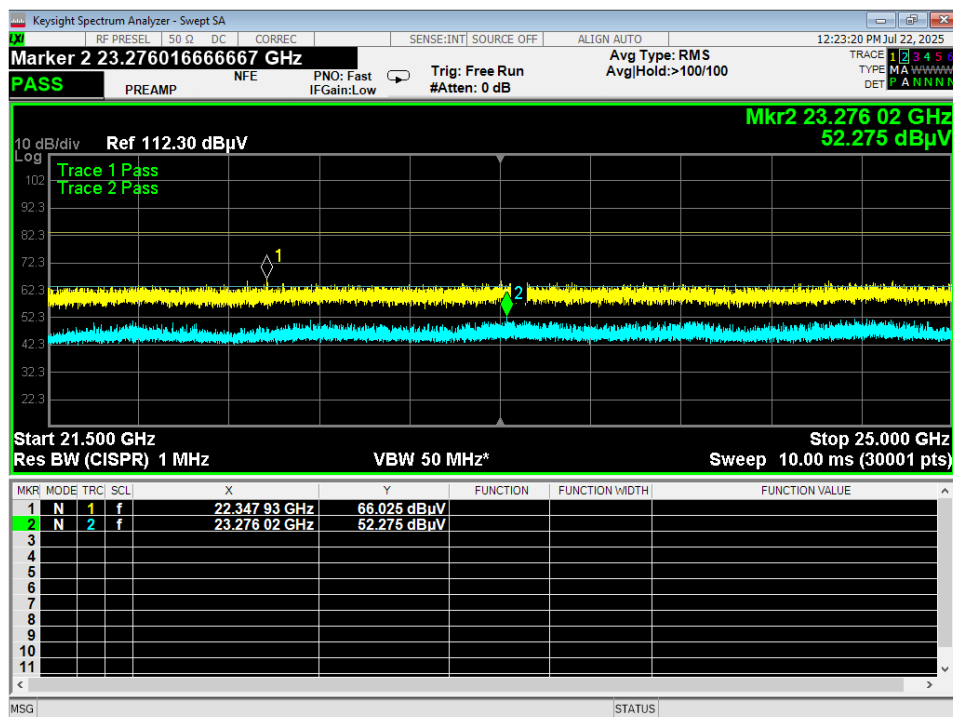


Figure 10 - Radiated Emissions Plot, 21.5-25GHz, 2EDR Mid, 1m test distance

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. Margin value = Limit value – Emission level
4. The worst-case plots from the 1-25GHz range are shown above. No measurements were found to be within 10dB of the applicable limits and therefore were not tabulated.



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4.5 CONDUCTED SPURIOUS EMISSIONS

Test Method: ANSI C63.10-2020, Section 6.7

Limits of spurious emissions:

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.

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:

Note that the limit shown on the plots does not apply. It is a line for reference.

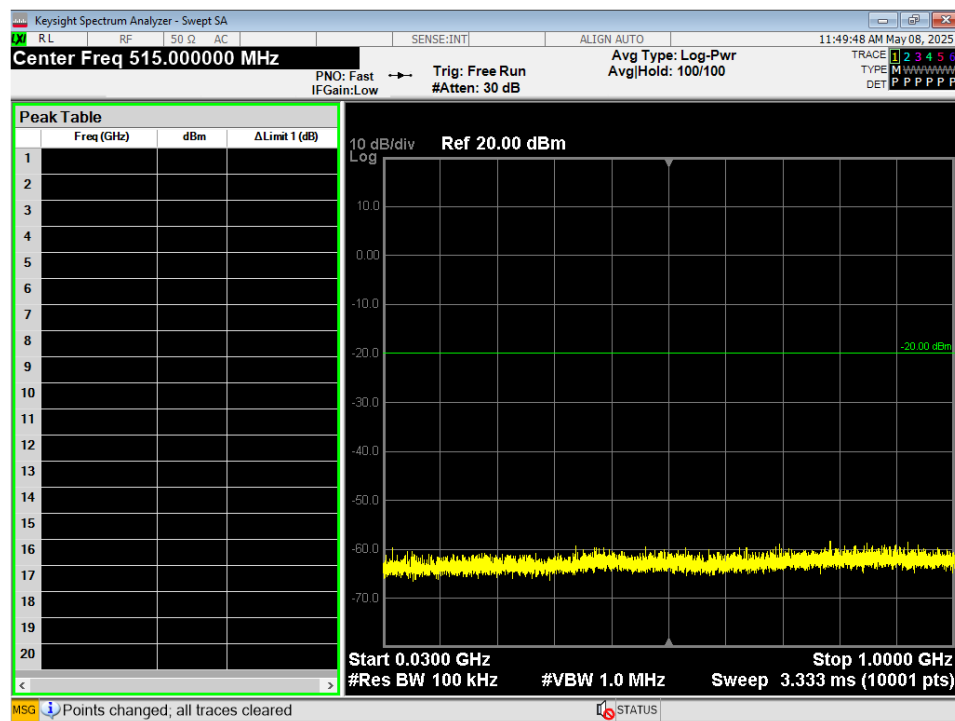


Figure 11 - Conducted Emissions Plot, 2EDR, 30MHz – 1GHz, Low

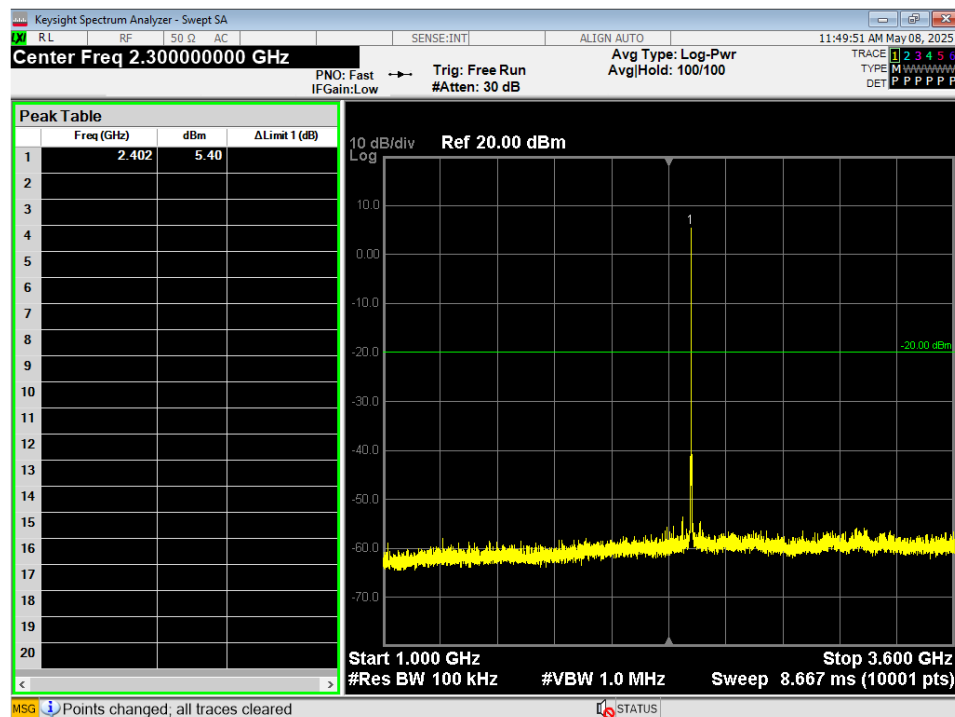


Figure 12 - Conducted Emissions Plot, 2EDR, 1GHz – 3.6GHz, Low

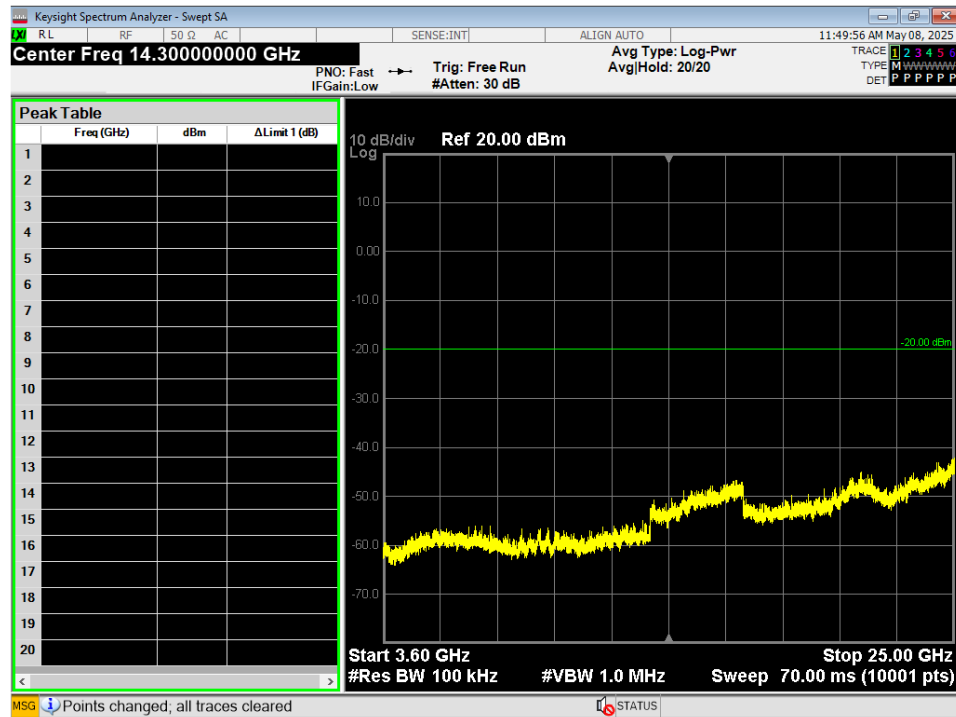


Figure 13 - Conducted Emissions Plot, 2EDR, 3.6GHz – 25GHz, Low

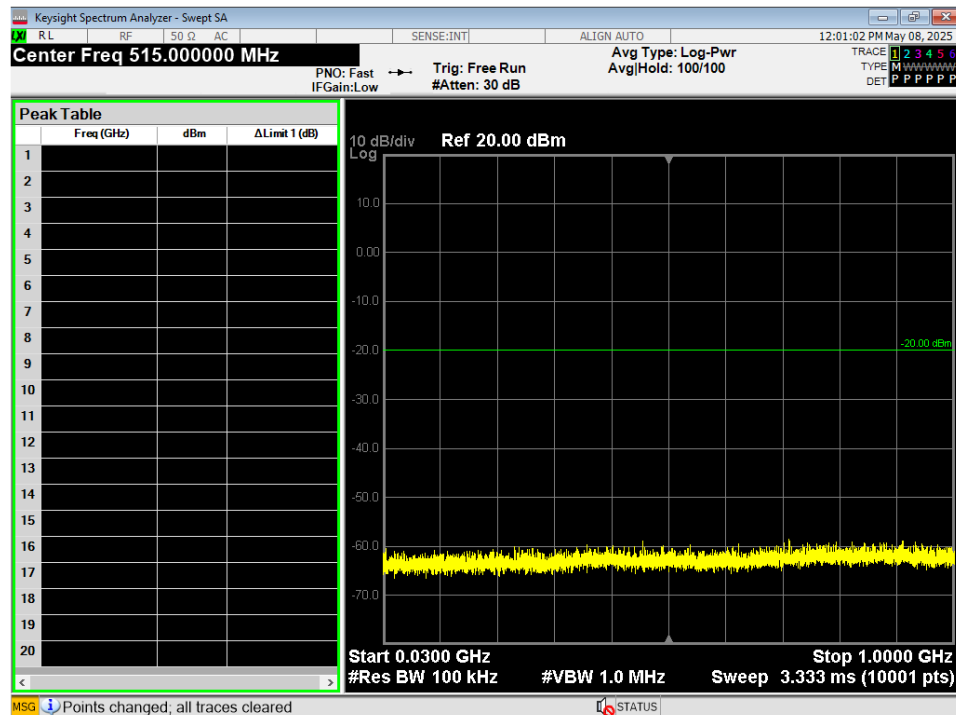


Figure 14 - Conducted Emissions Plot, 3EDR, 30MHz – 1GHz, Low

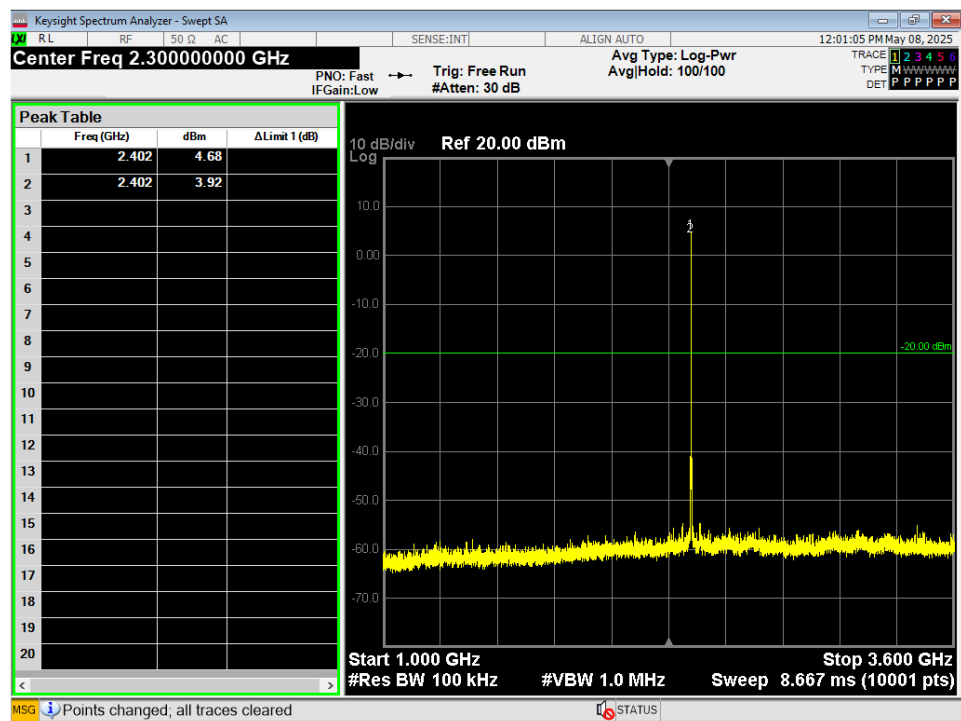


Figure 15 - Conducted Emissions Plot, 3EDR, 1GHz – 3.6GHz, Low

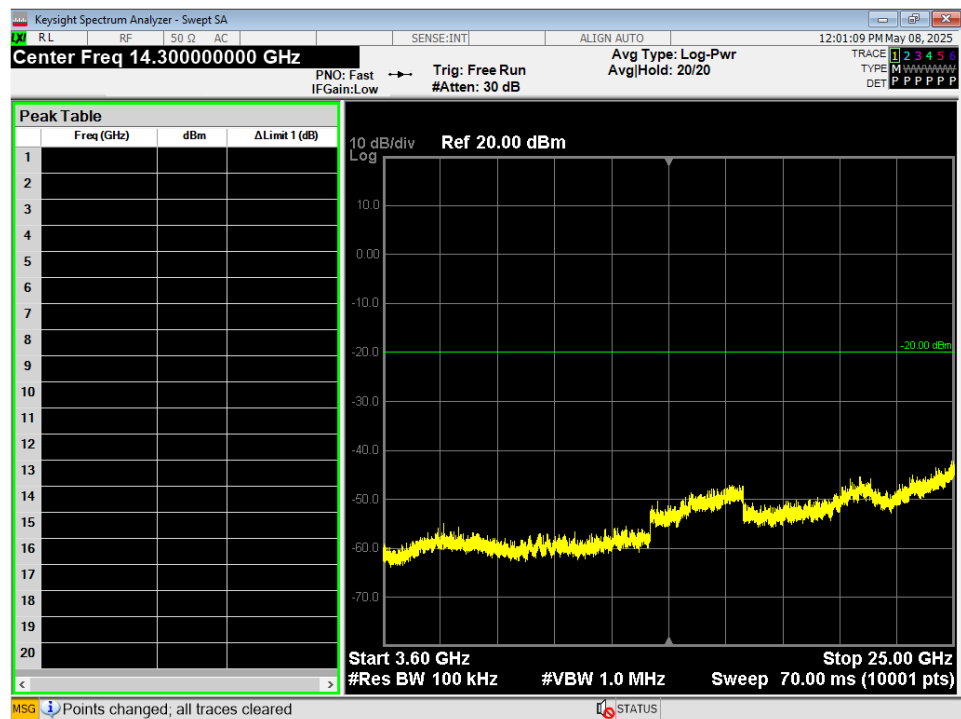


Figure 16 - Conducted Emissions Plot, 3EDR, 3.6GHz – 25GHz, Low

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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.
4. Tabulated data is listed in section 4.0.



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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. Tabulated data is listed in section 4.0.

4.8 CONDUCTED AC MAINS EMISSIONS

Test Method:

ANSI C63.10-2020, Section(s) 6.2

Limits for conducted emissions measurements:

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Test Procedures:

- a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
- d. Results were compared to the 15.207 limits.

Deviation from the test standard:

No deviation

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test Results:

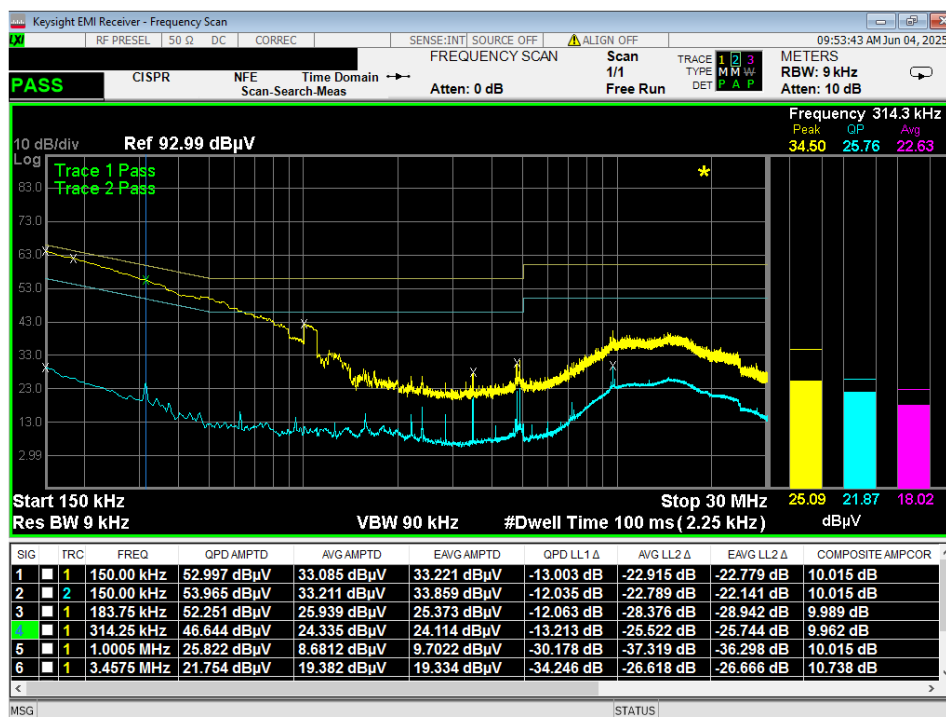


Figure 17 – Conducted Emissions Plot, charging on dock, TX, Line

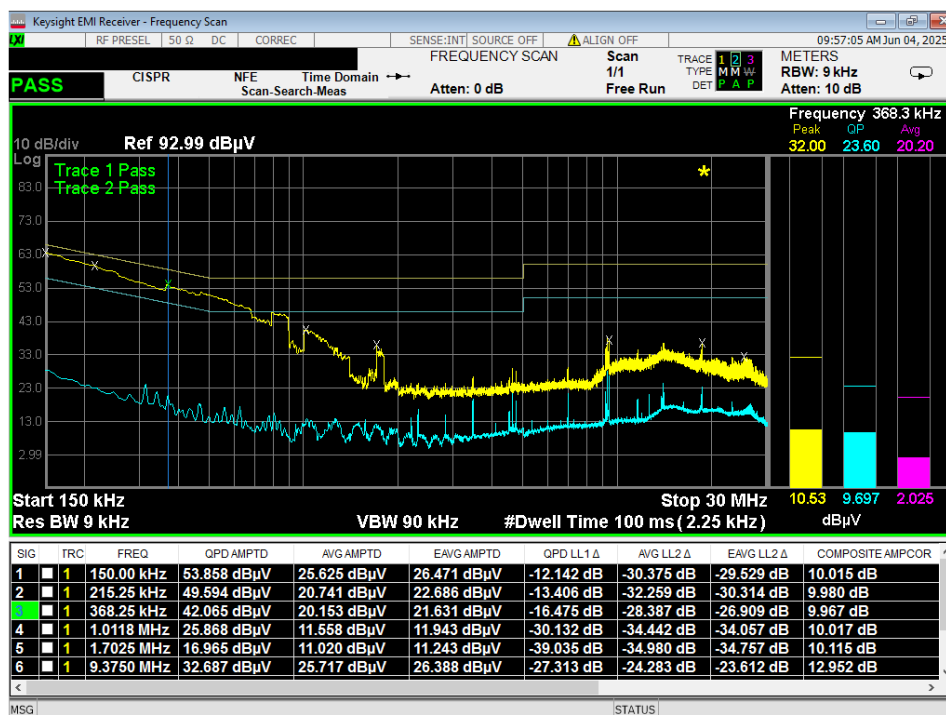


Figure 18 – Conducted Emissions Plot, charging on dock, TX, Neutral

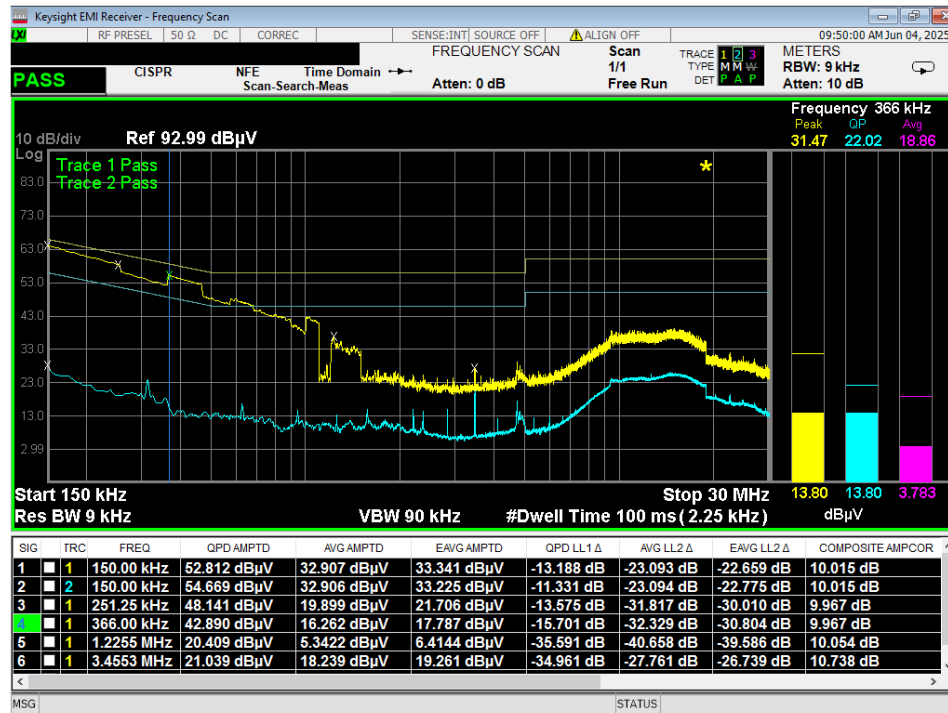


Figure 19 – Conducted Emissions Plot, charging on dock, IDLE, Line

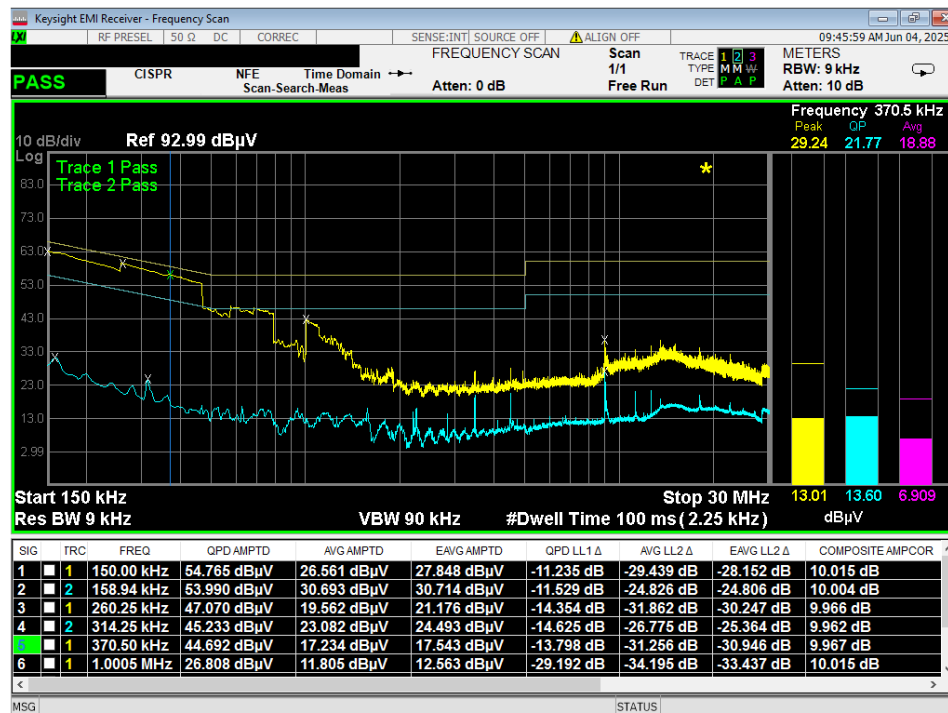


Figure 20 – Conducted Emissions Plot, charging on dock, IDLE, Neutral

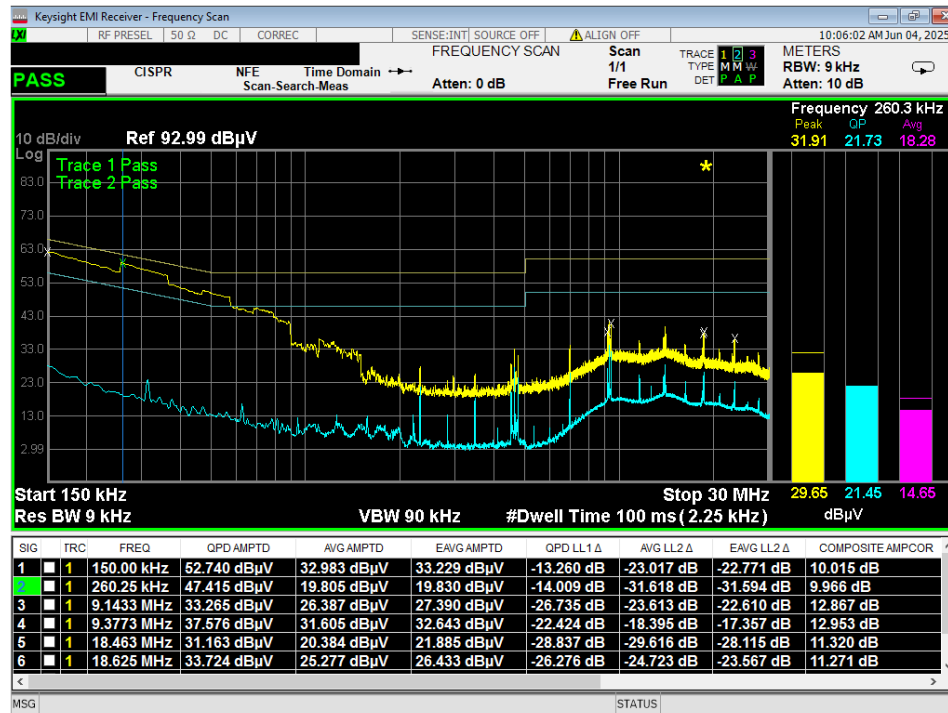


Figure 21 – Conducted Emissions Plot, charging via USB-C, TX, Line

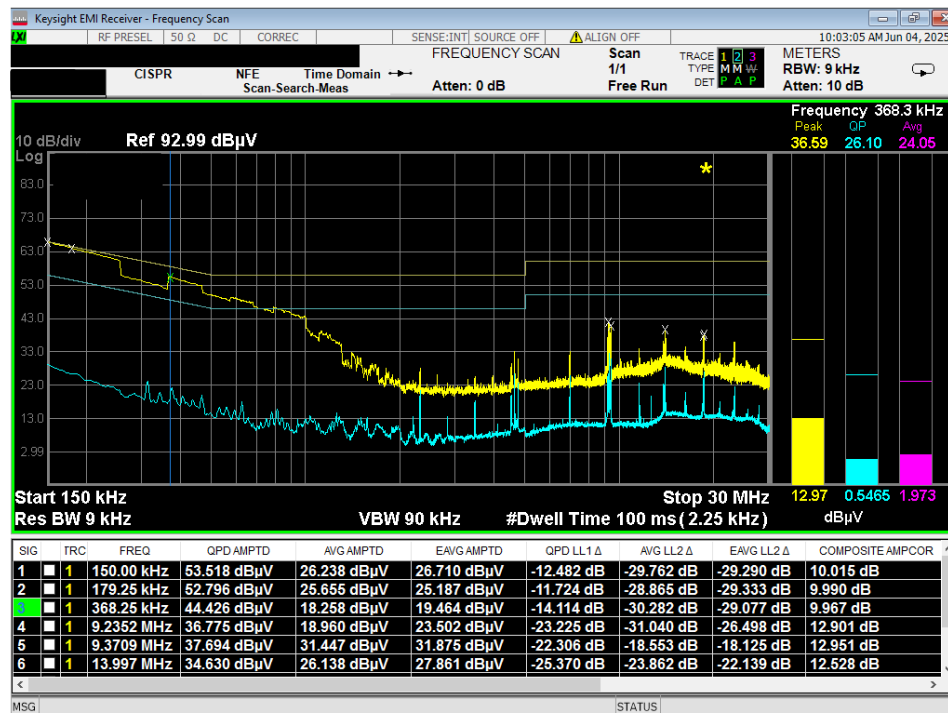


Figure 22 – Conducted Emissions Plot, charging via USB-C, TX, Neutral

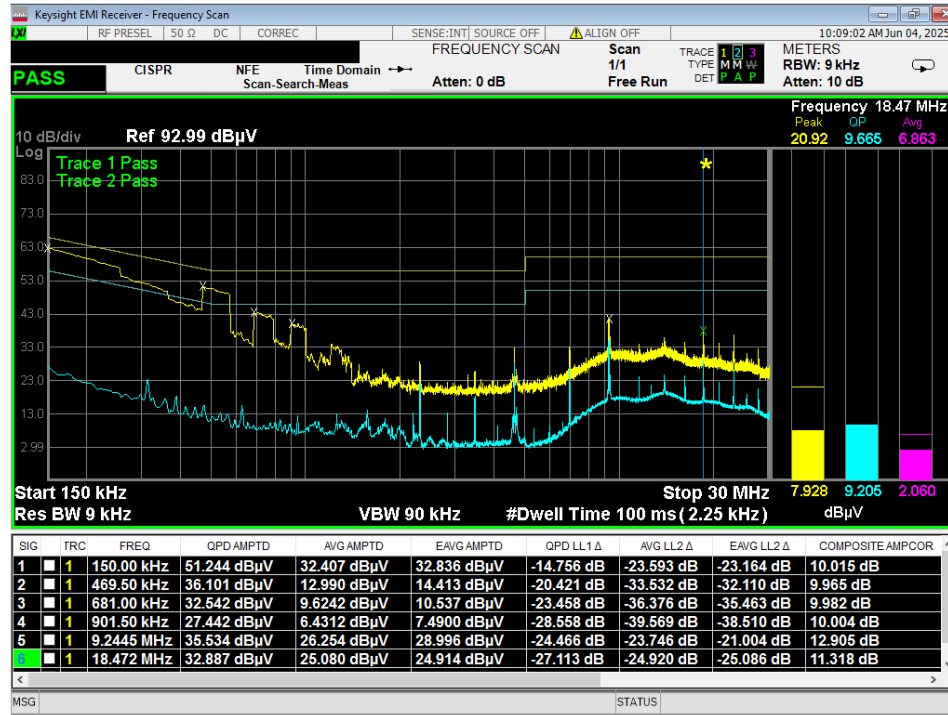


Figure 23 – Conducted Emissions Plot, charging via USB-C, IDLE, Line

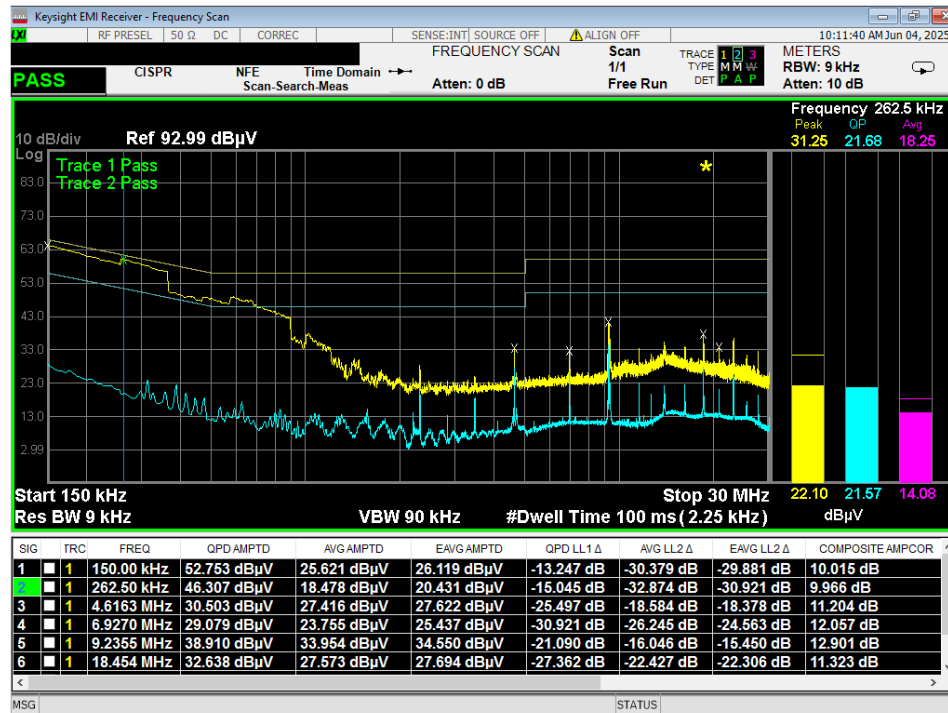


Figure 24 – Conducted Emissions Plot, charging via USB-C, IDLE, Neutral



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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;

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

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

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

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

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

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



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APPENDIX B – MEASUREMENT UNCERTAINTY

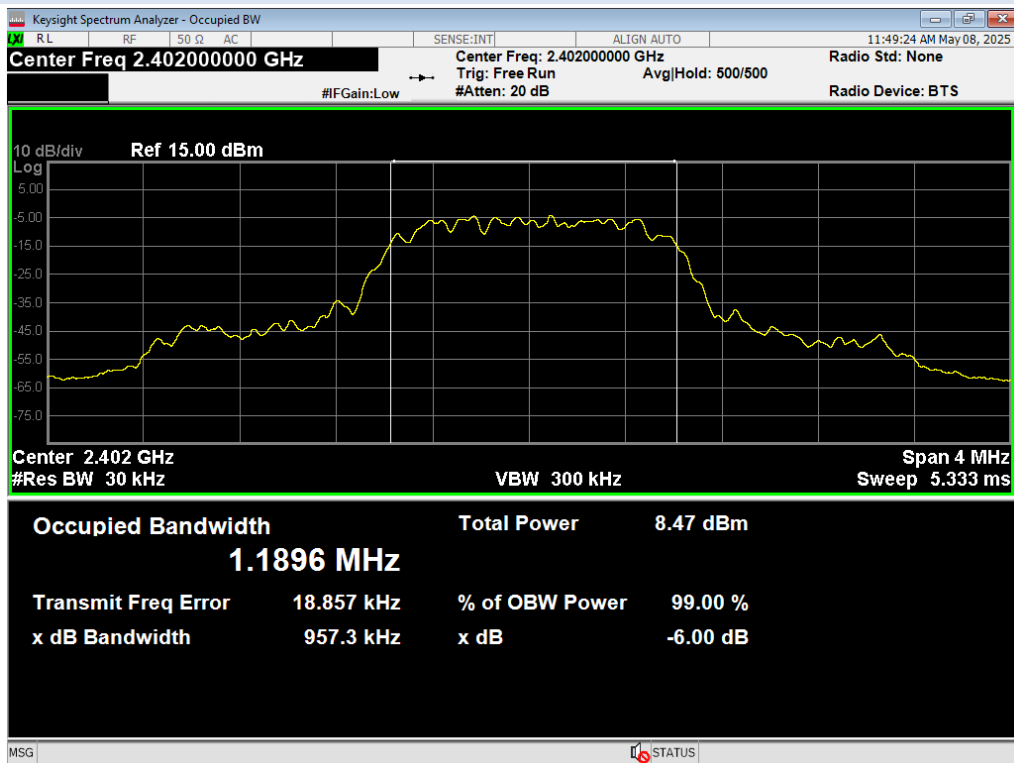
NCEE Labs does not add uncertainty levels to measurement levels

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

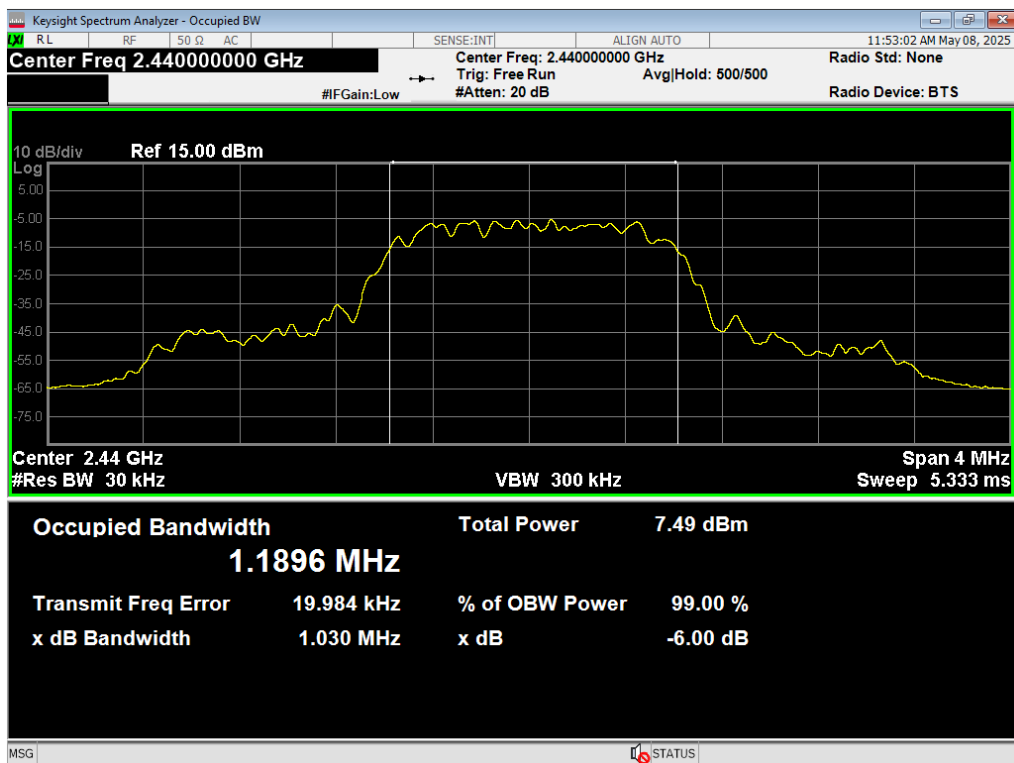
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz – 1GHz	±4.31
Radiated Emissions, 3m	1GHz – 18GHz	±5.08
Emissions limits, conducted	30MHz – 18GHz	±3.03

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

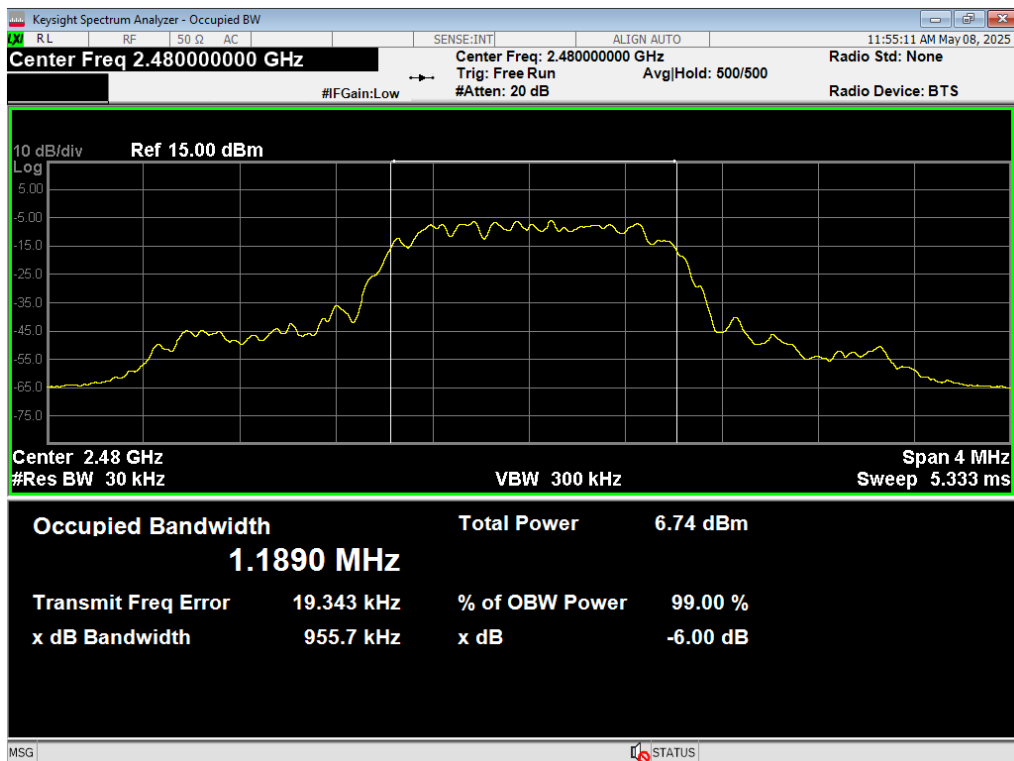
APPENDIX C – GRAPHS AND TABLES



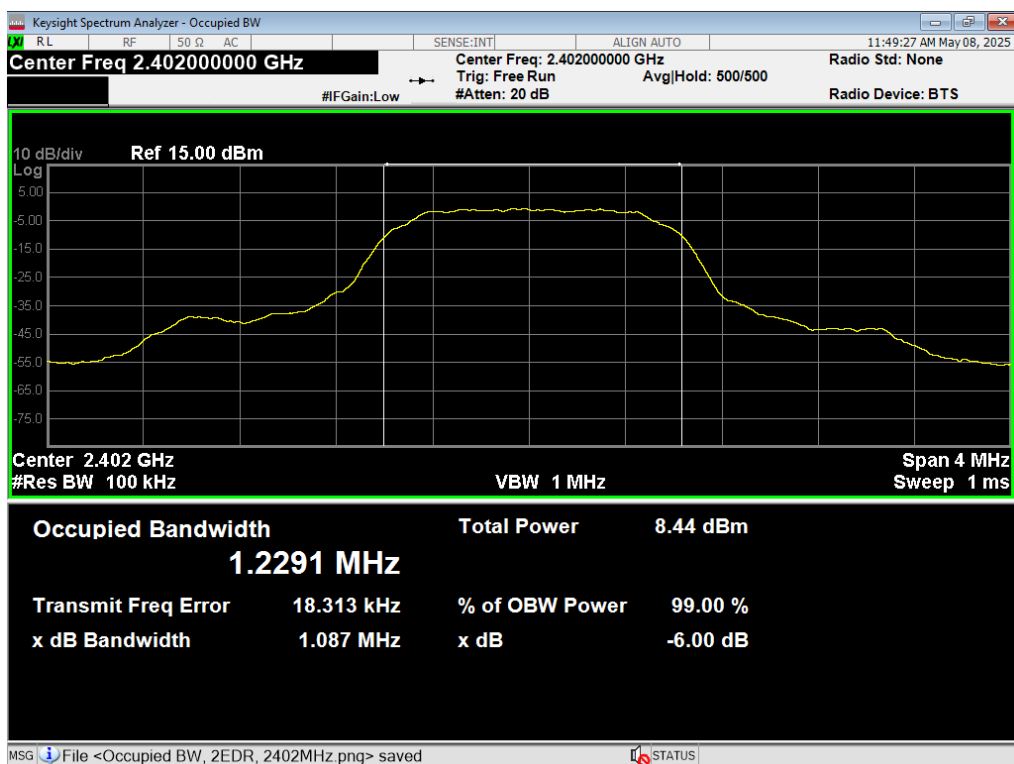
01 Occupied BW, 2EDR, 2402MHz



02 Occupied BW, 2EDR, 2440MHz

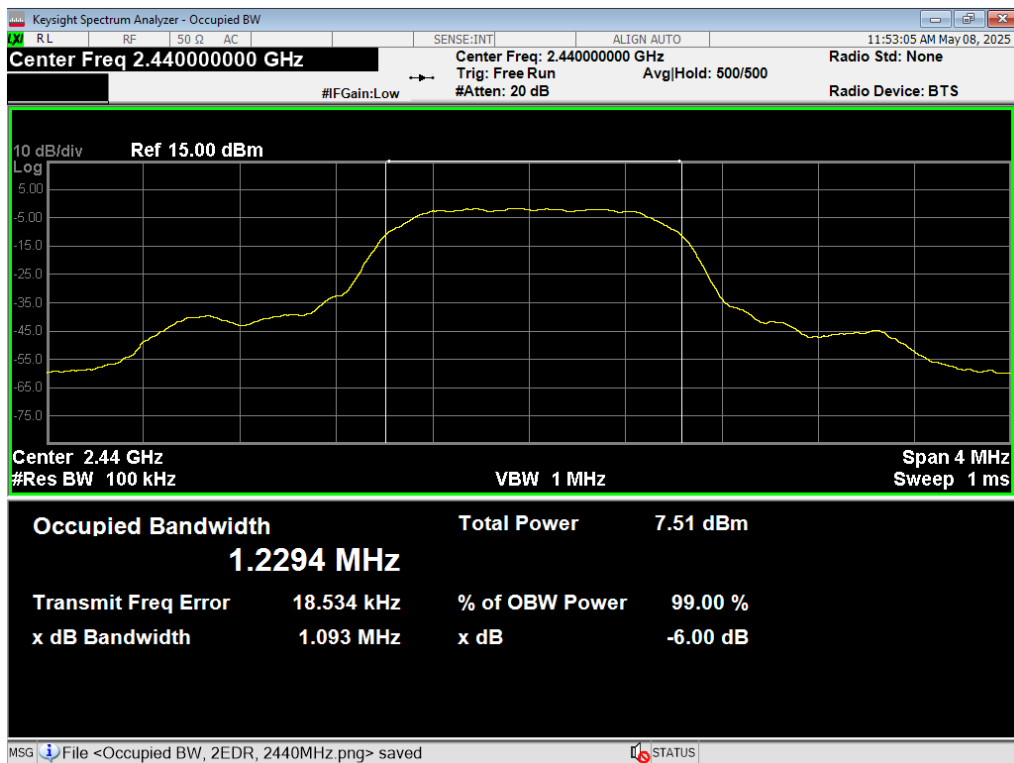


03 Occupied BW, 2EDR, 2480MHz

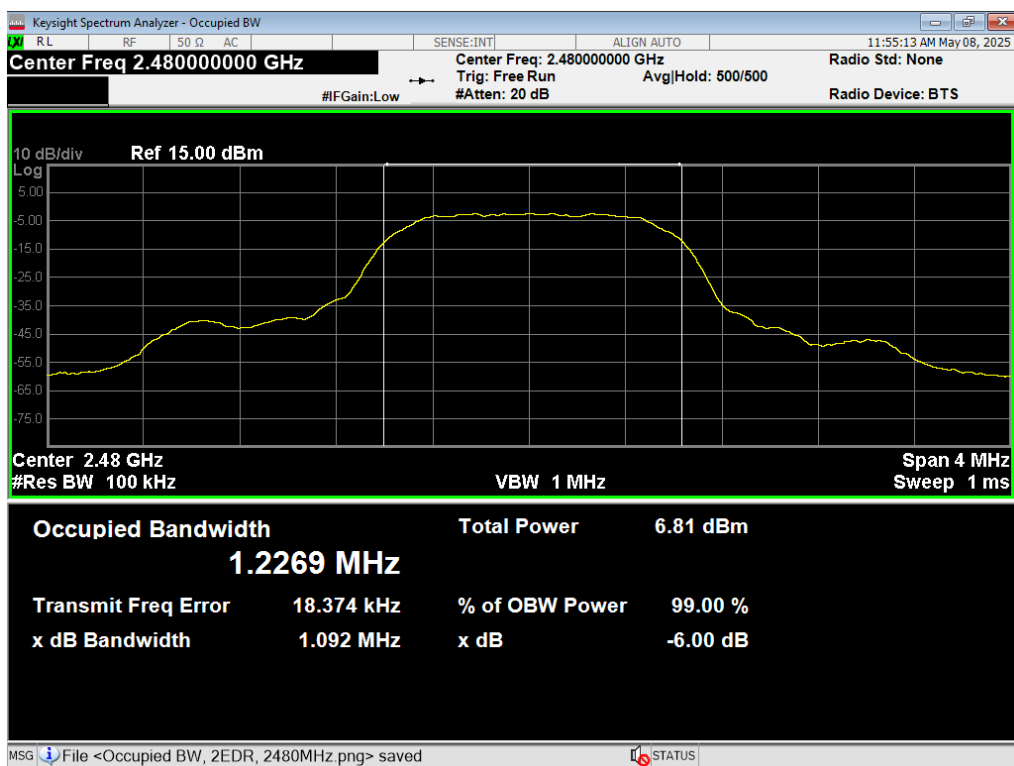


04 6dB BW, 2EDR, 2402MHz

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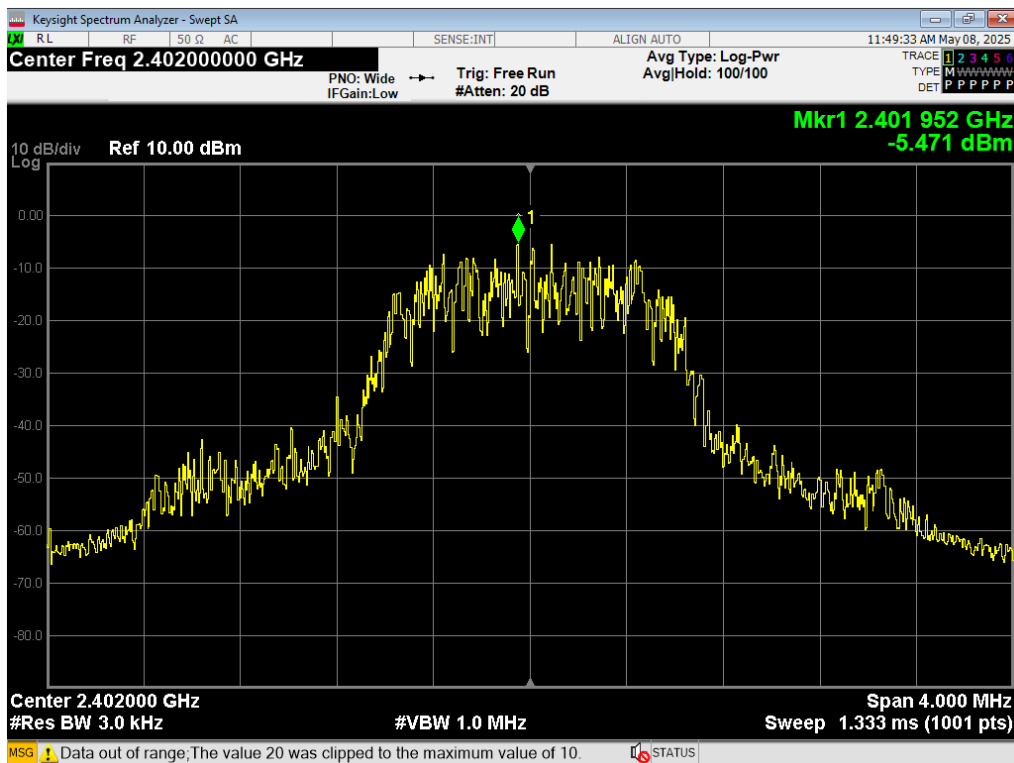


05 6dB BW, 2EDR, 2440MHz

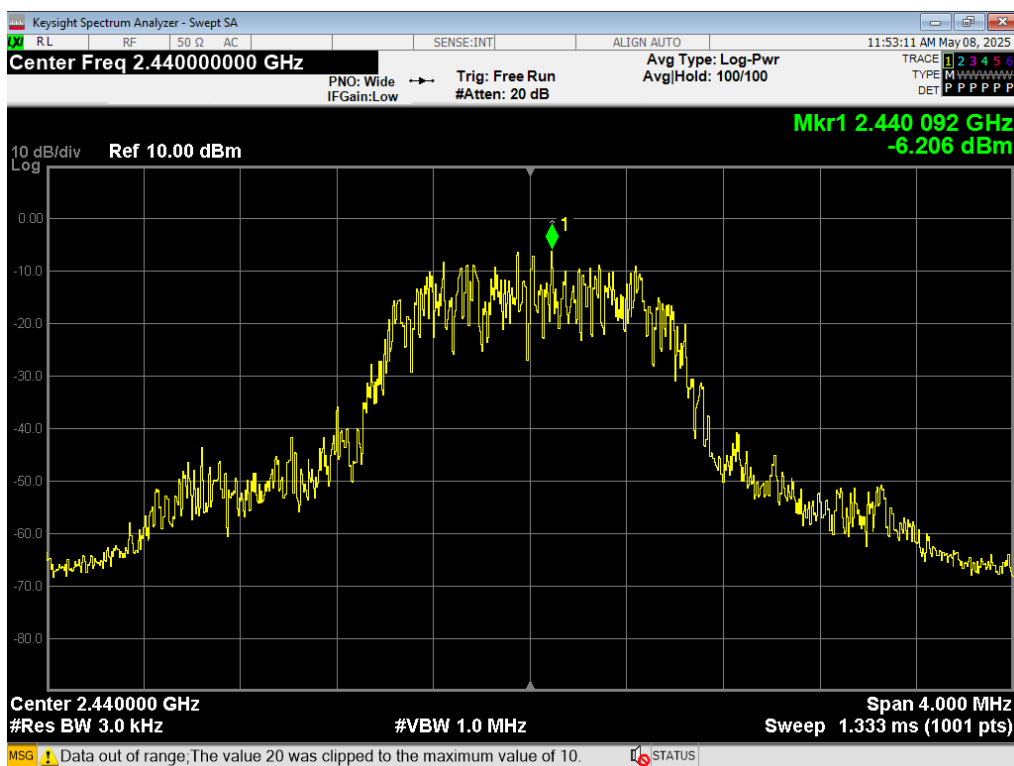


06 6dB BW, 2EDR, 2480MHz

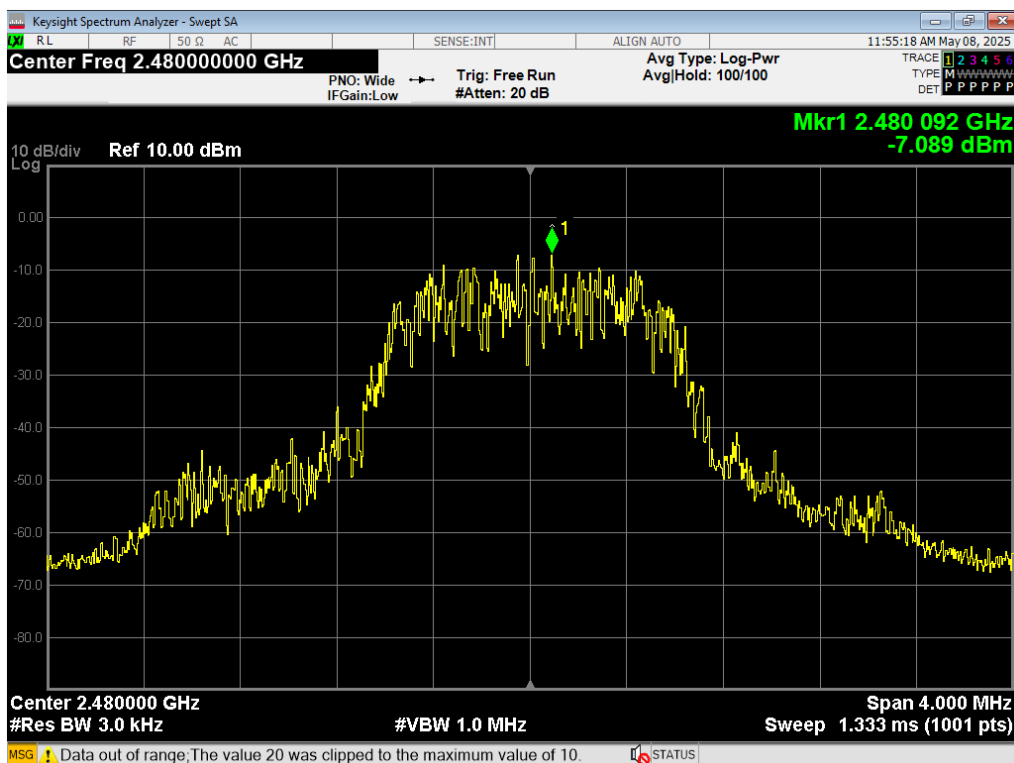
	Report Number:	R20250124-00-E3	Rev	B
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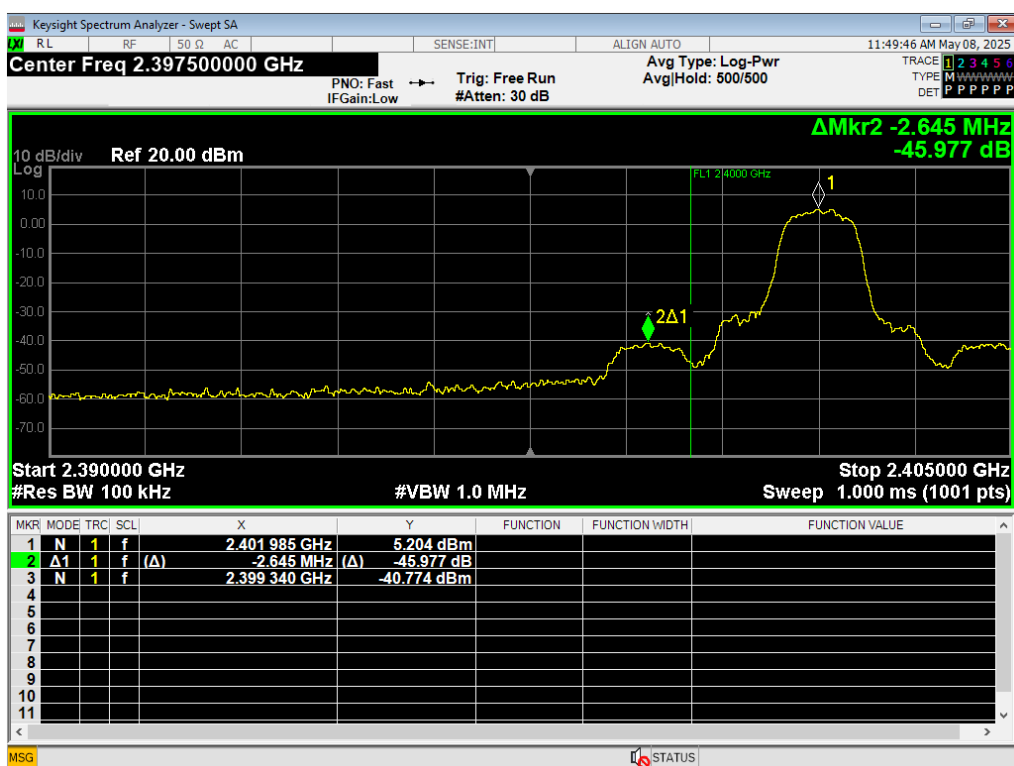
07 PSD, 2EDR, 2402MHz



08 PSD, 2EDR, 2440MHz

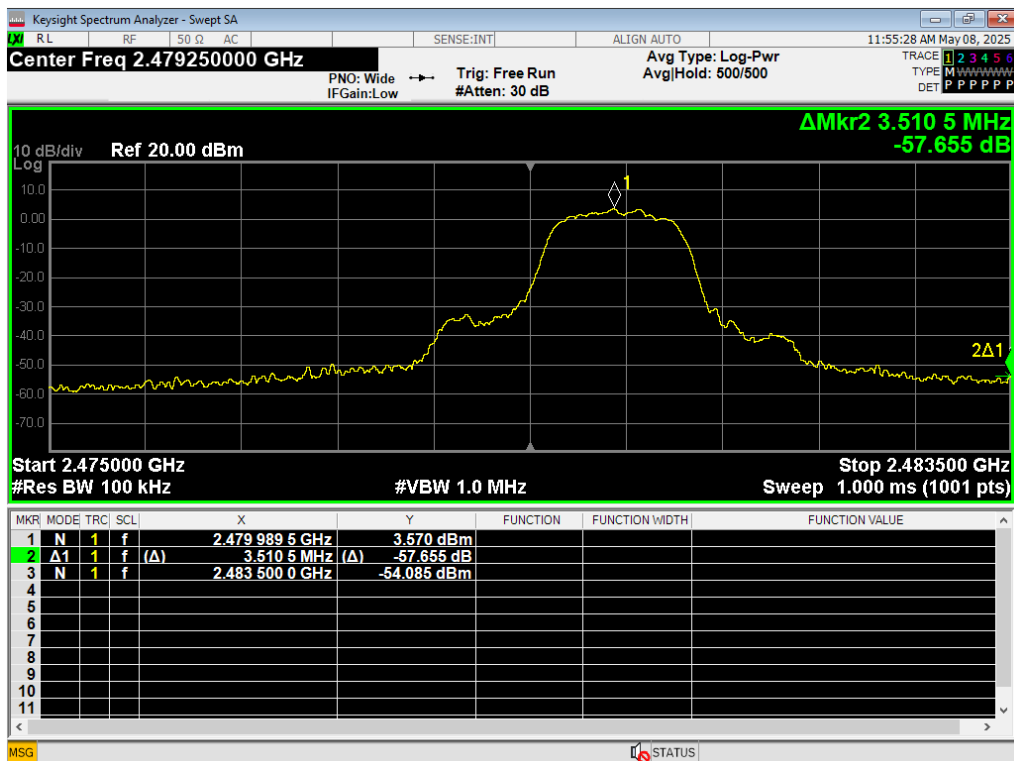


09 PSD, 2EDR, 2480MHz

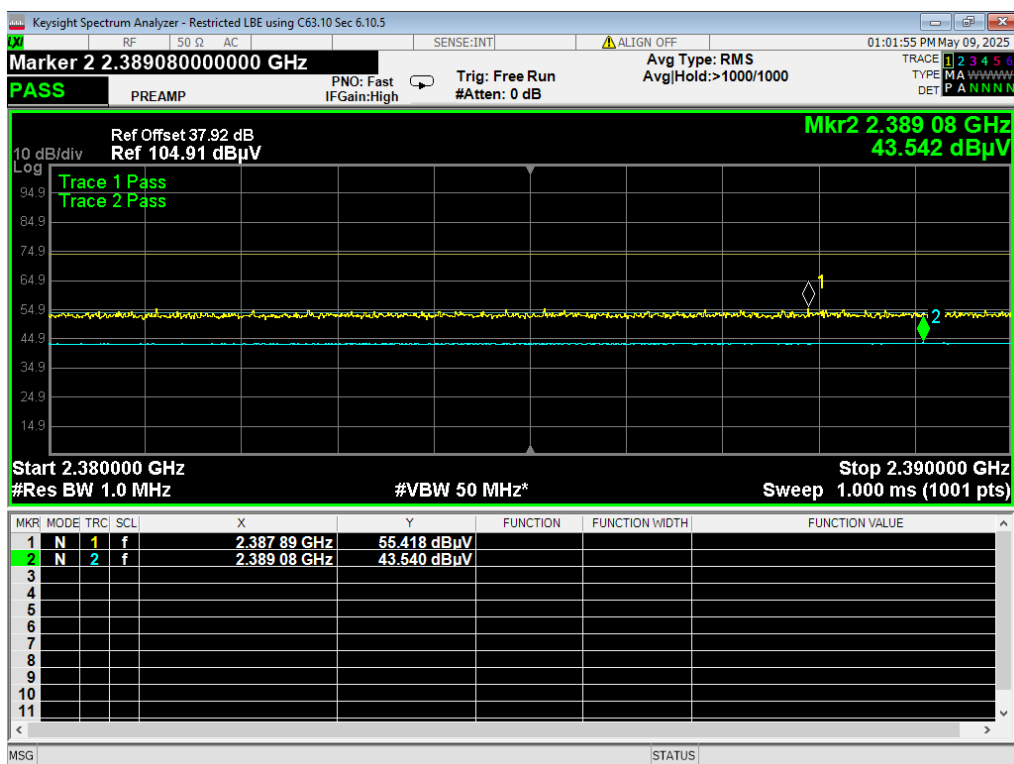


10 LBE Unrestricted, 2EDR

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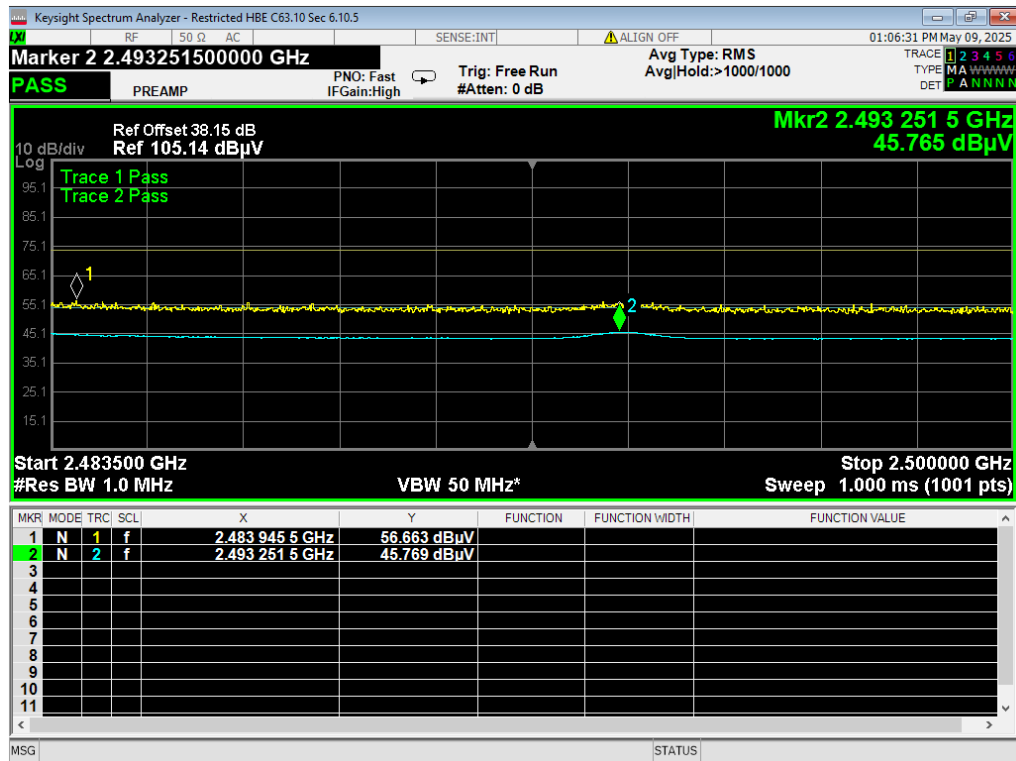


11 HBE Unrestricted, 2EDR

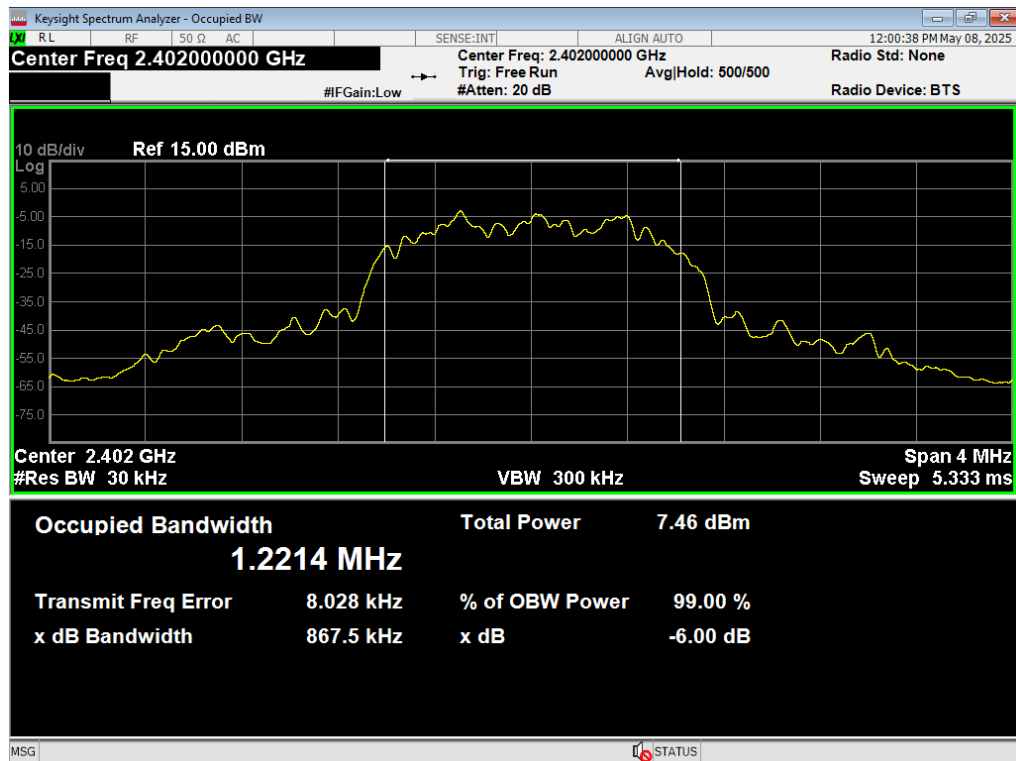


12 LBE Restricted, 2EDR

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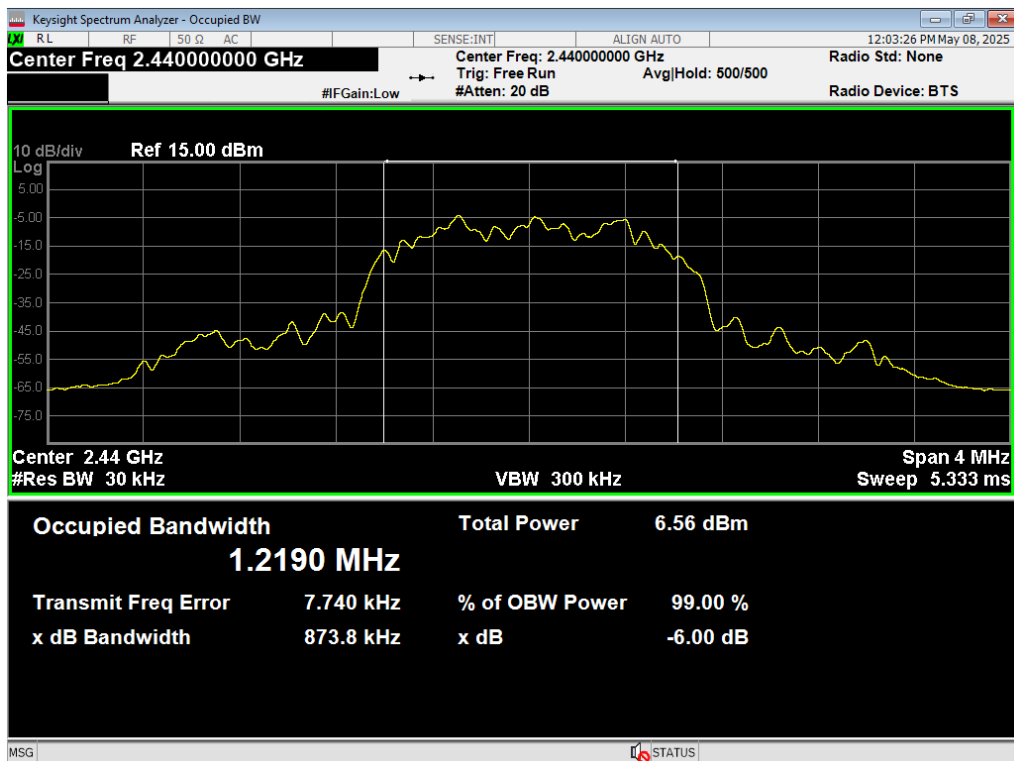


13 HBE Restricted, 2EDR

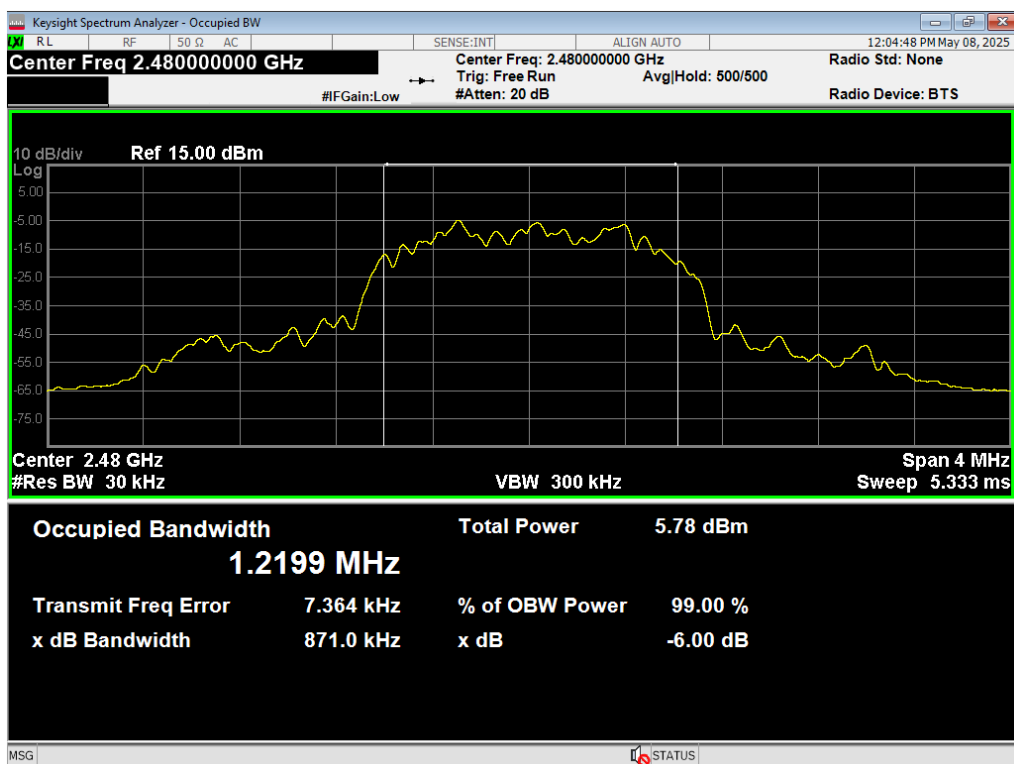


14 Occupied BW, 3EDR, 2402MHz

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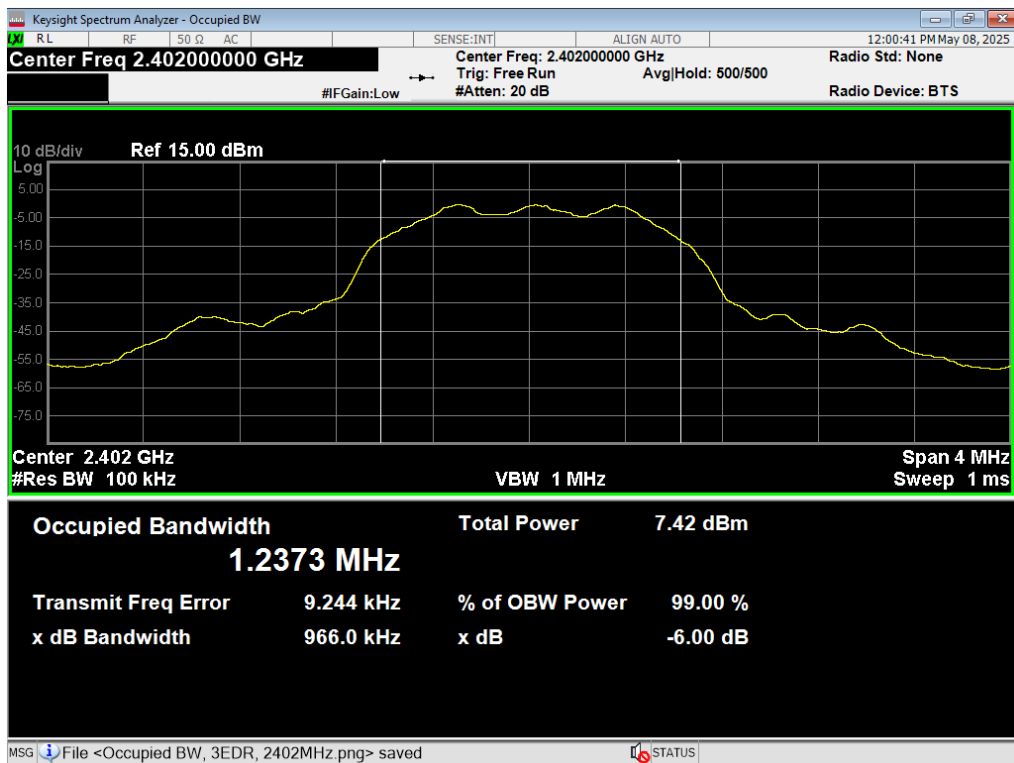


15 Occupied BW, 3EDR, 2440MHz

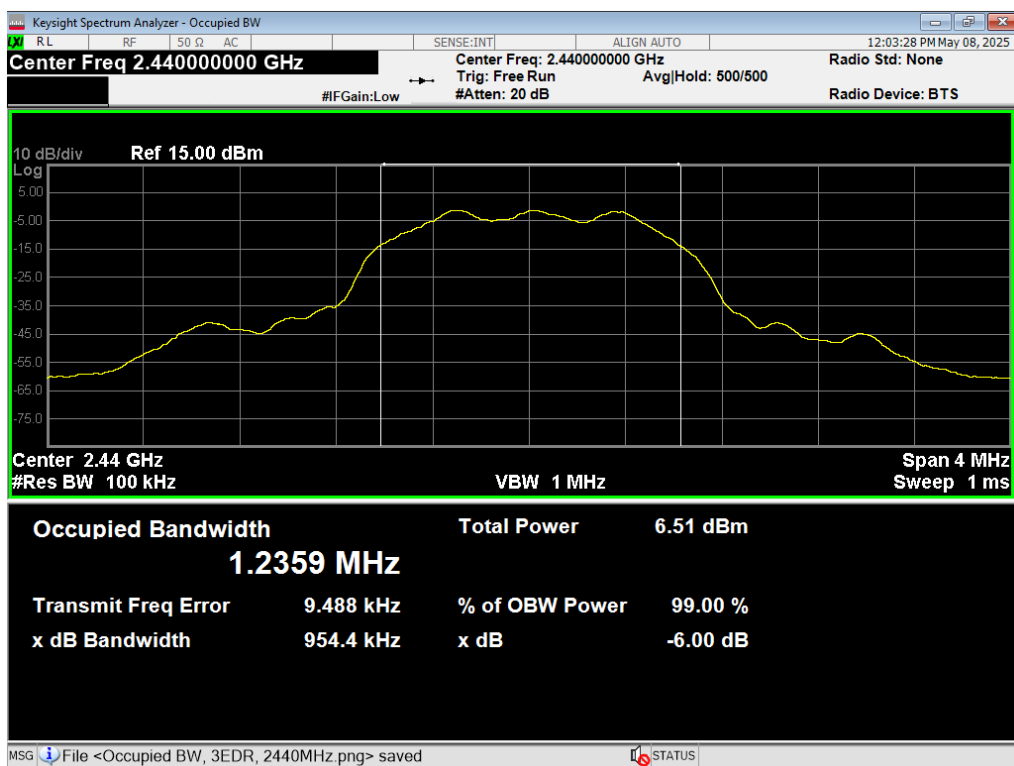


16 Occupied BW, 3EDR, 2480MHz

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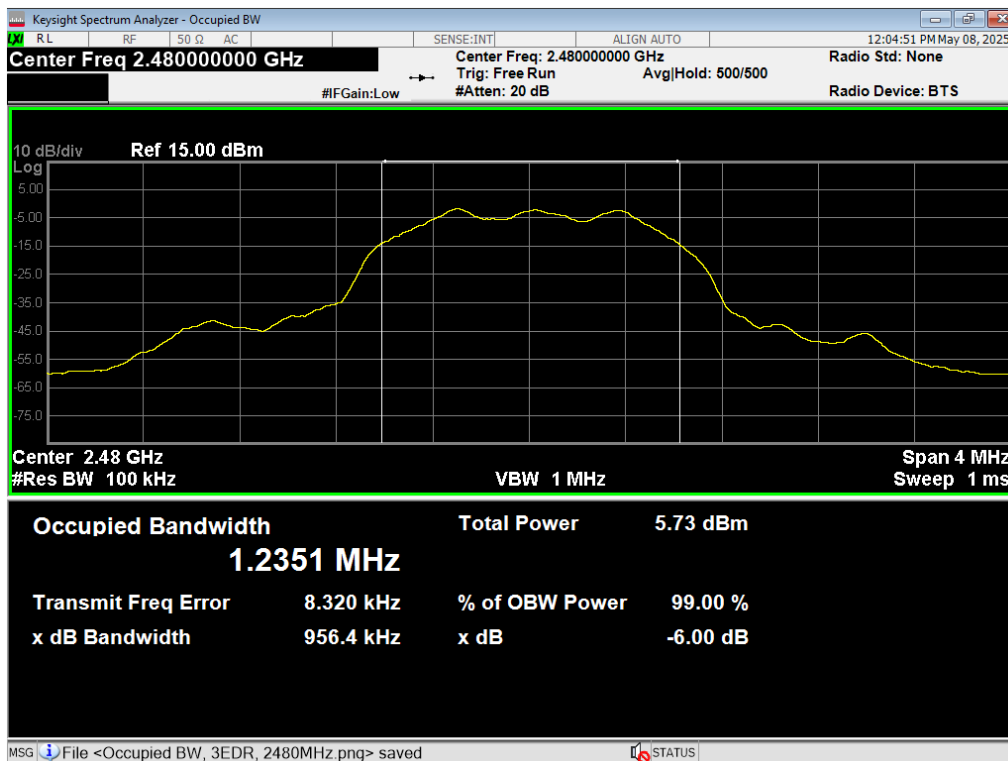


17 6dB BW, 3EDR, 2402MHz

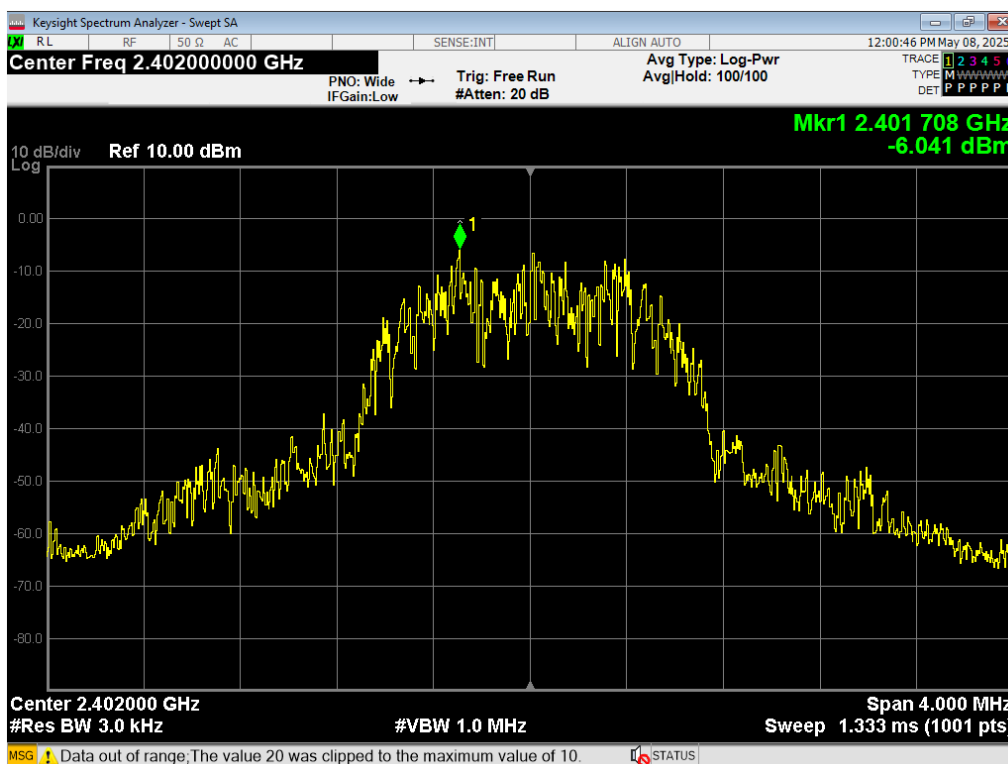


18 6dB BW, 3EDR, 2440MHz

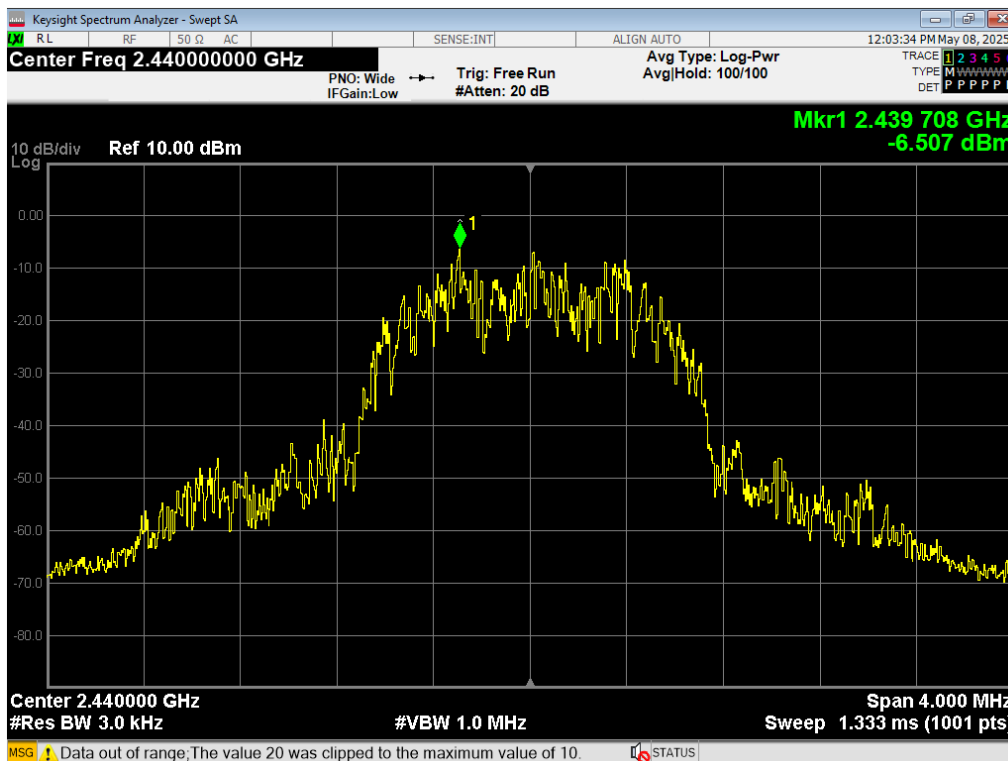
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Prepared for:	Garmin International, Inc.		



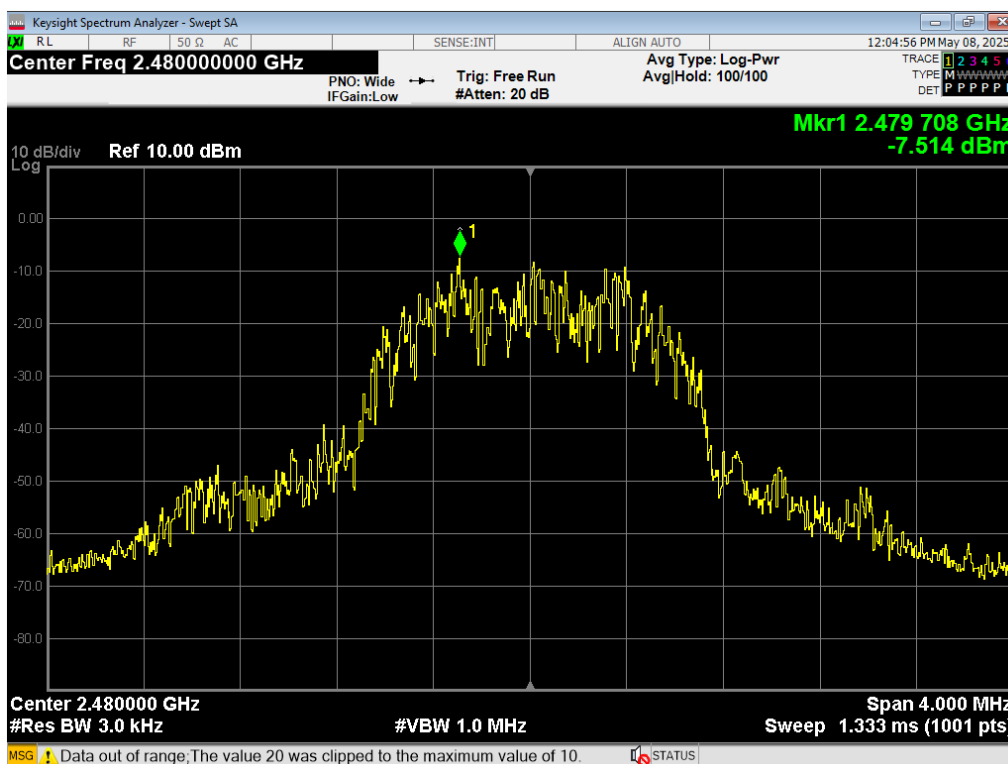
19 6dB BW, 3EDR, 2480MHz



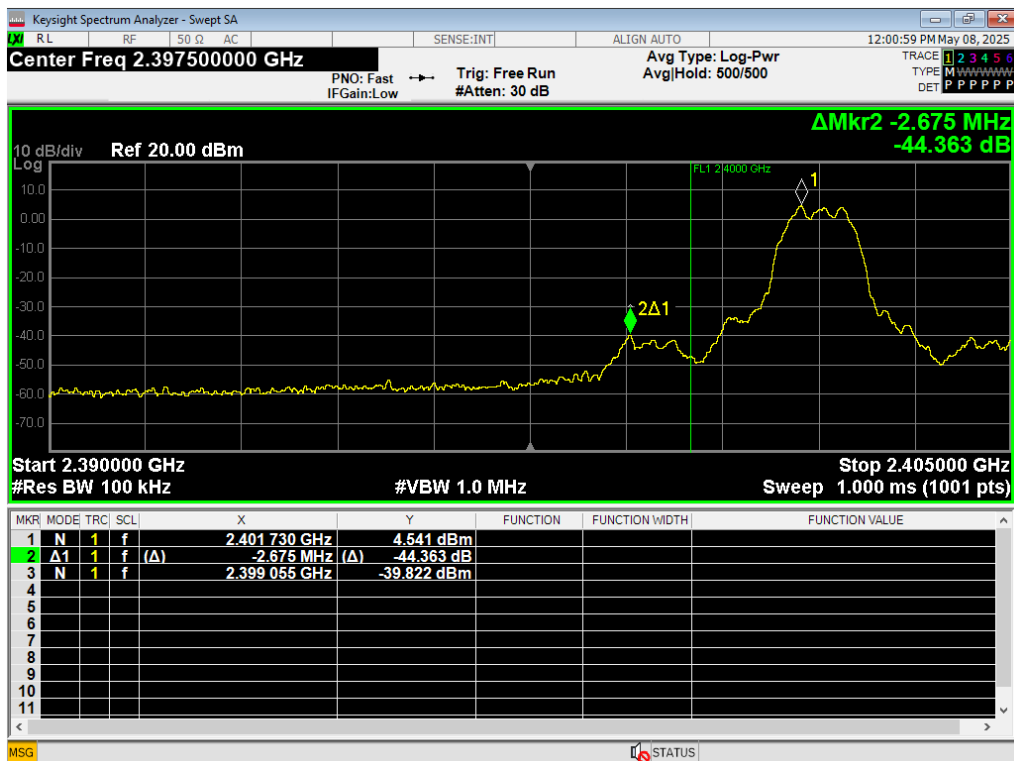
20 PSD, 3EDR, 2402MHz



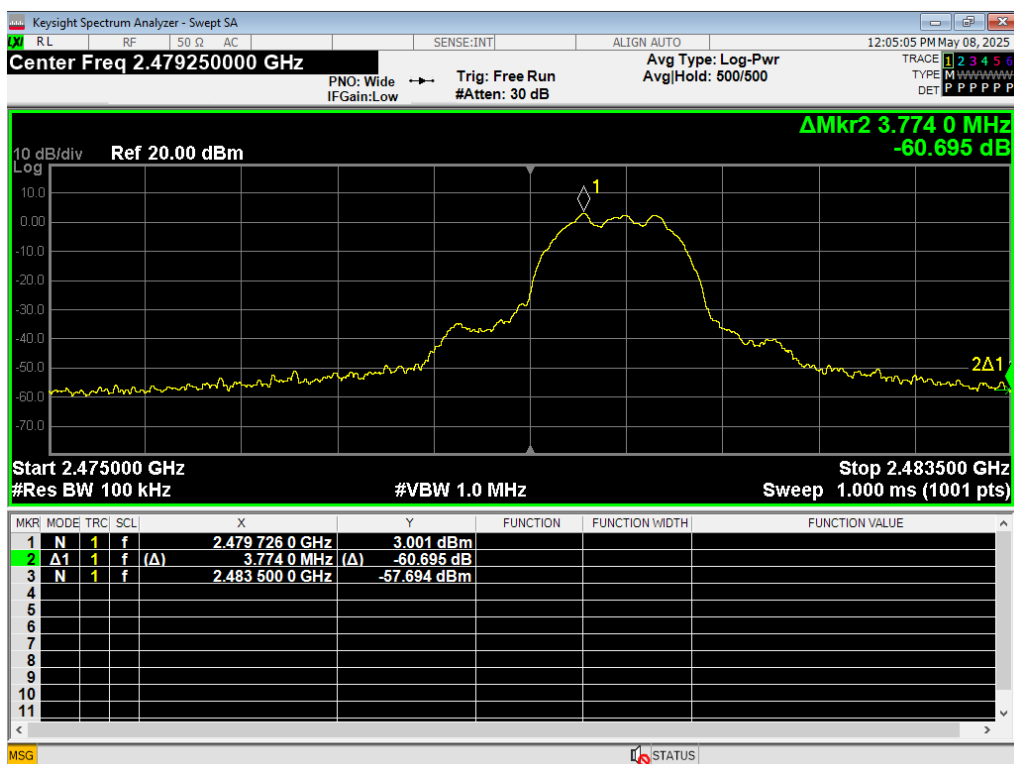
21 PSD, 3EDR, 2440MHz



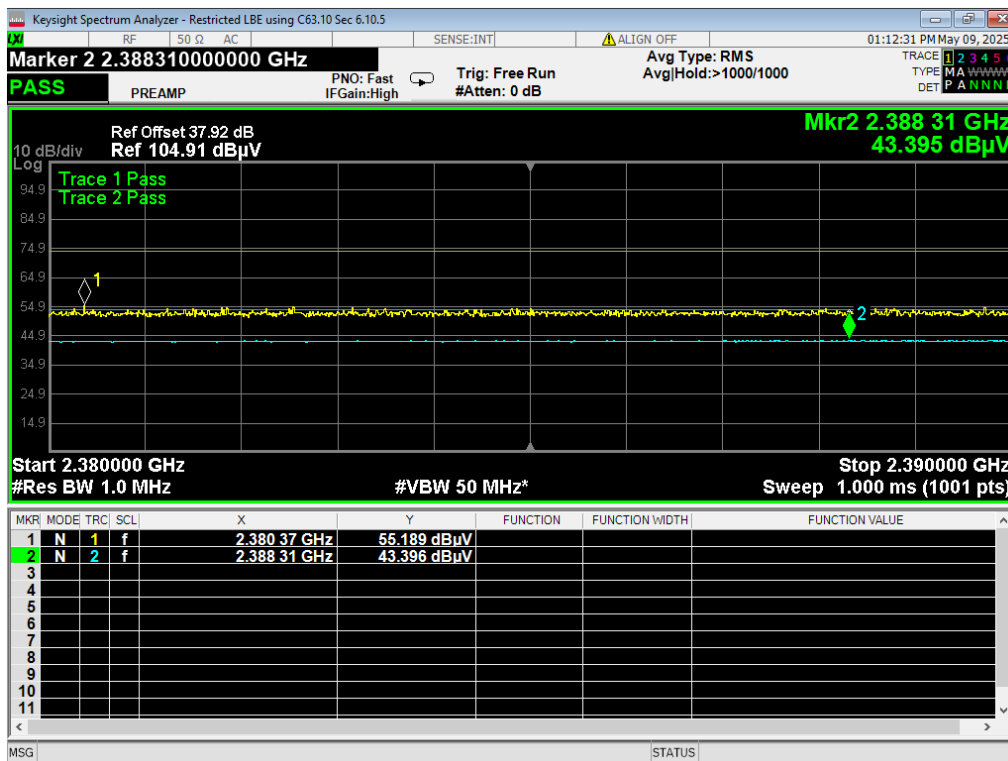
22 PSD, 3EDR, 2480MHz



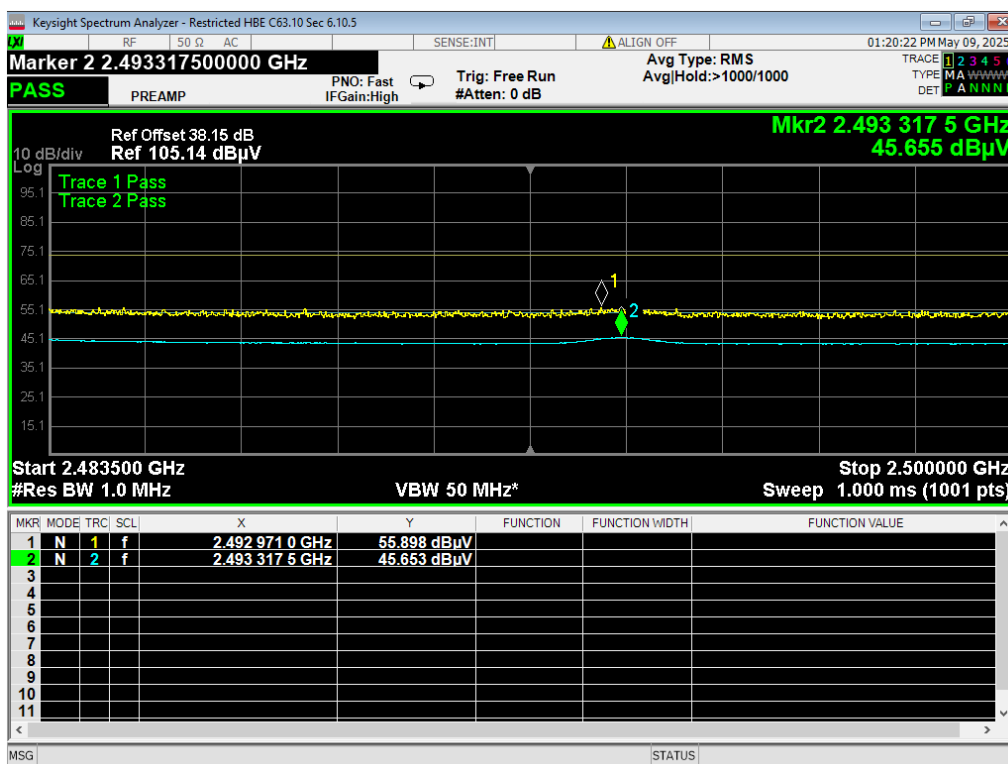
23 LBE Unrestricted, 3EDR



24 HBE Unrestricted, 3EDR



25 LBE Restricted, 3EDR



26 HBE Restricted, 3EDR



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REPORT END

FCC/ISED Test Report

Prepared for: Garmin International, Inc.

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

Product: A04828

Test Report No: R20250124-00-E1 **Rev:** B

Approved by:



Fox Lane,
EMC Test Engineer

DATE: July 28, 2025

Total Pages: 58

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Prepared for:	Garmin International, Inc.		

REVISION PAGE

Rev. No.	Date	Description
0	11 July 2025	Issued by FLane Prepared by FLane, ESchmidt
A	22 July 2025	Added FVIN in Section 2.1, Added plots for 1-25GHz scans in Section 4.4 – ES
B	28 July 2025	Updated to RSS-247 Issue 4

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	Prepared for:	Garmin International, Inc.		

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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 section:

- (1) US Code of Federal Regulations, Title 47, Part 15
- (2) ISED RSS-Gen, Issue 5
- (3) ISED RSS-247, Issue 4

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 4 Section 6.3	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 4 Section 6.3	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 4 Section 6.6, RSS-Gen Issue 5, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 4 Section 6.3	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 4 Section 6.6	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	Pass



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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04828
FCC ID	IPH-04828
IC ID	1792A-04828
FVIN	1.01
EUT Received	8 May 2025
EUT Tested	8 May 2025- 6 June 2025
Serial No.	3489571855 (Radiated Sample) 3489571782 (Conducted Sample)
Operating Band	2400 – 2483.5 MHz
Device Type	☒ GMSK ☒ GFSK ☐ BT BR ☐ BT EDR 2MB ☐ BT EDR 3MB ☐ 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: PSAl05R-050Q GPN: 362-00118-00 (Representative Power Supply)

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:

GFSK / GMSK 1MB Transmissions:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 MHz

GMSK 2MB Transmissions:

Channel	Frequency
Low	2404 MHz
Mid	2440 MHz
High	2478 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

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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 and Report
2	Blake Winter	Test Engineer	Testing
4	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.

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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
EMCO Horn Antenna	3116	2576	July 31, 2023	July 30, 2025
Com-Power LISN, Single Phase	LI-220C	20070017	July 17, 2023	July 17, 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
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	January 20, 2024	January 20, 2026
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	January 21, 2024	January 21, 2026
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	January 21, 2024	January 21, 2026
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	January 21, 2024	January 21, 2026
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	January 21, 2024	January 21, 2026
N connector bulkhead (control room)*	PE9128	NCEEBH2	January 21, 2024	January 21, 2026
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.

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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.

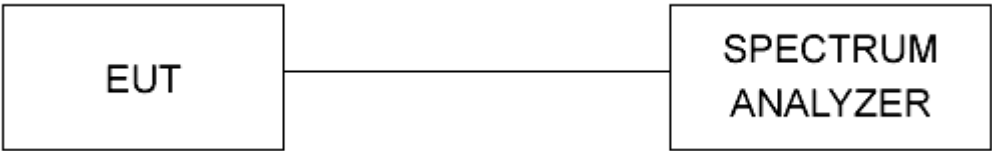


Figure 1 - Bandwidth Measurements Test Setup

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.

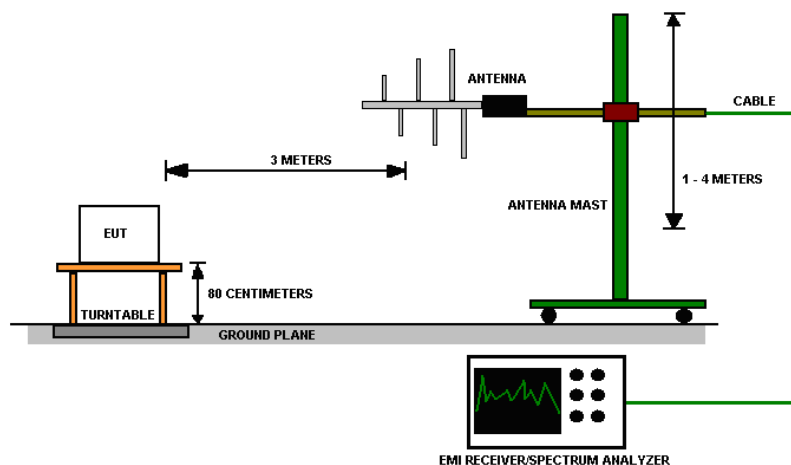


Figure 2 - Radiated Emissions Test Setup

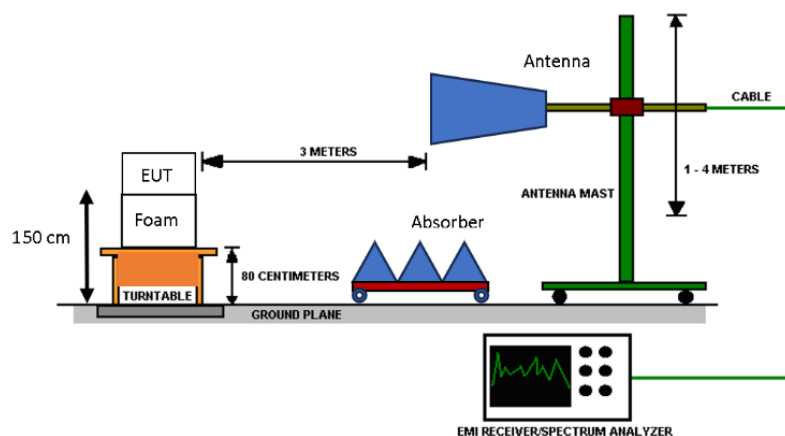


Figure 3 - Radiated Emissions Test Setup, >1GHz

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4.0 RESULTS

DTS Radio Measurements							
CHANNEL	Mode	Occupied BW (kHz)	6 dB BW (kHz)	PSD (dBm)	Average OUTPUT POWER (dBm)	Average OUTPUT POWER (mW)	RESULT
Low	BLE 1MB	1285.40	806.90	-17.653	-0.527	0.886	PASS
Mid	BLE 1MB	1264.60	834.50	-14.442	3.484	2.230	PASS
High	BLE 1MB	1230.50	770.60	-17.579	-0.345	0.924	PASS
Low	BLE 2MB	2507.40	1322.00	-12.418	-0.462	0.899	PASS
Mid	BLE 2MB	2441.40	1558.00	-14.474	3.528	2.253	PASS
High	BLE 2MB	2481.00	1198.00	-16.912	0.079	1.018	PASS
Low	ANT GFSK	1254.40	831.10	-17.285	-0.019	0.996	PASS
Mid	ANT GFSK	1258.20	825.60	-12.475	3.819	2.409	PASS
High	ANT GFSK	1241.40	763.10	-15.376	0.079	1.018	PASS
Occupied Bandwidth Lim = N/A; 6dB Bandwidth Lim = N/A				Peak Output Power Lim = 30dBm; PSD Lim = 8dBm			
Unrestricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level (dBm)	Relative Fundamental (dBm)	Delta (dB)	Min Delta (dB)	Result
Low	BLE 1MB	2400.00	-41.28	-1.89	39.39	30.00	PASS
Low	BLE 2MB	2400.00*	64.779	107.403	42.624	30.00	PASS
Low	ANT GFSK	2400.00	-49.90	-2.06	47.84	30.00	PASS
High	BLE 1MB	2483.50	-56.08	-2.53	53.54	30.00	PASS
High	BLE 2MB	2483.50*	59.566	103.160	43.594	30.00	PASS
High	ANT GFSK	2483.50	-53.85	-1.80	52.06	30.00	PASS
*dBuV units.							
Peak Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	BLE 1MB	2390.00	55.51	Peak	73.98	18.47	PASS
Low	BLE 2MB	2390.00	56.26	Peak	73.98	17.73	PASS
Low	ANT GFSK	2390.00	54.72	Peak	73.98	19.26	PASS
High	BLE 1MB	2483.50	57.38	Peak	73.98	16.61	PASS
High	BLE 2MB	2483.50	61.77	Peak	73.98	12.21	PASS
High	ANT GFSK	2483.50	56.94	Peak	73.98	17.05	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							



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Average Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Detector	Limit (dBuV/m @ 3m)	Margin	Result
Low	BLE 1MB	2390.00	43.27	Average	53.98	10.71	PASS
Low	BLE 2MB	2390.00	45.70	Average	53.98	8.28	PASS
Low	ANT GFSK	2390.00	43.31	Average	53.98	10.67	PASS
High	BLE 1MB	2483.50	46.78	Average	53.98	7.20	PASS
High	BLE 2MB	2483.50	52.23	Average	53.98	1.75	PASS
High	ANT GFSK	2483.50	45.56	Average	53.98	8.42	PASS
*Limit shown is the average limit taken from FCC Part 15.209							



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4.1 OUTPUT POWER

Test Method:

All measurements were performed using section 11.9.1.1 from 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:

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 output power plots can be found in Appendix C.
2. All the measurements were found to be compliant.
3. Tabulated data is listed in section 4.0.



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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/documentation 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. Tabulated data is listed in section 4.0.



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4.3 DUTY CYCLE

Modulations in this report have a duty cycle of >98%. No DCCF used.

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.
4. The EUT was tested for spurious emissions while running off of battery power and external USB power. The worse-case emissions were produced while running off of USB power, so results from this mode are presented.



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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.

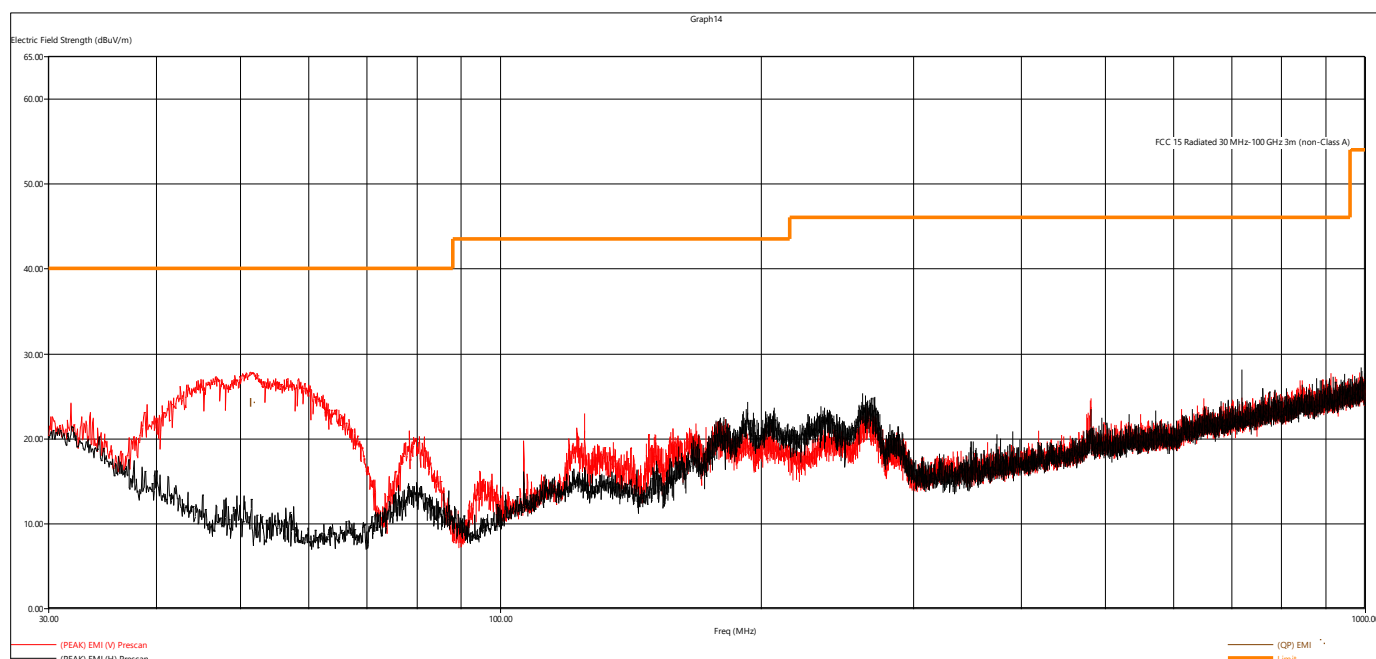


Figure 4 - Radiated Emissions Plot, Receive

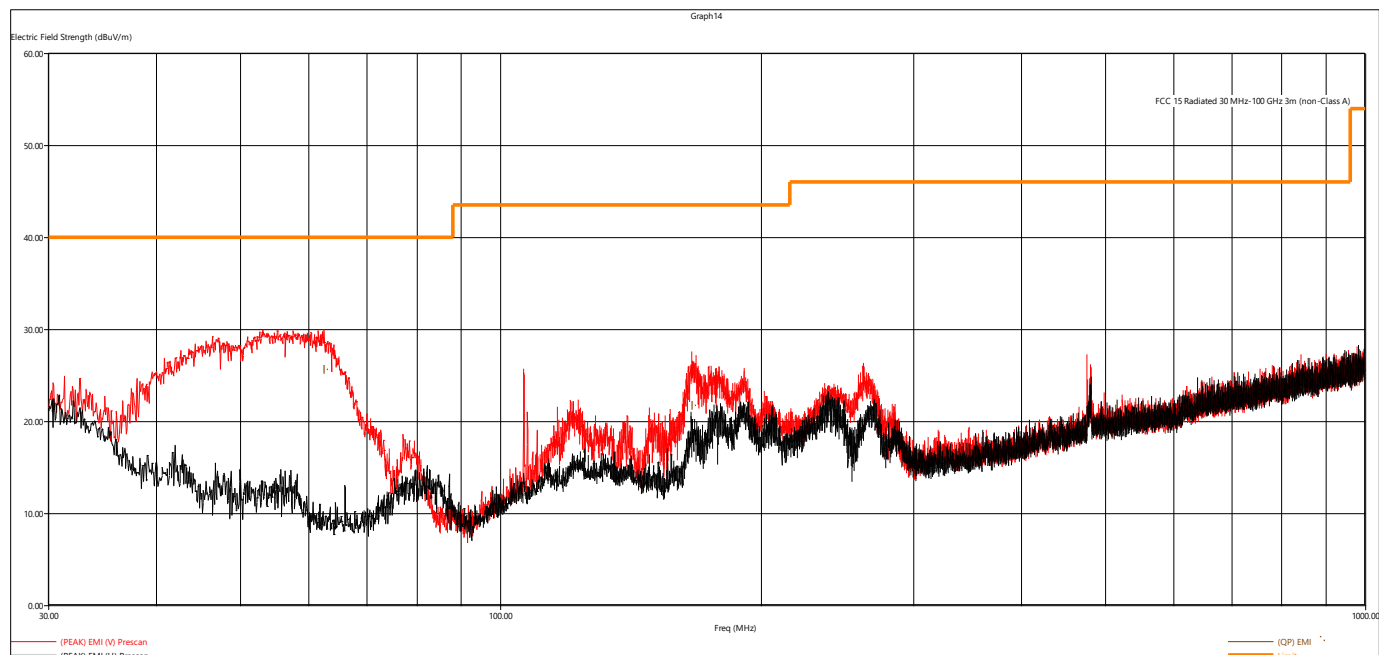


Figure 5 - Radiated Emissions Plot, GFSK

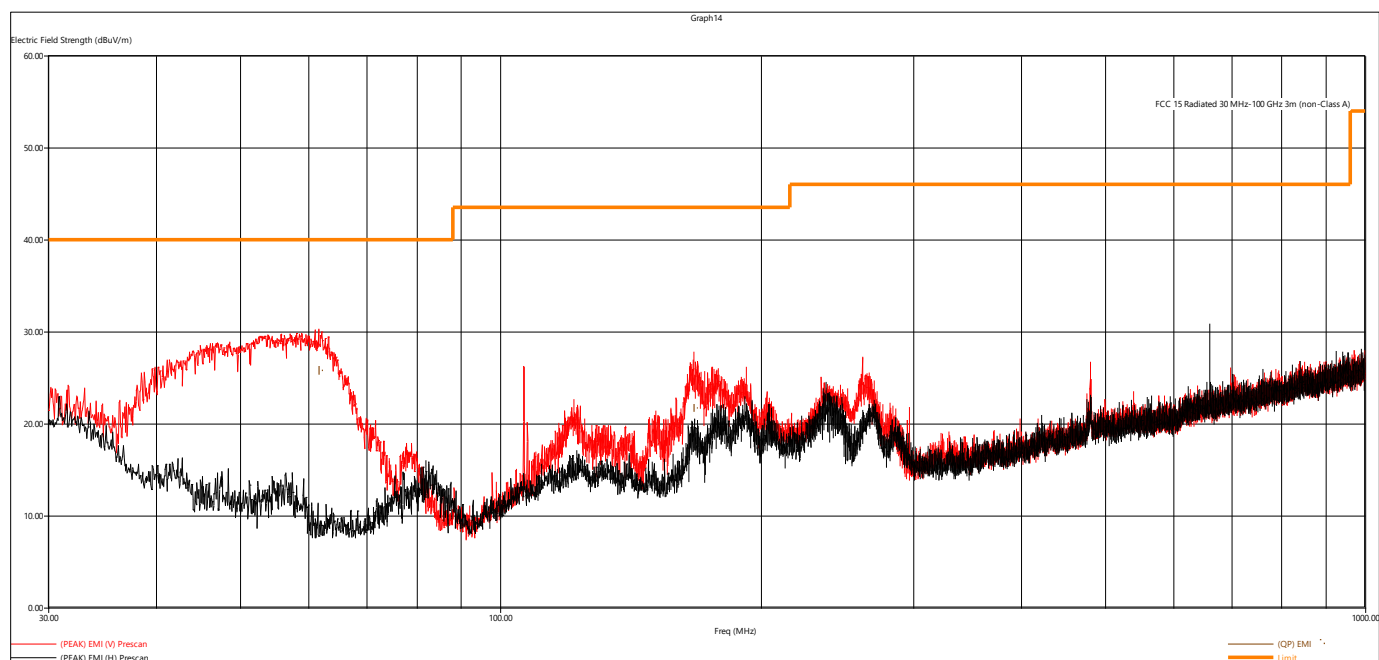


Figure 6 - Radiated Emissions Plot, GMSK 1MB

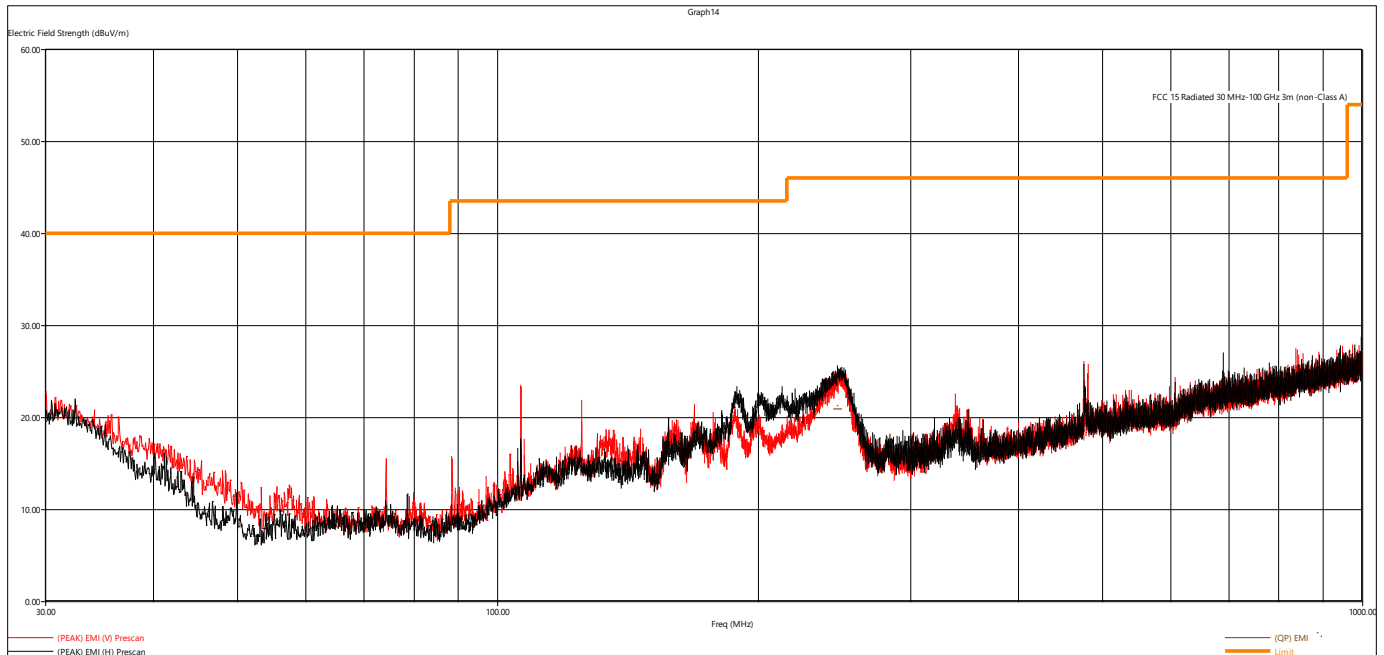


Figure 7 - Radiated Emissions Plot, GMSK 2MB

Quasi-Peak Measurements, 30MHz – 1GHz								
Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dBuV/m	dBuV/m	dB	cm.	deg.			
51.349920	24.23	40.00	15.77	105.91	51.50	V	RX	
62.411520	25.52	40.00	14.48	109.37	165.00	V	Low	GFSK
166.223280	21.63	43.52	21.89	113.31	179.75	V	Low	GFSK
61.604640	25.67	40.00	14.33	106.80	209.75	V	Low	GMSK 1MB
167.172240	21.60	43.52	21.92	122.56	182.75	V	Low	GMSK 1MB
246.966000	20.88	46.02	25.14	119.58	134.25	H	Low	GMSK 2MB

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the plot and table above.



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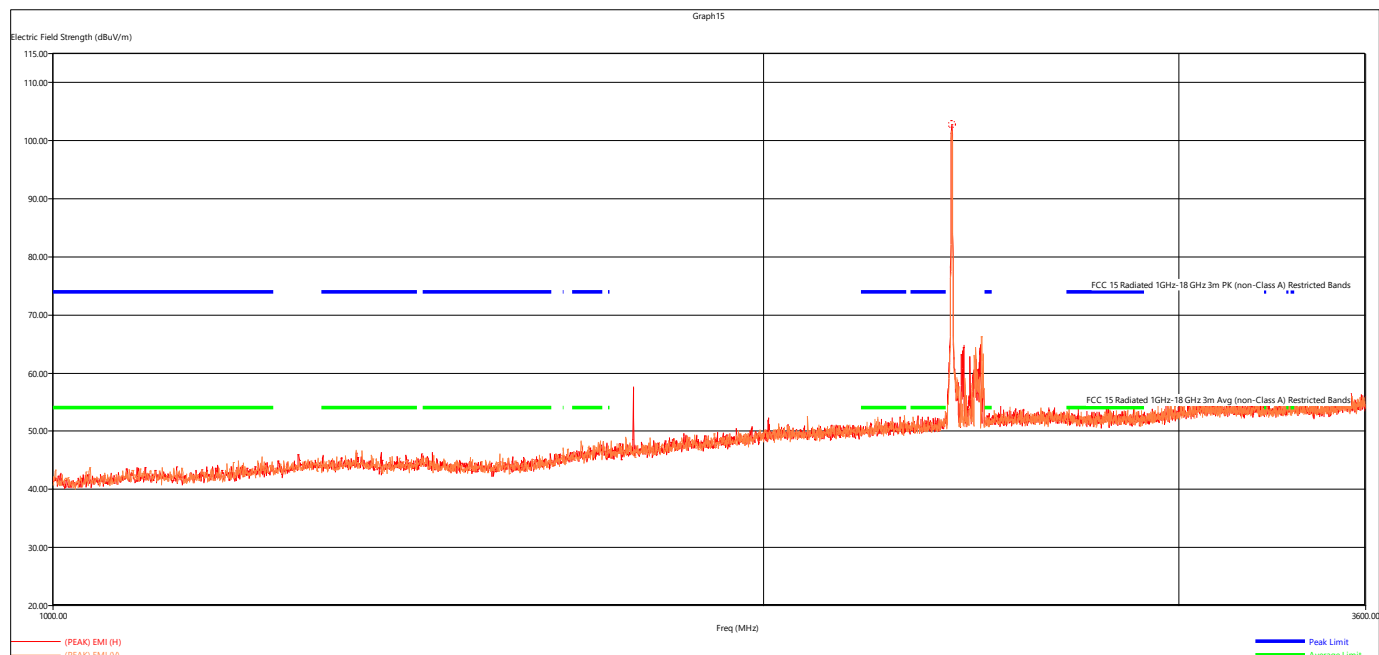


Figure 8 - Radiated Emissions Plot, 1-3.6GHz, GMSK 2MB Low

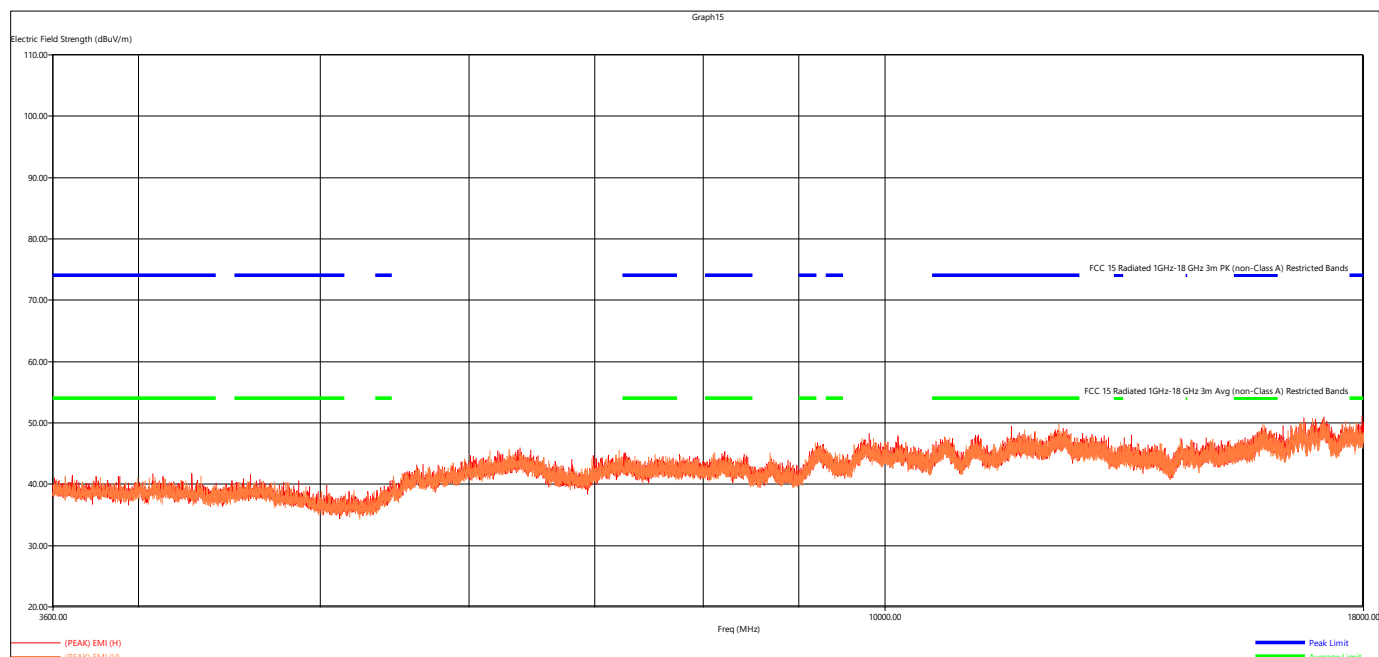


Figure 9 - Radiated Emissions Plot, 3.6-18GHz, GMSK 2MB Low

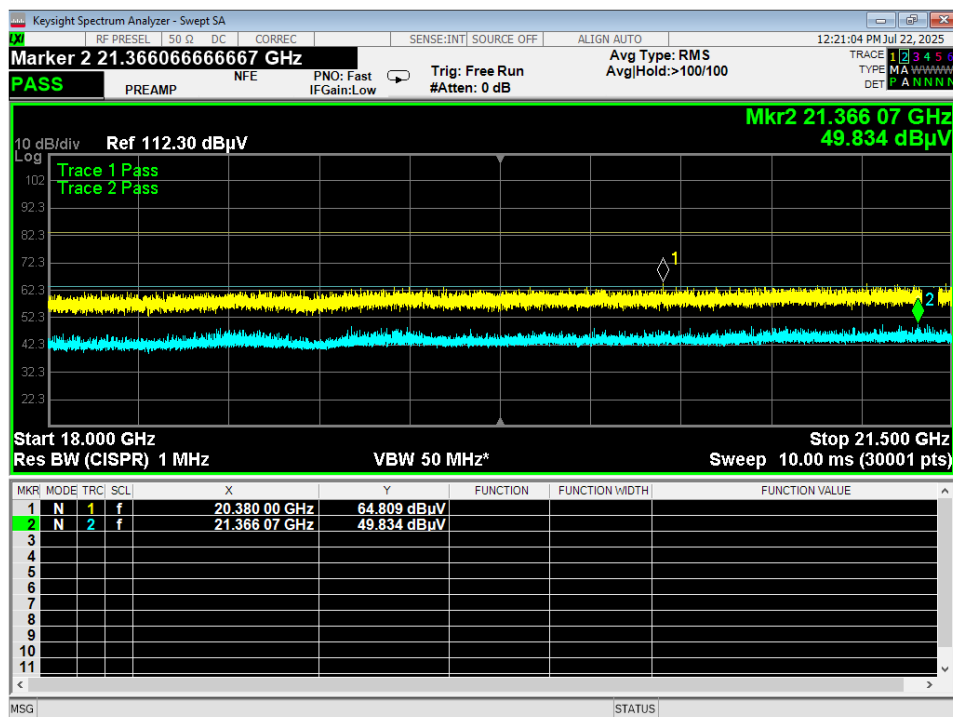


Figure 10 - Radiated Emissions Plot, 18-21.5GHz, BLE 2MB Mid
No emissions were found above lab noise floor, tabular data not provided

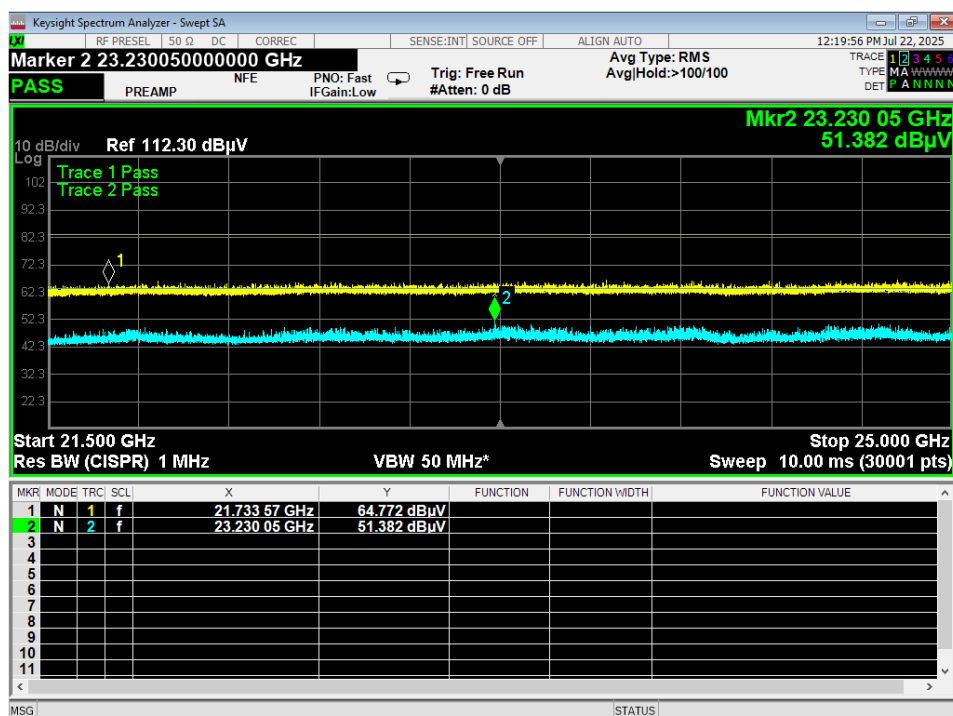


Figure 11 - Radiated Emissions Plot, 21.5-25GHz, BLE 2MB Mid
No emissions were found above lab noise floor, tabular data not provided



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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. Margin value = Emission level - Limit value
4. The worst-case plots from the 1-25GHz range are shown above.



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4.5 CONDUCTED SPURIOUS EMISSIONS

Test Method:

ANSI C63.10-2020, Section 6.7

Limits of spurious emissions:

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.

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:

Note that the limit shown on the plots does not apply. It is a line for reference.

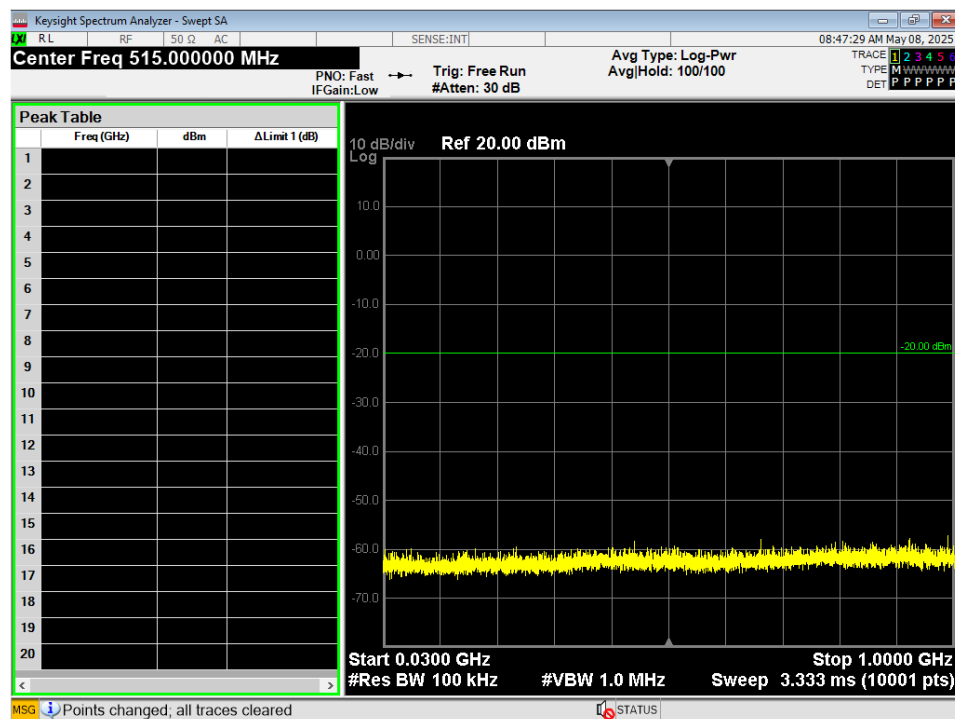


Figure 12 - Conducted Spurious Plot, GFSK, 30MHz – 1GHz, Mid

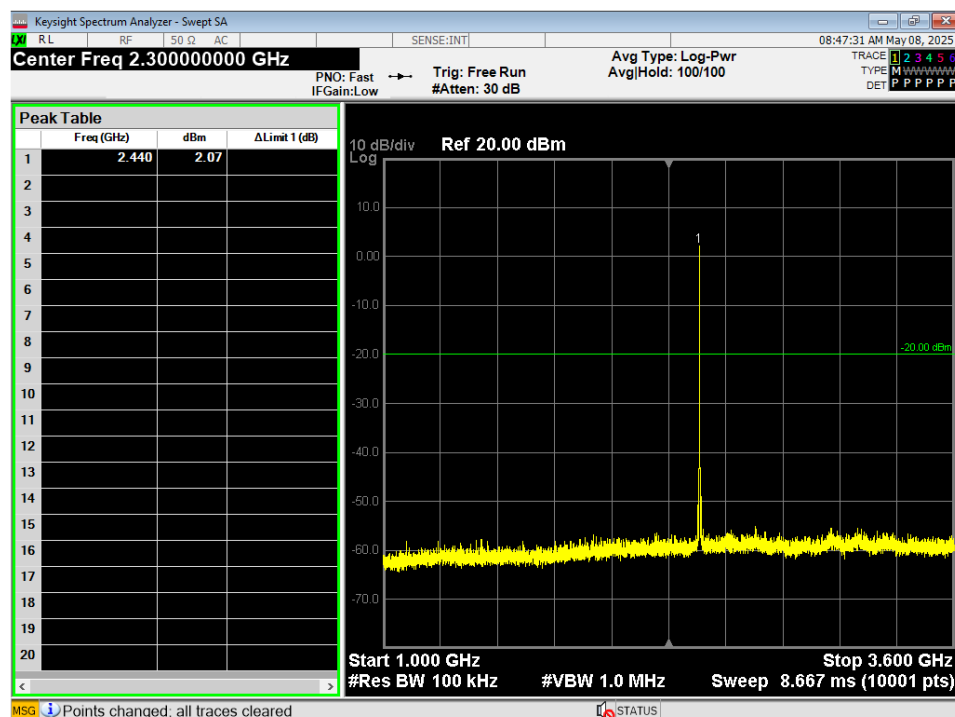


Figure 13 - Conducted Spurious Plot, GFSK, 1GHz – 3.6GHz, Mid

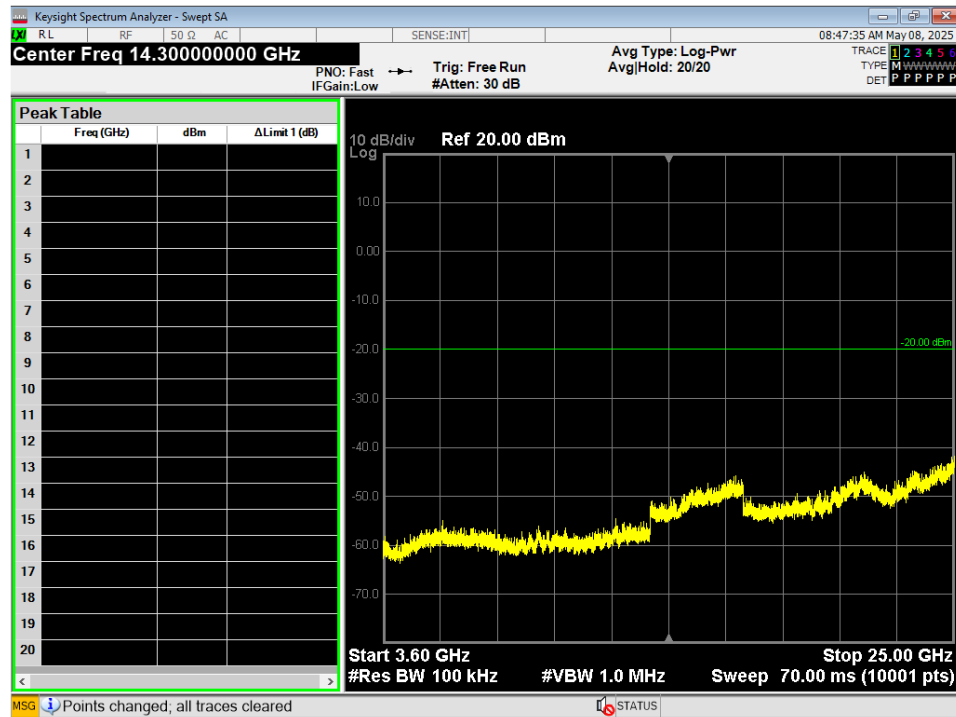


Figure 14 - Conducted Spurious Plot, GFSK, 3.6GHz – 25GHz, Mid

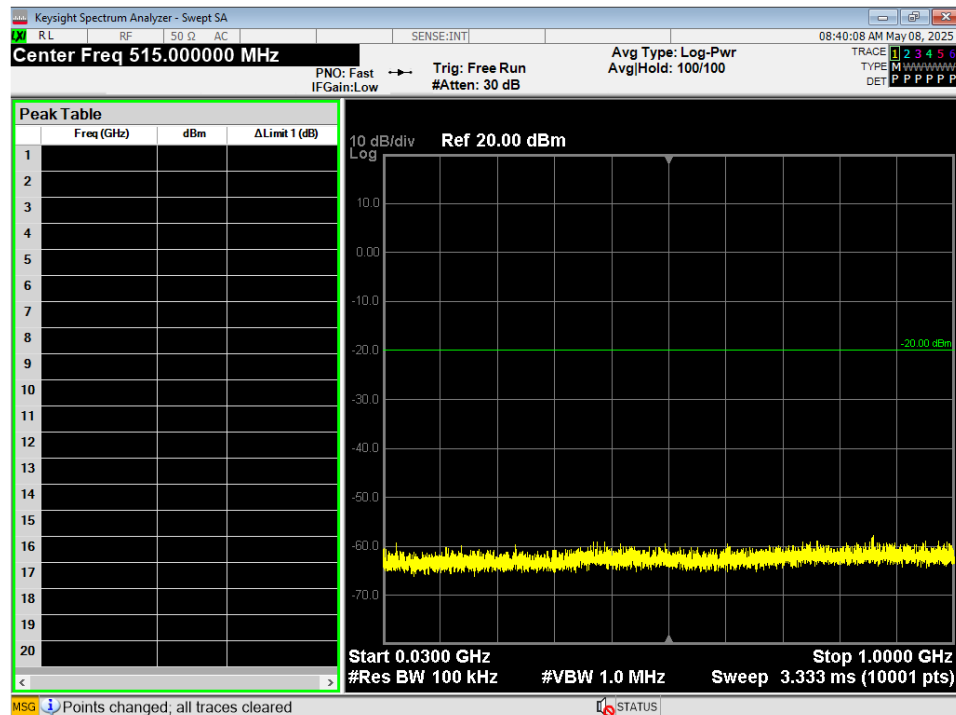


Figure 15 - Conducted Spurious Plot, GMSK 1MB, 30MHz – 1GHz, Mid

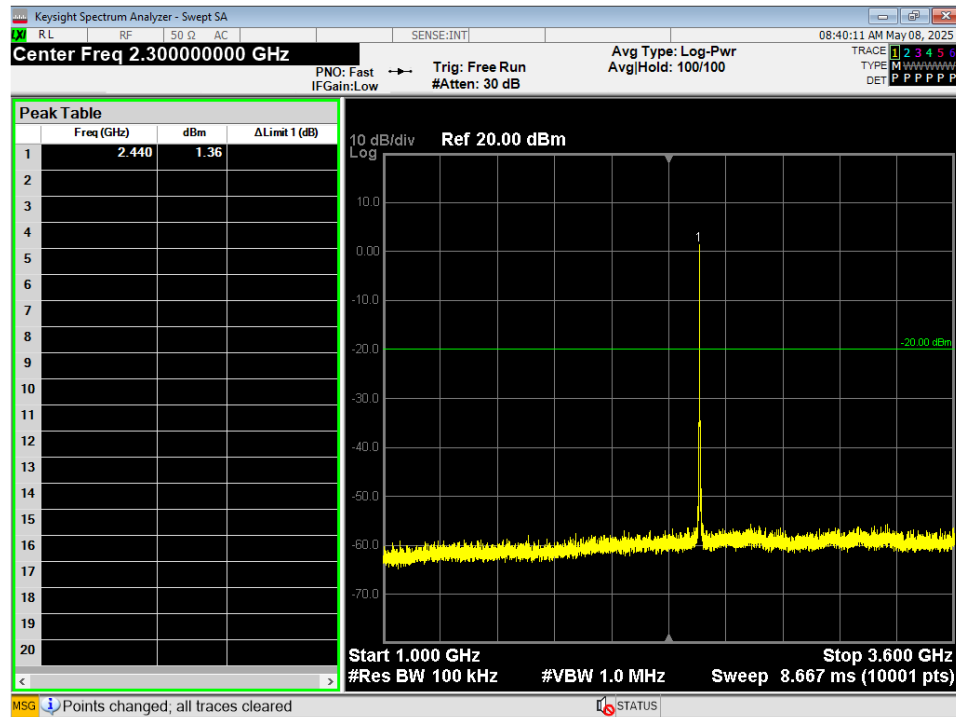


Figure 16 - Conducted Spurious Plot, GMSK 1MB, 1GHz – 3.6GHz, Mid

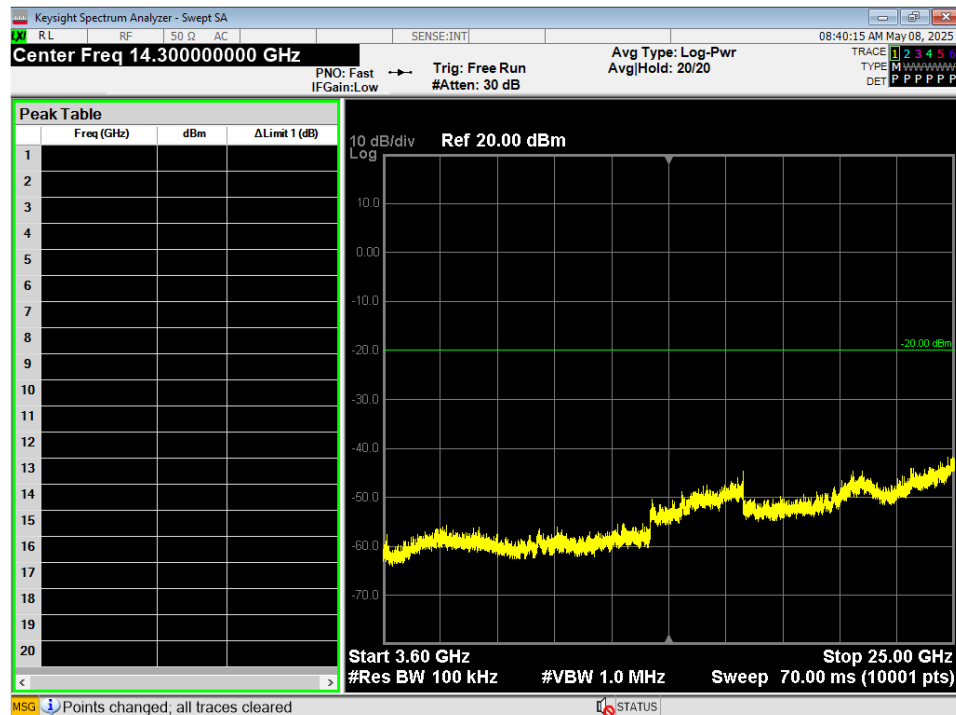


Figure 17 - Conducted Spurious Plot, GMSK 1MB, 3.6GHz – 25GHz, Mid

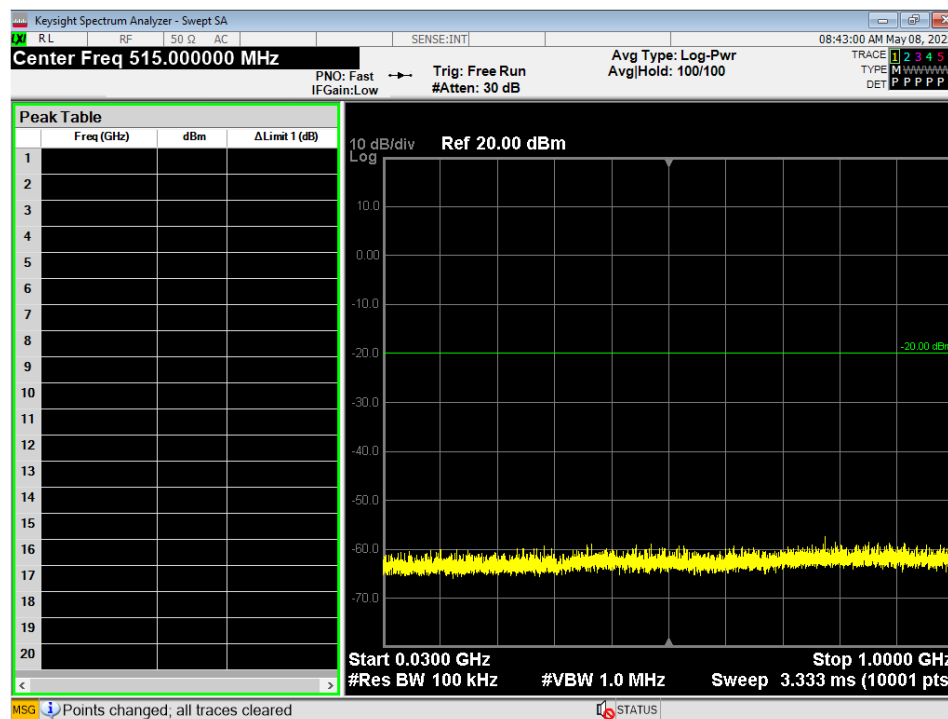


Figure 18 - Conducted Spurious Plot, GMSK 2MB, 30MHz – 1GHz, Mid

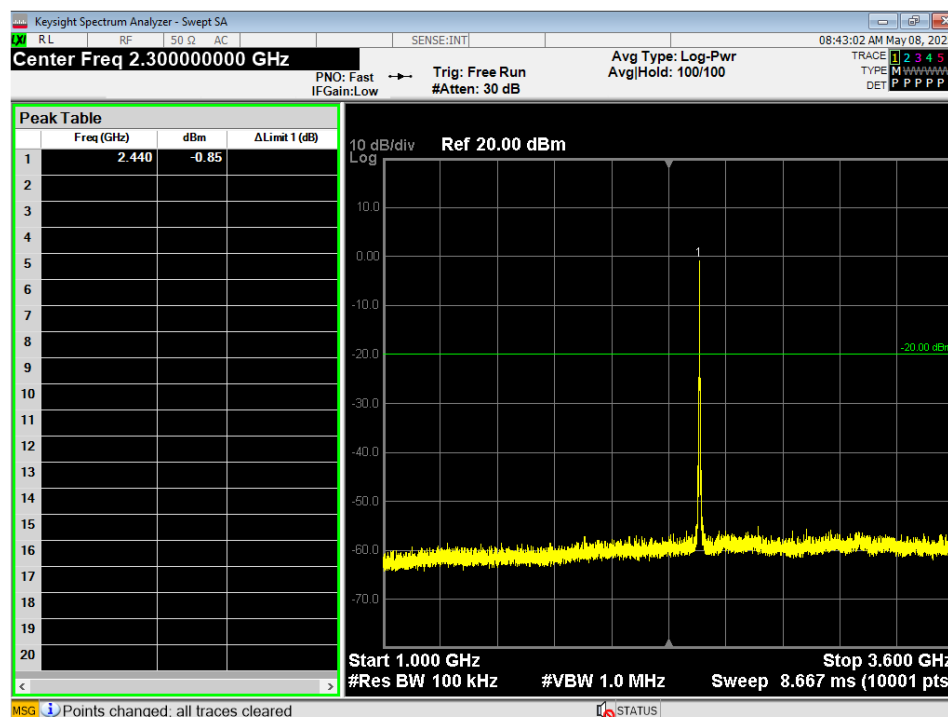


Figure 19 - Conducted Spurious Plot, GMSK 2MB, 1GHz – 3.6GHz, Mid

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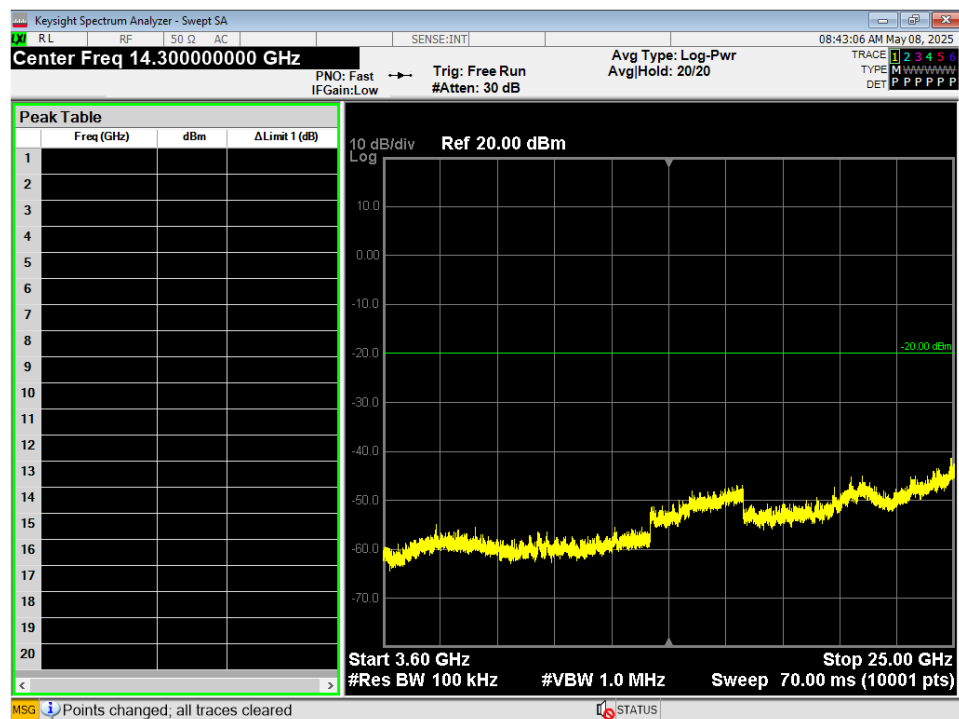


Figure 20 - Conducted Spurious Plot, GMSK 2MB, 3.6GHz – 25GHz, Mid

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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.
4. Tabulated data is listed in section 4.0.



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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. Tabulated data is listed in section 4.0.

4.8 CONDUCTED AC MAINS EMISSIONS

Test Method: ANSI C63.10-2020, Section(s) 6.2

Limits for conducted emissions measurements:

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Test Procedures:

- a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
- d. Results were compared to the 15.207 limits.

Deviation from the test standard:

No deviation

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test Results:

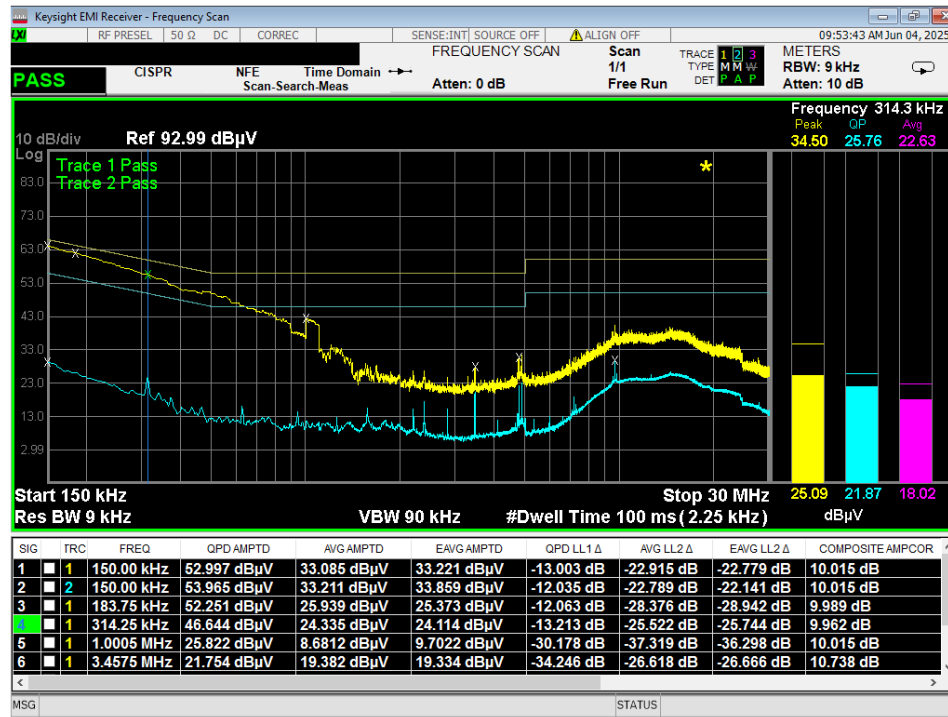


Figure 21 – Conducted Emissions Plot, charging on dock, TX, Line

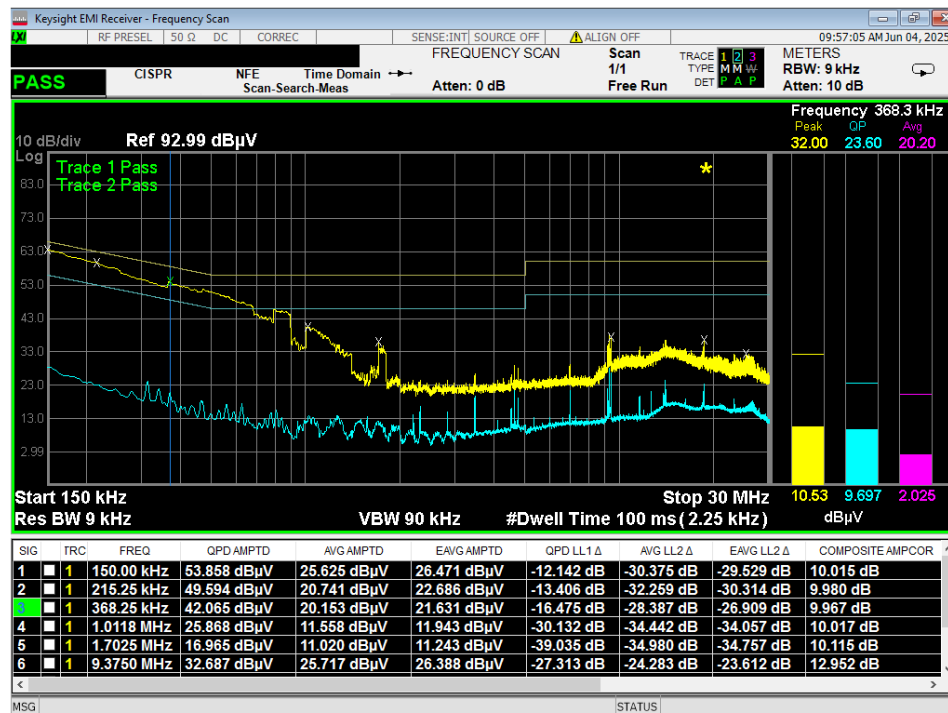


Figure 22 – Conducted Emissions Plot, charging on dock, TX, Neutral

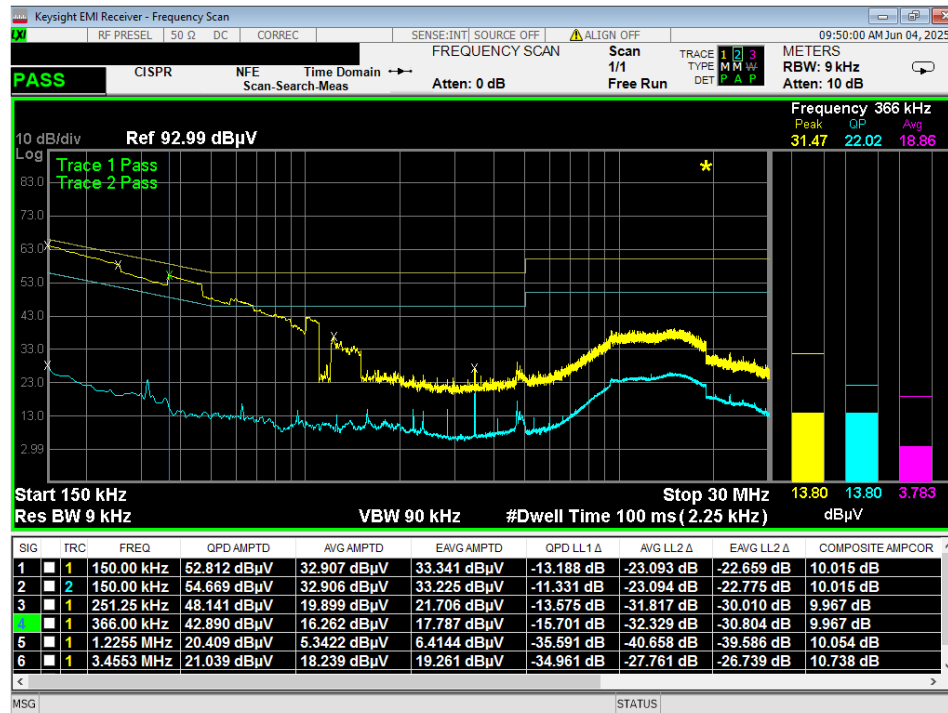


Figure 23 – Conducted Emissions Plot, charging on dock, IDLE, Line

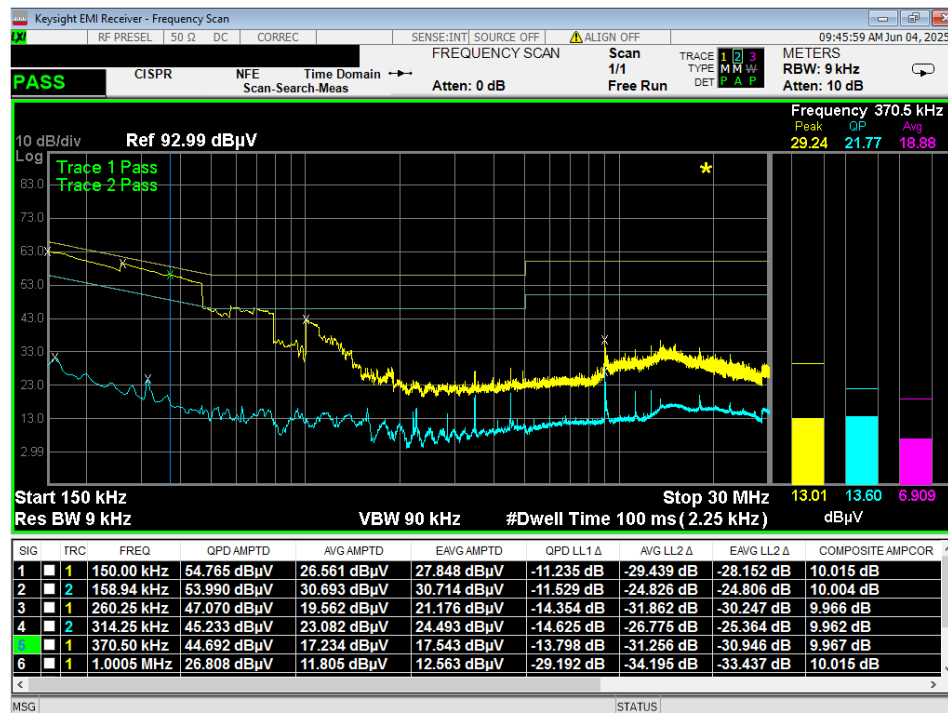


Figure 24 – Conducted Emissions Plot, charging on dock, IDLE, Neutral

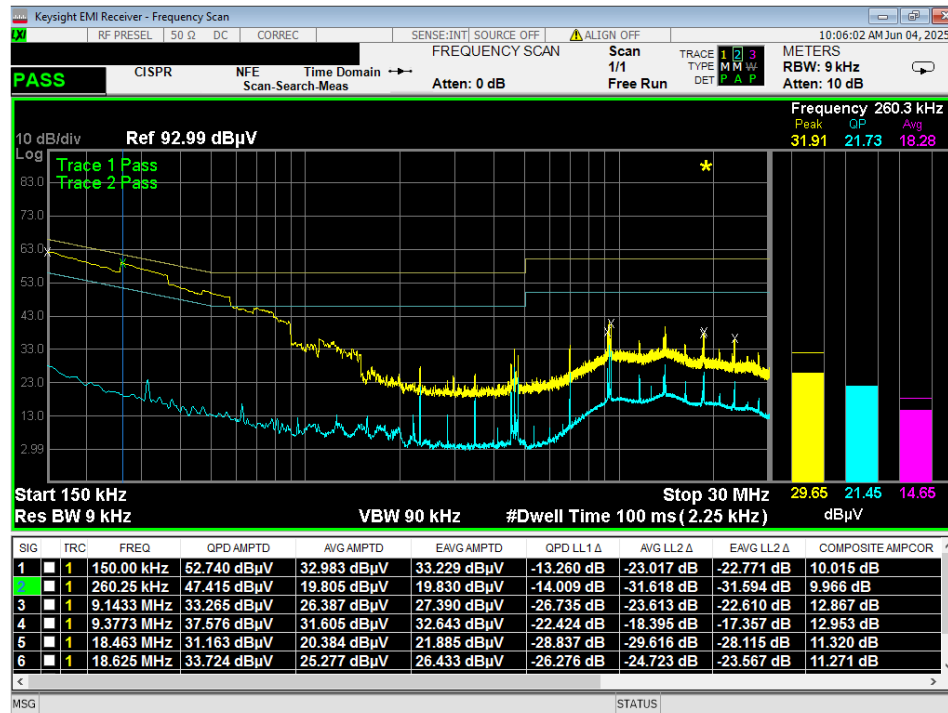


Figure 25 – Conducted Emissions Plot, charging via USB-C, TX, Line

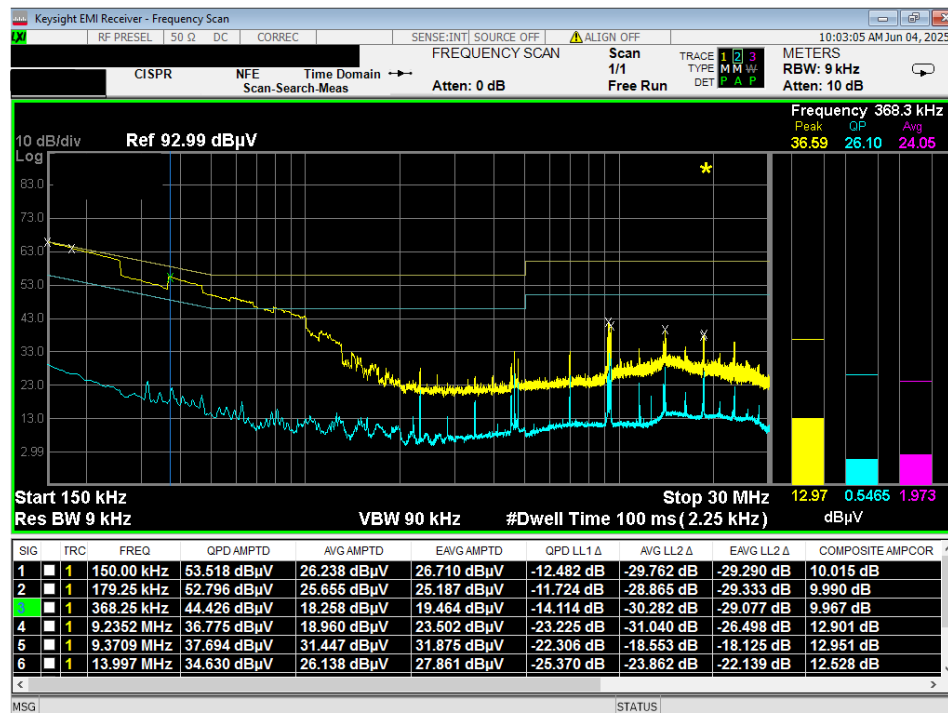


Figure 26 – Conducted Emissions Plot, charging via USB-C, TX, Neutral

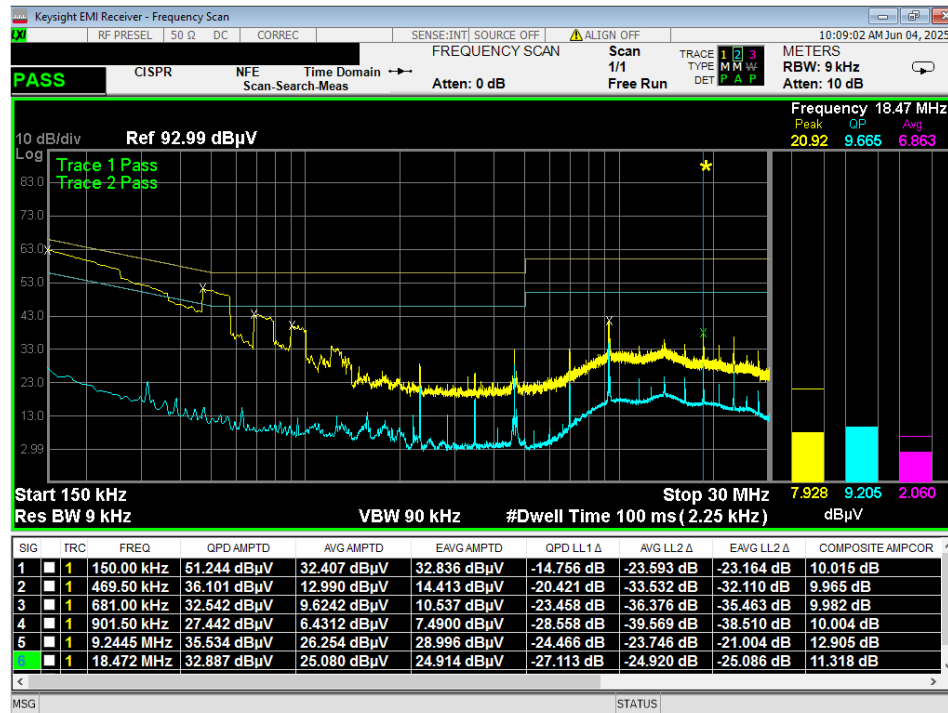


Figure 27 – Conducted Emissions Plot, charging via USB-C, IDLE, Line

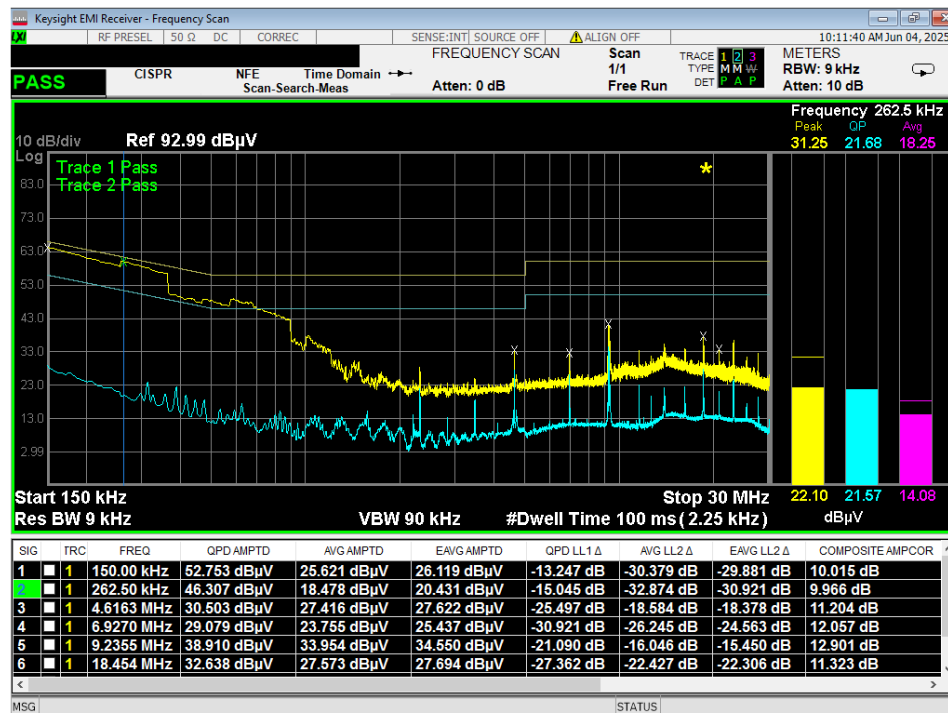


Figure 28 – Conducted Emissions Plot, charging via USB-C, IDLE, Neutral



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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;

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

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

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

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

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

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

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

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

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



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APPENDIX B – MEASUREMENT UNCERTAINTY

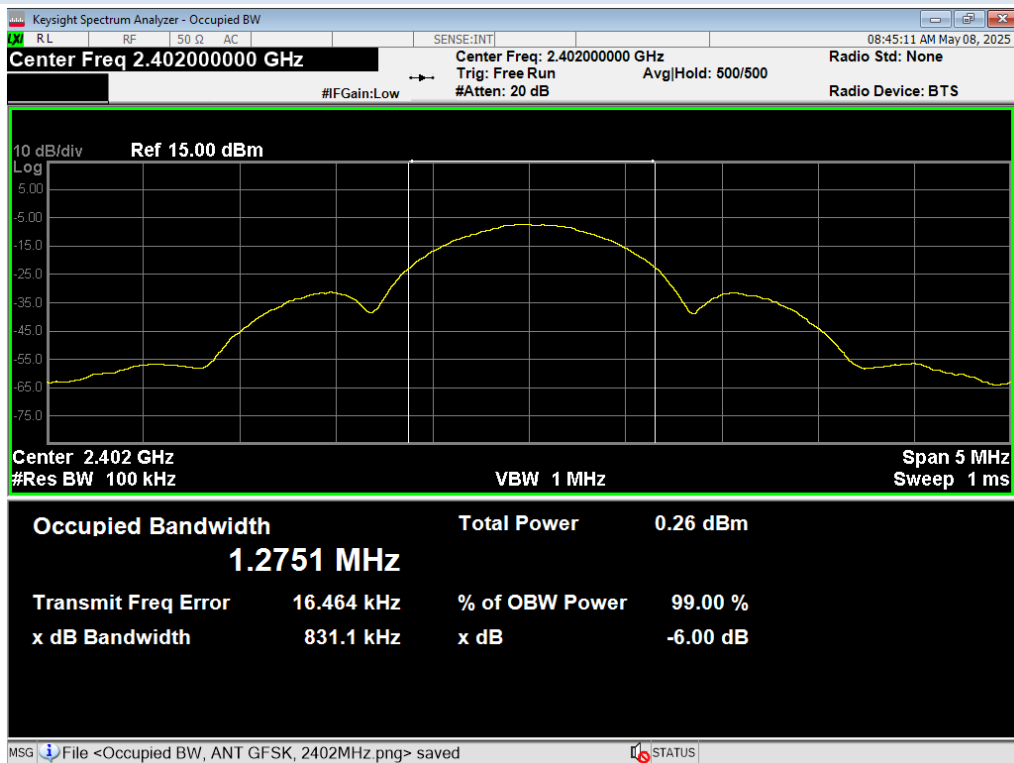
NCEE Labs does not add uncertainty levels to measurement levels

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

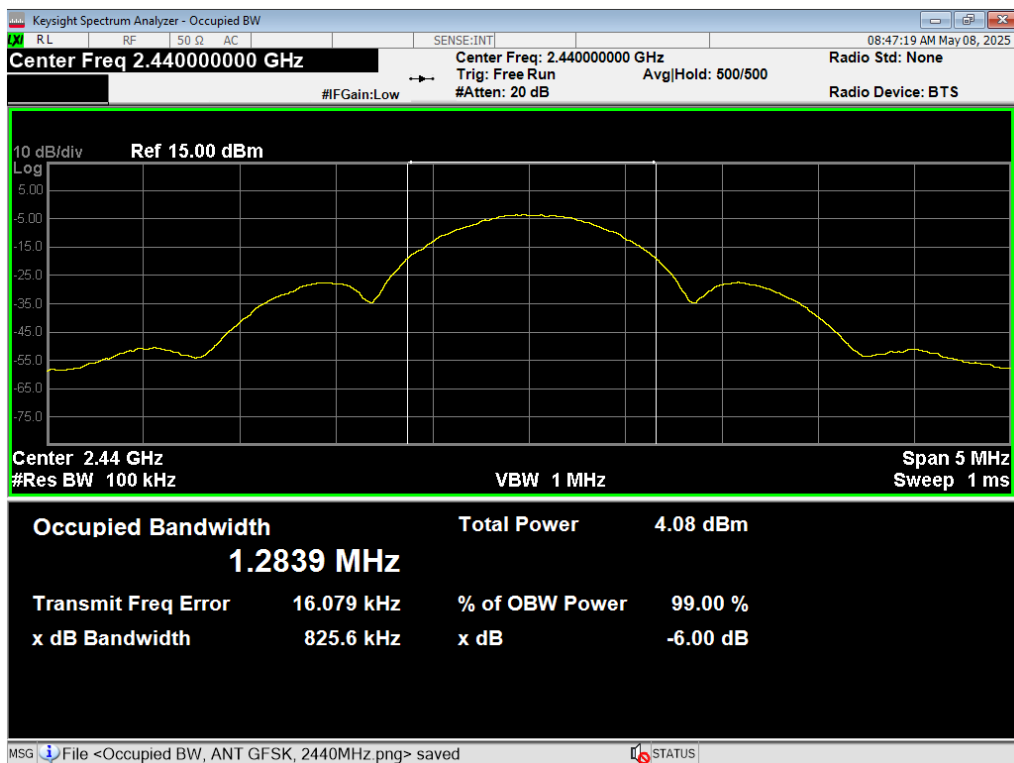
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08
Emissions limits, conducted	30MHz – 18GHz	±3.03

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

APPENDIX C – GRAPHS AND TABLES

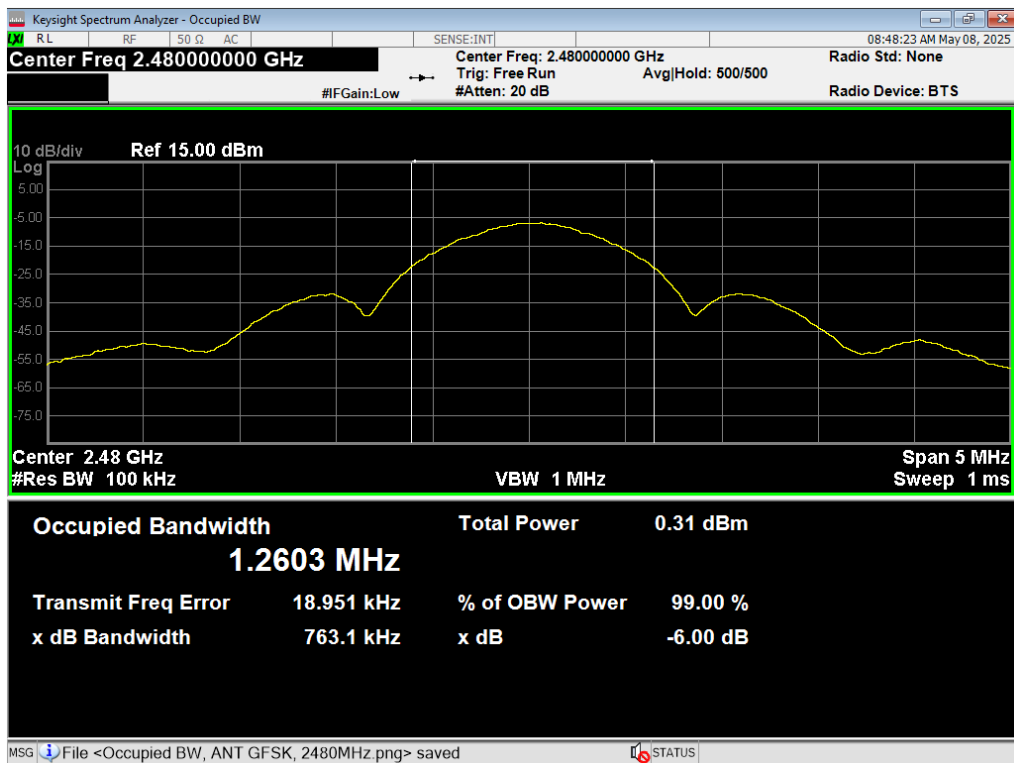


6dB BW, ANT GFSK, 2402MHz

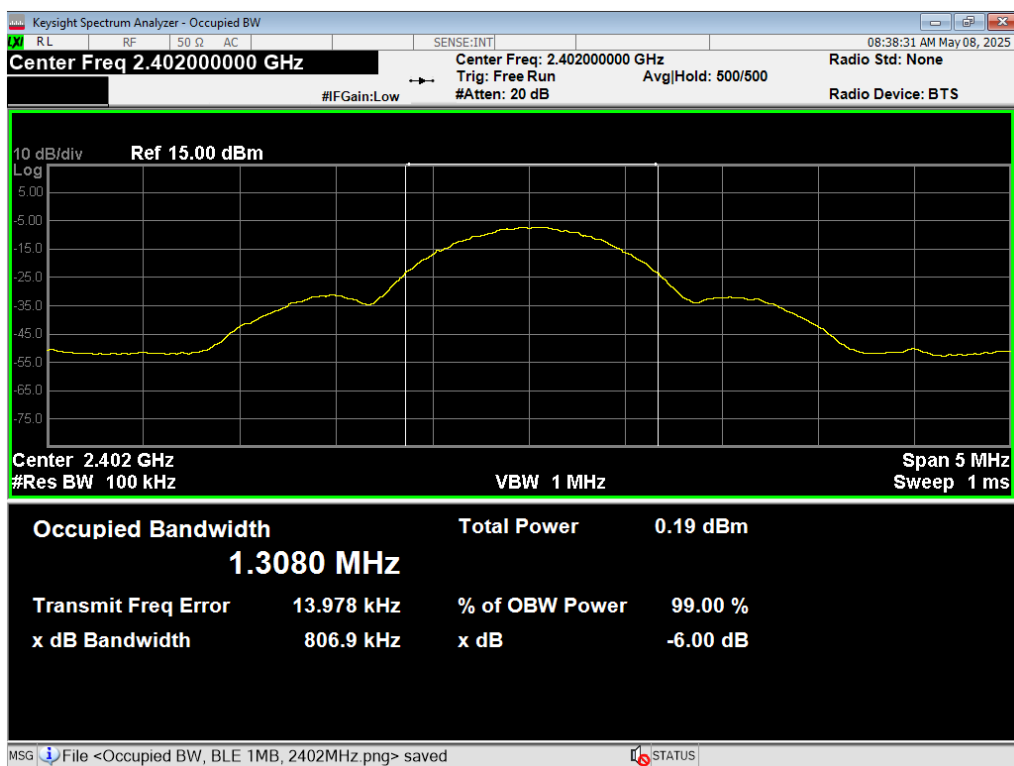


6dB BW, ANT GFSK, 2440MHz

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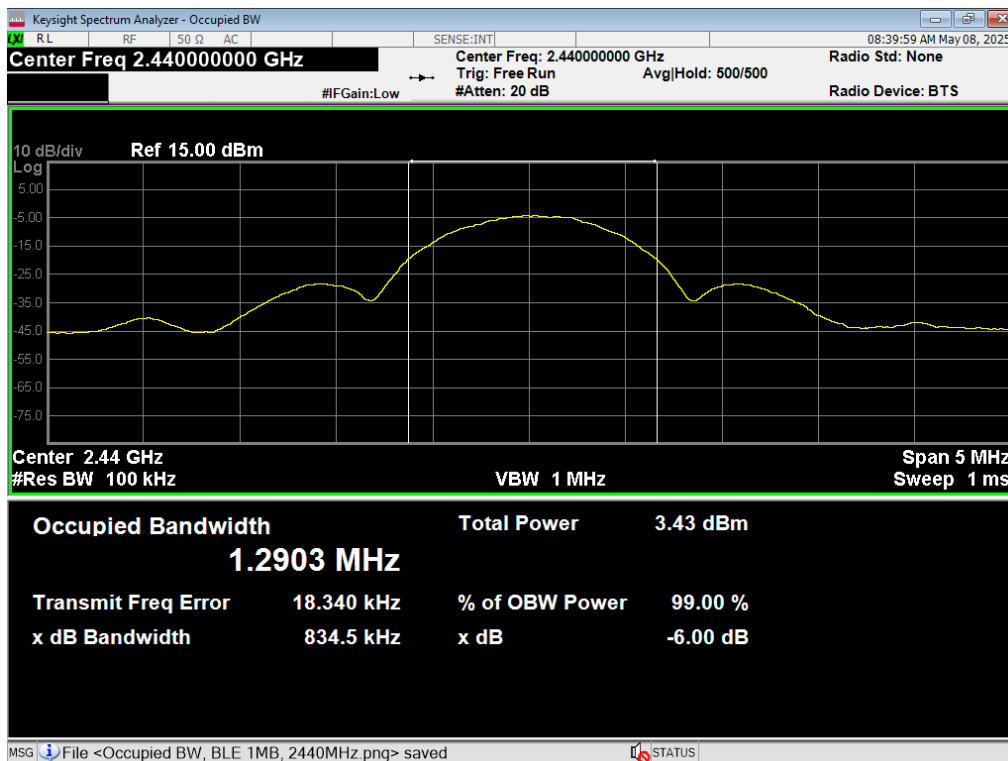


6dB BW, ANT GFSK, 2480MHz

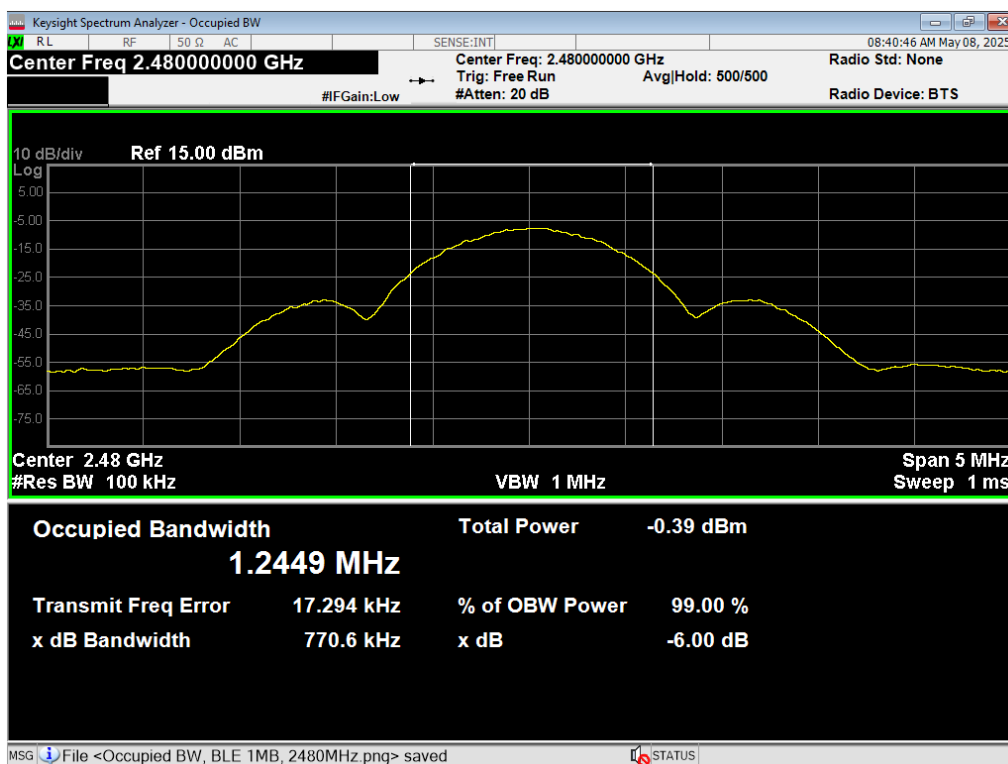


6dB BW, BLE 1MB, 2402MHz

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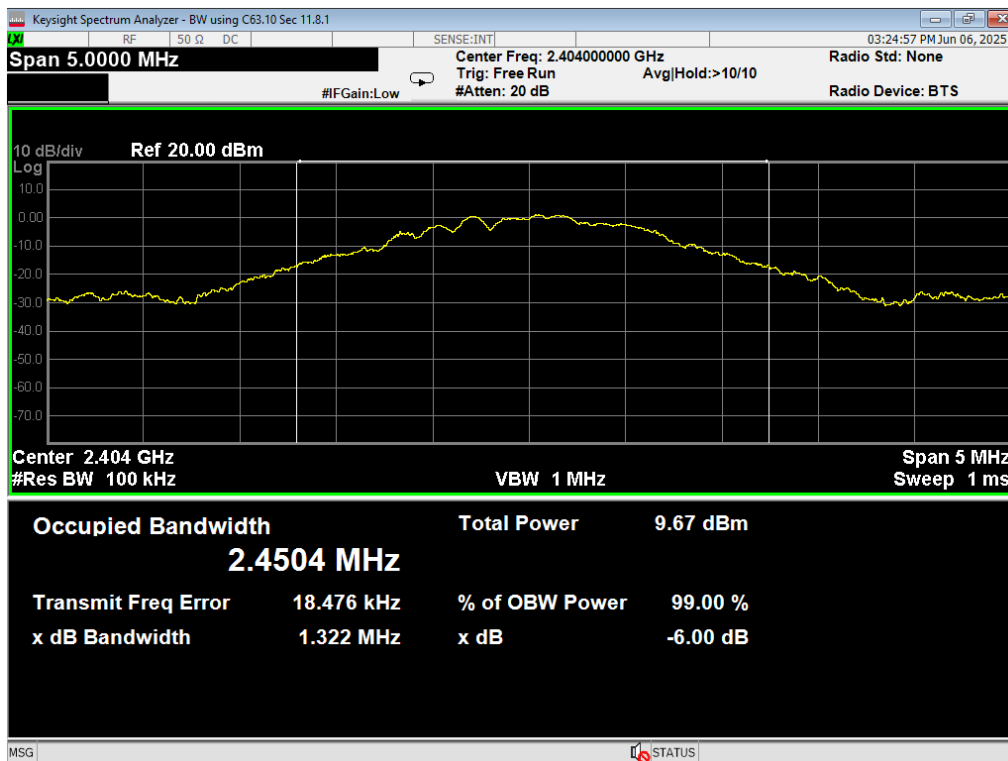


6dB BW, BLE 1MB, 2440MHz

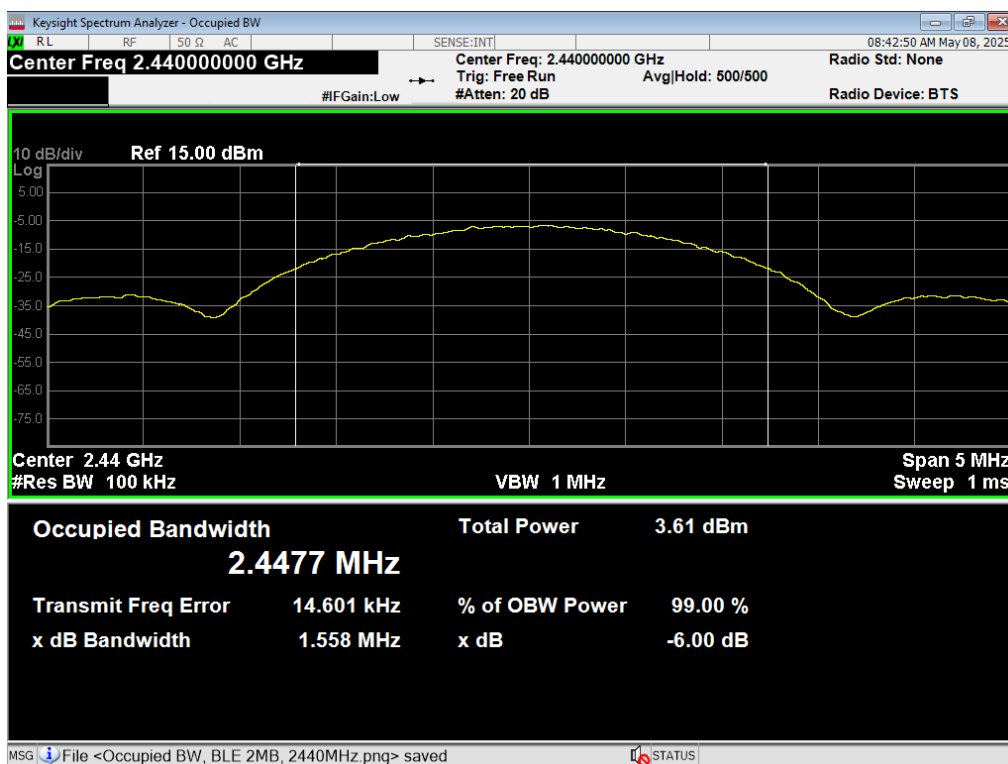


6dB BW, BLE 1MB, 2480MHz

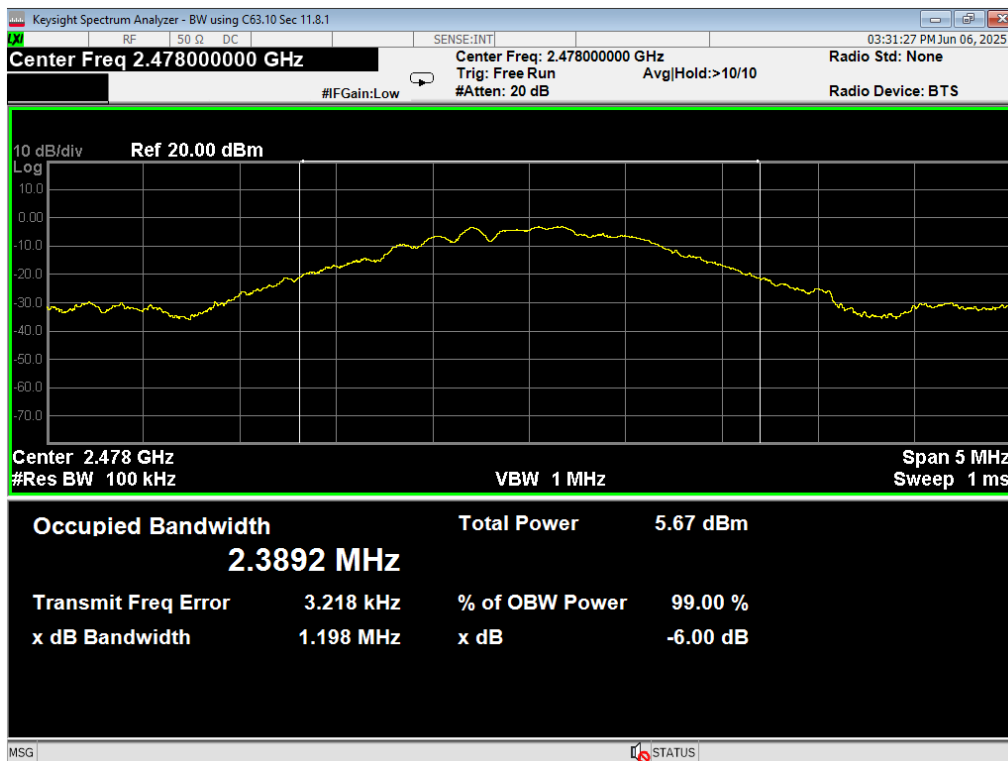
Report Number:	R20250124-00-E1	Rev	B
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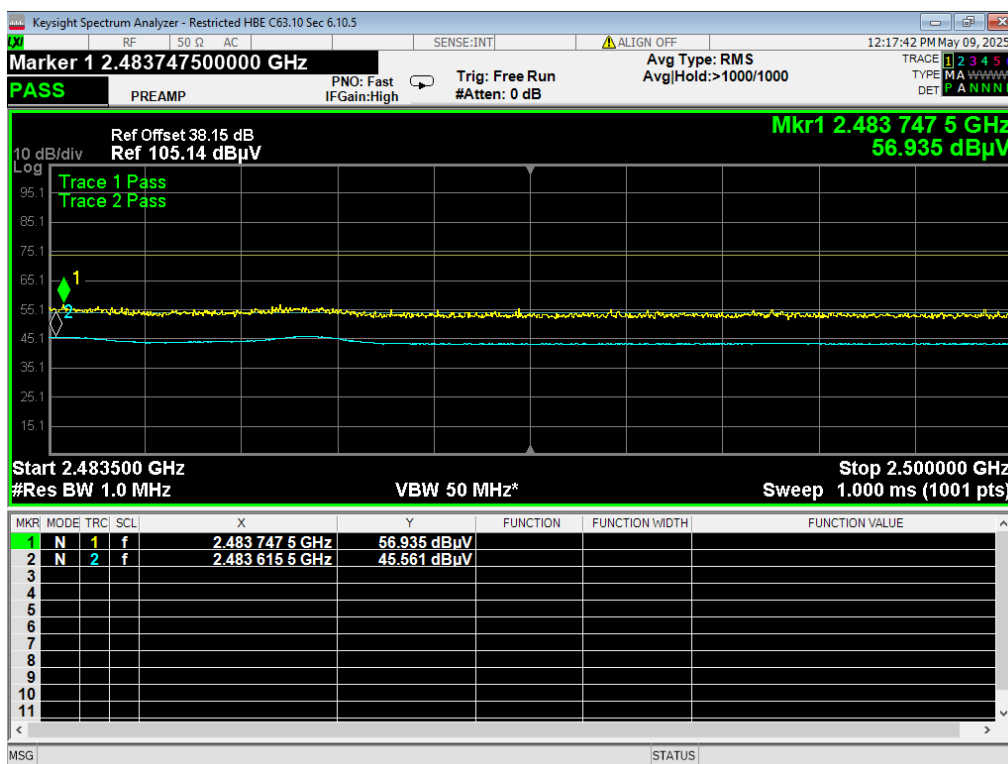
6dB BW, BLE 2MB, 2404MHz



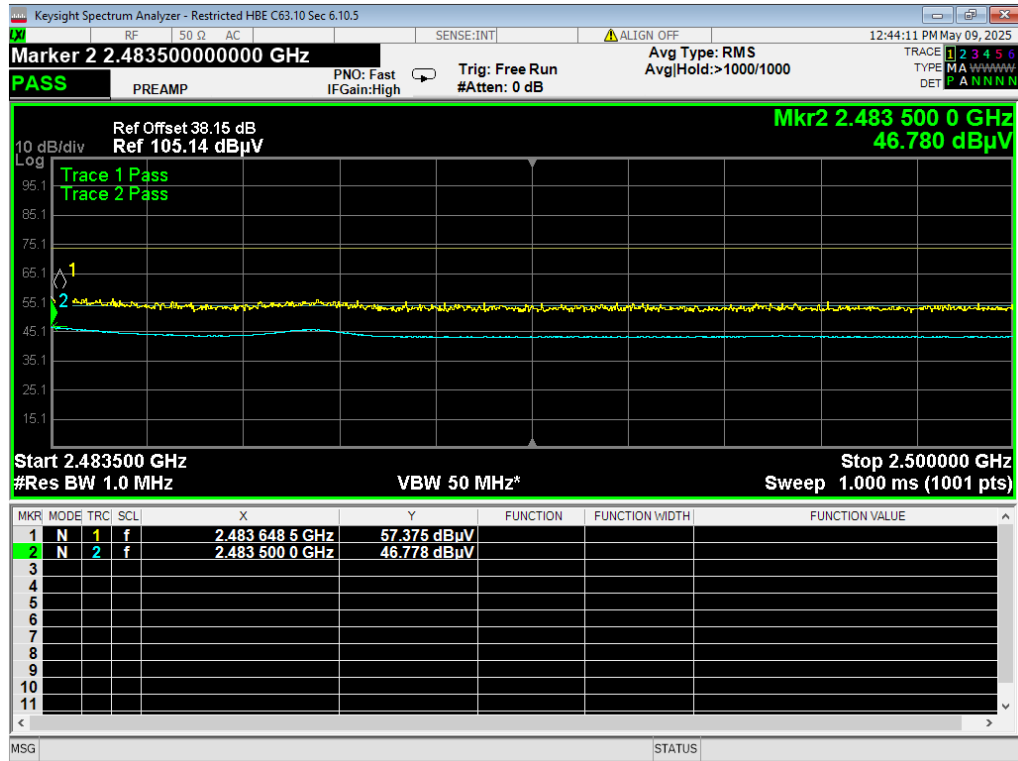
6dB BW, BLE 2MB, 2440MHz



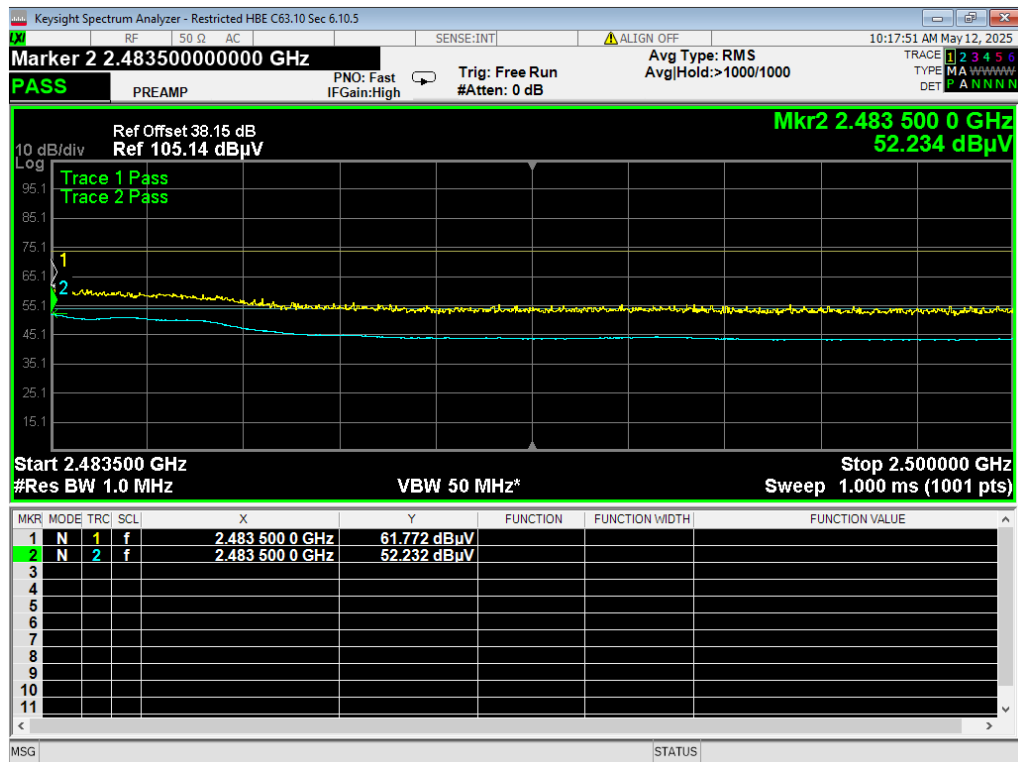
6dB BW, BLE 2MB, 2478MHz



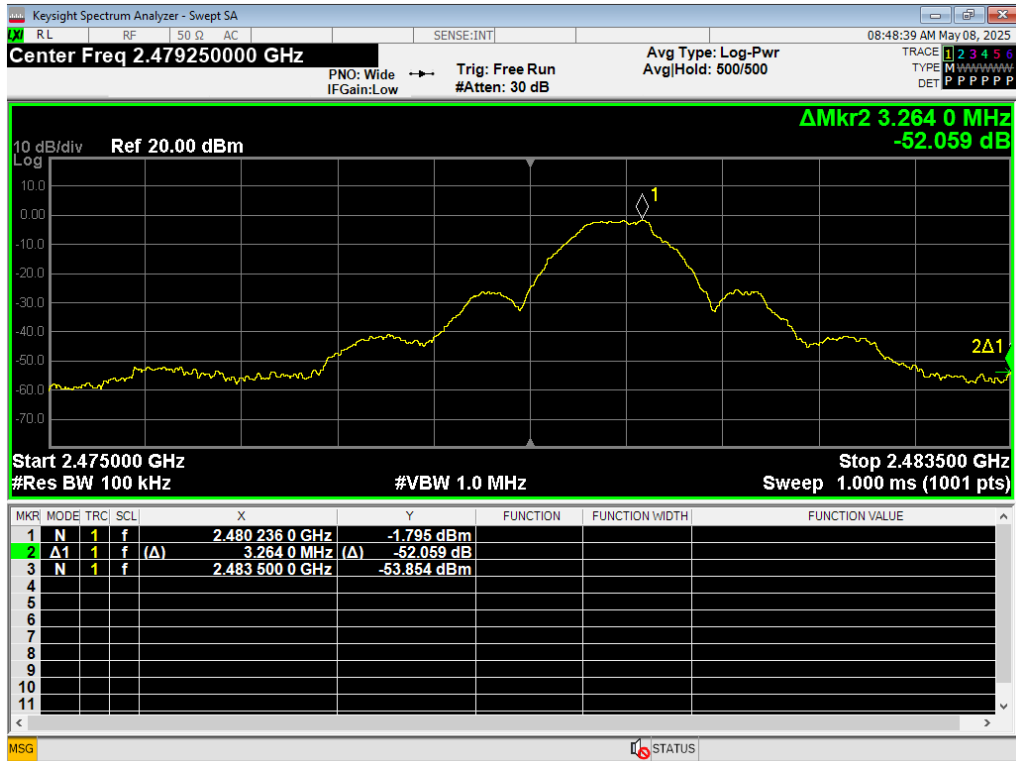
HBE Restricted, ANT GFSK



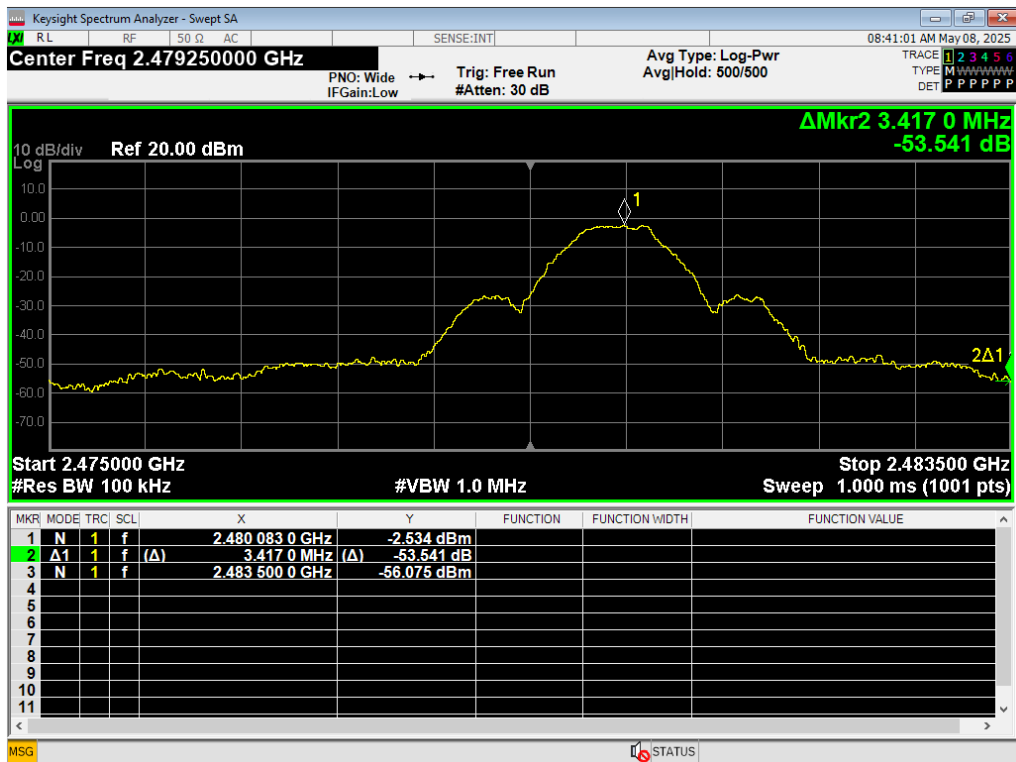
HBE Restricted, BLE 1MB



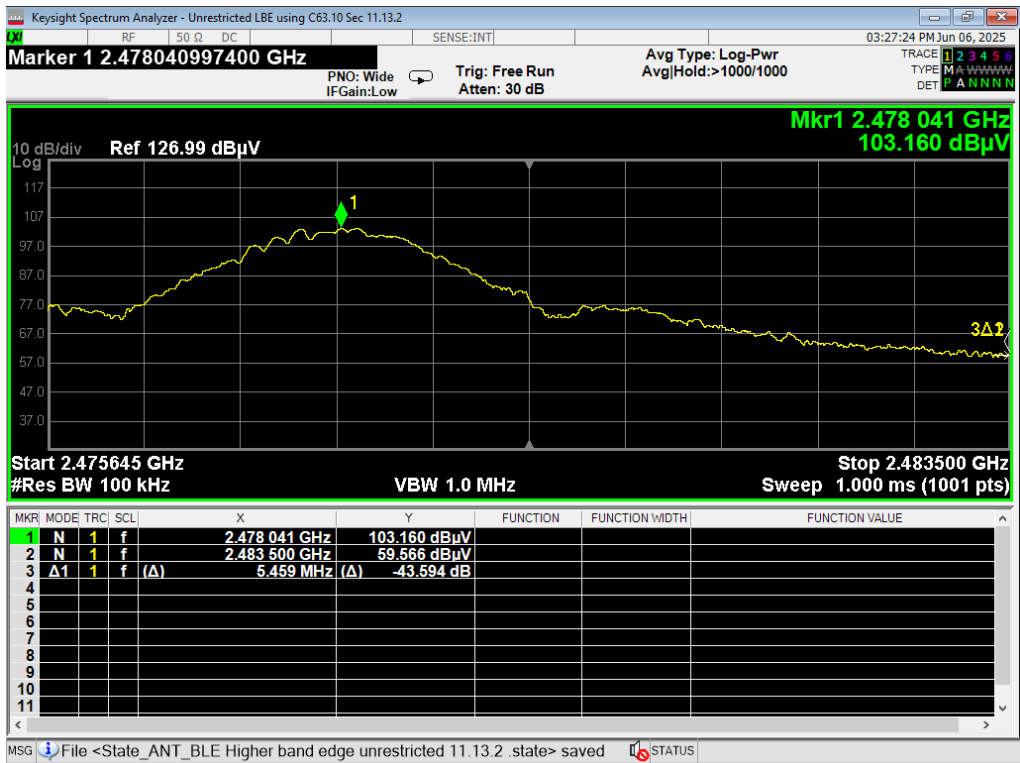
HBE Restricted, BLE 2MB, 2478MHz



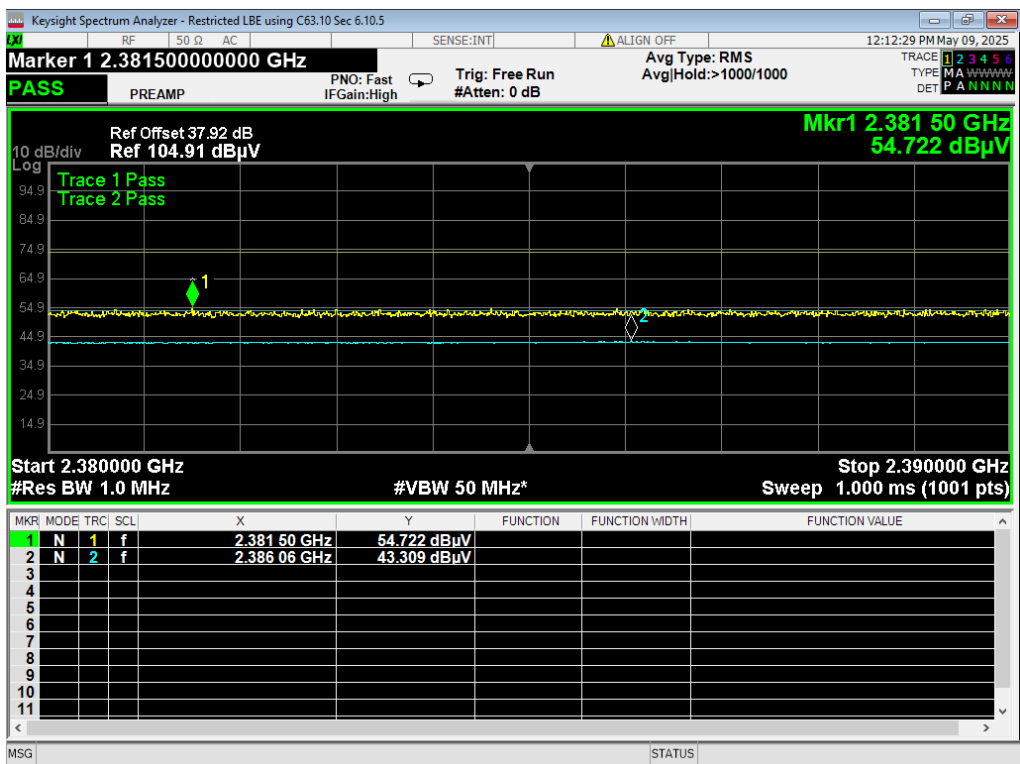
HBE Unrestricted, ANT GFSK



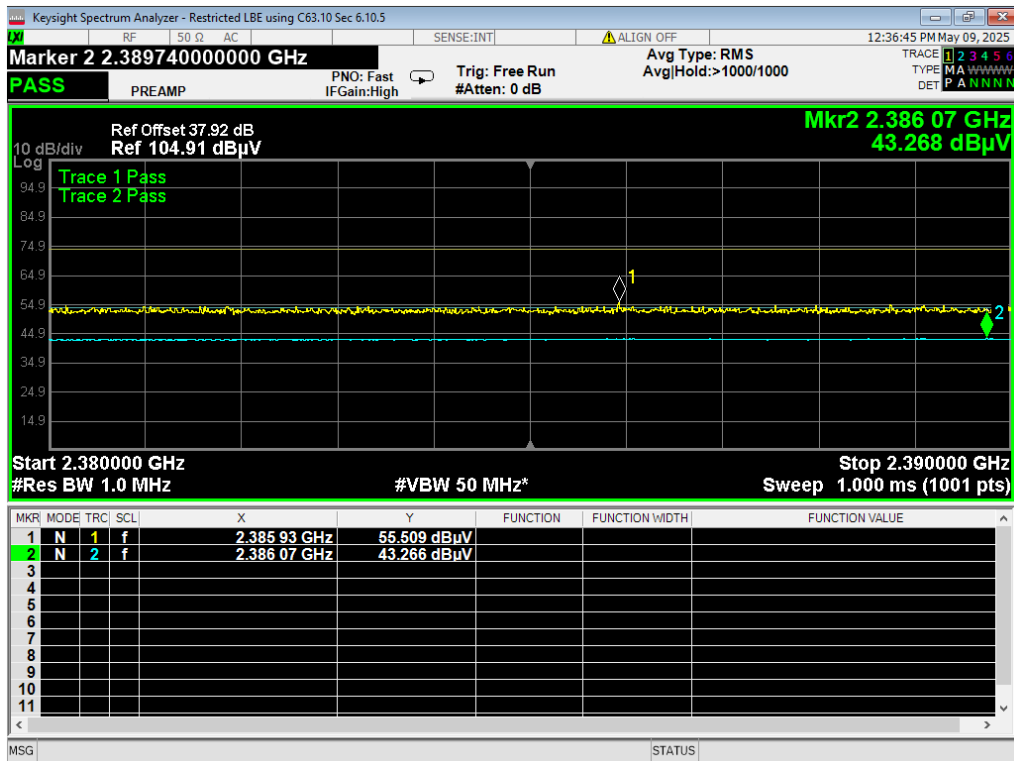
HBE Unrestricted, BLE 1MB



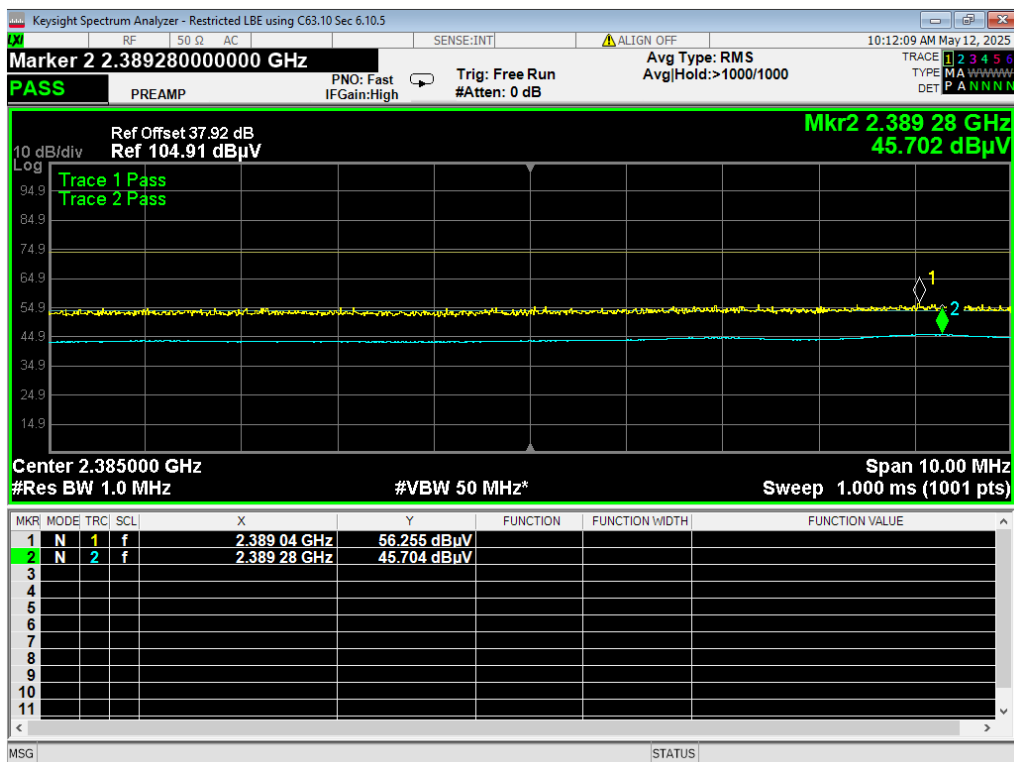
HBE Unrestricted, BLE 2MB, 2404MHz



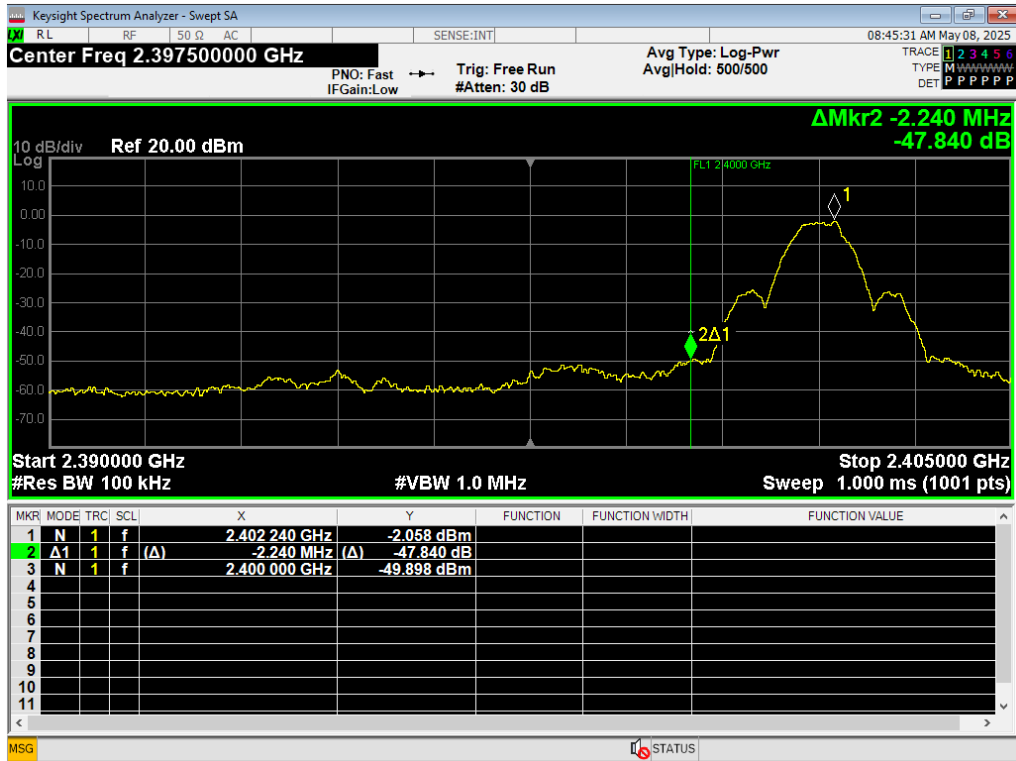
LBE Restricted, ANT GFSK



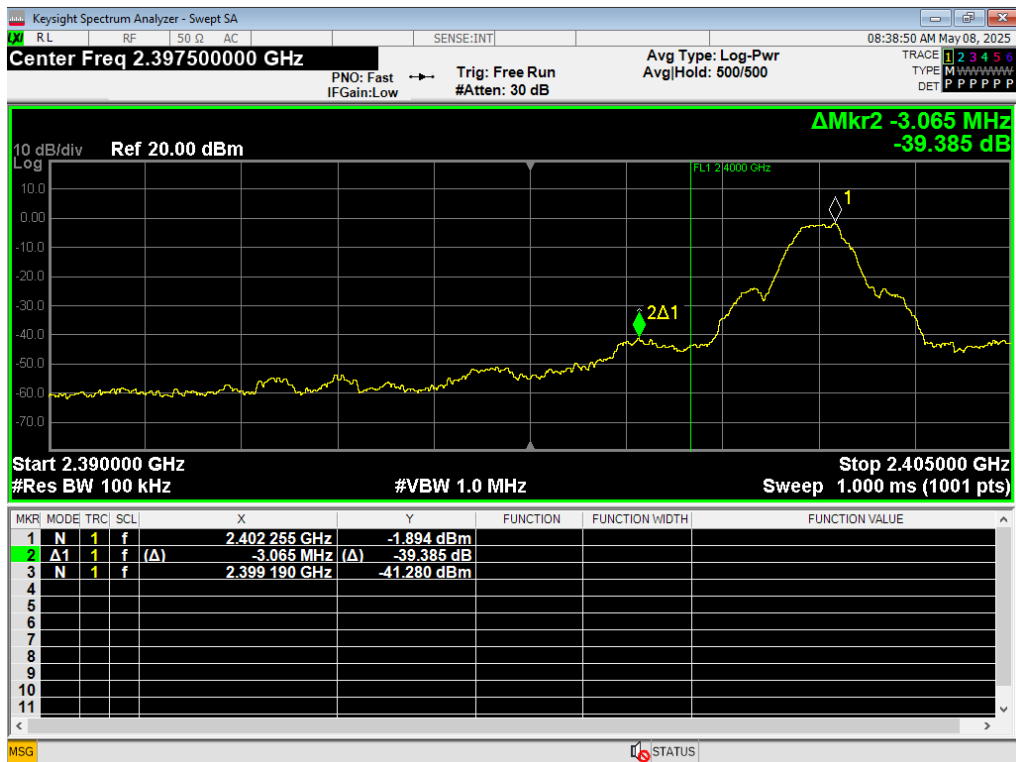
LBE Restricted, BLE 1MB



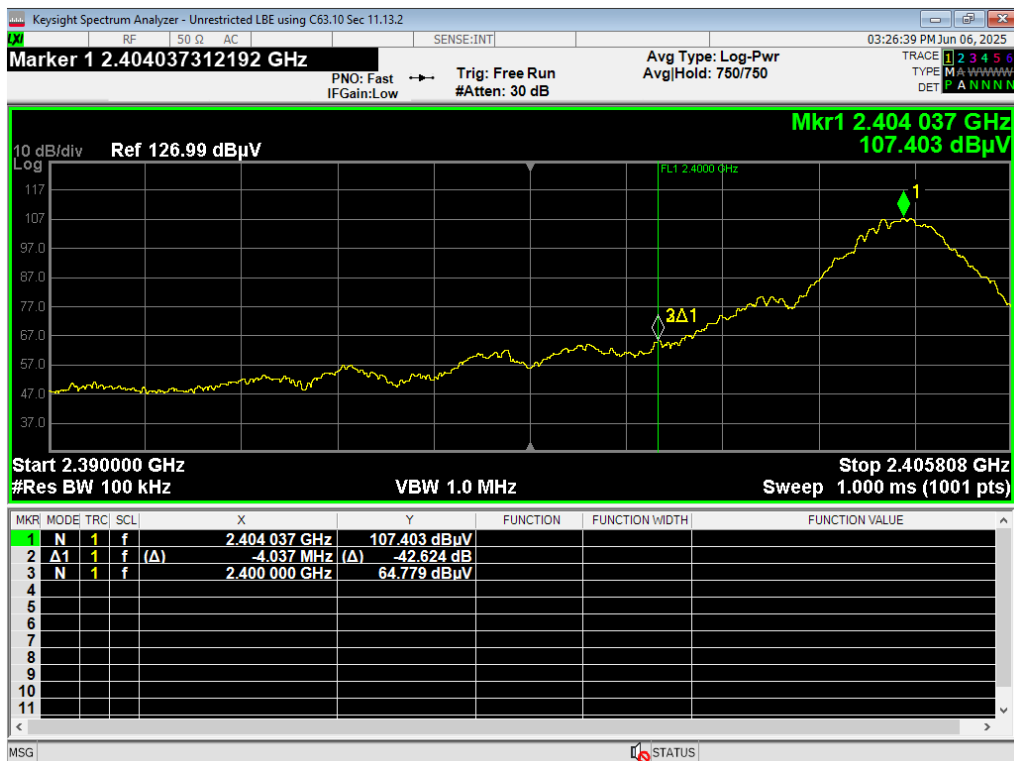
LBE Restricted, BLE 2MB, 2404MHz



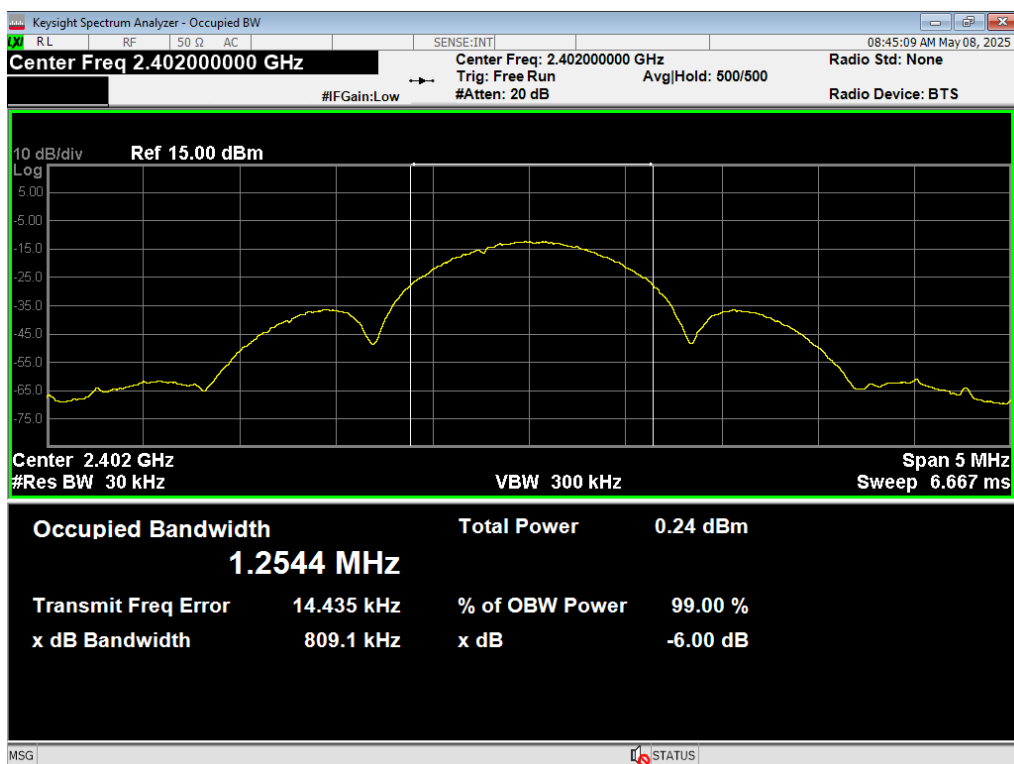
LBE Unrestricted, ANT GFSK



LBE Unrestricted, BLE 1MB

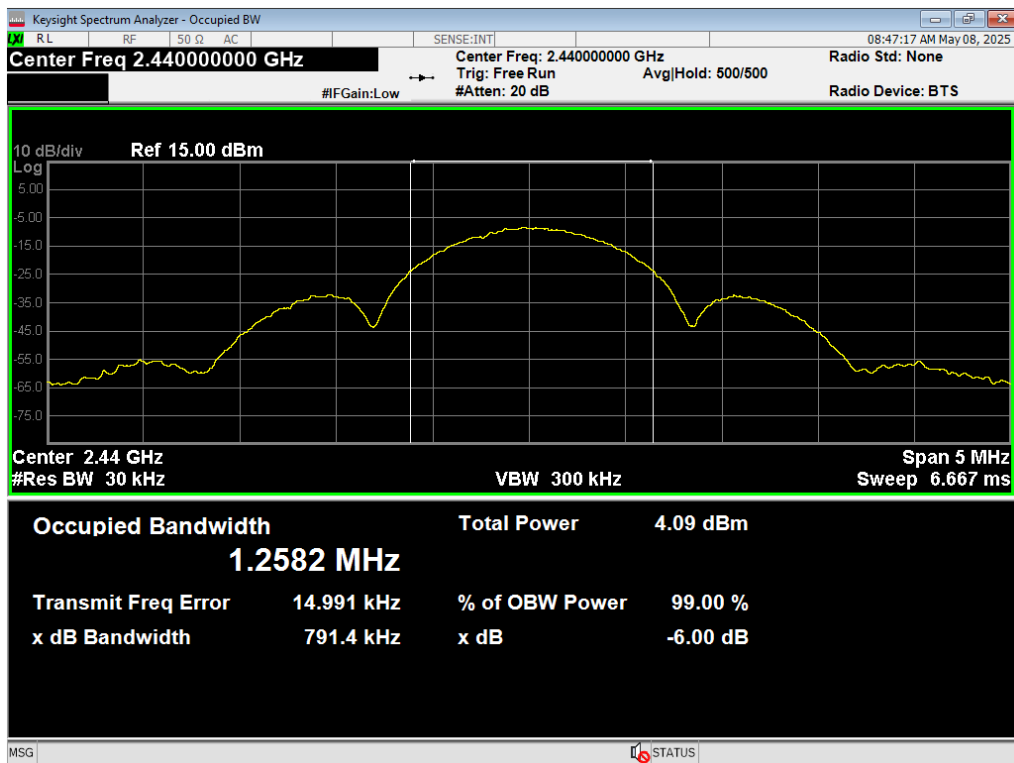


LBE Unrestricted, BLE 2MB, 2404MHz

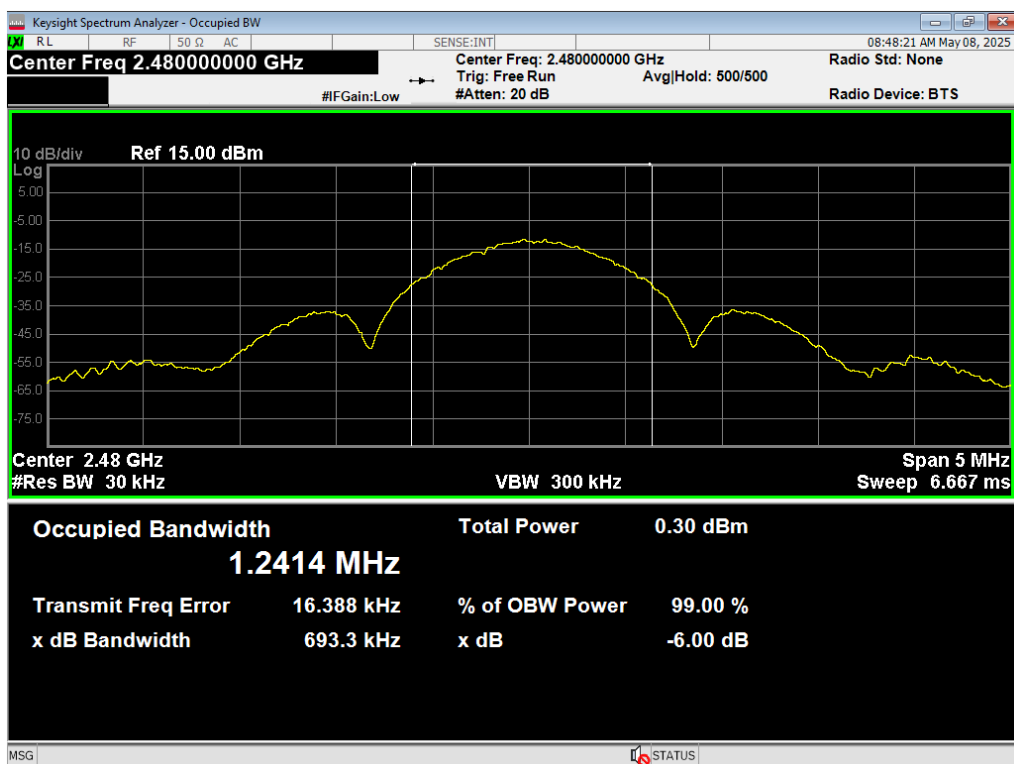


Occupied BW, ANT GFSK, 2402MHz

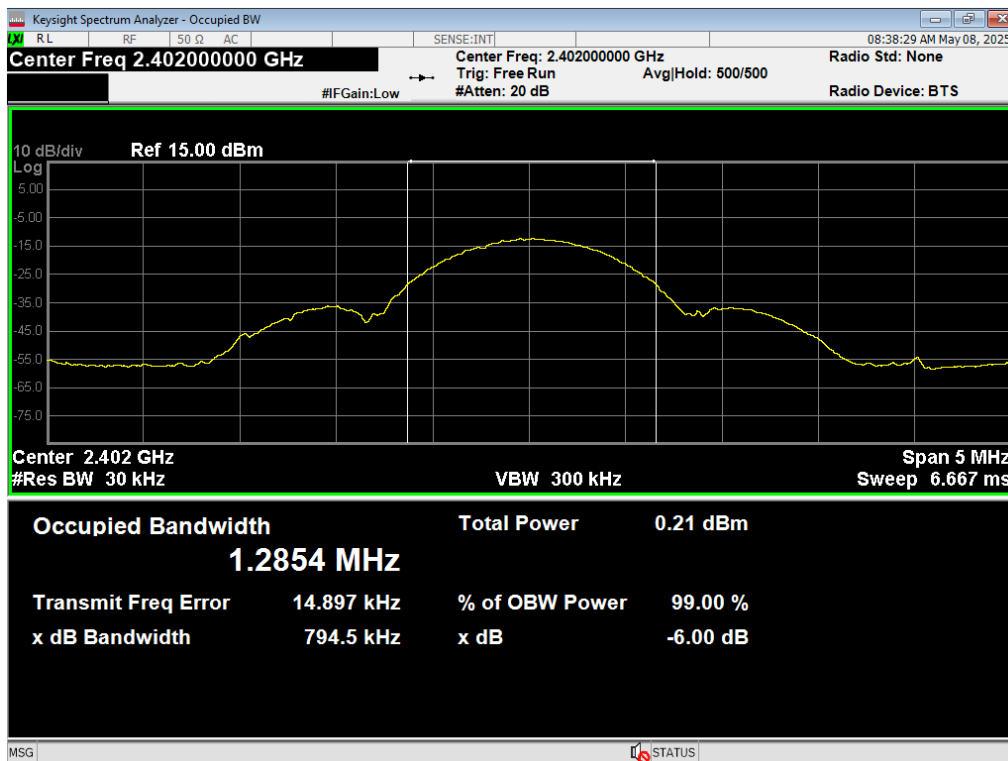
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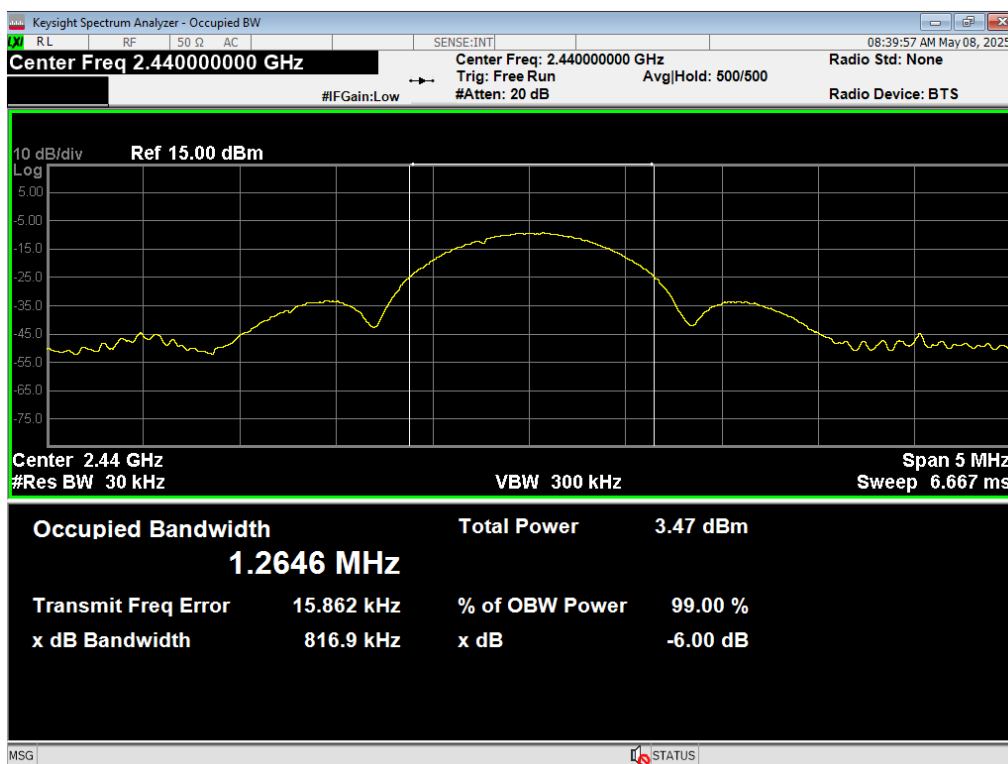
Occupied BW, ANT GFSK, 2440MHz



Occupied BW, ANT GFSK, 2480MHz

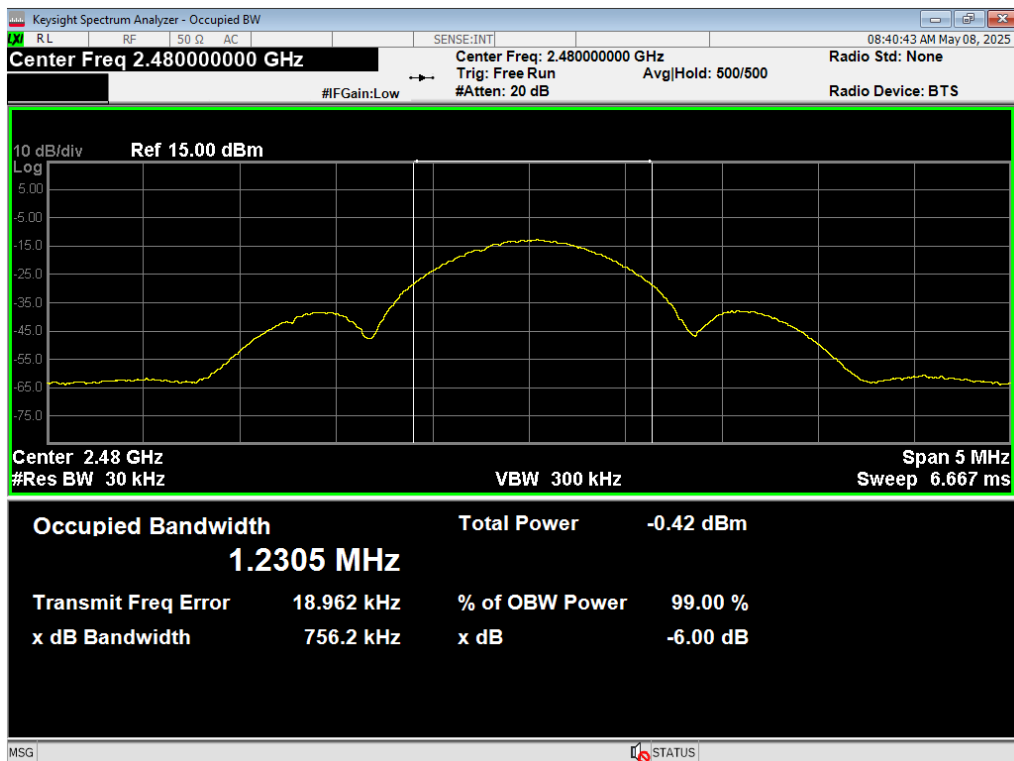


Occupied BW, BLE 1MB, 2402MHz

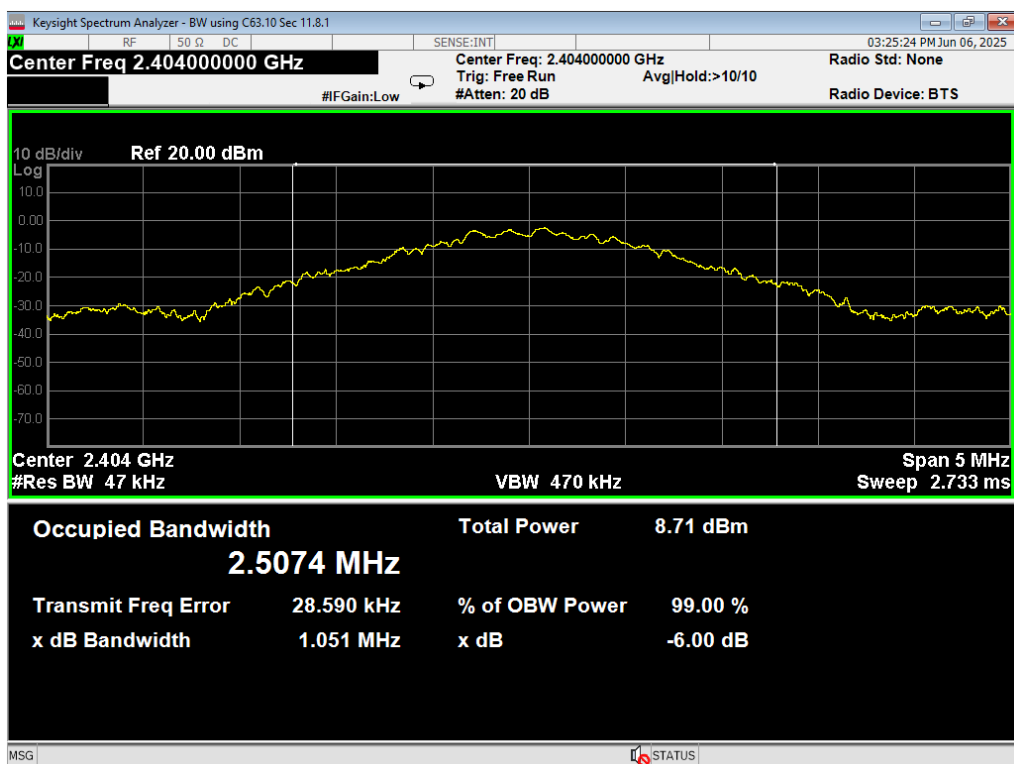


Occupied BW, BLE 1MB, 2440MHz

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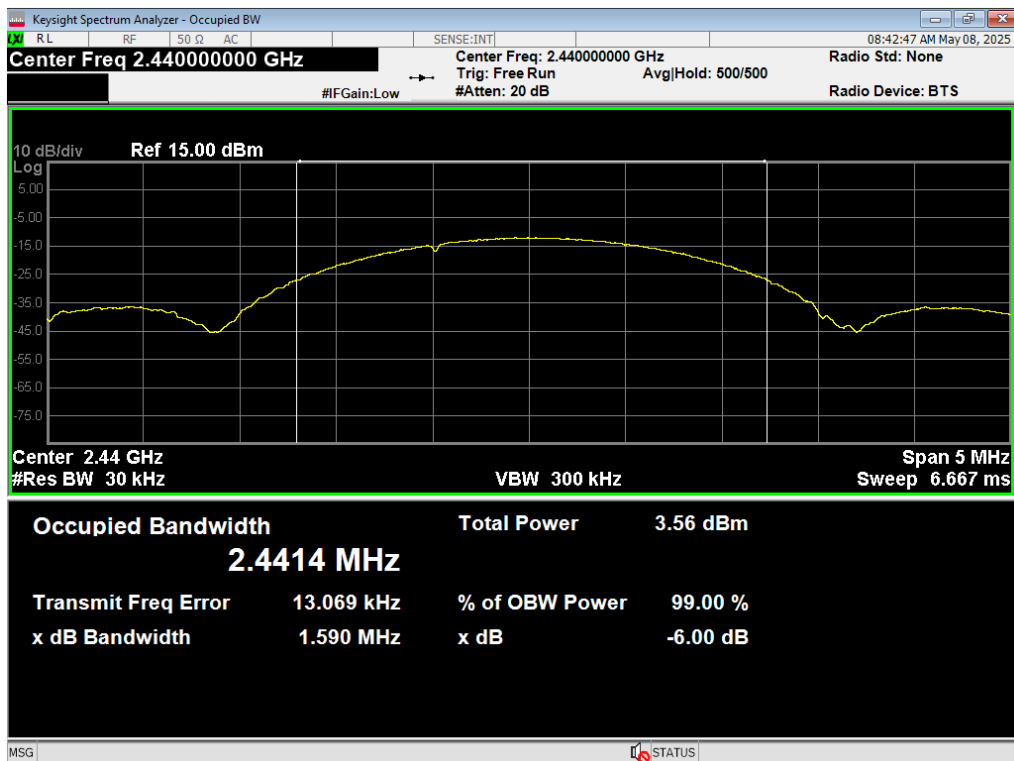


Occupied BW, BLE 1MB, 2480MHz

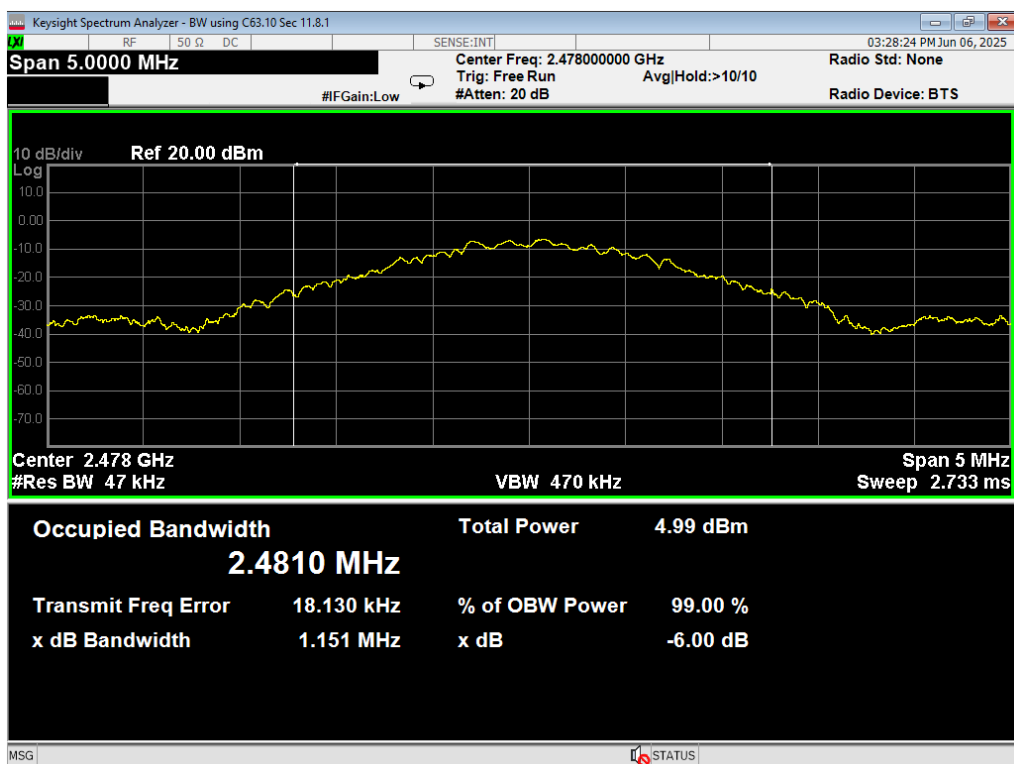


Occupied BW, BLE 2MB, 2404MHz

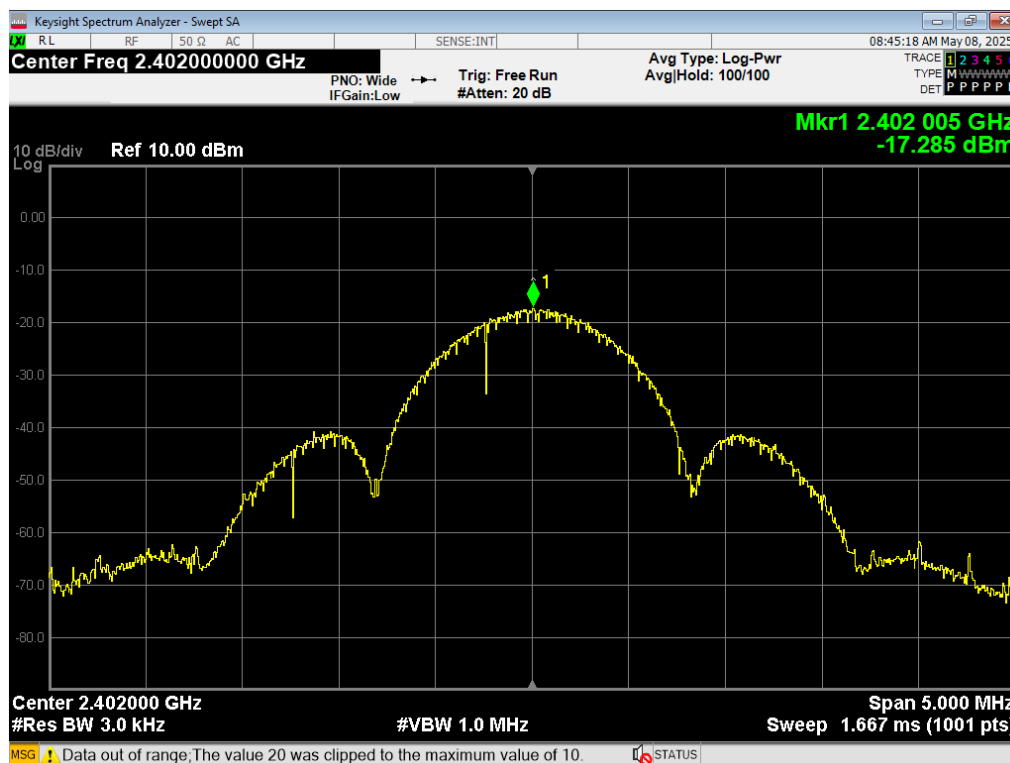
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Prepared for:	Garmin International, Inc.		



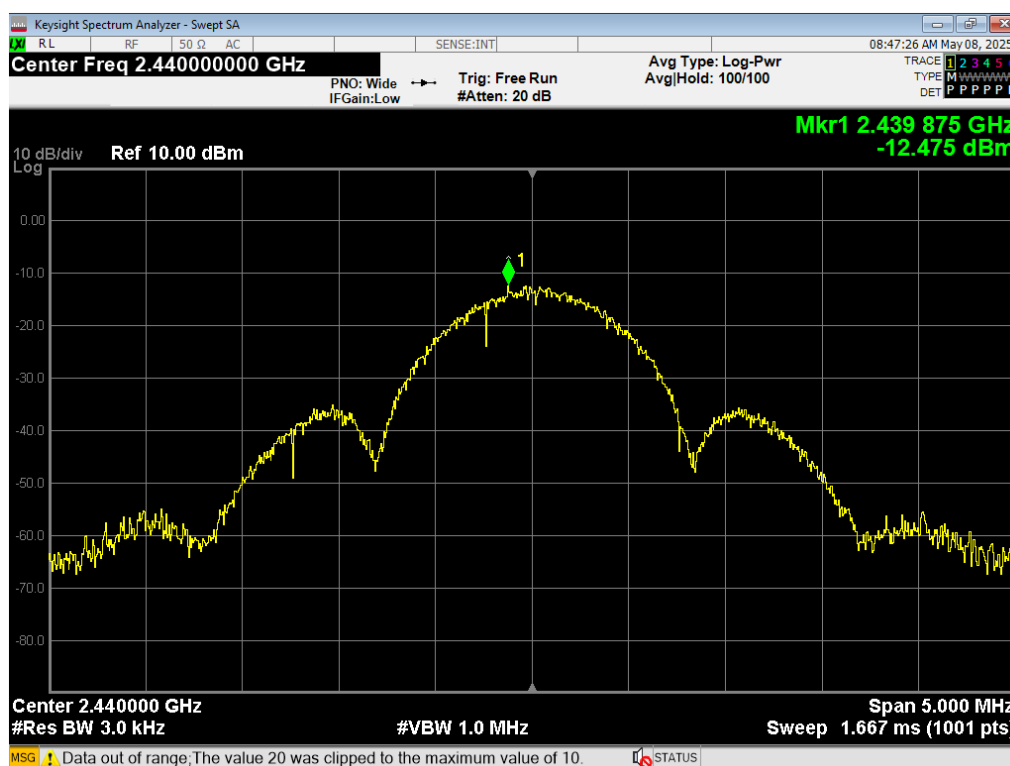
Occupied BW, BLE 2MB, 2440MHz



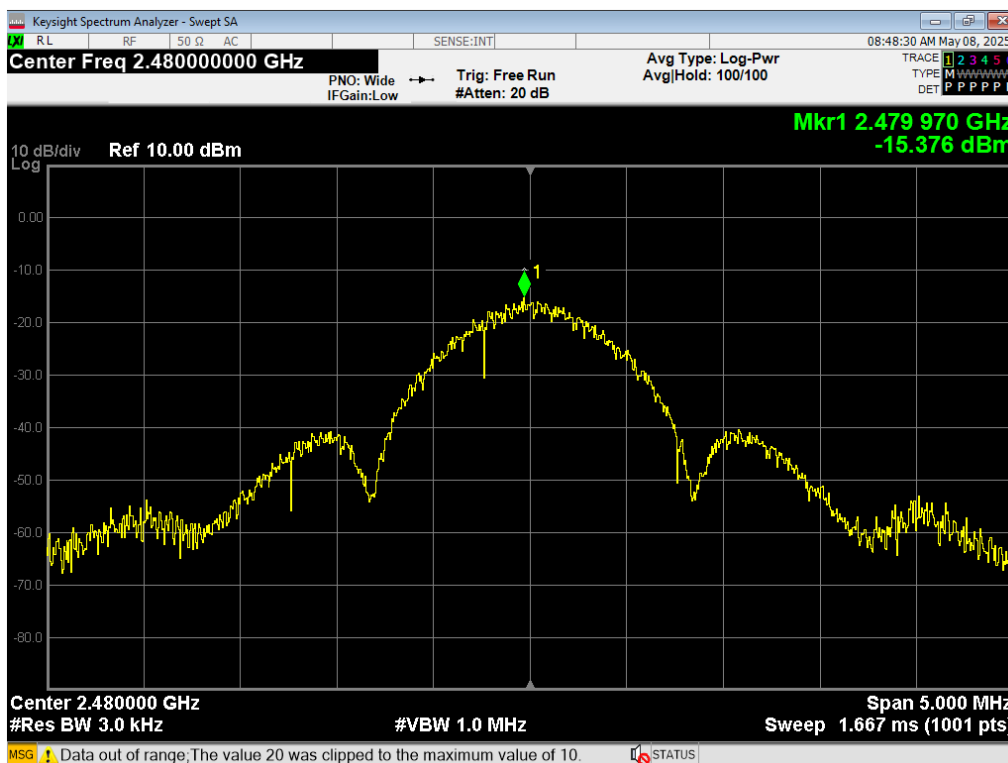
Occupied BW, BLE 2MB, 2480MHz



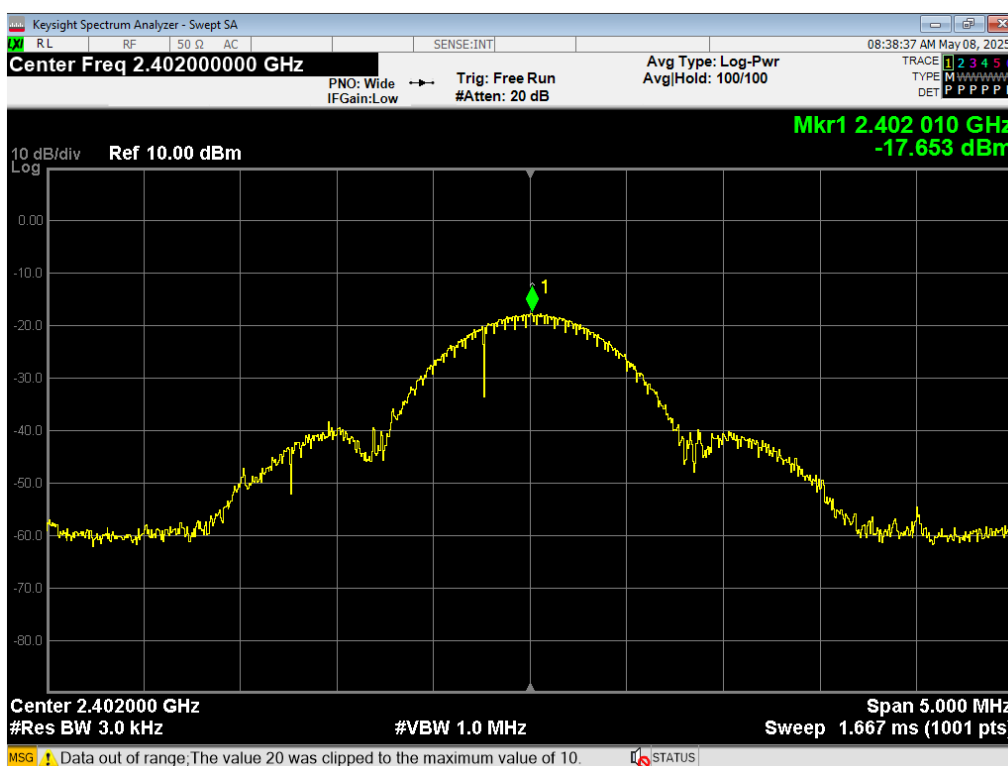
PSD, ANT GFSK, 2402MHz



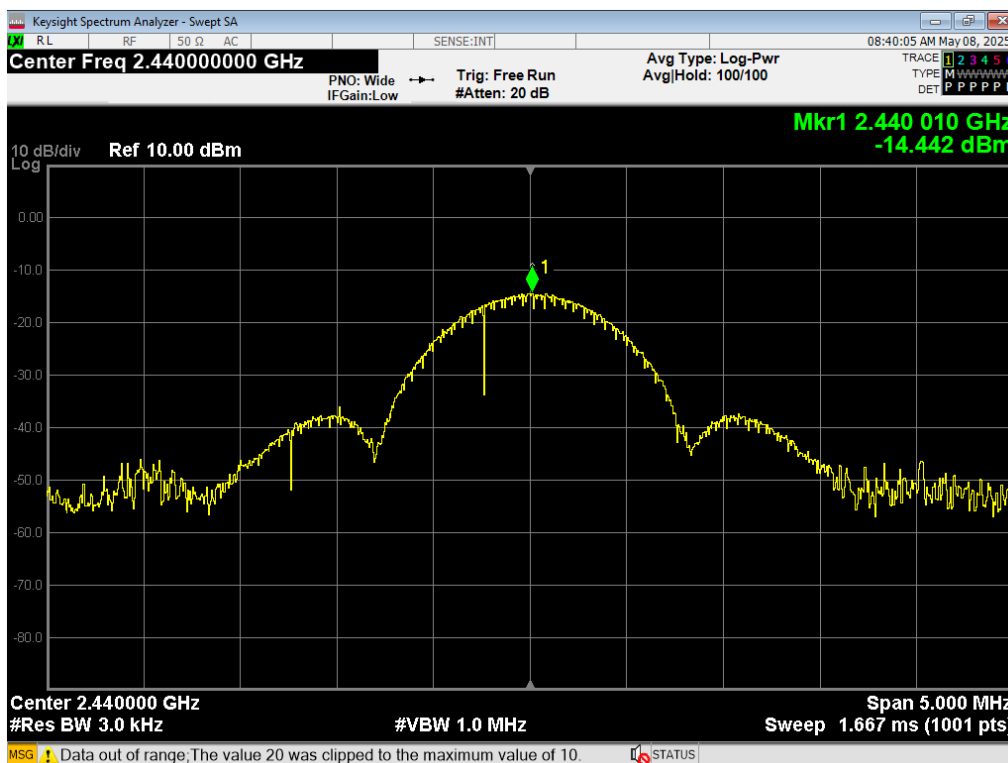
PSD, ANT GFSK, 2440MHz



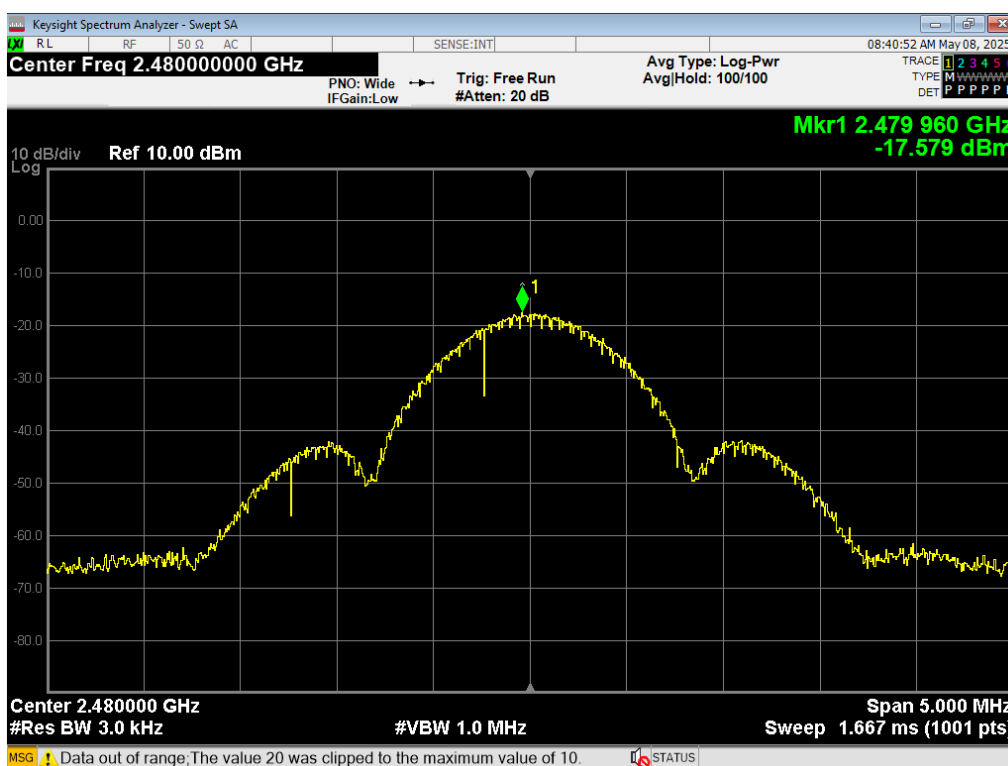
PSD, ANT GFSK, 2480MHz



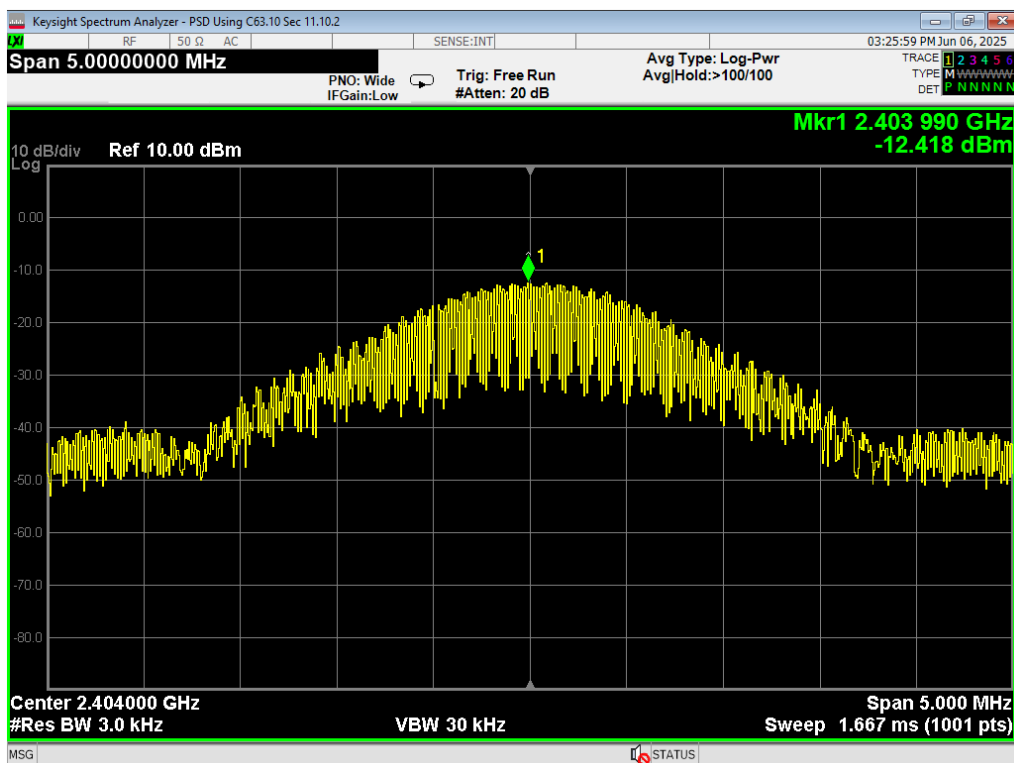
PSD, BLE 1MB, 2402MHz



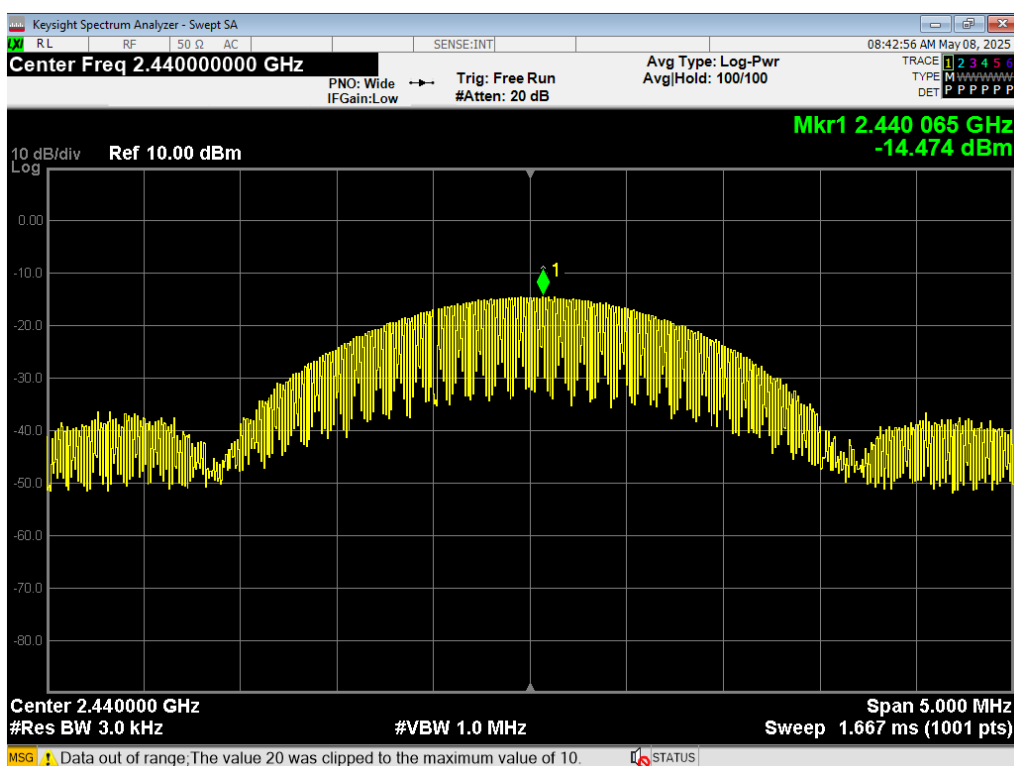
PSD, BLE 1MB, 2440MHz



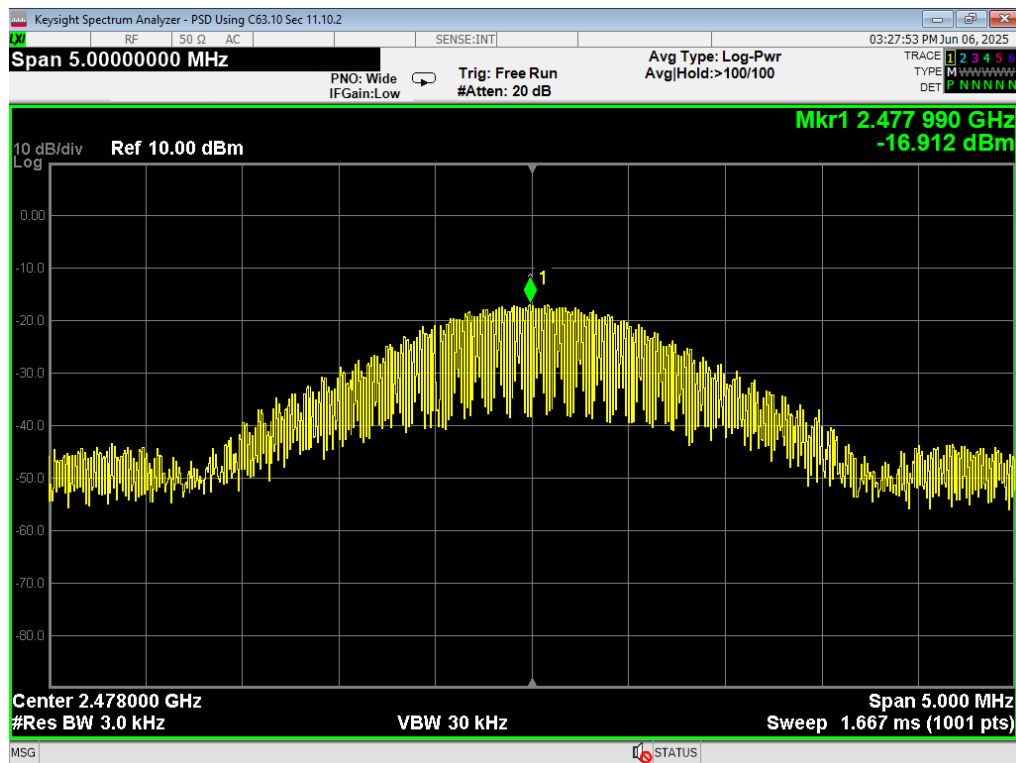
PSD, BLE 1MB, 2480MHz



PSD, BLE 2MB, 2404MHz



PSD, BLE 2MB, 2440MHz



PSD, BLE 2MB, 2480MHz



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Prepared for:	Garmin International, Inc.		

REPORT END

FCC/ISED Test Report

Prepared for: Garmin International, Inc.

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

Product: A04828

Test Report No: R20250124-00-E2 **Rev:** B

Approved by: 
Fox Lane
EMC Test Engineer

DATE: July 28, 2025

Total Pages: 81

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Prepared for:	Garmin International, Inc.		

REVISION PAGE

Rev. No.	Date	Description
0	11 July 2025	Issued by FLane Prepared by FLane, ESchmidt
A	22 July 2025	Added FVIN in Section 2.1, Added plots for 1-25GHz scans in Section 4.4 – ES
B	28 July 2025	Updated to new RSS-247 Issue 4

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	Prepared for:	Garmin International, Inc.		

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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 4

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 4 Section 6.3	Peak output power	Pass
FCC Part 15.247(a)(2) RSS-247 Issue 4 Section 6.3	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 4 Section 6.6, RSS-Gen Issue 5, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e) RSS-247 Issue 4 Section 6.3	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 4 Section 6.6	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 5, Section 8.8	Conducted Emissions	Pass



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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	A04828
FCC ID	IPH-04828
IC ID	1792A-04828
FVIN	1.01
EUT Received	8 May 2025
EUT Tested	8 May 2025- 6 June 2025
Serial No.	3489571855 (Radiated Sample) 3489571782 (Conducted Sample)
Operating Band	2400 – 2483.5 MHz
Device Type	☐ GMSK ☐ GFSK ☐ BT BR ☐ BT EDR 2MB ☐ BT EDR 3MB ☒ 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: PSAI05R-050Q GPN: 362-00118-00 (Representative Power Supply)

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	6.5MB/72.2MB

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

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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.

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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
EMCO Horn Antenna	3116	2576	July 31, 2023	July 30, 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, 2026
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	January 20, 2024	January 20, 2026
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	January 21, 2024	January 21, 2026
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	January 21, 2024	January 21, 2026
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	January 21, 2024	January 21, 2026
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	January 21, 2024	January 21, 2026
N connector bulkhead (control room)*	PE9128	NCEEBH2	January 21, 2024	January 21, 2026
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.

3.4 GENERAL TEST PROCEDURE AND SETUP FOR RADIO MEASUREMENTS

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.

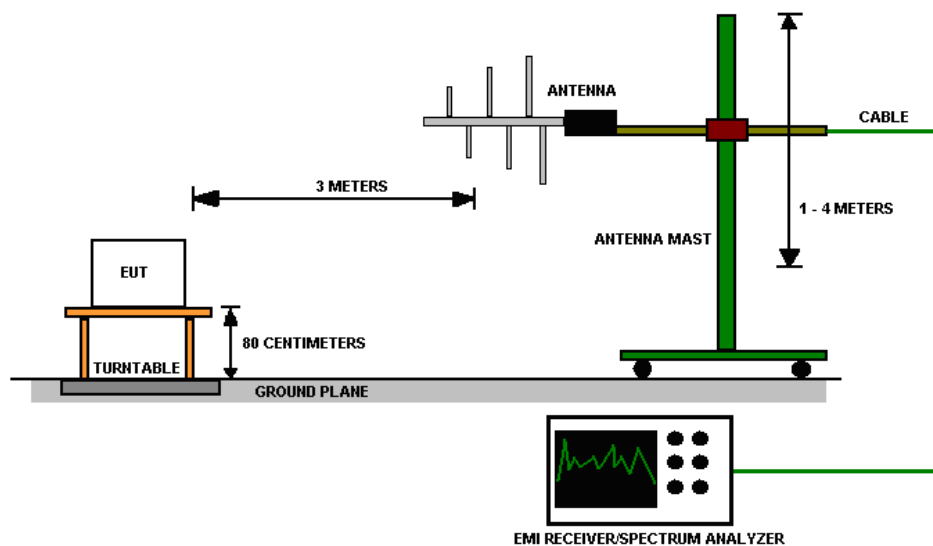


Figure 2 - Radiated Emissions Test Setup

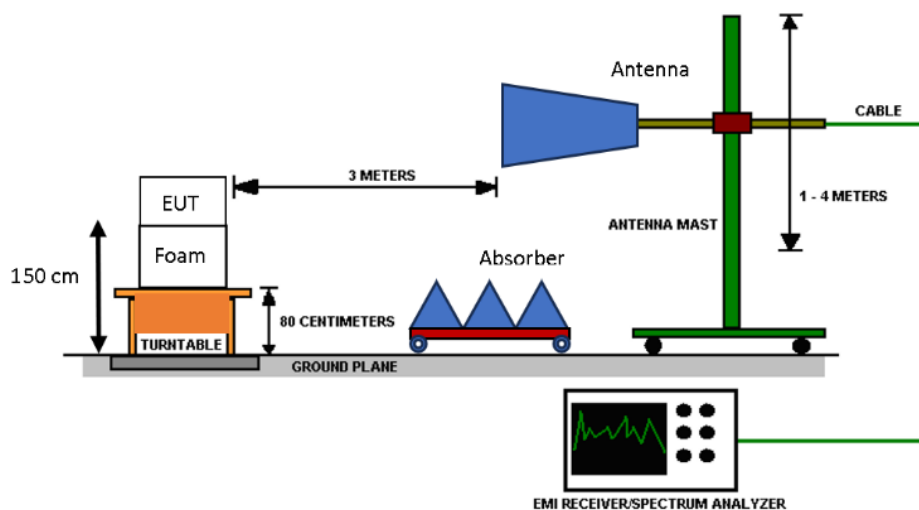


Figure 3 - Radiated Emissions Test Setup, >1GHz

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4.0 RESULTS

DTS Radio Measurements Low Data Rate							
CHANNEL	Transmitter	Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)	PSD (dBm)	RESULT		
Low	802.11b	14142	8626	-5.905	PASS		
Mid	802.11b	14274	8963	-6.279	PASS		
High	802.11b	14529	9016	-5.891	PASS		
Low	802.11g	16558	16540	-9.085	PASS		
Mid	802.11g	16590	16530	-13.411	PASS		
High	802.11g	16553	16540	-10.036	PASS		
Low	802.11n	17602	17720	-10.947	PASS		
Mid	802.11n	17616	17740	-10.599	PASS		
High	802.11n	17599	17720	-12.107	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	-28.193	9.253	37.45	30.00	PASS
Low	802.11g	2400.00	-30.463	7.392	37.86	30.00	PASS
Low	802.11n	2400.00	50.591	0.384	50.98	30.00	PASS
High	802.11b	2483.50	-45.889	10.269	56.16	30.00	PASS
High	802.11g	2483.50	-33.796	6.08	39.88	30.00	PASS
High	802.11n	2483.50	50.577	0.384	50.96	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	57.985	Peak	73.98	16.00	PASS
Low	802.11g	2390.00	67.551	Peak	73.98	6.43	PASS
Low	802.11n	2390.00	64.07	Peak	73.98	9.91	PASS
High	802.11b	2483.50	58.494	Peak	73.98	15.49	PASS
High	802.11g	2483.50	64.393	Peak	73.98	9.59	PASS
High	802.11n	2483.50	64.318	Peak	73.98	9.66	PASS
*Limit shown is the peak limit taken from FCC Part 15.209							



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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	46.783	0.231	47.01	Average	53.98	6.97	PASS
Low	802.11g	2390.00	51.976	0.388	52.36	Average	53.98	1.62	PASS
Low	802.11n	2390.00	50.591	0.384	50.98	Average	53.98	3.00	PASS
High	802.11b	2483.50	48.065	0.231	48.30	Average	53.98	5.68	PASS
High	802.11g	2483.50	51.019	0.388	51.41	Average	53.98	2.57	PASS
High	802.11n	2483.50	50.577	0.384	50.96	Average	53.98	3.02	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 true 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	17.956	0.115	18.071	64.140	PASS
Mid	802.11b	17.936	0.115	18.051	63.845	PASS
High	802.11b	18.200	0.115	18.315	67.847	PASS
Low	802.11g	16.304	0.194	16.498	44.648	PASS
Mid	802.11g	16.764	0.194	16.958	49.637	PASS
High	802.11g	15.042	0.194	15.236	33.389	PASS
Low	802.11n	14.588	0.192	14.780	30.062	PASS
Mid	802.11n	15.327	0.192	15.519	35.639	PASS
High	802.11n	13.910	0.192	14.102	25.717	PASS

Limit = 30dBm



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DTS Radio Measurements, High Data Rate

CHANNEL	Transmitter	Occupied Bandwidth (kHz)	6 dB Bandwidth (kHz)	PSD (dBm)	RESULT
Low	802.11b	13657	8934	-3.796	PASS
Mid	802.11b	13930	8889	-3.445	PASS
High	802.11b	13989	8982	-3.16	PASS
Low	802.11g	16497	16520	-12.695	PASS
Mid	802.11g	16492	16530	-12.936	PASS
High	802.11g	16495	16530	-12.907	PASS
Low	802.11n	17523	17670	-16.65	PASS
Mid	802.11n	17513	17620	-17.06	PASS
High	802.11n	17539	17640	-16.536	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	-29.517	10.681	40.20	30.00	PASS
Low	802.11g	2400.00	-37.853	2.121	39.97	30.00	PASS
Low	802.11n	2400.00	45.639	3.466	49.10	30.00	PASS
High	802.11b	2483.50	-41.907	11.285	53.19	30.00	PASS
High	802.11g	2483.50	-41.92	2.171	44.09	30.00	PASS
High	802.11n	2483.50	47.246	3.466	50.71	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	58.112	Peak	73.98	15.87	PASS
Low	802.11g	2390.00	63.025	Peak	73.98	10.96	PASS
Low	802.11n	2390.00	60.315	Peak	73.98	13.67	PASS
High	802.11b	2483.50	59.162	Peak	73.98	14.82	PASS
High	802.11g	2483.50	62.53	Peak	73.98	11.45	PASS
High	802.11n	2483.50	61.01	Peak	73.98	12.97	PASS

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



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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	46.378	1.668	48.05	Peak	53.98	5.93	PASS
Low	802.11g	2390.00	48.572	3.651	52.22	Peak	53.98	1.76	PASS
Low	802.11n	2390.00	45.639	3.466	49.10	Peak	53.98	4.88	PASS
High	802.11b	2483.50	47.217	1.668	48.88	Peak	53.98	5.10	PASS
High	802.11g	2483.50	49.384	3.651	53.04	Peak	53.98	0.94	PASS
High	802.11n	2483.50	47.246	3.466	50.71	Peak	53.98	3.27	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	16.293	0.834	17.127	51.605	PASS
Mid	802.11b	16.447	0.834	17.281	53.467	PASS
High	802.11b	17.916	0.834	18.750	74.987	PASS
Low	802.11g	11.626	1.826	13.452	22.139	PASS
Mid	802.11g	11.401	1.826	13.227	21.022	PASS
High	802.11g	11.469	1.826	13.295	21.353	PASS
Low	802.11n	8.777	1.733	10.510	11.245	PASS
Mid	802.11n	9.064	1.733	10.797	12.014	PASS
High	802.11n	8.617	1.733	10.350	10.839	PASS

Limit = 30dBm



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4.1 OUTPUT POWER

Test Method:

Power measurements were performed using ANSI C63.10 Section 11.

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.



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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

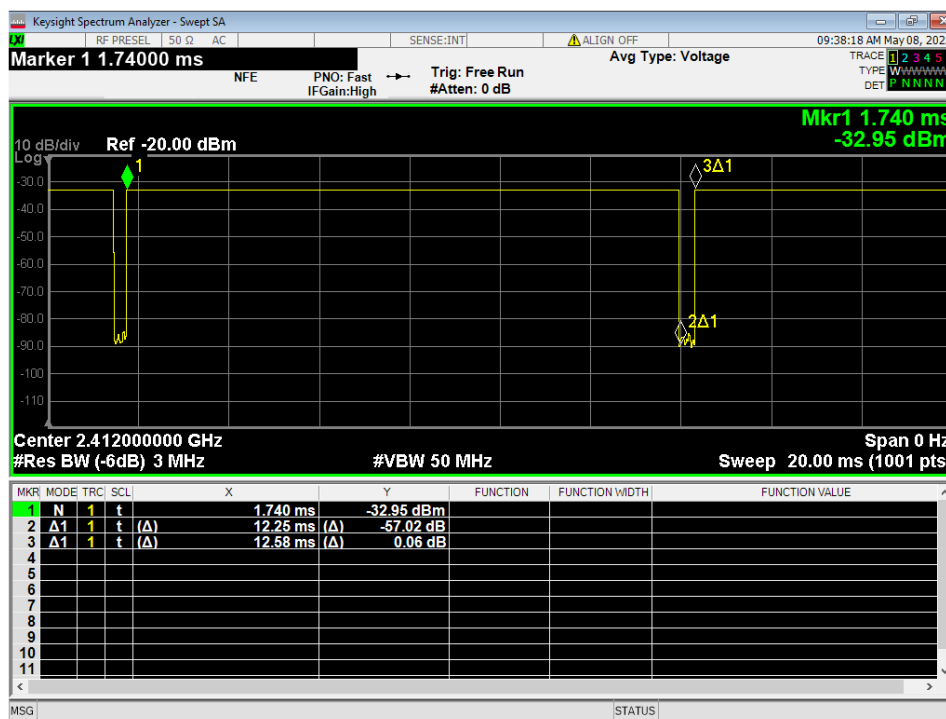


Figure 4 – Duty Cycle, 802.11b 1MB

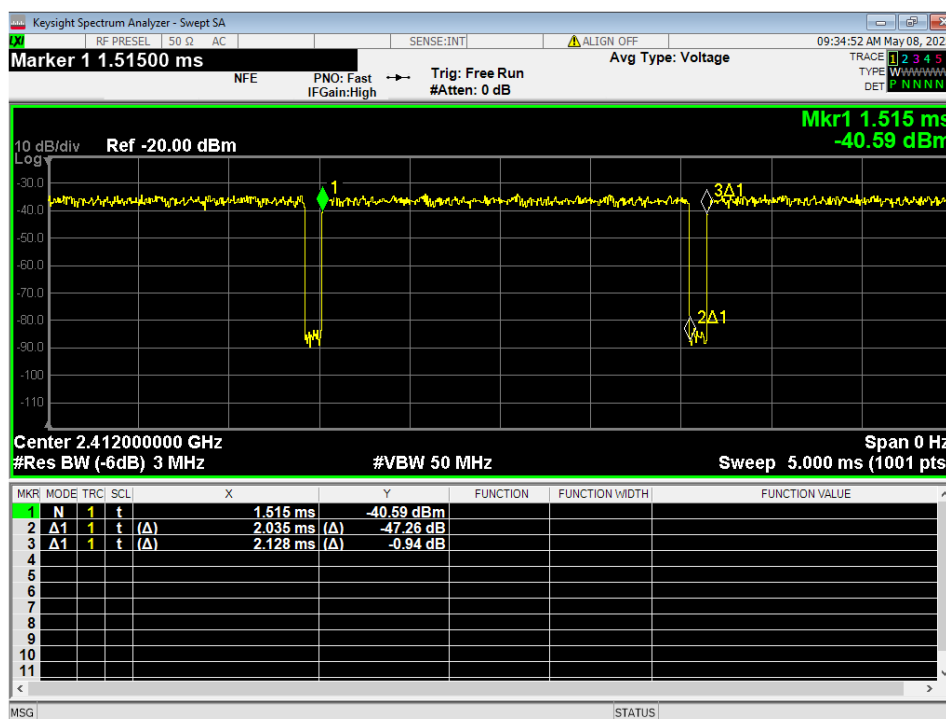


Figure 5 – Duty Cycle, 802.11G 6MB

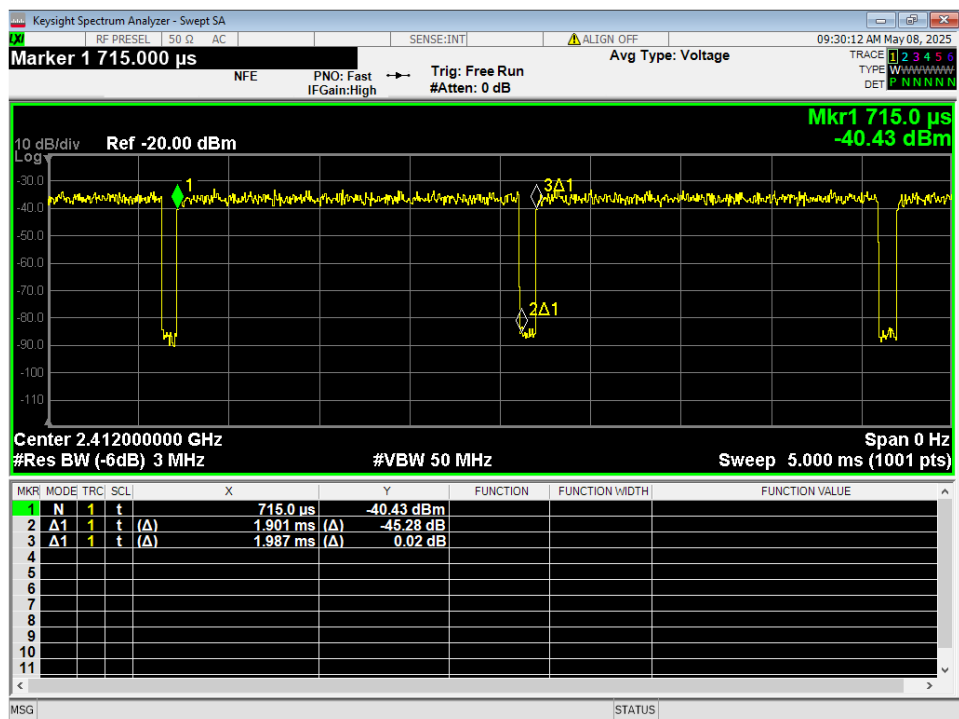


Figure 6 – Duty Cycle, 802.11N 6.5MB

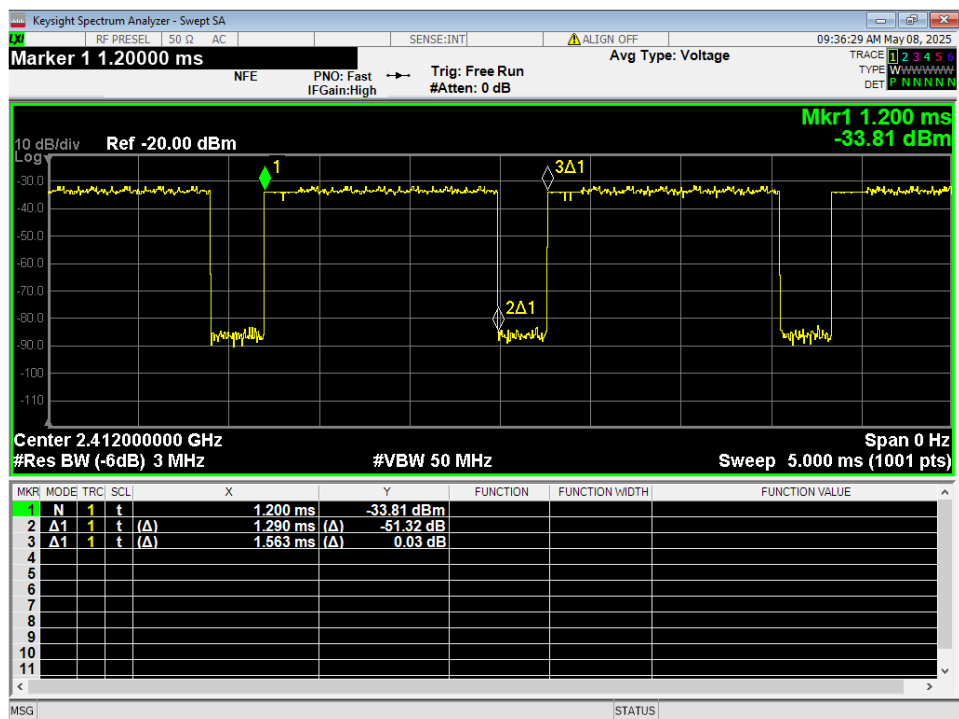


Figure 7 – Duty Cycle, 802.11b 11MB

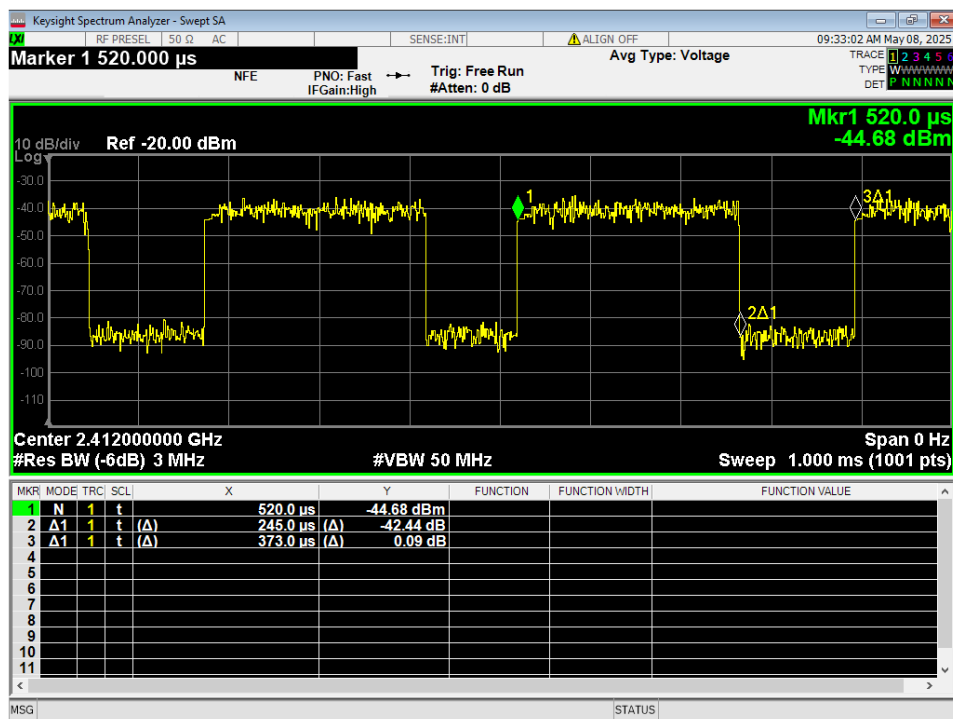


Figure 8 – Duty Cycle, 802.11G 54MB

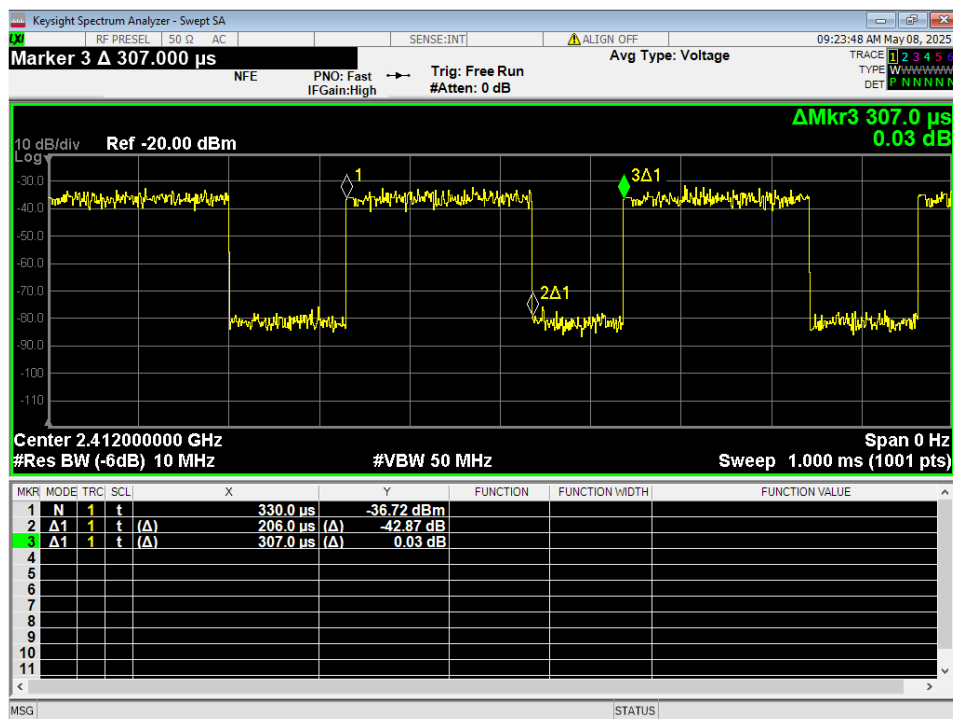


Figure 9 – Duty Cycle, 802.11N 72.2MB

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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: 0.974

Duty cycle correction factor (for emissions) for Wi-Fi B 1MB: 0.231dB

Duty Cycle correction factor (for power) for Wi-Fi B 1MB: 0.115dB

Duty cycle for Wi-Fi G 6MB: 0.956

Duty cycle correction factor (for emissions) for Wi-Fi G 6MB: 0.388dB

Duty Cycle correction factor (for power) for Wi-Fi G 6MB: 0.194dB

Duty cycle for Wi-Fi N 6.5MB: 0.957

Duty cycle correction factor (for emissions) for Wi-Fi N 6.5MB: 0.384dB

Duty Cycle correction factor (for power) for Wi-Fi N 6.5MB: 0.192dB

Duty cycle for Wi-Fi B 11MB: 0.825

Duty cycle correction factor (for emissions) for Wi-Fi B 11MB: 1.668 dB

Duty Cycle correction factor (for power) for Wi-Fi B 11MB: 0.834dB

Duty cycle for Wi-Fi G 54MB: 0.657

Duty cycle correction factor (for emissions) for Wi-Fi G 54MB: 3.651dB

Duty Cycle correction factor (for power) for Wi-Fi G 54MB: 1.826dB

Duty cycle for Wi-Fi N 72.2MB: 0.671

Duty cycle correction factor (for emissions) for Wi-Fi N 72.2MB: 3.466dB

Duty Cycle correction factor (for power) for Wi-Fi N 72.2MB: 1.733dB

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.



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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:

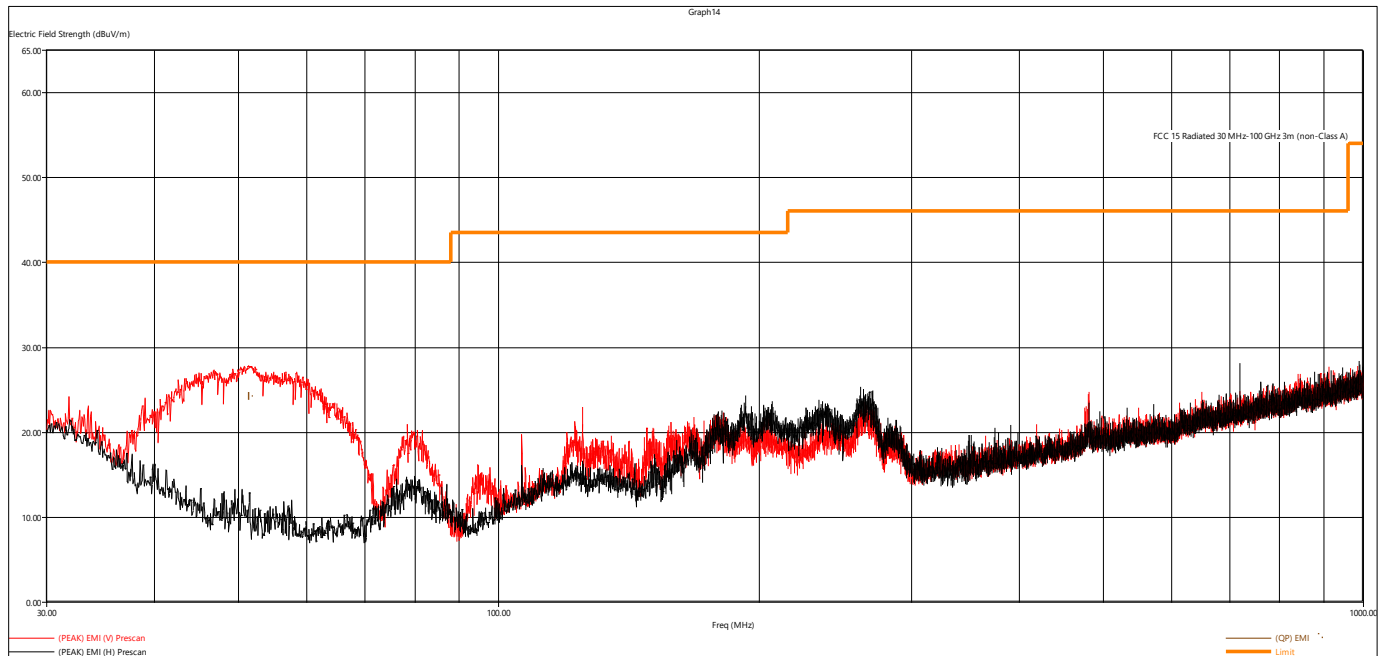


Figure 10 - Radiated Emissions Plot, Receive

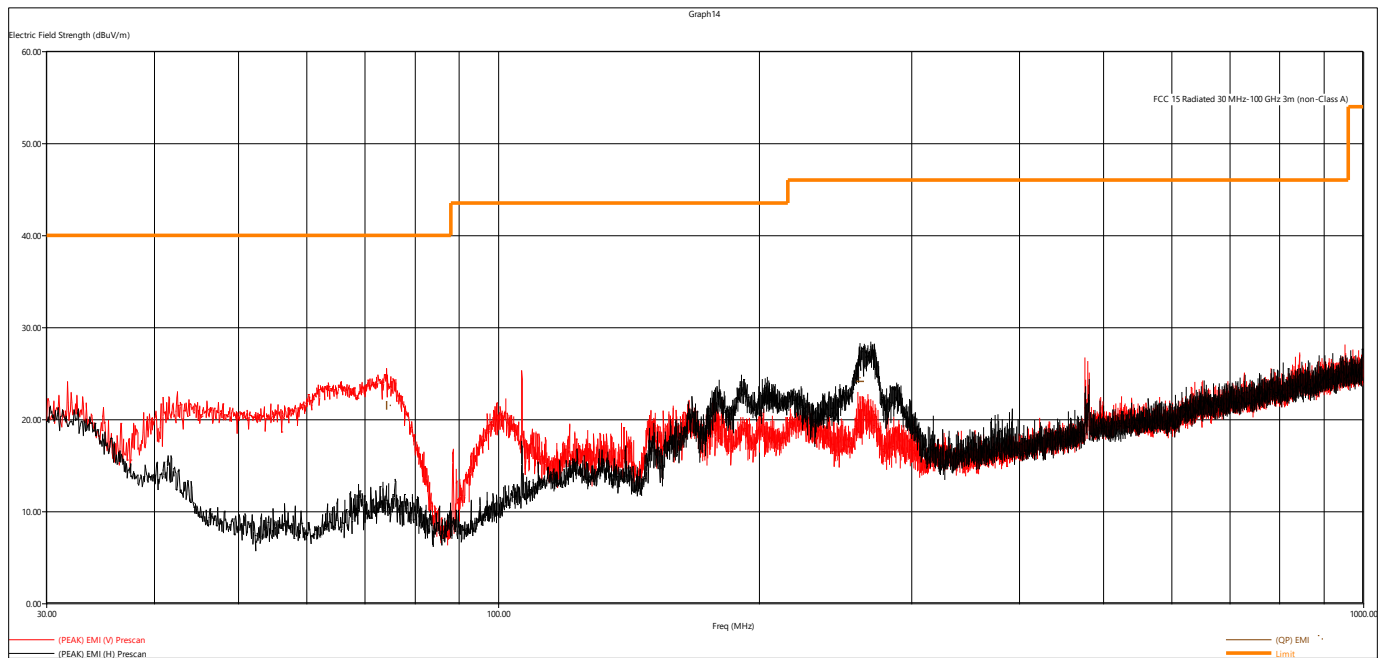


Figure 11 - Radiated Emissions Plot, 802.11b 1MB

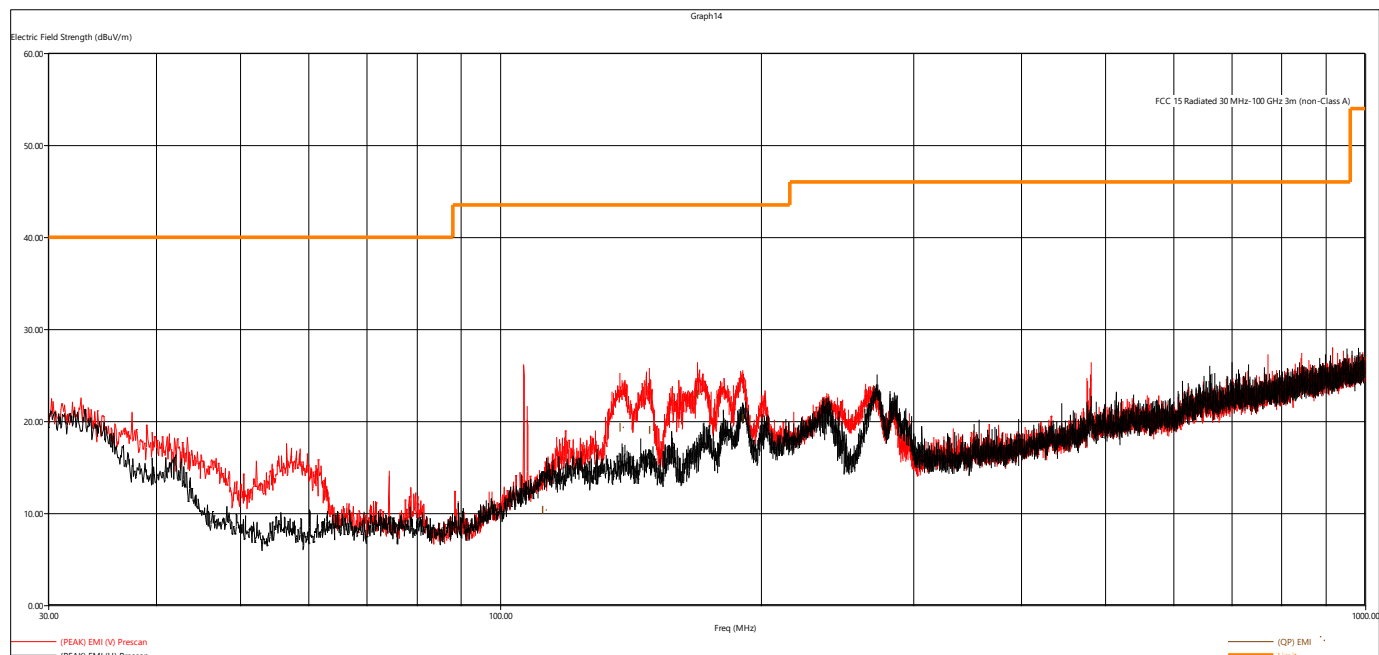


Figure 12 - Radiated Emissions Plot, 802.11b 11MB

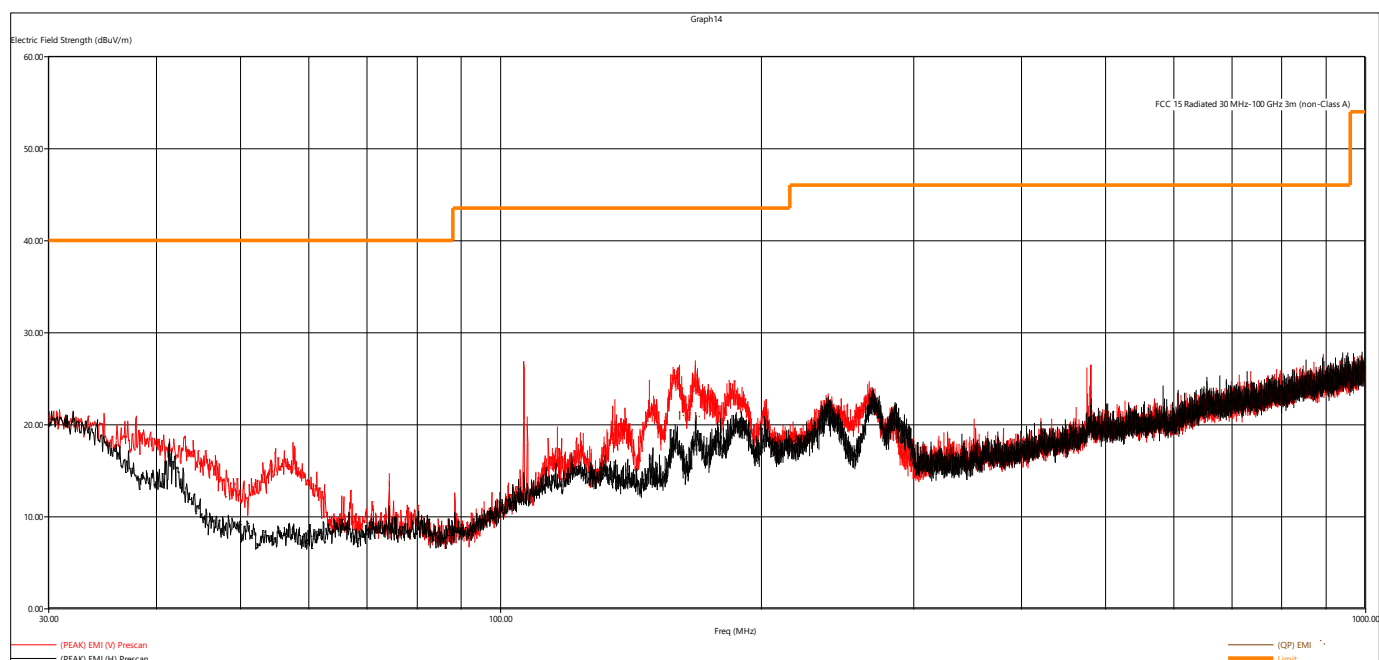


Figure 13 - Radiated Emissions Plot, 802.11g 6MB

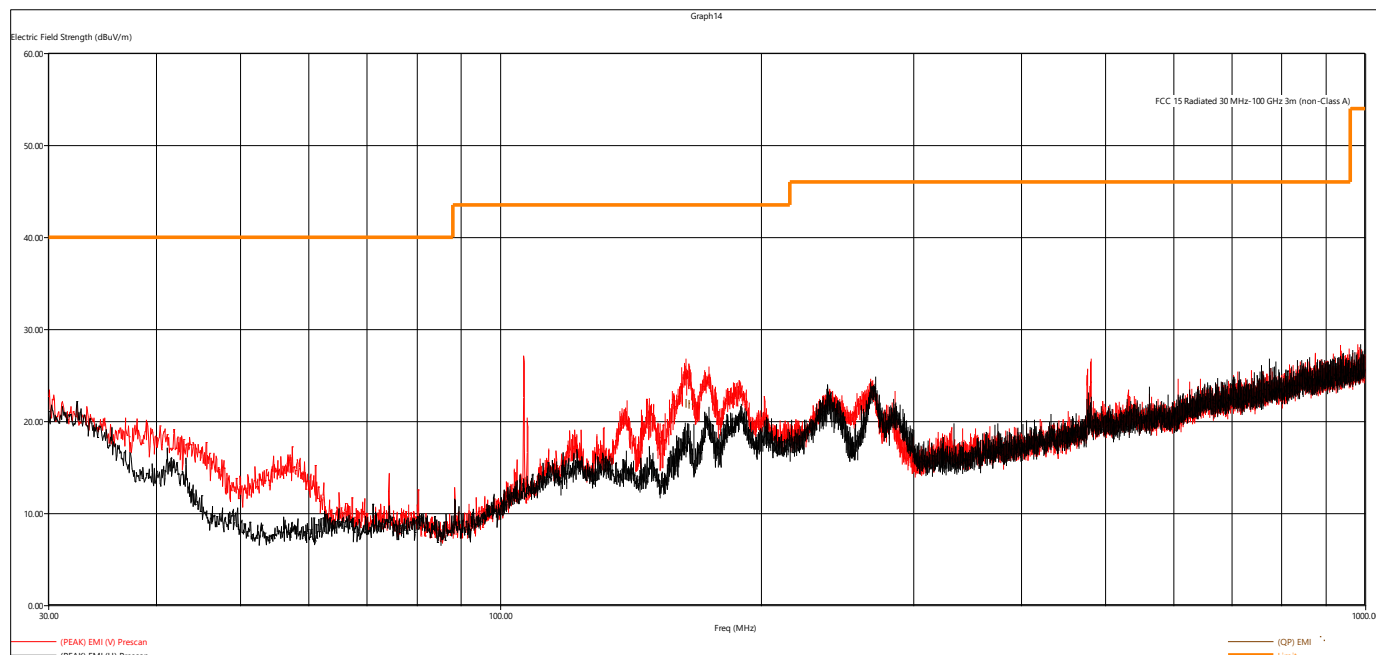


Figure 14 - Radiated Emissions Plot, 802.11g 54MB

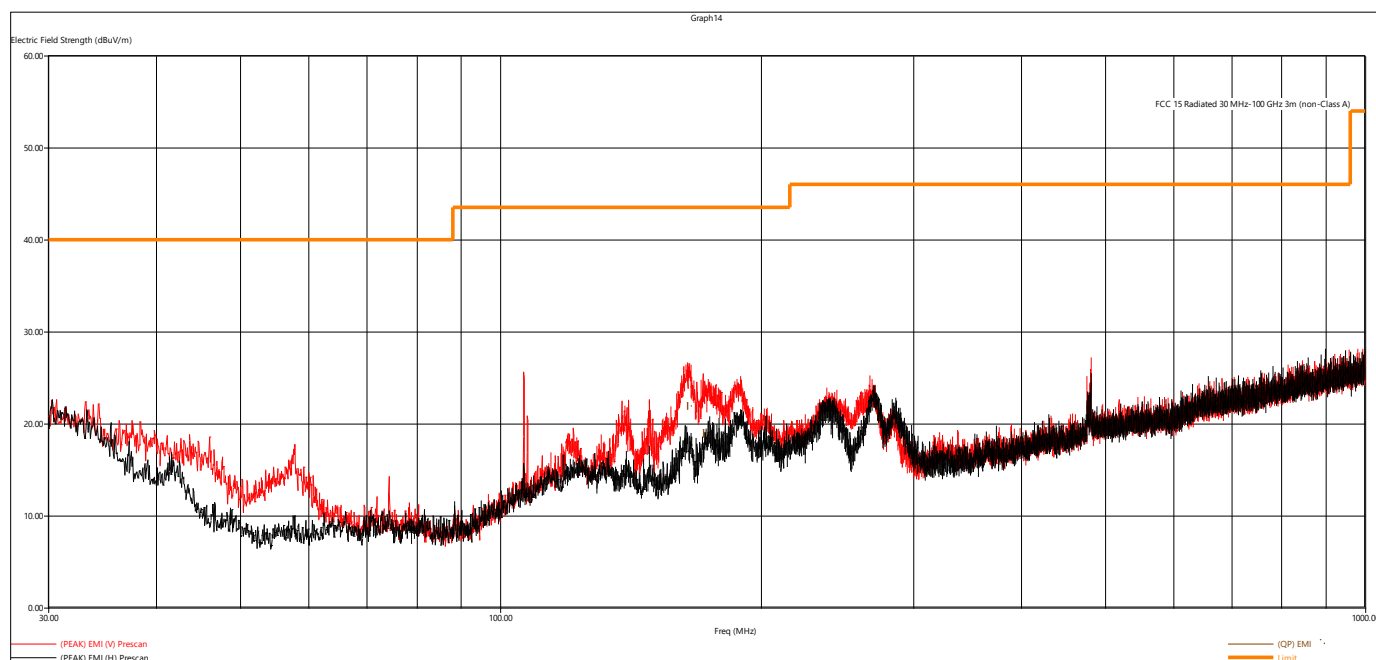


Figure 15 - Radiated Emissions Plot, 802.11n 6.5MB

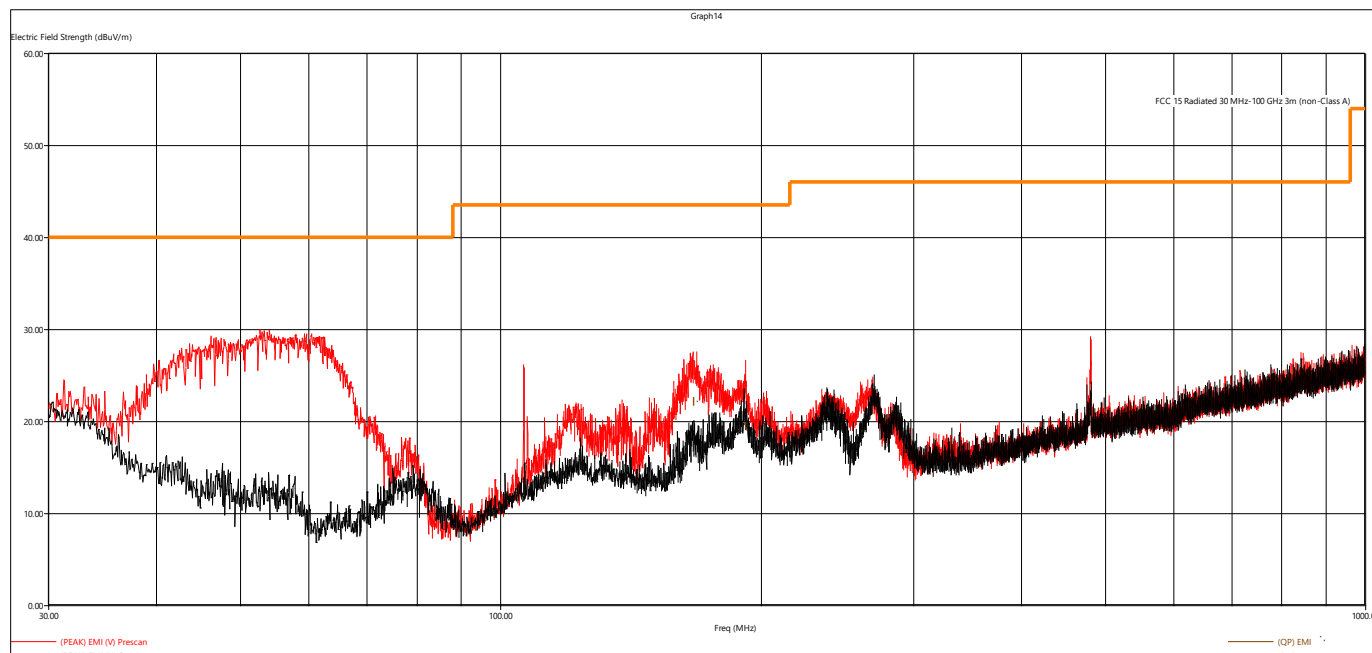


Figure 16 - Radiated Emissions Plot, 802.11n 72.2MB

Quasi-Peak Measurements, 802.11x							
Frequency	Level	Limit	Margin	Height	Angle	Pol	Modulation
MHz	dBμV/m	dBμV/m	dB	cm.	deg.		
51.349920	24.23	40.00	15.77	105.91	51.50	V	RX
261.564000	24.10	46.02	21.92	124.23	254.50	H	802.11b 1MB
74.213280	21.52	40.00	18.48	127.82	140.75	V	802.11b 1MB
137.187360	19.26	43.52	24.26	134.50	155.75	V	802.11b 11MB
148.427760	18.97	43.52	24.55	105.61	84.75	V	802.11b 11MB
168.847200	22.89	43.52	20.63	107.10	138.50	V	802.11b 11MB
190.461360	20.31	43.52	23.21	114.32	128.00	V	802.11b 11MB
160.731840	20.91	43.52	22.61	120.35	166.75	V	802.11g 6MB
167.812800	20.78	43.52	22.74	115.22	129.00	V	802.11g 6MB
163.659120	21.87	43.52	21.65	104.05	131.75	V	802.11g 54MB
165.006240	21.79	43.52	21.73	120.05	150.50	V	802.11g 54MB
164.069040	21.90	43.52	21.62	107.70	159.50	V	802.11n 6.5MB
171.335520	18.88	43.52	24.64	116.29	124.25	V	802.11n 6.5MB
166.541280	22.08	43.52	21.44	109.91	151.50	V	802.11n 72.2MB
191.869680	19.44	43.52	24.08	129.19	177.75	V	802.11n 72.2MB

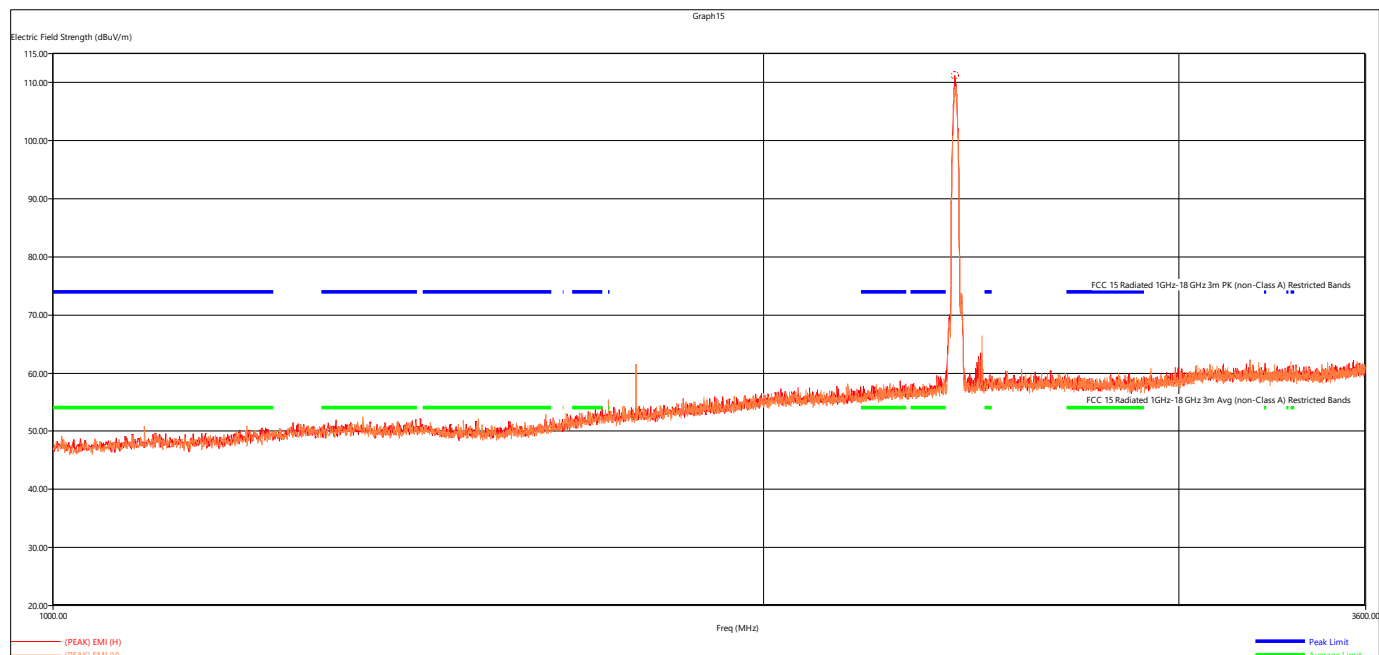


Figure 17 - Radiated Emissions Plot, 1-3.6GHz, 802.11b 11MB Low

Plot shows overages due to added attenuation to prevent receiver saturation; spurious emissions were investigated and found to be at least 6dB below applicable limits

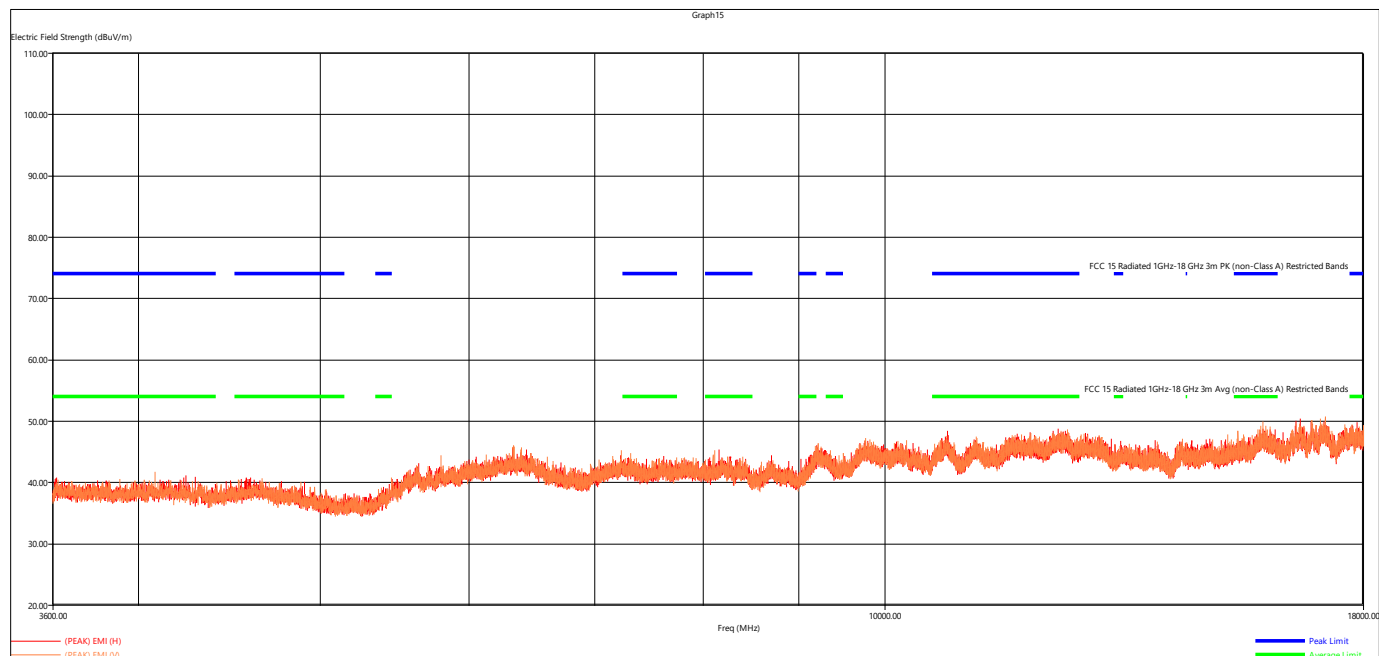


Figure 18 - Radiated Emissions Plot, 3.6-18GHz, 802.11b 11MB Low

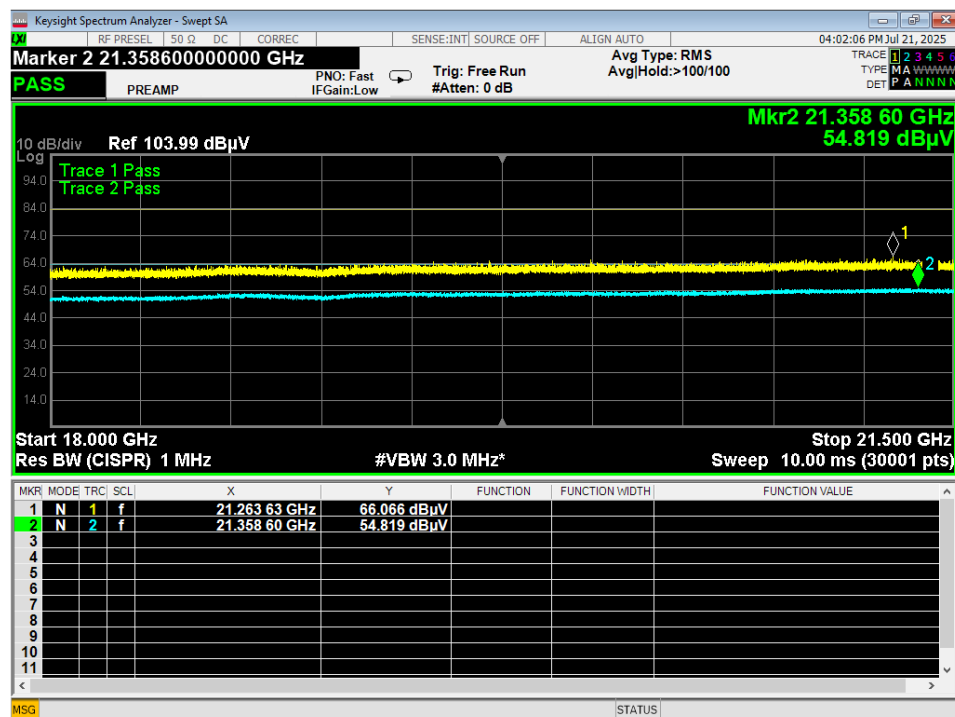


Figure 19 – Radiated Emissions Plot, 18-21.5GHz, 802.11b 1MB Mid, 1m test distance

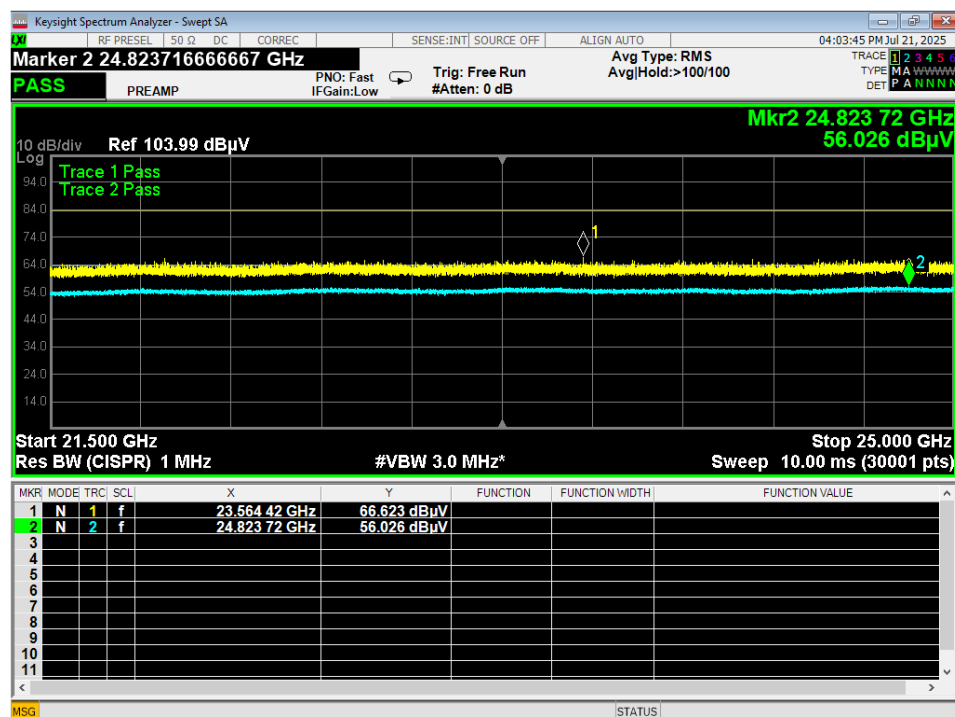


Figure 20 - Radiated Emissions Plot, 21.5-25GHz, 802.11b 1MB Mid, 1m test distance



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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. Margin value = Limit value – Emission level
4. The worst-case plots from the 1-25GHz range are shown above. No measurements were found to be within 10dB of the applicable limits and therefore were not tabulated.



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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.

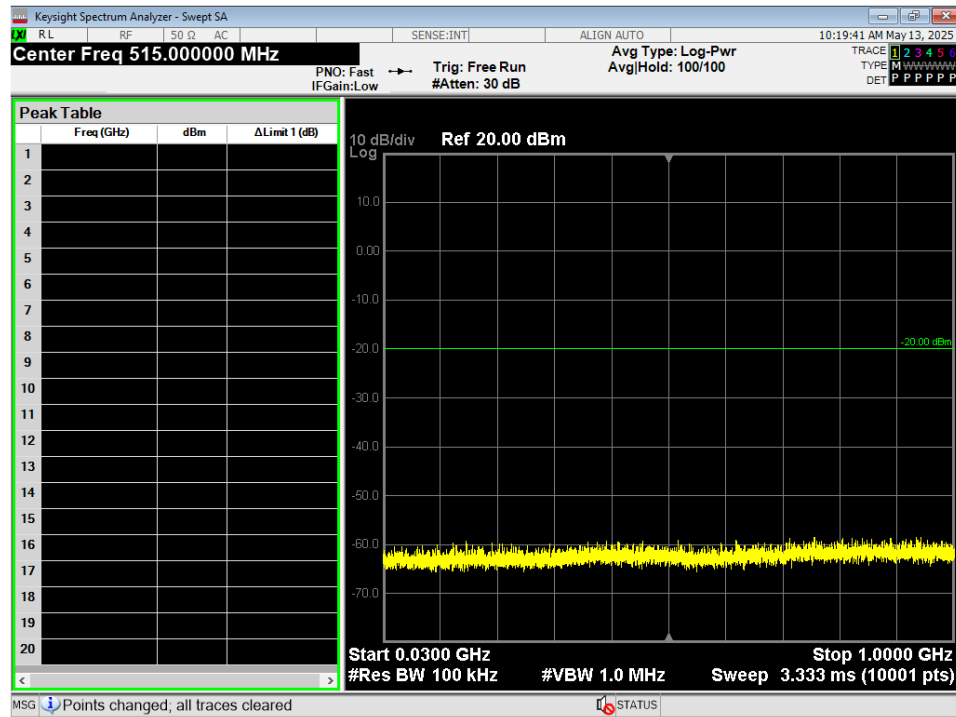


Figure 21 – Conducted Spurious Plot, WIFI 802.11b, 30M – 1G, Mid

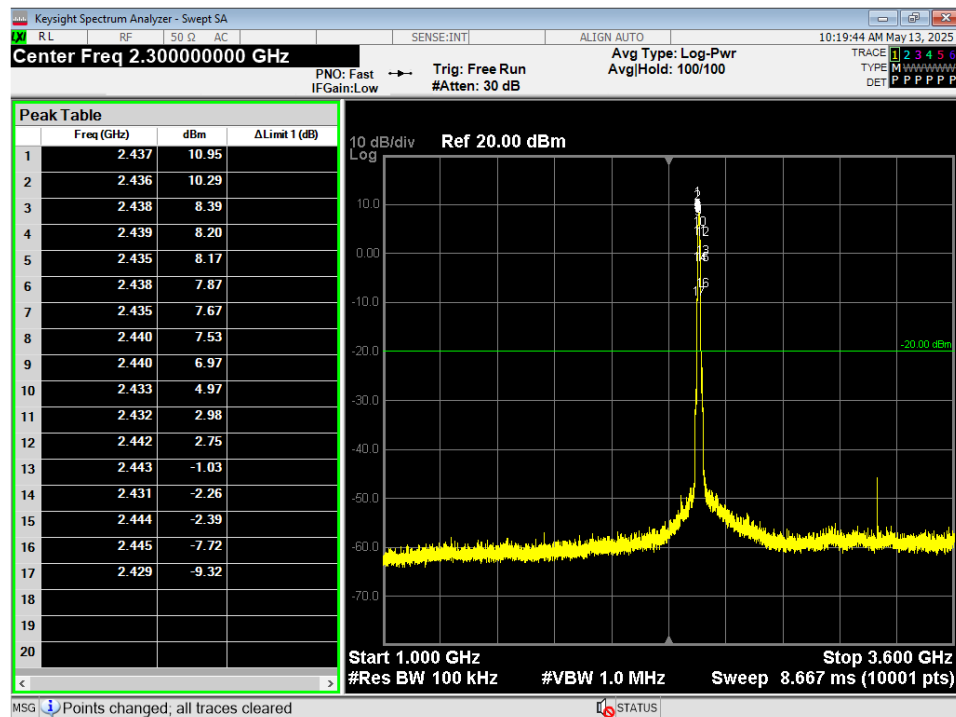


Figure 22 - Conducted Spurious Plot, WIFI 802.11b, 1G – 3.6G, Mid

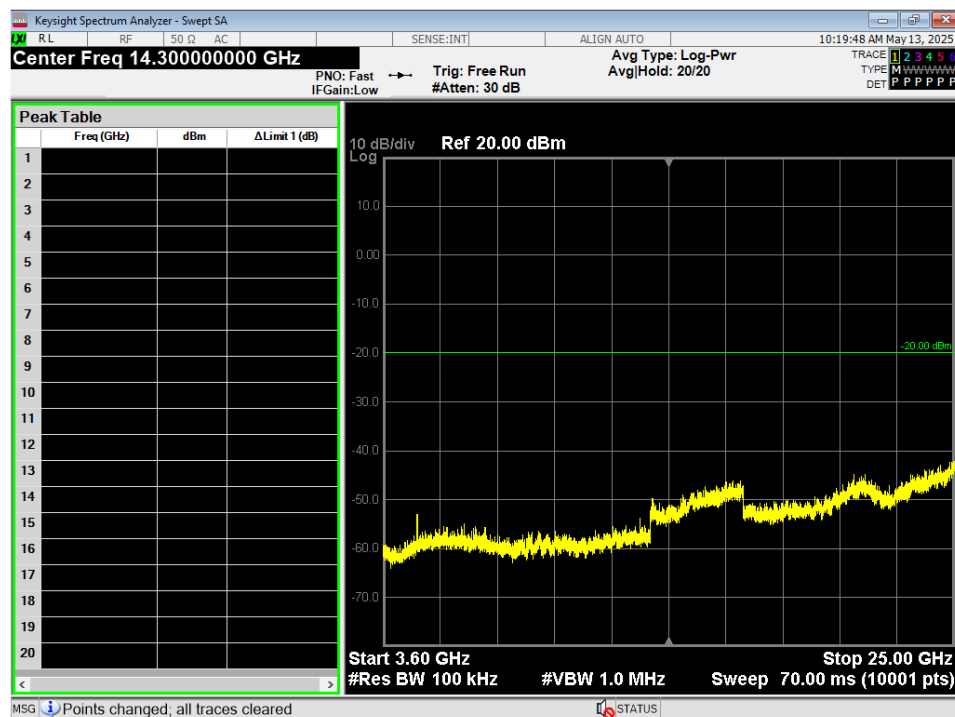


Figure 23 - Conducted Spurious Plot, WIFI 802.11b, 3.6G – 25G, Mid

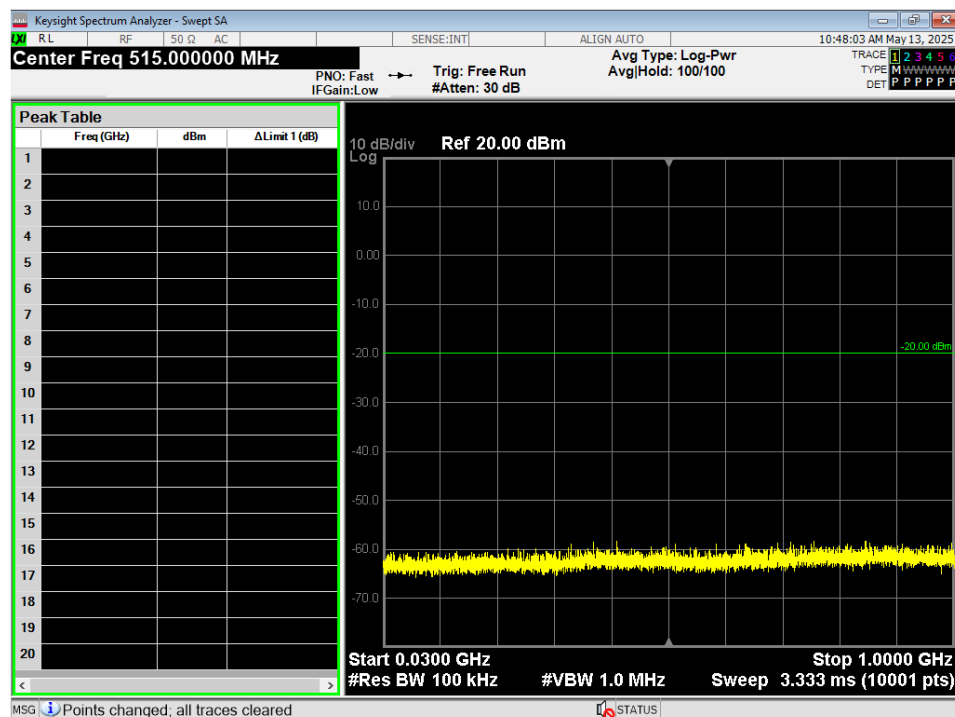


Figure 24 - Conducted Spurious Plot, WIFI 802.11g, 30M – 1G, Low

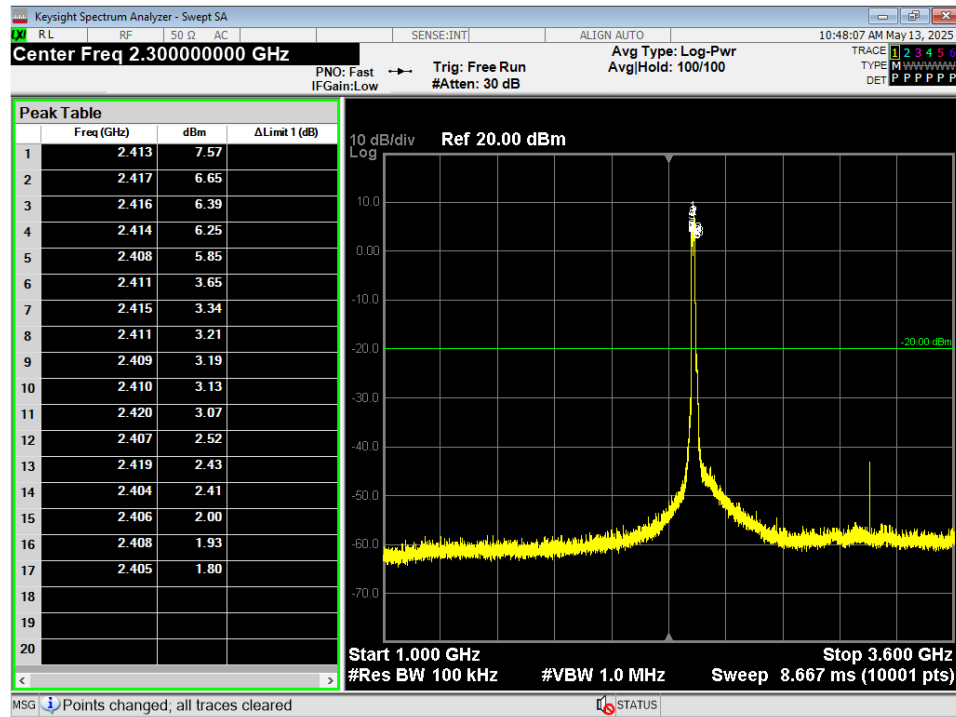


Figure 25 - Conducted Spurious Plot, WIFI 802.11g, 1G – 3.6G, Low

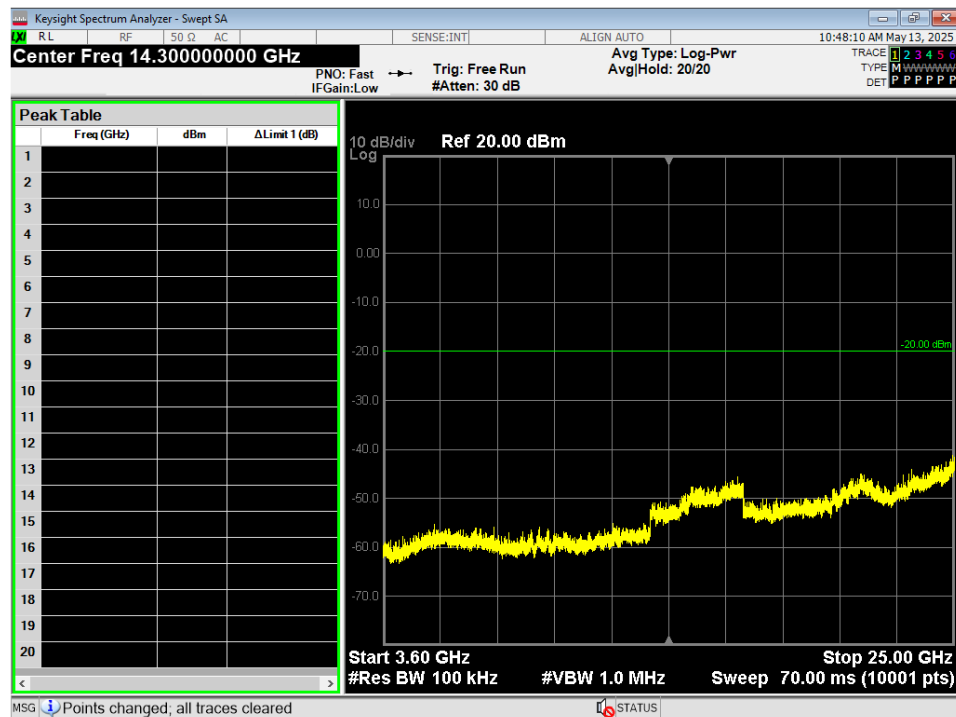


Figure 26 - Conducted Spurious Plot, WIFI 802.11g, 3.6G – 25G, Low

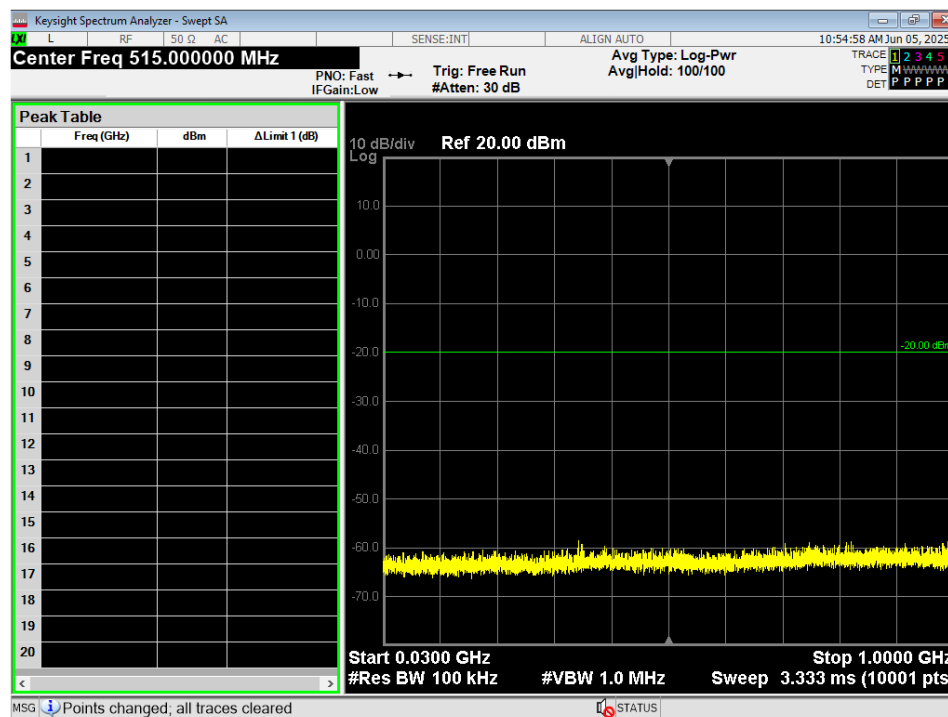


Figure 27 - Conducted Spurious Plot, WIFI 802.11n, 30M – 1G, Low

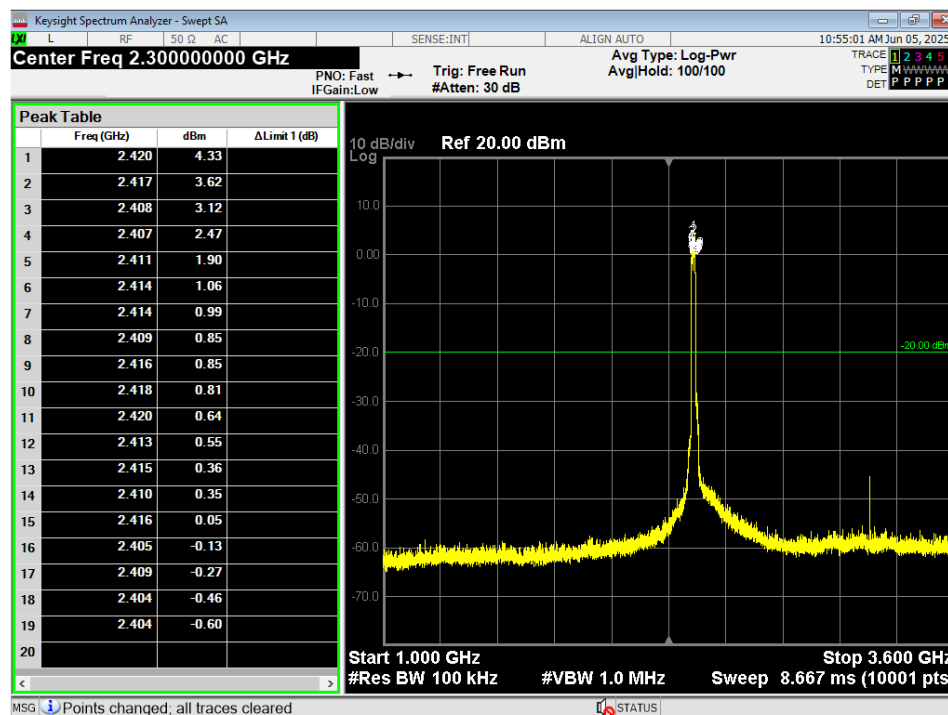


Figure 28 - Conducted Spurious Plot, WIFI 802.11n, 1G – 3.6G, Low

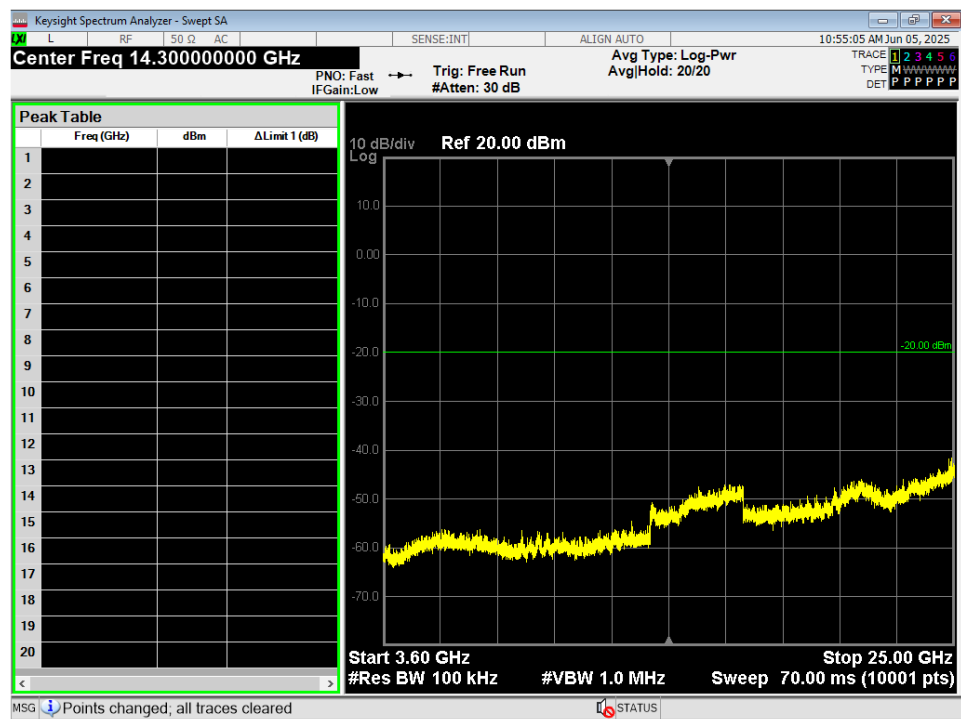


Figure 29 - Conducted Spurious Plot, WIFI 802.11n, 3.6G – 25G, Low

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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.



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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.

4.8 CONDUCTED AC MAINS EMISSIONS

Test Method: ANSI C63.10-2020, Section(s) 6.2

Limits for conducted emissions measurements:

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Test Procedures:

- a. The EUT was placed 0.8m above a ground reference plane and 0.4 meters from the conducting wall of a shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). The LISN provides 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference as well as the ground.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits are not reported.
- d. Results were compared to the 15.207 limits.

Deviation from the test standard:

No deviation

EUT operating conditions:

Details can be found in section 2.1 of this report.

Test Results:

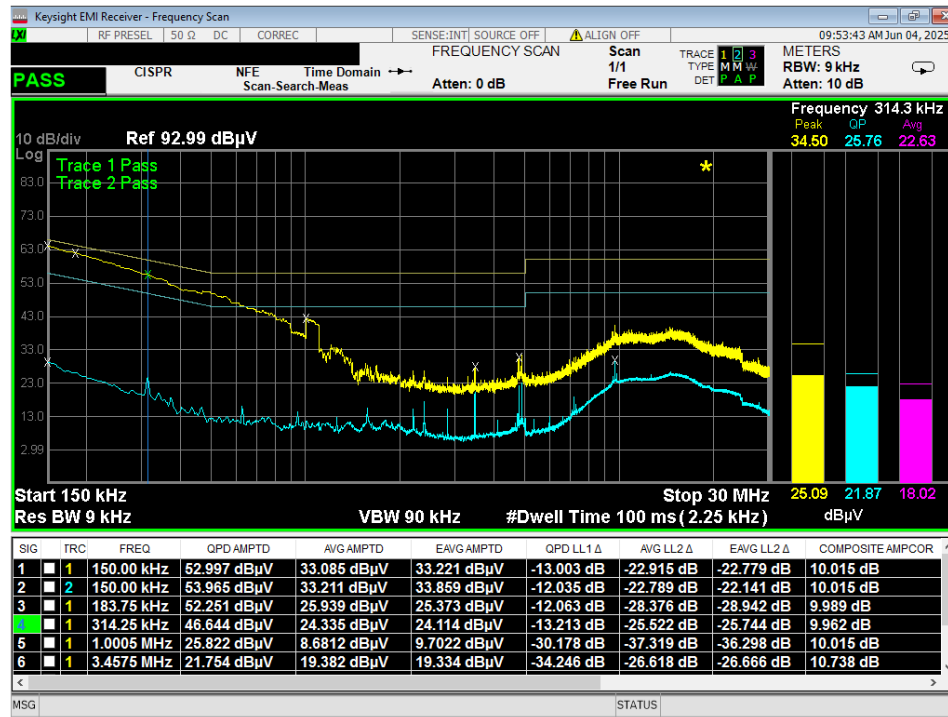


Figure 30 – Conducted Emissions Plot, charging on dock, TX, Line

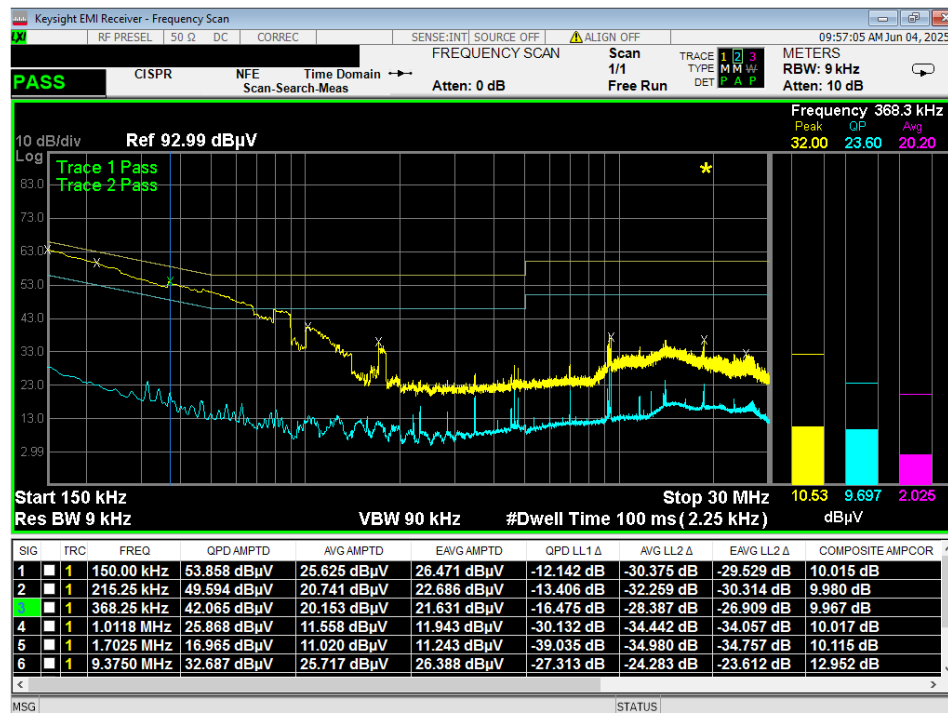


Figure 31 – Conducted Emissions Plot, charging on dock, TX, Neutral

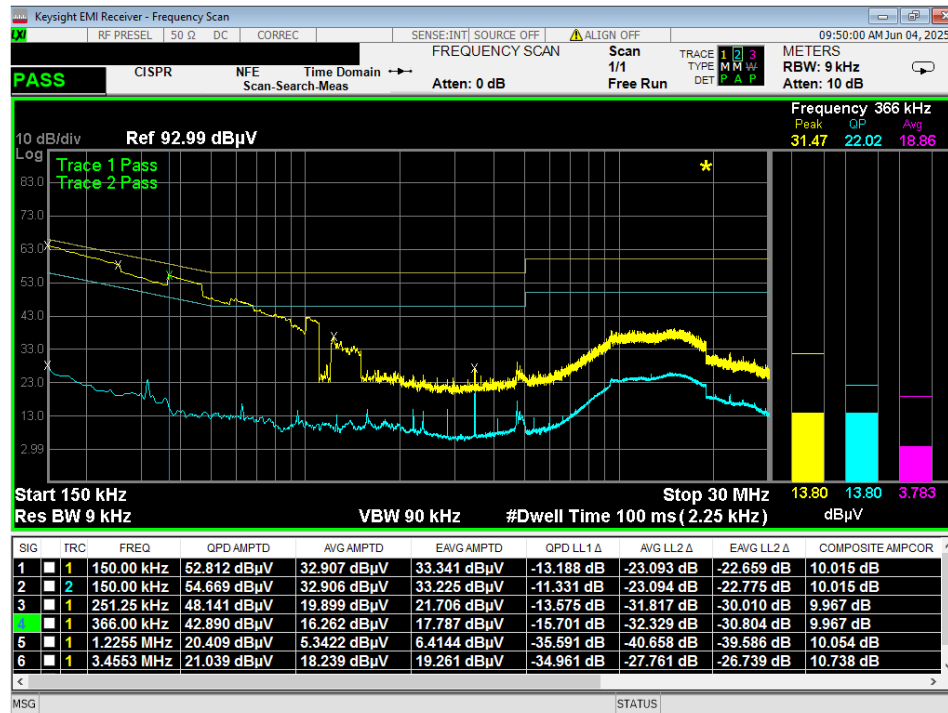


Figure 32 – Conducted Emissions Plot, charging on dock, IDLE, Line

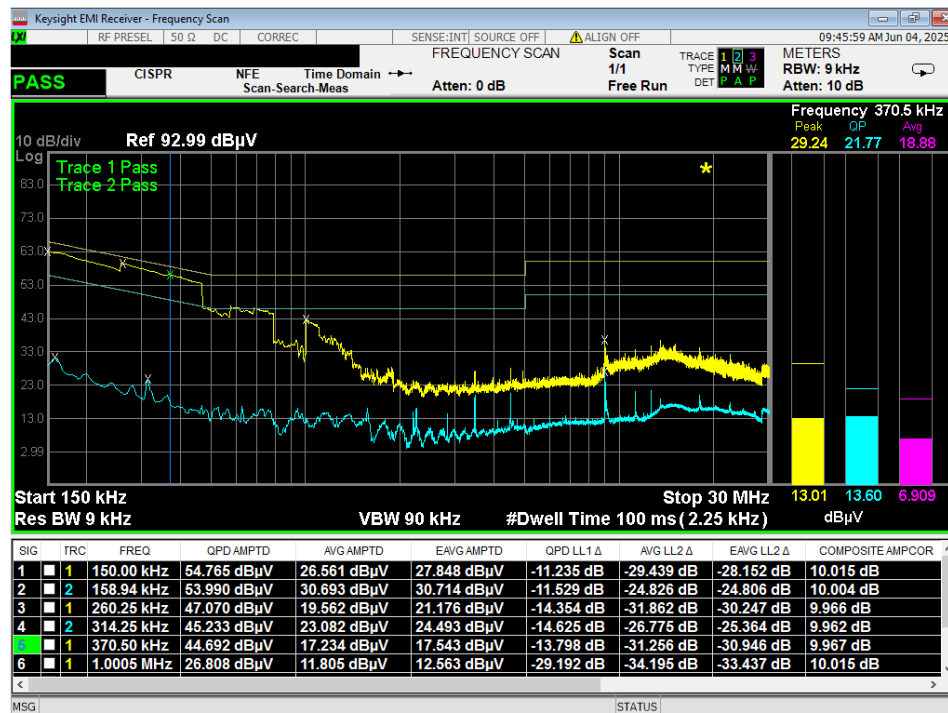


Figure 33 – Conducted Emissions Plot, charging on dock, IDLE, Neutral

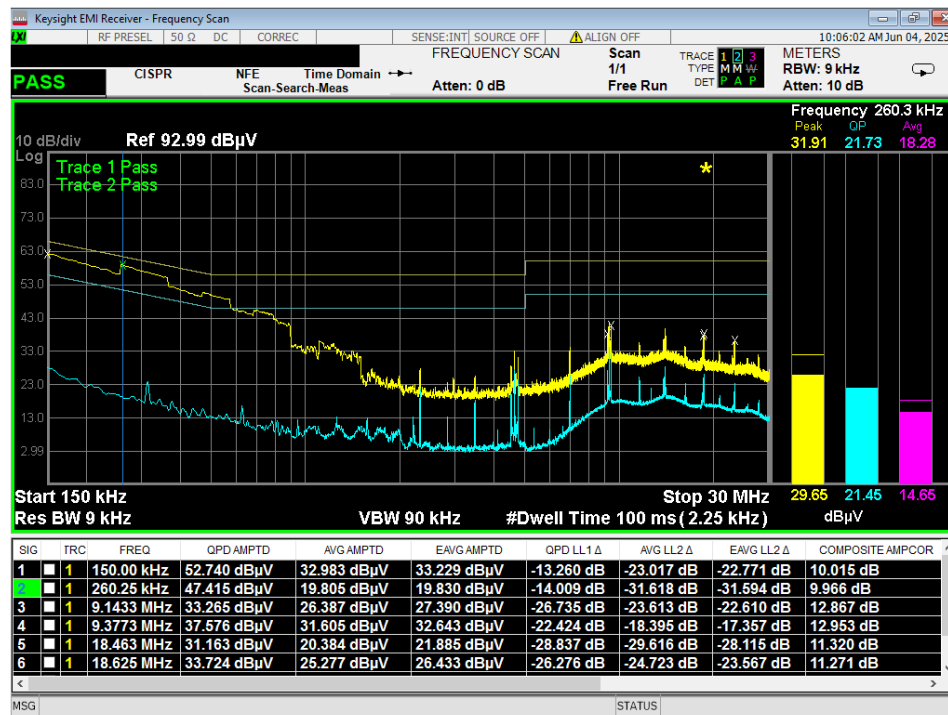


Figure 34 – Conducted Emissions Plot, charging via USB-C, TX, Line

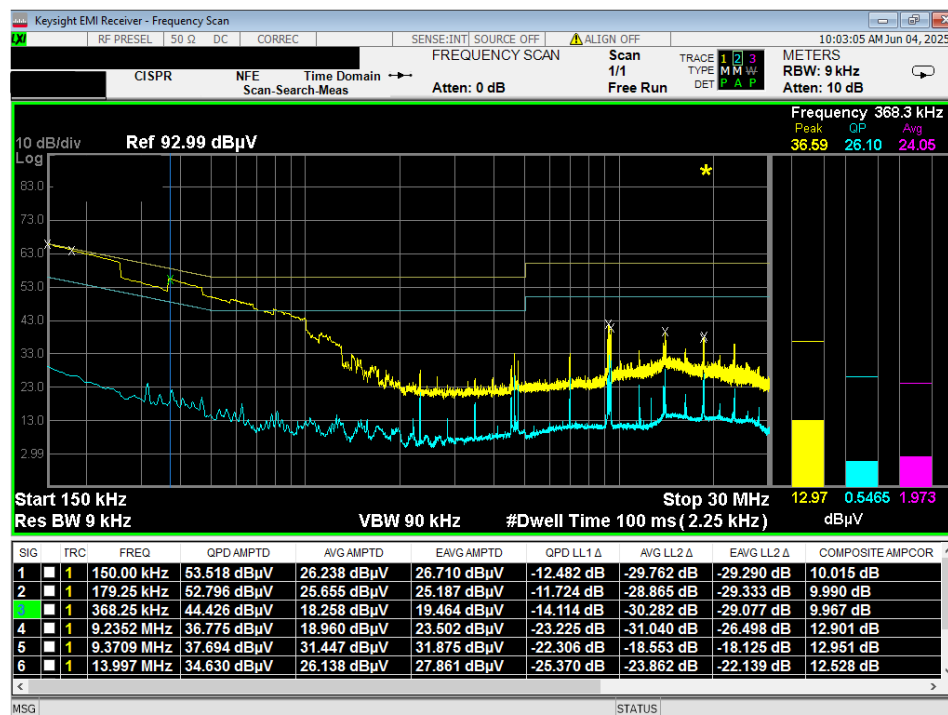


Figure 35 – Conducted Emissions Plot, charging via USB-C, TX, Neutral

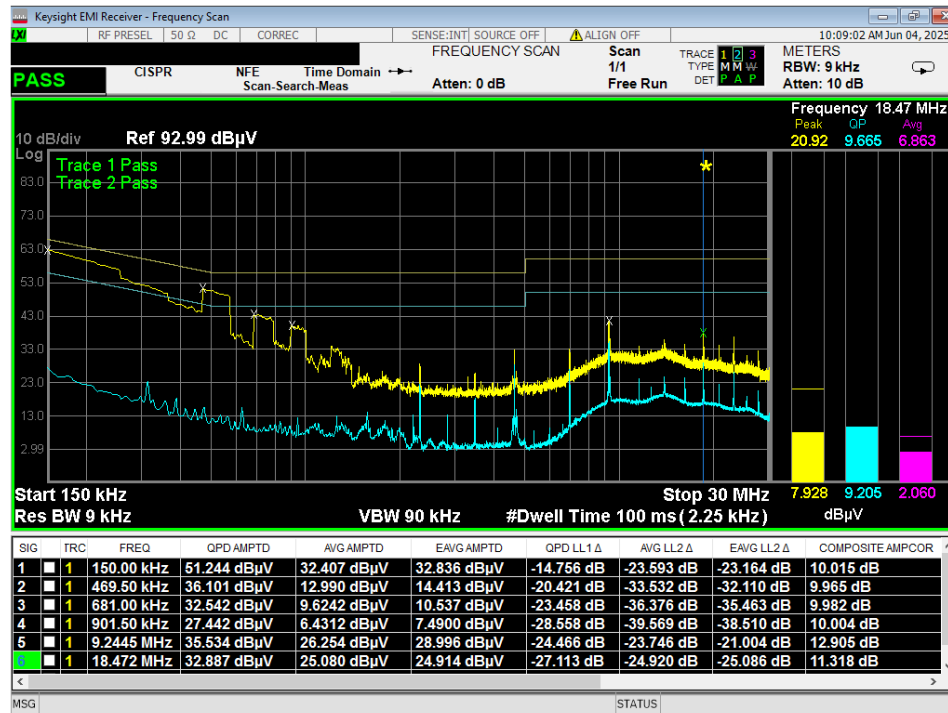


Figure 36 – Conducted Emissions Plot, charging via USB-C, IDLE, Line

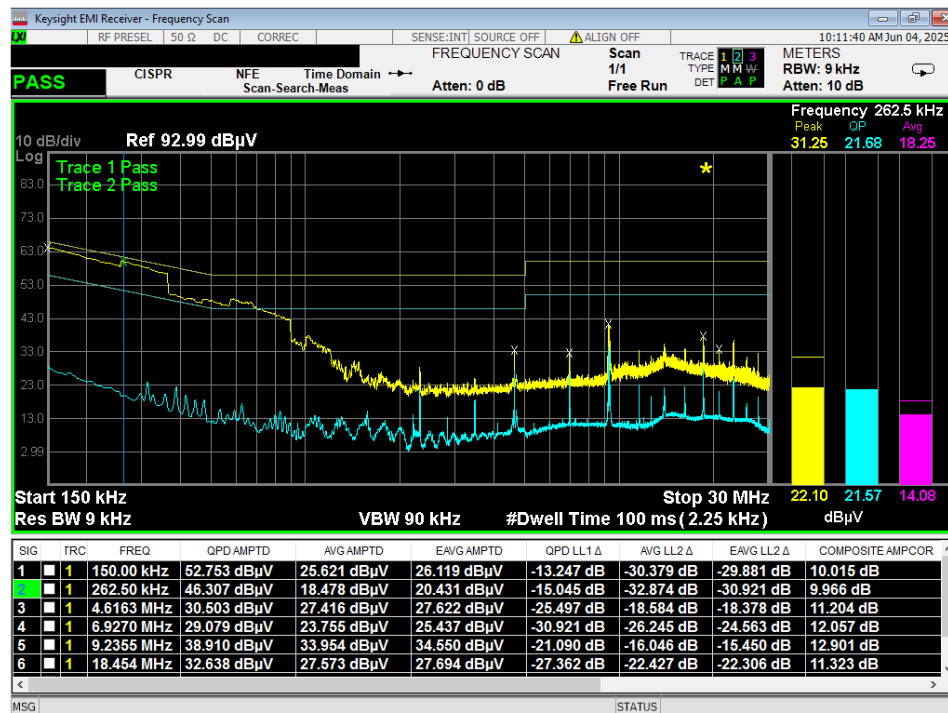


Figure 37 – Conducted Emissions Plot, charging via USB-C, IDLE, Neutral

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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



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APPENDIX B – MEASUREMENT UNCERTAINTY

NCEE Labs does not add uncertainty levels to measurement levels

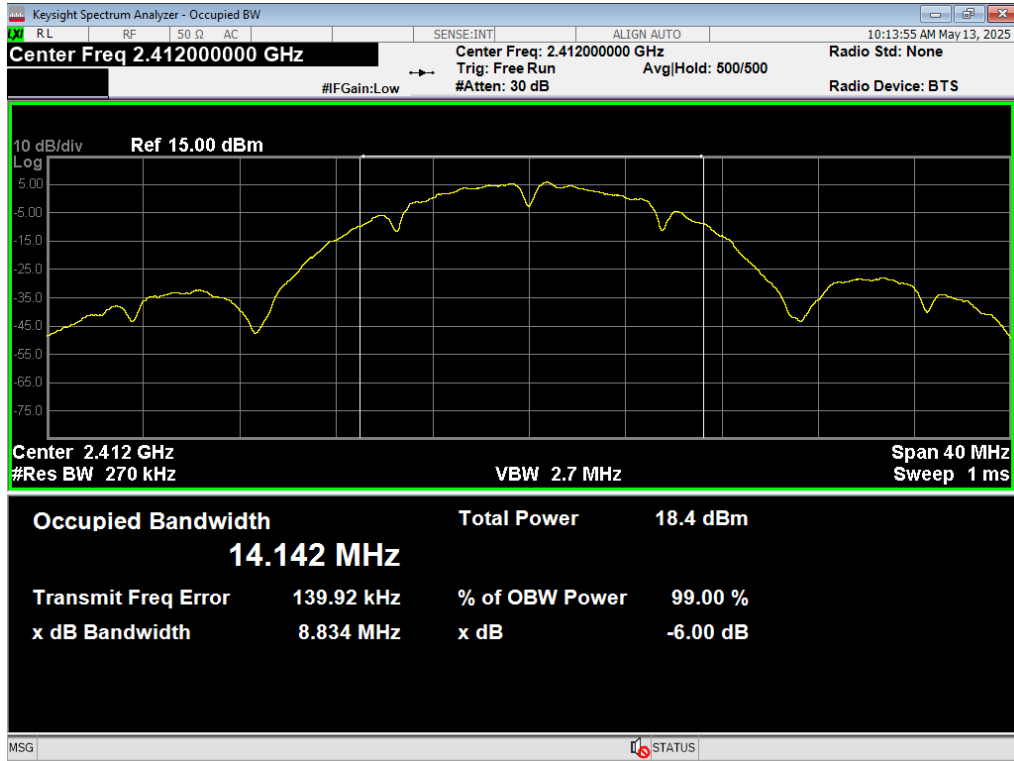
Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

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

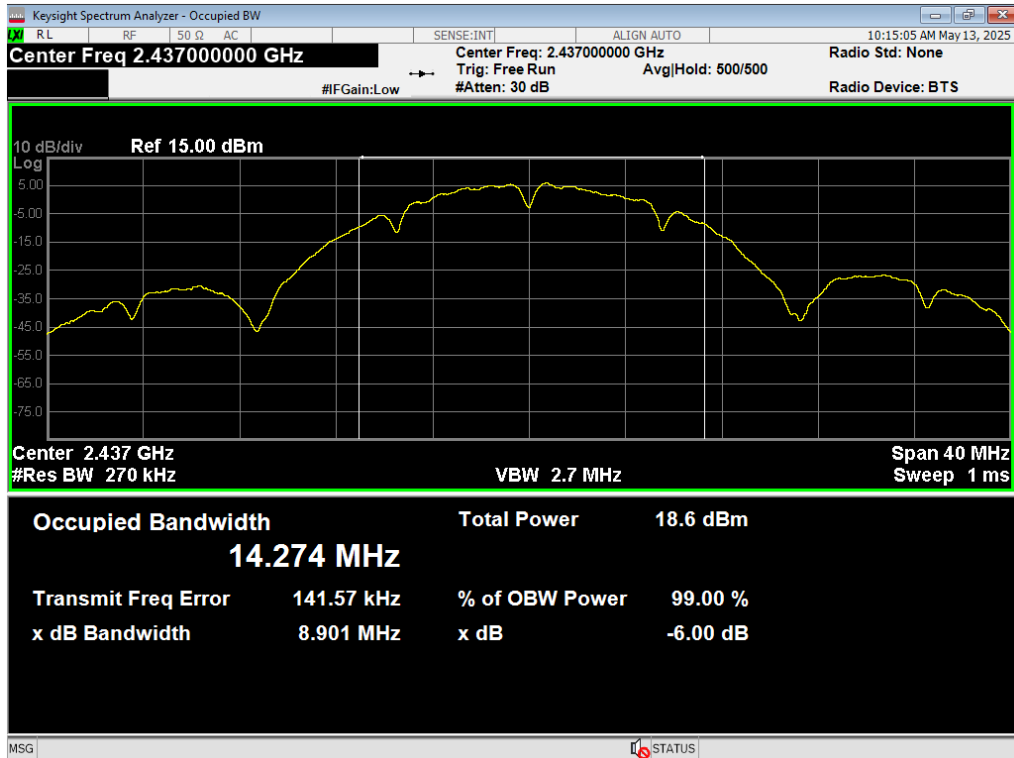
Expanded uncertainty values are calculated to a confidence level of 95%.

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APPENDIX C – GRAPHS AND TABLES

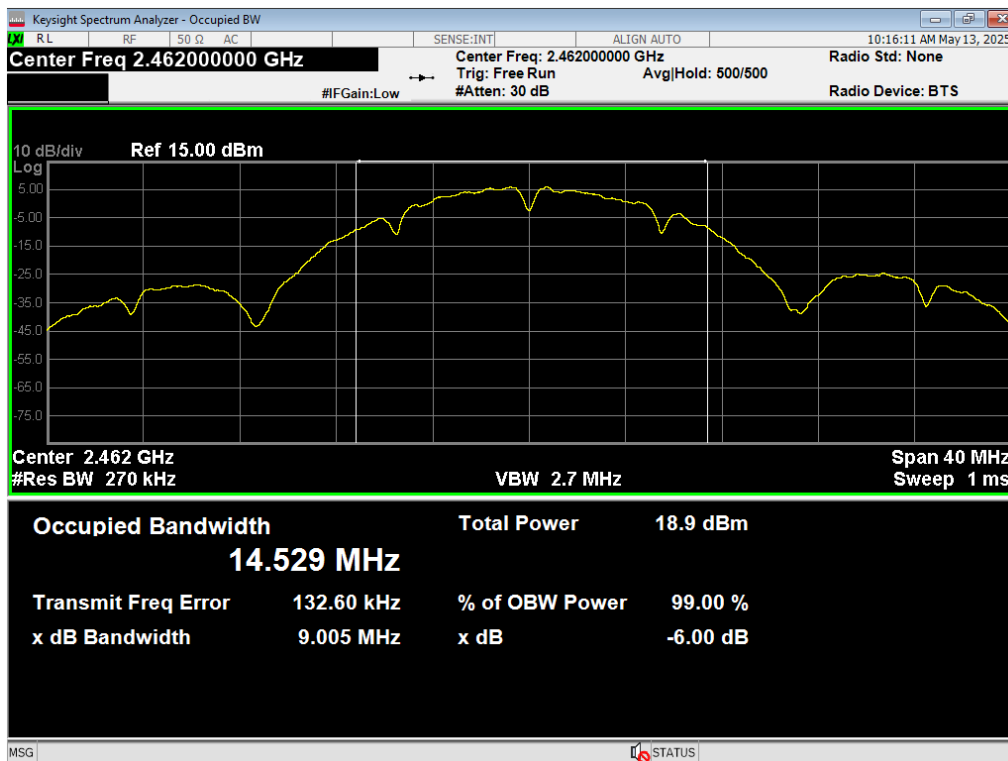


01 Occupied BW, WiFi B 1MB, 2412MHz

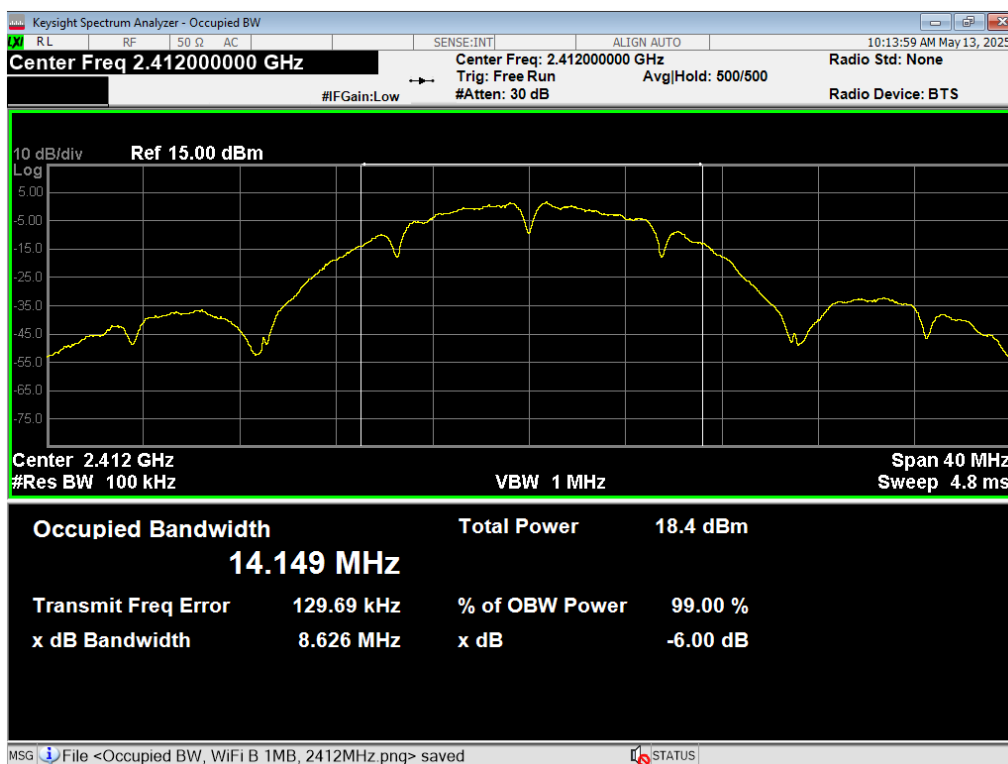


02 Occupied BW, WiFi B 1MB, 2437MHz

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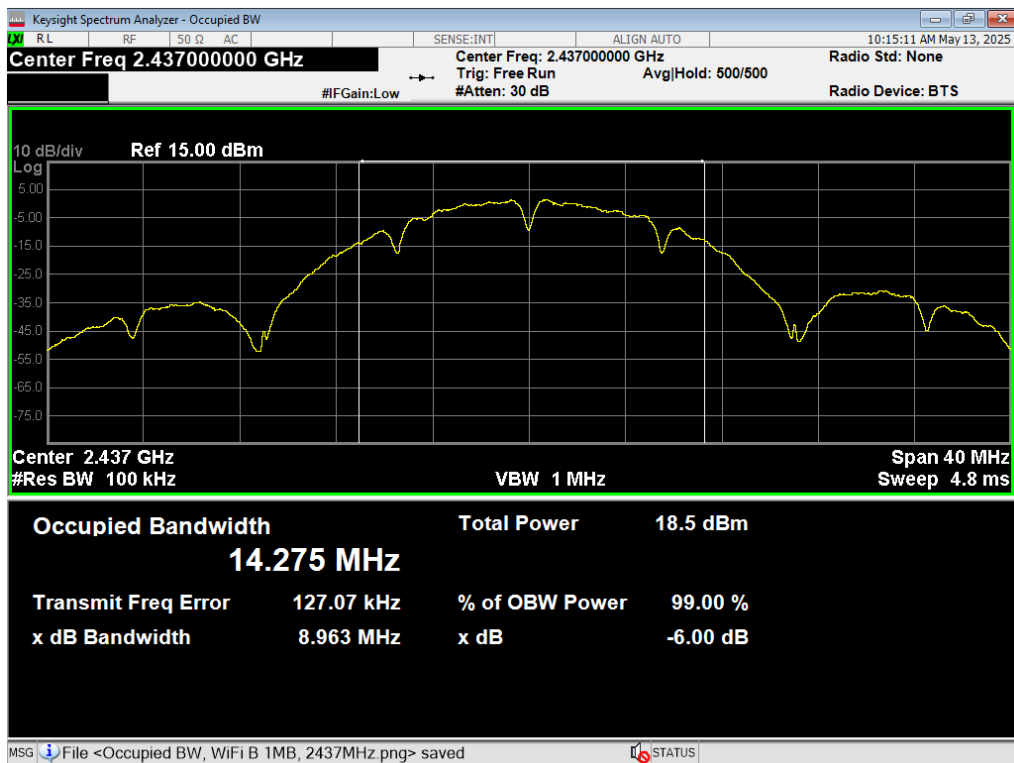


03 Occupied BW, WiFi B 1MB, 2462MHz

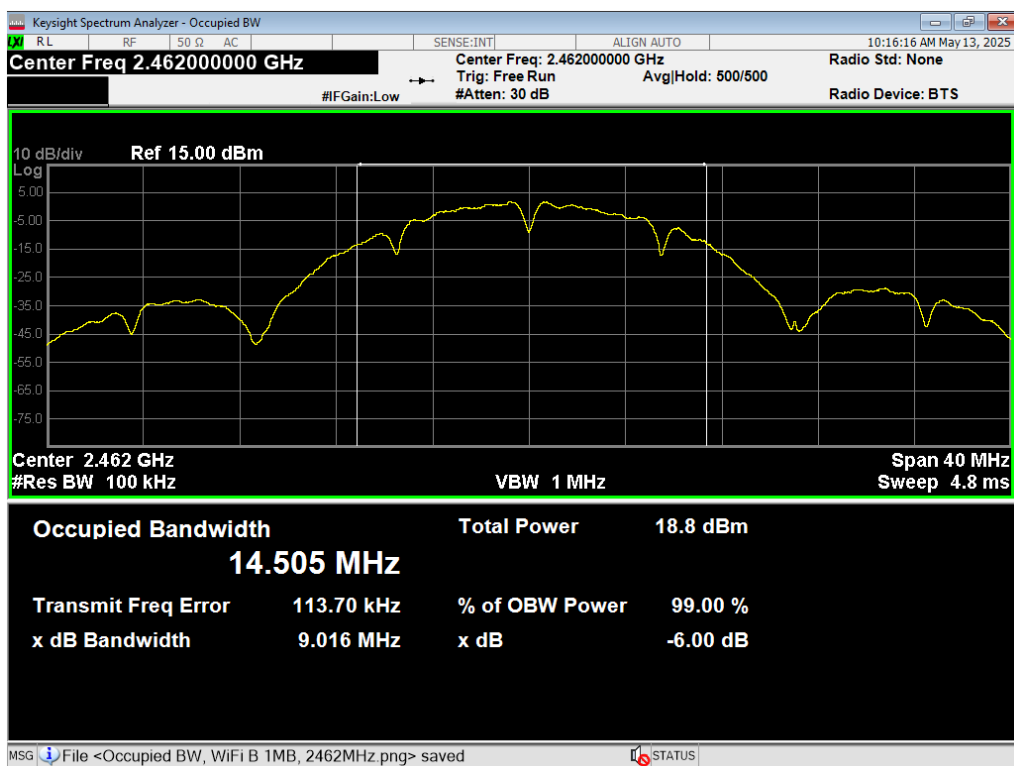


04 6dB BW, WiFi B 1MB, 2412MHz

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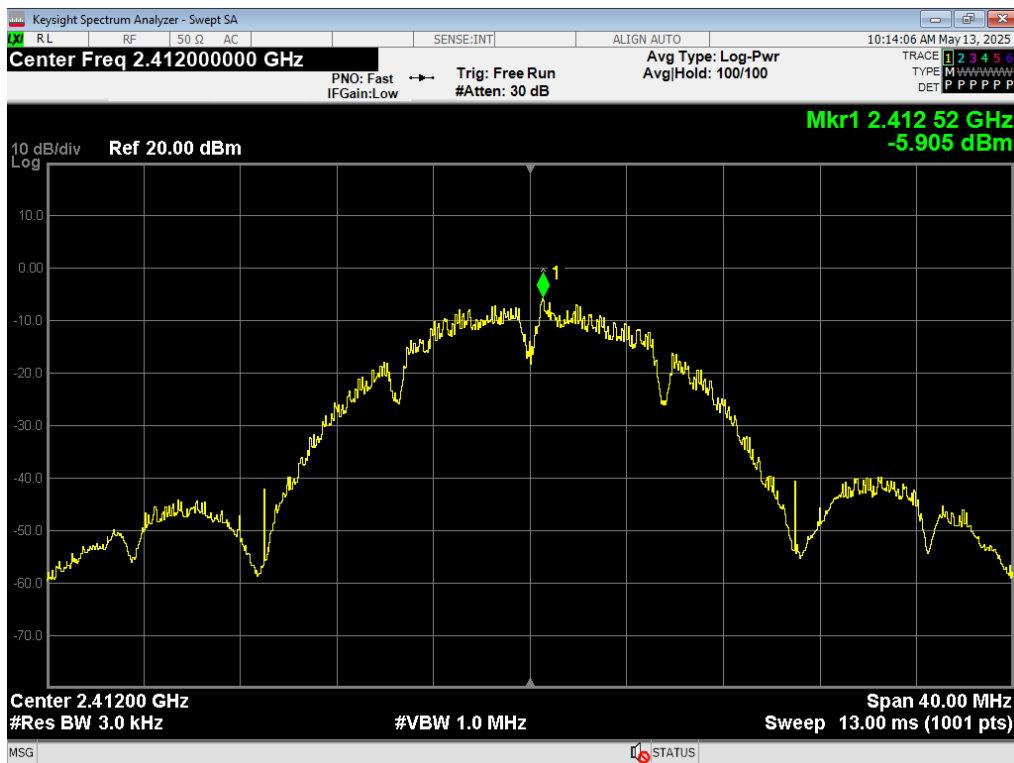


05 6dB BW, WiFi B 1MB, 2437MHz

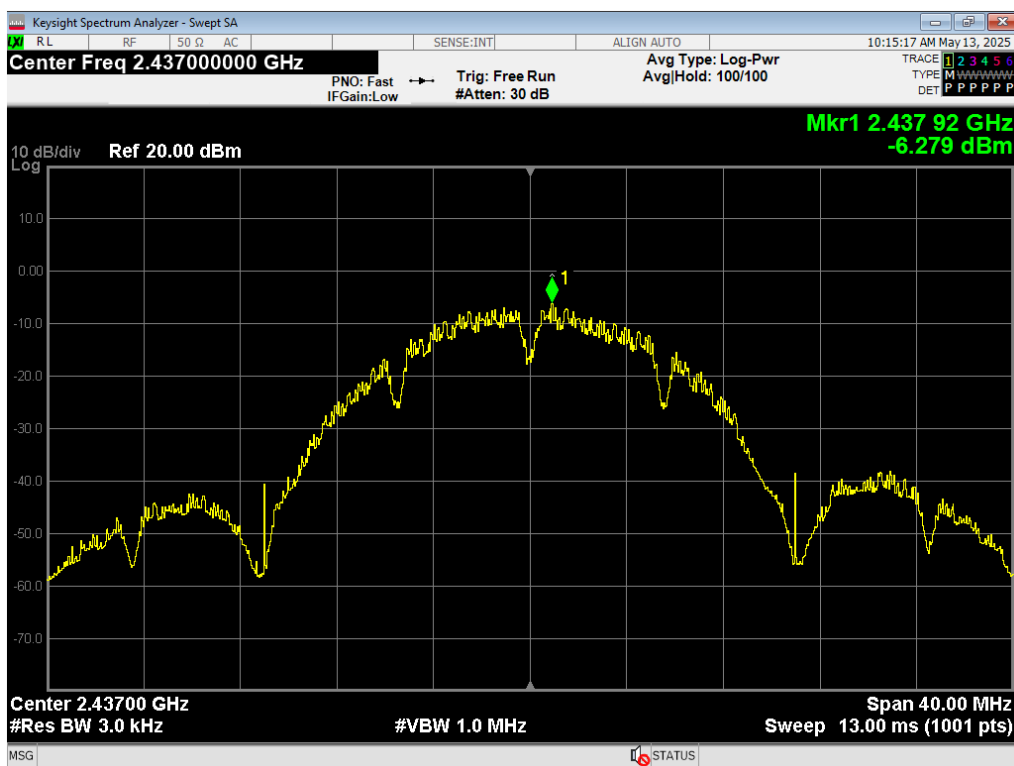


06 6dB BW, WiFi B 1MB, 2462MHz

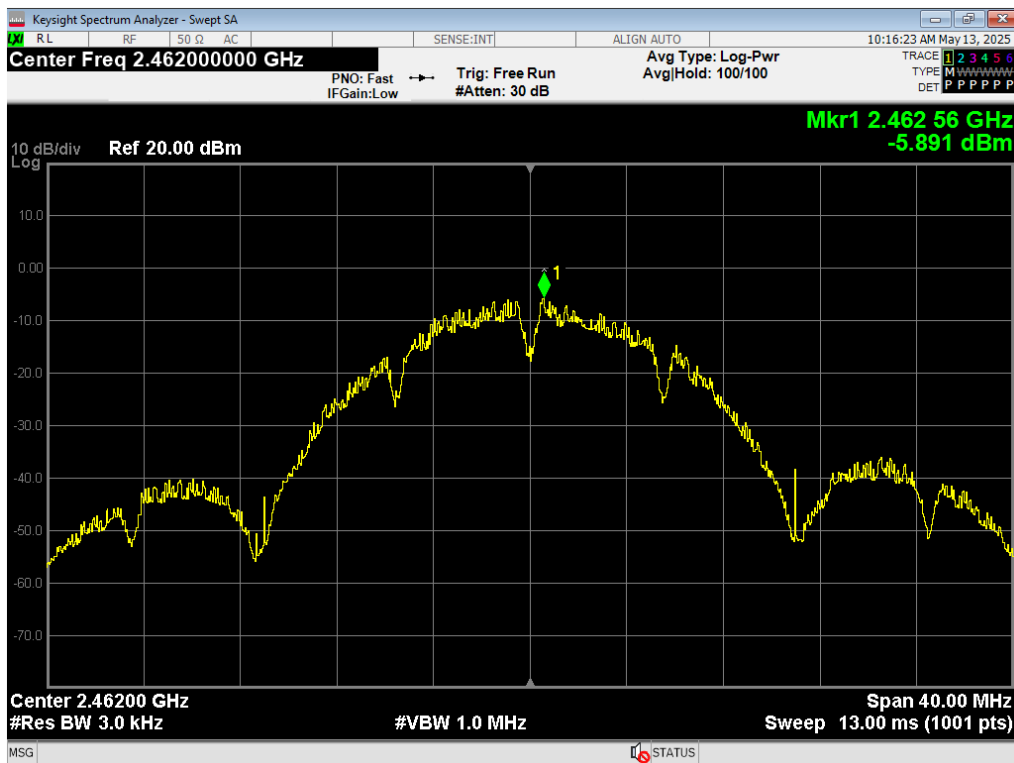
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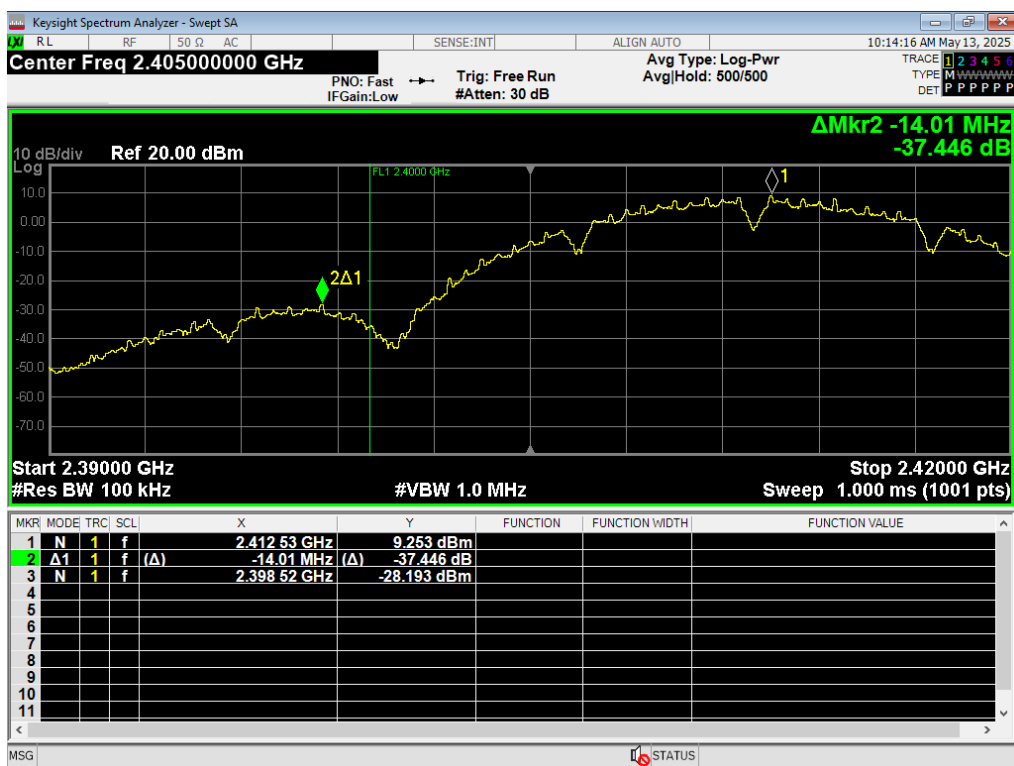
07 PSD, WiFi B 1MB, 2412MHz



08 PSD, WiFi B 1MB, 2437MHz



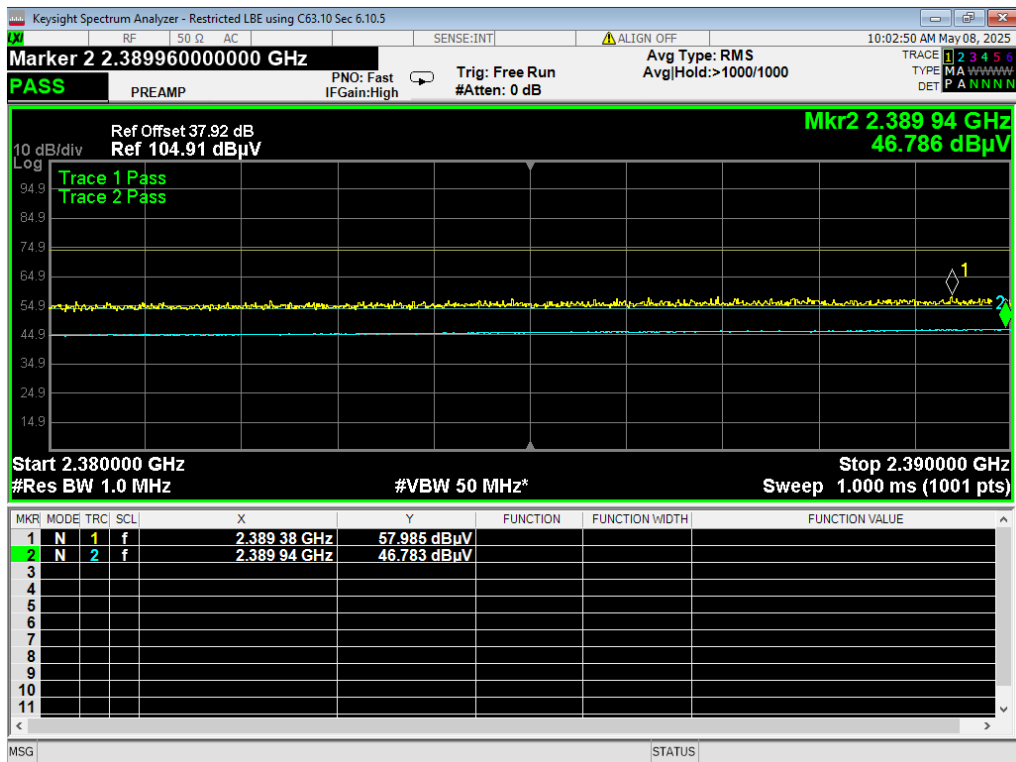
09 PSD, WiFi B 1MB, 2462MHz



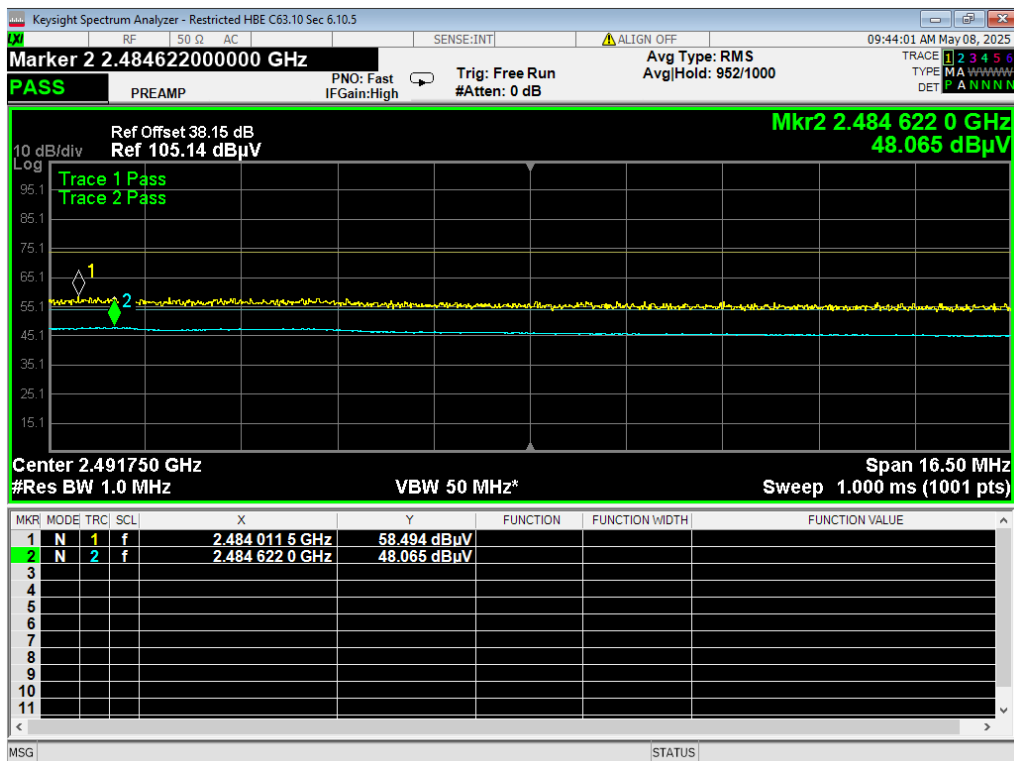
10 LBE Unrestricted, WiFi B 1MB



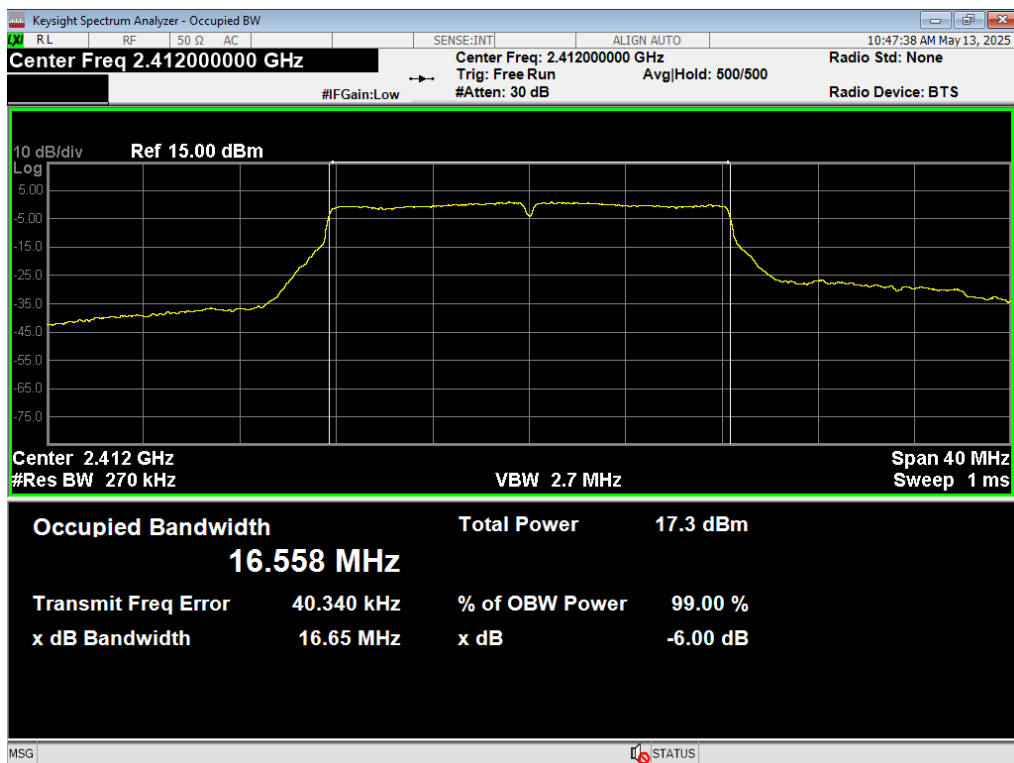
11 HBE Unrestricted, WiFi B 1MB



12 LBE Restricted, WiFi B 1MB

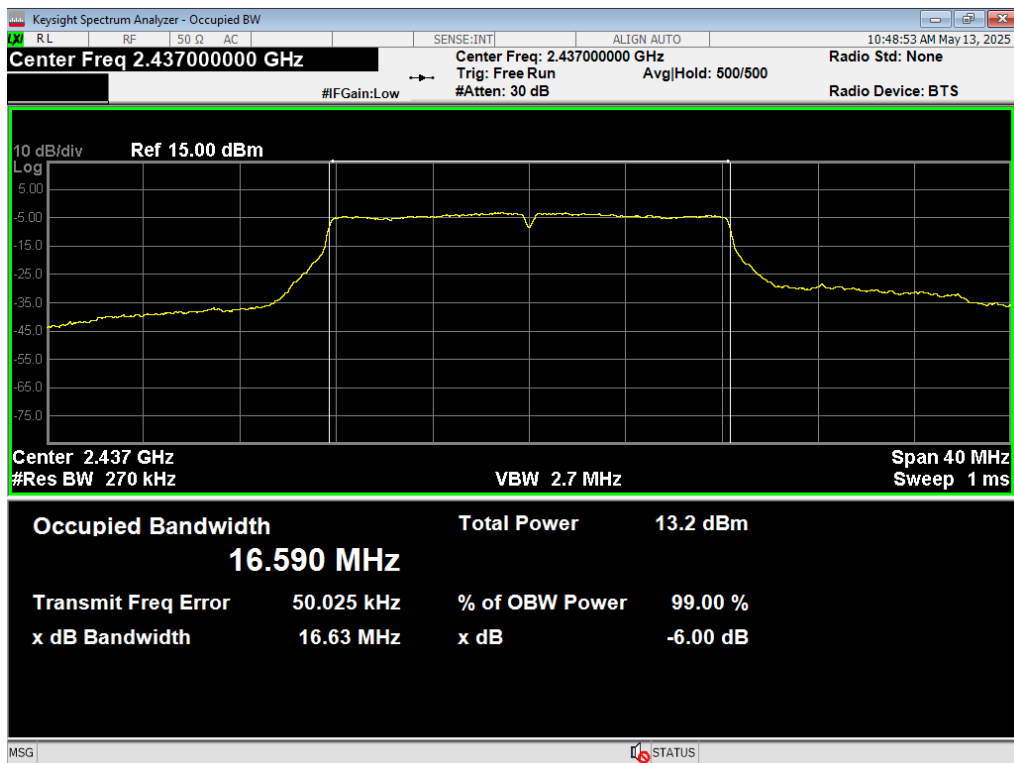


13 HBE Restricted, WiFi B 1MB, Ch11

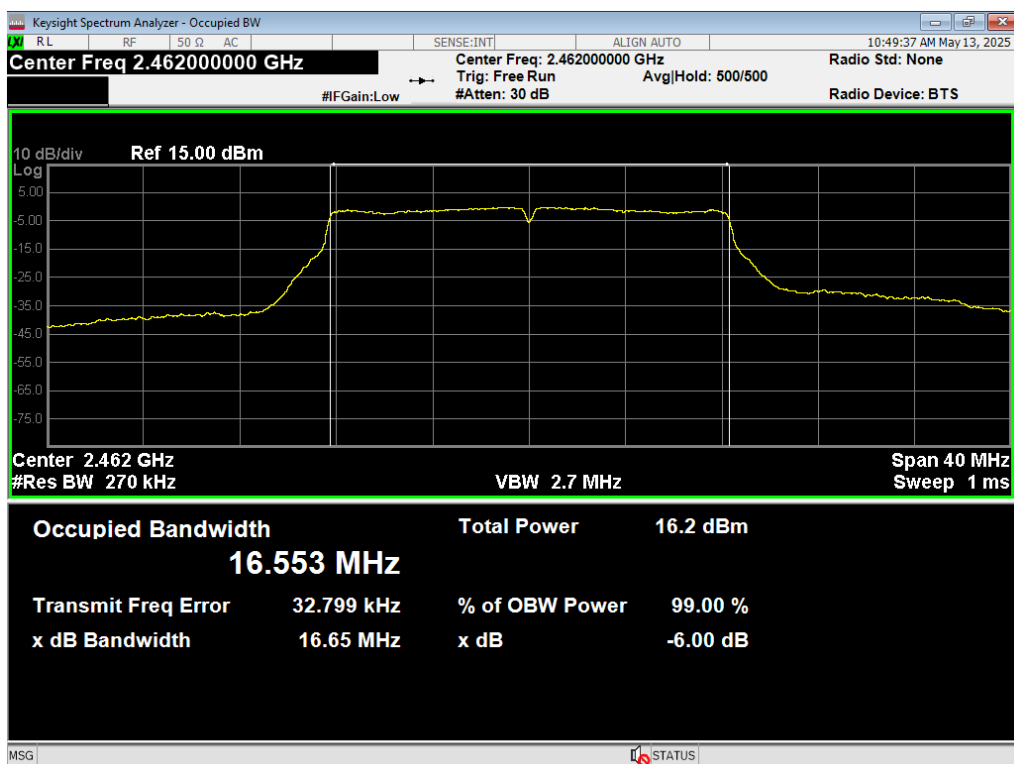


14 Occupied BW, WiFi G 6MB, 2412MHz

Report Number:	R20250124-00-E2	Rev	B
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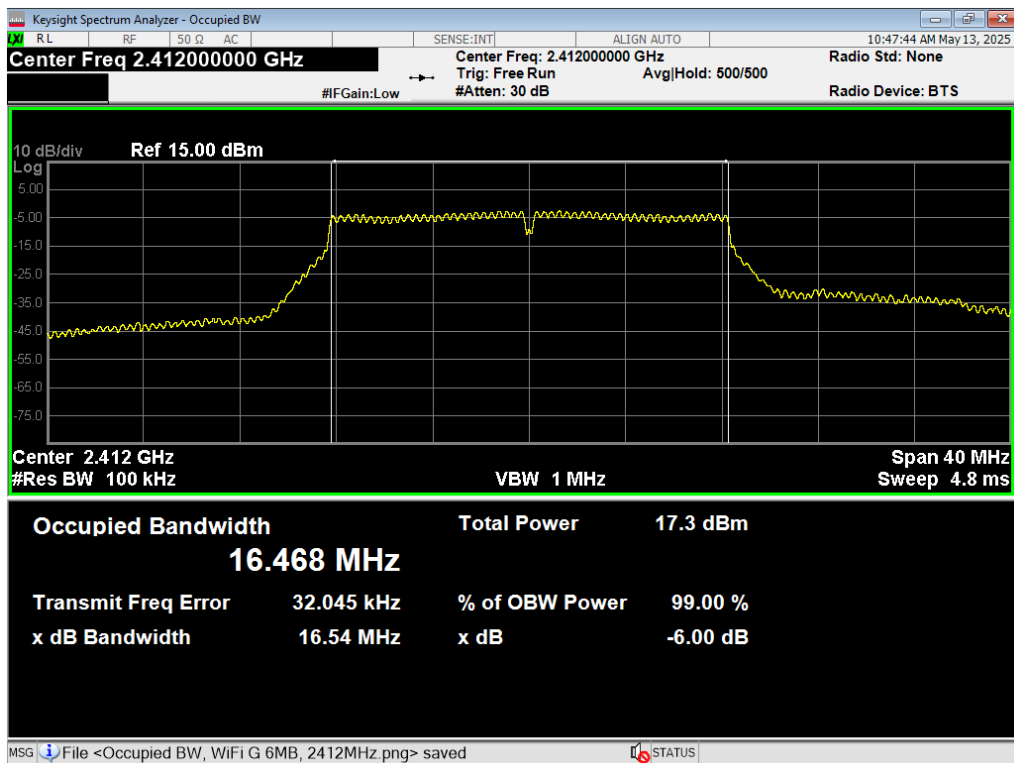


15 Occupied BW, WiFi G 6MB, 2437MHz

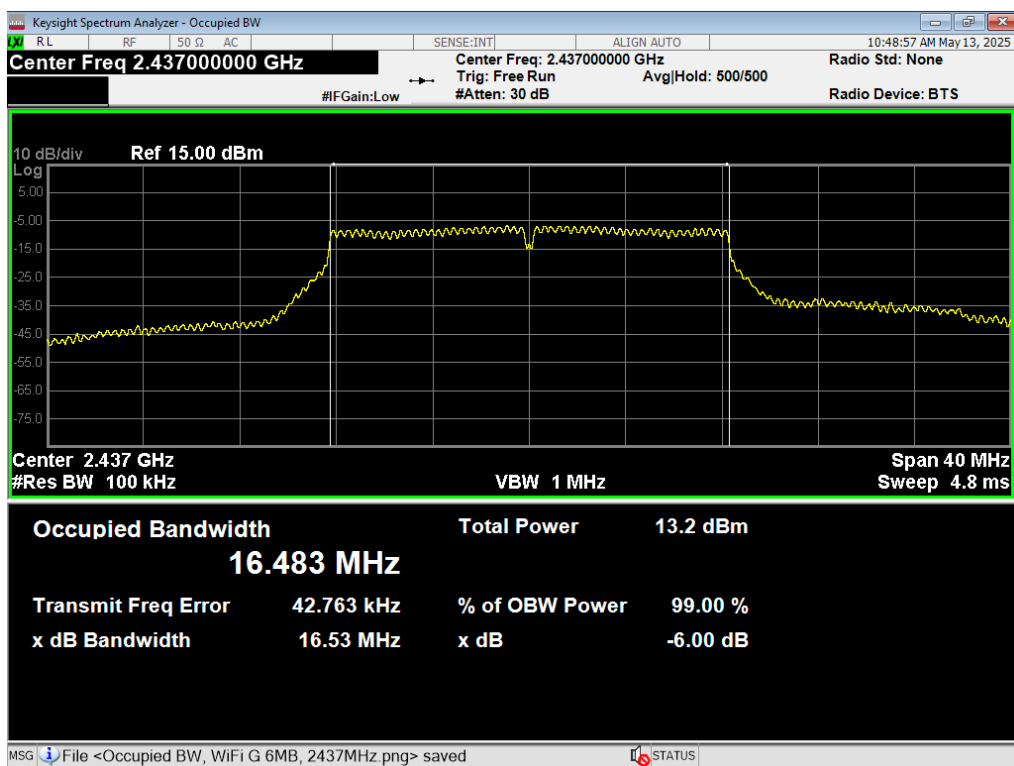


16 Occupied BW, WiFi G 6MB, 2462MHz

Report Number:	R20250124-00-E2	Rev	B
Prepared for:	Garmin International, Inc.		

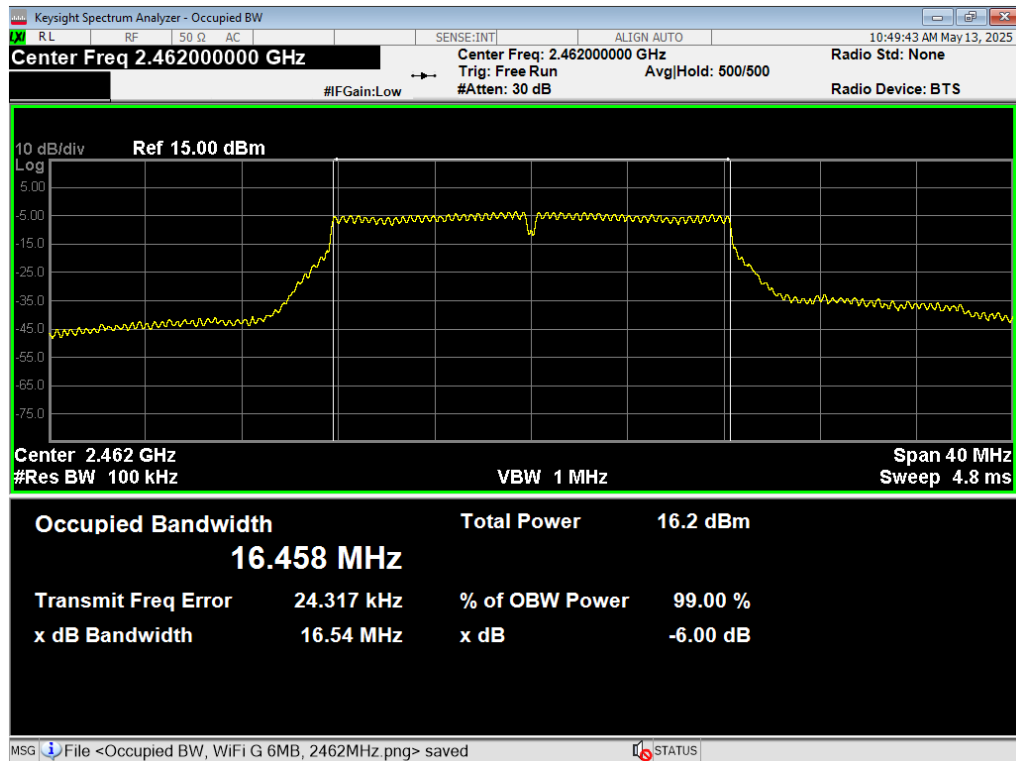


17 6dB BW, WiFi G 6MB, 2412MHz

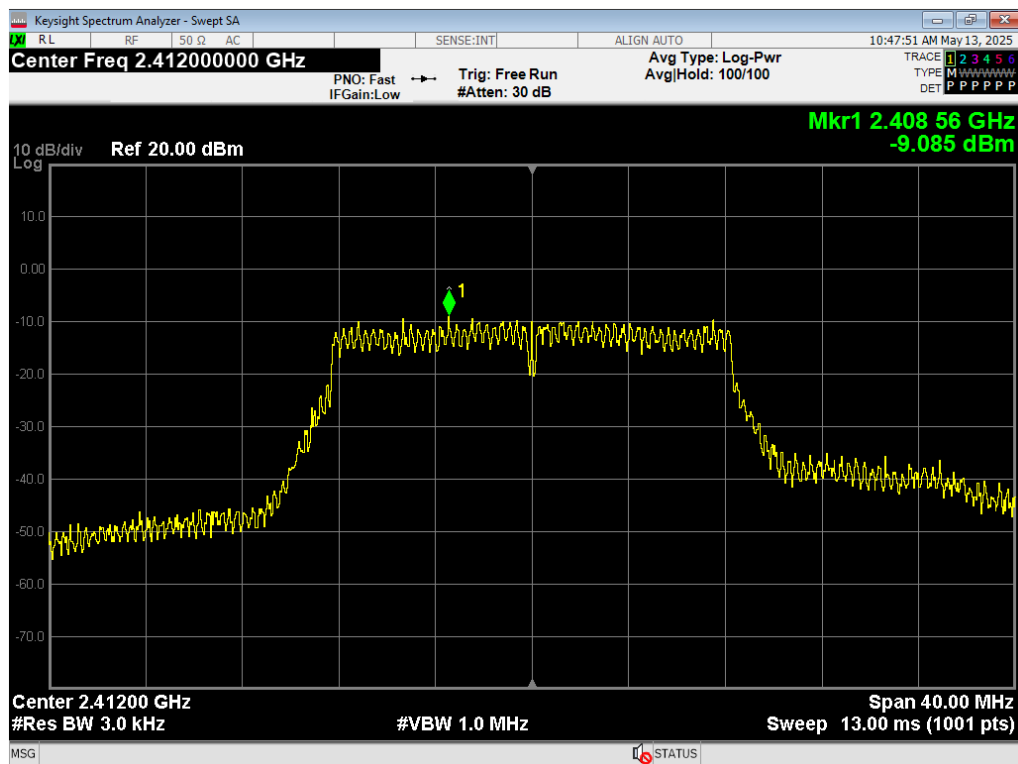


18 6dB BW, WiFi G 6MB, 2437MHz

	Report Number:	R20250124-00-E2	Rev	B
	Prepared for:	Garmin International, Inc.		

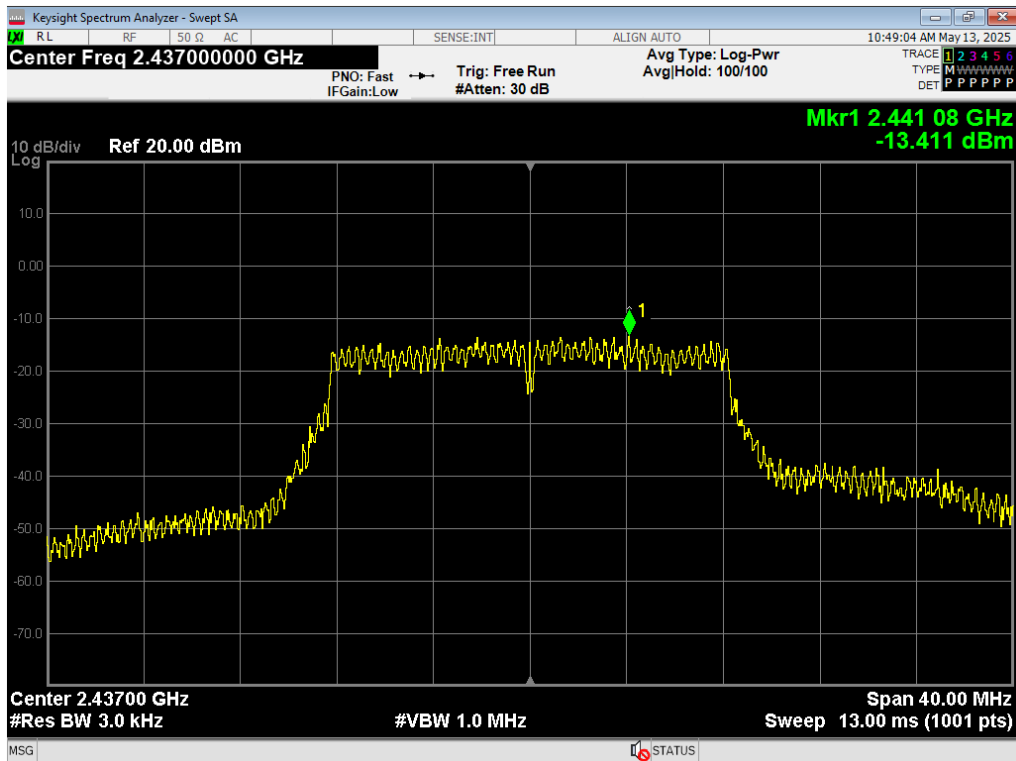


19 6dB BW, WiFi G 6MB, 2462MHz

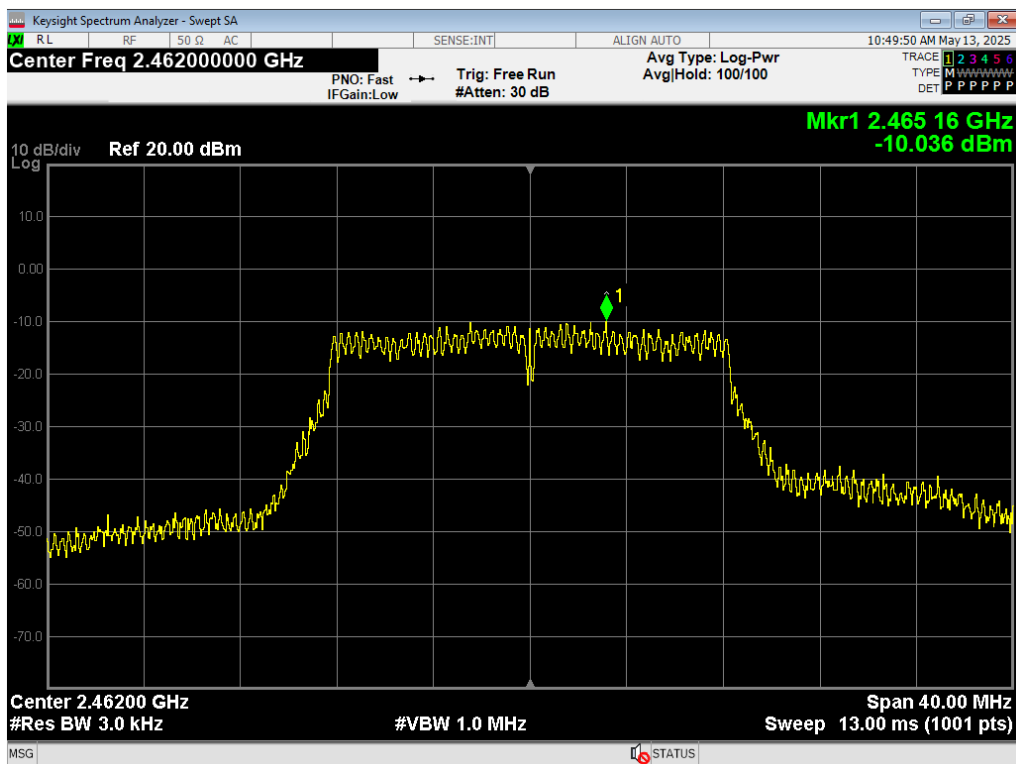


20 PSD, WiFi G 6MB, 2412MHz

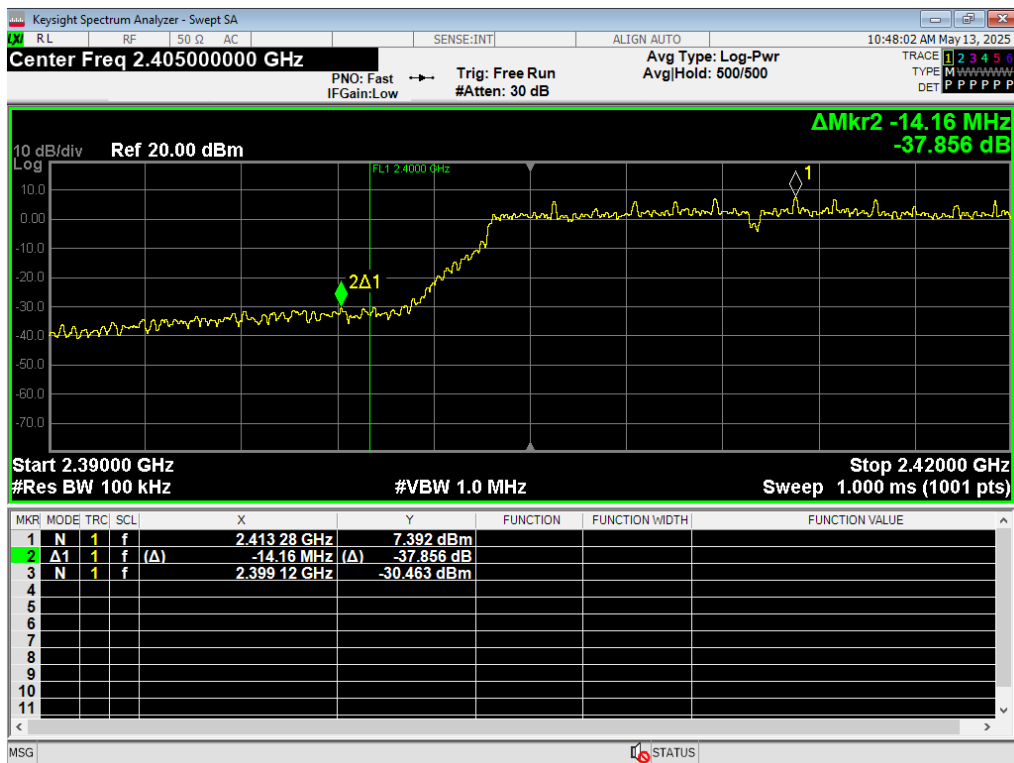
Report Number:	R20250124-00-E2	Rev	B
Prepared for:	Garmin International, Inc.		



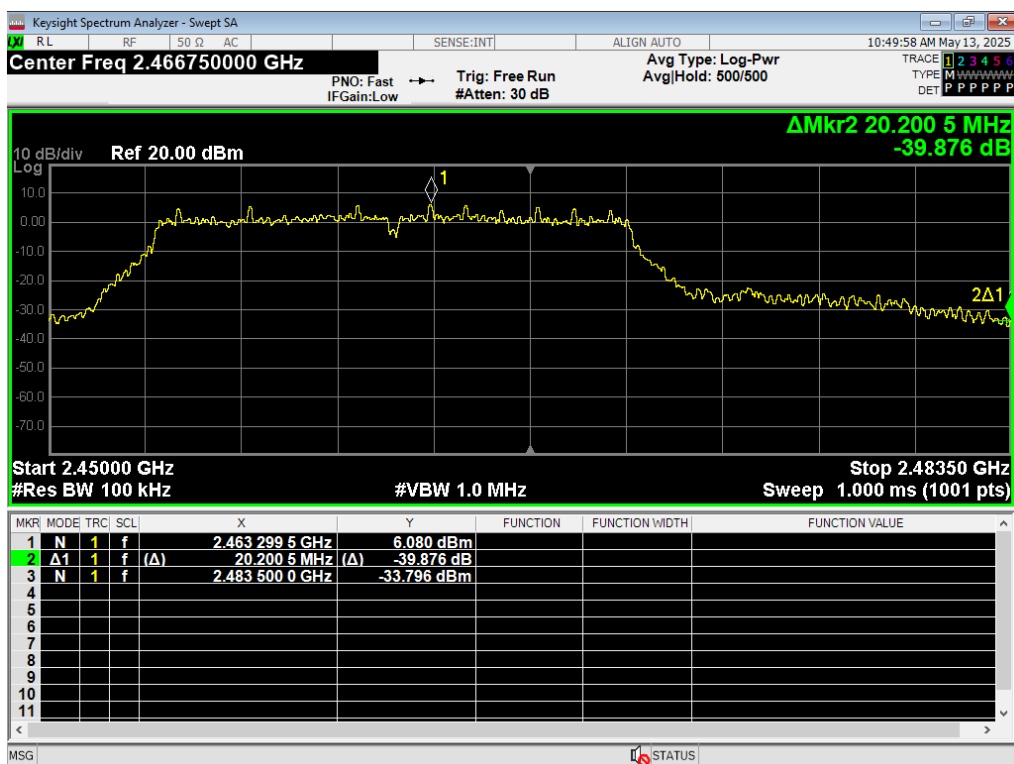
21 PSD, WiFi G 6MB, 2437MHz



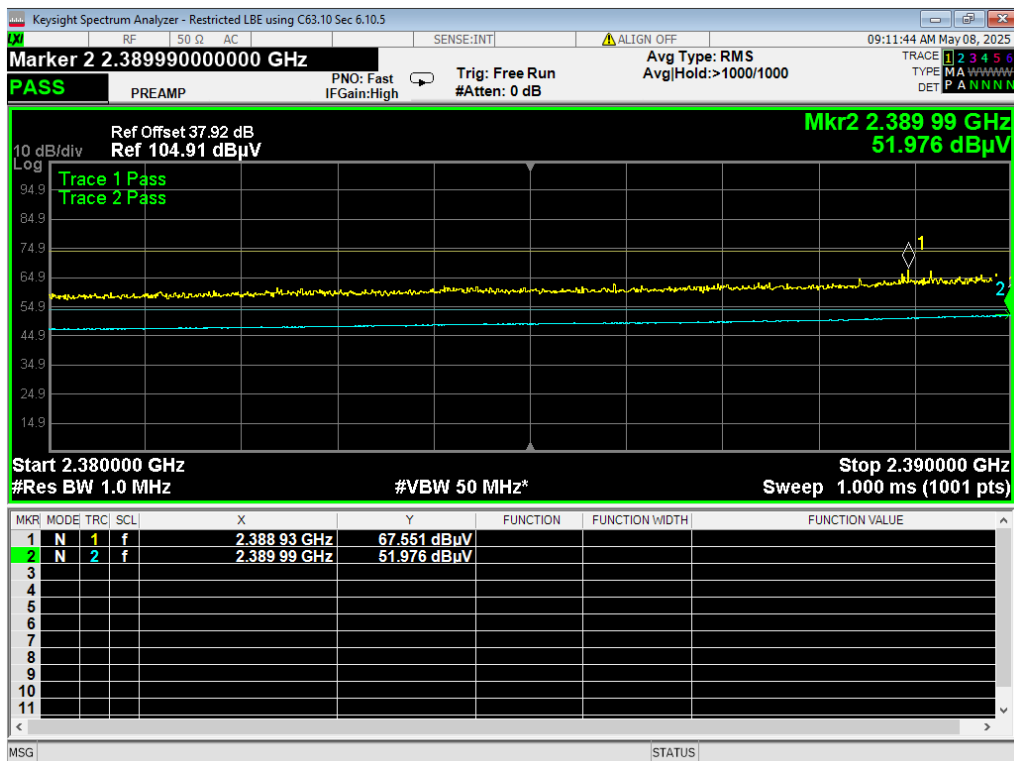
22 PSD, WiFi G 6MB, 2462MHz



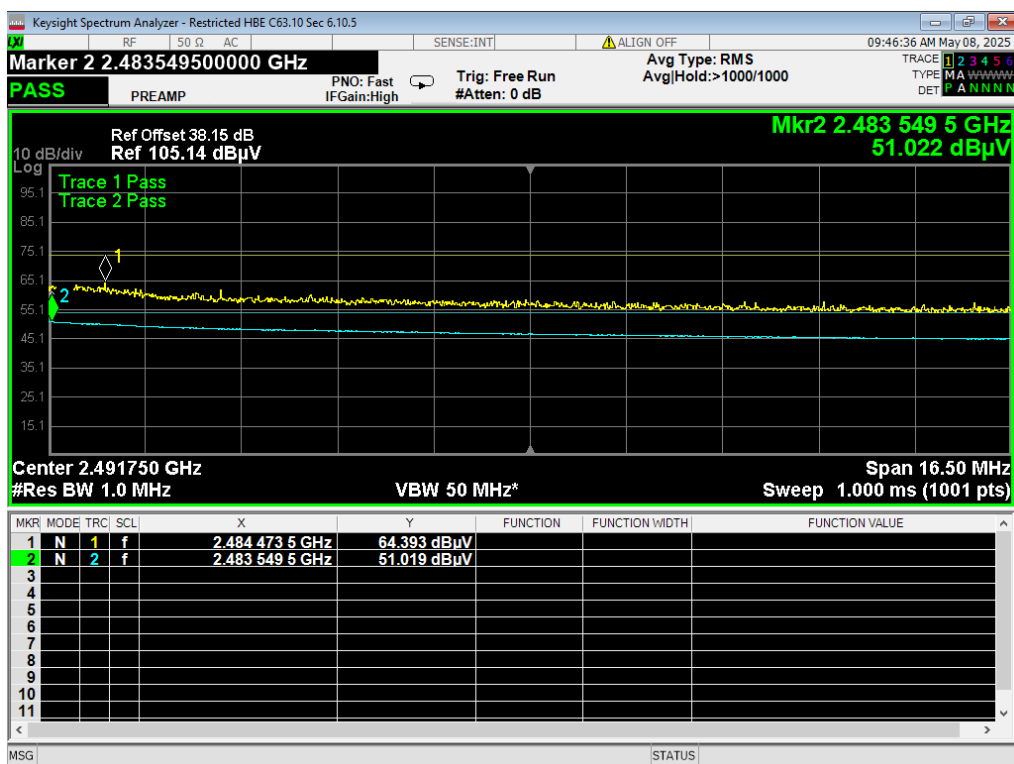
23 LBE Unrestricted, WiFi G 6MB



24 HBE Unrestricted, WiFi G 6MB

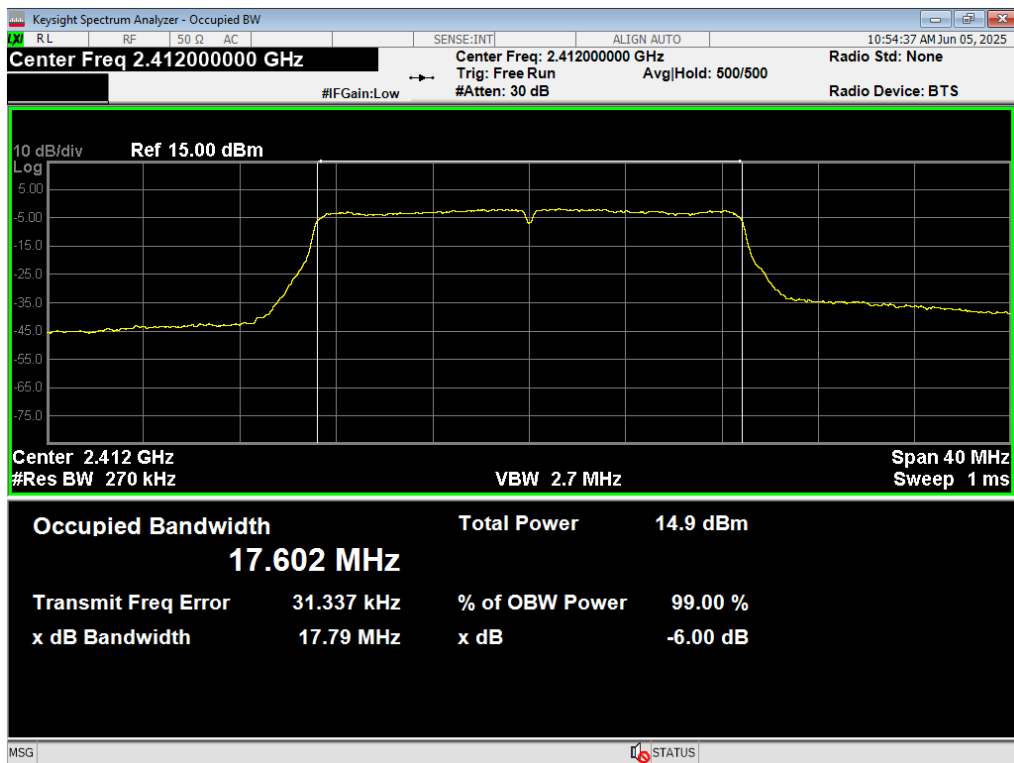


25 LBE Restricted, WiFi G 6MB

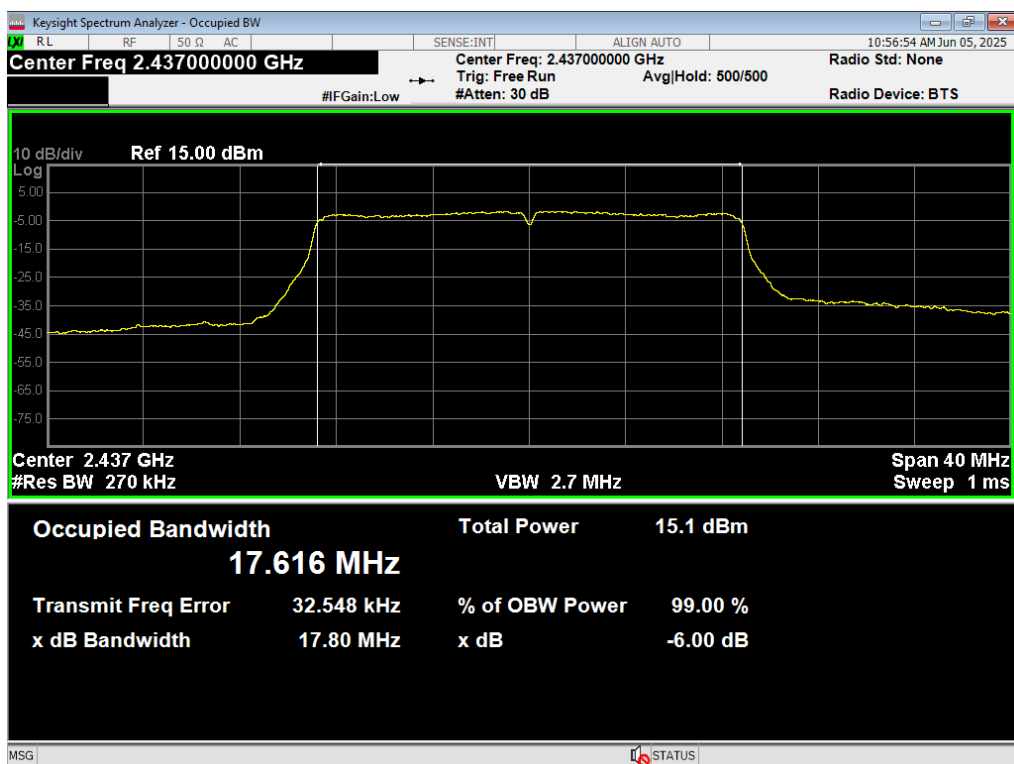


26 HBE Restricted, WiFi G 6MB, Ch11

Report Number:	R20250124-00-E2	Rev	B
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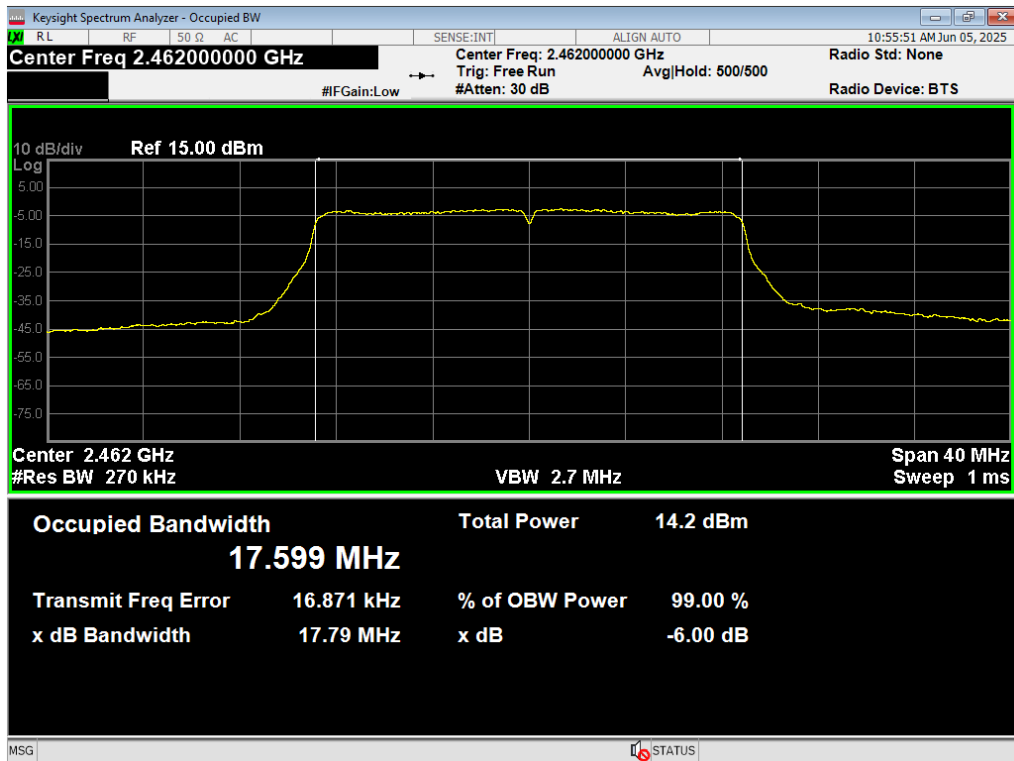


27 Occupied BW, WiFi N 6.5MB, 2412MHz

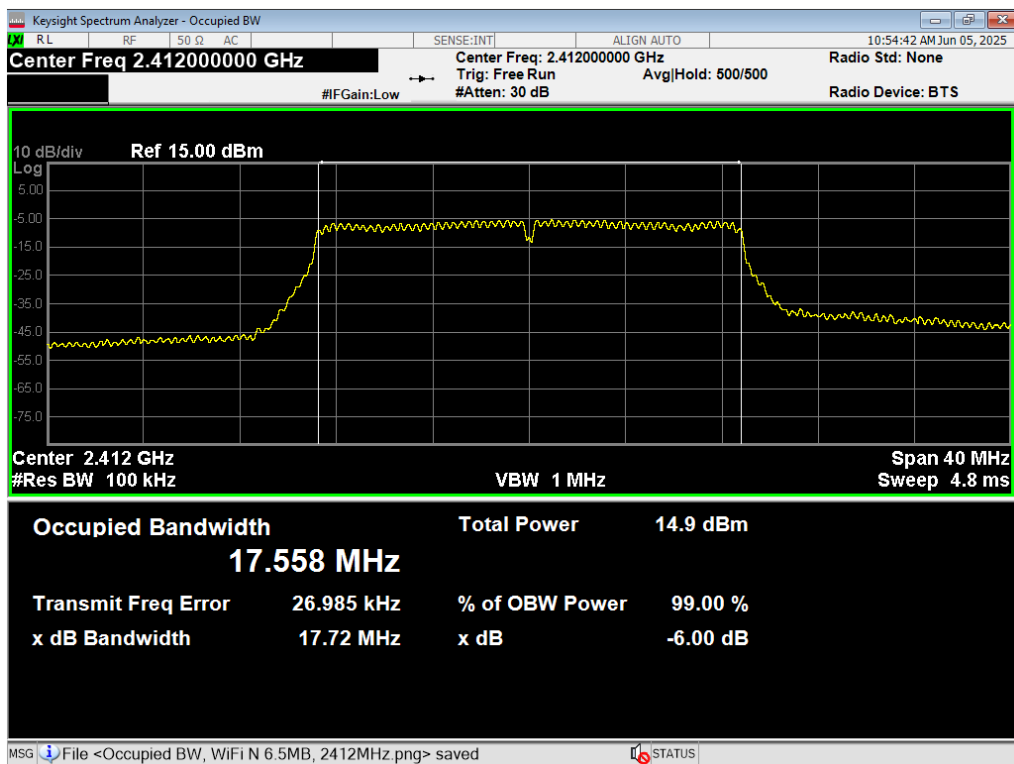


28 Occupied BW, WiFi N 6.5MB, 2437MHz

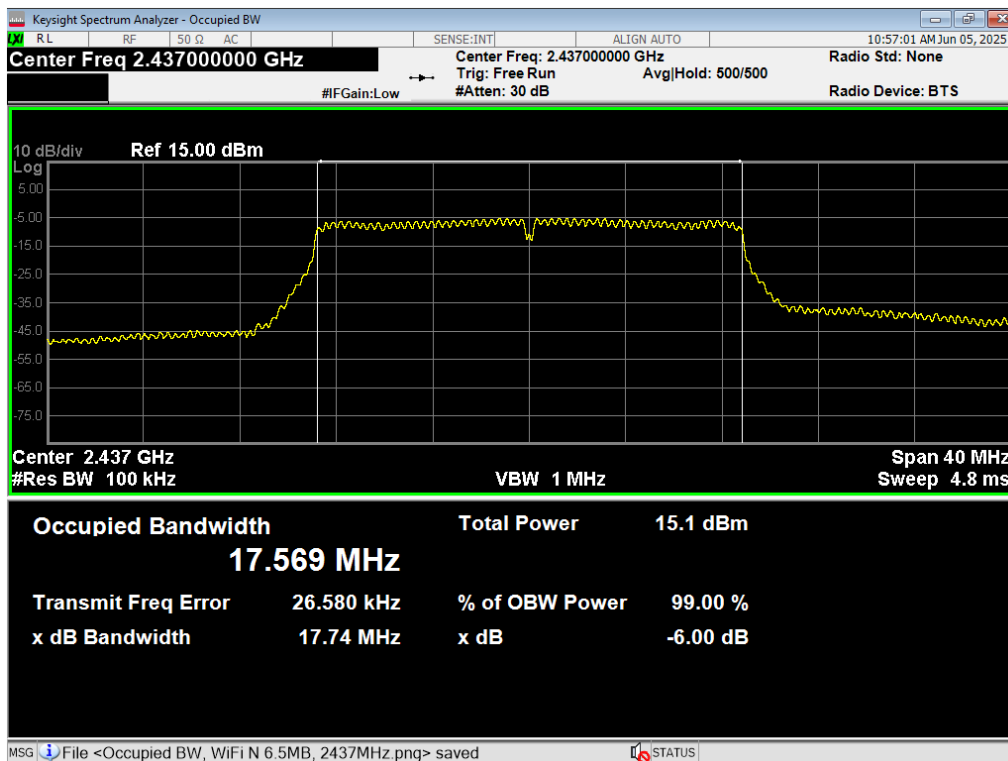
Report Number:	R20250124-00-E2	Rev	B
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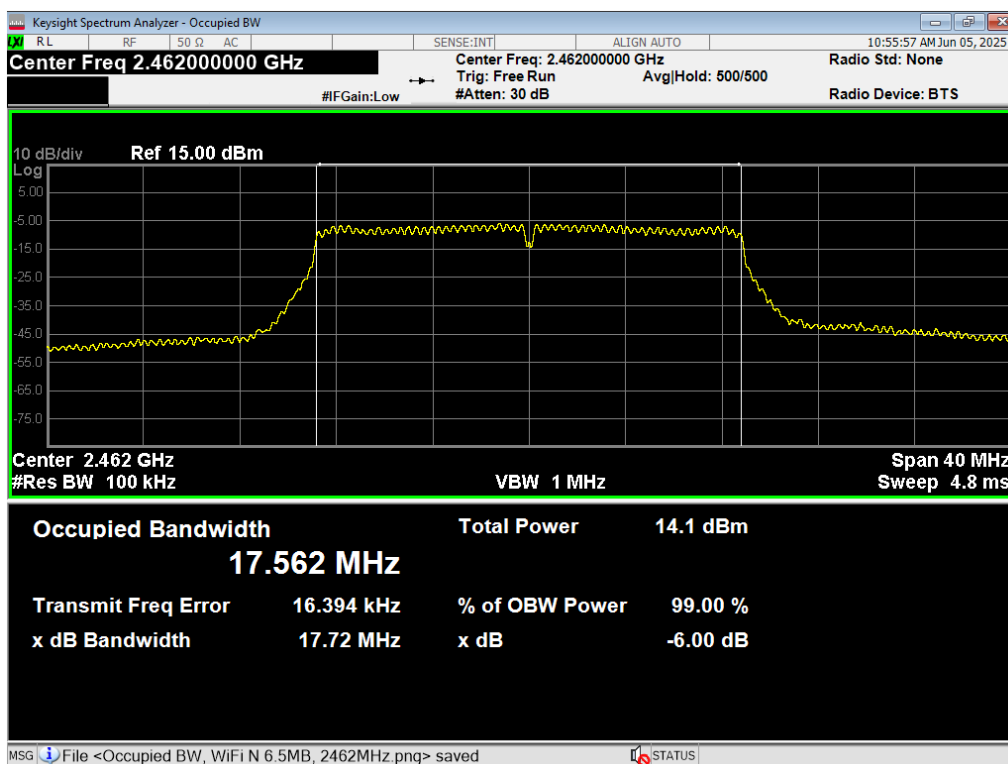
29 Occupied BW, WiFi N 6.5MB, 2462MHz



30 6dB BW, WiFi N 6.5MB, 2412MHz

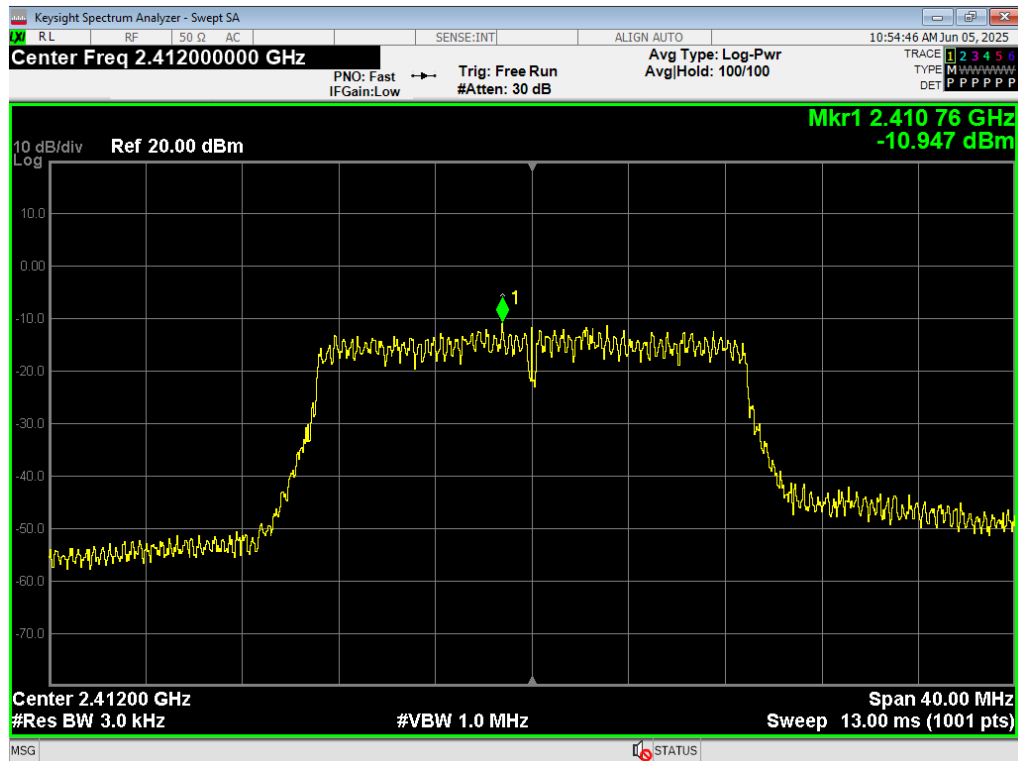


31 6dB BW, WiFi N 6.5MB, 2437MHz

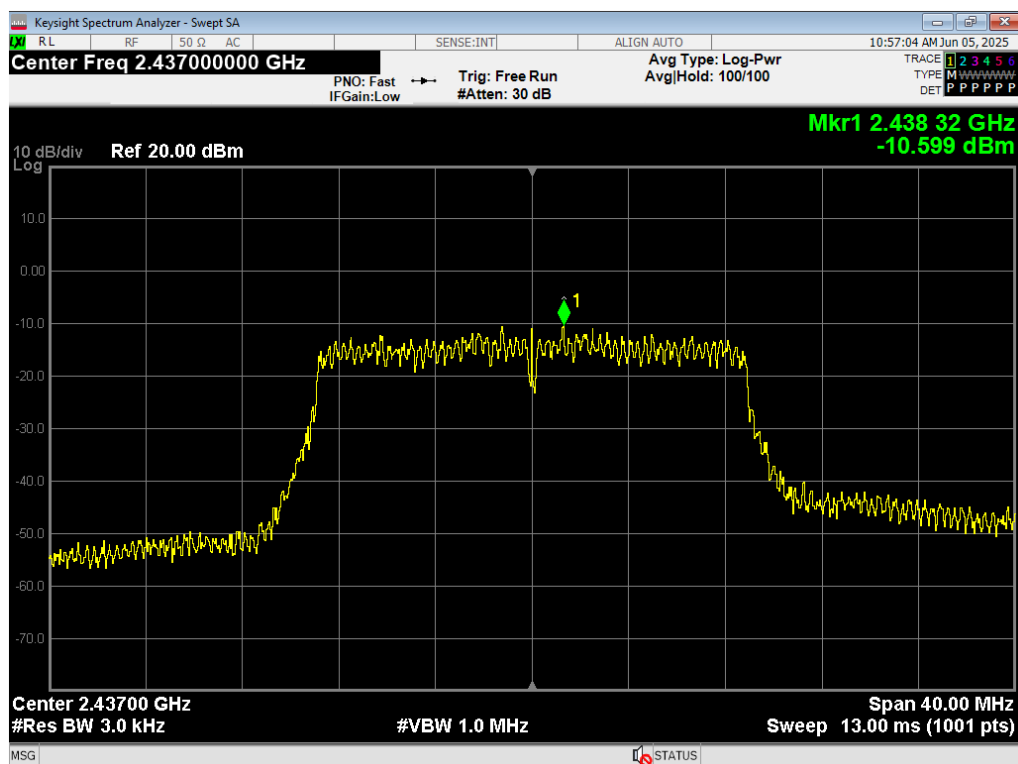


32 6dB BW, WiFi N 6.5MB, 2462MHz

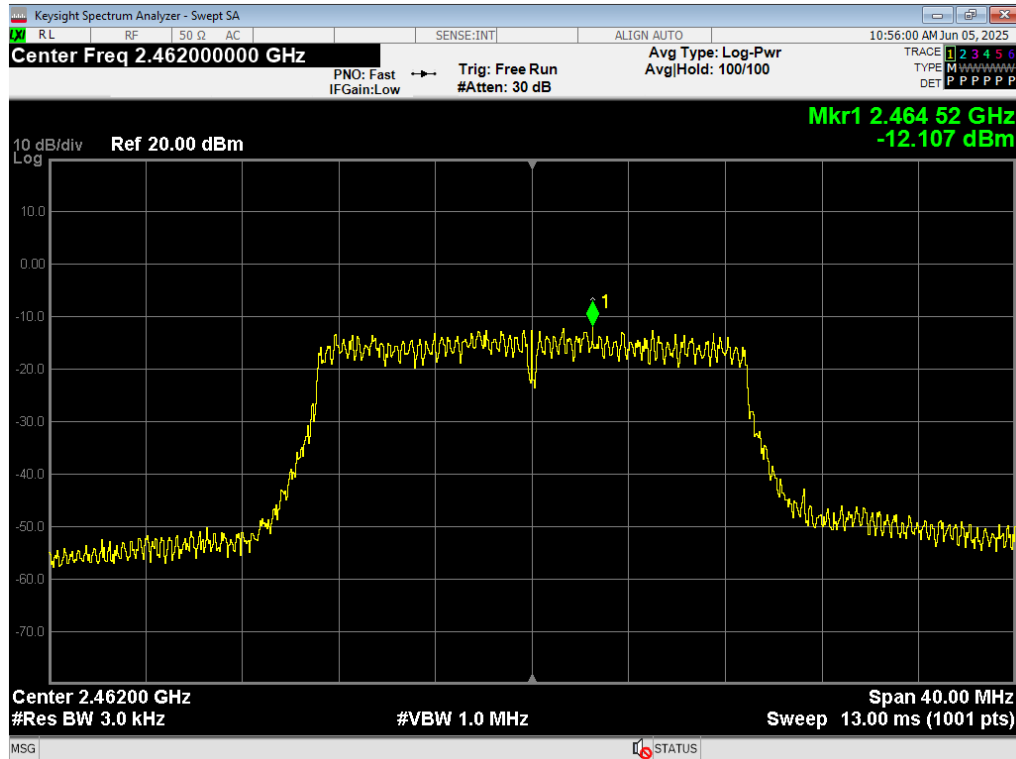
	Report Number:	R20250124-00-E2	Rev	B
	Prepared for:	Garmin International, Inc.		



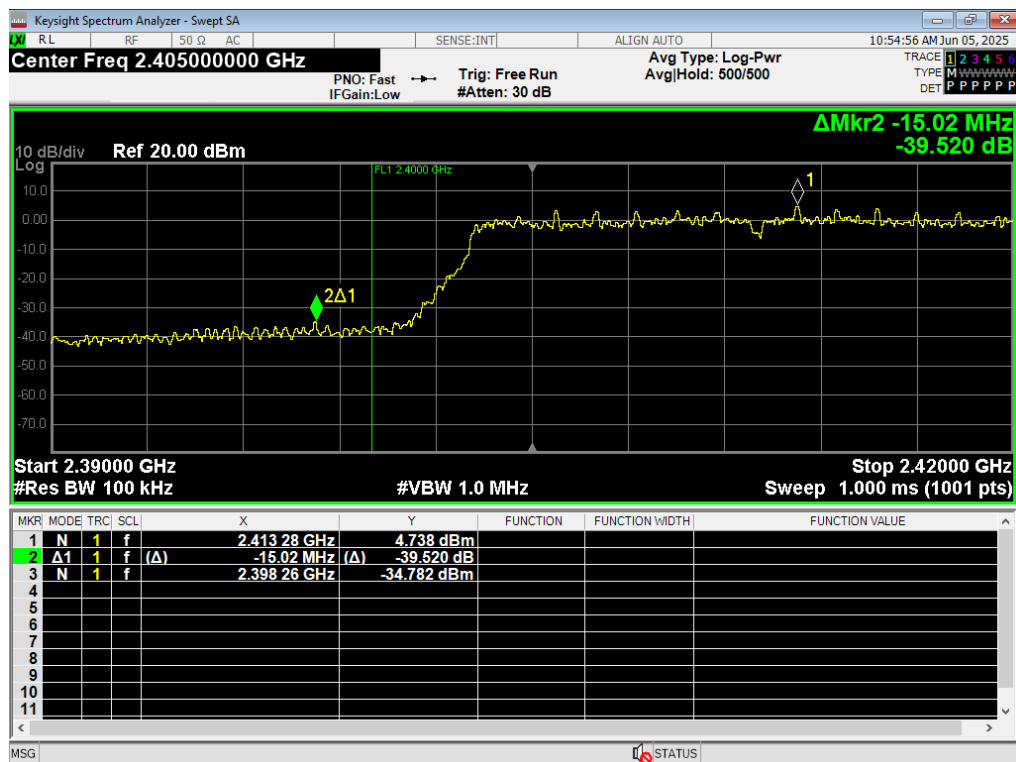
33 PSD, WiFi N 6.5MB, 2412MHz



34 PSD, WiFi N 6.5MB, 2437MHz



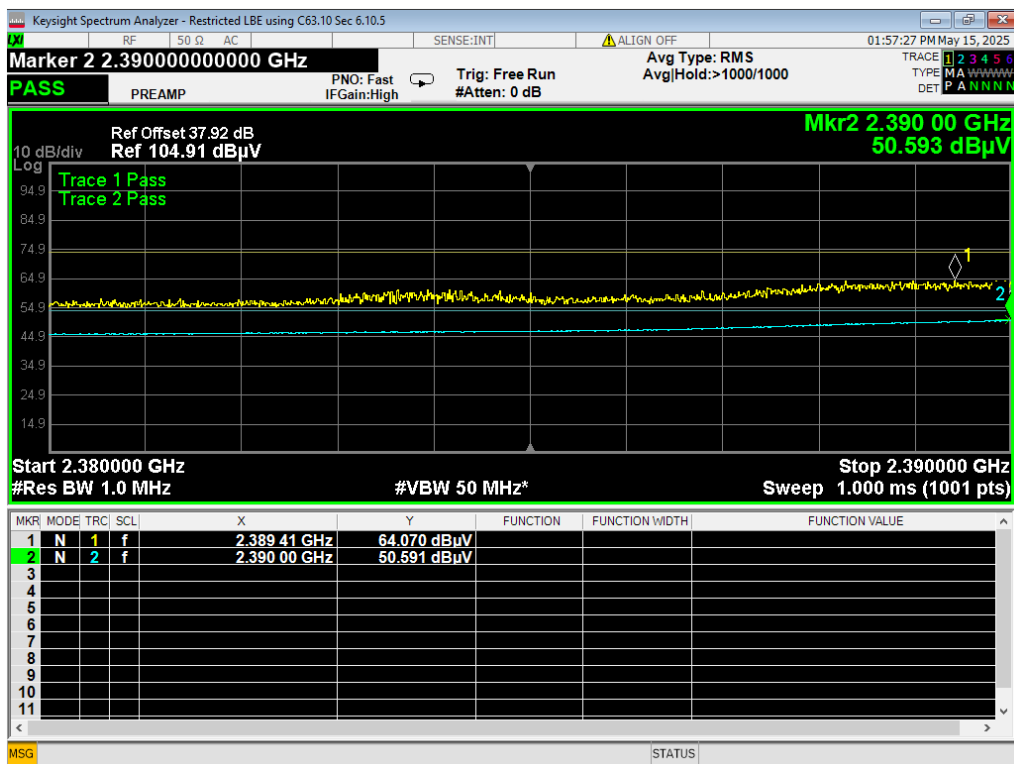
35 PSD, WiFi N 6.5MB, 2462MHz



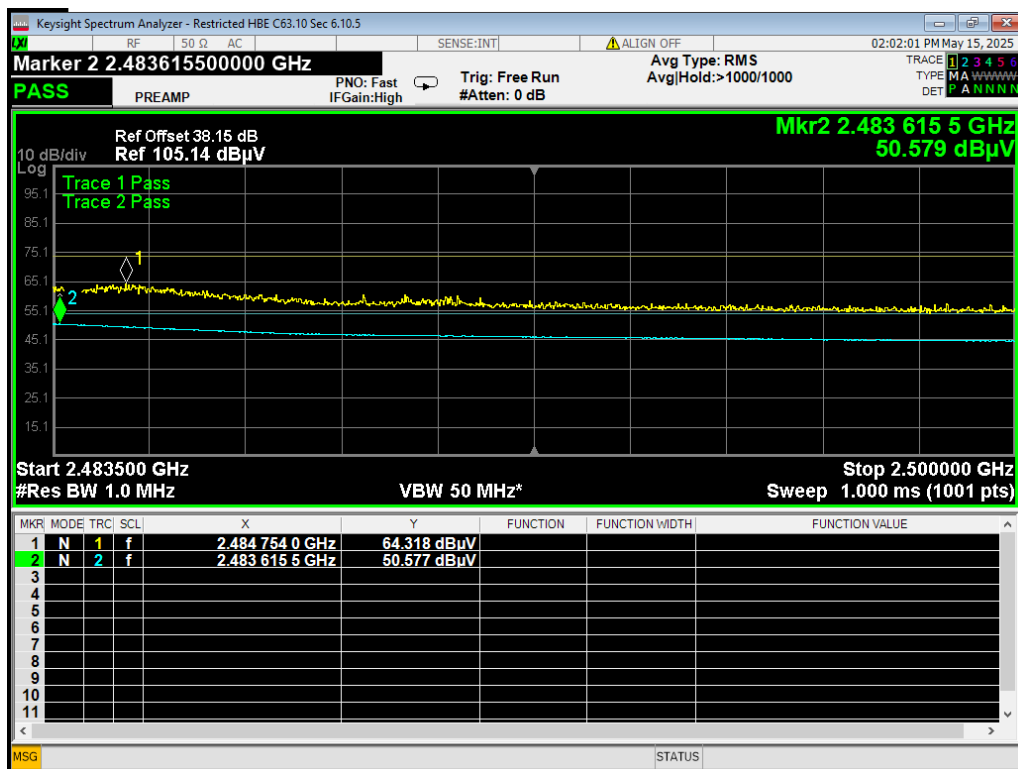
36 LBE Unrestricted, WiFi N 6.5MB



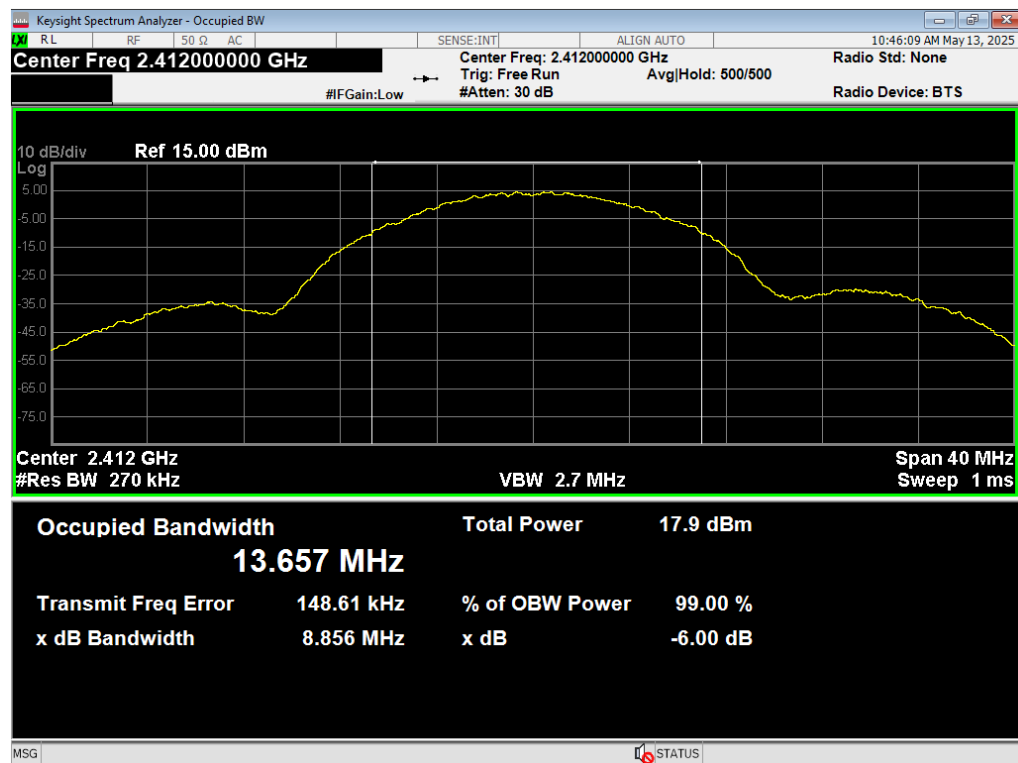
37 HBE Unrestricted, WiFi N 6.5MB



38 LBE Restricted, WiFi N 6.5MB

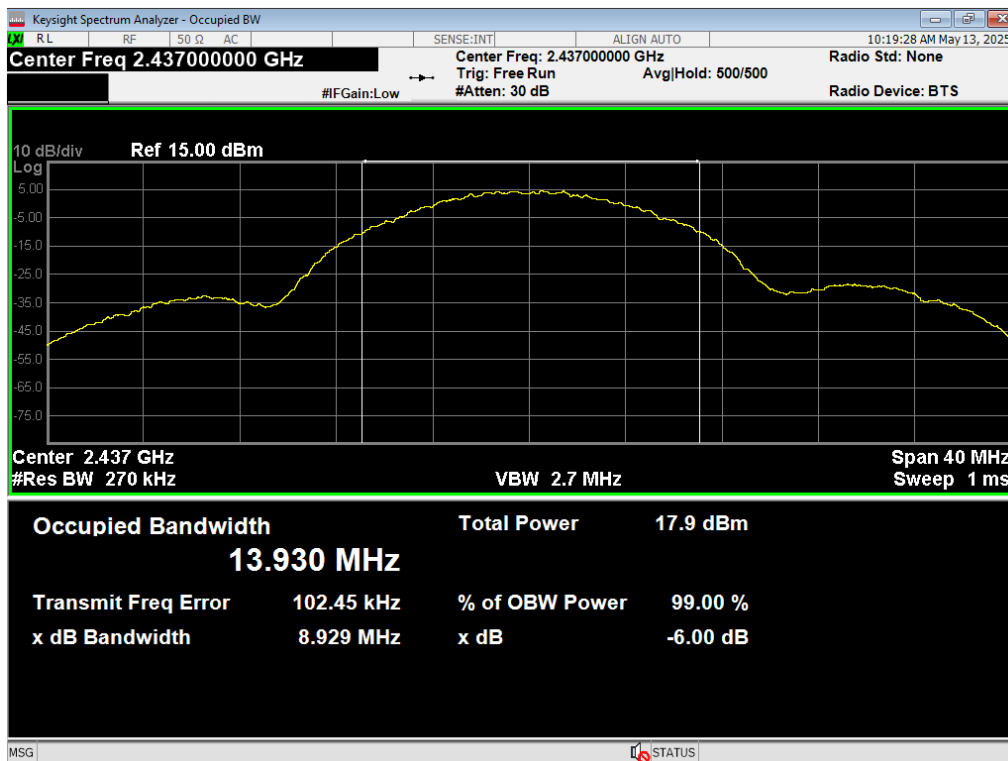


39 HBE Restricted, WiFi N 6.5MB

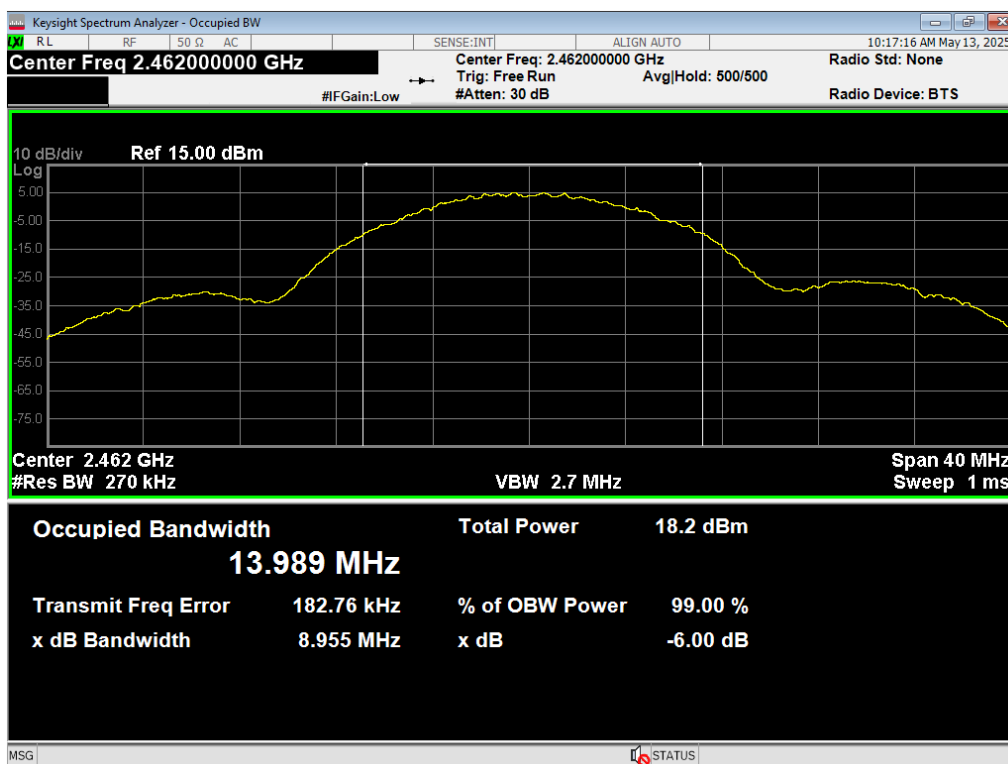


40 Occupied BW, WiFi B 11MB, 2412MHz

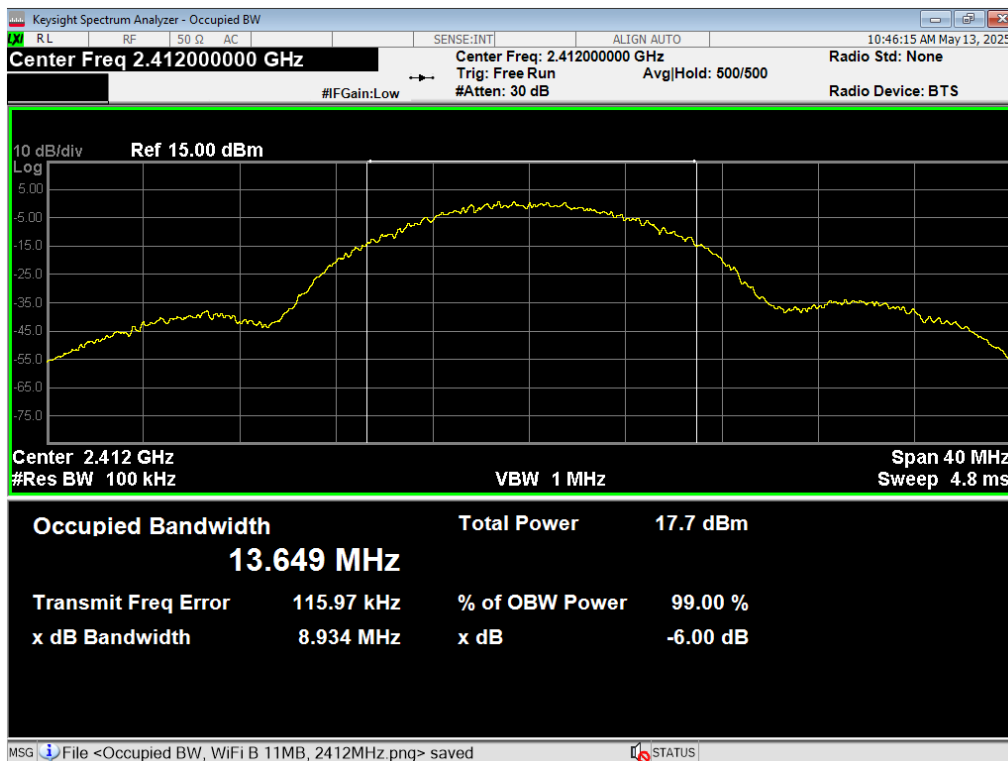
Report Number:	R20250124-00-E2	Rev	B
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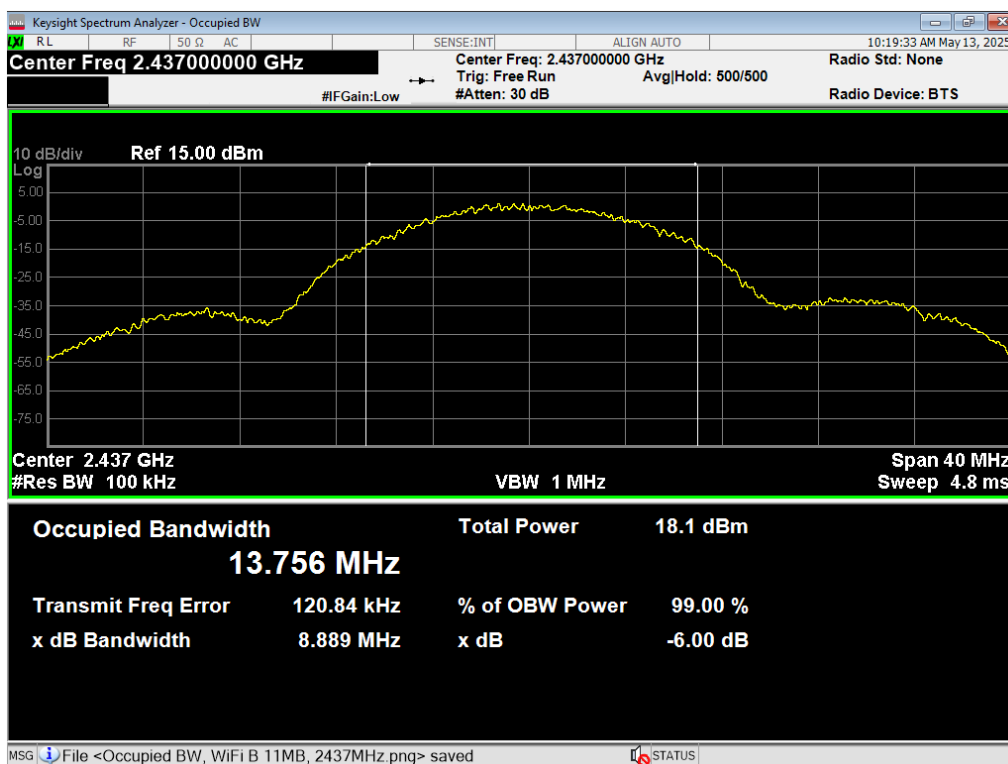
41 Occupied BW, WiFi B 11MB, 2437MHz



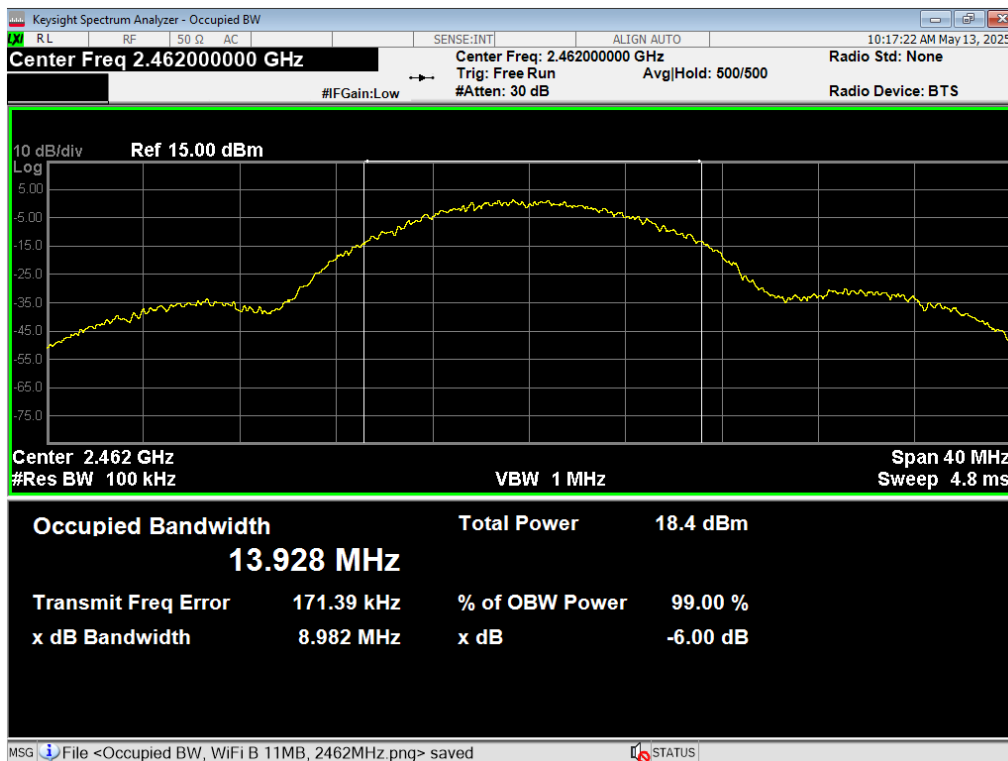
42 Occupied BW, WiFi B 11MB, 2462MHz



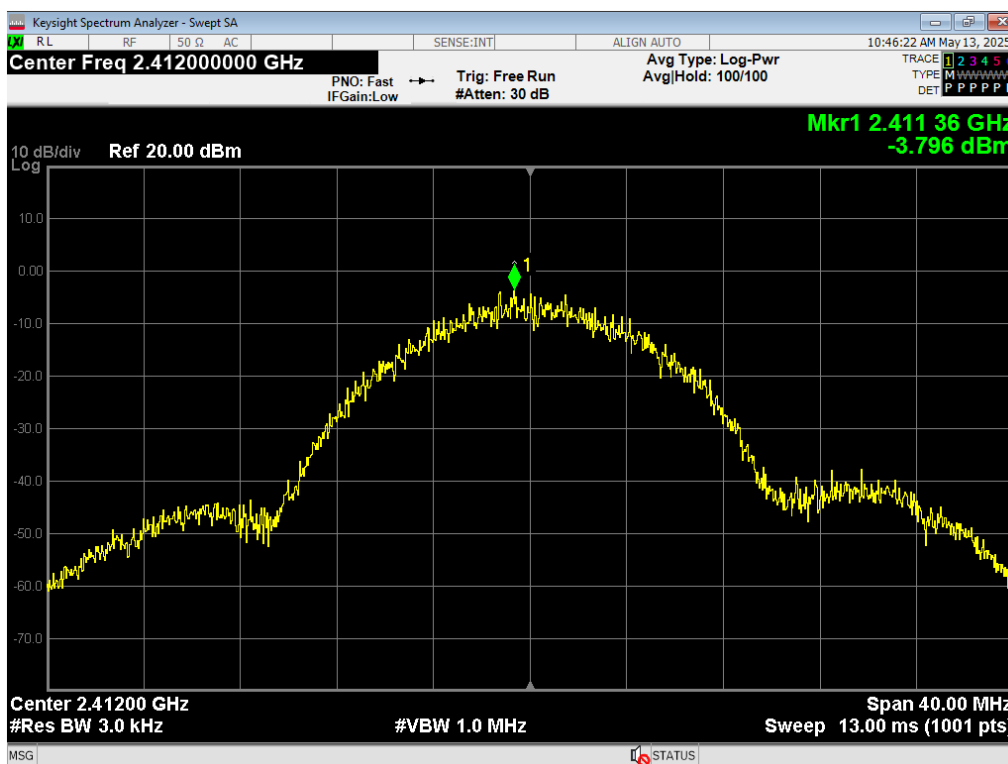
43 6dB BW, WiFi B 11MB, 2412MHz



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

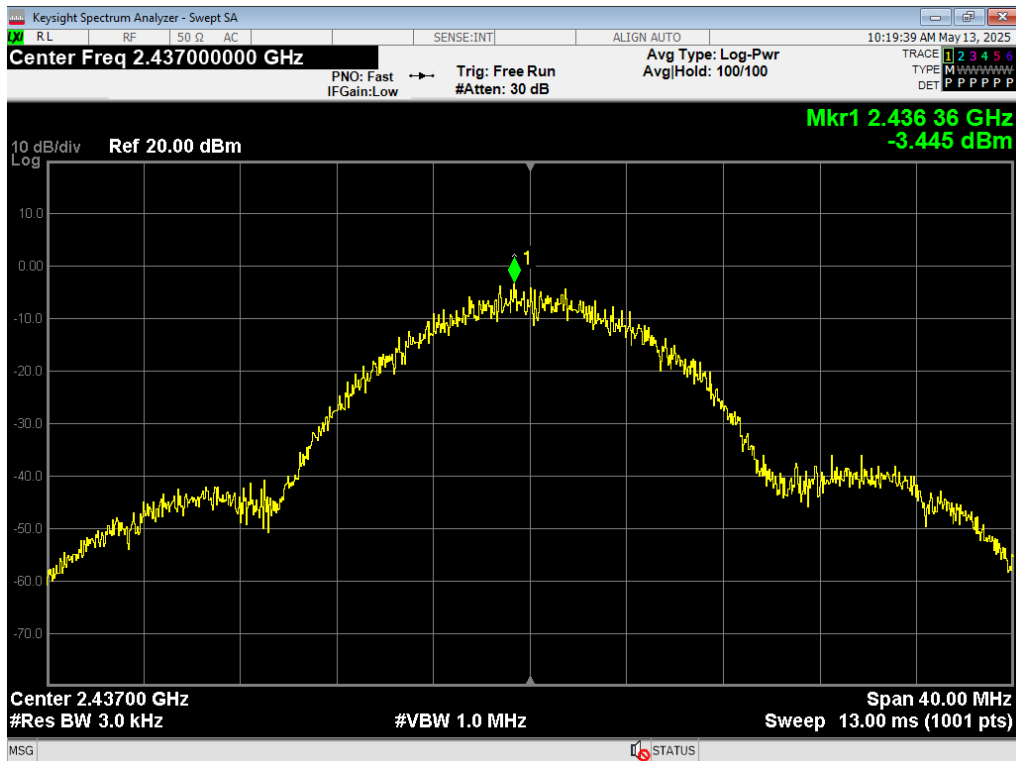


45 6dB BW, WiFi B 11MB, 2462MHz

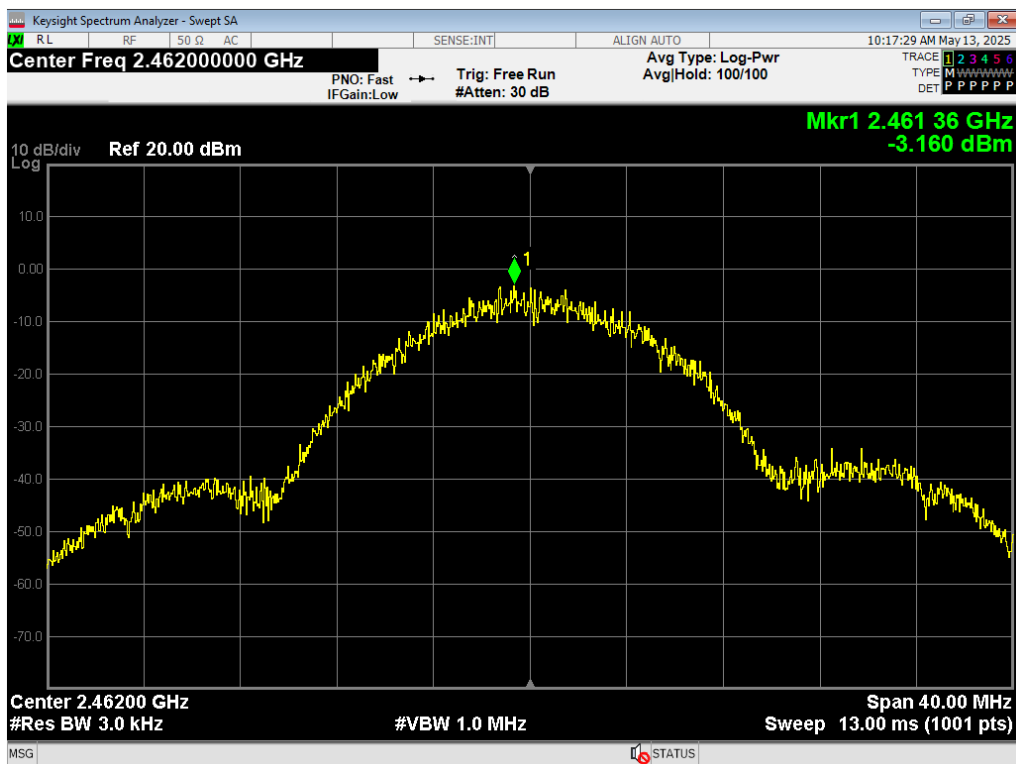


46 PSD, WiFi B 11MB, 2412MHz

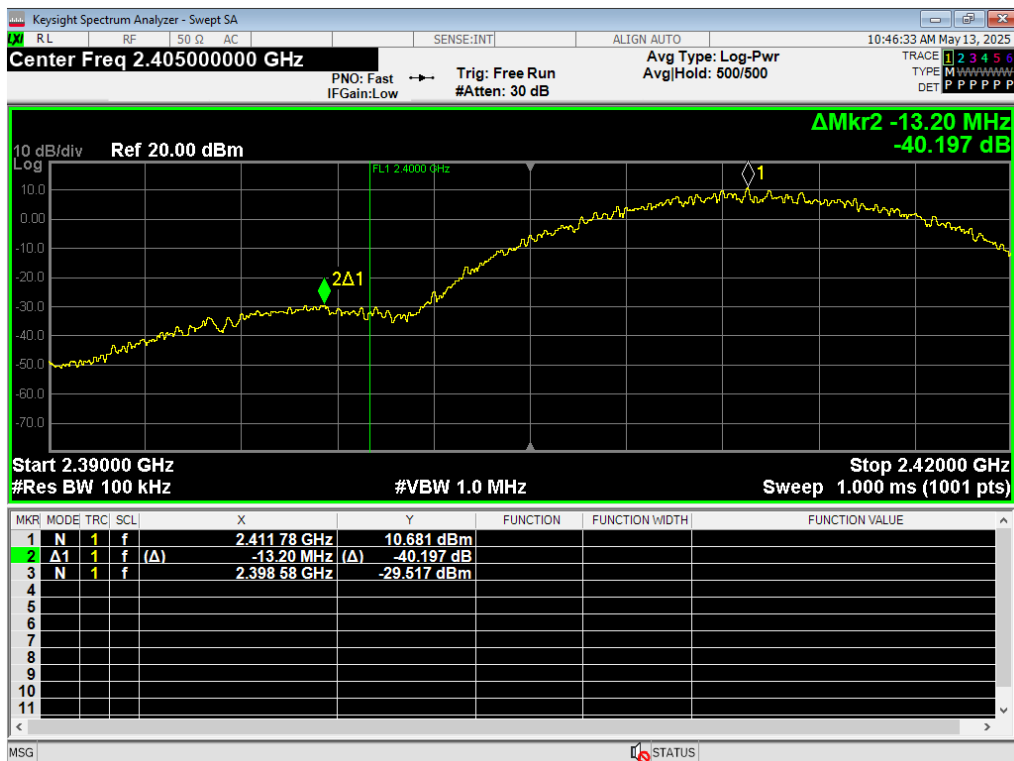
Report Number:	R20250124-00-E2	Rev	B
Prepared for:	Garmin International, Inc.		



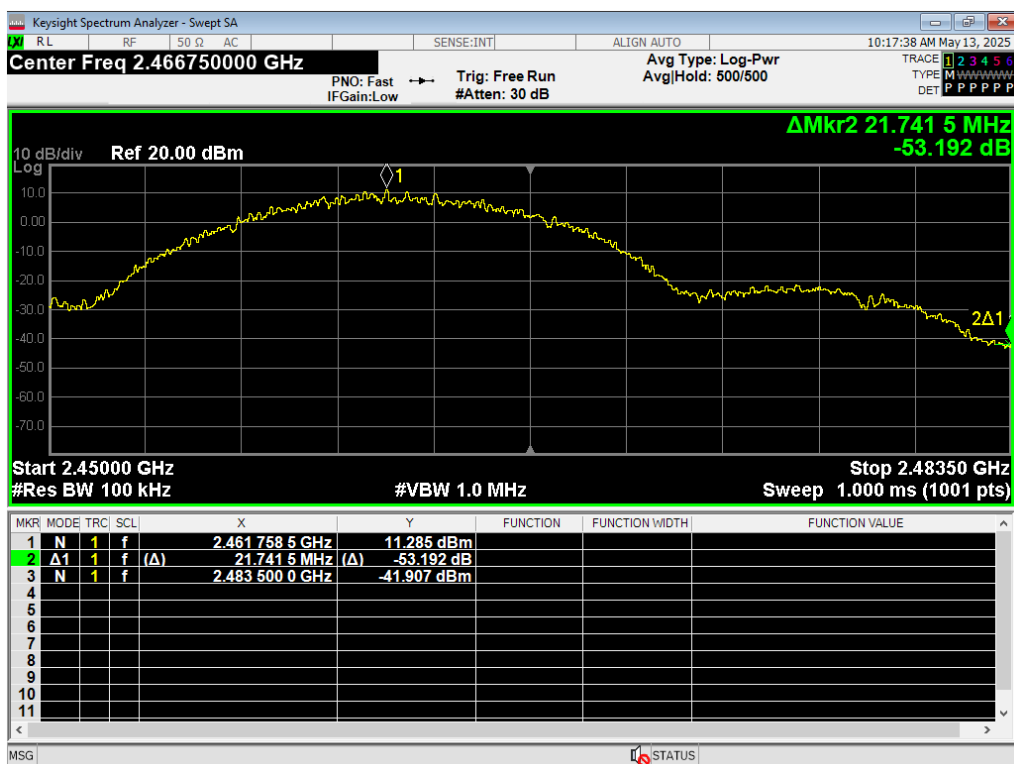
47 PSD, WiFi B 11MB, 2437MHz



48 PSD, WiFi B 11MB, 2462MHz

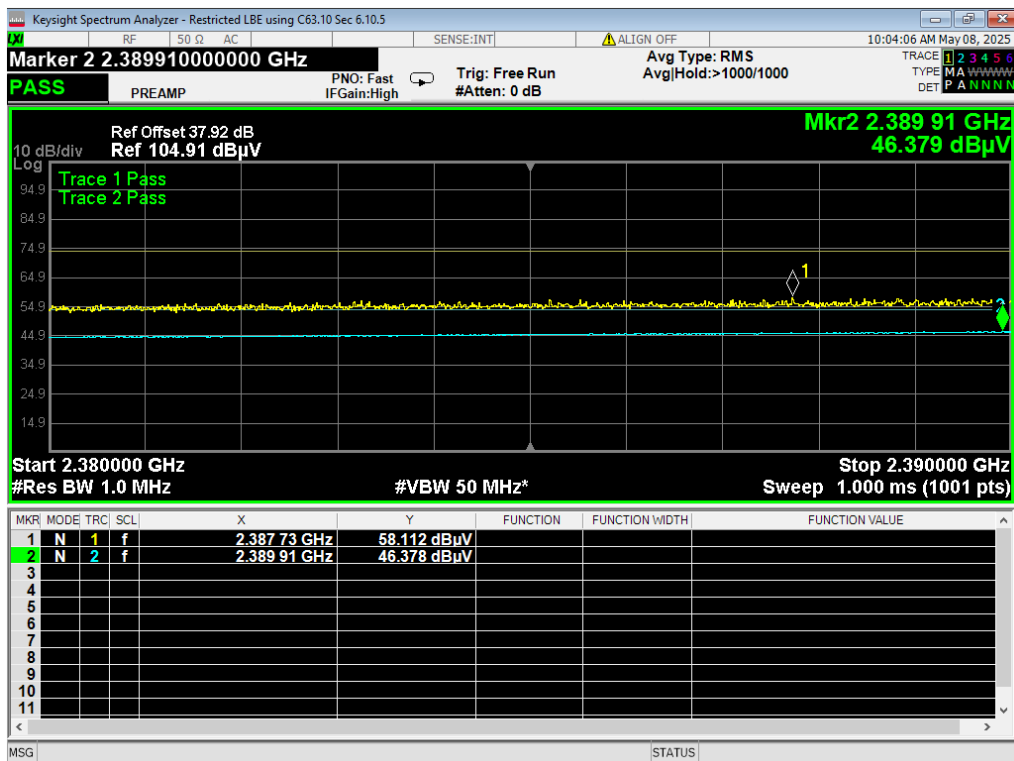


49 LBE Unrestricted, WiFi B 11MB

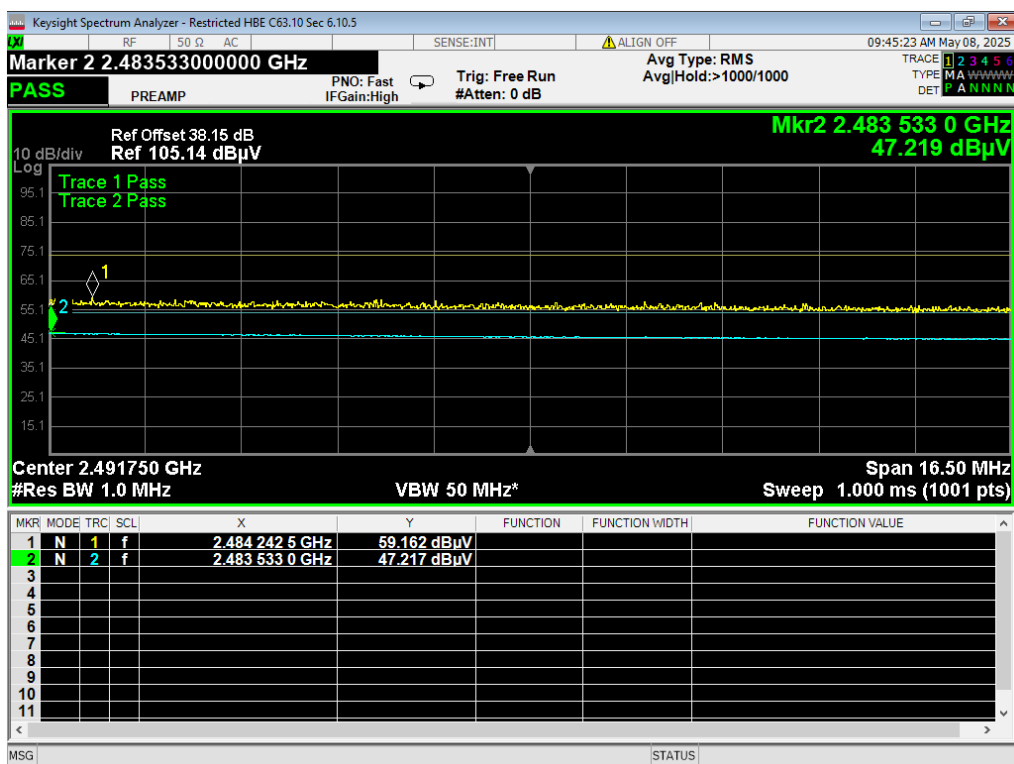


50 HBE Unrestricted, WiFi B 11MB

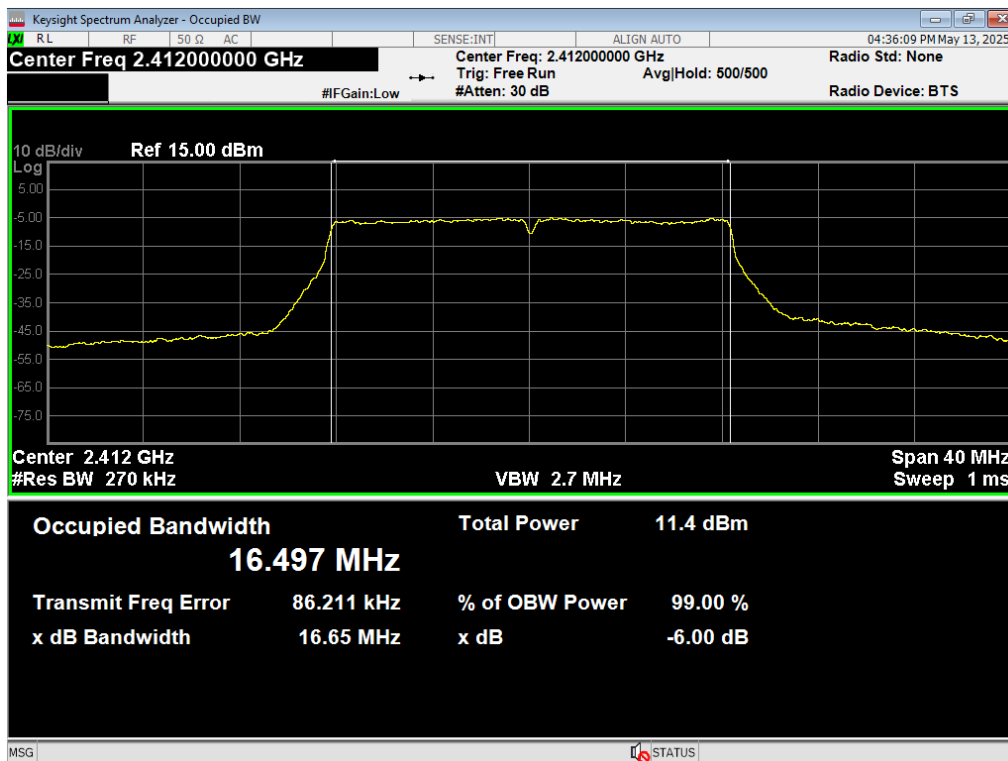
	Report Number:	R20250124-00-E2	Rev	B
	Prepared for:	Garmin International, Inc.		



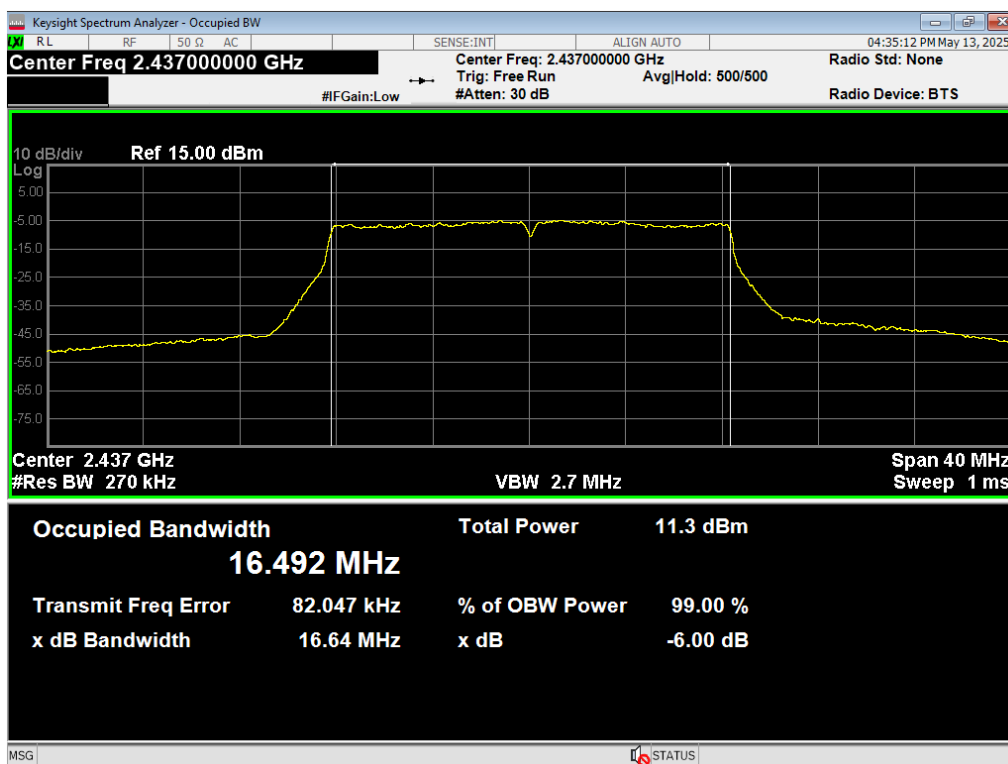
51 LBE Restricted, WiFi B 11MB



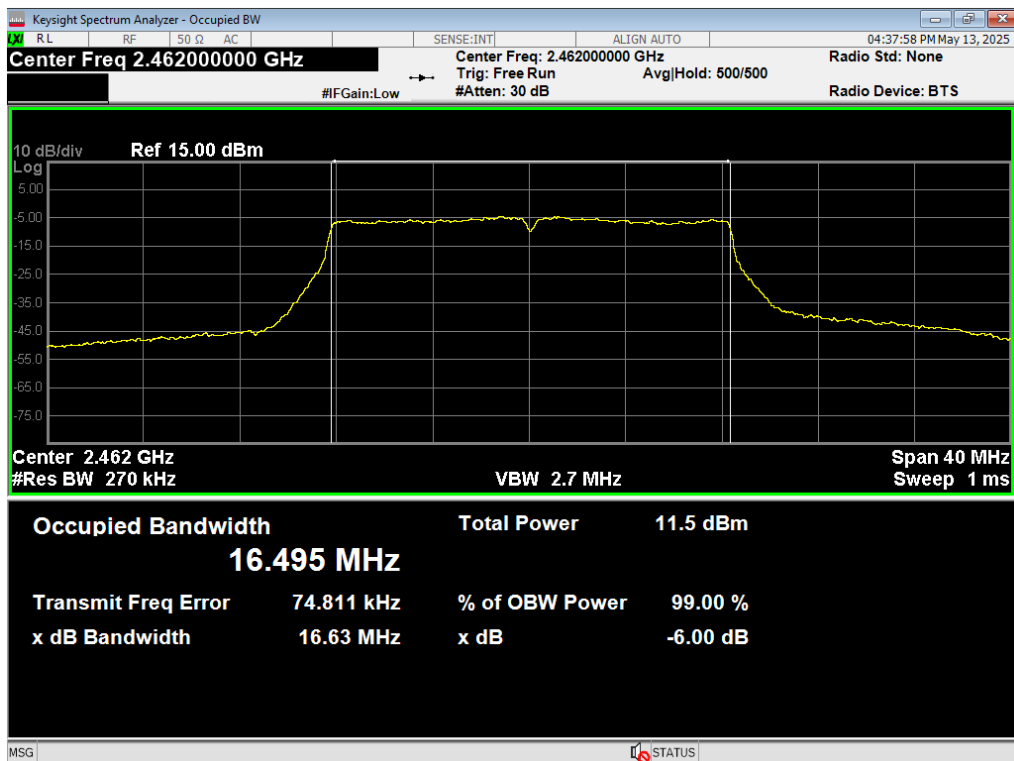
52 HBE Restricted, WiFi B 11MB, Ch11



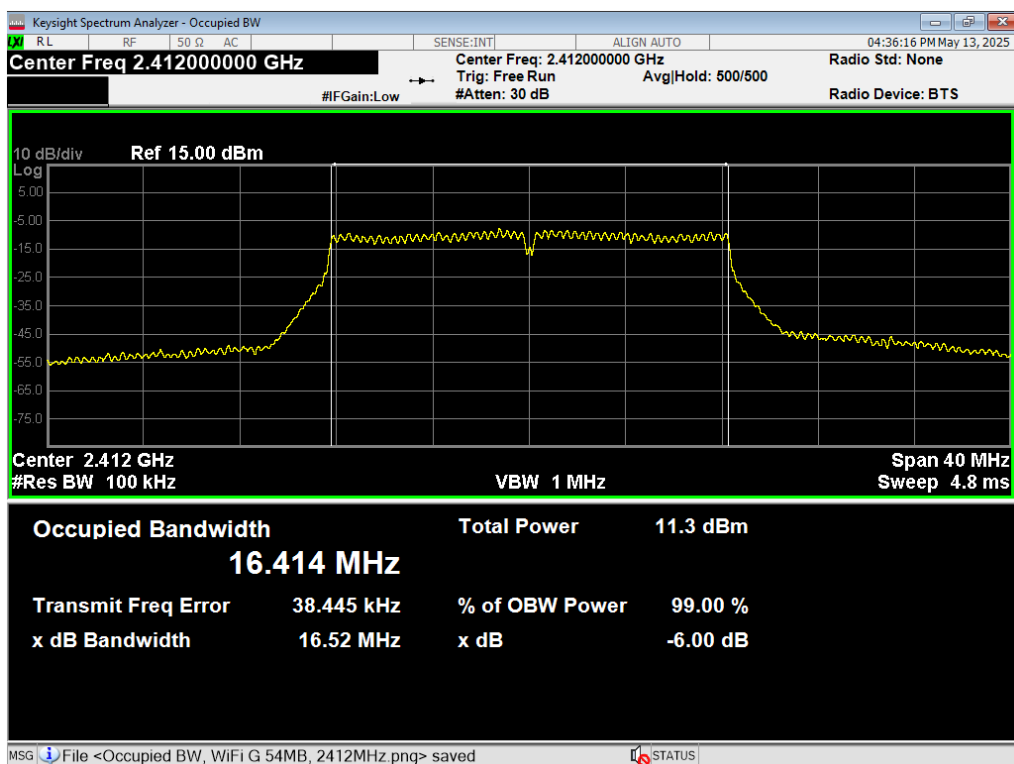
53 Occupied BW, WiFi G 54MB, 2412MHz



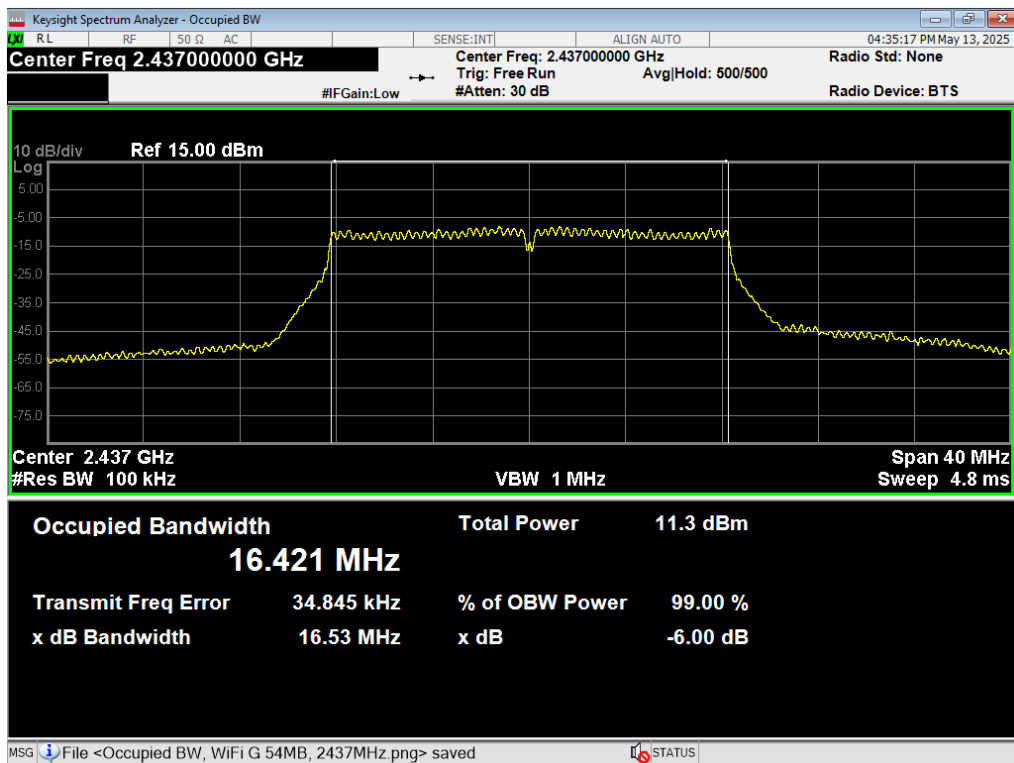
54 Occupied BW, WiFi G 54MB, 2437MHz



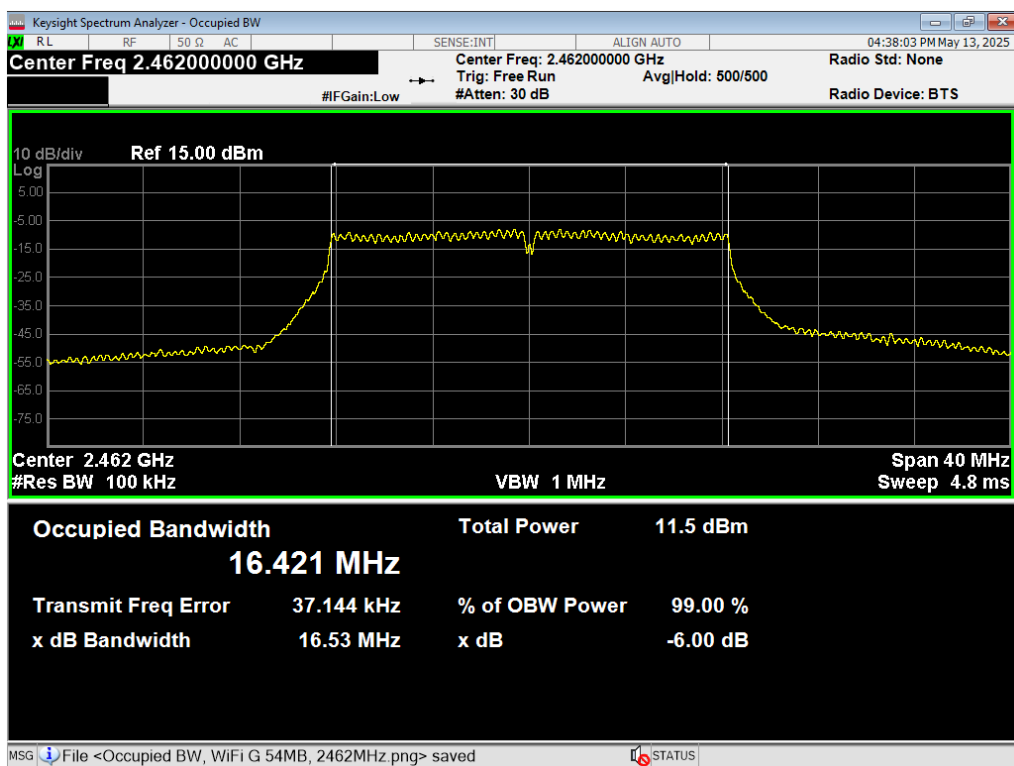
55 Occupied BW, WiFi G 54MB, 2462MHz



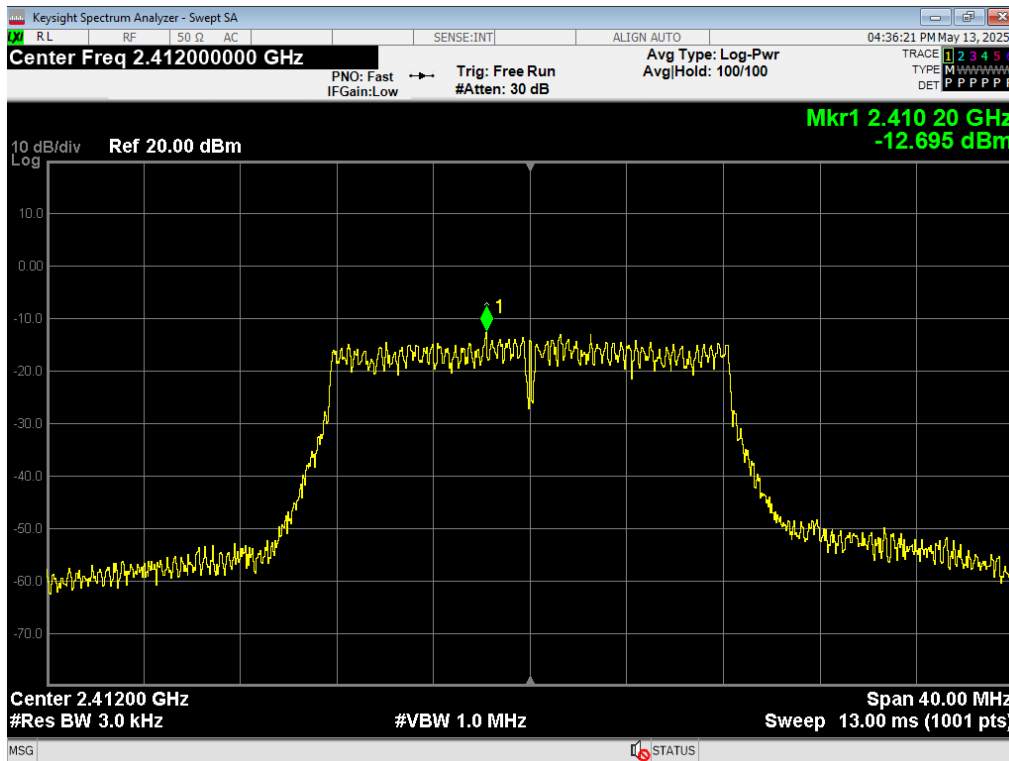
56 6dB BW, WiFi G 54MB, 2412MHz



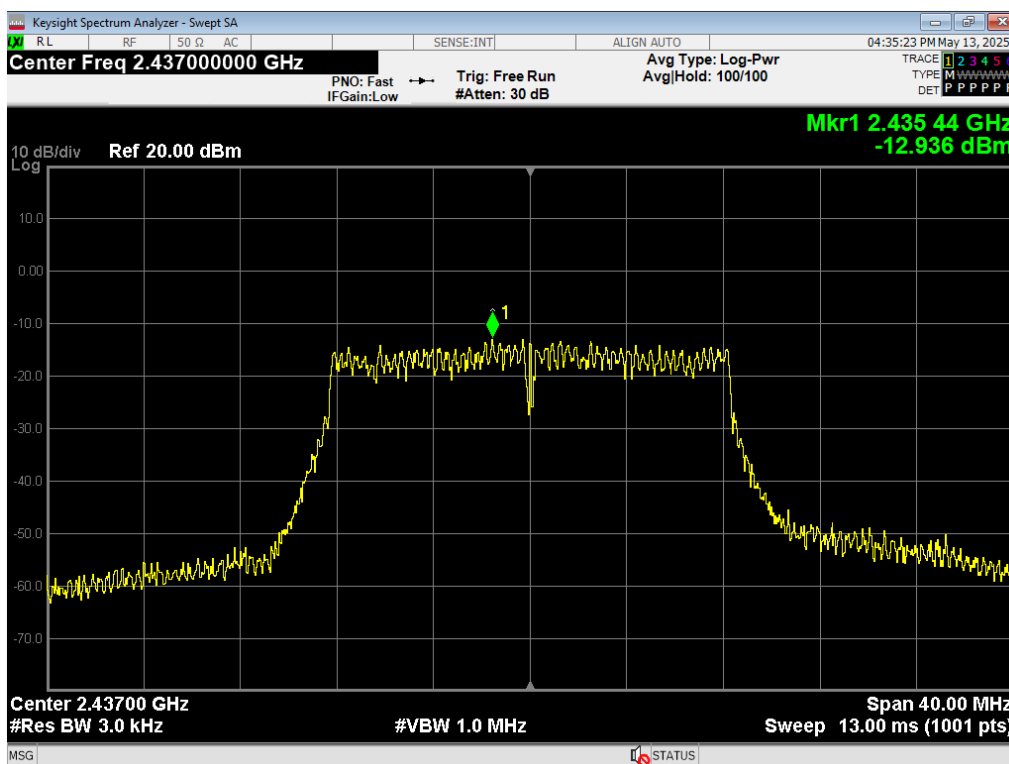
57 6dB BW, WiFi G 54MB, 2437MHz



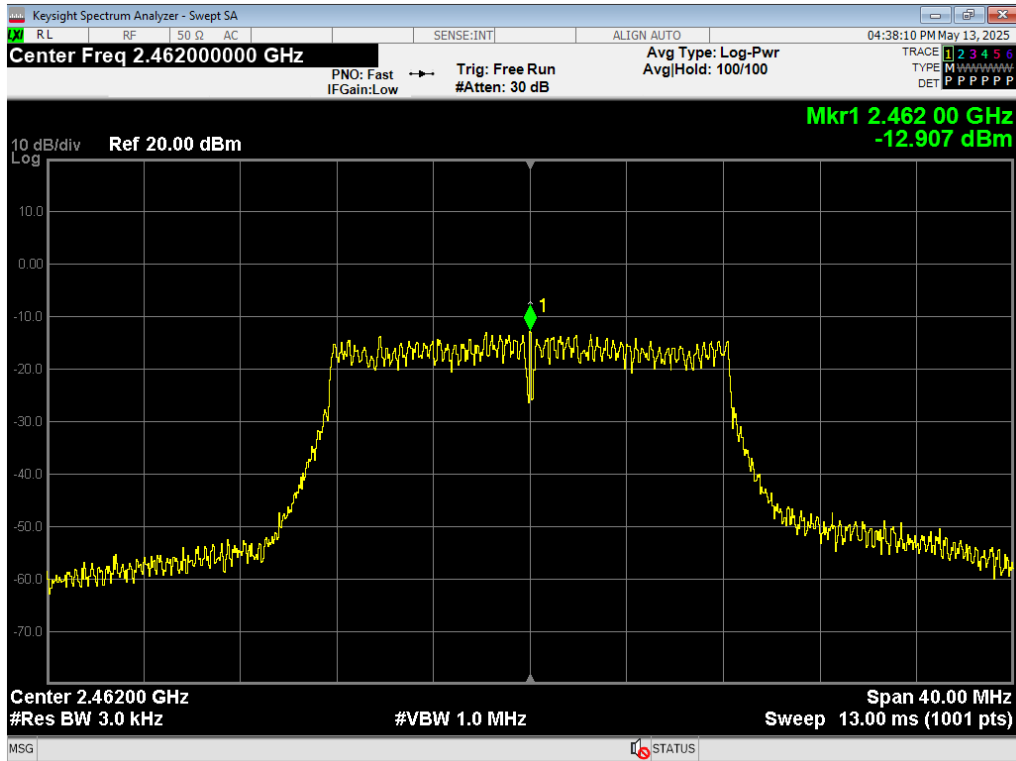
58 6dB BW, WiFi G 54MB, 2462MHz



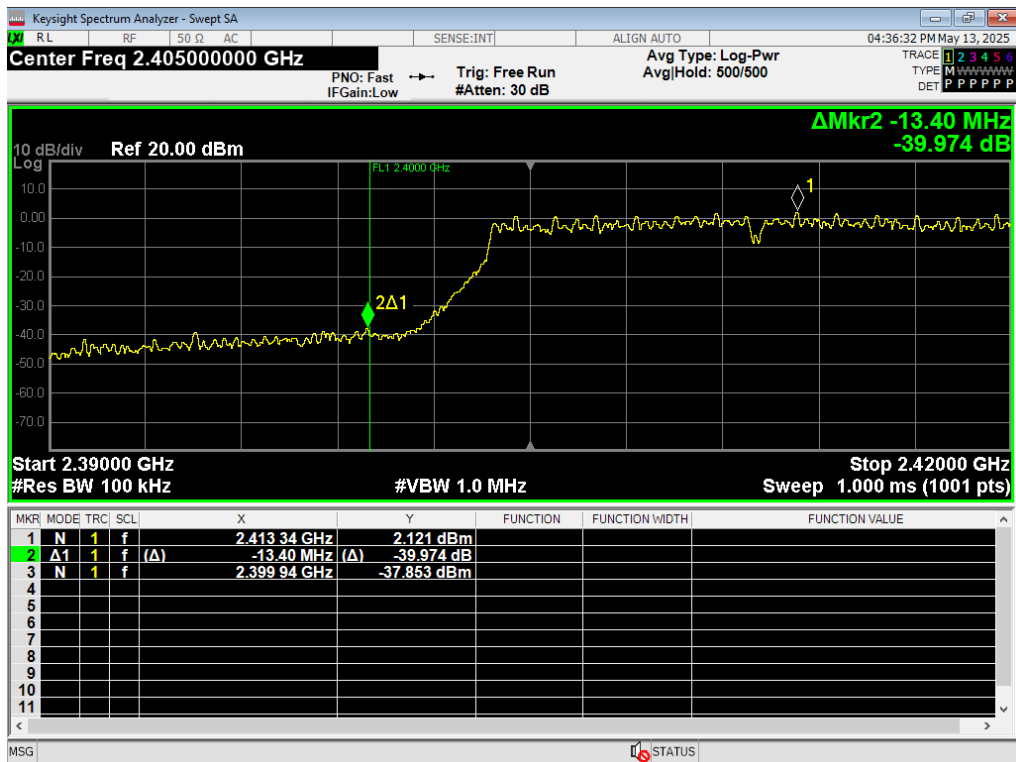
59 PSD, WiFi G 54MB, 2412MHz



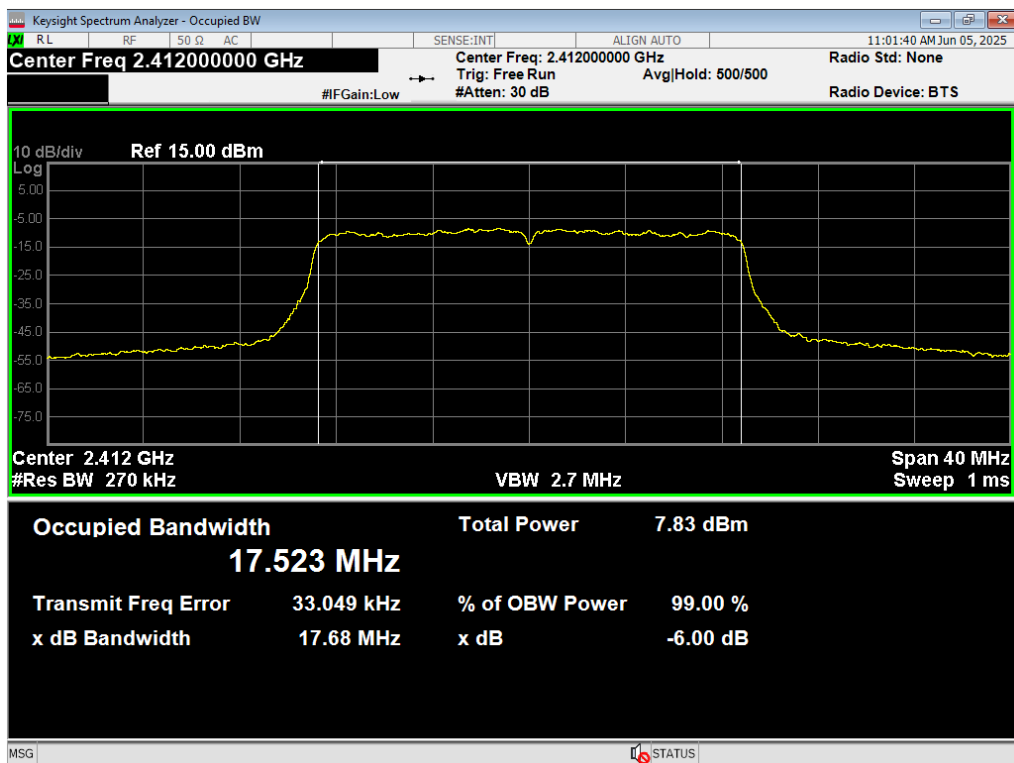
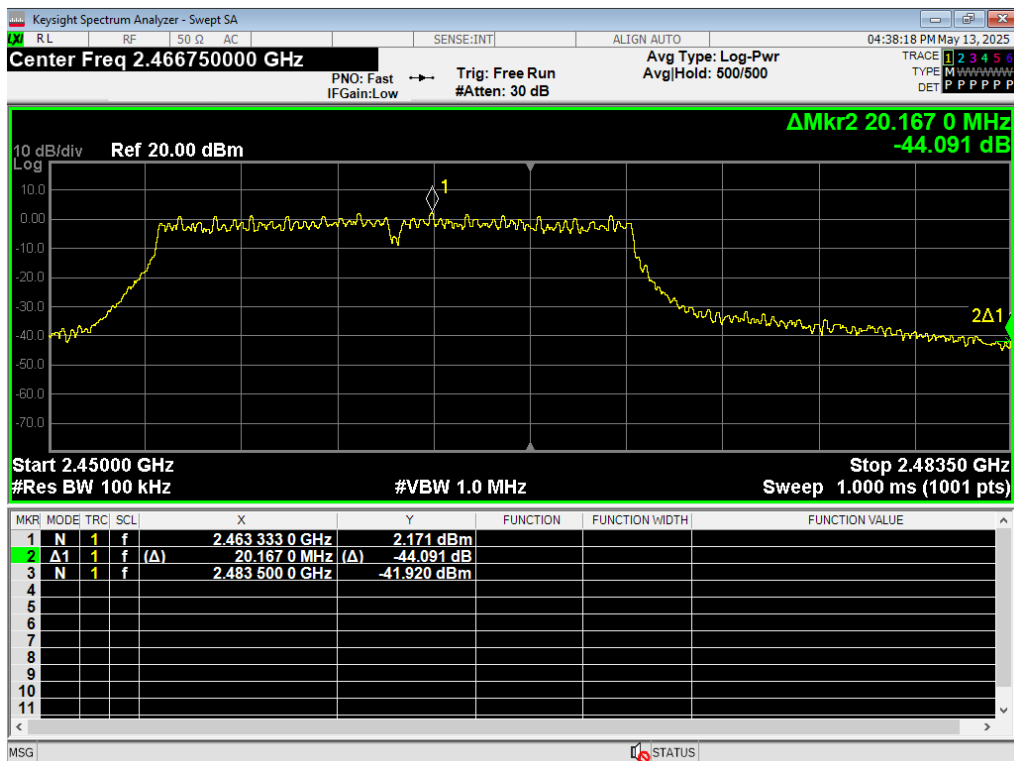
60 PSD, WiFi G 54MB, 2437MHz



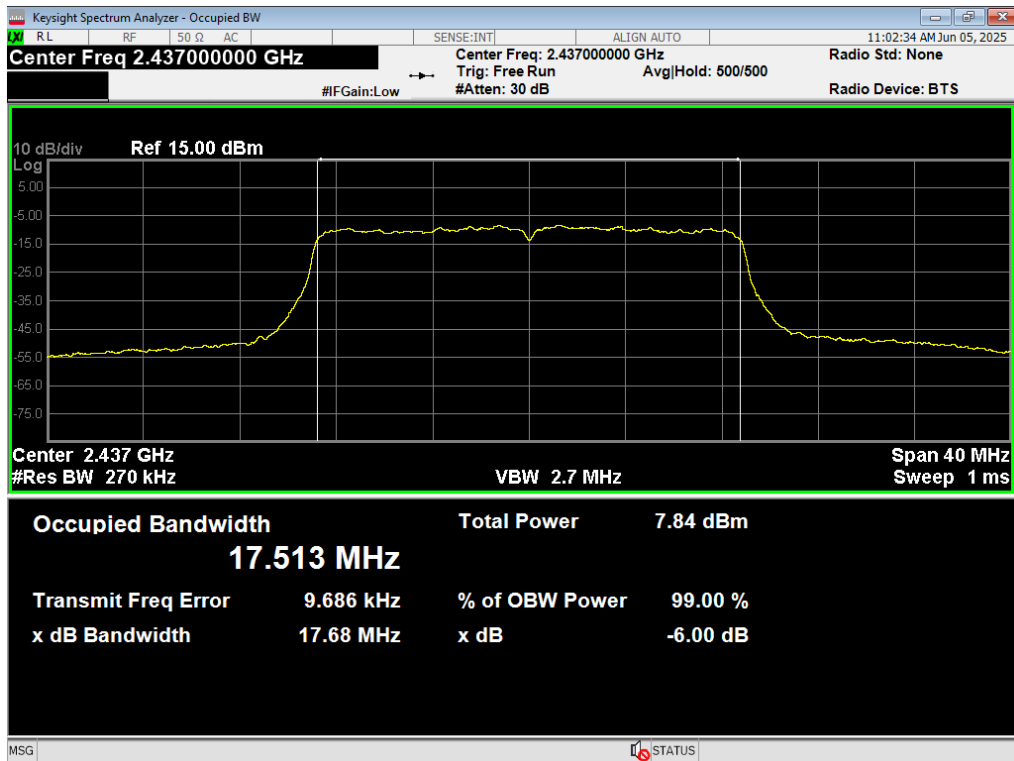
61 PSD, WiFi G 54MB, 2462MHz



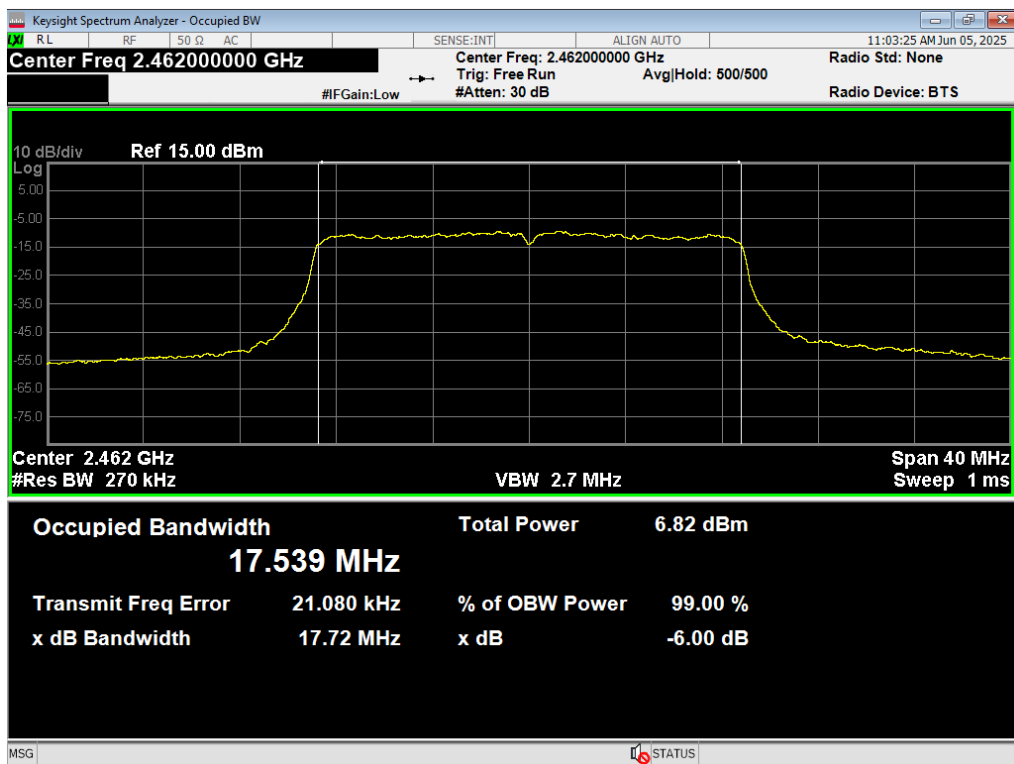
62 LBE Unrestricted, WiFi G 54MB



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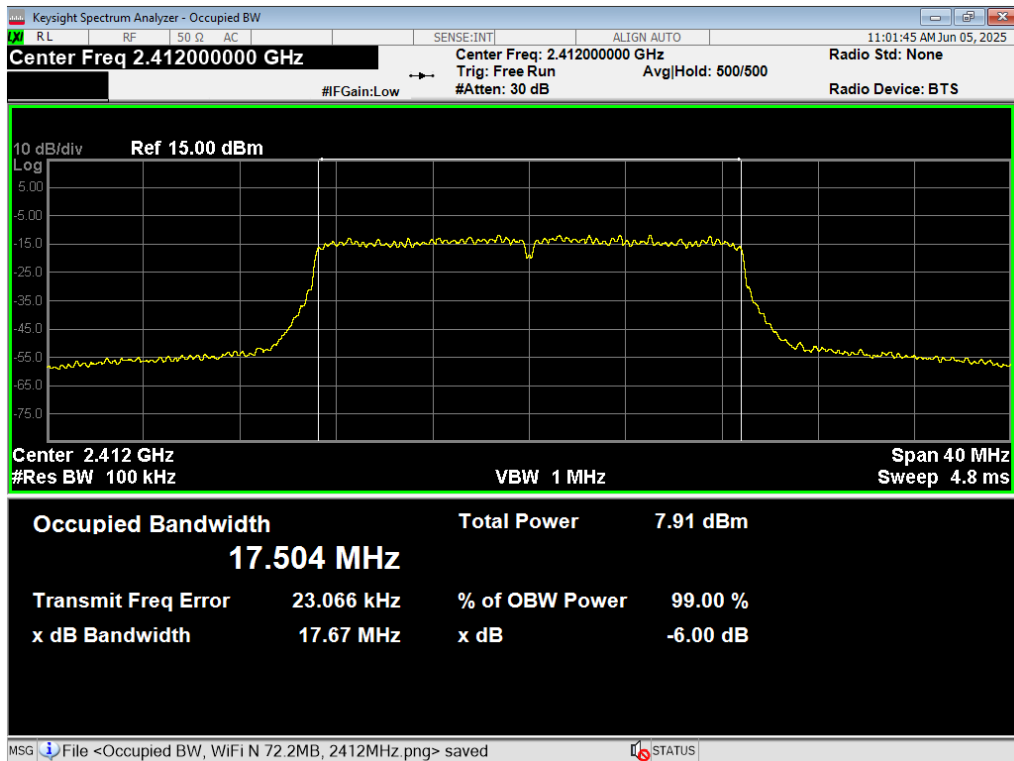


65 Occupied BW, WiFi N 72.2MB, 2437MHz

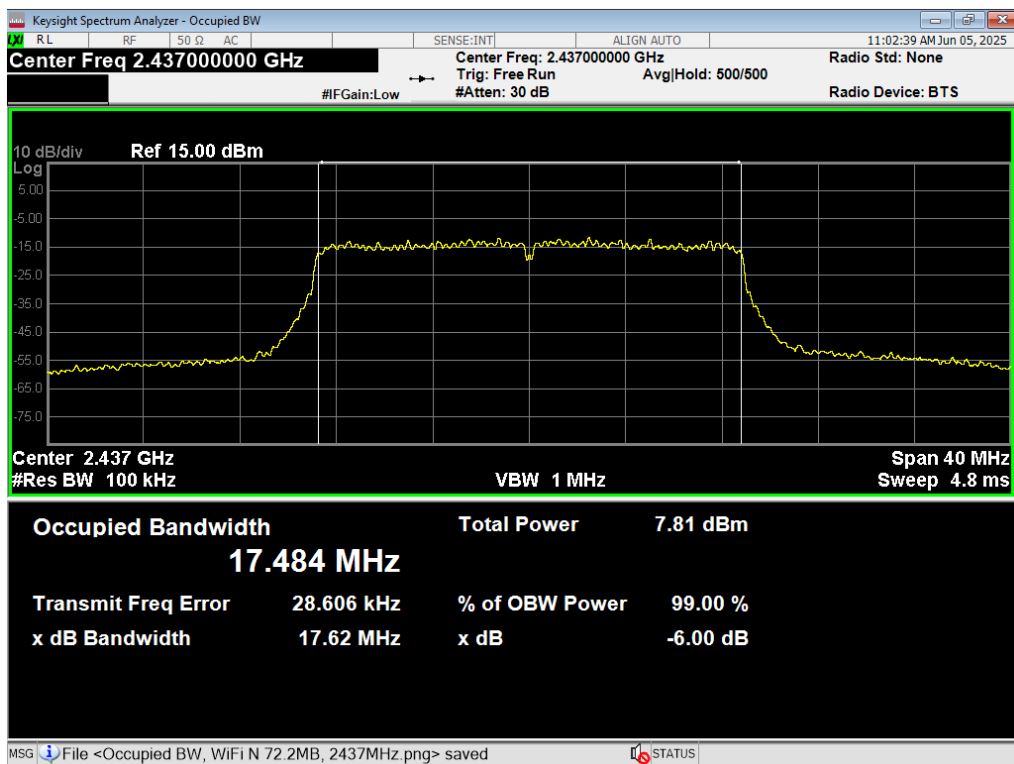


66 Occupied BW, WiFi N 72.2MB, 2462MHz

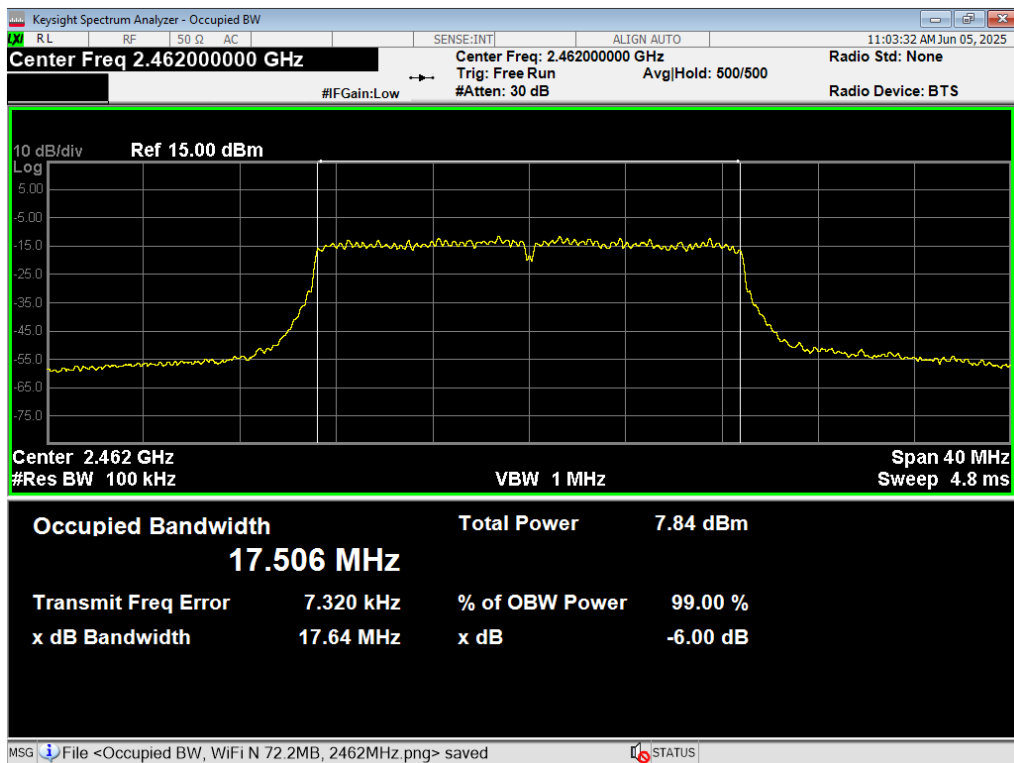
Report Number:	R20250124-00-E2	Rev	B
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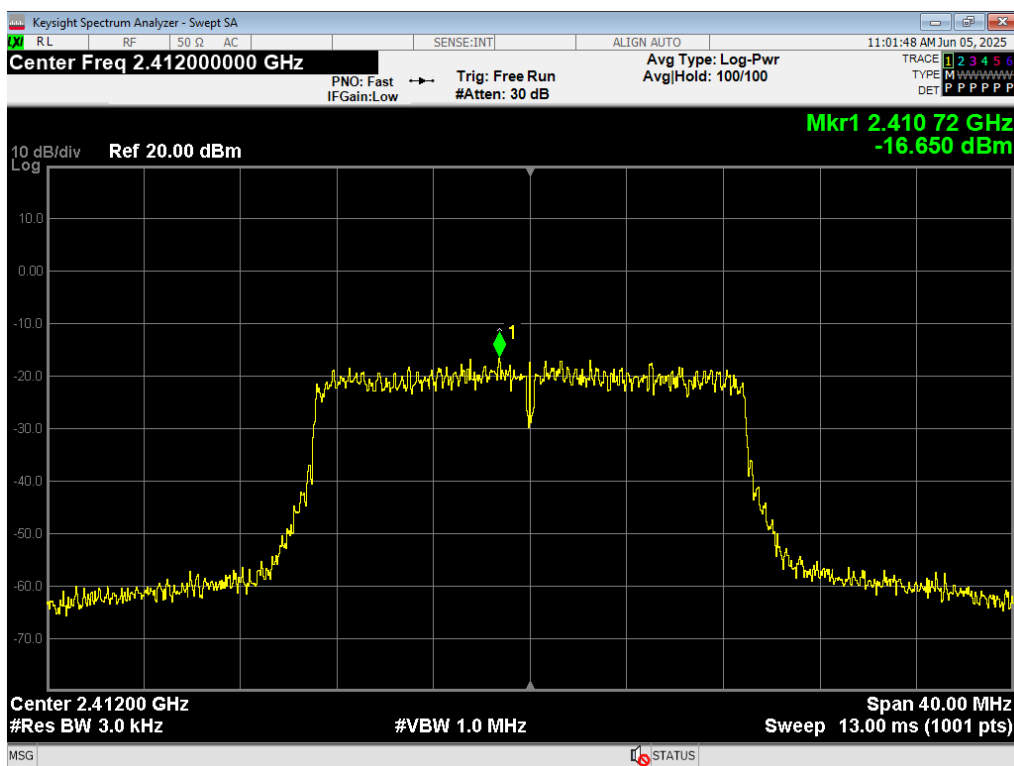
67 6dB BW, WiFi N 72.2MB, 2412MHz



68 6dB BW, WiFi N 72.2MB, 2437MHz

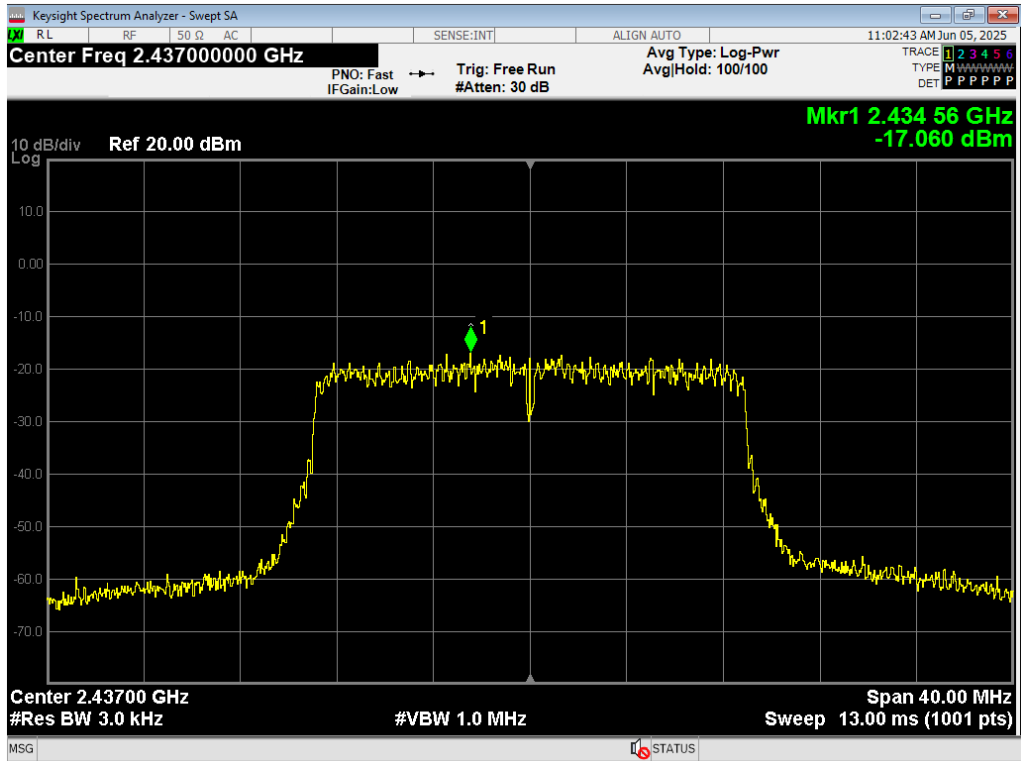


69 6dB BW, WiFi N 72.2MB, 2462MHz

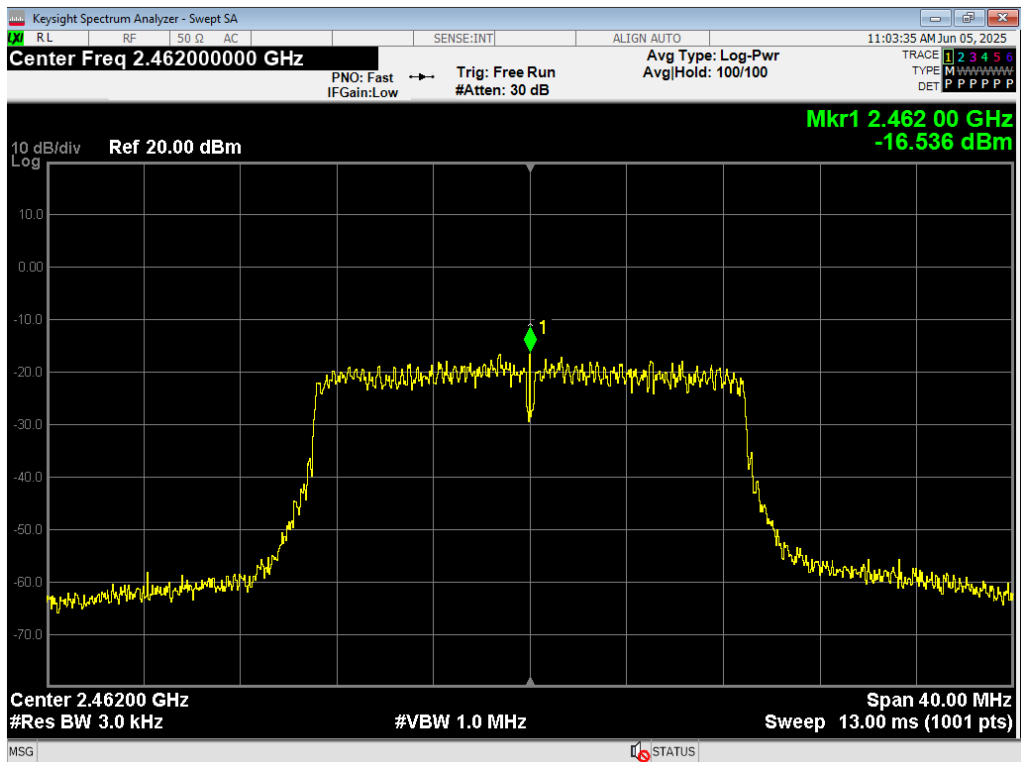


70 PSD, WiFi N 72.2MB, 2412MHz

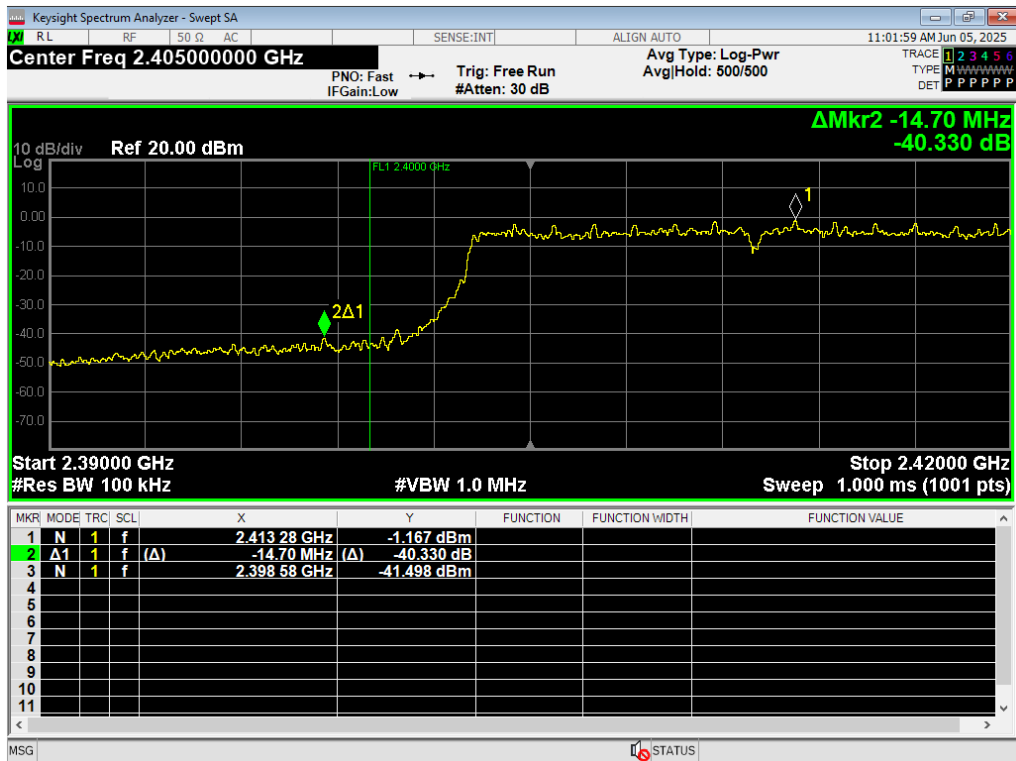
Report Number:	R20250124-00-E2	Rev	B
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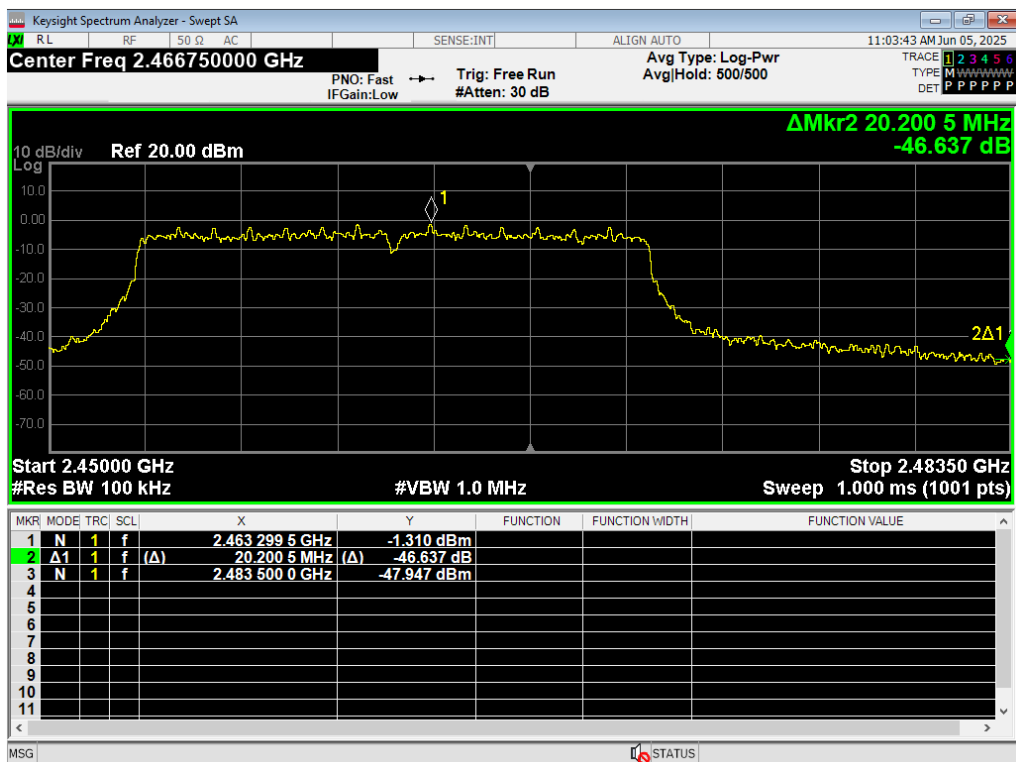
71 PSD, WiFi N 72.2MB, 2437MHz



72 PSD, WiFi N 72.2MB, 2462MHz



73 LBE Unrestricted, WiFi N 72.2MB



74 HBE Unrestricted, WiFi N 72.2MB



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REPORT END



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ANAB 17025 Certificate Number: AT-3274; CAB Identifier: US0239

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SAR EVALUATION REPORT

FCC ID:	IPH-04828 Contains FCC ID: IPH-04349
IC:	1792A-04828 Contains IC: 1792A-04349
HVIN/PMN/Model(s):	A04828 Contains M/N: A04349
FVIN:	1.01
Device Type:	Portable Digital Transceiver
Report Issue Date:	August 12, 2025

Garmin International, Inc.

1200 E. 151st Street,
Olathe, KS 66062, United States

Certification

Band/Mode	Body SAR [W/kg]	Extremity SAR [W/kg]	1g Simultaneous Tx SAR [W/kg]	10g Simultaneous Tx SAR [W/kg]
2.4 GHz WIFI	0.82	0.42	1.59	1.23
2.4 GHz Bluetooth	< 0.10	< 0.10	1.59	1.23
2.4 GHz ANT/ANT+	< 0.10	< 0.10	1.59	1.23
Iridium L-Band	1.51	0.81	1.59	1.23
FCC/ISED Limits	1.6	4.0	1.6	4.0

The measurement evaluations presented in this report are based on the maximum performance of the tested device(s), which has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure federal limits in 47CFR § 1.1310 and Health Canada Safety Code 6 and has been tested in accordance with the measurement procedures specified within this report.

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This document has been revised and replaces all previously issued versions of this document with the same Test Report S/N.



Steve Liu
President



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Appendix A: SAR Test Plots

Appendix B: Tissue Stimulating Liquids, System Checks and System Validation

Appendix C: System Check Plots

Appendix D: Calibration Certificates

Appendix E : Simultaneous Transmission Analysis

Appendix F : Test Setup Photos



1. DUT Specifics

1.1. Device under Test

The device under test is a portable digital transceiver, incorporating the technologies listed in Table 1-1 below. The manufacturer has confirmed that the device is within operational tolerances expected for production units and has the same physical, mechanical, and thermal characteristics expected for production units. The serial number of the device used for each test is indicated alongside the results.

Table 1-1 Supported Technologies

Band/Mode	Frequency (MHz)
Iridium L-Band	1616 - 1626.5 MHz
2.4 GHz WIFI	2412 - 2462 MHz
2.4 GHz Bluetooth	2402 - 2480 MHz
2.4 GHz ANT/ANT+	2402 - 2480 MHz

1.2. Maximum Time-Averaged Power From Manufacturer

The manufacturer has confirmed that this device follows the below target output power specifications and tolerances. SAR values were scaled to the maximum allowed power (including tolerance) to determine compliance per KDB Publication 447498 D04v01.

Table 1-2 2.4 GHz WIFI Target RF Output Power

2.4 GHz WIFI Target Power [dBm]					
Exposure Condition	Mode		802.11b	802.11g	802.11n
	Channel	Freq. [MHz]	2.4 GHz Antenna		
Body/Extremity	All		17.5	16	15.5
	1	2412		14	13
	2	2417		15	
	11	2462		13.5	12.5
Tolerance: +/-2 dB					



Table 1-3 2.4 GHz Bluetooth Target RF Output Power

2.4 GHz Bluetooth Target Power [dBm]				
Exposure Condition	Mode	Channel	Data Rate	2.4 GHz Antenna
Body/Extremity	Bluetooth BR	All	1Mbps	6.5
	Bluetooth EDR	All	2Mbps	6.5
	Bluetooth EDR	All	3Mbps	6.5
	BLE	0	1Mbps	-1.0
		1-37		3.5
		38		-1.0
		39		-1.0
	BLE	0	2Mbps	-0.5
		1-37		3.0
		38		-0.5
		39		-0.5
Tolerance: +/- 2 dB				

Table 1-4 2.4 GHz ANT/ANT+ Target RF Output Power

2.4 GHz ANT/ANT+ Target Power [dBm]		
Exposure Condition	Channel	2.4 GHz Antenna
Body/Extremity	0-1	0.0
	2-76	3.5
	77-78	0.0
Tolerance: +/- 2 dB		

Table 1-5 Iridium L-Band Target RF Output Power

Iridium L-Band Target Power [dBm]			
Exposure Condition	Modulation	Channel	Iridium Antenna
Body/Extremity	B1	1-240	34.2
	C1/C2		31.0
Tolerance: +/- 0.5 dB			

1.3. Surfaces Required for Testing

Antennas	Back	Front	Top	Bottom	Right	Left
Iridium Antenna	Yes	Yes	No	Yes	Yes	Yes
2.4 GHz Antenna	Yes	Yes	No	Yes	Yes	Yes

Note: Device is only handheld or body-worn, thus exposure on the top surface is not realistic during use.



1.4. Test Guidance Applied

- IEEE 1528-2013 (FCC)
- IEC/IEEE 62209-1528:2020 (ISED)
- RSS-102 Issue 6 (ISED)
- RSS-102.SAR.MEAS (ISED)
- Health Canada Safety Code 6 (ISED)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices) (FCC/ISED)
- FCC KDB Publication 447498 D04v01 (General SAR Guidance) (FCC/ISED)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz) (FCC)

2. DUT Conducted Powers

2.1. Power Measurement Setup

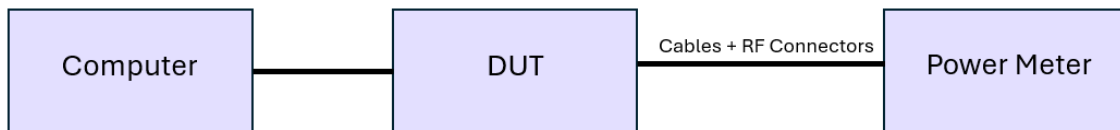


Figure 2-1 FTM Power Measurement Setup

2.2. WIFI Conducted Powers

Table 2-1

2.4 GHz WIFI Conducted Power [dBm]					
Exposure Condition	Mode		802.11b	802.11g	802.11n
	Ch.	Freq. [MHz]	2.4 GHz Antenna		
Body/Extremity	1	2412	17.73	12.67	11.38
	6	2437	18.03	15.93	15.09
	11	2462	18.80	14.45	13.48



2.3. Bluetooth Conducted Powers

Table 2-2

2.4 GHz Bluetooth Conducted Power [dBm]			
Exposure Condition / Mode	Channel	Freq [MHz]	2.4 GHz Antenna
Body/Extremity / Bluetooth	0	2402	7.01
	39	2441	7.18
	78	2480	7.78

2.4. ANT/ANT+ Conducted Powers

Table 2-3

2.4 GHz ANT/ANT+	Frequency [MHz]	2404.0	2441.0	2478.0
Antenna: 2.4 GHz Antenna	Channel Number	2	39	76
Exposure Condition	Modulation	Conducted Power [dBm]		
Body/Extremity	GFSK	4.08	4.26	4.31

2.5. Iridium L-Band Conducted Powers

Table 2-4

Iridium L-Band	Frequency [MHz]	1616.02	1621.02	1625.98
Antenna: Iridium	Channel Number	1	121	240
Exposure Condition	Modulation	Conducted Power [dBm]		
Body/Extremity	C1	31.19	31.11	31.06



3. DUT SAR Test Results

3.1. WIFI SAR Data

Table 3-1

Exposure Condition	Band/Mode	Antenna	DUT SN	Power Drift [dB]	Maximum Duty Cycle [%]	Measured Duty Cycle [%]	Frequency [MHz]	Channel	Modulation/Configuration	Data Rate [Mbps]	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Separation Distance [mm]	Position	Measured 1g SAR [W/kg]	Reported 1g SAR [W/kg]	Measured 10g SAR [W/kg]	Reported 10g SAR [W/kg]	Test Plot
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.03	100.0%	95.98%	2412	1	IEEE 802.11b - 22 MHz	1	19.5	17.73	0	Back	0.467	0.731	0.241	0.377	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.07	100.0%	95.98%	2437	6	IEEE 802.11b - 22 MHz	1	19.5	18.03	0	Back	0.469	0.685	0.240	0.351	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.16	100.0%	95.98%	2462	11	IEEE 802.11b - 22 MHz	1	19.5	18.80	0	Back	0.433	0.530	0.222	0.272	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.02	100.0%	95.98%	2412	1	IEEE 802.11b - 22 MHz	1	19.5	17.73	0	Front	0.489	0.766	0.267	0.418	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.03	100.0%	95.98%	2437	6	IEEE 802.11b - 22 MHz	1	19.5	18.03	0	Front	0.519	0.759	0.283	0.414	2
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.12	100.0%	95.98%	2462	11	IEEE 802.11b - 22 MHz	1	19.5	18.80	0	Front	0.490	0.600	0.267	0.327	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.18	100.0%	95.98%	2412	1	IEEE 802.11b - 22 MHz	1	19.5	17.73	0	Bottom	0.259	0.406	0.137	0.215	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.11	100.0%	95.98%	2437	6	IEEE 802.11b - 22 MHz	1	19.5	18.03	0	Bottom	0.250	0.365	0.132	0.193	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.02	100.0%	95.98%	2462	11	IEEE 802.11b - 22 MHz	1	19.5	18.80	0	Bottom	0.235	0.288	0.123	0.151	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.17	100.0%	95.98%	2412	1	IEEE 802.11b - 22 MHz	1	19.5	17.73	0	Right	0.521	0.816	0.243	0.381	1
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.08	100.0%	95.98%	2437	6	IEEE 802.11b - 22 MHz	1	19.5	18.03	0	Right	0.518	0.757	0.250	0.365	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	-0.04	100.0%	95.98%	2462	11	IEEE 802.11b - 22 MHz	1	19.5	18.80	0	Right	0.511	0.626	0.251	0.307	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.12	100.0%	95.98%	2412	1	IEEE 802.11b - 22 MHz	1	19.5	17.73	0	Left	0.062	0.097	0.030	0.047	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.12	100.0%	95.98%	2437	6	IEEE 802.11b - 22 MHz	1	19.5	18.03	0	Left	0.069	0.101	0.033	0.048	-
Body/Extremity	2.4 GHz WIFI	2.4 GHz Antenna	71808	0.02	100.0%	95.98%	2462	11	IEEE 802.11b - 22 MHz	1	19.5	18.80	0	Left	0.075	0.092	0.036	0.044	-

3.2. Bluetooth SAR Data

Table 3-2

Exposure Condition	Band/Mode	Antenna	DUT SN	Power Drift [dB]	Maximum Duty Cycle [%]	Measured Duty Cycle [%]	Frequency [MHz]	Channel	Modulation/Configuration	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Separation Distance [mm]	Position	Measured 1g SAR [W/kg]	Reported 1g SAR [W/kg]	Measured 10g SAR [W/kg]	Reported 10g SAR [W/kg]	Test Plot
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2402	0	FHSS	8.5	7.01	0	Back	0.050	0.070	0.025	0.035	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.10	100.0%	100.0%	2441	39	FHSS	8.5	7.18	0	Back	0.036	0.049	0.018	0.024	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2480	78	FHSS	8.5	7.78	0	Back	0.020	0.024	0.010	0.012	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2402	0	FHSS	8.5	7.01	0	Front	0.059	0.083	0.032	0.045	4
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.14	100.0%	100.0%	2441	39	FHSS	8.5	7.18	0	Front	0.049	0.066	0.026	0.035	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.17	100.0%	100.0%	2480	78	FHSS	8.5	7.78	0	Front	0.038	0.045	0.020	0.024	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2402	0	FHSS	8.5	7.01	0	Bottom	0.026	0.037	0.014	0.020	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.04	100.0%	100.0%	2441	39	FHSS	8.5	7.18	0	Bottom	0.019	0.026	0.010	0.014	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2480	78	FHSS	8.5	7.78	0	Bottom	0.013	0.015	0.007	0.008	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.01	100.0%	100.0%	2402	0	FHSS	8.5	7.01	0	Right	0.062	0.087	0.028	0.039	3
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.01	100.0%	100.0%	2441	39	FHSS	8.5	7.18	0	Right	0.050	0.068	0.024	0.033	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.02	100.0%	100.0%	2480	78	FHSS	8.5	7.78	0	Right	0.048	0.057	0.023	0.027	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2402	0	FHSS	8.5	7.01	0	Left	0.004	0.006	0.001	0.001	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	-0.04	100.0%	100.0%	2441	39	FHSS	8.5	7.18	0	Left	0.005	0.007	0.001	0.001	-
Body/Extremity	2.4 GHz Bluetooth	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2480	78	FHSS	8.5	7.78	0	Left	0.003	0.004	0.000	0.000	-

3.3. ANT/ANT+ SAR Data

Table 3-3

Exposure Condition	Band/Mode	Antenna	DUT SN	Power Drift [dB]	Maximum Duty Cycle [%]	Measured Duty Cycle [%]	Frequency [MHz]	Channel	Modulation/Configuration	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Separation Distance [mm]	Position	Measured 1g SAR [W/kg]	Reported 1g SAR [W/kg]	Measured 10g SAR [W/kg]	Reported 10g SAR [W/kg]	Test Plot
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.19	100.0%	100.0%	2404	2	GFSK	5.5	4.08	0	Back	0.014	0.019	0.006	0.008	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.12	100.0%	100.0%	2441	39	GFSK	5.5	4.26	0	Back	0.011	0.015	0.005	0.007	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.11	100.0%	100.0%	2478	76	GFSK	5.5	4.31	0	Back	0.006	0.008	0.002	0.003	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.17	100.0%	100.0%	2404	2	GFSK	5.5	4.08	0	Front	0.016	0.022	0.008	0.011	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	-0.09	100.0%	100.0%	2441	39	GFSK	5.5	4.26	0	Front	0.017	0.023	0.008	0.011	5
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.02	100.0%	100.0%	2478	76	GFSK	5.5	4.31	0	Front	0.013	0.017	0.006	0.008	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.09	100.0%	100.0%	2404	2	GFSK	5.5	4.08	0	Bottom	0.007	0.010	0.003	0.004	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.18	100.0%	100.0%	2441	39	GFSK	5.5	4.26	0	Bottom	0.006	0.008	0.003	0.004	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.13	100.0%	100.0%	2478	76	GFSK	5.5	4.31	0	Bottom	0.004	0.005	0.002	0.003	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	-0.13	100.0%	100.0%	2404	2	GFSK	5.5	4.08	0	Right	0.017	0.024	0.007	0.010	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.12	100.0%	100.0%	2441	39	GFSK	5.5	4.26	0	Right	0.015	0.020	0.007	0.009	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.15	100.0%	100.0%	2478	76	GFSK	5.5	4.31	0	Right	0.016	0.021	0.007	0.009	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.12	100.0%	100.0%	2404	2	GFSK	5.5	4.08	0	Left	0.000	0.000	0.000	0.000	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	0.04	100.0%	100.0%	2441	39	GFSK	5.5	4.26	0	Left	0.000	0.000	0.000	0.000	-
Body/Extremity	2.4 GHz ANT/ANT+	2.4 GHz Antenna	71808	-0.15	100.0%	100.0%	2478	76	GFSK	5.5	4.31	0	Left	0.000	0.000	0.000	0.000	-



3.4. Iridium L-Band SAR Data

Table 3-4

Exposure Condition	Band/Mode	Antenna	Additional Information	DUT SN	Power Drift [dB]	Maximum Duty Cycle [%]	Measured Duty Cycle [%]	Frequency [MHz]	Channel	Modulation/Configuration	Maximum Allowed Power [dBm]	Measured Conducted Power [dBm]	Separation Distance [mm]	Position	Measured 1g SAR [W/kg]	Reported 1g SAR [W/kg]	Measured 10g SAR [W/kg]	Reported 10g SAR [W/kg]	Test Plot
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.07	9.3%	8.79%	1616	1	C1	31.5	31.19	0	Back	1.170	1.329	0.628	0.714	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.10	9.3%	8.79%	1621	121	C1	31.5	31.11	0	Back	1.010	1.169	0.551	0.638	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.06	9.3%	8.79%	1626	240	C1	31.5	31.06	0	Back	0.942	1.103	0.533	0.624	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.09	9.3%	8.79%	1616	1	C1	31.5	31.19	0	Front	1.270	1.443	0.694	0.789	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.12	9.3%	8.79%	1621	121	C1	31.5	31.11	0	Front	1.300	1.505	0.699	0.809	6
Body/Extremity	Iridium L-Band	Iridium	Variability	71808	-0.18	9.3%	8.79%	1621	121	C1	31.5	31.11	0	Front	1.190	1.377	0.621	0.777	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	0.02	9.3%	8.79%	1626	240	C1	31.5	31.06	0	Front	1.280	1.499	0.683	0.800	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.01	9.3%	8.79%	1616	1	C1	31.5	31.19	0	Bottom	0.056	0.064	0.032	0.036	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	0.12	9.3%	8.79%	1616	1	C1	31.5	31.19	0	Right	0.147	0.167	0.084	0.095	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	0.02	9.3%	8.79%	1616	1	C1	31.5	31.19	0	Left	0.797	0.906	0.458	0.520	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	0.08	9.3%	8.79%	1621	121	C1	31.5	31.11	0	Left	0.789	0.913	0.448	0.519	-
Body/Extremity	Iridium L-Band	Iridium	-	71808	-0.01	9.3%	8.79%	1626	240	C1	31.5	31.06	0	Left	0.822	0.962	0.437	0.512	-

3.5. General SAR Testing Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013 and FCC KDB Publication 447498 D04v01 for FCC.
2. The test data reported are the worst-case SAR values according to test procedures specified in IEC/IEEE 62209-1528 and RSS-102.SAR.MEAS for ISED.
3. Per IEC/IEEE 62209-1528, SAR testing was performed using probes calibrated for the modulation specific signal.
4. SAR evaluations were made in accordance with the latest version of RSS-102 Issue 6 and RSS-102.SAR.MEAS, then IEC/IEEE 62209-1528. FCC KDB Publications listed in RSS-102 can be used as supplementary procedures due to limitation of technology specific testing protocols in the international standards.
5. Liquid tissue depth was at least 15.0 cm for all frequencies.
6. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D04v01.
7. Batteries are fully charged at the beginning of the SAR measurements.
8. Per IEC/IEEE 62209-1528, the worst case configuration was additionally evaluated for all channels.
9. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds below.
10. Since back/front/bottom/right/left surfaces of the device are intended for use on user's hand, extremity SAR is evaluated for these surfaces.
11. Since back/front/bottom/right/left surfaces of the device are in close proximity to the user's body, body SAR is also measured with these surfaces positioned against a flat phantom, representative of the operating conditions expected by users.
12. Simultaneous transmission analysis is provided in Appendix E.



3.6. WLAN Notes:

1. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI operations, the initial test configuration was selected according to the 802.11 transmission modes with the highest maximum allowed powers. SAR for other 802.11 modes was not required due to the maximum allowed powers and the highest reported SAR.
2. When the maximum reported 1g averaged SAR is ≤ 0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg or all test channels were measured.
3. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated Part 15 test reports.

3.7. Bluetooth Note:

1. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100.0% transmission duty factor for Bluetooth to determine compliance.

3.8. Iridium L-Band Note:

1. Per manufacturer, B1 transmission is a protocol-limited transmit mode that is limited to 6 RACH bursts per connection period, normally transitioning to C1/C2 transmissions. The B1 RACH transmission burst is 4.1 ms and the worst-case on-air connection period is 11.2 seconds, yielding a maximum duty factor of 0.22%. The maximum allowed (max tune-up) transmit power for B1 transmission mode is 34.7 dBm, so the effective source-based time-averaged output power is 8.1 dBm (6.5 mW). Thus, B1 modulation was excluded for SAR. C1 modulation was evaluated since it has a lower data rate than C2 modulation and C1/C2 targets are the same.

4. DUT SAR Measurement Variability Requirement

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. These additional measurements were repeated after the completion of all measurements requiring the same tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.



SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg
5. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

Table 4-1

Exposure Condition	Band/Mode	Antenna	DUT SN	Maximum Duty Cycle [%]	Measured Duty Cycle [%]	Frequency [MHz]	Channel	Modulation/Configuration	Separation Distance [mm]	Position	Measured 1g SAR [W/Kg]	Repeated Measured 1g SAR [W/Kg]	Ratio
Body	Iridium L-Band	Iridium	71808	9.3%	8.79%	1621	121	C1	0	Front	1.300	1.190	1.09

5. General Introduction

Title 47 of the Code of Federal Regulations (CFR) pertains to United States Federal regulation for Telecommunications. The **Federal Communications Commission (FCC)** is the agency responsible for implementing and enforcing these regulations. The rules define a **radiofrequency device** as any device which in its operation is capable of emitting radiofrequency energy by radiation, conduction, or other means.

47CFR §2.1093(b) states, “A **portable device** is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that the RF source's radiating structure(s) **is/are within 20 centimeters of the body of the user.**”

Also, 47CFR §2.1093(d)(6) states, that General population/uncontrolled exposure limits defined in §1.1310 “apply to portable devices intended for use by consumers or persons who are exposed as a consequence of their employment and may not be fully aware of the potential for exposure or cannot exercise control over their exposure.”

47CFR §2.1093(d)(2) states that evaluation of compliance within FCC’s SAR limits can be demonstrated by laboratory measurements. This test report serves this purpose.

6. Background on Radiofrequency (RF) Exposure Limits

6.1. Controlled Environment

Controlled environments are defined as locations where the RF field intensities have been adequately characterized by means of measurement or calculation and exposure is incurred by persons who are: aware



of the potential for RF field exposure, cognizant of the intensity of the RF fields in their environment, aware of the potential health risks associated with RF field exposure and able to control their risk using mitigation strategies. In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

6.2. Uncontrolled Environment

Uncontrolled environments are defined as locations where either insufficient assessment of RF fields have been conducted or where persons who are allowed access to these areas have not received proper RF field awareness/safety training and have no means to assess or, if required, to mitigate their exposure to RF fields. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed, or in which persons who may not be made fully aware of the potential for exposure, or cannot exercise control over their exposure. Members of the general public would fall under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

6.3. RF Exposure Limits for 100kHz – 6 GHz

Per FCC 47 CFR §1.1310 and Health Canada Safety Code 6, the SAR limits are applied for frequencies 100kHz ~ 6 GHz as shown below.

Table 6-1 Human Exposure to RF Radiation Limits in 47 CFR §1.1310 and Health Canada Safety Code 6- SAR Basic Restrictions

Environment	Condition	SAR	Averaging volume
Uncontrolled / General Population	Head, Neck Trunk	1.6 W/kg	1g cube
	Extremity	4.0 W/kg	10g cube
Controlled	Head/Trunk	8 W/kg	1g cube
	Extremity / Limbs	20 W/kg	10g cube



7. RF Safety Laboratory SAR Measurement System

7.1. SAR Measurement Hardware and Software

Peak spatially averaged SAR (psSAR) measurements are performed using a DASY8 robot system with cDASY8 module SAR software. The DASY8 is made by SPEAG in Switzerland and consists of a 6-axis robot, robot controller, computer, dosimetric probe, probe alignment light beam unit, and various SAR phantoms.

7.2. E-Field Probe

Manufacturer	Schmid & Partner Engineering AG
Model	EX3DV4
Description	Smallest isotropic electric (E-) field probe for high precision specific absorption rate (SAR) measurements
Frequency Range	10 MHz - 10.0 GHz
Dynamic Range	10 μ W/g – >100 mW/g
Overall Length (mm)	337
Body Diameter (mm)	12
Tip Length (mm)	337
Tip Diameter (mm)	2.5
Probe Tip to Sensor X Calibration Point (mm)	1
Probe Tip to Sensor Y Calibration Point (mm)	1
Applications	High precision dosimetric measurements in any exposure scenario (e.g. very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better than 30%
Compatibility	DASY8 robot + cDASY8 module SAR software

7.3. Peak Spatially Averaged SAR (psSAR) Measurements

SAR Evaluations are performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04, IEEE 1528:2013 and IEC/IEEE 62209-1528:



1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface, and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04, IEEE 1528:2013 and IEC/IEEE 62209-1528.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04, IEEE 1528:2013 and IEC/IEEE 62209-1528. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
 - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than the area scan and zoomscan resolutions specified in FCC KDB Publication 865664 D01v01r04 section 2.7.1, IEEE 1528:2013 table 6, and IEC/IEEE 62209-1528 table 3 & table 4. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
 - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
 - d. The zoom scan is confirmed to meet both of the following parameters if the result is $> 0.1 \text{ W/kg}$. If the result does not meet the below parameters, it is re-measured with a finer resolution scan until the below parameters are met.
 - (1) The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x- and y-directions.
 - (2) The ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum SAR value shall be at least 30%
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.



7.4. Test Positions

7.4.1. Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$.

7.4.2. Body SAR Test

Since back/front/bottom/right/left surfaces of the device are in close proximity to the user's body, body SAR is measured with these surfaces positioned against a flat phantom, representative of the operating conditions expected by users.

7.4.3. Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1g body and 10g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D04v01 should be applied to determine SAR test requirements.



7.5. RF Safety Laboratory SAR System Measurement Uncertainty

SAR Uncertainty for DUTs According to 62209-1528 (Frequencies: 300 MHz - 3 GHz)										
Symbol	Input Quantity (Xi) (Source of Uncertainty)	62209-1528 Ref	Unc. (xi)	Prob. Dist. PDFi	Div(qj)	ci (1g)	ci (10g)	Std Unc (1g)	Std. Unc (10g)	vi
Measurement System Errors										
CF	Probe Calibration	8.4.1.1	11.0%	N (k=2)	2	1	1	5.50%	5.5%	∞
CFdrift	Probe Calibration Drift	8.4.1.2	1.7%	R	√3	1	1	1.0%	1.0%	∞
LIN	Probe Linearity and Detection Limit	8.4.1.3	4.7%	R	√3	1	1	2.7%	2.7%	∞
BBS	Broadband Signal	8.4.1.4	2.8%	R	√3	1	1	1.6%	1.6%	∞
ISO	Probe Isotropy	8.4.1.5	7.6%	R	√3	1	1	4.4%	4.4%	∞
DAE	Other probe and data acquisition errors	8.4.1.6	0.8%	N	1	1	1	0.8%	0.8%	∞
AMB	RF Ambient and Noise	8.4.1.7	1.8%	N	1	1	1	1.8%	1.8%	∞
Δxyz	Probe Positioning Errors	8.4.1.8	0.006 mm	N	1	0.14	0.14	0.1%	0.1%	∞
DAT	Data Processing Errors	8.4.1.9	1.2%	N	1	1	1	1.2%	1.2%	∞
Phantom and Device Errors										
LIQ(σ)	Measurement of Phantom Conductivity	8.4.2.1	2.5%	N	1	0.78	0.71	2.0%	1.8%	∞
LIQ(Tc)	Temperature Effects (Medium)	8.4.2.2	3.3%	R	√3	0.78	0.71	1.5%	1.4%	∞
EPS	Shell Permittivity	8.4.2.3	14.0%	R	√3	0	0	0.0%	0.0%	∞
DIS	Distance between the radiating element of the DUT and the phantom medium	8.4.2.4	2.0%	N	1	2	2	4.0%	4.0%	∞
Dxyz	Repeatability of Positioning the DUT or source against the phantom	8.4.2.5	1.0%	N	1	1	1	1.0%	1.0%	5
H	Device Holder Effects	8.4.2.6	3.6%	N	1	1	1	3.6%	3.6%	8
MOD	Effect of Operating mode on probe sensitivity	8.4.2.7	2.4%	R	√3	1	1	1.4%	1.4%	∞
RFdrift	Variation in SAR due to Drift in output of DUT	8.4.2.9	2.5%	N	1	1	1	2.5%	2.5%	∞
VAL	Validation Antenna Uncertainty (Validation measurement only)	8.4.2.10	0.0%	N	1	1	1	0.0%	0.0%	∞
Pin	Uncertainty in Accepted Power (Validation Measurement only)	8.4.2.11	0.0%	N	1	1	1	0.0%	0.0%	∞
Correction to the SAR Results										
C(ε',σ)	Phantom Deviation from Target (ε',σ)	8.4.3.1	1.9%	N	1	1	0.84	1.9%	1.6%	∞
C(R)	SAR Scaling	8.4.3.2	0.0%	R	√3	1	1	0.0%	0.0%	∞
u(ΔSAR)	Combined Uncertainty							10.7%	10.6%	∞
U	Expanded Uncertainty and Effective Degrees of Freedom (k=2)							21.3%	21.1%	



8. Technology Specific Test Setup Requirements

8.1. Measured and Reported SAR

Per FCC KDB Publication 447498 D04v01, when SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

8.2. Procedures Used to Establish RF Signal for SAR

Devices under test are evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device is tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram and 10 gram SAR evaluation, to assess for any power drifts during the evaluation.

8.3. SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

8.3.1. General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR



scaling. The reported SAR is scaled to 100% duty factor to determine compliance at the maximum tune-up tolerance limit.

8.3.2. Initial Test Position Procedure

The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.

8.3.3. 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed. When 10g SAR measurement is considered, a factor of 2.5 is applied to the thresholds above.



9. Equipment List

Manufacturer	Model	Description	Serial Number	Calibration Date	Calibration Due	CBT
Amplifier Research	5S1G4	RF Broadband Amplifier (800 MHz - 4.2 GHz)	331258			✓
Anritsu	MA24118A	Microwave USB Power Sensor (10MHz - 18 GHz)	2123431	1/13/2025	1/13/2026	
Anritsu	MA24118A	Microwave USB Power Sensor (10MHz - 18 GHz)	2123500	1/13/2025	1/13/2026	
Anritsu	S820E	Vector Network Analyzer	2348026	11/30/2023	11/30/2025	
Control Company	4040	Ambient Thermometer	230581657	8/28/2023	8/28/2025	
Control Company	4040	Ambient Thermometer	230581656	8/28/2023	8/28/2025	
Control Company	4352	Long Stem Liquid Thermometer	230662212	9/28/2023	9/28/2025	
Control Company	4352	Long Stem Liquid Thermometer	230662223	9/28/2023	9/28/2025	
Micro-Coax	UFB205A-0-0240-30x30	SMA M-F RF test Cable (DC - 18 GHz)	-			✓
Mini-Circuits	BW-N20W20+	20dB RF Fixed Attenuator (DC - 18 GHz)	-			✓
Mini-Circuits	BW-N20W20+	20dB RF Fixed Attenuator (DC - 18 GHz)	-			✓
Mini-Circuits	BW-S3W2+	3dB RF Fixed Attenuator (DC - 18 GHz)	-			✓
Mini-Circuits	BW-S3W2+	3dB RF Fixed Attenuator (DC - 18 GHz)	-			✓
Mini-Circuits	CBL-6FT-SMNM+	Precision Test Cable SMA/N (DC - 18 GHz)	3318			✓
Mini-Circuits	CBL-6FT-SMNM+	Precision Test Cable SMA/N (DC - 18 GHz)	3335			✓
Mini-Circuits	CBL-6FT-SMNM+	Precision Test Cable SMA/N (DC - 18 GHz)	3329			✓
Mini-Circuits	NF-SF50+	RF Adapter N Male to SMA Female (DC - 18 GHz)	-			✓
Mini-Circuits	VLF-3000+	Coaxial Low Pass Filter (DC - 3 GHz)	-			✓
Mitutoyo	CD-4"AX	Digital Caliper	823243217	9/28/2023	9/28/2025	
Narda	24785-20	20 dB SMA Fixed Attenuator (DC - 4.0 GHz)	-			✓
Narda	4226-20 (26733)	20 dB SMA Directional Coupler (0.5 - 18 GHz)	0201			✓
Rohde & Schwarz	SMCV100B	R&S SMCV100B Vector Signal Generator (VSG)	103882	12/21/2023	12/19/2025	
SPEAG	D1640V2	1640 MHz System Validation Dipole	356	9/13/2024	9/13/2025	
SPEAG	D2450V2	2450 MHz System Validation Dipole	1112	11/15/2024	11/15/2025	
SPEAG	DAE4ip	Data Acquisition Electronics with Integ. Power	1839	9/4/2024	9/4/2025	
SPEAG	DAE4ip	Data Acquisition Electronics with Integ. Power	1905	4/25/2025	4/25/2026	
SPEAG	DAK-3.5	DAK-3.5 Dielectric Probe	1349	9/2/2024	9/2/2025	
SPEAG	EX3DV4	SAR Measurement Probe	7836	9/12/2024	9/12/2025	
SPEAG	EX3DV4	SAR Measurement Probe	7859	5/5/2025	5/5/2026	
SPEAG	Powersource1	Signal Generator	4341	1/9/2025	1/9/2026	
SPEAG	SE UMS 171 E	MAIA Modulation and Interference Analyzer	1814			
SPEAG	SE UMS 171 E	MAIA Modulation and Interference Analyzer	1817			
SPEAG	SE UMS 176 C	ANT Wideband Communication Antenna	1610			
SPEAG	SE UMS 176 C	ANT Wideband Communication Antenna	1590			

✓ Note: Components calibrated before testing. Prior to testing, the measurement paths containing a cable, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator, power sensor, or VNA) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.



**RF SAFETY
LAB**

A NEXT GENERATION
TEST LABORATORY™

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ANAB 17025 Certificate Number: AT-3274; CAB Identifier: US0239
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10. Conclusion

The SAR evaluation indicates that the DUT is capable of compliance with the RF radiation exposure limits of the FCC and ISED, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Antenna Data Sheet

Antenna Manufacturer Information:

Antenna(s) are manufactured and designed at Garmin headquarters located at 1200 E. 151st Street, Olathe, KS, 66062, USA. Garmin is an antenna manufacturer that specializes in antenna construction and has been a technology leader in high performance antenna design for over thirty years. State-of-the art equipment is used to design, measure, and analyze new designs that are superior to competitor designs and highly proprietary in nature.

Antenna Description:

This data sheet contains the antenna gain information for the A04828-A1 & A04349-A2 for Garmin Model A04828. The approximate operational frequency band of these technologies is given, and the maximum gain within the frequency band is shown in table 1.

Table 1 Antenna Gain:

Antenna Model Number	Antenna Type	Antenna Maximum Gain	Antenna Approximate Frequency Band
A04828-A1	Inverted-F PCB	4.03 dBi	2402 to 2480 MHz
A04349-A2	Quad Helix	1.95 dBi	1616 to 1626 MHz

Additional Information:

Contact Garmin for other information regarding antenna design, dimensions, cable length, etc.