

FCC/ISED Test Report

Prepared for: **Garmin International, Inc.**

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

Product: **AA4828**

Test Report No: **R20250124-00-E5** **Rev: B**

Approved by:


Fox Lane,
EMC Test Engineer

DATE: **July 22, 2025**

Total Pages: **58**

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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	22 July 2025	Added 1-3.6Ghz plot – FL



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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 3

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



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2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	AA4828
FCC ID	IPH-A4828
IC ID	1792A-A4828
FVIN	1.01
EUT Received	6 June 2025
EUT Tested	6 June 2025- 2 July 2025
Serial No.	3609442863 (Radiated Sample) 3609442792 (Conducted Sample)
Operating Band	2400 – 2483.5 MHz
Device Type	<input checked="" type="checkbox"/> GMSK <input checked="" type="checkbox"/> GFSK <input type="checkbox"/> BT BR <input type="checkbox"/> BT EDR 2MB <input type="checkbox"/> BT EDR 3MB <input type="checkbox"/> 802.11x
Power Supply / Voltage	Internal Battery / 5VDC Charger: Garmin (Phi Hong) Model: AQ27A-59CFA 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

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 ± 4%
 Temperature of 22 ± 3° 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, 2026
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.

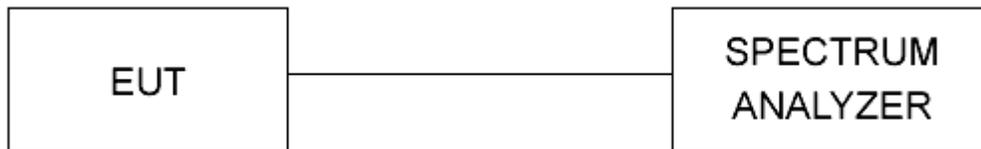


Figure 1 - Bandwidth Measurements Test Setup

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 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.

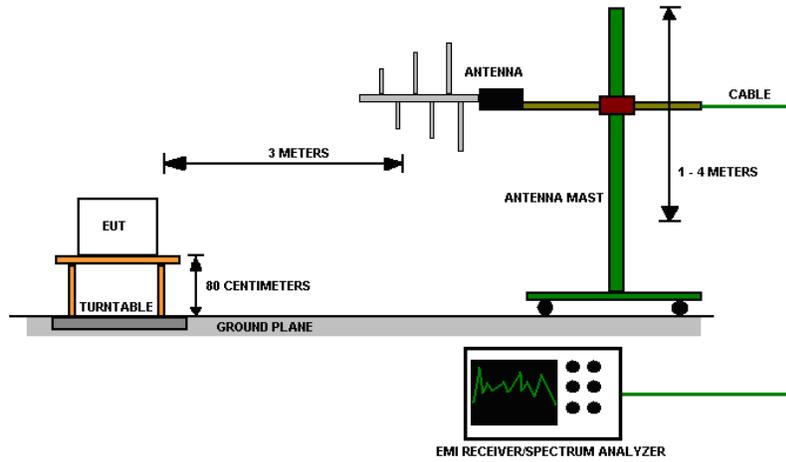


Figure 2 - Radiated Emissions Test Setup

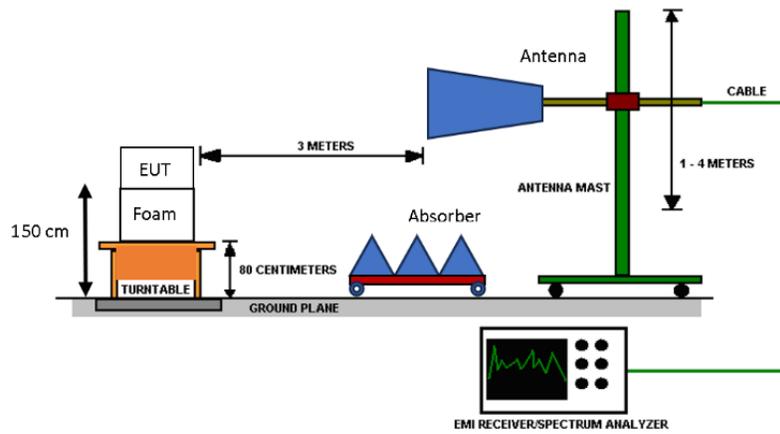


Figure 3 - Radiated Emissions Test Setup, >1GHz



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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	1305.80	779.00	-17.588	-0.222	0.950	PASS
Mid	BLE 1MB	1201.60	760.90	-13.824	3.536	2.257	PASS
High	BLE 1MB	1288.30	898.40	-18.138	-0.771	0.837	PASS
Low	BLE 2MB	2518.70	1500.00	-13.613	4.004	2.514	PASS
Mid	BLE 2MB	2562.50	1758.00	-14.385	3.846	2.424	PASS
High	BLE 2MB	2648.70	1881.00	-18.947	-0.743	0.843	PASS
Low	ANT GFSK	1242.30	801.70	-17.099	0.231	1.055	PASS
Mid	ANT GFSK	1237.00	708.70	-11.364	3.843	2.423	PASS
High	ANT GFSK	1264.10	830.40	-17.195	-0.327	0.927	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 (dBuV)	Relative Fundamental (dBuV)	Delta (dB)	Min Delta (dB)	Result
Low	BLE 1MB	2400.00	66.71	105.06	38.35	30.00	PASS
Low	BLE 2MB	2400.00	66.26	106.22	39.95	30.00	PASS
Low	ANT GFSK	2400.00	59.56	105.14	45.58	30.00	PASS
High	BLE 1MB	2483.50	53.22	103.67	50.45	30.00	PASS
High	BLE 2MB	2483.50	60.26	100.98	40.72	30.00	PASS
High	ANT GFSK	2483.50	53.05	104.99	51.94	30.00	PASS
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	55.18	Peak	73.98	18.80	PASS
Low	BLE 2MB	2390.00	54.80	Peak	73.98	19.18	PASS
Low	ANT GFSK	2390.00	54.19	Peak	73.98	19.79	PASS
High	BLE 1MB	2483.50	57.19	Peak	73.98	16.79	PASS
High	BLE 2MB	2483.50	60.98	Peak	73.98	13.01	PASS
High	ANT GFSK	2483.50	55.16	Peak	73.98	18.83	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	43.07	Average	53.98	10.91	PASS
Low	BLE 2MB	2390.00	43.58	Average	53.98	10.40	PASS
Low	ANT GFSK	2390.00	43.08	Average	53.98	10.90	PASS
High	BLE 1MB	2483.50	47.70	Average	53.98	6.28	PASS
High	BLE 2MB	2483.50	52.01	Average	53.98	1.97	PASS
High	ANT GFSK	2483.50	44.20	Average	53.98	9.78	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.

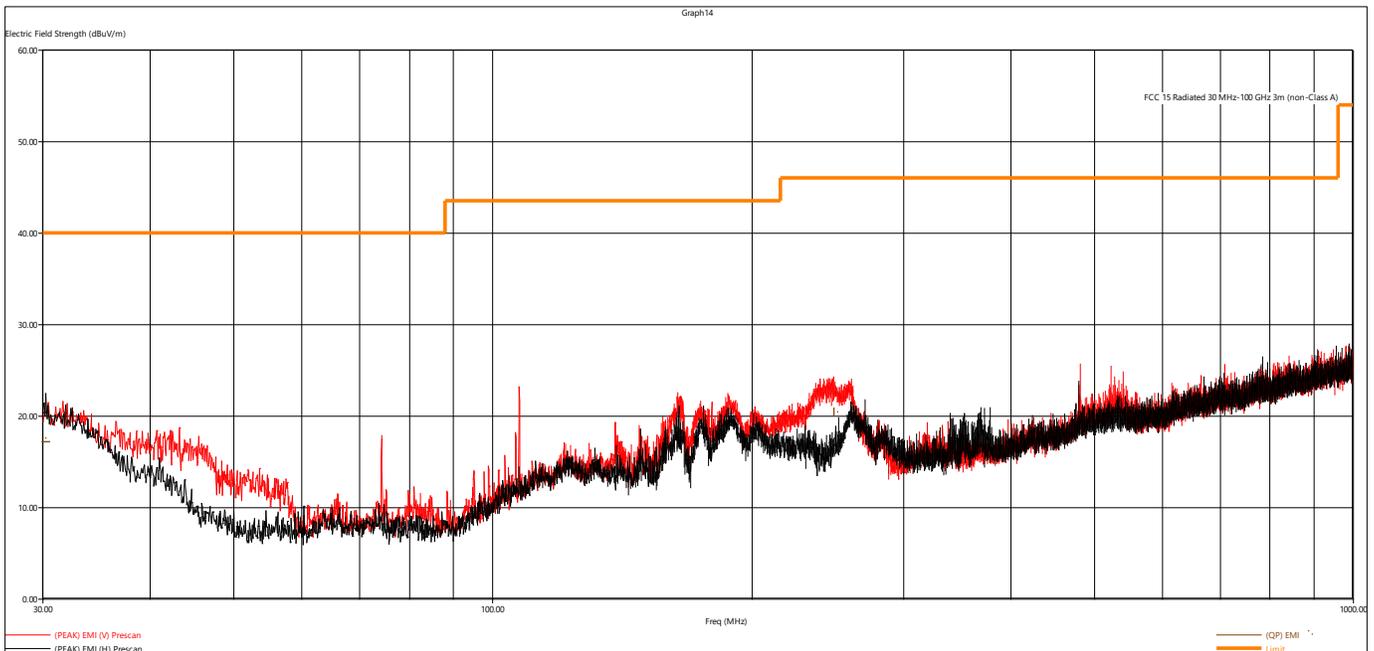


Figure 4 - Radiated Emissions Plot, Receive

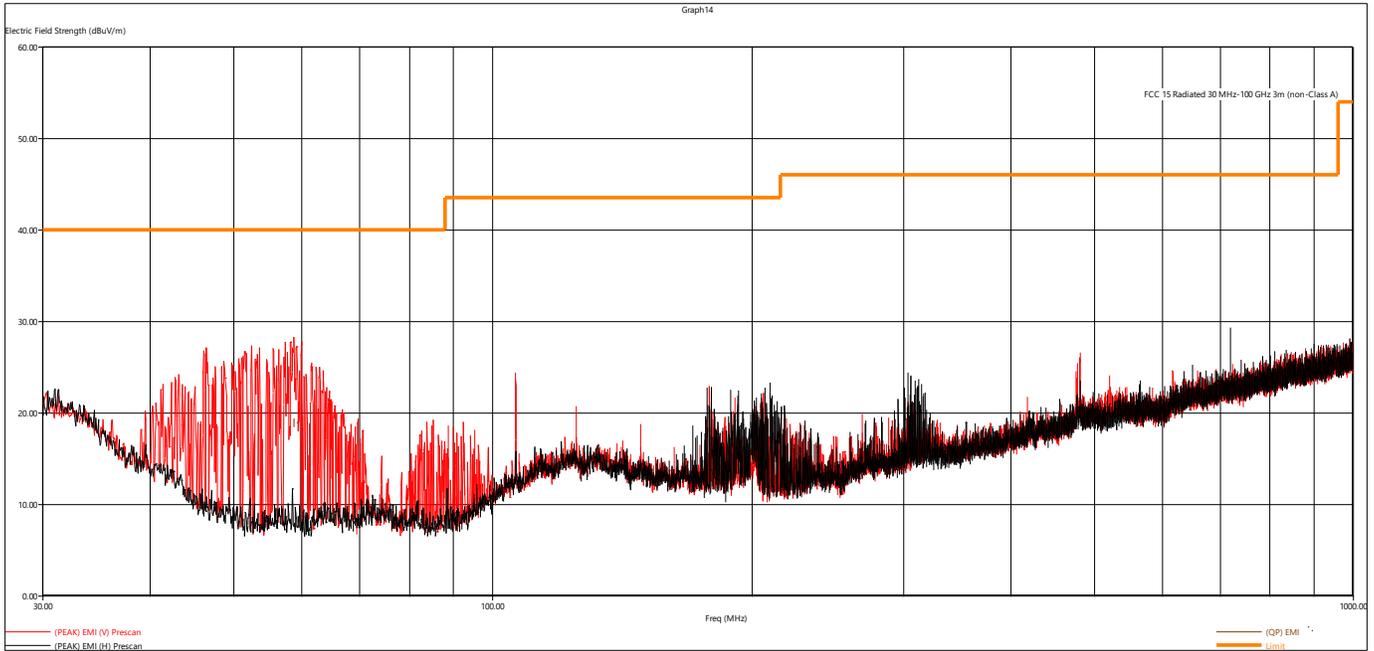


Figure 5 - Radiated Emissions Plot, GFSK

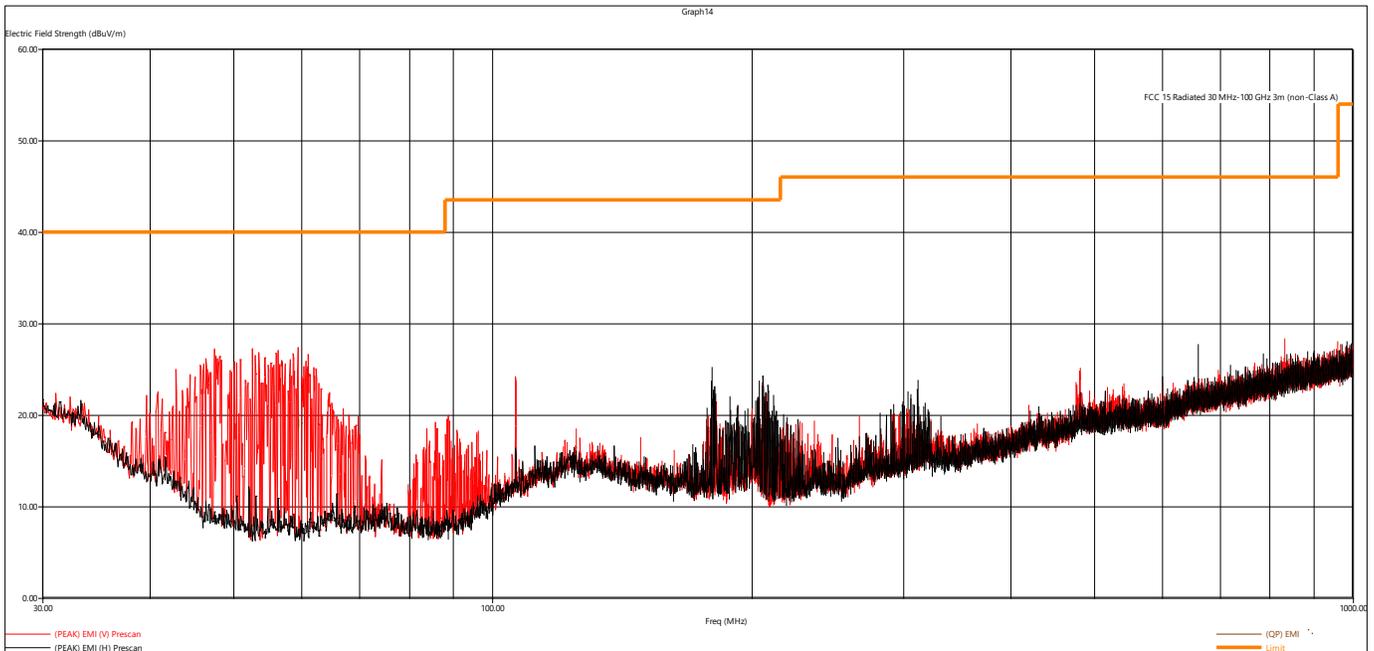


Figure 6 - Radiated Emissions Plot, GMSK 1MB

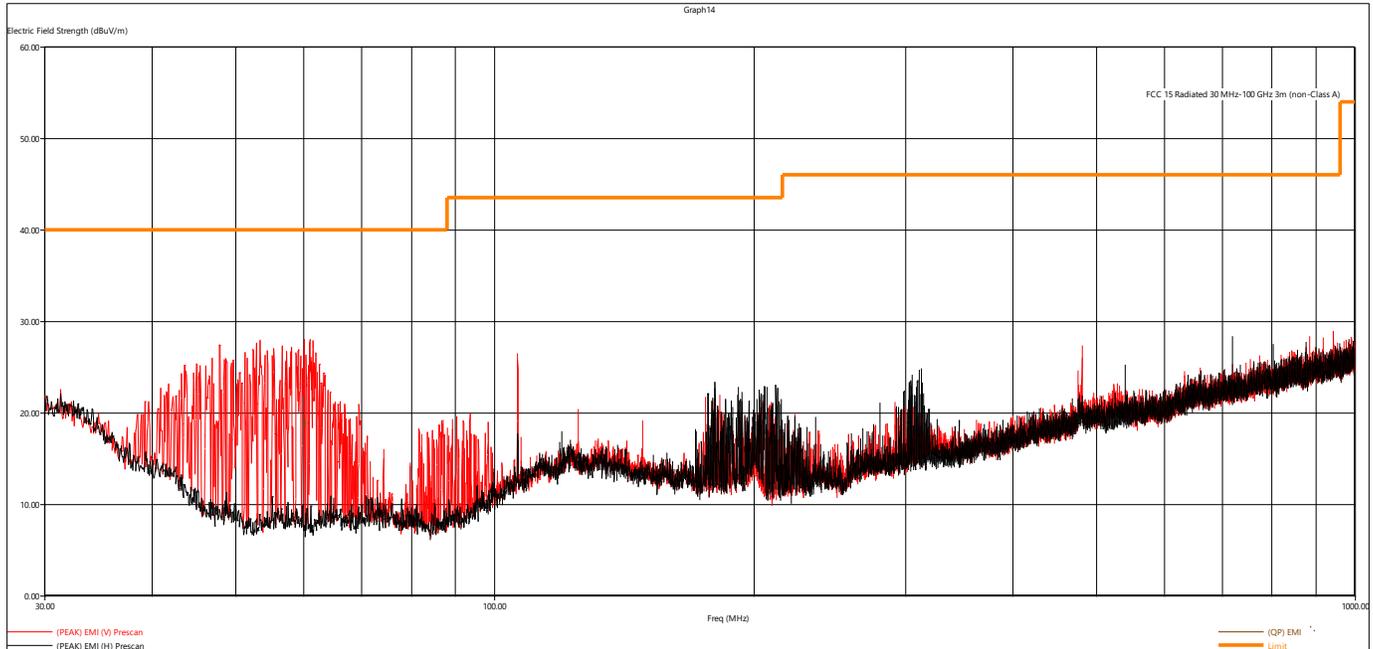


Figure 7 - Radiated Emissions Plot, GMSK 2MB

Quasi-Peak Measurements, 30MHz – 1GHz							
Frequency	Level	Limit	Margin	Height	Angle	Pol	Modulation
MHz	dB μ V/m	dB μ V/m	dB	cm.	deg.		
30.104160	17.08	40.00	22.92	399.88	13.75	H	RX
248.741280	20.39	46.02	25.63	103.46	164.75	V	RX
58.707360	18.81	40.00	21.19	107.16	355.50	V	GFSK
59.549520	19.04	40.00	20.96	111.70	282.75	V	GMSK 1MB
59.999040	18.86	40.00	21.14	115.76	323.75	V	GMSK 2MB

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

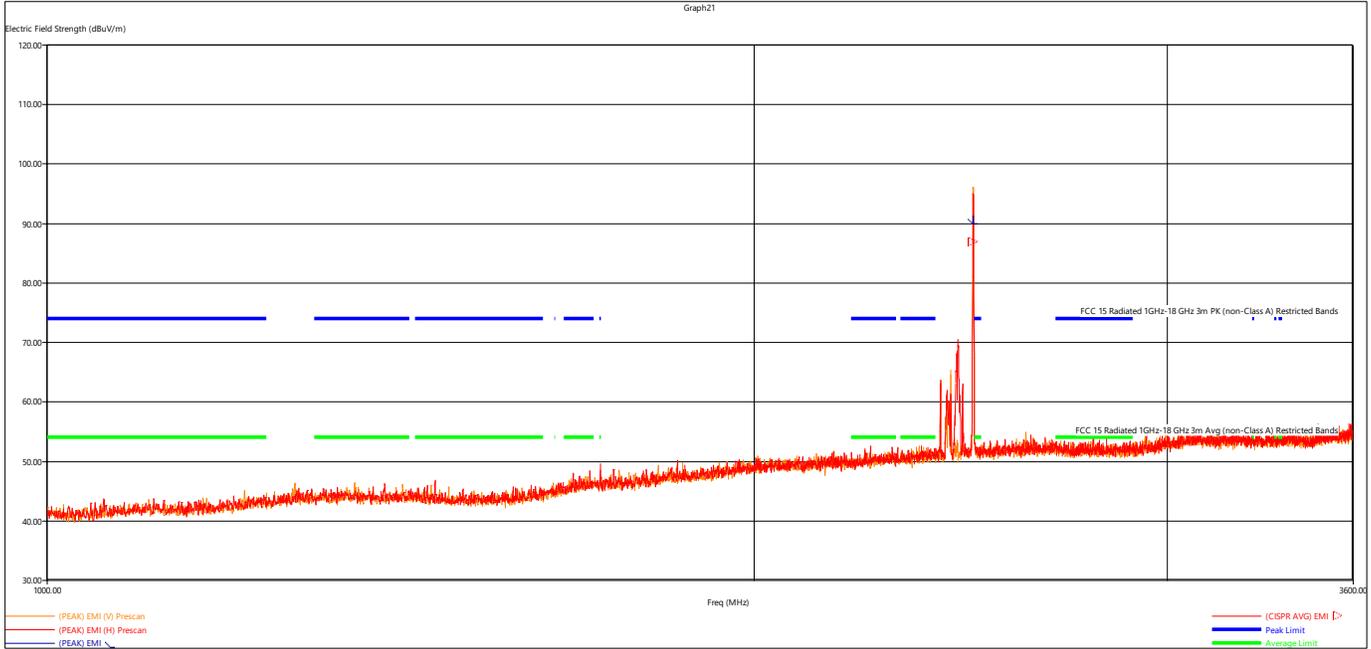


Figure 8 - Radiated Emissions Plot, 1-3.6GHz, BLE 2MB High

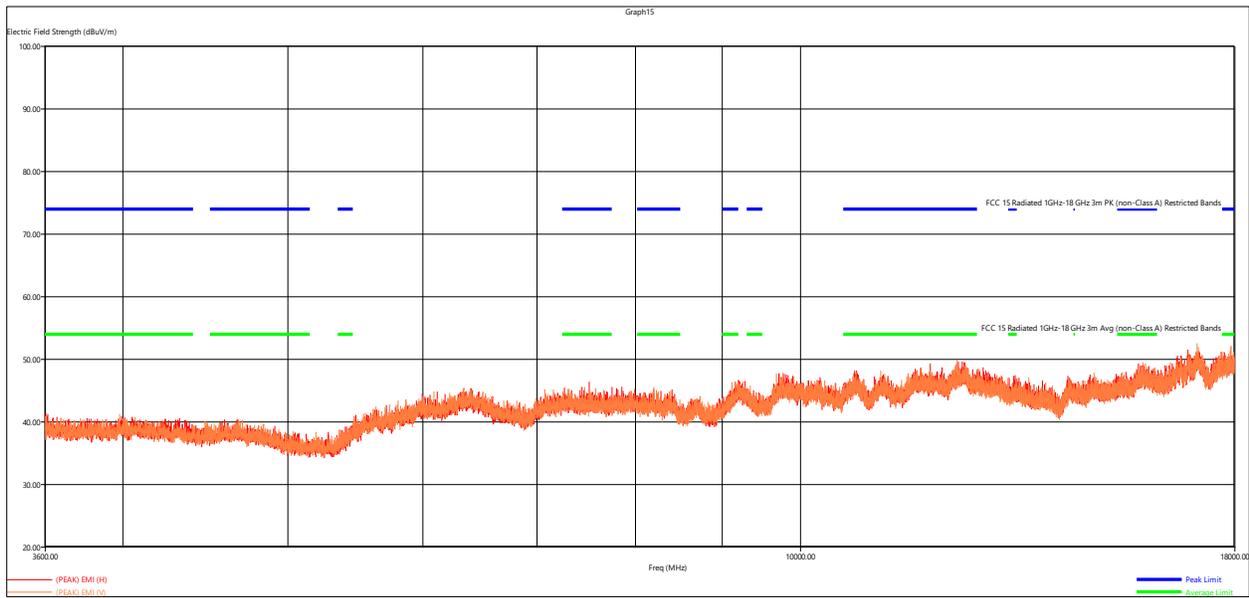


Figure 9 - Radiated Emissions Plot, 3.6-18GHz, BLE 2MB Low

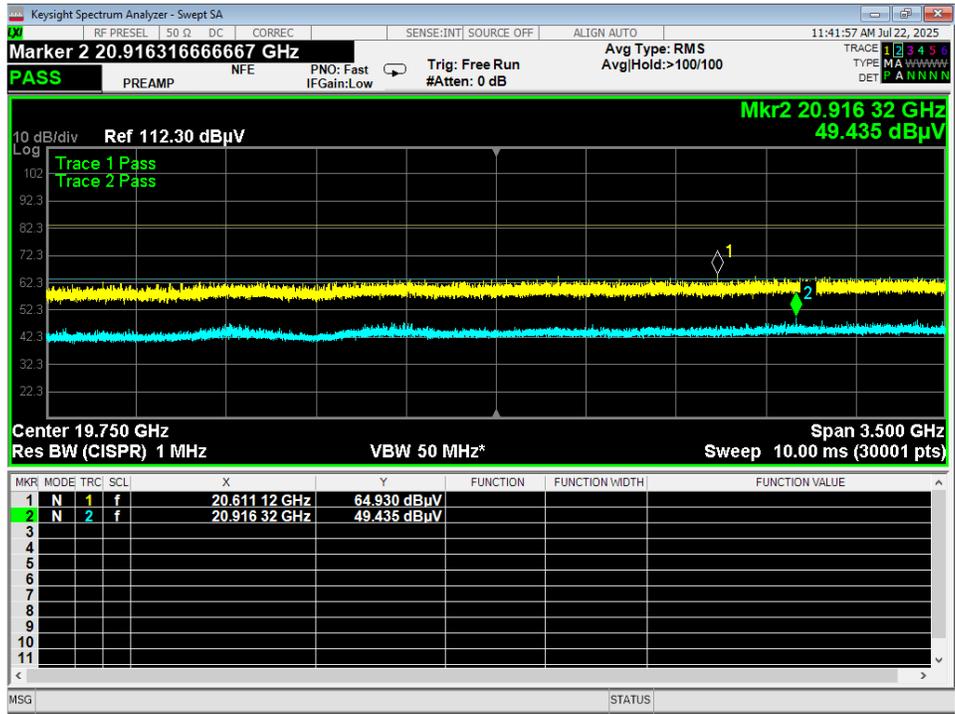


Figure 10 - Radiated Emissions Plot, 18-21.5GHz, BLE 2MB Mid, 1m test distance
 No emissions were found above lab noise floor, tabular data not provided

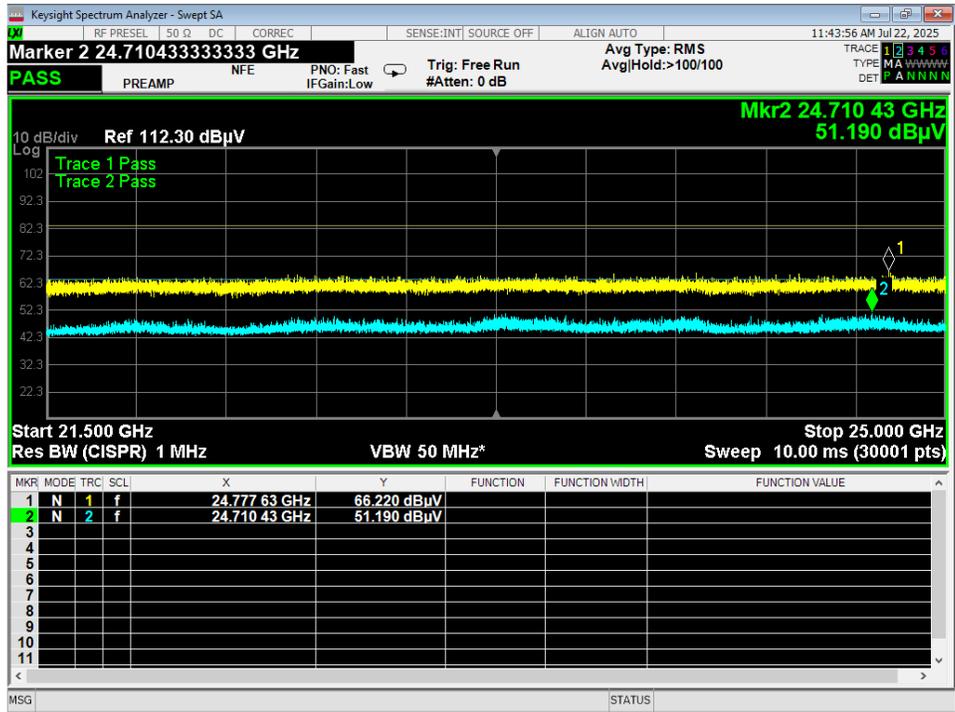


Figure 11 - Radiated Emissions Plot, 21.5-25GHz, BLE 2MB Mid, 1m test distance
 No emissions were found above lab noise floor, tabular data not provided



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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 for the 1-25GHz range are shown above. No levels in this range were found to be within 6dB 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.

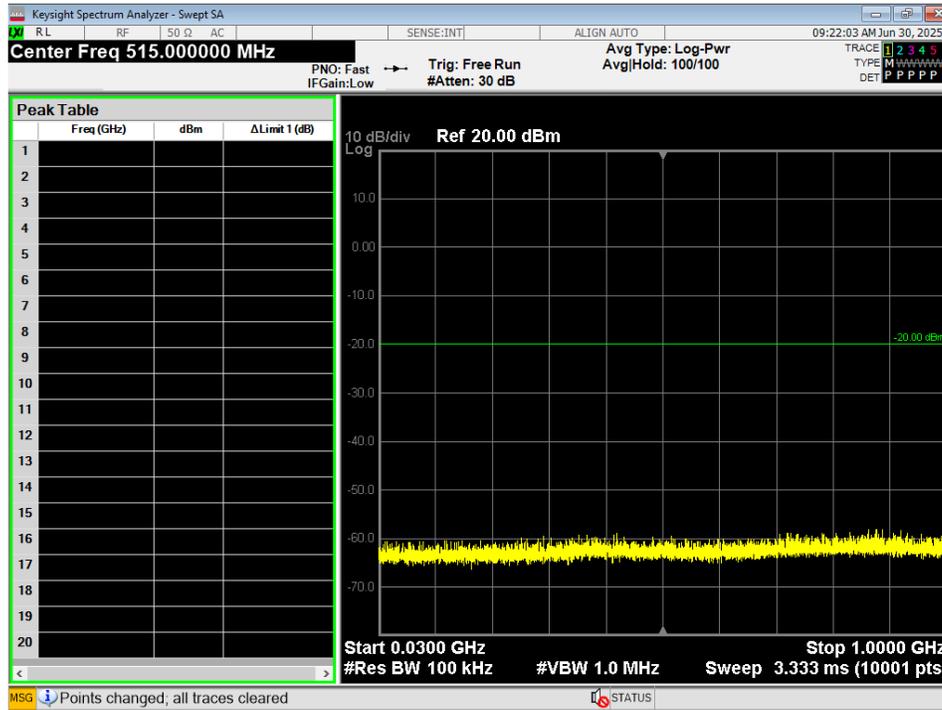


Figure 12 - Conducted Spurious Plot, GFSK, 30MHz – 1GHz, Mid

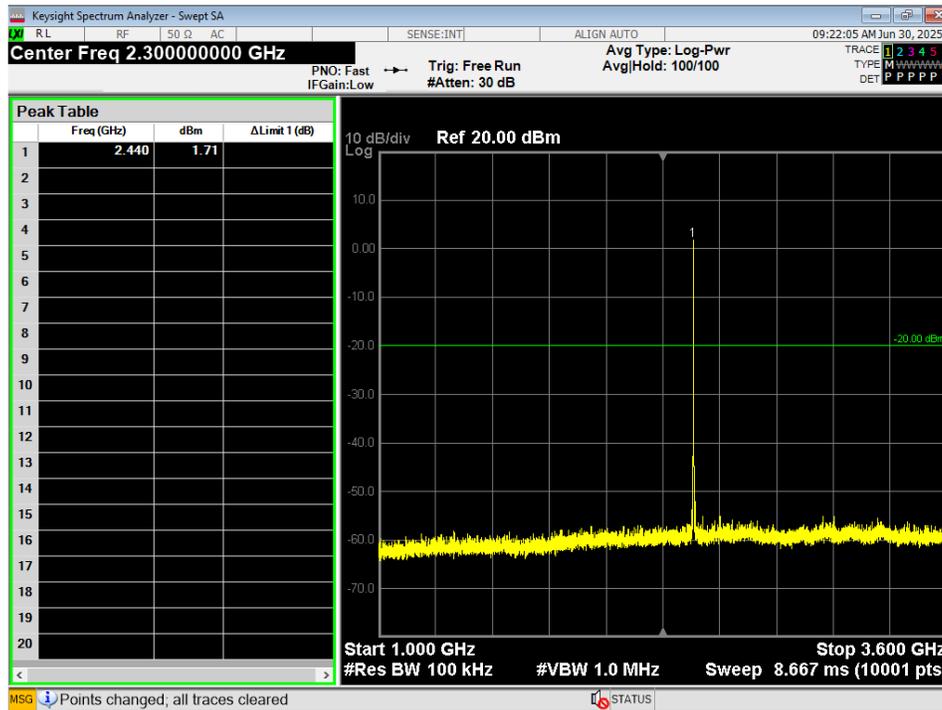


Figure 13 - Conducted Spurious Plot, GFSK, 1GHz – 3.6GHz, Mid

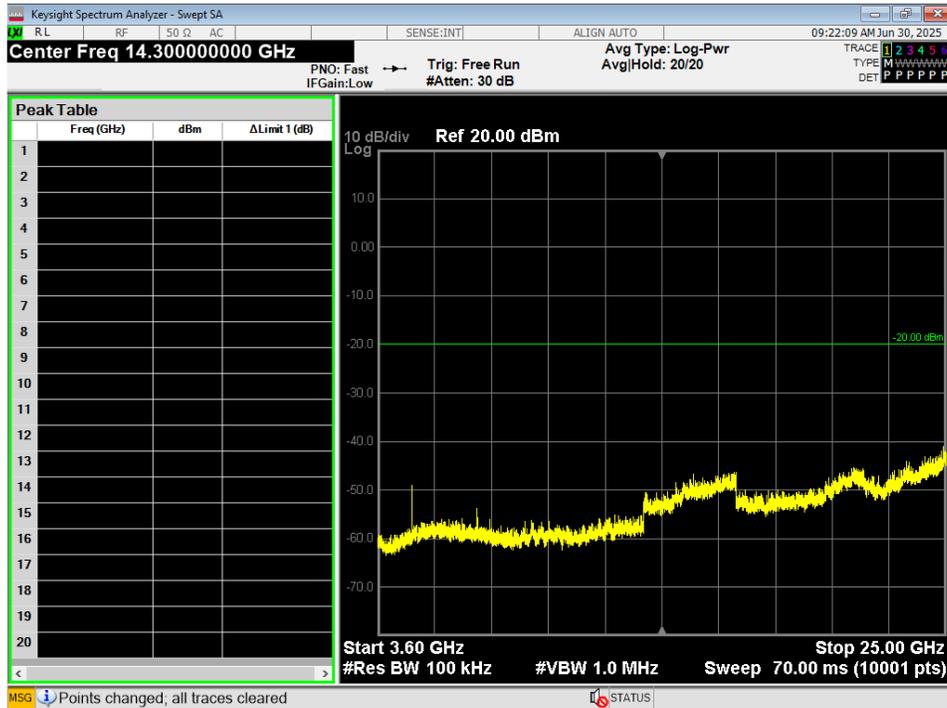


Figure 14 - Conducted Spurious Plot, GFSK, 3.6GHz – 25GHz, Mid

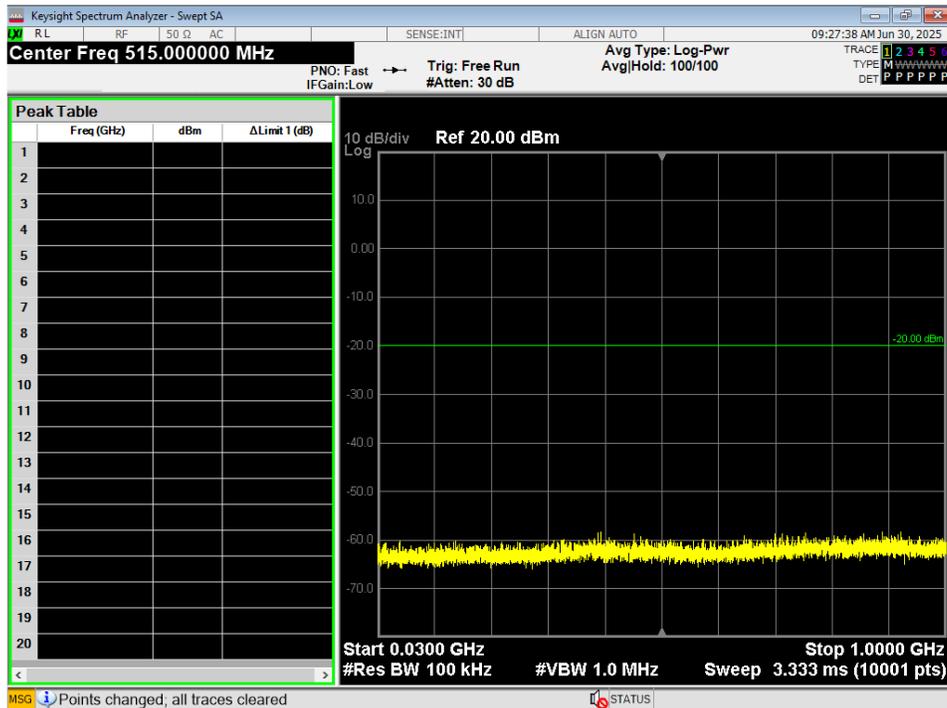


Figure 15 - Conducted Spurious Plot, GMSK 1MB, 30MHz – 1GHz, Mid

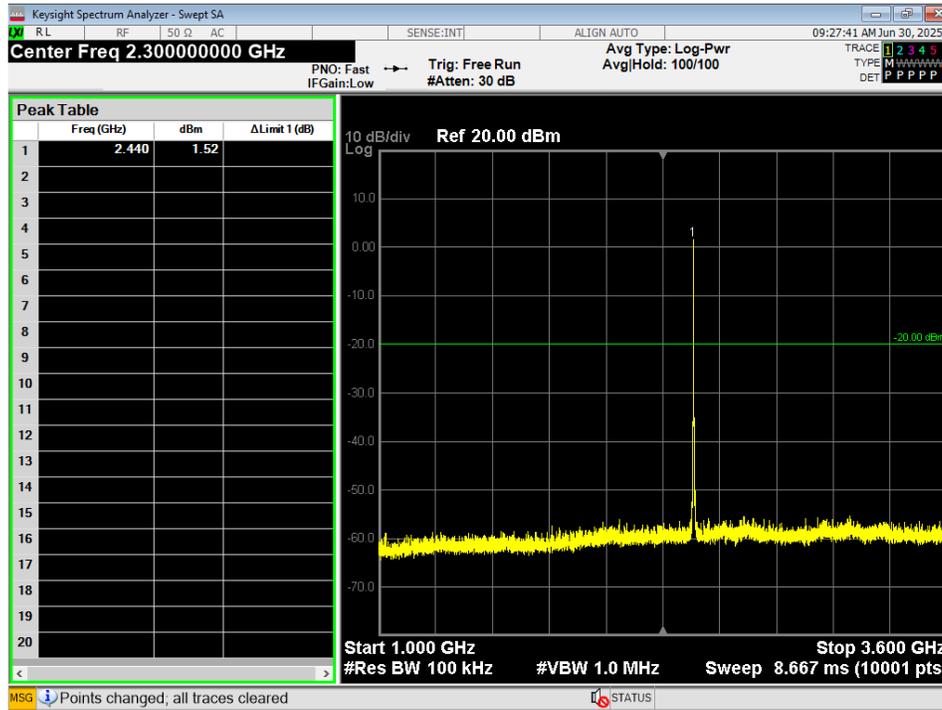


Figure 16 - Conducted Spurious Plot, GMSK 1MB, 1GHz – 3.6GHz, Mid

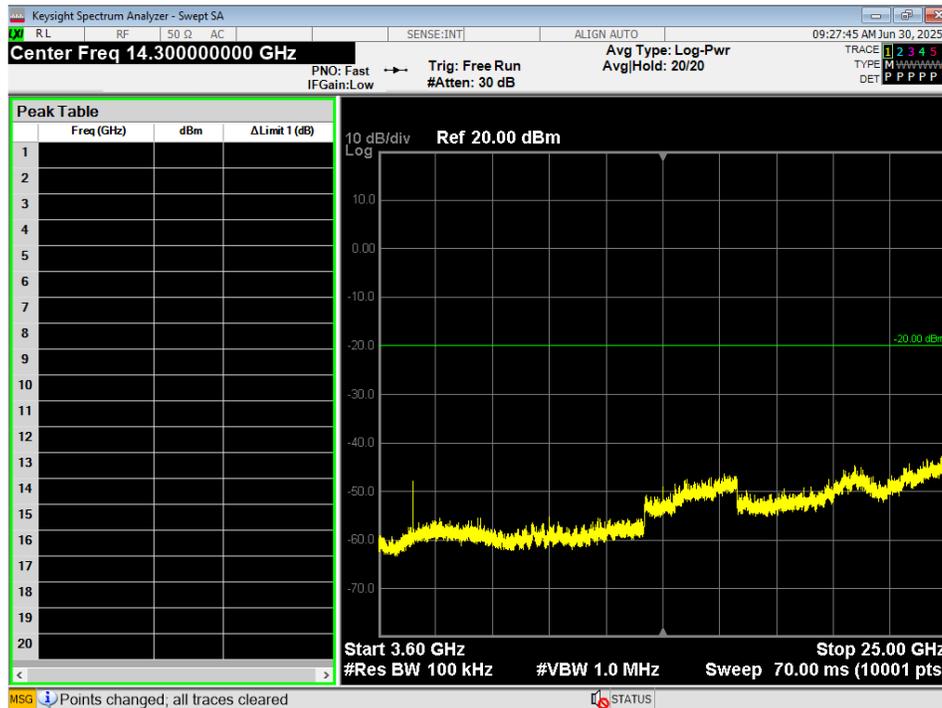


Figure 17 - Conducted Spurious Plot, GMSK 1MB, 3.6GHz – 25GHz, Mid

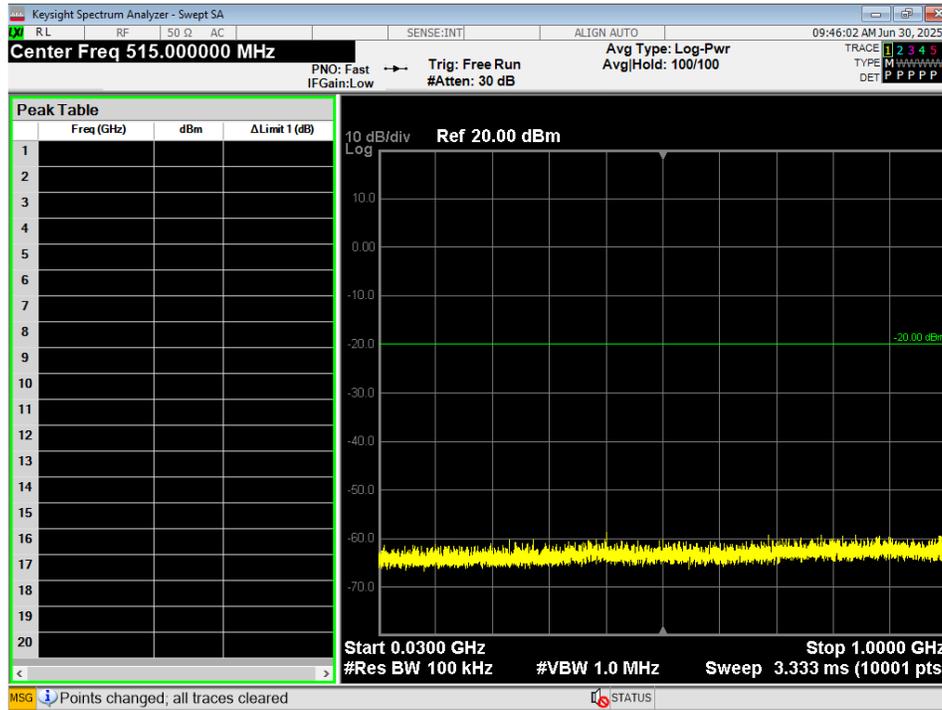


Figure 18 - Conducted Spurious Plot, GMSK 2MB, 30MHz – 1GHz, Low

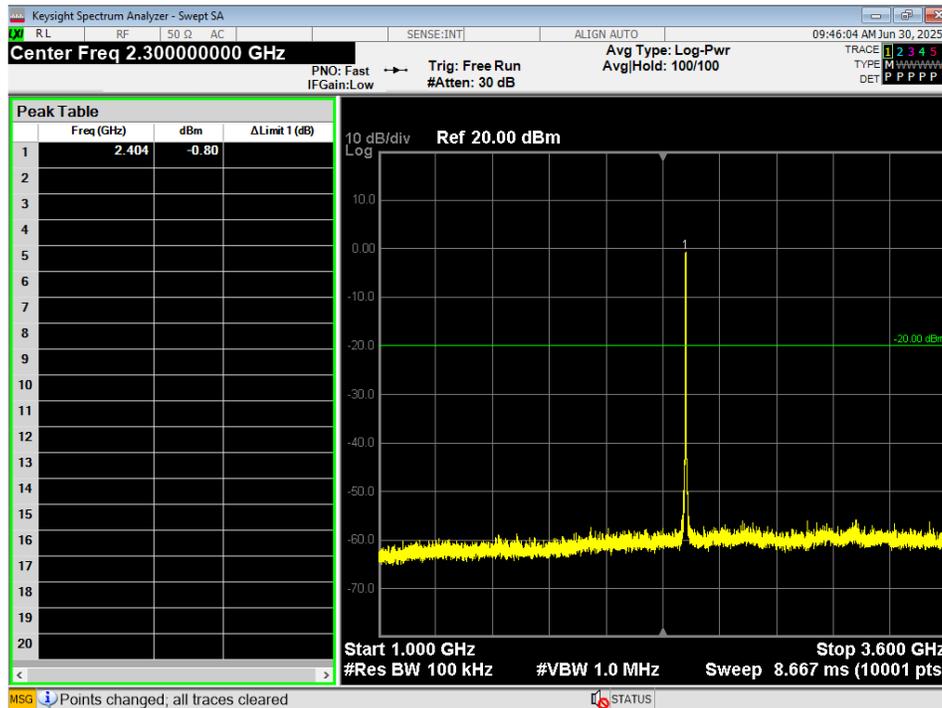


Figure 19 - Conducted Spurious Plot, GMSK 2MB, 1GHz – 3.6GHz, Low

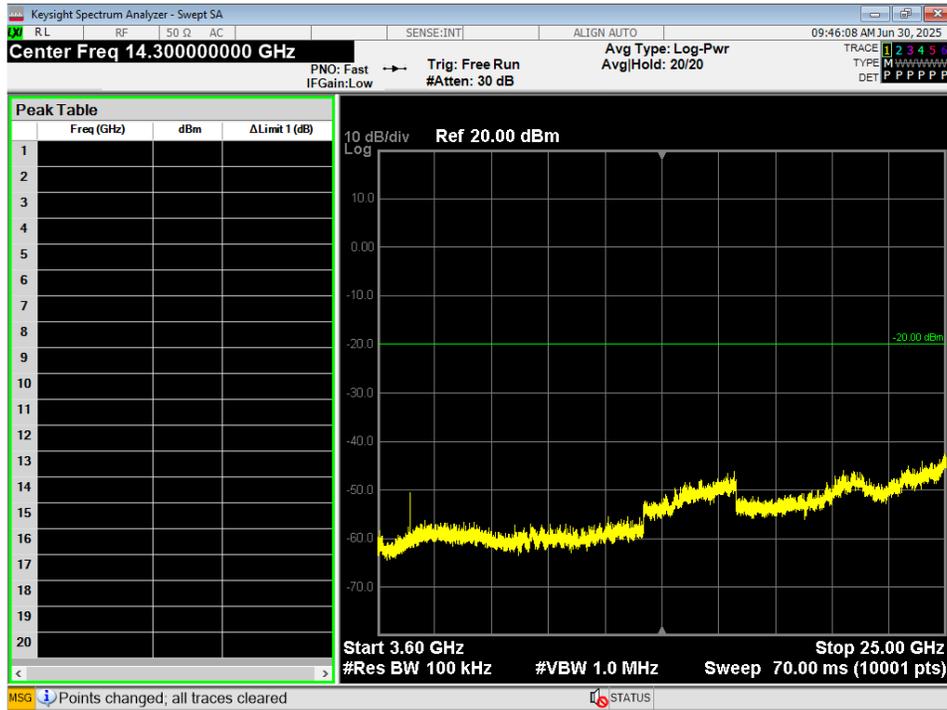


Figure 20 - Conducted Spurious Plot, GMSK 2MB, 3.6GHz – 25GHz, Low

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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:

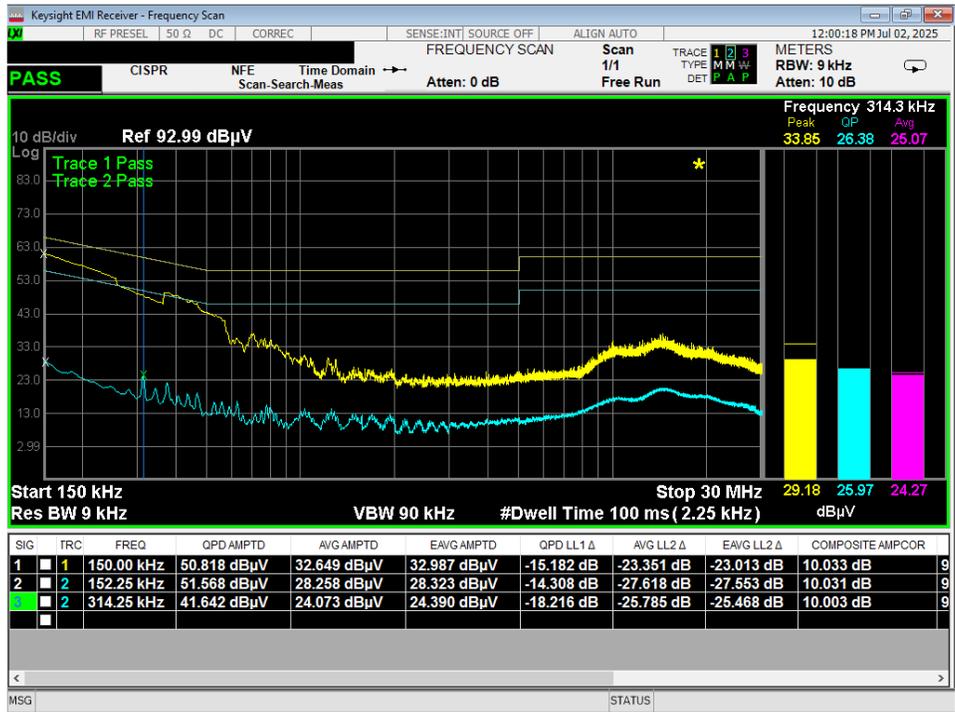


Figure 21 – Conducted Emissions Plot, charging on dock, TX, Line



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

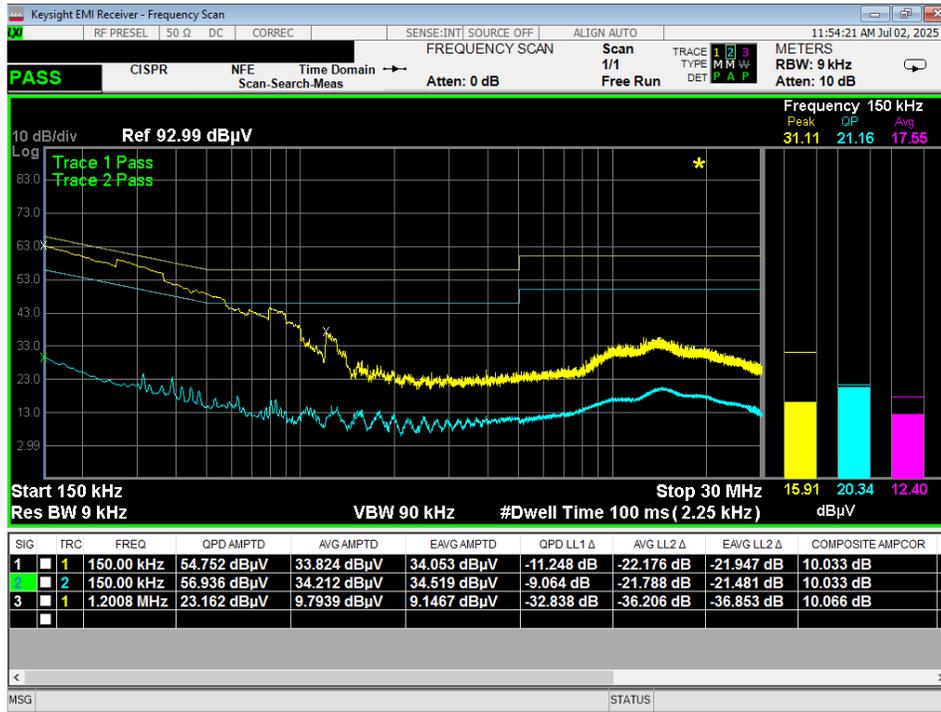


Figure 23 – Conducted Emissions Plot, charging on dock, IDLE, Line



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

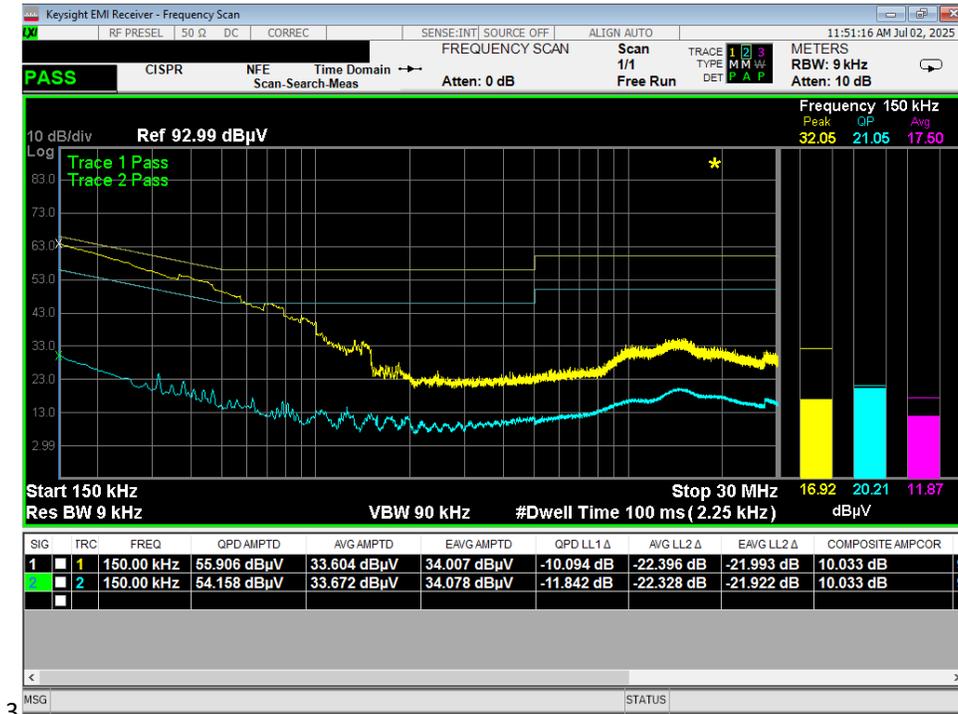


Figure 25 – Conducted Emissions Plot, charging via USB-C, TX, Line

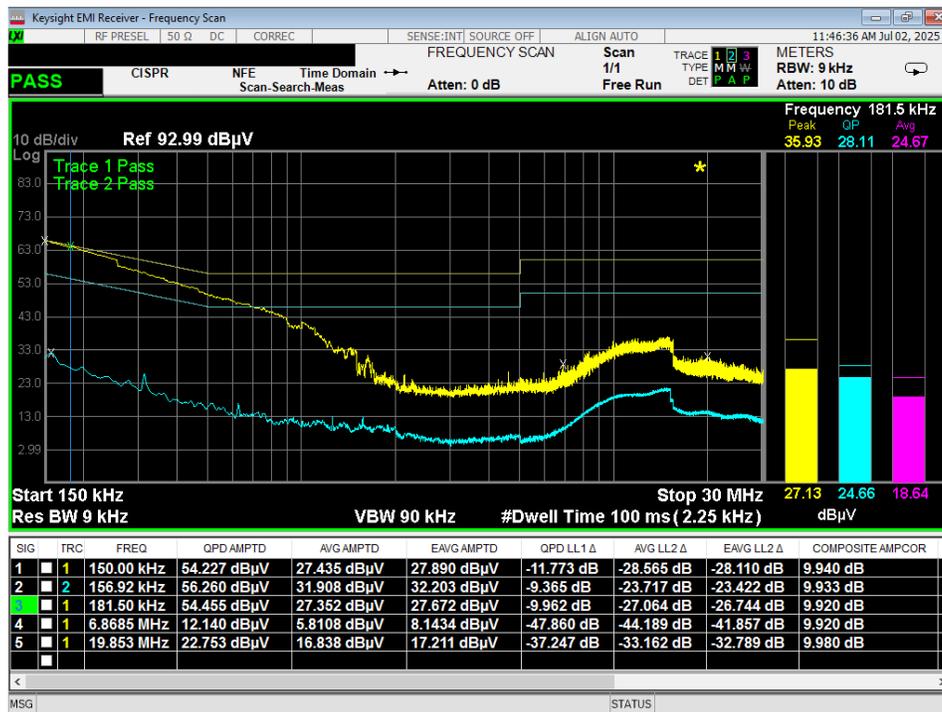


Figure 26 – Conducted Emissions Plot, charging via USB-C, TX, Neutral



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

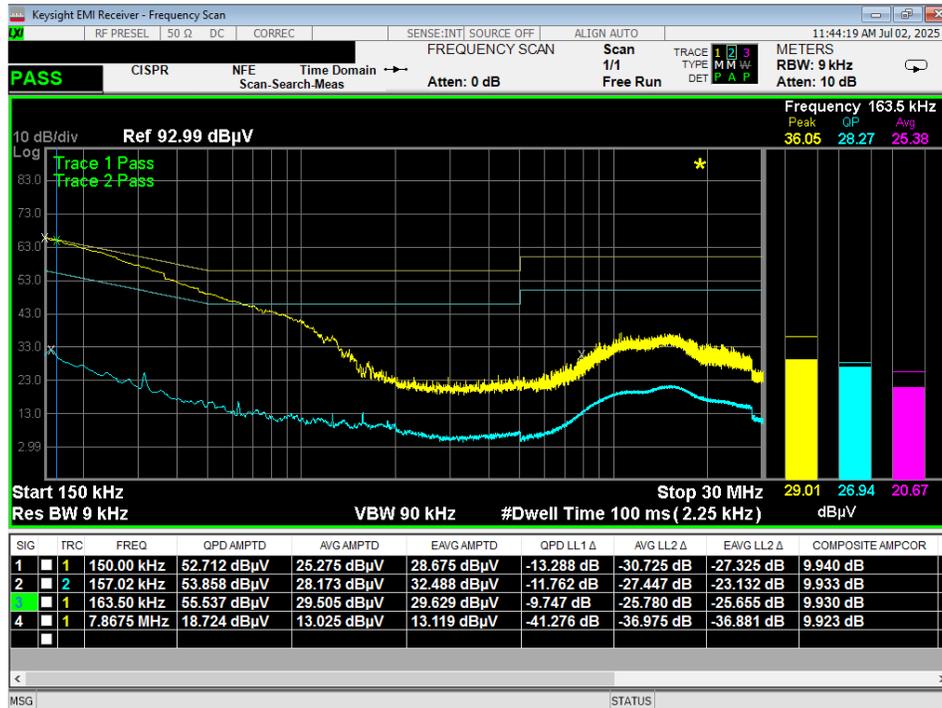


Figure 28 – Conducted Emissions Plot, charging via USB-C, IDLE, Neutral



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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;

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

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

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

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

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

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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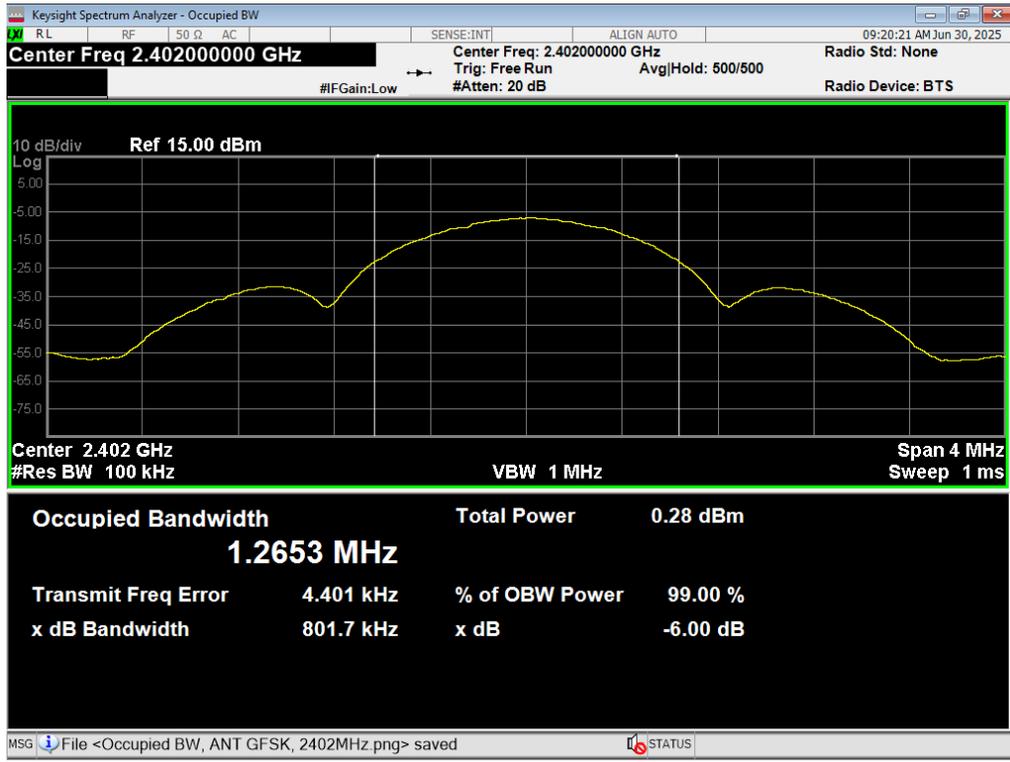
APPENDIX B – MEASUREMENT UNCERTAINTY

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:

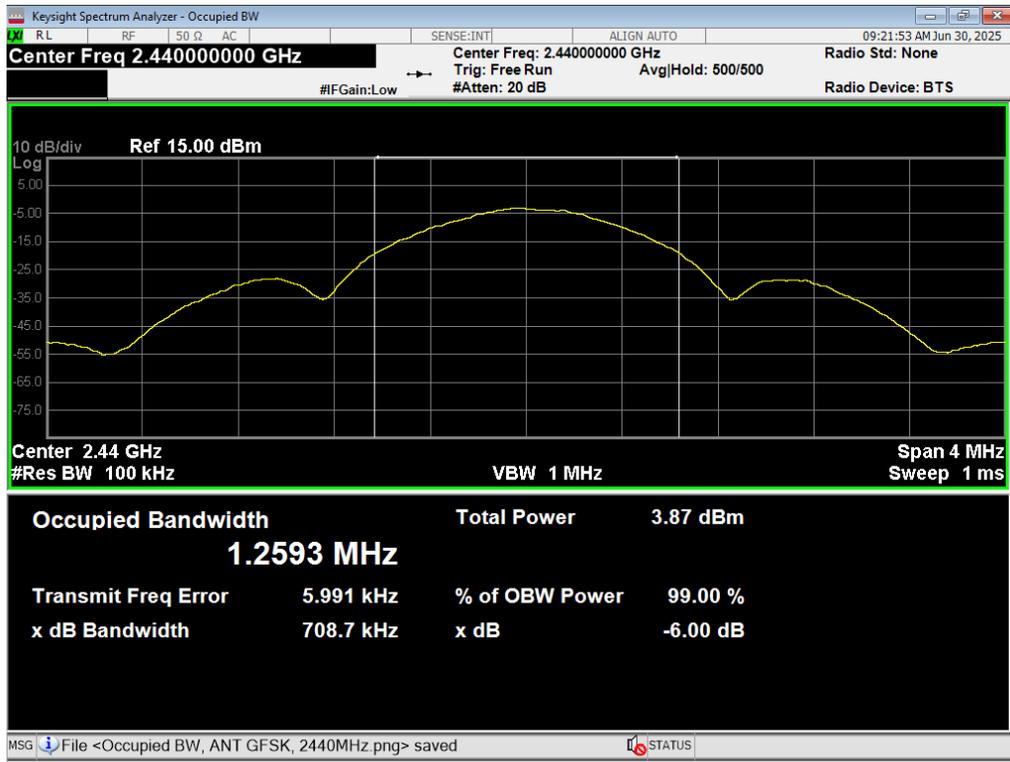
Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08
Emissions limits, conducted	30MHz – 18GHz	±3.03

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

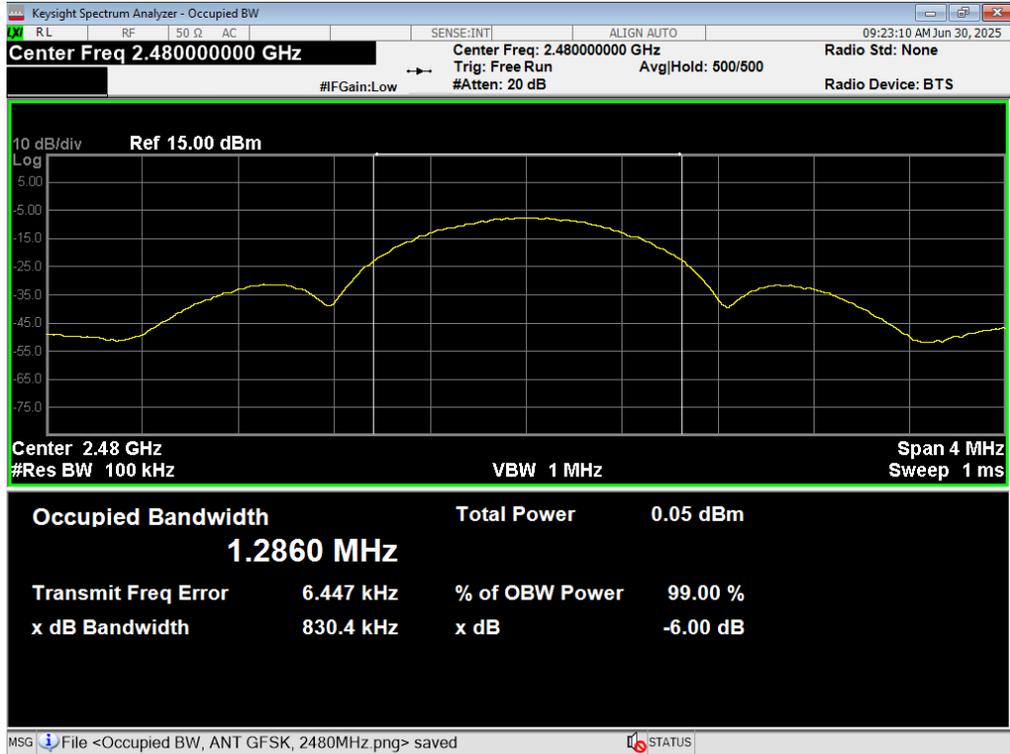
APPENDIX C – GRAPHS AND TABLES



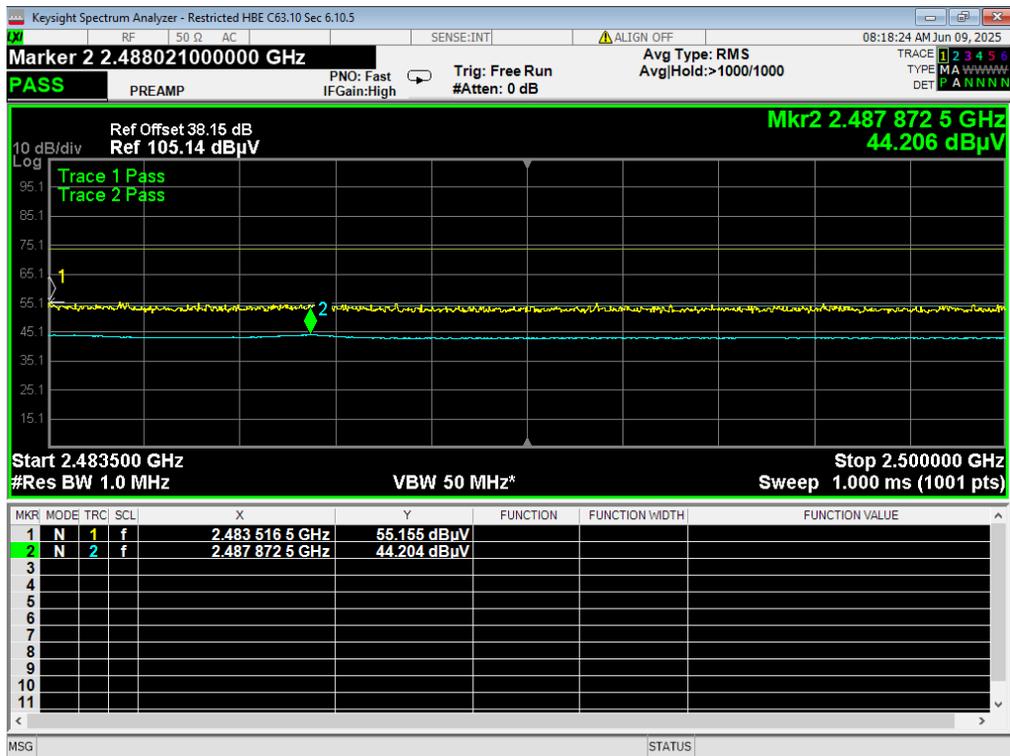
01 6dB BW, ANT GFSK, 2402MHz



02 6dB BW, ANT GFSK, 2440MHz



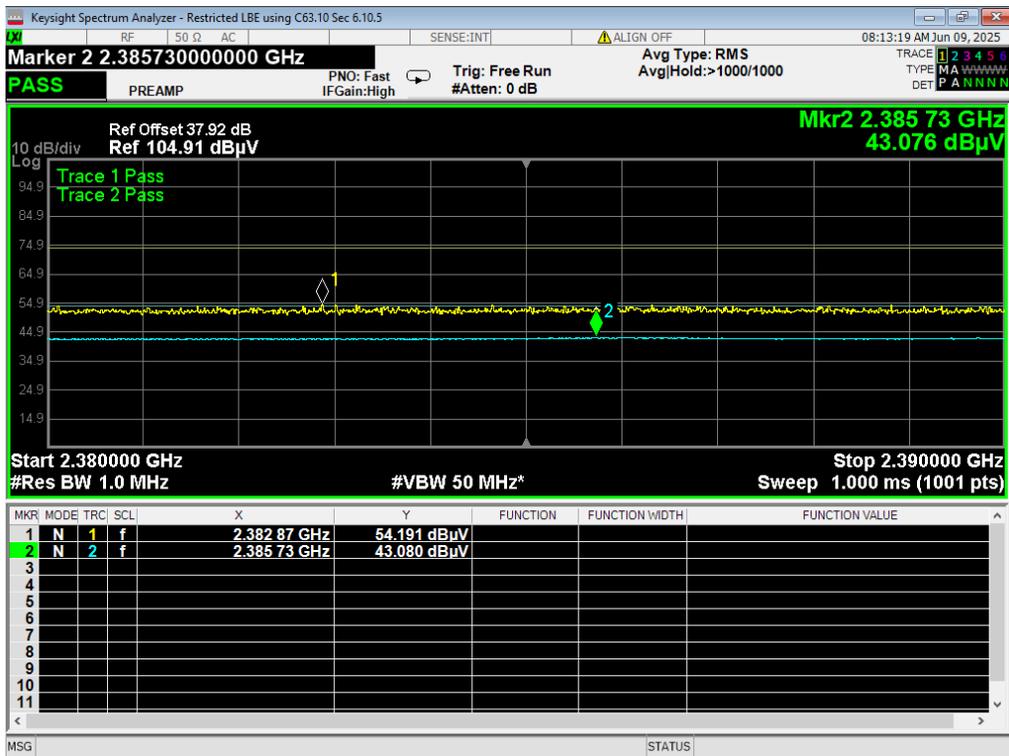
03 6dB BW, ANT GFSK, 2480MHz



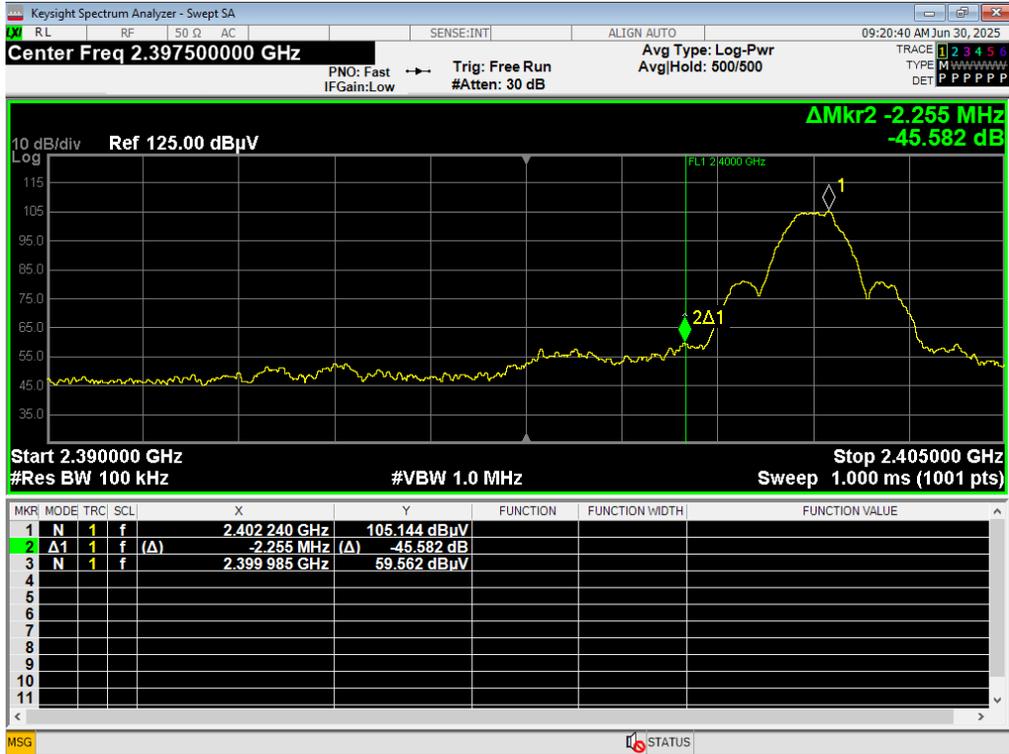
04 HBE Restricted, ANT GFSK, 2480MHz



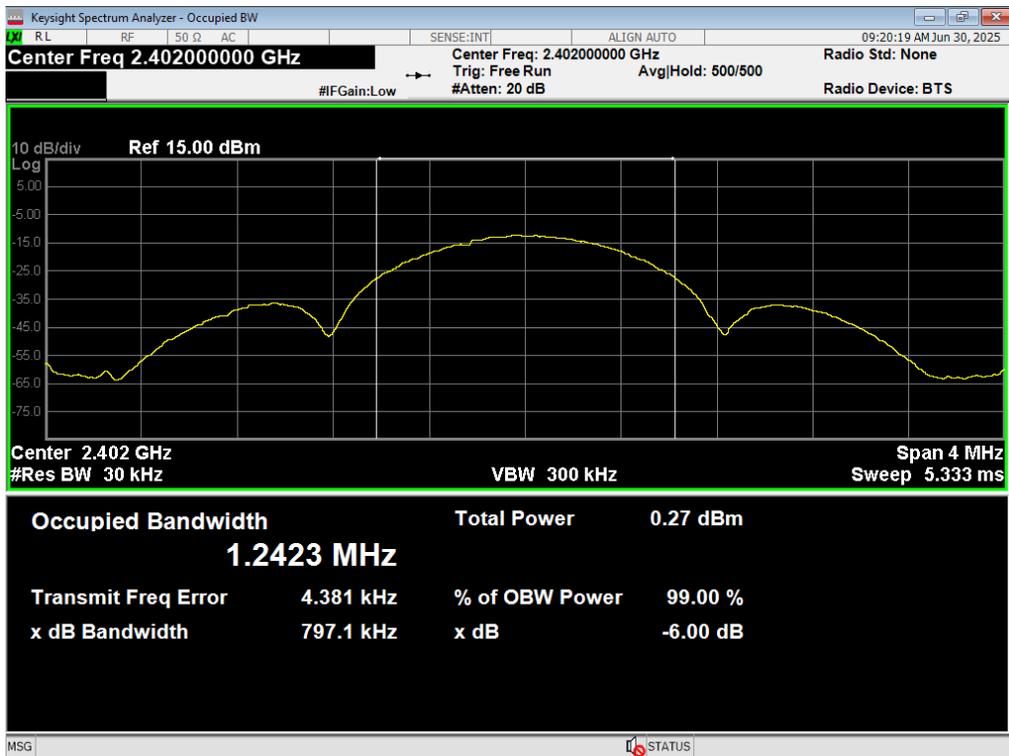
05 HBE Unrestricted, ANT GFSK, 2480MHz



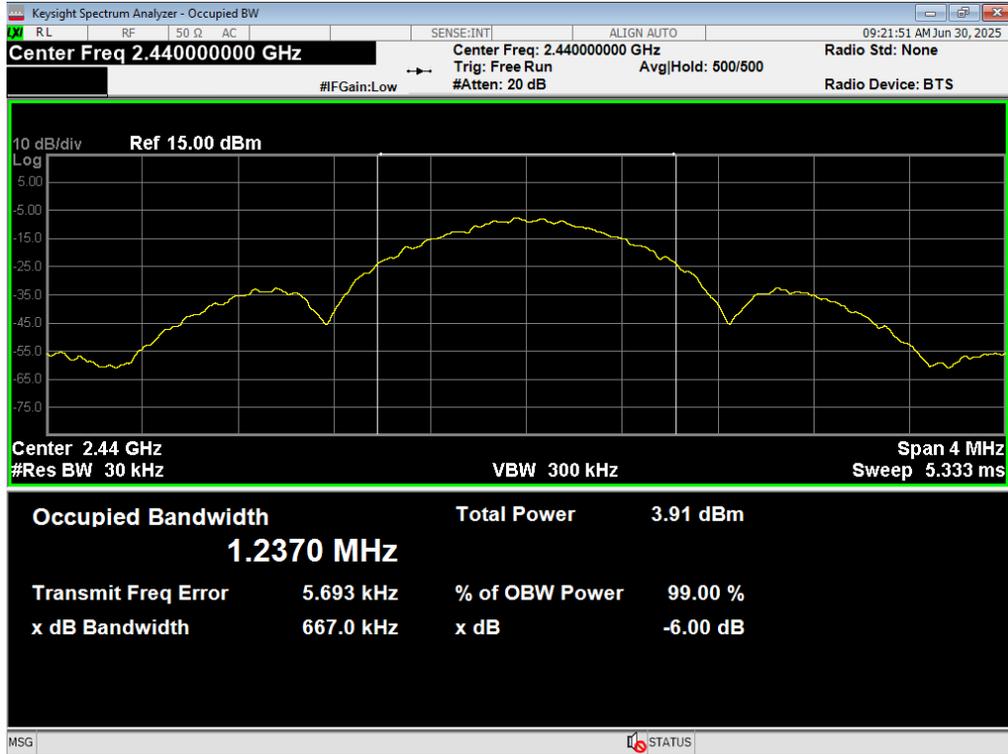
06 LBE Restricted, ANT GFSK, 2402MHz



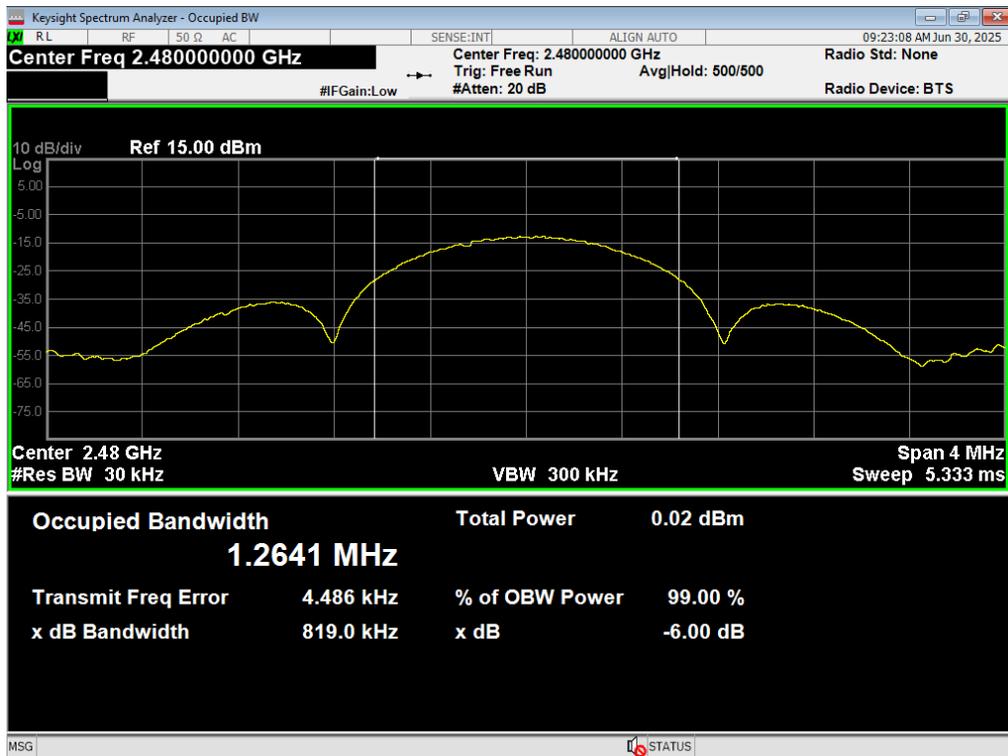
07 LBE Unrestricted, ANT GFSK, 2402MHz



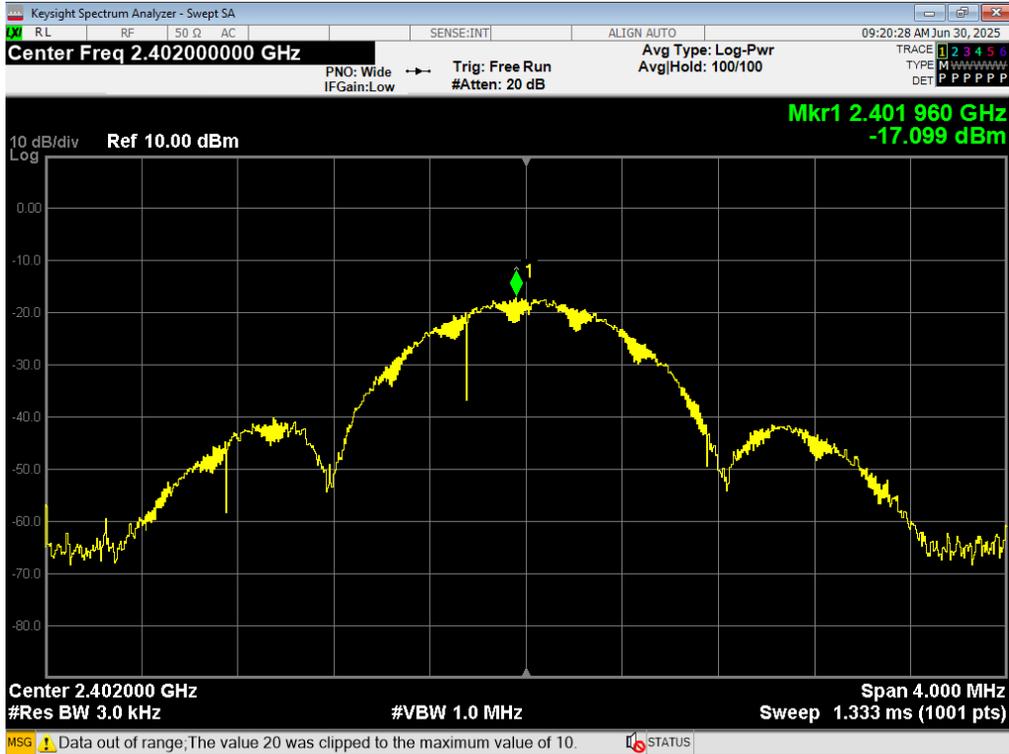
08 Occupied BW, ANT GFSK, 2402MHz



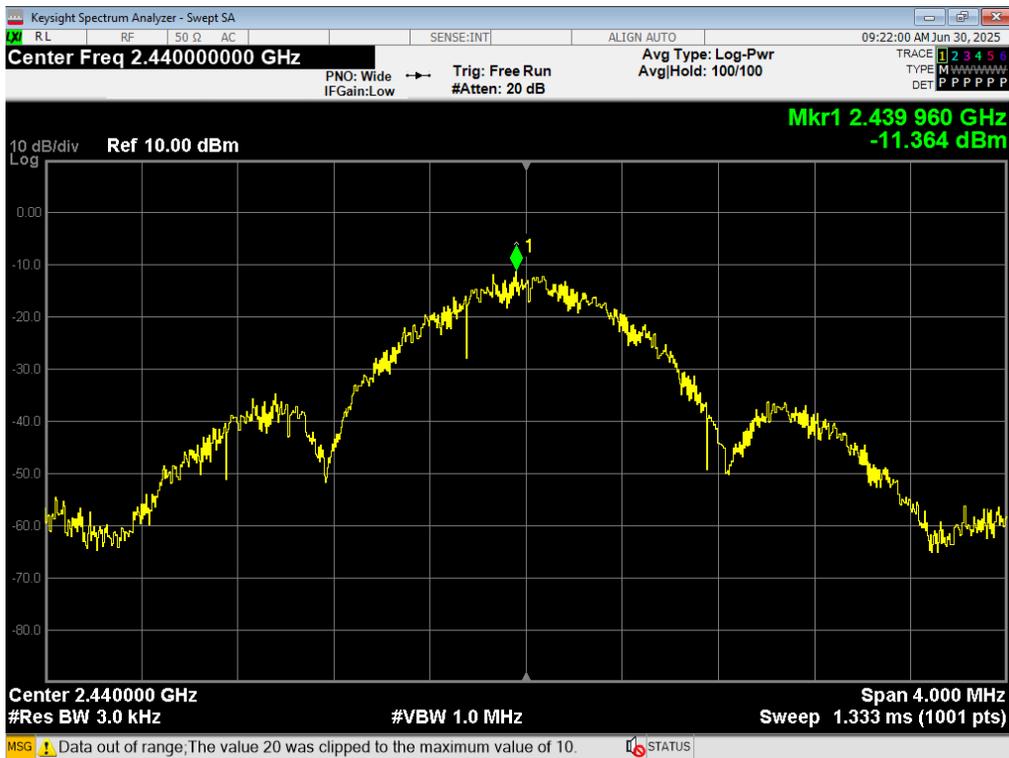
09 Occupied BW, ANT GFSK, 2440MHz



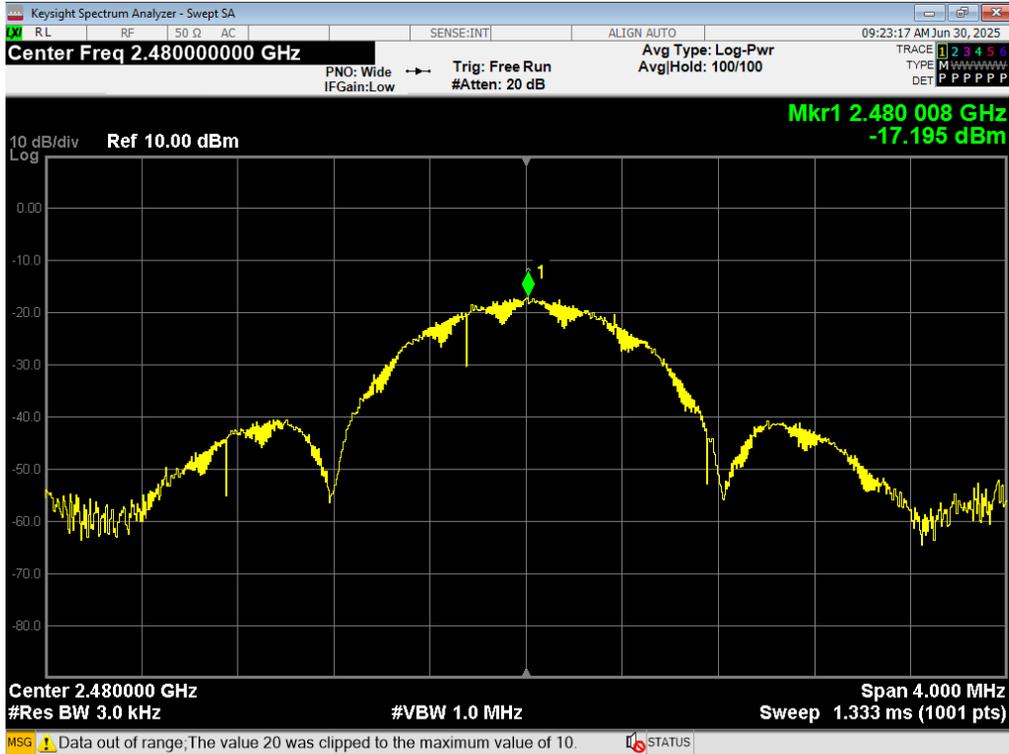
10 Occupied BW, ANT GFSK, 2480MHz



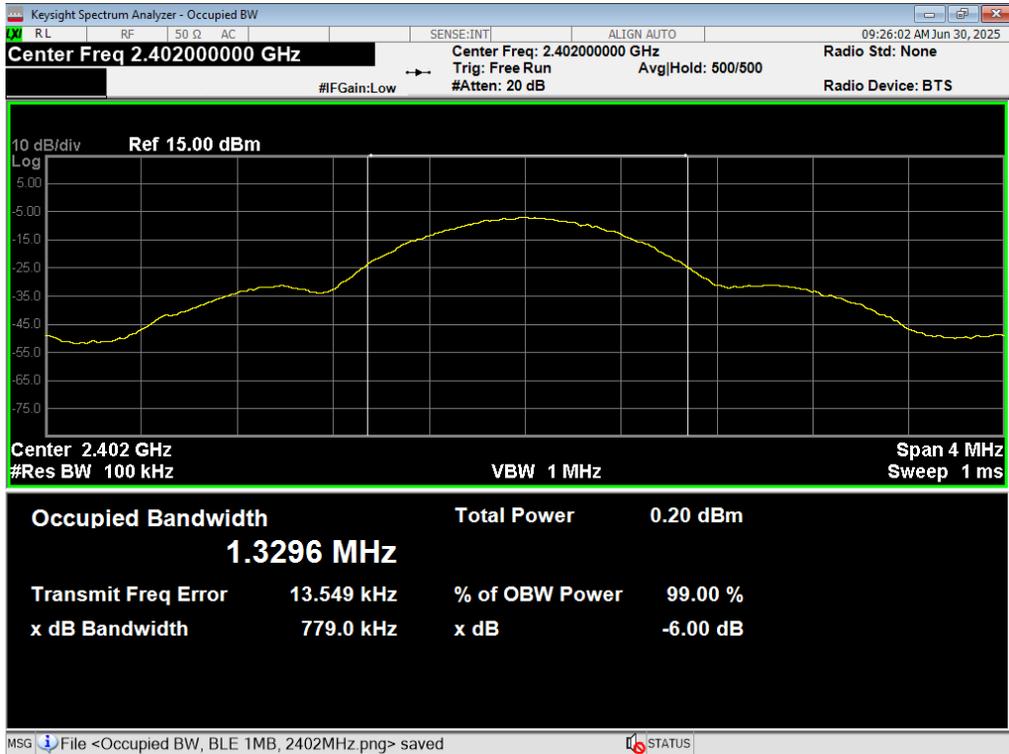
11 PSD, ANT GFSK, 2402MHz



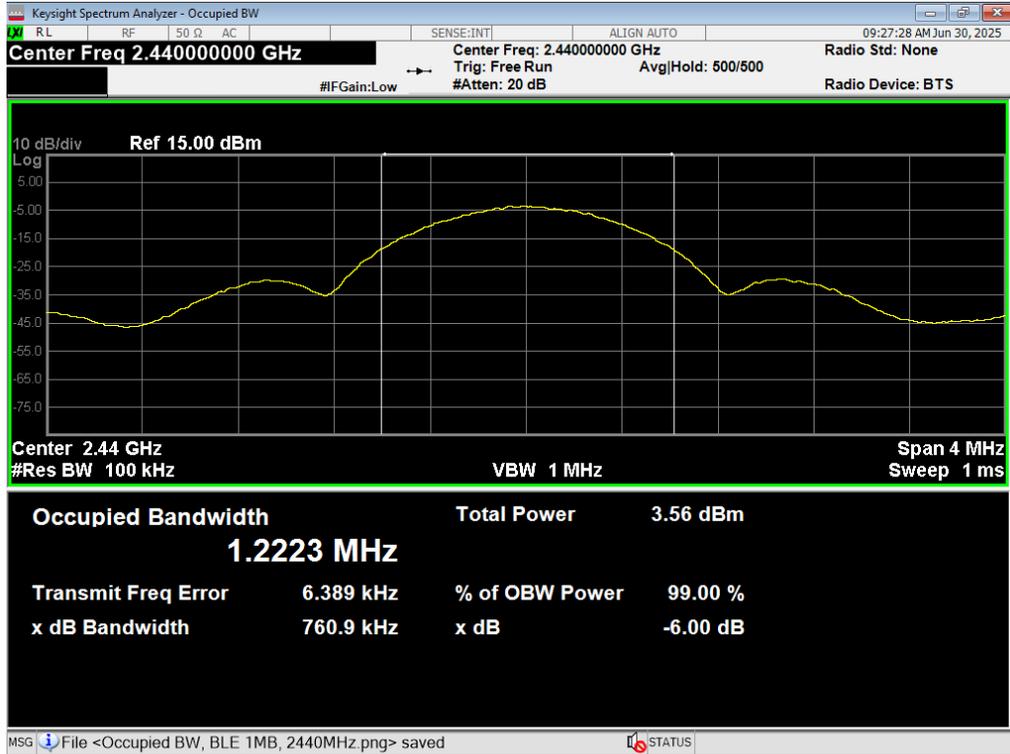
12 PSD, ANT GFSK, 2440MHz



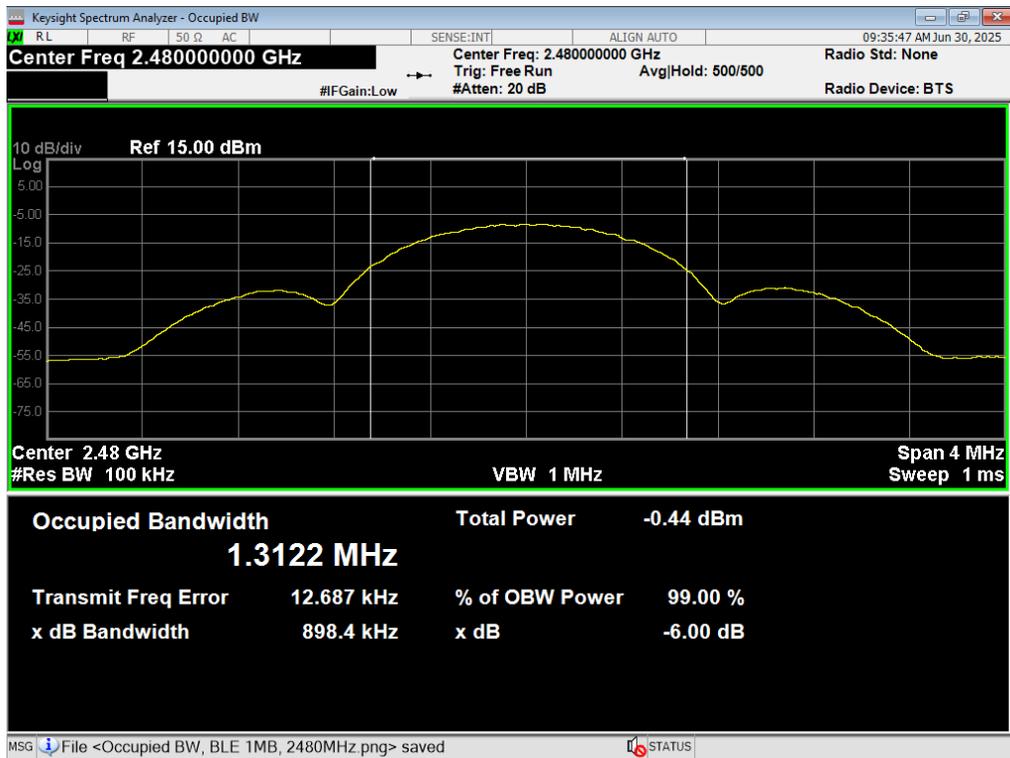
13 PSD, ANT GFSK, 2480MHz



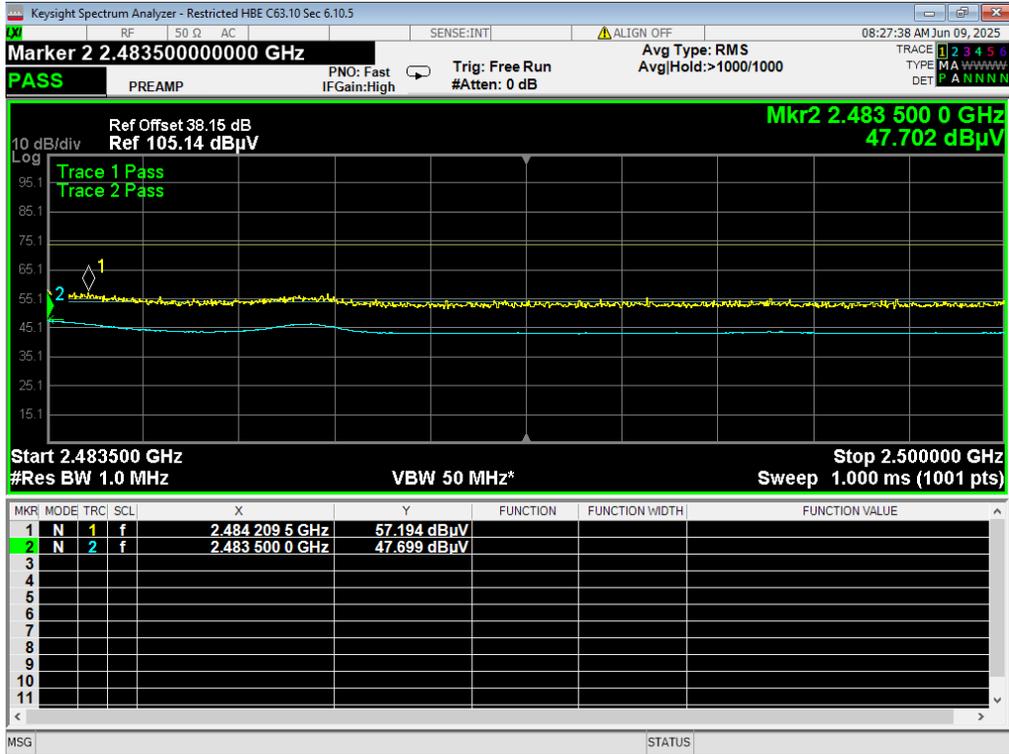
14 6dB BW, BLE 1MB, 2402MHz



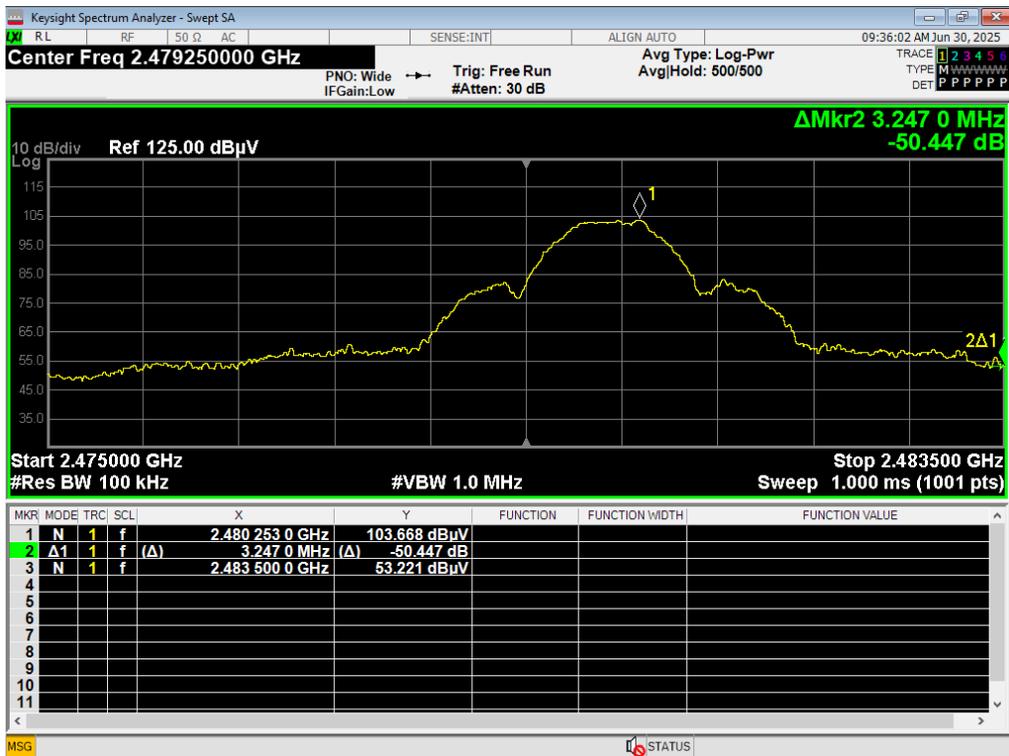
15 6dB BW, BLE 1MB, 2440MHz



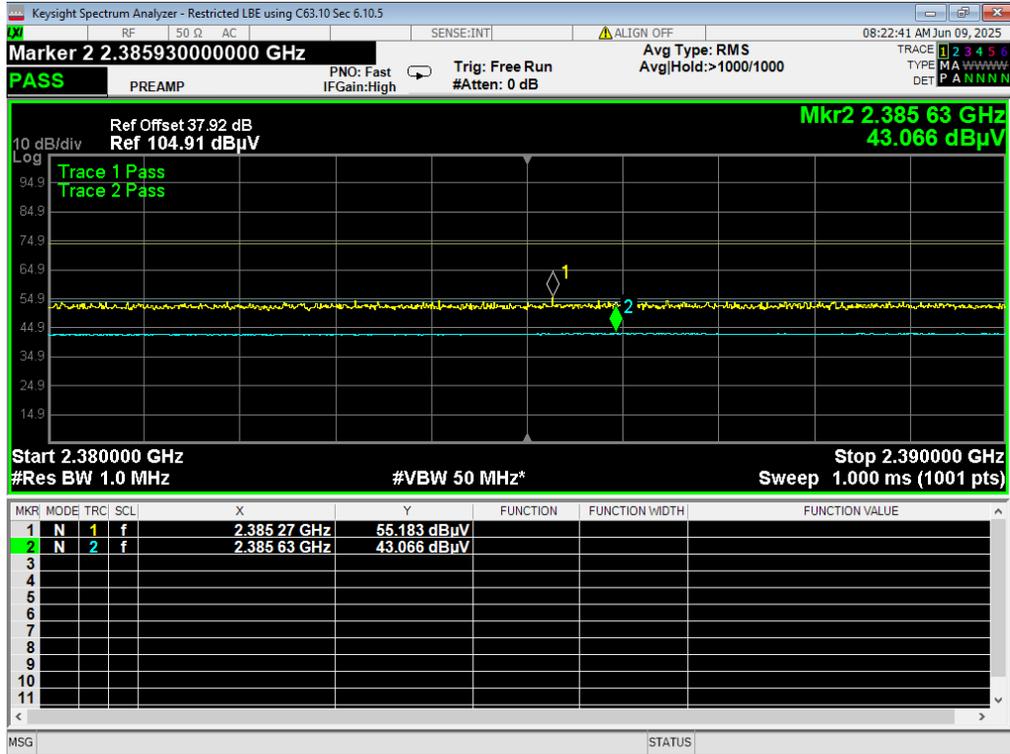
16 6dB BW, BLE 1MB, 2480MHz



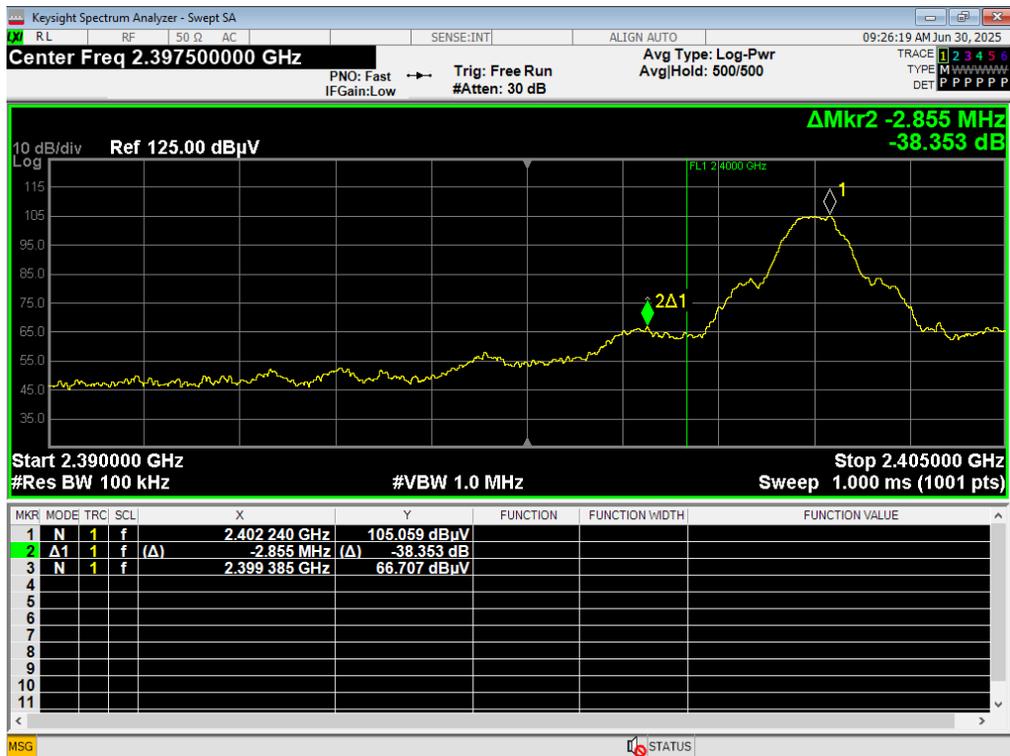
17 HBE Restricted, BLE 1MB, 2480MHz



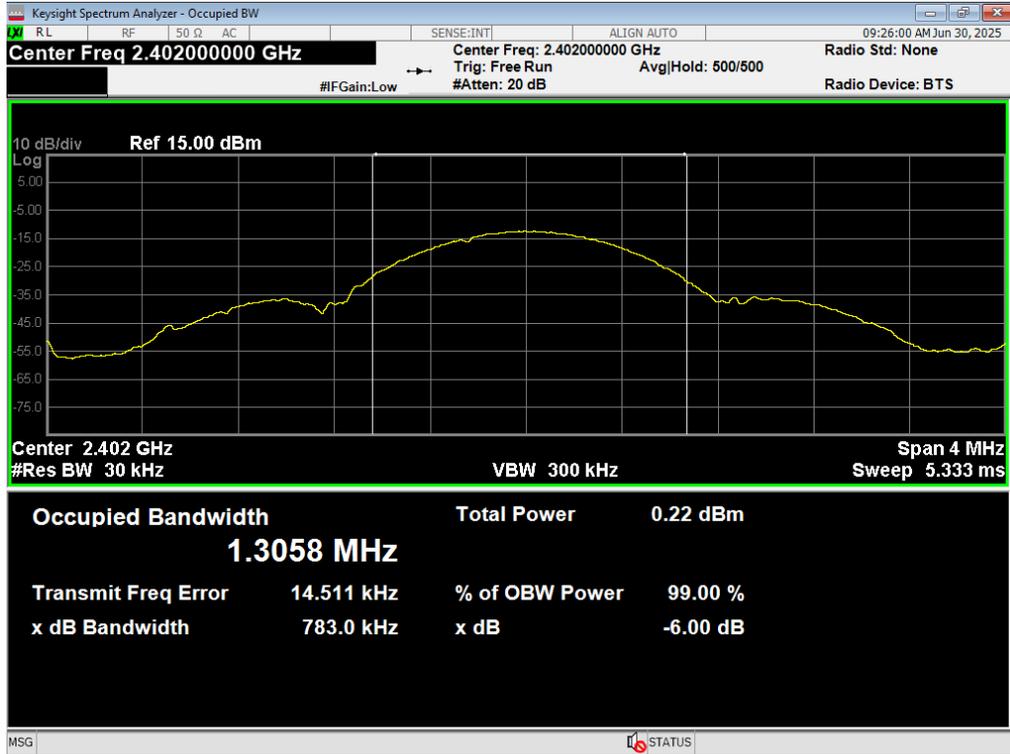
18 HBE Unrestricted, BLE 1MB, 2480MHz



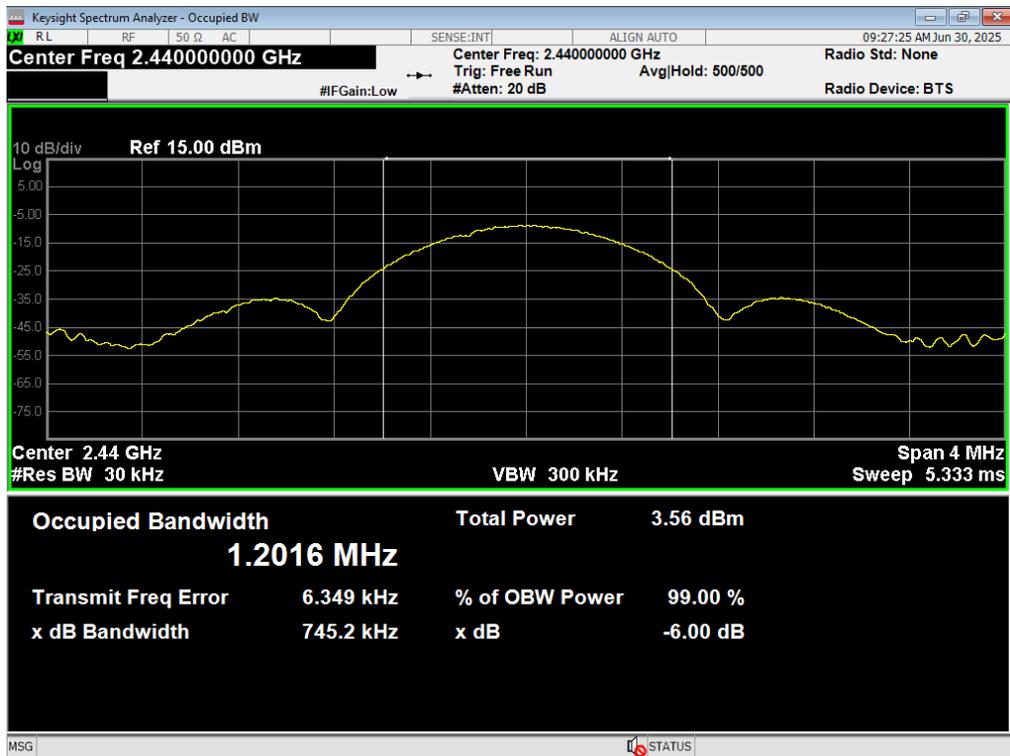
19 LBE Restricted, BLE 1MB, 2402MHz



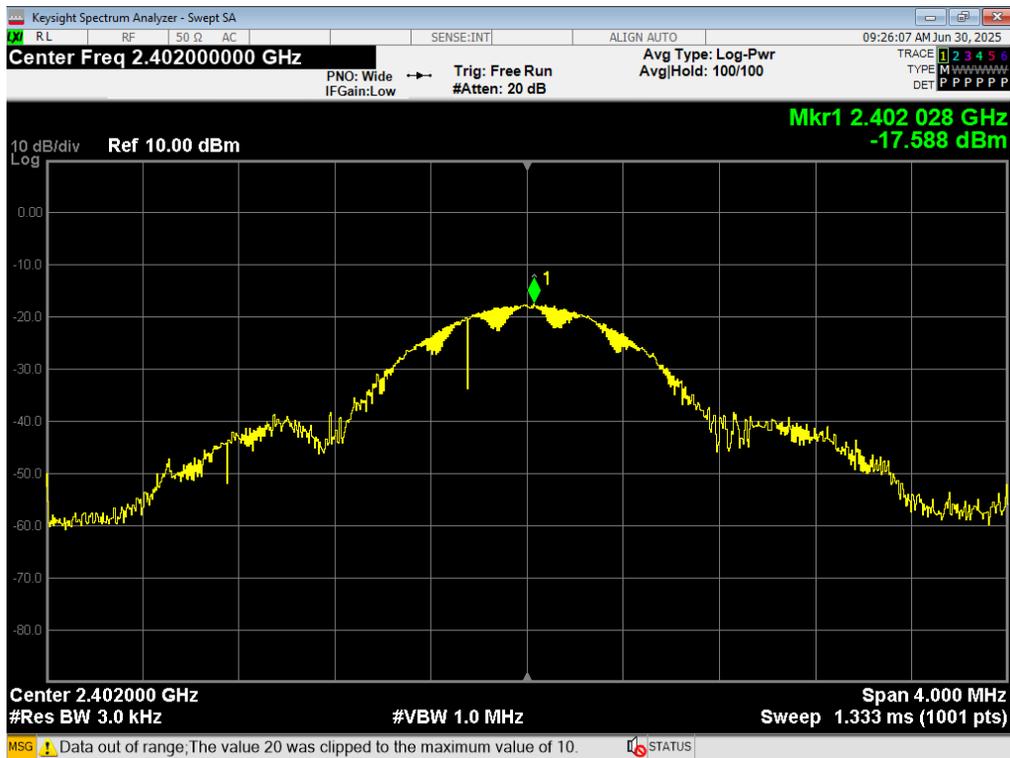
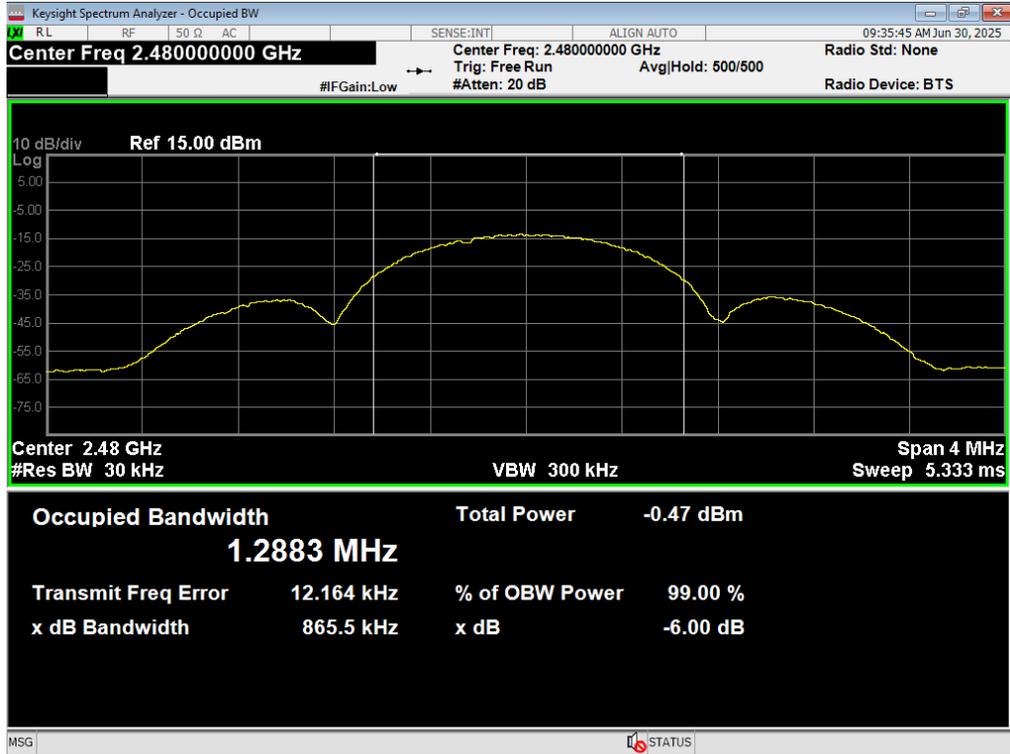
20 LBE Unrestricted, BLE 1MB, 2402MHz

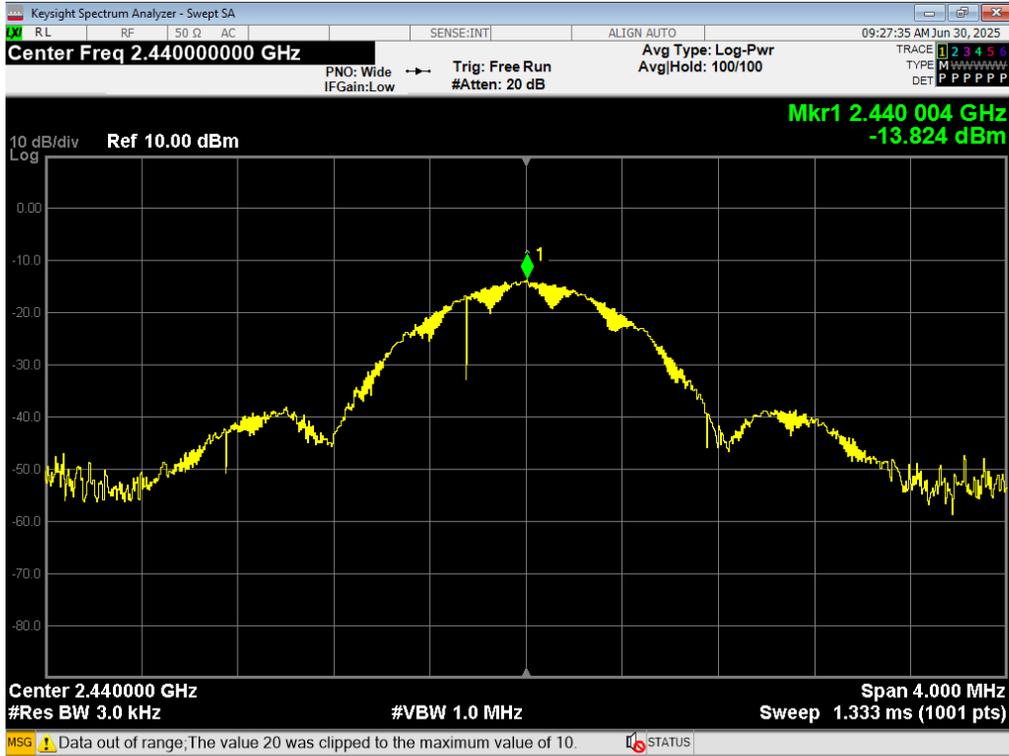


21 Occupied BW, BLE 1MB, 2402MHz

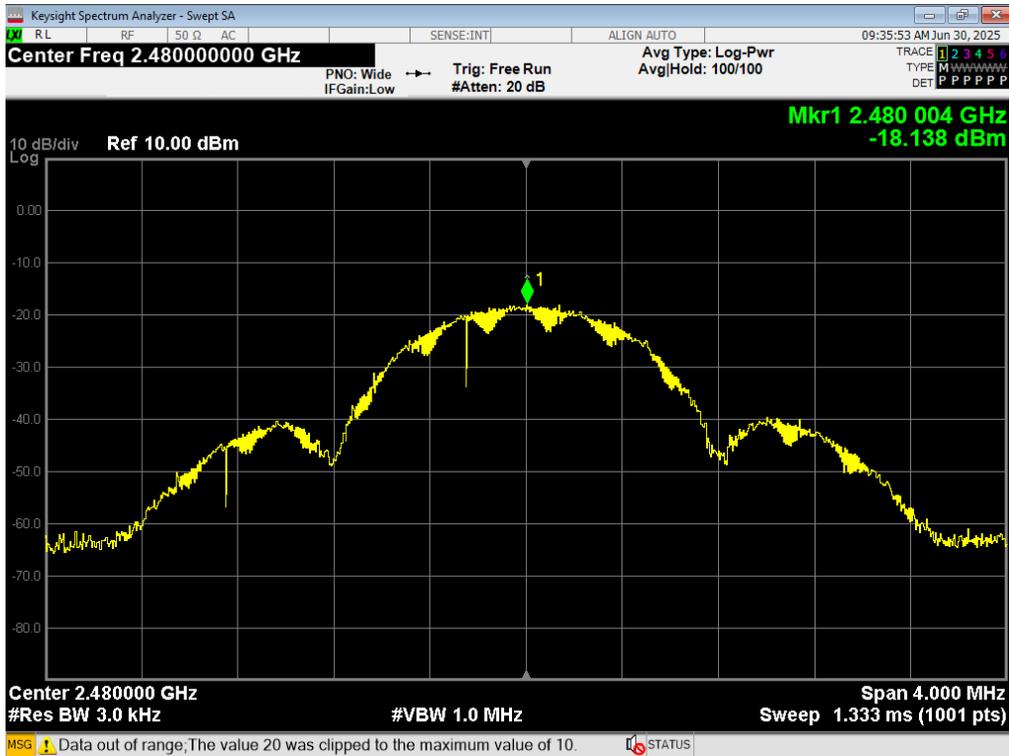


22 Occupied BW, BLE 1MB, 2440MHz





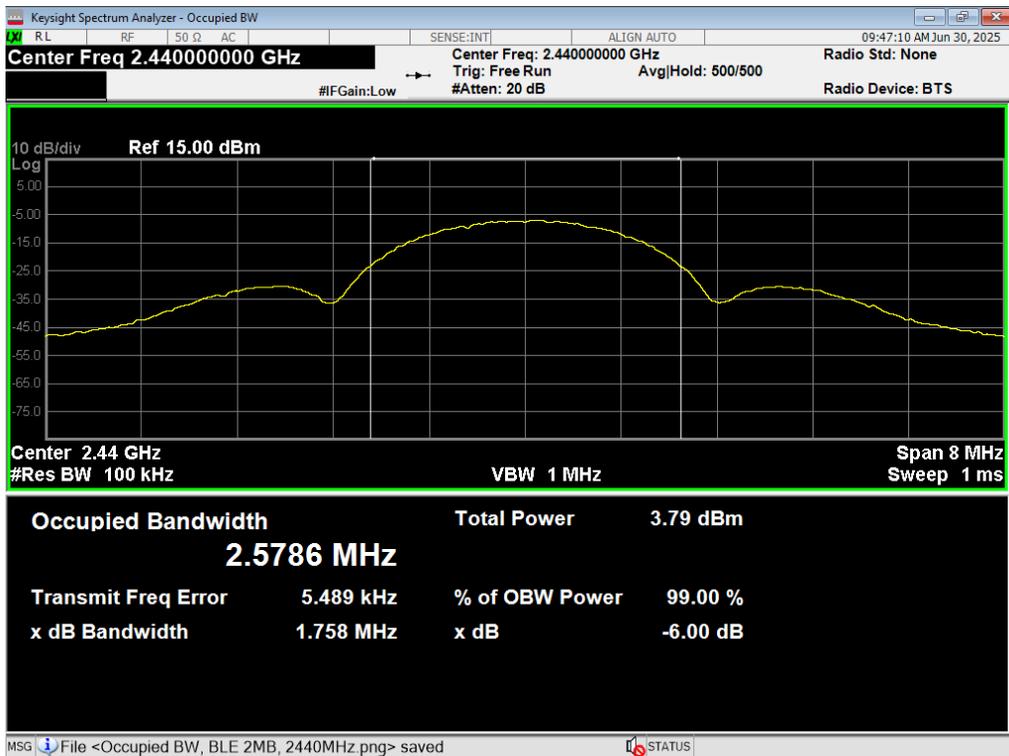
25 PSD, BLE 1MB, 2440MHz



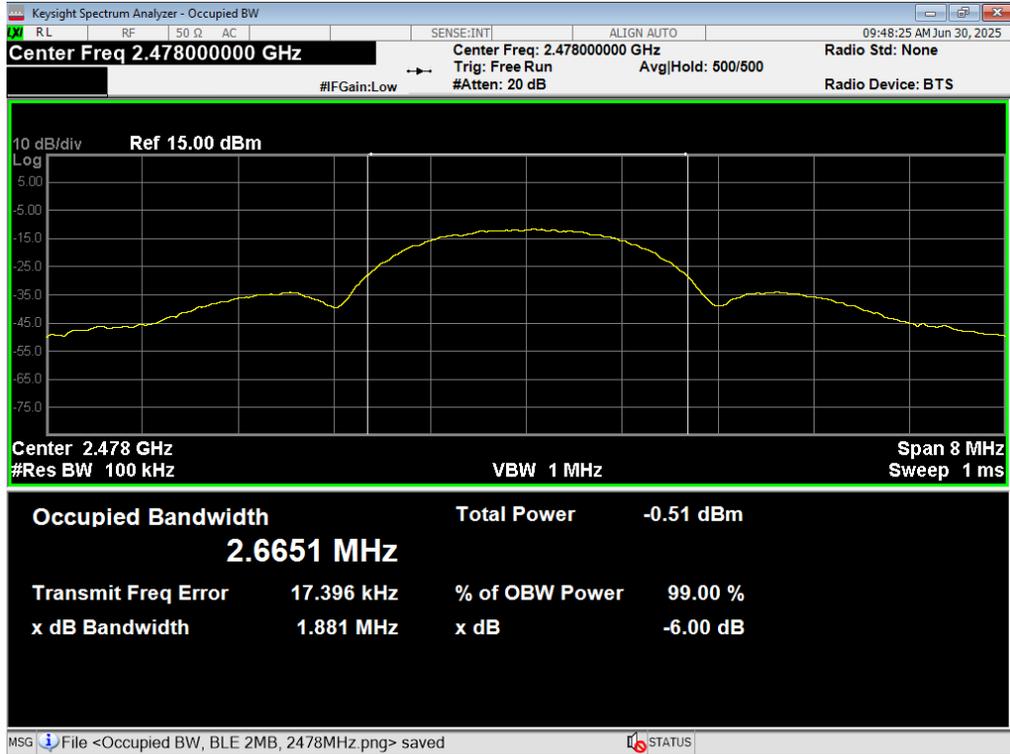
26 PSD, BLE 1MB, 2480MHz



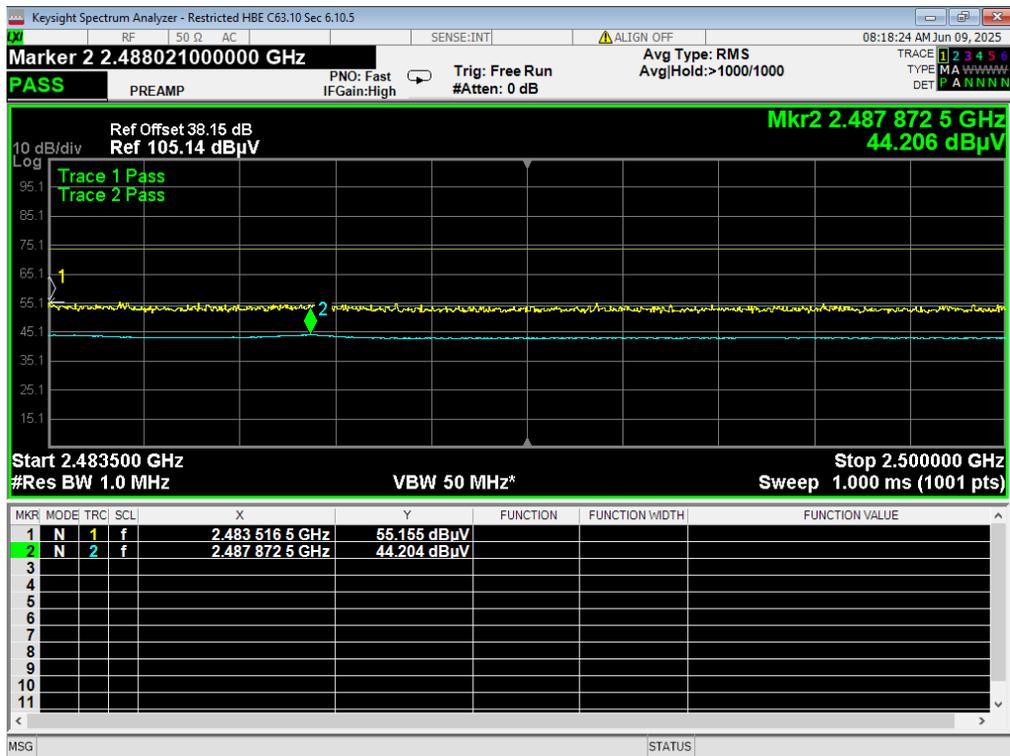
27 6dB BW, BLE 2MB, 2404MHz



28 6dB BW, BLE 2MB, 2440MHz



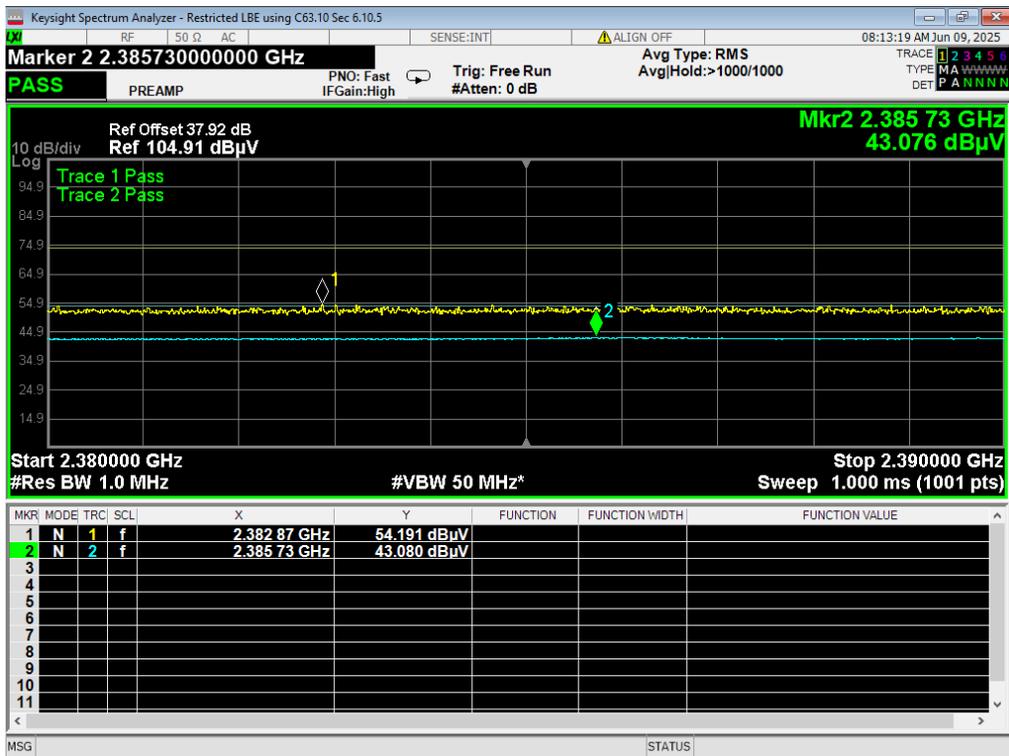
29 6dB BW, BLE 2MB, 2478MHz



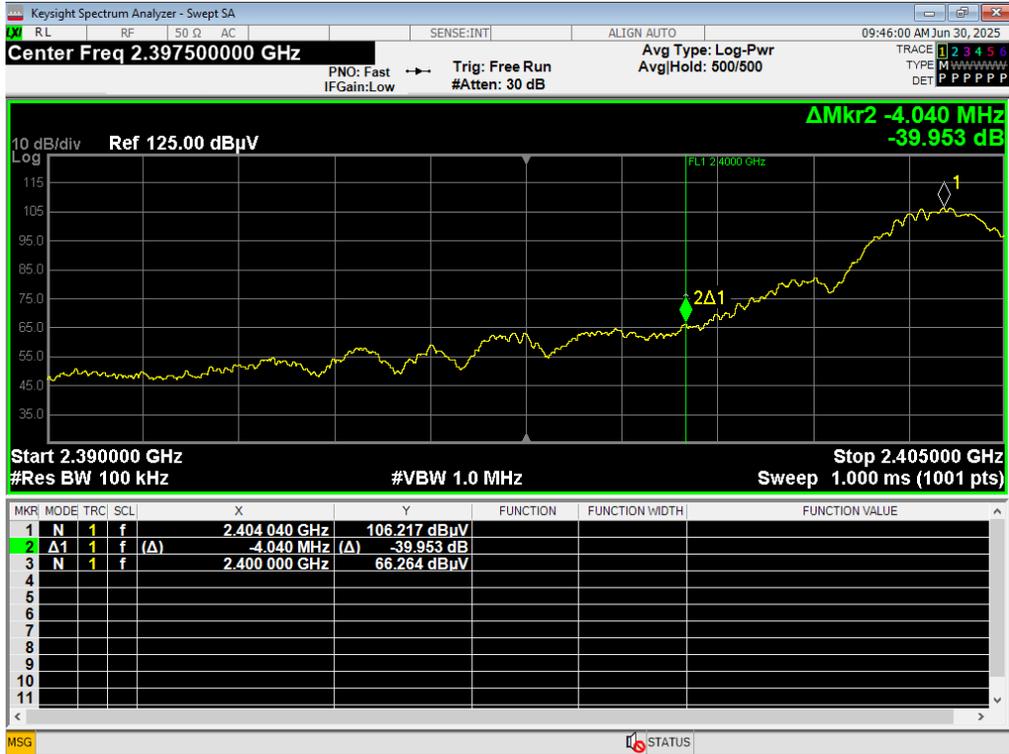
30 HBE Restricted, ANT GFSK, 2480MHz



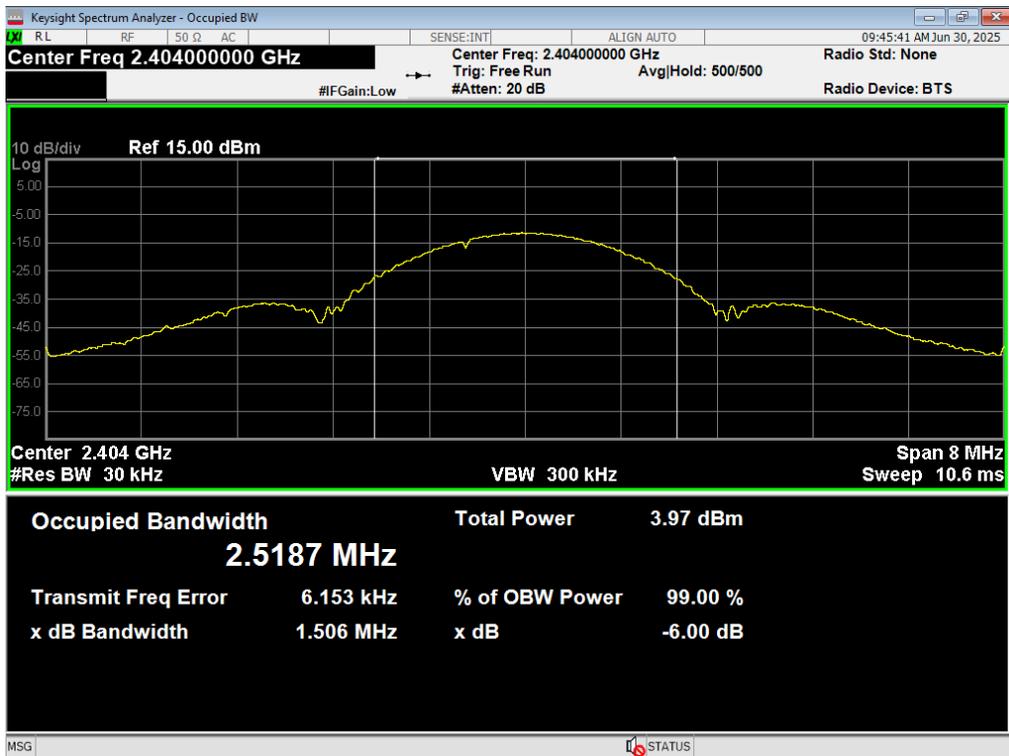
31 HBE Unrestricted, BLE 2MB, 2478MHz



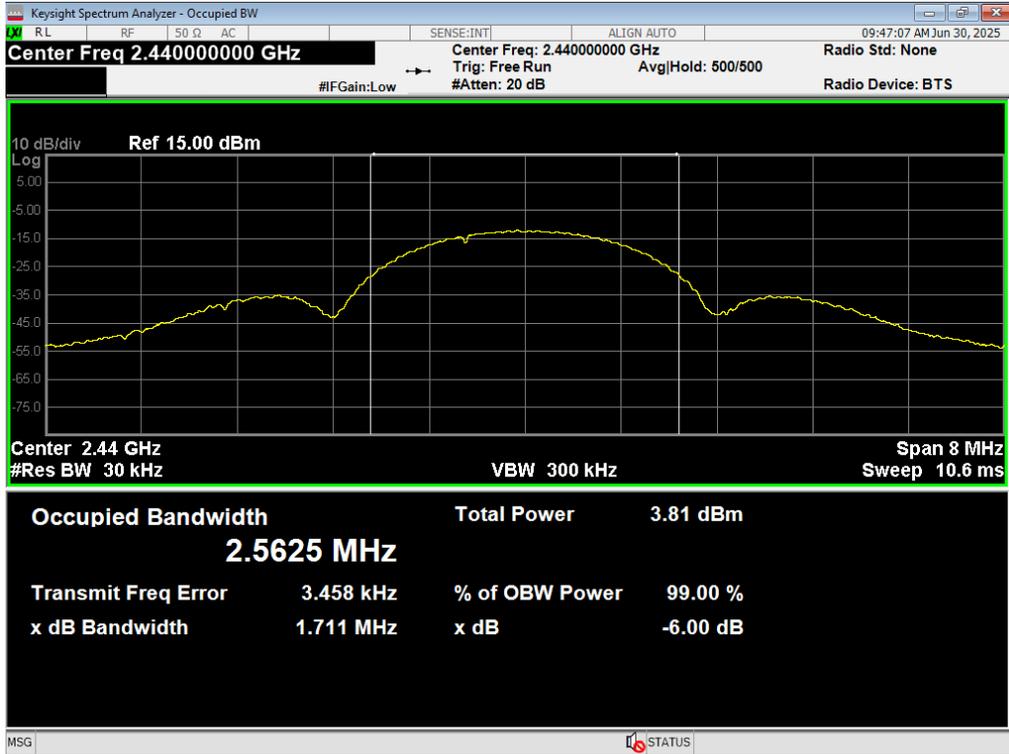
32 LBE Restricted, ANT GFSK, 2402MHz



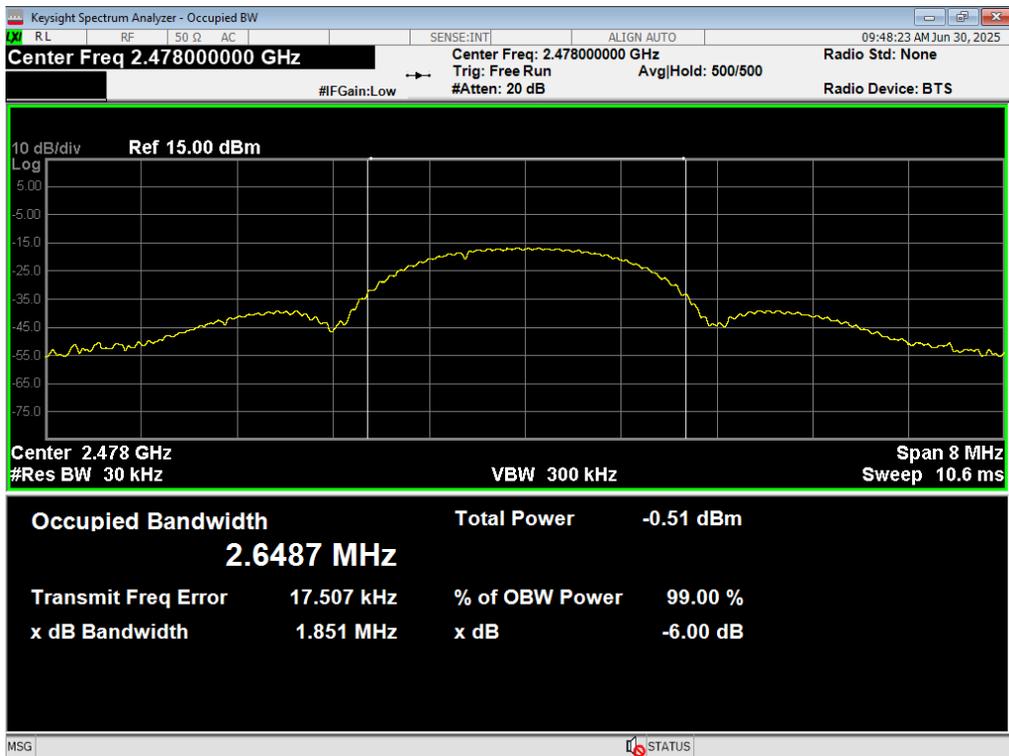
33 LBE Unrestricted, BLE 2MB, 2404MHz



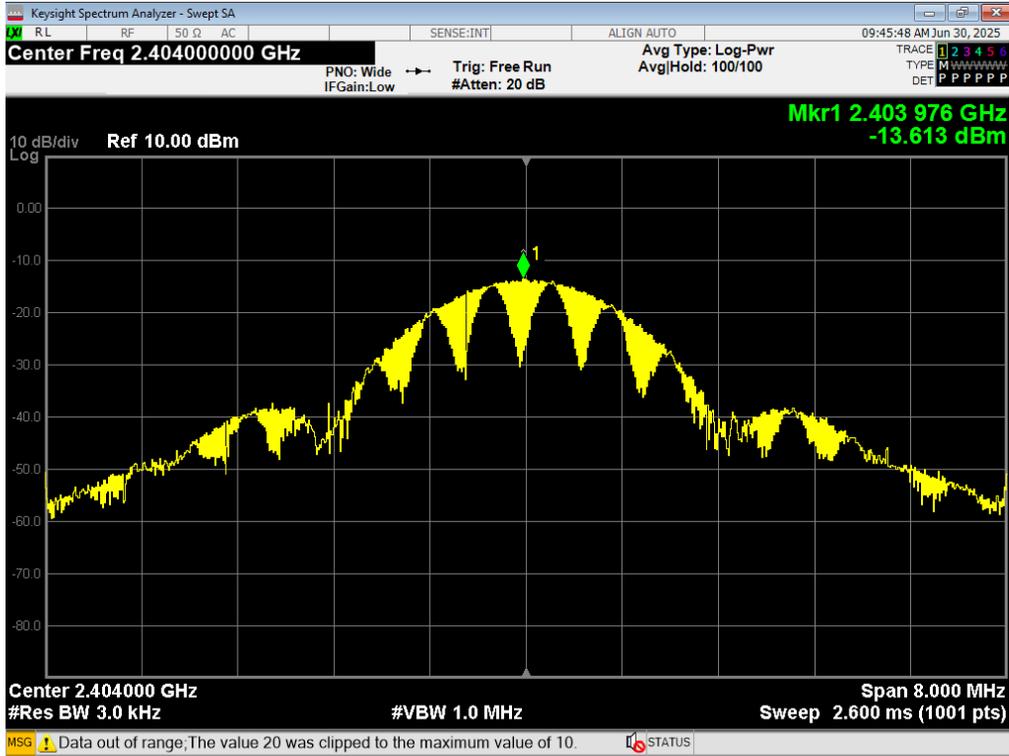
34 Occupied BW, BLE 2MB, 2404MHz



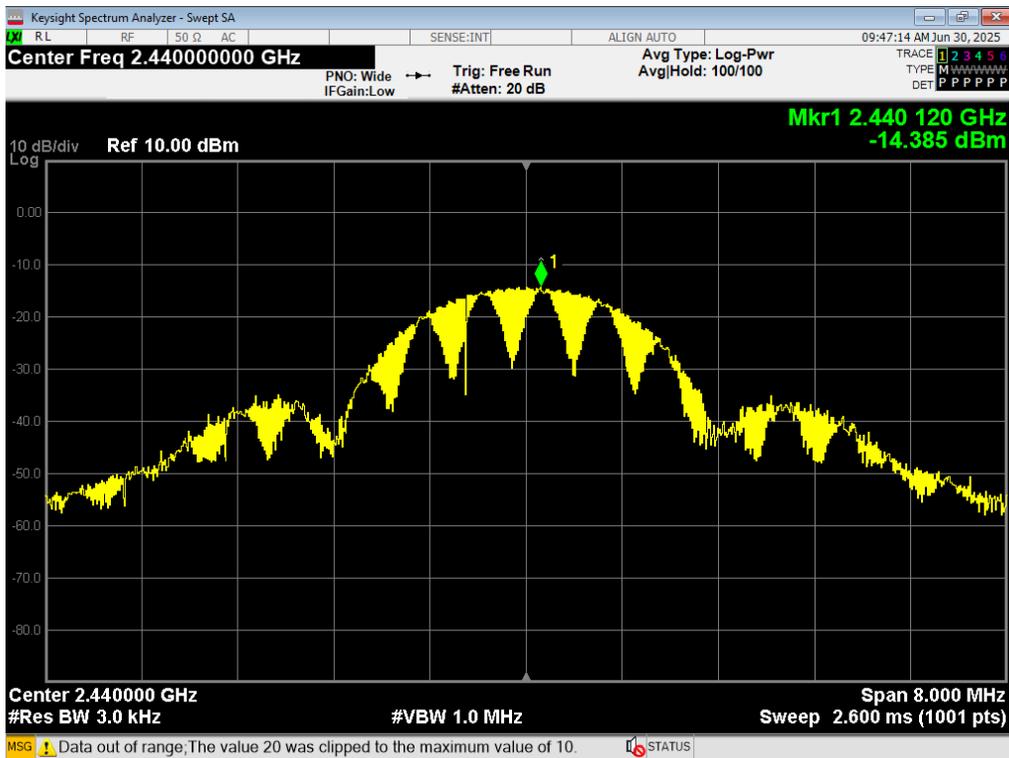
35 Occupied BW, BLE 2MB, 2440MHz



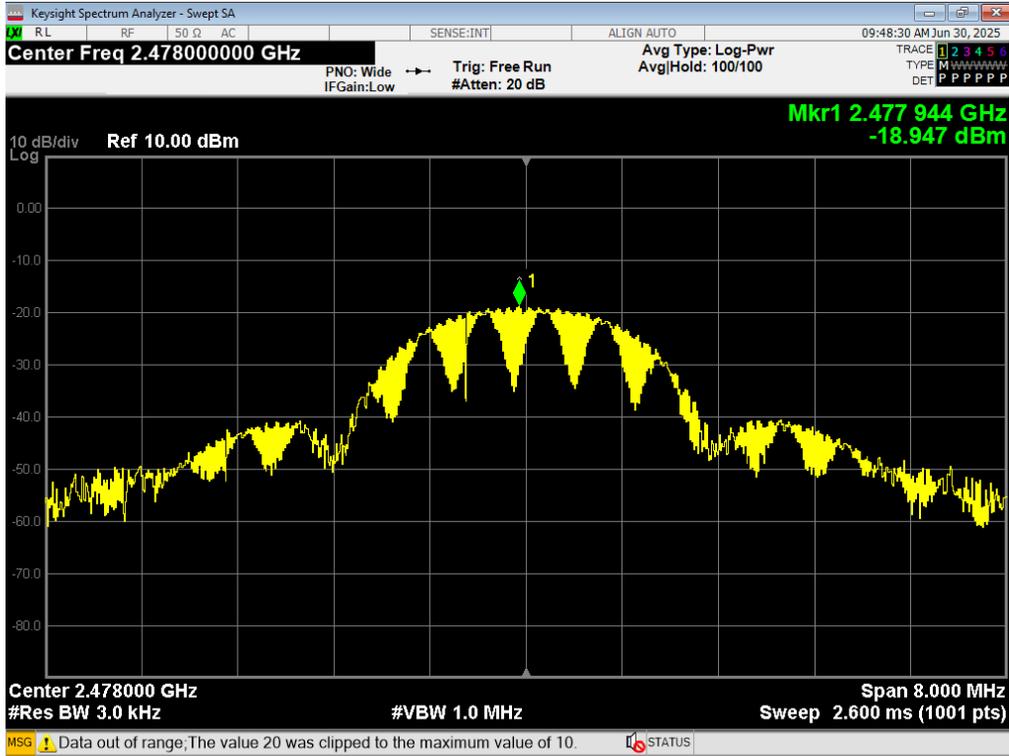
36 Occupied BW, BLE 2MB, 2478MHz



37 PSD, BLE 2MB, 2404MHz



38 PSD, BLE 2MB, 2440MHz



39 PSD, BLE 2MB, 2478MHz



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