

## FCC Test Report

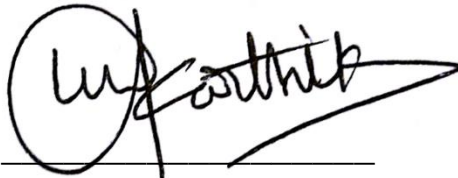
**Prepared for:** Garmin International, Inc.

**Address:** 1200 E. 151<sup>st</sup> Street  
Olathe, Kansas, 66062, USA

**Product:** A04223

**Test Report No:** R20220512-20-E1B

**Approved by:**



Mahendra Karthik Vepuri, NCE  
EMC Test Engineer,  
iNARTE Certified EMC Engineer #EMC-041453-E

**DATE:** April 3, 2023

**Total Pages:** 45

*The Nebraska Center for Excellence in Electronics (NCEE) authorizes the above-named company to reproduce this report provided it is reproduced in its entirety for use by the company's employees only. Any use that a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. NCEE accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested.*



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## REVISION PAGE

Rev. No.	Date	Description
0	10 January 2023	Issued by KVepuri Prepared by FLane/KVepuri
A	13 January 2023	ISED removed from title page – FL
B	3 April 2023	Section 4.0, section 4.3 and Appendix C were modified-KV



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## CONTENTS

Revision Page .....	2
<b>1.0 Summary of test results.....</b>	<b>4</b>
<b>2.0 EUT Description.....</b>	<b>5</b>
<b>2.1 Equipment under test .....</b>	<b>5</b>
<b>2.2 Description of test modes .....</b>	<b>6</b>
<b>2.3 Description of support units.....</b>	<b>6</b>
<b>3.0 Laboratory and General Test Description .....</b>	<b>7</b>
<b>3.1 Laboratory description.....</b>	<b>7</b>
<b>3.2 Test personnel.....</b>	<b>7</b>
<b>3.3 Test equipment.....</b>	<b>8</b>
<b>3.4 General Test Procedure and Setup for Radio Measuremnts.....</b>	<b>9</b>
<b>4.0 Results .....</b>	<b>10</b>
<b>4.1 Output Power .....</b>	<b>12</b>
<b>4.2 Bandwidth.....</b>	<b>13</b>
<b>4.3 Duty Cycle .....</b>	<b>14</b>
<b>4.4 Power Spectral Density.....</b>	<b>15</b>
<b>4.5 Radiated emissions.....</b>	<b>16</b>
<b>4.6 Band edges .....</b>	<b>22</b>
<b>4.7 Conducted AC Mains Emissions .....</b>	<b>23</b>
<b>Appendix A: Sample Calculation .....</b>	<b>26</b>
<b>Appendix B – Measurement Uncertainty .....</b>	<b>28</b>
<b>Appendix C – Graphs and Tables .....</b>	<b>29</b>
<b>REPORT END.....</b>	<b>45</b>



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## 1.0 SUMMARY OF TEST RESULTS

### FCC Part 15.247 ☒

The EUT has been tested according to the following specifications: US Code of Federal Regulations, Title 47, Part 15

APPLIED STANDARDS AND REGULATIONS		
Standard Section	Test Type	Result
FCC Part 15.35	Duty Cycle	Pass
FCC Part 15.247(b)(3)	Peak output power	Pass
FCC Part 15.247(a)(2)	Bandwidth	Pass
FCC Part 15.209	Receiver Radiated Emissions	Pass
FCC Part 15.209 (restricted bands), 15.247 (unrestricted)	Transmitter Radiated Emissions	Pass
FCC Part 15.247(e)	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d)	Band Edge Measurement	Pass
FCC Part 15.207	Conducted Emissions	Pass



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## 2.0 EUT DESCRIPTION

### 2.1 EQUIPMENT UNDER TEST

#### Summary and Operating Condition:

Equipment under test is a transceiver manufactured by Garmin International Inc.

<b>EUT</b>	A04223
<b>FCC ID:</b>	IPH-04223
<b>EUT Received</b>	22 September 2022
<b>EUT Tested</b>	22 September 2022 - 28 November 2022
<b>Serial No.</b>	3428794068 (Conducted Unit) 3428794249(Radiated Unit)
<b>Operating Band</b>	2400 – 2483.5 MHz
<b>Device Type</b>	<input checked="" type="checkbox"/> GMSK <input 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
<b>Power Supply / Voltage</b>	Internal Battery/ Charger: Garmin MN: 362-00113-00

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



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## 2.2 DESCRIPTION OF TEST MODES

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

The EUT was powered by 5 VDC. It was set to transmit continuously on the 3 different channels of its operating range where available

For GMSK 1MB Transmissions:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 MHz

For 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. See the operational description for a list of all channel frequency 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  $35 \pm 4\%$   
 Temperature of  $22 \pm 3^\circ$  Celsius



#### 3.2 TEST PERSONNEL

No.	PERSONNEL	TITLE	ROLE
1	Karthik Vepuri	Test Engineer	Review/editing
2	Fox Lane	Test Engineer	Testing and report
3	Blake Winter	Test Engineer	Testing
4	Grace Larsen	Test Engineer	Testing and report
5	Ethan Schmidt	Test Technician	Testing

**Notes:**

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



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

### 3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (44GHz)**	N9038A	MY59050109	July 19, 2022	July 19, 2024
Keysight MXE Signal Analyzer (26.5GHz)***	N9038A	MY56400083	July 19, 2022	July 19, 2024
Keysight EXA Signal Analyzer**	N9010A	MY56070862	July 20, 2021	July 20, 2023
SunAR RF Motion	JB1	A091418-1	July 26, 2022	July 26, 2023
ETS EMCO Red Horn Antenna	3115	00218655	July 21, 2022	July 21, 2023
Rohde & Schwarz Preamplifier*	TS-PR18	3545700803	March 21, 2022	March 21, 2024
8447F POT H64 Preamplifier	8447F POT H64	3113AD4667	March 21, 2022	March 21, 2024
Trilithic High Pass Filter*	6HC330	23042	March 21, 2022	March 21, 2024
TDK Emissions Lab Software	V11.25	700307	NA	NA
RF Cable (preamplifier to antenna)*	MFR-57500	01-07-002	March 21, 2022	March 21, 2024
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	September 24, 2021	September 24, 2023
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3864	September 24, 2021	September 24, 2023
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	September 24, 2021	September 24, 2023
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	September 24, 2021	September 24, 2023
N connector bulkhead (control room)*	PE9128	NCEEBH2	September 24, 2021	September 24, 2023

\*Internal Characterization

\*\*2 Year Cal Cycle

**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 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.

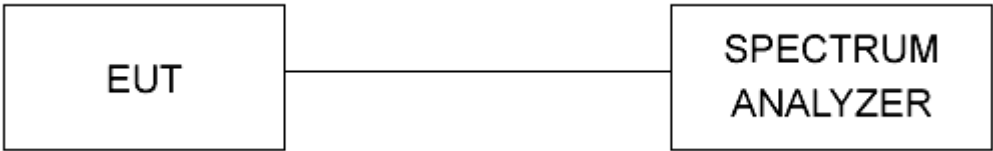


Figure 1 - Bandwidth Measurements Test Setup

**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.

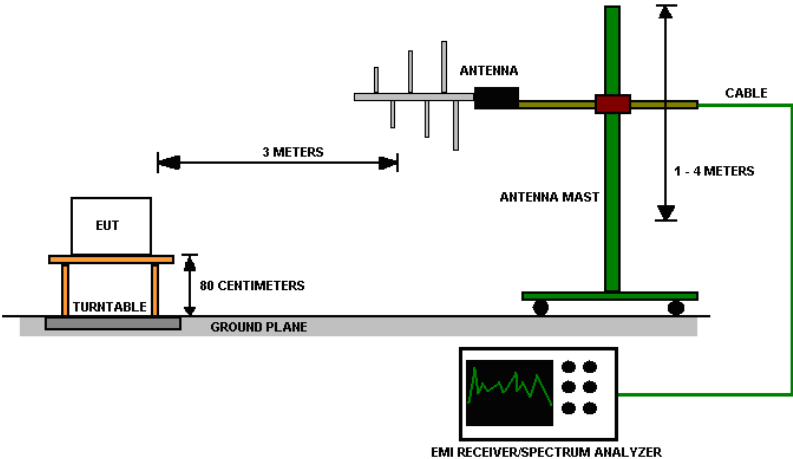


Figure 2 - Radiated Emissions Test Setup



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

#### 4.0 RESULTS

DTS Radio Measurements					
CHANNEL	Transmitter	Occupied Bandwidth (MHz)	6 dB Bandwidth (kHz)	PSD (dBm)	RESULT
Low	GMSK	1.0456	686.90	-14.552	PASS
Mid	GMSK	1.0516	684.50	-14.565	PASS
High	GMSK	1.0503	679.30	-14.719	PASS

Occupied Bandwidth = N/A; 6 dB Bandwidth Limit = 500 kHz | PSD Limit = 8 dBm

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	GMSK	2400.00	60.211	109.325	49.115	30.00	PASS
High	GMSK	2483.50	56.846	108.815	51.969	30.00	PASS

DTS Radio Measurements			
CHANNEL	Transmitter	Peak Output Power (dBm)	RESULT
Low	GMSK	1.963	PASS
Mid	GMSK	1.938	PASS
High	GMSK	2.052	PASS

Peak Output Power Limit = 30 dBm;

Peak Restricted Band-Edge							
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)	Margin	Result
Low	GMSK	2390.00	53.448	Peak	73.98	20.532	PASS
High	GMSK	2483.50	53.234	Peak	73.98	20.746	PASS

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



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

Average Restricted Band-Edge								
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Uncorrected highest average out of band level @ lower duty cycle (dBuV/m @ 3m)	Corrected highest average out of band level with duty cycle correction (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)	Margin	Result
Low	GMSK	2390.00	41.313	51.808	Average	53.98	2.172	PASS
High	GMSK	2483.50	41.967	52.462	Average	53.98	1.518	PASS
*Limit shown is the average limit taken from FCC Part 15.209 Corrected highest out of band level with duty cycle correction = Highest out of band level @ lower duty cycle +DCCF for Emissions (Restricted Bandedge), see section 4.3 for more details. Using ANSI C63.10; Section 11.13.3.4.								



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

#### 4.1 OUTPUT POWER

**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 allowed peak output power is 30 dBm / 1000 mW.

**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 the Appendix C.
2. All the measurements were found to be compliant.
3. Compiled values can be found in the Results section, 4.0.



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

## 4.2 BANDWIDTH

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

**Limits of bandwidth measurements:**

**For FCC Part 15.247 Device:**

The 99% occupied bandwidth is for informational purpose 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:**

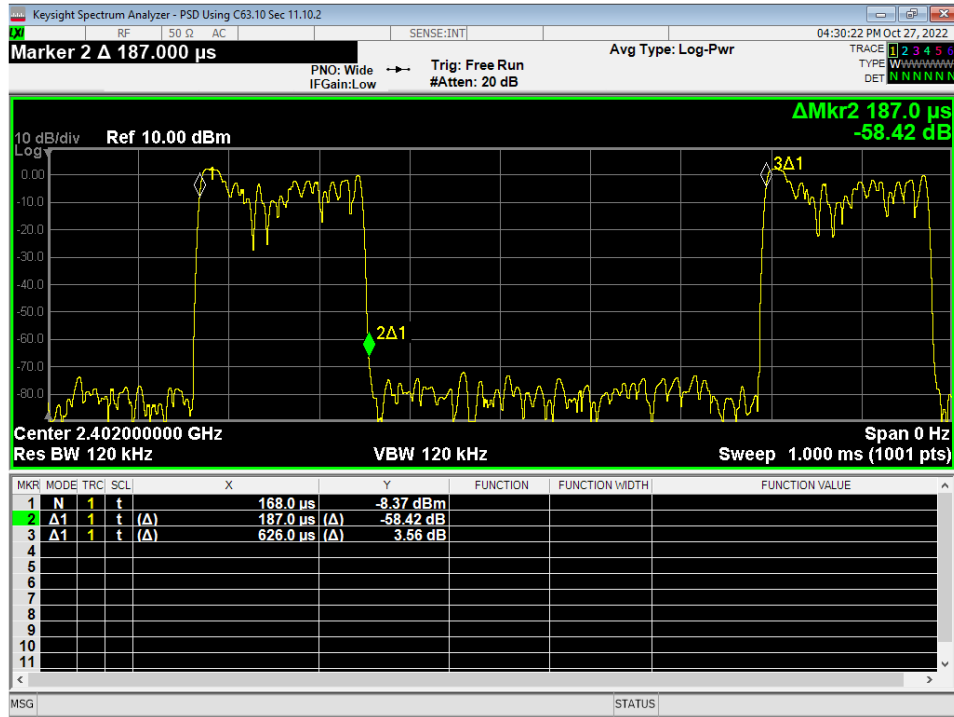
**Pass**

Comments:

1. All the bandwidth plots can be found in the Appendix C.
2. All the measurements were found to be compliant.

### 4.3 DUTY CYCLE

**Test Method:**



**Figure 3 – Duty Cycle GMSK**

Duty Cycle Correction Factor for Emissions (DCCF for Emissions (restricted bandedge)) =  $20 \cdot \log(1/0.3) = 10.495\text{dB}$   
 -Using ANSI C63.10; Section 11.13.3.4.

Duty Cycle Correction Factor for Emissions (DCCF for Emissions) =  $20 \cdot \log(0.3) = -10.495\text{dB}$

Duty Cycle Correction Factor for Power (DCCF for Power) =  $10 \cdot \log(0.3) = -5.247\text{dB}$



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

#### 4.4 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 the Appendix C.
2. All the measurements were found to be compliant.
3. The measurements are reported on the graph.

#### 4.5 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.

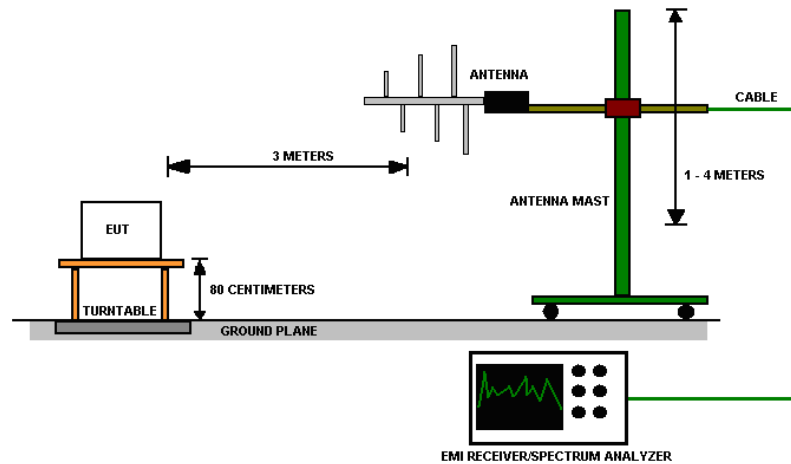




Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

**Test procedures:**

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

**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.

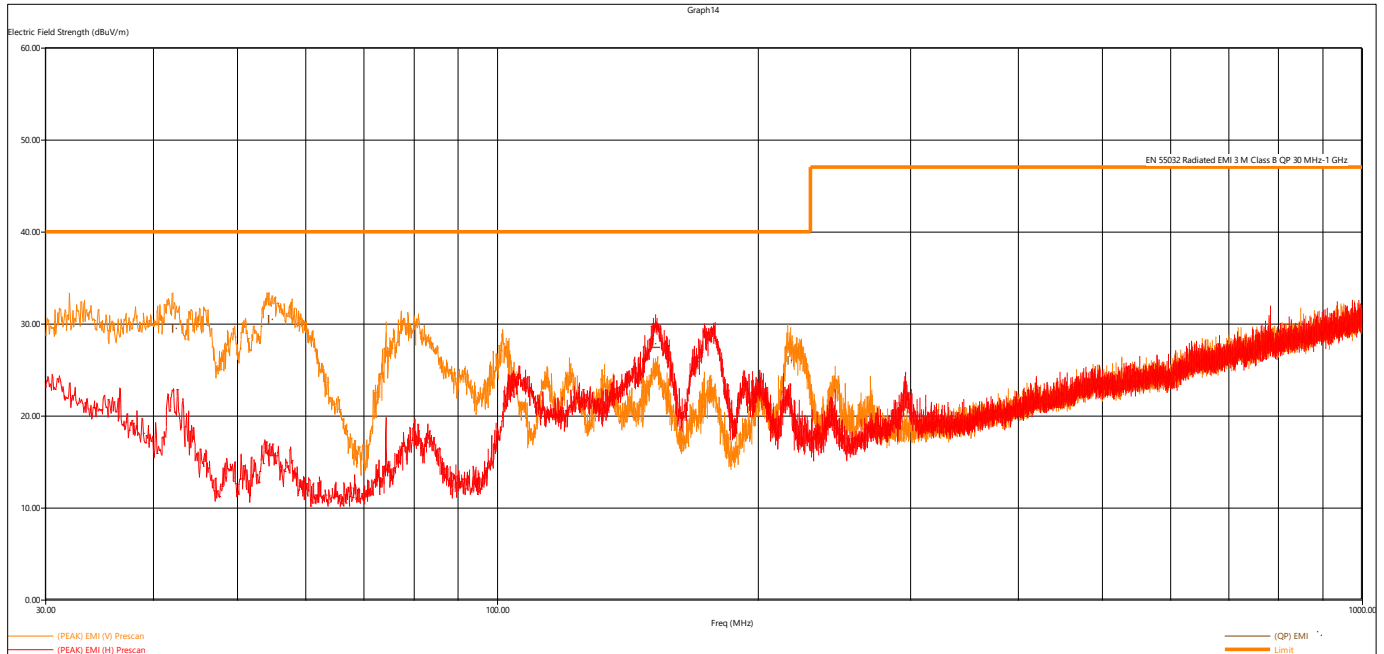
**Deviations from test standard:**

No deviation.

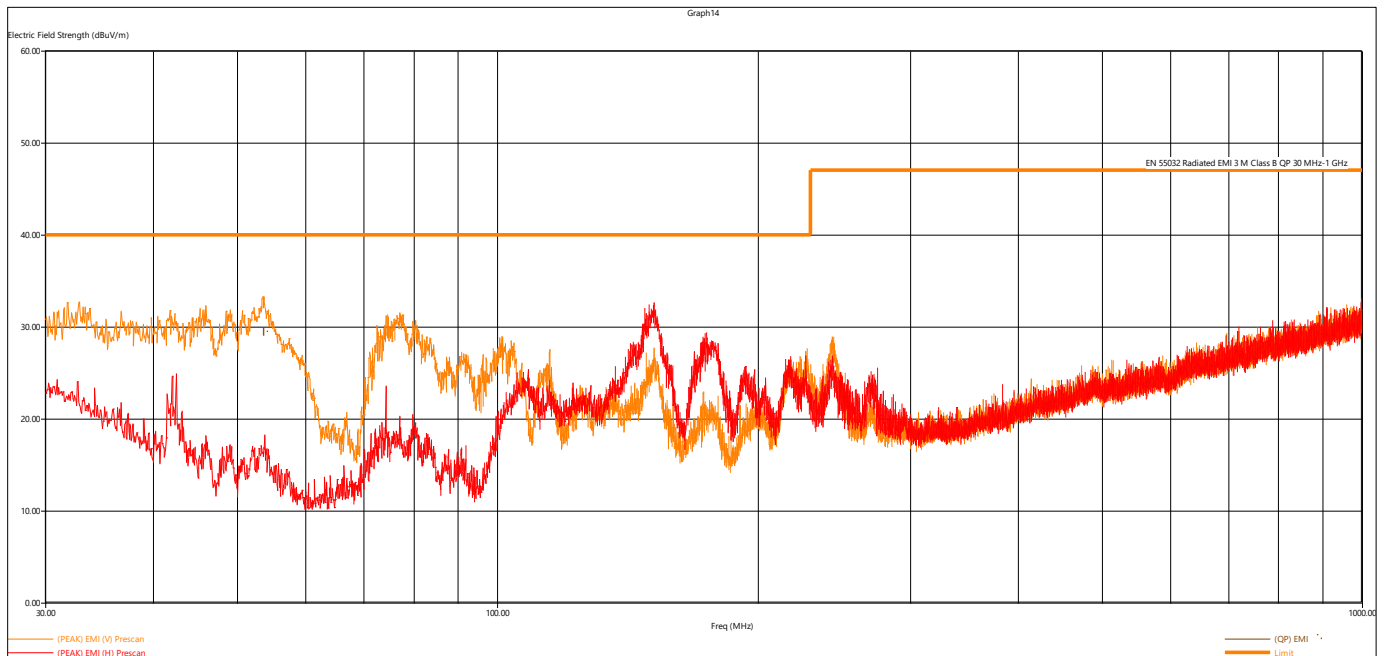
**EUT operating conditions**

Details can be found in section 2.1 of this report.

**Test results:**



**Figure 5 - Radiated Emissions Plot, Receive**



**Figure 6 - Radiated Emissions Plot, GMSK**

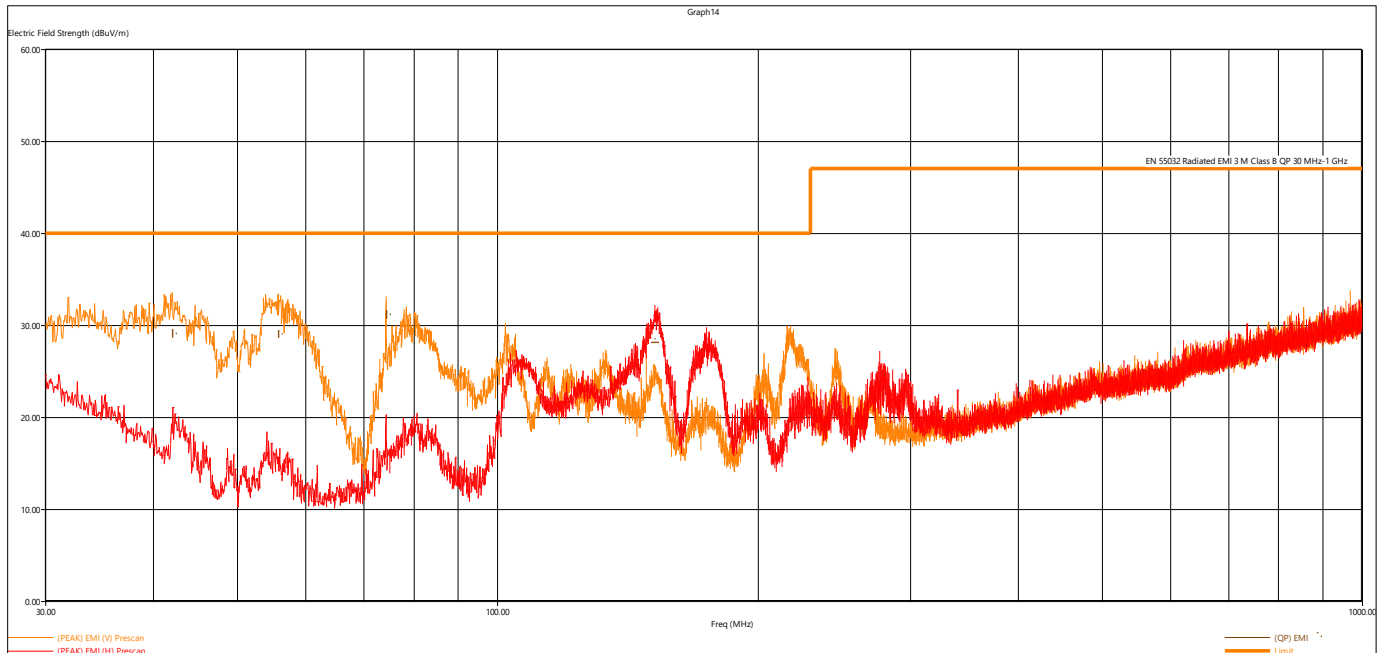


Figure 7 - Radiated Emissions Plot, GMSK, High Channel

**REMARKS:**

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

Quasi-Peak Measurements, GMSK								
Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	cm.	deg.			
53.471520	29.42	40.00	10.58	122.00	128.00	V	Mid	GMSK
151.932000	28.02	40.00	11.98	173.00	8.00	H	High	GMSK
42.064800	29.03	40.00	10.97	123.00	176.00	V	High	GMSK
55.642080	29.00	40.00	11.00	104.00	92.00	V	High	GMSK
<b>74.226000</b>	<b>31.07</b>	<b>40.00</b>	<b>8.93</b>	<b>115.00</b>	<b>230.00</b>	<b>V</b>	<b>High</b>	<b>GMSK</b>
152.266560	27.32	40.00	12.68	182.00	3.00	H	Receive	
41.995680	29.49	40.00	10.51	104.00	265.00	V	Receive	
54.320160	30.38	40.00	9.62	110.00	2.00	V	Receive	
216.453600	25.97	40.00	14.03	198.00	326.00	V	Receive	



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

**Peak Measurements, GMSK**

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	cm.	deg.			
7319.038	52.89	73.98	21.09	180	159	H	Mid	GMSK

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the plot and table above. All other emissions found to be at least 6dB below the limit line. System Noise floor was at least 6 dB below the limit line throughout the test range.

**Average Measurements, GMSK**

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	Modulation
MHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	cm.	deg.			
7319.038	42.52	53.98	11.46	180	159	H	Mid	GMSK

Average Level=Peal Level + Emissions DCCF from section 4.3

The EUT was maximized in all 3 orthogonal axes. The worst-case is shown in the plot and table above. All other emissions found to be at least 6dB below the limit line. System Noise floor was at least 6 dB below the limit line throughout the test range.

Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

#### 4.6 BAND EDGES

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

**Limits of band-edge measurements:**

**For FCC Part 15.247 Device:**

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

**Test procedures:**

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

**Deviations from test standard:**

No deviation.

**Test setup:**

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

**EUT operating conditions:**

Details can be found in section 2.1 of this report.

**Test results:**

**Pass**

Comments:

1. All the band edge plots can be found in 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.



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

#### 4.7 CONDUCTED AC MAINS EMISSIONS

**Test Method:** ANSI C63.10-2013, Section(s) 6.2

**Limits for conducted emissions measurements:**

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ 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:

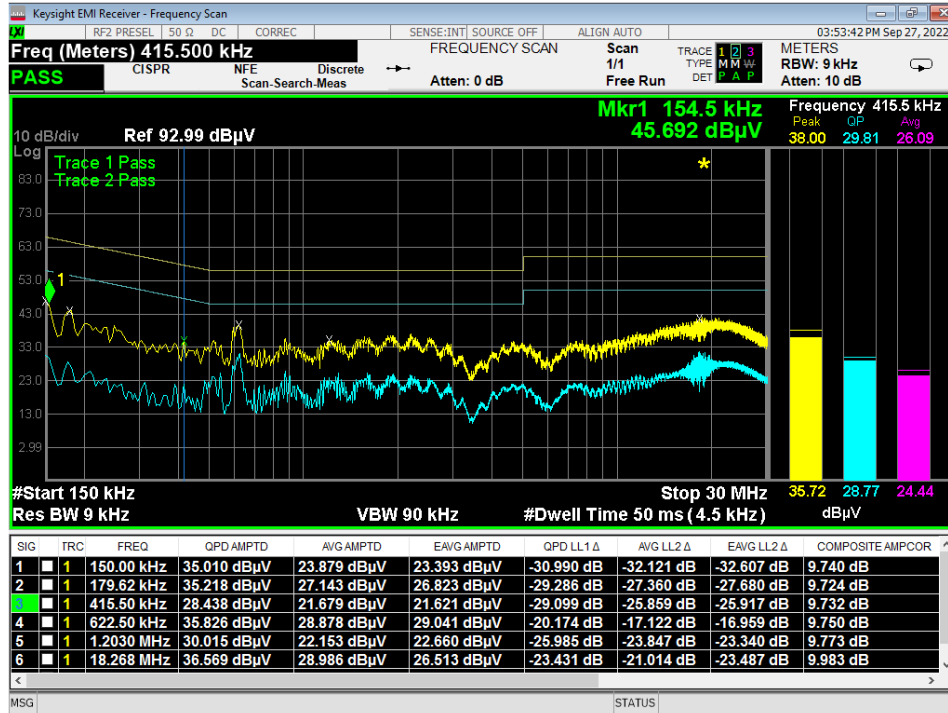


Figure 8 - Conducted Emissions Plot, Line, TX

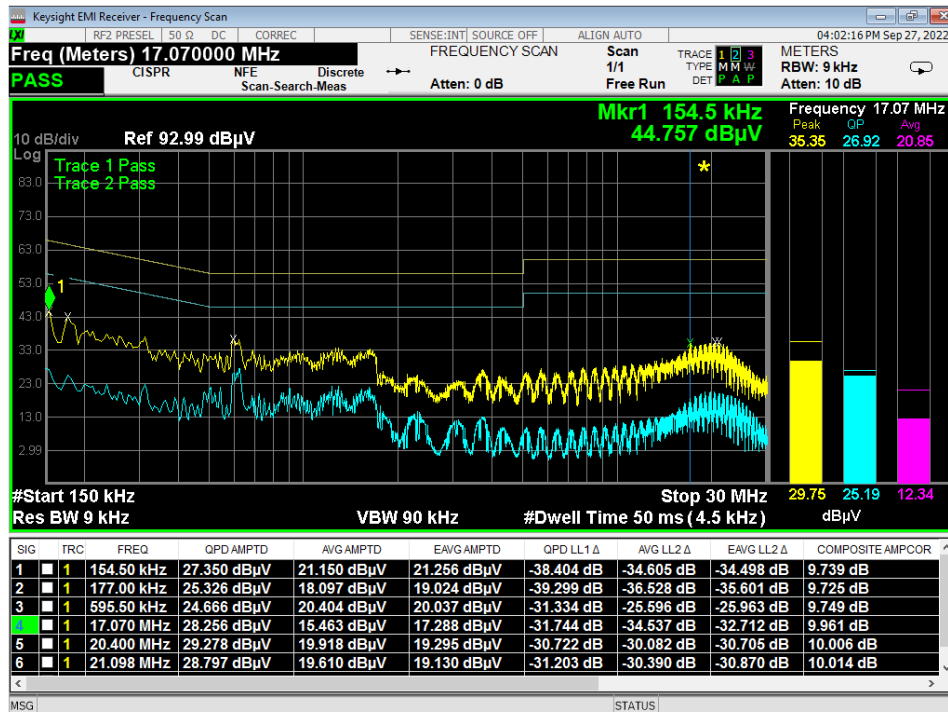


Figure 9 - Conducted Emissions Plot, Neutral, TX



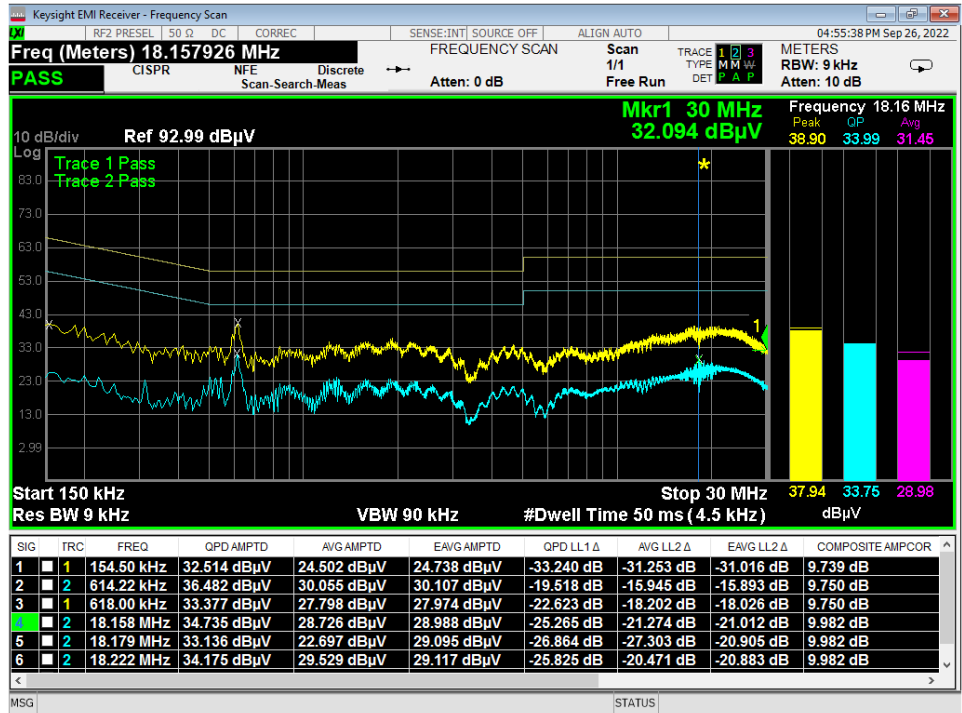


Figure 10 - Conducted Emissions Plot, Line, IDLE

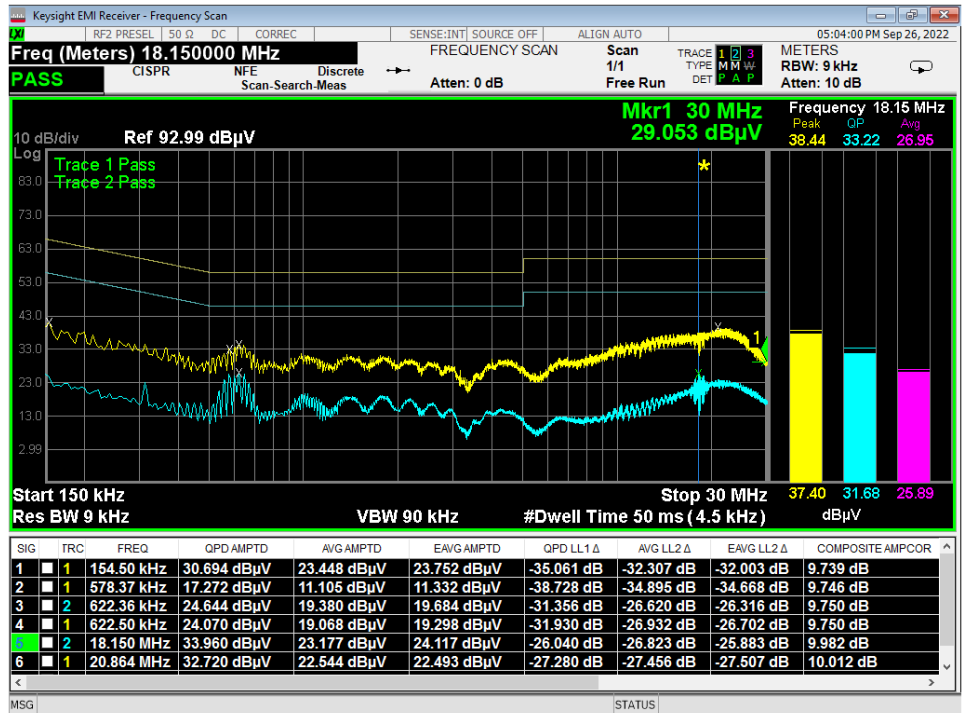



Figure 11 - Conducted Emissions Plot, Neutral, IDLE

	Report Number:	R20220512-20-E1B	Rev	B
	Prepared for:	Garmin International, Inc.		

## APPENDIX A: SAMPLE CALCULATION

### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and 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 $\mu$ 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 $\mu$ V/m.

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

The 48.1 dB $\mu$ V/m value can be mathematically converted to its corresponding level in  $\mu$ 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  $20 \cdot \log(T_{on}/100)$  where  $T_{on}$  is the maximum transmission time in any 100ms window.



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

**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;

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

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

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

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

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

Conversion from 3m field strength to EIRP (d=3):

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

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

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



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

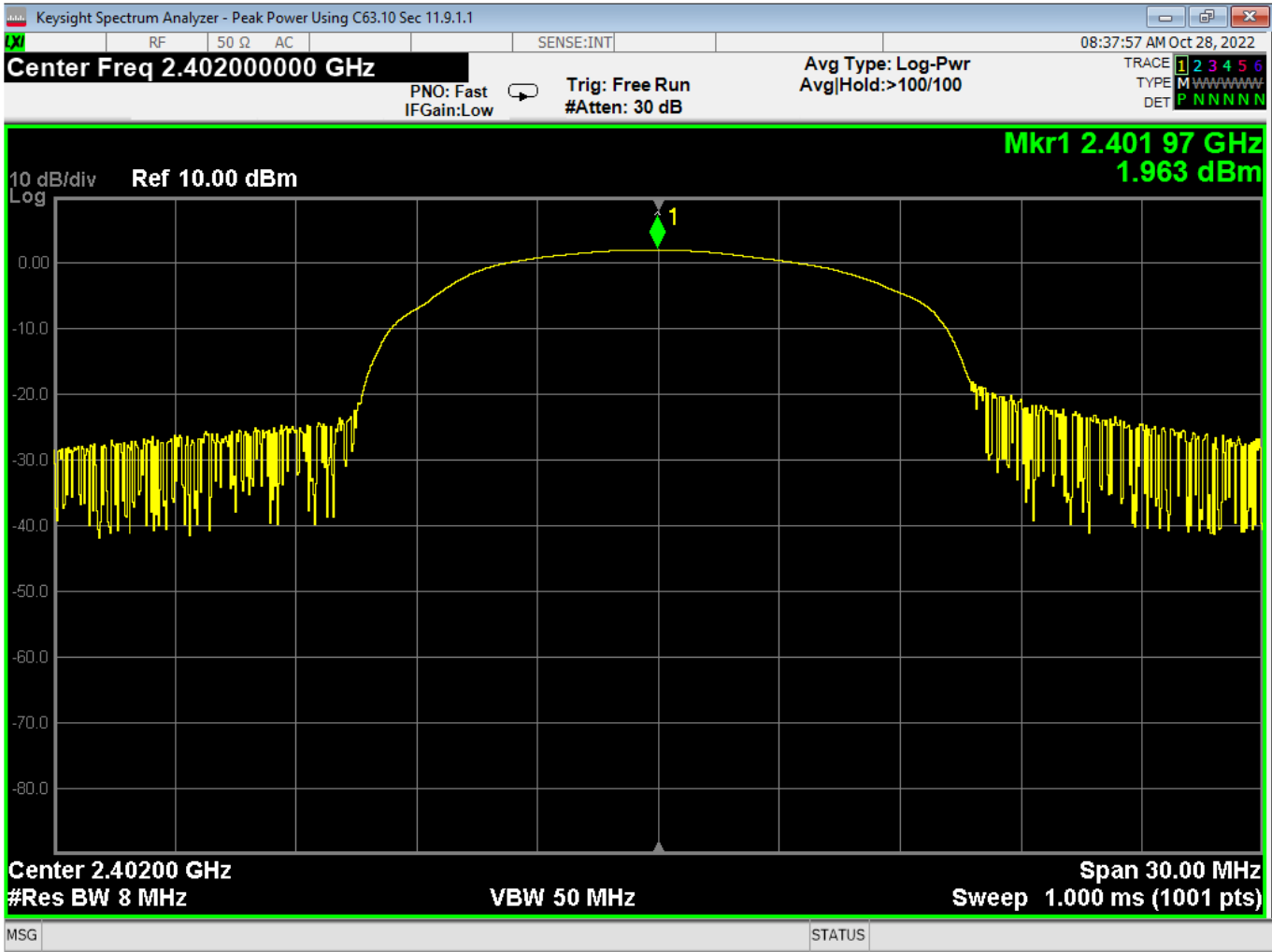
APPENDIX B – MEASUREMENT UNCERTAINTY

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%.

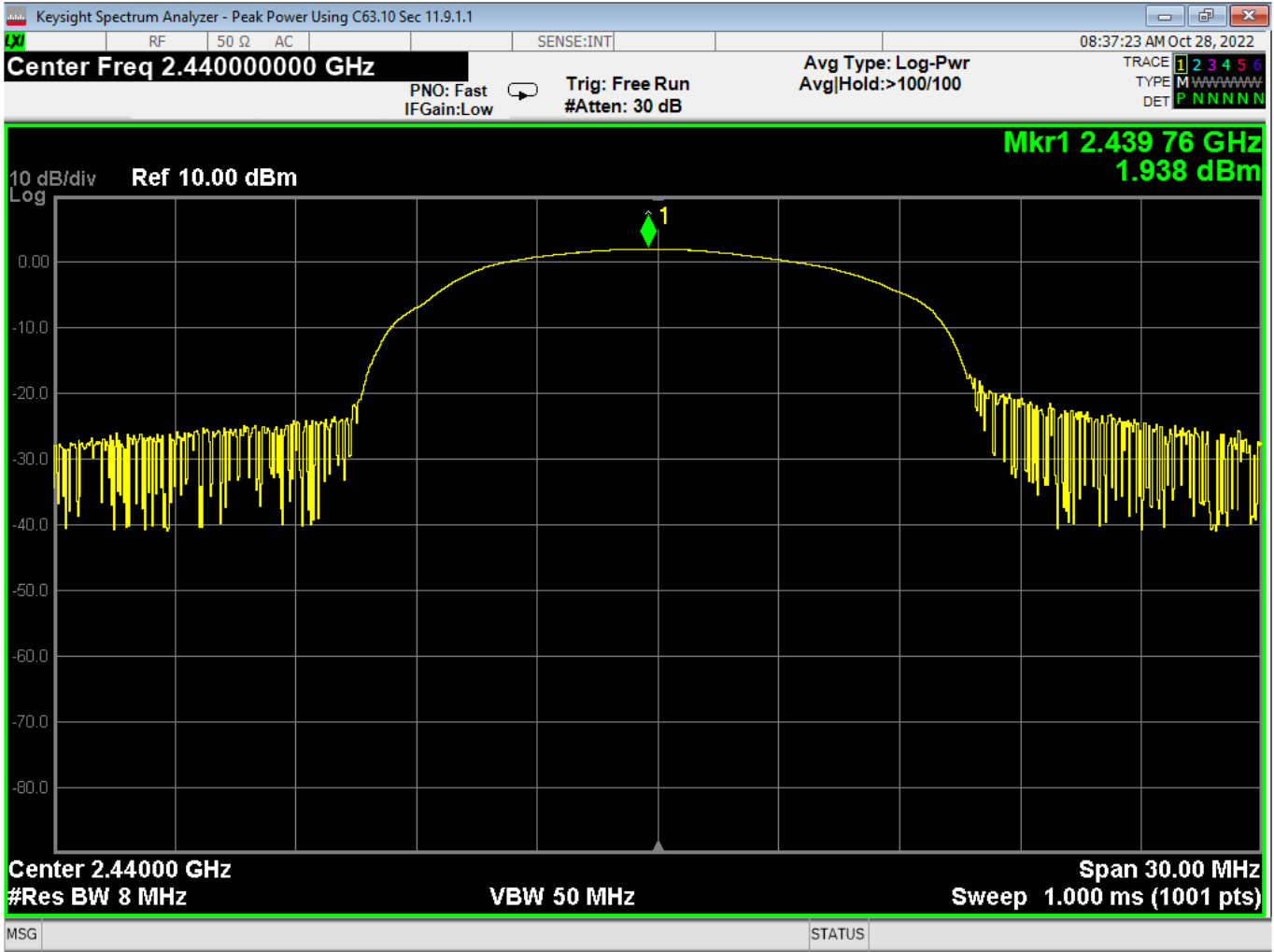
APPENDIX C – GRAPHS AND TABLES



1 Peak Power, Low Channel, GMSK



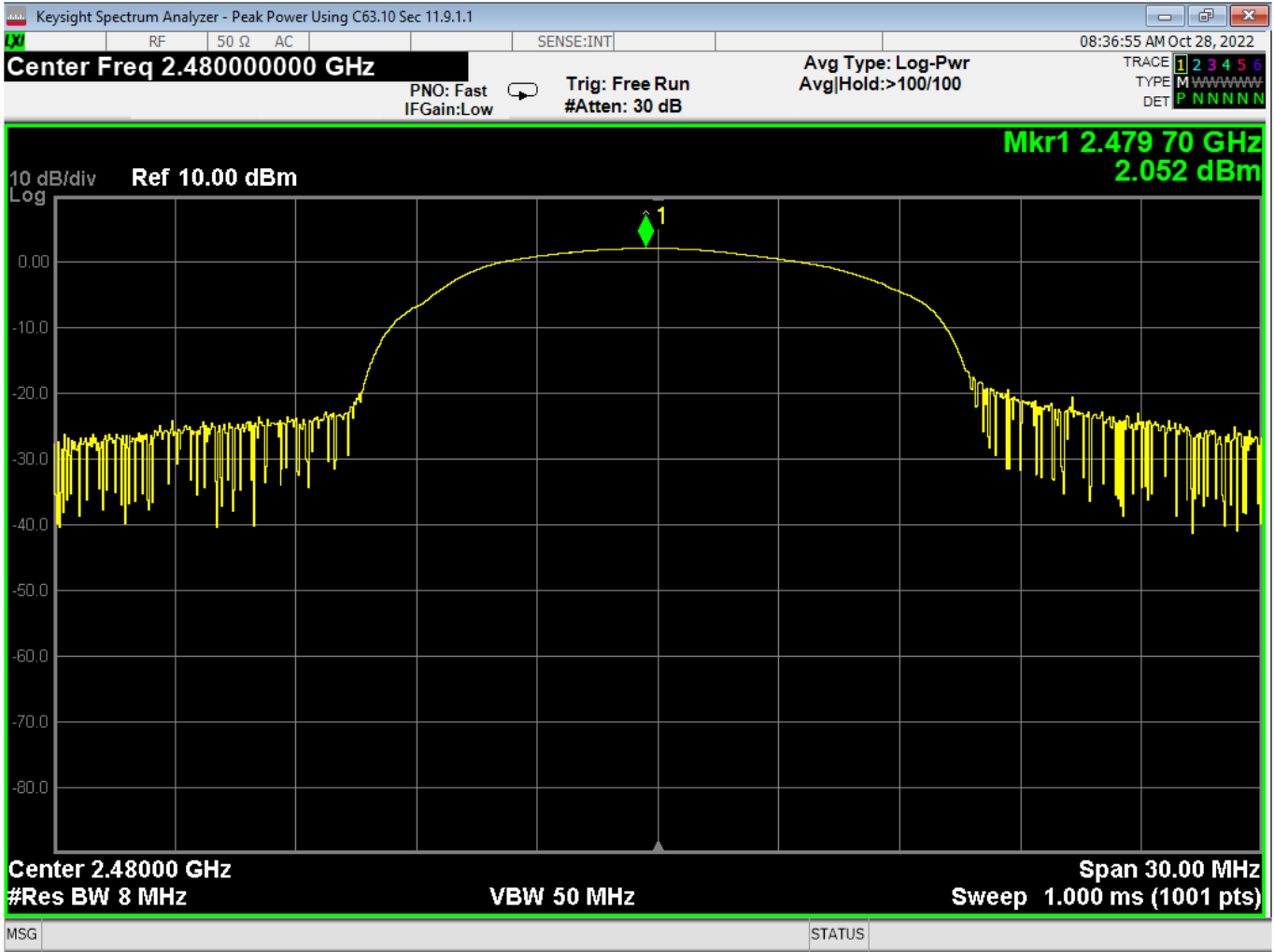
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



2 Peak Power, Mid Channel, GMSK



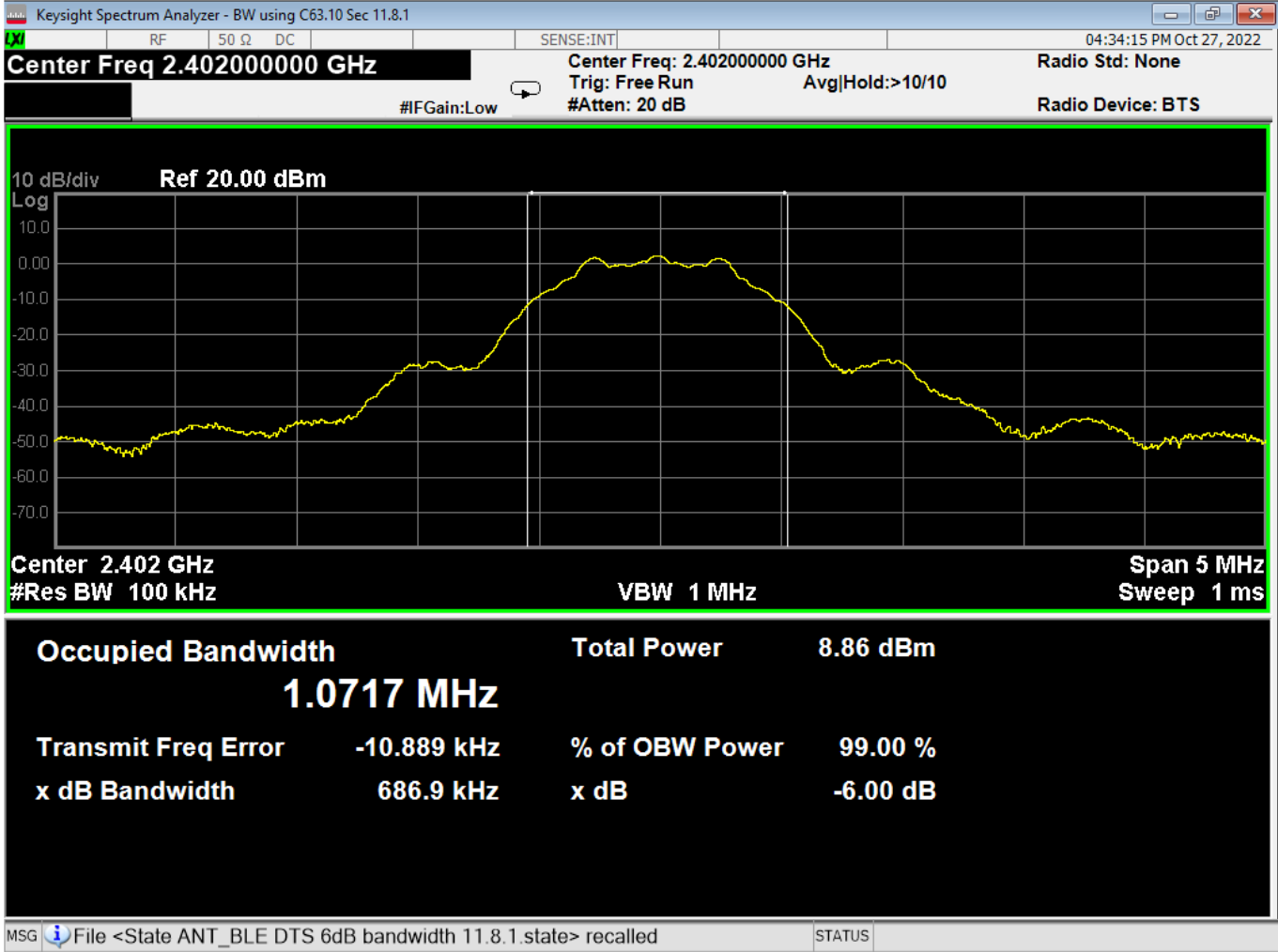
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



3 Peak Power, High Channel, GMSK



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

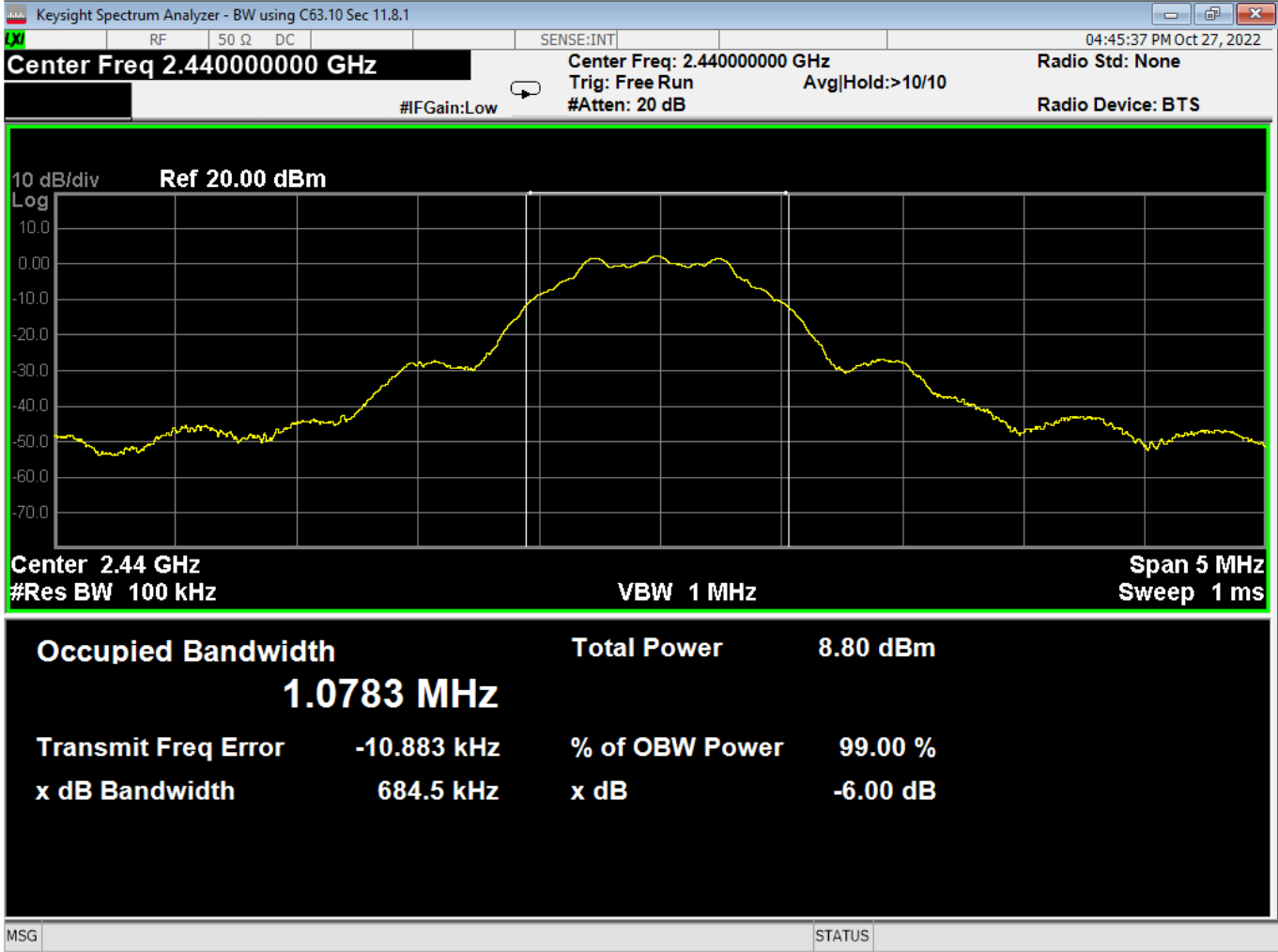


8 6dB Bandwidth, Low Channel, GMSK





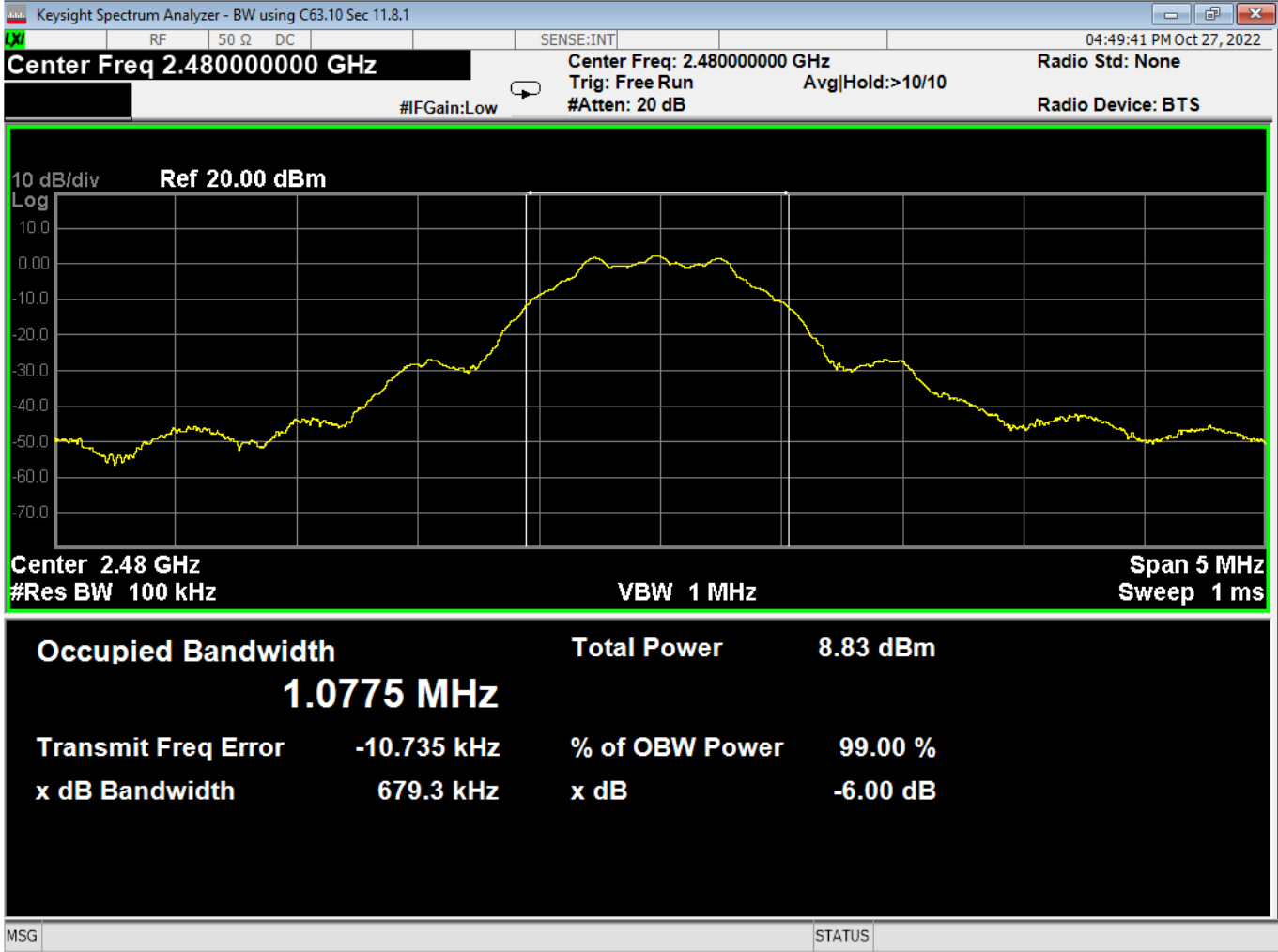
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



9 6dB Bandwidth, Mid Channel, GMSK



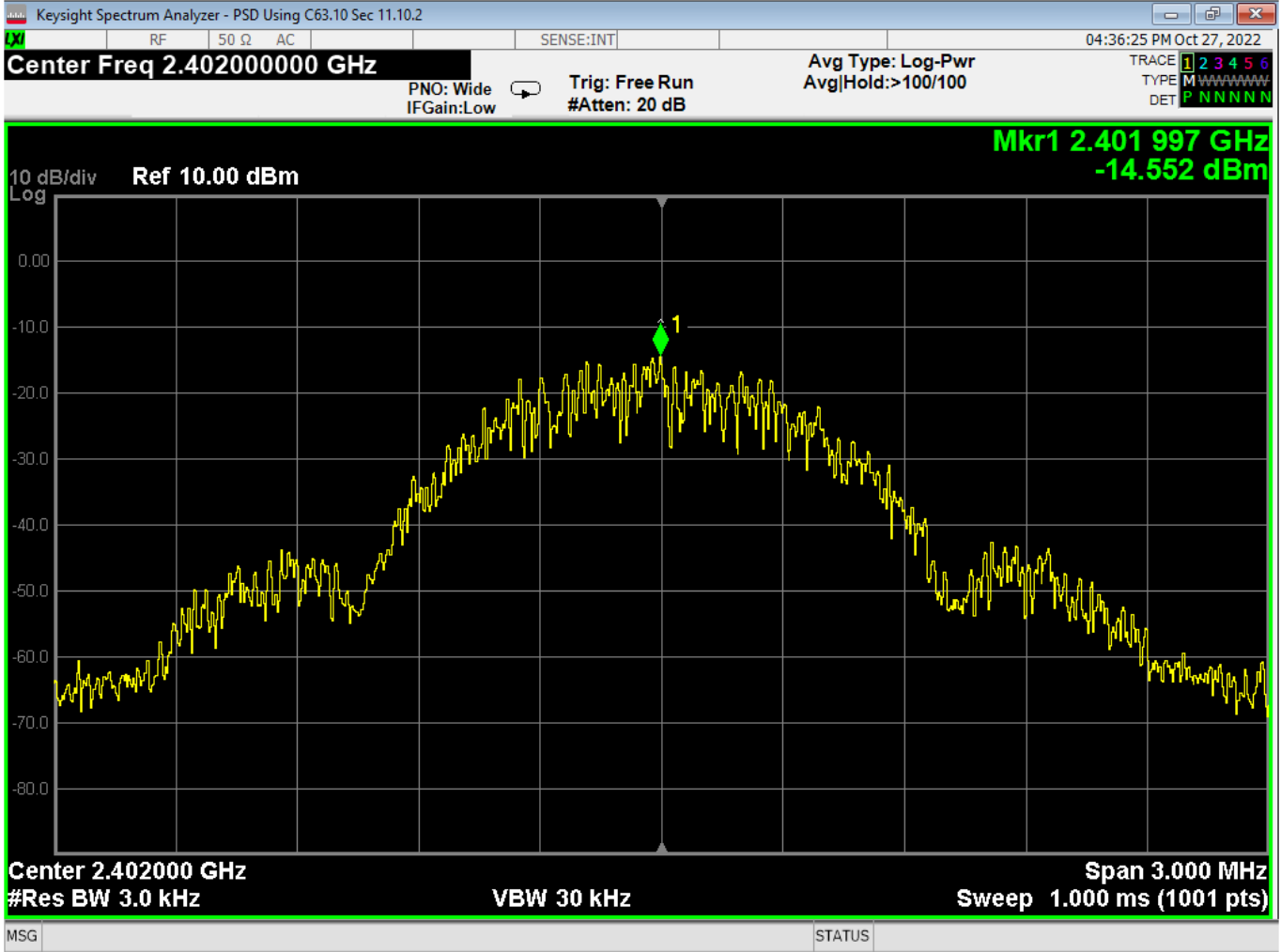
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



10 6dB Bandwidth, High Channel, GMSK



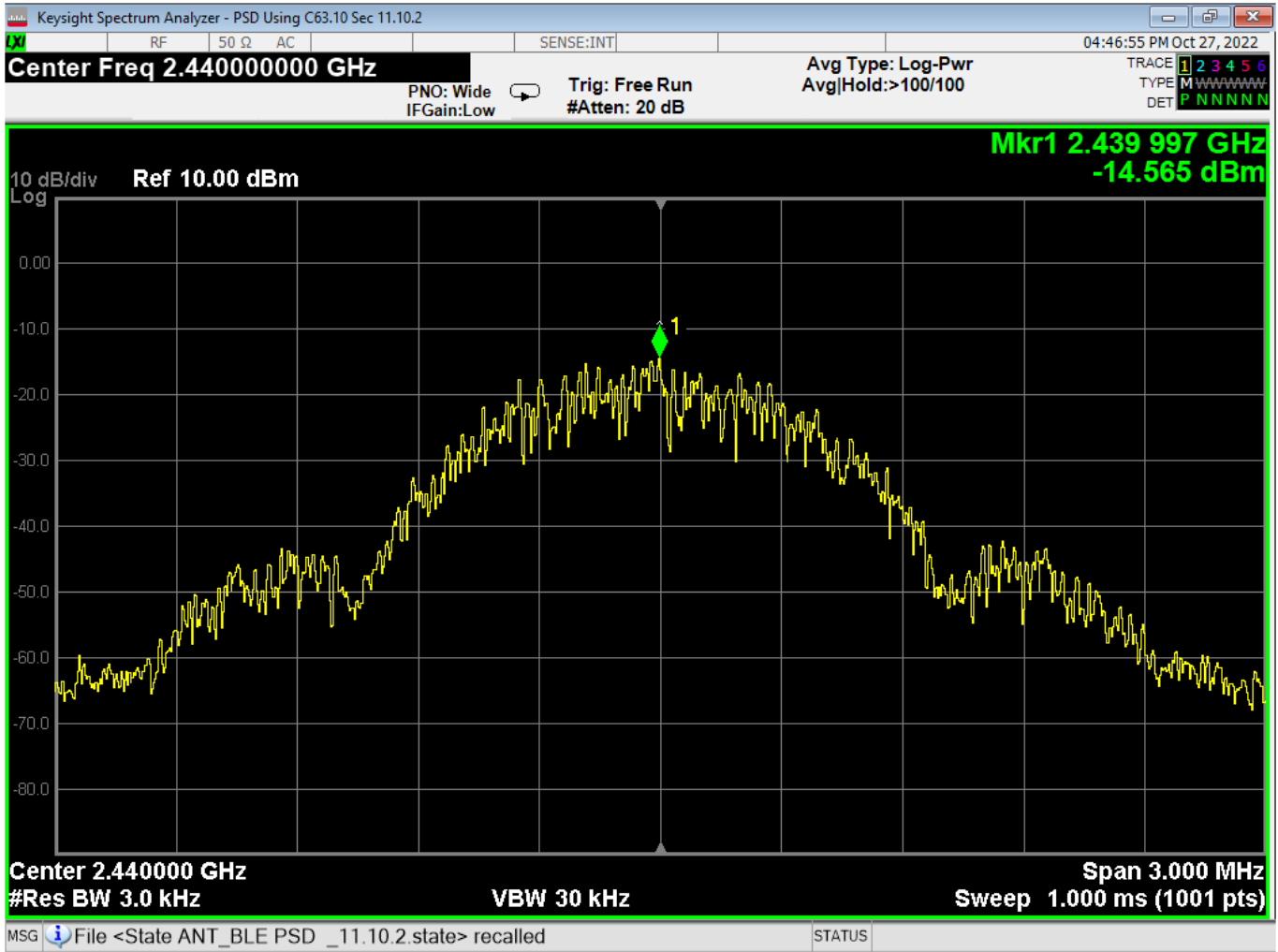
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



14 PSD, Low Channel, GMSK



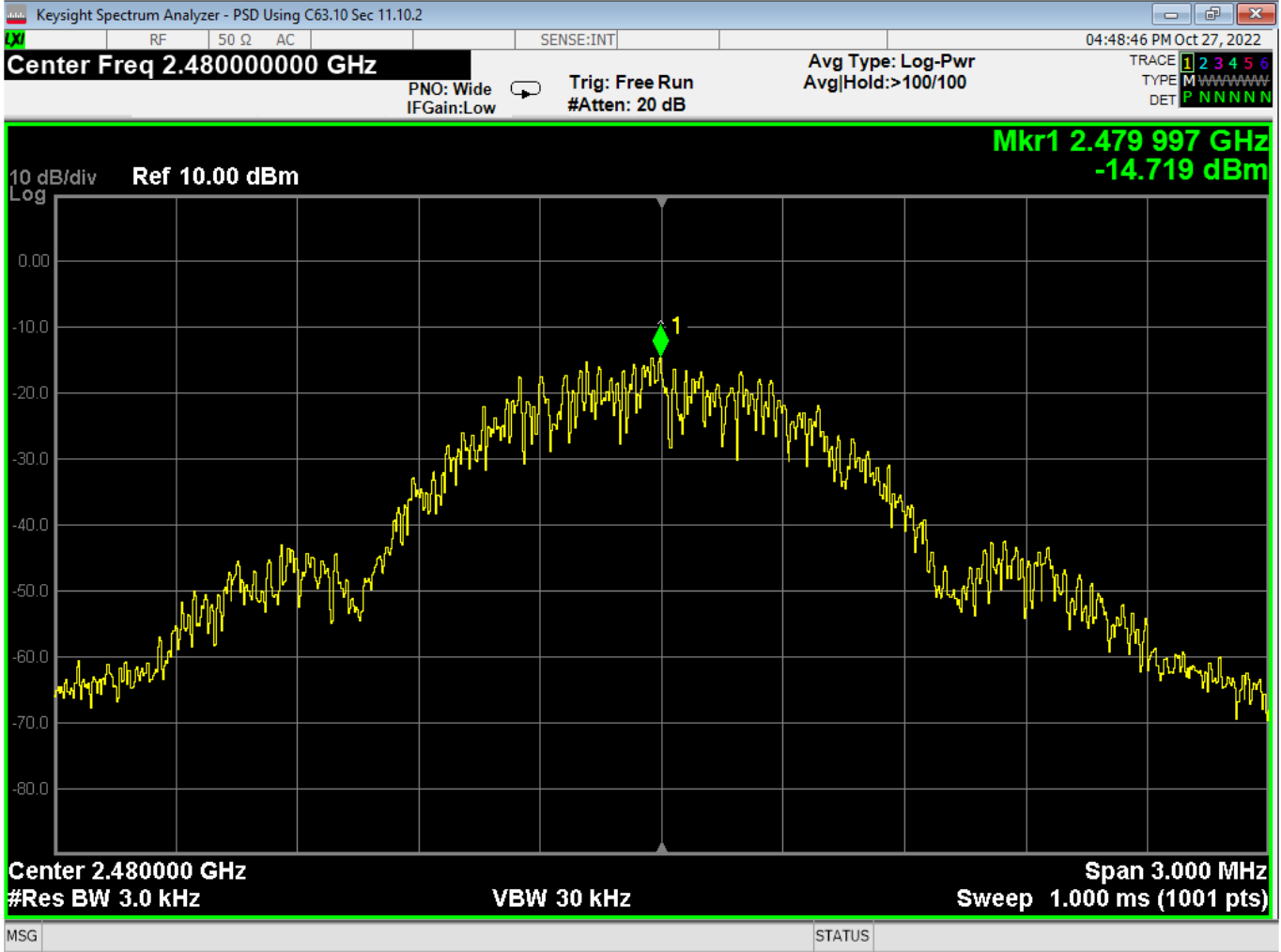
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



15 PSD, Mid Channel, GMSK



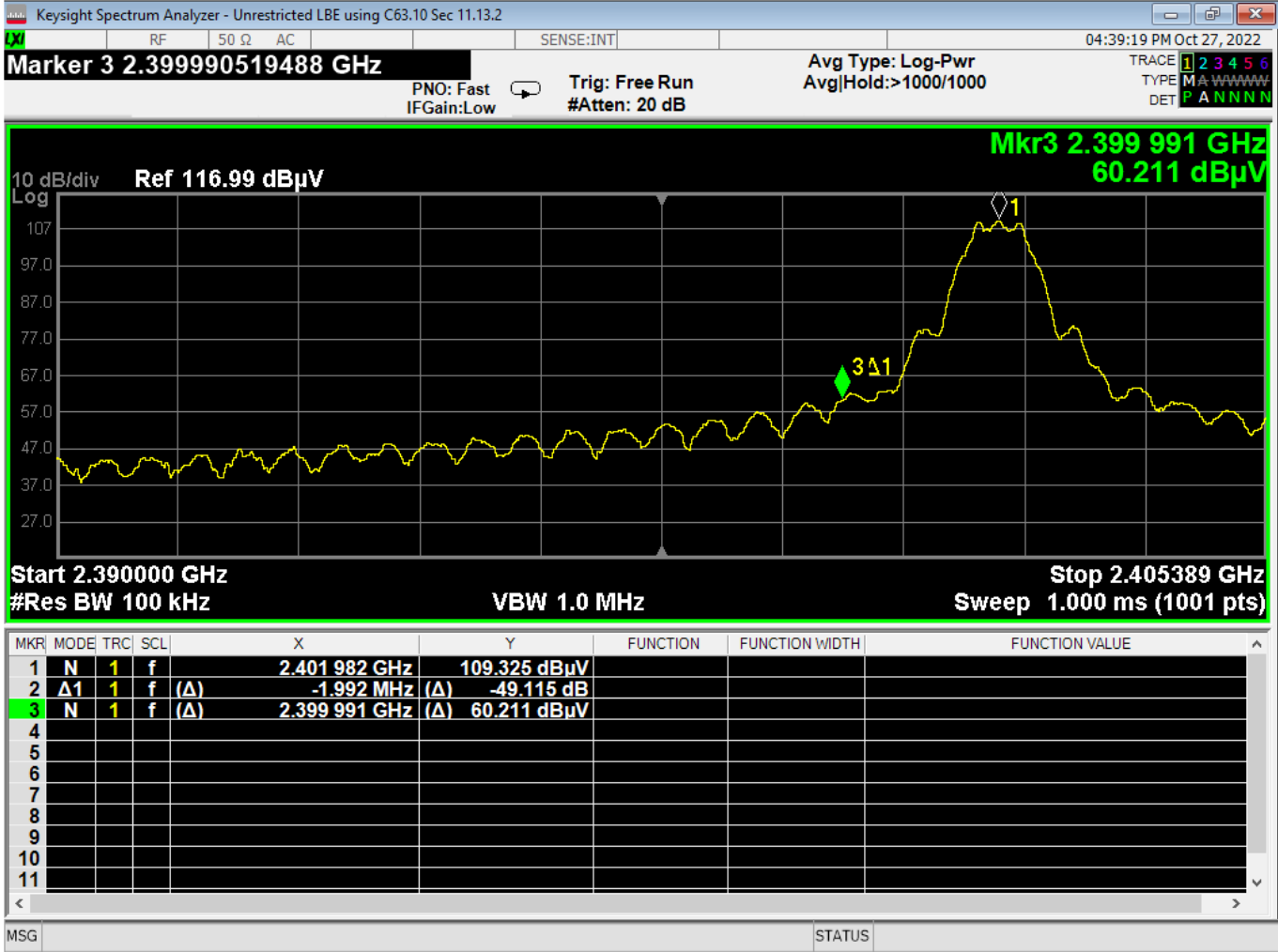
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



16 PSD, High Channel, GMSK



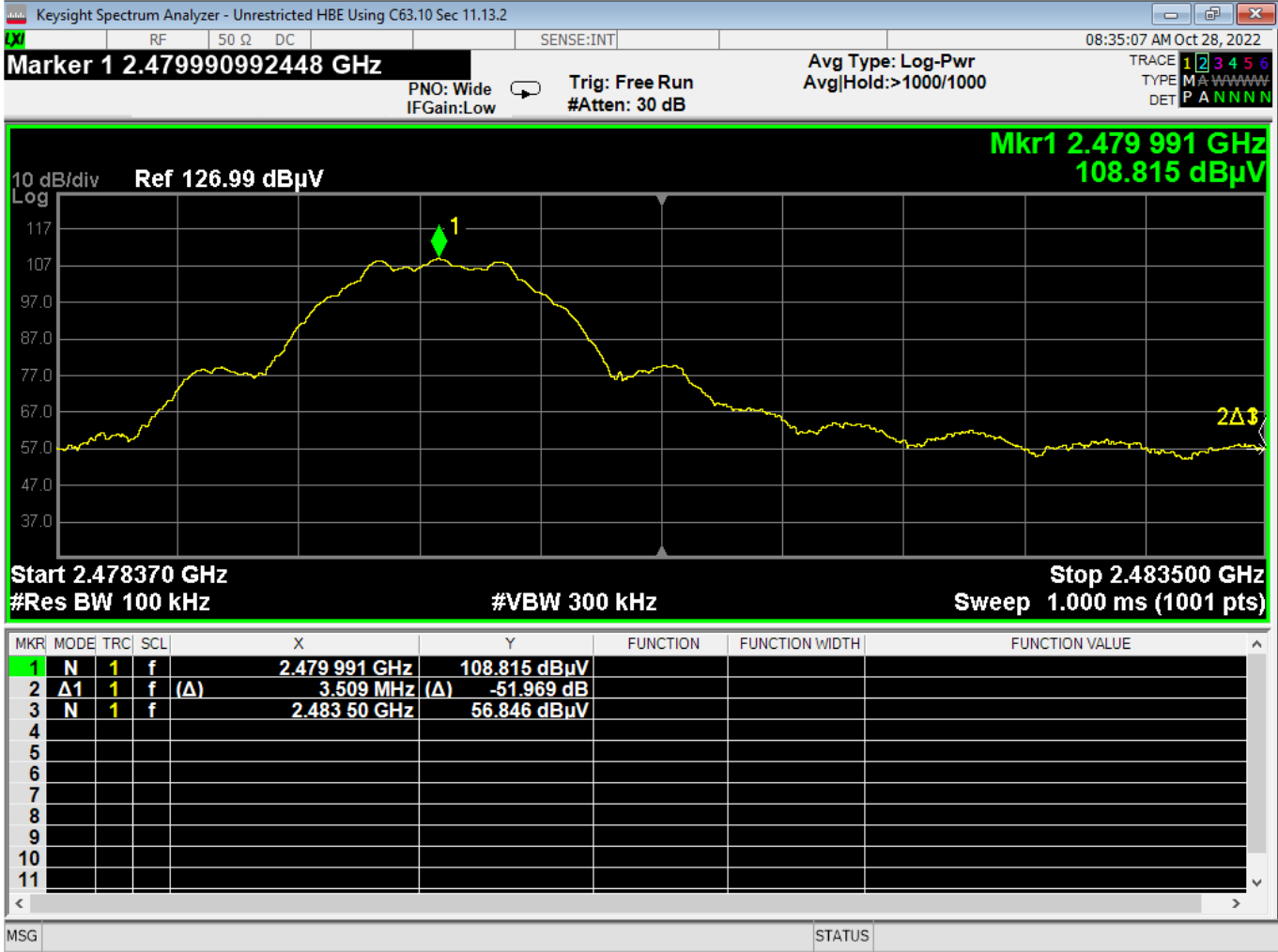
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



20 LBE, Unrestricted, GMSK



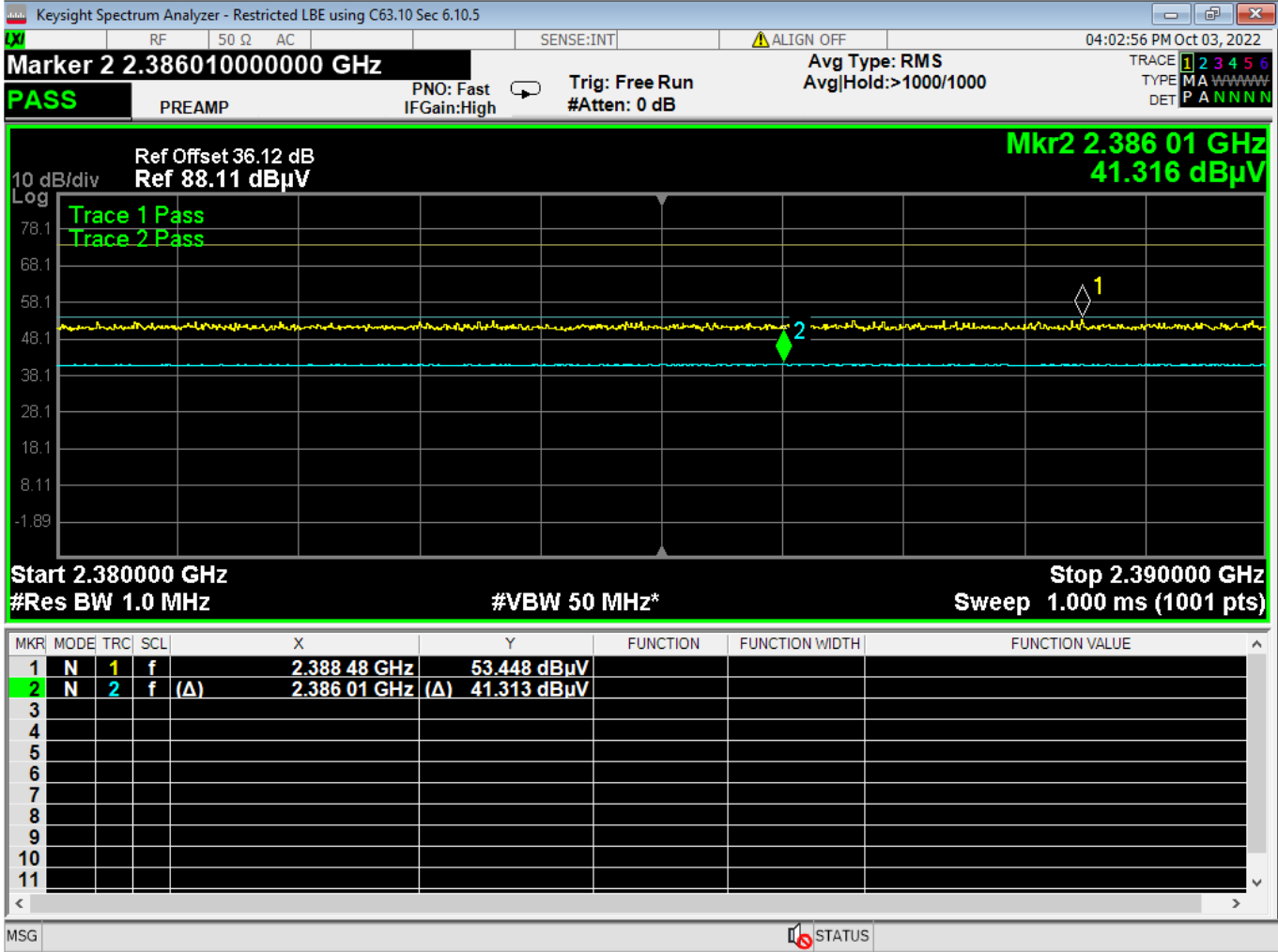
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



22 HBE, Unrestricted, GMSK



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



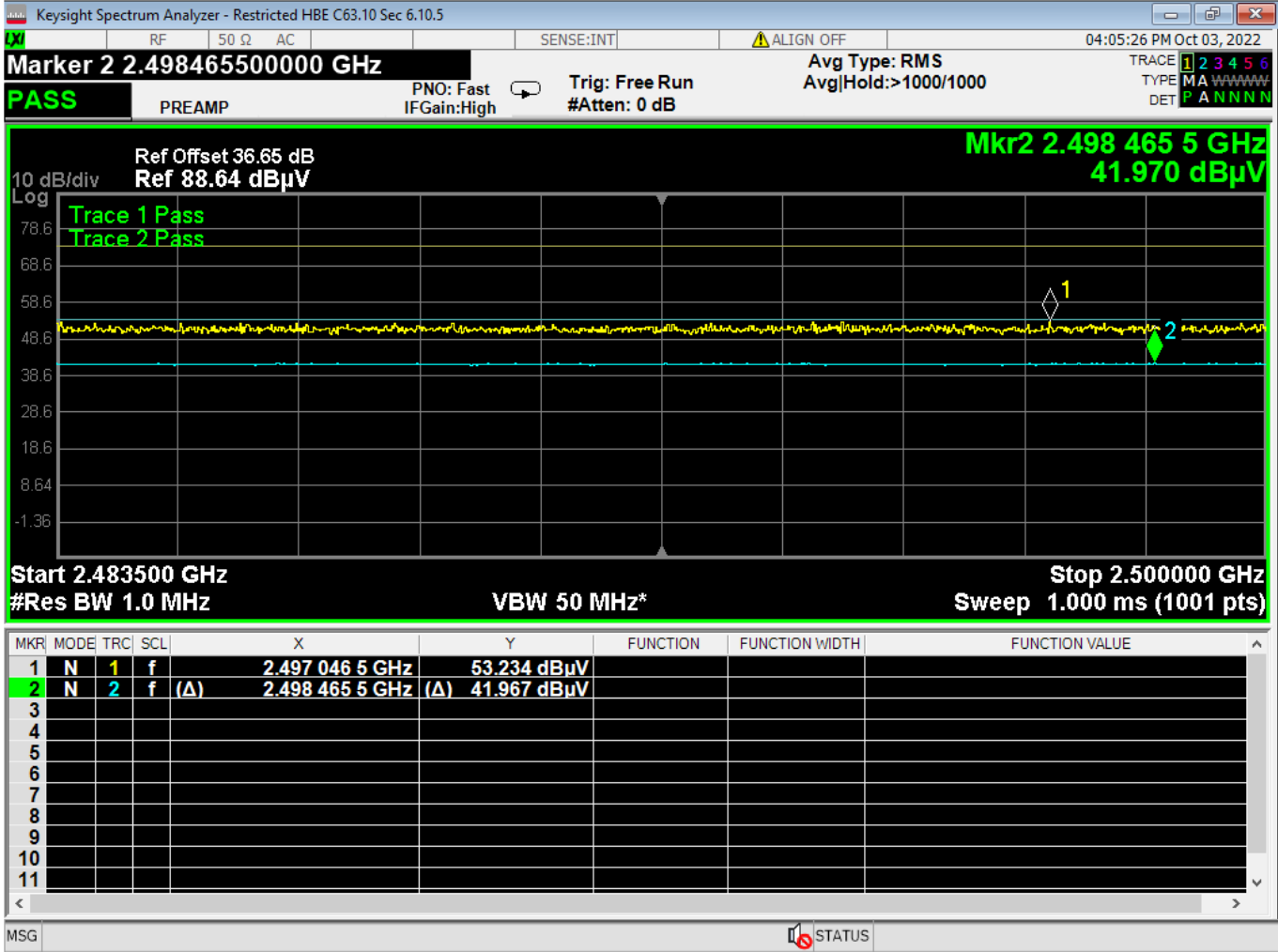
**24 LBE, Restricted, GMSK**

\*Note that average measurements were taken with a lower duty cycle than 98%, so duty cycle correction needs to be applied for final measurements. Duty cycle correction was added to the average measurement shown in the graph. Please see Section 4.0 for corrected measurement per ANSI C63.10; Section 11.13.3.4.





Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

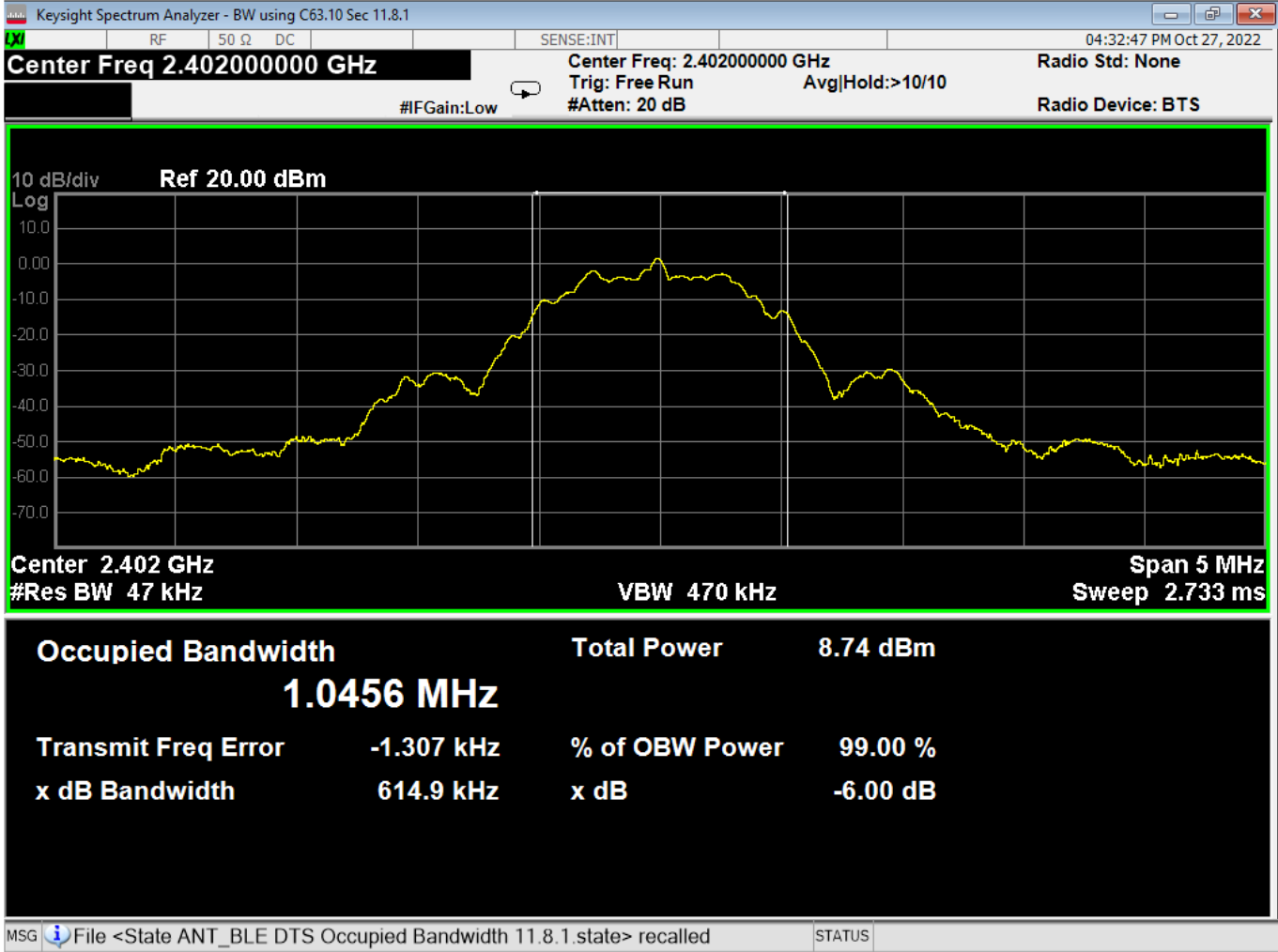


**26 HBE, Restricted, GMSK**

\*Note that average measurements were taken with a lower duty cycle than 98%, so duty cycle correction needs to be applied for final measurements. Duty cycle correction was added to the average measurement shown in the graph. Please see Section 4.0 for corrected measurement per ANSI C63.10; Section 11.13.3.4.



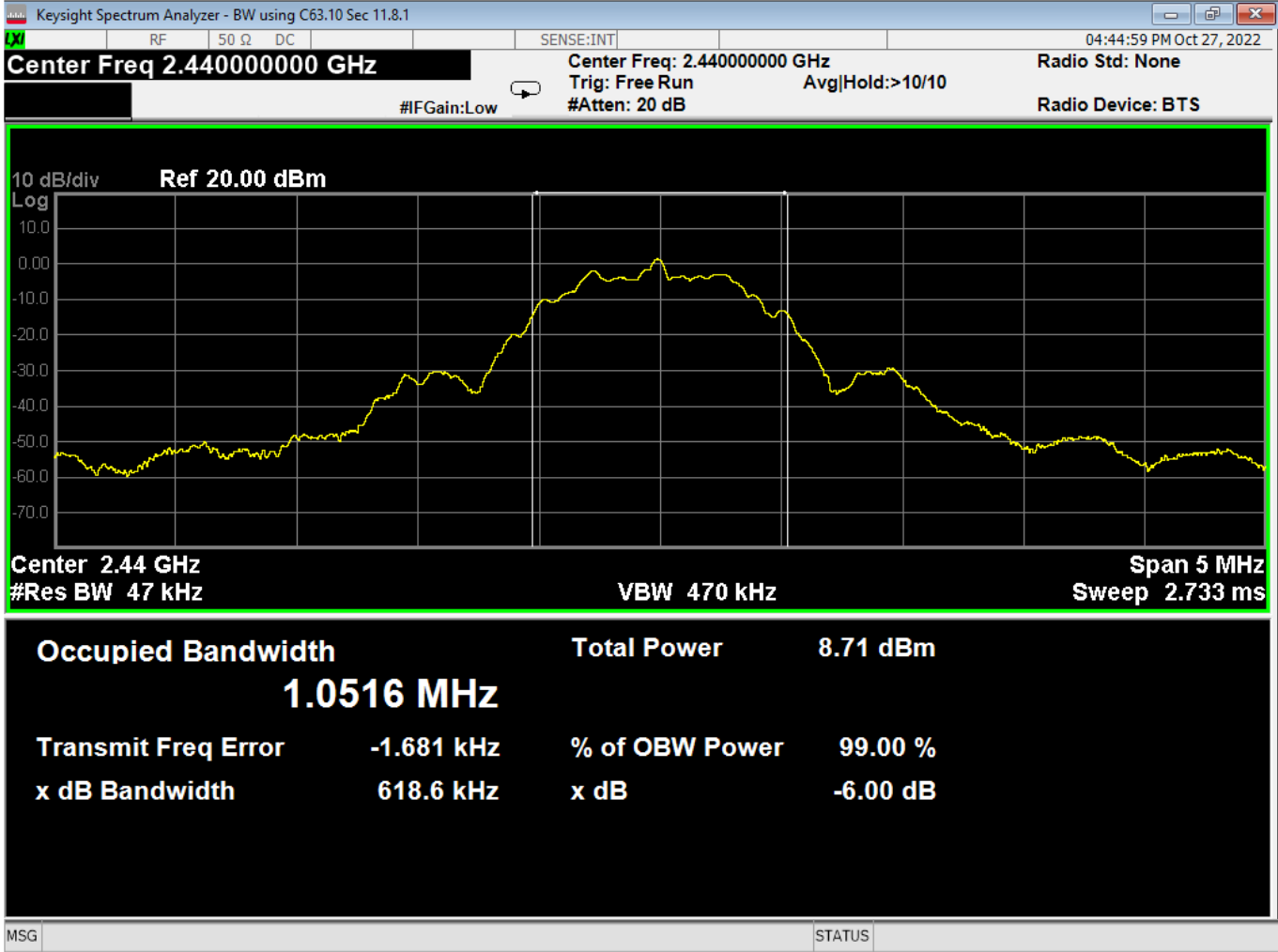
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



28 Occupied Bandwidth, Low Channel, GMSK



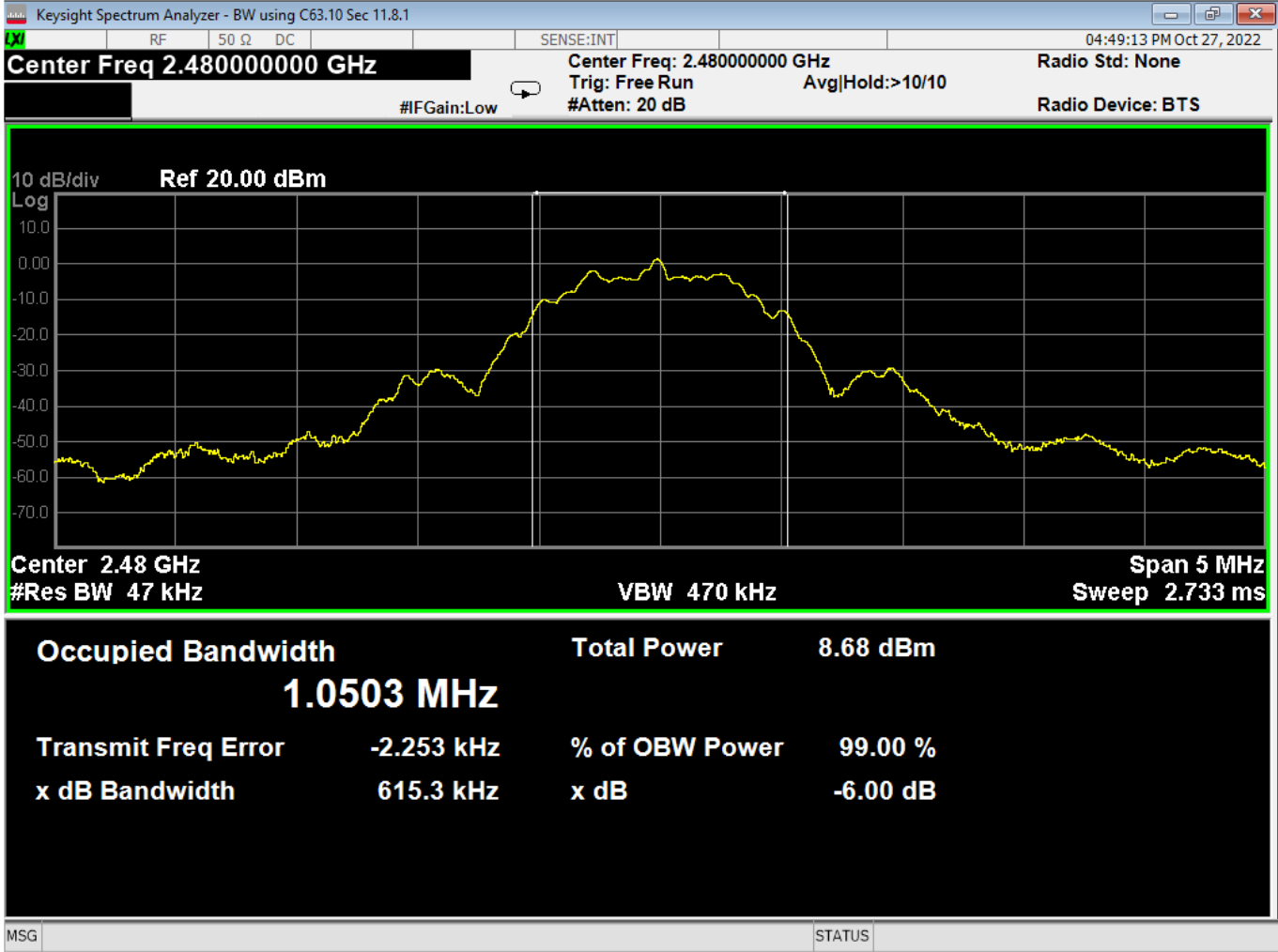
Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



29 Occupied Bandwidth, Mid Channel, GMSK



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		



30 Occupied Bandwidth, High Channel, GMSK



Report Number:	R20220512-20-E1B	Rev	B
Prepared for:	Garmin International, Inc.		

REPORT END