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FCC/ISED Test Report

Prepared for:

Garmin International, Inc.

Address:

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

Product:

AC4308

Test Report No:

Approved by:

R20211005-21-E15C

Nic Johr son, NCE Technical Manager iNARTE Certifed EMC Engineer

DATE:

17 May 2022

Total Pages:

44

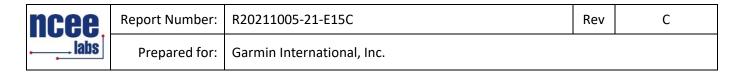
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REVISION PAGE

Rev. No.	Date	Description
0	5 March 2022	Original – KVepuri / NJohnson
		Prepared by FLane, GLarsen
А	13 May 2022	Removed power and bandwidth sections, and conducted spurious
		Removed conducted spurious emissions data
		Added DCCF values to tabular data
		Updated delta to fundamental
В	16 May 2022	Edited test description
С	16 May 2022	Corrected average measurements



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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:

FCC Part 15.249

The EUT has been tested according to the following specifications:

- (1) US Code of Federal Regulations, Title 47, Part 15
- (2) ISED RSS-Gen, Issue 5
- (3) ISED RSS-210, Issue 10

	SUMMARY		
Requirement	Test Type and Limit	Result	Remark
FCC 15.203	Unique Antenna Requirement	Pass	PCB Antenna
FCC 15.35 RSS-Gen, 6.10	Duty cycle of pulsed emissions	N/A	Informational Purpose Only
NA	Maximum Peak Output Power	N/A	Informational Purpose Only
NA	Minimum Bandwidth	N/A	Informational Purpose Only
FCC 15.209 RSS-Gen, 7.1, 7.3	Receiver Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.209 RSS-Gen, 8.9 RSS-210 A1.2 FCC 15.249(a)	Transmitter Radiated Emissions	Pass	Meets the requirement of the limit.
FCC 15.209, 15.205, 15.249(d) RSS-Gen, 8.9 RSS-210, 5	Band Edge Measurement	Pass	Meets the requirement of the limit.
FCC 15.207 RSS-Gen, 8.8	Conducted AC Emissions	Pass	Meets the requirement of the limit.



2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary and Operating Condition:

EUT	AC4308
EUT Received	6 December 2021
Test Dates	8 December 2021- 25 February 2022
Serial No.	3392435319 (Radiated Measurements) 3392435300 (Conducted Measurements)
Operating Band	2400 – 2483.5 MHz
Device Type	□ GMSK ⊠ GFSK □ BT BR □ BT EDR 2MB □ BT EDR 3MB □ 802.11x □ NFC
Power Supply / Voltage	Internal Battery/ 5VDC Charger: Garmin (Phi Hong) MN: PSAI10R-050Q (Representative Power Supply)

Device was tested alongside a similar unit, worst case was reported.

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 GFSK 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



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-1
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	Karthik Vepuri	Test Engineer	Review/Editing and Report
3	Blake Winter	Test Engineer	Testing
4	Grace Larsen	Test Technician	Testing and Report
5	Samuel Probst	Test Technician	Testing and Report
6	Matthew Emory	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.



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 21, 2021	July 21, 2023
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	May 5, 2020	May 5, 2022
Keysight EXA Signal Analyzer	N9010A	MY56070862	July 20, 2021	July 20, 2023
SunAR RF Motion	JB1	A091418	July 27, 2021	July 27, 2022
EMCO Horn Antenna	3115	6416	July 28, 2021	July 28, 2022
EMCO Horn Antenna	3116	2576	March 9, 2020	March 9, 2022
Com-Power LISN 50μΗ / 250μΗ - 50Ω	LI-220C	20070017	September 22, 2020	September 22, 2022
8447F POT H64 Preamplifier*	8447F POT H64	3113AD4667	February 1, 2021	February 1, 2023
Rohde & Schwarz Preamplifier*	TS-PR18	3545700803	April 14, 2020	April 14, 2022
Trilithic High Pass Filter*	6HC330	23042	April 14, 2020	April 14, 2022
ETS – Lindgren- VSWR on 10m Chamber	10m Semi- anechoic chamber- VSWR	4740 Discovery Drive	July 30, 2020	July 30, 2023
NCEE Labs-NSA on 10m Chamber	10m Semi- anechoic chamber-NSA	NCEE-001	October 25, 2019	October 25, 2022
TDK Emissions Lab Software	V11.25	700307	NA	NA
RF Cable (preamplifier to antenna)*	MFR-57500	01-07-002	April 14, 2020	April 14, 2022
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 MEASUREMNTS

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

Conducted \boxtimes

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.

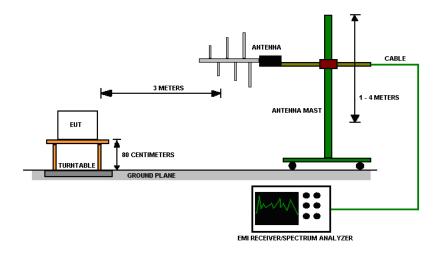


Figure 2 - Radiated Emissions Test Setup

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4.0 RESULTS

	Unrestricted Band-Edge							
CHANNE L	Mode	Band edge /Measuremen t Frequency (MHz)	Relative Highest out of band level (dBuV)	Relative Fundamental (dBuV)	Delta (dB)	Min Delta (dB)	Result -	
Low	GFSK PRBS9	2400.00	58.135	109.620	51.486	50.00	PASS	
Low	GFSK 0x00	2400.00	57.338	109.723	52.385	50.00	PASS	
Low	GFSK 0xFF	2400.00	57.120	109.723	52.603	50.00	PASS	
Low	GFSK 0xF0	2400.00	57.571	109.690	52.119	50.00	PASS	
Low	GFSK 0x55	2400.00	58.075	109.690	51.615	50.00	PASS	
High	GFSK PRBS9	2483.50	57.441	109.266	51.825	50.00	PASS	
High	GFSK 0x00	2483.50	56.397	109.303	52.906	50.00	PASS	
High	GFSK 0xFF	2483.50	57.145	109.319	52.174	50.00	PASS	
High	GFSK 0xF0	2483.50	56.524	109.254	52.730	50.00	PASS	
High	GFSK 0x55	2483.50	57.015	109.277	52.262	50.00	PASS	

		Peak	Restricted Ban	d-Edge				
CHANNE L	Mode	Band edge /Measuremen t Frequency (MHz)	Highest out of band level (dBuV/m @ 3m)	Measurement Type	Limit (dBuV/m @ 3m)	Margin	Result	
Low	GFSK PRBS9	2390.00	57.783	Peak	73.98	16.197	PASS	
Low	GFSK 0x00	2390.00	53.771	Peak	73.98	20.209	PASS	
Low	GFSK 0xFF	2390.00	52.624	Peak	73.98	21.356	PASS	
Low	GFSK 0xF0	2390.00	54.047	Peak	73.98	19.933	PASS	
Low	GFSK 0x55	2390.00	53.733	Peak	73.98	20.247	PASS	
High	GFSK PRBS9	2483.50	62.388	Peak	73.98	11.592	PASS	
High	GFSK 0x00	2483.50	61.261	Peak	73.98	12.719	PASS	
High	GFSK 0xFF	2483.50	61.621	Peak	73.98	12.359	PASS	
High	GFSK 0xF0	2483.50	61.154	Peak	73.98	12.826	PASS	
High	GFSK 0x55	2483.50	61.528	Peak	73.98	12.452	PASS	
*Limit showr	n is the peak limit	taken from FCC F	Part 15.209					



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	Average Restricted Band-Edge												
СН	Mode	Band edge /Measurement Frequency (MHz)	Peak Highest out of band level (dBuV/m @ 3m)	DCCF (For Emissions)	Average Highest out of band level (dBuV/m @ 3m)**	Measurement Type	Limit (dBuV/m @ 3m)*	Margin	Result				
Low	GFSK PRBS9	2390.00	57.783	-17.7211	40.0619	Average	53.98	13.408	PASS				
Low	GFSK 0x00	2390.00	53.771	-17.7211	36.0499	Average	53.98	17.42	PASS				
Low	GFSK 0xFF	2390.00	52.624	-17.7211	34.9029	Average	53.98	18.567	PASS				
Low	GFSK 0xF0	2390.00	54.047	-17.7211	36.3259	Average	53.98	17.144	PASS				
Low	GFSK 0x55	2390.00	53.733	-17.7211	36.0119	Average	53.98	17.458	PASS				
High	GFSK PRBS9	2483.50	62.388	-17.7211	44.6669	Average	53.98	8.803	PASS				
High	GFSK 0x00	2483.50	61.261	-17.7211	43.5399	Average	53.98	9.93	PASS				
High	GFSK 0xFF	2483.50	61.621	-17.7211	43.8999	Average	53.98	9.57	PASS				
High	GFSK 0xF0	2483.50	61.154	-17.7211	43.4329	Average	53.98	10.037	PASS				
High	GFSK 0x55	2483.50	61.528	-17.7211	43.8069	Average	53.98	9.663	PASS				
		rage limit taken fro			cions) C63 1	0 Sec. 11 12 2 5 2)						

**Average Highest out of band level = SA Peak Level + DCCF(For Emissions). C63.10 Sec. 11.12.2.5.2

See Sec 4.3 for more information on DCCF



4.1 DUTY CYCLE

Test Method:

Manufacturer declared that the maximum possible duty cycle is 13% so the duty cycle correction 20 log (0.13) = -17.7211 dB was used as the correction for emissions. DCCF For Emissions = -17.7211 dB

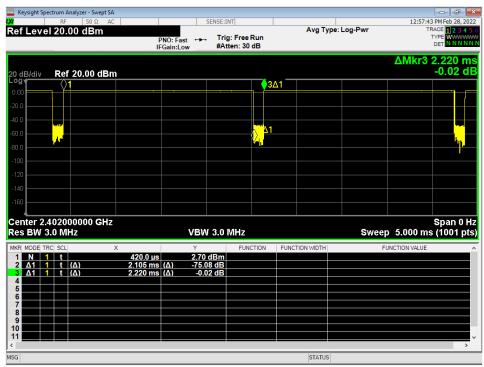


Figure 3 – Duty Cycle, ANT, Test Software

ANT Test Software, Duty Cycle DCCF For Power (Duty Cycle Correction Factor) = 20 * Log(Duty Cycle) -0.23 = 10 * Log(94.8 / 100)



4.2 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 (µV/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 * Emission level (µV/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 semianechoic 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.

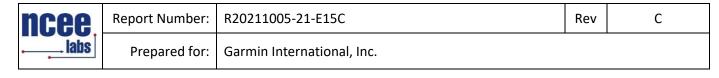
d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

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:



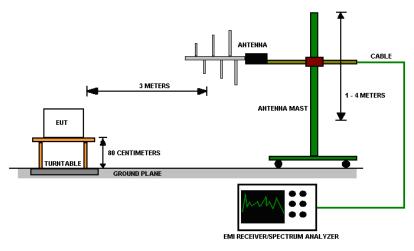


Figure 4 - Radiated Emissions Test Setup

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.

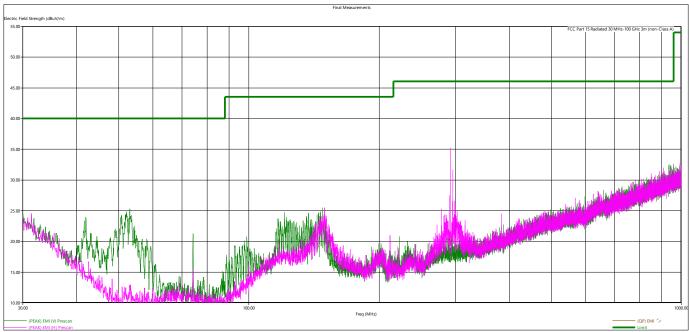
EUT operating conditions

Details can be found in section 2.1 of this report.



Test results:

Intermodulation products were investigated and found to be below system sensitivity. Thus, were not reported.





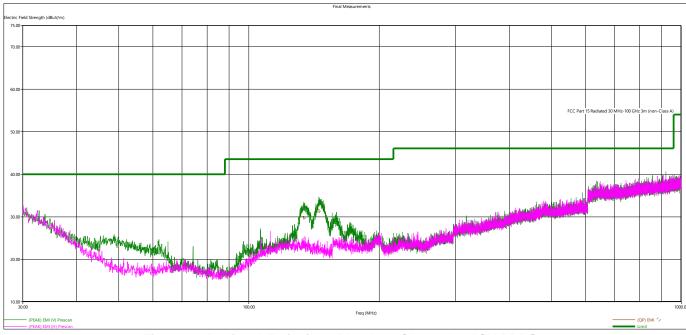


Figure 6 - Radiated Emissions Plot, Low Channel, GFSK PRBS9

REMARKS:

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

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

	Quasi-Peak Measurements, GFSK										
Frequency	Frequency Level Limit Margin Height Angle Pol Channel Modulation										
MHz	dBµV/m	dBµV/m	dB	cm.	deg.						
293.108880	20.22	46.02	25.80	126.00	3.00	Н	NA	RX			

	Peak Measurements, GFSK											
Frequency Level Limit Margin Height Angle Pol Channel Modulati								Modulation				
MHz	dBµV/m	dBµV/m	dB	cm.	deg.							
2402.214000	97.29	114.00	16.71	390.00	309.00	Н	Low	GFSK PRBS9				
2439.900000	98.30	114.00	15.70	283.00	306.00	Н	Mid	GFSK PRBS9				
2480.012000	99.26	114.00	14.74	476.00	304.00	Н	High	GFSK PRBS9				
All other emission	s found to be	at least 6dB l	pelow 15 209	9 limit line								

All other emissions found to be at least 6dB below 15.209 limit line

	Average Measurements											
Frequency Peak Level DCCF *AVG Level Limit Margin Height Angle Pol C						Channel	Modulation					
MHz	dBuV/m	dB	dBµV/m	dBµV/m	dB	cm.	deg.					
2401.784000	97.29	-17.7211	79.57	94.00	13.921	454.00	112.00	Н	Low	GFSK PRBS9		
2439.776000	98.30	-17.7211	80.5789	94.00	12.911	127.00	115.00	Н	Mid	GFSK PRBS9		
2479.590000	99.26	-17.7211	81.5389	94.00	11.951	485.00	119.00	н	High	GFSK PRBS9		
*Average Level =	Average Level = Peak level + DCCF (For Emissions),											

See Sec 4.2 for more information on DCCF

All other emissions were found to be at least 6dB below 15.209 limit line



4.3 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 15.249 Device:

For emissions outside of the allowed band of operation, the emission level needs to be 50dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

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. All data is in the table in results section 4.0.
- 3. If the device falls under FCC Part 15.249 (Details can be found in summary of test results), compliance is shown in the unrestricted band edges by showing minimum delta of 50 dB between peak and the band edge or band edge was compared to FCC Part 209 limit.
- 4. 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.



4.4 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 (dBuV)				
(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.

The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz
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.

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Test Results:





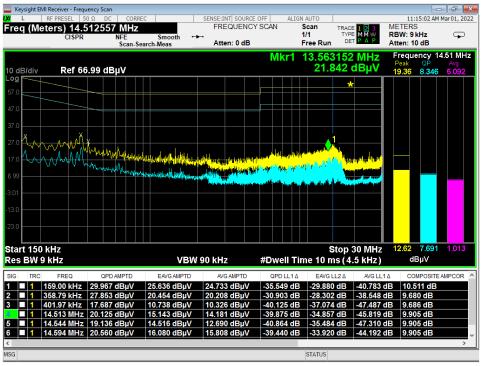


Figure 8 - Conducted Emissions Plot, TX, Neutral



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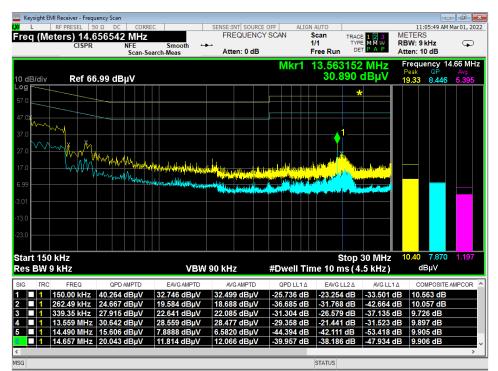


Figure 9 - Conducted Emissions Plot, Idle, Line

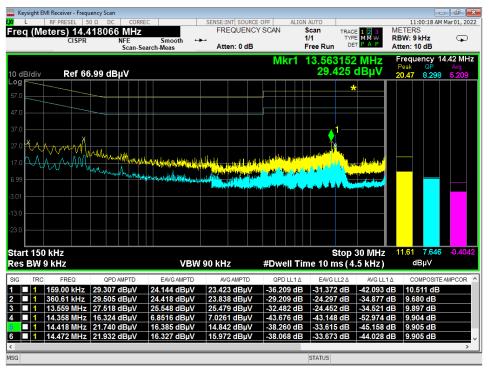


Figure 10 - Conducted Emissions Plot, Idle, Neutral

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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 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.

Level in μ V/m = Common Antilogarithm [(48.1 dB μ V/m)/20]= 254.1 μ V/m

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

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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) x antenna distance (m)]² / 30 Power (watts) = $10^{Power} (dBm)/10$] / 1000 Voltage (dB μ V) = Power (dBm) + 107 (for 50 Ω measurement systems) Field Strength (V/m) = 10^{Field} Strength (dB μ V/m) / 20] / 10^6 Gain = 1 (numeric gain for isotropic radiator) Conversion from 3m field strength to EIRP (d=3):

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

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

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



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	3.82
Radiated Emissions, 3m	1GHz - 18GHz	4.44
Emissions limits, conducted	30MHz – 18GHz	±3.30 dB

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

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

APPENDIX C – GRAPHS AND TABLES

🔛 Key	sight Spec	trum An	alyzer - Restricted		6.10.5								- 0 💌
Marl	(er 2	RF 2 483	50 Ω AC 37475000			SENSE:	INT]		<u>∧</u> A	LIGN OFF Avg Type:	RMS		AM Feb 25, 2022
PAS			EAMP		PNO: Fast G		ig: Free tten: 0 d			Avg Hold:	>1000/1000		
											Mkr	2 2.483 7	47 5 GHz
10 dE Log i	3/div	Ref	114.99 dB	μV								40.1	76 dBµV
105	Trace	1 Pa	SS										
95.0	Trace	2 Pa	SS										
85.0													
75.0													
65.0	1												
55.0	and a state of the		-	managen	man page lang	Actions	There are a	1 - 1 - 1					
45.0	Å ²			.1		· · · ·	(Apple 1)	Can a de	anter A	وإالا يقيه فيعدوك	Mary Jones and	demonanter and	- Annothing and -
35.0					-	<u>منا</u>							
25.0													
	t 2.483 s BW				VB	W 50	MHz*				Swee	Stop 2.5 p 1.000 ms	00000 GHz (1001 pts)
MKR 1	IODE TRO	SCL		x	Y		FUN	CTION	FUNCT	TION WIDTH	F	UNCTION VALUE	^
1	N 1 N 2	1	2.4	83 500 0 GH 83 747 5 GH	z 61.26	1 dBµV 2 dBµV							
3		Ľ†	2.4	53 141 3 GH	40.17								
4													
6		\vdash											
8													
9 10													
11													×
MSG										STATUS			

HBE Restricted, ANT 0x00

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

	F 50Ω AC 0	ORREC	SENSE:	INT	ALIGN OFF		11:01:40 AM Feb 25, 2
0.0	83566000000 G			ig: Free Run tten: 0 dB	Avg Type	: RMS :>1000/1000	TRACE 1 2 3 4 TYPE MA WW DET P A N
dB/div Re	ef 114.99 dBµV					Mkr2	2.483 830 0 GI 40.271 dBj
Trace 1 F	Pass			Ĭ			
Trace 2 F	Pass						
o							
0							
0							
° 2	1 1 1	and the second se	- Andrew Street of the	. المهام بمردر الهما	they and the strate of the second second	and a failed on the second second	100 Aller Madine market and
0							
0							
art 2.48350 es BW 1.0			VBW 50	MHz*		Sweep	Stop 2.500000 G 1.000 ms (1001 p
art 2.48350 es BW 1.0	MHz		Y	FUNCTION	FUNCTION WIDTH		Stop 2.500000 G 1.000 ms (1001 p
art 2.48350 es BW 1.0	MHz	6 5 GHz 61		FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.48350 es BW 1.0	MHz L X 2.483 510	6 5 GHz 61	۲ 528 dBµV	FUNCTION	FUNCTION WIDTH		· ·
art 2.48350 es BW 1.0	MHz L X 2.483 510	6 5 GHz 61	۲ 528 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.48350 es BW 1.0 MODE TRC SCI N 1 1 N 2 f	MHz L X 2.483 510	6 5 GHz 61	۲ 528 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.48350 es BW 1.0	MHz L X 2.483 510	6 5 GHz 61	۲ 528 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p

HBE Restricted, ANT 0x55

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

	50 Ω AC	CORREC	S	ENSE:INT	A	IGN OFF		11:11:03 AM Feb 25,
0.0	8361550000 PREAMP	PN	IO: Fast 😱	Trig: Free Ru #Atten: 0 dB		Avg Type: F Avg Hold:>1		TRACE 1 2 3 TYPE MA W DET P A N
							Mkr2	2.483 615 5 G
	f 114.99 dB	١V						40.293 dB
Trace 1 P Trace 2 P	ass ass							
0								
0								
1								
o Y		and the property and the second	1	-	inkila sa bira			
¢ ²					1		والاستارانية بعيديدي وال	for the formation of the second
0								
0								
							-	Stop 2.500000 (
			VBW	50 MHz*			Sweep	1.000 ms (1001
MODE TRC SCL	MHz		Y	FUNCTI	ON FUNCT	ION WIDTH		ICTION VALUE
es BW 1.0 I	MHz . × 2.48	3 615 5 GHz 3 615 5 GHz		FUNCTI BµV	DN FUNCT	ION WIDTH		
MODE TRC SCL	MHz . × 2.48	3 615 5 GHz	۲ 61.154 di	FUNCTI BµV	DN FUNCT	ION WIDTH		
MODE TRC SCL	MHz . × 2.48	3 615 5 GHz	۲ 61.154 di	FUNCTI BµV	ON FUNCT	ION WIDTH		
MODE TRC SCL	MHz . × 2.48	3 615 5 GHz	۲ 61.154 di	FUNCTI BµV	DN FUNCT	ION WIDTH		
MODE TRC SCL	MHz . × 2.48	3 615 5 GHz	۲ 61.154 di	FUNCTI BµV	DN FUNCT	ION WIDTH		
Image: Normal State 1 1 MODE TRC SCL N 1 1 1 N 2 1 1	MHz . × 2.48	3 615 5 GHz	۲ 61.154 di	FUNCTI BµV	DN FUNCT	ION WIDTH		

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ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

	50 Ω AC CORREC	SEN	ISE:INT	ALIGN OFF		10:50:19 AM Feb 25, 20
0.0	516500000 GHz		Trig: Free Run #Atten: 0 dB	Avg Type: Avg Hold:>		TRACE 2 3 4 TYPE MAW DET PANN
dB/div Ref	114.99 dBµV				Mkr1	2.483 516 5 GI 61.621 dB
Trace 1 Pa Trace 2 Pa	SS					
0						
1						
0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	*****	March March Marco	مر مدر می او او او و او و مر	ht-stateline the state of the state
° 2						
0						
art 2.483500 es BW 1.0 M		VBW 5	•0 MHz*		Sweep	Stop 2.500000 G 1.000 ms (1001 p
MODE TRC SCL	× 2.483 516 5 Gł	Y Hz 61.621 dB	FUNCTION	FUNCTION WIDTH	FUN	ICTION VALUE
N 2 f	2.483 599 0 G	Hz 40.235 dB				

HBE Restricted, ANT 0xFF

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

	RF 50 Ω	AC	5.10.5	NSE:INT	ALIGN OFF		11:00:38 AM Dec 07, 20
arker 2	2.4835495	00000 GHz	PNO: Fast 😱	Trig: Free Run #Atten: 0 dB	Avg Type	e: RMS :>1000/1000	TRACE 2 3 4 TYPE MAWW DET PANN
dB/div	Ref Offset 34 Ref 86.76	.77 dB dBuV				Mkr2	2.483 549 5 GH 40.618 dBµ
Trac	e 1 Pass			T T			
is phrac	e 2 Pass						
° 2	****************	lander and a state of the second	terror and the same	and the second	and a second	terre there are the strong to get	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
* *							
.8							
8							
6							
24							
	83500 GHz 1.0 MHz		VBW 5	50 MHz*		Sweep	Stop 2.500000 GI 1.000 ms (1001 pt
		x	Y	FUNCTION	FUNCTION WIDTH	FUI	ICTION VALUE
R MODE TR	RC SCL	2 402 502 5 CH					
NODE TR	RC SCL 1 1 2 1	2.483 582 5 GHz 2.483 549 5 GHz	62.388 dB 40.618 dB				
N N N	RC SCL 1 1 2 1	2.483 582 5 GHz 2.483 549 5 GHz	62.388 dB 40.618 dB				
N N N		2.483 582 5 GHz 2.483 549 5 GHz	62.388 dB 40.618 dB				
NODE TR	RC SCL	2,483 582 5 GHz 2,483 549 5 GHz	62.388 dB 40.618 dB				
	RC SCL	2,483 582 5 GHz 2,483 549 5 GHz	62,388 dB 40.618 dB				

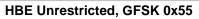
ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		





ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

Keysight Spectrum Analyzer - Unrestricted LBE using Cl RF 50 Ω AC arker 1 2.479991000000 GHz	PNO: Wide Tri	g: Free Run tten: 20 dB	Avg Type: I Avg Hold:>	1000/1000	01:25:42 PM Feb 28, 202 TRACE 234 5 TYPE ANN DET ANN
) dB/div Ref 116.99 dBµV				Mkr1	2.479 991 0 GH 109.277 dBµ
Pg 107 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7					34
tart 2.478000 GHz Res BW 100 kHz	VBW 1.0	MHz		Sweep	Stop 2.483500 GH 1.000 ms (1001 pts
KR MODE TRC SCL X 1 N 1 f 2.479 991 0 GH 2 N 1 f 2.483 500 0 GH 3 Δ1 1 f (Δ) 2.483 736 5 GH 4 -	iz 109.277 dBμV iz 57.015 dBμV iz (Δ) dB		FUNCTION WIDTH	FUN	CTION VALUE
s			STATUS		>



ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

0.0 0.0	Keysight Spectrum Analyzer - Unrestricted LBE using (RF 50.Ω AC arker 1 2.479991000000 GHz	PNO: Wide	nt] g: Free Run ten: 20 dB	Avg Type: Lo Avg Hold:>10	000/1000	01:34:06 PM Feb 28, 20 TRACE 234 TYPE MA DET PANN
99 107 97 97 97 97 97 97 97 97 97 97 97 97 97	0 dB/div Ref 116.99 dBµV				Mkr1	2.479 991 0 GH 109.254 dBµ
Res BW 100 kHz VBW 1.0 MHz Sweep 1.000 ms (1001 p MR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 N 1 f 2.479 991 0 GHz 109.254 dBµV FUNCTION FUNCTION VALUE 2 N 1 f 2.483 500 0 GHz 56.524 dBµV FUNCTION FUNCTION VALUE 3 Δ1 1 f (Δ) 2.483 736 5 GHz (Δ) dB FUNCTION FUNCTION VALUE F	107 97.0 97.0 77.0 77.0 57.0 47.0 37.0					3Δ
KR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 N 1 f 2.479 9910 GHz 109.254 dBµV 2 2 N 1 f 2.483 5000 GHz 56.524 dBµV 2 N 1 f 2.483 736.5 GHz 56.524 dBµV 4 - - - dB - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7 - - - - - - - 8 - - - - - - - 9 - - - - - - - 0 - - - - - - -		VBW 1.01	MHz		Sweep	Stop 2.483500 GH 1.000 ms (1001 pt
	1 N 1 f 2.479 991 0 G 2 N 1 f 2.483 500 0 G 3 Δ1 1 f (Δ) 2.483 736 5 G 4 -	Hz 109.254 dBuV	FUNCTION	FUNCTION WIDTH	FUN	

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		





ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		





ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

		using C63.10 Sec 6.10.5					
RF		CORREC	SENSE:I	NT	ALIGN OFF Avg Typ	DMC	10:20:02 AM Feb 25, 20 TRACE
0.0	5500000000	PNO: Fast IFGain:High		g: Free Run ten: 0 dB		l:>1000/1000	TYPE MAWW DET PANN
dBídiv Ref	115.55 dBµV					М	kr2 2.385 92 GH 39.306 dBµ
Trace 1 Pa	ss						
Trace 2 Pa	ISS						
5							
5							
5							
mennon	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	a dependence of the second	Sur stand the	مالي المراجعة المراجع	2	- drawwww.da.www.	portaneous and and a second
5					<u></u>		
5							
rt 2.380000							Stop 2 200000 C
	GHZ		#VBW 50	MH7*		Sweep	Stop 2.390000 G 1.000 ms (1001 p
			TAPAS 20	IVII 12		aweep	neee me (reer p
es BW 1.0 M	1Hz ×		Y	FUNCTION	FUNCTION WIDTH	· · · ·	NCTION VALUE
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.			FUNCTION WIDTH	· · · ·	
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.	Ƴ .771 dBµV		FUNCTION WIDTH	· · · ·	
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.	Ƴ .771 dBµV		FUNCTION WIDTH	· · · ·	
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.	Ƴ .771 dBµV		FUNCTION WIDTH	· · · ·	
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.	Ƴ .771 dBµV		FUNCTION WIDTH	· · · ·	
es BW 1.0 M	1Hz × 2.389	9 80 GHz 53.	Ƴ .771 dBµV		FUNCTION WIDTH	· · · ·	

LBE Restricted, ANT 0x00

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

RF 5(0 Ω AC CORREC		NOTATI			10-55-50 445-5 25 2
rker 2 2.385880	000000 GHz	PNO: Fast 😱	Trig: Free Run #Atten: 0 dB	ALIGN OFF Avg Type: Avg Hold:>		10:55:58 AM Feb 25, 20 TRACE 2 3 4 TYPE MA WW DET P A N N
Theorem		rGaminigh			М	kr2 2.386 15 GI
dB/div Ref 115.	55 dBµV		•			39.319 dBj
Trace 1 Pass Trace 2 Pass						
5						
5						
5			واددار وارتدار وروال		and a start and the start of the	\uparrow
5	والالالالالالالالالالالالالالالالالا	National All Contractions	uditessa, a sening ing ing ing ing ing ing ing ing ing		0 4 040,000,000,000,000,000,000,000,000,00	n and derive that the ne data read
5						
art 2.380000 GHz		#VBW	50 MHz*		Sweep	Stop 2.390000 G 1.000 ms (1001 p
art 2.380000 GHz es BW 1.0 MHz	x	Y	FUNCTION	FUNCTION WIDTH		Stop 2.390000 G 1.000 ms (1001 p kction value
art 2.380000 GHz es BW 1.0 MHz		Y 53.733 dE	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.380000 GHz es BW 1.0 MHz MODE TRC SCL N 1 1	× 2.389 35 GHz	Y 53.733 dE	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.380000 GHz es BW 1.0 MHz Mode TRC SCL N 1 1	× 2.389 35 GHz	Y 53.733 dE	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
art 2.380000 GHz es BW 1.0 MHz MODE TRC SCL N 1 1	× 2.389 35 GHz	Y 53.733 dE	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
Art 2.380000 GHz es BW 1.0 MHz MODE TRC SCL N 1 f N 2 f	× 2.389 35 GHz	Y 53.733 dE	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p

LBE Restricted, ANT 0x55

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

RF	50 Ω AC CO	ORREC	SENSE:	INT	ALIGN OFF		11:06:11 AM Feb 25, 2
0.0	670000000 G	PNO: Fas IFGain:Hig		g: Free Run tten: 0 dB	Avg Typ Avg Hold	e: RMS 1:>1000/1000	TRACE 234 TYPE MA WU DET PANN
dB/div Ref 1	115.55 dBµV					M	kr2 2.385 67 G 39.308 dB
Trace 1 Pas	ss						
5							
5							
5							^1
douver the second	-martestar	where we want	manpalater	mohanda	may 2 month themas	mound	๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛
5					X		
5							
rt 2.380000 C			#VBW 50	MHz*		Sweep	Stop 2.390000 G 1.000 ms (1001 p
nt 2.380000 (es BW 1.0 Mi	Hz ×	45 GHz 5	Y	FUNCTION	FUNCTION WIDTH		Stop 2.390000 G 1.000 ms (1001 p
	Hz × 2.389			FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
nt 2.380000 (es BW 1.0 Mi	Hz × 2.389		Ƴ 4.047 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
rt 2.380000 (es BW 1.0 Mi	Hz × 2.389		Ƴ 4.047 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p
rt 2.380000 (es BW 1.0 Mi	Hz × 2.389		Ƴ 4.047 dBµV	FUNCTION	FUNCTION WIDTH		1.000 ms (1001 p

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ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

K	F 50 Ω AC	CORREC		SENSE:INT	Δ.	ALIGN OFF		10:42:37 AM Feb 25,
0.0	887900000 Preamp	PN	IO: Fast 😱 ain:High	Trig: Free F #Atten: 0 d		Avg Type: R Avg Hold:>1		TRACE 2 3 TYPE MAW DET PAN
dB/div Re	f 115.55 dB	υV					M	kr2 2.385 68 G 39.400 dE
Trace 1	Pass							
Trace 21	Pass							
5								
5								
5								۵ ¹
harrow all		adaana ahaana		www.wester	- Standard	2 And alphanage	and an	and for the second s
; 					V			
5								
rt 2.38000 es BW 1.0			#VB	W 50 MHz*			Sweep	Stop 2.390000 1.000 ms (1001
MODE TRC SC		x 2.388 79 GHz	Y 52.624 (FUNC	TION FUNC	TION WIDTH	FUN	ICTION VALUE
N 1 f		2.385 68 GHz	39.400					

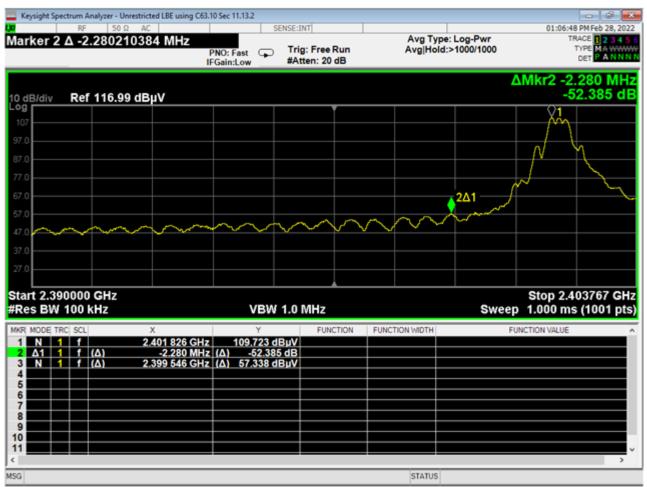
LBE Restricted, ANT 0xFF

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

RF	500 40		in the second		ICH OFF		10.54.10.110.0.07
rker 2 2.3858	50 Ω AC 10000000 GHz	5	SENSE:INT	A	IGN OFF Avg Type: RM		10:56:48 AM Dec 07, TRACE
SS PREA		PNO: Fast 😱 IFGain:High	Trig: Free Run #Atten: 0 dB		Avg Hold:>10	00/1000	DET P A N
Ref Off	set 34.61 dB					M	kr2 2.385 99 G
	6.60 dBµV						39.818 dB
Trace 1 Pass			<u> </u>				
⁶ Trace 2 Pass							
6							
mark the state of	and the second states a	and a second	garge-gaments of all from	at rough the	man man	and a start of the second	A ROAD AND A
6				•			
6							
6							
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			^				Stop 2.390000 0
rt 2 380000 G	H7						Otop 2.00000 C
		#VB	W 50 MHz*			Sweep	1.000 ms (1001
es BW 1.0 MH	X	Y	FUNCTION	FUNCT	ION WIDTH	· ·	1.000 ms (1001 p
es BW 1.0 MH	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	I FUNCT	ION WIDTH	· ·	
MODE TRC SCL	X	Y Hz 57.783 d	FUNCTION	I FUNCT	ION WIDTH	· ·	
MODE TRC SCL	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	I FUNCT	ION WIDTH	· ·	
art 2.380000 G es BW 1.0 MH; MODE TRC SCL N 1 f N 2 f	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	FUNCT	ION WIDTH	· ·	
es BW 1.0 MH	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	FUNCT	ION WIDTH	· ·	
MODE TRC SCL	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	FUNCT	ION WIDTH	· ·	
MODE TRC SCL	z X 2.390 00 Gi	Y Hz 57.783 d	FUNCTION	FUNCT	ION WIDTH	· ·	

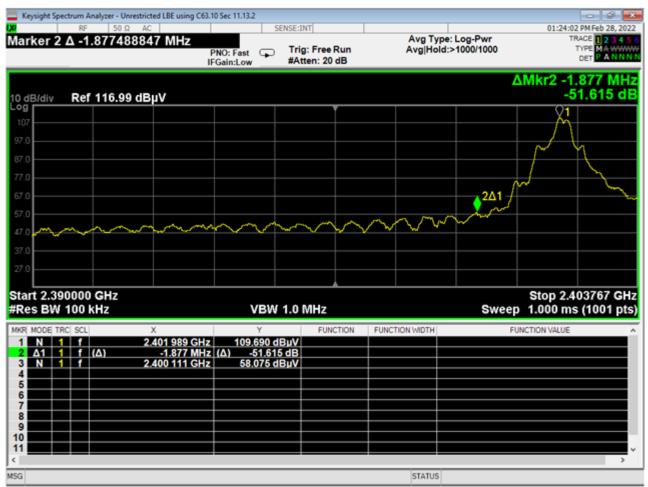
LBE Restricted, ANT PRBS9

ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		



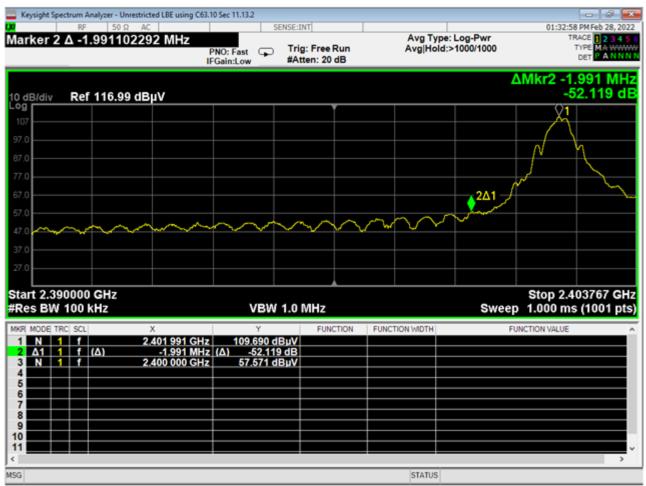


ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		



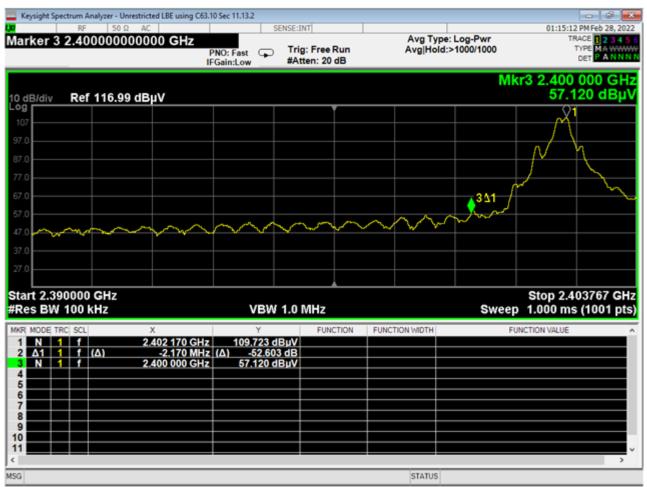


ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		



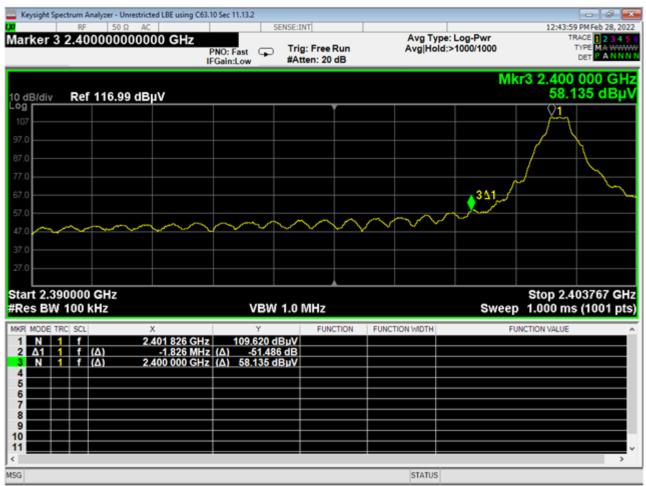


ncee,	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		





ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		





ncee.	Report Number:	R20211005-21-E15C	Rev	С
labs	Prepared for:	Garmin International, Inc.		

REPORT END