

4740 Discovery Drive | Lincoln, NE 68521 tel- 402.323.6233 | tel -888.657.6860 | fax - 402.323.6238 info@nceelabs.com | http://nceelabs.com

FCC/ISED Test Report

Prepared for:

Garmin International Inc.

Address:

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

Product:

A03645

Test Report No:

Approved by:

R20181219-20-12C

Nic S. Johnson, NCE Technical Manager iNARTE Certified EMC Engineer #EMC-003337-NE

DATE:

16 August 2019

Total Pages:

70

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.



ncee.	Report Number:	R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		

REVISION PAGE

Rev. No.	Date	Description
0	18 June 2019	Original – NJohnson
		Prepared by KVepuri/CFarrington
A	15 July 2019	Includes NCEE Labs report R20181219-20-12 and its amendment in
		fullNJ
В	13 August 2019	Includes NCEE Labs report R20181219-20-12A and its amendment
		in fullNJ
С	16 August 2019	Includes NCEE Labs report R20181219-20-12B and its amendment
		in fullNJ

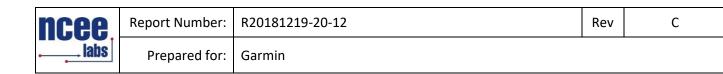


Garmin

Prepared for:

CONTENTS

Rev	ision Pa	ge2
1.0	Sum	nmary of test results4
2.0	EUT	Description5
	2.1	Equipment under test
	2.2	Description of test modes
	2.3	Description of support units
3.0	Lab	oratory description7
	3.1	Laboratory description7
	3.2	Test personnel7
	3.3	Test equipment8
4.0	Deta	ailed results9
	4.1	Duty Cycle9
	4.2	Output Power10
	4.3	Bandwidth19
	4.4	Radiated emissions
	4.5	Power spectral density
	4.5	Band edges
	4.7	Conducted AC Mains Emissions
Арр	endix A	: Sample Calculation67
Арр	endix B	– Measurement Uncertainty
REF		ND70



1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. The EUT has been tested according to the following specifications:

APPLIED STANDARDS AND	REGULATIONS	
Standard Section	Test Type	Result
FCC Part 15.35 RSS Gen, Issue 4, Section 6.10	Duty Cycle	Pass
FCC Part 15.247(a)(1) RSS-247 Issue 2 Section 5.2	Peak output power	Pass
FCC Part 15.247(a)(1) RSS-247 Issue 2 Section 5.2	Bandwidth	Pass
FCC Part 15.209 RSS-Gen Issue 4, Section 7.1	Receiver Radiated Emissions	Pass
FCC Part 15.209 (restricted bands), 15.247 (unrestricted) RSS-247 Issue 2 Section 5.5, RSS-Gen Issue 4, Section 8.9	Transmitter Radiated Emissions	Pass
FCC Part 15.247(a)(1) RSS-247 Issue 2 Section 5.2	Power Spectral Density	Pass
FCC Part 15.209, 15.247(d) RSS-247 Issue 2 Section 11.13	Band Edge Measurement	Pass
FCC Part 15.207 RSS-Gen Issue 4, Section 7.1	Conducted Emissions	Pass

See Section 4 for details on the test methods used for each test.



2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Summary

The Equipment Under Test (EUT) was a battery powered BT EDR 2MB, BT EDR 3MB and BT BR (GFSK) transceiver manufactured by GARMIN inc.

EUT	A03645
EUT Received	16 April 2019
EUT Tested	16 April 2019- 20 May 2019 (GMSK measurements) 10 June 2019 (GFSK measurements) 20 June 2019 (EIRP output power measurements)
Serial No.	3991631270 (radiated unit); 3991631460 (conducted unit)
Operating Band	2400 – 2483.5 MHz
Device Type	BT BR, BT EDR 2MB, BT EDR 3MB
Power Supply	Internal Battery/ Charger: Garmin (Phi Hong) MN: PSAI10R-050Q (Representative Power Supply)

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



Prepared for: Garmin

2.2 DESCRIPTION OF TEST MODES

The EUT operates on, and was tested at the frequencies below:

Channel	Frequency
Low	2402 MHz
Mid	2440 MHz
High	2480 MHz

С

Rev

These are the only three 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.

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on the lowest, middle and highest frequency channels.

The EUT was tested for spurious emissions while running off of battery power.

2.3 DESCRIPTION OF SUPPORT UNITS

None



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 С

Rev

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	Nic Johnson	Technical Manager	Review/editing
2	Karthik Vepuri	Test Engineer	Testing and report
3	Caleb Farrington	Test Technician	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.



С

Prepared for: Garmin

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Rohde & Schwarz Test Receiver	ES126	100037	30 Jan 2018	30 Jan 2020
Keysight EXA Signal Analyzer	N9010A	MY56070862	14 Dec 2018	14 Dec 2020
Rohde & Schwarz Test Receiver	ES17	100007	31 Jul 2017	31 Jul 2019
EMCO Biconilog Antenna	3142B	1647	02 Aug 2017	02 Aug 2019
EMCO Horn Antenna	3115	6416	26 Jan 2018	26 Jan 2020
EMCO Horn Antenna	3116	2576	31 Jan 2018	31 Jan 2020
Rohde & Schwarz Preamplifier	TS-PR18	3545700803	09 Mar 2018*	09 Mar 2020*
Trilithic High Pass Filter	6HC330	23042	09 Mar 2018*	09 Mar 2020*
Rohde & Schwarz LISN	ESH3-Z5	836679/010	26 Jul 2018	26 Jul 2019
Rohde & Schwarz Test Software	ES-K1	12575	NA	NA
RF Cable (preamplifier to antenna)	MFR-57500	01-07-002	09 Mar 2018*	09 Mar 2020*
RF Cable (antenna to 10m chamber bulkhead)	FSCM 64639	01E3872	09 Mar 2018*	09 Mar 2020*
RF Cable (10m chamber bulkhead to control room bulkhead)	FSCM 64639	01E3874	09 Mar 2018*	09 Mar 2020*
RF Cable (Control room bulkhead to RF switch)	FSCM 64639	01E3871	09 Mar 2018*	09 Mar 2020*
RF Cable (RF switch to test receiver)	FSCM 64639	01F1206	09 Mar 2018*	09 Mar 2020*
RF switch – Rohde and Schwarz	TS-RSP	1113.5503.14	09 Mar 2018*	09 Mar 2020*
N connector bulkhead (10m chamber)	PE9128	NCEEBH1	09 Mar 2018*	09 Mar 2020*
N connector bulkhead (control room)	PE9128	NCEEBH2	09 Mar 2018*	09 Mar 2020*

*Internal Characterization

Notes:

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

4.0 DETAILED RESULTS

4.1 DUTY CYCLE

Test Method: NA



4.2 OUTPUT POWER

Test Method: ANSI C63.10:

1. Section(s) 11.9.1.1 "RBW ≥ DTS Bandwidth"

Limits of power measurements:

The maximum allowed peak output power is 30 dBm.

Test procedures:

Except for BTBR mode (which was performed as an antenna port conducted measurement using a spectrum analyzer) all measurements were taken at a distance of 3m from the EUT. The EUT was maximized in all 3 orthogonal positions.10 MHz RBW and 10 MHz VBW was used.

Deviations from test standard:

No deviation.

Test setup:

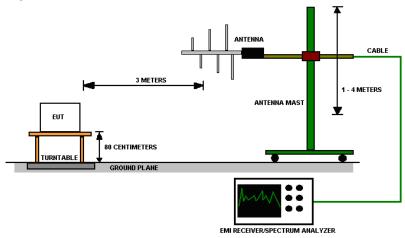


Figure 1 – Peak Output Power Measurements Test Setup

EUT operating conditions:

The EUT was set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

Note: EIRP measurements were performed instead on conducted measurements because on uncertainties in the integrity of the conducted RF connector for this test.

Test results:

The uncertainty for conducted peak power measurements is ± 1.1 dB and average power is ± 1.37 dB

Rev



Test results:

The uncertainty for conducted peak power measurements is ± 1.1 dB and average power is ± 1.37 dB

	Average Output Power						
CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE OUTPUT POWER (dBm)	AVERAGE OUTPUT POWER (mW)	Method	RESULT	Transmitter	
Low	2402	13.42	21.98	Conducted	PASS	BT BR (GFSK)	
Mid	2440	13.09	20.37	Conducted	PASS	BT BR (GFSK)	
High	2480	13.08	20.32	Conducted	PASS	BT BR (GFSK)	
Low	2402	6.26	4.2	Conducted	PASS	BT EDR 2MB	
Mid	2440	6.08	4.1	Conducted	PASS	BT EDR 2MB	
High	2480	5.11	3.2	Conducted	PASS	BT EDR 2MB	
Low	2402	6.45	4.4	Conducted	PASS	BT EDR 3MB	
Mid	2440	6.04	4.0	Conducted	PASS	BT EDR 3MB	
High	2480	5.04	3.2	Conducted	PASS	BT EDR 3MB	

ncee.	Report Number:	R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		

	R			SENSE:I	NT			02:52:14	4 PM Jun 06, 2
arker	1 2.4	017800000	PNC		g: Free Run ten: 40 dB	Avg Type Avg Hold	e: Log-Pwr :>100/100	TI	TYPE A WWW DET P N N
dB/div	v Re	ef 23.00 dBi	n					Mkr1 2.40 13.	1 78 G 419 dE
g 1.0					1				
00									
io									
0									
0		1							1
					5				
o —								-	
0									
	2.402 W 8 M	00 GHz IHz		#VBW 8.0	MHz		Swee	Span p 1.000 ms	20.00 N 6 (1001 p
NODE N	TRC SC		X 2.401 78 GHz	13.419 dBm	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
-									
						I STATUS			

Figure 2 - Average Output Power, Low Channel, BT BR (highest power of 3 channels)

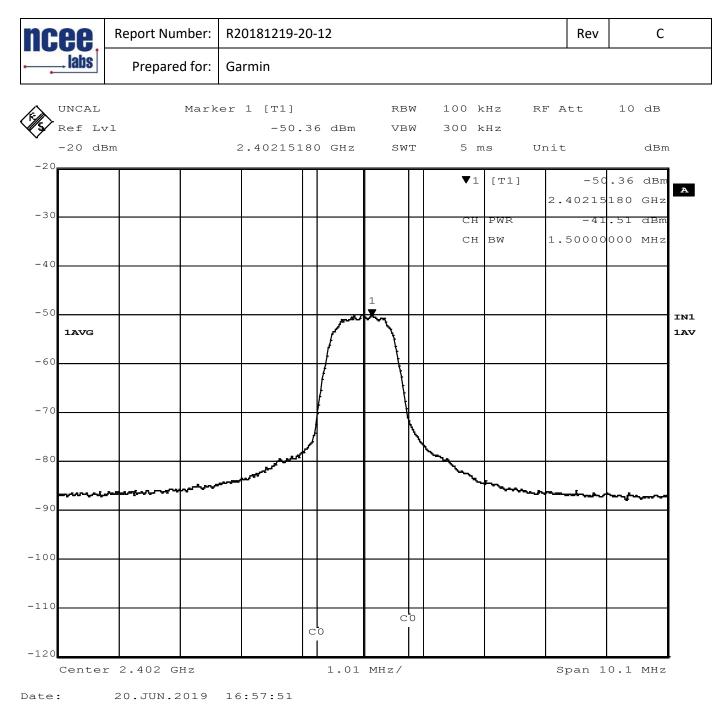


Figure 3 – Average Output Power, Low Channel, BT EDR 2MB

Maximum power = --41.51 + dBm + 107 + CL + AF - 95.23 = 6.26 dBm

 $\begin{array}{l} \text{CL} = \text{cable loss} = 7.70 \text{ dB} \\ \text{AF} = \text{antenna factor} = 28.30 \text{ dB} \\ 107 = \text{conversion from dBm to dB} \text{\muV on a } 50\Omega \text{ measurement system} \\ \text{-95.23} = \text{Conversion from field strength (dB} \text{\muV/m) to EIRP (dBm) at a 3m measurement distance} \end{array}$

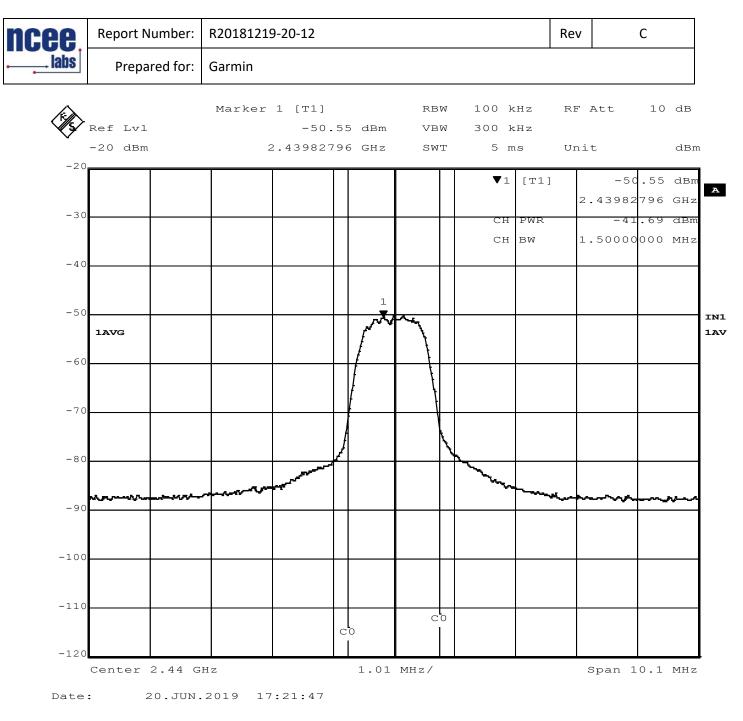


Figure 4 – Average Output Power, Mid Channel, BT EDR 2MB

Maximum power = --41.69 dBm + 107 + CL + AF - 95.23 = 6.08 dBm*

CL = cable loss = 7.70 dB AF = antenna factor = 28.30 dB $107 = conversion from dBm to dB\muV on a 50\Omega$ measurement system $-95.23 = Conversion from field strength (dB\muV/m) to EIRP (dBm) at a 3m measurement distance$

Figure 5 - Output Power, High Channel, BT EDR 2MB

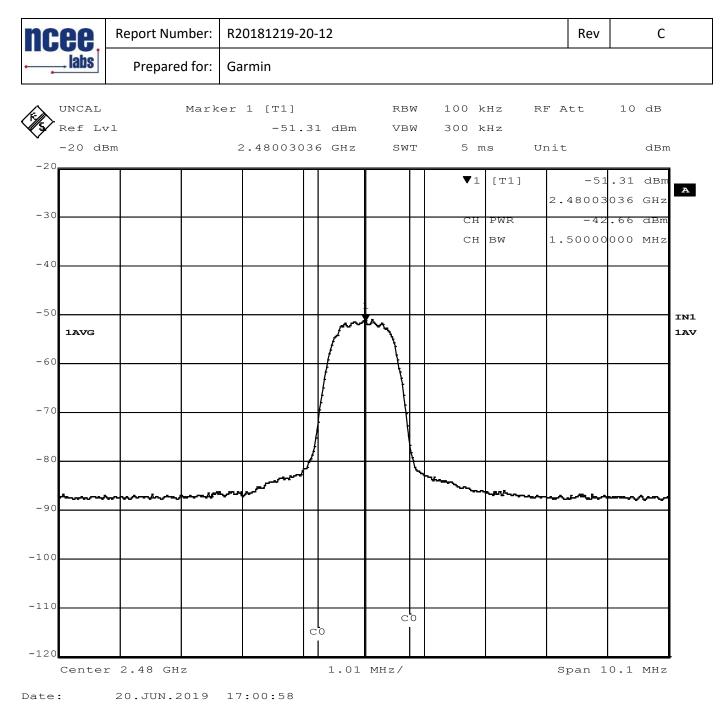


Figure 6 - Average Output Power, High Channel, BT EDR 2MB

Maximum power = -42.66 dBm + 107 + CL + AF - 95.23 = 5.11 dBm*

 $\begin{array}{l} \text{CL} = \text{cable loss} = 7.70 \text{ dB} \\ \text{AF} = \text{antenna factor} = 28.30 \text{ dB} \\ 107 = \text{conversion from dBm to dB}_{\mu}\text{V} \text{ on a } 50\Omega \text{ measurement system} \\ \text{-95.23} = \text{Conversion from field strength (dB}_{\mu}\text{V/m}) \text{ to EIRP (dBm) at a 3m measurement distance} \end{array}$

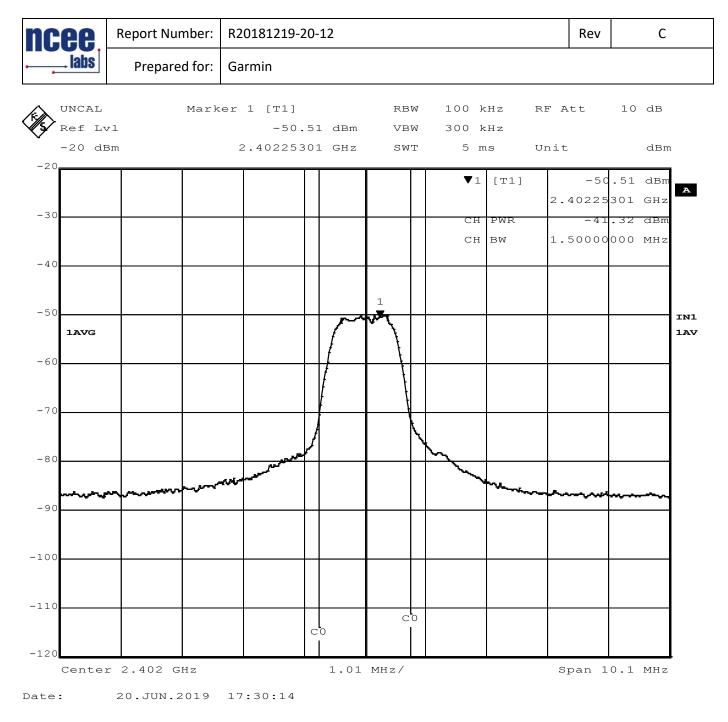


Figure 7 - Average Output Power, Low Channel, BT EDR 3MB

Maximum power = -41.32 dBm + 107 + CL + AF - 95.23 = 6.45 dBm

 $\begin{array}{l} \text{CL} = \text{cable loss} = 7.70 \text{ dB} \\ \text{AF} = \text{antenna factor} = 28.30 \text{ dB} \\ 107 = \text{conversion from dBm to dB}_{\mu}\text{V} \text{ on a } 50\Omega \text{ measurement system} \\ \text{-95.23} = \text{Conversion from field strength (dB}_{\mu}\text{V/m}) \text{ to EIRP (dBm) at a 3m measurement distance} \end{array}$

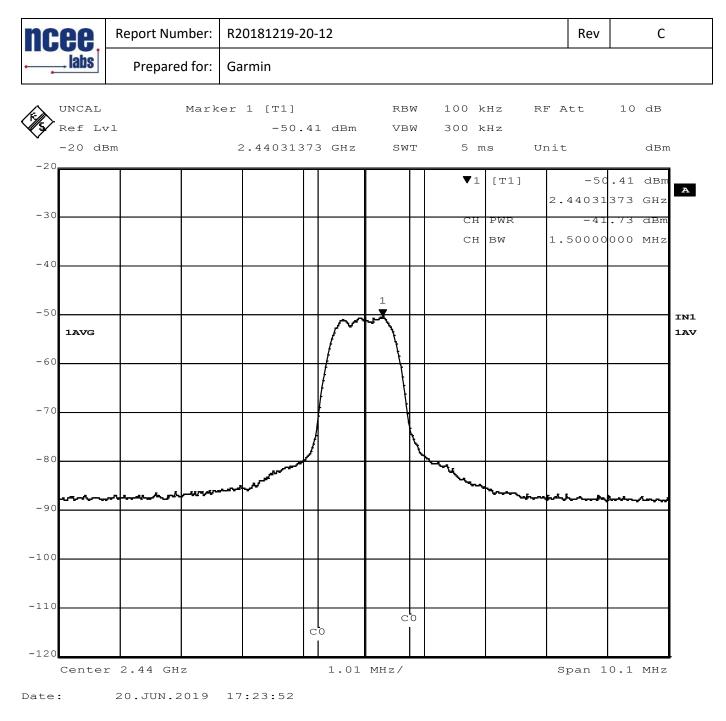


Figure 8 - Average Output Power, Mid Channel, BT EDR 3MB

Maximum power = -41.73 dBm + 107 + CL + AF - 95.23 = 6.04 dBm

CL = cable loss = 7.70 dB AF = antenna factor = 28.30 dB 107 = conversion from dBm to dB μ V on a 50 Ω measurement system -95.23 = Conversion from field strength (dB μ V/m) to EIRP (dBm) at a 3m measurement distance

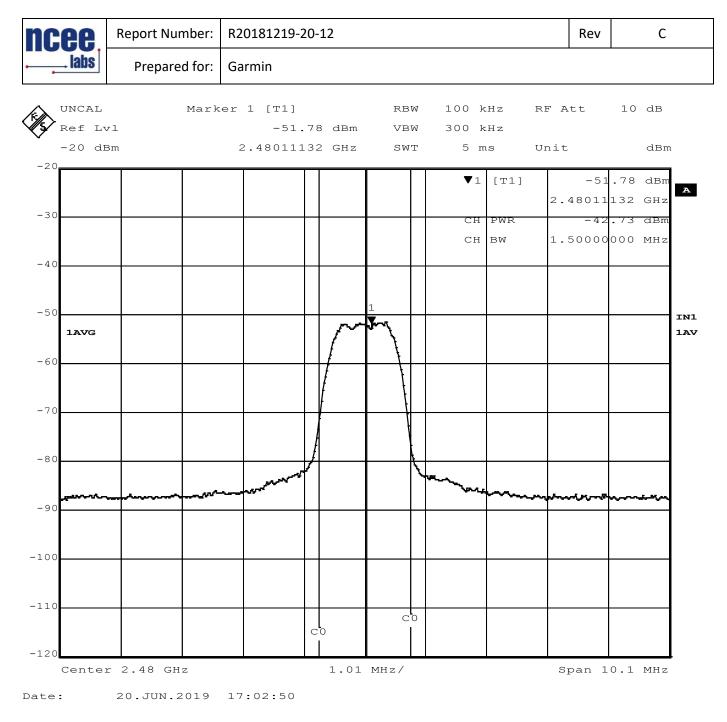


Figure 9 - Average Output Power, High Channel, BT EDR 3MB

Maximum power = -42.73 dBm + 107 + CL + AF - 95.23 = 5.04 dBm

 $\begin{array}{l} CL = cable \mbox{ loss} = 7.70 \mbox{ dB} \\ AF = antenna \mbox{ factor} = 28.30 \mbox{ dB} \\ 107 = conversion \mbox{ from dBm to } dB\mu V \mbox{ on a } 50\Omega \mbox{ measurement system} \\ -95.23 = Conversion \mbox{ from field strength } (dB\mu V/m) \mbox{ to } EIRP \mbox{ (dBm) at a 3m measurement distance} \end{array}$



Test Method: ANSI C63.10,

1. Section(s) 11.8.1 "DTS Bandwidth, Option 1"

Limits of bandwidth measurements:

The 99% occupied bandwidth is displayed.

The 6dB bandwidth of the signal must be greater than 500 kHz.

Test procedures:

The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 300 kHz VBW.

The 99% occupied is defined as the bandwidth at which 99% of the signal power is found. This corresponds to 20dB down from the maximum power level. The maximum power was measured with the largest resolution bandwidth possible (10MHz) and this value was recorded. The signal was then captured with a 1 MHz resolution bandwidth and the frequencies where the measurements were 20dB below the maximum power were marked. The bandwidth between these frequencies was recorded as the 99% occupied bandwidth.

The 6 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 6dB.

For peak output power measurements, the EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable with 3 MHz RBW and 10 MHz VBW.

Deviations from test standard:

No deviation

Test setup:

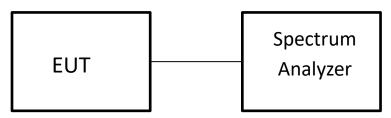


Figure 10 – Peak Output Power Measurements Test Setup

EUT operating conditions:

The EUT was powered by internal battery power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range on each indicated modulation.

Rev

Test results:

Occupied Bandwidth							
CHANNEL	Mode	CHANNEL FREQUENCY (MHz)	OBW (KHz)	RESULT			
Low	BT BR (GFSK)	2402	1095.0	PASS			
Mid	BT BR (GFSK)	2440	1068.0	PASS			
High	BT BR (GFSK)	2480	1070.4	PASS			
Low	BT EDR 2MB	2402	1309.1	PASS			
Mid	BT EDR 2MB	2440	1278.7	PASS			
High	BT EDR 2MB	2480	1263.6	PASS			
Low	BT EDR 3MB	2402	1306.4	PASS			
Mid	BT EDR 3MB	2440	1282.7	PASS			
High	BT EDR 3MB	2480	1279.5	PASS			

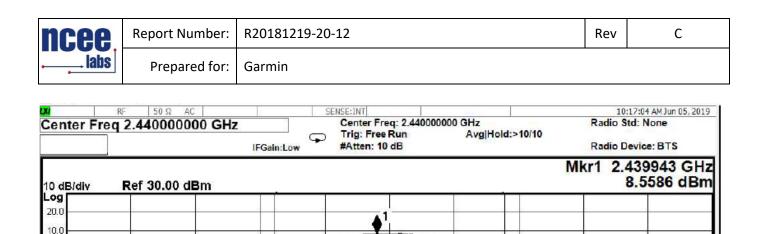
6dB Bandwidth

CHANNEL	Mode	CHANNEL FREQUENCY (MHz)	6dB (KHz)	RESULT
Low	BT BR (GFSK)	2402	649.8	PASS
Mid	BT BR (GFSK)	2440	565.0	PASS
High	BT BR (GFSK)	2480	573.6	PASS
Low	BT EDR 2MB	2402	1083	PASS
Mid	BT EDR 2MB	2440	1077	PASS
High	BT EDR 2MB	2480	1080	PASS
Low	BT EDR 3MB	2402	1092	PASS
Mid	BT EDR 3MB	2440	1091	PASS
High	BT EDR 3MB	2480	1105	PASS

ncee.	Report Number:	R20181219-20)-12		Rev	С
	Prepared for:	Garmin				
RI RI	50 Ω AC	9	ENSE:INT			12:11 AM Jun 05, 2019
Span 3.0000	MHz	IFGain:Low	Center Freq: 2.4020000 Trig: Free Run #Atten: 10 dB	00 GHz Avg Hold:>10/10	Radio St Radio D	td: None evice: BTS

ransmit Freq Error dB Bandwidth	699 Hz 649.8 kHz	% of OBW Power x dB	99.00 % -6.00 dB	
	0950 MHz			
Occupied Bandwidt	b	Total Power	15.0 dBm	
nter 2.402 GHz es BW 100 kHz		#VBW 300 kHz		Span 3 M #Sweep 1 r
é é é				
- man -				
<u>. </u>		1	0.48	<u>.</u>

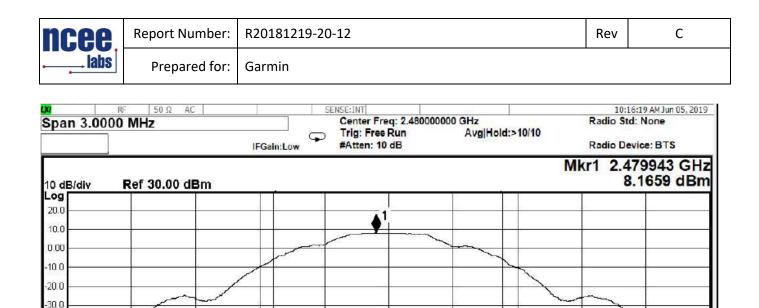
Figure 11 – Bandwidth, Low Channel, BT BR (GFSK)



Center 2.44 GHz #Res BW 100 kHz		#VBW 300 kHz		Span 3 MHz #Sweep 1 ms
Occupied Bandwidth 1.0680 MHz		Total Power 15.4 c		
Transmit Freq Error	-1.090 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	565.0 kHz	x dB	-6.00 dB	

Figure 12 - Bandwidth, Mid Channel, BT BR (GFSK)

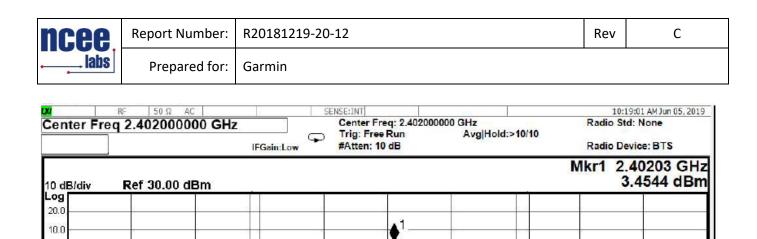
0.00 -10.0 -20.0 -30.0 -40.0



-50.0				
Center 2.48 GHz #Res BW 100 kHz				Span 3 MHz #Sweep 1 ms
Occupied Bandwidth		Total Power	15.1 dBm	
1.0	0704 MHz			
Transmit Freq Error	-4.166 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	573.6 kHz	x dB	-6.00 dB	

Figure 13 - Bandwidth, High Channel, BT BR (GFSK)

40.0



Center 2.402 GHz #Res BW 100 kHz		# VBW 300 kHz		Span 3 MHz #Sweep 1 ms
Occupied Bandwidt	h 3 <mark>091 MHz</mark>	Total Power	11.8 dBm	
Transmit Freq Error	8.032 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	1.083 MHz	x dB	-6.00 dB	

Figure 14 – Bandwidth, Low Channel, BT EDR 2MB

0.00 -10.0 -20.0 -30.0 -40.0

Report Number:		R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		
LXI R	RF 50 Ω AC	SENSE:INT	10	:17:48 AM Jun 05, 2019

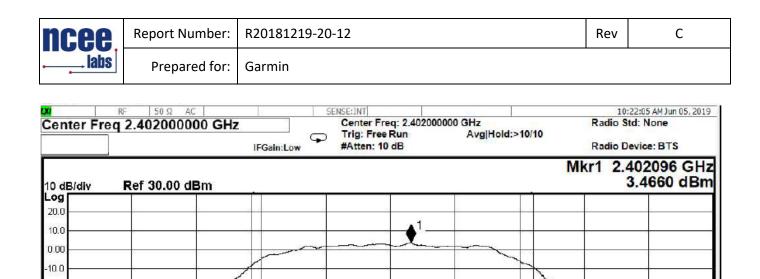
	IFGain:Low	Trig: Free Run #Atten: 10 dB	Avg Hold:>10/10	Radio Device: BTS
dB/div Ref 30.00 dBm				Mkr1 2.440027 GH 3.8783 dBr
9				
.0		1		_
0			\rightarrow	-
0		2 2		and the second second
0				
0			- 23	
0				
enter 2.44 GHz Res BW 100 kHz		#VBW 300 kHz		Span 3 Mł #Sweep 1 n
Occupied Bandwidth		Total Power	12.2 dBm	
	2787 MHz			
Transmit Freq Error	-2.543 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	1.077 MHz	x dB	-6.00 dB	

Figure 15 - Bandwidth, Mid Channel, BT EDR 2MB

ncee	Report Number:	R20181219-20-1	2		Rev	С
	Prepared for:	Garmin				
	K= 50 Ω AC	SENS	E:INT		10	:19:44 AM Jun 05, 2019
Center Freq	2.48000000 GHz		Center Freq: 2.4800000 Trig: Free Run	00 GHz Avg Hold:>10/10		itd: None

	IFGain:Low	#Atten: 10 dB		Ra	dio Device: BTS
) dB/div Ref 30.00 dBm	ŕ			Mkr1	2.480024 GH 3.2512 dBr
) g					
.0		▲ 1.			
0					
0					
0				-	
a	St.			And the second second	man annon
0					
0				-	
0					
enter 2.48 GHz					Span 3 MH
tes BW 100 kHz		#VBW 300 kHz			#Sweep 1 m
Occupied Bandwidth	1	Total Power	11.6 dBm		
1.2	2636 MHz				
Transmit Freq Error	-7.378 kHz	% of OBW Power	99.00 %		
x dB Bandwidth	1.080 MHz	x dB	-6.00 dB		

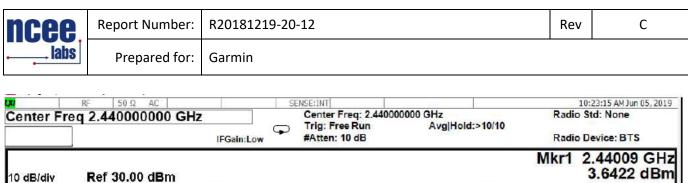
Figure 16 - Bandwidth, High Channel, BT EDR 2MB



-50.0				
Center 2.402 GHz #Res BW 100 kHz				Span 3 MHz #Sweep 1 ms
Occupied Bandwidth 1.3	n 3064 MHz	Total Power	12.0 dBm	
Transmit Freq Error	9.355 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	1.092 MHz	x dB	-6.00 dB	

Figure 17 – Bandwidth, Low Channel, BT EDR 3MB

-20.0 -30.0



9				25.5				
0	~~			~~		-		
D			2			÷		
	/		2		- Contraction of the second se	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~
1		2						
	0.9	8				-	-	
D		×		- 5 - 5		÷		
nter 2.44 GHz		#VBW 30	00 kHz			#	Span 3 #Sweep	
nter 2.44 GHz es BW 100 kHz	h	#VBW 30		12.2 dBm	n	#		
nter 2.44 GHz es BW 100 kHz Occupied Bandwidt	h 2827 MHz	10000-0010-234		12.2 dBn	n	#		
nter 2.44 GHz es BW 100 kHz Occupied Bandwidt		10000-0010-234		12.2 dBn 99.00 %		#		

Figure 18 - Bandwidth, Mid Channel, BT EDR 3MB

ncee.	Report Number:	R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		

AC 85 50 Ω AC Center Freq 2.480000000 G	Trig: I	SENSE:INT r Freq: 2.480000000 GH Free Run Avg H n: 10 dB	lz lold:>10/10	10:20:52 AM Jun Radio Std: Nor Radio Device:	ne
10 dB/div Ref 30.00 dBm			Mkr1	2.480084 3.4525	
20.0					
10.0					
0.00			\sim		
10.0					
20.0	20				54
30.0 processor from all and all all all all all all all all all al		2 2		and the second s	and the second second
40.0					
60.0					
Center 2.48 GHz #Res BW 100 kHz	#	VBW 300 kHz		Span #Sweep	
Occupied Bandwidth		Total Power	12.1	dBm	
1.2	795 MHz				
Transmit Freq Error	1.698 kHz	% of OBW Po	ower 99	.00 %	
x dB Bandwidth	1.105 MHz	x dB	-6.	00 dB	

Figure 19 - Bandwidth, High Channel, BT EDR 3MB



4.4 RADIATED EMISSIONS

Test Method: ANSI C63.10:2013:

- 1. Section 6.5, "Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz"
- Section 6.6, "Radiated emissions from unlicensed wireless devices above 1 GHz"
- 3. Section 11.11, "Measurement in nonrestricted frequency bands"
- 4. Section 11.12, "Emissions in restricted bands"

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 about requirement from FCC Part 15.247(d) and RSS-247, Section 5.5:

In addition to the limits shown above, all emissions were also required to be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. All measurements were performed with a 1 MHz bandwidth, but the bandwidth conversion from 1 MHz to 100 kHz would be equally applied to the highest emission and the spurious emissions, so it would not effect the delta measurement.

Since the fundamental emissions was at least 20 dB over the spurious emissions limits from 15.209 and all spurious emissions were below the 15.209 limit, this requirement was met.

NOTE:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level (dBuV/m) = 20 * log * Emission level (μ 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.



С

Rev

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.

h. Intermodulation products were investigated by measuring spurious emissions with each of the two 2.4 GHz radios running in parallel with the NFC radio. No intermodulation products were found above the labs system sensitivity.



Rev

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.

Test setup:

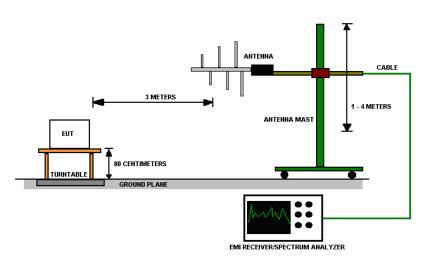


Figure 20 - Radiated Emissions Test Setup

EUT operating conditions

The EUT was powered by internal battery power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range on each indicated modulation.

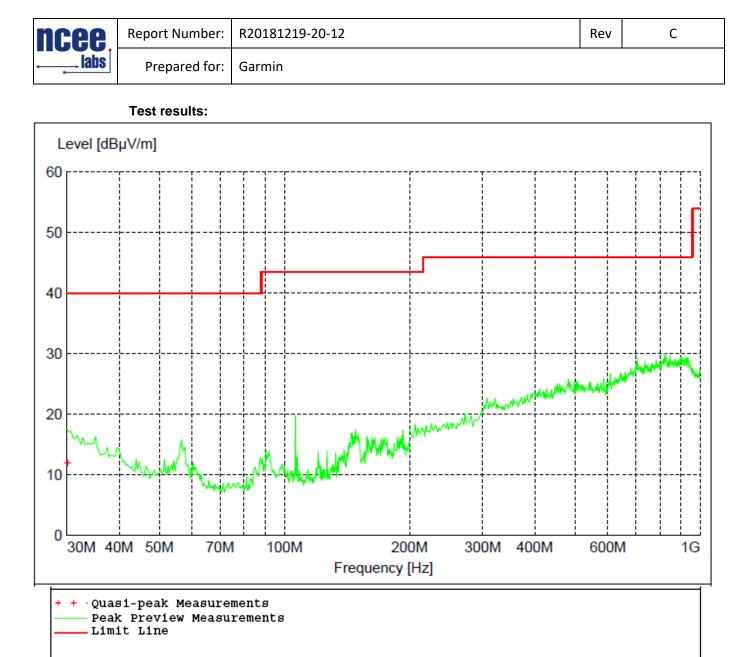


Figure 21 - Radiated Emissions Plot, Receive

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

Table 1 - Radiated Emissions Quasi-	peak Measurements, Receive
-------------------------------------	----------------------------

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
30.060000	11.82	40.00	28.18	246.00	4.00	VERT



Prepared for:

Garmin

С

Level [dBµV/m] 60 50 40 30 marther WWW WWW WWWWW 20 10 0 70M 200M 30M 40M 50M 100M 300M 400M 600M 1G Frequency [Hz] Quasi-peak Measurements . Peak Preview Measurements Limit Line

Figure 22 - Radiated Emissions Plot

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

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
39.720000	10.13	40.00	29.87	400.00	80.00	VERT
57.300000	10.79	40.00	29.21	100.00	123.00	VERT
106.260000	18.35	43.50	25.15	128.00	111.00	VERT

The Nebraska Center for Excellence in Electronics	
4740 Discovery Drive	
Lincoln, NE 68521	Page 34 of 70

2480.000000

104.55

NA

High

С

Rev

Table 3 - Radiated Emissions Average Measurements, BT BR (GFSK)								
Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel	
MHz	dBµV/m	dBµV/m	dB	cm.	deg.			
2402.000000	107.65	NA	NA	197.00	10.00	VERT	Low	
2440.000000	106.58	NA	NA	197.00	10.00	VERT	Mid	

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

197.00

10.00

VERT

NA

Table 4 - Radiated Emissions Peak Measurements, BT BR (GFSK)

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
2402.000000	108.41	NA	NA	197.00	10.00	VERT	Low
2440.000000	107.29	NA	NA	197.00	10.00	VERT	Mid
2480.000000	105.29	NA	NA	197.00	10.00	VERT	High

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

Table 5 - Radiated Emissions Average Measurements, BT EDR 2MB

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
2402.000000	100.22	NA	NA	197.00	10.00	VERT	Low
2440.000000	100.33	NA	NA	197.00	10.00	VERT	Mid
2480.000000	99.15	NA	NA	197.00	10.00	VERT	High

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

Table 6 - Radiated Emissions Peak Measurements, BT EDR 2MB

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
2402.000000	103.89	NA	NA	197.00	10.00	VERT	Low
2440.000000	103.77	NA	NA	197.00	10.00	VERT	Mid
2480.000000	102.85	NA	NA	197.00	10.00	VERT	High

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

Table 7 - Radiated Emissions Average Measurements, BT EDR 3MB

Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
2402.000000	100.14	NA	NA	197.00	10.00	VERT	Low
2440.000000	100.20	NA	NA	197.00	10.00	VERT	Mid
2480.000000	99.31	NA	NA	197.00	10.00	VERT	High
4804.200000	29.01	54.00	24.99	338.00	23.00	VERT	Low

The Nebraska Center for Excellence in Electronics
4740 Discovery Drive
Lincoln, NE 68521



Table 0 - Radiated Emissions Feak Measurements, DT EDR SMD							
Frequency	Level	Limit	Margin	Height	Angle	Pol	Channel
MHz	dBµV/m	dBµV/m	dB	cm.	deg.		
2402.000000	104.14	NA	NA	197.00	10.00	VERT	Low
2440.000000	104.15	NA	NA	197.00	10.00	VERT	Mid
2480.000000	103.1	NA	NA	197.00	10.00	VERT	High
4804.200000	43.43	74.00	30.57	338.00	23.00	VERT	Low

Table 8 - Radiated Emissions Peak Measurements, BT EDR 3MB



С

Prepared for: Garmin

4.5 **POWER SPECTRAL DENSITY**

Test Method: ANSI C63.10,

1. Section 11.10.2 "Method PKPSD (peak PSD)"

Limits of power measurements:

The maximum PSD allowed is 8 dBm.

Test procedures:

1. The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable.

2. The resolution bandwidth was set to 3 kHz and the video bandwidth was set to 10 kHz to capture the signal. The analyzer used a peak detector in max hold mode.

Test setup:

The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable on a bench top.

EUT operating conditions:

The EUT was powered by internal battery power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range on each indicated modulation.

Conducted measurements were performed because the direct RF connector was verified to have a good impedance match with low loss for this test.

Test results:

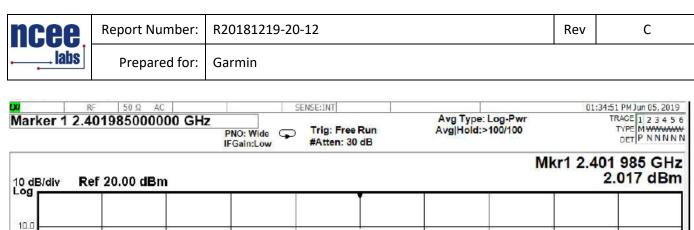


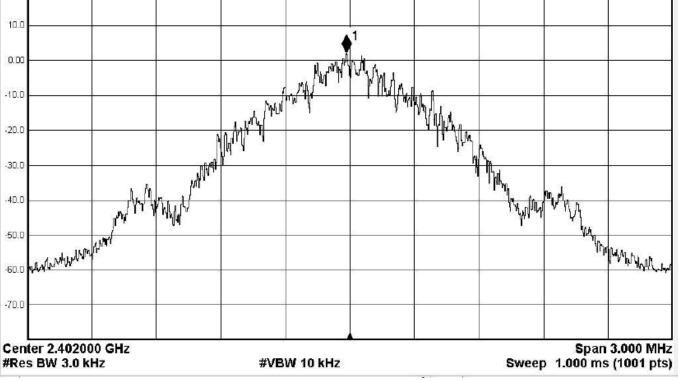
Prepared for: Garmin

		Fower 3	pectial Delisi	LY		
CHANNEL	MODE	CHANNEL FREQUENCY (MHz)	PEAK PSD(dBm)	Method	Limit (dBm)	RESULT
Low	BT BR	2402	2.02	Conducted	8.00	PASS
Middle	BT BR	2440	1.38	Conducted	8.00	PASS
High	BT BR	2480	2.69	Conducted	8.00	PASS
Low	BT EDR 2MB	2402	-10.66	Conducted	8.00	PASS
Middle	BT EDR 2MB	2440	-10.54	Conducted	8.00	PASS
High	BT EDR 2MB	2480	-10.56	Conducted	8.00	PASS
Low	BT EDR 3MB	2402	-10.24	Conducted	8.00	PASS
Middle	BT EDR 3MB	2440	-10.30	Conducted	8.00	PASS
High	BT EDR 3MB	2480	-10.05	Conducted	8.00	PASS

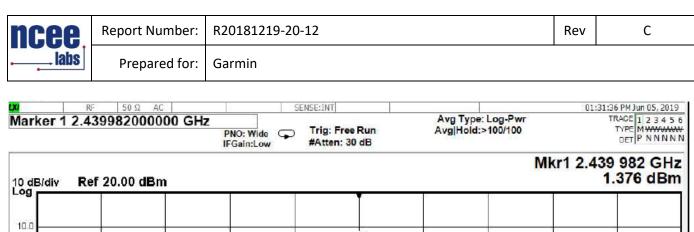
Power Spectral Density

Rev









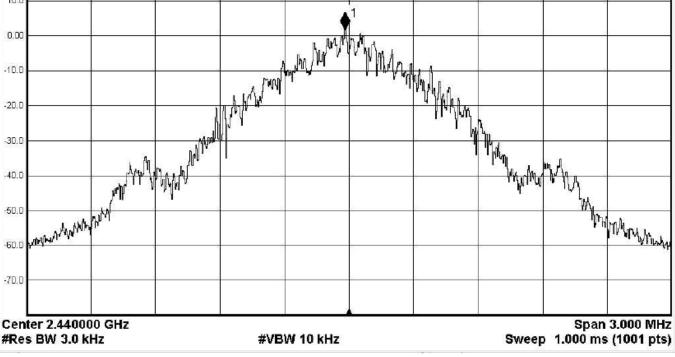
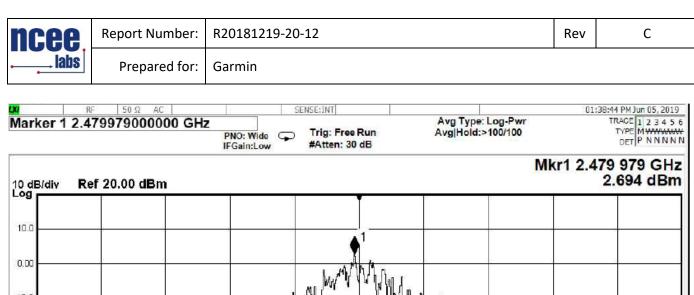


Figure 24 - Power Spectral Density, Mid Channel, BT BR (GFSK)



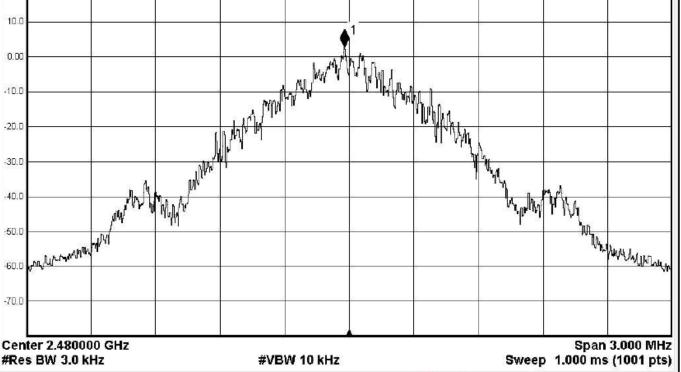
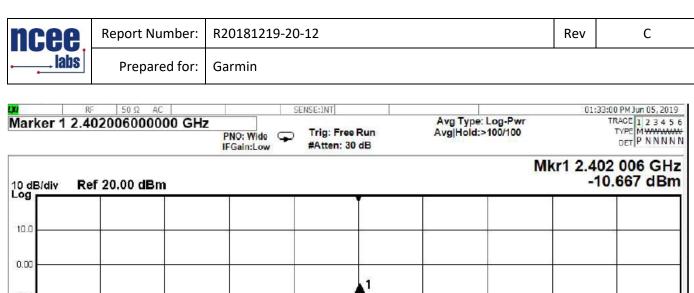


Figure 25 - Power Spectral Density, High Channel, BT BR (GFSK)



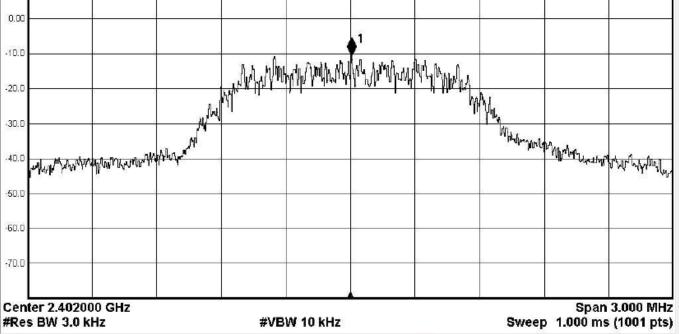
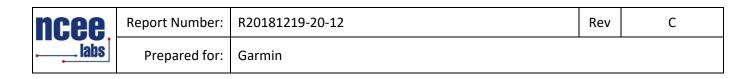


Figure 26 - Power Spectral Density, Low Channel, BT EDR 2MB



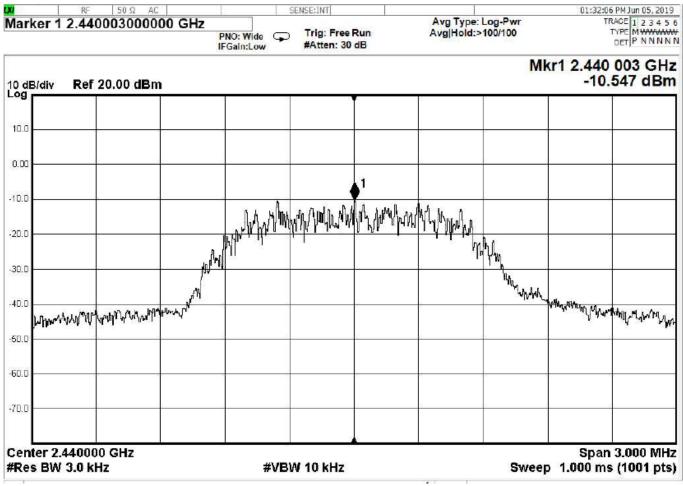
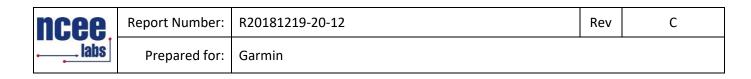


Figure 27 - Power Spectral Density, Mid Channel, BT EDR 2MB



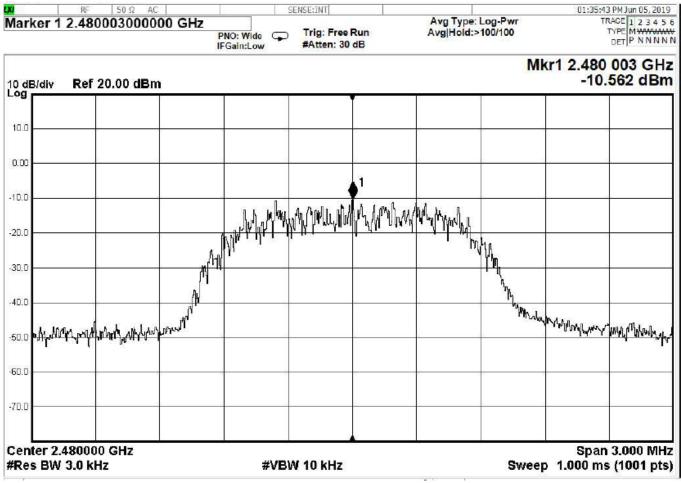
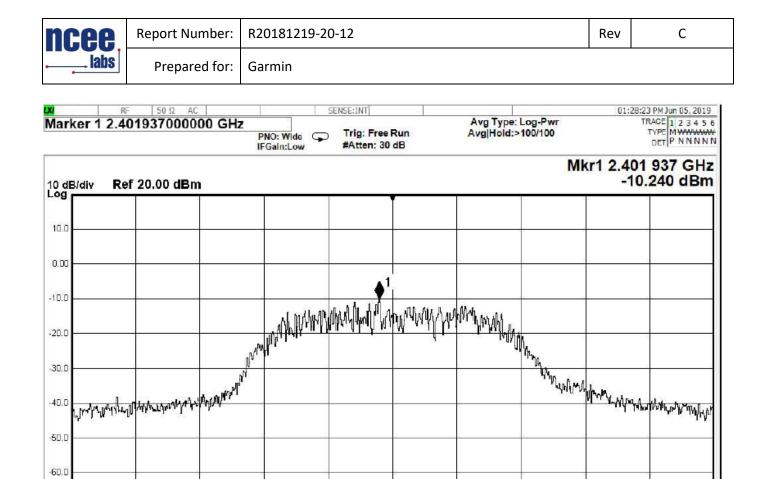


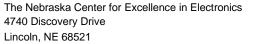
Figure 28 - Power Spectral Density, High Channel, BT EDR 2MB



Who want

Span 3.000 MHz

Sweep 1.000 ms (1001 pts)



-1D.D

-20.0

-30,D

-40.0

-50.0

-60.0

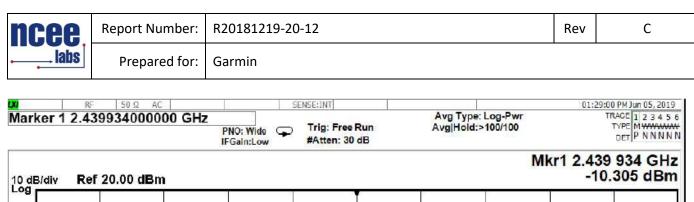
-70.0

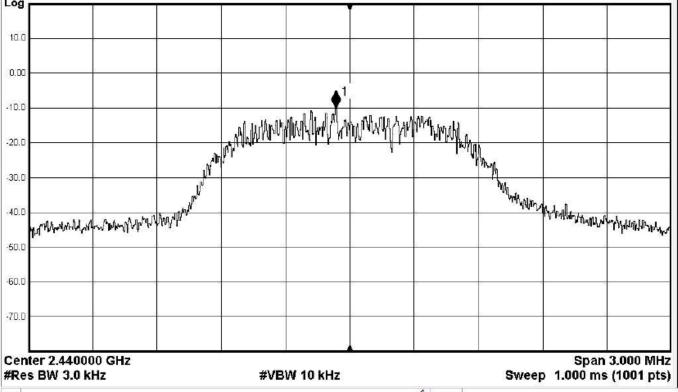
Center 2.402000 GHz

#Res BW 3.0 kHz

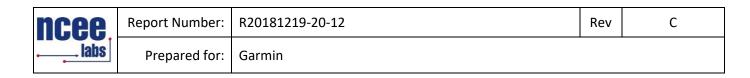
#VBW 10 kHz

Figure 29 - Power Spectral Density, Low Channel, BT EDR 3MB









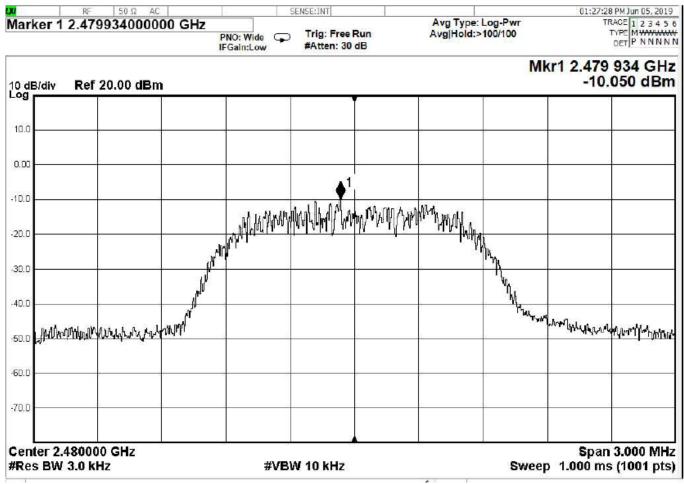


Figure 31 - Power Spectral Density, High Channel, BT EDR 3MB



Rev

С

4.5 BAND EDGES

Test Method: ANSI C63.10-2013, Section(s) 6.10.5

Limits of bandedge measurements:

For emissions outside of the allowed band of operation, the emission level needs to be 20dB 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:

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 resolution bandwidth was set to 100kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a peak detector. The highest emissions level beyond the bandedge was measured and recorded. All band edge measurements were evaluated to the general limits in Part 15.209.

To calculate the level at the bandedge frequencies, the difference between the peak and the band edge level was subtracted from the peak radiated value at the fundamental. This value was compared to the 15.209 radiated limits for compliance.

Deviations from test standard:

No deviation.

Test setup:

The field strength was measured by connecting the EUT directly to the spectrum analyzer.

EUT operating conditions:

The EUT was powered by internal battery power unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range on each indicated modulation.



Prepared for: Garmin

Tes	at results:						
CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level dBm	Relative Fundamental dBm	Delta (dB)	Min Delta (dB)	Result
Low, Continuous (restricted)	BT BR (GFSK)	2390	-56.97	13.13	70.10	54.41	PASS
High, Continuous (restricted)	BT BR (GFSK)	2483.5	-51.74	12.85	64.59	51.29	PASS
Low, Continuous (unrestricted)	BT BR (GFSK)	2400	-43.88	13.13	57.01	30.00	PASS
High, Continuous (unrestricted)	BT BR (GFSK)	2483.5	-52.52	12.85	65.37	30.00	PASS

*Minimum delta = [highest fundamental peak field strength from Section 4.2] – [Part 15.209 radiated emissions limit.]

From Section 4.2

Fundamental peak field strength at Low Channel BT BR (GFSK) = 108.41 dB μ V/m Fundamental peak field strength at High Channel BT BR (GFSK) = 105.29 dB μ V/m

Low Channel minimum delta BT BR (GFSK) = $108.41 - 54.0 \text{ dB}\mu\text{V/m} = 54.41 \text{ dBc}$ High Channel minimum delta BT BR (GFSK) = $105.29 - 54.0 \text{ dB}\mu\text{V/m} = 51.29 \text{ dBc}$ Rev

ncee.	Report Number:	R20181219-20-12	Rev	С
	Prepared for:	Garmin		

RF Narker 1 2.38384		SENSE:I	nt g: Periodic	Avg Typ Avg Hold	e: Log-Pwr :>100/100	03:22:1 T	6 PM Jun 05, 2019 RACE 1 2 3 4 5 TYPE M WWWW DET P N N N N
0 dB/div Ref 20.0	IFGa	in:Low Att	en: 30 dB			Mkr1 2.38 -56	
og 10.0			82 6. N	6			20
0.0							
D.D D.D							
0.0		1					
0.0 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	and american	man	4-000 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ne and the second	An and the second se	<u>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</u>	-1176-00-00
art 2.380000 GH: Res BW 100 kHz	z	#VBW 30	0 kHz		Swe	Stop 2.3 ep 1.000 m	390000 GI s (1001 pi
R MODE TRC SCL 1 N 1 f 2 3	x 2.383 84 GHz	Ƴ -56.977 dBm	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
4 5 6 7							
8 9 0 1							

Figure 32 - Band-edge Measurement, Low Channel, Restricted Frequency, Peak

cee.	Report	Number: R	20181219-20-1	2			Rev	С
labs	Prep	oared for: G	armin					
	RF 50Ω	AC.	SENS	SE:INT			03:24:	18 PM Jun 05, 2
rker 1 2.4	0216475	50000 GHz		Trig: Periodic Atten: 30 dB	Avg Type Avg Hold	:: Log-Pwr :>100/100		TYPE MWWW DET P N N N
dB/div R	ef 20.00 c					M	lkr1 2.402 13	2 165 G
	01 20100 0							
]								5
			-		5		<u></u>	1/
)	- C	34				-		1
)	25	20			ø	18		\checkmark
2					5		∆3∆1 ∫	-
					12	0	X m	
1			Manana and marking	and the second and the second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	and the second s		8
	and a start of the			208				-
j			* *				-	
rt 2.3900	0 GHz		5 (A)	^	2 2		Stop 2.	402350 G
es BW 10			#VBW :	300 kHz		Swee	ep 1.000 m	
MODE TRC S	CL	× 2.402 165 GHz	13.127 dB	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
Δ1 1 1	(Δ)	-2.165 MHz	(Δ) -57.011 d	B				
N 1 1		2.400 000 GHz	-43.884 dB	m				
				-				
a a a	1							

Figure 33 - Band-edge Measurement, Low Channel, Fundamental, Peak

cee	Rep	ort Number: F	20181219-20-12				Rev	С
labs] P	Prepared for: 0	Garmin					
	RF	50 Ω AC	SENSE:	NT			03:36:	30 PM Jun 05, 2
rker 1 2.	48406	1000000 GHz		g: Periodic ten: 30 dB		be: Log-Pwr d:>100/1 <mark>00</mark>		TYPE MWWW DET P N N I
B/div I	Ref 20.(00 dBm				Mkr1		061 0 G
0								
		20						
D.	÷.				2			-
0	6				Ø	34		Se.
)					10			
				7	1			-
mon	mar	hand and all soon				12 12 1911 - 1912		94
D.	- 266-25	Se astracty (marrian	and and here and	men langer	Re- morrow Manager Par	all all and the second s	aran ang ang ang ang ang ang ang ang ang a
0	-							
rt 2.483	500 GH2	7	SI SI		01		Stop 2.	500000 G
es BW 10		-	#VBW 30	0 kHz		Sweep		is (1 001 p
MODE TRC	SCL	× 2.484 061 0 GH	z -51.742 dBm	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE	
		2.464 001 0 Gr	-01./42 UDIII	-				
				2 2				
5 7 3			-					

Figure 34 - Band-edge Measurement, High Channel, Restricted Frequency, Peak

10

Cee,	Report Number	: R20181219-2	0-12			Rev	С
labs	Prepared for	: Garmin					
R	F 50 Ω AC		SENSE:INT			03:31	36 PM Jun 05, 201
arker 1 2.4	79992000000 G	Hz PNO: Wide	Trig: Periodic Atten: 30 dB	Avg Type Avg Hold	: Log-Pwr :>100/100		TRACE 1 2 3 4 TYPE MWWW DET P N N N
dB/div R	ef 20.00 dBm	2010 Setu Called Localado			M		9 992 GH .845 dB
	~ !			0			2
				5			
0		~			0		-
0				0		-	- 24
0						-	
0			John Marian	man mana			24
0				and the second second	- v- ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	hann	mm
D					1	1	- 61
.0							
art 2.47950 es BW 100		#VB	W 300 kHz		Swee		483500 Gi is (1 001 pi
MODE TRC SO		Y	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	
N 1 f	(Δ) 3.50	8 MHz (Δ) -65.37	1 dB	S			
N 1 f	2.483 50	0 GHz -52.527	dBm				

Figure 35 - Band-edge Measurement, High Channel, Fundamental, Peak



Rev

Prepared for: Garmin

CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level dBm	Relative Fundamental dBm	Delta (dB)	Min Delta (dB)	Result
Low, Continuous (restricted)	BT EDR 2MB	2390	-57.43	3.31	60.74	49.89	PASS
High, Continuous (restricted)	BT EDR 2MB	2483.5	-50.75	3.33	54.08	48.85	PASS
Low, Continuous (unrestricted)	BT EDR 2MB	2400	-33.30	3.31	36.61	30.00	PASS
High, Continuous (unrestricted)	BT EDR 2MB	2483.5	-50.15	3.33	53.48	30.00	PASS

*Minimum delta = [highest fundamental peak field strength from Section 4.2] – [Part 15.209 radiated emissions limit.]

From Section 4.2

Fundamental peak field strength at Low Channel BT EDR 2MB = 103.89 dB μ V/m Fundamental peak field strength at High Channel BT EDR 2MB = 102.85 dB μ V/m

Low Channel minimum delta BT EDR 2MB = $103.89 - 54.0 \text{ dB}\mu\text{V/m} = 49.89 \text{ dBc}$ High Channel minimum delta BT EDR 2MB = $102.85 - 74.0 \text{ dB}\mu\text{V/m} = 48.85 \text{ dBc}$

ncee.	Report Number:	R20181219-20-12	Rev	С
. labs	Prepared for:	Garmin		

XI RF	50 Ω AC	SENSE: INT		03:09:04 PM Jun 05, 2019
Marker 1 2.38013	0000000 GHz PNO: Wide (IFGain:Low	Trig: Periodic Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N
10 dB/div Ref 20.0	00 dBm		Mkr	1 2.380 13 GHz -57.439 dBm
10.0				
0.00				-
10.0				
20.0	_			
30.0	_		- <u>-</u>	
4D.D		-		-
50.0 1				-
50.0 Arran tor	man marsh - 191 and marsh - Upthe	and	iles and and a share and a share and a	- and many and many
70.0			×	
Start 2.380000 GH Res BW 100 kHz		W 300 kHz		Stop 2.390000 GHz .000 ms (1001 pts)
MKR MODE TRC SCL	2.380 13 GHz	-57.439 dBm	FUNCTION FUNCTION WIDTH	
2				
4 5 6				
6				· · ·

Figure 36 - Band-edge Measurement, Low Channel, Restricted Frequency, Peak

ncee.	Report Number:	R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		

			0Ω AC		÷	-	SENSE:1	TI								17 PM Jun 0	
rke r 2	2Δ	-2.024	567444	1	PNO: F FGain:l] ast Ģ⊃ Low		: Period en: 30 d			Avg T Avg H	ype: Log old:>100/	-Pwr 100			TYPE MW DET P N	MWW
B/div	R	ef 20.0	0 dBm											ΔM		2.025 36.601	
			-								<u></u>					^1	
					-									_	-/		
		35												241	1		
											1 and the second		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	3		-	
~										· ·····	20						
) 	^~~~	~~~~~	<u></u>	Cm Alman	nn	مسمامتهم		m		- Andrewson		84					
	~~~~			ᡣᢍᠰᡗ᠆᠆ᠬ	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	marlana	and a construction									5 	
rt 2.3		00 GHz		<u>^~~</u> ~~	<u></u>		W 300	) kHz	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	~~~~			Swee	Si ep 1.0	top 2.4 000 m	402814 s (1001	GP
rt 2.3 s BW	V 10	00 GHz 0 kHz	×			#VB)		) kHz	TION	FUNCT			2000-2010/2007	ep 1.0	top 2.4 000 m	402814 s (1001	Gp
Int 2.3 es BW	V 10 TRC S	00 GHz 0 kHz CL	× 2.40	02 019 GHz		#VB) 3,309	dBm	Nessonar 1	TION	FUNCT	ION WIDTH		2000-2010/2007	ep 1.0	000 m	402814 s (1001	G
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT	ION WIDTH		2000-2010/2007	ep 1.0	000 m	402814 s (1001	G
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz	(Δ)	#VB) 3,309	dBm 1 dB	Nessonar 1	TION	FUNCT	ION WIDTI-		2000-2010/2007	ep 1.0	000 m	402814 s (1001	Gi
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT			2000-2012/2017	ep 1.0	000 m	402814 s (1001	GI
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT			2000-2012/2017	ep 1.0	000 m	402814 s (1001	GI
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT			2000-2012/2017	ep 1.0	000 m	402814 s (1001	G
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT	ION WIDT-		2000-2012/2017	ep 1.0	000 m	402814 s (1001	G
rt 2.3 es BW	V 10 TRG 9 1	00 GHz 0 kHz f f (Δ)	× 2.40	02 019 GHz -2.025 MHz	(Δ)	#VB) ¥ 3.309 -36.60	dBm 1 dB	Nessonar 1	TION	FUNCT			2000-2012/2017	ep 1.0	000 m	402814 s (1001	G

Figure 37 - Band-edge Measurement, Low Channel, Fundamental, Peak

cee.	Report Numbe	er: R2018121	9-20-12			Rev	С
labs	Prepared fo	or: Garmin					
	F 50 Ω AC		SENSE:INT				39 PM Jun 05, 2
ker 1 2.4	83566000000	GHZ PNO: Fast IFGain:Low	Trig: Perio Atten: 30	dic A	vg Type: Log-Pwr /g Hold:>100/100	1	TYPE MWW DET PNN
B/div R	ef 20.00 dBm				Mki	1 2.483 5	566 0 G
							1
	o.c. 8			-			
				0		-	
						-	-
1				2		-	0
mon						- 6	94
		waare and a water	an a	have bar and the second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	-	n when
t 2.48350 s BW 100		#	VBW 300 kHz	ł	Swee	Stop 2.3 p 1.000 m	500000 0 s (1001
MODE TRC SO				CTION FUNCTION V	NIDTH	FUNCTION VALUE	
NII	2.483 56	6 U GHZ -5U	.753 dBm				
	2						

Figure 38 - Band-edge Measurement, High Channel, Restricted Frequency, Peak

Prepared for:         Garmin           Inter 3 2.483500000000 GHz         SENSE:INT         03:27:49 PM Jm 00           Inter 3 2.483500000000 GHz         Trig: Periodic Atten: 30 dB         Avg Type: Log-Pwr AvgIHoid:>100/100         Trie: Priodic Atten: 30 dB           Image: Sense: Introduct atten: 30 dB         Mkr3 2.483 500 0         October 100         Trie: Priodic Atten: 30 dB           Image: Sense: Introduct atten: 30 dB         Mkr3 2.483 500 0         October 100         Trie: Priodic Atten: 30 dB           Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         Mkr3 2.483 500 0         -50.150 c           Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         -50.150 c           Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         -50.150 c           Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         -50.150 c           Image: Sense: Introduct atten: 30 dB         -50.150 c           Image: Sense: Introduct atten: 30 dB         Image: Sense: Introduct atten: 30 dB         Image: Sense: Sense: Introduct atten: 30 dB         -50.150 c	Inbs         Prepared for:         Garmin           R         50 Ω         AC         SENSE:INT         03:27:19 PM Jun 05.           Ker 3 2.483500000000 GHz         Trig: Periodic         Avg Type: Log-Pwr Avg Hold:>100/100         Trig: Periodic           B/div         Ref 20.00 dBm         Garmin         Mkr3 2.483 500 G           B/div         Ref 20.00 dBm         -50.150 dI           Image: Compared for:         1         Image: Compared for:         2           Image: Compared for:         1         Image: Compared for:         Compared for:         Compared for:           Image: Compared for:         Image: Compared for:         Image: Compared for:         Compared for:         Compared for:         Compared for:           Image: Compared for:         Image: Compared for:         Image: Compared for:         Image: Compared for:         Com	cee,	Report Numbe	r: R20181219-20	)-12			Rev	С
International system         Avg Type: Log-Pwr Avg Hold:>100/100         Trace 1   2 Type: Log-Pwr Avg Hold:>100/100         Trace 1   2 Type: Log-Pwr Avg Hold:>100/100         Trace 1   2 Type: Log-Pwr Avg Hold:>100/100           dB/div         Ref 20.00 dBm         -50.150 c         -50.150 c           0         1         -50.150 c         -50.150 c           0         -1         -1         -1         -1           0         -1         -1         -1         -1           0         -1         -1         -1         -1         -1           0         -1         -1         -1         -1         -1           0         -1         -1         -1         -1         -1           0         -1         -1         -1 </td <td>ker 3 2.483500000000 GHz         PNO: Wide IFGain:Low         Trig: Periodic Atten: 30 dB         Avg Type: Log-Pwr Avg Hold:&gt;100/100         Trig: Operation Type: Log-Pwr Avg Hold:&gt;100/100           B/div         Ref 20.00 dBm        </td> <td></td> <td>Prepared fo</td> <td>r: Garmin</td> <td></td> <td></td> <td></td> <td></td> <td></td>	ker 3 2.483500000000 GHz         PNO: Wide IFGain:Low         Trig: Periodic Atten: 30 dB         Avg Type: Log-Pwr Avg Hold:>100/100         Trig: Operation Type: Log-Pwr Avg Hold:>100/100           B/div         Ref 20.00 dBm		Prepared fo	r: Garmin					
PNO: Wide IF Gain:Low         Trig: Periodic Atten: 30 dB         Avg Hold:>100/100         Type[Mw orr P: N           dB/div         Ref 20.00 dBm         -50.150 d         -50.150 d           0         1         -         -         -50.150 d           0         1         -         -         -         -           0         1         -         -         -         -         -           0         1         -         -         -         -         -         -           0         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         - <td>PNO: Wide IF Gain:Low         Trig: Periodic Atten: 30 dB         Avg Hold:&gt;100/100         Trig: Pinn DEP NN           B/div         Ref 20.00 dBm         -50.150 dI         -50.150 dI           1         1         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -</td> <td>1</td> <td>RF 50 Ω AC</td> <td></td> <td>ENSE:INT</td> <td></td> <td></td> <td>03:27:4</td> <td>9 PM Jun 05, 20</td>	PNO: Wide IF Gain:Low         Trig: Periodic Atten: 30 dB         Avg Hold:>100/100         Trig: Pinn DEP NN           B/div         Ref 20.00 dBm         -50.150 dI         -50.150 dI           1         1         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	1	RF 50 Ω AC		ENSE:INT			03:27:4	9 PM Jun 05, 20
dB/div         Ref 20.00 dBm         -50.150 d           0         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1<	B/div Ref 20.00 dBm -50.150 dB 1 1	rker 3 2.4	83500000000 G	PNO: Wide		Avg Type: Avg Hold:>	Log-Pwr 100/100	т	TYPE MWWW DET PNNN
Number         Construction	Image: Non-Line         Image: No	Bidiv R	ef 20.00 dBm	2000 12 40 40 40 40 10 200	CONTRACTOR OF CONTRACTOR		Mk		
Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ	Image: Non-State         Control Non-State				1				
Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ         Δ	Image: Non-State         Control Non-State	0 04 02	- Lana						
MODE         TRC         Science         Stop 2.483500           A1         1         1         1         1	Image: Non-State         Control Non-State	3							
MODE         TCI SCI         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         1         2.480 020 GHz         3.332 dBm         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 </td <td>Image: Non-State         Control Non-State</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>с в.</td> <td></td> <td>8</td>	Image: Non-State         Control Non-State						с в.		8
Image: state	Image: Non-State         Control Non-State			mana		¢			
MODE         TRC         Stop         2.483500           Λ         1         1         2.480 020 GHz         3.332 dBm           Λ         1         1         2.480 020 GHz         3.332 dBm	Image: state	22			X . 2000	man .			121
Mode         X         Y         Function         Function         Width         Function         Function         Width         Function         Value         Function         Function         Value         Function         Function <t< td=""><td>S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION</td><td></td><td></td><td>6 (C)</td><td>2</td><td>A COMPANY</td><td>monorman</td><td>and the second second</td><td>2.</td></t<>	S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION			6 (C)	2	A COMPANY	monorman	and the second second	2.
Mode         TRC Sci         X         Y         Function         Function         Function         Function         Function         Value           N         1         f         2.480 020 GHz         3.332 dBm         53.481 dB         54.480 mHz         55.480 mHz <td< td=""><td>S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION</td><td></td><td>-</td><td>6 %</td><td></td><td>¢ .</td><td>i i</td><td></td><td></td></td<>	S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION		-	6 %		¢ .	i i		
Int 2.479500 GHz         Stop 2.483500           es BW 100 kHz         #VBW 300 kHz         Sweep 1.000 ms (1001           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         A480 MHz (Δ)         -53.481 dB         -53.481 dB         A480 MHz (Δ)         -53.481 dB         -53.481 dB         -53.481 dB         -53.481 dB         -53.481 dB	S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION	10							1
es BW 100 kHz #VBW 300 kHz Sweep 1.000 ms (1001 MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE N 1 f 2.480 020 GHz 3.332 dBm Δ1 1 f (Δ) 3.480 MHz (Δ) -53.481 dB N 1 f 2.483 500 GHz -50.150 dBm	S BW 100 kHz         #VBW 300 kHz         Sweep         1.000 ms (1001 ms)           MODE TRG SQL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480 020 GHz         3.332 dBm         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           Δ1         1         f         (Δ)         -53.481 dB         FUNCTION         FUNCTION	D:	-						
MODE         TRC         SCL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480         020         GHz         3.332         dBm         6           Δ1         1         f         (Δ)         3.480         MHz         (Δ)         -53.481         dB         6	MODE         TRC         SCL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE           N         1         f         2.480         020         GHz         3.332         dBm         6           Δ1         1         f         (Δ)         3.480         MHz         (Δ)         -53.481         dB         6				•		A	Stop 2.4	83500 G
N         1         f         2.480 020 GHz         3.332 dBm           Δ1         1         f         (Δ)         3.480 MHz         (Δ)         -53.481 dB	N         1         f         2.480 020 GHz         3.332 dBm           Δ1         1         f         (Δ)         3.480 MHz         (Δ)         -53.481 dB	es BW 100	) kHz	#VB\	V 300 kHz		Sweep	1 <b>.00</b> 0 m	s (1 <b>001</b> p
Δ1 1 f (Δ) 3.480 MHz (Δ) -53.481 dB	Δ1 1 f (Δ) 3.480 MHz (Δ) -53.481 dB			Y 2220		FUNCTION WIDTH	FU	NCTION VALUE	
N 1 f 2.483 500 GHz -50.150 dBm	N 1 f 2.483 500 GHz -50.150 dBm			80 MHz (Δ) -53.48	1 dB	9			
		Δ1 1 f		00.011	Das	2			
		Δ1 1 f	2.483 5	00 GHZ -50.150	mac	9			

Figure 39 - Band-edge Measurement, High Channel, Fundamental, Peak



Rev

Prepared for: Garmin

CHANNEL	Mode	Band edge /Measurement Frequency (MHz)	Relative Highest out of band level dBm	Relative Fundamental dBm	Delta (dB)	Min Delta (dB)	Result
Low, Continuous (restricted)	BT EDR 3MB	2390	-57.30	3.40	60.70	50.14	PASS
High, Continuous (restricted)	BT EDR 3MB	2483.5	-50.06	3.18	53.24	49.10	PASS
Low, Continuous (unrestricted)	BT EDR 3MB	2400	-33.40	3.40	36.80	30.00	PASS
High, Continuous (unrestricted)	BT EDR 3MB	2483.5	-52.80	3.18	55.98	30.00	PASS

*Minimum delta = [highest fundamental peak field strength from Section 4.2] – [Part 15.209 radiated emissions limit.]

### From Section 4.2

Fundamental peak field strength at Low Channel BT EDR 3MB = 104.14 dB $\mu$ V/m Fundamental peak field strength at High Channel BT EDR 3MB = 103.10 dB $\mu$ V/m

Low Channel minimum delta BT EDR 3MB =  $104.14 - 54.0 \text{ dB}\mu\text{V/m} = 50.14 \text{ dBc}$ High Channel minimum delta BT EDR 3MB =  $103.10 - 54.0 \text{ dB}\mu\text{V/m} = 49.10 \text{ dBc}$ 

ncee.	Report Number:	R20181219-20-12	Rev	С
	Prepared for:	Garmin		

KF 50	0 Ω AC	SENSE: IN			03:15:54 PM Jun 05, 2019
Marker 1 2.389740	0000000 GHz PNO: Wide IFGain:Low	Trig: Periodic Atten: 30 dB		ype: Log-Pwr old:>100/100	TRACE 1 2 3 4 5 0 TYPE M
10 dB/div Ref 20.0	0 dBm			Mkr	1 2.389 74 GHz -57.296 dBm
Log					
10.0					6.
0.00					
-10.0			-		
-20.0					
-30.D		_			
-40.0					
-50.0					<b>_</b> 1
.60.0			manager	ware mary and	
-70.0			- 25 - 15 - 16 	1995 (2006) VIIIS	5 ki ki (1997)
Start 2.380000 GHz #Res BW 100 kHz		3W 300 kHz			top 2.390000 GHz 000 ms (1001 pts)
MKR MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1 N 1 f	2.389 74 GHz	-57.296 dBm			
2					
4	2 ×	2			
5				-	
6 7 8 9 10					
8					
9	24			55	
10					
	d			t	

Figure 40 - Band-edge Measurement, Low Channel, Restricted Frequency, Peak

ICEE		Report Number: F	20181219-20-12				Rev	С
lab	S	Prepared for: 0	Garmin					
	RF	50 Ω AC	SENSE:II	UT			02:15:	17 PM Jun 05.
arker 1		2083336074 GHz	PNO: Fast C Trig	: Periodic en: 30 dB	Avg Ty Avg Hol	pe: Log-Pwr d:>100/100		TYPE MWA
dB/div	Ref	20.00 dBm				M	lkr1 2.402 3	2 083 G .398 d
<b>og</b> 0.0				· · · ·				<b>1</b>
).00		c			5		5.	~
0.0								
0.0								
IO. D						0	341mm	2 ()
0.0							1	
50.0					m			
0.0	m	m	mon					-
70.0								
0.0								
tart 2.39 Res BW			#VBW 30	0 kHz		Swee	Stop 2.4 ep 1.000 m	402814 ( s (1001
KR MODE TR		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
1 N 1 2 Δ1 1	f	2.402 083 GH (Δ) -2.083 MH						
3 N 1	f	2.400 000 GH						
5								
6								
8	11							

Figure 41 - Band-edge Measurement, Low Channel, Fundamental, Peak

10

cee.	Report Num	nber: R2	20181219-20	)-12				Rev	С
labs	Preparec	for: G	armin						
1	RF 50Ω AC			ENSE:INT				03:38	24 PM Jun 05, 20
	8350000000		PNO: Fast	Trig: Pe Atten: 3	riodic 30 dB	Avg Type Avg Hold:	Log-Pwr 100/100		TRACE 1 2 3 4 TYPE MWWW DET P N N N
B/div R	ef 20.00 dBm						Mkr	1 2.483 -50	500 0 GI
]						5	10		
):									
							0. 		-
1							0	-	-
km.	-				2		14		
) how we want	Mary mary solars				man man	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	· ·····		-
i <u> </u>	-		-		-			-	-
rt 2.48350	10 GHz					1		Stop 2	500000 GI
es BW 100			#VB\	V 300 ki	łz		Swee	p 1.000 m	is (1001 p
MODE TRC SO			Y			FUNCTION WIDTH		FUNCTION VALUE	
N 1 f	2.483	500 0 GHz	-50.069	Bm	0				
0 0 0	54 5 *		54 55		0	75 			
			5 A.	-	1	-			
				-	8				

Figure 42 - Band-edge Measurement, High Channel, Restricted Frequency, Peak

Report Number:	R20181219-	20-12				Rev	С
Prepared for:	Garmin						
		SENSE:INT					46 PM Jun 05, 20:
30088000000 GH							TYPE MWWW DET P N N N
f 20.00 dBm			1.000 C		Mk		0 088 GH
1			1				
		_		5		-	
	mark and a second secon						
	Nonnan						
	1.15	www.w.	homme -				
	12		1	and more way was not	wwwww	man .	2Δ
		20		0			AL NOW - ACH
1 1							
+ +		6	20 22 N	-			
	#V	BW 300 kH	<u> </u>	2	Sweep		483500 GI is (1 <b>001</b> pi
	Y		NCTION FUN	CTION WIDTH	FL	INCTION VALUE	
		6 dBm 981 dB	0				
			1				
2.483 500	0 GHz -52.80	5 dBm		20			
	Prepared for: 50 Ω AC B0088000000 GF f 20.00 dBm f 20.00 dBm 0 GHz kHz X	Prepared for: Garmin	Prepared for: Garmin SO Ω AC SENSE:INT B0088000000 GHz PNO: Wide FOR Atten: 30 F 20.00 dBm f 20.00	Prepared for: Garmin	Prepared for: Garmin SO Ω AC BOO88000000 GHz PNO: Wide Trig: Periodic Avg Type: Avg Type: AvgHold:: F 20.00 dBm f 20.	Prepared for: Garmin           S0.02         AC         SENSE:INT         Avg Type: Log-Pwr           B0088000000 GHz         PNO: Wide         Trig: Periodic         Avg Hold:>100/100           F6 20.00 dBm         Mile         Mile         Mile           f 20.00 dBm	Prepared for: Garmin BOO88000000 GHZ PNO: Wide IFGain:Low Trig: Periodic Atten: 30 dB Mkr1 2.484 520.00 dBm Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 Mkr1 2.484 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100 100/100

					-
27		•	e e	>	
	- 2				4
	-				

Figure 43 - Band-edge Measurement, High Channel, Fundamental, Peak



# 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)			
	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:**

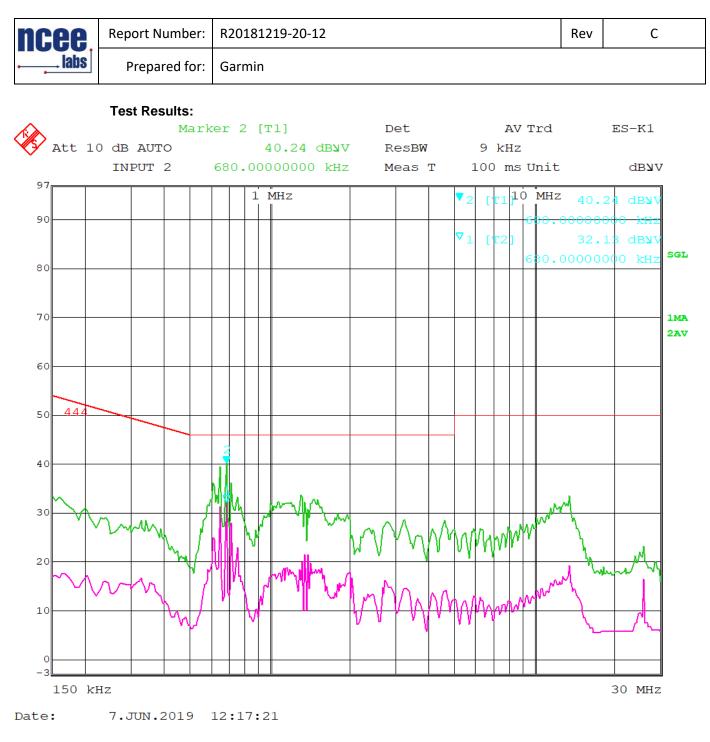
No deviation

### EUT operating conditions:

The EUT was powered by 5 VDC unless specified and set to transmit continuously on the middle channel. To produce the highest possible emissions, the WiFi mode that produced the highest output power was set to transmit simultaneously as well as the NFC radio.

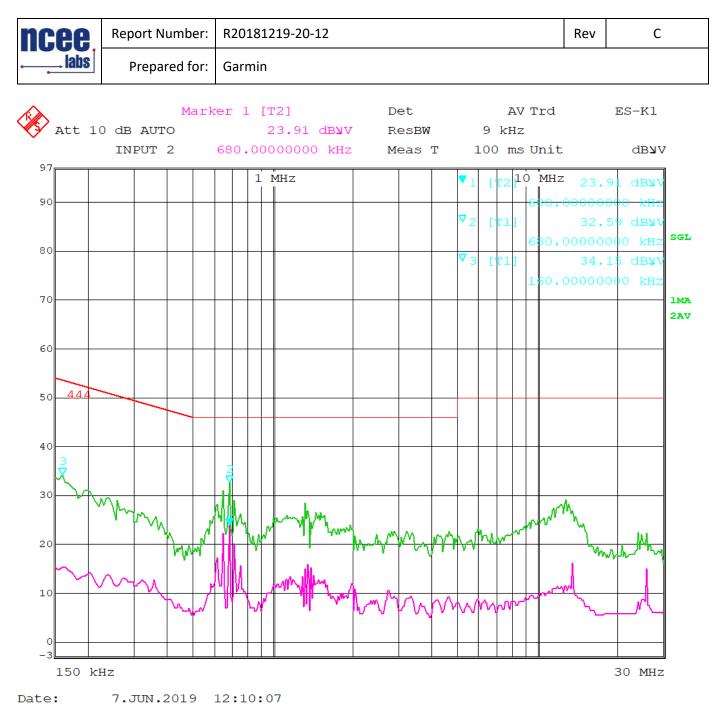
Rev

С





All Measurements were found to be at least 10 dB below the limits.



### Figure 45 - Conducted Emissions Plot, Neutral

All Measurements were found to be at least 10 dB below the limits.

The plot shows the composite maximum value of both the line and neutral conductors. It shows the worse-case at each frequency.



Rev

Prepared for: Garmin

### 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.

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

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

ncee.	Report Number:	R20181219-20-12	Rev	С
labs	Prepared for:	Garmin		

# **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 ( $dB\mu V$ ) = Power (dBm) + 107 (for 50 $\Omega$  measurement systems)

Field Strength (V/m) =  $10^{Field}$  Strength (dB $\mu$ 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%.



REPORT END