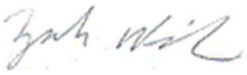
Test Report # 319351 B (RFx)

Equipment Under Test:	CC2564MODN
Test Date(s):	November 6th, 2020
Prepared for:	Polaris Incorporated Attn: Bob Puckette 1600 SE 18th Avenue Battle Ground, WA 98604

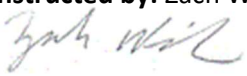
Report Issued by: Zach Wilson, EMC Engineer

Signature:  Date: 3/15/2021

Report Reviewed by: Adam Alger, Quality Manager

Signature:  Date: 2/18/2021

Report Constructed by: Zach Wilson, EMC Engineer

Signature:  Date: 2/17/2021

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Laird Connectivity Test Services in Review

The Laird Connectivity, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein unless otherwise noted

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Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers

Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

1 TEST REPORT SUMMARY

On **November 6th, 2020** the Equipment Under Test (EUT), **CC2564MODN**, as provided by **Polaris Incorporated** was tested to the following requirements of the **Federal Communications Commission** and **Innovation, Science and Economic Development Canada** :

Test Requirements	Description	Specification	Method	Compliant
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus	Reported	RSS-102 Section 2.5.2	Reported
FCC Part 1.1307, 2.1091, 2.1093	RF Exposure and equipment authorization requirements	Reported	FCC KDB 447498 D01	Reported

Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	N/A
Emissions – Frequency	N/A
Immunity	N/A

2 CLIENT INFORMATION

Company Name	Polaris Incorporated
Contact Person	Bob Puckette
Address	1600 SE 18th Avenue Battle Ground, WA 98604

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	CC2564MODN
Model Number	259-0005-01
Serial Number	Engineering Sample
FCC ID	2AOW7-MOD01
IC ID	5966A-MOD01

2.2 Product Description

CC2564MODN BT/BLE module. The antenna is a Johanson 2450AT18A100E chip antenna with a peak gain of -1.38 dBi @ 2450 MHz.

The radios cannot transmit simultaneously.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Power Settings

Power Setting 13 used for both BLE and Bluetooth Classic.

2.6 Radio Programming Information

Both radios were programmed using the CC2564_Direct software, version 1.0.0.0. The radio manufacturer provided the commands to put the radio into the correct test modes.

2.7 Distance to User and Use Environment

Per customer, the radio will be greater than 20cm from the user's body/head. The EUT is a mobile device used in an uncontrolled environment.

3 REFERENCES

Publication	Edition	Date
CFR Title 47	-	2021
RSS-102	5	2015
FCC KDB 447498 D01	v06	2015

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 BLE Fundamental Emission

Operator	Anthony Smith	**QA**	Shane Dock
Temperature	21.0°C	**R.H. %**	45.80%
Test Date	11/6/2020	**Location**	Conducted RF
Requirement	FCC 15.247 §b.3 RSS-247	**Method**	ANSI C63.10 §11.9.1.1

Test Parameters

Frequency	2402-2480MHz
RBW	3 MHz
VBW	50 MHz
EUT Power	5VDC
EUT Mode	BLE Transmit
EUT Channels	0 (2402 MHz), 19 (2440 MHz), 39 (2480 MHz)
Example Calculation	Conducted Power (e.i.r.p.) = Conducted Power (dBm) + Antenna Gain (dBi)

Instrumentation

Laird

Date : 4-Feb-2021 Test : Conducted 247 Job : C-3381

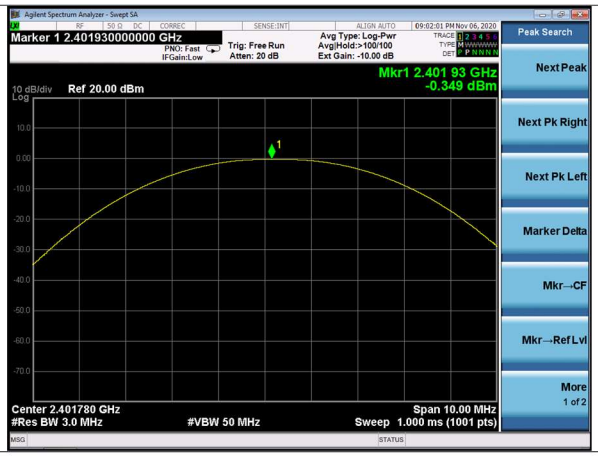
PE : Zach Wilson Customer : Polaris Quote : 319351

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	7/14/2020	7/14/2021	Active Calibration
2	AA 960143	Cable	Gore	EKD01D01048.0	5546519	2/3/2020	2/3/2022	Active Verification

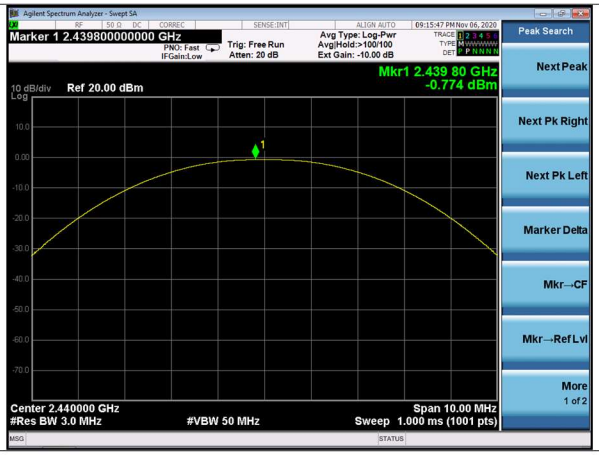
Data Table

Channel	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
Low	-0.35	-1.38	-1.73
Mid	-0.77	-1.38	-2.15
High	-1.31	-1.38	-2.69

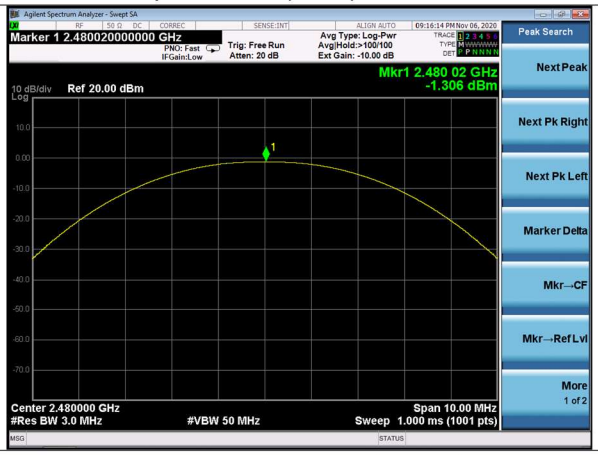
Plots



Output Power, BLE, Channel 0



Output Power, BLE, Channel 19



Output Power, BLE, Channel 39

5.2 BT Classic Fundamental Emission

Operator	Anthony Smith	**QA**	Shane Dock
Temperature	21.0°C	**R.H. %**	45.8%
Test Date	11/6/2020	**Location**	Conducted RF
Requirement	FCC 15.247 §b.1 RSS-247	**Method**	ANSI C63.10 §7.8.5

Test Parameters

Frequency	2402-2480MHz
RBW	3 MHz
VBW	50 MHz
EUT Power	5VDC
EUT Mode	Bluetooth Classic Transmit
EUT Channels	0 (2402 MHz), 39 (2440 MHz), 79 (2480 MHz)
Example Calculation	Conducted Power (e.i.r.p.) = Conducted Power (dBm) + Antenna Gain (dBi)

Instrumentation

Laird

Date : 4-Feb-2021 Test : Conducted 247 Job : C-3381

PE : Zach Wilson Customer : Polaris Quote : 319351

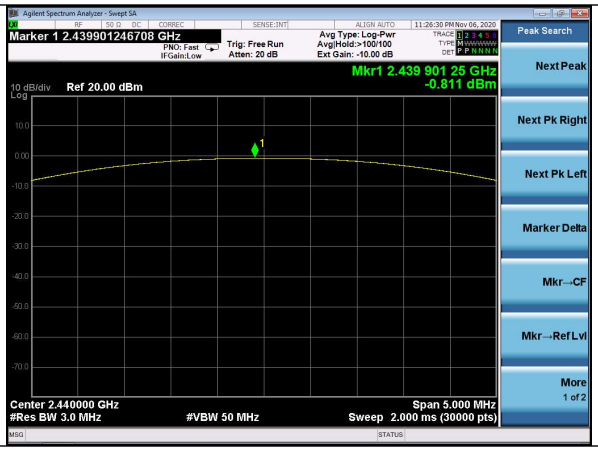
No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	7/14/2020	7/14/2021	Active Calibration
2	AA 960143	Cable	Gore	EKD01D01048.0	5546519	2/3/2020	2/3/2022	Active Verification

Data Table

Channel	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
Low	-0.39	-1.38	-1.77
Mid	-0.81	-1.38	-2.19
High	-1.32	-1.38	-2.70

Plots

Output Power, BT Classic, Channel 0



Output Power, BT Classic, Channel 39

Output Power, BT Classic, Channel 79

6 EXCLUSION CALCULATION

6.1 Technical Brief

BLE Worst Case: **-1.73 dBm** (Pout) + **1.00 dB** (Tune-Up Tolerance) = **-0.73 dBm = 0.85 mW**

BT Classic Worst Case: **-1.77 dBm** (Pout) + **1.00 dB** (Tune-Up Tolerance) = **-0.77 dBm = 0.84 mW**

Test Separation Distance: **Greater than 20cm**

6.2 FCC – BLE MPE Calculation

Prediction of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-0.35	(dBm)
Maximum peak output power at antenna input terminal:	0.923	(mW)
Antenna gain(typical):	-1.38	(dBi)
Numeric Antenna Gain:	0.728	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2450	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm^2)
Power density at prediction frequency:	0.000134	(mW/cm^2)

BLE CONFORMANCE STATEMENT

Routine SAR testing is ***excluded*** as 0.000134 mW/cm^2 is less than 1.000000 mW/cm^2.

6.3 FCC – BT Classic MPE Calculation

Prediction of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-0.39	(dBm)
Maximum peak output power at antenna input terminal:	0.914	(mW)
Antenna gain(typical):	-1.38	(dBi)
Numeric Antenna Gain:	0.728	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2450	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm^2)
Power density at prediction frequency:	0.000132	(mW/cm^2)

BT Classic CONFORMANCE STATEMENT

Routine SAR testing is ***excluded*** as 0.000132 mW/cm^2 is less than 1.000000 mW/cm^2.

6.4 ISED

BLE EIRP CALCULATION = OP + ANTENNA GAIN

-0.35 dBm – 1.38 dBi = -1.73 dBm (0.000671 W)

BLE POWER DENSITY LIMIT

ƒ= 2480 MHz

$0.02619 \times f^{0.6834} = 5.469$ W/m^2

BLE CONFORMANCE STATEMENT

Routine SAR testing is ***excluded*** as 0.000671 W/m^2 is less than 5.469 W/m^2.

BT Classic

BT CLASSIC EIRP CALCULATION = OP + ANTENNA GAIN

-0.39 dBm – 1.39 dBi = -1.78 dBm (0.000663 W)

BT CLASSIC POWER DENSITY LIMIT

ƒ= 2480 MHz

$0.02619 \times f^{0.6834} = 5.469$ W/m^2

BT CLASSIC CONFORMANCE STATEMENT

Routine SAR testing is ***excluded*** as 0.000663 W/m^2 is less than 5.469 W/m^2.

7 REVISION HISTORY

Version	Date	Notes	Person
v0	2/17/2021	Initial Draft	Zach Wilson
v1	3/15/2021	Revised antenna gain	Zach Wilson

END OF REPORT