

Penumbra Inc.

RF Exposure Exhibit

SCOPE OF WORK

EMC TESTING – Real Immersive System, Model: Xavier 1/Xavier 2, Part Number: 18284 (WSM, Wireless Sensor Module)

REPORT NUMBER

104407842MPK-026A

ISSUE DATE

January 08, 2021

REVISED DATE

March 19, 2021

PAGES

8

DOCUMENT CONTROL NUMBER

Non-Specific Radio Report Shell Rev. December 2017 MPK
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**RF Exposure Exhibit
(portable devices)**

Report Number: 104407842MPK-026A

Project Number: G104407842

Original Issue Date: January 08, 2021

Revision Issue Date: March 19, 2021

Product Designation: Real Immersive System

Model Tested: Xavier 1/Xavier 2

Part Number: 18284 (WSM, Wireless Sensor Module)

FCC ID: 2AQU7-REAL02S

IC: 24199-REAL02S

to

47CFR 2.1093

RSS-102 Issue 5

for

Penumbra Inc.

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Report No. 104407842MPK-026A	
Equipment Under Test:	Real Immersive System
Trade Name:	Penumbra Inc.
Model(s) Tested:	Xavier 1/Xavier 2
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Applicable Regulation:	47CFR 2.1093 RSS-102 Issue 5

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1.0 RF Exposure Summary

Test	Reference FCC	Reference Industry Canada	Result
Radio frequency Radiation Exposure Evaluation	47 CFR§2.1093	RSS-102 Issue 5	Complies

2.0 RF Exposure Limits

2.1 FCC Limits

According to FCC KDB 447498 D01 v06 Appendix A, at frequency 2479 MHz and separation distance of ≤ 5 mm SAR Exemption limit is ≤ 9.53 mW.

2.2 Industry Canada Limits

According to RSS-102 sec. 2.5.1, at frequency 2479 MHz and separation distance of ≤ 5 mm SAR Exemption limit is ≤ 3.94 mW.

3.0 Test Results (Portable Configuration)

3.1 Classification

For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

3.2 EIRP calculations

The Real Immersive System, Model: Xavier 1/Xavier 2 consist of one 2.4GHz radio.

3.3 Maximum RF Power

Real Immersive System, Model: Xavier 1/Xavier 2:

Frequency Range (MHz)	Peak RF Output	Antenna Gain ¹	Note
2402 – 2479	7.91dBm or 6.18mW	1.3dBi	Conducted power measurements were taken from 104407842MPK-026

¹As declared by the manufacturer.

3.4 RF Exposure Calculation

3.4.1 RF Exposure calculation for 2.4GHz radio, Real Immersive System, Model: Xavier 1/Xavier 2:

Duty Cycle calculation based on Operational Description provided by the manufacturer:

There are 244 Frames transmitted per second: $1/244 = 4096 \text{ usec}$ => Each TDMA frame (F) length is 4096 usec

Each packet sent is composed of 71 bits + payload length.

(71 bits: 8bit preamble + 40bit address + 7bit length + 16bit CRC)

Payload length (PNO + IMU mode 2) = 34 bytes

Total payload length: $34 \times 8 + 71 = 343 \text{ bits}$

Total payload sent at 2Mbps: $343 / 2000000 = 171.5 \text{ usec}$

Duty cycle: $171.5 / 4096 = 4.19\%$

3.4.2 RF Exposure calculation FCC

Calculations for this report are based on highest power measured.

Power input to antenna	Source-based Duty Cycle	Numerical Gain	Corrected input power into antenna	EIRP	Frequency
6.18 mW	4.19% (0.0419)	1.35	0.26 mW	0.35mW	2402 – 2479

Corrected Input Power = Power input*Duty Cycle

EIRP = Corrected Input Power*Antenna Gain*Duty Cycle

RF Exposure calculation for FCC KDB 447498 D01 v06

According to FCC KDB 447498 D01 v06 Appendix A, at frequency 2479 MHz and separation distance of $\leq 5 \text{ mm}$ SAR Exemption limit is $\leq 9.53 \text{ mW}$

Max Peak Conducted Power measured = 0.26 mW

Results: SAR evaluation is not required since the higher of the maximum conducted or equivalent isotopically radiated power (EIRP) source-based, time averaged output power is below the exemption limit.

3.4.3 RF Exposure calculation ISED

Calculations for this report are based on highest power measured.

Power input to antenna	Source-based Duty Cycle	Numerical Gain	Corrected Output Power into antenna	EIRP	Frequency
6.18 mW	4.19% (0.0419)	1.35	0.26 mW	0.35mW	2402 – 2479

Corrected Input Power = Power input*Duty Cycle

EIRP = Corrected Input Power*Antenna Gain*Duty Cycle

According to RSS-102 sec. 2.5.1, at frequency 2479 MHz and separation distance of $\leq 5 \text{ mm}$ SAR Exemption limit is $\leq 3.94 \text{ mW}$.

Max EIRP measured = 0.35 mW

Results: SAR evaluation is not required since the higher of the maximum conducted or equivalent isotopically radiated power (EIRP) source-based, time averaged output power is below the exemption limit.

Note: Antenna gains below 0 are considered as 0dBi.

4.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0/ G104407842	AS	KV	January 08, 2021	Original document
1.1/ G104407842	AS	KV	March 19, 2021	Updated DC calculation to coincide with operational description and updated limits.