RF Exposure Lab

802 N. Twin Oaks Valley Road, Suite 105 • San Marcos, CA 92069 • U.S.A.
TEL (760) 471-2100 • FAX (760) 471-2121
http://www.rfexposurelab.com

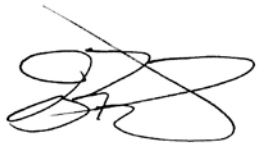
CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Penumbra Inc.		Dates of Test:	August 28, 2018
One Penumbra Place		Test Report Number:	R&D.20180801
Alameda, CA 94502			

FCC ID:	2AQU7-REAL00
IC Certificate:	24199-REAL00
Model(s) Number:	0
Model(s) Name:	HMD
Test Sample:	Engineering Unit Same as Production
Serial No.:	N/A
Equipment Type:	Wireless VR Handset
Classification:	Mobile Transmitter
TX Frequency Range:	2412 – 2462 MHz; 2402 – 2480 MHz; 5180 – 5320 MHz; 5500 – 5700 MHz; 5745 – 5825 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	2450 MHz (b) – 19.0 dBm, 2450 MHz (g) – 17.5 dBm, 2450 MHz (n20) – 17.5 dBm, 2450 MHz (n40) – 12.5 dBm, 5250 MHz (a) – 17.5 dBm, 5250 MHz (n20) – 17.5 dBm, 5250 MHz (n40) – 17.5 dBm, 5250 MHz (ac) – 17.5 dBm, 5600 MHz (a) – 17.5 dBm, 5600 MHz (n20) – 17.5 dBm, 5600 MHz (n40) – 17.5 dBm, 5600 MHz (ac) – 17.5 dBm, 5800 MHz (a) – 17.5 dBm, 5800 MHz (n20) – 17.5 dBm, 5800 MHz (n40) – 17.5 dBm, 5800 MHz (ac) – 17.5 dBm, Bluetooth (Internal to VR Headset) – 12.0 dBm, Bluetooth (Added to VR Headset) – 0 dBm Conducted
Signal Modulation:	DSSS, OFDM, GFSK, 8DPSK, π/4 DPSK
Antenna Type:	Internal
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C, 15E
KDB Methodology:	KDB 447498 D01 v06
Industry Canada:	RSS-102 Issue 5, Safety Code 6
Maximum SAR Value:	0.47 W/kg (From VR Original Report) 1 gram Average
Maximum SAR Value:	0.43 W/kg (From VR Original Report) 10 gram Average
Maximum Simultaneous SAR:	0.71 W/kg 1 gram Average (Head)
Maximum Simultaneous SAR:	0.55 W/kg 10 gram Average (Extremity)
Separation Distance:	0 mm

This wireless mobile and/or portable device has been shown to be compliant for RF exposure requirements for uncontrolled environment/general exposure limits specified in EN62311:2008, Directive 1999/519/EC, Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 2003, ARPANSA RPS No. 3, and AS 2772.2 – 2011: Radiofrequency radiation – Part 2 (See test report).

I attest to the accuracy of the data. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Jay M. Moulton
Vice President

ACCREDITED
Testing Cert. # 2387.01

Table of Contents

1. Introduction

This measurement report shows compliance of the Penumbra Inc. Model Number 0 Model Name HMD FCC ID: 2AQU7-REAL00 with FCC Part 2.1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 24199-REAL00 with RSS-102 Issue 5 & Safety Code 6. The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on August 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices.

The device is a wireless virtual reality headset with the addition of six(6) Bluetooth transmitters. The headset by itself is a pre-approved device manufactured by HTC Corporation model number 2Q27200. The FCC ID for the headset is NM82Q27200 and the ISED certificate number is 4115A-2Q27200. The data was extracted from the report dated April 13, 2018 report number FA821216.

This analysis report takes the original SAR data from the FCC filing under FCC ID NM82Q27200 and ISED certificate number 4115A-2Q27200. Using this data, this report shows the compliance of adding the six(6) Bluetooth transmitters to the headset. The simultaneous evaluation is calculated and shown to comply within this report.

2. Evaluation of Additional Bluetooth Transmitters

2.1 Specifications of Additional Bluetooth Transmitters

The additional Bluetooth transmitters operate in the frequency range of 2402 – 2480 MHz. The maximum tolerance transmit power of each Bluetooth transmitter is 0 dBm.

2.2 SAR Values Extracted from Original SAR Report for VR Headset

The following table indicated the maximum SAR values for the VR Headset for each transmitter located within the headset. The table also shows the maximum simultaneous evaluated SAR values for the filed VR headset report.

Band	Configuration	SAR Value
2450 MHz	Head	0.27 W/kg
2450 MHz	Extremity	0.43 W/kg
5 GHz	Head	0.47 W/kg
5 GHz	Extremity	0.25 W/kg
Internal Bluetooth	Head	<0.01 W/kg
Internal Bluetooth	Extremity	0.02 W/kg
Simultaneous	Head	0.47 W/kg
Simultaneous	Extremity	0.43 W/kg

2.3 SAR Test Exclusion Evaluation for Additional Bluetooth Transmitters

The six(6) additional Bluetooth transmitters are excluded from SAR testing per KDB447498 D01 v06 section 4.3.1 a) on page 12 and RSS-102 Issue 5 section 2.5.1 Table 1 on page 4. The maximum transmit power of the additional Bluetooth transmitters is 0 dBm which equates to 1 mW of power.

Per KDB 447498 D01 v06, the following equation is used to determine SAR test exclusion.

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- When the minimum test separation distance is < 5 mm, a distance of 5 mm according to KDB447498 D01 v06 4.1 f) is applied to determine SAR test exclusion.

Using the calculation in KDB 447498 D01 v06 section 4.3.1 a) on page 12, the following evaluation shows the additional Bluetooth transmitters are excluded from SAR testing.

Max. power of channel, including tune-up tolerance = 1 mW
Min. test separation distance = 5 mm
$F_{(GHz)}$ = 2.48 GHz

[1 mW / 5 mm] * √2.48 = 0.314 rounded to 0.3

Therefore, the Bluetooth transmitters are each excluded from SAR testing since 0.3 is less than 3.0 for Head and 7.5 for extremity.

Per RSS-102 Issue 5 section 2.5.1 Table 1 on page 4, the separation distance of ≤ 5 mm at 2450 MHz yields an exclusion of any transmitter which is 4 mW or less in maximum transmit power. Since the additional Bluetooth transmitters are a maximum of 1 mW transmit power, the additional Bluetooth transmitters are excluded from SAR testing per RSS-102 Issue 5 section 2.5.1 Table 1 on page 4.

2.4 Estimated SAR Value for Additional Bluetooth Transmitters

When an antenna qualifies for the standalone SAR test exclusion of KDB 447498 D01 v06 section 4.3.1 a) on page 12 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to KDB 447498 D01 v06 section 4.3.2 b) 1). The following is the formula used to estimate the standalone SAR value.

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [$\sqrt{f_{(GHz)}}$/x] W/kg, for test separation distances ≤ 50 mm, where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

Max. power of channel, including tune-up tolerance = 1 mW
Min. test separation distance = 5 mm
$F_{(GHz)}$ = 2.48 GHz

[1 mW / 5 mm] * [√2.48/7.5] = 0.0419 W/kg rounded to 0.04 W/kg for 1-g SAR

[1 mW / 5 mm] * [√2.48/18.75] = 0.0167 W/kg rounded to 0.02 W/kg for 10-g SAR

2.5 Simultaneous Evaluation with Additional Bluetooth Transmitters

Per KDB 447498 D01 v06 section 4.3.2 on page 13, simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneously transmitting antenna. When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

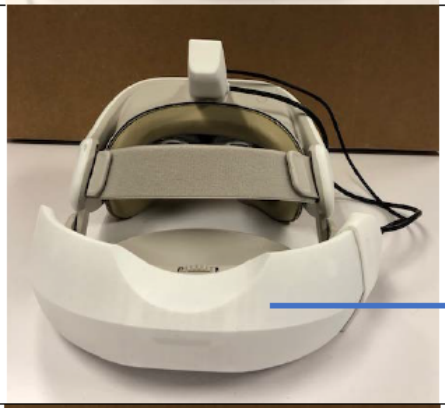
For the six(6) additional Bluetooth transmitters being added, the sum of the six(6) transmitters estimated SAR value is used to determine simultaneous SAR test exclusion. The estimated SAR value for each Bluetooth transmitter is 0.04 W/kg for the 1-g SAR value and 0.02 W/kg for the 10-g SAR value. Therefore, for all six(6) transmitters summed up the maximum simultaneous SAR value would be 0.24 W/kg for 1-g SAR and 0.12 W/kg for 10-g.

For the Head SAR configuration, the highest simultaneous SAR value is 0.47 W/kg from the table listed above on page 3 of this report. Using the summed estimated SAR for the six(6) additional Bluetooth transmitters, the total SAR value for simultaneous transmission SAR test exclusion is 0.71 W/kg. Since this value is less than the limit of 1.6 W/kg, the Head SAR configuration is excluded from simultaneous SAR testing.

For the Extremity SAR configuration, the highest simultaneous SAR value is 0.43 W/kg from the table listed above on page 3 of this report. Using the summed estimated SAR for the six(6) additional Bluetooth transmitters, the total SAR value for simultaneous transmission SAR test exclusion is 0.55 W/kg. Since this value is less than the limit of 4.0 W/kg, the Extremity SAR configuration is excluded from simultaneous SAR testing.

3. Photos of Device

HMD

View	Photo
Front	
Back	
Right