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Project: C6062

Report number: 14095TR6 Customer Details

Company name	Varjo Technologies Oy
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Equipment Under Test:	Varjo VR-3 Mixed Reality Headset
Operating frequency band	2400MHz to 2483.5MHz
PMN:	VR-3
HVIN:	HS-6
FVIN:	0.11.0.372
FCC ID:	2AROD-004
ISED number:	IC: 24483-004

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Exclusion Calculation - FCC

The calculation is according to the FCC Knowledge Database (KDB) document KDB 447498 D01 General RF Exposure Guidance V06.

Section 4.3.1 General SAR Test Exclusion Bands was applied. Section 4.3.1 a) for 100MHz to 6GHz and test separation distances ≤50mm was specifically applied. According to this section the SAR test exclusion thresholds are determined by the following:

$$\text{Threshold} = \left[\frac{P(mW)}{d(mm)}\right] . \sqrt{f(GHz)}$$

Where

P is the maximum measured power of the channel including tune-up tolerance in mW

d is the minimum test separation distance in mm

f is the RF channel frequency in GHz

The minimum test separation distance was considered t be 5mm in consultation with Section 4.2.2 Body-worn accessory exposure conditions.

This evaluation of the test exclusion threshold is compared to the threshold limit.

a. Limit for 1-g head or body worn devices: threshold limit ≤3

b. Limit for 10-g extremity worn devices: threshold limit ≤7.5

Since the device is head worn the limit “a” applies.

1) Output power measurement results (see test report 14046TR4):

Channel (MHz)	Antenna port 1 (dBm)	Antenna port 2 (dBm)	Antenna port 1 (Watts)	Antenna port 2 (Watts)	Antenna port 1+2 (Watts)
2402	-0.187	-0.252	0.001	0.0009	0.0019
2440	-0.572	-0.705	0.0009	0.0009	0.0018
2480	-1.229	-1.282	0.0008	0.0007	0.0015

2) Rated conducted RF output power and tune-up tolerances:

The rated conducted RF output power for transmitter 1 and transmitter 2 with tune-up tolerances are declared as being -0.5 dBm +/- 0.5 dB.

The peak antenna gain is 1.1 dBi (1.29 numerical) and thus the maximum EIRP emitted by transmitter 1 as well as transmitter 2 is 1.29 mW. In order to present a worst case approach to RF exposure this EIRP value will be used to determine test exclusion.

3) The calculated threshold for test exclusion was determined while using a distance of 5mm, and the results are tabulated in the table below (stand-alone test exclusion in accordance with KDB publication 447498 D01 General RF Exposure Guidance v06, section 4.3.1 a), for either transmitter 1 or transmitter 2):

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Calculated threshold	Threshold limit
2402	1.29	5	0.40	3
2440	1.29	5	0.40	3
2480	1.29	5	0.41	3

Conclusion: transmitter 1 and transmitter 2 meet the exemption limit requirements for test exclusion in a stand-alone configuration.

4) Test exclusion based on estimated SAR levels for simultaneous transmissions (KDB publication 447498 D01 General RF Exposure Guidance v06, section 4.3.2 b)):

Since the two transmitters can transmit simultaneously the SAR level (1 g, uncontrolled) of each transmitter needs to be estimated and the estimated SAR level of transmitter 1 + estimated SAR

level of transmitter 2 must be ≤100% of 1.6 W/kg (see KDB publication 447498 D01 General RF Exposure Guidance v06, section 4.3.2 b)).

Estimated SAR level transmitter 1:

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Estimated SAR level (W/kg)*)
2402	1.29	≤5	0.053
2440	1.29	≤5	0.054
2480	1.29	≤5	0.054

Estimated SAR level transmitter 2:

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Estimated SAR level (W/kg)*)
2402	1.29	≤5	0.053
2440	1.29	≤5	0.054
2480	1.29	≤5	0.054

*) The estimated SAR levels have been calculated using the appropriate equation from KDB publication 447498 D01 General RF Exposure Guidance v06, section 4.3.2 b): [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)/x] W/kg, for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR.

Estimated SAR level transmitter 1+2:

Channel (MHz)	Separation distance (mm)	Estimated SAR level (W/kg)*)	Estimated SAR level as a percentage of 1.6 W/kg (%)
2402	≤5	0.11	6.7
2440	≤5	0.11	6.7
2480	≤5	0.11	6.7

SAR transmitter 1 + SAR transmitter 2 must be ≤100% of 1.6 W/kg

Conclusion: the apparatus with transmitter 1 and transmitter 2 transmitting simultaneously meets the exemption limit requirements for test exclusion.

SAR Exclusion Calculation - ISED

Standard:

RSS-102 Radio Frequency (RF) ~Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), Issue 5 March 2015 incl. Amendment 1of February 2, 2021.
Notice 2016-DRS001, July 2020

1) Output power measurement results (see test report 14046TR4):

Channel (MHz)	Antenna port 1 (dBm)	Antenna port 2 (dBm)	Antenna port 1 (Watts)	Antenna port 2 (Watts)	Antenna port 1+2 (Watts)
2402	-0.187	-0.252	0.001	0.0009	0.0019
2440	-0.572	-0.705	0.0009	0.0009	0.0018
2480	-1.229	-1.282	0.0008	0.0007	0.0015

2) Rated conducted RF output power and tune-up tolerances:

The rated conducted RF output power for transmitter 1 and transmitter 2 with tune-up tolerances are declared as being -0.5 dBm +/- 0.5 dB.

The peak antenna gain is 1.1 dBi (1.29 numerical) and thus the maximum EIRP emitted by transmitter 1 as well as transmitter 2 is 1.29 mW. In order to present a worst case approach to RF exposure this EIRP value will be used to determine test exclusion.

3) Test exclusion was determined while using a distance of ≤5mm and the results are tabulated in the table below (stand-alone test exclusion in accordance with RSS-102, section 2.5.1, for either transmitter 1 or transmitter 2):

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Exemption limit (mW) *)
2402	1.29	≤5	4.26
2440	1.29	≤5	4.05
2480	1.29	≤5	3.94

Conclusion: transmitter 1 and transmitter 2 meet the exemption limit requirements for test exclusion in a stand-alone configuration

*) Exemption limit in mW for 2402 MHz, 2440 MHz and 2480 MHz has been calculated using linear interpolation based on 1900 – 2450 MHz (7 mW – 4 mW) and 2450 – 3500 MHz (4 mW – 2 mW)

4) Test exclusion based on estimated SAR levels for simultaneous transmissions (Notice 2016-DRS001, July 2020):

Since the two transmitters can transmit simultaneously the SAR level (1 g, uncontrolled) of each transmitter needs to be estimated and the estimated SAR level of transmitter 1 + estimated SAR level of transmitter 2 must be ≤100% of 1.6 W/kg.

Estimated SAR level transmitter 1:

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Exemption limit (mW) *)	Estimated SAR level (W/kg)*)
2402	1.29	≤5	4.26	0.12
2440	1.29	≤5	4.05	0.13
2480	1.29	≤5	3.94	0.13

Estimated SAR level transmitter 2:

Channel (MHz)	EIRP (mW)	Separation distance (mm)	Exemption limit (mW) *)	Estimated SAR level (W/kg)*)
2402	1.29	≤5	4.26	0.12
2440	1.29	≤5	4.05	0.13
2480	1.29	≤5	3.94	0.13

*) The estimated SAR levels have been calculated using the appropriate equation from Notice 2016-DRS001, July 2020: (maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) * 0.4 W/kg.

Estimated SAR level transmitter 1+2:

Channel (MHz)	Separation distance (mm)	Estimated SAR level (W/kg)*)	Estimated SAR level as a percentage of 1.6 W/kg (%)
2402	≤5	0.24	15
2440	≤5	0.26	16.3
2480	≤5	0.26	16.3

SAR transmitter 1 + SAR transmitter 2 must be ≤100% of 1.6 W/kg

Conclusion: the apparatus with transmitter 1 and transmitter 2 transmitting simultaneously meets the exemption limit requirements for test exclusion.