

## HS-10, HS-10A SAR Exclusion Calculation - FCC

### Reference documents

- KDB 447498 D01 General RF Exposure Guidance V06

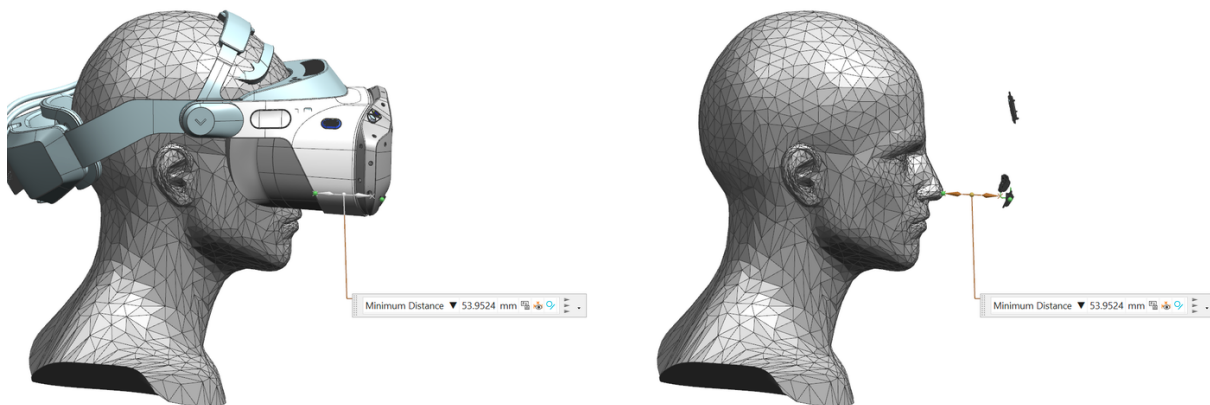
This calculation has been made according to Section 4.3.1a) for 100 MHz to 6 GHz and test separation distances  $\leq 50$  mm. According to this section of the General Exposure guidance V06 the SAR test exclusion thresholds are determined by the following:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. separation distance, mm})] * [\sqrt{f_{\text{(GHz)}}}] \leq 3.0$$

The device is a head-worn device, and it is stated in the user guide that the area of use should be cleared from people. Hence the minimum separation distance for head SAR is the distance of the antenna to the user's face when wearing the headset. This distance is measured as 54 mm as seen in the picture below, however as face proportions are different between people, the distance has been reduced to 40 mm to cover all possible use cases.

It is possible for the user to touch the headset with hands during use, so for the extremity SAR the minimum separation distance is the distance between the antenna and the external surface of the HMD. This distance is approximately 2.5 mm, so the minimum test separation used for the extremity SAR the calculations is 5 mm according to 4.1 f) of the General RF Exposure Guidance.

The tune-up tolerance has been declared as  $\pm 0.5$  dB, this value has been added to the measured output powers to cover the variation between devices.



The calculated test exclusion threshold is compared to the threshold limits:

1. Limit for 1-g head or body worn devices:  $\leq 3$
2. Limit for 10-g extremity worn devices:  $\leq 7.5$

Output power measurement results (see test report: HELEM2304000149-1):

| Data rate | Frequency [MHz] | Output power [dBm] | Output Power with Tune-up tolerance | EIRP with Tune-up tolerance [dBm] | EIRP with Tune-up tolerance [mW] |
|-----------|-----------------|--------------------|-------------------------------------|-----------------------------------|----------------------------------|
| 1 Mbps    | 2402            | 3.8                | 4.3                                 | 7.1829                            | 5.2                              |
| 1 Mbps    | 2440            | 4.3                | 4.8                                 | 7.6829                            | 5.9                              |
| 1 Mbps    | 2480            | 3.9                | 4.4                                 | 7.2829                            | 5.3                              |
| 2 Mbps    | 2404            | 3.9                | 4.4                                 | 7.2829                            | 5.3                              |
| 2 Mbps    | 2440            | 4.3                | 4.8                                 | 7.6829                            | 5.9                              |
| 2 Mbps    | 2478            | 4.0                | 4.5                                 | 7.3829                            | 5.5                              |

The used antenna has a peak gain of 2.8829 dBi and thus the maximum EIRP emitted by the transmitter is 5.9 mW. To present a worst-case approach to RF exposure this EIRP value will be used to determine test exclusion in the table below:

| Frequency [MHz] | EIRP with Tune-up tolerance [mW] | Separation distance [mm] (Head / Extremity) | Calculated threshold for head SAR [limit $\leq 3$ ] | Calculated threshold for extremity SAR [limit $\leq 7.5$ ] |
|-----------------|----------------------------------|---|---|--|
| 2402            | 5.2                              | 40 / 5                                      | 0.3   | 2.1  |
| 2404            | 5.3                              | 40 / 5                                      | 0.3   | 2.1  |
| 2440            | 5.9                              | 40 / 5                                      | 0.3   | 2.2  |
| 2478            | 5.5                              | 40 / 5                                      | 0.3   | 2.2  |
| 2480            | 5.3                              | 40 / 5                                      | 0.3   | 2.1  |

## Conclusion

The transmitter meets the exemption limit requirements for test exclusion in a stand-alone configuration.

## HS-10, HS-10A SAR Exclusion Calculation - ISED

### Reference documents

- RSS-102 Radio Frequency (RF) ~Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5 including Amendment 1 2021

## Output power measurement results

| Data rate | Frequency [MHz] | Output power [dBm] | Output Power with Tune-up tolerance | EIRP with Tune-up tolerance [dBm] | EIRP with Tune-up tolerance [mW] |
|-----------|-----------------|--------------------|-------------------------------------|-----------------------------------|----------------------------------|
| 1 Mbps    | 2402            | 3.8                | 4.3                                 | 7.1829                            | 5.2                              |
| 1 Mbps    | 2440            | 4.3                | 4.8                                 | 7.6829                            | 5.9                              |
| 1 Mbps    | 2480            | 3.9                | 4.4                                 | 7.2829                            | 5.3                              |
| 2 Mbps    | 2404            | 3.9                | 4.4                                 | 7.2829                            | 5.3                              |
| 2 Mbps    | 2440            | 4.3                | 4.8                                 | 7.6829                            | 5.9                              |
| 2 Mbps    | 2478            | 4.0                | 4.5                                 | 7.3829                            | 5.5                              |

The device is a head-worn device, and it is stated in the user guide that the area of use should be cleared from people. Hence the minimum separation distance for head SAR is the distance of the antenna to the user's face when wearing the headset. This distance is measured as 54 mm as seen in the picture below, however as face proportions are different between people, the distance has been reduced to 40 mm to cover all possible use cases.

It is possible for the user to touch the headset with hands during use, so for the extremity SAR the minimum separation distance is the distance between the antenna and the external surface of the HMD. This distance is approximately 2.5 mm, so the minimum test separation used for the extremity SAR the calculations is 5 mm according to clause 2.5.1 of the RSS-102.

The tune-up tolerance has been declared as  $\pm 0.5$  dB, this value has been added to the measured output powers to cover the variation between devices.

| Frequency [MHz] | EIRP with Tune-up tolerance [mW] | Separation distance [mm] (Head / Limb) | Exemption limit for head, 40 mm [mW] <sup>*)</sup> | Exemption limit for limbs, 5 mm [mW] <sup>*)</sup> |
|-----------------|----------------------------------|--|--|--|
| 2402            | 5.2                              | 40 / 5                                 | 177.54   | 10.65  |
| 2404            | 5.3                              | 40 / 5                                 | 177.35   | 10.63  |
| 2440            | 5.9                              | 40 / 5                                 | 173.95   | 10.14  |
| 2478            | 5.5                              | 40 / 5                                 | 172.92   | 9.87   |
| 2480            | 5.3                              | 40 / 5                                 | 172.91   | 9.86   |

<sup>\*)</sup> Exemption limits in mW for 2402 MHz, 2440 MHz and 2480 MHz has been calculated using linear interpolation. The exemption limit for limb-worn has been calculated by multiplying the interpolated value for 5 mm distance with 2.5 as instructed in clause 2.5.1 of RSS-102.

## Conclusion

The transmitter meets the exemption limit requirements for test exclusion in a stand-alone configuration.

