

Test report No:  
3809ERM.005A2

## Assessment report

### RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1093

|                                             |                                                                                           |
|---------------------------------------------|-------------------------------------------------------------------------------------------|
| (*) Identification of item under evaluation | Telematics Control Unit)                                                                  |
| (*) Trademark                               | Zoox L5 TCU                                                                               |
| (*) Model and /or type reference            | L5 TCU                                                                                    |
| (*) Other identification of the product     | FCC ID: 2AHPN-BE2873<br>HW version: C3<br>SW version: S7.8                                |
| (*) Features                                | UMTS, LTE, 4G, Wi-Fi (802.11 b,g,n,ac,ax)                                                 |
| (*) Manufacturer                            | Harman International.<br>30001 Cabot Drive<br>Novi, MI 48377<br>USA                       |
| Test method requested, standard             | FCC 47 CFR Part 2.1093. Radiofrequency radiation<br>exposure evaluation: portable devices |
| Summary                                     | IN COMPLIANCE                                                                             |
| Approved by (name / position & signature)   | Domingo Galvez<br>EMC&RF Lab Manager                                                      |
| Date of issue                               | 02-29-2024                                                                                |
| Report template No                          | FDT08_23<br>(*) "Data provided by the client"                                             |

# Index

Competences and guarantees ..... 3

General conditions ..... 3

Data provided by the client..... 3

Identification of the client..... 3

Document history ..... 3

Appendix A: FCC RF Exposure assessment result ..... 4

Appendix B: FCC RF Exposure information ..... 7

## Competences and guarantees

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification Inc. at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Assessment Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Certification Inc.

## General conditions

1. This report is only referred to the item that has undergone the assessment.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies

## Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a Telematics control unit developed by Harman for Zoox. Enables connectivity to the Zoox robotaxi.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Identification of the client

Harman International  
30001 Cabot Drive. Novi, MI 48377, USA

## Document history

| Report number | Date       | Description                                                                                                                                                           |
|---------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3809ERM.005   | 11-22-2023 | First release.                                                                                                                                                        |
| 3809ERM.005A1 | 01-23-2024 | Second release. Antenna gain values were updated in Appendix A. This modified test report cancels and replaces the test report 3809ERM.005.                           |
| 3809ERM.005A2 | 02-29-2024 | Third release. Antenna gain values were updated and LTE Bands were added in Appendix A. This modified test report cancels and replaces the test report 3809ERM.005A1. |

## Appendix A: FCC RF Exposure assessment result

## General description of the device under evaluation

The device under evaluation consists of a Telematics control unit developed by Harman for Zoox. Enables connectivity to the Zoxx robotaxi.

According to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 20cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

As stated into DEKRA Certification Inc. test reports num. 3809ERM.002A2 for Wi-Fi 2.4GHz, 3809ERM.003A2 for Wi-Fi 5 GHz and FCC Identifier T8GSAN9001 used for UMTS and LTE, the maximum measured output power levels for each supported technology shown in the table below.

The evaluation was performed under the configuration of two Telematics Control Units, the Mohawk antenna, and the internal Wi-Fi antennas:

| Technology / Mode | Operating Band | Frequency under evaluation (MHz) | Transmitting configuration | Maximum Conducted Output Power (Incl. Tune-Up) (dBm) | Antenna 1 peak gain (dBi) | Antenna 2 peak gain (dBi) | Maximum E.R.P. (dBm) | Maximum E.R.P. (mW) | Maximum E.I.R.P. (dBm) | Maximum E.I.R.P. (mW) |
|-------------------|----------------|----------------------------------|----------------------------|------------------------------------------------------|---------------------------|---------------------------|----------------------|---------------------|------------------------|-----------------------|
| UMTS              | II             | 1850 - 1910                      | SISO                       | 24.05                                                | 2.92                      | -                         | 24.82                | 303.39              | 26.97                  | 497.74                |
| UMTS              | IV             | 1710 - 1755                      | SISO                       | 23.92                                                | 3.44                      | -                         | 25.21                | 331.89              | 27.36                  | 544.50                |
| UMTS              | V              | 824 - 849                        | SISO                       | 24.61                                                | 1.01                      | -                         | 23.47                | 222.33              | 25.62                  | 364.75                |
| LTE               | 2              | 1850 - 1910                      | SISO                       | 22.77                                                | 3.60                      | -                         | 24.22                | 264.24              | 26.37                  | 433.51                |
| LTE               | 4              | 1710 - 1755                      | SISO                       | 23.00                                                | 4.00                      | -                         | 24.85                | 305.49              | 27.00                  | 501.19                |
| LTE               | 5              | 824 - 849                        | SISO                       | 20.73                                                | 2.20                      | -                         | 20.78                | 119.67              | 22.93                  | 196.34                |
| LTE               | 7              | 2500 - 2570                      | SISO                       | 22.90                                                | 4.50                      | -                         | 25.25                | 334.97              | 27.40                  | 549.54                |
| LTE               | 10             | 1710 - 1770                      | SISO                       | 23.00                                                | 4.00                      | -                         | 24.85                | 305.49              | 27.00                  | 501.19                |
| LTE               | 12             | 699 - 716                        | SISO                       | 23.00                                                | 1.30                      | -                         | 22.15                | 164.06              | 24.30                  | 269.15                |
| LTE               | 13             | 777 - 787                        | SISO                       | 23.00                                                | 2.30                      | -                         | 23.15                | 206.54              | 25.30                  | 338.84                |
| LTE               | 17             | 704 - 716                        | SISO                       | 23.00                                                | 1.90                      | -                         | 22.75                | 188.36              | 24.90                  | 309.03                |
| LTE               | 25             | 1850 - 1915                      | SISO                       | 23.79                                                | 3.80                      | -                         | 25.44                | 349.95              | 27.59                  | 574.12                |
| LTE               | 26             | 814 - 849                        | SISO                       | 23.40                                                | 2.20                      | -                         | 23.45                | 221.31              | 25.60                  | 363.08                |
| LTE               | 41             | 2496 - 2690                      | SISO                       | 22.58                                                | 4.30                      | -                         | 24.73                | 297.17              | 26.88                  | 487.53                |
| LTE               | 66             | 1710 - 1780                      | SISO                       | 22.60                                                | 4.00                      | -                         | 24.45                | 278.61              | 26.60                  | 457.09                |
| LTE               | 71             | 663 - 698                        | SISO                       | 23.00                                                | 0.50                      | -                         | 21.35                | 136.46              | 23.50                  | 223.87                |
| LTE               | 2              | 1850 - 1910                      | UL MIMO                    | 26.00                                                | 3.60                      | 2.20                      | 26.81                | 479.31              | 28.96                  | 786.35                |
| LTE               | 4              | 1710 - 1755                      | UL MIMO                    | 26.00                                                | 4.00                      | 2.10                      | 27.00                | 501.54              | 29.15                  | 822.83                |
| LTE               | 7              | 2500 - 2570                      | UL MIMO                    | 26.00                                                | 4.50                      | 3.80                      | 28.01                | 633.01              | 30.16                  | 1038.51               |
| LTE               | 41             | 2496 - 2690                      | UL MIMO                    | 26.00                                                | 4.30                      | 3.50                      | 27.77                | 598.19              | 29.92                  | 981.39                |
| LTE               | 66             | 1710 - 1780                      | UL MIMO                    | 26.00                                                | 4.00                      | 2.20                      | 27.04                | 506.13              | 29.19                  | 830.35                |
| 802.11b/g/n       | 2.4 GHz        | 2412 - 2484                      | SISO                       | 14.03                                                | -                         | 3.50                      | 15.38                | 34.51               | 17.53                  | 56.62                 |
| 802.11a/n/ac/ax   | 5 GHz          | 5150 - 5850                      | UL MIMO                    | 17.16                                                | 4.00                      | 3.80                      | 18.91                | 77.82               | 21.06                  | 127.68                |

**Table 1:** Equipment specifications

## RF Exposure Assessment result and verdict

The assessment summary according to the radiofrequency radiation exposure limits defined in FCC 47 CFR § 2.1093 is the following:

| Technology / Mode | Operating Band | Frequency under evaluation (MHz) | Transmitting configuration | Distance (cm) | Maximum E.R.P. (mW) | §1.1307(b)(3). i.(C) Exposure Limit (mW) | Verdict for exemption § 1.1307(b)(3).i |
|-------------------|----------------|----------------------------------|----------------------------|---------------|---------------------|------------------------------------------|----------------------------------------|
| UMTS              | II             | 1850 - 1910                      | SISO                       | 20.0          | 303.4               | 768.0                                    | Pass                                   |
| UMTS              | IV             | 1710 - 1755                      | SISO                       | 20.0          | 331.9               | 768.0                                    | Pass                                   |
| UMTS              | V              | 824 - 849                        | SISO                       | 20.0          | 222.3               | 421.9                                    | Pass                                   |
| LTE               | 2              | 1850 - 1910                      | SISO                       | 20.0          | 264.2               | 768.0                                    | Pass                                   |
| LTE               | 4              | 1710 - 1755                      | SISO                       | 20.0          | 305.5               | 768.0                                    | Pass                                   |
| LTE               | 5              | 824 - 849                        | SISO                       | 20.0          | 119.7               | 421.9                                    | Pass                                   |
| LTE               | 7              | 2500 - 2570                      | SISO                       | 20.0          | 335.0               | 768.0                                    | Pass                                   |
| LTE               | 10             | 1710 - 1770                      | SISO                       | 20.0          | 305.5               | 768.0                                    | Pass                                   |
| LTE               | 12             | 699 - 716                        | SISO                       | 20.0          | 164.1               | 357.9                                    | Pass                                   |
| LTE               | 13             | 777 - 787                        | SISO                       | 20.0          | 206.5               | 397.8                                    | Pass                                   |
| LTE               | 17             | 704 - 716                        | SISO                       | 20.0          | 188.4               | 360.4                                    | Pass                                   |
| LTE               | 25             | 1850 - 1915                      | SISO                       | 20.0          | 349.9               | 768.0                                    | Pass                                   |
| LTE               | 26             | 814 - 849                        | SISO                       | 20.0          | 221.3               | 416.8                                    | Pass                                   |
| LTE               | 41             | 2496 - 2690                      | SISO                       | 20.0          | 297.2               | 768.0                                    | Pass                                   |
| LTE               | 66             | 1710 - 1780                      | SISO                       | 20.0          | 278.6               | 768.0                                    | Pass                                   |
| LTE               | 71             | 663 - 698                        | SISO                       | 20.0          | 136.5               | 339.5                                    | Pass                                   |
| LTE               | 2              | 1850 - 1910                      | UL MIMO                    | 20.0          | 479.3               | 768.0                                    | Pass                                   |
| LTE               | 4              | 1710 - 1755                      | UL MIMO                    | 20.0          | 501.5               | 768.0                                    | Pass                                   |
| LTE               | 7              | 2500 - 2570                      | UL MIMO                    | 20.00         | 633.01              | 768.00                                   | Pass                                   |
| LTE               | 41             | 2496 - 2690                      | UL MIMO                    | 20.00         | 598.19              | 768.00                                   | Pass                                   |
| LTE               | 66             | 1710 - 1780                      | UL MIMO                    | 20.00         | 506.13              | 768.00                                   | Pass                                   |
| 802.11b/g/n       | 2.4 GHz        | 2412 - 2484                      | SISO                       | 20.00         | 34.51               | 768.00                                   | Pass                                   |
| 02.11a/n/ac/ax    | 5 GHz          | 5150 - 5850                      | UL MIMO                    | 20.00         | 77.82               | 768.00                                   | Pass                                   |

**Table 2: Assessment result and verdict**

The computed value(s) are below the limit(s), so according to KDB 447498 D01 – General RF Exposure Guidance, these modes qualify for Standalone SAR test exclusion for 1-g SAR and 10-g Extremity SAR.

## Simultaneous transmission assessment:

| Simultaneous technologies and modes               | Result ( $\sum$ of Pout/Pmax ratios) | Verdict ( $\sum \leq 1$ ) |
|---------------------------------------------------|--------------------------------------|---------------------------|
| LTE (UL MIMO) 7 + 802.11b/g/n 2.4 GHz             | 0.87                                 | Pass                      |
| LTE (UL MIMO) 7 + 802.11a/n/ac/ax (UL MIMO) 5 GHz | 0.93                                 | Pass                      |

**Table 3: Simultaneous Transmission assessment**

## Appendix B: FCC RF Exposure information

## FCC SAR test exclusion considerations for portable devices

For transmission frequencies below 6GHz, as stated by the FCC (47 CFR §2.1093), human exposure to RF emissions from portable devices, which are defined as transmitting devices to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user, must be evaluated with respect to the FCC-adopted limits for SAR.

According to FCC OET KDB 447498 D01 General RF Exposure Guidance:

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition is satisfied.

### - For distances ≤ 50 mm

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[ \frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR}$$

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

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table:

| MHz  | 5  | 10 | 15  | 20  | 25  | 30  | 35  | 40  | 45  | 50  | mm                                         |
|------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|--------------------------------------------|
| 150  | 39 | 77 | 116 | 155 | 194 | 232 | 271 | 310 | 349 | 387 | SAR Test<br>Exclusion<br>Threshold<br>(mW) |
| 300  | 27 | 55 | 82  | 110 | 137 | 164 | 192 | 219 | 246 | 274 |                                            |
| 450  | 22 | 45 | 67  | 89  | 112 | 134 | 157 | 179 | 201 | 224 |                                            |
| 835  | 16 | 33 | 49  | 66  | 82  | 98  | 115 | 131 | 148 | 164 |                                            |
| 900  | 16 | 32 | 47  | 63  | 79  | 95  | 111 | 126 | 142 | 158 |                                            |
| 1500 | 12 | 24 | 37  | 49  | 61  | 73  | 86  | 98  | 110 | 122 |                                            |
| 1900 | 11 | 22 | 33  | 44  | 54  | 65  | 76  | 87  | 98  | 109 |                                            |
| 2450 | 10 | 19 | 29  | 38  | 48  | 57  | 67  | 77  | 86  | 96  |                                            |
| 3600 | 8  | 16 | 24  | 32  | 40  | 47  | 55  | 63  | 71  | 79  |                                            |
| 5200 | 7  | 13 | 20  | 26  | 33  | 39  | 46  | 53  | 59  | 66  |                                            |
| 5400 | 6  | 13 | 19  | 26  | 32  | 39  | 45  | 52  | 58  | 65  |                                            |
| 5800 | 6  | 12 | 19  | 25  | 31  | 37  | 44  | 50  | 56  | 62  |                                            |

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm



**- For distances > 50 mm**

For 100 MHz to 6 GHz frequencies and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

**1) [Power allowed at numeric threshold for 50 mm in table 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz**

**2) [Power allowed at numeric threshold for 50 mm in table 1) + (test separation distance - 50 mm)·10] mW, at > 1500 MHz and ≤ 6 GHz**

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table

| MHz  | 50  | 60  | 70  | 80  | 90  | 100 | 110 | 120 | 130 | 140  | 150  | 160  | 170  | 180  | 190  | mm                                |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|-----------------------------------|
| 100  | 474 | 481 | 487 | 494 | 501 | 507 | 514 | 521 | 527 | 534  | 541  | 547  | 554  | 561  | 567  | SAR Test Exclusion Threshold (mW) |
| 150  | 387 | 397 | 407 | 417 | 427 | 437 | 447 | 457 | 467 | 477  | 487  | 497  | 507  | 517  | 527  |                                   |
| 300  | 274 | 294 | 314 | 334 | 354 | 374 | 394 | 414 | 434 | 454  | 474  | 494  | 514  | 534  | 554  |                                   |
| 450  | 224 | 254 | 284 | 314 | 344 | 374 | 404 | 434 | 464 | 494  | 524  | 554  | 584  | 614  | 644  |                                   |
| 835  | 164 | 220 | 275 | 331 | 387 | 442 | 498 | 554 | 609 | 665  | 721  | 776  | 832  | 888  | 943  |                                   |
| 900  | 158 | 218 | 278 | 338 | 398 | 458 | 518 | 578 | 638 | 698  | 758  | 818  | 878  | 938  | 998  |                                   |
| 1500 | 122 | 222 | 322 | 422 | 522 | 622 | 722 | 822 | 922 | 1022 | 1122 | 1222 | 1322 | 1422 | 1522 |                                   |
| 1900 | 109 | 209 | 309 | 409 | 509 | 609 | 709 | 809 | 909 | 1009 | 1109 | 1209 | 1309 | 1409 | 1509 |                                   |
| 2450 | 96  | 196 | 296 | 396 | 496 | 596 | 696 | 796 | 896 | 996  | 1096 | 1196 | 1296 | 1396 | 1496 |                                   |
| 3600 | 79  | 179 | 279 | 379 | 479 | 579 | 679 | 779 | 879 | 979  | 1079 | 1179 | 1279 | 1379 | 1479 |                                   |
| 5200 | 66  | 166 | 266 | 366 | 466 | 566 | 666 | 766 | 866 | 966  | 1066 | 1166 | 1266 | 1366 | 1466 |                                   |
| 5400 | 65  | 165 | 265 | 365 | 465 | 565 | 665 | 765 | 865 | 965  | 1065 | 1165 | 1265 | 1365 | 1465 |                                   |
| 5800 | 62  | 162 | 262 | 362 | 462 | 562 | 662 | 762 | 862 | 962  | 1062 | 1162 | 1262 | 1362 | 1462 |                                   |

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

**- For frequencies below 100 MHz**

The following may be considered for SAR test exclusion:

**1) For test separation distances > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by [1 + log(100/f(MHz))]**

**2) For test separation distances ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by ½**

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table

| MHz  | < 50 | 50   | 60   | 70   | 80   | 90   | 100  | 110  | 120  | 130  | 140  | 150  | 160  | 170  | 180  | 190  | mm |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|----|
| 100  | 237  | 474  | 481  | 487  | 494  | 501  | 507  | 514  | 521  | 527  | 534  | 541  | 547  | 554  | 561  | 567  | mW |
| 50   | 308  | 617  | 625  | 634  | 643  | 651  | 660  | 669  | 677  | 686  | 695  | 703  | 712  | 721  | 729  | 738  |    |
| 10   | 474  | 948  | 961  | 975  | 988  | 1001 | 1015 | 1028 | 1041 | 1055 | 1068 | 1081 | 1095 | 1108 | 1121 | 1135 |    |
| 1    | 711  | 1422 | 1442 | 1462 | 1482 | 1502 | 1522 | 1542 | 1562 | 1582 | 1602 | 1622 | 1642 | 1662 | 1682 | 1702 |    |
| 0.1  | 948  | 1896 | 1923 | 1949 | 1976 | 2003 | 2029 | 2056 | 2083 | 2109 | 2136 | 2163 | 2189 | 2216 | 2243 | 2269 |    |
| 0.05 | 1019 | 2039 | 2067 | 2096 | 2125 | 2153 | 2182 | 2211 | 2239 | 2268 | 2297 | 2325 | 2354 | 2383 | 2411 | 2440 |    |
| 0.01 | 1185 | 2370 | 2403 | 2437 | 2470 | 2503 | 2537 | 2570 | 2603 | 2637 | 2670 | 2703 | 2737 | 2770 | 2803 | 2837 |    |

SAR Test Exclusion Thresholds for frequencies < 100 MHz

**Simultaneous transmission assessment:**

When multiple sources are introduced into an environment, it becomes necessary to address the sources interdependently, since each source will contribute some percentage of the maximum exposure towards the total exposure at a fixed location. The sum of the ratios of the exposure from each source to the corresponding maximum exposure for the frequency of each source must be evaluated.

The exposure complies with the maximum permissible exposure if the sum of the ratios is less than unity:

$$\sum_{i=1}^n \frac{S_i}{P \max_i} < 1$$

Where

$S_i$  is the calculated SAR tests exclusion value of each source.

$P \max_i$  is the SAR test exclusion threshold.