



# Impedance Measurement Plot for Head TSL (5300, 5500, 5600, 5750, 5800 MHz)

| ile   | ⊻iew  | ⊆hannel                   | Sweep | Calibration | Irace | Scale | Marker   | System | Window | Help           |  | Here's  |
|---|---|---------------------------|-------|-------------|-------|-------|----------|--------|--------|----------------|--|---|
|   |   |                           |       |             |       |       | /        |        | _      | 3:             | 5.300000 GHz   | 46.215 Ω  |
|   |   |                           |       |             |       | X     | -        | 1-     | X      |                | 9.3639 pF  | -3.2069 Ω   |
|   |   |                           |       |             |       | /     | X        | 1-     | XI     | 4:             | 5.500000 GHz<br>9.2370 pF  | 49.978 Ω  |
|   |   |                           |       |             | /     | / /   | $\sim$   | 1-     | 1-1    | 5:             | 5.600000 GHz   | -3.1327 Ω<br>53.576 Ω   |
|   |   |                           |       |             | 1     |       | $\wedge$ | A      | K-1    | 9.             | 13.425 pH  | 472.39 mΩ   |
|   |   |                           |       |             | 1     | 6     |          | XX     | LA     | 6:             | 5.750000 GHz   | 51.897 Q  |
|   |   |                           |       |             |       |       |          |        | SAL    |                | 16.469 pF  | -1.6807 Ω   |
|   |   |                           |       |             | 1     | 1     | 1        | T      | XU     | >7:            | 5.800000 GHz<br>8.6324 pF  | 51.225 Ω<br>-3.1788 Ω   |
|   |   |                           |       |             | F     | C     | X        | Ě      | Į      |                |  |   |
|   |   | Ch 4 4                    | 00    |             |       |       |          | 1      |        |                |  |   |
| 0.0   | Ch1: Sta  | Ch 1 Avg =<br>art 5.00000 |       | _           |       |       |          |        |        | 3:             | 5.\$00000 GHz  | -25.759 dB  |
| 0.0   | Ch1: Sta  | rt 5.00000                |       | _           |       |       |          |        |        | 4:             | 5.300000 GHz<br>5.500000 GHz   | -25.759 dB<br>30.084 dB   |
| 10.0  | 0<br>0  | rt 5.00000                |       |             |       |       |          |        |        | -4:<br>5:      | 5.300000 GHz<br>5.500000 GHz<br>5.800000 GHz   | -25.759 dB<br>-20.094 dB<br>-29.163 dB  |
| 10.0<br>5.00  | 0 0   | rt 5.00000                |       |             |       |       |          |        |        | 4:             | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>30.084 dB<br>-29.163 dB<br>-32.088 dB                               |
| 10.0<br>5.00<br>0.00  | 0 0   | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.300000 GHz<br>5.500000 GHz<br>5.800000 GHz   | -25.759 dB<br>30.084 dB<br>-29.163 dB<br>-32.088 dB                               |
| 10.0<br>5.00<br>0.00  | 0 0   | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>30.084 dB<br>-29.163 dB<br>-32.088 dB                               |
| 10.0<br>5.00<br>0.00<br>-5.00   | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB                              |
| 10.0<br>5.00<br>5.00<br>5.00  | 00 00 00 00 00 00 00 00 00 00 00 00 00  | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | 6.00000 GHz<br>-25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB<br>-29.463 dB |
| 10.0<br>5.00<br>5.00<br>10.0<br>15.0<br>20.0                              | 00 00 00 00 00 00 00 00 00 00 00 00 00  | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB                              |
| 10.0<br>5.00<br>5.00<br>10.0<br>15.0<br>20.0                              | 0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0                                      | rt 5.00000                |       |             |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>30.084 dB<br>-29.163 dB<br>-32.088 dB                               |
| (<br>10.0<br>5.0<br>5.0<br>-10.0<br>-15.0<br>-20.0<br>-25.0<br>-25.0      | 0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0                                      | rt 5.00000                |       | 2           |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB                              |
| 10.0<br>5.00<br>5.00<br>-10.0<br>-15.0<br>-15.0<br>-20.0                  | Ch1: Sta<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0<br>0 | rt 5.00000                |       | 1 2         |       |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB                              |
| 10.0<br>5.00<br>5.00<br>5.00<br>-10.0<br>-15.0<br>-20.0<br>-25.0<br>-30.0 | Ch1: Sta<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0 0<br>0                            | rt 5.00000                | SHz   | 1 2         | 3     |       |          |        |        | 4:<br>5:<br>6: | 5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz<br>5.\$00000 GHz   | -25.759 dB<br>30.084 dB<br>-29.163 dB<br>-32.088 dB                               |
| 10.0<br>5.00<br>5.00<br>10.0<br>25.0<br>25.0<br>30.0<br>35.0              | Ch1: Sta  | IR \$1                    | 20    | 1 2         |       |       |          |        |        | 4:<br>5:<br>6: | 5.200000 GHz<br>5.500000 GHz<br>5.500000 GHz<br>5.50000 GHz<br>5.30000 GHz<br>5.30000 GHz<br>5.30000 GHz | -25.759 dB<br>-29.084 dB<br>-29.163 dB<br>-32.088 dB                              |

Certificate No: D5GHzV2-1060\_Jul22

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# 3500 MHz Dipole Calibration Certificate

| ccredited by the Swiss Accreditation<br>he Swiss Accreditation Service<br>ultilateral Agreement for the rec   | is one of the signatorie  | s to the EA   | ccreditation No.: SCS 0108   |
|---|---|---|--|
| client CTTL (Auden)   |   |   | : D3500V2-1016_Jul22   |
| CALIBRATION C   | ERTIFICATI  |   |  |
| Object  | D3500V2 - SN:10   | 016   |  |
| Calibration procedure(s)  | QA CAL-22.v6  |   |  |
|   | Calibration Proce   | dure for SAR Validation Sources   | between 3-10 GHz   |
| Calibration date:   | July 01, 2022   |   |  |
|   |   |   |  |
| This calibration certificate documer  | nts the traceability to natio   | onal standards, which realize the physical uni  | ts of measurements (SI).   |
| The measurements and the uncertain  | ainties with confidence pr  | robability are given on the following pages an  | d are part of the certificate.   |
|   |   |   |  |
|   |   |   |  |
| All calibrations have been conducte   | ed in the closed laborator  | y facility: environment temperature (22 ± 3)°C  | c and humidity < 70%.  |
| All calibrations have been conducte   | ed in the closed laborator  | y facility: environment temperature (22 ± 3)°C  | C and humidity < 70%.  |
|   |   | y facility: environment temperature (22 $\pm$ 3)°C  | c and humidity < 70%.  |
|   |   | y facility: environment temperature (22 ± 3)°C  | C and humidity < 70%.  |
| Calibration Equipment used (M&TE  | E critical for calibration)   |   |  |
| Calibration Equipment used (M&TE<br>Primary Standards   | critical for calibration)   | Cal Date (Certificate No.)  | Scheduled Calibration  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP  | Critical for calibration)   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)   | Scheduled Calibration<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91  | critical for calibration)   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)  | Scheduled Calibration<br>Apr-23<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91  | E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)  | Scheduled Calibration<br>Apr-23<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination   | ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4   | ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4   | E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23  |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards  | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 601           ID #  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. DAE4-601_May22)<br>02-May-22 (No. DAE4-601_May22)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check   |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B  | ID #         SN: 104778         SN: 103244         SN: 103245         SN: BH9394 (20k)         SN: 310982 / 06327         SN: 601         ID #         SN: GB39512475   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22   |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A   | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 601           ID #           SN: GB39512475           SN: US37292783  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A  | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: MY41093315  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06   | E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06   | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 100972           SN: US41080477  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A  | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 100972           SN: US41080477           Name  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22                           |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A  | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 100972           SN: US41080477  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>08-Mar-22 (No. EX3-3503_Mar22)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)<br>15-Jun-15 (in house check Oct-20)<br>31-Mar-14 (in house check Oct-20)   | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E44198<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A<br>Calibrated by: | ID #         SN: 104778         SN: 103244         SN: 103245         SN: 103245         SN: 103245         SN: 103245         SN: 819394 (20k)         SN: 310982 / 06327         SN: 3503         SN: 601         ID #         SN: GB39512475         SN: US37292783         SN: MY41093315         SN: 100972         SN: US41080477         Name         Joanna Lleshaj | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)           Function           Laboratory Technician | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E44198<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A<br>Calibrated by: | ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 100972           SN: US41080477           Name  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)  | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| Calibration Equipment used (M&TE<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A  | ID #         SN: 104778         SN: 103244         SN: 103245         SN: 103245         SN: 103245         SN: 103245         SN: 819394 (20k)         SN: 310982 / 06327         SN: 3503         SN: 601         ID #         SN: GB39512475         SN: US37292783         SN: MY41093315         SN: 100972         SN: US41080477         Name         Joanna Lleshaj | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)           Function           Laboratory Technician | Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |





# Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

#### Glossary:

| TSL   | tissue simulating liquid        |
|-------|---------------------------------|
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

#### Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
   b) KDR 265664, "SAR Measurements Feedback For 100 MHz to 6 CHz".
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
  of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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#### **Measurement Conditions**

DASY system configuration, as far as not given on page 1.

| DASY Version                 | DASY52   | V52.10.4                         |
|------------------------------|--|----------------------------------|
| Extrapolation                | Advanced Extrapolation                                   |                                  |
| Phantom                      | Modular Flat Phantom V5.0                                |                                  |
| Distance Dipole Center - TSL | 10 mm  | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4.0 mm, dz = 1.4 mm                             | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3400 MHz ± 1 MHz<br>3500 MHz ± 1 MHz<br>3600 MHz ± 1 MHz |                                  |

#### Head TSL parameters at 3400 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 38.0         | 2.81 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.3 ± 6 %   | 2.84 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 3400 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 100 mW input power              | 6.85 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 68.0 W/kg ± 19.9 % (k=2) |
|   |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition<br>100 mW input power | 2.57 W/kg                |

#### Head TSL parameters at 3500 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.9         | 2.91 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.2 ± 6 %   | 2.92 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 3500 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.79 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 67.5 W/kg ± 19.9 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
| SAR averaged over 10 cm (10 g) of Head 13L              | condition          |                          |
| SAR measured  | 100 mW input power | 2.54 W/kg                |
|   |                    |                          |

|                                     | and the second s | Liotting                 |
|-------------------------------------|--|--------------------------|
| SAR for nominal Head TSL parameters | normalized to 1W   | 25.3 W/kg ± 19.5 % (k=2) |
|                                     |  |                          |

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#### Head TSL parameters at 3600 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.8         | 3.02 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.1 ± 6 %   | 2.99 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 3600 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |
|---|---------------------------------|--------------------------|
| SAR measured  | 100 mW input power              | 6.66 W/kg                |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 66.4 W/kg ± 19.9 % (k=2) |
|   |                                 |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL                 | condition                       |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL<br>SAR measured | condition<br>100 mW input power | 2.49 W/kg                |

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#### Appendix (Additional assessments outside the scope of SCS 0108)

#### Antenna Parameters with Head TSL at 3400 MHz

| Impedance, transformed to feed point | 46.4 Ω - 8.7 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 20.2 dB       |  |

#### Antenna Parameters with Head TSL at 3500 MHz

| Impedance, transformed to feed point | 55.1 Ω - 3.7 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 24.5 dB       |

#### Antenna Parameters with Head TSL at 3600 MHz

| Impedance, transformed to feed point | <b>59.5</b> Ω <b>-</b> 0.4 jΩ |  |
|--------------------------------------|-------------------------------|--|
| Return Loss                          | - 21.2 dB                     |  |

#### **General Antenna Parameters and Design**

| Electrical Delay (one direction) | 1.137 ns |
|----------------------------------|----------|
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

| Manufactured by | SPEAG |
|-----------------|-------|
|                 |       |

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#### **DASY5 Validation Report for Head TSL**

Date: 01.07.2022

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1016

Communication System: UID 0 - CW; Frequency: 3500 MHz, Frequency: 3400 MHz, Frequency: 3600 MHz

Medium parameters used: f = 3500 MHz;  $\sigma$  = 2.92 S/m;  $\epsilon_r$  = 37.2;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 3400 MHz;  $\sigma$  = 2.84 S/m;  $\epsilon_r$  = 37.3;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 3600 MHz;  $\sigma$  = 2.99 S/m;  $\epsilon_r$  = 37.1;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz, ConvF(7.97, 7.97, 7.97) @ 3400 MHz, ConvF(7.91, 7.91, 7.91) @ 3600 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

#### Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.69 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.54 W/kg Smallest distance from peaks to all points 3 dB below = 8.6 mm Ratio of SAR at M2 to SAR at M1 = 74.7% Maximum value of SAR (measured) = 13.1 W/kg

#### Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3400MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.52 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.85 W/kg; SAR(10 g) = 2.57 W/kg Smallest distance from peaks to all points 3 dB below = 8.4 mm Ratio of SAR at M2 to SAR at M1 = 75.4% Maximum value of SAR (measured) = 12.9 W/kg

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Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3600MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.51 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.66 W/kg; SAR(10 g) = 2.49 W/kg Smallest distance from peaks to all points 3 dB below = 8.4 mm Ratio of SAR at M2 to SAR at M1 = 74.3%

Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

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|   |  | Channel                   |    |   |   | X                 |          | P | 1              | 3. | 50000 |                 |                | 55.115             |    |
|---|--|---------------------------|----|---|---|-------------------|----------|---|----------------|----|-------|-----------------|----------------|--------------------|----|
|   |  |                           |    |   | / | $\langle \rangle$ | $\times$ | t | 2              | 3  | 40000 | 370 pF<br>0 GHz |                | 3.6760<br>46.417   |    |
|   |  |                           |    |   | T | +                 | A        | Å | 57             | 10 | 5.38  | 807 pF          |                | 8.7011<br>59.498   |    |
|   |  |                           |    |   | - | +                 |          |   | X              | 2  |       | .71 pF          |                | 4.54 m             |    |
|   |  |                           |    |   | L | t                 | 12       | X | K              | 13 | 50000 |                 | 59             | .886 m             |    |
|   |  |                           |    |   | 1 |                   | $\times$ | A | 1              | 1  |       |                 |                | -33.701            |    |
|   |  |                           |    |   |   | X                 | -        | 1 | X              |    |       |                 |                |                    |    |
| (   | Ch1: St  | Ch 1 Avg =<br>art 3.20000 |    | _ |   |                   |          |   |                |    |       |                 | Stop           | 3.80000 G          | H  |
| 0.0   | 00 [   |                           |    | _ |   |                   | _        |   | 1:             |    | 50000 |                 | -2             | 4.453 c            | HE |
| 0.0   | 00   | art 3.20000               |    | _ |   |                   |          | > | 1:             | 3  | 40000 | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0   | 00   | art 3.20000               |    |   |   |                   |          | > | 1:<br>2:<br>3: | 3  |       | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0<br>i.0(<br>i.0(<br>i.0)   | 00   | art 3.20000               |    |   |   |                   |          | > | 1:<br>2:<br>3: | 3  | 40000 | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0<br>i.0(<br>i.0(<br>i.0)   | 00<br>0<br>0<br>0<br>0<br>00                           | art 3.20000               |    |   | 2 |                   |          | > | 1:<br>2:<br>3: | 3  | 40000 | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0<br>i.0(<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0(<br>i.0)<br>i.0()<br>i.0()<br>i.0)<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i.0()<br>i. | 00<br>0<br>0<br>0<br>0<br>00<br>00                     | art 3.20000               |    |   | 2 |                   |          | ~ | 1:<br>2:<br>3: | 3  | 40000 | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0<br>5.0<br>10.<br>15.<br>20.<br>25.  | 00<br>0<br>0<br>0<br>00<br>00<br>00<br>00              | art 3.20000               |    |   | 2 |                   |          | > | 1:             | 3  | 40000 | 0 GHz           | -2<br>-2       | 4.453 c<br>0.247 c |    |
| 0.0<br>5.0<br>0.0<br>10.<br>15.<br>20.<br>25.<br>30.<br>35.   | 00<br>0<br>0<br>00<br>00<br>00<br>00<br>00<br>00<br>00 | art 3.20000               | 20 |   | 2 |                   |          | > | 1:<br>2:<br>3: | 3  | 40000 | 0 GHz           | -2<br>-2<br>-2 | 4.453 c<br>0.247 c |    |

## Impedance Measurement Plot for Head TSL

Certificate No: D3500V2-1016\_Jul22

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# 3700 MHz Dipole Calibration Certificate

| chmid & Partner<br>Engineering AG<br>ughausstrasse 43, 8004 Zurich,   | of<br>Switzerland  | S S S S S S S S S S S S S S S S S S S   | Service suisse d'étalonnage<br>Servizio svizzero di taratura   |
|---|--|---|--|
| ccredited by the Swiss Accreditation<br>he Swiss Accreditation Service  |  |   | Accreditation No.: SCS 0108  |
| Iultilateral Agreement for the rec  | cognition of calibration   |   | lo: D3700V2-1004_Jul22   |
| CALIBRATION C   | ERTIFICATE   |   |  |
| Object  | D3700V2 - SN:10  | 004   |  |
| Calibration procedure(s)  | QA CAL-22.v6   |   |  |
|   | Calibration Proce  | dure for SAR Validation Source  | s between 3-10 GHz   |
|   |  |   |  |
| This calibration certificate docume<br>The measurements and the uncert  | ainties with confidence p  | onal standards, which realize the physical u<br>robability are given on the following pages a<br>y facility: environment temperature (22 ± 3)   | and are part of the certificate.   |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct  | nts the traceability to nati-<br>tainties with confidence p<br>ed in the closed laborator  | robability are given on the following pages a   | and are part of the certificate.   |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Ti  | nts the traceability to nati-<br>tainties with confidence p<br>ed in the closed laborator  | robability are given on the following pages a   | and are part of the certificate.   |
| This calibration certificate documents and the uncert<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP  | nts the traceability to nati-<br>tainties with confidence p<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)   | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23  |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91   | nts the traceability to nati-<br>tainties with confidence p<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244   | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)   | C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23   |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)  | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)  | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Tf<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)  | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Tf<br>Primary Standards<br>Power sensor NRP-291<br>Power sensor NRP-291<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4  | nts the traceability to nati-<br>tainties with confidence pr<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)   | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23  |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Tf<br>Primary Standards<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)  | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| This calibration certificate documen<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Tf<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4  | nts the traceability to nati-<br>tainties with confidence pr<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. EX3-3503_Mar22)   | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23  |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)   | *C and humidity < 70%.<br>*C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23  |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           02-May-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)   | and are part of the certificate.<br>°C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TF<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)   | and are part of the certificate.<br>*C and humidity < 70%.<br>*C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20) | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22             |
| This calibration certificate documents and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&TI<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A  | nts the traceability to nati-<br>tainties with confidence pre-<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103244<br>SN: 103245<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972   | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)   | and are part of the certificate.<br>*C and humidity < 70%.<br>*C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| This calibration certificate document<br>The measurements and the uncert<br>All calibrations have been conduct<br>Calibration Equipment used (M&Tf<br>Primary Standards<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A | nts the traceability to nati-<br>tainties with confidence pr<br>ed in the closed laborator<br>E critical for calibration)<br>ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972<br>SN: US41080477<br>Name | Cal Date (Certificate No.)           04-Apr-22 (No. 217-03525/03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03524)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03525)           04-Apr-22 (No. 217-03527)           04-Apr-22 (No. 217-03528)           08-Mar-22 (No. 217-03528)           08-Mar-22 (No. DAE4-601_May22)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)           15-Jun-15 (in house check Oct-20)           31-Mar-14 (in house check Oct-20)                                     | C and humidity < 70%.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Mar-23<br>Mar-23<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22             |
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#### Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

#### Glossary:

| TSL   | tissue simulating liquid        |
|-------|---------------------------------|
| ConvF | sensitivity in TSL / NORM x,y,z |
| N/A   | not applicable or not measured  |

## Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

c) DASY System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The source is mounted in a touch configuration below the . center marking of the flat phantom.
- Return Loss: This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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## Measurement Conditions

DASY system configuration, as far as not given on page 1.

| DASY Version                 | DASY52                               | V52.10.4                         |
|------------------------------|--------------------------------------|----------------------------------|
| Extrapolation                | Advanced Extrapolation               |                                  |
| Phantom                      | Modular Flat Phantom V5.0            |                                  |
| Distance Dipole Center - TSL | 10 mm                                | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4.0 mm, dz = 1.4 mm         | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3700 MHz ± 1 MHz<br>3800 MHz ± 1 MHz |                                  |

## Head TSL parameters at 3700 MHz

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.7         | 3.12 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.0 ± 6 %   | 3.07 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

#### SAR result with Head TSL at 3700 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.74 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 67.3 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.44 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 24.4 W/kg ± 19.5 % (k=2) |

## Head TSL parameters at 3800 MHz

The following parameters and calculations were applied

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 37.6         | 3.22 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 36.8 ± 6 %   | 3.15 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

## SAR result with Head TSL at 3800 MHz

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.57 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 65.7 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 2.40 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.9 W/kg ± 19.5 % (k=2) |

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# Appendix (Additional assessments outside the scope of SCS 0108)

## Antenna Parameters with Head TSL at 3700 MHz

| Impedance, transformed to feed point | 48.6 Ω - 6.6 jΩ |  |
|--------------------------------------|-----------------|--|
|                                      | - 23.3 dB       |  |
| Return Loss                          | E010 dB         |  |

## Antenna Parameters with Head TSL at 3800 MHz

| 57.5 Ω - 5.9 jΩ |  |
|-----------------|--|
| - 21.0 dB       |  |
|                 |  |

## General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.138 ns |
|----------------------------------|----------|

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### **Additional EUT Data**

| Manufactu | red by | SPEAG |  |
|-----------|--------|-------|--|
|           |        |       |  |

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#### DASY5 Validation Report for Head TSL

Date: 01.07.2022

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1004

Communication System: UID 0 - CW; Frequency: 3700 MHz, Frequency: 3800 MHz Medium parameters used: f = 3700 MHz;  $\sigma$  = 3.07 S/m;  $\epsilon_r$  = 37;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 3800 MHz;  $\sigma$  = 3.15 S/m;  $\epsilon_r$  = 36.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz, ConvF(7.73, 7.73, 7.73) @ 3800 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.98 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 19.1 W/kg SAR(1 g) = 6.74 W/kg; SAR(10 g) = 2.44 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 73.9% Maximum value of SAR (measured) = 13.1 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3800MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.05 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.9 W/kg SAR(1 g) = 6.57 W/kg; SAR(10 g) = 2.40 W/kg Smallest distance from peaks to all points 3 dB below = 8.2 mm Ratio of SAR at M2 to SAR at M1 = 73.1% Maximum value of SAR (measured) = 13.0 W/kg

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0 dB = 13.1 W/kg = 11.17 dBW/kg

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