

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

### Antenna Parameters with Head TSL at 5200 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.4 $\Omega$ - 3.0 j $\Omega$ |
| Return Loss                          | - 26.3 dB                      |

### Antenna Parameters with Head TSL at 5300 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 46.0 $\Omega$ - 1.2 j $\Omega$ |
| Return Loss                          | - 27.2 dB                      |

### Antenna Parameters with Head TSL at 5600 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 51.1 $\Omega$ + 2.7 j $\Omega$ |
| Return Loss                          | - 30.7 dB                      |

### Antenna Parameters with Head TSL at 5800 MHz

|                                      |                                |
|--------------------------------------|--------------------------------|
| Impedance, transformed to feed point | 54.9 $\Omega$ + 1.8 j $\Omega$ |
| Return Loss                          | - 26.0 dB                      |

### General Antenna Parameters and Design

|                                  |          |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.194 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 |
|-----------------|-------|

## DASY5 Validation Report for Head TSL

Date: 03.02.2023

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1371**

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 4.63$  S/m;  $\epsilon_r = 35.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.77$  S/m;  $\epsilon_r = 35.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.07$  S/m;  $\epsilon_r = 35.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.22$  S/m;  $\epsilon_r = 35$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.56 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 27.7 W/kg

**SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.25 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 70%

Maximum value of SAR (measured) = 17.7 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.36 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 28.4 W/kg

**SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.32 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 69.5%

Maximum value of SAR (measured) = 18.5 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.99 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.2 W/kg

**SAR(1 g) = 8.23 W/kg; SAR(10 g) = 2.34 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 68.1%

Maximum value of SAR (measured) = 19.2 W/kg

**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.12 V/m; Power Drift = -0.03 dB

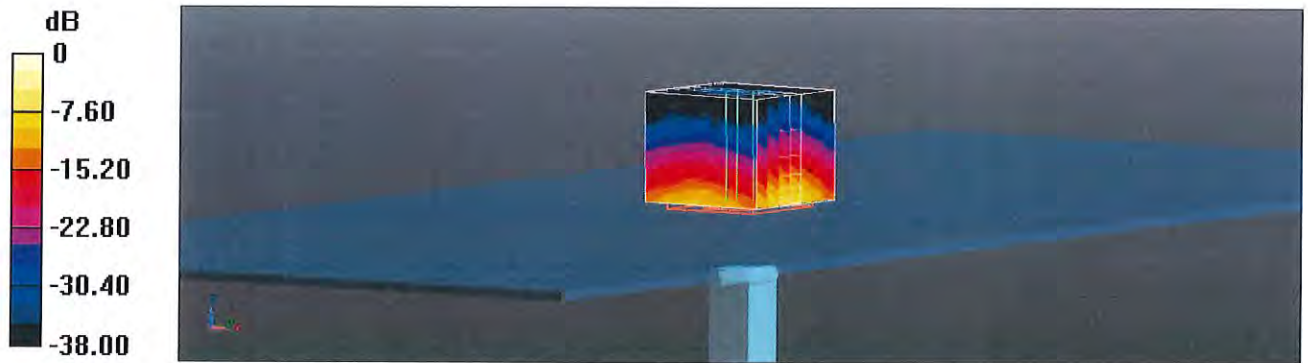
Peak SAR (extrapolated) = 31.3 W/kg

**SAR(1 g) = 8.00 W/kg; SAR(10 g) = 2.24 W/kg**

Smallest distance from peaks to all points 3 dB below = 7.2 mm

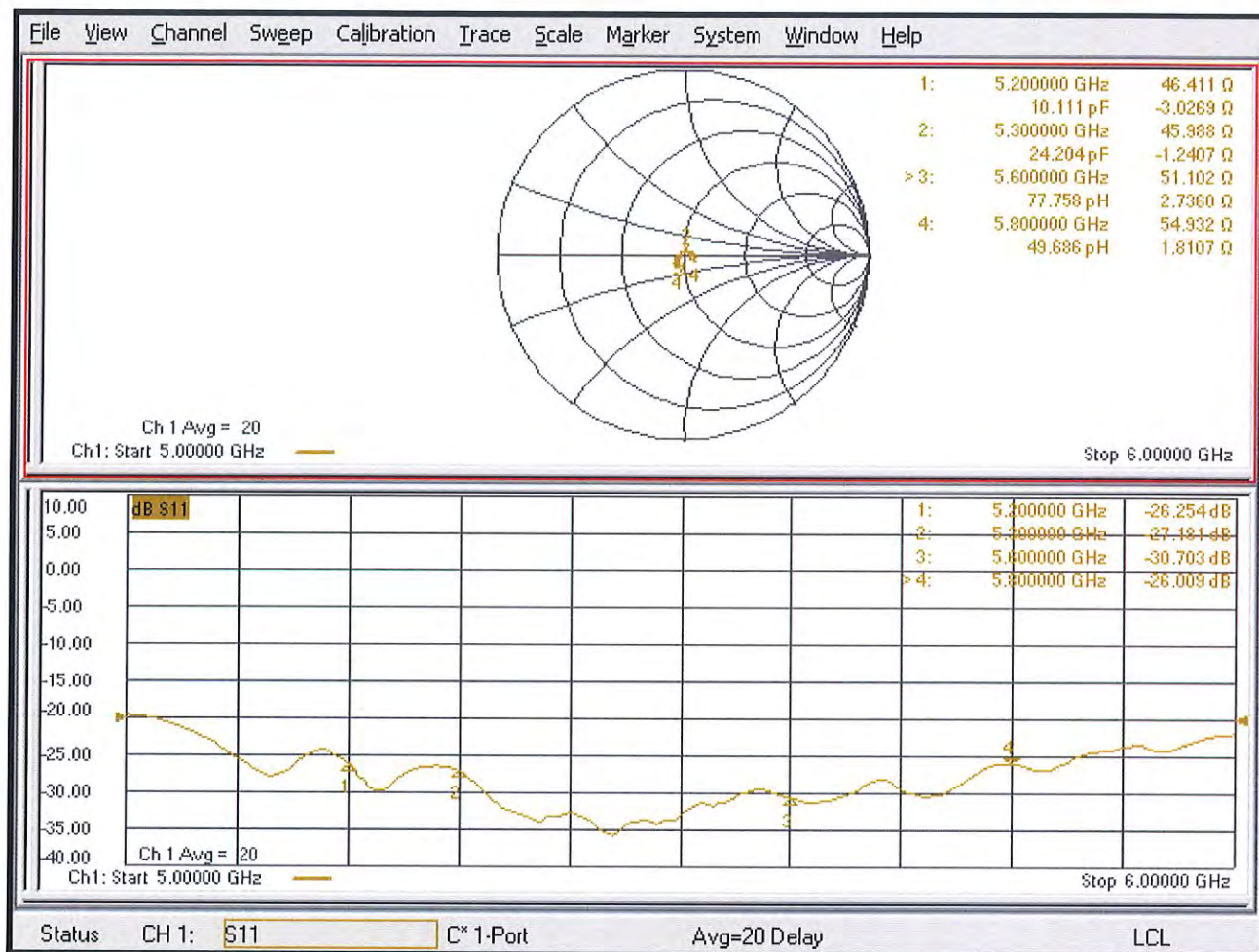
Ratio of SAR at M2 to SAR at M1 = 66.2%

Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 19.2 W/kg = 12.83 dBW/kg

## Impedance Measurement Plot for Head TSL



## Appendix: Transfer Calibration at Four Validation Locations on SAM Head<sup>1</sup>

### Evaluation Conditions (f=5200 MHz)

|         |                  |                             |
|---------|------------------|-----------------------------|
| Phantom | SAM Head Phantom | For usage with cSAR3DV2-R/L |
|---------|------------------|-----------------------------|

### SAR result with SAM Head (Top)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>83.5 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>23.9 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Mouth)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>87.4 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>25.0 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Neck)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>83.4 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>23.6 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Ear)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>53.1 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>17.9 W/kg ± 19.9 % (k=2)</b> |

<sup>1</sup> Additional assessments outside the current scope of SCS 0108

## Appendix: Transfer Calibration at Four Validation Locations on SAM Head<sup>2</sup>

### Evaluation Conditions (f=5800 MHz)

|         |                  |                             |
|---------|------------------|-----------------------------|
| Phantom | SAM Head Phantom | For usage with cSAR3DV2-R/L |
|---------|------------------|-----------------------------|

### SAR result with SAM Head (Top)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>82.9 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>23.3 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Mouth)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>89.7 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>25.2 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Neck)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>80.0 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>22.3 W/kg ± 19.9 % (k=2)</b> |

### SAR result with SAM Head (Ear)

|                                                             |                  |                                 |
|-------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b> | Condition        |                                 |
| SAR for nominal Head TSL parameters                         | normalized to 1W | <b>57.0 W/kg ± 20.3 % (k=2)</b> |

|                                                               |                  |                                 |
|---------------------------------------------------------------|------------------|---------------------------------|
| <b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b> | condition        |                                 |
| SAR for nominal Head TSL parameters                           | normalized to 1W | <b>18.9 W/kg ± 19.9 % (k=2)</b> |

<sup>2</sup> Additional assessments outside the current scope of SCS 0108

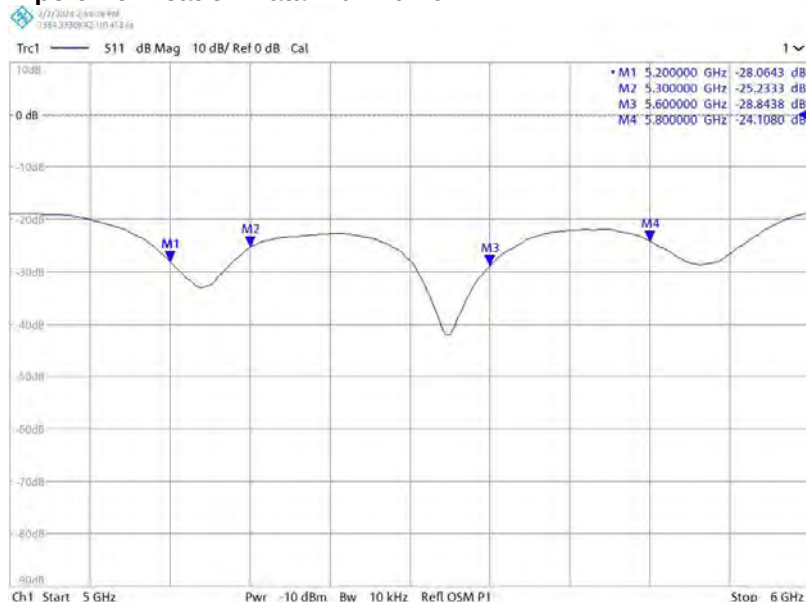
## D5GHzV2 SN 1371 Extended Dipole Calibrations

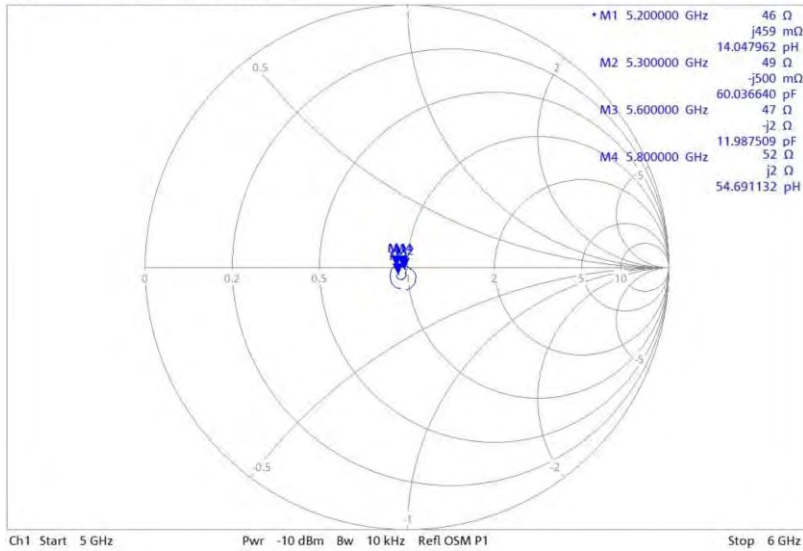
Referring to KDB 865664, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary, and the calibration interval can be extended.

| Dipole D5GHzV2 (SN 1371) |                 |            |                             |                |                                  |                |
|--------------------------|-----------------|------------|-----------------------------|----------------|----------------------------------|----------------|
| 5200MHz Head Liquid      |                 |            |                             |                |                                  |                |
| Date of Measurement      | Return Loss(dB) | $\Delta$ % | Real Impedance ( $\Omega$ ) | $\Delta\Omega$ | Imaginary Impedance ( $\Omega$ ) | $\Delta\Omega$ |
| 2023-02-03 (Cal. Report) | -26.254         | /          | 46.411                      | /              | -3.0269                          | /              |
| 2024-02-02 (extended)    | -28.0643        | 6.9        | 46                          | 0.411          | 0.459                            | 3.4859         |
| 2025-02-04 (extended)    | -26.817         | 2.14%      | 48.926                      | 2.515          | -3.8477                          | -0.8208        |
| 5300MHz Head Liquid      |                 |            |                             |                |                                  |                |
| 2023-02-03 (Cal. Report) | -27.181         | /          | 45.988                      | /              | -1.2407                          | /              |
| 2024-02-02 (extended)    | -25.2333        | -7.17      | 49                          | 3.012          | -0.5                             | 0.7407         |
| 2025-02-04 (extended)    | -28.187         | 3.70%      | 47.404                      | 1.416          | -0.64108                         | 0.59962        |
| 5600MHz Head Liquid      |                 |            |                             |                |                                  |                |
| 2023-02-03 (Cal. Report) | -30.703         | /          | 51.102                      | /              | 2.736                            | /              |
| 2024-02-02 (extended)    | -28.8438        | -6.06      | 47                          | 4.102          | -2                               | 4.736          |
| 2025-02-04 (extended)    | -29.577         | -3.67%     | 48.396                      | -2.706         | -1.916                           | -4.652         |
| 5800MHz Head Liquid      |                 |            |                             |                |                                  |                |
| 2023-02-03 (Cal. Report) | -26.009         | /          | 54.932                      | /              | 1.8107                           | /              |
| 2024-02-02 (extended)    | -24.108         | -7.31      | 52                          | 2.932          | 2                                | 0.1893         |
| 2025-02-04 (extended)    | -27.466         | 5.60%      | 51.06                       | -3.872         | -1.107                           | -2.9177        |

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

### Dipole Verification Data: 2024-02-02





## Dipole Verification Data: 2025-02-04

