Sporton

Client



S Schweizerischer Kalibrierdienst

- C Service suisse d'étalonnage
  - Servizio svizzero di taratura
- S 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

## Certificate No: D750V3-1107\_Jun22

| Object   | D750V3 - SN:11  | 107   |  |
|--|---|---|--|
|  | 0750V3 - 5N:1   | 107   |  |
| Calibration procedure(s)   | QA CAL-05.v11   |   |  |
| <ul> <li>In the CPU of the ALC Provide State Sta<br/>State State S</li></ul> |   | edure for SAR Validation Source   | es between 0.7-3 GHz   |
| Calibration date:  | June 22, 2022   |   |  |
| This self-   |   |   |  |
| This calibration certificate docum   | ents the traceability to na   | tional standards, which realize the physical u  | nits of measurements (SI).   |
| The measurements and the unce  | rtainties with confidence   | probability are given on the following pages a  | ind are part of the certificate  |
|  |   |   |  |
| All calibrations have been conduc  | cted in the closed laborate   | bry facility: environment temperature (22 $\pm$ 3)°   | C and humidity < 70%   |
|  |   | · · · · · · · · · · · · · · · · · · ·   | o and hamoly c 70%.  |
| Calibration Equipment used (Mar  | E critical for calibration)   |   |  |
| oanoration Equipment used (M&)   | = on to a location at one   |   |  |
| Calibration Equipment used (M&)  | control for calibration)  |   |  |
| Calibration Equipment used (M&T<br>Primary Standards   | D #   | Cal Date (Certificate No.)  |  |
| Primary Standards  | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration  |
| Primary Standards<br>Power meter NRP   | ID #<br>SN: 104778  | 04-Apr-22 (No. 217-03525/03524)   | Apr-23   |
| Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91   | ID #<br>SN: 104778<br>SN: 103244  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)  | Apr-23<br>Apr-23   |
| Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91   | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)   | Apr-23<br>Apr-23<br>Apr-23   |
| Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check  |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-2   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-2<br>In house check: Oct-2  |
| Primary Standards<br>Power meter NRP   | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22  |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972                           | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<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  |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972                           | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23   |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315<br>SN: 100972                           | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)             | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<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  |
| 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>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)<br>Function | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>Signature |
| 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>Power sensor HP 8481A<br>RF generator R&S SMT-06<br>Network Analyzer Agilent E8358A  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: 8H9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477         | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)             | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>Signature |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:   | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)<br>Function | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>Signature |
| 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 #<br>SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)<br>Function | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-2<br>In house check: Oct-2                    |

Glossary.



Schweizerischer Kalibrierdienst

C Service suisse d'étalonnage

S

- Servizio svizzero di taratura
- S Swiss Calibration Service

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

Accreditation No.: SCS 0108

| 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%.

#### **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   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 750 MHz ± 1 MHz        |             |

### **Head TSL parameters**

The following parameters and calculations were applied.

| see 3                                   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 41.9         | 0.89 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 40.6 ± 6 %   | 0.89 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 2.15 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 8.54 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | and the s          |                          |
| SAR measured  | condition          |                          |
| onn measureu  | 250 mW input power | 1 40 \\///               |
| SAR for nominal Head TSL parameters                     |                    | 1.40 W/kg                |

5.57 W/kg ± 16.5 % (k=2)

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 55.1 Ω - 0.6 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 26.2 dB       |  |

### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.031 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: 22.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1107

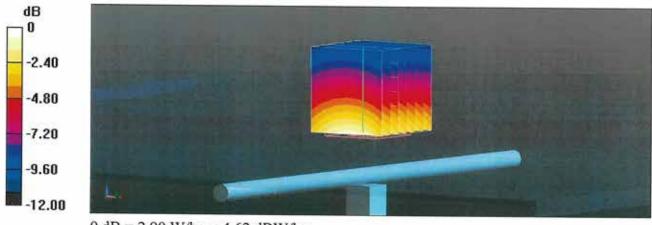
Communication System: UID 0 - CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz;  $\sigma = 0.89$  S/m;  $\epsilon_r = 40.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

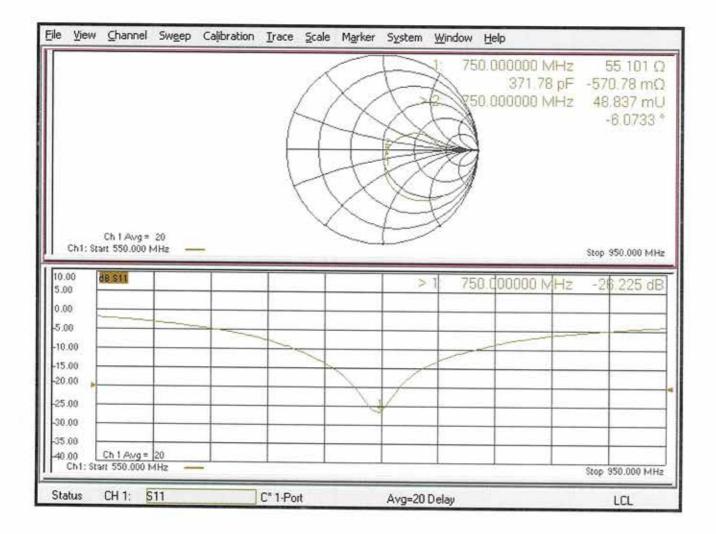
## Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 60.31 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 3.29 W/kg **SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.4 W/kg** Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm) Ratio of SAR at M2 to SAR at M1 = 64.9% Maximum value of SAR (measured) = 2.90 W/kg



0 dB = 2.90 W/kg = 4.62 dBW/kg

### Impedance Measurement Plot for Head TSL



Sporton

Client



S Schweizerischer Kalibrierdienst

C Service suisse d'étalonnage

Servizio svizzero di taratura

S 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

### Certificate No: D835V2-499\_Aug21

## CALIBRATION CERTIFICATE

|  | D835V2 - SN:49  | 99   |   |
|--|---|--|---|
| Calibration procedure(s)   | QA CAL-05.v11   |  |   |
|  |   | edure for SAR Validation Source  | s between 0.7-3 GHz   |
| Calibration date;  | August 18, 2021   |  |   |
|  |   |  |   |
| This calibration certificate docume  | ents the traceability to nat  | tional standards, which realize the physical u   | nite of managements (OI)  |
| he measurements and the uncer  | tainties with confidence p  | probability are given on the following pages a   | nd are part of the certificate  |
|  |   |  |   |
| Il calibrations have been conduct  | led in the closed laborato  | bry facility: environment temperature (22 $\pm$ 3)°  | C and burning the man   |
|  |   | ,  | o and numidity < 70%,   |
| alibration Equipment used (M&T   | E critical for calibration  |  |   |
| inter and inter  | = entreal for calibration)  |  |   |
| Primary Standards  | ID #  | Cal Data (Castificate No.)   |   |
|  |   | Cal Date (Certificate No.)   | Scheduled Calibration   |
| ower meter NRP   | SN: 104779  | 00 Any 04 (Min. 047 2000   |   |
|  | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)  | Apr-22  |
| ower sensor NRP-Z91  | SN: 103244  | 09-Apr-21 (No. 217-03291)  |   |
| 'ower sensor NRP-Z91<br>'ower sensor NRP-Z91   | SN: 103244<br>SN: 103245  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)   | Apr-22  |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Ype-N mismatch combination   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>ype-N mismatch combination<br>Reference Probe EX3DV4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination<br>Reference Probe EX3DV4  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| 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   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21  |
| 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   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check   |
| 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  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22   |
| 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   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03343)<br>09-Apr-21 (No. 217-03292)<br>02-Nov-20 (No. 217-03292)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03344)<br>28-Dec-20 (No. 217-0344)<br>28-Dec-20 (No. 217-044)<br>28-Dec-20 (No. | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Recondary Standards<br>ower meter E4419B<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>F generator R&S SMT-06  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41092317   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03344)<br>28-Dec-20 (No. 217-03343)<br>09-Apr-21 (No. 217-03292)<br>02-Nov-20 (No. 217-03292)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03344)<br>28-Dec-20 (No. 217-0344)<br>28-Dec-20 (No. 217-044)<br>28-Dec-20 (No. | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<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 |
| 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>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<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 |
| 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>Regenerator R&S SMT-06<br>letwork Analyzer Agilent E8358A  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. EX3-7349_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21  |
| 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>Recondary Standards<br>Tower meter E4419B<br>Rower sensor HP 8481A<br>Rower sensor HP 8481A<br>F generator R&S SMT-06<br>etwork Analyzer Agilent E8358A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03343)<br>02-Nov-20 (No. 217-03344)<br>28-Dec-20 (No. 217-0344)<br>28-Dec-20 (No. 217-0344)<br>29-Dec-20 (No | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<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 |
| 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><u>Secondary Standards</u><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<br>Calibrated by: | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>28-Dec-20 (No. 217-03343)<br>09-Apr-21 (No. 217-03292)<br>Check Date (in house)<br>30-Oct-14 (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)<br>Function   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<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 Laboratory of**

Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst

- s Service suisse d'étalonnage С
- Servizio svizzero di taratura
- S Swiss Calibration Service

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%.

Accreditation No.: SCS 0108

### **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   |             |
| Distance Dipole Center - TSL | 15 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 835 MHz ± 1 MHz        |             |

## Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 41.5         | 0.90 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 41.6 ± 6 %   | 0.92 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | (1010)       |                  |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 2.46 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 9.68 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 1.59 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.28 W/kg ± 16.5 % (k=2) |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 50.6 Ω - 4.7 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 26.6 dB       |  |

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

| Electrical Delay (one direction) | 1.391 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: 18.08.2021

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:499

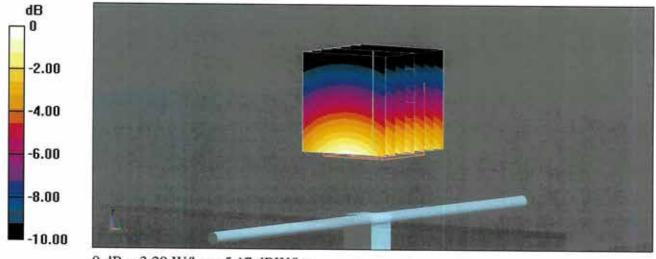
Communication System: UID 0 - CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz;  $\sigma = 0.92$  S/m;  $\epsilon_r = 41.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

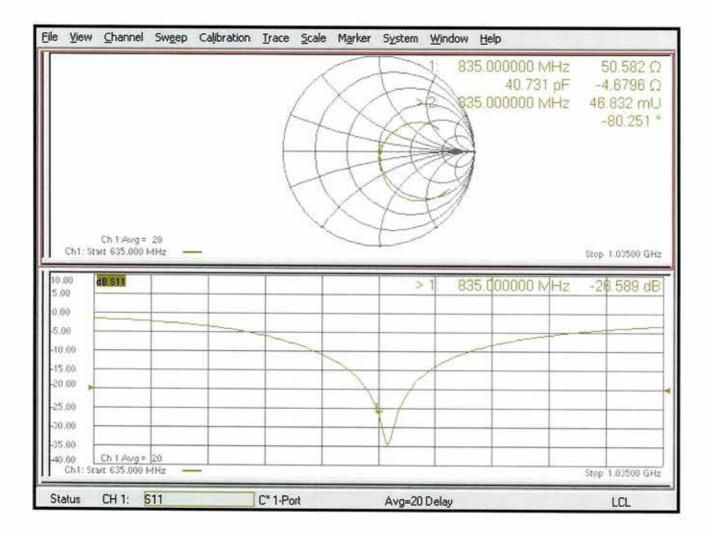
## Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 63.97 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 3.71 W/kg SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.59 W/kg Smallest distance from peaks to all points 3 dB below = 16 mm Ratio of SAR at M2 to SAR at M1 = 66% Maximum value of SAR (measured) = 3.29 W/kg



0 dB = 3.29 W/kg = 5.17 dBW/kg

## Impedance Measurement Plot for Head TSL





### D835V2, serial no. 499 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.

#### <Justification of the extended calibration>

| D <b>835</b> V2 – serial no. <b>499</b> |                  |           |                      |             |                           |             |
|---|------------------|-----------|----------------------|-------------|---------------------------|-------------|
|   |                  | 835MHZ    |                      |             |                           |             |
| Date of Measurement                     | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
| 08.18.2021<br>(Cal. Report)             | -26.589          |           | 50.582               |             | -4.6796                   |             |
| . ,                                     |                  |           |                      |             |                           |             |
| 08.17.2022<br>(extended)                | -25.515          | -4.04     | 49.077               | -1.505      | -4.9045                   | -0.2249     |

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.



1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1] 835.00000 MHz -25.515 dB >1 20.00 0.000 -30.00 1 Start 635 MHz Stop 1.035 GHz Cor IFBW 70 kHz 1 511 Smith (R+jX) Scale 1.0000 [F1 Del] >1 835.00000 MHz 49.077 Ω -4.9045 Ω 38-863 pF 1 Start 635 MHz IFBW 70 kHz Stop 1.035 GHz Cor

<Dipole Verification Data> - D835 V2, serial no. 499 (Data of Measurement : 08.17.2022) 835 MHz - Head



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С Servizio svizzero di taratura

S 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

Client Sporton Certificate No: D1750V2-1112\_Jun22

## CALIBRATION CERTIFICATE

| Object   | D1750V2 - SN:1  | 112   |   |
|--|---|---|---|
| Calibration procedure(s)   | QA CAL-05.v11<br>Calibration Proce  | edure for SAR Validation Sources  | s between 0.7-3 GHz   |
| Calibration date:  | June 22, 2022   |   |   |
| he measurements and the uncert   | ainties with confidence p<br>ed in the closed laborato  | ional standards, which realize the physical un<br>probability are given on the following pages an<br>ry facility: environment temperature (22 ± 3)°C  | d are part of the certificate.  |
| equipment used (mail   | - onlicar for calibration   |   |   |
| Primary Standards  | ID #  | Cal Date (Certificate No.)  | Scheduled Calibration   |
| the second se  | ID #<br>SN: 104778  | Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)   | Scheduled Calibration<br>Apr-23   |
| ower meter NRP   | and the second se |   |   |
| ower meter NRP<br>ower sensor NRP-Z91  | SN: 104778  | 04-Apr-22 (No. 217-03525/03524)   | Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91  | SN: 104778<br>SN: 103244  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)  | Apr-23<br>Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Type-N mismatch combination   | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)   | Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>leference 20 dB Attenuator<br>ype-N mismatch combination   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check   |
| 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>Recondary Standards<br>Power meter E4419B  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22   |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Fype-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Secondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Pype-N mismatch combination<br>Reference Probe EX3DV4<br>DAE4<br>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A                            | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Re generator R&S SMT-06 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23  |
| 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 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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)                                      | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477   | 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>31-Dec-21 (No. EX3-7349_Dec21)<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) | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<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 Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst

- C Service suisse d'étalonnage
- Servizio svizzero di taratura
- S Swiss Calibration Service

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#### 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%.

Accreditation No.: SCS 0108

### 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   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1750 MHz ± 1 MHz       |             |

## Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 40.1         | 1.37 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.6 ± 6 %   | 1.34 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

## SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL   | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 9.18 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 36.9 W/kg ± 17.0 % (k=2) |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|   |                    |                          |
| SAR measured  | 250 mW input power | 4.83 W/kg                |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 51.4 Ω + 0.0 jΩ |   |
|--------------------------------------|-----------------|---|
| Return Loss                          | - 37.3 dB       | - |

### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.216 ns |
|----------------------------------|----------|
|                                  | 1.210113 |

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 |
|-----------------|-------|
|                 | SFEAG |

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

Date: 22.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1112

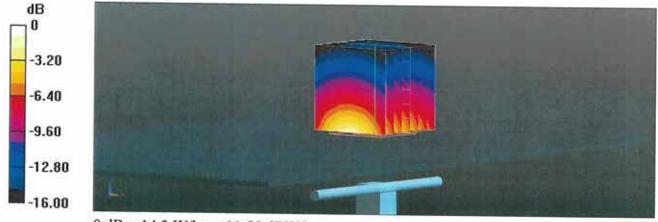
Communication System: UID 0 - CW; Frequency: 1750 MHz Medium parameters used: f = 1750 MHz;  $\sigma = 1.34$  S/m;  $\epsilon_r = 38.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 31.12.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 107.3 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 17.2 W/kg **SAR(1 g) = 9.18 W/kg; SAR(10 g) = 4.83 W/kg** Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 53.6% Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg

## Impedance Measurement Plot for Head TSL

|                                 |        |                                  |           |   |   | 1 |   | - | 1 | 1.750000          | GHZ   | 5            | 1.384 C                    |
|---------------------------------|--------|----------------------------------|-----------|---|---|---|---|---|---|-------------------|-------|--------------|----------------------------|
|                                 |        |                                  |           |   | É | 4 | X | X | A | 542.5<br>1.750000 | 59 fH | 5.98<br>13.0 | 361 m£<br>351 mL<br>3.63 m |
| Ch1<br>10.00<br>5.00<br>0.00    | : Star | Ch 1 Avg =<br>t 1.55000<br>B S11 | 20<br>GHz | - | + |   | X |   |   | 1.750000          | GHz   |              | .95000 GH:<br>297 dE       |
| 5.00<br>10.00<br>15.00<br>20.00 |        |                                  |           |   |   |   |   |   |   |                   |       | _            |                            |
| 25.00<br>30.00<br>35.00         |        |                                  |           |   |   |   | T | 1 |   |                   |       |              |                            |
| 40.00                           |        | Ch 1 Avg =<br>t 1.55000          | 20        |   |   |   | 6 | ¥ |   |                   |       |              | .95000 GHa                 |



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S 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

#### Client Sporton

Certificate No: D1900V2-5d185\_Jun22

# CALIBRATION CERTIFICATE

| Calibration date:   | June 17, 2022<br>ts the traceability to nat<br>inties with confidence p<br>d in the closed laborato   | edure for SAR Validation Sources<br>tional standards, which realize the physical un<br>probability are given on the following pages an<br>any facility: environment temperature (22 ± 3)°<br>Cal Date (Certificate No.)<br>04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03525)<br>04-Apr-22 (No. 217-03525) | nits of measurements (SI).<br>Ind are part of the certificate.  |
|---|---|--|---|
| This calibration certificate documents<br>The measurements and the uncertai<br>All calibrations have been conducted<br>Calibration Equipment used (M&TE of<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | ts the traceability to nat<br>inties with confidence p<br>d in the closed laborato<br>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. 217-03525)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23 |
| All calibrations have been conducted<br>Calibration Equipment used (M&TE of<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | d in the closed laborato<br>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. 217-03525)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23 |
| All calibrations have been conducted<br>Calibration Equipment used (M&TE of<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | d in the closed laborato<br>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. 217-03525)   | nd are part of the certificate.<br>C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23 |
| All calibrations have been conducted<br>Calibration Equipment used (M&TE of<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | d in the closed laborato<br>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. 217-03525)   | C and humidity < 70%.<br>Scheduled Calibration<br>Apr-23<br>Apr-23                                    |
| Calibration Equipment used (M&TE of<br>Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | 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)<br>04-Apr-22 (No. 217-03525)  | Scheduled Calibration<br>Apr-23<br>Apr-23   |
| Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23  |
| Primary Standards<br>Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | ID #<br>SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator   | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23  |
| Power sensor NRP-Z91<br>Reference 20 dB Attenuator  | SN: 103245  | 04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)   | Apr-23  |
| leference 20 dB Attenuator  | 이 집 같은 것이 같아요. 같은 것이 같이 많이 많이 같이 같이 같이 같이 같이 같이 많이  | 04-Apr-22 (No. 217-03525)  | 10.17 (d) 10.12   |
| 경기가 한 후 말장가 없었던 것을 많이 가 많이 같아요. 아이는 것이 나는 것이 같아요. 아이는 것이 않아요. 아이는 것이 같아요. 아이는 것이 ? 아이는 것이 ? 아이는 것이 않아요. 아이는 | SN: BH9394 (20k)  |  | Apr-23  |
|   | A STATE OF A STATE AND A STATE  | 04-Apr-22 (No. 217-03527)  | A 00  |
|   | SN: 310982 / 06327  | 04-Apr-22 (No. 217-03528)  | Apr-23  |
|   | SN: 7349  | 31-Dec-21 (No. EX3-7349_Dec21)   | Apr-23<br>Dec-22  |
| AE4   | SN: 601   | 02-May-22 (No. DAE4-601_May22)   | May-23  |
| econdary Standards  | ID #  |  |   |
| and the second se   | SN: GB39512475  | Check Date (in house)  | Scheduled Check   |
| 아이지 않는 것 같은 것 같은 것 같은 것 같이 있다.  | SN: US37292783  | 30-Oct-14 (in house check Oct-20)  | In house check: Oct-22  |
| S (222)   | SN: MY41093315  | 07-Oct-15 (in house check Oct-20)  | In house check: Oct-22  |
| F   | SN: 100972  | 07-Oct-15 (in house check Oct-20)  | In house check: Oct-22  |
|   | SN: US41080477  | 15-Jun-15 (in house check Oct-20)  | In house check: Oct-22  |
| gini accordine la   |   | 31-Mar-14 (in house check Oct-20)  | In house check: Oct-22  |
|   | Name  | Function   | Signature   |
| Calibrated by:  | Jeffrey Katzman   | Laboratory Technician  | 111   |
|   |   |  | S.C.  |
| pproved by:   | 0   |  | 00  |
| sphoted by.   | Sven Kühn   | Technical Manager  | 81  |
|   |   |  | 1.c   |

## Calibration Laboratory of

Glossarv:

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

| 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%.

### **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   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 1900 MHz ± 1 MHz       |             |

## Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 40.0         | 1.40 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.6 ± 6 %   | 1.40 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 9.82 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 39.0 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 5.12 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 20.4 W/kg ± 16.5 % (k=2) |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.7 Ω + 3.9 jΩ | - |
|--------------------------------------|-----------------|---|
| Return Loss                          | - 26.7 dB       |   |

## **General Antenna Parameters and Design**

| Electrical Delay (one direction) |          |
|----------------------------------|----------|
| cleandar belay (one direction)   | 1.203 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 to  |       |
|--|-------|
| Manufactured by  | SPEAG |
| the second s | SFEAG |

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

Date: 17.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d185

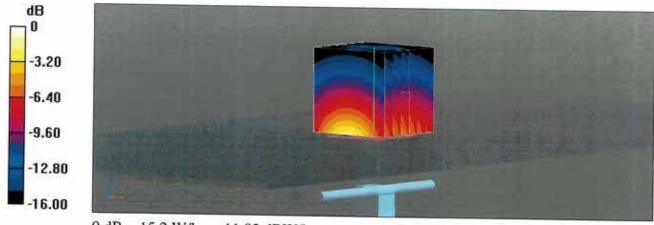
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.4 S/m;  $\epsilon_r$  = 38.6;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 31.12.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 108.9 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 18.1 W/kg **SAR(1 g) = 9.82 W/kg; SAR(10 g) = 5.12 W/kg** Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.7% Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.82 dBW/kg

## Impedance Measurement Plot for Head TSL

| File   | ⊻iew                                  | ⊆hannel                     | Sweep | Calibration | Irace | Scale | Marker    | System | Window | Help                               |    |  |
|--|---------------------------------------|-----------------------------|-------|-------------|-------|-------|-----------|--------|--------|------------------------------------|----|--|
|  |                                       |                             |       |             | Ę     |       | XXX       |        |        | 1.900000 G<br>328.47<br>1.900000 G | pH | 52,666<br>3,9213<br>46,150 m<br>53,606 |
|  | Ch1: St                               | Ch I Avg =<br>art 1.70000 ( | 20    |             |       | X     | $\sum$    | Ē      | S/     |                                    |    | · · · · · · · · · · · · · · · · · · ·  |
| 10.0<br>5.0<br>0.0   | 000                                   | dB \$11                     |       |             |       |       |           | >      | 1      | 1 900000 C                         | Hz | stop 2.10000 G                         |
| 10.0<br>5.0<br>-5.0<br>-10<br>-15<br>-20<br>-25<br>-30               | 00<br>0<br>00<br>00<br>00<br>00<br>00 |                             |       |             |       |       |           | >      |        | 1.900000 C                         | Hz |  |
| 10.0<br>5.0<br>-5.0<br>-10<br>-15<br>-20<br>-25<br>-35<br>-35<br>-40 | 00                                    |                             | 20    |             |       |       | $\bigvee$ | >      |        | 1.900000 C                         | Hz |  |



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Accreditation No.: SCS 0108

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Client Sporton

Certificate No: D2300V2-1006 Jan22

# CALIBRATION CERTIFICATE

| Object                               | D2300V2 - SN:1                     | 006  | and the second second          |
|--------------------------------------|------------------------------------|--|--------------------------------|
| Calibration procedure(s)             | QA CAL-05.v11<br>Calibration Proce | edure for SAR Validation Sources                 | s between 0.7-3 GHz            |
| Calibration date:                    | January 18, 2022                   | 2  |                                |
| This calibration certificate documer | nts the traceability to nati       | onal standards, which realize the physical un    | its of measurements (SI).      |
| The measurements and the uncerta     | ainties with confidence p          | robability are given on the following pages an   | d are part of the certificate. |
| All calibrations have been conducte  | ed in the closed laborator         | ry facility: environment temperature (22 ± 3)°C  | C and humidity < 70%.          |
| Calibration Equipment used (M&TE     | critical for calibration)          |  |                                |
| Primary Standards                    | ID #                               | Cal Date (Certificate No.)                       | Scheduled Calibration          |
| Power meter NRP                      | SN: 104778                         | 09-Apr-21 (No. 217-03291/03292)                  | Apr-22                         |
| ower sensor NRP-Z91                  | SN: 103244                         | 09-Apr-21 (No. 217-03291)                        | Apr-22                         |
| ower sensor NRP-Z91                  | SN: 103245                         | 09-Apr-21 (No. 217-03292)                        | Apr-22                         |
| eference 20 dB Attenuator            | SN: BH9394 (20k)                   | 09-Apr-21 (No. 217-03343)                        | Apr-22                         |
| ype-N mismatch combination           | SN: 310982 / 06327                 | 09-Apr-21 (No. 217-03344)                        | Apr-22                         |
| Reference Probe EX3DV4               | SN: 7349                           | 31-Dec-21 (No. EX3-7349_Dec21)                   | Dec-22                         |
| DAE4                                 | SN: 601                            | 01-Nov-21 (No. DAE4-601_Nov21)                   | Nov-22                         |
| Secondary Standards                  | ID #                               | Check Date (in house)                            | Scheduled Check                |
| Power meter E4419B                   | SN: GB39512475                     | 30-Oct-14 (in house check Oct-20)                | In house check: Oct-22         |
| Power sensor HP 8481A                | SN: US37292783                     | 07-Oct-15 (in house check Oct-20)                | In house check: Oct-22         |
| ower sensor HP 8481A                 | SN: MY41093315                     | 07-Oct-15 (in house check Oct-20)                | In house check: Oct-22         |
| RF generator R&S SMT-06              | SN: 100972                         | 15-Jun-15 (in house check Oct-20)                | In house check: Oct-22         |
| Network Analyzer Agilent E8358A      | SN: US41080477                     | 31-Mar-14 (in house check Oct-20)                | In house check: Oct-22         |
|                                      | Name                               | Function   | Signature                      |
| Calibrated by:                       | Aidonia Georgiadou                 | Laboratory Technician                            | d                              |
|                                      |                                    |  | My                             |
| Approved by:                         | Sven Kühn                          | Deputy Manager                                   | S.G                            |
|                                      |                                    | full without written approval of the laboratory. | Issued: January 19, 2022       |



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#### 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%.



## **Measurement Conditions**

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

| DASY52                 | V52.10.4   |
|------------------------|--|
| Advanced Extrapolation | V02.10.4   |
|                        |  |
| 10 mm                  | with Spacer  |
| dx, dy, dz = 5 mm      | mar opdoor   |
| 2300 MHz ± 1 MHz       |  |
|                        | Advanced Extrapolation<br>Modular Flat Phantom<br>10 mm<br>dx, dy, dz = 5 mm |

## Head TSL parameters

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 39.5         | 1.67 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 38.8 ± 6 %   | 1.69 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 12.2 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 48.3 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 250 mW input power | 5.90 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 23.5 W/kg ± 16.5 % (k=2) |
|   | Hormalized to TVV  | 23.5 W/Kg 1 16.          |

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

## Antenna Parameters with Head TSL

| 49.4 Ω - 2.4 jΩ |
|-----------------|
| - 31.9 dB       |
|                 |

## General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.168 ns  |
|----------------------------------|-----------|
|                                  | 1.100 115 |

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   |
|-----------------|---------|
|                 | or Erro |
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### **DASY5 Validation Report for Head TSL**

Date: 18.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1006

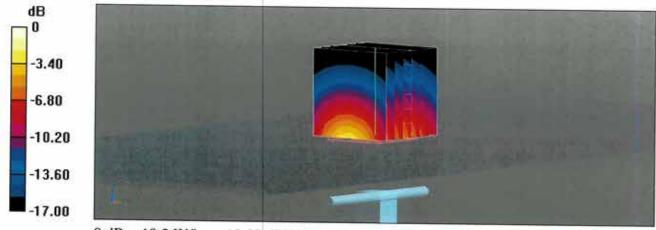
Communication System: UID 0 - CW; Frequency: 2300 MHz Medium parameters used: f = 2300 MHz;  $\sigma = 1.69$  S/m;  $\varepsilon_r = 38.8$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.98, 7.98, 7.98) @ 2300 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 116.5 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 22.3 W/kg **SAR(1 g) = 12.2 W/kg; SAR(10 g) = 5.9 W/kg** Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 55.1% Maximum value of SAR (measured) = 19.2 W/kg



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

# Impedance Measurement Plot for Head TSL

| jile  | View   | Channel               | Sweep     | Calibration | Irace     | Scale | Marker | System | Window | Help  | _                          |    |           |                                   |
|---|--|-----------------------|-----------|-------------|-----------|-------|--------|--------|--------|-------|----------------------------|----|-----------|-----------------------------------|
|   |  |                       |           |             | Ę         |       |        |        | A      | 1     | 0000 C<br>28.354<br>0000 C | PF | -2<br>25. | 9.391<br>.4405<br>299 m<br>102.60 |
| 4   | 2102200  | Ch 1 Avg =            | 20        |             |           | X     |        | P      | ×      |       |                            |    |           |                                   |
| 10.0<br>5.00<br>0.00  |  | art 2.10000<br>IB S11 | GHz -     |             |           |       |        | >      | 1      | 2.300 | 000 G                      | Hz | Stop 2    | .50000 Gi                         |
| 10.0<br>5.00<br>5.00<br>5.00<br>-10.0<br>-15.0<br>20.0                      |  |                       | GHz       |             |           |       |        | *      |        | 2.300 | 000 @                      | Hz | -         | -                                 |
| 10.0<br>5.00<br>-5.00<br>-5.00<br>-10.0<br>-25.0<br>-25.0<br>-35.0<br>-35.0 | 0 0<br>0 0<br>00 0<br>00 0<br>00 0<br>00 0<br>00 0<br>00 0 |                       | 20<br>6Hz |             | C* 1.Port |       |        | >      | 1      | 2.300 | 000 @                      |    | -31       | -                                 |



### D2300V2, serial no. 1006 Extended Dipole Calibrations

Referring to KDB 450824, 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.

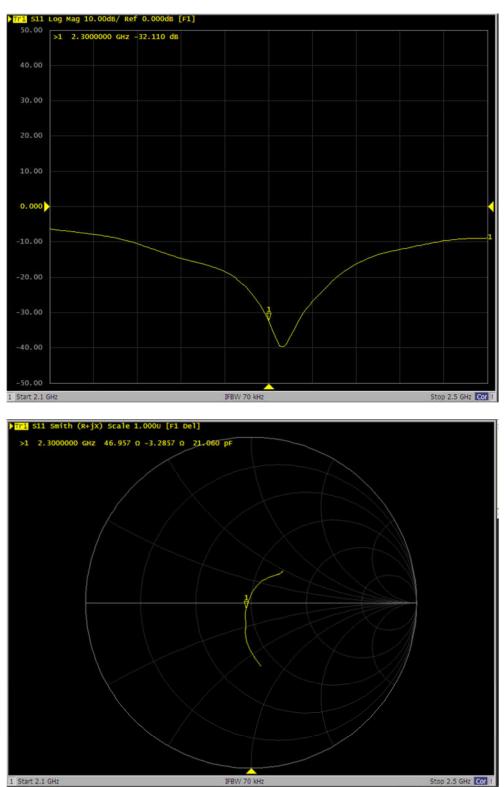
#### <Justification of the extended calibration>

| D2300V2 – serial no. <b>1006</b> |                  |           |                      |             |                           |             |  |  |  |  |
|----------------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|--|--|--|--|
|                                  | 2300MHZ          |           |                      |             |                           |             |  |  |  |  |
| Date of Measurement              | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |  |  |  |  |
| 01.18.2022                       | -31.938          |           | 49.391               |             | -2.4405                   |             |  |  |  |  |
| (Cal. Report)                    | -01.000          |           | 40.001               |             | -2.4400                   |             |  |  |  |  |
| 01.17.2023                       | -32.11           | 0.539     | 46.957               | -2.434      | -3.2857                   | -0.8452     |  |  |  |  |
| (extended)                       | -32.11           | 0.539     | 40.957               | -2.434      | -3.2037                   | -0.0452     |  |  |  |  |

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> - D2300V2, serial no. 1006 (Data of Measurement : 01.17.2023) 2300MHz - Head





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#### Client Sporton

#### Certificate No: D2600V2-1078\_Jun22

# **CALIBRATION CERTIFICATE**

|   | D2600V2 - SN:10   | 078  | - N   |
|---|---|--|---|
| Calibration procedure(s)  | QA CAL-05.v11<br>Calibration Proce  | edure for SAR Validation Sources   | between 0.7-3 GHz   |
| Calibration date:   | June 23, 2022   |  |   |
| The measurements and the uncert   | ainties with confidence p   | onal standards, which realize the physical uni<br>robability are given on the following pages an<br>ry facility: environment temperature (22 ± 3)°C  | d are part of the certificate.  |
| Calibration Equipment used (M&TE  |   |  |   |
| Orimony Clandarda   | ID#   | Cal Date (Certificate No.)   | Scheduled Calibration   |
|   | 10 11   | our pare (permidate No.)   | Scheduled Calibration   |
| ower meter NRP  | SN: 104778  | 04-Apr-22 (No. 217-03525/03524)  | Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91   |   |  |   |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91  | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)  | Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)   | Apr-23<br>Apr-23  |
| Power meter NRP<br>Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>ype-N mismatch combination   | SN: 104778<br>SN: 103244<br>SN: 103245  | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<br>04-Apr-22 (No. 217-03525)  | Apr-23<br>Apr-23<br>Apr-23  |
| ower meter NRP<br>ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>deference 20 dB Attenuator<br>ype-N mismatch combination<br>deference Probe EX3DV4  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23  |
| 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  | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349  | 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>31-Dec-21 (No. EX3-7349_Dec21)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22  |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check   |
| 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   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601   | 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>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22   |
| 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>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475   | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>31-Dec-21 (No. EX3-7349_Dec21)<br>02-May-22 (No. DAE4-601_May22)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Power sensor HP 8481A<br>Power sensor HP 8481A        | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783   | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<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)  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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                                    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: WY41093315   | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>31-Dec-21 (No. EX3-7349_Dec21)<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)   | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<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                                     |
| 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                                    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972                           | 04-Apr-22 (No. 217-03525/03524)<br>04-Apr-22 (No. 217-03524)<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>31-Dec-21 (No. EX3-7349_Dec21)<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)                                      | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22           |
| 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 | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477         | 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. 217-03525)<br>04-Apr-22 (No. 217-03527)<br>04-Apr-22 (No. 217-03528)<br>31-Dec-21 (No. EX3-7349_Dec21)<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) | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:    | SN: 104778<br>SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 7349<br>SN: 601<br>ID #<br>SN: GB39512475<br>SN: US37292783<br>SN: MY41093315<br>SN: 100972<br>SN: US41080477<br>Name | 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. 217-03525)<br>04-Apr-22 (No. 217-03528)<br>31-Dec-21 (No. EX3-7349_Dec21)<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)<br>Function                  | Apr-23<br>Apr-23<br>Apr-23<br>Apr-23<br>Dec-22<br>May-23<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22           |



S Schweizerischer Kalibrierdienst

- C Service suisse d'étalonnage
- Servizio svizzero di taratura
- S 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%.

#### 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   |             |
| Distance Dipole Center - TSL | 10 mm                  | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm      |             |
| Frequency                    | 2600 MHz ± 1 MHz       |             |

### **Head TSL parameters**

The following parameters and calculations were applied.

|   | Temperature     | Permittivity | Conductivity     |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters             | 22.0 °C         | 39.0         | 1.96 mho/m       |
| Measured Head TSL parameters            | (22.0 ± 0.2) °C | 37.8 ± 6 %   | 2.01 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        |              |                  |

### SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL                   | Condition                       |                          |  |
|---|---------------------------------|--------------------------|--|
| SAR measured  | 250 mW input power              | 14.1 W/kg                |  |
| SAR for nominal Head TSL parameters                                     | normalized to 1W                | 55.4 W/kg ± 17.0 % (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>250 mW input power | 6.29 W/kg                |  |

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

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 49.2 Ω - 7.3 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 22.6 dB       |  |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.153 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: 23.06.2022

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1078

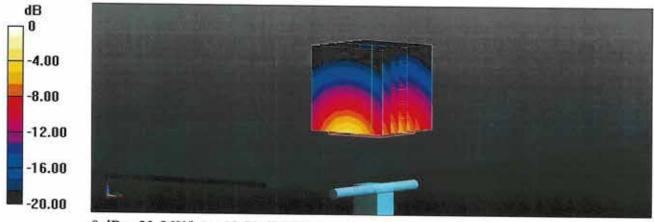
Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz;  $\sigma$  = 2.01 S/m;  $\epsilon_r$  = 37.8;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 31.12.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 117.7 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 28.0 W/kg SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.29 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 50.5% Maximum value of SAR (measured) = 23.5 W/kg



0 dB = 23.5 W/kg = 13.71 dBW/kg

# Impedance Measurement Plot for Head TSL

|  |   |                            |       | k | 6 | $\langle \rangle$ | Ę | -AA |     | 300000<br>8.393<br>300000 | 39 pF | -7<br>73 | 49.200 (<br>7.2926 (<br>.755 mL<br>.92.053 |
|--|---|----------------------------|-------|---|---|-------------------|---|-----|-----|---------------------------|-------|----------|--|
|  |   | Ch 1 Avg =                 |       | Ę | ł |                   |   |     |     |                           |       |          |  |
| _  | un I: Șta   | art 2.40000 (              | GHz — | _ |   | _                 |   | _   | _   | _                         | _     | Stop     | 2.80000 GH                                 |
| -  |   |                            |       |   |   |                   |   |     |     |                           |       |          |  |
| 5.00   |   | BSIL                       |       |   |   |                   | > | 1   | 2.8 | 00000                     | GHz   | -2.      | 2.644 dE                                   |
| 5.01<br>0.01   |   | JBSIL                      |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.01<br>0.01<br>5.0  |   | 3B S11                     |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.0(<br>5.0(<br>5.0)<br>10.)<br>15.)                                 | ) -<br>) -<br>0 -<br>00 -                                       | 11 S ST                    |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 5.0(<br>5.0)<br>5.0<br>10,)<br>15,)<br>20,)                          | )<br>0<br>00<br>00<br>00  | 38 ST1                     |       |   |   |                   | > | 1   | 2.6 | 00000                     | GHz   | -2       | 2.644 dE                                   |
| 5.0(<br>0.0)<br>5.0<br>10,)<br>15,)<br>20,)<br>25,)                  | ) -<br>) -<br>00 -<br>00 -<br>00 -                              | BB ST1                     |       |   |   |                   | ~ | 1   | 2.6 | 00000                     | GHz   | -2:      | 2.644 dE                                   |
| 10.0<br>5.0<br>5.0<br>5.0<br>10,<br>15,<br>20,<br>25,<br>30,         | )   | 38 311                     |       |   |   |                   | ~ |     | 2.6 | 00000                     | GHz   | -2       | 2.644 dE                                   |
| 5.0(<br>0.0)<br>5.0<br>10)<br>15)<br>20)<br>25)<br>30,<br>35)<br>40) | ) -<br>) -<br>0 -<br>00 -<br>00 -<br>00 -<br>00 -<br>00 -<br>00 | Ch 1 Avg =<br>nt 2.40000 ( | 20    |   |   |                   | ~ |     | 2.6 | 00000                     | GHz   | -23      | 2.644 dE                                   |

#### **Calibration Laboratory of** Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



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S 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

Client Sporton Certificate No: D3500V2-1014\_Jan22

# CALIBRATION CERTIFICATE

| Object                              | D3500V2 - SN:1              | 014  |                                    |
|-------------------------------------|-----------------------------|--|------------------------------------|
| Calibration procedure(s)            | QA CAL-22.v6                |  |                                    |
|                                     | Calibration Proc            | edure for SAR Validation Source                    | s between 3-10 GHz                 |
| Calibration date:                   | January 17, 202             | 2  |                                    |
| This calibration cortificate docume | ete the tree of 111 1       |  |                                    |
| The measurements and the uncer      | his the traceability to hal | ional standards, which realize the physical ur     | nits of measurements (SI).         |
|                                     | and an addition of          | probability are given on the following pages a     | to are part of the certificate.    |
| All calibrations have been conduct  | ed in the closed laborato   | ry facility: environment temperature (22 $\pm$ 3)° | 0                                  |
|                                     |                             | $(22 \pm 3)$                                       | C and numidity < 70%.              |
| Calibration Equipment used (M&TI    | E critical for calibration) |  |                                    |
|                                     |                             |  |                                    |
| Primary Standards                   | ID #                        | Cal Date (Certificate No.)                         | Scheduled Calibration              |
| Power meter NRP                     | SN: 104778                  | 09-Apr-21 (No. 217-03291/03292)                    | Apr-22                             |
| Power sensor NRP-Z91                | SN: 103244                  | 09-Apr-21 (No. 217-03291)                          | Apr-22<br>Apr-22                   |
| ower sensor NRP-Z91                 | SN: 103245                  | 09-Apr-21 (No. 217-03292)                          | Apr-22                             |
| Reference 20 dB Attenuator          | SN: BH9394 (20k)            | 09-Apr-21 (No. 217-03343)                          | Apr-22                             |
| ype-N mismatch combination          | SN: 310982 / 06327          | 09-Apr-21 (No. 217-03344)                          | Apr-22                             |
| Reference Probe EX3DV4              | SN: 3503                    | 31-Dec-21 (No. EX3-3503_Dec21)                     | Dec-22                             |
| DAE4                                | SN: 601                     | 01-Nov-21 (No. DAE4-601_Nov21)                     | Nov-22                             |
| econdary Standards                  | ID #                        | Check Date (in house)                              | Scheduled Check                    |
| ower meter E4419B                   | SN: GB39512475              | 30-Oct-14 (in house check Oct-20)                  | In house check: Oct-22             |
| ower sensor HP 8481A                | SN: US37292783              | 07-Oct-15 (in house check Oct-20)                  | In house check: Oct-22             |
| ower sensor HP 8481A                | SN: MY41093315              | 07-Oct-15 (in house check Oct-20)                  | In house check: Oct-22             |
| IF generator R&S SMT-06             | SN: 100972                  | 15-Jun-15 (in house check Oct-20)                  | In house check: Oct-22             |
| letwork Analyzer Agilent E8358A     | SN: US41080477              | 31-Mar-14 (in house check Oct-20)                  | In house check: Oct-22             |
|                                     | Name                        | Function   | Signature                          |
| alibrated by:                       | Michael Weber               | Laboratory Technician                              |                                    |
|                                     |                             |  | MARX                               |
|                                     |                             |  |                                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     |                                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     | M. MELT<br>S.C.                    |
| pproved by:                         | Sven Kühn                   | Deputy Manager                                     | Si Lik<br>Issued: January 20, 2022 |

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





- S Schweizerischer Kalibrierdienst
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- S 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%.

## **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       |                                  |
| Distance Dipole Center - TSL | 10 mm                      | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3500 MHz ± 1 MHz           |                                  |

### Head TSL parameters

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 %   | 2.91 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | <u> </u>     |                  |

# SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.75 W/kg                |
| SAR for nominal Head TSL parameters                   | normalized to 1W   | 67.2 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 | 2.52 W/kg                |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 25.1 W/kg ± 19.5 % (k=2) |

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

### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 54.7 Ω - 4.4 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 24.2 dB       |  |

### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.133 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

| SPEAG |       |
|-------|-------|
| _     | SPEAG |

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

Date: 17.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1014

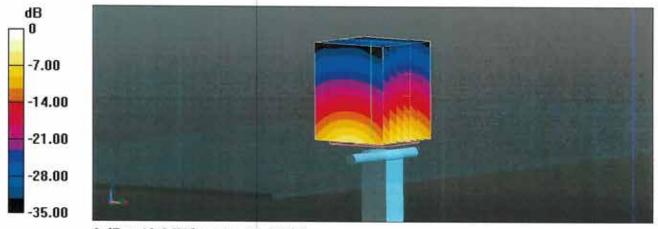
Communication System: UID 0 - CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz;  $\sigma = 2.91$  S/m;  $\epsilon_r = 37.2$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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 = 69.66 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 6.75 W/kg; SAR(10 g) = 2.52 W/kg Smallest distance from peaks to all points 3 dB below = 8.4 mm Ratio of SAR at M2 to SAR at M1 = 74.5% Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.12 dBW/kg

# Impedance Measurement Plot for Head TSL

| jle                      | View                | Channel                                | Sweep     | Calibration | Irace | Scale | Marker                                 | System | ₩indow | Help                          |      |           |   |
|--------------------------|---------------------|--|-----------|-------------|-------|-------|--|--------|--------|-------------------------------|------|-----------|---|
|                          |                     |  |           |             | Ę     |       | XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX |        | A      | 3.500000<br>10.26<br>3.500000 | 2 pF | -4<br>61. | 4.658 Ω<br>4314 Ω<br>375 mU<br>41 147 ° |
| 10.0<br>5.0<br>0.0       | 00                  | Ch 1 Avg =<br>art 3.30000 (<br>dB \$11 | 20<br>3Hz |             |       |       |  | >      | 1      | 3.500000 (                    | 3Hz  |           | .70000 GHz<br>240 dB                    |
| 5.0                      | .00                 |  |           |             |       |       |  |        |        |                               | -    |           |   |
| -15<br>-20<br>-25<br>-30 | .00 <b>,</b><br>.00 |  |           | -           |       |       |  |        |        |                               |      | _         |   |



### D3500V2, serial no. 1014Extended Dipole Calibrations

Referring to KDB 450824, 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.

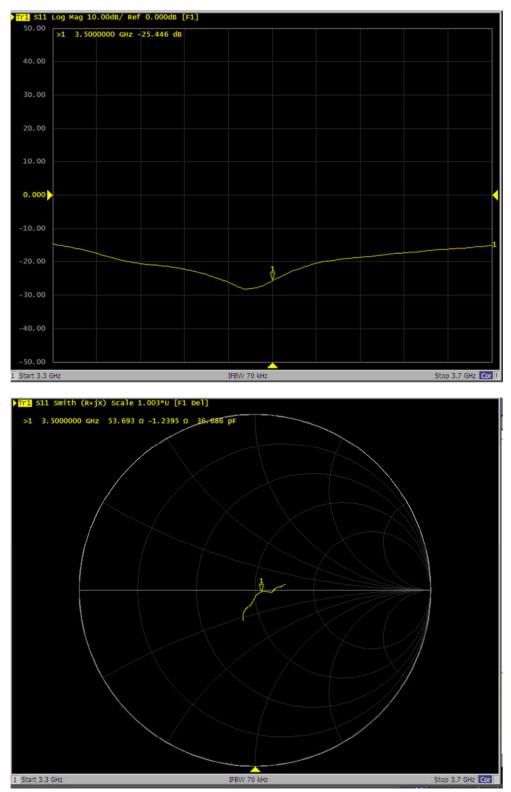
#### <Justification of the extended calibration>

| D3500V2 – serial no. 1014 |                  |           |                      |             |                           |             |  |  |  |
|---------------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|--|--|--|
|                           |                  | 3500MHZ   |                      |             |                           |             |  |  |  |
| Date of Measurement       | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |  |  |  |
| 01.17.2022                | -24.24           |           | 54.658               |             | -4.4314                   |             |  |  |  |
| (Cal. Report)             | -24.24           |           | 54.000               |             | -4.4314                   |             |  |  |  |
| 01.16.2023                | -25.446          | 4,739     | 53.693               | -0.965      | -1.2395                   | 3.1919      |  |  |  |
| (extended)                | -20.440          | 4.739     | 55.095               | -0.965      | -1.2395                   | 3.1919      |  |  |  |

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> - D3500 V2, serial no.1014 (Data of Measurement : 01.16.2023) 3500MHz - Head



#### **Calibration Laboratory of** Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

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Certificate No: D3700V2-1022 Jul21

# **CALIBRATION CERTIFICATE**

| Dbject   | D3700V2 - SN:10   | 022  |   |
|--|---|--|---|
| Calibration procedure(s)   | QA CAL-22.v6<br>Calibration Proce   | edure for SAR Validation Sources   | between 3-10 GHz  |
| Calibration date:  | July 14, 2021   |  |   |
| The measurements and the uncert  | ainties with confidence p<br>ad in the closed laborato  | ional standards, which realize the physical un robability are given on the following pages an<br>ry facility: environment temperature ( $22 \pm 3$ )°(   | d are part of the certificate.  |
| Primary Standards  | ID #  | Cal Date (Certificate No.)   | Scheduled Calibration   |
|  |   |  |   |
|  | SN: 104778  | 09-Apr-21 (No. 217-03291/03292)  | Apr-22  |
| ower sensor NRP-Z91  | SN: 103244  | 09-Apr-21 (No. 217-03291/03292)<br>09-Apr-21 (No. 217-03291)   | Apr-22<br>Apr-22  |
| wer sensor NRP-Z91<br>wer sensor NRP-Z91   | SN: 103244<br>SN: 103245  |  | C 2012 C 2012 C   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator  | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)  | Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>pe-N mismatch combination   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)   | Apr-22<br>Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>/pe-N mismatch combination<br>eference Probe EX3DV4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)   | Apr-22<br>Apr-22<br>Apr-22  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327  | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22  |
| Yower sensor NRP-Z91<br>Yower sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Ype-N mismatch combination<br>Reference Probe EX3DV4<br>PAE4   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>leference 20 dB Attenuator<br>ype-N mismatch combination<br>leference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21  |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)   | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check   |
| Power sensor NRP-Z91<br>Power sensor NRP-Z91<br>Reference 20 dB Attenuator<br>Pype-N mismatch combination<br>Reference Probe EX3DV4<br>PAE4<br>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A   | SN: 103244<br>SN: 103245<br>SN: BH9394 (20k)<br>SN: 310982 / 06327<br>SN: 3503<br>SN: 601<br>ID #<br>SN: GB39512475   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>F generator R&S SMT-06   | 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: MY41092317<br>SN: 100972                           | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<br>Check Date (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20)  | Apr-22<br>Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22   |
| ower sensor NRP-Z91<br>ower sensor NRP-Z91<br>eference 20 dB Attenuator<br>ype-N mismatch combination<br>eference Probe EX3DV4<br>AE4<br>econdary Standards<br>ower meter E4419B<br>ower sensor HP 8481A<br>ower sensor HP 8481A<br>F generator R&S SMT-06   | 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: MY41092317   | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-0344)<br>30-Dec-20 (No. 217-0344)<br>30-Oct-14 (in house)<br>30-Oct-14 (in house check Oct-20)<br>07-Oct-15 (in house check Oct-20) | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-22<br>In house check: Oct-22   |
| 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>Regenerator R&S SMT-06   | 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: MY41092317<br>SN: 100972                           | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-21 |
| 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>Recondary Standards<br>Power meter E4419B<br>Power sensor HP 8481A<br>Power sensor HP 8481A<br>Reference R&S SMT-06<br>Network Analyzer Agilent E8358A  | 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: MY41092317<br>SN: 100972<br>SN: US41080477         | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. EX3-3503_Dec20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)  | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<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   |
| 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: | 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: MY41092317<br>SN: 100972<br>SN: US41080477<br>Name | 09-Apr-21 (No. 217-03291)<br>09-Apr-21 (No. 217-03292)<br>09-Apr-21 (No. 217-03343)<br>09-Apr-21 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. 217-03344)<br>30-Dec-20 (No. DAE4-601_Nov20)<br>02-Nov-20 (No. DAE4-601_Nov20)<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)<br>Function   | Apr-22<br>Apr-22<br>Apr-22<br>Dec-21<br>Nov-21<br>Scheduled Check<br>In house check: Oct-22<br>In house check: Oct-21 |

Calibration Laboratory of Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



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|-------|---------------------------------|
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- 0 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%.

Accreditation No.: SCS 0108

### 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       |                                  |
| Distance Dipole Center - TSL | 10 mm                      | with Spacer                      |
| Zoom Scan Resolution         | dx, dy = 4 mm, dz = 1.4 mm | Graded Ratio = 1.4 (Z direction) |
| Frequency                    | 3700 MHz ± 1 MHz           |                                  |

### Head TSL parameters

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 | 37.7 ± 6 %   | 3.12 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C        | 1 - MAR - 1  | 3244             |

# SAR result with Head TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL     | Condition          |                          |
|---|--------------------|--------------------------|
| SAR measured  | 100 mW input power | 6.82 W/kg                |
| SAR for nominal Head TSL parameters                       | normalized to 1W   | 68.2 W/kg ± 19.9 % (k=2) |
| CAP overegoing over 10 em <sup>3</sup> (10 m) of blood TO |                    |                          |
| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL   | condition          |                          |

| (iog) official for                  | Condition          |                          |
|-------------------------------------|--------------------|--------------------------|
| \$AR measured                       | 100 mW input power | 2.47 W/kg                |
| SAR for nominal Head TSL parameters | normalized to 1W   | 24.7 W/kg ± 19.5 % (k=2) |

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

### Antenna Parameters with Head TSL

| mpedance, transformed to feed point | 51.2 Ω - 4.0 jΩ |  |
|-------------------------------------|-----------------|--|
| Return Loss                         | - 27.7 dB       |  |

### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.125 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: 14.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1022

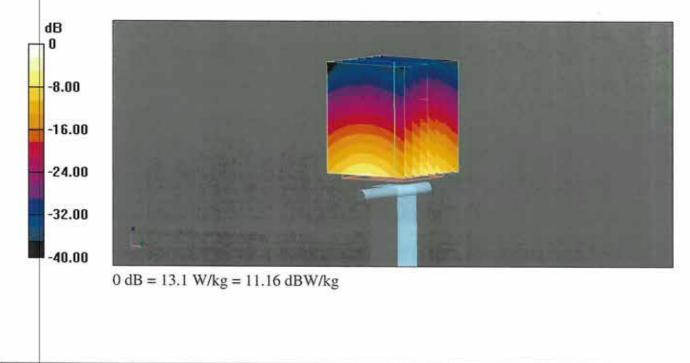
Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz;  $\sigma = 3.12$  S/m;  $\epsilon_r = 37.7$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

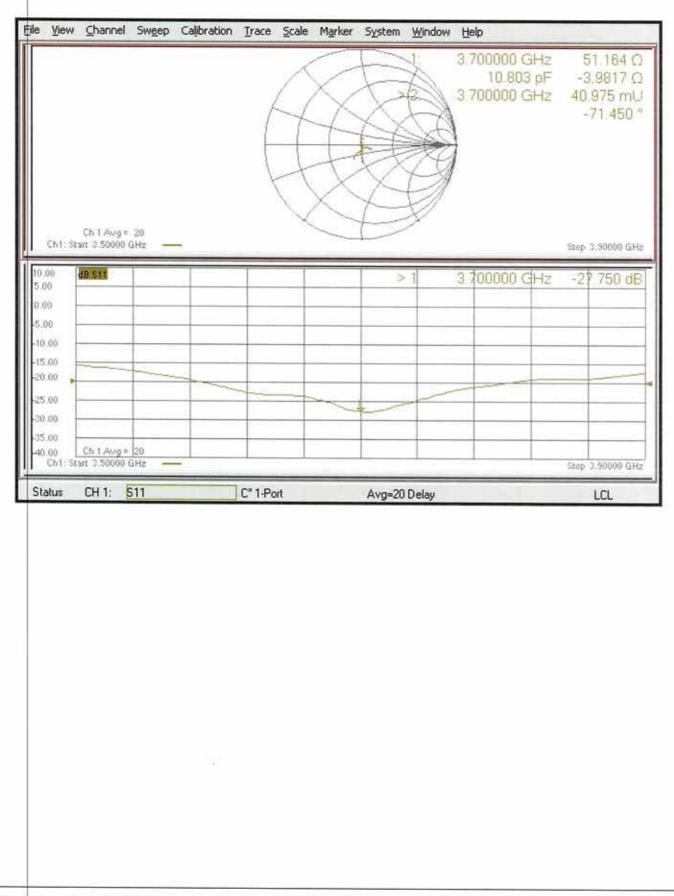
- Probe: EX3DV4 SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

# 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 = 72.98 V/m; Power Drift = -0.08 dB Peak \$AR (extrapolated) = 19.2 W/kg SAR(1 g) = 6.82 W/kg; SAR(10 g) = 2.47 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 72.8% Maximum value of SAR (measured) = 13.1 W/kg



## Impedance Measurement Plot for Head TSL





## D3700V2, serial no. 1022 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.

#### <Justification of the extended calibration>

| D <b>3700</b> V2 – serial no. <b>1022</b> |                  |           |                      |             |                           |             |  |
|---|------------------|-----------|----------------------|-------------|---------------------------|-------------|--|
|   |                  | 3700MHZ   |                      |             |                           |             |  |
| Date of Measurement                       | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |  |
| 07.14.2021                                | -27.75           |           | 51.164               |             | -3.9817                   |             |  |
| (Cal. Report)                             | -21.15           |           | 51.104               |             | -5.9017                   |             |  |
| 07.13.2022                                | -24,914          | 10.21     | 54.000               | 2.934       | -5.305                    | -1.3233     |  |
| (extended)                                | -24.914          | 10.21     | 54.098               | 2.934       | -5.305                    | -1.3233     |  |

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.

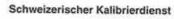


r1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1] 3.7000000 GHz -24.914 dB >1 0.000 -30.00 1 Start 3.5 GHz IFBW 70 kHz Stop 3.9 GHz Cor 1 S11 Smith (R+jX) Scale 1.000U [F1 Del] >1 3.7000000 GHz 54.098 Ω -5.3050 Ω 8.1083 pF 1 Start 3.5 GHz IFBW 70 kHz Stop 3.9 GHz Cor

<Dipole Verification Data> - D3700 V2, serial no. 1022 (Data of Measurement : 07.13.2022) 3700 MHz - Head

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Client Sporton

Certificate No: DAE4-699\_Feb22

Accreditation No.: SCS 0108

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# CALIBRATION CERTIFICATE

| Object   | DAE4 - SD 000 D                          | 004 BO - SN: 699  |   |
|--|--|---|---|
| Calibration procedure(s)                         | QA CAL-06.v30<br>Calibration proce       | dure for the data acquisition ele   | ctronics (DAE)  |
| Calibration date:                                | February 24, 202                         | 2   |   |
| The measurements and the unce                    | rtainties with confidence pro            | nal standards, which realize the physical ur<br>obability are given on the following pages a<br>r facility: environment temperature (22 ± 3)° | nd are part of the certificate.                                     |
| Calibration Equipment used (M&                   | TE critical for calibration)             |   |   |
| Primary Standards                                | ID #                                     | Cal Date (Certificate No.)  | Scheduled Calibration   |
| Keithley Multimeter Type 2001                    | SN: 0810278                              | 31-Aug-21 (No:31368)  | Aug-22  |
| econdary Standards                               | D #                                      | Check Date (in house)   | Columbia de Columbia  |
| Auto DAE Calibration Unit<br>Calibrator Box V2.1 | SE UWS 053 AA 1001<br>SE UMS 006 AA 1002 | 24-Jan-22 (in house check)  | Scheduled Check<br>In house check: Jan-23<br>In house check: Jan-23 |
|  | Name                                     | Function  | Signature   |
| Calibrated by:                                   | Dominique Steffen                        | Laboratory Technician   | N.S. MILLING  |
| Approved by:                                     | Sven Kühn                                | Deputy Manager  | Mahura  |
|  |  |   | V.V.ZLUMMU  |

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### Glossary

DAE Connector angle

data acquisition electronics information used in DASY system to align probe sensor X to the robot coordinate system.

# Methods Applied and Interpretation of Parameters

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - DC Voltage Measurement Linearity: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement.
  - Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage
  - Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements.
  - Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - Input resistance: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - Power consumption: Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement A/D - Converter Resolution nominal

| High Range:      | 1LSB =          | 6.1µV,          | full range =   | -100+300 mV |
|------------------|-----------------|-----------------|----------------|-------------|
| Low Range:       | 1LSB =          | 61nV .          | full range =   | -1 +3mV     |
| DASY measurement | parameters: Aut | to Zero Time: 3 | sec; Measuring | time: 3 sec |

| <b>Calibration Factors</b> | x                     | Y                     | Z  |
|----------------------------|-----------------------|-----------------------|--|
| High Range                 | 404.729 ± 0.02% (k=2) | 403.370 ± 0.02% (k=2) | 404.543 ± 0.02% (k=2)  |
| Low Range                  | 3.93275 ± 1.50% (k=2) | 3.95092 ± 1.50% (k=2) | o concrete concrete a service a service service and the service se |

# **Connector Angle**

| Connector Angle to be used in DASY system | 168.5 ° ± 1 ° |
|---|---------------|
|   | 100.0 1       |

# Appendix (Additional assessments outside the scope of SCS0108)

| High Range        | Reading (µV) | Difference (µV) | Error (%) |
|-------------------|--------------|-----------------|-----------|
| Channel X + Input | 199994.75    | 1.20            | 0.00      |
| Channel X + Input | 19999.74     | -1.76           | -0.01     |
| Channel X - Input | -19997.90    | 3.89            | -0.02     |
| Channel Y + Input | 199993.31    | 0.03            | 0.00      |
| Channel Y + Input | 19997.29     | -4.23           | -0.02     |
| Channel Y - Input | -20002.03    | -0.16           | 0.02      |
| Channel Z + Input | 199998.79    | 5.53            | 0.00      |
| Channel Z + Input | 19998.77     | -2.67           | -0.01     |
| Channel Z - Input | -20000.98    | 0.97            | -0.00     |

### 1. DC Voltage Linearity

| Low Range         | Reading (µV) | Difference (µV) | Error (%) |
|-------------------|--------------|-----------------|-----------|
| Channel X + Input | 2000.10      | -0.73           | -0.04     |
| Channel X + Input | 201.39       | 0.22            | 0.11      |
| Channel X - Input | -198.44      | 0.27            | -0.13     |
| Channel Y + Input | 2000.39      | -0.37           | -0.02     |
| Channel Y + Input | 201.37       | 0.21            | 0.10      |
| Channel Y - Input | -199.76      | -0.90           | 0.45      |
| Channel Z + Input | 2001.24      | 0.53            | 0.03      |
| Channel Z + Input | 200.72       | -0.31           | -0.16     |
| Channel Z - Input | -199.33      | -0.47           | 0.24      |

# 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | Common mode<br>Input Voltage (mV) | High Range<br>Average Reading (μV) | Low Range<br>Average Reading (μV) |
|-----------|-----------------------------------|------------------------------------|-----------------------------------|
| Channel X | 200                               | -3.03                              | -3.58                             |
|           | - 200                             | 4.76                               | 3.52                              |
| Channel Y | 200                               | 21.88                              | 22.22                             |
|           | - 200                             | -24.02                             | -24.12                            |
| Channel Z | 200                               | 8.79                               | 8.30                              |
|           | - 200                             | -8.42                              | -9.05                             |

# 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Input Voltage (mV) | Channel X (µV) | Channel Y (µV)    | Channel Z (µV)   |
|--------------------|----------------|-------------------|--|
| 200                |                |                   | -2.32  |
| 200                | 7.46           | -                 | -0.80  |
| 200                | 4.04           | 5.64              | -0.80  |
|                    | 200<br>200     | 200 -<br>200 7.46 | 200         -         -2.17           200         7.46         - |

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# 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

|           | High Range (LSB) | Low Range (LSB) |  |
|-----------|------------------|-----------------|--|
| Channel X | 16101            | 15333           |  |
| Channel Y | 16429            | 16302           |  |
| Channel Z | 16296            | 16248           |  |

### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec Input  $10M\Omega$ 

|           | Average (µV) | min. Offset (μV) | max. Offset (µV) | Std. Deviation<br>(µV) |
|-----------|--------------|------------------|------------------|------------------------|
| Channel X | 0.96         | -0.27            | 2.15             | 0.40                   |
| Channel Y | -0.83        | -2.49            | 0.64             | 0.59                   |
| Channel Z | 0.23         | -1.54            | 2.09             | 0.51                   |

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

# 7. Input Resistance (Typical values for information)

|           | Zeroing (kOhm) | Measuring (MOhm) |  |
|-----------|----------------|------------------|--|
| Channel X | 200            | 200              |  |
| Channel Y | 200            | 200              |  |
| Channel Z | 200            | 200              |  |

# 8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |  |
|----------------|-------------------|--|
| Supply (+ Vcc) | +7.9              |  |
| Supply (- Vcc) | -7.6              |  |

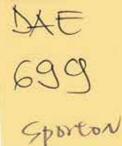
# 9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA |  |
|----------------|-------------------|---------------|------------------|--|
| Supply (+ Vcc) | +0.01             | +6            | +14              |  |
| Supply (- Vcc) | -0.01             | -8            | -9               |  |

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# spea



# **IMPORTANT NOTICE**

# **USAGE OF THE DAE4**

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

#### Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

#### Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the Estop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

#### Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

TN\_EH190306AE DAE4.docx

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Swiss Calibration Service

Accreditation No.: SCS 0108

Client Sporton

Certificate No: EX3-3728\_Mar22

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# CALIBRATION CERTIFICATE

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|---|-----|----|------------|----|-----|
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EX3DV4 - SN:3728

Calibration procedure(s)

QA CAL-01.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes

Calibration date:

March 2, 2022

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID               | Cal Date (Certificate No.)        | Scheduled Calibration  |
|----------------------------|------------------|-----------------------------------|------------------------|
| Power meter NRP            | SN: 104778       | 09-Apr-21 (No. 217-03291/03292)   | Apr-22                 |
| Power sensor NRP-Z91       | SN: 103244       | 09-Apr-21 (No. 217-03291)         | Apr-22                 |
| Power sensor NRP-Z91       | SN: 103245       | 09-Apr-21 (No. 217-03292)         | Apr-22                 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 09-Apr-21 (No. 217-03343)         | Apr-22                 |
| DAE4                       | SN: 660          | 13-Oct-21 (No. DAE4-660_Oct21)    | Oct-22                 |
| Reference Probe ES3DV2     | SN: 3013         | 27-Dec-21 (No. ES3-3013_Dec21)    | Dec-22                 |
| Secondary Standards        | ID               | Check Date (in house)             | Scheduled Check        |
| Power meter E4419B         | SN: GB41293874   | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: MY41498087   | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| Power sensor E4412A        | SN: 000110210    | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| RF generator HP 8648C      | SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| Network Analyzer E8358A    | SN: US41080477   | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

|                              | Name                                  | Function                                   | Signature             |
|------------------------------|---------------------------------------|--|-----------------------|
| Calibrated by:               | Jeton Kastrati                        | Laboratory Technician                      | And I                 |
| Approved by:                 | Sven Kühn                             | Deputy Manager                             | 5.5                   |
| This calibration certificate | shall not be reproduced except in ful | without written approval of the laboratory | Issued: March 7, 2022 |

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#### Glossary:

| TSL                 | tissue simulating liquid  |
|---------------------|---|
| NORMx,y,z           | sensitivity in free space   |
| ConvF               | sensitivity in TSL / NORMx,y,z  |
| DCP                 | diode compression point   |
| CF                  | crest factor (1/duty_cycle) of the RF signal  |
| A, B, C, D          | modulation dependent linearization parameters   |
| Polarization $\phi$ | φ rotation around probe axis  |
| Polarization 9      | 9 rotation around an axis that is in the plane normal to probe axis (at measurement center),                                  |
| Connector Angle     | i.e., 9 = 0 is normal to probe axis<br>information used in DASY system to align probe sensor X to the robot coordinate system |

#### 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"

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is
  implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included
  in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

#### **Basic Calibration Parameters**

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|-----------|
| Norm (µV/(V/m) <sup>2</sup> ) <sup>A</sup> | 0.34     | 0.34     | 0.36     | ± 10.1 %  |
| DCP (mV) <sup>B</sup>                      | 105.5    | 105.1    | 113.5    |           |

#### **Calibration Results for Modulation Response**

| UID    | Communication System Name   |   | A<br>dB | B<br>dBõV | С     | D<br>dB  | VR<br>mV | Max<br>dev. | Max<br>Unc <sup>E</sup><br>(k=2) |
|--------|-----------------------------|---|---------|-----------|-------|----------|----------|-------------|----------------------------------|
| 0      | CW                          | X | 0.00    | 0.00      | 1.00  | 0.00     | 141.3    | ± 3.5 %     | ±4.7%                            |
|        |                             | Y | 0.00    | 0.00      | 1.00  |          | 129.8    |             |                                  |
|        |                             | Z | 0.00    | 0.00      | 1.00  |          | 129.8    |             |                                  |
| 10352- | Pulse Waveform (200Hz, 10%) | X | 11.80   | 82.97     | 18.28 | 10.00    | 60.0     | ±2.8%       | ± 9.6 %                          |
| AAA    | 50h 3 R                     | Y | 20.00   | 93.22     | 22.31 | 1.04458  | 60.0     | 201202020   | 120306-000                       |
|        |                             | Z | 10.00   | 80.00     | 17.00 |          | 60.0     | 1           |                                  |
| 10353- | Pulse Waveform (200Hz, 20%) | X | 20.00   | 89.31     | 18.80 | 6.99     | 80.0     | ± 2.6 %     | ± 9.6 %                          |
| AAA    |                             | Y | 20.00   | 94.66     | 21.88 | aveauer. | 80.0     | -           |                                  |
|        |                             | Z | 20.00   | 88.44     | 18.08 |          | 80.0     |             |                                  |
| 10354- | Pulse Waveform (200Hz, 40%) | X | 20.00   | 88.68     | 16.89 | 3.98     | 95.0     | ± 1.8 %     | ± 9.6 %                          |
| AAA    |                             | Y | 20.00   | 99.52     | 22.80 |          | 95.0     |             |                                  |
|        |                             | Z | 20.00   | 91.73     | 17.90 |          | 95.0     |             |                                  |
| 10355- | Pulse Waveform (200Hz, 60%) | X | 20.00   | 86.96     | 14.77 | 2.22     | 120.0    |             | ± 9.6 %                          |
| AAA    |                             | Y | 20.00   | 108.79    | 25.71 |          | 120.0    |             |                                  |
|        |                             |   | 120.0   | 1         |       |          |          |             |                                  |
| 10387- | QPSK Waveform, 1 MHz        | X | 1.52    | 64.85     | 14.11 | 1.00     | 150.0    | ± 3.9 %     | ± 9.6 %                          |
| AAA    |                             | Y | 1.85    | 68.53     | 16.37 | 0.00220  | 150.0    |             |                                  |
|        |                             | Z | 20.00   | 115.12    | 31.80 |          | 150.0    | 1           |                                  |
| 10388- | QPSK Waveform, 10 MHz       | X | 2.03    | 66.71     | 14.90 | 0.00     | 150.0    | ± 1.6 %     | ± 9.6 %                          |
| AAA    |                             | Y | 2.49    | 70.43     | 17.08 |          | 150.0    |             |                                  |
|        |                             | Z | 7.16    | 93.07     | 26.47 |          | 150.0    | 1           |                                  |
| 10396- | 64-QAM Waveform, 100 kHz    | X | 3.07    | 70.37     | 18.52 | 3.01     | 150.0    | ± 1.4 %     | ± 9.6 %                          |
| AAA    |                             | Y | 3.50    | 73.78     | 20.42 |          | 150.0    | 0.00000000  |                                  |
|        |                             | Z | 5.03    | 84.03     | 24.46 |          | 150.0    | 1           |                                  |
| 10399- | 64-QAM Waveform, 40 MHz     | X | 3.52    | 67.19     | 15.70 | 0.00     | 150.0    | ± 2.2 %     | ± 9.6 %                          |
| AAA    |                             | Y | 3.64    | 68.12     | 16.39 |          | 150.0    | 0.00000000  | 1.750505319                      |
|        |                             | Z | 4.02    | 72.14     | 18.69 | 150.0    | 1        |             |                                  |
| 10414- | WLAN CCDF, 64-QAM, 40MHz    | X | 4.75    | 65.21     | 15.27 | 0.00     | 150.0    | ±4.1%       | ± 9.6 %                          |
| AAA    |                             | Y | 4.95    | 66.22     | 15.91 |          | 150.0    |             |                                  |
|        |                             | Z | 4.79    | 68.12     | 17.08 |          | 150.0    | 1           |                                  |

Note: For details on UID parameters see Appendix

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

E Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

<sup>&</sup>lt;sup>8</sup> Numerical linearization parameter: uncertainty not required.

#### C1 C2 T1 α T2 **T**3 T4 **T5 T6** fF V-1 ms.V-2 fF ms.V<sup>-1</sup> V-2 V-1 ms X 46.9 353.15 36.01 12.21 0.81 5.03 0.86 0.45 1.01 Y 44.5 326.88 34.72 15.85 0.45 5.09 1.17 0.31 1.01 Z 23.3 163.63 32.44 7.17 0.84 5.02 1.89 0.04 1.00

#### Sensor Model Parameters

### Other Probe Parameters

| Sensor Arrangement                            | Triangular |
|---|------------|
| Connector Angle (°)                           | -168.1     |
| Mechanical Surface Detection Mode             | enabled    |
| Optical Surface Detection Mode                | disabled   |
| Probe Overall Length                          | 337 mm     |
| Probe Body Diameter                           | 10 mm      |
| Tip Length                                    | 9 mm       |
| Tip Diameter                                  | 2.5 mm     |
| Probe Tip to Sensor X Calibration Point       | 1 mm       |
| Probe Tip to Sensor Y Calibration Point       | 1 mm       |
| Probe Tip to Sensor Z Calibration Point       | 1 mm       |
| Recommended Measurement Distance from Surface | 1.4 mm     |

Note: Measurement distance from surface can be increased to 3-4 mm for an Area Scan job.

| f (MHz) <sup>c</sup> | Relative<br>Permittivity <sup>F</sup> | Conductivity<br>(S/m) <sup>F</sup> | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup><br>(mm) | Unc<br>(k=2) |
|----------------------|---------------------------------------|------------------------------------|---------|---------|---------|--------------------|----------------------------|--------------|
| 750                  | 41.9                                  | 0.89                               | 9.63    | 9.63    | 9.63    | 0.46               | 0.84                       | ± 12.0 %     |
| 835                  | 41.5                                  | 0.90                               | 9.43    | 9.43    | 9.43    | 0.46               | 0.81                       | ± 12.0 %     |
| 900                  | 41.5                                  | 0.97                               | 9.30    | 9.30    | 9.30    | 0.44               | 0.80                       | ± 12.0 %     |
| 1750                 | 40.1                                  | 1.37                               | 8.12    | 8.12    | 8.12    | 0.26               | 0.80                       | ± 12.0 %     |
| 1900                 | 40.0                                  | 1.40                               | 8.00    | 8.00    | 8.00    | 0.32               | 0.80                       | ± 12.0 %     |
| 2000                 | 40.0                                  | 1.40                               | 7.93    | 7.93    | 7.93    | 0.36               | 0.80                       | ± 12.0 %     |
| 2300                 | 39.5                                  | 1.67                               | 7.79    | 7.79    | 7.79    | 0.25               | 0.91                       | ± 12.0 %     |
| 2450                 | 39.2                                  | 1.80                               | 7.44    | 7.44    | 7.44    | 0.23               | 0.98                       | ± 12.0 %     |
| 2600                 | 39.0                                  | 1.96                               | 7.26    | 7.26    | 7.26    | 0.32               | 0.83                       | ± 12.0 %     |
| 3300                 | 38.2                                  | 2.71                               | 6.68    | 6.68    | 6.68    | 0.30               | 1.35                       | ± 14.0 %     |
| 3500                 | 37.9                                  | 2.91                               | 6.61    | 6.61    | 6.61    | 0.30               | 1.35                       | ± 14.0 %     |
| 3700                 | 37.7                                  | 3.12                               | 6.52    | 6.52    | 6.52    | 0.30               | 1.35                       | ± 14.0 %     |
| 5250                 | 35.9                                  | 4.71                               | 5.23    | 5.23    | 5.23    | 0.40               | 1.80                       | ± 14.0 %     |
| 5600                 | 35.5                                  | 5.07                               | 4.59    | 4.59    | 4.59    | 0.40               | 1.80                       | ± 14.0 %     |
| 5750                 | 35.4                                  | 5.22                               | 4.74    | 4.74    | 4.74    | 0.40               | 1.80                       | ± 14.0 %     |

# Calibration Parameter Determined in Head Tissue Simulating Media

<sup>c</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. F At frequencies up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to

measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>o</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

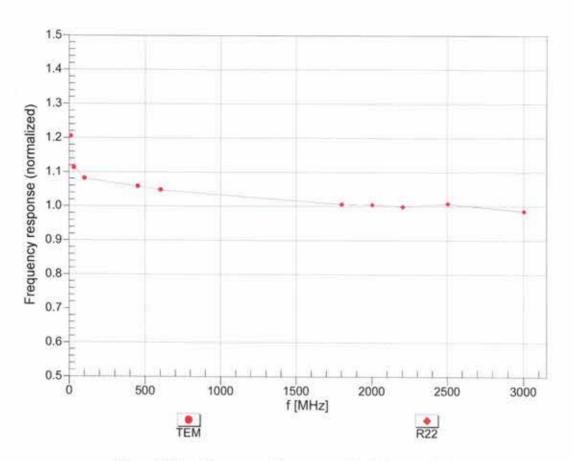
| f (MHz) <sup>c</sup> | Relative<br>Permittivity <sup>F</sup> | Conductivity<br>(S/m) F | ConvF X | ConvF Y | ConvF Z | Alpha <sup>G</sup> | Depth <sup>G</sup><br>(mm) | Unc<br>(k=2) |
|----------------------|---------------------------------------|-------------------------|---------|---------|---------|--------------------|----------------------------|--------------|
| 6500                 | 34.5                                  | 6.07                    | 5.00    | 5.00    | 5.00    | 0.20               | 2.50                       | ± 18.6 %     |

#### Calibration Parameter Determined in Head Tissue Simulating Media

<sup>G</sup> Frequency validity above 6GHz is ± 700 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

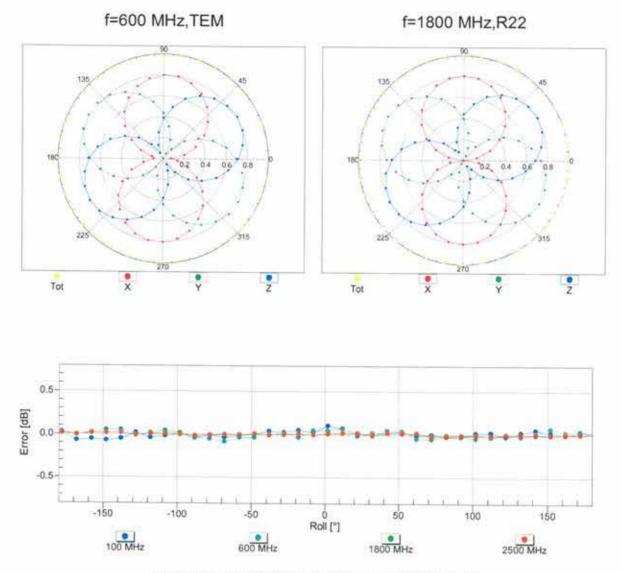
<sup>F</sup> At frequencies 6-10 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>6</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz; below ± 2% for frequencies between 3-6 GHz; and below ± 4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.



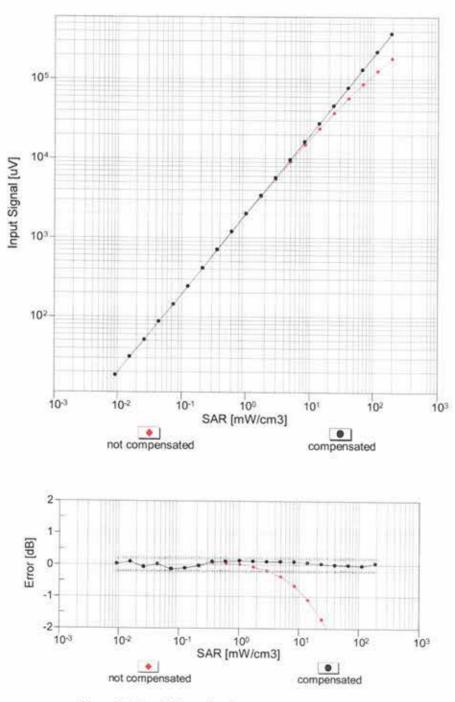
# Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)



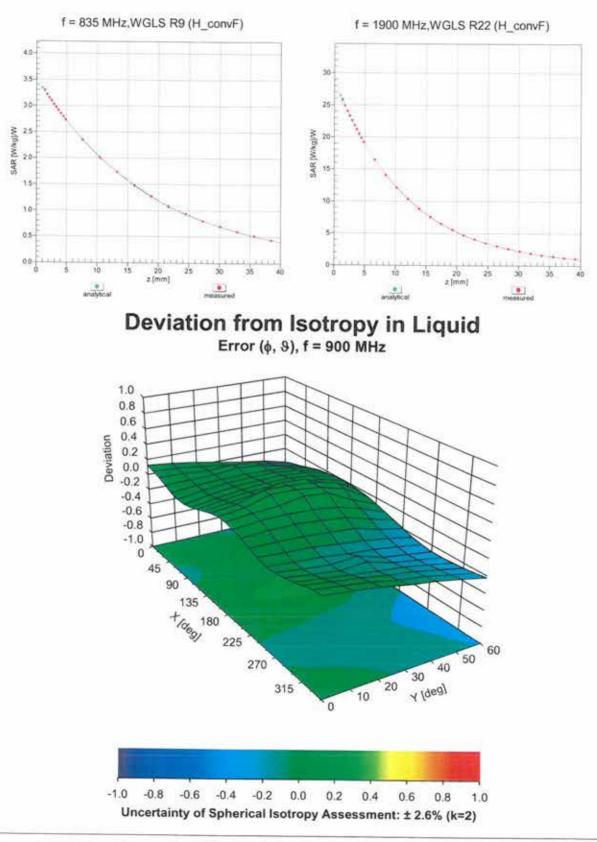
# Receiving Pattern ( $\phi$ ), $\vartheta = 0^{\circ}$

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)



# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , feval= 1900 MHz)

Uncertainty of Linearity Assessment: ± 0.6% (k=2)



# **Conversion Factor Assessment**

# Appendix: Modulation Calibration Parameters

| DID   | Rev | Communication System Name                           | Group     | PAR<br>(dB) | Unc <sup>i</sup><br>(k=2 |
|-------|-----|---|-----------|-------------|--------------------------|
| 0     | S   | CW  | CW        | 0.00        | ± 4.7                    |
| 10010 | CAA | SAR Validation (Square, 100ms, 10ms)                | Test      | 10.00       | ± 9.6 %                  |
| 10011 | CAB | UMTS-FDD (WCDMA)                                    | WCDMA     | 2.91        | ± 9.6 %                  |
| 10012 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)            | WLAN      | 1.87        | ± 9.6 °                  |
| 10013 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)       | WLAN      | 9.46        | ± 9.6 °                  |
| 10021 | DAC | GSM-FDD (TDMA, GMSK)                                | GSM       | 9.39        | ± 9.6 9                  |
| 10023 | DAC | GPRS-FDD (TDMA, GMSK, TN 0)                         | GSM       | 9.57        | ± 9.6 °                  |
| 10024 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1)                       | GSM       | 6.56        | ± 9.6 9                  |
| 10025 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0)                         | GSM       | 12.62       | ± 9.6 °                  |
| 10026 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1)                       | GSM       | 9.55        | ± 9.6 °                  |
| 10027 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2)                     | GSM       | 4.80        | ± 9.6 °                  |
| 10028 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)                   | GSM       | 3.55        | ± 9.6 °                  |
| 10029 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2)                     | GSM       | 7.78        | ± 9.6 %                  |
| 10030 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH1)                 | Bluetooth | 5.30        | ± 9.6 °                  |
| 10031 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH3)                 | Bluetooth | 1.87        | ± 9.6 9                  |
| 10032 | CAA | IEEE 802.15.1 Bluetooth (GFSK, DH5)                 | Bluetooth | 1.16        | ± 9.6 °                  |
| 10033 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)           | Bluetooth | 7.74        | ± 9.6 °                  |
| 10034 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)           | Bluetooth | 4.53        | ± 9.6 °                  |
| 10035 | CAA | IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)           | Bluetooth | 3.83        | ± 9.6 9                  |
| 10036 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH1)               | Bluetooth | 8.01        | ± 9.6 9                  |
| 10037 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH3)               | Bluetooth | 4.77        | ± 9.6 °                  |
| 10038 | CAA | IEEE 802.15.1 Bluetooth (8-DPSK, DH5)               | Bluetooth | 4.10        | ± 9.6 9                  |
| 10039 | CAB | CDMA2000 (1xRTT, RC1)                               | CDMA2000  | 4.57        | ± 9.6                    |
| 10042 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate) | AMPS      | 7.78        | ± 9.6                    |
| 10044 | CAA | IS-91/EIA/TIA-553 FDD (FDMA, FM)                    | AMPS      | 0.00        | ± 9.6                    |
| 10048 | CAA | DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)           | DECT      | 13.80       | ± 9.6                    |
| 10049 | CAA | DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)         | DECT      | 10.79       | ± 9.6 %                  |
| 10056 | CAA | UMTS-TDD (TD-SCDMA, 1.28 Mcps)                      | TD-SCDMA  | 11.01       | ± 9.6 °                  |
| 10058 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)                   | GSM       | 6.52        | ± 9.6 %                  |
| 10059 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)            | WLAN      | 2.12        | ± 9.6 %                  |
| 10060 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)          | WLAN      | 2.83        | ± 9.6 %                  |
| 10061 | CAB | IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)           | WLAN      | 3.60        | ± 9.6 %                  |
| 10062 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)            | WLAN      | 8.68        | ± 9.6 %                  |
| 10063 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)            | WLAN      | 8.63        | ± 9.6 %                  |
| 10064 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)           | WLAN      | 9.09        | ± 9.6 %                  |
| 10065 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)           | WLAN      | 9.00        | ± 9.6 %                  |
| 10066 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)           | WLAN      | 9.38        | ± 9.6 %                  |
| 10067 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)           | WLAN      | 10.12       | ± 9.6 %                  |
| 10068 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)           | WLAN      | 10.24       | ± 9.6 %                  |
| 10069 | CAD | IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)           | WLAN      | 10.56       | ± 9.6 %                  |
| 10071 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)       | WLAN      | 9.83        | ± 9.6 %                  |
| 10072 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)      | WLAN      | 9.62        | ± 9.6 %                  |
| 10073 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)      | WLAN      | 9.94        | ± 9.6 %                  |
| 10074 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)      | WLAN      | 10.30       | ± 9.6 %                  |
| 10075 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)      | WLAN      | 10.77       | ± 9.6 %                  |
| 10076 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)      | WLAN      | 10.94       | ± 9.6 %                  |
| 10077 | CAB | IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)      | WLAN      | 11.00       | ± 9.6 %                  |
| 10081 | CAB | CDMA2000 (1xRTT, RC3)                               | CDMA2000  | 3.97        | ± 9.6 %                  |
| 10082 | CAB | IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate) | AMPS      | 4.77        | ± 9.6 %                  |
| 10090 | DAC | GPRS-FDD (TDMA, GMSK, TN 0-4)                       | GSM       | 6.56        | ± 9.6 %                  |
| 10097 | CAB | UMTS-FDD (HSDPA)                                    | WCDMA     | 3.98        | ± 9.6 %                  |
| 10098 | CAB | UMTS-FDD (HSUPA, Subtest 2)                         | WCDMA     | 3.98        | ± 9.6 %                  |
| 10099 | DAC | EDGE-FDD (TDMA, 8PSK, TN 0-4)                       | GSM       | 9.55        | ± 9.6 %                  |

| 10100 | CAE | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)       | LTE-FDD | 5.67  | ± 9.6 % |
|-------|-----|--|---------|-------|---------|
| 10101 | CAE | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)     | LTE-FDD | 6.42  | ± 9.6 % |
| 10102 | CAE | LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)     | LTE-FDD | 6.60  | ± 9.6 % |
| 10103 | CAG | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)       | LTE-TDD | 9.29  | ± 9.6 % |
| 10104 | CAG | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)     | LTE-TDD | 9.97  | ± 9.6 % |
| 10105 | CAG | LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)     | LTE-TDD | 10.01 | ± 9.6 % |
| 10108 | CAG | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)       | LTE-FDD | 5.80  | ± 9.6 % |
| 10109 | CAG | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)     | LTE-FDD | 6.43  | ± 9.6 % |
| 10110 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)        | LTE-FDD | 5.75  | ± 9.6 % |
| 10111 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)      | LTE-FDD | 6.44  | ± 9.6 % |
| 10112 | CAG | LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)     | LTE-FDD | 6.59  | ± 9.6 % |
| 10113 | CAG | LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)      | LTE-FDD | 6.62  | ± 9.6 % |
| 10114 | CAD | IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)  | WLAN    | 8.10  | ± 9.6 % |
| 10115 | CAD | IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)  | WLAN    | 8.46  | ± 9.6 % |
| 10116 | CAD | IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM) | WLAN    | 8.15  | ± 9.6 % |
| 10117 | CAD | IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)       | WLAN    | 8.07  | ± 9.6 % |
| 10118 | CAD | IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)       | WLAN    | 8.59  | ± 9.6 % |
| 10119 | CAD | IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)      | WLAN    | 8.13  | ± 9.6 % |
| 10140 | CAE | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)     | LTE-FDD | 6.49  | ± 9.6 % |
| 10141 | CAE | LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)     | LTE-FDD | 6.53  | ± 9.6 % |
| 10142 | CAE | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)        | LTE-FDD | 5.73  | ± 9.6 % |
| 10143 | CAE | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)      | LTE-FDD | 6.35  | ± 9.6 % |
| 10144 | CAE | LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)      | LTE-FDD | 6.65  | ± 9.6 % |
| 10145 | CAF | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)      | LTE-FDD | 5.76  | ± 9.6 % |
| 10146 | CAF | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)    | LTE-FDD | 6.41  | ± 9.6 % |
| 10147 | CAF | LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)    | LTE-FDD | 6.72  | ± 9.6 % |
| 10149 | CAE | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)      | LTE-FDD | 6.42  | ± 9.6 % |
| 10150 | CAE | LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)      | LTE-FDD | 6.60  | ± 9.6 % |
| 10151 | CAG | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)        | LTE-TDD | 9.28  | ± 9.6 % |
| 10152 | CAG | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)      | LTE-TDD | 9.92  | ± 9.6 % |
| 10153 | CAG | LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)      | LTE-TDD | 10.05 | ± 9.6 % |
| 10154 | CAG | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)        | LTE-FDD | 5.75  | ± 9.6 % |
| 10155 | CAG | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)      | LTE-FDD | 6.43  | ± 9.6 % |
| 10156 | CAG | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)         | LTE-FDD | 5.79  | ± 9.6 % |
| 10157 | CAG | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)       | LTE-FDD | 6.49  | ± 9.6 % |
| 10158 | CAG | LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)      | LTE-FDD | 6.62  | ± 9.6 % |
| 10159 | CAG | LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)       | LTE-FDD | 6.56  | ± 9.6 % |
| 10160 | CAE | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)        | LTE-FDD | 5.82  | ± 9.6 % |
| 10161 | CAE | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)      | LTE-FDD | 6.43  | ± 9.6 % |
| 10162 | CAE | LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)      | LTE-FDD | 6.58  | ± 9.6 % |
| 10166 | CAF | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)       | LTE-FDD | 5.46  | ± 9.6 % |
| 10167 | CAF | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)     | LTE-FDD | 6.21  | ± 9.6 % |
| 10168 | CAF | LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)     | LTE-FDD | 6.79  | ± 9.6 % |
| 10169 | CAE | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | LTE-FDD | 5.73  | ± 9.6 % |
| 10170 | CAE | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | LTE-FDD | 6.52  | ± 9.6 % |
| 10171 | AAE | LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)        | LTE-FDD | 6.49  | ± 9.6 % |
| 10172 | CAG | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)          | LTE-TDD | 9.21  | ± 9.6 % |
| 10173 | CAG | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)        | LTE-TDD | 9.48  | ± 9.6 % |
| 10174 | CAG | LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)        | LTE-TDD | 10.25 | ± 9.6 % |
| 10175 | CAG | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)          | LTE-FDD | 5.72  | ± 9.6 % |
| 10176 | CAG | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)        | LTE-FDD | 6.52  | ± 9.6 % |
| 10177 | CAI | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)           | LTE-FDD | 5.73  | ± 9.6 % |
| 10178 | CAG | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)         | LTE-FDD | 6.52  | ± 9.6 % |
| 10179 | CAG | LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)        | LTE-FDD | 6.50  | ± 9.6 % |
| 10180 | CAG | LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)         | LTE-FDD | 6.50  | ± 9.6 % |
| 10181 | CAE | LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)          | LTE-FDD | 5.73  | ± 9.6 % |