| 1086 | S1 AAD | 5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz) | 1 | | ober 20, 20 |
|-------|--------|---|---------------|------|-------------|
| 1086 | 3 AAD | 5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz) | 5G NR FR1 TDE | | ± 9.6 |
| 1086 | 4 AAD | 5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz) | 5G NR FR1 TDD | | ± 9.6 |
| 1086 | 5 AAD | 5G NR (CP-OFDM 100% RB, 100 MHz, QPSK, 60 kHz) | 5G NR FR1 TDD | 8.37 | ± 9.6 |
| 1086 | 6 AAD | 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz) 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | | ± 9.6 |
| 1086 | 8 AAD | 5G NR (DET-s-DEDM 1000/ PD 100 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 |
| 1086 | | 100% RB, 100 MHz, OPSK 30 kHz | 5G NR FR1 TDD | | ± 9.6 |
| 1087 | | 1 3 OI DIVI, I RB, 100 MHz, OPSK 120 LH-1 | 5G NR FR2 TDD | | ± 9.6 ° |
| 1087 | - | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | | ± 9.6 |
| 1087 | | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | | ± 9.6 9 |
| 1087 | | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | | ± 9.6 9 |
| 1087 | - | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 6.61 | |
| 1087 | 10.10 | 5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 6.65 | ± 9.6 9 |
| 1087 | | 36 NR (CP-OFDM, 1 RB, 100 MHz, QPSK 120 kHz) | 5G NR FR2 TDD | 7.78 | ± 9.6 % |
| 1087 | | 5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | 1 | ± 9.6 % |
| 10878 | | 36 NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 8.39 | ± 9.6 % |
| 10879 | | 5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 7.95 | ± 9.6 % |
| 10880 | | 3G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 8.41 | ± 9.6 % |
| | | 3G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz) | | 8.12 | ± 9.6 % |
| 10881 | | 3G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | 8.38 | ± 9.6 % |
| 10882 | | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | 5.75 | ± 9.6 % |
| 10883 | | 3G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 5.96 | ± 9.6 % |
| 10884 | | 3G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 6.57 | ± 9.6 % |
| 10885 | - | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 6.53 | ± 9.6 % |
| 10886 | AAD | 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 6.61 | ± 9.6 % |
| 10887 | | 5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | 6.65 | ± 9.6 % |
| 10888 | | 5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz) | 5G NR FR2 TDD | 7.78 | ± 9.6 % |
| 10889 | AAD | 5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 8.35 | ± 9.6 % |
| 10890 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz) | 5G NR FR2 TDD | 8.02 | ± 9.6 % |
| 10891 | AAD | 5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 8.40 | ± 9.6 % |
| 10892 | AAD | 5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz) | 5G NR FR2 TDD | 8.13 | ± 9.6 % |
| 10897 | AAC | 5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz) | 5G NR FR2 TDD | 8.41 | ± 9.6 % |
| 10898 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.66 | ± 9.6 % |
| 10899 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.67 | ± 9.6 % |
| 10900 | AAB | 5G NR (DET-s-OEDM 1 RB, 20 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.67 | ± 9.6 % |
| 10901 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10902 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10903 | AAB | 5G NR (DET -s-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10904 | | 5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10905 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10906 | AAB | 30 NK (DFT-S-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | |
| 10907 | AAC | 5G NR (DFT-s-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.68 | ± 9.6 % |
| 10908 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.78 | ± 9.6 % |
| 10909 | | 5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.76 | ± 9.6 % |
| 10909 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | | ± 9.6 % |
| 10910 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.96 | ± 9.6 % |
| | AAB | 5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.83 | ± 9.6 % |
| 10912 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.93 | ± 9.6 % |
| 10913 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz) | | 5.84 | ± 9.6 % |
| 10914 | AAD | 56 NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.84 | ± 9.6 % |
| 10915 | AAB | 3G NR (DFT-s-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.85 | ± 9.6 % |
| 0916 | AAB | 5G NR (DFT-s-OFDM, 50% RB, 80 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.83 | ± 9.6 % |
| 0917 | AAD | 3G NR (DFT-s-OFDM, 50% RB, 100 MHz, OPSK, 30 kHz) | 5G NR FR1 TDD | 5.87 | ± 9.6 % |
| 0918 | AAC | 5G NR (DFT-s-OFDM, 100% RB, 5 MHz, OPSK, 30 kHz) | 5G NR FR1 TDD | 5.94 | ± 9.6 % |
| 0919 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.86 | ± 9.6 % |
| 0920 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz) | | 5.86 | ± 9.6 % |
| 0921 | AAB | 5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz) | | 5.87 | ± 9.6 % |
| 0922 | AAB : | 5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.84 | ± 9.6 % |
| - | | | 5G NR FR1 TDD | 5.82 | ± 9.6 % |

EX3DV4- SN:3708

| | 201 | AB 5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz | A | 50.00 | per 20, 20 |
|-------|-----------|--|-------------------|-------|--------------|
| | - | | | 5.84 | ± 9.6 |
| 109 | 925 A | AB 5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz | 5G NR FR1 TDD | 5.84 | ± 9.6 |
| 109 | | AB 5G NR (DFT-s-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz) AB 5G NR (DFT-s-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.95 | |
| 109 | 27 A | AB 5G NR (DFT-s-OFDM 100% RB, 60 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.84 | ± 9.6 |
| 109 | 28 A | AB 5G NR (DFT-s-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz) AC 5G NR (DFT-s-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz) | 5G NR FR1 TDD | 5.94 | ± 9.6 |
| 109 | 29 A | AC 5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz) | 5G NR FR1 FDD | | ± 9.6 |
| 109 | | (ST S OF DIVI, TRB. 10) MHZ OPSK 15 LULY | 5G NR FR1 FDD | 5.52 | ± 9.6 |
| 109 | | THE TENT OF THE STATE OF THE ST | 5G NR FR1 FDD | 5.52 | ± 9.6 |
| 109 | | THE COUNTY OF THE STATE OF THE | 5G NR FR1 FDD | 5.52 | ± 9.6 |
| 109 | | OF IN (DET-S-OFDM, 1 RB 25 MHz OPEN 45 LLL) | 5G NR FR1 FDD | 5.51 | ± 9.6 |
| 109 | | SO MIT OPEN ACTION | 5C NR FRI FDD | 5.51 | ± 9.6 |
| 109 | 1 | OF ITS OF DIM. 1 RB 40 MHz OPEN 15 LLL | 5G NR FR1 FDD | 5.51 | ± 9.6 % |
| 1093 | | OCIVICIDET -S-OFDM, 1 RB 50 MHz OPEN 45111 | 5G NR FR1 FDD | 5.51 | ± 9.6 % |
| 1093 | 1.0. | OF I-S-OFDM, 50% RR 5 MHz ORCK 45 LLL | 5G NR FR1 FDD | 5.51 | ± 9.6 % |
| 1093 | | 00 WK (DFT-S-OFDM, 50% RB 10 MHz OPEK 45 LL | 5G NR FR1 FDD | 5.90 | ± 9.6 % |
| | 1 | 50 MH (DFT-S-OFDM, 50% RB 15 MHz OBCK 45111 | 5G NR FR1 FDD | 5.77 | ± 9.6 % |
| 1093 | | 50 MHZ OBCK 45111 | 5G NR FR1 FDD | 5.90 | ± 9.6 % |
| 1094 | | 50 THE (B) 1-5-OFDIM, 50% RB 25 MHz OPEN 45 LLL | 5G NR FR1 FDD | 5.82 | ± 9.6 % |
| 1094 | - | 1 1-3-0FDM, 50% RB 30 MHz OBCK 45 HL | 5G NR FR1 FDD | 5.89 | ± 9.6 % |
| 1094 | 7 5 10 | 1-5-0FDM, 50% RB 40 MHz ODGK 45111 | 5G NR FR1 FDD | 5.83 | ± 9.6 % |
| 1094 | | 5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz) | 5G NR FR1 FDD | 5.85 | ± 9.6 % |
| 1094 | | 5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz) | EC NID ED L | | ± 9.6 % |
| 1094 | 5 AAC | 5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz) | EC NID ED L | | ± 9.6 % |
| 1094 | 6 AAC | 5G NR (DFT-s-OFDM 100% PR 15 NHz) | EC NID FOLDE | 5.05 | XXXX III III |
| 1094 | AAC | 5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz) 5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz) | EC ND FD. | F 00 | ± 9.6 % |
| 10948 | B AAC | 5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz) | EC ND FRA | | ± 9.6 % |
| 10949 | AAC | 5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz) | FO NID FD | | ± 9.6 % |
| 10950 | | 1 1 3 OF DIVI. 100% RB 30 MHz ODOK 45 111 | SC ND FD4 FD5 | | ± 9.6 % |
| 10951 | | 1 -S-OFDIVI, 100% RB 40 MHz ODOK 45111 | EC ND FD4 FFF | | ± 9.6 % |
| 10952 | 1 10 | 100% RR 50 MHz OPEN 45111 | EC ND FR | | ± 9.6 % |
| 10953 | 1 - 0 0 1 | 1 5 MHz 64 OAM 45 LLL | EC NID ED (=== | | ± 9.6 % |
| 10954 | | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | EC ND CD4 | | ± 9.6 % |
| 10955 | - | 1 15 MHz 64 0444 45 11 | EC ND FD. | | ± 9.6 % |
| 10956 | 1 1 1 1 1 | 1 | 5G NR FR1 FDD 8 | 3.23 | ± 9.6 % |
| 10957 | 1001 | 1 5 MHz 64 OAM 2011 | 5G NR FR1 FDD 8 | .42 | £ 9.6 % |
| 10958 | AAA | 1 | 5G NR FR1 FDD 8 | .14 ± | 9.6 % |
| | AAA | 1 | | .31 ± | 9.6 % |
| 10959 | AAA | 3 1 20 MHz C4 0 A 1 20 MHz | 5G NR FR1 FDD 8 | | 9.6 % |
| 10960 | AAC | 1 5 MHz 64 OAM 45 LL | 5G NR FR1 FDD 8 | | 9.6 % |
| 10961 | AAB | THE COLORDIN, IM 3.1 10 MHz 64 OAM 45 111 | 5G NR FR1 TDD 9 | | 9.6 % |
| 10962 | AAB | 1 00 MM DE (CP-OFDM, TM 3.1. 15 MHz 64 OAM 45 11) | 5G NR FR1 TDD 9 | | 9.6 % |
| 10963 | AAB | DE (CP-OFDM, TM 3.1 20 MHz 64 OAM 45.11) | 5G NR FR1 TDD 9. | | 9.6 % |
| 10964 | AAC | TO THE OF OF DIM, IM 3 1 5 MHz 64 OAM 20111 | 5G NR FR1 TDD 9. | | 9.6 % |
| 10965 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz) | FO ND FD. | | 9.6 % |
| 10966 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz) | EC ND FD. | - | |
| 10967 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 10 N/MZ, 64-QAM, 30 kHz) | 5G NR FR1 TDD 9. | | 9.6 % |
| 10968 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz) 5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz) | 5G NR FR1 TDD 9.4 | | 9.6 % |
| 10972 | AAB | 5G NR DL (CP-OFDM, TM 3.1, 100 MHz, 64-QAM, 30 kHz) 5G NR (CP-OFDM, 1 PD 20 MHz, 64-QAM, 30 kHz) | 5G NR FR1 TDD 9.4 | | 9.6 % |
| 10973 | AAB | 5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz) | EC ND FD (FF | | 9.6 % |
| 10974 | AAB | 5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz) | FO ND FD4 | | 9.6 % |
| 10978 | AAA | 5G NR (CP-OFDM, 100% RB, 100 MHz, 256-QAM, 30 kHz) ULLA BDR | EC ND FD. | | 9.6 % |
| 10979 | AAA | | 111 1 A | | 9.6 % |
| 10980 | AAA | ULLA HDR4 | 1111.0 | | 9.6 % |
| | AAA | ULLA HDR8 | ULLA 7.0 | | 9.6 % |
| 14400 | | ULLA HDRp4 | ULLA 8.8 | | 0.6 % |
| | AAA | ULLA HDRp8 | ULLA 1.50 |) ±9 | .6 % |
| | | nined using the max. deviation from linear response applying rectangl | 111110 | | |

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

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





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

Accreditation No.: SCS 0108

Certificate No: D450V2-1024 Oct20

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

SRTC (Auden)

CALIBRATION CERTIFICATE

Object D450V2 - SN: 1024

Calibration procedure(s) Q/

QA CAL-15.v9

Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date:

October 26, 2020

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)

| | Cal Date (Certificate No.) | |
|--------------------|--|--|
| SN: 104778 | 01-Apr-20 (No. 217-03100/03101) | Apr-21 |
| SN: 103244 | 01-Apr-20 (No. 217-03100) | Apr-21 |
| SN: 103245 | 01-Apr-20 (No. 217-03101) | Apr-21 |
| SN: CC2552 (20x) | 31-Mar-20 (No. 217-03106) | Apr-21 |
| SN: 310982 / 06327 | 31-Mar-20 (No. 217-03104) | Apr-21 |
| SN: 3877 | 31-Dec-19 (No. EX3-3877_Dec19) | Dec-20 |
| SN: 654 | 26-Jun-20 (No. DAE4-654_Jun20) | Jun-21 |
| ID# | Check Date (in house) | Scheduled Check |
| SN: GB41293874 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| SN: MY41498087 | 그 전에 가게 되면 하는데 하는 것이 하는데 하는데 하는데 가게 하는데 | In house check: Jun-22 |
| SN: 000110210 | 06-Apr-16 (in house check Jun-20) | In house check: Jun-22 |
| SN: US3642U01700 | 04-Aug-99 (in house check Jun-20) | In house check: Jun-22 |
| SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-21 |
| Name | Function | Signature |
| Jeton Kastrati | Laboratory Technician | |
| Katja Pokovic | Technical Manager | Alac. |
| | SN: 103244 SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: GB41293874 SN: MY41498087 SN: 000110210 SN: US3642U01700 SN: US41080477 Name Jeton Kastrati | SN: 103244 01-Apr-20 (No. 217-03100) SN: 103245 01-Apr-20 (No. 217-03101) SN: CC2552 (20x) 31-Mar-20 (No. 217-03106) SN: 310982 / 06327 31-Mar-20 (No. 217-03104) SN: 3877 31-Dec-19 (No. EX3-3877_Dec19) SN: 654 26-Jun-20 (No. DAE4-654_Jun20) ID # Check Date (in house) SN: GB41293874 06-Apr-16 (in house check Jun-20) SN: MY41498087 06-Apr-16 (in house check Jun-20) SN: US3642U01700 04-Aug-99 (in house check Jun-20) SN: US41080477 31-Mar-14 (in house check Oct-20) Name Function Jeton Kastrati |

Issued: October 28, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of

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





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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 N/A sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of

300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented

parallel to the body axis.

- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | DASY5 | V52.10.4 |
|------------------------------|------------------------|-----------------------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Flat Phantom V4.4 | Shell thickness: 6 ± 0.2 mm |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy , $dz = 5 mm$ | |
| Frequency | 450 MHz ± 1 MHz | |

Head TSL parameters
The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 43.5 | 0.87 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 43.4 ± 6 % | 0.87 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | **** | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 1.22 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 4.88 W/kg ± 18.1 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 0.809 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 3.23 W/kg ± 17.6 % (k=2) |

Certificate No: D450V2-1024_Oct20

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 55.5 Ω - 6.4 jΩ | |
|--------------------------------------|-----------------|--|
| Return Loss | - 21.9 dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.349 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 | |
|--|---------|--|
| Manufactured by | SI E/IG | |
| The second secon | | |

Certificate No: D450V2-1024_Oct20

DASY5 Validation Report for Head TSL

Date: 26.10.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN: 1024

Communication System: UID 0 - CW; Frequency: 450 MHz

Medium parameters used: f = 450 MHz; $\sigma = 0.87 \text{ S/m}$; $\varepsilon_r = 43.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN3877; ConvF(10.58, 10.58, 10.58) @ 450 MHz; Calibrated: 31.12.2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn654; Calibrated: 26.06.2020

Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4; Serial: 1002

• DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 44.73 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.90 W/kg

SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.809 W/kg

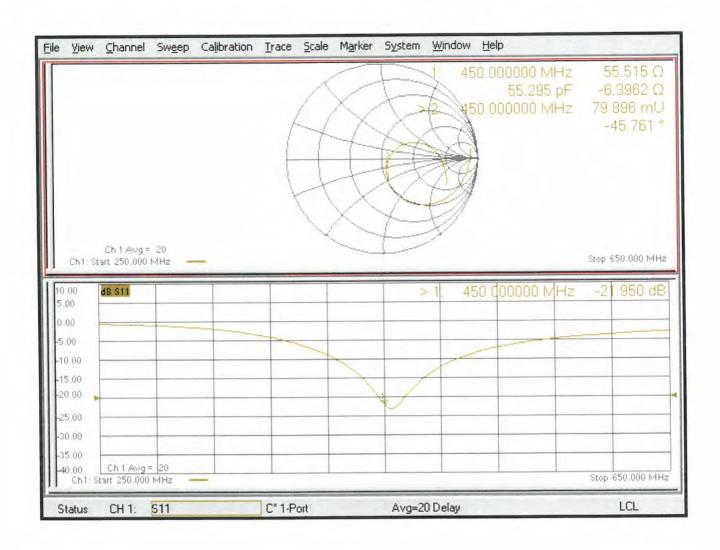
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)

Ratio of SAR at M2 to SAR at M1 = 64.1%

Maximum value of SAR (measured) = 1.65 W/kg



Impedance Measurement Plot for Head TSL





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CALIBRATION LABORATORY

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CALIBRATION **CNAS L0570**

Client

SRTC

Certificate No:

Z20-60393

CALIBRATION CERTIFICATE

Tel: +86-10-62304633-2079 E-mail: cttl@chinattl.com

Object D750V3 - SN: 1101

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 16, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|--------------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| | | | |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C MY4907 | | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |
| | | | |

Name **Function** Calibrated by: Zhao Jing **SAR Test Engineer** Reviewed by: Lin Hao SAR Test Engineer Approved by: Qi Dianyuan SAR Project Leader

Issued: October 22, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,y,z N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | Triple Flat Phantom 5.1C | |
| 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.

| | 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 | 41.7 ± 6 % | 0.91 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 2.13 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 8.40 W/kg ± 18.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 1.44 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 5.70 W/kg ± 18.7 % (<i>k</i> =2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 53.7Ω- 1.63jΩ |
|--------------------------------------|---------------|
| Return Loss | - 28.2dB |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 0.901 ns |
|----------------------------------|----------|
| Electrical Delay (one direction) | 0.001110 |

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 |
|-----------------|-------|

Certificate No: Z20-60393 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1101

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 750 MHz; $\sigma = 0.905$ S/m; $\varepsilon_r = 41.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

Reference Value = 54.36 V/m; Power Drift = -0.03 dB

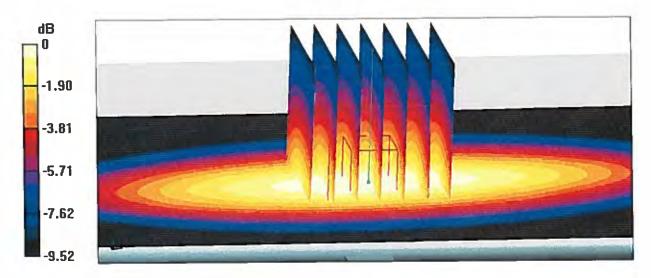
Peak SAR (extrapolated) = 3.04 W/kg

SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.44 W/kg

Smallest distance from peaks to all points 3 dB below = 18.4 mm

Ratio of SAR at M2 to SAR at M1 = 69.9%

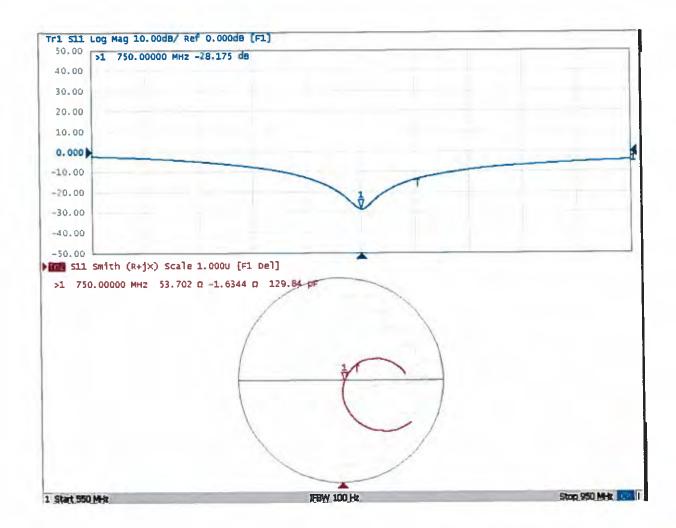
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg



Impedance Measurement Plot for Head TSL





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Client

E-mail: cttl@chinattl.com

Certificate No:

Z20-60394

CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d023

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 16, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| | | | |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |
| | | <u> </u> | |

Calibrated by:

Name Function

Lin Hao

Signature

Reviewed by:

Zhao Jing SAR Test Engineer

-pd 2%

Approved by:

Qi Dianyuan SAR Project Leader

30a

Issued: October 22, 2020

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Certificate No: Z20-60394

Page 1 of 6

SAR Test Engineer

Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)". March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 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%.

Certificate No: Z20-60394



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Measurement Conditions

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

| DASY Version | DA\$Y52 | V52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| 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.

| To | 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 | 41.7 ± 6 % | 0.91 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 2.36 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.38 W/kg ± 18.8 % (<i>k</i> =2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 1.57 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.25 W/kg ± 18.7 % (<i>k</i> =2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.6Ω- 2.37jΩ |
|--------------------------------------|---------------|
| Return Loss | - 29.3dB |

General Antenna Parameters and Design

| | |
|----------------------------------|----------|
| Electrical Delay (one direction) | 1.254 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 |

Certificate No: Z20-60394 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d023

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; $\sigma = 0.909$ S/m; $\varepsilon_r = 41.68$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(9.66, 9.66, 9.66) @ 835 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

Reference Value = 58.02 V/m; Power Drift = -0.03 dB

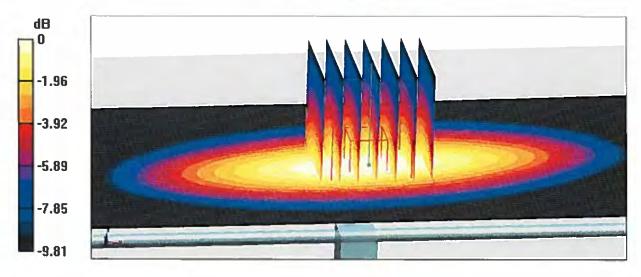
Peak SAR (extrapolated) = 3.40 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.57 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 69.4%

Maximum value of SAR (measured) = 3.08 W/kg

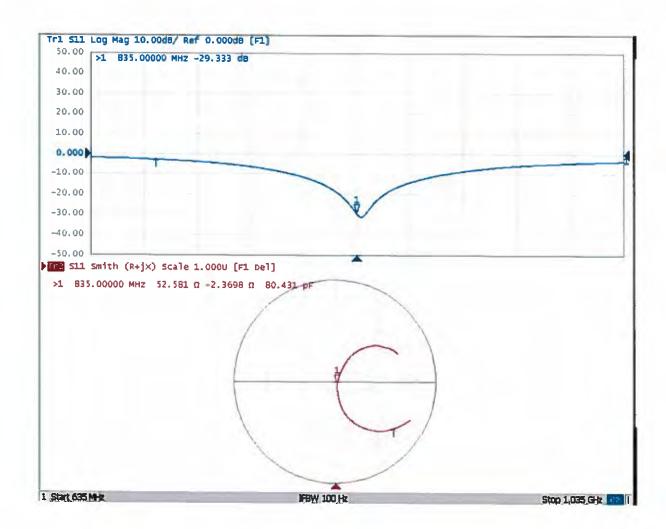


0 dB = 3.08 W/kg = 4.89 dBW/kg

Certificate No: Z20-60394 Page 5 of 6



Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60357

CALIBRATION CERTIFICATE

Object

D900V2 - SN:171

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 17, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Reference Probe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |

Name **Function** Calibrated by: Zhao Jing SAR Test Engineer Reviewed by: Lin Hao SAR Test Engineer Approved by: Qi Dianyuan SAR Project Leader

Issued: September 22, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z20-60357

Glossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,y,z N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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%.

Certificate No: Z20-60357 Page 2 of 6

Measurement Conditions

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

| DASY Version | DASY52 | 52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 15 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 900 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 | 0.97 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 41.8 ± 6 % | 0.97 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 2.72 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 10.9 W/kg ± 18.8 % (k=2) |
| SAR averaged over 10 cm^3 (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 1.75 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 7.00 W/kg ± 18.7 % (k=2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 49.1Ω- 6.69jΩ | |
|--------------------------------------|---------------|--|
| Return Loss | - 23.4dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.271 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 |
|-----------------|-------|
| | |

Certificate No: Z20-60357 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 171

Communication System: UID 0, CW; Frequency: 900 MHz; Duty Cycle: 1:1 Medium parameters used: f = 900 MHz; σ = 0.973 S/m; ϵ_r = 41.82; ρ = 1000 kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(9.56, 9.56, 9.56) @ 900 MHz; Calibrated: 2020-01-30

Date: 09.17.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

Reference Value = 59.63 V/m; Power Drift = -0.04 dB

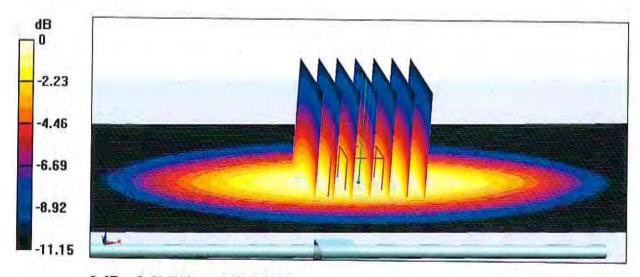
Peak SAR (extrapolated) = 4.13 W/kg

SAR(1 g) = 2.72 W/kg; SAR(10 g) = 1.75 W/kg

Smallest distance from peaks to all points 3 dB below = 16.3 mm

Ratio of SAR at M2 to SAR at M1 = 65.6%

Maximum value of SAR (measured) = 3.67 W/kg

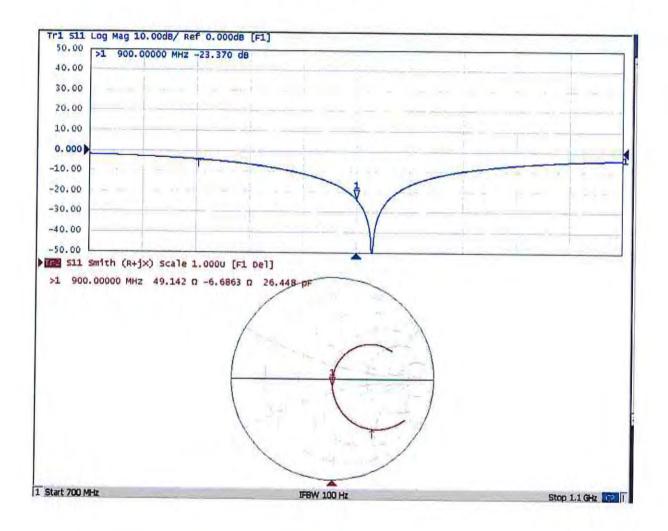


0 dB = 3.67 W/kg = 5.65 dBW/kg

Certificate No: Z20-60357 Page 5 of 6



Impedance Measurement Plot for Head TSL





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CALIBRATION **CNAS L0570**

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Client

SRTC

Certificate No:

Z20-60395

CALIBRATION CERTIFICATE

Object

D1450V2 - SN: 1065

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 16, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |
| | | | |

Name **Function** Calibrated by: Zhao Jing **SAR Test Engineer** Reviewed by: Lin Hao **SAR Test Engineer** Approved by: Qi Dianyuan SAR Project Leader

Issued: October 22, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z20-60395

Page 1 of 6



Glossary:

TSL

tissue simulating liquid

ConvF N/A sensitivity in TSL / NORMx,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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%.

Certificate No: Z20-60395



Measurement Conditions

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

| DASY Version | DASY52 | V52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1450 MHz ± 1 MHz | |

Head TSL parameters

The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 40.5 | 1.20 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.9 ± 6 % | 1.19 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 7.07 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 28.4 W/kg ± 18.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 3.98 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 16.0 W/kg ± 18.7 % (k=2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.4Ω - 1.35 jΩ | |
|--------------------------------------|-----------------|--|
| Return Loss | - 31.5 dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.122 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 |
|-----------------|-------|
| | |

Certificate No: Z20-60395 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1450 MHz; Type: D1450V2; Serial: D1450V2 - SN: 1065

Communication System: UID 0, CW; Frequency: 1450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1450 MHz; $\sigma = 1.186$ S/m; $\varepsilon_r = 39.87$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.72, 8.72, 8.72) @ 1450 MHz; Calibrated: 2020-01-30

Date: 10.16.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.90 V/m; Power Drift = -0.01 dB

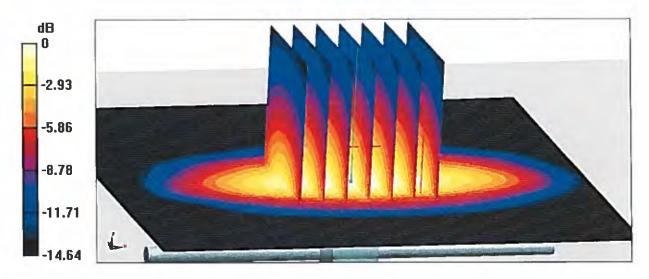
Peak SAR (extrapolated) = 12.3 W/kg

SAR(1 g) = 7.07 W/kg; SAR(10 g) = 3.98 W/kg

Smallest distance from peaks to all points 3 dB below = 11 mm

Ratio of SAR at M2 to SAR at M1 = 58.1%

Maximum value of SAR (measured) = 10.4 W/kg

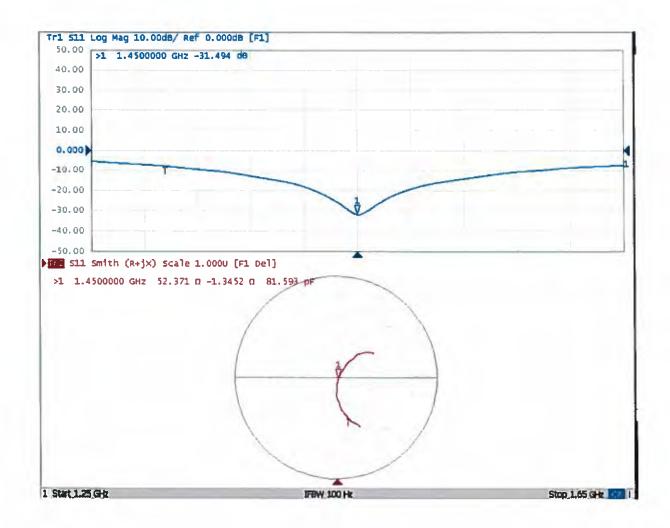


0 dB = 10.4 W/kg = 10.17 dBW/kg

Certificate No: Z20-60395 Page 5 of 6



Impedance Measurement Plot for Head TSL





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Client

E-mail: cttl@chinattl.com SRTC

Tel: +86-10-62304633-2079

Certificate No:

Z20-60358

CALIBRATION CERTIFICATE

Object

D1800V2 - SN: 2d084

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 18, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Reference Probe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |

Calibrated by:

Name Function Zhao Jing SAR Test Engineer

Reviewed by:

Lin Hao SAR Test Engineer

Approved by:

Qi Dianyuan SAR Project Leader

Issued: September 22, 2020

Signature

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Certificate No: Z20-60358

Page 1 of 6

Glossary:

TSL

tissue simulating liquid

ConvF N/A sensitivity in TSL / NORMx,y,z

not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.

Feed Point Impedance and Return Loss: These parameters are measured with the dipole
positioned under the liquid filled phantom. The impedance stated is transformed from the
measurement at the SMA connector to the feed point. The Return Loss ensures low
reflected power. No uncertainty required.

Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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%.

Certificate No: Z20-60358

Measurement Conditions

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

| DASY Version | DASY52 | V52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 1800 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 | 40.2 ± 6 % | 1.39 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 9.67 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 38.9 W/kg ± 18.8 % (k=2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 5.11 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.3 W/kg ± 18.7 % (k=2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 48.9Ω- 2.71 jΩ | |
|--------------------------------------|----------------|--|
| Return Loss | - 30.6 dB | |

General Antenna Parameters and Design

| DEPARTMENT OF THE PROPERTY OF | |
|---|----------|
| Electrical Delay (one direction) | 1.075 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

| 2/2-6 - 6 1200 0 0 0 0 0 0 0 0 | |
|--------------------------------|-------|
| Manufactured by | CDEAG |
| managed by | SPEAG |
| | |

Certificate No: Z20-60358 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d084

Communication System: UID 0, CW; Frequency: 1800 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1800 MHz; $\sigma = 1.39$ S/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.2, 8.2, 8.2) @ 1800 MHz; Calibrated: 2020-01-30

Date: 09.18.2020

- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.62 V/m; Power Drift = -0.03 dB

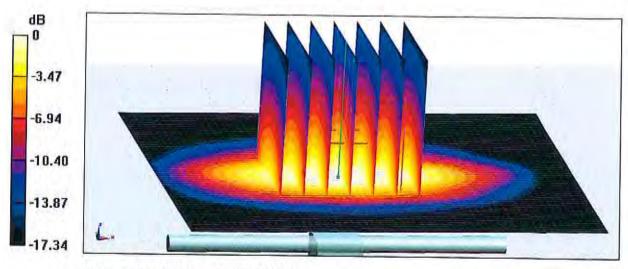
Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 9.67 W/kg; SAR(10 g) = 5.05 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

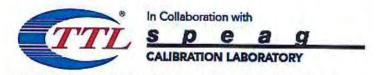
Ratio of SAR at M2 to SAR at M1 = 53.1%

Maximum value of SAR (measured) = 15.2 W/kg

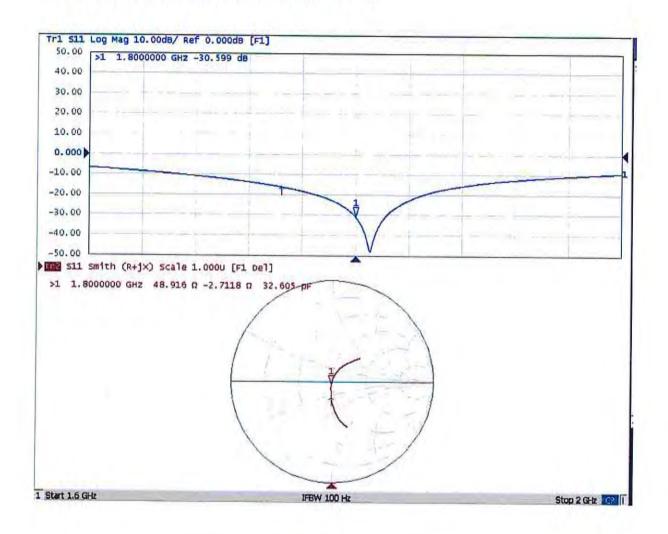


0 dB = 15.2 W/kg = 11.82 dBW/kg

Certificate No: Z20-60358 Page 5 of 6



Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60396

CALIBRATION CERTIFICATE

Tel: +86-10-62304633-2079

E-mail: cttl@chinattl.com

Object

D2000V2 - SN: 1009

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 14, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |
| | | | |

Calibrated by:

Name **Function** Zhao Jing **SAR Test Engineer**

Reviewed by:

Lin Hao **SAR Test Engineer**

Approved by:

Qi Dianyuan SAR Project Leader

Issued: October 22, 2020

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Certificate No: Z20-60396

Page 1 of 6



lossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,y,z

N/A not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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%.

Certificate No: Z20-60396 Page 2 of 6

Measurement Conditions

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

| DASY Version | DASY52 | V52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2000 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 | 41.2 ± 6 % | 1.41 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 10.2 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 41.0 W/kg ± 18.8 % (<i>k</i> =2) |
| SAR averaged over 10 cm ³ (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 | 20.5 W/kg ± 18.7 % (k=2) |

Certificate No: Z20-60396 Page 3 of 6

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 49.4Ω- 2.46jΩ | |
|--------------------------------------|---------------|--|
| Return Loss | - 31.9dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.048 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 |
|-----------------|-------|

Certificate No: Z20-60396 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1009

Communication System: UID 0, CW; Frequency: 2000 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2000 MHz; $\sigma = 1.406$ S/m; $\epsilon_r = 41.15$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(8.25, 8.25, 8.25) @ 2000 MHz; Calibrated: 2020-01-30

Date: 10.14.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.4 V/m; Power Drift = -0.04 dB

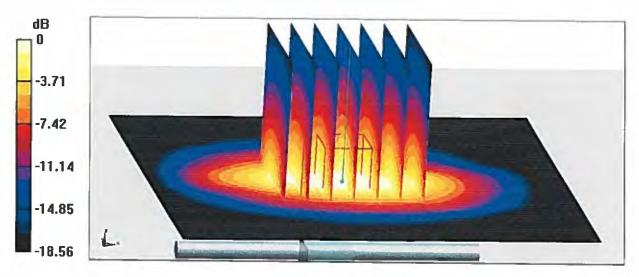
Peak SAR (extrapolated) = 19.5 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.12 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 52.5%

Maximum value of SAR (measured) = 16.2 W/kg

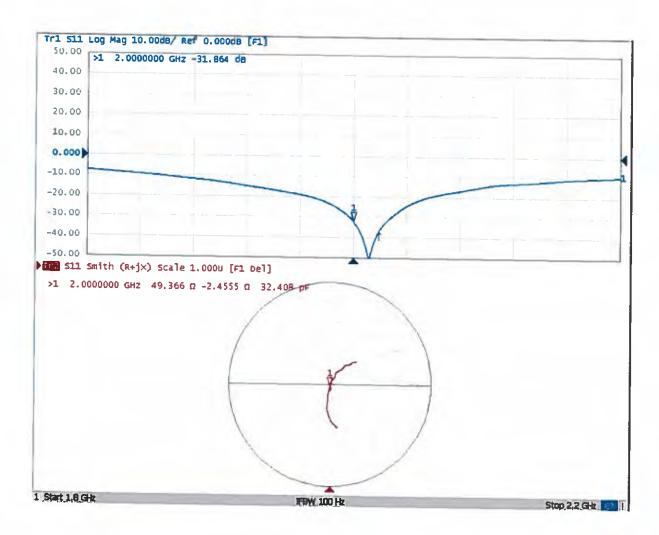


0 dB = 16.2 W/kg = 12.10 dBW/kg

Certificate No: Z20-60396 Page 5 of 6



Impedance Measurement Plot for Head TSL





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Client

SRTC

Certificate No:

Z20-60397

CALIBRATION CERTIFICATE

Object

D2450V2 - SN: 738

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

October 13, 2020

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(Calibrated by, Certificate No.) | Scheduled Calibration |
|-------------------------|------------|--|-----------------------|
| Power Meter NRP2 | 106276 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| Power sensor NRP6A | 101369 | 12-May-20 (CTTL, No.J20X02965) | May-21 |
| ReferenceProbe EX3DV4 | SN 3617 | 30-Jan-20(SPEAG,No.EX3-3617_Jan20) | Jan-21 |
| DAE4 | SN 771 | 10-Feb-20(CTTL-SPEAG,No.Z20-60017) | Feb-21 |
| Secondary Standards | ID# | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
| Signal Generator E4438C | MY49071430 | 25-Feb-20 (CTTL, No.J20X00516) | Feb-21 |
| NetworkAnalyzer E5071C | MY46110673 | 10-Feb-20 (CTTL, No.J20X00515) | Feb-21 |
| | | | |

Calibrated by:

Name **Function** Zhao Jing SAR Test Engineer

Reviewed by:

Lin Hao SAR Test Engineer

Approved by:

Qi Dianyuan SAR Project Leader

Issued: October 22, 2020

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Certificate No: Z20-60397

Page 1 of 6



Glossary:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORMx,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)". March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 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%.

Certificate No: Z20-60397 Page 2 of 6



In Collaboration with

e **CALIBRATION LABORATORY**

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com http://www.chinattl.cn

Measurement Conditions

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

| DASY Version | DASY52 | V52.10.4 |
|------------------------------|--------------------------|-------------|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Triple Flat Phantom 5.1C | |
| Distance Dipole Center - TSL | 10 mm | with Spacer |
| Zoom Scan Resolution | dx, dy, dz = 5 mm | |
| Frequency | 2450 MHz ± 1 MHz | - |

Head TSL parameters
The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 39.2 | 1.80 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 39.0 ± 6 % | 1.81 mho/m ± 6 % |
| Head TSL temperature change during test | <1.0 °C | | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|-----------------------------------|
| SAR measured | 250 mW input power | 13.3 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 53.0 W/kg ± 18.8 % (<i>k</i> =2) |
| SAR averaged over 10 cm ³ (10 g) of Head TSL | Condition | |
| SAR measured | 250 mW input power | 6.13 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.5 W/kg ± 18.7 % (<i>k</i> =2) |

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 53.3Ω+ 6.38 jΩ | |
|--------------------------------------|----------------|--|
| Return Loss | - 23.1dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.021 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 |
|-----------------|-------|
|-----------------|-------|

Certificate No: Z20-60397 Page 4 of 6



DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 738

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; $\sigma = 1.809$ S/m; $\varepsilon_r = 39.02$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

 Probe: EX3DV4 - SN3617; ConvF(7.65, 7.65, 7.65) @ 2450 MHz; Calibrated: 2020-01-30

Date: 10.13.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm,

dy=5mm, dz=5mm

Reference Value = 107.2 V/m; Power Drift = -0.05 dB

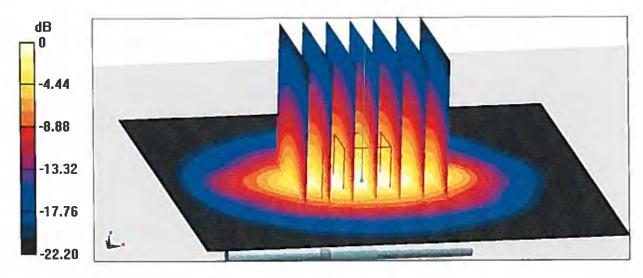
Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.13 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 47.7%

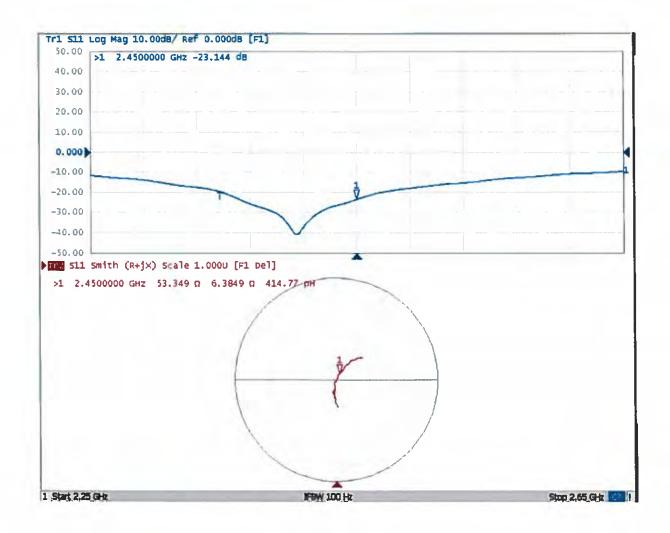
Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg = 13.56 dBW/kg



impedance Measurement Plot for Head TSL



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





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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

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Client

SRTC-BJ (Auden)

Certificate No: D2600V2-1166 Nov19

CALIBRATION CERTIFICATE

Object D2600V2 - SN:1166

Calibration procedure(s) QA CAL-05.v11

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: November 08, 2019

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 | 03-Apr-19 (No. 217-02892/02893) | Apr-20 |
| Power sensor NRP-Z91 | SN: 103244 | 03-Apr-19 (No. 217-02892) | Apr-20 |
| Power sensor NRP-Z91 | SN: 103245 | 03-Apr-19 (No. 217-02893) | Apr-20 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 04-Apr-19 (No. 217-02894) | Apr-20 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 04-Apr-19 (No. 217-02895) | Apr-20 |
| Reference Probe EX3DV4 | SN: 7349 | 29-May-19 (No. EX3-7349_May19) | May-20 |
| DAE4 | SN: 601 | 30-Apr-19 (No. DAE4-601_Apr19) | Apr-20 |
| Secondary Standards | ID# | Check Date (in house) | Scheduled Check |
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Feb-19) | In house check: Oct-20 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| Power sensor HP 8481A | SN: MY41092317 | 07-Oct-15 (in house check Oct-18) | In house check: Oct-20 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-18) | In house check: Oct-20 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-19) | In house check: Oct-20 |
| | Name | Function | Signatute |
| Calibrated by: | Claudio Leubler | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | \sim |

Issued: November 12, 2019

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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

N/A

sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

 a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | DASY5 | V52.10.3 |
|------------------------------|------------------------|-------------|
| 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 | 37.7 ± 6 % | 2.01 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | 2212 | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 14.4 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 56.5 W/kg ± 17.0 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 250 mW input power | 6.43 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 25.4 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 | 47.9 Ω - 7.8 jΩ | |
|--------------------------------------|-----------------|--|
| Return Loss | - 21.7 dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.148 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 |
|-----------------|-------|
|-----------------|-------|

Certificate No: D2600V2-1166_Nov19 Page 4 of 6

DASY5 Validation Report for Head TSL

Date: 08.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1166

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: f = 2600 MHz; $\sigma = 2.01 \text{ S/m}$; $\varepsilon_r = 37.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.69, 7.69, 7.69) @ 2600 MHz; Calibrated: 29.05.2019

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 30.04.2019

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

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 = 118.5 V/m; Power Drift = 0.06 dB

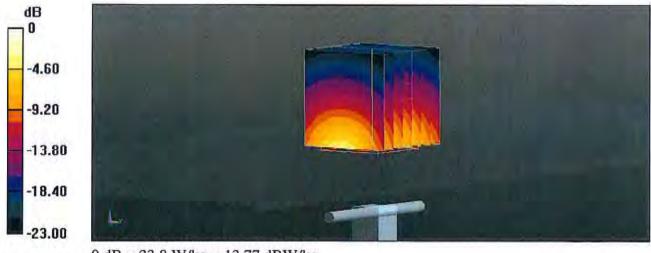
Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.43 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

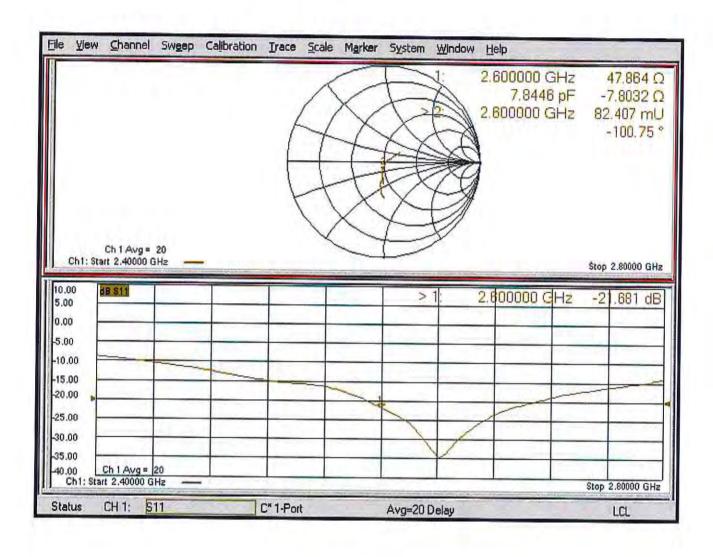
Ratio of SAR at M2 to SAR at M1 = 50.2%

Maximum value of SAR (measured) = 23.8 W/kg



0 dB = 23.8 W/kg = 13.77 dBW/kg

Impedance Measurement Plot for Head TSL



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





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Accreditation No.: SCS 0108

Client SRTC-BJ (Auden)

Certificate No: D3500V2-1090_Nov19

| Object | D3500V2 - SN:1090 | | |
|--|---|--|--|
| Calibration procedure(s) | QA CAL-22.v4 Calibration Prod | edure for SAR Validation Source | es between 3-6 GHz |
| Calibration date: | November 11, 2 | 019 | |
| This calibration certificate documents | ents the traceability to na | tional standards, which realize the physical uprobability are given on the following pages a | inits of measurements (SI). |
| | | ory facility: environment temperature (22 ± 3) | |
| Calibration Equipment used (M&T | | | and namedy 170%. |
| Primary Standards | ID# | Cal Date (Certificate No.) | Cabada a Carra |
| ower meter NRP | SN: 104778 | | Scheduled Calibration |
| OMOT HIRTON IALIL | 1 SIN: 104//B | 03-Apr-19 (No. 217-02902/02902) | 4 |
| | (2) | 03-Apr-19 (No. 217-02892/02893) | Apr-20 |
| ower sensor NRP-Z91 | SN: 103244 SN: 103245 | 03-Apr-19 (No. 217-02892) | Apr-20 |
| ower sensor NRP-Z91 | SN: 103244 SN: 103245 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) | Apr-20 Apr-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator | SN: 103244 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) | Apr-20 Apr-20 Apr-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination | SN: 103244 SN: 103245 SN: 5058 (20k) | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) | Apr-20 Apr-20 Apr-20 Apr-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) | Apr-20 Apr-20 Apr-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 AAE4 | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) | Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Recondary Standards | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Recondary Standards Power meter E4419B | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator ype-N mismatch combination Reference Probe EX3DV4 PAE4 Recondary Standards rower meter E4419B ower sensor HP 8481A | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator ype-N mismatch combination leference Probe EX3DV4 AE4 Recondary Standards ower meter E4419B Ower sensor HP 8481A Ower sensor HP 8481A F generator R&S SMT-06 | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (In house) 30-Oct-14 (In house check Feb-19) 07-Oct-15 (In house check Oct-18) 07-Oct-15 (in house check Oct-18) | Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Ypp-N mismatch combination Reference Probe EX3DV4 PAE4 Recondary Standards Ower meter E4419B Ower sensor HP 8481A F generator R&S SMT-06 | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) | Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3603 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) | Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 |
| Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 PAE4 Recondary Standards Tower meter E4419B Tower sensor HP 8481A | SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 | 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |
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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

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 N/A sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

 a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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%.

Certificate No: D3500V2-1090_Nov19

Page 2 of 6

Measurement Conditions DASY system configuration, as

| DASY Version | DASY5 | V52.10.3 |
|------------------------------|--------------------------------|----------------------------------|
| 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 | 37.4 ± 6 % | 2.90 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | 1 = 1 | |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (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 | 67.4 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm3 (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 2.54 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 25.3 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 | 52.6 Ω + 3.5 jΩ | |
|--------------------------------------|-----------------|--|
| Return Loss | - 27.4 dB | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1,142 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 | Manufactured by | |
|-----------------------|-----------------|--------|
| SILAG | Manufactured by | SPEAG |
| | | SI EAG |

DASY5 Validation Report for Head TSL

Date: 11.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1090

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: f = 3500 MHz; $\sigma = 2.9$ S/m; $\varepsilon_r = 37.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.75, 7.75, 7.75) @ 3500 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm 3500/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.47 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 6.75 W/kg; SAR(10 g) = 2.54 W/kg

Smallest distance from peaks to all points 3 dB below = 8.4 mm

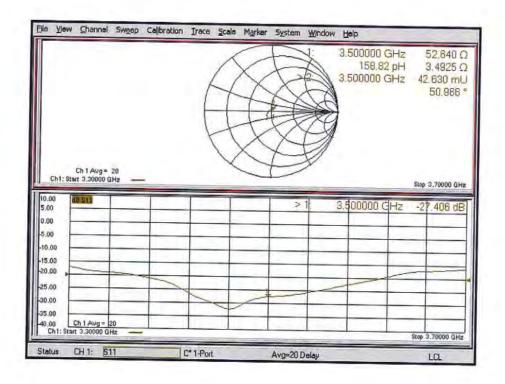
Ratio of SAR at M2 to SAR at M1 = 74.2%

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



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Head TSL



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





C

Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura 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

Client

SRTC-BJ (Auden)

Certificate No: D3700V2-1058_Nov19

| Object | D3700V2 - SN:1 | 058 | |
|--|--|---|---|
| Calibration procedure(s) | QA CAL-22,v4 Calibration Proc | edure for SAR Validation Sources | s between 3-6 GHz |
| Calibration date: | November 11, 2 | 019 | |
| This calibration certificate documents and the uncertificate documents and the uncertificate documents and the uncertificate documents are supplied to the uncertificate documents and the uncertificate documents are supplied to the uncertifica | ents the traceability to ne | tional standards, which realize the physical ur probability are given on the following pages ar | nits of measurements (SI), |
| | | ory facility: environment temperature (22 ± 3)° | |
| Calibration Equipment used (M& | TE critical for calibration) | | |
| | | | |
| Primary Standards | ID# | Cal Date (Certificate No.) | Scheduled Calibration |
| | ID# SN: 104778 | Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892/02893) | Scheduled Calibration Apr-20 |
| Primary Standards | | | |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 | SN: 104778 | 03-Apr-19 (No. 217-02892/02893) | Apr-20 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) | Apr-20 Apr-20 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) | Apr-20 Apr-20 Apr-20 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) | Apr-20 Apr-20 Apr-20 Apr-20 |
| Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 |
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| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In hause check: Oct-20 |
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst
C Service sulsse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accreditation No.: SCS 0108

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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:

 IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

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Additional Documentation:

e) DASY4/5 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.
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 point exactly below the center marking of the flat phantom section, with the arms oriented
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- Feed Point Impedance and Return Loss; These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | DASY5 | V52.10.3 |
|------------------------------|------------------------------|----------------------------------|
| 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 | 36.8 ± 6 % | 3.05 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | | - |

SAR result with Head TSL

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 6.88 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 68.8 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 2.50 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.9 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 | 48.3 Ω + 1.1 jΩ | | |
|--------------------------------------|-----------------|--|--|
| Return Loss | - 33.6 dB | | |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1.134 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: 11,11,2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1058

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: f = 3700 MHz; $\sigma = 3.05$ S/m; $\epsilon_r = 36.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.5, 7.5, 7.5) @ 3700 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm

(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.79 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 6.88 W/kg; SAR(10 g) = 2.5 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

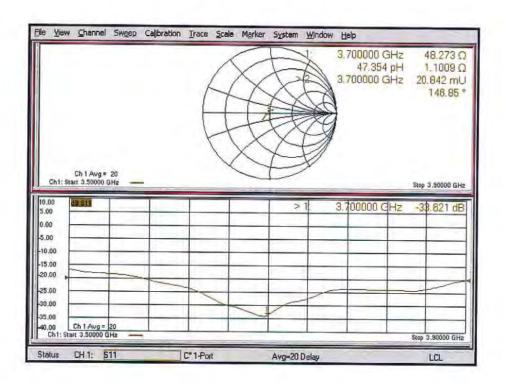
Ratio of SAR at M2 to SAR at M1 = 72.8%

Maximum value of SAR (measured) = 13.3 W/kg



0 dB = 13.3 W/kg = 11.24 dBW/kg

Impedance Measurement Plot for Head TSL



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





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Multilateral Agreement for the recognition of calibration certificates

Client SRTC-BJ (Auden)

Certificate No: D3900V2-1033_Nov19

Accreditation No.: SCS 0108

Issued: November 12, 2019

CALIBRATION CERTIFICATE

Object

D3900V2 - SN:1033

Calibration procedure(s)

QA CAL-22.v4

Calibration Procedure for SAR Validation Sources between 3-6 GHz

Calibration date:

November 11, 2019

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.) | Pahadalad C. E |
|--|---|---|---|
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) | Scheduled Calibration Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 |
| Secondary Standards | ID e | Check Date (in house) | Cabad dad on the |
| Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agillent E8358A | SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477 | 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) | Scheduled Check In house check: Oct-20 |
| | Name | Function | Signature |
| Calibrated by: | Claudio Leubler | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | auer |

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D3900V2-1033_Nov19

Page 1 of 7

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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 N/A sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | DASY5 | V52.10.3 |
|------------------------------|--------------------------------------|--|
| Extrapolation | Advanced Extrapolation | 135.10.0 |
| 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 | 3900 MHz ± 1 MHz 4100 MHz ± 1 MHz | The second of th |

Head TSL parameters at 3900 MHz
The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 37.5 | 3.32 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 36.6 ± 6 % | 3.21 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | - | |

SAR result with Head TSL at 3900 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 6.92 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 69.2 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 2.42 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.1 W/kg ± 19.5 % (k=2) |

Head TSL parameters at 4100 MHz The following parameters and calculations a

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22,0 °C | 37.2 | 3.53 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 36.3 ± 6 % | 3.39 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | **** | |

SAR result with Head TSL at 4100 MHz

| SAR averaged over 1 cm3 (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 6.79 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 67.9 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm3 (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 2.36 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.5 W/kg ± 19.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 3900 MHz

| Impedance, transformed to feed point | 48.3 Ω - 4.9 Ω |
|--------------------------------------|-----------------|
| Return Loss | - 25,6 dB |

Antenna Parameters with Head TSL at 4100 MHz

| Impedance, transformed to feed point | 59.0 Ω - 0.8 jΩ | |
|--------------------------------------|-----------------|--|
| Return Loss | -21.6 dB | |

General Antenna Parameters and Design

| Percent Andrews Income to the Control of the Contro | |
|--|----------|
| Electrical Delay (one direction) | 1,107 ns |
| | 21123334 |

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 |
|------------------|-------|
| The tales of the | SPEAG |

DASY5 Validation Report for Head TSL

Date: 11.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN:1033

Communication System: UID 0 - CW; Frequency: 3900 MHz, Frequency: 4100 MHz Medium parameters used: f=3900 MHz; $\sigma=3.21$ S/m; $\epsilon_r=36.6$; $\rho=1000$ kg/m 3 , Medium parameters used: f=4100 MHz; $\sigma=3.39$ S/m; $\epsilon_r=36.3$; $\rho=1000$ kg/m 3 Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.25, 7.25, 7.25) @ 3900 MHz, ConvF(7.05, 7.05, 7.05) @ 4100 MHz;
 Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.87 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 19.1 W/kg

SAR(1 g) = 6.92 W/kg; SAR(10 g) = 2.42 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74.8%

Maximum value of SAR (measured) = 13.4 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4100MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.24 V/m; Power Drift = 0.01 dB

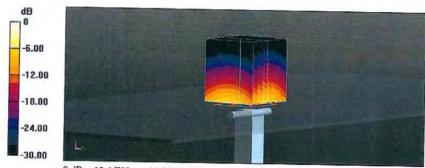
Peak SAR (extrapolated) = 19.4 W/kg

SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.36 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

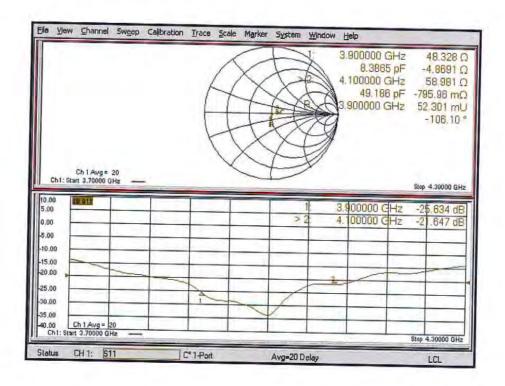
Ratio of SAR at M2 to SAR at M1 = 73.6%

Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg

Impedance Measurement Plot for Head TSL



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





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

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

Client SRTC-BJ (Auden)

Certificate No: D4200V2-1013_Nov19

| Object | D4200V2 - SN:1 | 013 | |
|---|---|--|--|
| Calibration procedure(s) | QA CAL-22.v4 Calibration Proce | edure for SAR Validation Sources | s between 3-6 GHz |
| Calibration date: | November 12, 20 | 019 | |
| The measurements and the uncer | tainties with confidence p | ional standards, which realize the physical un probability are given on the following pages a pry facility: environment temperature (22 ± 3)* | nd are part of the certificate. |
| Calibration Equipment used (M&T | | ny raomy, orinitativan'i ampositato (az 2 sy | |
| 23-3-3-3-4-4-4-4-4-4-4-4-4-4-4-4-4-4-4-4 | | | |
| Primary Standards | ID# | Cal Date (Certificate No.) | Scheduled Calibration |
| | ID # SN: 104778 | Cal Date (Certificate No.) 03-Apr-19 (No. 217-02892/02893) | Scheduled Calibration Apr-20 |
| ower meter NRP | | | |
| Power meter NRP Power sensor NRP-Z91 | SN: 104778 | 03-Apr-19 (No. 217-02892/02893) | Apr-20 |
| ower meter NRP lower sensor NRP-Z91 lower sensor NRP-Z91 | SN: 104778 SN: 103244 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) | Apr-20 Apr-20 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator | SN: 104778 SN: 103244 SN: 103245 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) | Apr-20 Apr-20 Apr-20 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) | Apr-20 Apr-20 Apr-20 Apr-20 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 |
| Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 |
| 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 PF generator R&S SMT-06 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02895) 25-Mar-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |
| 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 | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477 | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 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 RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: | SN: 104778 SN: 103244 SN: 103245 SN: 5058 (20k) SN: 5047.2 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: WY41092317 SN: US41080477 Name | 03-Apr-19 (No. 217-02892/02893) 03-Apr-19 (No. 217-02892) 03-Apr-19 (No. 217-02893) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. 217-02894) 04-Apr-19 (No. EX3-3503_Mar19) 30-Apr-19 (No. DAE4-601_Apr19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19) | Apr-20 Apr-20 Apr-20 Apr-20 Apr-20 Mar-20 Apr-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 |

Calibration Laboratory of

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





S Schweizerischer Kalibrierdienst
C Service sulsse d'étalonnage
Servizio svizzero di taratura
S Swias 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 applic

not applicable or not measured

Calibration is Performed According to the Following Standards:

 a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

 EC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 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 dipole is mounted with the spacer to position its feed
 point exactly below the center marking of the flat phantom section, with the arms oriented
 parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
 positioned under the liquid filled phantom. The Impedance stated is transformed from the
 measurement at the SMA connector to the feed point. The Return Loss ensures low
 reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
 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 | DASY5 | V52.10.3 |
|------------------------------|----------------------------|----------------------------------|
| Extrapolation | Advanced Extrapolation | 1 |
| 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 | 4300 MHz ± 1 MHz | |

Head TSL parameters at 4300 MHz The following parameters and calculations were applied.

| | Temperature | Permittivity | Conductivity |
|---|-----------------|--------------|------------------|
| Nominal Head TSL parameters | 22.0 °C | 37.0 | 3.73 mho/m |
| Measured Head TSL parameters | (22.0 ± 0.2) °C | 36.1 ± 6 % | 3.57 mho/m ± 6 % |
| Head TSL temperature change during test | < 0.5 °C | 1 **** | |

SAR result with Head TSL at 4300 MHz

| SAR averaged over 1 cm ³ (1 g) of Head TSL | Condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 6.80 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 67.9 W/kg ± 19.9 % (k=2) |

| SAR averaged over 10 cm ³ (10 g) of Head TSL | condition | |
|---|--------------------|--------------------------|
| SAR measured | 100 mW input power | 2.32 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | 23.1 W/kg ± 19.5 % (k=2) |

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 4300 MHz

| Impedance, transformed to feed point | 52.1 Ω - 1.6 μΩ |
|--------------------------------------|-----------------|
| Return Loss | - 31.7 dB |

General Antenna Parameters and Design

| Electrical Delay (one direction) | 1,112 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 | |
|-----------------|-------|--|
|-----------------|-------|--|

Date: 12.11.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 4200 MHz; Type: D4200V2; Serial: D4200V2 - SN:1013

Communication System: UID 0 - CW; Frequency: 4200 MHz, Frequency: 4300 MHz Medium parameters used: f = 4300 MHz; $\sigma = 3.57$ S/m; $\epsilon_r = 36.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(6.75, 6.75, 6.75) @ 4300 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4300MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.49 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 19.8 W/kg

SAR(1 g) = 6.8 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

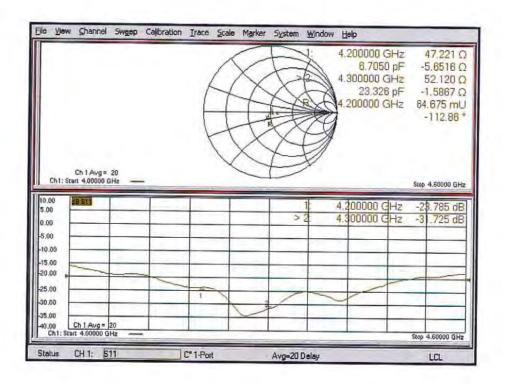
Ratio of SAR at M2 to SAR at M1 = 73.8%

Maximum value of SAR (measured) = 13.6 W/kg



0 dB = 13.6 W/kg = 11.34 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of

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





S Schweizerlacher Kallbrierdienst Service suisse d'étalonnage

C Service suisse d'étalonnage Servizio svizzero di taratura

Accreditation No.: SCS 0108

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

Client

SRTC-BJ (Auden)

Certificate No: D4600V2-1033 Nov19

CALIBRATION CERTIFICATE Object D4600V2 - SN:1033 Calibration procedure(s) QA CAL-22.v4 Calibration Procedure for SAR Validation Sources between 3-6 GHz Calibration date: November 12, 2019 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 03-Apr-19 (No. 217-02892/02893) Apr-20 Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20 Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20 Reference Probe EX3DV4 SN: 3503 25-Mar-19 (No. EX3-3503_Mar19) Mar-20 SN: 601 DAE4 30-Apr-19 (No. DAE4-601_Apr19) Apr-20 Secondary Standards Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20 Power sensor HP 8481A SN: MY41092317 07-Oct-15 (in house check Oct-18) In house check: Oct-20 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-19) In house check: Oct-20 Function Calibrated by: Leif Klysner Laboratory Technician Approved by: Katja Pokovic Technical Manager Issued: November 12, 2019 This calibration certificate shall not be reproduced except in full without written approval of the laboratory