# SAR Compliance Test Report

| | | | |
|---|---|---|---|
| **Date of Report** | 2/06/2023 | **Client's Contact person:** | Stephane Ranchon |
| **Number of pages:** | 77 | | |
| | | **Responsible Test engineer:** | Ilari Kinnunen |
| **Testing laboratory:** | **Verkotan Oy**<br>Elektroniikkatie 17<br>90590 Oulu<br>Finland | **Client:** | **LCIE BUREAU VERITAS**<br>ZI Centr'Alp<br>170 rue de Chatagnon<br>38430 Moirans<br>France |
| | | **Applicant:** | **INGENICO**<br>9 Avenue de la gare - Rovaltain TGV<br>BP25156 VALENCE Cedex 9<br>FRANCE 26958 |
| **Tested device** | **Move/2600 CL/4G/WiFi** | | |
| **Related reports:** | - | | |
| **Testing has been carried out in accordance with:** | **47CFR §2.1093**<br>Radiofrequency Radiation Exposure Evaluation: Portable Devices<br><br>**FCC published RF exposure KDB procedures**<br><br>**IEC/IEEE 62209-1528, 2020**<br>Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices<br><br>**RSS-102, Issue 5, 2015**<br>Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) | | |
| **Documentation:** | The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory | | |
| **Test Results:** | **The EUT complies with the requirements in respect of all parameters subject to the test.**<br>The test results relate only to devices specified in this document | | |
| **Date and signatures:** | 02.06.2023<br><br>**Laboratory Manager**<br>Miia Nurkkala<br>Digitaalinen allekirjoittaja: Miia Nurkkala<br>Päiväys: 2023.06.02 08:48:43 +03'00' | | |

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# 1. SUMMARY OF SAR TEST REPORT

## 1.1 Test Details

### Equipment under Test (DUT):

| | |
|---|---|
| **Product:** | Payment terminal |
| **Manufacturer:** | Ingenico |
| **Model:** | Move/2600 CL/4G/WiFi |
| **Serial Number:** | Conducted sample: 221967317151286025803467<br>SAR sample: 222107317151286026031053 |
| **FCC ID Number:** | XKB-M2600CL4GW |
| **ISED ID Number:** | 2586D- M2600CL4GW |
| **DUT Number:** | Conducted sample: 21194<br>SAR sample: 21191 |
| **Battery Type used in testing:** | Li-Ion Battery |
| **State of the Sample:** | Production sample |

### Testing information:

| | |
|---|---|
| **Testing performed:** | 05.05.2023 – 29.05.2023 |
| **Notes:** | - |
| **Document history:** | Initial version |
| **Document ID:** | FCC ISED SAR report_Move2600_ID6030c_02062023.docx |
| **Temperature °C** | 22±2 / Controlled |
| **Humidity RH%** | 30±20 / Controlled |
| **Measurement performed by:** | Ilari Kinnunen |
| **FCC Test Firm Designation Number:** | FI0005 |
| **ISED Company Number:** | 22218 |

## 1.2 Maximum Results

The maximum reported* SAR values for Extremity-configuration for transmitting systems are shown in a table below. The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) and Health Canada's RF exposure guideline, Safety Code 6 for Extremity $SAR_{10g}$ is 4.0 W/kg.



### 1.2.1 Standalone SAR

| System | Highest Reported* $SAR_{10g}$(W/kg) in Extremity Exposure Condition, 0mm separation | Result |
|---|---|---|
| GSM 850 | 3.74 | PASS |
| GSM 1900 | 2.46 | PASS |
| WCDMA 2 | 3.75 | PASS |
| WCDMA 5 | 1.49 | PASS |
| LTE 2 | 3.16 | PASS |
| LTE 4 | 3.26 | PASS |
| LTE 5 | 1.72 | PASS |
| 2.4 GHz WLAN | 0.90 | PASS |
| 5 GHz WLAN | 1.94 | PASS |

* Reported SAR Values are scaled to upper limit of power tuning tolerance.

### 1.2.2 Simultaneous Transmission SAR

#### 1.2.2.1 FCC

| Highest Simultaneous Transmission SAR | $SAR_{10g}$(W/kg) in Extremity Exposure Condition |
|---|---|
| WCDMA 2 + 5 GHz WLAN + NFC | 3.791 |

### 1.2.3 ISED

| Highest Simultaneous Transmission SAR | $SAR_{10g}$(W/kg) in Extremity Exposure Condition |
|---|---|
| WCDMA 2 + 5 GHz WLAN + NFC | 3.796 |

### 1.2.4 Maximum Drift

| Maximum Drift During Measurements | -1.19dB* |
|---|---|

*Larger than 5% drifts included to scaling factors



### 1.2.5 Measurement Uncertainty

SAR10g: 0.3 – 3 GHz:

| **Expanded Uncertainty (k=2) 95 %** | ±21.9 % |
|---|---|

SAR10g: 3 – 6 GHz:

| **Expanded Uncertainty (k=2) 95 %** | ±23.8 % |
|---|---|



## 2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a payment terminal which supports GPRS, WCDMA, LTE, 2.4 GHz WLAN and 5 GHz WLAN, with NFC.

Measurement report "Desk2600 cless Antenna.pdf" states antenna gain of -12dBi for the NFC.


| | |
|---|---|
| **Device Category** | Portable |
| **Exposure Environment** | General population uncontrolled |

### 2.1 Supported Frequency Bands and Operational Modes

| | **Modes of Operation** | **Transmitter Frequency Range [MHz]** |
|---|---|---|
| **TX Frequency bands** | GSM/GPRS 850 | 824 – 849 |
| | GSM/GPRS 1900 | 1850 – 1910 |
| | WCDMA 2 | 1850 – 1910 |
| | WCDMA 5 | 824 – 849 |
| | LTE 2 | 1850 – 1910 |
| | LTE 4 | 1710 – 1755 |
| | LTE 5 | 824 – 849 |
| | WLAN 2.4 GHz | 2412 – 2462 |
| | WLAN 5GHz | 5180 – 5825 |
| | NFC | 13.56 |



## 2.2 Test Exemptions

### 2.2.1 FCC

Exemption power threshold for distances ≤50mm in mW for less than 100 MHz, was calculated using the following equation below, stated in 447498 D01 General RF Exposure Guidance DR05-44791:

$$P_{7X}(d_{mm}, f_{MHz}) = S_f(f_{MHz}) * P_{431a}(d_{mm}, f_{MHz}) + \left(1 - S_f(f_{MHz})\right) * S_d(d_{mm}) P_{431b1}(50., 100.) * \left((1 + \log_{10}\left(\frac{100.}{f_{MHz}}\right)\right)$$

(Equation 1)

where,

$$S_f(f_{MHz}) = -\frac{e^{(f_{MHz}-100)^2}}{250}$$ (Equation 2)

$$S_d(d_{mm}) = \frac{1}{2} + \frac{\frac{(d_{mm}-50)^2}{250}}{2}$$ (Equation 3)

$$P_{431a}(d_{mm}, f_{MHz}) = \frac{3\, d_{mm}}{\sqrt{f_{MHz}/1000}}$$ (Equation 4)

$$P_{431b1}(d_{mm}, f_{MHz}) = \frac{3\, d_{mm}}{\sqrt{f_{MHz}/1000}} + \frac{(d_{mm}-50)*f_{MHz}}{150}$$ (Equation 5)

| Transmission mode | Frequency [MHz] | Separation distance [cm] | $P_{7x}$ [mW] |
|---|---|---|---|
| **NFC** | 13.56 | 0.5 | 443 |

#### 2.2.1.1 Maximum defined Output Power and ERP

Maximum output power of the DUT's NFC's transmitter is 0 dBm i.e. 1 mW.

According to Appendix B at 447498 D01 General RF Exposure Guidance DR05-44791, the table (B.1.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater. Since the maximum output power is greater than the ERP of the DUT for NFC, it is used for SAR test exemption.

| Transmission mode | Output power [dBm] | Output power [mW] | Power Gain of Antenna G [dBi] | ERP [dBm] | ERP [mW] | $P_{7x}$ [mW] |
|---|---|---|---|---|---|---|
| **NFC** | 0 | 1 | -12 | -14.15 | 0.04 | 443 |



2.2.2 ISED

SAR test exemption output power limits based on frequency and separation distance are from RSS-102, issue 5, 2015:

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]**

| Frequency (MHz) | Exemption Limits (mW) | | | | |
|---|---|---|---|---|---|
| | At separation distance of ≤5 mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300 | 71 mW | 101 mW | 132 mW | 162 mW | 193 mW |
| 450 | 52 mW | 70 mW | 88 mW | 106 mW | 123 mW |
| 835 | 17 mW | 30 mW | 42 mW | 55 mW | 67 mW |
| 1900 | 7 mW | 10 mW | 18 mW | 34 mW | 60 mW |
| 2450 | 4 mW | 7 mW | 15 mW | 30 mW | 52 mW |
| 3500 | 2 mW | 6 mW | 16 mW | 32 mW | 55 mW |
| 5800 | 1 mW | 6 mW | 15 mW | 27 mW | 41 mW |

SAR test exclusion power threshold for 13.56 MHz is 71mW at ≤5mm separation distance.

2.2.2.1.1 Maximum defined output power and EIRP

According to the manufacturer NFC transmitter maximum TX output power is 0 dBm i.e. 1 mW. Peak antenna gain is -12dBi according to datasheet "Desk2600 cless Antenna.pdf".

Maximum output power of the DUT's NFC transmitter is 0 dBm i.e. 1 mW. Since the maximum output power is greater than the EIRP of the DUT for NFC, it is used for SAR test exemption.

| Transmission mode | Output power [dBm] | Output power [mW] | Power Gain of Antenna, G [dBi] | EIRP [dBm] | EIRP [mW] |
|---|---|---|---|---|---|
| NFC | 0 | 1 | -12 | -12 | 0.06 |

The maximum output power of the NFC is below the test exclusion threshold.

## 2.3 Simultaneous transmission

Possible simultaneous transmissions are:
Cellular + WLAN 2.4GHz + NFC
Cellular + WLAN 5GHz + NFC



# 3. OUTPUT POWER

## 3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

| GPRS 850 Slot Configuration | Max Output Power [dBm] |
|---|---|
| GPRS (1Tx-slot) | 35 |
| GPRS (2Tx-slot) | 33 |

| GPRS 1900 Slot Configuration | Max Output Power [dBm] |
|---|---|
| GPRS (1Tx-slot) | 32 |
| GPRS (2Tx-slot) | 29.3 |

| WCDMA | Max Output Power [dBm] |
|---|---|
| WCDMA 2 | 23.5 |
| WCDMA 5 | 25 |

| LTE | Max Output Power [dBm] |
|---|---|
| LTE 2 | 24 |
| LTE 4 | 24 |
| LTE 5 | 25 |

| WLAN 2.4GHz | Max Output Power [dBm] |
|---|---|
| 802.11b | 21 |
| 802.11g | 19 |
| 802.11n | 19 |



| WLAN 5GHz | Max Output Power [dBm] |
|---|---|
| 802.11a | 20 |
| 802.11n | 19 |

| NFC | Max Output Power [dBm] |
|---|---|
| | 0 |



## 3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector.

**GSM:**

| Slot Configuration Info | GSM 850 CH128 824.2 MHz | GSM 850 CH 190 836.6 MHz | GSM 850 CH 251 848.8 MHz | GSM 1900 CH512 1850.2 MHz | GSM 1900 CH661 1880.0 MHz | GSM 1900 CH810 1909.8 MHz |
|---|---|---|---|---|---|---|
| GPRS (GMSK, 1Tx-slot) | 30.88 | 31.01 | 31.22 | 28.1 | 28.2 | 28.35 |
| GPRS (GMSK, 2Tx-slot) | **30.05** | **29.97** | **30.28** | **26.51** | **26.49** | **26.56** |
| GPRS (GMSK, 3Tx-slot) | 28.22 | 27.96 | 28.24 | 24.15 | 24.07 | 24.07 |
| GPRS (GMSK, 4Tx-slot) | 27.1 | 26.78 | 27.13 | 22.87 | 22.79 | 22.75 |

Time averaged power:

| Slot Configuration Info | GSM 900 CH975 880.2 MHz | GSM 900 CH38 897.6 MHz | GSM 900 CH124 914.8 MHz | GSM 1800 CH512 1710.2 MHz | GSM 1800 CH699 1747.6 MHz | GSM 1800 CH885 1784.8 MHz |
|---|---|---|---|---|---|---|
| GPRS (GMSK, 1Tx-slot) | 21.88 | 22.01 | 22.22 | 19.1 | 19.2 | 19.35 |
| GPRS (GMSK, 2Tx-slot) | **24.05** | **23.97** | **24.28** | **20.51** | **20.49** | **20.56** |
| GPRS (GMSK, 3Tx-slot) | 23.96 | 23.7 | 23.98 | 19.89 | 19.81 | 19.81 |
| GPRS (GMSK, 4Tx-slot) | 24.1 | 23.78 | 24.13 | 19.87 | 19.79 | 19.75 |

Slot configuration with highest time averaged power was selected for SAR testing.

**WCDMA:**

| Reference Channel | WCDMA 2 | | | WCDMA 5 | | |
|---|---|---|---|---|---|---|
| | CH 9262 1852.4 MHz | CH 9400 1880.0 MHz | CH 9538 1907.6 MHz | CH 4132 826.4 MHz | CH 4183 836.6 MHz | CH 4233 846.6 MHz |
| RMC 12.2K | **22.48** | **22.47** | **22.32** | **23.45** | **23.61** | **23.56** |
| HSDPA Subtest-1 | 21.59 | 21.63 | 21.56 | 23.3 | 23.25 | 23.3 |
| HSDPA Subtest-2 | 21.75 | 21.63 | 21.86 | 23.44 | 23.36 | 23.46 |
| HSDPA Subtest-3 | 21.27 | 21.08 | 21.36 | 23.33 | 22.82 | 23.02 |
| HSDPA Subtest-4 | 21.23 | 21.04 | 21.21 | 23.27 | 22.76 | 22.95 |
| HSUPA Subtest-1 | 21.79 | 21.66 | 21.86 | 23.7 | 23.34 | 23.55 |
| HSUPA Subtest-2 | 21.68 | 21.2 | 21.4 | 23.27 | 23.02 | 22.89 |
| HSUPA Subtest-3 | 22.17 | 21.67 | 21.92 | 23.83 | 23.29 | 23.66 |
| HSUPA Subtest-4 | 21.9 | 21.68 | 21.63 | 23.45 | 23.41 | 23.21 |
| HSUPA Subtest-5 | 22.26 | 21.65 | 21.94 | 23.71 | 23.45 | 23.6 |



**LTE:**

The DUT is LTE Cat 1 device and has limited data rate up to 5 Mb/s in uplink, for this reason the resource block allocations for 16QAM modulation have been changed.

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 18607 1850.7 MHz | CH18900 1880.0 MHz | CH19193 1909.3 MHz | 3GPP MPR [dB] | CH18607 1850.7 MHz | CH18900 1880.0 MHz | CH19193 1909.3 MHz | 3GPP MPR [dB] |
| 2 / 1.4M | 1 | 0 | 22.39 | 22.13 | 22.2 | 0 | 20.6 | 20.15 | 20.19 | 1 |
| | 1 | 2 | 22.57 | 22.19 | 22.2 | 0 | 20.61 | 20.06 | 20.41 | 1 |
| | 1 | 5 | 22.3 | 21.99 | 21.92 | 0 | 20.6 | 20.45 | 20.44 | 1 |
| | 3 | 0 | 22.23 | 22.12 | 22.2 | 0 | 20.86 | 20.88 | 20.9 | 1 |
| | 3 | 1 | 22.28 | 22.15 | 22.29 | 0 | 20.96 | 20.97 | 20.96 | 1 |
| | 3 | 3 | 22.22 | 22.19 | 22.11 | 0 | 20.91 | 20.94 | 20.97 | 1 |
| | 6 | 0 | 21.15 | 21.26 | 21.05 | 1 | 19.7 | 19.82 | 19.94 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH18615 1851.5 MHz | CH18900 1880.0 MHz | CH19185 1918.5 MHz | 3GPP MPR [dB] | CH18615 1851.5 MHz | CH18900 1880.0 MHz | CH19185 1918.5 MHz | 3GPP MPR [dB] |
| 2 / 3M | 1 | 0 | 22.11 | 22.28 | 22.29 | 0 | 20.13 | 20.41 | 20.52 | 1 |
| | 1 | 7 | 22.32 | 22.36 | 22.21 | 0 | 20.63 | 20.32 | 20.64 | 1 |
| | 1 | 14 | 22.18 | 22.19 | 22.21 | 0 | 19.99 | 20.31 | 20.49 | 1 |
| | 8 | 0 | 21.52 | 21.26 | 21.32 | 1 | 20.27 | 19.84 | 19.95 | 2 |
| | 8 | 3 | 21.38 | 21.22 | 21.22 | 1 | 19.82 | 19.92 | 20.31 | 2 |
| | 8 | 7 | 21.34 | 21.22 | 21.19 | 1 | 19.79 | 20.02 | 19.98 | 2 |
| | 15 | 0 | 21.34 | 21.24 | 21.21 | 1 | 19.74 | 19.87 | 20.2 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH18625 1852.5 MHz | CH18900 1880.0 MHz | CH19175 1907.5 MHz | 3GPP MPR [dB] | CH18625 1852.5 MHz | CH18900 1880.0 MHz | CH19175 1907.5 MHz | 3GPP MPR [dB] |
| 2 / 5M | 1 | 0 | 21.79 | 21.96 | 21.7 | 0 | 20.39 | 20.48 | 20.34 | 1 |
| | 1 | 12 | 22.0 | 21.88 | 22.11 | 0 | 20.73 | 20.45 | 20.72 | 1 |
| | 1 | 24 | 21.89 | 21.78 | 21.96 | 0 | 20.45 | 20.21 | 20.44 | 1 |
| | 12 | 0 | 20.97 | 21.02 | 20.99 | 1 | 19.79 | 19.54 | 19.73 | 2 |
| | 12 | 6 | 21.01 | 21.0 | 20.99 | 1 | 19.62 | 19.65 | 19.84 | 2 |
| | 12 | 13 | 21.1 | 20.95 | 21.04 | 1 | 20.04 | 19.76 | 19.88 | 2 |
| | 25 | 0 | 21.02 | 21.04 | 20.88 | 1 | 19.97 | 19.67 | 19.93 | 2 |



| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH18650 1855 MHz | CH18900 1880.0 | CH19150 1905 MHz | 3GPP MPR [dB] | CH18650 1855 MHz | CH18900 1880.0 MHz | CH19150 1905 MHz | 3GPP MPR [dB] |
| 2 / 10M | 1 | 0 | 22.17 | 22.18 | 22.02 | 0 | 20.87 | 20.66 | 20.25 | 1 |
| | 1 | 24 | 22.16 | 21.98 | 22.08 | 0 | 20.83 | 20.39 | 20.33 | 1 |
| | 1 | 49 | 21.81 | 22.1 | 22.08 | 0 | 20.19 | 20.14 | 20.13 | 1 |
| | 25 | 0 | 21.07 | 21.09 | 21.07 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 12 | 21.17 | 20.97 | 21.08 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 25 | 21.12 | 21.05 | 20.95 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 0 | 21.09 | 21.02 | 21.14 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 19.76 | 19.85 | 19.81 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH18675 1857.5 MHz | CH18900 1880.0 | CH19125 1902.5 MHz | 3GPP MPR [dB] | CH18675 1857.5 MHz | CH18900 1880.0 MHz | CH19125 1902.5 MHz | 3GPP MPR [dB] |
| 2 / 15M | 1 | 0 | 22.36 | 22.19 | 22.11 | 0 | 20.14 | 20.75 | 20.84 | 1 |
| | 1 | 37 | 22.39 | 22.26 | 22.55 | 0 | 20.31 | 20.63 | 20.87 | 1 |
| | 1 | 74 | 22.17 | 22.11 | 21.98 | 0 | 20.4 | 20.45 | 20.39 | 1 |
| | 36 | 0 | 21.25 | 21.18 | 21.12 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 36 | 19 | 21.17 | 21.07 | 21.09 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 36 | 39 | 21.17 | 21.09 | 21.07 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 75 | 0 | 21.22 | 21.12 | 21.0 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 19.85 | 19.98 | 19.95 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH18700 1860.0 MHz | CH18900 1880.0 | CH19100 1900.0 MHz | 3GPP MPR [dB] | CH18700 1860.0 MHz | CH18900 1880.0 | CH19100 1900.0 MHz | 3GPP MPR [dB] |
| 2 / 20M | 1 | 0 | 22.14 | 22.12 | 22.5 | 0 | 20.49 | 20.52 | 20.5 | 1 |
| | 1 | 50 | 22.04 | 22.05 | 22.26 | 0 | 20.52 | 20.47 | 20.67 | 1 |
| | 1 | 99 | 21.94 | 22.01 | 22.18 | 0 | 20.43 | 20.17 | 20.13 | 1 |
| | 50 | 0 | 21.43 | 21.37 | 21.34 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 25 | 21.38 | 21.27 | 21.24 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 50 | 21.28 | 21.32 | 21.28 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 100 | 0 | 21.18 | 21.39 | 21.21 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 19.89 | 19.87 | 20.12 | 2 |



| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 19957 1710.7 MHz | CH 20175 1732.5 MHz | CH 20393 1754.3 MHz | 3GPP MPR [dB] | CH 19957 1710.7 MHz | CH 20175 1732.5 MHz | CH 20393 1754.3 MHz | 3GPP MPR [dB] |
| 4 / 1.4M | 1 | 0 | 21.96 | 22.17 | 21.79 | 0 | 20.61 | 20.27 | 20.58 | 1 |
| | 1 | 2 | 22.12 | 22.12 | 21.92 | 0 | 20.83 | 20.35 | 20.86 | 1 |
| | 1 | 5 | 22.01 | 21.84 | 21.83 | 0 | 20.79 | 20.17 | 20.6 | 1 |
| | 3 | 0 | 22.15 | 22.21 | 21.94 | 0 | 21.01 | 21.16 | 20.92 | 1 |
| | 3 | 1 | 22.07 | 22.12 | 22.01 | 0 | 21.04 | 21.14 | 20.97 | 1 |
| | 3 | 3 | 22.07 | 22.13 | 21.94 | 0 | 21.05 | 21.02 | 20.87 | 1 |
| | 6 | 0 | 21.05 | 21.11 | 20.85 | 1 | 20.08 | 19.98 | 19.91 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 19965 1711.5 MHz | CH 20175 1732.5 MHz | CH 20385 1753.5 MHz | 3GPP MPR [dB] | CH 19965 1711.5 MHz | CH 20175 1732.5 MHz | CH 20385 1753.5 MHz | 3GPP MPR [dB] |
| 4 / 3M | 1 | 0 | 22.14 | 22.29 | 21.8 | 0 | 20.7 | 20.48 | 20.62 | 1 |
| | 1 | 7 | 22.19 | 22.27 | 21.85 | 0 | 20.95 | 20.46 | 20.7 | 1 |
| | 1 | 14 | 22.16 | 22.14 | 21.96 | 0 | 20.98 | 20.3 | 20.48 | 1 |
| | 8 | 0 | 21.15 | 21.17 | 20.74 | 1 | 20.2 | 20.21 | 19.81 | 2 |
| | 8 | 3 | 21.13 | 21.13 | 20.76 | 1 | 20.2 | 20.13 | 19.92 | 2 |
| | 8 | 7 | 21.21 | 21.08 | 20.94 | 1 | 20.25 | 20.28 | 20.0 | 2 |
| | 15 | 0 | 21.1 | 21.07 | 20.74 | 1 | 20.28 | 20.34 | 19.89 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 19975 1711.5 MHz | CH 20175 1732.5 MHz | CH 20375 1753.5 MHz | 3GPP MPR [dB] | CH 19975 1711.5 MHz | CH 20175 1732.5 MHz | CH 20375 1753.5 MHz | 3GPP MPR [dB] |
| 4 / 5M | 1 | 0 | 22.02 | 22.13 | 21.8 | 0 | 20.2 | 20.57 | 20.4 | 1 |
| | 1 | 12 | 22.16 | 21.95 | 21.88 | 0 | 20.97 | 20.56 | 20.71 | 1 |
| | 1 | 24 | 22.1 | 21.89 | 22.09 | 0 | 20.94 | 20.12 | 20.6 | 1 |
| | 12 | 0 | 21.07 | 21.1 | 20.94 | 1 | 19.87 | 19.95 | 19.65 | 2 |
| | 12 | 6 | 21.16 | 21.09 | 20.94 | 1 | 20.09 | 19.81 | 19.88 | 2 |
| | 12 | 13 | 21.19 | 20.93 | 20.9 | 1 | 20.34 | 19.75 | 19.81 | 2 |
| | 25 | 0 | 21.06 | 21.03 | 20.92 | 1 | 20.19 | 20.09 | 19.95 | 2 |



| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20000 1715.0 MHz | CH 20175 1732.5 MHz | CH 20350 1750.0 MHz | 3GPP MPR [dB] | CH 20000 1715.0 MHz | CH 20175 1732.5 MHz | CH 20350 1750.0 MHz | 3GPP MPR [dB] |
| 4 / 10M | 1 | 0 | 22.23 | 22.29 | 21.63 | 0 | 20.28 | 20.63 | 20.34 | 1 |
| | 1 | 24 | 22.29 | 21.98 | 21.82 | 0 | 20.56 | 20.49 | 20.34 | 1 |
| | 1 | 49 | 22.23 | 21.68 | 22.04 | 0 | 20.45 | 20.13 | 20.44 | 1 |
| | 25 | 0 | 21.26 | 21.15 | 20.88 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 12 | 21.24 | 20.98 | 20.85 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 25 | 21.19 | 21.0 | 20.93 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 0 | 21.1 | 21.12 | 20.85 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 20.13 | 20.24 | 19.78 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20025 1717.0 MHz | CH 20175 1732.5 MHz | CH 20325 1747.5 MHz | 3GPP MPR [dB] | CH 20025 1717.0 MHz | CH 20175 1732.5 MHz | CH 20325 1747.5 MHz | 3GPP MPR [dB] |
| 4 / 15M | 1 | 0 | 22.26 | 22.35 | 22.16 | 0 | 20.39 | 20.85 | 20.59 | 1 |
| | 1 | 37 | 22.54 | 21.7 | 22.14 | 0 | 21.07 | 20.46 | 20.68 | 1 |
| | 1 | 74 | 22.13 | 21.8 | 22.09 | 0 | 20.81 | 19.95 | 20.65 | 1 |
| | 36 | 0 | 21.31 | 21.23 | 20.82 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 36 | 19 | 21.27 | 21.07 | 20.88 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 36 | 39 | 21.28 | 20.98 | 20.83 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 75 | 0 | 21.18 | 21.19 | 20.81 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 20.25 | 20.39 | 19.74 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20050 1720.0 MHz | CH 20175 1732.5 MHz | CH 20300 1745.0 MHz | 3GPP MPR [dB] | CH 20050 1720.0 MHz | CH 20175 1732.5 MHz | CH 20300 1745.0 MHz | 3GPP MPR [dB] |
| 4 / 20M | 1 | 0 | 22.21 | 22.34 | 22.15 | 0 | 20.4 | 20.97 | 20.78 | 1 |
| | 1 | 50 | 22.25 | 21.95 | 21.86 | 0 | 21.01 | 20.69 | 20.37 | 1 |
| | 1 | 99 | 22.07 | 21.82 | 21.9 | 0 | 20.64 | 20.23 | 20.23 | 1 |
| | 50 | 0 | 21.18 | 21.22 | 20.97 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 25 | 21.23 | 21.16 | 20.93 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 50 | 21.27 | 20.97 | 20.87 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 100 | 0 | 21.15 | 21.13 | 20.94 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 20.2 | 20.21 | 20.14 | 2 |



| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20407 824.7 MHz | CH 20525 836.5 MHz | CH 20643 848.3 MHz | 3GPP MPR [dB] | CH 20407 824.7 MHz | CH 20525 836.5 MHz | CH 20643 848.3 MHz | 3GPP MPR [dB] |
| 5 / 1.4M | 1 | 0 | 22.92 | 22.73 | 22.69 | 0 | 21.27 | 21.32 | 21.26 | 1 |
| | 1 | 2 | 22.91 | 22.87 | 22.84 | 0 | 21.54 | 21.5 | 21.45 | 1 |
| | 1 | 5 | 22.74 | 22.78 | 22.74 | 0 | 21.27 | 21.47 | 21.38 | 1 |
| | 3 | 0 | 22.86 | 22.85 | 22.74 | 0 | 21.66 | 21.73 | 21.38 | 1 |
| | 3 | 1 | 22.87 | 22.87 | 22.83 | 0 | 21.97 | 21.94 | 21.74 | 1 |
| | 3 | 3 | 22.78 | 22.86 | 22.69 | 0 | 21.84 | 21.75 | 21.83 | 1 |
| | 6 | 0 | 21.75 | 21.78 | 21.67 | 1 | 20.56 | 20.74 | 20.5 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20415 825.5 MHz | CH 20525 836.5 MHz | CH 20635 847.5 MHz | 3GPP MPR [dB] | CH 20415 825.5 MHz | CH 20525 836.5 MHz | CH 20635 847.5 MHz | 3GPP MPR [dB] |
| 5 / 3M | 1 | 0 | 22.8 | 22.88 | 22.71 | 0 | 21.35 | 21.4 | 21.22 | 1 |
| | 1 | 7 | 22.81 | 22.91 | 22.77 | 0 | 21.22 | 21.48 | 21.33 | 1 |
| | 1 | 14 | 22.63 | 22.83 | 22.64 | 0 | 21.1 | 21.23 | 21.26 | 1 |
| | 8 | 0 | 21.88 | 21.82 | 21.77 | 1 | 20.65 | 20.87 | 20.57 | 2 |
| | 8 | 3 | 21.74 | 21.85 | 21.77 | 1 | 20.85 | 20.8 | 20.75 | 2 |
| | 8 | 7 | 21.62 | 21.85 | 21.82 | 1 | 20.7 | 20.85 | 20.8 | 2 |
| | 15 | 0 | 21.69 | 21.79 | 21.73 | 1 | 20.73 | 20.93 | 20.69 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20425 826.5 MHz | CH 20525 836.5 MHz | CH 20625 846.5 MHz | 3GPP MPR [dB] | CH 20425 826.5 MHz | CH 20525 836.5 MHz | CH 20625 846.5 MHz | 3GPP MPR [dB] |
| 5 / 5M | 1 | 0 | 22.72 | 22.66 | 22.53 | 0 | 21.29 | 21.35 | 20.77 | 1 |
| | 1 | 12 | 22.8 | 22.91 | 22.9 | 0 | 21.14 | 21.49 | 21.43 | 1 |
| | 1 | 24 | 22.6 | 22.72 | 22.68 | 0 | 21.1 | 21.22 | 21.26 | 1 |
| | 12 | 0 | 21.76 | 21.84 | 21.65 | 1 | 20.46 | 20.47 | 20.49 | 2 |
| | 12 | 6 | 21.58 | 21.86 | 21.8 | 1 | 20.27 | 20.85 | 20.73 | 2 |
| | 12 | 13 | 21.6 | 21.83 | 21.76 | 1 | 20.51 | 20.75 | 20.79 | 2 |
| | 25 | 0 | 21.67 | 21.8 | 21.73 | 1 | 20.59 | 20.72 | 20.64 | 2 |

| LTE Band / BW | RBs | RB Start | QPSK | | | | 16QAM | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CH 20450 829.0 MHz | CH 20525 836.5 MHz | CH 20600 844 MHz | 3GPP MPR [dB] | CH 20450 829.0 MHz | CH 20525 836.5 MHz | CH 20600 844 MHz | 3GPP MPR [dB] |
| 5 / 10M | 1 | 0 | 22.59 | 22.66 | 22.67 | 0 | 21.28 | 21.16 | 21.19 | 1 |
| | 1 | 24 | 22.8 | 22.87 | 22.61 | 0 | 20.99 | 21.35 | 20.81 | 1 |
| | 1 | 49 | 22.71 | 22.51 | 22.5 | 0 | 21.44 | 21.08 | 21.3 | 1 |
| | 25 | 0 | 21.65 | 21.84 | 21.65 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 12 | 21.7 | 21.79 | 21.63 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 25 | 25 | 21.74 | 21.78 | 21.71 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 50 | 0 | 21.76 | 21.72 | 21.7 | 1 | N/A* | N/A* | N/A* | N/A* |
| | 27 | 0 | N/A* | N/A* | N/A* | N/A* | 20.71 | 20.67 | 20.61 | 2 |



**WLAN 2.4 GHz:**

| Standard | Transmission mode | Data rate [Mbps] | Output power [dBm] | | |
|---|---|---|---|---|---|
| | | | CH 1 2412 MHz | CH 6 2437 MHz | CH 11 2462 MHz |
| 802.11b | DSSS | 1 | 19.5 | 19.35 | 19.24 |

**5GHz WLAN:**

| Standard | Channel | Frequency [MHz] | Transmission mode | Data Rate [Mbps] | Output power [dBm] |
|---|---|---|---|---|---|
| 802.11a | 52 | 5260 | OFDM | 6 | 18.74 |
| 802.11a | 56 | 5280 | OFDM | 6 | 18.88 |
| 802.11a | 60 | 5300 | OFDM | 6 | 18.96 |
| 802.11a | 64 | 5320 | OFDM | 6 | 19.06 |
| 802.11a | 100 | 5500 | OFDM | 6 | 19.3 |
| 802.11a | 112 | 5560 | OFDM | 6 | 19.53 |
| 802.11a | 116 | 5580 | OFDM | 6 | 19.46 |
| 802.11a | 128 | 5640 | OFDM | 6 | 19.16 |
| 802.11a | 132 | 5660 | OFDM | 6 | 19.05 |
| 802.11a | 149 | 5745 | OFDM | 6 | 18.77 |
| 802.11a | 165 | 5825 | OFDM | 6 | 18.01 |



## 4. TEST EQUIPMENT

Dasy52 near field scanning system, manufactured by SPEAG was used for SAR testing. The test system consists of high precision robotics system (Staubli), robot controller, computer, near-field probe, probe alignment sensor, and a phantom containing the tissue equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location of maximum electromagnetic field.

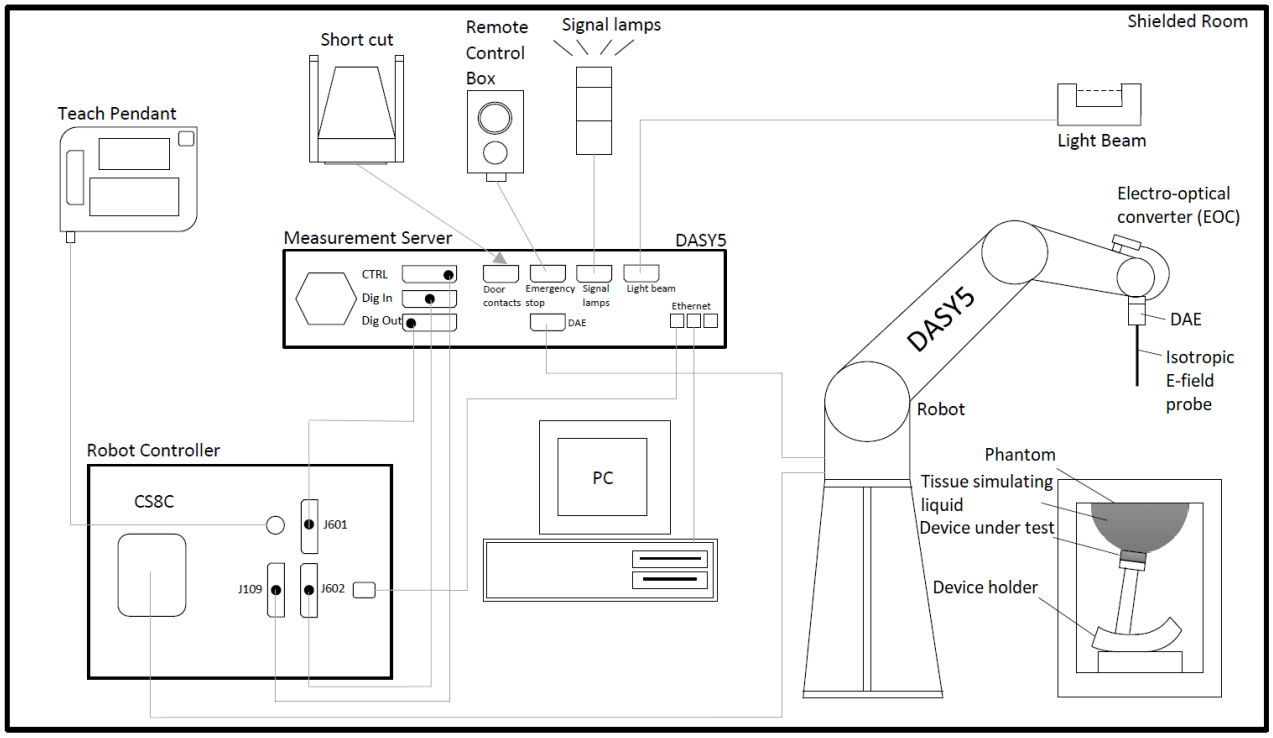



Figure 1 Schematic Laboratory Picture



## 4.1 Test Equipment List

Main used test system components are listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

| Test Equipment | Model | Serial Number | Calibration Date | Calibration Interval (years) |
|---|---|---|---|---|
| DASY5 Software | 52.8.8.1258 | - | N/A | N/A |
| Amplifier, 800-4200MHz, 50W | 5163F | 1022 | N/A | N/A |
| Amplifier, 500-8000MHz | ZX60-83LN12+ | NA | N/A | N/A |
| DAE4, converter | DAE4 | 710 | 10/2022 | 1 |
| Inline Peak Power Sensor | MA24105A | 2102058 | 11/2022 | 1 |
| Power Sensor | NRP-Z11 | 100265 | 12/2022 | 1 |
| Power Sensor | NRP8S | 1419.0006K02-108509-Zh | 08/2021 | 2 |
| Isotropic DOS probe | EX3DV4 | 7447 | 02/2023 | 1 |
| System validation dipole | D1800V2 | 249 | 07/2022 | 3 |
| System validation dipole | D1900V2 | 511 | 03/2023 | 3 |
| System validation dipole | D2450V2 | 729 | 07/2022 | 3 |
| System validation dipole | D5GHzV2 | 1045 | 03/2023 | 3 |
| System validation dipole | D835V2 | 455 | 07/2022 | 3 |
| Radio Communication Analyzer | MT8820C | 6200951734 | 12/2022 | 1 |
| Network Analyzer | E5071C | MY46102812 | 05/2022 | 1 |
| Vector Network Analyzer | P5008A | MY58100258 | 01/2023 | 1 |

### 4.1.1 Isotropic E-field Probe Type EX3DV4

| | |
|---|---|
| **Construction** | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| **Calibration** | Calibration certificate in Appendix D |
| **Frequency** | 10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz) |
| **Directivity** | ± 0.3 dB in HSL (rotation around probe axis)<br>± 0.5 dB in tissue material (rotation normal to probe axis) |
| **Dynamic Range** | 10 µW/g to > 100 mW/g, Linearity: ± 0.2 dB |
| **Dimensions** | Overall length: 330 mm<br>Tip length: 10 mm<br>Body diameter: 12 mm |
| **Application** | General dosimetry up to 6 GHz<br>Compliance tests of mobile phones<br>Fast automatic scanning in arbitrary phantoms |



### 4.2 Phantoms

Eli Phantom:

The phantom used in SAR tests was an ELI phantom, manufactured by SPEAG. ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures.

### 4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±10% of the recommended values at frequencies under 3GHz and ±5% at frequencies above 3GHz. A liquid compensation algorithm was used in DASY5 with which measured peak average SAR values were corrected for the deviation of used liquid. Depth of the tissue simulant was at least 15.0 cm from the inner surface of the flat phantom.

| Tissue simulant liquid Ingredients |
|---|
| Deionized Water, oil, salt, emulsifiers |

### 4.4 System Validation Status

| Frequency [MHz] | Dipole Type / SN | Probe Type / SN | Calibrated Signal Type | DAE Unit / SN | Dielectric Constant [ε'] | Conductivity σ [S/m] | Date |
|---|---|---|---|---|---|---|---|
| 835 | D835V2-SN:455 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 45.03 | 0.88 | 03/2023 |
| 1800 | D1800V2-SN:249 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 43.51 | 1.35 | 02/2023 |
| 1900 | D1900V2-SN:511 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 43.33 | 1.4 | 02/2023 |
| 2450 | D2450V2 - SN: 729 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 41.26 | 1.71 | 03/2023 |
| 5250 | D5GHzV2 - SN: 1045 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 34.53 | 4.77 | 03/2023 |
| 5600 | D5GHzV2 - SN: 1045 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 34.06 | 5.07 | 03/2023 |
| 5750 | D5GHzV2 - SN: 1014 | EX3DV4 - SN: 7447 | CW | DAE 4 / 1332 | 35.02 | 4.98 | 03/2023 |



## 4.5 System Check

| Date | Tissue Type | Tissue Temp. [°C] | Frequency [MHz] | Input Power [mW] | Measured $SAR_{1g}$ [W/kg] | 1 W Target $SAR_{1g}$ [W/kg] | 1 W Normalized $SAR_{1g}$ [W/kg] | Deviation [%] | Plot # |
|---|---|---|---|---|---|---|---|---|---|
| 10.05.2023 | WB Head | 22 | 835 | 250 | 2.5 | 9.69 | 10.0 | 3.2 | 1 |
| 15.05.2023 | WB Head | 22 | 1800 | 250 | 9.03 | 38.9 | 36.12 | -7.1 | 2 |
| 18.05.2023 | WB Head | 22 | 1900 | 250 | 9.16 | 38.02 | 36.64 | -3.6 | 3 |
| 22.05.2023 | WB Head | 22 | 2450 | 250 | 11.9 | 52.3 | 47.6 | -9.0 | 4 |
| 24.05.2023 | WB Head | 22 | 5250 | 250 | 7.11 | 73.09 | 71.1 | -2.7 | 5 |
| 25.05.2023 | WB Head | 22 | 5600 | 250 | 7.77 | 72.92 | 77.7 | 6.6 | 6 |
| 26.05.2023 | WB Head | 22 | 5750 | 250 | 7.34 | 69.05 | 73.4 | 6.3 | 7 |
| 29.05.2023 | WB Head | 22 | 5750 | 250 | 7.19 | 69.05 | 71.9 | 4.1 | 8 |

### 4.5.1 Tissue Simulant Verification

| | | | | Target | | Measured | | Deviation | |
|---|---|---|---|---|---|---|---|---|---|
| Date | Tissue Type | Tissue Temp [°C] | Frequency [MHz] | Dielectric Constant [ε] Target | Conductivity σ [S/m] Target | Dielectric Constant [ε] | Conductivity σ [S/m] | ε (%) | σ (%) |
| 10.05.2023 | WB Head | 22 | 824 | 41.55 | 0.9 | 42.68 | 0.89 | 2.7 | -0.6 |
| 10.05.2023 | WB Head | 22 | 826 | 41.54 | 0.9 | 42.68 | 0.89 | 2.7 | -0.6 |
| 10.05.2023 | WB Head | 22 | 835 | 41.5 | 0.9 | 42.67 | 0.9 | 2.8 | -0.4 |
| 10.05.2023 | WB Head | 22 | 836 | 41.5 | 0.9 | 42.66 | 0.9 | 2.8 | -0.5 |
| 10.05.2023 | WB Head | 22 | 836.5 | 41.5 | 0.9 | 42.66 | 0.9 | 2.8 | -0.5 |
| 10.05.2023 | WB Head | 22 | 837 | 41.5 | 0.9 | 42.66 | 0.9 | 2.8 | -0.5 |
| 10.05.2023 | WB Head | 22 | 847 | 41.5 | 0.91 | 42.65 | 0.9 | 2.8 | -1.4 |
| 10.05.2023 | WB Head | 22 | 849 | 41.5 | 0.92 | 42.64 | 0.9 | 2.8 | -1.5 |
| 12.05.2023 | WB Head | 22 | 829 | 41.53 | 0.9 | 42.57 | 0.89 | 2.5 | -1.6 |
| 12.05.2023 | WB Head | 22 | 835 | 41.5 | 0.9 | 42.56 | 0.89 | 2.6 | -1.4 |
| 12.05.2023 | WB Head | 22 | 836.5 | 41.5 | 0.9 | 42.57 | 0.89 | 2.6 | -1.5 |
| 12.05.2023 | WB Head | 22 | 844 | 41.5 | 0.91 | 42.55 | 0.89 | 2.5 | -2.1 |
| 15.05.2023 | WB Head | 22 | 1720 | 40.13 | 1.35 | 40.44 | 1.3 | 0.8 | -3.9 |
| 15.05.2023 | WB Head | 22 | 1732.5 | 40.11 | 1.36 | 40.42 | 1.31 | 0.8 | -3.9 |
| 15.05.2023 | WB Head | 22 | 1745 | 40.09 | 1.37 | 40.4 | 1.31 | 0.8 | -3.9 |
| 15.05.2023 | WB Head | 22 | 1800 | 40 | 1.4 | 40.33 | 1.35 | 0.8 | -3.7 |
| 15.05.2023 | WB Head | 22 | 1850 | 40 | 1.4 | 40.23 | 1.38 | 0.6 | -1.6 |
| 15.05.2023 | WB Head | 22 | 1860 | 40 | 1.4 | 40.2 | 1.38 | 0.5 | -1.2 |
| 15.05.2023 | WB Head | 22 | 1880 | 40 | 1.4 | 40.17 | 1.4 | 0.4 | -0.2 |
| 15.05.2023 | WB Head | 22 | 1900 | 40 | 1.4 | 40.16 | 1.41 | 0.4 | 0.6 |
| 15.05.2023 | WB Head | 22 | 1910 | 40 | 1.4 | 40.14 | 1.41 | 0.3 | 0.9 |
| 18.05.2023 | WB Head | 22 | 1852 | 40 | 1.4 | 39.9 | 1.41 | -0.3 | 0.5 |
| 18.05.2023 | WB Head | 22 | 1880 | 40 | 1.4 | 39.86 | 1.42 | -0.4 | 1.7 |
| 18.05.2023 | WB Head | 22 | 1900 | 40 | 1.4 | 39.84 | 1.44 | -0.4 | 2.6 |
| 18.05.2023 | WB Head | 22 | 1908 | 40 | 1.4 | 39.82 | 1.44 | -0.4 | 3.0 |
| 22.05.2023 | WB Head | 22 | 2412 | 39.27 | 1.77 | 37.46 | 1.66 | -4.6 | -6.1 |
| 22.05.2023 | WB Head | 22 | 2437 | 39.22 | 1.79 | 37.43 | 1.67 | -4.6 | -6.4 |
| 22.05.2023 | WB Head | 22 | 2450 | 39.2 | 1.8 | 37.39 | 1.68 | -4.6 | -6.5 |
| 22.05.2023 | WB Head | 22 | 2462 | 39.18 | 1.81 | 37.36 | 1.69 | -4.7 | -6.8 |
| 24.05.2023 | WB Head | 22 | 5250 | 35.93 | 4.71 | 36.32 | 4.48 | 1.1 | -4.9 |
| 24.05.2023 | WB Head | 22 | 5260 | 35.92 | 4.72 | 36.31 | 4.49 | 1.1 | -4.9 |



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 24.05.2023 | WB Head | 22 | 5300 | 35.87 | 4.76 | 36.22 | 4.53 | 1.0 | -4.7 |
| 24.05.2023 | WB Head | 22 | 5320 | 35.85 | 4.78 | 36.19 | 4.55 | 1.0 | -4.7 |
| 24.05.2023 | WB Head | 22 | 5500 | 35.64 | 4.96 | 35.88 | 4.75 | 0.7 | -4.3 |
| 24.05.2023 | WB Head | 22 | 5560 | 35.57 | 5.02 | 35.78 | 4.82 | 0.6 | -4.1 |
| 24.05.2023 | WB Head | 22 | 5600 | 35.53 | 5.06 | 35.7 | 4.86 | 0.5 | -4.0 |
| 24.05.2023 | WB Head | 22 | 5640 | 35.48 | 5.11 | 35.63 | 4.91 | 0.4 | -3.9 |
| 26.05.2023 | WB Head | 22 | 5660 | 35.46 | 5.13 | 35.12 | 5.02 | -1.0 | -2.0 |
| 26.05.2023 | WB Head | 22 | 5750 | 35.36 | 5.22 | 34.94 | 5.12 | -1.2 | -1.8 |
| 29.05.2023 | WB Head | 22 | 5660 | 35.46 | 5.13 | 35.76 | 4.96 | 0.8 | -3.3 |
| 29.05.2023 | WB Head | 22 | 5745 | 35.36 | 5.21 | 35.6 | 5.06 | 0.7 | -3.0 |
| 29.05.2023 | WB Head | 22 | 5750 | 35.36 | 5.22 | 35.59 | 5.06 | 0.7 | -3.0 |
| 29.05.2023 | WB Head | 22 | 5825 | 35.27 | 5.3 | 35.47 | 5.15 | 0.6 | -2.8 |



## 5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01, 248227 D01 802.11 Wi-Fi SAR and RSS-102, Issue 5.

Low, mid and high frequency channels for the configuration with the highest SAR value were tested as per ISED notice 2016-DRS001.

For the cellular technologies, the device was set to transmit using maximum power with a communication tester.

The DUT is LTE Cat 1 device and has limited data rate up to 5 Mb/s in uplink, for this reason the resource block allocations for 16QAM modulation have been changed.

A control software for WLAN was used to set the DUT to transmit at maximum power and maximum duty cycle of 68.7%. Reported SAR is then scaled to 100%, according to 248227 D01 802.11 Wi-Fi SAR, section 2.2.

The WLAN transmission modes for testing were selected according to largest channel bandwidth configuration, lowest order modulation and lowest data rate.
WLAN 2.4GHz was tested with 802.11b standard with data rate of 1Mbit/s and WLAN 5GHz was tested with 802.11a standard with data rate of 6Mbit/s.

### 5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.

Device holder supplied by SPEAG

### 5.2 Test Positions

#### 5.2.1 Extremity Configuration, 0mm separation distance

Extremity SAR was tested from all of the sides of the device. The device was placed on the top of a Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Photos of the test positions are presented in appendix A.



### 5.3 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

### 5.4 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy52 are all based on the modified Quadratic Shepard's method (Robert J. Renka," Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).
The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighboring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.



## 6. MEASUREMENT UNCERTAINTY

**DASY5 Uncertainty Budget**
**According to IEC/IEEE 62209-1528**
**(Frequency band: 300MHz - 3GHz range)**

| Symbol | Error Description | Uncert. value | Prob. Dist. | Div. | (ci) 1g | (ci) 10g | Std. Unc. (1g) | Std. Unc. (10g) |
|---|---|---|---|---|---|---|---|---|
| **Measurement System Errors** | | | | | | | | |
| CF | Probe Calibration | ±12.0% | N | √2 | 1 | 1 | ±6.0% | ±6.0% |
| $CF_{drift}$ | Probe Calibration Drift | ±1.7% | R | √3 | 1 | 1 | ±1.0% | ±1.0% |
| LIN | Probe Linearity | ±4.7% | R | √3 | 1 | 1 | ±2.7% | ±2.7% |
| BBS | Broadband Signal | ±3.0% | R | √3 | 1 | 1 | ±1.7% | ±1.7% |
| ISO | Probe Isotropy | ±7.6% | R | 3 | 1 | 1 | ±4.4% | ±4.4% |
| DAE | Data Acquisition | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% |
| AMB | RF Ambient | ±1.8% | N | 1 | 1 | 1 | ±1.8% | ±1.8% |
| $\Delta_{syz}$ | Probe Positioning | ±3.9% | N | 1 | 0.14 | 0.14 | ±0.5% | ±0.5% |
| DAT | Data Processing | ±1.2% | N | 1 | 1 | 1 | ±1.2% | ±1.2% |
| **Phantom and Device Errors** | | | | | | | | |
| LIQ(σ) | Conductivity (meas.)[DAK] | ±2.5% | N | √1 | 0.78 | 0.71 | ±2.0% | ±1.8% |
| $LIQ(T_\sigma)$ | Conductivity (temp.)[BB] | ±3.3% | R | √3 | 0.78 | 0.71 | ±1.5% | ±1.4% |
| EPS | Phantom Permittivity | ±14.0% | R | 3 | 0 | 0 | ±0% | ±0% |
| DIS | Distance DUT - TSL | ±2.0% | N | 1 | 2 | 2 | ±4.0% | ±4.0% |
| $D_{xyz}$ | Device Positioning (±0.5mm) | ±1.0% | N | 1 | 1 | 1 | ±1.0% | ±1.0% |
| H | Device Holder | ±3.6% | N | √1 | 1 | 1 | ±3.6% | ±3.6% |
| MOD | DUT Modulation[m] | ±2.4% | R | √3 | 1 | 1 | ±1.4% | ±1.4% |
| TAS | Time-average SAR | ±2.6% | R | 3 | 1 | 1 | ±1.5% | ±1.5% |
| $RF_{drift}$ | DUT drift | ±2.5% | N | 1 | 1 | 1 | ±2.5% | ±2.5% |
| VAL | Val Antenna Unc.[val] | ±0.0% | N | 1 | 1 | 1 | ±0% | ±0% |
| $RF_{in}$ | Unc. Input Power[val] | ±0.0% | N | 1 | 1 | 1 | ±0% | ±0% |
| **Correction to the SAR results** | | | | | | | | |
| C(ε, σ) | Deviation to Target | ±1.9% | N | √1 | 1 | 0.84 | ±1.9% | ±1.6% |
| C(R) | SAR scaling[p] | ±0% | R | 3 | 1 | 1 | ±0% | ±0% |
| u(ΔSAR) | Combined Uncertainty | | | | | | ±11.0% | ±10.9% |
| U | **Expanded Uncertainty** | | | | | | ±22.1% | ±21.9% |



## DASY5 Uncertainty Budget

**According to IEC/IEEE 62209-1528**

**(Frequency band: 3GHz - 6GHz range)**

| Symbol | Error Description | Uncert. value | Prob. Dist. | Div. | ($c_i$) 1g | ($c_i$) 10g | Std. Unc. (1g) | Std. Unc. (10g) |
|---|---|---|---|---|---|---|---|---|
| **Measurement System Errors** | | | | | | | | |
| CF | Probe Calibration | ±14.0% | N | √2 | 1 | 1 | ±7.0% | ±7.0% |
| $CF_{drift}$ | Probe Calibration Drift | ±1.7% | N | √3 | 1 | 1 | ±1.0% | ±1.0% |
| LIN | Probe Linearity | ±4.7% | R | √3 | 1 | 1 | ±2.7% | ±2.7% |
| BBS | Broadband Signal | ±2.6% | R | √3 | 1 | 1 | ±1.5% | ±1.5% |
| ISO | Probe Isotropy | ±7.6% | R | 3 | 1 | 1 | ±4.4% | ±4.4% |
| DAE | Data Acquisition | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% |
| AMB | RF Ambient | ±1.8% | N | 1 | 1 | 1 | ±1.8% | ±1.8% |
| $\Delta_{sys}$ | Probe Positioning | ±3.9% | N | 1 | 0.33 | 0.33 | ±1.3% | ±1.3% |
| DAT | Data Processing | ±2.3% | N | 1 | 1 | 1 | ±2.3% | ±2.3% |
| **Phantom and Device Errors** | | | | | | | | |
| LIQ($\sigma$) | Conductivity (meas.)$^{DAK}$ | ±2.5% | N | √1 | 0.78 | 0.71 | ±2.0% | ±1.8% |
| LIQ($T_\sigma$) | Conductivity (temp.)$^{BB}$ | ±3.4% | R | √3 | 0.78 | 0.71 | ±1.5% | ±1.4% |
| EPS | Phantom Permittivity | ±14.0% | R | 3 | 0.25 | 0.25 | ±2.0% | ±2.0% |
| DIS | Distance DUT - TSL | ±2.0% | N | 1 | 2 | 2 | ±4.0% | ±4.0% |
| $D_{xyz}$ | Device Positioning (±0.5mm) | ±1.0% | N | 1 | 1 | 1 | ±1.0% | ±1.0% |
| H | Device Holder | ±3.6% | N | √1 | 1 | 1 | ±3.6% | ±3.6% |
| MOD | DUT Modulation$^{m}$ | ±2.4% | R | √3 | 1 | 1 | ±1.4% | ±1.4% |
| TAS | Time-average SAR | ±2.6% | R | 3 | 1 | 1 | ±1.5% | ±1.5% |
| $RF_{drift}$ | DUT drift | ±2.5% | N | 1 | 1 | 1 | ±2.5% | ±2.5% |
| VAL | Val Antenna Unc.$^{val}$ | ±0.0% | N | 1 | 1 | 1 | ±0% | ±0% |
| $RF_{in}$ | Unc. Input Power$^{val}$ | ±0.0% | N | 1 | 1 | 1 | ±0% | ±0% |
| **Correction to the SAR results** | | | | | | | | |
| C($\varepsilon$, $\sigma$) | Deviation to Target | ±1.9% | N | √1 | 1 | 0.84 | ±1.9% | ±1.6% |
| C(R) | SAR scaling$^{p}$ | ±0% | R | 3 | 1 | 1 | ±0% | ±0% |
| u(ΔSAR) | Combined Uncertainty | | | | | | ±12.0% | ±11.9% |
| U | **Expanded Uncertainty** | | | | | | ±24.0% | ±23.8% |



# 7. TEST RESULTS

## 7.1 SAR Results for Extremity Condition with 0mm separation

GPRS:

| Band | Channel | Frequency [MHz] | Tx Slot Configuration | Maximum Power [dBm] | Conducted Power [dBm] | Test Position | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Front | 0.616 | -0.54 | 1:4 | 2.28 | 1.40 | |
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Back | 0.695 | -0.03 | 1:4 | 2.01 | 1.40 | |
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Left | 0.44 | -0.66 | 1:4 | 2.34 | 1.03 | |
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Right | 1.43 | -0.02 | 1:4 | 2.01 | 2.87 | |
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Top | 0.111 | 0.15 | 1:4 | 2.01 | 0.22 | |
| GPRS 850 | 190 | 836.6 | 2 | 33 | 29.97 | Bottom | 0.0614 | -0.02 | 1:4 | 2.01 | 0.12 | |
| GPRS 850 | 128 | 824.2 | 2 | 33 | 30.05 | Right | 1.79 | -0.25 | 1:4 | 2.09 | 3.74 | 9 |
| GPRS 850 | 251 | 848.8 | 2 | 33 | 30.28 | Right | 1.54 | -0.32 | 1:4 | 2.01 | 3.10 | |

*Larger than 5% drifts included to scaling factors

| Band | Channel | Frequency [MHz] | Tx Slot Configuration | Maximum Power [dBm] | Conducted Power [dBm] | Test Position | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Front | 0.106 | 0.02 | 1:4 | 1.91 | 0.20 | |
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Back | 0.0576 | 0.33 | 1:4 | 2.06 | 0.12 | |
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Left | 0.0663 | 0.12 | 1:4 | 1.91 | 0.13 | |
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Right | 1.29 | -0.15 | 1:4 | 1.91 | 2.46 | 10 |
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Top | 0.064 | 0.4 | 1:4 | 2.09 | 0.13 | |
| GPRS 1900 | 661 | 1880 | 2 | 29.3 | 26.49 | Bottom | 0.0528 | -0.18 | 1:4 | 1.91 | 0.10 | |
| GPRS 1900 | 512 | 1850.2 | 2 | 29.3 | 26.51 | Right | 1.25 | -0.11 | 1:4 | 1.90 | 2.38 | |
| GPRS 1900 | 810 | 1909.8 | 2 | 29.3 | 26.56 | Right | 1.15 | -0.05 | 1:4 | 1.88 | 2.16 | |

*Larger than 5% drifts included to scaling factors



WCDMA:

| Band | Channel | Frequency [MHz] | Mode | Maximum Power [dBm] | Conducted Power [dBm] | Test Position | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Front | 0.201 | 0.03 | 1.27 | 1:1 | 0.25 | |
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Back | 0.147 | -0.03 | 1.27 | 1:1 | 0.19 | |
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Left | 0.134 | -0.07 | 1.27 | 1:1 | 0.17 | |
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Right | 2.42 | 0.1 | 1.27 | 1:1 | 3.07 | |
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Top | 0.147 | -0.03 | 1.27 | 1:1 | 0.19 | |
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Bottom | 0.133 | 0.01 | 1.27 | 1:1 | 0.17 | |
| WCDMA 2 | 9262 | 1852.4 | RMC 12.2K | 23.5 | 22.48 | Right | 2.64 | 0.12 | 1.26 | 1:1 | 3.34 | |
| WCDMA 2 | 9538 | 1907.6 | RMC 12.2K | 23.5 | 22.32 | Right | 2.86 | 0.06 | 1.31 | 1:1 | 3.75 | 11 |

*Larger than 5% drifts included to scaling factors

WCDMA 2 Repeat Measurements:

| Band | Channel | Frequency [MHz] | Mode | Maximum Power [dBm] | Conducted Power [dBm] | Test Position | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WCDMA 2 | 9400 | 1880 | RMC 12.2K | 23.5 | 22.47 | Right | 2.72 | 0.18 | 1.27 | 1:1 | 3.45 | |
| WCDMA 2 | 9262 | 1852.4 | RMC 12.2K | 23.5 | 22.48 | Right | 2.51 | 0.1 | 1.26 | 1:1 | 3.17 | |
| WCDMA 2 | 9538 | 1907.6 | RMC 12.2K | 23.5 | 22.32 | Right | 2.7 | 0 | 1.31 | 1:1 | 3.54 | |

*Larger than 5% drifts included to scaling factors

| Band | Channel | Frequency [MHz] | Mode | Maximum Power [dBm] | Conducted Power [dBm] | Test Position | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Front | 0.462 | 0.07 | 1.38 | 1:1 | 0.64 | |
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Back | 0.515 | -0.41 | 1.51 | 1:1 | 0.78 | |
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Left | 0.328 | 0.07 | 1.38 | 1:1 | 0.45 | |
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Right | 1.03 | -0.15 | 1.38 | 1:1 | 1.42 | |
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Top | 0.0935 | -0.32 | 1.48 | 1:1 | 0.14 | |
| WCDMA 5 | 4183 | 836.6 | RMC 12.2K | 25 | 23.61 | Bottom | 0.0465 | 0.13 | 1.38 | 1:1 | 0.06 | |
| WCDMA 5 | 4132 | 826.4 | RMC 12.2K | 25 | 23.45 | Right | 1.04 | -0.17 | 1.43 | 1:1 | 1.49 | 12 |
| WCDMA 5 | 4233 | 846.6 | RMC 12.2K | 25 | 23.56 | Right | 0.998 | -0.14 | 1.39 | 1:1 | 1.39 | |

*Larger than 5% drifts included to scaling factors



LTE:

| Band | Channel | Frequency [MHz] | Modulation / BW [MHz] | RB Size | RB Offset | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measure $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Front | 0.151 | -0.1 | 1:1 | 1.41 | 0.21 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Front | 0.115 | 0.14 | 1:1 | 1.85 | 0.21 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Back | 0.0938 | -0.12 | 1:1 | 1.41 | 0.13 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Back | 0.0703 | -0.16 | 1:1 | 1.85 | 0.13 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Left | 0.122 | -0.43 | 1:1 | 1.56 | 0.19 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Left | 0.0967 | -0.01 | 1:1 | 1.85 | 0.18 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Right | 1.92 | 0.14 | 1:1 | 1.41 | 2.71 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Right | 1.5 | 0.09 | 1:1 | 1.85 | 2.77 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 100 | 0 | 24 | 21.21 | Right | 1.55 | 0.06 | 1:1 | 1.90 | 2.95 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Top | 0.105 | -0.05 | 1:1 | 1.41 | 0.15 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Top | 0.0765 | 0.1 | 1:1 | 1.85 | 0.14 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 1 | 0 | 24 | 22.5 | Bottom | 0.093 | -0.15 | 1:1 | 1.41 | 0.13 | |
| LTE 2 | 19100 | 1900 | QPSK / 20 | 50 | 0 | 24 | 21.34 | Bottom | 0.0741 | -0.07 | 1:1 | 1.85 | 0.14 | |
| LTE 2 | 18700 | 1860 | QPSK / 20 | 1 | 0 | 24 | 22.14 | Right | 1.95 | -0.07 | 1:1 | 1.53 | 2.99 | |
| LTE 2 | 18700 | 1860 | QPSK / 20 | 50 | 0 | 24 | 21.43 | Right | 1.55 | 0.1 | 1:1 | 1.81 | 2.80 | |
| LTE 2 | 18700 | 1860 | QPSK / 20 | 100 | 0 | 24 | 21.18 | Right | 1.53 | 0.06 | 1:1 | 1.91 | 2.93 | |
| LTE 2 | 18900 | 1880 | QPSK / 20 | 1 | 0 | 24 | 22.12 | Right | 2.04 | 0.09 | 1:1 | 1.54 | 3.15 | |
| LTE 2 | 18900 | 1880 | QPSK / 20 | 50 | 0 | 24 | 21.37 | Right | 1.68 | 0.15 | 1:1 | 1.83 | 3.08 | |
| LTE 2 | 18900 | 1880 | QPSK / 20 | 100 | 0 | 24 | 21.39 | Right | 1.68 | 0.01 | 1:1 | 1.82 | 3.06 | |

*Larger than 5% drifts included to scaling factors

LTE 2 Repeat Measurements:

| Band | Channel | Frequency [MHz] | Modulation / BW [MHz] | RB Size | RB Offset | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measure $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE 2 | 18900 | 1880 | QPSK / 20 | 1 | 0 | 24 | 22.12 | Right | 2.05 | 0.07 | 1:1 | 1.54 | 3.16 | 13 |

*Larger than 5% drifts included to scaling factors

| Band | Channel | Frequency [MHz] | Modulation / BW [MHz] | RB Size | RB Offset | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measure $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Front | 0.283 | 0.32 | 1:1 | 1.58 | 0.45 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Front | 0.219 | 0.1 | 1:1 | 1.90 | 0.42 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Back | 0.273 | 0.11 | 1:1 | 1.47 | 0.40 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Back | 0.206 | 0.06 | 1:1 | 1.90 | 0.39 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Left | 0.225 | -0.05 | 1:1 | 1.47 | 0.33 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Left | 0.171 | -0.05 | 1:1 | 1.90 | 0.32 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Right | 1.92 | 0.2 | 1:1 | 1.47 | 2.81 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Right | 1.52 | 0.05 | 1:1 | 1.90 | 2.88 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 100 | 0 | 24 | 21.13 | Right | 1.57 | 0.05 | 1:1 | 1.94 | 3.04 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Top | 0.0804 | 0.13 | 1:1 | 1.47 | 0.12 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Top | 0.0597 | 0.06 | 1:1 | 1.90 | 0.11 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 1 | 0 | 24 | 22.34 | Bottom | 0.212 | -0.05 | 1:1 | 1.47 | 0.31 | |
| LTE 4 | 20175 | 1732.5 | QPSK / 20 | 50 | 0 | 24 | 21.22 | Bottom | 0.17 | -0.02 | 1:1 | 1.90 | 0.32 | |
| LTE 4 | 20050 | 1720 | QPSK / 20 | 1 | 50 | 24 | 22.25 | Right | 1.94 | 0.05 | 1:1 | 1.50 | 2.90 | |
| LTE 4 | 20050 | 1720 | QPSK / 20 | 50 | 50 | 24 | 21.27 | Right | 1.49 | 0.02 | 1:1 | 1.87 | 2.79 | |
| LTE 4 | 20050 | 1720 | QPSK / 20 | 100 | 0 | 24 | 21.15 | Right | 1.49 | 0 | 1:1 | 1.93 | 2.87 | |
| LTE 4 | 20300 | 1745 | QPSK / 20 | 1 | 0 | 24 | 22.15 | Right | 2.11 | 0.06 | 1:1 | 1.53 | 3.23 | |
| LTE 4 | 20300 | 1745 | QPSK / 20 | 50 | 0 | 24 | 20.97 | Right | 1.58 | -0.06 | 1:1 | 2.01 | 3.17 | |
| LTE 4 | 20300 | 1745 | QPSK / 20 | 100 | 0 | 24 | 20.94 | Right | 1.61 | 0.09 | 1:1 | 2.02 | 3.26 | 14 |

*Larger than 5% drifts included to scaling factors



LTE 4 Repeat Measurements:

| Band | Channel | Frequency [MHz] | Modulation / BW [MHz] | RB Size | RB Offset | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measure $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE 4 | 20300 | 1745 | QPSK / 20 | 1 | 0 | 24 | 22.15 | Right | 1.98 | -0.15 | 1:1 | 1.53 | 3.03 | |

*Larger than 5% drifts included to scaling factors

| Band | Channel | Frequency [MHz] | Modulation / BW [MHz] | RB Size | RB Offset | Maximum Power [dBm] | Conducted Power [dBm] | Test position | Measure $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Duty Cycle | Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Front | 0.413 | 0.16 | 1:1 | 1.63 | 0.67 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Front | 0.316 | 0.03 | 1:1 | 2.07 | 0.65 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Back | 0.437 | -0.08 | 1:1 | 1.63 | 0.71 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Back | 0.341 | -0.05 | 1:1 | 2.07 | 0.71 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Left | 0.295 | 0.15 | 1:1 | 1.63 | 0.48 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Left | 0.227 | 0.01 | 1:1 | 2.07 | 0.47 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Right | 0.886 | -0.16 | 1:1 | 1.63 | 1.45 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Right | 0.716 | -0.64 | 1:1 | 2.40 | 1.72 | 15 |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 50 | 0 | 25 | 21.72 | Right | 0.699 | -0.03 | 1:1 | 2.13 | 1.49 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Top | 0.0824 | -0.12 | 1:1 | 1.63 | 0.13 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Top | 0.0634 | 0.09 | 1:1 | 2.07 | 0.13 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 1 | 24 | 25 | 22.87 | Bottom | 0.0415 | 0.08 | 1:1 | 1.63 | 0.07 | |
| LTE 5 | 20525 | 836.5 | QPSK / 10 | 25 | 0 | 25 | 21.84 | Bottom | 0.0321 | 0.52 | 1:1 | 2.33 | 0.07 | |
| LTE 5 | 20450 | 829 | QPSK / 10 | 1 | 24 | 25 | 22.8 | Right | 0.887 | -0.04 | 1:1 | 1.66 | 1.47 | |
| LTE 5 | 20450 | 829 | QPSK / 10 | 25 | 25 | 25 | 21.74 | Right | 0.698 | -0.28 | 1:1 | 2.26 | 1.58 | |
| LTE 5 | 20600 | 844 | QPSK / 10 | 1 | 0 | 25 | 22.67 | Right | 0.883 | 0.04 | 1:1 | 1.71 | 1.51 | |
| LTE 5 | 20600 | 844 | QPSK / 10 | 25 | 25 | 25 | 21.71 | Right | 0.681 | -0.01 | 1:1 | 2.13 | 1.45 | |

*Larger than 5% drifts included to scaling factors



2.4GHz WLAN:

| Mode | Data Rate [Mbps] | Frequency [MHz] | Channel | Test position | Maximum Power [dBm] | Conducted Power [dBm] | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Scaling Factor | Duty Cycle [%] | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | 1 | Front, 0mm | 21 | 19.5 | 0.085 | N/A** | 1.41 | 85 | 0.12 | |
| 802.11b | 1 | 2412 | 1 | Back. 0mm | 21 | 19.5 | 0.38 | 0.05 | 1.41 | 85 | 0.54 | |
| 802.11b | 1 | 2412 | 1 | Top, 0mm | 21 | 19.5 | 0.025 | 0.48 | 1.58 | 85 | 0.04 | |
| 802.11b | 1 | 2412 | 1 | Bottom, 0mm | 21 | 19.5 | 0.082 | 0.08 | 1.41 | 85 | 0.12 | |
| 802.11b | 1 | 2412 | 1 | Left, 0mm | 21 | 19.5 | 0.64 | 0.06 | 1.41 | 85 | 0.90 | 16 |
| 802.11b | 1 | 2412 | 1 | Right, 0mm | 21 | 19.5 | 0.03 | -0.07 | 1.41 | 85 | 0.04 | |
| 802.11b | 1 | 2437 | 6 | Left, 0mm | 21 | 19.35 | 0.61 | 0.05 | 1.46 | 85 | 0.90 | |
| 802.11b | 1 | 2462 | 11 | Left, 0mm | 21 | 19.24 | 0.59 | 0.02 | 1.50 | 85 | 0.88 | |

*Larger than 5% drifts included to scaling factors
**Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

5GHz WLAN:

| Mode | Data Rate [Mbps] | Frequency [MHz] | Channel | Test position | Maximum Power [dBm] | Conducted Power [dBm] | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Scaling Factor | Used Duty Cycle [%] | Duty Cycle Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11a | 6 | 5320 | 64 | Front, 0mm | 20 | 19.06 | 0.05 | N/A** | 1.24 | 68.7 | 1.46 | 0.08 | |
| 802.11a | 6 | 5320 | 64 | Back. 0mm | 20 | 19.06 | 0.59 | -0.14 | 1.24 | 68.7 | 1.46 | 1.06 | |
| 802.11a | 6 | 5320 | 64 | Top, 0mm | 20 | 19.06 | 0.004 | N/A** | 1.24 | 68.7 | 1.46 | 0.01 | |
| 802.11a | 6 | 5320 | 64 | Bottom, 0mm | 20 | 19.06 | 0.15 | 0.26 | 1.32 | 68.7 | 1.46 | 0.28 | |
| 802.11a | 6 | 5320 | 64 | Left, 0mm | 20 | 19.06 | 0.93 | -0.03 | 1.24 | 68.7 | 1.46 | 1.69 | |
| 802.11a | 6 | 5320 | 64 | Right, 0mm | 20 | 19.06 | 0.02 | -1.19 | 1.63 | 68.7 | 1.46 | 0.04 | |
| 802.11a | 6 | 5260 | 52 | Left, 0mm | 20 | 18.74 | 1.00 | 0.07 | 1.34 | 68.7 | 1.46 | 1.94 | 17 |
| 802.11a | 6 | 5300 | 60 | Left, 0mm | 20 | 18.96 | 0.95 | -0.17 | 1.27 | 68.7 | 1.46 | 1.76 | |

*Larger than 5% drifts included to scaling factors
**Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

| Mode | Data Rate [Mbps] | Frequency [MHz] | Channel | Test position | Maximum Power [dBm] | Conducted Power [dBm] | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Scaling Factor | Used Duty Cycle [%] | Duty Cycle Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11a | 6 | 5560 | 112 | Front, 0mm | 20 | 19.53 | 0.02 | -0.33 | 1.20 | 68.7 | 1.46 | 0.04 | |
| 802.11a | 6 | 5560 | 112 | Back. 0mm | 20 | 19.53 | 0.26 | 0.08 | 1.11 | 68.7 | 1.46 | 0.42 | |
| 802.11a | 6 | 5560 | 112 | Top, 0mm | 20 | 19.53 | 0.0002 | N/A** | 1.11 | 68.7 | 1.46 | 0.0003 | |
| 802.11a | 6 | 5560 | 112 | Bottom, 0mm | 20 | 19.53 | 0.07 | 0.25 | 1.18 | 68.7 | 1.46 | 0.13 | |
| 802.11a | 6 | 5560 | 112 | Left, 0mm | 20 | 19.53 | 0.51 | 0.04 | 1.11 | 68.7 | 1.46 | 0.82 | |
| 802.11a | 6 | 5560 | 112 | Right, 0mm | 20 | 19.53 | 0.02 | -0.96 | 1.39 | 68.7 | 1.46 | 0.03 | |
| 802.11a | 6 | 5560 | 112 | Front, 0mm | 20 | 19.3 | 0.63 | -0.17 | 1.17 | 68.7 | 1.46 | 1.08 | 18 |
| 802.11a | 6 | 5560 | 112 | Back. 0mm | 20 | 19.16 | 0.41 | 0.17 | 1.21 | 68.7 | 1.46 | 0.73 | |

*Larger than 5% drifts included to scaling factors
**Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

| Mode | Data Rate [Mbps] | Frequency [MHz] | Channel | Test position | Maximum Power [dBm] | Conducted Power [dBm] | Measured $SAR_{10g}$ [W/kg] | Power Drift* [dB] | Scaling Factor | Used Duty Cycle [%] | Duty Cycle Scaling Factor | Reported $SAR_{10g}$ [W/kg] | Plot # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11a | 6 | 5660 | 132 | Front, 0mm | 20 | 19.05 | 0.02 | -0.12 | 1.24 | 68.7 | 1.46 | 0.03 | |
| 802.11a | 6 | 5660 | 132 | Back. 0mm | 20 | 19.05 | 0.18 | -0.04 | 1.24 | 68.7 | 1.46 | 0.32 | |
| 802.11a | 6 | 5660 | 132 | Top, 0mm | 20 | 19.05 | 0.0002 | N/A** | 1.24 | 68.7 | 1.46 | 0.0003 | |
| 802.11a | 6 | 5660 | 132 | Bottom, 0mm | 20 | 19.05 | 0.06 | -0.67 | 1.45 | 68.7 | 1.46 | 0.13 | |
| 802.11a | 6 | 5660 | 132 | Left, 0mm | 20 | 19.05 | 0.39 | -0.02 | 1.24 | 68.7 | 1.46 | 0.70 | |
| 802.11a | 6 | 5660 | 132 | Right, 0mm | 20 | 19.05 | 0.005 | N/A** | 1.24 | 68.7 | 1.46 | 0.01 | |
| 802.11a | 6 | 5745 | 149 | Front, 0mm | 20 | 18.77 | 0.34 | -0.12 | 1.33 | 68.7 | 1.46 | 0.66 | |
| 802.11a | 6 | 5825 | 165 | Back. 0mm | 20 | 18.01 | 0.33 | 0.11 | 1.58 | 68.7 | 1.46 | 0.76 | 19 |

*Larger than 5% drifts included to scaling factors
**Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.



## 7.2 IEC 62209-2 AMD1:2019

According to IEC 62209-2 AMD1:2019, the zoom scan complies if the peak spatial-average SAR is below 0.1 W/kg, or if the following criteria is met:

1. The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak is larger than the horizontal grid step.

2. Ratio of SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum is at least 30%.

Zoom scan compliance according to IEC 62209-2 AMD1:2019 is automatically verified by DASY5 software and all zoom scans in this test report do pass the criteria. The smallest horizontal distance and Ratio between measurement points M2 and M1 of the highest SAR results is available in Appendix C.



## 7.3 Calculated NFC SAR

### 7.3.1 FCC

For simultaneous transmission evaluation the estimated standalone SAR values are calculated according to the following equation below.

$$SAR_{estimated} = 0.4 * Pant/Pth\ [w/kg] \quad \text{(Equation 6)}$$

Estimated NFC 13.56 MHz SAR = 0.4*(1.0/443) = 0.00090 W/kg

### 7.3.2 ISED

The estimated SAR value for NFC 13.56 MHz is evaluated according to the following equation stated in Notice 2016-DRS001:

(maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) * 0.4 W/kg

According to RSS-102, issue 5, 2015, the SAR test exclusion power threshold for NFC is 71mW at ≤5mm separation distance.

Estimated NFC SAR = 1/71*0.4 = 0.0056 W/kg



## 7.4 Simultaneous Transmission Analysis

Simultaneous transmission analysis for the maximum SAR is in the table below. Direct summation of SAR results was performed.

### 7.4.1 FCC

Extremity SAR:

| Exposure Condition | Extremity $SAR_{10g}$ [W/kg] | | | | | |
|---|---|---|---|---|---|---|
| **Test Position** | **Front** | **Back** | **Left** | **Right** | **Top** | **Bottom** |
| **GPRS 850** | 1.40 | 1.40 | 1.03 | 3.74 | 0.22 | 0.12 |
| **GPRS 1900** | 0.20 | 0.12 | 0.13 | 2.46 | 0.13 | 0.10 |
| **WCDMA 2** | 0.25 | 0.19 | 0.17 | 3.75 | 0.19 | 0.17 |
| **WCDMA 5** | 0.64 | 0.78 | 0.45 | 1.49 | 0.14 | 0.06 |
| **LTE 2** | 0.21 | 0.13 | 0.19 | 3.16 | 0.15 | 0.14 |
| **LTE 4** | 0.45 | 0.40 | 0.33 | 3.26 | 0.12 | 0.32 |
| **LTE 5** | 0.67 | 0.71 | 0.48 | 1.72 | 0.13 | 0.07 |
| **Maximum Cellular SAR** | **1.4** | **1.4** | **1.03** | **3.75** | **0.22** | **0.32** |
| **Maximum 2.4 GHz WLAN SAR** | **0.12** | **0.54** | **0.90** | **0.04** | **0.04** | **0.12** |
| **Maximum 5 GHz WLAN SAR** | **0.08** | **1.06** | **1.94** | **0.04** | **0.01** | **0.28** |
| **Maximum NFC SAR** | **0.0009** | | | | | |
| **SAR Summation:** | **1.521** | **2.461** | **2.971** | **3.791** | **0.261** | **0.601** |



### 7.4.2 ISED

Extremity SAR:

| Exposure Condition | Extremity $SAR_{10g}$ [W/kg] | | | | | |
|---|---|---|---|---|---|---|
| **Test Position** | **Front** | **Back** | **Left** | **Right** | **Top** | **Bottom** |
| **GPRS 850** | 1.40 | 1.40 | 1.03 | 3.74 | 0.22 | 0.12 |
| **GPRS 1900** | 0.20 | 0.12 | 0.13 | 2.46 | 0.13 | 0.10 |
| **WCDMA 2** | 0.25 | 0.19 | 0.17 | 3.75 | 0.19 | 0.17 |
| **WCDMA 5** | 0.64 | 0.78 | 0.45 | 1.49 | 0.14 | 0.06 |
| **LTE 2** | 0.21 | 0.13 | 0.19 | 3.16 | 0.15 | 0.14 |
| **LTE 4** | 0.45 | 0.40 | 0.33 | 3.26 | 0.12 | 0.32 |
| **LTE 5** | 0.67 | 0.71 | 0.48 | 1.72 | 0.13 | 0.07 |
| **Maximum Cellular SAR** | **1.4** | **1.4** | **1.03** | **3.75** | **0.22** | **0.32** |
| **Maximum 2.4 GHz WLAN SAR** | **0.12** | **0.54** | **0.90** | **0.04** | **0.04** | **0.12** |
| **Maximum 5 GHz WLAN SAR** | **0.08** | **1.06** | **1.94** | **0.04** | **0.01** | **0.28** |
| **Maximum NFC SAR** | **0.0056** | | | | | |
| **SAR Summation:** | **1.526** | **2.466** | **2.976** | **3.796** | **0.266** | **0.606** |



**APPENDIX A: PHOTOS OF THE DUT**

Size of the DUT is: 167 mm x 76 mm x 56 mm



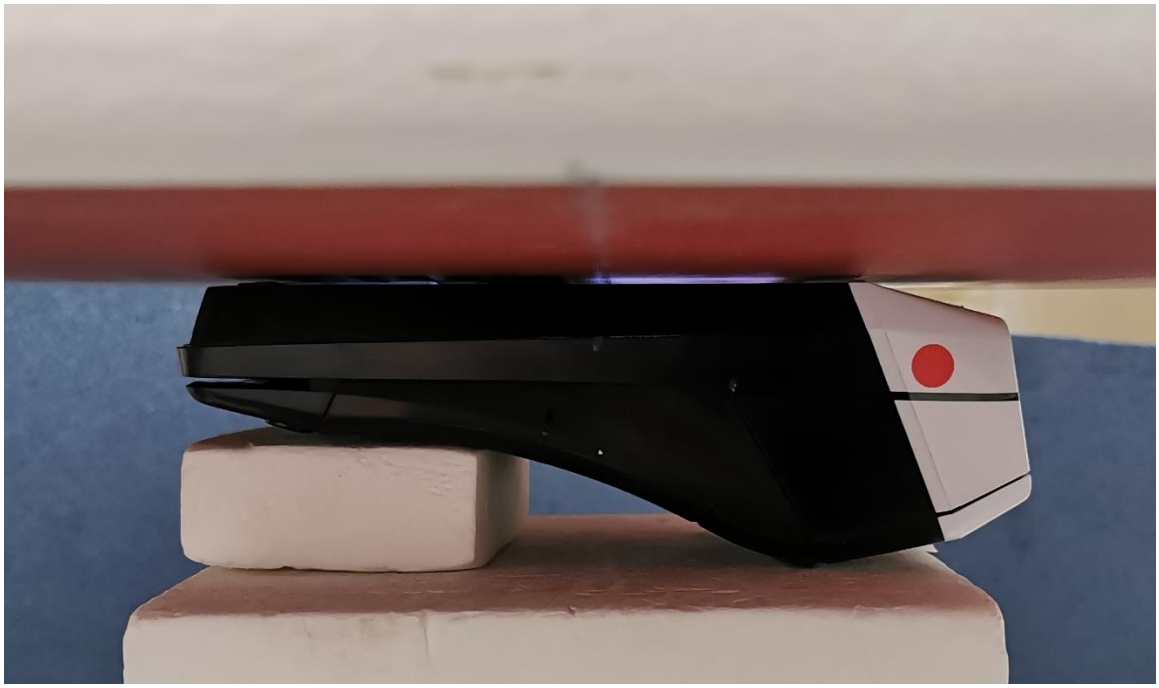


Figure 2 Front test position, 0mm separation distance

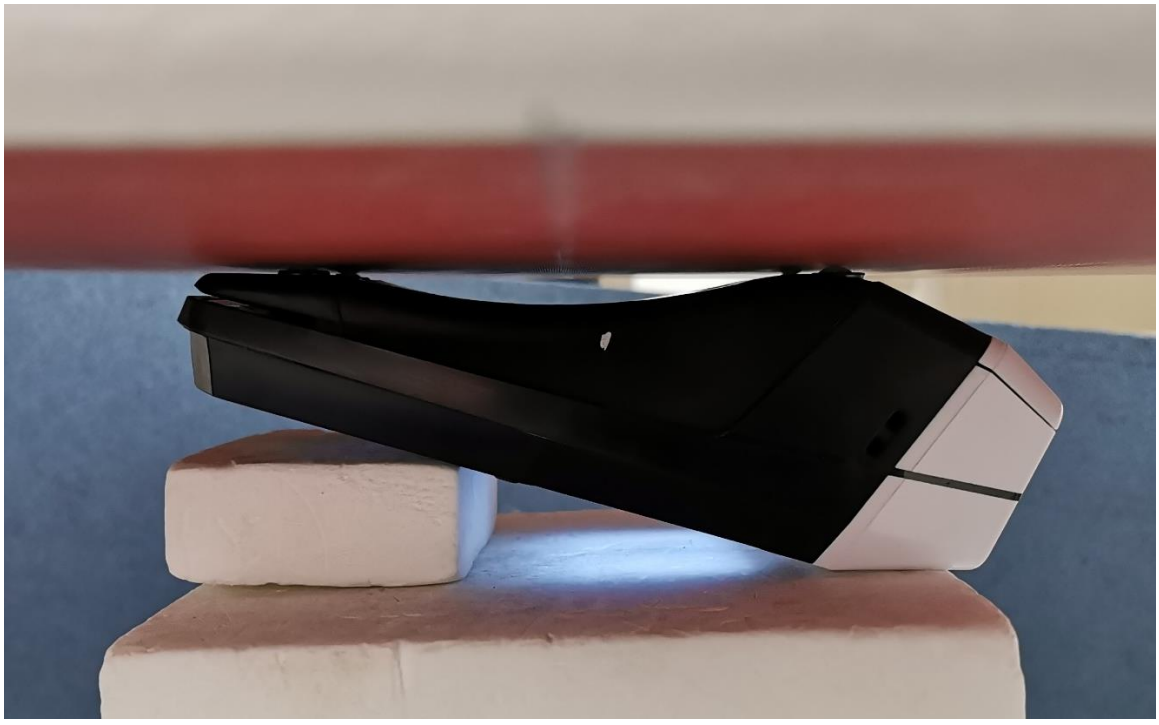


Figure 3 Back test position, 0mm separation distance




Figure 4 Left test position, 0mm separation distance

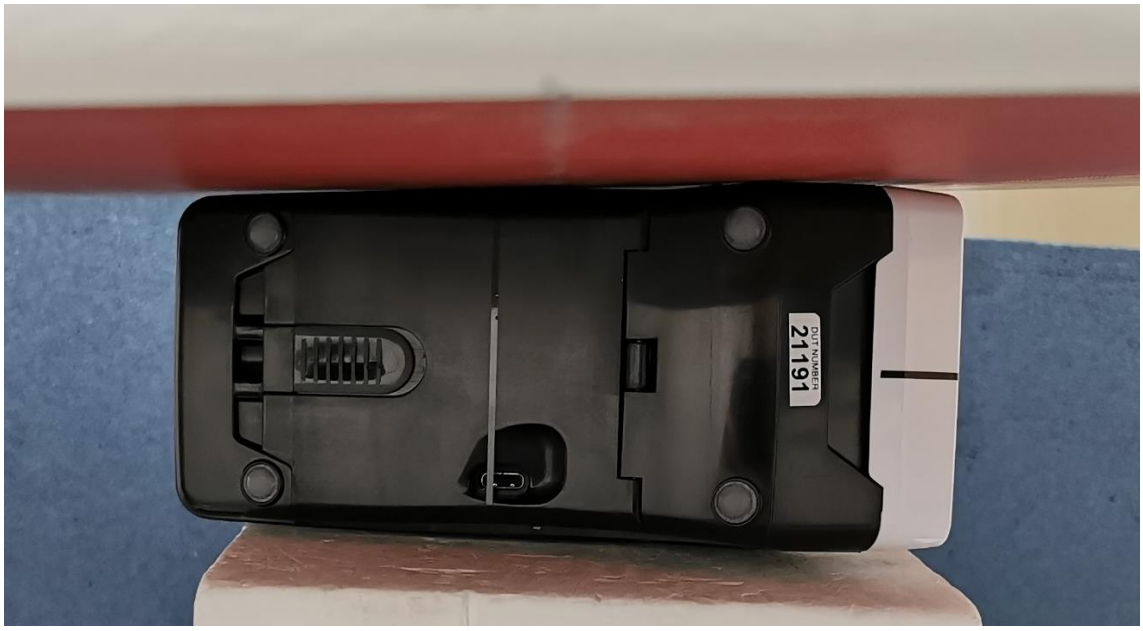



Figure 5 Right test position, 0mm separation distance




Figure 6 Top test position, 0mm separation distance


Figure 7 Bottom test position, 0mm separation distance



## APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 10.5.23 10:19:54

Test Laboratory: Verkotan Oy

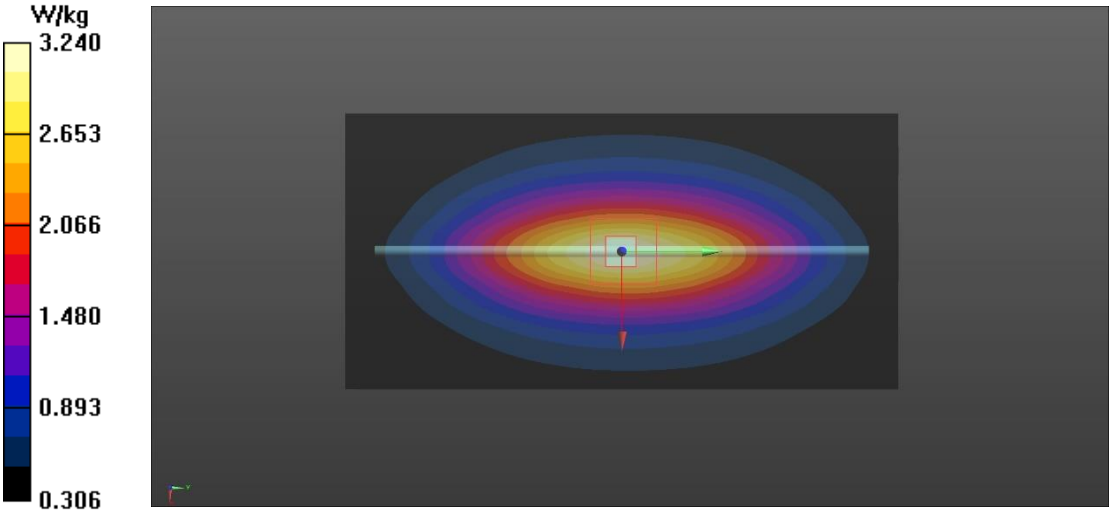
**DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455**

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; $\sigma$ = 0.897 S/m; $\varepsilon_r$ = 42.666; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 835 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/System check, 835MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.06 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.58 W/kg
**SAR(1 g) = 2.5 W/kg; SAR(10 g) = 1.65 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 16.6 mm
Ratio of SAR at M2 to SAR at M1 = 69%
Maximum value of SAR (measured) = 3.24 W/kg
**Configuration/System check, 835MHz/Area Scan (61x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.27 W/kg





Plot 2

Date/Time: 15.5.23 08:49:43

Test Laboratory: Verkotan Oy

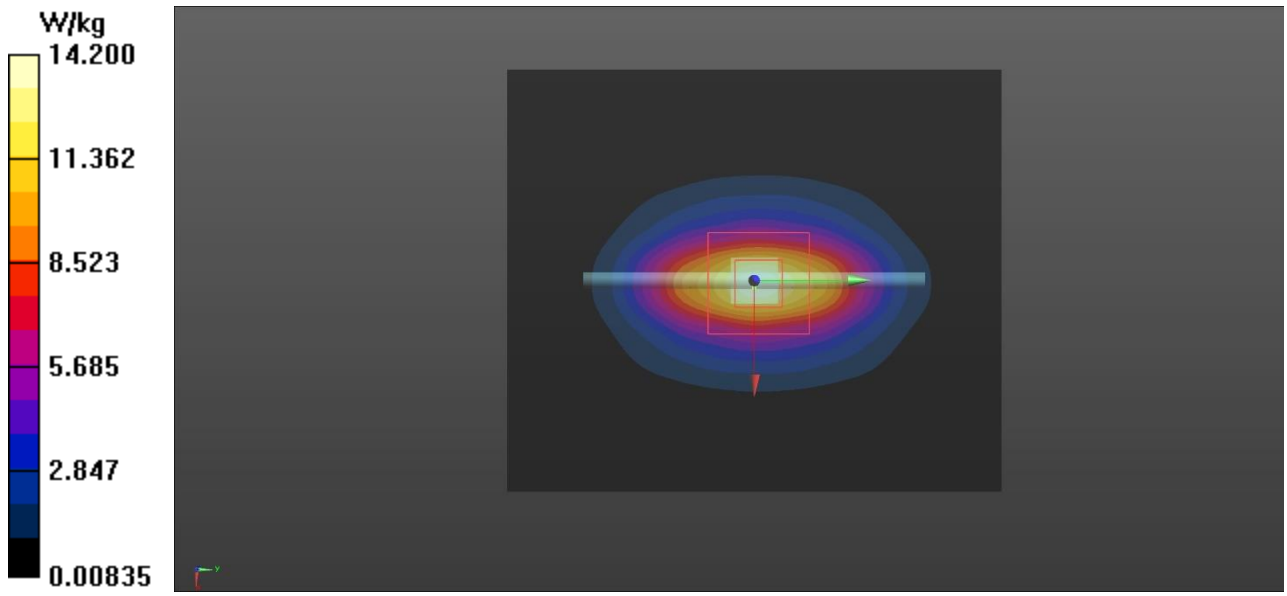
**DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:249**

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1800 MHz; $\sigma$ = 1.348 S/m; $\varepsilon_r$ = 40.325; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.45, 7.97, 8.4) @ 1800 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check/Area Scan (61x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.2 W/kg
**Configuration/system check/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.4 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 15.6 W/kg
**SAR(1 g) = 9.03 W/kg; SAR(10 g) = 4.8 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 57.2%
Maximum value of SAR (measured) = 13.3 W/kg





Plot 3

Date/Time: 18.5.23 08:26:19

Test Laboratory: Verkotan Oy

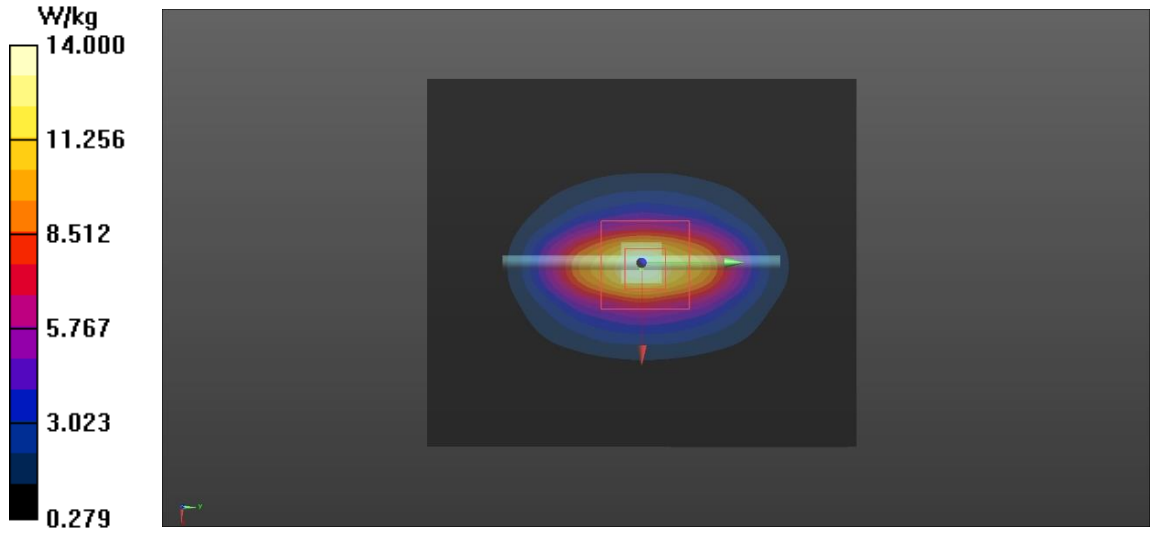
**DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:511**

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.436 S/m; $\varepsilon_r$ = 39.841; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1900 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.1 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.2 W/kg
**SAR(1 g) = 9.16 W/kg; SAR(10 g) = 4.91 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 57.6%
Maximum value of SAR (measured) = 14.0 W/kg
**Configuration/system check/Area Scan (61x71x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.0 W/kg





Plot 4

Date/Time: 22.5.23 15:11:44

Test Laboratory: Verkotan Oy

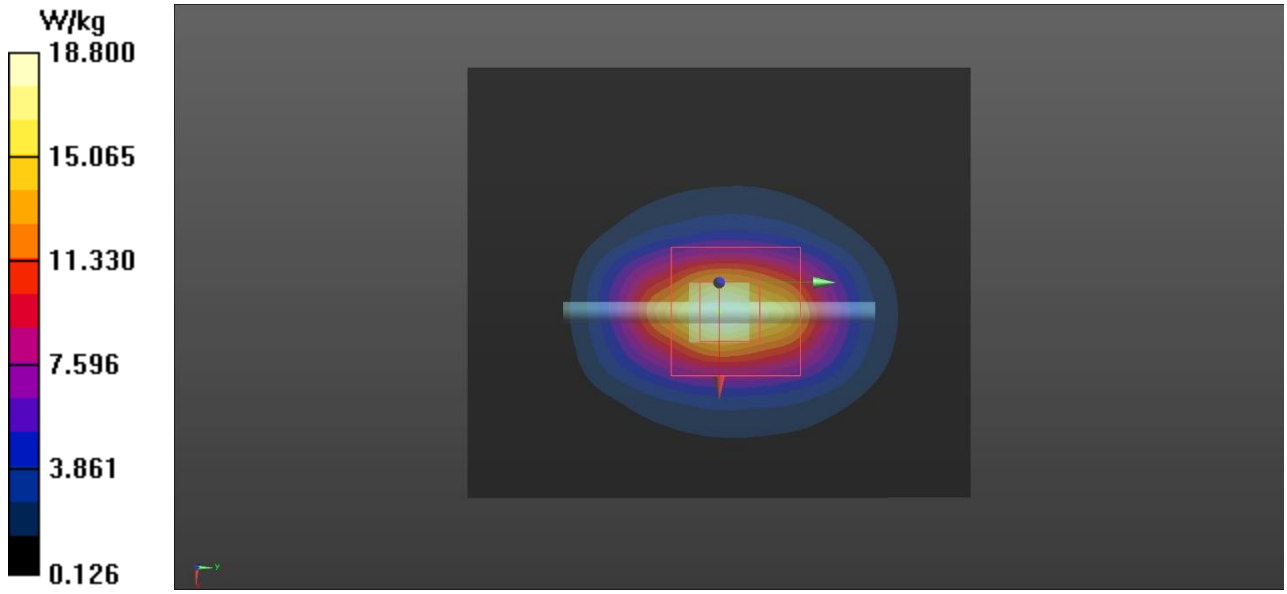
**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:729**

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.683 S/m; $\varepsilon_r$ = 37.394; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.7, 7.5, 7.63) @ 2450 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.3 V/m; Power Drift = -0.44 dB
Peak SAR (extrapolated) = 22.7 W/kg
**SAR(1 g) = 11.9 W/kg; SAR(10 g) = 5.61 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 51.9%
Maximum value of SAR (measured) = 18.8 W/kg
**Configuration/system check/Area Scan (71x61x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 19.7 W/kg





Plot 5

Date/Time: 24.5.23 12:44:26

Test Laboratory: Verkotan Oy

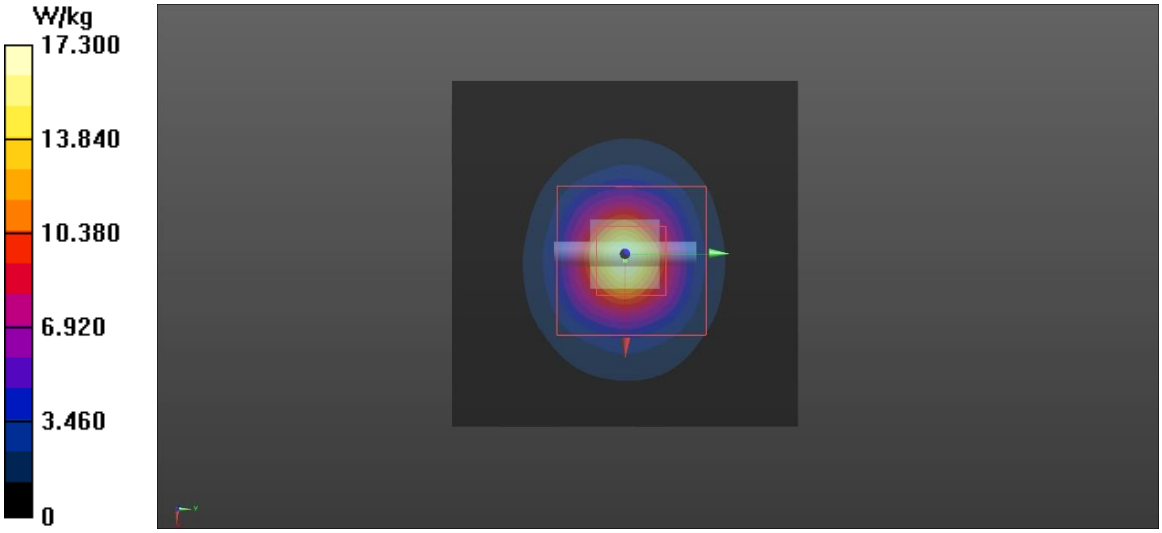
**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5250 MHz; $\sigma$ = 4.476 S/m; $\varepsilon_r$ = 36.318; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 4.99, 5.17) @ 5250 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check 5250MHz/Zoom Scan (7x7x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.17 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 26.9 W/kg
**SAR(1 g) = 7.11 W/kg; SAR(10 g) = 2.06 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.2%
Maximum value of SAR (measured) = 17.3 W/kg
**Configuration/system check 5250MHz/Area Scan (51x51x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.9 W/kg





Plot 6

Date/Time: 25.5.23 10:56:10

Test Laboratory: Verkotan Oy

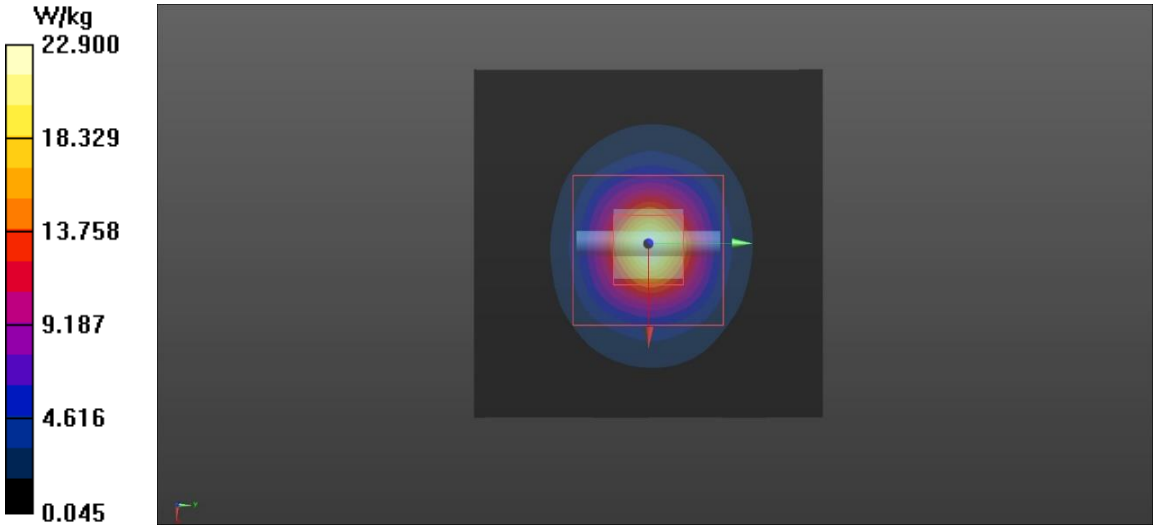
**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5600 MHz; $\sigma$ = 4.863 S/m; $\varepsilon_r$ = 35.7; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.4, 4.29, 4.43) @ 5600 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check 5600MHz/Area Scan (51x51x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 22.9 W/kg
**Configuration/system check 5600MHz/Zoom Scan (7x7x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.78 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.8 W/kg
**SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.18 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.9 mm
Ratio of SAR at M2 to SAR at M1 = 63.9%
Maximum value of SAR (measured) = 20.0 W/kg





Plot 7

Date/Time: 26.5.23 09:31:28

Test Laboratory: Verkotan Oy

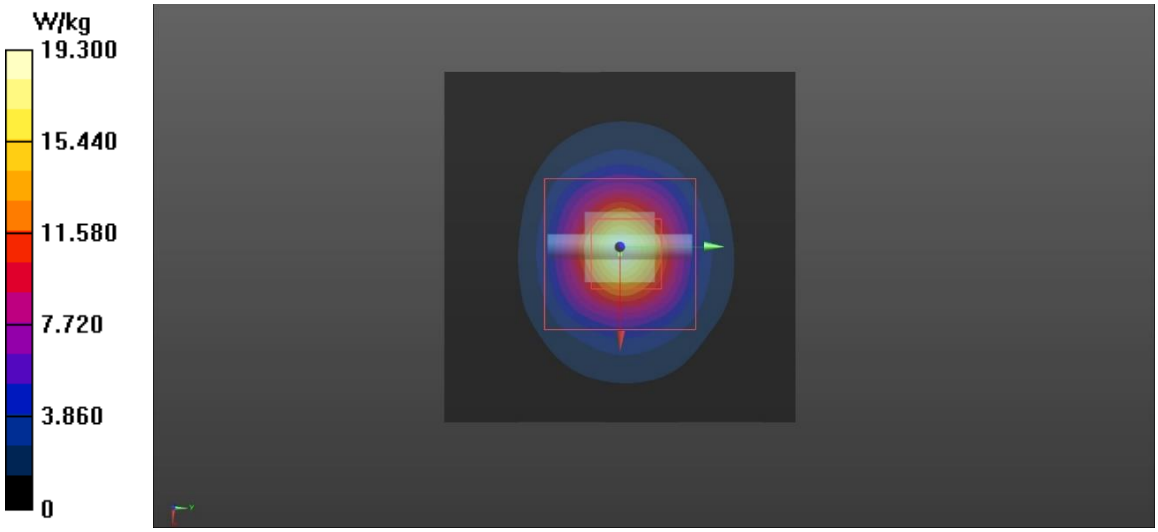
**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5750 MHz; $\sigma$ = 5.123 S/m; $\varepsilon_r$ = 34.944; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.47, 4.33, 4.53) @ 5750 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check 5750MHz/Zoom Scan (7x7x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.64 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 32.3 W/kg
**SAR(1 g) = 7.34 W/kg; SAR(10 g) = 2.09 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.1%
Maximum value of SAR (measured) = 19.3 W/kg
**Configuration/system check 5750MHz/Area Scan (51x51x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.5 W/kg





Plot 8

Date/Time: 29.5.23 09:01:47

Test Laboratory: Verkotan Oy

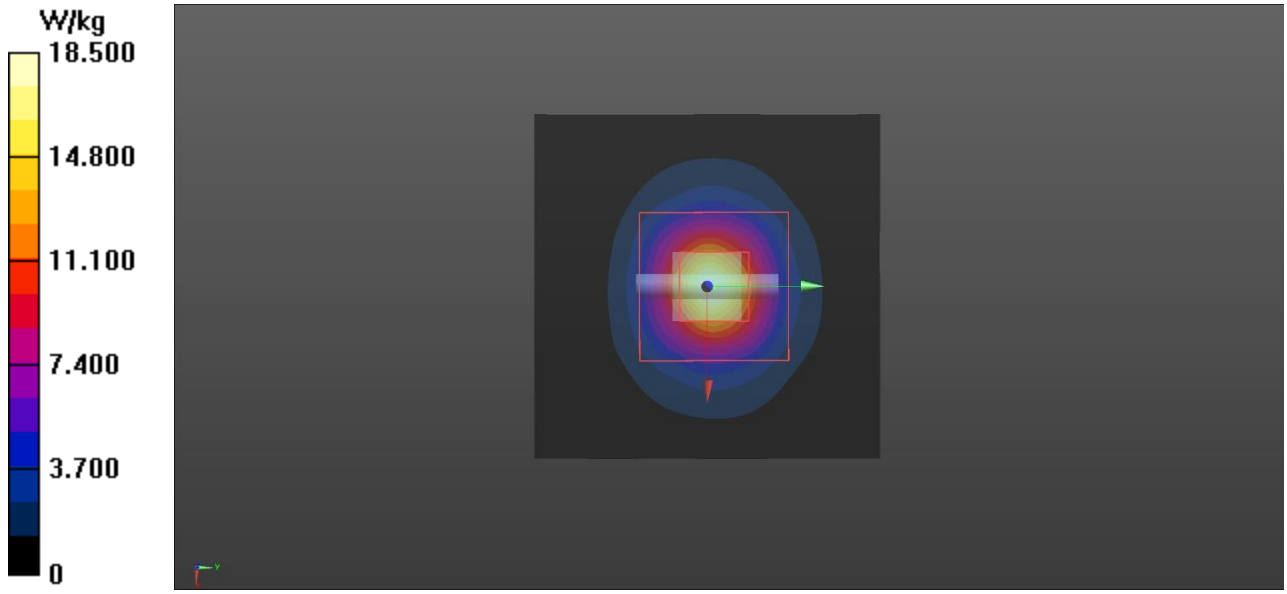
**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5750 MHz; $\sigma$ = 5.061 S/m; $\varepsilon_r$ = 35.593; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.47, 4.33, 4.53) @ 5750 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/system check 5750MHz/Zoom Scan (7x7x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.85 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 30.4 W/kg
**SAR(1 g) = 7.19 W/kg; SAR(10 g) = 2.07 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 62.9%
Maximum value of SAR (measured) = 18.5 W/kg
**Configuration/system check 5750MHz/Area Scan (51x51x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.5 W/kg





## APPENDIX C: MEASUREMENT SCANS

Plot 9

Date/Time: 11.5.23 08:14:54

Test Laboratory: Verkotan Oy

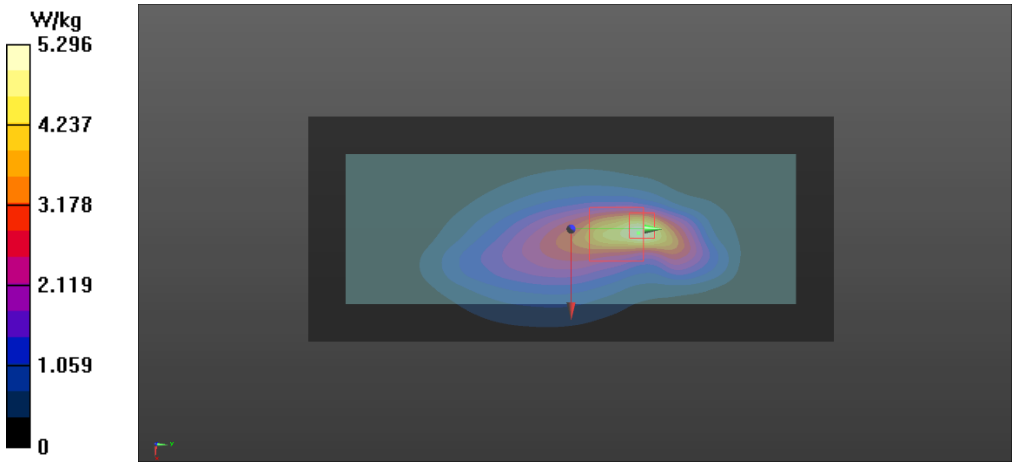
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, GPRS 2 slots (0); Communication System Band: GPRS 2 slots 850; Frequency: 824.2 MHz;
Communication System PAR: 6.335 dB;
Medium parameters used (interpolated): f = 824.2 MHz; $\sigma$ = 0.893 S/m; $\varepsilon_r$ = 42.679; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 824.2 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Left & Right/Right, GPRS 850, Low CH, 2 TX Slots/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 5.30 W/kg
**Left & Right/Right, GPRS 850, Low CH, 2 TX Slots/Zoom Scan (8x9x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 62.74 V/m; Power Drift = -0.26 dB
Peak SAR (extrapolated) = 7.81 W/kg
**SAR(1 g) = 3.27 W/kg; SAR(10 g) = 1.79 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 42.1%
Maximum value of SAR (measured) = 5.89 W/kg





Plot 10

Date/Time: 15.5.23 09:39:20

Test Laboratory: Verkotan Oy

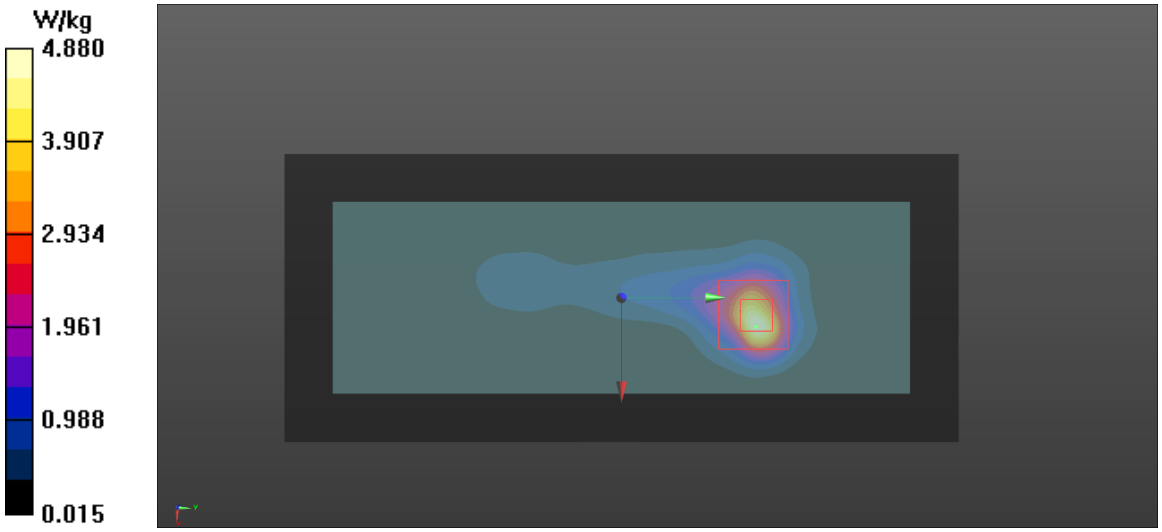
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, GPRS 2 slots (0); Communication System Band: GPRS 1900; Frequency: 1880 MHz;
Communication System PAR: 6.335 dB;
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.397 S/m; $\varepsilon_r$ = 40.174; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1880 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Left & Right/Right, GPRS 1900, Mid, 2 TX Slots/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.04 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 6.04 W/kg
**SAR(1 g) = 2.83 W/kg; SAR(10 g) = 1.29 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.6 mm
Ratio of SAR at M2 to SAR at M1 = 47.9%
Maximum value of SAR (measured) = 4.88 W/kg
**Left & Right/Right, GPRS 1900, Mid, 2 TX Slots/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 5.09 W/kg





Plot 11

Date/Time: 18.5.23 10:38:00

Test Laboratory: Verkotan Oy

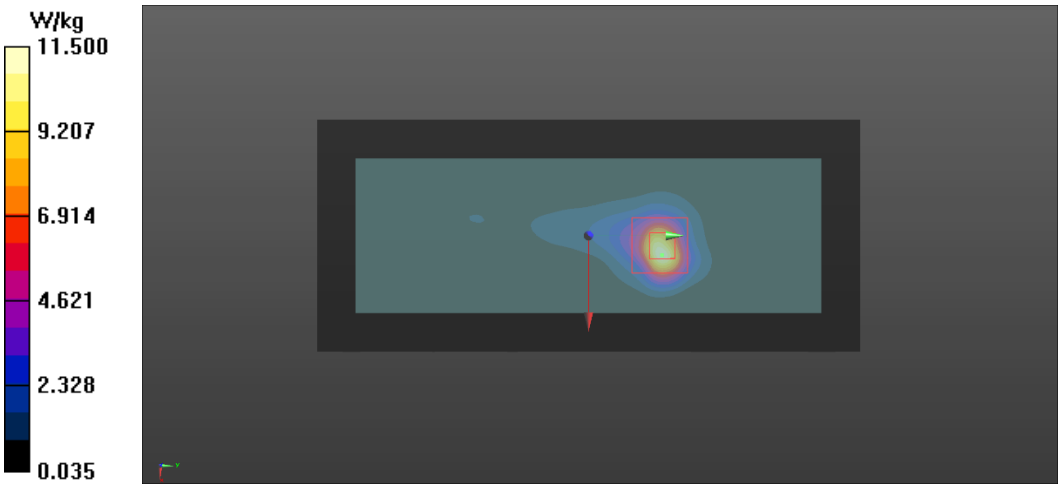
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WCDMA (0); Communication System Band: Band 2; Frequency: 1907.6 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1908 MHz; $\sigma$ = 1.441 S/m; $\varepsilon_r$ = 39.822; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1907.6 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/Right, WCDMA 2, HIGH, RMC 12.2K 2/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.31 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 14.2 W/kg
**SAR(1 g) = 6.4 W/kg; SAR(10 g) = 2.86 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.6 mm
Ratio of SAR at M2 to SAR at M1 = 46.9%
Maximum value of SAR (measured) = 11.5 W/kg
**Configuration/Right, WCDMA 2, HIGH, RMC 12.2K 2/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 11.1 W/kg





Plot 12

Date/Time: 11.5.23 12:34:39

Test Laboratory: Verkotan Oy

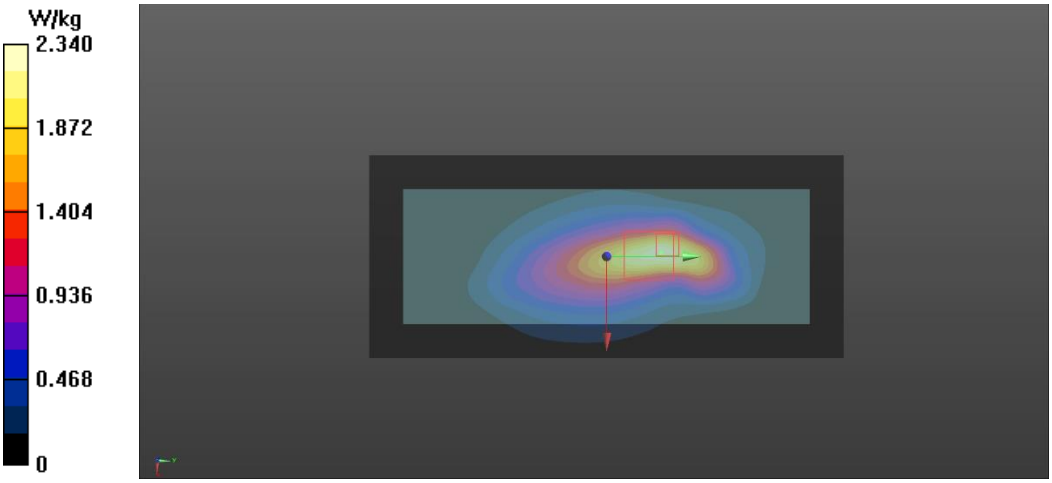
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WCDMA (0); Communication System Band: Band 5; Frequency: 826.4 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 826.4 MHz; $\sigma$ = 0.894 S/m; $\varepsilon_r$ = 42.677; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 826.4 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Left & Right 2/Right, WCDMA 5, Low, RMC 12.2K/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.34 W/kg
**Left & Right 2/Right, WCDMA 5, Low, RMC 12.2K/Zoom Scan (7x8x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.39 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 4.81 W/kg
**SAR(1 g) = 1.93 W/kg; SAR(10 g) = 1.04 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 39.1%
Maximum value of SAR (measured) = 3.59 W/kg





Plot 13

Date/Time: 16.5.23 08:57:39

Test Laboratory: Verkotan Oy

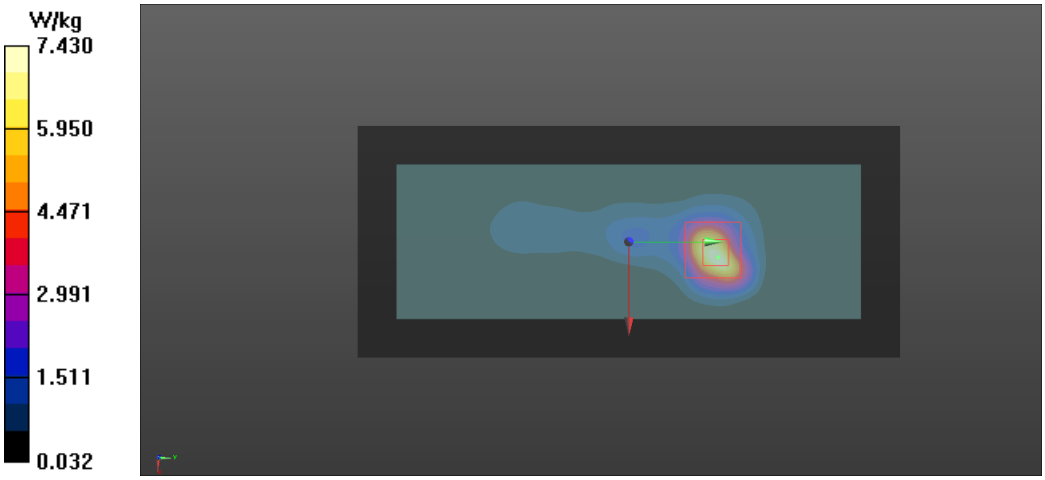
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.397 S/m; $\varepsilon_r$ = 40.174; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1880 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration 2/Right, LTE 2, MID, QPSK/20, RB1, Offset0 Repeat/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 36.22 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 9.38 W/kg
**SAR(1 g) = 4.47 W/kg; SAR(10 g) = 2.05 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.1 mm
Ratio of SAR at M2 to SAR at M1 = 48.2%
Maximum value of SAR (measured) = 7.43 W/kg
**Configuration 2/Right, LTE 2, MID, QPSK/20, RB1, Offset0 Repeat/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 7.46 W/kg





Plot 14

Date/Time: 17.5.23 08:45:01

Test Laboratory: Verkotan Oy

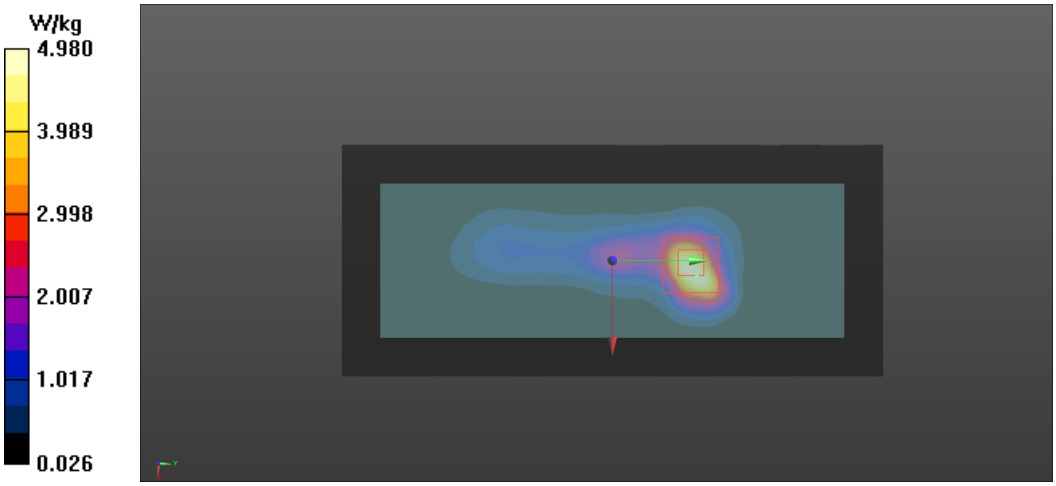
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1745 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 1745 MHz; $\sigma$ = 1.315 S/m; $\varepsilon_r$ = 40.398; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.45, 7.97, 8.4) @ 1745 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/Right, LTE 4, HIGH, QPSK/20, RB100, Offset0/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 41.14 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 6.30 W/kg
**SAR(1 g) = 3.28 W/kg; SAR(10 g) = 1.61 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 49.2%
Maximum value of SAR (measured) = 4.98 W/kg
**Configuration/Right, LTE 4, HIGH, QPSK/20, RB100, Offset0/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 5.04 W/kg





Plot 15

Date/Time: 12.5.23 09:01:56

Test Laboratory: Verkotan Oy

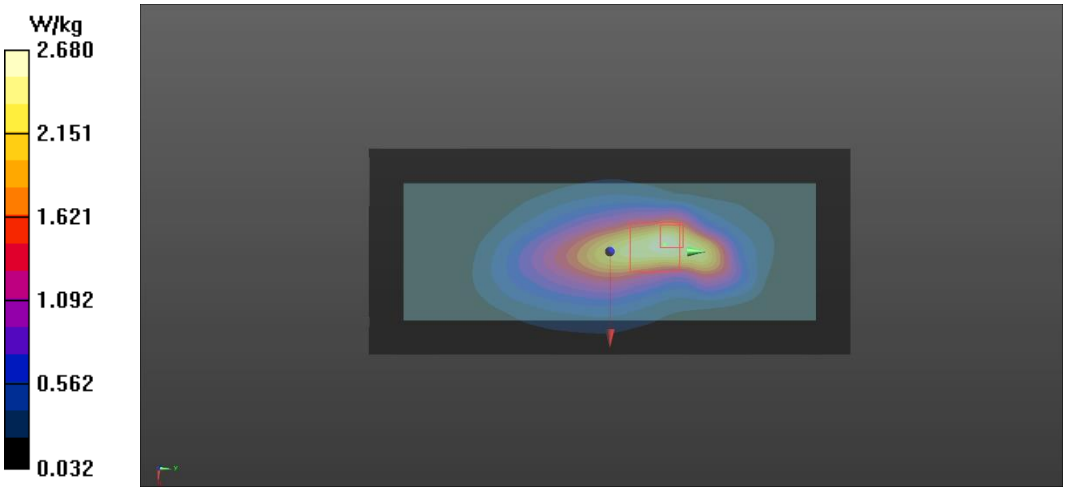
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 5, E-UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.5 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 836.5 MHz; $\sigma$ = 0.888 S/m; $\varepsilon_r$ = 42.566; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 836.5 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Right & Left/Right, LTE 5, MID, QPSK/10, RB25, Offset0/Zoom Scan (7x8x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 43.13 V/m; Power Drift = -0.65 dB
Peak SAR (extrapolated) = 3.66 W/kg
**SAR(1 g) = 1.37 W/kg; SAR(10 g) = 0.716 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6 mm
Ratio of SAR at M2 to SAR at M1 = 36.7%
Maximum value of SAR (measured) = 2.68 W/kg
**Right & Left/Right, LTE 5, MID, QPSK/10, RB25, Offset0/Area Scan (141x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.55 W/kg





Plot 16

Date/Time: 23.5.23 15:15:52

Test Laboratory: Verkotan Oy

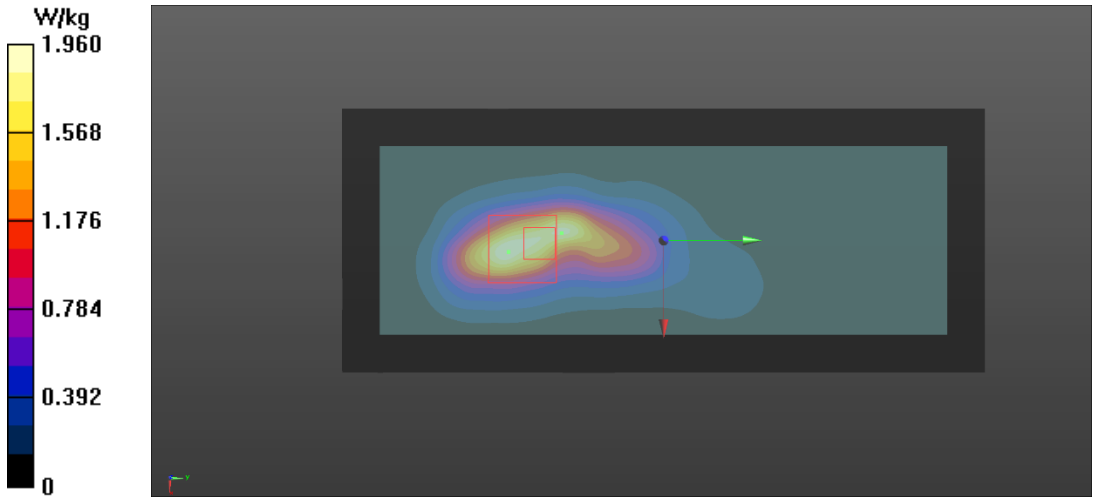
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WLAN 2.4 (0); Communication System Band: WLAN2.4GHz; Frequency: 2412 MHz;
Communication System PAR: 0.706 dB;
Medium parameters used: f = 2412 MHz; $\sigma$ = 1.658 S/m; $\varepsilon_r$ = 37.457; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.7, 7.5, 7.63) @ 2412 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/Left, WLAN 2.4GHz, CH 1, 802.11b, 1Mbps 2 2/Area Scan (171x71x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.96 W/kg
**Configuration/Left, WLAN 2.4GHz, CH 1, 802.11b, 1Mbps 2 2/Zoom Scan (7x8x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.98 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 2.70 W/kg
**SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.638 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 44.6%
Maximum value of SAR (measured) = 2.06 W/kg





Plot 17

Date/Time: 25.5.23 09:39:14

Test Laboratory: Verkotan Oy

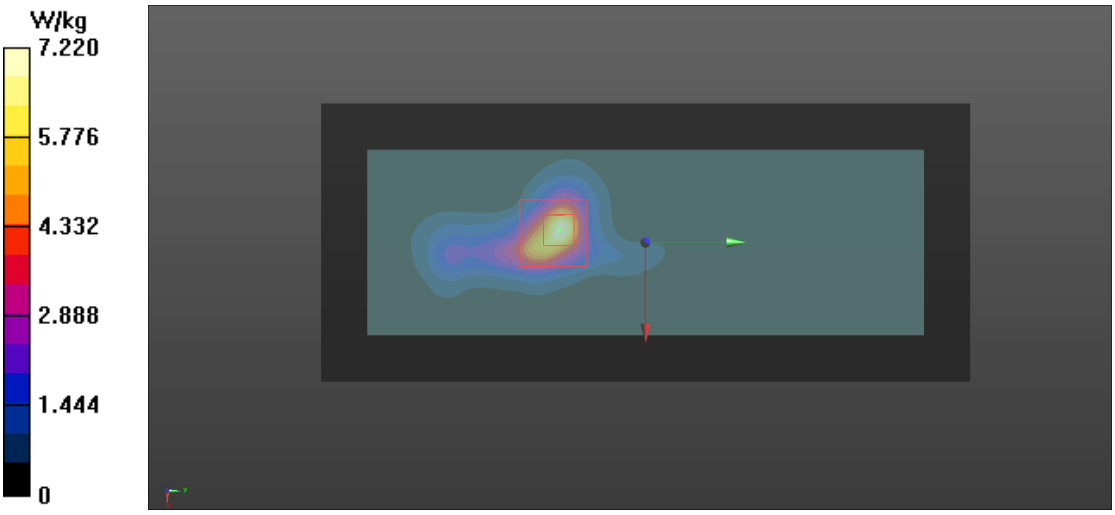
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5260 MHz;
Communication System PAR: 1.63 dB;
Medium parameters used: f = 5260 MHz; $\sigma$ = 4.487 S/m; $\varepsilon_r$ = 36.308; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 4.99, 5.17) @ 5260 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration 3/Left, WLAN 5GHz, CH 52, 802.11a, 6Mbps/Area Scan (211x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 7.22 W/kg
**Configuration 3/Left, WLAN 5GHz, CH 52, 802.11a, 6Mbps/Zoom Scan (9x9x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 44.73 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 12.0 W/kg
**SAR(1 g) = 3.29 W/kg; SAR(10 g) = 0.996 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.8 mm
Ratio of SAR at M2 to SAR at M1 = 65.9%
Maximum value of SAR (measured) = 7.80 W/kg





Plot 18

Date/Time: 26.5.23 08:24:51

Test Laboratory: Verkotan Oy

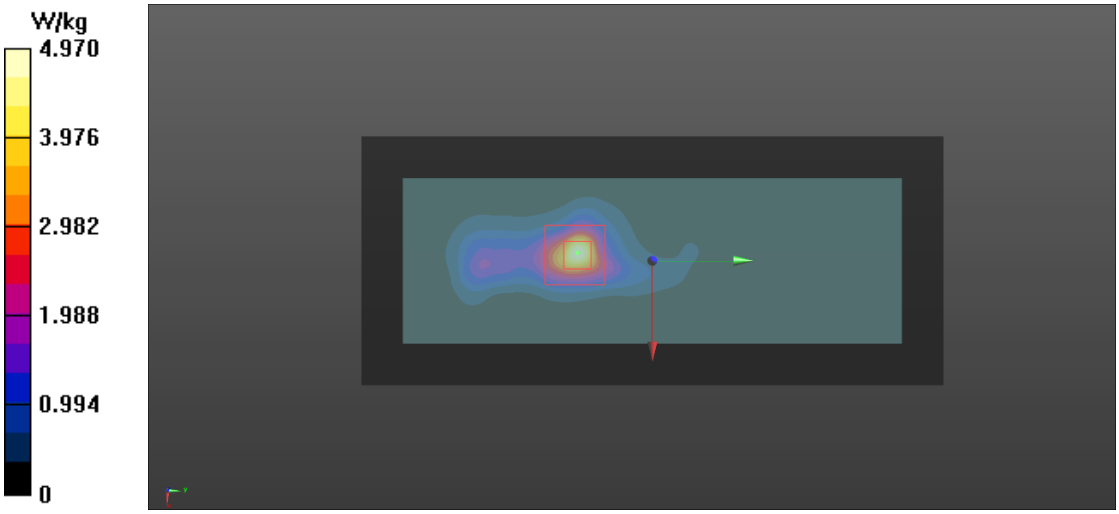
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5500 MHz;
Communication System PAR: 1.63 dB;
Medium parameters used: f = 5500 MHz; $\sigma$ = 4.747 S/m; $\varepsilon_r$ = 35.875; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.4, 4.29, 4.43) @ 5500 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration 2/Left, WLAN 5GHz, CH 100, 802.11a, 6Mbps 2/Zoom Scan (9x9x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 35.09 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 7.97 W/kg
**SAR(1 g) = 2.1 W/kg; SAR(10 g) = 0.631 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.4 mm
Ratio of SAR at M2 to SAR at M1 = 69.6%
Maximum value of SAR (measured) = 4.97 W/kg
**Configuration 2/Left, WLAN 5GHz, CH 100, 802.11a, 6Mbps 2/Area Scan (211x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 4.95 W/kg





Plot 19

Date/Time: 29.5.23 12:25:19

Test Laboratory: Verkotan Oy

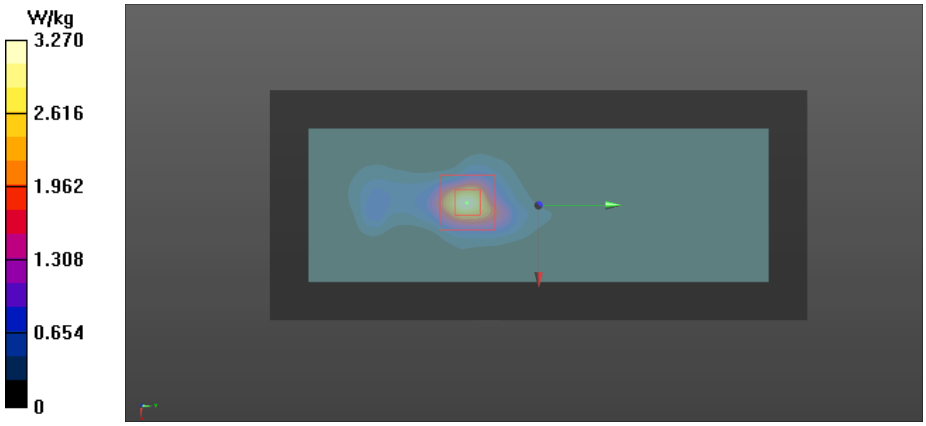
**DUT: Move/2600 CL/4G/WiFi**

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5825 MHz;
Communication System PAR: 1.63 dB;
Medium parameters used: f = 5825 MHz; $\sigma$ = 5.148 S/m; $\varepsilon_r$ = 35.472; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.47, 4.33, 4.53) @ 5825 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

**Configuration/Left, WLAN 5GHz, CH 165, 802.11a, 6Mbps/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 11.83 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 5.14 W/kg
**SAR(1 g) = 1.21 W/kg; SAR(10 g) = 0.329 W/kg** (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5.6 mm
Ratio of SAR at M2 to SAR at M1 = 65%
Maximum value of SAR (measured) = 3.27 W/kg
**Configuration/Left, WLAN 5GHz, CH 165, 802.11a, 6Mbps/Area Scan 2 (41x21x1):** Interpolated grid: dx=5.000 mm, dy=5.000 mm
Maximum value of SAR (interpolated) = 0.639 W/kg
**Configuration/Left, WLAN 5GHz, CH 165, 802.11a, 6Mbps/Area Scan (211x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.90 W/kg





## APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS

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

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

Accredited by the Swiss Accreditation Service (SAS)
**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

Accreditation No.: **SCS 0108**

| Client | Verkotan | Certificate No | EX-7447_Feb23 |
|---|---|---|---|

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:7447 |
| Calibration procedure(s) | QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8<br>Calibration procedure for dosimetric E-field probes |
| Calibration date | February 17, 2023 |

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 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | Apr-23 |
| OCP DAK-3.5 (weighted) | SN: 1249 | 20-Oct-22 (OCP-DAK3.5-1249_Oct22) | Oct-23 |
| OCP DAK-12 | SN: 1016 | 20-Oct-22 (OCP-DAK12-1016_Oct22) | Oct-23 |
| Reference 20 dB Attenuator | SN: CC2552 (20x) | 04-Apr-22 (No. 217-03527) | Apr-23 |
| DAE4 | SN: 660 | 10-Oct-22 (No. DAE4-660_Oct22) | Oct-23 |
| Reference Probe ES3DV2 | SN: 3013 | 06-Jan-23 (No. ES3-3013_Jan23) | Jan-24 |

| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB41293874 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: MY41498087 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| Power sensor E4412A | SN: 000110210 | 06-Apr-16 (in house check Jun-22) | In house check: Jun-24 |
| RF generator HP 8648C | SN: US3642U01700 | 04-Aug-99 (in house check Jun-22) | In house check: Jun-24 |
| Network Analyzer E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-22) | In house check: Oct-24 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by | Joanna Lleshaj | Laboratory Technician | |
| Approved by | Niels Kuster | Quality Manager | |

Issued: February 21, 2023

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

Certificate No: EX-7447_Feb23 Page 1 of 9



## Parameters of Probe: EX3DV4 - SN:7447

### Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc ($k = 2$) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$) [A] | 0.43 | 0.43 | 0.43 | ±10.1% |
| DCP (mV) [B] | 90.0 | 91.0 | 96.0 | ±4.7% |

### Calibration Results for Modulation Response

| UID | Communication System Name | | A dB | B $dB\sqrt{\mu V}$ | C | D dB | VR mV | Max dev. | Max Unc[E] $k = 2$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.00 | 0.00 | 1.00 | 0.00 | 130.7 | ±2.3% | ±4.7% |
| | | Y | 0.00 | 0.00 | 1.00 | | 130.1 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 134.6 | | |

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%.

[A] The uncertainties of Norm X,Y,Z do not affect the $E^2$-field uncertainty inside TSL (see Page 5).
[B] Linearization parameter uncertainty for maximum specified field strength.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.





## Parameters of Probe: EX3DV4 - SN:7447

### Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle | -139.3° |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 1.4 mm |

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



## Parameters of Probe: EX3DV4 - SN:7447

### Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz)[C] | Relative Permittivity[F] | Conductivity[F] (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unc ($k$ = 2) |
|---|---|---|---|---|---|---|---|---|
| 13 | 55.0 | 0.75 | 17.42 | 17.42 | 17.42 | 0.00 | 1.25 | ±13.3% |
| 750 | 41.9 | 0.89 | 9.91 | 8.74 | 9.52 | 0.31 | 1.27 | ±12.0% |
| 900 | 41.5 | 0.97 | 9.37 | 8.45 | 8.89 | 0.32 | 1.27 | ±12.0% |
| 1750 | 40.1 | 1.37 | 8.45 | 7.97 | 8.40 | 0.25 | 1.27 | ±12.0% |
| 1950 | 40.0 | 1.40 | 8.05 | 7.59 | 7.97 | 0.29 | 1.27 | ±12.0% |
| 2150 | 39.7 | 1.53 | 8.01 | 7.58 | 7.90 | 0.28 | 1.27 | ±12.0% |
| 2300 | 39.5 | 1.67 | 7.85 | 7.46 | 7.80 | 0.28 | 1.27 | ±12.0% |
| 2450 | 39.2 | 1.80 | 7.70 | 7.50 | 7.63 | 0.28 | 1.27 | ±12.0% |
| 2600 | 39.0 | 1.96 | 7.55 | 7.37 | 7.73 | 0.28 | 1.27 | ±12.0% |
| 3300 | 38.2 | 2.71 | 7.02 | 6.71 | 7.02 | 0.34 | 1.27 | ±14.0% |
| 5250 | 35.9 | 4.71 | 5.18 | 4.99 | 5.17 | 0.39 | 1.53 | ±14.0% |
| 5600 | 35.5 | 5.07 | 4.40 | 4.29 | 4.43 | 0.38 | 1.77 | ±14.0% |
| 5750 | 35.4 | 5.22 | 4.47 | 4.33 | 4.53 | 0.38 | 1.85 | ±14.0% |

[C] Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 6 GHz.

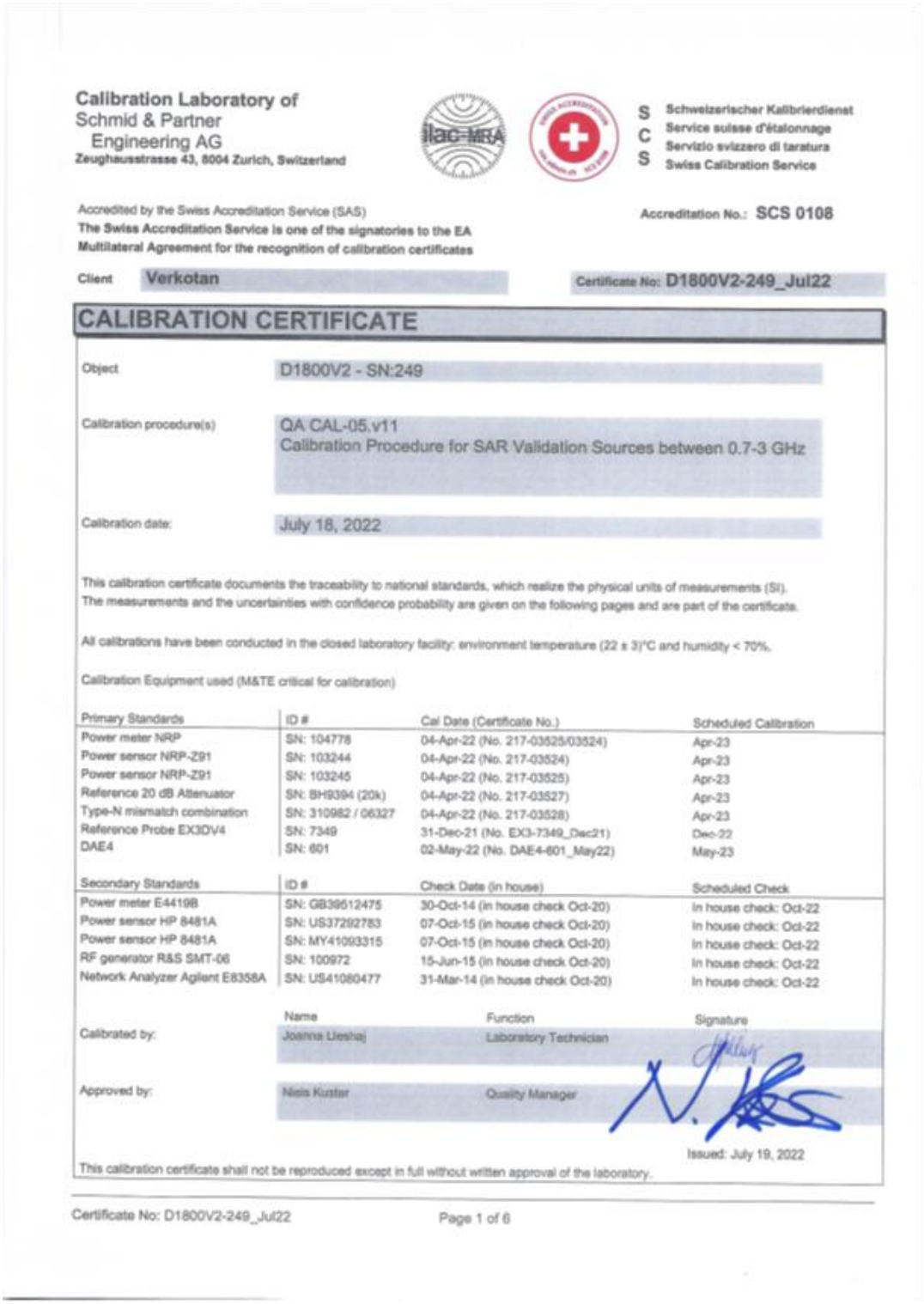
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the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





## APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS



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

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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client: Verkotan

Certificate No: D1800V2-249_Jul22

# CALIBRATION CERTIFICATE

Object: D1800V2 - SN:249

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: July 18, 2022

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter NRP | SN: 104778 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03525) | Apr-23 |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 04-Apr-22 (No. 217-03527) | Apr-23 |
| Type-N mismatch combination | SN: 310982 / 06327 | 04-Apr-22 (No. 217-03528) | Apr-23 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_Dec21) | Dec-22 |
| DAE4 | SN: 601 | 02-May-22 (No. DAE4-601_May22) | May-23 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-20) | In house check: Oct-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Joanna Lleshaj | Laboratory Technician | |
| Approved by: | Niels Kuster | Quality Manager | |

Issued: July 19, 2022

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

Certificate No: D1800V2-249_Jul22 Page 1 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** | Modular Flat Phantom | |
| **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 | 38.4 ± 6 % | 1.38 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | --- | --- |

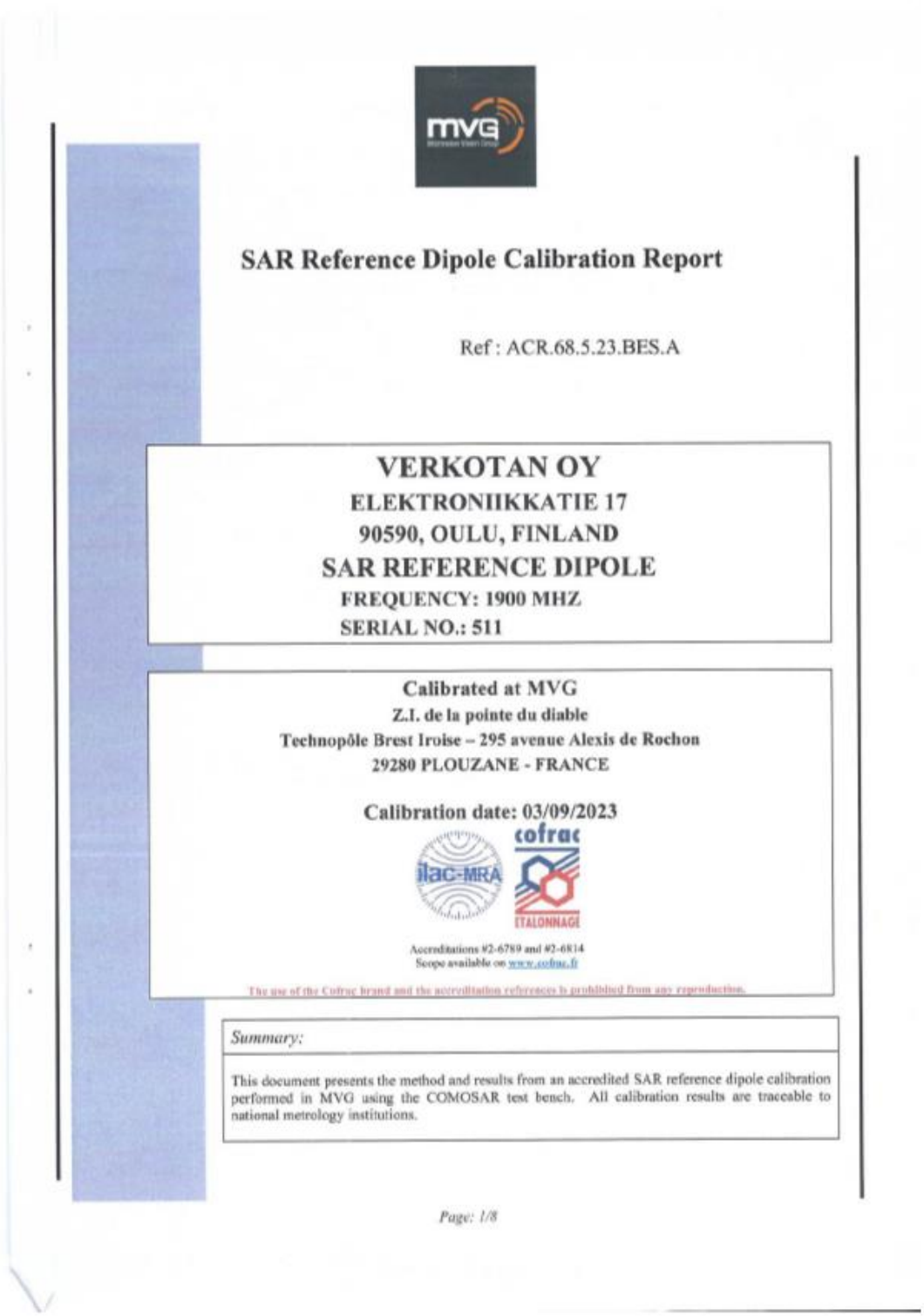
## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 9.74 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **38.9 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.07 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **20.3 W/kg ± 16.5 % (k=2)** |





# SAR Reference Dipole Calibration Report

Ref : ACR.68.5.23.BES.A

**VERKOTAN OY**
**ELEKTRONIIKKATIE 17**
**90590, OULU, FINLAND**
**SAR REFERENCE DIPOLE**
**FREQUENCY: 1900 MHZ**
**SERIAL NO.: 511**

**Calibrated at MVG**
**Z.I. de la pointe du diable**
**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**
**29280 PLOUZANE - FRANCE**

**Calibration date: 03/09/2023**

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.

*Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

*Page: 1/8*



mvg

**SAR REFERENCE DIPOLE CALIBRATION REPORT** Ref: ACR.68.5.23.BES.A

| | Name | Function | Date | Signature |
|---|---|---|---|---|
| *Prepared by :* | Cyrille ONNEE | Measurement Responsible | 3/9/2023 | |
| *Checked & approved by:* | Jérôme Luc | Technical Manager | 3/9/2023 | |
| *Authorized by:* | Yann Toutain | Laboratory Director | 3/9/2023 | |

Yann Toutain ID
Signature numérique de Yann Toutain ID
Date : 2023.03.09 15:01:12 +01'00'

| | Customer Name |
|---|---|
| *Distribution :* | Verkotan Oy |

| Issue | Name | Date | Modifications |
|---|---|---|---|
| A | Cyrille ONNEE | 3/9/2023 | Initial release |
| | | | |
| | | | |
| | | | |

*Page: 2/8*





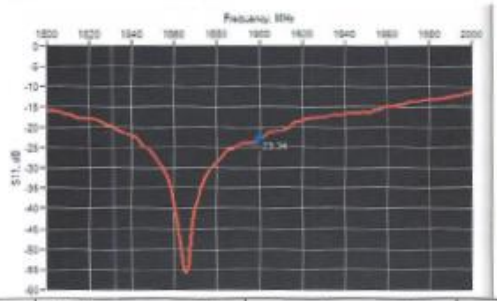
## 6 CALIBRATION RESULTS

### 6.1 MECHANICAL DIMENSIONS

| L mm | | h mm | | d mm | |
|---|---|---|---|---|---|
| Measured | Required | Measured | Required | Measured | Required |
| - | 68.00 +/- 2% | - | 39.50 +/- 2% | - | 3.60 +/- 2% |

### 6.2 S11 PARAMETER

#### 6.2.1 S11 parameter in Head Liquid




| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance |
|---|---|---|---|
| 1900 | -23.34 | -20 | 48.5Ω - 6.6jΩ |

### 6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

#### 6.3.1 SAR with Head Liquid

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.







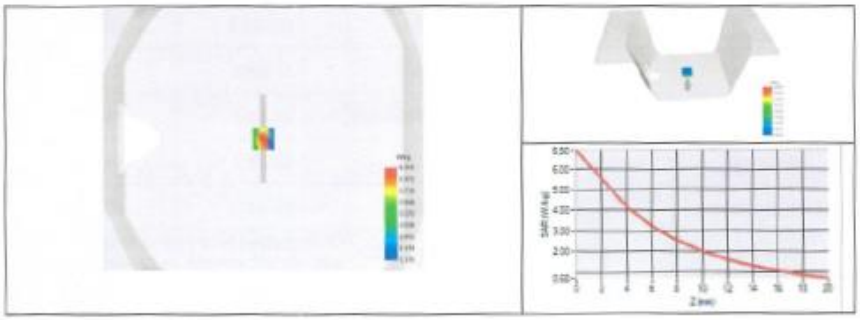
 

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BHSA

| | |
|---|---|
| Software | OPENSAR V5 |
| Phantom | SN 13/09 SAM68 |
| Probe | SN 41/18 EPGO333 |
| Liquid | Head Liquid Values: eps' : 40.4 sigma : 1.40 |
| Distance between dipole center and liquid | 10.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoom Scan Resolution | dx=8mm/dy=8mm/dz=5mm |
| Frequency | 1900 MHz |
| Input power | 20 dBm |
| Liquid Temperature | 20 +/- 1 °C |
| Lab Temperature | 20 +/- 1 °C |
| Lab Humidity | 30-70 % |

| Frequency | 1g SAR (W/kg) | | | 10g SAR (W/kg) | | |
|---|---|---|---|---|---|---|
| | Measured | Measured normalized to 1W | Target normalized to 1W | Measured | Measured normalized to 1W | Target normalized to 1W |
| 1900 MHz | 3.80 | 38.02 | 39.70 | 1.94 | 19.41 | 20.50 |

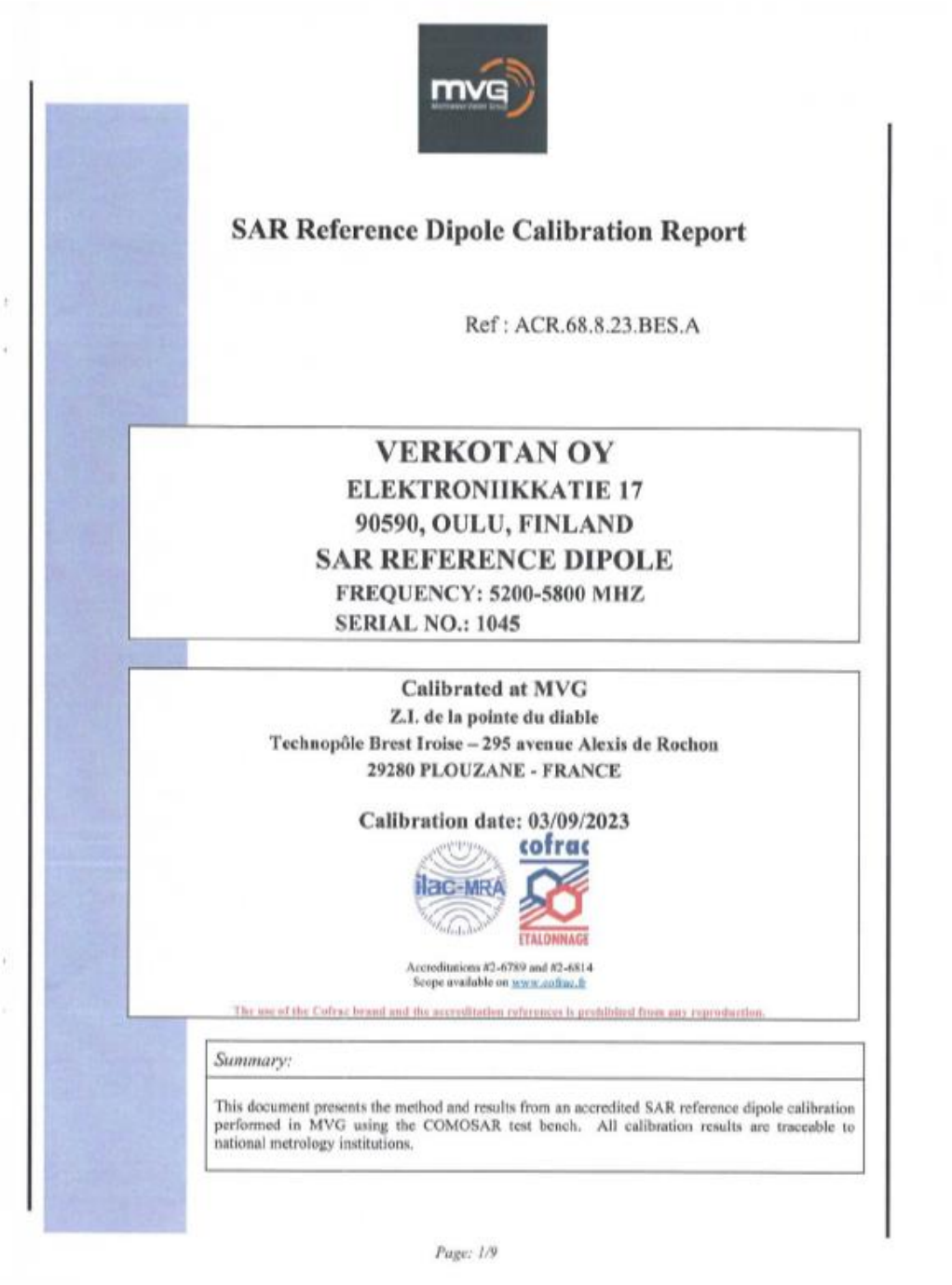










mvg

# SAR Reference Dipole Calibration Report

Ref : ACR.68.8.23.BES.A

**VERKOTAN OY**
**ELEKTRONIIKKATIE 17**
**90590, OULU, FINLAND**
**SAR REFERENCE DIPOLE**
**FREQUENCY: 5200-5800 MHZ**
**SERIAL NO.: 1045**

**Calibrated at MVG**
**Z.I. de la pointe du diable**
**Technopôle Brest Iroise – 295 avenue Alexis de Rochon**
**29280 PLOUZANE - FRANCE**

**Calibration date: 03/09/2023**

ilac-MRA cofrac ETALONNAGE

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr



*Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

*Page: 1/9*



mvg

**SAR REFERENCE DIPOLE CALIBRATION REPORT** Ref: ACR.68.8.23.BES.A

| | Name | Function | Date | Signature |
|---|---|---|---|---|
| *Prepared by :* | Cyrille ONNEE | Measurement Responsible | 3/9/2023 | |
| *Checked & approved by:* | Jérôme Luc | Technical Manager | 3/9/2023 | |
| *Authorized by:* | Yann Toutain | Laboratory Director | 3/9/2023 | |

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.03.09 15:05:03 +01'00'

| | Customer Name |
|---|---|
| *Distribution :* | Verkotan Oy |

| Issue | Name | Date | Modifications |
|---|---|---|---|
| A | Cyrille ONNEE | 3/9/2023 | Initial release |
| | | | |
| | | | |
| | | | |

*Page: 2/9*





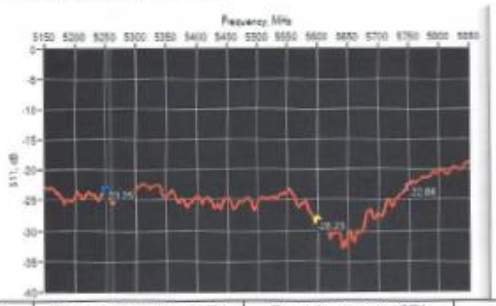
## 6 CALIBRATION RESULTS

### 6.1 MECHANICAL DIMENSIONS

| L mm | | h mm | | d mm | |
|---|---|---|---|---|---|
| Measured | Required | Measured | Required | Measured | Required |
| - | 20.60 +/- 2% | - | 40.30 +/- 2% | - | 3.60 +/- 2% |

### 6.2 S11 PARAMETER

#### 6.2.1 S11 parameter in Head Liquid



| Frequency (MHz) | S11 parameter (dB) | Requirement (dB) | Impedance |
|---|---|---|---|
| 5250 | -23.25 | -20 | 47.8Ω + 6.4jΩ |
| 5600 | -28.23 | -20 | 48.5Ω - 3.5jΩ |
| 5750 | -22.86 | -20 | 46.7Ω + 6.1jΩ |

### 6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

#### 6.3.1 SAR with Head Liquid

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.







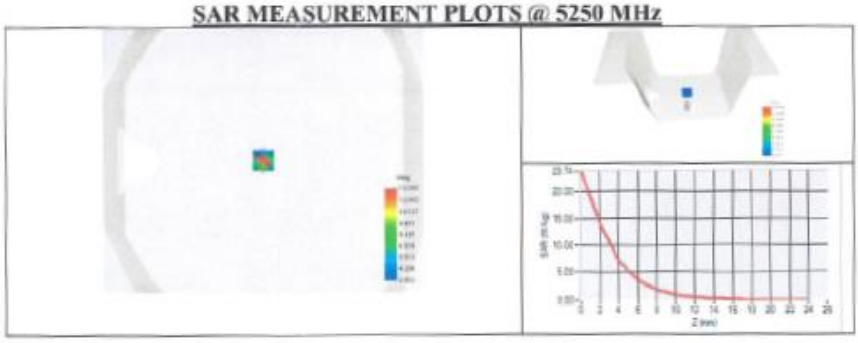
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.8.23.BES.A

| | |
|---|---|
| Software | OPENSAR V5 |
| Phantom | SN 13/09 SAM68 |
| Probe | SN 41/18 EPGO333 |
| Liquid | Head Liquid Values @ 5250 MHz: eps' : 34.3 sigma : 4.67<br>Head Liquid Values @ 5600 MHz: eps' : 33.6 sigma : 5.05<br>Head Liquid Values @ 5750 MHz: eps' : 32.9 sigma : 5.46 |
| Distance between dipole center and liquid | 10.0 mm |
| Area scan resolution | dx=8mm/dy=8mm |
| Zoon Scan Resolution | dx=4mm/dy=4mm/dz=2mm |
| Frequency | 5250 MHz<br>5600 MHz<br>5750 MHz |
| Input power | 20 dBm |
| Liquid Temperature | 20 +/- 1 °C |
| Lab Temperature | 20 +/- 1 °C |
| Lab Humidity | 30-70 % |

| Frequency | 1g SAR (W/kg) | | | 10g SAR (W/kg) | | |
|---|---|---|---|---|---|---|
| | Measured | Measured normalized to 1W | Target normalized to 1W | Measured | Measured normalized to 1W | Target normalized to 1W |
| 5250 MHz | 7.31 | 73.09 | - | 2.11 | 21.12 | - |
| 5600 MHz | 7.29 | 72.92 | 78.30 | 2.13 | 21.29 | 23.20 |
| 5750 MHz | 6.91 | 69.05 | - | 2.03 | 20.27 | - |

SAR MEASUREMENT PLOTS @ 5250 MHz



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Accreditation No.: SCS 0108

Client: Verkotan

Certificate No: D2450V2-729_Jul22

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN:729 |
| Calibration procedure(s) | QA CAL-05.v11<br>Calibration Procedure for SAR Validation Sources between 0.7-3 GHz |
| Calibration date: | July 15, 2022 |

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter NRP | SN: 104778 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03525) | Apr-23 |
| Reference 20 dB Attenuator | SN: BH9394 (20k) | 04-Apr-22 (No. 217-03527) | Apr-23 |
| Type-N mismatch combination | SN: 310982 / 06327 | 04-Apr-22 (No. 217-03528) | Apr-23 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_Dec21) | Dec-22 |
| DAE4 | SN: 601 | 02-May-22 (No. DAE4-601_May22) | May-23 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-20) | In house check: Oct-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Aldonia Georgiadou | Laboratory Technician | |
| Approved by: | Niels Kuster | Quality Manager | |

Issued: July 19, 2022

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Certificate No: D2450V2-729_Jul22 Page 1 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** | Modular Flat Phantom | |
| **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 | 37.9 ± 6 % | 1.85 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | --- | --- |

## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 13.4 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **52.3 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.21 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **24.5 W/kg ± 16.5 % (k=2)** |



 

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Accreditation No.: SCS 0108

Client: Verkotan

Certificate No: D835V2-455_Jul22

# CALIBRATION CERTIFICATE

Object: D835V2 - SN:455

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: July 15, 2022

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter NRP | SN: 104778 | 04-Apr-22 (No. 217-03525/03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103244 | 04-Apr-22 (No. 217-03524) | Apr-23 |
| Power sensor NRP-Z91 | SN: 103245 | 04-Apr-22 (No. 217-03525) | Apr-23 |
| Reference 20 dB Attenuator | SN: BH8394 (20k) | 04-Apr-22 (No. 217-03527) | Apr-23 |
| Type-N mismatch combination | SN: 310982 / 06327 | 04-Apr-22 (No. 217-03528) | Apr-23 |
| Reference Probe EX3DV4 | SN: 7349 | 31-Dec-21 (No. EX3-7349_Dec21) | Dec-22 |
| DAE4 | SN: 601 | 02-May-22 (No. DAE4-601_May22) | May-23 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter E4419B | SN: GB39512475 | 30-Oct-14 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: US37292783 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| Power sensor HP 8481A | SN: MY41093315 | 07-Oct-15 (in house check Oct-20) | In house check: Oct-22 |
| RF generator R&S SMT-06 | SN: 100972 | 15-Jun-15 (in house check Oct-20) | In house check: Oct-22 |
| Network Analyzer Agilent E8358A | SN: US41080477 | 31-Mar-14 (in house check Oct-20) | In house check: Oct-22 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Aldonia Georgiadou | Laboratory Technician | |
| Approved by: | Niels Kuster | Quality Manager | |

Issued: July 19, 2022

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Certificate No: D835V2-455_Jul22 Page 1 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** | Modular Flat Phantom | |
| **Distance Dipole Center - TSL** | 15 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 835 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 41.5 | 0.90 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 40.3 ± 6 % | 0.93 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | --- | --- |

## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 2.50 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **9.69 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.61 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **6.29 W/kg ± 16.5 % (k=2)** |



 