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Test report No:
2250816R-HP-US-P01V04

# SAR TEST REPORT

| | |
|---|---|
| Product | Touch All In One Computer |
| Product Name / Model No. | Elo |
| Trademark | ESY22I4 |
| FCC ID | RBWESYI4SV |
| IC | 10757B-ESYI4SV |
| Applicant´s name / address | Elo Touch Solutions, Inc<br>670 N. McCarthy Blvd., Suite 100, Milpitas, CA 95035, USA. |
| Test method requested, standard | FCC KDB Publication 248227 D01v02r02<br>FCC KDB Publication 447498 D01v06<br>FCC KDB Publication 865664 D01v01r04<br>IEEE Std. 1528-2013<br>FCC 47CFR §2.1093<br>ANSI C95.1-2005<br>RSS 102: Issue 5 |
| Maximum SAR | ESY22I4: Standalone SAR 1.187W/kg;<br>Simultaneous SAR 1.336W/kg |
| Verdict Summary | IN COMPLIANCE |
| Tested by (name / position & signature) | Tim Cao/Project Engineer<br>Tim.Cao |
| Approved by (name / position & signature) | Jack Zhang/ Manager<br>Jack zhang |
| Date of issue | 2022-09-16 |
| Report template No | Template_FCC SAR-RF-V1.0 |

| | |
|---|---|
| FCC Designation Number | CN1199 |
| ISED CAB identifier | CN0040 |

# INDEX

Page

**COMPETENCES AND GUARANTEES** ..... 5

**GENERAL CONDITIONS** ..... 5

**ENVIRONMENTAL CONDITIONS** ..... 6

**POSSIBLE TEST CASE VERDICTS** ..... 6

**DOCUMENT HISTORY** ..... 7

**REMARKS AND COMMENTS** ..... 7

**1 GENERAL INFORMATION** ..... 8

1.1 GENERAL DESCRIPTION OF THE ITEM(S) ..... 8

1.2 ANTENNA INFORMATION ..... 10

**2 SAR MEASUREMENT SYSTEM** ..... 13

2.1 DASY5 SYSTEM DESCRIPTION ..... 13

*2.1.1. Applications* ..... 14

*2.1.2. Area Scans* ..... 14

*2.1.3. Zoom Scan (Cube Scan Averaging)* ..... 14

*2.1.4. Uncertainty of Inter-/Extrapolation and Averaging* ..... 15

2.2 DASY5 E-FIELD PROBE ..... 16

2.3 BOUNDARY DETECTION UNIT AND PROBE MOUNTING DEVICE ..... 17

2.4 DATA ACQUISITION ELECTRONICS (DAE) AND MEASUREMENT SERVER ..... 17

2.5 ROBOT ..... 18

2.6 LIGHT BEAM UNIT ..... 18

2.7 DEVICE HOLDER ..... 19

2.8 SAM TWIN PHANTOM ..... 20

SAM TWIN PHANTOM ..... 20

ELI PHANTOM ..... 20

**3 TISSUE SIMULATING LIQUID** ..... 21

3.1 THE COMPOSITION OF THE TISSUE SIMULATING LIQUID ..... 21

3.2 TISSUE CALIBRATION RESULT ..... 22

3.3 TISSUE DIELECTRIC PARAMETERS FOR HEAD AND BODY PHANTOMS ..... 25

**4 SAR MEASUREMENT PROCEDURE** ..... 26

4.1 SAR SYSTEM VALIDATION ..... 26

*4.1.1. Validation Dipoles* ..... 26

*4.1.2. Validation Result* ..... *27*
4.2 SAR MEASUREMENT PROCEDURE ..... 28
**5 SAR EXPOSURE LIMITS ..... 29**
**6 TEST EQUIPMENT LIST ..... 30**
**7 MEASUREMENT UNCERTAINTY ..... 31**
**8 POWER TEST RESULTS ..... 33**
**9 SAR TEST RESULTS ..... 49**
9.1 STANDALONE SAR ..... 49
9.2 TEST POSITION AND CONFIGURATION ..... 54
9.3 SAR TEST EXCLUSIONS APPLIED ..... 55
9.4 SIMULTANEOUS TRANSMISSION ANALYSIS ..... 56
**APPENDIX A. SAR VALIDATION DATA ..... 57**
**APPENDIX B. SAR TEST DATA ..... 61**
**APPENDIX C. PROBE CALIBRATION DATA ..... 69**
**DIPOLE CALIBRATION DATA ..... 78**
**APPENDIX E. DAE CALIBRATION DATA ..... 92**

## COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

**IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

## GENERAL CONDITIONS

| | |
|---|---|
| Test Location | No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China |
| Date(receive sample) | May. 30, 2022 |
| Date (start test) | May. 31, 2022 |
| Date (finish test) | Aug. 08, 2022 |

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

## ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

| | |
|---|---|
| Ambient temperature | 18 °C – 25 °C |
| Relative Humidity air | 30% - 60% |

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

## POSSIBLE TEST CASE VERDICTS

| | |
|---|---|
| Test case does not apply to test object | N/A |
| Test object does meet requirement | P (Pass) / PASS |
| Test object does not meet requirement | F (Fail) / FAIL |
| Not measured | N/M |

## DOCUMENT HISTORY

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| 2250816R-HP-US-P01V04 | V1.0 | Initial issue of report. | 2022-09-16 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with FCC Part 2.1093.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:
   - Chapter 1.1 General Description of the Item(s);
   - Chapter 1.2 Antenna Information.

# 1 General Information

## 1.1 General Description of the Item(s)

| | | | | | | |
|---|---|---|---|---|---|---|
| Product Name | Touch All In One Computer | | | | | |
| Model No. | ESY22I4 | | | | | |
| HVIN | ESYI4SV | | | | | |
| Hardware Version | R05 | | | | | |
| Software Version | Android 10 | | | | | |
| FCC ID | RBWESYI4SV | | | | | |
| IC | 10757B-ESYI4SV | | | | | |
| Manufacturer | Elo Touch Solutions, Inc | | | | | |
| Manufacturer Address | 670 N. McCarthy Blvd., Suite 100, Milpitas, CA 95035, USA. | | | | | |
| EUT Voltage | 19 Vdc and POE 44-57V for ESY10I4, ESY15I4, ESY22I4, ESY15I4-C | | | | | |
| Frequency Range | For 2.4GHz Band<br>802.11b/g/n(20MHz): 2400~2483.5MHz | | | | | |
| Channel Number | For 2.4GHz Band<br>802.11b/g/n(20MHz): 11 | | | | | |
| Type of Modulation | 802.11b: DSSS-DBPSK, DQPSK, CCK | | | | | |
| | 802.11g/n: OFDM-BPSK, QPSK, 16QAM, 64QAM | | | | | |
| Data Rate | 802.11b: 1/2/5.5/11 Mbps | | | | | |
| | 802.11g: 6/9/12/18/24/36/48/54 Mbps | | | | | |
| | 802.11n: up to 144.4 Mbps | | | | | |
| Frequency Range | 5GHz Band | | | | | |
| Type of Modulation | OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM | | | | | |
| Data Rate | 802.11a: 6/9/12/18/24/36/48/54Mbps | | | | | |
| | 802.11n: up to 300Mbps | | | | | |
| | 802.11ac: up to 866.6Mbps | | | | | |
| Channel Control | Auto | | | | | |
| Transmit modes | ☒ | 802.11a | ☒ | 802.11n(20MHz) | ☒ | 802.11n(40MHz) |
| | ☒ | 802.11ac(20MHz) | ☒ | 802.11ac(40MHz) | ☒ | 802.11ac(80MHz) |
| Support Bands | ☒ | 5150MHz~5250MHz | ☐ | Outdoor AP | | |
| | | | ☐ | Indoor AP | | |
| | | | ☐ | Fixed point-to-point AP | | |
| | | | ☒ | Mobile and Portable Client | | |
| | ☒ | 5250MHz~5350MHz | | | | |
| | ☒ | 5470MHz~5725MHz for FCC | ☒ | With TDWR Channels | | |
| | | | ☐ | Without TDWR Channels | | |

| | | |
|---|---|---|
| | ☒ | 5470MHz~5600MHz and 5600MHz~5650MHz for ISED |
| | ☒ | 5725MHz~5850MHz |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wireless specification | Bluetooth | | | | | |
| Bluetooth Specification | V3.0 | | | | | |
| Frequency Range | 2400~2483.5MHz | | | | | |
| Type of Modulation | GFSK | | | | | |
| PHYs | ☒ | GFSK | ☒ | Pi/4 DQPSK | ☒ | 8DPSK |
| Data Rate | ☒ | 1Mbit/s | ☒ | 2Mbit/s | ☒ | 3Mbit/s |
| Number of channel | 79 | | | | | |
| Wireless specification | Bluetooth 5.0 | | | | | |
| Frequency Range | 2400~2483.5MHz | | | | | |
| Type of Modulation | GFSK | | | | | |
| PHYs | ☒ | LE 1M | ☒ | LE 2M | ☐ | LE Coded S=2/8 |
| Data Rate | ☒ | 1Mbit/s | ☒ | 2Mbit/s | ☐ | 500/125 Kbit/s |
| Number of channel | 40 | | | | | |
| Temperature Range | 0℃~40℃ | | | | | |

## 1.2 Antenna Information

### WLAN Antenna

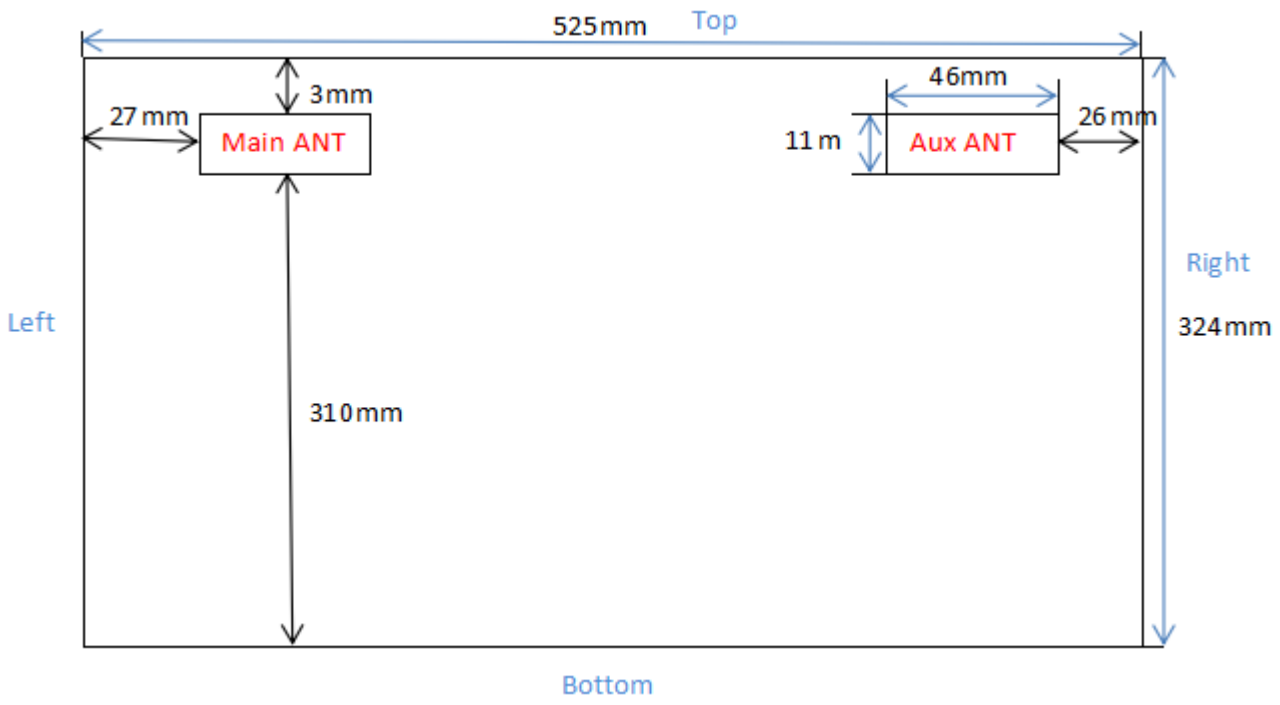
### 2.4GHz

| | | | | |
|---|---|---|---|---|
| Antenna model / type number ..... : | N/A | | | |
| Antenna serial number ..... : | N/A | | | |
| Antenna Delivery ..... : | ☒ | 1TX + 1RX | | |
| | ☒ | 2TX + 2RX | | |
| | ☐ | Others:…… | | |
| Antenna technology ..... : | ☒ | SISO | | |
| | ☒ | MIMO | ☒ | CDD |
| | | | ☐ | Beam-forming |
| Antenna Type..... : | ☐ | External | ☐ | Dipole |
| | | | ☐ | Sectorized |
| | ☒ | Internal | ☒ | PIFA |
| | | | ☐ | PCB |
| | | | ☐ | Metal Antenna |
| | | | ☐ | Others…….. |

**5GHz**

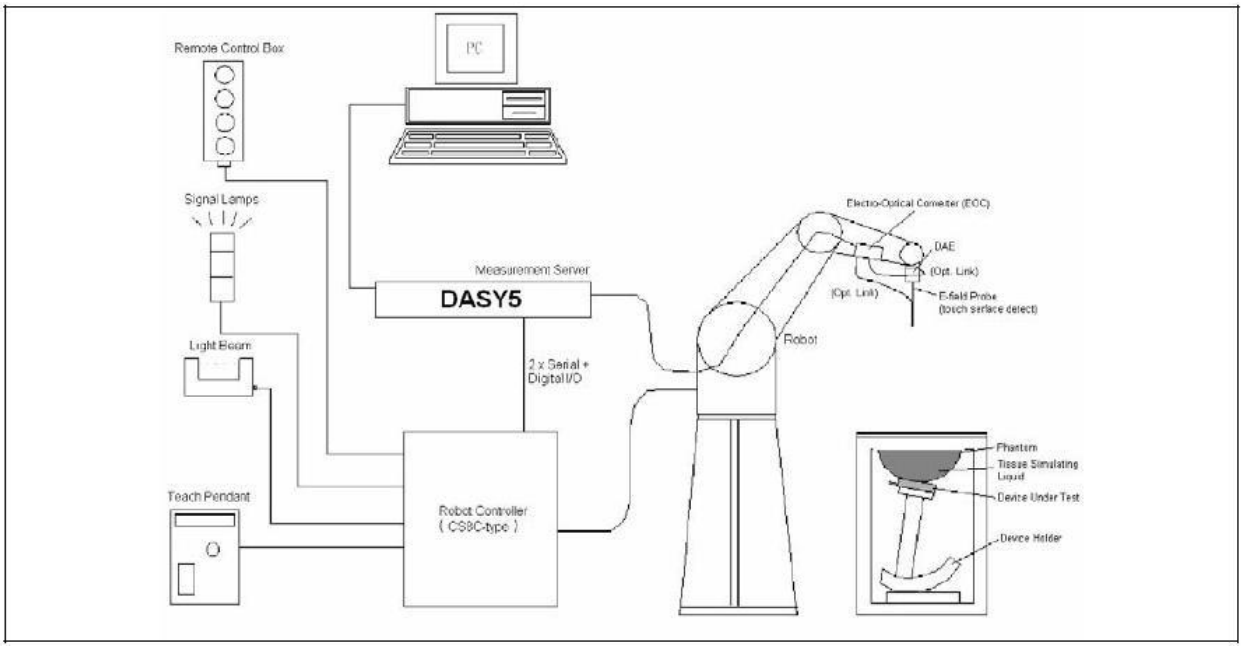
| | | | | |
|---|---|---|---|---|
| Antenna model / type number .. : | N/A | | | |
| Antenna serial number ..... : | N/A | | | |
| Antenna Delivery ..... : | ☒ | 1TX + 1RX | | |
| | ☒ | 2TX + 2RX | | |
| | ☐ | Others:…… | | |
| Antenna technology ..... : | ☒ | SISO | | |
| | ☒ | MIMO | ☒ | CDD |
| | | | ☐ | Beam-forming |
| Antenna Type ..... : | ☐ | External | ☐ | Dipole |
| | | | ☐ | Sectorized |
| | ☒ | Internal | ☒ | PIFA |
| | | | ☐ | PCB |
| | | | ☐ | Metal Antenna |
| | | | ☐ | Others…….. |

## Antenna Location Map



# 2 SAR MEASUREMENT SYSTEM

## 2.1 DASY5 System Description




| |
|---|
| The DASY5 system for performing compliance tests consists of the following items: |
| 1. A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE). |
| 2. A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC. |
| 3. The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server. |
| 4. The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning. |
| 5. A computer running WinXP and the DASY5 software. |
| 6. Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc. |
| 7. The phantom, the device holder and other accessories according to the targeted measurement. |

### 2.1.1. Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g., IEEE 1528, OET 65, IEC 62209-1, IEC 62209-2, EN 50360, EN 50383, EN62311 and others.

### 2.1.2. Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a $10mm^2$ step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

### 2.1.3. Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 $kg/m^3$ is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 7x7x7 (5mmx5mmx5mm) providing a volume of 30mm in the X & Y axis, and 30mm in the Z axis.

### 2.1.4. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}} \cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$

$$f_2(x,y,z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

## 2.2 DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.
SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D**.**

| **Model** | EX3DV4 | |
|---|---|---|
| **Construction** | Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE) | |
| **Frequency** | 10 MHz to 6 GHz<br>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<br>Linearity: ± 0.2 dB (noise: typically < 1 µW/g) | |
| **Dimensions** | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |
| **Application** | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. | |

## 2.3 Boundary Detection Unit and Probe Mounting Device

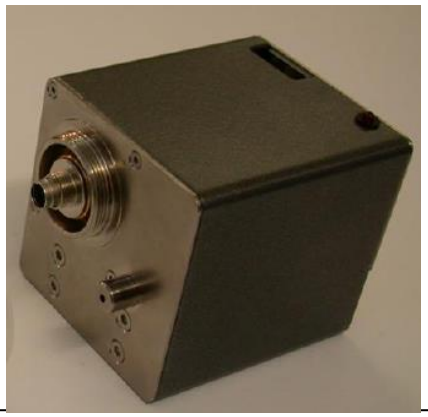
The DASY probes use a precise connector and an additional holder for the probe, consisting of a plastic tube and a flexible silicon ring to center the probe. The connector at the DAE is flexibly mounted and held in the default position with magnets and springs. Two switching systems in the connector mount detect frontal and lateral probe collisions and trigger the necessary software response.

## 2.4 DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit.

Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.

## 2.5 Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.
The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

## 2.6 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

## 2.7 Device Holder

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).
Thus the device needs no repositioning when changing the angles.
The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

## 2.8 SAM Twin Phantom

### SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- Left head
- Right head
- Flat phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

### ELI Phantom

The SAM phantom is a fiberglass shell phantom with 2mm shell thickness. It has one measurement areas:

- ELI phantom

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

# 3 TISSUE SIMULATING LIQUID

## 3.1 The composition of the tissue simulating liquid

| INGREDIENT (% Weight) | 2450MHz Body | 5250MHz Body | 5600MHz Body | 5750MHz Body |
|---|---|---|---|---|
| Water | 73.2 | 75.68 | 75.68 | 75.68 |
| Salt | 0.04 | 0.43 | 0.43 | 0.43 |
| Sugar | 0.00 | 0.00 | 0.00 | 0.00 |
| HEC | 0.00 | 0.00 | 0.00 | 0.00 |
| Preventol | 0.00 | 0.00 | 0.00 | 0.00 |
| DGBE | 26.76 | 4.42 | 4.42 | 4.42 |
| Triton X-100 | 0.00 | 19.47 | 19.47 | 19.47 |

## 3.2 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY5 Dielectric Probe Kit and Agilent Vector Network Analyzer E5071C

| **Head Tissue Simulant Measurement** | | | | |
|---|---|---|---|---|
| Frequency [MHz] | Description | Dielectric Parameters | | Tissue Temp. [°C] |
| | | $\varepsilon_r$ | σ [s/m] | |
| 2450 MHz | Reference result ± 5% window | 39.2 37.24 to 41.16 | 1.80 1.71 to 1.89 | N/A |
| | 08-07-2022 | 38.535 | 1.86 | 21.0 |
| 5250 MHz | Reference result ± 5% window | 35.94 34.14 to 37.74 | 4.69 4.46 to 4.92 | N/A |
| | 08-07-2022 | 36.049 | 4.604 | 21.0 |
| 5600 MHz | Reference result ± 5% window | 35.53 33.75 to 37.31 | 4.93 4.68 to 5.18 | N/A |
| | 08-07-2022 | 35.947 | 5.034 | 21.0 |
| 5750 MHz | Reference result ± 5% window | 35.36 33.59 to 37.13 | 5.04 4.79 to 5.29 | N/A |
| | 08-07-2022 | 35.386 | 5.101 | 21.0 |

**Head Tissue Simulant Measurement (Test Data: 08-03-2022)**

| Frequency [MHz] | Dielectric Parameters | | | | | | Tissue Temp. [°C] |
|---|---|---|---|---|---|---|---|
| | Permittivity $\varepsilon_r$ | Conductivity σ | Permittivity Target $\varepsilon_r$ | Conductivity Target σ | Delta ($\varepsilon_r$) % | Delta (σ) % | |
| 2402 | 38.57 | 1.81 | 39.29 | 1.76 | -1.86 | 2.84 | 21.0 |
| 2412 | 38.52 | 1.83 | 39.27 | 1.77 | -1.98 | 3.39 | 21.0 |
| 2437 | 38.42 | 1.86 | 38.46 | 1.79 | -0.21 | 3.91 | 21.0 |
| 2441 | 38.40 | 1.87 | 39.22 | 1.79 | -2.04 | 4.47 | 21.0 |
| 2462 | 38.32 | 1.89 | 39.18 | 1.81 | -2.24 | 4.42 | 21.0 |
| 2480 | 38.30 | 1.91 | 39.15 | 1.83 | -2.30 | 4.37 | 21.0 |
| 5220 | 36.10 | 4.56 | 36.47 | 4.72 | -1.10 | -3.39 | 21.0 |
| 5260 | 36.05 | 4.62 | 36.39 | 4.76 | -0.96 | -2.94 | 21.0 |
| 5320 | 35.98 | 4.66 | 36.30 | 4.78 | -0.88 | -2.51 | 21.0 |
| 5500 | 35.76 | 4.84 | 35.63 | 4.97 | 0.45 | -2.62 | 21.0 |
| 5580 | 35.61 | 4.93 | 35.53 | 5.05 | 0.31 | -2.38 | 21.0 |
| 5700 | 35.45 | 5.06 | 35.40 | 5.17 | 0.14 | -2.13 | 21.0 |
| 5745 | 35.40 | 5.09 | 35.36 | 5.22 | 0.00 | -2.49 | 21.0 |
| 5785 | 35.33 | 5.15 | 35.32 | 5.26 | 0.08 | -2.09 | 21.0 |
| 5825 | 35.32 | 5.18 | 35.28 | 5.30 | 0.06 | -2.26 | 21.0 |

Note:

1. The delta ($\varepsilon_r$) and (σ) are within ±5%, delta SAR value was not calculated in this report.
2. As per IEC 62209-2 Annex F, the SAR correction factor is given by:

   $\Delta SAR = c_\varepsilon \, \Delta\varepsilon_r + c_\sigma \, \Delta\sigma$

   For the1g average SAR Cε and Cσ are given by:

   Cε = -7.854x10^-4f^3 + 9.402x10^-3f^2 – 2.742x10^-2f – 0.2026

   Cσ = 9.804x10^-3f^3 – 8.661x10^-2f^2 + 2.981x10^-2f + 0.7829

   Where f is the frequency in GHz.

| Head Tissue Simulant Measurement (Test Data: 08-01-2022) | | | | | | |
|---|---|---|---|---|---|---|
| Frequency [MHz] | Dielectric Parameters | | | | | Tissue Temp. [°C] |
| | Delta ($\varepsilon_r$) % | Delta ($\sigma$) % | C$\varepsilon$ | C$\sigma$ | Delta SAR% | |
| 2402 | -1.86 | 2.84 | -0.23 | 0.49 | 1.81 | 21.0 |
| 2412 | -1.98 | 3.39 | -0.23 | 0.49 | 2.10 | 21.0 |
| 2437 | -0.21 | 3.91 | -0.22 | 0.48 | 1.94 | 21.0 |
| 2441 | -2.04 | 4.47 | -0.22 | 0.48 | 2.61 | 21.0 |
| 2462 | -2.24 | 4.42 | -0.22 | 0.48 | 2.61 | 21.0 |
| 2480 | -2.30 | 4.37 | -0.22 | 0.47 | 2.59 | 21.0 |
| 5220 | -1.10 | -3.39 | -0.20 | -0.03 | 0.31 | 21.0 |
| 5260 | -0.96 | -2.94 | -0.20 | -0.03 | 0.28 | 21.0 |
| 5320 | -0.88 | -2.51 | -0.20 | -0.03 | 0.26 | 21.0 |
| 5500 | 0.45 | -2.62 | -0.20 | -0.04 | 0.02 | 21.0 |
| 5580 | 0.31 | -2.38 | -0.20 | -0.04 | 0.04 | 21.0 |
| 5700 | 0.14 | -2.13 | -0.20 | -0.05 | 0.07 | 21.0 |
| 5745 | 0.00 | -2.49 | -0.20 | -0.05 | 0.11 | 21.0 |
| 5785 | 0.08 | -2.09 | -0.20 | -0.05 | 0.08 | 21.0 |
| 5825 | 0.06 | -2.26 | -0.20 | -0.04 | 0.09 | 21.0 |

Note: The ΔSAR refers to the percent change in SAR relative to the percent change in dielectric properties versus the target values. A negative ΔSAR would translate to a lower measured SAR value than what would be measured if using dielectric properties equal to the target values. A positive ΔSAR would translate to a higher measured SAR value than what would be measured if using dielectric properties equal to the target values. SAR correction shall not be made when the ΔSAR has a positive sign to provide a conservative SAR value.The SAR is only corrected when ΔSAR has a negative sign.

## 3.3 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

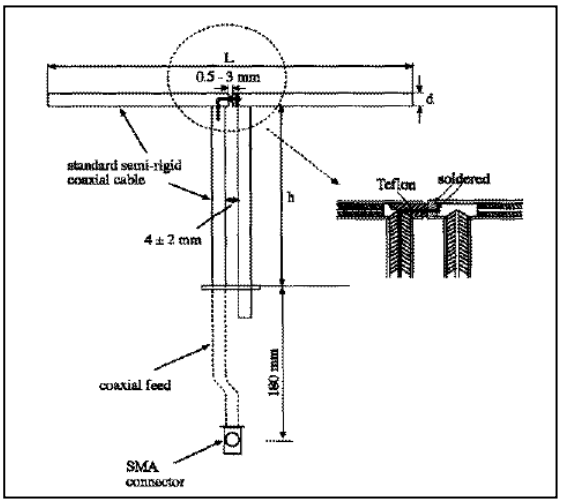
| Target Frequency | Head | |
|---|---|---|
| (MHz) | $\varepsilon_r$ | $\sigma$ (S/m) |
| 150 | 52.3 | 0.76 |
| 300 | 45.3 | 0.87 |
| 450 | 43.5 | 0.87 |
| 835 | 41.5 | 0.90 |
| 900 | 41.5 | 0.97 |
| 915 | 41.5 | 0.98 |
| 1450 | 40.5 | 1.20 |
| 1610 | 40.3 | 1.29 |
| 1800 – 2000 | 40.0 | 1.40 |
| 2450 | **39.2** | **1.80** |
| 4000 | 37.4 | 3.43 |
| 5200 | **36.0** | **4.66** |
| 5800 | **35.3** | **5.07** |

($\varepsilon_r$ = relative permittivity, $\sigma$ = conductivity and $\rho$ = 1000 kg/m$^3$)

# 4 SAR MEASUREMENT PROCEDURE

## 4.1 SAR System Validation

### 4.1.1. Validation Dipoles




The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of both IEEE and FCC Supplement C. the table below provides details for the mechanical and electrical specifications for the dipoles.

| Frequency | L (mm) | h (mm) | d (mm) |
|---|---|---|---|
| 2450MHz | 53.5 | 30.4 | 3.6 |
| 5250MHz | 20.6 | 14.2 | 3.6 |
| 5600MHz | 20.6 | 14.2 | 3.6 |
| 5750MHz | 20.6 | 14.2 | 3.6 |

### 4.1.2. Validation Result

| System Performance Check at 2450MHz, 5250MHz, 5600MHz and 5750MHz | | | | |
|---|---|---|---|---|
| Frequency [MHz] | Description | SAR [w/kg] 1g | SAR [w/kg] 10g | Tissue Temp. [°C] |
| 2450 MHz | Reference result ± 10% window | 51.2 46.08 to 56.32 | 23.6 21.24 to 25.96 | N/A |
| | 08-07-2022 | 52.00 | 24.28 | 21.0 |
| 5250 MHz | Reference result ± 10% window | 75.5 67.95 to 83.05 | 21.6 19.44 to 23.76 | N/A |
| | 08-07-2022 | 76.30 | 22.00 | 21.0 |
| 5600 MHz | Reference result ± 10% window | 79.7 71.73 to 87.67 | 23.0 20.7 to 25.3 | N/A |
| | 08-07-2022 | 79.90 | 22.90 | 21.0 |
| 5750 MHz | Reference result ± 10% window | 78.6 70.74 to 86.46 | 22.4 20.16 to 24.64 | N/A |
| | 08-07-2022 | 80.50 | 23.00 | 21.0 |
| Note: All SAR values are normalized to 1W forward power. | | | | |

## 4.2 SAR Measurement Procedure

The DASY 5 calculates SAR using the following equation,

$$SAR = \frac{\sigma |E|^2}{\rho}$$

σ: represents the simulated tissue conductivity
ρ: represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at $1mm^2$ ) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at $1mm^3$ ).

# 5 SAR EXPOSURE LIMITS

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Type Exposure | Uncontrolled Environment Limit |
|---|---|
| Spatial Peak SAR (1g cube tissue for brain or body) | **1.60 W/kg** |
| Spatial Average SAR (whole body) | **0.08 W/kg** |
| Spatial Peak SAR (10g for hands, feet, ankles and wrist) | **4.00 W/kg** |

# 6 TEST EQUIPMENT LIST

| Instrument | Manufacturer | Model No. | Serial No. | Cali. Due Date |
|---|---|---|---|---|
| Stäubli Robot TX60L | Stäubli | TX60L | F10/5C90A1/A/01 | N/A |
| Controller | Stäubli | SP1 | S-0034 | N/A |
| Dipole Validation Kits | Speag | D2450V2 | 938 | 2025.03.31 |
| Dipole Validation Kits | Speag | D5GHzV2 | 1078 | 2025.03.27 |
| SAM Twin Phantom | Speag | SAM | TP-1561/1562 | N/A |
| Device Holder | Speag | SD 000 H01 HA | N/A | N/A |
| Data Acquisition Electronic | Speag | DAE4 | 1220 | 2023.03.23 |
| E-Field Probe | Speag | EX3DV4 | 3710 | 2023.4.17 |
| SAR Software | Speag | DASY5 | V5.2 Build 162 | N/A |
| Power Amplifier | Mini-Circuit | ZVA-183-S+ | N657400950 | N/A |
| Directional Coupler | Agilent | 778D | 20160 | N/A |
| Vector Network | Agilent | E5071C | MY46103316 | 2022.10.26 |
| Signal Generator | Agilent | E4438C | MY45092174 | 2023.06.30 |
| Spectrum Analyzer | Agilent | N9010A | MY48030494 | 2023.06.30 |
| Temperature/Humidity Meter | RTS | RTS-8S | RF02 | 2023.03.09 |
| Temperature Meter | Dretec | O-274 | RF-001 | 2022.11.23 |

# 7 MEASUREMENT UNCERTAINTY

| **DASY5 Uncertainty according to IEEE std. 1528-2013**<br>Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram / 10 gram. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Error Description | Uncert. value | Prob. Dist. | Div. | ($c_i$) 1g | ($c_i$) 10g | Std. Unc.(1g) | Std. Unc.(10g) | ($v_i$) $v_{eff}$ |
| **Measurement System** | | | | | | | | |
| Probe Calibration | ±6.0% | N | 1 | 1 | 1 | ±6.0% | ±6.0% | ∞ |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Hemispherical Isotropy | ±9.6% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Boundary Effects | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| System Detection Limits | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Readout Electronics | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% | ∞ |
| Response Time | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Integration Time | ±2.6% | R | $\sqrt{3}$ | 1 | 1 | ±1.5% | ±1.5% | ∞ |
| RF Ambient Noise | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| RF Ambient Reflections | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Positioner | ±0.4% | R | $\sqrt{3}$ | 1 | 1 | ±0.2% | ±0.2% | ∞ |
| Probe Positioning | ±2.9% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Max. SAR Eval. | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| Device Holder | ±3.6% | N | 1 | 1 | 1 | ±3.6% | ±3.6% | 5 |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | ±4.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| Liquid Conductivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.64 | 0.43 | ±1.8% | ±1.2% | ∞ |
| Liquid Conductivity (meas.) | ±2.5% | N | 1 | 0.64 | 0.43 | ±1.6% | ±1.1% | ∞ |
| Liquid Permittivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.6 | 0.49 | ±1.7% | ±1.4% | ∞ |
| Liquid Permittivity (meas.) | ±2.5% | N | 1 | 0.6 | 0.49 | ±1.5% | ±1.2% | ∞ |
| **Combined Std. Uncertainty** | | | | | | ±11.0% | ±10.8% | 387 |
| **Expanded STD Uncertainty** | | | | | | ±22.0% | ±21.5% | |

| **DASY5 Uncertainty according to IEEE std. 1528-2013**<br>Measurement uncertainty for 3 GHz to 6 GHz averaged over 1 gram / 10 gram. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Error Description | Uncert. value | Prob. Dist. | Div. | ($c_i$) 1g | ($c_i$) 10g | Std. Unc. (1g) | Std. Unc. (10g) | ($v_i$) $v_{eff}$ |
| **Measurement System** | | | | | | | | |
| Probe Calibration | ±6.55% | N | 1 | 1 | 1 | ±6.55% | ±6.55% | ∞ |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Hemispherical Isotropy | ±9.6% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Boundary Effects | ±2.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.2% | ±1.2% | ∞ |
| Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| System Detection Limits | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Readout Electronics | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% | ∞ |
| Response Time | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Integration Time | ±2.6% | R | $\sqrt{3}$ | 1 | 1 | ±1.5% | ±1.5% | ∞ |
| RF Ambient Noise | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| RF Ambient Reflections | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Positioner | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Probe Positioning | ±9.9% | R | $\sqrt{3}$ | 1 | 1 | ±5.7% | ±5.7% | ∞ |
| Max. SAR Eval. | ±4.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| Device Holder | ±3.6% | N | 1 | 1 | 1 | ±3.6% | ±3.6% | 5 |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | ±4.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| Liquid Conductivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.64 | 0.43 | ±1.8% | ±1.2% | ∞ |
| Liquid Conductivity (meas.) | ±2.5% | N | 1 | 0.64 | 0.43 | ±1.6% | ±1.1% | ∞ |
| Liquid Permittivity (target) | ±5.0% | R | $\sqrt{3}$ | 0.6 | 0.49 | ±1.7% | ±1.4% | ∞ |
| Liquid Permittivity (meas.) | ±2.5% | N | 1 | 0.6 | 0.49 | ±1.5% | ±1.2% | ∞ |
| **Combined Std. Uncertainty** | | | | | | ±12.8% | ±12.6% | 330 |
| **Expanded STD Uncertainty** | | | | | | ±25.6% | ±25.2% | |

# 8 POWER TEST RESULTS

**2.4GHz：**

**SISO:**

| Mode | Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|---|
| | | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 802.11b | 01 | 2412 | 17.69 | 17.51 | 18.00 | 18.00 | 1.074 | 1.119 | Pass |
| | 06 | 2437 | 17.89 | 17.69 | 18.00 | 18.00 | 1.026 | 1.074 | Pass |
| | 11 | 2462 | 17.88 | 17.65 | 18.00 | 18.00 | 1.028 | 1.084 | Pass |
| 802.11g | 01 | 2412 | 18.66 | 18.39 | 19.00 | 19.00 | 1.081 | 1.151 | Pass |
| | 06 | 2437 | 18.72 | 18.45 | 19.00 | 19.00 | 1.067 | 1.135 | Pass |
| | 11 | 2462 | 18.65 | 18.33 | 19.00 | 19.00 | 1.084 | 1.167 | Pass |
| 802.11n | 01 | 2412 | 18.65 | 18.39 | 19.00 | 19.00 | 1.084 | 1.151 | Pass |
| | 06 | 2437 | 18.56 | 18.29 | 19.00 | 19.00 | 1.107 | 1.178 | Pass |
| | 11 | 2462 | 18.28 | 18.96 | 19.00 | 19.00 | 1.180 | 1.009 | Pass |

**MIMO**

| Mode | Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|---|
| 802.11g | 01 | 2412 | 21.82 | 22.00 | 1.042 | Pass |
| | 06 | 2437 | 21.86 | 22.00 | 1.033 | Pass |
| | 11 | 2462 | 21.65 | 22.00 | 1.084 | Pass |
| 802.11n | 01 | 2412 | 21.75 | 22.00 | 1.059 | Pass |
| | 06 | 2437 | 21.69 | 22.00 | 1.074 | Pass |
| | 11 | 2462 | 21.45 | 22.00 | 1.135 | Pass |

**5GHz 802.11a:**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 36 | 5180 | 14.15 | 13.26 | 14.50 | 13.50 | 1.084 | 1.057 | Pass |
| 44 | 5220 | 14.19 | 13.31 | 14.50 | 13.50 | 1.074 | 1.045 | Pass |
| 48 | 5240 | 14.18 | 13.28 | 14.50 | 13.50 | 1.076 | 1.052 | Pass |
| 52 | 5260 | 14.21 | 13.34 | 14.50 | 13.50 | 1.069 | 1.038 | Pass |
| 60 | 5300 | 14.22 | 13.29 | 14.50 | 13.50 | 1.067 | 1.050 | Pass |
| 64 | 5320 | 14.24 | 13.32 | 14.50 | 13.50 | 1.062 | 1.042 | Pass |
| 100 | 5500 | 12.21 | 11.32 | 12.50 | 11.50 | 1.069 | 1.042 | Pass |
| 116 | 5580 | 12.23 | 11.39 | 12.50 | 11.50 | 1.064 | 1.026 | Pass |
| 140 | 5700 | 12.24 | 11.41 | 12.50 | 11.50 | 1.062 | 1.021 | Pass |
| 149 | 5745 | 11.69 | 10.88 | 12.00 | 11.00 | 1.074 | 1.028 | Pass |
| 157 | 5785 | 11.75 | 10.90 | 12.00 | 11.00 | 1.059 | 1.023 | Pass |
| 165 | 5825 | 11.72 | 10.92 | 12.00 | 11.00 | 1.067 | 1.019 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 36 | 5180 | 16.77 | 17.50 | 1.183 | Pass |
| 44 | 5220 | 16.76 | 17.50 | 1.186 | Pass |
| 48 | 5240 | 16.82 | 17.50 | 1.169 | Pass |
| 52 | 5260 | 16.82 | 17.50 | 1.169 | Pass |
| 60 | 5300 | 16.82 | 17.50 | 1.169 | Pass |
| 64 | 5320 | 16.81 | 17.50 | 1.172 | Pass |
| 100 | 5500 | 14.25 | 15.50 | 1.334 | Pass |
| 116 | 5580 | 14.80 | 15.50 | 1.175 | Pass |
| 140 | 5700 | 14.84 | 15.50 | 1.164 | Pass |
| 149 | 5745 | 14.28 | 15.50 | 1.324 | Pass |
| 157 | 5785 | 14.31 | 15.50 | 1.315 | Pass |
| 165 | 5825 | 14.30 | 15.50 | 1.318 | Pass |

**5GHz 802.11n(20MHz):**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 36 | 5180 | 14.49 | 13.56 | 15.00 | 14.00 | 1.125 | 1.107 | Pass |
| 44 | 5220 | 14.51 | 13.58 | 15.00 | 14.00 | 1.119 | 1.102 | Pass |
| 48 | 5240 | 14.54 | 13.54 | 15.00 | 14.00 | 1.112 | 1.112 | Pass |
| 52 | 5260 | 14.47 | 13.60 | 15.00 | 14.00 | 1.130 | 1.096 | Pass |
| 60 | 5300 | 14.45 | 13.55 | 15.00 | 14.00 | 1.135 | 1.109 | Pass |
| 64 | 5320 | 14.44 | 13.53 | 15.00 | 14.00 | 1.138 | 1.114 | Pass |
| 100 | 5500 | 12.58 | 11.48 | 13.00 | 12.00 | 1.102 | 1.127 | Pass |
| 116 | 5580 | 12.62 | 11.45 | 13.00 | 12.00 | 1.091 | 1.135 | Pass |
| 140 | 5700 | 12.65 | 11.47 | 13.00 | 12.00 | 1.084 | 1.130 | Pass |
| 149 | 5745 | 12.15 | 10.98 | 12.50 | 11.50 | 1.084 | 1.127 | Pass |
| 157 | 5785 | 12.16 | 10.95 | 12.50 | 11.50 | 1.081 | 1.135 | Pass |
| 165 | 5825 | 12.19 | 10.92 | 12.50 | 11.50 | 1.074 | 1.143 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 36 | 5180 | 17.11 | 18.00 | 1.227 | Pass |
| 44 | 5220 | 17.14 | 18.00 | 1.219 | Pass |
| 48 | 5240 | 17.09 | 18.00 | 1.233 | Pass |
| 52 | 5260 | 17.07 | 18.00 | 1.239 | Pass |
| 60 | 5300 | 17.06 | 18.00 | 1.242 | Pass |
| 64 | 5320 | 17.03 | 18.00 | 1.250 | Pass |
| 100 | 5500 | 15.01 | 16.00 | 1.256 | Pass |
| 116 | 5580 | 15.08 | 16.00 | 1.236 | Pass |
| 140 | 5700 | 15.12 | 16.00 | 1.225 | Pass |
| 149 | 5745 | 14.64 | 15.50 | 1.219 | Pass |
| 157 | 5785 | 14.71 | 15.50 | 1.199 | Pass |
| 165 | 5825 | 14.66 | 15.50 | 1.213 | Pass |

**5GHz 802.11n(40MHz):**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 38 | 5190 | 14.28 | 13.36 | 14.50 | 13.50 | 1.052 | 1.033 | Pass |
| 46 | 5230 | 14.31 | 13.34 | 14.50 | 13.50 | 1.045 | 1.038 | Pass |
| 54 | 5270 | 14.35 | 13.39 | 14.50 | 13.50 | 1.035 | 1.026 | Pass |
| 62 | 5310 | 14.32 | 13.41 | 14.50 | 13.50 | 1.042 | 1.021 | Pass |
| 102 | 5510 | 12.28 | 11.41 | 12.50 | 11.50 | 1.052 | 1.021 | Pass |
| 118 | 5590 | 12.31 | 11.39 | 12.50 | 11.50 | 1.045 | 1.026 | Pass |
| 134 | 5670 | 12.35 | 11.45 | 12.50 | 11.50 | 1.035 | 1.012 | Pass |
| 151 | 5755 | 11.83 | 10.88 | 12.00 | 11.00 | 1.040 | 1.028 | Pass |
| 159 | 5795 | 11.87 | 10.91 | 12.00 | 11.00 | 1.030 | 1.021 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 38 | 5190 | 16.93 | 17.50 | 1.140 | Pass |
| 46 | 5230 | 16.91 | 17.50 | 1.146 | Pass |
| 54 | 5270 | 16.88 | 17.50 | 1.153 | Pass |
| 62 | 5310 | 16.87 | 17.50 | 1.156 | Pass |
| 102 | 5510 | 14.92 | 15.50 | 1.143 | Pass |
| 118 | 5590 | 14.92 | 15.50 | 1.143 | Pass |
| 134 | 5670 | 14.91 | 15.50 | 1.146 | Pass |
| 151 | 5755 | 14.39 | 15.00 | 1.151 | Pass |
| 159 | 5795 | 14.42 | 15.00 | 1.143 | Pass |

**5GHz 802.11ac(20MHz):**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 36 | 5180 | 14.18 | 13.26 | 14.50 | 13.50 | 1.076 | 1.057 | Pass |
| 44 | 5220 | 14.21 | 13.28 | 14.50 | 13.50 | 1.069 | 1.052 | Pass |
| 48 | 5240 | 14.23 | 13.29 | 14.50 | 13.50 | 1.064 | 1.050 | Pass |
| 52 | 5260 | 14.19 | 13.32 | 14.50 | 13.50 | 1.074 | 1.042 | Pass |
| 60 | 5300 | 14.16 | 13.33 | 14.50 | 13.50 | 1.081 | 1.040 | Pass |
| 64 | 5320 | 14.12 | 13.35 | 14.50 | 13.50 | 1.091 | 1.035 | Pass |
| 100 | 5500 | 12.25 | 11.31 | 12.50 | 11.50 | 1.059 | 1.045 | Pass |
| 116 | 5580 | 12.21 | 11.35 | 12.50 | 11.50 | 1.069 | 1.035 | Pass |
| 140 | 5700 | 12.25 | 11.34 | 12.50 | 11.50 | 1.059 | 1.038 | Pass |
| 149 | 5745 | 11.72 | 10.82 | 12.00 | 11.00 | 1.067 | 1.042 | Pass |
| 157 | 5785 | 11.69 | 10.84 | 12.00 | 11.00 | 1.074 | 1.038 | Pass |
| 165 | 5825 | 11.75 | 10.80 | 12.00 | 11.00 | 1.059 | 1.047 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 36 | 5180 | 16.83 | 17.50 | 1.167 | Pass |
| 44 | 5220 | 16.83 | 17.50 | 1.167 | Pass |
| 48 | 5240 | 16.85 | 17.50 | 1.161 | Pass |
| 52 | 5260 | 16.85 | 17.50 | 1.161 | Pass |
| 60 | 5300 | 16.83 | 17.50 | 1.167 | Pass |
| 64 | 5320 | 16.81 | 17.50 | 1.172 | Pass |
| 100 | 5500 | 14.85 | 15.50 | 1.161 | Pass |
| 116 | 5580 | 14.86 | 15.50 | 1.159 | Pass |
| 140 | 5700 | 14.83 | 15.50 | 1.167 | Pass |
| 149 | 5745 | 14.29 | 15.00 | 1.178 | Pass |
| 157 | 5785 | 14.28 | 15.00 | 1.180 | Pass |
| 165 | 5825 | 14.33 | 15.00 | 1.167 | Pass |

**5GHz 802.11ac(40MHz):**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 38 | 5190 | 14.05 | 13.11 | 14.50 | 13.50 | 1.109 | 1.094 | Pass |
| 46 | 5230 | 14.12 | 13.14 | 14.50 | 13.50 | 1.091 | 1.086 | Pass |
| 54 | 5270 | 14.02 | 13.09 | 14.50 | 13.50 | 1.117 | 1.099 | Pass |
| 62 | 5310 | 14.12 | 13.15 | 14.50 | 13.50 | 1.091 | 1.084 | Pass |
| 102 | 5510 | 12.15 | 11.04 | 12.50 | 11.50 | 1.084 | 1.112 | Pass |
| 118 | 5590 | 12.09 | 11.02 | 12.50 | 11.50 | 1.099 | 1.117 | Pass |
| 134 | 5670 | 12.12 | 11.08 | 12.50 | 11.50 | 1.091 | 1.102 | Pass |
| 151 | 5755 | 11.55 | 10.64 | 12.00 | 11.00 | 1.109 | 1.086 | Pass |
| 159 | 5795 | 11.57 | 10.66 | 12.00 | 11.00 | 1.104 | 1.081 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 38 | 5190 | 16.62 | 17.50 | 1.225 | Pass |
| 46 | 5230 | 16.65 | 17.50 | 1.216 | Pass |
| 54 | 5270 | 16.59 | 17.50 | 1.233 | Pass |
| 62 | 5310 | 16.65 | 17.50 | 1.216 | Pass |
| 102 | 5510 | 14.62 | 15.50 | 1.225 | Pass |
| 118 | 5590 | 14.59 | 15.50 | 1.233 | Pass |
| 134 | 5670 | 14.65 | 15.50 | 1.216 | Pass |
| 151 | 5755 | 14.11 | 15.00 | 1.227 | Pass |
| 159 | 5795 | 14.11 | 15.00 | 1.227 | Pass |

**5GHz 802.11ac(80MHz):**

**SISO:**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | | Tune up Power Output (dBm) | | Tune up Factor | | Result |
|---|---|---|---|---|---|---|---|---|
| | | Ant 1 | Ant 2 | Ant 1 | Ant 2 | Ant 1 | Ant 2 | |
| 42 | 5210 | 13.81 | 12.87 | 14.00 | 13.00 | 1.045 | 1.030 | Pass |
| 58 | 5290 | 13.83 | 12.91 | 14.00 | 13.00 | 1.040 | 1.021 | Pass |
| 106 | 5530 | 11.78 | 10.81 | 12.00 | 11.00 | 1.052 | 1.045 | Pass |
| 155 | 5775 | 11.32 | 10.29 | 11.50 | 10.50 | 1.042 | 1.050 | Pass |

**MIMO**

| Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|
| 42 | 5210 | 16.37 | 17.00 | 1.156 | Pass |
| 58 | 5290 | 16.42 | 17.00 | 1.143 | Pass |
| 106 | 5530 | 14.57 | 15.00 | 1.104 | Pass |
| 155 | 5775 | 14.04 | 14.50 | 1.112 | Pass |

## Bluetooth

| Mode | Channel | Test Frequency (MHz) | Conducted Power Output (dBm) | Tune up Power Output (dBm) | Tune up Factor | Result |
|---|---|---|---|---|---|---|
| GFSK | 00 | 2402 | 1.35 | 2.00 | 1.161 | Pass |
| | 39 | 2441 | 1.58 | 2.00 | 1.102 | Pass |
| | 78 | 2480 | 1.34 | 2.00 | 1.164 | Pass |
| Pi/4 DQPSK | 00 | 2402 | 4.32 | 5.00 | 1.169 | Pass |
| | 39 | 2441 | 3.83 | 5.00 | 1.309 | Pass |
| | 78 | 2480 | 4.33 | 5.00 | 1.167 | Pass |
| 8DPSK | 00 | 2402 | 4.35 | 5.00 | 1.161 | Pass |
| | 39 | 2441 | 3.94 | 5.00 | 1.276 | Pass |
| | 78 | 2480 | 4.43 | 5.00 | 1.140 | Pass |
| LE 1M | 00 | 2402 | 5.85 | 6.00 | 1.035 | Pass |
| | 19 | 2440 | 5.27 | 6.00 | 1.183 | Pass |
| | 39 | 2480 | 4.53 | 6.00 | 1.403 | Pass |
| LE 2M | 00 | 2402 | 5.51 | 6.00 | 1.119 | Pass |
| | 19 | 2440 | 4.84 | 6.00 | 1.306 | Pass |
| | 39 | 2480 | 4.12 | 6.00 | 1.542 | Pass |

**DUTY CYCLE**

| Test Mode | Tx On (ms) | Tx Off (ms) | Duty Cycle (%) | Duty Cycle Factor |
|---|---|---|---|---|
| 2.4GHz 802.11b | N/A | N/A | 100.00 | 1.00 |
| 2.4GHz 802.11g | N/A | N/A | 100.00 | 1.00 |
| 2.4GHz 802.11n(20MHz) | N/A | N/A | 100.00 | 1.00 |
| 5GHz 802.11a | 2.044 | 0.049 | 97.70 | 1.02 |
| 5GHz 802.11n(20MHz) | 2.044 | 0.049 | 97.70 | 1.02 |
| 5GHz 802.11n(40MHz) | 0.612 | 0.144 | 80.90 | 1.24 |
| 5GHz 802.11ac(20MHz) | 2.044 | 0.049 | 97.70 | 1.02 |
| 5GHz 802.11ac(40MHz) | 0.612 | 0.144 | 80.90 | 1.24 |
| 5GHz 802.11ac(80MHz) | 0.288 | 0.052 | 68.20 | 1.47 |
| Bluetooth3.0(DH5) | 2.22 | 1.53 | 59.20 | 1.69 |
| Bluetooth5.0(BLE) | 380 | 250 | 60.32 | 1.66 |

Note: We evaluated all models and only represented the worst data.

# 9 SAR TEST RESULTS

## 9.1 Standalone SAR

| SAR MEASUREMENT | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ambient Temperature (°C) : 21.5 ±2 | | | | Relative Humidity (%): 52 | | | |
| Liquid Temperature (°C) : 21.0 ±2 | | | | Depth of Liquid (cm):>15 | | | |
| Product:Touch All in One Computer_Test distance: 0mm | | | | | | | |
| Test Position | Test Mode | Frequency | | Antenna | Power Drift (<±0.2) | SAR 1g (W/kg) | Limit (W/kg) |
| | | Channel | MHz | | | | |
| WLAN2.4G Body SAR | | | | | | | |
| Top | 802.11b | 6 | 2437 | Main | 0.01 | 0.762 | 1.6 |
| Left | 802.11b | 6 | 2437 | Main | 0.05 | 0.014 | 1.6 |
| Top | 802.11b | 6 | 2437 | Aux | 0.11 | 0.725 | 1.6 |
| Right | 802.11b | 6 | 2437 | Aux | 0.03 | 0.011 | 1.6 |
| * Top | 802.11g | 6 | 2437 | MIMO Aux | -0.03 | 0.901 | 1.6 |
| Top | 802.11g | 6 | 2437 | MIMO Main | 0.02 | 0.841 | 1.6 |
| Top | 802.11g | 6 | 2437 | MIMO Aux | 0.01 | 0.854 | 1.6 |
| * Top | 802.11g | 1 | 2412 | MIMO Aux | 0.06 | 0.934 | 1.6 |
| Top | 802.11g | 1 | 2412 | MIMO Main | -0.02 | 0.894 | 1.6 |
| Top | 802.11g | 1 | 2412 | MIMO Aux | 0.06 | 0.906 | 1.6 |
| Top | 802.11g | 11 | 2462 | MIMO Aux | -0.03 | 0.767 | 1.6 |
| Top | 802.11g | 11 | 2462 | MIMO Main | 0.14 | 0.754 | 1.6 |
| Bluetooth Body SAR | | | | | | | |
| Top | DH5 | 0 | 2402 | Aux | -0.13 | 0.076 | 1.6 |
| Top | DH5 | 39 | 2441 | Aux | 0.05 | 0.056 | 1.6 |
| Top | DH5 | 78 | 2480 | Aux | 0.02 | 0.062 | 1.6 |
| WLAN5G Body SAR | | | | | | | |
| Top | 802.11n(20MHz) | 52 | 5260 | MIMO Aux | -0.01 | 0.742 | 1.6 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| * Top | 802.11n(20MHz) | 52 | 5260 | MIMO Main | 0.04 | 0.840 | 1.6 |
| Top | 802.11n(20MHz) | 52 | 5260 | MIMO Main | -0.01 | 0.803 | 1.6 |
| Right | 802.11n(20MHz) | 52 | 5260 | Mimo | 0.04 | 0.163 | 1.6 |
| Left | 802.11n(20MHz) | 52 | 5260 | Mimo | 0.03 | 0.151 | 1.6 |
| Top | 802.11n(20MHz) | 44 | 5220 | MIMO Aux | -0.12 | 0.906 | 1.6 |
| * Top | 802.11n(20MHz) | 44 | 5220 | MIMO Main | 0.07 | 0.916 | 1.6 |
| Top | 802.11n(20MHz) | 44 | 5220 | MIMO Main | 0.09 | 0.869 | 1.6 |
| Top | 802.11n(20MHz) | 64 | 5320 | MIMO Aux | 0.12 | 0.864 | 1.6 |
| * Top | 802.11n(20MHz) | 64 | 5320 | MIMO Main | -0.08 | 0.931 | 1.6 |
| Top | 802.11n(20MHz) | 64 | 5320 | MIMO Main | 0.09 | 0.912 | 1.6 |
| Top | 802.11n(20MHz) | 100 | 5500 | MIMO Aux | 0.01 | 0.590 | 1.6 |
| Top | 802.11n(20MHz) | 100 | 5500 | MIMO Main | 0.05 | 0.733 | 1.6 |
| Top | 802.11n(20MHz) | 116 | 5580 | MIMO Aux | 0.11 | 0.568 | 1.6 |
| Top | 802.11n(20MHz) | 116 | 5580 | MIMO Main | -0.11 | 0.685 | 1.6 |
| Top | 802.11n(20MHz) | 140 | 5700 | MIMO Aux | 0.13 | 0.556 | 1.6 |
| Top | 802.11n(20MHz) | 140 | 5700 | MIMO Main | -0.13 | 0.791 | 1.6 |
| Top | 802.11n(20MHz) | 165 | 5825 | MIMO Aux | 0.03 | 0.585 | 1.6 |
| Top | 802.11n(20MHz) | 165 | 5825 | MIMO Main | 0.02 | 0.786 | 1.6 |
| Top | 802.11n(20MHz) | 149 | 5745 | MIMO Aux | 0.01 | 0.738 | 1.6 |
| * Top | 802.11n(20MHz) | 149 | 5745 | MIMO Main | 0.09 | 0.881 | 1.6 |
| Top | 802.11n(20MHz) | 149 | 5745 | MIMO Main | -0.03 | 0.852 | 1.6 |
| Top | 802.11n(20MHz) | 157 | 5785 | MIMO Aux | 0.12 | 0.679 | 1.6 |
| Top | 802.11n(20MHz) | 157 | 5785 | MIMO Main | 0.04 | 0.777 | 1.6 |

| SAR MEASUREMENT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ambient Temperature (°C) : 21.5 ±2 | | | | | Relative Humidity (%): 52 | | | |
| Liquid Temperature (°C) : 21.0 ±2 | | | | | Depth of Liquid (cm):>15 | | | |
| Product: Touch All One Computer | | | | | | | | |
| Test Position | Test Mode | Frequency | | Antenna | Scaled Factor | Duty Factor | Reported SAR 1g (W/kg) | Limit (W/kg) |
| | | Channel | MHz | | | | | |
| WLAN2.4G Body SAR | | | | | | | | |
| Top | 802.11b | 6 | 2437 | Main | 1.026 | 1.00 | 0.782 | 1.6 |
| Left | 802.11b | 6 | 2437 | Main | 1.026 | 1.00 | 0.014 | 1.6 |
| Top | 802.11b | 6 | 2437 | Aux | 1.074 | 1.00 | 0.779 | 1.6 |
| Right | 802.11b | 6 | 2437 | Aux | 1.074 | 1.00 | 0.012 | 1.6 |
| * Top | 802.11g | 6 | 2437 | MIMO Aux | 1.033 | 1.00 | 0.931 | 1.6 |
| Top | 802.11g | 6 | 2437 | MIMO Main | 1.033 | 1.00 | 0.869 | 1.6 |
| Top | 802.11g | 6 | 2437 | MIMO Aux | 1.033 | 1.00 | 0.882 | 1.6 |
| * Top | 802.11g | 1 | 2412 | MIMO Aux | 1.042 | 1.00 | **0.973** | 1.6 |
| Top | 802.11g | 1 | 2412 | MIMO Main | 1.042 | 1.00 | 0.932 | 1.6 |
| Top | 802.11g | 1 | 2412 | MIMO Aux | 1.042 | 1.00 | 0.944 | 1.6 |
| Top | 802.11g | 11 | 2462 | MIMO Aux | 1.084 | 1.00 | 0.831 | 1.6 |
| Top | 802.11g | 11 | 2462 | MIMO Main | 1.084 | 1.00 | 0.817 | 1.6 |
| Bluetooth Body SAR | | | | | | | | |
| Top | DH5 | 0 | 2402 | Aux | 1.161 | 1.69 | **0.149** | 1.6 |
| Top | DH5 | 39 | 2441 | Aux | 1.276 | 1.69 | 0.121 | 1.6 |
| Top | DH5 | 78 | 2480 | Aux | 1.140 | 1.69 | 0.119 | 1.6 |
| WLAN5G Body SAR | | | | | | | | |
| Top | 802.11n(20MHz) | 52 | 5260 | MIMO Aux | 1.239 | 1.02 | 0.938 | 1.6 |
| * Top | 802.11n(20MHz) | 52 | 5260 | MIMO Main | 1.239 | 1.02 | 1.062 | 1.6 |
| Top | 802.11n(20MHz) | 52 | 5260 | MIMO Main | 1.239 | 1.02 | 1.015 | 1.6 |
| Right | 802.11n(20MHz) | 52 | 5260 | Mimo | 1.239 | 1.02 | 0.206 | 1.6 |
| Left | 802.11n(20MHz) | 52 | 5260 | Mimo | 1.239 | 1.02 | 0.191 | 1.6 |
| Top | 802.11n(20MHz) | 44 | 5220 | MIMO Aux | 1.219 | 1.02 | 1.127 | 1.6 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| * Top | 802.11n(20MHz) | 44 | 5220 | MIMO Main | 1.219 | 1.02 | 1.139 | 1.6 |
| Top | 802.11n(20MHz) | 44 | 5220 | MIMO Main | 1.219 | 1.02 | 1.080 | 1.6 |
| Top | 802.11n(20MHz) | 64 | 5320 | MIMO Aux | 1.250 | 1.02 | 1.102 | 1.6 |
| * Top | 802.11n(20MHz) | 64 | 5320 | MIMO Main | 1.250 | 1.02 | **1.187** | 1.6 |
| Top | 802.11n(20MHz) | 64 | 5320 | MIMO Main | 1.250 | 1.02 | 1.163 | 1.6 |
| Top | 802.11n(20MHz) | 100 | 5500 | MIMO Aux | 1.256 | 1.02 | 0.756 | 1.6 |
| Top | 802.11n(20MHz) | 100 | 5500 | MIMO Main | 1.256 | 1.02 | 0.939 | 1.6 |
| Top | 802.11n(20MHz) | 116 | 5580 | MIMO Aux | 1.236 | 1.02 | 0.716 | 1.6 |
| Top | 802.11n(20MHz) | 116 | 5580 | MIMO Main | 1.236 | 1.02 | 0.864 | 1.6 |
| Top | 802.11n(20MHz) | 140 | 5700 | MIMO Aux | 1.225 | 1.02 | 0.695 | 1.6 |
| Top | 802.11n(20MHz) | 140 | 5700 | MIMO Main | 1.225 | 1.02 | 0.988 | 1.6 |
| Top | 802.11n(20MHz) | 165 | 5825 | MIMO Aux | 1.213 | 1.02 | 0.724 | 1.6 |
| Top | 802.11n(20MHz) | 165 | 5825 | MIMO Main | 1.213 | 1.02 | 0.972 | 1.6 |
| Top | 802.11n(20MHz) | 149 | 5745 | MIMO Aux | 1.219 | 1.02 | 0.918 | 1.6 |
| * Top | 802.11n(20MHz) | 149 | 5745 | MIMO Main | 1.219 | 1.02 | 1.095 | 1.6 |
| Top | 802.11n(20MHz) | 149 | 5745 | MIMO Main | 1.219 | 1.02 | 1.059 | 1.6 |
| Top | 802.11n(20MHz) | 157 | 5785 | MIMO Aux | 1.199 | 1.02 | 0.830 | 1.6 |
| Top | 802.11n(20MHz) | 157 | 5785 | MIMO Main | 1.199 | 1.02 | 0.950 | 1.6 |
| | | | | | | | | |

Note:

1: * - repeated at the highest measured SAR according to the FCC KDB 865664

2: When the reported SAR of the initial test position is > 0.4 W/kg, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

3: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

4: Per NOTICE 2012-DRS0529, the SAR need to calculated only when the △SAR is a negative value.

5: Reference standard KDB447498 D04 formula calculation In SISO mode, some test surfaces meet the exemption requirements. For example, when the Main antenna is used, Bottom and Right meet the exemption requirements, and when the Aux antenna is used, Bottom and Left meet the exemption requirements.

6: All test positions were evaluated and only the worst positions were represented.

7: Since the back of the product needs to be connected to the adapter, the product will not touch the back during normal use, so there is no need to test.

## 9.2 Test position and configuration

1. Liquid tissue depth was at least 15.0 cm for all frequencies.
2. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
3. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.

## 9.3 SAR Test Exclusions Applied

### Wi-Fi/Bluetooth

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances<50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq \mathbf{3.0}$$

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances>50mm is defined by the following equation:

$$\frac{[\text{Power allowed at numeric threshold for 50 mm in step 1}) + (\text{Test separation distance} - 50\text{ mm})\cdot(\text{Frequency}(\text{MHz})/150)]\text{ mW}}{\text{Test Separation Dist}(\text{mm})} * \sqrt{Frequency(GHz)}$$

**The distance exclusion threshold per output power:**

| Exposure Position | Wireless Interface | 2.4GHz WLAN ANT Main | 2.4GHz WLAN ANT Aux | 2.4GHz WLAN ANT Mimo | 5GHz WLAN ANT Main | 5GHz WLAN ANT Aux | 5GHz WLAN ANT Mimo |
|---|---|---|---|---|---|---|---|
| | Calculated Frequency | 2462MHz | 2462MHz | 2462MHz | 5825MHz | 5825MHz | 5825MHz |
| | Maximum power (dBm) | 19 | 19 | 22 | 15 | 14 | 18 |
| | Maximum rated power(mW) | 79.0 | 79.0 | 158.0 | 32.0 | 25.0 | 63.0 |
| Top | Separation distance(mm) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| | exclusion threshold | 24.8 | 24.8 | 49.6 | 15.5 | 12.1 | 30.4 |
| | Testing required? | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** |
| Right | Separation distance(mm) | 452.0 | 26.0 | 26.0 | 452.0 | 26.0 | 26.0 |
| | exclusion threshold | 4116.0 | 4.8 | 9.5 | 4082.0 | 2.3 | 5.9 |
| | Testing required? | **No** | **Yes** | **Yes** | **No** | **No** | **Yes** |
| Left | Separation distance(mm) | 27.0 | 253.0 | 27.0 | 27.0 | 253.0 | 27.0 |
| | exclusion threshold | 4.6 | 2126.0 | 9.2 | 2.9 | 2092.0 | 5.6 |
| | Testing required? | **Yes** | **No** | **Yes** | **No** | **No** | **Yes** |

## 9.4 Simultaneous Transmission Analysis

Simultaneous Transmission Scenario with Bluetooth

| Simult Tx | Configuration | 2.4G WLAN SAR (W/kg) | BT SAR (W/kg) | 2.4G+BT SAR (W/kg) |
|---|---|---|---|---|
| Body | ESY15I4-C | 0.973 | 0.149 | 1.122 |
| Simult Tx | Configuration | 5G WLAN SAR (W/kg) | BT SAR (W/kg) | 5G+BT SAR (W/kg) |
| Body | ESY15I4-C | 1.187 | 0.149 | 1.336 |

# Appendix A. SAR Validation Data

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

System Check Head 2450MHz

**DUT: Dipole 2450 MHz D2450V2; Type: D2450V2**

Communication System: UID 0, CW; Communication System Band: D2450(2450MHz); Duty Cycle: 1:1;

Frequency: 2450 MHz; Medium parameters used (interpolated): f = 2450 MHz; $\sigma$ = 1.86 S/m; $\varepsilon_r$ = 38.535; $\rho$ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=250mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.39, 7.39, 7.39); Calibrated: 4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Check Head 2450MHz/Area Scan (9x9x1):** Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 14.7 W/kg

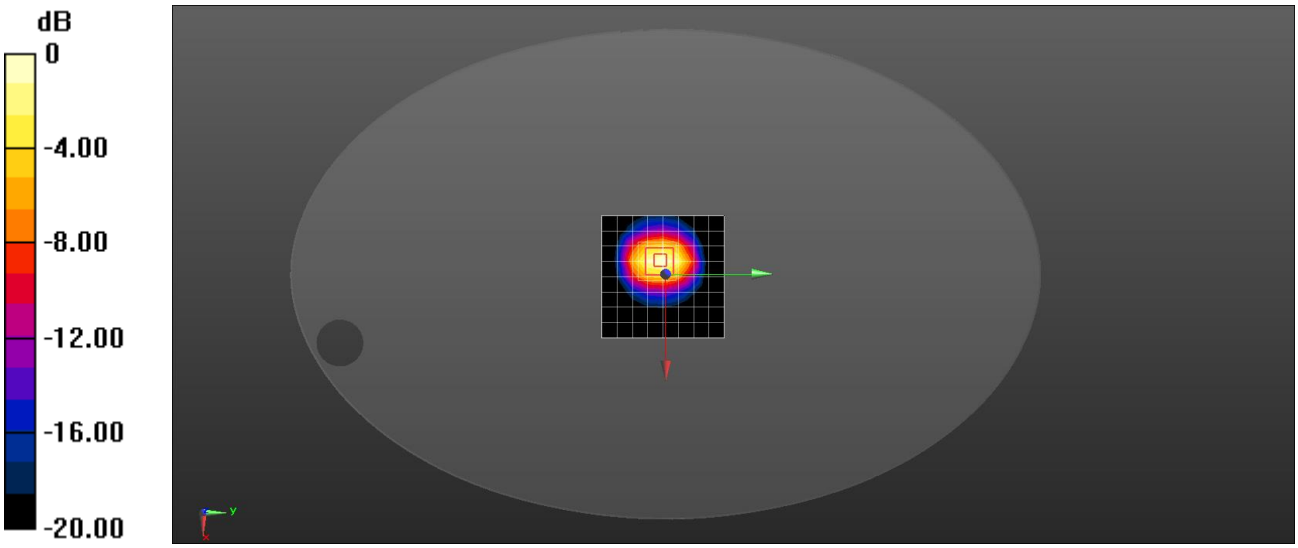
**System Check Head 2450MHz/Zoom Scan (7x7x8)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.87 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.3 W/kg

**SAR(1 g) = 13 W/kg; SAR(10 g) = 6.07 W/kg**

Maximum value of SAR (measured) = 14.6 W/kg




0 dB = 14.6 W/kg = 11.64 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

System Check Head 5250MHz

**DUT: Dipole D5GHzV2; Type: D5GHzV2**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5250 MHz; Medium parameters used (interpolated): f = 5250 MHz; σ = 4.604 S/m; εr = 36.049; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(5.4, 5.4, 5.4); Calibrated: 4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Check Head 5250MHz/Area Scan (11x11x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 7.19 W/kg

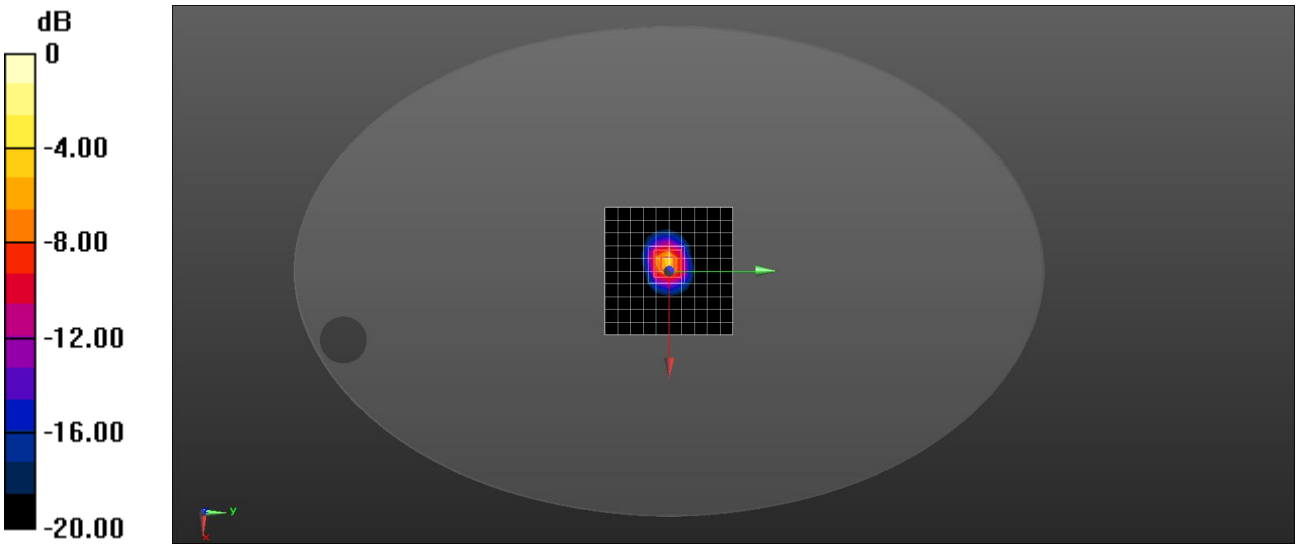
**System Check Head 5250MHz/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 35.72 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 29.8 W/kg

**SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.2 W/kg**

Maximum value of SAR (measured) = 18.4 W/kg




0 dB = 18.4 W/kg = 12.65 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

System Check Head 5600MHz

**DUT: Dipole D5GHzV2; Type: D5GHzV2**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5600 MHz; Medium parameters used: f = 5600 MHz; σ = 5.034 S/m; εr = 35.947; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.85, 4.85, 4.85); Calibrated: 4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Check Head 5600MHz/Area Scan (10x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 7.47 W/kg

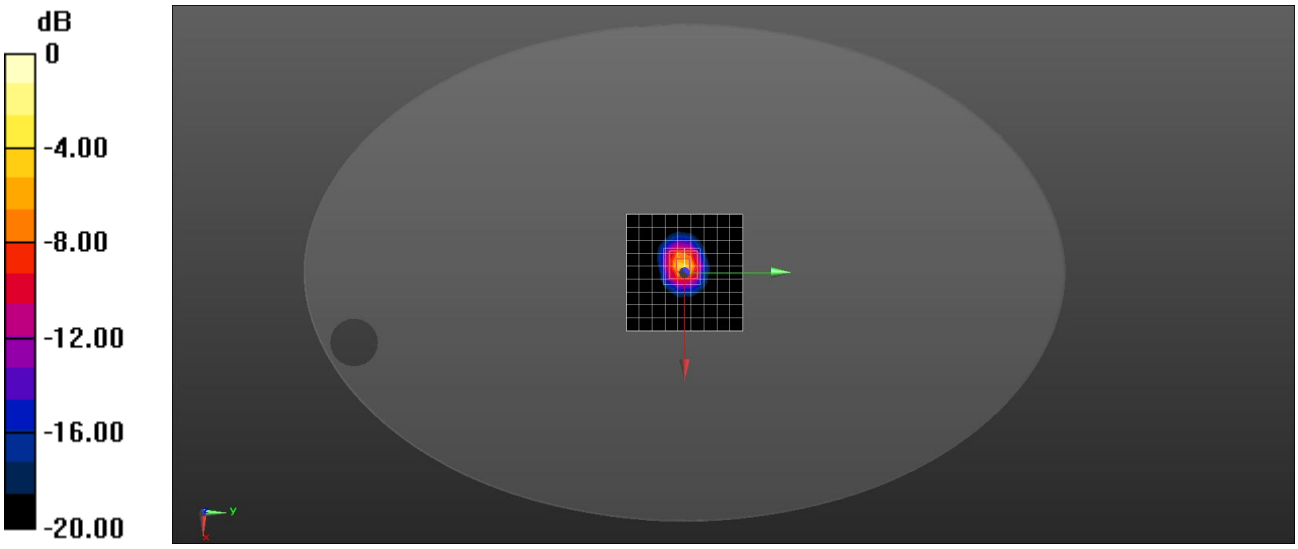
**System Check Head 5600MHz/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 34.72 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 32.8 W/kg

**SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.29 W/kg**

Maximum value of SAR (measured) = 19.9 W/kg




0 dB = 19.9 W/kg = 12.99 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

System Check Head 5750MHz

**DUT: Dipole D5GHzV2; Type: D5GHzV2**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5750 MHz; Medium parameters used: f = 5750 MHz; σ = 5.101 S/m; εr = 35.386; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.88, 4.88, 4.88); Calibrated: 4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**System Check Head 5750MHz/Area Scan (10x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 7.52 W/kg

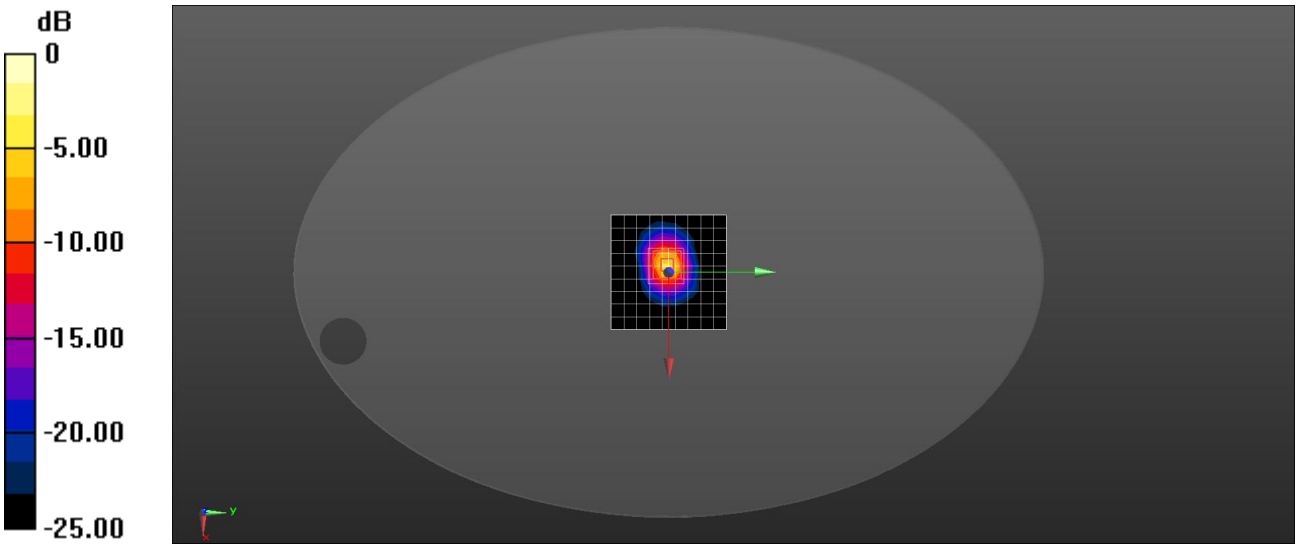
**System Check Head 5750MHz/Zoom Scan (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 34.61 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 33.1 W/kg

**SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.3 W/kg**

Maximum value of SAR (measured) = 20.1 W/kg




0 dB = 20.1 W/kg = 13.03 dBW/kg

# Appendix B. SAR Test Data

**Date: 8/7/2022**

Test Laboratory: DEKRA Lab

WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Aux Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11g; Duty Cycle: 1:1; Frequency: 2412 MHz; Medium parameters used: f = 2412 MHz; σ = 1.828 S/m; εr = 38.52; ρ = 1000 kg/m3 ;

Phantom section: Flat Section ; Input Power=250mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.39, 7.39, 7.39); Calibrated:4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Aux Top/Area Scan (11x11x1)**: Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.728 W/kg

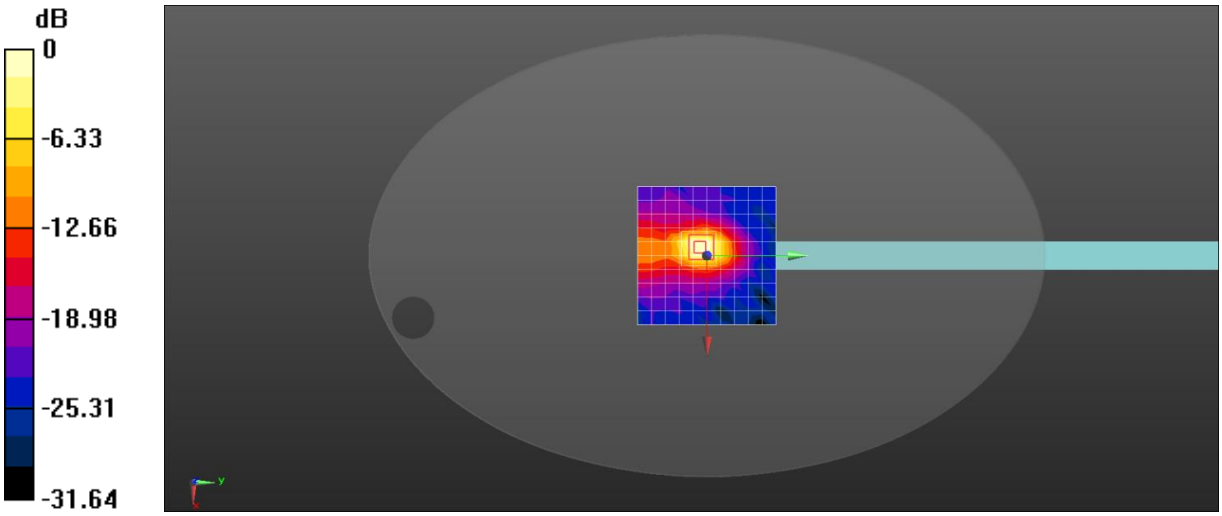
**WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Aux Top/Zoom Scan (7x7x5)/Cube 0**: Measurement grid: dx=5mm, dy=5mm, dz=4mm

Reference Value = 16.36 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 2.92 W/kg

**SAR(1 g) = 0.934 W/kg; SAR(10 g) = 0.367 W/kg**

Maximum value of SAR (measured) = 1.24 W/kg




0 dB = 0.728 W/kg = -1.38 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Main Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11g; Duty Cycle: 1:1; Frequency: 2412 MHz; Medium parameters used: f = 2412 MHz; σ = 1.828 S/m; εr = 38.52; ρ = 1000 kg/m3 ;

Phantom section: Flat Section ; Input Power=250mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.39, 7.39, 7.39); Calibrated:4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Main Top/Area Scan (11x11x1)**: Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.992 W/kg

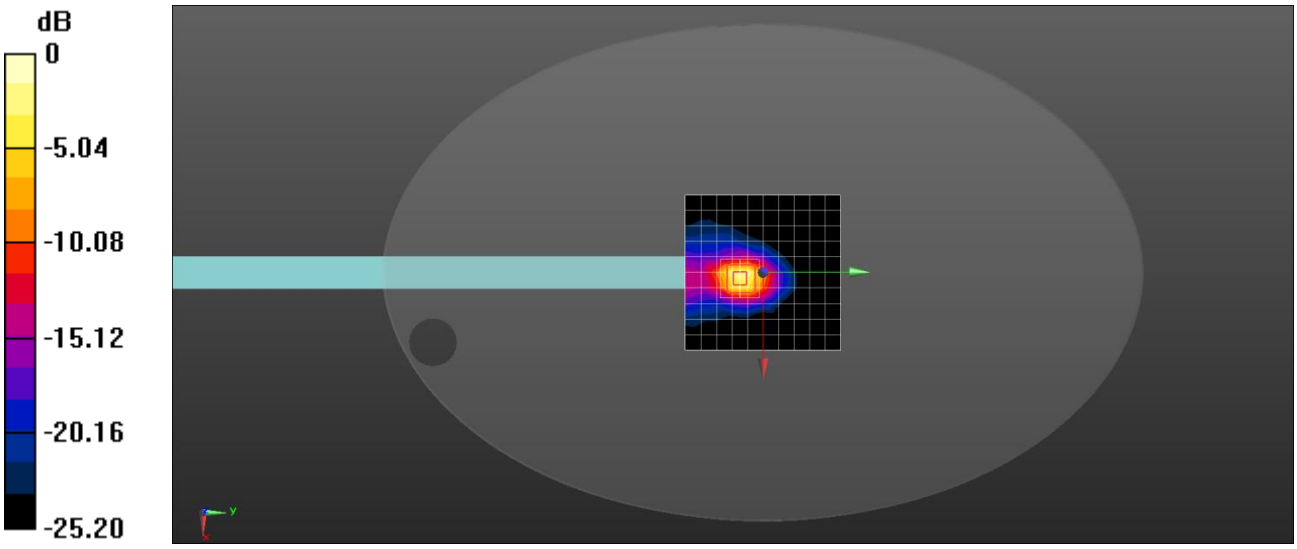
**WLAN2.4G 802.11g(20MHz) CH01 2412MHz MIMO Main Top/Zoom Scan (7x7x5)/Cube 0**: Measurement grid: dx=5mm, dy=5mm, dz=4mm

Reference Value = 11.52 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.64 W/kg

**SAR(1 g) = 0.894 W/kg; SAR(10 g) = 0.438 W/kg**

Maximum value of SAR (measured) = 1.55 W/kg




0 dB = 1.55 W/kg = 1.90 dBW/kg

**Date: 8/7/2022**

Test Laboratory: DEKRA Lab

BLE CH00 2402MHz Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, Bluetooth (0); Communication System Band: BLE; Duty Cycle: 1:1; Frequency: 2402 MHz; Medium parameters used (interpolated): f = 2402 MHz; σ = 1.769 S/m; εr = 40.089; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=250mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.39, 7.39, 7.39) ; Calibrated: 4/18/2022
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**CH00/Area Scan (11x12x1)**: Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.0654 W/kg

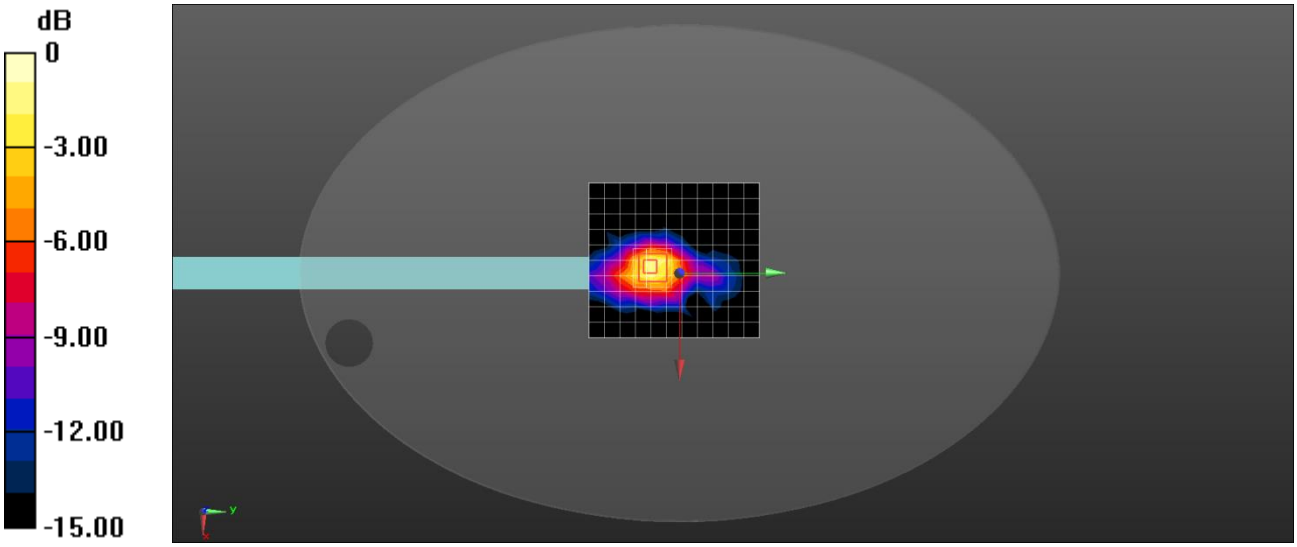
**CH00/Zoom Scan (7x7x5)/Cube 0**: Measurement grid: dx=5mm, dy=5mm, dz=4mm

Reference Value = 3.900 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 0.193 W/kg

**SAR(1 g) = 0.076 W/kg; SAR(10 g) = 0.035 W/kg**

Maximum value of SAR (measured) = 0.0833 W/kg




0 dB = 0.0833 W/kg = -10.79 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Aux Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5320 MHz; Medium parameters used: f = 5320 MHz; $\sigma$ = 4.658 S/m; $\varepsilon_r$ = 35.975; $\rho$ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(5.4, 5.4, 5.4); Calibrated:4/18/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Top/Area Scan (13x13x1)**: Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 2.01 W/kg

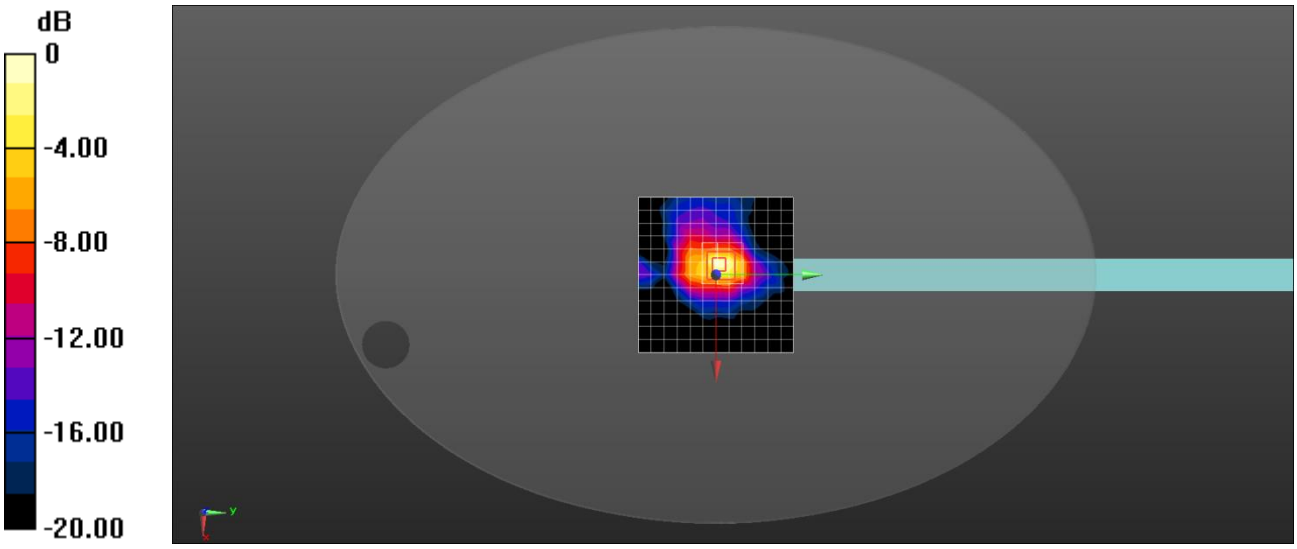
**WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Top/Zoom Scan (9x9x12)/Cube 0**: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 11.56 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 4.47 W/kg

**SAR(1 g) = 0.864 W/kg; SAR(10 g) = 0.331 W/kg**

Maximum value of SAR (measured) = 1.92 W/kg




0 dB = 1.92 W/kg = 2.83 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Main Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5320 MHz; Medium parameters used: f = 5320 MHz; $\sigma$ = 4.658 S/m; $\varepsilon_r$ = 35.975; $\rho$ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(5.4, 5.4, 5.4); Calibrated:4/18/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Top/Area Scan (13x13x1)**: Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.92 W/kg

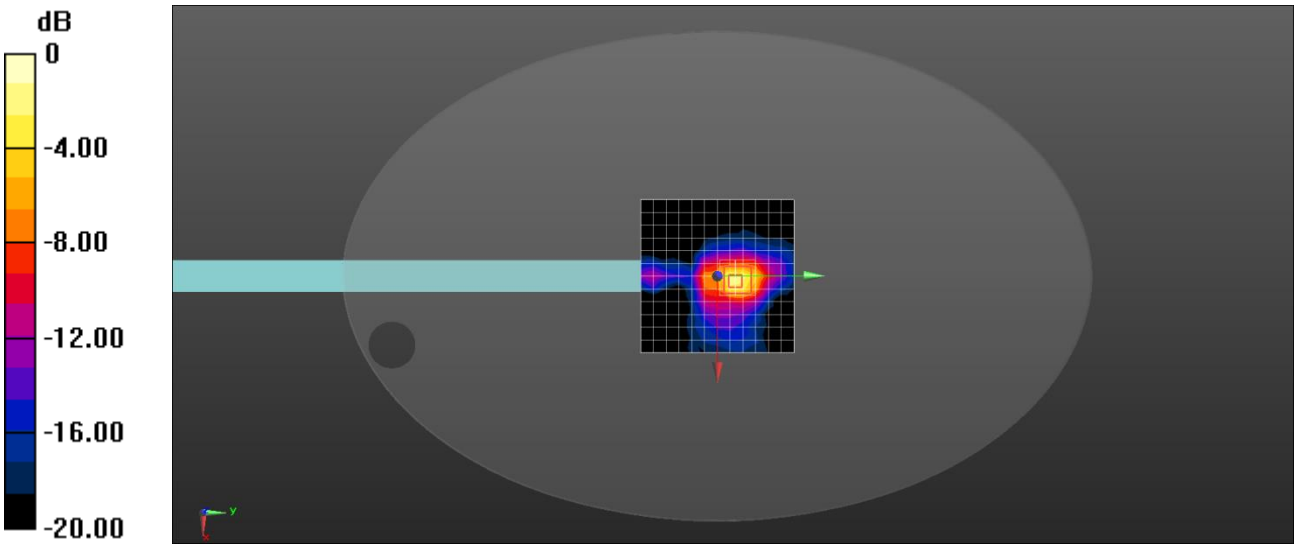
**WLAN5G 802.11n(20MHz) CH64 5320MHz MIMO Top/Zoom Scan (8x8x12)/Cube 0**: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 8.548 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 5.42 W/kg

**SAR(1 g) = 0.931 W/kg; SAR(10 g) = 0.410 W/kg**

Maximum value of SAR (measured) = 2.08 W/kg




0 dB = 2.68 W/kg = 4.28 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

WLAN5G 802.11n(20MHz) CH140 5700MHz MIMO Main Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5700 MHz; Medium parameters used (interpolated): f = 5700 MHz; $\sigma$ = 5.059 S/m; $\varepsilon_r$ = 35.452; $\rho$ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.85, 4.85, 4.85); Calibrated:4/18/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN5G 802.11n(20MHz) CH140 5570MHz MIMO Top/Area Scan (13x13x1)**: Measurement grid: dx=10mm, dy=10mm

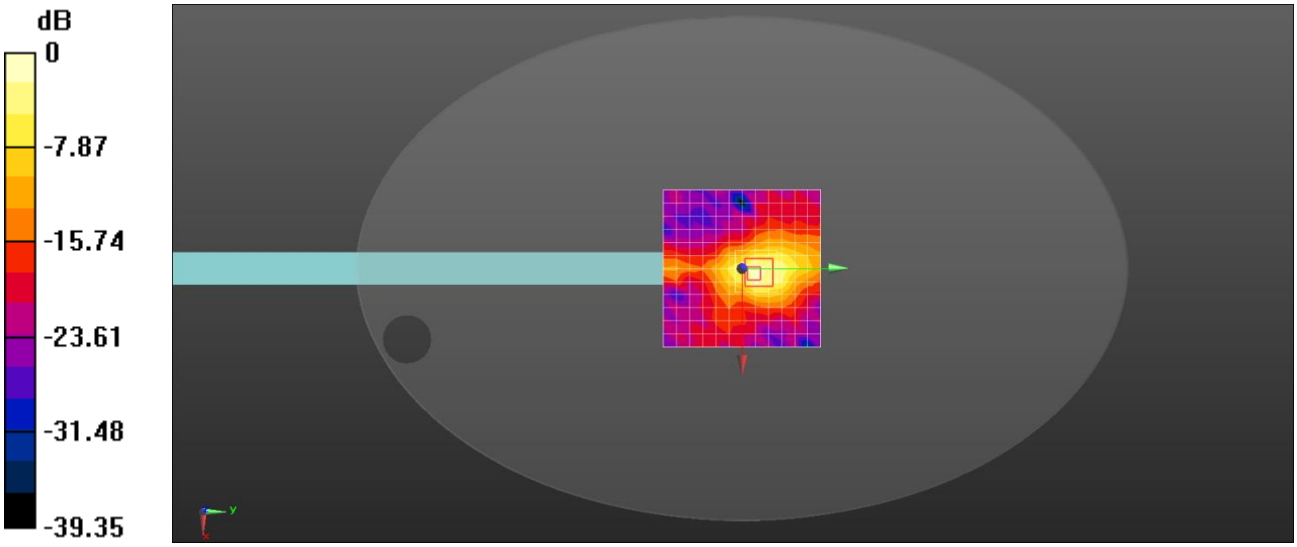
**WLAN5G 802.11n(20MHz) CH140 5570MHz MIMO Top/Zoom Scan (9x9x12)/Cube 0**: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.224 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 3.48 W/kg

**SAR(1 g) = 0.791 W/kg; SAR(10 g) = 0.236 W/kg**

Maximum value of SAR (measured) = 1.54 W/kg




0 dB = 1.39 W/kg = 1.43 dBW/kg

**Date: 8/7/2022**

Test Laboratory: DEKRA Lab

WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Aux Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5745 MHz; Medium parameters used (interpolated): f = 5745 MHz; $\sigma$ = 5.094 S/m; $\varepsilon_r$ = 35.396; $\rho$ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.88, 4.88, 4.88) ; Calibrated:4/18/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Top/Area Scan (13x13x1)**: Measurement grid: dx=10mm, dy=10mm

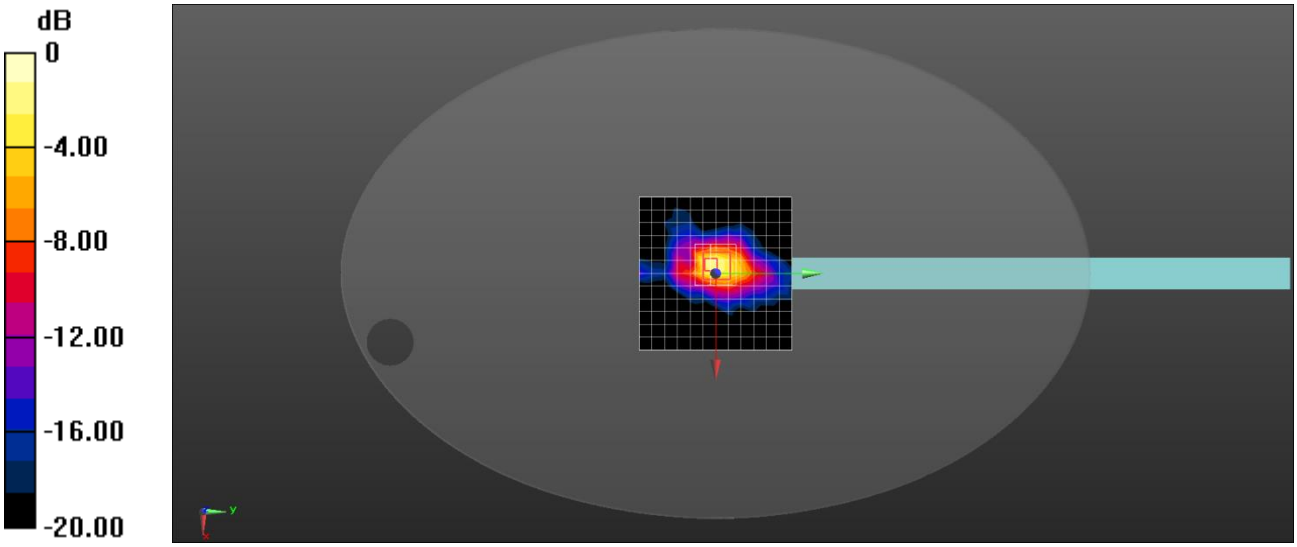
**WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Top/Zoom Scan (9x9x12)/Cube 0**: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 9.754 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.20 W/kg

**SAR(1 g) = 0.738 W/kg; SAR(10 g) = 0.231 W/kg**

Maximum value of SAR (measured) = 1.54 W/kg




0 dB = 1.54 W/kg = 1.88 dBW/kg

**Date:8/7/2022**

Test Laboratory: DEKRA Lab

WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Main Top

**DUT: Elo PAD; Type: ESY22I4**

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5745 MHz; Medium parameters used (interpolated): f = 5745 MHz; σ = 5.094 S/m; εr = 35.396; ρ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.88, 4.88, 4.88) ; Calibrated:4/18/2022
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated:3/24/2022
- Phantom: ELI1; Type: QDOVA002AA; Serial: TP:2106
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

**WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Top/Area Scan (13x13x1)**: Measurement grid: dx=10mm, dy=10mm

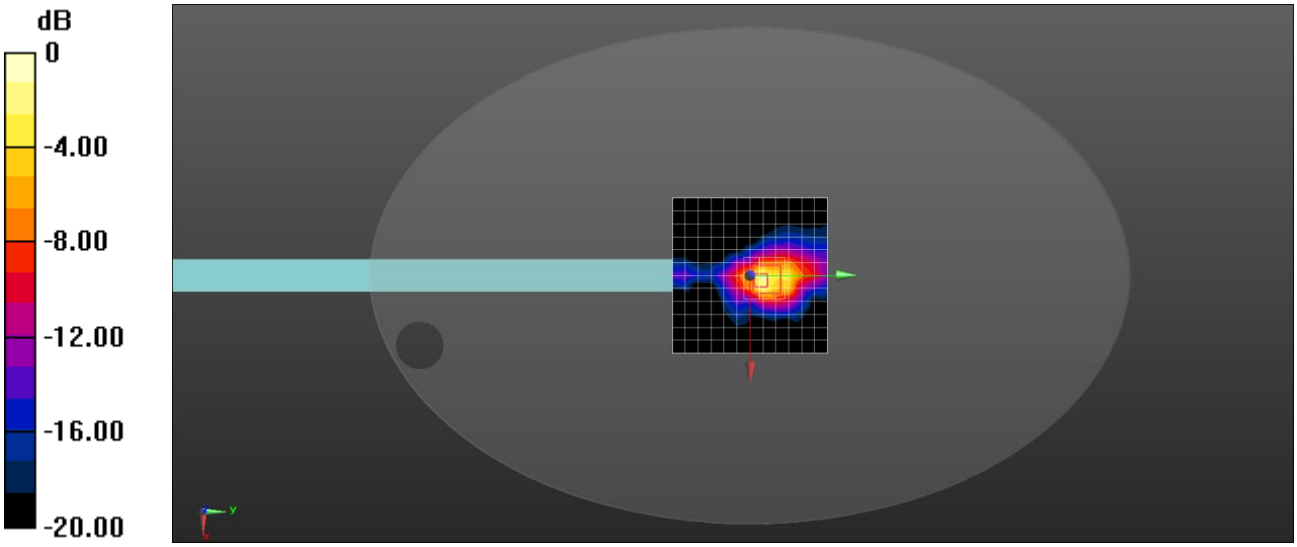
**WLAN5G 802.11n(20MHz) CH149 5745MHz MIMO Top/Zoom Scan (9x9x12)/Cube 0**: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.764 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 4.03 W/kg

**SAR(1 g) = 0.881 W/kg; SAR(10 g) = 0.263 W/kg**

Maximum value of SAR (measured) = 1.78 W/kg




0 dB = 1.78 W/kg = 2.50 dBW/kg

# Appendix C. Probe Calibration Data

In Collaboration with
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client Dekra-CN Certificate No: Z22-60083

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN : 3710 |
| Calibration Procedure(s) | FF-Z11-004-02<br>Calibration Procedures for Dosimetric E-field Probes |
| Calibration date: | April 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power Meter NRP2 | 101919 | 15-Jun-21(CTTL, No.J21X04466) | Jun-22 |
| Power sensor NRP-Z91 | 101547 | 15-Jun-21(CTTL, No.J21X04466) | Jun-22 |
| Power sensor NRP-Z91 | 101548 | 15-Jun-21(CTTL, No.J21X04466) | Jun-22 |
| Reference 10dBAttenuator | 18N50W-10dB | 20-Jan-21(CTTL, No.J21X00486) | Jan-23 |
| Reference 20dBAttenuator | 18N50W-20dB | 20-Jan-21(CTTL, No.J21X00485) | Jan-23 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG, No.EX3-7307_May21) | May-22 |
| Reference Probe EX3DV4 | SN 7464 | 26-Jan-22(SPEAG, No.EX3-7464_Jan22) | Jan-23 |
| DAE4 | SN 1555 | 20-Aug-21(SPEAG, No.DAE4-1555_Aug21/2) | Aug-22 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| SignalGenerator MG3700A | 6201052605 | 16-Jun-21(CTTL, No.J21X04467) | Jun-22 |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22(CTTL, No.J22X00406) | Jan-23 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Lin Hao | SAR Test Engineer | |
| Approved by: | Qi Dianyuan | SAR Project Leader | |

Issued: April 19, 2022

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

Certificate No: Z22-60083 Page 1 of 9

In Collaboration with
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CALIBRATION LABORATORY

CAICT

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E-mail: cttl@chinattl.com Http://www.chinattl.cn

**Glossary:**

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

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

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

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

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN:3710

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (*k*=2) |
|---|---|---|---|---|
| Norm(μV/(V/m)$^2$)[A] | 0.37 | 0.41 | 0.49 | ±10.0% |
| DCP(mV)[B] | 101.9 | 102.3 | 102.5 | |

## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Unc[E] (*k*=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 140.6 | ±2.1% |
| | | Y | 0.0 | 0.0 | 1.0 | | 148.8 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 170.6 | |

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 4).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN:3710

## Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz][C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 750 | 41.9 | 0.89 | 9.60 | 9.60 | 9.60 | 0.17 | 1.28 | ±12.1% |
| 835 | 41.5 | 0.90 | 9.31 | 9.31 | 9.31 | 0.15 | 1.41 | ±12.1% |
| 900 | 41.5 | 0.97 | 9.30 | 9.30 | 9.30 | 0.17 | 1.27 | ±12.1% |
| 1810 | 40.0 | 1.40 | 7.90 | 7.90 | 7.90 | 0.30 | 0.93 | ±12.1% |
| 1900 | 40.0 | 1.40 | 7.80 | 7.80 | 7.80 | 0.32 | 0.94 | ±12.1% |
| 2300 | 39.5 | 1.67 | 7.66 | 7.66 | 7.66 | 0.57 | 0.71 | ±12.1% |
| 2450 | 39.2 | 1.80 | 7.39 | 7.39 | 7.39 | 0.61 | 0.69 | ±12.1% |
| 2600 | 39.0 | 1.96 | 7.18 | 7.18 | 7.18 | 0.53 | 0.76 | ±12.1% |
| 3300 | 38.2 | 2.71 | 7.00 | 7.00 | 7.00 | 0.43 | 0.93 | ±13.3% |
| 3500 | 37.9 | 2.91 | 6.78 | 6.78 | 6.78 | 0.45 | 0.98 | ±13.3% |
| 3700 | 37.7 | 3.12 | 6.49 | 6.49 | 6.49 | 0.42 | 1.02 | ±13.3% |
| 3900 | 37.5 | 3.32 | 6.55 | 6.55 | 6.55 | 0.35 | 1.35 | ±13.3% |
| 4100 | 37.2 | 3.53 | 6.53 | 6.53 | 6.53 | 0.40 | 1.15 | ±13.3% |
| 4200 | 37.1 | 3.63 | 6.44 | 6.44 | 6.44 | 0.40 | 1.25 | ±13.3% |
| 4400 | 36.9 | 3.84 | 6.34 | 6.34 | 6.34 | 0.40 | 1.25 | ±13.3% |
| 4600 | 36.7 | 4.04 | 6.23 | 6.23 | 6.23 | 0.45 | 1.25 | ±13.3% |
| 4800 | 36.4 | 4.25 | 6.18 | 6.18 | 6.18 | 0.45 | 1.30 | ±13.3% |
| 4950 | 36.3 | 4.40 | 5.87 | 5.87 | 5.87 | 0.45 | 1.30 | ±13.3% |
| 5250 | 35.9 | 4.71 | 5.40 | 5.40 | 5.40 | 0.45 | 1.30 | ±13.3% |
| 5600 | 35.5 | 5.07 | 4.85 | 4.85 | 4.85 | 0.55 | 1.20 | ±13.3% |
| 5750 | 35.4 | 5.22 | 4.88 | 4.88 | 4.88 | 0.55 | 1.20 | ±13.3% |

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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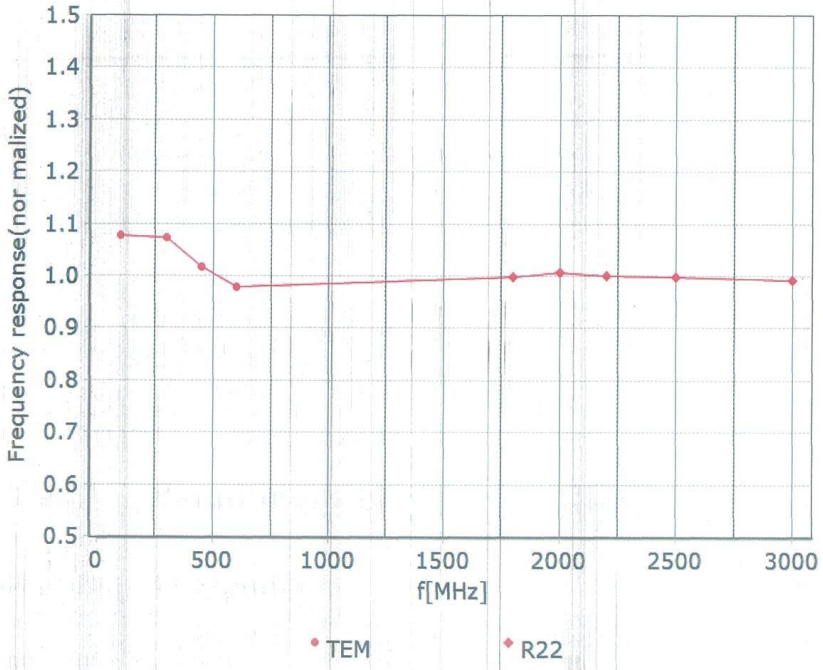
# Frequency Response of E-Field
## (TEM-Cell: ifi110 EXX, Waveguide: R22)




**Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)**

Certificate No:Z22-60083 Page 5 of 9

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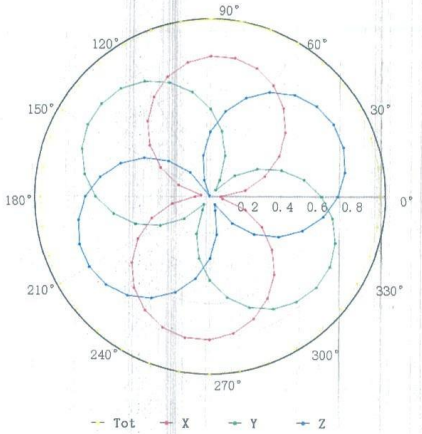
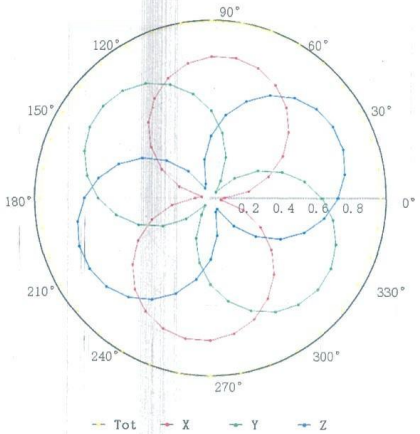
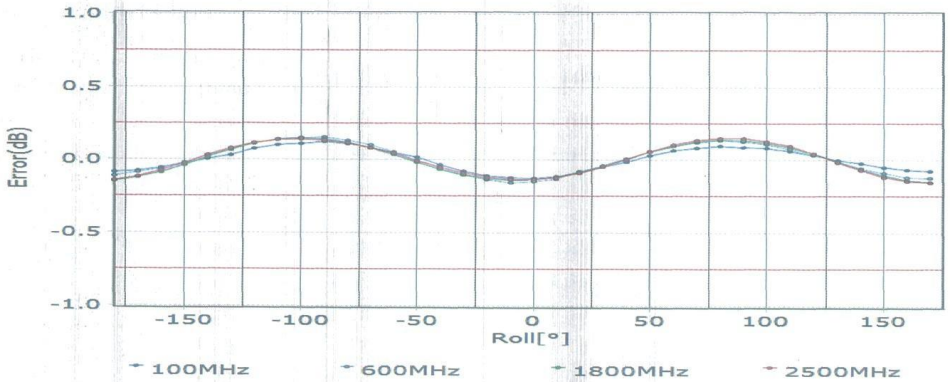
# Receiving Pattern (Φ), θ=0°

## f=600 MHz, TEM




## f=1800 MHz, R22




Uncertainty of Axial Isotropy Assessment: ±1.2% (*k*=2)

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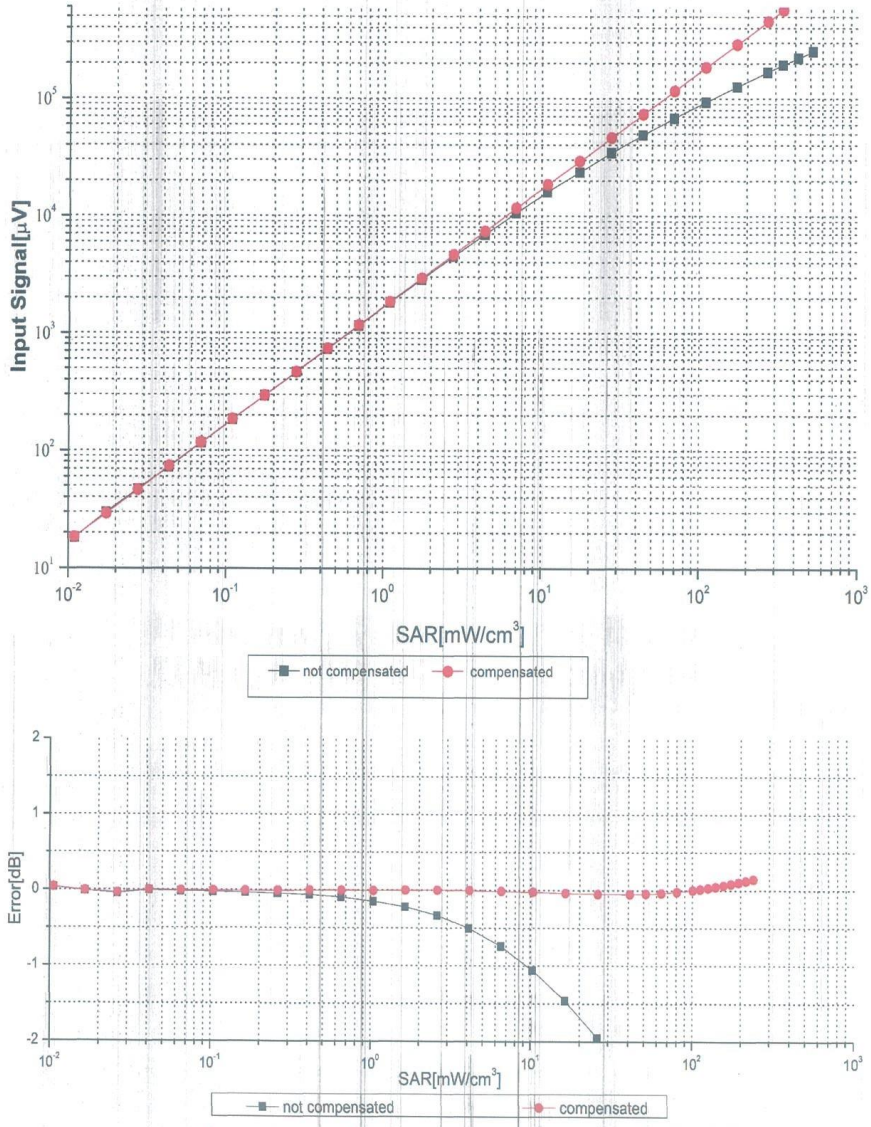
## Dynamic Range f($SAR_{head}$)
## (TEM cell, f = 900 MHz)




**Uncertainty of Linearity Assessment: ±0.9% (*k*=2)**

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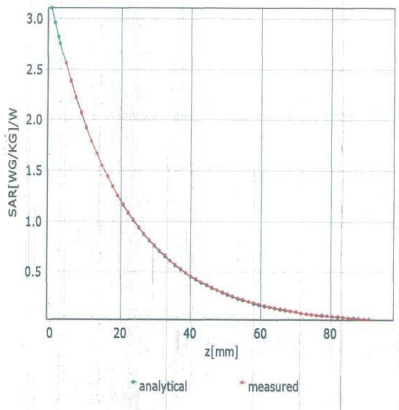
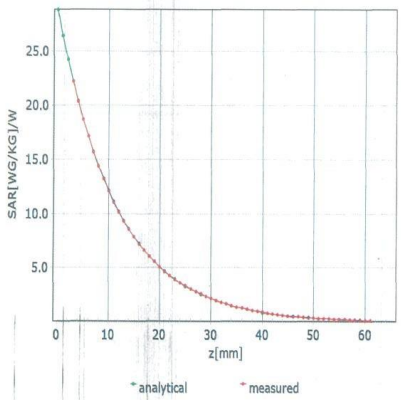
# Conversion Factor Assessment

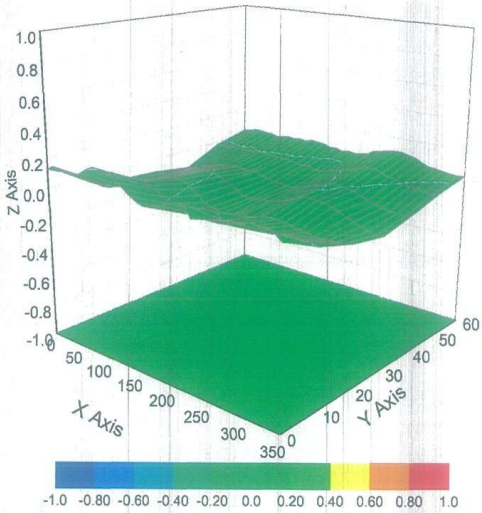
**f=750 MHz,WGLS R9(H_convF)**




**f=1810 MHz,WGLS R22(H_convF)**




# Deviation from Isotropy in Liquid




**Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)**

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN:3710

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle (°) | 81.3 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disable |
| Probe Overall Length | 337mm |
| Probe Body Diameter | 10mm |
| Tip Length | 9mm |
| Tip Diameter | 2.5mm |
| Probe Tip to Sensor X Calibration Point | 1mm |
| Probe Tip to Sensor Y Calibration Point | 1mm |
| Probe Tip to Sensor Z Calibration Point | 1mm |
| Recommended Measurement Distance from Surface | 1.4mm |

# Dipole Calibration Data

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CNAS L0570

Client Dekra-CN Certificate No: Z22-60089

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 839 |
| Calibration Procedure(s) | FF-Z11-003-01<br>Calibration Procedures for dipole validation kits |
| Calibration date: | April 1, 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 (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power Meter NRP2 | 106277 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Power sensor NRP8S | 104291 | 24-Sep-21 (CTTL, No.J21X08326) | Sep-22 |
| Reference Probe EX3DV4 | SN 7307 | 26-May-21(SPEAG,No.EX3-7307_May21) | May-22 |
| DAE4 | SN 1556 | 12-Jan-22(CTTL-SPEAG,No.Z22-60007) | Jan-23 |
| **Secondary Standards** | **ID #** | **Cal Date (Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| Signal Generator E4438C | MY49071430 | 13-Jan-22 (CTTL, No. J22X00409) | Jan-23 |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22 (CTTL, No.J22X00406) | Jan-23 |

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

Issued: April 6, 2022

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

Certificate No: Z22-60089 Page 1 of 6