



**KDB 865664 D01 SAR Measurement 100MHz to 6GHz  
FCC 47 CFR part 2 (2.1093)**

**SAR EVALUATION REPORT**

*For*

**Apple Magic Keyboard with Touch ID and Numeric Keypad**

**Model: A2520**

**FCC ID: BCGA2520**

**REPORT NUMBER UL-SAR-RP13559945JD42A V2.0**

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|      |               |                                         |              |

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**1. Attestation of Test Results**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                         |       |                                                                                      |            |              |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------|------------|--------------|------------|
| <b>Applicant Name:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Apple Inc.                                                                                                                              |       |                                                                                      |            |              |            |
| <b>Model:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | A2520                                                                                                                                   |       |                                                                                      |            |              |            |
| <b>Test Device is</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | A representative test sample                                                                                                            |       |                                                                                      |            |              |            |
| <b>Device category</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Portable                                                                                                                                |       |                                                                                      |            |              |            |
| <b>Date Tested</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 26 March 2021 to 26 March 2021                                                                                                          |       |                                                                                      |            |              |            |
| <b>FCC 47 CFR (2.1093) Guidelines Limits for SAR Exposure Characteristics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | General Population – Localised SAR (Body) – 1g-SAR limit 1.6 W/kg<br>General Population – Localised SAR (Limbs) –10g SAR limit 4.0 W/kg |       |                                                                                      |            |              |            |
| <b>The highest reported SAR values for Localized SAR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>RF Exposure Conditions</b>                                                                                                           |       | <b>Equipment Class</b>                                                               |            |              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                         |       | <b>Licensed</b>                                                                      | <b>DTS</b> | <b>U-NII</b> | <b>DSS</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Standalone                                                                                                                              | Body  | N/A                                                                                  | N/A        | N/A          | 0.021 W/kg |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Standalone                                                                                                                              | Limbs | N/A                                                                                  | N/A        | N/A          | 0.012 W/kg |
| <b>Applicable Standards</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | FCC 47 CFR part 2 (2.1093)<br>IEEE Std 1528:2013<br>KDB publications                                                                    |       |                                                                                      |            |              |            |
| <b>Test Results</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pass                                                                                                                                    |       |                                                                                      |            |              |            |
| <p>UL International (UK) Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL International (UK) Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties are in accordance with the above standard and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p><b>Note:</b> The results documented in this report apply only to the tested sample(s), under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL International (UK) Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL International (UK) Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by UKAS. This report is written to support regulatory compliance of the applicable standards stated above.</p> |                                                                                                                                         |       |                                                                                      |            |              |            |
| <b>Issued By:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                         |       | <b>Prepared By:</b>                                                                  |            |              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                         |       |  |            |              |            |
| Naseer Mirza<br>Lead Project Engineer<br>UL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                         |       | Masood Khan<br>Test Engineer<br>UL                                                   |            |              |            |

## **2.Test Specification, Methods and Procedures**

### **2.1.Test Specification**

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>       | <b>KDB Publication Number: 865664 D01 SAR Measurement 100 MHz to 6 GHz</b>                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Title:</b>           | SAR Measurement Requirements for 100 MHz to 6 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Introduction:</b>    | The SAR Measurement procedures for 100MHz to 6GHz are described in this document. Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in standard IEEE 1528-2013. The wireless product and technology specific procedures in applicable KDB publications are required to be used unless further guidance has been approved by the FCC. |
| <b>Purpose of Test:</b> | To determine if the Equipment Under Test complies with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093).                                                                                                                                                                                                                                                                                                       |

### **2.2. Methods and Procedures Reference Documentation**

The methods and procedures used were as detailed in:

#### **IEEE 1528:2013**

IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques.

#### **FCC KDB Publication:**

KDB 447498 D01 General RF Exposure Guidance v06  
 KDB 447498 D03 Supplement C Cross-Reference v01  
 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04  
 KDB 865664 D02 RF Exposure Reporting v01r02

### **2.3. Definition of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Section 4.3 contains a list of the test equipment used.

### **3.Facilities and Accreditation**

The measurement facilities used to collect data are located at

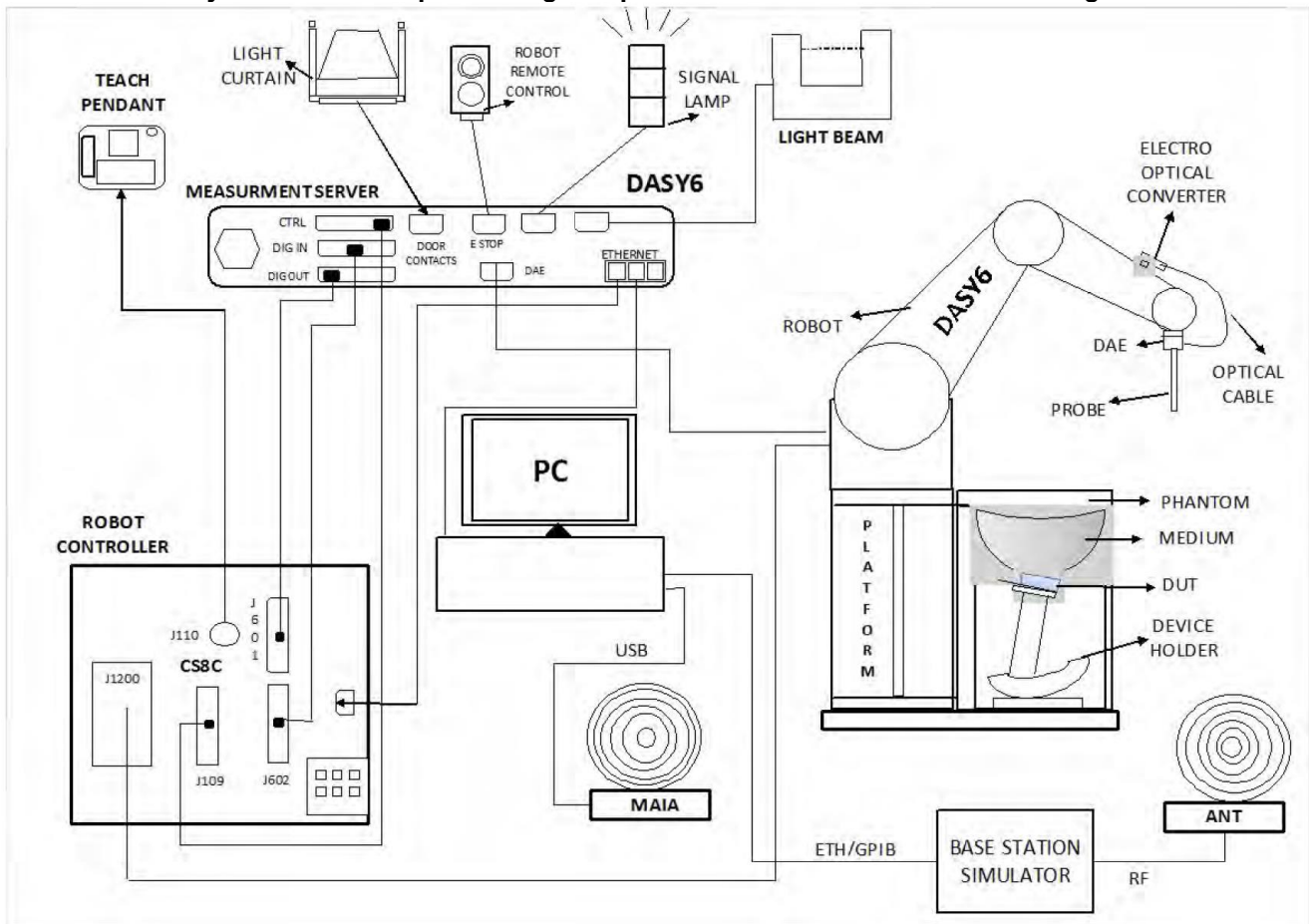
|                                                                                            |                                |
|--------------------------------------------------------------------------------------------|--------------------------------|
| Horizon Unit 1-3, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, UK | Facility Type                  |
| SAR Lab 63                                                                                 | Controlled Environment Chamber |

UL International (UK) Ltd is accredited by UKAS (United Kingdom Accreditation Service, Accredited to ISO/IEC 17025:2017), Laboratory UKAS Code 5772.

## 4. SAR Measurement System & Test Equipment

### 4.1. SAR Measurement System

The DASY test systems used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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.
- 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.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win10 with DASY software installed.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## 4.2. SAR Measurement Procedure

### 4.2.1. Normal SAR Measurement Procedure

The following procedure shall be performed for each of the test conditions

- a) Measure the local SAR at a test point within 8 mm of the phantom inner surface that is closest to the DUT.
- b) Measure the two-dimensional SAR distribution within the phantom (area scan procedure). The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grid spacing of 20 mm for frequencies below 3 GHz and  $(60/f \text{ [GHz]})$  mm for frequencies of 3 GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and  $\delta \ln(2)/2$  mm for frequencies of 3 GHz and greater, where  $\delta$  is the plane wave skin depth and  $\ln(x)$  is the natural logarithm. The maximum variation of the sensor-phantom surface distance shall be  $\pm 1$  mm for frequencies below 3 GHz and  $\pm 0,5$  mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than  $5^\circ$ . If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional uncertainty evaluation is needed.
- c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1 W/kg for 1,6 W /kg 1 g limit, or 1,26 W/kg for 2 W /kg, 10 g limit).
- d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step c) (zoom scan). For frequencies at or below 3 GHz, the following procedure shall be applied: The horizontal grid step shall be 8 mm or less. The grid step in the vertical direction shall be 5 mm or less if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell (M1 and M2) shall be 4 mm or less and the spacing between farther points shall increase by a factor of 1,5 or less. The minimum size of the zoom scan volume shall be 30 mm by 30 mm by 30 mm

For frequencies above 3 GHz, the minimum size of the zoom scan volume may be reduced to 22 mm by 22 mm by 22 mm. The horizontal grid step shall be  $(24/f \text{ [GHz]})$  mm or less. If uniform spacing in the vertical direction is used, the grid step in the vertical direction shall be  $(10/(f \text{ [GHz]} - 1))$  mm or less. If variable spacing is used in the vertical direction, the maximum spacing between the two measured points closest to the phantom shell shall be  $(12/f \text{ [GHz]})$  mm or less and the spacing between further points shall increase by a factor of 1,5 or less. For other parameters, see Zoom Scan Parameters table.

When the highest 1 g or 10 g cube is touching the boundary of a zoom-scan volume, the entire zoom scan shall be repeated with the new centre located at the maximum psSAR location indicated by the preceding zoom scan measurement. If the zoom scan measured as defined above complies with both of the following criteria, or if the peak spatial-average SAR is below 0,1 W/kg, no additional measurements are needed:

1) the smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x and y directions ( $\Delta x$ ,  $\Delta y$ ). This shall be checked for the measured zoom scan plane conformal to the phantom at the distance  $z_{M1}$ . The minimum distance shall be recorded in the SAR test report;

2) the ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum SAR value shall be at least 30 %. This ratio (in %) shall be recorded in the SAR test report.

If one or both of the above criteria are not met, the zoom scan measurement shall be repeated using a finer resolution while keeping the other zoom scan parameters compatible with Zoom Scan Parameters table. New horizontal and vertical grid steps shall be determined from the measured SAR distribution so that the above criteria are met. Compliance with the above two criteria shall be demonstrated for the new measured zoom scan. The size of the higher resolution zoom scan and other parameters of Zoom Scan Parameters table shall apply. The closest point to the phantom shell shall be 2 mm or less for graded grids and the grading factor shall be 1,5 or less.

Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved if the distance between the phantom surface and physical tip of the probe is larger than the probe tip diameter. Other methods may utilize correction procedures to compensate for boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe normal to the flat phantom surface shall be less than 5°.

#### Zoom Scan Parameters

| Parameter                                                                                                                                                                                                                                             | DUT transmit frequency being tested |                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------|
|                                                                                                                                                                                                                                                       | $f \leq 3 \text{ GHz}$              | $3 \text{ GHz} < f \leq 6 \text{ GHz}$ |
| Maximum distance between the closest measured points and the phantom surface ( $z_{M1}$ in Figure 14 and Table 2, in mm)                                                                                                                              | 5                                   | $\delta \ln(2)/2^a$                    |
| Maximum angle between the probe axis and the flat phantom surface normal ( $\alpha$ in Figure 14)                                                                                                                                                     | 5°                                  | 5°                                     |
| Maximum spacing between measured points in the x- and y-directions ( $\Delta x$ and $\Delta y$ , in mm)                                                                                                                                               | 8                                   | $24/f^{b,c}$                           |
| For uniform grids:<br>Maximum spacing between measured points in the direction normal to the phantom shell ( $\Delta z_1$ in Figure 14, in mm)                                                                                                        | 5                                   | $10/(f - 1)$                           |
| For graded grids:<br>Maximum spacing between the two closest measured points in the direction normal to the phantom shell ( $\Delta z_1$ in Figure 14, in mm)                                                                                         | 4                                   | $12/f$                                 |
| For graded grids:<br>Maximum incremental increase in the spacing between measured points in the direction normal to the phantom shell ( $R_z = \Delta z_2/\Delta z_1$ in Figure 14)                                                                   | 1,5                                 | 1,5                                    |
| Minimum edge length of the zoom scan volume in the x- and y-directions ( $L_z$ in 7.2.5.3, in mm)                                                                                                                                                     | 30                                  | 22                                     |
| Minimum edge length of the zoom scan volume in the direction normal to the phantom shell ( $L_h$ in 7.2.5.3, in mm)                                                                                                                                   | 30                                  | 22                                     |
| Tolerance in the probe angle                                                                                                                                                                                                                          | 1°                                  | 1°                                     |
| <sup>a</sup> $\delta$ is the penetration depth for a plane-wave incident normally on a planar half-space.<br><sup>b</sup> This is the maximum spacing allowed, which may not work for all circumstances.<br><sup>c</sup> $f$ is the frequency in GHz. |                                     |                                        |

- e) Use post processing (e.g. interpolation and extrapolation) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.
- f) The local SAR should be measured at the same location as in Step a). SAR drift is assessed and reported in the uncertainty budget.

In the event that the evaluation of measurement drift exceeds the 5 % tolerance, it is required that SAR be reassessed following guidelines contained within this standard.

If the drift is larger than 5 %, then the measurement drift shall be considered a bias, not an uncertainty. A correction shall be applied to the measured SAR value. It is not necessary to record the drift in the uncertainty budget (i.e.  $u_i = 0 \%$ ). The uncertainty budget reported in a measurement report should correspond to the highest SAR value reported (after correction, if applicable). Alternatively, the uncertainty budget reported should cover all measurements, i.e., it should report a conservative value.

### 4.3. Test Equipment

Measuring equipment used to perform the tests is documented in this report and has been calibrated in accordance with UKAS' recommendations and is traceable to recognized national standards.

| UL Asset No. | Instrument Name            | Manufacturer    | Type            | Serial No.      | Date Last Calibrated   | Cal. Interval (Months) |
|--------------|----------------------------|-----------------|-----------------|-----------------|------------------------|------------------------|
| PRE0194808   | E-Field Probe              | SPEAG           | EX3DV4          | 7549            | 16 Feb 2021            | 12                     |
| PRE0135114   | Data Acquisition Equipment | SPEAG           | DAE4            | 1435            | 19 Feb 2021            | 12                     |
| PRE0191245   | Phantom                    | SPEAG           | ELI V8          | 2091            | Cal. as part of system | -                      |
| PRE0131865   | Dipole Antenna             | SPEAG           | D2450V2         | 725             | 07 Oct 2020            | 12                     |
| PRE0191906   | POWERSOURCE1               | SPEAG           | SE UMS 160 BA   | 4012            | 29 Apr 2020            | 12                     |
| PRE0178467   | RS Hygrometer              | RS Components   | 408-6109        | 708Q06R         | 01 Apr 2020            | 12                     |
| PRE0179706   | Body Handset Positioner    | SPEAG           | MD4HACV5        | None            | Cal. not required      | -                      |
| PRE0178117   | Measurement Server         | SPEAG           | SE UMS 028 BB   | 1563            | Cal. not required      | -                      |
| PRE0179697   | Phantom Support Structure  | SPEAG           | Phantom Table   | -               | Cal. not required      | -                      |
| PRE0178114   | Robot Arm                  | Staubli         | TX60 L          | F17/5ENYF1/A/01 | Cal. not required      | -                      |
| PRE0178121   | Robot Power Supply         | SPEAG           | CS8C            | F17/5ENYF1/C/01 | Cal. not required      | -                      |
| PRE0135073   | Power Sensor               | Rohde & Schwarz | NRP-Z51         | 103246          | 05 Mar 2021            | 12                     |
| PRE0175232   | Power Sensor               | Rohde & Schwarz | NRP-Z51         | 104649-JG       | 16 Apr 2020            | 12                     |
| PRE0131421   | Vector Network Analyser    | Keysight        | 8753ES          | US39172406      | 08 Mar 2021            | 12                     |
| PRE0145189   | DAK 3.5 Fluid Probe        | SPEAG           | SM DAK 040 CA   | 1089            | Cal. before use        | -                      |
| PRE0135306   | Digital Camera             | Nikon           | S3600           | 41010357        | Cal. not required      | -                      |
| PRE0195838   | RF Coax Cable              | Taoglas         | CAB.721         | -               | Cal. not required      | -                      |
| PRE0195840   | RF Coax Cable              | Taoglas         | CAB.721         | -               | Cal. not required      | -                      |
| PRE0136931   | RF Coax Cable              | -               | 70530/4PE       | -               | Cal. not required      | -                      |
| PRE0140096   | RF Coax Cable              | Huber+Suhner    | ST18/SMAm/Nm/36 | -               | Cal. not required      | -                      |

**4.3.1. SAR System Specifications**

|                                                 |                                                                                                                                                                          |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Robot System</b>                             |                                                                                                                                                                          |
| <b>Positioner:</b>                              | Stäubli Unimation Corp. Robot Model: TX60L                                                                                                                               |
| <b>Repeatability:</b>                           | ±0.030 mm                                                                                                                                                                |
| <b>No. of Axis:</b>                             | 6                                                                                                                                                                        |
| <b>Serial Number:</b>                           | F17/5ENYF1/A/01                                                                                                                                                          |
| <b>Reach:</b>                                   | 800 mm                                                                                                                                                                   |
| <b>Payload:</b>                                 | 2.0 kg                                                                                                                                                                   |
| <b>Control Unit:</b>                            | CS8C                                                                                                                                                                     |
| <b>Programming Language:</b>                    | V+                                                                                                                                                                       |
| <b>Data Acquisition Electronic (DAE) System</b> |                                                                                                                                                                          |
| <b>Serial Number:</b>                           | DAE4 SN: 1435                                                                                                                                                            |
| <b>PC Controller</b>                            |                                                                                                                                                                          |
| <b>PC:</b>                                      | HP EliteDesk800                                                                                                                                                          |
| <b>Operating System:</b>                        | Windows 10                                                                                                                                                               |
| <b>Data Card:</b>                               | DASY Measurement Server                                                                                                                                                  |
| <b>Data Converter</b>                           |                                                                                                                                                                          |
| <b>Features:</b>                                | Signal Amplifier, multiplexer, A/D converted and control logic.                                                                                                          |
| <b>Software:</b>                                | DASY6 PRO Software                                                                                                                                                       |
| <b>Connecting Lines:</b>                        | Optical downlink for data and status info.<br>Optical uplink for commands and clock.                                                                                     |
| <b>PC Interface Card</b>                        |                                                                                                                                                                          |
| <b>Function:</b>                                | 24 bit (64 MHz) DSP for real time processing Link to DAE4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot. |
| <b>Phantom</b>                                  |                                                                                                                                                                          |
| <b>Phantom:</b>                                 | ELI Phantom                                                                                                                                                              |
| <b>Shell Material:</b>                          | Fibreglass                                                                                                                                                               |
| <b>Thickness:</b>                               | 2.0 ±0.1 mm                                                                                                                                                              |
| <b>E-Field Probe</b>                            |                                                                                                                                                                          |
| <b>Model:</b>                                   | EX3DV4                                                                                                                                                                   |
| <b>Serial No:</b>                               | 7549                                                                                                                                                                     |
| <b>Construction:</b>                            | Triangular core                                                                                                                                                          |
| <b>Frequency:</b>                               | 10 MHz to > 6 GHz                                                                                                                                                        |
| <b>Linearity:</b>                               | ±0.2 dB (30 MHz to 6 GHz)                                                                                                                                                |
| <b>Probe Length (mm):</b>                       | 337                                                                                                                                                                      |
| <b>Probe Diameter (mm):</b>                     | 10                                                                                                                                                                       |
| <b>Tip Length (mm):</b>                         | 9                                                                                                                                                                        |
| <b>Tip Diameter (mm):</b>                       | 2.5                                                                                                                                                                      |
| <b>Sensor X Offset (mm):</b>                    | 1                                                                                                                                                                        |
| <b>Sensor Y Offset (mm):</b>                    | 1                                                                                                                                                                        |
| <b>Sensor Z Offset (mm):</b>                    | 1                                                                                                                                                                        |

## 5. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Test Name                                                | Confidence Level | Calculated Uncertainty |
|----------------------------------------------------------|------------------|------------------------|
| Uncertainty- Freq. < 3 GHz Head & Body Configuration 1g  | 95%              | ±25.69%                |
| Uncertainty- Freq. < 3 GHz Head & Body Configuration 10g | 95%              | ±23.14%                |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

**5.1. Uncertainty – Freq. < 3 GHz Head & Body Configuration 1g**

| Type | Source of uncertainty                                                         | + Value | - Value | Probability Distribution | Divisor | C <sub>i</sub> (10g) | Standard Uncertainty |         | v <sub>i</sub> or v <sub>eff</sub> |
|------|-------------------------------------------------------------------------------|---------|---------|--------------------------|---------|----------------------|----------------------|---------|------------------------------------|
|      |                                                                               |         |         |                          |         |                      | + u (%)              | - u (%) |                                    |
| B    | Probe calibration                                                             | 10.100  | 10.100  | normal (k=2)             | 2.0000  | 1.0000               | 5.050                | 5.050   | ∞                                  |
| B    | Axial Isotropy                                                                | 0.500   | 0.500   | Rectangular              | 1.7321  | 0.7071               | 0.204                | 0.204   | ∞                                  |
| B    | Hemispherical Isotropy                                                        | 2.600   | 2.600   | Rectangular              | 1.7321  | 0.7071               | 1.061                | 1.061   | ∞                                  |
| B    | Boundary Effect                                                               | 1.000   | 1.000   | Rectangular              | 1.7321  | 1.0000               | 0.577                | 0.577   | ∞                                  |
| B    | Linearity                                                                     | 0.600   | 0.600   | normal (k=2)             | 2.0000  | 1.0000               | 0.300                | 0.300   | ∞                                  |
| B    | Detection Limits                                                              | 0.250   | 0.250   | Rectangular              | 1.7321  | 1.0000               | 0.144                | 0.144   | ∞                                  |
| B    | Readout Electronics                                                           | 0.300   | 0.300   | normal (k=1)             | 1.0000  | 1.0000               | 0.300                | 0.300   | ∞                                  |
| B    | Modulation Response Time                                                      | 9.600   | 9.600   | normal (k=2)             | 2.0000  | 1.0000               | 4.800                | 4.800   | ∞                                  |
| B    | Response Time                                                                 | 1.010   | 1.010   | Rectangular              | 1.7321  | 1.0000               | 0.583                | 0.583   | ∞                                  |
| B    | Integration Time                                                              | 4.320   | 4.320   | Rectangular              | 1.7321  | 1.0000               | 2.494                | 2.494   | ∞                                  |
| B    | RF Ambient conditions                                                         | 0.260   | 0.260   | Rectangular              | 1.7321  | 1.0000               | 0.150                | 0.150   | ∞                                  |
| B    | Probe Positioner Mechanical Tolerance                                         | 0.020   | 0.020   | Rectangular              | 1.7321  | 1.0000               | 0.012                | 0.012   | ∞                                  |
| B    | Probe Positioning with regard to Phantom Shell                                | 0.400   | 0.400   | Rectangular              | 1.7321  | 1.0000               | 0.231                | 0.231   | ∞                                  |
| B    | Extrapolation and integration/ Maximum SAR evaluation                         | 2.000   | 2.000   | Rectangular              | 1.7321  | 1.0000               | 1.155                | 1.155   | ∞                                  |
| A    | Test Sample Positioning                                                       | 4.590   | 4.590   | normal (k=1)             | 1.0000  | 1.0000               | 4.590                | 4.590   | 25                                 |
| A    | Device Holder uncertainty                                                     | 7.480   | 7.480   | normal (k=1)             | 1.0000  | 1.0000               | 7.480                | 7.480   | 5                                  |
| B    | Drift of output power                                                         | 6.410   | 6.410   | Rectangular              | 1.7321  | 1.0000               | 3.701                | 3.701   | ∞                                  |
| B    | Phantom Shell Uncertainty                                                     | 5.700   | 5.700   | Rectangular              | 1.7321  | 1.0000               | 3.291                | 3.291   | ∞                                  |
| B    | Uncertainty in SAR correction for deviations in permittivity and conductivity | 1.900   | 1.900   | Rectangular              | 1.7321  | 1.0000               | 1.097                | 1.097   | ∞                                  |
| B    | Liquid Conductivity (measured value)                                          | 4.990   | 1.930   | normal (k=2)             | 2.0000  | 0.0000               | 0.000                | 0.000   | ∞                                  |
| B    | Liquid Permittivity (measured value)                                          | 1.330   | 2.120   | normal (k=2)             | 2.0000  | 0.0000               | 0.000                | 0.000   | ∞                                  |
| B    | Liquid Conductivity (temperature uncertainty)                                 | 1.300   | 1.300   | Rectangular              | 1.7321  | 1.0000               | 0.751                | 0.751   | ∞                                  |
| B    | Liquid Permittivity (temperature uncertainty)                                 | 0.320   | 0.320   | Rectangular              | 1.7321  | 1.0000               | 0.185                | 0.185   | ∞                                  |
|      | Combined standard uncertainty                                                 |         |         | t-distribution           |         |                      | 12.71                | 12.71   | 40                                 |
|      | Expanded uncertainty                                                          |         |         | k = 2.021                |         |                      | 25.69                | 25.69   | 40                                 |

**5.2. Uncertainty – Freq. < 3 GHz Head & Body Configuration 10g**

| Type | Source of uncertainty                                                         | + Value | - Value | Probability Distribution | Divisor | C <sub>i</sub> (10g) | Standard Uncertainty |         | v <sub>i</sub> or v <sub>eff</sub> |
|------|-------------------------------------------------------------------------------|---------|---------|--------------------------|---------|----------------------|----------------------|---------|------------------------------------|
|      |                                                                               |         |         |                          |         |                      | + u (%)              | - u (%) |                                    |
| B    | Probe calibration                                                             | 10.100  | 10.100  | normal (k=2)             | 2.0000  | 1.0000               | 5.050                | 5.050   | ∞                                  |
| B    | Axial Isotropy                                                                | 0.500   | 0.500   | Rectangular              | 1.7321  | 0.7071               | 0.204                | 0.204   | ∞                                  |
| B    | Hemispherical Isotropy                                                        | 2.600   | 2.600   | Rectangular              | 1.7321  | 0.7071               | 1.061                | 1.061   | ∞                                  |
| B    | Boundary Effect                                                               | 1.000   | 1.000   | Rectangular              | 1.7321  | 1.0000               | 0.577                | 0.577   | ∞                                  |
| B    | Linearity                                                                     | 0.600   | 0.600   | normal (k=2)             | 2.0000  | 1.0000               | 0.300                | 0.300   | ∞                                  |
| B    | Detection Limits                                                              | 0.250   | 0.250   | Rectangular              | 1.7321  | 1.0000               | 0.144                | 0.144   | ∞                                  |
| B    | Readout Electronics                                                           | 0.300   | 0.300   | normal (k=1)             | 1.0000  | 1.0000               | 0.300                | 0.300   | ∞                                  |
| B    | Modulation Response Time                                                      | 9.600   | 9.600   | normal (k=2)             | 2.0000  | 1.0000               | 4.800                | 4.800   | ∞                                  |
| B    | Response Time                                                                 | 1.010   | 1.010   | Rectangular              | 1.7321  | 1.0000               | 0.583                | 0.583   | ∞                                  |
| B    | Integration Time                                                              | 4.320   | 4.320   | Rectangular              | 1.7321  | 1.0000               | 2.494                | 2.494   | ∞                                  |
| B    | RF Ambient conditions                                                         | 0.260   | 0.260   | Rectangular              | 1.7321  | 1.0000               | 0.150                | 0.150   | ∞                                  |
| B    | Probe Positioner Mechanical Tolerance                                         | 0.020   | 0.020   | Rectangular              | 1.7321  | 1.0000               | 0.012                | 0.012   | ∞                                  |
| B    | Probe Positioning with regard to Phantom Shell                                | 0.400   | 0.400   | Rectangular              | 1.7321  | 1.0000               | 0.231                | 0.231   | ∞                                  |
| B    | Extrapolation and integration/ Maximum SAR evaluation                         | 2.000   | 2.000   | Rectangular              | 1.7321  | 1.0000               | 1.155                | 1.155   | ∞                                  |
| A    | Test Sample Positioning                                                       | 4.240   | 4.240   | normal (k=1)             | 1.0000  | 1.0000               | 4.240                | 4.240   | 25                                 |
| A    | Device Holder uncertainty                                                     | 6.090   | 6.090   | normal (k=1)             | 1.0000  | 1.0000               | 6.090                | 6.090   | 5                                  |
| B    | Drift of output power                                                         | 5.000   | 5.000   | Rectangular              | 1.7321  | 1.0000               | 2.887                | 2.887   | ∞                                  |
| B    | Phantom Shell Uncertainty                                                     | 5.700   | 5.700   | Rectangular              | 1.7321  | 1.0000               | 3.291                | 3.291   | ∞                                  |
| B    | Uncertainty in SAR correction for deviations in permittivity and conductivity | 1.600   | 1.600   | Rectangular              | 1.7321  | 1.0000               | 0.924                | 0.924   | ∞                                  |
| B    | Liquid Conductivity (measured value)                                          | 4.990   | 1.930   | normal (k=2)             | 2.0000  | 0.0000               | 0.000                | 0.000   | ∞                                  |
| B    | Liquid Permittivity (measured value)                                          | 1.330   | 2.120   | normal (k=2)             | 2.0000  | 0.0000               | 0.000                | 0.000   | ∞                                  |
| B    | Liquid Conductivity (temperature uncertainty)                                 | 1.300   | 1.300   | Rectangular              | 1.7321  | 1.0000               | 0.751                | 0.751   | ∞                                  |
| B    | Liquid Permittivity (temperature uncertainty)                                 | 0.320   | 0.320   | Rectangular              | 1.7321  | 1.0000               | 0.185                | 0.185   | ∞                                  |
|      | Combined standard uncertainty                                                 |         |         | t-distribution           |         |                      | 11.57                | 11.57   | 62                                 |
|      | Expanded uncertainty                                                          |         |         | k = 2                    |         |                      | 23.14                | 23.14   | 62                                 |

## 6. Equipment Under Test (EUT)

### 6.1. Description of Equipment Under Test (EUT)

|                          |                                                                                                                          |                                                          |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Serial Number:           | Radiated Samples                                                                                                         | RPT 16 : F0T047300000VX903<br>RPT 17 : F0T0473000L0VX90H |
|                          | Conducted Sample                                                                                                         | RPT 14 : F0T0483001S0VX905<br>RPT 15 : F0T0483001A0VX90M |
| Hardware Version Number: | Rev 1.0                                                                                                                  |                                                          |
| Software Version Number: | 0xF125                                                                                                                   |                                                          |
| Country of Manufacture:  | China                                                                                                                    |                                                          |
| Date of Receipt:         | 19 March 2021                                                                                                            |                                                          |
| DUT Description:         | The device under test is a 'Apple Magic Keyboard with Touch ID and Numeric Keyboard and supports Bluetooth radio'.       |                                                          |
| Operating Configurations | Body and Limbs                                                                                                           |                                                          |
| Device dimension         | Overall (Length x Width x Depth): 418.70 mm x 114.40 mm x 10.81 mm                                                       |                                                          |
| Battery Type             | <input checked="" type="checkbox"/> Standard – Lithium-ion battery<br><input type="checkbox"/> Extended (large capacity) |                                                          |

## 6.2. Wireless Technologies

| Wireless technologies | Frequency bands | Operating mode                                                                                                                                                                      |                                              | Duty Cycle    |
|-----------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------|
| Bluetooth             | 2.4 GHz         | <input type="checkbox"/> Core Spec. 4.0<br><input type="checkbox"/> Core Spec. 4.1<br><input type="checkbox"/> Core Spec. 4.2<br><input checked="" type="checkbox"/> Core Spec. 5.0 | Basic Rate (BDR)<br>Enhanced Data Rate (EDR) | 1-DH1: 35.33% |
|                       |                 | <input checked="" type="checkbox"/> Power Class 1<br><input type="checkbox"/> Power Class 2<br><input type="checkbox"/> Power Class 3                                               |                                              |               |

### Additional Information Related to Testing:

|                  |                                      |
|------------------|--------------------------------------|
| Antenna Type:    | Internal integral                    |
| Antenna Lengths: | As specified in <b>Appendix 12.1</b> |

| Number of Antennas: | Antenna Name | Port / Core | Antenna Type | Antenna Description | Type    |
|---------------------|--------------|-------------|--------------|---------------------|---------|
|                     | ANT1         | Core 0      | WPAN         | Bluetooth           | 1 fixed |

## Wireless Technologies

| Bluetooth |                                  |                |                     |                 |
|-----------|----------------------------------|----------------|---------------------|-----------------|
| Band      | Description                      |                |                     |                 |
| Bluetooth | Frequency Range: 2402 - 2480 MHz |                |                     |                 |
|           | Mode                             | Channel Number | Channel Description | Frequency (MHz) |
|           | BDR/EDR Mode                     | 0              | Low                 | 2402.0          |
|           |                                  | 39             | Middle              | 2441.0          |
|           |                                  | 78             | High                | 2480.0          |

**6.2.1. Bluetooth**

| RF Air interface | Mode                         | Packet Type | Channel | Maximum Power (dBm) |
|------------------|------------------------------|-------------|---------|---------------------|
| Bluetooth        | BDR                          | DH1         | ALL     | 6.90                |
|                  | EDR - $\pi/4$ -DQPSK (2Mb/s) | DH1         | ALL     | 5.70                |
|                  | EDR - 8DPSK (3Mb/s)          | DH1         | ALL     | 5.70                |
|                  | EDR - 8DPSK (3Mb/s)          | DH5         | ALL     | 4.90                |

## **7. RF Exposure Conditions (Test Configurations)**

### **7.1. Configuration Consideration**

| Technology Port | Configuration | Antenna-to-User Separation | Position | Antenna-to-Edge Separation (mm) | Evaluation Considered |
|-----------------|---------------|----------------------------|----------|---------------------------------|-----------------------|
| BT<br>(Core 0)  | Body & Limbs  | 0mm                        | Front    | < 50                            | Yes                   |
|                 |               |                            | Back     | < 50                            | Yes                   |
|                 |               |                            | Top      | < 50                            | Yes                   |
|                 |               |                            | Right    | > 50                            | No                    |
|                 |               |                            | Bottom   | > 50                            | No                    |
|                 |               |                            | Left     | < 50                            | Yes                   |

#### **Notes:**

1. The Antenna to edge separation distances are indicated in the 'Antenna Schematics' located in Section 12.1 of this report

### **7.2. SAR Test Exclusion Consideration**

| Frequency Band | Configuration(s) |
|----------------|------------------|
|                | Body & Limbs     |
| Bluetooth      | No               |

#### **Note:**

1. The details for the Maximum Rated Power and tolerance(s) can be found in section 6.

## **8. Conducted output power measurements**

### **Wi-Fi Antennas**

#### **8.1. RF Output Average Power Measurement: Bluetooth**

##### **8.1.1. Bluetooth 2.4 GHz**

| Channel Number | Packet Type | Frequency (MHz) | Avg Power (dBm) | Operating Mode        |
|----------------|-------------|-----------------|-----------------|-----------------------|
| 0              | 1-DH1       | 2402            | 5.36            | <b>BDR<br/>(GFSK)</b> |
| 39             | 1-DH1       | 2441            | 5.87            |                       |
| 78             | 1-DH1       | 2480            | 5.78            |                       |

Note: Conducted power measurements on EDR operating modes were not performed as max. rated power including tolerance are  $\leq$  BDR mode.

## 9. Dielectric Property Measurements & System Check

### 9.1. Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within  $\pm 2^\circ\text{C}$  of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

#### IEEE 1528:2013

| Target Frequency (MHz) | Head         |                | Body (FCC only) |                |
|------------------------|--------------|----------------|-----------------|----------------|
|                        | $\epsilon_r$ | $\sigma$ (S/m) | $\epsilon_r$    | $\sigma$ (S/m) |
| 150                    | 52.30        | 0.76           | 61.90           | 0.80           |
| 300                    | 45.30        | 0.87           | 58.20           | 0.92           |
| 450                    | 43.50        | 0.87           | 56.70           | 0.94           |
| 750                    | 41.90        | 0.89           | -               | -              |
| 835                    | 41.50        | 0.90           | 55.20           | 0.97           |
| 900                    | 41.50        | 0.97           | 55.00           | 1.05           |
| 915                    | 41.50        | 0.98           | 55.00           | 1.06           |
| 1450                   | 40.50        | 1.20           | 54.00           | 1.30           |
| 1500                   | 40.40        | 1.23           | -               | -              |
| 1610                   | 40.30        | 1.29           | 53.80           | 1.40           |
| 1640                   | 40.20        | 1.31           | -               | -              |
| 1750                   | 40.10        | 1.37           | -               | -              |
| 1800                   | 40.00        | 1.40           | 53.30           | 1.52           |
| 1900                   | 40.00        | 1.40           | 53.30           | 1.52           |
| 2000                   | 40.00        | 1.40           | 53.30           | 1.52           |
| 2100                   | 39.80        | 1.49           | -               | -              |
| 2300                   | 39.50        | 1.67           | -               | -              |
| 2450                   | 39.20        | 1.80           | 52.70           | 1.95           |
| 2600                   | 39.00        | 1.96           | -               | -              |
| 3000                   | 38.50        | 2.40           | 52.00           | 2.73           |
| 3500                   | 37.90        | 2.91           | -               | -              |
| 4000                   | 37.40        | 3.43           | -               | -              |
| 4500                   | 36.80        | 3.94           | -               | -              |
| 5000                   | 36.20        | 4.45           | 49.30           | 5.07           |
| 5100                   | 36.10        | 4.55           | 49.10           | 5.18           |
| 5200                   | 36.00        | 4.66           | 49.00           | 5.30           |
| 5250                   | 35.90        | 4.71           | 48.90           | 5.36           |
| 5300                   | 35.90        | 4.76           | 48.90           | 5.42           |
| 5400                   | 35.80        | 4.86           | 48.70           | 5.53           |
| 5500                   | 35.60        | 4.96           | 48.60           | 5.65           |
| 5600                   | 35.50        | 5.07           | 48.50           | 5.77           |
| 5700                   | 35.40        | 5.17           | 48.30           | 5.88           |
| 5750                   | 35.40        | 5.22           | 48.30           | 5.94           |
| 5800                   | 35.30        | 5.27           | 48.20           | 6.00           |
| 6000                   | 35.10        | 5.48           | -               | -              |

**NOTE:** For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.

## **9.2. System Check**

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

## **9.3. Numerical SAR Target Values**

The numerical SAR target values are obtained from the reference standards. The measured values are normalised to 1 Watt.

| System Dipole | Freq. (MHz) | Numerical SAR Target Values (W/kg) |       |       |
|---------------|-------------|------------------------------------|-------|-------|
|               |             | 1g/10g                             | Head  | Body  |
| D2450V2       | 2450        | 1g                                 | 52.40 | 51.20 |
|               |             | 10g                                | 24.00 | 23.70 |

#### 9.4. Dielectric Property Measurements & System Check Results

The 1-g SAR and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within  $\pm 10\%$  of the manufacturer calibrated dipole SAR target. The internal limit is set to  $\pm 10\%$ .

##### Site 63

##### 2450 Head

Date: 25 Mar 2021

Reference Dipole Antenna: D2450V2 - SN725

| Simulant | Frequency (MHz) | Room Temp(°C) | Liquid Temp(°C) | Parameters     | Target Value | Measured Value | Deviation (%) | Limit (%) |
|----------|-----------------|---------------|-----------------|----------------|--------------|----------------|---------------|-----------|
| Head     | 2450            | 20.3          | 20.2            | $\epsilon_r$   | 39.20        | 38.92          | -0.72         | 10        |
|          |                 |               |                 | $\sigma$ (S/m) | 1.80         | 1.75           | -2.78         | 10        |
|          |                 |               |                 | 1g (W/kg)      | 52.40        | 48.68          | -7.09         | 10        |
|          |                 |               |                 | 10g (W/kg)     | 24.00        | 23.14          | -3.56         | 10        |

## 10. Measurements, Examinations and Derived Result

### 10.1. Specific Absorption Rate - Test Results – Bluetooth

#### 10.1.1. Bluetooth Body 1g

Max Reported SAR = 0.021 (W/kg)

| Mode | Dist. (mm) | EUT Position | Channel Number | Freq (MHz) | Power (dBm)   |       | 1g: SAR Results (W/kg) |              | Transmitting Antenna | Notes | Plot No. |
|------|------------|--------------|----------------|------------|---------------|-------|------------------------|--------------|----------------------|-------|----------|
|      |            |              |                |            | Tune Up Limit | Meas. | Meas. SAR Level        | Reported SAR |                      |       |          |
| GFSK | 0          | Front        | 39             | 2441.0     | 6.90          | 5.87  | 0.010                  | 0.013        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 39             | 2441.0     | 6.90          | 5.87  | 0.015                  | 0.019        | Core 0               | -     | -        |
| GFSK | 0          | Top          | 39             | 2441.0     | 6.90          | 5.87  | 0.010                  | 0.013        | Core 0               | -     | -        |
| GFSK | 0          | Left         | 39             | 2441.0     | 6.90          | 5.87  | 0.003                  | 0.004        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 0              | 2402.0     | 6.90          | 5.36  | 0.014                  | 0.020        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 78             | 2480.0     | 6.90          | 5.78  | 0.016                  | 0.021        | Core 0               | -     | 001      |

Note(s):

#### 10.1.2. Bluetooth Limbs 10g

Max Reported SAR = 0.012 (W/kg)

| Mode | Dist. (mm) | EUT Position | Channel Number | Freq (MHz) | Power (dBm)   |       | 10g: SAR Results (W/kg) |              | Transmitting Antenna | Notes | Plot No. |
|------|------------|--------------|----------------|------------|---------------|-------|-------------------------|--------------|----------------------|-------|----------|
|      |            |              |                |            | Tune Up Limit | Meas. | Meas. SAR Level         | Reported SAR |                      |       |          |
| GFSK | 0          | Front        | 39             | 2441.0     | 6.90          | 5.87  | 0.004                   | 0.005        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 39             | 2441.0     | 6.90          | 5.87  | 0.008                   | 0.010        | Core 0               | -     | -        |
| GFSK | 0          | Top          | 39             | 2441.0     | 6.90          | 5.87  | 0.004                   | 0.005        | Core 0               | -     | -        |
| GFSK | 0          | Left         | 39             | 2441.0     | 6.90          | 5.87  | 0.000                   | 0.000        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 0              | 2402.0     | 6.90          | 5.36  | 0.008                   | 0.011        | Core 0               | -     | -        |
| GFSK | 0          | Back         | 78             | 2480.0     | 6.90          | 5.78  | 0.009                   | 0.012        | Core 0               | -     | 001      |

Note(s):

## **10.2. SAR Measurement Variability**

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

### **Body 1g-SAR:**

1. Repeated measurement is not required when the original highest measured SAR is  $< 0.8$  W/Kg; steps 2) through 4) do not apply.
2. When the original highest measured 1g-SAR is  $\geq 0.8$  W/Kg, repeat that measurement once.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg (~10% from the 1g-SAR limit).
4. Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.50$  W/Kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

### **Limbs 10g-SAR:**

1. Repeated measurement is not required when the original highest measured SAR is  $< 2.0$  W/Kg; steps 2) through 4) do not apply.
2. When the original highest measured 10g-SAR is  $\geq 2.00$  W/Kg, repeat that measurement once.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 3.625$  W/kg (~10% from the 10g-SAR limit).
4. Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 3.75$  W/Kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

Note: Measured 1g-SAR & 10g-SAR levels were below the thresholds hence measurement variability was not considered.

## **11.Highest Standalone SAR and Simultaneous Transmission**

### **11.1.Highest Standalone Reported SAR**

#### **Individual Transmitter Evaluation per Band: Bluetooth**

##### **Bluetooth Body 1g**

| Exposure Configuration            | Technology Band | Reported 1g - SAR (W/Kg) | Equipment Class | Highest Reported 1g -SAR (W/Kg) |
|-----------------------------------|-----------------|--------------------------|-----------------|---------------------------------|
|                                   |                 | Core 0                   |                 |                                 |
|                                   |                 | Ant 1                    |                 |                                 |
| Body<br>(Separation Distance 0mm) | Bluetooth       | 0.021                    | DSS             | 0.021                           |

##### **Bluetooth Limbs 10g**

| Exposure Configuration             | Technology Band | Reported 10g - SAR (W/Kg) | Equipment Class | Highest Reported 10g -SAR (W/Kg) |
|------------------------------------|-----------------|---------------------------|-----------------|----------------------------------|
|                                    |                 | Core 0                    |                 |                                  |
|                                    |                 | Ant 1                     |                 |                                  |
| Limbs<br>(Separation Distance 0mm) | Bluetooth       | 0.012                     | DSS             | 0.012                            |

### **11.2. Simultaneous Transmission analysis**

Simultaneous transmission SAR test analysis is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

The worst case simultaneous transmission analysis is considered for the following cases:

Note: No simultaneous transmission analysis is required, as DUT do not support this feature.