



BUREAU  
VERITAS

## Part-0 SAR Characterization Report

# Part-0 SAR Characterization Report

Report No. : SFBBQZ-WTW-P24030292

Applicant and Manufacturer : NETGEAR, INC.

Address : 350 East Plumeria Drive San Jose CA 95134

Product : Nighthawk 5G Mobile Router

FCC ID : PY324100618

Brand : NETGEAR

Model No. : MR7400

Sample Received Date : Mar. 29, 2024

Lab Address : No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location : No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City, Taiwan

**CERTIFICATION:** The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch–Lin Kou Laboratories**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

Prepared By :

Vera Huang

Vera Huang / Specialist

Approved By :

Gordon Lin

Gordon Lin / Manager



FCC Accredited No.: TW0003

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

## Part-0 SAR Characterization Report

### Table of Contents

|                                                               |    |
|---------------------------------------------------------------|----|
| 1. Description of Equipment Under Test .....                  | 4  |
| 2. SAR Measurement System .....                               | 6  |
| 2.1. Definition of Specific Absorption Rate (SAR) .....       | 6  |
| 2.2. SPEAG DASY6 System .....                                 | 6  |
| 2.3. SAR Measurement Procedure .....                          | 7  |
| 2.3.1. Area Scan and Zoom Scan Procedure .....                | 8  |
| 2.3.2. Power Drift Monitoring .....                           | 9  |
| 2.3.3. Spatial Peak SAR Evaluation.....                       | 9  |
| 2.3.4. SAR Averaged Methods.....                              | 9  |
| 3. SAR Characterization .....                                 | 10 |
| 3.1. Smart Transmit feature for RF Exposure.....              | 10 |
| 3.2. SAR Design Target.....                                   | 10 |
| 3.3. SAR Characterization.....                                | 10 |
| 3.4. SAR Test Result For $P_{\text{limit}}$ Calculations..... | 10 |
| 4. Equipment List.....                                        | 11 |
| 5. Measurement Uncertainty .....                              | 12 |
| 6. Information of the Testing Laboratories.....               | 16 |

Appendix A. SAR Test Result For  $P_{\text{limit}}$  Calculations

Appendix B. Calibration of Test Equipment List



## Release Control Record

| Report No.           | Reason for Change | Date Issued   |
|----------------------|-------------------|---------------|
| SFBBQZ-WTW-P24030292 | Initial release   | Jul. 02, 2024 |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |
|                      |                   |               |

## Part-0 SAR Characterization Report

### 1. Description of Equipment Under Test

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT Type</b>                           | Nighthawk 5G Mobile Router                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>FCC ID</b>                             | PY324100618                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Brand Name</b>                         | NETGEAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Model Name</b>                         | MR7400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Tx Frequency Bands<br/>(Unit: MHz)</b> | LTE Band 2 : 1850.7 ~ 1909.3<br>LTE Band 4 : 1710.7 ~ 1754.3<br>LTE Band 5 : 824.7 ~ 848.3<br>LTE Band 7 : 2502.5 ~ 2567.5<br>LTE Band 12 : 699.7 ~ 715.3<br>LTE Band 14 : 790.5 ~ 795.5<br>LTE Band 30 : 2307.5 ~ 2312.5<br>LTE Band 40 : 2302.5 ~ 2397.5<br>LTE Band 48 : 3552.5 ~ 3697.5<br>LTE Band 66 : 1710.7 ~ 1779.3<br>5GNR-n2 : 1850 ~ 1910<br>5GNR-n5 : 824 ~ 849<br>5GNR-n12 : 699 ~ 716<br>5GNR-n14 : 788 ~ 798<br>5GNR-n30 : 2305 ~ 2315<br>5GNR-n48 : 3550 ~ 3700<br>5GNR-n66 : 1710 ~ 1780<br>5GNR-n77 : 3455.01 ~ 3544.98, 3705 ~ 3975<br>5GNR-n78 : 3455.01 ~ 3544.98, 3705 ~ 3795<br>WLAN : 2412 ~ 2462, 5180 ~ 5250, 5260 ~ 5320, 5500 ~ 5720, 5745 ~ 5825,<br>5815 ~ 5885, 5955 ~ 6415, 6435 ~ 6545, 6535 ~ 6885, 6895 ~ 7115 |

#### Note:

- The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

#### List of Accessory:

|                |                     |                  |
|----------------|---------------------|------------------|
| <b>Battery</b> | <b>Brand Name</b>   | NETGEAR          |
|                | <b>Model Name</b>   | W-20b            |
|                | <b>Power Rating</b> | 3.85Vdc, 19.96Wh |

## Part-0 SAR Characterization Report

### Time-Averaging for SAR

This device is enabled with Qualcomm Smart Transmit algorithm to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from 2G/3G/LTE/5G NR WWAN is in compliance with FCC requirements. This Part-0 report shows SAR characterization of WWAN radios for 2G/3G/LTE/5G NR sub-6. The characterization is achieved by determining  $P_{\text{limit}}$  for 2G/3G/LTE/5G NR sub-6 that corresponds to the exposure design targets after accounting for all device design related uncertainties. The SAR characterization is denoted as SAR Char in this report.

The compliance test under the static transmission scenario and simultaneous transmission analysis are reported in Part-1 report. The validation of the time-averaging algorithm and compliance under the dynamic (time-varying) transmission scenario for WWAN technologies are reported in Part-2 report.

### Nomenclature for Part-0 Report

| Technology      | Term               | Description                                                                                                                                 |
|-----------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 2G/3G/LTE/5G NR | $P_{\text{limit}}$ | Power level that corresponds to the exposure design target (SAR_design_target) after accounting for all device design related uncertainties |
|                 | $P_{\text{max}}$   | Maximum tune up output power                                                                                                                |
|                 | SAR_design_target  | Target SAR level < FCC SAR limit after accounting for all device design related uncertainties                                               |
|                 | SAR Char           | Table containing $P_{\text{limit}}$ for all technologies and bands                                                                          |

## **2. SAR Measurement System**

### **2.1. Definition of Specific Absorption Rate (SAR)**

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\text{SAR} = \frac{d}{dt} \left( \frac{dW}{dm} \right) = \frac{d}{dt} \left( \frac{dW}{\rho dv} \right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

### **2.2. SPEAG DASY6 System**

DASY6 system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY6 software defined. The DASY6 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.

## Part-0 SAR Characterization Report

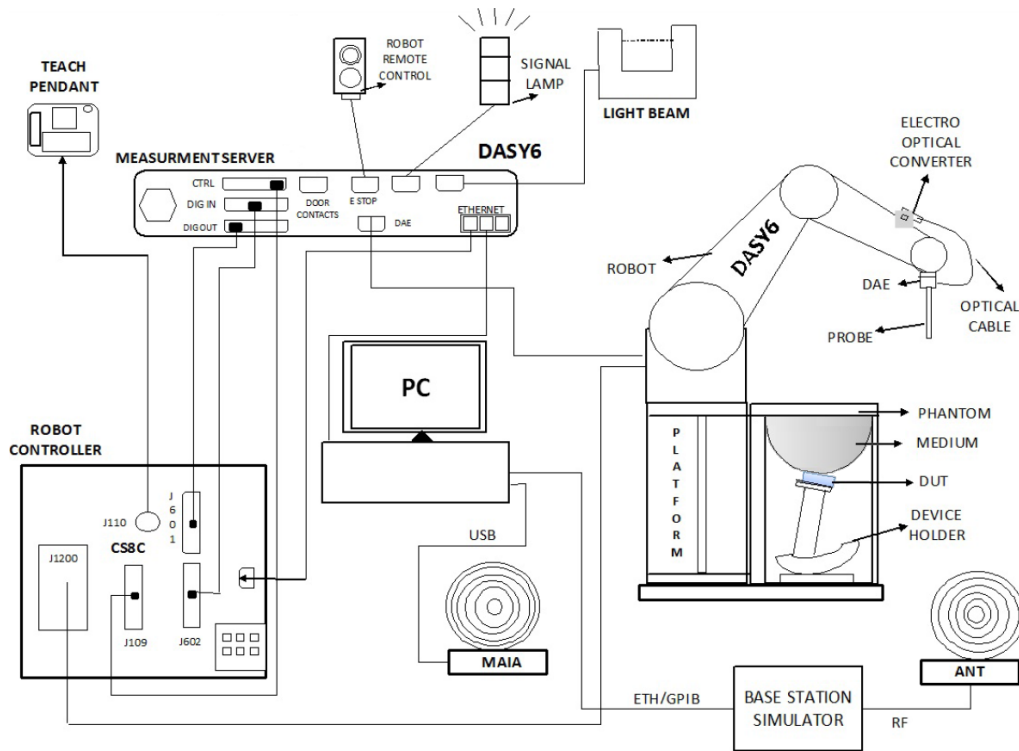


Fig-2.1 SPEAG DASY6 System Setup

### 2.3. SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- Power reference measurement
- Area scan
- Zoom scan
- Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

- Make EUT to transmit maximum output power
- Measure conducted output power through RF cable
- Place the EUT in the specific position of phantom
- Perform SAR testing steps on the DASY system
- Record the SAR value

## Part-0 SAR Characterization Report

### 2.3.1. Area Scan and Zoom Scan Procedure

First area scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an area scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, zoom scan is required. The zoom scan is performed around the highest E-field value to determine the averaged SAR-distribution.

Measure the local SAR at a test point at 1.4 mm of the inner surface of the phantom recommended by SEPAG. The area scan (two-dimensional SAR distribution) is performed cover at least an area larger than the projection of the EUT or antenna. The measurement resolution and spatial resolution for interpolation shall be chosen to allow identification of the local peak locations to within one-half of the linear dimension of the corresponding side of the zoom scan volume. Following table provides the measurement parameters required for the area scan.

| Parameter                                                                                 | $f \leq 3 \text{ GHz}$                                                                | $3 \text{ GHz} < f \leq 6 \text{ GHz}$                                               |
|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Maximum distance from closest measurement point to phantom surface                        | $5 \pm 1$                                                                             | $\delta \ln(2)/2 \pm 0.5$                                                            |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | $30^\circ \pm 1^\circ$                                                                | $20^\circ \pm 1^\circ$                                                               |
| Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$    | $\leq 2 \text{ GHz: } \leq 15 \text{ mm}$<br>$2 - 3 \text{ GHz: } \leq 12 \text{ mm}$ | $3 - 4 \text{ GHz: } \leq 12 \text{ mm}$<br>$4 - 6 \text{ GHz: } \leq 10 \text{ mm}$ |

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).

The zoom scan (three-dimensional SAR distribution) is performed at the local maxima locations identified in previous area scan procedure. The zoom scan volume must be larger than the required minimum dimensions. When graded grids are used, which only applies in the direction normal to the phantom surface, the initial grid separation closest to the phantom surface and subsequent graded grid increment ratios must satisfy the required protocols. The 1-g SAR averaging volume must be fully contained within the zoom scan measurement volume boundaries; otherwise, the measurement must be repeated by shifting or expanding the zoom scan volume. The similar requirements also apply to 10-g SAR measurements. Following table provides the measurement parameters required for the zoom scan.

| Parameter                                                                              |                                                     | $f \leq 3 \text{ GHz}$                                                              | $3 \text{ GHz} < f \leq 6 \text{ GHz}$                                                                                              |
|----------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$ |                                                     | $\leq 2 \text{ GHz: } \leq 8 \text{ mm}$<br>$2 - 3 \text{ GHz: } \leq 5 \text{ mm}$ | $3 - 4 \text{ GHz: } \leq 5 \text{ mm}$<br>$4 - 6 \text{ GHz: } \leq 4 \text{ mm}$                                                  |
| Maximum zoom scan spatial resolution, normal to phantom surface                        | <i>uniform grid:</i> $\Delta z_{\text{Zoom}}(n)$    | $\leq 5 \text{ mm}$                                                                 | $3 - 4 \text{ GHz: } \leq 4 \text{ mm}$<br>$4 - 5 \text{ GHz: } \leq 3 \text{ mm}$<br>$5 - 6 \text{ GHz: } \leq 2 \text{ mm}$       |
|                                                                                        | <i>graded grids:</i><br>$\Delta z_{\text{Zoom}}(1)$ | $\leq 4 \text{ mm}$                                                                 | $3 - 4 \text{ GHz: } \leq 3.0 \text{ mm}$<br>$4 - 5 \text{ GHz: } \leq 2.5 \text{ mm}$<br>$5 - 6 \text{ GHz: } \leq 2.0 \text{ mm}$ |
|                                                                                        | $\Delta z_{\text{Zoom}}(n>1)$                       | $\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1) \text{ mm}$                             |                                                                                                                                     |
| Minimum zoom scan volume (x, y, z)                                                     |                                                     | $\geq 30 \text{ mm}$                                                                | $3 - 4 \text{ GHz: } \geq 28 \text{ mm}$<br>$4 - 5 \text{ GHz: } \geq 25 \text{ mm}$<br>$5 - 6 \text{ GHz: } \geq 22 \text{ mm}$    |

## Part-0 SAR Characterization Report

---

### 2.3.2. Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

### 2.3.3. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

### 2.3.4. SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

## Part-0 SAR Characterization Report

### 3. SAR Characterization

#### 3.1. Smart Transmit feature for RF Exposure

The FCC RF exposure limit is defined based on time- averaged RF exposure. This product implements Qualcomm Smart Transmit feature which controls the instantaneous transmitting power for WWAN transmitter to ensure the product in compliance with FCC RF exposure limit over a defined time window, for SAR(transmit frequency < 6GHz). To control and manage transmitting power in real time and to ensure at all times the time-averaged RF exposure is compliant to the regulation requirement.

#### 3.2. SAR Design Target

The SAR\_design\_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer. The total uncertainties for this device is 1.0 dB. To account for total uncertainty, SAR\_design\_target is determined as below.

$$SAR_{design\_target} < SAR_{regulatory\ limit} \times 10^{\frac{-Total\ Uncertainty}{10}}$$

For 1g-SAR, the SAR<sub>regulatory limit</sub> is 1.2 W/kg, and the SAR\_design\_target is 0.95 W/kg.

The SAR\_design\_target for the TAS test is determined as

$$SAR_{design\_target} = 0.874 \frac{W}{Kg} \text{ for } 1g \text{ SAR}$$

As the EUT supports WLAN radio, which is not enabled by Smart Transmit, the above value has been chosen as to keep the simultaneous transmission in compliance with regulatory limit.

#### 3.3. SAR Characterization

The P<sub>limit</sub> is calculated by linearly scaling with the measured SAR at the P<sub>max</sub> to correspond to the SAR\_design\_target. The P<sub>limit</sub> determination for each exposure scenario corresponding to SAR\_design\_target are show next Section.

#### 3.4. SAR Test Result For P<sub>limit</sub> Calculations

Refer to Appendix A.

### 4. Equipment List

Refer to Appendix B.

## Part-0 SAR Characterization Report

### 5. Measurement Uncertainty

| Source of Uncertainty                                | Uncertainty<br>(± %) | Probability<br>Distribution | Divisor | Ci<br>(1g) | Ci<br>(10g) | Standard<br>Uncertainty<br>(± %, 1g) | Standard<br>Uncertainty<br>(± %, 10g) | Vi |
|------------------------------------------------------|----------------------|-----------------------------|---------|------------|-------------|--------------------------------------|---------------------------------------|----|
| <b>Measurement System</b>                            |                      |                             |         |            |             |                                      |                                       |    |
| Probe Calibration                                    | 6.0                  | Normal                      | 1       | 1          | 1           | 6.0                                  | 6.0                                   | ∞  |
| Axial Isotropy                                       | 4.7                  | Rectangular                 | √3      | √0.5       | √0.5        | 1.9                                  | 1.9                                   | ∞  |
| Hemispherical Isotropy                               | 9.6                  | Rectangular                 | √3      | √0.5       | √0.5        | 3.9                                  | 3.9                                   | ∞  |
| Boundary Effect                                      | 1.0                  | Rectangular                 | √3      | 1          | 1           | 0.6                                  | 0.6                                   | ∞  |
| Linearity                                            | 4.7                  | Rectangular                 | √3      | 1          | 1           | 2.7                                  | 2.7                                   | ∞  |
| Detection Limits                                     | 0.25                 | Rectangular                 | √3      | 1          | 1           | 0.14                                 | 0.14                                  | ∞  |
| Probe Modulation Response                            | 4.8                  | Rectangular                 | √3      | 1          | 1           | 2.8                                  | 2.8                                   | ∞  |
| Readout Electronics                                  | 0.3                  | Normal                      | 1       | 1          | 1           | 0.3                                  | 0.3                                   | ∞  |
| Response Time                                        | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| Integration Time                                     | 1.7                  | Rectangular                 | √3      | 1          | 1           | 1.0                                  | 1.0                                   | ∞  |
| RF Ambient Conditions – Noise                        | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| RF Ambient Conditions – Reflections                  | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| Probe Positioner Mechanical Tolerance                | 0.02                 | Rectangular                 | √3      | 1          | 1           | 0.01                                 | 0.01                                  | ∞  |
| Probe Positioning with Respect to Phantom            | 0.4                  | Rectangular                 | √3      | 1          | 1           | 0.2                                  | 0.2                                   | ∞  |
| Post-processing                                      | 2.0                  | Rectangular                 | √3      | 1          | 1           | 1.2                                  | 1.2                                   | ∞  |
| <b>Test Sample Related</b>                           |                      |                             |         |            |             |                                      |                                       |    |
| Test Sample Positioning                              | 2.82 / 1.60          | Normal                      | 1       | 1          | 1           | 2.8                                  | 1.6                                   | 35 |
| Device Holder Uncertainty                            | 2.55 / 2.76          | Normal                      | 1       | 1          | 1           | 2.6                                  | 2.8                                   | 7  |
| Power Drift of Measurement                           | 5.0                  | Rectangular                 | √3      | 1          | 1           | 2.9                                  | 2.9                                   | ∞  |
| PowerScaling                                         | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| <b>Phantom and Setup</b>                             |                      |                             |         |            |             |                                      |                                       |    |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 5.7                  | Rectangular                 | √3      | 1          | 1           | 3.3                                  | 3.3                                   | ∞  |
| Liquid Conductivity (Temperature Uncertainty)        | 2.58                 | Rectangular                 | √3      | 0.78       | 0.71        | 1.2                                  | 1.1                                   | ∞  |
| Liquid Conductivity (Measured)                       | 2.95                 | Normal                      | 1       | 0.78       | 0.71        | 2.3                                  | 2.1                                   | 61 |
| Liquid Permittivity (Temperature Uncertainty)        | 1.97                 | Rectangular                 | √3      | 0.23       | 0.26        | 0.3                                  | 0.3                                   | ∞  |
| Liquid Permittivity (Measured)                       | 3.04                 | Normal                      | 1       | 0.23       | 0.26        | 0.7                                  | 0.8                                   | 47 |
| <b>Combined Standard Uncertainty</b>                 |                      |                             |         |            |             | ± 10.9 %                             | ± 10.7 %                              |    |
| <b>Expanded Uncertainty (K=2)</b>                    |                      |                             |         |            |             | ± 21.8 %                             | ± 21.4 %                              |    |

#### Head SAR Uncertainty Budget for Frequency Range of 300 MHz to 3 GHz

## Part-0 SAR Characterization Report

| Source of Uncertainty                                | Uncertainty<br>(± %) | Probability<br>Distribution | Divisor | Ci<br>(1g) | Ci<br>(10g) | Standard<br>Uncertainty<br>(± %, 1g) | Standard<br>Uncertainty<br>(± %, 10g) | Vi |
|------------------------------------------------------|----------------------|-----------------------------|---------|------------|-------------|--------------------------------------|---------------------------------------|----|
| <b>Measurement System</b>                            |                      |                             |         |            |             |                                      |                                       |    |
| Probe Calibration                                    | 6.55                 | Normal                      | 1       | 1          | 1           | 6.55                                 | 6.55                                  | ∞  |
| Axial Isotropy                                       | 4.7                  | Rectangular                 | √3      | 0.7        | 0.7         | 1.9                                  | 1.9                                   | ∞  |
| Hemispherical Isotropy                               | 9.6                  | Rectangular                 | √3      | 0.7        | 0.7         | 3.9                                  | 3.9                                   | ∞  |
| Boundary Effect                                      | 2.0                  | Rectangular                 | √3      | 1          | 1           | 1.2                                  | 1.2                                   | ∞  |
| Linearity                                            | 4.7                  | Rectangular                 | √3      | 1          | 1           | 2.7                                  | 2.7                                   | ∞  |
| Detection Limits                                     | 0.25                 | Rectangular                 | √3      | 1          | 1           | 0.14                                 | 0.14                                  | ∞  |
| Probe Modulation Response                            | 4.8                  | Rectangular                 | √3      | 1          | 1           | 2.8                                  | 2.8                                   | ∞  |
| Readout Electronics                                  | 0.3                  | Normal                      | 1       | 1          | 1           | 0.3                                  | 0.3                                   | ∞  |
| Response Time                                        | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| Integration Time                                     | 1.7                  | Rectangular                 | √3      | 1          | 1           | 1.0                                  | 1.0                                   | ∞  |
| RF Ambient Conditions – Noise                        | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| RF Ambient Conditions – Reflections                  | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| Probe Positioner Mechanical Tolerance                | 0.04                 | Rectangular                 | √3      | 1          | 1           | 0.02                                 | 0.02                                  | ∞  |
| Probe Positioning with Respect to Phantom            | 0.8                  | Rectangular                 | √3      | 1          | 1           | 0.5                                  | 0.5                                   | ∞  |
| Post-processing                                      | 4.0                  | Rectangular                 | √3      | 1          | 1           | 2.3                                  | 2.3                                   | ∞  |
| <b>Test Sample Related</b>                           |                      |                             |         |            |             |                                      |                                       |    |
| Test Sample Positioning                              | 2.82 / 1.60          | Normal                      | 1       | 1          | 1           | 2.8                                  | 1.6                                   | 35 |
| Device Holder Uncertainty                            | 2.55 / 2.76          | Normal                      | 1       | 1          | 1           | 2.6                                  | 2.8                                   | 7  |
| Power Drift of Measurement                           | 5.0                  | Rectangular                 | √3      | 1          | 1           | 2.9                                  | 2.9                                   | ∞  |
| PowerScaling                                         | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| <b>Phantom and Setup</b>                             |                      |                             |         |            |             |                                      |                                       |    |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 6.2                  | Rectangular                 | √3      | 1          | 1           | 3.6                                  | 3.6                                   | ∞  |
| Liquid Conductivity (Temperature Uncertainty)        | 2.58                 | Rectangular                 | √3      | 0.78       | 0.71        | 1.2                                  | 1.1                                   | ∞  |
| Liquid Conductivity (Measured)                       | 2.95                 | Normal                      | 1       | 0.78       | 0.71        | 2.3                                  | 2.1                                   | 61 |
| Liquid Permittivity (Temperature Uncertainty)        | 1.97                 | Rectangular                 | √3      | 0.23       | 0.26        | 0.3                                  | 0.3                                   | ∞  |
| Liquid Permittivity (Measured)                       | 3.04                 | Normal                      | 1       | 0.23       | 0.26        | 0.7                                  | 0.8                                   | 47 |
| <b>Combined Standard Uncertainty</b>                 |                      |                             |         |            |             | ± 11.6 %                             | ± 11.3 %                              |    |
| <b>Expanded Uncertainty (K=2)</b>                    |                      |                             |         |            |             | ± 23.2 %                             | ± 22.6 %                              |    |

### Head SAR Uncertainty Budget for Frequency Range of 3 GHz to 6 GHz

## Part-0 SAR Characterization Report

| Source of Uncertainty                                | Uncertainty<br>(± %) | Probability<br>Distribution | Divisor | Ci<br>(1g) | Ci<br>(10g) | Standard<br>Uncertainty<br>(± %, 1g) | Standard<br>Uncertainty<br>(± %, 10g) | Vi |
|------------------------------------------------------|----------------------|-----------------------------|---------|------------|-------------|--------------------------------------|---------------------------------------|----|
| <b>Measurement System</b>                            |                      |                             |         |            |             |                                      |                                       |    |
| Probe Calibration                                    | 6.0                  | Normal                      | 1       | 1          | 1           | 6.0                                  | 6.0                                   | ∞  |
| Axial Isotropy                                       | 4.7                  | Rectangular                 | √3      | √0.5       | √0.5        | 1.9                                  | 1.9                                   | ∞  |
| Hemispherical Isotropy                               | 9.6                  | Rectangular                 | √3      | √0.5       | √0.5        | 3.9                                  | 3.9                                   | ∞  |
| Boundary Effect                                      | 1.0                  | Rectangular                 | √3      | 1          | 1           | 0.6                                  | 0.6                                   | ∞  |
| Linearity                                            | 4.7                  | Rectangular                 | √3      | 1          | 1           | 2.7                                  | 2.7                                   | ∞  |
| Detection Limits                                     | 0.25                 | Rectangular                 | √3      | 1          | 1           | 0.14                                 | 0.14                                  | ∞  |
| Probe Modulation Response                            | 4.8                  | Rectangular                 | √3      | 1          | 1           | 2.8                                  | 2.8                                   | ∞  |
| Readout Electronics                                  | 0.3                  | Normal                      | 1       | 1          | 1           | 0.3                                  | 0.3                                   | ∞  |
| Response Time                                        | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| Integration Time                                     | 1.7                  | Rectangular                 | √3      | 1          | 1           | 1.0                                  | 1.0                                   | ∞  |
| RF Ambient Conditions – Noise                        | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| RF Ambient Conditions – Reflections                  | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| Probe Positioner Mechanical Tolerance                | 0.02                 | Rectangular                 | √3      | 1          | 1           | 0.01                                 | 0.01                                  | ∞  |
| Probe Positioning with Respect to Phantom            | 0.4                  | Rectangular                 | √3      | 1          | 1           | 0.2                                  | 0.2                                   | ∞  |
| Post-processing                                      | 2.0                  | Rectangular                 | √3      | 1          | 1           | 1.2                                  | 1.2                                   | ∞  |
| <b>Test Sample Related</b>                           |                      |                             |         |            |             |                                      |                                       |    |
| Test Sample Positioning                              | 3.68 / 1.73          | Normal                      | 1       | 1          | 1           | 3.7                                  | 1.7                                   | 29 |
| Device Holder Uncertainty                            | 2.55 / 2.76          | Normal                      | 1       | 1          | 1           | 2.6                                  | 2.8                                   | 7  |
| Power Drift of Measurement                           | 5.0                  | Rectangular                 | √3      | 1          | 1           | 2.9                                  | 2.9                                   | ∞  |
| PowerScaling                                         | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| <b>Phantom and Setup</b>                             |                      |                             |         |            |             |                                      |                                       |    |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 7.2                  | Rectangular                 | √3      | 1          | 1           | 4.2                                  | 4.2                                   | ∞  |
| Liquid Conductivity (Temperature Uncertainty)        | 2.58                 | Rectangular                 | √3      | 0.78       | 0.71        | 1.2                                  | 1.1                                   | ∞  |
| Liquid Conductivity (Measured)                       | 2.95                 | Normal                      | 1       | 0.78       | 0.71        | 2.3                                  | 2.1                                   | 61 |
| Liquid Permittivity (Temperature Uncertainty)        | 1.97                 | Rectangular                 | √3      | 0.23       | 0.26        | 0.3                                  | 0.3                                   | ∞  |
| Liquid Permittivity (Measured)                       | 3.04                 | Normal                      | 1       | 0.23       | 0.26        | 0.7                                  | 0.8                                   | 47 |
| <b>Combined Standard Uncertainty</b>                 |                      |                             |         |            |             | ± 11.5 %                             | ± 11.0 %                              |    |
| <b>Expanded Uncertainty (K=2)</b>                    |                      |                             |         |            |             | ± 23.0 %                             | ± 22.0 %                              |    |

Body SAR Uncertainty Budget for Frequency Range of 300 MHz to 3 GHz

## Part-0 SAR Characterization Report

| Source of Uncertainty                                | Uncertainty<br>(± %) | Probability<br>Distribution | Divisor | Ci<br>(1g) | Ci<br>(10g) | Standard<br>Uncertainty<br>(± %, 1g) | Standard<br>Uncertainty<br>(± %, 10g) | Vi |
|------------------------------------------------------|----------------------|-----------------------------|---------|------------|-------------|--------------------------------------|---------------------------------------|----|
| <b>Measurement System</b>                            |                      |                             |         |            |             |                                      |                                       |    |
| Probe Calibration                                    | 6.55                 | Normal                      | 1       | 1          | 1           | 6.55                                 | 6.55                                  | ∞  |
| Axial Isotropy                                       | 4.7                  | Rectangular                 | √3      | 0.7        | 0.7         | 1.9                                  | 1.9                                   | ∞  |
| Hemispherical Isotropy                               | 9.6                  | Rectangular                 | √3      | 0.7        | 0.7         | 3.9                                  | 3.9                                   | ∞  |
| Boundary Effect                                      | 2.0                  | Rectangular                 | √3      | 1          | 1           | 1.2                                  | 1.2                                   | ∞  |
| Linearity                                            | 4.7                  | Rectangular                 | √3      | 1          | 1           | 2.7                                  | 2.7                                   | ∞  |
| Detection Limits                                     | 0.25                 | Rectangular                 | √3      | 1          | 1           | 0.14                                 | 0.14                                  | ∞  |
| Probe Modulation Response                            | 4.8                  | Rectangular                 | √3      | 1          | 1           | 2.8                                  | 2.8                                   | ∞  |
| Readout Electronics                                  | 0.3                  | Normal                      | 1       | 1          | 1           | 0.3                                  | 0.3                                   | ∞  |
| Response Time                                        | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| Integration Time                                     | 1.7                  | Rectangular                 | √3      | 1          | 1           | 1.0                                  | 1.0                                   | ∞  |
| RF Ambient Conditions – Noise                        | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| RF Ambient Conditions – Reflections                  | 3.0                  | Rectangular                 | √3      | 1          | 1           | 1.7                                  | 1.7                                   | ∞  |
| Probe Positioner Mechanical Tolerance                | 0.04                 | Rectangular                 | √3      | 1          | 1           | 0.02                                 | 0.02                                  | ∞  |
| Probe Positioning with Respect to Phantom            | 0.8                  | Rectangular                 | √3      | 1          | 1           | 0.5                                  | 0.5                                   | ∞  |
| Post-processing                                      | 4.0                  | Rectangular                 | √3      | 1          | 1           | 2.3                                  | 2.3                                   | ∞  |
| <b>Test Sample Related</b>                           |                      |                             |         |            |             |                                      |                                       |    |
| Test Sample Positioning                              | 3.68 / 1.73          | Normal                      | 1       | 1          | 1           | 3.7                                  | 1.7                                   | 29 |
| Device Holder Uncertainty                            | 2.55 / 2.76          | Normal                      | 1       | 1          | 1           | 2.6                                  | 2.8                                   | 7  |
| Power Drift of Measurement                           | 5.0                  | Rectangular                 | √3      | 1          | 1           | 2.9                                  | 2.9                                   | ∞  |
| PowerScaling                                         | 0.0                  | Rectangular                 | √3      | 1          | 1           | 0.0                                  | 0.0                                   | ∞  |
| <b>Phantom and Setup</b>                             |                      |                             |         |            |             |                                      |                                       |    |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 7.6                  | Rectangular                 | √3      | 1          | 1           | 4.4                                  | 4.4                                   | ∞  |
| Liquid Conductivity (Temperature Uncertainty)        | 2.58                 | Rectangular                 | √3      | 0.78       | 0.71        | 1.2                                  | 1.1                                   | ∞  |
| Liquid Conductivity (Measured)                       | 2.95                 | Normal                      | 1       | 0.78       | 0.71        | 2.3                                  | 2.1                                   | 61 |
| Liquid Permittivity (Temperature Uncertainty)        | 1.97                 | Rectangular                 | √3      | 0.23       | 0.26        | 0.3                                  | 0.3                                   | ∞  |
| Liquid Permittivity (Measured)                       | 3.04                 | Normal                      | 1       | 0.23       | 0.26        | 0.7                                  | 0.8                                   | 47 |
| <b>Combined Standard Uncertainty</b>                 |                      |                             |         |            |             | ± 12.1 %                             | ± 11.6 %                              |    |
| <b>Expanded Uncertainty (K=2)</b>                    |                      |                             |         |            |             | ± 24.2 %                             | ± 23.2 %                              |    |

### Body SAR Uncertainty Budget for Frequency Range of 3 GHz to 6 GHz

## Part-0 SAR Characterization Report

---

### 6. Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Taiwan Huaya Lab:**

Add: No. 19, Huaya 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan

Tel: +886-(0)3-318-3232

Fax: +886-(0)3-211-5834

**Taiwan Linkou Lab:**

Add: No. 47-2, Baodoucuokeng, Linkou Dist., New Taipei City 244, Taiwan

Tel: +886-(0)2-2605-2180

Fax: +886-(0)2-2605-2943

**Taiwan Hsinchu Lab1:**

Add: E-2, No. 1, Lixing 1st Rd., East Dist., Hsinchu City 300, Taiwan

Tel: +886-(0)3-666-8565

Fax: +886-(0)3-666-8323

**Taiwan Hsinchu Lab2:**

Add: No. 49, Ln. 206, Wende Rd., Qionglin Township, Hsinchu County 307, Taiwan

Tel: +886-(0)3-512-0595

Fax: +886-(0)3-512-0568

**Taiwan Xindian Lab:**

Add: B2F., No. 215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan

Tel: +886-(0)2-8914-5882

Fax: +886-(0)2-8914-5840

**Email:** [service.adt@bureauveritas.com](mailto:service.adt@bureauveritas.com)

**Web Site:** <http://ee.bureauveritas.com.tw>

The road map of all our labs can be found in our web site also.

---END---