Part-0 SAR Characterization Report

Report No.	:	**SFCDVB-WTW-P22080669A-1**
Applicant	:	**Getac Technology Corporation.**
Address	:	**5F., Building A, No. 209, Sec.1, Nangang Rd.,Nangang Dist., Taipei City 11568, Taiwan, R.O.C.**
Product	:	**Wireless Module**
FCC ID	:	**QYLEM9190K**
Brand	:	**Getac**
Model No.	:	**EM9190**
Sample Received Date	:	**Aug. 08, 2023**
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.

This report is issued as a supplementary report to BV CPS report no.: SFCDVB-WTW-P22080669-1. The difference compared with original report is enable 5G NR-n48 and 5G NR-n77 mode by software. Therefore, only 5G NR-n48 and 5G NR-n77 was performed on full testing.

Prepared By : Vera Huang

Vera Huang / Specialist

Approved By : Gordon Lin

Gordon Lin / Manager

Testing Laboratory 2021

FCC Accredited No.: TW0003

Table of Contents

Release Control Record

Report No.	Reason for Change	Date Issued
SFCDVB-WTW-P22080669A-1	Initial release	Sep. 06, 2023

1. Description of Equipment Under Test

EUT Type	Wireless Module
FCC ID	QYLEM9190K
Brand Name	Getac
Model Name	EM9190
Tx Frequency Bands (Unit: MHz)	WCDMA Band II : 1852.4 ~ 1907.6 WCDMA Band IV : 1712.4 ~ 1752.6 WCDMA Band V : 826.4 ~ 846.6 LTE Band 2 : 1850.7 ~ 1909.3 LTE Band 4 : 1710.7 ~ 1754.3 LTE Band 5 : 824.7 ~ 848.3 LTE Band 7 : 2502.5 ~ 2567.5 LTE Band 12 : 699.7 ~ 715.3 LTE Band 13 : 779.5 ~ 784.5 LTE Band 14 : 790.5 ~ 795.5 LTE Band 17 : 706.5 ~ 713.5 LTE Band 25 : 1850.7 ~ 1914.3 LTE Band 26 : 814.7 ~ 848.3 LTE Band 30 : 2307.5 ~ 2312.5 LTE Band 38 : 2572.5 ~ 2617.5 LTE Band 41 : 2498.5 ~ 2687.5 LTE Band 42 : 3550 ~ 3600 LTE Band 48 : 3550 ~ 3700 LTE Band 66 : 1710.7 ~ 1779.3 LTE Band 71 : 665.5 ~ 695.5 5G NR n2 : 1852.5 ~ 1907.5 5G NR n5 : 826.5 ~ 846.5 5G NR n48 : 3555 ~ 3694.98 5G NR n66 : 1712.5 ~ 1777.5 5G NR n71 : 665.5 ~ 695.5 5G NR n77 : 3455.01 ~ 3544.98 & 3710.01 ~ 3969.99 WLAN : 2412 ~ 2472, 5180 ~ 5240, 5260 ~ 5320, 5500 ~ 5720, 5745 ~ 5825 Bluetooth : 2402 ~ 2480 NFC : 13.56

Note:

1. The EUT is authorized for use in specific End-product. Please refer to below for more details.

Product	Brand	Model	Description
Tablet	Getac	K120Y (Y= 10 , Y can be 0-9, a-z, A-Z, "-", "_" or blank for marketing purpose)	For marketing purpose
		K120G2-R	

2. The WLAN/BT module (Brand: Intel® Wi-Fi 6 AX201, Model: AX201NGW) was installed in the End-product.
3. 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 End-product Accessory:

Battery 1	**Brand Name**	Getac
	Model Name	BP3S1P2100S-01
	Power Rating	11.1Vdc, 2040mAh, 24Wh
	Type	Li-ion
Battery 2	**Brand Name**	Getac
	Model Name	BP4S1P3450P-01
	Power Rating	14.4Vdc, 3300mAh, 48Wh
	Type	Li-ion

Report Issue History Record:

Issue No.	Description	Date Issued
SFBASM-WTW-P21081224-1	Initial release	Nov. 16, 2021
SFCDVB-WTW-P22080669-1	Add new appearance (with non-metallic coating) and series model for End-product.	Aug. 29, 2022
SFCDVB-WTW-P22080669A-1	Enable 5G NR-n48 and 5G NR-n77 mode by software	Sep. 06, 2023

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 Plimit 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_{limit}	Power level that corresponds to the exposure design target (SAR_design_target) after accounting for all device design related uncertainties
	P_{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_{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:

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

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

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

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

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 form the optical into digital electric signal of the DAE and transfers data to the PC.

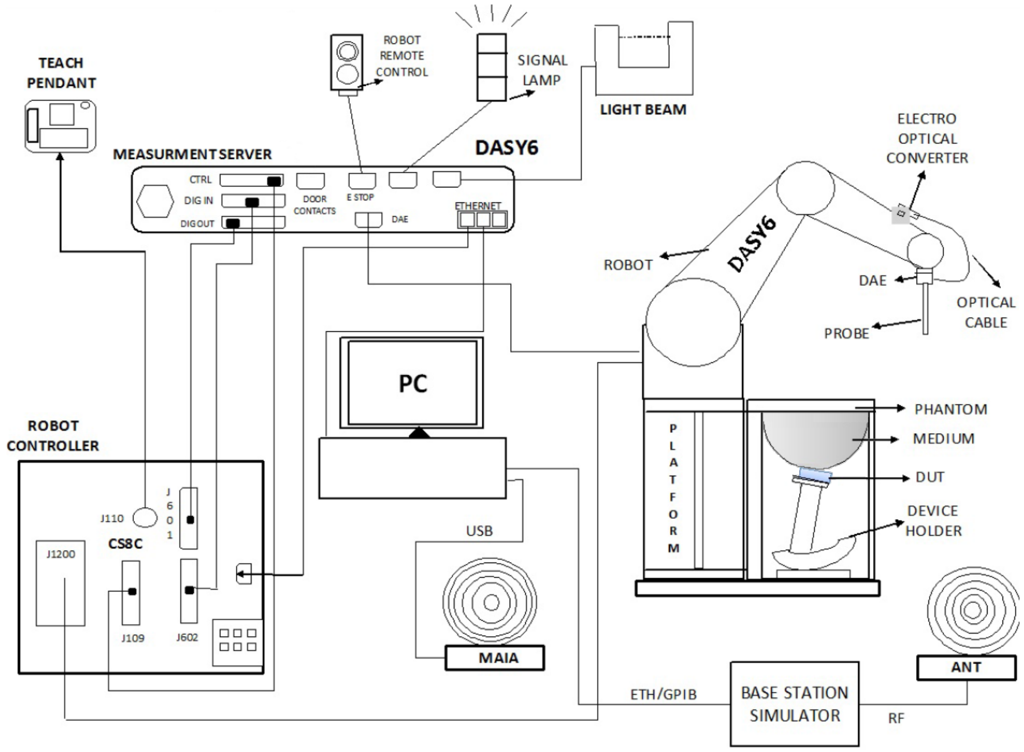

Fig-2.1 SPEAG DASY6 System Setup

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:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

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

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

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* ≦ 3 GHz	3 GHz < *f* ≦ 6 GHz
Maximum distance from closest measurement point to phantom surface	5 ± 1	δ ln(2)/2 ±0.5
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ±1°	20° ±1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≦2 GHz: ≦15 mm 2 – 3 GHz: ≦12 mm	3 – 4 GHz: ≦12 mm 4 – 6 GHz: ≦10 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* ≦ 3 GHz	3 GHz < *f* ≦ 6 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}		≦2 GHz: ≦8 mm 2 – 3 GHz: ≦5 mm	3 – 4 GHz: ≦5 mm 4 – 6 GHz: ≦4 mm
Maximum zoom scan spatial resolution, normal to phantom surface	*uniform grid:* $\Delta z_{Zoom}(n)$	≦5 mm	3 – 4 GHz: ≦4 mm 4 – 5 GHz: ≦3 mm 5 – 6 GHz: ≦2 mm
	graded grids: $\Delta z_{Zoom}(1)$	≦4 mm	3 – 4 GHz: ≦3.0 mm 4 – 5 GHz: ≦2.5 mm 5 – 6 GHz: ≦2.0 mm
	$\Delta z_{Zoom}(n>1)$	≦1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume (x, y, z)		≥30 mm	3 – 4 GHz: ≥28 mm 4 – 5 GHz: ≥25 mm 5 – 6 GHz: ≥22 mm

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 form 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.

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.

$$\text{SAR\_design\_target} < \text{SAR}_{\text{regulatory limit}} \times 10^{\frac{-\text{Total Uncertainty}}{10}}$$

For 1g-SAR, the $\text{SAR}_{\text{regulatory limit}}$ is 1.2 W/kg, and the SAR design target is 0.95 W/kg.

3.3. SAR Characterization

The P_{limit} is calculated by linearly scaling with the measured SAR at the P_{max} to correspond to the SAR design target. The P_{limit} determination for each exposure scenario corresponding to SAR design target are show next Section.

3.4. SAR Test Result For Plimit Calculations

Band	Mode	Test Position	Separation Distance (mm)	Channel	RB#	RB offset	Crest Factor	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)	SAR Design Target	Plimit	Plimit(with Dutycycle)	Minimum
5GNR-n48	DFT-S QPSK40M	Rear Face	0	642888	1	1	1.00	24.00	22.94	1.28	0.04	0.316	0.40	0.95	27.7	27.7	
5GNR-n48	DFT-S QPSK40M	Left Side	0	642888	1	1	1.00	24.00	22.94	1.28	0	<0.001	0.00	0.95	52.7	52.7	
5GNR-n48	DFT-S QPSK40M	Right Side	0	642888	1	1	1.00	24.00	22.94	1.28	0.02	0.141	0.18	0.95	31.2	31.2	
5GNR-n48	DFT-S QPSK40M	Top Side	0	642888	1	1	1.00	24.00	22.94	1.28	-0.06	0.556	0.71	0.95	25.3	25.3	
5GNR-n48	DFT-S QPSK40M	Bottom Side	0	642888	1	1	1.00	24.00	22.94	1.28	0	<0.001	0.00	0.95	52.7	52.7	
5GNR-n48	DFT-S QPSK40M	Rear Face	0	642888	50	28	1.00	24.00	22.92	1.28	0.04	0.309	0.40	0.95	27.8	27.8	
5GNR-n48	DFT-S QPSK40M	Left Side	0	642888	50	28	1.00	24.00	22.92	1.28	0	<0.001	0.00	0.95	52.7	52.7	25.3
5GNR-n48	DFT-S QPSK40M	Right Side	0	642888	50	28	1.00	24.00	22.92	1.28	-0.1	0.12	0.15	0.95	31.9	31.9	
5GNR-n48	DFT-S QPSK40M	Top Side	0	642888	50	28	1.00	24.00	22.92	1.28	-0.14	0.546	0.70	0.95	25.3	25.3	
5GNR-n48	DFT-S QPSK40M	Bottom Side	0	642888	50	28	1.00	24.00	22.92	1.28	0	<0.001	0.00	0.95	52.7	52.7	
5GNR-n48	DFT-S QPSK40M	Top Side	0	638000	1	1	1.00	24.00	22.77	1.33	0.06	0.477	0.63	0.95	25.8	25.8	
5GNR-n48	DFT-S QPSK40M	Top Side	0	640444	1	1	1.00	24.00	22.79	1.32	0.17	0.512	0.68	0.95	25.5	25.5	
5GNR-n48	DFT-S QPSK40M	Top Side	0	645332	1	1	1.00	24.00	22.89	1.29	0.12	0.542	0.70	0.95	25.3	25.3	
5GNR-n77	DFT-S QPSK100M	Rear Face	0	656000	1	1	1.00	24.50	22.94	1.43	0.06	0.3	0.43	0.95	27.9	27.9	
5GNR-n77	DFT-S QPSK100M	Left Side	0	656000	1	1	1.00	24.50	22.94	1.43	0	<0.001	0.00	0.95	52.7	52.7	
5GNR-n77	DFT-S QPSK100M	Right Side	0	656000	1	1	1.00	24.50	22.94	1.43	0.06	0.045	0.06	0.95	36.2	36.2	
5GNR-n77	DFT-S QPSK100M	Top Side	0	656000	1	1	1.00	24.50	22.94	1.43	-0.04	0.518	0.74	0.95	25.6	25.6	
5GNR-n77	DFT-S QPSK100M	Bottom Side	0	656000	1	1	1.00	24.50	22.94	1.43	0	<0.001	0.00	0.95	52.7	52.7	
5GNR-n77	DFT-S QPSK100M	Rear Face	0	656000	135	69	1.00	24.50	22.84	1.47	-0.03	0.297	0.44	0.95	27.9	27.9	
5GNR-n77	DFT-S QPSK100M	Left Side	0	656000	135	69	1.00	24.50	22.84	1.47	0	<0.001	0.00	0.95	52.6	52.6	
5GNR-n77	DFT-S QPSK100M	Right Side	0	656000	135	69	1.00	24.50	22.84	1.47	0.11	0.038	0.06	0.95	36.8	36.8	25.3
5GNR-n77	DFT-S QPSK100M	Top Side	0	656000	135	69	1.00	24.50	22.84	1.47	0.05	0.525	0.77	0.95	25.4	25.4	
5GNR-n77	DFT-S QPSK100M	Bottom Side	0	656000	135	69	1.00	24.50	22.84	1.47	0	<0.001	0.00	0.95	52.6	52.6	
5GNR-n77	DFT-S QPSK100M	Top Side	0	633332	1	1	1.00	24.50	23.09	1.38	-0.17	0.203	0.28	0.95	29.8	29.8	
5GNR-n77	DFT-S QPSK100M	Top Side	0	650000	1	1	1.00	24.50	22.86	1.46	0.02	0.505	0.74	0.95	25.6	25.6	
5GNR-n77	DFT-S QPSK100M	Top Side	0	653000	1	1	1.00	24.50	22.79	1.48	-0.09	0.497	0.74	0.95	25.6	25.6	
5GNR-n77	DFT-S QPSK100M	Top Side	0	659000	1	1	1.00	24.50	22.76	1.49	-0.08	0.531	0.79	0.95	25.3	25.3	
5GNR-n77	DFT-S QPSK100M	Top Side	0	662000	1	1	1.00	24.50	22.77	1.49	0.01	0.489	0.73	0.95	25.7	25.7	

Plimit and Pmax Summary

Exposure Scenario		Tablet & Laptop	P_{max}
Averaging Volume		1g	
Test Distance (mm)		0	
WWAN Bands	Antenna	P_{limit}	
5GNR-n48	0	25.3	23.0
5GNR-n77	0	25.3	23.5

Note：

1. When Pmax < Plimit, the DUT will operate at a power level up to Pmax.
2. All Plimit EFS and maximum tune up output power Pmax levels entered in above Table correspond to average power levels after accounting for duty cycle in the case of TDD modulation schemes (e.g. LTE TDD).
3. Maximum tune up output power Pmax is used to configure EUT during RF tune up procedure. The maximum allowed output power is equal to maximum Tune up output power + 1dB device design uncertainty.
4. The maximum time-averaged output power (dBm) for any 3G/4G/5G Sub6 WWAN technology, band, and DSI = minimum of "Plimit EFS" and "Maximum tune up output power Pmax" + 1dB device uncertainty. SAR values in this report were scaled to this maximum time-averaged output power to determine compliance per KDB Publication 447498 D01v06.

4. Equipment List

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D3500V2	1007	Jan. 22, 2023	1 Year
System Validation Dipole	SPEAG	D3700V2	1017	Feb. 23, 2023	1 Year
System Validation Dipole	SPEAG	D3900V2	1020	Feb. 23, 2023	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	7555	Jul. 19, 2023	1 Year
Data Acquisition Electronics	SPEAG	DAE4	1585	Jul. 14, 2023	1 Year
Universal Radio Communication Tester	Anritsu	MT8000A	6272278611	Aug. 26, 2022	1 Year
Thermometer	YFE	YF-160A	130504579	Sep. 23, 2022	1 Year
Dielectric Assessment Kit	SPEAG	DAKS-3.5	1092	May 23, 2023	1 Year
Dielectric Assessment Kit	SPEAG	DAKS_VNA R140	0010917	May 22, 2023	1 Year
Powersource1	SPEAG	SE_UMS_160 BA	1052	Jul. 13, 2023	1 Year

5. Measurement Uncertainty

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
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	∞
Test Sample Related								
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	∞
Phantom and Setup								
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
Combined Standard Uncertainty						± 10.9 %	± 10.7 %	
Expanded Uncertainty (K=2)						**± 21.8 %**	**± 21.4 %**	

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

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
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	∞
Test Sample Related								
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	∞
Phantom and Setup								
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
Combined Standard Uncertainty						± 11.6 %	± 11.3 %	
Expanded Uncertainty (K=2)						**± 23.2 %**	**± 22.6 %**	

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

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
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	∞
Test Sample Related								
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	∞
Phantom and Setup								
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
Combined Standard Uncertainty						± 11.5 %	± 11.0 %	
Expanded Uncertainty (K=2)						**± 23.0 %**	**± 22.0 %**	

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

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
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	∞
Test Sample Related								
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	∞
Phantom and Setup								
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
Combined Standard Uncertainty						± 12.1 %	± 11.6 %	
Expanded Uncertainty (K=2)						**± 24.2 %**	**± 23.2 %**	

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

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
Web Site: http://ee.bureauveritas.com.tw

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

---END---