

FCC SAR TEST REPORT

FCC ID : UZ7WR50
Equipment : RFID Accessory
Brand Name : Zebra
Model Name : WR50
Applicant : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Manufacturer : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



Approved by: Si Zhang

Sporton International Inc. (Kunshan)

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Table of Contents

1. Statement of Compliance	4
2. Administration Data	5
3. Guidance Applied.....	5
4. Equipment Under Test (EUT) Information.....	6
4.1 General Information	6
5. RF Exposure Limits.....	8
5.1 Uncontrolled Environment.....	8
5.2 Controlled Environment.....	8
6. Specific Absorption Rate (SAR).....	9
6.1 Introduction	9
6.2 SAR Definition.....	9
7. System Description and Setup	10
7.1 E-Field Probe	11
7.2 Data Acquisition Electronics (DAE)	11
7.3 Phantom.....	12
7.4 Device Holder.....	13
8. Measurement Procedures	14
8.1 Spatial Peak SAR Evaluation.....	14
8.2 Power Reference Measurement.....	15
8.3 Area Scan	15
8.4 Zoom Scan.....	16
8.5 Volume Scan Procedures.....	16
8.6 Power Drift Monitoring.....	16
9. Test Equipment List.....	17
10. System Verification	18
10.1 Tissue Simulating Liquids.....	18
10.2 Tissue Verification	18
10.3 System Performance Check Results.....	19
11. RF Exposure Positions	20
11.1 Extremity Exposure	20
12. WiFi/Bluetooth Output Power (Unit: dBm)	21
13. RFID Output Power (Unit: dBm)	24
14. Antenna Location	25
15. SAR Test Results	26
15.1 Head SAR	27
15.2 Body SAR	28
15.3 Extremity SAR.....	28
16. Simultaneous Transmission Analysis	30
16.1 Head Exposure Conditions	30
16.2 Extremity Exposure Conditions	30
17. Uncertainty Assessment	31
18. References.....	33
Appendixes.....	34
Appendix A. Plots of System Performance Check	34
Appendix B. Plots of High SAR Measurement	34
Appendix C. DASY Calibration Certificate.....	34
Appendix D. Test Setup Photos.....	34

History of this test report

Report No.	Version	Description	Issued Date
FA581302	01	Initial issue of report	Oct. 30, 2025

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) for Zebra Technologies Corporation, RFID Accessory, WR50, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Head Simultaneous Transmission 1g SAR (W/kg)	Highest Extremity Simultaneous Transmission 10g SAR (W/kg)	Highest Body Simultaneous Transmission 1g SAR (W/kg)
		Head (Separation 10mm)	Extremity (Separation 0mm)	Body (Separation 0mm)			
		1g SAR (W/kg)	10g SAR (W/kg)	1g SAR (W/kg)			
DSS	UHF RFID	0.19	0.16	1.03	1.38	0.78	1.03
DXX	NFC		< 0.01			0.78	
DTS	2.4GHz WLAN	0.25	0.48		0.86	0.78	
NII	5GHz WLAN	1.17	0.37		1.38	0.52	
Date of Testing:		2025/9/13 ~ 2025/9/22					

Declaration of Conformity:

The test results with all measurement uncertainty excluded is presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Extremity 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS, SAR05-KS	CN1257	314309

3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards.

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- IEC/IEEE 62209-1528:2020
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	RFID Accessory
Brand Name	Zebra
Model Name	WR50
FCC ID	UZ7WR50
Wireless Technology and Frequency Range	UHF RFID : 917.9 MHz ~ 927.7 MHz
Mode	UHF RFID: ASK
HW Version	DV1.2
FW Version	PAAFBS00-001-R07
MFD	12AUG25
EUT Stage	Identical Prototype
Remark: - Based on the original filing Sporton SAR report No.: FA512204, FCC ID: UZ7WS5012 to attach RFID module and in this report, only performed full SAR retesting for RFID operation, and all other bands verified the worst case found in original report to show compliance. - There are four kinds of SKU as below table. RF Exposure selects SKU2/SKU 6 to be tested and SKU4/SKU8 do not perform due to the change does not affect RF characteristics. - WLAN and Bluetooth share the same antenna and cannot transmit simultaneously.	

Host Information	
Equipment Name	WS501 Wearable Computer
FCC ID	UZ7WS5012
Brand Name	Zebra
Model Name	WS5012
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 2.4GHz 802.11ac VHT20 WLAN 2.4GHz 802.11ax HE20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac/ax VHT20/VHT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE NFC:ASK

Host Configuration with RFID	SKU2 (SKU -1)	SKU4 (SKU -2)	SKU6 (SKU -3)	SKU8 (SKU -4)
Type	RFID	RFID	RFID	RFID
Scanner	SR560	SR560	SR560	SR560
NFC	Yes	Yes	Yes	Yes
RFID	Yes	Yes	Yes	Yes
Camera	NA	NA	NA	NA
Battery	3X (2400mAh)	3X (2400mAh)	3X (2400mAh)	3X (2400mAh)
Mounting	Finger Trigger	RFID BOH	RFID Wrist /W external antenna	RFID BOH /W external antenna



Accessories Information				
Adaptor	Brand Name	Zebra	Model Number	PWR-WUA5V12W0US
3X Battery	Brand Name	Zebra	Model Number	BT-000446A
USB charging cable with cup	Brand Name	Zebra	Model Number	CBL-WS5X-USB1-01
USB C CABLE	Brand Name	Zebra	Model Number	CBL-TC2X-USBC-01
Helix Micro AB Cable	Brand Name	Zebra	Model Number	CBL-WS5X-USB1-02
Micro USB Cable	Brand Name	Zebra	Model Number	25-124330-01R
WS501 Wearable Computer	Brand Name	Zebra	Model Number	WS5012

Support unit				
WS50 RFID Shell	Brand Name	Zebra	Part Number Model Number	SG-WS5X-SHLRS-01
WS50 Replacement Deflector for RFID Shell	Brand Name	Zebra	Part Number Model Number	SG-WS5X-DFLTR-01
Replacement Finger Trigger for Converged	Brand Name	Zebra	Part Number Model Number	SG-WS5X-TRGA-01
WS50 Spare Finger Strap for Converged and RFID Trigger, 10 Pack	Brand Name	Zebra	Part Number Model Number	SG-WS5X-STRP-10
WS50 RFID Back of Hand Mount (SKU 4 & 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHRS-01
WS50 RFID Wrist Mount Plate (SKU 6)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-WSTRS-01
WS50 RFID Back of Hand Mount Glove, Left Hand Small (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPLS-02
WS50 RFID Back of Hand Mount Glove, Left Hand Medium (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPLM-02
WS50 RFID Back of Hand Mount Glove, Left Hand Large (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPLL-02
WS50 RFID Back of Hand Mount Glove, Right Hand Small (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPRS-02
WS50 RFID Back of Hand Mount Glove, Right Hand Medium (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPRM-02
WS50 RFID Back of Hand Mount Glove, Right Hand Large (SKU 4)	Brand Name	Zebra	Part Number Model Number	SG-WEAR-HNWPRL-02
Wrist Mount for WS50 RFID, Right Arm, Large (SKU 6)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-WMTRRL-01
Wrist Mount for WS50 RFID, Right Arm, Small (SKU 6)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-WMTRRS-01
Wrist Mount for WS50 RFID, Left Arm, Large (SKU 6)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-WMTRLL-01
Wrist Mount for WS50 RFID, Left Arm, Small (SKU 6)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-WMTRLS-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Right Large (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRRRL-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Right Medium (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRRM-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Right Small (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRRS-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Left Large (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRL-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Left Medium (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRLM-01
WS50 RFID Back of Hand Mount with Wrist Antenna Holder, Left Small (SKU 8)	Brand Name	Zebra	Part Number Model Number	SG-WS5X-BHWRLS-01
WS50 UHF RFID Antenna Cable, 800MHz, 210mm length for Wrist Mount, EMEA	Brand Name	Zebra	Part Number Model Number	CBL-WS5X-ANTR8S-01
WS50 UHF RFID Antenna Cable, 800MHz, 330mm length for Back of Hand Mount, EMEA	Brand Name	Zebra	Part Number Model Number	CBL-WS5X-ANTR8L-01
WS50 UHF RFID Antenna Cable, 900MHz, 210mm length for Wrist Mount, North America and Rest of World Minus EMEA	Brand Name	Zebra	Part Number Model Number	CBL-WS5X-ANTR9S-01
WS50 UHF RFID Antenna Cable, 900MHz, 330mm length for Back of Hand Mount, North America and Rest of World Minus EMEA	Brand Name	Zebra	Part Number Model Number	CBL-WS5X-ANTR9L-01

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

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.

6.2 SAR Definition

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:

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

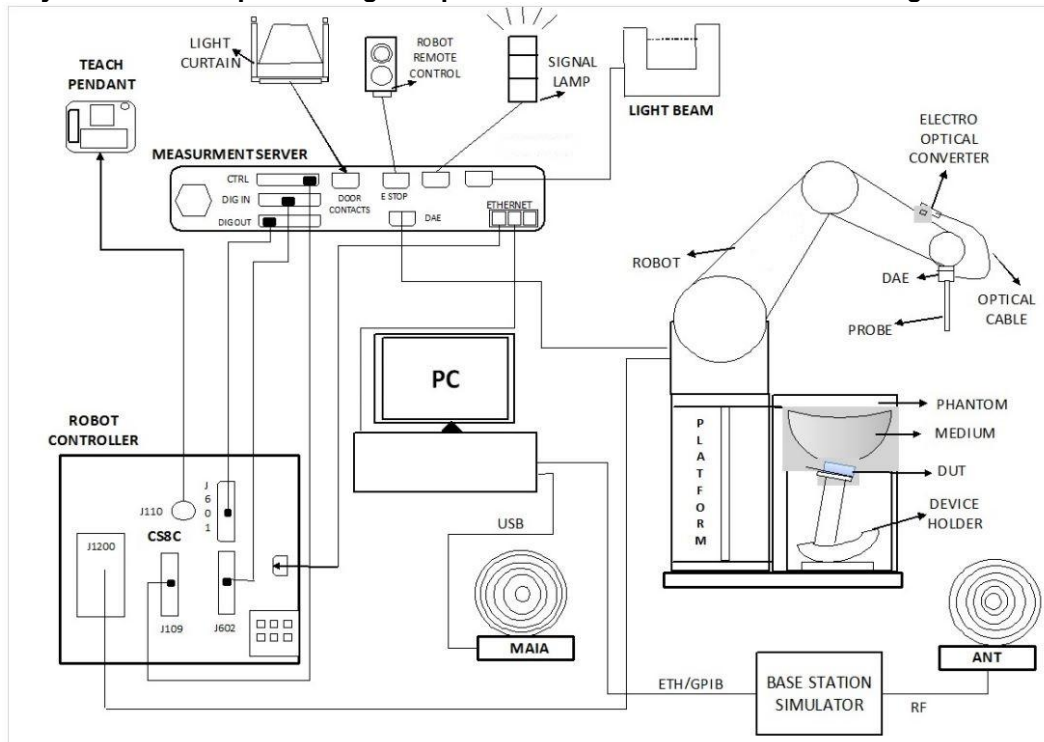
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

The DASY system 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 Win7 or Win10 and the DASY5 or DASY6 software.
- 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.

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	4 MHz – 10 GHz Linearity: ± 0.2 dB (30 MHz – 10 GHz)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 μ W/g – >100 mW/g Linearity: ± 0.2 dB (noise: typically <1 μ W/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm



7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

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



Photo of DAE

7.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom



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

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm



The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

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



Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
- (b) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

- (a) Use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the 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

8.1 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

8.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
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: Δx_{Area} , Δy_{Area}	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 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: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	$3 - 4$ GHz: ≤ 4 mm $4 - 5$ GHz: ≤ 3 mm $5 - 6$ GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	$3 - 4$ GHz: ≤ 3 mm $4 - 5$ GHz: ≤ 2.5 mm $5 - 6$ GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	$3 - 4$ GHz: ≥ 28 mm $4 - 5$ GHz: ≥ 25 mm $5 - 6$ GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

8.5 Volume Scan Procedures

The volume scan is used to assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 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 drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	900MHz System Validation Kit	D900V2	1d186	2025/3/12	2026/3/11
SPEAG	2450MHz System Validation Kit	D2450V2	1095	2024/2/8	2026/2/6
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	2022/9/23	2025/9/21
SPEAG	13MHz System Validation Kit	CLA13	1020	2025/6/5	2026/6/4
SPEAG	Data Acquisition Electronics	DAE4	1303	2024/12/6	2025/12/5
SPEAG	Data Acquisition Electronics	DAE4	690	2024/10/8	2025/10/7
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2025/2/19	2026/2/18
SPEAG	Dosimetric E-Field Probe	EX3DV4	7627	2025/7/1	2026/6/30
SPEAG	SAM Twin Phantom	SAM Twin	TP-1754	NCR	NCR
SPEAG	ELI Phantom	ELI V8.0	TP-2151	NCR	NCR
Beichuang	Thermo-Hygrometer	HTC-1	1959633	2025/5/27	2026/5/26
Beichuang	Thermo-Hygrometer	HTC-1	1959630	2025/5/27	2026/5/26
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46112129	2025/7/2	2026/7/1
SPEAG	Dielectric Probe Kit	DAK-3.5	1071	2025/2/24	2026/2/23
SPEAG	Dielectric Probe Kit	DAK-12	1173	2024/11/19	2025/11/18
Anritsu	Vector Signal Generator	MG3710A	6201682672	2025/1/3	2026/1/2
Rohde & Schwarz	Vector Signal Generator	SMBV100A	258305	2025/1/2	2026/1/1
Rohde & Schwarz	Power Meter	NRVD	102081	2025/7/2	2026/7/1
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2025/7/2	2026/7/1
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2025/7/2	2026/7/1
Rohde & Schwarz	Spectrum Analyzer	FSV7	101631	2024/10/11	2025/10/10
TES	DIGITAC THERMOMETER	TYPE-K	220305411	2025/1/2	2026/1/1
BONN Elektronik	Power Amplifier	BSA 0125-150	076577A	2025/1/6	2026/1/5
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note 1	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note 1	
Agilent	Dual Directional Coupler	778D	20500	Note 1	
Agilent	Dual Directional Coupler	11691D	MY48151020	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
MCL	Attenuation1	BW-S10W5+	N/A	Note 1	
MCL	Attenuation2	BW-S10W5+	N/A	Note 1	
MCL	Attenuation3	BW-S10W5+	N/A	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01. The dipoles are also not physically damaged, or repaired during the interval. The justification data in appendix C can be found which the return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration for each dipole.

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

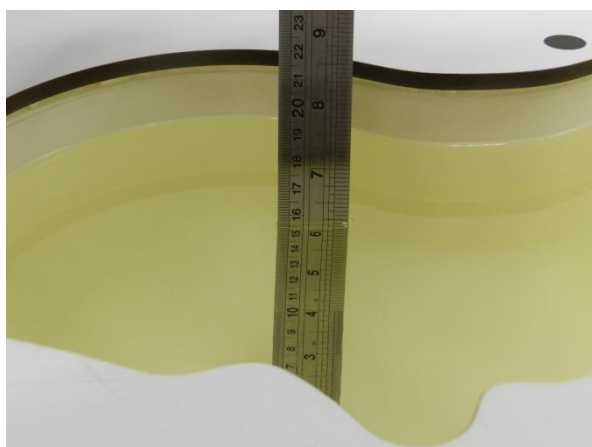


Fig 10.1 Photo of Liquid Height for Head SAR



Fig 10.2 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Head								
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
2450	55.0	0	0	0	0	45.0	1.80	39.2

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
900	22.8	0.951	42.525	0.97	41.50	-1.96	2.47	±5	2025/9/13
2450	22.7	1.771	39.307	1.80	39.20	-1.61	0.27	±5	2025/9/13
5250	22.7	4.702	36.433	4.71	35.95	-0.17	1.34	±5	2025/9/14
5600	22.7	5.086	35.765	5.07	35.50	0.32	0.75	±5	2025/9/14
5750	22.7	5.215	35.506	5.22	35.35	-0.10	0.44	±5	2025/9/15
13	22.7	0.728	54.4	0.75	55.00	-2.93	-1.09	±5	2025/9/22

10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2025/9/13	900	50	1d186	3857	1303	0.501	10.800	10.02	-7.22	0.372	6.930	7.44	7.36
2025/9/13	2450	50	1095	3857	1303	2.540	52.600	50.8	-3.42	1.180	24.700	23.6	-4.45
2025/9/14	5250	50	1113	3857	1303	4.020	81.500	80.4	-1.35	1.180	23.300	23.6	1.29
2025/9/14	5600	50	1113	3857	1303	4.080	82.600	81.6	-1.21	1.090	23.700	21.8	-8.02
2025/9/15	5750	50	1113	3857	1303	4.110	80.800	82.2	1.73	1.140	23.000	22.8	-0.87
2025/9/22	13	1000	1020	7627	690	0.531	0.548	0.531	-3.45	0.332	0.338	0.332	-2.35

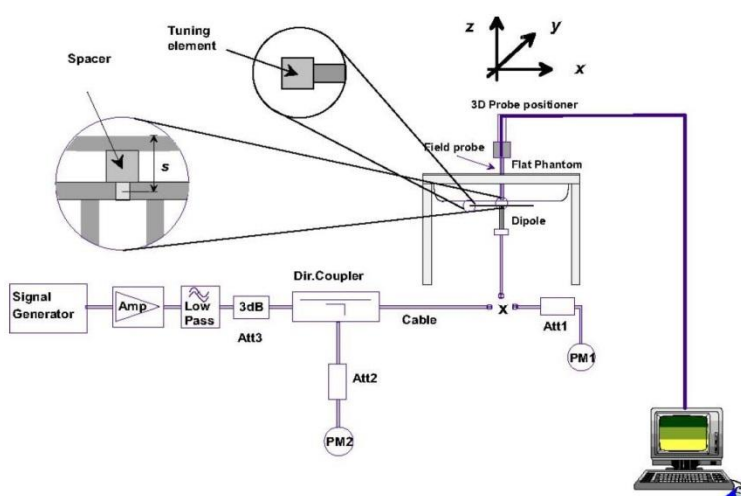


Fig 8.3.1 System Performance Check Setup



Fig 8.3.2 Setup Photo



Fig 8.3.2 Setup Photo



11. RF Exposure Positions

11.1 Extremity Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.
2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.⁶ The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

12. WiFi/Bluetooth Output Power (Unit: dBm)

General Note:

1. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, additional output power measurements were not necessary.
2. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
3. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
4. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
5. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
 - a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
 - b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
 - c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
6. Conducted power test against the variant project based on the worst-case SAR condition from the original project was performed in this filing to demonstrate the test data from original project remains representative for the variant project. Summary for power spot check for each rule entry and technology is listed as below:

**<2.4GHz WLAN>**

				Ant 0		
2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11b 1Mbps	11	2462	18.50	19.00	94.52

				Ant 1		
2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11b 1Mbps	11	2462	19.20	19.50	94.52

				Ant 0+1		
2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11b 1Mbps	11	2462	21.87	22.00	94.52

<5GHz WLAN>

				Ant 0		
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11n-HT40 MCS0	54	5270	18.50	19.00	87.07

				Ant 0		
5.5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11ac-VHT80 MCS0	138	5690	18.29	19.00	92.14

				Ant 0		
5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	149	5745	20.02	20.50	93.53

				Ant 1		
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11n-HT40 MCS0	54	5270	18.60	19.00	87.07

				Ant 1		
5.5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11ac-VHT80 MCS0	138	5690	17.49	18.00	92.14

				Ant 1		
5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	149	5745	21.09	21.50	93.53

				Ant 0+1		
5.3GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11n-HT40 MCS0	54	5270	21.56	22.50	87.07

				Ant 0+1		
5.5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11ac-VHT80 MCS0	138	5690	20.92	21.50	92.14

				Ant 0+1		
5.8GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	802.11a 6Mbps	149	5745	23.60	23.80	93.53

13. RFID Output Power (Unit: dBm)

Internal			
Mode	Frequency (MHz)	Average power (dBm)	Tune up
RFID	917.9	22.35	24
	922.7	22.38	24
	927.7	22.28	24
	Duty cycle: %	100	

External			
Mode	Frequency (MHz)	Average power (dBm)	Tune up
RFID	917.9	22.48	24
	922.7	22.47	24
	927.7	22.39	24
	Duty cycle: %	100	



14. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

15. SAR Test Results

General Note:

1. The UHF RFID was using engineering mode to continuous transmission.
2. The UHF RFID is made of a Core unit (main wearable computer running Android OS), one RFID module and one battery. In order to preserve the battery life as well as preventing excessive heat to be dissipated, RF duty cycle will be limited to 20% by SW.
3. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
 - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
 - c. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
 - d. For RFID: Reported SAR(W/kg)= Measured SAR(W/kg) * Tune-up Scaling Factor * Duty Cycle scaling factor
4. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
5. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Per KDB 248227 D01v02r02, WLAN5.2GHz SAR testing is not required when the WLAN5.3GHz band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for WLAN5.2GHz band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

NFC Note:

1. NFC mainly operate in hand-held extremity exposure conditions and NFC sensing distance with other device or reading tag is about 20cm, therefore Standalone 10-g extremity SAR testing for NFC will be performed with active mode and max power mode, with 100% duty cycle at 0mm separation distance.
2. NFC 13.56MHz antenna port is not available on the device to support conducted power measurement, therefore the measured results are referred to as reported SAR.
3. NFC SAR test tissue-simulating liquid parameter: refer to IEC/IEEE 62209-1528 2020.

15.1 Head SAR

<RFID SAR>

Plot No.	Band	Test Position	Gap (mm)	Antenna	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	UHF RFID	Front	10mm	RFID Internal Antenna	917.9	22.35	24.00	1.462	100	0.200	-0.05	0.501	0.147
	UHF RFID	Front	10mm	RFID Internal Antenna	922.7	22.38	24.00	1.452	100	0.200	0.08	0.448	0.130
	UHF RFID	Front	10mm	RFID Internal Antenna	927.7	22.28	24.00	1.486	100	0.200	0.01	0.444	0.132
	UHF RFID	Front	10mm	RFID External Antenna 9L	917.9	22.48	24.00	1.419	100	0.200	0.01	0.473	0.134
	UHF RFID	Front	10mm	RFID External Antenna 9L	922.7	22.47	24.00	1.422	100	0.200	-0.05	0.471	0.134
	UHF RFID	Front	10mm	RFID External Antenna 9L	927.7	22.39	24.00	1.449	100	0.200	0.02	0.411	0.119
	UHF RFID	Front	10mm	RFID External Antenna 9S	917.9	22.48	24.00	1.419	100	0.200	0.02	0.665	0.189
01	UHF RFID	Front	10mm	RFID External Antenna 9S	922.7	22.47	24.00	1.422	100	0.200	-0.04	0.680	0.193
	UHF RFID	Front	10mm	RFID External Antenna 9S	927.7	22.39	24.00	1.449	100	0.200	0.03	0.514	0.149

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
02	WLAN2.4GHz	802.11b 1Mbps	Front	10mm	Ant 0+1(0)	11	2462	18.50	19.00	1.122	94.52	1.058	-0.02	0.212	0.252
03	WLAN5GHz	802.11n-HT40 MCS0	Front	10mm	Ant 0+1(0)	54	5270	18.50	19.00	1.122	87.07	1.149	-0.07	0.907	1.169
04	WLAN5GHz	802.11ac-VHT80 MCS0	Front	10mm	Ant 0+1(0)	138	5690	18.29	19.00	1.178	92.14	1.085	0.05	0.677	0.865
05	WLAN5GHz	802.11a 6Mbps	Front	10mm	Ant 0+1(0)	149	5745	20.02	20.50	1.117	93.53	1.069	-0.02	0.680	0.812

15.2 Body SAR

<RFID SAR>

Plot No.	Band	Test Position	Gap (mm)	Antenna	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	UHF RFID	Front	0mm	RFID External Antenna 9L	917.9	22.48	24.00	1.419	100	0.200	-0.02	2.730	0.775
	UHF RFID	Front	0mm	RFID External Antenna 9L	922.7	22.47	24.00	1.422	100	0.200	0.01	2.610	0.742
	UHF RFID	Front	0mm	RFID External Antenna 9L	927.7	22.39	24.00	1.449	100	0.200	0.02	2.340	0.678
06	UHF RFID	Front	0mm	RFID External Antenna 9S	917.9	22.48	24.00	1.419	100	0.200	-0.1	3.610	1.025
	UHF RFID	Front	0mm	RFID External Antenna 9S	922.7	22.47	24.00	1.422	100	0.200	0.01	3.340	0.950
	UHF RFID	Front	0mm	RFID External Antenna 9S	927.7	22.39	24.00	1.449	100	0.200	0.02	2.750	0.797

15.3 Extremity SAR

<RFID SAR>

Plot No.	Band	Test Position	Gap (mm)	Antenna	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	UHF RFID	Back	0mm	RFID Internal Antenna	917.9	22.35	24.00	1.462	100	0.200	0.02	0.341	0.100
	UHF RFID	Back	0mm	RFID Internal Antenna	922.7	22.38	24.00	1.452	100	0.200	-0.09	0.416	0.121
	UHF RFID	Back	0mm	RFID Internal Antenna	927.7	22.28	24.00	1.486	100	0.200	0.03	0.360	0.107
07	UHF RFID	Back	0mm	RFID External Antenna 9L	917.9	22.48	24.00	1.419	100	0.200	-0.04	0.577	0.164
	UHF RFID	Back	0mm	RFID External Antenna 9L	922.7	22.47	24.00	1.422	100	0.200	0.03	0.484	0.138
	UHF RFID	Back	0mm	RFID External Antenna 9L	927.7	22.39	24.00	1.449	100	0.200	0.02	0.343	0.099
	UHF RFID	Back	0mm	RFID External Antenna 9S	917.9	22.48	24.00	1.419	100	0.200	0.02	0.496	0.141
	UHF RFID	Back	0mm	RFID External Antenna 9S	922.7	22.47	24.00	1.422	100	0.200	-0.02	0.501	0.143
	UHF RFID	Back	0mm	RFID External Antenna 9S	927.7	22.39	24.00	1.449	100	0.200	0.01	0.485	0.141

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
08	WLAN2.4GHz	802.11b 1Mbps	Back	0mm	Ant 0+1(0)	11	2462	18.50	19.00	1.122	94.52	1.058	-0.07	0.405	0.481
09	WLAN5GHz	802.11n-HT40 MCS0	Back	0mm	Ant 0+1(0)	54	5270	18.50	19.00	1.122	87.07	1.149	0.08	0.223	0.287
10	WLAN5GHz	802.11ac-VHT80 MCS0	Back	0mm	Ant 0+1(0)	138	5690	18.29	19.00	1.178	92.14	1.085	0.01	0.170	0.217
11	WLAN5GHz	802.11a 6Mbps	Back	0mm	Ant 0+1(0)	149	5745	20.02	20.50	1.117	93.53	1.069	0	0.309	0.369

<NFC SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Accessories	Freq. (MHz)	Power Drift (dB)	Measured 10g SAR (W/kg)
12	NFC	ASK	Back	0mm	Replacement protective shell	13.56	0.01	0.002

15.4 Repeated SAR Measurement

<1g>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN5GHz	-	-	-	-	802.11n-HT40 MCS0	Front	10mm	Ant 0+1(0)	54	5270	18.50	19.00	1.122	87.07	1.149	-0.07	0.907	1	1.169
2nd	WLAN5GHz	-	-	-	-	802.11n-HT40 MCS0	Front	10mm	Ant 0+1(0)	54	5270	18.50	19.00	1.122	87.07	1.149	-0.02	0.901	1.007	1.162
1st	UHF RFID	-	-	-	-	-	Front	0mm			917.9	22.48	24.00	1.419	100	0.200	-0.1	3.610	1	1.025
2nd	UHF RFID	-	-	-	-	-	Front	0mm			917.9	22.48	24.00	1.419	100	0.200	-0.7	3.540	1.020	1.005

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured* SAR.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Head	Extremity
1.	WLAN2.4GHz + RFID	Yes	Yes
2.	WLAN5GHz + RFID	Yes	Yes
3.	Bluetooth + RFID	Yes	Yes
4.	WLAN5GHz + Bluetooth + RFID	Yes	Yes
5.	WLAN2.4GHz + NFC + RFID		Yes
6.	WLAN5GHz + NFC + RFID		Yes
7.	Bluetooth + NFC + RFID		Yes
8.	WLAN5GHz + Bluetooth+ NFC + RFID		Yes

- Simultaneous transmission analysis for all bands and all position are based on max SAR results chosen between the original filing and variant Verification Data.
- The Scaled SAR summation is calculated based on the same configuration and test position.
- The NFC only operate on limbs exposure condition.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - Scalar SAR summation < 1.6W/kg and 10g Scalar SAR summation < 4.0W/kg.
 - $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
 - If $SPLSR \leq 0.04$ for 1g SAR and $SPLSR \leq 0.10$ for 10g SAR, simultaneously transmission SAR measurement is not necessary.
 - Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg and 10g SAR < 4.0W/kg.

16.1 Head Exposure Conditions

Exposure Position	1	2	3	4	2+3+4	1+4
	WLAN2.4GHz Ant 0+1	WLAN5GHz Ant 0+1	Bluetooth	RFID	Summed	Summed
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	10g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
Front at 10mm	0.668	1.184	0.003	0.193	1.38	0.86

16.2 Extremity Exposure Conditions

Exposure Position	1	2	3	4	5	1+4+5	2+3+4+5
	WLAN2.4GHz Ant 0+1	WLAN5GHz Ant 0+1	Bluetooth	NFC	RFID	Summed	Summed
	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)
Back at 0mm	0.617	0.348	0.009	0.002	0.164	0.78	0.52

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17. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be $\leq 30\%$, for a confidence interval of $k = 2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

Declaration of Conformity:

The test results with all measurement uncertainty excluded is presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor ^(a)	$1/k^{(b)}$	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) k is the coverage factor

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

Uncertainty Budget According to IEC/IEEE 62209-1528 (Frequency band: 4 MHz - 10 GHz range)							
Error Description	Uncert. Value (±%)	Prob. Dist.	Div.	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System errors							
Probe calibration	18.6	N	2	1	1	9.3	9.3
Probe calibration drift	1.7	R	1.732	1	1	1.0	1.0
Probe linearity and detection Limit	4.7	R	1.732	1	1	2.7	2.7
Broadband signal	2.8	R	1.732	1	1	1.6	1.6
Probe isotropy	7.6	R	1.732	1	1	4.4	4.4
Other probe and data acquisition errors	2.4	N	1	1	1	2.4	2.4
RF ambient and noise	1.8	N	1	1	1	1.8	1.8
Probe positioning errors	0.006	N	1	0.5	0.5	0.0	0.0
Data processing errors	4.0	N	1	1	1	4.0	4.0
Phantom and Device Errors							
Measurement of phantom conductivity (σ)	2.5	N	1	0.78	0.71	2.0	1.8
Temperature effects (medium)	5.4	R	1.732	0.78	0.71	2.4	2.2
Shell permittivity	14.0	R	1.732	0.5	0.5	4.0	4.0
Distance between the radiating element of the DUT and the phantom medium	2.0	N	1	2	2	4.0	4.0
Repeatability of positioning the DUT or source against the phantom	1.0	N	1	1	1	1.0	1.0
Device holder effects	3.6	N	1	1	1	3.6	3.6
Effect of operating mode on probe sensitivity	2.4	R	1.732	1	1	1.4	1.4
Time-average SAR	1.7	R	1.732	1	1	1.0	1.0
Variation in SAR due to drift in output of DUT	2.5	N	1	1	1	2.5	2.5
Validation antenna uncertainty (validation measurement only)	0.0	N	1	1	1	0.0	0.0
Uncertainty in accepted power (validation measurement only)	0.0	N	1	1	1	0.0	0.0
Correction to the SAR results							
Phantom deviation from target (ϵ', σ)	1.9	N	1	1	0.84	1.9	1.6
SAR scaling	0.0	R	1.732	1	1	0.0	0.0
Combined Std. Uncertainty						14.5%	14.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						29.0%	28.8%

18. References

- [1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
- [2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992
- [3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.
- [6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015
- [7] FCC KDB 865664 D01 v01r04, “SAR Measurement Requirements for 100 MHz to 6 GHz”, Aug 2015.
- [8] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.
- [9] IEC/IEEE 62209-1528:2020, “Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)”, Oct. 2020



Appendixes

Please refer to separated files for the following appendixes

Appendix A. Plots of System Performance Check

Appendix B. Plots of High SAR Measurement

Appendix C. DASY Calibration Certificate

Appendix D. Test Setup Photos

Appendix E. Product Equality Declaration

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