

TEST REPORT (SAR EVALUATION)

Applicant : Teijin Frontier Co., Ltd.

Address : NBF Comodio Shiodome 2-14-1, Higashishimbashi, Minato-ku,
Tokyo 105-0021, Japan

Products : RecoHand

Model No. : M920SRW

Serial No. : 00010

Test Standard : CFR 47 FCC Rules and Regulations Part 2 (§ 2.1093)

FCC ID : 2BEXRRHM920T001

Test Results : **Passed**

Date of Receipt : November 6, 2023

Date of Test : December 27, 2023



A handwritten signature in black ink, likely belonging to Kosei Shibata, is positioned above a horizontal line.

Kosei Shibata
Deputy Director
Japan Quality Assurance Organization
Kitakansai Testing Center
Saito EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents for the equipment under test (EUT) such as identification information in clause 2 of this report were provided by the applicant. JQA is not responsible for the test results affected by the incorrect information.
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- VLAC does not approve, certify or warrant the product by this test report.

REVISION HISTORY

File No.	Contents	Issue Date
KL80230810	Initial Issue	February 20, 2024

TABLE OF CONTENTS

	Page
1 Summary of Test Results.....	4
2 Description of Equipment Under Test (EUT).....	5
3 Test Methods and Procedures	6
4 Test Location.....	6
5 Accreditation of Test Laboratory	6
6 Measurement System Diagram	7
7 System Components	8
8 Measurement Process.....	10
9 Measurement Uncertainties	11
10 Test Arrangement	12
11 Tissue Verification	14
12 System Performance Check	16
13 RF Output Power Measurements	17
14 SAR Measurements	18
15 Test Instruments	20
16 Appendix.....	21

1 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 2 – Frequency Allocations and Radio
Treaty Matters; General Rules and Regulations
§ 2.1093 Radiofrequency radiation exposure evaluation: portable devices

Test Configuration	Reported 1 g SAR (W/kg)			Limit (W/kg)
	Licensed	RFID	BLE	
Body-worn	N/A	0.14	N/A	1.6
Simultaneous Transmission	N/A	N/A	N/A	

Test Configuration	Reported 10 g SAR (W/kg)			Limit (W/kg)
	Licensed	RFID	BLE	
Extremity	N/A	< 0.10	N/A	4.0
Simultaneous Transmission	N/A	N/A	N/A	

The test results are **passed** for exposure limits specified in FCC 47 CFR § 1.1310 and/or ANSI/IEEE Std. C95.1.

In the approval of test results,

- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by
Yasuhisa Sakai / Project Manager

Y. Sakai

Tested by
Yuji Shintaku / Assistant Manager

y. Shintaku

2 Description of Equipment Under Test (EUT)

2.1 General Information

Manufacturer	Teijin Frontier Co., Ltd. NBF Comodio Shiodome 2-14-1, Higashishimbashi, Minato-ku, Tokyo 105-0021, Japan
Products	RecoHand
Model No.	M920SRW
Serial No.	00010
Product Type	Mass Production
Date of Manufacture	October 19, 2023
Transmitting Frequency	RFID 920 MHz (917.1 MHz – 926.9 MHz) Bluetooth (2402 MHz – 2480 MHz)
Battery Option	Lithium-ion Battery (550 mAh)
Power Rating	3.7 VDC
EUT Grounding	None
Device Category	Portable Device (§ 2.1093)
Exposure Environments	General Population/Uncontrolled Exposure
FCC Rule Part(s)	§15.247

2.2 Wireless Technologies

Air Interface	Description	
RFID	Frequency band(s)	920 MHz
	Operating mode	ASK
Bluetooth	Frequency band(s)	2.4 GHz
	Operating mode	Version 5.1 LE

2.3 Maximum Output Power

Band	Max. Tune-up Limit (dBm)
RFID 920 MHz	12.0
Bluetooth LE	4.5

3 Test Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR §2.1093, IEEE Std.1528–2013 and the following FCC Published RF Exposure KDB Procedures.

447498 D01 General RF Exposure Guidance v06

865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

865664 D02 RF Exposure Reporting v01r02

In addition to above, the following information was used.

TCB Workshop October 2016; RF Exposure Procedures (DUT Holder Perturbations)

TCB Workshop May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)

TCB Workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))

4 Test Location

Japan Quality Assurance Organization (JQA)

Kitakansai Testing Center Saito EMC Branch

7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Accreditation of Test Laboratory

JQA Kitakansai Testing Center Saito EMC Branch is accredited under ISO/IEC 17025 by the following accreditation bodies and the test facility is registered by the following bodies. If the accreditation logo does not appear on this cover, it is outside the scope of ISO/IEC 17025.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : April 30, 2024)

A2LA Accreditation No. : 5498.01 (Expiry date : November 30, 2025)

VCCI Registration No. : A-0002 (Expiry date : April 30, 2024)

FCC Registration No. : JP5008 (Expiry date : April 30, 2024)

ISED Registration No. : JP0014 (Expiry date : November 30, 2025)

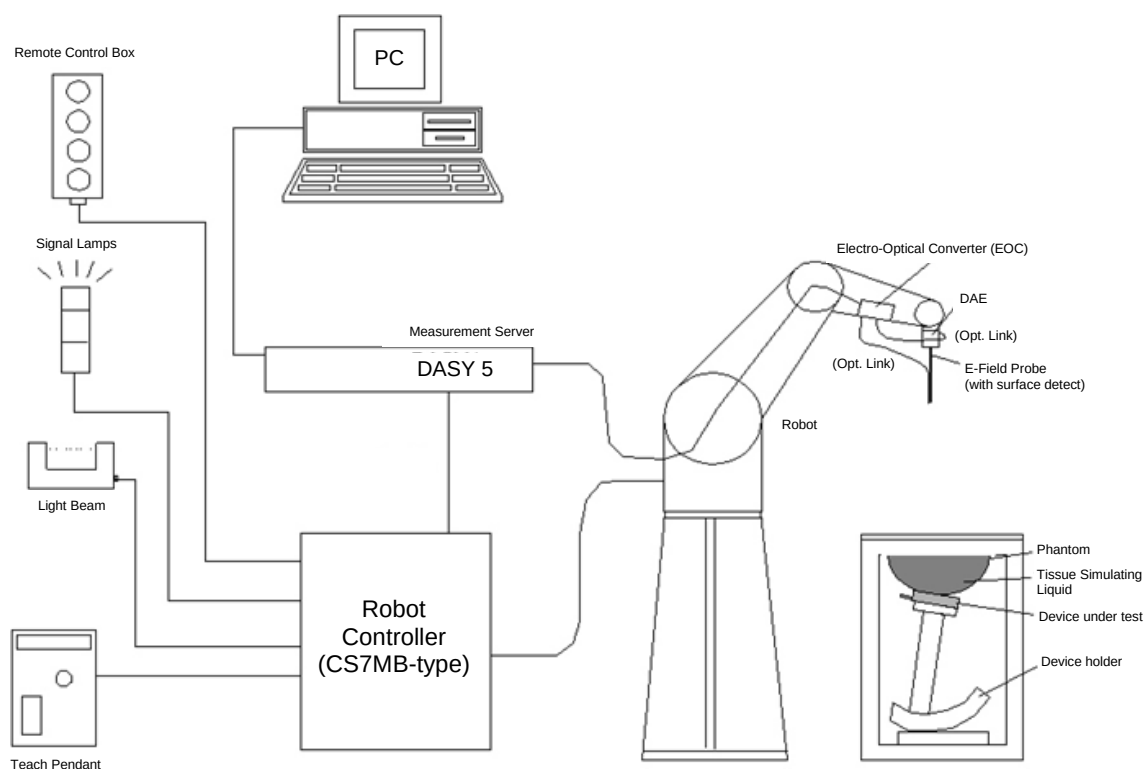
BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006
(Expiry date : September 14, 2025)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI.
(Expiry date : February 22, 2025)

6 Measurement System Diagram

These measurements are performed using the DASY5 automated dosimetric assessment system (manufactured by Schmid & Partner Engineering AG (SPEAG) in Zürich, Switzerland). It consists of high precision robotics system, cell controller system, DASY5 measurement server, personal computer with DASY5 software, data acquisition electronic (DAE) circuit, the Electro-optical converter (EOC), near-field probe, and the twin SAM phantom containing the equivalent tissue. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF).

The Robot is connected to the cell controller to allow software manipulation of the robot. The DAE is connected to the EOC. The DAE performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY5 measurement server.



7 System Components

7.1 Probe Specification EX3DV4

Construction	: Symmetrical design with triangular core Built-in shielding against static changes PEEK enclosure material (resistant to organic solvents, e.g., DGBE)		
Calibration	: In air form 10 MHz to 6 GHz In head tissue simulating liquid (HSL) and muscle tissue simulating liquid 900 MHz (accuracy $\pm 12.0\%$; $k=2$) 2450 MHz (accuracy $\pm 12.0\%$; $k=2$) 5250 MHz (accuracy $\pm 13.1\%$; $k=2$) 5600 MHz (accuracy $\pm 13.1\%$; $k=2$) 5750 MHz (accuracy $\pm 13.1\%$; $k=2$)		
Frequency	: 10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)		
Directivity	: ± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)		
Dynamic Range	: 10 μ W/g to >100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)		
Dimensions	Overall length	337 mm	
	Tip length	20 mm	
	Body diameter	12 mm	
	Tip diameter	2.5 mm	
	Distance from probe tip to dipole centers	1 mm	



7.2 Twin SAM Phantom

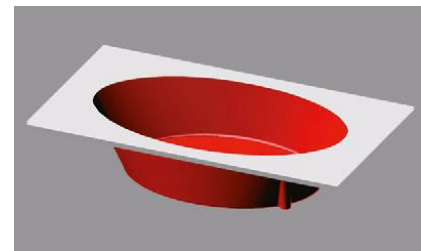
The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.



Shell Thickness : 2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume : Volume Approx. 25 liters
Dimensions : $810 \times 1000 \times 500$ mm (H $\times$ L $\times$ W)

7.3 ELI4 Flat Phantom

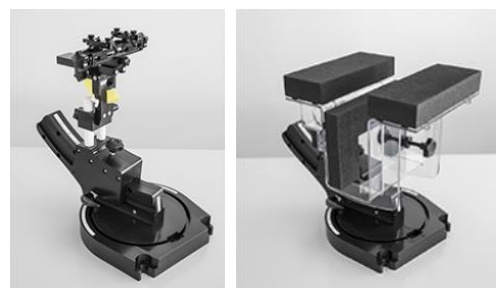
Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.



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

7.4 Mounting Device for Transmitters

In combination with the Twin SAM Phantom V4.0/V4.0c or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat point).



8 Measurement Process

Step 1 : Power Reference Measurement

The power reference job measures the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method. The minimum distance of probe sensors to surface set to 2 mm for EX3DV4 probe. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2 : 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 DASYS software can find the maximum locations in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. If only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maxima within 2 dB of the maximum SAR value are detected, the number of zoom scans has to be increased accordingly.

Step 3 : Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The zoom scan measures points specified in standards within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure.

Step 4 : Z Scan

The Z scan measures points along a vertical straight line. The line runs along the Z axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

Step 5 : Power Drift Measurement

The power drift measurement measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The power drift measurement gives the field difference in dB from the reading conducted within the last power reference measurement. The power reference measurement and power drift measurement are for monitoring the power drift of the device under test in the batch process.

9 Measurement Uncertainties

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg (in the case of 10-g SAR, it is multiplied by 2.5, i.e. < 3.75 W/kg), the extensive SAR measurement uncertainty analysis described in IEEE Std. 1528-2013 is not required in SAR reports submitted for equipment approval.

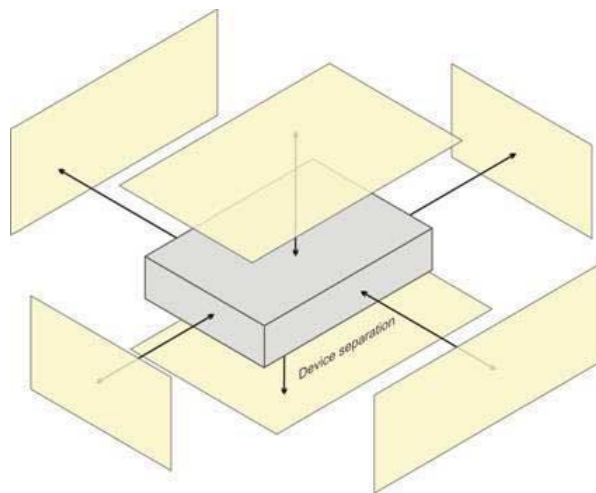
10 Test Arrangement

10.1 RF Exposure Conditions

For a device that cannot be categorized as any of the other specific device types, it shall be considered to be a generic device; i.e. represented by a closed box incorporating at least one internal RF transmitter and antenna.

The SAR evaluation shall be performed for all surfaces of the DUT that are accessible during intended use. The separation distance in testing shall correspond to the intended use distance as specified in the user instructions provided by the manufacturer. If the intended use is not specified, all surfaces of the DUT shall be tested directly against the flat phantom.

The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.



Test positions for a generic device

10.2 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1 g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by;

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot$

$[\sqrt{f_{\text{(GHz)}}}] \leq 3.0$, where

- $f_{\text{(GHz)}}$ is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

Band	Freq. (MHz)	Max. Power		Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)			
RFID 920 MHz	926.9	12.0	16	< 5	3.1	NO
Bluetooth LE	2480	4.5	3	< 5	0.9	YES

The minimum user separation distance was assumed to be 0 mm for the purpose of the SAR exclusion calculations.

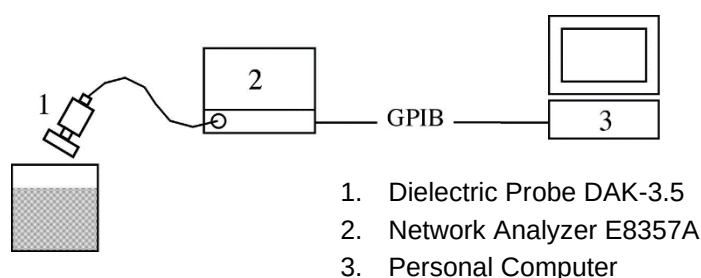
11 Tissue Verification

11.1 Tissue Verification Measurement Condition

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

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

It is verified by using the dielectric probe and the network analyzer.



11.2 Tissue Dielectric Properties

The tissue dielectric properties are specified in KDB 865664 D01 Appendix A.

Target Frequency [MHz]	Head		Body	
	Permittivity (ϵ_r)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity (σ)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

For tissue dielectric properties at other frequencies within the range, a linear interpolation method shall be used.

11.3 Tissue Verification Results

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

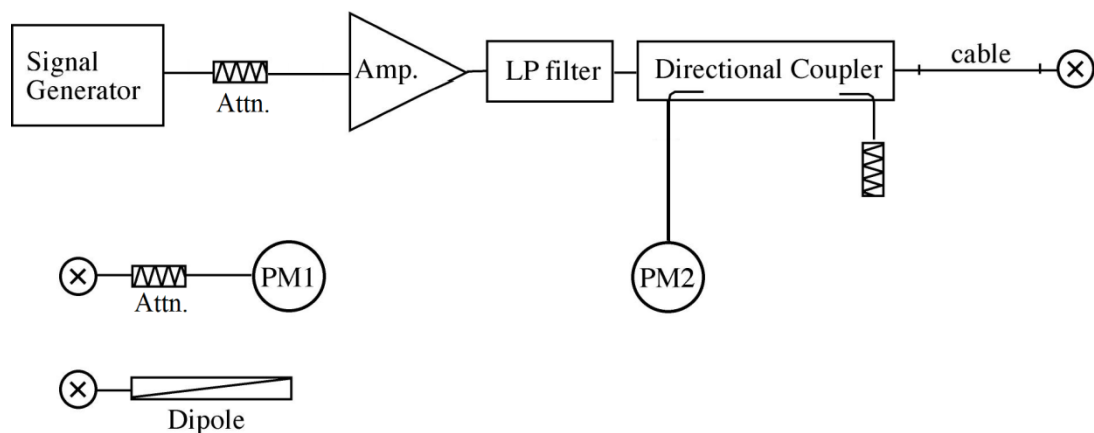
Date	Liquid	Frequency [MHz]	Parameters	Target	Measured	Deviation [%]	Limit [%]
12/27/2023	Head	900	Permittivity (ϵ_r)	41.5	42.91	+3.40	± 5
			Conductivity (σ)	0.97	0.980	+1.03	± 5
		920	Permittivity (ϵ_r)	41.5	42.92	+3.42	± 5
			Conductivity (σ)	0.97	0.984	+1.44	± 5
		930	Permittivity (ϵ_r)	41.4	42.95	+3.74	± 5
			Conductivity (σ)	0.98	0.991	+1.12	± 5

12 System Performance Check

12.1 System Performance Check Measurement Condition

The power meter PM1 (including Attenuator) measures the forward power at the location of the validation dipole connector. The signal generator is adjusted for 250 mW (100 mW for 3 to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

The dipole antenna is matched to be used near flat phantom filled with tissue simulating solution. A specific distance holder is used in the positioning of the antenna to ensure correct spacing between the phantom and the dipole.



12.2 Target SAR Values for System Performance Check

The target SAR values can be obtained from the calibration certificate of system validation dipoles.

System Dipole		Cal. Date	Frequency [MHz]	Target SAR Values [W/kg]	
Type	Serial				
D900V2	153	9/19/2023	900	1g	11.0
				10g	6.99

12.3 System Performance Check Results

The SAR measured with a system validation dipole, using the required tissue-equivalent medium at the test frequency, must be within 10 % of the manufacturer calibrated dipole SAR target.

Date	System Dipole		Liquid	Measured SAR [W/kg] (Normalized to 1 W)		Target	Deviation [%]	Limit [%]
	Type	Serial						
12/27/2023	D900V2	153	Head	1 g	10.56	11.0	-4.00	± 10
				10 g	6.84	6.99	-2.15	± 10

13 RF Output Power Measurements

Band	Mode	Ch#	Frequency (MHz)	Average Power (dBm)	
				Measured	Spec. Max.
RFID 920 MHz	ASK	1	917.1	11.72	12.0
		25	921.9	11.57	12.0
		50	926.9	11.46	12.0

14 SAR Measurements

SAR test reduction criteria are as follows:

When 10 g extremity SAR is required, SAR values indicated below are multiplied by 2.5, i.e. the ratio of the 1 g and extremity 10 g SAR limit.

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1 g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg when the transmission band is ≥ 200 MHz

14.1 Test Data**w/o Attachment**

ASK – Duty Cycle 100%									
RF Exposure Conditions	Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
					Tune-up Limit	Meas.	Meas.	Scaled	
Body-worn	Front	0	1	917.1	12.0	11.72	0.134	0.143	1
			25	921.9	12.0	11.57	0.123	0.136	
			50	926.9	12.0	11.46	0.121	0.137	
	Rear	0	25	921.9	12.0	11.57	< 0.001	< 0.001	
	Edge 1	0	25	921.9	12.0	11.57	0.001	0.001	
	Edge 2	0	25	921.9	12.0	11.57	< 0.001	< 0.001	
	Edge 3	0	25	921.9	12.0	11.57	0.005	0.006	
	Edge 4	0	25	921.9	12.0	11.57	0.005	0.006	

w/ Attachment (IC tag reading area around the user's index finger)

ASK – Duty Cycle 100%									
RF Exposure Conditions	Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Power [dBm]		1 g SAR [W/kg]		Plot No.
					Tune-up Limit	Meas.	Meas.	Scaled	
Body-worn	Case 1	0	1	917.1	12.0	11.72	0.007	0.007	2

w/ Attachment (accessible to the back of the user's hand and index finger)

ASK – Duty Cycle 100%									
RF Exposure Conditions	Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Power [dBm]		10 g SAR [W/kg]		Plot No.
					Tune-up Limit	Meas.	Meas.	Scaled	
Extremity	Case 2	0	1	917.1	12.0	11.72	0.002	0.002	3

14.2 SAR Measurement Variability

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

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a 2nd repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
- 4) Perform a 3rd repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

14.2.1 Highest Measured SAR Configuration in Each Frequency Band

Frequency Band [MHz]	Air Interface	Standalone SAR [W/kg]
920	RFID 920 MHz	0.134

14.2.2 Repeated SAR Measurement Results

Repeated SAR measurement is not required because the highest measured SAR is < 0.80 W/kg.

15 Test Instruments

Test Site : Shielded Room S3					
Type	Model	Serial No. (ID)	Manufacturer	Last Cal.	Cal. Due
RF Power Amplifier	CGA020M602-2633R	B10840 (A-51)	R&K	--	--
Power Meter	ML2495A	1423001 (B-16)	Anritsu	2023/08/14	2024/08/13
Power Sensor	MA2411B	1339136 (B-18)	Anritsu	2023/08/14	2024/08/13
Power Meter	E4417A	GB41290850 (B-51)	Agilent	2023/07/28	2024/07/27
Power Sensor	E9323A	US40411939 (B-59)	Agilent	2023/07/27	2024/07/26
Signal Generator	N5172B	MY57281588 (B-76)	Keysight	2023/04/04	2024/04/03
Attenuator	43KC-20	1480003 (D-41)	Anritsu	2023/08/29	2024/08/28
Attenuator	2-10	BA7557 (D-80)	Weinschel	2023/02/01	2024/01/31
Directional Coupler	4226-20	03736 (D-87)	Narda Microwave	--	--
DAE	DAE4	508 (S-3)	SPEAG	2023/09/19	2024/09/18
900MHz Dipole	D900V2	153 (S-4)	SPEAG	2023/09/19	2024/09/18
E-Field Probe	EX3DV4	7321 (S-17)	SPEAG	2023/09/27	2024/09/26
DASY5 Software	DASY52	Ver.52.8.8.1222	SPEAG	--	--
Dielectric Probe	DAK-3.5	1124 (S-32)	SPEAG	2023/10/05	2024/10/04
DAK Software	DAK	Ver.2.6.1.11	SPEAG	--	--
Network Analyzer	E8357A	US41070304	Agilent	2023/10/20	2024/10/19
Thermo-Hygrometer	testo 608-H2	30050650 (F-71)	testo	2023/04/24	2024/04/23
Barometer	BAROMEX	02952 (F-48)	SATO	2023/08/16	2024/08/15

16 Appendix

Refer to separated files for the following appendixes.

Appendix 1 – System Performance Check Plots

Appendix 2 – Highest SAR Test Plots

Appendix 3 – Dosimetric E-Field Probe Calibration Data

Appendix 4 – System Validation Dipole Calibration Data

Appendix 5 – Test Setup Photographs

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