

## TEST REPORT (SAR EVALUATION)

**Applicant** : KONICA MINOLTA,INC.  
**Address** : 2970 Ishikawa-machi, Hachioji-shi, Tokyo 192-8505 Japan.

**Products** : GAS Camera System  
**Model No.** : GMPC02  
**Serial No.** : --  
**FCC ID** : 2A4C6-GMP02

**Test Standard** : FCC Rules and Regulations Title 47 CFR Part 2

**Test Results** : Passed

**Date of Test** : April 11, 2022 – May 9, 2022



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Kousei Shibata  
Manager  
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- 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 1 and 10 of this report were provided by the applicant. JQA is not responsible for the test results affected by the incorrect information.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
- This test report shall not be reproduced except in full without the written approval of JQA.
- VLAC does not approve, certify or warrant the product by this test report.

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**1 Description of the Device Under Test (DUT)****1.1 General Information**

1. Manufacturer : KONICA MINOLTA,INC.  
2970 Ishikawa-machi, Hachioji-shi, Tokyo 192-8505 Japan.
2. Products : GAS Camera System
3. Model No. : GMPC02
4. Serial No. : --
5. Product Type : Mass Production
6. Date of Manufacture : February 22, 2022
7. Transmitting Frequency : WLAN 2.4 GHz (DTS : 2412 MHz – 2462 MHz)
8. Battery Option : Lithium-ion Battery Pack RRC2054 (3.45Ah)
9. Power Rating : 14.45VDC (Battery Operation)
10. DUT Grounding : None
11. Device Category : Portable Device (§2.1093)
12. Exposure Category : General Population/Uncontrolled Exposure
13. FCC Rule Part(s) : 15.247
14. DUT Authorization : Certification
15. Received Date of DUT : March 21, 2022

## 1.2 Wireless Technologies

Air Interface	Description	
WLAN (DTS)	Frequency band(s)	2.4 GHz
	Operating mode	802.11b 802.11g 802.11n [HT20] 802.11n [HT40]
	Tx Diversity Configuration	2Tx CDD (802.11b/g) 2Tx MIMO (802.11n)

## 1.3 Maximum Output Power

WLAN 2.4 GHz (DTS)	Mode	Max. Tune-up Limit (dBm)	
		Chain 0	Chain 1
	802.11b	<b>14.5</b>	<b>14.5</b>
	802.11g	<b>13.6</b>	<b>13.6</b>
	802.11n HT20	<b>13.5</b>	<b>13.3</b>
	802.11n HT20 High channel (Tx 2462MHz)	<b>12.7</b>	<b>12.6</b>
	802.11n HT40	<b>13.1</b>	<b>13.0</b>
	802.11n HT40 High channel (Tx 2462MHz)	<b>12.5</b>	<b>12.4</b>

## 2 Summary of Test Results

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

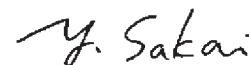
Test Configuration	Reported 1 g SAR (W/kg)	Limit (W/kg)
	DTS (WLAN)	
Body-worn Accessory	0.697	1.6

The test results are **passed** for exposure limits specified in ANSI/IEEE Std. C95.1.

In the approval of test results,

- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty (MIU).
- The expanded MIUs for the CISPR measurement methods determined by JQA are less than  $U_{cisp}$  according to CISPR 16-4-2.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by  
Yasuhisa Sakai / Manager



Tested by  
Takeshi Choda / Deputy Manager



### 3 Test Procedure

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

# 248227 D01 802.11 Wi-Fi SAR v02r02  
# 447498 D01 General RF Exposure Guidance v06  
# 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04  
# 865664 D02 RF Exposure Reporting v01r02

### 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 Recognition of Test Laboratory

JQA Kitakansai Testing Center Saito EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : March 30, 2024)  
A2LA Accreditation No. : 5498.01 (Expiry date : November 30, 2023)

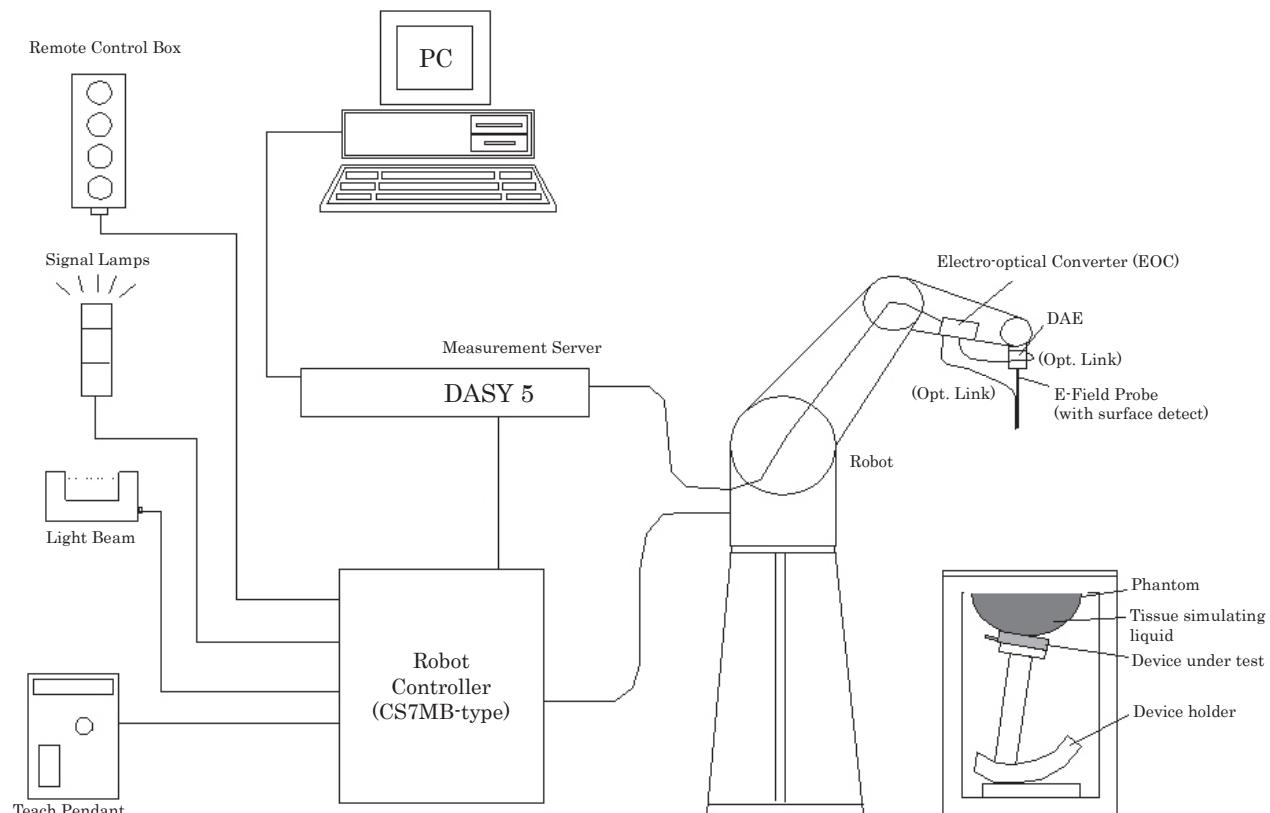
VCCI Registration No. : A-0002 (Expiry date : March 30, 2024)  
FCC Registration No. : JP5008 (Expiry date : March 30, 2024)  
ISED Registration No. : JP0014 (Expiry date : November 30, 2023)  
BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006  
(Expiry date : September 14, 2022)

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 from 10 MHz to 6 GHz  
In head tissue simulating liquid (HSL) and  
muscle tissue simulating liquid  
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:  $\pm$  0.2 dB (30 MHz to 6 GHz)

Directivity :  $\pm$  0.3 dB in HSL (rotation around probe axis)  
 $\pm$  0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range : 10  $\mu$ W/g to >100 mW/g; Linearity:  $\pm$  0.2 dB (noise: typically < 1  $\mu$ 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.



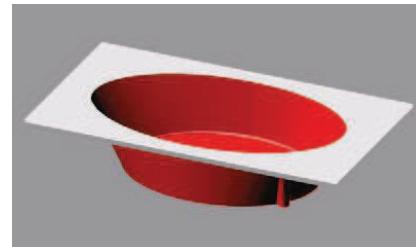
Shell Thickness :  $2 \pm 0.2$  mm; Center ear point:  $6 \pm 0.2$  mm

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 :  $2 \pm 0.2$  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 4 mm for an ET3DV6 probe, or 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 DASY 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.

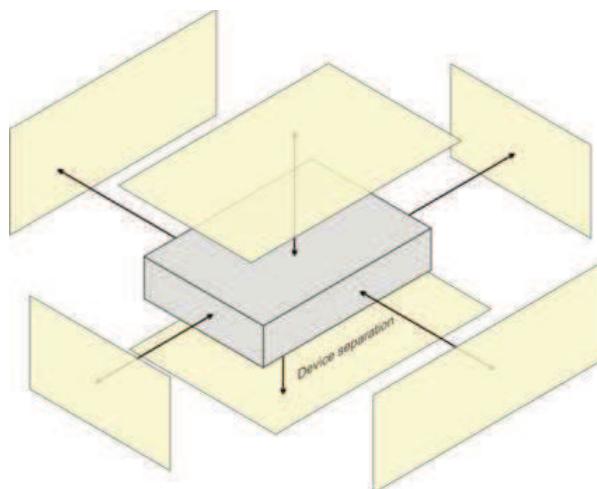
## 10 Test Arrangement

### 10.1 RF Exposure Conditions

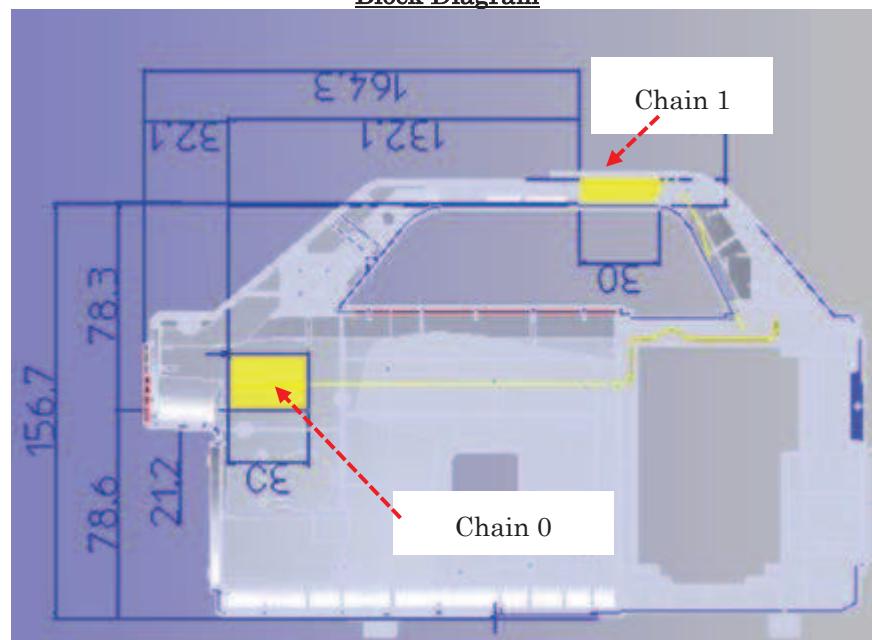
For a device that cannot be categorized as any of the other specific device types, it shall be considered to be a generic device; i.e. represented by a closed box incorporating at least one internal RF transmitter and antenna.

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.

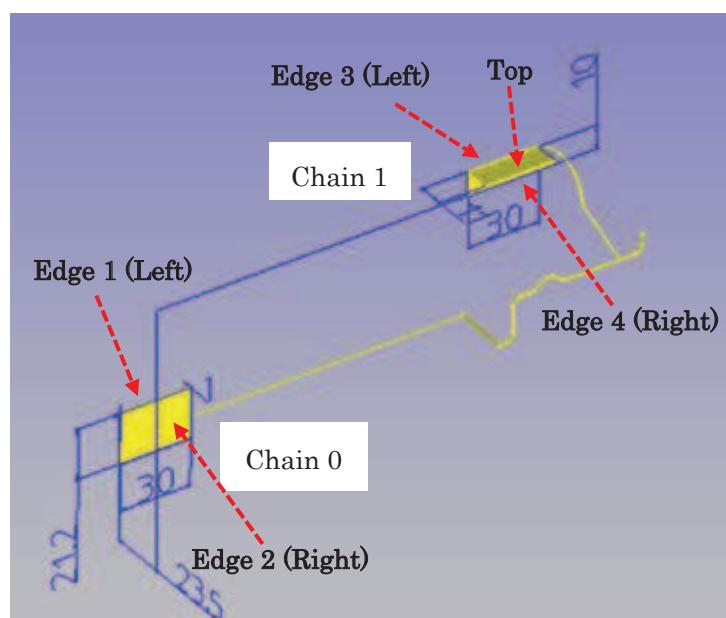
The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.



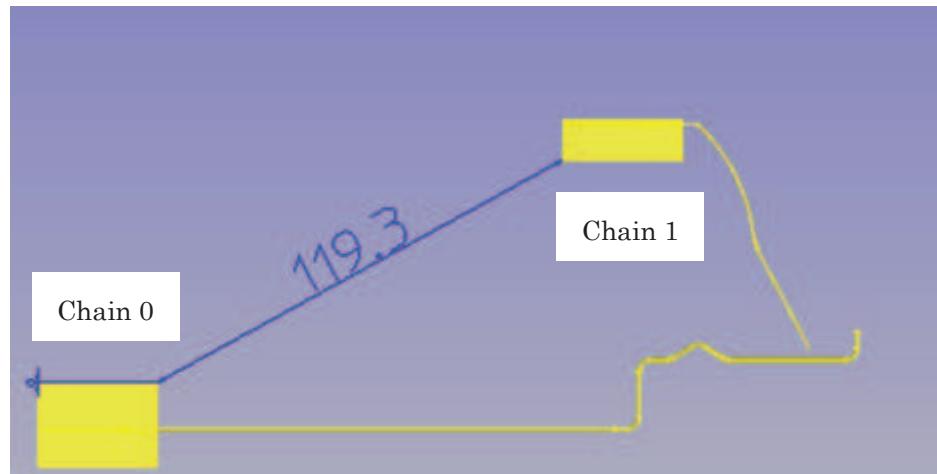
Test positions for a generic device

**10.2 Antenna Location and Separation Distances**Block Diagram

Antenna positions in enclosure



Antenna to Antenna



Shortest Distance Between Antennas

### 10.3 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*  $\leq$  50 mm are determined by;

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}}] \leq 3.0$  for 1-g SAR, and  $\leq 7.5$  for 10-g extremity SAR, 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

#### *SAR exclusion calculations for antenna $\leq$ 50 mm from the user*

##### *Chain 0*

Band	Freq. (MHz)	Max. Power		Test Position	Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)				
WLAN (DTS)	2462	14.5	28.2	Front	32.1	1.4	YES
				Edge 1 (Left)	8.0	5.5	NO*

##### *Chain 1*

Band	Freq. (MHz)	Max. Power		Test Position	Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)				
WLAN (DTS)	2462	14.5	28.2	Top	10.0	4.4	NO
				Edge 3 (Left)	7.0	6.3	NO
				Edge 4 (Right)	12.5	3.4	NO

At 100 MHz to 6 GHz and for *test separation distances*  $>$  50 mm, the SAR test exclusion threshold is determined according to the following;

$[(\text{Power allowed at numeric threshold for 50 mm}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f_{(\text{MHz})}/150)] \text{ mW}$ , at 100 MHz to 1500 MHz

$[(\text{Power allowed at numeric threshold for 50 mm}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$ , at  $>$  1500 MHz and  $\leq$  6 GHz

#### *SAR exclusion calculations for antenna $>$ 50 mm from the user*

##### *Chain 0*

Band	Freq. (MHz)	Max. Power		Test Position	Distance (mm)	Threshold (mW)	Test Exclusion
		(dBm)	(mW)				
WLAN (DTS)	2462	14.5	28.2	Top	88.3	476	YES
				Bottom	78.6	386	YES
				Rear	213.0	1726	YES
				Edge 2 (Left)	68.4	276	YES

##### *Chain 1*

Band	Freq. (MHz)	Max. Power		Test Position	Distance (mm)	Threshold (mW)	Test Exclusion
		(dBm)	(mW)				
WLAN (DTS)	2462	14.5	28.2	Bottom	156.7	1166	YES
				Front	164.3	1236	YES
				Rear	83.0	426	YES

Standalone SAR test exclusion was based upon the following criteria;

- The *test separation distance* used to determine SAR test exclusion for the surface and edges that contain an antenna is determined from the outer housing of the device.
- The *test separation distance* for SAR test exclusion of adjacent edges is determined by the closest distance between the antenna and outer housing on the adjacent edge of the device.

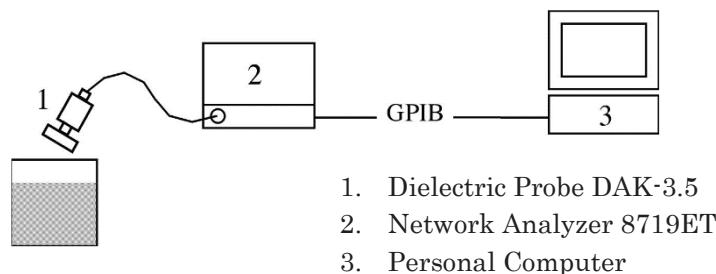
## 11 Tissue Verification

### 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.

Target Frequency [MHz]	Head		Body	
	Permittivity ( $\epsilon_r$ )	Conductivity (o)	Permittivity ( $\epsilon_r$ )	Conductivity (o)
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 Composition of Ingredients for the Tissue Material Used in the SAR Tests

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.

#### Head and Body Liquids (Below 1 GHz)

Item	Head and Muscle Tissue Simulation Liquids HSL/MSL 750, HSL/MSL 900
H <sub>2</sub> O	Water, 35 – 58 %
Sucrose	Sugar, white, refined, 40 – 60 %
NaCl	Sodium Chloride, 0 – 6 %
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), < 0.3 %
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7 %

#### Head and Body Liquids (1 to 3 GHz)

Item	Head and Muscle Tissue Simulation Liquids HSL/MSL 1750, HSL/MSL 1900, HSL/MSL 2450
H <sub>2</sub> O	Water, 52 – 75 %
C <sub>8</sub> H <sub>18</sub> O <sub>3</sub>	Diethylene glycol monobutyl ether (DGBE), 25 – 48% (CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8)
NaCl	Sodium Chloride, < 1.0 %

#### Head Liquids (3 to 6 GHz)

Item	Head Broad Band Tissue Simulation Liquids HBBL 3500-5800
Water	50 – 65 %
Mineral oil	10 – 30 %
Emulsifiers	8 – 25 %
Sodium salt	0 – 1.5 %
Safety relevant ingredients according to EU directives:	
EINECS-No 203-489-0	1.0 – 2.8 % 2-Methyl-pentane-2,4-diol (Hexylene Glycol): CAS-No 107-41-5 (Xi irritant, R36/38 irritant for eyes and skin)

#### Body Liquids (3 to 6 GHz)

Item	Muscle Broad Band Tissue Simulation Liquids MBBL 3500-5800
Water	60 – 80 %
Esters, Emulsifiers, Inhibitors	20 – 40 %
Sodium salt	0 – 1.5 %
Safety relevant ingredients according to EU directives: none	
Safety relevant ingredients according to other directives:	
CAS-No 26399-02-0	10 – 28 % Oleic acid, alkylester

#### 11.4 Tissue Verification Results

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

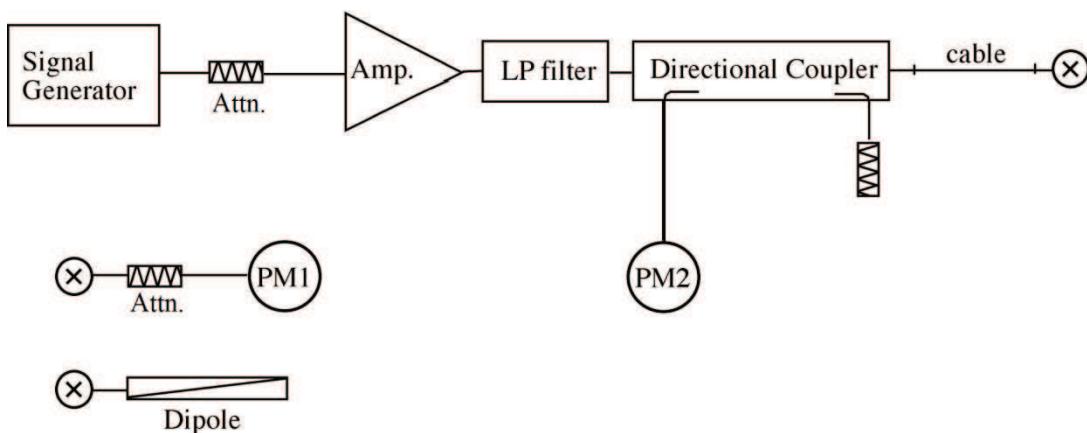
Date	Liquid	Frequency [MHz]	Parameters	Target	Measured	Deviation [%]	Limit [%]
4/25/2022	Body	2410	Permittivity ( $\epsilon_r$ )	52.8	51.94	-1.63	$\pm 5$
			Conductivity ( $\sigma$ )	1.91	1.889	-1.10	$\pm 5$
		2450	Permittivity ( $\epsilon_r$ )	52.7	51.77	-1.76	$\pm 5$
			Conductivity ( $\sigma$ )	1.95	1.946	-0.21	$\pm 5$
		2475	Permittivity ( $\epsilon_r$ )	52.7	51.67	-1.95	$\pm 5$
			Conductivity ( $\sigma$ )	1.99	1.975	-0.75	$\pm 5$
4/26/2022	Body	2410	Permittivity ( $\epsilon_r$ )	52.8	51.92	-1.67	$\pm 5$
			Conductivity ( $\sigma$ )	1.91	1.914	+0.21	$\pm 5$
		2450	Permittivity ( $\epsilon_r$ )	52.7	51.78	-1.75	$\pm 5$
			Conductivity ( $\sigma$ )	1.95	1.965	+0.77	$\pm 5$
		2475	Permittivity ( $\epsilon_r$ )	52.7	51.71	-1.88	$\pm 5$
			Conductivity ( $\sigma$ )	1.99	1.998	+0.40	$\pm 5$
5/06/2022	Body	2410	Permittivity ( $\epsilon_r$ )	52.8	51.47	-2.52	$\pm 5$
			Conductivity ( $\sigma$ )	1.91	1.918	+0.42	$\pm 5$
		2450	Permittivity ( $\epsilon_r$ )	52.7	51.33	-2.60	$\pm 5$
			Conductivity ( $\sigma$ )	1.95	1.97	+1.03	$\pm 5$
		2475	Permittivity ( $\epsilon_r$ )	52.7	51.24	-2.77	$\pm 5$
			Conductivity ( $\sigma$ )	1.99	2.044	+2.71	$\pm 5$
5/11/2022	Body	2410	Permittivity ( $\epsilon_r$ )	52.8	50.96	-3.48	$\pm 5$
			Conductivity ( $\sigma$ )	1.91	1.937	1.41	$\pm 5$
		2450	Permittivity ( $\epsilon_r$ )	52.7	50.77	-3.66	$\pm 5$
			Conductivity ( $\sigma$ )	1.95	1.996	2.36	$\pm 5$
		2475	Permittivity ( $\epsilon_r$ )	52.7	50.7	-3.80	$\pm 5$
			Conductivity ( $\sigma$ )	1.99	2.023	1.66	$\pm 5$

## 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			1g/10g	Head	Body
D2450V2	714	9/13/2021	2450	1g	53.7	50.3
				10g	25.2	23.9

### 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		1 g	52.4			
4/25/2022	D2450V2	714	Body	1 g	52.4	51.2	-2.29	± 10
				10 g	24.68	24.16	-2.11	± 10
4/26/2022	D2450V2	714	Body	1 g	52.4	49.6	-5.34	± 10
				10 g	24.68	23.32	-5.51	± 10
5/06/2022	D2450V2	714	Body	1 g	52.4	51.2	-2.29	± 10
				10 g	24.68	23.92	-3.08	± 10
5/11/2022	D2450V2	714	Body	1 g	52.4	53.6	2.29	± 10
				10 g	24.68	25.24	2.27	± 10

**13 RF Output Power Measurements****13.1 WLAN (DTS Band)****DTS Band Results (Chain 0)**

Band	Mode	Data Rate	Ch#	Frequency (MHz)	Average Power (dBm)	
					Measred	Spec. Max.
2.4 GHz (DTS)	802.11b	1 Mbps	1	2412	14.50	14.5
			6	2437	14.40	
			11	2462	14.30	
	802.11g	6 Mbps	1	2412	13.60	13.6
			6	2437	13.60	
			11	2462	13.40	
	802.11n [HT20]	MCS 0	1	2412	13.40	13.5
			6	2437	13.50	
			11	2462	12.70	12.7
	802.11n [HT40]	MCS 0	3	2422	13.10	13.1
			6	2437	13.10	
			9	2452	12.50	12.5

**DTS Band Results (Chain 1)**

Band	Mode	Data Rate	Ch#	Frequency (MHz)	Average Power (dBm)	
					Measred	Spec. Max.
2.4 GHz (DTS)	802.11b	1 Mbps	1	2412	14.30	14.5
			6	2437	14.50	
			11	2462	14.30	
	802.11g	6 Mbps	1	2412	13.40	13.6
			6	2437	13.60	
			11	2462	13.30	
	802.11n [HT20]	MCS 0	1	2412	13.20	13.3
			6	2437	13.30	
			11	2462	12.60	12.6
	802.11n [HT40]	MCS 0	3	2422	12.90	13.0
			6	2437	13.00	
			9	2452	12.40	12.4

**Note(s):**

Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units. (802.11b DSSS and 802.11g/n OFDM configurations are considered separately.)

- When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
- When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

## 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 248227 D01 802.11 Wi-Fi SAR:

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 GHz and 5 GHz bands, an initial test configuration is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units. 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, for each frequency band.

SAR is measured using the highest measured maximum output power channel for the determined exposure configurations. When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement. When there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

An initial test position is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration according to the OFDM procedures. The initial test position procedure is described in the following:

- When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combination within the frequency band or aggregated band.
- When the reported SAR of the initial test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1 g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the reported SAR is  $\leq 0.8$  W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, 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  $\leq 1.2$  W/kg or all required channels are tested.

To determine the initial test position, Area Scans were performed to determine the position with the estimated 1 g SAR (fast SAR). The position that produced the highest fast SAR is considered the worst case position; thus used as the initial test position. The averaged fast SAR is scaled according to reported SAR requirements.

#### 14.1 WLAN (DTS Band)

##### Chain 0

802.11b (1 Mbps) – Duty Cycle 100%										
RF Exposure Conditions	Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Averaged Fast SAR [W/kg]	Power [dBm]		1 g SAR [W/kg]		Plot No.
						Tune-up Limit	Meas.	Meas.	Scaled	
Body-worn & Hotspot	Edge 1 (Left)	0	1	2412	-	-	-	-	-	-
		0	6	2437	-	-	-	-	-	-
		0	11	2462	0.0152	14.5	14.30	0.011	<b>0.012</b>	1

##### Chain 1

802.11b (1 Mbps) – Duty Cycle 100%										
RF Exposure Conditions	Test Position	Dist. [mm]	Ch#	Freq. [MHz]	Averaged Fast SAR [W/kg]	Power [dBm]		1 g SAR [W/kg]		Plot No.
						Tune-up Limit	Meas.	Meas.	Scaled	
Body-worn & Hotspot	Top	0	1	2412	0.336	14.5	14.30	-	-	-
		0	6	2437	0.636	14.5	14.50	0.507	<b>0.507</b>	2
		0	11	2462	<b>0.911</b>	14.5	14.30	0.666	<b>0.697</b>	3
	Edge 3 (Left)	0	1	2412	-	-	-	-	-	-
		0	6	2437	-	-	-	-	-	-
		0	11	2462	0.126	14.5	14.30	0.097	<b>0.102</b>	-
	Edge 4 (Right)	0	1	2412	-	-	-	-	-	-
		0	6	2437	-	-	-	-	-	-
		0	11	2462	0.068	14.5	14.30	-	-	-

Note(s):

SAR is not required for 802.11g/n OFDM configurations 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  $\leq 1.2$  W/kg.

## 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  $< 0.80 \text{ W/kg}$ ; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80 \text{ W/kg}$ , 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  $\geq 1.45 \text{ W/kg}$  ( $\sim 10\%$  from the 1-g SAR limit).
- 4) Perform a 3rd repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5 \text{ W/kg}$  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]
2450	WLAN 802.11b	0.697

### 14.2.2 Repeated SAR Measurement Results

Repeated SAR measurement is not required because the highest measured SAR is  $< 0.80 \text{ W/kg}$ .

### 14.2.3 Sum of the SAR for WLAN

RF Exposure Conditions	Simultaneous Transmission Scenario		$\Sigma 1 \text{ g SAR (W/kg)}$	
	DTS			
	Chain 0	Chain 1		
Body-worn	0.012	0.697	<b>0.709</b>	

#### SAR to Peak Location Separation Ratio (SPLSR)

As the sum of the 1 g SAR is  $< 1.6 \text{ W/kg}$ , SPLSR assessment is not required.

#### Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1 g SAR is  $< 1.6 \text{ W/kg}$ .

**16 Test Instruments**

Shielded Room S3				
Type	Model	Serial No. (ID)	Manufacturer	Cal. Due
E-Field Probe	EX3DV4	7321 (S-17)	SPEAG	2022/08/15
DAE	DAE4	508 (S-3)	SPEAG	2022/08/05
Robot	RX60L	F02/5R10A1/A/01 (S-7)	Stäubli	N/A
Probe Alignment Unit	LB5/80	SE UKS 030 AA (S-13)	SPEAG	N/A
Network Analyzer	E8357A	US41070304	Agilent	2022/10/31
Dielectric Probe	DAK-3.5	1124 (S-32)	SPEAG	2022/07/08
2450MHz Dipole	D2450V2	714 (S-6)	SPEAG	2022/09/12
Signal Generator	MG3681A	6100216166 (B-3)	Anritsu	2022/08/31
RF Power Amplifier	CGA020M602-2633R	B10840 (A-51)	R&K	N/A
Directional Coupler	4226-20	03736 (D-87)	Narda Microwave	N/A
Power Meter	E4417A	GB41290850 (B-51)	Agilent	2022/07/06
Power Sensor	E9323A	US40411939 (B-59)	Agilent	2022/07/06
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2022/07/06
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2022/07/06
Attenuator	2-10	BA7557 (D-80)	Weinschel	2022/12/16

## 17 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**