SAR TEST REPORT

Test Report No.: 13218115S-A-R1

Applicant : **RICOH IMAGING COMPANY, LTD.**
Type of EUT : **Digital Camera**
Model Number of EUT : **R03010**
FCC ID : **2ACZS-R03010**
Test Standard : **FCC 47CFR §2.1093**
Test Result : **Complied** (Refer to Section 3.5)

Highest Reported SAR(1g)	SAR Type	SAR Limit	Frequency [MHz]	Mode	Output power (burst average)	
					Measured	Max.
1.49 W/kg	**Body-worn**	**1.6 W/kg**	2437	IEEE 802.11b (1Mbps)	10.90 dBm	12.0 dBm

*. **Highest reported SAR (1g) across all exposure conditions of this device is " 1.49 W/kg (body-worn, DTS band)."**

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7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report (-R1) is a revised version of 13218115S-A. 13218115S-A report is replaced with this report.

Date of test: May 8, 2020

Test engineer: H. Naka
Hiroshi Naka
Engineer, Consumer Technology Division

Approved by: T. Imamura
Toyokazu Imamura
Leader, Consumer Technology Division

☒ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☐ There is no testing item of "Non-accreditation".

CERTIFICATE 1266.03

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	13218115S-A	July 14, 2020	-	-
-R1	13218115S-A-R1	July 27, 2020	P38	p38; Corrected a mistake (serial number of dipole). (from, Serial: 765 -> to, Serial: 822)

*. By issue of new revision report, the report of an old revision becomes invalid.

Reference : Abbreviations (Including words undescribed in this report) (radio_r0v03_200214)

A2LA	The American Association for Laboratory Accreditation
AC	Alternating Current
AFH	Adaptive Frequency Hopping
AM	Amplitude Modulation
Amp, AMP	Amplifier
ANSI	American National Standards Institute
Ant, ANT	Antenna
AP	Access Point
ASK	Amplitude Shift Keying
Atten., ATT	Attenuator
AV	Average
BPSK	Binary Phase-Shift Keying
BR	Bluetooth Basic Rate
BT	Bluetooth
BT LE	Bluetooth Low Energy
BW	BandWidth
Cal Int	Calibration Interval
CCK	Complementary Code Keying
Ch., CH	Channel
CISPR	Comite International Special des Perturbations Radioelectriques
CW	Continuous Wave
DBPSK	Differential BPSK
DC	Direct Current
D-factor	Distance factor
DFS	Dynamic Frequency Selection
DQPSK	Differential QPSK
DSSS	Direct Sequence Spread Spectrum
DUT	Device Under Test
EDR	Enhanced Data Rate
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EN	European Norm
ERP, e.r.p.	Effective Radiated Power
EU	European Union
EUT	Equipment Under Test
Fac.	Factor
FCC	Federal Communications Commission
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
Freq.	Frequency
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency-Shift Keying
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hori.	Horizontal
ICES	Interference-Causing Equipment Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ILAC	International Laboratory Accreditation Conference
ISED	Innovation, Science and Economic Development Canada
ISO	International Organization for Standardization
JAB	Japan Accreditation Board
LAN	Local Area Network
LIMS	Laboratory Information Management System
MCS	Modulation and Coding Scheme
MRA	Mutual Recognition Arrangement
N/A	Not Applicable
NIST	National Institute of Standards and Technology
NS	No signal detect.
NSA	Normalized Site Attenuation
NVLAP	National Voluntary Laboratory Accreditation Program
OBW	Occupied Band Width
OFDM	Orthogonal Frequency Division Multiplexing
P/M	Power meter
PCB	Printed Circuit Board
PER	Packet Error Rate
PHY	Physical Layer
PK	Peak
PN	Pseudo random Noise
PRBS	Pseudo-Random Bit Sequence
PSD	Power Spectral Density
QAM	Quadrature Amplitude Modulation
QP	Quasi-Peak
QPSK	Quadrature Phase Shift Keying
RBW	Resolution Band Width
RDS	Radio Data System
RE	Radio Equipment
RF	Radio Frequency
RMS	Root Mean Square
RSS	Radio Standards Specifications
Rx	Receiving
SA, S/A	Spectrum Analyzer
SAR	Specific Absorption Rate
SG	Signal Generator
SVSWR	Site-Voltage Standing Wave Ratio
TR	Test Receiver
Tx	Transmitting
VBW	Video BandWidth
Vert.	Vertical
WLAN	Wireless LAN

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SECTION 1: Customer information

Company Name	RICOH IMAGING COMPANY, LTD.
Brand Name	PENTAX
Address	1-3-6 Naka magome, Ohta-ku, Tokyo 143-8555, Japan
Telephone Number	81-50-3534-5213
Contact Person	Kenji Daigo

The information provided from the customer is as follows;
- Applicant, Type of EUT, Model Number of EUT, FCC IDon the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT)
- SECTION 4: Operation of EUT during testing
- Appendix 1: The part of Antenna location information, Description of EUT and Support Equipment

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2, SECTION 4 and Appendix 1.

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of EUT	Digital Camera
Model Number	R03010
Serial Number	PP4-22
Condition of EUT	Production prototype (Not for sale: This samples is equivalent to mass-produced items.)
Receipt Date of Sample	April 9, 2020 (*. Sample for power measurement.) *. No modification by the test Lab. April 28, 2020 (*. Sample for SAR test.) *. No modification by the test Lab.
Country of Mass-production	Philippines
Category Identified	Portable device *. Since the specified platform which includes the EUT (Wireless Module) may contact to a human body during Wi-Fi operation, the partial-body SAR (1g) shall be observed.
Feature of EUT	Model number: R03010 (referred to as the EUT in this report) is a Digital Camera which has Wireless-LAN and Bluetooth LE functions.
SAR Accessory	None

	#	Classification	Model Number	Notes	SAR test condition. (n/a: not applied.)
Rating	1	DC 7.2 V, Lithium Ion Battery	D-LI90	Bundled	Tested.
	2	AC 100 V ~ AC 240 V, AC Adapter (Output : DC 5 V, DC 9 V, DC 12 V)	D-AC166	Option	Tested.
	3	Battery Grip (Case to use a lithium-ion battery. DC 7.2 V)	D-BG8	Option	n/a, An antenna is 17 mm away from the bottom surface, and the influence of this option battery grip is small.
	4	USB Adaptor (Output: DC 5 V)	AC-U2	Bundled	n/a, A USB connector is opposite to the location of an antenna.
	*. When AC adapter is connected, this is given most priority of the power supply. *. The user can set the priority either battery operation or Battery Grip operation. Default is auto selection (*. The high voltage one is chosen). *. When USB adapter is connected, only a charging for a battery is possible.				

2.2 Product Description (Wireless Module)

Equipment type	Transceiver				
Operation mode	Wi-Fi				BT LE (Bluetooth 4.2 Low Energy) (*. BDR/EDR is not supported)
Frequency of operation	(2412~2462) MHz (b, g, n20)				(2402~2480) MHz
Channel spacing	5 MHz				2MHz
Bandwidth	20 MHz (b, g, n20)				79 MHz
Type of modulation	(b) DSSS: DBPSK, DQPSK, CCK / (g, n20)) OFDM: BPSK, QPSK, 16QAM, 64QAM				FHSS: GFSK

	Mode	b	g	n(20HT)	BT LE
Transmit typical power and maximum tune-up tolerance limit	Typical	10.0 dBm	10.0 dBm	10.0 dBm	1.0 dBm
	Maximum	12.0 dBm	12.0 dBm	12.0 dBm	2.0 dBm
	Remarks	-	-	-	-
	*. The measured Tx output power (conducted) refers to section 6 in this report.				

Quantity of Antenna	1 piece	Antenna type	Embedded antenna	Antenna system	λ/2 Dipole antenna
Antenna connector type	Antenna side: MM5829-2700 <Murata> / Module side: MM5829-2700 <Murata>				
Antenna cable type	Coaxial cable: MXJA01JA0260C4 (50Ω, 0.4D single shield PFA coaxial cable, Dia. 0.81mm, L=25.6 ± 1mm) Coaxial cable connector (both-end): JSC right angle plug connector (*. It was purchased by a coaxial cable model: MXJA01JA0260C4.)				
Antenna gain (peak)	2.23 dBi (2.4GHz band) *.including antenna cable loss				

*. b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT)
*. The EUT do not use the special transmitting technique such as "beam-forming" and "time-space code diversity."
*. Wi-Fi and Bluetooth were not transmitted simultaneously. Therefore simultaneously transmitted SAR was not considered.

SECTION 3: Test specification, procedures and results

3.1 Test specification

FCC47CFR §2.1093: Radiofrequency radiation exposure evaluation: portable devices.

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992. The device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling in accordance with the following measurement procedures.

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 2, IEEE Std.1528-2013 (latest), the following FCC Published RF exposure KDB procedures, and TCB workshop updates.

KDB 447498 D01 (v06):	General RF exposure guidance
KDB 248227 D01 (v02r02):	SAR Guidance for IEEE 802.11 (Wi-Fi) transmitters
KDB 865664 D01 (v01r04):	SAR measurement 100MHz to 6GHz
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.

3.2 Exposure limit

Environments of exposure limit	Whole-Body (averaged over the entire body)	Partial-Body (averaged over any 1g of tissue)	Hands, Wrists, Feet and Ankles (averaged over any 10g of tissue)
(A) Limits for Occupational /Controlled Exposure (W/kg)	0.4	8.0	20.0
(B) Limits for General population /Uncontrolled Exposure (W/kg)	0.08	1.6	4.0

***. Occupational/Controlled Environments:** are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

***. General Population/Uncontrolled Environments:** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

The limit applied in this test report is;

General population / Uncontrolled exposure, Partial-Body (averaged over any 1g of tissue) limit: 1.6 W/kg (body touch)

3.3 Addition, deviation and exclusion to the test procedure

No addition, exclusion nor deviation has been made from the test procedure.

3.4 Test Location

UL Japan, Inc., Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone number: +81 463 50 6400 / Facsimile number: +81 463 50 6401
A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Used?	Place	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐	No.1 Semi-anechoic chamber	20.6 × 11.3 × 7.65	20.6 × 11.3	10 m
☐	No.2 Semi-anechoic chamber	20.6 × 11.3 × 7.65	20.6 × 11.3	10 m
☐	No.3 Semi-anechoic chamber	12.7 × 7.7 × 5.35	12.7 × 7.7	5 m
☐	No.4 Semi-anechoic chamber	8.1 × 5.1 × 3.55	8.1 × 5.1	-
☐	No.1 Shielded room	6.8 × 4.1 × 2.7	6.8 × 4.1	-
☐	No.2 Shielded room	6.8 × 4.1 × 2.7	6.8 × 4.1	-
☐	No.3 Shielded room	6.3 × 4.7 × 2.7	6.3 × 4.7	-
☐	No.4 Shielded room	4.4 × 4.7 × 2.7	4.4 × 4.7	-
☐	No.5 Shielded room	7.8 × 6.4 × 2.7	7.8 × 6.4	-
☐	No.6 Shielded room	7.8 × 6.4 × 2.7	7.8 × 6.4	-
☒	**No.7 Shielded room**	**2.76 × 3.76 × 2.4**	**2.76 × 3.76**	-
☐	No.8 Shielded room	3.45 × 5.5 × 2.4	3.45 × 5.5	-
☐	No.1 Measurement room	2.55 × 4.1 × 2.5	2.55 × 4.1	-

3.5 Procedures and Results

Test Procedure	SAR measurement: KDB 447498 D01, KDB 248227 D01, KDB 865664 D01, IEC Std. 1528		
Standard	FCC 47CFR §2.1093 (Portable device)	SAR type	Body-touch

Band (Operation frequency)	DTS: BT LE ((2402-2480) MHz)	DTS: Wi-Fi ((2412-2462) MHz)
Results (Reported SAR(1g))	Complied (*.SAR test was exempt (*. lower power), Refer to clause 4.3.)	Complied (Refer to Section 7)
SAR (1g) Limit	1.6 W/kg	1.6 W/kg
Reported SAR(1g) value	N/A	1.485 W/kg
Measured SAR value	N/A	1.14 W/kg
Liquid type	-	Body
Setup (separation distance)	-	0 mm
Mode, frequency	-	b(1Mbps), 2437
Duty cycle (S/F: duty scaled factor)	-	99.0 % (S/F: ×1.01)
Output average power (max. power, T/F: Tune-up factor)	-	10.90 dBm (max.12.0 dBm, T/F: ×1.29)

Note: UL Japan's SAR Work Procedures No.13-EM-W0429 and 13-EM-W0430. No addition, deviation nor exclusion has been made from standards
*. (mode) BT LE: Bluetooth Low Energy, b: IEEE 802.11b; max.: maximum.; n/a: not applied.
*. Since Bluetooth and Wii-Fi of 2.4GHz are used a same antenna, Bluetooth and Wi-Fi do not transmit simultaneously.
*. (Calculating formula) Corrected SAR to max.power(as Reported SAR) (W/kg) = (Measured SAR (W/kg)) × (Duty scaled factor) × (Tune-up factor)
where; Tune-up factor [-] = 1 / (10 ^ ("Δmax (burst average power - max.power), dB" / 10)), Duty scaled factor [-] = 100(%) / (duty cycle, %)

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for partial body) specified in FCC 47 CFR part 2 (2.1093), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

3.6 SAR measurement procedure

3.6.1 Normal SAR measurement procedure

Step 1: Confirmation before SAR testing

Before SAR test, the RF wiring for the sample had been switched to the antenna conducted power measurement line from the antenna line and the average power was measured. The SAR test reference power measurement and the SAR test were proceeded with the lowest data rate (which has the higher time-based average power typically) on each operation mode. Therefore, the average output power was measured on the lower, middle (or near middle), upper and specified channels with the lowest data rate of each operation mode. The power of other data rate was also measured to confirm the time-base average power and when it's required. The power measurement result is shown in Section 6.

*. The EUT transmission power was verified that it was within 2dB lower than the maximum tune-up tolerance limit when it was set the rated power. (Clause 4.1, KDB447498 D01 (v06))

Step 2: Power reference measurement

Measurement of the E-field at a fixed location above the central position of flat phantom (or/and furthermore an interpolated peak SAR location of area scan in step 2) was used as a reference value for assessing the power drop.

Step 3: Area Scan (Area scan parameters: KDB 865664 D01 (v01r04).)

The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and suitable horizontal grid spacing of EUT. Based on these data, the area of the maximum absorption was determined by splines interpolation.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 4: Zoom Scan and post-processing (Zoom scan parameters: KDB 865664 D01 (v01r04).)

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 (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.

A volume of 30 mm (X) × 30 mm (Y) × 30 mm (Z) (or more) was assessed by measuring 7×7×7 points (or more), ≤ 3GHz.

A volume of 28 mm (X) × 28 mm (Y) × 24mm (Z) (or more) was assessed by measuring 8×8×7 points (or more) (by "Ratio step" method (*1)), > 3 GHz.

When the SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are proceeded for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR. If the zoom scan measured as defined above complies with both of the following criteria. or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed.

*. The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x and y directions and recorded.

*. The ratio of the SAR at the second measured point to the SAR at the closest measured point at the x-y location of the measured maximum SAR value shall be at least 30 % and recorded.

				f ≤ 3 GHz	3 GHz < f ≤ 6 GHz
1	Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
2	Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
3		graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
4			$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5 · $\Delta z_{Zoom}(n-1)$ mm	
5	Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
	* The asterisk table-footnote is per KDB Pub. 865664 D01 v01r04. NOTE For uniformity purposes the integer frequency increments of rows 1 to 3 and 5 apply, rather than the corresponding variable and fixed parameters given in IEC 62209-1:2016 and IEC 62209-2:2010/AMD1:2019.				

Step 5: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement 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. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 2. It was checked that the power drift is within ±5% in the evaluation procedure of SAR testing. The verification of power drift during the SAR test is that DASY system calculates the power drift by measuring the e-filed at the same location at beginning and the end of the scan measurement for each test position. The result is shown in SAR plot data of APPENDIX 2.

*. DASY system calculation Power drift value[dB] =20log(Ea)/(Eb) (where, Before SAR testing: Eb[V/m] / After SAR testing: Ea[V/m])
Limit of power drift[W] = ±5%; Power drift limit (X) [dB] = 10log(P_drift)=10log(1.05/1) = 10log(1.05)-10log(1) = 0.21dB
from E-filed relations with power; S=E×H=E^2/η=P/(4×π×r^2) (η: Space impedance) → P=(E^2×4×π×r^2)/η
Therefore, The correlation of power and the E-filed
Power drift limit (X) dB=10log(P_drift) = 10log(E_drift)^2=20log(E_drift)
From the above mentioned, **the calculated power drift of DASY system must be the less than (±) 0.21dB.**

Step 6: 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.

*. The all SAR tests were conservatively performed with test separation distance 0 mm. The phantom bottom thickness is approx. 2mm. Typical distance from probe tip to dipole centers is 1mm. The distance between the SAR probe tip to the surface of test device which is touched the bottom surface of the phantom is approx. 3 mm for 2.4GHz band and 2.4 mm for 5GHz band.

*1. "Ratio step" method parameters used; the first measurement point: "1.4mm" from the phantom surface, the initial z grid separation: "1.4mm", subsequent graded grid ratio: "1.4". These parameters comply with the requirement of KDB 865664 D01and recommended by Schmid & Partner Engineering AG (DASY5 manual).

SECTION 4: Operation of EUT during testing

4.1 Operation mode for SAR testing

The EUT has Bluetooth (Low energy) and IEEE 802.11b, IEEE 802.11g, IEEE 802.11n(20HT) continuous transmitting modes. The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode	BT LE	b	g	n20
Tx band [MHz]	2402~2480	2412~2462		
Bandwidth [MHz]	2	20	20	20
Maximum power [dBm]	2.0	12.0	12.0	12.0
Modulation	FHSS	DSSS	OFDM	OFDM
Data rate [Mbps]	1	1 (*. lowest modulation)	6 (*. lowest modulation)	MCS0 (*. lowest modulation)
Frequency tested [MHz]	n/a (*1)	2412, 2437, 2462	2412, 2437, 2462	2412, 2437, 2462

	Test name	Software name	Version	Date	Storage location
Controlled software	Power measurement, SAR	R03010 Camera FW	Beta 4-SAR	2020/03/17	EUT (digital camera) memory (firmware)
		00078420.582	Script for RF TEST	2020/03/17	EUT (digital camera) memory (application)
		DEVELOP.MOD	Debug mode	2020/03/17	EUT (digital camera) memory (application)

*. n/a: SAR test was not applied, (mode) BT LE: Bluetooth Low Energy, b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT).
*1. Since it was enough lower power, SAR test for BT LE mode was exempt.

4.2 RF exposure conditions

Antenna separation distances in each test setup plan are shown as follows.

		Mode->	Wi-Fi	Bluetooth	
Setup plan	Explanation of SAR test setup plan (*. Refer to Appendix 1 for test setup photographs which had been tested.)	D [mm]	SAR Tested /Reduced	SAR Tested /Reduced	SAR type
Right-front (*. Initial setup)	A front portion of right surface on a camera is touched to the Flat phantom. The worst position was decided by moving the device holder base with 2.5 degrees in step (-5°, -2.5°, 0°, +2.5°, +5°).	2.802	Tested	*Reduced*	Body touch
Right	A right surface of camera is touched to the Flat phantom.	8.765	Tested	*Reduced*	
Front-grip	A front portion of grip of a camera is touched to the Flat phantom.	8.541	Tested	*Reduced*	
Bottom	A bottom surface of camera is touched to the Flat phantom.	16.95	Tested	*Reduced*	
Top-right	A right portion of top surface on a camera is touched to the Flat phantom.	27.861	Tested	*Reduced*	
Rear	A rear surface of camera is touched to the Flat phantom.	58.314	Tested	*Reduced*	
Left	A left surface of camera is touched to the Flat phantom.	121.102	*Reduced*	*Reduced*	
Rear	A rear of camera (Viewfinder, LCD side) is touched to the Flat phantom.	58.314	*Reduced*	*Reduced*	front-of-face

*. **D:** Antenna separation distance. It is the distance from the antenna to the outer surface of digital camera which an operator may touch.
. Size of EUT (camera): Approx. 138.5 mm (width) × 103.6 mm (height) × 80.4 mm (depth) (. The maximum dimensions which including projections.)
. Size of EUT (camera): Approx. 134.5 mm (width) × 103.5 mm (height) × 73.5 mm (depth) (. The nominal value which is not including projections.)

4.3 SAR test exclusion considerations accordance to KDB 447498 D01

The following is based on KDB447498D01;

Step 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max.power of channel, including tune-up tolerance, mW) / (min.test separation distance, mm)] × [√f(GHz)] ≤ 3.0 (for SAR(1g)), 7.5(for SAR(10g)) ····· formula (1)
If power is calculated from the upper formula (1);
[SAR(1g) test exclusion thresholds, mW] = 3 × [test separation distance, mm] / [√f(GHz)] ····· formula (2)
1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison
4. The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

When the calculated threshold value by a numerical formula above-mentioned in the following table is 3.0 or less, SAR test can be excluded.

Step 2) At 1500 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following,
[test exclusion thresholds, mW] = [(Power allowed at numeric threshold for 50mm in formula (1))] + [(test separation distance, mm) - (50mm)] × 10 ····· formula (3)
1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
2. Power and distance are rounded to the nearest mW and mm before calculation

When output power is less than the calculated threshold value by a numerical formula above-mentioned in the following table, SAR test is excluded.

[SAR exclusion calculations for step 1) antenna ≤50mm from the user, and for step 2) antenna > 50mm from the user.]

					Step 1) SAR exclusion calculations for antenna ≤50mm from the user.						Step 2) > 50mm from the user	
Band	Tx mode	Upper frequency [MHz]	Max. output power conducted		Calculated threshold value						Calculated threshold value	
			[dBm]	[mW]	Setup→	Right-front	Right	Front-grip	Bottom	Top-right	Rear	Left
					D[mm]	3 (≤ 5)	9	9	17	28	58 (≥ 50)	121 (≥ 50)
2.4GHz	BT-LE	2462	2.0	2	Judge	0.6, Reduce	< 0.6, Reduce	< 0.6, Reduce	< 0.6, Reduce	< 0.6, Reduce	≥ 96mW (@50mm), Reduce	
2.4GHz	b,g,n20	2462	12.0	16	Judge	**5.0, Measure**	2.8, Reduce	2.8, Reduce	1.5, Reduce	0.8, Reduce	≥ 96mW (@50mm), Reduce	

*. D: Antenna separation distance, Max.: Maximum, (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT).
Notes: 1. Power and distance are rounded to the nearest mW and mm before calculation.

<Conclusion for consideration for SAR test reduction>

1) For Wi-Fi operation, "Right-front (*.Initial setup)" setup which is near an antenna is applied the SAR test in body-liquid. The SAR test of "Right", "Front-grip", "Bottom", "Top-right" and "Rear" are also SAR tested to search the SAR peak location (as antenna position) even if the SAR test exclusion judge was "test can be reduced". The SAR test of other SAR setup ("Left") is reduced, because they have either more than 50 mm antenna separation distance and the SAR test exclusion judge was "test can be reduced".
2) For Bluetooth operation, the SAR test is reduced, because the SAR test exclusion judge was "test can be reduced".
3) The SAR test of "Rear" setup as front-of-face (tested by head liquid) wasn't considered, because the SAR test exclusion judge was "test can be reduced.".
4) The all SAR tests were conservatively performed with test separation distance 0mm.

By the determined test setup shown above, the SAR test was applied in the following procedures.

For Wi-Fi operation;

1) In body liquid, at the Initial setup, the higher SAR search by DSSS mode with changing the channels (lower/middle/upper frequencies of operation band).
2) (Fine adjustment) SAR position search around the Initial setup (by 2.5 degrees step) with a higher reported SAR(1g) channel in step 1) in above to verify the worst SAR setup position.
3) Add SAR test for OFDM mode to verify the worst SAR operation mode at the worst SAR setup.
4) Verify SAR on another setup.

*. During SAR test, the radiated power is always monitored by Spectrum Analyzer.

SECTION 5: Uncertainty Assessment (SAR measurement/Daily check)

*. Although this standard determines only the limit value of uncertainty, there is no applicable rule of uncertainty in this. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

Uncertainty of SAR measurement (2.4GHz~6GHz) (*.ε&σ: ≤±5%, DAK3.5, Tx: ≈100% duty cycle) (v09)	**1g SAR**	**10g SAR**
Combined measurement uncertainty of the measurement system (k=1)	**± 13.0 %**	**± 12.9 %**
Expanded uncertainty (k=2)	**± 26.0 %**	**± 25.8 %**

	Error Description (2.4-6GHz)	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g) (std. uncertainty)	ui (10g) (std. uncertainty)	Vi, veff
A	**Measurement System** (DASY5)								
1	Probe Calibration Error	±6.55 %	Normal	1	1	1	±6.55 %	±6.55 %	∞
2	Axial isotropy Error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy Error	±9.6 %	Rectangular	√3	√0.5	√0.5	±3.9 %	±3.9 %	∞
4	Linearity Error	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
5	Probe modulation response (v09)	±5.5 %	Rectangular	√3	1	1	±3.2 %	±3.2 %	∞
6	Sensitivity Error (detection limit)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	Boundary effects Error	±4.3%	Rectangular	√3	1	1	±2.5 %	±2.5 %	∞
8	Readout Electronics Error(DAE)	±0.3 %	Rectangular	√3	1	1	±0.3 %	±0.3 %	∞
9	Response Time Error	±0.8 %	Normal	1	1	1	±0.8 %	±0.8 %	∞
10	Integration Time Error (≈100% duty cycle)	±0 %	Rectangular	√3	1	1	0 %	0 %	∞
11	RF ambient conditions-noise (v09)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9 %	±1.9 %	∞
14	Probe Positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9 %	±3.9 %	∞
15	Max. SAR evaluation (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
B	**Test Sample Related**								
16	Device Holder or Positioner Tolerance (v09)	±3.2 %	Normal	1	1	1	±3.2 %	±3.2 %	5
17	Test Sample Positioning Error (v09)	±2.1 %	Normal	1	1	1	±2.1 %	±2.1 %	10
18	Power scaling	±0%	Rectangular	√3	1	1	±0 %	±0 %	∞
19	Drift of output power (measured, <0.2dB)	±2.3%	Rectangular	√3	1	1	±2.9 %	±2.9 %	∞
C	**Phantom and Setup**								
20	Phantom uncertainty (shape, thickness tolerances)	±7.5 %	Rectangular	√3	1	1	±4.3 %	±4.3 %	∞
21	Algorithm for correcting SAR (e',σ: ≤5%)	±1.2 %	Normal	1	1	0.84	±1.2 %	±0.97 %	∞
22	Measurement Liquid Conductivity Error (DAK3.5)	±3.0 %	Normal	1	0.78	0.71	±2.3 %	±2.1 %	7
23	Measurement Liquid Permittivity Error (DAK3.5)	±3.1 %	Normal	1	0.23	0.26	±0.7 %	±0.8 %	7
24	Liquid Conductivity-temp.uncertainty (≤2deg.C.)	±5.3 %	Rectangular	√3	0.78	0.71	±2.4 %	±2.2 %	∞
25	Liquid Permittivity-temp.uncertainty (≤2deg.C.)	±0.9 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	∞
	Combined Standard Uncertainty (v09)						**± 13.0** %	**± 12.9** %	945
	Expanded Uncertainty (k=2) (v09)						**± 26.0 %**	**± 25.8 %**	

*. This measurement uncertainty budget is suggested by IEEE Std.1528(2013) and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget). Per KDB 865664 D01 (v01r04) SAR Measurement 100 MHz to 6 GHz, Section 2.8.1., when the highest measured SAR(1g) within a frequency band is < 1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std.1528 (2013) is not required in SAR reports submitted for equipment approval.

Uncertainty of daily check (2.4GHz~6GHz) (*.ε&σ tolerance: ≤±5%, DAK3.5, CW) (v08)	**1g SAR**	**10g SAR**
Combined measurement uncertainty of the measurement system (k=1)	**± 11.0 %**	**± 10.9 %**
Expanded uncertainty (k=2)	**± 22.1 %**	**± 21.8 %**

	Error Description (v08)	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g) (std. uncertainty)	ui (10g) (std. uncertainty)	Vi, veff
A	**Measurement System** (DASY5)								
1	Probe Calibration Error	±6.55 %	Normal	1	1	1	±6.55 %	±6.55 %	∞
2	Axial isotropy error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy error	±9.6 %	Rectangular	√3	0	0	0 %	0 %	∞
4	Probe linearity	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
5	Probe modulation response (CW)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
6	System detection limit	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	Boundary effects	±4.8 %	Rectangular	√3	1	1	±2.8 %	±2.8 %	∞
8	System readout electronics (DAE)	±0.3 %	Normal	1	1	1	±0.3 %	±0.3 %	∞
9	Response Time Error (<5ms/100ms wait)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
10	Integration Time Error (CW)	±0.0 %	Rectangular	√3	1	1	0 %	0 %	∞
11	RF ambient conditions-noise	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9 %	±1.9 %	∞
14	Probe positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9 %	±3.9 %	∞
15	Max. SAR evaluation (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
B	**Test Sample Related**								
16	Deviation of the experimental source	±3.5 %	Normal	1	1	1	±3.5 %	±3.5 %	∞
17	Dipole to liquid distance (10mm±0.2mm,<2deg.)	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2 %	∞
18	Drift of output power (measured, <0.2dB)	±2.3 %	Rectangular	√3	1	1	±1.3 %	±1.3 %	∞
C	**Phantom and Setup**								
19	Phantom uncertainty	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2%	∞
20	Algorithm for correcting SAR (e',σ: ≤5%)	±1.2 %	Normal	1	1	0.84	±1.2 %	±0.97 %	∞
21	Liquid conductivity (meas.) (DAK3.5)	±3.0 %	Normal	1	0.78	0.71	±2.3 %	±2.1 %	∞
22	Liquid permittivity (meas.) (DAK3.5)	±3.1 %	Normal	1	0.23	0.26	±0.7 %	±0.8 %	∞
23	Liquid Conductivity-temp.uncertainty (≤2deg.C.)	±5.3 %	Rectangular	√3	0.78	0.71	±2.4 %	±2.2 %	∞
24	Liquid Permittivity-temp.uncertainty (≤2deg.C.)	±0.9 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	∞
	Combined Standard Uncertainty						**±11.0** %	**±10.9** %	
	Expanded Uncertainty (k=2)						**±22.1** %	**±21.8** %	

*. This measurement uncertainty budget is suggested by IEEE Std. 1528(2013) and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget).

*. Table of uncertainties are listed for ISO/IEC 17025.

SECTION 6: Confirmation before testing

6.1 SAR reference power measurement (*. Antenna terminal conducted average power)

*. Antenna gain (peak): 2.23 dBi (2.4GHz band)

Mode	Frequency		Data rate	Power Setting (software)	Duty cycle	Duty factor	Duty scaled factor	Measurement Result				Power correction				Power tuning applied?	Remarks
								Burst power		Time average power		Power		Δ from max.	Tune-up factor		
												Typical	Max.				
	[MHz]	CH	[Mbps]	[-]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]	[dB]	[-]		
BT LE	2402	0	1	-	-	-	-	-	-	-	-	1.0	2.0	-	-	-	Since BT LE was enough lower power, SAR test was "exempt".
	2440	19		-	-	-	-	-	-	-	-	1.0	2.0	-	-	-	
	2480	39		-	-	-	-	-	-	-	-	1.0	2.0	-	-	-	
11b	2412	1	1	11.0	99.0	0.04	1.01	**10.85**	12.16	10.81	12.05	10.0	12.0	-1.15	1.30	tuned (*1)	-
	2437	6	1	11.0	99.0	0.04	1.01	**10.90**	12.30	10.86	12.19	10.0	12.0	-1.10	1.29	tuned (*1)	-
	2462	11	1	11.0	99.0	0.04	1.01	**10.96**	12.47	10.92	12.36	10.0	12.0	-1.04	1.27	tuned (*1)	-
11g	2412	1	6	10.5	93.9	0.27	1.06	**10.86**	12.19	10.59	11.46	10.0	12.0	-1.14	1.30	tuned (*1)	-
	2437	6	6	10.5	93.9	0.27	1.06	**11.49**	14.09	11.22	13.24	10.0	12.0	-0.51	1.12	tuned (*1)	-
	2462	11	6	10.5	93.9	0.27	1.06	**10.75**	11.89	10.48	11.17	10.0	12.0	-1.25	1.33	tuned (*1)	-
11n (20HT)	2412	1	MCS0	10.5	93.5	0.29	1.07	**10.56**	11.38	10.27	10.64	10.0	12.0	-1.44	1.39	tuned (*1)	-
	2437	6	MCS0	10.5	93.5	0.29	1.07	**11.04**	12.71	10.75	11.89	10.0	12.0	-0.96	1.25	tuned (*1)	-
	2462	11	MCS0	10.5	93.5	0.29	1.07	**10.31**	10.74	10.02	10.05	10.0	12.0	-1.69	1.48	tuned (*1)	-

*. ☐: SAR test was applied.

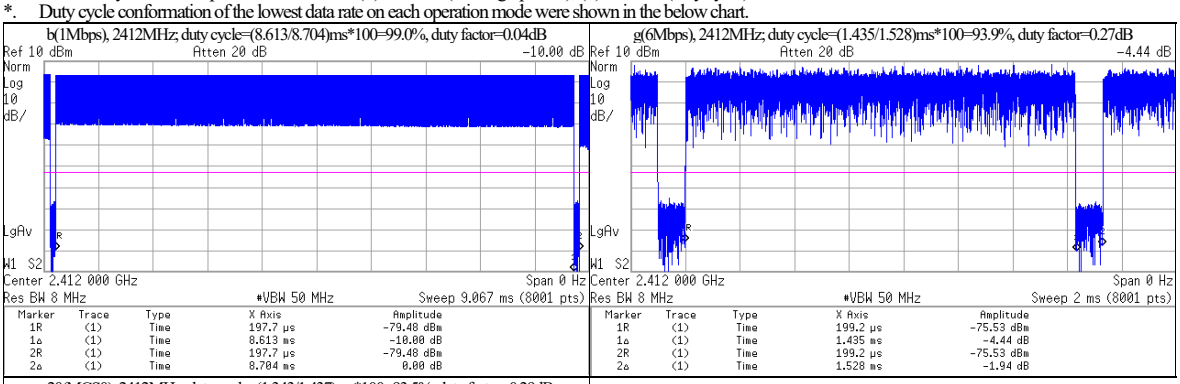
*. CH: channel, Max: Maximum, n/a: not applicable, (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT).

***1. The SAR test power was adjusted to not more than 2dB lower than maximum tune-up power (KDB 447498 D01 (v06) requirement).**

*. Calculating formula: Result-Time average power (dBm) = (P/M Reading, dBm)+(Cable loss, dB)+(Attenuator, dB)
Result-Burst power (dBm) (*.equal to 100% duty cycle) = (P/M Reading, dBm)+(Cable loss, dB)+(Attenuator, dB)+(duty factor, dB)
Duty cycle: (duty cycle, %) = (Tx on time, ms) / (1 cycle time, ms) × 100, where Duty factor (dBm) = 10 × log (100/(duty cycle, %))
Duty cycle scaled factor: Duty cycle correction factor for obtained SAR value, Duty scaled factor [-] = 100(%) / (duty cycle, %)
Δ form max. (dB) = (Results-Burst power (average, dBm)) - (Max.-specification output power (average, dBm))
Tune-up factor (Power tune-up factor for obtained SAR value) (unit: (-)) = 1 / (10 ^ ("Deviation from max., dB" / 10))

*. Date measured: April 13, 2020 / Measured by: H. Naka/ Place: Preparation room of No. 7 shield room. (23 deg.C./ (40~45) %RH)
Uncertainty of antenna port conducted test; (±) 1.06 dB (Average power), (±) 0.262 % (duty cycle).

*. Duty cycle conformation of the lowest data rate on each operation mode were shown in the below chart.



SECTION 7: SAR Measurement results

7.1 SAR Measurement results

[Liquid measurement]

Frequency [MHz] (Channel)	Liquid type	Liquid parameters (*a)								Temp. [deg.C.]	Depth [mm]	ΔSAR Coefficients(*b)		Date measured
		Permittivity (εr) [-]				Conductivity [S/m]						ΔSAR	Correction required?	
		Target	Measured		Limit	Target	Measured		Limit			1g [%]		
			Meas.	Δεr [%]			Meas.	Δσ [%]						
2412 (1)	Body	*52.75*	50.97	-3.4	±5	*1.914*	1.914	+0.1	±5	23.0	149	+0.78	not required.	May 8, 2020, before SAR test
2437 (6)		*52.72*	50.88	-3.5		*1.938*	1.946	+0.5				+1.00	not required.	
2462 (11)		*52.68*	50.78	-3.6		*1.967*	1.980	+0.7				+1.13	not required.	

[SAR measurement results]

SAR measurement results										Reported SAR (1g) [W/kg]					Remarks
Test setup						SAR (1g) [W/kg]			SAR plot # in Appendix 2-2	Duty cycle correction		Output burst average power correction			SAR Corrected (*d)	
Position	Gap [mm]	Source power	Mode	Frequency [MHz] (Channel)	Data rate [Mbps] or [Index]	Max.value of multi-peak										
						Meas.	ΔSAR [%]	ΔSAR corrected		Duty [%]	Duty scaled	Meas. [dBm].	Max. [dBm]	Tune-up factor		
Right-front (0°) (*. Initial setup)	0	ac adaptor	b	2462(11)	1	**1.11**	positive	n/a (*c)	Plot 1-2	99.0	1.01	10.96	12.0	1.27	**1.424**	-
	0	ac adaptor	b	2437(6)	1	**1.14**	positive	n/a (*c)	Plot 1-1	99.0	1.01	10.90	12.0	1.29	**1.485**	*.Higher
	0	Battery	b	2437(6)	1	**1.13**	positive	n/a (*c)	Plot 1-3	99.0	1.01	10.90	12.0	1.29	**1.472**	-
	0	ac adaptor	b	2412(1)	1	**0.979**	positive	n/a (*c)	Plot 1-4	99.0	1.01	10.85	12.0	1.30	**1.285**	-
	0	ac adaptor	g	2437(6)	6	**1.22**	positive	n/a (*c)	Plot 1-5	93.9	1.06	11.49	12.0	1.12	**1.448**	-
	0	ac adaptor	g	2412(1)	6	**0.974**	positive	n/a (*c)	Plot 1-6	93.9	1.06	10.86	12.0	1.30	**1.342**	-
	0	ac adaptor	g	2462(11)	6	**1.01**	positive	n/a (*c)	Plot 1-7	93.9	1.06	10.75	12.0	1.33	**1.424**	-
	0	ac adaptor	n20	2437(6)	MCS0	**1.05**	positive	n/a (*c)	Plot 1-8	93.5	1.07	11.04	12.0	1.25	**1.404**	-
	0	ac adaptor	n20	2412(1)	MCS0	**0.858**	positive	n/a (*c)	Plot 1-9	93.5	1.07	10.56	12.0	1.39	**1.276**	-
	0	ac adaptor	n20	2462(11)	MCS0	**0.891**	positive	n/a (*c)	Plot 1-10	93.5	1.07	10.31	12.0	1.48	**1.411**	-
Right-front (-2.5°)	0	ac adaptor	b	2437(6)	1	**1.08**	positive	n/a (*c)	Plot 1-11	99.0	1.01	10.90	12.0	1.29	**1.407**	-
Right-front (-5°)	0	ac adaptor	b	2437(6)	1	**1.06**	positive	n/a (*c)	Plot 1-12	99.0	1.01	10.90	12.0	1.29	**1.381**	-
Right-front (+2.5°)	0	ac adaptor	b	2437(6)	1	**1.09**	positive	n/a (*c)	Plot 1-13	99.0	1.01	10.90	12.0	1.29	**1.420**	-
Right-front (+5°)	0	ac adaptor	b	2437(6)	1	**1.04**	positive	n/a (*c)	Plot 1-14	99.0	1.01	10.90	12.0	1.29	**1.355**	-
Right	0	ac adaptor	b	2462(11)	1	**0.793**	positive	n/a (*c)	Plot 1-15	99.0	1.01	10.96	12.0	1.27	**1.017**	-
	0	ac adaptor	b	2437(6)	1	**0.885**	positive	n/a (*c)	Plot 1-16	99.0	1.01	10.90	12.0	1.29	**1.153**	-
	0	ac adaptor	b	2412(1)	1	**0.804**	positive	n/a (*c)	Plot 1-17	99.0	1.01	10.85	12.0	1.30	**1.056**	-
Front-grip	0	ac adaptor	b	2462(11)	1	**0.215**	positive	n/a (*c)	Plot 1-18	99.0	1.01	10.96	12.0	1.27	**0.276**	-
Bottom	0	ac adaptor	b	2462(11)	1	**0.062**	positive	n/a (*c)	Plot 1-19	99.0	1.01	10.96	12.0	1.27	**0.080**	-
Top-right	0	ac adaptor	b	2462(11)	1	**0.017**	positive	n/a (*c)	Plot 1-20	99.0	1.01	10.96	12.0	1.27	**0.022**	-
Rear	0	ac adaptor	b	2462(11)	1	**n/a**	positive	n/a (*c)	Plot 1-21	*. Zoom scan was not performed, because the measured interpolated maximum SAR value of area scan was very small.-						

Notes: *. (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); Max.: maximum.; Meas.: Measured.; n/a: not applied; Gap: It is the separation distance between the nearest position of camera outer surface and the bottom outer surface of phantom; During SAR test, the EUT had a battery in a camera body and was operated by either an AC adaptor (*. marked as "ac adaptor") or full charged battery (*. marked as "Battery").

*. Calibration frequency of the SAR measurement probe (and used conversion factors)
The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
2412, 2437, 2462 MHz	2450MHz	within ±50MHz of calibration frequency	7.78	±12.0%

*a. The target value is a parameter defined in Appendix A of KDB865664 D01 (v01r04), the dielectric parameters suggested for head and body tissue simulating liquid are given at (2000, 2450 and 3000) MHz Parameters for the frequencies (2000~2450) MHz and (2450~3000) MHz were obtained using linear interpolation.
[Calculating formula:]

*b. $\Delta SAR(1g) = C\varepsilon r \times \Delta\varepsilon r + C\sigma \times \Delta\sigma$, $C\varepsilon r = -7.854E\text{-}4 \times f^3 + 9.402E\text{-}3 \times f^2 - 2.742E\text{-}2 \times f + 0.2026$ / $C\sigma = 9.804E\text{-}3 \times f^3 - 8.661E\text{-}2 \times f^2 + 2.981E\text{-}2 \times f + 0.7829$
ΔSAR corrected SAR (1g) (W/kg) = (Meas. SAR(1g) (W/kg)) × (100 - (ΔSAR(%)) / 100

*c. Since ΔSAR of measured liquid parameters were shown the positive sign, the calculation of ΔSAR corrected SAR (1g) was not required.

*d. Reported SAR (1g) (@100% duty cycle) (W/kg) = (Measured SAR (1g) (W/kg)) × (Duty scaled) × (Tune-up factor)
Duty scaled = Duty scaled factor: Duty cycle correction factor for obtained SAR value, Duty scaled factor [-] = 100(%) / (duty cycle, %) and "*1" in above.
Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor [-] = 1 / (10 ^ ("Δmax (meas.power - max.power), dB" / 10))

(Clause 5, SAR TEST PROCEDURES, in KDB248227 D01 (v02r02))

5.1.1 Initial Test Position SAR Test Reduction Procedure

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. The initial test position procedure is described in the following:

c) 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 ≤ 1.2 W/kg or all required channels are tested. Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

5.2.1 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

b) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. **When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.**

7.2 SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 (v01r04) SAR measurement 100 MHz to 6 GHz. 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 test device 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 second 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 third 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.

Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup position	Measured SAR (1g) [W/kg]		Reported SAR (1g) [W/kg]		Largest to Smallest SAR Ratio	SAR plot # in Appendix 2-2	Remarks
				Original	Repeated	Original	Repeated			
b	2437 (6)	1	**Right-front** (0°)	**1.14**	**1.13**	**1.485**	**1.472**	**1.009**	Original: Plot 1-1 Repeated: Plot 2-1	*. 2nd repeated measurement is required since the original and repeated reported SAR 1g were higher than 1.45 W/kg (less 10% from the SAR 1g limit of 1.6 W/kg.)
b	2437 (6)	1	**Right-front** (0°)	**1.14**	**1.10**	**1.485**	**1.433**	**1.036**	Original: Plot 1-1 Repeated: Plot 2-2	*. 3rd repeated measurement is not required since the original, 1st and 2nd repeated reported SAR 1g were lower than 1.5 W/kg.

*. Calculating formula: Largest to Smallest SAR Ratio = (Highest reported SAR1g value) / (Smaller reported SAR 1g value)

7.3 Device holder perturbation verification

When the highest reported SAR of an antenna is > 1.2 W/kg, holder perturbation verification is required for each antenna, using the highest SAR configuration among all applicable frequency bands.

[Device holder perturbation verification; Measured and Reported (Scaled) SAR results]

SAR measurement results									Reported SAR (1g) [W/kg]						
Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup		SAR (1g) [W/kg]			SAR plot # in Appendix 2-2	Duty cycle correction		Output average power correction			SAR Corrected (Scaled) (*d)	Remarks
			Position	Gap [mm]	Max. value of multi-peak				Duty [%]	Duty scaled	Meas. [dBm].	Max. [dBm]	Tune-up factor		
					Meas.	ΔSAR [%]	ΔSAR corrected								
With device holder															
b	2437(6)	1	**Right-front** (0°)	0	**1.14**	positive	n/a (*c)	Plot 1-1	99.0	1.01	10.90	12.0	1.29	**1.485**	*. Higher
No device holder															
b	2437(6)	1	**Right-front** (0°)	0	**1.12**	positive	n/a (*c)	Plot 3-1	99.0	1.01	10.90	12.0	1.29	**1.459**	-

[Device holder perturbation verification]

Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup		Reported SAR (1g) [W/kg]		Device holder perturbation SAR Ratio	Remarks
			Position	Gap [mm]	Device holder			
					Exist	None		
b	2437(6)	1	**Right-front** (0°)	**0**	**1.485**	**1.459**	**- 1.8 %**	*.It was smaller than 2.1 % of uncertainty of the setup, so influence of a device holder was judged to be no problem.

*. Calculating formula: Device holder perturbation SAR Ratio (%) = {{((Reported SAR-none (W/kg)) / Reported SAR-exist (W/kg))} - 1}*100