SAR TEST REPORT

Test Report No.: 13024973S-A-R3

Applicant : Canon Inc.
Type of Equipment : Wireless LAN/Bluetooth Combo Module
Model No. : ES204 (*. Installed into the platform (1))
FCC ID : AZD241
Test Standard : FCC 47CFR §2.1093
Test Result : Complied (Refer to Section 3.5)

Highest Reported SAR(1g) [W/kg]				Platform			Remarks (DTS band)				Remarks (UNII band)				Reference report number
DTS band	U-NII band	SAR type	SAR Limit	No.	Type	Model	Frequency [MHz]	Mode	Output power (average) [dBm]		Frequency [MHz]	Mode	Output power (average) [dBm]		
									Measured	Max.			Measured	Max	
0.25	0.42	Body-worn	1.6	1	Digital Camera	DS126836	2462	b	8.36	10.0	5180	a	8.79	10.0	This report.

*. **Highest reported SAR (1g) across all exposure conditions for body-touch is "0.25 W/kg (DTS)" and "0.42 W/kg (U-NII)".**
*. **Highest reported SAR (1g) values for simultaneous transmission (Bluetooth + Wi-Fi (5GHz band)) is "0.50 W/kg (< 1.6 W/kg)".**
*. Since highest reported SAR (1g) on all platforms of model: ES204 (EUT) which obtained in accordance with KDB447498 (v06) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform (which was tested in above.).
*. Max.:Maximum, (Mode) b: IEEE 802.11b, a: IEEE 802.11a.

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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
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 (-R3) is a revised version of 13024973S-A-R2. 13024973S-A, 13024973S-A-R1, 13024973S-A-R2 reports are replaced with this report.

Date of test: November 11, 12 and 19, 2019

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	13006525S-A	December 10, 2019	-	-
-R1	13006525S-A-R1	December 18, 2019	-	(p2, REVISION HISTORY, Corrected issue date) was: December xx, 2019->R1: December 10, 2019
-R2	13024973S-A-R2	March 30, 2020	P1, 2, 4	p1&2; add revised (-R2) information, p4; (clause 2.1) "Rating" was changed. (was: DC 9.0 V -> R2: DC 9.0 V/5.0 V) p4; (clause 2.2) Add comment: "*1. The frequency band of U-NII-2C is (5500~5700) MHz. The EUT is not supported the frequency band of (5600~5650) MHz on this platform by the firmware."
-R3	13024973S-A-R3	April 2, 2020	P1, 2, 7	p1&2; add revised (-R2) information, p7; (clause 3.5) Corrected a mistake (asterisk number). (was: 0.417 (*2) -> R3: 0.417 (*1))

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

Reference: Abbreviations (Including words undescribed in this report) (radio_r0v02_191128)

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
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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Contents of appendixes

SECTION 1: Customer information

Company Name	Canon Inc.
Address	30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo 146-8501 Japan
Telephone Number	+81-3-5482-7283
Contact Person	Tomohiro Suzuki

The information provided from the customer is as follows;
- Applicant, Type of Equipment, Model No., FCC ID on the cover and other 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 and platform

	EUT	Platform
Type of Equipment	Wireless LAN/Bluetooth Combo Module	Digital Camera
Model Number	ES204	DS126836
Serial Number	DE1-C-012	3
Condition of EUT	Engineering prototype	Engineering prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	July 29, 2019 (*. Sample for power measurement.) *. No modification by the test Lab. October 23, 2019 (*. Sample for SAR test.) *. No modification by the test Lab. *. After power measurement, the EUT was returned to a customer to install into a platform.	
Rating	DC3.3V	DC 9.0 V/ 5.0 V
	*. The EUT is installed into the specified the platform that was operated by the re-chargeable Li-ion battery.	
Country of Mass-production	Japan	Japan
Category Identified	Portable device (*. Since EUT may contact and/or very close to a human body during Wi-Fi or Bluetooth operation, the partial-body SAR (1g) shall be observed.)	
Feature of EUT	Model: ES204 (referred to as the EUT in this report) is a Wireless LAN/Bluetooth Combo Module which installs into the specified platform.	
SAR Accessory	None	

2.2 Product Description (Model: ES204, Wireless LAN/Bluetooth Combo Module)

Equipment type		Transceiver
Frequency of operation	Bluetooth	2.4GHz band: (2402~2480) MHz (BDR (Basic Data Rate), EDR (Enhanced Data Rate), LE (Low Energy mode-PHY1&PHY2))
	Wi-Fi	2.4GHz band: (2412~2462) MHz (b, g, n20) / (2422~2452) MHz (n40); U-NII-1: (5180~5240) MHz (a, n20, ac20) / (5190, 5230) MHz (n40, ac40) / 5210 MHz (ac80); U-NII-2A: (5260~5320) MHz (a, n20, ac20) / (5270, 5310) MHz (n40, ac40) / 5290 MHz (ac80); U-NII-2C (*1): (5500~5580, 5660~5700) MHz (a, n20, ac20) / (5510, 5550, 5670) MHz (n40), ac40) / 5530 MHz (ac80); U-NII-3: (5745~5825) MHz (a, n20, ac20) / (5755, 5795) MHz (n40, ac40) / 5775 MHz (ac80);
Channel spacing	Bluetooth	1MHz (BDR, EDR), 2MHz (LE)
	Wi-Fi	5 MHz (2.4GHz band), 20 MHz (U-NII-1, U-NII- 2A, U-NII-2C, U-NII-3)
Bandwidth	Bluetooth	79MHz
	Wi-Fi	20 MHz (b, g, a, n20, ac20), 40 MHz (n40, ac40), 80 MHz (ac80)
Type of modulation	Bluetooth	FHSS: GFSK (*. EDR: GFSK+ π/4-DQPSK, GFSK+ 8DPSK)
	Wi-Fi	DSSS: DBPSK, DQPSK, CCK (b); OFDM: BPSK, QPSK, 16QAM, 64QAM, 256QAM (*.256QAM is only for ac80) (g, a, n20, ac20, n40, ac40, ac80)
Power rating		DC 3.3V
Typical and maximum transmit power		*. The specification of typical and maximum tune-up tolerance limit power (which may occur) refer to remarks in below table. *. The measured output power (conducted) as SAR reference power refers to section 6 in this report.

Quantity of Antenna	1 piece	Antenna type	Printed PCB	Antenna connector type	Antenna side: Not applicable (soldered) Module side: MHF4
Antenna gain (peak)	2.98 dBi (2.4GHz band), 4.94 dBi (5GHz band) (*.including cable loss)				

*1. The frequency band of U-NII-2C is (5500~5700) MHz. The EUT is not supported the frequency band of (5600~5650) MHz on this platform by the firmware.

[Typical and maximum transmit power]

Mode	Data rate	Output power (Typical and maximum) [dBm] (*. The measured output power (conducted) refers to section 6 in this report.)														
		2.4GHz			U-NII-1			U-NII-2A			U-NII-2C			U-NII-3		
		F [MHz]	Typical	Max.	F [MHz]	Typical	Max.	F [MHz]	Typical	Max.	F [MHz]	Typical	Max.	F [MHz]	Typical	Max.
BT-BDR	1Mbps	2402 ~2480	3.0	**6.0**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BT-EDR	(2~3)Mbps	2402 ~2480	0	**3.0**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BT-LE	1Mbps (PHY1) 2Mbps (PHY2)	2402 ~2480	3.0	**6.0**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
b	1~11Mbps	2412 ~2462	8.0	**10.0**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
g	6~54Mbps	2412 ~2462	8.0	**10.0**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
a	6~54Mbps	N/A	N/A	N/A	5180 ~5240	8.0	**10.0**	5260 ~5320	8.0	**10.0**	5500~5580, 5660~5700	8.0	**10.0**	5745 ~5825	8.0	**10.0**
n20	MCS0~7	2412 ~2462	7.0	**9.0**	5180 ~5240	7.0	**9.0**	5260 ~5320	7.0	**9.0**	5500~5580, 5660~5700	7.0	**9.0**	5745 ~5825	7.0	**9.0**
ac20	MCS0~8	N/A	N/A	N/A	5180 ~5240	7.0	**9.0**	5260 ~5320	7.0	**9.0**	5500~5580, 5660~5700	7.0	**9.0**	5745 ~5825	7.0	**9.0**
n40	MCS0~7	2422 ~2452	7.0	**9.0**	5190, 5230	7.0	**9.0**	5270, 5310	7.0	**9.0**	5510, 5550, 5670	7.0	**9.0**	5755, 5795	7.0	**9.0**
ac40	MCS0~9	N/A	N/A	N/A	5190, 5230	7.0	**9.0**	5270, 5310	7.0	**9.0**	5510, 5550, 5670	7.0	**9.0**	5755, 5795	7.0	**9.0**
ac80	MCS0~9	N/A	N/A	N/A	5210	7.0	**9.0**	5290	7.0	**9.0**	5530	7.0	**9.0**	5775	7.0	**9.0**

*. F: Frequency; Max.: maximum; N/A: Not applicable; (mode) b: IEEE 802.11b, g: IEEE 802.11g, a: IEEE 802.11a, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT), ac20: IEEE 802.11ac(20VHT), ac40: IEEE 802.11n(40VHT), ac80: IEEE 802.11ac(80VHT)
*. The EUT do not use the special transmitting technique such as "beam-forming" and "time-space code diversity."
*. Maximum tune-up tolerance limit is conducted burst average power and is defined by a customer as Duty cycle 100% (continuous transmitting).
*. Wi-Fi and Bluetooth use same single antenna. Therefore, simultaneously transmitted SAR was not considered for the Wi-Fi of 2.4GHz band and Bluetooth (2.4GHz). Simultaneously transmitted SAR was only considered for the Wi-Fi of 5GHz band and Bluetooth (2.4GHz).

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 (Partial-Body)

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		
Category	FCC 47CFR §2.1093 (Portable device)	SAR type	Partial-Body

Band	2.4GHz Band		5 GHz band Wi-Fi				Simultaneous Tx.
	Bluetooth	Wi-Fi (DTS)	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3	
Operation frequency [MHz]	2402~2480	2412~2472	5180~5240	5260~5320	5500~5700	5745~5825	
Results	Complied	Complied	Complied	Complied	Complied	Complied	Complied
Reference section of test results	Section 7.2	Section 7.3	Section 7.3	Section 7.3	Section 7.3	Section 7.3	Section 7.4
SAR (1g) limit [W/kg]	1.6 W/kg	1.6 W/kg	1.6 W/kg	1.6 W/kg	1.6 W/kg	1.6 W/kg	1.6 W/kg
Reported SAR (1g) [W/kg]	0.079	0.245	0.417 (*1)	0.330	0.321	0.254	< 1.6 (0.50)
Measured SAR (1g) [W/kg]	0.045	0.168	0.316	0.243	0.274	0.184	-
Mode (Data rate)	BT-LE (1Mbps)	b (1Mbps)	a (6Mbps)	a (6Mbps)	a (6Mbps)	a (6Mbps)	*. Simultaneous transmission of Bluetooth and 5GHz Wi-Fi.
Frequency [MHz]	2402	2462	5180	5260	5580	5795	
Burst average power [dBm]	5.46	8.36	8.79	8.68	9.33	8.60	
Tune-up limit [dBm]	6.0	10.0	10.0	10.0	10.0	10.0	
Tune-up factor [-]	1.13	1.46	1.32	1.36	1.17	1.38	
Duty cycle [%]	64.0	100	100	100	100	100	
Duty scaled factor [-]	1.56	1.00	1.00	1.00	1.00	1.00	

Note:

*1. SAR test was also applied to U-NII-1 band, even though the reported SAR 1g of U-NII-2A was enough lower than 1.2 W/kg.

*. UL Japan's SAR Work Procedures No.13-EM-W0429 and 13-EM-W0430. No addition, deviation nor exclusion has been made from standards

*. "yellow marker" in the table; The highest reported SAR(1g) of each operation band (DTS, U-NII) is shaded with yellow marker.

*. Since Bluetooth, Wii-Fi of 2.4GHz and Wi-Fi of 5GHz are used a same antenna, Bluetooth and Wi-Fi, DTS band and UNII band do not transmit simultaneously.

*. (mode) BT-LE: Bluetooth Low Energy; a: IEEE 802.11a, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT), ac80: IEEE 802.11ac(80VHT).

*. (Calculating formula) Corrected SAR to max.power (Reported SAR) (W/kg) = (Measured SAR (W/kg)) × (Duty scaled factor) × (Tune-up factor) where; Tune-up factor [-] = 1 / (10 ^ ("Δmax (max.power - burst average power), dB" / 10)), Duty scaled factor [-] = 100(%) / (duty cycle, %)

Test outline: Where the EUT is built into a new platform (1), it was verified whether multi-platform conditions can be suited in according with section 2) of 5.2.2 in KDB447498 D01 (v06).

Consideration of the test results:	**The highest reported SAR (1g) of this new platform (1) was kept; ≤ 0.8 W/kg.** **Since highest reported SAR (1g) on this EUT's platform obtained in accordance with KDB447498 D01 (v06) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform.**

3.6 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.

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

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 5: 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 Operating modes for SAR testing

The EUT has Bluetooth (BDR, EDR, Low energy) and IEEE 802.11b, g, a, n(20HT), n(40HT), ac(20VHT), ac(40VHT) and ac(80VHT) continuous transmitting modes. The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode	BDR	EDR	LE		b	g	n20	n40	a	n20	ac20	n40	ac40	ac80	a	n20	ac20	n40	ac40	ac80
band	Bluetooth				2.4GHz band				U-NII-1						U-NII-2A					
Tx band [MHz]	2402~2480				2412~2462			2422~2452	5180~5240			5190, 5230		5210	5260~5320			5270, 5310		5290
Bandwidth [MHz]	1	1	1		20	20	20	40	20	20	20	40	40	80	20	20	20	40	40	80
Max.power [dBm]	6	3	6		10	10	9	9	10	9	9	9	9	9	10	9	9	9	9	9
Modulation	FHSS	FHSS	FHSS		DSSS	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM
D/R [Mbps]	1	2~3	1	2	1	6	MCS0	MCS0	6	MCS0	MCS0	MCS0	MCS0	MCS0	6	MCS0	MCS0	MCS0	MCS0	MCS0
Frequency tested [MHz]	2402	n/a (*1)	2402	n/a (*1)	2412, 2437, 2462	n/a (*2)	n/a (*2)	n/a (*2)	5180, 5220, 5240 (*3)	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	5260, 5300, 5320	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)

Operation mode	a	n20	ac20	n40	ac40	ac80	a	n20	ac20	n40	ac40	ac80
band	U-NII-2C						U-NII-3					
Tx band [MHz]	5500~5580, 5660~5700			5510,5550,5670		5530	5745~5825			5755, 5795		5775
Bandwidth [MHz]	20	20	20	40	40	80	20	20	20	40	40	80
Max.power [dBm]	10	9	9	9	9	9	10	9	9	9	9	9
Modulation	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM	OFDM
D/R [Mbps]	6	MCS0	MCS0	MCS0	MCS0	MCS0	6	MCS0	MCS0	MCS0	MCS0	MCS0
Frequency tested [MHz]	5500, 5580, 5700	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	5745, 5785, 5825	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)	n/a (*4)

Controlled software	Power measurement and SAR test	Wi-Fi BT Tool (Version 1.0) (*. operated by Tera-Term)

*. D/R: Data rate, n/a: SAR test was not applied.
*. BLE: Bluetooth Low Energy; BDR: Basic Data Rate; EDR: Enhanced Data Rate; b: IEEE 802.11b, g: IEEE 802.11g, a: IEEE 802.11a, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT), ac20: IEEE 802.11ac(20VHT), ac40: IEEE 802.11n(40VHT), ac80: IEEE 802.11ac(80VHT)
*1. SAR test was applied to a maximum output power channel of BDR and BT-LE(PHY1) mode for the reference purpose.
*2. Since reported SAR 1g of DSSS mode which had highest output power was enough small (< 0.8 W/kg), SAR test was only applied DSSS mode.
*3. SAR test of U-NII-1 band was also applied for the reference purpose, even though the reported SAR(1g) of U-NII-2A band was enough lower than 1.2 W/kg.
*4. Since the maximum output power was lower than 11a mode, the SAR test was reduced.

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**	**D [mm]**	**SAR Tested /Reduced**	**SAR type**
Front-top-edge	An edge of front-upper portion on a camera is touched to the Flat phantom. (*Initial setup)	**2.1**	**Tested**	**2.1**	*Reduced*	Body touch
Front-upper	A front-upper portion on a camera is touched to the Flat phantom.	**≈2.1**	**Tested**	**≈2.1**	**Tested**	
Top-front	A front portion of top on a camera is touched to the Flat phantom.	**≈7**	**Tested**	**≈30**	*Reduced*	
Front	A front of camera (right-grip and lens section) is touched to the Flat phantom.	**≈9**	**Tested**	**≈9**	*Reduced*	
Rear	A rear of camera (View-finder, LCD side) is touched to the Flat phantom.	**≈42**	**Tested**	**≈42**	*Reduced*	
Left	A left surface of camera is touched to the Flat phantom.	**≈42**	*Reduced*	**≈42**	*Reduced*	
Right	A right surface of camera is touched to the Flat phantom.	**≈76**	*Reduced*	**≈76**	*Reduced*	
Bottom	A bottom surface of camera is touched to the Flat phantom.	**≈85**	*Reduced*	**≈85**	*Reduced*	
Rear	A rear of camera (View-finder, LCD side) is touched to the Flat phantom.	**≈42**	*Reduced*	**≈42**	*Reduced*	Front of face

*. D: Antenna separation distance. It is the distance from the antenna to the outer surface of platform which an operator may touch.
*. Size of platform (camera): 138.5 mm (width) × 97.4 mm (height) × 71.45 mm (depth)
*. Refer to Appendix 1 for the antenna location and the test setup photographs which had been tested.

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						
					Setup	Front-top-edge, Front-upper	Top-front	Front	Rear	Left	Right, Bottom
			[dBm]	[mW]	D [mm]	≤ 5 (≈2.1)	≈7	≈9	≈42	≈42	> 50
2.4GHz	BT-LE	2480	6.0	**4**	Judge	1.9, Reduce	Reduce	Reduce	Reduce	Reduce	≥ 95mW (50mm), Reduce
	b,g	2462	10.0	**10**	Judge	**3.1, Measure**	2.2, Reduce	1.7, Reduce	0.4, Reduce	0.4, Reduce	≥ 96mW (50mm), Reduce
U-NII-1	a	5240	10.0	**10**	Judge	**4.6, Measure**	**3.3, Measure**	2.5, Reduce	0.5, Reduce	0.5, Reduce	≥ 66mW (50mm), Reduce
U-NII-2A	a	5320	10.0	**10**	Judge	**4.6, Measure**	**3.3, Measure**	2.6, Reduce	0.5, Reduce	0.5, Reduce	≥ 65mW (50mm), Reduce
U-NII-2C	a	5700	10.0	**10**	Judge	**4.8., Measure**	**3.4, Measure**	2.7, Reduce	0.4, Reduce	0.4, Reduce	≥ 63mW (50mm), Reduce
U-NII-3	a	5825	10.0	**10**	Judge	**4.8, Measure**	**3.4, Measure**	2.7, Reduce	0.4, Reduce	0.4, Reduce	≥ 62mW (50mm), Reduce

*. D: Antenna separation distance, b: IEEE 802.11b, g: IEEE 802.11g, a: IEEE 802.11a.
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, "Front-top-edge (*. Initial setup)", "Front-upper" and "Top-front" setup which are near an antenna is applied the SAR test in body-liquid. The SAR test of "Front" and "Rear" setup are tested to search the SAR peak location even if the SAR test exclusion judge was "test can be reduced". The SAR test of "Left", "Right" and "Bottom" are reduced, because there have enough antenna separation distance and the SAR test exclusion judge was "test can be reduced".
2) For Bluetooth operation, the SAR test was only applied to the worst SAR setup of Wi-Fi operation even if the SAR test exclusion judge was "test can be reduced".
3) The SAR test of 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.

Step 1	On 2.4GHz band, in body liquid, worst SAR search by DSSS mode with a highest measurement output power channel. Add SAR test for OFDM mode at the worst SAR condition of DSSS mode, if it is required. Add SAR test for Bluetooth mode at the worst SAR condition of Wi-Fi mode.
Step 2 ~Step 4	On U-NII-2A, band, in body liquid, worst SAR search by largest channel bandwidth mode with a highest measurement output power channel. Add test for another bandwidth mode, if it is required. Repeat same test procedure in above for U-NII-2C band (step 3) and U-NII-3 band (step 4).

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

Uncertainty of SAR measurement (2.4-6GHz) (*.ε&σ: ≤±5%, DAK3.5, Tx: ≈100% duty cycle) (v08)	1g SAR	10g SAR
Combined measurement uncertainty of the measurement system (k=1)	± 13.7%	± 13.6%
Expanded uncertainty (k=2)	± 27.4%	± 27.2%

	Error Description (2.4-6GHz) (v08)	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g)	ui (10g)	Vi, veff
A	**Measurement System** (DASY5)						(std. uncertainty)	(std. uncertainty)	
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	±2.4 %	Rectangular	√3	1	1	±1.4 %	±1.4 %	∞
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	±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	Device Holder or Positioner Tolerance	±3.6 %	Normal	1	1	1	±3.6 %	±3.6 %	5
17	Test Sample Positioning Error	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	145
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						**±13.7 %**	**±13.6 %**	733
	Expanded Uncertainty (k=2)						**±27.4 %**	**±27.2 %**	

*. 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 (2.4~6GHz) (*.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)	ui (10g)	Vi, veff
A	**Measurement System** (DASY5)						(std. uncertainty)	(std. uncertainty)	
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).

SECTION 6: Confirmation before testing

6.1 SAR reference power measurement (antenna terminal conducted average power of EUT) - Worst data rate/channel determination

*. Antenna gain (peak): 2.98 dBi (2.4GHz band), 4.94 dBi 5GHz band)

Mode	Frequency		Data rate	Power Setting (software)	Duty cycle	Duty factor	Duty scaled factor	Measurement Result				Power correction				Power tuning applied?	Remarks
								Time average power		Burst power		Power		Δ from max.	Tune-up factor		
												Typical	Max.				
	[MHz]	CH	[Mbps]	[-]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]	[dB]	[-]		
BT-BDR	2402	0	1 (DH5)	4.5	77.3	1.12	1.29	4.43	2.77	**5.55**	3.59	3.0	6.0	-0.45	1.11	tuned-up	-
	2440	19	1 (DH5)	4.5	77.3	1.12	1.29	3.84	2.42	**4.96**	3.13	3.0	6.0	-1.04	1.27	tuned-up	-
	2480	39	1 (DH5)	4.5	77.3	1.12	1.29	3.15	2.07	**4.27**	2.67	3.0	6.0	-1.73	1.49	tuned-up	-
BT-LE (PHY1)	2402	0	1	4.5	64.0	1.94	1.56	3.52	2.25	**5.46**	3.52	3.0	6.0	-0.54	1.13	tuned-up	-
	2440	19	1	4.5	64.0	1.94	1.56	2.94	1.97	**4.88**	3.08	3.0	6.0	-1.12	1.29	tuned-up	-
	2480	39	1	4.5	64.0	1.94	1.56	2.24	1.67	**4.18**	2.62	3.0	6.0	-1.82	1.52	tuned-up	-
BT-LE (PHY2)	2402	0	2	4.5	34.4	4.63	2.91	0.81	1.21	**5.44**	3.50	3.0	6.0	-0.56	1.14	tuned-up	-
	2440	19	2	4.5	34.4	4.63	2.91	0.24	1.06	**4.87**	3.07	3.0	6.0	-1.13	1.30	tuned-up	-
	2480	39	2	4.5	34.4	4.63	2.91	-0.46	0.90	**4.17**	2.61	3.0	6.0	-1.83	1.52	tuned-up	-
11b	2412	1	1	9	100	0.00	1.00	8.72	7.45	**8.72**	7.45	8.0	10.0	-1.28	1.34	tuned-up	*.Initial channel.
	2437	6	1	9	100	0.00	1.00	8.63	7.29	**8.63**	7.29	8.0	10.0	-1.37	1.37	tuned-up	-
	2462	11	1	9	100	0.00	1.00	8.36	6.85	**8.36**	6.85	8.0	10.0	-1.64	1.46	tuned-up	-
11g	2412	1	6	9	100	0.00	1.00	8.54	7.14	**8.54**	7.14	8.0	10.0	-1.46	1.40	tuned-up	-
	2437	6	6	9	100	0.00	1.00	8.46	7.01	**8.46**	7.01	8.0	10.0	-1.54	1.43	tuned-up	-
	2462	11	6	9	100	0.00	1.00	8.20	6.61	**8.20**	6.61	8.0	10.0	-1.80	1.51	tuned-up	-
11n (20HT)	2412	1	MCS0	8	100	0.00	1.00	7.75	5.96	**7.75**	5.96	7.0	9.0	-1.25	1.33	tuned-up	-
	2437	6	MCS0	8	100	0.00	1.00	7.66	5.83	**7.66**	5.83	7.0	9.0	-1.34	1.36	tuned-up	-
	2462	11	MCS0	8	100	0.00	1.00	7.41	5.51	**7.41**	5.51	7.0	9.0	-1.59	1.44	tuned-up	-
11n (40HT)	2422	3	MCS0	8	100	0.00	1.00	7.68	5.86	**7.68**	5.86	7.0	9.0	-1.32	1.36	tuned-up	-
	2437	6	MCS0	8	100	0.00	1.00	7.62	5.78	**7.62**	5.78	7.0	9.0	-1.38	1.37	tuned-up	-
	2452	9	MCS0	8	100	0.00	1.00	7.50	5.62	**7.50**	5.62	7.0	9.0	-1.50	1.41	tuned-up	-
11a	5180	36	6	8	100	0.00	1.00	8.79	7.57	**8.79**	7.57	8.0	10.0	-1.21	1.32	n/a (default)	-
	5200	40	6	8	100	0.00	1.00	8.81	7.60	**8.81**	7.60	8.0	10.0	-1.19	1.32	n/a (default)	-
	5220	44	6	8	100	0.00	1.00	8.83	7.64	**8.83**	7.64	8.0	10.0	-1.17	1.31	n/a (default)	*.Initial channel.
	5240	48	6	8	100	0.00	1.00	8.77	7.53	**8.77**	7.53	8.0	10.0	-1.23	1.33	n/a (default)	-
	5260	52	6	8	100	0.00	1.00	8.68	7.38	**8.68**	7.38	8.0	10.0	-1.32	1.36	n/a (default)	*.Initial channel.
	5280	56	6	8	100	0.00	1.00	8.59	7.23	**8.59**	7.23	8.0	10.0	-1.41	1.38	n/a (default)	-
	5300	60	6	8	100	0.00	1.00	8.65	7.33	**8.65**	7.33	8.0	10.0	-1.35	1.36	n/a (default)	-
	5320	64	6	8	100	0.00	1.00	8.54	7.14	**8.54**	7.14	8.0	10.0	-1.46	1.40	n/a (default)	-
	5500	100	6	10	100	0.00	1.00	9.56	9.04	**9.56**	9.04	8.0	10.0	-0.44	1.11	tuned-up	*.Initial channel.
	5580	116	6	10	100	0.00	1.00	9.33	8.57	**9.33**	8.57	8.0	10.0	-0.67	1.17	tuned-up	-
	5700	140	6	10	100	0.00	1.00	9.09	8.11	**9.09**	8.11	8.0	10.0	-0.91	1.23	tuned-up	-
	5745	149	6	10	100	0.00	1.00	8.60	7.24	**8.60**	7.24	8.0	10.0	-1.40	1.38	tuned-up	*.Initial channel.
	5785	157	6	10	100	0.00	1.00	8.53	7.13	**8.53**	7.13	8.0	10.0	-1.47	1.40	tuned-up	-
	5825	165	6	10	100	0.00	1.00	8.45	7.00	**8.45**	7.00	8.0	10.0	-1.55	1.43	tuned-up	-
11n (20HT)	5180	36	MCS0	7	100	0.00	1.00	8.02	6.34	**8.02**	6.34	7.0	9.0	-0.98	1.25	n/a (default)	-
	5200	40	MCS0	7	100	0.00	1.00	8.03	6.35	**8.03**	6.35	7.0	9.0	-0.97	1.25	n/a (default)	-
	5220	44	MCS0	7	100	0.00	1.00	8.08	6.43	**8.08**	6.43	7.0	9.0	-0.92	1.24	n/a (default)	-
	5240	48	MCS0	7	100	0.00	1.00	8.01	6.32	**8.01**	6.32	7.0	9.0	-0.99	1.26	n/a (default)	-
	5260	52	MCS0	7	100	0.00	1.00	7.92	6.19	**7.92**	6.19	7.0	9.0	-1.08	1.28	n/a (default)	-
	5280	56	MCS0	7	100	0.00	1.00	7.82	6.05	**7.82**	6.05	7.0	9.0	-1.18	1.31	n/a (default)	-
	5300	60	MCS0	7	100	0.00	1.00	7.89	6.15	**7.89**	6.15	7.0	9.0	-1.11	1.29	n/a (default)	-
	5320	64	MCS0	7	100	0.00	1.00	7.78	6.00	**7.78**	6.00	7.0	9.0	-1.22	1.32	n/a (default)	-
	5500	100	MCS0	9	100	0.00	1.00	8.76	7.52	**8.76**	7.52	7.0	9.0	-0.24	1.06	tuned-up	-
	5580	116	MCS0	9	100	0.00	1.00	8.53	7.13	**8.53**	7.13	7.0	9.0	-0.47	1.11	tuned-up	-
	5700	140	MCS0	9	100	0.00	1.00	8.31	6.78	**8.31**	6.78	7.0	9.0	-0.69	1.17	tuned-up	-
	5745	149	MCS0	9	100	0.00	1.00	7.80	6.03	**7.80**	6.03	7.0	9.0	-1.20	1.32	tuned-up	-
	5785	157	MCS0	9	100	0.00	1.00	7.76	5.97	**7.76**	5.97	7.0	9.0	-1.24	1.33	tuned-up	-
	5825	165	MCS0	9	100	0.00	1.00	7.68	5.86	**7.68**	5.86	7.0	9.0	-1.32	1.36	tuned-up	-
11ac (20VHT)	5180	36	MCS0	7	100	0.00	1.00	8.03	6.35	**8.03**	6.35	7.0	9.0	-0.97	1.25	n/a (default)	-
	5200	40	MCS0	7	100	0.00	1.00	8.03	6.35	**8.03**	6.35	7.0	9.0	-0.97	1.25	n/a (default)	-
	5220	44	MCS0	7	100	0.00	1.00	8.06	6.40	**8.06**	6.40	7.0	9.0	-0.94	1.24	n/a (default)	-
	5240	48	MCS0	7	100	0.00	1.00	7.99	6.30	**7.99**	6.30	7.0	9.0	-1.01	1.26	n/a (default)	-
	5260	52	MCS0	7	100	0.00	1.00	7.91	6.18	**7.91**	6.18	7.0	9.0	-1.09	1.29	n/a (default)	-
	5280	56	MCS0	7	100	0.00	1.00	7.81	6.04	**7.81**	6.04	7.0	9.0	-1.19	1.32	n/a (default)	-
	5300	60	MCS0	7	100	0.00	1.00	7.90	6.17	**7.90**	6.17	7.0	9.0	-1.10	1.29	n/a (default)	-
	5320	64	MCS0	7	100	0.00	1.00	7.77	5.98	**7.77**	5.98	7.0	9.0	-1.23	1.33	n/a (default)	-
	5500	100	MCS0	9	100	0.00	1.00	8.77	7.53	**8.77**	7.53	7.0	9.0	-0.23	1.05	tuned-up	-
	5580	116	MCS0	9	100	0.00	1.00	8.55	7.16	**8.55**	7.16	7.0	9.0	-0.45	1.11	tuned-up	-
	5700	140	MCS0	9	100	0.00	1.00	8.33	6.81	**8.33**	6.81	7.0	9.0	-0.67	1.17	tuned-up	-
	5745	149	MCS0	9	100	0.00	1.00	7.80	6.03	**7.80**	6.03	7.0	9.0	-1.20	1.32	tuned-up	-
	5785	157	MCS0	9	100	0.00	1.00	7.72	5.92	**7.72**	5.92	7.0	9.0	-1.28	1.34	tuned-up	-
	5825	165	MCS0	9	100	0.00	1.00	7.67	5.85	**7.67**	5.85	7.0	9.0	-1.33	1.36	tuned-up	-

*. Since the maximum tuning -up power of BT-EDR was 3 dB smaller than BT-BDR, the power measurement of BT-EDR was omitted.

(cont'd)

(cont'd)

Mode	Frequency		Data rate	Power Setting (software)	Duty cycle	Duty factor	Duty scaled factor	Measurement Result				Power correction				Power tuning applied?	Remarks
								Time average power		Burst power		Power		Δ from max.	Tune-up factor		
												Typical	Max.				
	[MHz]	CH	[Mbps]	[-]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]	[dB]	[-]		
11n (40HT)	5190	38	MCS0	7	100	0.00	1.00	7.97	6.27	**7.97**	6.27	7.0	9.0	-1.03	1.27	n/a (default)	-
	5230	46	MCS0	7	100	0.00	1.00	8.01	6.32	**8.01**	6.32	7.0	9.0	-0.99	1.26	n/a (default)	-
	5270	54	MCS0	7	100	0.00	1.00	7.84	6.08	**7.84**	6.08	7.0	9.0	-1.16	1.31	n/a (default)	-
	5310	62	MCS0	7	100	0.00	1.00	7.80	6.03	**7.80**	6.03	7.0	9.0	-1.20	1.32	n/a (default)	-
	5510	102	MCS0	9	100	0.00	1.00	8.66	7.35	**8.66**	7.35	7.0	9.0	-0.34	1.08	tuned-up	-
	5550	110	MCS0	9	100	0.00	1.00	8.54	7.14	**8.54**	7.14	7.0	9.0	-0.46	1.11	tuned-up	-
	5670	134	MCS0	9	100	0.00	1.00	8.35	6.84	**8.35**	6.84	7.0	9.0	-0.65	1.16	tuned-up	-
	5755	151	MCS0	9	100	0.00	1.00	7.75	5.96	**7.75**	5.96	7.0	9.0	-1.25	1.33	tuned-up	-
	5795	159	MCS0	9	100	0.00	1.00	7.69	5.87	**7.69**	5.87	7.0	9.0	-1.31	1.35	tuned-up	-
11ac (40VHT)	5190	38	MCS0	7	100	0.00	1.00	7.97	6.27	**7.97**	6.27	7.0	9.0	-1.03	1.27	n/a (default)	-
	5230	46	MCS0	7	100	0.00	1.00	8.01	6.32	**8.01**	6.32	7.0	9.0	-0.99	1.26	n/a (default)	-
	5270	54	MCS0	7	100	0.00	1.00	7.84	6.08	**7.84**	6.08	7.0	9.0	-1.16	1.31	n/a (default)	-
	5310	62	MCS0	7	100	0.00	1.00	7.80	6.03	**7.80**	6.03	7.0	9.0	-1.20	1.32	n/a (default)	-
	5510	102	MCS0	9	100	0.00	1.00	8.67	7.36	**8.67**	7.36	7.0	9.0	-0.33	1.08	tuned-up	-
	5550	110	MCS0	9	100	0.00	1.00	8.54	7.14	**8.54**	7.14	7.0	9.0	-0.46	1.11	tuned-up	-
	5670	134	MCS0	9	100	0.00	1.00	8.33	6.81	**8.33**	6.81	7.0	9.0	-0.67	1.17	tuned-up	-
	5755	151	MCS0	9	100	0.00	1.00	7.76	5.97	**7.76**	5.97	7.0	9.0	-1.24	1.33	tuned-up	-
	5795	159	MCS0	9	100	0.00	1.00	7.68	5.86	**7.68**	5.86	7.0	9.0	-1.32	1.36	tuned-up	-
11ac (80VHT)	5210	42	MCS0	7	100	0.00	1.00	8.43	6.97	**8.43**	6.97	7.0	9.0	-0.57	1.14	n/a (default)	-
	5290	58	MCS0	7	100	0.00	1.00	8.24	6.67	**8.24**	6.67	7.0	9.0	-0.76	1.19	n/a (default)	-
	5530	106	MCS0	8	100	0.00	1.00	8.09	6.44	**8.09**	6.44	7.0	9.0	-0.91	1.23	tuned-up	-
	5775	155	MCS0	9	100	0.00	1.00	8.24	6.67	**8.24**	6.67	7.0	9.0	-0.76	1.19	tuned-up	-

*. : SAR test was applied.

*. The SAR test powers by setting power were not more than 2dB lower than maximum tune-up power (KDB 447498 D01 (v06) requirement).

*. On 2.4GHz band, according to KDB248227 D01, SAR is required for g, and n20 channels when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is >1.2 W/kg.

*. On 5GHz band, when the same transmission mode configurations have the same maximum output power on the same channel for the a/n/ac modes, the channel with the largest bandwidth and the lowest data rate is selected.

*. When the specified maximum output power is the same for both U-NII-1 band and U-NII-2A band, begin SAR measurement in U-NII-2A band, and if the highest reported SAR for U-NII-2A band is; ≤ 1.2 W/kg, SAR is not required for U-NII-1 band / > 1.2 W/kg, both bands should be tested independently for SAR.

*. CH: Channel; Max: Maximum; n/a: not applied; (mode) BT-LE: Bluetooth Low Energy; b: IEEE 802.11b, g: IEEE 802.11g, a: IEEE 802.11a, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT), ac20: IEEE 802.11ac(20VHT), ac40: IEEE 802.11n(40VHT), ac80: IEEE 802.11ac(80VHT).

*. Calculating formula: Burst power (dBm) = (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, %)
ΔMax. (Deviation form maximum power, dB) = (Burst power measured (average, dBm)) - (Max.tune-up limit power (average, dBm))
Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor [-] = 1 / (10 ^ ("Deviation from max., dB" / 10))

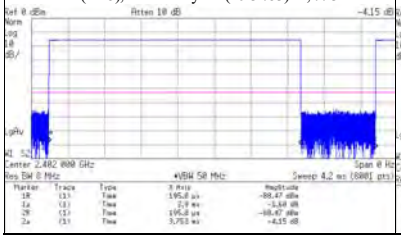
*. Date measured: October 9, 2019 / Measured by: H. Naka/ Place: Preparation room of No. 7 shield room. (25 deg.C./ 50 %RH)

*. Uncertainty of antenna port conducted test (Average power); 0.98 dB (BW20MHz and BW40MHz) / 1.06 dB (BW80MHz).

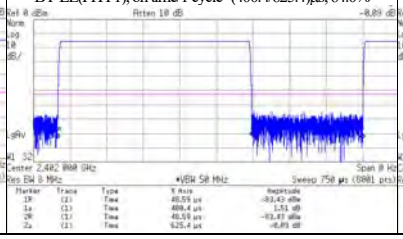
*. Uncertainty of Duty cycle and time measurement: 0.262 %

*. Chart of the worst duty cycle for each operation mode in right and in follows.

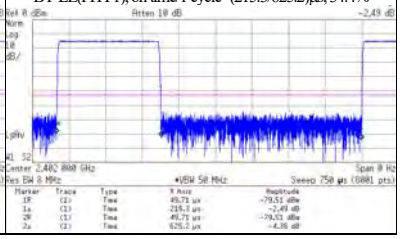
BDR(DH5), on time/1 cycle=(2.9/3.753)ms, 77.3%



BT-LE(PHY1), on time/1 cycle=(400.4/625.4)μs, 64.0%



BT-LE(PHY1), on time/1 cycle=(215.3/625.2)μs, 34.4%



SECTION 7: SAR Measurement results

Measurement date: November 11, 12 and 19, 2019 Measurement by: Hiroshi Naka

7.1 Liquid parameters

Liquid type	Frequency [MHz]	Liquid parameters (*a)										ΔSAR Coefficients(*b)			Date measured
		Permittivity (εr) [-]				Conductivity [S/m]				Temp. [deg.C.]	Depth [mm]	ΔSAR [%]		Correction required? (*c)	
		Target	Measured Value	Measured Δεr [%]	Limit [%]	Target	Measured Value	Measured Δσ [%]	Limit [%]			(1g)	(10g)		
Body	5500	***48.61***	46.37	-4.6	±5	***5.650***	5.805	+2.7	±5	22.9	150	+0.80	-	Not Required.	November 11, 2019 before SAR test
	5580	***48.50***	46.27	-4.6		***5.743***	5.913	+3.0				+0.79	-	Not Required.	
	5700	***48.34***	46.14	-4.6		***5.883***	6.079	+3.3				+0.75	-	Not Required.	
Body	5745	***48.27***	46.03	-4.7	±5	***5.936***	6.135	+3.4	±5	22.9	150	+0.77	-	Not Required.	November 11, 2019 before SAR test
	5785	***48.22***	45.95	-4.7		***5.982***	6.206	+3.7				+0.77	-	Not Required.	
	5825	***48.17***	45.89	-4.7		***6.029***	6.253	+3.7				+0.77	-	Not Required.	
Body	5180	***49.04***	46.94	-4.3	±5	***5.276***	5.389	+2.1	±5	22.9	150	+0.81	-	Not Required.	November 12, 2019 before SAR test
	5220	***48.99***	46.91	-4.2		***5.323***	5.449	+2.4				+0.79	-	Not Required.	
	5240	***48.96***	46.86	-4.3		***5.346***	5.468	+2.3				+0.80	-	Not Required.	
	5260	***48.93***	46.82	-4.3		***5.369***	5.479	+2.0				+0.81	-	Not Required.	
	5300	***48.88***	46.75	-4.4		***5.416***	5.519	+2.3				+0.81	-	Not Required.	
	5320	***48.85***	46.72	-4.4		***5.439***	5.542	+2.3				+0.81	-	Not Required.	
Body	2402	***52.76***	50.71	-3.9	±5	***1.904***	1.918	+0.7	±5	22.9	150	+1.22	-	Not Required.	November 19, 2019 before SAR test
	2412	***52.75***	50.69	-3.9		***1.914***	1.934	+1.0				+1.39	-	Not Required.	
	2437	***52.72***	50.60	-4.0		***1.938***	1.964	+1.4				+1.56	-	Not Required.	
	2462	***52.68***	50.51	-4.1		***1.967***	2.001	+1.7				+1.75	-	Not Required.	

*a. The target values of (2000, 2450, 3000 and 5800) MHz are parameters defined in Appendix A of KDB 865664 D01. For other frequencies, the target nominal dielectric values shall be obtained by linear interpolation between the higher and lower tabulated figures. Above 5800MHz were obtained using linear extrapolation.

*b. Calculating formula: $\Delta SAR(1g) = C\varepsilon r \times \Delta\varepsilon r + C\sigma \times \Delta\sigma$, $C\varepsilon = -7.854E\text{-}4 \times f^3 + 9.402E\text{-}3 \times f^2 - 2.742E\text{-}2 \times f - 0.2026$ / $C\sigma = 9.804E\text{-}3 \times f^3 - 8.661E\text{-}2 \times f^2 + 2.981E\text{-}2 \times f + 0.7829$

*c. Since the calculated ΔSAR values of the tested liquid had shown positive correction, the measured SAR was not converted by ΔSAR correction.
Calculating formula: ΔSAR corrected SAR (W/kg) = (Measured SAR (W/kg)) × (100 - (ΔSAR(%)) / 100

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

Liquid	SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
Body	(2402, 2412, 2437, 2462) MHz	2450 MHz	within ±50MHz of calibration frequency	7.37	± 12.0 %
Body	(5180, 5220, 5240) MHz	5250 MHz	within ±110 MHz of calibration frequency	4.42	± 13.1 %
Body	(5260, 5300, 5320) MHz	5250 MHz	within ±110 MHz of calibration frequency	4.42	± 13.1 %
Body	(5500, 5580, 5700) MHz	5600 MHz	within ±110 MHz of calibration frequency	3.83	± 13.1 %
Body	(5745, 5785, 5825) MHz	5750 MHz	within ±110 MHz of calibration frequency	4.01	± 13.1 %

7.2 SAR test results: 2.4GHz band

[SAR measurement results (2.4GHz band)]

SAR measurement results																				
Test setup							Measured SAR [W/kg]			SAR plot # in Appendix 2-2	Reported SAR [W/kg]									
							Max. value of multi-peak				Duty cycle correction		Output burst average power correction			SAR Corrected (*a)	SAR		Remarks
Position "+": Initial position.	Gap [mm]	LCD position	Battery ID	Mode "+": Initial mode.	Frequency [MHz] (Channel) "+": Initial ch.	Data rate	Meas.	ΔSAR sign	ΔSAR corrected		Duty [%]	Duty scaled	Measured. [dBm].	Max. [dBm]	Tune-up factor		Type	Limit	
Step 1: 2.4GHz Band, Body liquid																			
Front-top-edge*	0	CL.rvs	#58	b*	2412(1) *	1Mbps	**0.160**	Positive	n/a	1-2	100	1.00	8.72	10.0	1.34	**0.214**	Body, 1g	1.6	-
Front-upper	0	CL.rvs	#59	b*	2412(1) *	1Mbps	**0.177**	Positive	n/a	1-3	100	1.00	8.72	10.0	1.34	**0.237**	Body, 1g	1.6	-
Top-front	0	CL.rvs	#58	b*	2412(1) *	1Mbps	**0.109**	Positive	n/a	1-4	100	1.00	8.72	10.0	1.34	**0.146**	Body, 1g	1.6	-
Front (Lens)	0	CL.rvs	#58	b*	2412(1) *	1Mbps	**n/a**	Positive	n/a	1-8	*. Zoom scan was not performed, because the measured interpolated maximum SAR value of area scan was enough small.								
Rear (LCD)	0	CL.rvs	#58	b*	2412(1) *	1Mbps	**n/a**	Positive	n/a	1-9									
Front-upper	0	CL.rvs	#59	b*	2437(6)	1Mbps	**0.177**	Positive	n/a	1-5	100	1.00	8.63	10.0	1.37	**0.242**	Body, 1g	1.6	-
Front-upper	0	CL.rvs	#59	b*	2462(11)	1Mbps	**0.168**	Positive	n/a	1-1	100	1.00	8.36	10.0	1.46	**0.245**	Body, 1g	1.6	*.Higher, 2.4GHz.
Front-upper	0	CL.rvs	#59	BDR	2402	1Mbps	**0.055**	Positive	n/a	1-6	77.3	1.29	5.55	6.0	1.11	**0.0788**	Body, 1g	1.6	-
Front-upper	0	CL.rvs	#59	BT -LE	2402	1Mbps	**0.045**	Positive	n/a	1-7	64.0	1.56	5.46	6.0	1.13	**0.0793**	Body, 1g	1.6	-

Notes: *. The higher reported SAR on each configuration in this operation band is marked (shaded yellow marker).
*. (mode) BT-LE: Bluetooth Low Energy; b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT); Max.: maximum.; n/a: not applied. Gap: It is the separation distance between the platform surface and the bottom outer surface of phantom; LCD position: CL.rvs.: Close-reverse, Refer to Appendix 1 for more detail. Battery ID: Refer to Appendix 1. During test, the EUT was operated with full charged battery and connected to the host PC via an USB cable.

*a. Calculating formula: Reported SAR (W/kg) = (Measured SAR (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, %)
Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor [-] = 1 / (10 ^ ("Deviation from max., dB" / 10))

(Clause 5.2, 2.4GHz SAR Procedures, in KDB248227 D01 (v02r02))

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:

1) When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) 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.

5.2.2 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3, including sub-sections). SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

*. SAR test of OFDM mode was reduced, because the estimate reported SAR of OFDM mode was ≤ 1.2 W/kg by using the highest reported SAR of DSSS mode.

OFDM mode	Maximum tune-up tolerance limit				OFDM scaled factor [-]	DSSS worst reported SAR(1g) value			Estimated SAR (1g) value: OFDM [W/kg]	Exclusion limit [W/kg]	Standalone SAR test require?
	DSSS		OFDM								
	[dBm]	[mW] (a)	[dBm]	[mW] (b)	(b)/(a)×100	SAR type	Setup	[W/kg]			
g	10.0	10	10.0	10	1.00	Body-touch, 1g	Front-upper	0.245	**0.245**	**≤ 1.2**	**No**
n20	10.0	10	9.0	8	0.80	Body-touch, 1g	Front-upper	0.245	**0.196**	**≤ 1.2**	**No**
n40	10.0	10	9.0	8	0.80	Body-touch, 1g	Front-upper	0.245	**0.196**	**≤ 1.2**	**No**

*. (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT), n40: IEEE 802.11n(40HT).

7.3 SAR test results: 5GHz band

[SAR measurement results (5GHz band)]

SAR measurement results																					
Test setup							Measured SAR [W/kg]				Reported SAR [W/kg]										
							Max.value of multi-peak				Duty cycle correction		Output burst average power correction			SAR Corrected (*a)	SAR		Remarks
Position "sar": Initial position.	Gap [mm]	LCD position	Battery ID	Mode "sar": Initial mode.	Frequency [MHz] (Channel "sar": Initial ch.	Data rate	Meas.	ΔSAR sign	ΔSAR corrected	SAR plot # in Appendix 2-2	Duty [%]	Duty scaled	Measured. [dBm].	Max. [dBm]	Tune-up factor		Type	Limit	
Step 2: U-NII-2A (and U-NII-1) Band, Body liquid																					
Front-top-edge*	0	CL.rvs	#58	a*	5260(52)*	6Mbps	**0.243**	Positive	n/a	2-1	100	1.00	8.68	10.0	1.36	**0.330**	Body, 1g	1.6	*.Higher, U-NII-2A.
Front-upper	0	CL.rvs	#59	a*	5260(52)*	6Mbps	**0.179**	Positive	n/a	2-3	100	1.00	8.68	10.0	1.36	**0.243**	Body, 1g	1.6	-
Top-front	0	CL.rvs	#59	a*	5260(52)*	6Mbps	**0.185**	Positive	n/a	2-4	100	1.00	8.68	10.0	1.36	**0.252**	Body, 1g	1.6	-
Front (Lens)	0	CL.rvs	#59	a*	5260(52)*	6Mbps	**n/a**	Positive	n/a	2-9	*. Zoom scan was not performed, because the measured interpolated maximum SAR value of area scan was enough small.								
Rear (LCD)	0	CL.rvs	#58	a*	5260(52)*	6Mbps	**n/a**	Positive	n/a	2-10									
Front-top-edge*	0	CL.rvs	#58	a*	5300(60)	6Mbps	**0.217**	Positive	n/a	2-5	100	1.00	8.65	10.0	1.36	**0.295**	Body, 1g	1.6	-
Front-top-edge*	0	CL.rvs	#59	a*	5320(64)	6Mbps	**0.221**	Positive	n/a	2-6	100	1.00	8.54	10.0	1.40	**0.309**	Body, 1g	1.6	-
Front-top-edge*	0	CL.rvs	#58	a*	5180(36)	6Mbps	**0.316**	Positive	n/a	2-2	100	1.00	8.79	10.0	1.32	**0.417**	Body, 1g	1.6	*.Higher, U-NII-1.
Front-top-edge*	0	CL.rvs	#58	a*	5220(44)	6Mbps	**0.279**	Positive	n/a	2-7	100	1.00	8.83	10.0	1.31	**0.365**	Body, 1g	1.6	-
Front-top-edge*	0	CL.rvs	#58	a*	5240(48)	6Mbps	**0.256**	Positive	n/a	2-8	100	1.00	8.77	10.0	1.33	**0.340**	Body, 1g	1.6	-
Step 3: U-NII-2C Band, Body liquid																					
Front-top-edge*	0	CL.rvs	#58	a*	5500(100)*	6Mbps	**0.252**	Positive	n/a	3-2	100	1.00	9.56	10.0	1.11	**0.280**	Body, 1g	1.6	-
Front-upper	0	CL.rvs	#59	a*	5500(100)*	6Mbps	**0.187**	Positive	n/a	3-3	100	1.00	9.56	10.0	1.11	**0.208**	Body, 1g	1.6	-
Top-front	0	CL.rvs	#59	a*	5500(100)*	6Mbps	**0.191**	Positive	n/a	3-4	100	1.00	9.56	10.0	1.11	**0.212**	Body, 1g	1.6	-
Front (Lens)	0	CL.rvs	#59	a*	5500(100)*	6Mbps	**n/a**	Positive	n/a	3-6	*. Zoom scan was not performed, because the measured interpolated maximum SAR value of area scan was enough small.								
Rear (LCD)	0	CL.rvs	#58	a*	5500(100)*	6Mbps	**n/a**	Positive	n/a	3-7									
Front-top-edge*	0	CL.rvs	#59	a*	5580(116)	6Mbps	**0.274**	Positive	n/a	3-1	100	1.00	9.33	10.0	1.17	**0.321**	Body, 1g	1.6	*.Higher, U-NII-2C
Front-top-edge*	0	CL.rvs	#58	a*	5700(140)	6Mbps	**0.221**	Positive	n/a	3-5	100	1.00	9.09	10.0	1.23	**0.272**	Body, 1g	1.6	-
Step 4: U-NII-3 Band, Body liquid																					
Front-top-edge*	0	CL.rvs	#58	a*	5745(149)*	6Mbps	**0.184**	Positive	n/a	4-1	100	1.00	8.60	10.0	1.38	**0.254**	Body, 1g	1.6	*.Higher, U-NII-3
Front-upper	0	CL.rvs	#59	a*	5745(149)*	6Mbps	**0.131**	Positive	n/a	4-2	100	1.00	8.60	10.0	1.38	**0.181**	Body, 1g	1.6	-
Top-front	0	CL.rvs	#59	a*	5745(149)*	6Mbps	**0.128**	Positive	n/a	4-3	100	1.00	8.60	10.0	1.38	**0.177**	Body, 1g	1.6	-
Front (Lens)	0	CL.rvs	#59	a*	5745(149)*	6Mbps	**n/a**	Positive	n/a	4-6	*. Zoom scan was not performed, because the measured interpolated maximum SAR value of area scan was enough small.								
Rear (LCD)	0	CL.rvs	#58	a*	5745(149)*	6Mbps	**n/a**	Positive	n/a	4-7									
Front-top-edge*	0	CL.rvs	#58	a*	5785(157)	6Mbps	**0.165**	Positive	n/a	4-4	100	1.00	8.53	10.0	1.40	**0.231**	Body, 1g	1.6	-
Front-top-edge*	0	CL.rvs	#58	a*	5825(165)	6Mbps	**0.142**	Positive	n/a	4-5	100	1.00	8.45	10.0	1.43	**0.203**	Body, 1g	1.6	-

Notes: *. The higher reported SAR on each configuration in this operation band is marked (shaded yellow marker).
*. (mode) a: IEEE 802.11a; Max.: maximum.; n/a: not applied. Gap: It is the separation distance between the platform surface and the bottom outer surface of phantom; LCD position: CL.rvs.: Close-reverse, Refer to Appendix 1 for more detail. Battery ID: Refer to Appendix 1. During test, the EUT was operated with full charged battery and connected to the host PC via an USB cable.

*a. Calculating formula: Reported SAR (W/kg) = (Measured SAR (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, %)
Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor [-] = 1 / (10 ^ ("Deviation from max., dB" / 10))

***. Initial Test Position SAR Test Reduction Procedure. According to KDB248227D01**

1) Highest reported SAR(1g) is ≤ 0.4 W/kg . Therefore, further SAR measurements within this exposure condition are not required.
2) Highest reported SAR(1g) is > 0.4 W/kg . Due to the highest reported SAR for this test position, other test positions in standalone exposure condition were evaluated until a SAR(1g) ≤ 0.8 W/kg was reported.
3) For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR(1g) is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR(1g) is ≤ 1.2 W/kg or all required test channels are considered.

7.4 Simultaneous transmission evaluation

***. Simultaneous transmission SAR measurement (Volume Scan) was not required because the sum of the simulated SAR(1g) was < 1.6 W/kg.**

Simultaneous transmission scenario					ΣSAR (1g: ≤1.6)	SPLSR Check? (Yes/ No)	Antenna separation distance-design base [mm]	SPLSR (≤ 0.04)	Volume Scan? (Yes/No)
Test position	Wi-Fi		Highest Reported SAR (*1)						
	mode	band	Wi-Fi	Bluetooth					
Front-top-edge	b,g	2.4GHz	0.25 W/kg	0.08 W/kg	*. not supported	n/a	n/a	n/a	n/a
	a	U-NII-1	0.42 W/kg	0.08 W/kg	0.50 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	U-NII-2A	0.33 W/kg	0.08 W/kg	0.41 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	U-NII-2C	0.32 W/kg	0.08 W/kg	0.40 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	U-NII-3	0.25 W/kg	0.08 W/kg	0.33 W/kg	<1.6, No	0 (*. same antenna)	n/a	No

Note: *1. These values are measured higher reported SAR (1g) of each operation band. Refer to section 7.2 and 7.3.
*. This wireless module supports both Wi-Fi and Bluetooth on a same antenna.
*. Wi-Fi (5GHz) and Bluetooth can transmit simultaneously. *. Wi-Fi (2.4GHz) and Bluetooth can not transmit simultaneously.
*. Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the SAR(1g) is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

(Estimated method)
The following is based on KDB447498D01; When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
[(max. power of channel, including tune-up tolerance, mW) / (minimum test separation distance, mm)]·[√ f(GHz)/x] W/kg
*. for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR
*. 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.
*. When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.

[Estimated ΣSAR1g of simultaneous transmission]

Setup	Wi-Fi mode	Upper Frequency [GHz]		Max. Power				Estimated SAR 1g value		Estimated Σ SAR 1g value (≤ 1.6 W/kg)	SPLSR check required? (Yes/No)	Antenna separation distance b/w Wi-Fi and BT [mm]	SPLSR (≤ 0.04)	Volume Scan? (Yes/No)
				Wi-Fi		BT		Wi-Fi	BT					
		Wi-Fi	BT	[dBm]	[mW]	[dBm]	[mW]							
Front-top-edge	b,g	2.462	2.48	10.0	10	6.0	4	0.42 W/kg	0.17 W/kg	*. not supported	n/a	n/a	n/a	n/a
	a	5.24	2.48	10.0	10	6.0	4	0.61 W/kg	0.17 W/kg	0.78 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	5.32	2.48	10.0	10	6.0	4	0.62 W/kg	0.17 W/kg	0.79 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	5.7	2.48	10.0	10	6.0	4	0.64 W/kg	0.17 W/kg	0.81 W/kg	<1.6, No	0 (*. same antenna)	n/a	No
	a	5.825	2.48	10.0	10	6.0	4	0.64 W/kg	0.17 W/kg	0.81 W/kg	<1.6, No	0 (*. same antenna)	n/a	No

*. (mode) BT: Bluetooth; b: IEEE 802.11b, g: IEEE 802.11g, a: IEEE 802.11a; Max.: maximum.; n/a: not applied.