SAR TEST REPORT

Test Report No.: 12299291S

Applicant : **CAR MATE MFG. CO., LTD.**

Type of Equipment : **DRIVE ACTION RECORDER**

Model No. : **DC3000**

FCC ID : **2AP43-CMDC3000**

Test Standard : **FCC 47CFR §2.1093**

Test Result : **Complied**

Highest Reported SAR(1g) Value			Remarks			Output power (average)	
Tune-up value	Type	Limit	Band	Frequency	Mode	Measured	Maximum
0.85 W/kg	**Body-worn**	**1.6**	DTS	2462 MHz	11b(5.5Mbps)	12.31 dBm	13 dBm

*. **Highest reported SAR (1g) across all exposure conditions (body worn) of this device is "0.85 W/kg".**

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Date of test: July 26, 2018

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".

RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	12299291S	August 8, 2018	-	-

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

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Contents of appendixes

SECTION 1: Customer information

Company Name	CAR MATE MFG. CO., LTD.
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Telephone Number	+81-3-5926-1004
Facsimile Number	+81-3-5926-1250
Contact Person	Tomoaki Sasaki

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of Equipment	DRIVE ACTION RECORDER
Model Number	DC3000
Serial Number	71B140121
Condition of EUT	Production prototype (Not for sale: This samples is equivalent to mass-produced items.)
Receipt Date of Sample	June 26, 2018 (*. EUT for power measurement.) *. No modification by the test Lab. July 25, 2018 (*. EUT for SAR test.) *. No modification by the test Lab. *. After power measurement, the RF wiring of digital camera was changed to the original antenna line from the antenna conducted power measurement line for SAR test.
Country of Mass-production	Indonesia
Category Identified	Portable device *. Since the digital camera may contact a human body during Wi-Fi operation, the partial-body SAR (1g) shall be observed.
Rating	DC 3.7V (Li-ion battery operation), DC 5V (USB BUS power) *. During SAR test, the EUT was operated by a full-charged re-chargeable Li-ion battery.
Feature of EUT	Model: DC3000 (referred to as the EUT in this report) is a DRIVE ACTION RECORDER which support wireless LAN (Wi-Fi).
SAR Accessory	None

2.2 Product Description (Wireless LAN Module)

Equipment type:		Transceiver									
Transmit average power: (*. The measured Tx output power (antenna terminal conducted) refers to section 6 in this report.)		Mode	channel	Operation frequency [MHz]	Data rate [Mbps]	Modulation	Channel spacing [MHz]	Band width [MHz]	**Average power [dBm]**		
									Min.	**Typical**	**Max.**
		11b	1~11	2412~2462	1~11	DSSS	5	20	**11.0**	-	**13.0**
		11g	1~11	2412~2462	6~54	OFDM	5	20	**11.0**	-	**13.0**
		11n(20HT)	1~11	2412~2462	MCS0~7	OFDM	5	20	**9.0**	-	**11.0**
Type of modulation:	Bluetooth:	FHSS: GFSK									
	Wi-Fi:	DSSS: DBPSK, DQPSK, CCK / OFDM: BPSK, QPSK, 16QAM, 64QAM									
Power supply:		*. The DC power of wireless LAN module is supplied via constant voltage circuit.									
Quantity of Antenna:		1 piece									
Antenna type:		Pattern antenna		Antenna connector type:		No antenna connector					
Antenna gain (Peak):		-4.42 dBi									

*. The EUT do not use the special transmitting technique such as "beam-forming" and "time-space code diversity."

SECTION 3: Test specification, procedures and results

3.1 Test specification

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..

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
General population / uncontrolled exposure, Hands (averaged over any 10g of tissue) limit: 4 W/kg

3.3 Procedures and Results

Test Procedure	SAR measurement; KDB 447498, KDB 248227, KDB 865664, IEEE Std.1528		
Category	FCC 47CFR §2.1093 (Portable device)	SAR type	Body worn (body touch)

Band (Operation frequency [MHz])	Wi-Fi (DTS) (2412-2462)
Results (Reported SAR(1g))	Complied
SAR (1g) Limit [W/kg]	1.6
Reported SAR(1g) value	0.852 W/kg
Measured SAR value	0.721 W/kg
Mode, frequency[MHz]	11b (5.5Mbps), 2462
Duty cycle [%] (duty scaled factor)	98.6 (×1.01)
Output average power [dBm] (max. power, Tune-up factor)	12.31 (max. 13 dBm,, ×1.17)

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
*. N/A: Not applied, max. power: maximum output power.
*. (Calculating formula) Corrected SAR to max.power (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, %)

3.4 Test Location

UL Japan, Inc., Shonan EMC Lab.
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Telephone number: +81 463 50 6400 / Facsimile number: +81 463 50 6401
JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

Used?	Place	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
☐	No.1 Semi-anechoic chamber	2973D-1	20.6 × 11.3 × 7.65	20.6 × 11.3	10 m
☐	No.2 Semi-anechoic chamber	2973D-2	20.6 × 11.3 × 7.65	20.6 × 11.3	10 m
☐	No.3 Semi-anechoic chamber	2973D-3	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**	2973D-4	**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 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 result is shown in Section 6.

Step.1 Data rate check (*. The power measurement was applied to the following data rate in each operation mode.)

802.11b		802.11g				802.11n(20HT) (1×SS)					
Modulation	Data rate	Modulation	Data rate	Modulation	Data rate	MCS Index	Data rate	Modulation	MCS Index	Data rate	Modulation
DBPSK/DSSS	1	BPSK/OFDM	6	16QAM/OFDM	24	0	6.5	BPSK/OFDM	4	39	16QAM/OFDM
DQPSK/DSSS	2	BPSK/OFDM	9	16QAM/OFDM	36	1	13	QPSK/OFDM	5	52	64QAM/OFDM
CCK/DSSS	5.5	QPSK/OFDM	12	64QAM/OFDM	48	2	19.5	QPSK/OFDM	6	58.5	64QAM/OFDM
CCK/DSSS	11	QPSK/OFDM	18	64QAM/OFDM	54	3	26	16QAM/OFDM	7	65	64QAM/OFDM

*. Data rate: [Mbps], SS: Spatial Stream

Step.2 Consideration of SAR test channel

For the SAR test reference, on each operation band, the average output power was measured on the low/middle/upper channels with the worst data rate condition in step 1 in the above.

3.6 Confirmation after SAR testing

It was checked that the power drift [W] is within ±5% in the evaluation procedure of SAR testing. The verification of power drift during the SAR test is that DASY5 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 APPENDIX 2.

*. DASY5 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 DASY5 system must be the less than ±0.21dB.**

3.7 Test setup of EUT and SAR measurement procedure

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

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 type
Side (antenna)	A side which is nearest an antenna surface of an EUT is touched to the Flat phantom.	**1.57**	**Tested**	Body-touch, Hand-held
Top-side (antenna)	A upper section of side (antenna) surface of an EUT is touched to the Flat phantom.	**≈5**	**Tested**	
Side (none)	A side which has "CARMATE" logo of an EUT is touched to the Flat phantom.	**18.5**	**Tested**	
Top	A top (lens of camera) of an EUT is touched to the Flat phantom.	**19.07**	**Tested**	
Bottom	A bottom surface of an EUT is touched to the Flat phantom.	**34.5**	**Tested**	
Side (switch)	A side which has switches of an EUT is touched to the Flat phantom.	**38.85**	**Tested**	
Side (USB)	A side which has a USB connector and a micro-SD card slot of an EUT is touched to the Flat phantom.	**57.795**	**Tested**	

*. **D:** Antenna separation distance. It is the distance from the antenna inside EUT to the outer surface of EUT which an operator may touch.
. Size of EUT (digital camera): 42 mm (height) × 62 mm (width) × 64 mm (depth) (. without battery option)

<u>*. Consideration for SAR evaluation exemption</u>
SAR test exclusion considerations according to KDB447498 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.]

Antenna	Tx mode	Upper Freq.	Maximum output power		Step 1) SAR exclusion calculations for antenna ≤50mm from the user.							Step 2) > 50mm from the user
					Calculated threshold value							
					Setup	Side (antenna)	Top-side (antenna)	Side (none)	Top	Bottom	Side (switch)	Side (USB)
		[MHz]	[dBm]	[mW]	D[mm]	≤5 (1.57)	≤5 (≈5)	19	19	35	39	58
Main	b	2462	13	20	Judge	<u>6.3, Measure</u>	<u>6.3, Measure</u>	1.7, Reduce	1.7, Reduce	0.9, Reduce	0.8, Reduce	176 mW, Reduce
Main	g	2462	13	20	Judge	<u>6.3, Measure</u>	<u>6.3, Measure</u>	1.7, Reduce	1.7, Reduce	0.9, Reduce	0.8, Reduce	176 mW, Reduce
Main	n20	2462	11	13	Judge	<u>4.1, Measure</u>	<u>4.1, Measure</u>	1.1, Reduce	1.1, Reduce	0.6, Reduce	0.5, Reduce	176 mW, Reduce

*. Freq: Frequency, D: Antenna separation distance, b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); N/A: not applied..

<u><Conclusion for consideration for SAR test reduction></u>

1) The test was conservatively performed with test separation distance 0mm.
2) Setup of "Side (antenna)" and "Top-side (antenna)" which are near an antenna are applied the SAR test in body-liquid.
   All other setups are also applied because the EUT is small device even if the SAR test exclusion judge value are smaller than "3".
4) The EUT wasn't designed for head-mount condition and/or for front-of-face condition, so SAR test in head-liquid wasn't considered.

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

Worst SAR search by DSSS mode; 1) Determine the highest reported SAR(1g) of DSSS mode by SAR test. (*. Change the channel, if it is required.) 2) Check the SAR of OFDM mode by SAR test additionally, when if it is required.

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

SECTION 4: Operation of EUT during testing

4.1 Operating modes for SAR testing

This EUT has IEEE.802.11b, 11g and 11n(20HT) and Bluetooth Low Energy (BLE) continuous transmitting modes.
The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode		b		g	n20
Tx frequency band [MHz]		2412~2462			
Maximum power [dBm]		13		13	11
SAR tested condition	Frequency [MHz]	2412, 2437, 2462	2462	n/a	n/a
	Modulation	DSSS		OFDM	OFDM
	Data rate [Mbps]	1	5.5	6	6.5(MCS0)
SAR tested/reduced?		Tested	Tested	Reduced	Reduced
Controlled software		#802.11b Continuous Tx Mode Test #802.11g Continuous Tx Mode Test #802.11n(20MHz) Continuous Tx Mode Test The Tx parameters (channel, date rate, gain) were edited by the text editor on the PC and memorized into the micro SD card. During test, this SD card was inserted to the EUT and turned the EUT power on in order to transmit the continuous Wi-Fi wave. *. This power setting of software is the manufacture's worst case. Any conditions under the normal use do not exceed the condition of this power level setting. In addition, end users cannot change the settings of the output power of the product.			
Power setting	Power measurement	29 (*.default)		29 (*.default)	25 (*.default)
	SAR	29 (*.default)		29 (*.default)	25 (*.default)

*. b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); n/a: not applied.
*. Any output power reducing for channel 1 and 11 to meet restricted band requirements was not observed.

SECTION 5: Uncertainty Assessment (SAR measurement)

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) (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	±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 %**	

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

SECTION 6: Confirmation before testing

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

Mode	Frequency		Data rate	Power Setting (software)	Duty cycle	Duty factor	Duty scaled factor	Measurement Result				Power correction			Was power tuning applied?	Remarks *. Antenna gain (peak): -4.42 dBi
								Time average power		Burst power		Max. power	Δ from max.	Tune-up factor		
	[MHz]	CH	[Mbps]	[-]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dB]	[-]		
b	2412	1	1	29	99.7	0.01	×1.00	11.89	15.45	**11.90**	15.49	13.0	-1.10	×1.29	default(*1)	-
	2437	6	1	29	99.7	0.01	×1.00	11.84	15.28	**11.85**	15.31	13.0	-1.15	×1.30	default(*1)	-
	2462	11	1	29	99.7	0.01	×1.00	11.96	15.70	**11.97**	15.74	13.0	-1.03	×1.27	default(*1)	-
	2412	1	5.5	29	98.6	0.06	×1.01	12.15	16.41	**12.21**	16.63	13.0	-0.79	×1.20	default(*1)	-
	2437	6	5.5	29	98.6	0.06	×1.01	12.06	16.07	**12.12**	16.29	13.0	-0.88	×1.22	default(*1)	-
	2462	11	5.5	29	98.6	0.06	×1.01	12.25	16.79	**12.31**	17.02	13.0	-0.69	×1.17	default(*1)	-
g	2412	1	6	29	97.8	0.10	×1.02	11.48	14.06	**11.58**	14.39	13.0	-1.42	×1.39	default(*1)	-
	2437	6	6	29	97.8	0.10	×1.02	11.75	14.96	**11.85**	15.31	13.0	-1.15	×1.30	default(*1)	-
	2462	11	6	29	97.8	0.10	×1.02	11.95	15.67	**12.05**	16.03	13.0	-0.95	×1.24	default(*1)	-
n20	2412	1	MCS0	25	97.6	0.11	×1.03	10.10	10.23	**10.21**	10.50	11.0	-0.79	×1.20	default(*1)	-
	2437	6	MCS0	25	97.6	0.11	×1.03	10.04	10.09	**10.15**	10.35	11.0	-0.85	×1.22	default(*1)	-
	2462	11	MCS0	25	97.6	0.11	×1.03	10.21	10.50	**10.32**	10.76	11.0	-0.68	×1.17	default(*1)	-

*. : SAR test was applied.; *. xx.xx highlight is shown the maximum measured output power.; CH: channel, max: maximum, n/a: not applied.

*1. The SAR test power of Wi-Fi was not more than 2dB lower than maximum tune-up power by the default power setting. (KDB 447498 D01 (v06) requirement).

*. b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); n/a: not applicable.

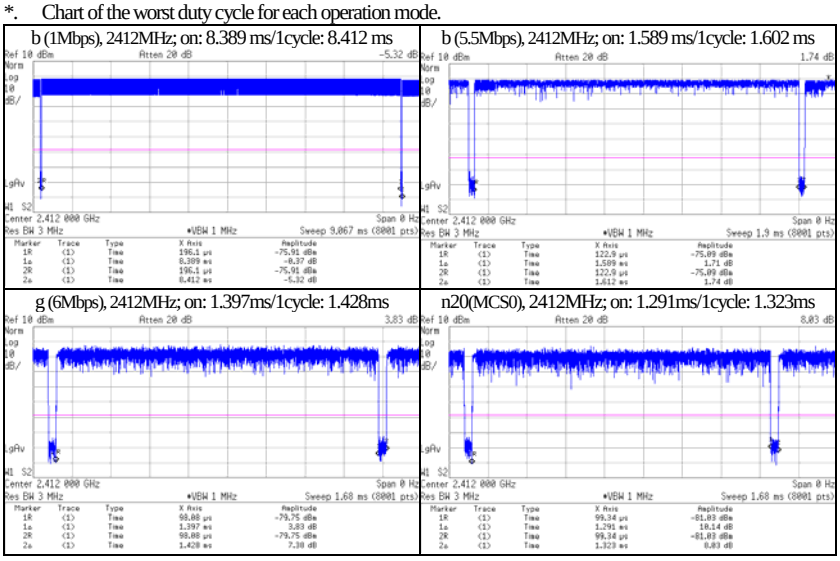
*. For DSSS mode, the lowest data rate (lowest modulation) mode (1Mbps) was selected for the SAR test.

*. Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test in following tables.

Data rate (D/R, [Mbps]) vs Time average power (dBm)

11b (2437MHz)				11g (2437MHz)								11n(20HT) (2437MHz)							
D/R	Duty cycle (%)	Duty factor (dB)	Power	D/R	Duty cycle (%)	Duty factor (dB)	Power	D/R	Duty cycle (%)	Duty factor (dB)	Power	D/R	Duty cycle (%)	Duty factor (dB)	Power	D/R	Duty cycle (%)	Duty factor (dB)	Power
1	99.7	0.01	11.84	**6**	97.8	0.10	**11.75**	24	91.8	0.37	11.44	**MCS0**	97.6	0.11	**10.04**	MCS4	87.9	0.56	9.50
2	99.5	0.02	11.97	9	96.7	0.14	11.69	36	88.2	0.55	11.31	MCS1	95.9	0.18	9.92	MCS5	85.8	0.67	9.36
5.5	98.6	0.06	**12.06**	12	95.6	0.20	11.64	48	84.8	0.72	11.15	MCS2	93.2	0.31	9.79	MCS6	94.9	0.71	9.27
11	97.2	0.12	11.96	18	93.6	0.29	11.55	56	83.6	0.77	11.10	MCS3	91.8	0.37	9.68	MCS7	82.5	0.83	9.21

*. Chart of the worst duty cycle for each operation mode.



*. 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 factor (dBm) = 10 × log (100/(duty cycle, %))
Δ form max. (dB) = (Results-Burst power (average, dBm)) - (Max.-specification output power (average, dBm))
Duty scaled factor (Duty cycle correction factor for obtained SAR value) (unit: (-)) = 100(%) / (duty cycle, %)
Tune-up factor (Power tune-up factor for obtained SAR value) (unit: (-)) = 1 / (10 ^ ("Deviation from max., dB" / 10))

*. Date measured: June 28, 2018 / Measured by: Hiroshi Naka / Place: preparation room of No. 7 shielded room. (24 deg.C. / 52 %RH)

*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 0.48 dB(Average)/(±) 0.66 dB(Peak).

*. Uncertainty of antenna port conducted test; Duty cycle and time measurement: (±) 0.012 %.

6.2 Comparison of power of SAR samples tested in the past

	DC3000 Serial number	Date power measured	Reference report#	Burst average power [dBm] ("*": Highest)								
				Max.	Power setting	b (1Mbps)			g(6Mbps)			
						2412MHz	2437MHz	2462MHz	2412MHz	2437MHz	2462MHz
EMC (Ref.)	71M060990	June 28, 2018	12299284S	**13.0**	29	**11.53***	11.48	11.42	**11.56***	11.48	11.43
SAR test	71B140121	June 28, 2018	this report	**13.0**	29	11.90	11.85	**11.97***	11.58	11.85	**12.05***

SECTION 7: SAR Measurement results

Measurement date: July 26, 2018 Measurement by: Hiroshi Naka

[Liquid measurement]

Target Frequency [MHz]	Liquid type	Liquid parameters (*a)									ΔSAR Coefficients(*c)		Date measured
		Permittivity (εr) [-]				Conductivity [S/m]				Temp. [deg.C.]	Depth [mm]	ΔSAR (1g) [%]	Correction required?	
		Target	Measured		Limit (*b)	Target	Measured		Limit (*b)					
			Meas.	Δεr [%]			Meas.	Δσ [%]						
2412	Body	*52.75*	50.77	-3.8	-5% ≤ εr-meas. ≤ 0%	*1.914*	1.936	+1.2	0% ≤ σ-meas. ≤ +5%	22.4	151	+1.43	not required.	July 26, 2018, before SAR test
2437		*52.72*	50.67	-3.9		*1.938*	1.971	+1.8				+1.72	not required.	
2462		*52.68*	50.57	-4.0		*1.967*	2.004	+1.9				+1.81	not required.	

[SAR measurement results]

SAR measurement results										Reported SAR (1g) [W/kg]						Remarks
Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT 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]	Battery ID	Max.value of multi-peak				Duty [%]	Duty scaled	Meas. [dBm].	Max. [dBm]	Tune-up factor		
						Meas.	ΔSAR [%]	ΔSAR corrected								
b	2462(11)	1	Side (antenna)	0	#1	**0.668**	+1.81	n/a (*c)	Plot 1-2	99.7	×1.00	11.97	13	×1.27	**0.848**	-
	2437(6)			0	#1	**0.556**	+1.72	n/a (*c)	Plot 1-3	99.7	×1.00	11.85	13	×1.30	**0.723**	-
	2412(1)			0	#1	**0.479**	+1.43	n/a (*c)	Plot 1-4	99.7	×1.00	11.90	13	×1.29	**0.618**	-
	2462(11)	5.5		0	#1	**0.721**	+2.34	n/a (*c)	**Plot 1-1**	98.6	×1.01	12.31	13	×1.17	**0.852**	*.Max. time-average power *. Higher reported SAR.
b	2462(11)	1	**Top-side (antenna)**	0	#2	**0.217**	+1.81	n/a (*c)	Plot 1-5	99.7	×1.00	11.97	13	×1.27	**0.276**	-
			Side (switch)	0	#2	**0.041**	+1.81	n/a (*c)	Plot 1-6	99.7	×1.00	11.97	13	×1.27	**0.052**	-
			Side (USB)	0	#1	**0.018**	+1.81	n/a (*c)	Plot 1-7	99.7	×1.00	11.97	13	×1.27	**0.023**	-
			Side (none)	0	#2	**0.018**	+1.81	n/a (*c)	Plot 1-8	99.7	×1.00	11.97	13	×1.27	**0.023**	-
			Top	0	#1	**0.060**	+1.81	n/a (*c)	Plot 1-9	99.7	×1.00	11.97	13	×1.27	**0.076**	-
			Bottom (battery)	0	#1	**0.026**	+1.81	n/a (*c)	Plot 1-10	99.7	×1.00	11.97	13	×1.27	**0.033**	-

Notes:

***.** 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.
Battery ID: Battery ID No.#1 and #2 are same. Refer to Appendix 1 for more detail.

*. During test, the EUT was operated with full charged battery and without all interface cables.

*. Calibration frequency of the SAR measurement probe (and used conversion factors)

SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
2412, 2437, 2462 MHz	2450MHz	within ±50MHz of calibration frequency	7.32	±12.0%

*. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

*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 and 2450MHz. Parameters for the frequencies 2000-2450MHz were obtained using linear interpolation. (Refer to appendix 3-4.)

*b. Refer to KDB865664 D01 (v01r04), item 2), Clause 2.6; "When nominal tissue dielectric parameters are recorded in the probe calibration data; for example, only target values and tolerance are reported, the measured εr and σ of the liquid used in routine measurements must be: ≤ the target εr and ≥ the target σ values and also within 5% of the required target dielectric parameters."

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

*d. Calculating formula: Reported SAR (1g) (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, %)
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 [-] (b)/(a)×100	DSSS 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)		Setup	[W/kg]			
11g	13.0	19.95	13.0	19.95	1.000	Side (antenna)	0.852	**0.852**	**≤ 1.2**	**No**
n (20HT)	13.0	19.95	11.0	12.59	0.631	Side (antenna)	0.852	**0.538**	**≤ 1.2**	**No**