



SAR TEST REPORT

Test Report No.: 11837857S-B

Applicant : MITSUMI ELECTRIC CO., LTD.
Type of Equipment : WIRELESS LAN + BLUETOOTH MODULE
(*: It's installed into a digital camera with a different Bluetooth module (K1506M).)
Model No. : DWM-W314K
FCC ID : EW4DWMW314K
Test Standard : FCC 47CFR §2.1093
Test Result : Complied

Highest Reported SAR(1g) [W/kg] (DTS band)						Platform		Remarks (Wi-Fi condition)		
EUT: DWM-W314K		K1506M	Simultaneous transmission	SAR Type	Limit	Type	Model	Frequency	Mode	Output power measured
Wi-Fi	BLE(2)	BDR/BLE(1)								
0.11 (evaluated) (14.5dBm.max.)	0.01 (estimated) (-2dBm.max.)	0.03 (estimated) (0.5dBm.max.)	0.14 (estimated) (BDR/BLE(1)+Wi-Fi)	Body-touch	1.6	Digital camera	GZE-1	2462MHz	11g(6Mbps)	13.72 dBm (average)

*. Highest reported SAR of this platform for body-worn and simultaneous transmission are "0.11 W/kg" and "0.14 W/kg".

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Date of test: July 18, 2017

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- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
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REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	11837857S-B	November 9, 2017	-	

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

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SECTION 1: Customer information

Company Name	MITSUMI ELECTRIC CO., LTD.
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SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

	EUT	Platform	2 nd Transmitter
Type of Equipment	Wireless LAN + Bluetooth module	Digital camera	Bluetooth module
Model Number	DWM-W314K	GZE-1	K1506M
Serial Number	7460744	89	263
FCC ID	EW4DWMW314K		BBQGZE1P
Condition of EUT	Production model	Engineering prototype (Not for sale: This samples is equivalent to mass-produced items.)	Engineering prototype
Country of Mass-production	Philippines	China	China
Receipt Date of Sample	July 3, 2017 (*. DWM-W314K for power measurement.) *. No modification by the Lab. July 13, 2017 (*. SAR test sample) *. No modification by the Lab.		
Category Identified	Portable device (*. Since this platform may contact and/or very close to a human body during Wi-Fi, Bluetooth and Wi-Fi+Bluetooth operation, the partial-body SAR (1g) shall be observed.)		
Rating	DC 3.7V (Digital camera: Li-ion battery operation)		
Feature of EUT	EUT is a Wireless LAN + Bluetooth module. EUT is installed in a platform above-mentioned with a different Bluetooth module.		
SAR Accessory	None		

2.2 Product Description (Wireless LAN + Bluetooth module, Bluetooth module)

Equipment name	Wireless LAN + Bluetooth module				Bluetooth module		
Equipment type	Transceiver				Transceiver		
Model number	DWM-W314K				K1506M		
Power supply	DC 3.3V from DC power supply				DC 3.3V from DC power supply		
Operation mode	Bluetooth (2) (BLE)	Wi-Fi			Bluetooth (1)		
Frequency of operation	2402-2480 MHz	b/g/n(20HT): 2412-2462 MHz			BDR/EDR/BLE: 2402-2480 MHz		
Number of channel	40	b/g/n(20HT):11			BDR/EDR: 79, BLE: 40		
Channel spacing	2MHz	b/g/n(20HT):5 MHz			BDR/EDR: 1MHz, BLE: 2MHz		
Bandwidth	2MHz	b/g/n(20HT):20 MHz			BDR/EDR: 1MHz, BLE: 2MHz		
Type of modulation	FHSS: GFSK	DSSS: DBPSK, DQPSK, CCK OFDM: BPSK, QPSK, 16QAM, 64QAM			FHSS: GFSK (BDR); GFSK and $\pi/4$ -DQPSK, 8DPSK (EDR); GFSK (BLE)		
Antenna type, connector	PCB printed antenna				Dipole antenna, Spring finger connector		
Antenna gain (Peak)	-4.7 dBi				0.96 dBi		
Transmit average power (Maximum) (*1)	BLE	b	g	n(20HT)	BDR	EDR	BLE
	-2 dBm	14.5 dBm	14.5 dBm	14.5 dBm	0.5 dBm	0 dBm	0.5 dBm

*1. The measured transmit average power (conducted) refers to section 6 in this report.

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

*. BDR: Basic Data Rate; EDR: Enhanced Data Rate; BLE: Low Energy

*. DWM-W314K supports both Wi-Fi and Bluetooth. Wi-Fi and Bluetooth of DWM-W314K are not transmitted simultaneously. Therefore maximum simultaneously transmitted SAR on this platform was considered for the summation of DWM-W314K's Wi-Fi and K1506M's BDR/BLE.

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 touch
Model	EUT: DWM-W314K		K1506M	Simultaneous transmission (*1)
Band (Operation frequency [MHz])	Wi-Fi (DTS) (2412-2462)	Bluetooth (2402-2480)	Bluetooth (2402-2480)	
Results (Reported SAR(1g))	Complied (measured)	Complied (estimated)	Complied (estimated)	Complied (estimated)
SAR (1g) Limit [W/kg]	1.6	1.6	1.6	1.6
Reported SAR(1g) value	0.112 W/kg (* Estimated SAR:0.39 W/kg)	0.01 W/kg (* Estimated)	0.03 W/kg (* Estimated)	0.14 W/kg (0.11(Wi-Fi)+0.03(BDR/BLE)W/kg)
Measured SAR value	0.093 W/kg	Estimated	Estimated	Estimated
Mode, frequency [MHz]	11g(6Mbps), 2462	BLE	BDR, BLE	-
Duty cycle [%] (scaled factor)	100 (×1.00)	-	-	-
Output average power [dBm] (max. power, scaled factor)	13.72 (14.5, ×1.20)	-2dBm maximum	0.5dBm maximum	Wi-Fi: 14.5dBm maximum BDR/BLE: 0.5dBm maximum

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

- *. (Calculating formula) Corrected SAR to max.power (W/kg) = (Measured SAR (W/kg)) × (Duty scaled) × (Tune-up factor)
where; Tune-up factor [-] = $1 / (10^{(\Delta \text{max (max.power - burst average power, dB)} / 10)})$, Duty scaled factor [-] = 100(%) / (duty cycle, %)
*1. DWM-W314K supports both Wi-Fi and Bluetooth. Wi-Fi and Bluetooth of DWM-W314K are not transmitted simultaneously. Therefore maximum simultaneously transmitted SAR on this platform was considered for the summation of DWM-W314K's Wi-Fi and K1506M's BDR/BLE.

3.4 Test Location

No.7 shielded room (2.76 m (Width) × 3.76 m (Depth) × 2.4 m (Height)) for SAR testing.

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3.5 Confirmation before SAR testing

3.5.1 Average power for SAR tests

Before SAR test, the RF wiring for the sample (model: DWM-W314K) had been switched to the antenna conducted power measurement line from the antenna line and the average power was measured. For the SAR test reference, on each operation band, the average output power was measured on the low/middle/upper channels with the lowest data rate condition.

*. The Bluetooth power of EUT was small enough, so a SAR test was reduced. Therefore Bluetooth power of EUT wasn't measured.

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

Table 1. Data rate (Model: DWM-W314K) (*. This device supported the following data rate in each operation mode.)

11b		11g				11n(20HT)						Bluetooth (BLE)	
Modulation	Data rate [Mbps]	Modulation	Data rate [Mbps]	Modulation	Data rate [Mbps]	MCS Index	Spatial Stream	Modulation	MCS Index	Spatial Stream	Modulation	Modulation	Packet type
DBPSK/DSSS	1	BPSK/OFDM	6	16QAM/OFDM	24	MCS0	1	BPSK/OFDM	MCS4	1	16QAM/OFDM	GFSK/FHSS	BLE (1Mbps)
DQPSK/DSSS	2	BPSK/OFDM	9	16QAM/OFDM	36	MCS1	1	QPSK/OFDM	MCS5	1	64QAM/OFDM		
CCK/DSSS	5.5	QPSK/OFDM	12	64QAM/OFDM	48	MCS2	1	QPSK/OFDM	MCS6	1	64QAM/OFDM		
CCK/DSSS	11	QPSK/OFDM	18	64QAM/OFDM	54	MCS3	1	16QAM/OFDM	MCS7	1	64QAM/OFDM		

Table 2. Data rate (Model: K1506M) (*. This device supported the following data rate in each operation mode.)

Bluetooth											
Type	Modulation	Packet type	Type	Modulation	Packet type	Type	Modulation	Packet type	Type	Modulation	Packet type
BLE	GFSK/FHSS	BLE (1Mbps)	BDR	GFSK/FHSS	DH1 (1Mbps)	EDR2	$\pi/4$ -DQPSK/FHSS	2-DH1 (2Mbps)	EDR3	8DPSK/FSSS	3-DH1 (3Mbps)
			BDR	GFSK/FHSS	DH3 (1Mbps)	EDR2	$\pi/4$ -DQPSK/FHSS	2-DH3 (2Mbps)	EDR3	8DPSK/FSSS	3-DH3 (3Mbps)
			BDR	GFSK/FHSS	DH5 (1Mbps)	EDR2	$\pi/4$ -DQPSK/FHSS	2-DH5 (2Mbps)	EDR3	8DPSK/FSSS	3-DH5 (3Mbps)

3.6 Confirmation after SAR testing

It was checked that the power drift [W] is within $\pm 5\%$ 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-field 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] = $20\log(E_a)/(E_b)$ (where, Before SAR testing: E_b [V/m] / After SAR testing: E_a [V/m])

Limit of power drift[W] = $\pm 5\%$

Power drift limit (X) [dB] = $10\log(P_drift) = 10\log(1.05/1) = 10\log(1.05) - 10\log(1) = 0.21\text{dB}$

from E-field relations with power.

$S = E \times H = E^2 / \eta = P / (4 \times \pi \times r^2)$ (η : Space impedance) $\rightarrow P = (E^2 \times 4 \times \pi \times r^2) / \eta$

Therefore, The correlation of power and the E-field

Power drift limit (X) dB = $10\log(P_drift) = 10\log(E_drift)^2 = 20\log(E_drift)$

From the above mentioned, **the calculated power drift of DASY5 system must be the less than $\pm 0.21\text{dB}$.**

3.7 Test setup of EUT and SAR measurement procedure

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

		EUT: DWM-W314K			K1506M		
Setup plan	Explanation of SAR test setup plan (* Refer to Appendix 1 for test setup photographs which had been tested.)	D [mm]	BLE	Wi-Fi	BDR/EDR/BLE		SAR type
			SAR Tested /Reduced	SAR Tested /Reduced	D [mm]	SAR Tested /Reduced	
Left-lower	The lower section of left of camera is touched to the Flat phantom.	15.3	Reduced	Tested	6.5	Reduced	Body-touch
Front-left	The left-lower section of front of camera is touched to the Flat phantom.	15.3	Reduced	Tested	6.5	Reduced	
Front	The front of camera is touched to the Flat phantom.	17.7	Reduced	Tested	28.9	Reduced	
Front-lower	The lower section of front of camera is touched to the Flat phantom.	17.7	Reduced	Tested	28.9	Reduced	
Bottom	The bottom of camera is touched to the Flat phantom.	19.1	Reduced	Tested	8.3	Reduced	
Back	(When test is required,) The back of camera is touched to the Flat phantom.	20.6	Reduced	Reduced	15.6	Reduced	
Left	(When test is required,) the left of camera is touched to the Flat phantom.	23.6	Reduced	Reduced	16.4	Reduced	
Right	(When test is required,) the right of camera is touched to the Flat phantom.	41.3	Reduced	Reduced	34.9	Reduced	
Top	(When test is required,) the top of camera is touched to the Flat phantom.	53.2	Reduced	Reduced	58.3	Reduced	

- *. D: Antenna separation distance. It is the distance from the antenna inside platform to the outer surface of platform which an operator may touch.
*. Size of EUT: DWM-W314K: 19.5 mm (width) × 9 mm (depth) × 1.6 mm (depth)
*. Size of K1506M: 56.9 mm (width) × 38.7 mm (depth) × 4.5 mm (thickness) (including antenna parts)
*. Size of platform: 74.1 mm (width) × 75 mm (height) × 46.4 mm (depth)

*. Consideration for SAR evaluation exemption

KDB 447498 D01 (v06) was taken into consideration to reduce SAR test.

Consideration of SAR test reduction by the antenna separation distance (100MHz~6GHz, ≤50mm)												
Band, Mode	Setup Position	Minimum distance		Upper frequency [GHz]	Maximum power			Calculation of exclusion (*2)	SAR type	SAR test exclusion		Remarks
		[mm]	[mm] (rounded)		[dBm]	[mW]	[mW] (rounded)			Judge for Exclusion	Standalone SAR test required?	
BLE (DWM-W314K)	-	5	≤5	2.480	-2	0.63	1	0.3	1g	≤3.0	*.Reduced	-
Wi-Fi(b,g,n) (DWM-W314K)	Left-lower, Front-left	15.3	15	2.462	14.5	28.18	28	2.9	1g	≤3.0	Not required	*.SAR test was applied.
	Front, Front-lower	17.7	18					2.4	1g	≤3.0	Not required	*.SAR test was applied.
	Bottom	19.1	19					2.3	1g	≤3.0	Not required	*.SAR test was applied.
	Back, Left, Right, Top	≥20	20					2.2	1g	≤3.0	*.Reduced	-
BDR/BLE (K1506M)	-	5	≤5	2.480	0.5	1.12	1	0.3	1g	≤3.0	*.Reduced	-

- *2. Parenthesis 1), Clause 4.3.1, KDB 447498 D01 (v06) gives the following formula to calculate the SAR(1g) test exclusion thresholds for 100MHz~6GHz at test separation distance ≤50mm.

$$[(\text{max.power of channel, including tune-up tolerance, mW}) / (\text{min.test separation distance, mm})] \times [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ (for SAR(1g))}, 7.5 \text{ (for SAR(10g))} \dots \text{formula (1)}$$
If power is calculated from the upper formula (1);

$$[\text{SAR(1g) test exclusion thresholds, mW}] = 3 \times [\text{test separation distance, mm}] / [\sqrt{f(\text{GHz})}] \dots \text{formula (2a)}$$

<Conclusion for consideration for SAR test reduction>

- 1) The SAR test of K1506M is reduced because it has lower power and judge of SAR test exclusion is smaller than 3.0.
- 2) The SAR test of BLE of DWM-W314K is reduced because it has lower power and judge of SAR test exclusion is smaller than 3.0.
- 3) At Wi-Fi operation of DWM-W314K, the SAR setups of near antenna which includes "Left-lower", "Front-left", "Front", "Front-lower" and "Bottom" are considered and applied the SAR test in body-liquid even if the SAR test exclusion judge was "It may reduce SAR test".

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

In body liquid, worst SAR search by DSSS mode with a highest measurement output power channel.
To confirm the influence to SAR of a frequency, the frequency is changed to lower/middle/upper channel.
Add SAR test for OFDM mode, if it's necessary.

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

SECTION 4: Operation of EUT during testing

4.1 Operation mode for SAR testing

The EUT (Wireless LAN+Bluetooth module (DWM-W314K)) has BLE and IEEE 802.11b, g, n(20HT), continuous transmitting modes. The K1506M has BDR/EDR/BLE mode. For inspection of simultaneous transmission SAR, Wi-Fi operation of DWM-W314K measured the SAR in the following conditions.

Module model	EUT: DWM-W314K				K1506M		
Operation mode	b	g	n20	BLE	BDR	EDR	BLE
Tx band [MHz]	2412~2462			2402~2480			
Bandwidth [MHz]	20	20	20	2	1	1	2
Max.power [dBm]	14.5	14.5	14.5	-2	0.5	0	0.5
Modulation	DSSS	OFDM	OFDM	FHSS	FHSS	FHSS	FHSS
Data rate [Mbps]	1	6	MCS0	1	1	3	1
Tested frequency [MHz]	2412, 2437, 2462	2462 (*1)	2462 (*1)	*. SAR test was reduced.	*. SAR test was reduced.	*. SAR test was reduced.	*. SAR test was reduced.
Controlled software	Software name: kx1506 RF TEST WLAN (Only send Mode) 2017/6/29 (by Tera Term)						

*1. This channel has a highest reported SAR(1g) in DSSS mode.

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)	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 (ε',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 DWM-W314K)

*. Antenna gain (peak): -4.7 dBi (2.4GHz band)

Mode	Frequency		Data rate	Power Setting (software)	Duty cycle	Duty factor	Duty scaled factor	Measurement Result				Power correction			Power Tune-up?	Remarks
								Time average power		Burst power		Max. power	Δ from max.	Tune-up factor		
	[MHz]	CH	[Mbps]	[-]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dB]	[-]		
11b	2412	1	1	(fix)	100	0.00	×1.00	14.21	26.36	14.21	26.36	14.5	-0.29	×1.07	not applied	-
	2437	6	1	(fix)	100	0.00	×1.00	13.79	23.93	13.79	23.93	14.5	-0.71	×1.18	not applied	-
	2462	11	1	(fix)	100	0.00	×1.00	13.47	22.23	13.47	22.23	14.5	-1.03	×1.27	not applied	-
11g	2412	1	6	(fix)	100	0.00	×1.00	14.38	27.42	14.38	27.42	14.5	-0.12	×1.03	not applied	-
	2437	6	6	(fix)	100	0.00	×1.00	14.30	26.92	14.30	26.92	14.5	-0.20	×1.05	not applied	-
	2462	11	6	(fix)	100	0.00	×1.00	13.72	23.55	13.72	23.55	14.5	-0.78	×1.20	not applied	-
11n (20HT)	2412	1	MCS0	(fix)	100	0.00	×1.00	14.38	27.42	14.38	27.42	14.5	-0.12	×1.03	not applied	-
	2437	6	MCS0	(fix)	100	0.00	×1.00	14.06	25.47	14.06	25.47	14.5	-0.44	×1.11	not applied	-
	2462	11	MCS0	(fix)	100	0.00	×1.00	13.75	23.71	13.75	23.71	14.5	-0.75	×1.19	not applied	-

*. SAR test was applied. *. **xx.xx** highlight is shown the higher measured output power in each operation mode, in each band.

*. 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) vs Time average power (dBm)																			
11b (2412MHz)				11g (2412MHz)				11n(20HT) (2412MHz)											
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	100	0.00	14.21	6	100	0.00	14.38	24	100	0.00	14.33	MCS0	100	0.00	14.38	MCS4	100	0.00	14.30
2	100	0.00	14.17	9	100	0.00	14.29	36	100	0.00	14.32	MCS1	100	0.00	14.30	MCS5	100	0.00	14.29
5.5	100	0.00	14.14	12	100	0.00	14.32	48	100	0.00	14.31	MCS2	100	0.00	14.33	MCS6	100	0.00	14.30
11	100	0.00	14.17	18	100	0.00	14.30	56	100	0.00	14.28	MCS3	100	0.00	14.32	MCS7	100	0.00	14.29

*. CH: channel, Max: Maximum.

*. 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) = $10 \times \log(100/(\text{duty cycle, \%}))$
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: (-)) = $100(\%) / (\text{duty cycle, \%})$
Tune-up factor (Power tune-up factor for obtained SAR value) (unit: (-)) = $1 / (10^{(\text{"Deviation from max., dB"} / 10)})$

*. Date measured: July 10, 2017 / Measured by: Hiroshi Naka / Place: preparation room of No. 7 shielded room. ((25±1) deg.C. / (50~60)%RH)

*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 0.72 dB(Average)/(±) 0.85 dB(Peak).

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

SECTION 7: SAR Measurement results

7.1 SAR measurement results

Measurement date: July 18, 2017

Measurement by: Hiroshi Naka

[Liquid measurement]

Frequency [MHz] (Channel)	Liquid type	Liquid parameters (*a)								ASAR Coefficients(*b)		Date measured		
		Permittivity (gr) [-]				Conductivity [S/m]				Temp. [deg.C]	Depth [mm]		ASAR	Correction required?
		Target	Measured		Limit	Target	Measured		Limit				1g [%]	
			Meas.	Δgr [%]			Meas.	Δσ [%]						
2412 (1)	Body	52.75	50.85	-3.6	-5% ≤	1.914	1.958	+2.3	0% ≤	22.2	152	+1.93	not required.	July 18, 2017, before SAR test
2437 (6)		52.72	50.81	-3.6	εr-meas	1.938	1.997	+3.1	σ-meas			+2.31	not required.	
2462 (11)		52.68	50.66	-3.9	≤ 0%	1.967	2.037	+3.6	≤ +5%			+2.58	not required.	

[Measured and Reported (Scaled) SAR 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.	ASAR [%]	ASAR corrected								
11b	2412(1)	1	Front	0	#1	0.030	+1.93	n/a (*c)	Plot 1-2	100	×1.00	14.21	14.5	×1.07	0.032	-
			Front-lower	0	#1	0.028	+1.93	n/a (*c)	Plot 1-3	100	×1.00	14.21	14.5	×1.07	0.030	-
			Front-left	0	#2	0.035	+1.93	n/a (*c)	Plot 1-4	100	×1.00	14.21	14.5	×1.07	0.037	-
			Left-lower	0	#2	0.041	+1.93	n/a (*c)	Plot 1-5	100	×1.00	14.21	14.5	×1.07	0.044	-
			Bottom	0	#3	0.056	+1.93	n/a (*c)	Plot 1-6	100	×1.00	14.21	14.5	×1.07	0.060	-
	0	#3		0.068	+2.31	n/a (*c)	Plot 1-7	100	×1.00	13.79	14.5	×1.18	0.080	-		
	2462(11)	0	#1	0.084	+2.58	n/a (*c)	Plot 1-8	100	×1.00	13.47	14.5	×1.27	0.107	Higher, DSSS.		
11g	2462(11)	6	Bottom	0	#1	0.093	+2.58	n/a (*c)	Plot 1-1	100	×1.00	13.72	14.5	×1.20	0.112	Higher, Wi-Fi.
n(20HT)	2462(11)	MCS0		0	#1	0.089	+2.58	n/a (*c)	Plot 1-9	100	×1.00	13.75	14.5	×1.19	0.106	

Notes:

- *. Gap: It is the separation distance between the nearest position of platform outer surface and the bottom outer surface of phantom; Battery ID: Battery ID No.#1, #2 and #3 are same. Refer to Appendix 1 for more detail.; Max.: maximum, Meas.: Measured; n/a: not applied.
- *. During SAR test, an interface cable was disconnected from the platform.
- *. 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	7.38	±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.
- *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: $\Delta SAR(1g) = C_{er} \times \Delta \epsilon_r + C_{\sigma} \times \Delta \sigma$, $C_{er} = 7.854E-4 \times f^3 + 9.402E-3 \times f^2 - 2.742E-2 \times f + 0.2026$ / $C_{\sigma} = 9.804E-3 \times f^3 - 8.661E-2 \times f^2 + 2.981E-2 \times f + 0.7829$
 $\Delta SAR \text{ corrected SAR (1g) (W/kg)} = (\text{Meas. SAR (1g) (W/kg)}) \times (100 - (\Delta SAR(\%))) / 100$
- *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))

Notes

(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.

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7.2 Simultaneous transmission evaluation

The this EUT: Wireless LAN + Bluetooth module (model: DWM-W314K) operates with the 2nd transmitter: Bluetooth module (K1506M) in the following simultaneously transmission.

[Table 7.2: Reported SAR summation of simultaneously transmission]

Test position	Simultaneous transmission scenario				Σ1g SAR [W/kg] (≤1.6)	SPLSR (Yes / No)	Calculated distance [mm]	SPLSR (≤0.04)	Volume Scan (Yes/No)	Figure	Remarks
	Highest Reported SAR(1g) [W/kg] (Standalone base)										
	K1506M		EUT: DWM-W314K								
	BDR	BLE(1)	BLE(2)	Wi-Fi							
Bottom	0.03 (*Estimated)			0.11 (*Measured)	0.14	No	-	-	-	-	BDR+Wi-Fi
Bottom		0.03 (*Estimated)		0.11 (*Measured)	0.14	No	-	-	-	-	BLE(1)+Wi-Fi
All setup	0.03 (*Estimated)		0.01 (*Estimated)		0.04	No	-	-	-	-	BDR+BLE(2)
All setup		0.03 (*Estimated)	0.01 (*Estimated)		0.04	No	-	-	-	-	BLE(1)+BLE(2)

General Note:

- For the DWM-W314K, BLE and Wi-Fi share the same antenna, and cannot transmit simultaneously.
- The Reported SAR simulation is calculated based on the same configuration and test position.
- Per KDB447498 D01(v06), simultaneously transmission SAR is compliant if;
 - Reported SAR summation < 1.6 W/kg
 - "SPLSR = (SAR1 + SAR2)^{1.5} / (minimum antenna separation distance, mm)", and the peak separation distance is determined from the square root of [(x1-x2)² + (y1-y2)² + (z1-z2)²], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR location in the zoom scan. (where; "SAR1" is simulated SAR(1g) of Bluetooth, "SAR2" is highest reported SAR(1g) on antenna when it is 5GHz Wi-Fi operated.)
 - if SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
 - Simultaneously transmission SAR, and the reported multi-band SAR < 1.6 W/kg.
- For simultaneously transmission analysis, Bluetooth SAR and Wi-Fi SAR are estimated per KDB447498 D01(v06) based on the formula below.
 - [(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
 - The minimum separation distance was decided in Appendix 1-1: Photograph of platform and antenna position.
 - The estimated SARs are conservatively determined by using "minimum separation distance" in above step (2), for all applicable exposure positions.

Transmitter	Maximum power			Exposure Position	Minimum separation distance [mm]		Upper operation frequency	Estimated SAR(1g)	Remarks
	Mode	dBm	mW		Rounded	Appendix 1-1			
K1506M	BDR/BLE	0.5	1	All test setup	7	6.5	2.480GHz	0.03 W/kg	-
	BLE	-2	1	All test setup	15	15.3	2.480GHz	0.01 W/kg	-
EUT: DWM-W314K	b/g/n	14.5	28	Left-lower, Front-left	15	15.3	2.462GHz	0.39 W/kg	Actual measured reported SAR(1g) value was "0.11 W/kg" in bottom setup (19.1mm separation). Refer to clause 7.1 and Plot 1-1. (*1)

*1. The actual reported Wi-Fi SAR value (0.11W/kg) was used to calculate "Reported SAR summation of simultaneously transmission" in table 7-2 instead of the estimated SAR value (0.39W/kg).