SAR TEST REPORT

Test Report No.: 11169435S-A-R1

Applicant : **Canon Inc.**

Type of Equipment : **Wireless Module**

Model No. : **WM237** (*. It was installed into the specified platform (digital camera).)

FCC ID : **AZD237**

Test Standard : **FCC 47CFR §2.1093**

Test Result : **Complied**

Highest Reported SAR(1g) Value	Platform type	Platform model	Remarks
1.07 W/kg (Measured: 0.778 W/kg)	Digital camera	PC2258	(DTS) 2437MHz, IEEE 802.11g (6Mbps, BPSK/OFDM) (Output power measured: 12.62 dBm, duty cycle: 100%).

*. **Highest reported SAR (1g) across all tested exposure conditions of this platform (body-touch) = "1.07 W/kg" = grant listing.**

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Date of test: March 23 and 24, 2016

Test engineer: Hiroshi Naka
Engineer, Consumer Technology Division

Approved by: Toyokazu Imamura
Leader, Consumer Technology Division

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☒ There is no testing item of "Non-accreditation".

ilac-MRA LAB JAB Testing RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	11169435S-A	April 4, 2016	-	-
-R01	11169435S-A-R1	May 9, 2016	all pages	Error correction.

*. 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	Canon Inc.
Brand Name	Canon
Address	30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo 146-8501 Japan
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Facsimile Number	+81-3-3757-8431
Contact Person	Yasushi Sasaki

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

	EUT	Platform
Type of Equipment	Wireless Module	Digital camera
Model Number	WM237	PC2258
Serial Number	60128BD5F005	3
Condition of EUT	Engineering prototype	Engineering prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	June 13, 2015 (*. EUT for power measurement.) *. No modification by the Lab. March 15, 2016 (*. EUT for SAR test.) *. No modification by the Lab. (*. The EUT that had been measured the power of SAR test reference, was installed into the platform-digital camera (model: PC2258) from the beginning. After power measurement, the EUT was returned to the customer, and the RF wiring was changed to the original antenna line from the antenna conducted power measurement line for SAR test. The EUT was installed into a platform which SAR tested, by the customer.)	
Country of Mass-production	Philippines	Japan
Category Identified	Portable device *. Since EUT may contact and/or very close to a human body during Wi-Fi operation, the partial-body SAR (1g) shall be observed.	
Rating	DC3.3V and DC1.8V supplied form the platform *. The EUT is installed into the specified the platform that was operated by the re-chargeable Li-ion battery. Therefore, each SAR test, the platform which had built-in EUT was operated with full-charged battery.	
Feature of EUT	The EUT is a Wireless Module which installs into the specified platform: digital camera.	
SAR Accessory	None	

2.2 Product Description (Wireless module: WM237)

Equipment type	Transceiver		
Frequency of operation	2412-2462MHz (11b, 11g, 11n(20HT))		
Channel spacing	5MHz		
Bandwidth	20MHz		
Type of modulation	DSSS(11b): CCK, DQPSK, DBPSK OFDM(11g, 11n(20HT): 64QAM, 16QAM, QPSK, BPSK		
Q'ty of Antenna	1 pc.		
Antenna type	Monopole type chip antenna (Parts No.: AMD0302-ST01T, Manufacture: Mitsubishi Material Corp.)		
Antenna gain (peak)	-3.10dBi (2442MHz)		
Transmit power and tolerance (Manufacture variation)	11b: 12dBm +2dB/-2.5dB	11g: 12dB m +2dB/-2.5dB	11n(20HT): 12dBm +2dB/-2.5dB
	*. Refer to clause 2.3 for more detail.		
	*. The measured Tx output power (conducted) refers to section 6 in this report.		
Maximum output power which may possible	**11b: 14dBm**	**11g: 14dBm**	**11n(20HT): 14dBm**
	*. Refer to clause 2.4 for more detail.		
Power supply	DC 3.3V, DC1.8V (*. The power of DC3.3V and DC1.8V are supplied from the platform via constant voltage circuit.)		

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

2.3 Tx output power specification (antenna port terminal conducted)

		Typical power [dBm] (average)																											
		11b				11g								11n(20HT)															
[MHz]	CH	1	2	5.5	11	6	9	12	18	24	36	48	54	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2412	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2417	2	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2422	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2427	4	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2432	5	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2437	6	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2442	7	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2447	8	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2452	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2457	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-
2462	11	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-

2.4. Maximum output power which may possible

		Maximum output power [dBm] (average)																											
		11b				11g								11n(20HT)															
[MHz]	CH	1	2	5.5	11	6	9	12	18	24	36	48	54	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
2412	1	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2417	2	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2422	3	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2427	4	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2432	5	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2437	6	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2442	7	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2447	8	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2452	9	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2457	10	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-
2462	11	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	-	-	-	-	-	-	-	-

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

3.3 Procedures and Results

	Wi-Fi (DTS) / in Platform: digital camera
Test Procedure	SAR measurement; KDB 447498, KDB 248227, KDB 865664, IEEE Std.1528
Category	FCC 47CFR §2.1093 (Portable device)
Results (SAR(1g))	Complied
Reported SAR value (*. Scaled)	1.07 W/kg
Measured SAR value	0.778 W/kg
Operation mode, channel	11g (6Mbps, BPSK/OFDM), 2437MHz (6ch)
Power measured/max. (scaled factor)	12.62 dBm/14dBm (×1.37)
Duty cycle [%] (scaled factor)	100 (×1.00)

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

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

Consideration of the test results: Since highest reported SAR (1g) on a platform for WM237 (EUT) which obtained in accordance with KDB447498 (v06) was > 0.8 W/kg and ≤ 1.2 W/kg, this EUT is limited to operate a single platform (PC2258).

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 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.

*. 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))

Check the power by data rate and operation channel

The data rate check was measured for all modes in one of default channel. For the SAR test reference, the average output power was measured on the lower, middle, upper channels with the worst data rate condition in.

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

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 (*1)	SAR type
Left	When test is required, the left surface of a digital camera is touched to the Flat phantom.	**3.90**	**Tested**	Body-touch
Left-front	When test is required, the front portion of left surface of a digital camera is touched to the Flat phantom.	**≈10**	**Tested**	
Rear (Body)	When test is required, the rear side of digital camera with opening of LCD is touched to the Flat phantom.	**10.80**	**Tested**	
Rear (LCD)	When test is required, the rear side of digital camera with closing of LCD is touched to the Flat phantom.	**17.57**	**Tested**	
Bottom	When test is required, the bottom flat surface of digital camera is touched to the Flat phantom.	**22.40**	**Tested**	
Front (Lens)	When test is required, the front side (Lens) of a digital camera is touched to the Flat phantom.	**19.90**	*Reduced*	
Top-left	When test is required, the left portion of top surface of a digital camera is touched to the Flat phantom.	**46.20**	*Reduced*	
Right	When test is required, the right-hand grip surface of digital camera is touched to the Flat phantom.	**111.70**	*Reduced*	
Rear (LCD)	When test is required, the rear side of digital camera with closing of LCD is touched to the Flat phantom.	**17.57**	*Reduced (*3)*	front-of-face

*. **D:** Antenna separation distance. It is the distance from the EUT antenna inside a platform to the outer surface of platform which an operator may touch.
*. Size of EUT (WM237): 22.5 mm (width) × 11.5 mm (depth) × 2.05 mm max (thickness)
*. Size of platform: 115.6 mm (width) × 89.2 mm (height) × 48.2 mm (depth) (This size is when the lens is in closed position. The convex portion is not contained in size.)

***1. 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	Position	Minimum distance		Upper frequency [GHz]	Maximum tune-up power			Calculation of exclusion: ≤3.0 (*2)	Standalone SAR test Required?		Remarks
		[mm]	[mm] (rounded)		[dBm]	[mW]	[mW] (rounded)				
WLAN2.4GHz	Left	3.90	4 (≤5)	2.462	14.00	25.12	25	7.8	**>3.0**	**Tested**	-
	Left-front	≈10	10	2.462	14.00	25.12	25	3.9	**>3.0**	**Tested**	-
	Rear (Body)	10.80	11	2.462	14.00	25.12	25	3.6	**>3.0**	**Tested**	-
	Rear (LCD)	17.57	18	2.462	14.00	25.12	25	2.2	≤3.0	**Tested**	* SAR test was applied. (*4)
	Bottom	22.40	22	2.462	14.00	25.12	25	1.8	≤3.0	**Tested**	* SAR test was applied. (*4)
	Front (Lens)	19.90	20	2.462	14.00	25.12	25	2.0	≤3.0	*Reduced*	-
	Top-left	46.20	46	2.462	14.00	25.12	25	0.9	≤3.0	*Reduced*	-

Consideration of SAR test reduction by the antenna separation distance (100MHz~6GHz, >50mm)										
Band, Mode	Position	Minimum distance		Upper frequency [GHz]	Maximum tune-up power			Calculation of test exclusion thresholds [mW] (*3)	Standalone SAR test	Remarks
		[mm]	[mm] (rounded)		[dBm]	[mW]	[mW] (rounded)			
WLAN2.4GHz	Right	111.70	101	2.462	14.00	25.12	25	715.6	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.
[(max.power of channel, including tune-up tolerance, mW) / (min.test separation distance, mm)] × [√f (GHz)] ≤ 3.0 (for SAR(1g)) ····· 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)
[SAR(1g) test exclusion thresholds, mW] = 3 × 50 / SQRT(2.462) = 96mW, where test separation distance=50mm
*3. Parenthesis 2), Clause 4.3.1, KDB 447498 D01 (v06) gives the following formula to calculate the SAR(1g) test exclusion thresholds for 1.5-6GHz at test separation distance >50mm.
[test exclusion thresholds, mW] = [(Power allowed at numeric threshold for 50mm in formula (1))] + [(test separation distance, mm) - (50mm)] × 10 formula (3)
*4. Even if a SAR test was judged exclusion by SAR threshold power, the near antenna section setup are considered body-touch SAR and are applied the SAR test in body-liquid, because the platform is small size of a compact digital camera.

<Conclusion for consideration for SAR test reduction>

1) Worst position search (OFDM) was applied the near antenna section setup conditions which includes Left, Left-front, Rear (Body), Rear (LCD) and Bottom.

2) The SAR tests for Front (Lens), Top-left and Right setup conditions of platform are reduced because there is enough antenna separation distance.

3) *(*3)* Since the Rear (LCD) setup condition has small measured SAR(1g) in body liquid and enough antenna separation distance, SAR test of head liquid (front-of-face) was reduced.

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

Step 1	Worst SAR position search of OFDM mode with a highest measured output channel.
Step 2	Change operation mode.
Step 3	Change channels.

*. 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) continuous transmitting modes.
The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode		11b	11g	11n(20HT)
Tx frequency band		2412-2462MHz		
SAR tested/reduced?		Tested	Tested	Tested
Tested condition	Frequency	2412, 2437, 2462 MHz (*1)	2412, 2437, 2462 MHz (*1)	2412, 2437, 2462 MHz (*1)
	Modulation	DBPSK/DSSS	BPSK/OFDM	BPSK/OFDM
	Data rate	1 Mbps	6 Mbps	MCS0
Controlled software		"RF TEST" mode.		
Power setting (power measurement)		default: 12	default: 12 Tune-up: 13	default: 12 Tune-up: 13
Power setting (SAR)		default: 12	Tune-up: 13	Tune-up: 13

*1. Any output power reducing for channel 1 and 11 to meet restricted band requirements was not observed. Therefore channel 1 and 11 was tested.

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 (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	Freq.	Data rate	Power Setting	Duty cycle	Duty factor	Duty scaled factor	Average power (100% duty cycle) Result		ΔRef.	PAR	Power tolerance & correction Target & (+)tolerance	Deviation from max	Tune-up factor	SAR Tested/ Reduced	Remarks (WM237 Serial number: 60128BD5F005)	Power Tune-up?
	[MHz]	[Mbps]	[dBm]	[%]	[dB]	[-]	[dBm]	[mW]	[dB]	[dB]	[dBm]	(-2≤x<0)[dB]	[-]			
11b	2412	**1**	12	100	0.00	×1.00	12.03	16.0	-0.19	2.70	12.0 +2	-1.97	×1.57	**Tested**	-	default
	2437	**1**	12	100	0.00	×1.00	**12.22**	16.7	Ref.b12	2.66	12.0 +2	-1.78	×1.51	**Tested**	Higher pwr-D/R.(11b) Max..output ch. (11b)	default
	2437	2	12	100	0.00	×1.00	12.20	16.6	-	2.68	12.0 +2	-1.80	×1.51	-	-	default
	2437	5.5	12	100	0.00	×1.00	12.22	16.7	-	2.03	12.0 +2	-1.78	×1.51	-	-	default
	2437	11	12	100	0.00	×1.00	12.21	16.6	-	2.63	12.0 +2	-1.79	×1.51	-	-	default
	2462	**1**	12	100	0.00	×1.00	12.18	16.5	-0.04	2.67	12.0 +2	-1.82	×1.52	**Tested**	-	default
11g	2412	**6**	12	100	0.00	×1.00	11.52	14.2	-0.16	9.83	12.0 +2	-2.48	×1.77	-	-	default
	2437	**6**	12	100	0.00	×1.00	11.68	14.7	Ref.g12	9.77	12.0 +2	-2.32	×1.71	-	Higher pwr-D/R..(11g)	default
	2437	9	12	100	0.00	×1.00	11.65	14.6	-	9.12	12.0 +2	-2.35	×1.72	-	-	default
	2437	12	12	100	0.00	×1.00	11.65	14.6	-	9.28	12.0 +2	-2.35	×1.72	-	-	default
	2437	18	12	100	0.00	×1.00	11.61	14.5	-	8.66	12.0 +2	-2.39	×1.73	-	-	default
	2437	24	12	100	0.00	×1.00	11.63	14.6	-	9.82	12.0 +2	-2.37	×1.73	-	-	default
	2437	36	12	100	0.00	×1.00	11.56	14.3	-	9.51	12.0 +2	-2.44	×1.75	-	-	default
	2437	48	12	100	0.00	×1.00	11.44	13.9	-	10.15	12.0 +2	-2.56	×1.80	-	-	default
	2437	56	12	100	0.00	×1.00	11.33	13.6	-	11.13	12.0 +2	-2.67	×1.85	-	-	default
	2462	**6**	12	100	0.00	×1.00	11.71	14.8	0.03	9.73	12.0 +2	-2.29	×1.69	-	-	default
	2412	**6**	13	100	0.00	×1.00	12.49	17.7	-0.13	9.59	12.0 +2	-1.51	×1.42	**Tested**	-	tune-up
	2437	**6**	13	100	0.00	×1.00	**12.62**	18.3	Ref.g13	9.55	12.0 +2	-1.38	×1.37	**Tested**	Higher pwr-ch..(11g)	tune-up
	2462	**6**	13	100	0.00	×1.00	12.60	18.2	-0.02	9.50	12.0 +2	-1.40	×1.38	**Tested**	-	tune-up
11n (20HT)	2412	**MCS0**	12	100	0.00	×1.00	11.56	14.3	-0.16	9.26	12.0 +2	-2.44	×1.75	-	-	default
	2437	**MCS0**	12	100	0.00	×1.00	11.72	14.9	Ref.2n12	9.16	12.0 +2	-2.28	×1.69	-	Higher pwr-D/R..(n20)	default
	2437	MCS1	12	100	0.00	×1.00	11.65	14.6	-	9.02	12.0 +2	-2.35	×1.72	-	-	default
	2437	MCS2	12	100	0.00	×1.00	11.71	14.8	-	9.67	12.0 +2	-2.29	×1.69	-	-	default
	2437	MCS3	12	100	0.00	×1.00	11.70	14.8	-	9.12	12.0 +2	-2.30	×1.70	-	-	default
	2437	MCS4	12	100	0.00	×1.00	11.67	14.7	-	8.77	12.0 +2	-2.33	×1.71	-	-	default
	2437	MCS5	12	100	0.00	×1.00	11.63	14.6	-	10.35	12.0 +2	-2.37	×1.73	-	-	default
	2437	MCS6	12	100	0.00	×1.00	11.45	14.0	-	11.40	12.0 +2	-2.55	×1.80	-	-	default
	2437	MCS7	12	100	0.00	×1.00	11.48	14.1	-	9.98	12.0 +2	-2.52	×1.79	-	-	default
	2462	**MCS0**	12	100	0.00	×1.00	11.69	14.8	-0.03	9.18	12.0 +2	-2.31	×1.70	-	-	default
	2412	**MCS0**	13	100	0.00	×1.00	12.47	17.7	-0.12	9.05	12.0 +2	-1.53	×1.42	**Tested**	-	tune-up
	2437	**MCS0**	13	100	0.00	×1.00	**12.59**	18.2	Ref.2n13	9.14	12.0 +2	-1.41	×1.38	**Tested**	Max..output ch. (n20)	tune-up
	2462	**MCS0**	13	100	0.00	×1.00	12.56	18.0	-0.03	9.12	12.0 +2	-1.44	×1.39	**Tested**	-	tune-up

*. : SAR test was applied. *. xx.xx highlight is shown the maximum measured output power.

*. Freq.: Frequency, PAR: Peak average ratio ("Peak power"-"Average power", in dBm), Ch: channel, D/R: Data Rate, pwr: power, Max.: Maximum, Ref: Reference.
*. Calculating formula: Average power-result: Results (dBm) = (P/M Reading (100% duty cycle), dBm)+(Cable loss, dB)+(Attenuator, dB)+(duty factor, dB)
Duty factor: (duty factor, dBm) = 10 × log (100/(duty cycle, %))
Deviation form max.: (Power deviation, dB) = (results power (average, dBm)) - (Max.-specification output power (average, dBm))
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))
*. Date measured: July 7, 2015 / Measured by: Hiroshi Naka / Place: preparation room of No. 7 shielded room. (25 deg.C. / 55 %RH)
*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 0.76 dB(Average)/(±) 0.79 dB(Peak)

6.2 Comparison of power of EMC sample

	Platform#	Platform model No.	RF serial No.	Date power measured	Reference report#	Tx mode	Data rate [Mbps]	Average power [dBm] ("*": Highest) Max. [dBm]	Frequency [MHz] 2412	2437	2462
EMC (Ref.)	-	-	F48139F1C455	Aug. 19, 2014	10407961S-N	11b	5.5	14	13.03	13.37*	13.28
						11g	18	14	12.05	12.40	12.71*
						n20	MCS2	14	12.43	12.53*	12.48
SAR test	Digital camera	PC2258	60128BD5F005	July 7, 2015	11169435S-A (This report)	11b	1	14	12.03	12.22*	12.18
						11g	6	14	12.49	12.62*	12.60
						n20	MCS0	14	12.47	12.59*	12.56

SECTION 7: SAR Measurement results

Measurement date: March 23, 2016 Measurement by: Hiroshi Naka

[Liquid measurement]

Target Frequency [MHz]	Liquid type	Liquid parameters (*a)								Temp. [deg.C.]	Depth [mm]	ΔSAR Coefficients(*c)		Date measured
		Permittivity (εr) [-]				Conductivity [S/m]								
		Target	Measured		Limit (*b)	Target	Measured		Limit (*b)			ΔSAR (1g) [%]	Correction required?	
			Meas.	Δεr [%]			Meas.	Δσ [%]						
2412	Body	*52.75*	50.67	-4.0	-5% ≤ εr-meas. ≤ 0%	*1.914*	1.935	+1.1	0% ≤ σ-meas. ≤ +5%	22.7	153	+1.43	not required.	March 23, 2016 Before SAR test
2437	Body	*52.72*	50.53	-4.2		*1.938*	1.968	+1.6				+1.69	not required.	
2462	Body	*52.68*	50.47	-4.2		*1.967*	2.002	+1.8				+1.80	not required.	
2437	Body	*52.72*	50.44	-4.3		*1.938*	1.971	+1.7		21.9	153	+1.81	not required.	March 24, 2016 Before SAR test

[SAR measurement results]

*. Initial test was determined by the manufacture's detail drawing for antenna location of platform.

Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup: Position	Gap [mm]	Bty. ID	LCD position	Power drift [dB]	SAR (1g) [W/kg] Max.value of multi-peak: Meas.	ΔSAR [%]	ΔSAR corrected	SAR plot # in Appendix 2-2	Reported SAR (1g) [W/kg]: Duty cycle correction: Duty [%]	Duty scaled	Output average power correction: Meas. [dBm].	Max. [dBm]	Tune-up factor	SAR Corrected (*d)	Remarks
Step 1: Worst SAR position search (OFDM)																		
11g	2437(6)	6	**Left**	0	#1	close	-0.05	**0.778**	+1.69	n/a (*c)	Plot 1-1	100	×1.00	12.62	14.0	×1.37	**1.066**	*. Highest.
				0	#1	op90	-0.06	**0.584**	+1.69	n/a (*c)	Plot 1-2	100	×1.00	12.62	14.0	×1.37	**0.800**	-
			Rear	0	#2	close	-0.16	**0.082**	+1.81	n/a (*c)	Plot 1-3	100	×1.00	12.62	14.0	×1.37	**0.112**	-
				0	#2	op180	-0.07	**0.094**	+1.81	n/a (*c)	Plot 1-4	100	×1.00	12.62	14.0	×1.37	**0.129**	-
			Left-front	0	#2	close	-0.10	**0.206**	+1.81	n/a (*c)	Plot 1-5	100	×1.00	12.62	14.0	×1.37	**0.282**	-
			Bottom	0	#3	close	0.07	**0.114**	+1.81	n/a (*c)	Plot 1-6	100	×1.00	12.62	14.0	×1.37	**0.156**	-
Step 2: Change operation mode (OFDM&DSSS).																		
11n (20HT)	2437(6)	MCS0	**Left**	0	#1	close	-0.05	**0.765**	+1.69	n/a (*c)	Plot 2-1	100	×1.00	12.59	14.0	×1.38	**1.056**	-
11b	2437(6)	1	**Left**	0	#1	close	0	**0.689**	+1.69	n/a (*c)	Plot 2-2	100	×1.00	12.22	14.0	×1.51	**1.040**	-
Step 3: Change channels																		
11g	2462(11)	6	**Left**	0	#1	close	-0.01	**0.741**	+1.80	n/a (*c)	Plot 3-1	100	×1.00	12.60	14.0	×1.38	**1.023**	-
	2412(1)				#1	close	0.01	**0.749**	+1.43	n/a (*c)	Plot 3-2	100	×1.00	12.49	14.0	×1.42	**1.064**	-
11n (20HT)	2462(11)	6	**Left**	0	#3	close	-0.01	**0.692**	+1.80	n/a (*c)	Plot 3-3	100	×1.00	12.56	14.0	×1.39	**0.962**	-
	2412(1)				#3	close	0	**0.705**	+1.43	n/a (*c)	Plot 3-4	100	×1.00	12.47	14.0	×1.42	**1.001**	-
11b	2462(11)	1	**Left**	0	#3	close	-0.04	**0.657**	+1.80	n/a (*c)	Plot 3-5	100	×1.00	12.18	14.0	×1.52	**0.999**	-
	2412(1)				#3	close	0.01	**0.661**	+1.43	n/a (*c)	Plot 3-6	100	×1.00	12.03	14.0	×1.57	**1.038**	-

Notes:

*. Gap: It is the separation distance between the nearest position of platform outer surface and the bottom outer surface of phantom.
Bty.: Battery; Max.: maximum, Meas.: Measured; n/a: not applied.

*. Battery ID No.#1, #2 and #3 were same model (Refer to Appendix 1).; LCD position; The condition of "LCD position" is shown in Appendix 1 in this report.

*. 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	7.17	±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))

(cont'd)

SECTION 7: SAR Measurement results (cont'd)

(cont'd)

(Clause 5: SAR TEST PROCEDURE, in KDB248227 D01(v02r02))

5.1.1 Initial Test Position SAR Test Reduction Procedure

1) When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combination within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).

2) When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.

3) For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

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.

***. SAR Measurement Variability**

In accordance with published RF Exposure KDB procedure 865664 D01 (v01r04) SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.