SAR TEST REPORT

Test Report No.: 11661106S-A

Applicant : **Canon Inc.**
Type of Equipment : **Wireless Module**
Model No. : **ES200** (*. It was installed into ES200's platform (9).)
FCC ID : **AZD230**
Test Standard : **FCC 47CFR §2.1093**
Test Result : **Complied**

Highest Reported SAR(1g)		SAR type	Platform No.	Platform type	Platform model	Band	Frequency [MHz]	Mode	Power [dBm]		ES200 Type	Report No.
Tune-up value	(Measured)								Actual	Max.		
0.88 W/kg	0.689 W/kg	Body-worn	#9	Digital camera	DS126701	DTS	2462	b(1Mbps,DSSS)	10.47	11.5	Low	*. This report.
*. This Wireless Module had installed into the following platforms under 1.2W/kg of reported SAR(1g) (KDB447498 D01 (v06); single-platform operation requirement).												
0.15 W/kg	0.123 W/kg	Body-worn	#1	Digital camera	DS126621	DTS	2437	b(1Mbps,DSSS)	12.79	13.5	Normal	10840761S-A
< 0.10 W/kg	0.056 W/kg	Body-worn	#2	Digital camera	DS126591	DTS	2462	b(1Mbps,DSSS)	12.62	13.5	Normal	10840759S-A
0.60 W/kg	0.508 W/kg	Body-worn	#3	Digital camera	DS126601	DTS	2437	b(1Mbps,DSSS)	12.79	13.5	Normal	10840760S-A-r03
< 0.10 W/kg	0.037 W/kg	Body-worn	#4	Digital camera	DS126651	DTS	2462	b(1Mbps,DSSS)	12.62	13.5	Normal	11353340S-A
< 0.10 W/kg	0.045 W/kg	Body-worn	#5	Digital camera	DS126661	DTS	2462	b(1Mbps,DSSS)	12.62	13.5	Normal	11353341S-A
0.25 W/kg	0.205 W/kg	Body-worn	#6	Digital camera	DS126671	DTS	2462	b(1Mbps,DSSS)	12.62	13.5	Normal	11355392S-A
0.66 W/kg	0.505 W/kg	Body-worn	#7	Digital camera	PC2329	DTS	2462	b(1Mbps,DSSS)	10.36	11.5	Low	11355370S-A
0.54 W/kg	0.387 W/kg	Body-worn	#8	Digital camera	PC2276	DTS	2462	b(1Mbps,DSSS)	10.03	11.5	Low	11628244S-A

*. **Highest reported SAR (1g) across all exposure conditions and on the platforms = " 0.88 W/kg (body-worn)" = grant listed.**
*. Since highest reported SAR (1g) on a platform of ES200 (EUT) which obtained in accordance with KDB447498 (v06) was kept under 1.2 W/kg, this EUT was approved to operate single-platform as "digital camera" (which were tested in above.).

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Date of test: March 9, 2017

Test engineer: Hiroshi Naka
Engineer, Consumer Technology Division

Approved by: Toyokazu Imamura
Leader, Consumer Technology Division

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JAB Testing RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	11661106S-A	March 27, 2017	-	-

*. 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	Kenji Inoue

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

	EUT	Platform
Type of Equipment	Wireless Module	Platform (9): Digital camera
Model Number	ES200	DS126701
Serial Number	2	269
Condition of EUT	Engineering prototype	Engineering prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	March 7, 2017 (*. EUT for SAR test.) *. No modification by the Lab. (*. The EUT that had been measured the power of SAR test reference. 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	China, Japan	Taiwan
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.	
Feature of EUT	The EUT is a Wireless Module which installs into the specified platform: digital camera.	
SAR Accessory	None	

2.2 Product Description (Model: ES200)

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			
Quantity of Antenna	1 pc.					
Antenna / Connector type	Pattern antenna / No connector (Printed on the PCB).					
Antenna gain (peak)	2.14 dBi					
Power level	**Normal power mode** (*1,*2)			**Low power mode** (*1,*2)		
Transmit power and tolerance	**11b: 12 dBm**	**11g: 12 dBm**	**11n(20HT): 11 dBm**	**11b: 10 dBm**	**11g: 8 dBm**	**11n(20HT): 7 dBm**
Manufacture variation	+1.5/-1.5 dB	+1.5/-1.5 dB	+1.5/-1.5 dB	+1.5/-1.5 dB	+1.5/-1.5 dB	+1.5/-1.5 dB
Maximum output power	**13.5 dBm**	**13.5 dBm**	**12.5 dBm**	**11.5 dBm**	**9.5 dBm**	**8.5 dBm**
-	*. The measured Tx output power (conducted) refers to section 6 in this report.					
Power supply	DC 3.3V, DC1.8V (*. These powers 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."

***1. ES200 has two kinds of power level which specified as "Normal power" mode and "Low power" mode. The power of "Low power" mode is lower than "Normal power" mode for all Tx conditions.**

***2. Since "Low power mode" is selected by firmware in this platform, the EUT cannot output power level of "Normal power" mode.**

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 (9)
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)	**0.88 w/kg**
Measured SAR value	0.689 W/kg
Operation mode, channel	802.11b, 1 Mbps (DBPSK/DSSS), 2462 MHz (11ch)
Power measured/max. (scaled factor)	10.47 dBm/11.5 dBm (×1.27) **(*. Low power mode)**
Duty cycle [%] (scaled factor)	99.9 (×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 (9), it was verified whether single-platform conditions can be suited in according with section 2) of 5.2.2 in KDB447498 D01 (v06).

Consideration of the test results: **The highest reported SAR (1g) of this platform (8) was kept; ≤ 1.2 W/kg.**
Since highest reported SAR (1g) on this EUT's platform obtained in accordance with KDB447498 D01 (v06) was kept under 1.2 W/kg, this EUT was approved to operate single-platform (as digital camera series).

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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Telephone number: +81 463 50 6400 / Facsimile number: +81 463 50 6401

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 and upper channels with the worst data rate condition in.

11b		11g				11n(20HT)					
Modulation	Data rate [Mbps]	Modulation	Data rate [Mbps]	Modulation	Data rate [Mbps]	MCS Index	Spatial Stream	Modulation	MCS Index	Spatial Stream	Modulation
DBPSK/DSSS	1	BPSK/OFDM	6	16QAM/OFDM	24	MCS0	1	BPSK/OFDM	MCS4	1	16QAM/OFDM
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

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 (left-hand grip) of a camera is touched to the Flat phantom.	**4.9**	**Tested**	Body-touch
Left-front-tilt	When test is required, the front portion of left surface on a camera is touched to the Flat phantom.	**13.57**	**Tested**	
Rear (LCD)	When test is required, the rear surface (LCD) of a camera is touched to the Flat phantom.	**20.00**	**Tested**	
Front	When test is required, the front surface (Lens) of a camera is touched to the Flat phantom.	**29.80**	**Tested**	
Bottom	When test is required, the bottom surface on a camera is touched to the Flat phantom.	**26.8**	**Tested**	
Top-left-tilt	When test is required, the left portion of top surface on a camera is touched to the Flat phantom..	**37.8**	*Reduced*	
Right	When test is required, the right surface (right-hand grip) of a camera is touched to the Flat phantom.	**124.0**	*Reduced*	
Rear (LCD)	When test is required, the rear surface (LCD) of a camera is touched to the Flat phantom.	**20.00**	*Reduced*	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 (ES200): 11.5 mm (width) × 22.5 mm (depth) × 2.0 mm max (thickness)
. Size of platform: 129.0 mm (width) × 101.6 mm (height) × 77.1 mm (depth) (. The convex portion is not contained in size.)

***1. 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 [mm]	Minimum distance [mm] (rounded)	Upper frequency [GHz]	Maximum power [dBm]	Maximum power [mW]	Maximum power [mW] (rounded)	Calculation of exclusion (*2)	SAR type	SAR test exclusion: Judge for Exclusion	SAR test exclusion: Standalone SAR test required?	Remarks
WLAN 2.4GHz 11b	Left	4.9	≤ 5	2.462	11.5	14.13	**14**	**4.4**	1g	***≤3.0***	**(>3.0) Required**	-
	Left-front-tilt	13.57	14					**2.0**	1g	***≤3.0***	Not required	*.SAR test was applied.
	Rear (LCD)	20.00	20					**1.1**	1g	***≤3.0***	Not required	*.SAR test was applied.
	Front	29.80	30					**0.7**	1g	***≤3.0***	Not required	*.SAR test was applied.
	Bottom	26.8	27					**0.8**	1g	***≤3.0***	Not required	*.SAR test was applied.
	Top-left-tilt	37.8	38					**0.6**	1g	***≤3.0***	Not required	≥ 38mm → Test was 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)), 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)

<Conclusion for consideration for SAR test reduction>

1) The SAR setups of the near antenna which includes "Left" and "Left-front-tilt" are applied the SAR test in body-liquid. In addition, the SAR setups of "Rear (LCD)", "Front" and " Bottom" are considered and applied the SAR test in body-liquid even if the SAR test exclusion judge was "Reduced SAR test".
2) The SAR tests of "Top-left-tilt" and "Right" setup are reduced because there is enough antenna separation distance.
3) The SAR test of front-of-face (which tested by head liquid) wasn't considered, because the SAR value of "Rear" setup in body liquid was enough small..

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

Worst SAR search by DSSS mode;
. Determine the highest reported SAR(1g) of DSSS mode. (. Change the channel, if it is necessary.)
*. Check the SAR of OFDM mode (which is lower power than DSSS mode) at a highest measured output channel.

*. 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		
Maximum power [dBm]		11.5	9.5	8.5
SAR tested/reduced?		Tested	Tested (*.lower power than 11b)	Tested (*.lower power than 11b)
Tested condition	Frequency	2412, 2437, 2462 MHz (*1, *2)	2412 MHz (*3)	2412 MHz (*3)
	Modulation	DBPSK/DSSS	BPSK/OFDM	BPSK/OFDM
	Data rate	1 Mbps	6 Mbps	MCS0
Controlled software		"RF TEST" mode. (*. Low power mode) This software was used for both antenna terminal conducted power measurement and SAR measurement. Set Tx parameters which includes; "channel", "BW(20MHz or 40MHz)", "Power(dBm)"and "data rate" via LCD of platform.		
Power setting (power measurement)		default=10	default=8	default=7
Power setting (SAR)		default=10	default=8	default=7

*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.
*2. (KDB248227 D01 (v02r02)) Since the reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, the SAR testing for other channels were omitted. However, the SAR testing was applied to lower, middle and upper channels for the worst SAR condition.
*3. This channel is a highest measured output power channel on each operation 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 EUT) - Worst data rate/channel determination

*. Antenna gain (peak): 2.14 dBi (2.4 GHz band)

Mode	Freq.	Data rate	Power Setting	Duty cycle	Duty factor	Duty scaled factor	Time average power Result		PAR	Power tolerance & correction			SAR Tested/ Reduced	ES200 Power Level Type	Remarks (*. Low power mode)	Power Tune-up?
										Target & (+)tolerance	Deviation from max	Tune-up factor				
	[MHz]	[Mbps]	[dBm]	[%]	[dB]	[-]	[dBm]	[mW]	[dB]	[dBm]	(-2≤x<0)[dB]	[-]				
11b	2412	1	10	99.9	0.00	×1.00	**10.65**	11.61	2.5	10.0 +1.5	-0.85	×1.22	**Tested**	**Low**	-	n/a
	2437	1	10	99.9	0.00	×1.00	**10.55**	11.35	2.6	10.0 +1.5	-0.95	×1.24	**Tested**	**Low**	(*1)	n/a
	2462	1	10	99.9	0.00	×1.00	**10.47**	11.14	2.6	10.0 +1.5	-1.03	×1.27	**Tested**	**Low**	(*1)	n/a
11g	2412	6	8	99.4	0.03	×1.01	**8.66**	7.35	10.7	8.0 +1.5	-0.84	×1.21	**Tested**	**Low**	higher output power ch. (*2)	n/a
	2437	6	8	99.4	0.03	×1.01	**8.62**	7.28	10.6	8.0 +1.5	-0.88	×1.22	*Reduced*	**Low**	*. lower power than 11b.	n/a
	2462	6	8	99.4	0.03	×1.01	**8.56**	7.18	10.6	8.0 +1.5	-0.94	×1.24	*Reduced*	**Low**	*. lower power than 11b.	n/a
11n (20HT)	2412	MCS0	7	99.4	0.03	×1.01	**7.55**	5.69	10.1	7.0 +1.5	-0.95	×1.24	**Tested**	**Low**	higher output power ch. (*2)	n/a
	2437	MCS0	7	99.4	0.03	×1.01	**7.45**	5.56	10.1	7.0 +1.5	-1.05	×1.27	*Reduced*	**Low**	*. lower power than 11b.	n/a
	2462	MCS0	7	99.4	0.03	×1.01	**7.37**	5.46	10.1	7.0 +1.5	-1.13	×1.30	*Reduced*	**Low**	*. lower power than 11b.	n/a

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

*. 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 (add duty factor) (dBm)														
11b (2412MHz)			11g (2412MHz)						11n(20HT) (2412MHz)					
D/R	Duty cycle (%)	Duty factor (dB)	D/R	Duty cycle (%)	Duty factor (dB)	D/R	Duty cycle (%)	Duty factor (dB)	D/R	Duty cycle (%)	Duty factor (dB)	D/R	Duty cycle (%)	Duty factor (dB)
1	99.9	0.00	**6**	99.4	0.03	24	97.8	0.10	**MCS0**	99.4	0.03	MCS4	96.7	0.15
2	99.9	0.01	9	99.2	0.04	36	96.8	0.15	MCS1	98.9	0.05	MCS5	95.6	0.19
5.5	99.6	0.02	12	98.9	0.05	48	95.8	0.19	MCS2	98.4	0.07	MCS6	95.3	0.21
11	99.1	0.04	18	98.3	0.07	56	95.6	0.20	MCS3	97.8	0.10	MCS7	95.3	0.21

*. Freq.: Frequency, PAR: Peak average ratio ("Peak power"-"Average power", in dBm), Ch: channel, D/R: Data Rate, pwr: power, Ref: Reference.

*. Calculating formula: Time average power-result: Results (dBm) = (P/M Reading, 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))

*. The power data above-mentioned diverted a result of measurement of EMC test of report identifier: 10840757S-G.

*. The ES200 of serial number: 2 with which power was measured in EMC test was used for a SAR test.

*1. The SAR testing was applied to low, middle and high channels for the worst SAR condition even if SAR of a DSSS maximum output power channel was lower than 0.8 W/kg.

*2. The SAR test was also applied to the OFDM operation mode on a highest measured output power channel even if SAR of DSSS was lower than 0.8 W/kg.

***. EUT (ES200) has two kinds of power level which specified as "Normal power" mode and "Low power" mode. The power of "Low power" mode is lower than "Normal power" mode for all Tx conditions.**

***. Since "Low power mode" is selected by firmware in this platform, the EUT cannot output power level of "Normal power" mode.**

6.2 Comparison of power of EMC sample (ES200 Low power mode)

	Platform#	Platform model No.	RF serial No.	Date power measured	Reference report#	Tx mode	Data rate [Mbps]	Time average power [dBm] ("*": Highest)					
								Max.	Typ.	Power setting	Frequency [MHz]		
											2412	2437	2462
EMC (Ref.)	-	-	2	July 10, 2015	10840757S-G	11b	1	11.5	10	10 (Low)	**10.65***	10.55	10.47
SAR test	Platform (7)	PC2329	A408EA544874	July 7, 2016	11359370S-A	11b	1	11.5	10	10 (Low)	**10.71***	10.38	10.36
SAR test	Platform (8)	PC2276	A408EA540865	July 7, 2016	11628244S-A	11b	1	11.5	10	10 (Low)	**10.25***	10.08	10.03

SECTION 7: SAR Measurement results

Measurement date: March 9, 2017 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	50.68	-3.9	-5% ≤ εr-meas. ≤ 0%	1.914	1.982	+3.6	0% ≤ σ-meas. ≤ +5%	22.4	152	+2.63	not required.	March 9, 2017, before SAR test
2437		52.72	5059	-4.0		1.938	2.012	+3.9				+2.77	not required.	
2462		52.68	5050	-4.2		1.967	2.041	+3.7				+2.72	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 average power correction			SAR Corrected (*d)	
			Position	Gap [mm]	Bty. ID	LCD position	Max.value of multi-peak				Duty [%]	Duty scaled	Meas. [dBm].	Max. [dBm]	Tune-up factor		
							Meas.	ΔSAR [%]	ΔSAR corrected								
11b	2412(1)	1	Left	0	#1	n/a (fix)	0.701	+2.63	n/a (*c)	Plot 2	99.9	×1.00	10.65	11.5	×1.22	0.855	-
	2437(6)			0	#1	n/a (fix)	0.664	+2.77	n/a (*c)	Plot 3	99.9	×1.00	10.55	11.5	×1.24	0.823	-
	2462(11)			0	#1	n/a (fix)	0.689	+2.72	n/a (*c)	Plot 1	99.9	×1.00	10.47	11.5	×1.27	0.875	Higher.
	2412(1)		Rear (LCD)	0	#2	n/a (fix)	0.028	+2.72	n/a (*c)	Plot 4	99.9	×1.00	10.65	11.5	×1.22	0.034	-
			Bottom	0	#2	n/a (fix)	0.096	+2.72	n/a (*c)	Plot 5	99.9	×1.00	10.65	11.5	×1.22	0.117	-
			Left-front-tilt	0	#2	n/a (fix)	0.291	+2.72	n/a (*c)	Plot 6	99.9	×1.00	10.65	11.5	×1.22	0.359	-
			Front	0	#2	n/a (fix)	0.00783	+2.72	n/a (*c)	Plot 7	99.9	×1.00	10.65	11.5	×1.22	0.010	-
11g	2412(1)	6	Left	0	#1	n/a (fix)	0.422	+2.63	n/a (*c)	Plot 8	99.4	×1.01	8.66	9.5	×1.21	0.547	*. lower power than 11b.
n(20HT)		MCS0		0	#1	n/a (fix)	0.353	+2.63	n/a (*c)	Plot 9	99.4	×1.01	7.55	8.5	×1.24	0.442	

Notes:

*. Gap: It is the separation distance between the nearest position of platform outer surface and the bottom outer surface of phantom;
Bty.ID: Battery ID (*. Battery ID No.#1 and #2 are same. Refer to Appendix 1 for more detail.); Max.: maximum, Meas.: Measured; n/a: not applied.

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