SAR TEST REPORT

Test Report No.: 10840760S-A

Applicant : **Canon Inc.**

Type of Equipment : **Wireless Module**

Model No. : **ES200** (*. It was installed into ES200's platform (3).)

FCC ID : **AZD230**

Test Standard : **FCC 47CFR §2.1093**

Test Result : **Complied**

Highest Reported SAR(1g)		Platform No.	Platform type	Platform model	Remarks				
Tune-up value	(Measured)				Band	Frequency	Mode	Output power	Report No.
0.60 W/kg	0.508 W/kg	#3	Digital camera	DS126601	DTS	2437 MHz	11b(1Mbps,DSSS)	12.79 dBm (Ave.)	*. This report.
*. This Wireless Module had installed into the following platforms under 0.8W/kg of reported SAR(1g) (KDB447498 D01 (v06); multi-platform operation requirement).									
0.15 W/kg	0.123 W/kg	#1	Digital camera	DS126621	DTS	2437 MHz	11b(1Mbps,DSSS)	12.79 dBm (Ave.)	10840761S-A
< 0.10 W/kg	0.056 W/kg	#2	Digital camera	DS126591	DTS	2462 MHz	11b(1Mbps,DSSS)	12.62 dBm (Ave.)	10840759S-A

*. **Highest reported SAR (1g) across all exposure conditions and on the platforms = " 0.60 W/kg" = grant listed.**

*. Since highest reported SAR (1g): <0.10 W/kg on a platform of ES200 (EUT) which obtained in accordance with KDB447498 (v06) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform (which were tested in above.).

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Date of test: April 21, 2016

Test engineer: H. Naka

Hiroshi Naka
Engineer, Consumer Technology Division

Approved by: T. Imamura

Toyokazu Imamura
Leader, Consumer Technology Division

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

ilac-MRA LAB JAB Testing RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	10840760S-A	May 10, 2016	-	-
-r01	10840760S-A	May 12, 2016	p1,2	(p1) Error correction.
-r02	10840760S-A	May 24, 2016	p1,2,21	(p21) Error correction.
-r03	10840760S-A	May 25, 2016	p1,2,5	(p5) 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
Telephone Number	+81-3-3757-6218
Facsimile Number	+81-3-3757-8431
Contact Person	Takato Matsuura

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

	EUT	Platform
Type of Equipment	Wireless Module	Platform (3): Digital camera
Model Number	ES200	DS126601
Serial Number	2	526
Condition of EUT	Engineering prototype	Engineering prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	April 19, 2016 (*. 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	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 (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		
Q'ty of Antenna	1 pc.		
Antenna / Connector type	Pattern antenna / No connector (Printed on the PCB).		
Antenna gain (peak)	2.14 dBi		
Transmit power and tolerance (Manufacture variation)	11b: 12 dBm +1.5/-1.5 dB	11g: 12 dBm +1.5/-1.5 dB	11n(20HT): 11 dBm +1.5/-1.5 dB
	*. 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: 13.5 dBm**	**11g: 13.5 dBm**	**11n(20HT): 12.5 dBm**
	*. Refer to clause 2.4 for more detail.		
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."

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	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2417	2	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2422	3	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2427	4	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2432	5	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2437	6	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2442	7	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2447	8	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2452	9	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2457	10	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2462	11	12	12	12	12	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-

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	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2417	2	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2422	3	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2427	4	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2432	5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2437	6	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2442	7	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2447	8	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2452	9	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2457	10	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
2462	11	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-

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 (3)
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)	**0.60 W/kg**
Measured SAR value	0.508 W/kg
Operation mode, channel	802.11b, 1 Mbps (DBPSK/DSSS), 2437 MHz (6ch)
Power measured/max. (scaled factor)	12.79 dBm/13 dBm (×1.18)
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 (3), 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: **The highest reported SAR (1g) of this platform (3) was kept; ≤ 0.8 W/kg.**
Since highest reported SAR (1g) on this EUT's platform obtained in accordance with KDB447498 D01 (v06) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform.

3.4 Test Location

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

UL Japan, Inc., Shonan EMC Lab.
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
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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
Top	When test is required, the middle portion of top on a camera is touched to the Flat phantom.	**2.5**	**Tested**	Body-touch
Top-front	When test is required, the front portion of top on a camera is touched to the Flat phantom.	**≈3**	**Tested**	
Top-left-front	When test is required, the left-front portion of top on a camera is touched to the Flat phantom with tilted in right.	**≈3**	**Tested**	
Top-front-left	When test is required, the front portion of top on a camera is touched to the Flat phantom with tilted in right.	**≈3**	**Tested**	
Top-right	When test is required, the right portion of top on a camera is touched to the Flat phantom with tilted in left.	**≈25**	**Tested**	
Front-top	When test is required, the top portion of front side (Lens mount) on a camera is touched to the Flat phantom.	**≈20**	**Tested**	
Rear	When test is required, the rear side (LCD) of a camera is touched to the Flat phantom.	**≈40**	**Tested**	
Left	When test is required, the left surface on a camera is touched to the Flat phantom.	**≈49**	*Reduced*	
Bottom	When test is required, the bottom surface on a camera is touched to the Flat phantom.	**≈110**	*Reduced*	
Right	When test is required, the right surface on a camera is touched to the Flat phantom.	**≈100**	*Reduced*	
Rear	When test is required, the rear side (LCD) of a camera is touched to the Flat phantom.	**≈40**	*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: 150.7 mm (width) × 116.4 mm (height) × 75.9 mm (depth) (.The lens unit is detached. 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 [mm]	Minimum distance [mm] (rounded)	Upper frequency [GHz]	Maximum tune-up power [dBm]	Maximum tune-up power [mW]	Maximum tune-up power [mW] (rounded)	Calculation of exclusion: ≤ 3.0 (*2)	Standalone SAR test Required?		Remarks
WLAN2.4GHz (b,g)	Top	2.5	≤ 5	2.462	13.50	22.39	**22**	**6.9**	**>3.0**	**Tested**	-
	Top-front	≈3	≤ 5	2.462	13.50	22.39	**22**	**6.9**	**>3.0**	**Tested**	-
	Top-left-front	≈3	≤ 5	2.462	13.50	22.39	**22**	**6.9**	**>3.0**	**Tested**	-
	Top-front-left	≈3	≤ 5	2.462	13.50	22.39	**22**	**6.9**	**>3.0**	**Tested**	-
	Front-top	≈20	20	2.462	13.50	22.39	**22**	**1.7**	<3.0	*Reduced*	*.SAR test was applied. (*4)
	Top-right	≈25	25	2.462	13.50	22.39	**22**	**1.4**	<3.0	*Reduced*	*.SAR test was applied. (*4)
	Rear	≈40	40	2.462	13.50	22.39	**22**	**0.9**	<3.0	*Reduced*	*.SAR test was applied. (*4)
	Left	≈49	49	2.462	13.50	22.39	**22**	**0.7**	<3.0	*Reduced*	-

Consideration of SAR test reduction by the antenna separation distance (100MHz~6GHz, >50mm)

Band, Mode	Position	Minimum distance [mm]	Minimum distance [mm] (rounded)	Upper frequency [GHz]	Maximum tune-up power [dBm]	Maximum tune-up power [mW]	Maximum tune-up power [mW] (rounded)	Calculation of test exclusion thresholds [mW] (*3)	Standalone SAR test	Remarks
WLAN2.4GHz (b,g)	Right	≈100	111	2.462	13.50	22.39	**22**	**596**	Reduced	-
	Bottom	≈110	101	2.462	13.50	22.39	**22**	**706**	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, these setup conditions are considered body-touch SAR and are applied the SAR test in body-liquid., because the antenna separation distance is small.

<Conclusion for consideration for SAR test reduction>

1) **The SAR setups for the near antenna which includes Top, Top-front, Top-left-front, Top-front-left, Front-top and Rear are considered body-touch SAR and are applied the SAR test in body-liquid.**
2) **The SAR tests for Left, Bottom and Right setup are reduced because there is enough antenna separation distance.**
3) **Since the Rear (LCD) setup condition has enough antenna separation distance and has small SAR value (in body liquid), 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 search of DSSS mode; Determine the highest reported SAR(1g) of DSSS mode. (*. Change the channel, if it is necessary.)
Step 2	Check SAR of OFDM mode; Check the SAR of OFDM mode at the worst SAR condition of DSSS mode in above step1.

*. 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, *2)	2437 MHz	2437 MHz
	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	default: 11
Power setting (SAR)		default: 12	default: 12	default: 11

*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.

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			PAR	Power tolerance & correction			SAR Tested/ Reduced	Remarks (ES200 serial number: 2)	Power Tune-up?
							Result		ΔRef.		Target & (+)tolerance	Deviation from max	Tune-up factor			
	[MHz]	[Mbps]	[dBm]	[%]	[dB]	[-]	[dBm]	[mW]	[dB]	[dB]	[dBm]	(-2≤x<0)[dB]	[-]			
11b	2412	**1**	12	99.9	0.00	×1.00	**12.83**	19.19	0.04	2.6	12.0 +1.5	-0.67	×1.17	**Tested**	-	default
	2412	2	12	99.9	0.01	×1.00	12.82	19.14	-	2.6	12.0 +1.5	-0.68	×1.17	-	-	default
	2412	5.5	12	99.5	0.02	×1.00	12.62	18.28	-	2.5	12.0 +1.5	-0.88	×1.22	-	-	default
	2412	11	12	99.1	0.04	×1.01	12.70	18.62	-	2.6	12.0 +1.5	-0.80	×1.20	-	-	default
	2437	**1**	12	99.9	0.00	×1.00	**12.79**	19.01	Ref.b	2.6	12.0 +1.5	-0.71	×1.18	**Tested**	-	default
	2462	**1**	12	99.9	0.00	×1.00	**12.62**	18.28	-0.17	2.5	12.0 +1.5	-0.88	×1.22	**Tested**	-	default
11g	2412	**6**	12	99.4	0.02	×1.00	**12.63**	18.32	0.10	10.1	12.0 +1.5	-0.87	×1.22	-	-	default
	2412	9	12	99.2	0.04	×1.01	12.63	18.32	-	9.5	12.0 +1.5	-0.87	×1.22	-	-	default
	2412	12	12	98.9	0.05	×1.01	12.57	18.07	-	9.4	12.0 +1.5	-0.93	×1.24	-	-	default
	2412	18	12	98.3	0.07	×1.02	12.61	18.24	-	9.4	12.0 +1.5	-0.89	×1.23	-	-	default
	2412	24	12	97.8	0.10	×1.02	12.57	18.07	-	10.0	12.0 +1.5	-0.93	×1.24	-	-	default
	2412	36	12	96.8	0.14	×1.03	12.50	17.78	-	9.9	12.0 +1.5	-1.00	×1.26	-	-	default
	2412	48	12	95.8	0.19	×1.04	12.39	17.34	-	10.1	12.0 +1.5	-1.11	×1.29	-	-	default
	2412	56	12	95.6	0.20	×1.05	12.60	18.20	-	9.8	12.0 +1.5	-0.90	×1.23	-	-	default
	2437	**6**	12	99.4	0.02	×1.00	**12.53**	17.91	Ref.g	10.2	12.0 +1.5	-0.97	×1.25	**Tested**	-	default
	2462	**6**	12	99.4	0.02	×1.00	**12.37**	17.26	-0.16	10.1	12.0 +1.5	-1.13	×1.30	-	-	default
11n (20HT)	2412	**MCS0**	11	99.4	0.03	×1.01	**11.73**	14.89	0.06	9.9	11.0 +1.5	-0.77	×1.19	-	-	default
	2412	MCS1	11	98.9	0.05	×1.01	11.69	14.76	-	9.9	11.0 +1.5	-0.81	×1.21	-	-	default
	2412	MCS2	11	98.4	0.07	×1.02	11.65	14.62	-	9.7	11.0 +1.5	-0.85	×1.22	-	-	default
	2412	MCS3	11	97.8	0.10	×1.02	11.60	14.45	-	9.0	11.0 +1.5	-0.90	×1.23	-	-	default
	2412	MCS4	11	96.7	0.15	×1.04	11.46	14.00	-	9.8	11.0 +1.5	-1.04	×1.27	-	-	default
	2412	MCS5	11	95.6	0.19	×1.04	11.52	14.19	-	9.6	11.0 +1.5	-0.98	×1.25	-	-	default
	2412	MCS6	11	95.3	0.21	×1.05	11.55	14.29	-	10.0	11.0 +1.5	-0.95	×1.24	-	-	default
	2412	MCS7	11	95.3	0.21	×1.05	11.47	14.03	-	9.9	11.0 +1.5	-1.03	×1.27	-	-	default
	2437	**MCS0**	11	99.4	0.03	×1.01	**11.67**	14.69	Ref.n20	9.9	11.0 +1.5	-0.83	×1.21	**Tested**	-	default
	2462	**MCS0**	11	99.4	0.03	×1.01	**11.57**	14.35	-0.10	9.9	11.0 +1.5	-0.93	×1.24	-	-	default

*. : 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, Ref: Reference.
*. Calculating formula: 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.
*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 0.76 dB(Average)/(±) 0.79 dB(Peak)

SECTION 7: SAR Measurement results

Measurement date: April 21, 2016 Measurement by: Hiroshi Naka

[Liquid measurement]

Target Frequency [MHz]	Liquid type	Liquid parameters (*a)										ΔSAR Coefficients(*c)		Date measured
		Permittivity (εr) [-]				Conductivity [S/m]				Temp. [deg.C.]	Depth [mm]	ΔSAR (1g) [%]	Correction required?	
		Target	Measured		Limit (*b)	Target	Measured		Limit (*b)					
			Meas.	Δεr [%]			Meas.	Δσ [%]						
2412	Body	*52.75*	50.78	-3.7	-5% ≤ εr-meas. ≤ 0%	*1.914*	1.948	+1.8	0% ≤ σ-meas. ≤ +5%	22.5	155	+1.71	not required.	April 21, 2016, before SAR test
2437		*52.72*	50.61	-4.0		*1.938*	1.983	+2.4				+2.04	not required.	
2462		*52.68*	50.57	-4.0		*1.967*	2.016	+2.5				+2.10	not required.	

[SAR measurement results]

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

SAR measurement results													Reported SAR (1g) [W/kg]							Remarks
Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup				Power drift [dB]	SAR (1g) [W/kg] Max.value of multi-peak			SAR plot # in Appendix 2-2		Duty cycle correction		Output average power correction			SAR Corrected (*d)	
			Position	Gap [mm]	Bty. ID	LCD position		Meas.	ΔSAR [%]	ΔSAR corrected			Duty [%]	Duty scaled	Meas. [dBm].	Max. [dBm]	Tune-up factor		
Step 1: Worst SAR search of DSSS mode.																				
11b	2412(1)	1	Top	0	#15	fix	-0.06	**0.470**	+1.71	n/a (*c)	Plot 1-2		99.9	×1.00	12.83	13.5	×1.17	**0.550**	-
	2437(6)			0	#15	fix	0.01	**0.508**	+2.04	n/a (*c)	**Plot 1-1**		99.9	×1.00	12.79	13.5	×1.18	**0.599**	Highest
	2462(11)			0	#15	fix	-0.01	**0.438**	+2.10	n/a (*c)	Plot 1-3		99.9	×1.00	12.62	13.5	×1.22	**0.534**	-
	2437(6)		Top-front	0	#15	fix	-0.07	**0.312**	+2.04	n/a (*c)	Plot 1-4		99.9	×1.00	12.79	13.5	×1.18	**0.368**	-
			Top-left-front	0	#23	fix	-0.02	**0.382**	+2.04	n/a (*c)	Plot 1-5		99.9	×1.00	12.79	13.5	×1.18	**0.451**	-
			Top-front-left	0	#15	fix	0.01	**0.438**	+2.04	n/a (*c)	Plot 1-6		99.9	×1.00	12.79	13.5	×1.18	**0.517**	-
			Top-right	0	#15	fix	-0.07	**0.109**	+2.04	n/a (*c)	Plot 1-7		99.9	×1.00	12.79	13.5	×1.18	**0.129**	-
			Front-top	0	#23	fix	-0.10	0.047	+2.04	n/a (*c)	Plot 1-8		99.9	×1.00	12.79	13.5	×1.18	**0.056**	-
			Rear	0	#23	fix	-0.20	1.02E-4	+2.04	n/a (*c)	Plot 1-9		99.9	×1.00	12.79	13.5	×1.18	**0.0001**	-
Step 2: OFDM mode																				
11g	2437(6)	6	Top	0	#15	fix	0.04	**0.469**	+2.04	n/a (*c)	Plot 2-1		99.4	×1.00	12.53	13.5	×1.25	**0.585**	-
11n (20HT)	2437(6)	MCS0		0	#15	fix	0.08	**0.368**	+2.04	n/a (*c)	Plot 2-2		99.4	×1.01	11.67	12.5	×1.21	**0.445**	-

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.15 and #23 are same. Refer to Appendix 1 for more detail.
*. During test, the EUT was operated with full charged battery and without all interface cables.
*. Calibration frequency of the SAR measurement probe (and used conversion factors)

SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
2412, 2437, 2462 MHz	2450MHz	within ±50MHz of calibration frequency	7.17	±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))

(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.