SAR TEST REPORT

Test Report No.: 10407964S-A

Applicant : **Canon Inc.**

Type of Equipment : **Wireless Module**

Model No. : **WM227** (*. Installed into the WM227's platform (1))

FCC ID : **AZD227**

Test Standard : **FCC 47CFR §2.1093**

Test Result : **Complied**

Highest Reported SAR(1g) Value	Platform #	Platform type	Platform model	Remarks
0.59 W/kg (*1)	Platform(1)	Digital camera	PC2241	(DTS) 2437MHz, IEEE 802.11b (1Mbps, DBPSK/DSSS) *1. This had a highest measured SAR(1g) value: 0.512 W/kg (output power: 13.35dBm).

*. **The highest reported SAR (1g) value for body-touch condition is "0.59 W/kg" = grant listing.**
*. Since highest reported SAR (1g): 0.59 W/kg on this platforms with WM227 (EUT) which obtained in accordance with KDB447498 (v05) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform.

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Date of test: July 24 and August 8, 2014

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".

JAB Testing RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	10407964S-A	August 28, 2014	-	-

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

CONTENTS PAGE

REVISION HISTORY 2
CONTENTS 2
SECTION 1: Customer information 3
SECTION 2: Equipment under test (EUT) 3
2.1 Identification of EUT 3
2.2 Product Description 3
2.3 Tx output power specification (antenna port terminal conducted) 4
2.4 Maximum output power which may possible 4
SECTION 3: Test specification, procedures and results 5
3.1 Test specification 5
3.2 Exposure limit 5
3.3 Procedure and result 5
3.4 Test location 5
3.5 Confirmation before SAR testing 6
3.6 Confirmation after SAR testing 6
3.7 Test setup of EUT and SAR measurement procedure 7
SECTION 4: Operation of EUT during testing 8
SECTION 5: Uncertainty assessment (SAR measurement) 8
SECTION 6: Confirmation before testing 9
6.1 SAR reference power measurement (antenna terminal conducted average power of EUT) 9
6.2 Comparison of power of EMC sample 9
SECTION 7: Measurement results 10
7.1 SAR test results of platform (1) 10

Contents of appendixes

APPENDIX 1: Photographs of test setup 11
Appendix 1-1 Photograph of Platform (1) and antenna position 11
Appendix 1-2 EUT and support equipment 12
Appendix 1-3 Photograph of test setup / Platform (1) 13
APPENDIX 2: SAR Measurement data 15
Appendix 2-1 Evaluation procedure 15
Appendix 2-2 SAR measurement data 16
APPENDIX 3: Test instruments 21
Appendix 3-1 Equipment used 21
Appendix 3-2 Configuration and peripherals 22
Appendix 3-3 Test system specification 23
Appendix 3-4 Simulated tissues composition and parameter confirmation 24
Appendix 3-5 System check results 24
Appendix 3-6 System check measurement data 25
Appendix 3-7 System check uncertainty 25
Appendix 3-8 Calibration certificate: E-Field Probe (EX3DV4) 26
Appendix 3-9 Calibration certificate: Dipole (D2450V2) 37

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	+81-3-5482-8070
Facsimile Number	+81-3-3757-8431
Contact Person	Hironobu Saida

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of Equipment	Wireless Module	*. The EUT was installed into the platform(1): digital camera
Model Number	WM227	*. Platform(1) model: PC2241
Serial Number	F48139F1C42D	*. Platform(1) serial number: 48
Condition of EUT	WM227: Engineering prototype	*. Platform(1): Engineering prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	June 30, 2014 (*. EUT for power measurement.) *. No modification by the Lab. August 6, 2014(*. 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(1)-digital camera (model: PC2241) from the beginning. After power measurement, the EUT was returned to the customer, and the RF wiring was changed to the original antenna line form the antenna conducted power measurement line of the SAR test. The EUT was installed into a platform(1) which SAR tested, by the customer.)	
Country of Mass-production	WM227: Philippines	(*. Platform(1): Japan, China)
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.	
SAR Accessory	None	

2.2 Product Description (Wireless module: WM227)

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.)		
Operation temperature range	-20 to +85 deg.C.		

*. 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 (v05r02): General RF exposure guidance
KDB 248227 D01 (v01r02): SAR Measurement Procedures for 802.11a/b/g Transmitters
KDB 865664 D01 (v01r03): SAR measurement 100MHz to 6GHz
IEEE Std. 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
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.
(*. The reference for Uncertainty in SAR correction for deviations in permittivity and conductivity, in clause E.3.2.)

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(1) (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)	**0.59 W/kg**
Measured SAR value	0.512 W/kg
Operation mode, channel	11b, 1Mbps, 2437MHz (6ch)
Power measured/max. (scaled factor)	13.35 dBm/14dBm (×1.16)

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 2 in KDB447498 D01 (v05).

Consideration of the test results: **The highest reported SAR (1g) of Platform (1) was kept; ≤ 0.8 W/kg.**
Since highest reported SAR (1g) on this EUT's platform obtained in accordance with KDB447498 (v05) was kept under 0.8 W/kg, this EUT was approved to operate multi-platform.

3.4 Test Location

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

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1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
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(v05))

Step.1 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 low/middle/high 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

Step.2 Consideration of SAR test channel

The following operation mode, data rate and channels were determined to apply SAR test by SAR reference power measured.

Mode	MHz	Channel	default	SAR Tested/Reduced			Remarks
			11b/g/n(20HT)	11b	11g	11n(20HT)	
802.11 b/g/n	2412	1 (*1)	√	Reduced (*4)	Reduced (*2)	Reduced (*2)	SAR test were applied to 11b mode, in lowest data rate. (*3)
	2422	3					
	2437	6	√	**Tested**	Reduced (*2)	Reduced (*2)	
	2452	9					
	2462	11 (*1)	√	Reduced (*4)	Reduced (*2)	Reduced (*2)	

√ = "default test channels of requested by KDB248227"

*1. Any output power reducing for channel 1 and 11 to meet restricted band requirements was not observed. Therefore channel 1 and 11 was selected for the default channels of power measurement and SAR test plan.

*2. (KDB248227) Since the average power of 11g and 11n(20HT) were less than 0.25dB higher than the corresponded 11b power, SAR test was only considered to apply 11b mode. (Refer to Section 6.)

*3. (KDB248227) In 11b mode, since the average power of higher data rate were less than 0.25dB higher than the lowest data rate, SAR test were only applied to the lowest data rate. (Refer to Section 6.)

*4. (KDB248227) During SAR test, since the extrapolated maximum peak SAR for the maximum output channel was ≤1.6W/kg and the 1g averaged SAR was ≤0.8W/kg, the testing for other channels were omitted.

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

After considering the outline of EUT, the SAR test was carried out on the following setup conditions.

Setup	Explanation of EUT setup position (*. Refer to Appendix 1 for test setup photographs.)	Antenna distance [mm]	(*1) SAR Tested /Reduced	SAR type
Top	The top surface of platform (digital camera) was touched to the Flat phantom.	**3.65**	**Tested**	Body (touch)
Rear-top(tilt)	The back part on the top side of a platform (digital camera) was touched to the Flat phantom.	**5.5**	**Tested**	
Front-top(tilt)	The front part on the top side of a platform (digital camera) was touched to the Flat phantom.	**9.2**	**Tested**	
Rear(LCD)	The rear side (LCD) of platform (digital camera) was touched to the Flat phantom.	**8.04**	**Tested**	
Front(Lens)	The front side (Lens) of a platform (digital camera) was touched to the Flat phantom.	**14.5**	**Tested** (*2)	
Right-hand	The right-hand surface of platform (digital camera) was touched to the Flat phantom.	**65.26**	**Tested** (*2)	
Left-hand	The left-hand surface of platform (digital camera) was touched to the Flat phantom.	**38.44**	**Tested** (*2)	
Bottom	The bottom flat surface of platform (digital camera) was touched to the Flat phantom.	**56.9**	**Tested** (*2)	

*. **Antenna distance**: this means the distance from the EUT antenna inside a platform to the outer surface of platform which an operator may touch.
*. **Size of EUT(WM227): 22.5mm (width) × 11.5mm (depth) × 2.05mm max (thickness)**
. Size of platform: 103.8mm (width) ×26.0mm (depth) ×61.0mm (height) (. This size is when the lens is in closed position. The convex portion is not contained in size.)

***1. SAR test reduction consideration**

KDB 447498 D01 (v05) was taken into consideration as other approaches to reduce SAR test..
<Standalone SAR estimation>

Mode	Position	Minimum distance	Upper frequency	Max. power (including tune-up tolerance)	Estimate SAR(1g)	Remarks
11b	Top	3.65 [mm]	2.462 [GHz]	14 [dBm] (-> 25 [mW])	1.43 [W/kg]	>0.4W/kg, SAR test is required.

Calculating formula: Estimate standalone SAR(1g) = [(max.power, mW) / (min.test separation distance, mm)] × [√f(GHz)] / [7.5]

Parenthesis 1), Clause 4.3.1, KDB 447498 D01 (v05) 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))
Parenthesis 2), Clause 4.3.1, KDB 447498 D01 (v05) 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))
According to this formula, the calculated results in typical antenna distance of platform are shown in the following table.

SAR(1g) test exclusion thresholds [mW]				EUT's maximum power [mW] (including tune-up tolerance)
Upper frequency in band [GHz]	Antenna separation distance [mm]			
	5	13	14	
2.462	**10** (10.00dBm)	**25** (13.98dBm)	**27** (14.31dBm)	**25 (14.00dBm)**

*. The measured average power of EUT was shown in Section 6: Confirmation before SAR testing.

***. SAR test may reduce where the antenna distance is equal to or more than 14mmm.**

***2. Although SAR(1g) test exclusion threshold power of this surface was satisfied, since the platform was small at the compact digital camera, the SAR test was carried out in all setup surfaces.**

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

Step 1	Change the setup positions by 11b mode with highest output power 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		
SAR tested/reduced?		Tested	Reduced (*1)	Reduced (*1)
Tested condition	Frequency	2437MHz (*2)	-	-
	Modulation	DBPSK/DSSS	-	-
	Data rate	1Mbps (*3)	-	-
	Duty cycle	100% duty cycle	-	-
Controlled software		"RF TEST" mode. (*. Power setting (for power measurement and SAR test (11b alone)): 13 (11b) / 13 (11g) / 13(11n(20HT)		

*1. Since the average power of 11g and 11n(20HT) were less than 0.25dB higher than the corresponded 11b power, SAR test was only considered to apply 11b mode. (KDB248227)
*2. SAR test was only applied to a highest output channels of 11b mode, because the reported SAR (1g) value of highest output power channel was small enough to 0.8W/kg and the peak-SAR was small enough to 1.6W/kg. (KDB248227)
*3. Since the average powers of higher data rate were less than 0.25dB higher than the lowest data rate, SAR test was only applied to the lowest data rate. (KDB248227)

SECTION 5: Uncertainty Assessment (SAR measurement)

Uncertainty of SAR measurement (2.4-6GHz) (*.ε&σ: ≤ ± 5%, DAK3.5, Tx: ≈100% duty cycle) (v08)	1g SAR	10g SAR
Combined measurement uncertainty of the measurement system (k=1)	± 13.7%	± 13.6%
Expanded uncertainty (k=2)	± 27.4%	± 27.2%

	Error Description (2.4-6GHz) (v08)	Uncertainty Value	Probability distribution	Divisor	ci (1g)	ci (10g)	ui (1g) (std. uncertainty)	ui (10g) (std. uncertainty)	Vi, veff
A	**Measurement System** (DASY5)								
1	Probe Calibration Error	±6.55 %	Normal	1	1	1	±6.55 %	±6.55 %	∞
2	Axial isotropy Error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy Error	±9.6 %	Rectangular	√3	√0.5	√0.5	±3.9 %	±3.9 %	∞
4	Linearity Error	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
5	Probe modulation response	±2.4 %	Rectangular	√3	1	1	±1.4 %	±1.4 %	∞
6	Sensitivity Error (detection limit)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
7	Boundary effects Error	±4.3%	Rectangular	√3	1	1	±2.5 %	±2.5 %	∞
8	Readout Electronics Error(DAE)	±0.3 %	Rectangular	√3	1	1	±0.3 %	±0.3 %	∞
9	Response Time Error	±0.8 %	Normal	1	1	1	±0.8 %	±0.8 %	∞
10	Integration Time Error (≈100% duty cycle)	±0 %	Rectangular	√3	1	1	0 %	0 %	∞
11	RF ambient conditions-noise	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9 %	±1.9 %	∞
14	Probe Positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9 %	±3.9 %	∞
15	Max. SAR evaluation (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	∞
B	**Test Sample Related**								
16	Device Holder or Positioner Tolerance	±3.6 %	Normal	1	1	1	±3.6 %	±3.6 %	5
17	Test Sample Positioning Error	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	145
18	Power scaling	±0%	Rectangular	√3	1	1	±0 %	±0 %	∞
19	Drift of output power (measured, <0.2dB)	±2.3%	Rectangular	√3	1	1	±2.9 %	±2.9 %	∞
C	**Phantom and Setup**								
20	Phantom uncertainty (shape, thickness tolerances)	±7.5 %	Rectangular	√3	1	1	±4.3 %	±4.3 %	∞
21	Algorithm for correcting SAR (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 SAR Measurement 100 MHz to 6 GHz v01r01 Section 2.8.1., when the highest measured SAR(1g) within a frequency band is < 1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std.1528 (2013) is not required in SAR reports submitted for equipment approval.

SECTION 6: Confirmation before testing

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

Mode	Frequency [MHz]	Data rate [Mbps]	Cable Loss [dB]	Atten-uator [dB]	Duty factor [dB]	Average power			PAR [dB]	Power tolerance & correction				SAR Tested/ Reduced	Remarks
						P/M Reading [dBm]	Result [dBm]	Result [mW]		Target & (+)tolerance [dBm]	Deviation from max.. [dB]	Scaled Factor [-]	≤ 2 dB from max.?		
11b	2437	1	0.50	10.02	0.00	2.83	**13.35**	21.6	2.75	12.0 +2	-0.65	x1.16	Yes	**Tested**	Highest in Ch.(11b)
	2437	2	0.50	10.02	0.00	2.79	13.31	21.4	2.84	12.0 +2	-0.69	x1.17	Yes	-	-
	2437	5.5	0.50	10.02	0.00	2.87	**13.39**	21.8	2.19	12.0 +2	-0.61	x1.15	Yes	Reduced(*1)	Highest in D/R.(11b)
	2437	11	0.50	10.02	0.00	2.78	13.30	21.4	2.84	12.0 +2	-0.70	x1.17	Yes	-	-
	2412	**1**	0.50	10.02	0.00	2.79	**13.31**	21.4	2.86	12.0 +2	-0.69	x1.17	Yes	Reduced(*3)	-
	2462	**1**	0.50	10.02	0.00	2.78	**13.30**	21.4	2.80	12.0 +2	-0.70	x1.17	Yes	Reduced(*3)	-
11g	2437	6	0.50	10.02	0.00	2.14	**12.66**	18.5	9.14	12.0 +2	-1.34	x1.36	Yes	Reduced(*2)	Highest in Ch.(11g)
	2437	9	0.50	10.02	0.00	2.08	12.60	18.2	8.91	12.0 +2	-1.40	x1.38	Yes	-	-
	2437	12	0.50	10.02	0.00	2.11	12.63	18.3	9.10	12.0 +2	-1.37	x1.37	Yes	-	-
	2437	18	0.50	10.02	0.00	2.19	**12.71**	18.7	8.68	12.0 +2	-1.29	x1.35	Yes	Reduced(*1)	Highest in D/R.(11g)
	2437	24	0.50	10.02	0.00	2.01	12.53	17.9	9.61	12.0 +2	-1.47	x1.40	Yes	-	-
	2437	36	0.50	10.02	0.00	2.12	12.64	18.4	9.19	12.0 +2	-1.36	x1.37	Yes	-	-
	2437	48	0.50	10.02	0.00	2.03	12.55	18.0	10.42	12.0 +2	-1.45	x1.40	Yes	-	-
	2437	56	0.50	10.02	0.00	1.97	12.49	17.7	10.16	12.0 +2	-1.51	x1.42	Yes	-	-
	2412	**6**	0.50	10.02	0.00	2.08	**12.60**	18.2	9.21	12.0 +2	-1.40	x1.38	Yes	Reduced(*2)	-
	2462	**6**	0.50	10.02	0.00	2.12	**12.64**	18.4	9.70	12.0 +2	-1.36	x1.37	Yes	Reduced(*2)	-
11n (20HT)	2437	MCS0	0.50	10.02	0.00	2.33	**12.85**	19.3	8.90	12.0 +2	-1.15	x1.30	Yes	Reduced(*2)	Highest in D/R&Ch.(n20)
	2437	MCS1	0.50	10.02	0.00	2.28	12.80	19.1	8.82	12.0 +2	-1.20	x1.32	Yes	-	-
	2437	MCS2	0.50	10.02	0.00	2.24	12.76	18.9	9.68	12.0 +2	-1.24	x1.33	Yes	-	-
	2437	MCS3	0.50	10.02	0.00	2.30	12.82	19.1	9.19	12.0 +2	-1.18	x1.31	Yes	-	-
	2437	MCS4	0.50	10.02	0.00	2.30	12.82	19.1	8.85	12.0 +2	-1.18	x1.31	Yes	-	-
	2437	MCS5	0.50	10.02	0.00	2.14	12.66	18.5	9.84	12.0 +2	-1.34	x1.36	Yes	-	-
	2437	MCS6	0.50	10.02	0.00	2.12	12.64	18.4	10.42	12.0 +2	-1.36	x1.37	Yes	-	-
	2437	MCS7	0.50	10.02	0.00	2.10	12.62	18.3	10.17	12.0 +2	-1.38	x1.37	Yes	-	-
	2412	**MCS0**	0.50	10.02	0.00	2.27	**12.79**	19.0	8.83	12.0 +2	-1.21	x1.32	Yes	Reduced(*2)	-
	2462	**MCS0**	0.50	10.02	0.00	2.29	**12.81**	19.1	9.08	12.0 +2	-1.19	x1.32	Yes	Reduced(*2)	-

*. : SAR test was applied.

*1. (KDB248227) Since the average power of higher data rate was less than 0.25dB higher than lowest data rate, SAR test was considered at lowest data rate.
*2. (KDB248227) Since the average power of 11g and 11n(20HT) were less than 0.25dB higher than the corresponded 11b power, SAR test was only considered to apply 11b mode.
*3. (KDB248227) Since the extrapolated maximum peak SAR for the maximum output channel was ≤1.6W/kg and the 1g averaged SAR was ≤0.8W/kg, the testing for other channels were omitted.

*. Duty Factor: 0dB=100% duty cycle, P/M: Power Meter, PAR: Peak average ratio ("Peak power"-"Average power", in dBm), Ch: channel, D/R: Data Rate.
*. Calculating formula: Results (Ave, dBm) = (P/M Reading)+(Cable loss)+(Attenuator)+(duty factor), where (duty factor, dBm)=10 × log (100/(duty cycle, %))
Deviation form max.: (Power deviation, dB) = (results power (average, dBm)) - (Max.-specification output power (average, dBm))
Scaled Factor: Power scaled factor for obtained SAR value, Scaled Factor [-] = 1 / (10 ^ ("Deviation from max." / 10))
*. SAR reference; Date measured July 24, 2014 / measured by: Tomochika Sato / 23deg.C./53%RH (at preparation room of No.7 shielded room)
*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB

6.2 Comparison of power of EMC sample

		EMC test	SAR test
		-	Platform (1)
Platform model No.		-	PC2241
Serial No.		F48139F1C 455	F48139F1C 42D
Date power measured		Aug. 19, 2014	July 24, 2014
Reference report#		10407961S-A	This report.
Tx operation mode		11b	11b
Data rate [Mbps]		1	1
Average power [dBm]	2412	**12.44**	**13.31**
	2437	**12.80**	**13.35***
	2462	**13.19***	**13.30**

*. Since the deviation of the maximum output average power between EMC ample and SAR sample was less than 0.5dB, it was judged that the EUT was equivalent.

SECTION 7: Measurement results

7.1 SAR test results of platform(1)-Digital camera (model: PC2241)

Measurement date: August 8, 2014 Measurement by: Hiroshi Naka

[Liquid measurement]

Target Frequency [MHz]	Liquid type	Liquid parameters (Body liquid) (*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						
2437	Body	*52.72*	51.21	-2.9%	-5% ≤ εr-meas. ≤ 0%	*1.938*	1.994	+2.9%	0% ≤ σ-meas. ≤ +5%	22.2	155	+2.04	not required.	August 8, 2014 before SAR test

[SAR measurement results (Partial-Body)]

SAR measurement results (Body simulated tissue)														Reported SAR (1g) [W/kg]			
Mode	[MHz] (CH)	Data rate	EUT setup conditions				Liquid temp. [deg.C.]	Power drift [dB]	SAR (1g) [W/kg]			SAR plot # in Appendix 2-2	Average power [dBm]	Max. power [dBm]	Scaled factor	Tuned-up SAR (*d)
			Setup	LCD position	Gap [mm]	Battery ID	Before/After		maximum value of multi-peak Measured	ΔSAR [%]	ΔSAR corrected					
11b (*2)	2437(6) (*1)	1Mbps, DBPSK /DSSS	Top	-(fixed type)	0	#3	22.1/22.1	-0.20	**0.512**	+2.04	n/a (*c)	Plot 1-1	13.35	14.0	×1.16	**0.59**
			Rear-top(tilt)	-(fixed type)	0	#1	22.1/22.1	-0.20	**0.222**	+2.04	n/a (*c)	Plot 1-2	13.35	14.0	×1.16	**0.26**
			Front-top(tilt)	-(fixed type)	0	#1	22.1/22.2	-0.20	**0.184**	+2.04	n/a (*c)	Plot 1-3	13.35	14.0	×1.16	**0.21**
			Rear (LCD)	-(fixed type)	0	#1	22.2/22.2	-0.06	**0.057**	+2.04	n/a (*c)	Plot 1-4	13.35	14.0	×1.16	**0.07**
			Front (Lens)	-(fixed type)	0	#2	22.2/22.2	-0.16	**0.119**	+2.04	n/a (*c)	Plot 1-5	13.35	14.0	×1.16	**0.14**
			Right-hand	-(fixed type)	0	#2	22.2/22.2	-0.20	**0.022**	+2.04	n/a (*c)	Plot 1-6	13.35	14.0	×1.16	**0.03**
			Left-hand	-(fixed type)	0	#2	22.2/22.3	-0.15	**0.050**	+2.04	n/a (*c)	Plot 1-7	13.35	14.0	×1.16	**0.06**
			Bottom	-(fixed type)	0	#3	22.3/22.3	-0.16	**0.036**	+2.04	n/a (*c)	Plot 1-8	13.35	14.0	×1.16	**0.04**

Notes:

*1. At the highest output power channel (2437MHz), since the extrapolated maximum peak SAR for the maximum output channel was ≤1.6W/kg and the 1g averaged SAR was ≤0.8W/kg, the testing for other channels were omitted. (KDB248227)

*2. Since the average power of 11g and 11n(20HT) were less than 0.25dB higher than the corresponded 11b power, SAR test was only applied 11b mode. (KDB248227)

*. Gap: It is the separation distance between the nearest position of platform outer surface and the bottom outer surface of phantom; n/a: not applied.

*. Battery No.#1, #2 and #3 were same model. Refer to Appendix 1 for more details.

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

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

SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
2437MHz	2450MHz	within ±50MHz of calibration frequency	7.73	±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, 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, 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. The coefficients are parameters defined in clause E.3.3.2, IEEE Std 1528(2013). Since the measured liquid parameters were ≤ the target εr and ≥ the target σ values and also within 5% of the required target dielectric parameters, the measured SAR was not compensated by ΔSAR coefficients (. Clause 2) of 2.6, KDB865664 D01).
ΔSAR(1g)= Cεr ×Δεr + Cσ ×Δσ, Cεr=-7.854E-4×f^3+9.402E-3×f^2-2.742E-2×f-0.2026 / Cσ =9.804E-3×f^3-8.661E-2×f^2+2.981E-2×f+0.7829

*d. Tuned-up SAR by scaled factor: Accordance with KDB 447498 D01; "When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance (clause 4, 4.1, 4))." (Refer to section 6 in this report for "Scaled factor" of channels, each operation mode.)

*. Calculating formula: ΔSAR corrected SAR (1g) (W/kg) = (Observed SAR(1g) (W/kg)) × (100 - (ΔSAR(%)) / 100
Reported SAR(1g) (=Tuned-up SAR) (W/kg) = (Observed SAR(1g) (W/kg)) × (Sacled factor)