SAR TEST REPORT

Test Report No.: 10941712S-A

Applicant : **CASIO COMPUTER CO., LTD.**

Type of Equipment : **RF Module**

Model No. : **WSD-F10** (*. It was installed into a specified WSD-F10's platform.)

FCC ID : **BBQ-WSDF10**

Test Standard : **FCC 47CFR §2.1093**

Test Result : **Complied**

RF Exposure Condition	SAR Value (W/kg)		Platform type	Platform model	Remarks
	Highest Reported	Limit			
Extremity (Wrist)	SAR(10g): < 0.10	4	wrist watch	smart watch: WSD-F10	(DTS) 2437 MHz, 11b(1Mbps,DSSS), Output power: 17.70 dBm.
Next-to-Mouth	SAR(1g): 0.17	1.6			(DTS) 2412 MHz, 11b(1Mbps,DSSS), Output power: 17.80 dBm.

***. The platform (smart watch) which has EUT built-in is a wristwatch and the voice command is supported.**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: December 7 and 8, 2015

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
JAB Testing RTL02610

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	10941712S-A	December 14, 2015	-	-
-r01	10941712S-A	January 14, 2016	p1,2,3,4,6,10	(p1,3,4,6,10) Comment of "the platform (smart watch) which has EUT built-in is a wristwatch and the voice command is supported" or related information were added.

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

CONTENTS PAGE

Contents of appendixes

SECTION 1: Customer information

Company Name	CASIO COMPUTER CO., LTD.
Address	2-1, Sakaecho 3-chome, Hamura-shi, Tokyo, 205-8555 Japan
Telephone Number	+81-42-579-7282
Facsimile Number	+81-42-579-7744
Contact Person	Hiroaki Suzuki

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

	EUT	Platform
Type of Equipment	RF Module	Platform: smart watch
Model Number	WSD-F10	WSD-F10
Serial Number	34	201A5XAM10000157
Condition of EUT	Production prototype	Production prototype
	(*. Not for sale: These samples are equivalent to mass-produced items.)	
Receipt Date of Sample	November 16, 2015 (*. EUT for power measurement.) *. No modification by the Lab. December 2, 2015 (*. 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 from the beginning. After power measurement, the EUT was returned to the customer, and the RF wiring was changed to the original antenna line from the antenna conducted power measurement line for SAR test. The EUT was installed into the platform which SAR tested, by the customer.)	
Country of Mass-production	Japan	Japan
Category Identified	Portable device (wristwatch)	
Rating	DC3.2 ~ 4.8V supplied form the platform *. During SAR test, the EUT was installed into the specified 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 RF Module which installs into the specified platform (smart watch). The smart watch supports the following operations and functions by using the voice command. • Creating memos, configuring reminder, alarm, and timer settings • Checking appointments • Responding to mail and SMS messages • Checking temperature, sports, movie, and other information • Looking up the meanings of words, translating terms • Converting between different units and currency units	
SAR Accessory	Removable wrist band: non-metallic.	

2.2 Product Description (RF Module)

Model number	WSD-F10					
Equipment type	Transceiver					
Operation type	**Wi-Fi**			**Bluetooth**		
Frequency of operation	2412-2462 MHz (11b, g, n(20HT))			2402-2480 MHz		
Channel spacing	5 MHz			1 MHz (BDR, EDR), 2MHz (LE)		
Bandwidth	20 MHz			79 MHz		
Type of modulation	DSSS(11b): CCK, DQPSK, DBPSK OFDM(11g, n(20HT)): 64QAM, 16QAM, QPSK, BPSK			FHSS: GFSK (*. EDR: GFSK + π/4-DQPSK, 8DPSK)		
Transmit power typical	11b: 16 dBm	11g: 12 dBm	11n(20HT): 11 dBm	BDR: -2 dBm	EDR: -6 dBm	LE: -2 dBm
Maximum output power which may possible	**11b: 19 dBm**	**11g: 15 dBm**	**11n(20HT): 14 dBm**	**BDR: 1 dBm**	**EDR: -3 dBm**	**LE: 1 dBm**
	*. The measured Tx output power (conducted) of Wi-Fi operation refers to section 6 in this report.			*. Since Bluetooth power was enough small, antenna conducted output power was not measured for the SAR test reference.		
Quantity of Antenna	1 pc. *. **No simultaneous transmission for Wi-Fi mode and Bluetooth mode.** Therefore, the SAR test was only applied to Wi-Fi mode operation. The SAR test was not applied to Bluetooth mode, because the output power was enough small (equal to or less than 1 mW).					
Antenna type / model number	Reverse L Type (Printed on the PCB) / Model: TX201 ANT-UNIT					
Antenna connector type	No connector (*. It was soldered on the WSD-F10's PCB directly.)					
Antenna gain (peak)	-6.55 dBi					
Power supply	DC3.2 ~ 4.8V (*. This power is 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."

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, Extremity (averaged over any 10g of tissue) limit: 4 W/kg (Wrist)
General population / uncontrolled exposure, Partial-Body (averaged over any 1g of tissue) limit: 1.6 W/kg (Next-to-Mouth)

***. The platform (smart watch) which has EUT built-in is a wristwatch and the voice command is supported.**

3.3 Procedures and Results

	Wi-Fi (DTS) / in Platform	
Test Procedure	SAR measurement; KDB 447498, KDB 248227, KDB 865664, IEEE Std.1528	
Category	FCC 47CFR §2.1093 (Portable device)	
RF Exposure condition	Extremity (Wrist)	Partial-body (Next-to-Mouth)
Limit	4 W/kg (SAR(10g))	1.6 W/kg (SAR(1g))
Results	Complied	Complied
Reported SAR value (*. Scaled)	0.016 W/kg	0.173 W/kg
Measured SAR value	0.0118 W/kg	0.130 W/kg
Operation mode, channel	11b (1Mbps, DSSS), 2437 MHz (6ch)	11b (1Mbps, DSSS), 2412 MHz (1ch)
Duty cycle (duty cycle factor)	99.3 % (×1.01)	99.3 % (×1.01)
Power measured/max. (scaled factor)	17.70 dBm / 19.0 dBm (×1.35)	17.80 dBm / 19.0 dBm (×1.32)

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

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
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, 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
Rear	When test is required, the rear flat-surface of smart watch is touched to the Flat phantom.	**7.05**	**Tested**	Wrist-touch
Front	When test is required, the front surface of smart watch is set parallel to the Flat phantom with 10mm separation gap.	**7.34**	**Tested**	Next-to-Mouth
Bezel-left	When test is required, the left side of bezel of smart watch is touched to the Flat phantom.	**10.3**	***Reduced*** (*3)	-
Near side	When test is required, the near side of bezel of smart watch is touched to the Flat phantom.	**23.701**	***Reduced*** (*3)	
Far side	When test is required, the far side of bezel of smart watch is touched to the Flat phantom.	**25.36**	***Reduced*** (*3)	
Bezel-right	When test is required, the right side of bezel of smart watch is touched to the Flat phantom.	**42.838**	***Reduced*** (*3)	

*. **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 (WSD-F10): 31.65 mm (width) × 38.5 mm (depth) × 2.8 mm maximum (thickness)
. Overall of platform (smart watch): 57.961 mm (length) × 56.388mm (width) × 15.69 mm (thickness) (. excluding strap and strap holder.)

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

Consideration of SAR test reduction by the antenna separation distance (100MHz~6GHz, ≤50mm)										
Band, Mode	Position	Minimum distance		Upper frequency [GHz]	Maximum tune-up power			Calculation of SAR exclusion: (*2)		Standalone SAR test Required?	Remarks
		[mm]	[mm] (rounded)		[dBm]	[mW]	[mW] (rounded)	Value	Limit		
Bluetooth (BDR)	Front	7.34	7	2.480	1.0	1.26	1	0.20	**≤ 3.0**	***Not Required***	(Setup separation gap: 0mm)
WLAN2.4GHz (11b)	Rear	7.05	7	2.462	19.0	79.43	79	17.7	**≤ 7.5**	**Required**	(Setup separation gap: 0mm)
	Front	7.34	7					17.7	**≤ 3.0**	**Required**	(Setup separation gap: 0mm)

*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)) and ≤ 7.5 (for SAR(10g))formula (1)

***3. The platform (smart watch) which has EUT built-in is a wristwatch and the voice command is supported.**
According to KDB447498 D01 (v05r02), Clause 6.2. Wrist watch and wrist-worn transmitters;
Transmitters that are built-in within a wrist watch or similar wrist-worn devices typically operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. Next to the mouth exposure requires 1-g SAR and the wrist-worn condition requires 10-g extremity SAR. The 10-g extremity and 1-g SAR test exclusions may be applied to the wrist and face exposure conditions. When SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The wrist bands should be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands should be unstrapped and touching the phantom. The space introduced by the watch or wrist bands and the phantom must be representative of actual use conditions; otherwise, if applicable, the neck or a curved head region of the SAM phantom may be used, provided the device positioning and SAR probe access issues have been addressed through a KDB inquiry. When other device positioning and SAR measurement considerations are necessary, a KDB inquiry is also required for the test results to be acceptable; for example, devices with rigid wrist bands or electronic circuitry and/or antenna(s) incorporated in the wrist bands. These test configurations are applicable only to devices that are worn on the wrist and cannot support other use conditions; therefore, the operating restrictions must be fully demonstrated in both the test reports and user manuals.

<Conclusion for consideration for SAR test reduction>

1) **The Rear setup is considered extremity (wrist) SAR (touch) and is applied the SAR test in body-liquid.**
2) **The Front setup is considered partial body SAR (next-to-mouth, 10 mm separation gap) and is applied the SAR test in head-liquid.**

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

Step 1	Worst extremity SAR(10g) (wrist) search of DSSS mode; Determine the highest reported SAR(1g) of DSSS mode. (*. Change the channel, if it is necessary.)
Step 2	Worst partial body SAR(1g) (next-to-mouth) search of DSSS mode; Determine the highest reported SAR(1g) of DSSS mode. (*. Change the channel, if it is necessary.)

*. 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		2412-2462 MHz		
SAR tested/reduced?		Tested	Reduced (*3)	Reduced (*3)
Tested condition	Frequency	2412, 2437, 2462 MHz (*1, *2)	-	-
	Modulation	DBPSK/DSSS	BPSK/OFDM	BPSK/OFDM
	Data rate	1 Mbps	6 Mbps	MCS0
	Maximum output power	19.0 dBm	15.0 dBm	14.0 dBm
Controlled software		WSD-F10-radio		
Power setting (power measurement)		fix	fix	fix
Power setting (SAR)		fix	-	-

*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. The SAR test of OFDM mode (11g, 11n) was reduced, because 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. (KDB248227 D01 v02r02)

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.

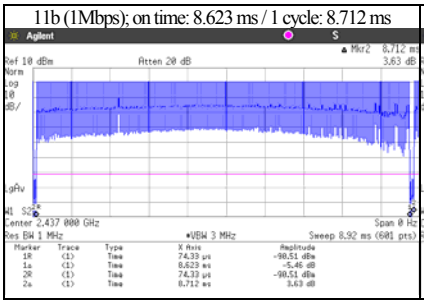
SECTION 6: Confirmation before testing

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

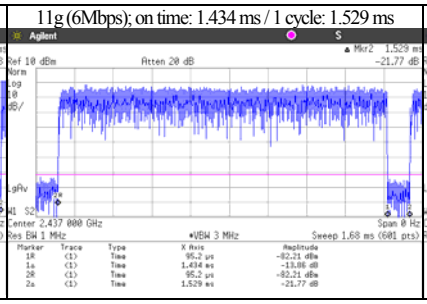
Mode	Freq.	Data rate	Power Setting	Duty cycle	Duty factor	Duty scaled factor	Average power					PAR	Power tolerance, correction			SAR Tested/ Reduced	Remarks	Power Tune-up?
							Frame power		Burst power				Target & (+)tolerance	Deviation from max	Tune-up factor			
	[MHz]	[Mbps]	[dBm]	[%]	[dB]	[-]	[dBm]	[mW]	[dBm]	[mW]	ΔRef. [dB]	[dB]	[dBm]	[dB] (-2≤x<0)	[-]			
11b	2412	**1**	fix	99.3	0.03	×1.01	17.77	59.8	**17.80**	60.3	0.10	2.49	16.0 +3.0	-1.20	×1.32	**Tested**	-	default
	2437	**1**	fix	99.3	0.03	×1.01	17.67	58.5	**17.70**	58.9	Ref.b	2.56	16.0 +3.0	-1.30	×1.35	**Tested**	-	default
	2437	2	fix	98.2	0.08	×1.02	17.56	57.0	17.64	58.1	-	2.60	16.0 +3.0	-1.36	×1.37	-	-	default
	2437	5.5	fix	95.1	0.22	×1.05	17.47	55.8	17.69	58.7	-	2.67	16.0 +3.0	-1.31	×1.35	-	-	default
	2437	11	fix	90.7	0.42	×1.10	17.26	53.2	17.68	58.6	-	3.07	16.0 +3.0	-1.32	×1.36	-	-	default
	2462	**1**	fix	99.3	0.03	×1.01	17.75	59.6	**17.78**	60.0	0.08	2.52	16.0 +3.0	-1.22	×1.32	**Tested**	-	default
11g	2412	**6**	fix	93.8	0.28	×1.07	13.66	23.2	**13.94**	24.8	-0.04	9.78	12.0 +3.0	-1.06	×1.28	Reduced	(*1)	default
	2437	**6**	fix	93.8	0.28	×1.07	13.70	23.4	**13.98**	25.0	Ref.g	9.24	12.0 +3.0	-1.02	×1.26	Reduced	(*1)	default
	2437	9	fix	91.4	0.39	×1.09	13.46	22.2	13.85	24.3	-	9.38	12.0 +3.0	-1.15	×1.30	-	-	default
	2437	12	fix	88.2	0.55	×1.14	13.37	21.7	13.92	24.7	-	9.76	12.0 +3.0	-1.08	×1.28	-	-	default
	2437	18	fix	84.5	0.73	×1.18	13.10	20.4	13.83	24.2	-	9.91	12.0 +3.0	-1.17	×1.31	-	-	default
	2437	24	fix	79.8	0.98	×1.25	12.89	19.5	13.87	24.4	-	10.62	12.0 +3.0	-1.13	×1.30	-	-	default
	2437	36	fix	72.4	1.40	×1.38	12.42	17.5	13.82	24.1	-	10.57	12.0 +3.0	-1.18	×1.31	-	-	default
	2437	48	fix	67.2	1.73	×1.49	12.01	15.9	13.74	23.7	-	11.10	12.0 +3.0	-1.26	×1.34	-	-	default
	2437	56	fix	65.2	1.86	×1.53	11.93	15.6	13.79	23.9	-	11.06	12.0 +3.0	-1.21	×1.32	-	-	default
	2462	**6**	fix	93.8	0.28	×1.07	13.67	23.3	**13.95**	24.8	-0.03	9.63	12.0 +3.0	-1.05	×1.27	Reduced	(*1)	default
11n (20HT)	2412	**MCS0**	fix	93.3	0.30	×1.07	12.56	18.0	**12.86**	19.3	-0.05	9.53	11.0 +3.0	-1.14	×1.30	Reduced	(*1)	default
	2437	**MCS0**	fix	93.3	0.30	×1.07	12.61	18.2	**12.91**	19.5	Ref.n20	10.32	11.0 +3.0	-1.09	×1.29	Reduced	(*1)	default
	2437	MCS1	fix	87.7	0.57	×1.14	12.22	16.7	12.79	19.0	-	9.63	11.0 +3.0	-1.21	×1.32	-	-	default
	2437	MCS2	fix	83.5	0.78	×1.20	11.94	15.6	12.72	18.7	-	10.04	11.0 +3.0	-1.28	×1.34	-	-	default
	2437	MCS3	fix	79.1	1.02	×1.26	11.81	15.2	12.83	19.2	-	10.32	11.0 +3.0	-1.17	×1.31	-	-	default
	2437	MCS4	fix	72.7	1.38	×1.37	11.40	13.8	12.78	19.0	-	10.67	11.0 +3.0	-1.22	×1.32	-	-	default
	2437	MCS5	fix	67.6	1.70	×1.48	10.95	12.4	12.65	18.4	-	11.10	11.0 +3.0	-1.35	×1.36	-	-	default
	2437	MCS6	fix	66.1	1.80	×1.51	10.92	12.4	12.72	18.7	-	11.06	11.0 +3.0	-1.28	×1.34	-	-	default
	2437	MCS7	fix	63.9	1.94	×1.56	10.80	12.0	12.74	18.8	-	11.24	11.0 +3.0	-1.26	×1.34	-	-	default
	2462	**MCS0**	fix	93.3	0.30	×1.07	12.54	17.9	**12.84**	19.2	-0.07	9.59	11.0 +3.0	-1.16	×1.31	Reduced	(*1)	default

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

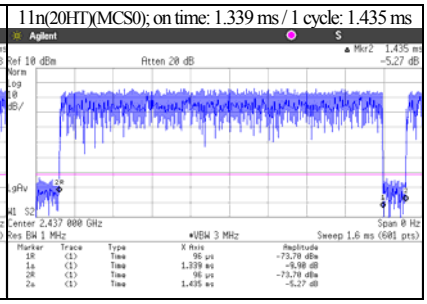
11b (1Mbps); on time: 8.623 ms / 1 cycle: 8.712 ms



11g (6Mbps); on time: 1.434 ms / 1 cycle: 1.529 ms



11n(20HT)(MCS0); on time: 1.339 ms / 1 cycle: 1.435 ms



*1. The SAR test of OFDM mode (11g, 11n) was reduced, because 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. (KDB248227 D01 v02r02)

*. Freq.: Frequency, PAR: Peak average ratio ("Peak power"-"Burst average power", in dBm), Max.: Maximum, Ref: Reference.
*. Calculating formula: Average power (Frame power) (dBm) = (P/M Reading, dBm)+(Cable loss, dB)+(Attenuator, dB)
Average power (Burst power) (dBm) = (P/M Reading, dBm)+(Cable loss, dB)+(Attenuator, dB)+(duty factor, dB)
Duty cycle: (duty cycle, %) = (Tx on time, ms) / (1 cycle time, ms) × 100; Duty factor: (duty factor, dBm) = 10 × log (100/(duty cycle, %))
Duty scaled factor: Duty cycle correction factor for obtained SAR value, Duty scaled factor [-] = 100(%) / (duty cycle, %)
Deviation form max.: (Power deviation, dB) = (results power (average, dBm)) - (Max.-specification output power (average, dBm))
Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor [-] = 1 / (10 ^ ("Deviation from max., dB" / 10))
*. Date measured: November 24, 2015 / Measured by: Hiroshi Naka / Place: preparation room of No. 7 shielded room. (25 deg.C./48 %RH)
*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 0.76 dB.

6.2 Comparison of power of EMC sample

	Platform model No.	RF serial No.	Date power measured	Reference report#	Tx mode	Data rate [Mbps]	Average power (burst) [dBm] ("*": Highest)			
							Max. power	Frequency [MHz]		
								2412	2437	2462
EMC (Ref.)		001	October 28, 2015	10941706S-C	11b	5.5	19.0	17.51	17.45	17.70*
SAR test	WSD-F10	34	November 24, 2014	10941712S-A(*.This report)	11b	1	19.0	17.80*	17.70	17.78

*. The power data above-mentioned diverted a result of measurement of EMC test of report identifier: 10941706S-C which was tested and published by UL Japan, Inc..

SECTION 7: Measured and reported (scaled) SAR results

Measurement date: December 7 and 8, 2015 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]						ΔSAR [%]		Correction required?	
		Target	Measured Meas.	Measured Δεr [%]	Limit (*b)	Target	Measured Meas.	Measured Δσ [%]	Limit (*b)						
2412	Body	52.75	50.70	-3.9	-5% ≤ εr-meas. ≤ 0%	1.914	1.976	3.3	0% ≤ σ-meas. ≤ +5%	21.9	152	+1.49	10g	not required.	December 7, 2015 before SAR test
2437		52.72	50.63	-4.0		1.938	2.008	3.6				+1.58	10g	not required.	
2462		52.68	50.52	-4.1		1.967	2.041	3.8				+1.62	10g	not required.	
2412	Head	39.27	38.10	-3.0	-5% ≤ εr-meas. ≤ 0%	1.766	1.824	3.3	0% ≤ σ-meas. ≤ +5%	23.3	150	+2.27	1g	not required.	December 8, 2015 before SAR test
2437		39.22	37.99	-3.2		1.788	1.860	4.0				+2.63	1g	not required.	
2462		39.18	37.88	-3.3		1.813	1.889	4.2				+2.75	1g	not required.	

[Measured and Reported (Scaled) SAR results]

SAR measurement results											Reported SAR [W/kg]							Meas.: Measured; Max.: Maximum; n/a: not applied.
Mode	Frequency [MHz] (Channel)	Data rate [Mbps]	EUT setup Position	EUT setup Gap [mm]	Power drift [dB]	SAR [W/kg] Maximum value of multi-peak liquid type	SAR [W/kg] Maximum value of multi-peak Meas.	SAR [W/kg] Maximum value of multi-peak ΔSAR [%]	SAR [W/kg] Maximum value of multi-peak ΔSAR corrected	SAR plot # in Appendix 2-2	Duty cycle correction Duty [%]	Duty cycle correction Duty scaled	Output burst-average power correction Meas. [dBm].	Output burst-average power correction Max. [dBm]	Output burst-average power correction Tune-up factor	SAR Corrected (Scaled) (*d)	Limit [W/kg]	Remarks
Step 1: Worst extremity SAR(10g) (wrist) search of DSSS mode																		
11b	2412(1)	1	Rear	0	0.14	Body	**0.011**	+1.49	n/a (*c)	Plot 1-2	99.3	×1.01	17.80	19.0	×1.32	**0.015**	4	-
	2437(6)				-0.19		**0.012**	+1.58	n/a (*c)	Plot 1-1	99.3	×1.01	17.70	19.0	×1.35	**0.016**	4	Highest
	2462(11)				0.20		**0.0081**	+1.62	n/a (*c)	Plot 1-3	99.3	×1.01	17.78	19.0	×1.32	**0.011**	4	-
Step 2: Worst partial body SAR(1g) (next-to-mouth) search of DSSS mode																		
11b	2412(1)	1	Front	10	-0.03	Head	**0.130**	+2.27	n/a (*c)	Plot 2-1	99.3	×1.01	17.80	19.0	×1.32	**0.173**	1.6	Highest
	2437(6)				0.04		**0.125**	+2.63	n/a (*c)	Plot 2-2	99.3	×1.01	17.70	19.0	×1.35	**0.170**	1.6	-
	2462(11)				-0.20		**0.109**	+2.75	n/a (*c)	Plot 2-3	99.3	×1.01	17.78	19.0	×1.32	**0.145**	1.6	-

*. Gap: It is the separation distance between the platform outer surface and the bottom outer surface of phantom.
*. 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)

Liquid	SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty
Body	2412, 2437, 2462 MHz	2450MHz	within ±50MHz of calibration frequency	7.17	±12.0%
Head	2412, 2437, 2462 MHz	2450MHz	within ±50MHz of calibration frequency	7	±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 4), 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. 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 (v01r04)).

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

$\Delta SAR(10g) = C\varepsilon r \times \Delta\varepsilon r + C\sigma \times \Delta\sigma$, $C\varepsilon r = 3.456 \times 10^{-3} \times f^3 - 3.531 \times 10^{-2} \times f^2 + 7.675 \times 10^{-2} \times f - 0.1860$ / $C\sigma = 4.479 \times 10^{-3} \times f^3 - 1.586 \times 10^{-2} \times f^2 - 0.1972 \times f + 0.7717$

ΔSAR corrected SAR (W/kg) = (Meas. SAR (W/kg)) × (100 - (ΔSAR(%)) / 100

*d. Calculating formula: Reported SAR (W/kg) = (Measured SAR (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.

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.

OFDM mode	Maximum tune-up tolerance limit DSSS [dBm]	DSSS [mW] (a)	OFDM [dBm]	OFDM [mW] (b)	OFDM scaled factor [-] (b)/(a)×100	DSSS reported SAR(1g) value Setup	[W/kg]	Estimated SAR(1g) value: OFDM [W/kg]	Exclusion limit [W/kg]	Standalone SAR test require?
11g	19.0	79.43	15.0	31.62	0.398	Front	0.173	**0.069**	**≤ 1.2**	**No**
n (20HT)	19.0	79.43	14.0	25.12	0.316	Front	0.173	**0.055**	**≤ 1.2**	**No**