SAR TEST REPORT

Test Report No.: 10005573S-A

Applicant	:	**YAMAHA CORPORATION**
Type of Equipment	:	**USB WIRELESS LAN ADAPTOR**
Model No.	:	**UD-WL01**
FCC ID	:	**A6RUDWL01**
Test Standard	:	**FCC 47CFR §2.1093, Supplement C (Edition 01-01) to OET Bulletin 65**
Test Result	:	**Complied**

Highest Reported SAR(1g) Value	Remarks
0.67 W/kg	(DTS) 2462MHz, IEEE 802.11b, (1Mbps, DBPSK/DSSS)) *. Highest measured SAR(1g) value: 0.476 W/kg

*. **Highest reported SAR (1g) across exposure conditions = 0.67 W/kg = grant listing.**

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3. This sample tested is in compliance with the limits of the above regulation.
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Date of test: May 8, 2013

Test engineer: H. Naka

Hiroshi Naka
Engineer of WiSE Japan, UL Verification Service

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Toyokazu Imamura
Leader of WiSE Japan, UL Verification Service

☐ 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	10005573S-A	June 20, 2013	-	-

*. 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	YAMAHA CORPORATION
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SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of Equipment	USB WIRELESS LAN ADAPTOR
Model Number	UD-WL01
Serial Number	No.4
Condition of EUT	Engineering prototype (*. Not for sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	May 7, 2013 (*. No modification by the Lab.)
Country of Mass-production	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	DC5.0V (*. The power of EUT is supplied from the host equipment via USB connector. During antenna port conducted power measurement and SAR test, the DC5V power was supplied from the DC power supply.)
Feature of EUT	The EUT is a USB WIRELESS LAN ADAPTOR connected to the host equipment specified as the manufacturer.
SAR accessary	none

2.2 Product Description (RF)

Equipment type	Transceiver		
Frequency of operation	2412-2462MHz (11b,11g,,11n(20HT))		
Channel spacing	5MHz		
Bandwidth	20MHz (11b,11g,,11n(20HT))		
ITU code	G1D(11b), D1D(11g,11n(20HT))		
Type of modulation	DSSS(11b): CCK, DQPSK, DBPSK OFDM(11g,11n(20HT)): 64QAM, 16QAM, QPSK, BPSK		
Q'ty of Antenna	1 pc.		
Antenna type / connector	Type: Chip antenna / Connector: none (An antenna is soldered to a PCB (print circuit board).)		
Antenna gain (peak)	0.2 dBi		
Transmit power and tolerance (Manufacture variation)	11b: 12dBm ±2dBm	11g: 10dBm ±2dBm	11n(20HT): 9dBm ±2dBm
	*. 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: 12dBm	11n(20HT): 11dBm
	*. Refer to clause 2.4 for more detail.		
Power supply	DC 3.3V (*.The RF transmitter is constantly provided voltage (DC3.3V) through the regulator regardless of input voltage.)		
Operation temperature range	0 to +40 deg.C. (*. EUT specification temperature.)		

*. 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)

		Target Power (Tx output power specification) [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	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2417	2	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2422	3	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2427	4	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2432	5	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2437	6	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2442	7	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2447	8	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2452	9	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2457	10	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-
2462	11	12	12	12	12	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-

2.4. Maximum output power which may possible

		Maximum output power which may possible [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	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2417	2	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2422	3	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2427	4	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2432	5	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2437	6	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2442	7	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2447	8	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2452	9	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2457	10	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-
2462	11	14	14	14	14	12	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	-	-	-	-	-	-	-	-

SECTION 3: Test specification, procedures and results

3.1 Test specification / Requirements for compliance testing defined by the FCC

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. According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, 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.

1. Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).
2. IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.

Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01):

Supplement C (Edition 01-01) - Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions
OET Bulletin 65 (Edition 97-01) - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

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 Supplement C

In additions; ☒**KDB 447498 D01 (v05):** General RF exposure guidance
☒**KDB 865664 D01 (v01):** SAR measurement 100MHz to 6GHz
☒**KDB 248227 D01 (v01r02):** SAR measurement procedures for 802.11a/b/g transmitters

***.** In this report, IEC 62209-1:2005 and IEC 62209-2:2010-03 are also considered as reference. The comment is attached to the portion to which IEC 62209-1 and IEC 62209-2 were referred to specially.

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)
Test Procedure	FCC OET Bulletin 65, Supplement C SAR
Category	FCC 47CFR §2.1093
Results (SAR(1g))	Complied
Reported SAR value (*. Scaled)	0.67 W/kg
Measured SAR value	0.476 W/kg
Operation mode	11b, 1Mbps, DSSS, 2462MHz (11ch)
Output power (scaled factor)	12.50 dBm (×1.41)

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 (2.76m (Width) × 3.76m (Depth) × 2.4m (Height)) for SAR testing.

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3.5 Confirmation before SAR testing

3.5.1 Correlation of Output Power between EMC and SAR tests

It was checked that the antenna port power was correlated within 0~+5% (FCC requirements).
The result is shown in Section 6.

Test	Remarks	Serial number
SAR	Before SAR test, the RF wiring for the sample that was actually used for the SAR test, had been switched to the antenna conducted power measurement line from the antenna line, and then the average power was measured. The average and peak power of specified operation mode(s) were measured at default channel. *. The power was measured by the calibrated power sensor and power meter (65MHz measurement bandwidth).	No.4
EMC	The EUT of the EMC test was measured the peak power. The average power that was reference of SAR test was also measured additionally.	25

3.5.2 Average power for SAR tests

Step.1 Data rate check

The EUT supported the following data rate in each operation mode.
Even if the target power of 11b mode was more than 2dB higher than other operation mode (11g, 11n(20HT), the average powers related with all data rate were measured for all operation mode.

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

Step.2 Decision of SAR test channel

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

Mode	MHz	Channel	default	SAR tested channel			Remarks
			11b/g/n(20HT)	11b	11g	11n(20HT)	
802.11 b/g/n	2412	1 (*1)	√	#	n/a (*2)	n/a (*2)	SAR test was only applied to 11b mode, in lowest data rate. (*2)
	2437	6	√	#	n/a (*2)	n/a (*2)	
	2462	11 (*1)	√	#	n/a (*2)	n/a (*2)	

√ = "default test channels of requested by KDB248227", n/a: SAR test was not applied, # = SAR test was applied.

*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 and SAR test was applied.

*2. Since the target average power of 11g and 11n(20HT) were more than 2dB lower than the corresponded 11b power, SAR test was not applied to the 11g and 11n(20HT) mode. In 11b mode, the average power of higher data rate was less than 0.25dB higher than the lowest data rate. Therefore, SAR test was only applied to the lowest data rate. (KDB248227) (Refer to Section 6.)

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.
*. Refer to Appendix 1 for test setup photographs.

Setup	Explanation of EUT setup position	Antenna to user distance	Applied SAR test?	SAR type
Horizontal-Down	The horizontal-down surface of EUT was touched to the Flat phantom.	≈7mm	applied	Body (touch)
Horizontal-Up	The horizontal-up surface of EUT was touched to the Flat phantom.	≈7mm	applied	
Vertical-Front	The vertical-front surface of EUT was touched to the Flat phantom.	≈10mm	applied	
Vertical-Back	The vertical-back surface of EUT was touched to the Flat phantom.	≈18mm	applied	
Tip	The tip surface of EUT was touched to the Flat phantom.	≈6mm	applied	

*. **Antenna to user distance**: this means the distance from the antenna inside a product to the surface of the product which an operator touches.

***. Size of EUT: 31 mm (width) × 69 mm (depth) × 15 mm (height)** (with USB type-A connector.)

*. USB Connector Orientations. (KDB447498 D02 v02)

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

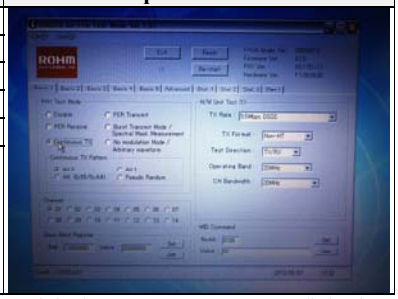
Step 1	Change the positions.
Step 2	Change the channels. (at the worst position.)

*. 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 (*1)	The example of a software screen
Tx frequency band	2412-2462MHz	
Tested frequency	2412, 2437, 2462MHz (*2)	
Modulation	DBPSK/DSSS	
Data rate	1Mbps (*3)	
Crest factor	1.0 (100% duty cycle)	
Controlled software	Application: RADITS for 11n Test Mode ver .1.51 Before SAR test, the Tx type and channel were set by the software installed in the laptop PC via signal cable. During SAR test, the signal cable for Tx parameter setting up was disconnected. The software screen is shown in the right.	

*1. Since the target average power of 11g and 11n(20HT) were more than 2dB lower than the corresponded 11b power, SAR test was not applied to the 11g and 11n(20HT) mode. (KDB248227) (Refer to Section 6 for the output power data.)
*2. 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 and SAR test was applied.
*3. In 11b mode, the average power of higher data rate was less than 0.25dB higher than the lowest data rate. Therefore, SAR test was only applied to the lowest data rate. (KDB248227) (Refer to Section 6 for the output power data.)

SECTION 5: Uncertainty Assessment (SAR measurement)

Uncertainty of SAR measurement(v06) (*. Body tissue, ε & σ tolerance: ≤ ± 5%, Tx: ≈100% duty cycle)	Under 3 GHz	
	1g SAR	10g SAR
Combined measurement uncertainty of the measurement system (k=1)	± 12.5%	± 12.2%
Expanded uncertainty (k=2)	± 25.0%	± 24.4%

	Error Description (Under 3GHz) (v06)	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	±6.0 %	Normal	1	1	1	±6.0 %	±6.0 %	∞
2	Axial isotropy Error	±4.7 %	Rectangular	√3	0.7	0.7	±1.9 %	±1.9 %	∞
3	Hemispherical isotropy Error (<5deg, flat phantom)	±9.6 %	Rectangular	√3	0.7	0.7	±3.9 %	±3.9 %	∞
4	Boundary effects Error	±1.4 %	Rectangular	√3	1	1	±0.8 %	±0.8 %	∞
5	Linearity Error	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	∞
6	Probe modulation response (CW)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
7	Sensitivity Error (detection limit)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
8	Response Time Error (<5ms/100ms wait)	±0.0 %	Normal	1	1	1	±0.0 %	±0.0 %	∞
9	Integration Time Error (100% duty cycle)	±0.0 %	Rectangular	√3	1	1	±0.0 %	±0.0 %	∞
10	Readout Electronics Error(DAE)	±0.3 %	Rectangular	√3	1	1	±0.3 %	±0.3 %	∞
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	±1.1 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
14	Probe Positioning with respect to phantom shell	±2.9 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	∞
15	Errors: Extrapol., Interpol. & Integration Algorithms	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	∞
B	**Test Sample Related**								
16	Test Sample Positioning Error	±5.0 %	Normal	1	1	1	±5.0 %	±5.0 %	145
17	Device Holder or Positioner Tolerance	±3.6 %	Normal	1	1	1	±3.6 %	±3.6 %	5
18	Test Sample Output Power Drift Error	±5.0 %	Rectangular	√3	1	1	±2.9 %	±2.9 %	∞
C	**Phantom and Setup**								
19	Phantom uncertainty (shape, thickness tolerances)	±7.5 %	Rectangular	√3	1	1	±4.3 %	±4.3 %	∞
20	Target Liquid Conductivity Tolerance (≤5%)	±5.0 %	Rectangular	√3	0.64	0.43	±1.8 %	±1.2 %	∞
21	Measurement Liquid Conductivity Error	±2.9 %	Normal	1	0.64	0.43	±1.9 %	±1.2 %	3
22	Target Liquid Permittivity Tolerance (≤5%)	±5.0 %	Rectangular	√3	0.6	0.49	±1.7 %	±1.4 %	∞
23	Measurement Liquid Permittivity Error	±2.9 %	Normal	1	0.6	0.49	±1.7 %	±1.4 %	3
24	Liquid Conductivity-temp.uncertainty (≤2deg.C.)	±5.2 %	Rectangular	√3	0.78	0.71	±2.3 %	±2.1 %	∞
25	Liquid Permittivity-temp.uncertainty (≤2deg.C.)	±0.8 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	∞
	Combined Standard Uncertainty						**±12.5** %	**±12.2** %	479
	Expanded Uncertainty (k=2)						**±25.0 %**	**±24.4 %**	

*. This measurement uncertainty budget is suggested by IEEE 1528, IEC 62209-2 and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget).

SECTION 6: Confirmation before testing

6.1 Assessment for the conducted power of EUT

6.1.1 Comparison with EMC data (average power)

Mode	Freq. [MHz]	D/R [Mbps]	Cable Loss [dB]	Att. [dB]	D/F [dB]	Average power P/M Reading [dBm]	Average power Result [dBm]	Average power Result [mW]	PAR [dB]	Power tolerance & correction Target & tolerance [dBm]	Power tolerance & correction Deviation from max.. [dB]	Power tolerance & correction Scaled Factor [-]	≤2 dB? (Y: yes)	Apply SAR test? (Y: yes)	Output power of EMC test Aver. [dBm]	Output power of EMC test ΔSAR [dB]	Remarks
11b (Pwr. Setting =14)	2437	1	1.50	10.02	0.00	-0.23	11.29	13.5	2.3	12.0±2	-	-	-	-	11.16	0.13	-
	2437	2	1.50	10.02	0.00	-0.21	11.31	13.5	2.2	12.0±2	-	-	-	-	11.26	0.05	-
	2437	5.5	1.50	10.02	0.00	-0.20	11.32	13.6	2.1	12.0±2	-	-	-	-	11.28	0.04	-
	2437	11	1.50	10.02	0.00	-0.24	11.28	13.4	2.3	12.0±2	-	-	-	-	11.26	0.02	-
	2412	**5.5**	1.50	10.02	0.00	-0.30	11.22	13.2	2.2	12.0±2	-	-	-	-	11.05	0.17	
	2462	**5.5**	1.50	10.02	0.00	-0.51	11.01	12.6	2.2	12.0±2	-	-	-	-	10.81	0.20	
	2412	1	1.50	10.02	0.00	-0.20	11.32	13.6	2.4	12.0±2	-	-	-	-	-	-	-
	2462	1	1.50	10.02	0.00	-0.41	11.11	12.9	2.4	12.0±2	-	-	-	-	-	-	-

*. Power setting; (WID command) Numb: 0106 / Value: 03.
*. The difference between the SAR reference power and the power of EMC test was not less than 0dB and not higher than 0.21dB.
Therefore it was judged that EUT that was used for SAR test was equivalent to the EUT used for EMC test.
*. "Power of EMC test"; this reference is described in the test report of 33AE0243-SH-01-D.

6.1.2 SAR test reference: worst data rate / worst channel determination

Mode	Freq. [MHz]	D/R [Mbps]	Cable Loss [dB]	Att. [dB]	D/F [dB]	Average power P/M Reading [dBm]	Average power Result [dBm]	Average power Result [mW]	PAR [dB]	Power tolerance & correction Target & tolerance [dBm]	Power tolerance & correction Deviation from max.. [dB]	Power tolerance & correction Scaled Factor [-]	≤2 dB? Y: yes)	Apply SAR test? (Y: yes)	Output power of EMC test Aver. [dBm]	Output power of EMC test ΔSAR [dB]	Remarks
11b (Pwr. Setting =13)	2437	1	1.50	10.02	0.00	1.08	**12.60**	18.2	2.4	12.0±2	-1.40	**×1.38**	Y	Y (*1)	-	-	-
	2437	2	1.50	10.02	0.00	1.14	12.66	18.5	2.5	12.0±2	-1.34	×1.36	Y	-	-	-	-
	2437	5.5	1.50	10.02	0.00	1.17	12.69	18.6	2.2	12.0±2	-1.31	×1.35	Y	(*1)	-	-	-
	2437	11	1.50	10.02	0.00	1.14	12.66	18.5	2.5	12.0±2	-1.34	×1.36	Y	-	-	-	-
	2412	**1**	1.50	10.02	0.00	1.11	**12.63**	18.3	2.4	12.0±2	-1.37	**×1.37**	Y	Y	-	-	Highest CH (11b)
	2462	**1**	1.50	10.02	0.00	0.98	**12.50**	17.8	2.4	12.0±2	-1.50	**×1.41**	Y	Y	-	-	-
11g (*1) (Pwr. Setting =11)	2437	6	1.50	10.02	0.00	-0.93	10.59	11.5	9.7	10.0±2	-1.41	×1.38	Y	- (*2)	-	-	-
	2437	9	1.50	10.02	0.00	-1.01	10.51	11.2	9.1	10.0±2	-1.49	×1.41	Y	-	-	-	-
	2437	12	1.50	10.02	0.00	-1.02	10.50	11.2	9.6	10.0±2	-1.50	×1.41	Y	-	-	-	-
	2437	18	1.50	10.02	0.00	-1.00	10.52	11.3	8.6	10.0±2	-1.48	×1.41	Y	-	-	-	-
	2437	24	1.50	10.02	0.00	-1.11	10.41	11.0	10.1	10.0±2	-1.59	×1.44	Y	-	-	-	-
	2437	36	1.50	10.02	0.00	-1.15	10.37	10.9	9.1	10.0±2	-1.63	×1.46	Y	-	-	-	-
	2437	48	1.50	10.02	0.00	-1.13	10.39	10.9	9.7	10.0±2	-1.61	×1.45	Y	-	-	-	-
	2437	56	1.50	10.02	0.00	-1.15	10.37	10.9	9.4	10.0±2	-1.63	×1.46	Y	-	-	-	-
	2412	**6**	1.50	10.02	0.00	-0.94	10.58	11.4	9.9	10.0±2	-1.42	×1.39	Y	- (*2)	-	-	-
	2462	**6**	1.50	10.02	0.00	-1.10	10.42	11.0	9.4	10.0±2	-1.58	×1.44	Y	- (*2)	-	-	-
11n (20HT) (*1) (Pwr. Setting =11)	2437	MCS0	1.50	10.02	0.00	-2.02	9.50	8.9	9.0	9.0±2	-1.50	×1.41	Y	- (*2)	-	-	-
	2437	MCS1	1.50	10.02	0.00	-2.16	9.36	8.6	9.2	9.0±2	-1.64	×1.46	Y	-	-	-	-
	2437	MCS2	1.50	10.02	0.00	-2.04	9.48	8.9	10.0	9.0±2	-1.52	×1.42	Y	-	-	-	-
	2437	MCS3	1.50	10.02	0.00	-2.10	9.42	8.7	8.8	9.0±2	-1.58	×1.44	Y	-	-	-	-
	2437	MCS4	1.50	10.02	0.00	-2.03	9.49	8.9	9.2	9.0±2	-1.51	×1.42	Y	-	-	-	-
	2437	MCS5	1.50	10.02	0.00	-2.07	9.45	8.8	9.1	9.0±2	-1.55	×1.43	Y	-	-	-	-
	2437	MCS6	1.50	10.02	0.00	-2.04	9.48	8.9	10.0	9.0±2	-1.52	×1.42	Y	-	-	-	-
	2437	MCS7	1.50	10.02	0.00	-2.08	9.44	8.8	9.2	9.0±2	-1.56	×1.43	Y	-	-	-	-
	2412	**MCS0**	1.50	10.02	0.00	-2.01	9.51	8.9	8.8	9.0±2	-1.49	×1.41	Y	- (*2)	-	-	-
	2462	**MCS0**	1.50	10.02	0.00	-2.17	9.35	8.6	8.9	9.0±2	-1.65	×1.46	Y	- (*2)	-	-	-

*. Power setting; (WID command) Numb: 0106 / Value: 02.
*1. The average power of higher data rate was less than 0.25dB higher than the lowest data rate. Therefore, SAR test was only applied to the lowest data rate. (KDB248227)
*2. Since the target average power of 11g and 11n(20HT) were more than 2dB lower than the corresponded 11b power, the power measurement and SAR test were not applied to the 11g and 11n(20HT) mode. (KDB248227)

*. Freq.: Frequency, D/R: Data Rate, Att.: Attenuator loss, D/F: Duty Factor (0dB=100% duty cycle), n/a: not applied, P/M: Power Meter, PAR: Peak average ratio.
*. Calculating formula: Results (Ave) = ["P/M Reading"]+["Cable loss"]+["Attenuator"]+["duty factor"]
Deviation form max.: Power deviation (Deviation [dB] = "results power (average)" - "Max.-specification output power (average)")
Scaled Factor: Power scaled factor for obtained SAR value, Scaled Factor [-] = 1 / (10 ^ ("Deviation from max." / 10))
***. EUT serial number: "4" for SAR test and SAR reference power measurement. / "25" for EMC test.**
*. Uncertainty of antenna port conducted test; Power measurement uncertainty above 1GHz for this test was: (±) 1.5dB / Place: preparation room of No. 7 shielded room.
*. SAR reference; Date measured: May 7 and 8, 2013 / Measured by: Hiroshi Naka / 25 deg.C. & 39 %RH (May 7), 24 deg.C. & 47 %RH (May 8),

SECTION 7: Measurement results

7.1 SAR measurement results

Measurement date: May 8, 2013 Measurement by: Hiroshi Naka

[Liquid measurement (Body simulated tissue)]

Target Frequency [MHz]	Liquid parameters						ΔSAR Coefficients		Remarks / Environment
	Permittivity (εr) [-]			Conductivity [S/m]		Temp. [deg.C.]	Depth [mm]	ΔSAR (1g) [%]	Correction required?	
	Target	Measured (Δεr)		Target	Measured (Δσ)					
2450	**52.7**	50.56	-4.1%	**1.95**	1.992	+2.1%	22.8	154	(+1.94) (*1)	not required.	May 8, 2013, before SAR test /ambient; 22.6 deg.C., 41%RH
2412 (1)	***52.75***	50.72	-3.9%	***1.914***	1.946	+1.7%			(+1.68) (*1)	not required.	
2437 (6)	***52.72***	50.60	-4.0%	***1.938***	1.981	+2.3%			(+1.99) (*1)	not required.	
2462 (11)	***52.68***	50.49	-4.2%	***1.967***	2.012	+2.3%			(+2.02) (*1)	not required.	

*. The target value is a parameter defined in OET65 Supplement C. In the current standards (e.g., IEEE 1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given at 1800-2000, 2450, and 3000MHz. As an intermediate solution, dielectric parameters for the frequencies between 2000 to 3000 MHz were obtained using linear interpolation. (Refer to Appendix 3-4)

*1. The number of ΔSAR(1g) of body simulated tissue was reference purpose only. ΔSAR coefficients are parameters defined in Annex F, IEC 62209-2:2010 (head tissue). In accordance with clause 6.1.1 of IEC62209-2; "If the correction ΔSAR has a negative sign, the measured SAR results shall not be corrected", the calculated ΔSAR values of the tested liquid had shown negative correction. Therefore the measured SAR was not required ΔSAR correction.
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

[SAR measurement results (Partial-Body)]

SAR measurement results (Body simulated tissue)													Reported SAR		
Mode	[MHz] (CH)	Modulation /Data rate / Crest factor	EUT setup conditions: USB dongle position (*1)	Separation distance	Liquid temp. [deg.C.]: Before	After	Power drift [dB]	SAR (1g) [W/kg] maximum value of multi-peak: Observed	ΔSAR [%]	ΔSAR corrected	Data# in Appendix 2-2		SAR (1g) [W/kg]: Scaled factor	tune-up SAR	Remarks
Step 1: Change the positions															
11b	2412(1)	BPSK &DSSS /1Mbps /1.0	**Horizontal-Down**	0mm	22.4	22.4	-0.02	**0.424**	-	-	Step 1-1		×1.37	**0.58**	-
			Horizontal-Up	0mm	22.4	22.4	-0.08	**0.432**	-	-	Step 1-2		×1.37	**0.59**	-
			Vertical-Front	0mm	22.4	22.4	-0.06	**0.173**	-	-	Step 1-3		×1.37	**0.24**	-
			Vertical-Back	0mm	22.4	22.5	-0.05	**0.136**	-	-	Step 1-4		×1.37	**0.19**	-
			Tip	0mm	22.5	22.5	-0.20	**0.308**	-	-	Step 1-5		×1.37	**0.42**	-
Step 2: Changed the channels															
11b	2437(6)	BPSK &DSSS /1Mbps /1.0	**Horizontal-Up**	0mm	22.5	22.5	-0.07	**0.472**	-	-	Step 2-1		×1.38	**0.65**	-
	2462(11)			0mm	22.5	22.5	-0.07	**0.476**	-	-	Step 2-2		×1.41	**0.67**	->Highest SAR.

Notes:

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

*. Since the target average power of 11g and 11n(20HT) were more than 2dB lower than the corresponded 11b power, the SAR test were not applied to the 11g and 11n(20HT) mode. (KDB248227)

*. During test, the DC5V was supplied from DC power supply via USB connector.

(A) Horizontal-Up (B) Horizontal-Down (C) Vertical-Front (D) Vertical-Back

*1. USB Connector Orientations. (KDB447498 D02 v02)

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

SAR test frequency	Probe calibration frequency	Validity [MHz]	Used conversion factor	Uncertainty
2412 MHz	2450 MHz	-38MHz, within ±50 of calibration frequency	6.77	±12.0%
2437 MHz	2450 MHz	-13MHz, within ±50 of calibration frequency	6.77	±12.0%
2462 MHz	2450 MHz	+12MHz, within ±50 of calibration frequency	6.77	±12.0%

*. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.