SAR TEST REPORT

Test Report No.: 33CE0267-SH-01-R03

Applicant	:	**Toshiba Corporation**
Type of Equipment	:	**Laptop Computer**
Model No.	:	**Satellite U930**
FCC ID	:	**CJ6UPSU7FPC1**
Test Standard	:	**FCC 47CFR §2.1093, Supplement C (Edition 01-01) to OET Bulletin 65**
Test Result	:	**Complied**

The highest reported SAR(1g) Value for the device is 0.24 W/kg

Simultaneous transmission test was excluded
The highest sum of SAR(1g) for the simultaneous transmitting antennas Value for the device is 0.25 W/kg

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Date of test: November 15-17, 2012

Test engineer: T. Sato
Tomochika Sato
Engineer of WiSE Japan, UL Verification Service

Approved by: T. Imamura
Toyokazu Imamura
Leader of WiSE Japan, UL Verification Service

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JAB Testing RTL02610

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REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents
Original	33CE0267-SH-01	December 5, 2012	-	-
1	33CE0267-SH-01-R01	December 19, 2012	1, 4, 9, 12	Highest SAR value: Correction of errors 3.1 Add KDB 616217 / 6.1.1 Correction of errors / 7.1 Correction of errors
2	33CE0267-SH-01-R02	December 21, 2012	3, 4, 9, 12	2.1 Correction of errors / 3.1 Correction of errors / 6.1.1 Correction of errors 7.1 Add reason of exclusion test
3	33CE0267-SH-01-R03	December 25, 2012	1, 11, 12,	Add highest sum of SAR(1g) value 7.1 Formatting changes and Correction of errors / Add section 7.2

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

SECTION 1: Customer information

Company Name	Toshiba Corporation
Brand Name	TOSHIBA
Address	2-9, Suehiro-Cho, Ome, Tokyo 198-8710 JAPAN
Telephone Number	+81-428-34-2403
Facsimile Number	+81-428-30-7906
Contact Person	Kazuya Fukushima

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT (*.Main unit including antenna and RF module)

Type of Equipment	Laptop Computer
Model Number	Satellite U930
Serial Number	XC125734H
Condition of EUT	Production prototype (*. Not for sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample	November 14, 2012 (*. No modification by the Lab.)
Country of Mass-production	China
Rating	DC19V
Category Identified	Portable device
Feature of EUT	The EUT is a laptop computer installed Wireless LAN and Bluetooth module.
Simultaneous transmission	Wireless LAN can not transmit simultaneously with Bluetooth
Size of EUT	W:316 mm * D:207 mm * H:17.8 mm

2.2 Product Description (*.Antenna and RF module)

Bluetooth

Equipment type	Transceiver
Frequency of operation channel	2402-2480 MHz
Channel spacing	1MHz for BDR and EDR, 2MHz for Low energy
Bandwidth	79MHz
Type of modulation	FHSS, DSSS
Q'ty of Antenna	1 pc.
Antenna type	PIFA
Antenna gain (peak)	3.24dBi for 2.4GHz band
Transmit power	Refer to section 6 in this report.
Power supply	DC3.3V (*. with constantly voltage circuit operation.)

Wireless LAN(IEEE 802.11b/g/n20HT/n40HT)

Equipment type	Transceiver
Frequency of operation channel	2412-2462 MHz for IEEE 802.11b, 11g and n20HT 2422-2452 MHz for IEEE 802.11 n40HT,
Channel spacing	5MHz
Bandwidth	20MHz for b, g and n20HT, 40MHz for n40HT
Type of modulation	DSSS, OFDM
Q'ty of Antenna	2 pc.
Antenna type	PIFA
Antenna gain (peak)	3.24dBi for 2.4GHz band
Transmit power	Refer to section 6 in this report.
Power supply	DC3.3V (*. with constantly voltage circuit operation.)

SECTION 3: Test specification, procedures and results

3.1 Requirements for compliance testing defined by the FCC / 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. 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 (v04) (11/13/2009):**	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
☒**KDB 248227 (rev.1.2) (5/29/2007):**	SAR Measurement Procedures for 802.11a/b/g Transmitters
☒**KDB 450824 D01 (v01r01) (Jan.2007):**	SAR Probe Calibration and System Verification Considerations for Measurements at 150MHz-3GHz
☒**KDB 450824 D02 (v01) (11/13/2009):**	Dipole Requirements for SAR System Validation and Verification
☒**KDB 616217 D01 (v01) (11/13/2009):**	SAR for laptop with Screen Ant

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

Transmitter	Wireless LAN	Bluetooth
Test Procedure	FCC OET Bulletin 65, Supplement C	Exemption (Power <12mW)*1
	SAR	
Category	FCC 47CFR §2.1093	FCC 47CFR §2.1093

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

***1:** Bluetooth mode is excluded from SAR test since power was lower than 1/2*60/f(GHz) [mW].

3.4 Test Location

No.7 shielded room (2.76(Width) × 3.76m(Depth) × 2.4m(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 Data rate

*. The power corresponding with the data rate was measured. The following table is reference of modulation.

11b		11g	
Modulation	Data rate	Modulation	Data rate
DBPSK/DSSS	1 Mbps	BPSK/OFDM	6 Mbps
DQPSK/DSSS	2 Mbps	BPSK/OFDM	9 Mbps
CCK/DSSS	5.5 Mbps	QPSK/OFDM	12 Mbps
CCK/DSSS	11 Mbps	QPSK/OFDM	18 Mbps
		16QAM/OFDM	24 Mbps
		16QAM/OFDM	36 Mbps
		64QAM/OFDM	48 Mbps
		64QAM/OFDM	54 Mbps

11n(20HT)					11n(40HT)				
Modulation	Data rate	Stream	Data rate	Stream	Modulation	Data rate	Stream	Data rate	Stream
BPSK/OFDM	MCS0	1	MCS8	2	BPSK/OFDM	MCS0	1	MCS8	2
QPSK/OFDM	MCS1	1	MCS9	2	QPSK/OFDM	MCS1	1	MCS9	2
QPSK/OFDM	MCS2	1	MCS10	2	QPSK/OFDM	MCS2	1	MCS10	2
16QAM/OFDM	MCS3	1	MCS11	2	16QAM/OFDM	MCS3	1	MCS11	2
16QAM/OFDM	MCS4	1	MCS12	2	16QAM/OFDM	MCS4	1	MCS12	2
64QAM/OFDM	MCS5	1	MCS13	2	64QAM/OFDM	MCS5	1	MCS13	2
64QAM/OFDM	MCS6	1	MCS14	2	64QAM/OFDM	MCS6	1	MCS14	2
64QAM/OFDM	MCS7	1	MCS15	2	64QAM/OFDM	MCS7	1	MCS15	2

3.5.2 Decision of SAR test channel

Decision of SAR test channel

The operating mode for SAR testing was decided by the output power

Mode	GHz	Channel	"Default Test Channel"			
			FCC 15.247		UNII	
			802.11b	802.11g		
802.11 b/g/n20	2.412	1	√	Δ		
	2.437	6	√	Δ		
	2.462	11	√	Δ		

√ = "default test channels"

Δ = Possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

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 DASY 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.

*. DASY 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)=0.212dB

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 DASY system must be the less than ±0.212dB.

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.

Configuration	Antenna to user distance	Explanation of EUT setup position	SAR test	SAR type
Lap held(Bottom face)	**7.5 mm**	The bottom surface of EUT was touched to the Flat phantom. **This section is the closest to an antenna.**	applied	Body-touch
Right side	**53 mm**	The right surface of EUT was touched to the Flat phantom.	applied	Body-touch
Left side	**53 mm**	The left surface of EUT was touched to the Flat phantom.	applied	Body-touch
LCD back side(Nearby person)	**12 mm**	The LCD back side of EUT was touched to the Flat phantom.	applied	Body-touch

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

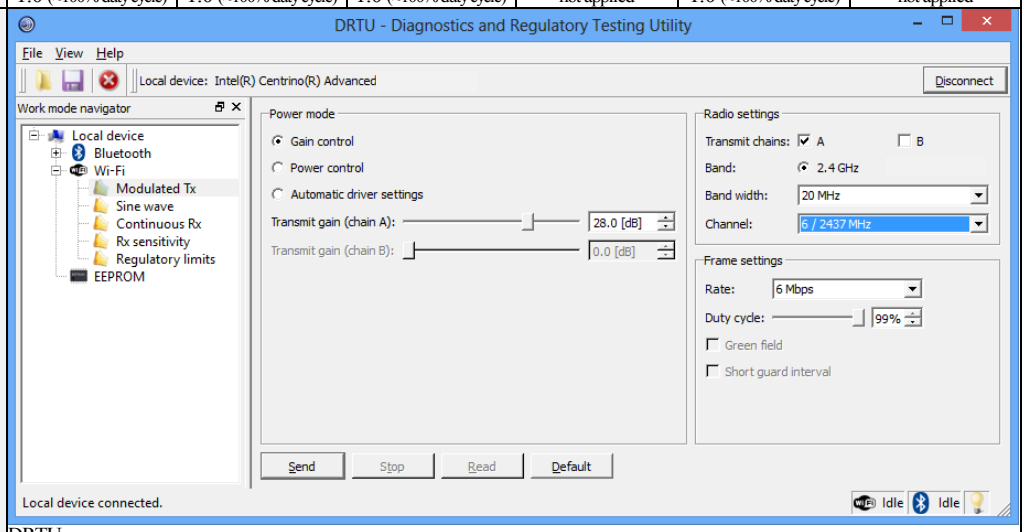
Operation modes: IEEE 802.11b/g/n(20HT)/n(40HT)

Step 1	Worst position search.
Step 2	Change the operation modes. (at the worst SAR position in step1.)

*. Radiated spectrum is monitored by spectrum analyzer during SAR test.

SECTION 4: Operation of EUT during testing

This EUT has IEEE.802.11b, 11g, 11n(20HT) and 11n(40HT) continuous transmitting modes.
The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode	11b	11g	11n(20HT) siso	11n(40HT) siso	11n(20HT) mimo	11n(40HT) mimo
Tx frequency band	2412-2462MHz			2422-2452MHz	2412-2462MHz	2422-2452MHz
Tested frequency	2437MHz	2437MHz(*1)	2437MHz(*1)	not applied	2437MHz	not applied
Modulation	DBPSK/DSSS	BPSK/OFDM	BPSK/OFDM	not applied	BPSK/OFDM	not applied
Data rate	1Mbps (*2)	6Mbps (*2)	MCS0 (*2)	not applied	MCS0 (*2)	not applied
Crest factor	1.0 (≈100% duty cycle)	1.0 (≈100% duty cycle)	1.0 (≈100% duty cycle)	not applied	1.0 (≈100% duty cycle)	not applied
Controlled software						

DRTU
Version: 1.5.7-0432
*: The sample photograph of setting parameters and setting window is in above.

*1. SAR test was applied since average output power is higher than 11b.
*2. Since the average power of higher data rate was less than 0.25dB higher than the lowest data rate, the SAR test was only applied to the lowest data rate.

SECTION 5: Uncertainty Assessment (SAR measurement)

Uncertainty of SAR measurement system (Body tissue, conductivity& permittivity tolerance: ≤ ± 5%, 100% duty cycle) (v06)	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)	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	±5.0 %	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	±5.0 %	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 Worst data rate & worst channel determination of SAR

Mode	Antenna	Freq. [MHz]	Ch.	Data rate	Loss[dB] Cable	Loss[dB] Attn	Duty cycle / factor [%]	Duty cycle / factor [dB]	Average output power Reading[dBm]	Average output power Result[dBm]	Average output power Result[mW]	Remarks
Bluetooth BDR	Chain B(Aux)	2402	low	DH5	0.74	10	78.7	1.04	-5.00	6.78	4.76	
		2441	mid	DH5	0.75	10	78.7	1.04	-4.88	**6.91**	**4.91**	
		2480	high	DH5	0.75	10	78.7	1.04	-4.95	6.84	4.83	
Bluetooth EDR	Chain B(Aux)	2402	low	3DH5	0.74	10	78.7	1.04	-8.54	3.24	2.11	
		2441	mid	3DH5	0.75	10	78.7	1.04	-8.23	**3.56**	**2.27**	
		2480	high	3DH5	0.75	10	78.7	1.04	-8.32	3.47	2.22	
Bluetooth Low Energy	Chain B(Aux)	2402	low	-	0.74	10	78.7	1.04	-7.55	4.23	2.65	
		2442	mid	-	0.75	10	78.7	1.04	-6.80	**4.99**	**3.16**	
		2480	high	-	0.75	10	78.7	1.04	-7.91	3.88	2.44	

Bluetooth mode is excluded from SAR test since power was lower than 1/2*60/f(GHz) [mW].

Mode	Antenna	Freq. [MHz]	Ch.	Data rate	Loss[dB] Cable	Loss[dB] Attn	Duty cycle / factor [%]	Duty cycle / factor [dB]	Average output power Reading[dBm]	Average output power Result[dBm]	Average output power Result[mW]	Remarks
802.11b	Data rate check at main antenna	2437	6	1Mbps	0.75	10.00	99.03	0.04	6.72	17.51	56.39	Worst data rate of 11b
		2437	6	2Mbps	0.75	10.00	98.97	0.04	6.55	17.34	54.26	
		2437	6	5.5Mbps	0.75	10.00	98.96	0.05	6.53	17.33	54.02	
		2437	6	11Mbps	0.75	10.00	97.84	0.09	6.50	17.34	54.26	
	Chain A(Main)	2412	1	1Mbps	0.74	10.00	99.03	0.04	5.75	16.53	45.00	
		2437	6	1Mbps	0.75	10.00	99.03	0.04	6.72	**17.51**	**56.39**	
		2462	11	1Mbps	0.75	10.00	99.03	0.04	6.63	17.42	55.24	
	Chain B(Aux)	2412	1	1Mbps	0.74	10.00	99.03	0.04	6.27	17.05	50.73	
		2437	6	1Mbps	0.75	10.00	99.03	0.04	7.16	17.95	62.41	
		2462	11	1Mbps	0.75	10.00	99.03	0.04	7.30	**18.09**	**64.45**	
802.11g	Data rate check at main antenna	2437	6	6Mbps	0.75	10.00	98.86	0.05	7.26	18.06	63.97	Worst data rate of 11g
		2437	6	9Mbps	0.75	10.00	97.93	0.09	7.03	17.87	61.25	
		2437	6	12Mbps	0.75	10.00	97.67	0.10	6.99	17.84	60.85	
		2437	6	18Mbps	0.75	10.00	96.71	0.15	7.01	17.91	61.74	
		2437	6	24Mbps	0.75	10.00	95.55	0.20	6.83	17.78	59.95	
		2437	6	36Mbps	0.75	10.00	93.51	0.29	6.81	17.85	60.98	
		2437	6	48Mbps	0.75	10.00	91.47	0.39	6.78	17.92	61.91	
		2437	6	54Mbps	0.75	10.00	90.51	0.43	6.76	17.94	62.27	
	Chain A(Main)	2412	1	6Mbps	0.74	10.00	98.86	0.05	4.96	15.75	37.58	
		2437	6	6Mbps	0.75	10.00	98.86	0.05	7.26	**18.06**	**63.97**	
		2462	11	6Mbps	0.75	10.00	98.86	0.05	5.13	15.93	39.17	
	Chain B(Aux)	2412	1	6Mbps	0.74	10.00	98.86	0.05	4.95	15.74	37.50	
		2437	6	6Mbps	0.75	10.00	98.86	0.05	7.58	**18.38**	**68.87**	
		2462	11	6Mbps	0.75	10.00	98.86	0.05	5.67	16.47	44.36	
802.11n 20HT SISO	Data rate check at main antenna	2437	6	mcs0	0.75	10.00	98.77	0.05	7.06	17.86	61.14	Worst data rate of 11n20HT SISO
		2437	6	mcs1	0.75	10.00	97.43	0.11	6.82	17.68	58.66	
		2437	6	mcs2	0.75	10.00	96.40	0.16	6.92	17.83	60.66	
		2437	6	mcs3	0.75	10.00	95.53	0.20	6.90	17.85	60.93	
		2437	6	mcs4	0.75	10.00	93.40	0.30	6.80	17.85	60.90	
		2437	6	mcs5	0.75	10.00	91.53	0.38	6.68	17.81	60.46	
		2437	6	mcs6	0.75	10.00	91.24	0.40	6.52	17.67	58.45	
		2437	6	mcs7	0.75	10.00	90.55	0.43	6.49	17.67	58.49	
	Chain A(Main)	2412	1	mcs0	0.74	10.00	98.77	0.05	3.30	14.09	25.67	
		2437	6	mcs0	0.75	10.00	98.77	0.05	7.06	**17.86**	**61.14**	
		2462	11	mcs0	0.75	10.00	98.77	0.05	4.41	15.21	33.22	
	Chain B(Aux)	2412	1	mcs0	0.74	10.00	98.77	0.05	4.13	14.92	31.07	
		2437	6	mcs0	0.75	10.00	98.77	0.05	7.48	**18.28**	**67.35**	
		2462	11	mcs0	0.75	10.00	98.77	0.05	4.76	15.56	36.00	
802.11n 40HT SISO	Data rate check at main antenna	2437	6	mcs0	0.75	10.00	97.38	0.12	0.91	11.78	15.05	Worst data rate of 11n40HT SISO
		2437	6	mcs1	0.75	10.00	95.12	0.22	0.82	11.77	15.02	
		2437	6	mcs2	0.75	10.00	93.46	0.29	0.69	11.73	14.91	
		2437	6	mcs3	0.75	10.00	88.95	0.51	0.67	11.83	15.24	Not 0.25dB higher than lowest data rate.
		2437	6	mcs4	0.75	10.00	88.52	0.53	0.62	11.70	14.79	
		2437	6	mcs5	0.75	10.00	85.84	0.66	-0.54	10.87	12.23	
		2437	6	mcs6	0.75	10.00	85.46	0.68	-2.45	8.98	7.91	
		2437	6	mcs7	0.75	10.00	84.31	0.74	-3.64	7.85	6.10	
	Chain A(Main)	2422	3	mcs0	0.74	10.00	97.38	0.12	-2.38	8.48	7.04	
		2437	6	mcs0	0.75	10.00	97.38	0.12	0.91	**11.78**	**15.05**	
		2452	9	mcs0	0.75	10.00	97.38	0.12	0.88	11.75	14.95	
	Chain B(Aux)	2422	3	mcs0	0.74	10.00	97.38	0.12	-4.95	5.91	3.90	
		2437	6	mcs0	0.75	10.00	97.38	0.12	1.31	**12.18**	**16.50**	
		2452	9	mcs0	0.75	10.00	97.38	0.12	0.95	11.82	15.19	

Mode	Antenna	Freq. [MHz]	Ch.	Data rate	Loss[dB] Cable	Loss[dB] Attn	Duty cycle / factor [%] / [dB]	Average output power Chain A(Main) Reading[dBm]	Chain A(Main) Result[dBm]	Chain B(Aux) Reading[dBm]	Chain B(Aux) Result[dBm]	A + B [dBm]	Remarks
802.11n 20HT MIMO	Data rate check at main antenna	2437	6	mcs8	0.75	10.00	98.77 / 0.05	4.02	14.82	4.66	15.46	18.17	Worst data rate of 11n20HT MIMO
		2437	6	mcs9	0.75	10.00	97.43 / 0.11	3.91	14.77	4.53	15.39	18.10	
		2437	6	mcs10	0.75	10.00	96.40 / 0.16	3.81	14.72	4.47	15.38	18.07	
		2437	6	mcs11	0.75	10.00	95.53 / 0.20	3.78	14.73	4.31	15.26	18.01	
		2437	6	mcs12	0.75	10.00	93.40 / 0.30	3.66	14.71	4.25	15.30	18.02	
		2437	6	mcs13	0.75	10.00	91.53 / 0.38	3.62	14.75	4.20	15.33	18.06	
		2437	6	mcs14	0.75	10.00	91.24 / 0.40	3.61	14.76	4.17	15.32	18.06	
		2437	6	mcs15	0.75	10.00	90.55 / 0.43	3.57	14.75	4.17	15.35	18.07	
		2412	1	mcs8	0.74	10.00	98.77 / 0.05	1.76	12.55	2.03	12.82	15.70	
		2437	6	mcs8	0.75	10.00	98.77 / 0.05	**4.02**	**14.82**	**4.66**	**15.46**	**18.17**	
		2462	11	mcs8	0.75	10.00	98.77 / 0.05	3.18	13.98	3.72	14.52	17.27	
802.11n 40HT MIMO	Data rate check at main antenna	2437	6	mcs8	0.75	10.00	98.72 / 0.06	-1.67	9.14	-1.43	9.38	12.27	Worst data rate of 11n40HT MIMO
		2437	6	mcs9	0.75	10.00	97.52 / 0.11	-1.95	8.91	-1.50	9.36	12.15	
		2437	6	mcs10	0.75	10.00	96.68 / 0.15	-1.99	8.91	-1.64	9.26	12.10	
		2437	6	mcs11	0.75	10.00	95.35 / 0.21	-1.98	8.98	-1.72	9.24	12.12	
		2437	6	mcs12	0.75	10.00	93.58 / 0.29	-2.15	8.89	-1.82	9.22	12.07	
		2437	6	mcs13	0.75	10.00	91.72 / 0.38	-2.23	8.90	-1.85	9.28	12.10	
		2437	6	mcs14	0.75	10.00	90.88 / 0.42	-3.05	8.12	-3.98	7.19	10.69	
		2437	6	mcs15	0.75	10.00	90.91 / 0.41	-5.75	5.41	-5.50	5.66	8.55	
		2422	3	mcs8	0.74	10.00	98.72 / 0.06	-5.65	5.15	-5.46	5.34	8.25	
		2437	6	mcs8	0.75	10.00	98.72 / 0.06	**-1.67**	**9.14**	**-1.43**	**9.38**	**12.27**	
		2452	9	mcs8	0.75	10.00	98.72 / 0.06	-2.35	8.46	-1.83	8.98	11.73	

*. SAR reference; Date tested: November 15, 2012 / Measured by: Tomochika Sato / Place: preparation room of No. 7 shielded room. (24 deg.C / 45 %RH)
*. Calculating formula: Results = ["Reading"] +["Loss(Cable+Attn)"(Cable loss and attenuator loss)] + ["Duty factor"]
*. A red figure indicates it is the maximum value in each operation condition.
*. Since the average power of 11n(40HT) was lower than the corresponded 11b power, the SAR test was not applied to 11n(40HT) mode. (KDB248227)

SECTION 7: Measurement results

7.1 SAR test results

Measurement date: November 15, 2012 Measurement by: Tomochika Sato

[Liquid measurement (Body tissue)]

Used Target Frequency [MHz]	Target Body Tissue		Measured Body Tissue				Environment		Remarks
	Permittivity [-]	Conductivity [S/m]	Permittivity (εr) [-]	Conductivity (σ) [S/m]	Temp. [deg.C.]	Depth [mm]	Temp. [deg.C.]	Humidity [%RH]	
2450	**52.7**	**1.95**	50.45 (-4.3%)	1.98 (1.4%)	22.9	153	24	45	-
2412	***52.75***	***1.914***	50.69 (-3.9%)	1.92 (0.2%)					
2437	***52.72***	***1.938***	50.51 (-4.2%)	1.94 (0.4%)					
2462	***52.68***	***1.967***	50.46 (-4.2%)	1.99 (1.0%)					

Measurement date: November 16, 2012 Measurement by: Tomochika Sato

[Liquid measurement (Body tissue)]

Used Target Frequency [MHz]	Target Body Tissue		Measured Body Tissue				Environment		Remarks
	Permittivity [-]	Conductivity [S/m]	Permittivity (εr) [-]	Conductivity (σ) [S/m]	Temp. [deg.C.]	Depth [mm]	Temp. [deg.C.]	Humidity [%RH]	
2450	**52.7**	**1.95**	50.32 (-4.5%)	2.01 (3.0%)	22.3	153	24	42	-
2412	***52.75***	***1.914***	50.34 (-4.6%)	1.94 (1.2%)					
2437	***52.72***	***1.938***	50.31 (-4.6%)	1.98 (2.2%)					
2462	***52.68***	***1.967***	50.14 (-4.8%)	2.00 (1.9%)					

*. 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 2450MHz. As an intermediate solution, dielectric parameters for the frequencies between 2000 to 2450 MHz and 2450 to 3000MHz were obtained using linear interpolation. (Refer to Appendix 3-7 in this report)

[SAR measurement results for Chain A(Main antenna)]

SAR measurement results (Body tissue)												
Mode	Frequency		Modulation / Data rate / crest factor	EUT setup conditions		Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg]	Data# in Appendix 2-2	Remarks
	Ch.	[MHz]		Position	Separation distance	Before	After		max. value of multi-peak		
Step 1: Worst position search											
11b	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Lap held(Bottom face)	0 mm (touch)	23.0	23.0	0.14	**0.182**	Step 1-1	Worst position
				Left side		23.0	23.0	-0.05	**0.081**	Step 1-2	-
				LCD back side		23.0	23.0	-0.05	**0.087**	Step 1-3	-
Step 2: Change the operation mode, data rate											
11g	6	2437	BPSK&OFDM / 6Mbps / 1.0	Lap held(Bottom face)	0 mm (touch)	23.0	23.0	-0.04	**0.243**	Step 2-1	Worst SAR of Chain A
11n (20HT) SISO	6	2437	BPSK&OFDM / MCS0 / 1.0			23.0	23.0	-0.02	**0.243**	Step2-2	Worst SAR of Chain A

[SAR measurement results for Chain B(Aux antenna)]

SAR measurement results (Body tissue)												
Mode	Frequency		Modulation / Data rate / crest factor	EUT setup conditions		Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg]	Data# in Appendix 2-2	Remarks
	Ch.	[MHz]		Position	Separation distance	Before	After		max. value of multi-peak		
Step 1: Worst position search											
11b	6	2437	DBPSK&DSSS / 1Mbps / 1.0	Lap held(Bottom face)	0 mm (touch)	23.0	23.0	-0.02	**0.166**	Step 1-4	Worst position
				Right side		23.0	23.0	0.03	**0.044**	Step 1-5	-
				LCD back side		23.0	23.0	-0.04	**0.059**	Step 1-6	-
Step 2: Change the operation mode, data rate											
11g	6	2437	BPSK&OFDM / 6Mbps / 1.0	Lap held(Bottom face)	0 mm (touch)	23.0	23.0	-0.01	**0.198**	Step 2-3	Worst SAR of Chain B
11n (20HT) SISO	6	2437	BPSK&OFDM / MCS0 / 1.0			23.0	23.0	0.02	**0.184**	Step2-4	-

[SAR measurement results for Chain A and B(Main and Aux antenna)(MIMO)]

SAR measurement results (Body tissue)													
Mode	Frequency		Modulation / Data rate / crest factor	EUT setup conditions		Liquid temp. [deg.C]		Power drift [dB]	SAR(1g) [W/kg]		Data# in Appendix 2-2	Remarks
	Ch.	[MHz]		Position	Separation distance	Before	After		Chain A	Chain B		
Step 3: Change the operation mode, data rate												
11n (20HT) MIMO	6	2437	BPSK&OFDM / MCS8 / 1.0	Lap held(Bottom face)	0 mm (touch)	23.0	23.0	-0.13	**0.128**	**0.126**	Step2-5	SUM of 1g SAR = 0.254 W/kg

Notes:

*1. SAR measurement were tested at the maximum output power each mode or band.

*2. SAR measurement were reduced the low and high channels based on 1g SAR value(=<0.8W/kg) and extrapolated maximum peak SAR value(=<1.6W/kg). (KDB 248227 and KDB 447489)

*. Calibration frequency of the SAR measurement probe: EX3DV4 (serial number: 3679) (and used conversion factors)

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

7.2 Decision of the simultaneous transmission measurement

We were based on the following procedure to exclude the simultaneous transmission measurement.

- Step 1

The EUT transmitting power is greater than (60/f) mW, therefore applied the following formula.[KDB 616217]

Following formula was applied for the highest power condition of MIMO (IEEE802.11n 20HT).

"n=P/(60/f)-1" *P=Output power of Chain A or Chain B [mW], f=Frequency [GHz]

n(Chain A)
P : 14.82dBm = 30mW, f : 2.45GHz, n= 30/(60/2.45)-1 = 0.225

n(Chain B)
P : 15.46dBm = 35mW, f : 2.45GHz, n= 35/(60/2.45)-1 = 0.429

Antenna X(Chain A) is (0.75 cm) =>(5+1/2*n(Chain A))=5.113 cm from users and nearby persons, and it is also =>(5+1/2*n(Chain A)+1/2*n(Chain B))=5.33 cm from another simultaneous transmitting antenna Y(Chain B).

Actual separation distance antenna A to user (0.75 cm) is less than calculated separation distance. Actual separation distance antenna A to B (11 cm) is greater than calculated separation distance. Considering the distance of antenna A to user is required simultaneous transmission measurement.

- Step 2

Comparing the 1g SAR limit (1.6W/kg) and worst condition of the simultaneous transmissions sum of 1g SAR value. [KDB 616217]

The measurements were performed highest power condition of MIMO, and following calculation on the based of measured 1g SAR results.
Antenna A(0.128 W/kg) + Antenna B(0.126 W/kg) = 0.254 W/kg … 0.254 W/kg is lower than 1g SAR limit(1.6 W/kg)
Since the total value is lower than 1g SAR limit(1.6 W/kg), the simultaneous transmission measurement is not required.

- Decision

The simultaneous transmission measurement is not required