SAR TEST REPORT

Test Report No. : 10691531H-A-R3

Applicant	:	**silex technology, Inc.**
Type of Equipment	:	**SDIO Wireless Module**
Model No.	:	**SX-SDMAN**
FCC ID	:	**N6C-SDMAN**
Test regulation	:	**FCC47CFR 2.1093**
Test Result	:	**Complied**
Reported SAR(1g) Value		**The highest reported SAR(1g)** DTS: 2412-2462MHz band: 0.076 W/kg UNII: 5180-5320MHz band: 0.134 W/kg UNII: 5745-5825MHz band: 0.237 W/kg

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 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 NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers SAR technical requirements. It does not cover administrative issues such as Manual or non-SAR test related Requirements. (if applicable)
7. This report is a revised version of 10691531H-A-R2. 10691531H-A-R2 is replaced with this report.

Date of test: June 22 to August 4, 2015

Representative test engineer:
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NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

REVISION HISTORY

Original Test Report No.: 10691531H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10691531H-A	August 24, 2015	-	-
1	10691531H-A-R1	September 15, 2015	P.16	Correction of 11ch value (11n-20HT) of Wi-Fi 2.4GHz (DTS Band) in Clause 6.1.
2	10691531H-A-R2	September 16, 2015	All page	Correction of test report No.
2	10691531H-A-R2	September 16, 2015	P.11, 14	Correction of Upper frequency of band in WLAN 5.3 GHz OFDM mode table
3	10691531H-A-R3	September 17, 2015	P.9	Addition of explanatory note for calculation of exclusion
3	10691531H-A-R3	September 17, 2015	P.28, 30	Addition of explanatory note *3 for result of Body SAR
3	10691531H-A-R3	September 17, 2015	P.98	Addition of the distance in antenna position

CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	silex technology, Inc.
Address	:	2-3-1 Hikaridai, Seika-cho, Kyoto 619-0237, Japan
Telephone Number	:	+81-774-98-3878
Facsimile Number	:	+81-774-98-3758
Contact Person	:	Toshiro Kometani

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	SDIO Wireless Module
Model No.	:	SX-SDMAN
Serial No.	:	001
Rating	:	DC 3.3 V
Receipt Date of Sample	:	June 30, 2015
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

[Identification of Host]

Type of Equipment	:	WIRELESS TEACH PENDANT
Model No.	:	FDWLTPDSJN-2
Serial No.	:	02-1L22660YZ56823006
Rating	:	230 V AC 50 / 60 Hz
Option battery	:	None

2.2 Product Description

Model: SX-SDMAN (referred to as the EUT in this report) is a SDIO Wireless Module.

General Specification

Clock frequency(ies) in the system : 26MHz

Radio Specification

Radio Type : Transceiver
Method of Frequency Generation : Synthesizer
Power Supply (inner) : DC1.2V

Specification of Wireless LAN (IEEE802.11b/g/a/n-20/n-40)

Type of radio	IEEE802.11b	IEEE802.11g	IEEE802.11a	IEEE802.11n (20 M band)	IEEE802.11n (40 M band)
Frequency of operation	2412-2462MHz	2412-2462MHz	5180-5320MHz 5745-5825MHz	2412-2462MHz 5180-5320MHz 5745-5825MHz	5190-5310MHz 5755-5795MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		
Channel spacing	5MHz		20MHz	2.4GHz band 5MHz 5GHz band 20MHz	40MHz
Antenna type	Sleeve antenna: Sansei				
Antenna Gain	1.0dBi (2.4GHz including cableloss 0.5dB), 1.1dBi (5GHz including cableloss 1.0dB)				
Antenna Connector type	U.FL connector				

Specification of Bluetooth (Ver.4.0 + EDR)

Type of radio	Bluetooth
Frequency of Operation	2402-2480MHz
Type of Modulation	FHSS
Channel spacing	1MHz
Antenna type	Embedded antenna: Ethertronics
Antenna Gain	2.0dBi (2.4GHz including cableloss 0.5dB), 2.5dBi (5GHz including cableloss 1.0dB)
Antenna Connector Type	U.FL Alternative connector

Specification of Low Energy (Ver.4.0 + EDR/LE Dual mode)

Type of radio	Low Energy
Frequency of Operation	2402-2480MHz
Type of Modulation	DSSS
Channel spacing	2MHz
Antenna type	Embedded antenna: Ethertronics
Antenna Gain	2.0dBi (2.4GHz including cableloss 0.5dB), 2.5dBi (5GHz including cableloss 1.0dB)
Antenna Connector Type	U.FL Alternative connector

*This test report applies for Wireless LAN (IEEE802.11b/g/a/n-20/n-40).
Wireless LAN and Bluetooth do not transmit simultaneously.
Bluetooth doesn't function in this host. Therefore Bluetooth isn't evaluated.

SECTION 3 : Test standard information

3.1 Test Specification

Title : **FCC47CFR 2.1093**
Radiofrequency radiation exposure evaluation: portable devices.

: **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.

: **Published RF exposure KDB procedures**

☑	**KDB447498D01(v05r02)**	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
☐	**KDB447498D02(v02)**	SAR Measurement Procedures for USB Dongle Transmitters
☐	**KDB648474D04(v01r02)**	SAR Evaluation Considerations for Wireless Handsets
☐	**KDB941225D01(v02)**	SAR Measurement Procedures for 3G Devices
☐	**KDB941225D02(v02r02)**	3GPP R6 HSPA and R7 HSPA+ SAR Guidance
☐	**KDB941225D03(v01)**	Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE
☐	**KDB941225D04(v01)**	Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode
☐	**KDB941225D05(v02r03)**	SAR for LTE Devices
☐	**KDB941225D06(v01r01)**	SAR test procedures for devices incorporating SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities (Hot Spot SAR)
☐	**KDB941225D07(v01r01)**	SAR Evaluation Procedures for UMPC Mini-Tablet Devices
☐	**KDB616217D04(v01r01)**	SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers
☑	**KDB865664D01(v01r03)**	SAR Measurement Requirements for 100MHz to 6 GHz
☑	**KDB248227D01(v02r01)**	SAR Measurement Procedures for 802.11a//b/g Transmitters

Reference
[1]SPEAG uncertainty document (AN 15-7/AN19-17) for DASY 5 System from SPEAG (Schmid & Partner Engineering AG).
[2] 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 Procedure

Transmitter	**WLAN**
Test Procedure	Published RF exposure KDB procedures
	SAR
Category	FCC47CFR 2.1093
Note: UL Japan, Inc. 's SAR Work Procedures 13-EM-W0429 and 13-EM-W0430	

3.3 Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
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.

NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE
SPATIAL PEAK(averaged over any 1g of tissue) LIMIT
1.6 W/kg

3.4 Test Location

*Shielded room for SAR testings
UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

SECTION 4 : Test result

4.1 Stand-alone SAR result

Reported SAR

Measured SAR is scaled to the maximum tune-up tolerance limit by the following formulas.
Reported SAR= Measured SAR [W/kg] · Scaled factor *1
Maximum tune-up tolerance limit is by the specification from a customer.

Body SAR

Mode	Frequency	Measured power [dBm]*2	Measured power [mW]	Maximum tune-up tolerance limit [dBm]*3	Maximum tune-up tolerance limit [mW]*3	Measured SAR [W/kg]	Scaled factor	**Reported SAR [W/kg]**
WLAN 11b (DTS : 2412 - 2462MHz band)	2437MHz	14.48	28.05	14.50	28.18	0.076	1.005	**0.076**
WLAN 11n-40 (UNII : 5180 - 5320MHz band)	5270MHz	15.05	31.99	15.50	35.48	0.121	1.109	**0.134**
WLAN 11n40 (UNII : 5745 - 5825MHz band)	5795MHz	13.85	24.27	14.50	28.18	0.204	1.161	**0.237**

Note

*1 Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
*2 The sample used by the SAR test is within the tune-up tolerance but not more than 2 dB lower than the maximum tune-up tolerance limit. That is, measured power is included the tune-up tolerance range.
*3 Maximum tune-up tolerance limit is defined as maximum timed-average value. (Considering to maximum duty cycle of WLAN.)

SECTION 5 SAR test exclusion considerations according to KDB447498 D01

.

The following is based on KDB447498D01.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

WLAN 2.4GHz DSSS mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (2.4GHz band)	☑	Front	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	13 [mm]	3.4
WLAN (2.4GHz band)	☑	Rear	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	12 [mm]	3.7
WLAN (2.4GHz band)	☑	Bottom	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	10 [mm]	4.4
WLAN (2.4GHz band)	☐	Left	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	17 [mm]	2.6 *1)

WLAN 2.4GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (2.4GHz band)	☑	Front	11g,11n-20	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	13 [mm]	3.4
WLAN (2.4GHz band)	☑	Rear	11g,11n-20	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	12 [mm]	3.7
WLAN (2.4GHz band)	☑	Bottom	11g,11n-20	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	10 [mm]	4.4
WLAN (2.4GHz band)	☐	Left	11g,11n-20	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	17 [mm]	2.6 *1)

*1) We excluded the test because of the following reasons.
The calculation of exclusion value was equal to or less than “3”.
In addition, SAR value of the front position in 2.4 GHz band was lower than that SAR value of the front position in 5 GHz band.

WLAN 5.2GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.2GHz band)	☑	Front	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	13 [mm]	6.2
WLAN (5.2GHz band)	☑	Rear	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	12 [mm]	6.7
WLAN (5.2GHz band)	☑	Bottom	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	10 [mm]	8.0
WLAN (5.2GHz band)	☑	Left	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	17 [mm]	4.7

WLAN 5.2GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.2GHz band)	☑	Front	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	13 [mm]	6.2
WLAN (5.2GHz band)	☑	Rear	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	12 [mm]	6.7
WLAN (5.2GHz band)	☑	Bottom	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	10 [mm]	8.0
WLAN (5.2GHz band)	☑	Left	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	17 [mm]	4.7

WLAN 5.3GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.3GHz band)	☑	Front	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	13 [mm]	6.2
WLAN (5.3GHz band)	☑	Rear	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	12 [mm]	6.7
WLAN (5.3GHz band)	☑	Bottom	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	10 [mm]	8.1
WLAN (5.3GHz band)	☑	Left	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	17 [mm]	4.7

WLAN 5.3GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.3GHz band)	☑	Front	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	13 [mm]	6.2
WLAN (5.3GHz band)	☑	Rear	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	12 [mm]	6.7
WLAN (5.3GHz band)	☑	Bottom	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	10 [mm]	8.0
WLAN (5.3GHz band)	☑	Left	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	17 [mm]	4.7

WLAN 5.8GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.8GHz band)	☑	Front	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	13 [mm]	5.2
WLAN (5.8GHz band)	☑	Rear	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	12 [mm]	5.6
WLAN (5.8GHz band)	☑	Bottom	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	10 [mm]	6.8
WLAN (5.8GHz band)	☑	Left	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	17 [mm]	4.0

WLAN 5.8GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
WLAN (5.8GHz band)	☑	Front	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	13 [mm]	5.2
WLAN (5.8GHz band)	☑	Rear	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	12 [mm]	5.6
WLAN (5.8GHz band)	☑	Bottom	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	10 [mm]	6.7
WLAN (5.8GHz band)	☑	Left	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	17 [mm]	4.0

Bluetooth mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance *2	Calculation of exclusion *3
Bluetooth (2.4GHz band)	☐	Front	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	13 [mm]	1.2
Bluetooth (2.4GHz band)	☐	Rear	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	12 [mm]	1.3
Bluetooth (2.4GHz band)	☐	Bottom	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	10 [mm]	1.6
Bluetooth (2.4GHz band)	☐	Left	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	17 [mm]	0.9

2) At 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following.
a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100MHz to 1500 MHz
b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and≤ 6 GHz

WLAN 2.4GHz DSSS mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (2.4GHz band)	☐	Top	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	177 [mm]	1366 [mW]
WLAN (2.4GHz band)	☐	Right	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	117 [mm]	766 [mW]

WLAN 2.4GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (2.4GHz band)	☐	Top	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	177 [mm]	1366 [mW]
WLAN (2.4GHz band)	☐	Right	11b	2462 [MHz] (11ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	117 [mm]	766 [mW]

WLAN 5.2GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.2GHz band)	☐	Top	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	177 [mm]	1336 [mW]
WLAN (5.2GHz band)	☐	Right	11a, 11n20	5240 [MHz] (48ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	117 [mm]	736 [mW]

WLAN 5.2GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.2GHz band)	☐	Top	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	177 [mm]	1336 [mW]
WLAN (5.2GHz band)	☐	Right	11n40	5230 [MHz] (46ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	117 [mm]	736 [mW]

WLAN 5.3GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.3GHz band)	☐	Top	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	177 [mm]	1335 [mW]
WLAN (5.3GHz band)	☐	Right	11a, 11n20	5320 [MHz] (64ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	117 [mm]	735 [mW]

WLAN 5.3GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.3GHz band)	☐	Top	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	177 [mm]	1335 [mW]
WLAN (5.3GHz band)	☐	Right	11n40	5270 [MHz] (54ch)	15.5 [dBm] 35.48 [mW] 35 [mW]*5	117 [mm]	735 [mW]

WLAN 5.8GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.8GHz band)	☐	Top	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	177 [mm]	1332 [mW]
WLAN (5.8GHz band)	☐	Right	11a, 11n20	5825 [MHz] (165ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	117 [mm]	732 [mW]

WLAN 5.8GHz OFDM mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
WLAN (5.8GHz band)	☐	Top	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	177 [mm]	1332 [mW]
WLAN (5.8GHz band)	☐	Right	11n40	5795 [MHz] (159ch)	14.5 [dBm] 28.18 [mW] 28 [mW]*5	117 [mm]	732 [mW]

Bluetooth mode

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *4	Min distance	Calculation of threshold*6
Bluetooth (2.4GHz band)	☐	Top	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	177 [mm]	1365 [mW]
Bluetooth (2.4GHz band)	☐	Right	BDR, EDR, LE	2480 [MHz] (78ch)	10 [dBm] 10.00 [mW] 10 [mW]*5	117 [mm]	765 [mW]

*1 The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
*2 Based on KDB447498D01, min distance is 5mm. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. Refer to Appendix 4.
*3 [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0
If it is Calculation of exclusion ≤ 3.0 standalone SAR test is excluded.
*4 Maximum tune-up tolerance limit is by the specification from a customer.
*5 Maximum tune-up tolerance limit(mW) is rounded to one decimal place.
*6 $[(3\cdot50)/(\sqrt{f_{(GHz)}}))$ + (test separation distance - 50 mm)·(f(MHz)/150)] mW at > 100 MHz and ≤ 1500 MHz
$[(3\cdot50)/(\sqrt{f_{(GHz)}}))$ + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

SECTION 6 : SAR test opearting mode

6.1 Output Power and SAR test required

The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures (section 4). When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

1) The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

Wi-Fi 2.4GHz (DTS Band)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Measured average Power (dBm)	Tune-up upper Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	13.20	14.5	YES	
			6	2437	14.48			
			11	2462	14.39			
	802.11g	6 Mbps	1	2412	7.84	9.50	No	1
			2	2417	13.92	14.50		
			6	2437	12.39	12.50		
			11	2462	8.48	10.00		
	802.11n (HT20)	6.5 Mbps	1	2412	7.83	8.50	No	1
			2	2417	13.57	14.00		
			6	2437	11.05	11.50		
			11	2462	8.24	9.00		

Note(s):

1. According to KDB248227D01, SAR is not required for 802.11g/n HT20 channels 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.

Software information
*The power value of the EUT was set for testing as follows (setting value might be different from product specification value); Power Setting: Refer to the following table. Software: Atheros Test Command (Athtestcmd) - v3.1.1 Build 563 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.

[Power Settings]

	Ch1	Ch2	Ch6	Ch11
11b(1Mbps)	14 dBm	-	15.5 dBm	15 dBm
11g(6Mbps)	8.5 dBm	14.5 dBm	13.5 dBm	9 dBm
11n-20(MCS0)	8.5 dBm	14.5 dBm	12 dBm	9 dBm

Wi-Fi 5GHz (U-NII Bands)

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Measured average Power (dBm)	Tune-up upper Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	13.68	15.5	No	1
			40	5200	13.85			
			44	5220	14.10			
			48	5240	14.59			
	802.11n (HT20)	6.5 Mbps	36	5180	13.51	14.5	No	1
			40	5200	13.71	15.5		
			44	5220	14.13			
			48	5240	14.21			
	802.11n (HT40)	13.5 Mbps	38	5190	10.57	11.0	No	3
			46	5230	15.12	15.5		
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	13.50	15.5	No	1
			56	5280	14.18			
			60	5300	14.12			
			64	5320	14.08			
	802.11n (HT20)	6.5 Mbps	52	5260	13.54	15.5	No	1
			56	5280	14.37			
			60	5300	13.56			
			64	5320	14.12			
	802.11n (HT40)	13.5 Mbps	54	5270	15.05	15.5	YES	
			62	5310	12.91	13.0		
5.8 (UNII-3)	802.11a	6 Mbps	149	5745	13.37	14.5	No	1
			153	5765	13.21			
			157	5785	13.08			
			161	5805	12.99			
			165	5825	12.96			
	802.11n (HT20)	6.5 Mbps	149	5745	13.51	14.5	No	1
			153	5765	13.34			
			157	5785	13.20			
			161	5805	13.15			
			165	5825	13.02			
	802.11n (HT40)	13.5 Mbps	151	5755	13.61	14.5	YES	
			159	5795	13.85			

Note(s):

1. According to KDB248227D01, SAR measurement is not required for 802.11a and 802.11n HT20 channels because the specified tune-up tolerances for 802.11a and 802.11n HT20 are lower than 802.11n HT40 and the measured SAR is ≤ 1.2 W/Kg.
2. According to KDB248227D01, when the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.
3. According to KDB248227D01, when the specified maximum output power is the same for both UNII band 1 and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
   - ≤ 1.2 W/kg, SAR is not required for UNII band 1
   - > 1.2 W/kg, both bands should be tested independently for SAR.

Software information

*The power value of the EUT was set for testing as follows (setting value might be different from product specification value);

Power Setting: Refer to the following table.
Software: Atheros Test Command (Athtestcmd)
- v3.1.1 Build 563
*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

[Power Settings]

20MHz Band W52	ch36	ch40	ch44	ch48
11a (6Mbps)	14.5 dBm	14.5 dBm	14.5 dBm	14.5 dBm
11n-20 (MCS0)	14.5 dBm	14.5 dBm	14.5 dBm	14.5 dBm

20MHz Band W53	ch52	ch56	ch60	ch64
11a (6Mbps)	13.5 dBm	14.5 dBm	14.5 dBm	14.5 dBm
11n-20 (MCS0)	13.5 dBm	14.5 dBm	14.5 dBm	14.5 dBm

20MHz Band W58	ch149	ch153	ch157	ch161	ch165
11a (6Mbps)	14 dBm	14 dBm	14 dBm	14 dBm	14 dBm
11n-20 (MCS0)	14 dBm	14 dBm	14 dBm	14 dBm	14 dBm

40MHz Band W52	ch38	ch46
11n-40 (MCS0)	12.5 dBm	15.5 dBm

40MHz Band W53	ch54	ch62
11n-40 (MCS0)	15.5 dBm	13.5 dBm

40MHz Band W58	ch151	ch159
11n-40 (MCS0)	15 dBm	15 dBm

SECTION 7: Description of the Body setup

7.1 Test position for Body setup

i) Procedure for SAR testing

-The tested procedure was performed according to the KDB447498 D01 (Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies)

ii) Test mode

WLAN 2.4GHz	**11b**
WLAN 5GHz	**11n-40**

iii) Test position

No.	Position	Test distance	WLAN 2.4GHz	WLAN 5GHz
			Tested	Tested
1	Front	0mm	☑	☑
2	Rear	0mm	☑	☑
3	Left	0mm	☐	☑
4	Right	0mm	☐	☐
5	Top	0mm	☐	☐
6	Bottom	0mm	☑	☑

SECTION 8 : Test surrounding

8.1 Measurement uncertainty

This measurement uncertainty budget is suggested by IEEE Std 1528(2013) and IEC62209-2:2010, 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.

<0.3 – 3GHz range Body>

Error Description	Uncertai value ±	Probability distribution	divisor	(ci) 1g	Standard (1g)	vi or veff
Measurement System						
Probe calibration	± 6.00	Normal	1	1	± 6.00	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	0.7	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	0.7	± 3.9	∞
Boundary effects	± 1.0	Rectangular	√3	1	± 0.6	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Modulation response	± 2.4	Rectangular	√3	1	± 1.4	∞
Readout electronics	± 0.3	Normal	1	1	± 0.3	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5	∞
RF ambient Noise	± 3.0	Rectangular	√3	1	± 1.7	∞
RF ambient Reflections	± 3.0	Rectangular	√3	1	± 1.7	∞
Probe Positioner	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7	∞
Max.SAR Eval.	± 2.0	Rectangular	√3	1	± 1.2	∞
Test Sample Related						
Device positioning	± 2.9	Normal	1	1	± 2.9	2
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	2
Power drift	± 5.0	Rectangular	√3	1	± 2.9	∞
Power Scaling	+ 0.0	Rectangular	√3	1	± 0.0	∞
Phantom and Setup						
Phantom uncertainty	± 6.1	Rectangular	√3	1	± 3.5	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	± 1.9	Normal	1	1	± 1.9	∞
Liquid conductivity (meas.)	+ 3.4	Rectangular	1	0.78	+ 2.7	∞
Liquid permittivity (meas.)	- 3.8	Rectangular	1	0.23	- 0.9	∞
Liquid conductivity - temp.unc (below 2deg.C.)	± 5.2	Rectangular	√3	0.78	± 2.3	∞
Liquid permittivity - temp.unc (below 2deg.C.)	± 0.8	Rectangular	√3	0.23	± 0.1	∞
Combined Standard Uncertainty					± **11.602**	
Expanded Uncertainty (k=2)					± **23.2**	

*. Table of uncertainties are listed for ISO/IEC 17025.

<3 – 6GHz range Body>

Error Description	Uncertai value ±	Probability distribution	divisor	(ci) 1g	Standard (1g)	vi or veff
Measurement System						
Probe calibration	± 6.55	Normal	1	1	± 6.55	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	0.7	± 1.9	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	0.7	± 3.9	∞
Boundary effects	± 2.0	Rectangular	√3	1	± 1.2	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Modulation response	± 2.4	Rectangular	√3	1	± 1.4	∞
Readout electronics	± 0.3	Normal	1	1	± 0.3	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 2.6	Rectangular	√3	1	± 1.5	∞
RF ambient Noise	± 3.0	Rectangular	√3	1	± 1.7	∞
RF ambient Reflections	± 3.0	Rectangular	√3	1	± 1.7	∞
Probe Positioner	± 0.8	Rectangular	√3	1	± 0.5	∞
Probe positioning	± 6.7	Rectangular	√3	1	± 3.9	∞
Max.SAR Eval.	± 4.0	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 2.9	Normal	1	1	± 2.9	3
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	7
Power drift	± 5.0	Rectangular	√3	1	± 2.9	∞
Power Scaling	+ 0.0	Rectangular	√3	1	± 0.0	∞
Phantom and Setup						
Phantom uncertainty	± 6.6	Rectangular	√3	1	± 3.8	∞
Algorithm for correcting SAR for deviations in permittivity and conductivity	± 1.9	Normal	1	1	± 1.9	∞
Liquid conductivity (meas.)	– 2.5	Rectangular	1	0.78	+ 2.0	∞
Liquid permittivity (meas.)	– 4.0	Rectangular	1	0.23	- 0.9	∞
Liquid conductivity - temp.unc (below 2deg.C.)	± 2.4	Rectangular	√3	0.78	± 1.1	∞
Liquid permittivity - temp.unc (below 2deg.C.)	± 0.8	Rectangular	√3	0.23	± 0.1	∞
Combined Standard Uncertainty					± **12.390**	
Expanded Uncertainty (k=2)					± **24.8**	

*. Table of uncertainties are listed for ISO/IEC 17025.

SECTION 9 : Measurement results

9.1 Body SAR of 2.4GHz

(1)Method of measurement

Step.1 The searching for the worst position
The test was performed at the highest power channel of DSSS. *1*2

Note:
*1 Highest measured output power channel was tested initially according to KDB248227D01.

*2 SAR is not required for the following 2.4 GHz OFDM conditions according to KDB248227D01.
1) When KDB447498D01 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. Refer to (4) OFDM mode exclusion considerations.

*3 According to KDB248227D01
1) When the *reported* SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the *reported* SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any *reported* SAR is > 1.2 W/kg, SAR is required for the third channel.

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the DAKS dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
-	-	-	-	-	2000	εr	53.3	-	-	-	*1
						σ [mho/m]	1.52	-	-	-	
22-Jul	24.0	58	MSL 2450	23.5	2437	εr	52.7	50.7	-3.8	+/-5	*2
						σ [mho/m]	1.94	2.01	3.4	+/-5	
-	-	-	-	-	2450	εr	52.7	-	-	-	*1
						σ [mho/m]	1.95	-	-	-	

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in KDB 865664D01.
*2 The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

(3)Result of Body SAR

SAR MEASUREMENT RESULTS														
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Scaled factor *1	Reported SAR(1g) [W/kg] *2	Remark
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]				
Step.1 The searching for the worst position														
1	2437	11b 1Mbps	14.48	28.05	14.50	28.18	Flat	Fixed	Front	0	**0.076**	**1.005**	**0.076**	
1	2437	11b 1Mbps	14.48	28.05	14.50	28.18	Flat	Fixed	Rear	0	**0.005**	**1.005**	**0.005**	
1	2437	11b 1Mbps	14.48	28.05	14.50	28.18	Flat	Fixed	Bottom	0	**0.002**	**1.005**	**0.002**	

*1 Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
*2 Reported SAR= Measured SAR [W/kg] · Scaled factor
*3 OFDM mode exclusion considerations
OFDM was excluded from the following table according to KDB248227D01.

Maximum tune-up tolerance limit		Maximum tune-up tolerance limit		OFDM scaled	Position	DSSS Reported SAR value [W/kg]	OFDM Estimated SAR value [W/kg] *5	Exclusion limit [W/kg]	**Standalone SAR tested**
DSSS		OFDM							
[dBm]	[mW]	[dBm]	[mW]						
14.50	28.18	14.50	28.18	1.000	**Front**	**0.076**	**0.076**	< 1.2	**No**

*4 OFDM scaled factor = Maximum tune-up tolerance limit of OFDM [mW] / Maximum tune-up tolerance limit of DSSS [mW]
*5 Estimated SAR of OFDM= Reported SAR of DSSS[W/kg] · OFDM scaled factor

9.2 Body SAR of 5.3GHz

(1)Method of measurement

Step.1 The searching for the worst position

The test was performed at the highest power channel of 5.3GHz band 11n40 MCS0. *1 *2

Note:

*1 According to KDB248227D01

1) The largest channel bandwidth configuration is selected among the multiple configurations in a frequency band with the same specified maximum output power.

2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.

3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.

4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

*2 SAR is not required for the following OFDM U-NII-1(5.2 GHz band) conditions according to KDB248227D01.

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A(5.3GHz band) band by applying the OFDM SAR requirements. If the highest *reported* SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1(5.2GHz band) band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest *reported* SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the DAKS dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
-	-	-	-	-	3000	εr	52.0	-	-	-	*1
						σ [mho/m]	2.73	-	-	-	
24-Jul	24.0	50	MBBL 3.5-5.8	23.5	5270	εr	48.9	47.0	-4.0	+/-5	*2
						σ [mho/m]	5.38	5.25	-2.5	+/-5	
-	-	-	MBBL 3.5-5.8	-	5800	εr	48.2	-	-	+/-5	*1
						σ [mho/m]	6.00	-	-	+/-5	

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in KDB 865664D01.
*2 The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

(3)Result of Body SAR

SAR MEASUREMENT RESULTS														
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Scaled factor *1	Reported SAR(1g) [W/kg] *2	Remark
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]				
Step.1 The searching for the worst position														
54	5270	11n40 MCS0	15.05	31.99	15.50	35.48	Flat	Fixed	Front	0	**0.120**	**1.109**	**0.133**	
54	5270	11n40 MCS0	15.05	31.99	15.50	35.48	Flat	Fixed	Rear	0	**0.008**	**1.109**	**0.009**	
54	5270	11n40 MCS0	15.05	31.99	15.50	35.48	Flat	Fixed	Bottom	0	**0.017**	**1.109**	**0.019**	
54	5270	11n40 MCS0	15.05	31.99	15.50	35.48	Flat	Fixed	Left	0	**0.121**	**1.109**	**0.134**	**0.189[W/kg]*3 *4**

*1 Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
*2 Reported SAR= Measured SAR [W/kg] · Scaled factor
*3 Reference value=Reported SAR [W/kg] · Separation factor
Separation factor = 25.0[mm] (The distance of antenna to the projection portion surface) /17.7[mm] (The shortest distance of antenna to chassis surface)
*4 OFDM 5.2GHz band mode exclusion considerations
OFDM 5.2GHz band was excluded from the following table according to KDB248227D01.

Maximum tune-up tolerance limit		Maximum tune-up tolerance limit		OFDM scaled factor *5	Position	OFDM 5.3GHz band Reported SAR value [W/kg]	OFDM 5.2GHz band Estimated SAR value [W/kg] *6	Exclusion limit [W/kg]	**Standalone SAR tested**
OFDM 5.3GHz band		OFDM 5.2GHz band							
[dBm]	[mW]	[dBm]	[mW]						
13.50	22.39	13.50	22.39	1.000	**Front**	**0.134**	**0.134**	< 1.2	**No**

*5 OFDM scaled factor = Maximum tune-up tolerance limit of OFDM 5.2GHz band [mW] / Maximum tune-up tolerance limit of 5.3GHz band [mW]
*6 Estimated SAR of OFDM 5.2GHz band= Reported SAR of 5.3GHz band [W/kg] · OFDM scaled factor

9.3 Body SAR of 5.8GHz

(1)Method of measurement

Step.1 The searching for the worst position

The test was performed at the highest power channel of 5.8GHz band 11n40 MCS0. *1 *2

Note:
*1 According to KDB248227D01
1) The largest channel bandwidth configuration is selected among the multiple configurations in a frequency band with the same specified maximum output power.
2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected.

*2 SAR is not required for the following OFDM U-NII-1(5.2 GHz band) conditions according to KDB248227D01.
1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A(5.3GHz band) band by applying the OFDM SAR requirements. If the highest *reported* SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1(5.2GHz band) band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest *reported* SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the DAKS dielectric probe kit.
The dielectric parameters measurement is reported in each correspondent section.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
-	-	-	-	-	3000	εr	52.0	-	-	-	*1
						σ [mho/m]	2.73	-	-	-	
4-Aug	24.0	56	MBBL 3.5-5.8	23.5	5795	εr	48.2	46.4	-3.8	+/-5	*2
						σ [mho/m]	5.99	6.06	1.1	+/-5	
-	-	-	MBBL 3.5-5.8	-	5800	εr	48.2	-	-	+/-5	*1
						σ [mho/m]	6.00	-	-	+/-5	

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in KDB 865664D01.
*2 The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

(3)Result of Body SAR

SAR MEASUREMENT RESULTS														
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Scaled factor *1	Reported SAR(1g) [W/kg] *2	Remark
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]				
Step.1 The searching for the worst position														
159	5795	11n40 MCS0	13.85	24.27	14.50	28.18	Flat	Fixed	Front	0	**0.120**	**1.161**	**0.139**	
159	5795	11n40 MCS0	13.85	24.27	14.50	28.18	Flat	Fixed	Rear	0	**0.008**	**1.161**	**0.009**	
159	5795	11n40 MCS0	13.85	24.27	14.50	28.18	Flat	Fixed	Bottom	0	**0.102**	**1.161**	**0.118**	
159	5795	11n40 MCS0	13.85	24.27	14.50	28.18	Flat	Fixed	Left	0	**0.204**	**1.161**	**0.237**	**0.335[W/kg]*3**

*1 Scaled factor = Maximum tune-up tolerance limit [mW] / Measured power [mW]
*2 Reported SAR= Measured SAR [W/kg] · Scaled factor
*3 Reference value=Reported SAR [W/kg] · Separation factor
Separation factor = 25.0[mm] (The distance of antenna to the projection portion surface) /17.7[mm](The shortest distance of antenna to chassis surface)

SECTION 10 Test instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPM-12	Power Meter	Anritsu	ML2495A	0825002	SAR	2015/06/09 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	SAR	2015/06/09 * 12
MAT-58	Attenuator(10dB)	Suhner	6810.19.A	-	SAR	2015/01/09 * 12
MCC-98	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30819/2	SAR	2015/05/01 * 12
MOS-30	Thermo-Hygrometer	Custom	CTH-201	3001	SAR	2015/07/07 * 12
MOS-31	Thermo-Hygrometer	Custom	CTH-201	3101	SAR	2015/07/07 * 12
MDPK-03	Dielectric assessment kit	Schmid&Partner Engineering AG	DAK-3.5	0008	SAR	2015/03/10 * 12
COTS-MSAR-04	Dielectric assessment kit	Schmid&Partner Engineering AG	DAK		SAR	-
MDAE-03	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	1372	SAR	2015/06/15 * 12
MPB-09	Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV4	3922	SAR	2015/06/17 * 12
MPF-03	2mm Oval Flat Phantom	Schmid&Partner Engineering AG	QDOVA001BB	1203	SAR	2015/05/11 * 12
MPF-04	2mm Oval Flat Phantom	Schmid&Partner Engineering AG	QDOVA001BB	1207	SAR	2015/05/11 * 12
MOS-38	Digital thermometer	HANNA	Checktemp 4	-	SAR	2015/04/28 * 12
MOS-10	Digtal thermometer	HANNA	Checktemp-2	MOS-10	SAR	2015/04/28 * 12
COTS-MSAR-03	Dasy5	Schmid&Partner Engineering AG	DASY5	-	SAR	-
MRBT-03	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F13/5PP1D1/A/01	SAR	2015/06/23 * 12
MRBT-04	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F13/5PP1A1/A/01	SAR	2015/06/23 * 12
MPM-01	Power Meter	Agilent	E4417A	GB41290639	SAR	2015/04/22 * 12
MPSE-01	Power Sensor	Agilent	E9300B	US40010300	SAR	2015/04/16 * 12
MAT-15	Attenuator	Agilent	8498A	US40010300	SAR	2015/04/09 * 12
MHDC-12	Dual Directional Coupler	Hewlett Packard	772D	2839A0016	SAR	Pre Check
MSG-10	Signal Generator	Agilent	N5181A	MY47421098	SAR	2014/11/07 * 12
MRFA-24	Pre Amplifier	R&K	R&K CGA020M602-2633R	B30550	SAR	2015/06/15 * 12
MAT-78	Attenuator	Telegrartner	J01156A0011	0042294119	SAR	Pre Check
MDA-08	Dipole Antenna	Schmid&Partner Engineering AG	D5GHzV2	1020	SAR	2015/01/13 * 12
MDA-07	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	SAR	2015/07/21 * 36
MSL2450					Daily check	Target value ± 5%
MBBL3.5-5.8					Daily check	Target value ± 5%
SAR Room					Daily check Ambient Noise<0.012W/kg	

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

APPENDIX 1 : SAR Measurement data

1. Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was 15 mm x 15 mm, 12 mm x 12 mm or 10mm x 10mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point found in the Step 2 (area scan), a volume of 30mm x 30mm x 30mm or more was assessed by measuring 7 x 7 x 7 points at least for below 3GHz and a volume of 28 mm x 28mm x 22.5mm or more was assessed by measuring 8 x 8 x 6(ratio step method (*1)) points at least for 5GHz band.

And for any secondary peaks found in the Step2 which are within 2dB of maximum peak and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1). The data at the surface were extrapolated, since the center of the dipoles is 1mm(EX3DV4) away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes.
This polynomial was then used to evaluate the points between the surface and the probe tip.

(2). The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot"-condition (in x, y and z-directions) [4], [5]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

(3). All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the E-field at the same location as in Step 1.
It was checked that the power drift [W] is within +/-5%.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.
DASY5 system calculation Power drift value[dB] =20log(Ea)/(Eb)
Before SAR testing : Eb[V/m]
After SAR testing : Ea[V/m]
Limit of power drift[W] =+/-5%
X[dB]=10log[P]=10log(1.05/1)=10log(1.05)-10log(1)=0.212dB
from E-filed relations with power.
p=E^2/η=E^2/
Therefore, The correlation of power and the E-filed
XdB=10log(P)=10log(E)^2=20log(E)
Therefore,
The calculated power drift of DASY5 System must be the less than +/-0.212dB.

***1. Ratio step method parameters used;**
The first measurement point: 2mm from the phantom surface, the initial grid separation: 2mm, subsequent graded grid ratio: 1.5
These parameters comply with the requirement of the KDB 865664D01.

2. Measurement data(2.4GHz)

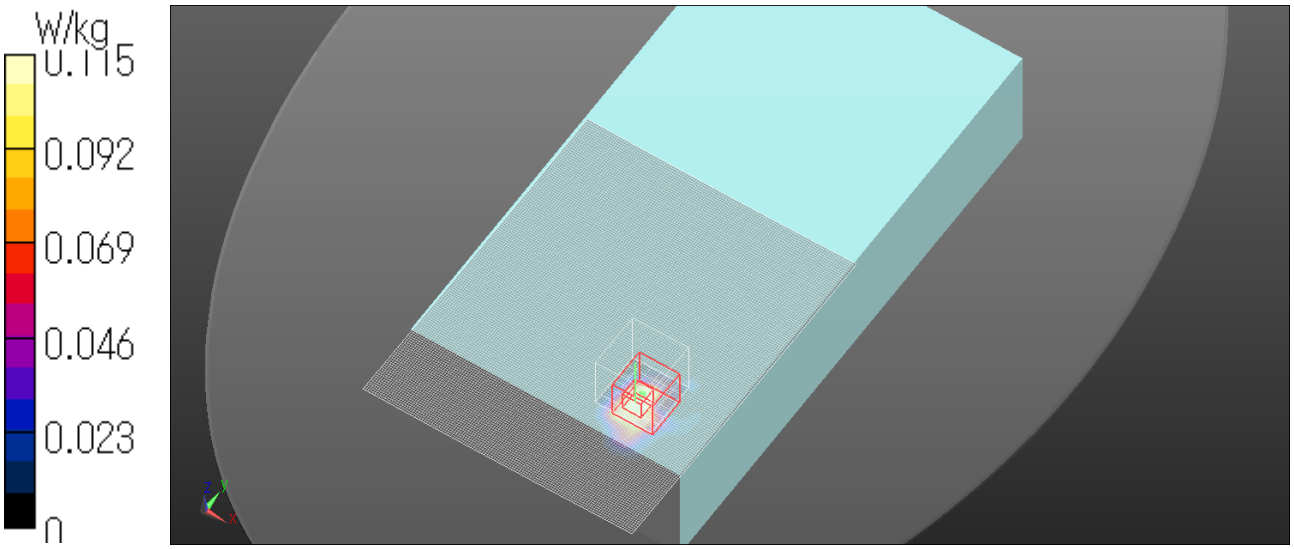
WLAN 2.4G 11b 1Mpbs 2437MHz Front 0mm
Communication System: UID 0, WLAN (0); Communication System Band: 11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.006 S/m; ε_r = 50.711; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/06/17;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 TP1207; Type: QDOVA001BB; Serial: TP:1207
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan (121x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.241 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.735 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.406 W/kg
SAR(1 g) = 0.076 W/kg; SAR(10 g) = 0.026 W/kg

Maximum value of SAR (measured) = 0.115 W/kg
Date: 2015/07/22
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



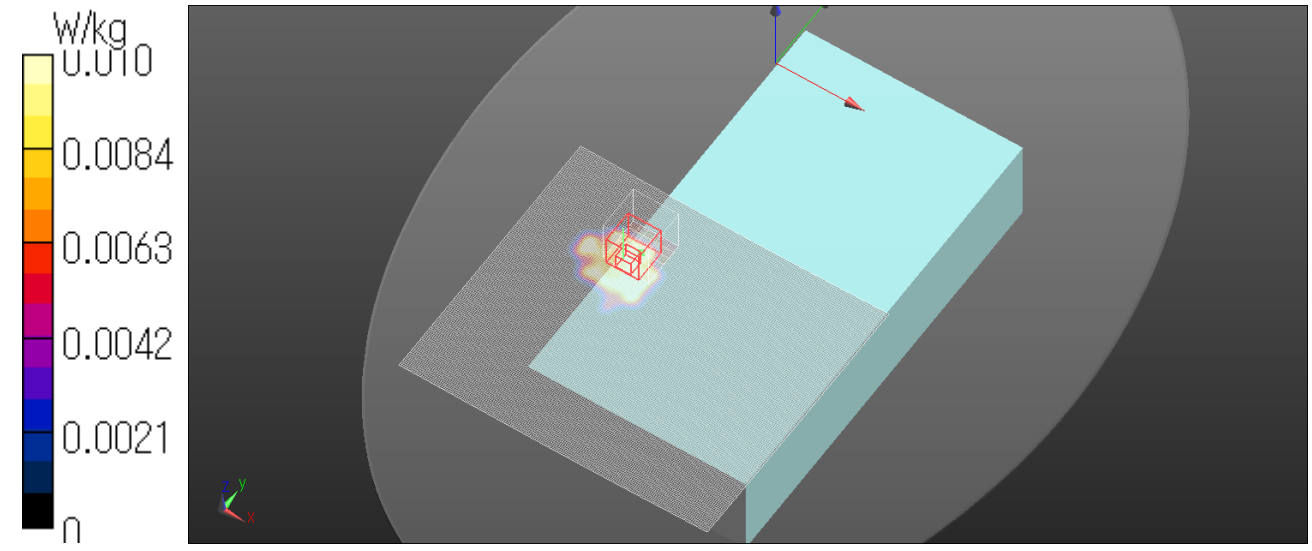
WLAN 2.4G 11b 1Mpbs 2437MHz Rear 0mm
Communication System: UID 0, WLAN (0); Communication System Band: 11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.006 S/m; ε_r = 50.711; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/06/17;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 TP1207; Type: QDOVA001BB; Serial: TP:1207
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan (171x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0221 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.177 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.0260 W/kg
SAR(1 g) = 0.00491 W/kg; SAR(10 g) = 0.00197 W/kg

IMaximum value of SAR (measured) = 0.0105 W/kg
Date: 2015/07/22
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



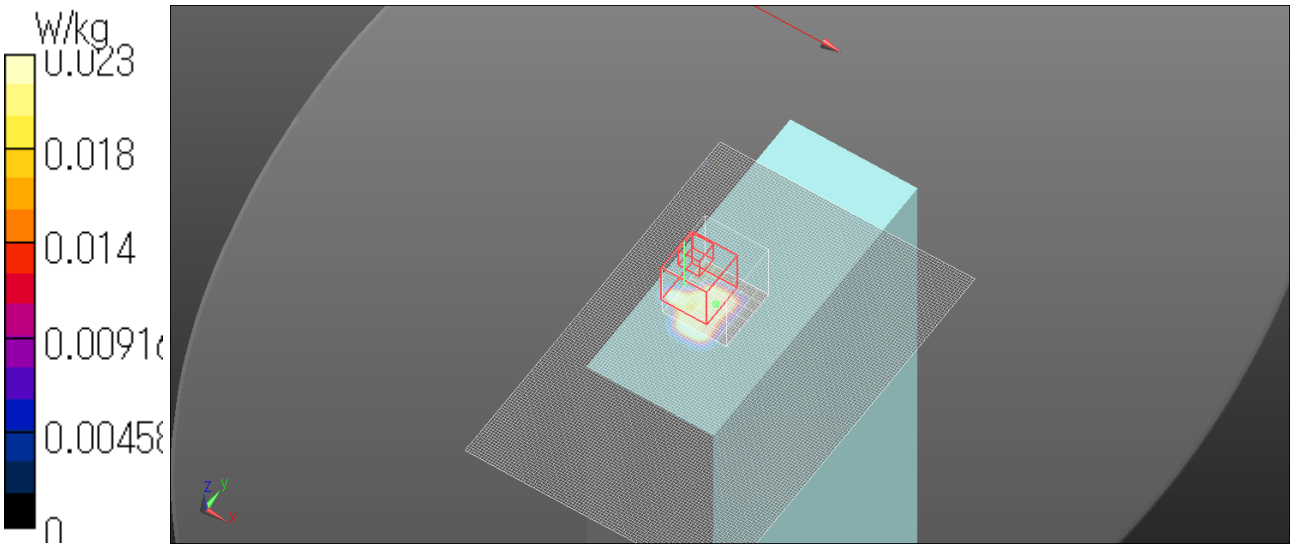
WLAN 2.4G 11b 1Mpbs 2437MHz Bottom 0mm
Communication System: UID 0, WLAN (0); Communication System Band: 11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.006 S/m; ε_r = 50.711; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/06/17;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 TP1207; Type: QDOVA001BB; Serial: TP:1207
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan (101x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.0693 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.935 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.0120 W/kg
SAR(1 g) = 0.0015 W/kg; SAR(10 g) = 0.000511 W/kg

Maximum value of SAR (measured) = 0.0229 W/kg
Date: 2015/07/22
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



3. Measurement data(5.3GHz)

WLAN 5G 11n40 MCS0 5270MHz Front 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5270 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5270 MHz; σ = 5.245 S/m; ε_r = 46.985; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

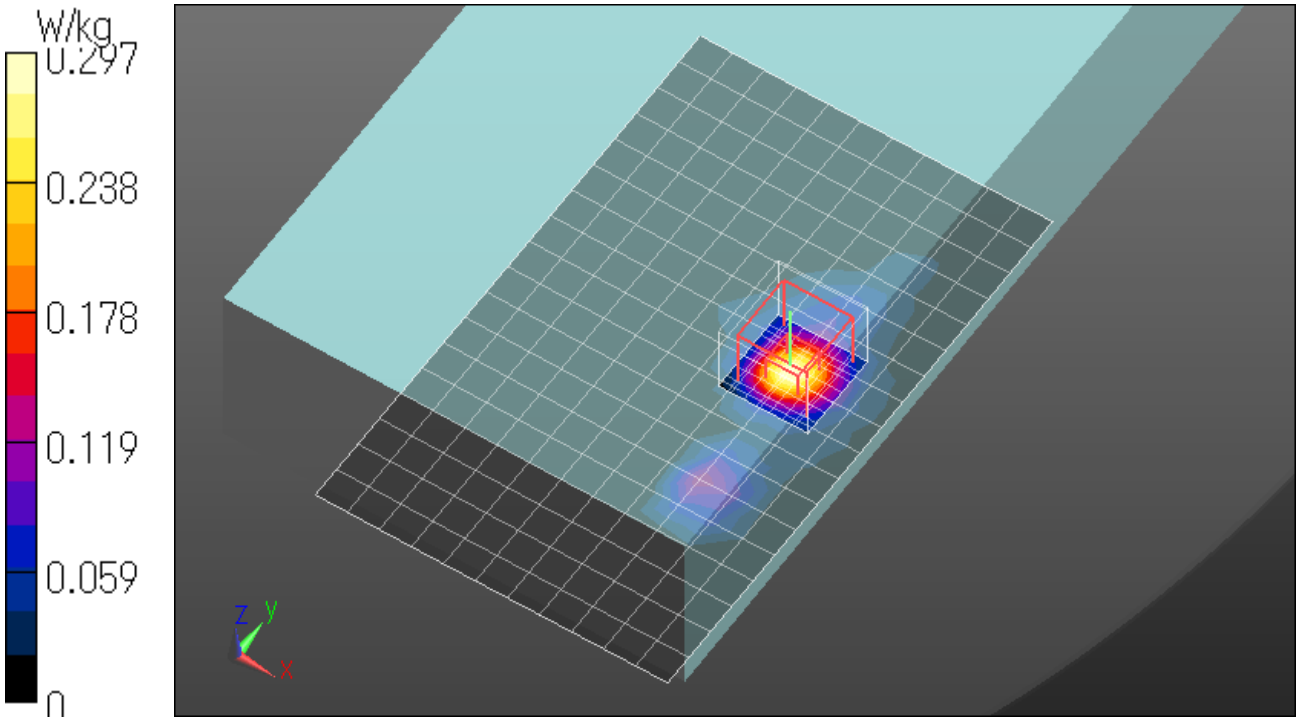
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (12x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.296 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 7.493 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.490 W/kg
SAR(1 g) = 0.120 W/kg; SAR(10 g) = 0.036 W/kg
Maximum value of SAR (measured) = 0.297 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5270MHz Rear 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5270 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5270 MHz; σ = 5.245 S/m; ε_r = 46.985; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

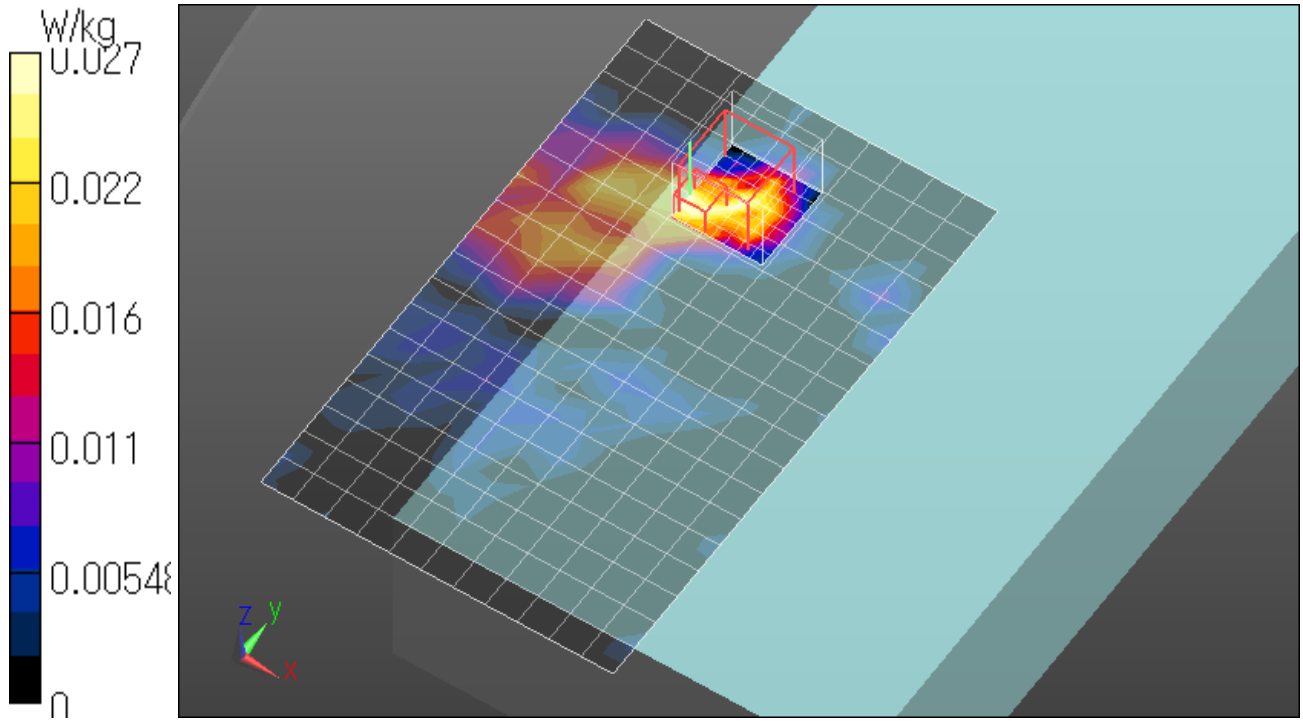
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 2 (12x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.0244 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 2.039 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.00837 W/kg; SAR(10 g) = 0.00245 W/kg
Maximum value of SAR (measured) = 0.0274 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5270MHz Bottom 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5270 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5270 MHz; σ = 5.245 S/m; ε_r = 46.985; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

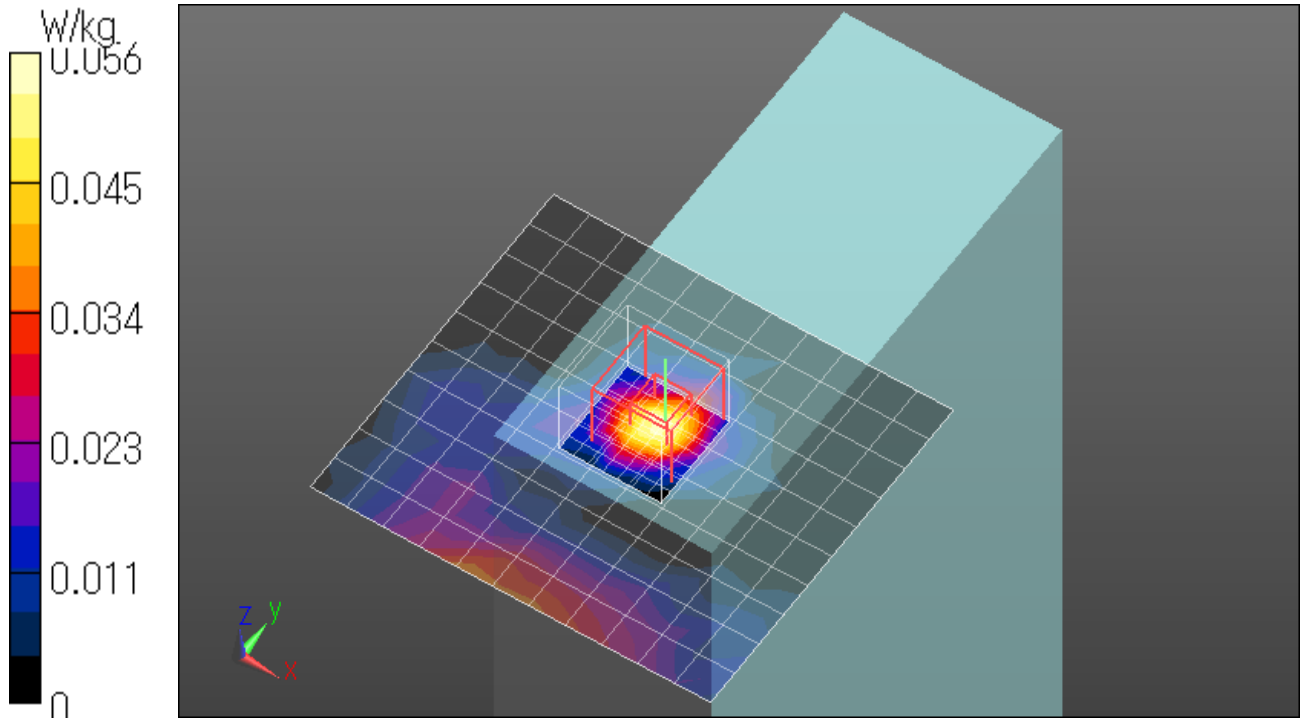
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (12x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.0611 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 2.900 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.112 W/kg
SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.00498 W/kg
Maximum value of SAR (measured) = 0.0563 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5270MHz Left 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5270 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5270 MHz; σ = 5.245 S/m; ε_r = 46.985; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

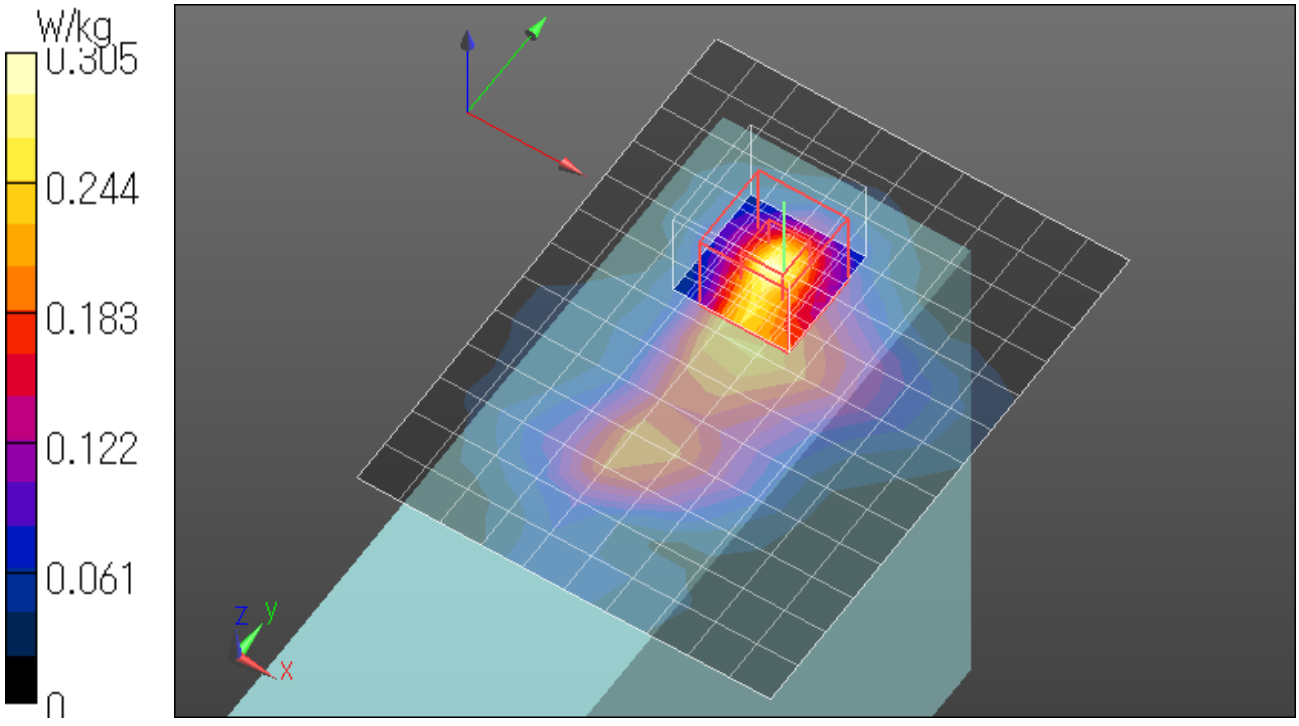
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (11x14x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.312 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 7.286 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.520 W/kg
SAR(1 g) = 0.121 W/kg; SAR(10 g) = 0.041 W/kg
Maximum value of SAR (measured) = 0.305 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



4. Measurement data(5.8GHz)

WLAN 5G 11n40 MCS0 5795MHz Front 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5795 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5795 MHz; σ = 6.058 S/m; ε_r = 46.39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

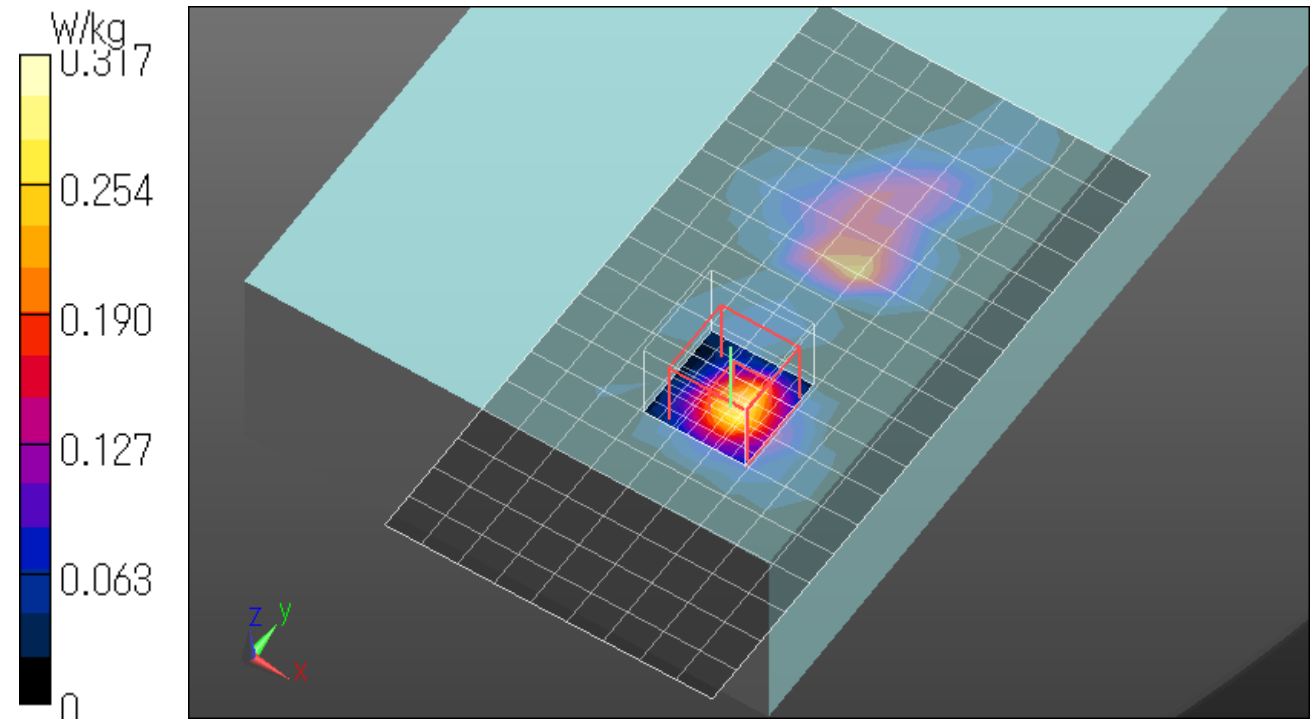
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (10x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.266 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 6.508 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.120 W/kg; SAR(10 g) = 0.035 W/kg
Maximum value of SAR (measured) = 0.317 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5795MHz Rear 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5795 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5795 MHz; σ = 6.058 S/m; ε_r = 46.39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

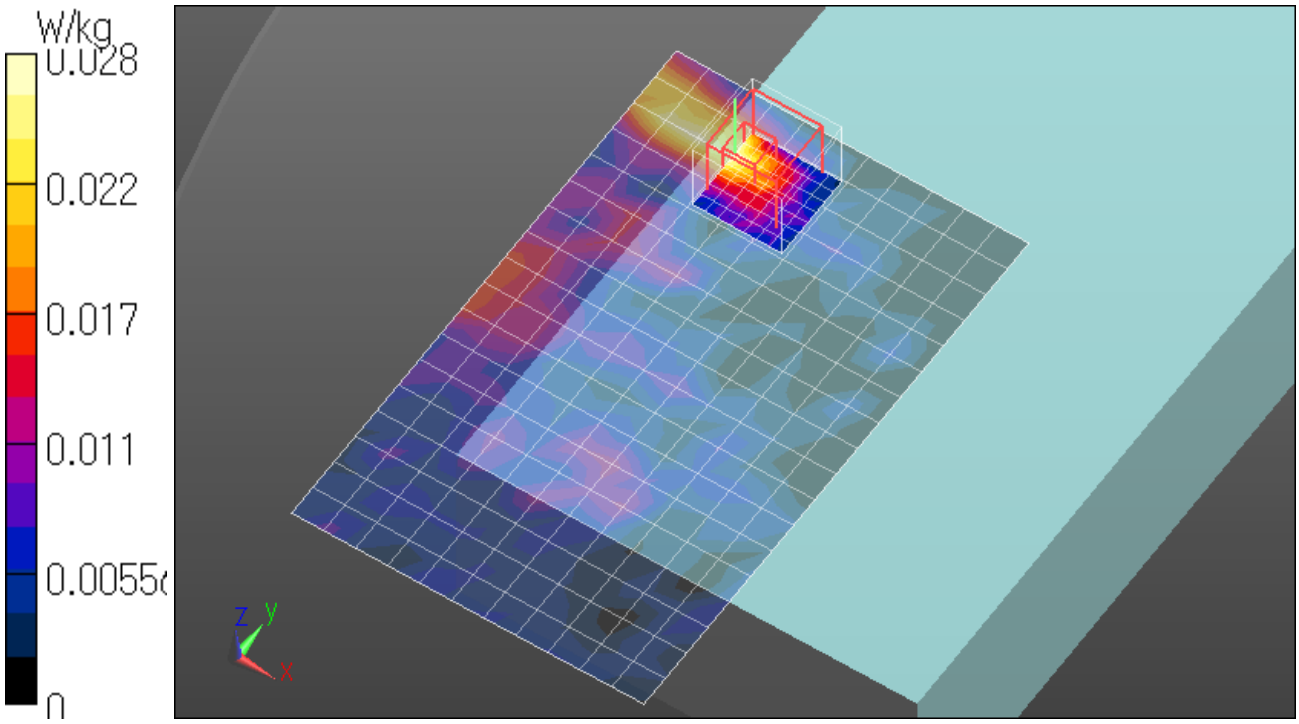
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (12x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.0272 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.665 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.100 W/kg
SAR(1 g) = 0.00807 W/kg; SAR(10 g) = 0.00219 W/kg
Maximum value of SAR (measured) = 0.0278 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5795MHz Bottom 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5795 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5795 MHz; σ = 6.058 S/m; ε_r = 46.39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

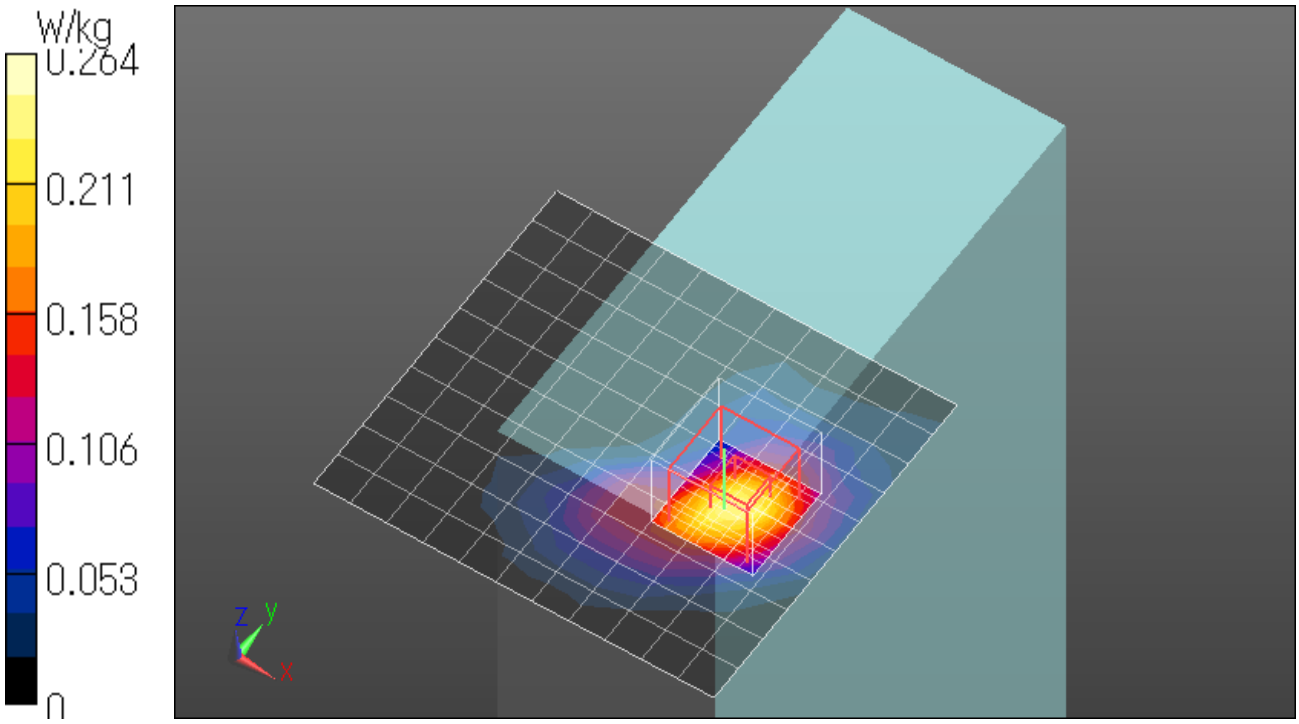
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (12x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.227 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 6.480 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.416 W/kg
SAR(1 g) = 0.102 W/kg; SAR(10 g) = 0.038 W/kg
Maximum value of SAR (measured) = 0.264 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



WLAN 5G 11n40 MCS0 5795MHz Left 0mm

Communication System: UID 0, WLAN (0); Communication System Band: 11n40; Frequency: 5795 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5795 MHz; σ = 6.058 S/m; ε_r = 46.39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

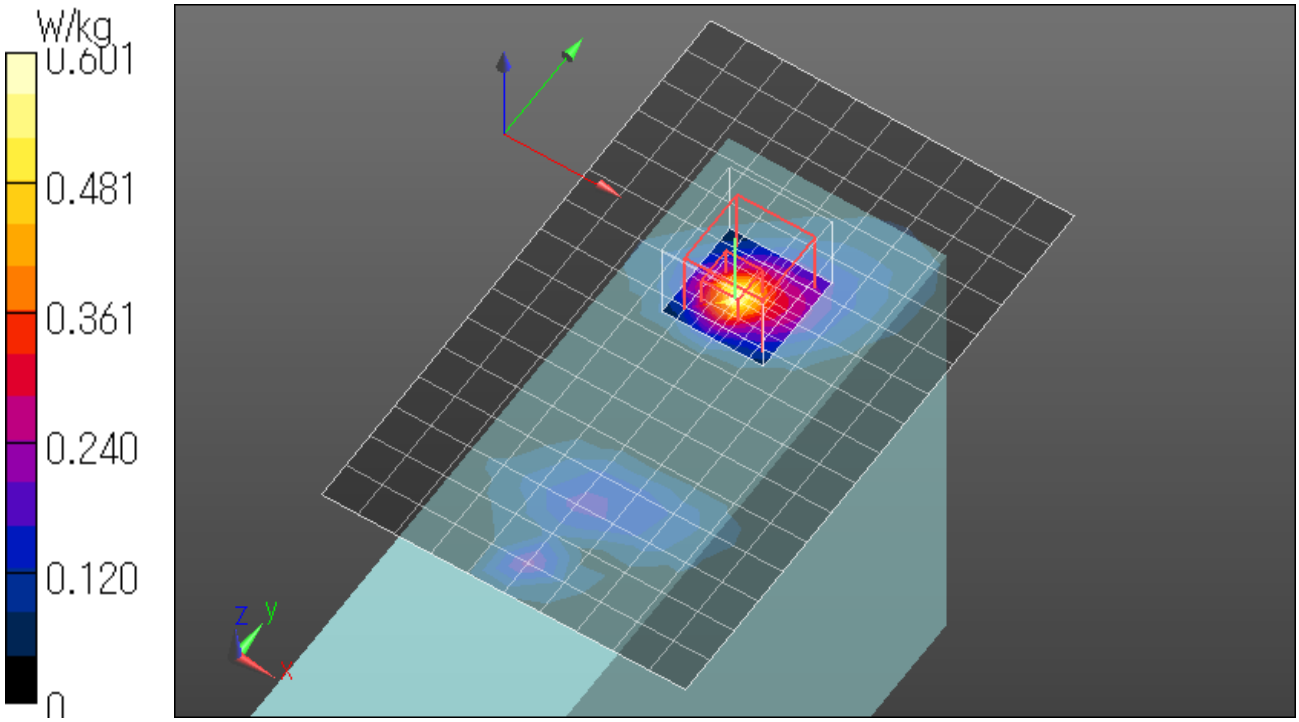
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan 2 (11x17x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.504 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 9.105 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.981 W/kg
SAR(1 g) = 0.204 W/kg; SAR(10 g) = 0.063 W/kg
Maximum value of SAR (measured) = 0.601 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



APPENDIX2 : System Check

1. System check result Body 2450MHz

(1) Simulated Tissue Liquid Parameter confirmation

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
22-Jul	24.0	58	MSL 2450	23.5	2450	εr	52.7	50.6	-3.9	+/-5	*1
						σ [mho/m]	1.95	2.02	3.7	+/-5	

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in KDB 865664D01.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
22-Jul	24.0	58	MSL 2450	23.5	2450	εr	52.2	50.6	-3.0	+/-6	*2 *3
						σ [mho/m]	2.00	2.02	1.2	+/-6	

εr: Relative Permittivity / σ : Coductivity
*2 The target value is the calibrated dipole Body TSL parameters. (D2450V2 SN:713, Measured Body TSL parameters)
*3 The limit is for deviation provided by manufacture.

(2) System check result (for calibration by manufacture)

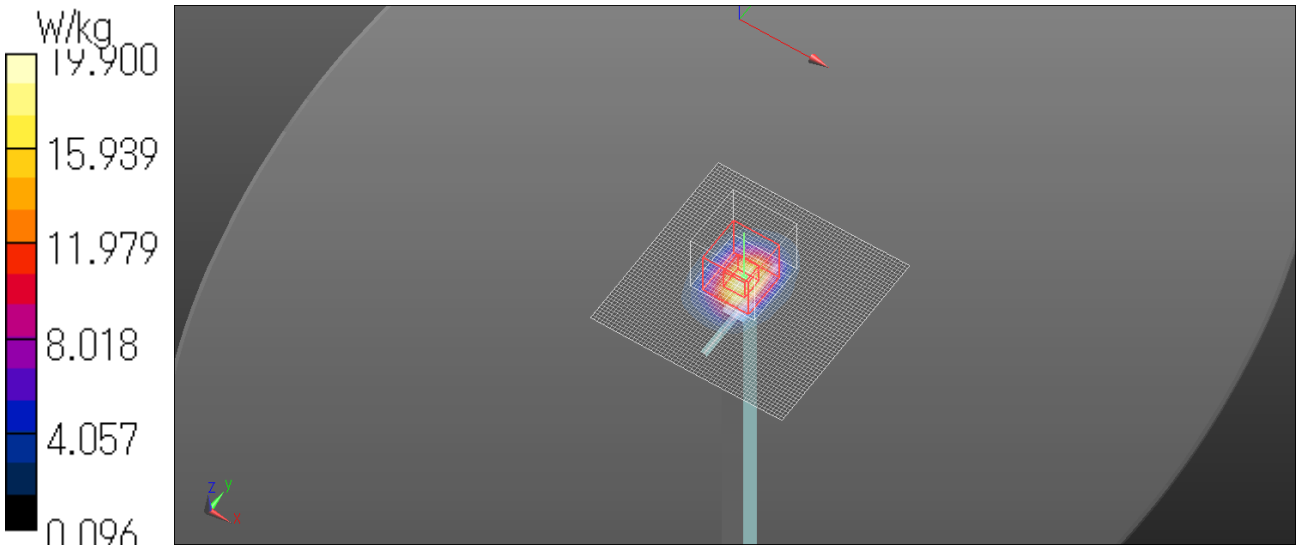
Date	Frequency [MHz]	SAR 1g [W/kg]			Deviation [%]	Limit [%]	Remark
		Forward Power Measured	Conversion 1W Calculation	Target Value(1W)			
22-Jul	2450.00	13.00	52.00	50.40	3.2	+/-10	*4

*4 The taget value is the parameter defined in SAR measured x4(12.6 x 4 = 50.4) in manufacturer calibrated dipole (D2450V2 SN:713)
Please refer to " SAR result with Body TSL of Appendix 2 System Check Dipole (D2450V2 SN:713)".

SystemPerformanceCheck-D2450
Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.023 S/m; ε_r = 50.64; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/06/17;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1207
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

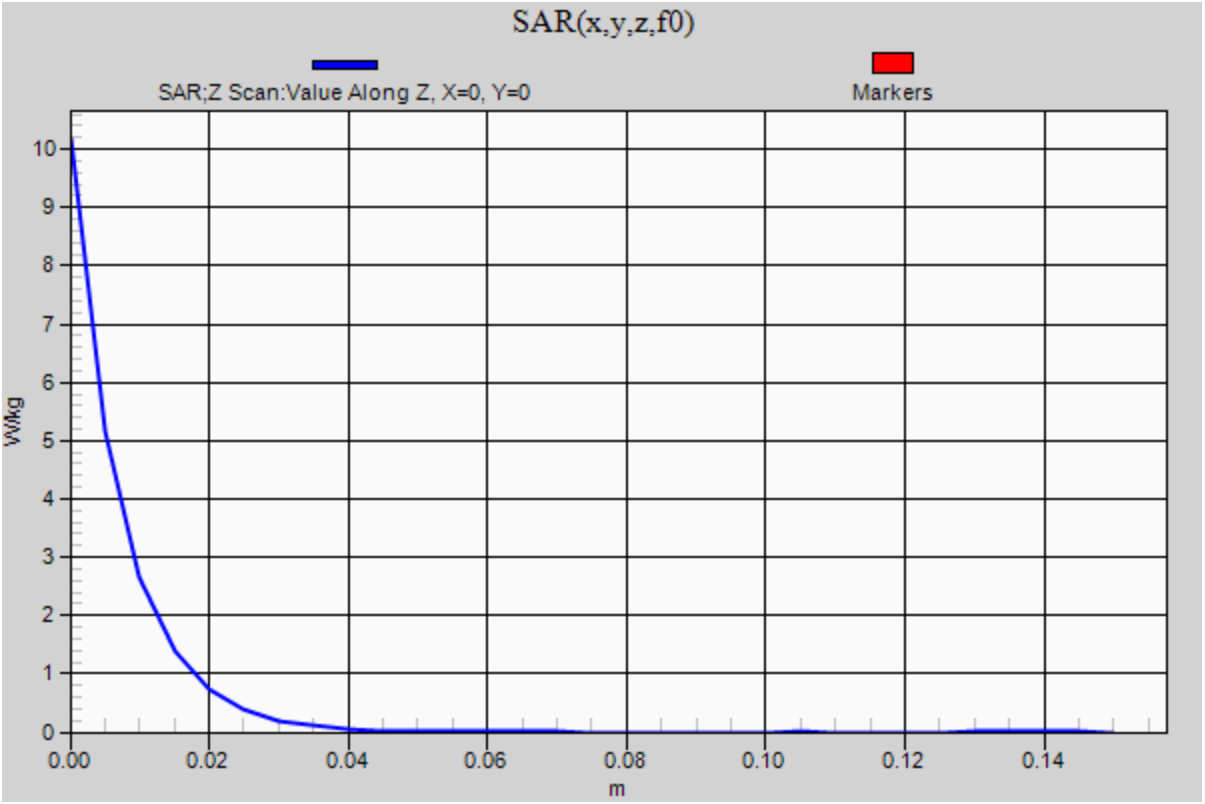
Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 19.3 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.3 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.91 W/kg
Maximum value of SAR (measured) = 19.9 W/kg
Date: 2015/07/22
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



SystemPerformanceCheck-D2450
Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.023 S/m; ε_r = 50.64; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3922; ConvF(7.49, 7.49, 7.49); Calibrated: 2015/06/17;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 TP1207 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1207
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 10.2 W/kg
Date: 2015/07/22
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



2. System check result Body 5250MHz

(1) Simulated Tissue Liquid Parameter confirmation

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
-	-	-	-	-	3000	εr	52.0	-	-	-	*1
						σ [mho/m]	2.73	-	-	-	
24-Jul	24.0	50	MBBL 3.5-5.8	23.5	5250	εr	49.0	46.9	-4.2	+/-5	*2
						σ [mho/m]	5.36	5.26	-1.9	+/-5	
-	-	-	-	-	5800	εr	48.2	-	-	-	*1
						σ [mho/m]	6.00	-	-	-	

εr: Relative Permittivity / σ : Coductivity

*1 The Target value is a parameter defined in KDB 865664D01.

*2 The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
24-Jul	24.0	50	MBBL 3.5-5.8	23.5	5250	εr	49.3	46.9	-4.9	+/-6	*3*4
						σ [mho/m]	5.48	5.26	-4.0	+/-6	

εr: Relative Permittivity / σ : Coductivity

*3 The target value is the calibrated dipole Body TSL parameters. (D5GHzV2 SN:1020, Measured Body TSL parameters)

*4 The limit is for deviation provided by manufacture.

(2) System check result (for calibration by manufacture)

SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]					
		Forward Power Measured	Conversion 1W Calculation	Target Value(1W)	Deviation [%]	Limit [%]	Remark
24-Jul	5250.00	7.78	77.80	73.80	5.4	+/-10	*5

*5 The taget value is the parameter defined in SAR measured x 10(7.38 x 10 = 73.8) in manufacturer calibrated dipole (D5GHzV2 SN:1020)
Please refer to " SAR result with Body TSL of Appendix 2 System Check Dipole (D5GHzV2 SN:1020)".

Body 5250MHz System Check Data / D5GHzV2 / Forward Conducted Power: 100mW

Communication System: UID 0, CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5250 MHz; σ = 5.26 S/m; ε_r = 46.892; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

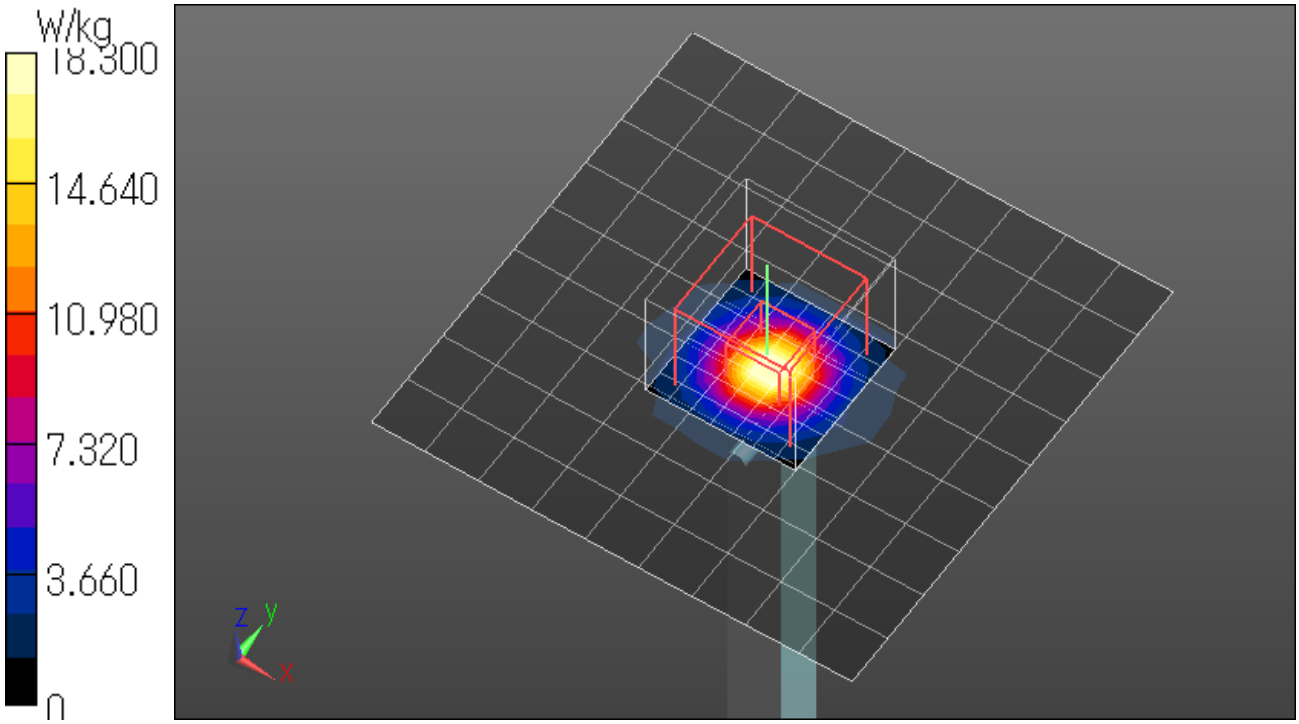
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.3 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.65 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



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Body 5250MHz System Check Data / D5GHzV2 / Forward Conducted Power: 100mW

Communication System: UID 0, CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz; Duty Cycle: 1:1

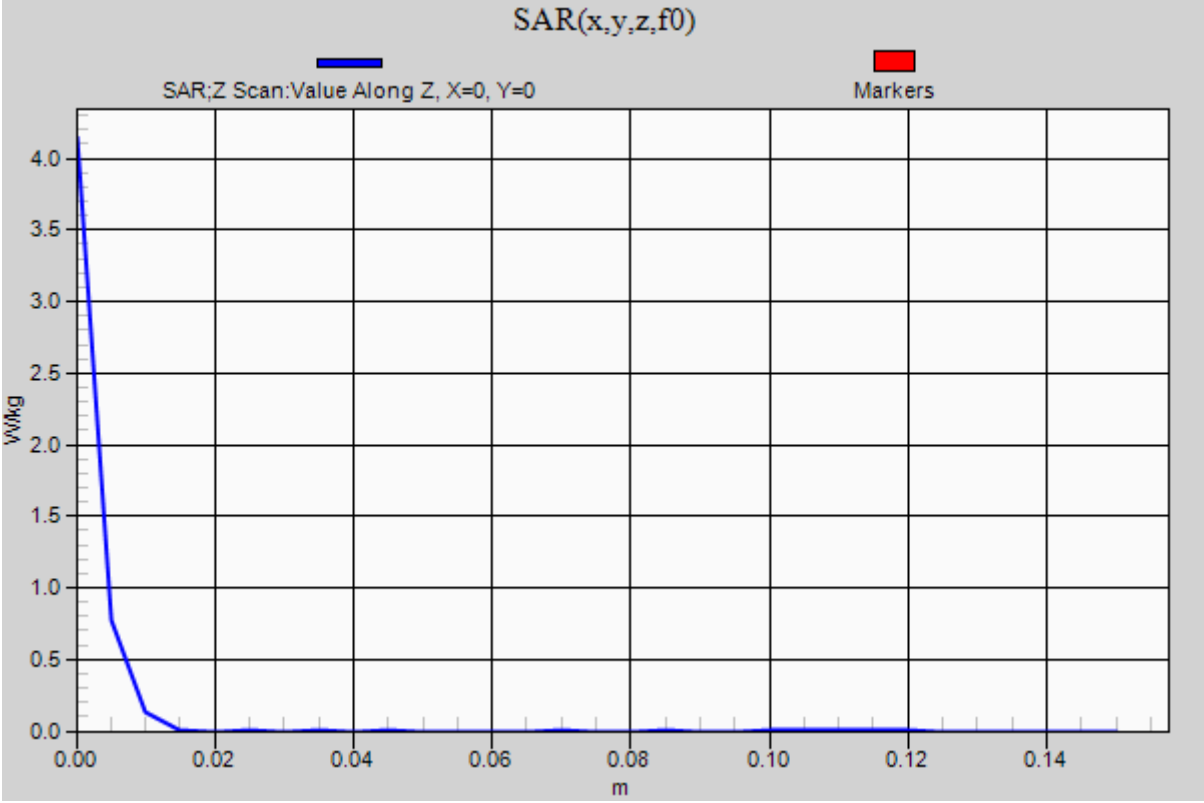
Medium parameters used: f = 5250 MHz; σ = 5.26 S/m; ε_r = 46.892; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.46, 4.46, 4.46); Calibrated: 2015/06/17;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 4.14 W/kg

Date: 2015/07/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



3. System check result Body 5750MHz

(1) Simulated Tissue Liquid Parameter confirmation

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
-	-	-	-	-	3000	εr	52.0	-	-	-	*1
						σ [mho/m]	2.73	-	-	-	
4-Aug	24.0	56	MBBL 3.5-5.8	23.5	5750	εr	48.3	46.4	-3.9	+/-5	*2
						σ [mho/m]	5.94	6.01	1.1	+/-5	
-	-	-	-	-	5800	εr	48.2	-	-	-	*1
						σ [mho/m]	6.00	-	-	-	

εr: Relative Permittivity / σ : Coductivity
*1 The Target value is a parameter defined in KDB 865664D01.
*2 The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

DIELECTRIC PARAMETERS MEASUREMENT RESULTS											
Date	Ambient Temp. [deg.c]	Relative Humidity [%]	Liquid type	Liquid Temp. [deg.c]	Measured Frequency [MHz]	Parameters	Target Value	Measured	Deviation [%]	Limit [%]	Remark
4-Aug	24.0	56	MBBL 3.5-5.8	23.5	5750	εr	48.5	46.4	-4.3	+/-6	*3*4
						σ [mho/m]	6.18	6.01	-2.8	+/-6	

εr: Relative Permittivity / σ : Coductivity
*3 The target value is the calibrated dipole Body TSL parameters. (D5GHzV2 SN:1020, Measured Body TSL parameters)
*4 The limit is for deviation provided by manufacture.

(2) System check result (for calibration by manufacture)

SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]		Target Value(1W)	Deviation [%]	Limit [%]	Remark
		Forward Power Measured	Conversion 1W Calculation				
4-Aug	5750.00	7.71	77.10	73.70	4.6	+/-10	*5

*5 The taget value is the parameter defined in SAR measured x 10(7.37 x 10 = 73.7) in manufacturer calibrated dipole (D5GHzV2 SN:1020)
Please refer to " SAR result with Body TSL of Appendix 2 System Check Dipole (D5GHzV2 SN:1020)".

Body 5750MHz System Check Data / D5GHzV2 / Forward Conducted Power: 100mW

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5750 MHz; σ = 6.007 S/m; ε_r = 46.41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

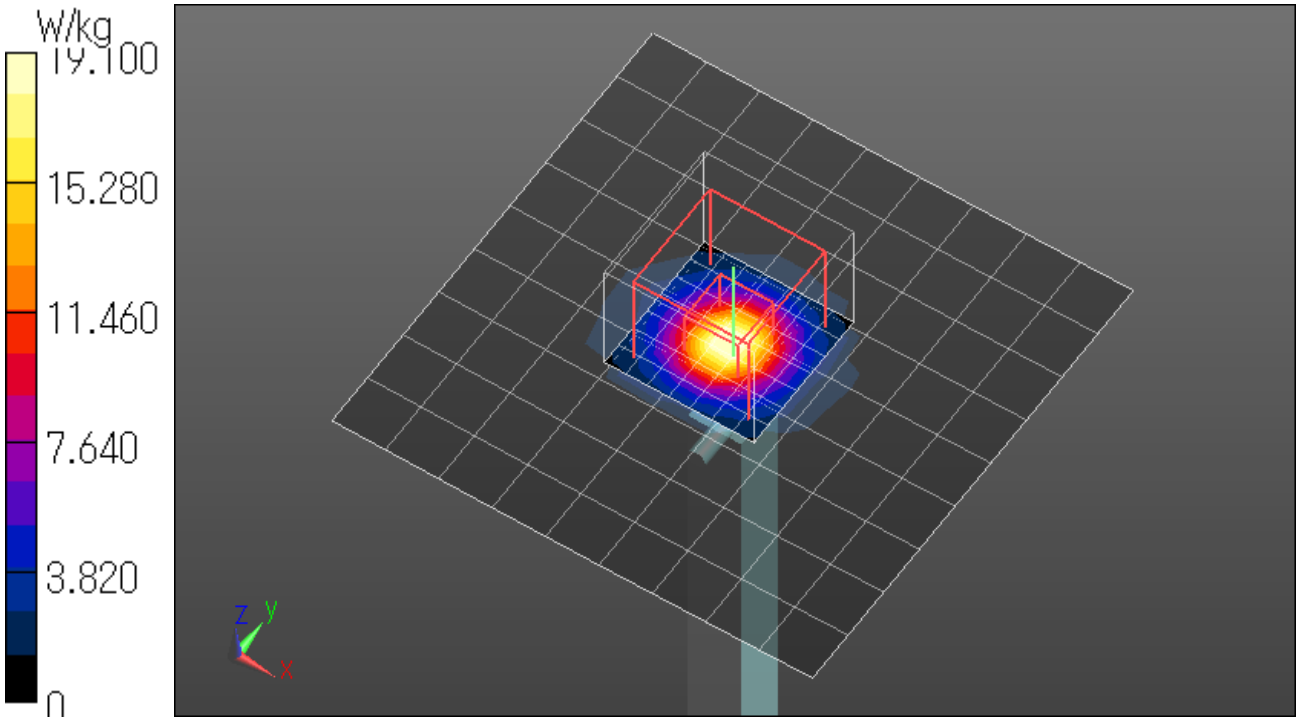
DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.6 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.64 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 36.7 W/kg
SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 19.1 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



Body 5750MHz System Check Data / D5GHzV2 / Forward Conducted Power: 100mW

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz; Duty Cycle: 1:1

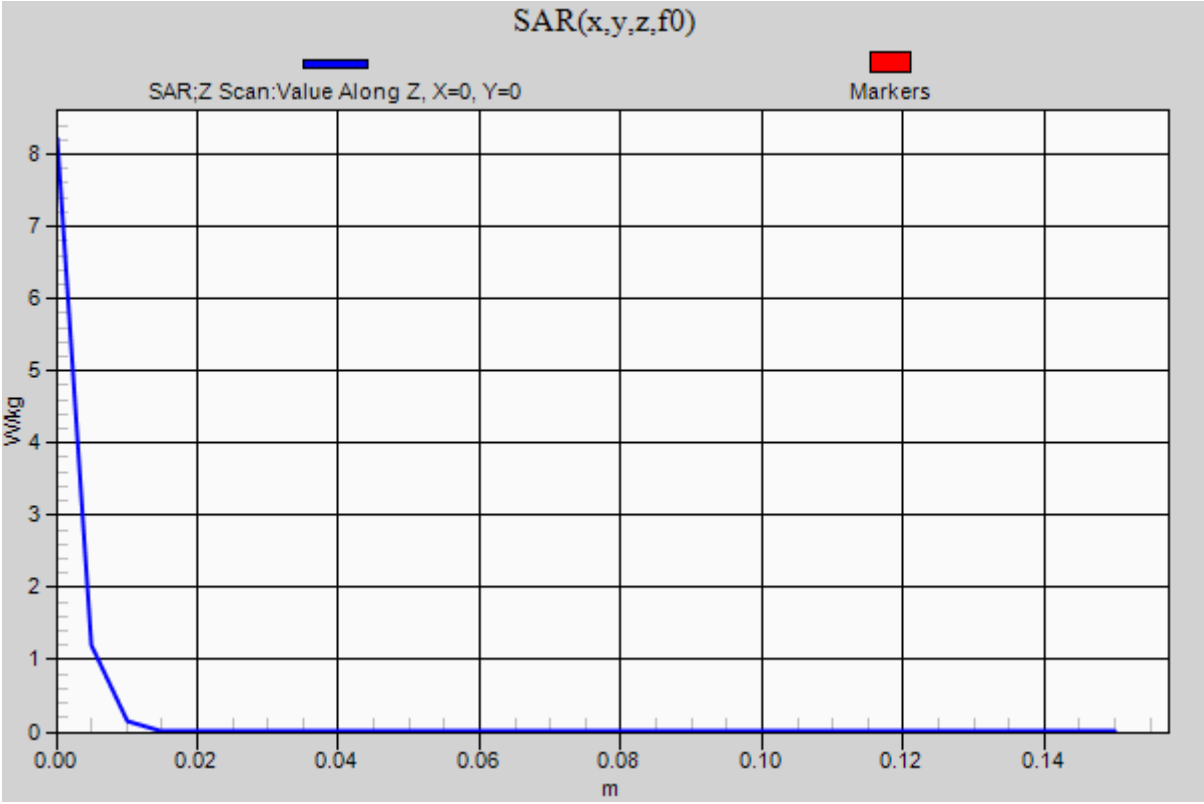
Medium parameters used: f = 5750 MHz; σ = 6.007 S/m; ε_r = 46.41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY5 Configuration

Probe: EX3DV4 - SN3922; ConvF(4.08, 4.08, 4.08); Calibrated: 2015/06/17;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1372; Calibrated: 2015/06/15
Phantom: ELI v5.0 (30deg probe tilt); Type: QDOVA002AA; Serial: TP:xxxx
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 8.21 W/kg

Date: 2015/08/04
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



4. System Check Dipole (D2450V2,S/N:713)

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client UL Japan (PTT)

Certificate No: D2450V2-713_Sep13

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 713

Calibration procedure(s) QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: September 10, 2013

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 10, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D2450V2-713_Sep13 Page 1 of 8

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.4 W/kg ± 16.5 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω + 0.7 jΩ
Return Loss	- 34.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.7 Ω + 2.8 jΩ
Return Loss	- 30.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 05, 2002

DASY5 Validation Report for Head TSL

Date: 10.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 713

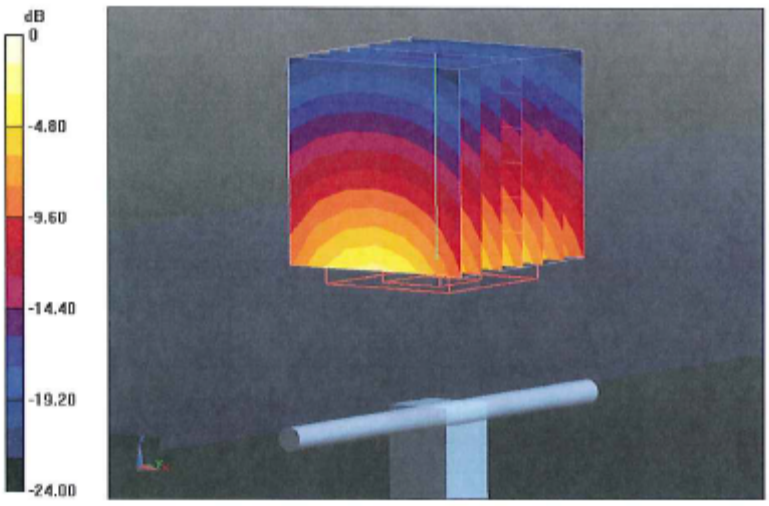
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

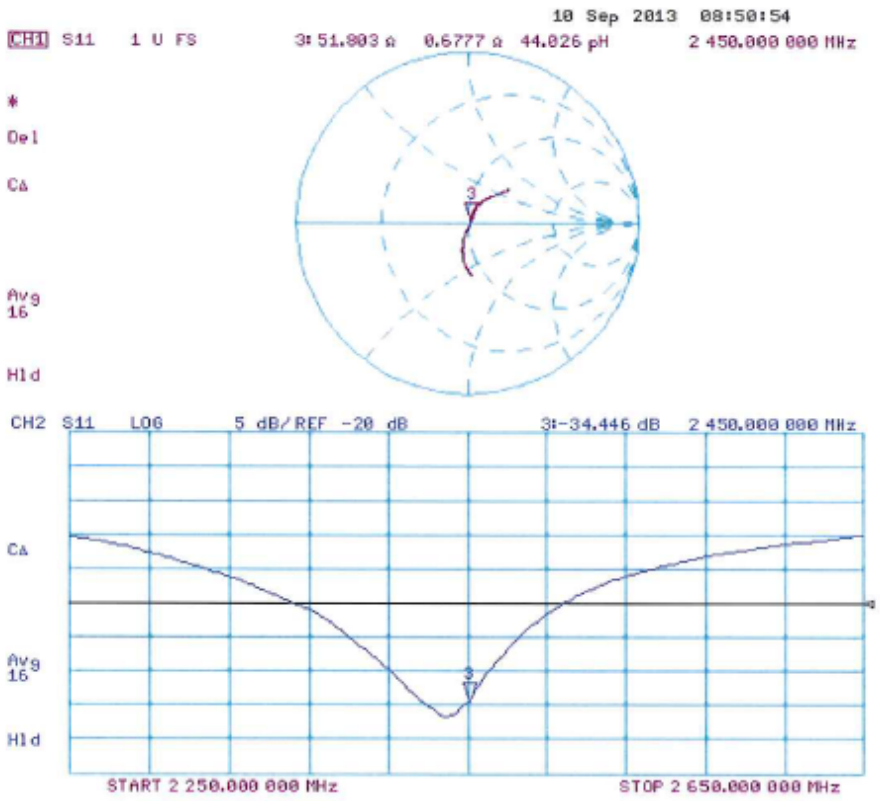
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.095 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.05 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 10.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 713

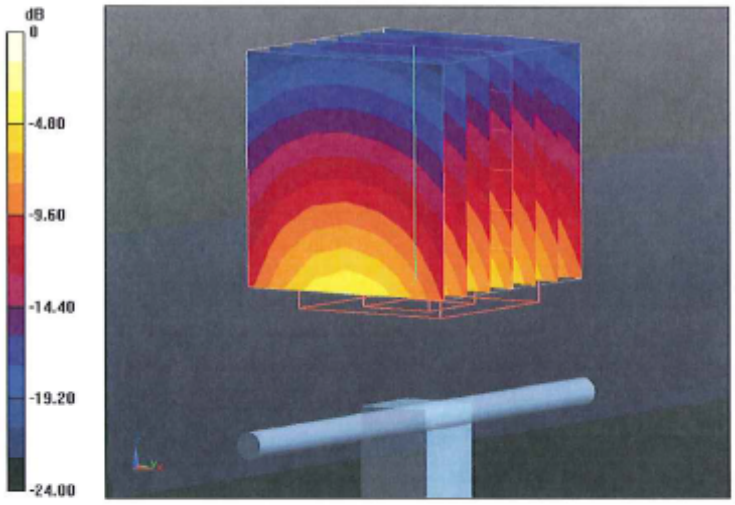
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

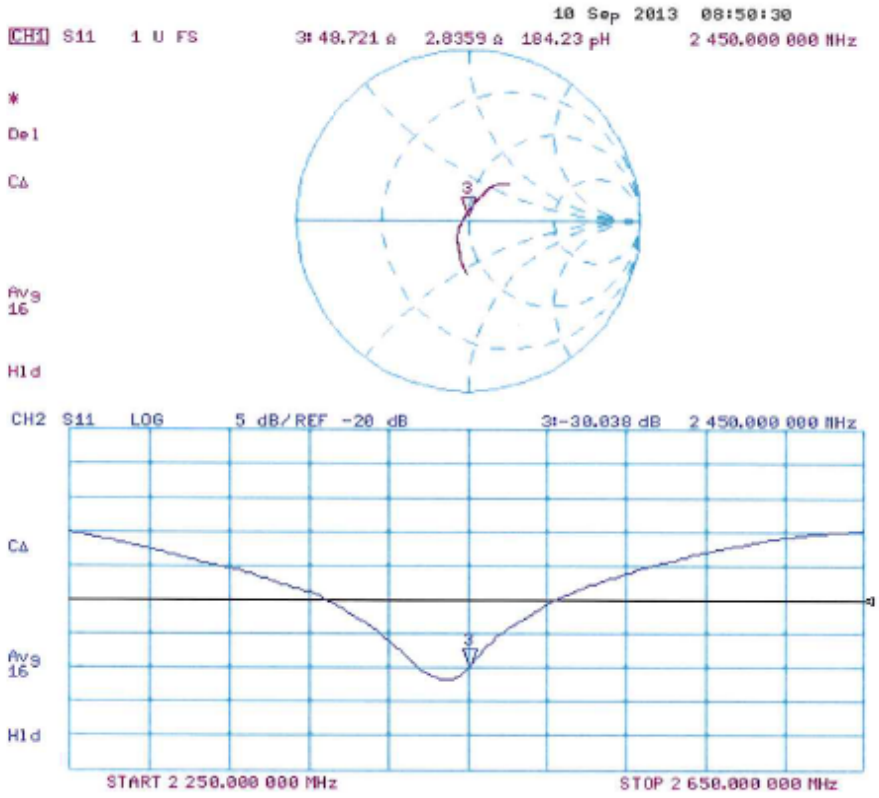
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.095 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.1 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.89 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

Impedance Measurement Plot for Body TSL



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D2450V2 Calibration for Impedance and Return-loss

1. Test environment

Date	September 18, 2014		
Ambient Temperature	24.0 deg.C	Relative humidity	50%RH

2. Equipment used

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MNA-01	Network Analyzer	Agilent/HP	E8358A	US41080381	SAR	2014/08/21 * 12
MNCK-01	Type N Calibration Kit	Agilent	85032F	MY41495257	SAR	2014/08/18 * 12
EST-46	3.5mm ECONOMY CALIBRATION KIT	Agilent	85052D	MY43252869	SAR	2014/08/15 * 12
MPSAM-03	SAM Phantom	Schmid&Partner Engineering AG	QD000P40CD	1764	SAR	2014/06/03 * 12
MPF-03	2mmOval Flat Phantom ERI 5.0	Schmid&Partner Engineering AG	QDOVA001BB	1203	SAR	2014/06/03 * 12
MOS-30	Thermo-Hygrometer	Custom	CTH-201	3001	SAR	2014/07/06 * 12
MOS-35	Digital thermometer	HANNA	Checktemp 4	-	SAR	2014/07/06 * 12
HSL2450						Daily check
MSL2450						Daily check
SAR room1						Daily check

3. Test Result

Impeadance,Transformed to feed point	Head	Deviation	Tolerance	Result
Calibration (SPEAG) 2013/09/10	51.8 Ω+0.7jΩ	-	-	-
Calibration(ULJ)2014/9/18	51.5Ω+0.9jΩ	-0.3Ω+0.2jΩ	+/-5Ω+/-5jΩ	Complied

Return loss	Head	Deviation	Tolerance	Result
Calibration (SPEAG) 2013/09/10	-34.4dB	-	-	-
Calibration(ULJ)2014/9/18	-35.3dB	-0.9dB	-34.4 *+/-20%	Complied

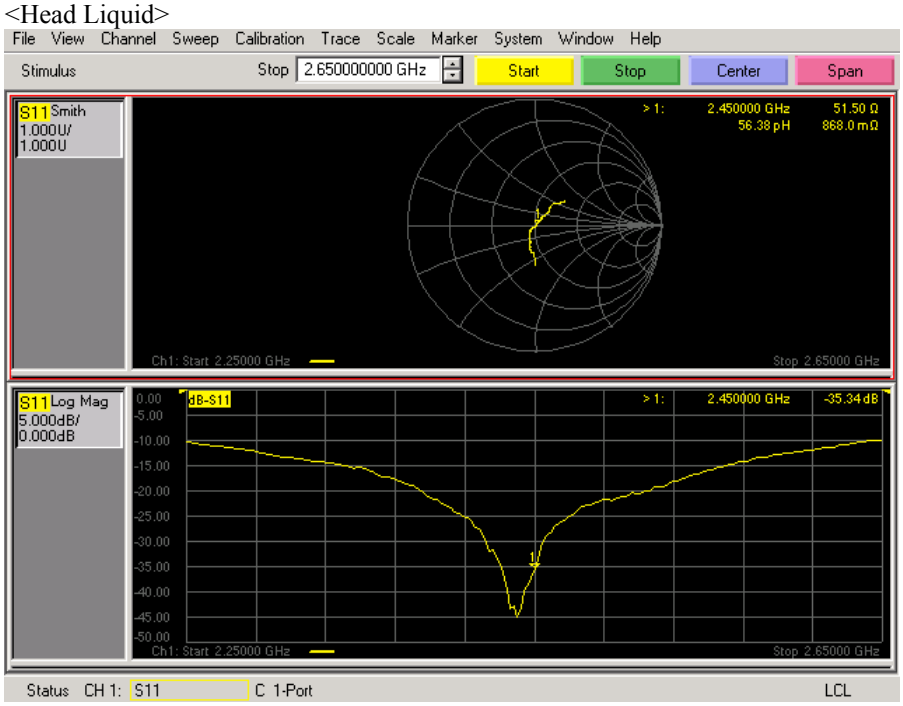
Impeadance,Transformed to feed point	Body	Deviation	Tolerance	Result
Calibration (SPEAG) 2013/09/10	48.7Ω+2.8jΩ	-	-	-
Calibration(ULJ)2014/9/18	49.6Ω+2.8jΩ	+0.9Ω+/-0jΩ	+/-5Ω+/-5jΩ	Complied

Return loss	Body		Tolerance	Result
Calibration (SPEAG) 2013/09/10	-30.0dB	-	-	-
Calibration(ULJ)2014/9/18	-31.0dB	-1.0dB	-30.0 *+/-20%	Complied

*Tolerance : According to the KDB450824D02

Measurement Plots

<Head Liquid>



<Body Liquid>