SAR TEST REPORT

Test Report No. : 10243432S-A

Applicant	:	**Honda Engineering Co., Ltd.**
Type of Equipment	:	**WLAN CARD**
Model No.	:	**E3000-02-01**
FCC ID	:	**N43E30000201**
Test regulation	:	**FCC47CFR 2.1093**
Test Result	:	**Complied**
Reported SAR(1g) Value		**The highest reported SAR(1g)** **WLAN 11b/g/n** Body : 0.897W/kg **WLAN 11a/n** Body : 0.524W/kg

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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.

Date of test: March 19 to 25, 2014

Representative test engineer:

Hisayoshi Sato
Engineer
Consumer Technology Division

Approved by :

Takahiro Hatakeda
Leader
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http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

REVISION HISTORY

Original Test Report No.: 10243432S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10243432S	July 14, 2014	-	-

CONTENTS PAGE

SECTION 1: Customer information

Applicant:

Company Name	:	Honda Engineering Co., Ltd.
Address	:	6-1, Hagadai, Haga-Machi, Haga-Gun, Tochigi, 321-3395 Japan
Telephone Number	:	+81-28-677-6946
Facsimile Number	:	+81-28-677-6980
Contact Person	:	Tomokazu Takasaka

Manufacturer:

Company Name	:	NEC Engineering, Ltd.
Address	:	1753 Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8666 Japan
Telephone Number	:	+81-44-455-8765
Facsimile Number	:	+81-44-455-8927
Contact Person	:	Atsushi Suzuki

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

2.1 Identification of E.U.T.

Type of Equipment	:	WLAN CARD
Model No.	:	E3000-02-01
Serial No.	:	2BE030014K
Rating	:	DC5V
Receipt Date of Sample	:	March 7, 2014
Country of Mass-production	:	Japan
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product description

Model: E3000-02-01 (referred to as the EUT in this report) is a WLAN CARD.

Clock frequency(ies) in the system	:	32.768kHz, 26MHz

Radio specification:

Equipment type	:	Transceiver	
Frequency of operation	:	2.4GHz:	2412-2462MHz (IEEE 802.11b, 11g, 11n-20HT)
		W52:	5180-5240MHz (IEEE 802.11a, 11n-20HT)
		W53:	5260-5320MHz (IEEE 802.11a, 11n-20HT)
		W56:	5500-5700MHz (IEEE 802.11a, 11n-20HT)
		W58:	5745-5825MHz (IEEE 802.11a, 11n-20HT)
Bandwidth	:	20MHz	
Channel spacing	:	5MHz (2.4GHz), 20MHz (IEEE 802.11a, 11n-20HT, 5GHz))	
Type of modulation	:	DSSS, OFDM	
Antenna type	:	2.4GHz band: λ/4 monopole, 5GHz band: λ/4 dipole	
Antenna gain with cable loss	:	2.4GHz band: 1.6dBi, 5GHz band: 4.1dBi	
Antenna connector type	:	SMD	
ITU code	:	D1D, G1D	
Operation temperature range	:	0 to +60 deg.C	

* The EUT does not perform simultaneous transmission of 2.4GHz and 5GHz Wireless LAN.

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

☑ **KDB450824 D01(v01r01)**	SAR Prob Cal and Ver Meas
☑ **KDB450824 D02(v01r01)**	Dipole SAR Validation Verification
☑ **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(v01r02)**	SAR Measurement Procedures for 802.11a//b/g Transmitters

Reference

[1]ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
[2]SPEAG uncertainty document (AN 15-7/AN19-17) for DASY 5 System from SPEAG (Schmid & Partner Engineering AG).

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 HQ 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= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

Maximum tune-up tolerance limit is by the specification from a customer.

Mode	Frequency	Measured power [mW]*1	Maximum tune-up tolerance limit [mW]	Measured SAR [W/kg]	Reported SAR [W/kg]
WLAN 11b	2412MHz	54.20	79.43	0.612	0.897
WLAN 11a	5660MHz	21.43	25.12	0.447	0.524

Note

*1 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.

WLAN Maximum tune-up tolerance limit

Mode	Maximum tune-up tolerance limit [dBm]	Maximum tune-up tolerance limit [mW]
WLAN 11b	19	79.43
WLAN 11g	15	31.62
WLAN 11n (2.4G)	14	25.12
WLAN 11a	14	25.12
WLAN 11n (5G)	14	25.12

SECTION 5 : Description of the operating mode

5.1 Output power operating modes

Mode	Frequency Band	Test Frequency	Modulation
IEEE802.11b	2412-2462MHz	2412MHz (1ch) 2437MHz(6ch) 2462MHz(11ch)	DSSS (DBPSK.DQPSK.CCK)
IEEE802.11g	2412-2462MHz	2412MHz (1ch)	OFDM (BPSK.QPSK.16QAM,64QAM)
IEEE802.11n20 (2.4G)	2412-2462MHz	2412MHz (1ch)	
IEEE802.11a	5180-5240MHz	5180MHz (36ch) 5200MHz (40ch) 5220MHz (44ch) 5240MHz (48ch)	
	5260-5320MHz	5260MHz (52ch) 5280MHz (56ch) 5300MHz (60ch) 5320MHz (64ch)	
	5500-5700MHz	5500MHz (100ch) 5520MHz (104ch) 5540MHz (108ch) 5560MHz (112ch) 5580MHz (116ch) 5600MHz (120ch) 5620MHz (124ch) 5640MHz (128ch) 5660MHz (132ch) 5680MHz (136ch) 5700MHz (140ch)	
	5745-5825MHz	5745MHz (149ch) 5765MHz (153ch) 5785MHz (157ch) 5805MHz (161ch) 5825MHz (165ch)	
IEEE802.11n20 (5G)	5180-5240MHz	5180MHz (36ch)	
	5260-5320MHz	5260MHz (52ch)	
	5500-5700MHz	5500MHz (100ch)	
	5745-5825MHz	5745MHz (149ch)	

WLAN

*Power of the EUT was set by the software as follows;
Software/version: WlanCalib/v0.08
Power setting: 2.4GHz 11b : 17dBm, 11g : 13dBm, 11n-20 : 12dBm
5GHz 11a : 12dBm : 11n-20 : 12dBm
*The above setting 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.

5.2 Output power measurement results

Output power measurement for WLAN

1) WLAN (11b/g/n (2.4G))

[IEEE802.11b] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
1.0	2412	-4.88	1.99	20.23	17.34	54.20
2.0	2412	-4.96	1.99	20.23	17.26	53.21
5.5	2412	-5.06	1.99	20.23	17.16	52.00
11.0	2412	-5.11	1.99	20.23	17.11	51.40

:Worst data rate

IEEE802.11b 1Mbps

Ch	Frequency [MHz]	P/M Reading AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
1	2412	-4.88	1.99	20.23	17.34	54.20
6	2437	-4.76	1.99	20.23	17.46	55.72
11	2462	-4.68	2.00	20.23	17.55	56.89

:SAR test channel

[IEEE802.11g] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
6.0	2412	-8.86	1.99	20.23	13.36	21.68
9.0	2412	-8.93	1.99	20.23	13.29	21.33
12.0	2412	-9.02	1.99	20.23	13.20	20.89
18.0	2412	-9.16	1.99	20.23	13.06	20.23
24.0	2412	-9.18	1.99	20.23	13.04	20.14
36.0	2412	-9.44	1.99	20.23	12.78	18.97
48.0	2412	-9.68	1.99	20.23	12.54	17.95
54.0	2412	-9.76	1.99	20.23	12.46	17.62

:Worst data rate

[IEEE802.11n-20] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
MCS0	2412	-9.86	1.99	20.23	12.36	17.22
MCS1	2412	-10.07	1.99	20.23	12.15	16.41
MCS2	2412	-10.18	1.99	20.23	12.04	16.00
MCS3	2412	-10.21	1.99	20.23	12.01	15.89
MCS4	2412	-10.45	1.99	20.23	11.77	15.03
MCS5	2412	-10.68	1.99	20.23	11.54	14.26
MCS6	2412	-10.75	1.99	20.23	11.47	14.03
MCS7	2412	-10.71	1.99	20.23	11.51	14.16

:Worst data rate

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

2) WLAN (11a/n (5G))
5.2GHz

[IEEE802.11a] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
6.0	5180	-11.38	3.20	20.35	12.17	16.48
9.0	5180	-11.47	3.20	20.35	12.08	16.14
12.0	5180	-11.50	3.20	20.35	12.05	16.03
18.0	5180	-11.65	3.20	20.35	11.90	15.49
24.0	5180	-11.77	3.20	20.35	11.78	15.07
36.0	5180	-12.00	3.20	20.35	11.55	14.29
48.0	5180	-12.16	3.20	20.35	11.39	13.77
54.0	5180	-12.23	3.20	20.35	11.32	13.55

:Worst data rate

IEEE802.11a 6Mbps

Ch	Frequency [MHz]	P/M Reading AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
36	5180	-11.38	3.20	20.35	12.17	16.48
40	5200	-11.27	3.21	20.34	12.28	16.90
44	5220	-11.28	3.22	20.34	12.28	16.90
48	5240	-11.26	3.22	20.33	12.29	16.94

:SAR test channel

[IEEE802.11n-20] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
MCS0	5180	-11.53	3.20	20.35	12.02	15.92
MCS1	5180	-11.60	3.20	20.35	11.95	15.67
MCS2	5180	-11.73	3.20	20.35	11.82	15.21
MCS3	5180	-11.84	3.20	20.35	11.71	14.83
MCS4	5180	-12.04	3.20	20.35	11.51	14.16
MCS5	5180	-12.28	3.20	20.35	11.27	13.40
MCS6	5180	-12.36	3.20	20.35	11.19	13.15
MCS7	5180	-12.36	3.20	20.35	11.19	13.15

:Worst data rate

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

5.3GHz

[IEEE802.11a] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
6.0	5260	-11.18	3.22	20.33	12.37	17.26
9.0	5260	-11.42	3.22	20.33	12.13	16.33
12.0	5260	-11.42	3.22	20.33	12.13	16.33
18.0	5260	-11.52	3.22	20.33	12.03	15.96
24.0	5260	-11.69	3.22	20.33	11.86	15.35
36.0	5260	-12.32	3.22	20.33	11.23	13.27
48.0	5260	-12.40	3.22	20.33	11.15	13.03
54.0	5260	-12.42	3.22	20.33	11.13	12.97

:Worst data rate

IEEE802.11a 6Mbps

Ch	Frequency [MHz]	P/M Reading AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
52	5260	-11.18	3.22	20.33	12.37	17.26
56	5280	-11.16	3.23	20.32	12.39	17.34
60	5300	-11.12	3.23	20.32	12.43	17.50
64	5320	-11.12	3.24	20.31	12.43	17.50

:SAR test channel

[IEEE802.11n-20] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
MCS0	5260	-11.22	3.22	20.33	12.33	17.10
MCS1	5260	-11.60	3.22	20.33	11.95	15.67
MCS2	5260	-11.73	3.22	20.33	11.82	15.21
MCS3	5260	-11.84	3.22	20.33	11.71	14.83
MCS4	5260	-12.04	3.22	20.33	11.51	14.16
MCS5	5260	-12.28	3.22	20.33	11.27	13.40
MCS6	5260	-12.36	3.22	20.33	11.19	13.15
MCS7	5260	-12.30	3.22	20.33	11.25	13.34

:Worst data rate

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

5.6GHz

[IEEE802.11a] Rate Check

Rate [Mbps]	Freq. [MHz]	P/M Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
6.0	5500	-10.65	3.48	20.26	13.09	20.37
9.0	5500	-11.38	3.48	20.26	12.36	17.22
12.0	5500	-11.39	3.48	20.26	12.35	17.18
18.0	5500	-11.42	3.48	20.26	12.32	17.06
24.0	5500	-11.40	3.48	20.26	12.34	17.14
36.0	5500	-11.28	3.48	20.26	12.46	17.62
48.0	5500	-11.47	3.48	20.26	12.27	16.87
54.0	5500	-11.53	3.48	20.26	12.21	16.63

:Worst data rate

IEEE802.11a 6Mbps

Ch	Frequency [MHz]	P/M Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
100	5500	-10.65	3.48	20.26	13.09	20.37
104	5520	-10.65	3.48	20.26	13.09	20.37
108	5540	-10.65	3.48	20.26	13.09	20.37
112	5560	-10.67	3.48	20.26	13.07	20.28
116	5580	-10.62	3.48	20.26	13.12	20.51
120	5600	-10.42	3.48	20.25	13.31	21.43
124	5620	-10.41	3.48	20.25	13.32	21.48
128	5640	-10.47	3.48	20.25	13.26	21.18
132	5660	-10.42	3.48	20.25	13.31	21.43
136	5680	-10.51	3.48	20.25	13.22	20.99
140	5700	-10.48	3.48	20.25	13.25	21.13

:SAR test channel

[IEEE802.11n-20] Rate Check

Rate [Mbps]	Freq. [MHz]	P/M Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
MCS0	5745	-10.83	3.48	20.26	12.91	19.54
MCS1	5745	-10.88	3.48	20.26	12.86	19.32
MCS2	5745	-10.91	3.48	20.26	12.83	19.19
MCS3	5745	-11.02	3.48	20.26	12.72	18.71
MCS4	5745	-11.31	3.48	20.26	12.43	17.50
MCS5	5745	-11.42	3.48	20.26	12.32	17.06
MCS6	5745	-11.39	3.48	20.26	12.35	17.18
MCS7	5745	-11.62	3.48	20.26	12.12	16.29

:Worst data rate

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

5.8GHz

[IEEE802.11a] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
6.0	5745	1.63	1.40	10.04	13.07	20.28
9.0	5745	1.59	1.40	10.04	13.03	20.09
12.0	5745	1.47	1.40	10.04	12.91	19.54
18.0	5745	1.33	1.40	10.04	12.77	18.92
24.0	5745	1.17	1.40	10.04	12.61	18.24
36.0	5745	1.01	1.40	10.04	12.45	17.58
48.0	5745	0.83	1.40	10.04	12.27	16.87
54.0	5745	0.76	1.40	10.04	12.20	16.60

:Worst data rate

IEEE802.11a 6Mbps

Ch	Frequency [MHz]	P/M Reading AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
149	5745	1.63	1.40	10.04	13.07	20.28
153	5765	1.63	1.40	10.04	13.07	20.28
157	5785	1.62	1.40	10.04	13.06	20.23
161	5805	1.64	1.40	10.04	13.08	20.32
165	5825	1.55	1.40	10.04	12.99	19.91

:SAR test channel

[IEEE802.11n-20] Rate Check

Rate [Mbps]	Freq. [MHz]	Reading [dBm] AVG	Cable Loss [dB]	Atten. [dB]	Result [dBm] AVG	Result [mW] AVG
MCS0	5745	1.53	1.40	10.04	12.97	19.82
MCS1	5745	1.39	1.40	10.04	12.83	19.19
MCS2	5745	1.33	1.40	10.04	12.77	18.92
MCS3	5745	1.11	1.40	10.04	12.55	17.99
MCS4	5745	0.96	1.40	10.04	12.40	17.38
MCS5	5745	0.68	1.40	10.04	12.12	16.29
MCS6	5745	0.66	1.40	10.04	12.10	16.22
MCS7	5745	0.61	1.40	10.04	12.05	16.03

:Worst data rate

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

5.3 SAR testing operating modes

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

1) SAR measurement for WLAN

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		
802.11a/n20	UNII	5.18	36			√	
		5.20	40				*
		5.22	44				*
		5.24	48			√	
		5.26	52			√	
		5.28	56				*
		5.30	60				*
		5.32	64			√	
		5.50	100				*
		5.52	104			√	
		5.54	108				*
		5.56	112				*
		5.58	116			√	
		5.60	120				*
		5.62	124			√	
		5.64	128				*
		5.66	132				*
		5.68	136			√	
		5.70	140				*
	UNII or FCC 15.247	5.745	149	√		√	
		5.765	153		*		*
		5.785	157	√			*
		5.805	161		*	√	
	FCC 15.247	5.825	165	√			

√ = "default test channels"
* = Possible 802.11a channels with maximum average output > the "default test channels"
Δ = Possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"
= when output power is reduced for channel 1 and/or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested

Mode	Test Frequency	Modulation	Crest factor	Note
IEEE802.11b	2412MHz(1ch) 2437MHz(6ch) 2462MHz(11ch)	DBPSK(1Mbps)	1	
IEEE802.11g	Not required			*1
IEEE802.11n20 (2.4G)	Not required			*1
IEEE802.11a	5240MHz(48ch)	BPSK(6Mbps)	1	*2
	5320MHz(64ch)	BPSK(6Mbps)	1	*2
	5520MHz(104ch) 5600MHz(120ch) 5620MHz(124ch) 5660MHz(132ch)	BPSK(6Mbps)	1	
	5805MHz(161ch)	BPSK(6Mbps)	1	*2
IEEE802.11n20 (5G)	Not required			*3
WLAN				
*Power of the EUT was set by the software as follows; Software/version: WlanCalib/v0.08 Power setting: 2.4GHz 11b : 17dBm, 11g : 13dBm, 11n-20 : 12dBm 5GHz 11a : 12dBm : 11n-20 : 12dBm *The above setting 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.				

*1 The 11b mode was maximum average power. The 11g/n SAR is not required for other mode because the maximum average output power for other mode is less than 1/4dB higher than that measured 11b mode.
*2 The other channel was not required since maximum average output power channel SAR value is less than 0.8W/kg.
*3 The 11a mode was maximum average power. The 11n SAR is not required for other mode because the maximum average output power for other mode is lower than that measured 11a mode.

5.4 Confirmation after SAR testing

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.

SECTION 6 SAR test exclusion considerations

.
The host device is “Wireless applications for shop inspection equipment”.
Please refer to Appendix 4 about host device.

6.1 Standalone SAR test exclusion considerations

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

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of exclusion *3
WLAN(2.4GHz band)	☑	Top	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	13 [mm]	9.5
WLAN(2.4GHz band)	☑	Front	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	30 [mm]	4.1
WLAN(2.4GHz band)	☑	Rear	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	19 [mm]	6.5
WLAN(2.4GHz band)	☑	Right	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	33 [mm]	3.8

WLAN 5.2GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of exclusion *3
WLAN(5GHz band)	☑	Top	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	12 [mm]	4.8
WLAN(5GHz band)	☐	Front	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	23 [mm]	2.5
WLAN(5GHz band)	☑	Rear	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	18 [mm]	3.2
WLAN(5GHz band)	☐	Left	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	28 [mm]	2.0

WLAN 5.3GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of exclusion *3
WLAN(5GHz band)	☑	Top	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	12 [mm]	4.8
WLAN(5GHz band)	☐	Front	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	23 [mm]	2.5
WLAN(5GHz band)	☑	Rear	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	18 [mm]	3.2
WLAN(5GHz band)	☐	Left	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	28 [mm]	2.1

WLAN 5.6GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of exclusion *3
WLAN(5GHz band)	☑	Top	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	12 [mm]	5.0
WLAN(5GHz band)	☐	Front	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	23 [mm]	2.6
WLAN(5GHz band)	☑	Rear	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	18 [mm]	3.3
WLAN(5GHz band)	☐	Left	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	28 [mm]	2.1

WLAN 5.8GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of exclusion *3
WLAN(5GHz band)	☑	Top	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	12 [mm]	5.0
WLAN(5GHz band)	☐	Front	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	23 [mm]	2.6
WLAN(5GHz band)	☑	Rear	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	18 [mm]	3.4
WLAN(5GHz band)	☐	left	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	28 [mm]	2.2

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 100 MHz 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

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of threshold*4
WLAN(2.4GHz band)	☐	Bottom	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	225 [mm]	1846 [mW]
WLAN(2.4GHz band)	☐	Left	11b DBPSK(1Mbps)	2462 [MHz] (11ch)	19 [dBm] 79.43 [mW] 79 [mW]*6	77 [mm]	366 [mW]

WLAN 5.2GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of threshold*4
WLAN(5GHz band)	☐	Bottom	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	225 [mm]	1816 [mW]
WLAN(5GHz band)	☐	Right	11a BPSK(6Mbps)	5240 [MHz] (48ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	75 [mm]	316 [mW]

WLAN 5.3GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of threshold*4
WLAN(5GHz band)	☐	Bottom	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	225 [mm]	1815 [mW]
WLAN(5GHz band)	☐	Right	11a BPSK(6Mbps)	5320 [MHz] (64ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	75 [mm]	315 [mW]

WLAN 5.6GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of threshold*4
WLAN(5GHz band)	☐	Bottom	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	225 [mm]	1813 [mW]
WLAN(5GHz band)	☐	Right	11a BPSK(6Mbps)	5700 [MHz] (140ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	75 [mm]	313 [mW]

WLAN 5.8GHz

Band	Standalone SAR tested	Positiom	Mode	Upper frequency of band *1	Maximum tune-up tolerance limit *5	Min distance *2	Calculation of threshold*4
WLAN(5GHz band)	□	Bottom	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	225 [mm]	1812 [mW]
WLAN(5GHz band)	□	Right	11a BPSK(6Mbps)	5825 [MHz] (165ch)	14 [dBm] 25.12 [mW] 25 [mW]*6	75 [mm]	312 [mW]

*1 The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
*2 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 $[(3\cdot 50)/(\sqrt{f_{(GHz)}}))$ + (test separation distance - 50 mm)·(f(MHz)/150)] mW at > 100 MHz and ≤ 1500 MHz
$[(3\cdot 50)/(\sqrt{f_{(GHz)}}))$ + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz
If it is maximum tune-up tolerance limit < Threshold, standalone SAR test is excluded.
*5 Maximum tune-up tolerance limit is by the specification from a customer.
*6 Maximum tune-up tolerance limit(mW) is rounded to one decimal place.

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 2.4G	**Data transmission mode (11b)**
WLAN 5G	**Data transmission mode (11a)**

iii) Test position

No.	Position	Test distance	WLAN (2.4G)		
			Tested	Antenna	Separation from user
1	Top	0mm	☑	Fixed	12.9mm
2	Front	0mm	☑	Fixed	30.2mm
3	Rear	0mm	☑	Fixed	19.3mm
4	Right	0mm	☑	Fixed	33mm

No.	Position	Test distance	WLAN (5G)		
			Tested	Antenna	Separation from user
1	Top	0mm	☑	Fixed	12.4mm
2	Rear	0mm	☑	Fixed	18.3mm

SECTION 8 : Test surrounding

8.1 Measurement uncertainty

The uncertainty budget has been determined for the DASY5 measurement system according to the SPEAG documents[2] and is given in the following Table.

<0.3 – 3GHz range>

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	6
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	3
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	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.64	± 1.8	∞
Liquid conductivity (meas.)	+ 3.1	Rectangular	1	0.64	+ 2.0	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (meas.)	- 3.7	Rectangular	1	0.6	- 2.2	∞
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					± **11.768**	
Expanded Uncertainty (k=2)					± **23.5**	

<3 – 6GHz range>

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	11
Device holder uncertainty	± 3.6	Normal	1	1	± 3.6	1
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	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.64	± 1.8	∞
Liquid conductivity (meas.)	+ 4.1	Rectangular	1	0.64	+ 2.6	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (meas.)	– 2.0	Rectangular	1	0.6	- 1.2	∞
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					± **12.649**	
Expanded Uncertainty (k=2)					± **25.3**	

SECTION 9 : Measurement results

9.1 WLAN Body SAR (2.4G)

(1)Method of measurement

Step.1 The searching for the worst position.
The test was performed at the worst transmit rate and channel.
Step2. The changing to the other channels (Low, Mid)
The test was performed at the worst condition of Step1.

Note:
1)The other channel was not required since maximum average output power channel SAR value is less than 0.8W/kg.
2) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D 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	-	-	-	
20-Mar	24	39	MSL 2450	23.5	2412	εr	52.8	50.9	-3.6	+/-5	*2
						σ [mho/m]	1.91	1.88	-1.6	+/-5	
20-Mar	24	39	MSL 2450	23.5	2437	εr	52.7	50.8	-3.7	+/-5	*2
						σ [mho/m]	1.94	2.00	3.1	+/-5	
19-Mar	24	38	MSL 2450	23.5	2450	εr	52.7	51.0	-3.3	+/-5	*1
						σ [mho/m]	1.95	2.00	2.3	+/-5	
20-Mar	24	39	MSL 2450	23.5	2450	εr	52.7	50.7	-3.8	+/-5	*1
						σ [mho/m]	1.95	1.93	-1.1	+/-5	
19-Mar	24	38	MSL 2450	23.5	2462	εr	52.7	50.8	-3.5	+/-5	*2
						σ [mho/m]	1.97	2.00	1.7	+/-5	
-	-	-	-	-	3000	εr	52.0	-	-	-	*1
						σ [mho/m]	2.73	-	-	-	

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

BODY SAR MEASUREMENT RESULTS												
Frequency		Modulation	Measured Power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Reported SAR(1g) *1 [W/kg]
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]	Maximum of multi-peak	Maximum of multi-peak
Step.1 Position searching												
11	2462	11b 1Mbps	17.55	56.89	19.00	79.43	Flat	Fixed	Top	0	**0.603**	**0.842**
11	2462	11b 1Mbps	17.55	56.89	19.00	79.43	Flat	Fixed	Front	0	**0.064**	**0.089**
11	2462	11b 1Mbps	17.55	56.89	19.00	79.43	Flat	Fixed	Rear	0	**0.395**	**0.552**
11	2462	11b 1Mbps	17.55	56.89	19.00	79.43	Flat	Fixed	Right	0	**0.118**	**0.165**
Step.2 Channel change (SAR level in Step.1 > 0.8 w/kg)												
1	2412	11b 1Mbps	17.34	54.20	19.00	79.43	Flat	Fixed	Top	0	**0.612**	**0.897**
6	2437	11b 1Mbps	17.46	55.72	19.00	79.43	Flat	Fixed	Top	0	**0.627**	**0.894**

*1 Reported SAR= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

9.2 WLAN Body SAR (5G)

(1)Method of measurement

Step.1 The searching for the worst position.
The test was performed at the worst transmit rate and channel.
Step2. The changing to the other channels (Low, Mid) *1
The test was performed at the worst condition of Step1.

*1 5.6GHz Band only

Note:
1)
a) In case of 5180-5240MHz, 5260-5320MHz and 5745-5825MHz frequency range.
The other channel was not required since maximum average output power channel SAR value is less than 0.8W/kg.
b) In case of 5500-5700MHz frequency range.
The other channel was not required since maximum average output power channel SAR value is less than 0.4W/kg

2) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

(2)Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D 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
-	-	-	-	-	5200	εr	49.0	-	-	-	*1
						σ [mho/m]	5.30	-	-	-	
20-Mar	24	39	MBBL 3.5-5.8	23.5	5240	εr	49.0	48.4	-1.2	+/-5	*2
						σ [mho/m]	5.35	5.55	3.8	+/-5	
24-Mar	24	38	MBBL 3.5-5.8	23.5	5240	εr	49.0	48.7	-0.6	+/-5	*2
						σ [mho/m]	5.35	5.55	3.8	+/-5	
20-Mar	24	39	MBBL 3.5-5.8	23.5	5300	εr	48.9	48.3	-1.3	+/-5	*1
						σ [mho/m]	5.42	5.66	4.5	+/-5	
24-Mar	24	38	MBBL 3.5-5.8	23.5	5300	εr	48.9	48.6	-0.7	+/-5	*1
						σ [mho/m]	5.42	5.64	4.0	+/-5	
24-Mar	24	38	MBBL 3.5-5.8	23.5	5320	εr	48.9	48.5	-0.7	+/-5	*2
						σ [mho/m]	5.44	5.67	4.1	+/-5	
-	-	-	-	-	5500	εr	48.6	-	-	-	*1
						σ [mho/m]	5.65	-	-	-	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5520	εr	48.6	47.7	-1.9	+/-5	*2
						σ [mho/m]	5.67	5.85	3.2	+/-5	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5600	εr	48.5	47.5	-2.0	+/-5	*1
						σ [mho/m]	5.77	5.97	3.4	+/-5	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5620	εr	48.5	47.5	-2.0	+/-5	*2
						σ [mho/m]	5.79	5.99	3.4	+/-5	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5660	εr	48.4	47.4	-2.0	+/-5	*2
						σ [mho/m]	5.84	6.04	3.5	+/-5	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5800	εr	48.2	48.9	1.4	+/-5	*1
						σ [mho/m]	6.00	6.19	3.1	+/-5	
25-Mar	24	40	MBBL 3.5-5.8	23.5	5805	εr	48.2	48.8	1.4	+/-5	*2
						σ [mho/m]	6.01	6.20	3.2	+/-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

5.2GHz Band

BODY SAR MEASUREMENT RESULTS												
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Reported SAR(1g) *1 [W/kg]
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]	Maximum of multi-peak	Maximum of multi-peak
Step.1 Position searching												
48	5240	11a 6Mbps	12.29	16.94	14.00	25.12	Flat	Fixed	Top	0	**0.250**	**0.371**
48	5240	11a 6Mbps	12.29	16.94	14.00	25.12	Flat	Fixed	Rear	0	**0.065**	**0.096**

*1 Reported SAR= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

5.3GHz Band

BODY SAR MEASUREMENT RESULTS												
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Reported SAR(1g) *1 [W/kg]
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]	Maximum of multi-peak	Maximum of multi-peak
Step.1 Position searching												
64	5320	11a 6Mbps	12.43	17.50	14.00	25.12	Flat	Fixed	Top	0	**0.294**	**0.422**
64	5320	11b 6Mbps	12.43	17.50	14.00	25.12	Flat	Fixed	Rear	0	**0.045**	**0.065**

*1 Reported SAR= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

5.6GHz Band

BODY SAR MEASUREMENT RESULTS												
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Reported SAR(1g) *1 [W/kg]
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]	Maximum of multi-peak	Maximum of multi-peak
Step.1 Position searching												
124	5620	11a 6Mbps	13.31	21.43	14.00	25.12	Flat	Fixed	Top	0	**0.445**	**0.522**
124	5620	11a 6Mbps	13.31	21.43	14.00	25.12	Flat	Fixed	Rear	0	**0.049**	**0.057**
Step.2 Channel change (SAR level in Step.1 > 0.4 w/kg)												
104	5520	11a 6Mbps	13.09	20.37	14.00	25.12	Flat	Fixed	Top	0	**0.417**	**0.514**
120	5600	11a 6Mbps	13.31	21.43	14.00	25.12	Flat	Fixed	Top	0	**0.441**	**0.517**
132	5660	11a 6Mbps	13.31	21.43	14.00	25.12	Flat	Fixed	Top	0	**0.447**	**0.524**

*1 Reported SAR= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

5.8GHz Band

BODY SAR MEASUREMENT RESULTS												
Frequency		Modulation	Measured power		Maximum tune-up tolerance limit		Phantom Section	EUT Set-up Conditions			Measured SAR(1g) [W/kg]	Reported SAR(1g) *1 [W/kg]
Channel	[MHz]		[dBm]	[mW]	[dBm]	[mW]		Antenna	Position	Separation [mm]	Maximum of multi-peak	Maximum of multi-peak
Step.1 Position searching												
161	5805	11a 6Mbps	13.08	20.32	14.00	25.12	Flat	Fixed	Top	0	**0.404**	**0.499**
161	5805	11a 6Mbps	13.08	20.32	14.00	25.12	Flat	Fixed	Rear	0	**0.032**	**0.040**

*1 Reported SAR= Maximum tune-up tolerance limit [mW] / Measured power [mW] · Measured SAR [W/kg]

SECTION 10 Test instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MNA-01	Network Analyzer	Agilent/HP	E8358A	US41080381	SAR	2013/09/09 * 12
MNCK-01	Type N Calibration Kit	Agilent	85032F	MY41495257	SAR	2013/09/07 * 12
MDPK-01	Dielectric probe kit	Agilent	85070D	702	SAR	2013/09/09 * 12
COTS-MSAR-02	S-Parameter Network Analyzer	Agilent	―	―	SAR	-
MPM-15	Power Meter	Agilent	N1914A	MY53060017	SAR	2013/06/05 * 12
MPSE-20	Power sensor	Agilent	N8482H	MY53050001	SAR	2013/06/05 * 12
MPSE-21	Power sensor	Agilent	N8482H	MY52460010	SAR	2013/06/05 * 12
MHDC-22	Directional Coupler	Agilent	87300B	14893A	SAR	Pre Check
MRFA-24	Pre Amplifier	R&K	R&K CGA020M602-2633R	B30550	SAR	2013/06/06 * 12
MSG-13	Signal Generator	Rohde & Schwarz	SMA 100A	103764	SAR	2013/06/05 * 12
MOS-30	Thermo-Hygrometer	Custom	CTH-201	3001	SAR	2013/07/29 * 12
MOS-10	Digtal thermometer	HANNA	Checktemp-2	MOS-10	SAR	2013/08/23 * 12
MDA-07	Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	SAR	2013/09/10 * 12
MPB-08	Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV4	3917	SAR	2013/05/14 * 12
MDAE-02	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	1369	SAR	2013/05/13 * 12
MPF-03	2mm Oval Flat Phantom	Schmid&Partner Engineering AG	QDOVA001BB	1203	SAR	2013/06/11 * 12
MRBT-03	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F13/5PP1D1/A/01	SAR	2013/06/12 * 12
COTS-MSAR-03	Dasy5	Schmid&Partner Engineering AG	DASY5	-	SAR	-
MDA-08	Dipole Antenna	Schmid&Partner Engineering AG	D5GHzV2	1020	SAR	2014/01/17 * 12
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.

***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

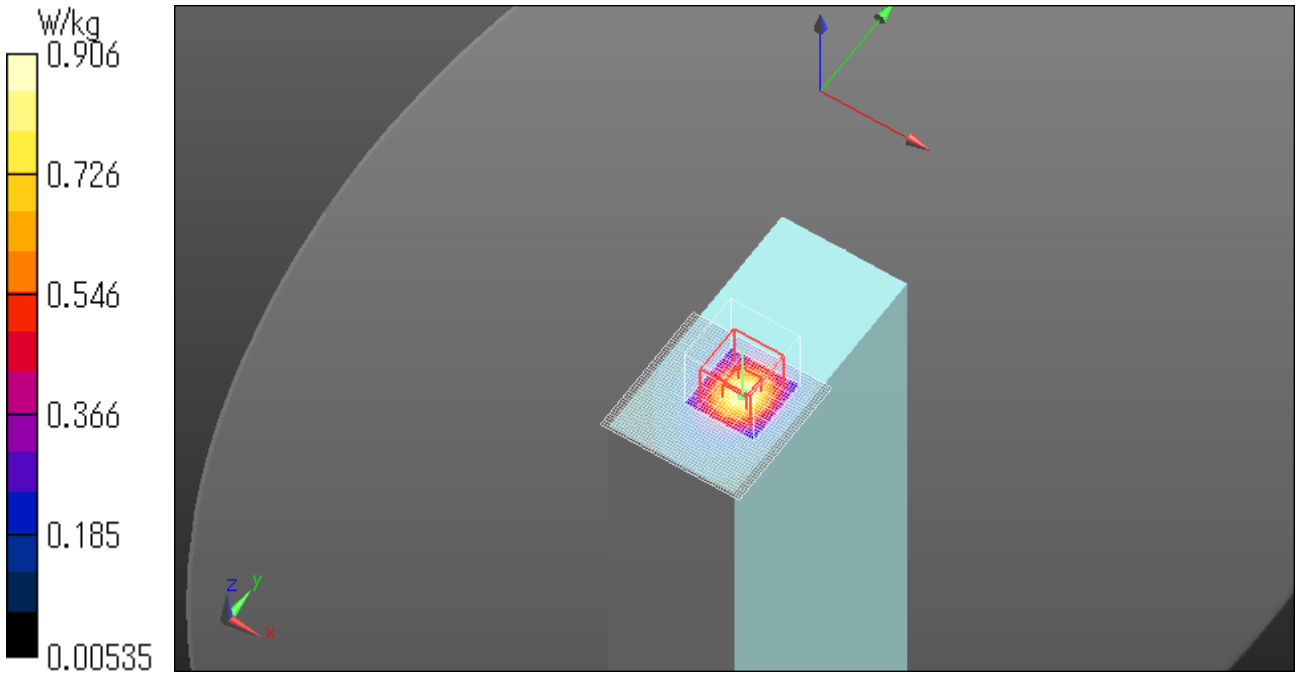
i) WLAN Body 2.4GHz Band

WLAN 11b 1Mbps Top 2462MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.003 S/m; ε_r = 50.84; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.917 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.546 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.603 W/kg; SAR(10 g) = 0.292 W/kg

Maximum value of SAR (measured) = 0.906 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

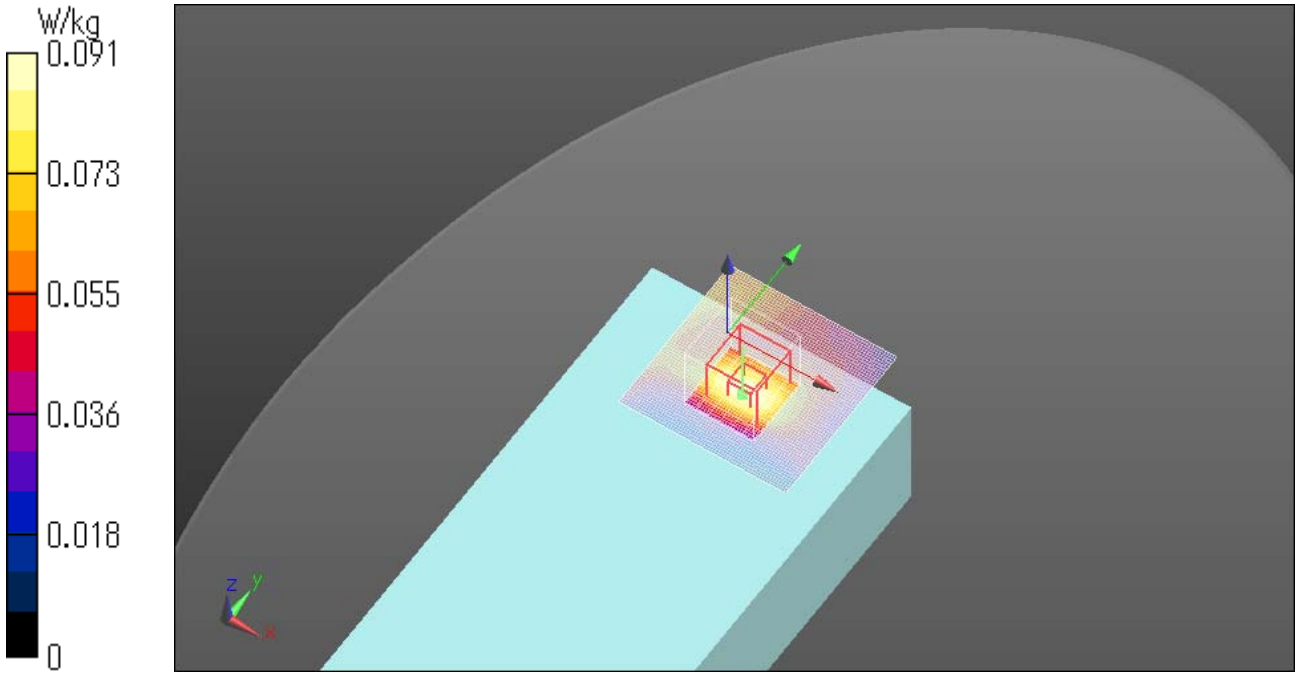


WLAN 11b 1Mbps Front 2462MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.003 S/m; ε_r = 50.84; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0928 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.862 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.125 W/kg
SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.034 W/kg

Maximum value of SAR (measured) = 0.0910 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

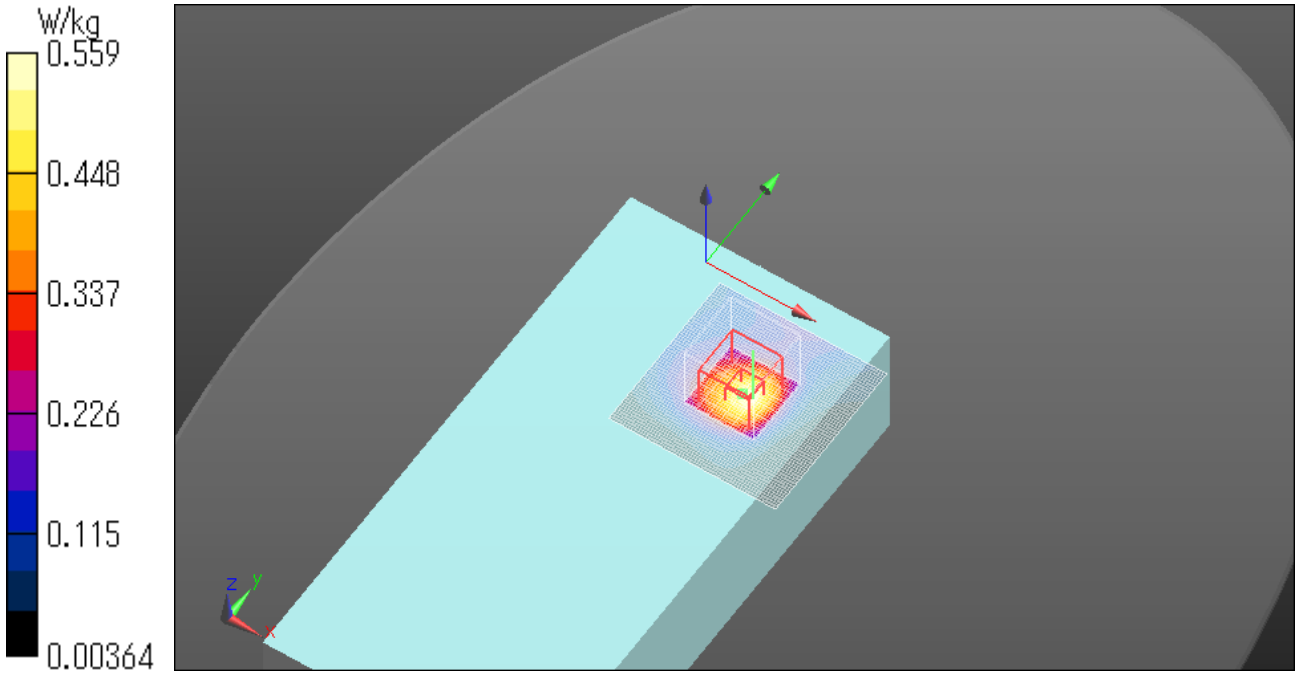


WLAN 11b 1Mbps Rear 2462MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.003 S/m; ε_r = 50.84; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.584 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.467 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.737 W/kg
SAR(1 g) = 0.395 W/kg; SAR(10 g) = 0.207 W/kg

Maximum value of SAR (measured) = 0.559 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

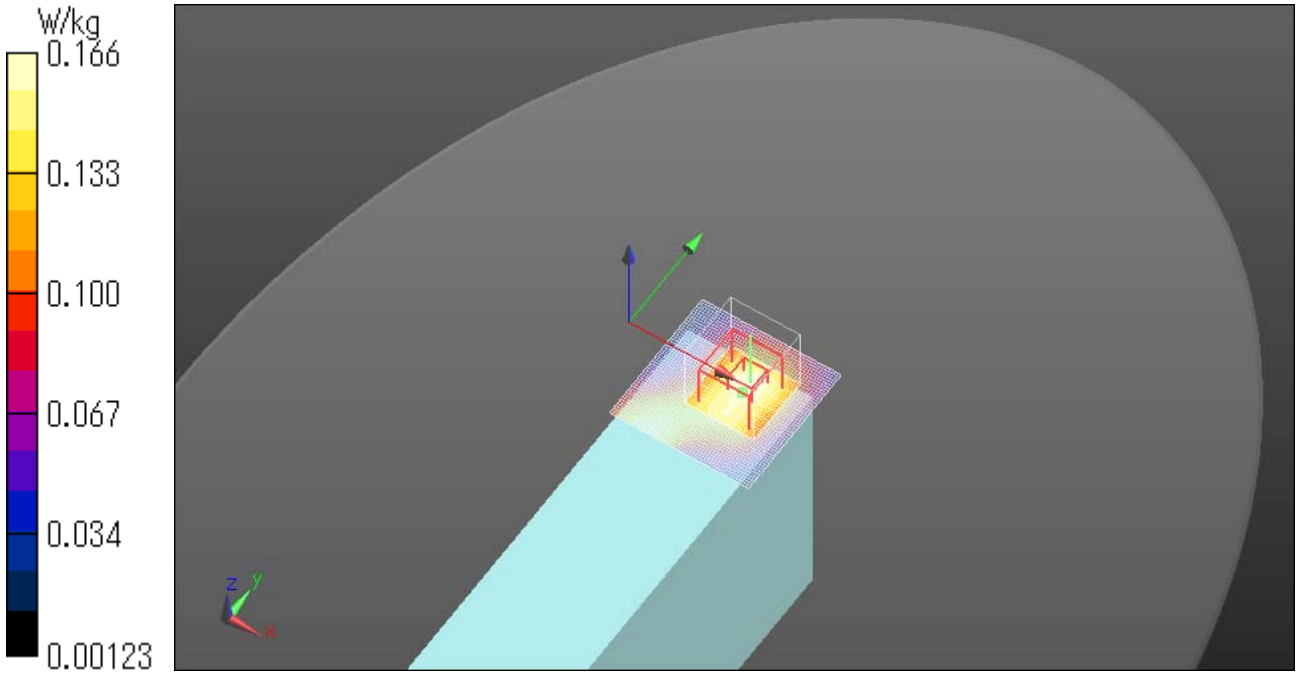


WLAN 11b 1Mbps Right 2462MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.003 S/m; ε_r = 50.84; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.167 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.035 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.219 W/kg
SAR(1 g) = 0.118 W/kg; SAR(10 g) = 0.067 W/kg

Maximum value of SAR (measured) = 0.166 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



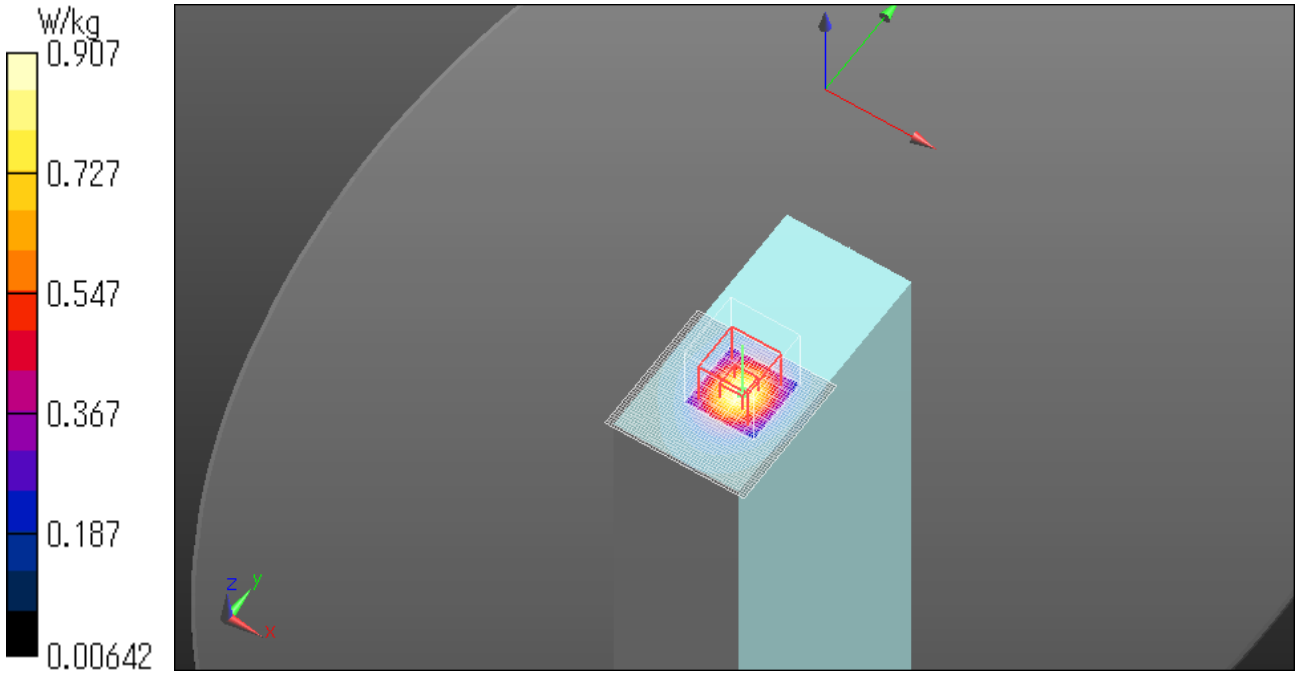
WLAN 11b 1Mbps Top 2412MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2412 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.88 S/m; ε_r = 50.861; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.925 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.117 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.612 W/kg; SAR(10 g) = 0.300 W/kg

Maximum value of SAR (measured) = 0.907 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



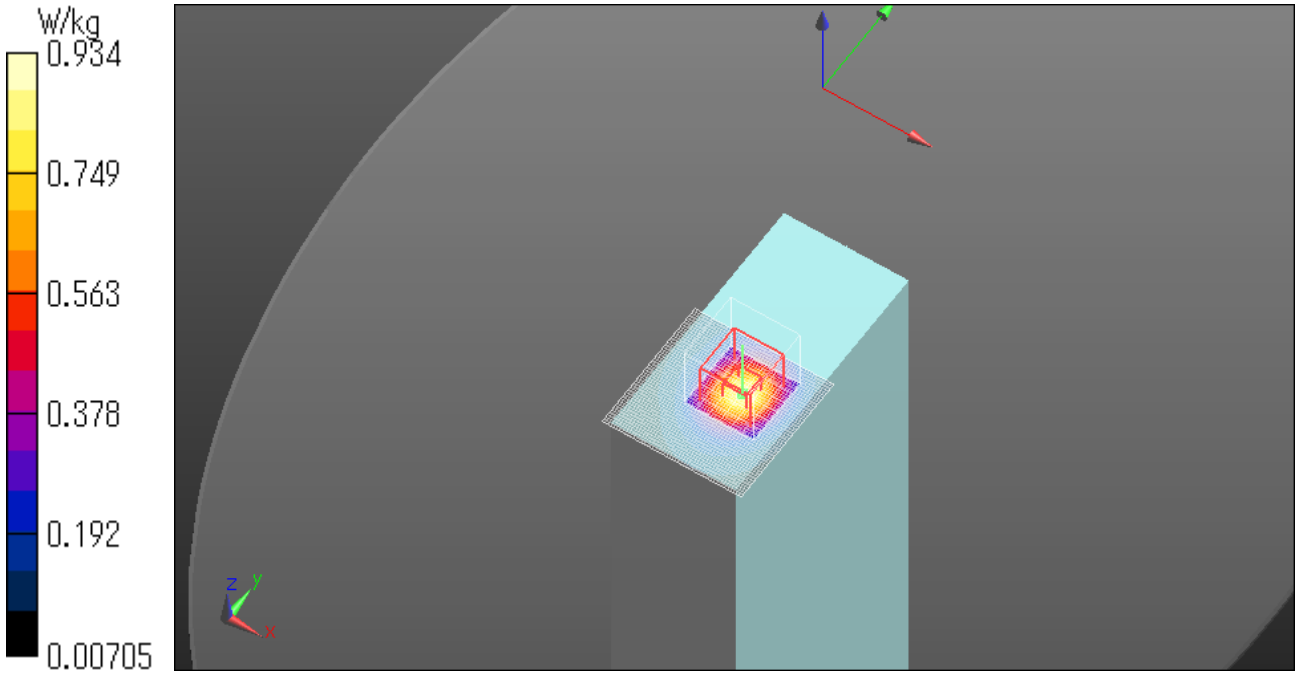
WLAN 11b 1Mbps Top 2437MHz
Communication System: UID 0, WLAN 2.4G 11b/g/n (0); Communication System Band: WLAN 2.4G 11b/g/n;
Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.913 S/m; ε_r = 50.76; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.962 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.541 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.627 W/kg; SAR(10 g) = 0.310 W/kg

Maximum value of SAR (measured) = 0.934 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

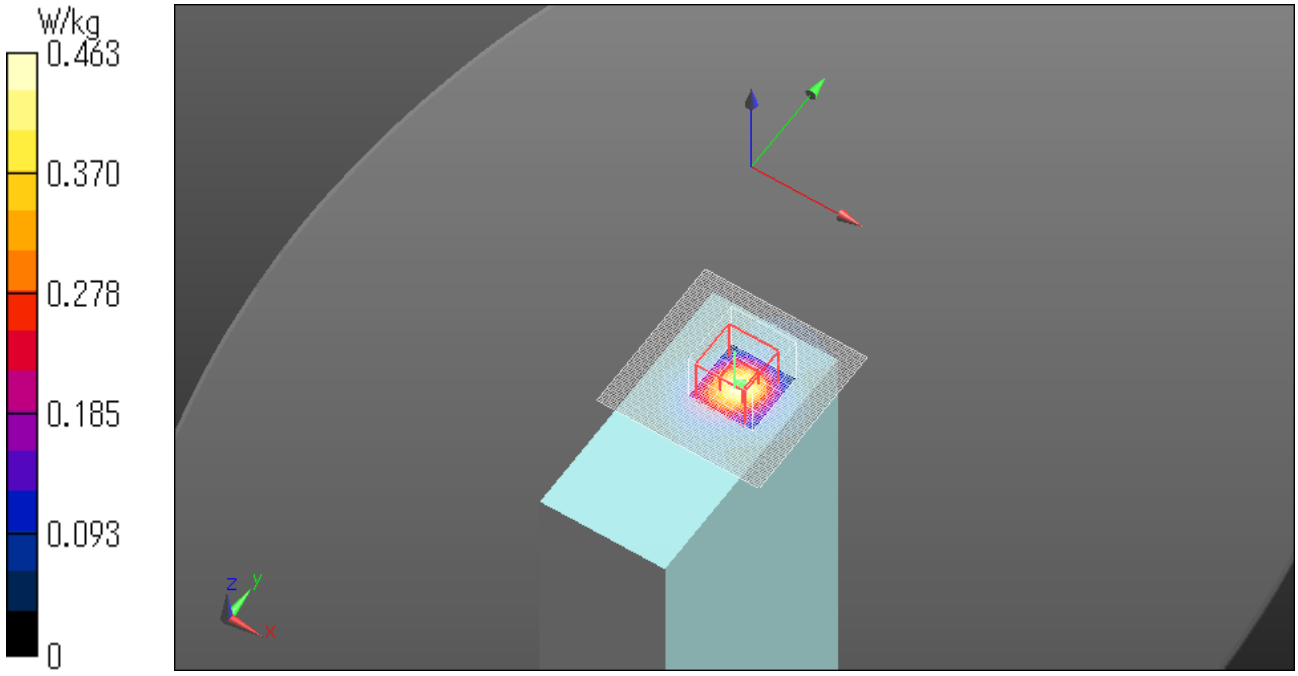


ii) WLAN Body 5.2GHz Band

WLAN 11a 6Mbps Top 5240MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W52; Frequency: 5240 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.553 S/m; ε_r = 48.378; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.72, 4.72, 4.72); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.470 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.978 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.861 W/kg
SAR(1 g) = 0.250 W/kg; SAR(10 g) = 0.088 W/kg
Maximum value of SAR (measured) = 0.463 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

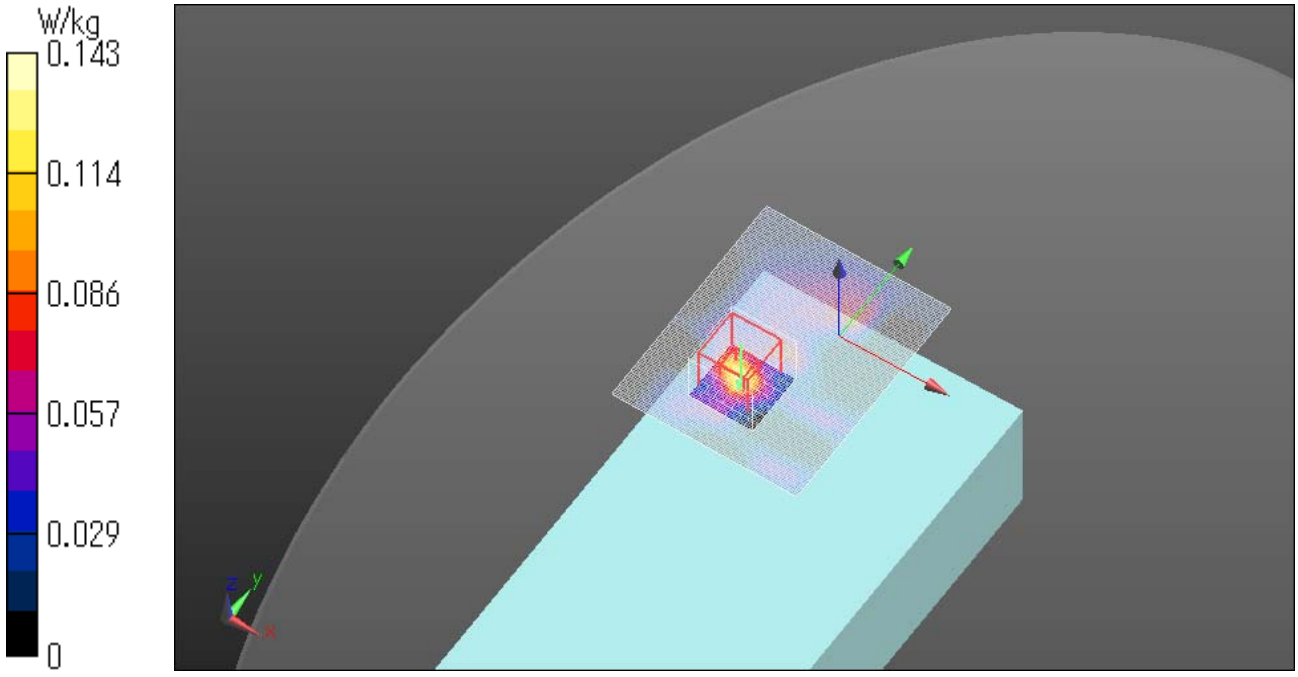


WLAN 11a 6Mbps Rear 5240MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W52; Frequency: 5240 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.549 S/m; ε_r = 48.682; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.72, 4.72, 4.72); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (81x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.126 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.765 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.234 W/kg
SAR(1 g) = 0.065 W/kg; SAR(10 g) = 0.020 W/kg

Maximum value of SAR (measured) = 0.143 W/kg
Date: 2014/03/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

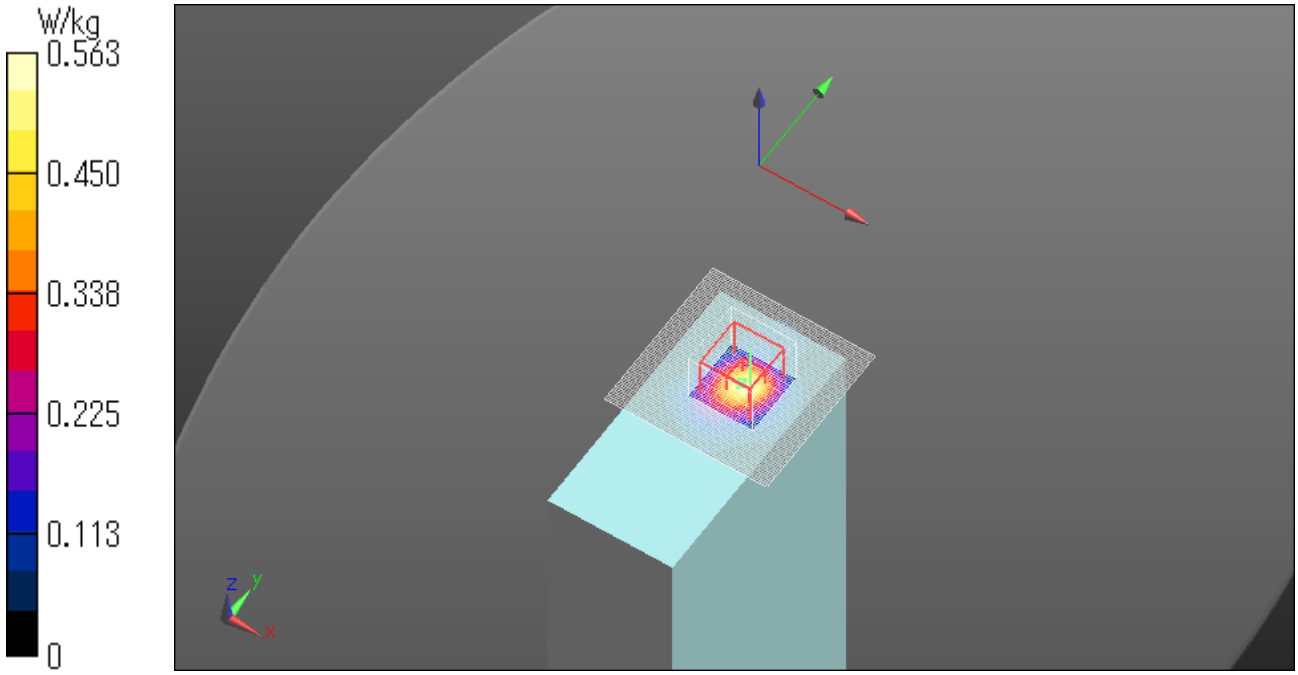


iii) WLAN Body 5.3GHz Band

WLAN 11a 6Mbps Top 5320MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W53; Frequency: 5320 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5320 MHz; σ = 5.666 S/m; ε_r = 48.516; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.556 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 9.166 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.294 W/kg; SAR(10 g) = 0.098 W/kg
Maximum value of SAR (measured) = 0.563 W/kg
Date: 2014/03/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

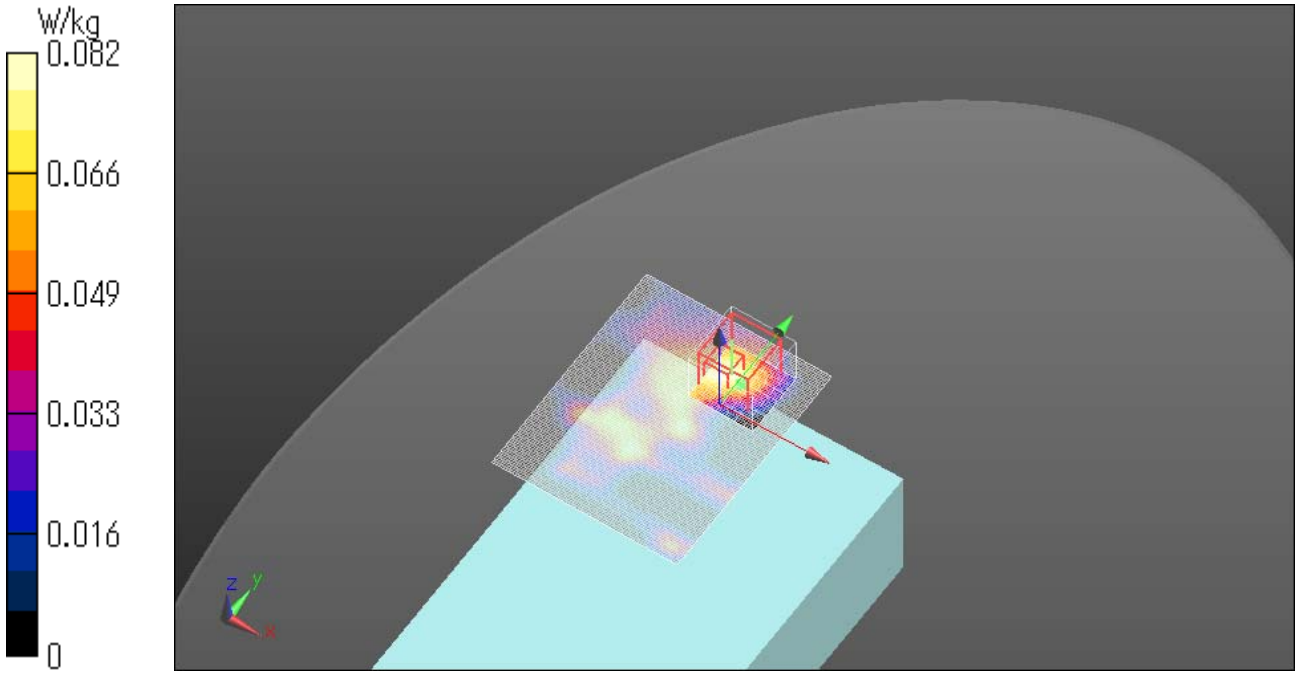


WLAN 11a 6Mbps Rear 5320MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W53; Frequency: 5320 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5320 MHz; σ = 5.666 S/m; ε_r = 48.516; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (81x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0819 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.688 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.182 W/kg
SAR(1 g) = 0.045 W/kg; SAR(10 g) = 0.016 W/kg

Maximum value of SAR (measured) = 0.0824 W/kg
Date: 2014/03/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

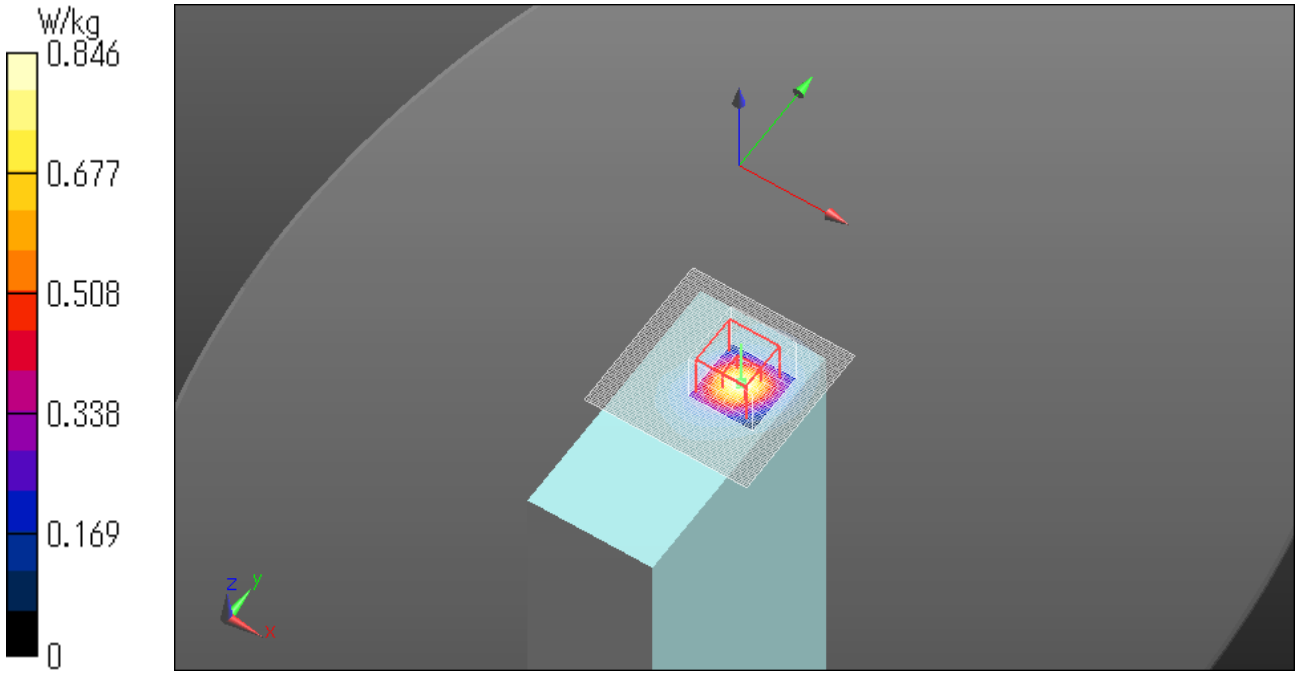


iv) WLAN Body 5.6GHz Band

WLAN 11a 6Mbps Top 5620MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W56; Frequency: 5620 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5620 MHz; σ = 5.992 S/m; ε_r = 47.505; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.876 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.339 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.445 W/kg; SAR(10 g) = 0.153 W/kg
Maximum value of SAR (measured) = 0.846 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.

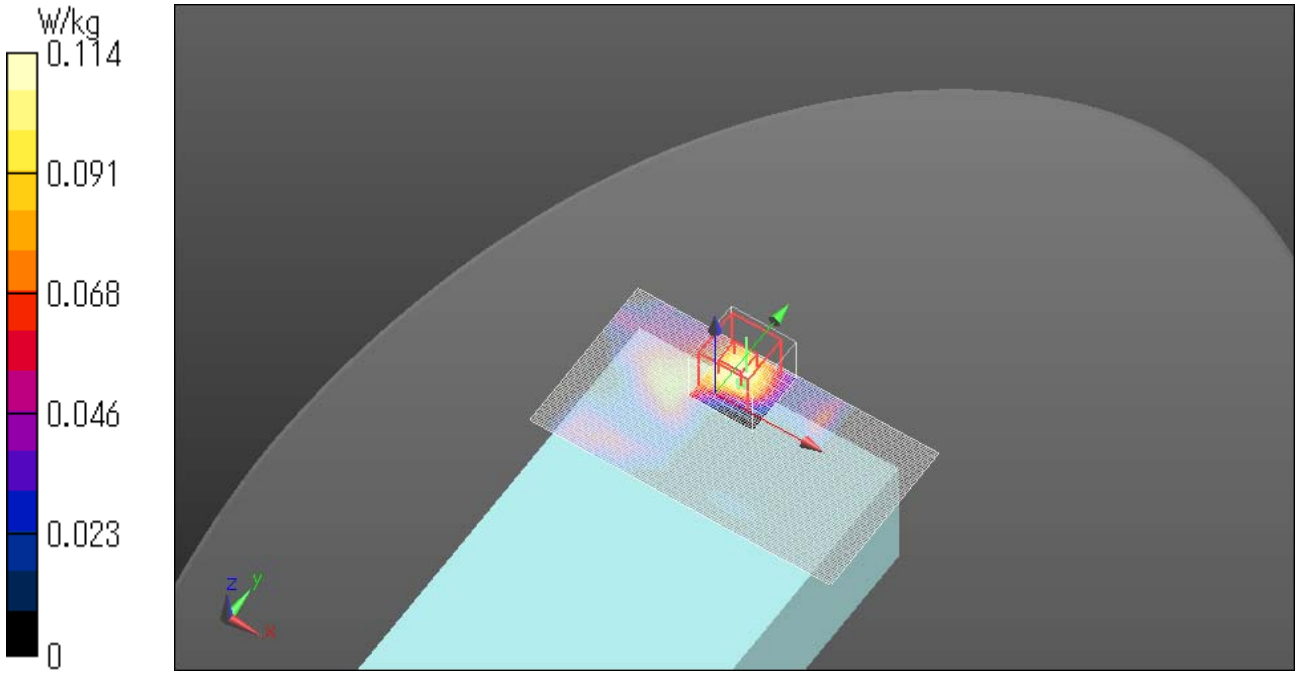


WLAN 11a 6Mbps Rear 5620MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W56; Frequency: 5620 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5620 MHz; σ = 5.992 S/m; ε_r = 47.505; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (131x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.118 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.480 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.280 W/kg
SAR(1 g) = 0.049 W/kg; SAR(10 g) = 0.018 W/kg

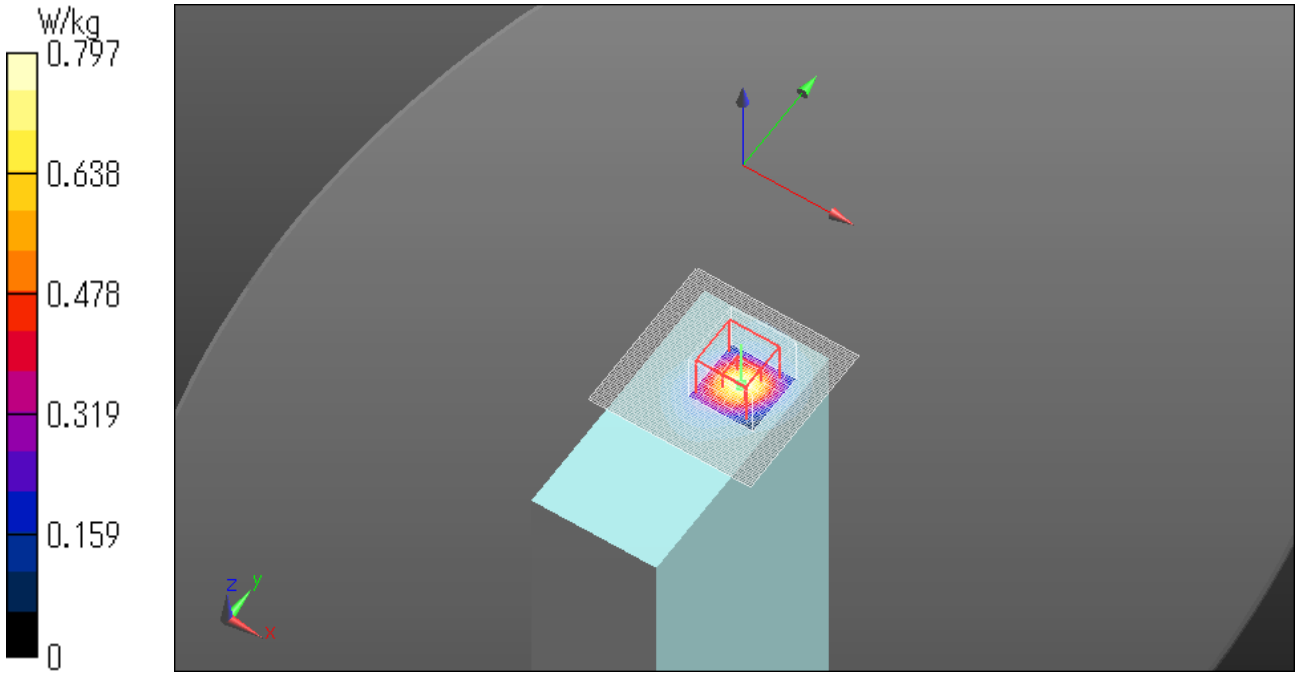
Maximum value of SAR (measured) = 0.114 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



WLAN 11a 6Mbps Top 5520MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W56; Frequency: 5520 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5520 MHz; σ = 5.854 S/m; ε_r = 47.658; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.15, 4.15, 4.15); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.820 W/kg

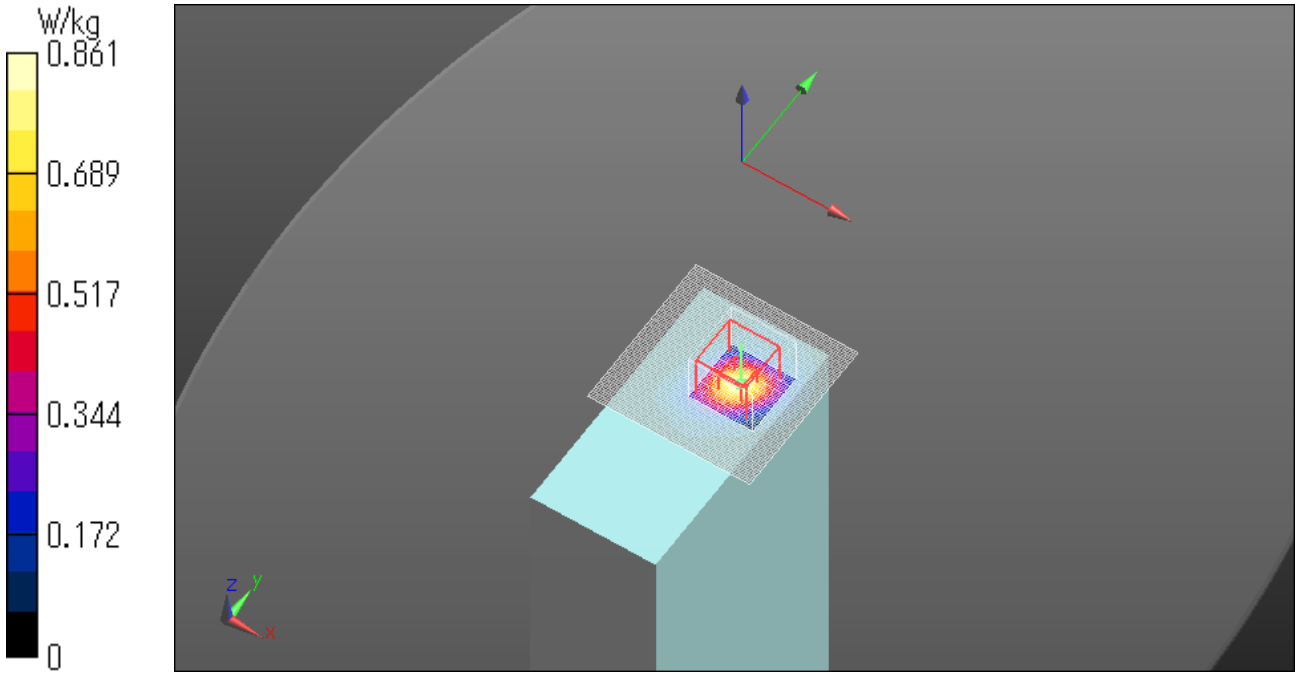
Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.225 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.417 W/kg; SAR(10 g) = 0.141 W/kg
Maximum value of SAR (measured) = 0.797 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



WLAN 11a 6Mbps Top 5600MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W56; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.966 S/m; ε_r = 47.541; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.834 W/kg

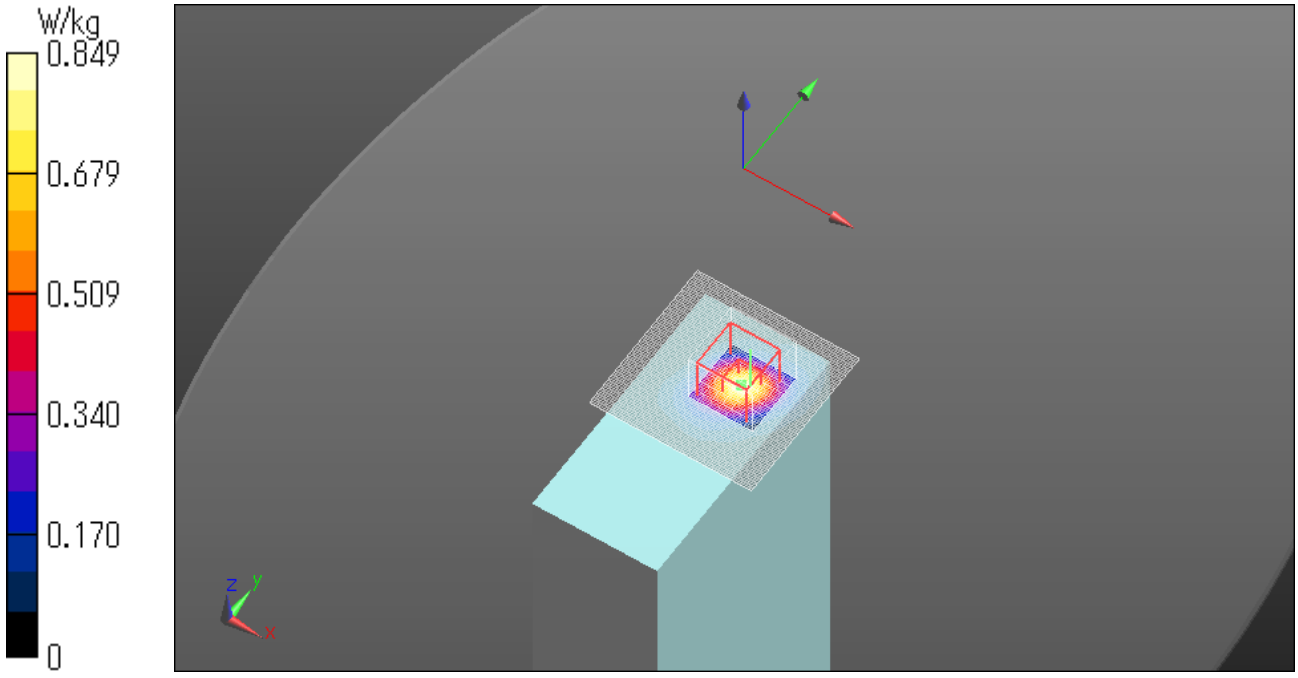
Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.806 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.60 W/kg
SAR(1 g) = 0.441 W/kg; SAR(10 g) = 0.149 W/kg
Maximum value of SAR (measured) = 0.861 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



WLAN 11a 6Mbps Top 5660MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W56; Frequency: 5660 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5660 MHz; σ = 6.043 S/m; ε_r = 47.42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.892 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.160 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 0.447 W/kg; SAR(10 g) = 0.151 W/kg
Maximum value of SAR (measured) = 0.849 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



v) WLAN Body 5.8GHz Band

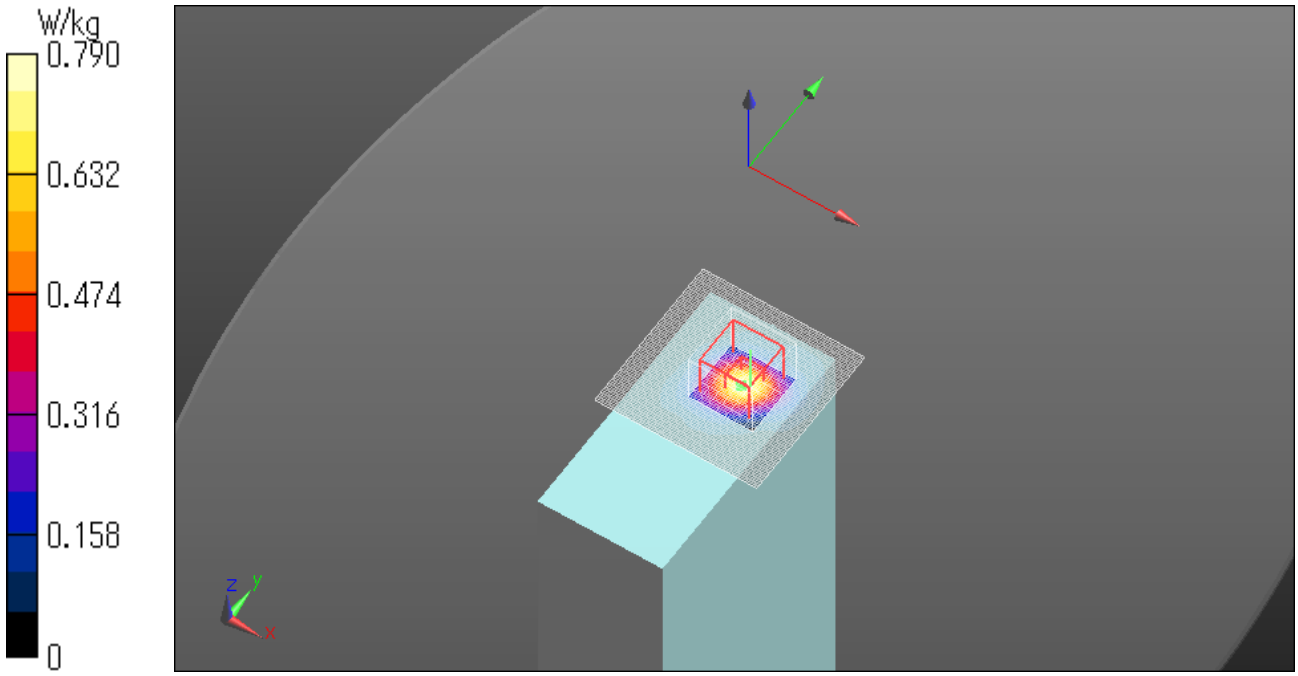
WLAN 11a 6Mbps Top 5805MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W58; Frequency: 5805 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5805 MHz; σ = 6.196 S/m; ε_r = 48.848; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.33, 4.33, 4.33); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.806 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.550 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.49 W/kg
SAR(1 g) = 0.404 W/kg; SAR(10 g) = 0.135 W/kg

Maximum value of SAR (measured) = 0.790 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



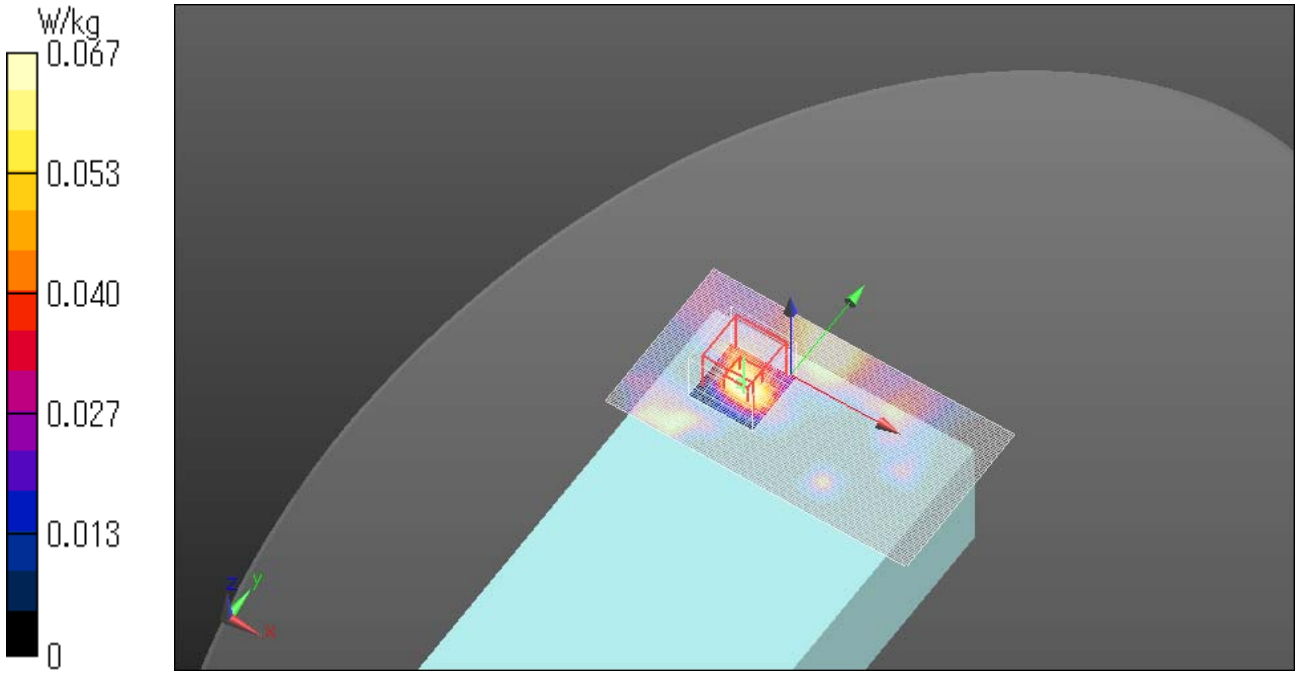
WLAN 11a 6Mbps Rear 5805MHz
Communication System: UID 0, WLAN 5G 11a/n (0); Communication System Band: W58; Frequency: 5805 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5805 MHz; σ = 6.196 S/m; ε_r = 48.848; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.33, 4.33, 4.33); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (131x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0900 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.734 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.139 W/kg
SAR(1 g) = 0.032 W/kg; SAR(10 g) = 0.011 W/kg

Maximum value of SAR (measured) = 0.0666 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



APPENDIX2 : System Check

1. System check result Body 2450MHz

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
19-Mar	24	38	MSL 2450	23.5	2450	εr	52.7	51.0	-3.3	+/-5	*1
						σ [mho/m]	1.95	2.00	2.3	+/-5	
20-Mar	24	39	MSL 2450	23.5	2450	εr	52.7	50.7	-3.8	+/-5	*1
						σ [mho/m]	1.95	1.93	-1.1	+/-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
19-Mar	24	38	MSL 2450	23.5	2450	εr	52.2	51.0	-2.4	+/-6	*2 *3
						σ [mho/m]	2.00	2.00	-0.3	+/-6	
20-Mar	24	39	MSL 2450	23.5	2450	εr	52.2	50.7	-2.9	+/-6	*2 *3
						σ [mho/m]	2.00	1.93	-3.6	+/-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.

System check result (for calibration by manufacture)

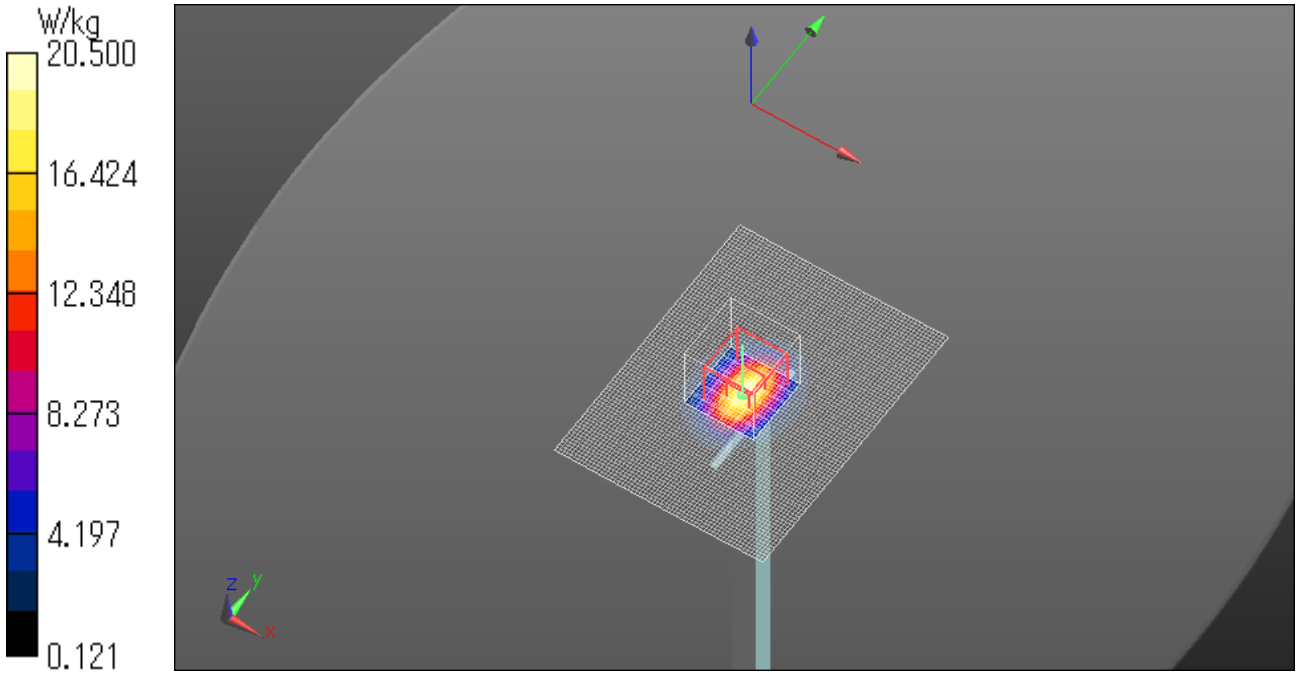
SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]					
		Forward Power 250mW Measured	Conversion 1W Calculation	Target Value(1W)	Deviation [%]	Limit [%]	Remark
19-Mar	2450.00	13.50	54.00	50.40	7.1	+/-10	*4
20-Mar	2450.00	13.20	52.80	50.40	4.8	+/-10	*4

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

Body 2450MHz System Check DATA / Dipole2450MHz / Forward Conducted Power : 250mW
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 = 1.995 S/m; ε_r = 50.969; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

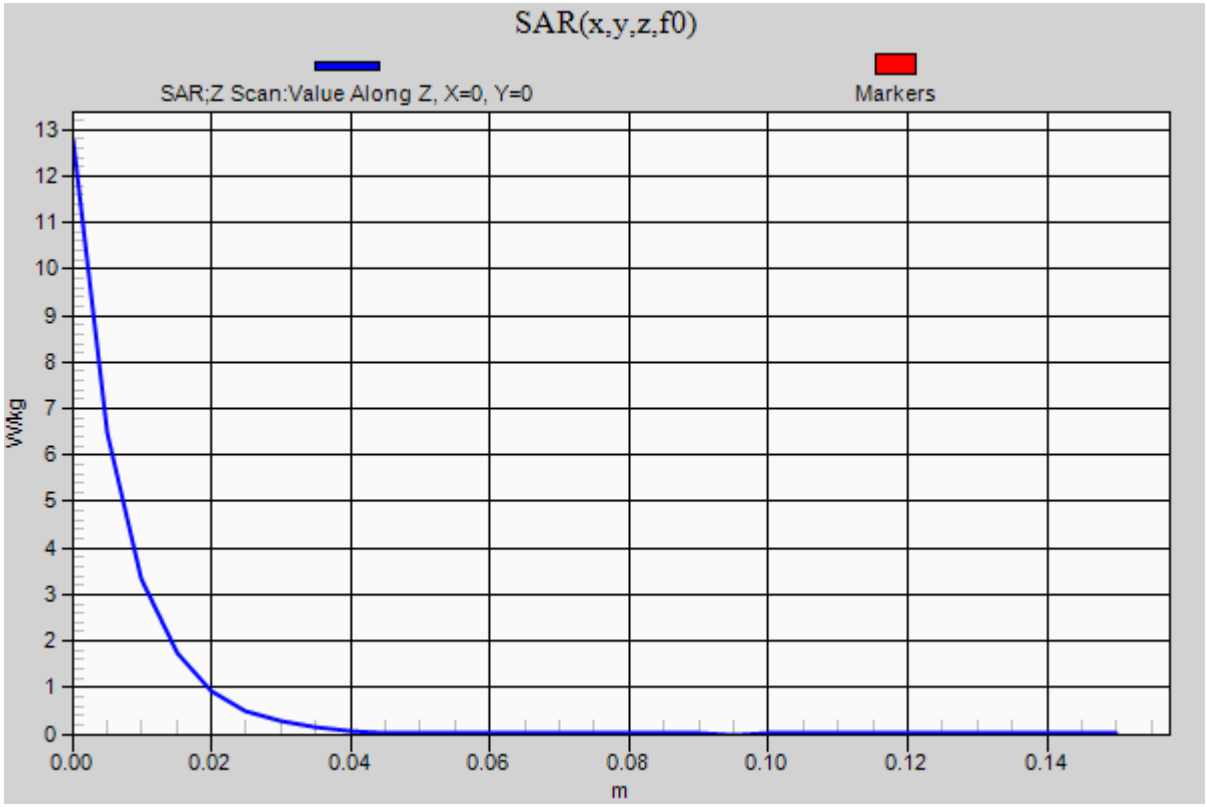
Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 21.2 W/kg

Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.3 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.24 W/kg
Maximum value of SAR (measured) = 20.5 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 2450MHz System Check DATA / Dipole2450MHz / Forward Conducted Power : 250mW
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 = 1.995 S/m; ε_r = 50.969; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

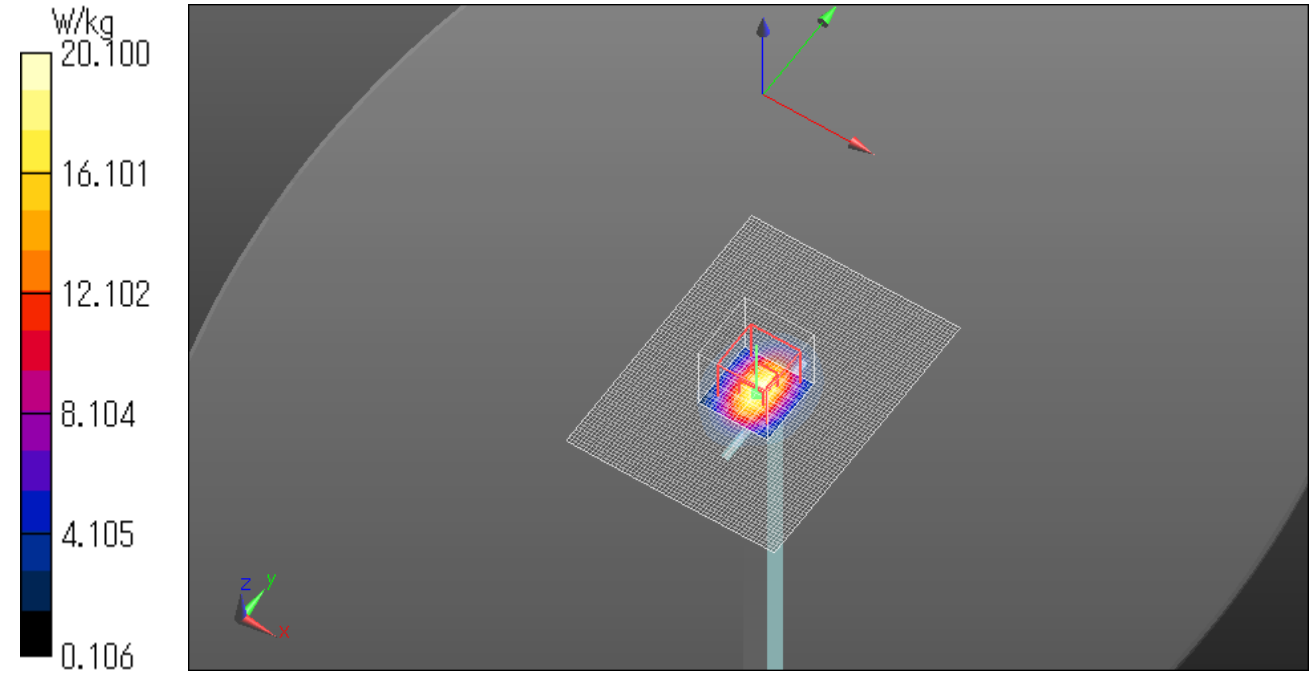
Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.8 W/kg
Date: 2014/03/19
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 2450MHz System Check DATA / Dipole2450MHz / Forward Conducted Power : 250mW
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 = 1.929 S/m; ε_r = 50.708; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

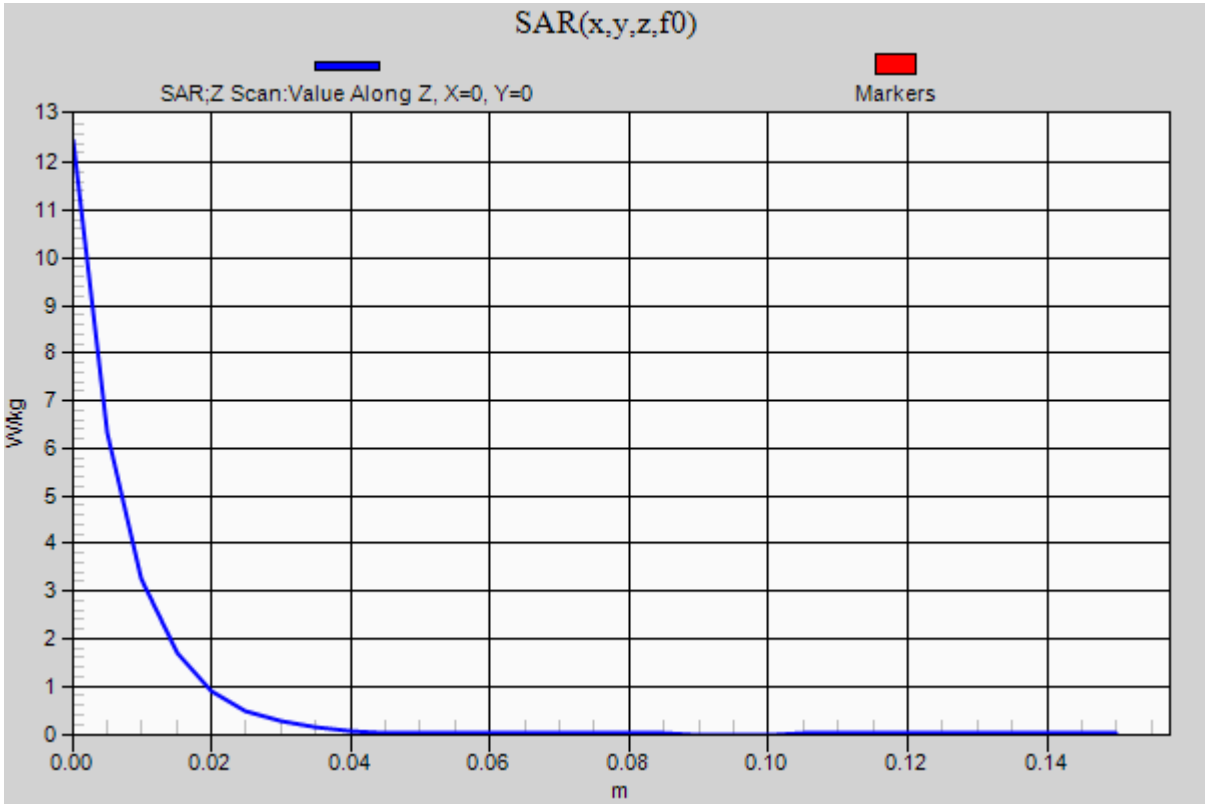
Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 20.9 W/kg

Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.8 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.07 W/kg
Maximum value of SAR (measured) = 20.1 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 2450MHz System Check DATA / Dipole2450MHz / Forward Conducted Power : 250mW
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 = 1.929 S/m; ε_r = 50.708; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.27, 7.27, 7.27); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.5 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



2. 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	
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
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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

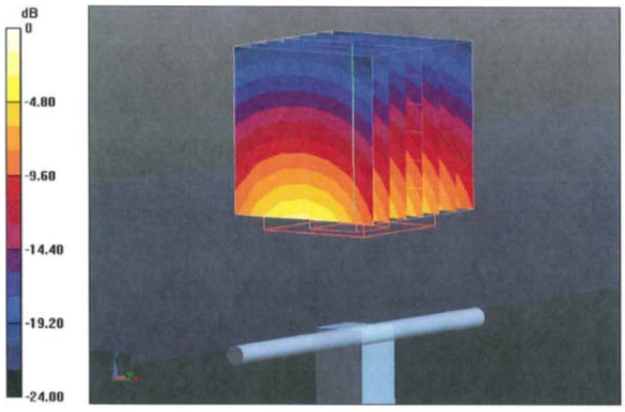
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 713

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:

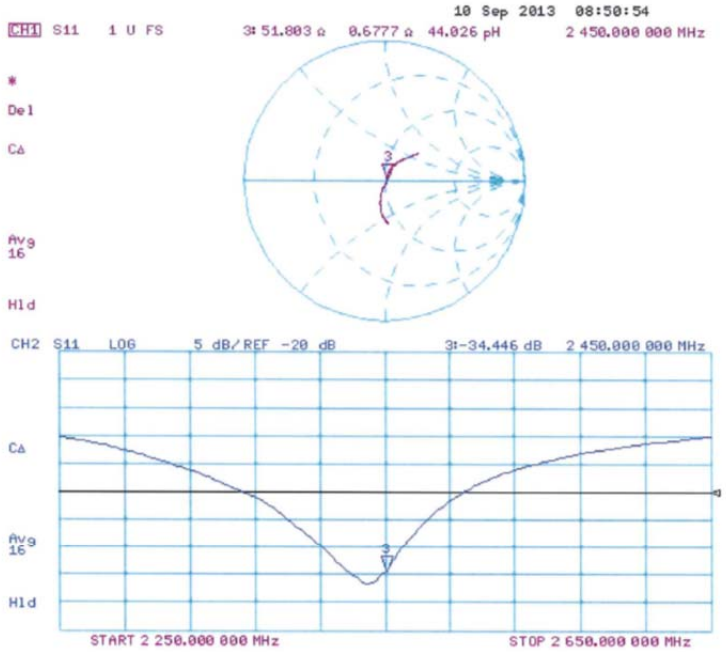
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

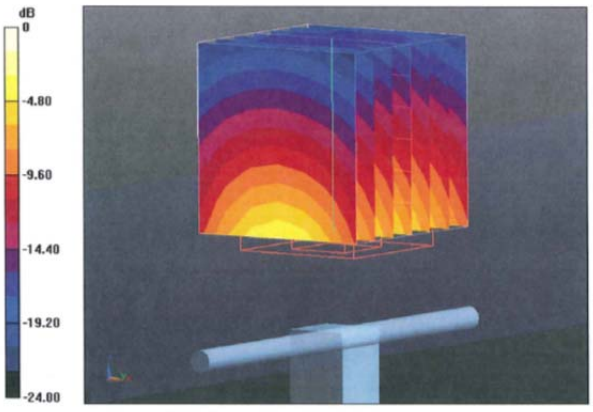
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 713

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

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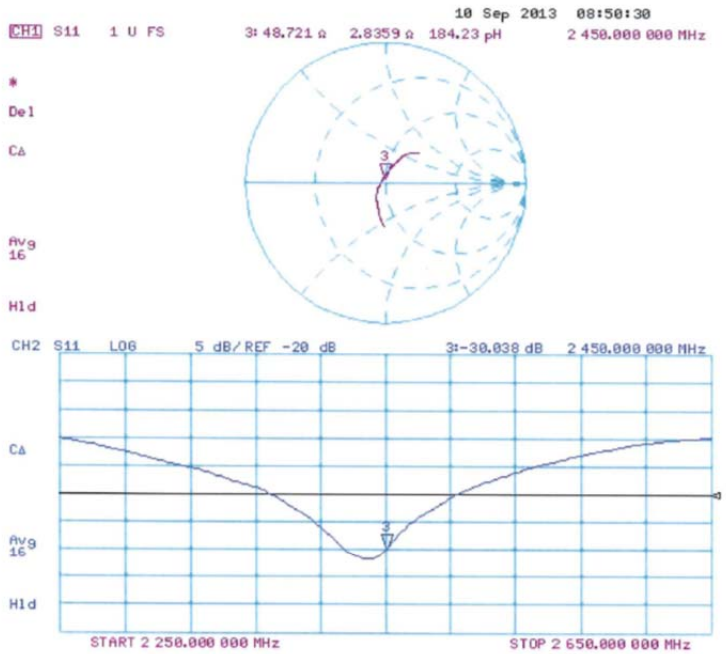
Impedance Measurement Plot for Body TSL



3. System check result Body 5300MHz

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
20-Mar	24	39	MBBL 3.5-5.8	23.5	5300	εr	48.9	48.3	-1.3	+/-5	*1
						σ [mho/m]	5.42	5.66	4.5	+/-5	
24-Mar	24	38	MBBL 3.5-5.8	23.5	5300	εr	48.9	48.6	-0.7	+/-5	*1
						σ [mho/m]	5.42	5.64	4.0	+/-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
20-Mar	24	39	MBBL 3.5-5.8	23.5	5300	εr	47.2	48.3	2.3	+/-6	*2 *3
						σ [mho/m]	5.57	5.66	1.7	+/-6	
24-Mar	24	38	MBBL 3.5-5.8	23.5	5300	εr	47.2	48.6	2.9	+/-6	*2 *3
						σ [mho/m]	5.57	5.64	1.2	+/-6	

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

System check result (for calibration by manufacture)

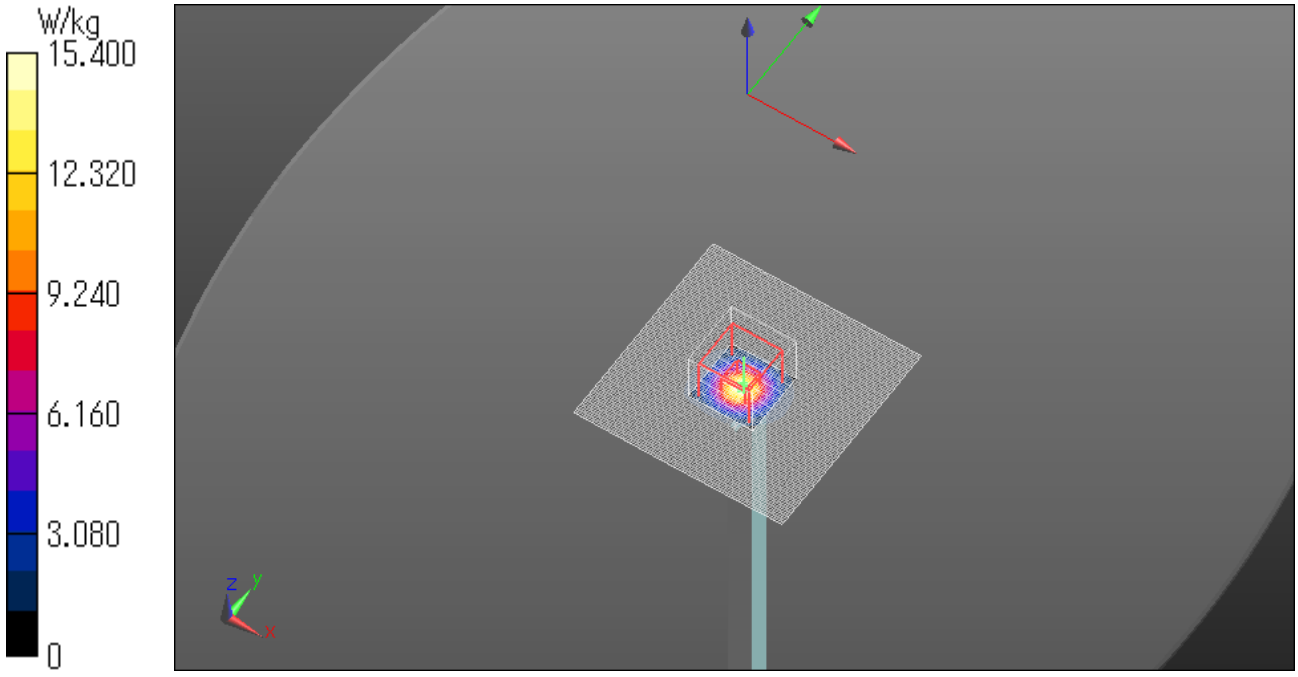
SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]			Deviation [%]	Limit [%]	Remark
		Forward Power 100mW Measured	Conversion 1W Calculation	Target Value(1W)			
20-Mar	5300.00	7.81	78.10	76.30	2.4	+/-10	*4
24-Mar	5300.00	7.65	76.50	76.30	0.3	+/-10	*4

*4 The taget value is the parameter defined in SAR mesured x 10(7.63 x 10 = 76.3) in manufacturer calibrated dipole (D5GHzV2 SN:1020)
Please refer to " SAR result with Body TSL of Appendix 2 2. System Check Dipole (D5GHzV2,S/N: 1020)".

Body 5300MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.664 S/m; ε_r = 48.263; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

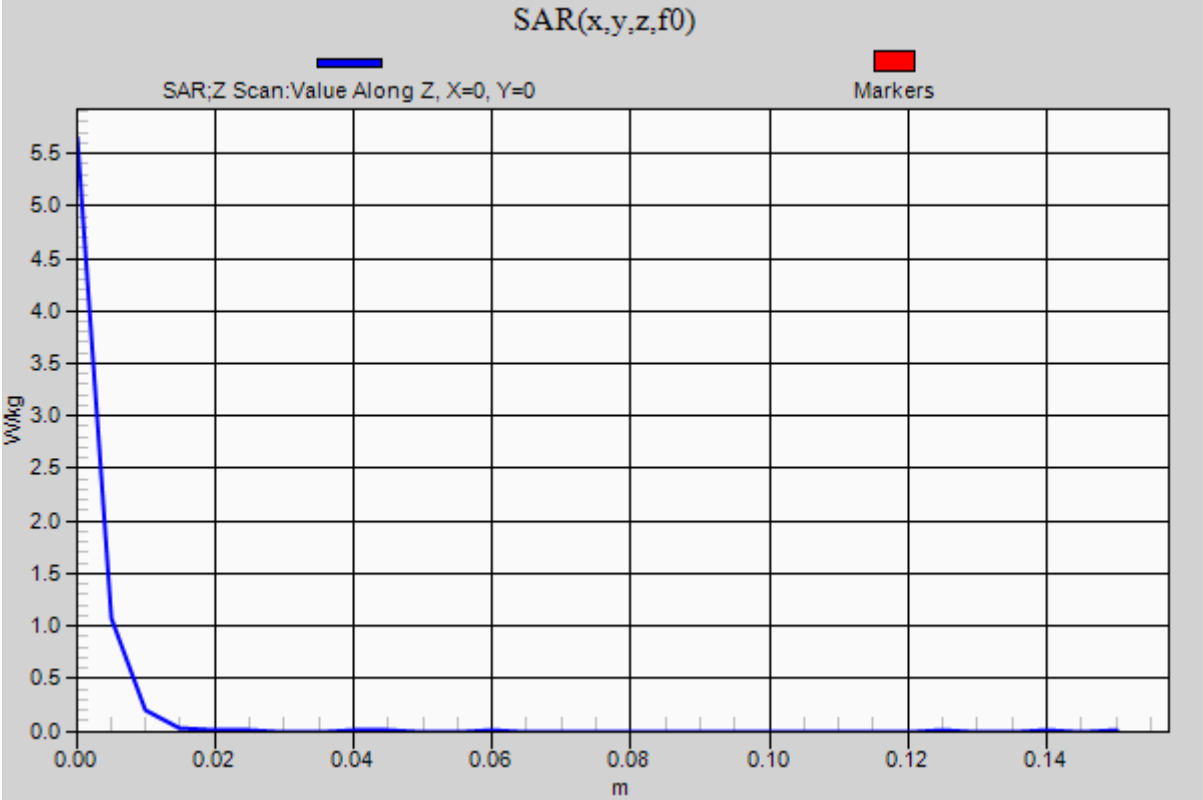
Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 14.8 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 64.929 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 15.4 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 5300MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.664 S/m; ε_r = 48.263; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

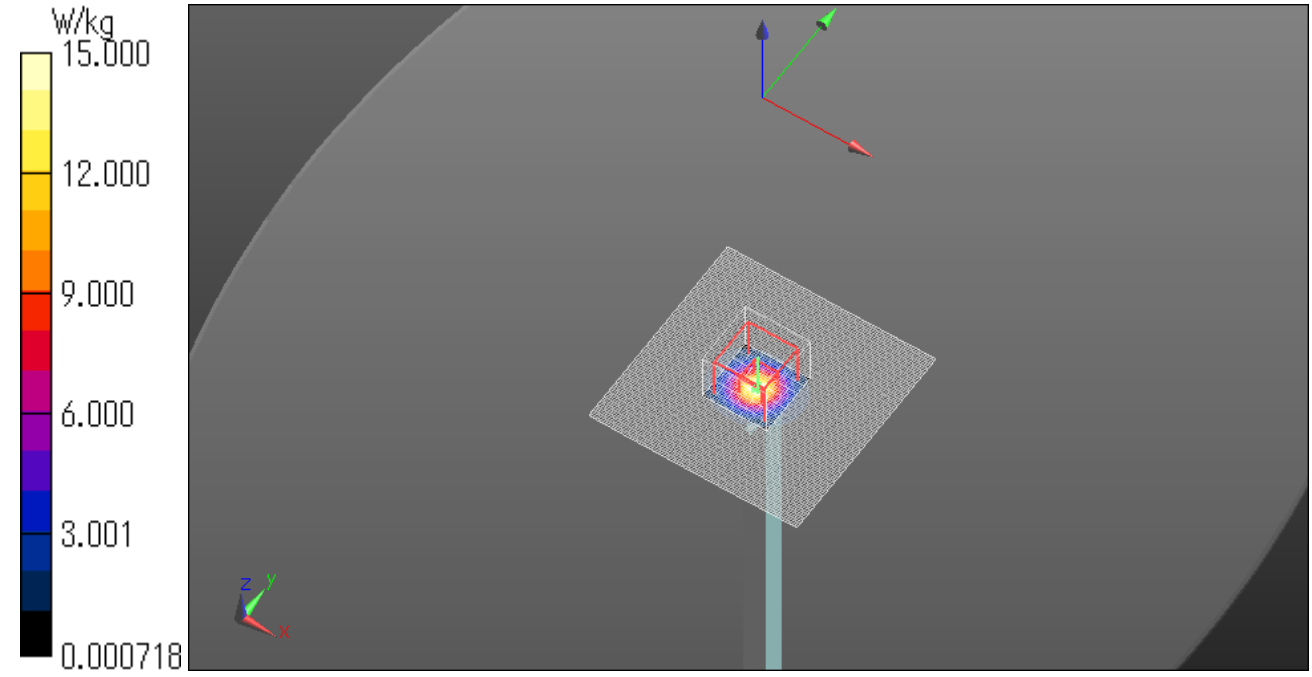
Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 5.65 W/kg
Date: 2014/03/20
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 5300MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.637 S/m; ε_r = 48.562; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

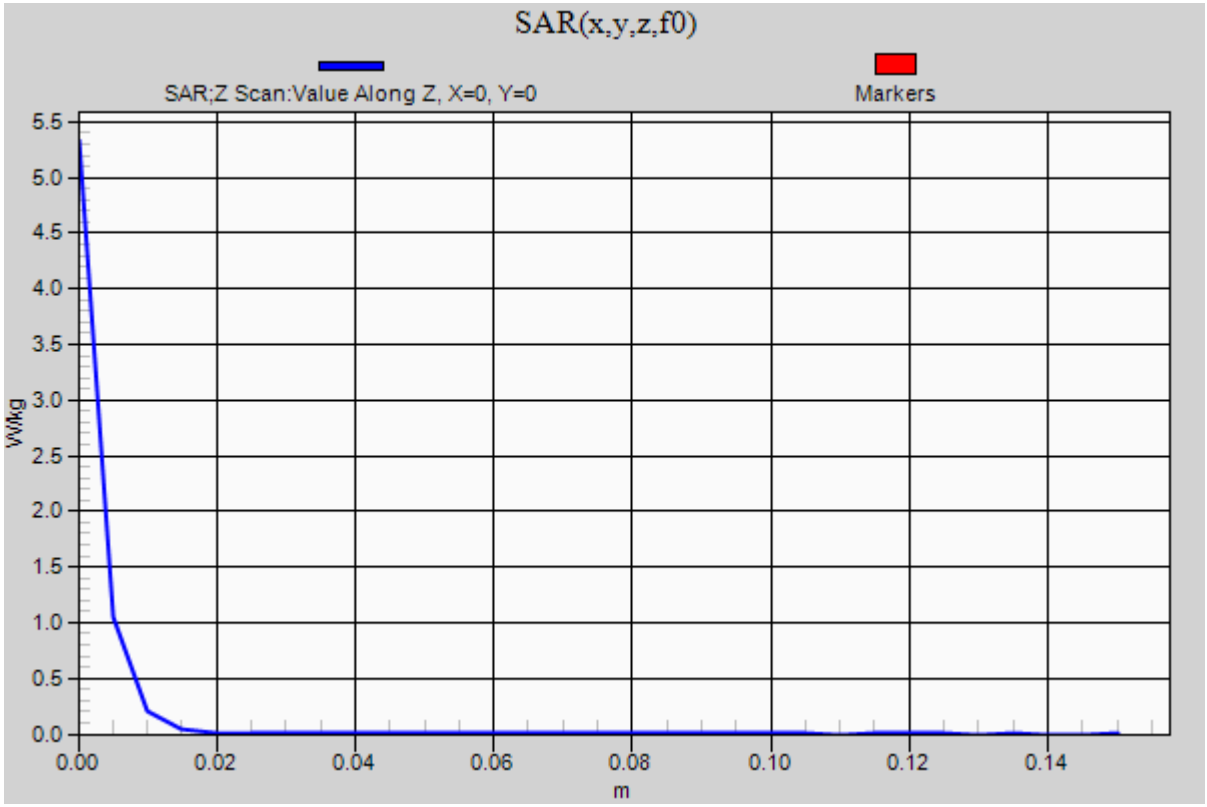
Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 14.7 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 64.537 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 15.0 W/kg
Date: 2014/03/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 5300MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.637 S/m; ε_r = 48.562; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.56, 4.56, 4.56); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 5.33 W/kg
Date: 2014/03/24
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



4. System Check result Body 5600MHz

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
25-Mar	24	40	MBBL 3.5-5.8	23.5	5600	εr	48.5	47.5	-2.0	+/-5	*1
						σ [mho/m]	5.77	5.97	3.4	+/-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
25-Mar	24	40	MBBL 3.5-5.8	23.5	5600	εr	46.6	47.5	2.0	+/-6	*2 *3
						σ [mho/m]	5.98	5.97	-0.2	+/-6	

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

System check result (for calibration by manufacture)

SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]					
		Forward Power 100mW Measured	Conversion 1W Calculation	Target Value(1W)	Deviation [%]	Limit [%]	Remark
25-Mar	5600.00	7.95	79.50	80.80	-1.6	+/-10	*4

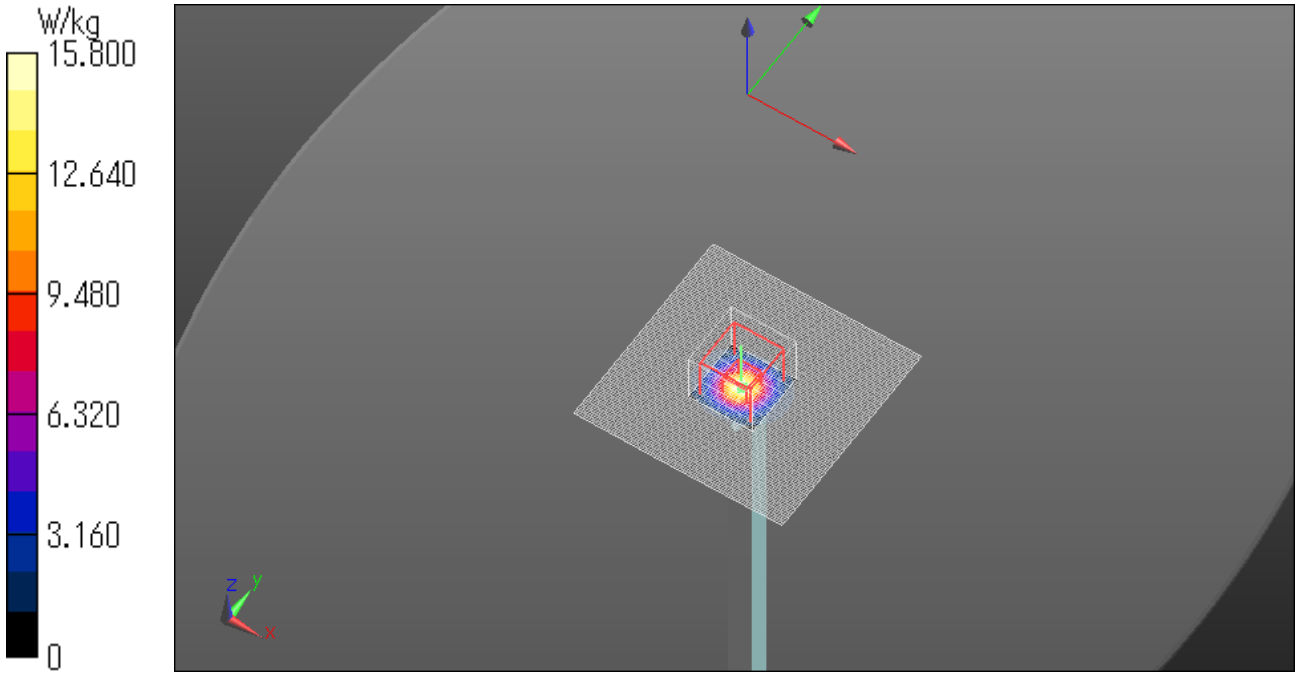
*4 The taget value is the parameter defined in SAR mesured x 10(8.08 x 10 = 80.8) in manufacturer calibrated dipole (D5GHzV2 SN:1020)
Please refer to " SAR result with Body TSL of Appendix 2 2. System Check Dipole (D5GHzV2,S/N: 1020)".

Body 5600MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.966 S/m; ε_r = 47.541; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.7 W/kg

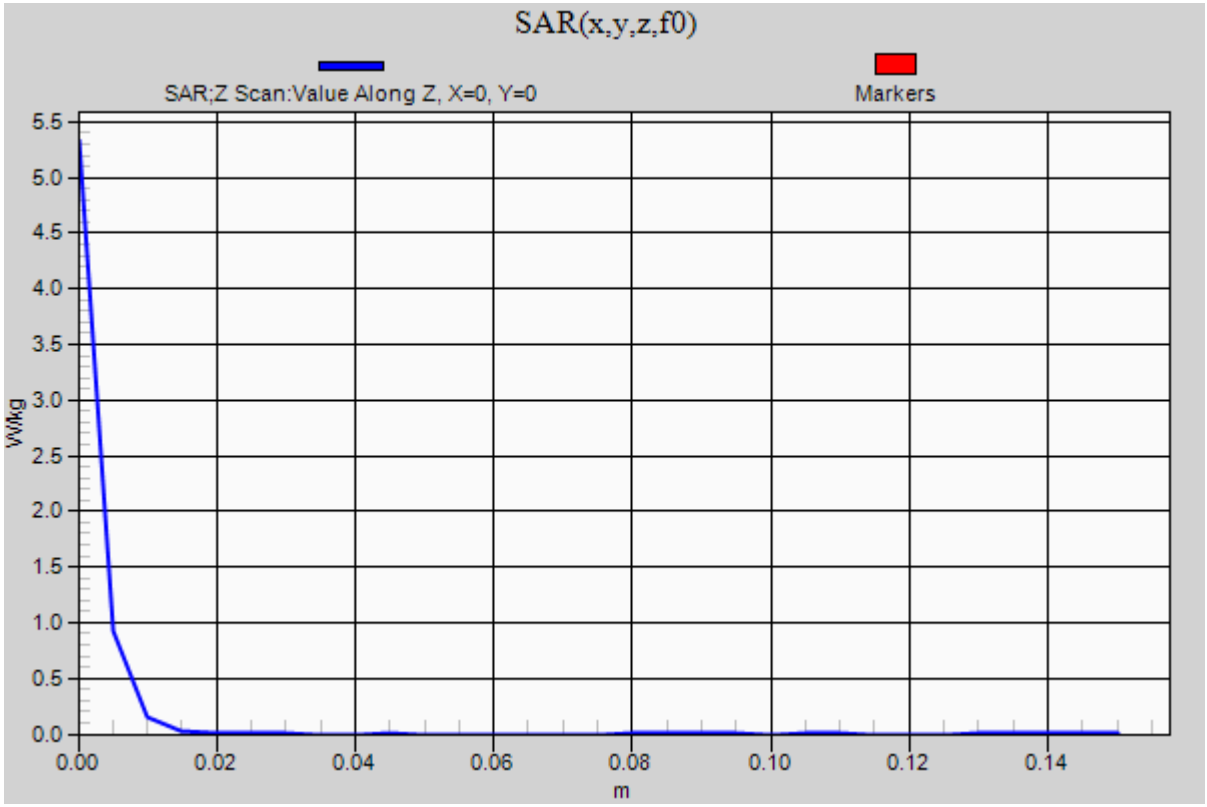
Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 65.782 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 15.8 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 5600MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.966 S/m; ε_r = 47.541; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4, 4, 4); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 5.33 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



5. System check result Body 5800MHz

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
25-Mar	24	40	MBBL 3.5-5.8	23.5	5800	εr	48.2	48.9	1.4	+/-5	*1
						σ [mho/m]	6.00	6.19	3.1	+/-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
25-Mar	24	40	MBBL 3.5-5.8	23.5	5800	εr	46.3	48.9	5.5	+/-6	*2 *3
						σ [mho/m]	6.23	6.19	-0.7	+/-6	

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

System check result (for calibration by manufacture)

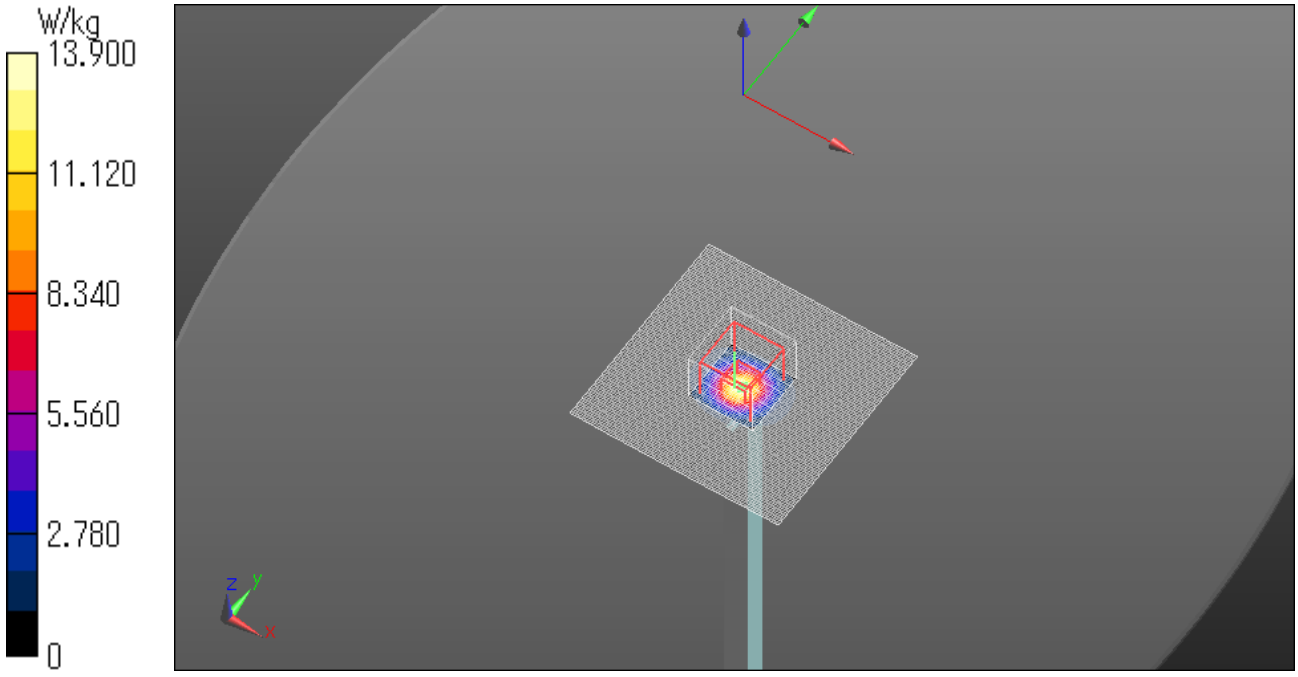
SYSTEM CHECK							
Date	Frequency [MHz]	SAR 1g [W/kg]					
		Forward Power 100mW Measured	Conversion 1W Calculation	Target Value(1W)	Deviation [%]	Limit [%]	Remark
25-Mar	5800.00	6.89	68.90	75.30	-8.5	+/-10	*4

*4 The taget value is the parameter defined in SAR mesured x 10(7.53 x 10 = 75.3) in manufacturer calibrated dipole (D5GHzV2 SN:1020)
Please refer to " SAR result with Body TSL of Appendix 2 2. System Check Dipole (D5GHzV2,S/N: 1020)".

Body 5800MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.189 S/m; ε_r = 48.852; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.33, 4.33, 4.33); Calibrated: 2013/05/14;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

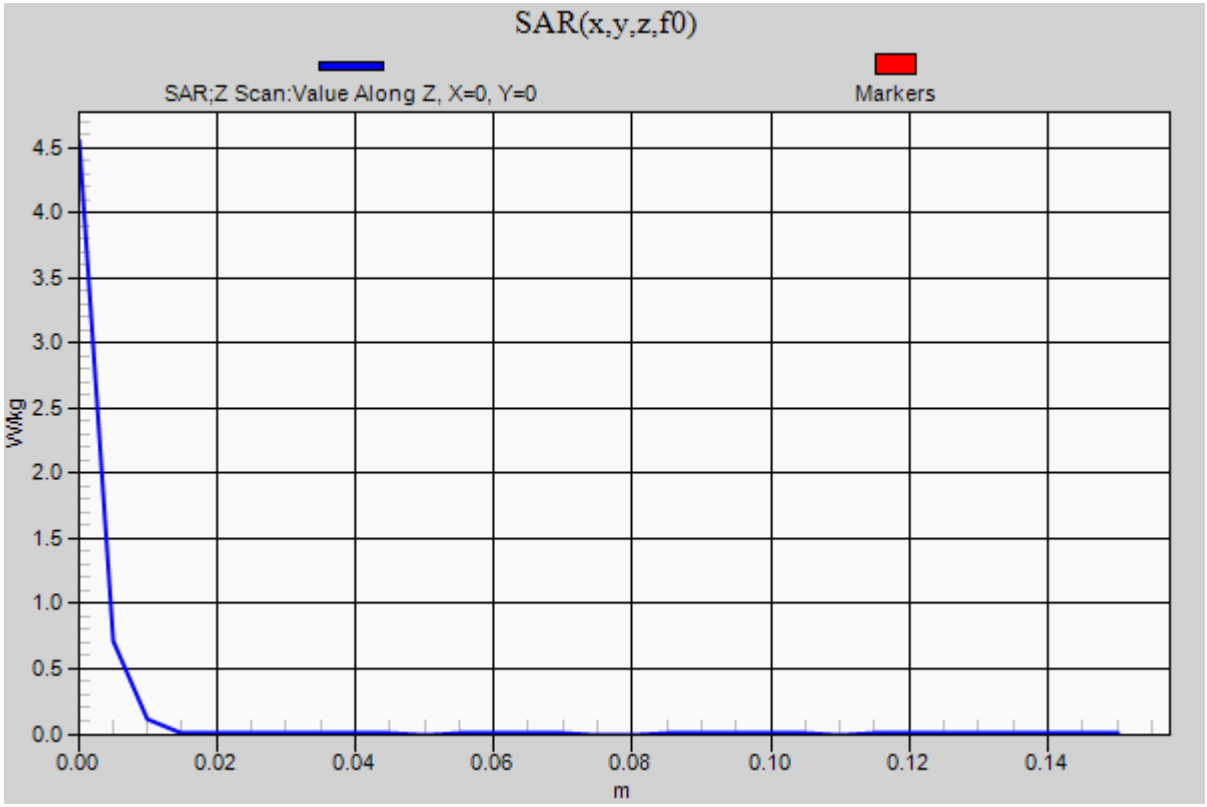
Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 13.6 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 62.285 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 30.2 W/kg
SAR(1 g) = 6.89 W/kg; SAR(10 g) = 1.91 W/kg
Maximum value of SAR (measured) = 13.9 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



Body 5800MHz System Check DATA / Dipole5GHz / Forward Conducted Power : 100mW
Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5800 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.189 S/m; ε_r = 48.852; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(4.33, 4.33, 4.33); Calibrated: 2013/05/14;
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn1369; Calibrated: 2013/05/13
Phantom: ELI v5.0 SN1203; Type: QDOVA002AA; Serial: TP:1203
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 4.55 W/kg
Date: 2014/03/25
Ambient Temp. : 24.0 degree.C. Liquid Temp.: 23.5 degree.C.



6. System Check Dipole (D5GHzV2,S/N:1020)

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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: D5GHzV2-1020_Jan14

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1020

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: January 17, 2014

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
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 EX3DV4	SN: 3503	30-Dec-13 (No. EX3-3503_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 23, 2014

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

Accreditation No.: SCS 108

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

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) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

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 V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.0 ± 6 %	4.45 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

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Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.5 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.74 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.61 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 19.5 % (k=2)**

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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	5.07 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-----	-----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.44 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.50 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.57 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.84 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

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Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	6.23 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 19.5 % (k=2)**

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