FCC SAR TEST REPORT

Test File No : F690501/RF-SAR002221

Equipment Under Test	SAMSUNG NOTEBOOK
Model No.	QCNFA354
Host PC Name	NP900X3K
Applicant	Qualcomm Atheros, Inc.
Address of Applicant	1700 Technology Drive, San Jose, CA 95110
FCC ID	PPD-QCNFA354
Device Category	Laptop Device
Exposure Category	General Population/Uncontrolled Exposure
Standards	FCC 47 CFR Part 2 (2.1093) IEEE 1528, 2003 ANSI/IEEE C95.1, C95.3
Date of Test(s)	2014-10-22 ~ 2014-10-24
Date of Issue	2014-11-13

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

Report prepared by /
Jongwon Ma
Test Engineer

Approved by /
Nicky You
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Revision history

Revision	Date of issue	Revisions	Revised By
-	November, 13 2014	Initial issue	-

Contents

1 Testing Laboratory

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2 Details of Manufacturer

Applicant	Qualcomm Atheros, Inc.
Address	1700 Technology Drive, San Jose, CA 95110
Contact Person	Stanley Lin
Phone No.	408-773-5200

3 Description of EUT(s)

EUT Type	SAMSUNG NOTE PC
Model No.	QCNFA354
Host PC Name	NP900X3K
Serial Number	0EPN91ZF900101Y
Mode of Operation	WLAN, Bluetooth
Duty Cycle	1 (WLAN)
Body worn Accessory	None
Tx Frequency Range	2412 ㎒ ~ 2462 ㎒ (WLAN_11b/g/n) 5180 ㎒ ~ 5240 ㎒, 5260 ㎒ ~ 5320 ㎒ (WLAN_11a/n/ac) 5500 ㎒ ~ 5700 ㎒, 5745 ㎒ ~ 5825 ㎒ (WLAN_11a/n/ac) 2402 ㎒ ~ 2480 ㎒ (Bluetooth)

Antenna Information

Port	Main	Aux
Type	SUS	SUS

Main Antenna Gain (dBi)		Aux Antenna Gain (dBi)	
2.40 GHz	0.23	2.40 GHz	-3.78
5.150 GHz ~ 5.350 GHz	-0.48	5.150 GHz ~ 5.350 GHz	-1.50
5.470 GHz ~ 5.725 GHz	-3.79	5.470 GHz ~ 5.725 GHz	2.20
5.725 GHz ~ 5.850 GHz	-1.84	5.725 GHz ~ 5.850 GHz	3.24

4 The Highest Reported SAR Values

Equipment Class	Band	Highest Reported SAR 1g (W/kg)
DTS	2.4 ㎓ WLAN	0.50
UNII	5.8 ㎓ WLAN	0.44
NII	5.2 ㎓ WLAN	0.57
	5.3 ㎓ WLAN	0.90
	5.6 ㎓ WLAN	1.04
DSS	Bluetooth	N/A
Simultaneous SAR per KDB 690783 D01v01r03		1.26

5 Test Methodology

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

Test tests documented in this report were performed in accordance with IEEE Standard 1528-2003 & IEEE 1528a-2005 and the following published KDB procedures.

In additions;

☒	**KDB 865664 D01v01r03**	**SAR Measurement Requirements for 100 MHz to 6 GHz**
☒	**KDB 447498 D01v05r02**	**Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies**
☐	KDB 447498 D02v02	SAR Measurement Procedures for USB Dongle Transmitters
☒	**KDB 248227 D01v01r02**	**SAR Measurement Procedures for 802.11a,b,g Transmitters**
☐	KDB 615223 D01v01	802.16e/WiMax SAR Measurement Guidance
☒	**KDB 616217 D04v01r01**	**SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers**
☐	KDB 643646 D01v01r01	SAR Test Reduction Considerations for Occupational PTT Radios
☐	KDB 648474 D03v01r02	Evaluation and Approval Considerations for Handsets with Specific Wireless Charging Battery Covers
☐	KDB 648474 D04v01r02	SAR Evaluation Considerations for Wireless Handsets
☐	KDB 680106 D01v02	RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications
☐	KDB 941225 D01v03	SAR Measurement Procedures for 3G Devices (CDMA 2000 / Ev-Do, WCDMA/HSDPA/HSPA
☐	KDB 941225 D02v02r02	SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced
☐	KDB 941225 D03v01	Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE
☐	KDB 941225 D04v01	Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode
☐	KDB 941225 D05v02r03	SAR Evaluation Considerations for LTE Devices
☐	KDB 941225 D06v02	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
☐	KDB 941225 D07v01r01	SAR Evaluation Procedures for UMPC Mini-Tablet Devices

6 Testing Environment

Ambient temperature	: 18°C ~ 25°C
Relative humidity	: 30% ~ 70%
Liquid temperature of during the test	: <± 2°C
Ambient noise & Reflection	: < 0.012 W/kg

7 Specific Absorption Rate (SAR)

7.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled

7.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7.3 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 ㎑ to 300 ㎓," ANSI/IEEE C95.3–2003, Copyright 2003 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 ㎑ to 6 ㎓. Portable devices that transmit at frequencies above 6 ㎓ are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 ㎓ should be made at a minimum distance of 5 cm from the radiating source.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube). Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Partial Peak SAR (Partial)	1.60 m W/g	8.00 m W/g
Partial Average SAR (Whole Body)	0.08 m W/g	0.40 m W/g
Partial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 m W/g	20.00 m W/g

1. The spatial Peak value of the SAR averaged over any 1g gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

8 The SAR Measurement System

A block diagram of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ ($|Ei|^2$)/ ρ where σ and ρ are the conductivity and mass density of the tissue-simulant.

The DASY 5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Staubli TX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- A dosimeter probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- Data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

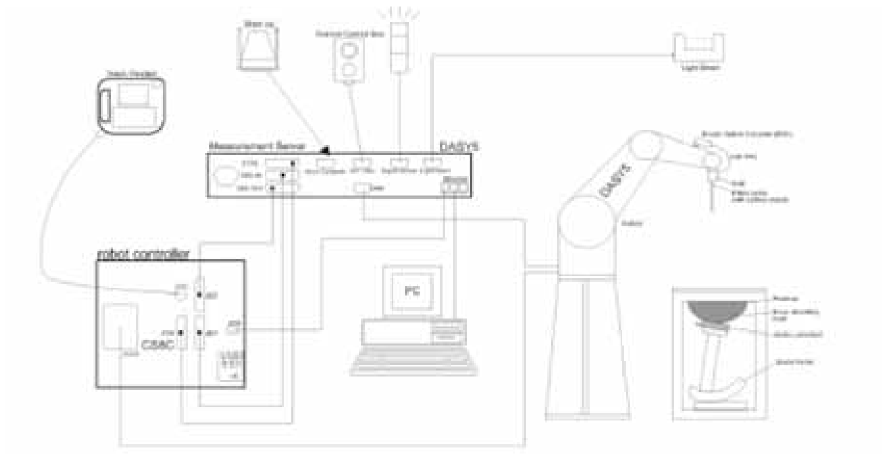


Fig a. The microwave circuit arrangement used for SAR system verification

- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows7
- DASY 5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The ELI phantom enabling testing flat usage.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.

9 System Components

9.1 Probe

EX3DV4 E-Field Probe

Construction	:	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	:	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 835 and HSL1900. Additional CF-Calibration for other liquids and frequencies upon request.
Frequency	:	10 ㎒ to 6 ㎓; Linearity: ± 0.2 ㏈ (30 ㎒ to 6 ㎓)
Directivity	:	± 0.3 ㏈ in HSL (rotation around probe axis) ± 0.5 ㏈ in tissue material (rotation normal to probe axis)
Dynamic Range	:	10µW/g to > 100 m W/g; Linearity: ± 0.2 ㏈(noise: typically < 1 µW/g)
Dimensions	:	Overall length: 337 ㎜ (Tip length: 20 ㎜) Tip diameter: 2.5 ㎜ (Body diameter: 12 ㎜) Distance from probe tip to dipole centers: 1 ㎜
Application	:	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 ㎓ with precision of better 30%
Construction	:	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

NOTE:

1. The Probe parameters have been calibrated by the SPEAG. Please reference “APPENDIX C” for the Calibration Certification Report.

9.2 ELI Phantom

ELI Phantom

Construction	:	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 ㎒ to 6 ㎓. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles. ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure
Shell Thickness	:	2.0 mm ± 0.2 mm
Dimensions	:	Major axis: 600 ㎜ Minor axis: 400 ㎜

9.3 Device Holder

Construction: **:** In combination with the Twin SAM PhantomV4.0/V4.0C or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Device Holder

Construction: **:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (a.q.. laptops, Cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioned.

Device Holder

10 SAR Measurement Procedures

10.1 Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2 ㎜. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2 and 3: Area Scan & Zoom Scan Procedures

The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1 g and 10 g.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

< Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r03 >

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>$\frac{1}{2}\cdot\delta\cdot\ln(2) \pm 0.5$ mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5\cdot\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

11 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. 1. The daily system accuracy verification occurs within the flat section of the ELI phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. These tests were done at 2450 ㎒ and 5200 ㎒, 5300 ㎒, 5600 ㎒, 5800 ㎒. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1. (SAR values are normalized to 1W forward power delivered to the dipole). During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) °C, the relative humidity was in the range (55 ± 5) % R.H and the liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency ≤ 3 GHz) or ≥ 10 cm ± 5 mm (frequency > 3 G Hz)in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

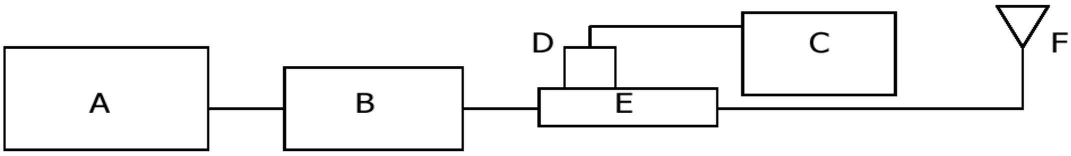


Fig 1. The microwave circuit arrangement used for SAR system verification

A. Agilent Model E8247C Signal Generator
B. EMPOWER Model 2001-BBS3Q7ECK Amplifier
   EMPOWER Model 2092-BBS5K8CAJ Amplifier
C. Agilent Model E4419B Power Meter
D. Agilent Model 9300H Power Sensor
E. Agilent Model 86205A Directional RF Bridges
F. Reference dipole Antenna

Photo of the dipole Antenna

Verification Kit	**Probe S/N**	**Tissue**	**Target SAR 1 g from Calibration Certificate (1 W)**	**Measured SAR 1 g (0.1 W)**	**Normalized SAR 1 g (1 W)**	**Deviation (%)**	**Date**	**Liquid Temp. (°C)**
D2450V2 S/N: 734	3862	2450 ㎒ Body	49.8 W/kg	5.08	50.8	**2.01**	2014-10-24	22.4
D5 ㎓ V2 S/N: 1130	3862	5200 ㎒ Body	76.1 W/kg	8.02	80.2	**5.39**	2014-10-22	22.3
D5 ㎓ V2 S/N: 1130	3862	5300 ㎒ Body	78.4 W/kg	8.31	83.1	**5.99**	2014-10-22	22.3
D5 ㎓ V2 S/N: 1130	3862	5600 ㎒ Body	83.0 W/kg	8.49	84.9	**2.29**	2014-10-23	22.1
D5 ㎓ V2 S/N: 1130	3862	5800 ㎒ Body	77.6 W/kg	7.71	77.1	**-0.64**	2014-10-23	22.1

Table1. Results system verification

12. Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this simulant fluid were measured by using the Speag Model DAK-3.5 Dielectric Probe in conjunction with Agilent E5071C Network Analyzer(300 ㎑ - 6 ㎓) by using a procedure detailed in Section V.

f (㎒)	Tissue type	Limits / Measured	Dielectric Parameters		
			Permittivity	Conductivity	Simulated Tissue Temp(℃)
2450	Body	Measured, 2014-10-24	50.8	1.94	22.4
		Target Tissue	*52.7*	*1.95*	
		Deviation (%)	**-3.61**	**-0.51**	
2412		Measured, 2014-10-24	50.9	1.89	
		Deviation (%)	**-3.42**	**-3.08**	
2462		Measured, 2014-10-24	50.8	1.95	
		Deviation (%)	**-3.61**	**0.00**	
5200	Body	Measured, 2014-10-22	47.4	5.27	22.3
		Target Tissue	*49.0*	*5.30*	
		Deviation (%)	**-3.27**	**-0.57**	
5180		Measured, 2014-10-22	47.5	5.24	
		Deviation (%)	**-3.06**	**-1.13**	
5240		Measured, 2014-10-22	47.3	5.34	
		Deviation (%)	**-3.47**	**0.75**	
5300	Body	Measured, 2014-10-22	47.2	5.43	22.3
		Target Tissue	*48.9*	*5.42*	
		Deviation (%)	**-3.48**	**0.18**	
5260		Measured, 2014-10-22	47.3	5.38	
		Deviation (%)	**-3.27**	**-0.74**	
5320		Measured, 2014-10-22	47.1	5.46	
		Deviation (%)	**-3.68**	**0.74**	
5600	Body	Measured, 2014-10-23	48.5	5.76	22.1
		Target Tissue	*48.5*	*5.77*	
		Deviation (%)	**0.00**	**-0.17**	
5520		Measured, 2014-10-23	48.7	5.65	
		Deviation (%)	**0.41**	**-2.08**	
5680		Measured, 2014-10-23	48.3	5.91	
		Deviation (%)	**-0.41**	**2.43**	
5800	Body	Measured, 2014-10-23	48.0	6.08	22.1
		Target Tissue	*48.2*	*6.00*	
		Deviation (%)	**-0.41**	**1.33**	
5745		Measured, 2014-10-23	48.2	5.99	
		Deviation (%)	**0.00**	**-0.17**	
5825		Measured, 2014-10-23	48.0	6.11	
		Deviation (%)	**-0.41**	**1.83**	

The composition of the brain & muscle tissue simulating liquid

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99 $^{+}$% Pure Sodium Chloride

Sugar: 98 $^{+}$% Pure Sucrose

Water: De-ionized, 16 MΩ^{+} resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99 $^{+}$% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral Oil	11
Emulsifiers	9
Additives and Salt	2

13. Test System Validation

Per FCC KDB 865664 D01v01r03, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the require tissue-equivalent media for system validation, according to the procedures outlined in IEEE 1528-2013 and FCC KDB 865664 D01v01r03. Since frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters has been included.

f (MHz)	Date	Probe S/N	Probe Cal point	Tissue Type	Dielectric Parameters		CW Validation			Modulated Validation		
					Permittivity	Conductivity	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR
2450	2014/09/29	3862	2450	Body	51.11	2.08	PASS	PASS	PASS	OFDM	N/A	PASS
5200	2014/10/06	3862	5200	Body	49.94	5.32	PASS	PASS	PASS	OFDM	N/A	PASS
5300	2014/10/06	3862	5300	Body	49.66	5.48	PASS	PASS	PASS	OFDM	N/A	PASS
5600	2014/10/02	3862	5600	Body	50.14	5.75	PASS	PASS	PASS	OFDM	N/A	PASS
5800	2014/10/02	3862	5800	Body	49.63	6.06	PASS	PASS	PASS	OFDM	N/A	PASS

< SAR System Validation Summary>

14 Instruments List

Test Platform	SPEAG DASY5 Professional
Location	SGS Korea Co., Ltd. 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, E&E Lab
Manufacture	SPEAG
Description	SAR Test System (Frequency range 300 ㎒ - 6 ㎓)
Software Reference	DASY52: 52.8.7(1137) SEMCAD X: 14.6.10(7164)

Hardware Reference

Equipment	Type	Serial Number	Cal Date	Cal Interval	Cal Due
Robot	TX90XL	F12/5LP8A1/A/01	N/A	N/A	N/A
Software	DASY5 V52	-	N/A	N/A	N/A
Phantom	ELI Phantom	TP-1200	N/A	N/A	N/A
2450 ㎒ System Validation Dipole	D2450V2	734	2014-05-20	Biennial	2016-05-20
5 ㎓ System Validation Dipole	D5GHzV2	1130	2014-05-22	Biennial	2016-05-22
Dosimetric E-Field Probe	EX3DV4	3862	2014-09-15	Annual	2015-09-15
Data acquisition Electronics	DAE4	1340	2014-05-19	Annual	2015-05-19
Network Analyzer	E5071C	MY46111535	2014-07-04	Annual	2015-07-04
Dielectric Assessment Kit	DAK-3.5	1107	2014-01-19	Annual	2015-01-19
Power Meter	E4419B	GB43311715	2014-06-25	Annual	2015-06-25
Power Sensor	E9300H	MY41495314	2014-07-02	Annual	2015-07-02
		MY41495307	2014-07-02	Annual	2015-07-02
Signal Generator	E8247C	MY43321024	2014-06-25	Annual	2015-06-25
Power Amplifier	2001-BBS3Q7ECK	1032 D/C 0336	2014-01-02	Annual	2015-01-02
Power Amplifier	2092-BBS5K8CAJ	1010	2014-06-27	Annual	2015-06-27
Directional RF Bridges	86205A	MY31402302	2014-07-03	Annual	2015-07-03
LP Filter	LA-30N	N/A	2014-07-01	Annual	2015-07-01
LP Filter	LA-60N	N/A	2014-07-01	Annual	2015-07-01
Attenuator	8491B	50566	2014-07-01	Annual	2015-07-01
Hygro- Thermometer	BJ5478	12091382-1	2014-06-30	Annual	2015-06-30
Digital Thermometer	DTM3000	3027	2014-07-02	Annual	2015-07-02
Spectrum Analyzer	E4445A	MY44020523	2014-06-25	Annual	2015-06-25

15 FCC Power Measurement Procedures

The SAR measurement Software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5 % occurred, the tests were repeated.

16 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05r02, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported SAR. Test highest reported SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r03.

17 Maximum Output Power Specifications

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05r02.

Average power for Production (dB m)				
Mode	**Channel**	**Normal/Maximum**	**Main**	**Aux**
802.11b	All channel	Maximum	**18.0**	**18.0**
		Normal	16.5	16.5
802.11g	1 Channel	Maximum	**16.0**	**16.0**
		Normal	14.5	14.5
	6 Channel	Maximum	**18.0**	**18.0**
		Normal	16.5	16.5
	11 Channel	Maximum	**15.5**	**15.5**
		Normal	14.0	14.0
802.11n HT20	1 Channel	Maximum	**15.5**	**15.5**
		Normal	14.0	14.0
	6 Channel	Maximum	**18.0**	**18.0**
		Normal	16.5	16.5
	11 Channel	Maximum	**15.0**	**15.0**
		Normal	13.5	13.5
802.11n HT40	3 Channel	Maximum	**12.0**	**12.0**
		Normal	10.5	10.5
	6 Channel	Maximum	**18.0**	**18.0**
		Normal	16.5	16.5
	9 Channel	Maximum	**10.5**	**10.5**
		Normal	9.0	9.0
Tune-up Tolerance: -1.5 dB / + 1.5 dB				

Average power for Production (dB m)				
Mode	**Channel**	**Normal/Maximum**	**Main**	**Aux**
802.11a	All Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
802.11n HT20	All Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
802.11n HT40	All Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
802.11ac VHT20	All Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
802.11ac VHT40	All Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
802.11ac VHT80	42, 122, 138, 155 Channel	Maximum	**15.0**	**15.0**
		Normal	13.0	13.0
	58, 106 Channel	Maximum	**14.5**	**14.5**
		Normal	12.5	12.5
Tune-up Tolerance: -2.0 dB / + 2.0 dB				

Average power for Production (dBm)					
Mode	**Normal/Maximum**	**GFSK**	**PI/4DQPSK**	**8DPSK**	**LE**
Bluetooth	Maximum	**5.0**	**5.0**	**5.0**	**-1.0**
	Normal	3.0	3.0	3.0	-3.0
Tune-up Tolerance: -2.0 dB / + 2.0 dB					

18 RF Conducted Power Measurement

WLAN 2.4 ㎓

Mode	Freq. (㎒)	Ch. #	Rate	Measured Power [㏈ m]	
				Main	AUX
802.11b	2412	1	1	17.70	17.99
	2437	6	1	17.18	17.87
	2462	11	1	17.30	17.86
802.11g	2412	1	6	15.67	15.48
	2437	6	6	17.32	17.52
	2462	11	6	15.11	15.25
802.11n HT20	2412	1	MCS0	15.05	15.04
	2437	6	MCS0	17.57	17.38
	2462	11	MCS0	14.51	14.62
802.11n HT40	2422	3	MCS0	11.69	11.53
	2437	6	MCS0	17.52	17.41
	2452	9	MCS0	10.22	10.03

WLAN 5.2 ㎓

Mode	Freq. (㎒)	Ch. #	Rate	Measured Power [㏈ m]	
				Main	AUX
802.11a	5180	36	6	14.63	14.99
	5200	40	6	14.60	14.98
	5220	44	6	14.61	14.65
	5240	48	6	14.89	14.72
802.11n HT20	5180	36	MCS0	14.47	14.45
	5200	40	MCS0	14.32	14.52
	5220	44	MCS0	14.34	14.43
	5240	48	MCS0	14.37	14.39
802.11n HT40	5190	38	MCS0	14.31	14.36
	5230	46	MCS0	14.21	14.41
802.11ac VTH20	5180	36	MCS0	14.57	14.42
	5200	40	MCS0	14.48	14.22
	5220	44	MCS0	14.36	14.13
	5240	48	MCS0	14.39	14.21
802.11ac VTH40	5190	38	MCS0	14.14	14.19
	5230	46	MCS0	14.32	14.29
802.11ac VTH80	5210	42	MCS0	14.98	14.39

WLAN 5.3 ㎓

Mode	Freq. (㎒)	Ch. #	Rate	Measured Power [dB m]	
				Main	AUX
802.11a	5260	52	6	14.62	14.53
	5280	56	6	14.59	14.24
	5300	60	6	14.86	14.77
	5320	64	6	14.95	14.79
802.11n HT20	5260	52	MCS0	14.48	14.51
	5280	56	MCS0	14.29	14.32
	5300	60	MCS0	14.72	14.72
	5320	64	MCS0	14.71	14.77
802.11n HT40	5270	54	MCS0	14.41	14.52
	5310	62	MCS0	14.67	14.63
802.11ac VTH20	5260	52	MCS0	14.49	14.54
	5280	56	MCS0	14.20	14.27
	5300	60	MCS0	14.39	14.59
	5320	64	MCS0	14.51	14.55
802.11ac VTH40	5270	54	MCS0	14.43	14.38
	5310	62	MCS0	14.38	14.25
802.11ac VTH80	5290	58	MCS0	14.49	14.48

WLAN 5.6 ㎓

Mode	Freq. (㎒)	Ch. #	Rate	Measured Power [㏈ m]	
				Main	AUX
802.11a	5500	100	6	14.73	14.86
	5520	104	6	14.86	14.99
	5540	108	6	14.76	14.96
	5560	112	6	14.54	14.93
	5580	116	6	14.62	14.98
	5660	132	6	14.48	14.30
	5680	136	6	14.76	14.92
	5700	140	6	14.72	14.14
802.11n HT20	5500	100	MCS0	14.17	14.68
	5520	104	MCS0	14.11	14.83
	5540	108	MCS0	14.08	14.77
	5560	112	MCS0	14.13	14.61
	5580	116	MCS0	14.04	14.79
	5680	136	MCS0	14.39	14.67
	5700	140	MCS0	14.38	14.71
802.11n HT40	5510	102	MCS0	14.02	14.68
	5550	110	MCS0	14.17	14.72
	5670	134	MCS0	14.42	14.67
802.11ac VTH20	5500	100	MCS0	14.11	14.51
	5520	104	MCS0	14.17	14.71
	5540	108	MCS0	14.34	14.66
	5560	112	MCS0	14.31	14.63
	5580	116	MCS0	14.18	14.51
	5680	136	MCS0	14.47	14.6
	5700	140	MCS0	14.39	14.64
802.11ac VTH40	5510	102	MCS0	14.22	14.61
	5550	110	MCS0	14.17	14.54
	5670	134	MCS0	14.56	14.61
	5710	142	MCS0	14.43	14.38
802.11ac VTH80	5530	106	MCS0	14.39	14.49
	5690	138	MCS0	14.27	14.98

WLAN 5.8 ㎓

Mode	Freq. (㎒)	Ch. #	Rate	Measured Power [dB m]	
				Main	AUX
802.11a	5745	149	6	14.86	14.32
	5765	153	6	14.82	14.29
	5785	157	6	14.90	14.51
	5805	161	6	14.78	14.46
	5825	165	6	14.48	14.14
802.11n HT20	5745	149	MCS0	14.77	14.71
	5765	153	MCS0	14.28	14.68
	5785	157	MCS0	14.71	14.48
	5805	161	MCS0	14.66	14.45
	5825	165	MCS0	14.62	14.67
802.11n HT40	5755	151	MCS0	14.61	14.47
	5795	159	MCS0	14.28	14.53
802.11ac VTH20	5745	149	MCS0	14.73	14.66
	5765	153	MCS0	14.19	14.62
	5785	157	MCS0	14.55	14.78
	5805	161	MCS0	14.61	14.61
	5825	165	MCS0	14.36	14.76
802.11ac VTH40	5755	151	MCS0	14.53	14.61
	5795	159	MCS0	14.35	14.63
802.11ac VTH80	5775	155	MCS0	14.47	14.53

Bluetooth

Channel	Frequency (㎒)	GFSK (dB m)	4DPSK (dB m)	8DPSK (dB m)	LE (dB m)
Low	2402	3.06	2.52	2.54	-4.25
Middle	2441	3.61	3.38	3.51	-3.69
High	2480	**4.12**	**3.78**	3.92	-3.15

18.1 SAR Test Configuration

IEEE 802.11 Transmitters

802.11 a/b/g and 4.9 ㎓ operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channel 1, 6, and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15 ~ 5.25 ㎓ band, channels 52 and 64 in the 5.25 ~ 5.35 ㎓ band, channels 104, 116, 124 and 136 in the 5.470 ~ 5.725 ㎓ band, and channels 149 and 161 in the 5.8 ㎓ band. When 5.8 ㎓ §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 802.11g mode was evaluated only if the output power was 0.25 ㏈ higher than the 802.11b mode.

Mode		GHz	Channel	Turbo Channel	"Default Test Channels" §15.247 802.11b	"Default Test Channels" §15.247 802.11g	"Default Test Channels" UNII	
802.11 b/g		2.412	1#		√	∇		
		2.437	6	6	√	∇		
		2.462	11#		√	∇		
802.11a	UNII	5.18	36	42 (5.21 GHz)			√	
		5.20	40					*
		5.22	44					*
		5.24	48	50 (5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58 (5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.500	100	Unknown				*
		5.520	104				√	
		5.540	108					*
		5.560	112					*
		5.580	116				√	
		5.600	120					*
		5.620	124				√	
		5.640	128					*
		5.660	132					*
		5.680	136				√	
		5.700	140					*
	UNII or §15.247	5.745	149		√		√	
		5.765	153	152 (5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160 (5.80 GHz)		*	√	
	§15.247	5.825	165		√			

- √ = "default test channels"
- * = possible 802.11a channels with maximum average output > the "default test channels"
- ∇ = 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

18.2 SAR Test Exclusions Applied

Per FCC KDB 447498 D01v05r02, the SAR exclusion threshold for distances < 50 ㎜ is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Distance (mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0$$

Based on the maximum tune-up tolerance limit of Bluetooth the antenna to use separation distance,

Bluetooth SAR was not required: [3.16/5 * √2.480] = 1.0<3.0

Bluetooth LE SAR was not required: [2.00/5 * √2.480] = 0.6<3.0

<The Distance information of Antenna to Edges of EUT>

19 SAR Data Summary

WLAN 2.4 GHz Body SAR

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Power(dBm)		1-g SAR (W/kg)		1 g SAR Limits (W/kg)
			Frequency (㎒)	Channel		Measured Power	Tune-Up Limit	Measured SAR	Scaled SAR	
802.11b	Main	Base	2412	1	0	17.70	18.00	0.390	0.418	1.6
802.11b	Aux	Base	2412	1	0	17.99	18.00	0.496	0.497	

WLAN 5.2 GHz Body SAR

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Power(dBm)		1-g SAR (W/kg)		1 g SAR Limits (W/kg)
			Frequency (㎒)	Channel		Measured Power	Tune-Up Limit	Measured SAR	Scaled SAR	
802.11a	Main	Base	5240	48	0	14.89	15.00	0.192	0.197	1.6
	Aux	Base	5180	36	0	14.99	15.00	0.498	0.499	
			5240	48	0	14.72	15.00	0.538	0.574	
802.11ac	Main	Base	5210	42	0	14.98	15.00	0.118	0.119	
	Aux	Base	5210	42	0	14.39	15.00	0.344	0.396	

WLAN 5.3 GHz Body SAR

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Power(dBm)		1-g SAR (W/kg)		1 g SAR Limits (W/kg)
			Frequency (㎒)	Channel		Measured Power	Tune-Up Limit	Measured SAR	Scaled SAR	
802.11a	Main	Base	5260	52	0	14.62	15.00	0.191	0.208	1.6
			5320	64	0	14.95	15.00	0.369	0.373	
	Aux	Base	5260	52	0	14.53	15.00	0.575	0.641	
			5320	64	0	14.79	15.00	0.854	0.896	
802.11ac	Main	Base	5290	58	0	14.49	14.50	0.226	0.227	
	Aux	Base	5290	58	0	14.48	14.50	0.550	0.553	
802.11a	Aux	Base	5320	64	0	14.79	15.00	0.847	0.889	

WLAN 5.6 GHz Body SAR

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Power(dBm)		1-g SAR (W/kg)		1 g SAR Limits (W/kg)
			Frequency (㎒)	Channel		Measured Power	Tune-Up Limit	Measured SAR	Scaled SAR	
802.11a	Main	Base	5520	104	0	14.86	15.00	0.150	0.155	1.6
	Aux	Base	5520	104	0	14.99	15.00	1.040	1.042	
			5580	116	0	14.98	15.00	0.747	0.750	
			5680	136	0	14.92	15.00	0.525	0.535	
802.11ac	Main	Base	5530	106	0	14.39	14.50	0.112	0.115	
	Aux		5690	138	0	14.98	15.00	0.357	0.359	
802.11a	Aux	Base	5520	104	0	14.99	15.00	1.030	1.032	

WLAN 5.8 GHz Body SAR

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Power(dBm)		1-g SAR (W/kg)		1 g SAR Limits (W/kg)
			Frequency (㎒)	Channel		Measured Power	Tune-Up Limit	Measured SAR	Scaled SAR	
802.11a	Main	Base	5745	149	0	14.86	15.00	0.377	0.389	1.6
			5785	157	0	14.90	15.00	0.433	0.443	
			5825	165	0	14.48	15.00	0.378	0.426	
	Aux	Base	5745	149	0	14.32	15.00	0.357	0.418	
			5785	157	0	14.51	15.00	0.392	0.439	
			5825	165	0	14.14	15.00	0.359	0.438	
802.11ac	Main	Base	5775	155	0	14.47	15.00	0.298	0.337	
	Aux	Base	5775	155	0	14.53	15.00	0.239	0.266	

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2013, FCC KDB Publication 865664 D01v03 and FCC KDB Publication 447498 D01v05 r02.
2. All modes of operation were investigated, and worst-case results are reported.
3. The EUT is tested 2nd hot-spot peak, if it is less than 2 dB below the highest peak.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05 r02.

WLAN Notes:

1. For 2.4 GHz, justification for reduced test configuration for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers were not greater than 0.25 ㏈ than that of the corresponding channel in the lowest data rate IEEE 802.11b modes
2. For 5 GHz, justification for reduced test configuration for WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n HT20 MHz and HT40, VHT20, VHT40) were not investigated since the average output powers were not greater than 0.25 ㏈ than that of the corresponding channel in the lowest data rate IEEE 802.11a modes
3. For 802.11ac SAR evaluation for each frequency band, 802.11ac VHT80 will verified at the worst case found in 802.11a SAR testing.
4. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was ≤ 1.6 W/kg and the reported 1g averaged SAR was < 0.8 W/kg, SAR testing on other default channels was not required.
5. According to KDB248227 D01v01, when the maximum average output channel in each frequency band is not include in the "default test channels", the maximum average output power channel should be tested instead of an adjacent "default test channels".

6. According to KDB447498 D01v05 r02 the 1-g SAR for the highest output channel is less than 0.8 W/kg, where the transmission band corresponding to all channels is ≤ 100 ㎒, testing for the other channels is not required.
7. According to KDB447498 D01v05 r02 the 1-g SAR for the highest output channel is less than 0.4 W/kg, where the transmission band corresponding to all channels is ≥ 200 ㎒, testing for the other channels is not required.
8. WLAN transmission was verified using a spectrum analyzer.

20 SAR Measurement Variability

20.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r03, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.

2. A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Repeated SAR Measurement

Test Mode	Antenna (Chain)	EUT Position	Traffic Channel		Distance (㎜)	Measured 1 g SAR (W/kg)	1st Repeated 1 g SAR (W/kg)	Deviation (%)
			Frequency (㎒)	Channel				
802.11a	Main	Base	5320	64	0	0.854	0.847	-0.82
802.11a	Main	Base	5520	104	0	1.040	1.030	-0.96

20.2 Measurement Uncertainty

The measured SAR was < 1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r03, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

21 Simultaneous Multi-band Transmission Evaluation

21.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 r02 are applicable to handsets with built-in unlicensed transmitters such as Bluetooth devices which may simultaneously transmit with the licensed transmitter.

21.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 r02 IV.C.1,iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured per FCC KDB 447498 D01v05r02 4.3.2.2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} * \frac{\text{(Max Power of channel, mW)}}{\text{Min. Separation Distance, mm}}$$

Mode	Frequency	Maximum Allowed Power	Separation Distance	Estimated SAR
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	5	5	0.126

<Tablet.3 Estimated SAR >

21.3 The Simultaneous Transmission possibilities are listed as below

No	Capable TX Configuration	Body SAR
1	WLAN Only MIMO Mode	Yes
2	2.45 GHz Main Ant + Bluetooth Aux	Yes
3	5 GHz Main Ant + Bluetooth Aux	Yes

Note:

- The simultaneous transmission possibilities are listed as below.
- WLAN Aux and Bluetooth Aux share the same antenna and cannot transmit simultaneously.

21.4 Body SAR Simultaneous Transmission Analysis

Simultaneous TX	configuration	Channel	Main Ant SAR(W/kg)	Aux Ant SAR(W/kg)	∑SAR (W/kg)
2.4 GHz WLAN MIMO Mode	Base	1	0.418	0.497	0.915
5.2 GHz WLAN MIMO Mode	Base	36	N/A	0.499	0.499
		48	0.197	0.574	0.771
		42	0.119	0.396	0.515
5.3 GHz WLAN MIMO Mode	Base	52	0.208	0.641	0.849
		64	0.373	0.896	1.267
		58	0.227	0.553	0.780
5.6 GHz WLAN MIMO Mode	Base	104	0.155	1.042	1.197
		116	N/A	0.750	0.750
		136	N/A	0.535	0.535
		138	0.115	0.359	0.474
5.8 GHz WLAN MIMO Mode	Base	149	0.389	0.418	0.807
		157	0.443	0.439	0.882
		165	0.426	0.438	0.864
		155	0.337	0.266	0.603

Simultaneous TX	configuration	2.4 GHz Main Ant	Bluetooth SAR (W/kg)	∑SAR (W/kg)
Body	Base	0.418	0.126	0.544
Simultaneous TX	configuration	5 GHz Main Ant	Bluetooth SAR (W/kg)	∑SAR (W/kg)
Body	Base	0.443	0.126	0.569

Note:

- The above numerical summed SAR was below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit. Therefore, no volumetric SAR summation is required since the numerical sums are below the limit.
- SAR Value of “N/A” is not measured. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was ≤ 1.6 W/kg and the reported 1g averaged SAR was < 0.8 W/kg.

Appendixes List

Appendix A.1 Verification Test Plots for 2450 MHz

Date: 2014-10-24

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 2450MHz Verification.da53:0

Input Power : 100 mW

Ambient Temp : 23.1 ℃ Tissue Temp : 22.4 ℃

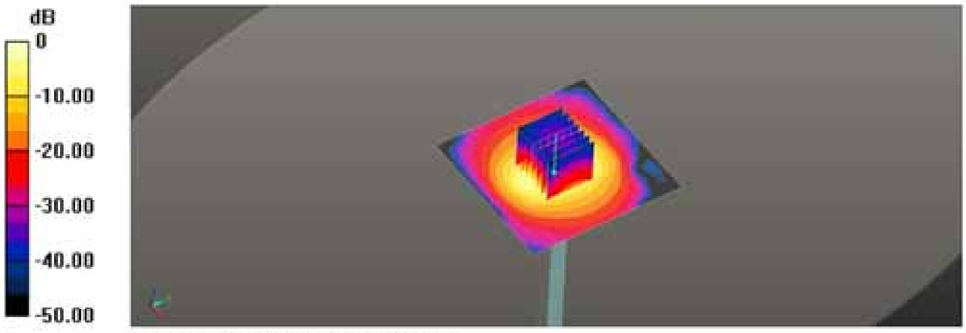
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:734

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.939 S/m; ε_r = 50.819; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(7.21, 7.21, 7.21); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

Verification/2450MHz Verification/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 7.83 W/kg

Verification/2450MHz Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.942 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 10.5 W/kg
SAR(1 g) = 5.08 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 7.72 W/kg



0 dB = 7.83 W/kg = 8.94 dBW/kg

Appendix A.2 Verification Test Plots for 5200 MHz

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5200MHz Verification.da53:0

Input Power : 100 mW

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

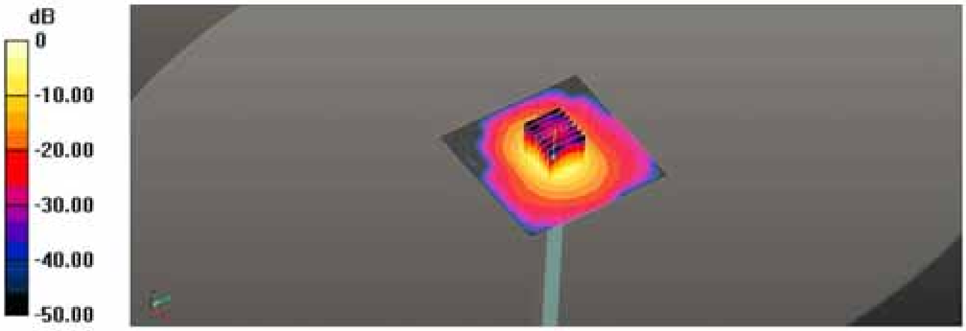
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1130

Communication System: UID 0, CW (0); Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; $\sigma = 5.271$ S/m; $\varepsilon_r = 47.439$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.49, 4.49, 4.49); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

5200MHz Verification/5200MHz Verification/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.5 W/kg

5200MHz Verification/5200MHz Verification/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 60.662 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 16.3 W/kg



0 dB = 15.5 W/kg = 11.90 dBW/kg

Appendix A.3 Verification Test Plots for 5300 MHz

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5300MHz Verification.da53:0

Input Power : 100 mW

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

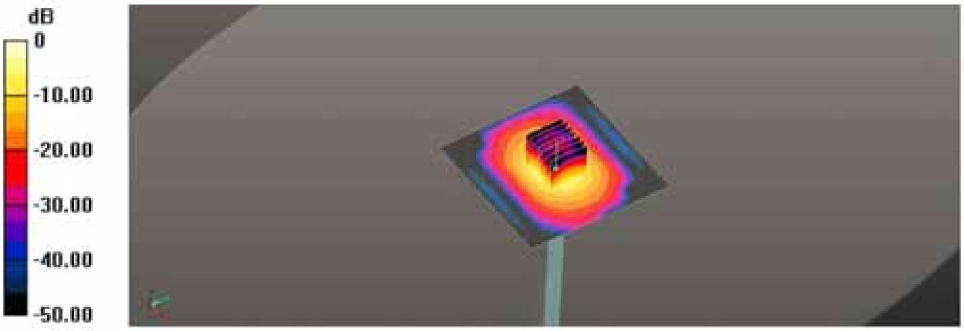
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1130

Communication System: UID 0, CW (0); Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.429 S/m; ε_r = 47.182; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.31, 4.31, 4.31); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

5300MHz Verification/5300MHz Verification/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.9 W/kg

5300MHz Verification/5300MHz Verification/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 61.170 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 15.9 W/kg = 12.01 dBW/kg

Appendix A.4 Verification Test Plots for 5600 MHz

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5600MHz Verification.da53:0

Input Power : 100 mW

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

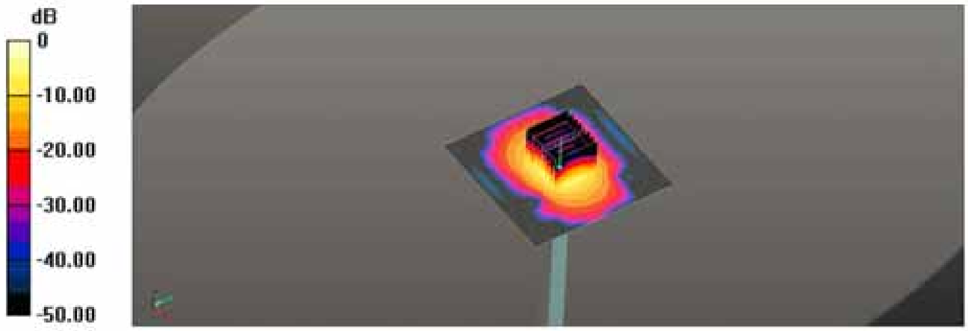
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1130

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.762 S/m; ε_r = 48.535; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.89, 3.89, 3.89); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

5600MHz Verification/5600MHz Verification/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.4 W/kg

5600MHz Verification/5600MHz Verification/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 60.123 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 8.49 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 16.4 W/kg = 12.15 dBW/kg

Appendix A.5 Verification Test Plots for 5800 MHz

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5800MHz Verification.da53:0

Input Power : 100 mW

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

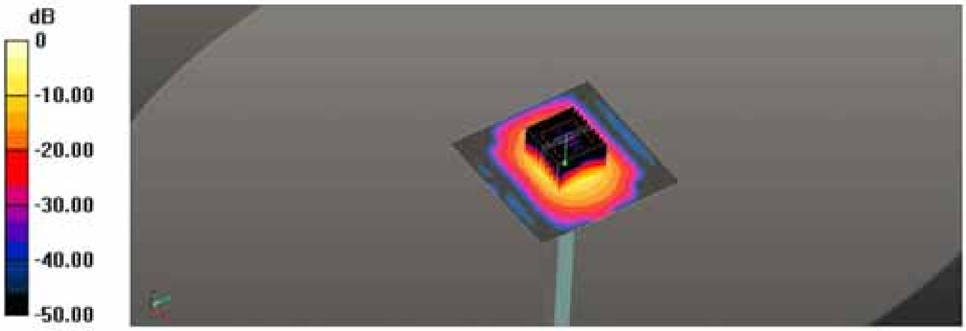
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1130

Communication System: UID 0, CW (0); Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.078 S/m; ε_r = 48.026; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.9, 3.9, 3.9); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

5800MHz Verification/5800MHz Verification/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.1 W/kg

5800MHz Verification/5800MHz Verification/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.280 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 16.2 W/kg



0 dB = 15.1 W/kg = 11.79 dBW/kg

Appendix A.6 SAR Test Plots for WLAN 2.45GHz

Date: 2014-10-24

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 2.45GHz_WLAN_802.11b_1Mbps_Base_CH1__Main.da53:0

Ambient Temp : 23.1 ℃ Tissue Temp : 22.4 ℃

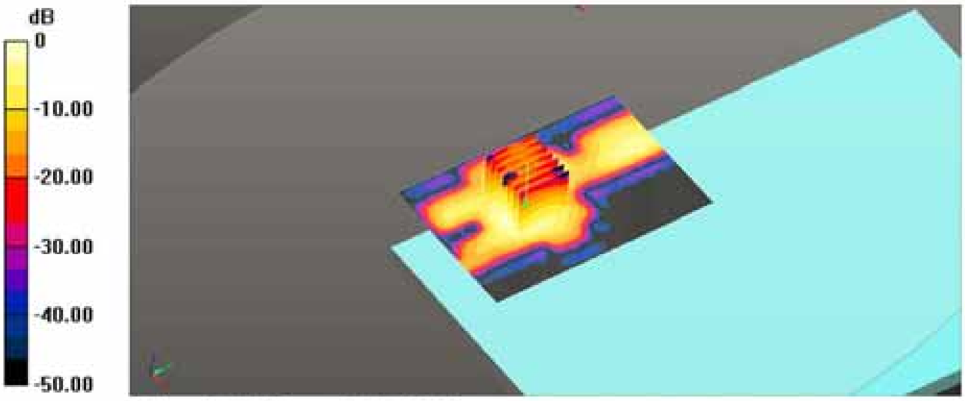
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, WLAN 2.45GHz (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2412 MHz; σ = 1.893 S/m; ε_r = 50.926; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(7.21, 7.21, 7.21); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/2.45GHz_WLAN_802.11b_1Mbps_Base_CH1_Main/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.444 W/kg

WLAN/2.45GHz_WLAN_802.11b_1Mbps_Base_CH1_Main/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.925 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.872 W/kg
SAR(1 g) = 0.390 W/kg; SAR(10 g) = 0.179 W/kg
Maximum value of SAR (measured) = 0.445 W/kg



0 dB = 0.444 W/kg = -3.53 dBW/kg

Date: 2014-10-24

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 2.45GHz_WLAN_802.11b_1Mbps_Base_CH1_ Aux.da53:0

Ambient Temp : 23.1 ℃ Tissue Temp : 22.4 ℃

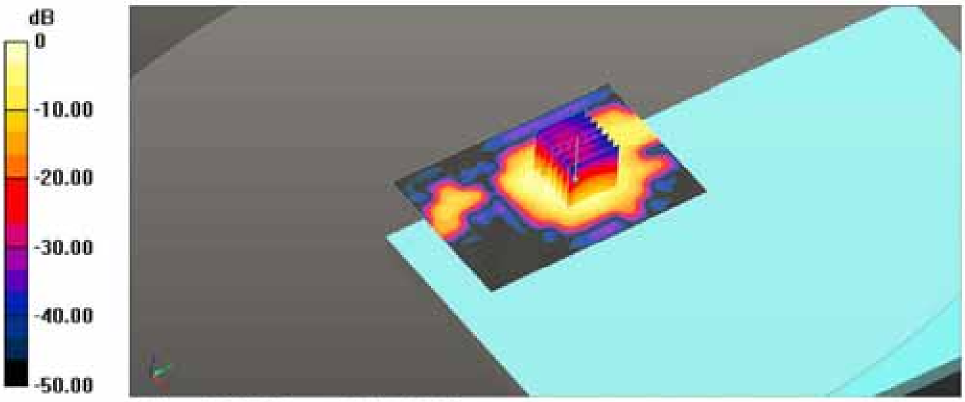
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, WLAN 2.45GHz (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2412 MHz; σ = 1.893 S/m; ε_r = 50.926; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(7.21, 7.21, 7.21); Calibrated: 2014-09-15;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/2.45GHz_WLAN_802.11b_1Mbps_Base_CH1_ Aux/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.590 W/kg

WLAN/2.45GHz_WLAN_802.11b_1Mbps_Base_CH1_ Aux/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.875 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.03 W/kg
SAR(1 g) = 0.496 W/kg; SAR(10 g) = 0.226 W/kg
Maximum value of SAR (measured) = 0.579 W/kg



0 dB = 0.590 W/kg = -2.29 dBW/kg

Appendix A.7 SAR Test Plots for WLAN 5.2GHz

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH48_Main.da53:0

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

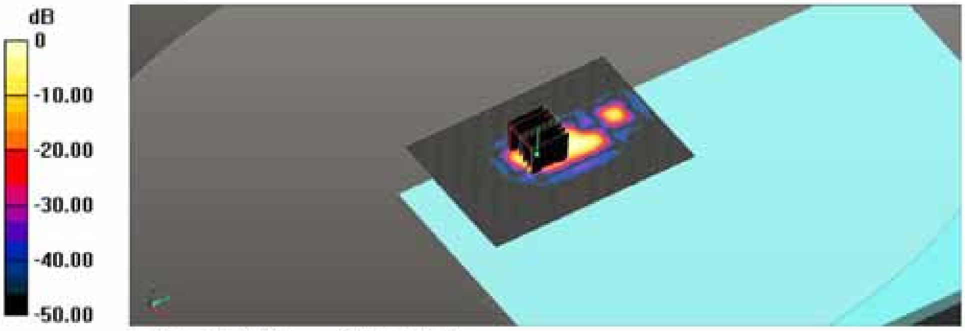
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5240 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.337 S/m; ε_r = 47.317; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.49, 4.49, 4.49); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH48_Main/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.519 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH48_Main/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 7.401 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.862 W/kg
SAR(1 g) = 0.192 W/kg; SAR(10 g) = 0.038 W/kg
Maximum value of SAR (measured) = 0.486 W/kg



0 dB = 0.519 W/kg = -2.85 dBW/kg

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH48_Aux.da53:0

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

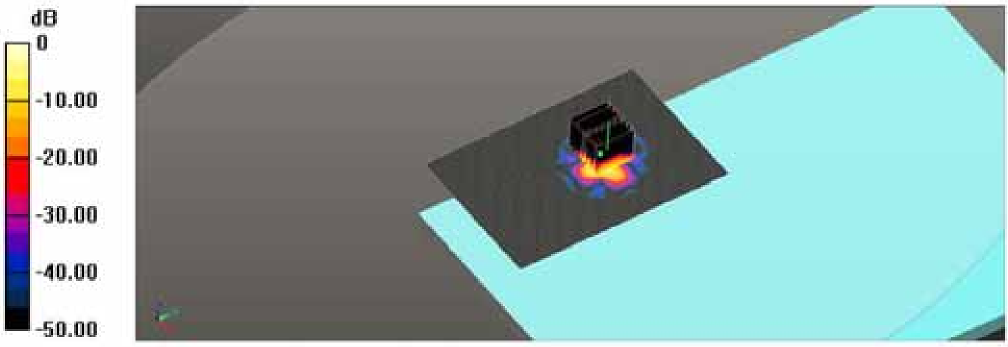
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5240 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.337 S/m; ε_r = 47.317; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.49, 4.49, 4.49); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH48_Aux/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.12 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH48_Aux/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.847 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 6.22 W/kg
SAR(1 g) = 0.538 W/kg; SAR(10 g) = 0.101 W/kg
Maximum value of SAR (measured) = 1.20 W/kg



0 dB = 1.12 W/kg = 0.49 dBW/kg

Appendix A.8 SAR Test Plots for WLAN 5.3GHz

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH64_Main.da53:0

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

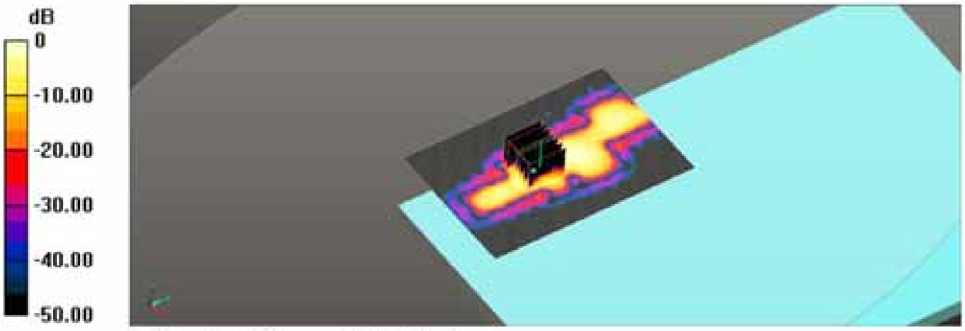
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5320 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5320 MHz; σ = 5.458 S/m; ε_r = 47.116; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.31, 4.31, 4.31); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Main/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.668 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Main/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.738 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 4.17 W/kg
SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.100 W/kg
Maximum value of SAR (measured) = 0.768 W/kg



0 dB = 0.668 W/kg = -1.75 dBW/kg

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux.da53:0

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

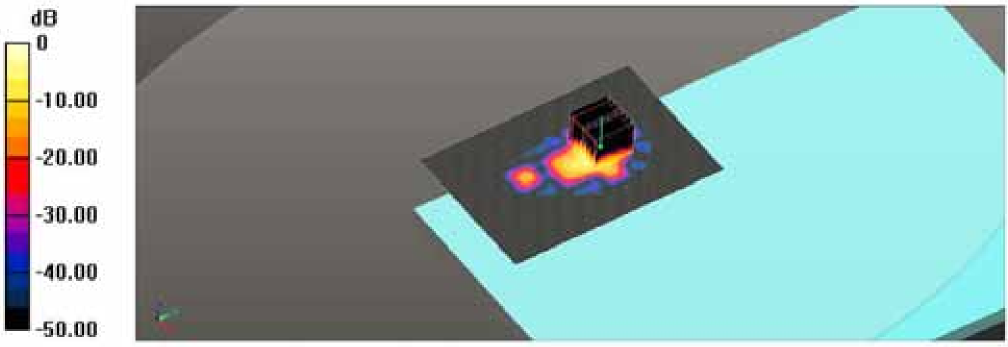
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5320 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5320 MHz; σ = 5.458 S/m; ε_r = 47.116; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.31, 4.31, 4.31); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.47 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.491 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 7.11 W/kg
SAR(1 g) = 0.854 W/kg; SAR(10 g) = 0.174 W/kg
Maximum value of SAR (measured) = 2.26 W/kg



0 dB = 2.47 W/kg = 3.93 dBW/kg

Appendix A.9 SAR Test Plots for WLAN 5.6GHz

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH104_Main.da53:0

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

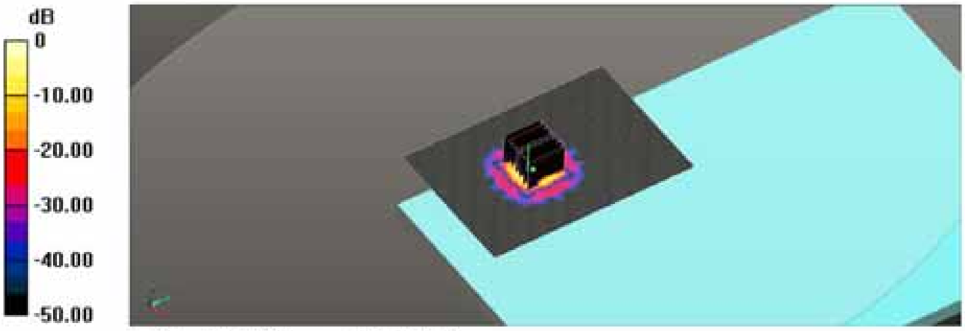
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5520 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5520 MHz; σ = 5.651 S/m; ε_r = 48.717; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.98, 3.98, 3.98); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Main/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.374 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Main/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.420 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.903 W/kg
SAR(1 g) = 0.150 W/kg; SAR(10 g) = 0.044 W/kg
Maximum value of SAR (measured) = 0.326 W/kg



0 dB = 0.374 W/kg = -4.27 dBW/kg

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux.da53:0

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

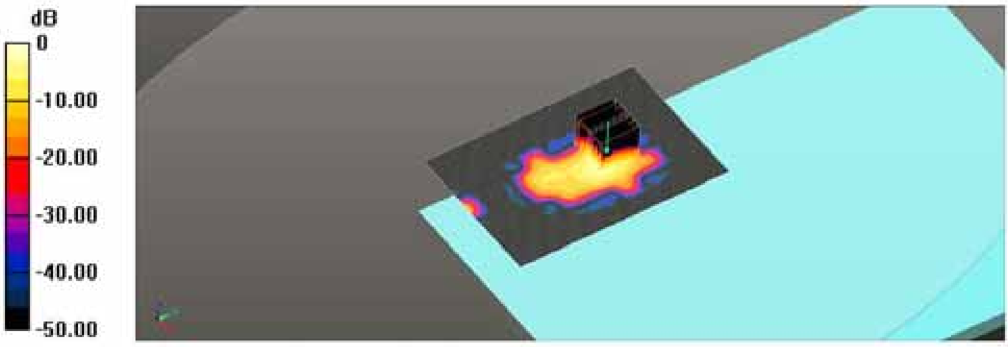
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5520 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5520 MHz; σ = 5.651 S/m; ε_r = 48.717; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.98, 3.98, 3.98); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.61 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.215 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 5.15 W/kg
SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.253 W/kg
Maximum value of SAR (measured) = 2.52 W/kg



0 dB = 3.61 W/kg = 5.58 dBW/kg

Appendix A.10 SAR Test Plots for WLAN 5.8GHz

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH157_Main.da53:0

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

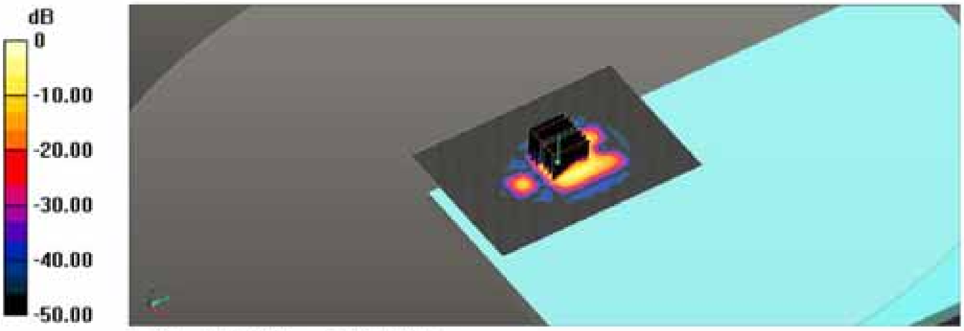
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5785 MHz; σ = 6.05 S/m; ε_r = 48.057; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.9, 3.9, 3.9); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH157_Main/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH157_Main/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 13.712 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 0.433 W/kg; SAR(10 g) = 0.122 W/kg
Maximum value of SAR (measured) = 0.873 W/kg



0 dB = 1.54 W/kg = 1.88 dBW/kg

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH157_Aux.da53:0

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

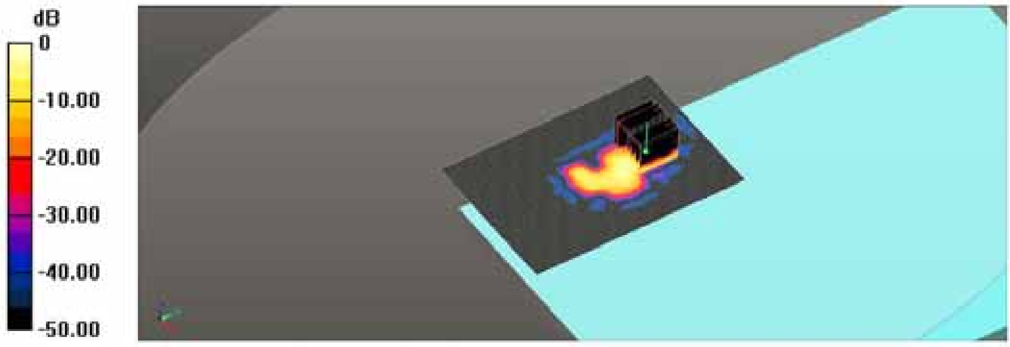
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5785 MHz; $\sigma = 6.05$ S/m; $\varepsilon_r = 48.057$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.9, 3.9, 3.9); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH157_Aux/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.33 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH157_Aux/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 6.798 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 1.85 W/kg
SAR(1 g) = 0.392 W/kg; SAR(10 g) = 0.089 W/kg
Maximum value of SAR (measured) = 1.00 W/kg



0 dB = 1.33 W/kg = 1.24 dBW/kg

Appendix A.11 SAR Test Plots for Repeated Test

Date: 2014-10-22

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux_Repeated Test.da53:0

Ambient Temp : 22.9 ℃ Tissue Temp : 22.3 ℃

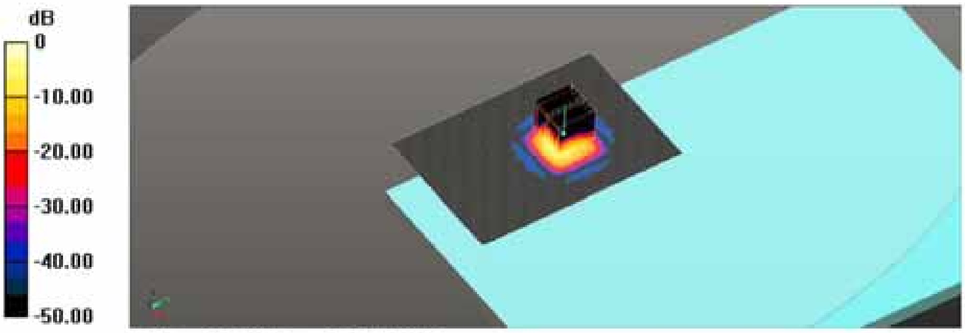
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5320 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5320 MHz; σ = 5.458 S/m; ε_r = 47.116; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(4.31, 4.31, 4.31); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux_Repeated Test/Area Scan (91x131x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.36 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH64_Aux_Repeated Test/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.662 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 4.31 W/kg
SAR(1 g) = 0.847 W/kg; SAR(10 g) = 0.174 W/kg
Maximum value of SAR (measured) = 2.12 W/kg



0 dB = 2.36 W/kg = 3.73 dBW/kg

Date: 2014-10-23

Test Laboratory : SGS Korea (Gunpo Laboratory)
File Name: 5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux_Repeated Test.da53:0

Ambient Temp : 22.7 ℃ Tissue Temp : 22.1 ℃

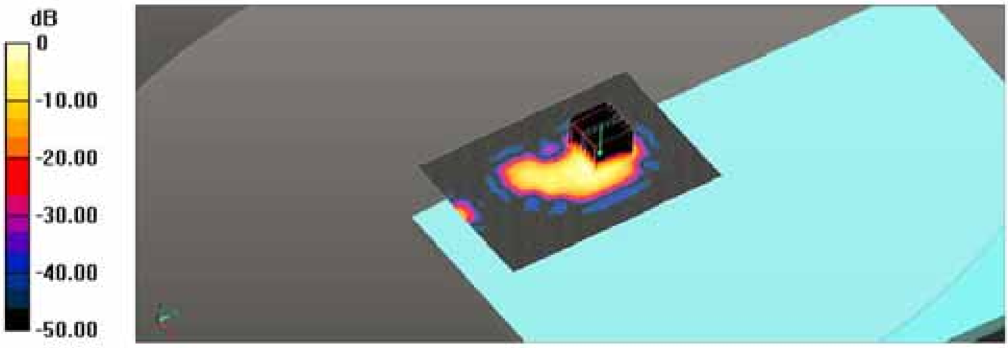
DUT: NP900X3K; Type: Notebook; Serial: 0EPN91ZF900101Y

Communication System: UID 0, 5GHz WLAN (0); Frequency: 5520 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5520 MHz; σ = 5.651 S/m; ε_r = 48.717; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY52 Configuration:
- Probe: EX3DV4 - SN3862; ConvF(3.98, 3.98, 3.98); Calibrated: 2014-09-15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1340; Calibrated: 2014-05-19
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1200
- DASY52 52.8.7(1137)SEMCAD X 14.6.10(7164)

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux_Repeated Test/Area Scan (91x131x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.44 W/kg

WLAN/5GHz_WLAN_802.11a_6Mbps_Base_CH104_Aux_Repeated Test/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.358 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 6.10 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.247 W/kg
Maximum value of SAR (measured) = 2.63 W/kg



0 dB = 2.44 W/kg = 3.87 dBW/kg

Appendix B.1 Uncertainty Analysis

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

a	b	c	d	e = f(d,k)	g	i = cxg/e	k
Uncertainty Component	Section in P1528	Tol (%)	Prob . Dist.	Div.	Ci (1g)	1g ui (%)	Vi (Veff)
Probe calibration	E.2.1	6.0	N	1	1	6.00	∞
Axial isotropy	E.2.2	4.7	R	1.73	0.71	1.93	∞
hemispherical isotropy	E.2.2	9.6	R	1.73	0.71	3.94	∞
Boundary effect	E.2.3	1.0	R	1.73	1	0.58	∞
Linearity	E.2.4	4.7	R	1.73	1	2.72	∞
System detection limit	E.2.5	0.3	R	1.73	1	0.17	∞
Readout electronics	E.2.6	0.3	N	1	1	0.30	∞
Response time	E.2.7	0.5	R	1.73	1	0.29	∞
Integration time	E.2.8	2.6	R	1.73	1	1.50	∞
RF ambient Condition -Noise	E.6.1	3	R	1.73	1	1.73	∞
RF ambient Condition - reflections	E.6.1	3	R	1.73	1	1.73	∞
Probe positioning- mechanical tolerance	E.6.2	1.5	R	1.73	1	0.87	∞
Probe positioning- with respect to phantom	E.6.3	2.9	R	1.73	1	1.68	∞
Max. SAR evaluation	E.5.2	1.0	R	1.73	1	0.58	∞
Test sample positioning	E.4.2	1.32	N	1	1	1.32	9
Device holder uncertainty	E.4.1	3.6	N	1	1	3.60	4
Output power variation -SAR drift measurement	6.6.3	5	R	1.73	1	2.89	∞
Phantom uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	2.31	∞
Liquid conductivity – deviation from target values	E.3.2	5	R	1.73	0.64	1.85	∞
Liquid conductivity - measurement uncertainty	E.3.2	0.38	N	1	0.64	0.24	9
Liquid permittivity – deviation from target values	E.3.3	5	R	1.73	0.6	1.73	∞
Liquid permittivity – deviation from target values	E.3.3	0.27	N	1	0.6	0.16	9
Combined standard uncertainty				RSS		10.82	287
Expanded uncertainty (95% CONFIDENCE INTERVAL)				*k*=2		**21.00**	

Measurement uncertainty for 3 GHz to 6 GHz averaged over 1 gram

a	b	c	d	e = f(d,k)	g	i = cxg/e	k
Uncertainty Component	Section in P1528	Tol (%)	Prob . Dist.	Div.	Ci (1g)	1g ui (%)	Vi (Veff)
Probe calibration	E.2.1	6.55	N	1	1	6.55	∞
Axial isotropy	E.2.2	4.7	R	1.73	0.71	1.93	∞
hemispherical isotropy	E.2.2	9.6	R	1.73	0.71	3.94	∞
Boundary effect	E.2.3	1.0	R	1.73	1	0.58	∞
Linearity	E.2.4	4.7	R	1.73	1	2.72	∞
System detection limit	E.2.5	0.3	R	1.73	1	0.17	∞
Readout electronics	E.2.6	0.3	N	1	1	0.30	∞
Response time	E.2.7	0.5	R	1.73	1	0.29	∞
Integration time	E.2.8	2.6	R	1.73	1	1.50	∞
RF ambient Condition -Noise	E.6.1	3	R	1.73	1	1.73	∞
RF ambient Condition - reflections	E.6.1	3	R	1.73	1	1.73	∞
Probe positioning- mechanical tolerance	E.6.2	1.5	R	1.73	1	0.87	∞
Probe positioning- with respect to phantom	E.6.3	2.9	R	1.73	1	1.68	∞
Max. SAR evaluation	E.5.2	1.0	R	1.73	1	0.58	∞
Test sample positioning	E.4.2	1.32	N	1	1	1.32	9
Device holder uncertainty	E.4.1	3.6	N	1	1	3.60	4
Output power variation -SAR drift measurement	6.6.3	5	R	1.73	1	2.89	∞
Phantom uncertainty (shape and thickness tolerances)	E.3.1	4	R	1.73	1	2.31	∞
Liquid conductivity – deviation from target values	E.3.2	5	R	1.73	0.64	1.85	∞
Liquid conductivity - measurement uncertainty	E.3.2	0.38	N	1	0.64	0.24	9
Liquid permittivity – deviation from target values	E.3.3	5	R	1.73	0.6	1.73	∞
Liquid permittivity – deviation from target values	E.3.3	0.27	N	1	0.6	0.16	9
Combined standard uncertainty				RSS		10.82	324
Expanded uncertainty (95% CONFIDENCE INTERVAL)				*k*=2		**21.64**	

Appendix C.1 Calibration certificate for Probe(S/N 3862)

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
Swiss Calibration Service

기술책임자
2014. 9. 26

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 **SGS (Dymstec)**

Certificate No: **EX3-3862_Sep14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3862

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: September 15, 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 E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: September 18, 2014

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

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

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

Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) 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
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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3862

Manufactured:	February 2, 2012
Repaired:	September 2, 2014
Calibrated:	September 15, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3862

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	0.37	0.35	0.41	± 10.1 %
DCP (mV)[B]	102.3	99.2	101.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.0	±3.3 %
		Y	0.0	0.0	1.0		131.1	
		Z	0.0	0.0	1.0		142.9	

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%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3862

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	41.5	0.90	9.47	9.47	9.47	0.19	1.61	± 12.0 %
900	41.5	0.97	9.35	9.35	9.35	0.32	0.93	± 12.0 %
1750	40.1	1.37	8.25	8.25	8.25	0.64	0.62	± 12.0 %
1900	40.0	1.40	7.99	7.99	7.99	0.49	0.68	± 12.0 %
2300	39.5	1.67	7.64	7.64	7.64	0.26	0.95	± 12.0 %
2450	39.2	1.80	7.24	7.24	7.24	0.33	0.86	± 12.0 %
5200	36.0	4.66	5.43	5.43	5.43	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.24	5.24	5.24	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.83	4.83	4.83	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.70	4.70	4.70	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.64	4.64	4.64	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

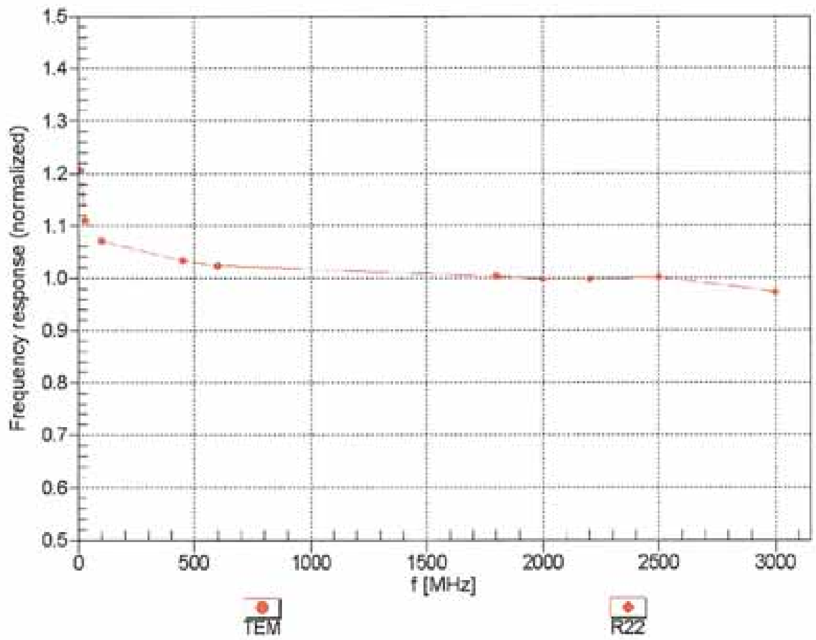
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3862

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
835	55.2	0.97	9.54	9.54	9.54	0.22	1.28	± 12.0 %
1750	53.4	1.49	7.93	7.93	7.93	0.51	0.72	± 12.0 %
1900	53.3	1.52	7.61	7.61	7.61	0.50	0.73	± 12.0 %
2450	52.7	1.95	7.21	7.21	7.21	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.49	4.49	4.49	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.31	4.31	4.31	0.40	1.90	± 13.1 %
5500	48.6	5.65	3.98	3.98	3.98	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.89	3.89	3.89	0.45	1.90	± 13.1 %
5800	48.2	6.00	3.90	3.90	3.90	0.50	1.90	± 13.1 %

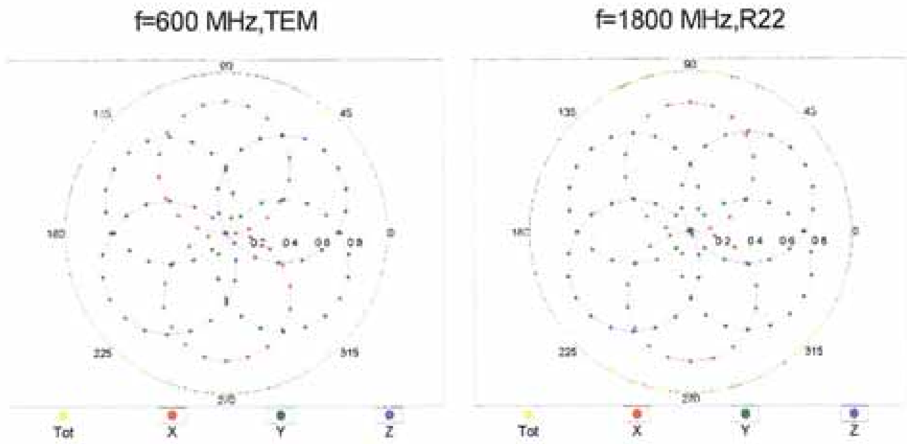
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

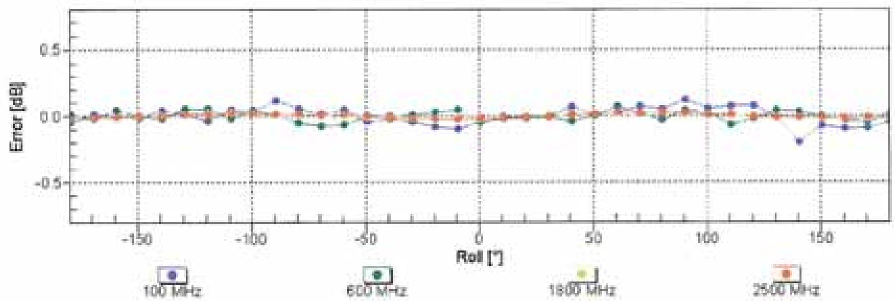
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



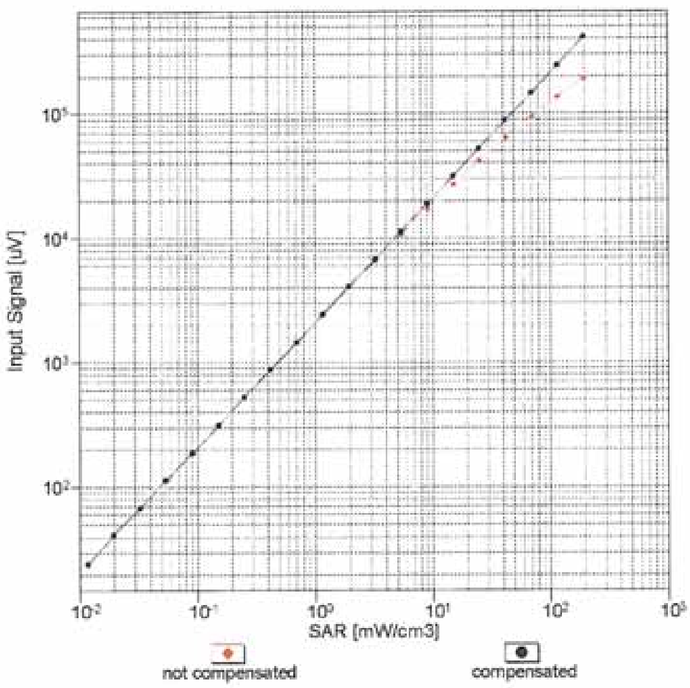


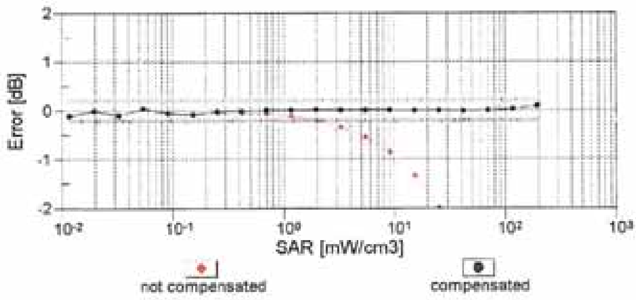
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3862 September 15, 2014

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)



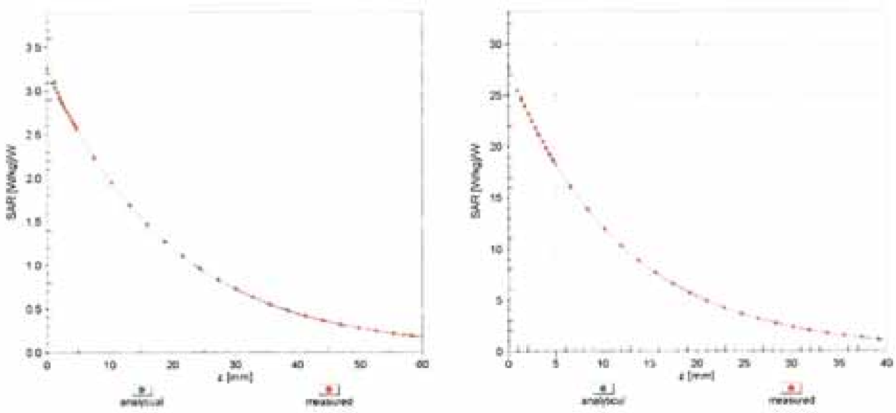


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: EX3-3862_Sep14 Page 9 of 11

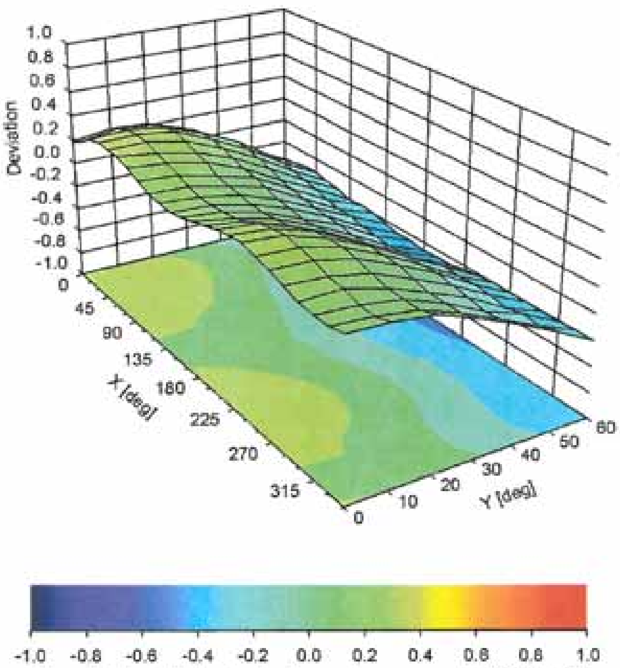
Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF) f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3862

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-29.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Appendix C.2 Calibration certificate for DAE

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

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Accreditation No.: SCS 108

기술책임자

2014. 6. 2

Client SGS (Dymstec)

Certificate No: DAE4-1340_May14

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BJ - SN: 1340

Calibration procedure(s): QA CAL-06.v26
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: May 19, 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
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: May 19, 2014

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Certificate No: DAE4-1340_May14 Page 1 of 5

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.444 ± 0.02% (k=2)	404.371 ± 0.02% (k=2)	404.455 ± 0.02% (k=2)
Low Range	3.98216 ± 1.50% (k=2)	3.98232 ± 1.50% (k=2)	4.01144 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	255.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199996.75	0.62	0.00
Channel X	+ Input	20002.86	2.07	0.01
Channel X	- Input	-19998.70	2.14	-0.01
Channel Y	+ Input	199998.47	2.32	0.00
Channel Y	+ Input	19998.25	-2.43	-0.01
Channel Y	- Input	-20003.12	-2.05	0.01
Channel Z	+ Input	199998.55	1.78	0.00
Channel Z	+ Input	20000.17	-0.46	-0.00
Channel Z	- Input	-20002.80	-1.74	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.85	0.13	0.01
Channel X	+ Input	201.55	0.57	0.28
Channel X	- Input	-198.00	0.97	-0.49
Channel Y	+ Input	2001.14	0.22	0.01
Channel Y	+ Input	200.26	-0.86	-0.43
Channel Y	- Input	-200.11	-1.20	0.60
Channel Z	+ Input	2001.08	0.33	0.02
Channel Z	+ Input	200.51	-0.33	-0.17
Channel Z	- Input	-199.40	-0.25	0.13

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	2.81	0.32
	- 200	1.56	-0.16
Channel Y	200	-13.87	-13.93
	- 200	11.69	11.57
Channel Z	200	-9.93	-10.42
	- 200	9.21	9.16

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-1.61	-2.83
Channel Y	200	6.75	-	1.34
Channel Z	200	10.61	3.30	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15824	15758
Channel Y	16240	16273
Channel Z	16028	14710

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.86	-2.43	-0.08	0.38
Channel Y	-1.68	-2.57	-0.85	0.37
Channel Z	-1.83	-2.96	-0.09	0.45

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	–0.01	-8	-9

Appendix C.3 Calibration certificate for Dipole

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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client SGS (Dymstec)

Certificate No: D2450V2-734_May14

2014. 6. 2

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 734
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 20, 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)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

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-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 21, 2014

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Certificate No: D2450V2-734_May14 Page 1 of 8

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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 1528-2013, "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
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	V52.8.8
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	38.5 ± 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 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	50.8 ± 6 %	2.03 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	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 4.2 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 5.2 jΩ
Return Loss	- 25.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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	May 07, 2003

DASY5 Validation Report for Head TSL

Date: 20.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

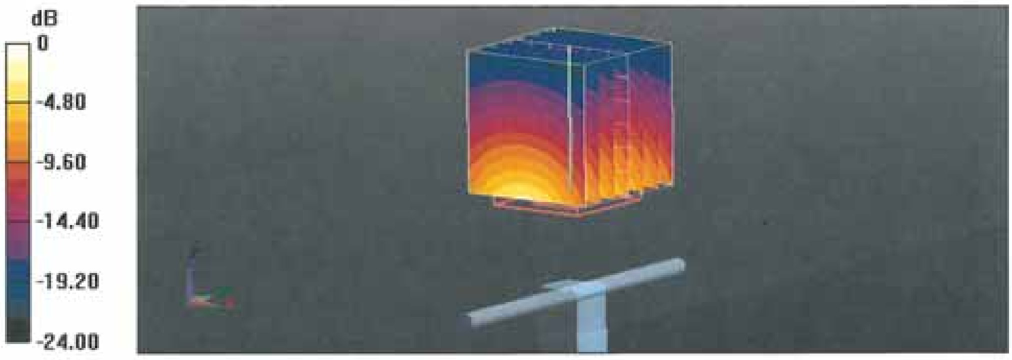
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 734

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

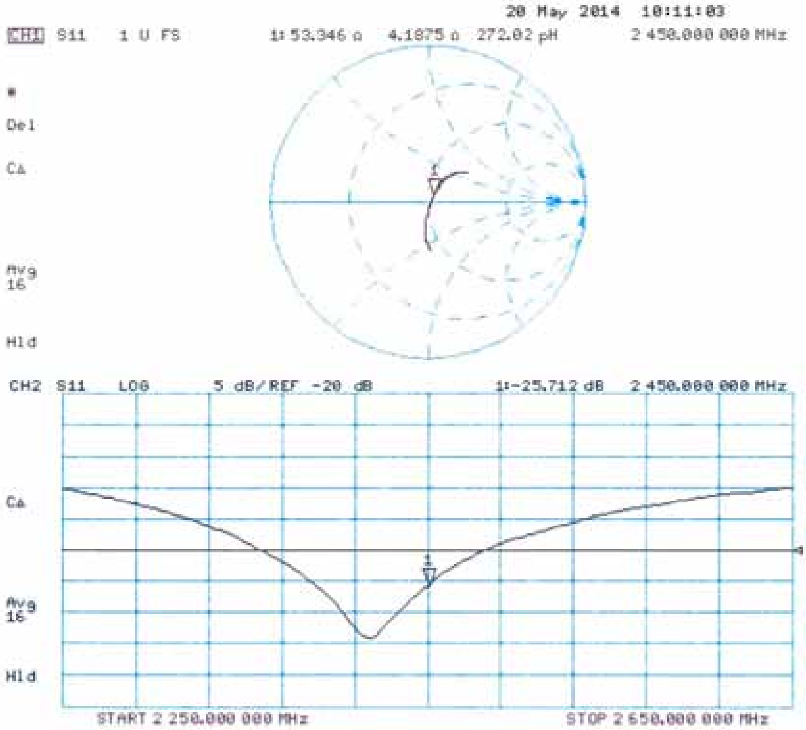
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 101.3 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.11 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

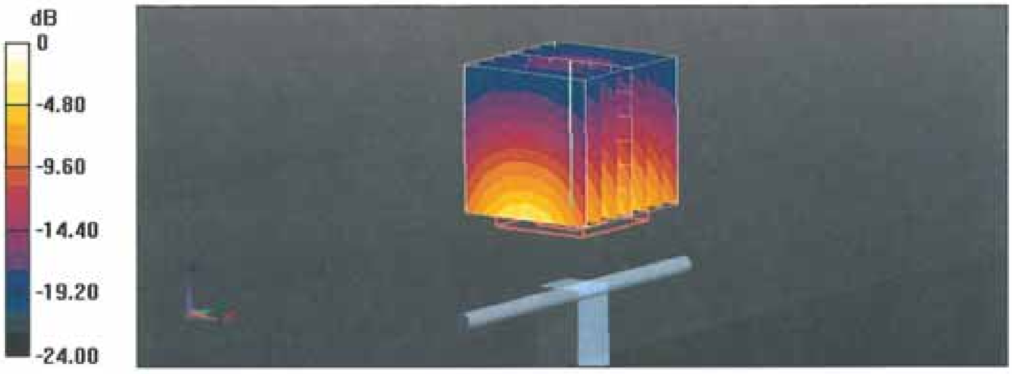
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 734

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

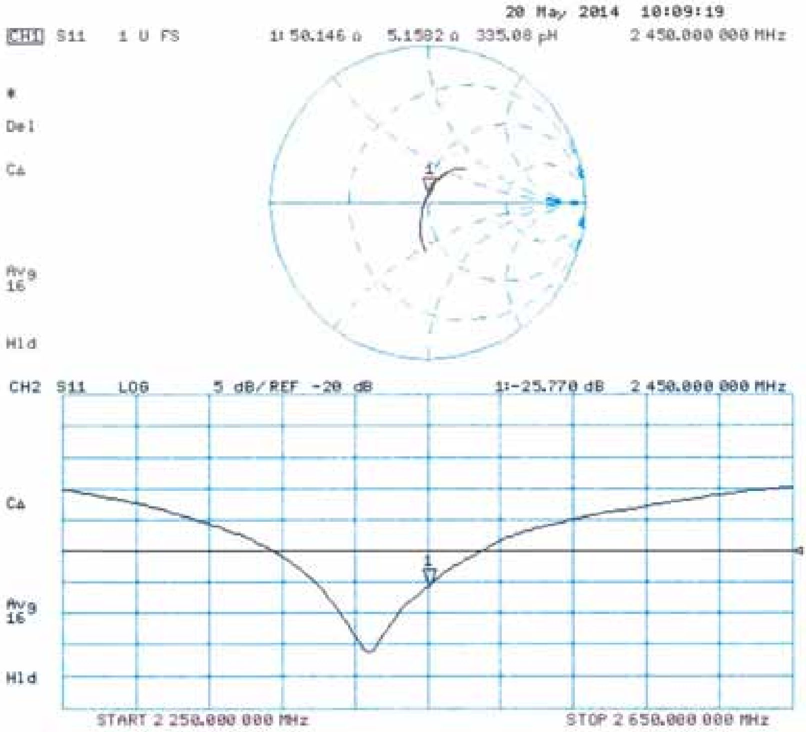
- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 94.69 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 27.0 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.9 W/kg
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 12.33 dBW/kg

Impedance Measurement Plot for Body TSL



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

S Schweizerischer Kalibrierdienst
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기술책임자
2014.6.2

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 SGS (Dymstec)

Certificate No: D5GHzV2-1130_May14

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1130
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	May 22, 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)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe EX3DV4	SN: 3503	30-Dec-13 (No. EX3-3503_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

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-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: May 22, 2014

Calibration Laboratory of
Schmid & Partner
Engineering AG
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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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	V52.8.8
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	35.5 ± 6 %	4.55 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	7.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

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	35.4 ± 6 %	4.66 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	8.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.7 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	**24.3 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	35.1 ± 6 %	4.86 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	**85.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 19.5 % (k=2)**

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	35.0 ± 6 %	4.96 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	8.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 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	34.7 ± 6 %	5.18 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	**81.0 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	**23.0 W/kg ± 19.5 % (k=2)**

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	47.0 ± 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	7.67 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 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	46.8 ± 6 %	5.59 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	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

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	46.5 ± 6 %	5.85 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	8.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**81.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.6 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	46.4 ± 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	8.36 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**83.0 W/kg ± 19.9 % (k=2)**

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

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	46.0 ± 6 %	6.27 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	7.82 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.2 Ω - 9.8 jΩ
Return Loss	- 20.3 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	52.1 Ω - 4.2 jΩ
Return Loss	- 26.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	52.5 Ω - 4.3 jΩ
Return Loss	- 26.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.7 Ω - 3.8 jΩ
Return Loss	- 22.8 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.1 Ω - 1.9 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	55.7 Ω + 6.8 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	52.0 Ω + 3.3 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.6 Ω + 3.0 jΩ
Return Loss	- 29.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	50.3 Ω + 7.5 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	49.1 Ω + 6.2 jΩ
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.205 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	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 22.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1130

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.55 S/m; ε_r = 35.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.66 S/m; ε_r = 35.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.86 S/m; ε_r = 35.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.96 S/m; ε_r = 35; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.18 S/m; ε_r = 34.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

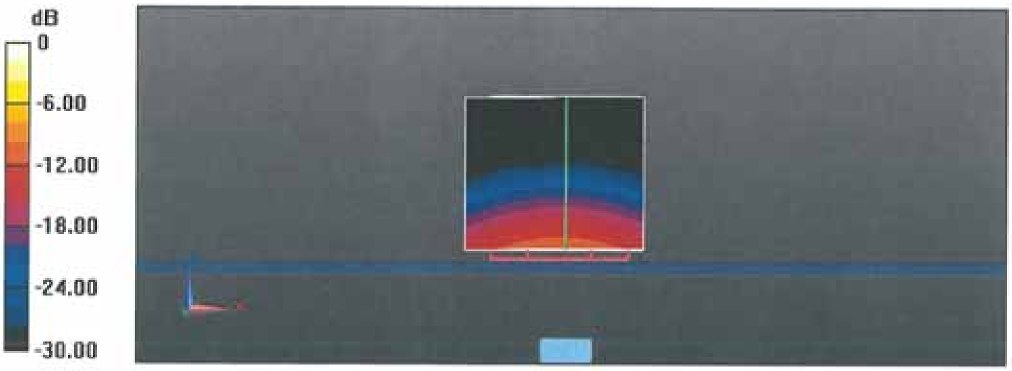
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.34 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 28.7 W/kg
SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 18.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.92 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 8.5 W/kg; SAR(10 g) = 2.44 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.08 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.61 W/kg; SAR(10 g) = 2.46 W/kg
Maximum value of SAR (measured) = 21.0 W/kg

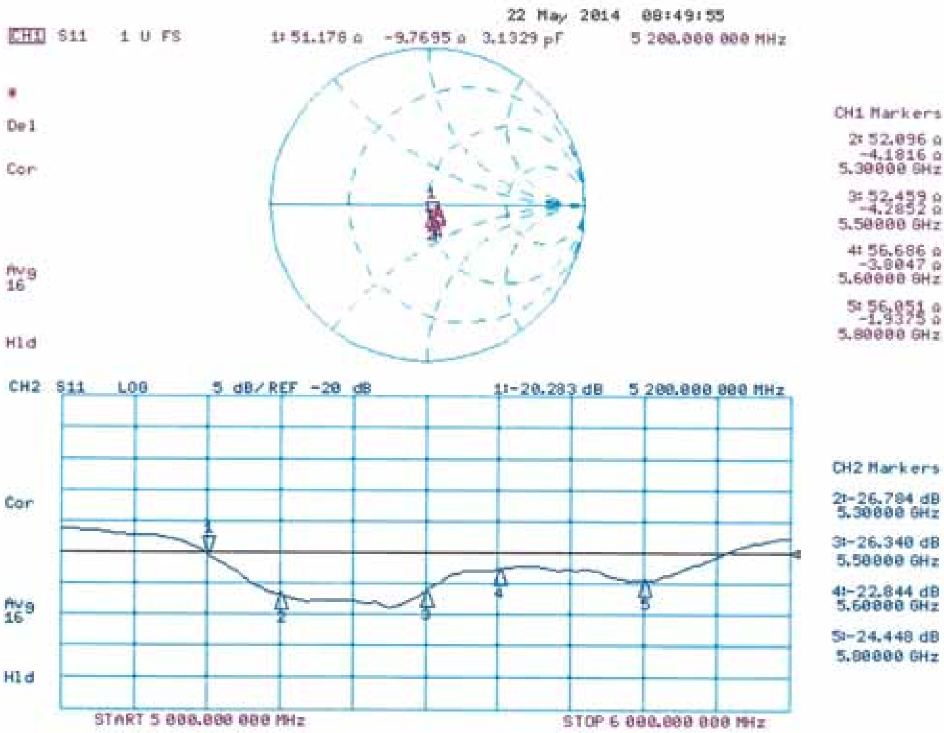
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.82 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.59 W/kg; SAR(10 g) = 2.44 W/kg
Maximum value of SAR (measured) = 21.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.19 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.31 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.05.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1130

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.44 S/m; ε_r = 47; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.59 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.85 S/m; ε_r = 46.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.98 S/m; ε_r = 46.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.27 S/m; ε_r = 46; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.52, 4.52, 4.52); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

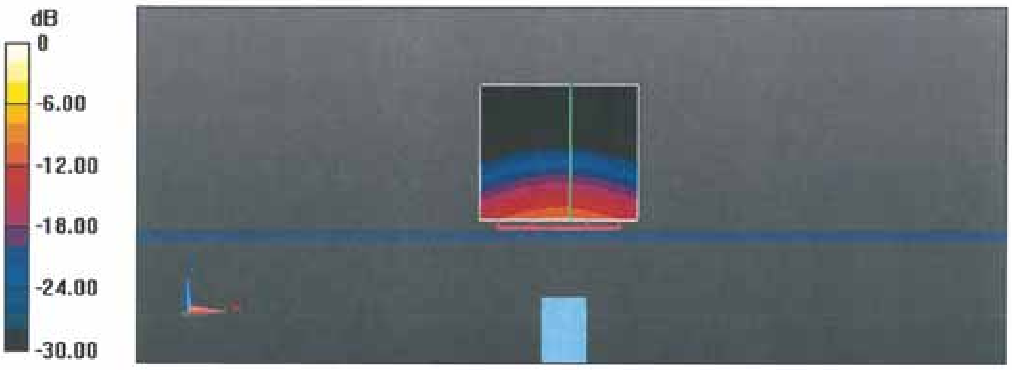
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.37 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 17.8 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.51 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.52 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 19.8 W/kg

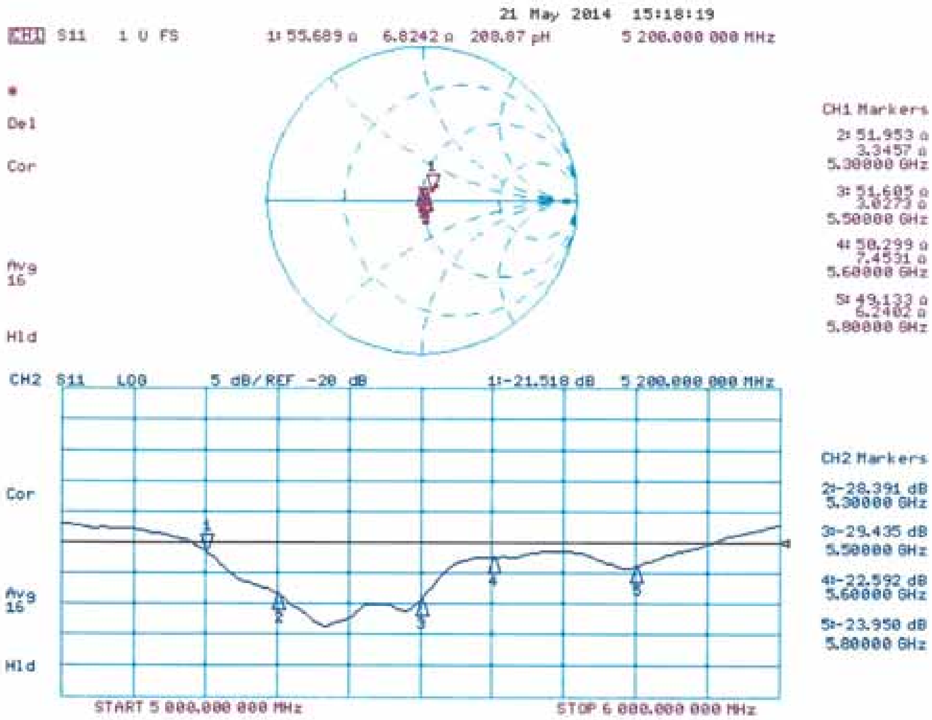
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.41 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 8.36 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.24 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 36.6 W/kg
SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.2 W/kg = 12.83 dBW/kg

Impedance Measurement Plot for Body TSL



-THE END-