ANSI/IEEE Std. C95.1-1992
In accordance with the requirements of FCC Report and Order:
ET Docket 93-62；FCC 47 CFR Part 2 (2.1093)
IC RSS-102 Issue 4, March 2010
IEC 62209-2:2010

FCC SAR TEST REPORT

For

Product Name: 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E Mini Card

Model No.: BCM94352Z

Series Model: N/A

Test Report Number:
C140623R01-SF

Issued for

Broadcom Corporation

190 MATHILDA PLACE SUNNYVALE, CA 94086, U.S.A.

Issued by

Compliance Certification Services Inc.

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TESTING CERT #2541.01

Revision History

Revision	REPORT NO.	Date	Page Revised	Contents
Original	C140623R01-SF	July 16, 2014	N/A	N/A
01	C140623R01-SF	August 7, 2014	All report	Update 5.8GHz Power result and related information
01	C140623R01-SF	August 7, 2014	All report	Add the Probe and DAE equipment information

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1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Product Name:	802.11a/b/g/n/ac WLAN + Bluetooth PCI-E Mini Card
Model Name.:	BCM94352Z
Series Model:	N/A
Device Category:	PORTABLE DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE
Date of Test:	July 4, 2014 to July 9, 2014 and August 7, 2014
Applicant:	**Broadcom Corporation** 190 MATHILDA PLACE SUNNYVALE, CA 94086, U.S.A.
Manufacturer:	**Broadcom Corporation** 190 MATHILDA PLACE SUNNYVALE, CA 94086, U.S.A.
Application Type:	Certification

APPLICABLE STANDARDS AND TEST PROCEDURES

STANDARDS AND TEST PROCEDURES	TEST RESULT
ANSI/IEEE C95.1-1992 RSS-102 issue 4: 2010	No non-compliance noted

Deviation from Applicable Standard
None

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Jeff Fang
RF Manager
Compliance Certification Services Inc.

Tested by:

Luck.Fu
Test Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product Name:	802.11a/b/g/n/ac WLAN + Bluetooth PCI-E Mini Card
Model Name.:	BCM94352Z
Series Model:	N/A
FCC ID:	QDS-BRCM1076
IC:	4324A-BRCM1076
Power reduction:	NO
DTM Description:	N/A
Device Category:	Production unit
Frequency Range:	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Max. Reported SAR(1g):	Body: WLAN 2.4GHz Band:0.504 W/kg WLAN 5.2GHz Band:1.243 W/kg WLAN 5.3GHz Band:1.390 W/kg WLAN 5.5GHz Band:1.315 W/kg WLAN 5.8GHz Band:1.276 W/kg
Modulation Technique:	802.11a/b/g/n HT20/HT40/VHT20/VHT40/VHT80 Bluetooth:3.0 + EDR, 8-DPSK Bluetooth:4.0
Operating Mode:	Maximum continuous output

Tested System Details

Product	Manufacturer	Model No.
Notebook Computer	Lenovo	Lenovo YOGA 3 Pro-1370

2.1 MAXIMUM RF OUTPUT POWER WITH TEST CHANNEL

Band / Mode	Average Power(dBm)	
	V3.0 + EDR, GFSK	V3.0 + EDR, 8-DPSK
Bluetooth	5.1	5.2

Band / Mode	Average Power(dBm)
	BLE4.0, GFSK
Bluetooth	-2.17

Band / Frequency (MHz)		IEEE 802.11 Average Power (dBm)					
		Chain0			Chain1		
		11b	11g	HT20	11b	11g	HT20
2.4GHz Band	2412	14.46	14.43	14.41	14.45	14.4	14.46
	2422						
	2437	14.5	14.44	14.46	14.47	14.42	14.46
	2452						
	2462	14.48	14.47	14.44	14.43	14.44	14.42

Band / Frequency (MHz)		IEEE 802.11 Average Power (dBm)							
		Chain0				Chain1			
		11a	HT20 VTH20	HT40 VHT40	VHT80	11a	HT20 VTH20	HT40 VHT40	VHT80
5.2GHz Band	5180	12.99	12.92			12.98	12.95		
	5190			12.94				12.95	
	5200	12.9	12.95			12.81	12.83		
	5210				13				12.98
	5220	12.97	12.93			12.93	12.91		
	5230			12.97				12.89	
	5240	13	12.96			13	12.97		
5.3GHz Band	5260	13.97	13.92			14	13.91		
	5270			13.89				13.86	
	5280	13.8	13.81			13.97	13.9		
	5290				13.95				13.95
	5300	13.82	13.8			13.99	13.87		
	5310			13.87				13.85	
	5320	13.98	13.96			14	13.92		
5.5GHz Band	5500	13.92	13.87			13.92	13.89		
	5510			13.89				13.82	13.93
	5520	13.96	13.92			13.95	13.9		
	5530				13.9				
	5540	13.9	13.85			13.91	13.92		
	5550			13.86				13.81	13.97
	5560	13.91	13.89			13.9	13.87		
	5580	13.95	13.91			13.98	13.96		
	5600	13.92	13.87			13.94	13.92		
	5610				13.95				
	5620	13.91	13.88			13.93	13.89		
	5630								
	5640	13.9	13.86			13.94	13.85		
	5650								
	5660	13.95	13.91			13.93	13.83		
	5670			13.9				13.83	13.94
	5680	14	13.98			14	13.91		
	5690				13.91				
	5700	13.98	13.92			13.96	13.86		
5.8GHz Band	5745	14.05	13.92			14.02	13.95		
	5755			13.94				13.97	
	5765	14.03	13.93			14	13.97		
	5775				14.01				14.06
	5785	14.02	13.91			14.05	13.96		
	5795			13.9				13.94	
	5805	14	13.97			14.02	13.99		
	5825	14.04	13.97			14.04	13.92		

3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/Kg for an uncontrolled environment and 8.0 W/Kg for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992.

4. TEST METHODOLOGY

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

☒ FCC 47 CFR Part 2 (2.1093)
☒ ANSI/IEEE C95.1-1992
☒ IEEE 1528-2003
☒ IEEE 1528-2013
☒ RSS-102 issue 4: 2010
☒ Notice 2013-DRS0911
☒ KDB 447498 D01v05r02 General RF Exposure Guidance v05
☒ KDB 865664 D01v01r03 Measurement 100 MHz to 6 GHz
☒ KDB 865664 D02v01r01 RF Exposure Reporting
☒ KDB 248227 D01v01r02 SAR Measurement Procedures for 802.11 a/b/g Transmitters
☒ KDB 616217 D04v01r01 SAR for laptop and tablets v01r01

5. TEST CONFIGURATION

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool,and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting

For WLAN SAR testing, WLAN engineering test software installed on the EUT can provide continuous transmitting RF signal.

6. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from ATTENNESSA. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEE P1528 and CENELEC EN 62209.

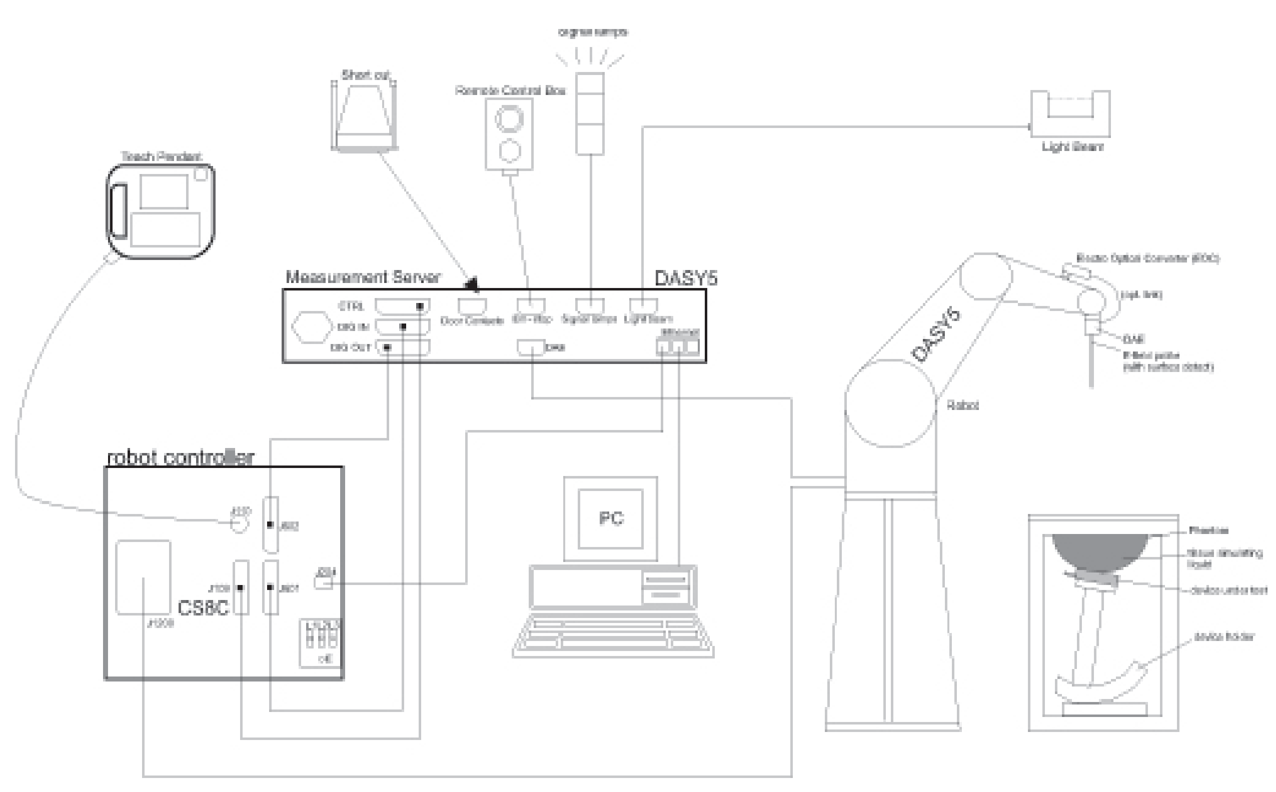
The following table gives the recipes for tissue simulating liquids.

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

Simulating Liquids for 5 GHz, Manufactured by SPEAG

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

6.1 MEASUREMENT SYSTEM DIAGRAM



The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric 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.
- A 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.
- 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 Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

6.2 SYSTEM COMPONENTS

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.

The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

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: 10-3000 MHz.
Conversion Factors (CF) for HSL 900 and HSL 1800
CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (rotation normal to probe axis)

Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 µW/g)

Dimensions: Overall length: 337 mm (Tip: 9 mm)
Tip diameter: 2.5 mm (Body: 10 mm)
Distance from probe tip to dipole centers: 1 mm

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 GHz with precision of better 30%.

Interior of probe

SAM Twin Phantom

Construction:

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 850mm; Length: 1000mm; Width: 750mm

SAM Phantom (ELI4 v4.0)

Description Construction:

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 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 supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm

Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom, 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, and flat phantom).

System Validation Kits for SAM Twin Phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900,1800,2450,5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm
D1800V2: dipole length: 72.5 mm; overall height: 300 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300mm

System Validation Kits for ELI4 phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900, 1800, 2450, 5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm
D1800V2: dipole length: 72.5 mm; overall height: 300 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

7. EVALUATION PROCEDURES

DATA EVALUATION

The DASY 5 post processing software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY 5 components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY 5 parameter)
dcp_i = Diode compression point (DASY 5 parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
μV/(V/m)^2 for E0field Probes
$ConvF$ = Sensitivity enhancement in solution
aij = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
Ei = Electric field strength of channel i in V/m
Hi = Magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

SAR EVALUATION PROCEDURES

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

- **Power Reference Measurement**

  The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

  The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

  Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

  The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

  The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a}) cos(\pi \frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes (a<<λ), the cos-term can be omitted. Factors *Sb* (parameter Alpha in the DASY 5 software) and *a* (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30_ to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

8. MEASUREMENT UNCERTAINTY

UNCERTAINTY BUDGE ACCORDING TO IEEE 1528-2003						
Error Description	**Uncertainty Value ±%**	**Probability distribution**	**Divisor**	**C_1 1g**	**Standard unc.(1g) ±%**	**V_1 or V_{eff}**
Measurement System						
Probe calibration	±5.5	normal	1	1	±5.5	∞
Axial isotropy of probe	±4.7	rectangular	√3	0.7	±1.9	∞
Hemispherical Isotropy of probe	±9.6	rectangular	√3	0.7	±3.9	∞
Probe linearity	±4.7	rectangular	√3	1	±2.7	∞
Detection Limit	±1.0	rectangular	√3	1	±0.6	∞
Boundary effects	±1.0	rectangular	√3	1	±0.6	∞
Readout electronics	±0.3	normal	1	1	±0.3	∞
Response time	±0.8	rectangular	√3	1	±0.5	∞
Integration time	±2.6	rectangular	√3	1	±1.5	∞
Probe positioning	±2.9	rectangular	√3	1	±1.7	∞
Probe positioner	±0.4	rectangular	√3	1	±0.2	∞
RF ambient Noise	±3.0	rectangular	√3	1	±1.7	∞
RF ambient Reflections	±3.0	rectangular	√3	1	±1.7	∞
Max.SAR Eval	±1.0	rectangular	√3	1	±0.6	∞
Test Sample Related						
Device positioning	±2.9	normal	1	1	±2.9	145
Device holder uncertainty	±3.6	normal	1	1	±3.6	5
Power drift	±5.0	rectangular	√3	1	±2.9	∞
Phantom and Set up						
Phantom uncertainty	±4.0	rectangular	√3	1	±2.3	∞
Liquid conductivity(target)	±5.0	rectangular	√3	0.64	±1.8	∞
Liquid conductivity(meas.)	±2.5	rectangular	1	0.64	±1.6	∞
Liquid permittivity(target)	±5.0	rectangular	√3	0.6	±1.7	∞
Liquid permittivity(meas.)	±2.5	rectangular	1	0.6	±1.5	∞
Combined Standard Uncertainty					±10.7	387
Coverage Factor for 95%		kp=2				
Expanded Standard Uncertainty					±21.4	

Table: Worst-case uncertainty for DASY5
The budge is valid for the frequency range 300 MHz to 6G Hz and represents a worst-case analysis.

9. EXPOSURE LIMIT

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Note: Whole-Body SAR is averaged over the entire body, **partial-body SAR** is averaged over any 10 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 1 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

10. MEASUREMENT RESULTS

10.1 TEST LIQUIDS CONFIRMATION

SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the SPEAG DAK3.5 dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

10.2 LIQUID MEASUREMENT RESULTS

The following table show the measuring results for simulating liquid:

Liquid Type	Liquid Temp. (°C)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body2412	21.5	Permitivity(ε)	52.75	52.14	-1.16	± 5	2014-7-9
		Conductivity(σ)	1.90	1.84	-3.20	± 5	
Body2437	21.5	Permitivity(ε)	52.72	52.13	-1.12	± 5	
		Conductivity(σ)	1.93	1.86	-3.82	± 5	
Body2462	21.5	Permitivity(ε)	52.68	51.96	-1.37	± 5	
		Conductivity(σ)	1.97	1.89	-4.07	± 5	
Body5180	21.5	Permitivity(ε)	49.06	49.10	0.08	± 5	2014-7-4
		Conductivity(σ)	5.33	5.17	-2.99	± 5	
Body5210	21.5	Permitivity(ε)	49.02	48.53	-1.00	± 5	
		Conductivity(σ)	5.37	5.21	-2.97	± 5	
Body5240	21.5	Permitivity(ε)	48.98	48.51	-0.95	± 5	
		Conductivity(σ)	5.40	5.40	0.01	± 5	
Body5260	21.5	Permitivity(ε)	48.95	48.77	-0.36	± 5	2014-7-5
		Conductivity(σ)	5.42	5.41	-0.14	± 5	
Body5290	21.5	Permitivity(ε)	48.91	48.71	-0.42	± 5	
		Conductivity(σ)	5.45	5.29	-3.00	± 5	
Body5320	21.5	Permitivity(ε)	48.87	48.25	-1.27	± 5	
		Conductivity(σ)	5.49	5.38	-2.02	± 5	
Body5520	21.5	Permitivity(ε)	48.59	47.87	-1.48	± 5	2014-7-6
		Conductivity(σ)	5.70	5.58	-2.20	± 5	
Body5580	21.5	Permitivity(ε)	48.51	48.24	-0.56	± 5	
		Conductivity(σ)	5.77	5.82	0.92	± 5	
Body5680	21.5	Permitivity(ε)	48.37	48.14	-0.46	± 5	
		Conductivity(σ)	5.87	6.05	2.91	± 5	
Body5610	21.5	Permitivity(ε)	48.58	48.43	-0.32	± 5	
		Conductivity(σ)	5.78	5.75	-0.52	± 5	
Body5745	21.5	Permitivity(ε)	48.28	47.55	-1.51	± 5	2014-7-7
		Conductivity(σ)	5.94	6.03	1.42	± 5	
Body5775	21.5	Permitivity(ε)	48.24	48.04	-0.41	± 5	
		Conductivity(σ)	5.97	6.23	4.29	± 5	
Body5785	21.5	Permitivity(ε)	48.22	48.39	0.34	± 5	
		Conductivity(σ)	5.98	6.23	4.09	± 5	
Body5825	21.5	Permitivity(ε)	47.85	48.19	0.70	± 5	
		Conductivity(σ)	6.02	6.10	1.26	± 5	

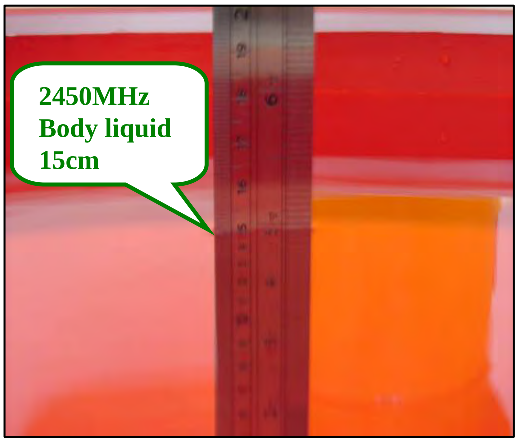
Liquid Type	Liquid Temp. (°C)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body5745	21.5	Permitivity(ε)	48.28	47.96	-0.66	± 5	2014-8-7
		Conductivity(σ)	5.94	5.82	-2.11	± 5	
Body5775	21.5	Permitivity(ε)	48.24	48.45	0.44	± 5	
		Conductivity(σ)	5.97	6.02	0.77	± 5	
Body5785	21.5	Permitivity(ε)	48.22	48.80	1.19	± 5	
		Conductivity(σ)	5.98	6.02	0.58	± 5	
Body5825	21.5	Permitivity(ε)	47.85	48.60	1.56	± 5	
		Conductivity(σ)	6.02	5.89	-2.22	± 5	

10.3 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system withan E-fileld probe EX3DV4 SN: 3798/3753 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx= 5 mm, dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole less than 3G input power was 250mW±3%.
- The dipole above than 3G input power was 100mW±3%.
- The results are normalized to 1 W input power.



- Note: For SAR testing, less than 3G the liquid depth is 15cm shown above
- Note: For SAR testing, above than 3G the liquid depth is 10cm shown above

SYSTEM PERFORMANCE CHECK RESULTS

Liquid Type	Ambient Temp. (°C)	Liquid Temp. (°C)	Input Power (W)	Measured SAR_{1g} (W/Kg)	1W Target SAR_{1g}(W/Kg)	1W Normalized SAR_{1g}(W/Kg)	Deviation (%)	Limited (%)	Date
Body2450	22	21.5	0.25	12.60	49.20	50.40	2.44	± 10	2014-7-9
Body5200	22	21.5	0.1	7.47	74.60	74.7	0.13	± 10	2014-7-4
Body5300	22	21.5	0.1	7.92	76.00	79.2	4.21	± 10	2014-7-5
Body5500	22	21.5	0.1	8.13	79.10	81.3	2.78	± 10	2014-7-6
Body5600	22	21.5	0.1	8.09	77.80	80.9	3.98	± 10	2014-7-6
Body5800	22	21.5	0.1	7.78	75.00	77.8	3.73	± 10	2014-7-7
Body5800	22	21.5	0.1	7.83	75.00	78.3	4.40	± 10	2014-8-7

10.4 EUT TUNE-UP PROCEDURES AND TEST MODE

Conducted output power(dBm):

WLAN 2.4G Chain0

Mode	Channel	Frequence (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 b	1	2412	13	±1.5	14.50	14.46
	6	2437	13	±1.5	14.50	14.50
	11	2462	13	±1.5	14.50	14.48
802.11 g	1	2412	13	±1.5	14.50	14.42
	6	2437	13	±1.5	14.50	14.44
	11	2462	13	±1.5	14.50	14.47
802.11 n HT20	1	2412	13	±1.5	14.50	14.41
	6	2437	13	±1.5	14.50	14.46
	11	2462	13	±1.5	14.50	14.44

WLAN 2.4G Chain1

Mode	Channel	Frequence (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 b	1	2412	13	±1.5	14.50	14.45
	6	2437	13	±1.5	14.50	14.47
	11	2462	13	±1.5	14.50	14.43
802.11 g	1	2412	13	±1.5	14.50	14.40
	6	2437	13	±1.5	14.50	14.42
	11	2462	13	±1.5	14.50	14.44
802.11 n HT20	1	2412	13	±1.5	14.50	14.46
	6	2437	13	±1.5	14.50	14.45
	11	2462	13	±1.5	14.50	14.42

WLAN 2.4G Chain0+1

Mode	Channel	Frequence (MHZ)	Total Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 n HT20	1	2412	13.5	±1.5	14.50	14.44
	6	2437	13.5	±1.5	14.50	14.48
	11	2462	13.5	±1.5	14.50	14.45

WLAN Conducted output power(dBm):

Band 5.2G Chain0

Mode	Channel	Frequence (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	36	5180	11.5	±1.5	13	12.99
	40	5200	11.5	±1.5	13	12.90
	44	5220	11.5	±1.5	13	12.97
	48	5240	11.5	±1.5	13	13.00
802.11 n (HT20)	36	5180	11.5	±1.5	13	12.92
	40	5200	11.5	±1.5	13	12.95
	44	5220	11.5	±1.5	13	12.93
	48	5240	11.5	±1.5	13	12.96
802.11 n (HT40)	38	5180	11.5	±1.5	13	12.94
	46	5230	11.5	±1.5	13	12.97
802.11 ac (VHT80)	42	5210	11.5	±1.5	13	13

Band 5.2G Chain1

Mode	Channel	Frequence (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up pow (dBm)	Average pow (dBm)
802.11 a	36	5180	11.5	±1.5	13	12.98
	40	5200	11.5	±1.5	13	12.81
	44	5220	11.5	±1.5	13	12.93
	48	5240	11.5	±1.5	13	13.00
802.11 n (HT20)	36	5180	11.5	±1.5	13	12.95
	40	5200	11.5	±1.5	13	12.83
	44	5220	11.5	±1.5	13	12.91
	48	5240	11.5	±1.5	13	12.97
802.11 n (HT40)	38	5180	11.5	±1.5	13	12.95
	46	5230	11.5	±1.5	13	12.89
802.11 ac (VHT80)	42	5210	11.5	±1.5	13	12.98

Band 5.2G Chain0+1

Mode	Channel	Frequence (MHZ)	Total Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up pow (dBm)	Average pow (dBm)
802.11 n (HT20)	36	5180	11.5	±1.5	13	12.96
	40	5200	11.5	±1.5	13	12.93
	44	5220	11.5	±1.5	13	12.94
	48	5240	11.5	±1.5	13	12.95
802.11 n (HT40)	38	5180	11.5	±1.5	13	12.91
	46	5230	11.5	±1.5	13	12.87
802.11 ac (VHT80)	42	5210	11.5	±1.5	13	12.92

Band 5.3G Chain0

Mode	Channel	Frequence (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	52	5260	12.5	±1.5	14	13.97
	56	5280	12.5	±1.5	14	13.80
	60	5300	12.5	±1.5	14	13.82
	64	5320	12.5	±1.5	14	13.98
802.11 n (HT20)	52	5260	12.5	±1.5	14	13.92
	56	5280	12.5	±1.5	14	13.81
	60	5300	12.5	±1.5	14	13.80
	64	5320	12.5	±1.5	14	13.96
802.11 n (HT40)	54	5270	12.5	±1.5	14	13.89
	62	5310	12.5	±1.5	14	13.87
802.11 ac (VHT80)	58	5290	12.5	±1.5	14	13.95

Band 5.3G Chain1

Mode	Channel	Frequence (MHZ)	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	52	5260	12.5	±1.5	14	14.00
	56	5280	12.5	±1.5	14	13.97
	60	5300	12.5	±1.5	14	13.99
	64	5320	12.5	±1.5	14	14.00
802.11 n (HT20)	52	5260	12.5	±1.5	14	13.91
	56	5280	12.5	±1.5	14	13.90
	60	5300	12.5	±1.5	14	13.87
	64	5320	12.5	±1.5	14	13.92
802.11 n (HT40)	54	5270	12.5	±1.5	14	13.86
	62	5310	12.5	±1.5	14	13.85
802.11 ac (VHT80)	58	5290	12.5	±1.5	14	13.95

Band 5.3G Chain0+1

Mode	Channel	Frequence (MHZ)	TotalTarget power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 n (HT20)	52	5260	12.5	±1.5	14	13.92
	56	5280	12.5	±1.5	14	13.81
	60	5300	12.5	±1.5	14	13.80
	64	5320	12.5	±1.5	14	13.96
802.11 n (HT40)	54	5270	12.5	±1.5	14	13.89
	62	5310	12.5	±1.5	14	13.87
802.11 ac (VHT80)	58	5290	12.5	±1.5	14	13.95

Band 5.5G Chain0

Mode	Channel	Frequence MHZ	Chain0 Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	100	5500	12.5	±1.5	14	13.92
	104	5520	12.5	±1.5	14	13.96
	108	5540	12.5	±1.5	14	13.90
	112	5560	12.5	±1.5	14	13.91
	116	5580	12.5	±1.5	14	13.95
	120	5600	12.5	±1.5	14	13.92
	124	5620	12.5	±1.5	14	13.91
	128	5640	12.5	±1.5	14	13.90
	132	5660	12.5	±1.5	14	13.95
	136	5680	12.5	±1.5	14	14.00
	140	5700	12.5	±1.5	14	13.98
802.11 n (HT20)	100	5500	12.5	±1.5	14	13.87
	104	5520	12.5	±1.5	14	13.92
	108	5540	12.5	±1.5	14	13.85
	112	5560	12.5	±1.5	14	13.89
	116	5580	12.5	±1.5	14	13.91
	120	5600	12.5	±1.5	14	13.87
	124	5620	12.5	±1.5	14	13.88
	128	5640	12.5	±1.5	14	13.86
	132	5660	12.5	±1.5	14	13.91
	136	5680	12.5	±1.5	14	13.98
	140	5700	12.5	±1.5	14	13.92
802.11 n (HT40)	102	5510	12.5	±1.5	14	13.89
	110	5550	12.5	±1.5	14	13.86
	134	5670	12.5	±1.5	14	13.90
802.11 ac (VHT80)	106	5530	12.5	±1.5	14	13.90
	122	5610	12.5	±1.5	14	13.95
	138	5690	12.5	±1.5	14	13.91

Band 5.5G Chain1

Mode	Channel	Frequence MHZ	Chain1 Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	100	5500	12.5	±1.5	14	13.92
	104	5520	12.5	±1.5	14	13.95
	108	5540	12.5	±1.5	14	13.91
	112	5560	12.5	±1.5	14	13.90
	116	5580	12.5	±1.5	14	13.98
	120	5600	12.5	±1.5	14	13.94
	124	5620	12.5	±1.5	14	13.93
	128	5640	12.5	±1.5	14	13.94
	132	5660	12.5	±1.5	14	13.93
	136	5680	12.5	±1.5	14	14.00
	140	5700	12.5	±1.5	14	13.96
802.11 n (HT20)	100	5500	12.5	±1.5	14	13.89
	104	5520	12.5	±1.5	14	13.90
	108	5540	12.5	±1.5	14	13.92
	112	5560	12.5	±1.5	14	13.87
	116	5580	12.5	±1.5	14	13.96
	120	5600	12.5	±1.5	14	13.92
	124	5620	12.5	±1.5	14	13.89
	128	5640	12.5	±1.5	14	13.85
	132	5660	12.5	±1.5	14	13.83
	136	5680	12.5	±1.5	14	13.91
	140	5700	12.5	±1.5	14	13.86
802.11 n (HT40)	102	5510	12.5	±1.5	14	13.82
	110	5550	12.5	±1.5	14	13.81
	134	5670	12.5	±1.5	14	13.83
802.11 ac (VHT80)	106	5530	12.5	±1.5	14	13.93
	122	5610	12.5	±1.5	14	13.97
	138	5690	12.5	±1.5	14	13.94

Band 5.5G Chain0+1

Mode	Channel	Frequence MHZ	Total Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 n (HT20)	100	5500	12.5	±1.5	14	13.81
	104	5520	12.5	±1.5	14	13.85
	108	5540	12.5	±1.5	14	13.83
	112	5560	12.5	±1.5	14	13.88
	116	5580	12.5	±1.5	14	13.91
	120	5600	12.5	±1.5	14	13.90
	124	5620	12.5	±1.5	14	13.86
	128	5640	12.5	±1.5	14	13.87
	132	5660	12.5	±1.5	14	13.89
	136	5680	12.5	±1.5	14	13.92
	140	5700	12.5	±1.5	14	13.87
802.11 n (HT40)	102	5510	12.5	±1.5	14	13.82
	110	5550	12.5	±1.5	14	13.86
	134	5670	12.5	±1.5	14	13.84
802.11 ac (VHT80)	106	5530	12.5	±1.5	14	13.90
	122	5610	12.5	±1.5	14	13.92
	138	5690	12.5	±1.5	14	13.87

Band 5.8G Chain0

Mode	Channel	Frequence	Chain0 Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	149	5745	13	±1.5	14.5	14.05
	153	5765	13	±1.5	14.5	14.03
	157	5785	13	±1.5	14.5	14.02
	161	5805	13	±1.5	14.5	14.00
	165	5825	13	±1.5	14.5	14.04
802.11 n (HT20)	149	5745	13	±1.5	14.5	13.92
	153	5765	13	±1.5	14.5	13.93
	157	5785	13	±1.5	14.5	13.91
	161	5805	13	±1.5	14.5	13.97
	165	5825	13	±1.5	14.5	13.97
802.11 n (HT40)	151	5755	13	±1.5	14.5	13.90
	159	5795	13	±1.5	14.5	13.94
802.11 ac (VHT80)	155	5755	13	±1.5	14.5	14.01

Band 5.8G Chain1

Mode	Channel	Frequence	Chain1 Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	149	5745	13	±1.5	14.5	14.02
	153	5765	13	±1.5	14.5	14.00
	157	5785	13	±1.5	14.5	14.03
	161	5805	13	±1.5	14.5	14.02
	165	5825	13	±1.5	14.5	14.04
802.11 n (HT20)	149	5745	13	±1.5	14.5	13.95
	153	5765	13	±1.5	14.5	13.97
	157	5785	13	±1.5	14.5	13.96
	161	5805	13	±1.5	14.5	13.99
	165	5825	13	±1.5	14.5	13.92
802.11 n (HT40)	151	5755	13	±1.5	14.5	13.97
	159	5795	13	±1.5	14.5	13.94
802.11 ac (VHT80)	155	5755	13	±1.5	14.5	14.06

Band 5.8G Chain0+1

Mode	Channel	Frequence	Total Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 n (HT20)	149	5745	13	±1.5	14.5	13.95
	153	5765	13	±1.5	14.5	13.93
	157	5785	13	±1.5	14.5	13.97
	161	5805	13	±1.5	14.5	13.94
	165	5825	13	±1.5	14.5	13.91
802.11 n (HT40)	151	5755	13	±1.5	14.5	13.90
	159	5795	13	±1.5	14.5	13.90
802.11 ac (VHT80)	155	5755	13	±1.5	14.5	13.98

Bluetooth3.0 Conducted output power(dBm):

Mode	CH	Frequency	Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)
V3.0 + EDR, GFSK	CH00	2402MHZ	5.1	4.2+1/-2	5.2
	CH39	2441MHZ	4.9	4.2+1/-2	5.2
	CH78	2480MHZ	4.9	4.2+1/-2	5.2
V3.0 + EDR, 8-DPSK	CH00	2402MHZ	5.2	4.2+1/-2	5.2
	CH39	2441MHZ	5.0	4.2+1/-2	5.2
	CH78	2480MHZ	4.8	4.2+1/-2	5.2

BLE4.0 Conducted output power(dBm):

Mode	CH	Frequency	Average power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)
GFSK	CH00	2402MHZ	-2.17	-2+1/-2	-1
	CH19	2440MHZ	-2.46	-2+1/-2	-1
	CH39	2480MHZ	-2.89	-2+1/-2	-1

10.5 STANDALONE SAR TEST EXCLUSION

SAR evaluation for this device was performed with a separation distance of 5 mm. Observing the SAR evaluation exemption limit table (Table 1, see below) found in § 2.5.1 of IC Notice 2013-DDRS0911, it was determined that the SAR exemption limit for this device is 4 mW for 2.4 GHz transmission, and 1 mW for 5 GHz transmission.
No Wi-Fi mode qualified for test exemption as all power levels were above the stated thresholds. On the contrary, Bluetooth, with a frequency of 2402 MHz and a maximum output power of 3.32 mW (5.2 dBm, tune-up tolerance accounted for), is below the exemption threshold and therefore exempt from SAR evaluation for either the intended user or bystanders.

Table 1: SAR evaluation- exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	16 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥ 50 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	16 mW	27 mW	41 mW

According to KDB447498 D01:The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[24] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[25]
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below
- If the test separation distance (antenna-user) is < 5mm, 5mm is used for excluded SAR calculation

	Wireless Interface	Bluetooth
Tune-up Maximum power (dBm)		5.2
Tune-up Maximum rated power (mW)		3.3
Body	Antenna to user (mm)	5
	Frequency(GHz)	2.402
	SAR exclusion threshold	0.9

Per KDB 447498 D01 exclusion thresholds is 0.9 < 3, Bluetooth RF exposure evaluation is not required.

10.6 SAR TEST CONFIGURATIONS

<Tablet>

This EUT was tested in Two different positions. They are reverse side of tablet, Edge 1.In these positions, the surface of EUT is touching with phantom 0cm.

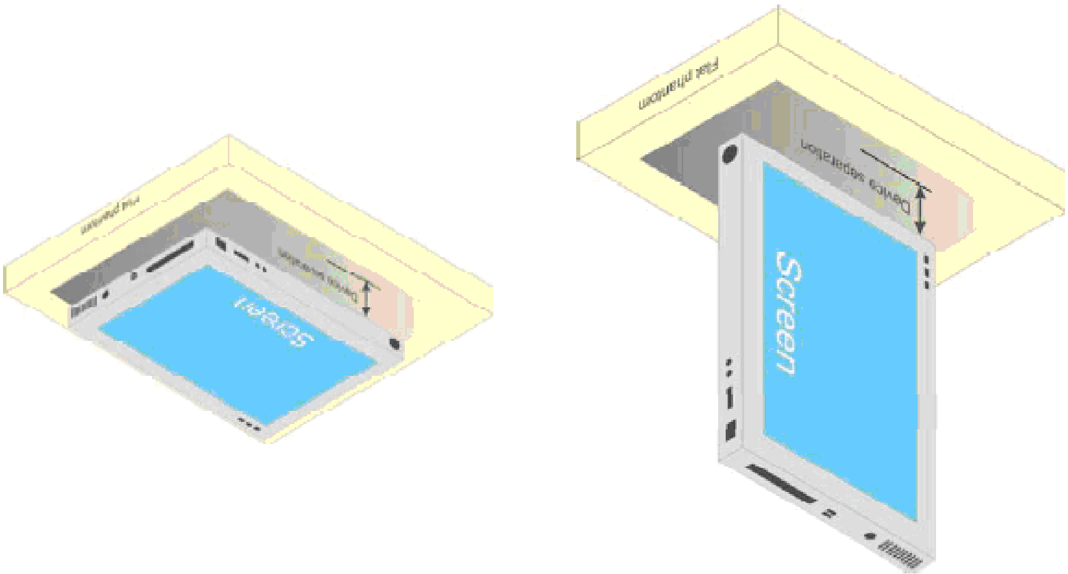


Fig Illustration for Lap-touching Position

<Laptop>

According to KDB 616217 D04, SAR testing for laptop PC is required for bottom surface. This EUT was tested in the base of EUT directly against the flat phantom.

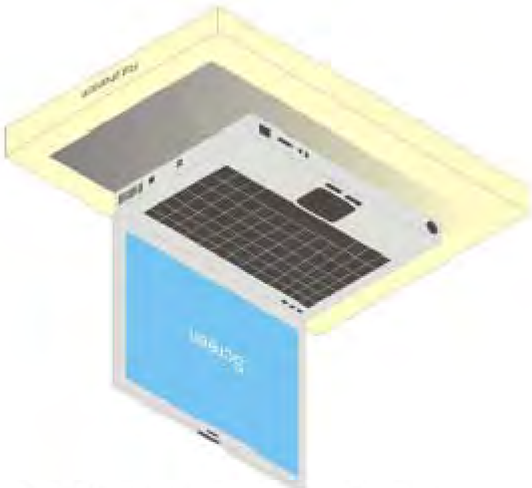
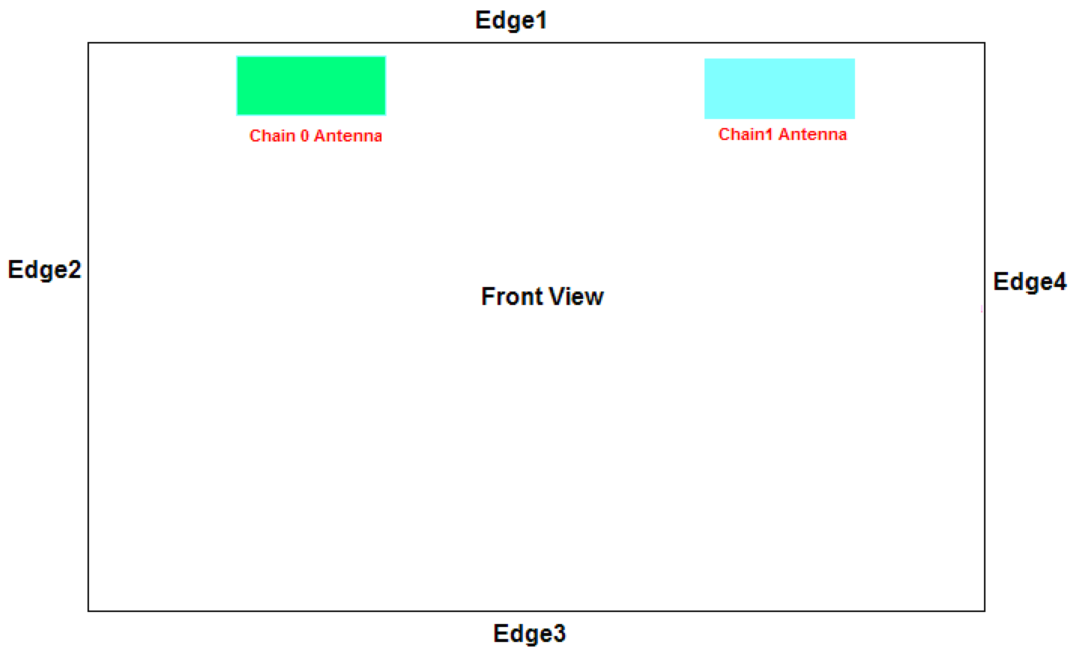


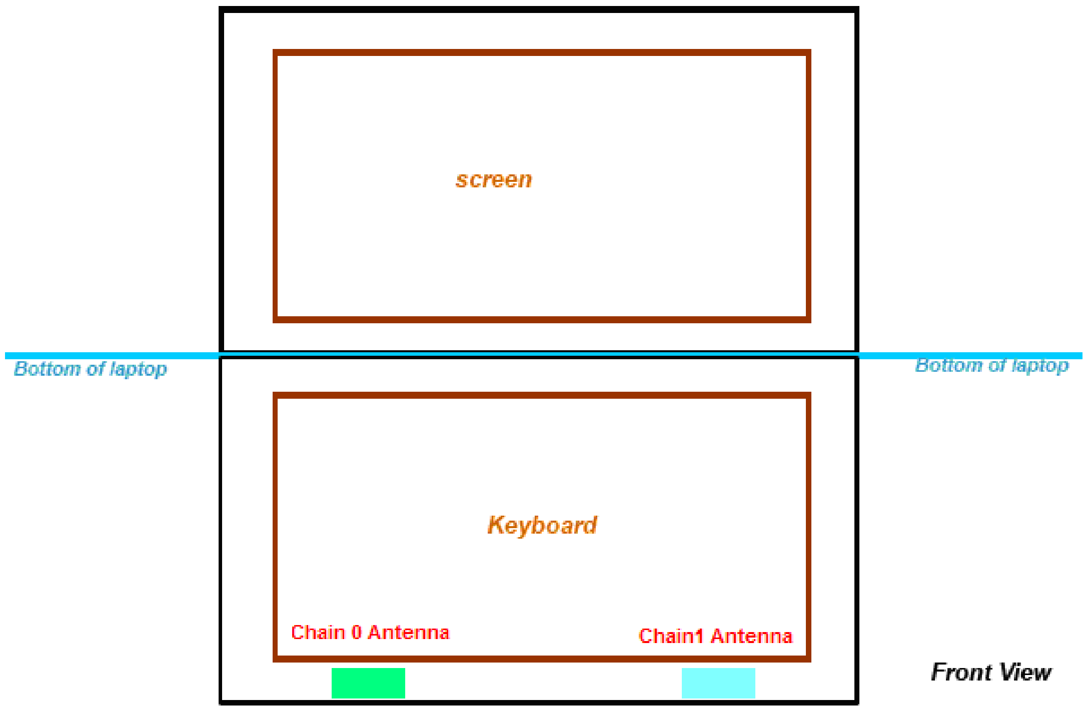
Fig Illustration for Laptop Setup

10.7 ANTENNA LOCATION

<Tablet>



<Notebook>



Device dimensions (H x W): 330 x 220 mm

Antennas	Wireless Interface
Bluetooth &WLAN Antenna	WLAN 2.4GHz WLAN 5.2GHz WLAN 5.3GHz WLAN 5.5GHz WLAN 5.8GHz Bluetooth
Chain0	WLAN
Chain1	WLAN+ Bluetooth

Test Mode

IEEE 802.11	Data transmission mode(802.11a;b)

10.8 BODY TEST EXCLUSION THRESHOLDS

The following SAR test exclusion Thresholds based on KDB 447498 D01 General RF Exposure Guidance v05r02) 4.3.1)

Exposure Position	Wireless Interface	WLAN 802.11 b Chain0	WLAN 802.11 b Chain1	WLAN 802.11 a Chain0	WLAN 802.11 a Chain1
Exposure Position	Maximum power	14.5	14.5	14.5	14.5
	Maximum rated power(mW)	28.18	28.18	28.18	28.18
Rear view	Antenna to user (mm)	5	5	5	5
	SAR exclusion threshold	9.58	9.58	6.23	6.23
	SAR testing required?	Yes	Yes	Yes	Yes
Edge1	Antenna to user (mm)	5	5	5	5
	SAR exclusion threshold	9.58	9.58	6.23	6.23
	SAR testing required?	Yes	Yes	Yes	Yes
Edge2	Antenna to user (mm)	52	228	52	228
	SAR exclusion threshold	116.00	1876.00	82.28	1842.28
	SAR testing required?	No	No	No	No
Edge3	Antenna to user (mm)	208	208	208	208
	SAR exclusion threshold	1676.00	1676.00	1642.28	1642.28
	SAR testing required?	No	No	No	No
Edge4	Antenna to user (mm)	228	52	228	52
	SAR exclusion threshold	1876.00	116.00	1842.28	82.28
	SAR testing required?	No	No	No	No

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
2. Per KDB 447498 D01v05r02, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01v05r02, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   f(GHz) is the RF channel transmit frequency in GHz
   Power and distance are rounded to the nearest mW and mm before calculation
   The result is rounded to one decimal place for comparison
   For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare.
   This formula is [3.0] / [√f(GHz)] ·[(*min. test separation distance, mm*)] = exclusion threshold of mW.
5. Per KDB 447498 D01v05r02, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
   a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz
6. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

10.9 SAR MEASUREMENT RESULTS

Note:

1. Per KDB 447498 D01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
3. Per KDB 447498 D01, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

SAR Results for Test Records

Band	Mode	Configure	Test Position	Dist. (mm)	Ch.	Chain	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	1	0	2412	14.46	14.5	1.009	0.16	0.426	0.430
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	6	0	2437	14.50	14.5	1.000	0.15	0.296	0.296
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	11	0	2462	14.48	14.5	1.005	0.13	0.396	0.398
WLAN 2.4Ghz	802.11b	Tablet	Edge1	0	6	0	2437	14.50	14.5	1.000	-0.11	0.435	0.435
WLAN 2.4Ghz	802.11b	NB	Bottom	0	1	0	2412	14.46	14.5	1.009	0.07	0.424	0.428
WLAN 2.4Ghz	802.11b	NB	Bottom	0	6	0	2437	14.50	14.5	1.000	0.14	0.411	0.411
WLAN 2.4Ghz	802.11b	NB	Bottom	0	11	0	2462	14.48	14.5	1.005	-0.18	0.401	0.403

Band	Mode	Configure	Test Position	Dist. (mm)	Ch.	Chain	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	36	0	5180	12.99	13	1.002	0.03	1.24	1.243
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	48	0	5240	13	13	1.000	0.00	1.19	1.190
WLAN 5.2Ghz	802.11a	Tablet	Edge1	0	48	0	5240	13	13	1.000	0.13	1.14	1.140
WLAN 5.2Ghz	802.11ac VHT80	Tablet	Rear	0	42	0	5210	13	13	1.000	0.03	1.21	1.210
WLAN 5.2Ghz	802.11a	NB	Bottom	0	36	0	5180	12.99	13	1.002	-0.10	0.920	0.922
WLAN 5.2Ghz	802.11a	NB	Bottom	0	48	0	5240	13	13	1.000	0.14	1.06	1.060
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	52	0	5260	13.97	14	1.007	0.00	1.38	1.390
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	64	0	5320	13.98	14	1.005	0.13	1.3	1.306
WLAN 5.3Ghz	802.11a	Tablet	Edge1	0	64	0	5320	13.98	14	1.005	0.11	1.22	1.226
WLAN 5.3Ghz	802.11ac VHT80	Tablet	Rear	0	58	0	5290	13.95	14	1.012	0.00	1.13	1.143
WLAN 5.3Ghz	802.11a	NB	Bottom	0	52	0	5260	13.97	14	1.007	0.00	1	1.007
WLAN 5.3Ghz	802.11a	NB	Bottom	0	64	0	5320	13.98	14	1.005	0.00	0.780	0.784
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	104	0	5520	13.96	14	1.009	0.00	1.13	1.140
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	116	0	5580	13.95	14	1.012	-0.07	1.24	1.254
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	136	0	5680	14.00	14	1.000	0.00	0.643	0.643
WLAN 5.5Ghz	802.11a	Tablet	Edge1	0	136	0	5680	14.00	14	1.000	-0.11	0.520	0.520

WLAN 5.5Ghz	802.11ac VHT80	Tablet	Rear	0	122	0	5610	13.95	14	1.021	-0.16	0.760	0.776
WLAN 5.5Ghz	802.11a	NB	Bottom	0	104	0	5520	13.96	14	1.009	0.10	1.14	1.151
WLAN 5.5Ghz	802.11a	NB	Bottom	0	116	0	5580	13.95	14	1.012	0.00	1.29	1.305
WLAN 5.5Ghz	802.11a	NB	Bottom	0	136	0	5680	14.00	14	1.000	0.16	0.676	0.676
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	149	0	5745	14.05	14.5	1.109	0.15	0.757	0.840
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	157	0	5785	14.02	14.5	1.117	0.00	0.840	0.938
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	165	0	5825	14.04	14.5	1.112	0.00	1.02	1.134
WLAN 5.8Ghz	802.11a	Tablet	Edge1	0	149	0	5745	14.05	14.5	1.109	-0.05	0.848	0.941
WLAN 5.8Ghz	802.11ac VHT80	Tablet	Rear	0	155	0	5775	13.94	14.5	1.138	0.17	0.766	0.871
WLAN 5.8Ghz	802.11a	NB	Bottom	0	149	0	5745	14.05	14.5	1.109	0.00	0.421	0.467

Band	Mode	Configure	Test Position	Dist. (mm)	Ch.	Chain	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	1	1	2412	14.45	14.5	1.012	0.19	0.498	0.504
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	6	1	2437	14.47	14.5	1.007	0.17	0.480	0.483
WLAN 2.4Ghz	802.11b	Tablet	Rear	0	11	1	2462	14.43	14.5	1.016	0.08	0.409	0.416
WLAN 2.4Ghz	802.11b	Tablet	Edge1	0	6	1	2437	14.47	14.5	1.007	0.02	0.147	0.148
WLAN 2.4Ghz	802.11b	NB	Bottom	0	1	1	2412	14.45	14.5	1.012	0.08	0.350	0.354
WLAN 2.4Ghz	802.11b	NB	Bottom	0	6	1	2437	14.47	14.5	1.007	0.00	0.323	0.325
WLAN 2.4Ghz	802.11b	NB	Bottom	0	11	1	2462	14.43	14.5	1.016	0.00	0.329	0.334

Band	Mode	Configure	Test Position	Dist. (mm)	Ch.	Chain	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	36	1	5180	12.98	13	1.005	0.00	1.11	1.115
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	48	1	5240	13	13	1.000	0.00	0.839	0.839
WLAN 5.2Ghz	802.11a	Tablet	Edge1	0	48	1	5240	13	13	1.000	0.00	0.793	0.793
WLAN 5.2Ghz	802.11ac VHT80	Tablet	Rear	0	42	1	5210	12.98	13	1.005	0.00	1.04	1.045
WLAN 5.2Ghz	802.11a	NB	Bottom	0	36	1	5180	12.98	13	1.005	0.00	0.837	0.841
WLAN 5.2Ghz	802.11a	NB	Bottom	0	48	1	5240	13	13	1.000	0.00	0.748	0.748
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	52	1	5260	14	14	1.000	0.00	0.949	0.949
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	64	1	5320	14	14	1.000	-0.18	0.822	0.822
WLAN 5.3Ghz	802.11a	Tablet	Edge1	0	52	1	5260	14	14	1.000	0.19	0.929	0.929
WLAN 5.3Ghz	802.11ac VHT80	Tablet	Rear	0	58	1	5290	13.95	14	1.000	0.00	0.711	0.711
WLAN 5.3Ghz	802.11a	NB	Bottom	0	52	1	5260	14	14	1.000	0.00	0.944	0.944
WLAN 5.3Ghz	802.11a	NB	Bottom	0	64	1	5320	14	14	1.000	0.18	0.777	0.777
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	104	1	5520	13.95	14	1.012	-0.17	0.670	0.678
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	116	1	5580	13.98	14	1.005	0.00	1.09	1.095
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	136	1	5680	14	14	1.000	0.04	0.668	0.668

WLAN 5.5Ghz	802.11a	Tablet	Edge1	0	136	1	5680	14	14	1.000	0.15	0.459	0.459
WLAN 5.5Ghz	802.11ac VHT80	Tablet	Rear	0	122	1	5610	13.97	14	1.007	0.00	0.953	0.960
WLAN 5.5Ghz	802.11a	NB	Bottom	0	104	1	5520	13.95	14	1.012	0.00	1.02	1.032
WLAN 5.5Ghz	802.11a	NB	Bottom	0	116	1	5580	13.98	14	1.005	0.00	1.13	1.135
WLAN 5.5Ghz	802.11a	NB	Bottom	0	136	1	5680	14	14	1.000	0.00	0.829	0.829
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	149	1	5745	14.02	14.5	1.117	0.03	0.738	0.824
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	157	1	5785	14.05	14.5	1.109	0.00	0.836	0.927
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	165	1	5825	14.04	14.5	1.112	-0.09	0.861	0.957
WLAN 5.8Ghz	802.11a	Tablet	Edge1	0	157	1	5785	14.03	14.5	1.114	0.00	0.715	0.797
WLAN 5.8Ghz	802.11ac VHT80	Tablet	Rear	0	155	1	5775	14.06	14.5	1.107	-0.10	0.674	0.746
WLAN 5.8Ghz	802.11a	NB	Bottom	0	157	1	5785	14.05	14.5	1.109	0.00	0.428	0.475

Repeated SAR Results for Test Records

Band	Mode	Configure	Test Position	Dist. (mm)	Ch.	Chain	Freq. (MHZ)	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	36	0	5180	12.99	13	1.002	0.00	1.11	1.113
WLAN 5.2Ghz	802.11a	NB	Bottom	0	48	0	5240	13	13	1.000	0.00	0.997	0.997
WLAN 5.2Ghz	802.11a	Tablet	Rear	0	36	1	5180	12.98	13	1.005	0.00	1.08	1.085
WLAN 5.2Ghz	802.11a	NB	Bottom	0	36	1	5180	12.98	13	1.005	0.00	0.833	0.837
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	52	0	5260	13.97	14	1.007	0.00	1.36	1.369
WLAN 5.3Ghz	802.11a	NB	Bottom	0	52	0	5260	13.97	14	1.007	0.00	1.01	1.017
WLAN 5.3Ghz	802.11a	Tablet	Rear	0	52	1	5260	14	14	1.000	0.00	0.893	0.893
WLAN 5.3Ghz	802.11a	NB	Bottom	0	52	1	5260	14	14	1.000	0.00	0.939	0.939
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	116	0	5580	13.95	14	1.012	0.00	1.27	1.285
WLAN 5.5Ghz	802.11a	NB	Bottom	0	116	0	5580	13.95	14	1.012	0.09	1.3	1.315
WLAN 5.5Ghz	802.11a	Tablet	Rear	0	116	1	5580	13.98	14	1.005	0.00	1.08	1.085
WLAN 5.5Ghz	802.11a	NB	Bottom	0	116	1	5580	13.98	14	1.005	0.15	1.13	1.135
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	165	0	5825	14.04	14.5	1.112	0.01	0.912	1.014
WLAN 5.8Ghz	802.11a	Tablet	Rear	0	165	1	5825	14.04	14.5	1.112	0.00	0.728	0.809

10.10 REPEATED SAR MEASUREMENT

Band	Mode	Test Position	Chain	Dist. (mm)	Ch.	Original Measured SAR1g (mW/g)	1st Repeated SAR1g (mW/g)	Ratio	Original Measured SAR1g (mW/g)	2nd Repeated SAR1g (mW/g)	Ratio
WLAN 5.2Ghz	802.11a	Rear	0	0	36	1.24	1.11	1.12	--	--	--
WLAN 5.2Ghz	802.11a	Bottom	0	0	48	0.920	0.997	1.08	--	--	--
WLAN 5.2Ghz	802.11a	Rear	1	0	36	1.11	1.08	1.03	--	--	--
WLAN 5.2Ghz	802.11a	Bottom	1	0	36	0.837	0.833	1.01	--	--	--
WLAN 5.3Ghz	802.11a	Rear	0	0	52	1.38	1.36	1.02	--	--	--
WLAN 5.3Ghz	802.11a	Bottom	0	0	52	1	1.01	1.01	--	--	--
WLAN 5.3Ghz	802.11a	Rear	1	0	52	0.949	0.893	1.06	--	--	--
WLAN 5.3Ghz	802.11a	Bottom	1	0	52	0.944	0.939	1.01	--	--	--
WLAN 5.5Ghz	802.11a	Rear	0	0	116	1.24	1.27	1.03	--	--	--
WLAN 5.5Ghz	802.11a	Bottom	0	0	116	1.29	1.3	1.01	--	--	--
WLAN 5.5Ghz	802.11a	Rear	1	0	116	1.09	1.08	1.01	--	--	--
WLAN 5.5Ghz	802.11a	Bottom	1	0	116	1.13	1.13	1	--	--	--
WLAN 5.8Ghz	802.11a	Rear	0	0	165	1.02	0.912	1.12	--	--	--
WLAN 5.8Ghz	802.11a	Rear	1	0	165	0.861	0.728	1.18	--	--	--

Note:

1. Per KDB 865664 D01v01,for each frequence band, repeated SAR measurement is required only when the measured SAR is ⩾ 0.8W/Kg
2. Per KDB 865664 D01v01,if the ratio of largest to smallest SAR for the original and first repeated measurement is ⩽1.2 and the measured SAR ＜1.45W/Kg,only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated measured SAR.

10.11 SAR HANDSETS MULTI XMITER ASSESSMENT

	Position	Applicable Combination
Simultaneous Transmission	Body-worn	WLAN Chain0 + Bluetooth Chain1

Note:

1. Chain0 2.4GHz WLAN and BT share the same antenna, and cannot transmit simultaneously.
   The DUT does not support chain0 and chain1 WLAN simultaneous transmission
2. The reported SAR summation is calculated based on the same configuration and test position.
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05 based on the formula below.
   (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√ f(GHz)/x] W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
   0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Bluetooth:

	Max power	Head (5mm distance)
Estimated SAR (W/kg)	5.2dBm	0.137 W/kg

4. Per KDB 447498 D01v05, simultaneous transmission SAR is compliant if,
   1) Scalar SAR summation < 1.6W/kg.
   2) SPLSR = (SAR1 + SAR2)1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
   If SPLSR ≤ 0.04, simultaneously transmission SAR is compliant
   3) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg

Result of SUM ∑SAR1g for Body worn

SUM ∑SAR1g Chain1 WLAN 2.4G + Chain0 Bluetooth				
Position	Distance	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
	[mm]	WLAN 2.4G	Bluetooth	WLAN + Bluetooth
Rear	0	0.435	0.137	0.572

SUM ∑SAR1g Chain1 WLAN 5G + Chain1 Bluetooth				
Position	Distance	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
	[mm]	WLAN 5G	Bluetooth	WLAN + Bluetooth
Rear	0	1.390	0.137	1.527

11. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Calibration	Calibration Due
P C	HP	Core(rm)3.16G	CZCO48171H	N/A	N/A
Signal Generator	Agilent	83732B	US37101915	05/30/2014	05/29/2015
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	03/17/2014	03/16/2015
Wireless Communication Test Set	R&S	CMU200	SN:109525	01/24/2014	01/23/2015
Power Meter	Agilent	E4416A	GB41292714	3/18/2014	3/17/2015
Peak & Average sensor	Agilent	E9327A	us40441788	3/18/2014	3/17/2015
E-field PROBE	SPEAG	EX3DV4	3798	07/26/2013	07/25/2014
DAE	SD000D04BJ	DEA4	1245	07/25/2013	07/24/2014
E-field PROBE	SPEAG	EX3DV4	3753	03/26/2014	03/25/2015
DAE	SPEAG	DEA4	914	03/26/2014	03/25/2015
DIPOLE 2450MHZ ANTENNA	SPEAG	D2450V2	817	07/31/2013	07/30/2014
DIPOLE 5GHZ ANTENNA	SPEAG	D5GHzV2	1095	05/31/2013	05/28/2015
DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
SAM PHANTOM (ELI4 v4.0)	SPEAG	QDOVA001BB	1102	N/A	N/A
Twin SAM Phantom	SPEAG	QD000P40CD	1609	N/A	N/A
ROBOT	SPEAG	TX60	F10/5E6AA1/A101	N/A	N/A
ROBOT KRC	SPEAG	CS8C	F10/5E6AA1/C101	N/A	N/A
LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A	N/A

12. FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

13. REFERENCES

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14. ATTACHMENTS

Exhibit	Content
1	System Performance Check Plots
2	Dipole calibration report D2450V2 SN: 817
3	Dipole calibration report D5GHzV2 SN: 1095
4	Probe calibration report EX3DV4 SN3798
5	DAE calibration report DEA4 SD000D04BJ SN:1245
6	Probe calibration report EX3DV4 SN3753
7	DAE calibration report DEA4 SD000D04BK SN:914
8	SAR Test Plots

APPENDIX A: DUT AND SAR STEUP PHOTO

APPENDIX B: PLOTS OF PERFORMANCE CHECK

The plots are showing as followings.

Test Laboratory: Compliance Certification Services Inc. Date: 7/9/2014

System Performance Check D2450

DUT: Dipole 2450 MHz; Type: D24500V2; Serial: 817

Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.869 S/m; ε_r = 52.052; ρ = 1000 kg/m^3

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.08, 7.08, 7.08); Calibrated: 7/26/2013;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 14.2 W/kg

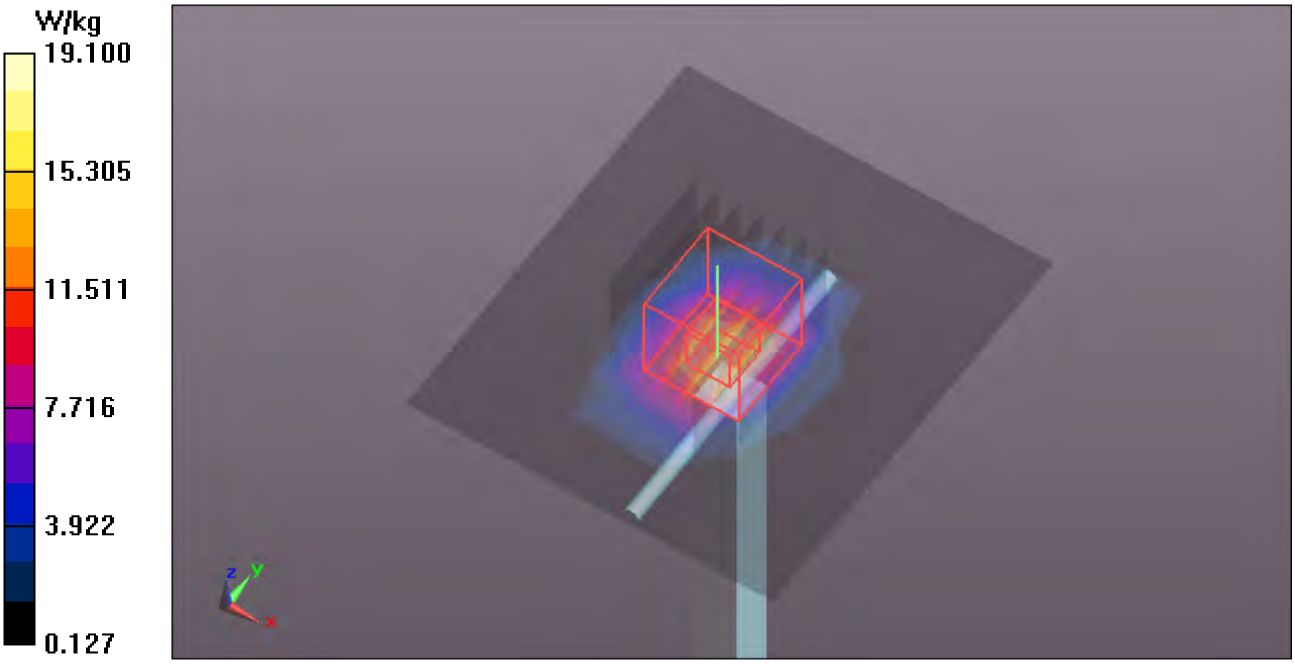
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.34 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 25.8 W/kg

SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.87 W/kg

Maximum value of SAR (measured) = 19.1 W/kg

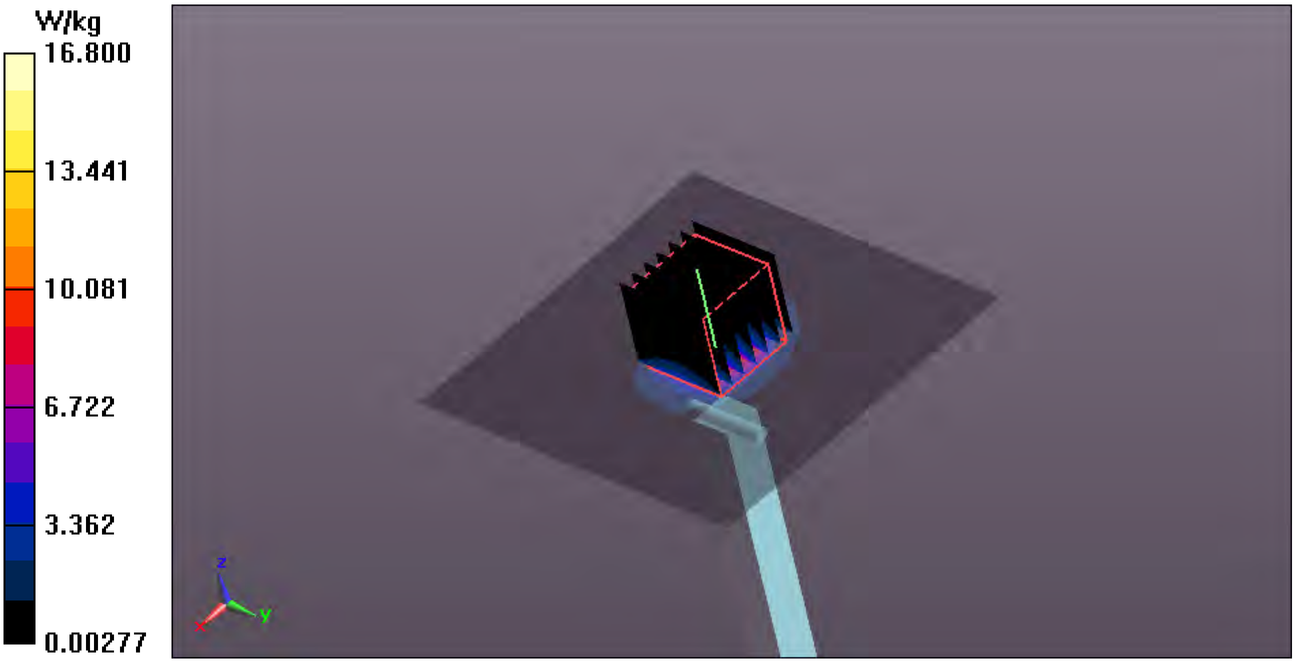


Test Laboratory: Compliance Certification Services Inc. Date: 7/4/2014
System Performance Check-D5200
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095
Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.163 S/m; ε_r = 48.709; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.38, 4.38, 4.38); Calibrated: 7/26/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5200 MHz 2/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.0 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5200 MHz 2/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 69.66 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.47 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 16.8 W/kg



Test Laboratory: Compliance Certification Services Inc. Date: 7/5/2014

System Performance Check-D5300

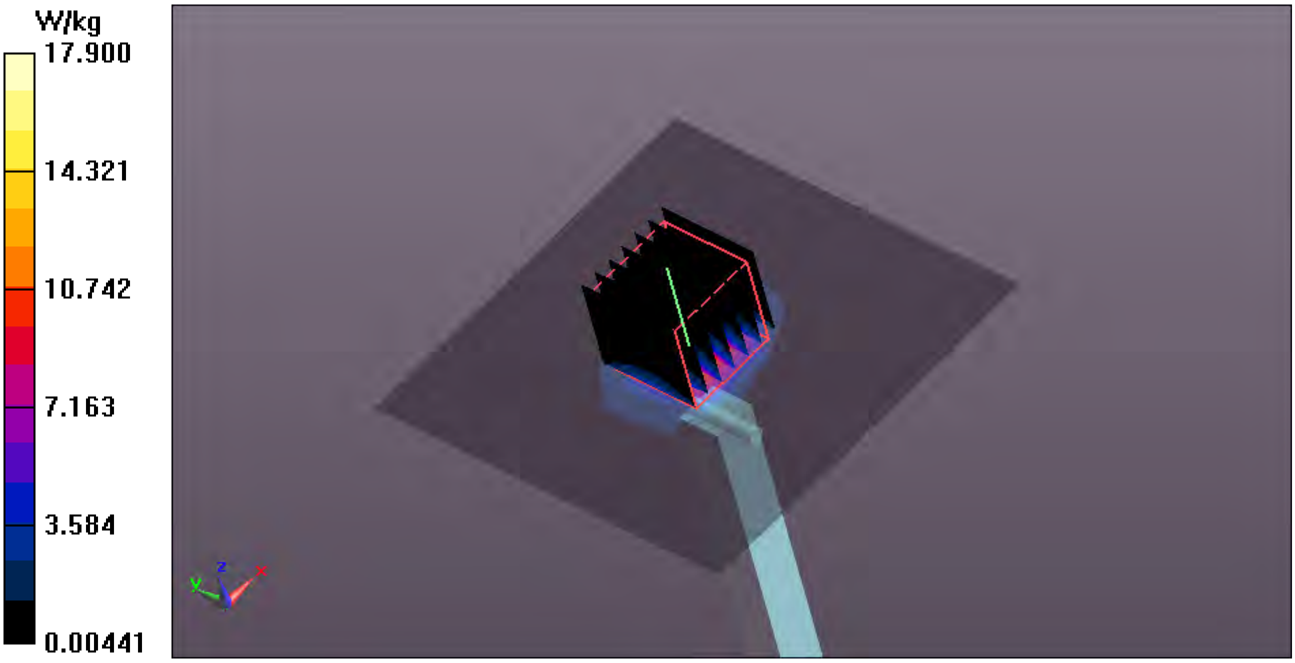
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.285 S/m; ε_r = 48.537; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.22, 4.22, 4.22); Calibrated: 7/26/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5300 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.4 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5300 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 71.30 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 35.3 W/kg
SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 17.9 W/kg



Test Laboratory: Compliance Certification Services Inc. Date: 7/6/2014

System Performance Check-D5500

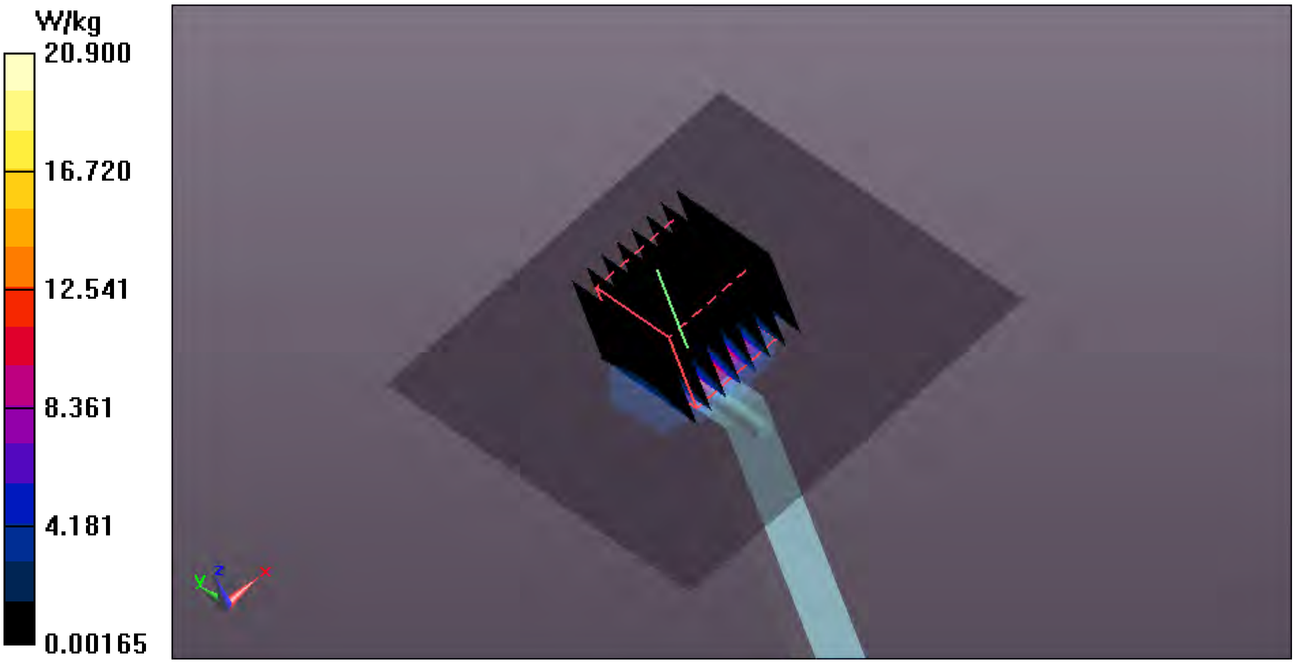
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.542 S/m; ε_r = 48.253; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(3.93, 3.93, 3.93); Calibrated: 7/26/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5500 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.4 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.26 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 37.9 W/kg
SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 20.9 W/kg



Test Laboratory: Compliance Certification Services Inc. Date: 7/6/2014

System Performance Check-D5600

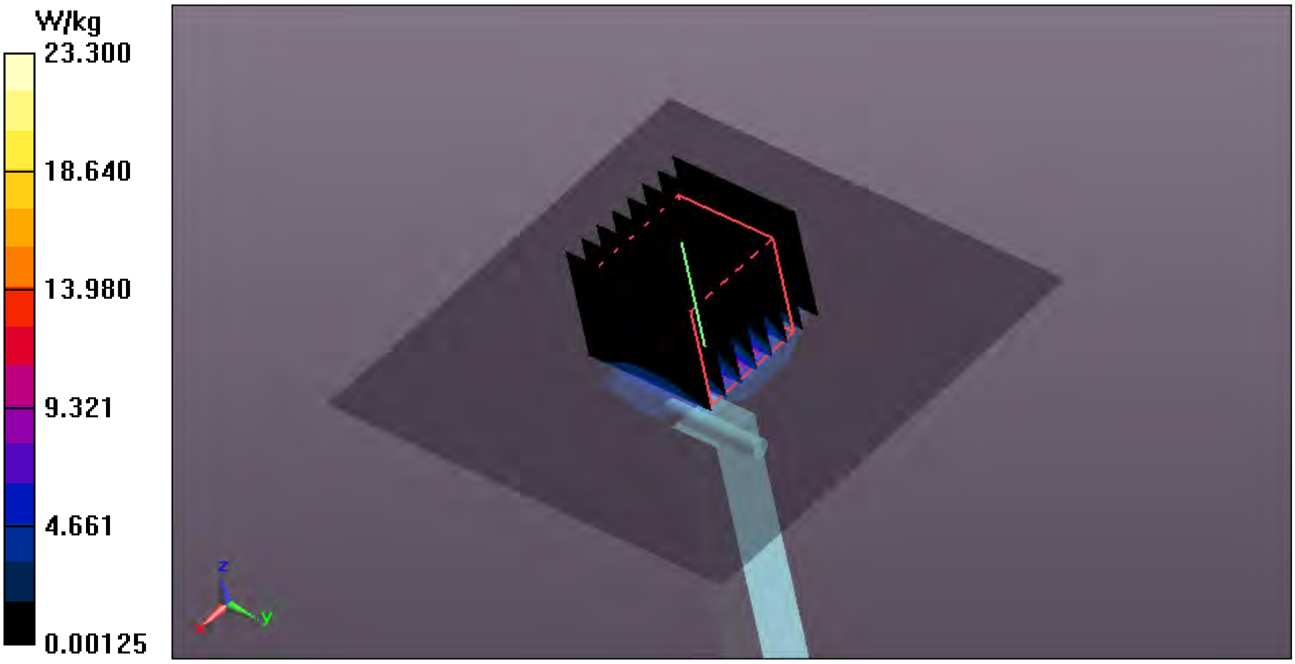
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.764 S/m; ε_r = 48.525; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(3.92, 3.92, 3.92); Calibrated: 7/26/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.6 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.49 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 43.8 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 23.3 W/kg

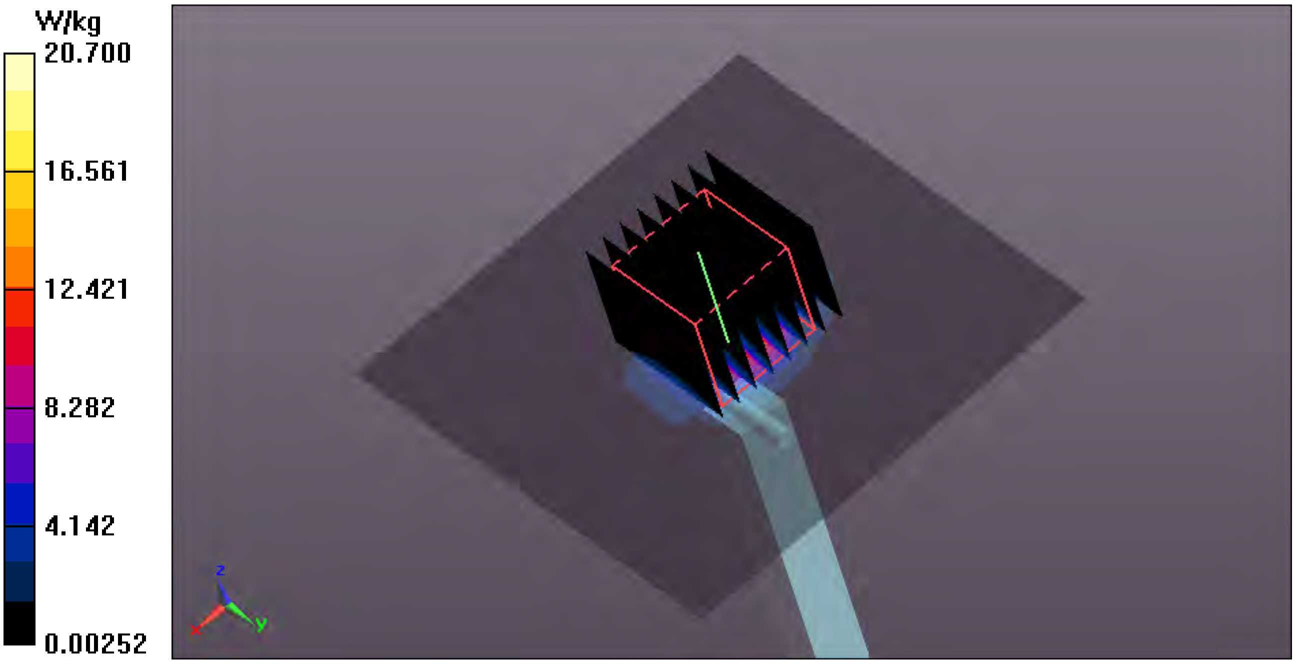


Test Laboratory: Compliance Certification Services Inc. Date: 7/7/2014
System Performance Check-D5800
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095
Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.169 S/m; ε_r = 48.686; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.24, 4.24, 4.24); Calibrated: 7/26/2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/25/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.1 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.86 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 39.0 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 20.7 W/kg



Test Laboratory: Compliance Certification Services Inc. Date: 8/7/2014

System Performance Check 5800

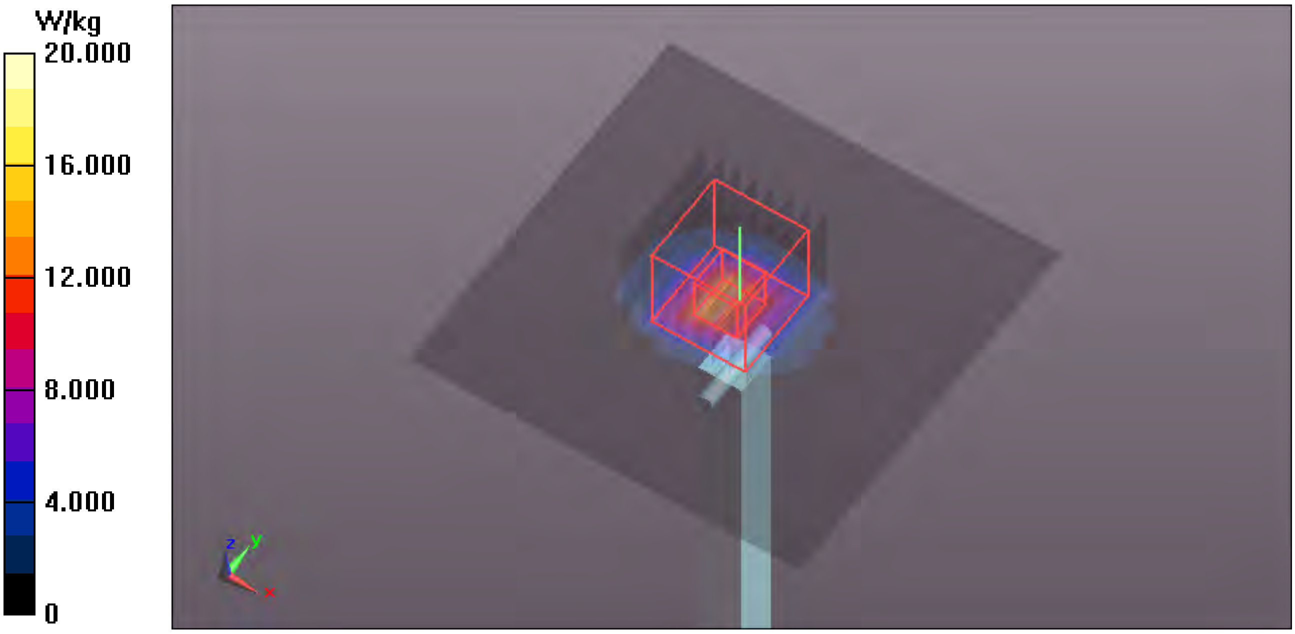
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz);
Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.959 S/m; ε_r = 49.096; ρ = 1000 kg/m^3
Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY Configuration:

- Probe: EX3DV4 - SN3753; ConvF(4.24, 4.24, 4.24); Calibrated: 3/26/2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn914; Calibrated: 12/18/2013
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.6 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.73 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 38.1 W/kg
SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 20.0 W/kg



APPENDIX C: DASY CALIBRATION CERTIFICATE

The DASY Calibration Certificates are showing as followings .

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

S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 108

Client **CCS-CN (Auden)**

Certificate No: **D2450V2-817_Jul13**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 817

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

Calibration date: July 31, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: July 31, 2013

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Certificate No: D2450V2-817_Jul13 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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.81 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 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	50.5 ± 6 %	2.01 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	**49.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.87 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω + 2.9 jΩ
Return Loss	- 27.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 4.5 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 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	October 23, 2007

DASY5 Validation Report for Head TSL

Date: 31.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

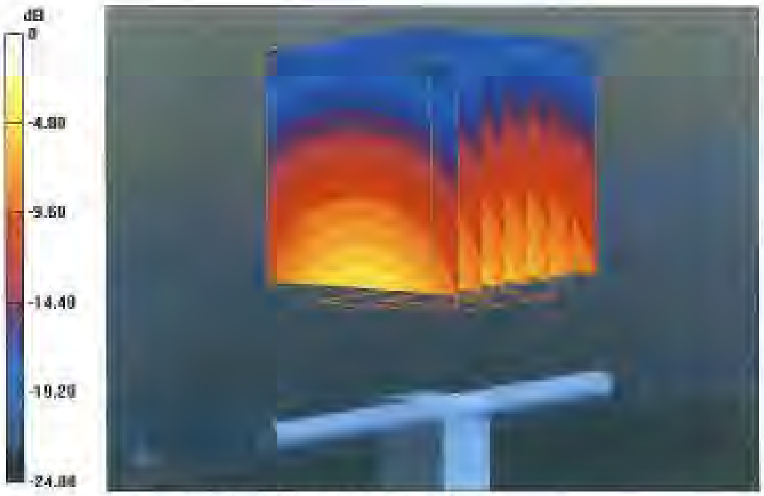
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

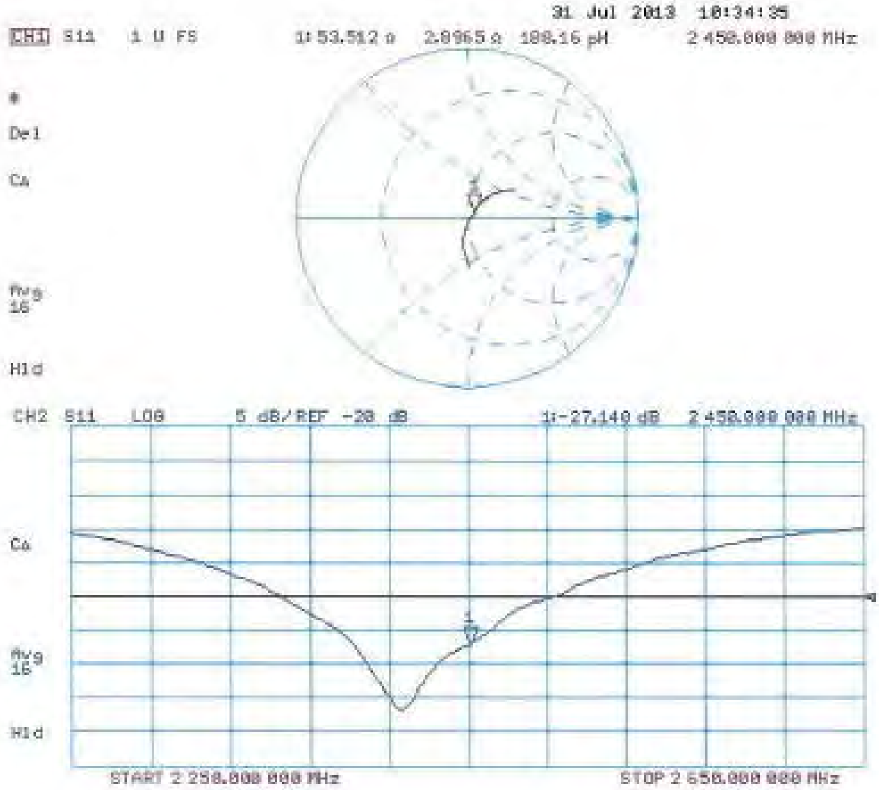
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.781 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.18 W/kg
Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-817_Jul13 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 31.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

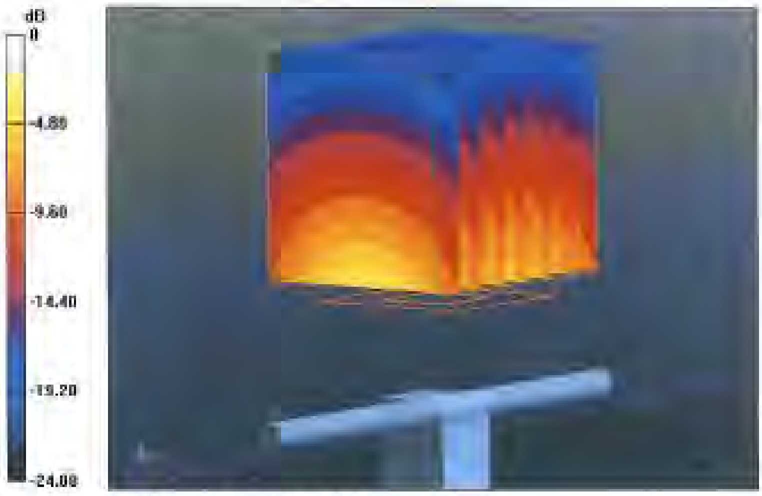
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ε_r = 50.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

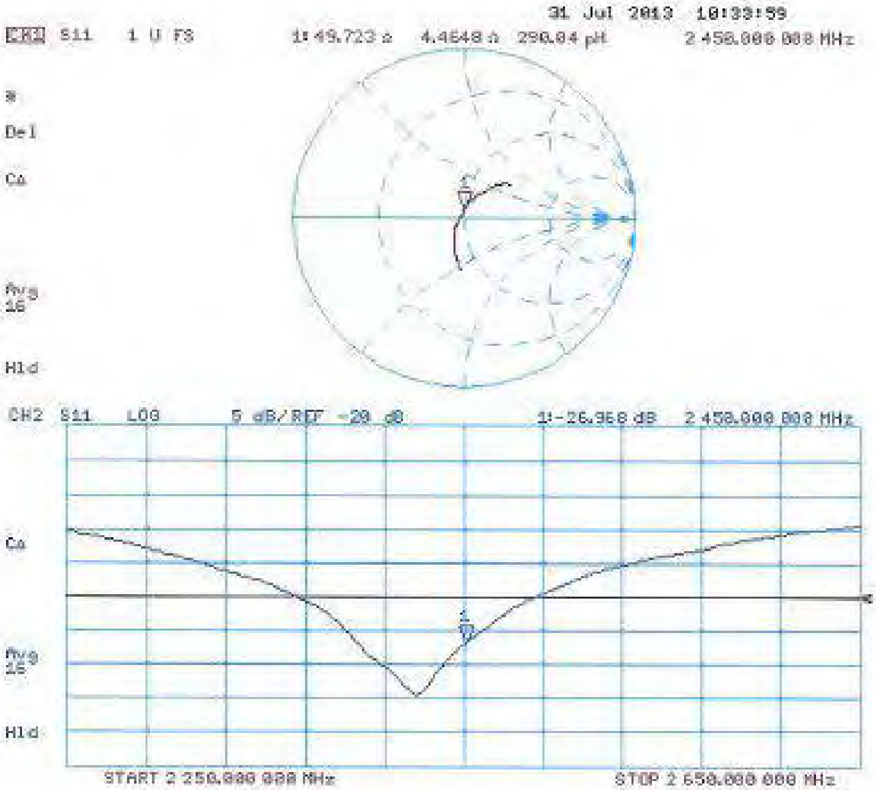
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.151 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.87 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



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

Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-817_Jul13 Page 8 of 8

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Accreditation No.: SCS 108

Client **CCS-CN (Auden)**

Certificate No: **D5GHzV2-1095_May13**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1095
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	May 31, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 31, 2013

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Certificate No: D5GHzV2-1095_May13 Page 1 of 16

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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) 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) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

c) 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	V52.8.6
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	36.5 ± 6 %	4.50 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	7.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 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	36.3 ± 6 %	4.60 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	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.1 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 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	36.1 ± 6 %	4.79 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	8.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 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	36.0 ± 6 %	4.89 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	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 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	35.7 ± 6 %	5.11 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	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 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	49.6 ± 6 %	5.41 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	7.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 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	49.4 ± 6 %	5.53 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	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.3 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	49.1 ± 6 %	5.80 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.0 ± 6 %	5.80 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	7.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 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	48.6 ± 6 %	6.24 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	7.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.2 Ω - 6.4 jΩ
Return Loss	- 23.9 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.2 Ω - 3.3 jΩ
Return Loss	- 29.6 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	53.2 Ω - 2.2 jΩ
Return Loss	- 28.5 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 1.1 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.4 Ω - 2.8 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	50.7 Ω - 5.3 jΩ
Return Loss	- 25.5 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	50.8 Ω - 1.5 jΩ
Return Loss	- 35.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	53.8 Ω - 1.2 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.2 Ω + 1.1 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.6 Ω + 0.3 jΩ
Return Loss	- 25.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.208 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 24, 2010

DASY5 Validation Report for Head TSL

Date: 30.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095

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 = 4.5 S/m; ε_r = 36.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.6 S/m; ε_r = 36.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.79 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.89 S/m; ε_r = 36; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.11 S/m; ε_r = 35.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

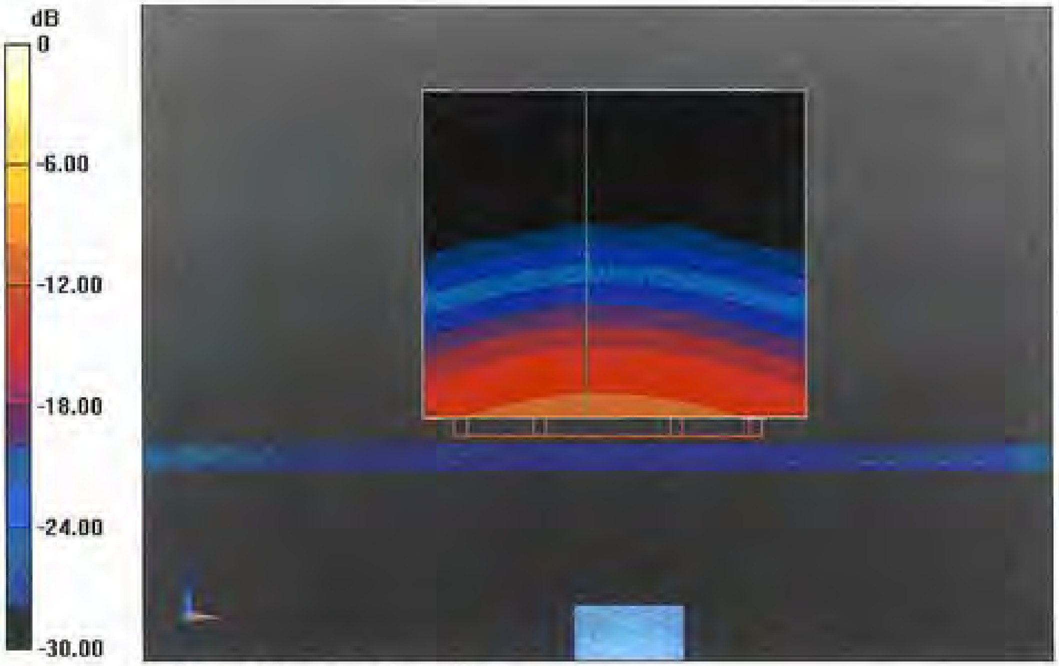
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.153 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 18.3 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 = 65.596 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 19.3 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 = 65.084 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 33.1 W/kg
SAR(1 g) = 8.42 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 20.0 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 = 64.341 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

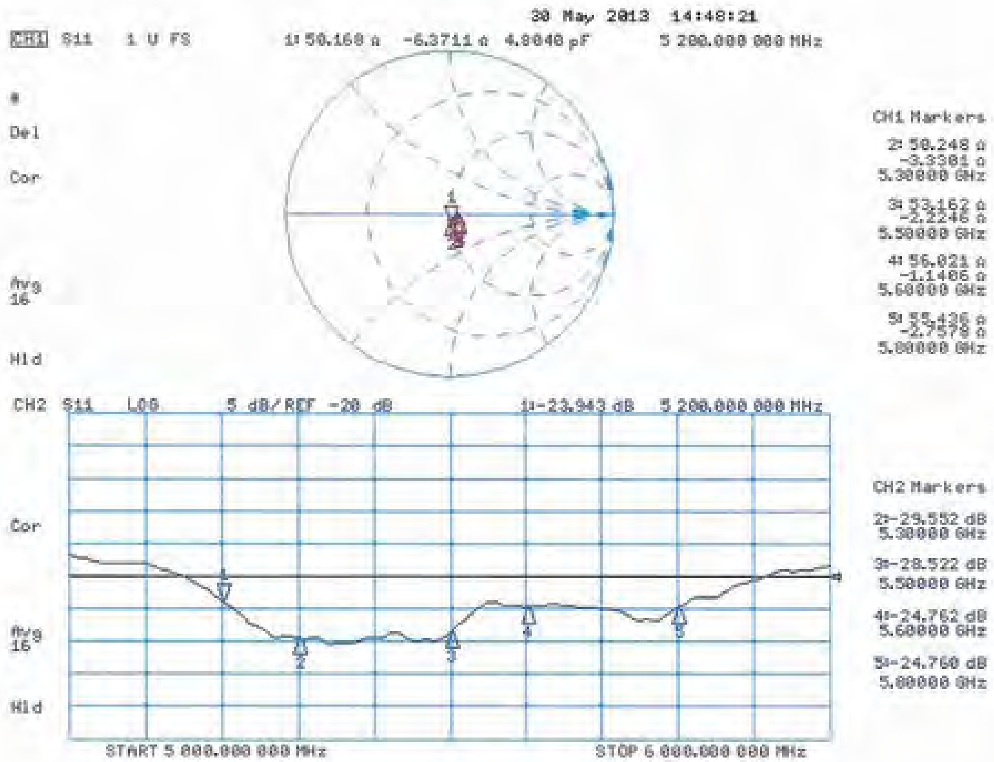
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.473 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.2 W/kg



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

Certificate No: D5GHzV2-1095_May13 Page 12 of 16

Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1095_May13 Page 13 of 16

DASY5 Validation Report for Body TSL

Date: 31.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095

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 = 5.41 S/m; ε_r = 49.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.53 S/m; ε_r = 49.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.8 S/m; ε_r = 49.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.8 S/m; ε_r = 49; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.24 S/m; ε_r = 48.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

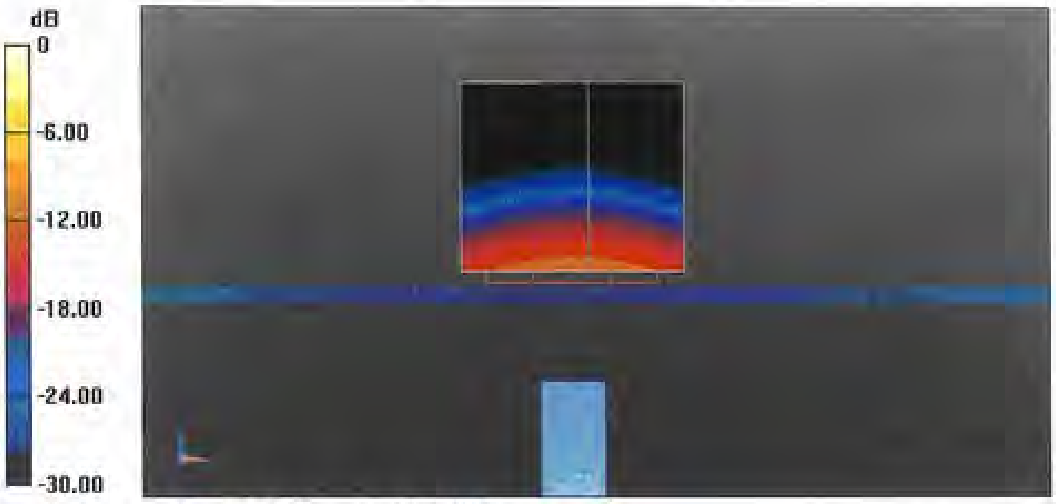
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.744 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 29.0 W/kg
SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 17.0 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 = 58.871 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 17.5 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 = 58.666 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 18.7 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 = 58.108 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 34.2 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 18.5 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 = 55.451 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 34.6 W/kg
SAR(1 g) = 7.47 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

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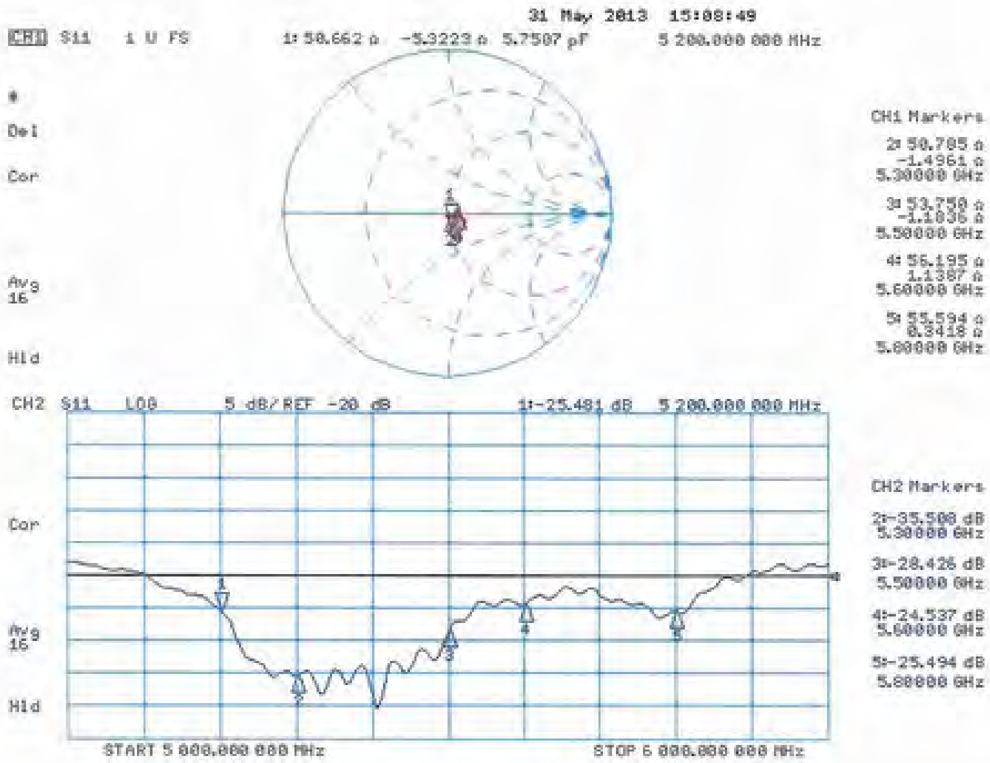
Impedance Measurement Plot for Body TSL



Certificate No: D5GHzV2-1095_May13 Page 16 of 16

D5GHzV2,Serial No.1095 Extended Dipole Calibrations

Per KDB 865664 D01,if dipoles are verified in return loss(<-20dB,within 20% of prior calibration),and in impedance (within 5 ohm of prior calibration),the annual calibration is not necessary and the calibration interval can be extended.

Justification of the extended calibration

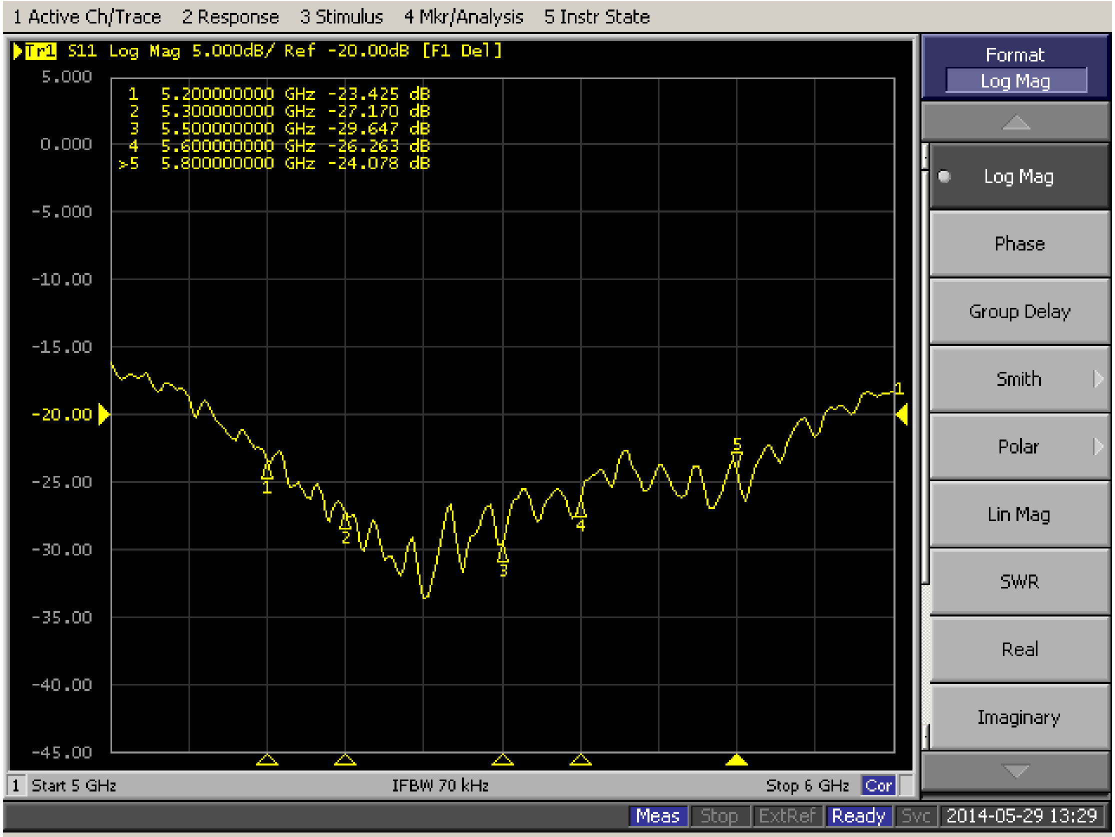
D5GHzV2 Serial No.1095							
Head							
Date of Measurement		Return Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
5200MHz	5.31.2013	-23.943	--	50.168	--	-6.371	--
	5.29.2014	-23.425	2.16	50.749	0.581	-6.752	0.381
5300MHz	5.31.2013	-29.552	--	50.248	--	-3.330	--
	5.29.2014	-27.170	8.06	49.802	0.446	-4.424	1.094
5500MHz	5.31.2013	-28.522	--	53.162	--	-2.225	--
	5.29.2014	-29.647	3.94	52.249	0.913	-2.350	0.125
5600MHz	5.31.2013	-24.762	--	56.021	--	-1.141	--
	5.29.2014	-26.263	6.06	54.956	1.065	-1.291	0.150
5800MHz	5.31.2013	-24.760	--	55.436	--	-2.758	--
	5.29.2014	-24.078	2.75	56.550	1.114	-1.310	1.448

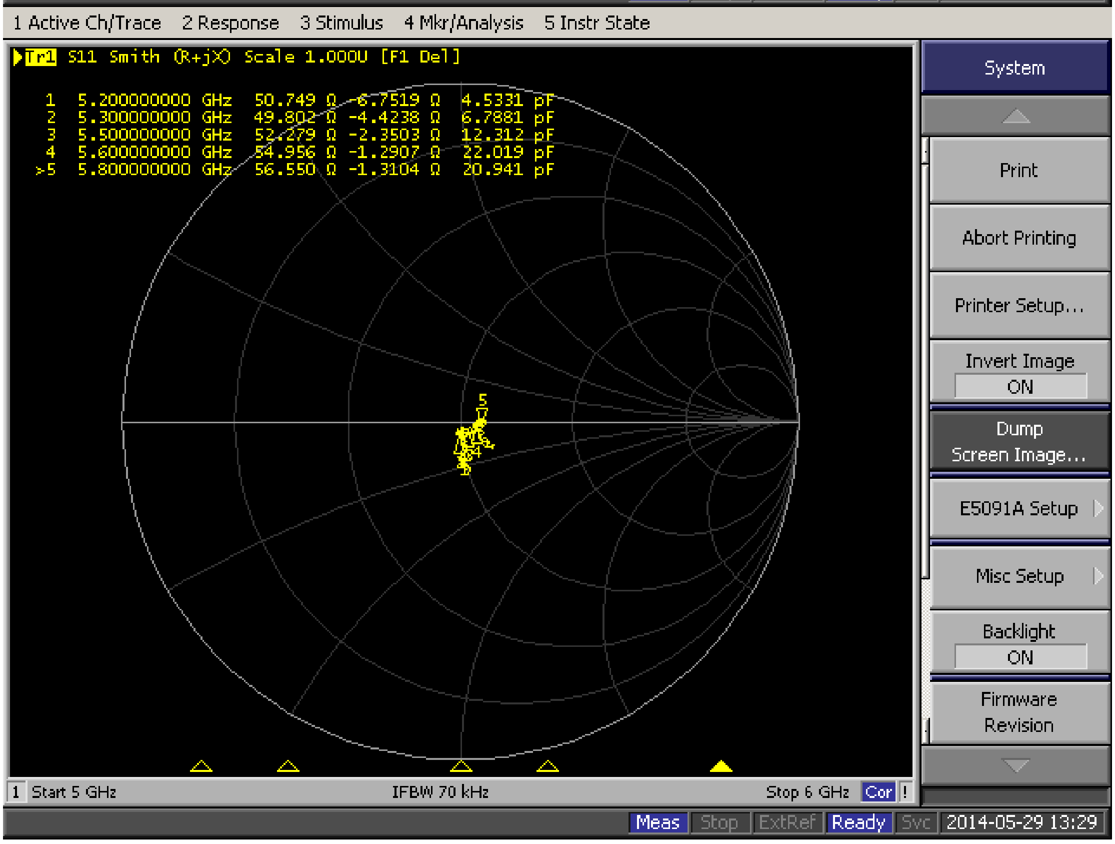
D5GHzV2 Serial No.1095							
Body							
Date of Measurement		Return Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
5200MHz	5.31.2013	-25.481	--	50.662	--	-5.322	--
	5.29.2014	-23.945	6.03	50.975	0.313	-6.336	1.014
5300MHz	5.31.2013	-35.508	--	50.785	--	-1.496	--
	5.29.2014	-31.173	12.21	49.992	0.793	-2.732	1.236
5500MHz	5.31.2013	-28.426	--	53.750	--	-1.184	--
	5.29.2014	-28.353	0.26	52.867	0.883	-2.742	1.558
5600MHz	5.31.2013	-24.537	--	56.195	--	1.139	--
	5.29.2014	-24.330	0.84	56.344	0.149	0.347	0.792
5800MHz	5.31.2013	-25.494	--	55.594	--	0.342	--
	5.29.2014	-24.908	2.30	55.887	0.293	-1.203	1.545

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration.Therefore the verification result should support extended calibration.

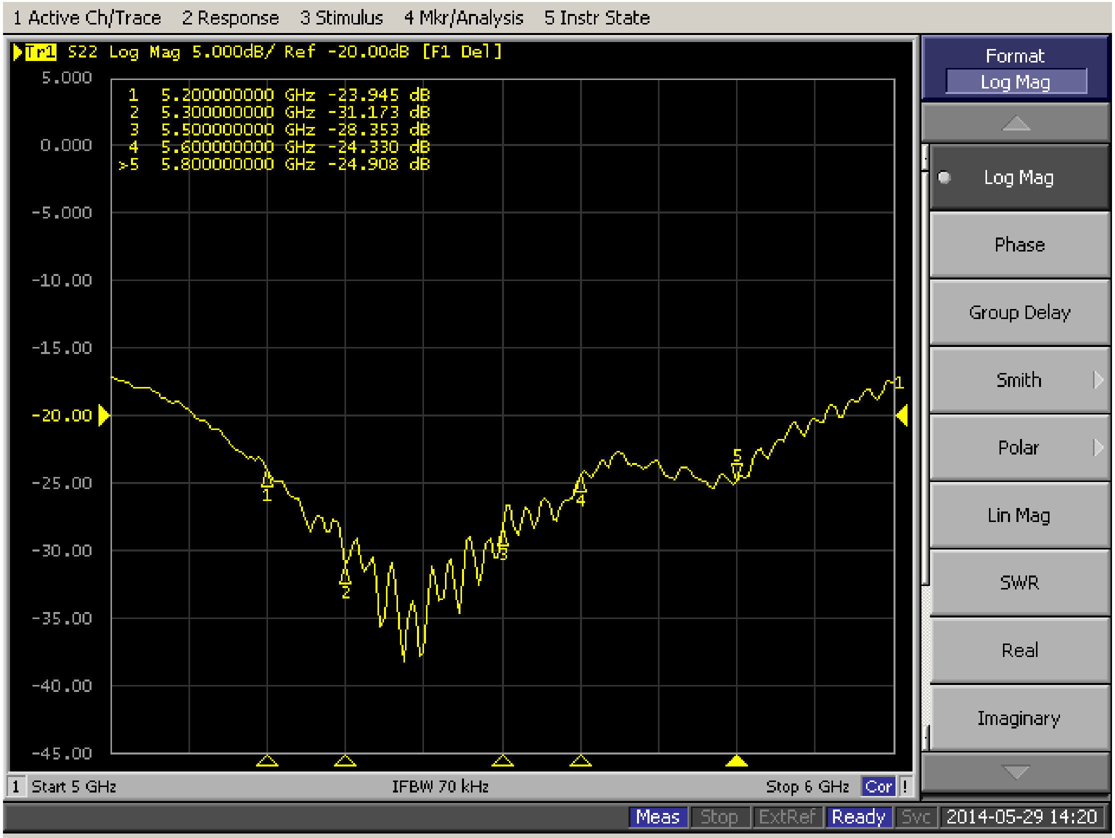
Dipole Verification Data D5GHzV2 Serial No.1095

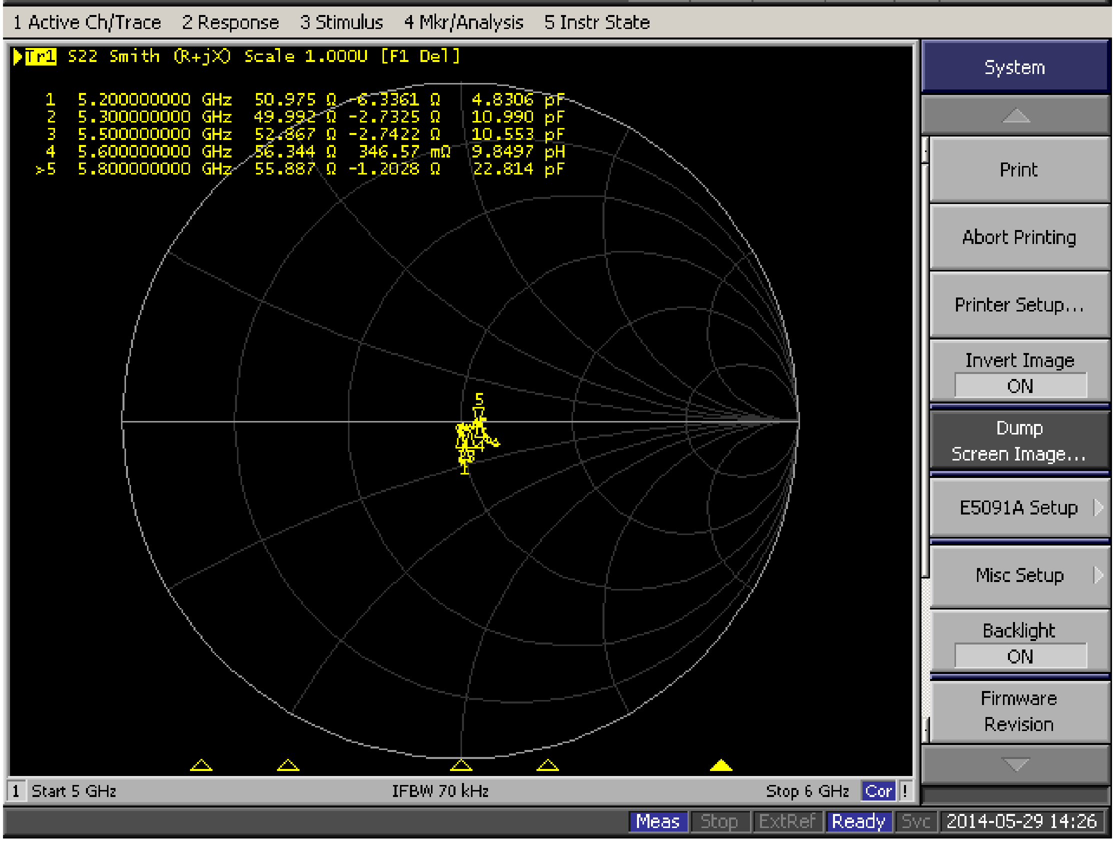
D5GHzV2-Head





D5GHzV2-Body





Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

1245

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 108**

Client **CCS-CN (Auden)**

Certificate No: **DAE4-1245_Jul13**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 1245

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

Calibration date: July 25, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	02-Oct-12 (No:12728)	Oct-13
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

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

Issued: July 25, 2013

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

Certificate No: DAE4-1245_Jul13 Page 1 of 5

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Multilateral Agreement for the recognition of calibration certificates

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	405.940 ± 0.02% (k=2)	404.664 ± 0.02% (k=2)	405.801 ± 0.02% (k=2)
Low Range	4.00386 ± 1.50% (k=2)	3.98278 ± 1.50% (k=2)	4.02487 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	30.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199992.97	-4.47	-0.00
Channel X	+ Input	20001.91	0.89	0.00
Channel X	- Input	-19999.11	1.66	-0.01
Channel Y	+ Input	199994.30	-3.32	-0.00
Channel Y	+ Input	20001.64	0.75	0.00
Channel Y	- Input	-20000.51	0.28	-0.00
Channel Z	+ Input	199995.90	-1.30	-0.00
Channel Z	+ Input	20000.30	-0.60	-0.00
Channel Z	- Input	-19999.90	0.89	-0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.51	0.38	0.02
Channel X	+ Input	201.72	0.21	0.11
Channel X	- Input	-198.76	-0.28	0.14
Channel Y	+ Input	2000.72	-0.41	-0.02
Channel Y	+ Input	199.98	-1.50	-0.74
Channel Y	- Input	-198.85	-0.28	0.14
Channel Z	+ Input	2000.21	-0.84	-0.04
Channel Z	+ Input	200.77	-0.56	-0.28
Channel Z	- Input	-199.95	-1.29	0.65

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	-8.24	-10.01
	- 200	10.27	8.63
Channel Y	200	-7.32	-7.74
	- 200	6.53	6.34
Channel Z	200	-5.94	-6.42
	- 200	5.13	4.65

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	-	4.16	-2.61
Channel Y	200	8.79	-	3.99
Channel Z	200	9.96	7.22	-

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	15874	16183
Channel Y	16451	15694
Channel Z	15932	15717

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	0.94	-0.24	2.04	0.48
Channel Y	-0.42	-1.91	0.54	0.47
Channel Z	-0.83	-2.62	0.57	0.60

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

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Accreditation No.: **SCS 108**

Client **CCS-CN (Auden)**

Certificate No: **EX3-3798_Jul13**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3798

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: July 26, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 26, 2013

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Certificate No: EX3-3798_Jul13 Page 1 of 11

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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

Calibration is Performed According to the Following Standards:

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

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.

Probe EX3DV4

SN:3798

Manufactured: April 5, 2011
Calibrated: July 26, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3798

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.54	0.51	0.59	± 10.1 %
DCP (mV)[B]	95.9	98.8	98.6	

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	164.4	±3.0 %
		Y	0.0	0.0	1.0		168.1	
		Z	0.0	0.0	1.0		130.9	

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:3798

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	Depth (mm)	Unct. (k=2)
835	41.5	0.90	9.16	9.16	9.16	0.35	0.94	± 12.0 %
900	41.5	0.97	9.01	9.01	9.01	0.35	0.93	± 12.0 %
1810	40.0	1.40	7.79	7.79	7.79	0.73	0.59	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.68	0.62	± 12.0 %
2000	40.0	1.40	7.73	7.73	7.73	0.80	0.58	± 12.0 %
2450	39.2	1.80	7.08	7.08	7.08	0.66	0.62	± 12.0 %
5200	36.0	4.66	4.85	4.85	4.85	0.37	1.80	± 13.1 %
5300	35.9	4.76	4.71	4.71	4.71	0.38	1.80	± 13.1 %
5500	35.6	4.96	4.76	4.76	4.76	0.36	1.80	± 13.1 %
5600	35.5	5.07	4.51	4.51	4.51	0.42	1.80	± 13.1 %
5800	35.3	5.27	4.48	4.48	4.48	0.40	1.80	± 13.1 %

[C] Frequency validity 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.
[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.

EX3DV4 - SN:3798 July 26, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3798

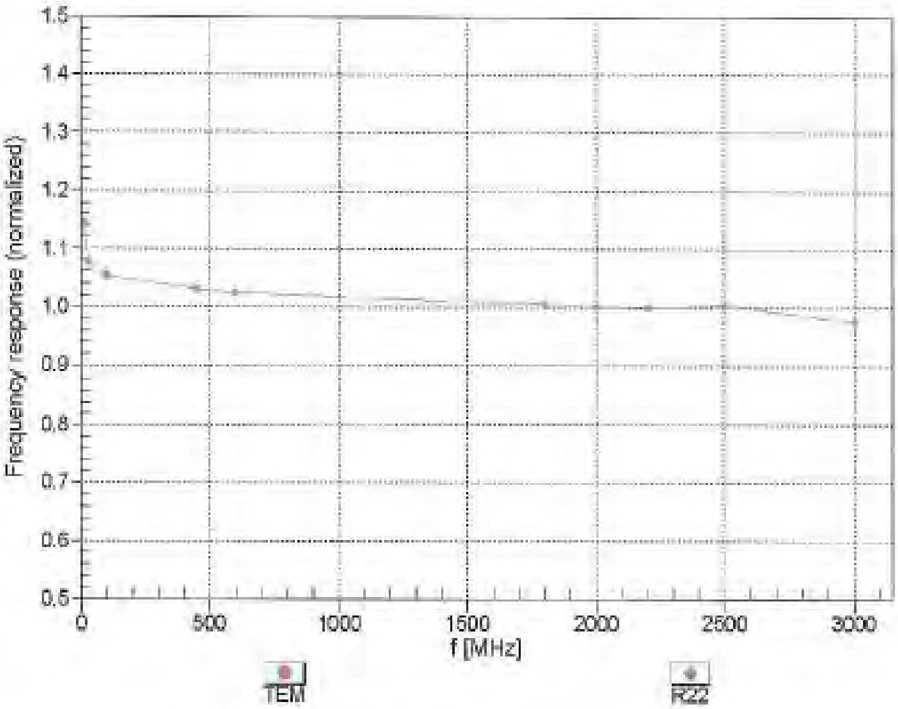
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	9.27	9.27	9.27	0.49	0.84	± 12.0 %
900	55.0	1.05	9.11	9.11	9.11	0.80	0.62	± 12.0 %
1810	53.3	1.52	7.45	7.45	7.45	0.37	0.88	± 12.0 %
1900	53.3	1.52	7.32	7.32	7.32	0.37	0.86	± 12.0 %
2000	53.3	1.52	7.54	7.54	7.54	0.29	1.01	± 12.0 %
2450	52.7	1.95	7.08	7.08	7.08	0.80	0.57	± 12.0 %
5200	49.0	5.30	4.38	4.38	4.38	0.41	1.90	± 13.1 %
5300	48.9	5.42	4.22	4.22	4.22	0.41	1.90	± 13.1 %
5500	48.6	5.65	3.93	3.93	3.93	0.46	1.90	± 13.1 %
5600	48.5	5.77	3.92	3.92	3.92	0.38	1.90	± 13.1 %
5800	48.2	6.00	4.24	4.24	4.24	0.46	1.90	± 13.1 %

[C] Frequency validity 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.
[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.

Frequency Response of E-Field

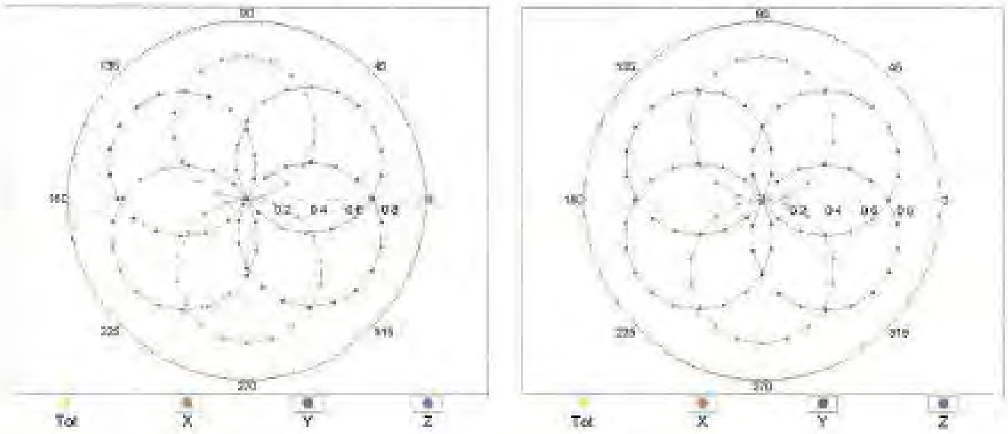
(TEM-Cell:ifi110 EXX, Waveguide: R22)

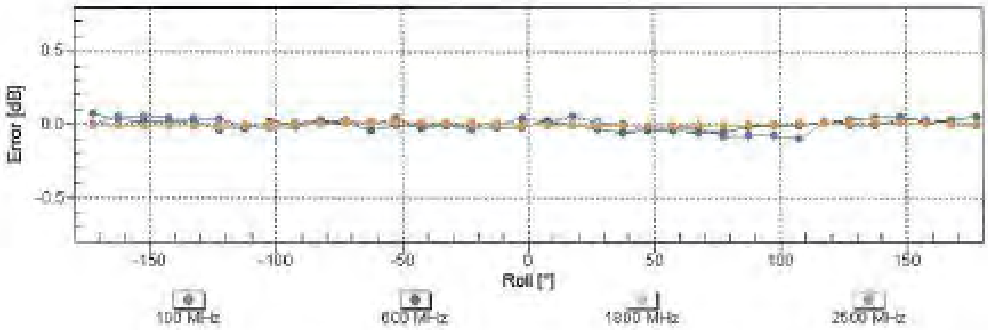


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22



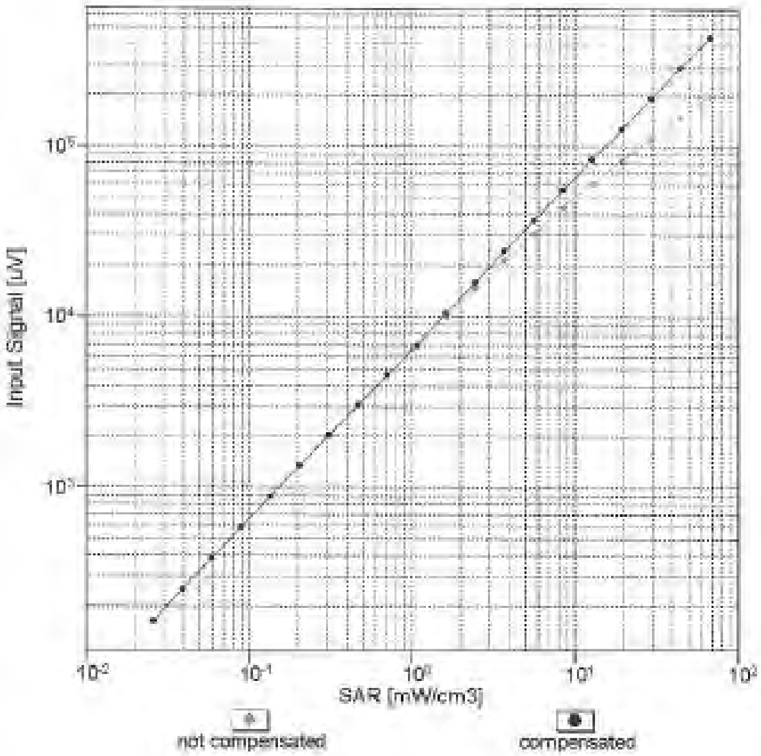


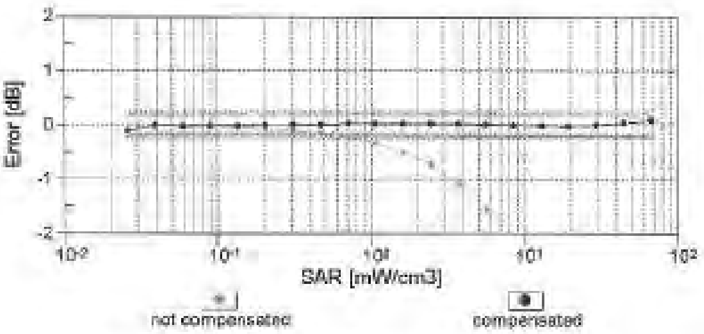
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3798 July 26, 2013

Dynamic Range f(SAR$_{head}$)

(TEM cell , f = 900 MHz)





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

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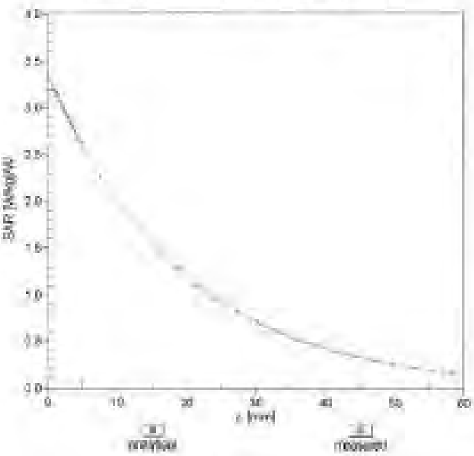
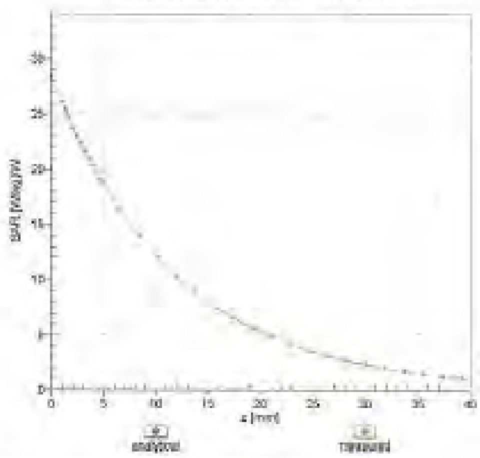
EX3DV4– SN:3798 July 26, 2013

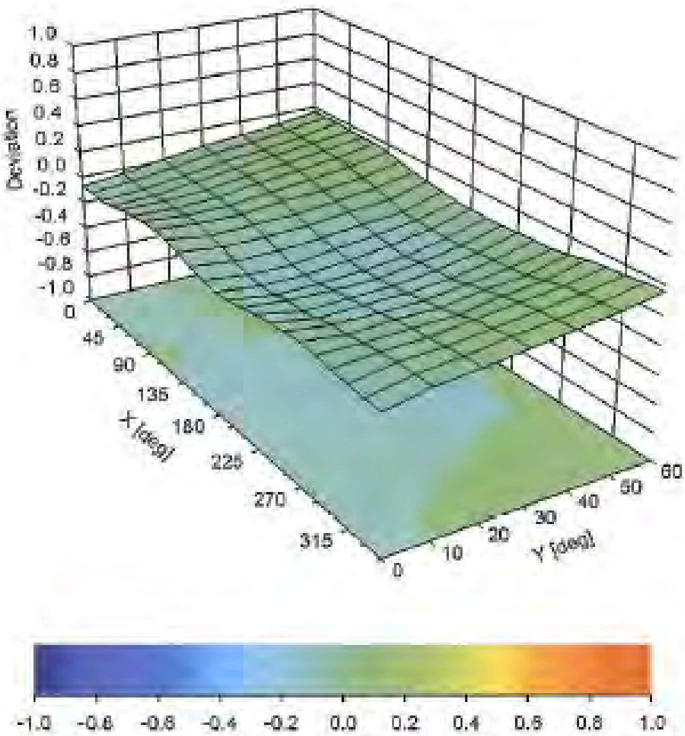
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3798

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-42.4
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	2 mm

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s p e a g

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IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

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Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **DAE4-914_Dec13**

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BK - SN: 914

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

Calibration date: December 18, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
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-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: December 18, 2013

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Certificate No: DAE4-914_Dec13 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	405.118 ± 0.02% (k=2)	404.310 ± 0.02% (k=2)	403.890 ± 0.02% (k=2)
Low Range	3.98952 ± 1.50% (k=2)	3.98612 ± 1.50% (k=2)	3.99042 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	64.5 ° ± 1 °

Certificate No: DAE4-914_Dec13 Page 3 of 5

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200035.19	-0.12	-0.00
Channel X	+ Input	20001.72	-1.52	-0.01
Channel X	- Input	-20006.18	0.51	-0.00
Channel Y	+ Input	200036.49	1.00	0.00
Channel Y	+ Input	19999.76	-3.26	-0.02
Channel Y	- Input	-20007.63	-0.81	0.00
Channel Z	+ Input	200035.76	0.54	0.00
Channel Z	+ Input	20000.37	-2.65	-0.01
Channel Z	- Input	-20008.14	-1.30	0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	1999.47	-0.12	-0.01
Channel X	+ Input	199.91	0.38	0.19
Channel X	- Input	-200.52	-0.12	0.06
Channel Y	+ Input	1999.45	-0.10	-0.00
Channel Y	+ Input	199.13	-0.35	-0.18
Channel Y	- Input	-200.77	-0.27	0.13
Channel Z	+ Input	1999.45	0.04	0.00
Channel Z	+ Input	198.18	-1.21	-0.61
Channel Z	- Input	-201.73	-1.15	0.57

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	-12.42	-14.05
	- 200	15.91	14.42
Channel Y	200	-5.09	-5.23
	- 200	4.77	4.36
Channel Z	200	4.87	4.87
	- 200	-7.31	-7.72

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	-	2.26	-3.82
Channel Y	200	7.97	-	3.05
Channel Z	200	9.34	6.11	-

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	16145	15538
Channel Y	16158	16194
Channel Z	16035	16180

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	1.33	0.47	2.40	0.34
Channel Y	0.79	-1.05	2.82	0.74
Channel Z	-1.14	-2.26	1.30	0.66

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

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ilac-MRA CNAS 校准 CNAS L0442

Client: Auden Certificate No: Z14-97009

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3753

Calibration Procedure(s): TMC-OS-E-02-195
Calibration Procedures for Dosimetric E-field Probes

Calibration date: March 26, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	03-Sep-13(SPEAG,No.EX3-3846_Sep13)	Sep-14
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
DAE4	SN 915	11-Jun-13 (SPEAG, DAE4-915_Jun13)	Jun -14
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: March 28, 2014

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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 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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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 (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;VRx,y,z:*A,B,C 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≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued 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±50MHz to±100MHz.
- *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).

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Probe EX3DV4

SN: 3753

Calibrated: March 26, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: Z14-97009 Page 3 of 11

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DASY – Parameters of Probe: EX3DV4 - SN: 3753

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.45	0.29	0.45	±10.8%
DCP(mV)[B]	103.6	105.4	103.2	

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	185.5	±2.2%
		Y	0.0	0.0	1.0		140.5	
		Z	0.0	0.0	1.0		182.2	

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

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DASY – Parameters of Probe: EX3DV4 - SN: 3753

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)
750	41.9	0.89	9.48	9.48	9.48	1.17	0.55	±12%
850	41.5	0.92	9.13	9.13	9.13	0.20	1.08	±12%
900	41.5	0.97	9.35	9.35	9.35	0.08	1.64	±12%
1750	40.1	1.37	8.06	8.06	8.06	0.18	1.40	±12%
1900	40.0	1.40	7.91	7.91	7.91	0.20	1.28	±12%
2000	40.0	1.40	7.86	7.86	7.86	0.14	2.71	±12%
2450	39.2	1.80	7.29	7.29	7.29	0.65	0.70	±12%
5200	36.0	4.66	4.83	4.83	4.83	0.38	1.09	±13%
5300	35.9	4.76	4.92	4.92	4.92	0.40	1.25	±13%
5500	35.6	4.96	4.80	4.80	4.80	0.38	1.39	±13%
5600	35.5	5.07	4.65	4.65	4.65	0.41	1.33	±13%
5800	35.3	5.27	4.58	4.58	4.58	0.43	1.42	±13%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequency 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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DASY – Parameters of Probe: EX3DV4 - SN: 3753

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)
750	55.5	0.96	9.54	9.54	9.54	1.97	0.55	±12%
850	55.2	0.99	9.14	9.14	9.14	0.20	1.23	±12%
900	55.0	1.05	9.12	9.12	9.12	0.27	1.02	±12%
1750	53.4	1.49	7.80	7.80	7.80	0.15	2.08	±12%
1900	53.3	1.52	7.49	7.49	7.49	0.15	2.30	±12%
2000	53.3	1.52	7.83	7.83	7.83	0.15	3.24	±12%
2450	52.7	1.95	7.31	7.31	7.31	0.55	0.80	±12%
2600	52.5	2.16	6.93	6.93	6.93	0.55	0.79	±12%
3500	51.3	3.31	6.60	6.60	6.60	0.36	1.26	±13%
5200	49.0	5.30	4.67	4.67	4.67	0.39	1.24	±13%
5300	48.9	5.42	4.42	4.42	4.42	0.43	1.43	±13%
5500	48.6	5.65	4.21	4.21	4.21	0.39	1.70	±13%
5600	48.5	5.77	4.15	4.15	4.15	0.43	1.66	±13%
5800	48.2	6.00	4.24	4.24	4.24	0.44	1.62	±13%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequency 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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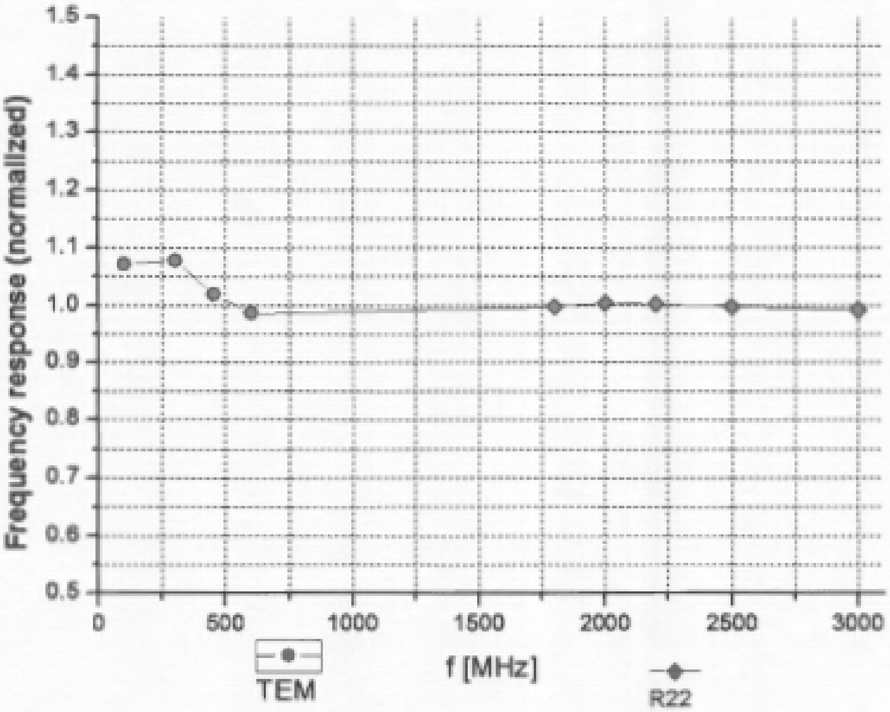
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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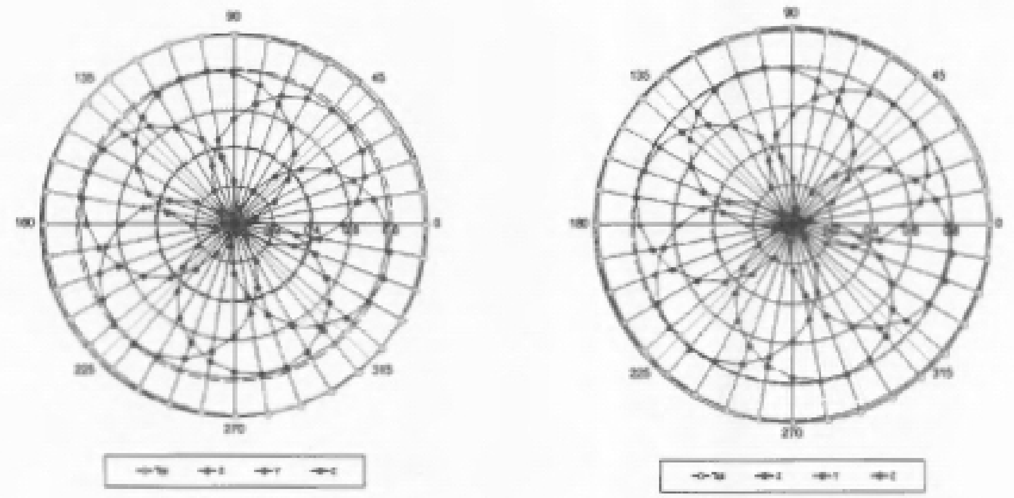
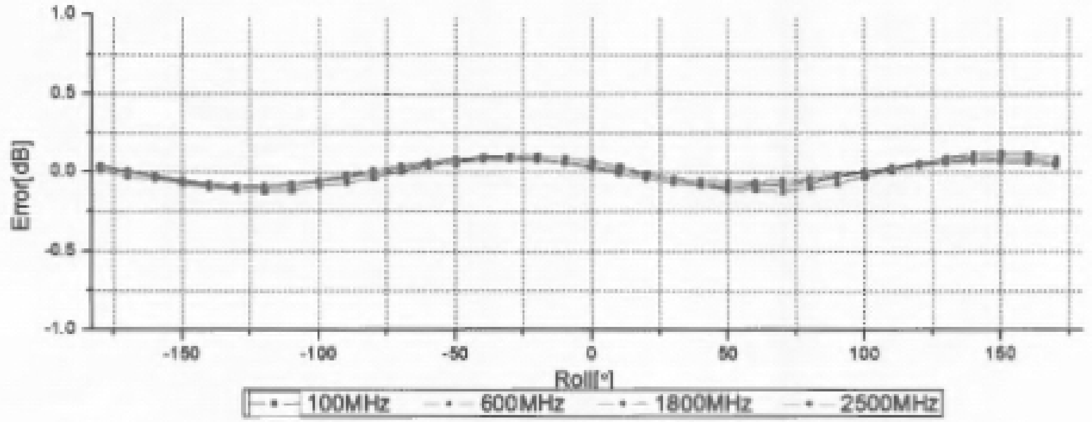
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM **f=1800 MHz, R22**





Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)

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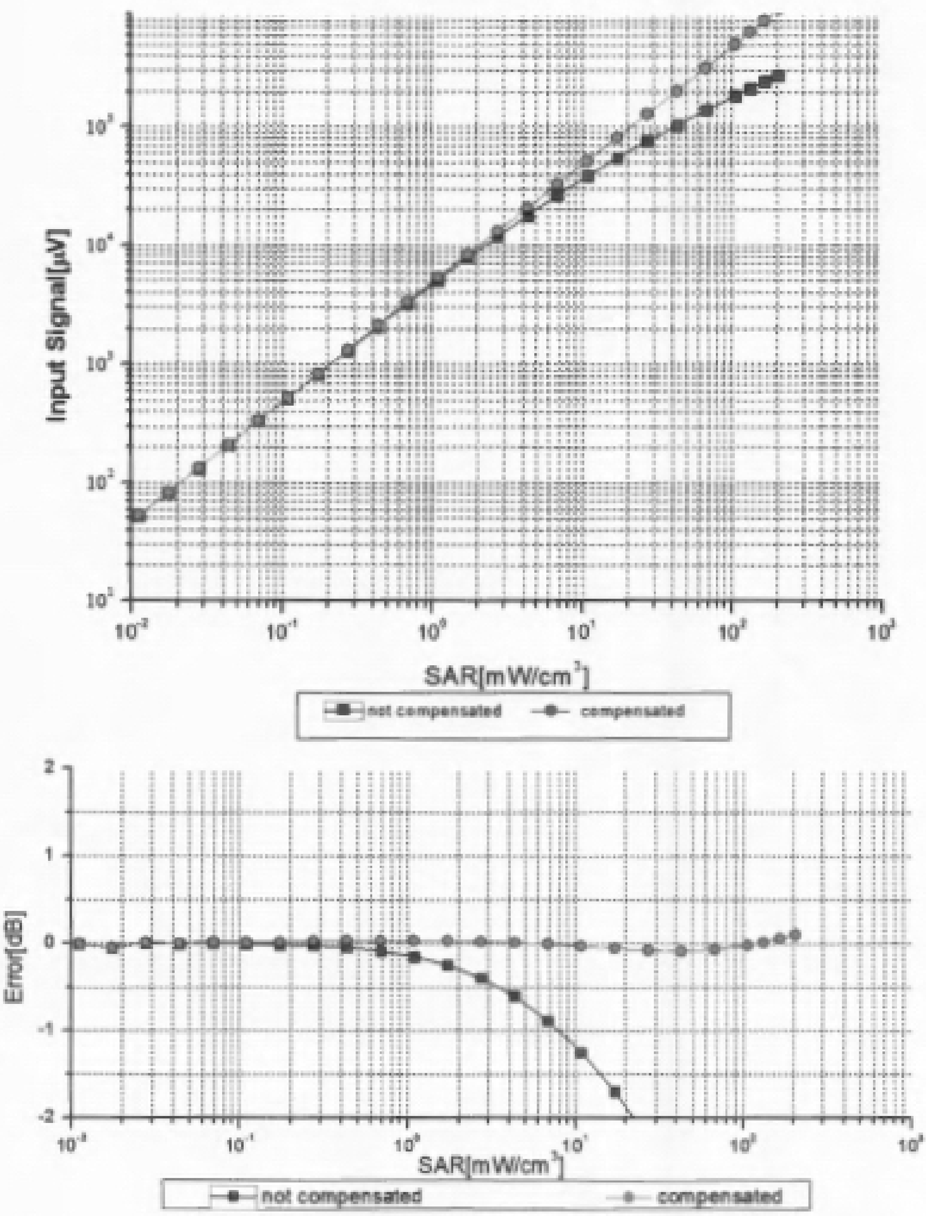
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)

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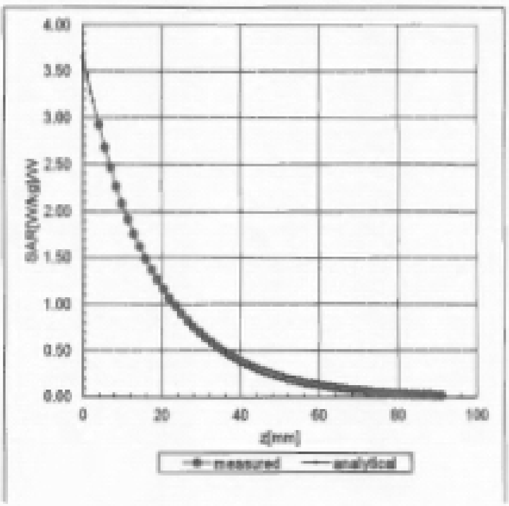
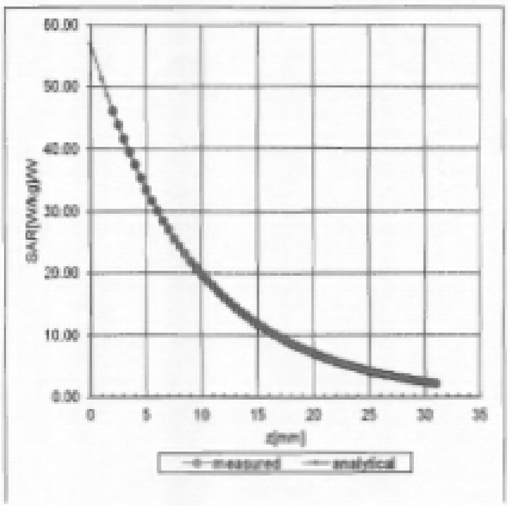
Conversion Factor Assessment

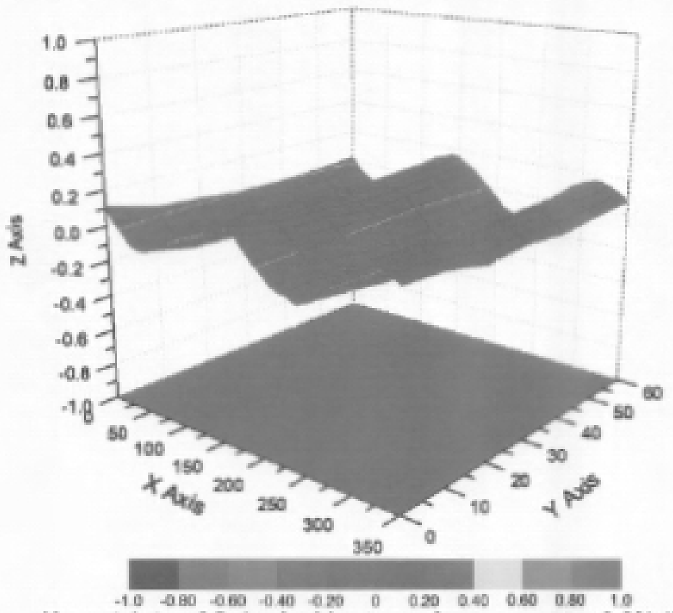
f=900 MHz, WGLS R9(H_convF)



f=2450 MHz, WGLS R26(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

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DASY - Parameters of Probe: EX3DV4 - SN: 3753

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	47.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	2mm

APPENDIX D: PLOTS OF SAR TEST RESULT

The plots are showing in the file named Appendix D Plots of SAR Test Result

APPENDIX E: OUTPUT POWER TEST RESULT

The result are showing in the file named Appendix E output power test result

END REPORT