RF Exposure Lab

802 N. Twin Oaks Valley Road, Suite 105 • San Marcos, CA 92069 • U.S.A.
TEL (760) 471-2100 • FAX (760) 471-2121
http://www.rfexposurelab.com

CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Novatel Wireless 9645 Scranton Road, Suite 205 San Diego, CA 92121	Dates of Test: April 27-May 2, 2013 Test Report Number: SAR.20130402 Revision C

FCC ID:	PKRNVWMIFI5580
Model(s):	MiFi5580
Test Sample:	Engineering Unit Same as Production
FID Number:	SY16413700029
Equipment Type:	Wireless Hotspot Modem
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	824 – 849 MHz; 1850 – 1910 MHz; 816 – 824 MHz, 1850 – 1915 MHz, 814 – 849 MHz, 2496 – 2690 MHz, 2412 – 2462 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	850 MHz (CDMA) – 24.49 dBm, 1900 MHz (CDMA) – 24.41 dBm, 800 MHz (CDMA) – 24.45 dBm 850 MHz (LTE) – 24.33 dBm, 1900 MHz (LTE) – 24.50 dBm; 2600 MHz (LTE) – 23.99 dBm 2450 MHz – 17.00 dBm Conducted
Signal Modulation:	CDMA, QPSK, 16QAM, DSSS, OFDM
Antenna Type:	WWAN – Ethertronics, P/N 01019835 (EvDo/LTE B25/B26 Main), Monopole Antenna; Novatel Wireless, P/N N/A (LTE B41 Main), Etched on PCB Monopole Antenna WLAN – Novatel Wireless, P/N N/A, Etched on PCB Monopole Antenna
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C, 22, 24, 27, 90
KDB Test Methodology:	KDB 447498 D01 v05, KDB 248227 v01r02, KDB 941225 D01 v02, D05 v02r01 & D06 v01
Industry Canada:	RSS-102, Safety Code 6
Max. Stand Alone SAR Value:	1.49 W/kg
Max. Simultaneous SAR Value:	1.57 W/kg
Separation Distance:	10 mm

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2003, and OET Bulletin 65 Supp. C (See test report).

I attest to the accuracy of the data. All measurements were performed by myself or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RF Exposure Lab, LLC certifies that no party to this application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Jay M. Moulton
Vice President

ACCREDITED
Certificate # 2387.01

Table of Contents

1. Introduction

This measurement report shows compliance of the Novatel Wireless Model MiFi5580 FCC ID: PKRNVWMIFI5580 with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices. The FCC have adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on August 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices. [1], [6]

The test results recorded herein are based on a single type test of Novatel Wireless Model MiFi5580 and therefore apply only to the tested sample.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], FCC OET Bulletin 65 Supp. C – 2001 [4], IEEE Std.1528 – 2003 Recommended Practice [5], and Industry Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz were employed.

The following table indicates all the wireless technologies operating in the MiFi5580 wireless modem. The table also shows the tolerance for the power level for each mode.

Band	Technology	Class	3GPP Nominal Power dBm	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 25 – 1900 MHz	LTE – FDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 26 – 850 MHz	LTE – FDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 41 – 2600 MHz	LTE – TDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 2 – 835 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
Band 5 – 1900 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
Band Class 10 – 850 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
WLAN – 2.4 GHz	802.11b*	N/A	N/A	15	+2.0/-2.0	13.0	17.0
WLAN – 2.4 GHz	802.11g/n(Ch. 1)*	N/A	N/A	15	+1.2/-2.0	13.0	16.2
WLAN – 2.4 GHz	802.11 g/n(Ch. 2-10)*	N/A	N/A	15	+2.0/-2.0	13.0	17.0

* Note: 802.11b/g/n channel 11 is blocked

SAR Definition [5]

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (*dW*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (ρ).

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

SAR is expressed in units of watts per kilogram (W/kg). *SAR* can be related to the electric field at a point by

$$SAR = \frac{\sigma \mid E \mid^2}{\rho}$$

where:

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m^3)

E = rms electric field strength (V/m)

2. SAR Measurement Setup

Robotic System

These measurements are performed using the DASY52 automated dosimetric assessment system. The DASY52 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Intel Core2 computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 2.1).

System Hardware

A cell controller system contains the power supply, robot controller teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the HP Intel Core2 computer with Windows XP system and SAR Measurement Software DASY52, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

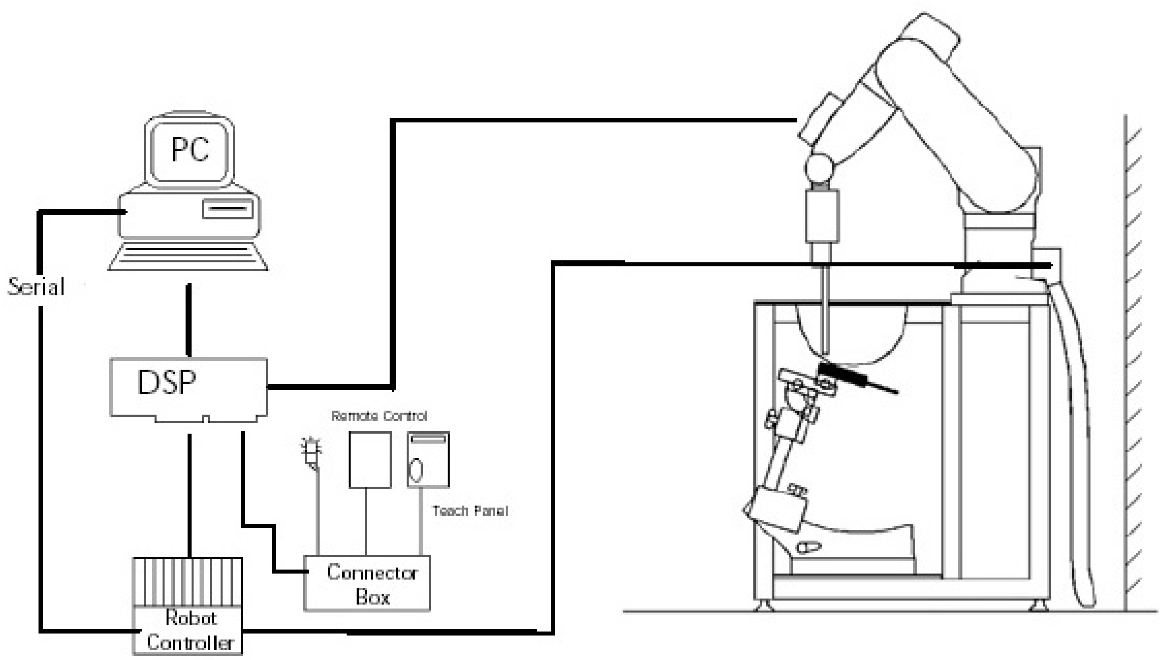


Figure 2.1 SAR Measurement System Setup

System Electronics

The 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

Probe Measurement System

The SAR measurements were conducted with the dosimetric probe EX3DV4, designed in the classical triangular configuration (see Fig. 2.2) and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi fiber line ending at the front of the probe tip. (see Fig. 2.3) It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY52 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped at reaching the maximum.

DAE System

Probe Specifications

Calibration: In air from 10 MHz to 6.0 GHz
In brain and muscle simulating tissue at Frequencies of 450 MHz, 835 MHz, 1750 MHz, 1900 MHz, 2450 MHz, 2600 MHz, 3500 MHz, 5200 MHz, 5300 MHz, 5600 MHz, 5800 MHz

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

Tip length: 20 mm

Body diameter: 12 mm

Tip diameter: 2.5 mm

Distance from probe tip to sensor center: 1 mm

Application: SAR Dosimetry Testing
Compliance tests of wireless device

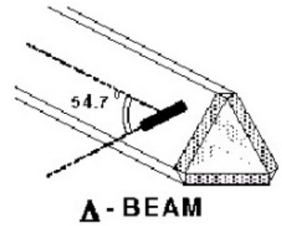


Figure 2.2 Triangular Probe Configurations

Figure 2.3 Probe Thick-Film Technique

Probe Calibration Process

Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in and found to be better than +/-0.25dB. The sensitivity parameters (Norm X, Norm Y, Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe is tested.

Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a waveguide above 1GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity at the proper orientation with the field. The probe is then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

Temperature Assessment *

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium, correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor based temperature probe is used in conjunction with the E-field probe

$$\text{SAR} = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

$$\text{SAR} = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place.
Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;

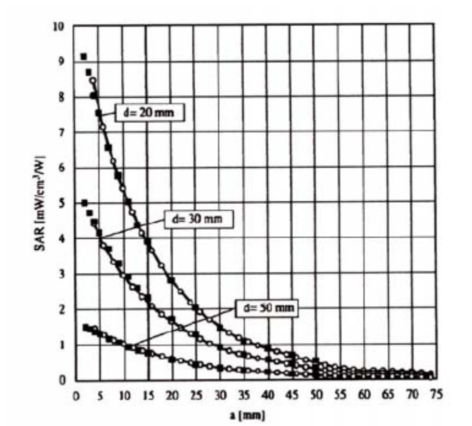


Figure 2.4 E-Field and Temperature Measurements at 900MHz

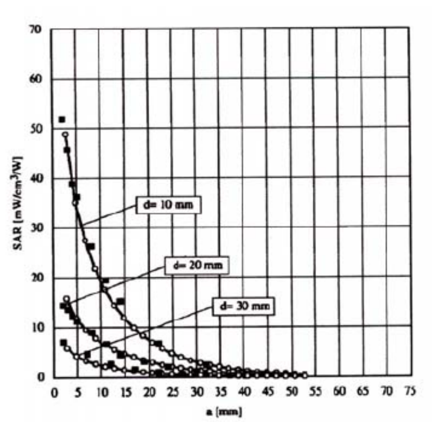


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

Data Extrapolation

The DASY52 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. 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 like below;

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

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 parameter)
dcp_i = diode compression point (DASY parameter)

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

E-field probes:

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

with V_i = compensated signal of channel i (i = x,y,z)
$Norm_i$ = sensor sensitivity of channel i (i = x,y,z) $\mu V/(V/m)^2$ for E-field probes
ConvF = sensitivity of enhancement in solution
E_i = electric field strength of channel i in V/m

The RSS value of the field components gives the total field strength (Hermetian 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 W/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

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

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$

with P_{pwe} = equivalent power density of a plane wave in W/cm^2
E_{tot} = total electric field strength in V/m

SAM PHANTOM

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. 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 the 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 in the robot. (see Fig. 2.6)

Phantom Specification

Phantom: SAM Twin Phantom (V4.0)
Shell Material: Vivac Composite
Thickness: 2.0 ± 0.2 mm

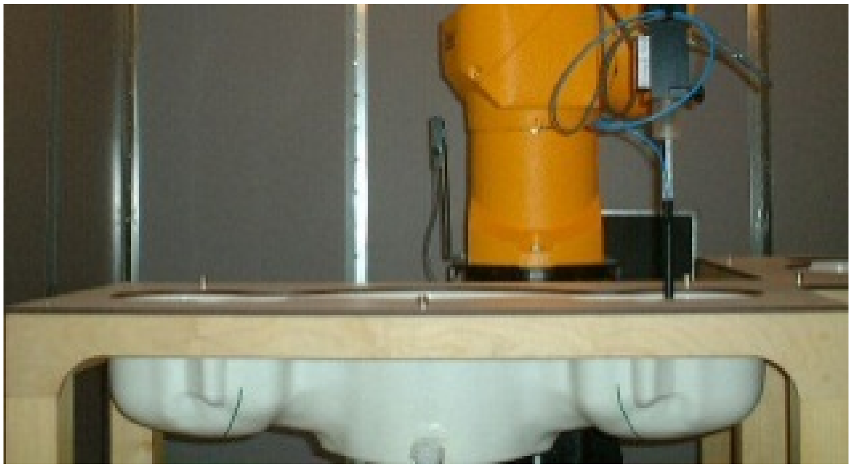


Figure 2.6 SAM Twin Phantom

Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0 the Mounting Device (see Fig. 2.7), enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately, and repeat ably be positioned according to the FCC, CENELEC, IEC and IEEE specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Figure 2.7 Mounting Device

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produce infinite number of configurations. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

3. Probe and Dipole Calibration

See Appendix D and E.

4. Simulating Tissue Specifications

Head & Body Simulating Mixture Characterization

The head and body mixtures consist of the material based on the table listed below. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. Body tissue parameters that have not been specified in P1528 are derived from the issue dielectric parameters computed from the 4-Cole-Cole equations.

Table 4.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue			
		835 MHz Body	1900 MHz Body	2450 MHz Body	2590 MHz Body
Mixing Percentage					
Water		52.50	69.91	73.20	Proprietary
Sugar		45.00	0.00	0.00	
Salt		1.40	0.13	0.10	
HEC		1.00	0.00	0.00	
Bactericide		0.10	0.00	0.00	
DGBE		0.00	29.96	26.70	
Dielectric Constant	Target	55.20	53.30	52.70	52.52
Conductivity (S/m)	Target	0.97	1.52	1.95	2.19

5. ANSI/IEEE C95.1 – 1992 RF Exposure Limits [2]

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 5.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIROMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR[1] Head	1.60	8.00
SPATIAL AVERAGE SAR[2] Whole Body	0.08	0.40
SPATIAL PEAK SAR[3] Hands, Feet, Ankles, Wrists	4.00	20.00

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

6. Measurement Uncertainty

Measurement uncertainty table is not required per KDB 865664 D01 v01 section 2.8.2 page 12. SAR measurement uncertainty analysis is required in the SAR report only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR. The equivalent ratio (1.5/1.6) should be applied to extremity and occupational exposure conditions. Using the ratio calculation of (1.5/1.6)*4=3.75 W/kg, shows that the measurement uncertainty table is not required since no SAR value in this report is above the respective limit.

7. System Validation

Tissue Verification

Table 7.1 Measured Tissue Parameters

		835 MHz Body		1900 MHz Body		2590 MHz Body	
Date(s)		Apr. 29, 2013		Apr. 27, 2013		May 1, 2013	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		55.20	55.91	53.30	52.07	52.52	52.39
Conductivity: σ		0.97	0.99	1.52	1.47	2.15	2.19

		2450 MHz Body	
Date(s)		Apr. 28, 2013	
Liquid Temperature (˚C)	20.0	Target	Measured
Dielectric Constant: ε		52.70	52.24
Conductivity: σ		1.95	2.00

See Appendix A for data printout.

Test System Verification

Prior to assessment, the system is verified to the ±10% of the specifications at the test frequency by using the system kit. Power is normalized to 1 watt. (Graphic Plots Attached)

Table 7.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR_{1g} (W/kg)	Measure SAR_{1g} (W/kg)	Tissue Used for Verification	Deviation (%)	Plot Number
29-Apr-2013	835 MHz	9.51	9.63	Body	+ 1.26	1
27-Apr-2013	1900 MHz	40.20	39.00	Body	- 2.99	2
01-May-2013	2550 MHz	53.00	52.10	Body	- 1.70	3
28-Apr-2013	2450 MHz	51.50	52.40	Body	+ 1.75	4

See Appendix A for data plots.

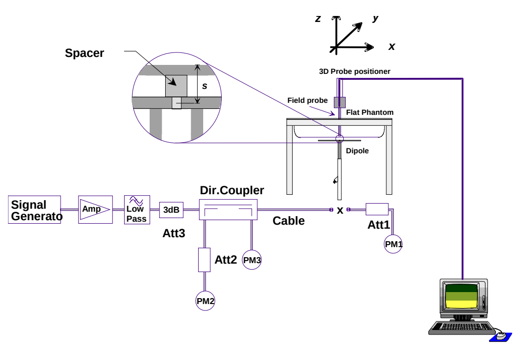


Figure 7.1 Dipole Validation Test Setup

8. LTE Document Checklist

1) Identify the operating frequency range of each LTE transmission band used by the device

LTE Operating Band	Uplink (transmit) Low - high	Downlink (Receive) Low - high	Duplex mode (FDD/TDD)
25	1850-1915	1930-1995	FDD
26	814-849	859-894	FDD
41	2496-2690	2496-2690	TDD

2) Identify the channel bandwidths used in each frequency band; 1.4, 3, 5, 10, 15, 20 MHz etc

LTE Band Class	Bandwidth (MHz)	Frequency or Freq. Band (MHz)
25	3, 5, 10	1850-1915 MHz
26	1.4, 3, 5, 10	814-849 MHz
41	10, 15, 20	2496-2690 MHz

3) Identify the high, middle and low (H, M, L) channel numbers and frequencies in each LTE frequency band

LTE Band Class	Bandwidth (MHz)	Frequency (MHz)/Channel #					
		Low		Mid		High	
25	3	1851.5	26055	1882.5	26365	1913.4	26674
	5	1852.5	26065	1882.5	26365	1912.5	26665
	10	1855.0	26090	1882.5	26365	1910.0	26640
26	1.4	814.7	26697	831.5	26865	848.3	27033
	3	815.5	26705	831.5	26865	847.7	27025
	5	816.5	26715	831.5	26865	846.5	27015
	10	819.0	26740	831.5	26865	844.0	26990
41	10	2501.0	39700	2593.0	40620	2685.0	41540
	15	2503.5	39725	2593.0	40620	2682.5	41515
	20	2506.0	39750	2593.0	40620	2680.0	41490

4) Specify the UE category and uplink modulations used:
   - UE Category: 3
   - Uplink modulations: QPSK and 16QAM

5) Include descriptions of the LTE transmitter and antenna implementation; and also identify whether it is a standalone transmitter operating independently of other wireless transmitters in the device or sharing hardware components and/or antenna(s) with other transmitters etc

The MiFi5580 has 6 antennas:

- WWAN EvDo/LTE B25/B26 Main (Transmit and Receive) Antenna
- WWAN EvDo/LTE B25/B26 Diversity (Receive Only) Antenna
- WWAN LTE B41 Main (Transmit and Receive) Antenna
- WWAN LTE B41 Diversity (Receive Only) Antenna
- WLAN Main (Transmit and Receive) Antenna
- GPS (Receive Only) Antenna

Transmission relationship

- All transmission (TX) is limited to the WWAN and WLAN antennas only
- The device is unable to transmit CDMA and LTE simultaneously.
- The Diversity antenna is receive only antenna which is reserved for the WWAN operation.
- Rx is simultaneous on Main and Diversity
- Simultaneous Tx with the WWAN and WLAN is allowed.

Antenna port	CDMA		LTE – B25/B26		LTE – B41		802.11 b/g/n		GPS
	TX	RX	TX	RX	TX	RX	TX	RX	RX
#1 EvDo/LTE B25, B26 Main	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No	No
#2 EvDo/LTE B25, B26 Diversity	No	**Yes**	No	Yes	No	No	No	No	No
#3 LTE B41	No	No	No	No	**Yes**	**Yes**	No	No	No
#4 LTE B41 Diversity	No	No	No	No	No	**Yes**	No	No	No
#5 WLAN	No	No	No	No	No	No	**Yes**	**Yes**	No
#6 GPS	No	No	No	No	No	No	No	No	**Yes**

6) Identify the LTE voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions etc

The MiFi5580 is a data only hotspot device. Data mode was tested in each operating mode and exposure condition in the body configuration per KDB 941225 D06 v01. See test setup photos to see all configurations tested.

7) Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design:

a) Only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards

MPR is mandatory, built-in by design on all production units. It was enabled during testing.

Modulation	Channel Bandwidth/transmission Bandwidth Configuration (RB)						MPR (dB)
	1.4 MHz	3.0 MHZ	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

b) A-MPR (additional MPR) must be disabled
c) A-MPR was disabled during testing.

8) Identify all other U.S. wireless operating modes (3G, Wi-Fi, WiMax, Bluetooth etc), device/exposure configurations (head and body, antenna and handset flip-cover or slide positions, antenna diversity conditions etc.) and frequency bands used for these modes

Other wireless modes:

Band	Technology	Class	3GPP Nominal Power dBm	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 25 – 1900 MHz	LTE – FDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 26 – 850 MHz	LTE – FDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 41 – 2600 MHz	LTE – TDD	3	23	23.0	+1.5/-1.0	22.0	24.5
Band 2 – 835 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
Band 5 – 1900 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
Band Class 10 – 850 MHz	CDMA	3	23	23.8	+0.7/-0.8	23.0	24.5
WLAN – 2.4 GHz	802.11b*	N/A	N/A	15	+2.0/-2.0	13.0	17.0
WLAN – 2.4 GHz	802.11g/n(Ch. 1)*	N/A	N/A	15	+1.2/-2.0	13.0	16.2
WLAN – 2.4 GHz	802.11 g/n(Ch. 2-10)*	N/A	N/A	15	+2.0/-2.0	13.0	17.0

* Note: 802.11b/g/n channel 11 is blocked

9) Identify the simultaneous transmission conditions for the voice and data configurations supported by all wireless modes, device configurations and frequency bands, for the head and body exposure conditions and device operating configurations (handset flip or cover positions, antenna diversity conditions etc.)

The device is unable to transmit CDMA and LTE simultaneously.
The MiFi5580 is able to transmit WWAN and WLAN simultaneously.

TX Modes	CDMA	LTE	802.11 b/g/n
1	**ON**	OFF	**ON**
2	OFF	**ON**	**ON**

10) When power reduction is applied to certain wireless modes to satisfy SAR compliance for simultaneous transmission conditions, other equipment certification or operating requirements, include the maximum average conducted output power measured in each power reduction mode applicable to the simultaneous voice/data transmission configurations for such wireless configurations and frequency bands; and also include details of the power reduction implementation and measurement setup

Power reduction is not required to satisfy SAR compliance.

9. SAR Test Data Summary

See Measurement Result Data Pages

See Appendix B for SAR Test Data Plots.
See Appendix C for SAR Test Setup Photos.

Procedures Used To Establish Test Signal

The device was either placed into simulated transmit mode using the manufacturer's test codes or the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

Device Test Condition

In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power unless otherwise noted. If a conducted power deviation of more than 5% occurred, the test was repeated. The power drift of each test is measured at the start of the test and again at the end of the test. The drift percentage is calculated by the formula ((end/start)-1)*100 and rounded to three decimal places. The drift percentage is calculated into the resultant SAR value on the data sheet for each test.

The testing was conducted on all edges closest to each antenna. Side A, Side B, Side C, Side D and Side E testing was conducted for the WWAN antenna. The Side F was not tested as the WWAN antenna was more than 2.5 cm from this side. All sides were tested for the WLAN antenna. All further test reductions are shown on pages 25 for CDMA bands, page 24 for WLAN and pages 34-48 for LTE bands. All testing was conducted per KDB 941225 D06 v01. See the photo in Appendix C for a pictorial of the setups, labeling of the sides tested and antenna locations.

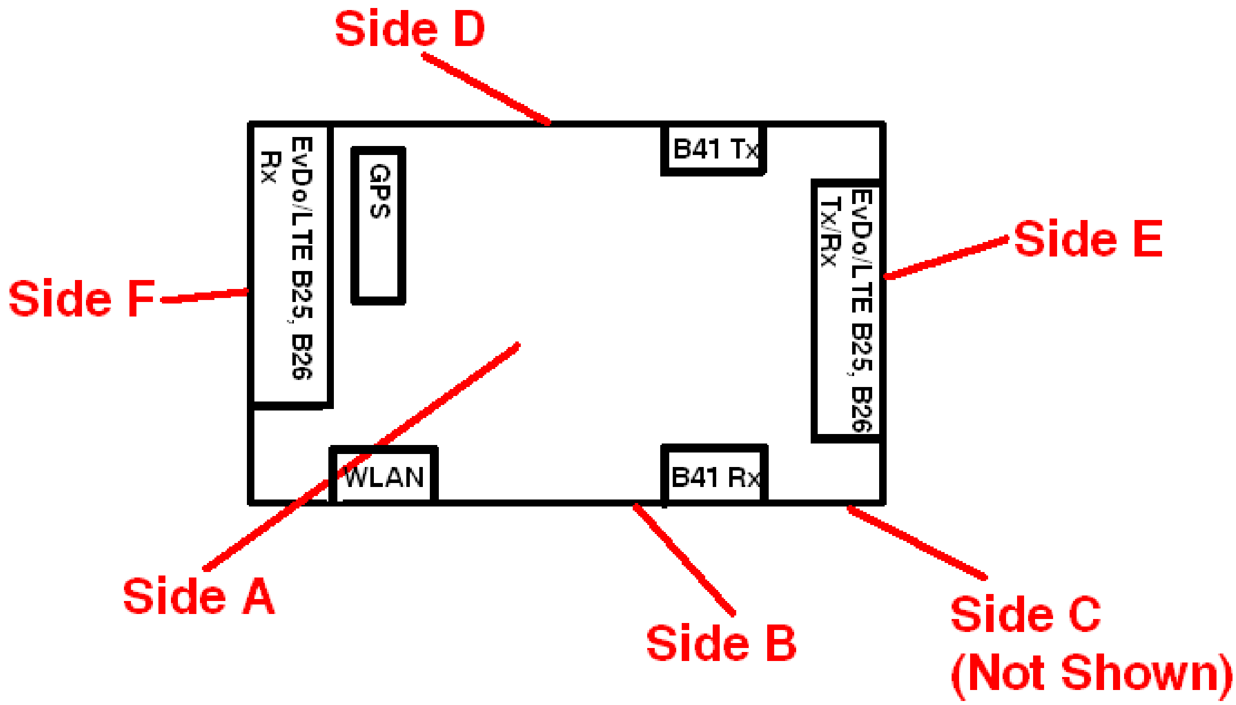
The 1xRTT testing was conducted in RC3 with the device configured using TDSO/SO32 with FCH transmitting at full rate. The power control was set to "All Bits Up." 1xRTT did not require SAR testing due to the measured power being less than ¼ dB higher than Rev. 0.

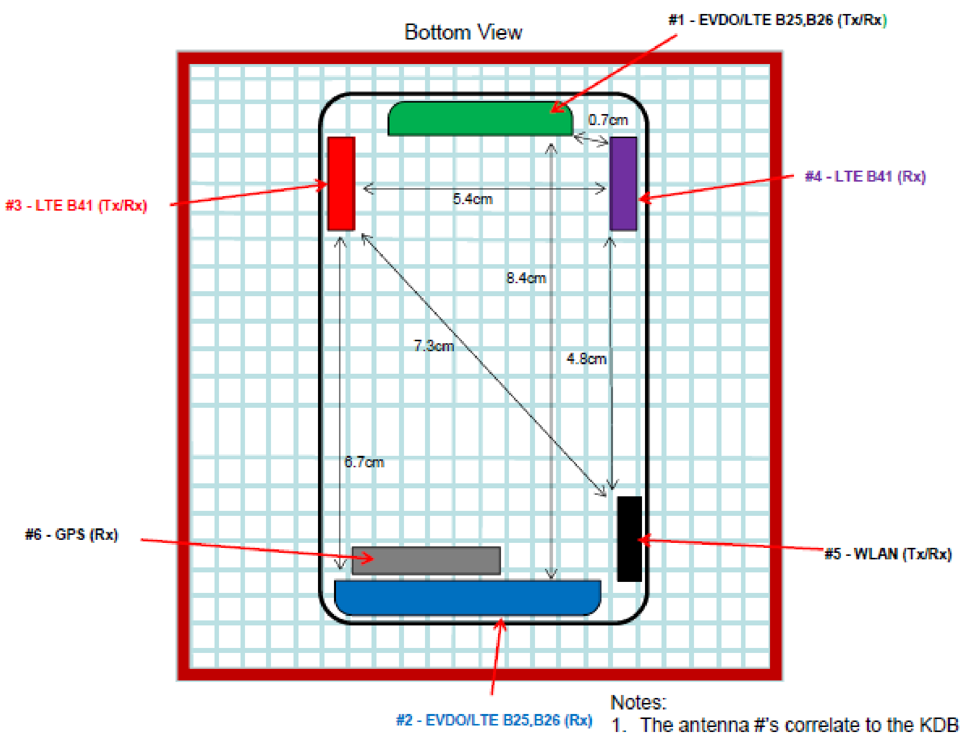
The Rev. 0 testing was conducted with the Reverse Data Channel rate of 153.6 kbps. The Forward Traffic Channel data rate is set to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. The power control was set to "All Bits Up." Other rates were not tested due to the conducted power measured was less than ¼ dB higher than 153.6 kbps.

The Rev. A Subtype 2 testing was conducted with the Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots. The Forward Traffic Channel data rate is set to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. The power control was set to "All Bits Up." Rev. A did not require SAR testing due to the measured power being less than ¼ dB higher than Rev. 0.

Band class 10 is transmitting in subclass 2 and 3 only. Subclass 0,1 and 4 are turned off and will not transmit.

Figure 9.1
SAR Location Diagram of Modem Testing





Notes:
1. The antenna #'s correlate to the KDB 941225 D05 document supporting this inquiry.
2. Antenna #1 and 3 are unable to transmit simultaneously.

Antenna Distances

10. FCC 3G Measurement Procedures

Power measurements were performed using a base station simulator under average power.

10.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a screen room. Such test signals offer a consistent means for testing SAR and recommended for evaluating SAR. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

10.2 SAR Measurement Conditions for CDMA2000, 1xEV-DO

10.2.1 Output Power Verification 1xRTT

Use CDMA2000 Rev 6 protocol in the call box.

1) Test for RC 3 Reverse FCH, RC3 Reverse SCH0 and demodulation of RC 3, 4 and 5.
    a. Set up a call using Supplemental Channel Test Mode 3 (RC 3, SO 32) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
    b. As per C.S0011 or TIA/EIA-98-F Table 4.4.5.2-2, set the test parameters.
    c. Send alternating '0' and '1' power control bit to the device
    d. Determine the active channel configuration. If the desired channel configuration is not the active channel configuration, increase Îor by 1 dB and repeat the verification. Repeat this step until the desired channel configuration becomes active.
    e. Measure the output power at the device antenna connector.
    f. Decrease Îor by 0.5 dB.
    g. Determine the active channel configuration. If the active channel configuration is the desired channel configuration, measure the output power at the device antenna connector.
    h. Repeat step f and g until the output power no longer increases or the desired channel configuration is no longer active. Record the highest output power achieved with the desired channel configuration active.
    i. Repeat step a through h ten times and average the result.

10.2.2 Output Power Verification 1xEvDo

1) Use 1xEV-DO Rel 0 protocol in the call box 8960.
    a. FTAP
        - Select Test Application Protocol to FTAP
        - Set FTAP Rate to 307.2 kbps (2 Slot, QPSK)
        - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
        - Set Îor to -60 dBm/1.23 MHz
        - Send continuously '0' power control bits
        - Measure the power at device antenna connector
    b. RTAP
        - Select Test Application Protocol to RTAP
        - Set RTAP Rate to 9.6 kbps

- Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
- Set Îor to -60 dBm/1.23 MHz
- Send continuously '0' power control bits
- Measure the power at device antenna connector
- Repeat above steps for RTAP Rate = 19.2 kbps, 38.4 kbps, 76.8 kbps and 153.6 kbps respectively

2) Use 1xEV-DO Rev A protocol in the call box 8960
   a. FETAP
      - Select Test Application Protocol to FETAP
      - Set FETAP Rate to 307.2 kbps (2 Slot, QPSK)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at device antenna connector
   b. RETAP
      - Select Test Application Protocol to RETAP
      - F-Traffic Format -> 4 (1024, 2, 128) Canonical (307.2k, QPSK) • Set R-Data Pkt Size to 128
      - Protocol Subtype Config -> Release A Physical Layer Subtype -> Subtype 2 ->PL Subtype 2 Access Channel MAC Subtype -> Default (Subtype 0)
      - Generator Info -> Termination Parameters -> Max Forward Packet Duration -> 16 Slots ->ACK R-Data After -> Subpacket 0 (All ACK)
      - Set Îor to -60 dBm/1.23 MHz
      - Send continuously '0' power control bits
      - Measure the power at device antenna connector
      - Repeat above steps for R-Data Pkt Size = 256, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288 respectively.

		IS-2000	1Xev-Do Rev. 0	1Xev-Do Rev. A Subtype 0/1
	Channel	TDSO SO32 RC3	RTAP/153.6 kbps [dBm]	RETAP/4096 kbps [dBm]
Cellular	1013	24.30	24.31	24.31
	384	24.36	24.49	24.44
	777	24.15	24.46	24.40
PCS	25	24.28	24.32	24.25
	600	24.39	24.41	24.37
	1175	24.28	24.30	24.21
BC10	476	24.42	24.26	24.24
	580	24.45	24.25	24.22
	684	24.34	24.15	24.13

CDMA Power Measurements
Power Control was set in "All Bits Up" for all measurements.

Band	Mode	Channel	Data Rate	Frequency (MHz)	Conducted Power (dBm)
					Main
2450 MHz	802.11b	1	1	2412	16.78
			2		16.80
			5.5		16.75
			11		16.70
		6	1	2437	16.91
			2		16.90
			5.5		16.85
			11		16.83
		10	1	2457	16.63
			2		16.61
			5.5		16.52
			11		16.49
	802.11g	1	6	2412	15.79
			9		15.74
			12		15.68
			18		15.73
			24		15.98
			36		15.91
			48		15.84
			54		15.76
		6	6	2437	16.62
			9		15.59
			12		16.55
			18		16.57
			24		16.95
			36		16.87
			48		16.85
			54		16.73
		10	6	2457	17.00
			9		16.94
			12		16.89
			18		16.91
			24		16.71
			36		16.62
			48		16.58
			54		16.51
	802.11n	1	6.5/7.2	2412	16.05
			13/14.4		15.89
			19.5/21.7		15.94
			26/28.9		15.93
			39/43.3		15.83
			52/57.8		15.77
			58.5/65		15.73
			65/72.2		15.75
		6	6.5/7.2	2437	17.00
			13/14.4		16.86
			19.5/21.7		16.90
			26/28.9		16.96
			39/43.3		16.81
			52/57.8		16.75
			58.5/65		16.70
			65/72.2		16.61
		10	6.5/7.2	2457	16.91
			13/14.4		16.72
			19.5/21.7		16.78
			26/28.9		16.73
			39/43.3		16.73
			52/57.8		16.68
			58.5/65		16.58
			65/72.2		16.53

Conducted Average Power Measurements

Figure 10.2.1 Test Reduction Table – WiFi

Mode	Side	Required Channel	Tested/Reduced
802.11b	Side A	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
	Side B	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
	Side C	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
	Side D	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
	Side E	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
	Side F	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		10 – 2457 MHz	Reduced[1]
802.11g	Side A	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side B	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side C	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side D	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side E	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side F	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
802.11n	Side A	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side B	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side C	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side D	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side E	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]
	Side F	1 – 2412 MHz	Reduced[2]
		6 – 2437 MHz	Reduced[2]
		10 – 2457 MHz	Reduced[2]

Reduced[1] – When the mid channel is 3 dB below the limit, the remaining channels are not required per KDB 447498 D01 v05 section 4.3.3 page 13.

Reduced[2] – When the conducted power in this mode is less than 0.25 dB higher than the b mode, testing is not required per KDB248227 v01r02 page 4-5.

Figure 10.2.2 Test Reduction Table – 3G

Band/ Frequency (MHz)	Technology	Side	Required Channel	Tested/ Reduced
Band 5 824-849 MHz	CDMA	A	1013	Tested
			384	Tested
			777	Tested
		B	1013	Reduced[1]
			384	Tested
			777	Reduced[1]
		C	1013	Tested
			384	Tested
			777	Tested
		D	1013	Reduced[1]
			384	Tested
			777	Reduced[1]
		E	1013	Reduced[1]
			384	Tested
			777	Reduced[1]
Band 2 1850-1910 MHz	CDMA	A	25	Tested
			600	Tested
			1175	Tested
		B	25	Reduced[1]
			600	Tested
			1175	Reduced[1]
		C	25	Tested
			600	Tested
			1175	Tested
		D	25	Reduced[1]
			600	Tested
			1175	Reduced[1]
		E	25	Tested
			600	Tested
			1175	Tested
Band Class 10 816-824	CDMA	A	476	Tested
			580	Tested
			684	Tested
		B	476	Reduced[1]
			580	Tested
			684	Reduced[1]
		C	476	Tested
			580	Tested
			684	Tested
		D	476	Reduced[1]
			580	Tested
			684	Reduced[1]
		E	476	Reduced[1]
			580	Tested
			684	Reduced[1]

Reduced[1] – When the highest conducted power channel is 3 dB below the limit, the remaining channels are not required per KDB 447498 D01 v05 section 4.3.3 page 13.

10.3 SAR Measurement Conditions for LTE Bands

10.3.1 LTE Functionality

The follow table identifies all the channel bandwidths in each frequency band supported by this device.

LTE Band Class	Bandwidth (MHz)	Frequency or Freq. Band (MHz)
25	3, 5, 10	1850-1915 MHz
26	1.4, 3, 5, 10	814-849 MHz
41	10, 15, 20	2496-2690 MHz

10.3.2 Test Conditions

All SAR measurements for LTE were performed using the Anritsu MT8820C. A closed loop power control setting allowed the UE to transmit at the maximum output power during the SAR measurements. The Figure 10.3.2 table indicates all the test reduction utilized for this report.

MPR was enabled for this device. A-MPR was disabled for all SAR test measurements.

Band 41 is a TDD signal. The testing was conducted with the Anritsu MT8820C in uplink/downlink configuration 6 and special frame configuration 1. This configuration set the transmit duty cycle to 50% during the measurements. The maximum the uplink duty cycle the device can transmit in uplink/downlink configuration 0 with special frames at maximum uplink is 63.33% duty cycle. Therefore, the measured SAR value was first scaled to 63.33% duty cycle and then scaled to maximum conducted power listed in the tune up procedure. The reported SAR value is the fully scaled number.

Table 10.3.1 LTE Power Measurements

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
25	QPSK	3 MHz	1	0	26055	1851.5	24.17
					26365	1882.5	24.30
					26674	1913.4	23.72
			1	7	26055	1851.5	24.28
					26365	1882.5	24.36
					26674	1913.4	23.83
			1	14	26055	1851.5	24.26
					26365	1882.5	24.25
					26674	1913.4	23.71
			8	0	26055	1851.5	23.23
					26365	1882.5	23.22
					26674	1913.4	22.87
			8	3	26055	1851.5	23.14
					26365	1882.5	23.31
					26674	1913.4	22.82
			8	7	26055	1851.5	23.29
					26365	1882.5	23.31
					26674	1913.4	22.80
			15	0	26055	1851.5	23.27
					26365	1882.5	23.25
					26674	1913.4	22.75
		5 MHz	1	0	26065	1852.5	24.21
					26365	1882.5	24.40
					26665	1912.5	23.77
			1	12	26065	1852.5	24.33
					26365	1882.5	24.27
					26665	1912.5	23.76
			1	24	26065	1852.5	24.22
					26365	1882.5	24.24
					26665	1912.5	23.76
			12	0	26065	1852.5	23.36
					26365	1882.5	23.31
					26665	1912.5	22.77
			12	6	26065	1852.5	23.28
					26365	1882.5	23.32
					26665	1912.5	22.76
			12	13	26065	1852.5	23.32
					26365	1882.5	23.28
					26665	1912.5	22.72
			25	0	26065	1852.5	23.17
					26365	1882.5	23.17
					26665	1912.5	22.67
		10 MHz	1	0	26090	1855.0	24.40
					26365	1882.5	24.50
					26640	1910.0	24.02
			1	24	26090	1855.0	24.37
					26365	1882.5	24.40
					26640	1910.0	23.85
			1	49	26090	1855.0	24.37
					26365	1882.5	24.29
					26640	1910.0	23.81
			25	0	26090	1855.0	23.34
					26365	1882.5	23.31
					26640	1910.0	22.88
			25	12	26090	1855.0	23.17
					26365	1882.5	23.13
					26640	1910.0	22.72
			25	25	26090	1855.0	23.25
					26365	1882.5	23.18
					26640	1910.0	22.66
			50	0	26090	1855.0	23.11
					26365	1882.5	23.18
					26640	1910.0	22.73

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
25	16QAM	3 MHz	1	0	26055	1851.5	23.28
					26365	1882.5	23.35
					26674	1913.4	22.75
			1	7	26055	1851.5	23.27
					26365	1882.5	23.28
					26674	1913.4	23.84
			1	14	26055	1851.5	23.38
					26365	1882.5	23.30
					26674	1913.4	22.73
			8	0	26055	1851.5	22.27
					26365	1882.5	22.29
					26674	1913.4	21.84
			8	3	26055	1851.5	22.02
					26365	1882.5	22.25
					26674	1913.4	21.76
			8	7	26055	1851.5	22.09
					26365	1882.5	22.32
					26674	1913.4	21.78
			15	0	26055	1851.5	22.20
					26365	1882.5	22.22
					26674	1913.4	21.78
		5 MHz	1	0	26065	1852.5	23.25
					26365	1882.5	23.38
					26665	1912.5	22.72
			1	12	26065	1852.5	23.30
					26365	1882.5	23.30
					26665	1912.5	22.80
			1	24	26065	1852.5	23.28
					26365	1882.5	23.22
					26665	1912.5	22.79
			12	0	26065	1852.5	22.40
					26365	1882.5	22.33
					26665	1912.5	21.85
			12	6	26065	1852.5	22.36
					26365	1882.5	22.41
					26665	1912.5	21.87
			12	13	26065	1852.5	22.35
					26365	1882.5	22.35
					26665	1912.5	21.82
			25	0	26065	1852.5	22.16
					26365	1882.5	22.15
					26665	1912.5	21.63
		10 MHz	1	0	26090	1855.0	23.30
					26365	1882.5	23.32
					26640	1910.0	22.95
			1	24	26090	1855.0	23.43
					26365	1882.5	23.43
					26640	1910.0	22.96
			1	49	26090	1855.0	23.48
					26365	1882.5	23.36
					26640	1910.0	22.85
			25	0	26090	1855.0	22.19
					26365	1882.5	22.23
					26640	1910.0	21.82
			25	12	26090	1855.0	22.12
					26365	1882.5	22.20
					26640	1910.0	21.75
			25	25	26090	1855.0	22.26
					26365	1882.5	22.31
					26640	1910.0	21.82
			50	0	26090	1855.0	22.21
					26365	1882.5	22.20
					26640	1910.0	21.74

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
26	QPSK	1.4 MHz	1	0	26697	814.7	24.09
					26865	831.5	24.11
					27033	848.3	24.17
			1	3	26697	814.7	24.17
					26865	831.5	24.18
					27033	848.3	24.08
			1	5	26697	814.7	24.19
					26865	831.5	23.99
					27033	848.3	23.73
			3	0	26697	814.7	24.16
					26865	831.5	24.07
					27033	848.3	24.07
			3	1	26697	814.7	24.15
					26865	831.5	24.12
					27033	848.3	24.02
			3	3	26697	814.7	24.03
					26865	831.5	24.08
					27033	848.3	23.77
			6	0	26697	814.7	23.18
					26865	831.5	23.15
					27033	848.3	22.95
		3 MHz	1	0	26705	815.5	24.01
					26865	831.5	23.84
					27025	847.7	24.16
			1	7	26705	815.5	24.18
					26865	831.5	24.16
					27025	847.7	24.06
			1	14	26705	815.5	24.33
					26865	831.5	24.13
					27025	847.7	23.68
			8	0	26705	815.5	23.16
					26865	831.5	22.97
					27025	847.7	23.11
			8	3	26705	815.5	23.19
					26865	831.5	23.09
					27025	847.7	23.03
			8	7	26705	815.5	23.28
					26865	831.5	22.99
					27025	847.7	22.90
			15	0	26705	815.5	23.08
					26865	831.5	22.98
					27025	847.7	22.84
		5 MHz	1	0	26715	816.5	24.11
					26865	831.5	23.90
					27015	846.5	24.02
			1	12	26715	816.5	24.15
					26865	831.5	24.09
					27015	846.5	24.17
			1	24	26715	816.5	23.98
					26865	831.5	24.00
					27015	846.5	23.64
			12	0	26715	816.5	23.06
					26865	831.5	22.89
					27015	846.5	23.04
			12	6	26715	816.5	23.06
					26865	831.5	22.97
					27015	846.5	23.06
			12	13	26715	816.5	23.10
					26865	831.5	22.95
					27015	846.5	22.89
			25	0	26715	816.5	22.94
					26865	831.5	22.72
					27015	846.5	22.94

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
26	QPSK	10 MHz	1	0	26740	819.0	24.16
26	QPSK	10 MHz	1	0	26865	831.5	23.82
26	QPSK	10 MHz	1	0	26990	844.0	22.89
26	QPSK	10 MHz	1	24	26740	819.0	24.03
26	QPSK	10 MHz	1	24	26865	831.5	24.03
26	QPSK	10 MHz	1	24	26990	844.0	23.96
26	QPSK	10 MHz	1	49	26740	819.0	23.71
26	QPSK	10 MHz	1	49	26865	831.5	24.00
26	QPSK	10 MHz	1	49	26990	844.0	24.06
26	QPSK	10 MHz	25	0	26740	819.0	22.91
26	QPSK	10 MHz	25	0	26865	831.5	22.76
26	QPSK	10 MHz	25	0	26990	844.0	22.41
26	QPSK	10 MHz	25	12	26740	819.0	22.72
26	QPSK	10 MHz	25	12	26865	831.5	22.76
26	QPSK	10 MHz	25	12	26990	844.0	22.95
26	QPSK	10 MHz	25	25	26740	819.0	22.58
26	QPSK	10 MHz	25	25	26865	831.5	22.72
26	QPSK	10 MHz	25	25	26990	844.0	23.00
26	QPSK	10 MHz	50	0	26740	819.0	22.52
26	QPSK	10 MHz	50	0	26865	831.5	22.59
26	QPSK	10 MHz	50	0	26990	844.0	22.85
26	16QAM	1.4 MHz	1	0	26697	814.7	23.05
26	16QAM	1.4 MHz	1	0	26865	831.5	23.04
26	16QAM	1.4 MHz	1	0	27033	848.3	23.22
26	16QAM	1.4 MHz	1	3	26697	814.7	23.18
26	16QAM	1.4 MHz	1	3	26865	831.5	23.15
26	16QAM	1.4 MHz	1	3	27033	848.3	23.03
26	16QAM	1.4 MHz	1	5	26697	814.7	23.15
26	16QAM	1.4 MHz	1	5	26865	831.5	23.02
26	16QAM	1.4 MHz	1	5	27033	848.3	22.82
26	16QAM	1.4 MHz	3	0	26697	814.7	23.21
26	16QAM	1.4 MHz	3	0	26865	831.5	23.16
26	16QAM	1.4 MHz	3	0	27033	848.3	23.20
26	16QAM	1.4 MHz	3	1	26697	814.7	23.18
26	16QAM	1.4 MHz	3	1	26865	831.5	23.16
26	16QAM	1.4 MHz	3	1	27033	848.3	23.11
26	16QAM	1.4 MHz	3	3	26697	814.7	23.15
26	16QAM	1.4 MHz	3	3	26865	831.5	23.12
26	16QAM	1.4 MHz	3	3	27033	848.3	22.90
26	16QAM	1.4 MHz	6	0	26697	814.7	22.22
26	16QAM	1.4 MHz	6	0	26865	831.5	22.12
26	16QAM	1.4 MHz	6	0	27033	848.3	22.10
26	16QAM	3 MHz	1	0	26705	815.5	23.05
26	16QAM	3 MHz	1	0	26865	831.5	22.85
26	16QAM	3 MHz	1	0	27025	847.7	23.15
26	16QAM	3 MHz	1	7	26705	815.5	23.13
26	16QAM	3 MHz	1	7	26865	831.5	23.03
26	16QAM	3 MHz	1	7	27025	847.7	23.09
26	16QAM	3 MHz	1	14	26705	815.5	23.20
26	16QAM	3 MHz	1	14	26865	831.5	22.99
26	16QAM	3 MHz	1	14	27025	847.7	22.67
26	16QAM	3 MHz	8	0	26705	815.5	22.08
26	16QAM	3 MHz	8	0	26865	831.5	21.91
26	16QAM	3 MHz	8	0	27025	847.7	22.09
26	16QAM	3 MHz	8	3	26705	815.5	22.10
26	16QAM	3 MHz	8	3	26865	831.5	22.00
26	16QAM	3 MHz	8	3	27025	847.7	22.03
26	16QAM	3 MHz	8	7	26705	815.5	22.18
26	16QAM	3 MHz	8	7	26865	831.5	21.97
26	16QAM	3 MHz	8	7	27025	847.7	21.95
26	16QAM	3 MHz	15	0	26705	815.5	21.99
26	16QAM	3 MHz	15	0	26865	831.5	21.98
26	16QAM	3 MHz	15	0	27025	847.7	21.96

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
26	16QAM	5 MHz	1	0	26715	816.5	23.03
					26865	831.5	22.94
					27015	846.5	23.02
			1	12	26715	816.5	23.28
					26865	831.5	23.11
					27015	846.5	23.10
			1	24	26715	816.5	22.93
					26865	831.5	22.96
					27015	846.5	22.63
			12	0	26715	816.5	22.06
					26865	831.5	21.95
					27015	846.5	22.09
			12	6	26715	816.5	22.14
					26865	831.5	22.05
					27015	846.5	22.19
			12	13	26715	816.5	22.09
					26865	831.5	21.98
					27015	846.5	21.92
			25	0	26715	816.5	21.91
					26865	831.5	21.74
					27015	846.5	21.95
		10 MHz	1	0	26740	819.0	23.10
					26865	831.5	22.79
					26990	844.0	21.80
			1	24	26740	819.0	22.95
					26865	831.5	23.07
					26990	844.0	22.96
			1	49	26740	819.0	22.81
					26865	831.5	23.06
					26990	844.0	23.06
			25	0	26740	819.0	21.85
					26865	831.5	21.70
					26990	844.0	21.27
			25	12	26740	819.0	21.70
					26865	831.5	21.78
					26990	844.0	21.91
			25	25	26740	819.0	21.54
					26865	831.5	21.78
					26990	844.0	21.97
			50	0	26740	819.0	21.54
					26865	831.5	21.52
					26990	844.0	21.83

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
41	QPSK	10 MHz	1	0	39700	2501.0	22.94
					40620	2593.0	23.65
					41540	2685.0	23.99
			1	24	39700	2501.0	22.43
					40620	2593.0	23.58
					41540	2685.0	23.89
			1	49	39700	2501.0	22.72
					40620	2593.0	23.70
					41540	2685.0	23.49
			25	0	39700	2501.0	22.35
					40620	2593.0	22.55
					41540	2685.0	22.81
			25	12	39700	2501.0	22.41
					40620	2593.0	22.46
					41540	2685.0	22.72
			25	25	39700	2501.0	22.62
					40620	2593.0	22.55
					41540	2685.0	22.60
			50	0	39700	2501.0	22.31
					40620	2593.0	22.45
					41540	2685.0	22.65
		15 MHz	1	0	39725	2503.5	22.07
					40620	2593.0	23.72
					41515	2682.5	23.92
			1	37	39725	2503.5	22.55
					40620	2593.0	23.46
					41515	2682.5	23.75
			1	74	39725	2503.5	22.82
					40620	2593.0	23.69
					41515	2682.5	23.47
			36	0	39725	2503.5	22.30
					40620	2593.0	22.60
					41515	2682.5	22.75
			36	19	39725	2503.5	22.50
					40620	2593.0	22.37
					41515	2682.5	22.67
			36	39	39725	2503.5	22.68
					40620	2593.0	22.60
					41515	2682.5	22.58
			75	0	39725	2503.5	22.40
					40620	2593.0	22.45
					41515	2682.5	22.72
		20 MHz	1	0	39750	2506.0	22.12
					40620	2593.0	23.83
					41490	2680.0	23.97
			1	49	39750	2506.0	22.83
					40620	2593.0	23.49
					41490	2680.0	23.79
			1	99	39750	2506.0	22.94
					40620	2593.0	23.74
					41490	2680.0	23.41
			50	0	39750	2506.0	22.48
					40620	2593.0	22.56
					41490	2680.0	22.82
			50	25	39750	2506.0	22.59
					40620	2593.0	22.71
					41490	2680.0	22.72
			50	50	39750	2506.0	22.64
					40620	2593.0	22.44
					41490	2680.0	22.63
			100	0	39750	2506.0	22.52
					40620	2593.0	22.38
					41490	2680.0	22.75

Band	Modulation	Bandwidth	RB Size	RB Offset	Channel	Frequency	Power
41	16QAM	10 MHz	1	0	39700	2501.0	20.13
					40620	2593.0	22.86
					41540	2685.0	23.02
			1	24	39700	2501.0	20.57
					40620	2593.0	22.70
					41540	2685.0	23.06
			1	49	39700	2501.0	20.86
					40620	2593.0	22.85
					41540	2685.0	22.62
			25	0	39700	2501.0	19.17
					40620	2593.0	21.51
					41540	2685.0	21.78
			25	12	39700	2501.0	19.29
					40620	2593.0	21.45
					41540	2685.0	21.62
			25	25	39700	2501.0	19.51
					40620	2593.0	21.57
					41540	2685.0	21.55
			50	0	39700	2501.0	19.27
					40620	2593.0	21.42
					41540	2685.0	21.61
		15 MHz	1	0	39725	2503.5	20.17
					40620	2593.0	22.87
					41515	2682.5	23.04
			1	37	39725	2503.5	20.82
					40620	2593.0	22.65
					41515	2682.5	22.94
			1	74	39725	2503.5	21.01
					40620	2593.0	22.82
					41515	2682.5	22.64
			36	0	39725	2503.5	19.20
					40620	2593.0	21.45
					41515	2682.5	21.82
			36	19	39725	2503.5	19.36
					40620	2593.0	21.37
					41515	2682.5	21.66
			36	39	39725	2503.5	19.58
					40620	2593.0	21.44
					41515	2682.5	21.45
			75	0	39725	2503.5	19.31
					40620	2593.0	21.37
					41515	2682.5	21.68
		20 MHz	1	0	39750	2506.0	20.30
					40620	2593.0	22.98
					41490	2680.0	22.15
			1	49	39750	2506.0	20.99
					40620	2593.0	22.63
					41490	2680.0	22.93
			1	99	39750	2506.0	21.11
					40620	2593.0	22.84
					41490	2680.0	22.60
			50	0	39750	2506.0	19.47
					40620	2593.0	21.54
					41490	2680.0	21.82
			50	25	39750	2506.0	19.51
					40620	2593.0	21.47
					41490	2680.0	21.82
			50	50	39750	2506.0	19.68
					40620	2593.0	21.61
					41490	2680.0	21.70
			100	0	39750	2506.0	19.50
					40620	2593.0	21.57
					41490	2680.0	21.82

Table 10.3.2 Test Reduction Table – LTE

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 25 1850-1915 MHz	A	26090	10 MHz	QPSK	1	0	Tested
		26365					Tested
		26640					Tested
		26090			1	24	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			1	49	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			25	0	Tested
		26365					Tested
		26640					Tested
		26090			25	12	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			25	25	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			50	0	Reduced[2]
		26365					Tested
		26640					Reduced[2]
		26090		16QAM	1	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	24	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	49	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	12	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	25	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			50	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 25 1850-1915 MHz	B	26090	10 MHz	QPSK	1	0	Tested
		26365					Tested
		26640					Tested
		26090			1	24	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			1	49	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			25	0	Tested
		26365					Tested
		26640					Tested
		26090			25	12	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			25	25	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			50	0	Reduced[2]
		26365					Tested
		26640					Reduced[2]
		26090		16QAM	1	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	24	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	49	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	12	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	25	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			50	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 25 1850-1915 MHz	C	26090	10 MHz	QPSK	1	0	Tested
		26365					Tested
		26640					Tested
		26090			1	24	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			1	49	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			25	0	Tested
		26365					Tested
		26640					Tested
		26090			25	12	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			25	25	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			50	0	Reduced[2]
		26365					Tested
		26640					Reduced[2]
		26090		16QAM	1	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	24	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	49	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	12	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	25	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			50	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 25 1850-1915 MHz	D	26090	10 MHz	QPSK	1	0	Tested
		26365					Tested
		26640					Tested
		26090			1	24	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			1	49	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			25	0	Tested
		26365					Tested
		26640					Tested
		26090			25	12	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			25	25	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			50	0	Reduced[2]
		26365					Tested
		26640					Reduced[2]
		26090		16QAM	1	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	24	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	49	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	12	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	25	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			50	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 25 1850-1915 MHz	E	26090	10 MHz	QPSK	1	0	Tested
		26365					Tested
		26640					Tested
		26090			1	24	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			1	49	Reduced[1]
		26365					Tested
		26640					Reduced[1]
		26090			25	0	Tested
		26365					Tested
		26640					Tested
		26090			25	12	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			25	25	Tested
		26365					Reduced[1]
		26640					Reduced[1]
		26090			50	0	Reduced[2]
		26365					Tested
		26640					Reduced[2]
		26090		16QAM	1	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	24	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			1	49	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	12	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			25	25	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		26090			50	0	Reduced[3]
		26365					Reduced[3]
		26640					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 26 814-849 MHz	A	26740	10 MHz	QPSK	1	0	Tested
		26865					Reduced[1]
		26990					Reduced[1]
		26740			1	24	Tested
		26865					Tested
		26990					Reduced[1]
		26740			1	49	Tested
		26865					Reduced[1]
		26990					Tested
		26740			25	0	Tested
		26865					Tested
		26990					Tested
		26740			25	12	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			25	25	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			50	0	Reduced[2]
		26865					Reduced[2]
		26990					Tested
		26740		16QAM	1	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	24	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	49	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	12	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	25	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			50	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz, 1.4 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 26 814-849 MHz	B	26740	10 MHz	QPSK	1	0	Tested
		26865					Reduced[1]
		26990					Reduced[1]
		26740			1	24	Tested
		26865					Tested
		26990					Reduced[1]
		26740			1	49	Tested
		26865					Reduced[1]
		26990					Tested
		26740			25	0	Tested
		26865					Tested
		26990					Tested
		26740			25	12	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			25	25	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			50	0	Reduced[2]
		26865					Reduced[2]
		26990					Tested
		26740		16QAM	1	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	24	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	49	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	12	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	25	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			50	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz, 1.4 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 26 814-849 MHz	C	26740	10 MHz	QPSK	1	0	Tested
		26865					Reduced[1]
		26990					Reduced[1]
		26740			1	24	Tested
		26865					Tested
		26990					Reduced[1]
		26740			1	49	Tested
		26865					Reduced[1]
		26990					Tested
		26740			25	0	Tested
		26865					Tested
		26990					Tested
		26740			25	12	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			25	25	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			50	0	Reduced[2]
		26865					Reduced[2]
		26990					Tested
		26740		16QAM	1	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	24	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	49	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	12	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	25	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			50	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz, 1.4 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 26 814-849 MHz	D	26740	10 MHz	QPSK	1	0	Tested
		26865					Reduced[1]
		26990					Reduced[1]
		26740			1	24	Tested
		26865					Tested
		26990					Reduced[1]
		26740			1	49	Tested
		26865					Reduced[1]
		26990					Tested
		26740			25	0	Tested
		26865					Tested
		26990					Tested
		26740			25	12	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			25	25	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			50	0	Reduced[2]
		26865					Reduced[2]
		26990					Tested
		26740		16QAM	1	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	24	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	49	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	12	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	25	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			50	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz, 1.4 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 26 814-849 MHz	E	26740	10 MHz	QPSK	1	0	Tested
		26865					Reduced[1]
		26990					Reduced[1]
		26740			1	24	Tested
		26865					Tested
		26990					Reduced[1]
		26740			1	49	Tested
		26865					Reduced[1]
		26990					Tested
		26740			25	0	Tested
		26865					Tested
		26990					Tested
		26740			25	12	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			25	25	Reduced[1]
		26865					Reduced[1]
		26990					Tested
		26740			50	0	Reduced[2]
		26865					Reduced[2]
		26990					Tested
		26740		16QAM	1	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	24	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			1	49	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	12	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			25	25	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		26740			50	0	Reduced[3]
		26865					Reduced[3]
		26990					Reduced[3]
		All lower bandwidths (5 MHz, 3 MHz, 1.4 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 41 2496-2690 MHz	A	39750	20 MHz	QPSK	1	0	Reduced[1]
		40620					Tested
		41490					Tested
		39750			1	49	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			1	99	Tested
		40620					Reduced[1]
		41490					Tested
		39750			50	0	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			50	25	Reduced[1]
		40620					Tested
		41490					Tested
		39750			50	50	Tested
		40620					Reduced[1]
		41490					Tested
		39750			100	0	Reduced[2]
		40620					Reduced[2]
		41490					Tested
		39750		16QAM	1	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	49	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	99	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	25	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	50	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			100	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		All lower bandwidths (15 MHz, 10 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 41 2496-2690 MHz	B	39750	20 MHz	QPSK	1	0	Reduced[1]
		40620					Tested
		41490					Tested
		39750			1	49	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			1	99	Tested
		40620					Reduced[1]
		41490					Tested
		39750			50	0	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			50	25	Reduced[1]
		40620					Tested
		41490					Tested
		39750			50	50	Tested
		40620					Reduced[1]
		41490					Tested
		39750			100	0	Reduced[2]
		40620					Reduced[2]
		41490					Tested
		39750		16QAM	1	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	49	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	99	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	25	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	50	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			100	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		All lower bandwidths (15 MHz, 10 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 41 2496-2690 MHz	C	39750	20 MHz	QPSK	1	0	Reduced[1]
		40620					Tested
		41490					Tested
		39750			1	49	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			1	99	Tested
		40620					Reduced[1]
		41490					Tested
		39750			50	0	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			50	25	Reduced[1]
		40620					Tested
		41490					Tested
		39750			50	50	Tested
		40620					Reduced[1]
		41490					Tested
		39750			100	0	Reduced[2]
		40620					Reduced[2]
		41490					Tested
		39750		16QAM	1	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	49	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	99	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	25	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	50	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			100	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		All lower bandwidths (15 MHz, 10 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 41 2496-2690 MHz	D	39750	20 MHz	QPSK	1	0	Reduced[1]
		40620					Tested
		41490					Tested
		39750			1	49	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			1	99	Tested
		40620					Reduced[1]
		41490					Tested
		39750			50	0	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			50	25	Reduced[1]
		40620					Tested
		41490					Tested
		39750			50	50	Tested
		40620					Reduced[1]
		41490					Tested
		39750			100	0	Reduced[2]
		40620					Reduced[2]
		41490					Tested
		39750		16QAM	1	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	49	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	99	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	25	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	50	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			100	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		All lower bandwidths (15 MHz, 10 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 41 2496-2690 MHz	E	39750	20 MHz	QPSK	1	0	Reduced[1]
		40620					Tested
		41490					Tested
		39750			1	49	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			1	99	Tested
		40620					Reduced[1]
		41490					Tested
		39750			50	0	Reduced[1]
		40620					Reduced[1]
		41490					Tested
		39750			50	25	Reduced[1]
		40620					Tested
		41490					Tested
		39750			50	50	Tested
		40620					Reduced[1]
		41490					Tested
		39750			100	0	Reduced[2]
		40620					Reduced[2]
		41490					Tested
		39750		16QAM	1	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	49	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			1	99	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	25	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			50	50	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		39750			100	0	Reduced[3]
		40620					Reduced[3]
		41490					Reduced[3]
		All lower bandwidths (15 MHz, 10 MHz)					Reduced[4]

Reduced[1] – When the reported SAR is ≤1.45 W/kg in the highest maximum output power among RB offsets, test only the RB offset configuration with the highest output power for remaining channels per KDB 941225 D05 v02r01 sections 5.2.1 and 5.2.2 page 5.

Reduced[2] – SAR is measured for the highest output power channel; and if the reported SAR ≤1.45 W/kg the remaining required test channels are not required per KDB 941225 D05 v02r01 section 5.2.3 page 5.

Reduced[3] – If the highest maximum output power for the configuration in the higher order modulation is ≤ ½ dB than the same configuration in QPSK and the reported SAR ≤1.45 W/kg, the higher order modulation is not required per KDB 941225 D05 v02r01 section 5.2.4 page 5.

Reduced[4]- If the highest maximum output power for the configuration in the lower bandwidths is ≤ ½ dB than the same configuration in highest bandwidth and the reported SAR ≤1.45 W/kg, the lower bandwidths are not required per KDB 941225 D05 v02r01 section 5.3 page 5.

SAR Data Summary – BC0 835 MHz Body – CDMA EvDo

MEASUREMENT RESULTS										
Gap	**Plot**	**Frequency**		**Technology**	**Position**	**End Power**	**Reverse Channel**	**Forward Channel**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
		MHz	**Ch.**			**(dBm)**				
10 mm	-	824.7	1013	Rev. 0	Side A	24.31	153.6 kbps	2 Slot 307.2 kbps	1.42	1.48
	-	836.52	384	Rev. 0		24.49	153.6 kbps	2 Slot 307.2 kbps	1.32	1.32
	-	848.31	777	Rev. 0		24.46	153.6 kbps	2 Slot 307.2 kbps	1.02	1.03
	-	836.52	384	Rev. 0	Side B	24.49	153.6 kbps	2 Slot 307.2 kbps	0.646	0.65
	1	824.7	1013	Rev. 0	Side C	24.31	153.6 kbps	2 Slot 307.2 kbps	1.43	1.49
	-	836.52	384	Rev. 0		24.49	153.6 kbps	2 Slot 307.2 kbps	1.17	1.17
	-	848.31	777	Rev. 0		24.46	153.6 kbps	2 Slot 307.2 kbps	0.964	0.97
	-	836.52	384	Rev. 0	Side D	24.49	153.6 kbps	2 Slot 307.2 kbps	0.726	0.73
	-	836.52	384	Rev. 0	Side E	24.49	153.6 kbps	2 Slot 307.2 kbps	0.145	0.15
						Body 1.6 W/kg (mW/g) averaged over 1 gram				

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – BC10 835 MHz Body – CDMA EvDo

MEASUREMENT RESULTS

Gap	Plot	Frequency		Technology	Position	End Power	Reverse Channel	Forward Channel	Measured SAR (W/kg)	Reported SAR (W/kg)
		MHz	Ch.			(dBm)				
10 mm	2	817.9	476	Rev. 0	Side A	24.26	153.6 kbps	2 Slot 307.2 kbps	1.39	1.47
	-	820.5	580	Rev. 0		24.25	153.6 kbps	2 Slot 307.2 kbps	1.33	1.41
	-	823.1	684	Rev. 0		24.15	153.6 kbps	2 Slot 307.2 kbps	1.36	1.47
	-	820.5	580	Rev. 0	Side B	24.25	153.6 kbps	2 Slot 307.2 kbps	0.654	0.69
	-	817.9	476	Rev. 0	Side C	24.26	153.6 kbps	2 Slot 307.2 kbps	1.28	1.35
	-	820.5	580	Rev. 0		24.25	153.6 kbps	2 Slot 307.2 kbps	1.32	1.40
	-	823.1	684	Rev. 0		24.15	153.6 kbps	2 Slot 307.2 kbps	1.34	1.45
	-	820.5	580	Rev. 0	Side D	24.25	153.6 kbps	2 Slot 307.2 kbps	0.750	0.79
	-	820.5	580	Rev. 0	Side E	24.25	153.6 kbps	2 Slot 307.2 kbps	0.158	0.17

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – BC1 1900 MHz Body – CDMA EvDo

MEASUREMENT RESULTS

Gap	Plot	Frequency		Technology	Position	End Power	Reverse Channel	Forward Channel	Measured SAR (W/kg)	Reported SAR (W/kg)
		MHz	Ch.			(dBm)				
10 mm	-	1851.25	25	Rev. 0	Side A	24.32	153.6 kbps	2 Slot 307.2 kbps	0.905	0.94
	-	1880.00	600	Rev. 0		24.41	153.6 kbps	2 Slot 307.2 kbps	0.961	0.98
	-	1908.75	1175	Rev. 0		24.30	153.6 kbps	2 Slot 307.2 kbps	1.13	1.18
	-	1880.00	600	Rev. 0	Side B	24.41	153.6 kbps	2 Slot 307.2 kbps	0.645	0.66
	-	1851.25	25	Rev. 0	Side C	24.32	153.6 kbps	2 Slot 307.2 kbps	1.23	1.28
	-	1880.00	600	Rev. 0		24.41	153.6 kbps	2 Slot 307.2 kbps	1.26	1.29
	-	1908.75	1175	Rev. 0		24.30	153.6 kbps	2 Slot 307.2 kbps	1.07	1.12
	-	1880.00	600	Rev. 0	Side D	24.41	153.6 kbps	2 Slot 307.2 kbps	0.220	0.22
	3	1851.25	25	Rev. 0	Side E	24.32	153.6 kbps	2 Slot 307.2 kbps	1.27	1.32
	-	1880.00	600	Rev. 0		24.41	153.6 kbps	2 Slot 307.2 kbps	1.26	1.29
	-	1908.75	1175	Rev. 0		24.30	153.6 kbps	2 Slot 307.2 kbps	1.24	1.30

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
2. Test Signal Call Mode ☐Test Code ☒Base Station Simulator
3. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – 1900 MHz Body – LTE Band 25

MEASUREMENT RESULTS

Gap	Plot	Position	Frequency MHz	Frequency Ch.	BW/ Modulation	RB Size	RB Offset	MPR Target	End Power (dBm)	Measured SAR (W/kg)	Reported SAR (W/kg)
10 mm	-	Side A	1882.5	26365	10 MHz/QPSK	1	0	0	24.50	1.11	1.11
	-					1	24	0	24.40	1.16	1.19
	-					1	49	0	24.29	1.17	1.23
	-		1855.0	26090		1	0	0	24.40	0.894	0.91
	-		1910.0	26640		1	0	0	24.02	1.07	1.20
	-		1855.0	26090		25	0	1	23.34	0.781	0.81
	-					25	12	1	23.17	0.778	0.84
	-					25	25	1	23.25	0.790	0.84
	-		1882.5	26365		25	0	1	23.31	0.821	0.86
	-		1910.0	26640		25	0	1	22.88	0.856	0.99
	-		1882.5	26365		50	0	1	23.18	0.831	0.89
	-	Side B	1882.5	26365		1	0	0	24.50	0.494	0.49
	-					1	24	0	24.40	0.460	0.47
	-					1	49	0	24.29	0.428	0.45
	-		1855.0	26090		1	0	0	24.40	0.593	0.61
	-		1910.0	26640		1	0	0	24.02	0.285	0.32
	-		1855.0	26090		25	0	1	23.34	0.471	0.49
	-					25	12	1	23.17	0.451	0.49
	-					25	25	1	23.25	0.447	0.47
	-		1882.5	26365		25	0	1	23.31	0.347	0.36
	-		1910.0	26640		25	0	1	22.88	0.180	0.21
	-		1882.5	26365		50	0	1	23.18	0.441	0.47
	-	Side C	1882.5	26365		1	0	0	24.50	1.33	1.33
	-					1	24	0	24.40	1.33	1.36
	-					1	49	0	24.29	1.31	1.37
	-		1855.0	26090		1	0	0	24.40	1.20	1.23
	-		1910.0	26640		1	0	0	24.02	1.16	1.30
	-		1855.0	26090		25	0	1	23.34	1.08	1.12
	-					25	12	1	23.17	0.995	1.07
	-					25	25	1	23.25	1.03	1.09
	-		1882.5	26365		25	0	1	23.31	0.991	1.04
	-		1910.0	26640		25	0	1	22.88	0.828	0.96
	-		1882.5	26365		50	0	1	23.18	0.944	1.02
	-	Side D	1882.5	26365		1	0	0	24.50	0.197	0.20
	-					1	24	0	24.40	0.192	0.20
	-					1	49	0	24.29	0.183	0.19
	-		1855.0	26090		1	0	0	24.40	0.186	0.19
	-		1910.0	26640		1	0	0	24.02	0.185	0.21
	-		1855.0	26090		25	0	1	23.34	0.149	0.15
	-					25	12	1	23.17	0.147	0.16
	-					25	25	1	23.25	0.147	0.16
	-		1882.5	26365		25	0	1	23.31	0.135	0.14
	-		1910.0	26640		25	0	1	22.88	0.154	0.18
	-		1882.5	26365		50	0	1	23.18	0.139	0.15
	-	Side E	1882.5	26365		1	0	0	24.50	1.38	1.38
	-					1	24	0	24.40	1.38	1.41
	-					1	49	0	24.29	1.29	1.35
	4		1855.0	26090		1	0	0	24.40	1.40	1.43
	-		1910.0	26640		1	0	0	24.02	1.13	1.26
	-		1855.0	26090		25	0	1	23.34	1.07	1.11
	-					25	12	1	23.17	1.05	1.13
	-					25	25	1	23.25	1.05	1.11
	-		1882.5	26365		25	0	1	23.31	0.939	0.98
	-		1910.0	26640		25	0	1	22.88	0.817	0.94
	-		1882.5	26365		50	0	1	23.18	0.907	0.98

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – 835 MHz Body – LTE Band 26

MEASUREMENT RESULTS

Gap	Plot	Position	Frequency MHz	Frequency Ch.	BW/ Modulation	RB Size	RB Offset	MPR Target	End Power (dBm)	Measured SAR (W/kg)	Reported SAR (W/kg)
10 mm	-	Side A	819.0	26740	10 MHz/QPSK	1	0	0	24.16	1.32	1.43
	5					1	24	0	24.03	1.29	1.44
	-					1	49	0	23.71	1.11	1.33
	-		831.5	26865		1	24	0	24.03	1.27	1.42
	-		844.0	26990		1	49	0	24.06	0.907	1.00
	-		844.0	26990		25	0	1	22.41	1.01	1.30
	-					25	12	1	22.95	0.920	1.19
	-					25	25	1	23.00	0.887	1.00
	-		819.0	26740		25	0	1	22.91	0.972	1.11
	-		831.5	26865		25	0	1	22.76	1.02	1.22
	-		844.0	26990		50	0	1	22.85	0.827	0.96
	-	Side B	819.0	26740		1	0	0	24.16	0.660	0.71
	-					1	24	0	24.03	0.610	0.68
	-					1	49	0	23.71	0.617	0.74
	-		831.5	26865		1	24	0	24.03	0.657	0.73
	-		844.0	26990		1	49	0	24.06	0.459	0.51
	-		844.0	26990		25	0	1	22.41	0.438	0.56
	-					25	12	1	22.95	0.449	0.58
	-					25	25	1	23.00	0.429	0.48
	-		819.0	26740		25	0	1	22.91	0.490	0.56
	-		831.5	26865		25	0	1	22.76	0.513	0.61
	-		844.0	26990		50	0	1	22.85	0.426	0.49
	-	Side C	819.0	26740		1	0	0	24.16	1.23	1.33
	-					1	24	0	24.03	1.14	1.27
	-					1	49	0	23.71	1.19	1.43
	-		831.5	26865		1	24	0	24.03	1.04	1.16
	-		844.0	26990		1	49	0	24.06	0.758	0.84
	-		844.0	26990		25	0	1	22.41	0.741	0.95
	-					25	12	1	22.95	0.770	0.99
	-					25	25	1	23.00	0.742	0.83
	-		819.0	26740		25	0	1	22.91	0.892	1.02
	-		831.5	26865		25	0	1	22.76	0.873	1.04
	-		844.0	26990		50	0	1	22.85	0.730	0.85
	-	Side D	819.0	26740		1	0	0	24.16	0.720	0.78
	-					1	24	0	24.03	0.723	0.81
	-					1	49	0	23.71	0.749	0.90
	-		831.5	26865		1	24	0	24.03	0.765	0.85
	-		844.0	26990		1	49	0	24.06	0.568	0.63
	-		844.0	26990		25	0	1	22.41	0.541	0.70
	-					25	12	1	22.95	0.574	0.74
	-					25	25	1	23.00	0.540	0.61
	-		819.0	26740		25	0	1	22.91	0.580	0.66
	-		831.5	26865		25	0	1	22.76	0.631	0.76
	-		844.0	26990		50	0	1	22.85	0.544	0.63
	-	Side E	819.0	26740		1	0	0	24.16	0.154	0.17
	-					1	24	0	24.03	0.161	0.18
	-					1	49	0	23.71	0.132	0.16
	-		831.5	26865		1	24	0	24.03	0.128	0.14
	-		844.0	26990		1	49	0	24.06	0.126	0.14
	-		844.0	26990		25	0	1	22.41	0.0919	0.12
	-					25	12	1	22.95	0.0855	0.11
	-					25	25	1	23.00	0.0827	0.09
	-		819.0	26740		25	0	1	22.91	0.104	0.12
	-		831.5	26865		25	0	1	22.76	0.0869	0.10
	-		844.0	26990		50	0	1	22.85	0.0834	0.10

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – 2600 MHz Body – LTE Band 41

MEASUREMENT RESULTS

Gap	Plot	Position	Frequency		BW/ Modulation	RB Size	RB Offset	MPR Target	End Power	Measured SAR (W/kg)	Reported SAR (W/kg)
			MHz	Ch.					(dBm)		
10 mm	-	Side A	2680.0	41490	20 MHz/QPSK	1	0	0	23.97	0.695	0.99
	-					1	49	0	23.79	0.658	0.98
	-					1	99	0	23.41	0.554	0.90
	-		2506.0	39750		1	99	0	22.94	0.447	0.81
	-		2593.0	40620		1	0	0	23.83	0.518	0.77
	-		2680.0	41490		50	0	1	22.82	0.538	0.80
	-					50	25	1	22.72	0.517	0.78
	-					50	50	1	22.67	0.501	0.78
	-		2506.0	39750		50	50	1	22.64	0.338	0.52
	-		2593.0	40620		50	25	1	22.71	0.349	0.53
	-		2680.0	41490		100	0	1	22.75	0.519	0.78
	6	Side B	2680.0	41490		1	0	0	23.97	0.769	1.10
	-					1	49	0	23.79	0.740	1.10
	-					1	99	0	23.41	0.653	1.06
	-		2506.0	39750		1	99	0	22.94	0.569	1.03
	-		2593.0	40620		1	0	0	23.83	0.645	0.95
	-		2680.0	41490		50	0	1	22.82	0.596	0.88
	-					50	25	1	22.72	0.602	0.91
	-					50	50	1	22.67	0.583	0.90
	-		2506.0	39750		50	50	1	22.64	0.439	0.68
	-		2593.0	40620		50	25	1	22.71	0.474	0.72
	-		2680.0	41490		100	0	1	22.75	0.600	0.90
	-	Side C	2680.0	41490		1	0	0	23.97	0.389	0.56
	-					1	49	0	23.79	0.371	0.55
	-					1	99	0	23.41	0.336	0.55
	-		2506.0	39750		1	99	0	22.94	0.308	0.56
	-		2593.0	40620		1	0	0	23.83	0.315	0.47
	-		2680.0	41490		50	0	1	22.82	0.312	0.46
	-					50	25	1	22.72	0.308	0.47
	-					50	50	1	22.67	0.309	0.48
	-		2506.0	39750		50	50	1	22.64	0.243	0.38
	-		2593.0	40620		50	25	1	22.71	0.229	0.35
	-		2680.0	41490		100	0	1	22.75	0.309	0.46
	-	Side D	2680.0	41490		1	0	0	23.97	0.0808	0.12
	-					1	49	0	23.79	0.0662	0.10
	-					1	99	0	23.41	0.0544	0.09
	-		2506.0	39750		1	99	0	22.94	0.0608	0.11
	-		2593.0	40620		1	0	0	23.83	0.0776	0.11
	-		2680.0	41490		50	0	1	22.82	0.0569	0.08
	-					50	25	1	22.72	0.0513	0.08
	-					50	50	1	22.67	0.0467	0.07
	-		2506.0	39750		50	50	1	22.64	0.0457	0.07
	-		2593.0	40620		50	25	1	22.71	0.0606	0.09
	-		2680.0	41490		100	0	1	22.75	0.0493	0.07
	-	Side E	2680.0	41490		1	0	0	23.97	0.106	0.15
	-					1	49	0	23.79	0.0995	0.15
	-					1	99	0	23.41	0.0663	0.11
	-		2506.0	39750		1	99	0	22.94	0.0842	0.15
	-		2593.0	40620		1	0	0	23.83	0.109	0.16
	-		2680.0	41490		50	0	1	22.82	0.0734	0.11
	-					50	25	1	22.72	0.0723	0.11
	-					50	50	1	22.67	0.0648	0.10
	-		2506.0	39750		50	50	1	22.64	0.0652	0.10
	-		2593.0	40620		50	25	1	22.71	0.0793	0.12
	-		2680.0	41490		100	0	1	22.75	0.073	0.11

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☐ Test Code ☒ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – 2450 MHz Body 802.11b

MEASUREMENT RESULTS									
Gap	Plot	Position	Frequency		Modulation	Antenna	End Power	Measured SAR (W/kg)	Reported SAR (W/kg)
			MHz	Ch.			(dBm)		
10 mm	-	Side A	2437	6	DSSS	Main	16.91	0.0866	0.09
	-	Side B	2437	6	DSSS		16.91	0.0103	0.01
	-	Side C	2437	6	DSSS		16.91	0.0754	0.08
	-	Side D	2437	6	DSSS		16.91	0.0414	0.04
	-	Side E	2437	6	DSSS		16.91	0.00638	0.01
	7	Side F	2437	6	DSSS		16.91	0.107	0.11

Body
1.6 W/kg (mW/g)
averaged over 1 gram

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Eli4 ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☒ Test Code ☐ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

SAR Data Summary – Simultaneous Transmit

MEASUREMENT RESULTS									
Plot	Position	Frequency (WLAN)		Frequency (WWAN)		WWAN Technology	Reported SAR (W/kg) WLAN	Reported SAR (W/kg) WWAN	Total SAR (W/kg)
		MHz	Ch.	MHz	Ch.				
-	Side A	2437	6	824.7	1013	EvDo Rev 0	0.09	1.48	1.57
-	Side B	2437	6	819.0	26740	LTE	0.01	0.74	0.75
-	Side C	2437	6	824.7	1013	EvDo Rev 0	0.08	1.49	1.57
-	Side D	2437	6	819.0	26740	LTE	0.04	0.90	0.94
-	Side E	2437	6	1855.0	26090	LTE	0.01	1.43	1.44
-	Side F	2437	6	Calculated*		N/A	0.11	0.40	0.51
						Body 1.6 W/kg (mW/g) averaged over 1 gram			

1. SAR Measurement
   Phantom Configuration ☐ Left Head ☒ Uniphantom ☐ Right Head
   SAR Configuration ☐ Head ☒ Body
2. Test Signal Call Mode ☒ Test Code ☐ Base Station Simulator
3. Test Configuration ☐ With Belt Clip ☐ Without Belt Clip ☒ N/A
4. Tissue Depth is at least 15.0 cm

Note: The WWAN and WLAN antennas can transmit simultaneously. Therefore, the SAR is calculated by summing the individual SAR values on each side. The highest reported SAR value of all bands was used to determine each side's compliance.

* The WWAN bands were not tested on the Side F as the distance from any of the antennas is greater than 50 mm. Per KDB 447498 D01 v05 section 4.3.2 2), the estimated SAR for the Side F is 0.4 W/kg when the standalone SAR is not required and the separation distance from the antenna to the phantom is > 50 mm.

11. Test Equipment List

Table 11.1 Equipment Specifications

Type	Calibration Due Date	Calibration Done Date	Serial Number
Staubli Robot TX60L	N/A	N/A	F07/55M6A1/A/01
Measurement Controller CS8c	N/A	N/A	1012
ELI4 Flat Phantom	N/A	N/A	1065
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	08/15/2012	08/15/2013	759
SAR Software V52.8.2.969	N/A	N/A	N/A
SPEAG E-Field Probe EX3DV4	08/20/2013	08/20/2012	3693
SPEAG E-Field Probe ES3DV3	01/16/2014	01/16/2013	3311
Speag Validation Dipole D835V2	12/03/2013	12/03/2012	4d089
Speag Validation Dipole D1900V2	12/06/2013	12/06/2012	5d116
Speag Validation Dipole D2450V2	12/04/2013	12/04/2012	829
Speag Validation Dipole D2550V2	12/04/2013	12/04/2012	1003
Agilent N1911A Power Meter	03/25/2014	03/25/2013	GB45100254
Agilent N1922A Power Sensor	03/27/2014	03/27/2013	MY45240464
Advantest R3261A Spectrum Analyzer	03/25/2014	03/25/2013	31720068
Agilent (HP) 8350B Signal Generator	03/25/2014	03/25/2013	2749A10226
Agilent (HP) 83525A RF Plug-In	03/25/2014	03/25/2013	2647A01172
Agilent (HP) 8753C Vector Network Analyzer	03/25/2014	03/25/2013	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/25/2014	03/25/2013	2904A00595
Agilent (HP) 8960 Base Station Sim.	04/05/2014	04/05/2012	MY48360364
Anritsu MT8820C	08/03/2014	08/03/2012	6201176199
Aprel Dielectric Probe Assembly	N/A	N/A	0011
Body Equivalent Matter (835 MHz)	N/A	N/A	N/A
Body Equivalent Matter (1900 MHz)	N/A	N/A	N/A
Body Equivalent Matter (2450 MHz)	N/A	N/A	N/A
Body Equivalent Matter (2600 MHz)	N/A	N/A	N/A

12. Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape, and size of the body; the orientation of the body with respect to the field vectors; and, the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

13. References

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radio Frequency Radiation, August 1996

[2] ANSI/IEEE C95.1 – 1992, American National Standard Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300kHz to 100GHz, New York: IEEE, 1992.

[3] ANSI/IEEE C95.3 – 1992, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 1992.

[4] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, June 2001.

[5] IEEE Standard 1528 – 2003, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, October 2003.

[6] Industry Canada, RSS – 102e, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), March 2010.

[7] Health Canada, Safety Code 6, Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz, 2009.

Appendix A – System Validation Plots and Data

```
************************************************************
Test Result for UIM Dielectric Parameter
Mon 29/Apr/2013 05:38:38
Freq  Frequency(GHz)
FCC_eH      FCC Bulletin 65 Supplement C ( June 2001) Limits for Head Epsilon
FCC_sH      FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB      FCC Limits for Body Epsilon
FCC_sB      FCC Limits for Body Sigma
Test_e      Epsilon  of  UIM
Test_s      Sigma of UIM
************************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
0.8050	55.32	0.97	56.05	0.96
0.8150	55.28	0.97	56.00	0.98
0.8179	55.268	0.97	55.986	0.98*
0.8190	55.264	0.97	55.98	0.98*
0.8205	55.258	0.97	55.973	0.98*
0.8231	55.248	0.97	55.960	0.98*
0.8247	55.241	0.97	55.952	0.98*
0.8250	55.24	0.97	55.95	0.98
0.8315	55.214	0.97	55.924	0.986*
0.8350	55.20	0.97	55.91	0.99
0.83652	55.195	0.972	55.902	0.99*
0.8440	55.173	0.979	55.865	0.99*
0.8450	55.17	0.98	55.86	0.99
0.84831	55.160	0.983	55.853	0.993*
0.8550	55.14	0.99	55.84	1.00
0.8650	55.11	1.01	55.80	1.01
0.8750	55.08	1.02	55.78	1.03
0.8850	55.05	1.03	55.73	1.03
0.8950	55.02	1.04	55.70	1.04

* value interpolated

****
Test Result for UIM Dielectric Parameter
Sat 27/Apr/2013 05:28:55
Freq Frequency(GHz)
FCC_eH   FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH   FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB   FCC Limits for Body Epsilon
FCC_sB   FCC Limits for Body Sigma
Test_e   Epsilon of UIM
Test_s   Sigma of UIM
****

Freq	FCC_eB	FCC_sB	Test_e	Test_s
1.8400	53.30	1.52	52.04	1.43
1.8500	53.30	1.52	52.03	1.44
1.85125	53.30	1.52	52.03	1.44*
1.8550	53.30	1.52	52.03	1.44*
1.8600	53.30	1.52	52.03	1.44
1.8700	53.30	1.52	52.14	1.45
1.8800	53.30	1.52	52.10	1.45
1.8825	53.30	1.52	52.118	1.453*
1.8900	53.30	1.52	52.17	1.46
1.9000	53.30	1.52	52.07	1.47
1.90875	53.30	1.52	52.114	1.496*
1.9100	53.30	1.52	52.12	1.50
1.9200	53.30	1.52	52.00	1.50

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Wed 01/May/2012 05:41:51
Freq  Frequency(GHz)
FCC_eH      FCC Bulletin 65 Supplement C ( June 2001) Limits for Head Epsilon
FCC_sH      FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB      FCC Limits for Body Epsilon
FCC_sB      FCC Limits for Body Sigma
Test_e      Epsilon  of  UIM
Test_s      Sigma of UIM
***********************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.4900	52.65	2.01	52.60	2.02
2.5000	52.64	2.02	52.58	2.03
2.5060	52.628	2.032	52.562	2.042*
2.5100	52.62	2.04	52.55	2.05
2.5200	52.61	2.05	52.52	2.07
2.5300	52.60	2.06	52.50	2.09
2.5400	52.59	2.08	52.49	2.11
2.5500	52.57	2.09	52.47	2.12
2.5600	52.56	2.11	52.45	2.14
2.5700	52.55	2.12	52.43	2.16
2.5800	52.53	2.13	52.42	2.17
2.5900	52.52	2.15	52.39	2.19
2.5930	52.517	2.153	52.387	2.196*
2.6000	52.51	2.16	52.38	2.21
2.6100	52.50	2.18	52.35	2.22
2.6200	52.48	2.19	52.33	2.25
2.6300	52.47	2.21	52.32	2.27
2.6400	52.46	2.22	52.30	2.29
2.6500	52.45	2.23	52.29	2.30
2.6600	52.43	2.25	52.27	2.32
2.6700	52.42	2.26	52.25	2.34
2.6800	52.41	2.28	52.23	2.35
2.6900	52.39	2.29	52.20	2.37
2.7000	52.38	2.30	52.19	2.39

* value interpolated

```
**************************************************************
Test Result for UIM Dielectric Parameter
Sun 28/Apr/2013 02:56:41
Freq  Frequency(GHz)
FCC_eH      FCC Bulletin 65 Supplement C ( June 2001) Limits for Head Epsilon
FCC_sH      FCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB      FCC Limits for Body Epsilon
FCC_sB      FCC Limits for Body Sigma
Test_e      Epsilon  of  UIM
Test_s      Sigma of UIM
**************************************************************
```

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.4000	52.76	1.90	52.42	1.94
2.4100	52.75	1.91	52.35	1.95
2.4200	52.74	1.92	52.31	1.96
2.4300	52.73	1.93	52.30	1.98
2.4370	52.716	1.937	52.279	1.987*
2.4400	52.71	1.94	52.27	1.99
2.4500	52.70	1.95	52.24	2.00
2.4600	52.69	1.96	52.21	2.01
2.4700	52.67	1.98	52.19	2.02
2.4800	52.66	1.99	52.10	2.03

* value interpolated

RF Exposure Lab

Plot 1

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d089

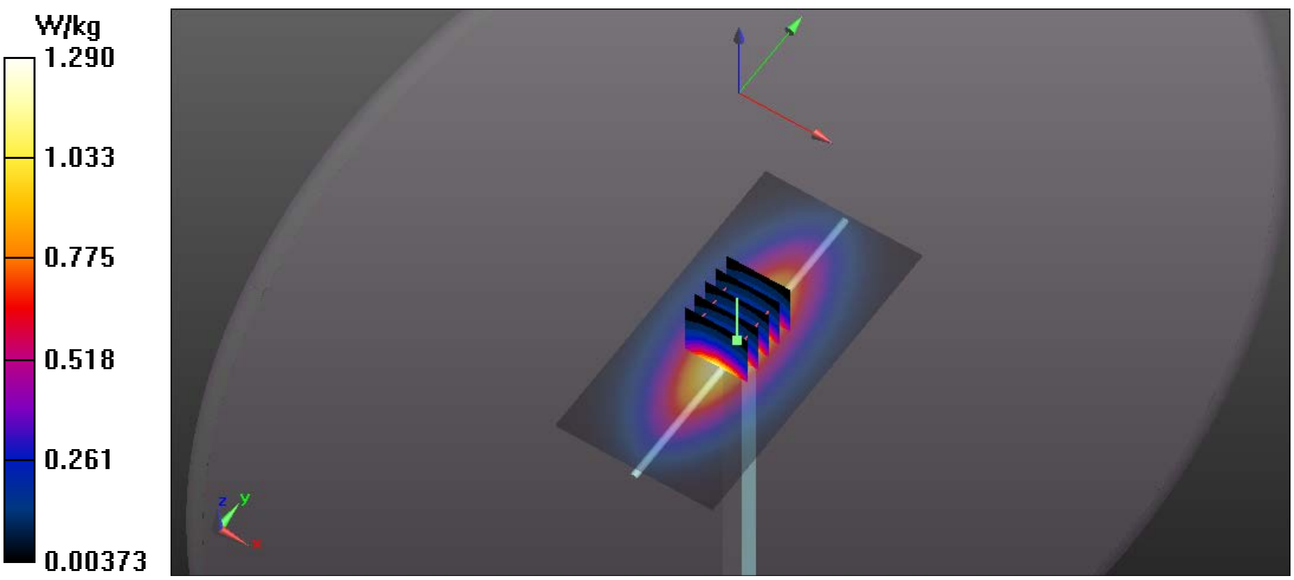
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 55.91; ρ = 1000 kg/m^3
Phantom section: Flat Section

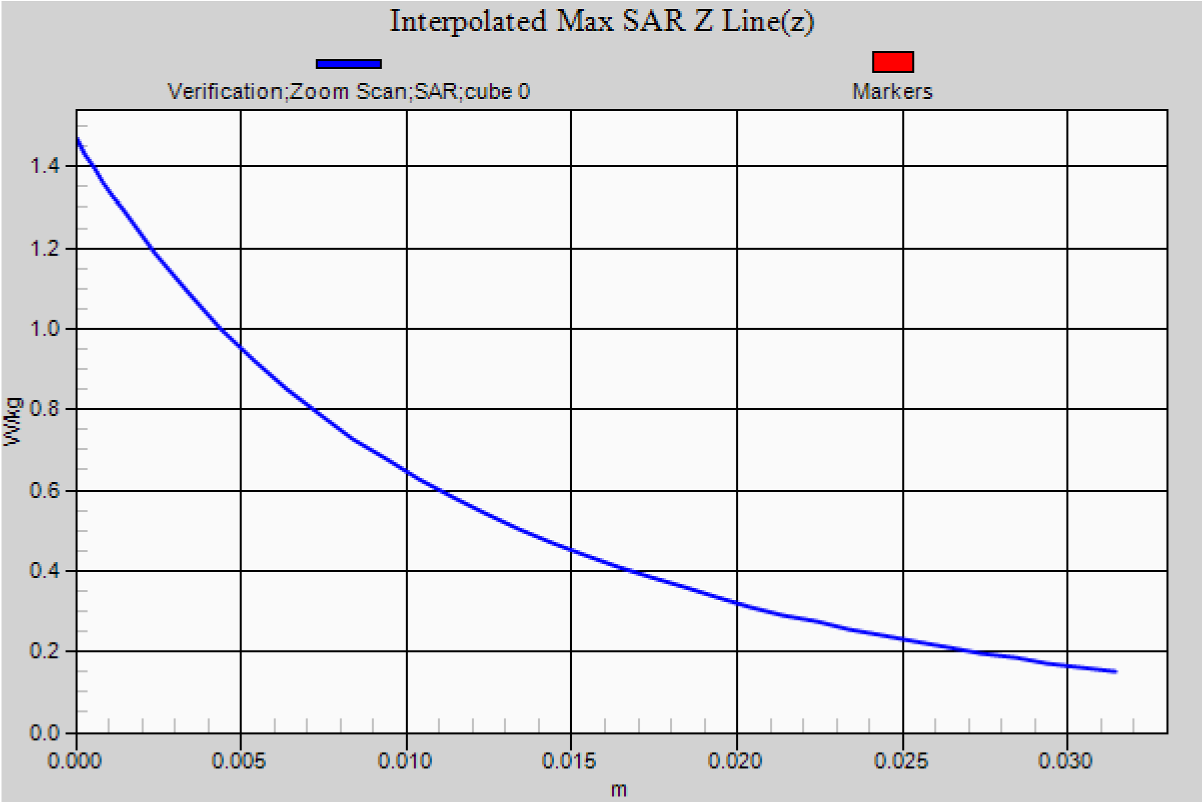
Test Date: Date: 4/29/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

835 MHz Body/Verification/Area Scan (81x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.29 W/kg

835 MHz Body/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.612 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.963 W/kg; SAR(10 g) = 0.632 W/kg
Maximum value of SAR (measured) = 1.29 W/kg




Interpolated Max SAR Z Line(z)
Verification;Zoom Scan;SAR;cube 0
Markers
W/kg
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

RF Exposure Lab

Plot 2

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d116

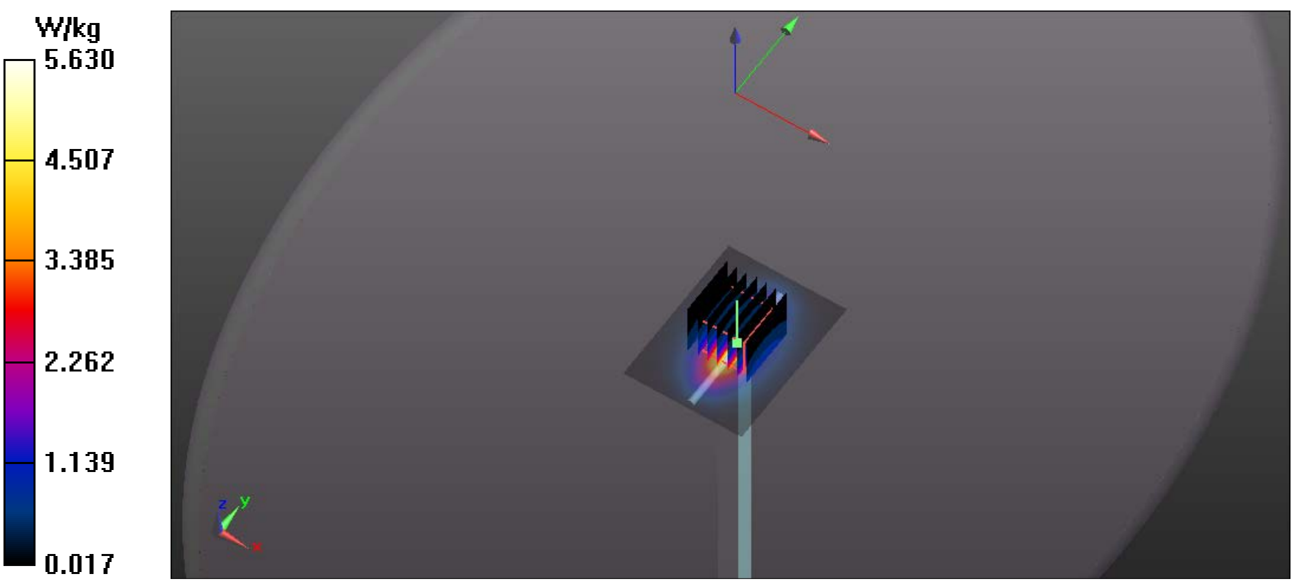
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used: f = 1900 MHz; σ = 1.47 S/m; ε_r = 52.07; ρ = 1000 kg/m^3
Phantom section: Flat Section

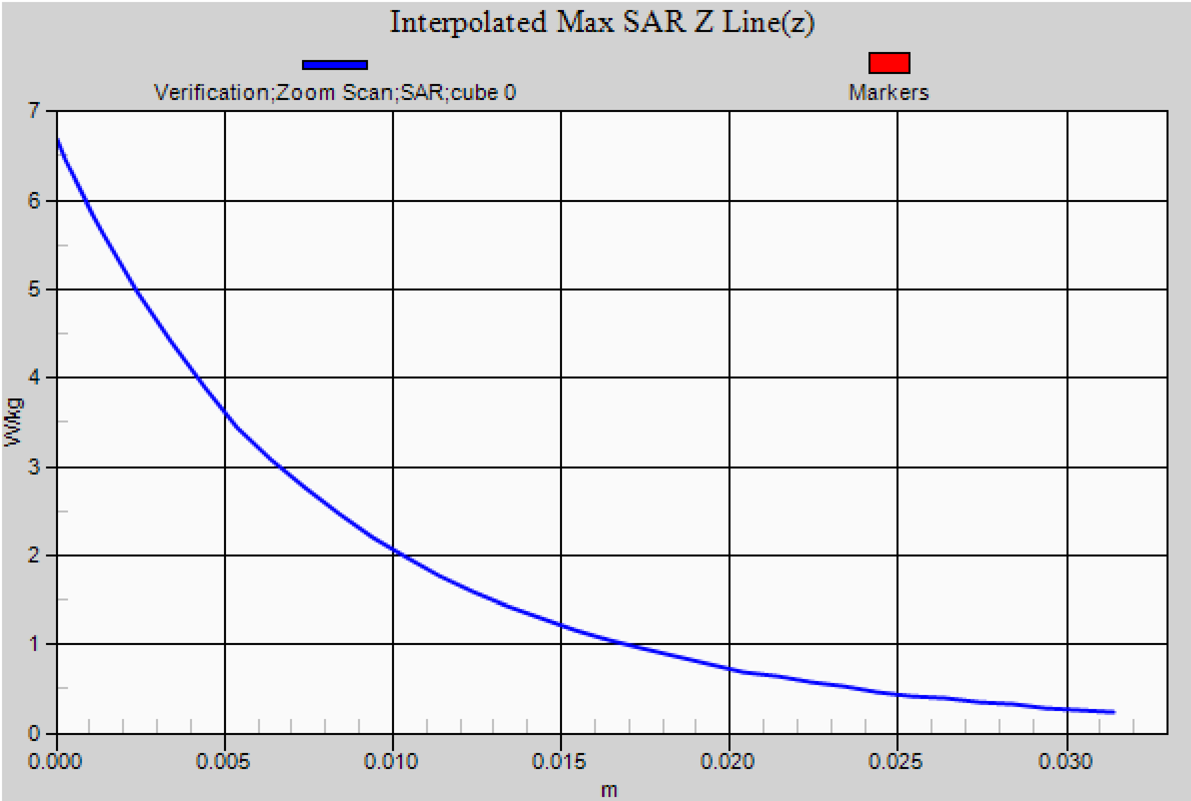
Test Date: Date: 4/27/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(7.13, 7.13, 7.13); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

1900 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 5.63 W/kg

1900 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.612 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.68 W/kg
SAR(1 g) = 3.9 W/kg; SAR(10 g) = 1.92 W/kg
Maximum value of SAR (measured) = 5.63 W/kg




Interpolated Max SAR Z Line(z)
Verification;Zoom Scan;SAR;cube 0
Markers
W/kg
7
6
5
4
3
2
1
0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

RF Exposure Lab

Plot 3

DUT: Dipole 2550 MHz D2550V2; Type: D2550V2; Serial: D2550V2 - SN:1003

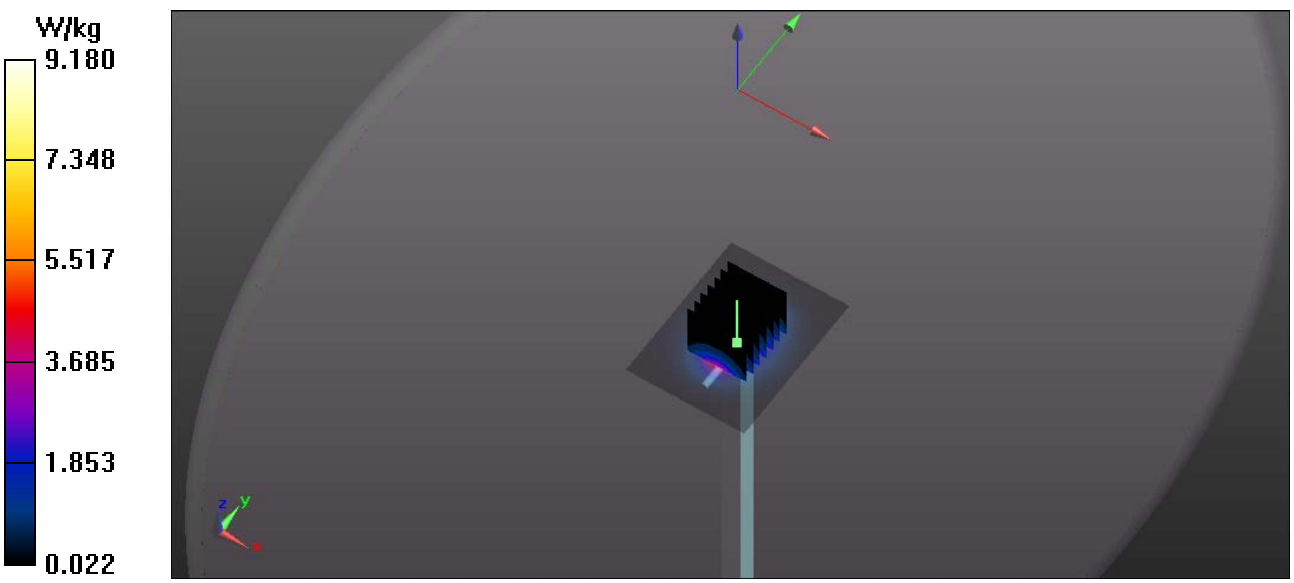
Communication System: CW; Frequency: 2550 MHz; Duty Cycle: 1:1
Medium: MSL2600; Medium parameters used: f = 2550 MHz; σ = 2.12 S/m; ε_r = 52.47; ρ = 1000 kg/m^3
Phantom section: Flat Section

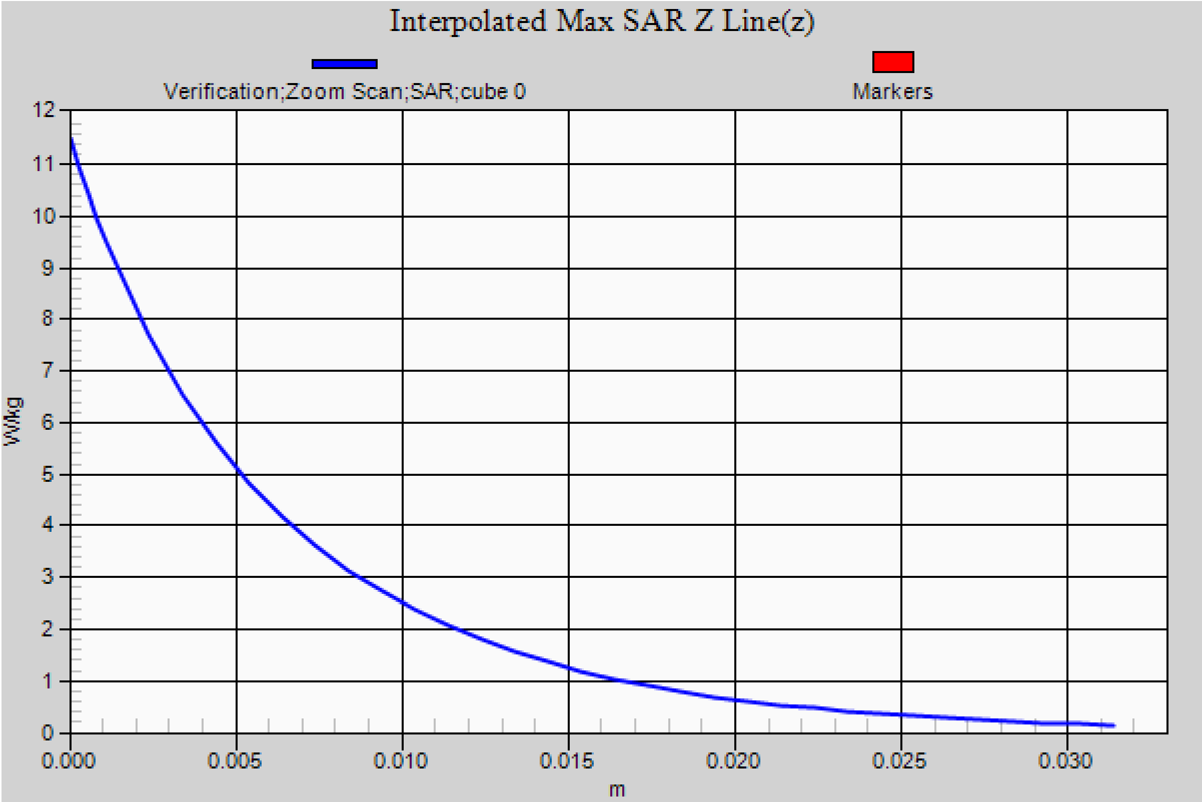
Test Date: Date: 5/1/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: ES3DV3 - SN3311; ConvF(4.22, 4.22, 4.22); Calibrated: 1/16/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

2550 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 9.18 W/kg

2550 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.541 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.5 W/kg
SAR(1 g) = 5.21 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 8.98 W/kg




Interpolated Max SAR Z Line(z)
Verification;Zoom Scan;SAR;cube 0
Markers
W/kg
m
0
1
2
3
4
5
6
7
8
9
10
11
12
0.000
0.005
0.010
0.015
0.020
0.025
0.030

RF Exposure Lab

Plot 4

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:829

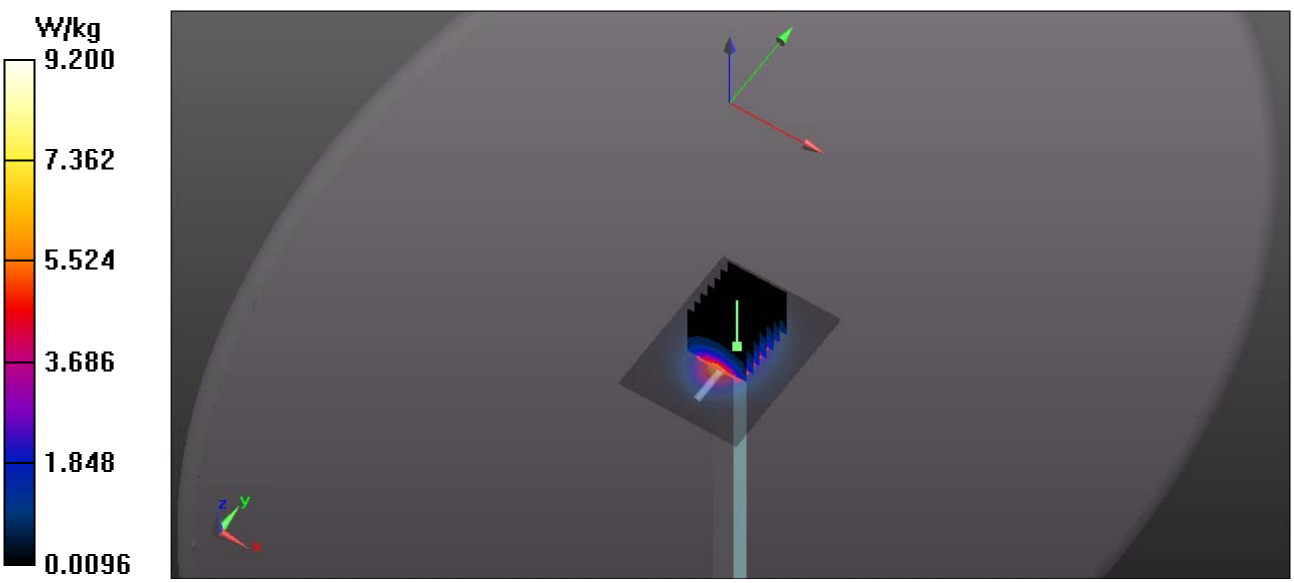
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 52.24; ρ = 1000 kg/m^3
Phantom section: Flat Section

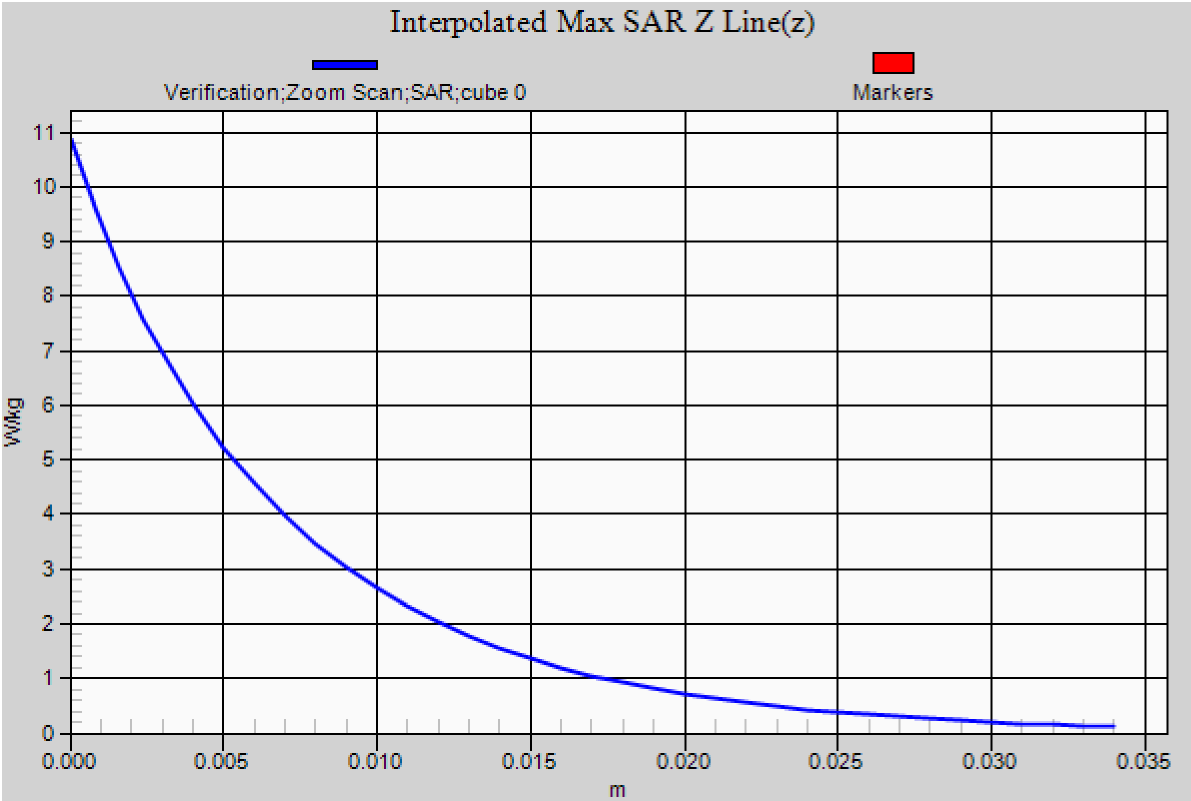
Test Date: Date: 4/28/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(6.76, 6.76, 6.76); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

2450 MHz Body/Verification/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 9.20 W/kg

2450 MHz Body/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.541 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 10.9 W/kg
SAR(1 g) = 5.24 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 5.95 W/kg




Interpolated Max SAR Z Line(z)
Verification;Zoom Scan;SAR;cube 0
Markers
W/kg
m
0
1
2
3
4
5
6
7
8
9
10
11
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035

Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

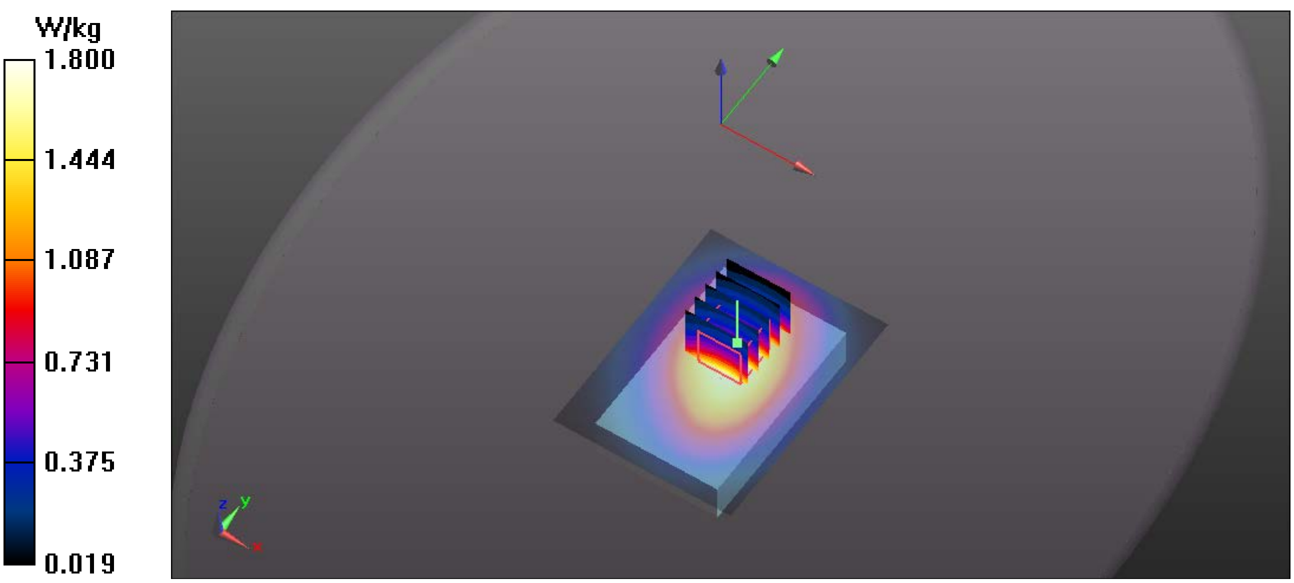
Communication System: CDMA2000 (1xEV-DO); Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used: f = 825 MHz; σ = 0.98 S/m; ε_r = 55.95; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/30/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

Band 5 Rev. 0/Side C Low/Area Scan (91x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.80 W/kg

Band 5 Rev. 0/Side C Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.659 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.97 W/kg
SAR(1 g) = 1.43 W/kg; SAR(10 g) = 1.05 W/kg
Maximum value of SAR (measured) = 1.78 W/kg



RF Exposure Lab

Plot 2

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

Communication System: CDMA2000 (1xEV-DO); Frequency: 817.9 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 817.9 MHz; σ = 0.98 S/m; ε_r = 55.986; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/30/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

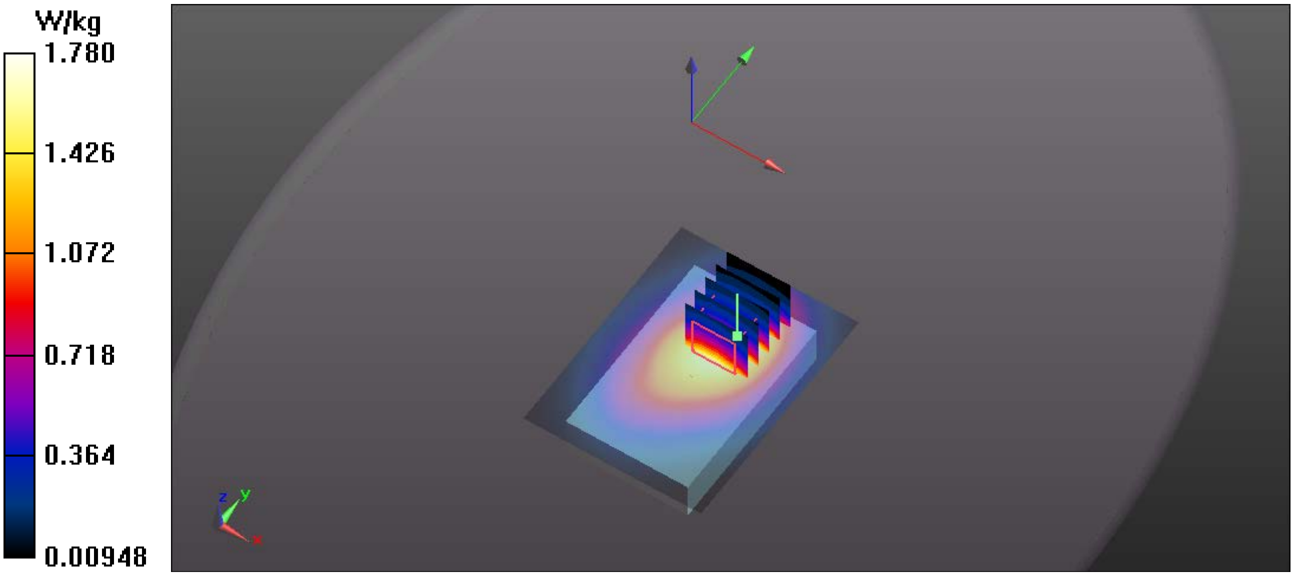
Procedure Notes:

Band 10 Rev. 0/Side A Low/Area Scan (91x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.78 W/kg

Band 10 Rev. 0/Side A Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.695 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 2.01 W/kg
SAR(1 g) = 1.39 W/kg; SAR(10 g) = 0.975 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.77 W/kg



RF Exposure Lab

Plot 3

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

Communication System: CDMA2000 (1xEV-DO); Frequency: 1851.25 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): f = 1851.25 MHz; σ = 1.44 S/m; ε_r = 52.03; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/27/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(7.13, 7.13, 7.13); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

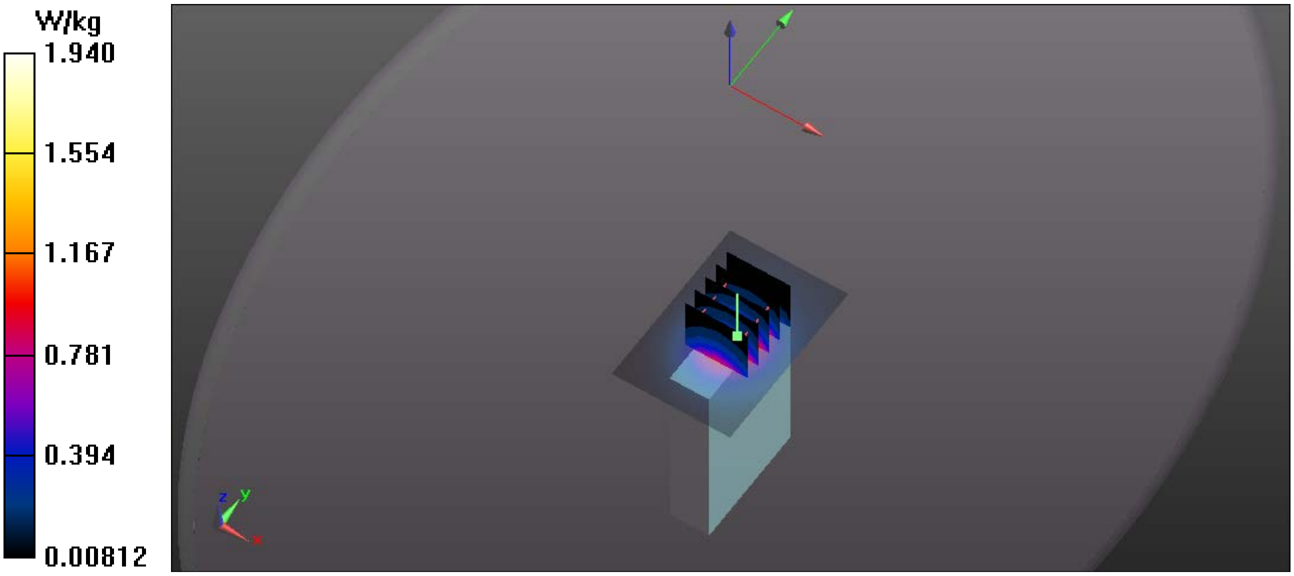
Procedure Notes:

Band 2 Rev. 0/Side E Low/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.94 W/kg

Band 2 Rev. 0/Side E Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.079 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.27 W/kg; SAR(10 g) = 0.680 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.87 W/kg



RF Exposure Lab

Plot 4

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 1855 MHz; Duty Cycle: 1:1
Medium: MSL1900; Medium parameters used (interpolated): f = 1855 MHz; σ = 1.44 S/m; ε_r = 52.03; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/28/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(7.13, 7.13, 7.13); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

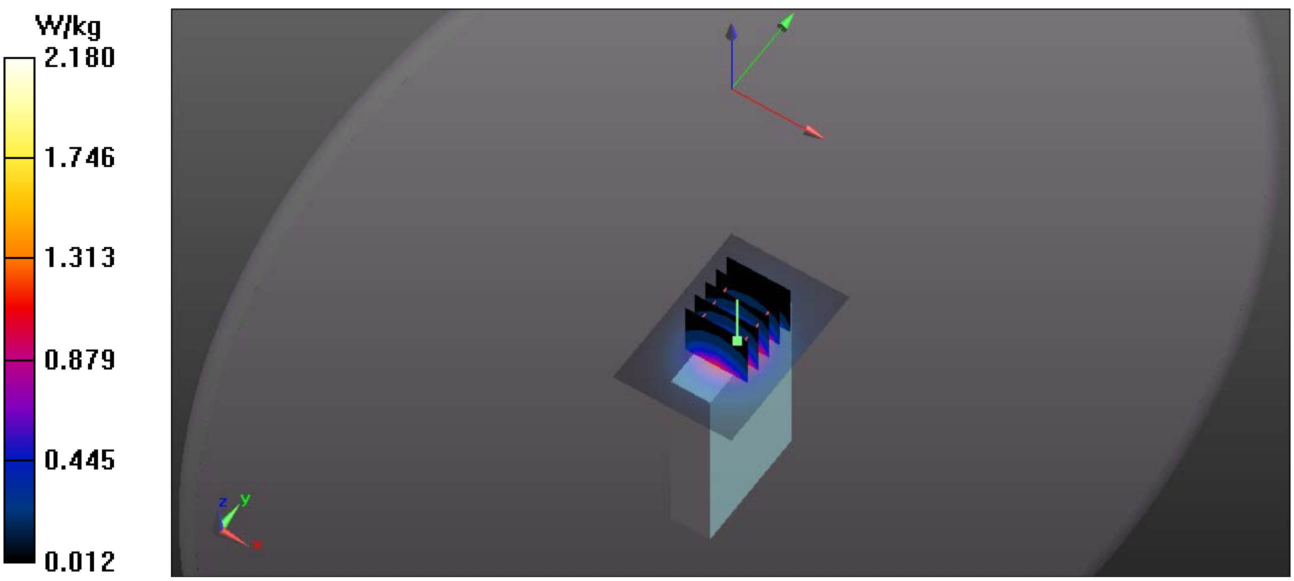
Procedure Notes:

Band 25 LTE/Side E, 1 RB Low, Low/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 2.18 W/kg

Band 25 LTE/Side E, 1 RB Low, Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.435 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.42 W/kg
SAR(1 g) = 1.4 W/kg; SAR(10 g) = 0.753 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.06 W/kg



RF Exposure Lab

Plot 5

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 819 MHz; Duty Cycle: 1:1
Medium: MSL835; Medium parameters used (interpolated): f = 819 MHz; σ = 0.98 S/m; ε_r = 55.98; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/29/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(8.87, 8.87, 8.87); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

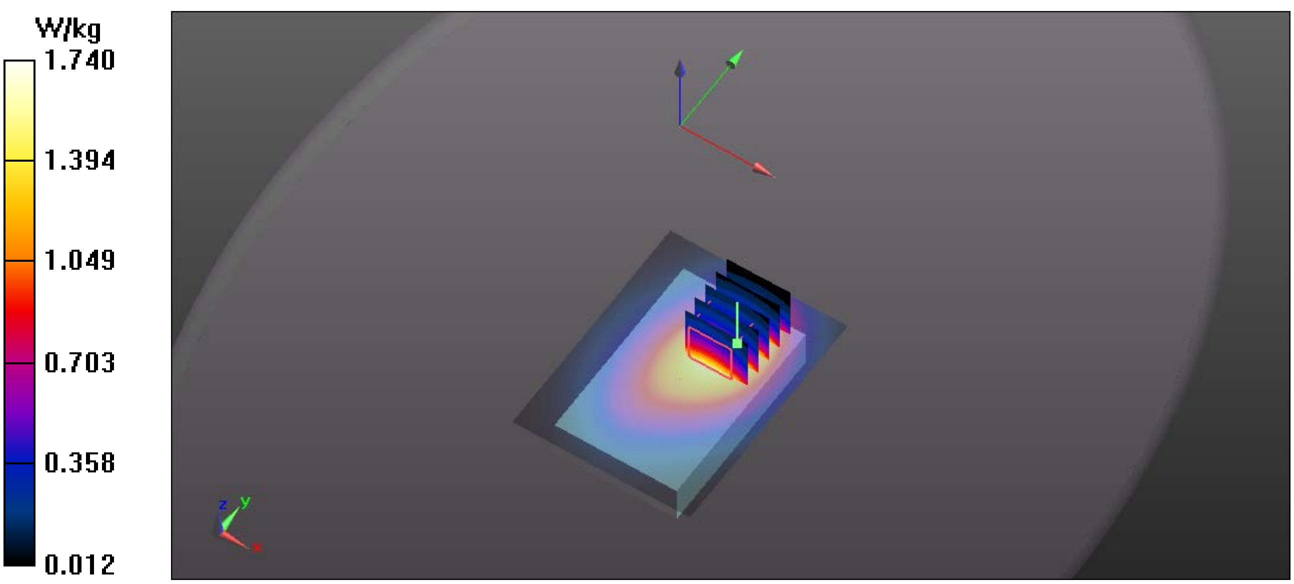
Procedure Notes:

Band 26 LTE/Side A, 1 RB Middle, Low/Area Scan (91x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.74 W/kg

Band 26 LTE/Side A, 1 RB Middle, Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.311 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.95 W/kg
SAR(1 g) = 1.29 W/kg; SAR(10 g) = 0.941 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.73 W/kg



RF Exposure Lab

Plot 6

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

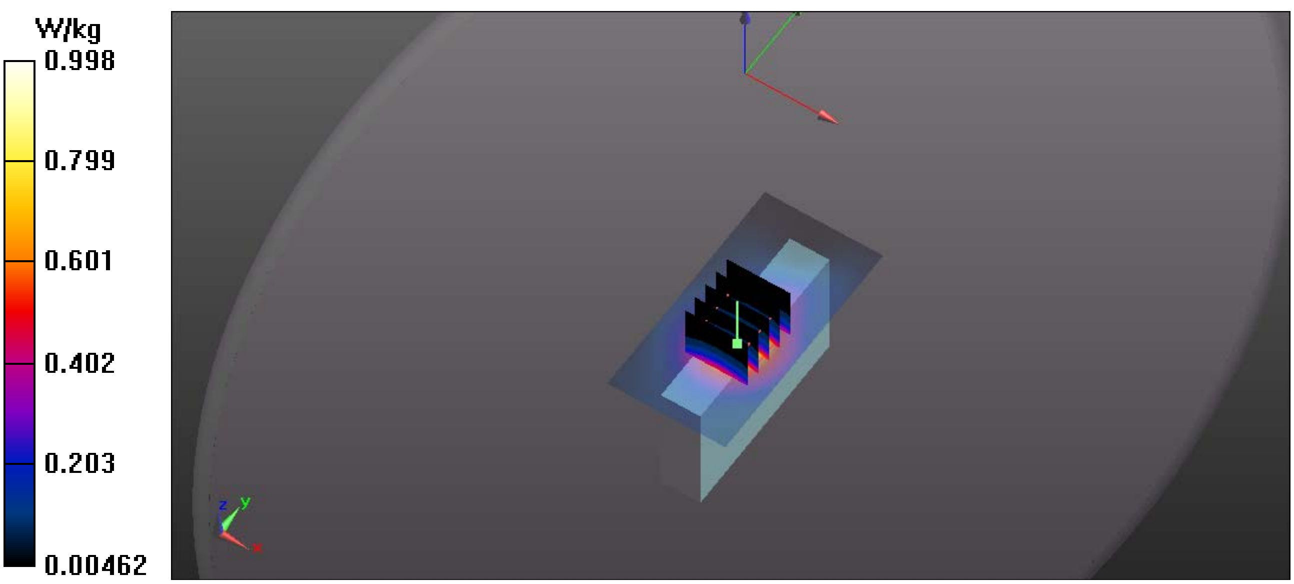
Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK) 50% Duty Cycle; Frequency: 2680 MHz; Duty Cycle: 1:2.00032
Medium: MSL2600; Medium parameters used: f = 2680 MHz; σ = 2.35 S/m; ε_r = 52.23; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 5/1/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: ES3DV3 - SN3311; ConvF(4.22, 4.22, 4.22); Calibrated: 1/16/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

Procedure Notes:

Band 41 LTE-2/Right, 1 RB Low, High/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.998 W/kg

Band 41 LTE-2/Right, 1 RB Low, High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.836 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.58 W/kg
SAR(1 g) = 0.769 W/kg; SAR(10 g) = 0.396 W/kg
Maximum value of SAR (measured) = 0.970 W/kg



RF Exposure Lab

Plot 7

DUT: Spencer; Type: Hotspot; Serial: SY16413700029

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: MSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.987 S/m; ε_r = 52.279; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 4/28/2013; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN3693; ConvF(6.76, 6.76, 6.76); Calibrated: 8/20/2012;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/15/2012
Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1065
Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

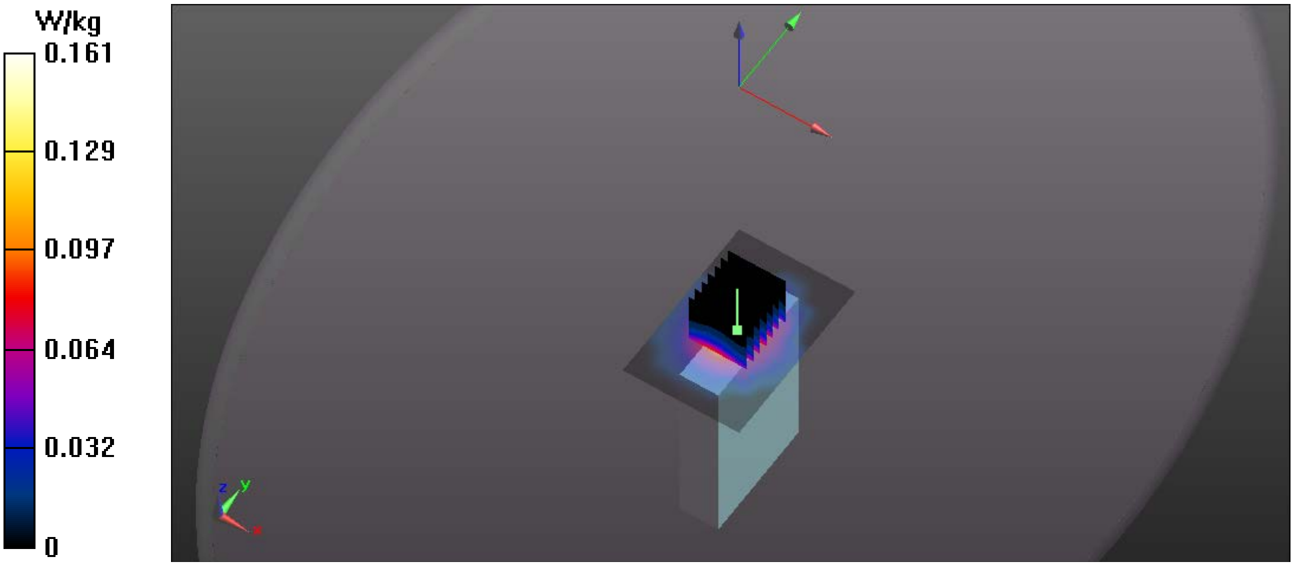
Procedure Notes:

2450 MHz/Side F Mid/Area Scan (61x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.161 W/kg

2450 MHz/Side F Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.805 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.212 W/kg
SAR(1 g) = 0.107 W/kg; SAR(10 g) = 0.055 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.166 W/kg



Appendix D – Probe Calibration Data Sheets

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

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

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

Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: EX3-3693_Aug12

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3693

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: August 20, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: August 20, 2012

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	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, 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 ≤ 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:3693

Manufactured: April 22, 2009
Calibrated: August 20, 2012

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.49	0.48	0.46	± 10.1 %
DCP (mV)[B]	98.3	100.5	98.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	161.4	±3.0 %
			Y	0.00	0.00	1.00	154.4	
			Z	0.00	0.00	1.00	158.9	

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:3693

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)
750	41.9	0.89	8.99	8.99	8.99	0.23	1.20	± 12.0 %
835	41.5	0.90	8.55	8.55	8.55	0.18	1.56	± 12.0 %
1750	40.1	1.37	8.00	8.00	8.00	0.51	0.76	± 12.0 %
1900	40.0	1.40	7.67	7.67	7.67	0.75	0.63	± 12.0 %
2450	39.2	1.80	6.72	6.72	6.72	0.29	1.09	± 12.0 %
2550	39.1	1.91	6.55	6.55	6.55	0.39	0.93	± 12.0 %
5200	36.0	4.66	4.97	4.97	4.97	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.78	4.78	4.78	0.30	1.80	± 13.1 %
5600	35.5	5.07	4.22	4.22	4.22	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.34	4.34	4.34	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.

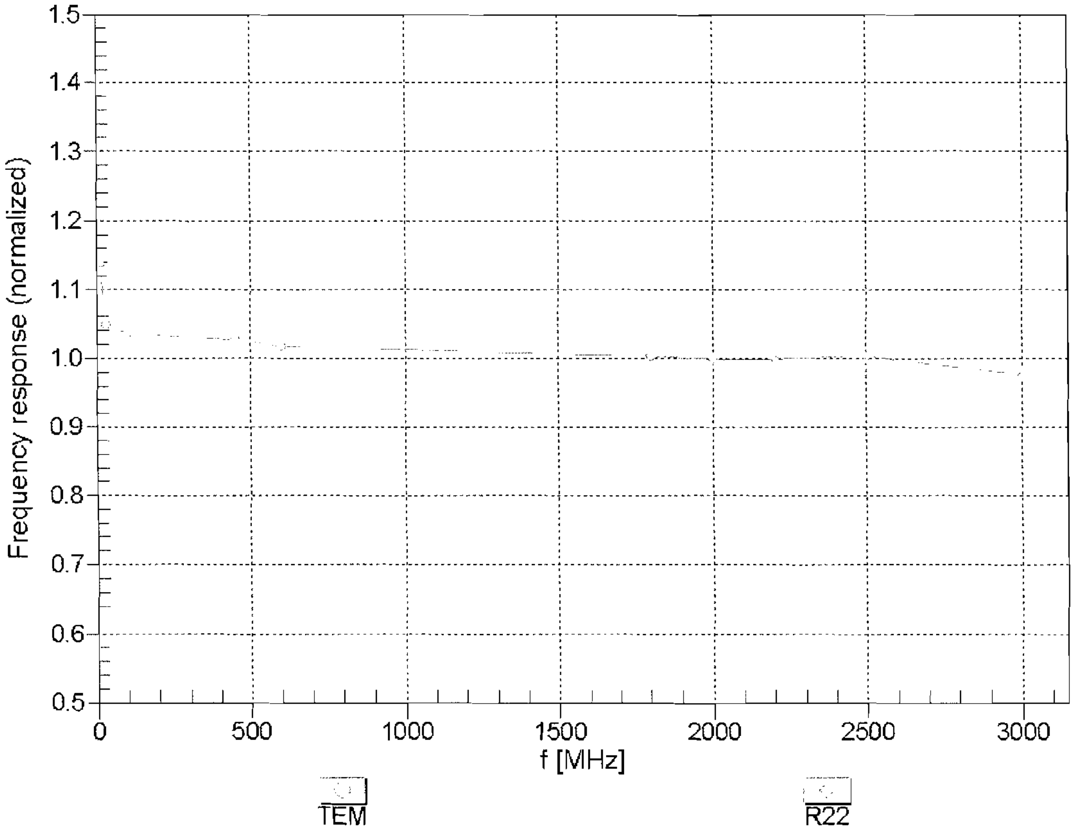
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

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)
750	55.5	0.96	8.84	8.84	8.84	0.29	1.09	± 12.0 %
835	55.2	0.97	8.87	8.87	8.87	0.60	0.71	± 12.0 %
1750	53.4	1.49	7.43	7.43	7.43	0.41	0.85	± 12.0 %
1900	53.3	1.52	7.13	7.13	7.13	0.41	0.82	± 12.0 %
2450	52.7	1.95	6.76	6.76	6.76	0.80	0.50	± 12.0 %
2550	52.6	2.09	6.75	6.75	6.75	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.31	4.31	4.31	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.24	4.24	4.24	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.76	3.76	3.76	0.45	1.90	± 13.1 %
5800	48.2	6.00	4.08	4.08	4.08	0.50	1.90	± 13.1 %

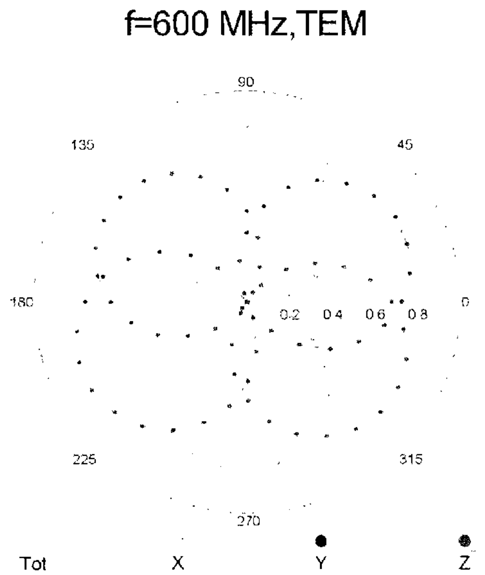
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.

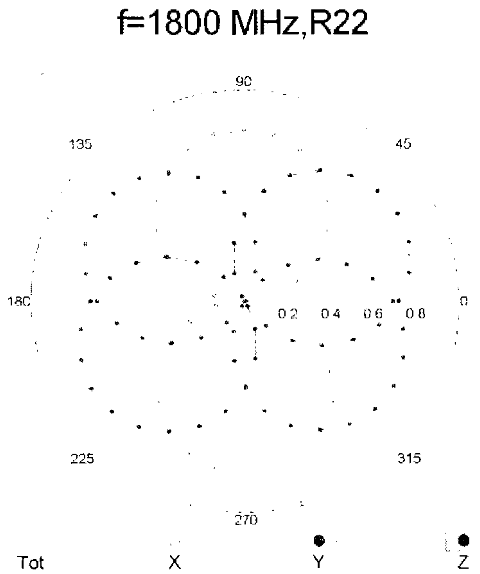
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

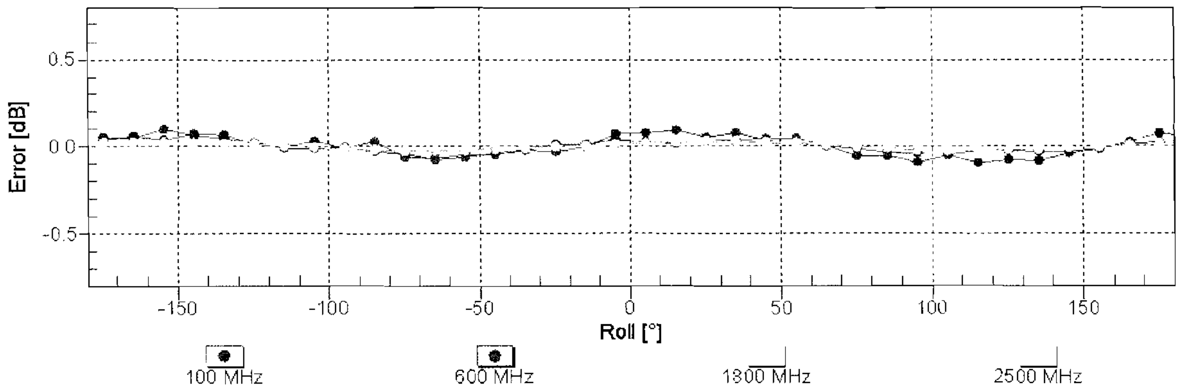


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

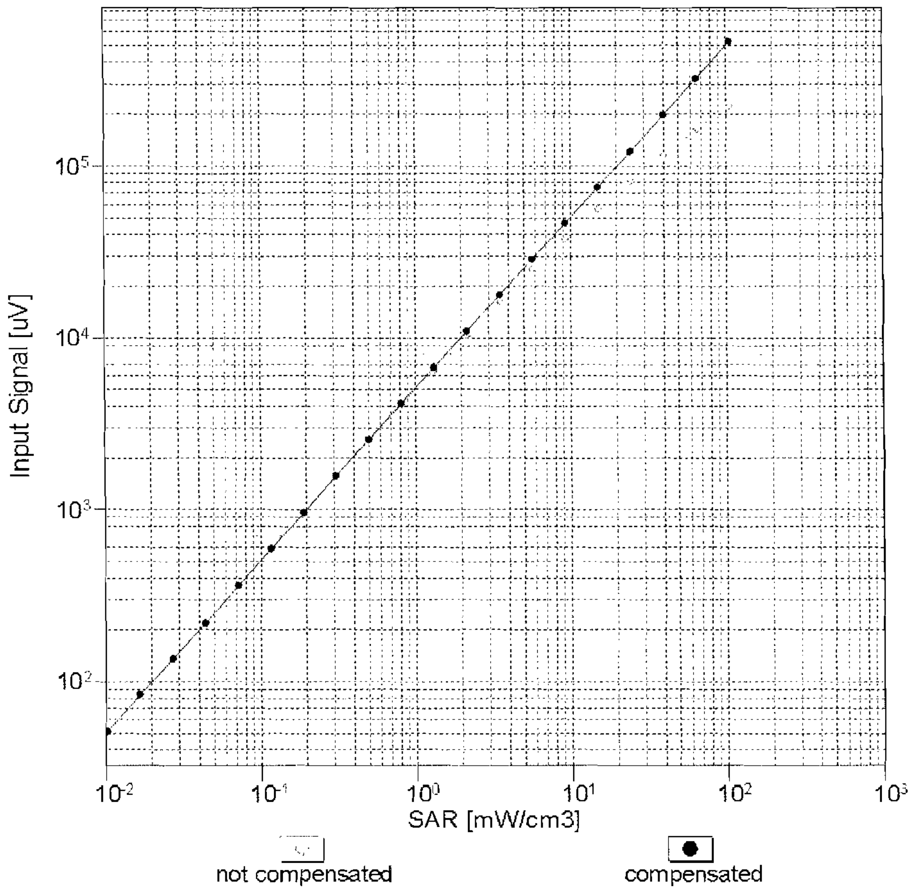


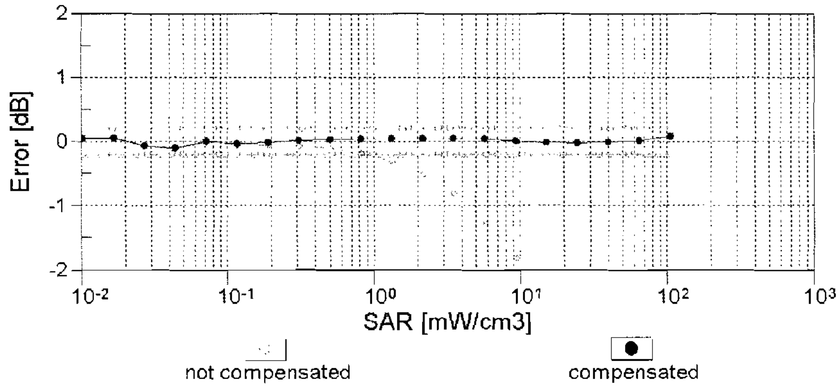




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

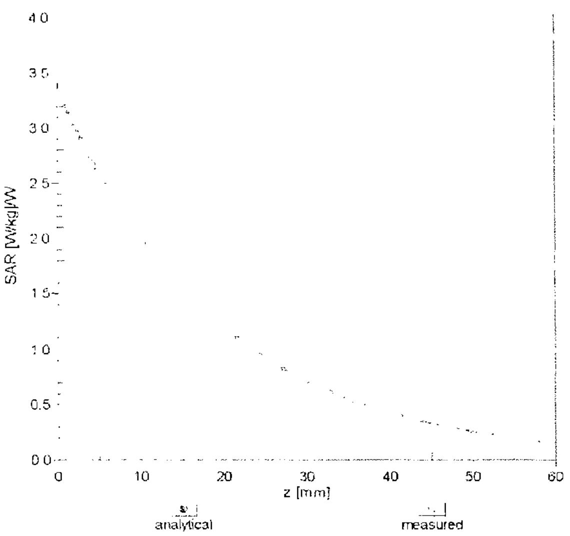
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

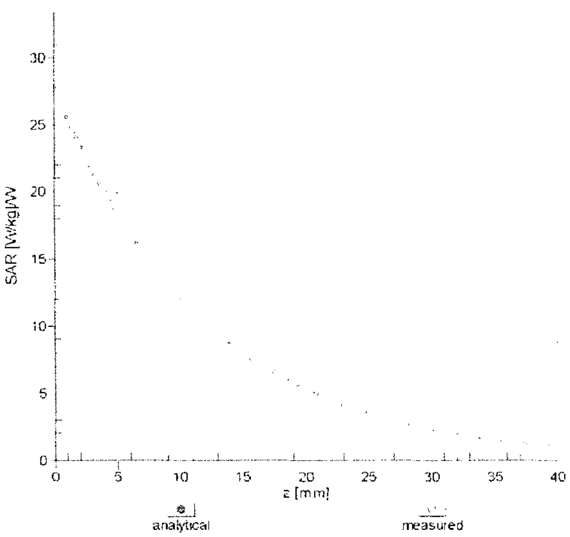




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

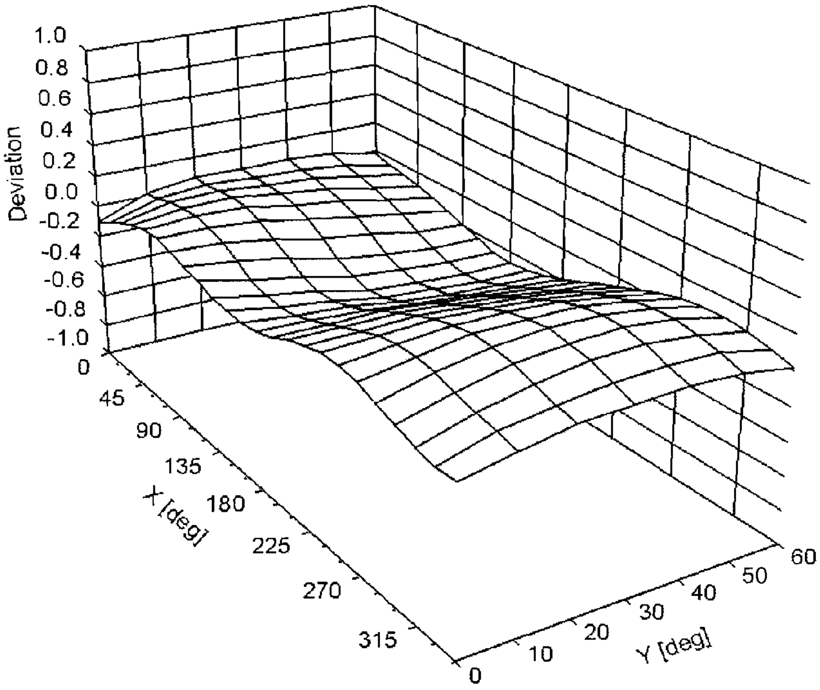
Conversion Factor Assessment

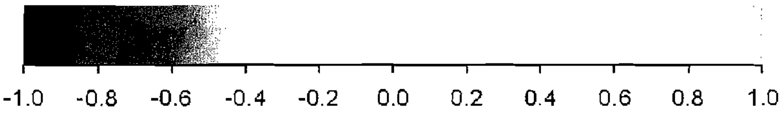




Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3693

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	155.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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

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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: ES3-3311_Jan13

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3311

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: January 16, 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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	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: January 16, 2013

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 ES3DV3

SN:3311

Manufactured: July 5, 2011
Calibrated: January 16, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3311

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.28	1.07	0.47	± 10.1 %
DCP (mV)[B]	99.3	101.9	96.2	

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	166.2	±3.0 %
		Y	0.0	0.0	1.0		143.1	
		Z	0.0	0.0	1.0		160.5	

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: ES3DV3 - SN:3311

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)
300	45.3	0.87	7.72	7.72	7.72	0.28	1.40	± 13.4 %
450	43.5	0.87	7.12	7.12	7.12	0.19	2.14	± 13.4 %
900	41.5	0.97	6.17	6.17	6.17	0.27	2.14	± 12.0 %
2600	39.0	1.96	4.44	4.44	4.44	0.80	1.37	± 12.0 %

[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.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3311

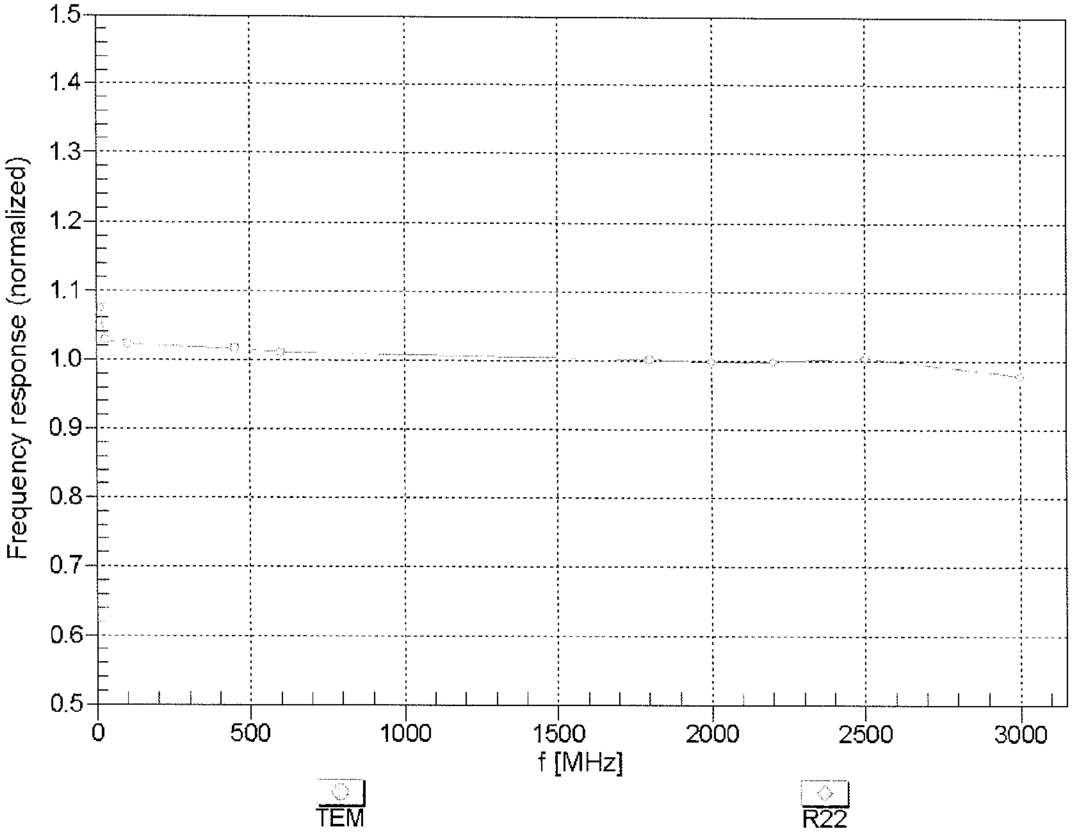
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	7.03	7.03	7.03	0.22	1.55	± 13.4 %
450	56.7	0.94	7.16	7.16	7.16	0.11	1.00	± 13.4 %
900	55.0	1.05	6.14	6.14	6.14	0.38	1.67	± 12.0 %
2600	52.5	2.16	4.22	4.22	4.22	0.71	1.01	± 12.0 %

[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

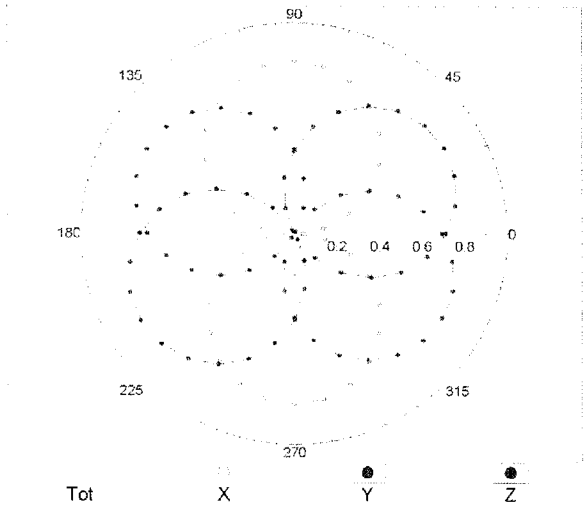
(TEM-Cell:ifi110 EXX, Waveguide: R22)



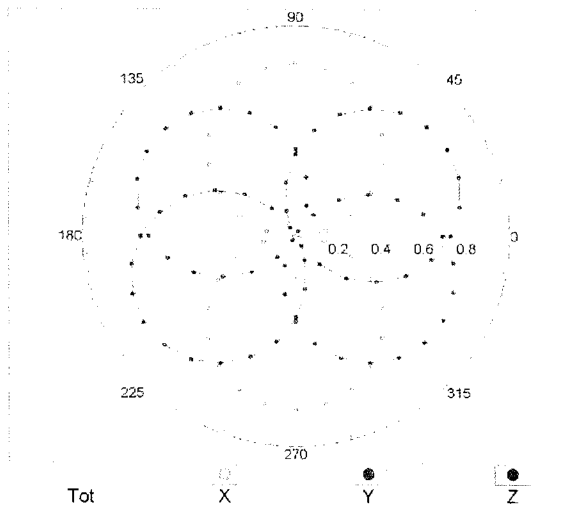
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

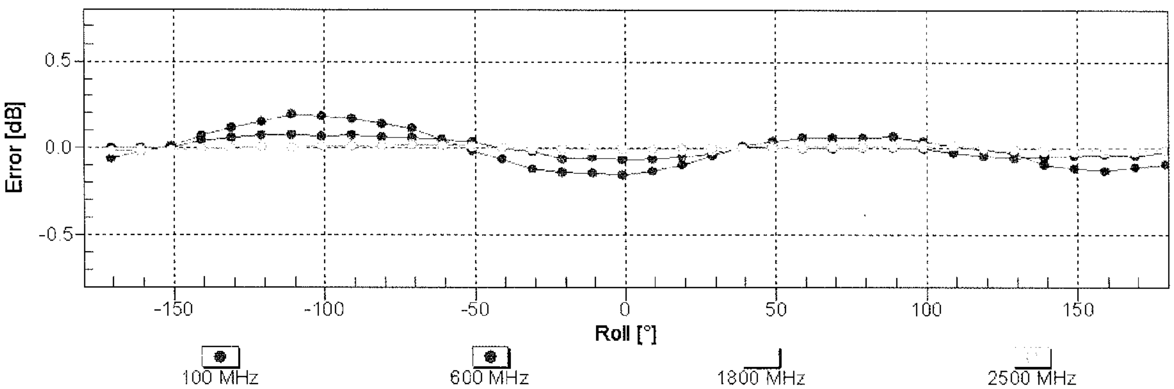
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



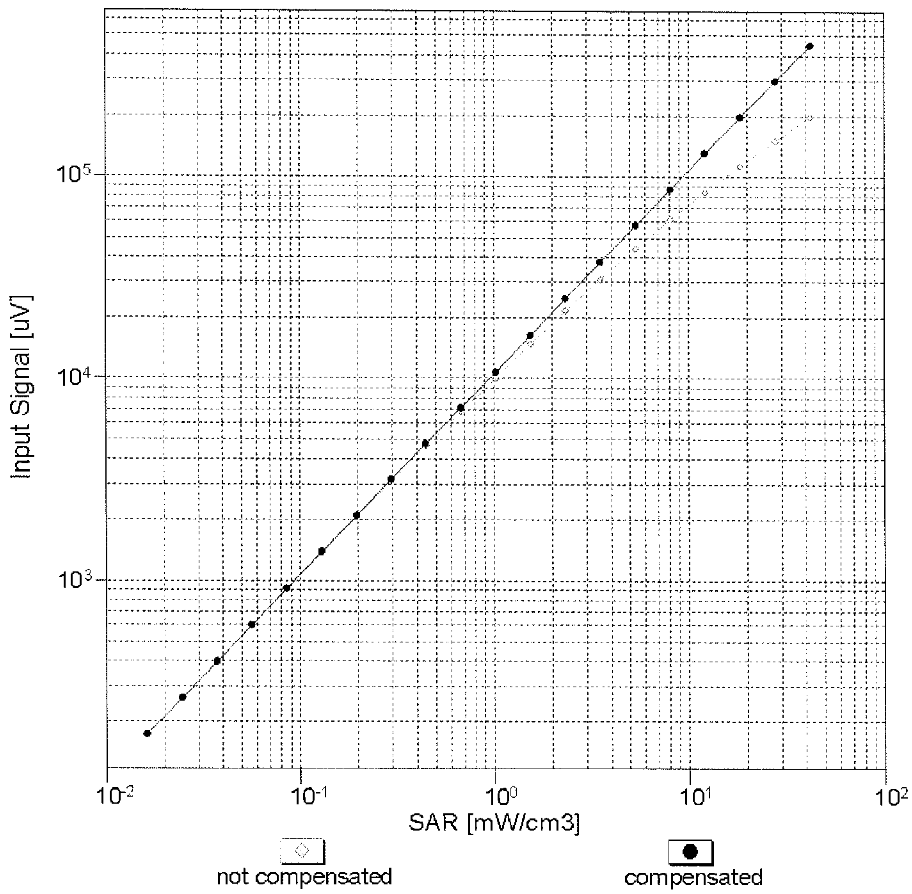
f=1800 MHz,R22

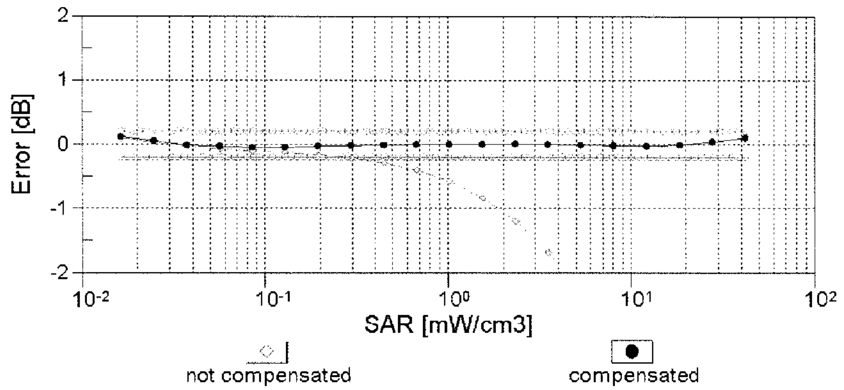




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

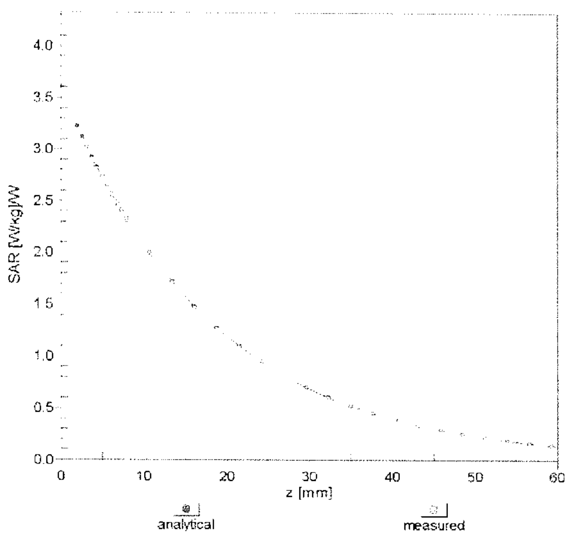




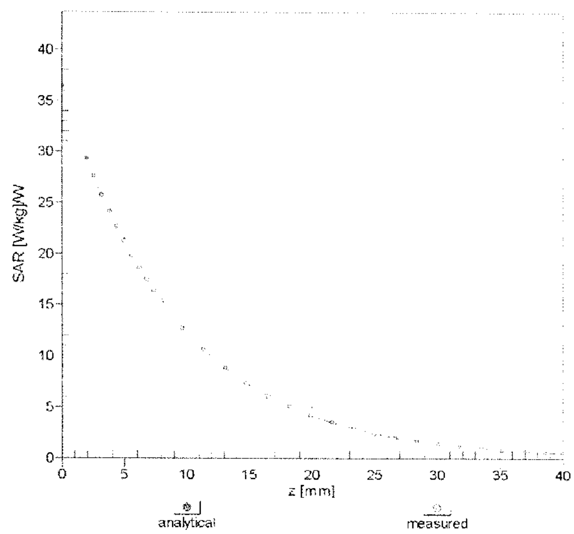
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

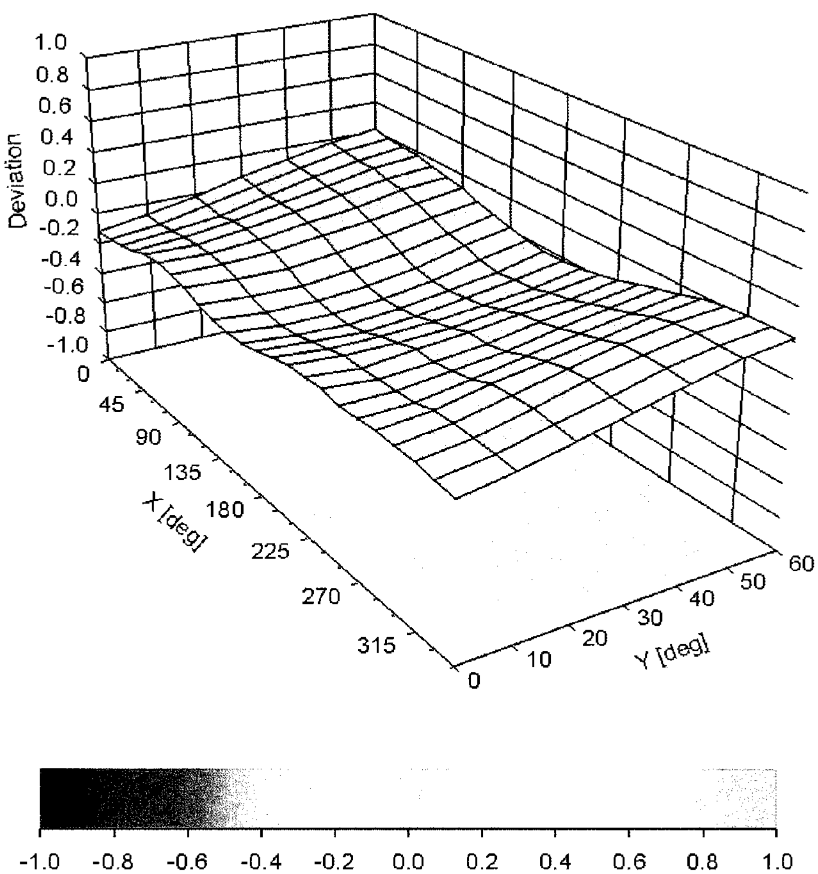


f = 2600 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3311

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	59
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Schmid & Partner Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Additional Conversion Factors

for Dosimetric E-Field Probe

Type:	**ES3DV3**
Serial Number:	**3311**
Place of Assessment:	**Zurich**
Date of Assessment:	**January 17, 2013**
Probe Calibration Date:	**January 16, 2013**

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 300, 450 and 900 MHz.

Assessed by:

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Dosimetric E-Field Probe ES3DV3 SN:3311

Conversion factor (± standard deviation)

150 ± 50 MHz	*ConvF*	**8.39 ± 10%**	ε_r = 52.3 ±5% σ = 0.76 ±5% mho/m (head tissue)
250 ± 50 MHz	*ConvF*	**7.80 ± 10%**	ε_r = 47.6 ±5% σ = 0.83 ±5% mho/m (head tissue)
150 ± 50 MHz	*ConvF*	**8.10 ± 10%**	ε_r = 61.9 ±5% σ = 0.80 ±5% mho/m (body tissue)
250 ± 50 MHz	*ConvF*	**7.68 ± 10%**	ε_r = 59.4 ±5% σ = 0.88 ±5% mho/m (body tissue)

Important Note:

For numerically assessed probe conversion factors, parameters Alpha and Delta in the DASY software must have the following entries: Alpha = 0 and Delta = 1.

Please see also DASY Manual.

Appendix E – Dipole Calibration Data Sheets

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

S **Schweizerischer Kalibrierdienst**
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Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: D835V2-4d089_Dec12

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d089
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 03, 2012

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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: December 3, 2012

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

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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	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.92 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	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.36 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.12 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.5 ± 6 %	0.99 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	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.51 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.27 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 2.5 jΩ
Return Loss	- 30.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω - 4.8 jΩ
Return Loss	- 25.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 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 17, 2008

Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d089

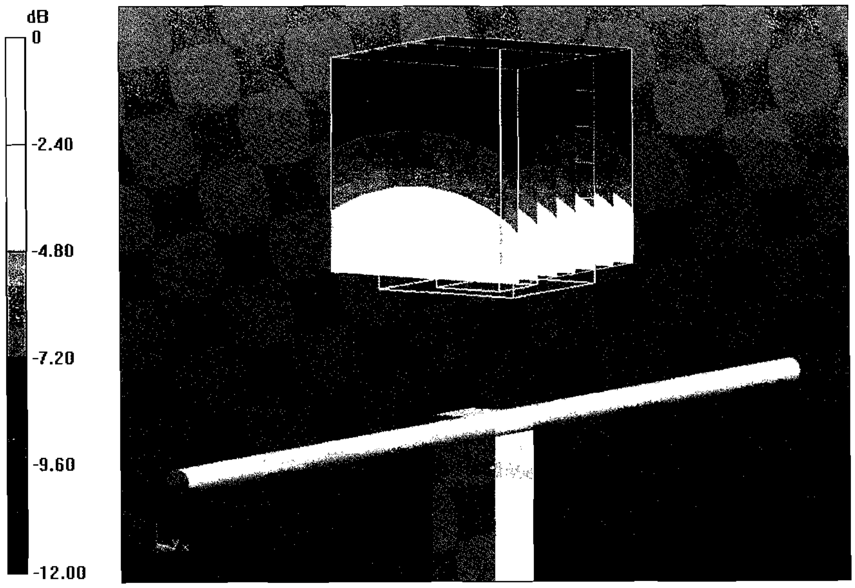
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

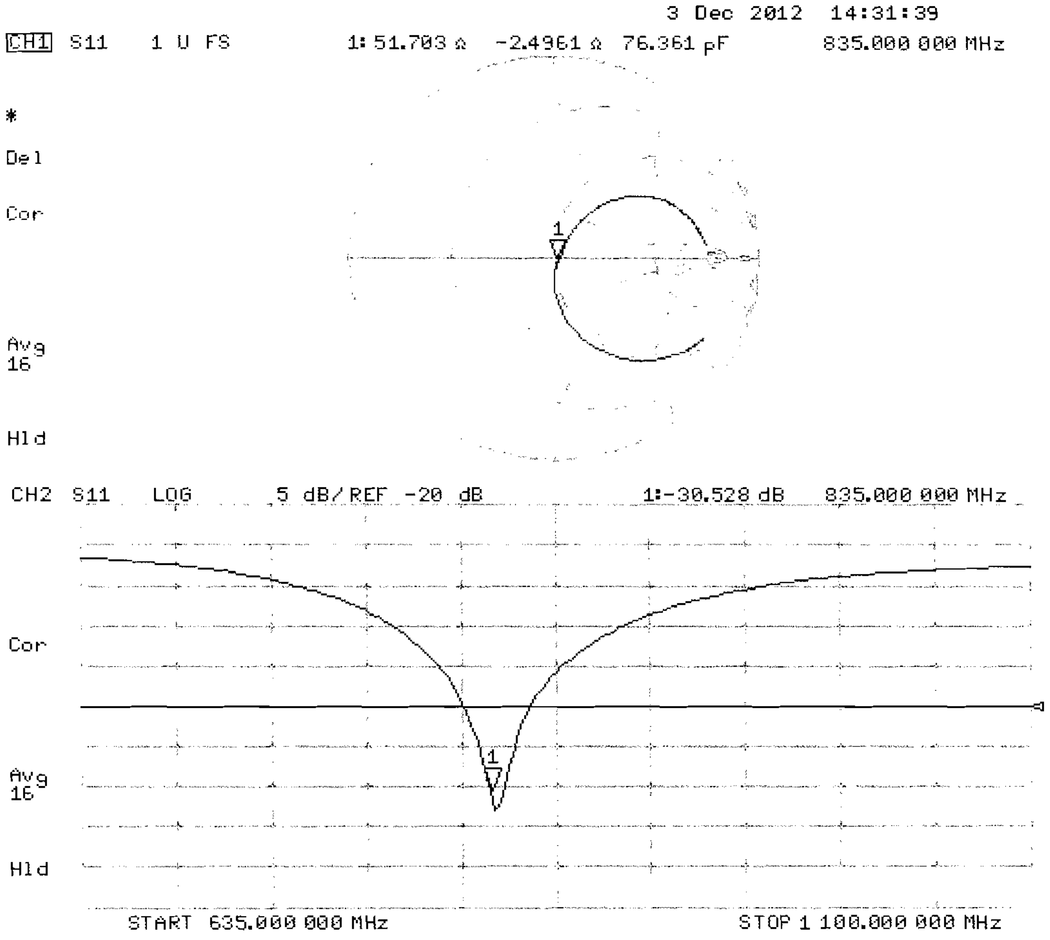
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.782 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.58 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 2.79 W/kg



0 dB = 2.79 W/kg = 4.46 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d089

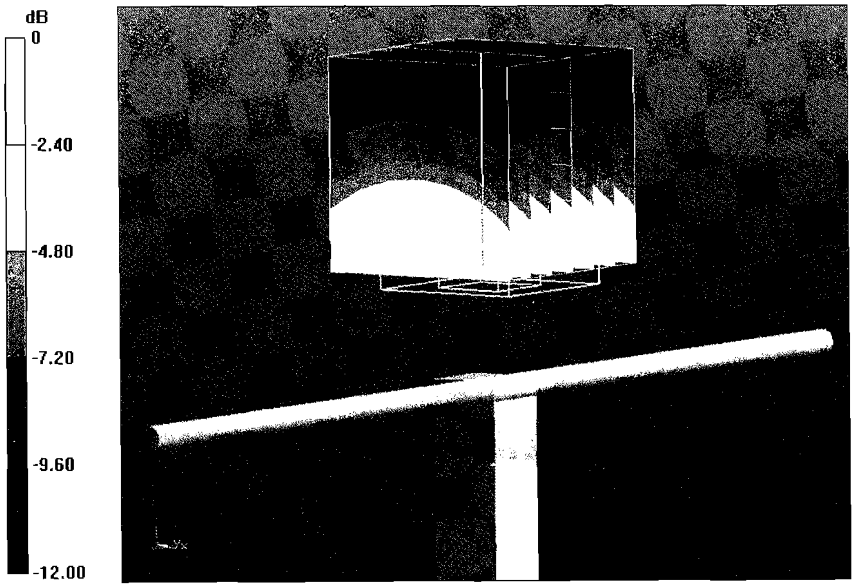
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

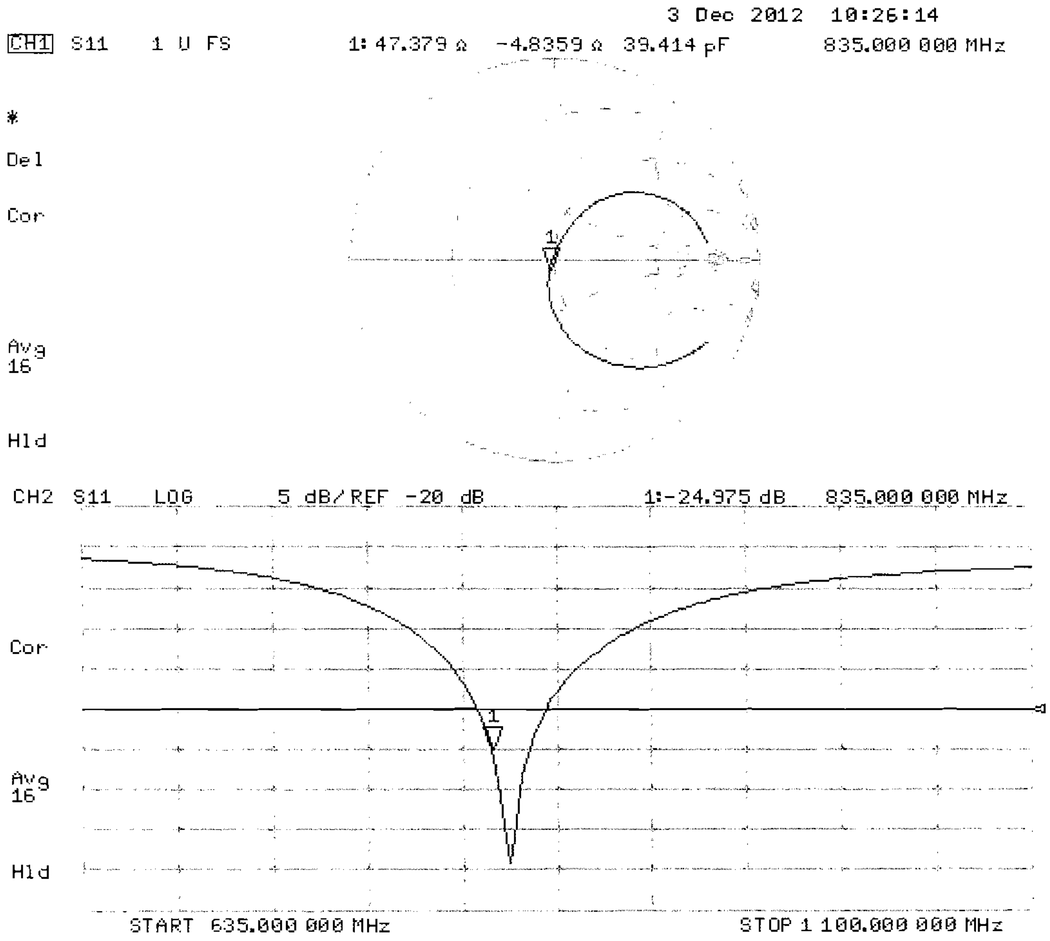
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.384 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.82 W/kg



0 dB = 2.82 W/kg = 4.50 dBW/kg

Impedance Measurement Plot for Body TSL



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

S **Schweizerischer Kalibrierdienst**
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Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: D1900V2-5d116_Dec12

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d116
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 06, 2012

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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: December 6, 2012

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	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.38 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	9.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.0 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.52 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	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω + 6.6 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω + 6.7 jΩ
Return Loss	- 22.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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	August 21, 2009

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d116

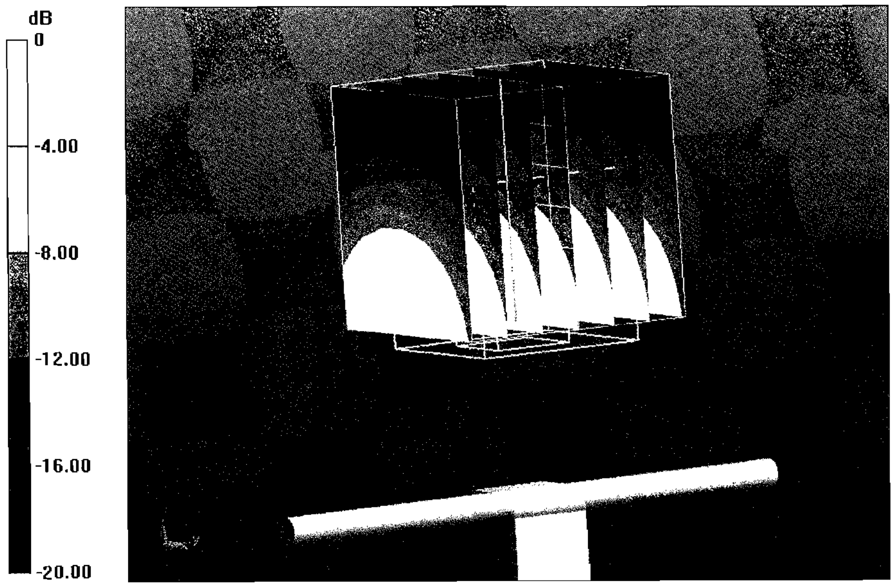
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

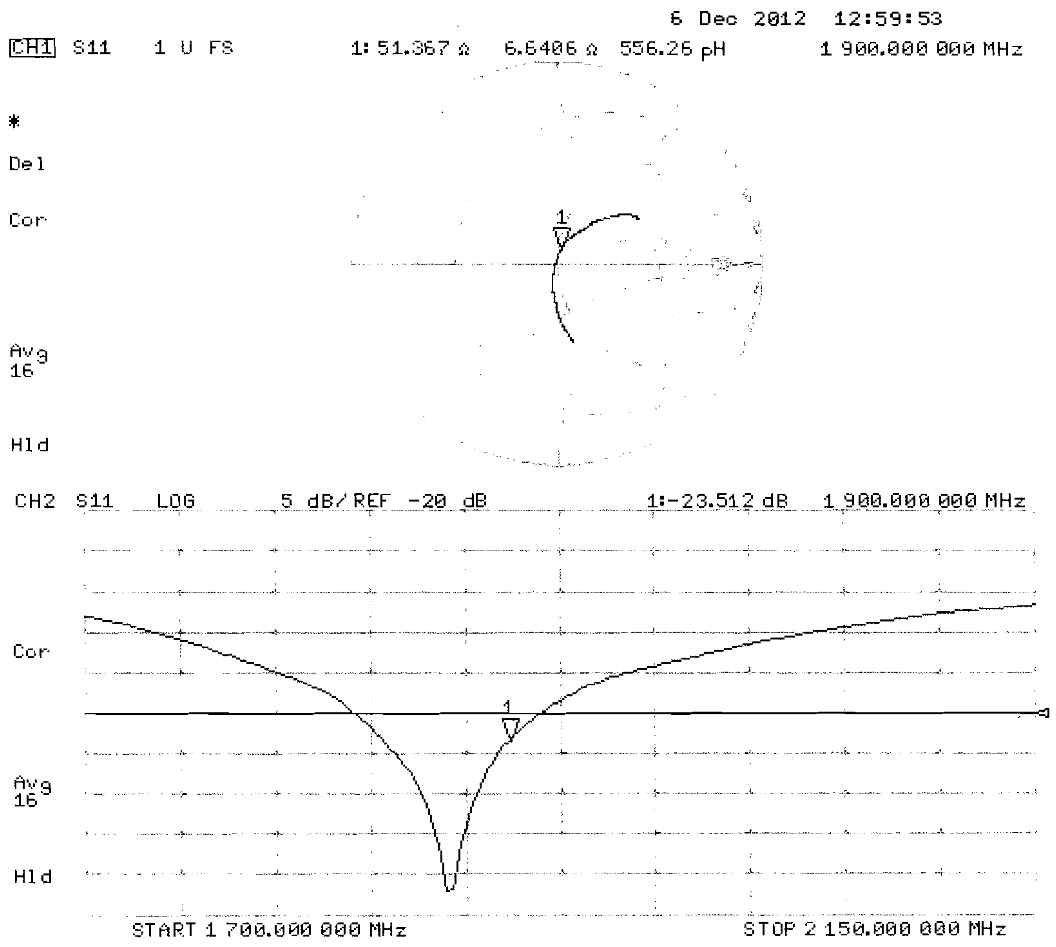
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.363 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.24 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d116

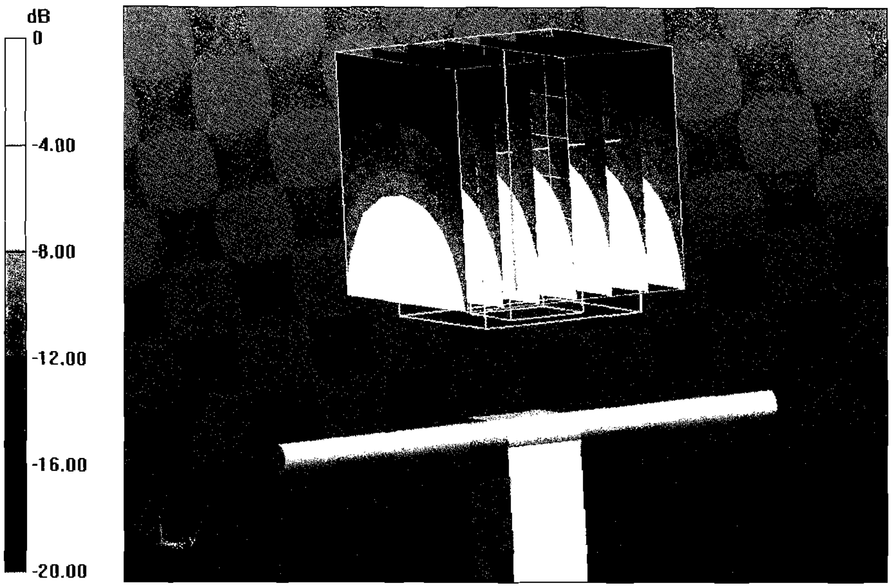
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

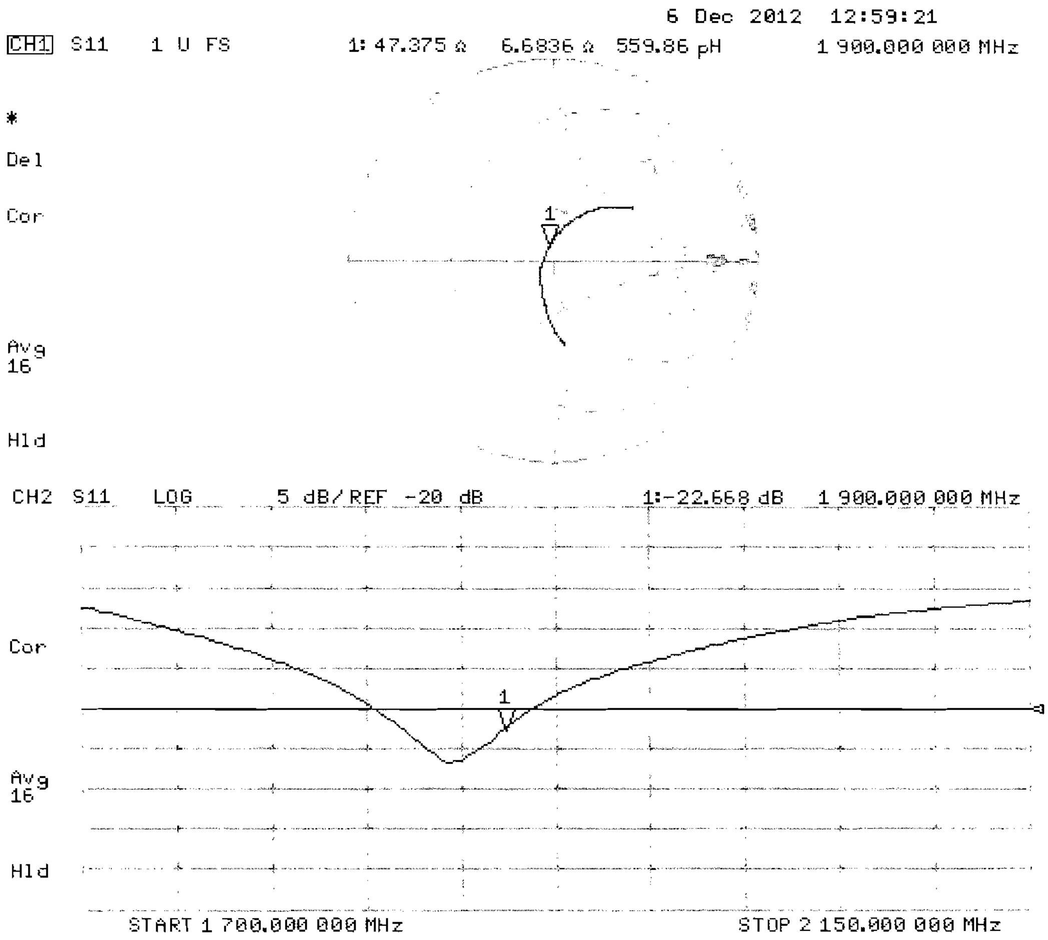
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.415 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.31 W/kg
Maximum value of SAR (measured) = 12.7 W/kg



0 dB = 12.7 W/kg = 11.04 dBW/kg

Impedance Measurement Plot for Body TSL



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

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Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: D2450V2-829_Dec12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 829
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 04, 2012

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 4, 2012

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	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.84 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	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.1 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.7 ± 6 %	2.02 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	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 4.2 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.7 Ω + 5.1 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 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	December 11, 2008

Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 829

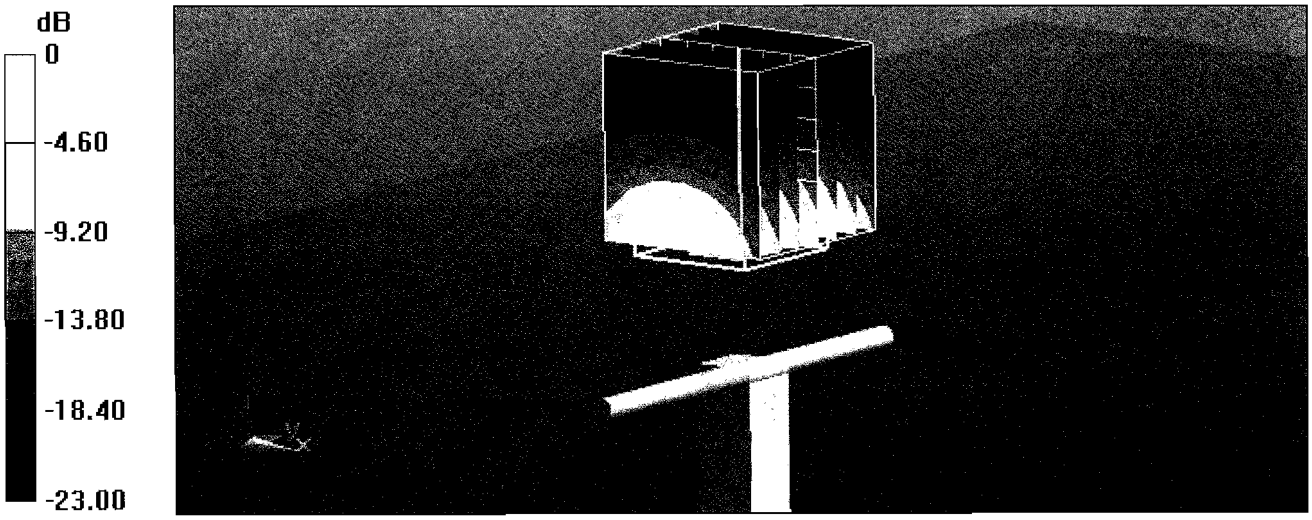
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 38.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

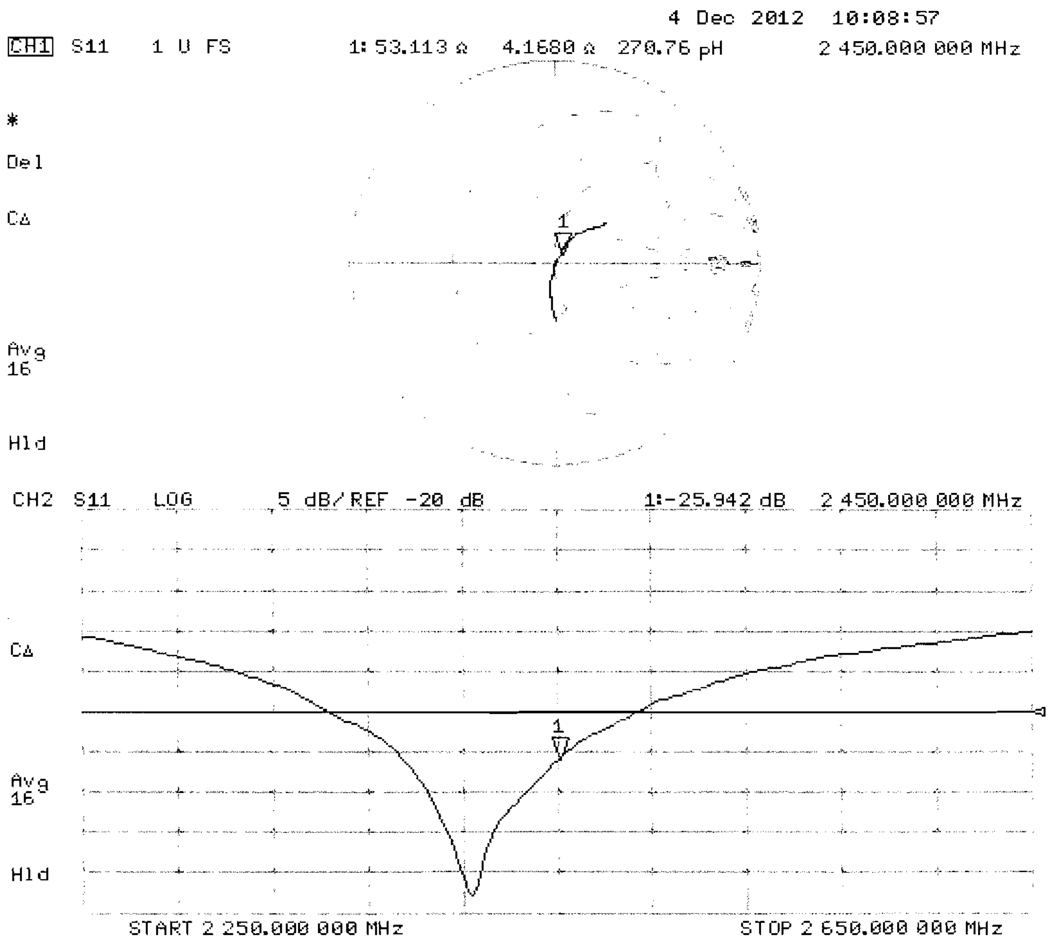
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.1 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.33 W/kg
Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 829

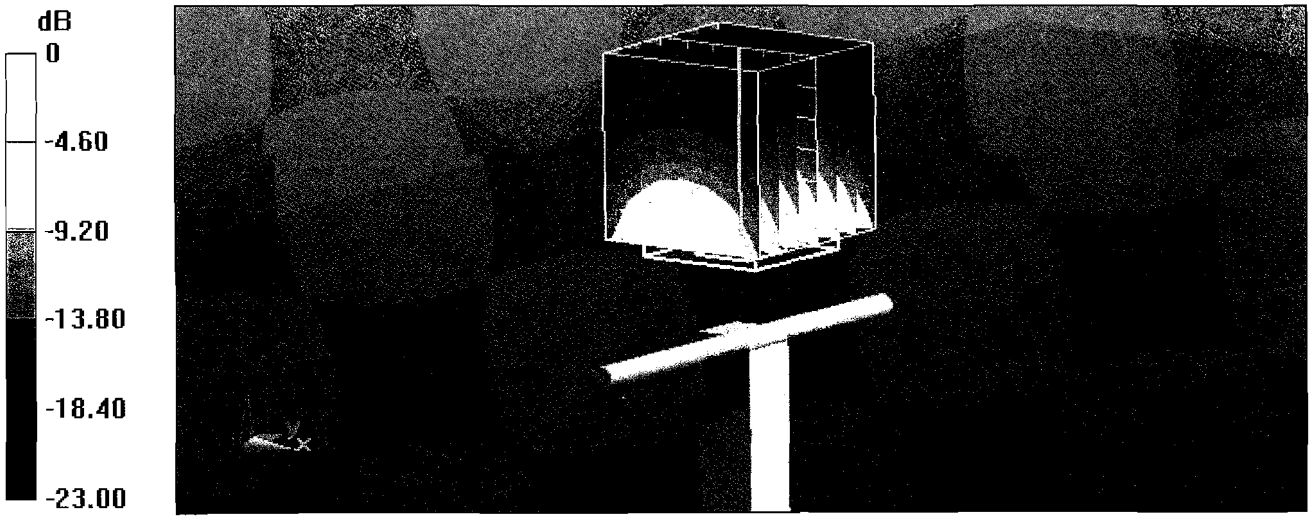
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

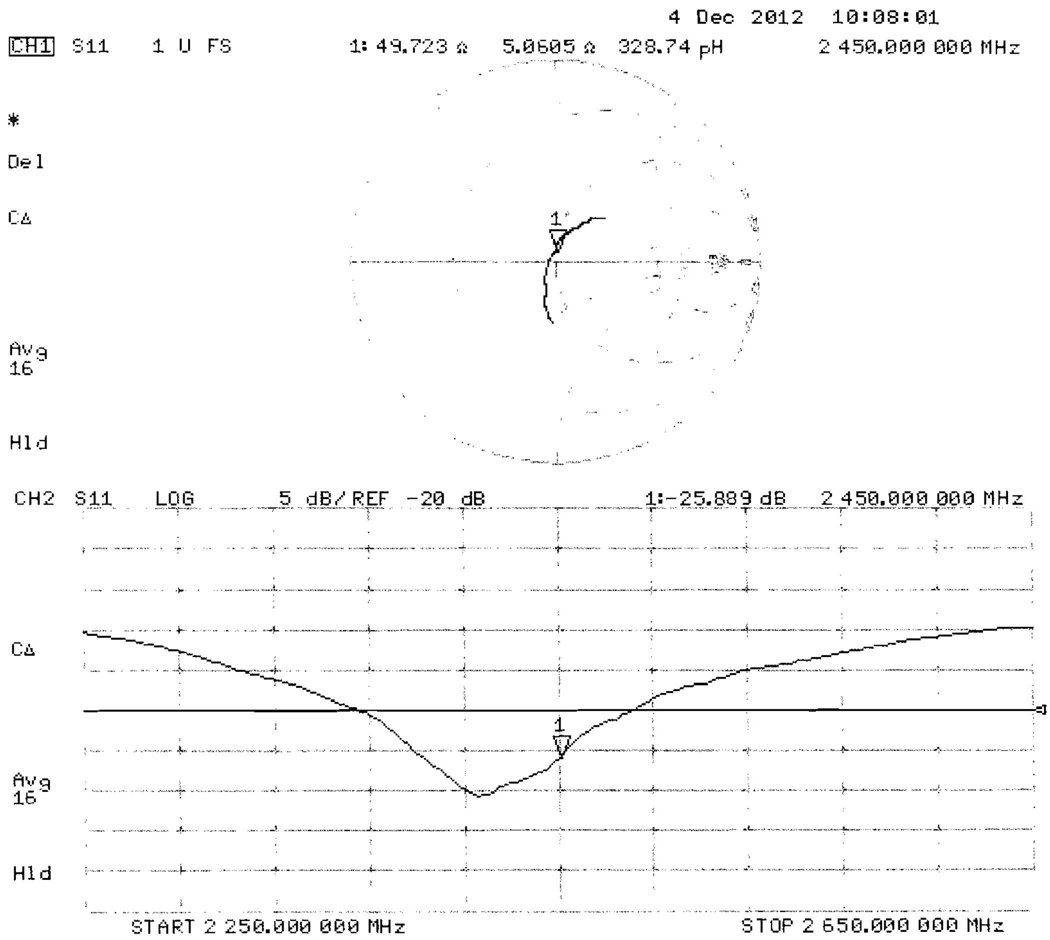
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.1 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

Impedance Measurement Plot for Body TSL



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

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

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

Accreditation No.: SCS 108

Client **RF Exposure Lab**

Certificate No: D2550V2-1003_Dec12

CALIBRATION CERTIFICATE

Object	D2550V2 - SN: 1003
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 04, 2012

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 4, 2012

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	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2550 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.1	1.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.95 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	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.2 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	52.6	2.09 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.4 ± 6 %	2.13 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	13.5 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**53.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω - 2.4 jΩ
Return Loss	- 31.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω - 1.4 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 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	April 01, 2010

Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN: 1003

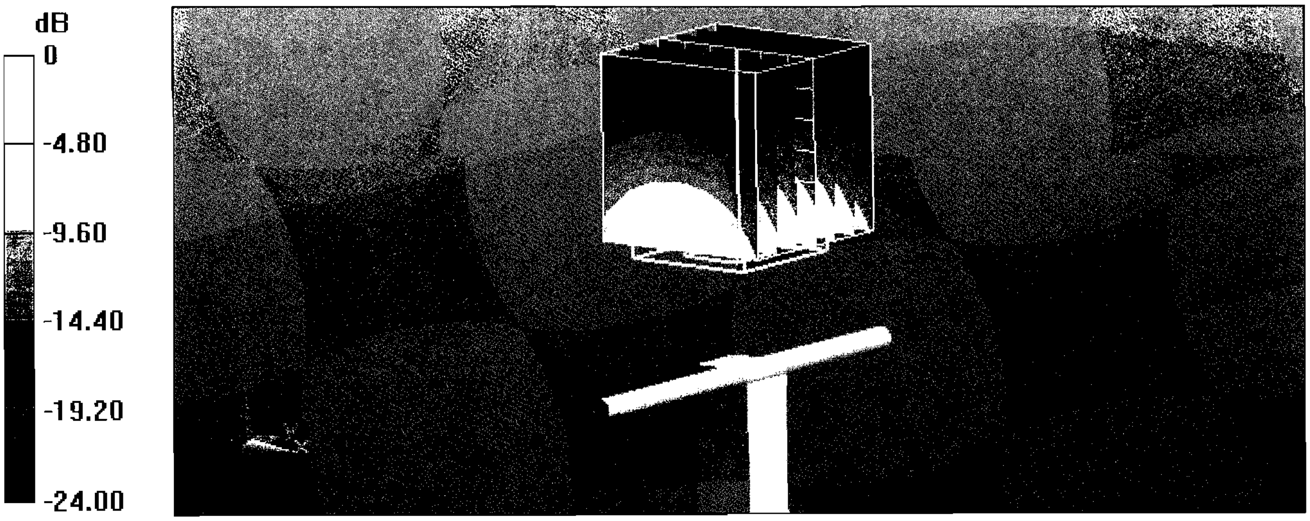
Communication System: CW; Frequency: 2550 MHz
Medium parameters used: f = 2550 MHz; σ = 1.95 mho/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.39, 4.39, 4.39); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

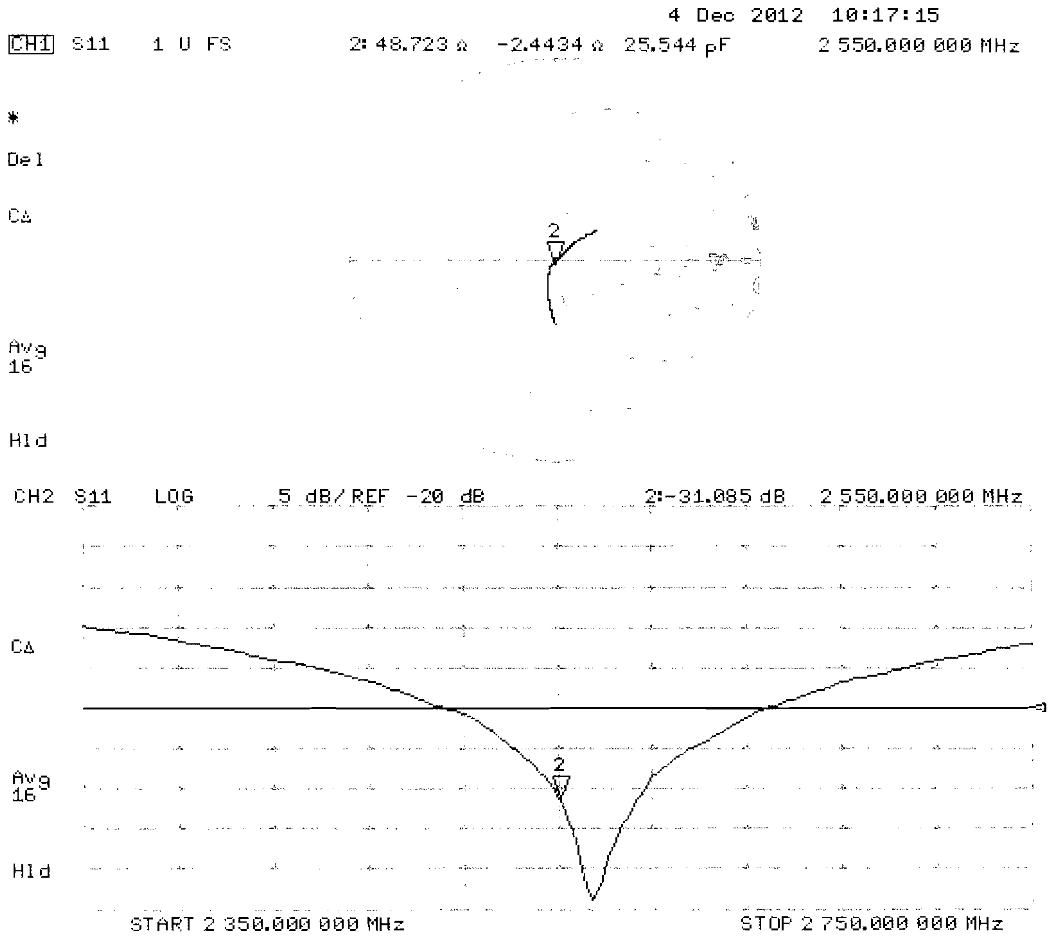
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.0 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.36 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.72 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 04.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN: 1003

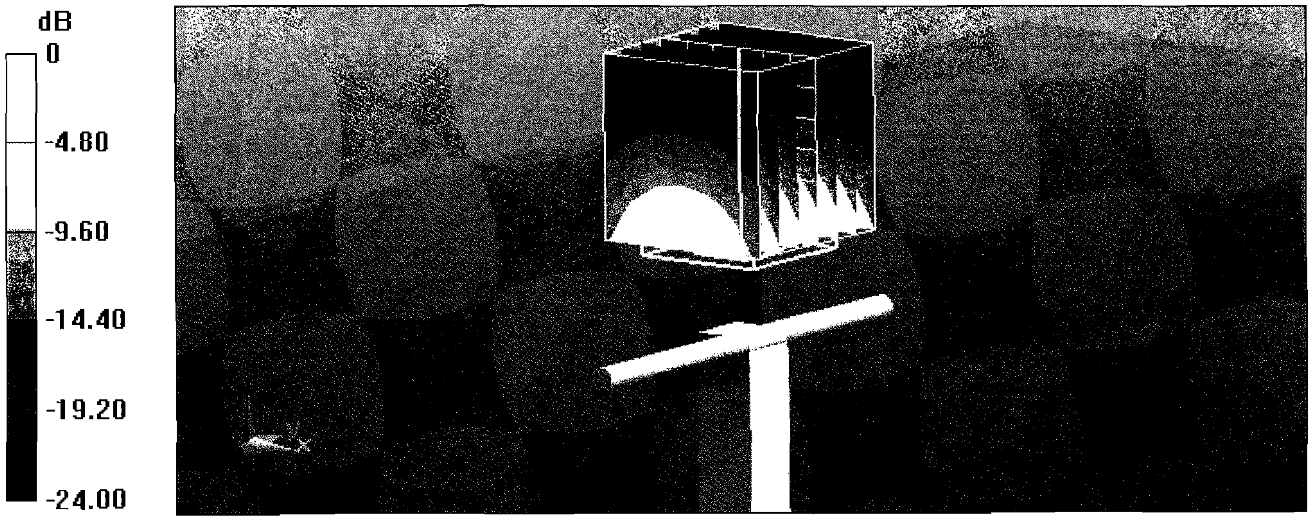
Communication System: CW; Frequency: 2550 MHz
Medium parameters used: f = 2550 MHz; σ = 2.13 mho/m; ε_r = 50.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.16, 4.16, 4.16); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

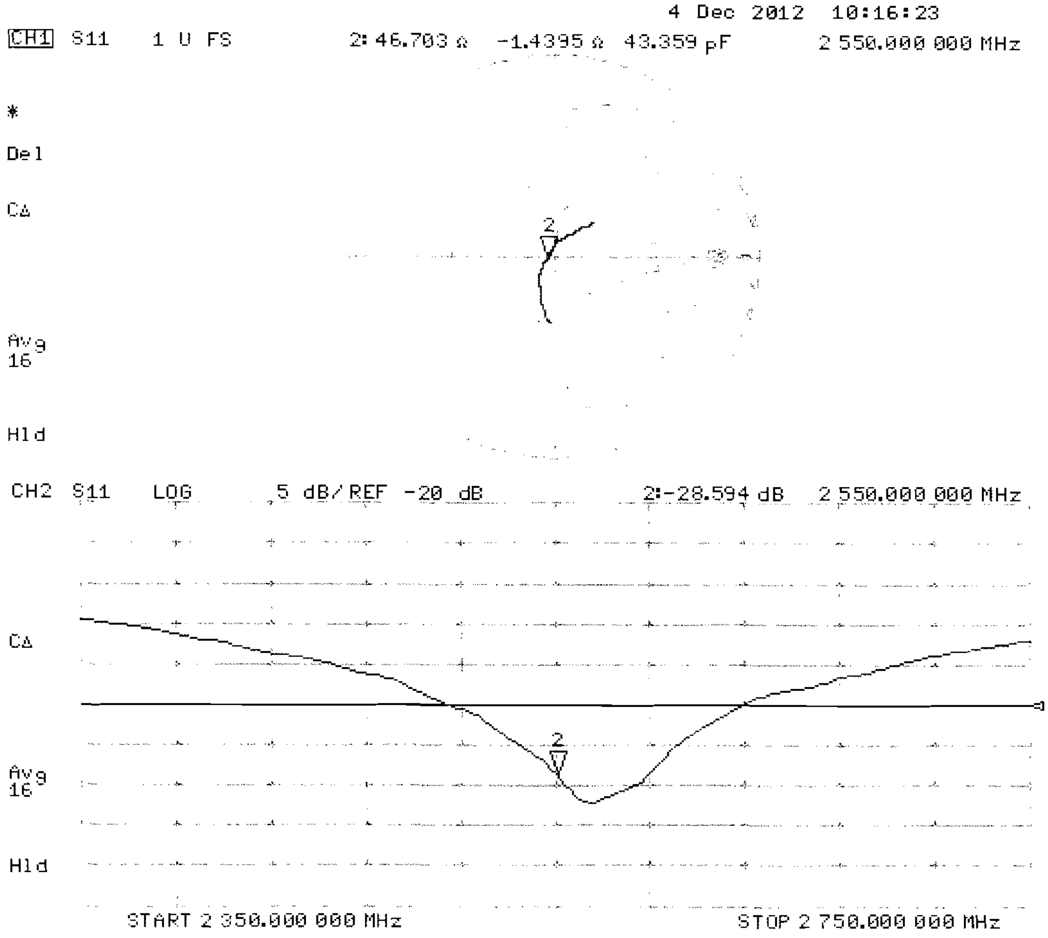
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.0 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.06 W/kg
Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix F – Phantom Calibration Data Sheets

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 4.0
Type No	QD OVA 001 B
Series No	1003 and higher
Manufacturer	Untersee Composites Knebelstrasse 8 CH-8268 Mannenbach, Switzerland

Tests
Complete tests were made on the prototype units QD OVA 001 AA 1001, QD OVA 001 AB 1002, pre-series units QD OVA 001 BA 1003-1005 as well as on the series units QD OVA 001 BB, 1006 ff.

Test	Requirement	Details	Units tested
Material thickness	Compliant with the standard requirements	Bottom plate: 2.0mm +/- 0.2mm	all
Material parameters	Dielectric parameters for required frequencies	< 6 GHz: Rel. permittivity = 4 +/-1, Loss tangent ≤ 0.05	Material sample
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions.	DGBE based simulating liquids. Observe Technical Note for material compatibility.	Equivalent phantoms, Material sample
Shape	Thickness of bottom material, Internal dimensions, Sagging compatible with standards from minimum frequency	Bottom elliptical 600 x 400 mm Depth 190 mm, Shape is within tolerance for filling height up to 155 mm, Eventual sagging is reduced or eliminated by support via DUT	Prototypes, Sample testing

Standards

[1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001
[2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003
[3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005
[4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005
[5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

Based on the tests above, we certify that this item is in compliance with the standards [1] to [5] if operated according to the specific requirements and considering the thickness. The dimensions are fully compliant with [4] from 30 MHz to 6 GHz. For the other standards, the minimum lower frequency limit is limited due to the dimensional requirements ([1]: 450 MHz, [2]: 300 MHz, [3]: 800 MHz, [5]: 375 MHz) and possibly further by the dimensions of the DUT.

Date 28.4.2008 **Signature / Stamp**

s p e a g
Schmid & Partner Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com