RF Exposure Lab

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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Cubic Transportation Systems Inc.	Dates of Test: March 21 – 24, 2022
5650 Kearny Mesa Road	Test Report Number: SAR.20220312
San Diego, CA 92111	Revision B
	Lab Designation Number: US1195 (FCC) & US0194 ISED)

FCC ID:	LVCVAL3LTE & LVCVAL3
IC Certificate:	4387A-VAL3LTE & 4387A-VAL3
Model(s):	10055834 & 10055645
Marketing Name:	Validator 3.0
Test Sample:	Engineering Unit Same as Production
Serial Number:	Eng 1
Equipment Type:	Wireless Payment Station
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	663 – 698 MHz, 699 – 716 MHz, 777 – 787 MHz, 788 – 798 MHz, 814 – 849 MHz, 1710 – 1780 MHz, 1850 – 1915 MHz, 2412 – 2462 MHz, 5150 – 5350 MHz, 5500 – 5700 MHz, 5745 – 5825 MHz, 2402 – 2480 MHz, 13.56 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	600 MHz (LTE) – 24.0 dBm, 750 MHz (LTE) – 24.0 dBm, 850 MHz (WCDMA) – 24.0 dBm, 850 MHz (LTE) – 23.5 dBm, 1750 MHz (LTE) – 23.5 dBm, 1900 MHz (WCDMA) – 24.0 dBm, 1900 MHz (LTE) – 23.5 dBm, 2450 MHz (b) – 18.0 dBm, 2450 MHz (g) – 17.5 dBm, 2450 MHz (n20) – 15.5 dBm, 5250 MHz (a) – 13.0 dBm, 5250 MHz (n20) – 12.5 dBm, 5250 MHz (n40) – 10.5 dBm, 5250 MHz (ac) – 12.5 dBm, 5600 MHz (a) – 13.0 dBm, 5600 MHz (n20) – 12.5 dBm, 5600 MHz (n40) – 10.5 dBm, 5600 MHz (ac) – 12.5 dBm, 5800 MHz (a) – 11.5 dBm, 5800 MHz (n20) – 11.0 dBm, 5800 MHz (n40) – 10.5 dBm, 5800 MHz (ac) – 10.5 dBm, 2450 MHz (BT) – 8.0 dBm, 13.56 MHz – <1.0 dBm Conducted
Signal Modulation:	WCDMA, QPSK, 16QAM, DSSS, OFDM, GMSK, 8-PSK, ASK
Antenna Type:	Internal
Application Type:	Certification
FCC Rule Parts:	Part 2, 15, 22, 24, 27, 90
KDB Test Methodology:	KDB 447498 D01 v07, KDB 248227 v02r02, KDB 941225 D01 v03r01, D02 v02r01 & D05 v02r05
Industry Canada:	RSS-102 Issue 5, Safety Code 6
Max. Stand Alone SAR Value:	0.30 W/kg Reported (10055834) & 0.24 W/kg Reported (10055645)
Max. Simultaneous SAR Value:	0.47 W/kg Reported (10055834) & N/A (10055645)
Separation Distance:	0 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 1528-2013 and IEC 62209-1528:2020 (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
Testing Cert. # 2387.01

Table of Contents

Comment/Revision	Date
Original Release	June 23, 2022
Revision A – Add FCC/ISED IDs for LTE version of device and correct PMN/Model number	November 30, 2022
Revision B – Add second model number and SAR values for second model number	December 2, 2022

Note: The latest version supersedes all previous versions listed in the above table. The latest version shall be used.

1. Introduction

This measurement report shows compliance of the Cubic Transportation Systems Inc. Model 10055834 & 10055645 FCC ID: LVCVAL3LTE & LVCVAL3 with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 4387A-VAL3LTE & 4387A-VAL3 with RSS102 Issue 5 & Safety Code 6. The FCC has 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 difference between the two IDs is the ID with the LTE in it has a cellular module installed which is covered in this report. The IDs that have the LTE remove has the cellular module removed and only has WiFi, BT and NFC which are all covered in this report.

The test results recorded herein are based on a single type test of Cubic Transportation Systems Inc. Model 10055834 and therefore apply only to the tested sample.

The test procedures and limits, 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], IEEE Std.1528 – 2013 Recommended Practice [4], 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 10055834 & 10055834 Wireless Payment Station. The table also shows the tolerance for the power level for each mode.

Band	Technology	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 71 – 600 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 12 – 750 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 13 – 750 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 14 – 750 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 5 – 835 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 4 – 1750 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 66 – 1750 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 2 – 1900 MHz (10055834 Only)	LTE	23.0	23.0	±1.0	22.0	24.0
Band 5 – 850 MHz (10055834 Only)	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
Band 4 – 1750 MHz (10055834 Only)	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
Band 2 – 1900 MHz (10055834 Only)	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
WLAN – 2.4 GHz	802.11b	N/A	N/A	N/A	N/A	18.0
WLAN – 2.4 GHz	802.11g	N/A	N/A	N/A	N/A	17.5
WLAN – 2.4 GHz	802.11n20	N/A	N/A	N/A	N/A	15.5
WLAN – 5 GHz Band I,IIA,IIC	802.11a	N/A	N/A	N/A	N/A	13.0
WLAN – 5 GHz Band I,IIA,IIC	802.11n/ac20	N/A	N/A	N/A	N/A	12.5
WLAN – 5 GHz Band I,IIA,IIC	802.11n/ac20n/ac40/ac80	N/A	N/A	N/A	N/A	10.5
WLAN – 5 GHz Band III	802.11a	N/A	N/A	N/A	N/A	11.5
WLAN – 5 GHz Band III	802.11n/ac20	N/A	N/A	N/A	N/A	11.0
WLAN – 5 GHz Band III	802.11n/ac20n/ac40/ac80	N/A	N/A	N/A	N/A	10.5
BT – BDR	Bluetooth	N/A	10.0	±1.5	8.5	11.5
BT – EDR2 & EDR3	Bluetooth	N/A	9.5	±1.5	8.0	11.0
BT – BLE	Bluetooth	N/A	8.5	±1.5	7.0	8.0
13.56 MHz	NFC	N/A	N/A	N/A	N/A	<1.0

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.

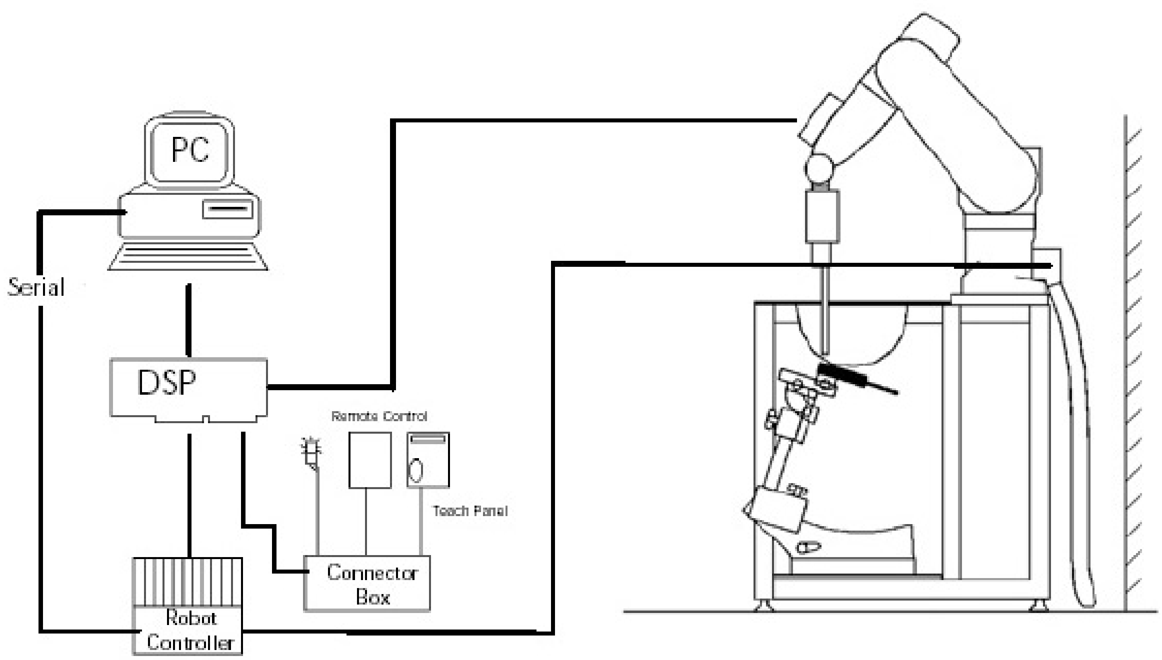


Figure 2.1 SAR Measurement System Setup

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

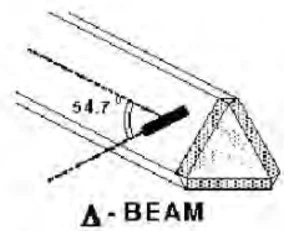


Figure 2.2 Triangular Probe Configurations

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

Figure 2.3 Probe Thick-Film Technique

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

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;

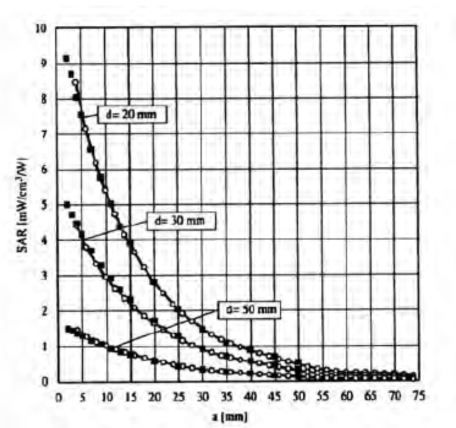


Figure 2.4 E-Field and Temperature Measurements at 900MHz

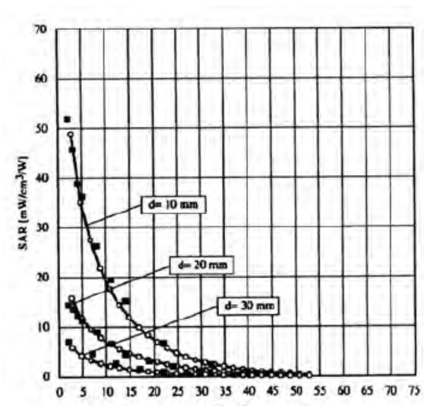


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

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

Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The „reference“ and „drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. +/- 5 %.

- The highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Using predefined locations for measurements is not accurate enough. Any shift of the phantom (e.g., slight deformations after filling it with liquid) would produce high uncertainties. For an automatic and accurate detection of the phantom surface, the DASY5 system uses the mechanical surface detection. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.

- The „area scan“ measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges ≤ 2GHz is 15 mm in x - and y- dimension. For higher frequencies a finer resolution is needed, thus for the grid spacing is reduced according the following table:

Area scan grid spacing for different frequency ranges	
Frequency range	Grid spacing
≤ 2 GHz	≤ 15 mm
2 – 4 GHz	≤ 12 mm
4 – 6 GHz	≤ 10 mm

Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex B.

- A „zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse“ scan. It uses a fine meshed grid where the robot moves the probe in steps along all the 3 axis (x,y and z-axis) starting at the bottom of the Phantom. The grid spacing for the cube measurement is varied according to the measured frequency range, the dimensions are given in the following table:

Zoom scan grid spacing and volume for different frequency ranges			
Frequency range	Grid spacing for x, y axis	Grid spacing for z axis	Minimum zoom scan volume
≤ 2 GHz	≤ 8 mm	≤ 5 mm	≥ 30 mm
2 – 3 GHz	≤ 5 mm	≤ 5 mm	≥ 28 mm
3 – 4 GHz	≤ 5 mm	≤ 4 mm	≥ 28 mm
4 – 5 GHz	≤ 4 mm	≤ 3 mm	≥ 25 mm
5 – 6 GHz	≤ 4 mm	≤ 2 mm	≥ 22 mm

DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in annex B. Test results relevant for the specified standard (see section 3) are shown in table form in section 7.

Spatial Peak SAR Evaluation

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of all points in the three directions x, y and z. The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 1 to 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

- All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

Volume Averaging

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

Advanced Extrapolation

DASY uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

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

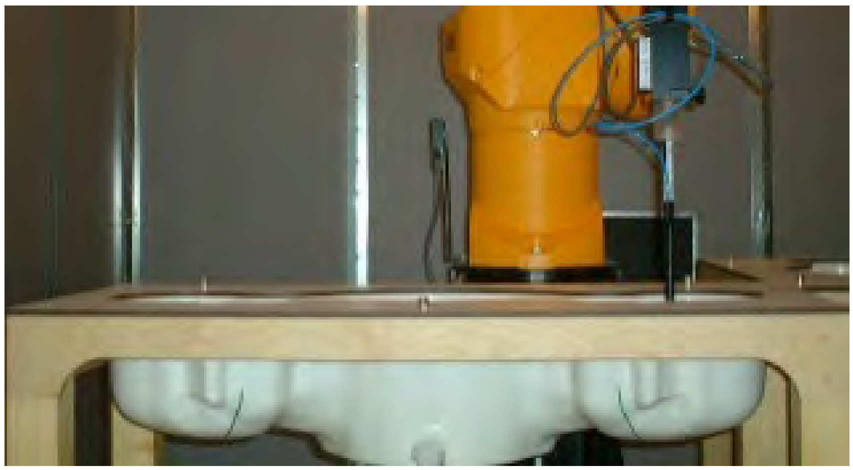


Figure 2.6 SAM Twin Phantom

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. Phantom & 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 IEEE1528 – 2013 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				
		600 MHz Head	750 MHz Head	900 MHz Head	1750 MHz Head	1900 MHz Head
Mixing Percentage						
Water		Proprietary Purchased From Speag				
Sugar						
Salt						
HEC						
Bactericide						
DGBE						
Dielectric Constant	Target	42.72	41.94	41.50	40.08	40.00
Conductivity (S/m)	Target	0.88	0.89	0.97	1.37	1.40

Ingredients		Simulating Tissue				
		2450 MHz Head	5250 MHz Head	5600 MHz Head	5750 MHz Head	13 MHz Head
Mixing Percentage						
Water		Proprietary Purchased From Speag				
Sugar						
Salt						
HEC						
Bactericide						
DGBE						
Dielectric Constant	Target	39.20	35.93	35.53	35.36	53.30
Conductivity (S/m)	Target	1.80	4.71	5.07	5.22	0.74

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. The highest reported value is less than 1.5 W/kg. Therefore, the measurement uncertainty table is not required.

7. System Validation

Tissue Verification

Table 7.1 Measured Tissue Parameters

		600 MHz Head		750 MHz Head		900 MHz Head	
Date(s)		Mar. 24, 2022		Mar. 23, 2022		Mar. 23, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		42.72	42.11	41.94	41.46	41.50	41.34
Conductivity: σ		0.88	0.92	0.89	0.90	0.97	0.98
		1750 MHz Head		1900 MHz Head		2450 MHz Head	
Date(s)		Mar. 22, 2022		Mar. 22, 2022		Mar. 21, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		40.08	39.24	40.00	39.87	39.20	38.34
Conductivity: σ		1.37	1.40	1.40	1.39	1.80	1.81
		5250 MHz Head		5600 MHz Head		5750 MHz Head	
Date(s)		Mar. 21, 2022		Mar. 21, 2022		Mar. 21, 2022	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		35.93	34.77	35.53	34.35	35.36	34.18
Conductivity: σ		4.71	4.73	5.07	5.11	5.22	5.28

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
24-Mar-2022	600 MHz	6.51	6.56	Head	+ 0.77	1
23-Mar-2022	750 MHz	8.57	8.58	Head	+ 0.12	2
23-Mar-2022	900 MHz	11.20	11.50	Head	+ 2.68	3
22-Mar-2022	1750 MHz	37.70	37.80	Head	+ 0.27	4
22-Mar-2022	1900 MHz	40.40	41.50	Head	+ 2.72	5
21-Mar-2022	2450 MHz	54.10	54.60	Head	+ 0.92	6
21-Mar-2022	5250 MHz	79.50	80.30	Head	+ 1.01	7
21-Mar-2022	5600 MHz	83.20	83.50	Head	+ 0.36	8
21-Mar-2022	5750 MHz	80.50	80.50	Head	+ 0.00	9

See Appendix A for data plots.

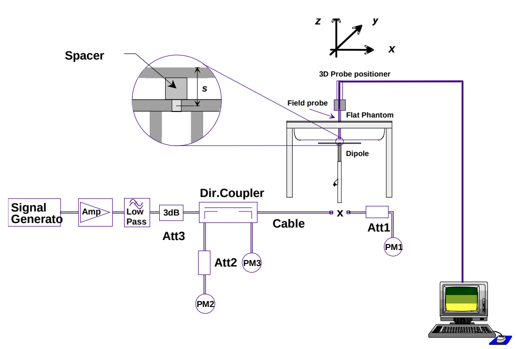


Figure 7.1 Dipole Validation Test Setup

8. LTE Document Checklist

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

LTE Operating Band	Uplink (transmit)	Downlink (Receive)	Duplex mode (FDD/TDD)
	Low - high	Low - high	
2	1850-1910	1930-1990	FDD
4	1710-1755	2110-2155	FDD
5	824-849	869-894	FDD
12	699-716	729-746	FDD
13	777-787	746-756	FDD
14	788-798	758-768	FDD
66	1710-1780	2110-2200	FDD
71	663-698	617-652	FDD

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)
2	1.4, 3, 5, 10, 15, 20	1850-1910 MHz
4	1.4, 3, 5, 10, 15, 20	1710-1755 MHz
5	1.4, 3, 5, 10	824-849 MHz
12	1.4, 3, 5, 10	699-716 MHz
13	5, 10	777-787 MHz
14	5, 10	788-798 MHz
66	1.4, 3, 5, 10, 15, 20	1710-1780 MHz
71	5, 10, 15, 20	663-698 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	
2	1.4	1850.7	18607	1880.0	18900	1909.3	19193
2	3	1851.5	18615	1880.0	18900	1908.5	19185
2	5	1852.5	18625	1880.0	18900	1907.5	19175
2	10	1855.0	18650	1880.0	18900	1905.0	19150
2	15	1857.5	18675	1880.0	18900	1902.5	19125
2	20	1860.0	18700	1880.0	18900	1900.0	19100
4	1.4	1710.7	19957	1732.5	20175	1754.3	20393
4	3	1711.5	19965	1732.5	20175	1753.5	20385
4	5	1712.5	19975	1732.5	20175	1752.5	20375
4	10	1715.0	20000	1732.5	20175	1750.0	20350
4	15	1717.5	20025	1732.5	20175	1747.5	20325
4	20	1720.0	20050	1732.5	20175	1745.0	20300
5	1.4	824.7	20407	836.5	20525	848.3	20643
5	3	825.5	20415	836.5	20525	847.5	20635
5	5	826.5	20425	836.5	20525	846.5	20625
5	10	829.0	20450	836.5	20525	844.0	20600
12	1.4	699.7	23017	707.5	23095	715.3	23173
12	3	700.5	23025	707.5	23095	714.5	23165
12	5	701.5	23035	707.5	23095	713.5	23155
12	10	704.0	23060	707.5	23095	711.0	23130
13	5	779.5	23205	782.0	23230	784.5	23225
13	10	-----	-----	782.0	23230	-----	-----
14	5	790.5	23305	793.0	23330	795.5	23355
14	10	-----	-----	793.0	23330	-----	-----
66	1.4	1710.7	131979	1755.0	132422	1779.3	132665
66	3	1711.5	131987	1755.0	132422	1778.5	132657
66	5	1712.5	131997	1755.0	132422	1777.4	132646
66	10	1716.1	132033	1755.0	132422	1774.9	132621
66	15	1717.5	132047	1755.0	132422	1772.4	132596
66	20	1720.0	132072	1755.0	132422	1769.9	132571
71	5	665.5	133147	680.5	133297	695.5	133447
71	10	668.0	133172	680.5	133297	693.0	133422
71	15	670.5	133197	680.5	133297	690.5	133397
71	20	673.0	133222	680.5	133297	688.0	133372

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 device has 4 antennas:

- WWAN Main (Transmit and Receive) Antenna
- WWAN Diversity (Receive Only) Antenna
- WLAN Primary (Transmit and Receive) Antenna
- NFC Coil

Transmission relationship

- All transmission (TX) is limited to the WWAN and WLAN antennas only
- The device is unable to transmit WCDMA/HSPA 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/NFC/WiFi and WWAN/NFC/BT is allowed.

Antenna port	WCDMA/HSPA		LTE		802.11 b/g/n/BT	
	TX	RX	TX	RX	TX	RX
#1 WWAN Main	**Yes**	**Yes**	**Yes**	**Yes**	No	No
#2 WLAN Primary	No	No	No	No	**Yes**	**Yes**
#2 WLAN Secondary	No	No	No	No	**Yes**	**Yes**
#3 (Diversity)	No	**Yes**	No	**Yes**	No	No

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 device is a data only. Data mode was tested in each operating mode and exposure condition in the body configuration. 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) Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band:

The maximum average conducted output power measured for the testing is listed on pages 40-56 of this report. The below table shows the factory set point with the allowable tolerance.

Band	Technology	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 71 – 600 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 12 – 750 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 13 – 750 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 14 – 750 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 5 – 835 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 4 – 1750 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 66 – 1750 MHz	LTE	23.0	23.0	±1.0	22.0	24.0
Band 2 – 1900 MHz	LTE	23.0	23.0	±1.0	22.0	24.0

9) 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	3GPP Nominal Power dBm	Calibrated Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 5 – 850 MHz	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
Band 4 – 1750 MHz	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
Band 2 – 1900 MHz	WCDMA/HSPA	23.0	23.0	±1.0	22.0	24.0
WLAN – 2.4 GHz	802.11bgn20n40/ac	N/A	13.0	±1.5	11.5	14.5
WLAN – 5 GHz Band I & IIA	802.11an20n40/ac	N/A	11.25	±1.5	9.75	12.75
WLAN – 5 GHz Band IIC	802.11an20n40/ac	N/A	11.0	±1.5	9.5	12.5
WLAN – 5 GHz Band III	802.11an20n40/ac	N/A	11.5	±1.5	10.0	13.0
BT – BDR	Bluetooth	N/A	10.0	±1.5	8.5	11.5
BT – EDR2 & EDR3	Bluetooth	N/A	9.5	±1.5	8.0	11.0
BT – BLE	Bluetooth	N/A	8.5	±1.5	7.0	10.0
13.56 MHz	NFC	N/A	N/A	N/A	N/A	30.0

10) Include the maximum average conducted output power measured for the other wireless modes and frequency bands.

The maximum average conducted output power measured for the testing is listed on pages 27-31 of this report. The table in item 9 shows the factory set point with the allowable tolerance.

11) 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 WCDMA & LTE simultaneously.

The device is able to transmit WWAN/NFC/WiFi and WWAN/NFC//BT simultaneously.

TX Modes	WCDMA	LTE	WiFi	Bluetooth	NFC
1	ON	OFF	ON	OFF	ON
2	OFF	ON	ON	OFF	ON
3	ON	OFF	OFF	ON	ON
4	OFF	ON	OFF	ON	ON

12) 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 required to satisfy SAR compliance. The DUT has a capacitive coupling sensor to sense the body being close to the unit. When the sensor is triggered, the maximum power is backed off based on the power levels listed on page 4 of this report. Only the cellular bands are backed off.

13) Include descriptions of the test equipment, test software, built-in test firmware etc. required to support testing the device when power reduction is applied to one or more transmitters/antennas for simultaneous voice/data transmission

The DUT back off was set in the firmware of the module using the existing AT commands. There was no special test equipment or test software required for the testing.

14) When appropriate, include a SAR test plan proposal with respect to the above

Testing was conduct at 0 mm with the sensor operational for all measurements. The sensor was tested by moving the DUT away from the phantom and slowly moving it closer to see when the sensor would trip. The closest distance the sensor trip was 23 mm. The highest SAR value in each band was then tested at 22 mm with the sensor disabled to insure it would not trip.

15) If applicable, include preliminary SAR test data and/or supporting information in laboratory testing inquiries to address specific issues and concerns or for requesting further test reduction considerations appropriate for the device; for example, simultaneous transmission configurations.

Not applicable.

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. The front, right and top sides were tested for the WWAN antenna. The remaining sides were not tested as the WWAN antenna was more than 2.5 cm from the side. The front and top sides were tested for the WLAN antenna. The remaining sides were not tested as the antenna was more than 2.5 cm from these sides. All further test reductions are shown on pages 38 for WCDMA bands, page 32-37 for WLAN/BT and pages 57-68 for LTE bands. See the photo in Appendix C for a pictorial of the setups and antenna locations.

The NFC transmitter is less than 1 mW in power. Per KDB447498 D01 v07, the transmitter is categorically excluded from SAR testing.

The WCDMA testing was conducted using 12.2 kbps RMC configured in Test Loop Mode 1. The HSPA testing was conducted with HS-DPCCH, E-DPCCH and E-DPDCH all enabled and a 12.2 kbps RMC. FRC was configured according to HS-DPCCH Sub-Test 1 using H-set 1 and QPSK.

9.1 SAR Measurement Conditions for WCDMA/HSDPA/HSUPA

Configure the call box 8960 to support all WCDMA tests in respect to the 3GPP 34.121 (listed in Table below). Measure the power at Ch4132, 4182 and 4233 for US cell; Ch9262, 9400 and 9538 for US PCS band.

For Rel99

- Set a Test Mode 1 loop back with a 12.2kbps Reference Measurement Channel (RMC).
- Set and send continuously Up power control commands to the device
- Measure the power at the device antenna connector using the power meter with average detector.

For HSDPA Rel 6

- Establish a Test Mode 1 look back with both 1 12.2kbps RMC channel and a H-Set1 Fixed Reference Channel (FRC). With the 8960 this is accomplished by setting the signal Channel Coding to “Fixed Reference Channel” and configuring for HSET-1 QKSP.
- Set beta values and HSDPA settings for HSDPA Subtest1 according to Table below.
- Send continuously Up power control commands to the device
- Measure the power at the device antenna connector using the power meter with modulated average detector.
- Repeat the measurement for the HSDPA Subtest2, 3 and 4 as given in Table below.

For HSUPA Rel 6

- Use UL RMC 12.2kbps and FRC H-Set1 QPSK, Test Mode 1 loop back. With the 8960 this is accomplished by setting the signal Channel Coding to “E-DCH Test Channel” and configuring the equipment category to Cat5_10ms.
- Set the Absolute Grant for HSUPA Subtest1 according to Table below.
- Set the device power to be at least 5dB lower than the Maximum output power
- Send power control bits to give one TPC_cmd = +1 command to the device. If device doesn’t send any E-DPCH data with decreased E-TFCI within 500ms, then repeat this process until the decreased E-TFCI is reported.
- Confirm that the E-TFCI transmitted by the device is equal to the target E-TFCI in Table below. If the E-TFCI transmitted by the device is not equal to the target E-TFCI, then send power control bits to give one TPC_cmd = -1 command to the UE. If UE sends any E-DPCH data with decreased E-TFCI within 500 ms, send new power control bits to give one TPC_cmd = -1 command to the UE. Then confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table below.
- Measure the power using the power meter with modulated average detector.
- Repeat the measurement for the HSUPA Subtest2, 3, 4 and 5 as given in Table below.

Power Measurements

3GPP Release Version	Mode	Cellular Band [dBm]			Sub-Test (See Table Below)	MPR
		4132	4183	4233		
99	WCDMA	22.72	22.82	22.64	-	-
6	HSDPA	22.56	22.61	22.54	1	0
6		22.66	22.83	22.59	2	0
6		22.50	22.24	22.49	3	0.5
6		22.43	22.31	22.41	4	0.5
6	HSUPA	22.59	22.54	22.76	1	0
6		20.78	20.64	20.98	2	2
6		21.93	21.65	21.94	3	1
6		20.85	20.65	20.76	4	2
6		22.88	23.00	22.87	5	0

3GPP Release Version	Mode	AWS Band [dBm]			Sub-Test (See Table Below)	MPR
		1312	1413	1513		
99	WCDMA	23.00	22.98	22.86	-	-
6	HSDPA	22.94	22.91	22.76	1	0
6		22.82	22.76	22.66	2	0
6		22.53	22.25	22.34	3	0.5
6		22.15	22.26	22.58	4	0.5
6	HSUPA	22.87	23.02	22.65	1	0
6		20.91	20.72	21.06	2	2
6		21.85	21.97	21.84	3	1
6		20.74	20.84	20.94	4	2
6		22.86	22.64	22.93	5	0

3GPP Release Version	Mode	PCS Band [dBm]			Sub-Test (See Table Below)	MPR
		9262	9400	9538		
99	WCDMA	23.00	22.82	22.92	-	-
6	HSDPA	22.81	22.95	22.69	1	0
6		22.95	22.88	22.70	2	0
6		22.32	22.56	22.16	3	0.5
6		22.51	22.51	22.54	4	0.5
6	HSUPA	22.66	22.81	22.92	1	0
6		21.10	20.96	20.81	2	2
6		22.04	21.82	21.90	3	1
6		20.65	20.74	20.84	4	2
6		22.69	22.78	22.85	5	0

Sub-Test Setup for Release 6 HSDPA

Sub-Test	β_c	β_d	B_c/β_d	β_{hs}
1	2/15	15/15	2/15	4/15
2	12/15	15/15	15/15	24/15
3	15/15	8/15	15/8	30/15
4	15/15	4/15	15/4	30/15
Δ_{ack}, Δ_{nack} and Δ_{cqi} = 8				

Sub-Test Setup for Release 6 HSUPA

Sub-Test	β_c	β_d	B_c/β_d	β_{hs}	B_{ec}	B_{ed}	MPR	AG Index	E-TFCI
1	11/15	15/15	11/15	22/15	209/225	1039/225	0.0	20	75
2	6/15	15/15	6/15	12/15	12/15	94/75	2.0	12	67
3	15/15	9/15	15/9	30/15	30/15	47/15	1.0	15	92
4	2/15	15/15	2/15	4/15	2/15	56/15	2.0	17	71
5	15/15	15/15	15/15	30/15	24/15	134/15	0.0	21	81
Δ_{ack}, Δ_{nack} and Δ_{cqi} = 8									

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
2450 MHz	802.11b	20	1	2412	1 Mbps	Primary	17.83	18.00
			6	2437			17.74	18.00
			11	2462			17.41	18.00
	802.11g	20	1	2412	6 Mbps	Primary	Not Required	17.50
			6	2437				17.50
			11	2462				17.50
	802.11n	20	1	2412	HT0	Primary		15.50
			6	2437				15.50
			11	2462				15.50
5.15-5.25 GHz	802.11a	20	36	5180	6 Mbps	Primary	12.74	13.00
			40	5200			12.73	13.00
			44	5220			12.75	13.00
			48	5240			12.72	13.00
	802.11n	20	36	5180	HT0	Primary	Not Required	12.50
			40	5200				12.50
			44	5220				12.50
			48	5240				12.50
	802.11n	40	38	5190	HT0	Primary		10.50
			46	5230				10.50
	802.11ac	80	42	5210	VHT0	Primary		10.50
5.25-5.35 GHz	802.11a	20	52	5260	6 Mbps	Primary	12.72	13.00
			56	5280			12.73	13.00
			60	5300			12.74	13.00
			64	5320			12.75	13.00
	802.11n	20	54	5270	HT0	Primary	Not Required	12.50
			56	5280				12.50
			60	5300				12.50
			62	5310				12.50
	802.11n	40	54	5270	HT0	Primary		10.50
			62	5310				10.50
	802.11ac	80	58	5290	VHT0	Primary		10.50

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
5600 MHz	802.11a	20	100	5500	6 Mbps	Primary	12.48	13.00
			104	5520			12.42	13.00
			108	5540			12.45	13.00
			112	5560			12.43	13.00
			116	5580			12.44	13.00
			120	5600			12.43	13.00
			124	5620			12.41	13.00
			128	5640			12.40	13.00
			132	5660			12.42	13.00
			136	5680			12.45	13.00
			140	5700			12.46	13.00
	802.11n	20`	100	5500	HT0	Primary	Not Required	12.50
			104	5520				12.50
			108	5540				12.50
			112	5560				12.50
			116	5580				12.50
			120	5600				12.50
			124	5620				12.50
			128	5640				12.50
			132	5660				12.50
			136	5680				12.50
			140	5700				12.50
	802.11n	40	102	5510	HT0	Primary		10.50
			110	5550				10.50
			118	5580				10.50
			126	5610				10.50
			134	5670				10.50
	802.11ac	80	106	5530	VHT0	Primary		10.50
			122	5610				10.50
			138	5690				10.50

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
5800 MHz	802.11a	20	149	5745	6 Mbps	Primary	10.86	11.50
			153	5765			10.82	11.50
			157	5785			10.79	11.50
			161	5805			10.91	11.50
			165	5825			11.04	11.50
	802.11n	20	150	5750	HT0	Primary	Not Required	11.00
			153	5765				11.00
			157	5785				11.00
			161	5805				11.00
			164	5820				11.00
	802.11n	40	152	5760	HT0	Primary		10.50
			159	5795				10.50
	802.11ac	80	155	5775	VHT0	Primary		10.50

Band	Mode	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
2450 MHz	Bluetooth v4.0	0	2402	Basic Rate GFSK	Secondary	7.42	8.00
		39	2441			7.58	8.00
		78	2480			7.48	8.00
		0	2402	EDR π/4 DQPSK		Not Required	6.00
		39	2441				6.00
		78	2480				6.00
		0	2402	EDR 8-DPSK			6.00
		39	2441				6.00
		78	2480				6.00
		0	2402	Low Energy GFSK			9.00
		39	2441				9.00
		78	2480				9.00

Figure 9.1 Test Reduction Table – 2.4 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11b	Front	1 – 2412 MHz	Tested
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Tested
	Top	1 – 2412 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		11 – 2462 MHz	Reduced[1]
	Right, Left, Back, Bottom	1 – 2412 MHz	Reduced[4]
		6 – 2437 MHz	Reduced[4]
		11 – 2462 MHz	Reduced[4]
802.11g	Front	1 – 2412 MHz	Reduced[3]
		6 – 2437 MHz	Reduced[3]
		11 – 2462 MHz	Reduced[3]
	Top	1 – 2412 MHz	Reduced[3]
		6 – 2437 MHz	Reduced[3]
		11 – 2462 MHz	Reduced[3]
	Right, Left, Back, Bottom	1 – 2412 MHz	Reduced[4]
		6 – 2437 MHz	Reduced[4]
		11 – 2462 MHz	Reduced[4]
802.11n	Front	1 – 2412 MHz	Reduced[3]
		6 – 2437 MHz	Reduced[3]
		11 – 2462 MHz	Reduced[3]
	Top	1 – 2412 MHz	Reduced[3]
		6 – 2437 MHz	Reduced[3]
		11 – 2462 MHz	Reduced[3]
	Right, Left, Back, Bottom	1 – 2412 MHz	Reduced[4]
		6 – 2437 MHz	Reduced[4]
		11 – 2462 MHz	Reduced[4]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.8 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 3) page 9.
Reduced[3] – When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required per KDB 248227 D01 v02r02 section 5.2.2 2) page 10.
Reduced[4] – The side is excluded per 47 CFR 1.1307.

Figure 9.2 Test Reduction Table – 5.1 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11a 5150 MHz	Front	36 – 5180 MHz	Reduced[1]
		40 – 5200 MHz	Reduced[1]
		44 – 5220 MHz	Reduced[1]
		48 – 5240 MHz	Reduced[1]
	Top	36 – 5180 MHz	Reduced[1]
		40 – 5200 MHz	Reduced[1]
		44 – 5220 MHz	Reduced[1]
		48 – 5240 MHz	Reduced[1]
	Right, Left, , Back, Bottom	36 – 5180 MHz	Reduced[2]
		40 – 5200 MHz	Reduced[2]
		44 – 5220 MHz	Reduced[2]
		48 – 5240 MHz	Reduced[2]
802.11n 5150 MHz	Front	36 – 5180 MHz	Reduced[1]
		40 – 5200 MHz	Reduced[1]
		44 – 5220 MHz	Reduced[1]
		48 – 5240 MHz	Reduced[1]
	Top	36 – 5180 MHz	Reduced[1]
		40 – 5200 MHz	Reduced[1]
		44 – 5220 MHz	Reduced[1]
		48 – 5240 MHz	Reduced[1]
	Right, Left, , Back, Bottom	36 – 5180 MHz	Reduced[2]
		40 – 5200 MHz	Reduced[2]
		44 – 5220 MHz	Reduced[2]
		48 – 5240 MHz	Reduced[2]
802.11ac 5210 MHz	Front	42 – 5210 MHz	Reduced[1]
	Top	42 – 5210 MHz	Reduced[1]
	Right, Left, Back, Bottom	42 – 5210 MHz	Reduced[2]

Reduced[1] – When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the UNII-1 with the same or lower maximum output power in that test configuration per KDB 248227 D01 v02r02 section 5.3.1 1) page 11.
Reduced[2] – The side is excluded per 47 CFR 1.1307.

Figure 9.3 Test Reduction Table – 5.2 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11a 5250 MHz	Front	52 – 5260 MHz	Reduced[1]
		56 – 5280 MHz	Reduced[1]
		60 – 5300 MHz	Tested
		64 – 5320 MHz	Reduced[1]
	Top	52 – 5260 MHz	Reduced[1]
		56 – 5280 MHz	Reduced[1]
		60 – 5300 MHz	Tested
		64 – 5320 MHz	Reduced[1]
	Right, Left, , Back, Bottom	52 – 5260 MHz	Reduced[3]
		56 – 5280 MHz	Reduced[3]
		60 – 5300 MHz	Reduced[3]
		64 – 5320 MHz	Reduced[3]
802.11n 5250 MHz	Front	52 – 5260 MHz	Reduced[1]
		56 – 5280 MHz	Reduced[1]
		60 – 5300 MHz	Reduced[1]
		64 – 5320 MHz	Reduced[1]
	Top	52 – 5260 MHz	Reduced[1]
		56 – 5280 MHz	Reduced[1]
		60 – 5300 MHz	Reduced[1]
		64 – 5320 MHz	Reduced[1]
	Right, Left, , Back, Bottom	52 – 5260 MHz	Reduced[3]
		56 – 5280 MHz	Reduced[3]
		60 – 5300 MHz	Reduced[3]
		64 – 5320 MHz	Reduced[3]
802.11ac 5210 MHz	Front	58 – 5290 MHz	Reduced[1]
	Top	58 – 5290 MHz	Reduced[1]
	Right, Left, Back, Bottom	58 – 5290 MHz	Reduced[3]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.4 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 2) page 9.
Reduced[3] – The side is excluded per 47 CFR 1.1307.

Figure 9.4 Test Reduction Table – 5.6 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11a 5600 MHz	Front	100 – 5500 MHz	Reduced[1]
		104 – 5520 MHz	Reduced[1]
		108 – 5540 MHz	Reduced[1]
		112 – 5560 MHz	Reduced[1]
		116 – 5580 MHz	Reduced[1]
		120 – 5600 MHz	Reduced[1]
		124 – 5620 MHz	Tested
		128 – 5640 MHz	Reduced[1]
		132 – 5660 MHz	Reduced[1]
		136 – 5680 MHz	Reduced[1]
		140 – 5700 MHz	Reduced[1]
	Top	100 – 5500 MHz	Reduced[1]
		104 – 5520 MHz	Reduced[1]
		108 – 5540 MHz	Reduced[1]
		112 – 5560 MHz	Reduced[1]
		116 – 5580 MHz	Reduced[1]
		120 – 5600 MHz	Reduced[1]
		124 – 5620 MHz	Tested
		128 – 5640 MHz	Reduced[1]
		132 – 5660 MHz	Reduced[1]
		136 – 5680 MHz	Reduced[1]
		140 – 5700 MHz	Reduced[1]
	Right, Left, Back, Bottom	100 – 5500 MHz	Reduced[3]
		104 – 5520 MHz	Reduced[3]
		108 – 5540 MHz	Reduced[3]
		112 – 5560 MHz	Reduced[3]
		116 – 5580 MHz	Reduced[3]
		120 – 5600 MHz	Reduced[3]
		124 – 5620 MHz	Reduced[3]
		128 – 5640 MHz	Reduced[3]
		132 – 5660 MHz	Reduced[3]
		136 – 5680 MHz	Reduced[3]
		140 – 5700 MHz	Reduced[3]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.8 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 3) page 9.
Reduced[3] – The side is excluded per 47 CFR 1.1307.

Figure 9.5 Test Reduction Table – 5.6 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11n 5600 MHz	Front	100 – 5500 MHz	Reduced[1]
		104 – 5520 MHz	Reduced[1]
		108 – 5540 MHz	Reduced[1]
		112 – 5560 MHz	Reduced[1]
		116 – 5580 MHz	Reduced[1]
		120 – 5600 MHz	Reduced[1]
		124 – 5620 MHz	Reduced[1]
		128 – 5640 MHz	Reduced[1]
		132 – 5660 MHz	Reduced[1]
		136 – 5680 MHz	Reduced[1]
		140 – 5700 MHz	Reduced[1]
	Top	100 – 5500 MHz	Reduced[1]
		104 – 5520 MHz	Reduced[1]
		108 – 5540 MHz	Reduced[1]
		112 – 5560 MHz	Reduced[1]
		116 – 5580 MHz	Reduced[1]
		120 – 5600 MHz	Reduced[1]
		124 – 5620 MHz	Reduced[1]
		128 – 5640 MHz	Reduced[1]
		132 – 5660 MHz	Reduced[1]
		136 – 5680 MHz	Reduced[1]
		140 – 5700 MHz	Reduced[1]
	Right, Left, Back, Bottom	100 – 5500 MHz	Reduced[3]
		104 – 5520 MHz	Reduced[3]
		108 – 5540 MHz	Reduced[3]
		112 – 5560 MHz	Reduced[3]
		116 – 5580 MHz	Reduced[3]
		120 – 5600 MHz	Reduced[3]
		124 – 5620 MHz	Reduced[3]
		128 – 5640 MHz	Reduced[3]
		132 – 5660 MHz	Reduced[3]
		136 – 5680 MHz	Reduced[3]
		140 – 5700 MHz	Reduced[3]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.8 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 3) page 9.
Reduced[3] – The side is excluded per 47 CFR 1.1307.

Figure 9.6 Test Reduction Table – 5.6 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11ac 5600 MHz	Front	106 – 5530 MHz	Reduced[1]
		122 – 5610 MHz	Reduced[1]
		138 – 5690 MHz	Reduced[1]
	Top	106 – 5530 MHz	Reduced[1]
		122 – 5610 MHz	Reduced[1]
		138 – 5690 MHz	Reduced[1]
	Right, Left, Back, Bottom	106 – 5530 MHz	Reduced[3]
		122 – 5610 MHz	Reduced[3]
		138 – 5690 MHz	Reduced[3]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.8 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 3) page 9.
Reduced[3] – The side is excluded per 47 CFR 1.1307.

Figure 9.7 Test Reduction Table – 5.8 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11a 5800 MHz	Front	149 – 5745 MHz	Reduced[1]
		153 – 5765 MHz	Reduced[1]
		157 – 5785 MHz	Tested
		161 – 5805 MHz	Reduced[1]
		165 – 5825 MHz	Reduced[1]
	Top	149 – 5745 MHz	Reduced[1]
		153 – 5765 MHz	Reduced[1]
		157 – 5785 MHz	Tested
		161 – 5805 MHz	Reduced[1]
		165 – 5825 MHz	Reduced[1]
	Right, Left, Back, Bottom	149 – 5745 MHz	Reduced[3]
		153 – 5765 MHz	Reduced[3]
		157 – 5785 MHz	Reduced[3]
		161 – 5805 MHz	Reduced[3]
		165 – 5825 MHz	Reduced[3]
802.11n 5800 MHz	Front	149 – 5745 MHz	Reduced[1]
		153 – 5765 MHz	Reduced[1]
		157 – 5785 MHz	Reduced[1]
		161 – 5805 MHz	Reduced[1]
		165 – 5825 MHz	Reduced[1]
	Top	149 – 5745 MHz	Reduced[1]
		153 – 5765 MHz	Reduced[1]
		157 – 5785 MHz	Reduced[1]
		161 – 5805 MHz	Reduced[1]
		165 – 5825 MHz	Reduced[1]
	Right, Left, Back, Bottom	149 – 5745 MHz	Reduced[3]
		153 – 5765 MHz	Reduced[3]
		157 – 5785 MHz	Reduced[3]
		161 – 5805 MHz	Reduced[3]
		165 – 5825 MHz	Reduced[3]
802.11ac 5800 MHz	Front	155 – 5775 MHz	Reduced[1]
	Top	155 – 5775 MHz	Reduced[1]
	Right, Left, Back, Bottom	155 – 5775 MHz	Reduced[3]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.
Reduced[2] – When the reported SAR is >0.8 W/kg, test the next highest configuration until the SAR value is ≤ 1.2 W/kg per KDB 248227 D01 v02r02 section 5.1.1 3) page 9.
Reduced[3] – The side is excluded per 47 CFR 1.1307.

Figure 9.8 Test Reduction Table – 3G WCDMA

Band/ Frequency (MHz)	Technology	Side	Required Channel	Tested/ Reduced
Band 5 824-849 MHz	WCDMA	Front	4132	Reduced[1]
			4183	Tested
			4233	Reduced[1]
		Right	4132	Reduced[1]
			4183	Tested
			4233	Reduced[1]
		Top	4132	Reduced[1]
			4183	Tested
			4233	Reduced[1]
		Remaining Sides		Reduced[2]
Band 4 1710-1755 MHz		Front	1312	Reduced[1]
			1413	Tested
			1513	Reduced[1]
		Right	1312	Reduced[1]
			1413	Tested
			1513	Reduced[1]
		Top	1312	Reduced[1]
			1413	Tested
			1513	Reduced[1]
		Remaining Sides		Reduced[2]
Band 2 1850-1910 MHz		Front	9262	Reduced[1]
			9400	Tested
			9538	Reduced[1]
		Right	9262	Reduced[1]
			9400	Tested
			9538	Reduced[1]
		Top	9262	Reduced[1]
			9400	Tested
			9538	Reduced[1]
		Remaining Sides		Reduced[2]

Reduced[1] – When the mid channel is 3 dB below the limit, the remaining channels are not required per KDB 447498 D01 v07 section 4.3.3 page 14.
Reduced[2] – The side is excluded per 47 CFR 1.1307.

9.1.1 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)
2	1.4, 3, 5, 10, 15, 20	1850-1910 MHz
4	1.4, 3, 5, 10, 15, 20	1710-1755 MHz
5	1.4, 3, 5, 10	824-849 MHz
12	1.4, 3, 5, 10	699-716 MHz
13	5, 10	777-787 MHz
14	5, 10	788-798 MHz
66	1.4, 3, 5, 10, 15, 20	1710-1780 MHz
71	5, 10, 15, 20	663-698 MHz

9.1.2 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.

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

Table 9.1.1 LTE Power Measurements

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	1.4 MHz	1	0	18607	1850.7	23.3	22.1
				18900	1880.0	23.4	22.5
				19193	1909.3	23.3	22.0
			3	18607	1850.7	23.4	21.9
				18900	1880.0	23.2	21.8
				19193	1909.3	23.1	22.4
			5	18607	1850.7	23.4	21.9
				18900	1880.0	23.1	22.1
				19193	1909.3	22.8	21.9
		3	0	18607	1850.7	22.8	22.3
				18900	1880.0	23.5	22.4
				19193	1909.3	23.5	22.3
			1	18607	1850.7	23.4	22.3
				18900	1880.0	22.8	22.0
				19193	1909.3	23.4	22.5
			3	18607	1850.7	23.1	22.1
				18900	1880.0	22.9	22.3
				19193	1909.3	22.9	22.4
		6	0	18607	1850.7	22.5	21.1
				18900	1880.0	22.3	21.1
				19193	1909.3	22.4	21.2
	3 MHz	1	0	18615	1851.5	22.9	21.9
				18900	1880.0	23.1	22.4
				19185	1908.5	23.4	21.9
			7	18615	1851.5	23.0	22.2
				18900	1880.0	23.3	22.1
				19185	1908.5	23.3	21.9
			14	18615	1851.5	23.5	22.3
				18900	1880.0	22.9	22.2
				19185	1908.5	23.0	22.0
		8	0	18615	1851.5	22.3	20.8
				18900	1880.0	22.1	21.0
				19185	1908.5	22.4	21.3
			7	18615	1851.5	22.1	21.3
				18900	1880.0	22.3	21.0
				19185	1908.5	22.3	21.3
			14	18615	1851.5	22.0	21.2
				18900	1880.0	22.2	21.2
				19185	1908.5	22.0	21.4
		15	0	18615	1851.5	22.0	20.9
				18900	1880.0	22.0	21.1
				19185	1908.5	22.0	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	5 MHz	1	0	18625	1852.5	22.8	21.9
				18900	1880.0	23.4	22.2
				19175	1907.5	23.1	22.2
			12	18625	1852.5	23.3	22.2
				18900	1880.0	23.2	22.2
				19175	1907.5	23.3	21.8
			24	18625	1852.5	23.2	22.3
				18900	1880.0	23.2	22.3
				19175	1907.5	23.3	22.2
		12	0	18625	1852.5	21.9	21.3
				18900	1880.0	22.0	21.1
				19175	1907.5	22.3	21.2
			6	18625	1852.5	22.0	21.0
				18900	1880.0	21.9	21.3
				19175	1907.5	22.4	21.3
			13	18625	1852.5	22.2	21.3
				18900	1880.0	22.3	21.3
				19175	1907.5	22.0	21.2
		25	0	18625	1852.5	21.8	21.4
				18900	1880.0	22.2	21.4
				19175	1907.5	22.1	21.1
	10 MHz	1	0	18650	1855.0	23.1	22.4
				18900	1880.0	23.2	22.1
				19150	1905.0	23.4	21.9
			24	18650	1855.0	22.9	22.4
				18900	1880.0	23.0	22.4
				19150	1905.0	23.4	22.2
			49	18650	1855.0	23.5	22.1
				18900	1880.0	23.0	21.9
				19150	1905.0	23.3	21.8
		25	0	18650	1855.0	21.8	21.3
				18900	1880.0	22.0	21.1
				19150	1905.0	21.9	21.2
			13	18650	1855.0	22.3	20.8
				18900	1880.0	22.2	20.8
				19150	1905.0	22.2	20.9
			25	18650	1855.0	22.1	21.3
				18900	1880.0	22.1	21.2
				19150	1905.0	22.0	21.2
		50	0	18650	1855.0	22.1	21.3
				18900	1880.0	21.9	21.3
				19150	1905.0	21.8	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	15 MHz	1	0	18675	1857.5	23.0	22.0
				18900	1880.0	23.5	21.9
				19125	1902.5	22.9	22.4
			37	18675	1857.5	22.9	22.0
				18900	1880.0	23.4	22.4
				19125	1902.5	23.3	21.9
			74	18675	1857.5	23.5	22.1
				18900	1880.0	23.4	22.3
				19125	1902.5	23.0	22.4
		36	0	18675	1857.5	21.8	21.2
				18900	1880.0	22.0	20.9
				19125	1902.5	21.9	21.1
			19	18675	1857.5	22.1	21.3
				18900	1880.0	21.9	20.9
				19125	1902.5	22.0	21.1
			39	18675	1857.5	22.2	21.0
				18900	1880.0	22.0	20.9
				19125	1902.5	21.9	21.1
		75	0	18675	1857.5	22.3	20.9
				18900	1880.0	22.3	21.4
				19125	1902.5	22.3	21.2
	20 MHz	1	0	18700	1860.0	22.8	22.5
				18900	1880.0	22.9	22.5
				19100	1900.0	23.3	22.4
			49	18700	1860.0	22.8	22.3
				18900	1880.0	22.9	22.1
				19100	1900.0	22.8	21.9
			99	18700	1860.0	23.1	22.1
				18900	1880.0	23.5	21.9
				19100	1900.0	23.5	21.9
		50	0	18700	1860.0	22.4	21.5
				18900	1880.0	22.3	21.1
				19100	1900.0	21.9	21.4
			24	18700	1860.0	22.4	21.0
				18900	1880.0	22.5	21.2
				19100	1900.0	21.9	21.2
			50	18700	1860.0	22.2	20.8
				18900	1880.0	22.3	20.9
				19100	1900.0	21.9	20.9
		100	0	18700	1860.0	22.0	21.1
				18900	1880.0	22.5	21.1
				19100	1900.0	22.2	21.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	1.4 MHz	1	0	19957	1710.7	22.9	22.1
				20175	1732.5	23.1	22.1
				20393	1754.3	23.2	22.2
			3	19957	1710.7	23.1	22.5
				20175	1732.5	23.4	21.9
				20393	1754.3	23.4	22.3
			5	19957	1710.7	23.3	22.4
				20175	1732.5	23.5	22.2
				20393	1754.3	23.5	22.2
		3	0	19957	1710.7	22.8	22.4
				20175	1732.5	23.0	22.2
				20393	1754.3	23.3	22.4
			1	19957	1710.7	22.9	22.3
				20175	1732.5	23.2	22.4
				20393	1754.3	23.5	22.4
			3	19957	1710.7	23.4	22.3
				20175	1732.5	23.3	22.4
				20393	1754.3	23.2	22.3
		6	0	19957	1710.7	22.4	21.5
				20175	1732.5	21.9	21.4
				20393	1754.3	22.4	21.4
	3 MHz	1	0	19965	1711.5	23.3	22.3
				20175	1732.5	23.1	22.4
				20385	1753.5	23.2	22.0
			7	19965	1711.5	23.5	21.9
				20175	1732.5	23.5	22.4
				20385	1753.5	23.1	22.4
			14	19965	1711.5	22.9	22.2
				20175	1732.5	23.4	22.0
				20385	1753.5	23.4	22.3
		8	0	19965	1711.5	22.3	21.2
				20175	1732.5	22.5	20.8
				20385	1753.5	21.9	20.9
			7	19965	1711.5	22.1	21.0
				20175	1732.5	21.9	21.4
				20385	1753.5	22.0	21.1
			14	19965	1711.5	22.1	21.0
				20175	1732.5	22.0	21.5
				20385	1753.5	22.5	21.2
		15	0	19965	1711.5	22.0	21.0
				20175	1732.5	22.3	21.3
				20385	1753.5	21.9	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	5 MHz	1	0	19975	1712.5	23.3	22.2
				20175	1732.5	23.4	22.5
				20375	1752.5	23.1	22.1
			12	19975	1712.5	23.1	22.1
				20175	1732.5	23.2	21.9
				20375	1752.5	23.0	21.9
			24	19975	1712.5	23.1	22.0
				20175	1732.5	22.9	22.5
				20375	1752.5	23.3	22.2
		12	0	19975	1712.5	21.8	21.1
				20175	1732.5	22.1	20.9
				20375	1752.5	21.9	20.9
			6	19975	1712.5	22.2	21.4
				20175	1732.5	22.0	21.4
				20375	1752.5	22.1	21.4
			13	19975	1712.5	22.5	21.4
				20175	1732.5	22.0	21.3
				20375	1752.5	21.8	20.9
		25	0	19975	1712.5	22.4	21.3
				20175	1732.5	22.1	21.0
				20375	1752.5	22.4	21.4
	10 MHz	1	0	20000	1715.0	23.3	22.0
				20175	1732.5	23.3	22.0
				20350	1750.0	23.2	22.3
			24	20000	1715.0	23.1	22.4
				20175	1732.5	23.4	22.0
				20350	1750.0	23.1	22.1
			49	20000	1715.0	23.1	22.3
				20175	1732.5	23.2	22.3
				20350	1750.0	23.3	22.1
		25	0	20000	1715.0	22.3	20.9
				20175	1732.5	22.3	21.3
				20350	1750.0	22.5	21.1
			13	20000	1715.0	22.1	21.3
				20175	1732.5	22.1	21.3
				20350	1750.0	21.9	21.4
			25	20000	1715.0	22.0	21.2
				20175	1732.5	22.1	21.5
				20350	1750.0	21.9	21.3
		50	0	20000	1715.0	22.2	21.3
				20175	1732.5	22.1	20.9
				20350	1750.0	21.9	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	15 MHz	1	0	20025	1717.5	23.4	22.1
				20175	1732.5	23.2	22.5
				20325	1747.5	23.1	22.0
			37	20025	1717.5	22.9	22.2
				20175	1732.5	23.5	22.4
				20325	1747.5	23.3	22.1
			74	20025	1717.5	23.1	22.5
				20175	1732.5	23.0	22.4
				20325	1747.5	23.2	22.0
		36	0	20025	1717.5	22.3	21.5
				20175	1732.5	22.4	21.1
				20325	1747.5	22.5	21.1
			19	20025	1717.5	22.2	20.9
				20175	1732.5	22.0	21.0
				20325	1747.5	22.4	21.0
			39	20025	1717.5	22.4	20.9
				20175	1732.5	21.9	20.9
				20325	1747.5	21.9	21.4
		75	0	20025	1717.5	22.2	21.2
				20175	1732.5	22.0	21.1
				20325	1747.5	21.9	21.5
	20 MHz	1	0	20050	1720.0	23.4	22.3
				20175	1732.5	23.2	22.3
				20300	1745.0	23.2	22.3
			49	20050	1720.0	23.3	21.9
				20175	1732.5	23.1	22.3
				20300	1745.0	23.0	22.0
			99	20050	1720.0	23.4	22.4
				20175	1732.5	23.3	22.1
				20300	1745.0	23.4	22.4
		50	0	20050	1720.0	21.8	21.1
				20175	1732.5	21.9	21.1
				20300	1745.0	22.1	21.1
			24	20050	1720.0	22.1	21.4
				20175	1732.5	22.4	20.9
				20300	1745.0	22.4	20.9
			50	20050	1720.0	22.3	21.3
				20175	1732.5	22.5	21.2
				20300	1745.0	22.4	21.5
		100	0	20050	1720.0	21.9	21.4
				20175	1732.5	22.4	21.3
				20300	1745.0	22.4	20.9

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	1.4 MHz	1	0	20407	824.7	23.3	21.9
				20525	836.5	23.1	21.9
				20643	848.3	22.8	22.3
			3	20407	824.7	23.3	22.3
				20525	836.5	22.8	22.1
				20643	848.3	23.3	22.2
			5	20407	824.7	23.1	22.0
				20525	836.5	23.1	22.5
				20643	848.3	23.3	21.8
		3	0	20407	824.7	23.1	22.1
				20525	836.5	22.8	22.1
				20643	848.3	22.9	22.1
			1	20407	824.7	23.1	22.2
				20525	836.5	23.4	21.9
				20643	848.3	23.5	21.9
			3	20407	824.7	23.0	21.8
				20525	836.5	23.3	22.3
				20643	848.3	23.1	21.9
		6	0	20407	824.7	22.2	20.9
				20525	836.5	22.2	21.4
				20643	848.3	21.9	21.0
	3 MHz	1	0	20415	825.5	23.2	22.4
				20525	836.5	23.1	21.9
				20635	847.5	23.4	22.5
			7	20415	825.5	23.1	21.9
				20525	836.5	23.3	22.4
				20635	847.5	23.0	21.8
			14	20415	825.5	23.0	22.3
				20525	836.5	22.8	21.9
				20635	847.5	23.2	22.3
		8	0	20415	825.5	22.4	21.0
				20525	836.5	22.5	21.4
				20635	847.5	22.0	21.2
			7	20415	825.5	21.8	21.1
				20525	836.5	22.5	20.9
				20635	847.5	22.4	20.9
			14	20415	825.5	22.3	21.3
				20525	836.5	22.2	21.2
				20635	847.5	22.5	21.2
		15	0	20415	825.5	22.2	21.2
				20525	836.5	22.0	21.2
				20635	847.5	22.1	20.9

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	5 MHz	1	0	20425	826.5	23.3	22.3
				20525	836.5	23.2	21.9
				20625	846.5	22.9	22.2
			12	20425	826.5	23.4	22.4
				20525	836.5	23.1	22.5
				20625	846.5	23.3	22.4
			24	20425	826.5	23.4	22.4
				20525	836.5	23.4	22.4
				20625	846.5	23.2	22.2
		12	0	20425	826.5	22.5	21.4
				20525	836.5	22.1	21.1
				20625	846.5	22.4	21.3
			6	20425	826.5	22.2	21.4
				20525	836.5	22.1	21.2
				20625	846.5	22.5	21.1
			13	20425	826.5	22.0	21.0
				20525	836.5	22.2	21.0
				20625	846.5	21.9	20.8
		25	0	20425	826.5	22.4	21.3
				20525	836.5	21.9	21.0
				20625	846.5	22.1	21.0
	10 MHz	1	0	20450	829.0	23.0	22.0
				20525	836.5	23.4	21.8
				20600	844.0	23.0	22.5
			24	20450	829.0	23.2	22.4
				20525	836.5	23.2	22.4
				20600	844.0	23.3	22.3
			49	20450	829.0	23.4	22.2
				20525	836.5	23.0	21.8
				20600	844.0	23.2	22.1
		25	0	20450	829.0	21.9	21.2
				20525	836.5	22.4	21.3
				20600	844.0	22.2	21.5
			13	20450	829.0	22.1	20.9
				20525	836.5	22.1	21.4
				20600	844.0	22.4	21.0
			25	20450	829.0	22.0	21.5
				20525	836.5	22.2	21.3
				20600	844.0	22.4	21.5
		50	0	20450	829.0	21.9	21.0
				20525	836.5	22.2	20.8
				20600	844.0	22.0	21.2

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	1.4 MHz	1	0	23017	699.7	23.5	23.0
				23095	707.5	23.7	22.5
				23173	715.3	23.4	22.3
			3	23017	699.7	23.9	22.7
				23095	707.5	23.7	22.8
				23173	715.3	23.5	22.4
			5	23017	699.7	23.9	22.9
				23095	707.5	24.0	22.5
				23173	715.3	23.8	22.9
		3	0	23017	699.7	23.4	22.8
				23095	707.5	23.9	22.6
				23173	715.3	23.5	22.5
			1	23017	699.7	23.6	22.3
				23095	707.5	23.9	23.0
				23173	715.3	23.5	22.5
			3	23017	699.7	23.3	22.6
				23095	707.5	23.4	22.4
				23173	715.3	23.5	22.6
		6	0	23017	699.7	23.0	21.8
				23095	707.5	22.4	21.4
				23173	715.3	22.4	21.9
	3 MHz	1	0	23025	700.5	23.3	22.9
				23095	707.5	23.7	22.8
				23165	714.5	23.4	22.5
			7	23025	700.5	23.9	22.6
				23095	707.5	23.5	22.8
				23165	714.5	23.6	22.4
			14	23025	700.5	23.9	22.3
				23095	707.5	23.3	22.8
				23165	714.5	23.6	23.0
		8	0	23025	700.5	22.8	21.4
				23095	707.5	22.9	21.4
				23165	714.5	22.7	21.5
			7	23025	700.5	22.9	21.4
				23095	707.5	22.9	21.3
				23165	714.5	22.7	21.8
			14	23025	700.5	22.3	21.7
				23095	707.5	22.5	21.9
				23165	714.5	22.5	21.5
		15	0	23025	700.5	22.7	21.4
				23095	707.5	22.4	21.4
				23165	714.5	22.7	21.6

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	5 MHz	1	0	23035	701.5	23.9	22.7
				23095	707.5	23.8	22.9
				23155	713.5	23.5	22.9
			12	23035	701.5	23.5	22.9
				23095	707.5	23.6	22.6
				23155	713.5	23.9	22.8
			24	23035	701.5	23.4	22.7
				23095	707.5	23.4	22.7
				23155	713.5	23.7	22.9
		12	0	23035	701.5	22.4	21.6
				23095	707.5	22.6	21.7
				23155	713.5	22.4	21.4
			6	23035	701.5	22.4	21.4
				23095	707.5	23.0	21.7
				23155	713.5	22.9	21.4
			13	23035	701.5	23.0	21.9
				23095	707.5	22.9	21.5
				23155	713.5	22.9	21.6
		25	0	23035	701.5	22.7	21.4
				23095	707.5	22.3	21.9
				23155	713.5	22.7	21.7
	10 MHz	1	0	23060	704.0	23.7	22.5
				23095	707.5	23.9	22.9
				23130	711.0	23.5	22.5
			24	23060	704.0	23.6	22.8
				23095	707.5	23.7	22.4
				23130	711.0	23.8	22.6
			49	23060	704.0	23.4	22.5
				23095	707.5	23.8	22.8
				23130	711.0	23.6	22.4
		25	0	23060	704.0	22.4	21.9
				23095	707.5	22.8	21.4
				23130	711.0	22.9	21.3
			13	23060	704.0	22.6	21.5
				23095	707.5	22.6	21.4
				23130	711.0	23.0	21.9
			25	23060	704.0	22.9	21.6
				23095	707.5	22.8	21.7
				23130	711.0	22.8	21.4
		50	0	23060	704.0	22.4	21.5
				23095	707.5	22.9	21.6
				23130	711.0	22.9	21.8

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
13	5 MHz	1	0	23205	779.5	23.9	22.5
				23230	782.0	23.7	22.7
				23129	784.5	23.6	22.5
			12	23205	779.5	23.7	22.8
				23230	782.0	23.5	22.8
				23129	784.5	23.8	22.6
			24	23205	779.5	23.9	22.9
				23230	782.0	23.4	22.8
				23129	784.5	23.6	22.9
		12	0	23205	779.5	22.3	21.6
				23230	782.0	22.6	21.9
				23129	784.5	22.4	21.5
			6	23205	779.5	22.6	21.9
				23230	782.0	22.3	21.4
				23129	784.5	23.0	21.7
			13	23205	779.5	22.6	21.4
				23230	782.0	22.7	21.5
				23129	784.5	22.4	21.6
		25	0	23205	779.5	23.0	21.5
				23230	782.0	23.0	21.3
				23129	784.5	22.9	22.0
	10 MHz	1	0	23230	782.0	23.4	22.8
			24	23230	782.0	23.9	22.7
			49	23230	782.0	23.6	22.8
		25	0	23230	782.0	22.9	21.4
			13	23230	782.0	22.8	21.7
			25	23230	782.0	22.9	21.6
		50	0	23230	782.0	22.9	21.7

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
14	5 MHz	1	0	23305	790.5	23.5	22.8
				23330	793.0	23.9	22.6
				23355	795.5	23.4	22.5
			12	23305	790.5	23.3	22.5
				23330	793.0	23.7	22.5
				23355	795.5	23.6	22.6
			24	23305	790.5	23.9	22.7
				23330	793.0	23.8	22.9
				23355	795.5	24.0	22.7
		12	0	23305	790.5	22.8	21.9
				23330	793.0	22.5	21.5
				23355	795.5	22.8	21.6
			6	23305	790.5	22.8	21.4
				23330	793.0	22.9	21.6
				23355	795.5	22.9	21.9
			13	23305	790.5	22.5	21.7
				23330	793.0	22.6	21.3
				23355	795.5	22.5	21.6
		25	0	23305	790.5	22.5	21.3
				23330	793.0	22.6	21.5
				23355	795.5	22.6	21.9
	10 MHz	1	0	23330	793.0	23.7	22.3
			24	23330	793.0	23.8	22.9
			49	23330	793.0	23.5	22.9
		25	0	23330	793.0	22.5	21.8
			13	23330	793.0	22.6	21.6
			25	23330	793.0	22.6	21.7
		50	0	23330	793.0	22.7	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	1.4 MHz	1	0	131979	1710.7	23.1	22.1
				132322	1745.0	23.0	22.2
				132665	1779.3	22.9	22.5
			3	131979	1710.7	22.9	21.9
				132322	1745.0	23.0	21.9
				132665	1779.3	23.3	22.2
			5	131979	1710.7	23.4	22.3
				132322	1745.0	23.1	22.0
				132665	1779.3	22.9	21.9
		3	0	131979	1710.7	23.3	22.1
				132322	1745.0	23.3	22.1
				132665	1779.3	23.2	22.4
			1	131979	1710.7	22.9	21.8
				132322	1745.0	23.0	22.3
				132665	1779.3	22.9	22.4
			3	131979	1710.7	23.0	22.0
				132322	1745.0	23.3	22.2
				132665	1779.3	23.1	22.0
		6	0	131979	1710.7	21.8	21.1
				132322	1745.0	22.4	21.2
				132665	1779.3	21.9	21.3
	3 MHz	1	0	131987	1711.5	23.0	22.4
				132322	1745.0	23.2	22.0
				132657	1778.5	22.9	21.9
			7	131987	1711.5	23.4	22.3
				132322	1745.0	23.1	22.0
				132657	1778.5	23.5	22.2
			14	131987	1711.5	22.9	22.0
				132322	1745.0	23.1	21.9
				132657	1778.5	23.3	22.0
		8	0	131987	1711.5	22.0	21.3
				132322	1745.0	21.8	21.0
				132657	1778.5	22.2	21.4
			7	131987	1711.5	21.9	20.9
				132322	1745.0	22.4	21.1
				132657	1778.5	22.2	21.3
			14	131987	1711.5	22.1	21.3
				132322	1745.0	22.5	21.1
				132657	1778.5	22.5	21.1
		15	0	131987	1711.5	22.5	21.2
				132322	1745.0	22.5	21.0
				132657	1778.5	22.2	21.1

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	5 MHz	1	0	131997	1712.5	23.1	22.5
				132322	1745.0	23.3	21.9
				132646	1777.4	23.3	22.0
			12	131997	1712.5	23.3	22.1
				132322	1745.0	23.3	22.1
				132646	1777.4	23.3	22.3
			24	131997	1712.5	23.4	22.3
				132322	1745.0	23.2	22.4
				132646	1777.4	23.2	22.0
		12	0	131997	1712.5	22.1	21.5
				132322	1745.0	21.9	21.1
				132646	1777.4	21.8	20.8
			6	131997	1712.5	22.4	21.0
				132322	1745.0	22.0	21.1
				132646	1777.4	22.4	21.3
			13	131997	1712.5	21.9	20.8
				132322	1745.0	22.3	21.1
				132646	1777.4	22.4	20.9
		25	0	131997	1712.5	22.4	21.1
				132322	1745.0	21.9	21.3
				132646	1777.4	22.0	21.5
	10 MHz	1	0	132033	1716.1	23.0	21.8
				132322	1745.0	23.0	21.9
				132621	1774.9	23.0	22.2
			24	132033	1716.1	22.9	22.4
				132322	1745.0	22.9	22.4
				132621	1774.9	23.0	22.0
			49	132033	1716.1	22.9	22.2
				132322	1745.0	23.4	22.0
				132621	1774.9	23.3	22.5
		25	0	132033	1716.1	21.9	21.4
				132322	1745.0	21.8	21.3
				132621	1774.9	21.9	21.1
			13	132033	1716.1	22.0	21.0
				132322	1745.0	22.1	21.4
				132621	1774.9	22.4	21.3
			25	132033	1716.1	22.1	21.4
				132322	1745.0	22.0	21.1
				132621	1774.9	22.2	21.3
		50	0	132033	1716.1	21.9	21.5
				132322	1745.0	22.5	21.3
				132621	1774.9	22.4	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	15 MHz	1	0	132047	1717.5	23.4	21.8
				132322	1745.0	23.3	22.1
				132596	1772.4	23.0	22.1
			37	132047	1717.5	23.3	22.1
				132322	1745.0	23.4	22.4
				132596	1772.4	23.3	21.8
			74	132047	1717.5	23.1	22.3
				132322	1745.0	23.3	22.5
				132596	1772.4	23.1	22.3
		36	0	132047	1717.5	22.4	21.3
				132322	1745.0	22.1	21.2
				132596	1772.4	22.5	21.0
			19	132047	1717.5	21.8	20.8
				132322	1745.0	22.5	21.1
				132596	1772.4	22.2	21.4
			39	132047	1717.5	22.3	20.8
				132322	1745.0	22.2	21.4
				132596	1772.4	22.0	21.0
		75	0	132047	1717.5	21.8	20.9
				132322	1745.0	21.9	21.0
				132596	1772.4	22.0	21.5
	20 MHz	1	0	132072	1720.0	23.4	22.0
				132322	1745.0	23.3	21.9
				132571	1769.9	22.9	22.1
			49	132072	1720.0	23.2	22.3
				132322	1745.0	23.2	22.4
				132571	1769.9	22.9	21.9
			99	132072	1720.0	23.0	22.0
				132322	1745.0	23.1	22.2
				132571	1769.9	23.0	22.2
		50	0	132072	1720.0	21.9	21.4
				132322	1745.0	22.4	20.9
				132571	1769.9	21.8	21.0
			24	132072	1720.0	22.1	21.0
				132322	1745.0	22.2	21.2
				132571	1769.9	22.0	21.2
			50	132072	1720.0	22.1	21.3
				132322	1745.0	22.1	21.5
				132571	1769.9	22.4	21.3
		100	0	132072	1720.0	22.4	20.9
				132322	1745.0	22.0	20.9
				132571	1769.9	22.3	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
71	5 MHz	1	0	133147	665.5	23.4	22.7
				133297	680.5	23.7	22.5
				133447	695.5	23.4	22.6
			12	133147	665.5	23.5	22.6
				133297	680.5	23.7	22.5
				133447	695.5	23.4	22.4
			24	133147	665.5	23.8	22.9
				133297	680.5	23.6	22.4
				133447	695.5	23.4	22.4
		12	0	133147	665.5	22.8	21.8
				133297	680.5	22.6	21.4
				133447	695.5	22.3	21.3
			6	133147	665.5	22.7	21.9
				133297	680.5	22.5	21.7
				133447	695.5	22.8	21.7
			13	133147	665.5	22.7	21.4
				133297	680.5	22.6	21.4
				133447	695.5	22.8	21.4
		25	0	133147	665.5	22.6	21.9
				133297	680.5	22.3	21.5
				133447	695.5	22.3	21.4
	10 MHz	1	0	133172	668.0	23.7	22.7
				133297	680.5	23.8	22.3
				133422	693.0	23.6	23.0
			24	133172	668.0	23.8	22.5
				133297	680.5	24.0	22.9
				133422	693.0	23.6	22.7
			49	133172	668.0	23.6	22.8
				133297	680.5	23.9	22.7
				133422	693.0	23.8	22.5
		25	0	133172	668.0	22.4	21.8
				133297	680.5	22.5	21.7
				133422	693.0	22.6	21.4
			13	133172	668.0	22.5	21.4
				133297	680.5	22.5	21.6
				133422	693.0	22.5	21.6
			25	133172	668.0	23.0	21.5
				133297	680.5	22.9	21.4
				133422	693.0	23.0	21.6
		50	0	133172	668.0	22.5	21.6
				133297	680.5	22.9	21.9
				133422	693.0	22.9	21.5

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
71	15 MHz	1	0	133197	670.5	23.8	22.5
				133297	680.5	23.8	23.0
				133397	690.5	23.7	22.4
			37	133197	670.5	23.6	22.3
				133297	680.5	23.9	22.4
				133397	690.5	23.4	23.0
			74	133197	670.5	23.3	22.8
				133297	680.5	23.4	22.6
				133397	690.5	23.9	22.4
		36	0	133197	670.5	22.4	21.5
				133297	680.5	22.8	22.0
				133397	690.5	22.5	22.0
			19	133197	670.5	22.4	21.4
				133297	680.5	22.4	21.8
				133397	690.5	22.4	21.7
			39	133197	670.5	22.5	21.9
				133297	680.5	22.9	21.8
				133397	690.5	22.4	21.6
		75	0	133197	670.5	23.0	21.4
				133297	680.5	22.5	21.5
				133397	690.5	22.6	21.7
	20 MHz	1	0	133222	673.0	23.6	22.5
				133297	680.5	24.0	22.3
				133372	688.0	23.5	22.7
			49	133222	673.0	23.4	22.8
				133297	680.5	23.8	22.4
				133372	688.0	23.8	22.4
			99	133222	673.0	23.8	22.4
				133297	680.5	23.4	22.5
				133372	688.0	23.5	22.5
		50	0	133222	673.0	22.6	21.3
				133297	680.5	22.6	21.9
				133372	688.0	22.8	21.5
			24	133222	673.0	22.5	21.7
				133297	680.5	23.0	21.8
				133372	688.0	22.7	21.8
			50	133222	673.0	23.0	21.8
				133297	680.5	22.8	21.3
				133372	688.0	22.7	21.7
		100	0	133222	673.0	22.4	21.8
				133297	680.5	22.4	21.4
				133372	688.0	22.7	21.7

Table 9.1.3 Test Reduction Table – LTE

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 12 699-716 MHz	Front	23060	10 MHz	QPSK	25	12	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060				49	Reduced[2]
		23095					Reduced[2]
		23130					Reduced[2]
		23060		16QAM	25	12	Reduced[3]
		23095					Reduced[3]
		23130					Reduced[3]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		23060				49	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Right	23060	10 MHz	QPSK	25	12	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060				49	Reduced[2]
		23095					Reduced[2]
		23130					Reduced[2]
		23060		16QAM	25	12	Reduced[3]
		23095					Reduced[3]
		23130					Reduced[3]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		23060				49	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 12 699-716 MHz	Top	23060	10 MHz	QPSK	25	12	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[1]
		23095					Tested
		23130					Reduced[1]
		23060				49	Reduced[2]
		23095					Reduced[2]
		23130					Reduced[2]
		23060		16QAM	25	12	Reduced[3]
		23095					Reduced[3]
		23130					Reduced[3]
		23060			50	0	Reduced[1]
		23095					Reduced[1]
		23130					Reduced[1]
		23060			1	24	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		23060				49	Reduced[4]
		23095					Reduced[4]
		23130					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.
Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.
Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.
Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.
Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 13 777-787 MHz	Front	23230	10 MHz	QPSK	25	12	Tested
		23230			50	0	Reduced[1]
		23230			1	24	Tested
		23230				49	Reduced[2]
		23230		16QAM	25	12	Reduced[3]
		23230			50	0	Reduced[1]
		23230			1	24	Reduced[4]
		23230				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Right	23230	10 MHz	QPSK	25	12	Tested
		23230			50	0	Reduced[1]
		23230			1	24	Tested
		23230				49	Reduced[2]
		23230		16QAM	25	12	Reduced[3]
		23230			50	0	Reduced[1]
		23230			1	24	Reduced[4]
		23230				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Top	23230	10 MHz	QPSK	25	12	Tested
		23230			50	0	Reduced[1]
		23230			1	24	Tested
		23230				49	Reduced[2]
		23230		16QAM	25	12	Reduced[3]
		23230			50	0	Reduced[1]
		23230			1	24	Reduced[4]
		23230				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.
Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.
Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.
Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.
Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 14 788-798 MHz	Front	23330	10 MHz	QPSK	25	12	Tested
		23330			50	0	Reduced[1]
		23330			1	24	Tested
		23330				49	Reduced[2]
		23330		16QAM	25	12	Reduced[3]
		23330			50	0	Reduced[1]
		23330			1	24	Reduced[4]
		23330				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Right	23330	10 MHz	QPSK	25	12	Tested
		23330			50	0	Reduced[1]
		23330			1	24	Tested
		23330				49	Reduced[2]
		23330		16QAM	25	12	Reduced[3]
		23330			50	0	Reduced[1]
		23330			1	24	Reduced[4]
		23330				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Top	23330	10 MHz	QPSK	25	12	Tested
		23330			50	0	Reduced[1]
		23330			1	24	Tested
		23330				49	Reduced[2]
		23330		16QAM	25	12	Reduced[3]
		23330			50	0	Reduced[1]
		23330			1	24	Reduced[4]
		23330				49	Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 2 1850-1910 MHz	Front	18700	20 MHz	QPSK	50	0	Reduced[1]
		18900					Tested
		19100					Reduced[1]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Reduced[2]
		18900					Tested
		19100					Reduced[2]
		18700				99	Reduced[2]
		18900					Reduced[2]
		19100					Reduced[2]
		18700		16QAM	50	25	Reduced[3]
		18900					Reduced[3]
		19100					Reduced[3]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		18700				99	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]
	Right	18700	20 MHz	QPSK	50	25	Reduced[1]
		18900					Tested
		19100					Reduced[1]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Tested
		18900					Tested
		19100					Tested
		18700				99	Reduced[2]
		18900					Reduced[2]
		19100					Reduced[2]
		18700		16QAM	50	25	Reduced[3]
		18900					Reduced[3]
		19100					Reduced[3]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		18700				99	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 2 1850-1910 MHz	Top	18700	20 MHz	QPSK	50	25	Reduced[1]
		18900					Tested
		19100					Reduced[1]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Reduced[2]
		18900					Tested
		19100					Reduced[2]
		18700				99	Reduced[2]
		18900					Reduced[2]
		19100					Reduced[2]
		18700		16QAM	50	25	Reduced[3]
		18900					Reduced[3]
		19100					Reduced[3]
		18700			100	0	Reduced[1]
		18900					Reduced[1]
		19100					Reduced[1]
		18700			1	49	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		18700				99	Reduced[4]
		18900					Reduced[4]
		19100					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 5 824-849 MHz	Front	20050	10 MHz	QPSK	25	12	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050				49	Reduced[2]
		20175					Reduced[2]
		20300					Reduced[2]
		20050		16QAM	25	12	Reduced[3]
		20175					Reduced[3]
		20300					Reduced[3]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		20050				49	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]
	Right	20050	10 MHz	QPSK	25	12	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050				49	Reduced[2]
		20175					Reduced[2]
		20300					Reduced[2]
		20050		16QAM	25	12	Reduced[3]
		20175					Reduced[3]
		20300					Reduced[3]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		20050				49	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 5 824-849 MHz	Top	20050	10 MHz	QPSK	25	12	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[1]
		20175					Tested
		20300					Reduced[1]
		20050				49	Reduced[2]
		20175					Reduced[2]
		20300					Reduced[2]
		20050		16QAM	25	12	Reduced[3]
		20175					Reduced[3]
		20300					Reduced[3]
		20050			50	0	Reduced[1]
		20175					Reduced[1]
		20300					Reduced[1]
		20050			1	24	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		20050				49	Reduced[4]
		20175					Reduced[4]
		20300					Reduced[4]
		All lower bandwidths (5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 66 1710-1780 MHz	Front	132072	20 MHz	QPSK	50	25	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072				99	Reduced[2]
		132322					Reduced[2]
		132572					Reduced[2]
		132072		16QAM	50	25	Reduced[3]
		132322					Reduced[3]
		132572					Reduced[3]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		132072				99	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]
	Right	132072	20 MHz	QPSK	50	25	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072				99	Reduced[2]
		132322					Reduced[2]
		132572					Reduced[2]
		132072		16QAM	50	25	Reduced[3]
		132322					Reduced[3]
		132572					Reduced[3]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		132072				99	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 66 1710-1780 MHz	Top	132072	20 MHz	QPSK	50	25	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[1]
		132322					Tested
		132572					Reduced[1]
		132072				99	Reduced[2]
		132322					Reduced[2]
		132572					Reduced[2]
		132072		16QAM	50	25	Reduced[3]
		132322					Reduced[3]
		132572					Reduced[3]
		132072			100	0	Reduced[1]
		132322					Reduced[1]
		132572					Reduced[1]
		132072			1	49	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		132072				99	Reduced[4]
		132322					Reduced[4]
		132572					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz, 3 MHz, 1.4 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 71 663-698 MHz	Front	133222	20 MHz	QPSK	50	25	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222				99	Reduced[2]
		133297					Reduced[2]
		133372					Reduced[2]
		133222		16QAM	50	25	Reduced[3]
		133297					Reduced[3]
		133372					Reduced[3]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		133222				99	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz)					Reduced[5]
	Right	133222	20 MHz	QPSK	50	25	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222				99	Reduced[2]
		133297					Reduced[2]
		133372					Reduced[2]
		133222		16QAM	50	25	Reduced[3]
		133297					Reduced[3]
		133372					Reduced[3]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		133222				99	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

Band/ Frequency (MHz)	Side	Required Test Channel	Bandwidth	Modulation	RB Allocation	RB Offset	Tested/ Reduced
Band 71 663-698 MHz	Top	133222	20 MHz	QPSK	50	25	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[1]
		133297					Tested
		133372					Reduced[1]
		133222				99	Reduced[2]
		133297					Reduced[2]
		133372					Reduced[2]
		133222		16QAM	50	25	Reduced[3]
		133297					Reduced[3]
		133372					Reduced[3]
		133222			100	0	Reduced[1]
		133297					Reduced[1]
		133372					Reduced[1]
		133222			1	49	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		133222				99	Reduced[4]
		133297					Reduced[4]
		133372					Reduced[4]
		All lower bandwidths (15 MHz, 10 MHz, 5 MHz)					Reduced[5]

Reduced[1] – If the SAR value in the 50% RB testing is less than 1.45 W/kg, the 100% RB testing is reduced per KDB941225 D05 3) A) I) page 4.

Reduced[2] - If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 3) B) I) page 4.

Reduced[3] - If the SAR value in the 50% RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) A) I) page 4.

Reduced[4]- If the SAR value in the 1 RB testing is less than 1.45 W/kg, the remaining channels are reduced per KDB941225 D05 4) B) I) page 5.

Reduced[5]- If the conducted power is within ±0.5 dB, all testing where the SAR value is less than 1.45 W/kg is reduced per KDB941225 D05 5) B) I) page 5.

All remaining sides are reduced based on the calculations in 47 CFR 1310 (B).

SAR Data Summary – 600 MHz Body – LTE Band 71 (10055834 Only)

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)		
0 mm	-----	Front	680.5	133297	20 MHz/QPSK	1	49	0	23.8	0.0317	0.03
	-----		680.5	133297	20 MHz/QPSK	50	24	1	23.0	0.0242	0.02
	1	Right	680.5	133297	20 MHz/QPSK	1	49	0	23.8	0.145	0.15
	-----		688.0	133372	20 MHz/QPSK	50	24	1	23.0	0.123	0.12
	-----	Top	680.5	133297	20 MHz/QPSK	1	49	0	23.8	0.0968	0.10
	-----		680.5	133297	20 MHz/QPSK	50	24	1	23.0	0.081	0.08

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 750 MHz Body – LTE Band 12 (10055834 Only)

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)		
0 mm	-----	Front	707.5	23095	10 MHz/QPSK	1	24	0	23.7	0.0267	0.03
	-----		707.5	23095	10 MHz/QPSK	25	13	1	22.6	0.0221	0.02
	2	Right	707.5	23095	10 MHz/QPSK	1	24	0	23.7	0.0861	0.09
	-----		707.5	23095	10 MHz/QPSK	25	13	1	22.6	0.0693	0.08
	-----	Top	707.5	23095	10 MHz/QPSK	1	24	0	23.7	0.0836	0.09
	-----		707.5	23095	10 MHz/QPSK	25	13	1	22.6	0.0571	0.06

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 750 MHz Body – LTE Band 13 (10055834 Only)

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)		
0 mm	-----	Front	782.0	23230	10 MHz/QPSK	1	24	0	23.9	0.0112	0.01
	-----		782.0	23230	10 MHz/QPSK	25	13	1	22.8	0.00757	0.01
	-----	Right	782.0	23230	10 MHz/QPSK	1	24	0	23.9	0.0477	0.05
	-----		782.0	23230	10 MHz/QPSK	25	13	1	22.8	0.0373	0.04
	3	Top	782.0	23230	10 MHz/QPSK	1	24	0	23.9	0.0579	0.06
	-----		782.0	23230	10 MHz/QPSK	25	13	1	22.8	0.0423	0.04

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 750 MHz Body – LTE Band 14 (10055834 Only)

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)		
0 mm	-----	Front	793.0	23330	10 MHz/QPSK	1	24	0	23.8	0.0066	0.01
	-----		793.0	23330	10 MHz/QPSK	25	13	1	22.6	0.00415	0.01
	4	Right	793.0	23330	10 MHz/QPSK	1	24	0	23.8	0.0528	0.06
	-----		793.0	23330	10 MHz/QPSK	25	13	1	22.6	0.044	0.05
	-----	Top	793.0	23330	10 MHz/QPSK	1	24	0	23.8	0.0341	0.04
	-----		793.0	23330	10 MHz/QPSK	25	13	1	22.6	0.0287	0.03

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 835 MHz Body - WCDMA (10055834 Only)

MEASUREMENT RESULTS										
Gap	Plot	Frequency		Modulation	Position	End Power	RMC	Test Set Up	Measured SAR (W/kg)	Reported SAR (W/kg)
		MHz	Ch.			(dBm)				
0 mm	----	836.6	4183	WCDMA	Front	22.82	12.2 kbps	Test Loop 1	0.0517	0.07
	5	836.6	4183	WCDMA	Right	22.82	12.2 kbps	Test Loop 1	0.106	0.14
	----	836.6	4183	WCDMA	Top	22.82	12.2 kbps	Test Loop 1	0.0328	0.04

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 835 MHz Body – LTE Band 5 (10055834 Only)

MEASUREMENT RESULTS											
Gap	**Plot**	**Position**	**Frequency**		**BW/ Modulation**	**RB Size**	**RB Offset**	**MPR Target**	**End Power**	**Measured SAR**	**Reported SAR**
			MHz	**Ch.**					**(dBm)**	**(W/kg)**	**(W/kg)**
0 mm	-----	Front	836.5	20525	10 MHz/QPSK	1	24	0	23.2	0.033	0.04
	-----		836.5	20525	10 MHz/QPSK	25	13	1	22.1	0.0259	0.03
	-----	Right	836.5	20525	10 MHz/QPSK	1	24	0	23.2	0.120	0.14
	6		836.5	20525	10 MHz/QPSK	25	13	1	22.1	0.0963	0.12
	-----	Top	836.5	20525	10 MHz/QPSK	1	24	0	23.2	0.0256	0.03
	-----		836.5	20525	10 MHz/QPSK	25	13	1	22.1	0.0204	0.03

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 1750 MHz Body - WCDMA (10055834 Only)

MEASUREMENT RESULTS										
Gap	**Plot**	**Frequency**		**Rev Level/ Modulation**	**Position**	**End Power**	**RMC**	**Test Set Up**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
		MHz	**Ch.**			**(dBm)**				
0 mm	----	1732.6	1413	WCDMA	Front	22.98	12.2 kbps	Test Loop 1	0.143	0.18
	7	1732.6	1413	WCDMA	Right	22.98	12.2 kbps	Test Loop 1	0.205	0.26
	----	1732.6	1413	WCDMA	Top	22.98	12.2 kbps	Test Loop 1	0.184	0.23
						Head 1.6 W/kg (mW/g) averaged over 1 gram				

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 1750 MHz Body – LTE Band 66 (10055834 Only)

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)		
0 mm	-----	Front	1745.0	132322	20 MHz/QPSK	1	49	0	23.2	0.044	0.05
	-----		1745.0	132322	20 MHz/QPSK	50	24	1	22.2	0.0335	0.04
	8	Right	1745.0	132322	20 MHz/QPSK	1	49	0	23.2	0.221	0.27
	-----		1745.0	132322	20 MHz/QPSK	50	24	1	22.2	0.173	0.21
	-----	Top	1745.0	132322	20 MHz/QPSK	1	49	0	23.2	0.140	0.17
	-----		1745.0	132322	20 MHz/QPSK	50	24	1	22.2	0.105	0.13

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

Note: Band 4 LTE is fully within the frequency band of B66. Therefore, Band 4 was not tested for standalone SAR.

SAR Data Summary – 1900 MHz Body - WCDMA (10055834 Only)

MEASUREMENT RESULTS

Gap	Plot	Frequency		Rev Level/ Modulation	Position	End Power	RMC	Test Set Up	Measured SAR (W/kg)	Reported SAR (W/kg)
		MHz	Ch.			(dBm)				
0 mm	----	1880.0	9400	WCDMA	Front	22.82	12.2 kbps	Test Loop 1	0.174	0.23
	9	1880.0	9400	WCDMA	Right	22.82	12.2 kbps	Test Loop 1	0.216	0.28
	----	1880.0	9400	WCDMA	Top	22.82	12.2 kbps	Test Loop 1	0.201	0.26

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 1900 MHz Body – LTE Band 2 (10055834 Only)

MEASUREMENT RESULTS											
Gap	**Plot**	**Position**	**Frequency**		**BW/ Modulation**	**RB Size**	**RB Offset**	**MPR Target**	**End Power**	**Measured SAR**	**Reported SAR**
			MHz	**Ch.**					**(dBm)**	**(W/kg)**	**(W/kg)**
0 mm	-----	Front	1880.0	18900	20 MHz/QPSK	1	49	0	22.9	0.102	0.13
	-----		1880.0	18900	20 MHz/QPSK	50	24	1	22.5	0.0796	0.09
	-----	Right	1880.0	18900	20 MHz/QPSK	1	49	0	22.9	0.210	0.27
	-----		1880.0	18900	20 MHz/QPSK	50	24	1	22.5	0.166	0.19
	-----	Top	1860.0	18700	20 MHz/QPSK	1	49	0	22.8	0.207	0.27
	10		1880.0	18900	20 MHz/QPSK	1	49	0	22.9	0.232	0.30
	-----		1900.0	19100	20 MHz/QPSK	1	49	0	22.8	0.219	0.29
	-----		1880.0	18900	20 MHz/QPSK	50	24	1	22.5	0.180	0.20

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

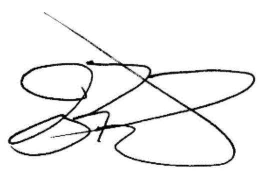
Jay M. Moulton
Vice President

SAR Data Summary – 2450 MHz Body 802.11b & BT

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
-----	0 mm	Front	2412	1	DSSS	Primary	17.83	0.211	0.22
11			2437	6	DSSS		17.74	0.227	0.24
-----			2462	11	DSSS		17.41	0.207	0.24
-----		Top	2437	6	DSSS		17.74	0.0151	0.02
-----		Front	2441	39	GMSK		7.58	0.0187	0.02
-----		Top	2441	39	GMSK		7.58	0.0013	<0.01

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm



Jay M. Moulton
Vice President

SAR Data Summary – 5250 MHz Body 802.11a

MEASUREMENT RESULTS									
Plot	Gap	Position	Frequency		Modulation	Antenna	End Power	Measured SAR (W/kg)	Reported SAR (W/kg)
			MHz	Ch.			(dBm)		
12	0 mm	Front	5300	60	OFDM	Primary	12.74	0.116	0.12
-----		Top	5300	60	OFDM		12.74	0.00871	0.01

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 5600 MHz Body 802.11a

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR**	**Reported SAR**
			MHz	**Ch.**			**(dBm)**	**(W/kg)**	**(W/kg)**
13	0 mm	Front	5600	120	OFDM	Primary	12.43	0.124	0.14
-----		Top	5600	120	OFDM		12.43	0.0447	0.05

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

SAR Data Summary – 5800 MHz Body 802.11a

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
14	0 mm	Front	5785	157	OFDM	Primary	10.79	0.149	0.18
-----		Top	5785	157	OFDM		10.79	0.038	0.05

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

1. Battery is fully charged for all tests.
   Power Measured ☒Conducted ☐ERP ☐EIRP
2. SAR Measurement
   Phantom Configuration ☐Left Head ☒Eli4 ☐Right Head
   SAR Configuration ☐Head ☒Body
3. Test Signal Call Mode ☒Test Code ☐Base Station Simulator
4. Test Configuration ☐With Belt Clip ☐Without Belt Clip ☒N/A
5. Tissue Depth is at least 15.0 cm

Jay M. Moulton
Vice President

Carrier Aggregation Evaluation

Downlink Only Carrier Aggregation

This device supports LTE Carrier Aggregation (CA) in the downlink. All uplink communications are identical to Release 8 specifications. Per FCC KDB Publication 941225 D05A v01r02 and Fall 2017 TCB Workshop Notes, SAR for LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive.

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05A v01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. For every supported combination of downlink only carrier aggregation, additional conducted output power are measured with the downlink carrier aggregation active for the configuration with the highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05A v01r02, no SAR measurements are required for carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with the downlink only carrier aggregation inactive.

MIMO

This device only supports LTE downlink 2x2 MIMO. Per Fall 2017 TCB Workshop Notes, SAR for LTE MIMO operations was not needed since the maximum average output power in LTE MIMO mode was not >0.25 dB higher than the maximum output power when MIMO is inactive.

SAR Data Summary – Simultaneous Transmit (WWAN-WLAN)

MEASUREMENT RESULTS

Plot	Position	SAR (W/kg) WWAN	SAR (W/kg) WLAN	Total SAR (W/kg)
-----	Front	0.23	0.24	0.47
-----	Right	0.28	[redacted]	0.28
-----	Top	0.30	0.05	0.35
			Head **1.6 W/kg (mW/g)** averaged over 1 gram	

The sum SAR value is less than the limit; therefore, per KDB447498 D01 v07, the simultaneous requirement is met.

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
ELI5 Flat Phantom	N/A	N/A	2037
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	04/22/2022	04/22/2021	1416
SPEAG E-Field Probe EX3DV4	04/16/2022	04/16/2021	7531
Speag Validation Dipole D600V3	02/18/2022	02/18/2019	1012
Speag Validation Dipole D750V2	06/04/2022	06/04/2021	1053
Speag Validation Dipole D900V2	06/04/2022	06/04/2021	1d128
Speag Validation Dipole D1750V2	06/03/2022	06/03/2021	1061
Speag Validation Dipole D1900V2	06/04/2022	06/04/2021	5d147
Speag Validation Dipole D2450V2	06/03/2022	06/03/2021	881
Speag Validation Dipole D5GHzV2	06/08/2022	06/08/2021	1119
Agilent N1911A Power Meter	03/16/2023	03/16/2022	GB45100254
Agilent N1922A Power Sensor	03/17/2023	03/17/2022	MY45240464
Agilent (HP) 8561E Spectrum Analyzer	03/17/2023	03/17/2022	31720068
Agilent (HP) 83752A Synthesized Sweeper	03/17/2023	03/17/2022	3610A01048
Agilent (HP) 8753C Vector Network Analyzer	03/17/2023	03/17/2022	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/16/2023	03/16/2022	2904A00595
Agilent 778D Dual Directional Coupler	N/A	N/A	MY48220184
Anritsu MT8820C	04/23/2022	04/23/2021	6201381721
Aprel Dielectric Probe Assembly	N/A	N/A	0011
Head Equivalent Matter (600 MHz)	N/A	N/A	N/A
Head Equivalent Matter (750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (900 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1750 MHz)	N/A	N/A	N/A
Head Equivalent Matter (1900 MHz)	N/A	N/A	N/A
Head Equivalent Matter (2450 MHz)	N/A	N/A	N/A
Head Equivalent Matter (5 GHz)	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/IC. 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] International Electrotechnical Commission, IEC 62209-2 (Edition 1.0), Human Exposure to radio frequency fields from hand-held and body mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), March 2010.

[5] IEEE Standard 1528 – 2013, IEEE Recommended Practice for Determining the Peak-Spatial Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques, June 2013.

[6] Industry Canada, RSS – 102 Issue 5, Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), March 2015.

[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
Thu 24/Mar/2022
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.5800	42.82	0.88	42.22	0.91
0.5900	42.77	0.88	42.16	0.92
0.6000	42.72	0.88	42.11	0.92
0.6100	42.67	0.88	42.06	0.93
0.6200	42.62	0.88	42.01	0.93
0.6300	42.56	0.88	41.94	0.93
0.6400	42.51	0.88	41.88	0.93
0.6500	42.46	0.88	41.82	0.93
0.6600	42.41	0.88	41.76	0.94
0.6700	42.36	0.89	41.70	0.94
0.6730	42.345	0.89	41.682	0.94*
0.6800	42.31	0.89	41.64	0.94
0.6805	42.307	0.89	41.637	0.941*
0.6880	42.262	0.89	41.592	0.948*
0.6900	42.25	0.89	41.58	0.95
0.7000	42.20	0.89	41.52	0.95

* value intepolated

****

Test Result for UIM Dielectric Parameter
Wed 23/Mar/2022
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
0.7000	42.20	0.89	41.76	0.86
0.7040	42.18	0.89	41.732	0.864*
0.7075	42.163	0.89	41.708	0.868*
0.7100	42.15	0.89	41.69	0.87
0.7110	42.145	0.89	41.685	0.871*
0.7200	42.10	0.89	41.64	0.88
0.7300	42.05	0.89	41.57	0.89
0.7400	41.99	0.89	41.51	0.89
0.7500	41.94	0.89	41.46	0.90
0.7600	41.89	0.89	41.40	0.91
0.7700	41.84	0.89	41.34	0.92
0.7800	41.79	0.90	41.28	0.92
0.7820	41.778	0.90	41.268	0.922*
0.7900	41.73	0.90	41.22	0.93
0.7930	41.715	0.90	41.208	0.93*
0.8000	41.68	0.90	41.18	0.93

* value interpolated

****
Test Result for UIM Dielectric Parameter
Wed 23/Mar/2022
Freq Frequency(GHz)
eH Limits for Head Epsilon
sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	eH	sH	Test_e	Test_s
0.8000	41.68	0.90	41.52	0.89
0.8100	41.63	0.90	41.47	0.90
0.8200	41.58	0.90	41.41	0.91
0.8264	41.548	0.90	41.442	0.91*
0.8290	41.535	0.90	41.455	0.91*
0.8300	41.53	0.90	41.46	0.91
0.8365	41.511	0.907	41.441	0.917*
0.8366	41.51	0.907	41.44	0.917*
0.8400	41.50	0.91	41.43	0.92
0.8440	41.50	0.914	41.422	0.924*
0.8466	41.50	0.917	41.417	0.927*
0.8500	41.50	0.92	41.41	0.93
0.8600	41.50	0.93	41.39	0.94
0.8700	41.50	0.94	41.37	0.95
0.8800	41.50	0.95	41.36	0.96
0.8900	41.50	0.96	41.35	0.97
0.9000	41.50	0.97	41.34	0.98
0.9100	41.50	0.98	41.33	0.99
0.9200	41.49	0.98	41.32	0.99

* value interpolated

****
Test Result for UIM Dielectric Parameter
Tue 22/Mar/2022
Freq Frequency(GHz)
eH Limits for Head Epsilon
sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	eH	sH	Test_e	Test_s
1.7000	40.16	1.34	39.34	1.36
1.7100	40.14	1.35	39.32	1.37
1.7124	40.138	1.35	39.315	1.372*
1.7200	40.13	1.35	39.30	1.38
1.7300	40.11	1.36	39.28	1.38
1.7326	40.105	1.363	39.275	1.383*
1.7400	40.09	1.37	39.26	1.39
1.7450	40.085	1.37	39.25	1.395*
1.7500	40.08	1.37	39.24	1.40
1.7526	40.075	1.373	39.235	1.403*
1.7600	40.06	1.38	39.22	1.41
1.7700	40.05	1.38	39.20	1.42
1.7800	40.03	1.39	39.18	1.42
1.7900	40.02	1.39	39.16	1.43

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Tue 22/Mar/2022
Freq   Frequency(GHz)
eH Limits for Head Epsilon
sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
***********************************************************
```

Freq	eH	sH	Test_e	Test_s
1.8500	40.00	1.40	39.97	1.37
1.8524	40.00	1.40	39.65	1.372*
1.8600	40.00	1.40	39.95	1.38
1.8700	40.00	1.40	39.93	1.38
1.8800	40.00	1.40	39.91	1.39
1.8900	40.00	1.40	39.89	1.39
1.9000	40.00	1.40	39.87	1.39
1.9076	40.00	1.40	39.855	1.398*
1.9100	40.00	1.40	39.85	1.40
1.9200	40.00	1.40	39.84	1.41

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Mon 21/Mar/2022
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
***********************************************************
```

Freq	FCC_eH	FCC_sH	Test_e	Test_s
2.4100	39.26	1.76	38.44	1.76
2.4120	39.258	1.762	38.436	1.762*
2.4200	39.25	1.77	38.42	1.77
2.4300	39.24	1.78	38.40	1.78
2.4370	39.226	1.787	38.393	1.794*
2.4400	39.22	1.79	38.39	1.80
2.4420	39.216	1.792	38.38	1.802*
2.4500	39.20	1.80	38.34	1.81
2.4600	39.19	1.81	38.34	1.82
2.4620	39.186	1.812	38.336	1.822*
2.4700	39.17	1.82	38.32	1.83
2.4720	39.168	1.822	38.316	1.836*
2.4800	39.16	1.83	38.30	1.86

* value interpolated

****
Test Result for UIM Dielectric Parameter
Mon 21/Mar/2022
Freq   Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
5.1000	36.10	4.55	34.94	4.56
5.1200	36.08	4.57	34.92	4.58
5.1400	36.05	4.59	34.89	4.60
5.1600	36.03	4.61	34.87	4.63
5.1800	36.01	4.63	34.85	4.65
5.2000	35.99	4.65	34.82	4.67
5.2200	35.96	4.68	34.80	4.69
5.2400	35.94	4.70	34.78	4.71
5.2500	35.93	4.71	34.765	4.725*
5.2600	35.92	4.72	34.75	4.74
5.2800	35.89	4.74	34.72	4.76
5.3000	35.87	4.76	34.69	4.78
5.3200	35.85	4.78	34.67	4.80
5.3400	35.83	4.80	34.65	4.83
5.3600	35.80	4.82	34.63	4.85
5.3800	35.78	4.84	34.60	4.87
5.4000	35.76	4.86	34.58	4.89
5.4200	35.73	4.88	34.56	4.92
5.4400	35.71	4.90	34.55	4.94
5.4600	35.69	4.92	34.52	4.96
5.4800	35.67	4.94	34.49	4.98
5.5000	35.64	4.96	34.46	5.00
5.5200	35.62	4.98	34.44	5.02
5.5400	35.60	5.00	34.42	5.04
5.5600	35.57	5.02	34.40	5.07
5.5800	35.55	5.04	34.37	5.09
5.6000	35.53	5.07	34.35	5.11
5.6200	35.51	5.09	34.32	5.13
5.6400	35.48	5.11	34.30	5.16
5.6600	35.46	5.13	34.28	5.18
5.6800	35.44	5.15	34.26	5.20
5.7000	35.41	5.17	34.23	5.22
5.7200	35.39	5.19	34.21	5.25
5.7400	35.37	5.21	34.19	5.27
5.7450	35.365	5.215	34.185	5.275*
5.7500	35.36	5.22	34.18	5.28*
5.7600	35.35	5.23	34.17	5.29
5.7800	35.32	5.25	34.15	5.31
5.7850	35.315	5.255	34.14	5.315*
5.8000	35.30	5.27	34.11	5.33
5.8200	35.28	5.29	34.09	5.36
5.8250	35.273	5.295	34.085	5.365*
5.8400	35.25	5.31	34.07	5.38
5.8600	35.23	5.33	34.05	5.40

* value interpolated

RF Exposure Lab

Plot 1

DUT: Dipole 600 MHz D600V3; Type: D600V3; Serial: D600V3 - SN:1012

Communication System: CW; Frequency: 600 MHz; Duty Cycle: 1:1
Medium: HSL600; Medium parameters used: f = 600 MHz; σ = 0.92 S/m; ε_r = 42.11; ρ = 1000 kg/m^3
Phantom section: Flat Section

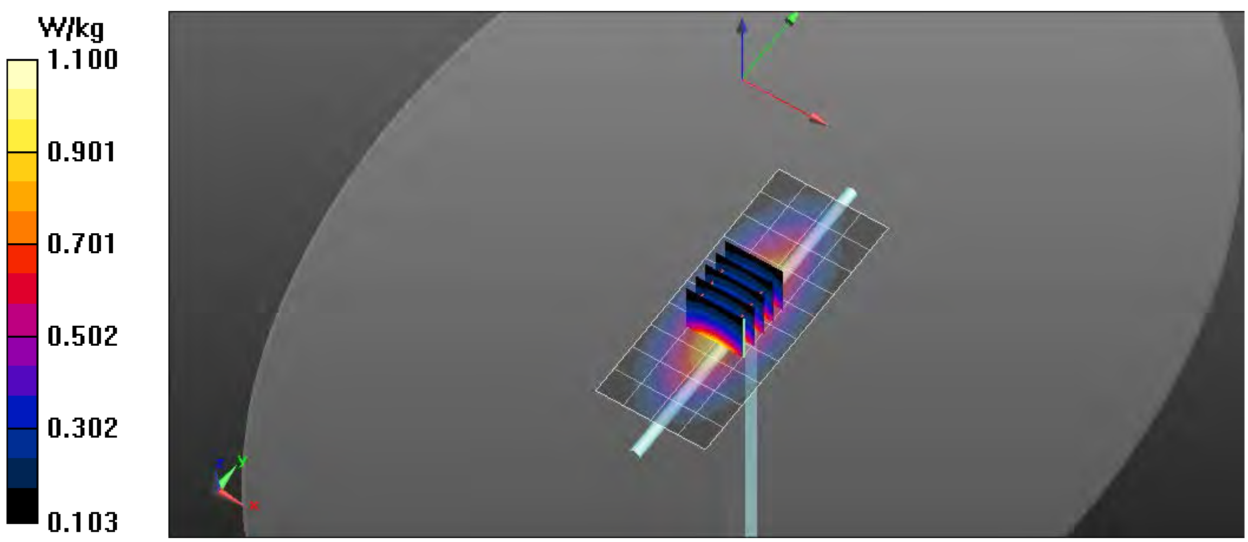
Test Date: Date: 3/24/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

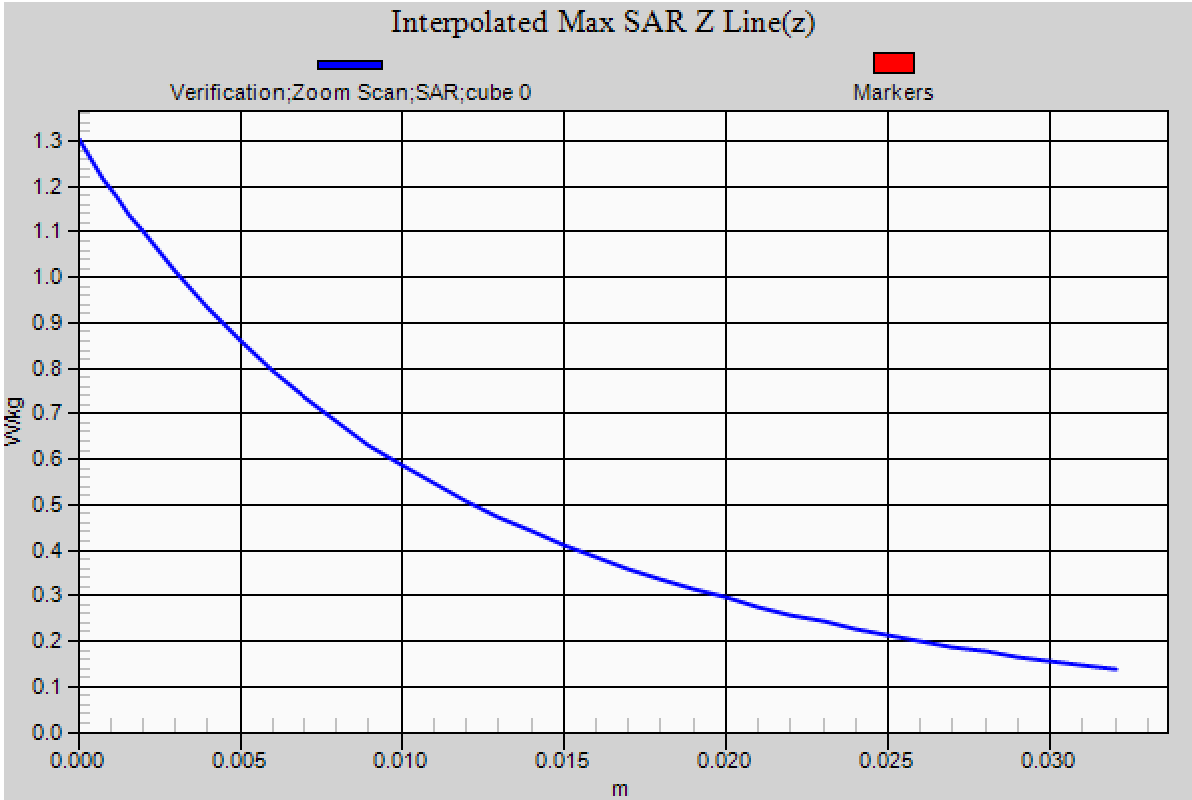
Probe: EX3DV4 – SN7531; ConvF(10.64, 10.64, 10.64); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Head Verification/600 MHz/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.04 W/kg

Head Verification/600 MHz//Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.468 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.28 W/kg
P_{in}= 100 mW
SAR(1 g) = 0.656 W/kg; SAR(10 g) = 0.432 W/kg
Maximum value of SAR (measured) = 1.08 W/kg




Interpolated Max SAR Z Line(z)
Verification;Zoom Scan;SAR;cube 0
Markers
W/kg
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

RF Exposure Lab

Plot 2

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1053

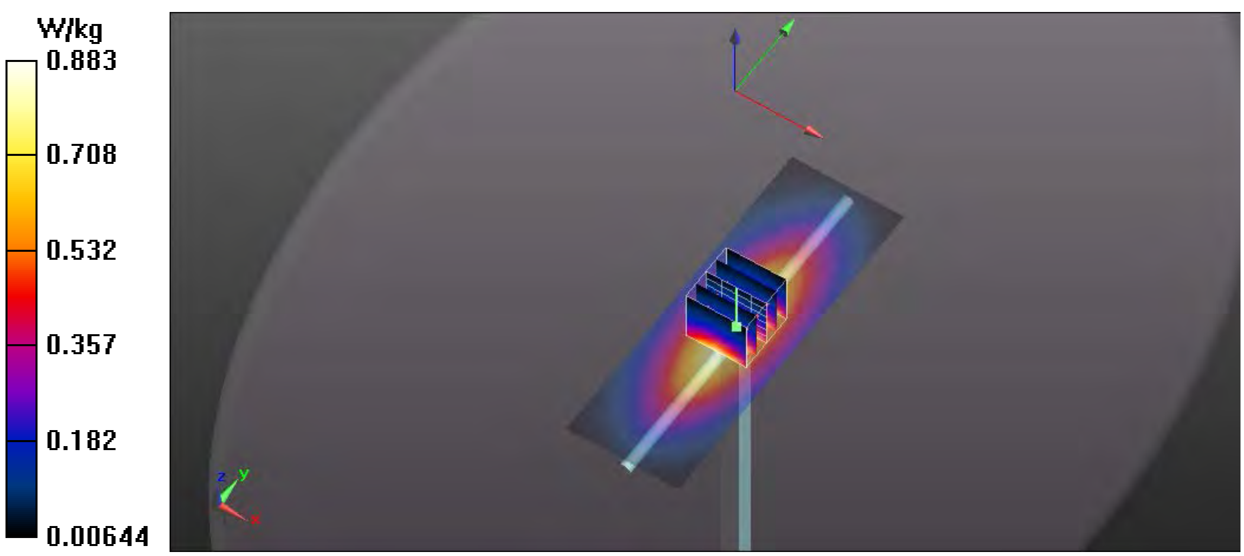
Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.9 S/m; ε_r = 41.46; ρ = 1000 kg/m^3
Phantom section: Flat Section

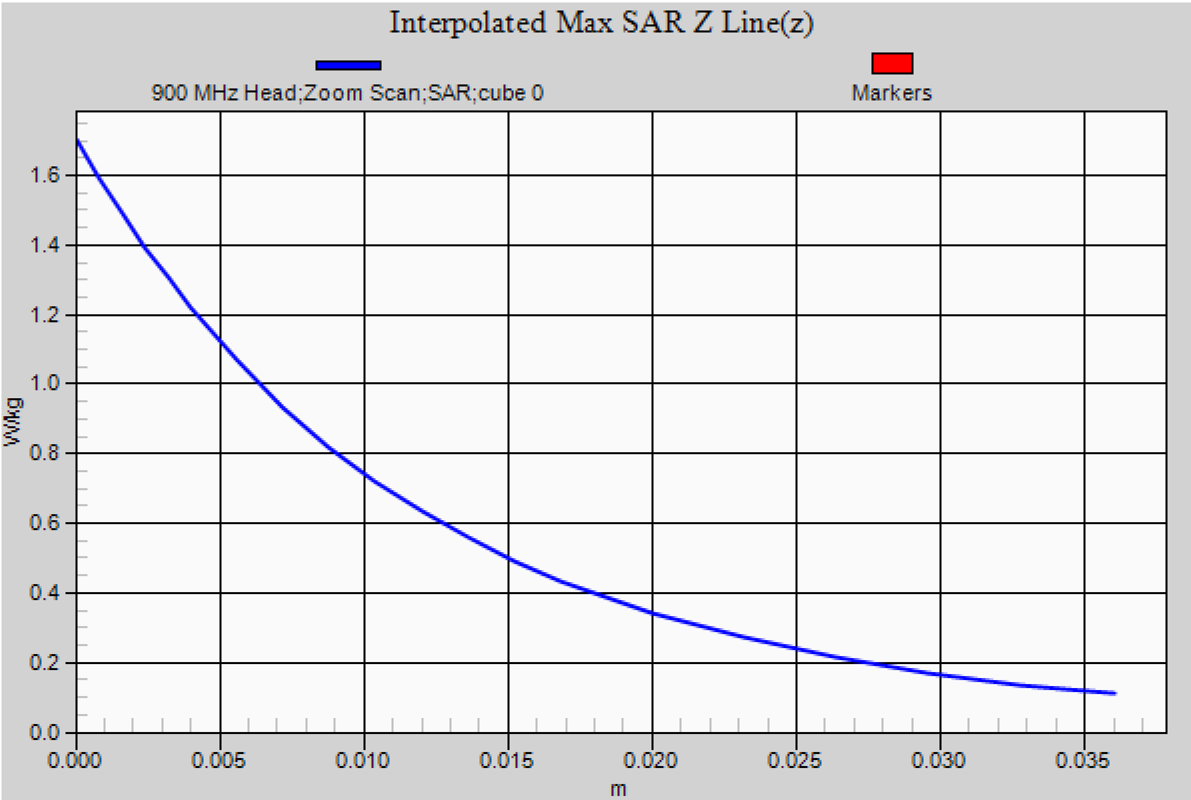
Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7531; ConvF(10.49, 10.49, 10.49); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

750 MHz Head/Verification/Area Scan (41x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.883 W/kg

750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.949 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.691 mW/g
P_{in}= 100 mW
SAR(1 g) = 0.858 mW/g; SAR(10 g) = 0.552 mW/g
Maximum value of SAR (measured) = 0.888 W/kg




Interpolated Max SAR Z Line(z)
900 MHz Head;Zoom Scan;SAR;cube 0
Markers
W/kg
1.6
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
0.035
m

RF Exposure Lab

Plot 3

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN:1d128

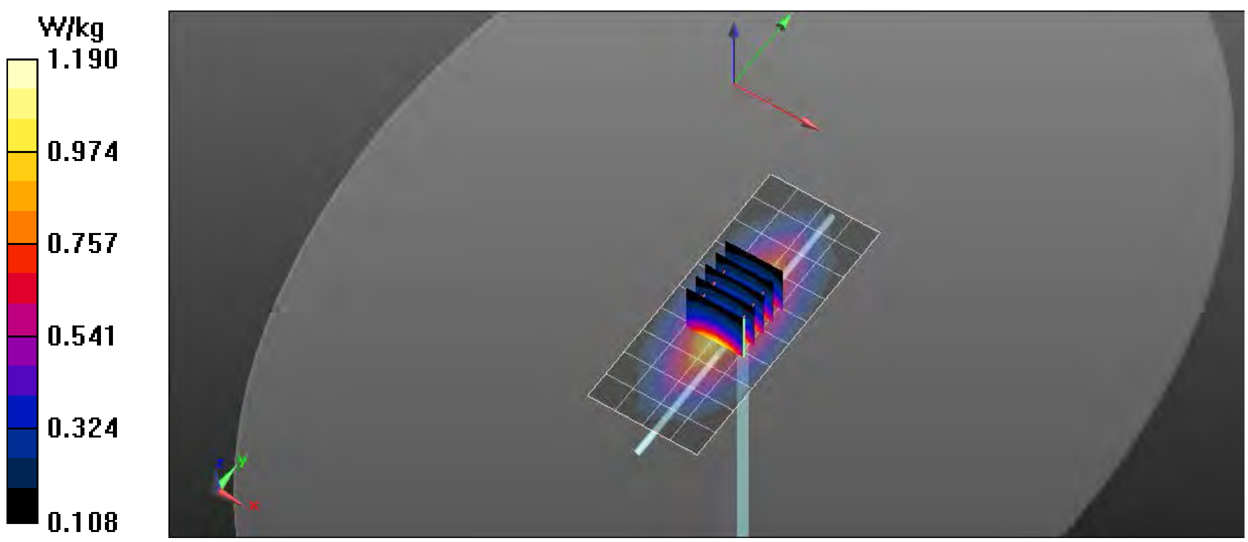
Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used: f = 900 MHz; σ = 0.98 S/m; ε_r = 41.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

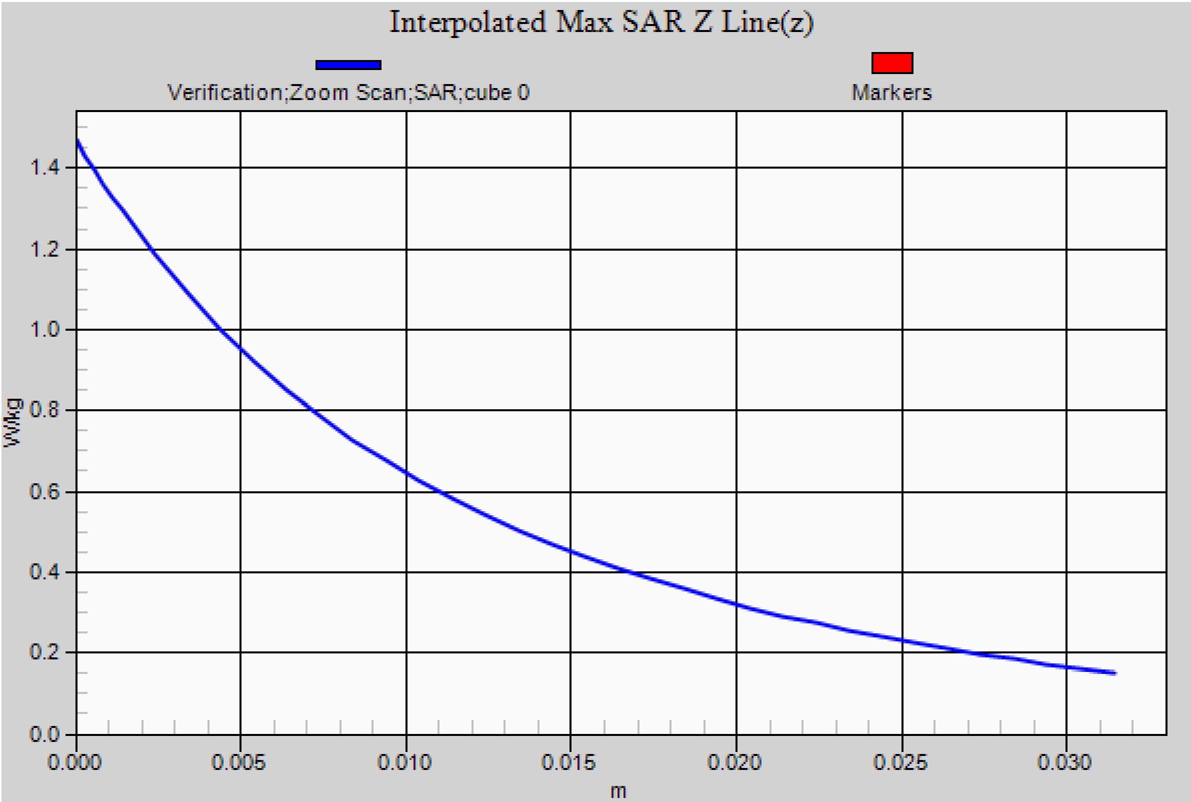
Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN7531; ConvF(10.16, 10.16, 10.16); Calibrated: 4/15/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

900 MHz/Verification/Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.19 W/kg

900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.568 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.43 W/kg
P_{in}= 100 mW
SAR(1 g) = 1.15 W/kg; SAR(10 g) = 0.712 W/kg
Maximum value of SAR (measured) = 1.2 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 4

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN:1061

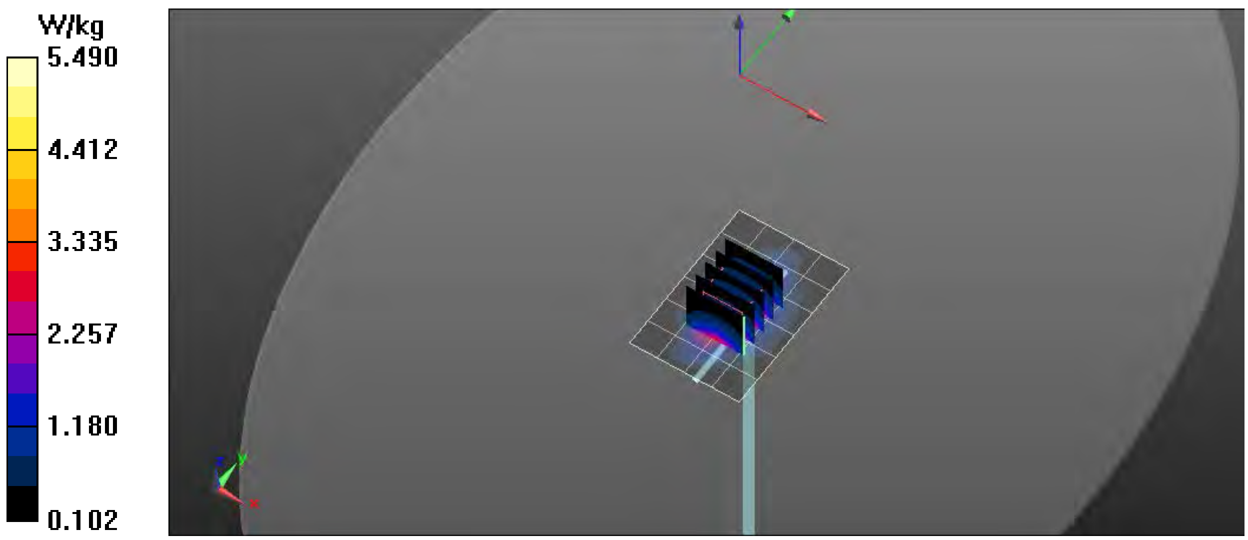
Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.4 S/m; ε_r = 39.24; ρ = 1000 kg/m^3
Phantom section: Flat Section

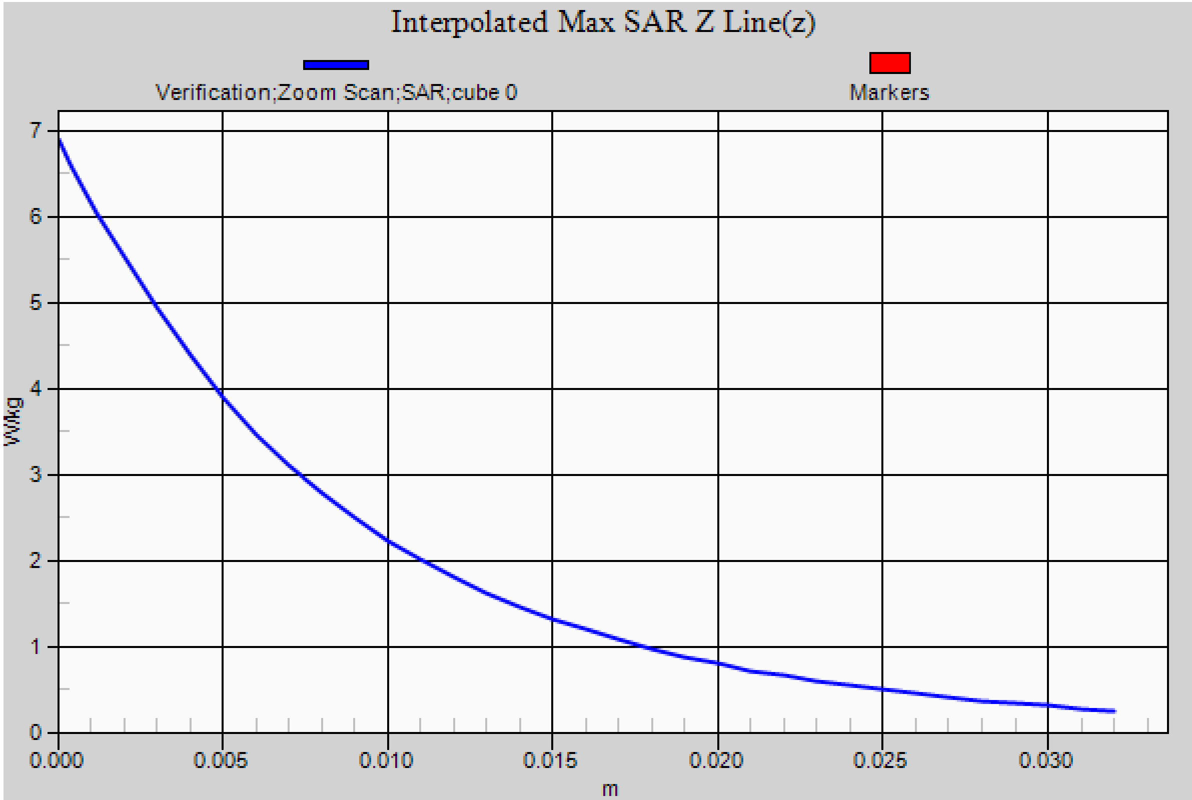
Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN7531; ConvF(8.57, 8.57, 8.57); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1750 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.38 W/kg

1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.639 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.87 W/kg
P_{in}= 100 mW
SAR(1 g) = 3.78 W/kg; SAR(10 g) = 1.97 W/kg
Maximum value of SAR (measured) = 5.47 W/kg




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

RF Exposure Lab

Plot 5

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN: 5d147

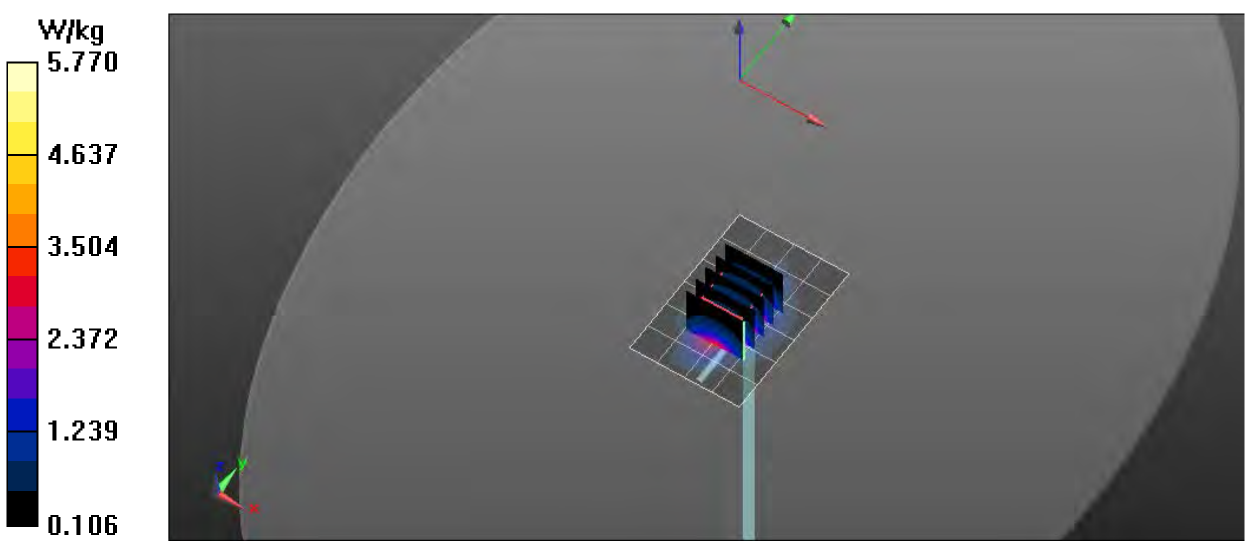
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1950; Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ε_r = 39.87; ρ = 1000 kg/m^3
Phantom section: Flat Section

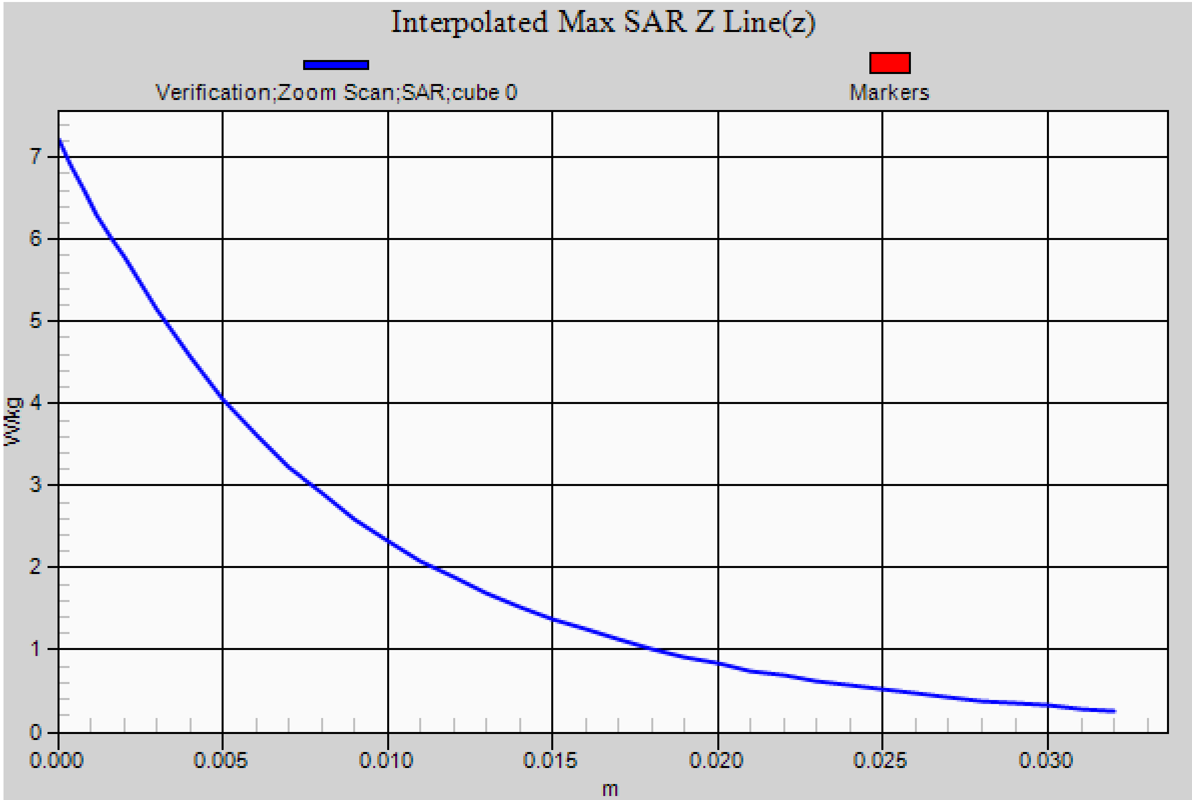
Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 - SN7531; ConvF(8.05, 8.05, 8.05); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

1900 MHz/Verification/Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.52 W/kg

1900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.186 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 7.25 W/kg
P_{in}= 100 mW
SAR(1 g) = 4.15 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 5.79 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 6

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 881

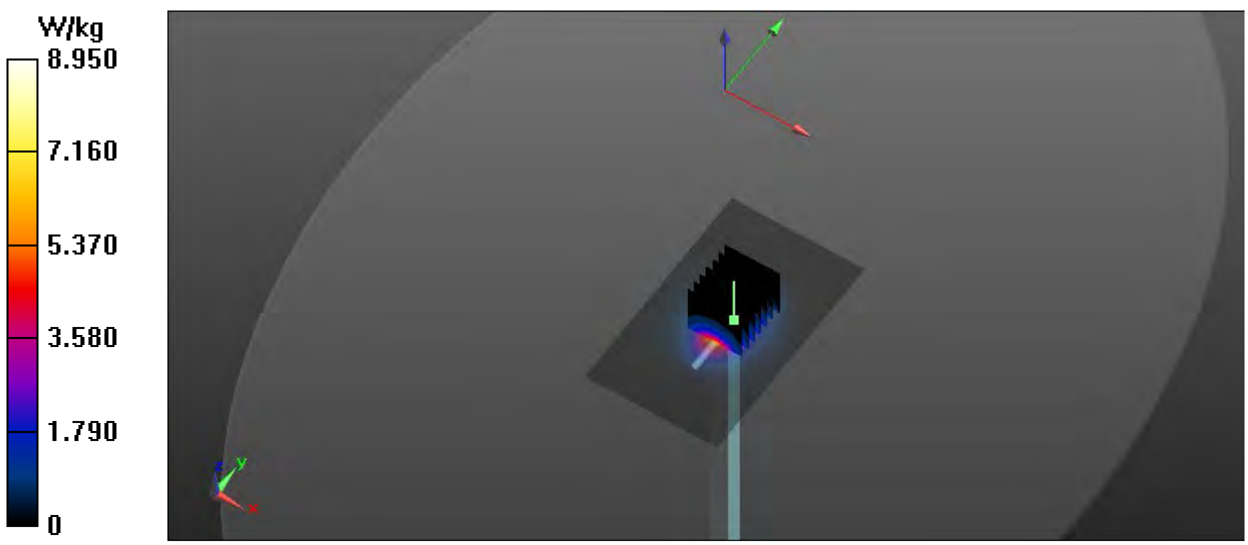
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 38.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

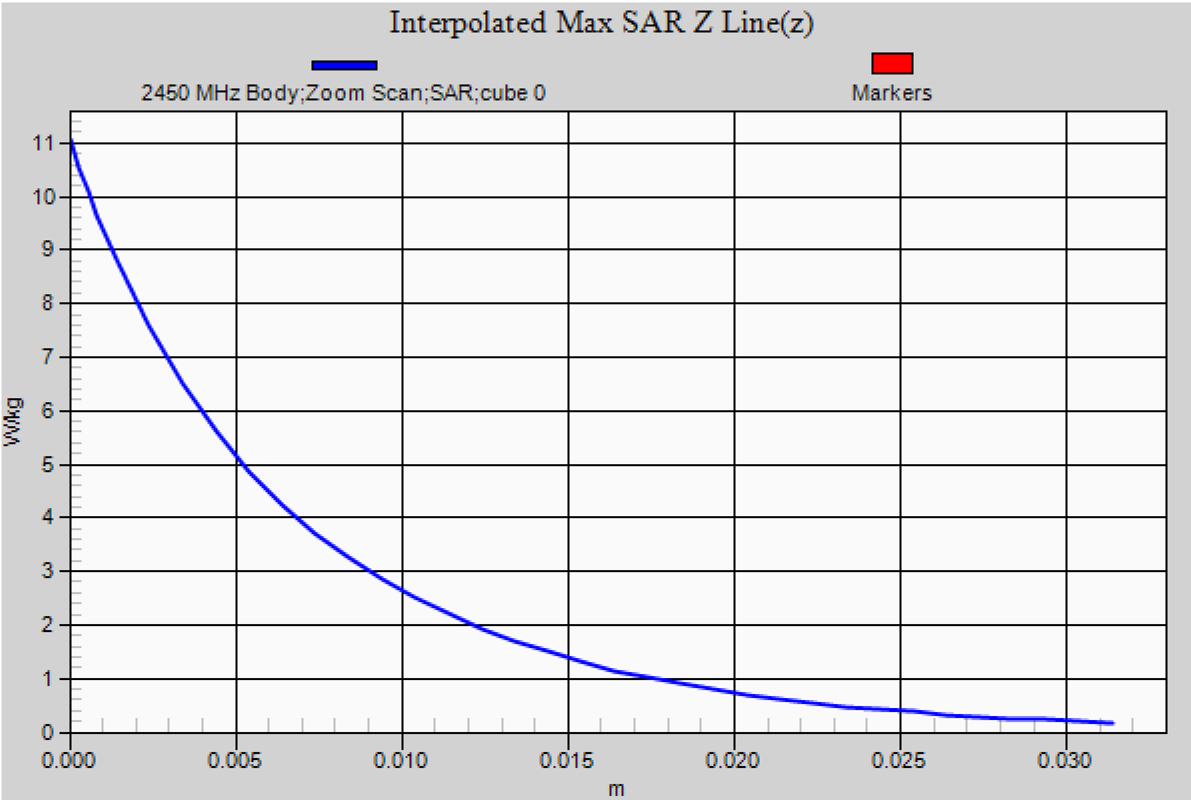
Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7531; ConvF(7.57, 7.57, 7.57); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Head Verification/2450 MHz/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.22 W/kg

Head Verification/2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.025 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 11.05 W/kg
P_{in}= 100 mW
SAR(1 g) = 5.46 W/kg; SAR(10 g) = 2.52 W/kg
Maximum value of SAR (measured) = 8.96 W/kg




Interpolated Max SAR Z Line(z)
2450 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
11
10
9
8
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 7

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used (interpolated): f = 5250 MHz; σ = 4.725 S/m; ε_r = 34.765; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7531; ConvF(5.19, 5.19, 5.19); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

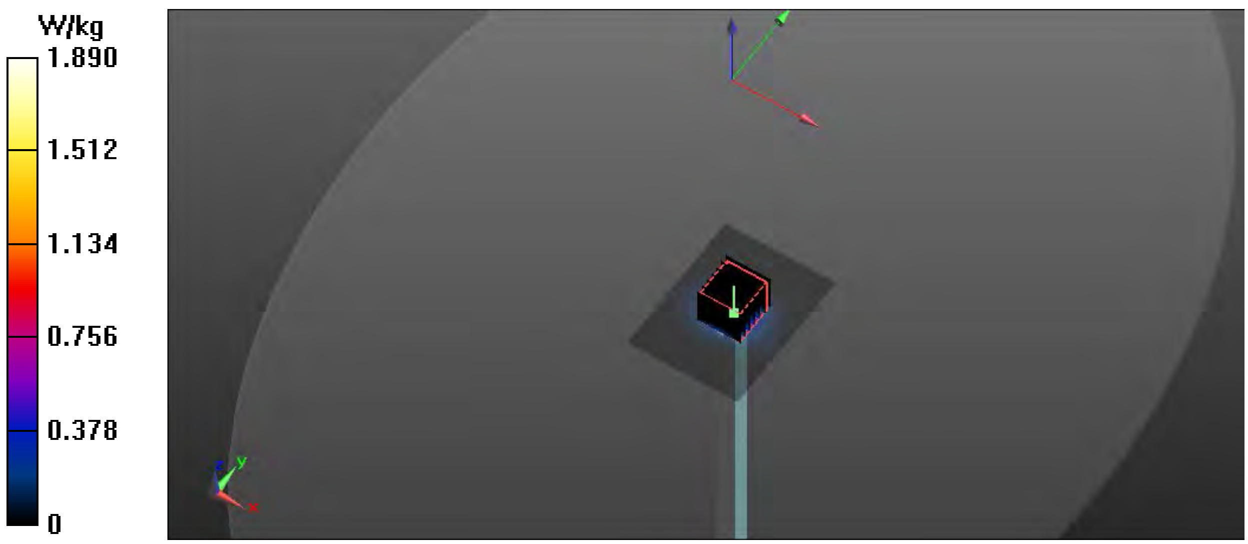
Procedure Notes:

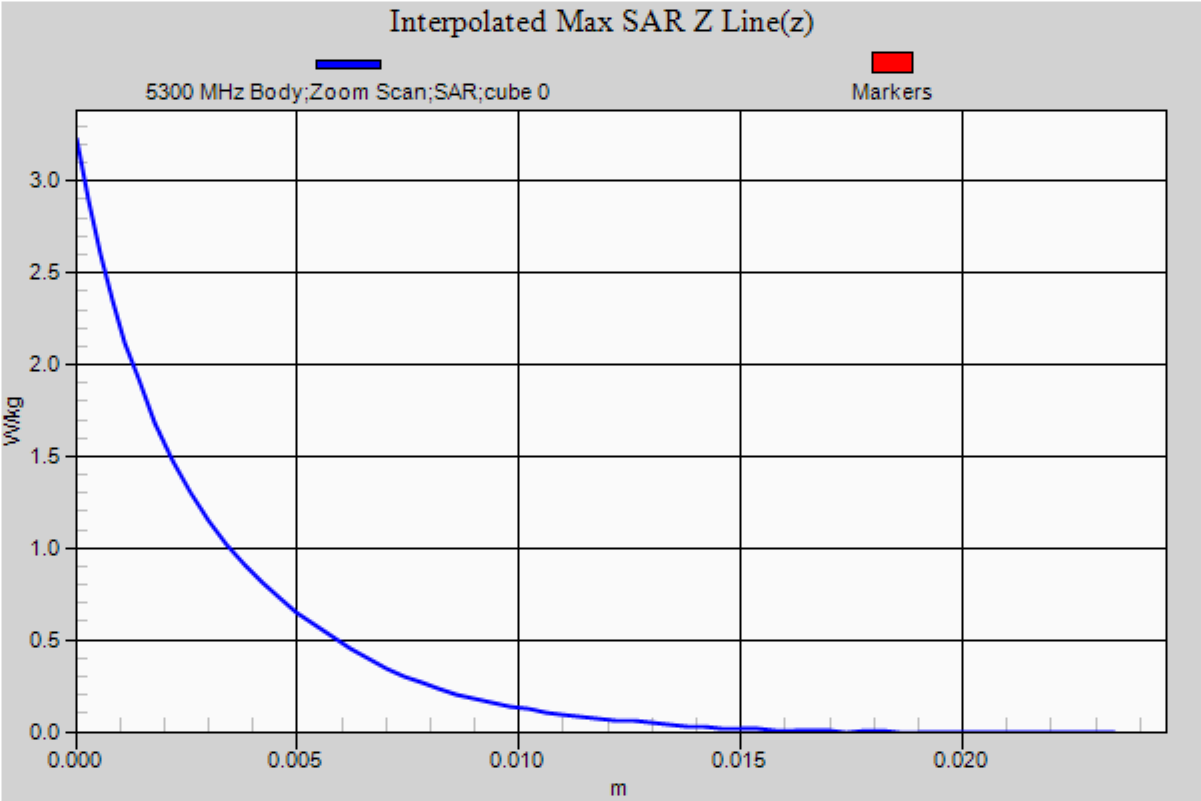
Head Verification/5250 MHz/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.47 W/kg

Head Verification/5250 MHz/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 15.267 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.22 W/kg
Pin=10 mW
SAR(1 g) = 0.803 W/kg; SAR(10 g) = 0.226 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.88 W/kg




Interpolated Max SAR Z Line(z)
5300 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.000
0.005
0.010
0.015
0.020
m

RF Exposure Lab

Plot 8

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

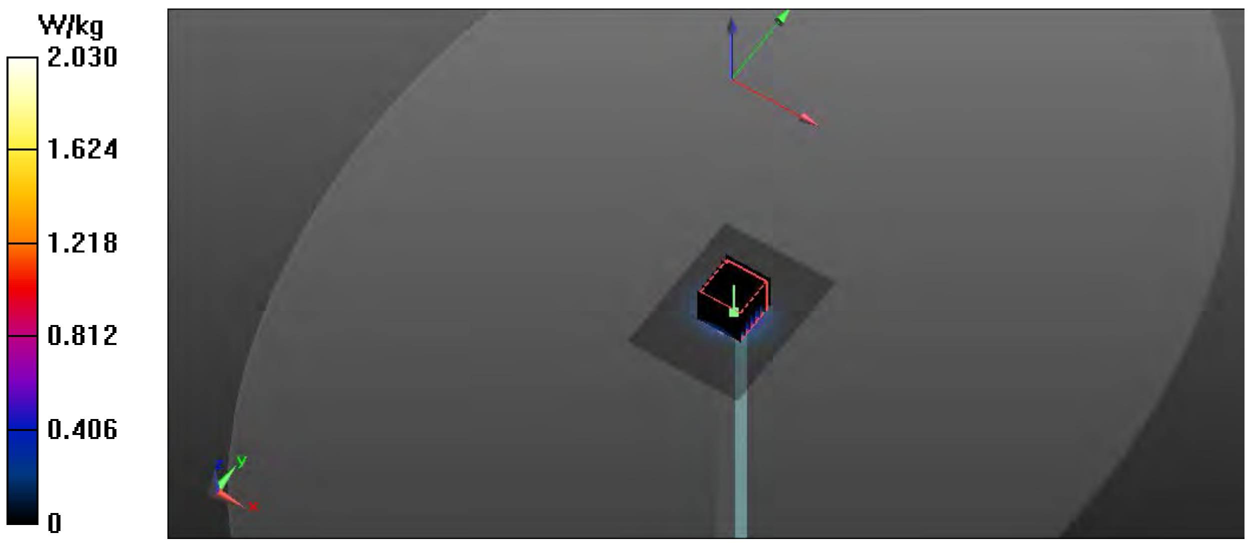
Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used: f = 5600 MHz; σ = 5.11 S/m; ε_r = 34.35; ρ = 1000 kg/m^3
Phantom section: Flat Section

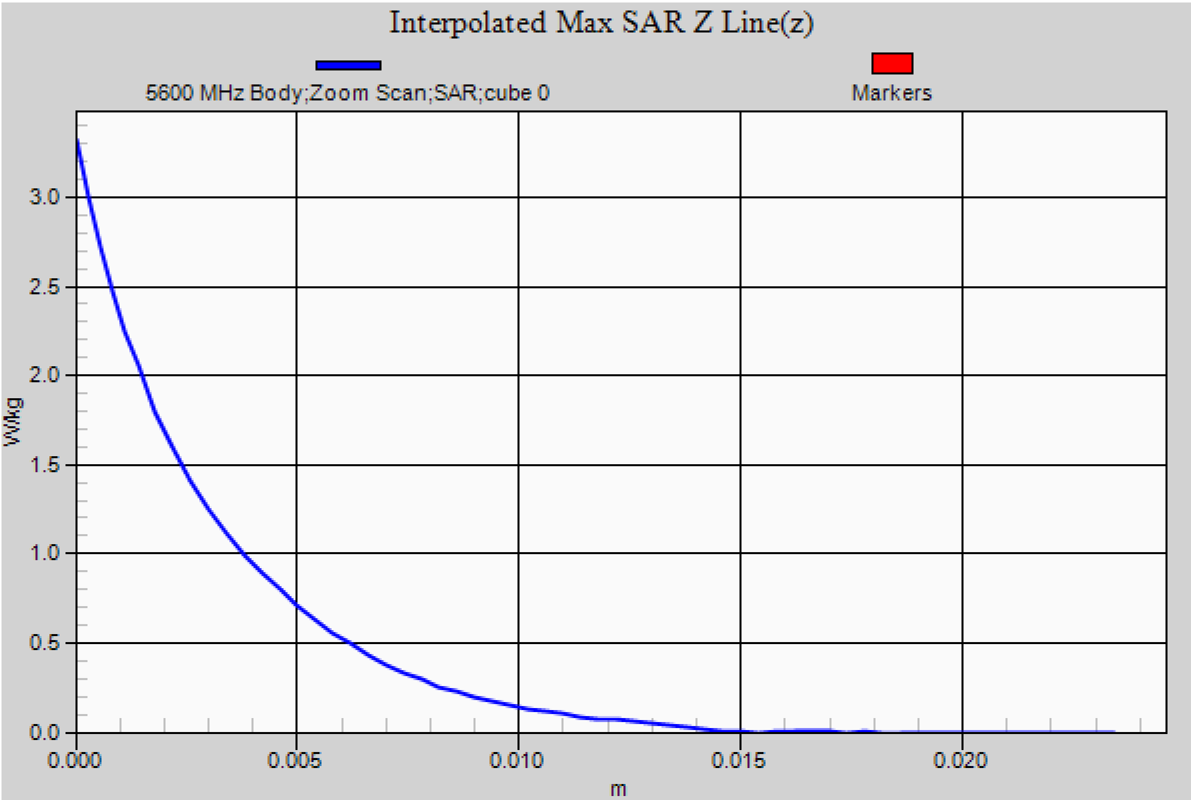
Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7531; ConvF(4.65, 4.65, 4.65); Calibrated: 4/16/2021;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Head Verification/5600 MHz/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.72 W/kg

Head Verification/5600 MHz/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 15.398 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.59 W/kg
Pin=10 mW
SAR(1 g) = 0.835 W/kg; SAR(10 g) = 0.241 W/kg
Maximum value of SAR (measured) = 2.01 W/kg




Interpolated Max SAR Z Line(z)
5600 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.000
0.005
0.010
0.015
0.020
m

RF Exposure Lab

Plot 9

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1119

Communication System: CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used (interpolated): f = 5750 MHz; σ = 5.28 S/m; ε_r = 34.18; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7531; ConvF(4.75, 4.75, 4.75); Calibrated: 4/16/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

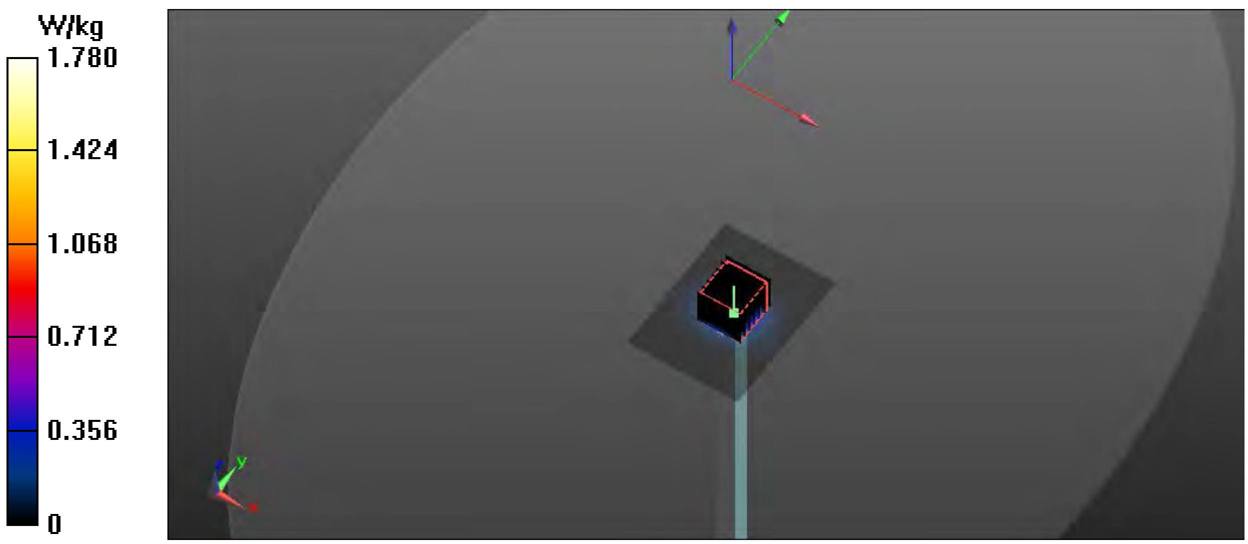
Procedure Notes:

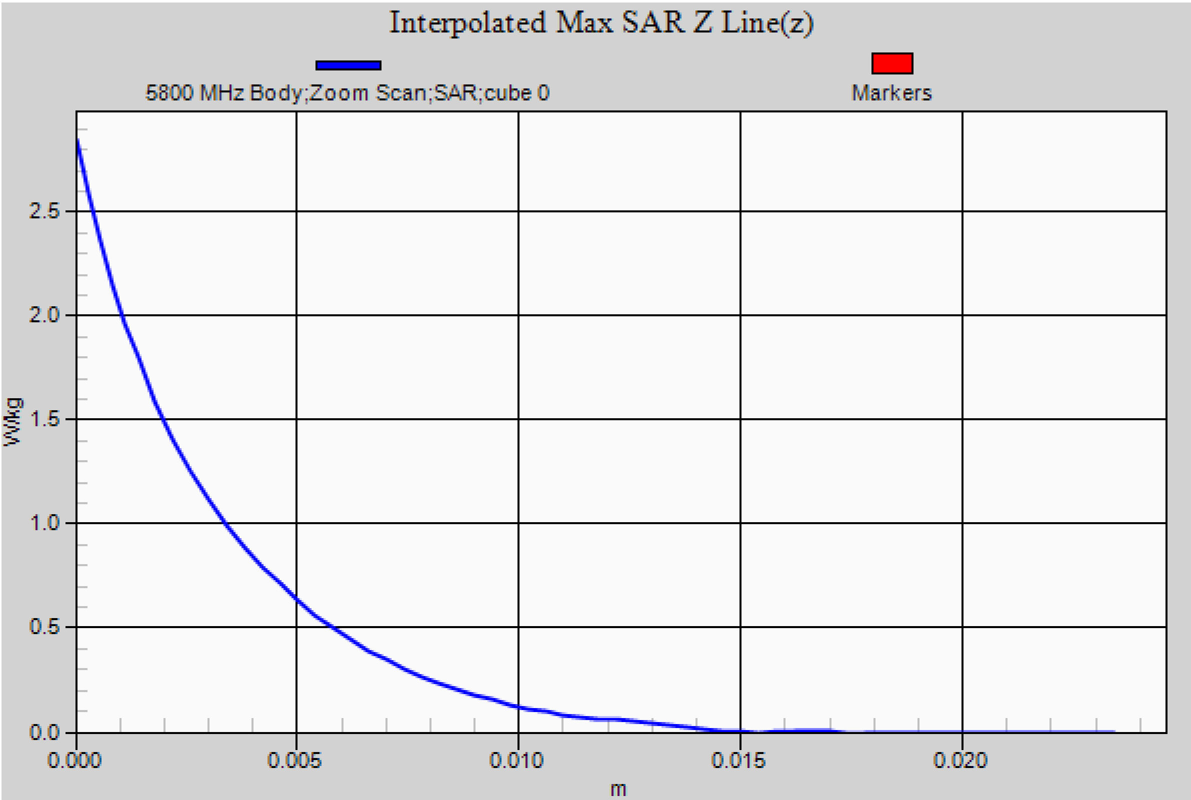
Head Verification/5750 MHz/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.61 W/kg

Head Verification/5750 MHz/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 14.521 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.34 W/kg
Pin=10 mW
SAR(1 g) = 0.805 W/kg; SAR(10 g) = 0.233 W/kg

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




Interpolated Max SAR Z Line(z)
5800 MHz Body;Zoom Scan;SAR;cube 0
Markers
W/kg
2.5
2.0
1.5
1.0
0.5
0.0
0.000
0.005
0.010
0.015
0.020
m

Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: HSL600; Medium parameters used (interpolated): f = 680.5 MHz; σ = 0.941 S/m; ε_r = 41.637; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/24/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.49, 10.49, 10.49); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

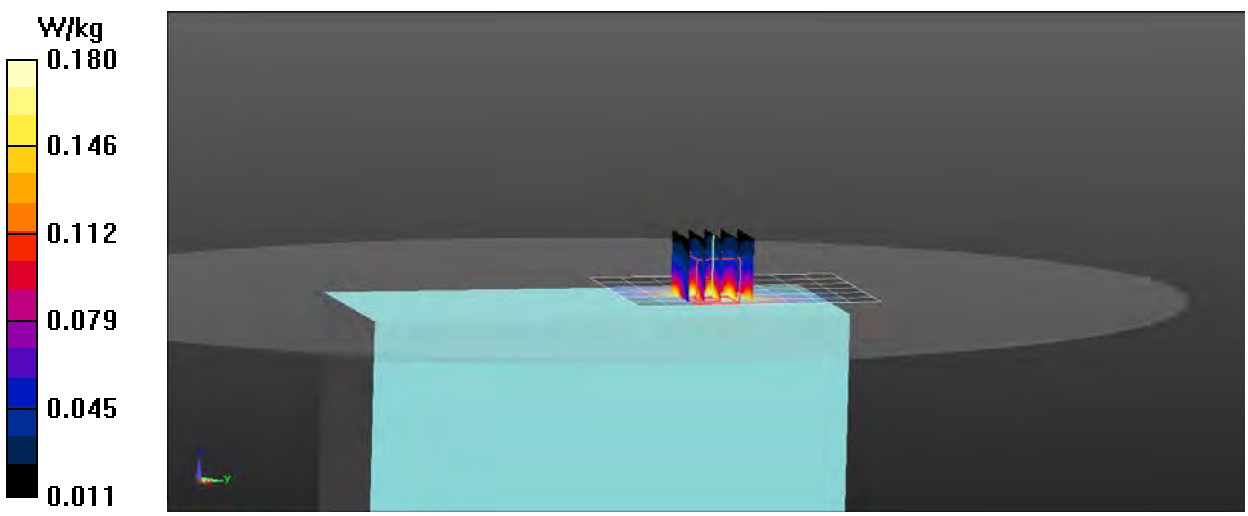
Procedure Notes:

Band 71 LTE/Right 1 RB 49 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.185 W/kg

Band 71 LTE/Right 1 RB 49 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.631 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.216 W/kg
SAR(1 g) = 0.145 W/kg; SAR(10 g) = 0.095 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.180 W/kg



RF Exposure Lab

Plot 2

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.868 S/m; ε_r = 41.708; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.49, 10.49, 10.49); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

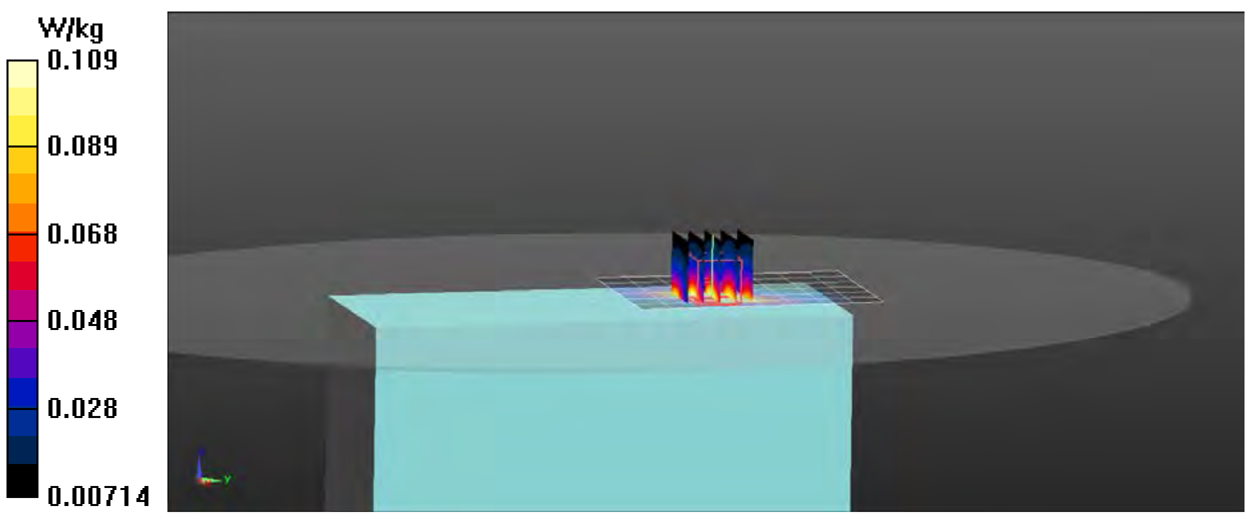
Procedure Notes:

Band 12 LTE/Right 1 RB 24 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.109 W/kg

Band 12 LTE/Right 1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.216 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.131 W/kg
SAR(1 g) = 0.086 W/kg; SAR(10 g) = 0.055 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.109 W/kg



RF Exposure Lab

Plot 3

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 782 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 782 MHz; σ = 0.922 S/m; ε_r = 41.268; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.49, 10.49, 10.49); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

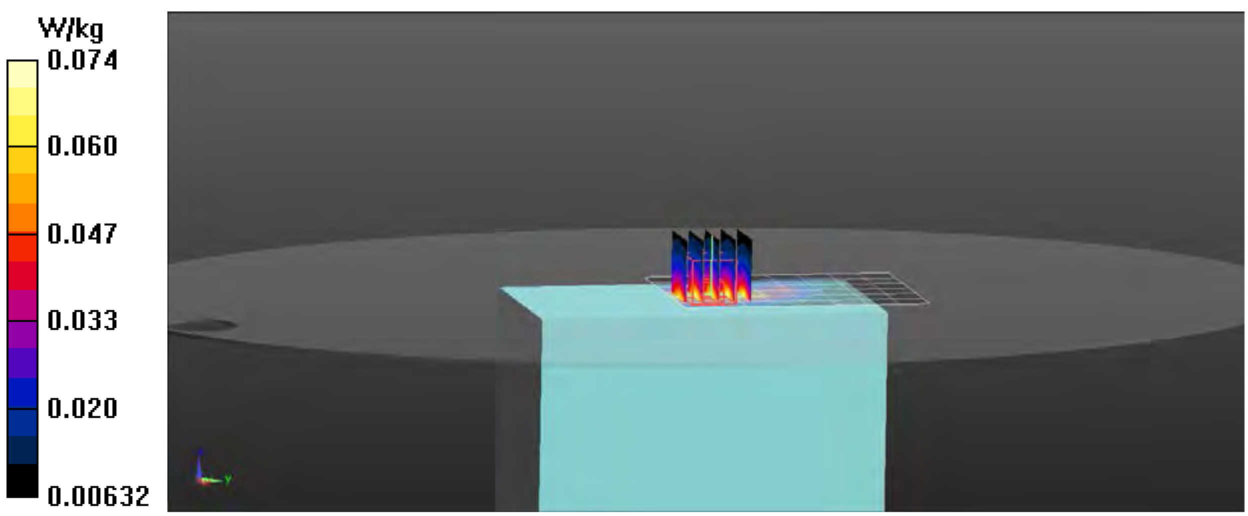
Procedure Notes:

Band 13 LTE/Top 1 RB 24 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0737 W/kg

Band 13 LTE/Top 1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.527 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.0870 W/kg
SAR(1 g) = 0.058 W/kg; SAR(10 g) = 0.039 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0740 W/kg



RF Exposure Lab

Plot 4

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 793 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 793 MHz; σ = 0.93 S/m; ε_r = 41.208; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.49, 10.49, 10.49); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

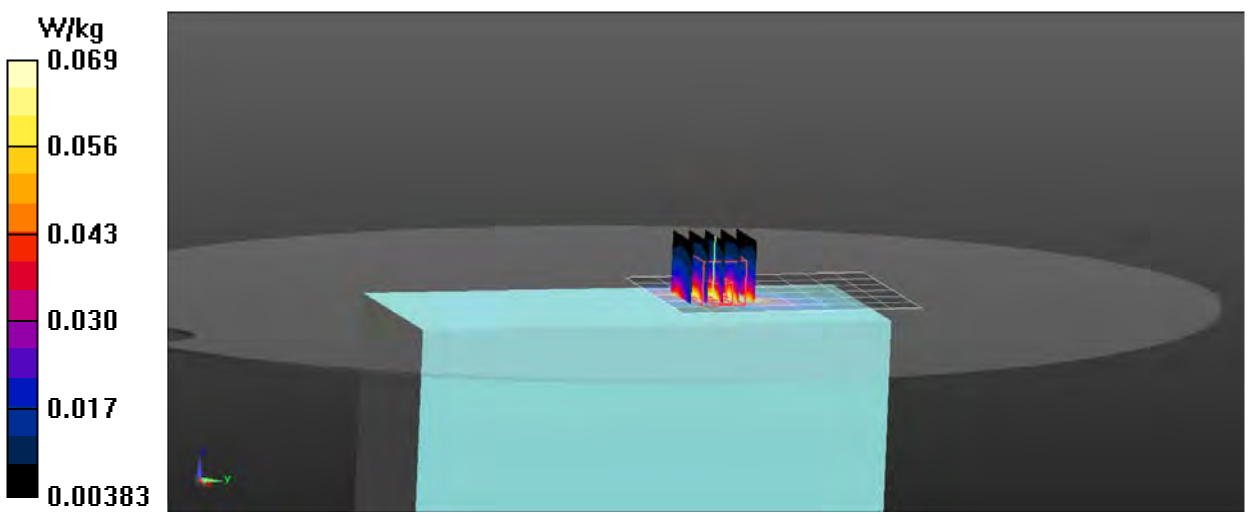
Procedure Notes:

Band 14 LTE/Right 1 RB 24 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0615 W/kg

Band 14 LTE/Right 1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.062 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.0850 W/kg
SAR(1 g) = 0.053 W/kg; SAR(10 g) = 0.032 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0688 W/kg



RF Exposure Lab

Plot 5

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.917 S/m; ε_r = 41.44; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.16, 10.16, 10.16); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

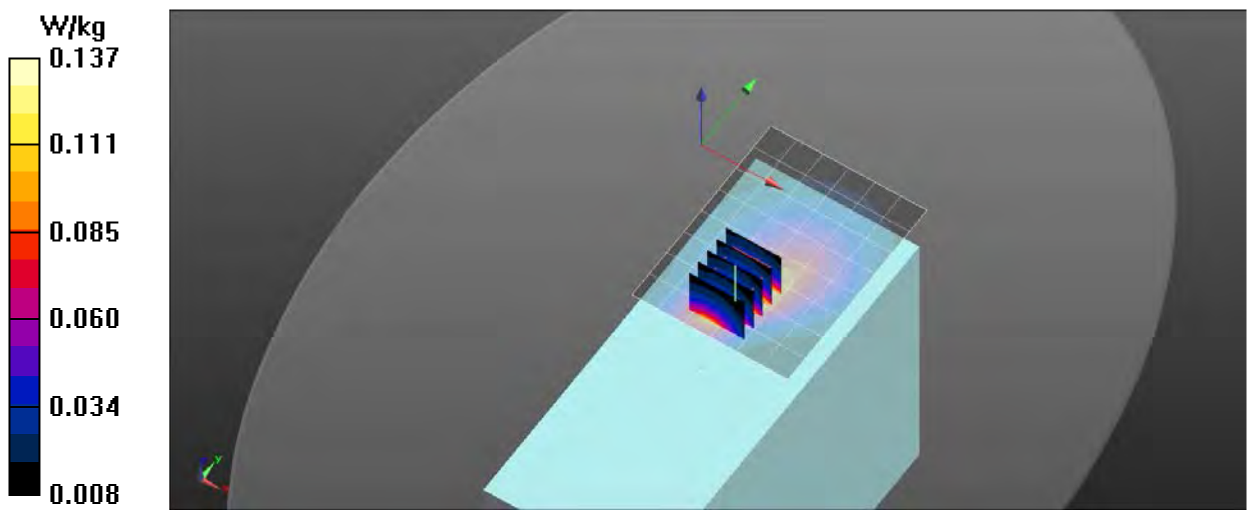
Procedure Notes:

Band 5 UMTS/Right Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.131 W/kg

Band 5 UMTS/Right Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.084 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.161 W/kg
SAR(1 g) = 0.106 W/kg; SAR(10 g) = 0.067 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.137 W/kg



RF Exposure Lab

Plot 6

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: HSL835; Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.917 S/m; ε_r = 41.441; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/23/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(10.16, 10.16, 10.16); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

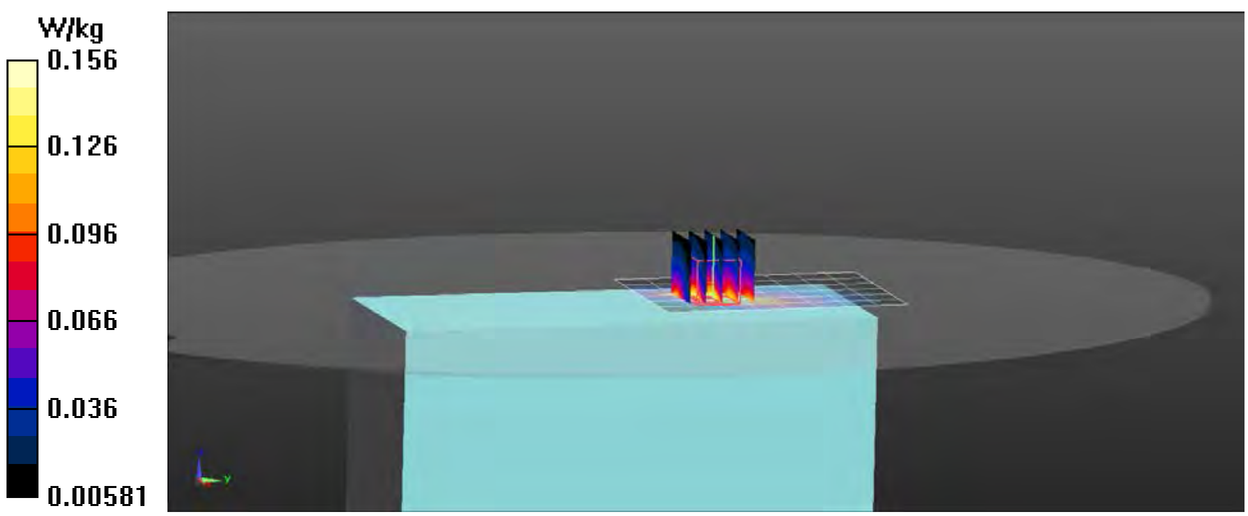
Procedure Notes:

Band 5 LTE/Right 1 RB 24 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.134 W/kg

Band 5 LTE/Right 1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.918 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.194 W/kg
SAR(1 g) = 0.120 W/kg; SAR(10 g) = 0.074 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.156 W/kg



RF Exposure Lab

Plot 7

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: UMTS (WCDMA); Frequency: 1732.6 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1732.6 MHz; σ = 1.383 S/m; ε_r = 39.275; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(8.57, 8.57, 8.57); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

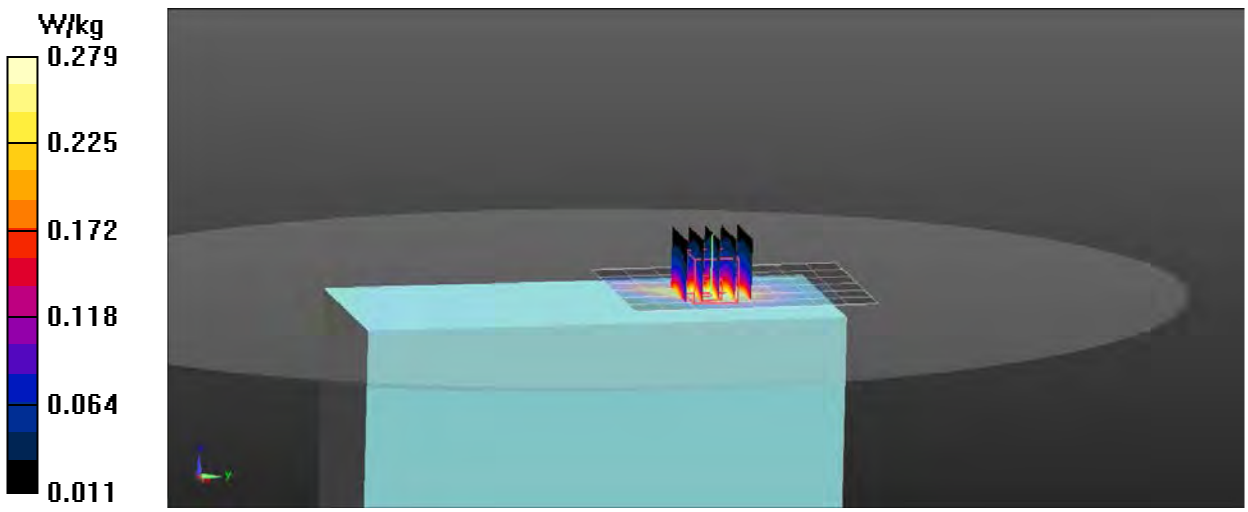
Procedure Notes:

Band 4 WCDMA/Right Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.245 W/kg

Band 4 WCDMA/Right Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.658 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.298 W/kg
SAR(1 g) = 0.205 W/kg; SAR(10 g) = 0.128 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.242 W/kg



RF Exposure Lab

Plot 8

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1745 MHz; σ = 1.395 S/m; ε_r = 39.25; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(8.57, 8.57, 8.57); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

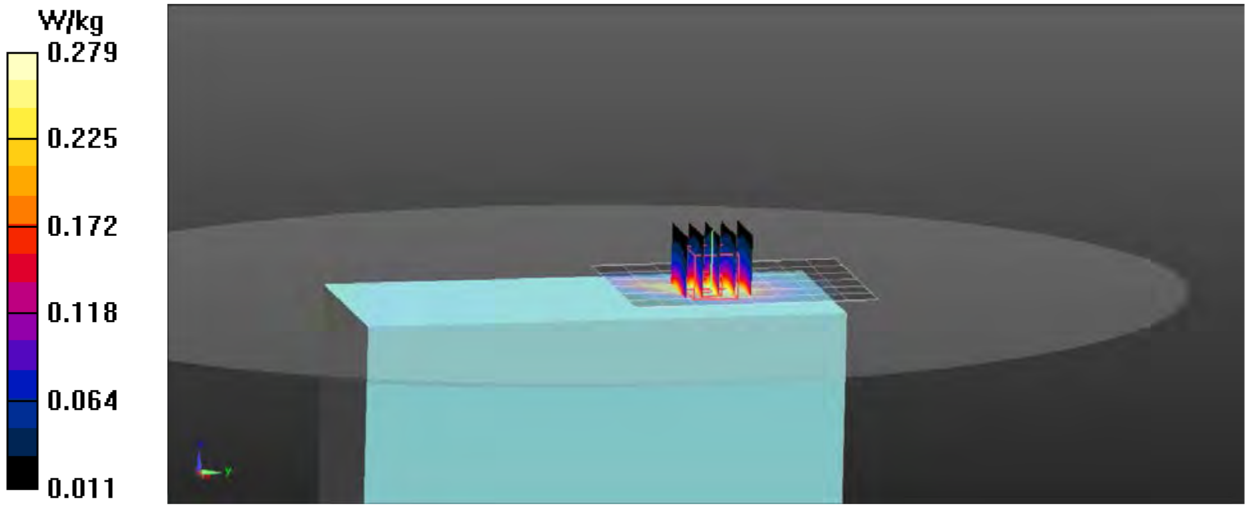
Procedure Notes:

Band 66 LTE/Right 1 RB 49 Offset Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.288 W/kg

Band 66 LTE/Right 1 RB 49 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.259 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.329 W/kg
SAR(1 g) = 0.221 W/kg; SAR(10 g) = 0.139 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.279 W/kg



RF Exposure Lab

Plot 9

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: UMTS (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.39 S/m; ε_r = 39.91; ρ = 1000 kg/m^3
Phantom section: Flat Section

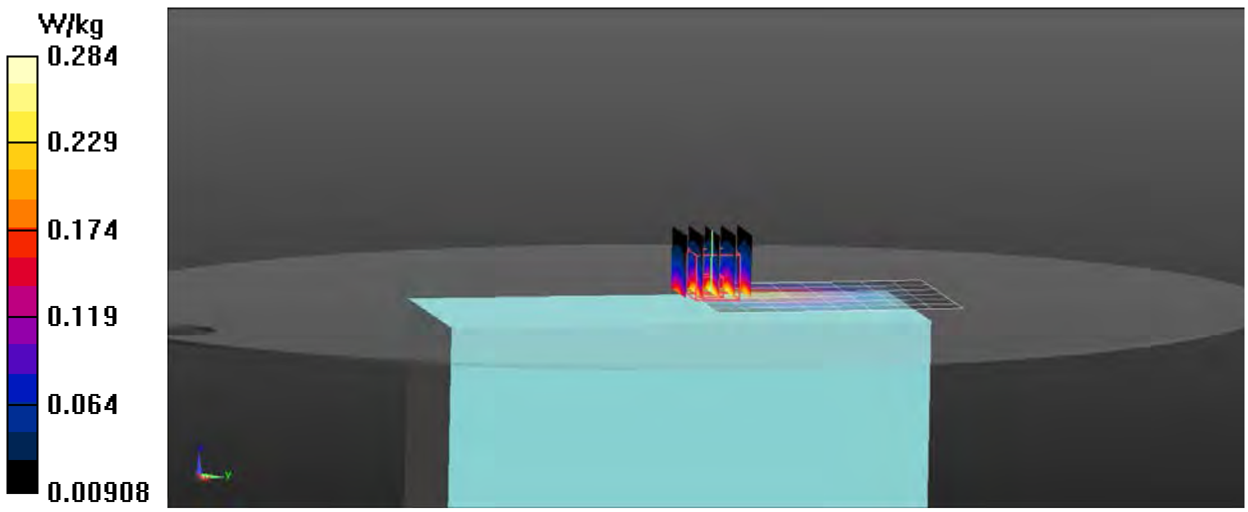
Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(8.05, 8.05, 8.05); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Band 2 UMTS/Right Mid/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.276 W/kg

Band 2 UMTS/Right Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.995 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.344 W/kg
SAR(1 g) = 0.216 W/kg; SAR(10 g) = 0.131 W/kg
Maximum value of SAR (measured) = 0.284 W/kg



RF Exposure Lab

Plot 10

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.39 S/m; ε_r = 39.91; ρ = 1000 kg/m^3
Phantom section: Flat Section

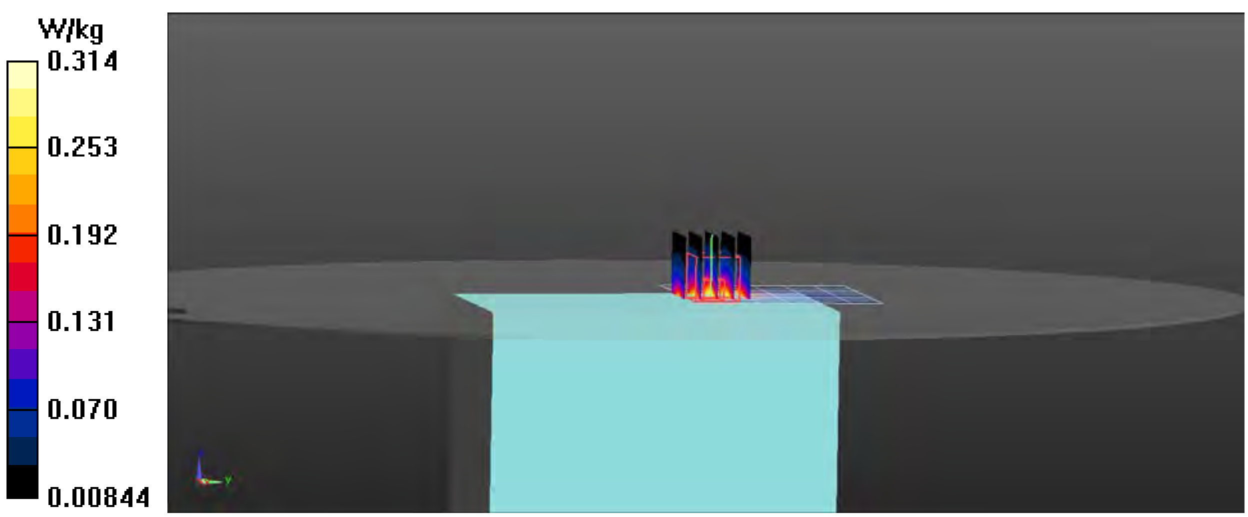
Test Date: Date: 3/22/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(8.05, 8.05, 8.05); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Band 2 LTE/Top 1 RB 49 Offset Mid/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.272 W/kg

Band 2 LTE/Top 1 RB 49 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.204 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.389 W/kg
SAR(1 g) = 0.232 W/kg; SAR(10 g) = 0.136 W/kg
Maximum value of SAR (measured) = 0.314 W/kg



RF Exposure Lab

Plot 11

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: WiFi 802.11b (DSSS, 1 Mbps); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.794 S/m; ε_r = 38.393; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(7.57, 7.57, 7.57); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

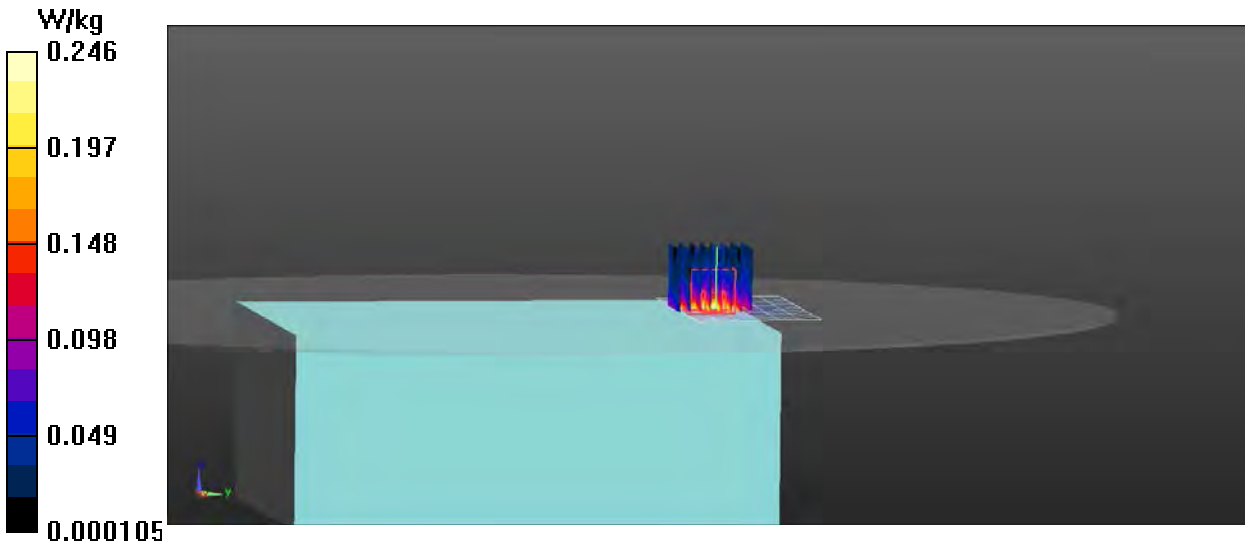
Procedure Notes:

2450 MHz/Front Mid/Area Scan (13x7x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.196 W/kg

2450 MHz/Front Mid/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.385 W/kg
SAR(1 g) = 0.227 W/kg; SAR(10 g) = 0.119 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.245 W/kg



RF Exposure Lab

Plot 12

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: WiFi 802.11a (OFDM, 6 Mbps); Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 5300 MHz; σ = 4.78 S/m; ε_r = 34.69; ρ = 1000 kg/m^3
Phantom section: Flat Section

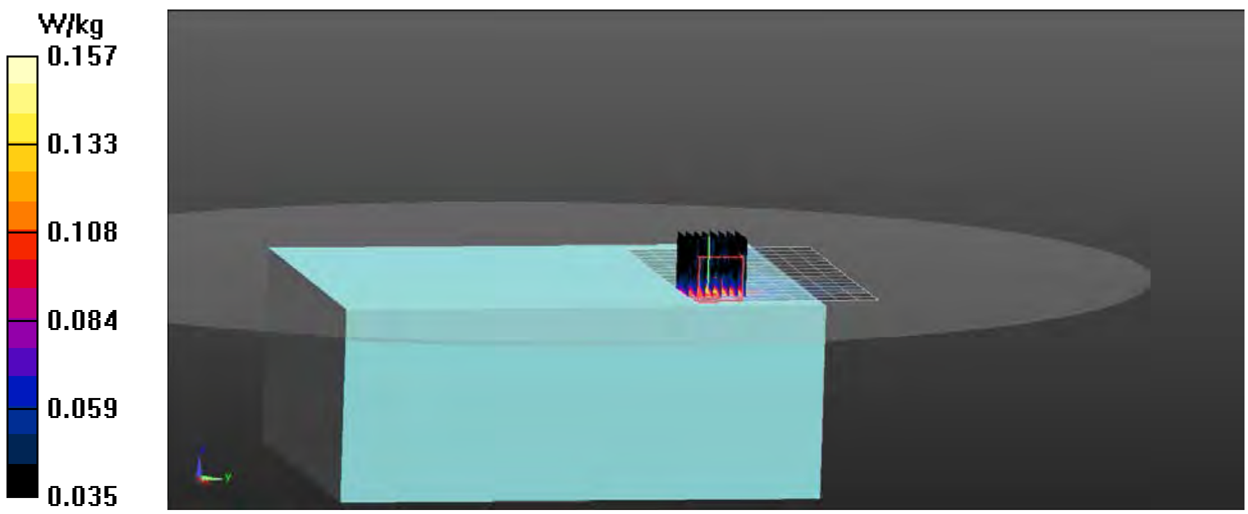
Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(5.19, 5.19, 5.19); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

5300 MHz/Front 60/Area Scan (16x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.141 W/kg

5300 MHz/Front 60/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.178 W/kg
SAR(1 g) = 0.116 W/kg; SAR(10 g) = 0.095 W/kg
Maximum value of SAR (measured) = 0.148 W/kg



RF Exposure Lab

Plot 13

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: WiFi 802.11a (OFDM, 6 Mbps); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 5600 MHz; σ = 5.11 S/m; ε_r = 34.35; ρ = 1000 kg/m^3
Phantom section: Flat Section

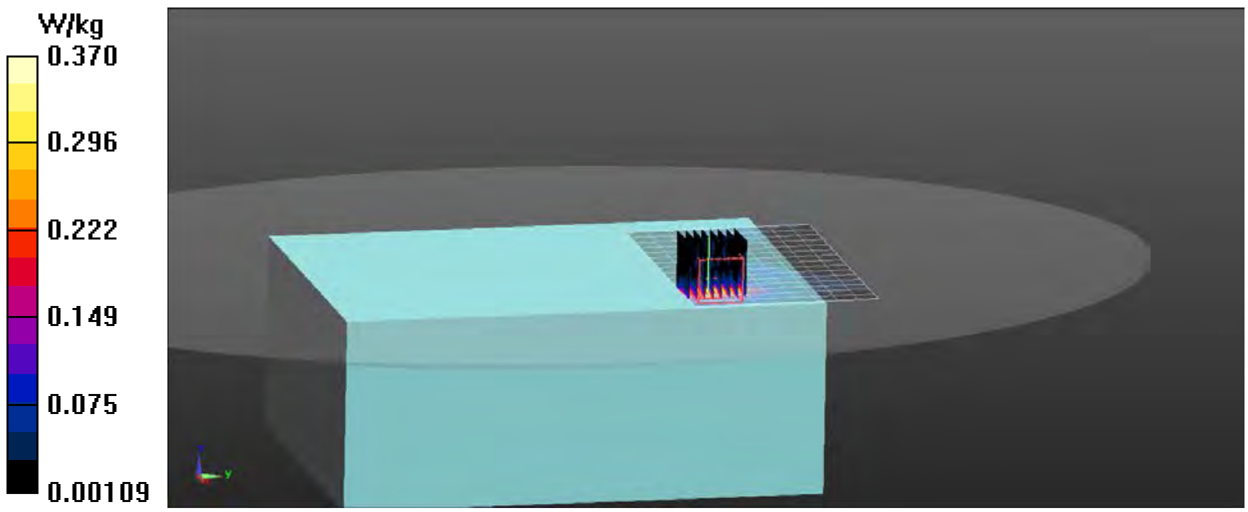
Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN7531; ConvF(4.65, 4.65, 4.65); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

5600 MHz/Front 120/Area Scan (16x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.184 W/kg

5600 MHz/Front 120/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.172 W/kg
SAR(1 g) = 0.124 W/kg; SAR(10 g) = 0.095 W/kg
Maximum value of SAR (measured) = 0.157 W/kg



RF Exposure Lab

Plot 14

DUT: Validator 3; Type: Wireless Payment Station; Serial: Eng 1

Communication System: WiFi 802.11a (OFDM, 6 Mbps); Frequency: 5785 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 5785 MHz; σ = 5.315 S/m; ε_r = 34.14; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 3/21/2022; Ambient Temp: 23 °C; Tissue Temp: 21 °C

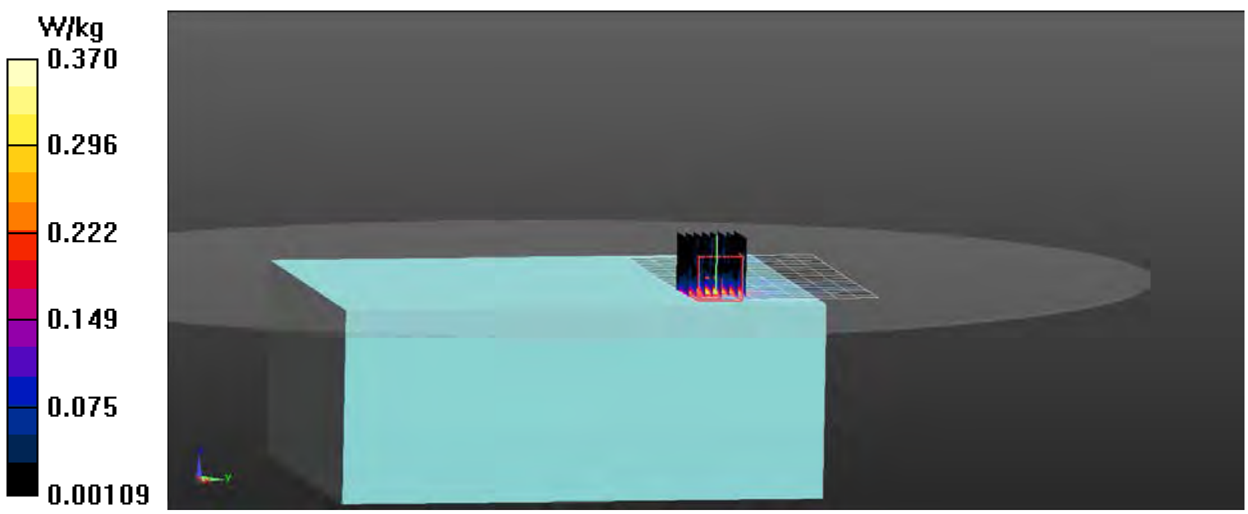
Probe: EX3DV4 - SN7531; ConvF(4.75, 4.75, 4.75); Calibrated: 4/16/2021
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/22/2021
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

5750 MHz/Front 157/Area Scan (16x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.159 W/kg

5750 MHz/Front 157/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.339 W/kg
SAR(1 g) = 0.149 W/kg; SAR(10 g) = 0.111 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.177 W/kg



Appendix C – SAR Test Setup Photos

Test Position Front 0 mm Gap

Test Position Right 0 mm Gap

Test Position Top 0 mm Gap

Front of Device

Back of Device

Appendix D – Probe Calibration Data Sheets

Gm

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 0108

Client **RF Exposure Lab**

Certificate No: EX3-7531_Apr21

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7531

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: April 16, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	09-Apr-21 (No. 217-03343)	Apr-22
DAE4	SN: 660	23-Dec-20 (No. DAE4-660_Dec20)	Dec-21
Reference Probe ES3DV2	SN: 3013	30-Dec-20 (No. ES3-3013_Dec20)	Dec-21
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

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

Issued: April 20, 2021

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7531

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.39	0.47	0.40	± 10.1 %
DCP (mV)[B]	100.2	101.2	98.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	195.5	±3.3 %
		Y	0.0	0.0	1.0		189.5	
		Z	0.0	0.0	1.0		192.0	

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

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see 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:7531

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-173.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3-4 mm for an *Area Scan* job.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7531

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
150	52.3	0.76	12.89	12.89	12.89	0.00	1.00	± 13.3 %
220	49.0	0.81	12.66	12.66	12.66	0.00	1.00	± 13.3 %
300	45.3	0.87	12.09	12.09	12.09	0.10	1.30	± 13.3 %
450	43.5	0.87	11.21	11.21	11.21	0.16	1.30	± 13.3 %
600	42.7	0.88	10.64	10.64	10.64	0.10	1.25	± 13.3 %
750	41.9	0.89	10.49	10.49	10.49	0.63	0.80	± 12.0 %
900	41.5	0.97	10.16	10.16	10.16	0.54	0.80	± 12.0 %
1750	40.1	1.37	8.57	8.57	8.57	0.33	0.86	± 12.0 %
1900	40.0	1.40	8.05	8.05	8.05	0.37	0.86	± 12.0 %
2300	39.5	1.67	7.88	7.88	7.88	0.29	0.90	± 12.0 %
2450	39.2	1.80	7.57	7.57	7.57	0.37	0.90	± 12.0 %
2600	39.0	1.96	7.30	7.30	7.30	0.40	0.90	± 12.0 %
3500	37.9	2.91	6.80	6.80	6.80	0.40	1.35	± 13.1 %
3700	37.7	3.12	6.40	6.40	6.40	0.40	1.35	± 13.1 %
5250	35.9	4.71	5.19	5.19	5.19	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.65	4.65	4.65	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.75	4.75	4.75	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7531

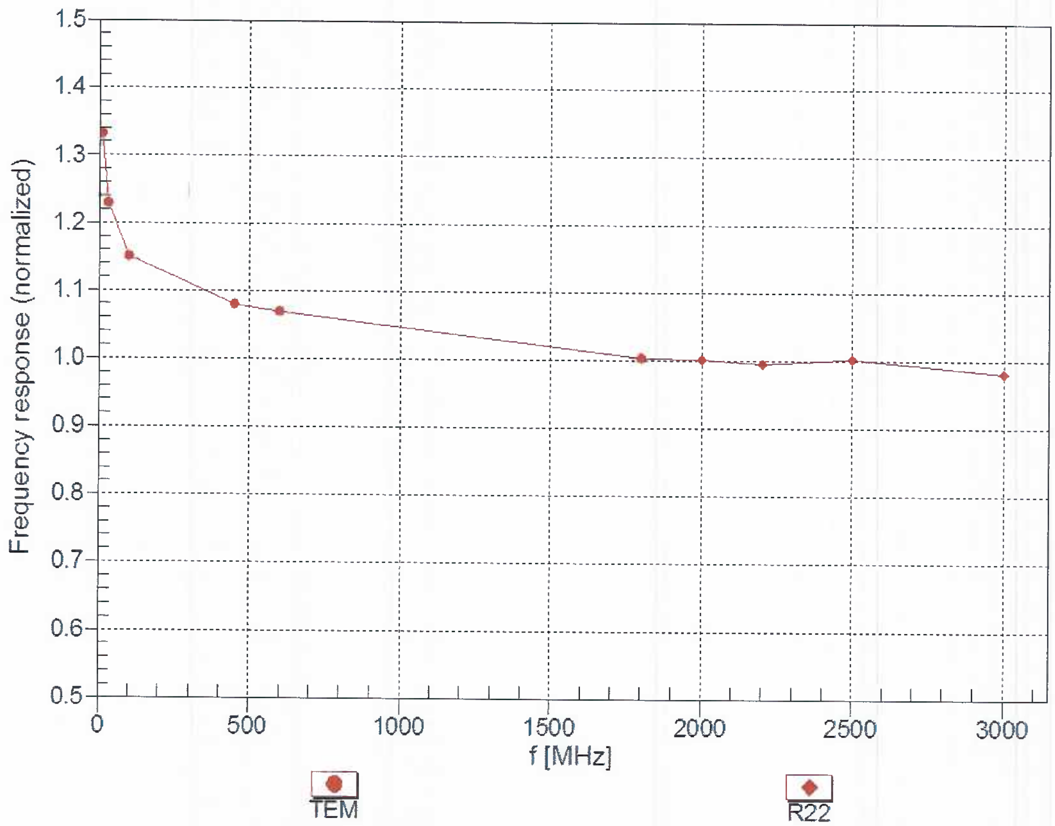
Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
6500	34.5	6.07	5.40	5.40	5.40	0.20	2.50	± 18.6 %

[C] Frequency validity above 6GHz is ± 700 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies 6-10 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz; below ± 2% for frequencies between 3-6 GHz; and below ± 4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

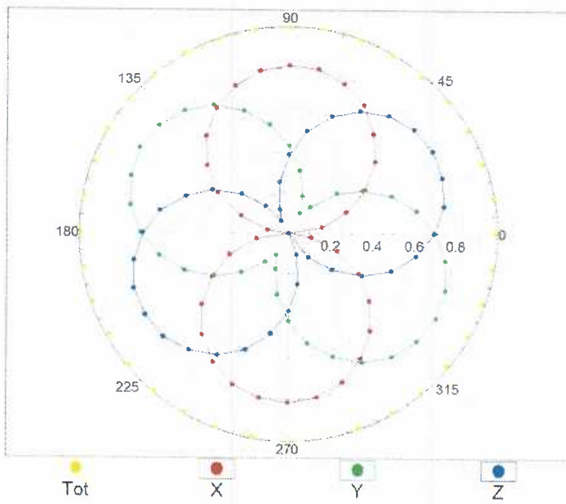
(TEM-Cell:ifi110 EXX, Waveguide: R22)



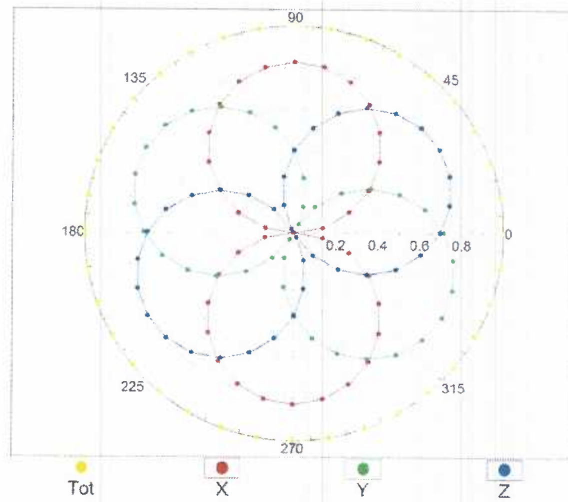
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

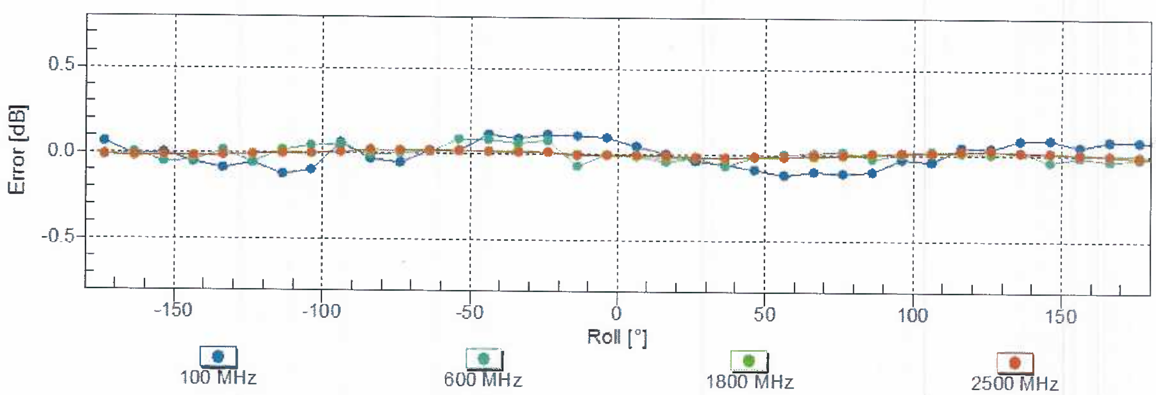
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



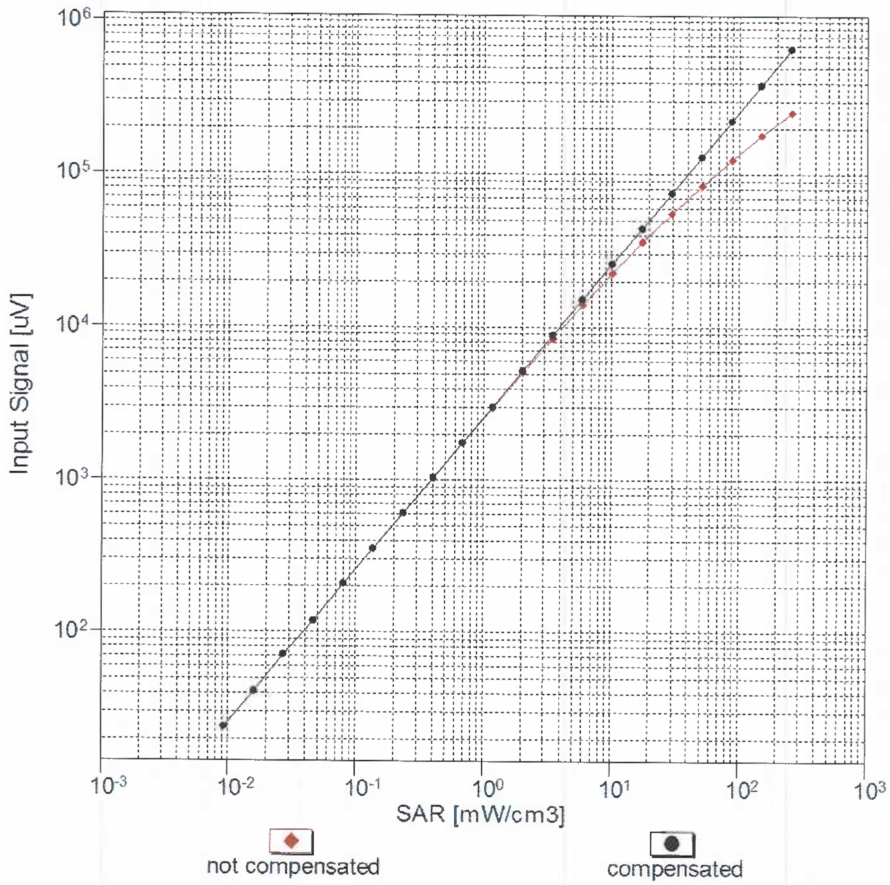
f=1800 MHz,R22

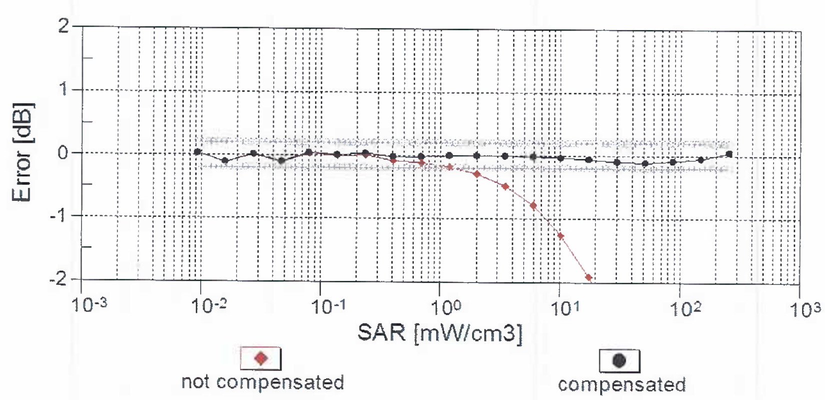




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

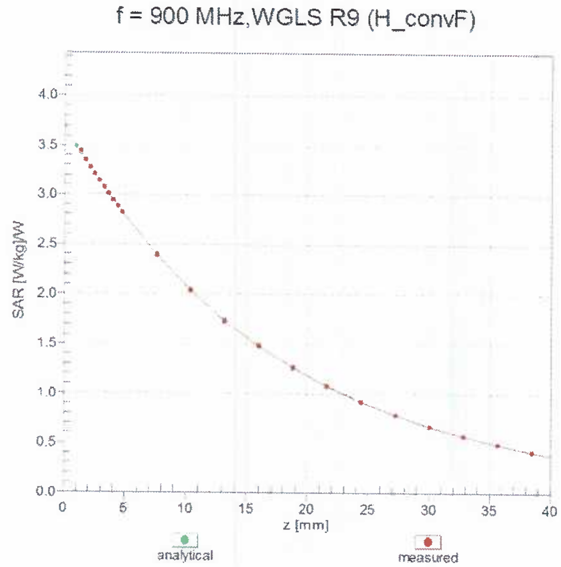
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

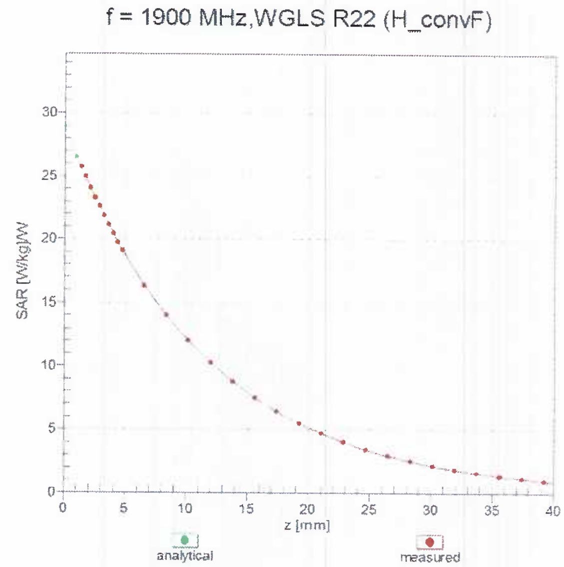




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

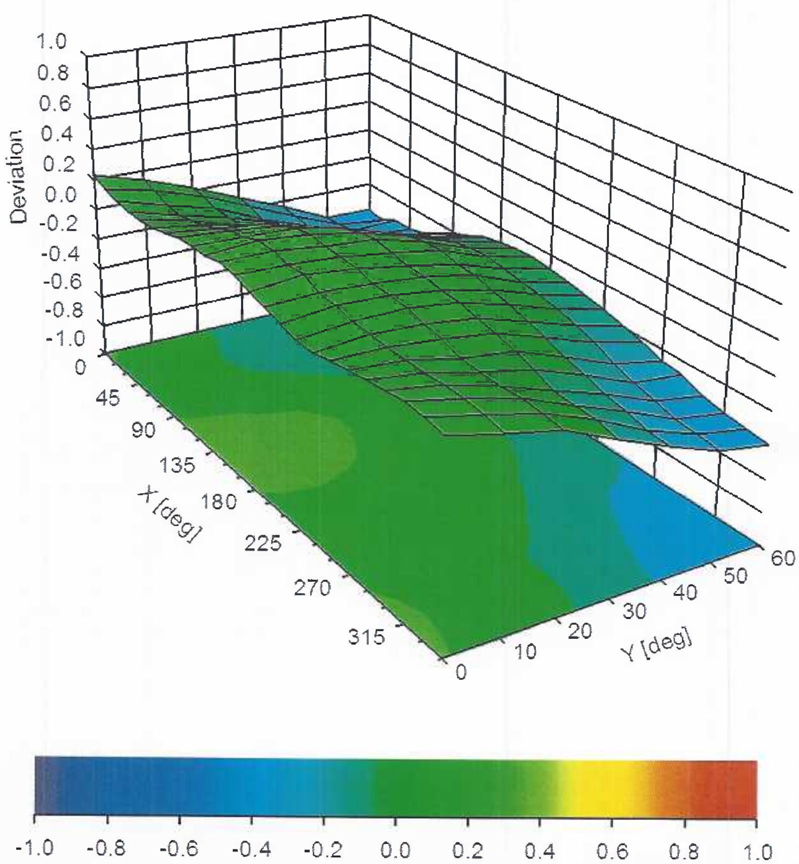
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Appendix E – Dipole Calibration Data Sheets

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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D600V3-1012_Feb22

CALIBRATION CERTIFICATE

Object	D600V3 - SN: 1012
Calibration procedure(s)	QA CAL-15.v9 Calibration Procedure for SAR Validation Sources below 700 MHz
Calibration date:	February 15, 2022

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 3877	31-Dec-21 (No. EX3-3877_Dec21)	Dec-22
DAE4	SN: 654	26-Jan-22 (No. DAE4-654_Jan22)	Jan-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: February 16, 2022

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. 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	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	42.7	0.88 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.5 ± 6 %	0.89 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	1.62 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.42 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**4.25 W/kg ± 17.6 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.9 Ω - 4.1 jΩ
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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

DASY5 Validation Report for Head TSL

Date: 15.02.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 600 MHz; Type: D600V3; Serial: D600V3 - SN: 1012

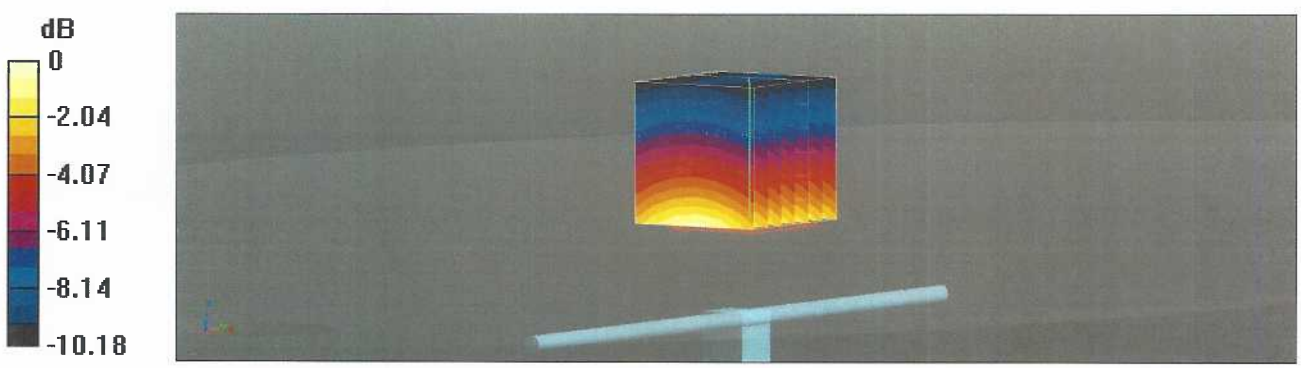
Communication System: UID 0, CW; Frequency: 600 MHz
Medium parameters used: f = 600 MHz; σ = 0.89 S/m; ε_r = 42.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.08, 10.08, 10.08) @ 600 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.01.2022
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

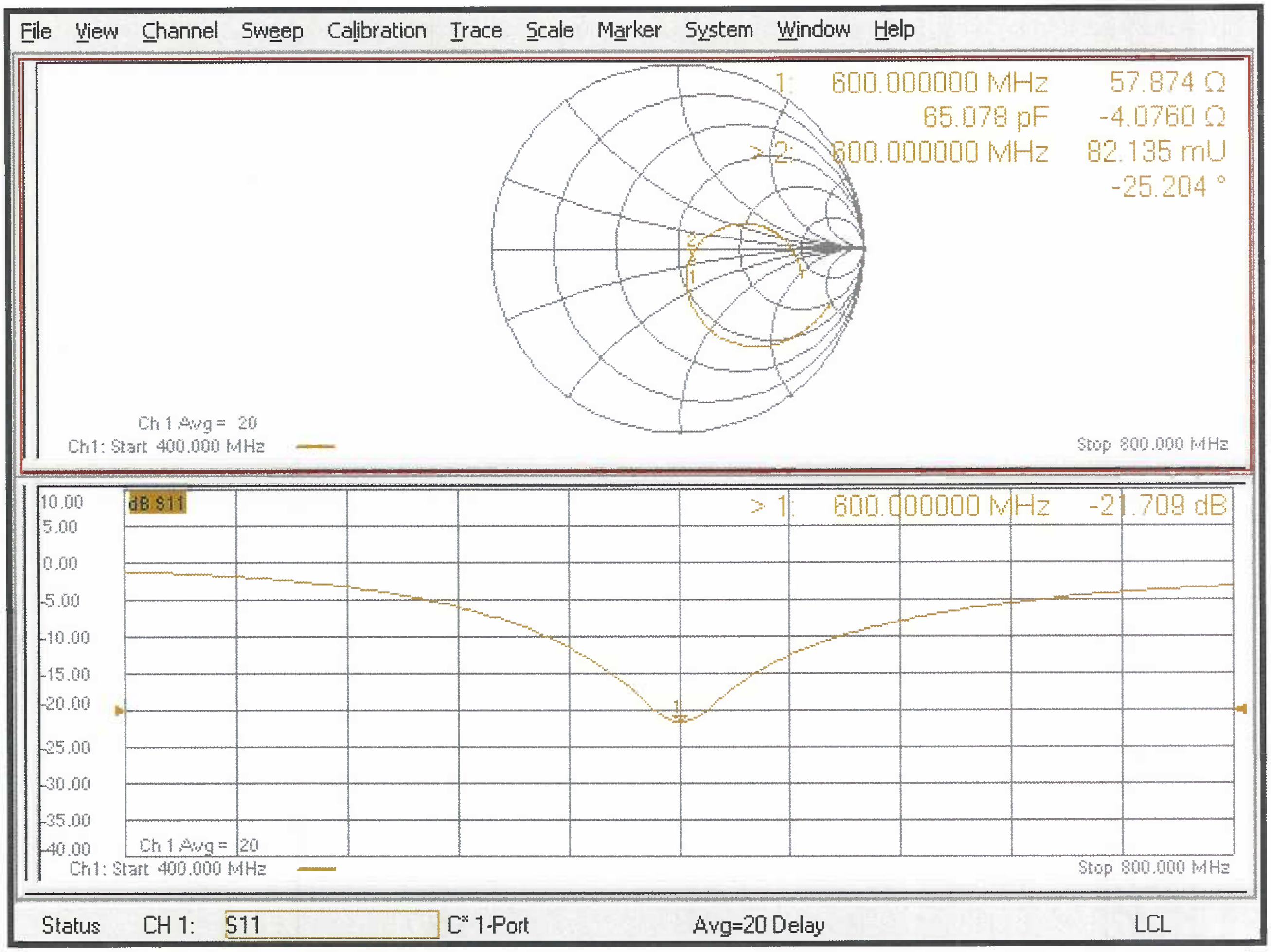
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.27 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 2.54 W/kg
SAR(1 g) = 1.62 W/kg; SAR(10 g) = 1.07 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)
Ratio of SAR at M2 to SAR at M1 = 64%
Maximum value of SAR (measured) = 2.20 W/kg



0 dB = 2.20 W/kg = 3.42 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D750V3-1053_Jun21

CALIBRATION CERTIFICATE

Object: D750V3 - SN:1053

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: June 04, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

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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 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.7 ± 6 %	0.91 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.57 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.58 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.5 Ω + 0.1 jΩ
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 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

DASY5 Validation Report for Head TSL

Date: 04.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

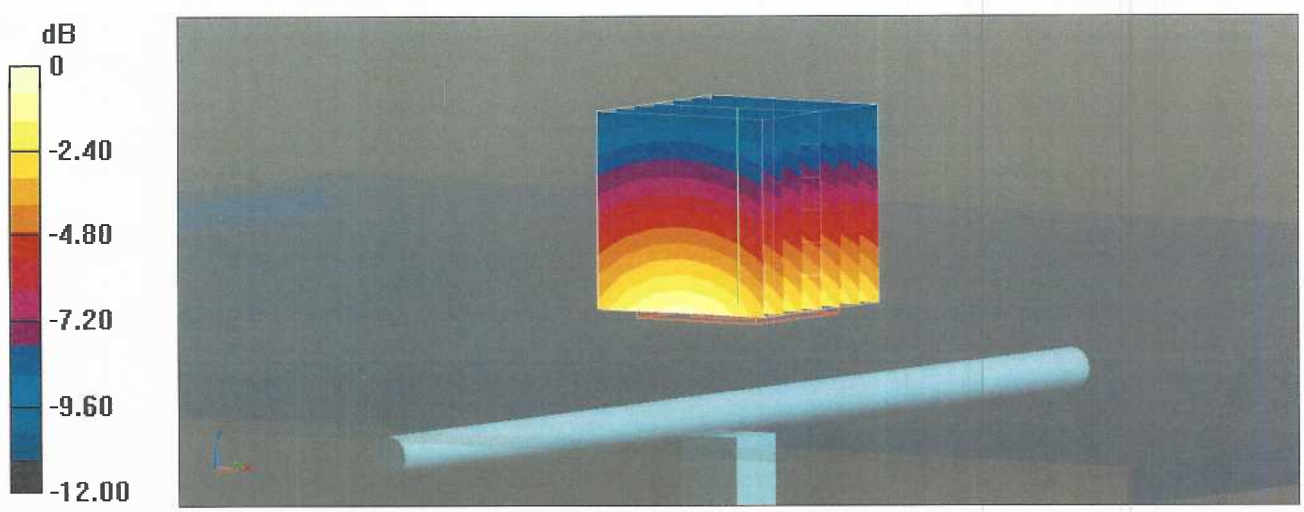
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1053

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 42.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

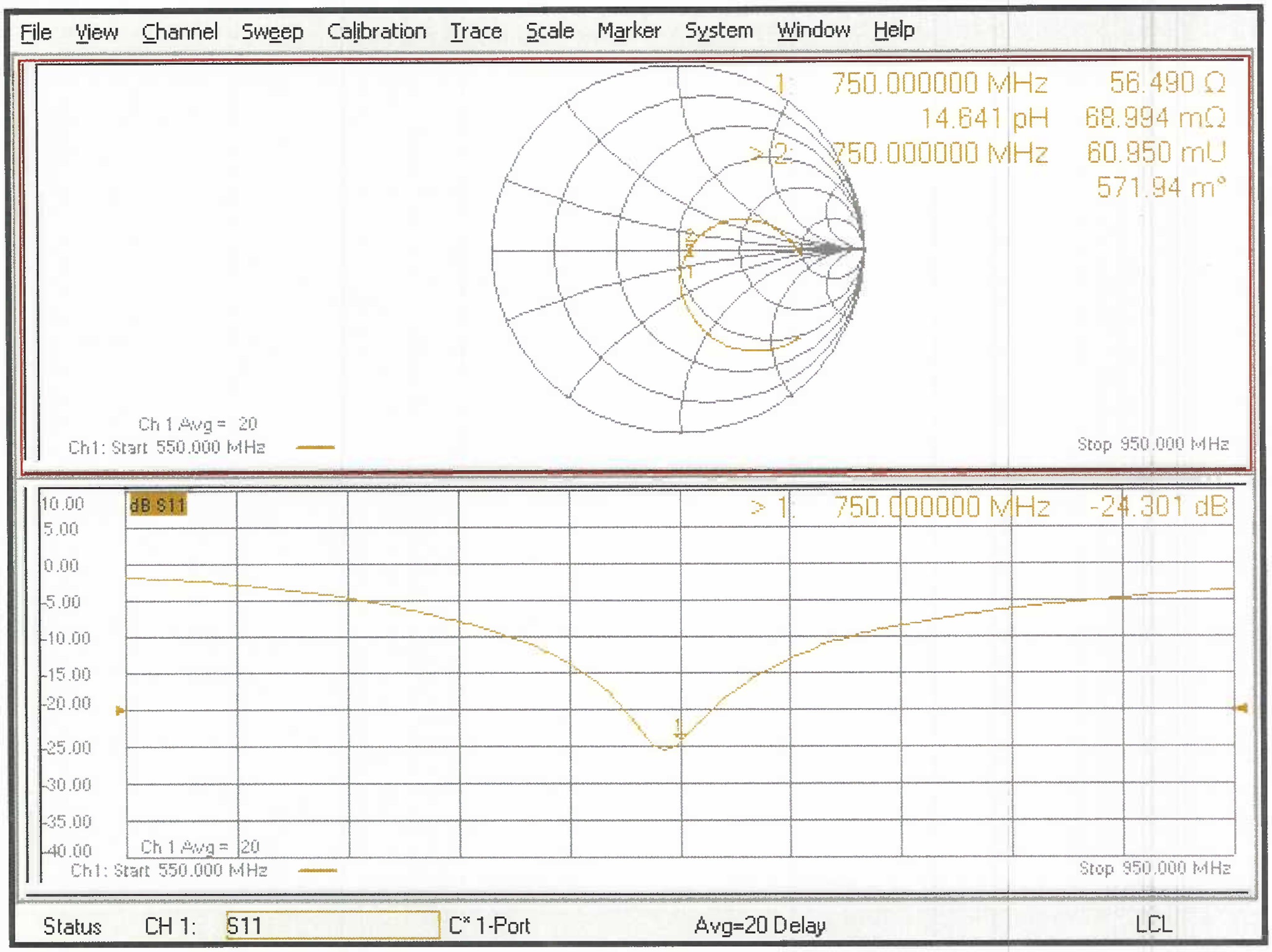
- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 59.74 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.30 W/kg
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.41 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)
Ratio of SAR at M2 to SAR at M1 = 65.5%
Maximum value of SAR (measured) = 2.93 W/kg



0 dB = 2.93 W/kg = 4.67 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D900V2-1d128_Jun21

CALIBRATION CERTIFICATE

Object	D900V2 - SN:1d128
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	June 04, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 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	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.96 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	2.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**11.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**7.14 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0 Ω - 0.6 jΩ
Return Loss	- 38.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.412 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

DASY5 Validation Report for Head TSL

Date: 04.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d128

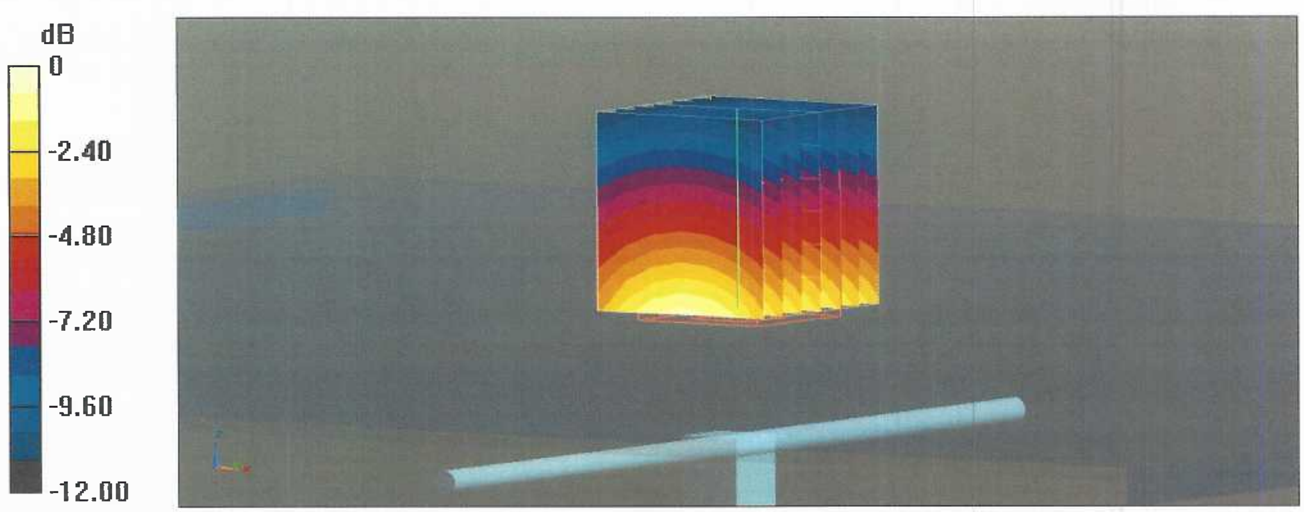
Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.96 S/m; ε_r = 42.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.62, 9.62, 9.62) @ 900 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

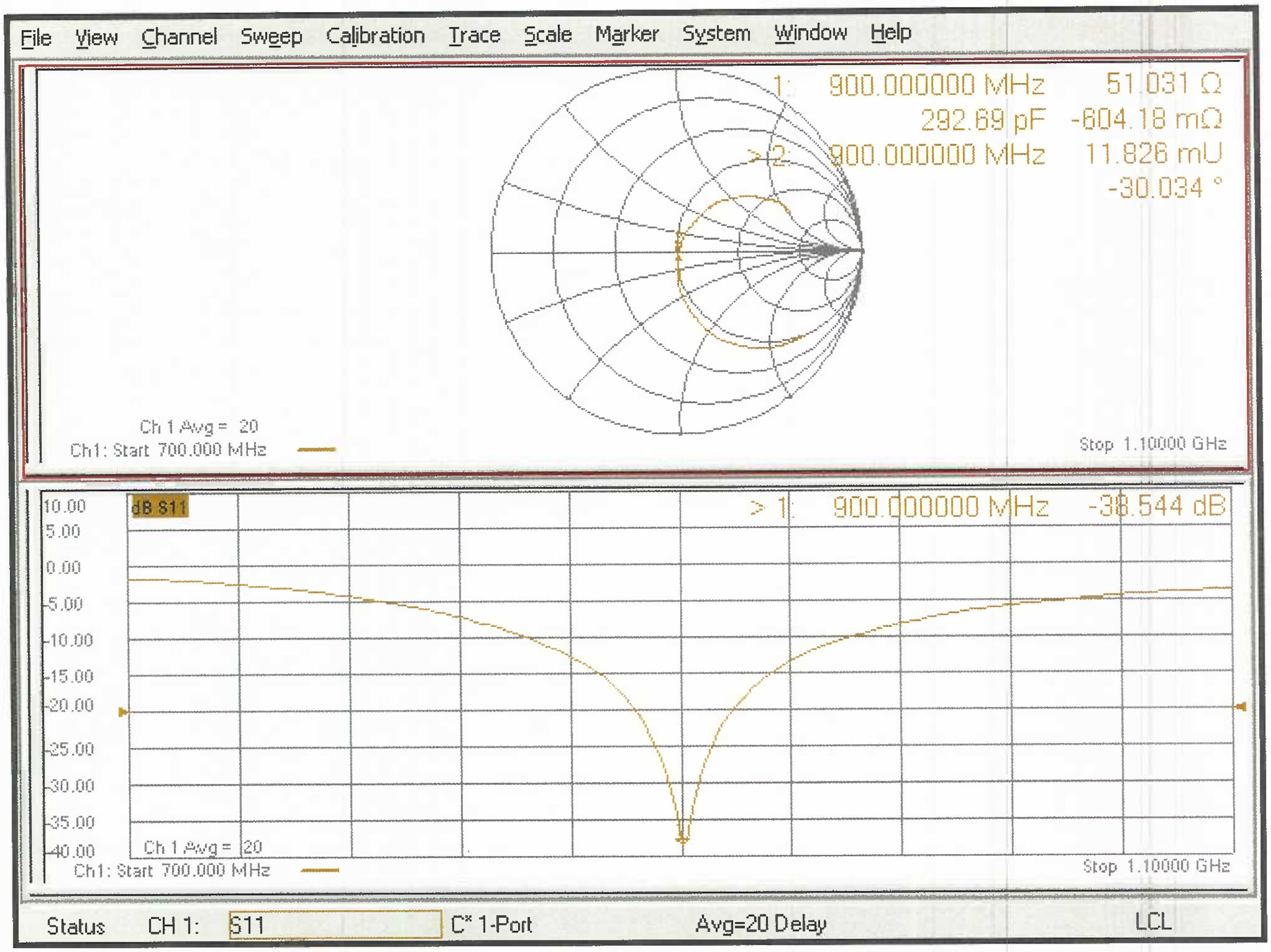
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 65.79 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 4.23 W/kg
SAR(1 g) = 2.76 W/kg; SAR(10 g) = 1.77 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 65%
Maximum value of SAR (measured) = 3.74 W/kg



0 dB = 3.74 W/kg = 5.73 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client RF Exposure Lab

Certificate No: D1750V2-1061_Jun21

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1061
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	June 03, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.7 ± 6 %	1.37 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	9.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω + 0.0 jΩ
Return Loss	- 44.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 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

DASY5 Validation Report for Head TSL

Date: 03.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

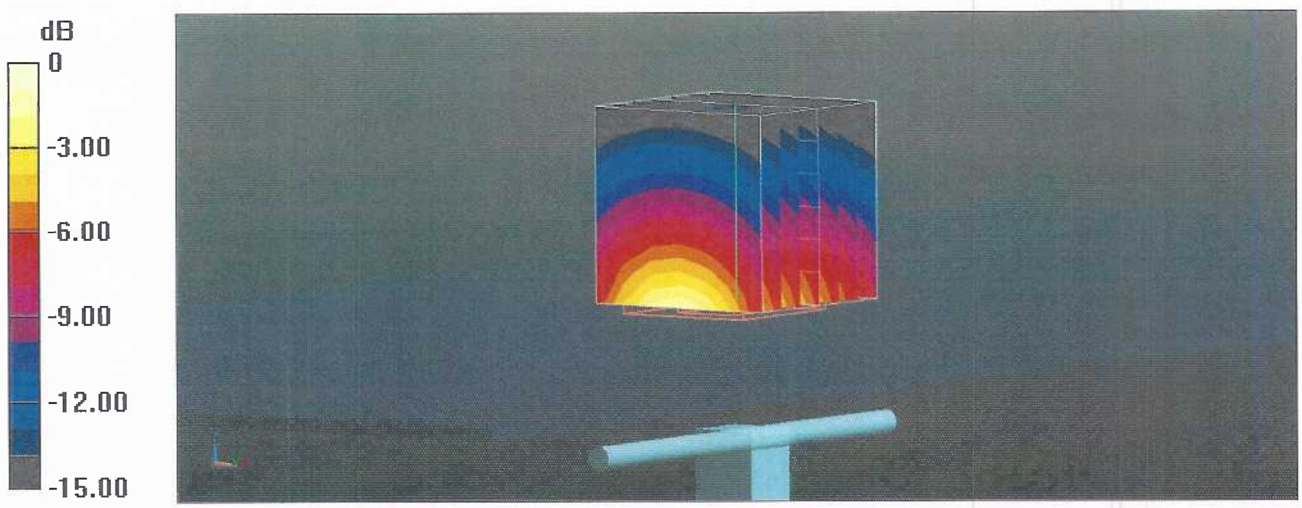
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1061

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; $\sigma = 1.37$ S/m; $\varepsilon_r = 40.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

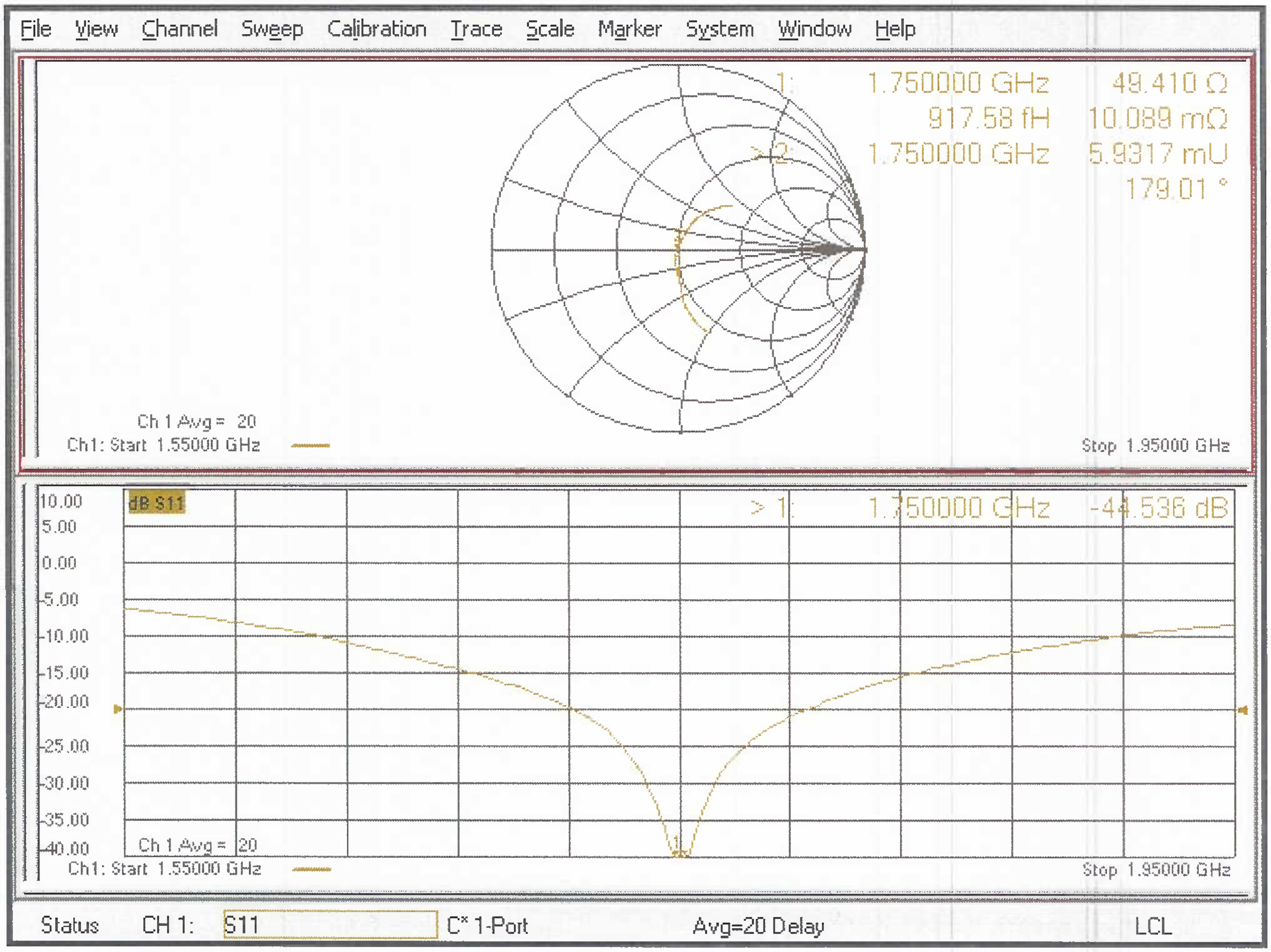
- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 107.4 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 17.5 W/kg
SAR(1 g) = 9.38 W/kg; SAR(10 g) = 4.93 W/kg
Smallest distance from peaks to all points 3 dB below = 9.1 mm
Ratio of SAR at M2 to SAR at M1 = 54%
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.6 W/kg = 11.64 dBW/kg

Impedance Measurement Plot for Head TSL



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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D1900V2-5d147_Jun21

CALIBRATION CERTIFICATE

Object: D1900V2 - SN:5d147

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: June 04, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
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	40.9 ± 6 %	1.41 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.1 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.3\ \Omega + 5.4\ j\Omega$
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 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

DASY5 Validation Report for Head TSL

Date: 04.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d147

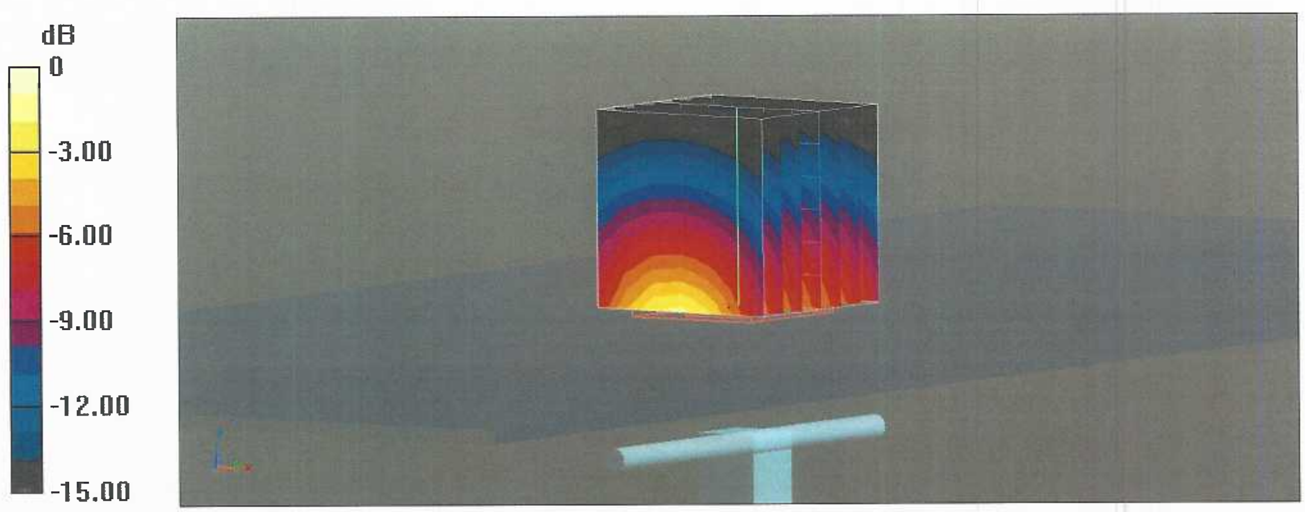
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.41$ S/m; $\varepsilon_r = 40.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

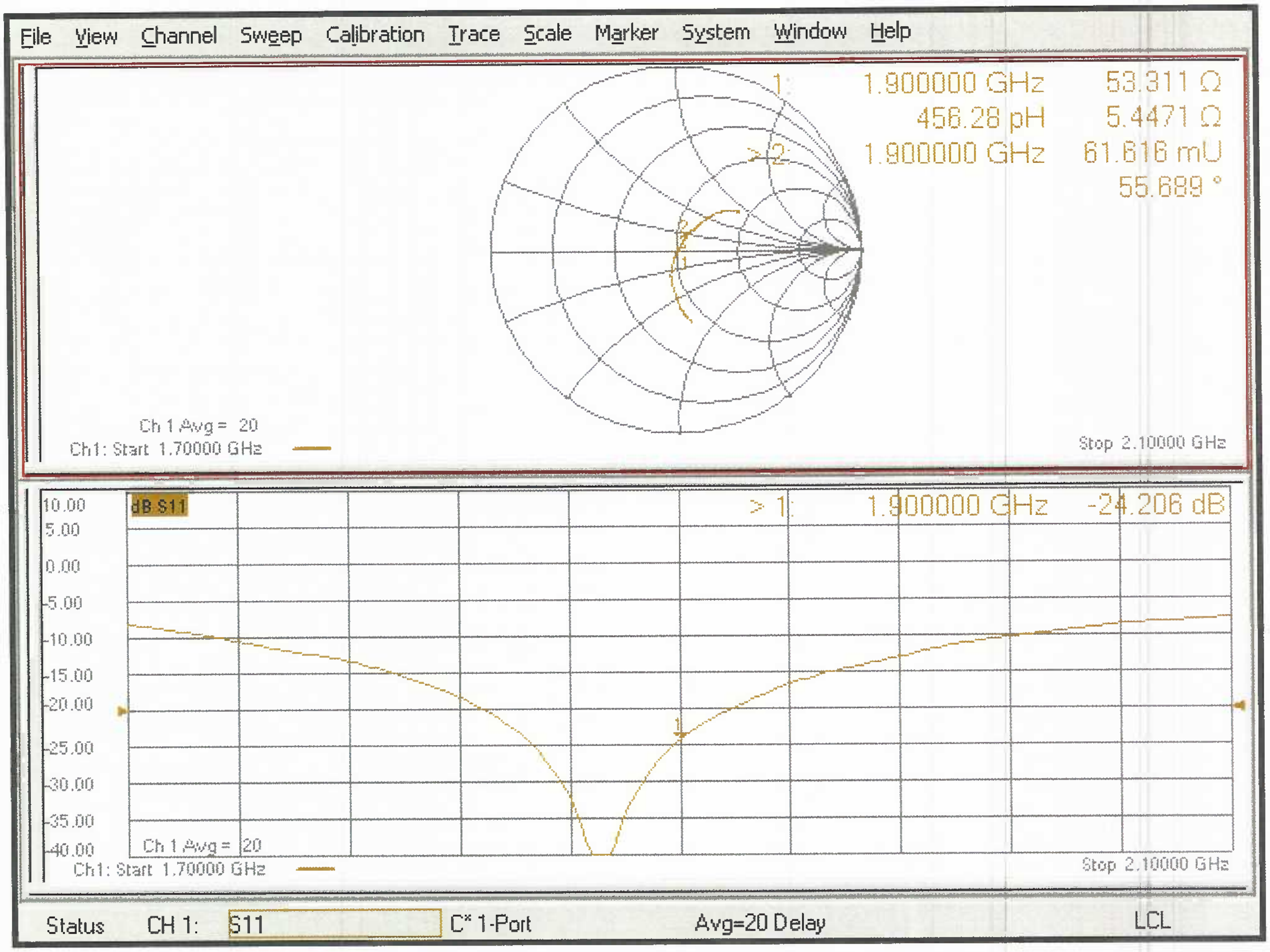
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.2 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.7 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 54.6%
Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D2450V2-881_Jun21

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:881
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	June 03, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.87 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	13.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**54.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.0 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.3 Ω + 4.3 jΩ
Return Loss	- 24.7 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

DASY5 Validation Report for Head TSL

Date: 03.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

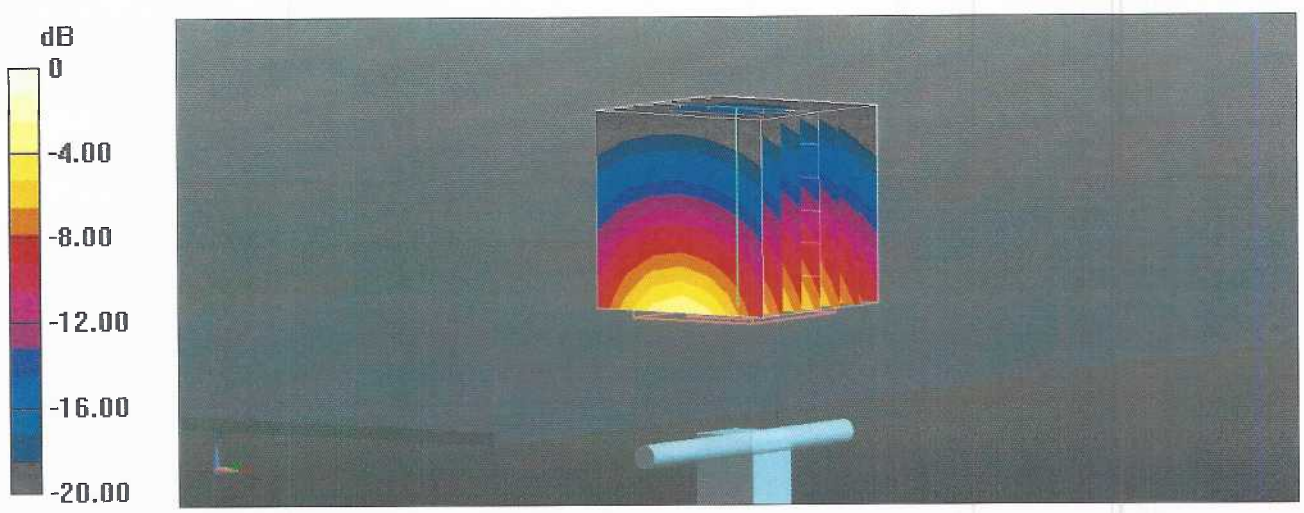
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:881

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

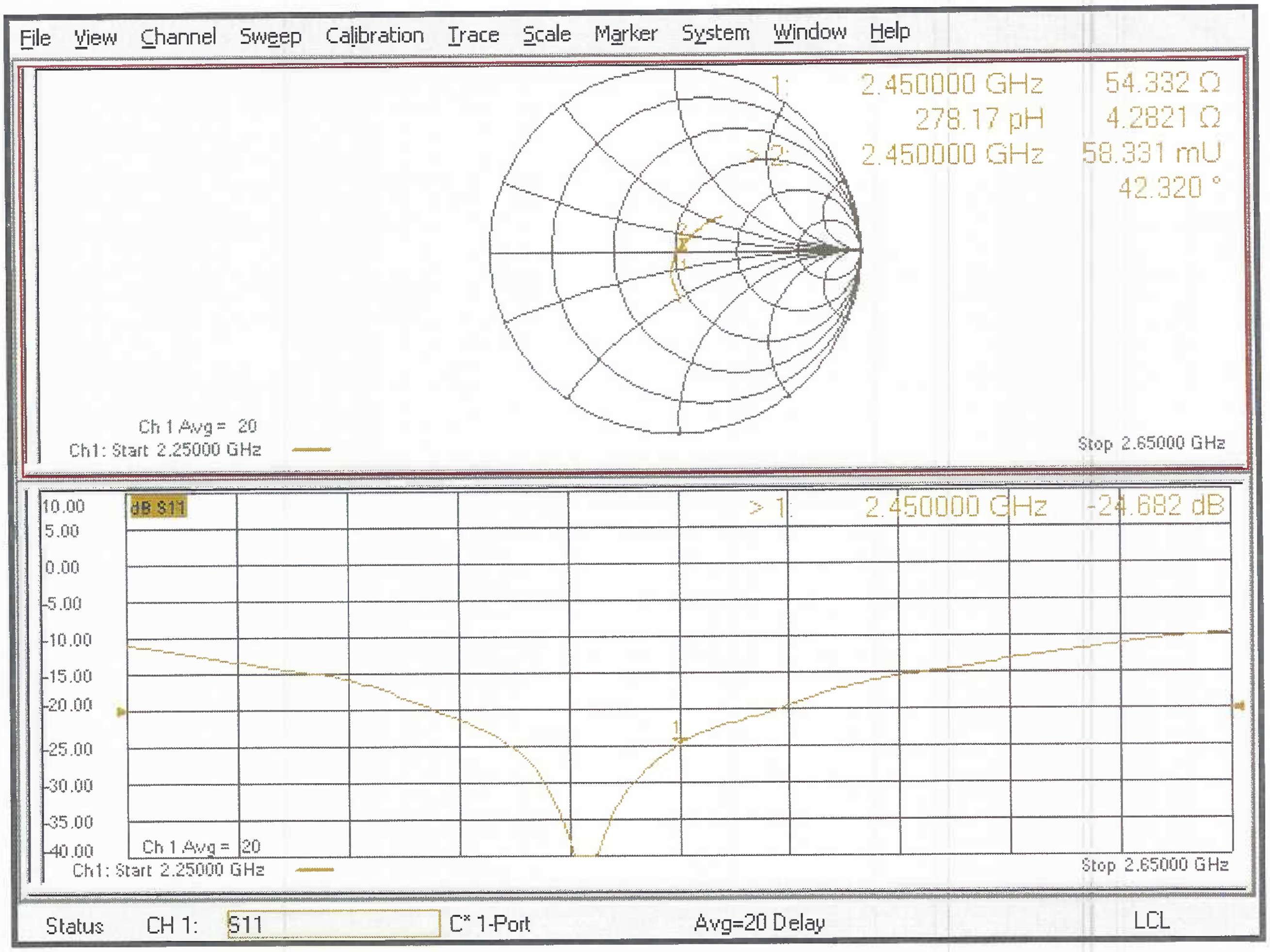
- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 119.0 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.34 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 49.5%
Maximum value of SAR (measured) = 23.1 W/kg



0 dB = 23.1 W/kg = 13.64 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**

Certificate No: D5GHzV2-1119_Jun21

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1119

Calibration procedure(s): QA CAL-22.v6
Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date: June 08, 2021

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 NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 3503	30-Dec-20 (No. EX3-3503_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 8, 2021

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	4.95 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.0 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	51.9 Ω - 7.3 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.8 Ω - 1.3 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.9 Ω - 1.8 jΩ
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 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

DASY5 Validation Report for Head TSL

Date: 08.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1119

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.59 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.95 S/m; ε_r = 34.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.1 S/m; ε_r = 33.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

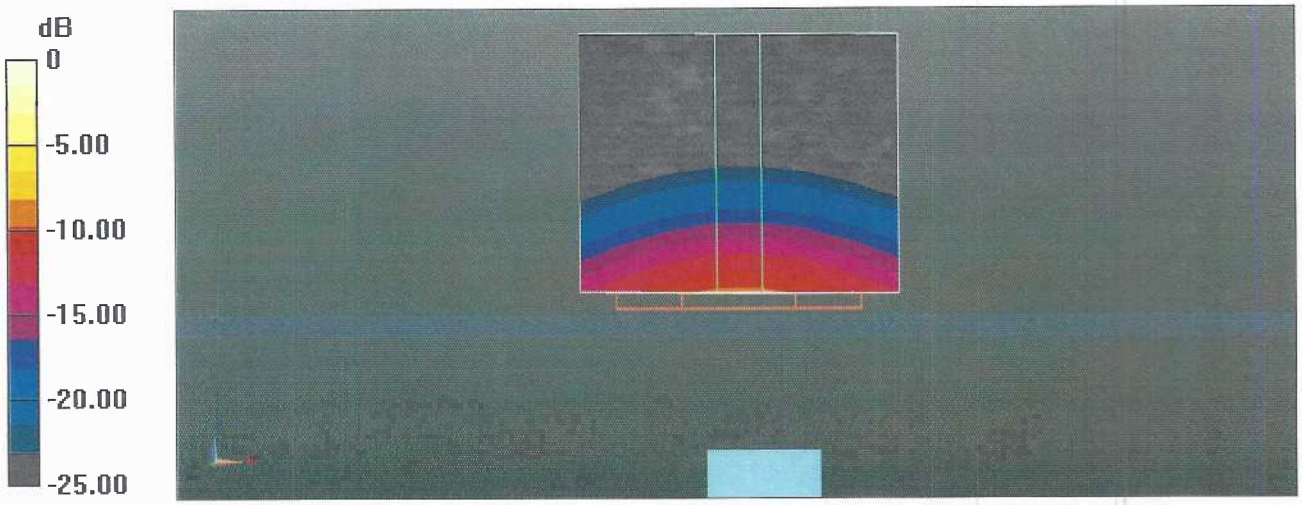
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.83 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 8.02 W/kg; SAR(10 g) = 2.32 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70.7%
Maximum value of SAR (measured) = 17.7 W/kg

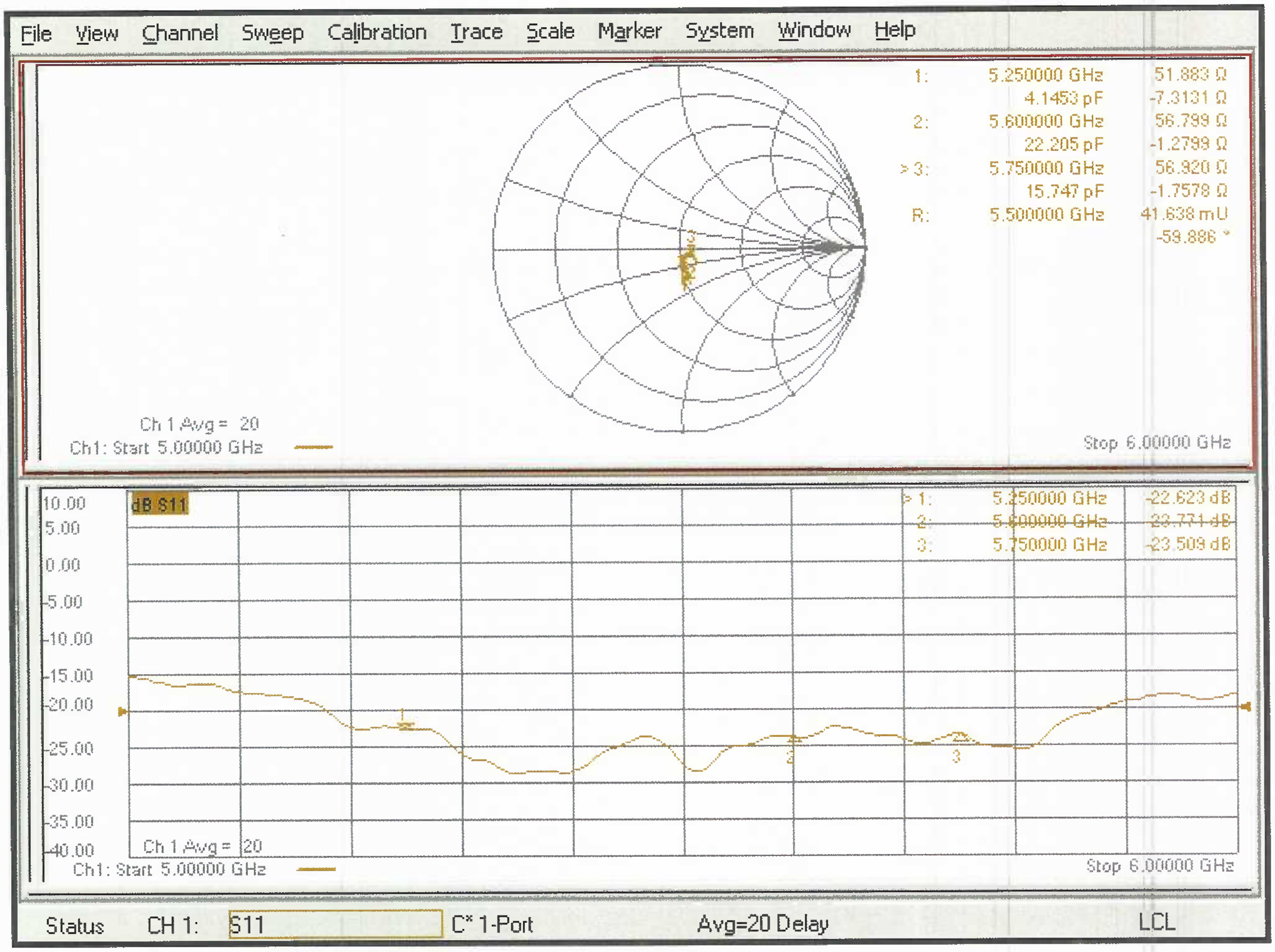
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.09 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 8.4 W/kg; SAR(10 g) = 2.41 W/kg
Smallest distance from peaks to all points 3 dB below = 7.5 mm
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.64 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 8.13 W/kg; SAR(10 g) = 2.33 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



Appendix F – Phantom Calibration Data Sheets

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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
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Appendix G – Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue equivalent media for system validation according to the procedures outlined in FCC KDB 865664 D01 v01r04 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point using the system that normally operates with the probe for routine SAR measurements and according to the required tissue equivalent media.

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

Table G-1
SAR System Validation Summary

SAR System #	Freq. (MHz)	Date	Probe S/N	Probe Type	Probe Cal. Point		Cond. (σ)	Perm. (ε_r)	CW Validation			Modulation Validation		
									Sens-itivity	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
2	600	05/03/2021	7531	EX3DV4	600	Head	0.90	42.36	Pass	Pass	Pass	QPSK	Pass	Pass
2	750	05/03/2021	7531	EX3DV4	750	Head	0.91	41.21	Pass	Pass	Pass	QPSK	Pass	Pass
2	900	05/03/2021	7531	EX3DV4	900	Head	0.99	41.03	Pass	Pass	Pass	QPSK	Pass	Pass
2	900	05/03/2021	7531	EX3DV4	900	Head	0.99	41.03	Pass	Pass	Pass	WCDMA	Pass	Pass
2	1750	05/04/2021	7531	EX3DV4	1750	Head	1.38	38.22	Pass	Pass	Pass	QPSK	Pass	Pass
2	1750	05/04/2021	7531	EX3DV4	1750	Head	1.38	38.22	Pass	Pass	Pass	WCDMA	Pass	Pass
2	1900	05/04/2021	7531	EX3DV4	1900	Head	1.42	39.17	Pass	Pass	Pass	QPSK	Pass	Pass
2	1900	05/04/2021	7531	EX3DV4	1900	Head	1.42	39.17	Pass	Pass	Pass	WCDMA	Pass	Pass
3	2450	05/05/2022	7531	EX3DV4	2450	Head	1.81	38.34	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
3	5250	05/06/2022	7531	EX3DV4	5250	Head	4.73	34.77	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
3	5600	05/06/2022	7531	EX3DV4	5600	Head	5.11	34.35	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
3	5750	05/06/2022	7531	EX3DV4	5750	Head	5.28	34.18	Pass	Pass	Pass	OFDM/TDD	Pass	Pass
3	13	02/24/2022	7530	EX3DV4	13	Head	0.76	54.63	Pass	Pass	Pass	ASK	Pass	Pass