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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Qwake Technologies, Inc.
2632 Larkin St., Apt 6
San Francisco, CA 94109

Dates of Test: October 24-25, 2024
Test Report Number: SAR.20241009
Revision A
Lab Designation Number: US1195

FCC ID:	2BH7A-QW-NAV-1R0-24
Contains FCC ID:	XMR202008EC25AXFD & R68OQ865S
Model(s):	Navigator 1
Test Sample:	Engineering Unit Same as Production
Serial Number:	Eng 1
Equipment Type:	Wireless Firefighter Helmut
Classification:	Portable Transmitter Next to Head
TX Frequency Range:	663 – 698 MHz, 699 – 716 MHz, 777 – 787 MHz, 788 – 798 MHz, 824 – 849 MHz, 1710 – 1780 MHz, 1850 – 1910 MHz, 2412 – 2462 MHz; 5180 – 5320 MHz; 5500 – 5700 MHz; 5745 – 5825 MHz, 13.56 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	750 MHz (LTE) – 25.0 dBm, 900 MHz (WCDMA) – 25.0 dBm, 900 MHz (LTE) – 25.0 dBm, 1750 MHz (WCDMA) – 25.0 dBm, 1750 MHz (LTE) – 25.0 dBm, 1900 MHz (WCDMA) – 25.0 dBm, 1900 MHz (LTE) – 25.0 dBm, 2450 MHz (b) – 20.0 dBm, 2450 MHz (g) – 20.0 dBm, 2450 MHz (n20) – 20.0 dBm, 5250 MHz (a) – 20.0 dBm, 5250 MHz (n/ac/ax20) – 20.0 dBm, 5250 MHz (ac/ax40/80) – 19.5 dBm, 5600 MHz (a) – 20.0 dBm, 5600 MHz (n/ac/ax20) – 20.0 dBm, 5600 MHz (ac/ax40/80) – 19.5 dBm, 5800 MHz (a) – 20.0 dBm, 5800 MHz (n/ac/ax20) – 20.0 dBm, 5800 MHz (ac/ax40/80) – 19.5 dBm, 2450 MHz (BT) – 17.0 dBm, 13.56 MHz – 31.1 dBm Conducted
Signal Modulation:	WCDMA, QPSK, 16QAM, DSSS, OFDM, GFSK
Antenna Type:	Internal Antenna
Application Type:	Certification
FCC Rule Parts:	Part 2, 22, 24, 27, 15C, 15E
KDB Test Methodology:	KDB 447498 D01 v06, KDB 248227 v02r02, KDB 941225 D01 v03r01, D05 v02r05
Maximum SAR Value:	0.31 W/kg Reported
Maximum Simultaneous:	0.77 W/kg Reported
Separation Distance to Probe:	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 C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields, IEEE Std.1528 – 2013 Recommended Practice and had been tested in accordance with the measurement procedures specified in KDB 447498, KDB 248227 and KDB 941225 (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

Testing Cert. # 2387.01

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Comment/Revision	Date
Original Release	November 8, 2024
Revision A – Add 13.56 MHz transmitter and justification for exclusion on page 23	July 30, 2025

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 Qwake Technologies, Inc. Model Navigator 1 FCC ID: 2BH7A-QW-NAV-1R0-24 containing FCC ID: XMR202008EC25AXFD & R68OQ865S with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices. The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation to protect the public and workers from the potential hazards of RF emissions due to FCC regulated portable devices.

The test results recorded herein are based on a single type test of Qwake Technologies, Inc. Model Navigator 1 and therefore apply only to the tested sample.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields, IEEE Std.1528 – 2013 Recommended Practice, KDB 447498, KDB 248227 and KDB 941225 were employed.

The following table indicates all the wireless technologies operating in the Navigator 1 Wireless Firefighter Helmut. The table also shows the tolerance for the power level for each mode.

Band	Technology	3GPP Nominal Power dBm	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 2	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 4	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 5	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 12	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 13	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 14	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 66	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 71	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 2	WCDMA	23.0	23.0	± 2.0	21.0	25.0
Band 4	WCDMA	23.0	23.0	± 2.0	21.0	25.0
Band 5	WCDMA	23.0	23.0	± 2.0	21.0	25.0
WLAN – 2.4 GHz	802.11b/g/n20	N/A	N/A	N/A	N/A	20.0
WLAN – 5 GHz	802.11a/n20/ac20/ax20	N/A	N/A	N/A	N/A	20.0
WLAN – 5 GHz	802.11ac40/ax40/ac80/ax80	N/A	N/A	N/A	N/A	19.5
Bluetooth	Bluetooth	N/A	N/A	N/A	N/A	17.0
13.56 MHz	RFID	N/A	N/A	N/A	N/A	31.1

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

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

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.

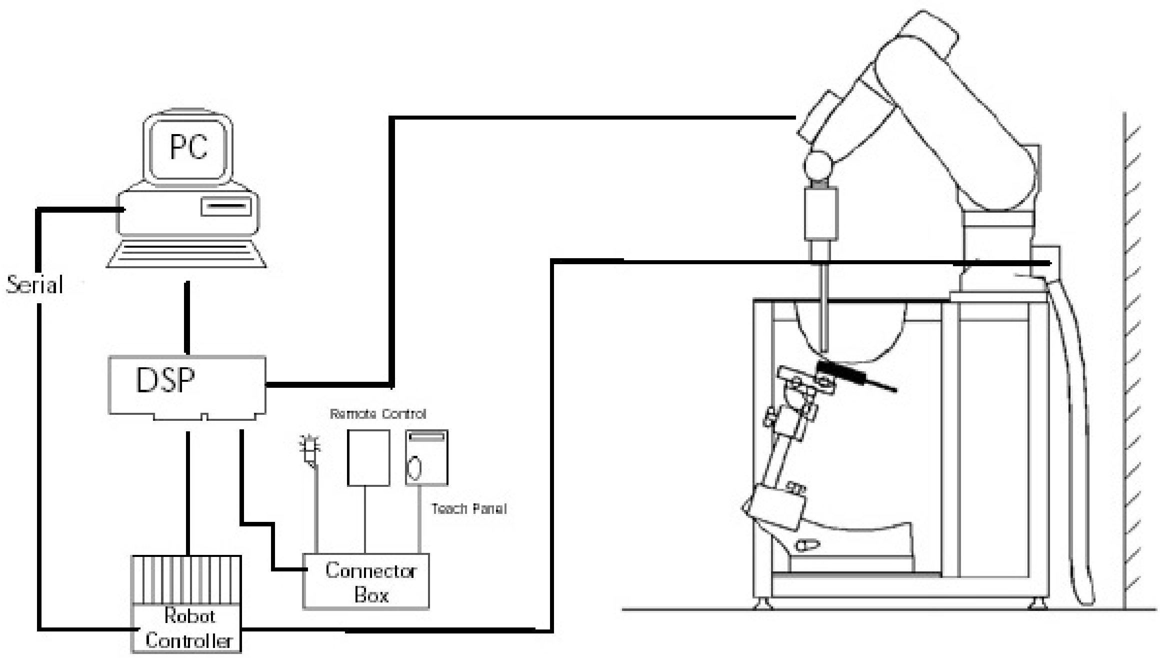


Figure 2.1 SAR Measurement System Setup

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

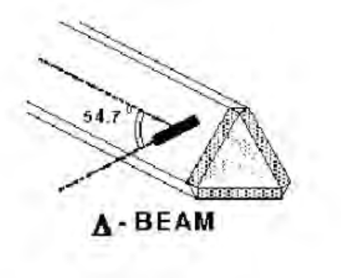


Figure 2.2 Triangular Probe Configurations

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 ΔT / Δt , 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;

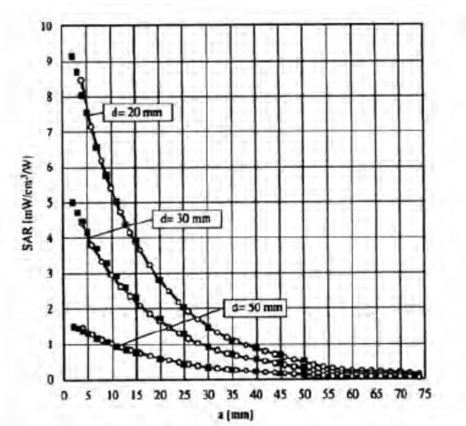


Figure 2.4 E-Field and Temperature Measurements at 900MHz

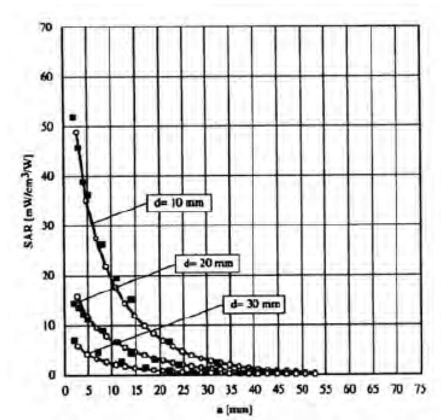


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

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

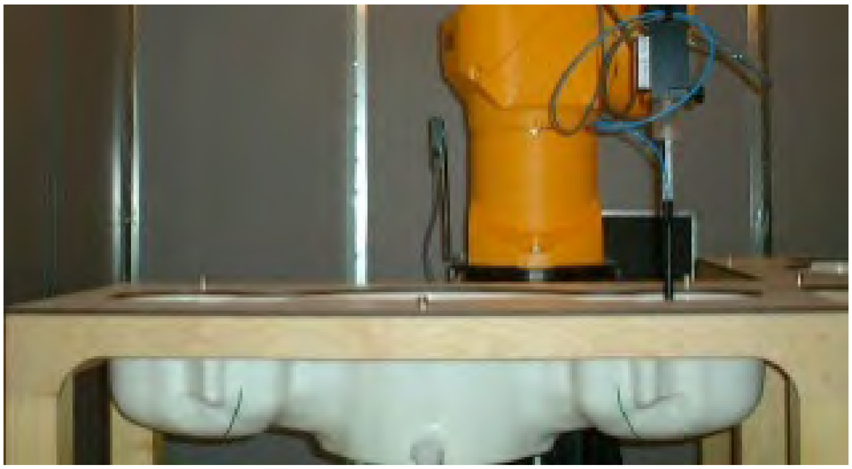


Figure 2.6 SAM Twin Phantom

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 mixture 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.

Table 4.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue			
		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	41.94	41.50	40.08	40.00
Conductivity (S/m)	Target	0.89	0.97	1.37	1.40

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

5. 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

		750 MHz Head		900 MHz Head		1750 MHz Head	
Date(s)		Oct. 24, 2024		Oct. 24, 2024		Oct. 24, 2024	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		41.94	41.35	41.50	41.12	40.08	39.77
Conductivity: σ		0.89	0.91	0.97	0.99	1.37	1.38
		1900 MHz Head		2450 MHz Head		5250 MHz Head	
Date(s)		Oct. 25, 2024		Oct. 25, 2024		Oct. 25, 2024	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		40.00	39.82	39.20	38.34	35.93	34.77
Conductivity: σ		1.40	1.38	1.80	1.81	4.71	4.73
		5600 MHz Head		5750 MHz Head			
Date(s)		Oct. 25, 2024		Oct. 25, 2024			
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured		
Dielectric Constant: ε		35.53	34.35	35.36	34.18		
Conductivity: σ		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 Target and Fast SAR to SAR (%)	Plot Number
24-Oct-2024	750 MHz	8.76	8.58	Head	- 2.05	1
24-Oct-2024	900 MHz	11.00	11.40	Head	+ 3.64	2
24-Oct-2024	1750 MHz	36.70	37.90	Head	+ 3.27	3
25-Oct-2024	1900 MHz	40.60	41.20	Head	+ 1.48	4
25-Oct-2024	2450 MHz	53.30	54.60	Head	+ 2.44	5
25-Oct-2024	5250 MHz	80.00	80.30	Head	+ 0.38	6
25-Oct-2024	5600 MHz	83.00	83.50	Head	+ 0.60	7
25-Oct-2024	5750 MHz	80.20	80.50	Head	+ 0.37	8

See Appendix A for data plots.

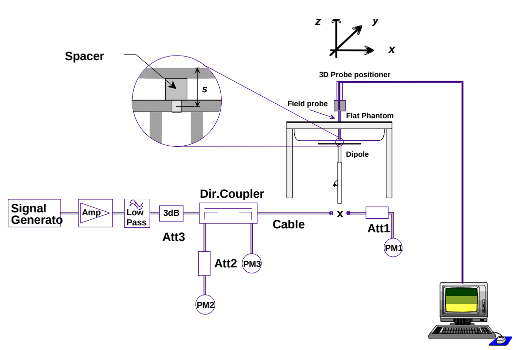


Figure 7.1 Dipole Validation Test Setup

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	132987	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 5 antennas:
- 1 – WWAN (Transmit and Receive) Antenna
- 1 – WWAN (Receive Only) Antenna
- 2 – WiFi (Transmit and Receive) Antenna
- 1 – RFID (Transmit and Receive) Antenna

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 headstand 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 29-45 of this report. The below table shows the factory set point with the allowable tolerance.

Band	Technology	3GPP Nominal Power dBm	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 2	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 4	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 5	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 12	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 13	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 14	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 66	LTE	23.0	23.0	± 2.0	21.0	25.0
Band 71	LTE	23.0	23.0	± 2.0	21.0	25.0

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	Setpoint Nominal Power dBm	Tolerance dBm	Lower Tolerance dBm	Upper Tolerance dBm
Band 2	WCDMA	23.0	23.0	± 2.0	21.0	25.0
Band 4	WCDMA	23.0	23.0	± 2.0	21.0	25.0
Band 5	WCDMA	23.0	23.0	± 2.0	21.0	25.0
WLAN – 2.4 GHz	802.11b/g/n20	N/A	N/A	N/A	N/A	20.0
WLAN – 5 GHz	802.11a/n20/ac20/ax20	N/A	N/A	N/A	N/A	20.0
WLAN – 5 GHz	802.11ac40/ax40/ac80/ax80	N/A	N/A	N/A	N/A	19.5
Bluetooth	Bluetooth	N/A	N/A	N/A	N/A	17.0

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

The WiFi bands were excluded from SAR testing. Therefore, no conducted power measurements were performed. The GPRS and WCDMA measurements are on pages 27 & 46-48. The table in item 9 shows the factory set point with the allowable tolerance.

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

    Power reduction is not required to satisfy SAR compliance.

12) 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

    Not applicable.

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

    Not applicable.

14) 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.

This device is worn on the head of the user. All tests were conduct using the headstand phantom.

The data rates used when evaluating the WiFi transmitter were the lowest data rates and widest bandwidth with the highest conduct power limit for each mode. The device was operating at its maximum output power for all measurements.

The 13.56 MHz transmitter is excluded due to the low average power and distance from the head. The transmitter operates at 31.1 dBm (1300 mW) at a 3% duty cycle. The average power for the transmitter is 39 mW. The distance from the user's head is less than 50 mm.

Using the table in KDB447498 v06 Appendix C for the exclusion and extrapolating from 10 MHz to 50 MHz for 13.56 MHz, the exclusion power level is 459 mW. Since the maximum average power for the 13.56 MHz transmitter is 39 mW, the transmitter is excluded from SAR testing.

The antenna was on a minimum of 10 cm of Styrofoam during each test.

WCDMA Conducted Power

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c , and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c .

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

SETUP CONFIGURATION

HSUPA SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 4) (Note 5)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM *(dB) (Note 2)*	MPR *(dB) (Note 2) (Note 6)*	*AG Index (Note 5)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c . For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with β_{hs} = 5/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

SETUP CONFIGURATION

DC-HSDPA 3GPP RELEASE 8 SETUP CONFIGURATION:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table,
      C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

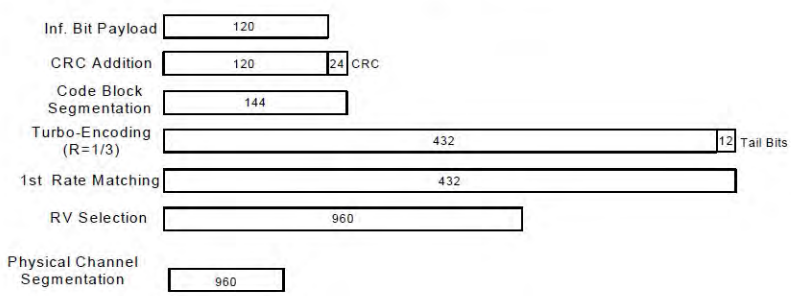


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

SETUP CONFIGURATION

<WCDMA Conducted Power>

GENERAL NOTE:

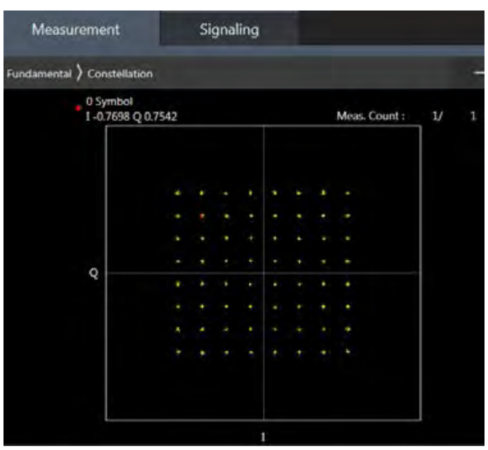
1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513		4132	4182	4233	
Rx Channel		9662	9800	9938		1537	1638	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6		826.4	836.4	846.6	
3GPP Rel 99	AMR 12.2Kbps	23.65	23.55	23.92	25.00	23.74	23.87	23.97	25.00	23.57	23.88	23.75	25.00
3GPP Rel 99	RMC 12.2Kbps	23.75	23.87	23.74	25.00	23.68	23.83	23.62	25.00	23.97	23.58	24.00	25.00
3GPP Rel 6	HSDPA Subtest-1	22.55	22.71	22.60	24.00	22.59	22.73	22.70	24.00	22.93	22.88	22.83	24.00
3GPP Rel 6	HSDPA Subtest-2	22.58	22.58	22.53	24.00	22.79	22.52	22.53	24.00	22.60	22.61	22.91	24.00
3GPP Rel 6	HSDPA Subtest-3	23.36	23.06	23.11	24.50	23.48	23.45	23.17	24.50	23.50	23.32	23.26	24.50
3GPP Rel 6	HSDPA Subtest-4	23.20	23.31	23.13	24.50	23.06	23.07	23.04	24.50	23.14	23.44	23.03	24.50
3GPP Rel 8	DC-HSDPA Subtest-1	22.71	22.50	22.55	24.00	22.67	22.56	22.91	24.00	22.54	22.52	22.60	24.00
3GPP Rel 8	DC-HSDPA Subtest-2	22.54	22.68	22.60	24.00	22.64	22.95	22.92	24.00	22.79	22.96	22.84	24.00
3GPP Rel 8	DC-HSDPA Subtest-3	23.26	23.45	23.41	24.50	23.20	23.27	23.20	24.50	23.26	23.28	23.00	24.50
3GPP Rel 8	DC-HSDPA Subtest-4	23.28	23.14	23.50	24.50	23.21	23.10	23.45	24.50	23.12	23.19	23.25	24.50
3GPP Rel 6	HSUPA Subtest-1	22.54	22.63	22.97	24.00	22.91	22.95	22.81	24.00	22.77	22.99	22.95	24.00
3GPP Rel 6	HSUPA Subtest-2	20.65	20.79	20.73	22.00	20.54	20.57	20.98	22.00	20.79	20.64	20.53	22.00
3GPP Rel 6	HSUPA Subtest-3	21.62	21.91	21.67	23.00	21.51	21.93	21.99	23.00	21.56	21.83	21.82	23.00
3GPP Rel 6	HSUPA Subtest-4	20.89	20.75	20.97	22.00	20.54	20.70	20.68	22.00	20.99	20.73	20.94	22.00
3GPP Rel 6	HSUPA Subtest-5	22.98	22.86	22.76	24.00	22.64	22.77	22.98	24.00	22.93	22.73	22.52	24.00

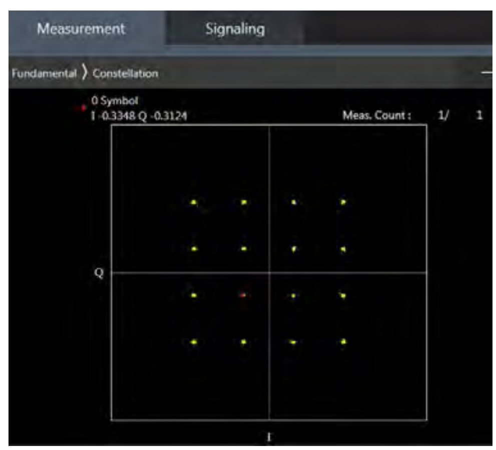
LTE Conducted Power

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. LTE band 4 SAR test was covered by Band 66; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band
9. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the MT8821C base station, therefore, the device 64QAM and 16QAM signal modulation are correct.



64QAM



16QAM

Table 9.1 LTE Power Measurements

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	1.4 MHz	1	0	18607	1850.7	22.9	22.6
				18900	1880.0	23.0	22.2
				19193	1909.3	23.4	21.9
			3	18607	1850.7	23.5	22.3
				18900	1880.0	23.4	22.2
				19193	1909.3	23.3	22.2
			5	18607	1850.7	23.5	22.5
				18900	1880.0	23.0	22.3
				19193	1909.3	23.2	22.5
		3	0	18607	1850.7	23.0	22.6
				18900	1880.0	23.1	22.1
				19193	1909.3	22.9	22.3
			1	18607	1850.7	23.4	22.4
				18900	1880.0	23.3	22.3
				19193	1909.3	23.0	22.3
			3	18607	1850.7	23.4	22.5
				18900	1880.0	23.3	22.2
				19193	1909.3	23.4	22.6
		6	0	18607	1850.7	22.4	21.2
				18900	1880.0	22.4	21.3
				19193	1909.3	22.0	21.0
	3 MHz	1	0	18615	1851.5	23.3	22.4
				18900	1880.0	23.6	22.3
				19185	1908.5	23.4	22.6
			7	18615	1851.5	23.6	22.5
				18900	1880.0	23.4	22.3
				19185	1908.5	22.9	21.9
			14	18615	1851.5	23.6	22.3
				18900	1880.0	23.0	22.2
				19185	1908.5	23.2	22.2
		8	0	18615	1851.5	22.5	20.9
				18900	1880.0	22.0	21.2
				19185	1908.5	22.0	21.1
			7	18615	1851.5	22.1	21.1
				18900	1880.0	22.0	21.0
				19185	1908.5	22.6	21.5
			14	18615	1851.5	22.2	21.3
				18900	1880.0	22.1	21.5
				19185	1908.5	22.3	21.2
		15	0	18615	1851.5	22.1	21.3
				18900	1880.0	22.3	20.9
				19185	1908.5	22.4	21.1

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	5 MHz	1	0	18625	1852.5	23.5	22.3
				18900	1880.0	23.4	22.1
				19175	1907.5	22.9	22.0
			12	18625	1852.5	22.9	22.4
				18900	1880.0	23.2	22.0
				19175	1907.5	23.4	22.4
			24	18625	1852.5	23.1	22.4
				18900	1880.0	23.1	22.6
				19175	1907.5	23.2	22.5
		12	0	18625	1852.5	22.4	21.3
				18900	1880.0	22.5	21.3
				19175	1907.5	22.1	21.2
			6	18625	1852.5	22.5	21.4
				18900	1880.0	22.3	21.4
				19175	1907.5	22.2	21.1
			13	18625	1852.5	22.2	21.5
				18900	1880.0	22.0	21.0
				19175	1907.5	22.3	21.0
		25	0	18625	1852.5	22.1	21.4
				18900	1880.0	22.5	21.6
				19175	1907.5	22.5	21.2
	10 MHz	1	0	18650	1855.0	23.5	22.2
				18900	1880.0	23.0	22.4
				19150	1905.0	23.3	21.9
			24	18650	1855.0	23.3	22.3
				18900	1880.0	23.3	22.0
				19150	1905.0	23.3	22.2
			49	18650	1855.0	23.3	22.2
				18900	1880.0	23.3	22.5
				19150	1905.0	23.4	22.4
		25	0	18650	1855.0	21.9	21.2
				18900	1880.0	22.0	21.2
				19150	1905.0	22.5	21.5
			13	18650	1855.0	22.1	21.3
				18900	1880.0	22.2	21.0
				19150	1905.0	22.3	21.4
			25	18650	1855.0	22.2	21.3
				18900	1880.0	22.0	21.6
				19150	1905.0	22.2	21.5
		50	0	18650	1855.0	22.5	21.3
				18900	1880.0	22.2	20.9
				19150	1905.0	22.4	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
2	15 MHz	1	0	18675	1857.5	23.0	22.6
				18900	1880.0	23.5	22.3
				19125	1902.5	23.3	22.1
			37	18675	1857.5	23.3	22.5
				18900	1880.0	23.6	22.0
				19125	1902.5	23.1	22.3
			74	18675	1857.5	23.3	22.5
				18900	1880.0	22.9	22.0
				19125	1902.5	23.2	22.3
		36	0	18675	1857.5	22.4	21.2
				18900	1880.0	22.1	21.1
				19125	1902.5	22.0	21.3
			19	18675	1857.5	21.9	21.6
				18900	1880.0	22.5	20.9
				19125	1902.5	22.1	21.2
			39	18675	1857.5	22.0	21.5
				18900	1880.0	22.3	21.5
				19125	1902.5	22.0	21.4
		75	0	18675	1857.5	21.9	20.9
				18900	1880.0	22.4	21.6
				19125	1902.5	22.2	21.4
	20 MHz	1	0	18700	1860.0	23.0	22.3
				18900	1880.0	22.9	22.0
				19100	1900.0	23.2	22.1
			49	18700	1860.0	23.0	22.3
				18900	1880.0	23.2	21.9
				19100	1900.0	23.2	22.6
			99	18700	1860.0	23.4	22.0
				18900	1880.0	23.1	22.4
				19100	1900.0	23.3	22.3
		50	0	18700	1860.0	22.2	21.5
				18900	1880.0	22.1	21.6
				19100	1900.0	22.0	21.3
			24	18700	1860.0	22.3	21.5
				18900	1880.0	22.5	21.5
				19100	1900.0	22.3	21.4
			50	18700	1860.0	22.2	21.6
				18900	1880.0	22.4	21.4
				19100	1900.0	21.9	21.5
		100	0	18700	1860.0	22.2	21.0
				18900	1880.0	22.2	21.5
				19100	1900.0	22.4	21.2

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	1.4 MHz	1	0	19957	1710.7	23.5	22.4
				20175	1732.5	23.0	22.3
				20393	1754.3	23.4	22.2
			3	19957	1710.7	23.4	22.6
				20175	1732.5	23.2	22.1
				20393	1754.3	23.6	22.4
			5	19957	1710.7	23.4	22.5
				20175	1732.5	23.0	22.5
				20393	1754.3	22.9	22.1
		3	0	19957	1710.7	23.6	22.5
				20175	1732.5	23.1	22.0
				20393	1754.3	23.4	21.9
			1	19957	1710.7	22.9	22.0
				20175	1732.5	23.4	22.2
				20393	1754.3	23.0	22.3
			3	19957	1710.7	23.3	22.5
				20175	1732.5	23.2	22.1
				20393	1754.3	22.9	22.2
		6	0	19957	1710.7	22.6	21.2
				20175	1732.5	22.6	21.1
				20393	1754.3	22.2	21.4
	3 MHz	1	0	19965	1711.5	22.9	22.6
				20175	1732.5	23.0	22.2
				20385	1753.5	23.5	22.2
			7	19965	1711.5	23.0	22.1
				20175	1732.5	23.4	22.1
				20385	1753.5	23.2	22.2
			14	19965	1711.5	23.5	22.2
				20175	1732.5	23.6	22.5
				20385	1753.5	23.1	22.1
		8	0	19965	1711.5	22.4	21.6
				20175	1732.5	22.1	21.1
				20385	1753.5	22.6	21.6
			7	19965	1711.5	22.0	21.2
				20175	1732.5	22.5	21.2
				20385	1753.5	22.2	20.9
			14	19965	1711.5	22.5	21.1
				20175	1732.5	22.3	21.3
				20385	1753.5	22.6	21.4
		15	0	19965	1711.5	21.9	21.1
				20175	1732.5	22.2	21.1
				20385	1753.5	22.3	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	5 MHz	1	0	19975	1712.5	23.6	22.1
				20175	1732.5	23.5	22.3
				20375	1752.5	23.0	22.6
			12	19975	1712.5	23.1	22.1
				20175	1732.5	23.1	22.3
				20375	1752.5	23.3	22.6
			24	19975	1712.5	23.0	22.5
				20175	1732.5	23.1	22.2
				20375	1752.5	23.0	22.6
		12	0	19975	1712.5	22.6	21.4
				20175	1732.5	22.6	21.1
				20375	1752.5	22.5	21.3
			6	19975	1712.5	22.4	21.5
				20175	1732.5	22.5	21.5
				20375	1752.5	21.9	21.0
			13	19975	1712.5	22.4	21.6
				20175	1732.5	22.2	21.1
				20375	1752.5	22.1	21.2
		25	0	19975	1712.5	22.3	21.0
				20175	1732.5	22.5	21.0
				20375	1752.5	22.3	21.0
	10 MHz	1	0	20000	1715.0	23.1	22.1
				20175	1732.5	23.3	22.2
				20350	1750.0	23.4	22.5
			24	20000	1715.0	23.1	22.3
				20175	1732.5	23.4	22.4
				20350	1750.0	23.1	22.6
			49	20000	1715.0	23.0	22.4
				20175	1732.5	23.4	22.0
				20350	1750.0	23.1	22.2
		25	0	20000	1715.0	22.4	21.5
				20175	1732.5	22.2	21.4
				20350	1750.0	22.5	21.4
			13	20000	1715.0	22.1	21.3
				20175	1732.5	22.1	21.4
				20350	1750.0	22.1	21.1
			25	20000	1715.0	22.3	21.2
				20175	1732.5	22.2	21.0
				20350	1750.0	22.5	21.3
		50	0	20000	1715.0	22.1	21.5
				20175	1732.5	22.1	21.0
				20350	1750.0	22.2	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
4	15 MHz	1	0	20025	1717.5	23.3	22.4
				20175	1732.5	23.5	22.1
				20325	1747.5	23.1	22.2
			37	20025	1717.5	23.5	22.3
				20175	1732.5	23.3	22.3
				20325	1747.5	23.0	22.6
			74	20025	1717.5	23.1	22.6
				20175	1732.5	23.1	22.3
				20325	1747.5	23.1	22.1
		36	0	20025	1717.5	22.1	21.4
				20175	1732.5	22.4	21.2
				20325	1747.5	22.2	21.2
			19	20025	1717.5	22.3	21.5
				20175	1732.5	21.9	20.9
				20325	1747.5	22.4	21.2
			39	20025	1717.5	22.3	20.9
				20175	1732.5	22.4	21.2
				20325	1747.5	22.5	21.3
		75	0	20025	1717.5	22.5	21.2
				20175	1732.5	22.5	21.0
				20325	1747.5	22.4	21.2
	20 MHz	1	0	20050	1720.0	23.0	22.2
				20175	1732.5	23.3	22.5
				20300	1745.0	23.5	22.2
			49	20050	1720.0	23.6	22.2
				20175	1732.5	23.3	22.1
				20300	1745.0	23.0	22.4
			99	20050	1720.0	23.4	22.4
				20175	1732.5	23.3	22.5
				20300	1745.0	23.2	22.3
		50	0	20050	1720.0	22.0	21.2
				20175	1732.5	22.5	21.2
				20300	1745.0	22.2	21.0
			24	20050	1720.0	22.1	20.9
				20175	1732.5	22.3	21.4
				20300	1745.0	22.6	20.9
			50	20050	1720.0	22.1	21.1
				20175	1732.5	22.0	21.6
				20300	1745.0	22.2	21.1
		100	0	20050	1720.0	22.3	21.2
				20175	1732.5	22.2	21.4
				20300	1745.0	22.5	21.1

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	1.4 MHz	1	0	20407	824.7	23.0	22.2
				20525	836.5	23.2	22.3
				20643	848.3	23.5	22.1
			3	20407	824.7	23.4	22.0
				20525	836.5	23.0	22.1
				20643	848.3	23.3	22.6
			5	20407	824.7	23.4	22.0
				20525	836.5	23.5	22.5
				20643	848.3	23.5	22.1
		3	0	20407	824.7	22.9	22.4
				20525	836.5	23.4	22.1
				20643	848.3	23.4	22.3
			1	20407	824.7	23.0	22.5
				20525	836.5	23.1	22.3
				20643	848.3	23.3	21.9
			3	20407	824.7	23.2	22.4
				20525	836.5	23.0	22.3
				20643	848.3	23.5	22.1
		6	0	20407	824.7	22.2	21.4
				20525	836.5	22.3	21.0
				20643	848.3	22.3	21.2
	3 MHz	1	0	20415	825.5	23.1	22.0
				20525	836.5	23.3	22.2
				20635	847.5	22.9	22.2
			7	20415	825.5	23.1	22.5
				20525	836.5	23.0	22.4
				20635	847.5	23.4	22.1
			14	20415	825.5	23.3	22.3
				20525	836.5	23.3	22.2
				20635	847.5	23.1	22.4
		8	0	20415	825.5	22.5	21.5
				20525	836.5	22.6	21.3
				20635	847.5	22.3	21.1
			7	20415	825.5	22.4	21.3
				20525	836.5	22.5	21.0
				20635	847.5	22.0	20.9
			14	20415	825.5	22.1	21.2
				20525	836.5	22.1	21.2
				20635	847.5	22.4	21.1
		15	0	20415	825.5	22.0	21.5
				20525	836.5	22.6	21.5
				20635	847.5	22.1	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
5	5 MHz	1	0	20425	826.5	23.4	22.4
				20525	836.5	23.0	22.2
				20625	846.5	23.0	22.3
			12	20425	826.5	23.1	22.5
				20525	836.5	23.2	22.5
				20625	846.5	23.4	22.0
			24	20425	826.5	23.0	22.0
				20525	836.5	23.5	22.0
				20625	846.5	23.4	22.0
		12	0	20425	826.5	22.4	21.3
				20525	836.5	22.1	21.2
				20625	846.5	22.1	21.0
			6	20425	826.5	22.3	21.4
				20525	836.5	22.2	21.1
				20625	846.5	21.9	21.4
			13	20425	826.5	22.5	21.1
				20525	836.5	22.3	21.3
				20625	846.5	22.4	21.2
		25	0	20425	826.5	22.3	21.1
				20525	836.5	22.4	20.9
				20625	846.5	22.0	21.2
	10 MHz	1	0	20450	829.0	23.0	22.2
				20525	836.5	23.1	22.6
				20600	844.0	23.0	22.2
			24	20450	829.0	23.1	22.3
				20525	836.5	23.3	22.2
				20600	844.0	23.6	21.9
			49	20450	829.0	23.4	22.0
				20525	836.5	23.0	22.6
				20600	844.0	23.1	22.1
		25	0	20450	829.0	22.5	21.2
				20525	836.5	22.2	21.0
				20600	844.0	22.0	21.0
			13	20450	829.0	22.5	21.2
				20525	836.5	22.2	21.2
				20600	844.0	22.4	21.0
			25	20450	829.0	22.3	21.0
				20525	836.5	22.2	21.5
				20600	844.0	22.4	21.3
		50	0	20450	829.0	22.1	21.6
				20525	836.5	22.3	21.0
				20600	844.0	22.5	20.9

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	1.4 MHz	1	0	23017	699.7	23.3	22.5
				23095	707.5	23.4	22.4
				23173	715.3	23.2	22.4
			3	23017	699.7	23.3	22.1
				23095	707.5	23.4	22.5
				23173	715.3	23.3	22.2
			5	23017	699.7	23.4	22.4
				23095	707.5	23.2	22.4
				23173	715.3	23.5	21.9
		3	0	23017	699.7	23.2	22.0
				23095	707.5	23.1	22.1
				23173	715.3	23.5	22.1
			1	23017	699.7	23.1	22.0
				23095	707.5	23.5	21.9
				23173	715.3	23.5	22.4
			3	23017	699.7	23.1	22.1
				23095	707.5	23.4	22.0
				23173	715.3	23.3	22.3
		6	0	23017	699.7	22.3	21.5
				23095	707.5	22.2	21.5
				23173	715.3	22.3	21.0
	3 MHz	1	0	23025	700.5	23.6	22.4
				23095	707.5	23.1	22.0
				23165	714.5	23.2	22.1
			7	23025	700.5	23.0	22.4
				23095	707.5	23.0	22.1
				23165	714.5	23.4	22.4
			14	23025	700.5	23.4	22.4
				23095	707.5	23.4	22.2
				23165	714.5	23.0	22.5
		8	0	23025	700.5	22.1	21.4
				23095	707.5	22.3	21.4
				23165	714.5	22.0	20.9
			7	23025	700.5	22.5	21.5
				23095	707.5	22.3	21.1
				23165	714.5	22.5	21.5
			14	23025	700.5	22.0	21.0
				23095	707.5	22.2	21.1
				23165	714.5	22.5	21.5
		15	0	23025	700.5	22.5	21.2
				23095	707.5	22.1	21.6
				23165	714.5	22.2	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
12	5 MHz	1	0	23035	701.5	23.5	22.0
				23095	707.5	22.9	22.3
				23155	713.5	22.9	22.6
			12	23035	701.5	23.1	21.9
				23095	707.5	22.9	22.6
				23155	713.5	23.4	22.0
			24	23035	701.5	23.5	22.1
				23095	707.5	23.0	22.4
				23155	713.5	22.9	22.1
		12	0	23035	701.5	22.6	21.3
				23095	707.5	21.9	21.5
				23155	713.5	22.5	20.9
			6	23035	701.5	22.3	21.2
				23095	707.5	22.0	20.9
				23155	713.5	21.9	21.0
			13	23035	701.5	22.0	21.6
				23095	707.5	22.5	21.3
				23155	713.5	22.4	21.3
		25	0	23035	701.5	22.3	21.6
				23095	707.5	22.2	21.1
				23155	713.5	22.0	21.5
	10 MHz	1	0	23060	704.0	23.5	22.3
				23095	707.5	23.6	22.5
				23130	711.0	23.0	21.9
			24	23060	704.0	23.2	21.9
				23095	707.5	23.1	22.2
				23130	711.0	23.2	22.4
			49	23060	704.0	23.2	22.2
				23095	707.5	23.2	21.9
				23130	711.0	23.3	21.9
		25	0	23060	704.0	22.1	21.1
				23095	707.5	22.6	21.3
				23130	711.0	22.4	21.1
			13	23060	704.0	22.1	21.5
				23095	707.5	22.4	21.1
				23130	711.0	22.1	21.4
			25	23060	704.0	21.9	21.4
				23095	707.5	22.2	21.2
				23130	711.0	22.4	21.4
		50	0	23060	704.0	22.6	21.2
				23095	707.5	22.5	21.6
				23130	711.0	21.9	21.4

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
13	5 MHz	1	0	23205	779.5	23.2	22.6
				23230	782.0	23.4	22.1
				23129	784.5	23.3	22.4
			12	23205	779.5	23.5	22.0
				23230	782.0	23.3	22.1
				23129	784.5	23.6	21.9
			24	23205	779.5	23.5	22.4
				23230	782.0	23.3	22.1
				23129	784.5	23.6	22.3
		12	0	23205	779.5	22.4	21.2
				23230	782.0	22.0	21.5
				23129	784.5	22.5	21.4
			6	23205	779.5	22.1	21.3
				23230	782.0	22.0	21.5
				23129	784.5	22.1	21.5
			13	23205	779.5	22.0	21.5
				23230	782.0	22.3	21.4
				23129	784.5	22.0	21.2
		25	0	23205	779.5	22.0	21.6
				23230	782.0	22.5	21.3
				23129	784.5	22.5	20.9
	10 MHz	1	0	23230	782.0	23.5	22.5
			24	23230	782.0	23.3	22.2
			49	23230	782.0	23.4	22.2
		25	0	23230	782.0	22.0	21.5
			13	23230	782.0	21.9	21.2
			25	23230	782.0	22.4	21.5
		50	0	23230	782.0	22.5	21.1

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
14	5 MHz	1	0	23305	790.5	23.0	21.9
				23330	793.0	23.5	22.0
				23355	795.5	23.5	22.5
			12	23305	790.5	23.2	22.5
				23330	793.0	23.5	21.9
				23355	795.5	23.2	22.0
			24	23305	790.5	22.9	22.4
				23330	793.0	23.4	21.9
				23355	795.5	23.3	22.0
		12	0	23305	790.5	22.1	21.6
				23330	793.0	22.6	21.5
				23355	795.5	22.1	21.3
			6	23305	790.5	22.5	21.4
				23330	793.0	22.0	21.2
				23355	795.5	22.1	21.5
			13	23305	790.5	22.3	21.4
				23330	793.0	22.1	21.5
				23355	795.5	22.6	21.3
		25	0	23305	790.5	22.5	21.6
				23330	793.0	22.1	20.9
				23355	795.5	22.1	21.3
	10 MHz	1	0	23330	793.0	23.5	22.1
			24	23330	793.0	23.0	22.6
			49	23330	793.0	23.4	22.6
		25	0	23330	793.0	22.5	21.2
			13	23330	793.0	21.9	21.0
			25	23330	793.0	22.1	20.9
		50	0	23330	793.0	22.1	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	1.4 MHz	1	0	131979	1710.7	23.5	22.0
				132322	1745.0	23.4	22.0
				132665	1779.3	23.0	22.3
			3	131979	1710.7	23.1	22.3
				132322	1745.0	23.4	22.5
				132665	1779.3	23.5	22.0
			5	131979	1710.7	23.4	21.9
				132322	1745.0	23.6	22.0
				132665	1779.3	23.3	22.0
		3	0	131979	1710.7	23.4	22.0
				132322	1745.0	23.3	22.2
				132665	1779.3	23.5	22.6
			1	131979	1710.7	23.5	22.4
				132322	1745.0	23.1	21.9
				132665	1779.3	23.4	22.5
			3	131979	1710.7	23.4	22.5
				132322	1745.0	23.1	22.1
				132665	1779.3	23.3	22.0
		6	0	131979	1710.7	22.2	21.0
				132322	1745.0	22.5	21.6
				132665	1779.3	21.9	21.3
	3 MHz	1	0	131987	1711.5	23.2	22.1
				132322	1745.0	23.0	22.1
				132657	1778.5	23.6	22.5
			7	131987	1711.5	23.4	22.5
				132322	1745.0	23.2	22.2
				132657	1778.5	23.5	22.2
			14	131987	1711.5	23.0	22.4
				132322	1745.0	23.0	21.9
				132657	1778.5	23.4	22.1
		8	0	131987	1711.5	22.3	21.1
				132322	1745.0	22.4	21.2
				132657	1778.5	22.4	21.0
			7	131987	1711.5	22.2	21.5
				132322	1745.0	22.4	20.9
				132657	1778.5	22.5	21.1
			14	131987	1711.5	22.0	21.2
				132322	1745.0	22.0	21.4
				132657	1778.5	22.2	21.4
		15	0	131987	1711.5	22.6	21.2
				132322	1745.0	22.1	21.0
				132657	1778.5	22.1	21.3

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	5 MHz	1	0	131997	1712.5	23.4	22.0
				132322	1745.0	23.1	22.3
				132646	1777.4	23.2	22.0
			12	131997	1712.5	23.4	22.1
				132322	1745.0	23.5	22.0
				132646	1777.4	23.6	22.4
			24	131997	1712.5	23.2	22.4
				132322	1745.0	23.0	22.3
				132646	1777.4	23.1	22.2
		12	0	131997	1712.5	22.3	21.4
				132322	1745.0	22.6	20.9
				132646	1777.4	22.0	20.9
			6	131997	1712.5	22.5	21.2
				132322	1745.0	22.1	21.4
				132646	1777.4	22.1	21.2
			13	131997	1712.5	22.3	21.4
				132322	1745.0	22.5	21.5
				132646	1777.4	22.3	21.2
		25	0	131997	1712.5	22.6	21.1
				132322	1745.0	22.4	21.3
				132646	1777.4	22.4	21.5
	10 MHz	1	0	132033	1716.1	23.3	22.2
				132322	1745.0	23.1	22.5
				132621	1774.9	23.1	22.5
			24	132033	1716.1	23.1	22.3
				132322	1745.0	22.9	22.2
				132621	1774.9	23.5	22.2
			49	132033	1716.1	23.6	22.5
				132322	1745.0	23.2	22.2
				132621	1774.9	23.3	22.0
		25	0	132033	1716.1	22.3	21.1
				132322	1745.0	22.0	21.5
				132621	1774.9	22.1	21.5
			13	132033	1716.1	22.3	21.5
				132322	1745.0	21.9	21.3
				132621	1774.9	22.6	21.2
			25	132033	1716.1	22.4	21.5
				132322	1745.0	22.1	21.4
				132621	1774.9	22.2	21.5
		50	0	132033	1716.1	22.1	21.2
				132322	1745.0	22.6	21.4
				132621	1774.9	22.1	21.2

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
66	15 MHz	1	0	132047	1717.5	23.6	22.4
				132322	1745.0	23.5	21.9
				132596	1772.4	23.0	22.2
			37	132047	1717.5	23.0	22.3
				132322	1745.0	23.1	22.3
				132596	1772.4	23.4	22.4
			74	132047	1717.5	23.5	22.2
				132322	1745.0	23.2	22.2
				132596	1772.4	23.5	22.2
		36	0	132047	1717.5	22.3	21.3
				132322	1745.0	22.0	21.1
				132596	1772.4	22.3	21.3
			19	132047	1717.5	22.4	21.1
				132322	1745.0	22.5	21.3
				132596	1772.4	22.3	21.3
			39	132047	1717.5	22.2	21.3
				132322	1745.0	22.5	21.5
				132596	1772.4	22.5	21.4
		75	0	132047	1717.5	22.2	21.2
				132322	1745.0	22.1	21.5
				132596	1772.4	22.2	21.5
	20 MHz	1	0	132072	1720.0	23.0	22.2
				132322	1745.0	23.0	22.5
				132571	1769.9	23.2	22.5
			49	132072	1720.0	23.4	22.2
				132322	1745.0	23.1	22.5
				132571	1769.9	23.3	22.2
			99	132072	1720.0	23.1	22.1
				132322	1745.0	23.0	22.6
				132571	1769.9	23.5	22.1
		50	0	132072	1720.0	22.2	21.2
				132322	1745.0	22.2	21.4
				132571	1769.9	22.1	21.4
			24	132072	1720.0	22.1	21.3
				132322	1745.0	22.5	21.4
				132571	1769.9	22.1	20.9
			50	132072	1720.0	22.3	21.4
				132322	1745.0	22.6	21.3
				132571	1769.9	22.3	21.0
		100	0	132072	1720.0	22.0	21.5
				132322	1745.0	22.0	21.6
				132571	1769.9	22.3	21.1

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
71	5 MHz	1	0	133147	665.5	23.0	22.3
				133297	680.5	23.1	22.5
				133447	695.5	22.9	22.4
			12	133147	665.5	22.9	22.4
				133297	680.5	23.5	22.0
				133447	695.5	23.4	22.2
			24	133147	665.5	23.2	22.1
				133297	680.5	23.4	22.5
				133447	695.5	23.1	21.9
		12	0	133147	665.5	22.3	21.3
				133297	680.5	22.2	21.2
				133447	695.5	22.0	21.2
			6	133147	665.5	22.0	21.5
				133297	680.5	22.6	21.2
				133447	695.5	22.6	21.3
			13	133147	665.5	22.2	21.0
				133297	680.5	22.6	21.6
				133447	695.5	22.4	21.1
		25	0	133147	665.5	22.3	20.9
				133297	680.5	22.0	21.3
				133447	695.5	22.1	21.2
	10 MHz	1	0	133172	668.0	23.2	22.1
				133297	680.5	23.2	22.1
				133422	693.0	23.2	22.0
			24	133172	668.0	22.9	22.2
				133297	680.5	23.4	22.3
				133422	693.0	23.5	22.2
			49	133172	668.0	23.5	22.2
				133297	680.5	23.5	22.2
				133422	693.0	22.9	22.1
		25	0	133172	668.0	22.5	21.4
				133297	680.5	22.3	21.0
				133422	693.0	22.0	21.3
			13	133172	668.0	22.2	21.6
				133297	680.5	22.0	21.2
				133422	693.0	22.1	21.1
			25	133172	668.0	22.6	21.5
				133297	680.5	22.4	21.0
				133422	693.0	22.2	21.4
		50	0	133172	668.0	22.0	21.1
				133297	680.5	22.0	21.3
				133422	693.0	22.3	21.0

Band	Bandwidth	RB Size	RB Offset	Channel	Frequency	QPSK	16QAM
71	15 MHz	1	0	133197	670.5	23.3	21.9
				133297	680.5	23.1	22.1
				133397	690.5	22.9	22.3
			37	133197	670.5	23.3	22.3
				133297	680.5	22.9	22.6
				133397	690.5	23.2	22.2
			74	133197	670.5	23.5	22.3
				133297	680.5	23.3	22.5
				133397	690.5	23.1	22.6
		36	0	133197	670.5	22.1	21.0
				133297	680.5	22.0	21.1
				133397	690.5	22.3	21.0
			19	133197	670.5	22.4	21.3
				133297	680.5	22.0	21.0
				133397	690.5	22.0	21.3
			39	133197	670.5	22.4	21.2
				133297	680.5	21.9	21.6
				133397	690.5	22.6	21.3
		75	0	133197	670.5	22.2	21.1
				133297	680.5	22.1	21.0
				133397	690.5	22.2	21.4
	20 MHz	1	0	133222	673.0	23.4	22.2
				133297	680.5	23.2	22.2
				133372	688.0	23.6	22.2
			49	133222	673.0	23.2	22.3
				133297	680.5	23.0	22.4
				133372	688.0	23.2	22.3
			99	133222	673.0	23.4	22.1
				133297	680.5	23.1	22.3
				133372	688.0	23.3	22.2
		50	0	133222	673.0	22.1	20.9
				133297	680.5	22.0	21.3
				133372	688.0	22.4	21.1
			24	133222	673.0	22.3	21.2
				133297	680.5	22.2	21.2
				133372	688.0	22.0	21.1
			50	133222	673.0	22.4	21.5
				133297	680.5	22.0	20.9
				133372	688.0	22.1	21.5
		100	0	133222	673.0	22.1	21.2
				133297	680.5	22.4	21.3
				133372	688.0	22.0	21.6

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	Tx0	18.04	20.00
			6	2437			18.12	20.00
			11	2462			18.00	20.00
			1	2412		Tx1	18.06	20.00
			6	2437			18.18	20.00
			11	2462			18.11	20.00
	802.11g	20	1	2412	6 Mbps	Tx0	Not Required	20.00
			6	2437				20.00
			11	2462				20.00
			1	2412		Tx1		20.00
			6	2437				20.00
			11	2462				20.00
	802.11n	20	1	2412	MCS0	Tx0		20.00
			6	2437				20.00
			11	2462				20.00
			1	2412		Tx1		20.00
			6	2437				20.00
			11	2462				20.00
5.15-5.25 GHz	802.11a	20	36	5180	6 Mbps	Tx0	Not Required	20.00
			40	5200				20.00
			44	5220				20.00
			48	5240				20.00
			36	5180		Tx1		20.00
			40	5200				20.00
			44	5220				20.00
			48	5240				20.00
	802.11n/ac/ax	20	36	5180	MCS0	Tx0		20.00
			40	5200				20.00
			44	5220				20.00
			48	5240				20.00
			36	5180		Tx1		20.00
			40	5200				20.00
			44	5220				20.00
			48	5240				20.00
	802.11n/ac/ax	40/80	36	5180	MCS0	Tx0		19.50
			40	5200				19.50
			44	5220				19.50
			48	5240				19.50
			36	5180		Tx1		19.50
			40	5200				19.50
			44	5220				19.50
			48	5240				19.50

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Antenna	Avg Power (dBm)	Tune-up Pwr (dBm)
5.25-5.35 GHz	802.11a	20	52	5260	6 Mbps	Tx0	18.19	20.00
			56	5280			18.22	20.00
			60	5300			18.28	20.00
			64	5320			18.21	20.00
			52	5260		Tx1	18.23	20.00
			56	5280			18.29	20.00
			60	5300			18.31	20.00
			64	5320			18.26	20.00
	802.11n/ac/ax	20	52	5260	MCS0	Tx0	Not Required	20.00
			56	5280				20.00
			60	5300				20.00
			64	5320				20.00
			52	5260		Tx1		20.00
			56	5280				20.00
			60	5300				20.00
			64	5320				20.00
	802.11n/ac/ax	40/80	54	5270	MCS0	Tx0		19.50
			56	5280				19.50
			60	5300				19.50
			62	5310				19.50
			54	5270		Tx1		19.50
			56	5280				19.50
			60	5300				19.50
			62	5310				19.50
5600 MHz	802.11a	20	104	5520	6 Mbps	Tx0	18.35	20.00
			116	5580			18.39	20.00
			124	5620			18.42	20.00
			136	5680			18.34	20.00
			104	5520		Tx1	18.41	20.00
			116	5580			18.45	20.00
			124	5620			18.49	20.00
			136	5680			18.38	20.00
	802.11n/ac/ax	20	104	5520	MCS0	Tx0	Not Required	20.00
			116	5580				20.00
			124	5620				20.00
			136	5680				20.00
			104	5520		Tx1		20.00
			116	5580				20.00
			124	5620				20.00
			136	5680				20.00
	802.11n/ac/ax	40/80	104	5520	MCS0	Tx0		19.50
			116	5580				19.50
			124	5620				19.50
			136	5680				19.50
			104	5520		Tx1		19.50
			116	5580				19.50
			124	5620				19.50
			136	5680				19.50

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	Tx0	18.27	20.00
			153	5765			18.21	20.00
			157	5785			18.36	20.00
			161	5805			18.25	20.00
			165	5825			18.32	20.00
			149	5745		Tx1	18.32	20.00
			153	5765			18.29	20.00
			157	5785			18.39	20.00
			161	5805			18.31	20.00
			165	5825			18.36	20.00
	802.11n/ac/ax	20	149	5745	MCS0	Tx0	Not Required	20.00
			153	5765				20.00
			157	5785				20.00
			161	5805				20.00
			165	5825				20.00
			149	5745		Tx1		20.00
			153	5765				20.00
			157	5785				20.00
			161	5805				20.00
			165	5825				20.00
	802.11n/ac/ax	40/80	149	5745	MCS0	Tx0		19.50
			153	5765				19.50
			157	5785				19.50
			161	5805				19.50
			165	5825				19.50
			149	5745		Tx1		19.50
			153	5765				19.50
			157	5785				19.50
			161	5805				19.50
			165	5825				19.50

10. SAR Test Results

General Note:

1. Per KDB 447498 D01 v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
2. Per KDB 447498 D01 v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01 v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

UMTS Note:

1. Per KDB 941225 D01 v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01 v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

LTE Note:

1. Per KDB 941225 D05 v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
2. Per KDB 941225 D05 v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05 v02r05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
4. Per KDB 941225 D05 v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
5. Per KDB 941225 D05 v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05 v02r05, smaller bandwidth SAR testing is not required.
6. For LTE band 13/14, the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05 v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
7. LTE band 4 SAR test was covered by Band 66; according to TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. The maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion.
   b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA II	RMC 12.2Kbps	Headstand	0mm	9400	1880	23.75	25.00	0.132	0.18
1	WCDMA II	RMC 12.2Kbps		0mm	9262	1852.4	23.87	25.00	0.176	0.23
	WCDMA II	RMC 12.2Kbps		0mm	9400	1880	23.74	25.00	0.153	0.20
	WCDMA IV	RMC 12.2Kbps		0mm	1312	1712.4	23.68	25.00	0.154	0.21
2	WCDMA IV	RMC 12.2Kbps		0mm	1413	1732.6	23.83	25.00	0.179	0.23
	WCDMA IV	RMC 12.2Kbps		0mm	1513	1752.6	23.62	25.00	0.144	0.20
	WCDMA V	RMC 12.2Kbps		0mm	4132	826.4	23.97	25.00	0.168	0.21
3	WCDMA V	RMC 12.2Kbps		0mm	4183	836.6	23.58	25.00	0.182	0.25
	WCDMA V	RMC 12.2Kbps		0mm	4233	846.6	24.00	25.00	0.157	0.20

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 2	20M	QPSK	1	49	Headstand	0mm	18700	1860	23.0	25.0	0.125	0.20
4	LTE Band 2	20M	QPSK	1	49		0mm	18900	1880	23.2	25.0	0.139	0.21
	LTE Band 2	20M	QPSK	1	49		0mm	19099	1900	23.2	25.0	0.114	0.17
	LTE Band 2	20M	QPSK	50	24		0mm	18900	1880	22.5	24.0	0.0852	0.12
	LTE Band 5	10M	QPSK	1	24		0mm	20450	829.0	23.1	25.0	0.115	0.18
5	LTE Band 5	10M	QPSK	1	24		0mm	20525	836.5	23.3	25.0	0.126	0.19
	LTE Band 5	10M	QPSK	1	24		0mm	20599	844.0	23.6	25.0	0.108	0.15
	LTE Band 5	10M	QPSK	25	12		0mm	20525	836.5	22.2	24.0	0.0816	0.12
	LTE Band 12	10M	QPSK	1	24		0mm	23060	704.0	23.2	25.0	0.129	0.20
6	LTE Band 12	10M	QPSK	1	24		0mm	23095	707.5	23.1	25.0	0.137	0.21
	LTE Band 12	10M	QPSK	1	24		0mm	23129	711.0	23.2	25.0	0.124	0.19
	LTE Band 12	10M	QPSK	25	12		0mm	23095	707.5	22.4	24.0	0.101	0.15
7	LTE Band 13	10M	QPSK	1	24		0mm	23230	782	23.3	25.0	0.106	0.16
	LTE Band 13	10M	QPSK	25	12		0mm	23230	782	21.9	24.0	0.0627	0.10
8	LTE Band 14	10M	QPSK	1	24		0mm	23330	793	23.0	25.0	0.102	0.16
	LTE Band 14	10M	QPSK	25	12		0mm	23330	793	21.9	24.0	0.0597	0.10
	LTE Band 66	20M	QPSK	1	49		0mm	132072	1720	23.4	25.0	0.149	0.22
9	LTE Band 66	20M	QPSK	1	49		0mm	132322	1745	23.1	25.0	0.161	0.25
	LTE Band 66	20M	QPSK	1	49		0mm	132571	1770	23.3	25.0	0.151	0.22
	LTE Band 66	20M	QPSK	50	24		0mm	132322	1745	22.5	24.0	0.137	0.19
	LTE Band 71	20M	QPSK	1	49		0mm	133222	680.5	23.2	25.0	0.112	0.17
10	LTE Band 71	20M	QPSK	1	49		0mm	133222	680.5	23.0	25.0	0.119	0.19
	LTE Band 71	20M	QPSK	1	49		0mm	133222	680.5	23.2	25.0	0.102	0.15
	LTE Band 71	20M	QPSK	50	24		0mm	133222	680.5	22.2	24.0	0.0863	0.13

Plot No.	Band	BW (MHz)	Modulation	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	2.45 GHz Ant Tx0	20M	CCK	Back	0mm	6	2437	18.12	20.00	0.0156	0.02
11	2.45 GHz Ant Tx1	20M	CCK		0mm	6	2437	18.18	20.00	0.0370	0.06
	5.25 GHz Ant Tx0	20M	OFDM		0mm	60	5300	18.21	20.00	0.0968	0.15
12	5.25 GHz Ant Tx1	20M	OFDM		0mm	60	5300	18.26	20.00	0.140	0.21
	5.60 GHz Ant Tx0	20M	OFDM		0mm	124	5620	18.42	20.00	0.0829	0.12
13	5.60 GHz Ant Tx1	20M	OFDM		0mm	124	5620	18.49	20.00	0.150	0.21
	5.75 GHz Ant Tx0	20M	OFDM		0mm	157	5785	18.36	20.00	0.141	0.21
14	5.75 GHz Ant Tx1	20M	OFDM		0mm	157	5785	19.39	20.00	0.271	0.31

11. Simultaneous Transmission Analysis

Sim-Tx configuration

No.	Simultaneous Transmission Configuration	Exposure Positions
		Head
1	UMTS + 2.4 GHz Wifi Tx0 + 2.4 GHz WiFi Tx1	Yes
2	UMTS + 5 GHz Wifi Tx0 + 5 GHz WiFi Tx1	Yes
3	LTE + 2.4 GHz Wifi Tx0 + 2.4 GHz WiFi Tx1	Yes
4	LTE + 5 GHz Wifi Tx0 + 5 GHz WiFi Tx1	Yes

General Note:

1. The following summations represent the absolute worst cases for simultaneous transmission with WWAN and WLAN.
2. The Scaled SAR summation is calculated based on the same configuration and test position.

Head Exposure Conditions

WWAN Band	Antenna	Exposure Position	1	2	3	4	5	1+2+3 Summed 1g SAR (W/kg)	1+4+5 Summed 1g SAR (W/kg)
			WWAN	2.4GHz Wi-Fi Tx0	2.4GHz Wi-Fi Tx1	5GHz Wi-Fi Tx0	5GHz Wi-Fi Tx1		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
WCDMA Band 2	Main	Headstand	0.23	0.02	0.06	0.21	0.31	0.31	0.75
WCDMA Band 4	Main		0.23	0.02	0.06	0.21	0.31	0.31	0.75
WCDMA Band 5	Main		0.25	0.02	0.06	0.21	0.31	0.33	0.77
LTE Band 2	Main		0.21	0.02	0.06	0.21	0.31	0.29	0.73
LTE Band 5	Main		0.19	0.02	0.06	0.21	0.31	0.27	0.71
LTE Band 12	Main		0.21	0.02	0.06	0.21	0.31	0.29	0.73
LTE Band 13	Main		0.16	0.02	0.06	0.21	0.31	0.24	0.68
LTE Band 14	Main		0.16	0.02	0.06	0.21	0.31	0.24	0.68
LTE Band 66	Main		0.25	0.02	0.06	0.21	0.31	0.33	0.77
LTE Band 71	Main		0.19	0.02	0.06	0.21	0.31	0.27	0.71

The worst case summation is WCDMA Band 5 with 5 GHz WiFi (MIMO) and LTE Band 66 with 5 GHz WiFi (MIMO). The value is 0.77 W/kg which is below the limit. Therefore, the simultaneous evaluation is excluded..

12. Test Equipment List

Table 12.1 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
Headstand Phantom	N/A	N/A	1005
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	09/04/2025	09/04/2024	759
SPEAG E-Field Probe EX3DV4	01/18/2025	01/18/2024	7530
Speag Validation Dipole D750V2	05/10/2025	05/10/2024	1016
Speag Validation Dipole D900V2	05/10/2025	05/10/2024	1d044
Speag Validation Dipole D1750V2	05/10/2025	05/10/2024	1018
Speag Validation Dipole D1900V2	05/06/2025	05/06/2024	5d116
Speag Validation Dipole D2450V2	05/06/2025	05/06/2024	829
Speag Validation Dipole D5GHzV2	05/08/2025	05/08/2024	1085
Agilent N1911A Power Meter	03/08/2025	03/08/2024	GB45100254
Agilent N1922A Power Sensor	03/08/2025	03/08/2024	MY45240464
Agilent (HP) 8596E Spectrum Analyzer	03/08/2025	03/08/2024	3826A01468
Agilent (HP) 83752A Synthesized Sweeper	03/08/2025	03/08/2024	3610A01048
Agilent (HP) 8753C Vector Network Analyzer	03/08/2025	03/08/2024	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/07/2025	03/07/2024	2904A00595
Copper Mountain R140 Vector Reflectometer	03/08/2025	03/08/2024	21390004
Anritsu MT8820C	N/A	N/A	6201381721
Aprel Dielectric Probe Assembly	N/A	N/A	0011
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 (3-6 GHz)	N/A	N/A	N/A

13. Conclusion

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

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

14. 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 – 2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, 2002.

[4] 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.

Appendix A – System Validation Plots and Data

****
Test Result for UIM Dielectric Parameter
Thu 24/Oct/2024
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
0.6700	42.27	0.88	41.72	0.86
0.6730	42.264	0.883	41.711	0.863*
0.6800	42.25	0.89	41.69	0.87
0.6805	42.249	0.89	41.689	0.87*
0.6880	42.226	0.89	41.674	0.87*
0.6900	42.22	0.89	41.67	0.87
0.7000	42.20	0.89	41.65	0.87
0.7040	42.18	0.89	41.622	0.874*
0.7075	42.163	0.89	41.598	0.878*
0.7100	42.15	0.89	41.58	0.88
0.7110	42.145	0.89	41.575	0.881*
0.7200	42.10	0.89	41.53	0.89
0.7300	42.05	0.89	41.46	0.90
0.7400	41.99	0.89	41.40	0.90
0.7500	41.94	0.89	41.35	0.91
0.7600	41.89	0.89	41.29	0.92
0.7700	41.84	0.89	41.23	0.93
0.7800	41.79	0.90	41.17	0.93
0.7820	41.778	0.90	41.158	0.932*
0.7900	41.73	0.90	41.11	0.94
0.7930	41.715	0.90	41.098	0.94*
0.8000	41.68	0.90	41.07	0.94

* value interpolated

****
Test Result for UIM Dielectric Parameter
Thu 24/Oct/2024
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	41.30	0.90
0.8100	41.63	0.90	41.25	0.91
0.8200	41.58	0.90	41.19	0.92
0.8264	41.548	0.90	41.222	0.92*
0.8290	41.535	0.90	41.235	0.92*
0.8300	41.53	0.90	41.24	0.92
0.8365	41.511	0.907	41.221	0.927*
0.8366	41.51	0.907	41.22	0.927*
0.8400	41.50	0.91	41.21	0.93
0.8440	41.50	0.92	41.19	0.94*
0.8466	41.50	0.917	41.197	0.937*
0.8500	41.50	0.92	41.19	0.94
0.8600	41.50	0.93	41.17	0.95
0.8700	41.50	0.94	41.15	0.96
0.8800	41.50	0.95	41.14	0.97
0.8900	41.50	0.96	41.13	0.98
0.9000	41.50	0.97	41.12	0.99
0.9100	41.50	0.98	41.11	1.00
0.9200	41.49	0.98	41.10	1.00
0.9300	41.47	0.99	41.08	1.01

* value interpolated

****
Test Result for UIM Dielectric Parameter
Thu 24/Oct/2024
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	39.87	1.34
1.7100	40.14	1.35	39.85	1.35
1.7124	40.138	1.35	39.845	1.352*
1.7200	40.13	1.35	39.83	1.36
1.7300	40.11	1.36	39.81	1.36
1.7326	40.105	1.363	39.805	1.363*
1.7400	40.09	1.37	39.79	1.37
1.7450	40.085	1.37	39.78	1.375*
1.7500	40.08	1.37	39.77	1.38
1.7524	40.075	1.372	39.765	1.382*
1.7600	40.06	1.38	39.75	1.39
1.7700	40.05	1.38	39.73	1.40
1.7800	40.03	1.39	39.71	1.40
1.7900	40.02	1.39	39.69	1.41

* value interpolated

****
Test Result for UIM Dielectric Parameter
Fri 25/Oct/2024
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
1.8500	40.00	1.40	39.88	1.36
1.8524	40.00	1.40	39.875	1.36*
1.8600	40.00	1.40	39.86	1.36
1.8700	40.00	1.40	39.84	1.37
1.8800	40.00	1.40	39.83	1.37
1.8900	40.00	1.40	39.82	1.38
1.9000	40.00	1.40	39.82	1.38
1.9076	40.00	1.40	39.805	1.388*
1.9100	40.00	1.40	39.80	1.39
1.9200	40.00	1.40	39.79	1.39
1.9300	40.00	1.40	39.78	1.40

*value interpolated

```
************************************************************
Test Result for UIM Dielectric Parameter
Fri 25/Oct/2024
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
2.4500	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
2.4800	39.16	1.83	38.30	1.86

* value interpolated

****
Test Result for UIM Dielectric Parameter
Fri 25/Oct/2024
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 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN 1016

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.91 S/m; ε_r = 41.35; ρ = 1000 kg/m^3
Phantom section: Flat Section

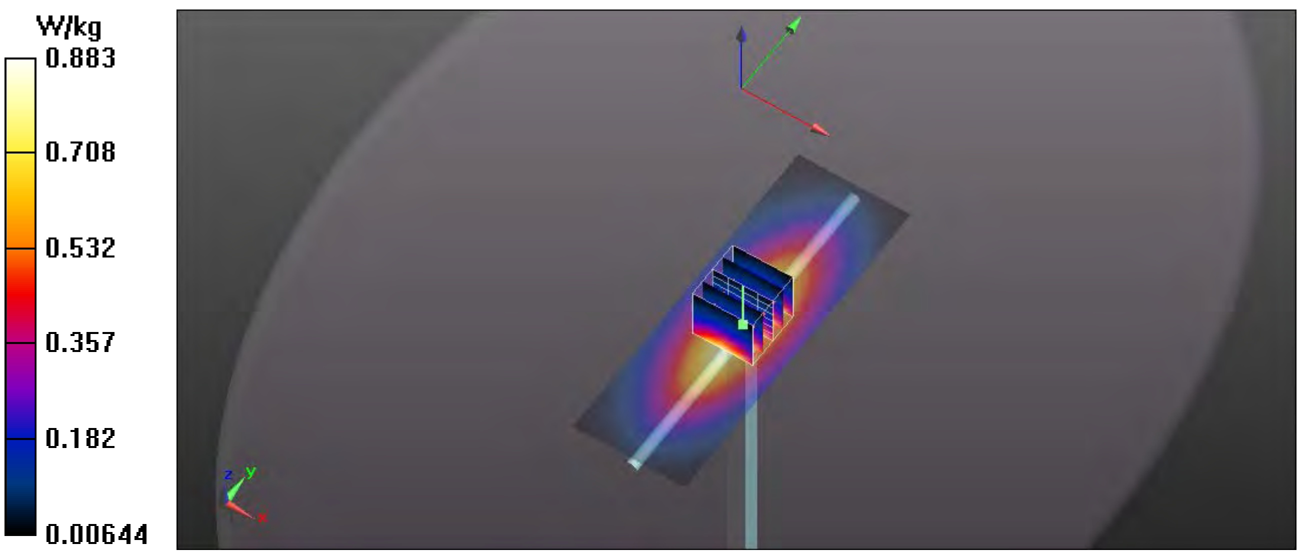
Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.27, 9.72, 10); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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) = 0.875 W/kg

750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.697 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.923 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) = 0.883 W/kg



RF Exposure Lab

Plot 2

DUT: Dipole 900 MHz D900V2; Type: D900V2; Serial: D900V2 - SN: 1d144

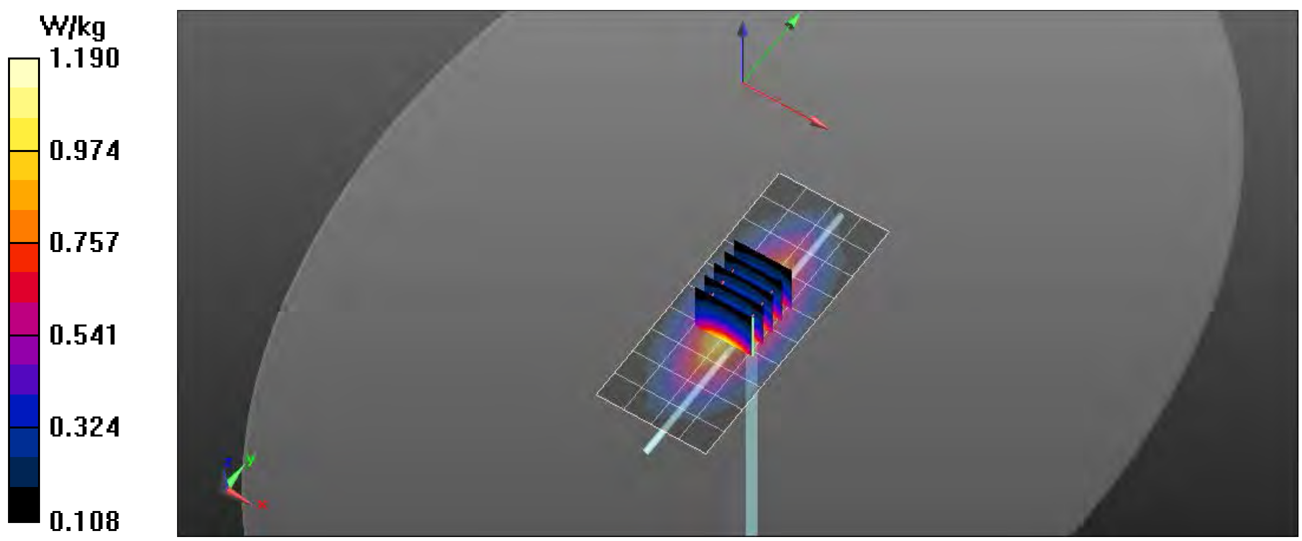
Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used: f = 900 MHz; σ = 0.99 S/m; ε_r = 41.12; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(9.35, 9.36, 8.99); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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) = 1.14 W/kg

900 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.692 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.44 W/kg
P_{in}= 100 mW
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.722 W/kg
Maximum value of SAR (measured) = 1.19 W/kg



RF Exposure Lab

Plot 3

DUT: Dipole 1750 MHz D1750V2; Type: D1750V2; Serial: D1750V2 - SN: 1018

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.38 S/m; ε_r = 39.77; ρ = 1000 kg/m^3
Phantom section: Flat Section

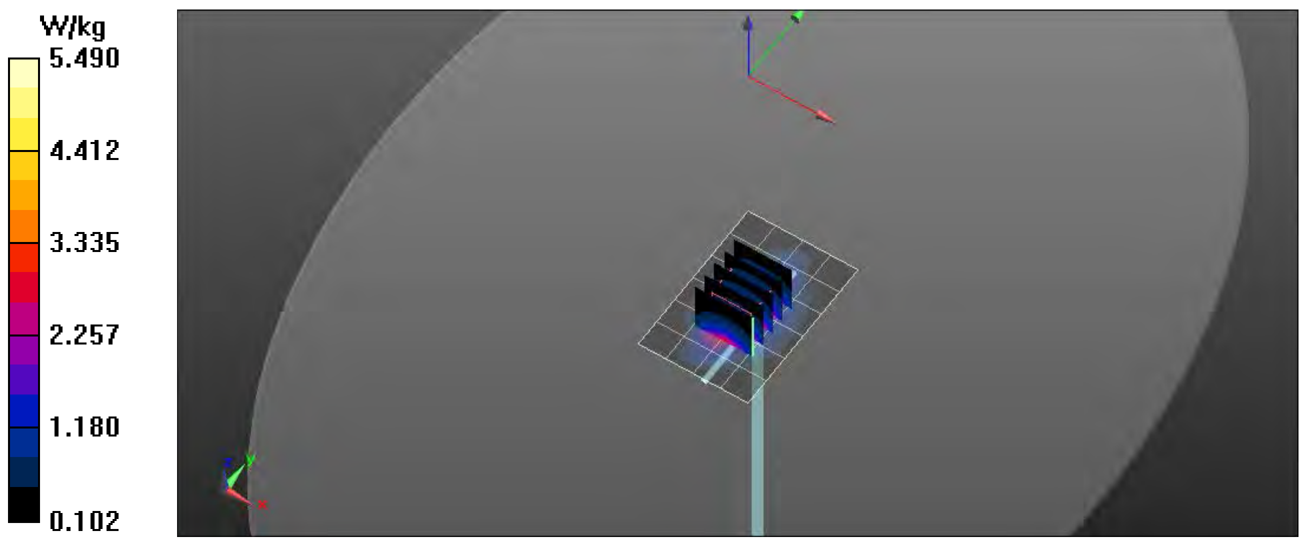
Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.14, 8.22, 8.4); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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) = 5.33 W/kg

1750 MHz/Verification/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.227 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 6.89 W/kg
P_{in}= 100 mW
SAR(1 g) = 3.79 W/kg; SAR(10 g) = 1.99 W/kg
Maximum value of SAR (measured) = 5.49 W/kg



RF Exposure Lab

Plot 4

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.82; ρ = 1000 kg/m^3
Phantom section: Flat Section

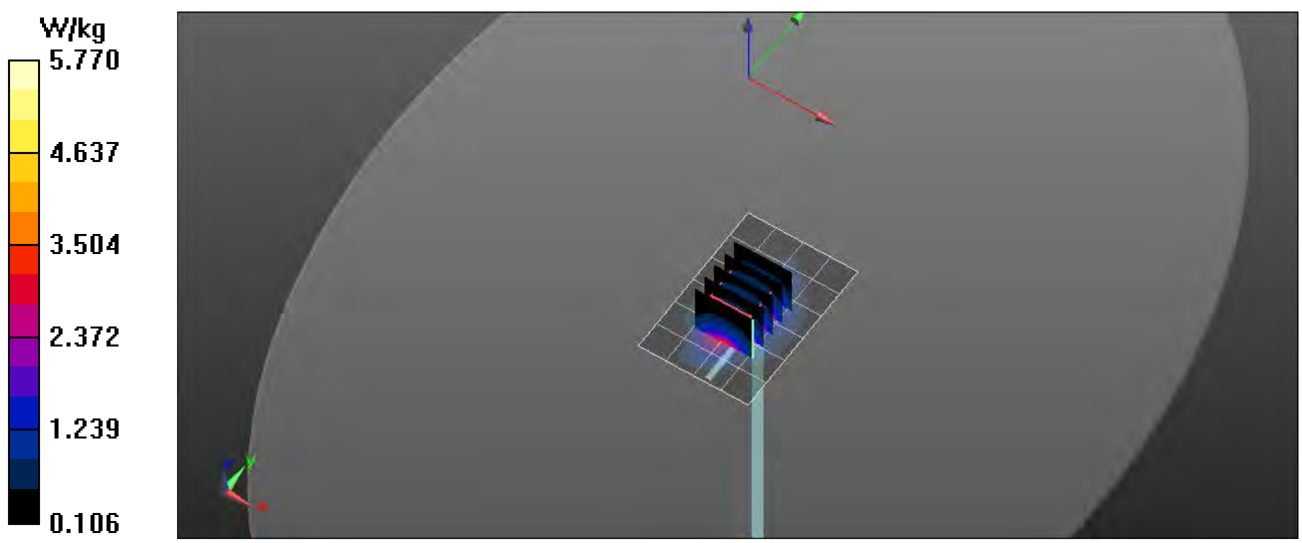
Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.99, 8.02, 8.17); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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) = 4.12 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 5.79 W/kg



RF Exposure Lab

Plot 5

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

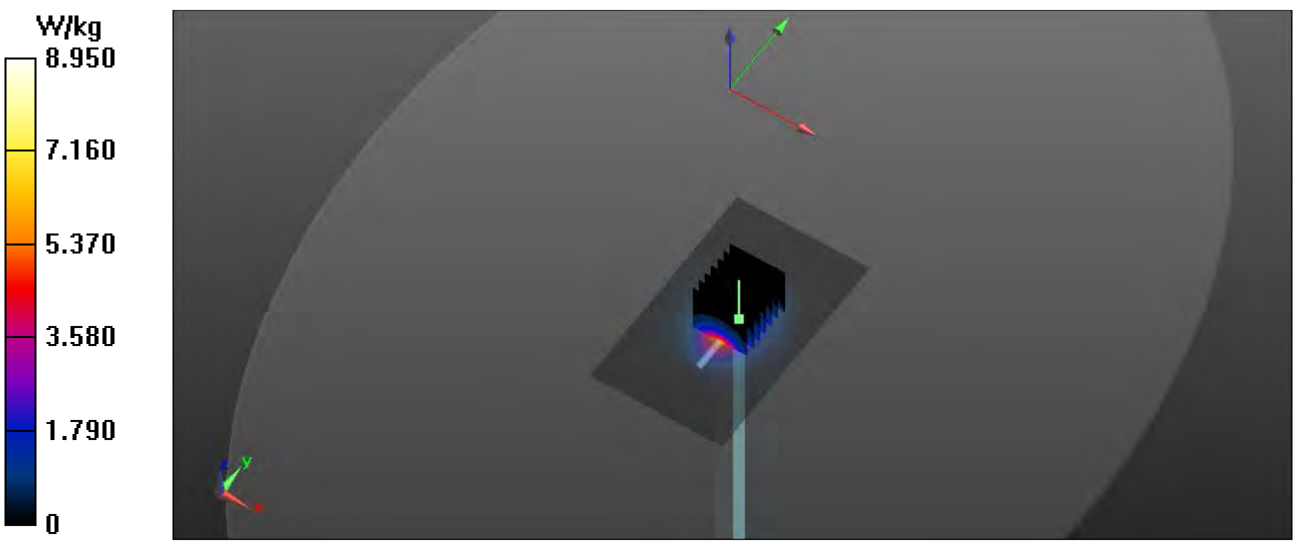
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 38.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(7.13, 7.14, 7.18); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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



RF Exposure Lab

Plot 6

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1085

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: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(5.2, 5.25, 5.31); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

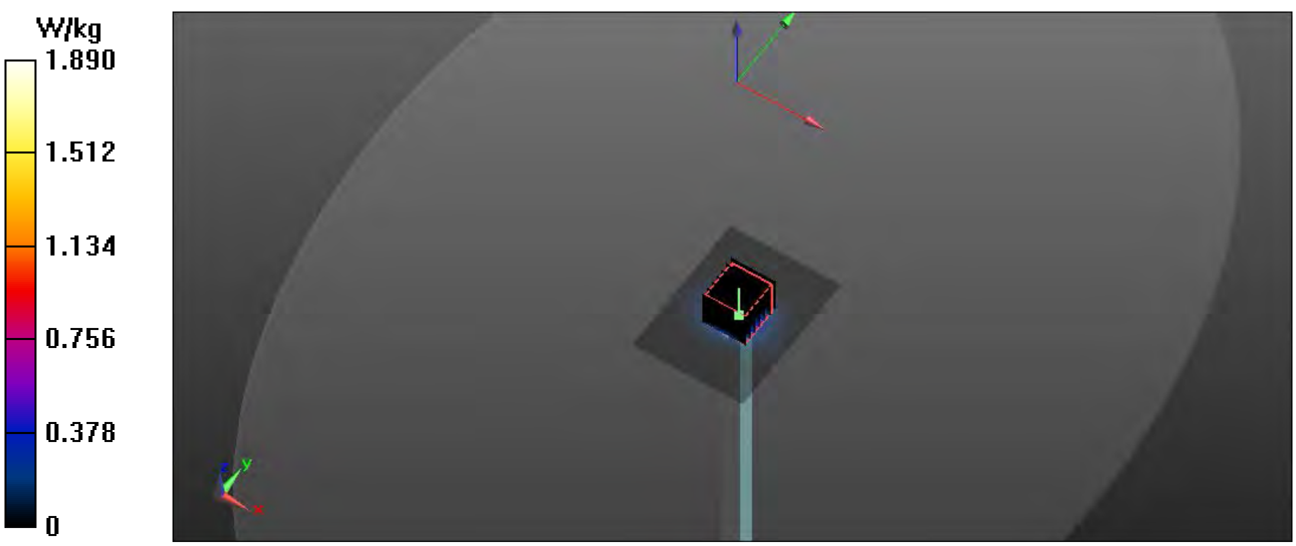
Procedure Notes:

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



RF Exposure Lab

Plot 7

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1085

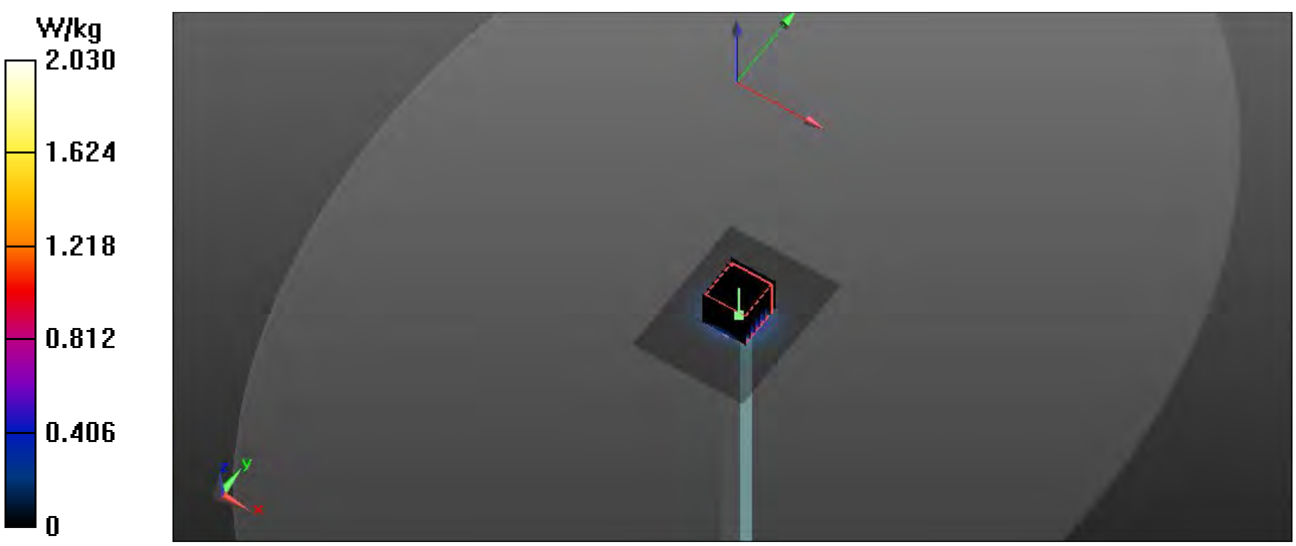
Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used: f = 5600 MHz; σ = 5.11 S/m; ε_r = 34.35; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(4.31, 4.38, 4.47); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
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



RF Exposure Lab

Plot 8

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1085

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: 10/25/2025; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN7530; ConvF(4.5, 4.55, 4.68); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

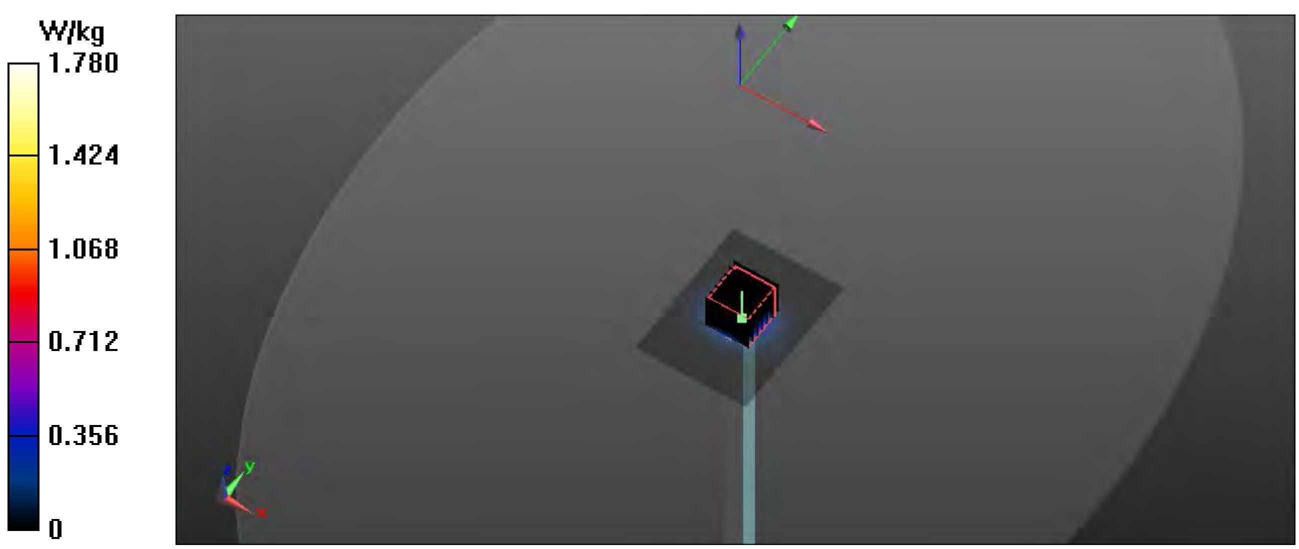
Procedure Notes:

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



Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: UMTS (WCDMA); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1880 MHz; σ = 1.37 S/m; ε_r = 39.83; ρ = 1000 kg/m^3
Phantom section: Head Section

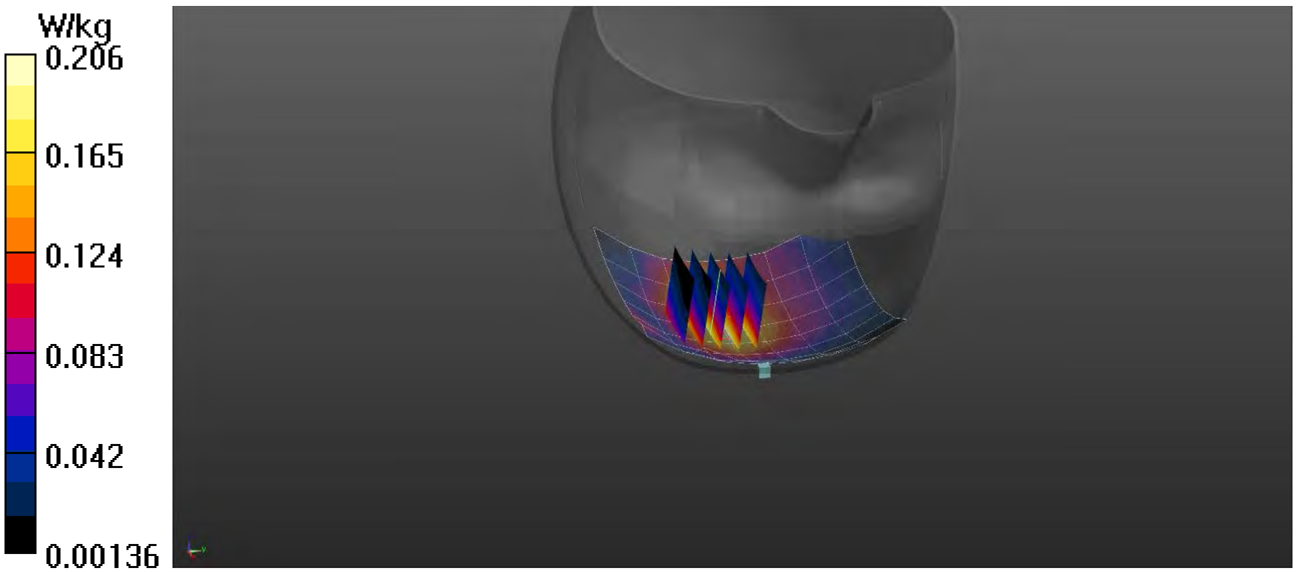
Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.99, 8.02, 8.17); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Band 2 UMTS/Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.208 W/kg

Band 2 UMTS/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.398 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.239 W/kg
SAR(1 g) = 0.176 W/kg
Maximum value of SAR (measured) = 0.206 W/kg



RF Exposure Lab

Plot 2

DUT: Firefighter Helmet; Type: Connected Helmet; 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 = 1.363 S/m; ε_r = 39.805; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.14, 8.22, 8.4); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

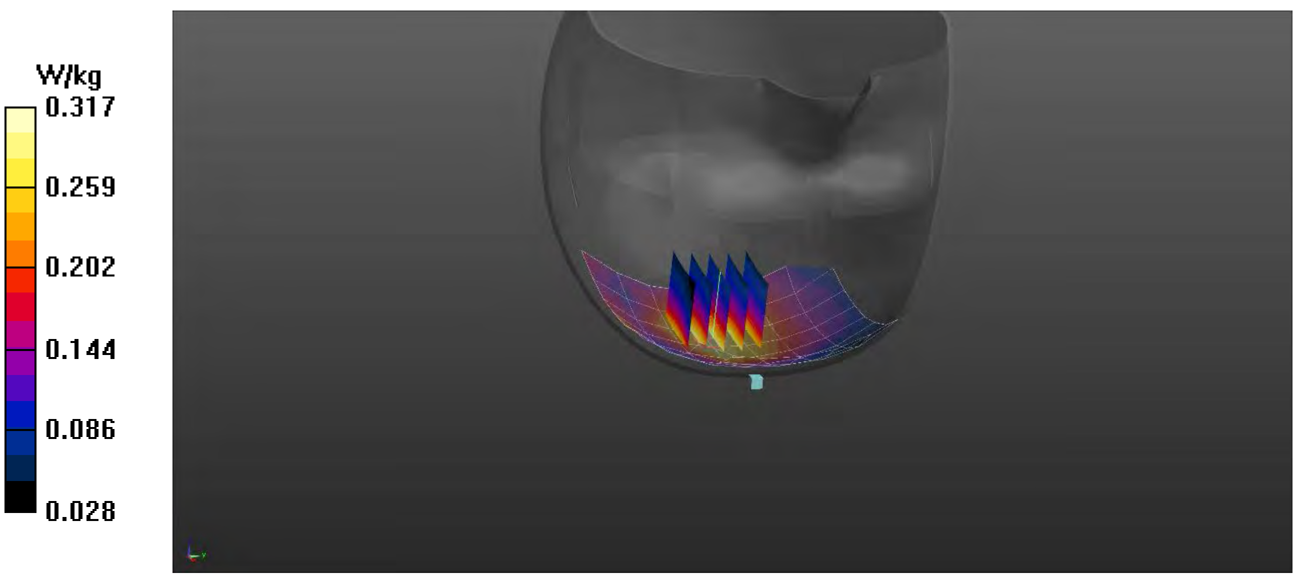
Procedure Notes:

Band 4 UMTS/1 RB 49 Offset Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.320 W/kg

Band 4 UMTS/1 RB 49 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.959 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.368 W/kg
SAR(1 g) = 0.179 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.317 W/kg



RF Exposure Lab

Plot 3

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: UMTS (WCDMA); Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.927 S/m; ε_r = 41.22; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.35, 9.36, 8.99); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

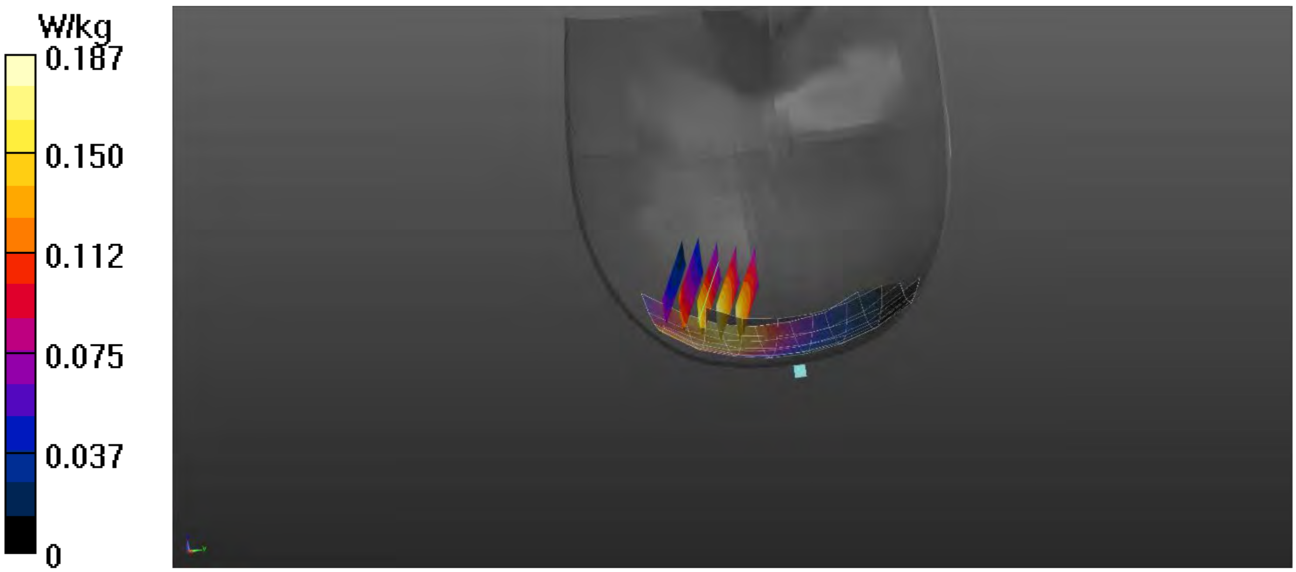
Procedure Notes:

Band 5 UMTS/Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.176 W/kg

Band 5 UMTS/Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.577 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.205 W/kg
SAR(1 g) = 0.182 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.187 W/kg



RF Exposure Lab

Plot 4

DUT: Firefighter Helmet; Type: Connected Helmet; 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 = 1.37 S/m; ε_r = 39.83; ρ = 1000 kg/m^3
Phantom section: Head Section

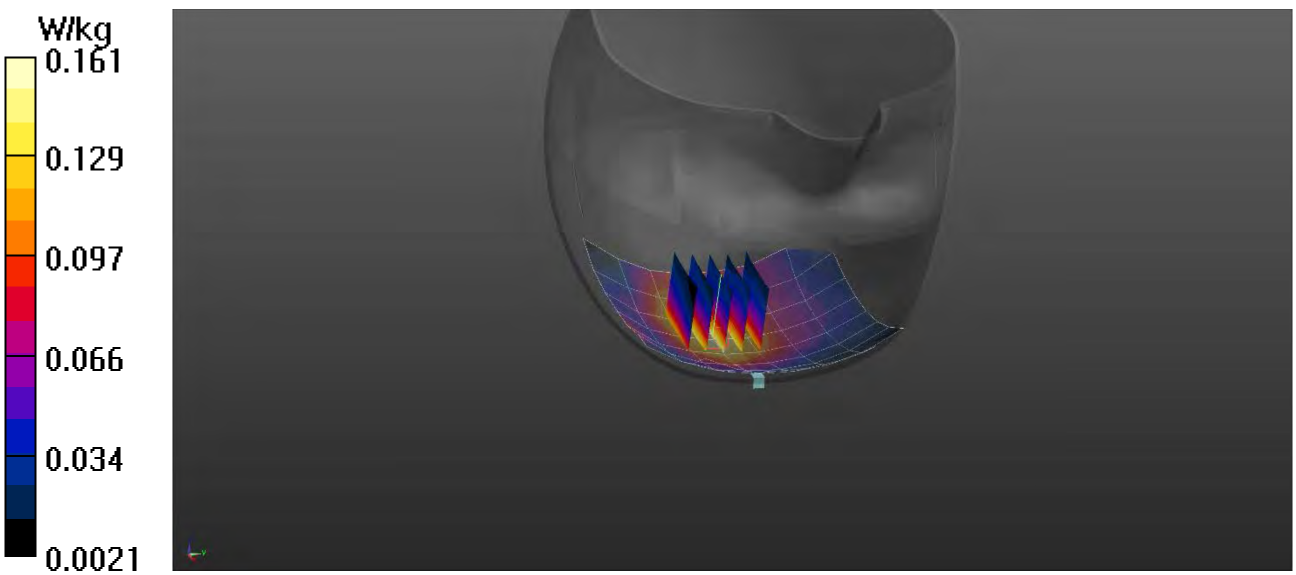
Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.99, 8.02, 8.17); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Band 2 LTE/1 RB 49 Offset Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.157 W/kg

Band 2 LTE/1 RB 49 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.152 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.186 W/kg
SAR(1 g) = 0.139 W/kg
Maximum value of SAR (measured) = 0.161 W/kg



RF Exposure Lab

Plot 5

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.927 S/m; ε_r = 41.221; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.35, 9.36, 8.99); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

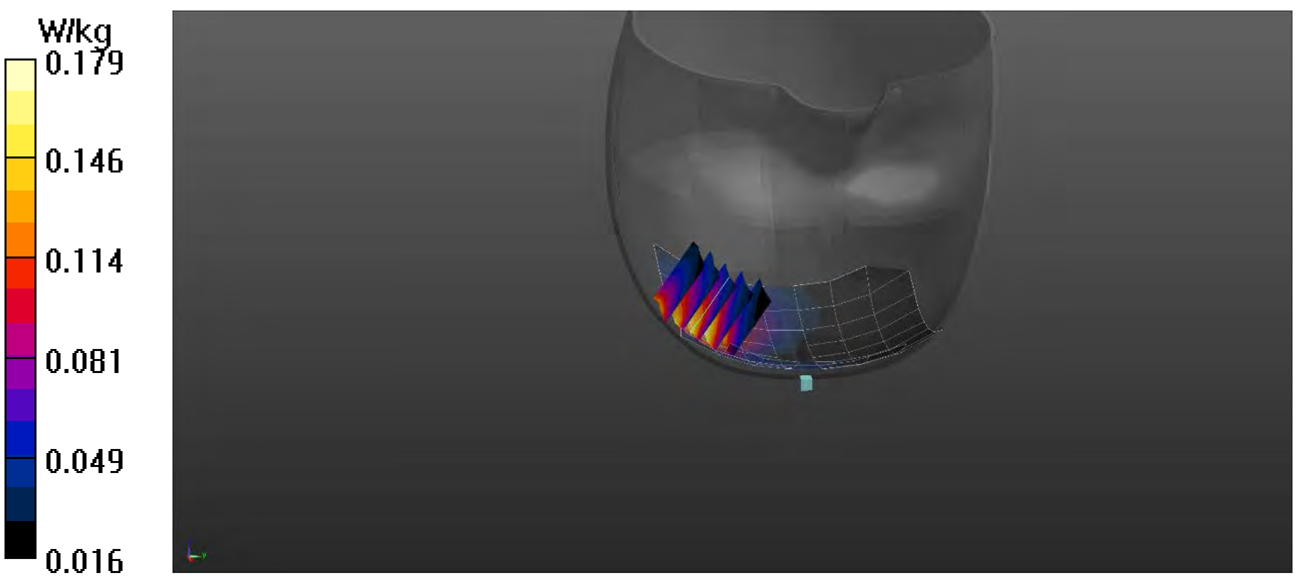
Procedure Notes:

Band 5 LTE/1 RB 24 Offset Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.174 W/kg

Band 5 LTE/1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.345 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.193 W/kg
SAR(1 g) = 0.126 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.179 W/kg



RF Exposure Lab

Plot 6

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 711 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.878 S/m; ε_r = 41.598; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.27, 9.72, 10); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

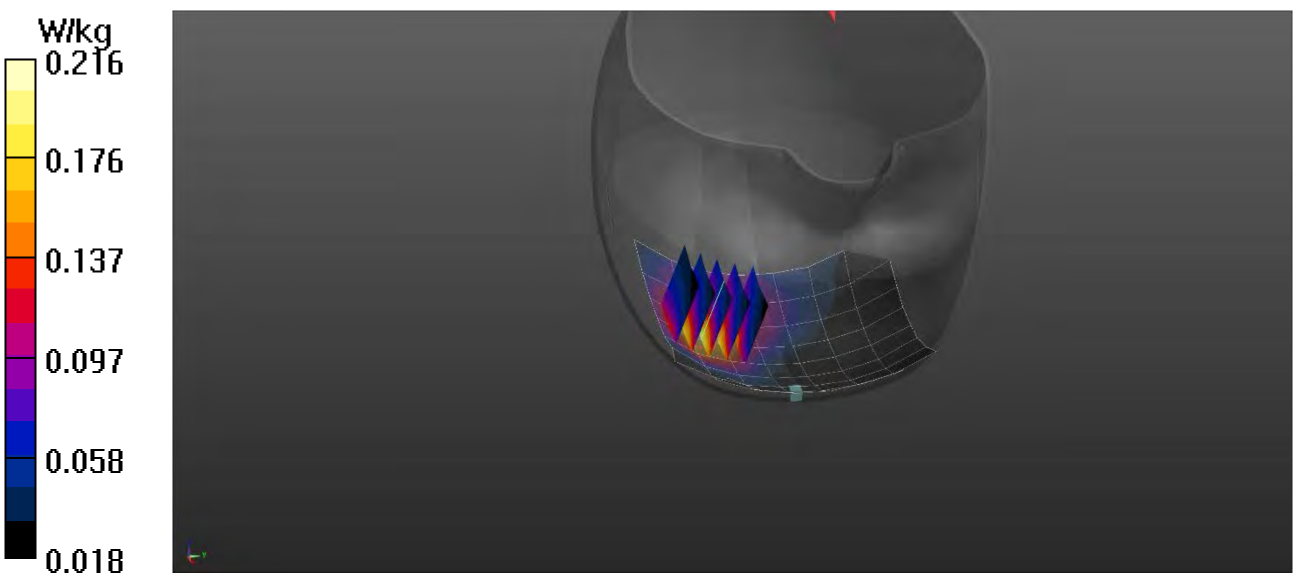
Procedure Notes:

Band 12 LTE/1 RB 24 Offset High/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.197 W/kg

Band 12 LTE/1 RB 24 Offset High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.143 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.234 W/kg
SAR(1 g) = 0.137 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.216 W/kg



RF Exposure Lab

Plot 7

DUT: Firefighter Helmet; Type: Connected Helmet; 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 = 0.932 S/m; ε_r = 41.158; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.27, 9.72, 10); Calibrated: 1/18/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

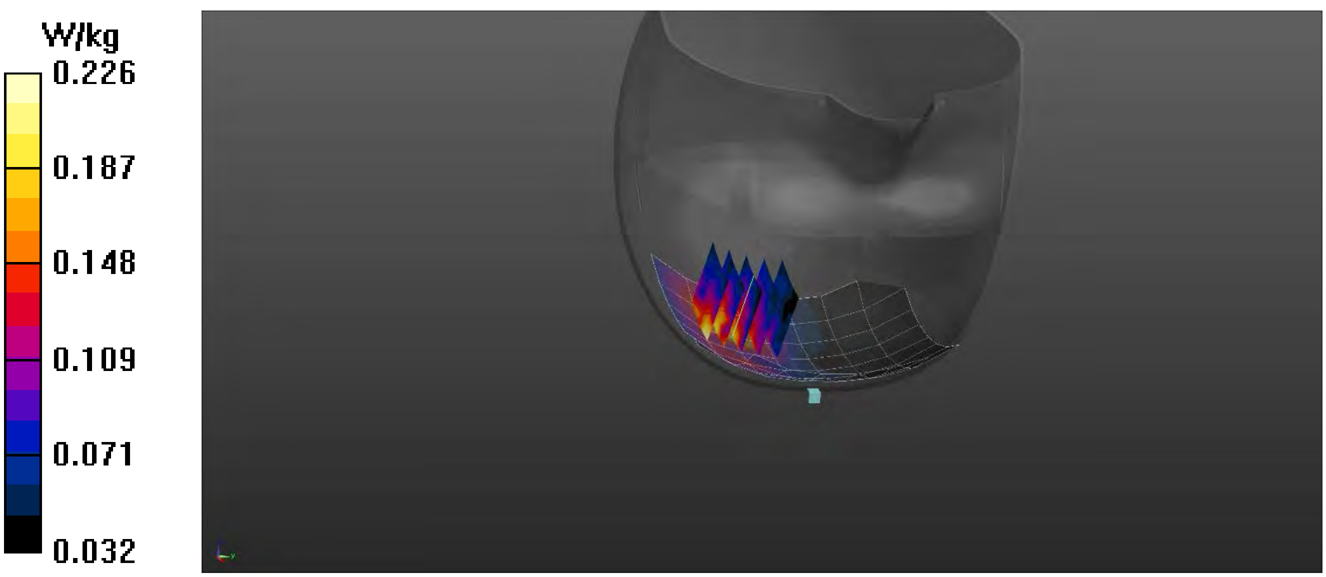
Procedure Notes:

Band 13 LTE/1 RB 24 Offset Mid/Area Scan (11x8x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.214 W/kg

Band 13 LTE/1 RB 24 Offset Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.253 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.253 W/kg
SAR(1 g) = 0.106 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.226 W/kg



RF Exposure Lab

Plot 8

DUT: Firefighter Helmet; Type: Connected Helmet; 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 = 0.94 S/m; ε_r = 41.098; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.27, 9.72, 10); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

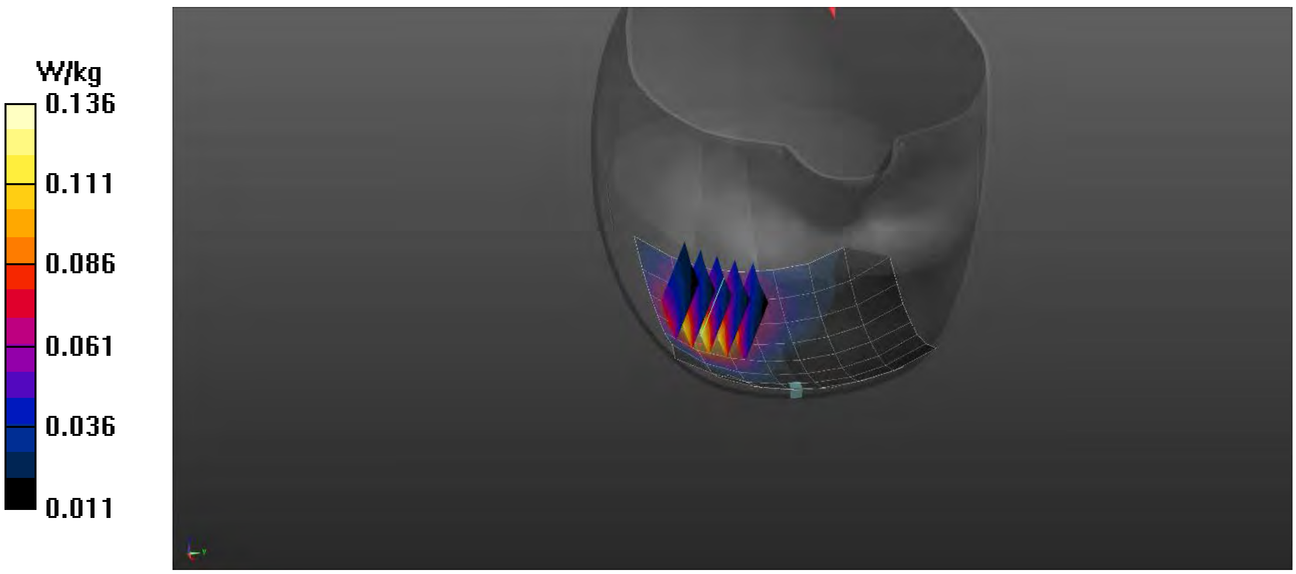
Procedure Notes:

B14 LTE/1 RB 24 Offset Mid/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.135 W/kg

B14 LTE/1 RB 24 Offset Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.96 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.155 W/kg
SAR(1 g) = 0.102 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.136 W/kg



RF Exposure Lab

Plot 9

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1745 MHz; σ = 1.375 S/m; ε_r = 39.78; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(8.14, 8.22, 8.4); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

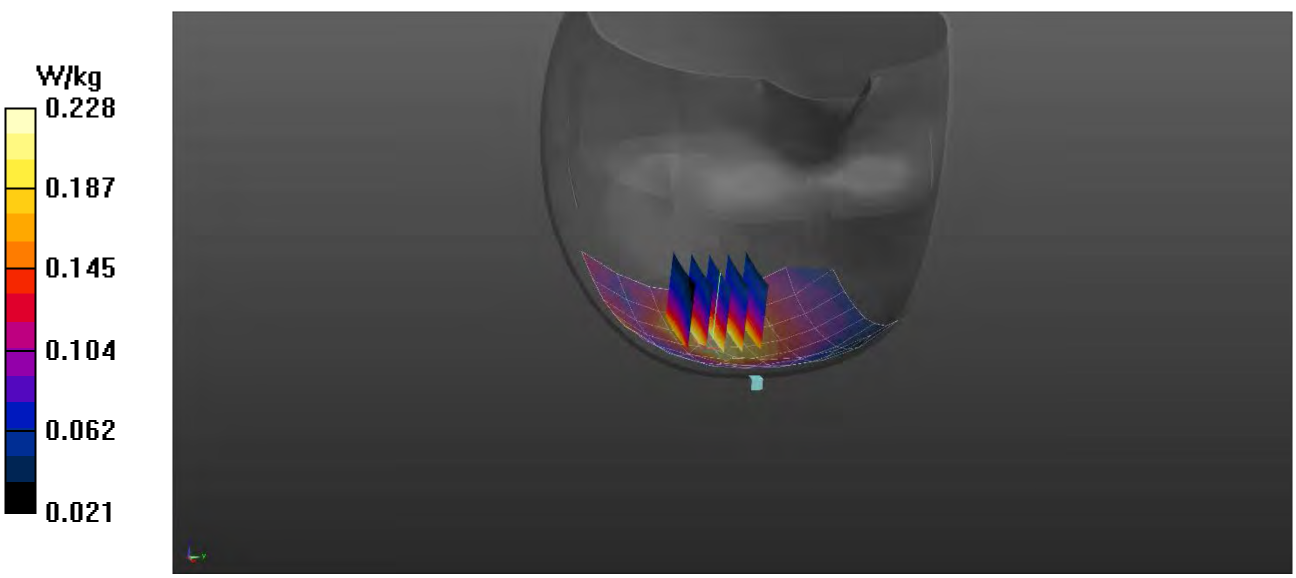
Procedure Notes:

B66 LTE/1 RB 49 Offset Mid/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.226 W/kg

B66 LTE/1 RB 49 Offset Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.945 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.263 W/kg
SAR(1 g) = 0.161 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.228 W/kg



RF Exposure Lab

Plot 10

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 680.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 680.5 MHz; σ = 0.87 S/m; ε_r = 41.689; ρ = 1000 kg/m^3
Phantom section: Flat Section

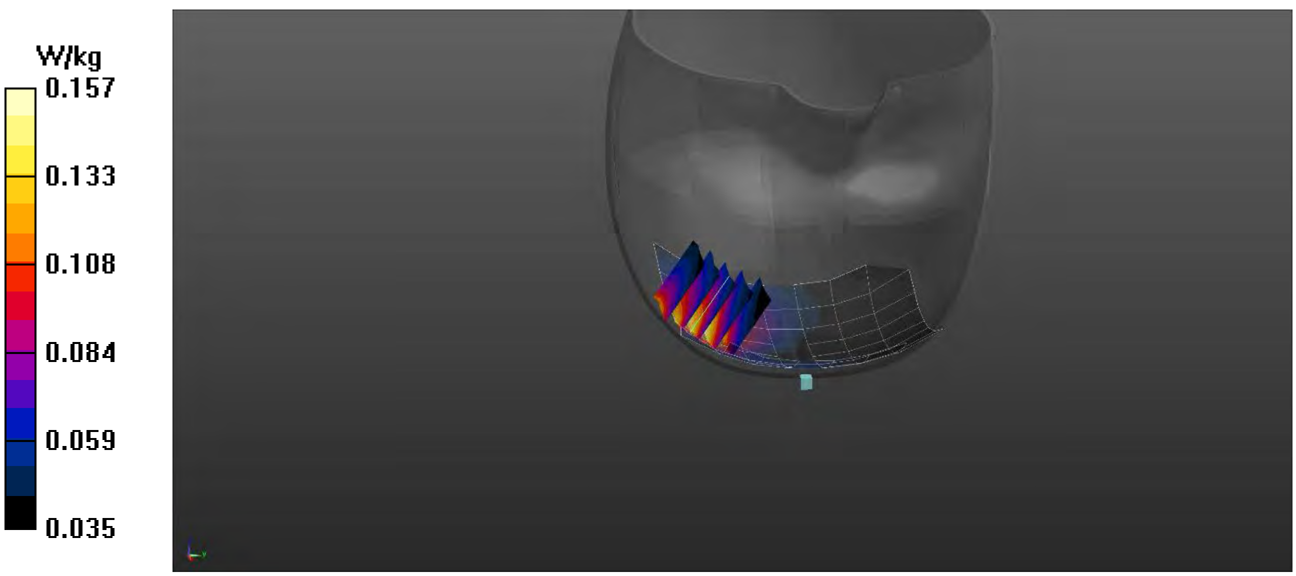
Test Date: Date: 10/24/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(9.27, 9.72, 10); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

B71 LTE/1 RB 49 Offset Mid/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.184 W/kg

B71 LTE/1 RB 49 Offset Mid/Zoom Scan (8x8x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.697 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.172 W/kg
SAR(1 g) = 0.119 W/kg
Maximum value of SAR (measured) = 0.157 W/kg



RF Exposure Lab

Plot 11

DUT: Firefighter Helmet; Type: Connected Helmet; 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: Head Section

Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(7.13, 7.14, 7.18); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

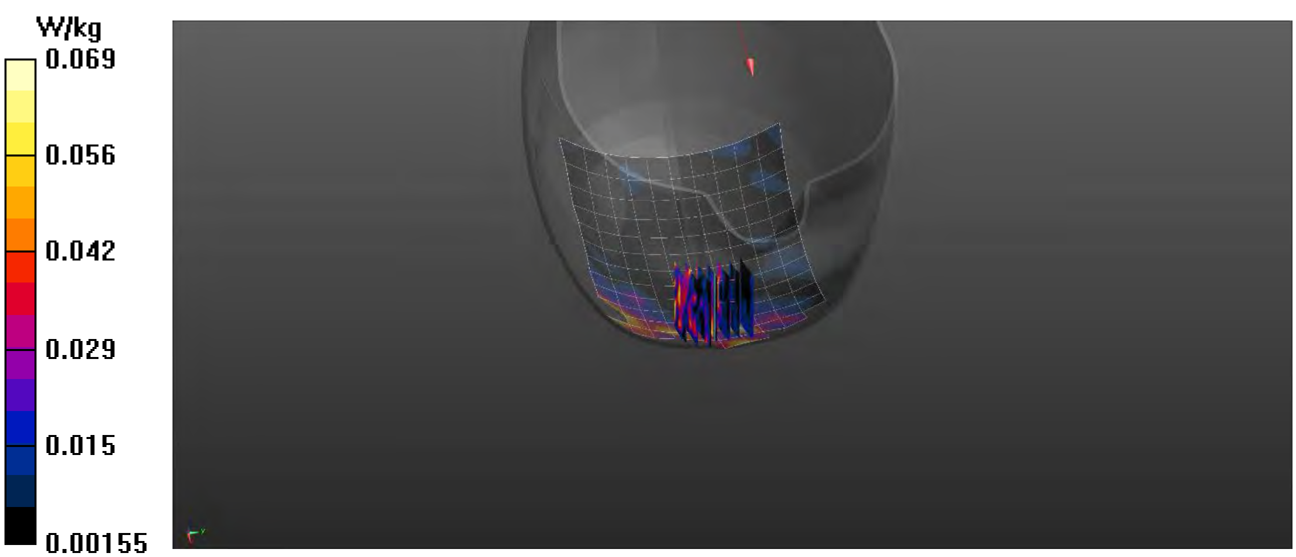
Procedure Notes:

2450 MHz/Mid/Area Scan (16x11x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0481 W/kg

2450 MHz/Mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.118 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.112 W/kg
SAR(1 g) = 0.037 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0695 W/kg



RF Exposure Lab

Plot 12

DUT: Firefighter Helmet; Type: Connected Helmet; 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: Head Section

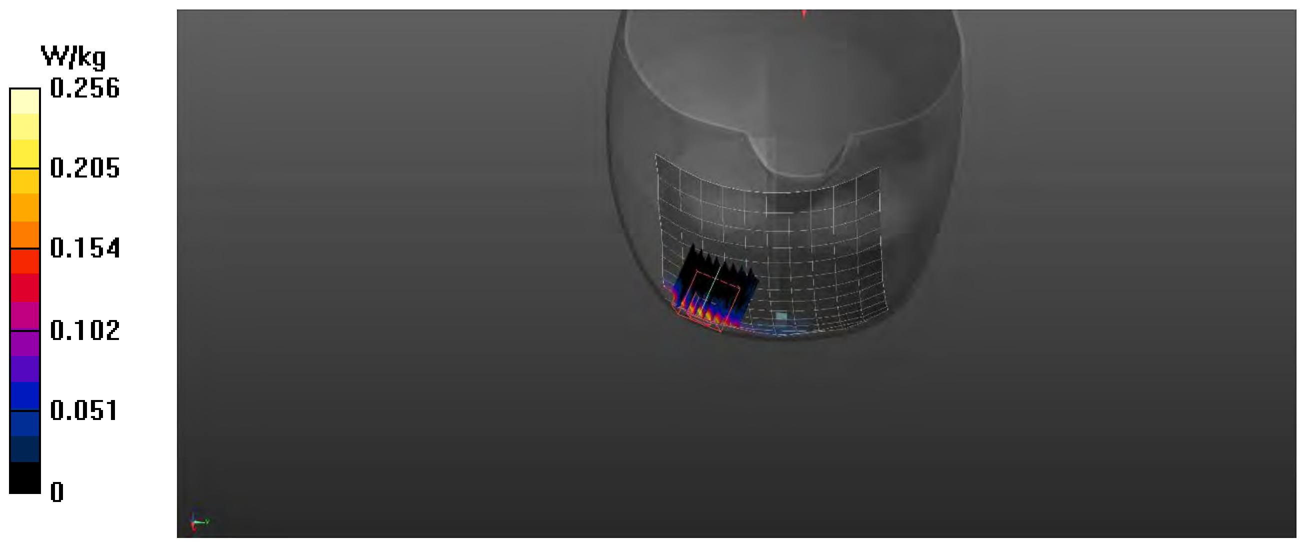
Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(5.2, 5.25, 5.31); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

5200 MHz/60/Area Scan (16x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.239 W/kg

5200 MHz/60/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.742 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.468 W/kg
SAR(1 g) = 0.140 W/kg
Maximum value of SAR (measured) = 0.256 W/kg



RF Exposure Lab

Plot 13

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

Communication System: WiFi 802.11a (OFDM, 6 Mbps); Frequency: 5620 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used: f = 5620 MHz; σ = 5.13 S/m; ε_r = 34.32; ρ = 1000 kg/m^3
Phantom section: Head Section

Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

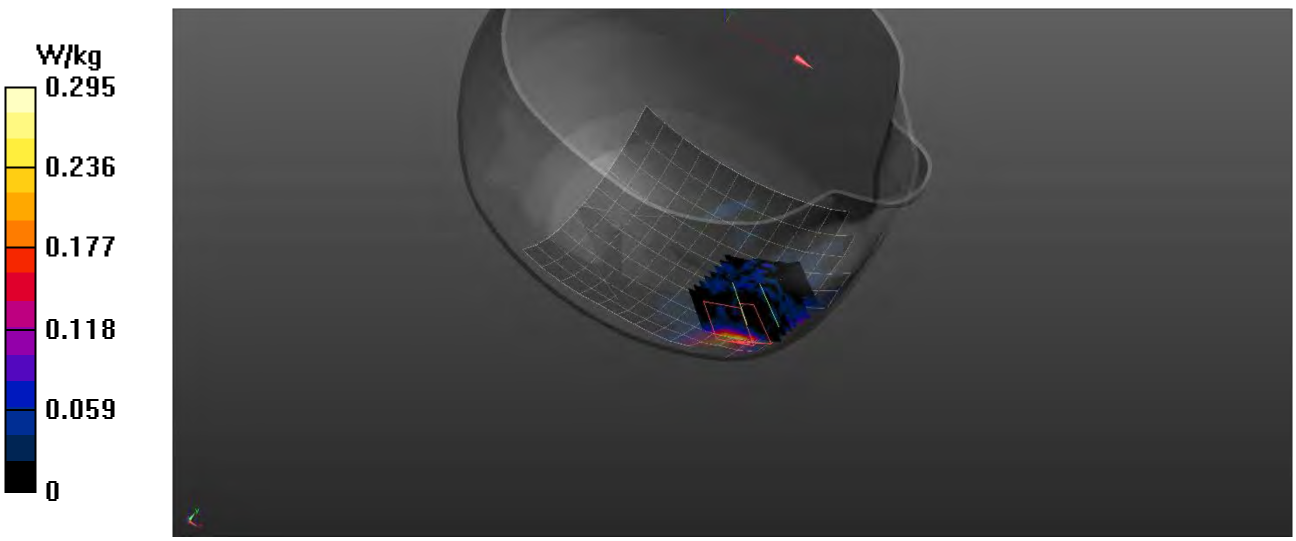
Probe: EX3DV4 – SN7530; ConvF(4.31, 4.38, 4.47); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

5600 MHz/124/Area Scan (16x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.281 W/kg

5600 MHz/124/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=4mm
Reference Value = 3.439 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.494 W/kg
SAR(1 g) = 0.150 W/kg
Maximum value of SAR (measured) = 0.295 W/kg

5600 MHz/124/Zoom Scan (8x8x12)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.439 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.416 W/kg
SAR(1 g) = 0.139 W/kg
Maximum value of SAR (measured) = 0.211 W/kg



RF Exposure Lab

Plot 14

DUT: Firefighter Helmet; Type: Connected Helmet; Serial: Eng 1

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

Test Date: Date: 10/25/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7530; ConvF(4.5, 4.55, 4.68); Calibrated: 1/18/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 9/4/2024
Phantom: SAM-HeadStand V10.0; Type: QD 012 003 Bx; Serial: 1005
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

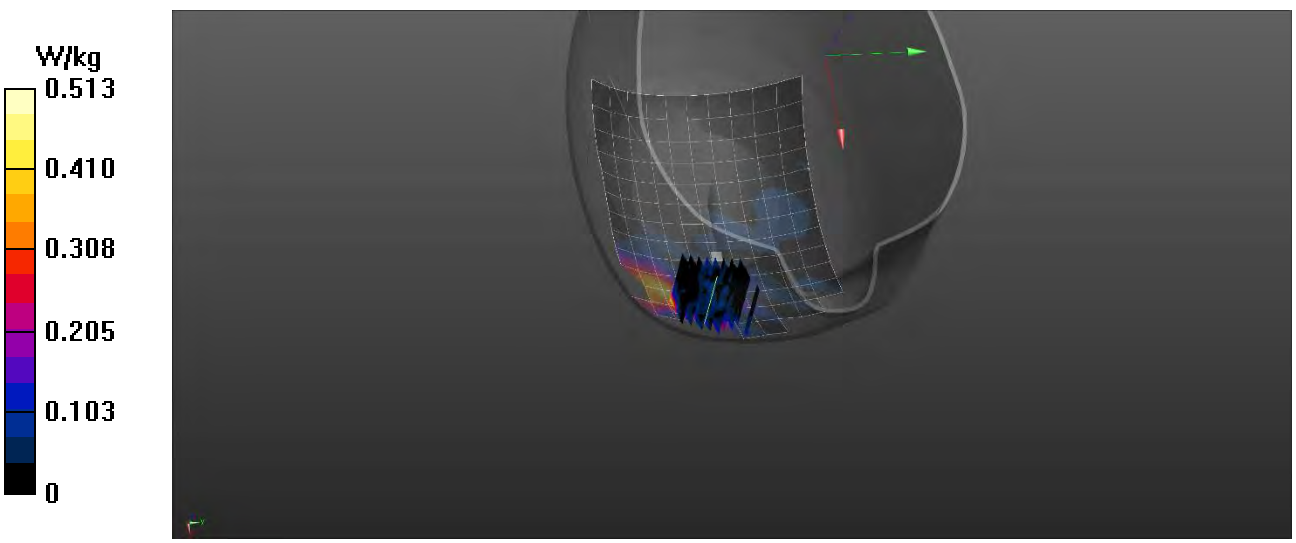
Procedure Notes:

5800 MHz/157/Area Scan (16x11x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.478 W/kg

5800 MHz/157/Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.597 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.965 W/kg
SAR(1 g) = 0.271 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.513 W/kg



Appendix C – SAR Test Setup Photos

Test Position Back 0 mm Gap

Top of Device

Inside/Bottom of Device

Appendix D – Probe Calibration Data Sheets

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

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

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

Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. **EX-7530_Jan24**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7530

Calibration procedure(s): QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8
Calibration procedure for dosimetric E-field probes

Calibration date: January 18, 2024

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
OCP DAK-3.5 (weighted)	SN: 1249	05-Oct-23 (OCP-DAK3.5-1249_Oct23)	Oct-24
OCP DAK-12	SN: 1016	05-Oct-23 (OCP-DAK12-1016_Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2552 (20x)	30-Mar-23 (No. 217-03809)	Mar-24
DAE4	SN: 660	16-Mar-23 (No. DAE4-660_Mar23)	Mar-24
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by	Jeton Kastrati	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: January 18, 2024

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., $\vartheta = 0$ 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) 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"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ 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. 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 $f \leq 800$ 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).

Parameters of Probe: EX3DV4 - SN:7530

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.42	0.52	0.43	±10.1%
DCP (mV) [B]	98.8	99.5	101.6	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Max Unc[E] $k = 2$
0	CW	X	0.00	0.00	1.00	0.00	130.6	±2.3%	±4.7%
		Y	0.00	0.00	1.00		127.6		
		Z	0.00	0.00	1.00		132.9		

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

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

Parameters of Probe: EX3DV4 - SN:7530

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	37.8°
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.

Parameters of Probe: EX3DV4 - SN:7530

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc ($k = 2$)
13	55.0	0.75	21.16	21.16	21.16	0.00	1.25	±13.3%
30	55.0	0.75	18.31	18.31	18.31	0.00	1.25	±13.3%
750	41.9	0.89	9.27	9.72	10.00	0.36	1.27	±12.0%
900	41.5	0.97	9.35	9.36	8.99	0.37	1.27	±12.0%
1300	40.8	1.14	8.18	8.17	8.37	0.53	1.27	±12.0%
1750	40.1	1.37	8.14	8.22	8.40	0.22	1.43	±12.0%
1900	40.0	1.40	7.99	8.02	8.17	0.30	1.27	±12.0%
2300	39.5	1.67	7.49	7.51	7.55	0.32	1.27	±12.0%
2450	39.2	1.80	7.13	7.14	7.18	0.32	1.27	±12.0%
2600	39.0	1.96	7.37	7.40	7.46	0.31	1.27	±12.0%
3300	38.2	2.71	6.79	6.83	6.85	0.36	1.27	±14.0%
3500	37.9	2.91	6.66	6.72	6.74	0.37	1.27	±14.0%
3700	37.7	3.12	6.48	6.49	6.59	0.37	1.27	±14.0%
3900	37.5	3.32	6.64	6.73	6.74	0.38	1.27	±14.0%
4200	37.1	3.63	6.41	6.45	6.53	0.38	1.27	±14.0%
4400	36.9	3.84	6.10	6.14	6.24	0.38	1.27	±14.0%
4600	36.7	4.04	6.32	6.39	6.46	0.38	1.27	±14.0%
4950	36.3	4.40	5.51	5.54	5.62	0.45	1.36	±14.0%
5250	35.9	4.71	5.20	5.25	5.31	0.34	1.65	±14.0%
5600	35.5	5.07	4.31	4.38	4.47	0.41	1.67	±14.0%
5750	35.4	5.22	4.50	4.55	4.68	0.39	1.84	±14.0%

[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] The probes are calibrated using tissue simulating liquids (TSL) that deviate for ε and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 6 GHz.

[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.

Parameters of Probe: EX3DV4 - SN:7530

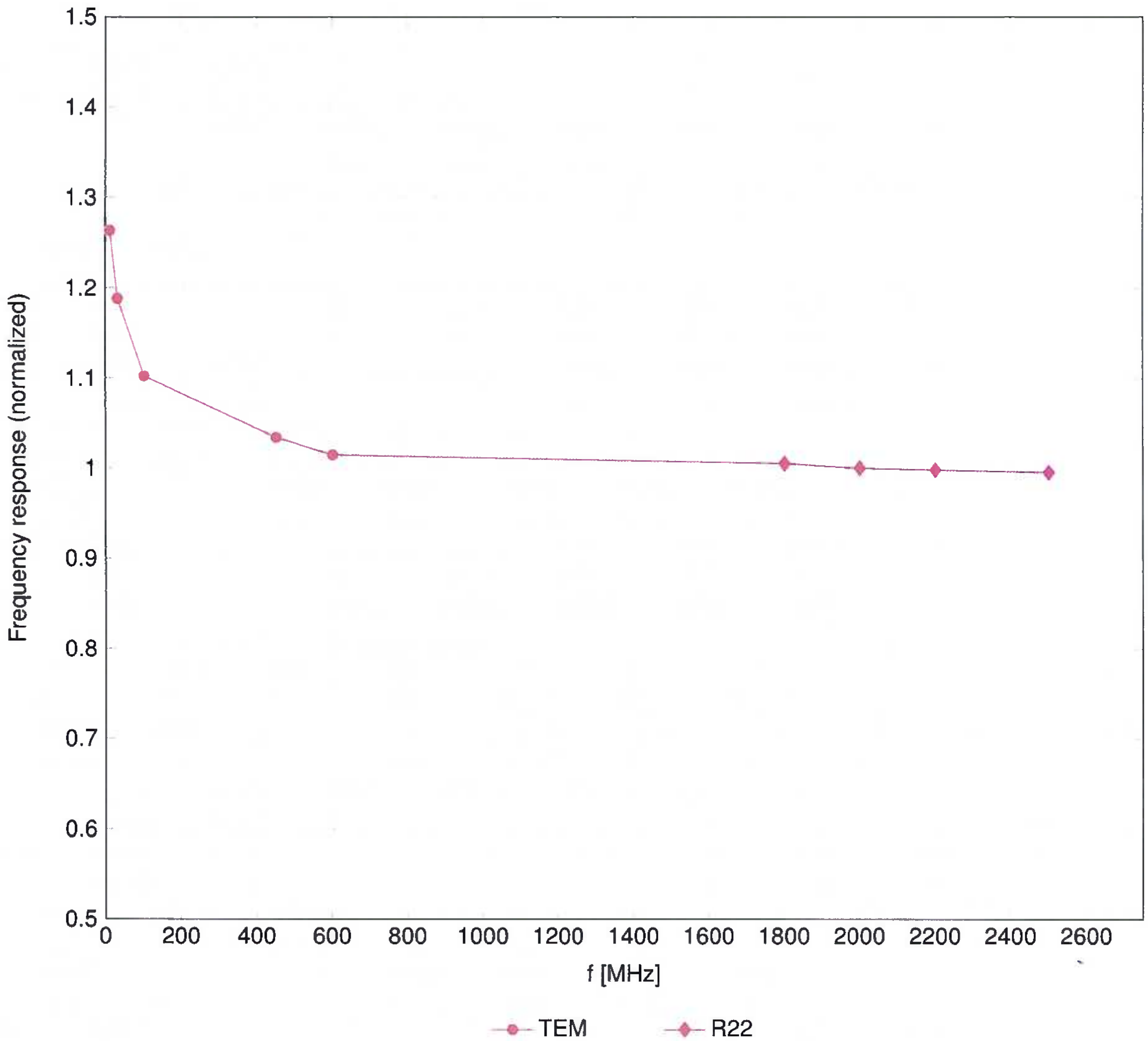
Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc (k = 2)
6500	34.5	6.07	5.21	5.35	5.56	0.20	2.50	±18.6%

[C] Frequency validity at 6.5 GHz is −600/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for ε and σ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.
[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.

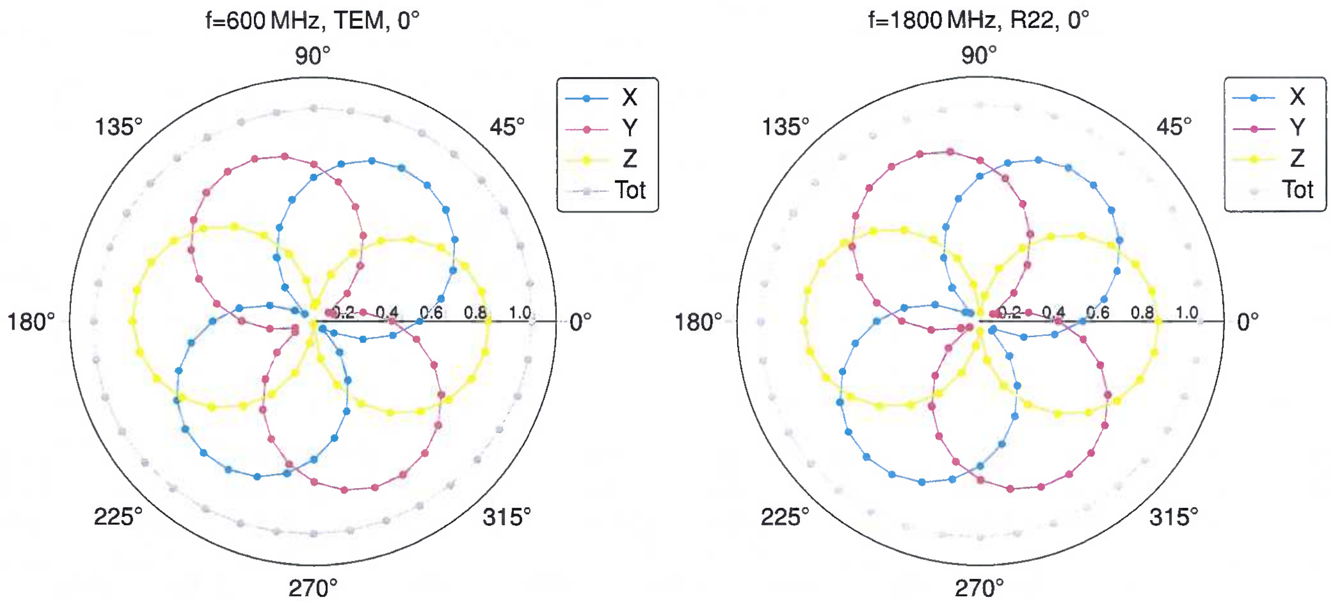
Frequency Response of E-Field

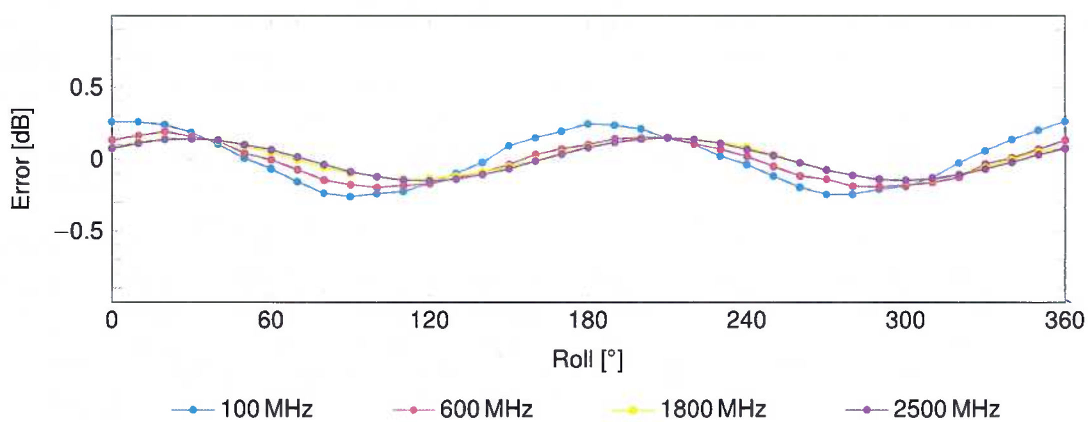
(TEM-Cell:ifi110 EXX, Waveguide:R22)



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

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

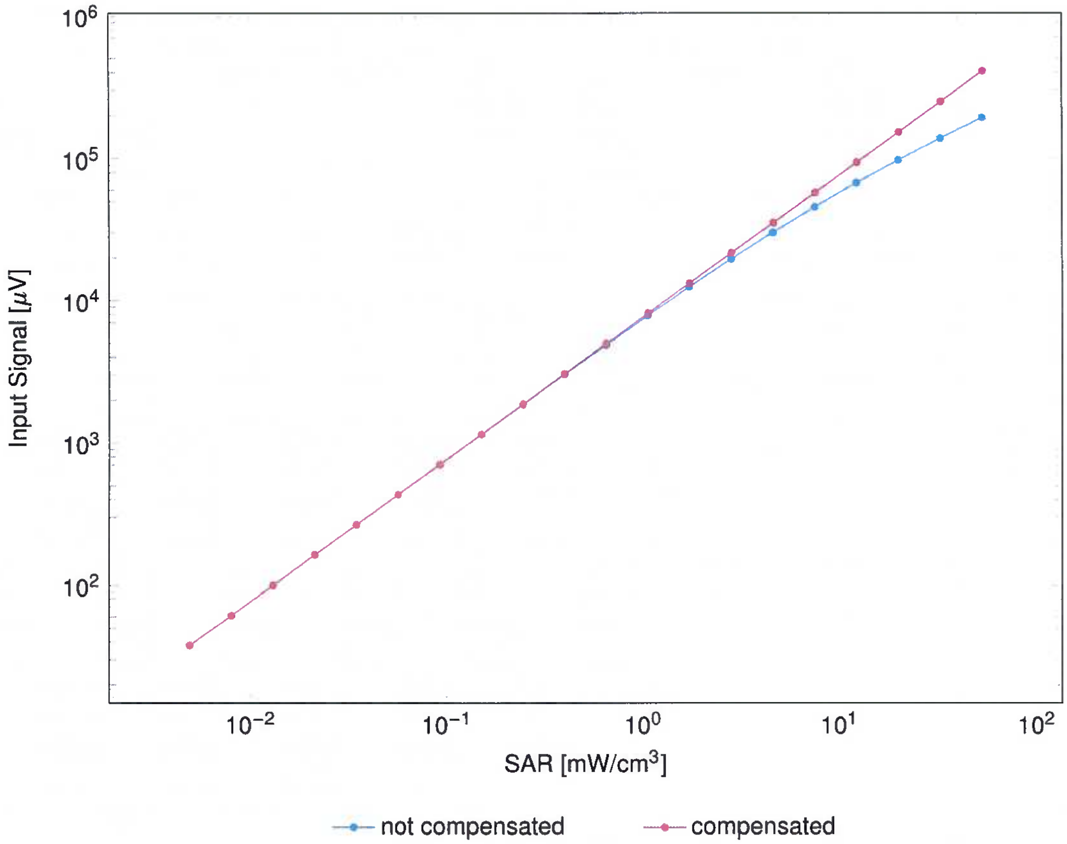


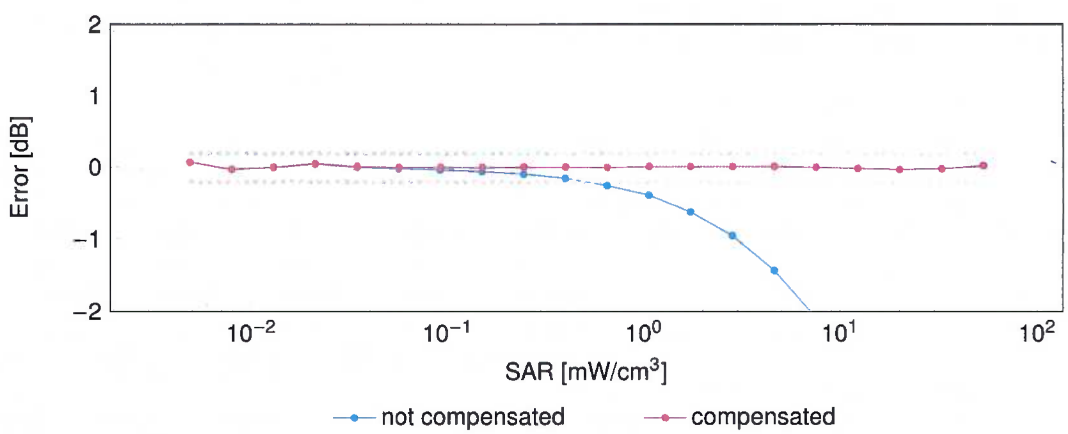


Uncertainty of Axial Isotropy Assessment: ±0.5% (k=2)

Dynamic Range f(SAR_{head})

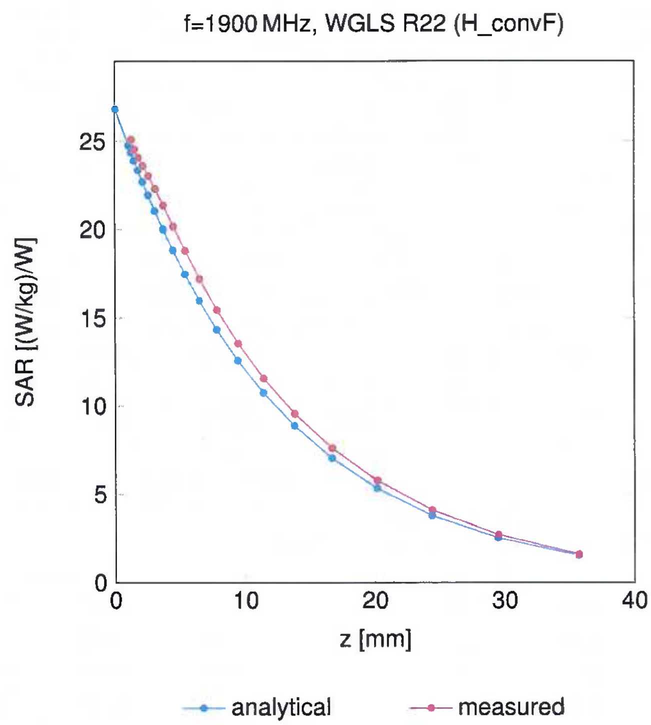
(TEM cell, f_{eval} = 1900 MHz)



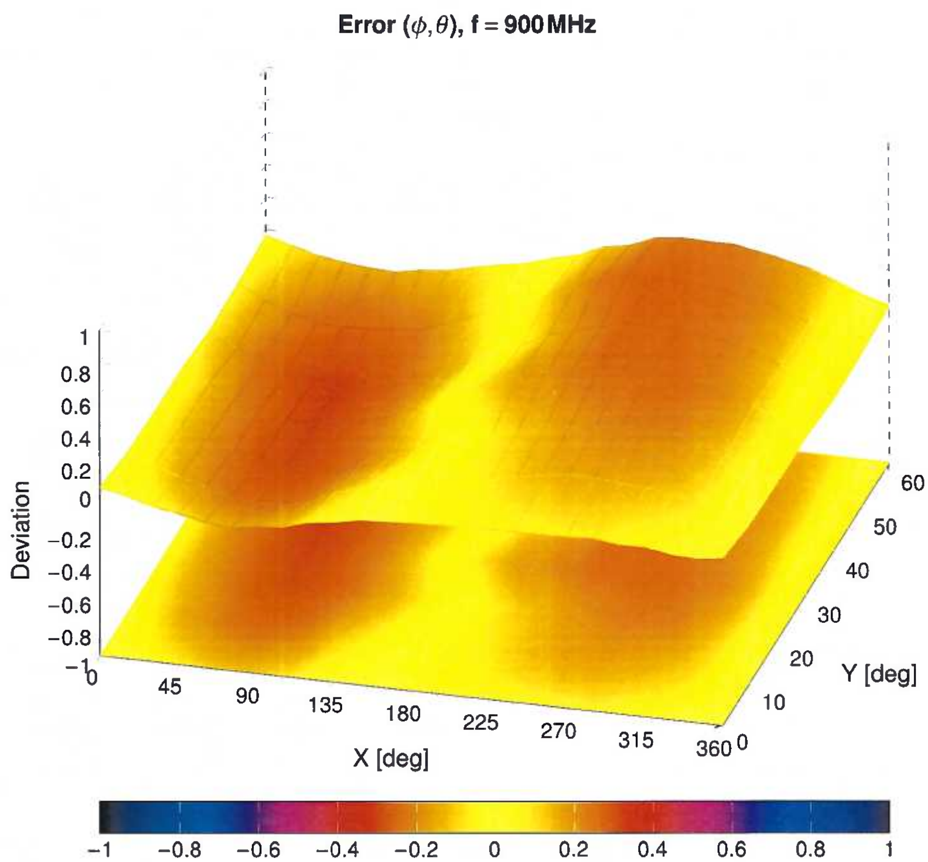


Uncertainty of Linearity Assessment: ±0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid



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

Appendix E – Dipole Calibration Data Sheets

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

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

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

Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. **D750V3-1016_May24**

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1016
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 10, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 13, 2024

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	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	43.2 ± 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	2.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.76 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.71 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	52.8 Ω - 1.1 jΩ
Return Loss	- 30.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 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

Date: 10.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1016

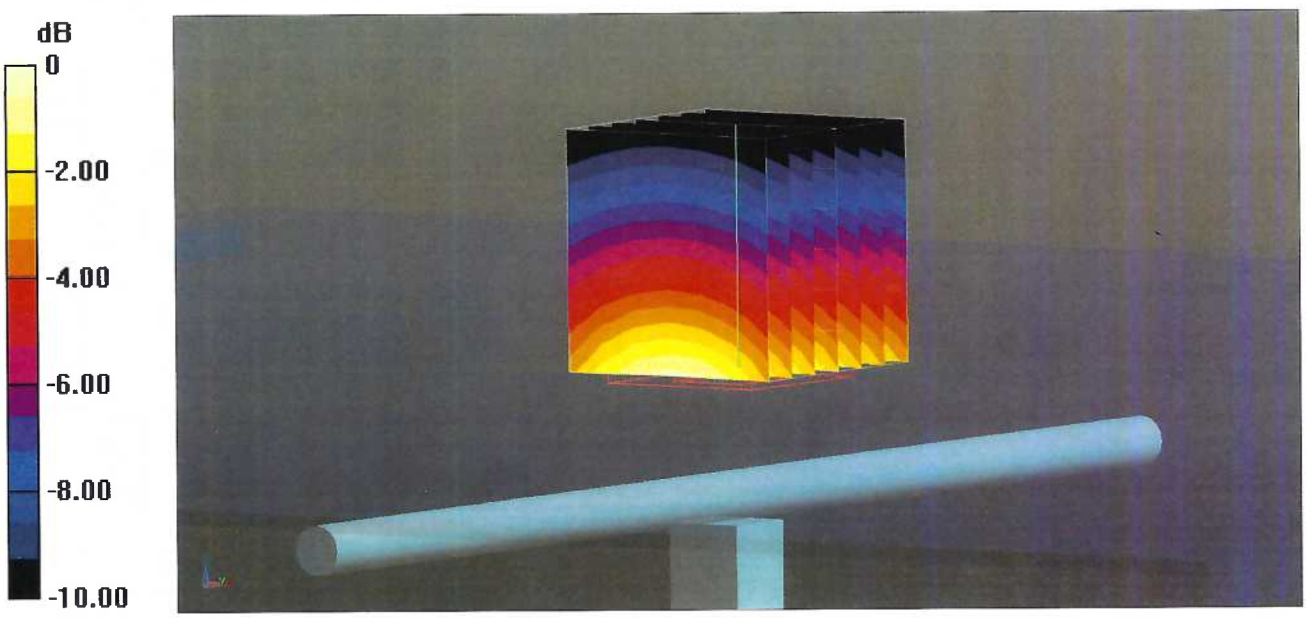
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 43.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

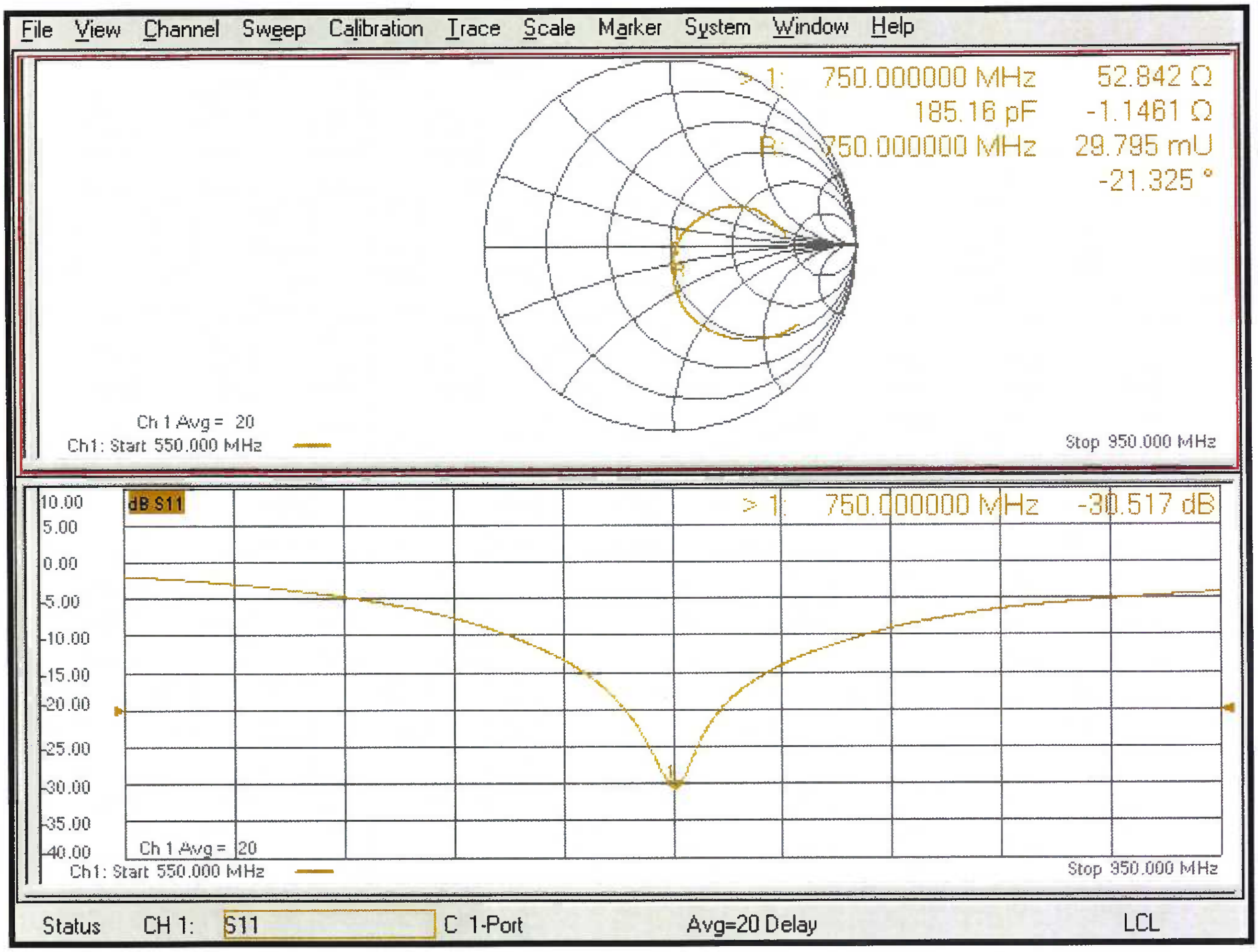
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 61.05 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.35 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.42 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 = 64.9%
Maximum value of SAR (measured) = 2.95 W/kg



0 dB = 2.95 W/kg = 4.70 dBW/kg

Impedance Measurement Plot for Head TSL



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

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

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

Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. D900V2-1d044_May24

CALIBRATION CERTIFICATE

Object: D900V2 - SN:1d044

Calibration procedure(s): QA CAL-05.v12
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: May 10, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 13, 2024

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	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	42.8 ± 6 %	0.95 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.70 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**11.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**7.05 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	49.3 Ω - 6.6 jΩ
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.409 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

Date: 10.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d044

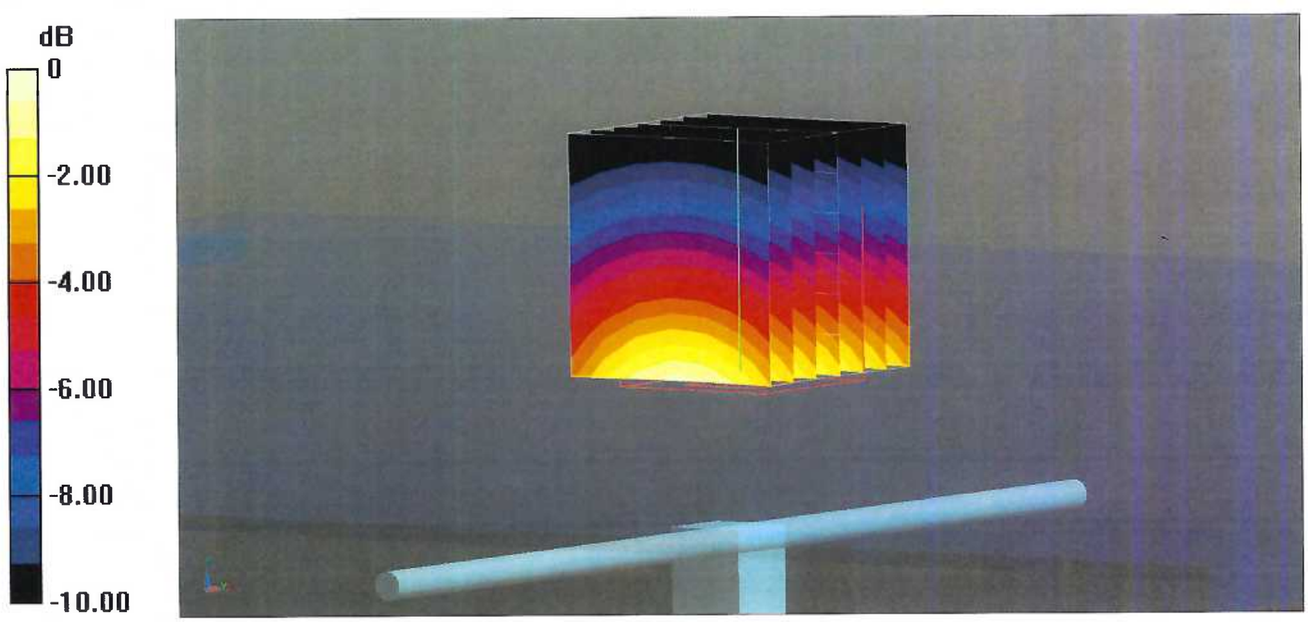
Communication System: UID 0 - CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.95 S/m; ε_r = 42.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.62, 9.62, 9.62) @ 900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

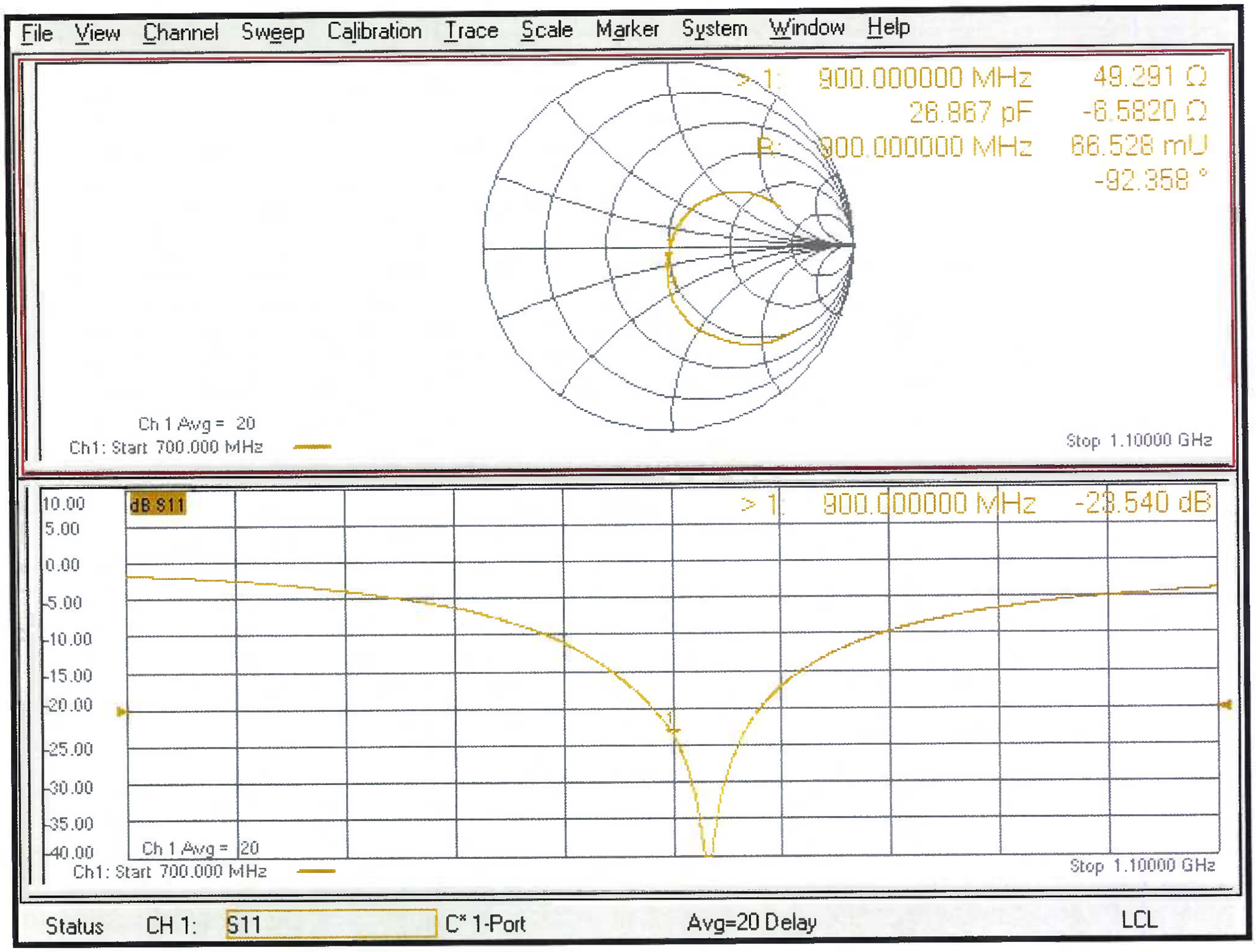
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 65.98 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 4.17 W/kg
SAR(1 g) = 2.70 W/kg; SAR(10 g) = 1.73 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 64.9%
Maximum value of SAR (measured) = 3.65 W/kg



0 dB = 3.65 W/kg = 5.62 dBW/kg

Impedance Measurement Plot for Head TSL



Calibration Laboratory of
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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**
San Marcos, USA

Certificate No. D1750V2-1018_May24

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1018
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	May 10, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 13, 2024

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	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	41.3 ± 6 %	1.34 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	8.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.3 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	50.3 Ω - 0.1 jΩ
Return Loss	- 50.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.223 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

Date: 10.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1018

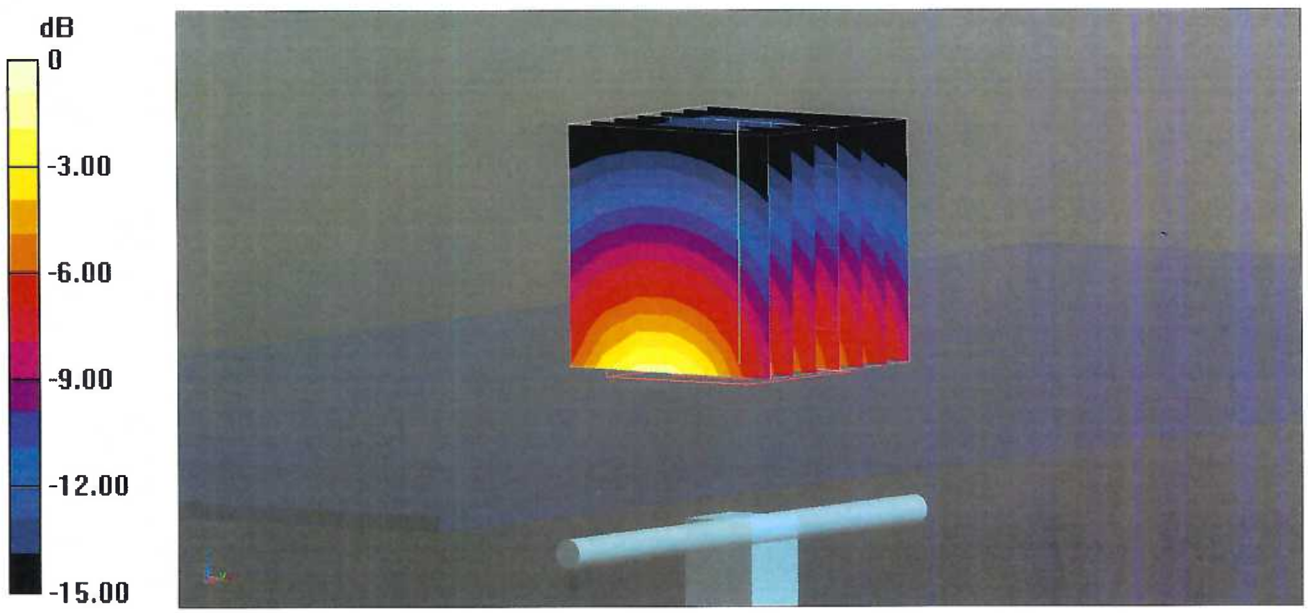
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

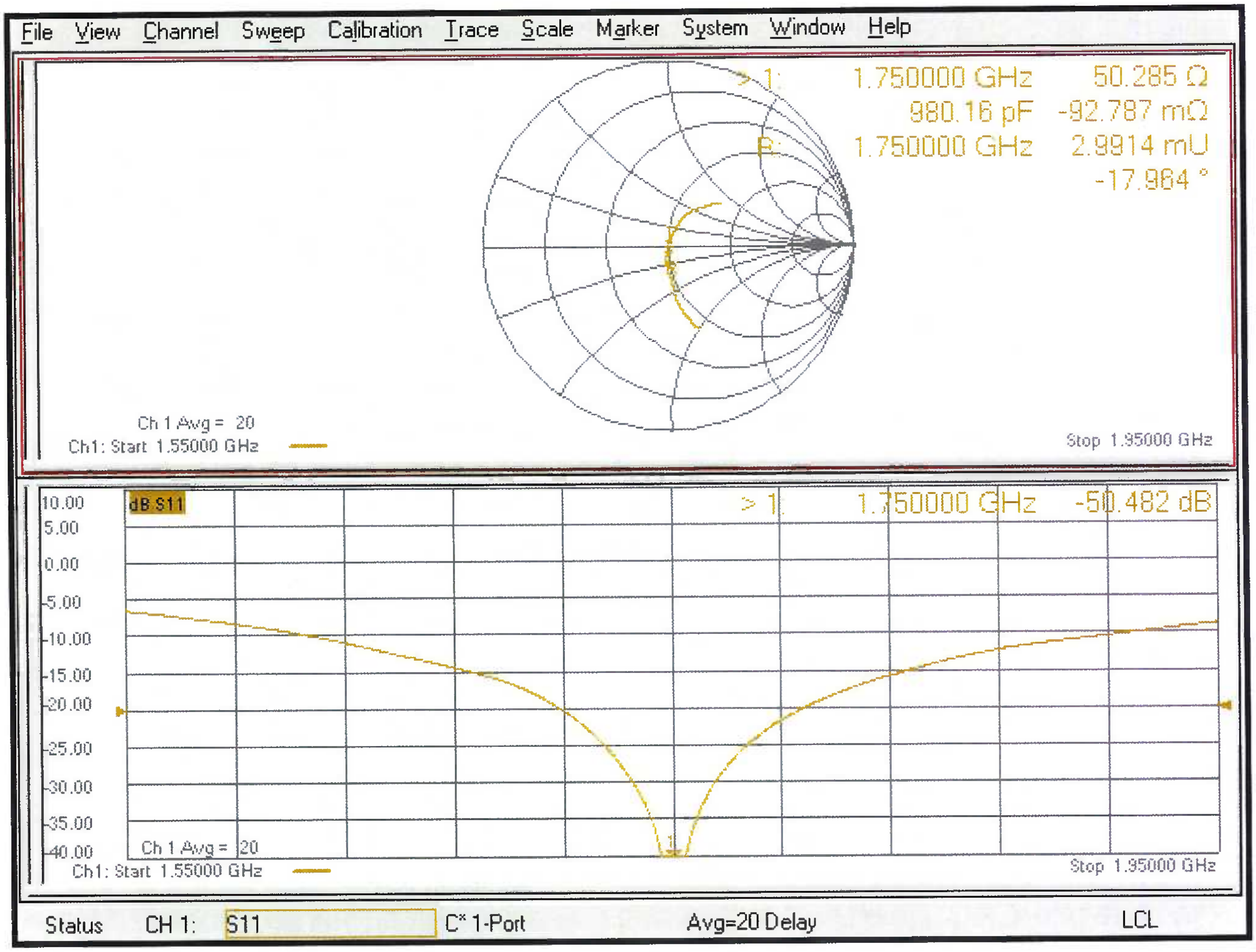
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.9 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 16.6 W/kg
SAR(1 g) = 8.98 W/kg; SAR(10 g) = 4.76 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 55.3%
Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.26 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 0108**

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. **D1900V2-5d116_May24**

CALIBRATION CERTIFICATE

Object: D1900V2 - SN:5d116

Calibration procedure(s): QA CAL-05.v12
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: May 06, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 6, 2024

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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	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	41.1 ± 6 %	1.40 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	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.2 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	49.7 Ω + 6.1 jΩ
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Date: 06.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

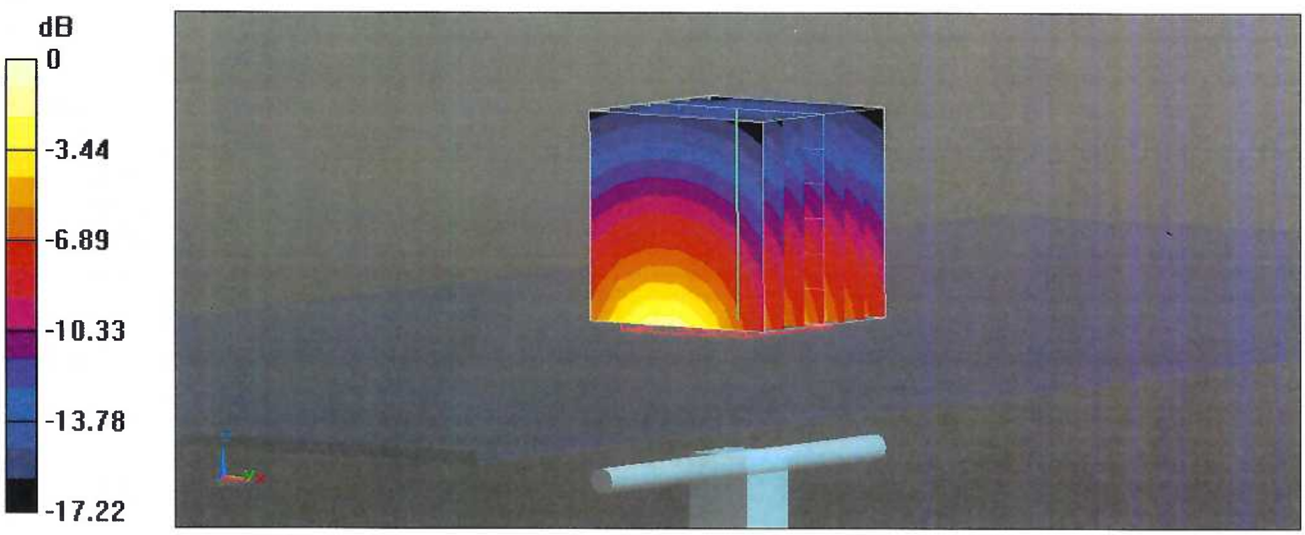
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d116

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.4 S/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

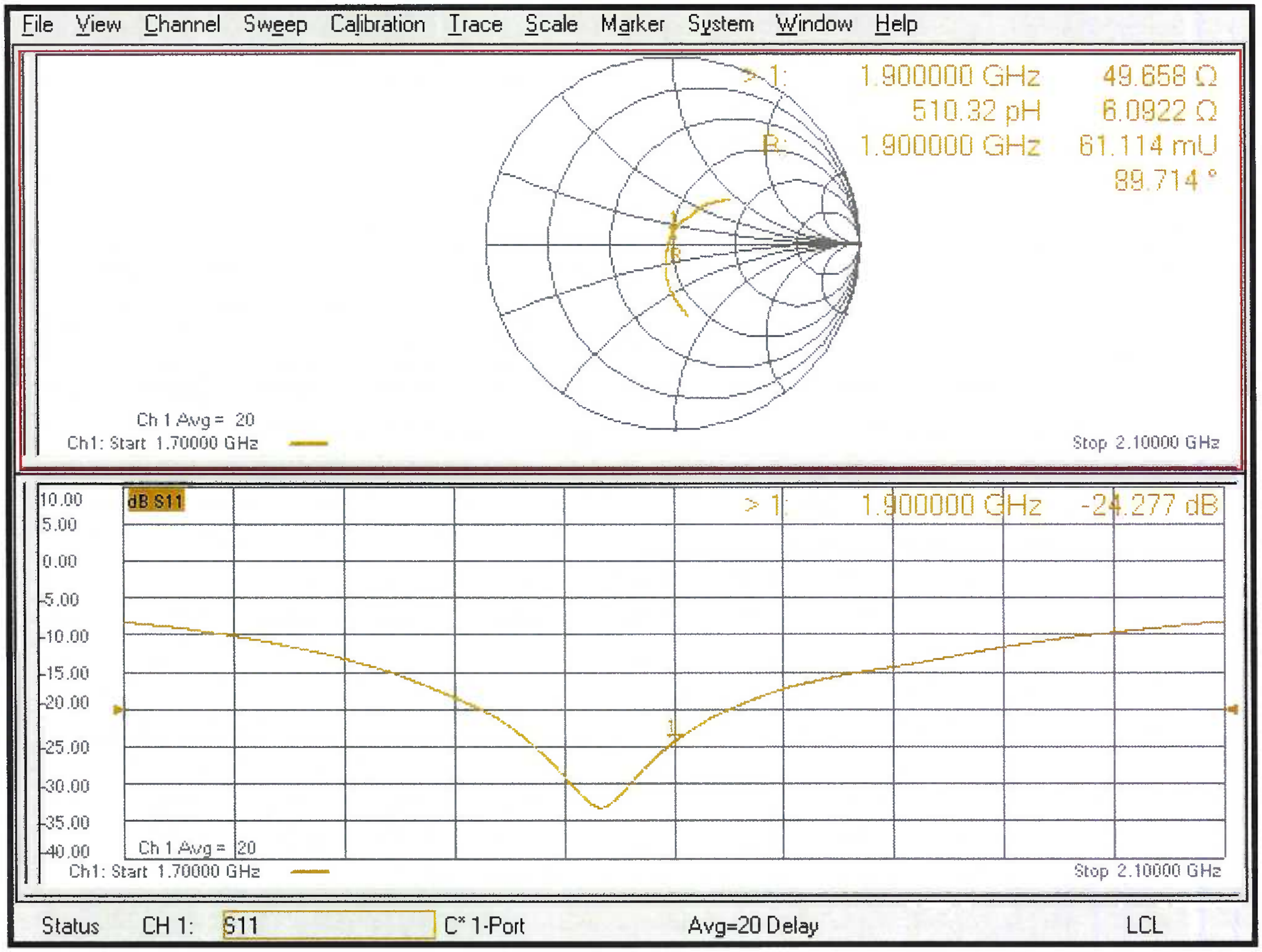
- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 109.5 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 18.6 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.27 W/kg
Smallest distance from peaks to all points 3 dB below = 9.8 mm
Ratio of SAR at M2 to SAR at M1 = 55%
Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. D2450V2-829_May24

CALIBRATION CERTIFICATE

Object: D2450V2 - SN:829

Calibration procedure(s): QA CAL-05.v12
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: May 06, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 7, 2024

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	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	37.9 ± 6 %	1.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.0 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	53.9 Ω + 4.1 jΩ
Return Loss	- 25.4 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

Date: 06.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

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

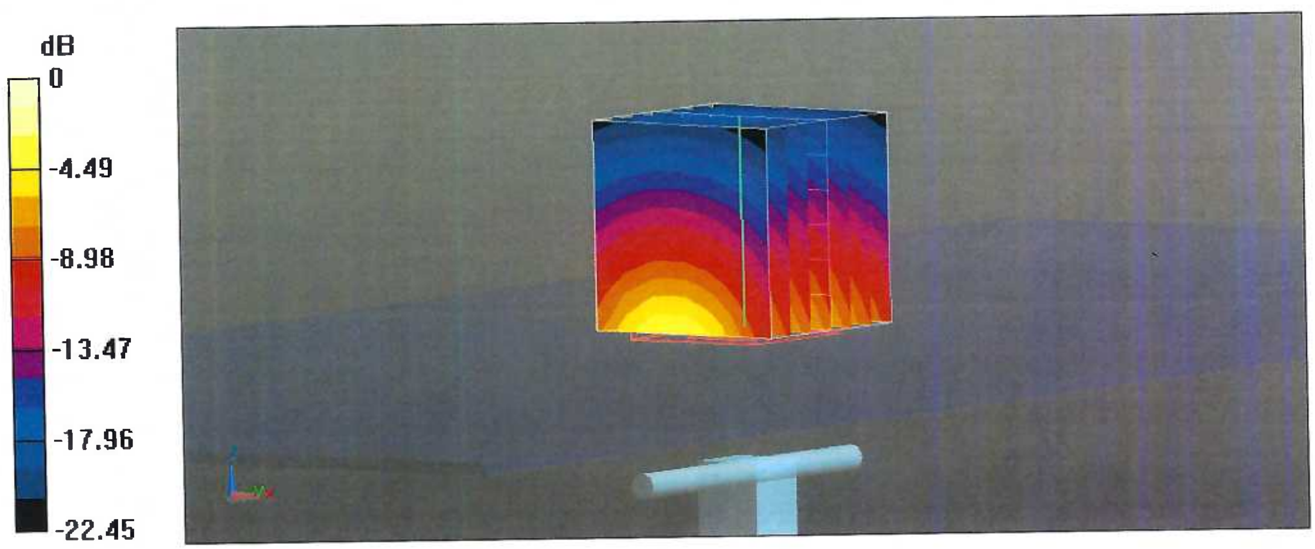
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

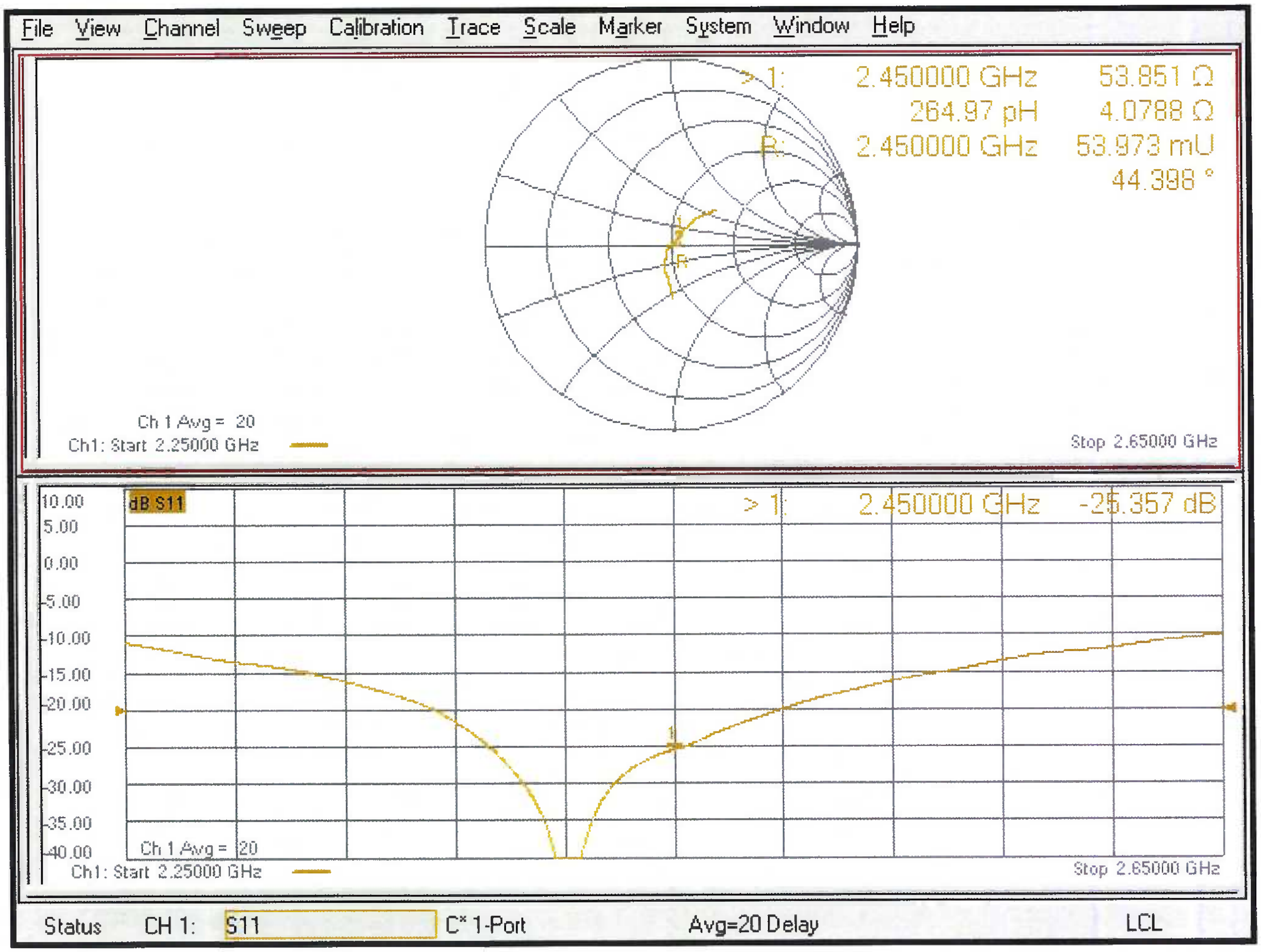
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 116.7 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.36 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50.6%
Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos, USA

Certificate No. D5GHzV2-1085_May24

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1085
Calibration procedure(s)	QA CAL-22.v7 Calibration Procedure for SAR Validation Sources between 3-10 GHz
Calibration date:	May 08, 2024

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 NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 06327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 3503	07-Mar-24 (No. EX3-3503_Mar24)	Mar-25
DAE4	SN: 601	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Joanna Lleshaj	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: May 10, 2024

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	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	36.7 ± 6 %	4.58 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.0 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 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	35.8 ± 6 %	5.14 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	8.00 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 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	49.8 Ω - 4.2 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	57.5 Ω - 3.5 jΩ
Return Loss	- 22.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	54.2 Ω + 0.0 jΩ
Return Loss	- 28.0 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

Date: 08.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1085

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.58 S/m; ε_r = 36.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.14 S/m; ε_r = 35.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

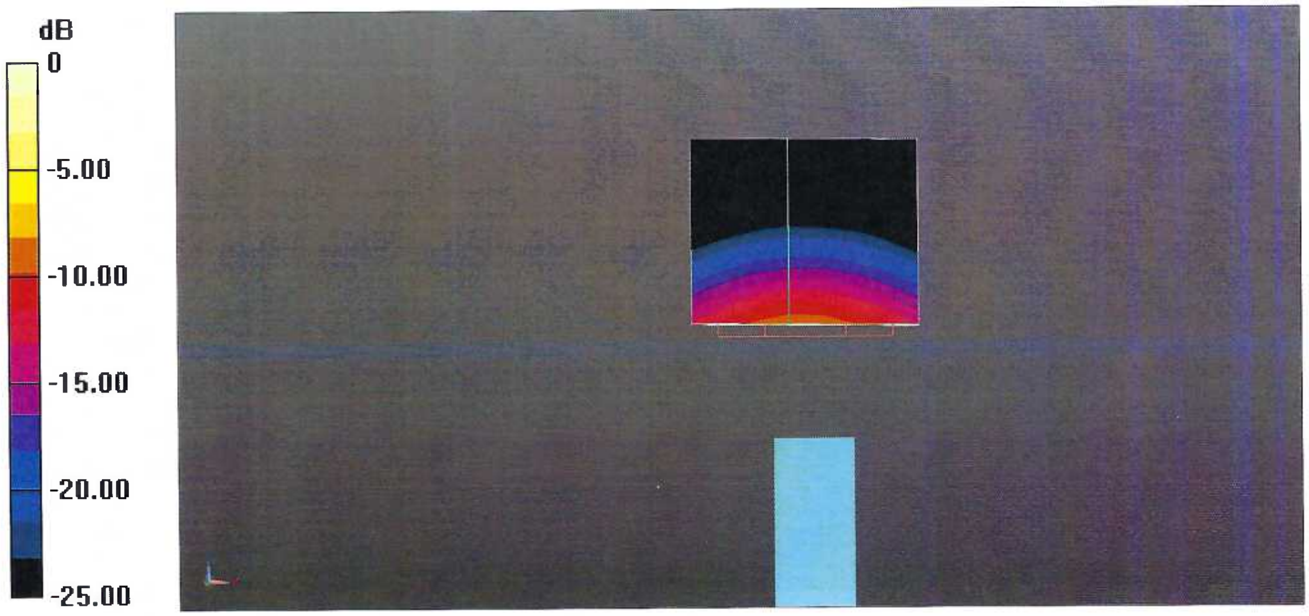
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.39, 5.39, 5.39) @ 5250 MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 07.03.2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 73.26 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 26.6 W/kg
SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 71.3%
Maximum value of SAR (measured) = 18.3 W/kg

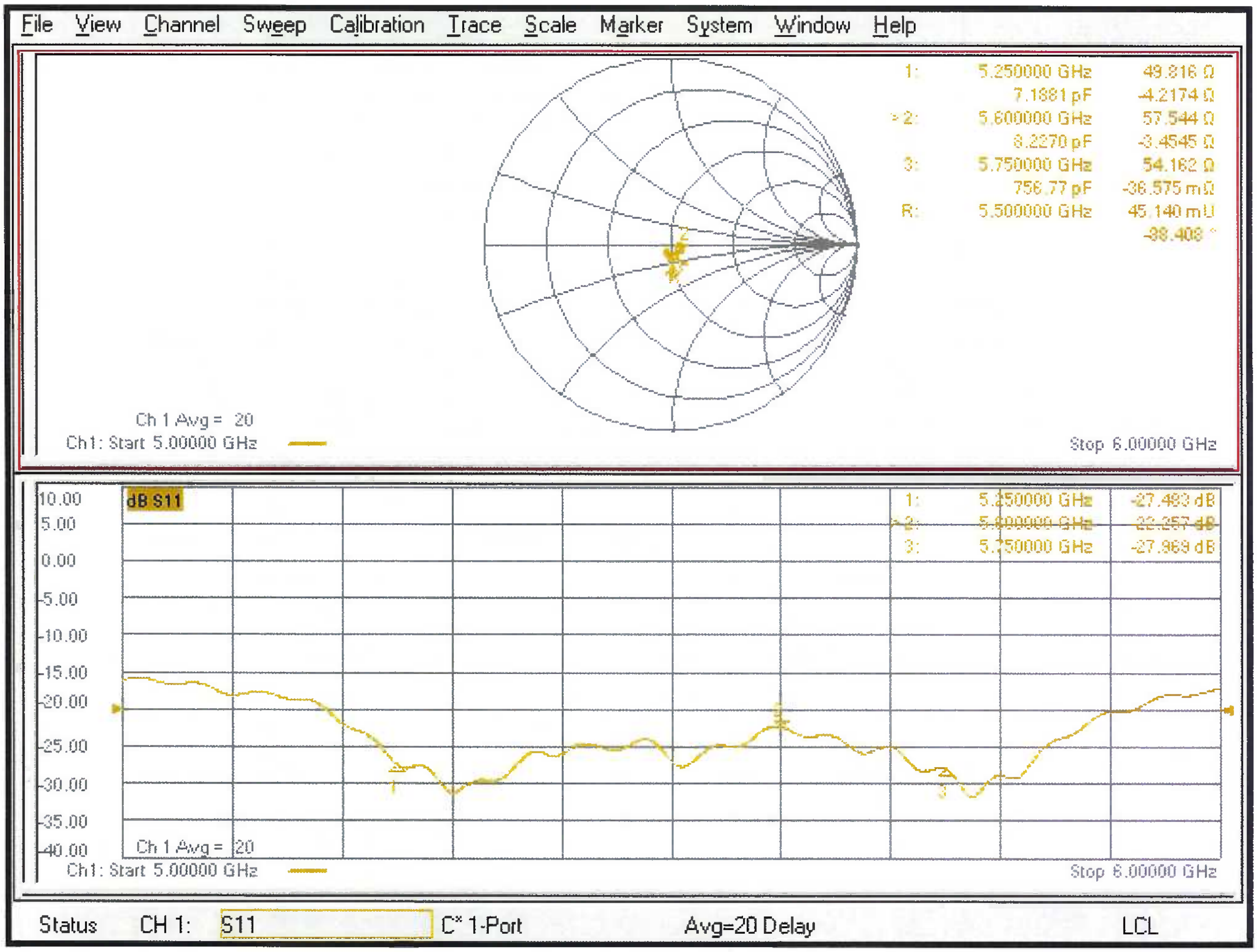
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.31 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 30.0 W/kg
SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.36 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 19.7 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 = 70.21 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 30.5 W/kg
SAR(1 g) = 8.00 W/kg; SAR(10 g) = 2.28 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 66.6%
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Head TSL



Appendix F – DAE Calibration Data Sheets

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

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

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

Accreditation No.: SCS 0108

Client **RF Exposure Lab**
San Marcos - USA

Certificate No: DAE4-759_Sep24

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 759

Calibration procedure(s): QA CAL-06.v30
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: September 04, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	27-Aug-24 (No:40547)	Aug-25
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	23-Jan-24 (in house check)	In house check: Jan-25
Calibrator Box V2.1	SE UMS 006 AA 1002	23-Jan-24 (in house check)	In house check: Jan-25

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	i.V.

Issued: September 4, 2024

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	**X**	**Y**	**Z**
High Range	406.205 ± 0.02% (k=2)	406.072 ± 0.02% (k=2)	406.474 ± 0.02% (k=2)
Low Range	3.97093 ± 1.50% (k=2)	4.01172 ± 1.50% (k=2)	3.98833 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	215.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199999.30	-0.94	-0.00
Channel X	+ Input	20005.26	0.45	0.00
Channel X	- Input	-19996.32	4.05	-0.02
Channel Y	+ Input	200001.58	1.32	0.00
Channel Y	+ Input	20003.45	-1.27	-0.01
Channel Y	- Input	-19997.50	2.87	-0.01
Channel Z	+ Input	199999.52	-0.44	-0.00
Channel Z	+ Input	20002.49	-2.16	-0.01
Channel Z	- Input	-19999.27	1.26	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2004.87	1.47	0.07
Channel X	+ Input	204.68	1.12	0.55
Channel X	- Input	-196.25	-0.08	0.04
Channel Y	+ Input	2004.20	0.87	0.04
Channel Y	+ Input	203.79	0.36	0.18
Channel Y	- Input	-196.52	-0.24	0.12
Channel Z	+ Input	2004.04	0.85	0.04
Channel Z	+ Input	202.64	-0.68	-0.34
Channel Z	- Input	-198.33	-1.86	0.95

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	6.03	4.12
	- 200	-1.99	-3.56
Channel Y	200	7.61	7.94
	- 200	-9.04	-8.77
Channel Z	200	-15.46	-15.41
	- 200	14.40	13.90

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-1.45	-2.83
Channel Y	200	8.29	-	-0.85
Channel Z	200	5.98	6.18	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15753	15749
Channel Y	15681	16332
Channel Z	15967	16055

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.29	-1.91	2.13	0.54
Channel Y	-0.88	-2.08	-0.01	0.47
Channel Z	1.90	0.54	4.01	0.65

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

Appendix G – Phantom Calibration Data Sheets

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
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info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	SAM Head Stand Phantom V10
Type No	QD 012 003 Cx
Series No	1001 and higher
Manufacturer / Origin	Schmid & Partner Engineering AG Zeughausstrasse 43, CH-8004 Zürich, Switzerland

Tests

Complete tests were made on the pre-series QD 012 003 C, # TP-1001. Certain parameters are retested on series items.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File *	File verified
Material thickness of shell	2mm ± 0.2mm with respect to CAD file		First article, All items
Material parameters	Dielectric parameters	rel. permittivity 3.0 ± 0.5 loss tangent ≤ 0.05	Material samples
Material resistivity	Compatibility with tissue simulating liquids	Compatible with SPEAG liquids. **	Phantoms, Material sample

* The IT'IS CAD file is derived from [1] and is also within the tolerance requirements of the shapes of the other documents.

** Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility.

*** Note: Phantom shall not be exposed to direct sunlight.

Standards

[1] IEEE 1528-2013, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, June 2013

[2] IEC 62209–1, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Conformity

Based on the tests and simulations above, we certify that shape and material parameters of this item are in compliance with the requirements in [1-2].

Date 10.10.2016 / KP

Signature / Stamp

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

Appendix H – 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 H-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
1	750	02/20/2024	7530	EX3DV4	750	Head	0.90	41.67	Pass	Pass	Pass	QPSK	Pass	Pass
1	900	02/20/2024	7530	EX3DV4	900	Head	0.99	40.53	Pass	Pass	Pass	WCDMA	Pass	Pass
1	900	02/20/2024	7530	EX3DV4	900	Head	0.99	40.53	Pass	Pass	Pass	QPSK	Pass	Pass
1	1750	02/20/2024	7530	EX3DV4	1750	Head	1.40	39.21	Pass	Pass	Pass	WCDMA	Pass	Pass
1	1750	02/20/2024	7530	EX3DV4	1750	Head	1.40	39.21	Pass	Pass	Pass	QPSK	Pass	Pass
1	1900	02/21/2024	7530	EX3DV4	1900	Head	1.41	39.07	Pass	Pass	Pass	WCDMA	Pass	Pass
1	1900	02/21/2024	7530	EX3DV4	1900	Head	1.41	39.07	Pass	Pass	Pass	QPSK	Pass	Pass
1	2450	02/08/2024	7530	EX3DV4	3900	Head	1.83	38.49	Pass	Pass	Pass	DSS/OFDM	Pass	Pass
1	5250	02/08/2024	7530	EX3DV4	5250	Head	4.75	35.21	Pass	Pass	Pass	OFDM	Pass	Pass
1	5600	02/08/2024	7530	EX3DV4	5600	Head	5.11	34.95	Pass	Pass	Pass	OFDM	Pass	Pass
1	5750	02/09/2024	7530	EX3DV4	5750	Head	5.27	34.72	Pass	Pass	Pass	OFDM	Pass	Pass