RF Exposure Lab

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

# CERTIFICATE OF COMPLIANCE
# SAR EVALUATION

| | | | |
|---|---|---|---|
| DMS-Service LLC | | Dates of Test: | August 29-30, 2024 |
| 11845 W. Olympic Blvd., Ste 880W | | Test Report Number: | SAR.20240816 |
| Los Angeles, CA  90064 | | | |

Lab Designation Number: US1195

| | |
|---|---|
| FCC ID: | 2A3KO-RC7611 |
| Contains WiFi Module: | Espressif Model ESP-PICO-MINI-02 FCC ID: 2AC7Z-ESPPICOMINI |
| HVIN/Model(s): | RC7611 |
| Host Marketing Name: | 3000sl-b |
| Test Sample: | Engineering Unit Same as Production |
| Serial Number: | Eng 1 |
| Equipment Type: | Wireless ECG Monitor |
| Classification: | Portable Transmitter Next to Body |
| TX Frequency Range: | 663 – 698 MHz, 699 – 716 MHz, 777 – 787 MHz, 788 – 798 MHz, 814 – 849 MHz, 1710 – 1780 MHz, 1850 – 1915 MHz, 2412 – 2462 MHz, 2402 – 2480 MHz |
| Frequency Tolerance: | ± 2.5 ppm |
| Maximum RF Output: | 750 MHz (LTE) – 24.0 dBm, 850 MHz (LTE) – 24.0 dBm, 1750 MHz (LTE) – 24.0 dBm, 1900 MHz (LTE) – 24.0 dBm, 2450 MHz (b) – 19.5 dBm, 2450 MHz (g) – 18.0 dBm, 2450 MHz (n) – 18.0 dBm, 2450 MHz (BT) – 9.0 dBm Conducted |
| Signal Modulation: | GMSK, QPSK, 16QAM, DSSS, OFDM |
| Antenna Type: | Internal |
| Application Type: | Certification |
| FCC Rule Parts: | Part  2, 15C, 22, 24, 27 |
| KDB Test Methodology: | KDB 447498 D01 v06, KDB 248227 D01 v02r02, KDB 941225 D01 v03r01 & D05 v02r05 |
| Max. Stand Alone SAR Value: | 1.32 W/kg Reported |
| Separation Distance: | 0 mm |

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI 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

ACCREDITED
**Testing Cert. # 2387.01**

# Table of Contents

| Comment/Revision | Date |
|---|---|
| Original Release | September 5, 2024 |
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**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 DMS-Services LLC Model 3000sl-b with FCC ID: 2A3KO-RC7611 and contains FCC ID: 2AC7Z-ESPPICOMINI 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 DMS-Service LLC Model 3000sl-b 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 3000sl-b Wireless ECG Monitor. The table also shows the tolerance for the power level for each mode.

| Module | Band | Technology | Class | 3GPP Nominal Power dBm | Setpoint Nominal Power dBm | Tolerance dBm | Lower Tolerance dBm | Upper Tolerance dBm |
|---|---|---|---|---|---|---|---|---|
| RC7611 | Band 2 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 4 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 5 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 12 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 13 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 14 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 25 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 26 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 66 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 71 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| Espressif ESP-PICO-MINI-02 | 2.4 GHz | 802.11b | N/A | N/A | N/A | N/A | N/A | 19.5 |
| | 2.4 GHz | 802.11g | N/A | N/A | N/A | N/A | N/A | 18.0 |
| | 2.4 GHz | 802.11n | N/A | N/A | N/A | N/A | N/A | 18.0 |
| | 2.4 GHz | Bluetooth | N/A | N/A | N/A | N/A | N/A | 9.0 |

# SAR Definition [5]

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

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

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:

$\sigma$ = conductivity of the tissue (S/m)

$\rho$ = 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.

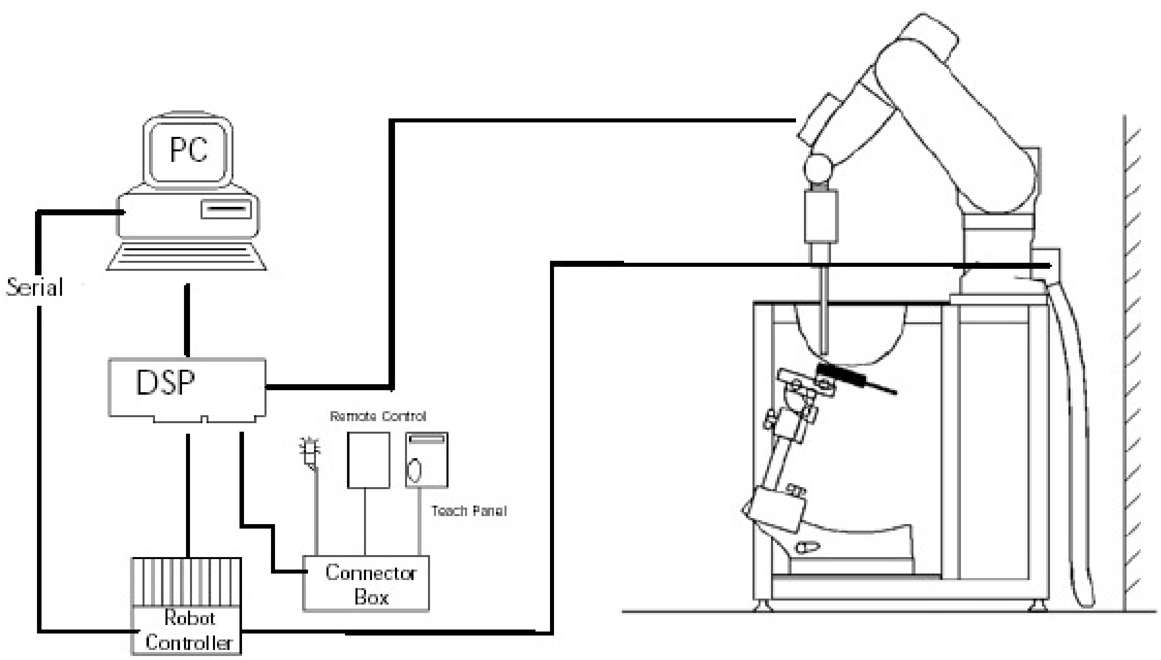



**Figure 2.1 SAR Measurement System Setup**

## 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

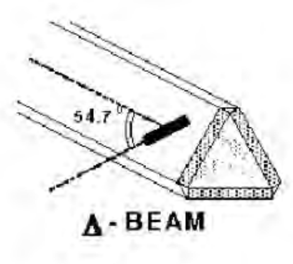



Figure 2.2 Triangular Probe Configurations

**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

**Tip length:** 20 mm

**Body diameter:** 12 mm

**Tip diameter:** 2.5 mm

**Distance from probe tip to sensor center:** 1 mm

Figure 2.3 Probe Thick-Film Technique

**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:

$\Delta t$ = exposure time (30 seconds),

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

$\Delta T$ = temperature increase due to RF exposure.

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

where:

$\sigma$ = simulated tissue conductivity,

$\rho$ = 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;

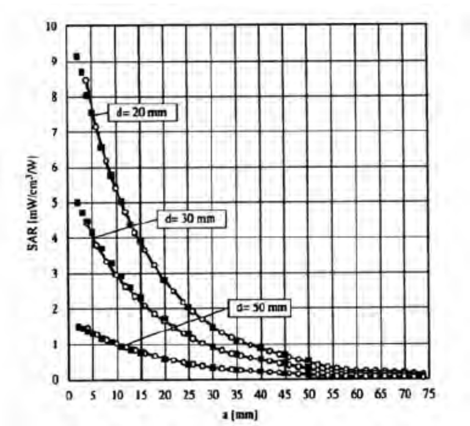



**Figure 2.4 E-Field and Temperature Measurements at 900MHz**

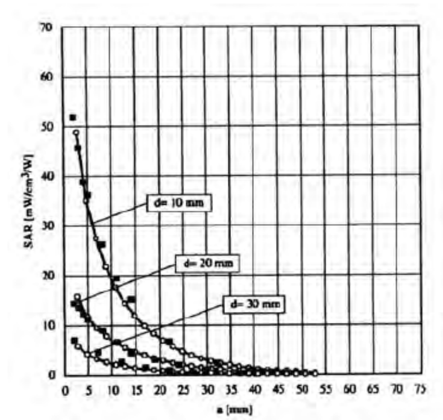



**Figure 2.5 E-Field and Temperature Measurements at 1800MHz**

## 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

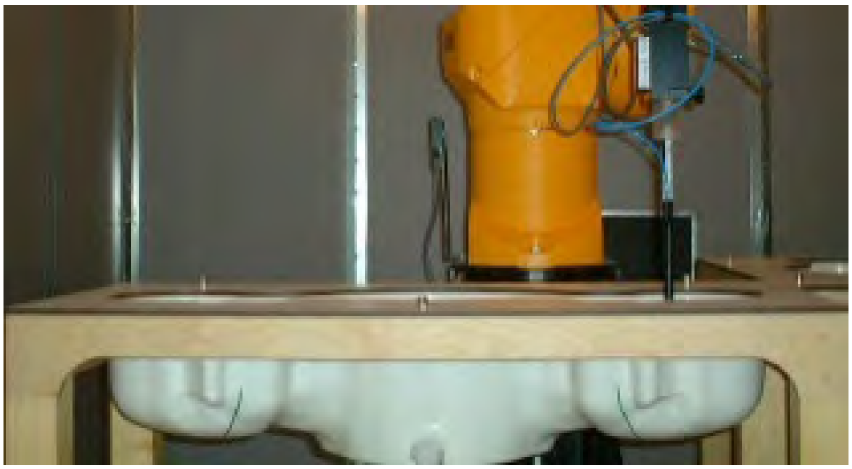


**Figure 2.6 SAM Twin Phantom**

## 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 consists 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 | 2450 MHz Head |
| Mixing Percentage | | | | | | |
| Water | | Proprietary Mixture Procured from Speag | | | | |
| Sugar | | | | | | |
| Salt | | | | | | |
| HEC | | | | | | |
| Bactericide | | | | | | |
| DGBE | | | | | | |
| Dielectric Constant | Target | 41.94 | 41.50 | 40.08 | 40.00 | 39.20 |
| Conductivity (S/m) | Target | 0.89 | 0.97 | 1.37 | 1.40 | 1.80 |

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

## Uncontrolled Environment

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

## Controlled Environment

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

**Table 5.1 Human Exposure Limits**

| | UNCONTROLLED ENVIRONMENT<br>General Population<br>(W/kg) or (mW/g) | CONTROLLED ENVIROMENT<br>Professional Population<br>(W/kg) or (mW/g) |
|---|---|---|
| SPATIAL PEAK SAR [1]<br>Head | 1.60 | 8.00 |
| SPATIAL AVERAGE SAR [2]<br>Whole Body | 0.08 | 0.40 |
| SPATIAL PEAK SAR [3]<br>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) | | Aug. 29, 2024 | | Aug. 29, 2024 | | Aug. 29, 2024 | |
| Liquid Temperature (˚C) | 20.0 | Target | Measured | Target | Measured | Target | Measured |
| Dielectric Constant: ε | | 41.94 | 41.60 | 41.50 | 40.43 | 40.08 | 39.02 |
| Conductivity: σ | | 0.89 | 0.91 | 0.97 | 1.01 | 1.37 | 1.41 |
| | | 1900 MHz Head | | 2450 MHz Head | | | |
| Date(s) | | Aug. 30, 2024 | | Aug. 30, 2024 | | | |
| Liquid Temperature (˚C) | 20.0 | Target | Measured | Target | Measured | | |
| Dielectric Constant: ε | | 40.00 | 39.04 | 39.20 | 38.32 | | |
| Conductivity: σ | | 1.40 | 1.43 | 1.80 | 1.83 | | |

See Appendix A for data printout.

## Test System Verification

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

**Table 7.2 System Dipole Validation Target & Measured**

| | Test Frequency | Targeted $SAR_{1g}$ (W/kg) | Measure $SAR_{1g}$ (W/kg) | Tissue Used for Verification | Deviation (%) | Plot Number |
|---|---|---|---|---|---|---|
| 29-Aug-2024 | 750 MHz | 8.76 | 8.49 | Head | - 3.08 | 1 |
| 29-Aug-2024 | 900 MHz | 11.00 | 11.70 | Head | + 6.36 | 2 |
| 29-Aug-2024 | 1750 MHz | 36.70 | 37.50 | Head | + 2.18 | 3 |
| 30-Aug-2024 | 1900 MHz | 40.60 | 41.50 | Head | + 2.22 | 4 |
| 30-Aug-2024 | 2450 MHz | 53.30 | 52.30 | Head | - 1.88 | 5 |

See Appendix A for data plots.

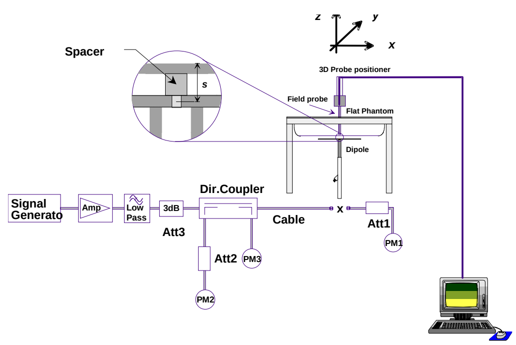



**Figure 7.1 Dipole Validation Test Setup**

# 8. LTE Document Checklist

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

| LTE Operating Band | Uplink (transmit) Low - high | Downlink (Receive) Low - high | Duplex mode (FDD/TDD) |
|---|---|---|---|
| 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 |
| 25 | 1850-1915 | 1930-1995 | FDD |
| 26 | 814-849 | 859-894 | 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 |
| 25 | 1.4, 3, 5, 10, 15, 20 | 1850-1915 MHz |
| 26 | 1.4, 3, 5, 10, 15 | 814-849 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 | ----- | ----- |
| 25 | 1.4 | 1850.7 | 26047 | 1882.5 | 26365 | 1914.3 | 26683 |
| 25 | 3 | 1851.5 | 26055 | 1882.5 | 26365 | 1913.5 | 26675 |
| 25 | 5 | 1852.5 | 26065 | 1882.5 | 26365 | 1912.5 | 26665 |
| 25 | 10 | 1855.0 | 26090 | 1882.5 | 26365 | 1910.0 | 26640 |
| 25 | 15 | 1857.5 | 26115 | 1882.5 | 26365 | 1907.5 | 26615 |
| 25 | 20 | 1860.0 | 26140 | 1882.5 | 26365 | 1905.0 | 26590 |
| 26 | 1.4 | 814.7 | 26697 | 831.5 | 26865 | 848.3 | 27033 |
| 26 | 3 | 815.5 | 26705 | 831.5 | 26865 | 847.5 | 27025 |
| 26 | 5 | 816.5 | 26715 | 831.5 | 26865 | 846.5 | 27015 |
| 26 | 10 | 819.0 | 26740 | 831.5 | 26865 | 844.0 | 26990 |
| 26 | 15 | 821.5 | 26765 | 831.5 | 26865 | 841.5 | 26995 |
| 66 | 1.4 | 1710.7 | 131979 | 1755.0 | 132422 | 1779.3 | 132665 |
| 66 | 3 | 1711.5 | 131987 | 1755.0 | 132422 | 1778.5 | 132657 |
| 66 | 5 | 1712.5 | 131997 | 1755.0 | 132422 | 1777.4 | 132646 |
| 66 | 10 | 1716.1 | 132033 | 1755.0 | 132422 | 1774.9 | 132621 |
| 66 | 15 | 1717.5 | 132047 | 1755.0 | 132422 | 1772.4 | 132596 |
| 66 | 20 | 1720.0 | 132072 | 1755.0 | 132422 | 1769.9 | 132571 |
| 71 | 5 | 665.5 | 133147 | 680.5 | 133297 | 695.5 | 133447 |
| 71 | 10 | 668.0 | 133172 | 680.5 | 133297 | 693.0 | 133422 |
| 71 | 15 | 670.5 | 133197 | 680.5 | 133297 | 690.5 | 133397 |
| 71 | 20 | 673.0 | 133222 | 680.5 | 133297 | 688.0 | 133372 |

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

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

The device has 2 antennas:
- 1 – WWAN (Transmit and Receive) Antenna
- 1 – WiFi (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 body configuration. See test setup photos to see all configurations tested.

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

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

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

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

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

8) Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band:

The maximum average conducted output power measured for the testing is listed on pages 25-47 of this report. The below table shows the factory set point with the allowable tolerance.

| Module | Band | Technology | Class | 3GPP Nominal Power dBm | Setpoint Nominal Power dBm | Tolerance dBm | Lower Tolerance dBm | Upper Tolerance dBm |
|---|---|---|---|---|---|---|---|---|
| RC7611 | Band 2 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 4 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 5 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 12 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 13 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 14 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 25 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 26 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 66 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |
| | Band 71 | LTE-FDD | 3 | 23.0 | 23.0 | ± 1.0 | 22.0 | 24.0 |

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

Other wireless modes:

| Module | Band | Technology | Class | 3GPP Nominal Power dBm | Setpoint Nominal Power dBm | Tolerance dBm | Lower Tolerance dBm | Upper Tolerance dBm |
|---|---|---|---|---|---|---|---|---|
| Espressif ESP-PICO-MINI-02 | 2.4 GHz | 802.11b | N/A | N/A | N/A | N/A | N/A | 19.5 |
| | 2.4 GHz | 802.11g | N/A | N/A | N/A | N/A | N/A | 18.0 |
| | 2.4 GHz | 802.11n | N/A | N/A | N/A | N/A | N/A | 18.0 |
| | 2.4 GHz | Bluetooth | N/A | N/A | N/A | N/A | N/A | 9.0 |

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, WCDMA and WiFi measurements are on page 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.

The EUT was tested on the front and back sides of the device for the both the cellular and WiFi transmitters. The device is mounted on an electrode pad which is adhered to the patient's body. Therefore, the electrode was used for the measurements on the back side of the device. The device has an inherent duty cycle of 20%. It operated only 20 seconds every 15 minutes. Due to the FCC limit for the period in calculating the duty cycle to a 100 second period, the duty cycle is 20%. Please review the duty cycle justification document as part of this application. The user will only have the back and front next to the body when it is adhered to the body. All remaining sides were excluded due to the installation and use of the device. See Appendix C for photos of the setup.

The minimum distance from the Bluetooth antenna to the user is 6 mm. The calculation for the exclusion is based on KDB447498 D01 v06 section 4.3.1 a). The calculation is shown below for body SAR. The maximum transmit power of the Bluetooth transmitter is 8 mW. Therefore, the Bluetooth transmitter is excluded from SAR testing.

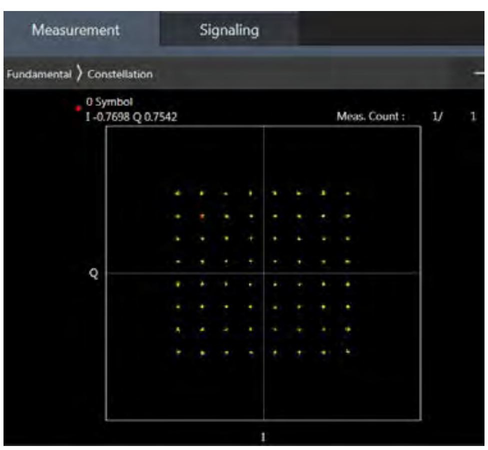
[(max power, mW) / (min distance, mm)] * [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g extremity SAR

[8 mW/6 mm] * $\sqrt{2.48}$ = 2.1, which is less than 3.0

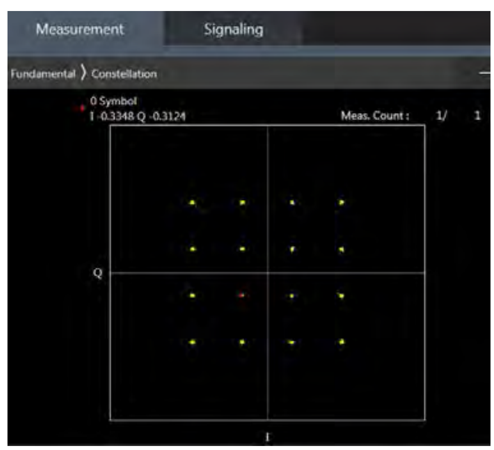
**LTE Conducted Power**

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 2/4/5 SAR test was covered by Band 25/26/66; 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 | 22.4 | 21.1 |
| | | | | 18900 | 1880.0 | 22.1 | 21.6 |
| | | | | 19193 | 1909.3 | 22.1 | 21.1 |
| | | | 3 | 18607 | 1850.7 | 22.1 | 21.3 |
| | | | | 18900 | 1880.0 | 22.6 | 21.2 |
| | | | | 19193 | 1909.3 | 22.3 | 21.6 |
| | | | 5 | 18607 | 1850.7 | 22.6 | 21.6 |
| | | | | 18900 | 1880.0 | 22.5 | 21.6 |
| | | | | 19193 | 1909.3 | 22.2 | 21.6 |
| | | 3 | 0 | 18607 | 1850.7 | 22.6 | 21.6 |
| | | | | 18900 | 1880.0 | 22.6 | 21.3 |
| | | | | 19193 | 1909.3 | 22.2 | 21.6 |
| | | | 1 | 18607 | 1850.7 | 22.5 | 21.3 |
| | | | | 18900 | 1880.0 | 22.3 | 21.5 |
| | | | | 19193 | 1909.3 | 22.3 | 21.5 |
| | | | 3 | 18607 | 1850.7 | 22.5 | 21.3 |
| | | | | 18900 | 1880.0 | 22.2 | 21.5 |
| | | | | 19193 | 1909.3 | 22.5 | 21.2 |
| | | 6 | 0 | 18607 | 1850.7 | 21.5 | 20.6 |
| | | | | 18900 | 1880.0 | 21.3 | 20.1 |
| | | | | 19193 | 1909.3 | 21.2 | 20.6 |
| | 3 MHz | 1 | 0 | 18615 | 1851.5 | 22.5 | 21.3 |
| | | | | 18900 | 1880.0 | 22.2 | 21.2 |
| | | | | 19185 | 1908.5 | 22.1 | 21.6 |
| | | | 7 | 18615 | 1851.5 | 22.1 | 21.6 |
| | | | | 18900 | 1880.0 | 22.6 | 21.2 |
| | | | | 19185 | 1908.5 | 22.5 | 21.5 |
| | | | 14 | 18615 | 1851.5 | 22.6 | 21.2 |
| | | | | 18900 | 1880.0 | 22.3 | 21.4 |
| | | | | 19185 | 1908.5 | 22.5 | 21.0 |
| | | 8 | 0 | 18615 | 1851.5 | 21.3 | 20.6 |
| | | | | 18900 | 1880.0 | 21.6 | 20.1 |
| | | | | 19185 | 1908.5 | 21.2 | 20.5 |
| | | | 7 | 18615 | 1851.5 | 21.6 | 20.5 |
| | | | | 18900 | 1880.0 | 21.2 | 20.1 |
| | | | | 19185 | 1908.5 | 21.1 | 20.5 |
| | | | 14 | 18615 | 1851.5 | 21.4 | 20.3 |
| | | | | 18900 | 1880.0 | 21.3 | 20.7 |
| | | | | 19185 | 1908.5 | 21.3 | 20.4 |
| | | 15 | 0 | 18615 | 1851.5 | 21.2 | 20.0 |
| | | | | 18900 | 1880.0 | 21.6 | 20.6 |
| | | | | 19185 | 1908.5 | 21.5 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 2 | 5 MHz | 1 | 0 | 18625 | 1852.5 | 22.4 | 21.6 |
| | | | | 18900 | 1880.0 | 22.4 | 21.3 |
| | | | | 19175 | 1907.5 | 22.1 | 21.1 |
| | | | 12 | 18625 | 1852.5 | 22.4 | 21.2 |
| | | | | 18900 | 1880.0 | 22.5 | 21.2 |
| | | | | 19175 | 1907.5 | 22.1 | 21.5 |
| | | | 24 | 18625 | 1852.5 | 22.6 | 21.2 |
| | | | | 18900 | 1880.0 | 22.7 | 21.0 |
| | | | | 19175 | 1907.5 | 22.1 | 21.7 |
| | | 12 | 0 | 18625 | 1852.5 | 21.3 | 20.1 |
| | | | | 18900 | 1880.0 | 21.1 | 20.1 |
| | | | | 19175 | 1907.5 | 21.6 | 20.2 |
| | | | 6 | 18625 | 1852.5 | 21.0 | 20.6 |
| | | | | 18900 | 1880.0 | 21.5 | 20.2 |
| | | | | 19175 | 1907.5 | 21.3 | 20.2 |
| | | | 13 | 18625 | 1852.5 | 21.3 | 20.2 |
| | | | | 18900 | 1880.0 | 21.6 | 20.6 |
| | | | | 19175 | 1907.5 | 21.2 | 20.3 |
| | | 25 | 0 | 18625 | 1852.5 | 21.7 | 20.5 |
| | | | | 18900 | 1880.0 | 21.4 | 20.1 |
| | | | | 19175 | 1907.5 | 21.5 | 20.7 |
| | 10 MHz | 1 | 0 | 18650 | 1855.0 | 22.6 | 21.5 |
| | | | | 18900 | 1880.0 | 22.2 | 21.0 |
| | | | | 19150 | 1905.0 | 22.4 | 21.6 |
| | | | 24 | 18650 | 1855.0 | 22.0 | 21.3 |
| | | | | 18900 | 1880.0 | 22.5 | 21.1 |
| | | | | 19150 | 1905.0 | 22.1 | 21.4 |
| | | | 49 | 18650 | 1855.0 | 22.7 | 21.3 |
| | | | | 18900 | 1880.0 | 22.2 | 21.2 |
| | | | | 19150 | 1905.0 | 22.4 | 21.1 |
| | | 25 | 0 | 18650 | 1855.0 | 21.0 | 20.0 |
| | | | | 18900 | 1880.0 | 21.6 | 20.0 |
| | | | | 19150 | 1905.0 | 21.6 | 20.7 |
| | | | 13 | 18650 | 1855.0 | 21.3 | 20.0 |
| | | | | 18900 | 1880.0 | 21.1 | 20.2 |
| | | | | 19150 | 1905.0 | 21.1 | 20.4 |
| | | | 25 | 18650 | 1855.0 | 21.0 | 20.7 |
| | | | | 18900 | 1880.0 | 21.1 | 20.2 |
| | | | | 19150 | 1905.0 | 21.6 | 20.6 |
| | | 50 | 0 | 18650 | 1855.0 | 21.3 | 20.2 |
| | | | | 18900 | 1880.0 | 21.6 | 20.6 |
| | | | | 19150 | 1905.0 | 21.3 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 2 | 15 MHz | 1 | 0 | 18675 | 1857.5 | 22.5 | 21.4 |
| | | | | 18900 | 1880.0 | 22.3 | 21.3 |
| | | | | 19125 | 1902.5 | 22.0 | 21.6 |
| | | | 37 | 18675 | 1857.5 | 22.1 | 21.6 |
| | | | | 18900 | 1880.0 | 22.1 | 21.4 |
| | | | | 19125 | 1902.5 | 22.2 | 21.4 |
| | | | 74 | 18675 | 1857.5 | 22.6 | 21.4 |
| | | | | 18900 | 1880.0 | 22.5 | 21.3 |
| | | | | 19125 | 1902.5 | 22.3 | 21.2 |
| | | 36 | 0 | 18675 | 1857.5 | 21.3 | 20.5 |
| | | | | 18900 | 1880.0 | 21.1 | 20.4 |
| | | | | 19125 | 1902.5 | 21.4 | 20.5 |
| | | | 19 | 18675 | 1857.5 | 21.7 | 20.7 |
| | | | | 18900 | 1880.0 | 21.5 | 20.2 |
| | | | | 19125 | 1902.5 | 21.2 | 20.7 |
| | | | 39 | 18675 | 1857.5 | 21.5 | 20.4 |
| | | | | 18900 | 1880.0 | 21.3 | 20.6 |
| | | | | 19125 | 1902.5 | 21.4 | 20.2 |
| | | 75 | 0 | 18675 | 1857.5 | 21.6 | 20.6 |
| | | | | 18900 | 1880.0 | 21.4 | 20.4 |
| | | | | 19125 | 1902.5 | 21.4 | 20.6 |
| | 20 MHz | 1 | 0 | 18700 | 1860.0 | 22.0 | 21.7 |
| | | | | 18900 | 1880.0 | 22.3 | 21.3 |
| | | | | 19100 | 1900.0 | 22.5 | 21.5 |
| | | | 49 | 18700 | 1860.0 | 22.5 | 21.5 |
| | | | | 18900 | 1880.0 | 22.5 | 21.5 |
| | | | | 19100 | 1900.0 | 22.3 | 21.3 |
| | | | 99 | 18700 | 1860.0 | 22.7 | 21.0 |
| | | | | 18900 | 1880.0 | 22.6 | 21.2 |
| | | | | 19100 | 1900.0 | 22.4 | 21.3 |
| | | 50 | 0 | 18700 | 1860.0 | 21.5 | 20.6 |
| | | | | 18900 | 1880.0 | 21.0 | 20.1 |
| | | | | 19100 | 1900.0 | 21.6 | 20.4 |
| | | | 24 | 18700 | 1860.0 | 21.3 | 20.6 |
| | | | | 18900 | 1880.0 | 21.3 | 20.1 |
| | | | | 19100 | 1900.0 | 21.7 | 20.3 |
| | | | 50 | 18700 | 1860.0 | 21.3 | 20.5 |
| | | | | 18900 | 1880.0 | 21.2 | 20.7 |
| | | | | 19100 | 1900.0 | 21.7 | 20.4 |
| | | 100 | 0 | 18700 | 1860.0 | 21.7 | 20.5 |
| | | | | 18900 | 1880.0 | 21.1 | 20.1 |
| | | | | 19100 | 1900.0 | 21.5 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 4 | 1.4 MHz | 1 | 0 | 19957 | 1710.7 | 22.2 | 21.5 |
| | | | | 20175 | 1732.5 | 22.7 | 21.5 |
| | | | | 20393 | 1754.3 | 22.4 | 21.1 |
| | | | 3 | 19957 | 1710.7 | 22.5 | 21.4 |
| | | | | 20175 | 1732.5 | 22.6 | 21.5 |
| | | | | 20393 | 1754.3 | 22.1 | 21.5 |
| | | | 5 | 19957 | 1710.7 | 22.1 | 21.2 |
| | | | | 20175 | 1732.5 | 22.2 | 21.5 |
| | | | | 20393 | 1754.3 | 22.0 | 21.2 |
| | | 3 | 0 | 19957 | 1710.7 | 22.5 | 21.1 |
| | | | | 20175 | 1732.5 | 22.7 | 21.0 |
| | | | | 20393 | 1754.3 | 22.2 | 21.7 |
| | | | 1 | 19957 | 1710.7 | 22.5 | 21.4 |
| | | | | 20175 | 1732.5 | 22.1 | 21.4 |
| | | | | 20393 | 1754.3 | 22.6 | 21.6 |
| | | | 3 | 19957 | 1710.7 | 22.1 | 21.6 |
| | | | | 20175 | 1732.5 | 22.6 | 21.4 |
| | | | | 20393 | 1754.3 | 22.1 | 21.3 |
| | | 6 | 0 | 19957 | 1710.7 | 21.5 | 20.1 |
| | | | | 20175 | 1732.5 | 21.1 | 20.4 |
| | | | | 20393 | 1754.3 | 21.4 | 20.1 |
| | 3 MHz | 1 | 0 | 19965 | 1711.5 | 22.1 | 21.3 |
| | | | | 20175 | 1732.5 | 22.5 | 21.3 |
| | | | | 20385 | 1753.5 | 22.4 | 21.6 |
| | | | 7 | 19965 | 1711.5 | 22.3 | 21.7 |
| | | | | 20175 | 1732.5 | 22.7 | 21.4 |
| | | | | 20385 | 1753.5 | 22.3 | 21.1 |
| | | | 14 | 19965 | 1711.5 | 22.1 | 21.1 |
| | | | | 20175 | 1732.5 | 22.3 | 21.1 |
| | | | | 20385 | 1753.5 | 22.6 | 21.6 |
| | | 8 | 0 | 19965 | 1711.5 | 21.4 | 20.0 |
| | | | | 20175 | 1732.5 | 21.4 | 20.7 |
| | | | | 20385 | 1753.5 | 21.5 | 20.0 |
| | | | 7 | 19965 | 1711.5 | 21.4 | 20.6 |
| | | | | 20175 | 1732.5 | 21.4 | 20.4 |
| | | | | 20385 | 1753.5 | 21.3 | 20.2 |
| | | | 14 | 19965 | 1711.5 | 21.1 | 20.4 |
| | | | | 20175 | 1732.5 | 21.6 | 20.5 |
| | | | | 20385 | 1753.5 | 21.1 | 20.3 |
| | | 15 | 0 | 19965 | 1711.5 | 21.5 | 20.7 |
| | | | | 20175 | 1732.5 | 21.6 | 20.2 |
| | | | | 20385 | 1753.5 | 21.2 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 4 | 5 MHz | 1 | 0 | 19975 | 1712.5 | 22.5 | 21.7 |
| | | | | 20175 | 1732.5 | 22.6 | 21.0 |
| | | | | 20375 | 1752.5 | 22.7 | 21.2 |
| | | | 12 | 19975 | 1712.5 | 22.6 | 21.4 |
| | | | | 20175 | 1732.5 | 22.3 | 21.5 |
| | | | | 20375 | 1752.5 | 22.2 | 21.7 |
| | | | 24 | 19975 | 1712.5 | 22.5 | 21.1 |
| | | | | 20175 | 1732.5 | 22.1 | 21.4 |
| | | | | 20375 | 1752.5 | 22.1 | 21.4 |
| | | 12 | 0 | 19975 | 1712.5 | 21.1 | 20.2 |
| | | | | 20175 | 1732.5 | 21.1 | 20.5 |
| | | | | 20375 | 1752.5 | 21.5 | 20.5 |
| | | | 6 | 19975 | 1712.5 | 21.6 | 20.3 |
| | | | | 20175 | 1732.5 | 21.6 | 20.6 |
| | | | | 20375 | 1752.5 | 21.0 | 20.5 |
| | | | 13 | 19975 | 1712.5 | 21.2 | 20.4 |
| | | | | 20175 | 1732.5 | 21.2 | 20.4 |
| | | | | 20375 | 1752.5 | 21.4 | 20.2 |
| | | 25 | 0 | 19975 | 1712.5 | 21.3 | 20.2 |
| | | | | 20175 | 1732.5 | 21.5 | 20.5 |
| | | | | 20375 | 1752.5 | 21.6 | 20.4 |
| | 10 MHz | 1 | 0 | 20000 | 1715.0 | 22.1 | 21.1 |
| | | | | 20175 | 1732.5 | 22.5 | 21.6 |
| | | | | 20350 | 1750.0 | 22.6 | 21.6 |
| | | | 24 | 20000 | 1715.0 | 22.4 | 21.4 |
| | | | | 20175 | 1732.5 | 22.1 | 21.0 |
| | | | | 20350 | 1750.0 | 22.1 | 21.4 |
| | | | 49 | 20000 | 1715.0 | 22.2 | 21.6 |
| | | | | 20175 | 1732.5 | 22.4 | 21.5 |
| | | | | 20350 | 1750.0 | 22.1 | 21.6 |
| | | 25 | 0 | 20000 | 1715.0 | 21.3 | 20.6 |
| | | | | 20175 | 1732.5 | 21.3 | 20.2 |
| | | | | 20350 | 1750.0 | 21.2 | 20.2 |
| | | | 13 | 20000 | 1715.0 | 21.0 | 20.2 |
| | | | | 20175 | 1732.5 | 21.5 | 20.0 |
| | | | | 20350 | 1750.0 | 21.0 | 20.7 |
| | | | 25 | 20000 | 1715.0 | 21.5 | 20.2 |
| | | | | 20175 | 1732.5 | 21.6 | 20.0 |
| | | | | 20350 | 1750.0 | 21.7 | 20.3 |
| | | 50 | 0 | 20000 | 1715.0 | 21.1 | 20.5 |
| | | | | 20175 | 1732.5 | 21.6 | 20.4 |
| | | | | 20350 | 1750.0 | 21.2 | 20.5 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 4 | 15 MHz | 1 | 0 | 20025 | 1717.5 | 22.7 | 21.3 |
| | | | | 20175 | 1732.5 | 22.2 | 21.5 |
| | | | | 20325 | 1747.5 | 22.5 | 21.2 |
| | | | 37 | 20025 | 1717.5 | 22.5 | 21.2 |
| | | | | 20175 | 1732.5 | 22.3 | 21.4 |
| | | | | 20325 | 1747.5 | 22.7 | 21.7 |
| | | | 74 | 20025 | 1717.5 | 22.5 | 21.3 |
| | | | | 20175 | 1732.5 | 22.1 | 21.6 |
| | | | | 20325 | 1747.5 | 22.7 | 21.2 |
| | | 36 | 0 | 20025 | 1717.5 | 21.6 | 20.4 |
| | | | | 20175 | 1732.5 | 21.7 | 20.5 |
| | | | | 20325 | 1747.5 | 21.4 | 20.0 |
| | | | 19 | 20025 | 1717.5 | 21.4 | 20.5 |
| | | | | 20175 | 1732.5 | 21.1 | 20.2 |
| | | | | 20325 | 1747.5 | 21.6 | 20.3 |
| | | | 39 | 20025 | 1717.5 | 21.6 | 20.1 |
| | | | | 20175 | 1732.5 | 21.6 | 20.3 |
| | | | | 20325 | 1747.5 | 21.5 | 20.1 |
| | | 75 | 0 | 20025 | 1717.5 | 21.3 | 20.4 |
| | | | | 20175 | 1732.5 | 21.7 | 20.5 |
| | | | | 20325 | 1747.5 | 21.3 | 20.7 |
| | 20 MHz | 1 | 0 | 20050 | 1720.0 | 22.2 | 21.6 |
| | | | | 20175 | 1732.5 | 22.6 | 21.7 |
| | | | | 20300 | 1745.0 | 22.2 | 21.3 |
| | | | 49 | 20050 | 1720.0 | 22.7 | 21.2 |
| | | | | 20175 | 1732.5 | 22.7 | 21.0 |
| | | | | 20300 | 1745.0 | 22.5 | 21.1 |
| | | | 99 | 20050 | 1720.0 | 22.4 | 21.2 |
| | | | | 20175 | 1732.5 | 22.2 | 21.4 |
| | | | | 20300 | 1745.0 | 22.4 | 21.3 |
| | | 50 | 0 | 20050 | 1720.0 | 21.6 | 20.2 |
| | | | | 20175 | 1732.5 | 21.6 | 20.1 |
| | | | | 20300 | 1745.0 | 21.0 | 20.5 |
| | | | 24 | 20050 | 1720.0 | 21.5 | 20.5 |
| | | | | 20175 | 1732.5 | 21.6 | 20.6 |
| | | | | 20300 | 1745.0 | 21.4 | 20.2 |
| | | | 50 | 20050 | 1720.0 | 21.1 | 20.5 |
| | | | | 20175 | 1732.5 | 21.5 | 20.5 |
| | | | | 20300 | 1745.0 | 21.6 | 20.0 |
| | | 100 | 0 | 20050 | 1720.0 | 21.3 | 20.0 |
| | | | | 20175 | 1732.5 | 21.7 | 20.7 |
| | | | | 20300 | 1745.0 | 21.0 | 20.5 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 5 | 1.4 MHz | 1 | 0 | 20407 | 824.7 | 22.5 | 21.1 |
| | | | | 20525 | 836.5 | 22.6 | 21.6 |
| | | | | 20643 | 848.3 | 22.1 | 21.5 |
| | | | 3 | 20407 | 824.7 | 22.5 | 21.5 |
| | | | | 20525 | 836.5 | 22.1 | 21.2 |
| | | | | 20643 | 848.3 | 22.0 | 21.7 |
| | | | 5 | 20407 | 824.7 | 22.7 | 21.3 |
| | | | | 20525 | 836.5 | 22.2 | 21.2 |
| | | | | 20643 | 848.3 | 22.5 | 21.2 |
| | | 3 | 0 | 20407 | 824.7 | 22.6 | 21.4 |
| | | | | 20525 | 836.5 | 22.3 | 21.4 |
| | | | | 20643 | 848.3 | 22.4 | 21.2 |
| | | | 1 | 20407 | 824.7 | 22.6 | 21.3 |
| | | | | 20525 | 836.5 | 22.1 | 21.6 |
| | | | | 20643 | 848.3 | 22.1 | 21.2 |
| | | | 3 | 20407 | 824.7 | 22.5 | 21.5 |
| | | | | 20525 | 836.5 | 22.2 | 21.5 |
| | | | | 20643 | 848.3 | 22.1 | 21.4 |
| | | 6 | 0 | 20407 | 824.7 | 21.4 | 20.6 |
| | | | | 20525 | 836.5 | 21.2 | 20.3 |
| | | | | 20643 | 848.3 | 21.2 | 20.7 |
| | 3 MHz | 1 | 0 | 20415 | 825.5 | 22.3 | 21.1 |
| | | | | 20525 | 836.5 | 22.4 | 21.2 |
| | | | | 20635 | 847.5 | 22.6 | 21.4 |
| | | | 7 | 20415 | 825.5 | 22.1 | 21.1 |
| | | | | 20525 | 836.5 | 22.1 | 21.3 |
| | | | | 20635 | 847.5 | 22.3 | 21.2 |
| | | | 14 | 20415 | 825.5 | 22.6 | 21.4 |
| | | | | 20525 | 836.5 | 22.5 | 21.3 |
| | | | | 20635 | 847.5 | 22.4 | 21.5 |
| | | 8 | 0 | 20415 | 825.5 | 21.5 | 20.4 |
| | | | | 20525 | 836.5 | 21.2 | 20.6 |
| | | | | 20635 | 847.5 | 21.7 | 20.2 |
| | | | 7 | 20415 | 825.5 | 21.7 | 20.2 |
| | | | | 20525 | 836.5 | 21.1 | 20.3 |
| | | | | 20635 | 847.5 | 21.0 | 20.3 |
| | | | 14 | 20415 | 825.5 | 21.6 | 20.7 |
| | | | | 20525 | 836.5 | 21.7 | 20.0 |
| | | | | 20635 | 847.5 | 21.2 | 20.3 |
| | | 15 | 0 | 20415 | 825.5 | 21.3 | 20.4 |
| | | | | 20525 | 836.5 | 21.2 | 20.1 |
| | | | | 20635 | 847.5 | 21.2 | 20.2 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 5 | 5 MHz | 1 | 0 | 20425 | 826.5 | 22.7 | 21.5 |
| | | | | 20525 | 836.5 | 22.5 | 21.1 |
| | | | | 20625 | 846.5 | 22.2 | 21.4 |
| | | | 12 | 20425 | 826.5 | 22.3 | 21.5 |
| | | | | 20525 | 836.5 | 22.4 | 21.3 |
| | | | | 20625 | 846.5 | 22.7 | 21.0 |
| | | | 24 | 20425 | 826.5 | 22.4 | 21.7 |
| | | | | 20525 | 836.5 | 22.1 | 21.3 |
| | | | | 20625 | 846.5 | 22.4 | 21.6 |
| | | 12 | 0 | 20425 | 826.5 | 21.5 | 20.3 |
| | | | | 20525 | 836.5 | 21.6 | 20.5 |
| | | | | 20625 | 846.5 | 21.6 | 20.1 |
| | | | 6 | 20425 | 826.5 | 21.3 | 20.6 |
| | | | | 20525 | 836.5 | 21.4 | 20.6 |
| | | | | 20625 | 846.5 | 21.4 | 20.2 |
| | | | 13 | 20425 | 826.5 | 21.4 | 20.6 |
| | | | | 20525 | 836.5 | 21.0 | 20.3 |
| | | | | 20625 | 846.5 | 21.2 | 20.3 |
| | | 25 | 0 | 20425 | 826.5 | 21.5 | 20.3 |
| | | | | 20525 | 836.5 | 21.4 | 20.2 |
| | | | | 20625 | 846.5 | 21.1 | 20.1 |
| | 10 MHz | 1 | 0 | 20450 | 829.0 | 22.1 | 21.5 |
| | | | | 20525 | 836.5 | 22.4 | 21.6 |
| | | | | 20600 | 844.0 | 22.6 | 21.5 |
| | | | 24 | 20450 | 829.0 | 22.3 | 21.4 |
| | | | | 20525 | 836.5 | 22.5 | 21.7 |
| | | | | 20600 | 844.0 | 22.0 | 21.5 |
| | | | 49 | 20450 | 829.0 | 22.1 | 21.3 |
| | | | | 20525 | 836.5 | 22.0 | 21.3 |
| | | | | 20600 | 844.0 | 22.5 | 21.7 |
| | | 25 | 0 | 20450 | 829.0 | 21.2 | 20.4 |
| | | | | 20525 | 836.5 | 21.4 | 20.6 |
| | | | | 20600 | 844.0 | 21.4 | 20.1 |
| | | | 13 | 20450 | 829.0 | 21.1 | 20.4 |
| | | | | 20525 | 836.5 | 21.1 | 20.3 |
| | | | | 20600 | 844.0 | 21.5 | 20.7 |
| | | | 25 | 20450 | 829.0 | 21.4 | 20.6 |
| | | | | 20525 | 836.5 | 21.3 | 20.5 |
| | | | | 20600 | 844.0 | 21.1 | 20.1 |
| | | 50 | 0 | 20450 | 829.0 | 21.6 | 20.5 |
| | | | | 20525 | 836.5 | 21.4 | 20.1 |
| | | | | 20600 | 844.0 | 21.4 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 12 | 1.4 MHz | 1 | 0 | 23017 | 699.7 | 22.7 | 21.3 |
| | | | | 23095 | 707.5 | 22.2 | 21.3 |
| | | | | 23173 | 715.3 | 22.3 | 21.1 |
| | | | 3 | 23017 | 699.7 | 22.4 | 21.3 |
| | | | | 23095 | 707.5 | 22.3 | 21.3 |
| | | | | 23173 | 715.3 | 22.3 | 21.2 |
| | | | 5 | 23017 | 699.7 | 22.1 | 21.6 |
| | | | | 23095 | 707.5 | 22.1 | 21.6 |
| | | | | 23173 | 715.3 | 22.1 | 21.4 |
| | | 3 | 0 | 23017 | 699.7 | 22.4 | 21.2 |
| | | | | 23095 | 707.5 | 22.0 | 21.5 |
| | | | | 23173 | 715.3 | 22.2 | 21.5 |
| | | | 1 | 23017 | 699.7 | 22.0 | 21.4 |
| | | | | 23095 | 707.5 | 22.2 | 21.3 |
| | | | | 23173 | 715.3 | 22.2 | 21.2 |
| | | | 3 | 23017 | 699.7 | 22.5 | 21.6 |
| | | | | 23095 | 707.5 | 22.6 | 21.1 |
| | | | | 23173 | 715.3 | 22.7 | 21.2 |
| | | 6 | 0 | 23017 | 699.7 | 21.4 | 20.6 |
| | | | | 23095 | 707.5 | 21.0 | 20.1 |
| | | | | 23173 | 715.3 | 21.5 | 20.5 |
| | 3 MHz | 1 | 0 | 23025 | 700.5 | 22.3 | 21.5 |
| | | | | 23095 | 707.5 | 22.5 | 21.2 |
| | | | | 23165 | 714.5 | 22.1 | 21.6 |
| | | | 7 | 23025 | 700.5 | 22.5 | 21.2 |
| | | | | 23095 | 707.5 | 22.6 | 21.5 |
| | | | | 23165 | 714.5 | 22.4 | 21.4 |
| | | | 14 | 23025 | 700.5 | 22.5 | 21.6 |
| | | | | 23095 | 707.5 | 22.0 | 21.3 |
| | | | | 23165 | 714.5 | 22.2 | 21.0 |
| | | 8 | 0 | 23025 | 700.5 | 21.6 | 20.6 |
| | | | | 23095 | 707.5 | 21.7 | 20.2 |
| | | | | 23165 | 714.5 | 21.1 | 20.0 |
| | | | 7 | 23025 | 700.5 | 21.6 | 20.3 |
| | | | | 23095 | 707.5 | 21.7 | 20.2 |
| | | | | 23165 | 714.5 | 21.4 | 20.2 |
| | | | 14 | 23025 | 700.5 | 21.6 | 20.2 |
| | | | | 23095 | 707.5 | 21.5 | 20.2 |
| | | | | 23165 | 714.5 | 21.5 | 20.4 |
| | | 15 | 0 | 23025 | 700.5 | 21.4 | 20.5 |
| | | | | 23095 | 707.5 | 21.4 | 20.5 |
| | | | | 23165 | 714.5 | 21.6 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 12 | 5 MHz | 1 | 0 | 23035 | 701.5 | 22.7 | 21.1 |
| | | | | 23095 | 707.5 | 22.0 | 21.4 |
| | | | | 23155 | 713.5 | 22.7 | 21.4 |
| | | | 12 | 23035 | 701.5 | 22.1 | 21.6 |
| | | | | 23095 | 707.5 | 22.5 | 21.0 |
| | | | | 23155 | 713.5 | 22.2 | 21.5 |
| | | | 24 | 23035 | 701.5 | 22.5 | 21.1 |
| | | | | 23095 | 707.5 | 22.1 | 21.4 |
| | | | | 23155 | 713.5 | 22.3 | 21.2 |
| | | 12 | 0 | 23035 | 701.5 | 21.6 | 20.7 |
| | | | | 23095 | 707.5 | 21.2 | 20.0 |
| | | | | 23155 | 713.5 | 21.1 | 20.3 |
| | | | 6 | 23035 | 701.5 | 21.5 | 20.3 |
| | | | | 23095 | 707.5 | 21.3 | 20.1 |
| | | | | 23155 | 713.5 | 21.7 | 20.5 |
| | | | 13 | 23035 | 701.5 | 21.4 | 20.1 |
| | | | | 23095 | 707.5 | 21.4 | 20.5 |
| | | | | 23155 | 713.5 | 21.7 | 20.7 |
| | | 25 | 0 | 23035 | 701.5 | 21.4 | 20.5 |
| | | | | 23095 | 707.5 | 21.1 | 20.2 |
| | | | | 23155 | 713.5 | 21.4 | 20.6 |
| | 10 MHz | 1 | 0 | 23060 | 704.0 | 22.7 | 21.2 |
| | | | | 23095 | 707.5 | 22.6 | 21.2 |
| | | | | 23130 | 711.0 | 22.5 | 21.6 |
| | | | 24 | 23060 | 704.0 | 22.7 | 21.3 |
| | | | | 23095 | 707.5 | 22.5 | 21.4 |
| | | | | 23130 | 711.0 | 22.1 | 21.0 |
| | | | 49 | 23060 | 704.0 | 22.1 | 21.1 |
| | | | | 23095 | 707.5 | 22.5 | 21.6 |
| | | | | 23130 | 711.0 | 22.1 | 21.1 |
| | | 25 | 0 | 23060 | 704.0 | 21.6 | 20.4 |
| | | | | 23095 | 707.5 | 21.5 | 20.5 |
| | | | | 23130 | 711.0 | 21.3 | 20.6 |
| | | | 13 | 23060 | 704.0 | 21.1 | 20.6 |
| | | | | 23095 | 707.5 | 21.4 | 20.3 |
| | | | | 23130 | 711.0 | 21.3 | 20.4 |
| | | | 25 | 23060 | 704.0 | 21.2 | 20.3 |
| | | | | 23095 | 707.5 | 21.6 | 20.7 |
| | | | | 23130 | 711.0 | 21.0 | 20.2 |
| | | 50 | 0 | 23060 | 704.0 | 21.2 | 20.3 |
| | | | | 23095 | 707.5 | 21.4 | 20.5 |
| | | | | 23130 | 711.0 | 21.4 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 13 | 5 MHz | 1 | 0 | 23205 | 779.5 | 22.3 | 21.4 |
| | | | | 23230 | 782.0 | 22.4 | 21.4 |
| | | | | 23129 | 784.5 | 22.7 | 21.5 |
| | | | 12 | 23205 | 779.5 | 22.5 | 21.3 |
| | | | | 23230 | 782.0 | 22.7 | 21.3 |
| | | | | 23129 | 784.5 | 22.4 | 21.1 |
| | | | 24 | 23205 | 779.5 | 22.3 | 21.3 |
| | | | | 23230 | 782.0 | 22.2 | 21.2 |
| | | | | 23129 | 784.5 | 22.1 | 21.4 |
| | | 12 | 0 | 23205 | 779.5 | 21.3 | 20.5 |
| | | | | 23230 | 782.0 | 21.4 | 20.2 |
| | | | | 23129 | 784.5 | 21.3 | 20.1 |
| | | | 6 | 23205 | 779.5 | 21.0 | 20.4 |
| | | | | 23230 | 782.0 | 21.3 | 20.3 |
| | | | | 23129 | 784.5 | 21.7 | 20.3 |
| | | | 13 | 23205 | 779.5 | 21.3 | 20.0 |
| | | | | 23230 | 782.0 | 21.0 | 20.1 |
| | | | | 23129 | 784.5 | 21.3 | 20.6 |
| | | 25 | 0 | 23205 | 779.5 | 21.4 | 20.4 |
| | | | | 23230 | 782.0 | 21.5 | 20.2 |
| | | | | 23129 | 784.5 | 21.2 | 20.7 |
| | 10 MHz | 1 | 0 | 23230 | 782.0 | 22.2 | 21.1 |
| | | | 24 | 23230 | 782.0 | 22.3 | 21.6 |
| | | | 49 | 23230 | 782.0 | 22.1 | 21.7 |
| | | 25 | 0 | 23230 | 782.0 | 21.1 | 20.4 |
| | | | 13 | 23230 | 782.0 | 21.3 | 20.1 |
| | | | 25 | 23230 | 782.0 | 21.1 | 20.4 |
| | | 50 | 0 | 23230 | 782.0 | 21.6 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 14 | 5 MHz | 1 | 0 | 23305 | 790.5 | 22.6 | 21.1 |
| | | | | 23330 | 793.0 | 22.2 | 21.2 |
| | | | | 23355 | 795.5 | 22.7 | 21.1 |
| | | | 12 | 23305 | 790.5 | 22.6 | 21.4 |
| | | | | 23330 | 793.0 | 22.5 | 21.2 |
| | | | | 23355 | 795.5 | 22.2 | 21.2 |
| | | | 24 | 23305 | 790.5 | 22.6 | 21.1 |
| | | | | 23330 | 793.0 | 22.6 | 21.2 |
| | | | | 23355 | 795.5 | 22.5 | 21.6 |
| | | 12 | 0 | 23305 | 790.5 | 21.3 | 20.0 |
| | | | | 23330 | 793.0 | 21.4 | 20.7 |
| | | | | 23355 | 795.5 | 21.4 | 20.1 |
| | | | 6 | 23305 | 790.5 | 21.2 | 20.1 |
| | | | | 23330 | 793.0 | 21.2 | 20.5 |
| | | | | 23355 | 795.5 | 21.7 | 20.5 |
| | | | 13 | 23305 | 790.5 | 21.6 | 20.5 |
| | | | | 23330 | 793.0 | 21.5 | 20.3 |
| | | | | 23355 | 795.5 | 21.4 | 20.5 |
| | | 25 | 0 | 23305 | 790.5 | 21.6 | 20.0 |
| | | | | 23330 | 793.0 | 21.6 | 20.7 |
| | | | | 23355 | 795.5 | 21.0 | 20.2 |
| | 10 MHz | 1 | 0 | 23330 | 793.0 | 22.0 | 21.5 |
| | | | 24 | 23330 | 793.0 | 22.6 | 21.5 |
| | | | 49 | 23330 | 793.0 | 22.1 | 21.4 |
| | | 25 | 0 | 23330 | 793.0 | 21.1 | 20.0 |
| | | | 13 | 23330 | 793.0 | 21.6 | 20.6 |
| | | | 25 | 23330 | 793.0 | 21.2 | 20.1 |
| | | 50 | 0 | 23330 | 793.0 | 21.6 | 20.6 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 25 | 1.4 MHz | 1 | 0 | 26047 | 1850.7 | 22.4 | 21.6 |
| | | | | 26365 | 1882.5 | 22.5 | 21.4 |
| | | | | 26683 | 1914.3 | 22.6 | 21.0 |
| | | | 3 | 26047 | 1850.7 | 22.1 | 21.2 |
| | | | | 26365 | 1882.5 | 22.1 | 21.3 |
| | | | | 26683 | 1914.3 | 22.2 | 21.2 |
| | | | 5 | 26047 | 1850.7 | 22.7 | 21.1 |
| | | | | 26365 | 1882.5 | 22.4 | 21.3 |
| | | | | 26683 | 1914.3 | 22.1 | 21.2 |
| | | 3 | 0 | 26047 | 1850.7 | 22.2 | 21.6 |
| | | | | 26365 | 1882.5 | 22.6 | 21.1 |
| | | | | 26683 | 1914.3 | 22.5 | 21.2 |
| | | | 1 | 26047 | 1850.7 | 22.6 | 21.2 |
| | | | | 26365 | 1882.5 | 22.6 | 21.2 |
| | | | | 26683 | 1914.3 | 22.4 | 21.3 |
| | | | 3 | 26047 | 1850.7 | 22.0 | 21.3 |
| | | | | 26365 | 1882.5 | 22.5 | 21.5 |
| | | | | 26683 | 1914.3 | 22.2 | 21.0 |
| | | 6 | 0 | 26047 | 1850.7 | 21.1 | 20.2 |
| | | | | 26365 | 1882.5 | 21.4 | 20.6 |
| | | | | 26683 | 1914.3 | 21.4 | 20.0 |
| | 3 MHz | 1 | 0 | 26055 | 1851.5 | 22.3 | 21.2 |
| | | | | 26365 | 1882.5 | 22.2 | 21.0 |
| | | | | 26675 | 1913.5 | 22.3 | 21.2 |
| | | | 7 | 26055 | 1851.5 | 22.5 | 21.1 |
| | | | | 26365 | 1882.5 | 22.0 | 21.7 |
| | | | | 26675 | 1913.5 | 22.6 | 21.0 |
| | | | 14 | 26055 | 1851.5 | 22.5 | 21.2 |
| | | | | 26365 | 1882.5 | 22.2 | 21.1 |
| | | | | 26675 | 1913.5 | 22.5 | 21.4 |
| | | 8 | 0 | 26055 | 1851.5 | 21.1 | 20.3 |
| | | | | 26365 | 1882.5 | 21.1 | 20.6 |
| | | | | 26675 | 1913.5 | 21.2 | 20.7 |
| | | | 7 | 26055 | 1851.5 | 21.5 | 20.0 |
| | | | | 26365 | 1882.5 | 21.5 | 20.2 |
| | | | | 26675 | 1913.5 | 21.5 | 20.0 |
| | | | 14 | 26055 | 1851.5 | 21.4 | 20.2 |
| | | | | 26365 | 1882.5 | 21.3 | 20.4 |
| | | | | 26675 | 1913.5 | 21.2 | 20.5 |
| | | 15 | 0 | 26055 | 1851.5 | 21.6 | 20.2 |
| | | | | 26365 | 1882.5 | 21.2 | 20.3 |
| | | | | 26675 | 1913.5 | 21.2 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 25 | 5 MHz | 1 | 0 | 26065 | 1852.5 | 22.3 | 21.4 |
| | | | | 26365 | 1882.5 | 22.4 | 21.7 |
| | | | | 26665 | 1912.5 | 22.1 | 21.2 |
| | | | 12 | 26065 | 1852.5 | 22.4 | 21.4 |
| | | | | 26365 | 1882.5 | 22.2 | 21.6 |
| | | | | 26665 | 1912.5 | 22.2 | 21.1 |
| | | | 24 | 26065 | 1852.5 | 22.4 | 21.4 |
| | | | | 26365 | 1882.5 | 22.4 | 21.7 |
| | | | | 26665 | 1912.5 | 22.4 | 21.3 |
| | | 12 | 0 | 26065 | 1852.5 | 21.3 | 20.3 |
| | | | | 26365 | 1882.5 | 21.4 | 20.6 |
| | | | | 26665 | 1912.5 | 21.5 | 20.1 |
| | | | 6 | 26065 | 1852.5 | 21.4 | 20.3 |
| | | | | 26365 | 1882.5 | 21.3 | 20.3 |
| | | | | 26665 | 1912.5 | 21.0 | 20.6 |
| | | | 13 | 26065 | 1852.5 | 21.7 | 20.5 |
| | | | | 26365 | 1882.5 | 21.5 | 20.0 |
| | | | | 26665 | 1912.5 | 21.2 | 20.3 |
| | | 25 | 0 | 26065 | 1852.5 | 21.7 | 20.5 |
| | | | | 26365 | 1882.5 | 21.1 | 20.7 |
| | | | | 26665 | 1912.5 | 21.7 | 20.1 |
| | 10 MHz | 1 | 0 | 26090 | 1855.0 | 22.4 | 21.4 |
| | | | | 26365 | 1882.5 | 22.4 | 21.1 |
| | | | | 26640 | 1910.0 | 22.2 | 21.1 |
| | | | 24 | 26090 | 1855.0 | 22.1 | 21.7 |
| | | | | 26365 | 1882.5 | 22.6 | 21.6 |
| | | | | 26640 | 1910.0 | 22.2 | 21.5 |
| | | | 49 | 26090 | 1855.0 | 22.3 | 21.2 |
| | | | | 26365 | 1882.5 | 22.2 | 21.7 |
| | | | | 26640 | 1910.0 | 22.6 | 21.1 |
| | | 25 | 0 | 26090 | 1855.0 | 21.7 | 20.2 |
| | | | | 26365 | 1882.5 | 21.1 | 20.7 |
| | | | | 26640 | 1910.0 | 21.3 | 20.3 |
| | | | 13 | 26090 | 1855.0 | 21.0 | 20.0 |
| | | | | 26365 | 1882.5 | 21.5 | 20.0 |
| | | | | 26640 | 1910.0 | 21.2 | 20.2 |
| | | | 25 | 26090 | 1855.0 | 21.4 | 20.1 |
| | | | | 26365 | 1882.5 | 21.5 | 20.2 |
| | | | | 26640 | 1910.0 | 21.0 | 20.5 |
| | | 50 | 0 | 26090 | 1855.0 | 21.4 | 20.6 |
| | | | | 26365 | 1882.5 | 21.2 | 20.6 |
| | | | | 26640 | 1910.0 | 21.1 | 20.5 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 25 | 15 MHz | 1 | 0 | 26115 | 1857.5 | 22.6 | 21.2 |
| | | | | 26365 | 1882.5 | 22.3 | 21.6 |
| | | | | 26615 | 1907.5 | 22.3 | 21.7 |
| | | | 37 | 26115 | 1857.5 | 22.4 | 21.5 |
| | | | | 26365 | 1882.5 | 22.1 | 21.5 |
| | | | | 26615 | 1907.5 | 22.5 | 21.4 |
| | | | 74 | 26115 | 1857.5 | 22.2 | 21.1 |
| | | | | 26365 | 1882.5 | 22.3 | 21.4 |
| | | | | 26615 | 1907.5 | 22.2 | 21.6 |
| | | 36 | 0 | 26115 | 1857.5 | 21.7 | 20.1 |
| | | | | 26365 | 1882.5 | 21.6 | 20.3 |
| | | | | 26615 | 1907.5 | 21.3 | 20.5 |
| | | | 19 | 26115 | 1857.5 | 21.3 | 20.5 |
| | | | | 26365 | 1882.5 | 21.4 | 20.2 |
| | | | | 26615 | 1907.5 | 21.7 | 20.3 |
| | | | 39 | 26115 | 1857.5 | 21.4 | 20.1 |
| | | | | 26365 | 1882.5 | 21.4 | 20.1 |
| | | | | 26615 | 1907.5 | 21.4 | 20.7 |
| | | 75 | 0 | 26115 | 1857.5 | 21.1 | 20.5 |
| | | | | 26365 | 1882.5 | 21.5 | 20.4 |
| | | | | 26615 | 1907.5 | 21.5 | 20.3 |
| | 20 MHz | 1 | 0 | 26140 | 1860.0 | 22.4 | 21.2 |
| | | | | 26365 | 1882.5 | 22.2 | 21.5 |
| | | | | 26590 | 1905.0 | 22.1 | 21.7 |
| | | | 49 | 26140 | 1860.0 | 22.2 | 21.1 |
| | | | | 26365 | 1882.5 | 22.5 | 21.5 |
| | | | | 26590 | 1905.0 | 22.9 | 21.2 |
| | | | 99 | 26140 | 1860.0 | 22.3 | 21.1 |
| | | | | 26365 | 1882.5 | 22.5 | 21.7 |
| | | | | 26590 | 1905.0 | 22.6 | 21.0 |
| | | 50 | 0 | 26140 | 1860.0 | 21.2 | 20.4 |
| | | | | 26365 | 1882.5 | 21.3 | 20.1 |
| | | | | 26590 | 1905.0 | 21.2 | 20.4 |
| | | | 24 | 26140 | 1860.0 | 21.2 | 20.6 |
| | | | | 26365 | 1882.5 | 21.6 | 20.0 |
| | | | | 26590 | 1905.0 | 21.4 | 20.2 |
| | | | 50 | 26140 | 1860.0 | 21.5 | 20.3 |
| | | | | 26365 | 1882.5 | 21.0 | 20.7 |
| | | | | 26590 | 1905.0 | 21.2 | 20.1 |
| | | 100 | 0 | 26140 | 1860.0 | 21.6 | 20.7 |
| | | | | 26365 | 1882.5 | 21.2 | 20.4 |
| | | | | 26590 | 1905.0 | 21.6 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 26 | 1.4 MHz | 1 | 0 | 26697 | 814.7 | 22.5 | 21.1 |
| | | | | 26865 | 831.5 | 22.5 | 21.6 |
| | | | | 27033 | 848.3 | 22.7 | 21.7 |
| | | | 3 | 26697 | 814.7 | 22.2 | 21.2 |
| | | | | 26865 | 831.5 | 22.5 | 21.1 |
| | | | | 27033 | 848.3 | 22.0 | 21.5 |
| | | | 5 | 26697 | 814.7 | 22.4 | 21.4 |
| | | | | 26865 | 831.5 | 22.4 | 21.2 |
| | | | | 27033 | 848.3 | 22.5 | 21.2 |
| | | 3 | 0 | 26697 | 814.7 | 22.6 | 21.4 |
| | | | | 26865 | 831.5 | 22.4 | 21.6 |
| | | | | 27033 | 848.3 | 22.4 | 21.1 |
| | | | 1 | 26697 | 814.7 | 22.3 | 21.4 |
| | | | | 26865 | 831.5 | 22.3 | 21.3 |
| | | | | 27033 | 848.3 | 22.1 | 21.7 |
| | | | 3 | 26697 | 814.7 | 22.4 | 21.0 |
| | | | | 26865 | 831.5 | 22.4 | 21.1 |
| | | | | 27033 | 848.3 | 22.3 | 21.5 |
| | | 6 | 0 | 26697 | 814.7 | 21.3 | 20.7 |
| | | | | 26865 | 831.5 | 21.5 | 20.1 |
| | | | | 27033 | 848.3 | 21.2 | 20.4 |
| | 3 MHz | 1 | 0 | 26705 | 815.5 | 22.5 | 21.5 |
| | | | | 26865 | 831.5 | 22.2 | 21.3 |
| | | | | 27025 | 847.5 | 22.7 | 21.3 |
| | | | 7 | 26705 | 815.5 | 22.5 | 21.4 |
| | | | | 26865 | 831.5 | 22.5 | 21.1 |
| | | | | 27025 | 847.5 | 22.1 | 21.2 |
| | | | 14 | 26705 | 815.5 | 22.6 | 21.2 |
| | | | | 26865 | 831.5 | 22.0 | 21.1 |
| | | | | 27025 | 847.5 | 22.2 | 21.0 |
| | | 8 | 0 | 26705 | 815.5 | 21.3 | 20.4 |
| | | | | 26865 | 831.5 | 21.1 | 20.1 |
| | | | | 27025 | 847.5 | 21.2 | 20.4 |
| | | | 7 | 26705 | 815.5 | 21.6 | 20.2 |
| | | | | 26865 | 831.5 | 21.4 | 20.3 |
| | | | | 27025 | 847.5 | 21.6 | 20.5 |
| | | | 14 | 26705 | 815.5 | 21.1 | 20.3 |
| | | | | 26865 | 831.5 | 21.7 | 20.5 |
| | | | | 27025 | 847.5 | 21.2 | 20.5 |
| | | 15 | 0 | 26705 | 815.5 | 21.3 | 20.7 |
| | | | | 26865 | 831.5 | 21.4 | 20.1 |
| | | | | 27025 | 847.5 | 21.1 | 20.5 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 26 | 5 MHz | 1 | 0 | 26715 | 816.5 | 22.5 | 21.5 |
| | | | | 26865 | 831.5 | 22.4 | 21.6 |
| | | | | 27015 | 846.5 | 22.2 | 21.3 |
| | | | 12 | 26715 | 816.5 | 22.5 | 21.6 |
| | | | | 26865 | 831.5 | 22.3 | 21.2 |
| | | | | 27015 | 846.5 | 22.2 | 21.4 |
| | | | 24 | 26715 | 816.5 | 22.6 | 21.3 |
| | | | | 26865 | 831.5 | 22.6 | 21.3 |
| | | | | 27015 | 846.5 | 22.1 | 21.1 |
| | | 12 | 0 | 26715 | 816.5 | 21.2 | 20.2 |
| | | | | 26865 | 831.5 | 21.1 | 20.5 |
| | | | | 27015 | 846.5 | 21.2 | 20.4 |
| | | | 6 | 26715 | 816.5 | 21.5 | 20.0 |
| | | | | 26865 | 831.5 | 21.3 | 20.4 |
| | | | | 27015 | 846.5 | 21.2 | 20.2 |
| | | | 13 | 26715 | 816.5 | 21.3 | 20.4 |
| | | | | 26865 | 831.5 | 21.0 | 20.1 |
| | | | | 27015 | 846.5 | 21.1 | 20.6 |
| | | 25 | 0 | 26715 | 816.5 | 21.0 | 20.4 |
| | | | | 26865 | 831.5 | 21.5 | 20.4 |
| | | | | 27015 | 846.5 | 21.4 | 20.3 |
| | 10 MHz | 1 | 0 | 26740 | 819.0 | 22.6 | 21.5 |
| | | | | 26865 | 831.5 | 22.5 | 21.3 |
| | | | | 26990 | 844.0 | 22.0 | 21.2 |
| | | | 24 | 26740 | 819.0 | 22.0 | 21.2 |
| | | | | 26865 | 831.5 | 22.5 | 21.1 |
| | | | | 26990 | 844.0 | 22.6 | 21.2 |
| | | | 49 | 26740 | 819.0 | 22.1 | 21.1 |
| | | | | 26865 | 831.5 | 22.6 | 21.5 |
| | | | | 26990 | 844.0 | 22.6 | 21.0 |
| | | 25 | 0 | 26740 | 819.0 | 21.5 | 20.4 |
| | | | | 26865 | 831.5 | 21.3 | 20.5 |
| | | | | 26990 | 844.0 | 21.5 | 20.4 |
| | | | 13 | 26740 | 819.0 | 21.4 | 20.4 |
| | | | | 26865 | 831.5 | 21.6 | 20.4 |
| | | | | 26990 | 844.0 | 21.4 | 20.5 |
| | | | 25 | 26740 | 819.0 | 21.3 | 20.5 |
| | | | | 26865 | 831.5 | 21.7 | 20.0 |
| | | | | 26990 | 844.0 | 21.6 | 20.5 |
| | | 50 | 0 | 26740 | 819.0 | 21.3 | 20.3 |
| | | | | 26865 | 831.5 | 21.5 | 20.3 |
| | | | | 26990 | 844.0 | 21.4 | 20.1 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 26 | 15 MHz | 1 | 0 | 26765 | 821.5 | 22.2 | 21.1 |
| | | | | 26865 | 831.5 | 22.2 | 21.6 |
| | | | | 26965 | 841.5 | 22.3 | 21.5 |
| | | | 37 | 26765 | 821.5 | 22.5 | 21.2 |
| | | | | 26865 | 831.5 | 22.7 | 21.7 |
| | | | | 26965 | 841.5 | 22.7 | 21.6 |
| | | | 74 | 26765 | 821.5 | 22.1 | 21.0 |
| | | | | 26865 | 831.5 | 22.1 | 21.1 |
| | | | | 26965 | 841.5 | 22.3 | 21.1 |
| | | 36 | 0 | 26765 | 821.5 | 21.1 | 20.4 |
| | | | | 26865 | 831.5 | 21.3 | 20.5 |
| | | | | 26965 | 841.5 | 21.5 | 20.0 |
| | | | 19 | 26765 | 821.5 | 21.1 | 20.0 |
| | | | | 26865 | 831.5 | 21.7 | 20.6 |
| | | | | 26965 | 841.5 | 21.5 | 20.1 |
| | | | 39 | 26765 | 821.5 | 21.7 | 20.7 |
| | | | | 26865 | 831.5 | 21.2 | 20.4 |
| | | | | 26965 | 841.5 | 21.2 | 20.7 |
| | | 75 | 0 | 26765 | 821.5 | 21.3 | 20.3 |
| | | | | 26865 | 831.5 | 21.3 | 20.3 |
| | | | | 26965 | 841.5 | 21.4 | 20.5 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 66 | 1.4 MHz | 1 | 0 | 131979 | 1710.7 | 22.0 | 21.2 |
| | | | | 132322 | 1745.0 | 22.5 | 21.5 |
| | | | | 132665 | 1779.3 | 22.2 | 21.2 |
| | | | 3 | 131979 | 1710.7 | 22.2 | 21.2 |
| | | | | 132322 | 1745.0 | 22.6 | 21.7 |
| | | | | 132665 | 1779.3 | 22.2 | 21.3 |
| | | | 5 | 131979 | 1710.7 | 22.0 | 21.4 |
| | | | | 132322 | 1745.0 | 22.1 | 21.6 |
| | | | | 132665 | 1779.3 | 22.4 | 21.1 |
| | | 3 | 0 | 131979 | 1710.7 | 22.4 | 21.1 |
| | | | | 132322 | 1745.0 | 22.3 | 21.6 |
| | | | | 132665 | 1779.3 | 22.7 | 21.5 |
| | | | 1 | 131979 | 1710.7 | 22.1 | 21.5 |
| | | | | 132322 | 1745.0 | 22.7 | 21.0 |
| | | | | 132665 | 1779.3 | 22.6 | 21.3 |
| | | | 3 | 131979 | 1710.7 | 22.6 | 21.3 |
| | | | | 132322 | 1745.0 | 22.5 | 21.6 |
| | | | | 132665 | 1779.3 | 22.0 | 21.1 |
| | | 6 | 0 | 131979 | 1710.7 | 21.6 | 20.3 |
| | | | | 132322 | 1745.0 | 21.5 | 20.1 |
| | | | | 132665 | 1779.3 | 21.1 | 20.7 |
| | 3 MHz | 1 | 0 | 131987 | 1711.5 | 22.7 | 21.5 |
| | | | | 132322 | 1745.0 | 22.2 | 21.1 |
| | | | | 132657 | 1778.5 | 22.5 | 21.2 |
| | | | 7 | 131987 | 1711.5 | 22.2 | 21.6 |
| | | | | 132322 | 1745.0 | 22.3 | 21.3 |
| | | | | 132657 | 1778.5 | 22.4 | 21.6 |
| | | | 14 | 131987 | 1711.5 | 22.6 | 21.0 |
| | | | | 132322 | 1745.0 | 22.4 | 21.2 |
| | | | | 132657 | 1778.5 | 22.1 | 21.5 |
| | | 8 | 0 | 131987 | 1711.5 | 21.5 | 20.1 |
| | | | | 132322 | 1745.0 | 21.4 | 20.1 |
| | | | | 132657 | 1778.5 | 21.5 | 20.7 |
| | | | 7 | 131987 | 1711.5 | 21.3 | 20.4 |
| | | | | 132322 | 1745.0 | 21.6 | 20.6 |
| | | | | 132657 | 1778.5 | 21.1 | 20.7 |
| | | | 14 | 131987 | 1711.5 | 21.4 | 20.6 |
| | | | | 132322 | 1745.0 | 21.0 | 20.2 |
| | | | | 132657 | 1778.5 | 21.6 | 20.5 |
| | | 15 | 0 | 131987 | 1711.5 | 21.2 | 20.5 |
| | | | | 132322 | 1745.0 | 21.1 | 20.3 |
| | | | | 132657 | 1778.5 | 21.4 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 66 | 5 MHz | 1 | 0 | 131997 | 1712.5 | 22.1 | 21.7 |
| | | | | 132322 | 1745.0 | 22.2 | 21.4 |
| | | | | 132646 | 1777.4 | 22.5 | 21.1 |
| | | | 12 | 131997 | 1712.5 | 22.5 | 21.5 |
| | | | | 132322 | 1745.0 | 22.5 | 21.6 |
| | | | | 132646 | 1777.4 | 22.5 | 21.6 |
| | | | 24 | 131997 | 1712.5 | 22.4 | 21.3 |
| | | | | 132322 | 1745.0 | 22.7 | 21.4 |
| | | | | 132646 | 1777.4 | 22.3 | 21.4 |
| | | 12 | 0 | 131997 | 1712.5 | 21.5 | 20.7 |
| | | | | 132322 | 1745.0 | 21.1 | 20.6 |
| | | | | 132646 | 1777.4 | 21.4 | 20.3 |
| | | | 6 | 131997 | 1712.5 | 21.4 | 20.1 |
| | | | | 132322 | 1745.0 | 21.2 | 20.4 |
| | | | | 132646 | 1777.4 | 21.3 | 20.3 |
| | | | 13 | 131997 | 1712.5 | 21.1 | 20.6 |
| | | | | 132322 | 1745.0 | 21.2 | 20.4 |
| | | | | 132646 | 1777.4 | 21.3 | 20.1 |
| | | 25 | 0 | 131997 | 1712.5 | 21.0 | 20.1 |
| | | | | 132322 | 1745.0 | 21.1 | 20.5 |
| | | | | 132646 | 1777.4 | 21.0 | 20.1 |
| | 10 MHz | 1 | 0 | 132033 | 1716.1 | 22.6 | 21.7 |
| | | | | 132322 | 1745.0 | 22.1 | 21.7 |
| | | | | 132621 | 1774.9 | 22.6 | 21.0 |
| | | | 24 | 132033 | 1716.1 | 22.6 | 21.6 |
| | | | | 132322 | 1745.0 | 22.5 | 21.5 |
| | | | | 132621 | 1774.9 | 22.7 | 21.6 |
| | | | 49 | 132033 | 1716.1 | 22.1 | 21.7 |
| | | | | 132322 | 1745.0 | 22.2 | 21.2 |
| | | | | 132621 | 1774.9 | 22.5 | 21.2 |
| | | 25 | 0 | 132033 | 1716.1 | 21.2 | 20.3 |
| | | | | 132322 | 1745.0 | 21.4 | 20.7 |
| | | | | 132621 | 1774.9 | 21.6 | 20.3 |
| | | | 13 | 132033 | 1716.1 | 21.3 | 20.5 |
| | | | | 132322 | 1745.0 | 21.7 | 20.2 |
| | | | | 132621 | 1774.9 | 21.3 | 20.5 |
| | | | 25 | 132033 | 1716.1 | 21.2 | 20.4 |
| | | | | 132322 | 1745.0 | 21.0 | 20.7 |
| | | | | 132621 | 1774.9 | 21.2 | 20.2 |
| | | 50 | 0 | 132033 | 1716.1 | 21.3 | 20.2 |
| | | | | 132322 | 1745.0 | 21.3 | 20.3 |
| | | | | 132621 | 1774.9 | 21.1 | 20.4 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| 66 | 15 MHz | 1 | 0 | 132047 | 1717.5 | 22.3 | 21.3 |
| | | | | 132322 | 1745.0 | 22.0 | 21.5 |
| | | | | 132596 | 1772.4 | 22.2 | 21.2 |
| | | | 37 | 132047 | 1717.5 | 22.5 | 21.1 |
| | | | | 132322 | 1745.0 | 22.6 | 21.5 |
| | | | | 132596 | 1772.4 | 22.5 | 21.5 |
| | | | 74 | 132047 | 1717.5 | 22.2 | 21.2 |
| | | | | 132322 | 1745.0 | 22.5 | 21.6 |
| | | | | 132596 | 1772.4 | 22.1 | 21.6 |
| | | 36 | 0 | 132047 | 1717.5 | 21.0 | 20.3 |
| | | | | 132322 | 1745.0 | 21.1 | 20.5 |
| | | | | 132596 | 1772.4 | 21.7 | 20.1 |
| | | | 19 | 132047 | 1717.5 | 21.6 | 20.2 |
| | | | | 132322 | 1745.0 | 21.4 | 20.6 |
| | | | | 132596 | 1772.4 | 21.1 | 20.3 |
| | | | 39 | 132047 | 1717.5 | 21.2 | 20.3 |
| | | | | 132322 | 1745.0 | 21.1 | 20.2 |
| | | | | 132596 | 1772.4 | 21.0 | 20.4 |
| | | 75 | 0 | 132047 | 1717.5 | 21.4 | 20.6 |
| | | | | 132322 | 1745.0 | 21.3 | 20.5 |
| | | | | 132596 | 1772.4 | 21.4 | 20.1 |
| | 20 MHz | 1 | 0 | 132072 | 1720.0 | 22.3 | 21.4 |
| | | | | 132322 | 1745.0 | 22.1 | 21.2 |
| | | | | 132571 | 1769.9 | 22.1 | 21.4 |
| | | | 49 | 132072 | 1720.0 | 22.3 | 21.7 |
| | | | | 132322 | 1745.0 | 22.5 | 21.7 |
| | | | | 132571 | 1769.9 | 22.6 | 21.4 |
| | | | 99 | 132072 | 1720.0 | 22.4 | 21.6 |
| | | | | 132322 | 1745.0 | 22.1 | 21.3 |
| | | | | 132571 | 1769.9 | 22.7 | 21.0 |
| | | 50 | 0 | 132072 | 1720.0 | 21.0 | 20.2 |
| | | | | 132322 | 1745.0 | 21.5 | 20.6 |
| | | | | 132571 | 1769.9 | 21.3 | 20.3 |
| | | | 24 | 132072 | 1720.0 | 21.7 | 20.3 |
| | | | | 132322 | 1745.0 | 21.3 | 20.1 |
| | | | | 132571 | 1769.9 | 21.5 | 20.2 |
| | | | 50 | 132072 | 1720.0 | 21.6 | 20.6 |
| | | | | 132322 | 1745.0 | 21.0 | 20.5 |
| | | | | 132571 | 1769.9 | 21.6 | 20.4 |
| | | 100 | 0 | 132072 | 1720.0 | 21.3 | 20.5 |
| | | | | 132322 | 1745.0 | 21.1 | 20.5 |
| | | | | 132571 | 1769.9 | 21.4 | 20.3 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 71 | 5 MHz | 1 | 0 | 133147 | 665.5 | 22.4 | 21.1 |
| | | | | 133297 | 680.5 | 22.5 | 21.3 |
| | | | | 133447 | 695.5 | 22.4 | 21.5 |
| | | | 12 | 133147 | 665.5 | 22.5 | 21.5 |
| | | | | 133297 | 680.5 | 22.4 | 21.4 |
| | | | | 133447 | 695.5 | 22.1 | 21.5 |
| | | | 24 | 133147 | 665.5 | 22.4 | 21.5 |
| | | | | 133297 | 680.5 | 22.0 | 21.3 |
| | | | | 133447 | 695.5 | 22.4 | 21.1 |
| | | 12 | 0 | 133147 | 665.5 | 21.1 | 20.3 |
| | | | | 133297 | 680.5 | 21.4 | 20.4 |
| | | | | 133447 | 695.5 | 21.4 | 20.1 |
| | | | 6 | 133147 | 665.5 | 21.2 | 20.2 |
| | | | | 133297 | 680.5 | 21.3 | 20.5 |
| | | | | 133447 | 695.5 | 21.6 | 20.6 |
| | | | 13 | 133147 | 665.5 | 21.5 | 20.6 |
| | | | | 133297 | 680.5 | 21.5 | 20.5 |
| | | | | 133447 | 695.5 | 21.5 | 20.1 |
| | | 25 | 0 | 133147 | 665.5 | 21.2 | 20.2 |
| | | | | 133297 | 680.5 | 21.5 | 20.1 |
| | | | | 133447 | 695.5 | 21.7 | 20.5 |
| | 10 MHz | 1 | 0 | 133172 | 668.0 | 22.5 | 21.1 |
| | | | | 133297 | 680.5 | 22.4 | 21.4 |
| | | | | 133422 | 693.0 | 22.5 | 21.7 |
| | | | 24 | 133172 | 668.0 | 22.2 | 21.2 |
| | | | | 133297 | 680.5 | 22.5 | 21.5 |
| | | | | 133422 | 693.0 | 22.0 | 21.6 |
| | | | 49 | 133172 | 668.0 | 22.0 | 21.3 |
| | | | | 133297 | 680.5 | 22.2 | 21.6 |
| | | | | 133422 | 693.0 | 22.4 | 21.3 |
| | | 25 | 0 | 133172 | 668.0 | 21.1 | 20.6 |
| | | | | 133297 | 680.5 | 21.2 | 20.6 |
| | | | | 133422 | 693.0 | 21.6 | 20.3 |
| | | | 13 | 133172 | 668.0 | 21.6 | 20.3 |
| | | | | 133297 | 680.5 | 21.0 | 20.6 |
| | | | | 133422 | 693.0 | 21.3 | 20.6 |
| | | | 25 | 133172 | 668.0 | 21.1 | 20.3 |
| | | | | 133297 | 680.5 | 21.4 | 20.3 |
| | | | | 133422 | 693.0 | 21.1 | 20.4 |
| | | 50 | 0 | 133172 | 668.0 | 21.2 | 20.5 |
| | | | | 133297 | 680.5 | 21.0 | 20.3 |
| | | | | 133422 | 693.0 | 21.1 | 20.6 |

| Band | Bandwidth | RB Size | RB Offset | Channel | Frequency | QPSK | 16QAM |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 71 | 15 MHz | 1 | 0 | 133197 | 670.5 | 22.4 | 21.3 |
| | | | | 133297 | 680.5 | 22.2 | 21.0 |
| | | | | 133397 | 690.5 | 22.5 | 21.7 |
| | | | 37 | 133197 | 670.5 | 22.4 | 21.1 |
| | | | | 133297 | 680.5 | 22.2 | 21.7 |
| | | | | 133397 | 690.5 | 22.0 | 21.4 |
| | | | 74 | 133197 | 670.5 | 22.1 | 21.0 |
| | | | | 133297 | 680.5 | 22.6 | 21.5 |
| | | | | 133397 | 690.5 | 22.5 | 21.6 |
| | | 36 | 0 | 133197 | 670.5 | 21.3 | 20.1 |
| | | | | 133297 | 680.5 | 21.3 | 20.4 |
| | | | | 133397 | 690.5 | 21.1 | 20.5 |
| | | | 19 | 133197 | 670.5 | 21.6 | 20.4 |
| | | | | 133297 | 680.5 | 21.2 | 20.0 |
| | | | | 133397 | 690.5 | 21.1 | 20.7 |
| | | | 39 | 133197 | 670.5 | 21.0 | 20.4 |
| | | | | 133297 | 680.5 | 21.1 | 20.4 |
| | | | | 133397 | 690.5 | 21.6 | 20.3 |
| | | 75 | 0 | 133197 | 670.5 | 21.4 | 20.5 |
| | | | | 133297 | 680.5 | 21.6 | 20.4 |
| | | | | 133397 | 690.5 | 21.7 | 20.3 |
| | 20 MHz | 1 | 0 | 133222 | 673.0 | 22.4 | 21.7 |
| | | | | 133297 | 680.5 | 22.2 | 21.1 |
| | | | | 133372 | 688.0 | 22.3 | 21.2 |
| | | | 49 | 133222 | 673.0 | 22.1 | 21.2 |
| | | | | 133297 | 680.5 | 22.2 | 21.5 |
| | | | | 133372 | 688.0 | 22.3 | 21.4 |
| | | | 99 | 133222 | 673.0 | 22.1 | 21.3 |
| | | | | 133297 | 680.5 | 22.1 | 21.6 |
| | | | | 133372 | 688.0 | 22.0 | 21.4 |
| | | 50 | 0 | 133222 | 673.0 | 21.3 | 20.3 |
| | | | | 133297 | 680.5 | 21.1 | 20.6 |
| | | | | 133372 | 688.0 | 21.3 | 20.3 |
| | | | 24 | 133222 | 673.0 | 21.3 | 20.4 |
| | | | | 133297 | 680.5 | 21.1 | 20.7 |
| | | | | 133372 | 688.0 | 21.0 | 20.1 |
| | | | 50 | 133222 | 673.0 | 21.2 | 20.1 |
| | | | | 133297 | 680.5 | 21.6 | 20.3 |
| | | | | 133372 | 688.0 | 21.2 | 20.2 |
| | | 100 | 0 | 133222 | 673.0 | 21.7 | 20.4 |
| | | | | 133297 | 680.5 | 21.0 | 20.1 |
| | | | | 133372 | 688.0 | 21.5 | 20.4 |

| Band | Mode | Bandwidth (MHz) | Channel | Frequency (MHz) | Data Rate | Avg Power (dBm) | Tune-up Pwr (dBm) |
|---|---|---|---|---|---|---|---|
| 2450 MHz | 802.11b | 20 | 1 | 2412 | 1 Mbps | 17.86 | 19.50 |
| | | | 6 | 2437 | | 17.95 | 19.50 |
| | | | 11 | 2462 | | 17.89 | 19.50 |
| | 802.11g | 20 | 1 | 2412 | 6 Mbps | Not Required | 18.00 |
| | | | 6 | 2437 | | | 18.00 |
| | | | 11 | 2462 | | | 18.00 |
| | 802.11n | 20 | 1 | 2412 | MCS0 | | 18.00 |
| | | | 6 | 2437 | | | 18.00 |
| | | | 11 | 2462 | | | 18.00 |

# 10. SAR Test Results

**General Note:**

1. Per KDB 447498 D01v06, 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 D01v06, 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 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

**LTE Note:**

1. 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.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. 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.
4. 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.
5. 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.
6. LTE band 2/4/5 SAR test was covered by Band 25/26/66 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.
7. For LTE bands 13/14 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, 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.

| 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 12 | 10M | QPSK | 1 | 24 | Front | 0mm | 23060 | 704 | 22.7 | 24.00 | 0.695 | 0.19 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23060 | 704 | 21.1 | 23.00 | 0.516 | 0.16 |
| 1 | LTE Band 12 | 10M | QPSK | 1 | 24 | | 0mm | 23095 | 707.5 | 22.5 | 24.00 | 0.787 | 0.22 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23095 | 707.5 | 21.4 | 23.00 | 0.529 | 0.15 |
| | LTE Band 12 | 10M | QPSK | 1 | 24 | | 0mm | 23129 | 711 | 22.1 | 24.00 | 0.726 | 0.22 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23129 | 711 | 21.3 | 23.00 | 0.517 | 0.15 |
| | LTE Band 12 | 10M | QPSK | 1 | 24 | Back | 0mm | 23060 | 704 | 22.7 | 24.00 | 0.703 | 0.19 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23060 | 704 | 21.1 | 23.00 | 0.599 | 0.19 |
| | LTE Band 12 | 10M | QPSK | 1 | 24 | | 0mm | 23095 | 707.5 | 22.5 | 24.00 | 0.727 | 0.21 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23095 | 707.5 | 21.4 | 23.00 | 0.648 | 0.19 |
| | LTE Band 12 | 10M | QPSK | 1 | 24 | | 0mm | 23129 | 711 | 22.1 | 24.00 | 0.685 | 0.21 |
| | LTE Band 12 | 10M | QPSK | 25 | 12 | | 0mm | 23129 | 711 | 21.3 | 23.00 | 0.637 | 0.19 |
| | LTE Band 13 | 10M | QPSK | 1 | 24 | Front | 0mm | 23230 | 782 | 22.3 | 24.00 | 0.839 | 0.25 |
| | LTE Band 13 | 10M | QPSK | 25 | 12 | | 0mm | 23230 | 782 | 21.3 | 23.00 | 0.779 | 0.23 |
| 2 | LTE Band 13 | 10M | QPSK | 1 | 24 | Back | 0mm | 23230 | 782 | 22.3 | 24.00 | 1.41 | 0.42 |
| | LTE Band 13 | 10M | QPSK | 25 | 12 | | 0mm | 23230 | 782 | 21.3 | 23.00 | 1.02 | 0.30 |
| | LTE Band 14 | 10M | QPSK | 1 | 24 | Front | 0mm | 23330 | 793 | 22.6 | 24.00 | 0.839 | 0.23 |
| | LTE Band 14 | 10M | QPSK | 25 | 12 | | 0mm | 23330 | 793 | 21.6 | 23.00 | 0.703 | 0.19 |
| 3 | LTE Band 14 | 10M | QPSK | 1 | 24 | Back | 0mm | 23330 | 793 | 22.6 | 24.00 | 1.36 | 0.38 |
| | LTE Band 14 | 10M | QPSK | 25 | 12 | | 0mm | 23330 | 793 | 21.6 | 23.00 | 0.986 | 0.27 |
| | LTE Band 25 | 20M | QPSK | 1 | 49 | Front | 0mm | 26140 | 1860 | 22.2 | 24.00 | 2.19 | 0.66 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26140 | 1860 | 21.2 | 23.00 | 1.97 | 0.60 |
| | LTE Band 25 | 20M | QPSK | 1 | 49 | | 0mm | 26365 | 1882.5 | 22.1 | 24.00 | 2.23 | 0.69 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26365 | 1882.5 | 21.6 | 23.00 | 2.06 | 0.57 |
| | LTE Band 25 | 20M | QPSK | 1 | 49 | | 0mm | 26590 | 1905 | 22.2 | 24.00 | 2.04 | 0.62 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26590 | 1905 | 21.4 | 23.00 | 1.85 | 0.53 |
| | LTE Band 25 | 20M | QPSK | 1 | 49 | Back | 0mm | 26140 | 1860 | 22.2 | 24.00 | 3.29 | 1.00 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26140 | 1860 | 21.2 | 23.00 | 2.59 | 0.78 |
| | LTE Band 25 | 20M | QPSK | 1 | 49 | | 0mm | 26365 | 1882.5 | 22.5 | 24.00 | 4.28 | 1.21 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26365 | 1882.5 | 21.6 | 23.00 | 3.67 | 1.01 |
| 4 | LTE Band 25 | 20M | QPSK | 1 | 49 | | 0mm | 26590 | 1905 | 22.9 | 24.00 | 5.11 | 1.32 |
| | LTE Band 25 | 20M | QPSK | 50 | 24 | | 0mm | 26590 | 1905 | 21.4 | 23.00 | 3.92 | 1.13 |
| | LTE Band 26 | 15M | QPSK | 1 | 37 | Front | 0mm | 26765 | 821.5 | 22.5 | 24.00 | 0.822 | 0.23 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26765 | 821.5 | 21.1 | 23.00 | 0.716 | 0.22 |
| | LTE Band 26 | 15M | QPSK | 1 | 37 | | 0mm | 26865 | 831.5 | 22.7 | 24.00 | 0.842 | 0.23 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26865 | 831.5 | 21.7 | 23.00 | 0.739 | 0.20 |
| | LTE Band 26 | 15M | QPSK | 1 | 37 | | 0mm | 26965 | 841.5 | 22.7 | 24.00 | 0.816 | 0.22 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26965 | 841.5 | 21.5 | 23.00 | 0.704 | 0.20 |
| | LTE Band 26 | 15M | QPSK | 1 | 37 | Back | 0mm | 26765 | 821.5 | 22.5 | 24.00 | 1.15 | 0.32 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26765 | 821.5 | 21.1 | 23.00 | 0.958 | 0.30 |
| 5 | LTE Band 26 | 15M | QPSK | 1 | 37 | | 0mm | 26865 | 831.5 | 22.7 | 24.00 | 1.31 | 0.35 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26865 | 831.5 | 21.7 | 23.00 | 1.02 | 0.28 |
| | LTE Band 26 | 15M | QPSK | 1 | 37 | | 0mm | 26965 | 841.5 | 22.7 | 24.00 | 1.27 | 0.34 |
| | LTE Band 26 | 15M | QPSK | 36 | 19 | | 0mm | 26965 | 841.5 | 21.5 | 23.00 | 0.995 | 0.28 |

**Note: The reported SAR value is the measured value first scaled to the upper end of the tolerance and then scaled to the 20% duty cycle.**

| 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 66 | 20M | QPSK | 1 | 49 | Front | 0mm | 132072 | 1720 | 22.3 | 24.00 | 1.32 | 0.39 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132072 | 1720 | 21.7 | 23.00 | 0.957 | 0.26 |
| | LTE Band 66 | 20M | QPSK | 1 | 49 | | 0mm | 132322 | 1745 | 22.5 | 24.00 | 1.68 | 0.47 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132322 | 1745 | 21.3 | 23.00 | 1.16 | 0.34 |
| | LTE Band 66 | 20M | QPSK | 1 | 49 | | 0mm | 132572 | 1770 | 22.6 | 24.00 | 1.41 | 0.39 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132572 | 1770 | 21.5 | 23.00 | 1.04 | 0.29 |
| | LTE Band 66 | 20M | QPSK | 1 | 49 | Back | 0mm | 132072 | 1720 | 22.3 | 24.00 | 1.98 | 0.59 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132072 | 1720 | 21.7 | 23.00 | 1.22 | 0.33 |
| 6 | LTE Band 66 | 20M | QPSK | 1 | 49 | | 0mm | 132322 | 1745 | 22.5 | 24.00 | 2.12 | 0.60 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132322 | 1745 | 21.3 | 23.00 | 1.39 | 0.41 |
| | LTE Band 66 | 20M | QPSK | 1 | 49 | | 0mm | 132572 | 1770 | 22.6 | 24.00 | 2.07 | 0.57 |
| | LTE Band 66 | 20M | QPSK | 50 | 24 | | 0mm | 132572 | 1770 | 21.5 | 23.00 | 1.29 | 0.36 |
| | LTE Band 71 | 20M | QPSK | 1 | 49 | Front | 0mm | 133222 | 673 | 22.1 | 24.00 | 0.658 | 0.20 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133222 | 673 | 21.3 | 23.00 | 0.523 | 0.15 |
| | LTE Band 71 | 20M | QPSK | 1 | 49 | | 0mm | 133297 | 680.5 | 22.2 | 24.00 | 0.694 | 0.21 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133297 | 680.5 | 21.1 | 23.00 | 0.549 | 0.17 |
| | LTE Band 71 | 20M | QPSK | 1 | 49 | | 0mm | 133372 | 688 | 22.3 | 24.00 | 0.671 | 0.20 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133372 | 688 | 21.0 | 23.00 | 0.532 | 0.17 |
| | LTE Band 71 | 20M | QPSK | 1 | 49 | Back | 0mm | 133222 | 673 | 22.1 | 24.00 | 0.911 | 0.28 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133222 | 673 | 21.3 | 23.00 | 0.802 | 0.24 |
| 7 | LTE Band 71 | 20M | QPSK | 1 | 49 | | 0mm | 133297 | 680.5 | 22.2 | 24.00 | 0.964 | 0.29 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133297 | 680.5 | 21.1 | 23.00 | 0.826 | 0.26 |
| | LTE Band 71 | 20M | QPSK | 1 | 49 | | 0mm | 133372 | 688 | 22.3 | 24.00 | 0.946 | 0.28 |
| | LTE Band 71 | 20M | QPSK | 50 | 24 | | 0mm | 133372 | 688 | 21.0 | 23.00 | 0.811 | 0.26 |

**Note: The reported SAR value is the measured value first scaled to the upper end of the tolerance and then scaled to the 20% duty cycle.**

| 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 | 20M | CCK | Front | 0mm | 1 | 2412 | 17.86 | 19.50 | 0.144 | 0.21 |
| | 2.45 GHz | 20M | CCK | | 0mm | 6 | 2437 | 17.95 | 19.50 | 0.166 | 0.24 |
| | 2.45 GHz | 20M | CCK | | 0mm | 11 | 2462 | 17.89 | 19.50 | 0.138 | 0.20 |
| | 2.45 GHz | 20M | CCK | Back | 0mm | 1 | 2412 | 17.86 | 19.50 | 0.182 | 0.27 |
| 8 | 2.45 GHz | 20M | CCK | | 0mm | 6 | 2437 | 17.95 | 19.50 | 0.208 | 0.30 |
| | 2.45 GHz | 20M | CCK | | 0mm | 11 | 2462 | 17.89 | 19.50 | 0.194 | 0.28 |

**Note: The reported SAR value is the measured value scaled to the upper end of the tolerance.**

# 11. Simultaneous Transmission Analysis

The two transmitters do not simultaneously transmit at any time.

# 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 |
| ELI5 Flat Phantom | N/A | N/A | 2037 |
| Device Holder | N/A | N/A | N/A |
| Data Acquisition Electronics 4 | 04/09/2025 | 04/09/2024 | 1416 |
| SPEAG E-Field Probe EX3DV4 | 02/14/2025 | 02/14/2024 | 3662 |
| Speag Validation Dipole D750V2 | 05/10/2025 | 05/10/2024 | 1016 |
| Speag Validation Dipole D900V2 | 05/10/2025 | 05/10/2024 | 1d014 |
| 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 |
| 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 MT8821C | 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 |

# 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 29/Aug/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 |
|---|---|---|---|---|
| 0.6600 | 42.41 | 0.88 | 42.28 | 0.86 |
| 0.6700 | 42.36 | 0.89 | 42.12 | 0.87 |
| 0.6730 | 42.345 | 0.89 | 42.081 | 0.87* |
| 0.6800 | 42.31 | 0.89 | 41.99 | 0.87 |
| 0.6805 | 42.306 | 0.89 | 41.987 | 0.87* |
| 0.6880 | 42.238 | 0.89 | 41.934 | 0.87* |
| 0.6900 | 42.22 | 0.89 | 41.92 | 0.87 |
| 0.7000 | 42.20 | 0.89 | 41.90 | 0.87 |
| 0.7040 | 42.180 | 0.89 | 41.872 | 0.874* |
| 0.7075 | 42.163 | 0.89 | 41.848 | 0.878* |
| 0.7100 | 42.15 | 0.89 | 41.83 | 0.88 |
| 0.7110 | 42.145 | 0.89 | 41.825 | 0.881* |
| 0.7200 | 42.10 | 0.89 | 41.78 | 0.89 |
| 0.7300 | 42.05 | 0.89 | 41.71 | 0.90 |
| 0.7400 | 41.99 | 0.89 | 41.65 | 0.90 |
| 0.7500 | 41.94 | 0.89 | 41.60 | 0.91 |
| 0.7600 | 41.89 | 0.89 | 41.54 | 0.92 |
| 0.7700 | 41.84 | 0.89 | 41.48 | 0.93 |
| 0.7800 | 41.79 | 0.90 | 41.42 | 0.93 |
| 0.7820 | 41.778 | 0.90 | 41.408 | 0.932* |
| 0.7900 | 41.73 | 0.90 | 41.36 | 0.94 |
| 0.7930 | 41.715 | 0.90 | 41.345 | 0.94* |
| 0.8000 | 41.68 | 0.90 | 41.31 | 0.94 |

* value interpolated

************************************************************
Test Result for UIM Dielectric Parameter
Thu 29/Aug/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 | 40.61 | 0.92 |
| 0.8100 | 41.63 | 0.90 | 40.56 | 0.93 |
| 0.8200 | 41.58 | 0.90 | 40.50 | 0.94 |
| 0.8215 | 41.573 | 0.90 | 40.508 | 0.94* |
| 0.8300 | 41.53 | 0.90 | 40.55 | 0.94 |
| 0.8315 | 41.526 | 0.902 | 40.546 | 0.942* |
| 0.8400 | 41.50 | 0.91 | 40.52 | 0.95 |
| 0.8415 | 41.50 | 0.912 | 40.517 | 0.952* |
| 0.8500 | 41.50 | 0.92 | 40.50 | 0.96 |
| 0.8600 | 41.50 | 0.93 | 40.48 | 0.97 |
| 0.8700 | 41.50 | 0.94 | 40.46 | 0.98 |
| 0.8800 | 41.50 | 0.95 | 40.45 | 0.99 |
| 0.8900 | 41.50 | 0.96 | 40.44 | 1.00 |
| 0.9000 | 41.50 | 0.97 | 40.43 | 1.01 |
| 0.9100 | 41.50 | 0.98 | 40.42 | 1.02 |
| 0.9200 | 41.49 | 0.98 | 40.41 | 1.02 |

* value interpolated

************************************************************
Test Result for UIM Dielectric Parameter
Thu 29/Aug/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 | 39.12 | 1.37 |
| 1.7100 | 40.14 | 1.35 | 39.10 | 1.38 |
| 1.7200 | 40.13 | 1.35 | 39.08 | 1.39 |
| 1.7300 | 40.11 | 1.36 | 39.06 | 1.39 |
| 1.7400 | 40.09 | 1.37 | 39.04 | 1.40 |
| 1.7450 | 40.085 | 1.37 | 39.03 | 1.405* |
| 1.7500 | 40.08 | 1.37 | 39.02 | 1.41 |
| 1.7600 | 40.06 | 1.38 | 39.00 | 1.42 |
| 1.7700 | 40.05 | 1.38 | 38.98 | 1.43 |
| 1.7800 | 40.03 | 1.39 | 38.96 | 1.43 |
| 1.7900 | 40.02 | 1.39 | 38.94 | 1.44 |

* value interpolated

************************************************************
Test Result for UIM Dielectric Parameter
Fri 30/Aug/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 |
|---|---|---|---|---|
| 1.8500 | 40.00 | 1.40 | 39.14 | 1.41 |
| 1.8600 | 40.00 | 1.40 | 39.12 | 1.42 |
| 1.8700 | 40.00 | 1.40 | 39.10 | 1.42 |
| 1.8800 | 40.00 | 1.40 | 39.08 | 1.43 |
| 1.8825 | 40.00 | 1.40 | 39.075 | 1.43* |
| 1.8900 | 40.00 | 1.40 | 39.06 | 1.43 |
| 1.9000 | 40.00 | 1.40 | 39.04 | 1.43 |
| 1.9050 | 40.00 | 1.40 | 39.03 | 1.435* |
| 1.9100 | 40.00 | 1.40 | 39.02 | 1.44 |
| 1.9200 | 40.00 | 1.40 | 39.01 | 1.45 |

* value interpolated

************************************************************

Test Result for UIM Dielectric Parameter
Fri 30/Aug/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 | 38.42 | 1.78 |
| 2.4120 | 39.258 | 1.762 | 38.416 | 1.782* |
| 2.4200 | 39.25 | 1.77 | 38.40 | 1.79 |
| 2.4300 | 39.24 | 1.78 | 38.38 | 1.80 |
| 2.4370 | 39.226 | 1.787 | 38.373 | 1.814* |
| 2.4400 | 39.22 | 1.79 | 38.37 | 1.82 |
| 2.4500 | 39.20 | 1.80 | 38.32 | 1.83 |
| 2.4600 | 39.19 | 1.81 | 38.32 | 1.84 |
| 2.4620 | 39.186 | 1.812 | 38.316 | 1.842* |
| 2.4700 | 39.17 | 1.82 | 38.30 | 1.85 |
| 2.4800 | 39.16 | 1.83 | 38.28 | 1.88 |

* value interpolated

# RF Exposure Lab

## Plot 1

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

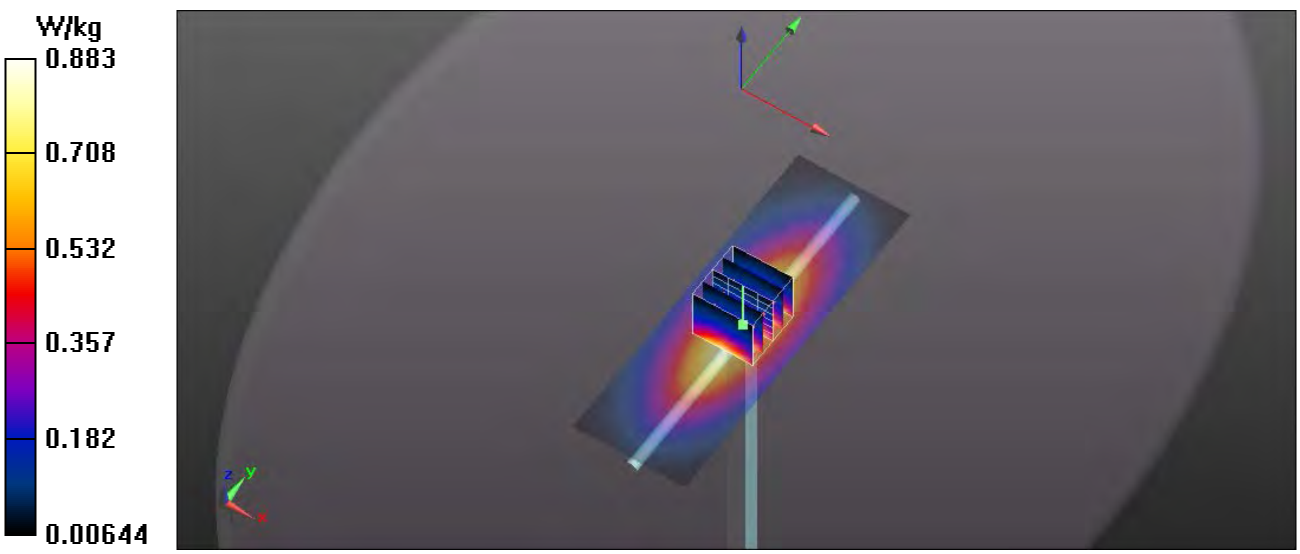
Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 750 MHz; σ = 0.91 S/m; $\varepsilon_r$ = 41.60; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3662; ConvF(8.69, 9.23, 7.72); Calibrated: 2/14/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### Procedure Notes:

**750 MHz Head/Verification/Area Scan (41x121x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.885 W/kg

**750 MHz Head/Verification /Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.114 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.511 mW/g
$P_{in}$= 100 mW
**SAR(1 g) = 0.849 mW/g; SAR(10 g) = 0.553 mW/g**
Maximum value of SAR (measured) = 0.882 W/kg



# RF Exposure Lab

## Plot 2

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

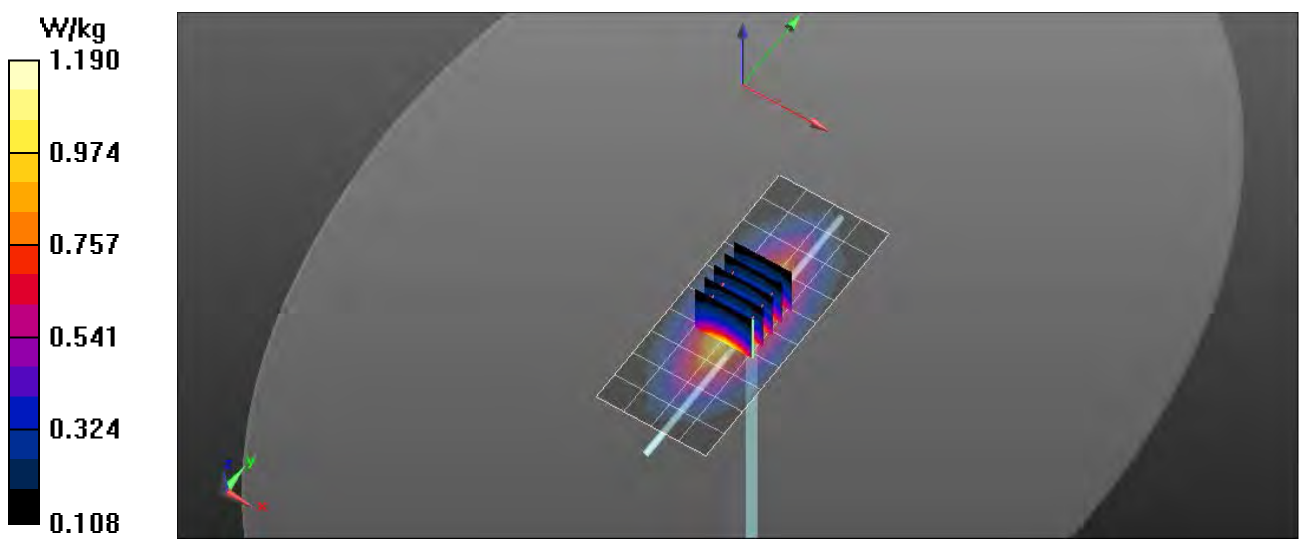
Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used: f = 900 MHz; σ = 1.01 S/m; $\varepsilon_r$ = 40.43; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3662; ConvF(8.07, 8.67, 7.35); Calibrated: 2/14/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### Procedure Notes:

**900 MHz Head/Verification/Area Scan (5x11x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.27 W/kg

**900 MHz Head/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.128 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.48 W/kg
$P_{in}$= 100 mW
**SAR(1 g) = 1.17 W/kg; SAR(10 g) = 0.719 W/kg**
Maximum value of SAR (measured) = 1.18 W/kg



# RF Exposure Lab

## Plot 3

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

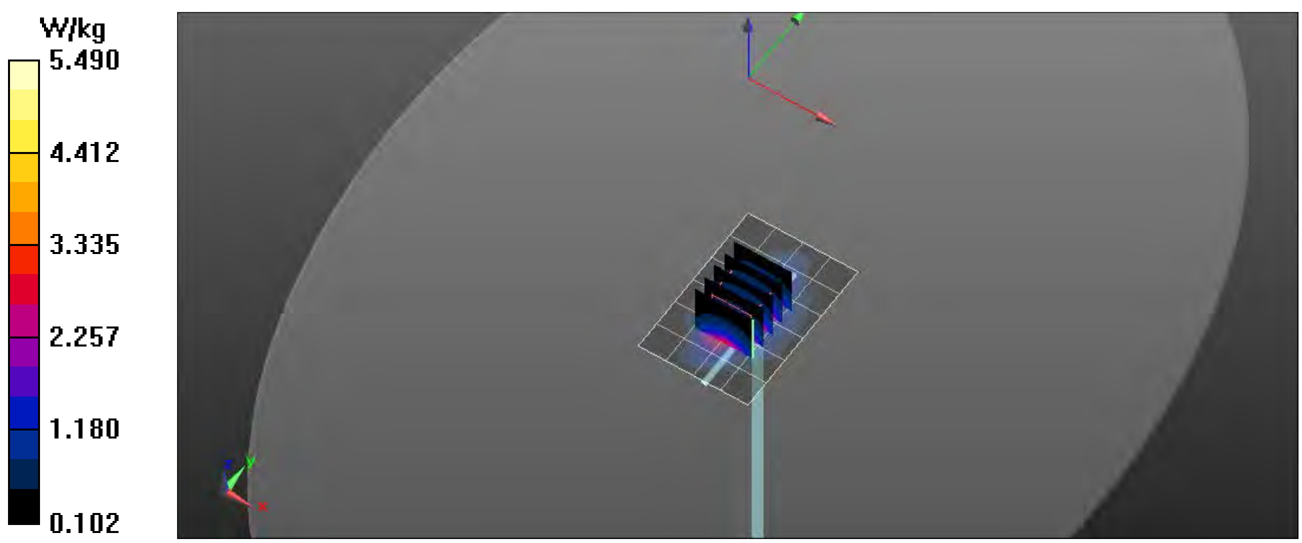
Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used: f = 1750 MHz; σ = 1.41 S/m; $\varepsilon_r$ = 39.02; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3662; ConvF(7.65, 8.01, 6.62); Calibrated: 2/14/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### Procedure Notes:

**1750 MHz Head/Verification/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.19 W/kg

**1750 MHz Head/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.865 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 6.82 W/kg
$P_{in}$= 100 mW
**SAR(1 g) = 3.75 W/kg; SAR(10 g) = 1.95 W/kg**
Maximum value of SAR (measured) = 5.48 W/kg



# RF Exposure Lab

## Plot 4

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

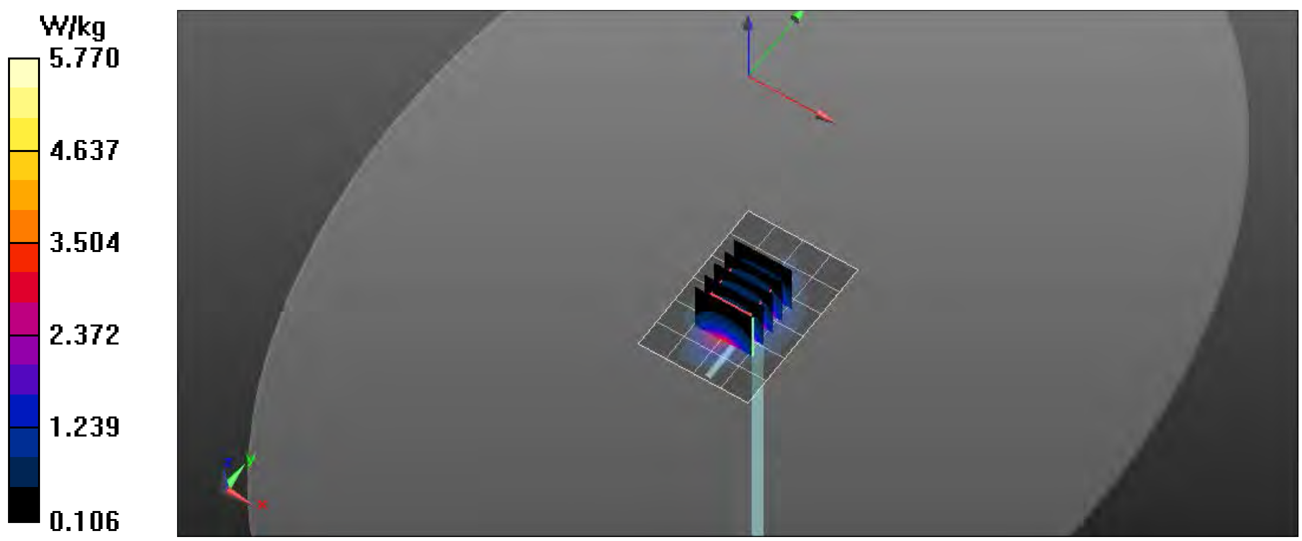
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used: f = 1900 MHz; $\sigma$ = 1.43 S/m; $\varepsilon_r$ = 39.04; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/30/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3662; ConvF(7.37, 7.91, 6.59); Calibrated: 2/14/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### Procedure Notes:

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

**1900 MHz Head/Verification/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.367 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 7.19 W/kg
$P_{in}$= 100 mW
**SAR(1 g) = 4.15 W/kg; SAR(10 g) = 2.16 W/kg**
Maximum value of SAR (measured) = 5.75 W/kg



# RF Exposure Lab

## Plot 5

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

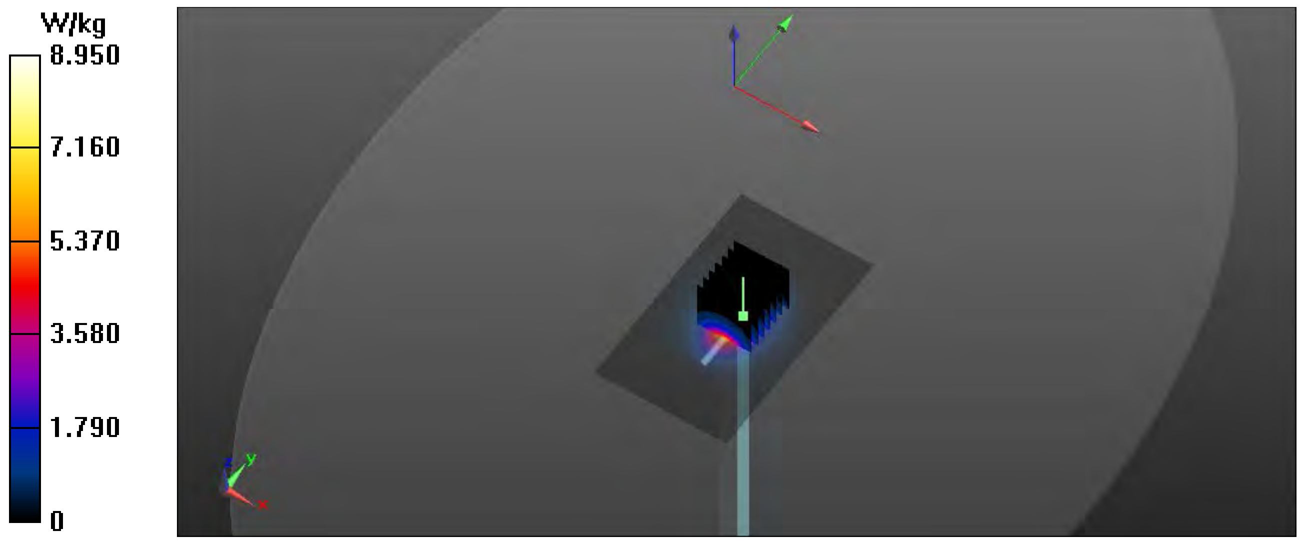
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; $\varepsilon_r$ = 38.32; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/30/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3662; ConvF(6.93, 7.49, 6.22); Calibrated: 2/14/2024;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

### Procedure Notes:

**Head Verification/2450 MHz/Area Scan (61x101x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.62 W/kg

**Head Verification/2450 MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.165 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 11.08 W/kg
$P_{in}$= 100 mW
**SAR(1 g) = 5.23 W/kg; SAR(10 g) = 2.51 W/kg**
Maximum value of SAR (measured) = 8.96 W/kg



# Appendix B – SAR Test Data Plots

# RF Exposure Lab

## Plot 1

### DUT: myPatch-sl; Type: ECG Monitor; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 10 MHz, QPSK); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: HSL750; Medium parameters used (interpolated): f = 707.5 MHz; $\sigma$ = 0.878 S/m; $\varepsilon_r$ = 41.848; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.69, 9.23, 7.72); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

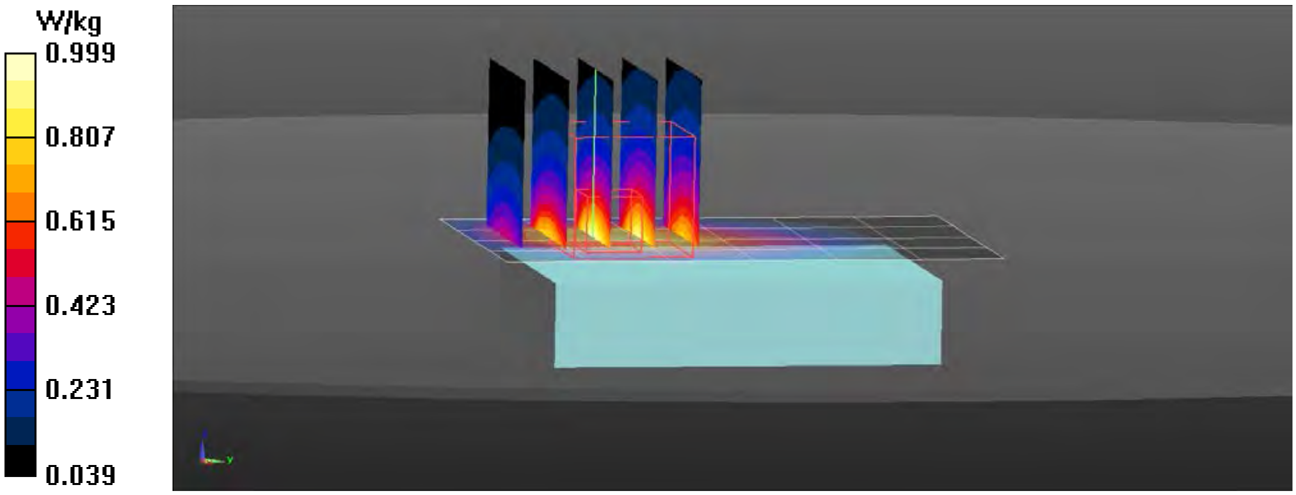
### Procedure Notes:

**B12 LTE/Front Mid 1 RB 24 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.928 W/kg

**B12 LTE/Front Mid 1 RB 24 Offset/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.29 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.17 W/kg
**SAR(1 g) = 0.787 W/kg; SAR(10 g) = 0.508 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.999 W/kg



# RF Exposure Lab

## Plot 2

### DUT: myPatch-sl; Type: ECG Monitor; 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; $\varepsilon_r$ = 41.408; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.69, 9.23, 7.72); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

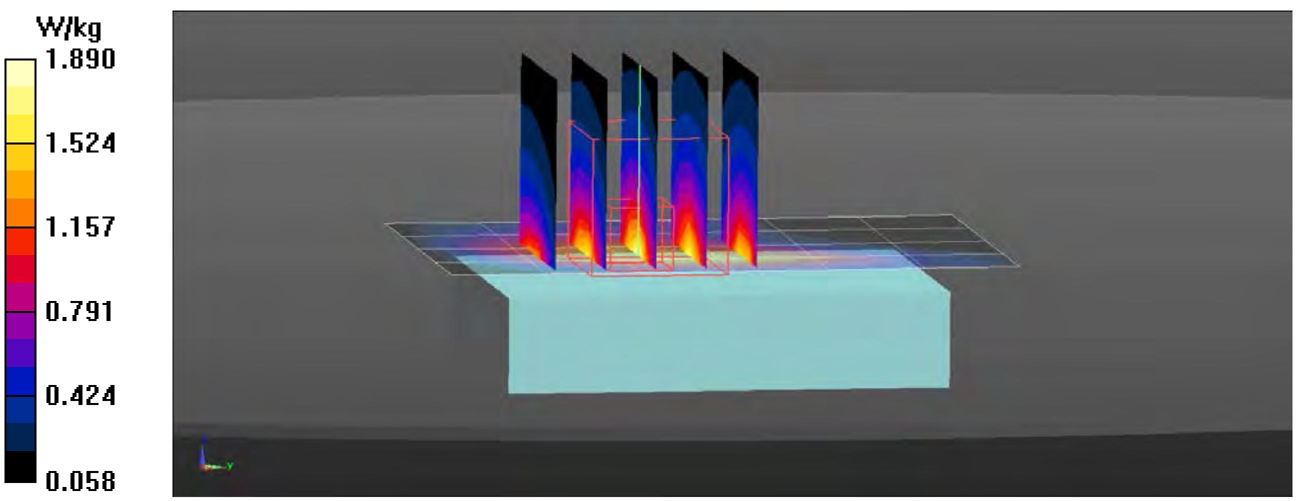
### Procedure Notes:

**B13 LTE/Back Mid 1 RB 24 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.53 W/kg

**B13 LTE/Back Mid 1 RB 24 Offset/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.36 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 2.17 W/kg
**SAR(1 g) = 1.41 W/kg; SAR(10 g) = 0.867 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.89 W/kg



# RF Exposure Lab

## Plot 3

### DUT: myPatch-sl; Type: ECG Monitor; 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; $\varepsilon_r$ = 41.345; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.69, 9.23, 7.72); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

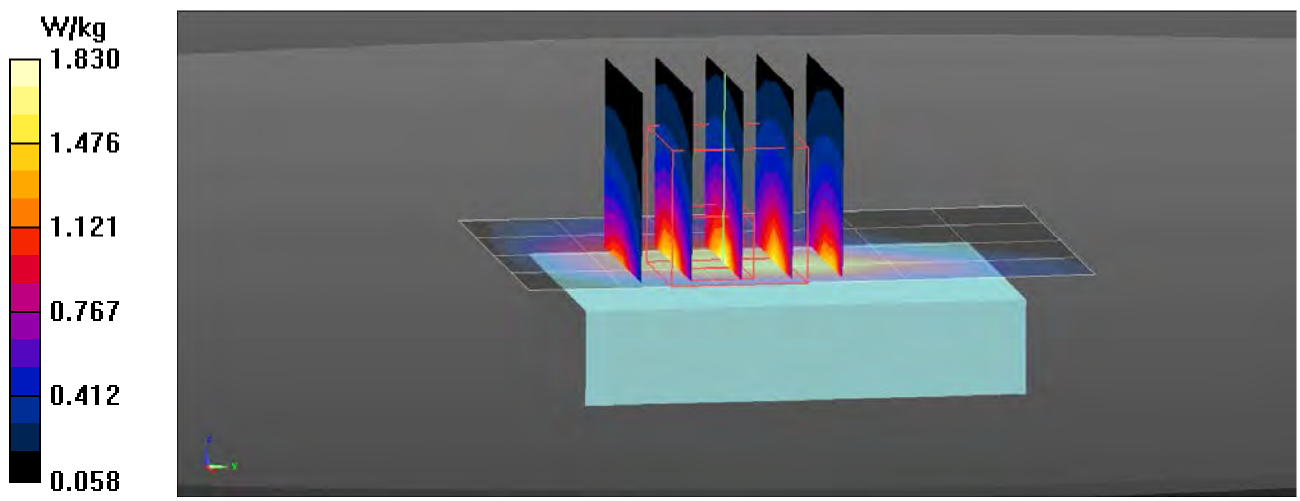
### Procedure Notes:

**B14 LTE/Back Low 1 RB 24 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.62 W/kg

**B14 LTE/Back Low 1 RB 24 Offset/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.67 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 2.09 W/kg
**SAR(1 g) = 1.36 W/kg; SAR(10 g) = 0.840 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.83 W/kg



# RF Exposure Lab

## Plot 4

### DUT: myPatch-sl; Type: ECG Monitor; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1905 MHz; Duty Cycle: 1:1
Medium: HSL1900; Medium parameters used (interpolated): f = 1905 MHz; σ = 1.435 S/m; $\varepsilon_r$ = 39.03; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/30/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.37, 7.91, 6.59); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

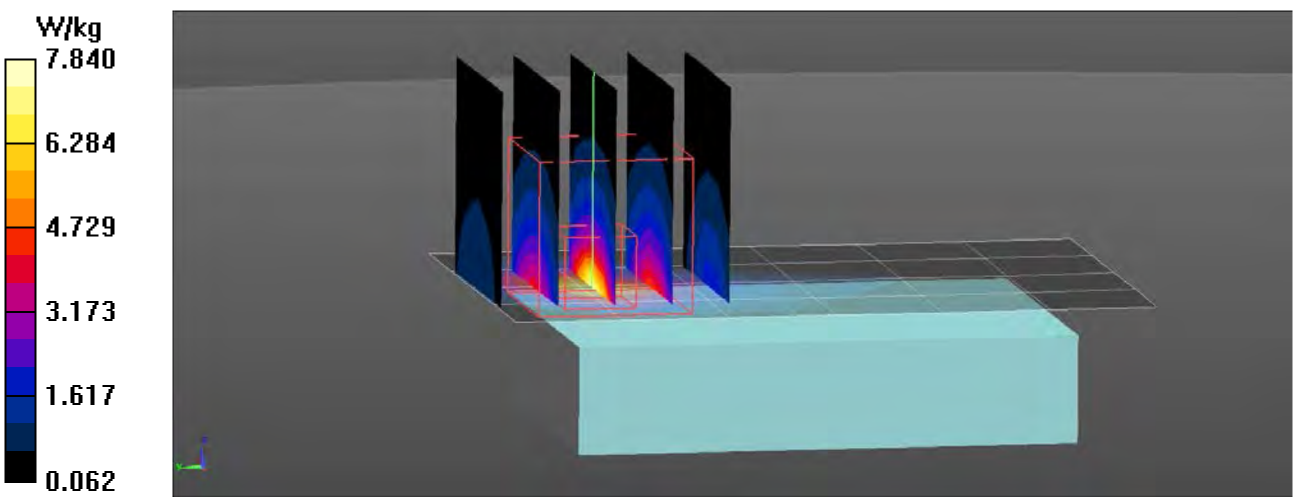
### Procedure Notes:

**B25 LTE/Back High 1 RB 49 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 7.27 W/kg

**B25 LTE/Back High 1 RB 49 Offset/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.38 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 9.92 W/kg
**SAR(1 g) = 5.11 W/kg; SAR(10 g) = 2.38 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 7.84 W/kg



# RF Exposure Lab

## Plot 5

### DUT: myPatch-sl; Type: ECG Monitor; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 15 MHz, QPSK); Frequency: 831.5 MHz; Duty Cycle: 1:1
Medium: HSL900; Medium parameters used (interpolated): f = 831.5 MHz; σ = 0.942 S/m; $\varepsilon_r$ = 40.546; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.07, 8.67, 7.35); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

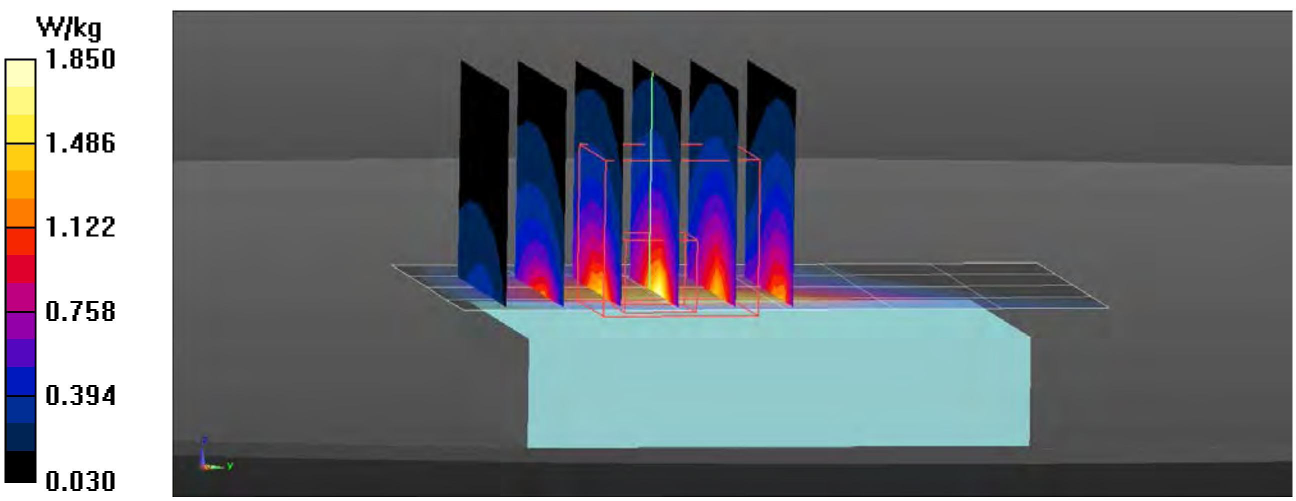
### Procedure Notes:

**B26 LTE/Back Mid 1 RB 37 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.60 W/kg

**B26 LTE/Back Mid 1 RB 37 Offset/Zoom Scan (6x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.11 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 2.15 W/kg
**SAR(1 g) = 1.31 W/kg; SAR(10 g) = 0.784 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.85 W/kg



# RF Exposure Lab

## Plot 6

### DUT: myPatch-sl; Type: ECG Monitor; Serial: Eng 1

Communication System: LTE (SC-FDMA, 1 RB, 20 MHz, QPSK); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: HSL1750; Medium parameters used (interpolated): f = 1745 MHz; $\sigma$ = 1.405 S/m; $\varepsilon_r$ = 39.03; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(7.65, 8.01, 6.62); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

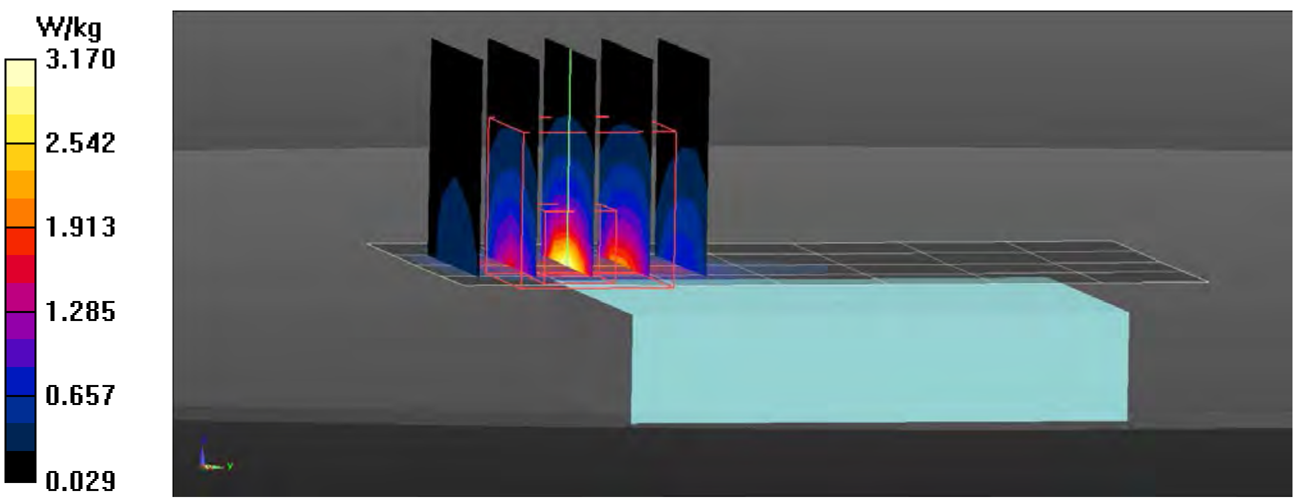
### Procedure Notes:

**B66 LTE/Back Mid 1 RB 49 Offset/Area Scan (5x8x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.98 W/kg

**B66 LTE/Back Mid 1 RB 49 Offset/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.61 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 4.15 W/kg
**SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.02 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 3.17 W/kg



# RF Exposure Lab

## Plot 7

### DUT: myPatch-sl; Type: ECG Monitor; 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; $\varepsilon_r$ = 41.987; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/29/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(8.69, 9.23, 7.72); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

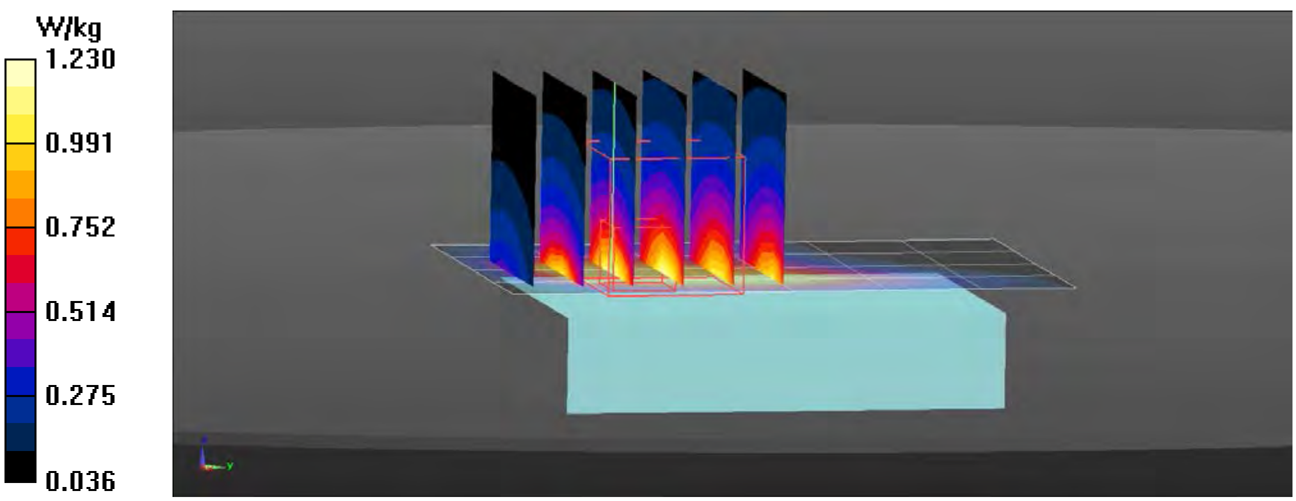
### Procedure Notes:

**B71 LTE/Back Mid 1 RB 49 Offset/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.11 W/kg

**B71 LTE/Back Mid 1 RB 49 Offset/Zoom Scan (5x6x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.56 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.56 W/kg
**SAR(1 g) = 0.964 W/kg; SAR(10 g) = 0.615 W/kg**

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.23 W/kg



# RF Exposure Lab

## Plot 8

### DUT: myPatch-sl; Type: ECG Monitor; 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 = 1.814 S/m; $\varepsilon_r$ = 38.373; ρ = 1000 kg/m$^3$
Phantom section: Flat Section

Test Date: Date: 8/30/2024; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3662; ConvF(6.93, 7.49, 6.22); Calibrated: 2/14/2024
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1416; Calibrated: 4/9/2024
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 2037
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

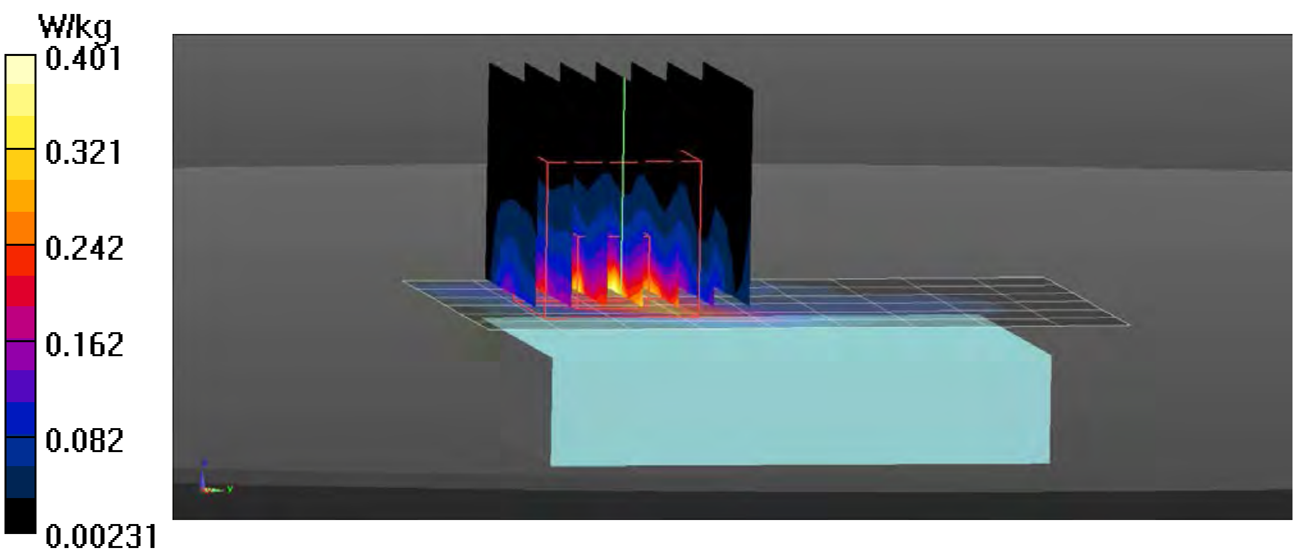
### Procedure Notes:

**2450 MHz/Back Ch 6/Area Scan (7x10x1):** Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.401 W/kg

**2450 MHz/Back Ch 6/Zoom Scan (8x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.713 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.630 W/kg
**SAR(1 g) = 0.208 W/kg; SAR(10 g) = 0.102 W/kg**

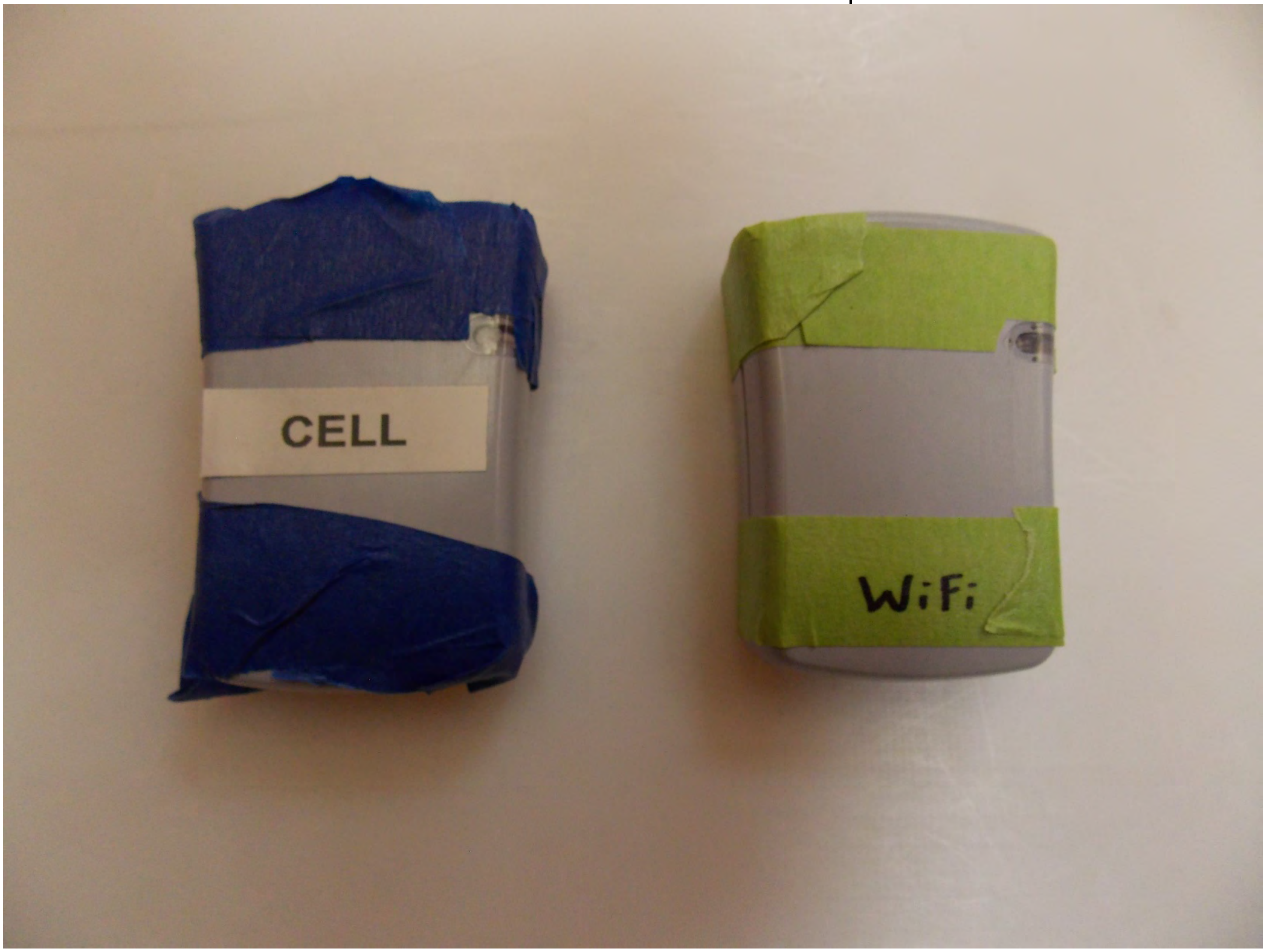
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.401 W/kg



## Appendix C – SAR Test Setup Photos

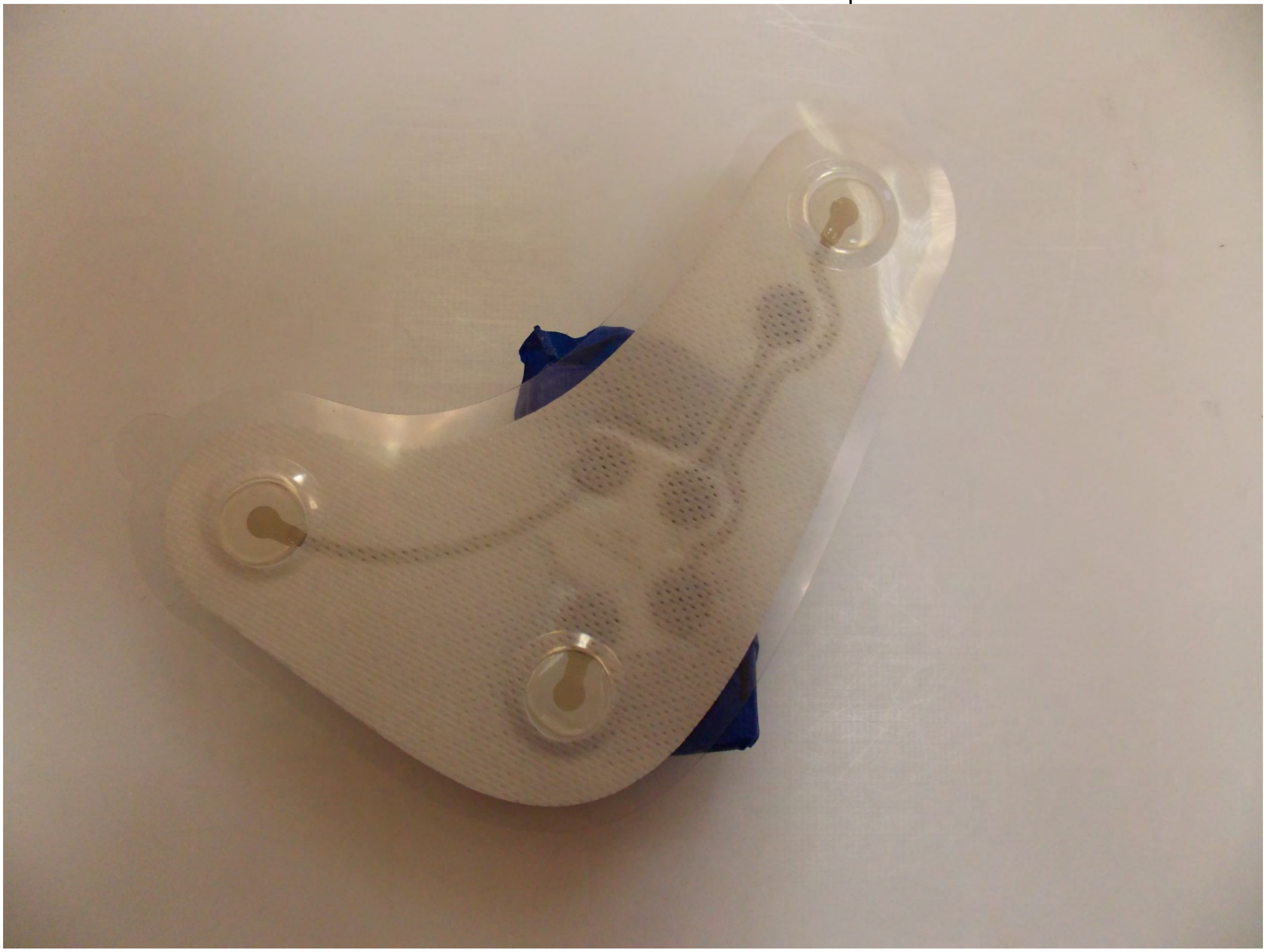
**Test Position Front 0 mm Gap**

Test Position Back 0 mm Gap




**Front of Device**

**Back of Device**



**Electrode**

# 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-3662_Feb24** |
|---|---|---|---|

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:3662 |
| Calibration procedure(s) | QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8<br>Calibration procedure for dosimetric E-field probes |
| Calibration date | February 14, 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 | Jeffrey Katzman | Laboratory Technician | |
| Approved by | Sven Kühn | Technical Manager | |

Issued: February 14, 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 $\varphi$ | $\varphi$ rotation around probe axis |
| Polarization $\vartheta$ | $\vartheta$ 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:3662

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc ($k = 2$) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$) [A] | 0.41 | 0.49 | 0.51 | ±10.1% |
| DCP (mV) [B] | 100.0 | 100.2 | 97.8 | ±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 | 142.1 | ±2.6% | ±4.7% |
| | | Y | 0.00 | 0.00 | 1.00 | | 135.7 | | |
| | | Z | 0.00 | 0.00 | 1.00 | | 122.6 | | |

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:3662

## Other Probe Parameters

| | |
|---|---|
| Sensor Arrangement | Triangular |
| Connector Angle | 80.8° |
| 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:3662

## 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 ($k = 2$) |
|---|---|---|---|---|---|---|---|---|
| 150 | 52.3 | 0.76 | 11.37 | 11.37 | 11.37 | 0.00 | 1.25 | ±13.3% |
| 220 | 49.0 | 0.81 | 11.10 | 11.10 | 11.10 | 0.00 | 1.25 | ±13.3% |
| 300 | 45.3 | 0.87 | 10.56 | 10.56 | 10.56 | 0.09 | 1.00 | ±13.3% |
| 450 | 43.5 | 0.87 | 10.11 | 10.11 | 10.11 | 0.16 | 1.30 | ±13.3% |
| 600 | 42.7 | 0.88 | 9.72 | 9.72 | 9.72 | 0.10 | 1.25 | ±13.3% |
| 750 | 41.9 | 0.89 | 8.69 | 9.23 | 7.72 | 0.38 | 1.27 | ±11.0% |
| 900 | 41.5 | 0.97 | 8.07 | 8.67 | 7.35 | 0.37 | 1.27 | ±11.0% |
| 1450 | 40.5 | 1.20 | 7.68 | 8.23 | 6.89 | 0.36 | 1.27 | ±11.0% |
| 1640 | 40.2 | 1.31 | 7.61 | 8.12 | 6.82 | 0.32 | 1.27 | ±11.0% |
| 1750 | 40.1 | 1.37 | 7.65 | 8.01 | 6.62 | 0.28 | 1.27 | ±11.0% |
| 1900 | 40.0 | 1.40 | 7.37 | 7.91 | 6.59 | 0.30 | 1.27 | ±11.0% |
| 2300 | 39.5 | 1.67 | 7.08 | 7.67 | 6.36 | 0.32 | 1.27 | ±11.0% |
| 2450 | 39.2 | 1.80 | 6.93 | 7.49 | 6.22 | 0.30 | 1.27 | ±11.0% |
| 2600 | 39.0 | 1.96 | 6.81 | 7.33 | 6.11 | 0.30 | 1.27 | ±11.0% |
| 5250 | 35.9 | 4.71 | 5.12 | 5.37 | 4.57 | 0.33 | 1.72 | ±13.1% |
| 5600 | 35.5 | 5.07 | 4.70 | 4.92 | 4.17 | 0.41 | 1.67 | ±13.1% |
| 5750 | 35.4 | 5.22 | 4.83 | 5.08 | 4.30 | 0.41 | 1.75 | ±13.1% |

[C] Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10% if SAR correction is applied.

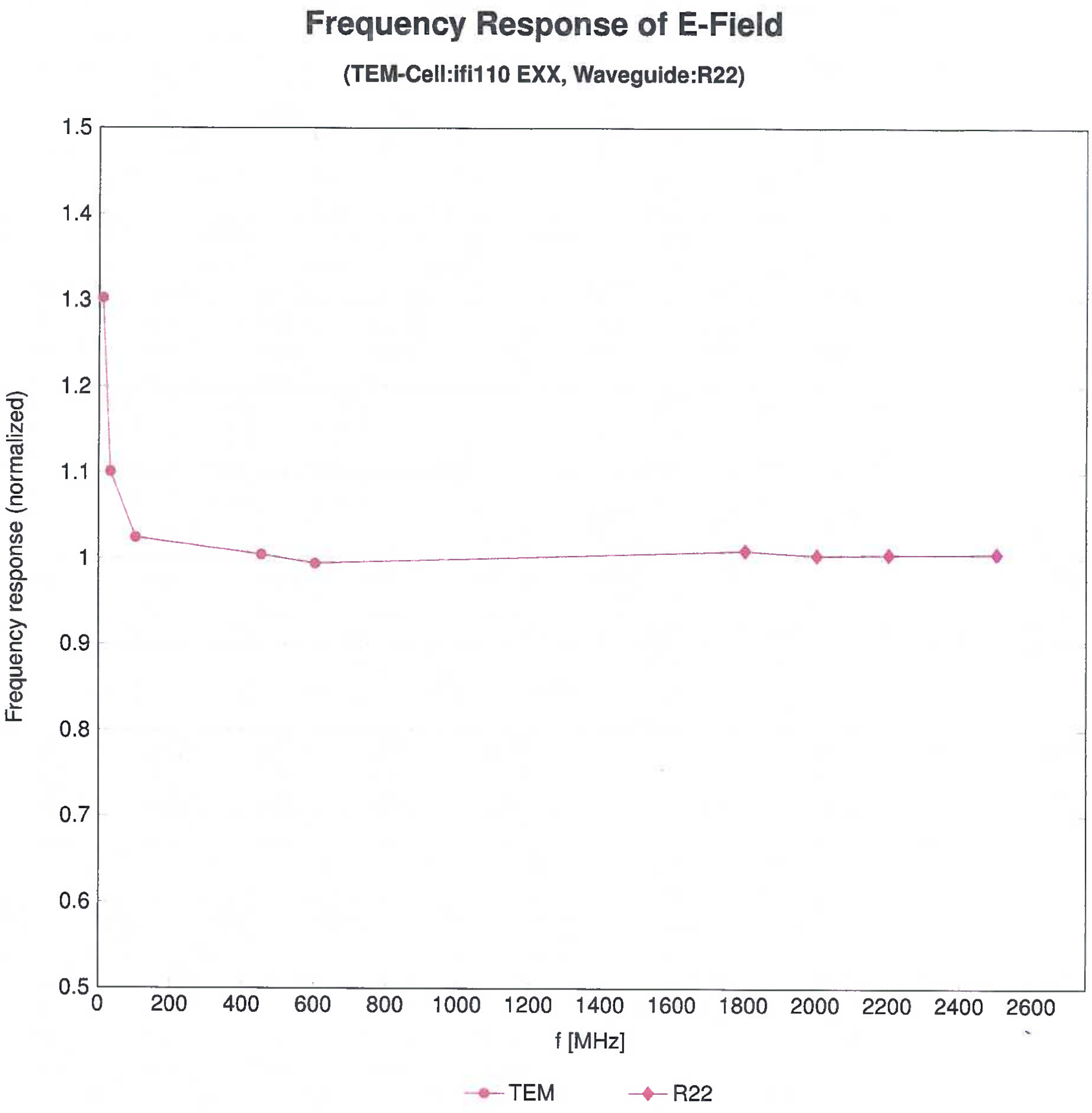
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

# Parameters of Probe: EX3DV4 - SN:3662

## Calibration Parameter Determined in Head Tissue Simulating Media

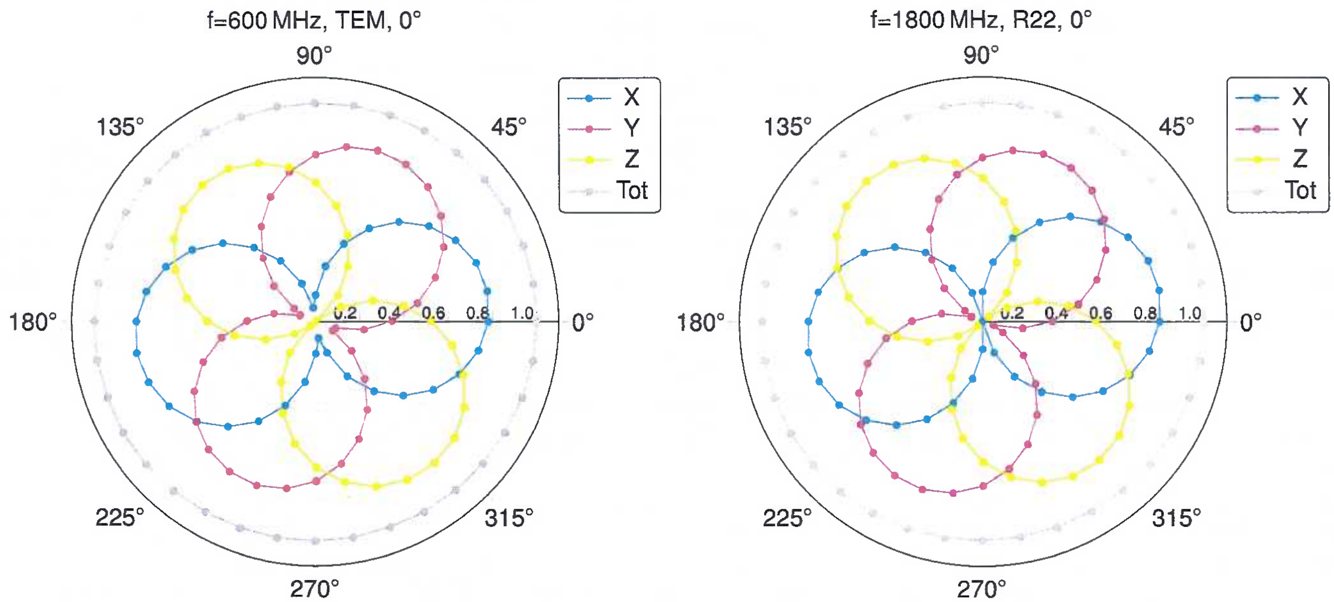
| f (MHz)[C] | Relative Permittivity[F] | Conductivity[F] (S/m) | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unc ($k = 2$) |
|---|---|---|---|---|---|---|---|---|
| 6500 | 34.5 | 6.07 | 5.53 | 5.80 | 5.00 | 0.20 | 2.00 | ±18.6% |

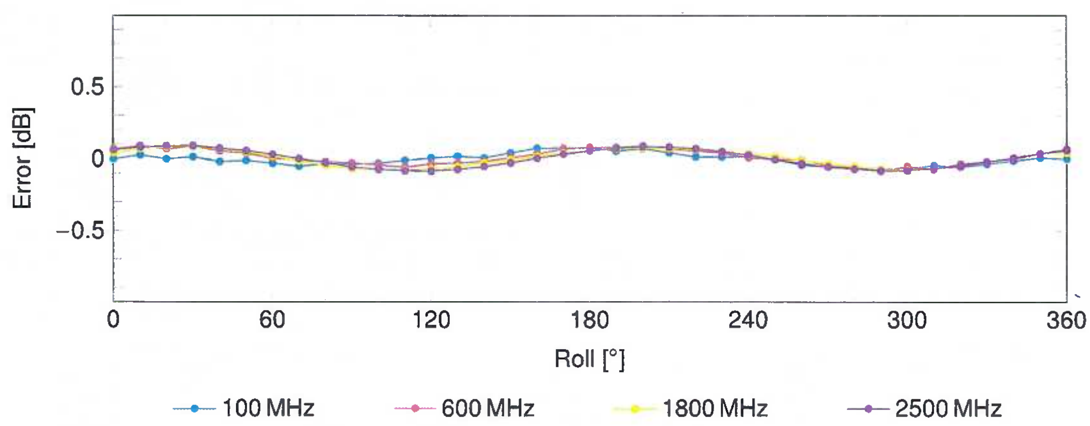
[C] Frequency validity at 6.5 GHz is −600/+700 MHz, and ±700 MHz at or above 7 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for $\varepsilon$ and $\sigma$ 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.




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

## Receiving Pattern ($\phi$), $\vartheta = 0°$

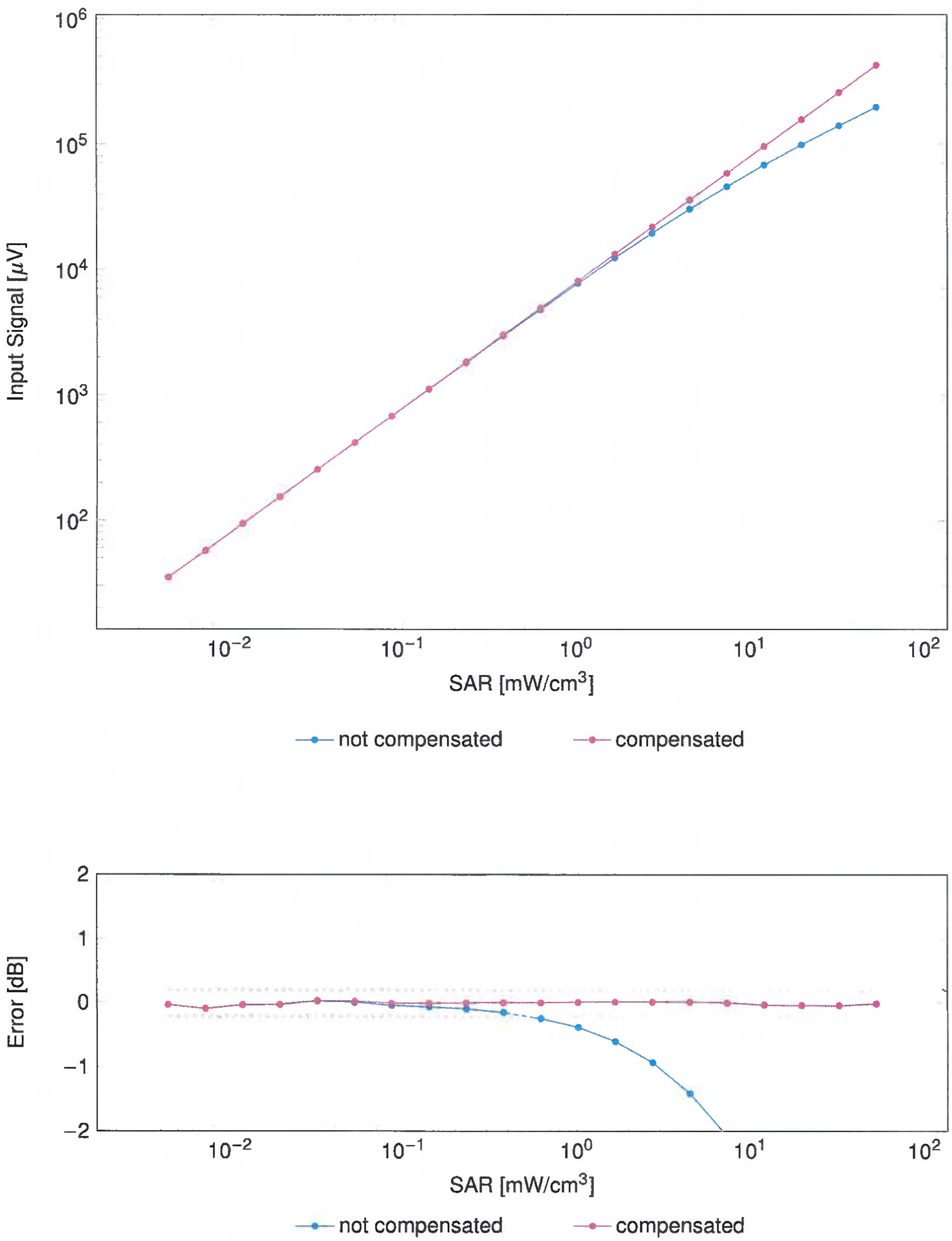



Uncertainty of Axial Isotropy Assessment: ±0.5% (k=2)

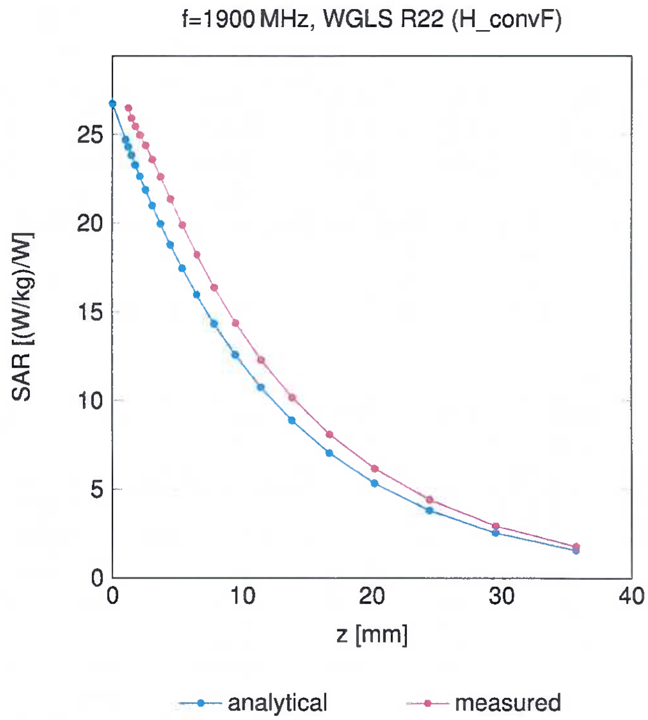
## Dynamic Range f($SAR_{head}$)

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

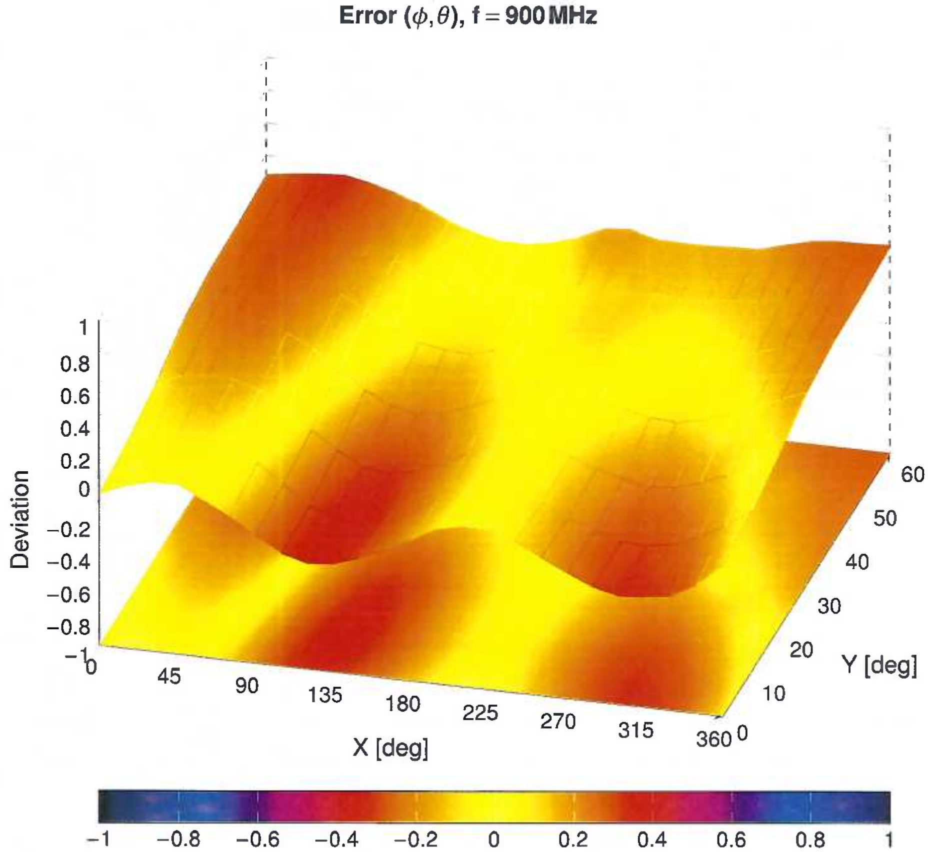



Uncertainty of Linearity Assessment: ±0.6% (k=2)

## 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<br>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

**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**

## 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**

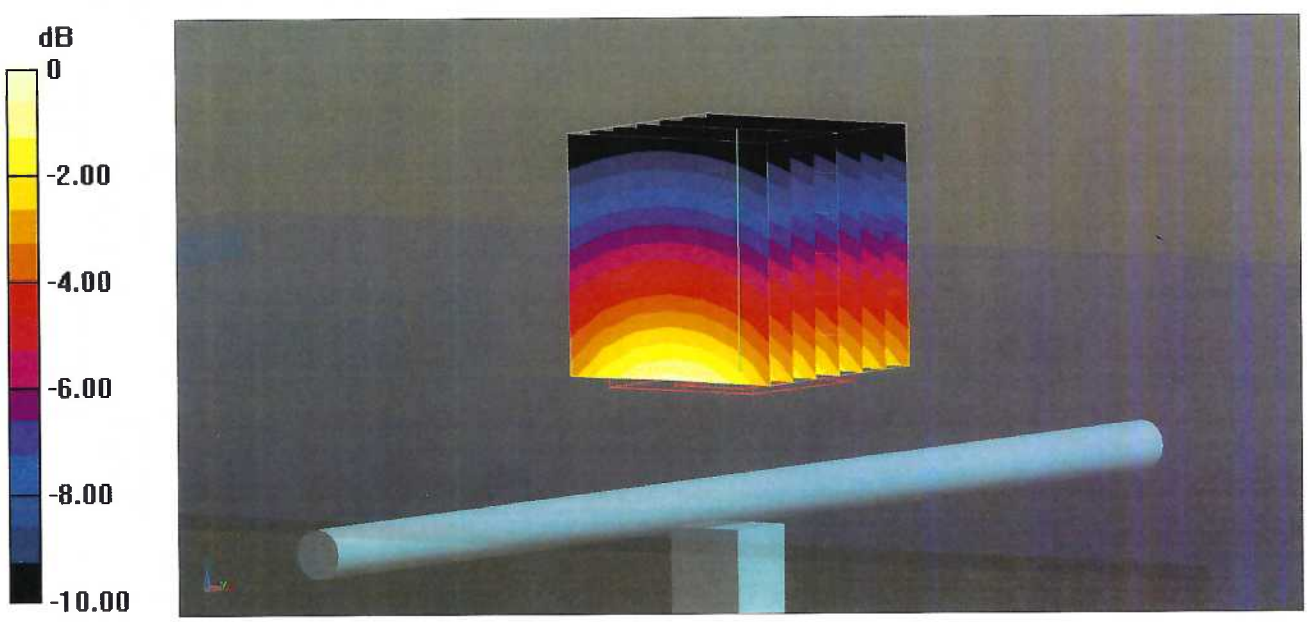
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma$ = 0.89 S/m; $\varepsilon_r$ = 43.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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)

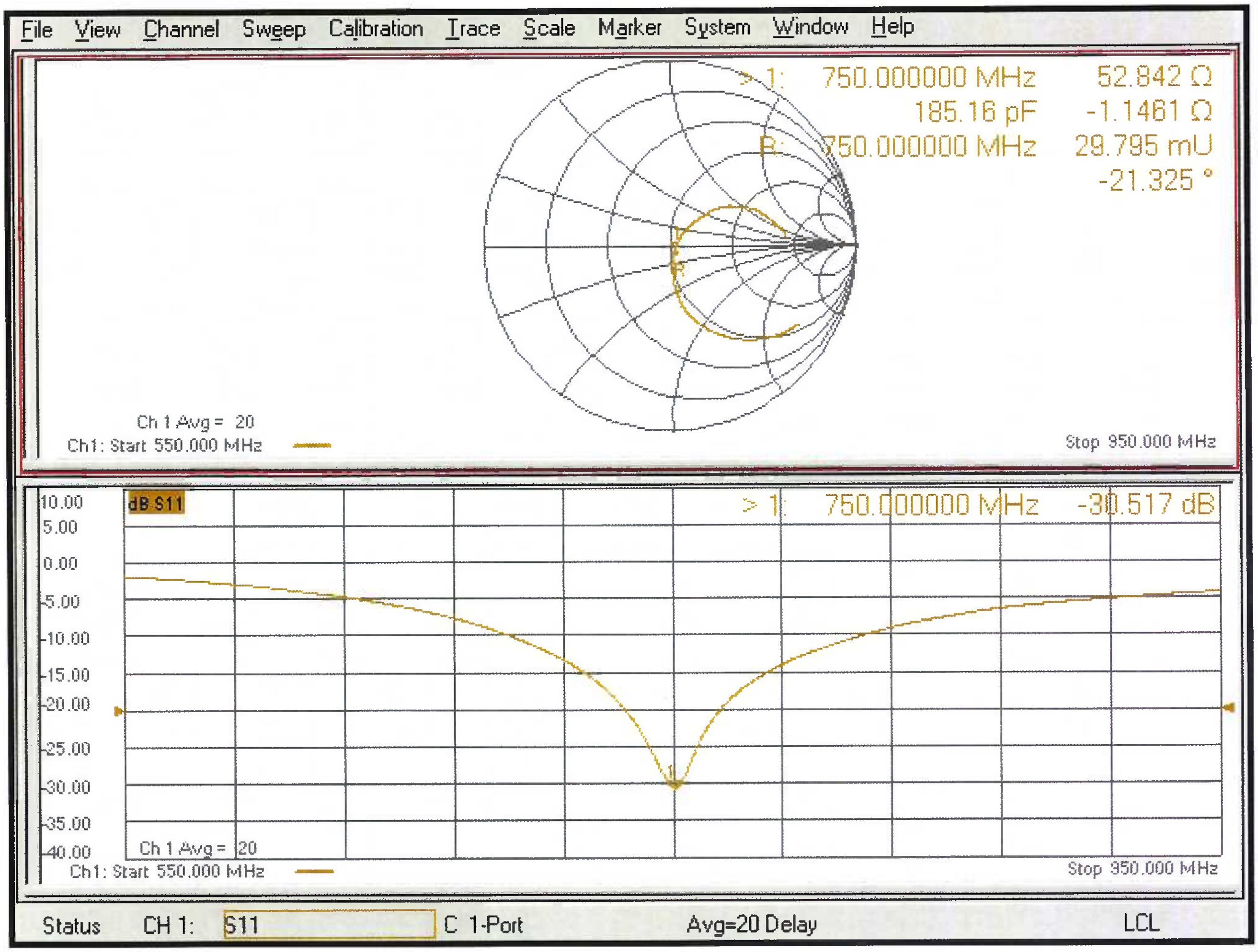
## Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

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**



**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

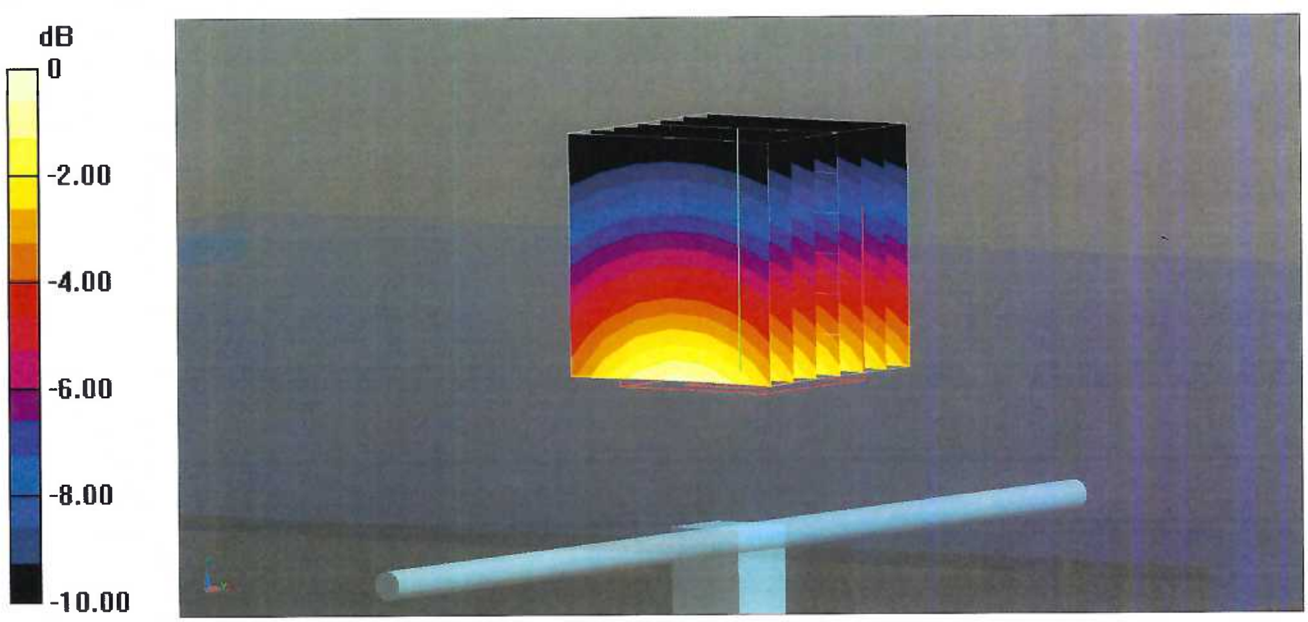
**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:1d044**

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

DASY52 Configuration:

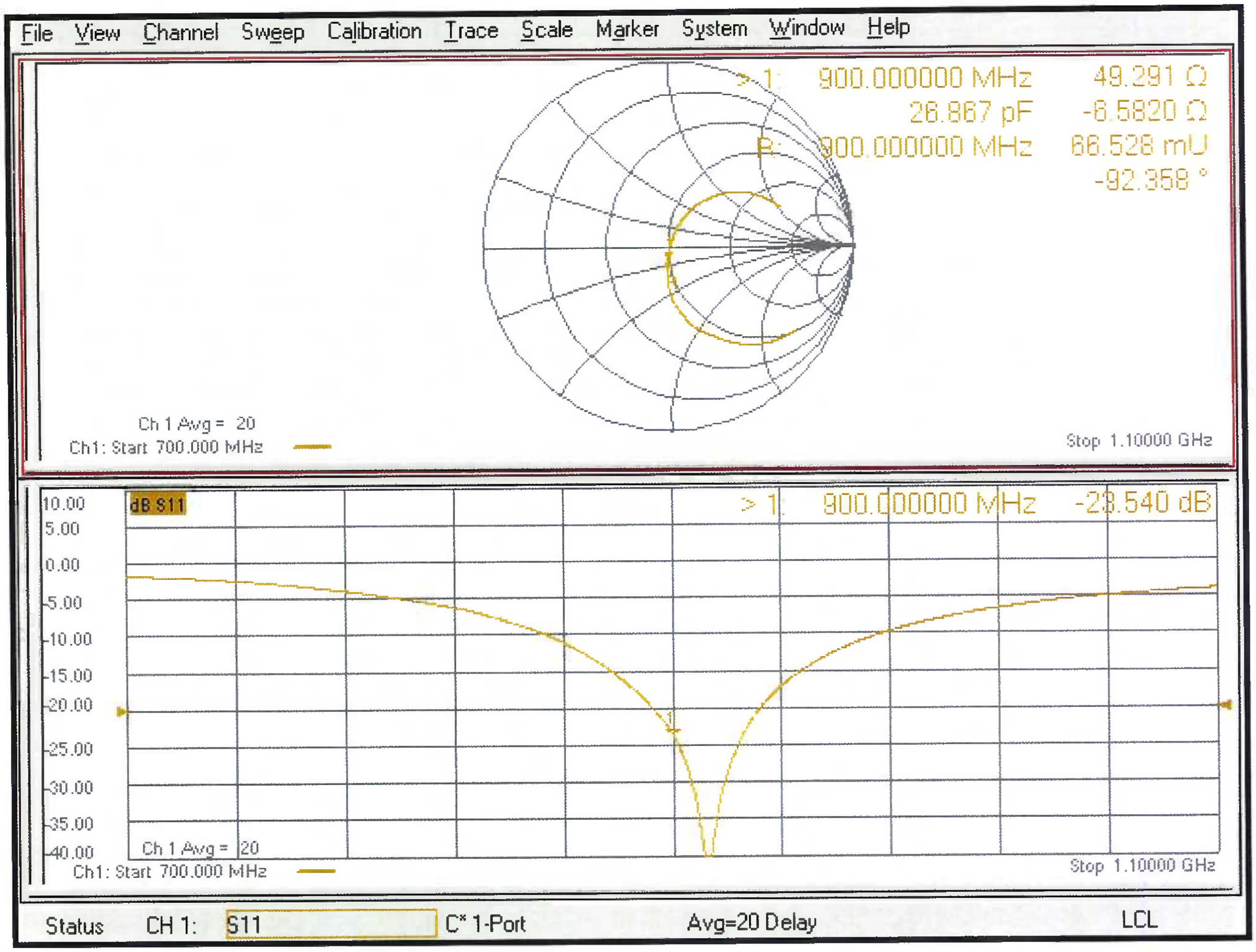
- Probe: EX3DV4 - SN7349; ConvF(9.62, 9.62, 9.62) @ 900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**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**



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Schmid & Partner
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**Swiss Calibration Service**

**Accreditation No.: SCS 0108**

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**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 |

## DASY5 Validation Report for Head TSL

Date: 10.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

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

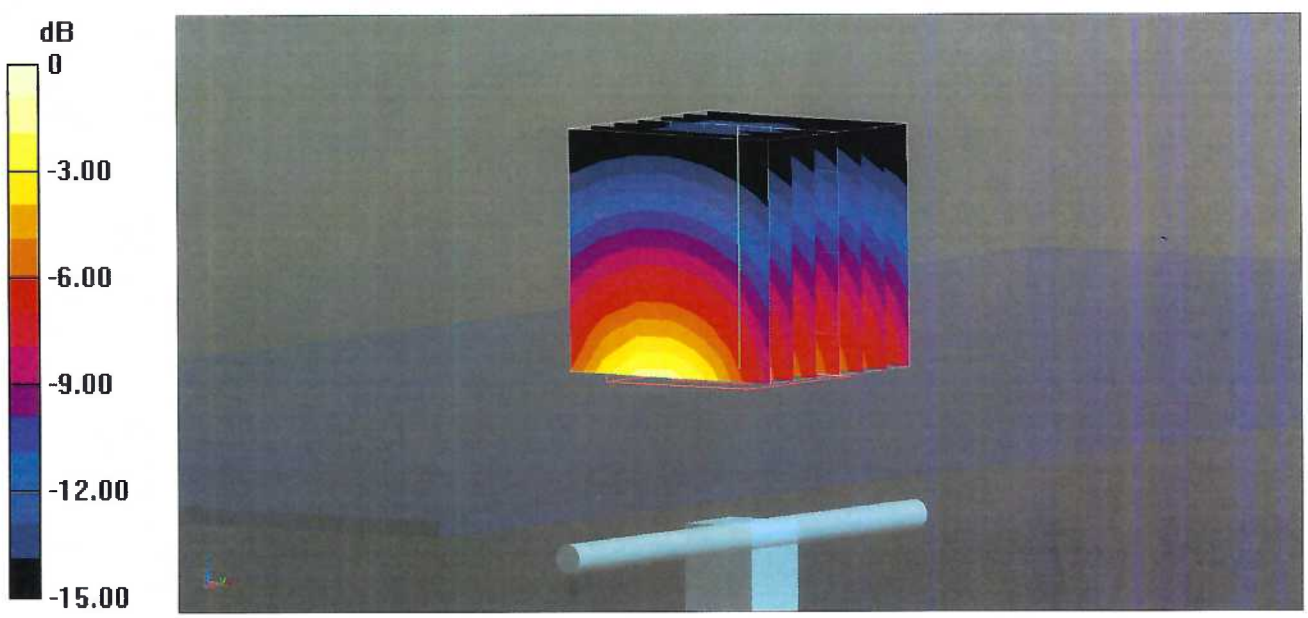
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; $\sigma$ = 1.34 S/m; $\varepsilon_r$ = 41.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 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)

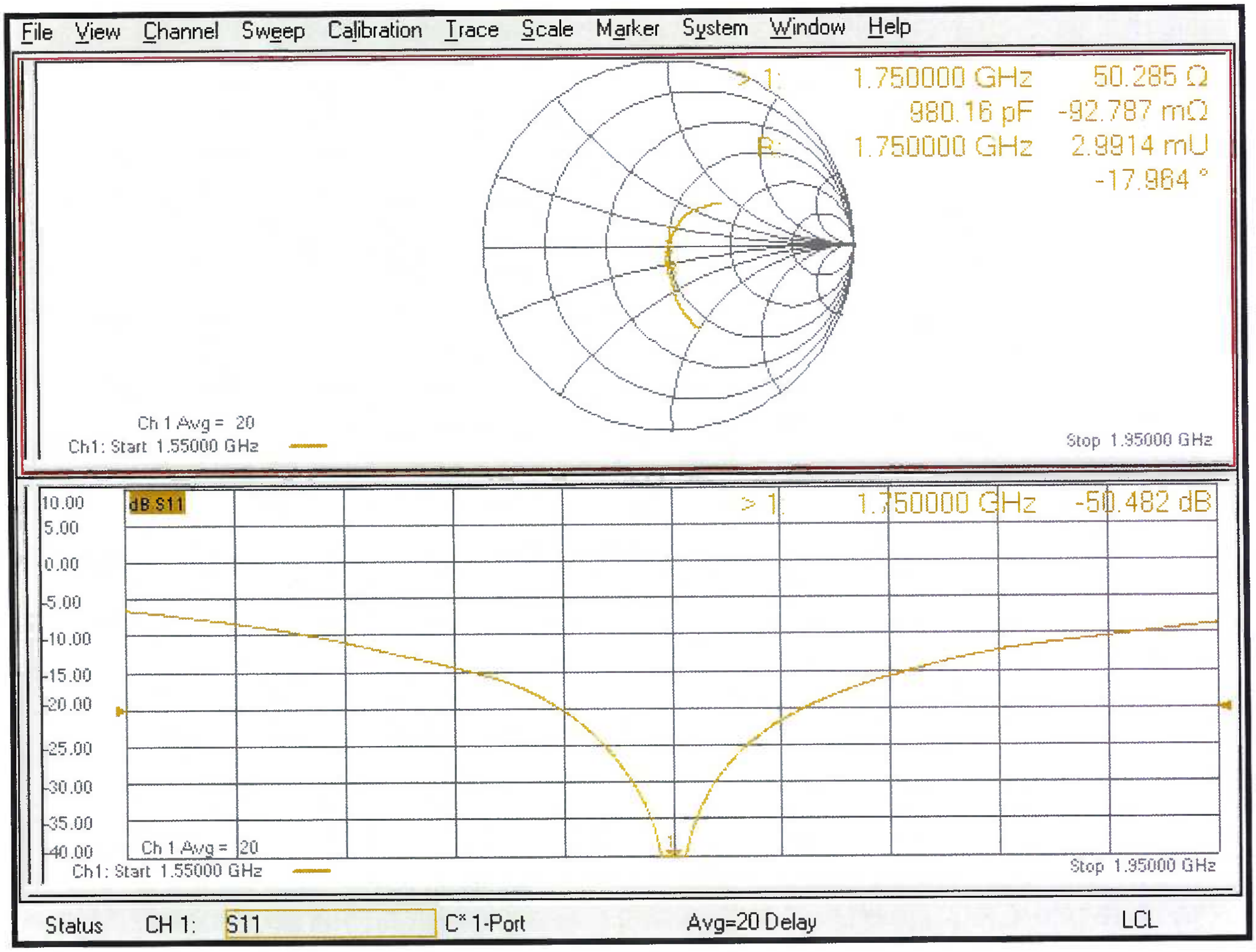
### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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

## 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 cm³ (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 cm³ (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**

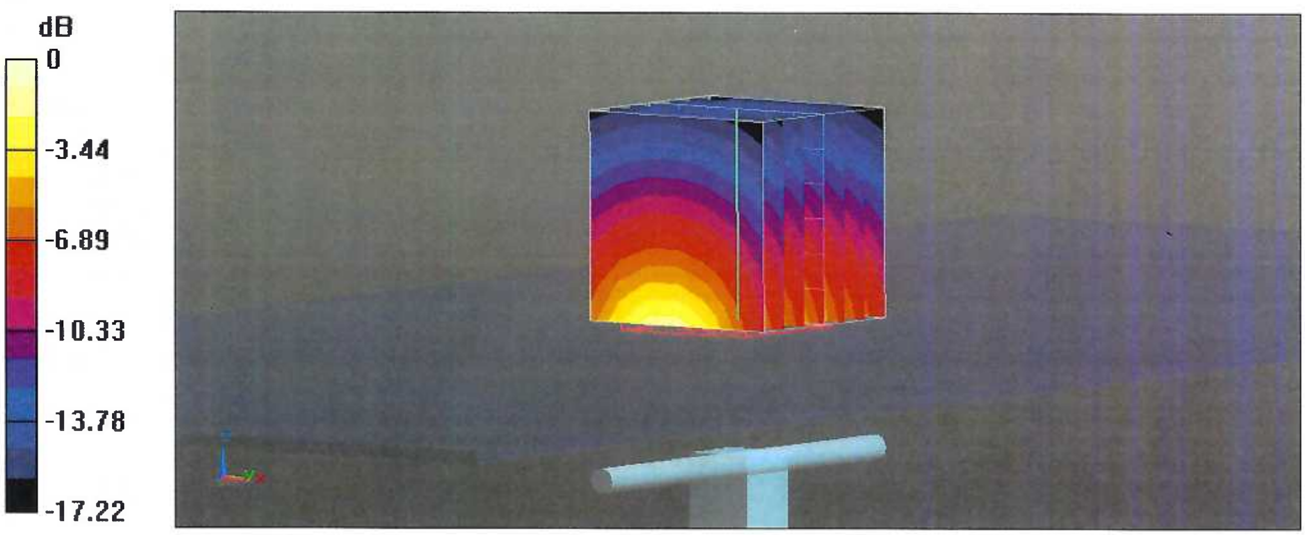
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.4 S/m; $\varepsilon_r$ = 41.1; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 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)

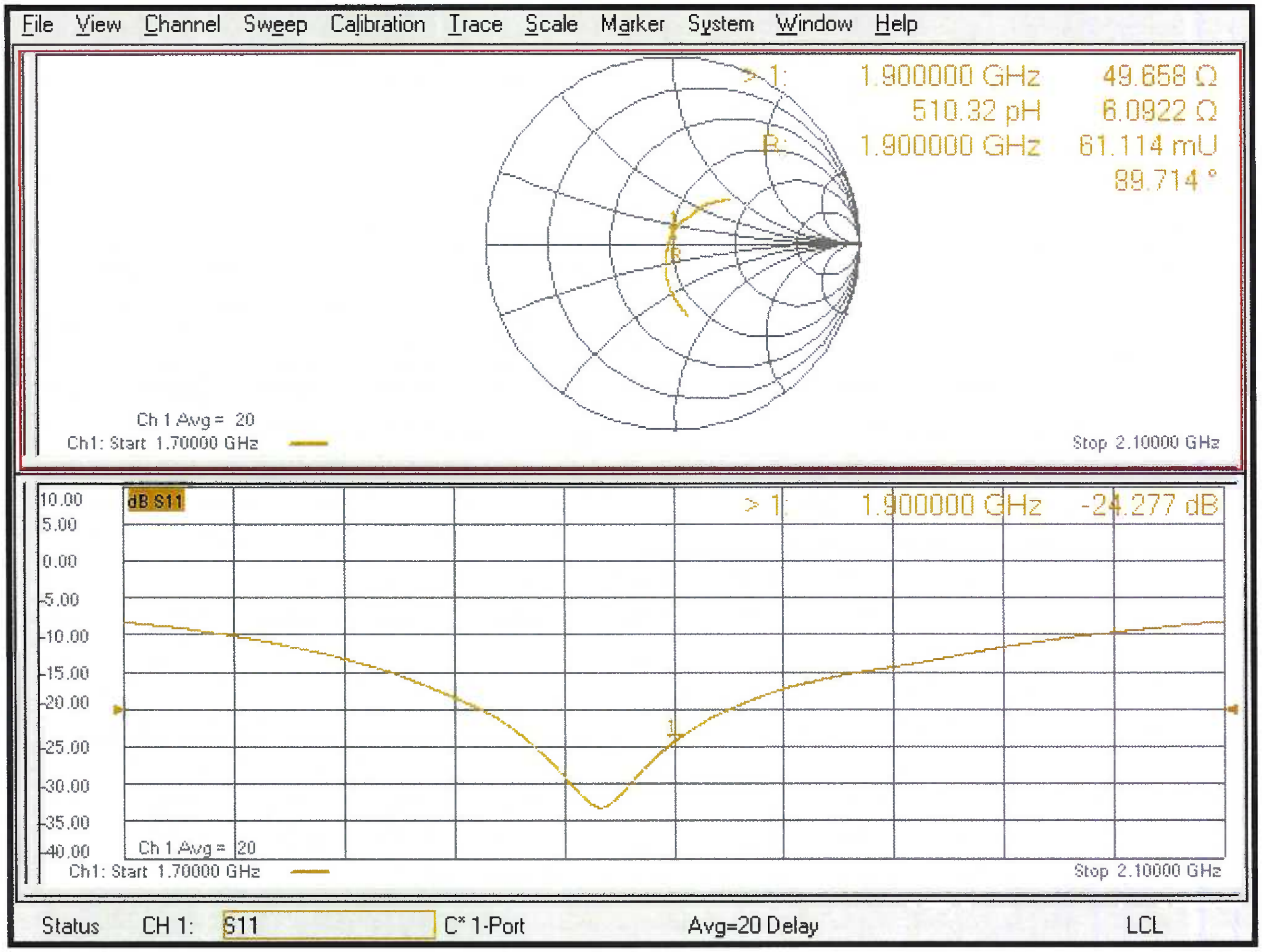
## Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



**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**

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

**Accreditation No.: SCS 0108**

Client **RF Exposure Lab**
**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

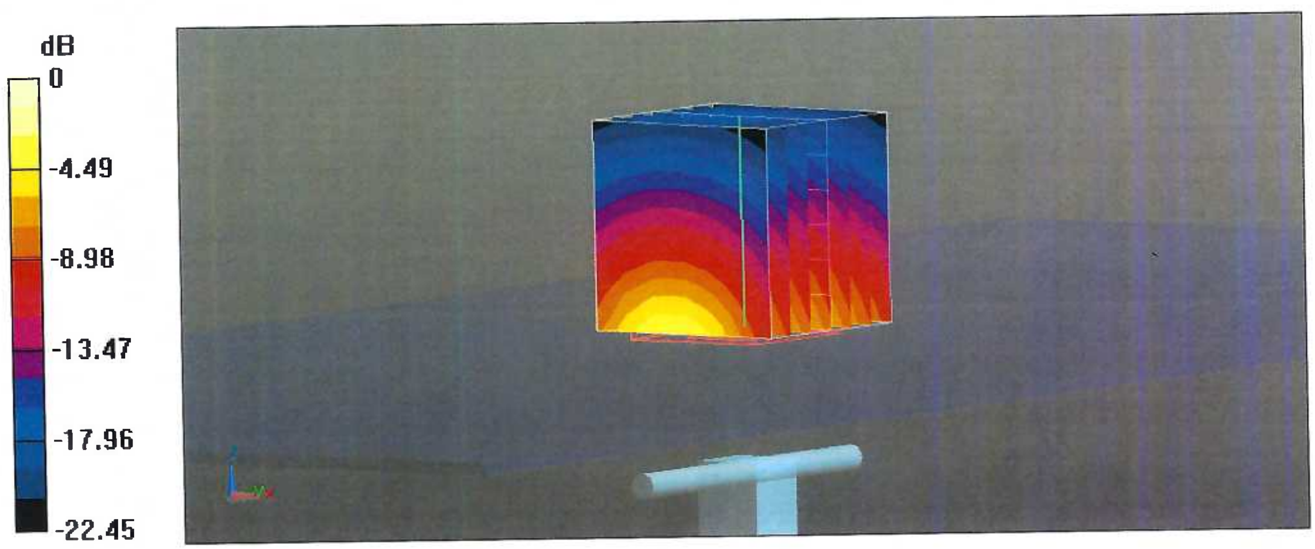
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:829**

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

DASY52 Configuration:

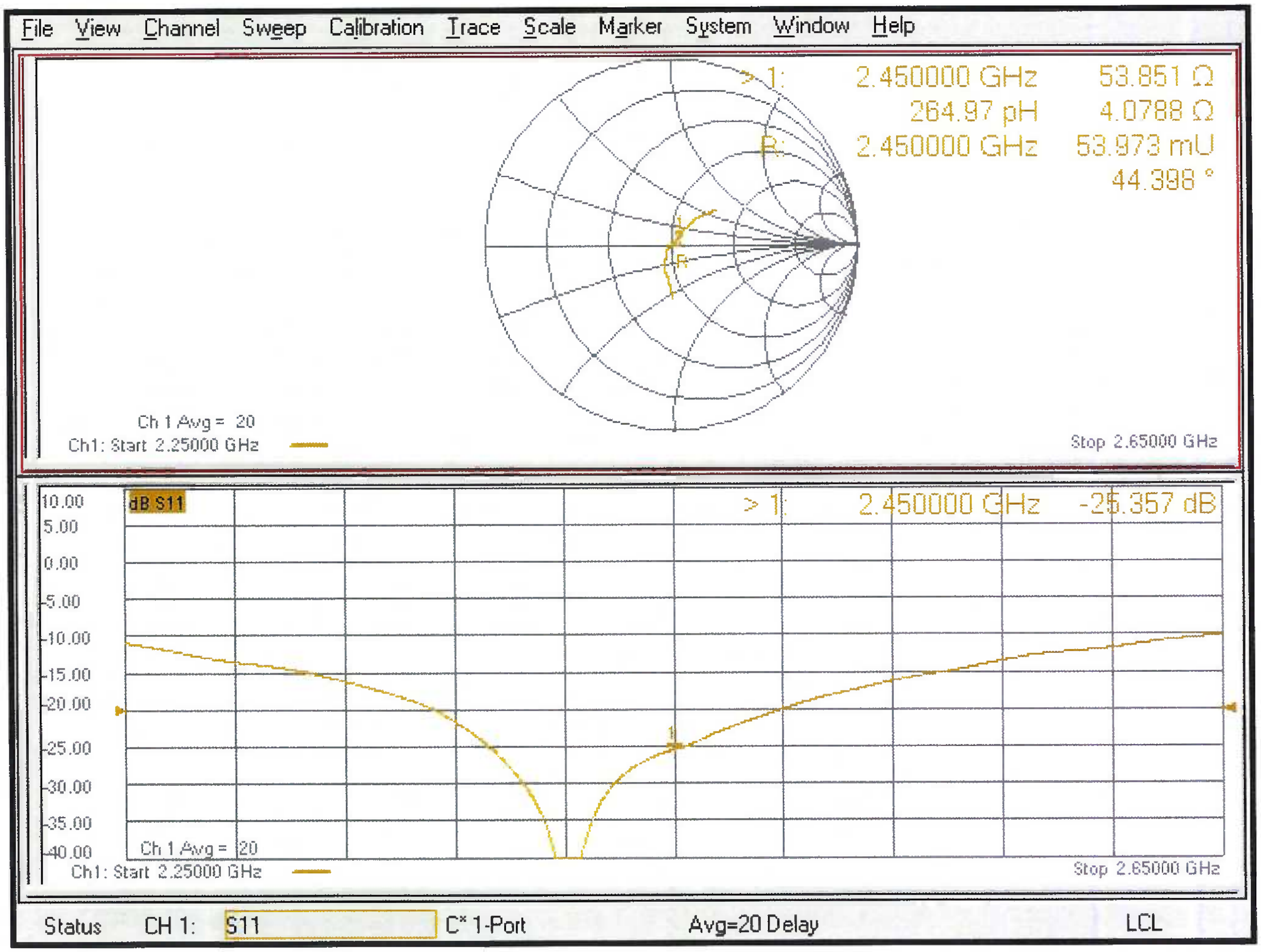
- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**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



# Appendix F – DAE Calibration Data Sheets

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

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**Accreditation No.: SCS 0108**

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

**Certificate No: DAE4-1416_Apr24**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BM - SN: 1416 |
| Calibration procedure(s) | QA CAL-06.v30<br>Calibration procedure for the data acquisition electronics (DAE) |
| Calibration date: | April 09, 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 | 29-Aug-23 (No:37421) | Aug-24 |

| 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 | |

Issued: April 9, 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 | 403.583 ± 0.02% (k=2) | 403.888 ± 0.02% (k=2) | 404.151 ± 0.02% (k=2) |
| Low Range | 3.97982 ± 1.50% (k=2) | 3.99762 ± 1.50% (k=2) | 3.97089 ± 1.50% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 181.0 ° ± 1 ° |

## Appendix (Additional assessments outside the scope of SCS0108)

### 1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 200029.84 | -1.90 | -0.00 |
| Channel X | + Input | 20001.96 | -1.11 | -0.01 |
| Channel X | - Input | -20009.17 | 0.42 | -0.00 |
| Channel Y | + Input | 200032.57 | 1.10 | 0.00 |
| Channel Y | + Input | 20001.75 | -1.10 | -0.01 |
| Channel Y | - Input | -20010.59 | -1.02 | 0.01 |
| Channel Z | + Input | 200029.56 | -2.10 | -0.00 |
| Channel Z | + Input | 19998.68 | -4.17 | -0.02 |
| Channel Z | - Input | -20010.50 | -1.10 | 0.01 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 1998.08 | 0.01 | 0.00 |
| Channel X | + Input | 198.10 | 0.12 | 0.06 |
| Channel X | - Input | -202.31 | -0.48 | 0.24 |
| Channel Y | + Input | 1998.12 | -0.11 | -0.01 |
| Channel Y | + Input | 197.25 | -0.82 | -0.41 |
| Channel Y | - Input | -203.11 | -1.31 | 0.65 |
| Channel Z | + Input | 1998.11 | 0.15 | 0.01 |
| Channel Z | + Input | 197.09 | -0.78 | -0.40 |
| Channel Z | - Input | -202.49 | -0.48 | 0.24 |

### 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 | -3.82 | -4.91 |
| | - 200 | 5.74 | 4.07 |
| Channel Y | 200 | -7.67 | -7.90 |
| | - 200 | 5.72 | 5.34 |
| Channel Z | 200 | -23.54 | -23.13 |
| | - 200 | 22.06 | 21.91 |

### 3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|---|---|---|---|---|
| Channel X | 200 | - | 2.43 | -3.45 |
| Channel Y | 200 | 8.24 | - | 3.56 |
| Channel Z | 200 | 9.27 | 5.97 | - |

## 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** | 15994 | 17332 |
| **Channel Y** | 16145 | 15865 |
| **Channel Z** | 16124 | 14765 |

## 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** | 0.73 | -0.19 | 1.36 | 0.30 |
| **Channel Y** | -1.07 | -2.06 | 0.38 | 0.38 |
| **Channel Z** | -0.38 | -1.82 | 0.69 | 0.31 |

## 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

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

## Certificate of Conformity / First Article Inspection

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

**Tests**

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

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

**Standards**

[1] CENELEC EN 50361-2001, « Basic standard for the measurement of the Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz) », July 2001

[2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003

[3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005

[4] IEC 62209 – 2, Draft, "Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices – Human models, Instrumentation and Procedures – Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30 MHz to 6 GHz Handheld and Body-Mounted Devices used in close proximity to the Body.", February 2005

[5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition January 2001

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

**Date** 28.4.2008 **Signature / Stamp**

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