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CERTIFICATE OF COMPLIANCE
SAR EVALUATION

Robert Bosch GmbH	Dates of Test: July 26-28 & Aug. 22 & 29, 2023
Robert-Bosch-Str. 200	Test Report Number: SAR.20230711
Hildesheim, 31139	Revision D
Germany	Lab Designation Number: US1195 (FCC); US0194 (ISED)

FCC ID:	2AUXS-VCUNM1
IC Certificate:	25847-VCUNM1
Model(s):	VCUNM1
HVIN:	VCUNM1
PMN:	VCUNM1
Product Name:	Virtual Cockpit Unit
HW Version:	C2
SW Version:	SQBR3-39+
Test Sample:	Engineering Unit Same as Production
Serial Number:	1000013
Equipment Type:	UNII Device
Classification:	Portable Transmitter Next to Body
TX Frequency Range:	2412 – 2462 MHz; 5180 – 5240 MHz; 5745 – 5825 MHz, 2402 – 2480 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum RF Output:	2450 MHz – 14.00 dBm, 5250 MHz – 19.00 dBm, 5800 MHz – 19.00 dBm, 2450 MHz (Bluetooth) – 3.5 dBm Conducted
Signal Modulation:	DSSS, OFDM, GFSK
Antenna Type:	External Antenna Part Number 2310901, Internal Antenna Inverted-F
Application Type:	Certification
FCC Rule Parts:	Part 2, 15C, 15E
KDB Test Methodology:	KDB 447498 D01 v06, KDB248227 D01 v02
Industry Canada:	RSS-102 Issue 5, Safety Code 6
Maximum SAR Value:	0.05 W/kg Reported
Separation Distance:	47 mm & 160 mm for Test Jig Front

This wireless mobile and/or portable device has been shown to be compliant for localized specific absorption rate (SAR) for uncontrolled environment/general exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and IEC 62209-2:2010 (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	July 28, 2023
Revision A – Add HW and SW version, correct applicant name and address, correct model number and device descriptions, add BT frequency to page 1 and page 4, add antenna gain table to page 4, add comment to page 20 for the exclusion of BT, correct separation distance to 47 mm on page 1 and data tables, correct the serial number, add dimensions to the photos in Appendix C, add photo of the VCU location during test, add photo of label on test unit and change wording for upper end of tolerance on page 4.	August 17, 2023
Revision B – Add Data with the metal rod using Robert Bosch GmbH test jig on the top and back side of the setup	August 23, 2023
Revision C – Add DAE SN 1217 to equipment list and re-run the verification plots for plots 1-3.	August 25, 2023
Revision D – Add Date with the metal rod using Rober Bosch GmbH test jug on the front of the setup	August 29, 2023

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 Robert Bosch GmbH Model VCUNM1 FCC ID: 2AUXS-VCUNM1 with FCC Part 2, 1093, ET Docket 93-62 Rules for mobile and portable devices and IC Certificate: 25847-VCUNM1 with RSS102 Issue 5 & Safety Code 6. The FCC/ISED have 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/ISED regulated portable devices. [1], [6]

The test results recorded herein are based on a single type test of Robert Bosch GmbH Model VCUNM1 and therefore apply only to the tested sample.

The test procedures, as described in ANSI C95.1 – 1999 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [2], ANSI C95.3 – 2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields [3], IEEE Std.1528 – 2013 Recommended Practice [4], and Industry Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3kHz to 300 GHz were employed.

The following table indicates all the wireless technologies operating in the VCUNM1 UNII Device. The table also shows the tolerance for the power level for each mode. The Bluetooth transmitter was not evaluated in this report due to it operating only on the internal antenna.

Band	Technology	Measured Device Setting including Tolerance dBm
WLAN – 2.4 GHz	802.11b/g/n/ax	14.0
WLAN – 5.25 GHz	802.11a/n/ac/ax	19.0
WLAN – 5.8 GHz	802.11a/n/ac/ax	19.0
2.4 GHz	Bluetooth/Bluetooth LE	3.5

Note: There are two multiband antennas used, both are active at the same time for WLAN. Bluetooth will always use the internal antenna.

In case of presence of external antenna, WLAN will be routed on the external antenna, BT will use the internal antenna.

The following table contains the peak gain of the external antenna.

Frequency (MHz)	Gain (dBi)
2412	1.7
2437	2.0
2462	2.1
5150	2.6
5325	2.4
5850	2.8

SAR Definition [5]

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

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

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

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

where:

σ = conductivity of the tissue (S/m)

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

E = rms electric field strength (V/m)

2. SAR Measurement Setup

Robotic System

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

System Hardware

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

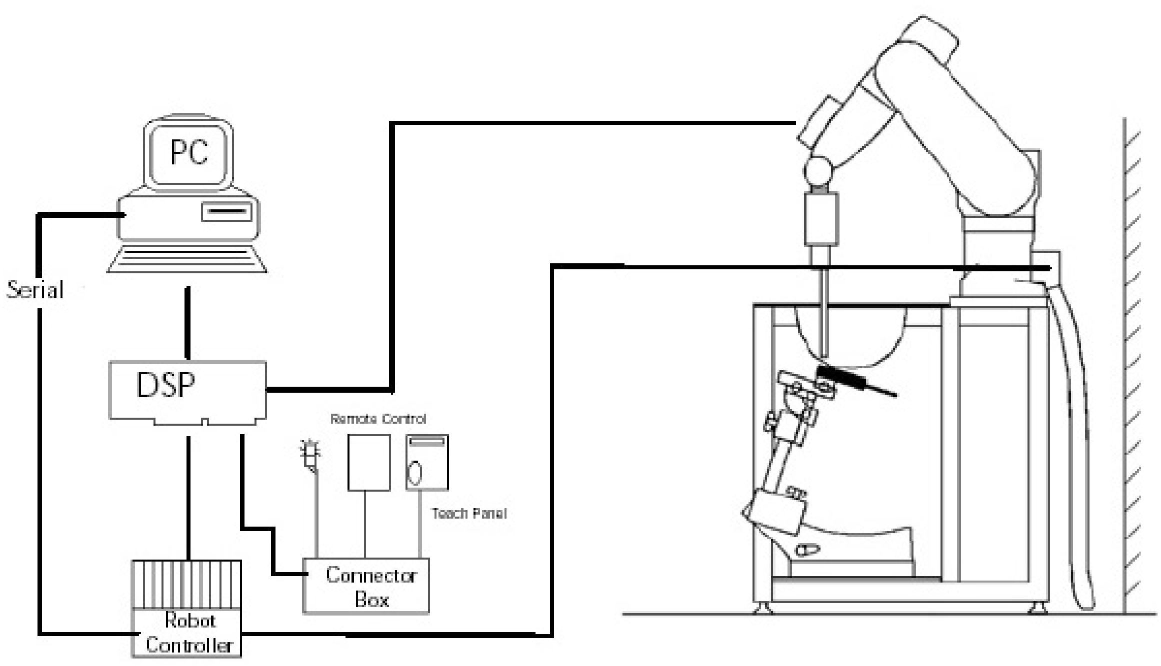


Figure 2.1 SAR Measurement System Setup

System Electronics

The DAE4 consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

Probe Measurement System

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

DAE System

Probe Specifications

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

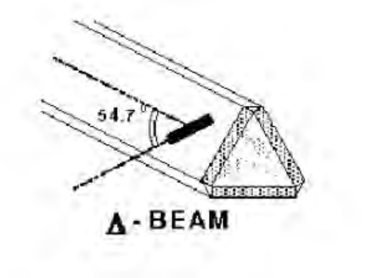


Figure 2.2 Triangular Probe Configurations

Frequency: 10 MHz to 6 GHz

Linearity: ±0.2dB (30 MHz to 6 GHz)

Dynamic: 10 mW/kg to 100 W/kg

Range: Linearity: ±0.2dB

Dimensions: Overall length: 330 mm

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:

Δt = exposure time (30 seconds),

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

ΔT = temperature increase due to RF exposure.

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

where:

σ = simulated tissue conductivity,

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

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

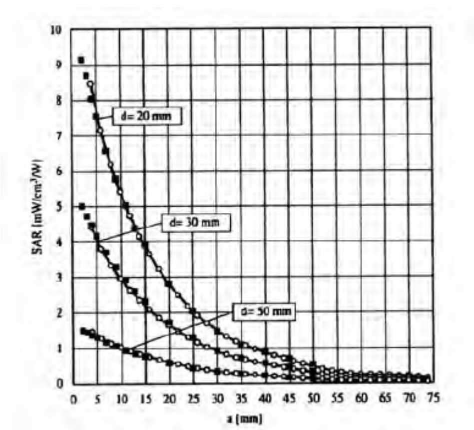


Figure 2.4 E-Field and Temperature Measurements at 900MHz

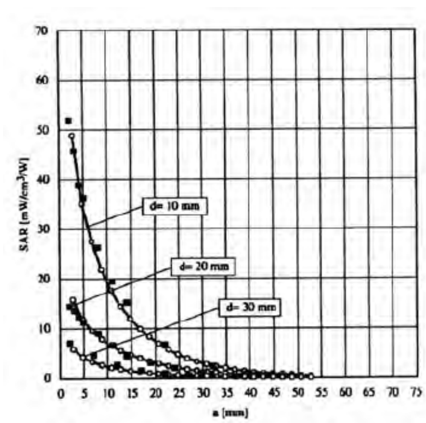


Figure 2.5 E-Field and Temperature Measurements at 1800MHz

Data Extrapolation

The DASY52 software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given like below;

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

with V_i = compensated signal of channel i (i=x,y,z)
U_i = input signal of channel i (i=x,y,z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

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

E-field probes:

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

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

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

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

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

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

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

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

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

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

Scanning procedure

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

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

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

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

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

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

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

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

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

Spatial Peak SAR Evaluation

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

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

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

- All neighboring volumes are evaluated until no neighboring 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: ELI Phantom (V5.0)
Shell Material: Vivac Composite
Thickness: 2.0 ± 0.2 mm

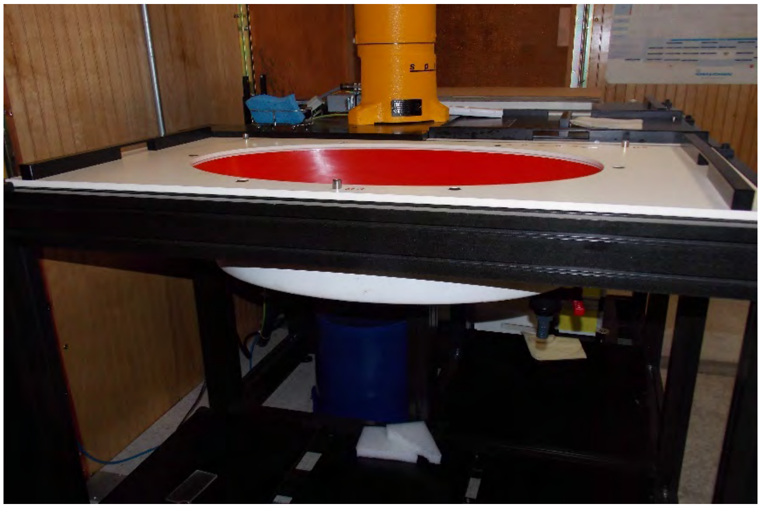


Figure 2.6 ELI Phantom

Device Holder for Transmitters

In combination with the ELI Phantom V5.0 the Mounting Device (see Fig. 2.7), enables the setting of the mounted transmitter. The devices can be easily, accurately, and repeatably be positioned according to the FCC, CENELEC, IEC and IEEE specifications. The device holder can be moved at different phantom locations.

Figure 2.7 Mounting Device

3. Probe and Dipole Calibration

See Appendix D and E.

4. Phantom & Simulating Tissue Specifications

Head & Body Simulating Mixture Characterization

The head and body mixtures consist of the material based on the table listed below. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. Body tissue parameters that have not been specified in IEEE1528-2013 are derived from the issue dielectric parameters computed from the 4-Cole-Cole equations.

Table 4.1 Typical Composition of Ingredients for Tissue

Ingredients		Simulating Tissue		
		2450 MHz Head	5250 MHz Head	5785 MHz Head
Mixing Percentage				
Water		Proprietary Mixture Procured from Speag		
Sugar				
Salt				
HEC				
Bactericide				
DGBE				
Dielectric Constant	Target	39.20	35.93	35.36
Conductivity (S/m)	Target	1.80	4.71	5.22

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

Uncontrolled Environment

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

Controlled Environment

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

Table 5.1 Human Exposure Limits

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

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

6. Measurement Uncertainty

Measurement uncertainty table is not required per KDB 865664 D01 v01 section 2.8.2 page 12. SAR measurement uncertainty analysis is required in the SAR report only when the highest measured SAR in a frequency band is ≥ 1.5 W/kg for 1-g SAR. The equivalent ratio (1.5/1.6) should be applied to extremity and occupational exposure conditions. The highest reported value is less than 1.5 W/kg. Therefore, the measurement uncertainty table is not required.

7. System Validation

Tissue Verification

Table 7.1 Measured Tissue Parameters

		2450 MHz Head		5250 MHz Head		5750 MHz Head	
Date(s)		Jul. 27, 2023		Jul. 26, 2023		Jul. 26, 2023	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		39.20	38.34	35.93	34.77	35.36	34.18
Conductivity: σ		1.80	1.81	4.71	4.73	5.22	5.28
		2450 MHz Head		5250 MHz Head		5750 MHz Head	
Date(s)		Aug. 22, 2023		Aug. 22, 2023		Aug. 22, 2023	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		39.20	38.43	35.93	35.19	35.36	34.60
Conductivity: σ		1.80	1.83	4.71	4.74	5.22	5.29
		2450 MHz Head		5250 MHz Head		5750 MHz Head	
Date(s)		Aug. 29, 2023		Aug. 29, 2023		Aug. 29, 2023	
Liquid Temperature (˚C)	20.0	Target	Measured	Target	Measured	Target	Measured
Dielectric Constant: ε		39.20	38.96	35.93	35.95	35.36	35.36
Conductivity: σ		1.80	1.84	4.71	4.81	5.22	5.36

See Appendix A for data printout.

Test System Verification

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

Table 7.2 System Dipole Validation Target & Measured

	Test Frequency	Targeted SAR_{1g} (W/kg)	Measure SAR_{1g} (W/kg)	Tissue Used for Verification	Deviation Target and Fast SAR to SAR (%)	Plot Number
27-Jul-2023	2450 MHz	54.10	54.60	Head	+ 0.92	1
26-Jul-2023	5250 MHz	79.50	80.30	Head	+ 1.01	2
26-Jul-2023	5750 MHz	80.50	80.50	Head	+ 0.00	3
22-Aug-2023	2450 MHz	54.10	54.50	Head	+ 0.74	4
22-Aug-2023	5250 MHz	79.50	80.60	Head	+ 1.38	5
22-Aug-2023	5750 MHz	80.50	82.60	Head	+ 2.61	6
29-Aug-2023	2450 MHz	54.10	55.60	Head	+ 2.77	7
29-Aug-2023	5250 MHz	79.50	81.10	Head	+ 2.01	8
29-Aug-2023	5750 MHz	80.50	82.30	Head	+ 2.24	9

See Appendix A for data plots.5

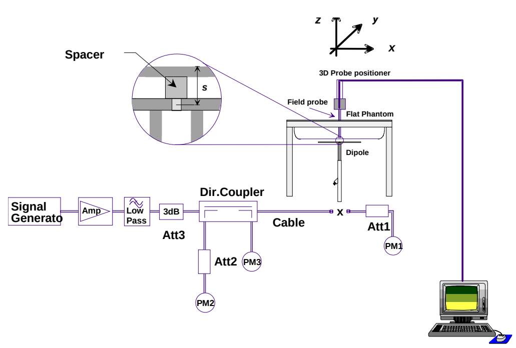


Figure 7.1 Dipole Validation Test Setup

8. 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.

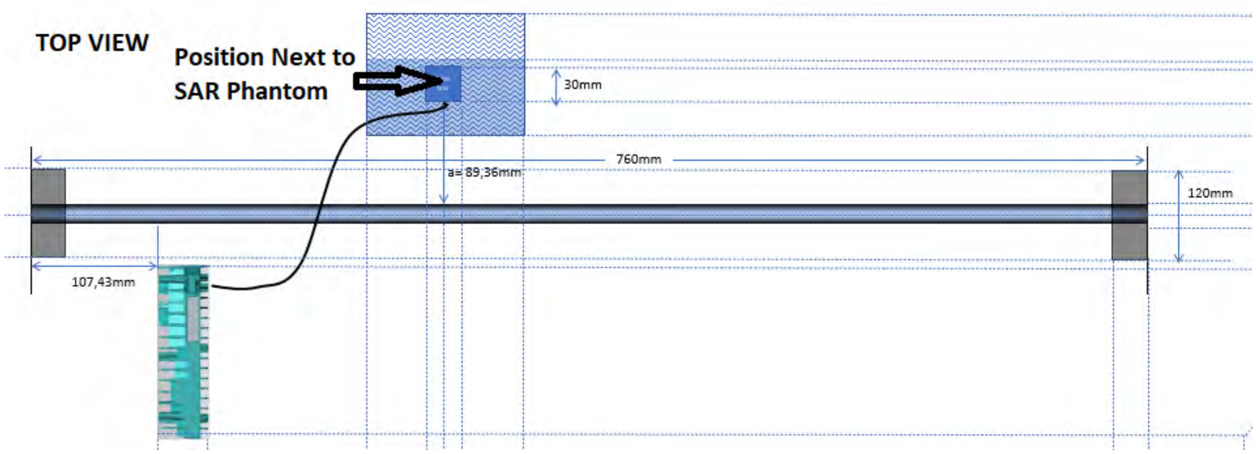
Device Test Condition

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.

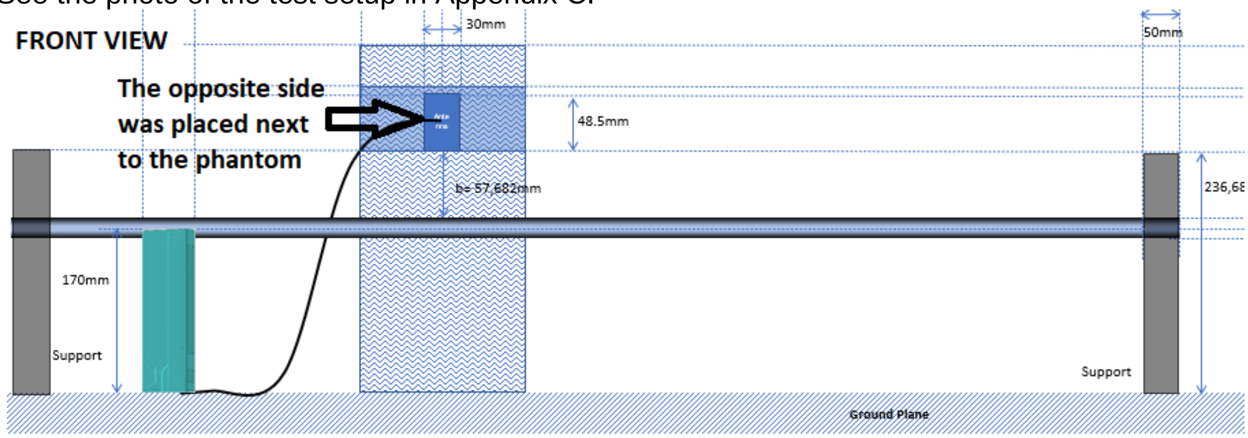
The EUT was tested on all sides of the of the antenna. All measurements were conducted with the side of the antenna 47 mm from the phantom per the KDB guidance filed with the FCC.

The external antenna is the only antenna evaluated in this report. The internal antenna is greater than 20 cm from the body and only has to meet the MPE evaluation requirements. The MPE evaluation is covered in another report within this filing.

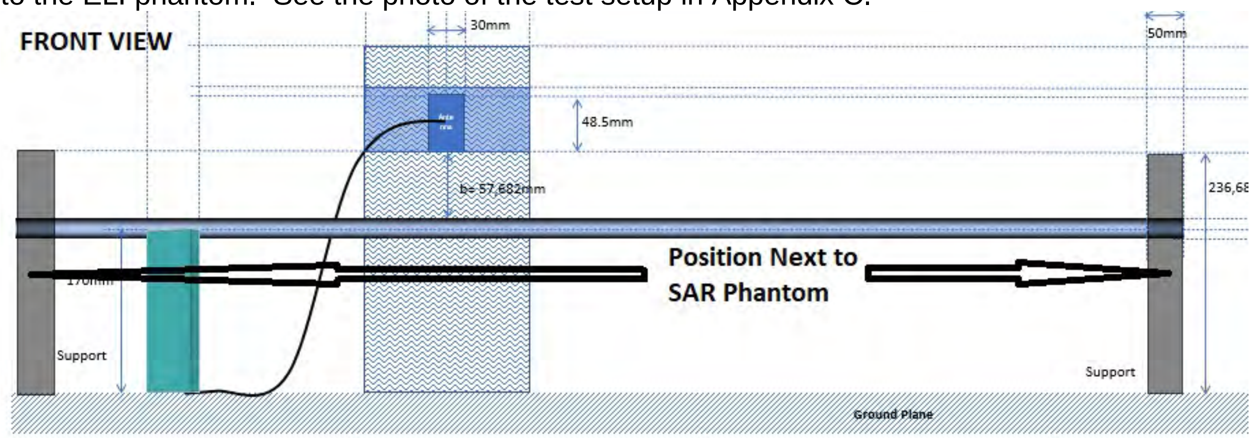
The antenna was mounted in the test jig supplied by Robert Bosch GmbH. The top of the Styrofoam as shown in the below drawing was set under the ELI Phantom with the Styrofoam in contact with the phantom. See the photo of the test setup in Appendix C.



The back of the test jig was tested. The back of the Styrofoam as shown in the below drawing was set under the ELI Phantom with the Styrofoam in contact with the phantom. See the photo of the test setup in Appendix C.



The front of the test jig was tested. The front of the two Styrofoam rod holders were put up next to the bottom of the ELI phantom. The antenna was approximately 160 mm from the bottom of the ELI phantom. The drawing below shows the location that was set next to the ELI phantom. See the photo of the test setup in Appendix C.



No other sides of the test jig was measured. The remaining sides did not allow the test jig to fit up under the ELI phantom. Therefore, all six sides of the antenna was also tested outside the jig with a gap of 47 mm to show that the antenna can meet on all sides of the antenna. The influence from the metal rod is not causing the SAR value to increase.

There are two multiband antennas used, both are active at the same time for WLAN. Bluetooth will always use the internal antenna.

In case of presence of external antenna, WLAN will be routed on the external antenna, BT will use the internal antenna.

The Bluetooth/Bluetooth LE transmitter is was not evaluated as it is only present on the internal antenna which is not part of this report.

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

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	Not Required	14.0
			6	2437			14.0
			11	2462			14.0
	802.11g	20	1	2412	6 Mbps		14.0
			6	2437			14.0
			11	2462			14.0
	802.11n	20	1	2412	MCS0		14.0
			6	2437			14.0
			11	2462			14.0
	802.11n	40	3	2422	MCS0	12.1	14.0
			6	2437		12.2	14.0
			9	2452		12.0	14.0
	802.11ax	20	1	2412	MCS0	Not Required	14.0
			6	2437			14.0
			11	2462			14.0
	802.11ax	40	3	2422	MCS0		14.0
			6	2437			14.0
			9	2452			14.0

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Avg Power (dBm)	Tune-up Pwr (dBm)
5250 MHz	802.11a	20	36	5180	6 Mbps	Not Required	19.0
			40	5200			19.0
			44	5220			19.0
			48	5240			19.0
	802.11n	20	36	5180	MCS0		19.0
			40	5200			19.0
			44	5220			19.0
			48	5240			19.0
	802.11n	40	38	5190	MCS0		19.0
			46	5230			19.0
	802.11ac	20	36	5180	MCS0		19.0
			40	5200			19.0
			44	5220			19.0
			48	5240			19.0
	802.11ac	40	38	5190	MCS0		19.0
			46	5230			19.0
	802.11ac	80	42	5210	MCS0	17.1	19.0
	802.11ax	20	36	5180	MCS0	Not Required	19.0
			40	5200			19.0
			44	5220			19.0
			48	5240			19.0
	802.11ax	40	38	5190	MCS0		19.0
			46	5230			19.0
	802.11ax	80	42	5210	MCS0		19.0

Band	Mode	Bandwidth (MHz)	Channel	Frequency (MHz)	Data Rate	Avg Power (dBm)	Tune-up Pwr (dBm)
5750 MHz	802.11a	20	149	5745	6 Mbps	Not Required	19.0
			153	5765			19.0
			157	5785			19.0
			161	5805			19.0
			165	5825			19.0
	802.11n	20	149	5745	MCS0		19.0
			153	5765			19.0
			157	5785			19.0
			161	5805			19.0
			165	5825			19.0
	802.11n	40	151	5755	MCS0		19.0
			159	5795			19.0
	802.11ac	20	149	5745	MCS0		19.0
			153	5765			19.0
			157	5785			19.0
			161	5805			19.0
			165	5825			19.0
	802.11ac	40	151	5755	MCS0		19.0
			159	5795			19.0
	802.11ac	80	155	5775	MCS0	17.3	19.0
	802.11ax	20	149	5745	MCS0	Not Required	19.0
			153	5765			19.0
			157	5785			19.0
			161	5805			19.0
			165	5825			19.0
	802.11ax	40	151	5755	MCS0		19.0
			159	5795			19.0
	802.11ax	80	155	5775	MCS0		19.0

Figure 8.1 Test Reduction Table – 2.4 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11n40	Back	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]
	Front	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]
	Left	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]
	Right	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]
	Top	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]
	Bottom	3 – 2422 MHz	Reduced[1]
		6 – 2437 MHz	Tested
		9 – 2452 MHz	Reduced[1]

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.

Figure 8.2 Test Reduction Table – 5.25 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11ac80	Back	42 – 5210 MHz	Tested
	Front	42 – 5210 MHz	Tested
	Left	42 – 5210 MHz	Tested
	Right	42 – 5210 MHz	Tested
	Top	42 – 5210 MHz	Tested
	Bottom	42 – 5210 MHz	Tested

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.

Figure 8.2 Test Reduction Table – 5.75 GHz

Mode	Side	Required Channel	Tested/Reduced
802.11ac80	Back	155 – 5775 MHz	Tested
	Front	155 – 5775 MHz	Tested
	Left	155 – 5775 MHz	Tested
	Right	155 – 5775 MHz	Tested
	Top	155 – 5775 MHz	Tested
	Bottom	155 – 5775 MHz	Tested

Reduced[1] – When the reported SAR is ≤ 0.4 W/kg, SAR is not required for the remaining test configuration per KDB 248227 D01 v02r02 section 5.1.1 1) page 9.

SAR Data Summary – 2450 MHz Body

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
-----	47 mm	Back	2437	6	QPSK	Main	12.2	0.00536	0.01
-----		Front	2437	6	QPSK		12.2	0.00317	0.01
-----		Left	2437	6	QPSK		12.2	0.00545	0.01
-----		Right	2422	3	QPSK		12.1	0.00611	0.01
1			2437	6	QPSK		12.2	0.00638	0.01
-----			2452	9	QPSK		12.0	0.00597	0.01
-----		Top	2437	6	QPSK		12.2	0.00194	<0.01
-----		Bottom	2437	6	QPSK		12.2	0.00370	0.01
-----	Test Jig	Top	2437	6	QPSK		12.2	0.000830	<<0.01
-----		Back	2437	6	QPSK		12.2	0.000133	<<0.01
-----		Front	2437	6	QPSK		12.2	0	0

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

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

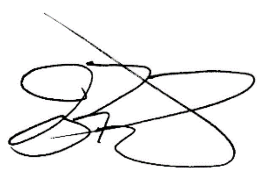
Jay M. Moulton
Vice President

SAR Data Summary – 5250 MHz Body

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
-----	47 mm	Back	5210	42	QPSK	Main	17.1	0.00575	0.01
-----		Front	5210	42	QPSK		17.1	0.00952	0.02
-----		Left	5210	42	QPSK		17.1	0.00770	0.01
2		Right	5210	42	QPSK		17.1	0.00968	0.02
-----		Top	5210	42	QPSK		17.1	0.00801	0.01
-----		Bottom	5210	42	QPSK		17.1	0.00878	0.01
-----	Test Jig	Top	5210	42	QPSK		17.1	$5.64e^{-05}$	<<0.01
-----		Back	5210	42	QPSK		17.1	$6.30e^{-05}$	<<0.01
-----		Front	5210	42	QPSK		17.1	0	0

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

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



Jay M. Moulton
Vice President

SAR Data Summary – 5750 MHz Body

MEASUREMENT RESULTS									
Plot	**Gap**	**Position**	**Frequency**		**Modulation**	**Antenna**	**End Power**	**Measured SAR (W/kg)**	**Reported SAR (W/kg)**
			MHz	**Ch.**			**(dBm)**		
3	47 mm	Back	5775	155	QPSK	Main	17.3	0.0318	0.05
-----		Front	5775	155	QPSK		17.3	0.0179	0.03
-----		Left	5775	155	QPSK		17.3	0.0284	0.04
-----		Right	5775	155	QPSK		17.3	0.0293	0.04
-----		Top	5775	155	QPSK		17.3	0.0132	0.02
-----		Bottom	5775	155	QPSK		17.3	0.0121	0.02
-----	Test Jig	Top	5775	155	QPSK		17.3	$4.25e^{-05}$	<<0.01
-----		Back	5775	155	QPSK		17.3	$4.43e^{-05}$	<<0.01
-----		Front	5775	155	QPSK		17.3	0	0

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

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

Jay M. Moulton
Vice President

9. Test Equipment List

Table 9.1 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	1251
Device Holder	N/A	N/A	N/A
Data Acquisition Electronics 4	08/16/2023	08/16/2022	759
Data Acquisition Electronics 4	02/14/2024	02/14/2023	1217
SPEAG E-Field Probe EX3DV4	08/28/2023	08/28/2022	3693
SPEAG E-Field Probe EX3DV4	04/20/2024	04/20/2023	7531
Speag Validation Dipole D2450V2	06/03/2024	06/03/2021	881
Speag Validation Dipole D5GHzV2	06/08/2024	06/08/2021	1119
Agilent N1911A Power Meter	03/14/2024	03/14/2023	GB45100254
Agilent N1922A Power Sensor	03/13/2024	03/13/2023	MY45240464
Agilent (HP) 8596E Spectrum Analyzer	03/13/2024	03/13/2023	3826A01468
Agilent (HP) 83752A Synthesized Sweeper	03/14/2024	03/14/2023	3610A01048
Agilent (HP) 8753C Vector Network Analyzer	03/14/2024	03/14/2023	3135A01724
Agilent (HP) 85047A S-Parameter Test Set	03/14/2024	03/14/2023	2904A00595
Copper Mountain R140 Vector Reflectometer	03/13/2024	03/13/2023	21390004
Agilent 778D Dual Directional Coupler	N/A	N/A	MY48220184
MiniCircuits BW-N20W5+ Fixed 20 dB Attenuator	N/A	N/A	N/A
MiniCircuits SPL-10.7+ Low Pass Filter	N/A	N/A	R8979513746
Aprel Dielectric Probe Assembly	N/A	N/A	0011
Head Equivalent Matter (2450 MHz)	N/A	N/A	N/A
Head Equivalent Matter (3-6 GHz)	N/A	N/A	N/A

10. Conclusion

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

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

11. References

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

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

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

[4] International Electrotechnical Commission, IEC 62209-2 (Edition 1.0), Human Exposure to radio frequency fields from hand-held and body mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), March 2010.

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

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

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

Appendix A – System Validation Plots and Data

****
Test Result for UIM Dielectric Parameter
Thu 27/Jul/2023
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
2.4100	39.26	1.76	38.44	1.76
2.4200	39.25	1.77	38.42	1.77
2.4220	39.248	1.772	38.416	1.772*
2.4300	39.24	1.78	38.40	1.78
2.4370	39.226	1.787	38.393	1.794*
2.4400	39.22	1.79	38.39	1.80
2.4500	39.20	1.80	38.34	1.81
2.4520	39.198	1.802	38.34	1.812*
2.4600	39.19	1.81	38.34	1.82
2.4700	39.17	1.82	38.32	1.83
2.4800	39.16	1.83	38.30	1.86

* value interpolated

****
Test Result for UIM Dielectric Parameter
Tue 22/Aug/2023
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	38.53	1.78
2.4120	39.258	1.762	38.526	1.782*
2.4200	39.25	1.77	38.51	1.79
2.4300	39.24	1.78	38.49	1.80
2.4370	39.226	1.787	38.483	1.814*
2.4400	39.22	1.79	38.48	1.82
2.4500	39.20	1.80	38.43	1.83
2.4600	39.19	1.81	38.43	1.84
2.4620	39.186	1.812	38.426	1.842*
2.4700	39.17	1.82	38.41	1.85
2.4800	39.16	1.83	38.39	1.88

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Tue 29/Aug/2023
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	39.06	1.79
2.4120	39.258	1.762	39.056	1.792*
2.4200	39.25	1.77	39.04	1.80
2.4300	39.24	1.78	39.02	1.81
2.4370	39.226	1.787	39.013	1.824*
2.4400	39.22	1.79	39.01	1.83
2.4500	39.20	1.80	38.96	1.84
2.4600	39.19	1.81	38.96	1.85
2.4620	39.186	1.812	38.956	1.852*
2.4700	39.17	1.82	38.94	1.86
2.4800	39.16	1.83	38.92	1.89

* value interpolated

****
Test Result for UIM Dielectric Parameter
Wed 26/Jul/2023
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
5.1000	36.10	4.55	34.94	4.56
5.1200	36.08	4.57	34.92	4.58
5.1400	36.05	4.59	34.89	4.60
5.1600	36.03	4.61	34.87	4.63
5.1800	36.01	4.63	34.85	4.65
5.2000	35.99	4.65	34.82	4.67
5.2100	35.975	4.665	34.81	4.68*
5.2200	35.96	4.68	34.80	4.69
5.2400	35.94	4.70	34.78	4.71
5.2500	35.93	4.71	34.765	4.725*
5.2600	35.92	4.72	34.75	4.74
5.2800	35.89	4.74	34.72	4.76
5.3000	35.87	4.76	34.69	4.78
5.3200	35.85	4.78	34.67	4.80
5.3400	35.83	4.80	34.65	4.83
5.3600	35.80	4.82	34.63	4.85
5.3800	35.78	4.84	34.60	4.87
5.4000	35.76	4.86	34.58	4.89
5.4200	35.73	4.88	34.56	4.92
5.4400	35.71	4.90	34.55	4.94
5.4600	35.69	4.92	34.52	4.96
5.4800	35.67	4.94	34.49	4.98
5.5000	35.64	4.96	34.46	5.00
5.5200	35.62	4.98	34.44	5.02
5.5400	35.60	5.00	34.42	5.04
5.5600	35.57	5.02	34.40	5.07
5.5800	35.55	5.04	34.37	5.09
5.6000	35.53	5.07	34.35	5.11
5.6200	35.51	5.09	34.32	5.13
5.6400	35.48	5.11	34.30	5.16
5.6600	35.46	5.13	34.28	5.18
5.6800	35.44	5.15	34.26	5.20
5.7000	35.41	5.17	34.23	5.22
5.7200	35.39	5.19	34.21	5.25
5.7400	35.37	5.21	34.19	5.27
5.7500	35.36	5.22	34.18	5.28*
5.7600	35.35	5.23	34.17	5.29
5.7750	35.328	5.245	34.155	5.305*
5.7800	35.32	5.25	34.15	5.31
5.8000	35.30	5.27	34.11	5.33
5.8200	35.28	5.29	34.09	5.36
5.8400	35.25	5.31	34.07	5.38
5.8600	35.23	5.33	34.05	5.40

* value interpolated

****
Test Result for UIM Dielectric Parameter
Tue 22/Aug/2023
Freq Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM
****

Freq	FCC_eH	FCC_sH	Test_e	Test_s
5.1000	36.10	4.55	35.36	4.57
5.1200	36.08	4.57	35.34	4.59
5.1400	36.05	4.59	35.31	4.61
5.1600	36.03	4.61	35.29	4.64
5.1800	36.01	4.63	35.27	4.66
5.2000	35.99	4.65	35.24	4.68
5.2100	35.975	4.665	35.23	4.69*
5.2200	35.96	4.68	35.22	4.70
5.2400	35.94	4.70	35.20	4.72
5.2500	35.93	4.71	35.185	4.735*
5.2600	35.92	4.72	35.17	4.75
5.2800	35.89	4.74	35.14	4.77
5.3000	35.87	4.76	35.11	4.79
5.3200	35.85	4.78	35.09	4.81
5.3400	35.83	4.80	35.07	4.84
5.3600	35.80	4.82	35.05	4.86
5.3800	35.78	4.84	35.02	4.88
5.4000	35.76	4.86	35.00	4.90
5.4200	35.73	4.88	34.98	4.93
5.4400	35.71	4.90	34.97	4.95
5.4600	35.69	4.92	34.94	4.97
5.4800	35.67	4.94	34.91	4.99
5.5000	35.64	4.96	34.88	5.01
5.5200	35.62	4.98	34.86	5.03
5.5400	35.60	5.00	34.84	5.05
5.5600	35.57	5.02	34.82	5.08
5.5800	35.55	5.04	34.79	5.10
5.6000	35.53	5.07	34.77	5.12
5.6200	35.51	5.09	34.74	5.14
5.6400	35.48	5.11	34.72	5.17
5.6600	35.46	5.13	34.70	5.19
5.6800	35.44	5.15	34.68	5.21
5.7000	35.41	5.17	34.65	5.23
5.7200	35.39	5.19	34.63	5.26
5.7400	35.37	5.21	34.61	5.28
5.7500	35.36	5.22	34.60	5.29*
5.7600	35.35	5.23	34.59	5.30
5.7750	35.328	5.245	34.575	5.315*
5.7800	35.32	5.25	34.57	5.32
5.8000	35.30	5.27	34.53	5.34
5.8200	35.28	5.29	34.51	5.37
5.8400	35.25	5.31	34.49	5.39
5.8600	35.23	5.33	34.47	5.41

* value interpolated

```
***********************************************************
Test Result for UIM Dielectric Parameter
Tue 29/Aug/2023
Freq    Frequency(GHz)
FCC_eH Limits for Head Epsilon
FCC_sH Limits for Head Sigma
Test_e Epsilon  of  UIM
Test_s Sigma of UIM
***********************************************************
```

Freq	FCC_eH	FCC_sH	Test_e	Test_s
5.1000	36.10	4.55	36.12	4.64
5.1200	36.08	4.57	36.10	4.66
5.1400	36.05	4.59	36.07	4.68
5.1600	36.03	4.61	36.05	4.71
5.1800	36.01	4.63	36.03	4.73
5.2000	35.99	4.65	36.00	4.75
5.2100	35.975	4.665	35.99	4.76*
5.2200	35.96	4.68	35.98	4.77
5.2400	35.94	4.70	35.96	4.79
5.2500	35.93	4.71	35.945	4.805*
5.2600	35.92	4.72	35.93	4.82
5.2800	35.89	4.74	35.90	4.84
5.3000	35.87	4.76	35.87	4.86
5.3200	35.85	4.78	35.85	4.88
5.3400	35.83	4.80	35.83	4.91
5.3600	35.80	4.82	35.81	4.93
5.3800	35.78	4.84	35.78	4.95
5.4000	35.76	4.86	35.76	4.97
5.4200	35.73	4.88	35.74	5.00
5.4400	35.71	4.90	35.73	5.02
5.4600	35.69	4.92	35.70	5.04
5.4800	35.67	4.94	35.67	5.06
5.5000	35.64	4.96	35.64	5.08
5.5200	35.62	4.98	35.62	5.10
5.5400	35.60	5.00	35.60	5.12
5.5600	35.57	5.02	35.58	5.15
5.5800	35.55	5.04	35.55	5.17
5.6000	35.53	5.07	35.53	5.19
5.6100	35.52	5.08	35.515	5.20*
5.6200	35.51	5.09	35.50	5.21
5.6400	35.48	5.11	35.48	5.24
5.6600	35.46	5.13	35.46	5.26
5.6800	35.44	5.15	35.44	5.28
5.7000	35.41	5.17	35.41	5.30
5.7200	35.39	5.19	35.39	5.33
5.7400	35.37	5.21	35.37	5.35
5.7500	36.36	5.22	35.36	5.36*
5.7600	35.35	5.23	35.35	5.37
5.7750	35.328	5.245	35.335	5.385*
5.7800	35.32	5.25	35.33	5.39
5.8000	35.30	5.27	35.29	5.41
5.8200	35.28	5.29	35.27	5.44
5.8400	35.25	5.31	35.25	5.46

* value interpolated

RF Exposure Lab

Plot 1

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

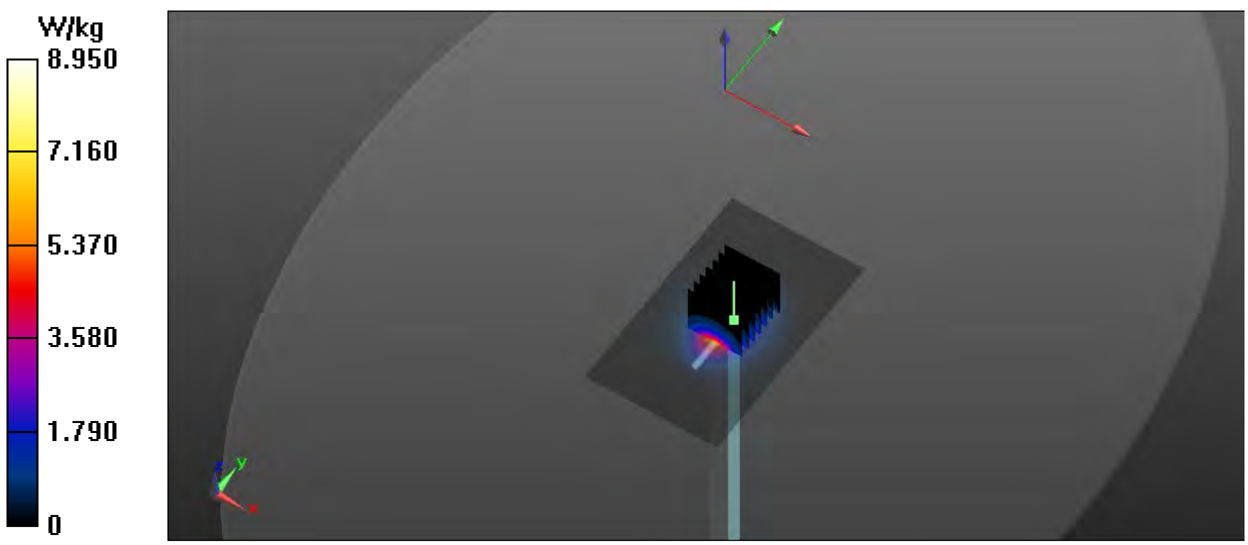
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.81 S/m; ε_r = 38.34; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 7/27/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(8.06, 8.06, 8.06); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

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

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



RF Exposure Lab

Plot 2

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

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

Test Date: Date: 7/26/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(5.3, 5.3, 5.3); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

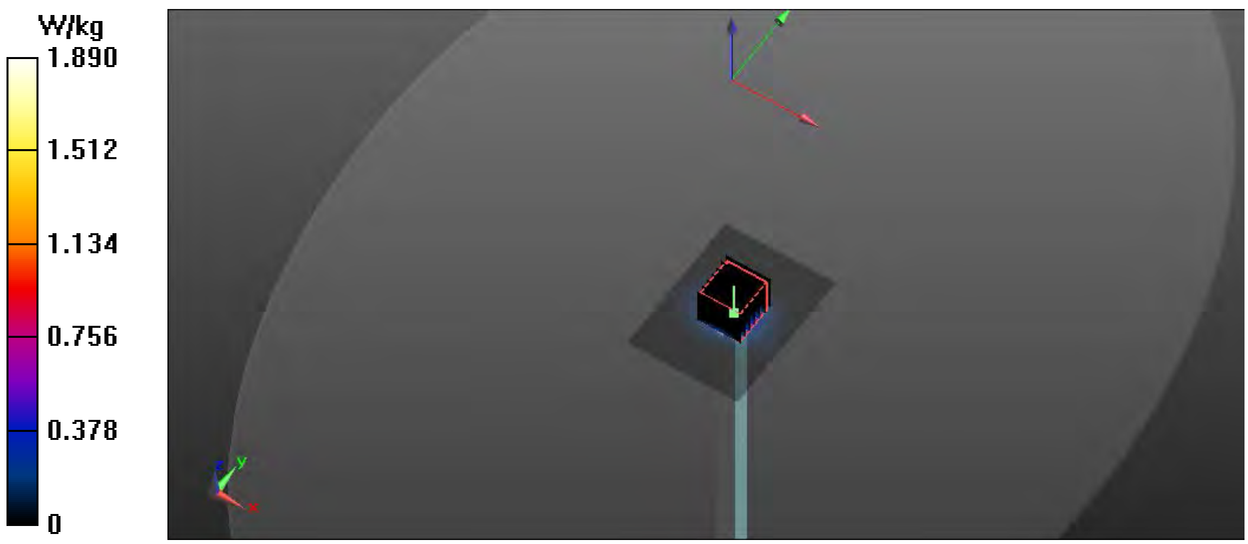
Procedure Notes:

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

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

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

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



RF Exposure Lab

Plot 3

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

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

Test Date: Date: 7/26/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(4.7, 4.7, 4.7); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

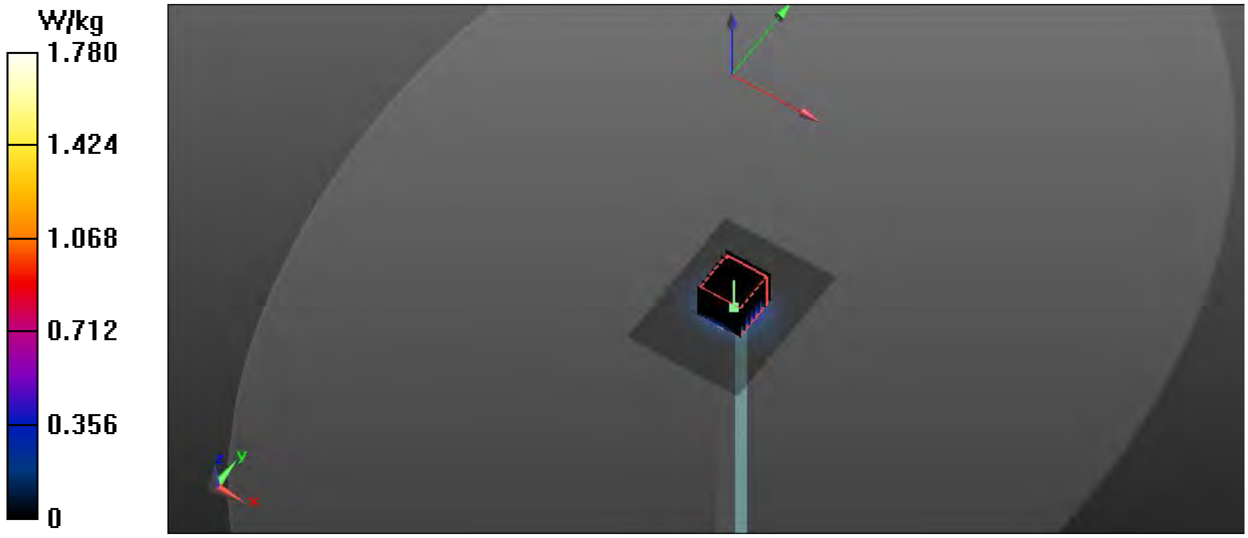
Procedure Notes:

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

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

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

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



RF Exposure Lab

Plot 4

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

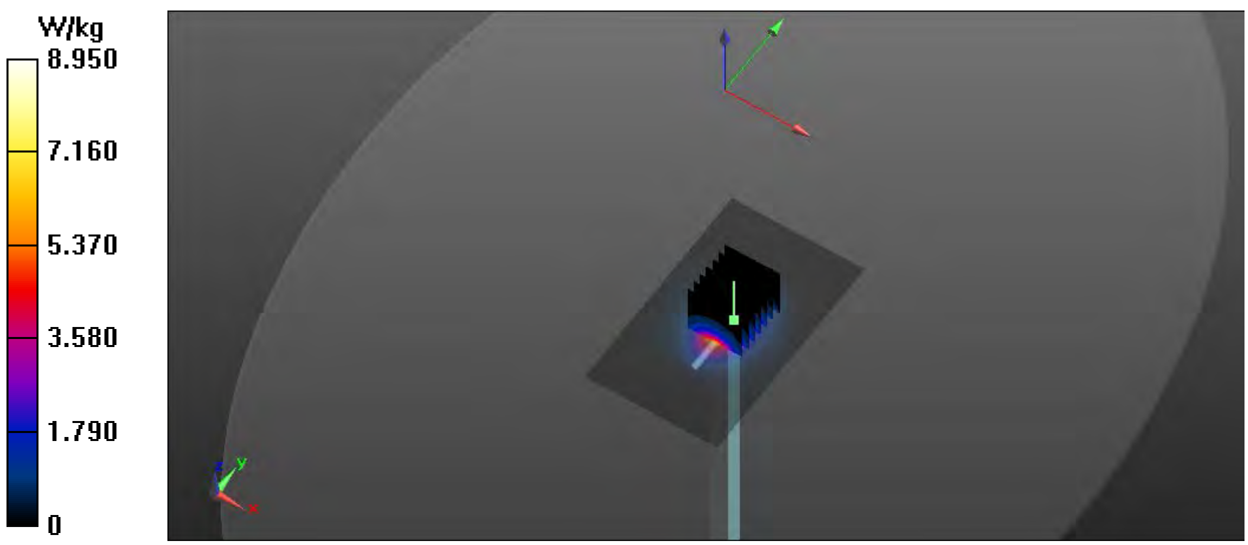
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.83 S/m; ε_r = 38.43; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 8/22/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(8.06, 8.06, 8.06); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

Head Verification/2450 MHz/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.34 W/kg

Head Verification/2450 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.967 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 11.24 W/kg
P_{in}= 100 mW
SAR(1 g) = 5.45 W/kg; SAR(10 g) = 2.54 W/kg
Maximum value of SAR (measured) = 8.95 W/kg



RF Exposure Lab

Plot 5

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

Communication System: CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used (interpolated): f = 5250 MHz; σ = 4.735 S/m; ε_r = 35.185; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 8/22/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(5.3, 5.3, 5.3); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

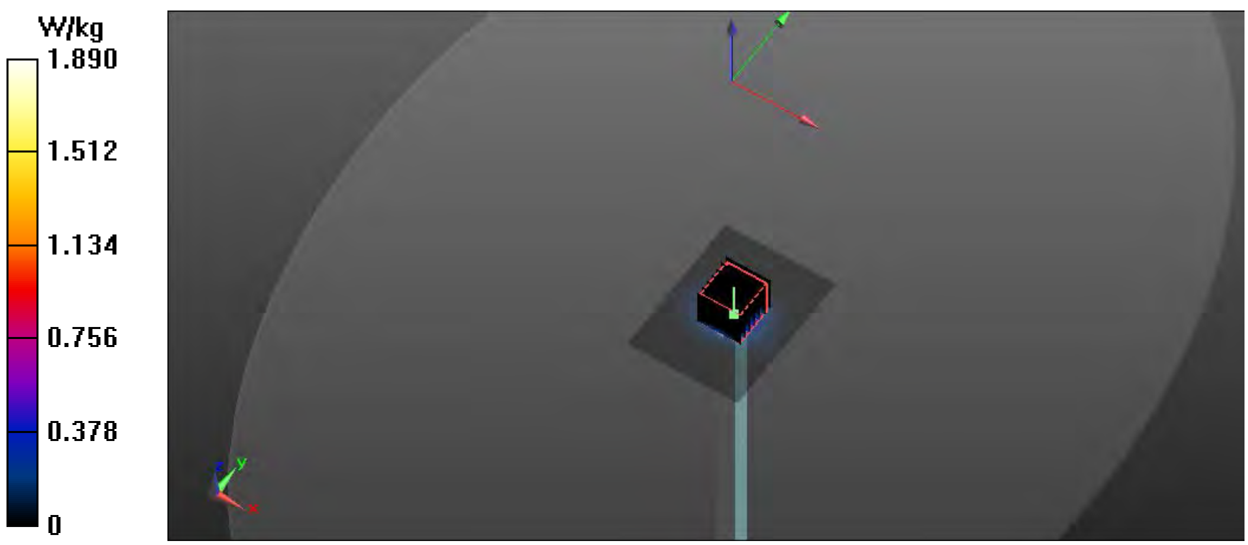
Procedure Notes:

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

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

Head Verification/5250 MHz/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 14.539 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.26 W/kg
Pin=10 mW
SAR(1 g) = 0.806 W/kg; SAR(10 g) = 0.234 W/kg

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



RF Exposure Lab

Plot 6

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

Communication System: CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: HSL 3-6 GHz; Medium parameters used (interpolated): f = 5750 MHz; σ = 5.29 S/m; ε_r = 34.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 8/22/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C
Probe: EX3DV4 – SN3693; ConvF(4.7, 4.7, 4.7); Calibrated: 8/28/2022;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

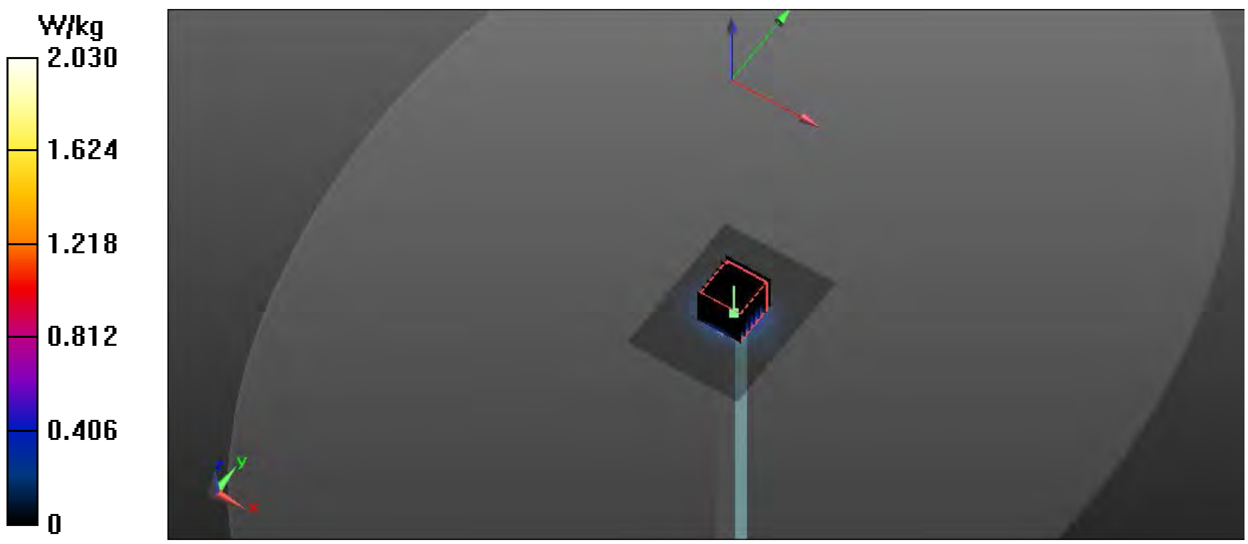
Procedure Notes:

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

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.69 W/kg

Head Verification/5750 MHz/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 14.867 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.92 W/kg
Pin=10 mW
SAR(1 g) = 0.826 W/kg; SAR(10 g) = 0.223 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 2.03 W/kg



RF Exposure Lab

Plot 7

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 38.96; ρ = 1000 kg/m^3
Phantom section: Flat Section

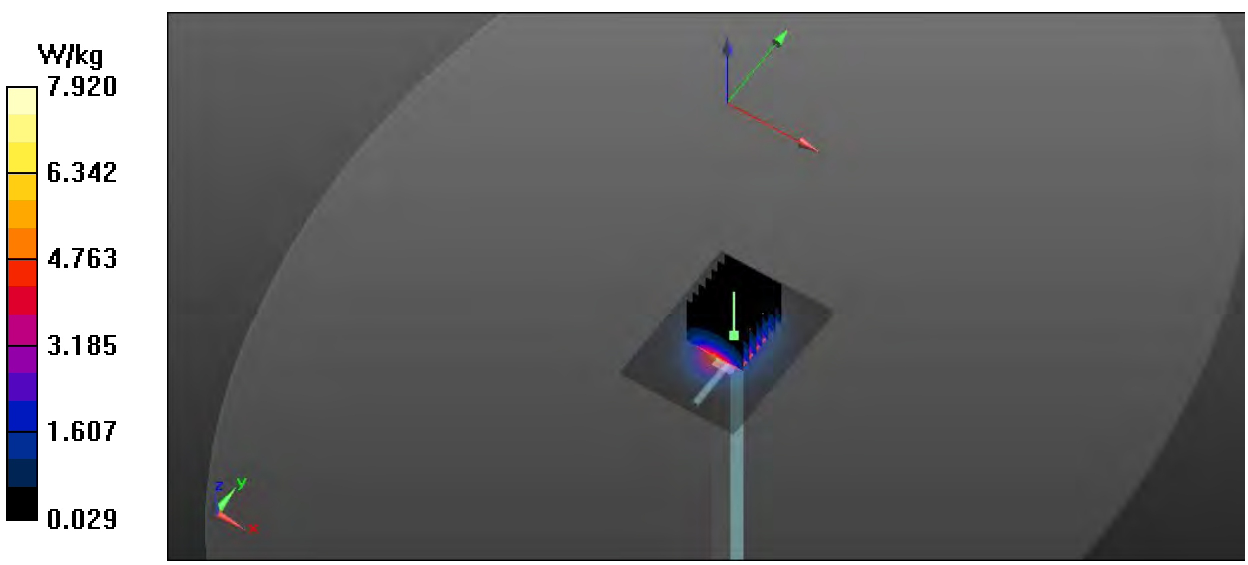
Test Date: Date: 8/29/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7531; ConvF(7, 7.18, 7.72); Calibrated: 4/20/2023;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

Procedure Notes:

2450 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 7.93 W/kg

2450 MHz Head/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.792 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 11.15 W/kg
SAR(1 g) = 5.56 W/kg; SAR(10 g) = 2.88 W/kg
Maximum value of SAR (measured) = 8.39 W/kg



RF Exposure Lab

Plot 8

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

Communication System: CW; Frequency: 5250 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used (interpolated): f = 5250 MHz; σ = 4.805 S/m; ε_r = 35.945; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 8/29/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7531; ConvF(5.07, 5.24, 5.58); Calibrated: 4/20/2023;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

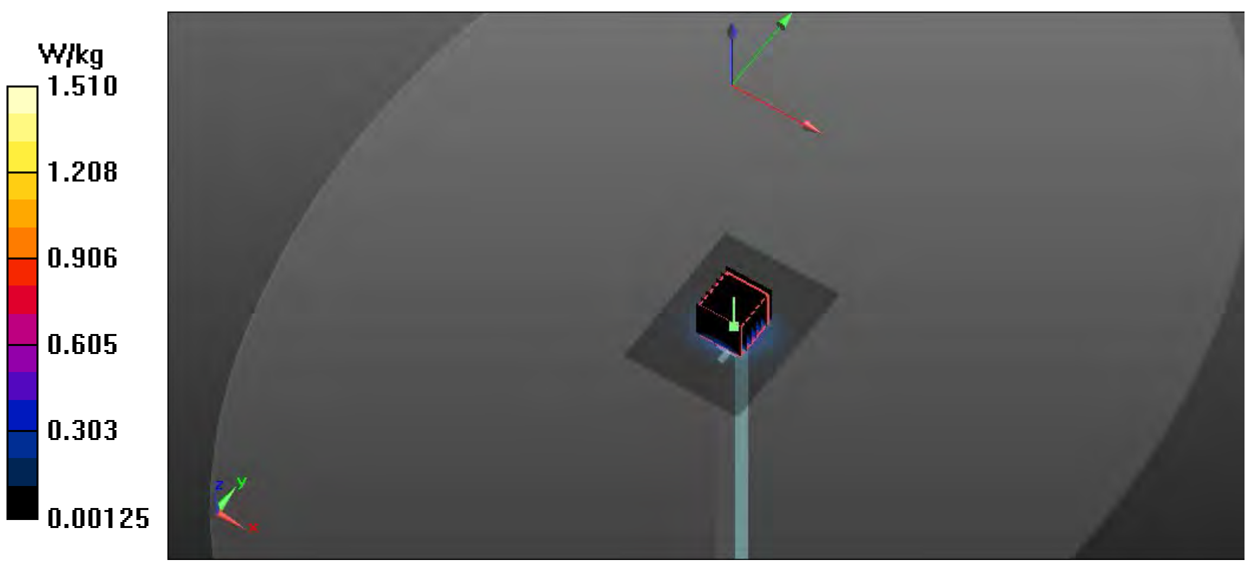
Procedure Notes:

5200 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.5 W/kg

5200 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 58.697 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.06 W/kg
SAR(1 g) = 0.811 W/kg; SAR(10 g) = 0.235 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.96 W/kg



RF Exposure Lab

Plot 9

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

Communication System: CW; Frequency: 5750 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used (interpolated): f = 5750 MHz; σ = 5.36 S/m; ε_r = 35.36; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 8/29/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 – SN7531; ConvF(4.6, 4.74, 5.06); Calibrated: 4/20/2023;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1217; Calibrated: 2/14/2023
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

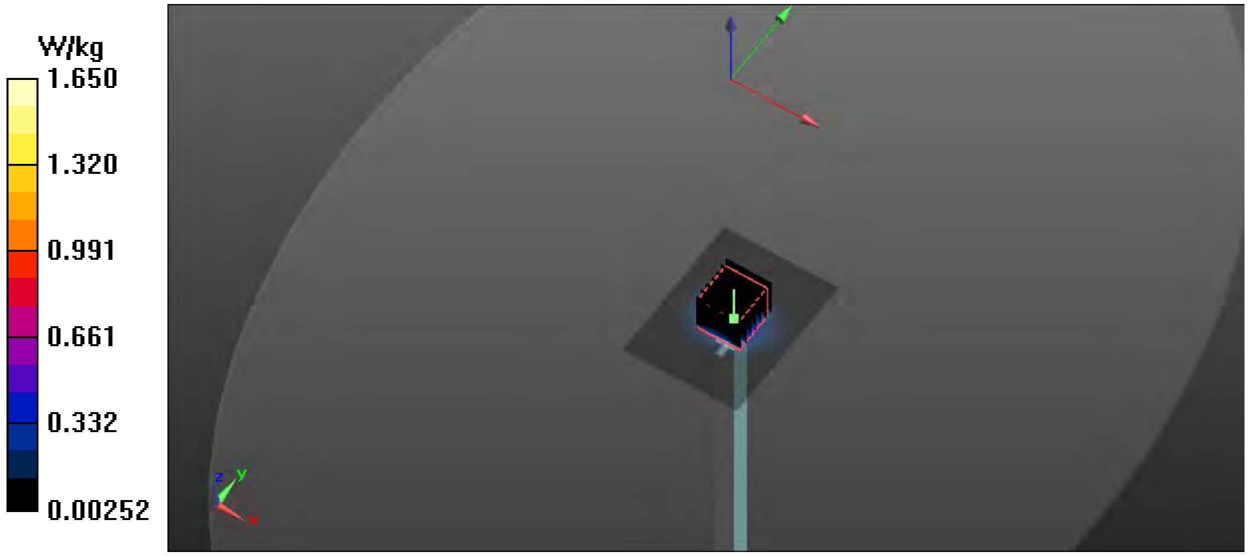
Procedure Notes:

5800 MHz Head/Verification/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.67 W/kg

5800 MHz Head/Verification/Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.942 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 0.823 W/kg; SAR(10 g) = 0.239 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.86 W/kg



Appendix B – SAR Test Data Plots

RF Exposure Lab

Plot 1

DUT: VCUNM1; Type: Infotainment System; Serial: 1000013

Communication System: WiFi 802.11n40 (MCS0); Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: HSL2450; Medium parameters used (interpolated): f = 2437 MHz; σ = 1.794 S/m; ε_r = 38.393; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 7/27/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3693; ConvF(8.06, 8.06, 8.06); Calibrated: 8/28/2022
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

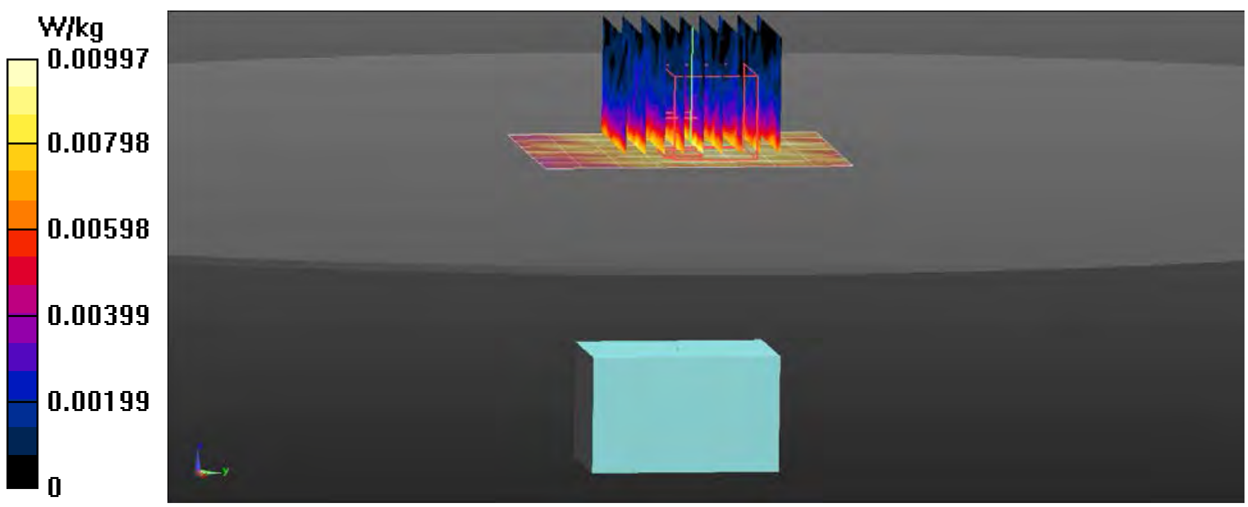
Procedure Notes:

2450 MHz/Right Mid/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.00969 W/kg

2450 MHz/Right Mid/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.091 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.0140 W/kg
SAR(1 g) = 0.00638 W/kg; SAR(10 g) = 0.00386 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.00997 W/kg



RF Exposure Lab

Plot 2

DUT: VCUNM1; Type: Infotainment System; Serial: 1000013

Communication System: WiFi 802.11ac80 (MCS0); Frequency: 5210 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used (interpolated): f = 5210 MHz; σ = 4.68 S/m; ε_r = 34.81; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 7/27/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3693; ConvF(5.3, 5.3, 5.3); Calibrated: 8/28/2022
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

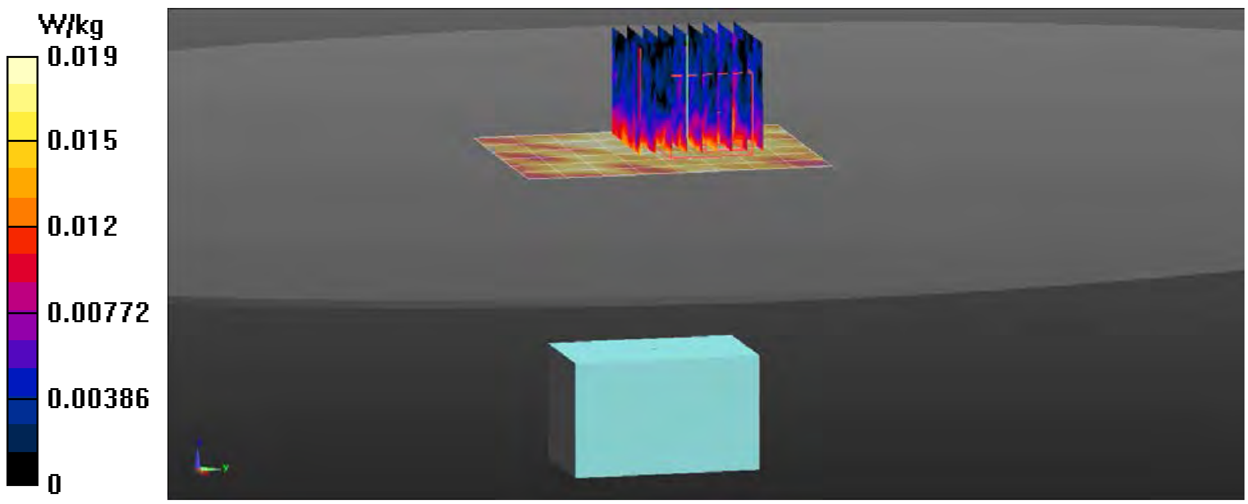
Procedure Notes:

5200 MHz/Right 42/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0217 W/kg

5200 MHz/Right 42/Zoom Scan (9x9x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.491 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.0220 W/kg
SAR(1 g) = 0.00968 W/kg; SAR(10 g) = 0.00491 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0193 W/kg



RF Exposure Lab

Plot 3

DUT: VCUNM1; Type: Infotainment System; Serial: 1000013

Communication System: WiFi 802.11ac80 (MCS0); Frequency: 5775 MHz; Duty Cycle: 1:1
Medium: HSL3-6GHz; Medium parameters used (interpolated): f = 5775 MHz; σ = 5.305 S/m; ε_r = 34.155; ρ = 1000 kg/m^3
Phantom section: Flat Section

Test Date: Date: 7/26/2023; Ambient Temp: 23 °C; Tissue Temp: 21 °C

Probe: EX3DV4 - SN3693; ConvF(4.7, 4.7, 4.7); Calibrated: 8/28/2022
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn759; Calibrated: 8/16/2022
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: 1251
Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

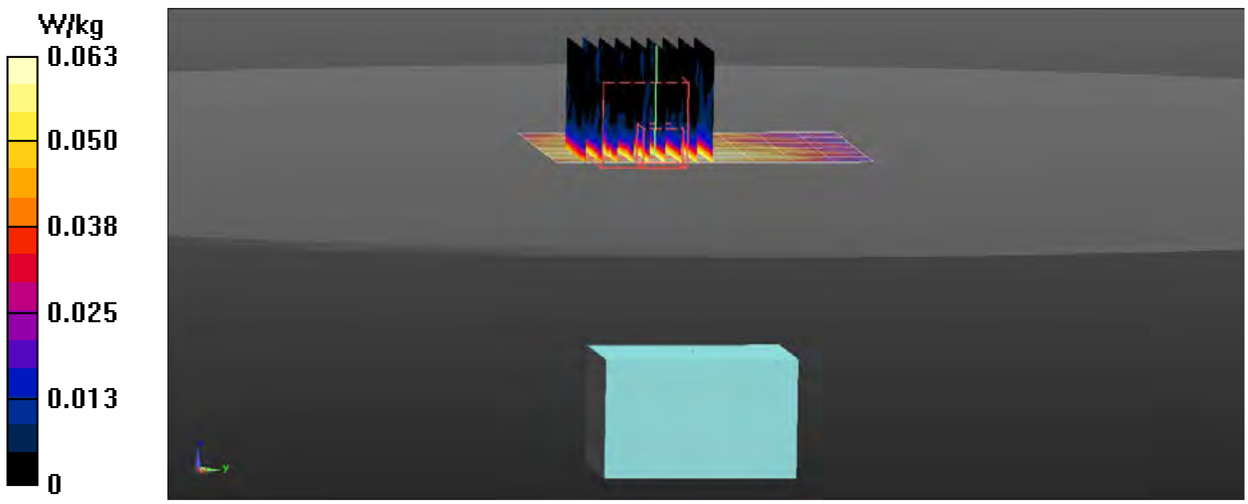
Procedure Notes:

5800 MHz/Front 155/Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0697 W/kg

5800 MHz/Front 155/Zoom Scan (9x9x16)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.226 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.105 W/kg
SAR(1 g) = 0.032 W/kg; SAR(10 g) = 0.014 W/kg

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0631 W/kg



Appendix C – SAR Test Setup Photos

Test Position Back 47 mm Gap

Note: The spacer is a Plexiglas material used to support the device and hold it in a more horizonal position.

Test Position Front 47 mm Gap

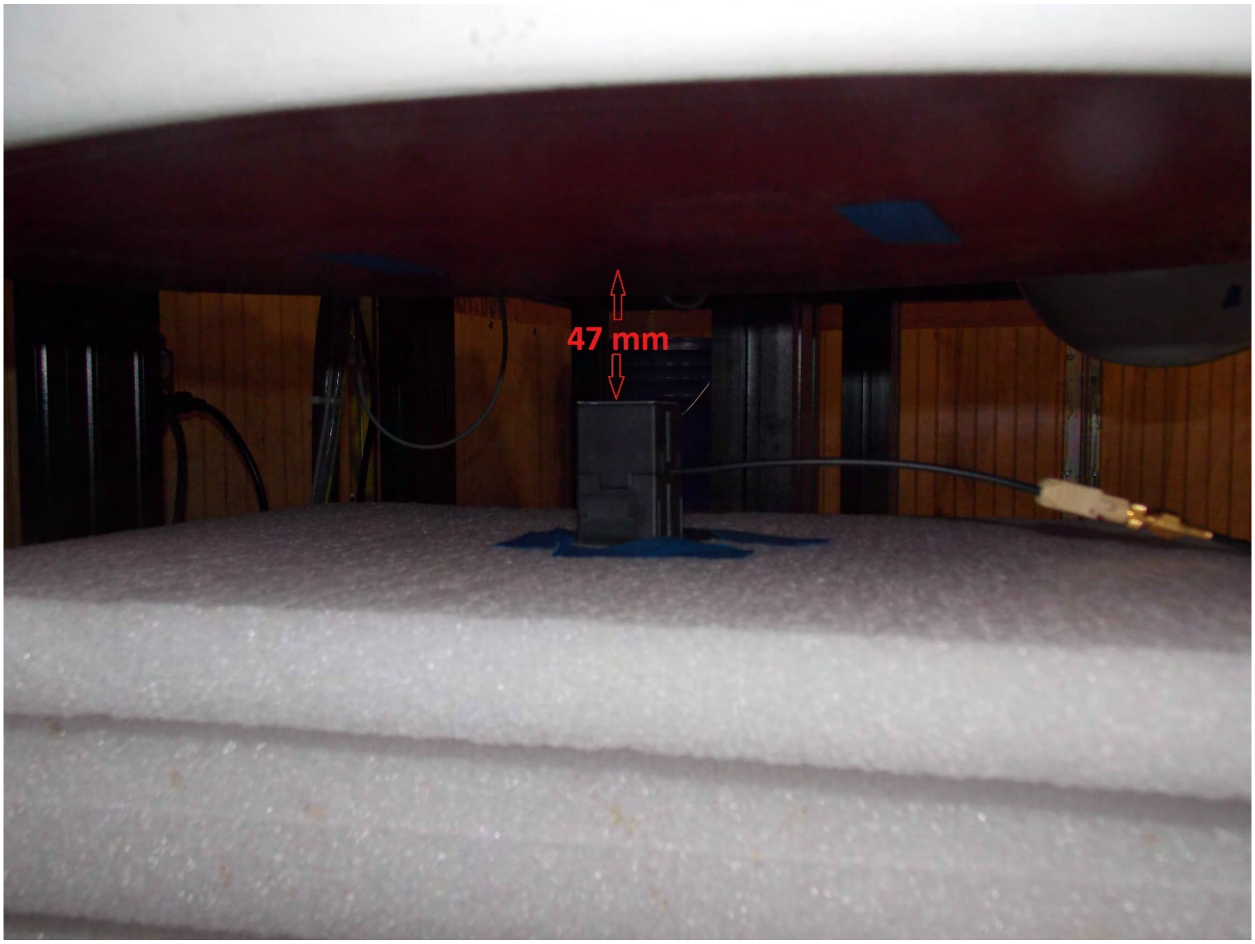
Note: The spacer is a Plexiglas material used to support the device and hold it in a more horizonal position.

Test Position Left 47 mm Gap

Note: The spacer is a Plexiglas material used to support the device and hold it in a more horizonal position.

Test Position Right 47 mm Gap

Note: The spacer is a Plexiglas material used to support the device and hold it in a more horizonal position.



Test Position Top 47 mm Gap

Test Position Bottom 47 mm Gap

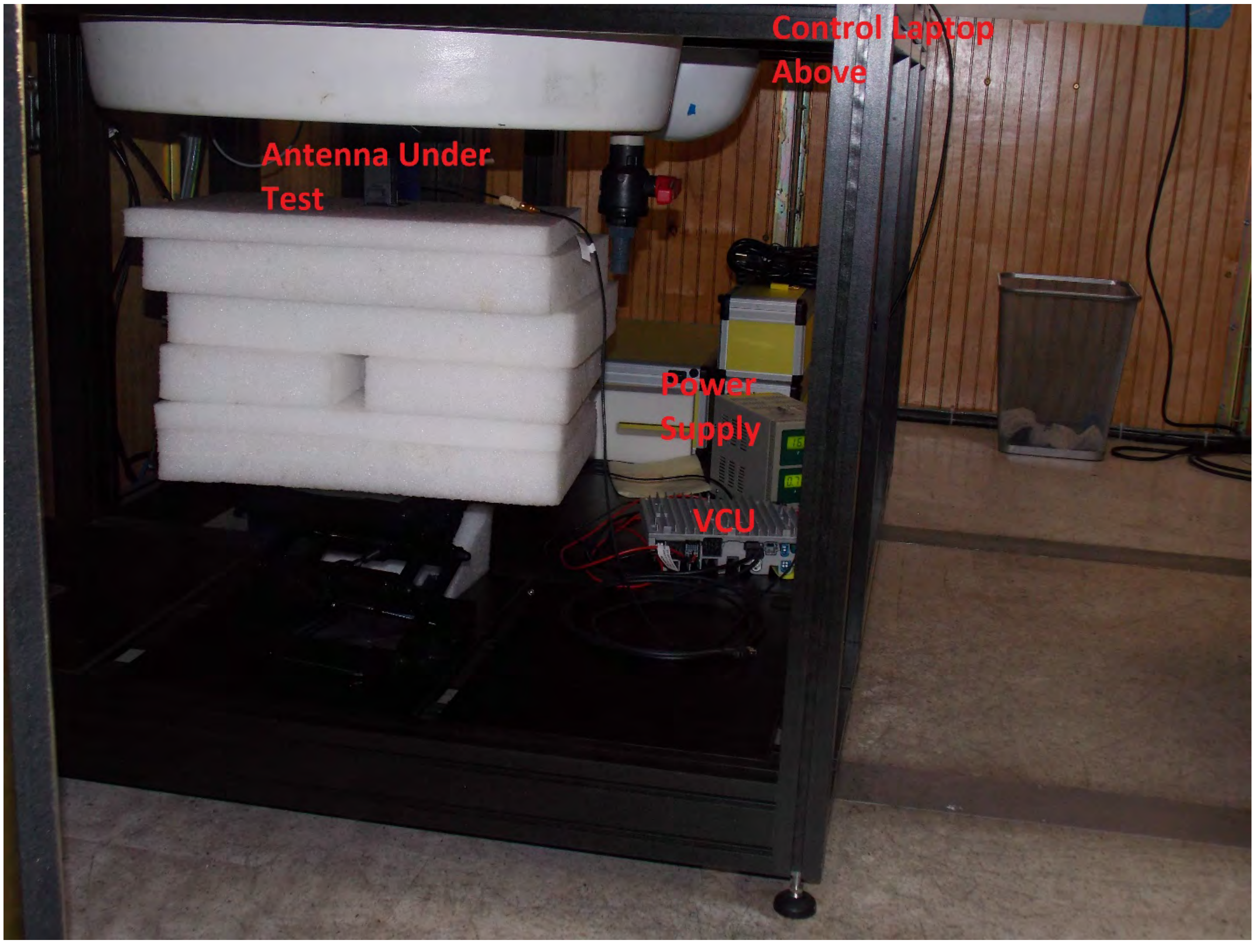
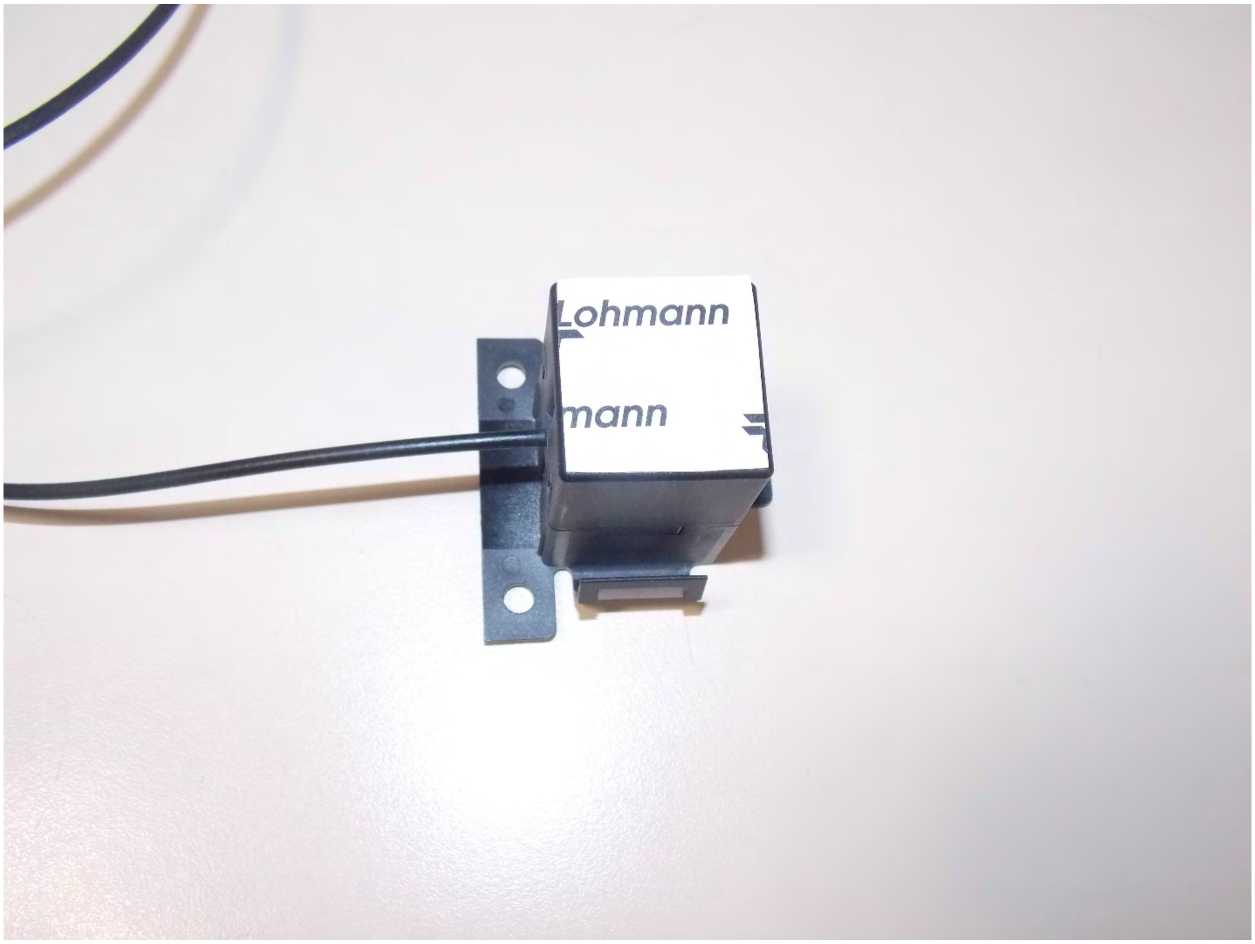


Photo of the Setup showing the VCU location during each test

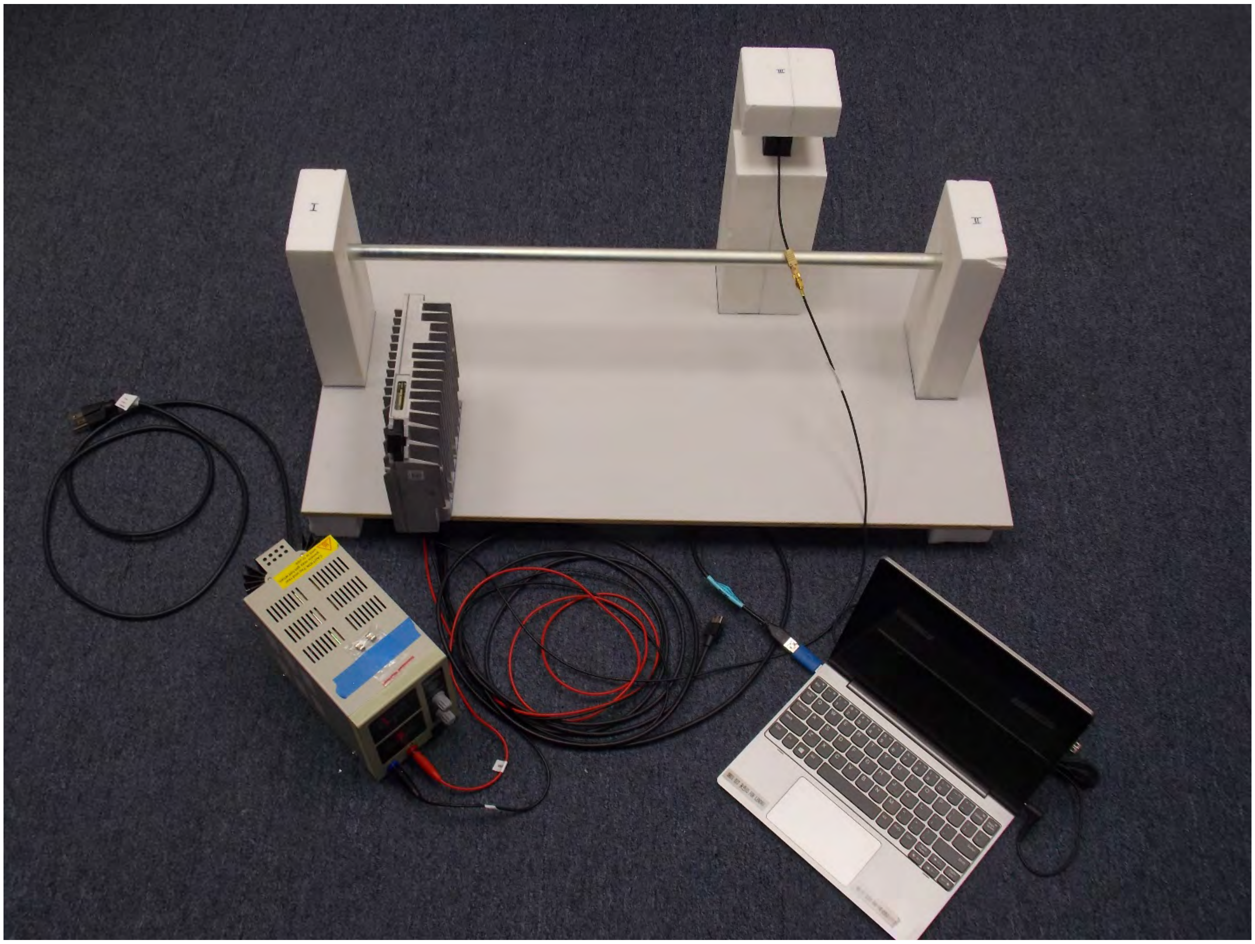
Front of Device

Back of Device

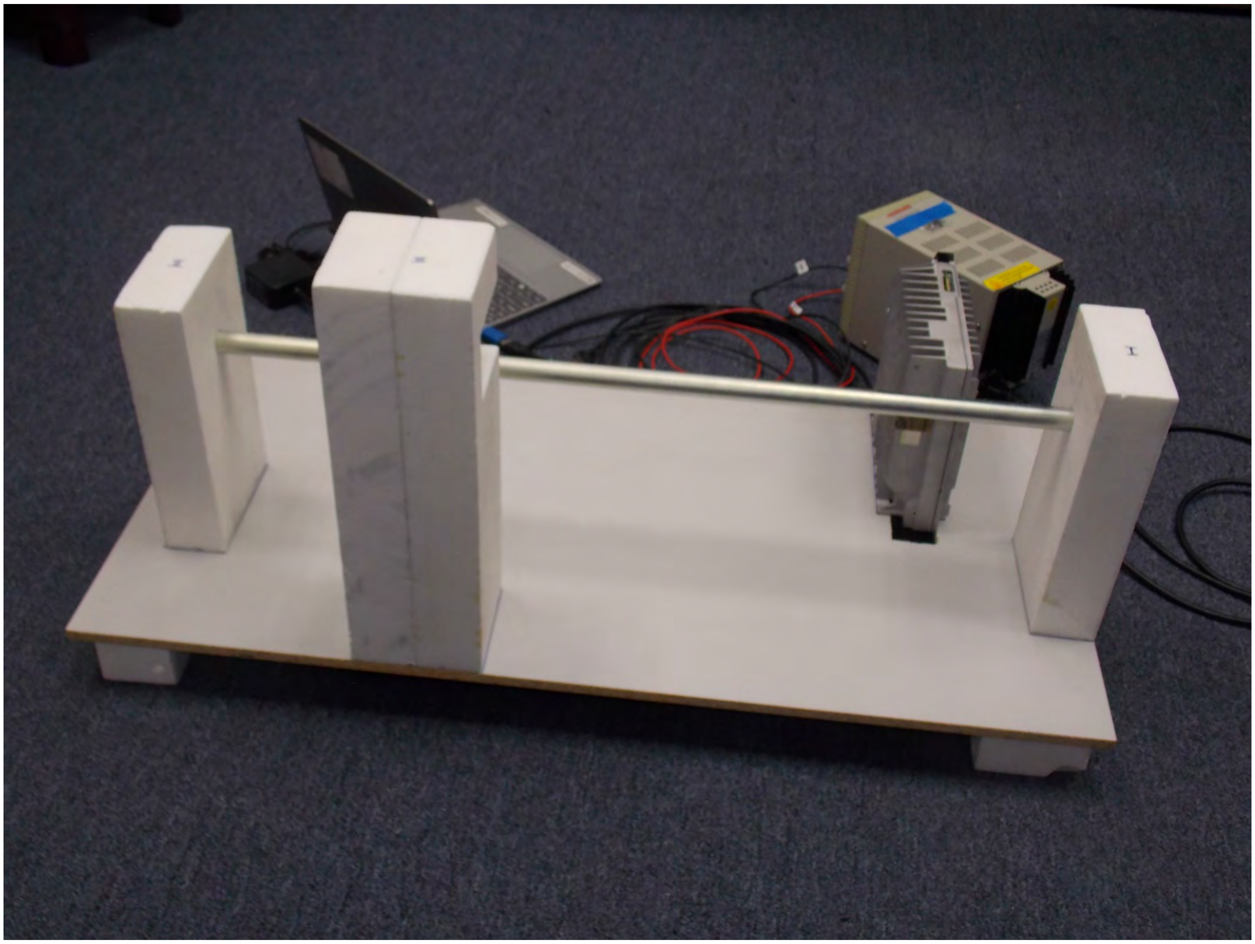


Antenna Module

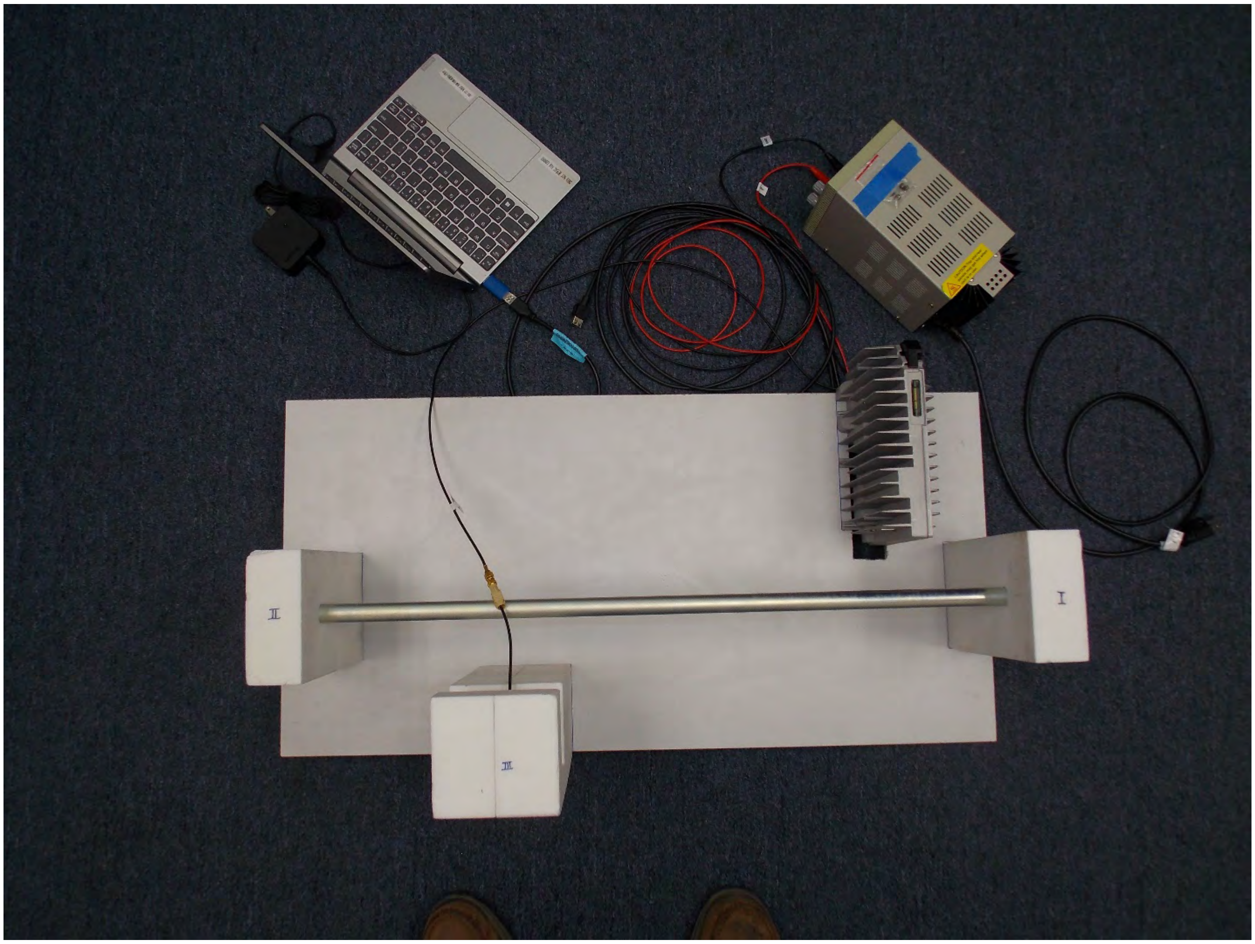
Photo of Label on Test Unit



Test Jig Supplied by Robert Bosch Front View



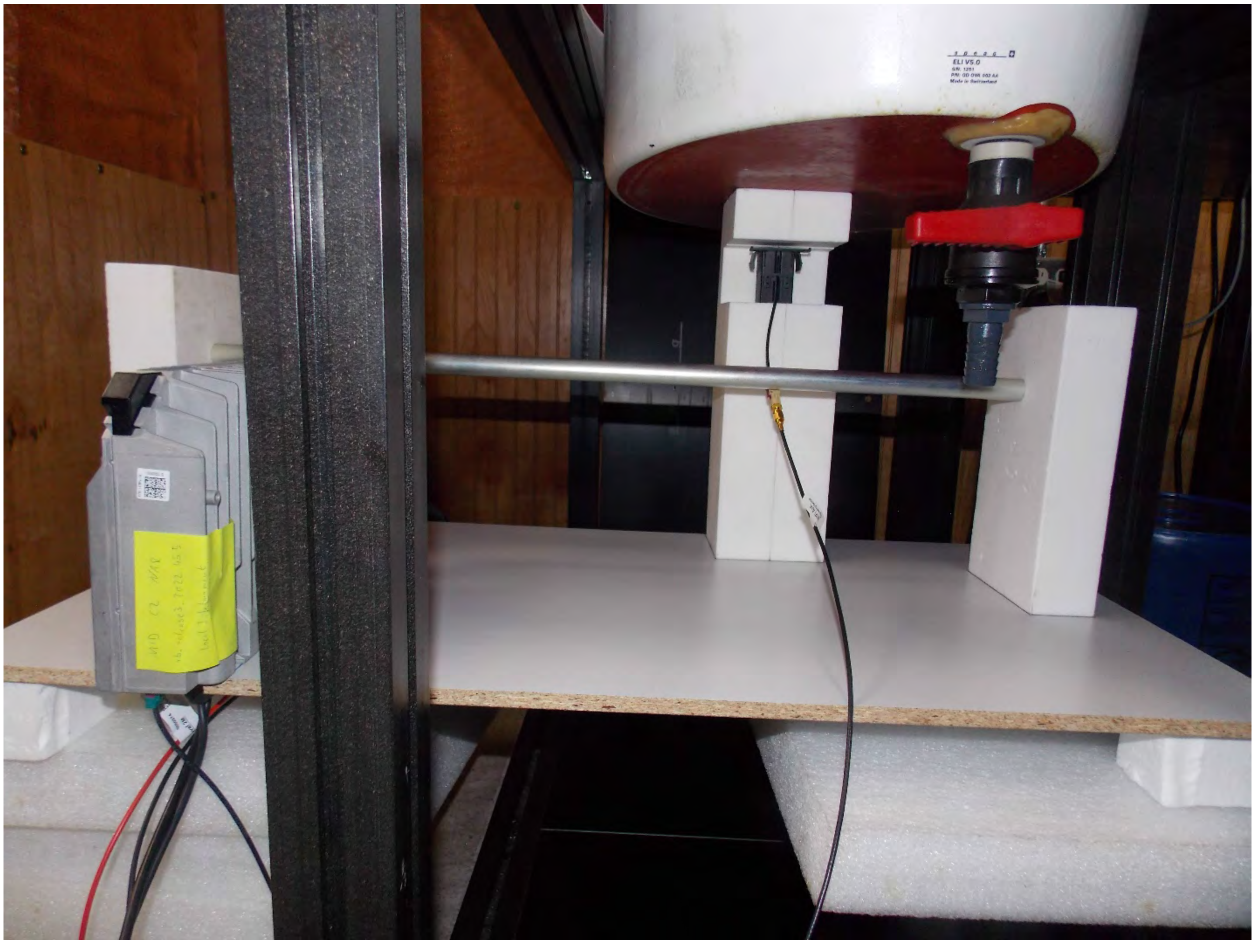
Test Jig Supplied by Robert Bosch Back View



Test Jig Supplied by Robert Bosch Top View

Test Jig Supplied by Robert Bosch Antenna Location

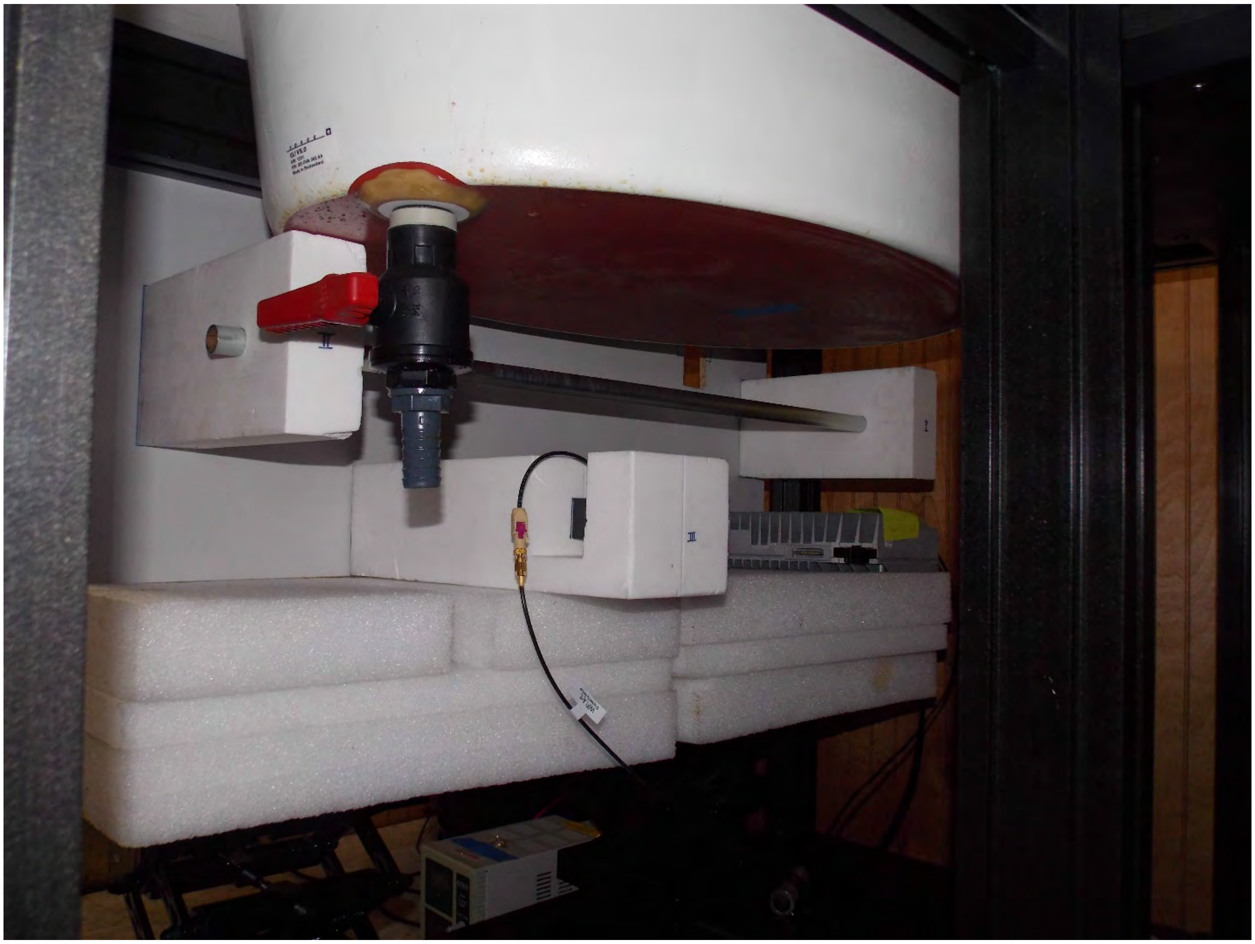
**Top Test Position using Test Jig Supplied by Robert Bosch
Front View**



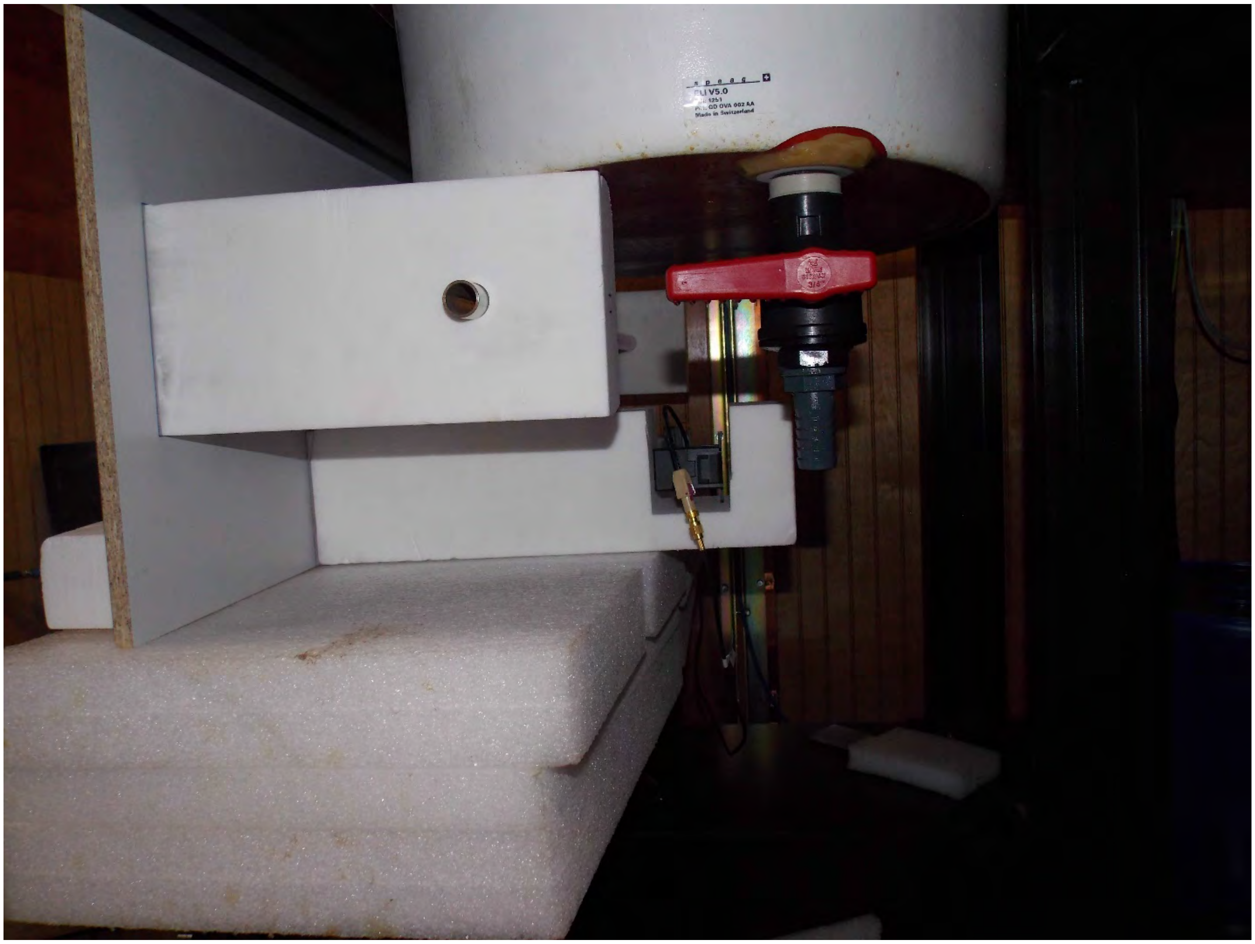
**Top Test Position using Test Jig Supplied by Robert Bosch
Side View**

Back Test Position using Test Jig Supplied by Robert Bosch
Front View

Back Test Position using Test Jig Supplied by Robert Bosch Side View



Front Test Position using Test Jig Supplied by Robert Bosch
Top View



Front Test Position using Test Jig Supplied by Robert Bosch
Side View

Front Test Position using Test Jig Supplied by Robert Bosch
Control Equipment Location

Appendix D – Probe Calibration Data Sheets

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

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

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

Accreditation No.: SCS 0108

Client RF Exposure Lab

Certificate No EX-3693_Aug22

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3693

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

Calibration date: August 28, 2022

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
OCP DAK-3.5 (weighted)	SN: 1249	20-Oct-21 (OCP-DAK3.5-1249_Oct21)	Oct-22
OCP DAK-12	SN: 1016	20-Oct-21 (OCP-DAK12-1016_Oct21)	Oct-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
DAE4	SN: 660	13-Oct-21 (No. DAE4-660_Oct21)	Oct-22
Reference Probe ES3DV2	SN: 3013	27-Dec-21 (No. ES3-3013_Dec21)	Dec-22

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-20)	In house check: Oct-22

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

Issued: August 30, 2022

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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Accreditation No.: SCS 0108

Glossary

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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