

# A Test Lab Techno Corp.

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## SAR EVALUATION REPORT

Test Report No.	: 1805FS12-01
Applicant	: SHENZHEN PANODUX IMAGE TECHNOLOGY CO.,LTD
Product Type	: Panoramic camera
Trade Name	: Unicornis
Model Number	: Unicornis360
Date of Received	: Dec. 20, 2017
Test Period	: Apr. 25 ~ Apr. 27, 2018
Date of Issued	: May 15, 2018
Test Environment	: Ambient Temperature : $22 \pm 2^{\circ} \text{C}$ Relative Humidity : 40 - 70 %
Standard	: ANSI/IEEE C95.1-1995 / IEEE Std. 1528-2013 47 CFR Part §2.1093 KDB 865664 D01 v01r04 / KDB 865664 D02 v01r02 KDB 447498 D01 v06 / KDB 248227 D01 v02r02
Test Lab Location	: Chang-an Lab
Test Firm MRA designation number	: TW0010



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2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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Approved By : Yung-Tan Tsai

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Tested By : Eric Chao

(Eric Chao)



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## 1. Summary of Maximum Reported SAR Value

Equipment Class	Mode	Highest Reported
		Extremity standalone SAR <sub>10g</sub> (W/kg)
NII	5GHz U-NII-1	3.3
Highest Simultaneous Transmission SAR		Extremity SAR <sub>10g</sub> (W/kg)
test position side1		3.3

NOTE: 1. The SAR limit (Extremity: SAR<sub>10g</sub> 4.0 W/kg) for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1995



## 2. Description of Equipment under Test (EUT)

Applicant	SHENZHEN PANODUX IMAGE TECHNOLOGY CO.,LTD Room 201,building A,Qian wan Road 1,No.1,Qianhai Shenzhen Hong Kong cooperation zone,ShenZhen City	
Manufacture	GUANGDONG LITE ARRAY CO.,ltd Galaxy Industrial Area,QingXi,Dongguan,Guangdong	
Product Type	Panoramic camera	
Trade Name	Unicornis	
Model Number	Unicornis360	
FCC ID	2AORDUNICORNIS360	
RF Function	Operate Bands	Operate Frequency (MHz)
	IEEE 802.11a UNII Band I	5180 - 5240
	IEEE 802.11ac / 802.11n 5GHz 20MHz UNII Band I	5180 - 5240
	IEEE 802.11ac / 802.11n 5GHz 40MHz UNII Band I	5190 - 5230
	IEEE 802.11ac 80MHz UNII Band I	5210
Antenna Type	FPCB Antenna	
Battery Option	Standard	
	Trade Name: SHENZHEN Utility Power Source CO.,LTD Model: M1 Spec: DC 7.4 V / 6400mAh	
Device Category	Portable Device	
Application Type	Certification	

Note:The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

### 3. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user of **SHENZHEN PANODUX IMAGE TECHNOLOGY CO.,LTD Trade Name : Unicornis Model(s) : Unicornis360**. The test procedures, as described in American National Standards, Institute C95.1-1999 [ 1 ] were employed and they specify the maximum exposure limit of 1.6mW/g as averaged over any 1 gram of tissue for portable devices being used within 20cm between user and EUT in the uncontrolled environment. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment used are included within this test report.

#### 3.1 SAR Definition

Specific Absorption Rate (SAR) 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 ( $\rho$ ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Figure 2).

$$\text{SAR} = \frac{d}{dt} \left( \frac{dw}{dm} \right) = \frac{d}{dt} \left( \frac{dw}{\rho dv} \right)$$

Figure 2. SAR Mathematical Equation

SAR is expressed in units of Watts per kilogram (W/kg)

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

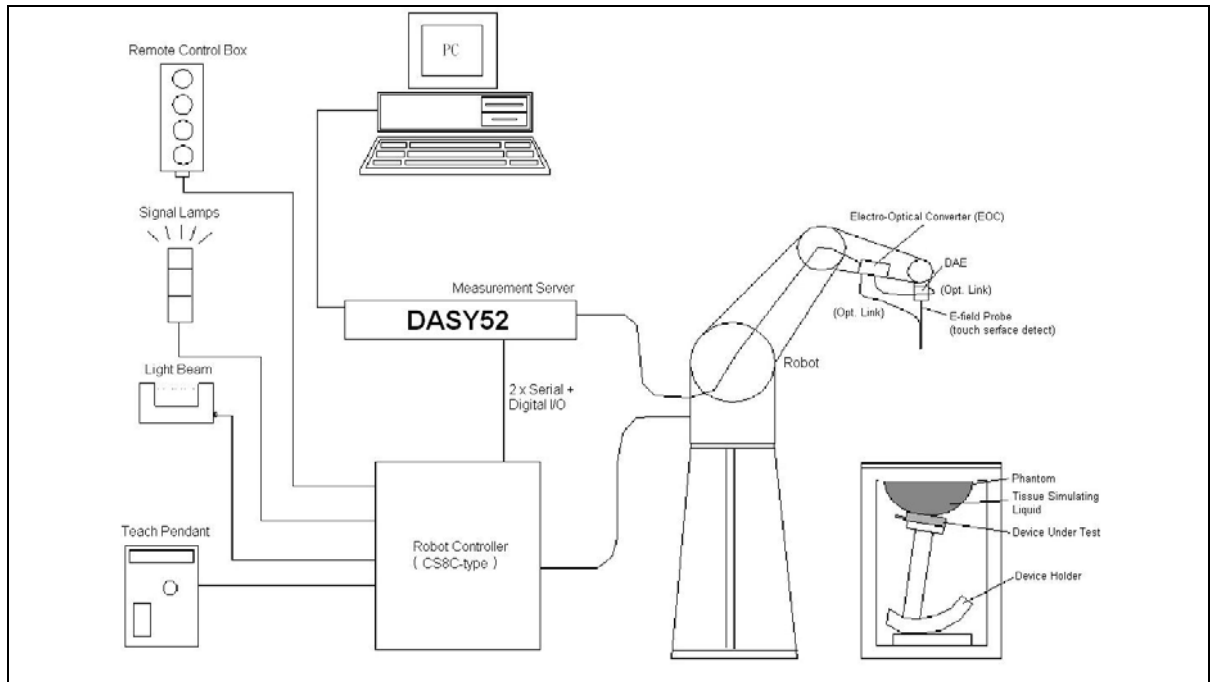
Where :

- $\sigma$  = conductivity of the tissue (S/m)
- $\rho$  = mass density of the tissue (kg/m<sup>3</sup>)
- $E$  = RMS electric field strength (V/m)

\*Note :

The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane [ 2 ]

## 4. SAR Measurement Setup



The DASY52 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 2000 or Windows XP.
7. DASY52 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. Validation dipole kits allowing validating the proper functioning of the system.

## 4.1 DASY E-Field Probe System

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration [ 3 ] 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. 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 DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

### 4.1.1 E-Field Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in brain tissue (rotation around probe axis) $\pm 0.5$ dB in brain tissue (rotation normal probe axis)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

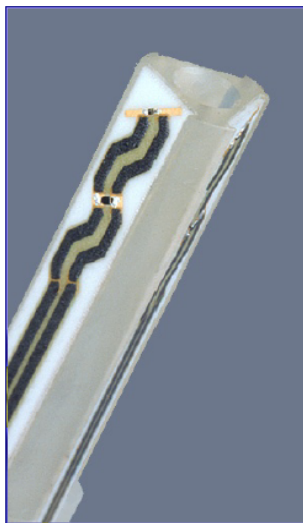


Figure 3. E-field Probe



Figure 4. Probe setup on robot



#### 4.1.2 E-Field Probe Calibration process

##### Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm<sup>2</sup>) using an RF Signal generator, TEM cell, and RF Power Meter.

##### Free Space Assessment

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

##### Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the 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 (head or body),

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

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

Where :

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).





## 4.2 Data Acquisition Electronic (DAE) System

Model : DAE3, DAE4  
Construction : Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.  
Measurement Range : -100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)  
Input Offset Voltage : < 5 $\mu$ V (with auto zero)  
Input Bias Current : < 50 fA  
Dimensions : 60 x 60 x 68 mm

## 4.3 Robot

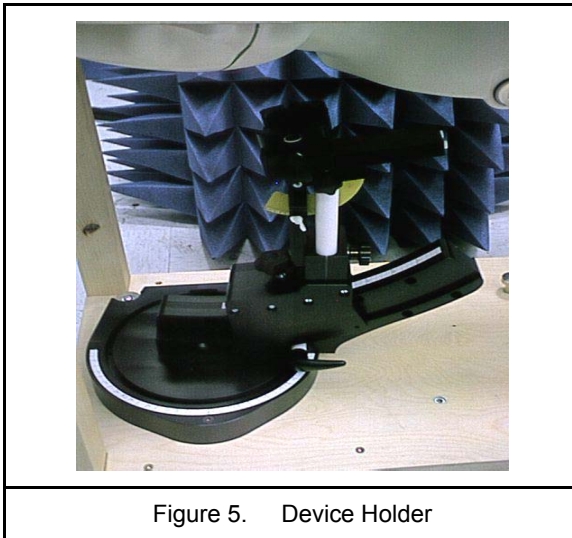
Positioner : Stäubli Unimation Corp. Robot Model: TX90XL  
Repeatability :  $\pm 0.02$  mm  
No. of Axis : 6

## 4.4 Measurement Server

Processor : PC/104 with a 400MHz intel ULV Celeron  
I/O-board : Link to DAE4 (or DAE3)  
16-bit A/D converter for surface detection system  
Digital I/O interface  
Serial link to robot  
Direct emergency stop output for robot

#### 4.5 Device Holder

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon=3$  and loss tangent  $\delta=0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



#### 4.6 Oval Flat Phantom - ELI 4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (Oval Flat) phantom defined in IEEE 1528-2013, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of wireless portable device usage as well as body mounted usage at the flat phantom region. A cover prevents 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 with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 30 liters
Dimensions	190×600×400 mm (H×L×W)
Table 1. Specification of ELI 4.0	

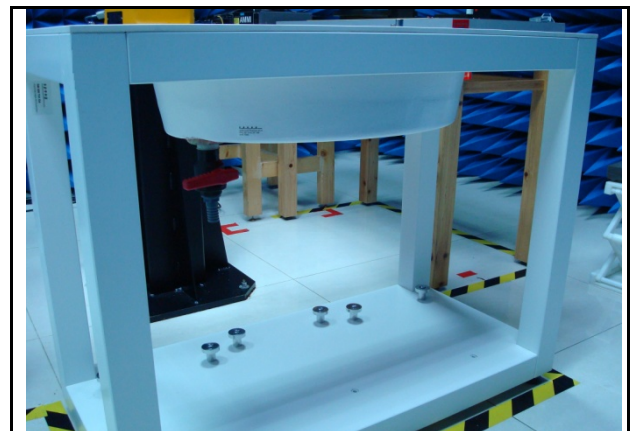


Figure 6. Oval Flat Phantom



## 4.7 Data Storage and Evaluation

### 4.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension DA4 or DA5. The post processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

### 4.7.2 Data Evaluation

The DASY post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software :

- Probe parameters : - Sensitivity  $Norm_i, ai0, ai1, ai2$   
- Conversion factor  $ConvFi$   
- Diode compression point  $dcp_i$
- Device parameters : - Frequency  $f$   
- Crest factor  $cf$
- Media parameters : - Conductivity  $\sigma$   
- Density  $\rho$

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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 as :

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

- 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 :

$$E\text{-field probes : } E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H\text{-field probes : } H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

- 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 enhancement in solution
- $a_{ij}$  = sensor sensitivity factors for H-field probes
- $f$  = carrier frequency [GHz]
- $E_i$  = electric field strength of channel i in V/m
- $H_i$  = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian 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 mW/g
- $E_{tot}$  = total field strength in V/m
- $\sigma$  = conductivity in [mho/m] or [Siemens/m]
- $\rho$  = equivalent tissue density in g/cm<sup>3</sup>

\* Note : That the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

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

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = \frac{H_{tot}^2}{37.7}$$

- with  $P_{pwe}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>
- $E_{tot}$  = total electric field strength in V/m
- $H_{tot}$  = total magnetic field strength in A/m



## 5. Tissue Simulating Liquids

The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

### IEEE SCC-34/SC-2 in 1528 recommended Tissue Dielectric Parameters

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in human head. Other head and body tissue parameters that have not been specified in 1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equation and extrapolated according to the head parameter specified in 1528.

Target Frequency	Head		Body	
(MHz)	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 - 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(  $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho = 1000 \text{ kg/m}^3$  )

Table 2. Tissue dielectric parameters for head and body phantoms



## 5.1 Ingredients

The following ingredients are used:

- Water: deionized water (pure H<sub>2</sub>O), resistivity  $\geq 16 \text{ M } \Omega$  -as basis for the liquid
- Sugar: refined white sugar (typically 99.7 % sucrose, available as crystal sugar in food shops)  
-to reduce relative permittivity
- Salt: pure NaCl -to increase conductivity
- Cellulose: Hydroxyethyl-cellulose, medium viscosity (75-125 mPa.s, 2% in water, 20 °C), CAS # 54290 -to increase viscosity and to keep sugar in solution.
- Preservative: Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 -to prevent the spread of bacteria and molds
- DGBE: Diethylenglycol-monobutyl ether (DGBE), Fluka Chemie GmbH, CAS # 112-34-5 -to reduce relative permittivity

## 5.2 Recipes

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands.

Note: The goal dielectric parameters (at 22 °C) must be achieved within a tolerance of  $\pm 5\%$  for  $\epsilon$  and  $\pm 5\%$  for  $\sigma$ .

Ingredients (% by weight)	Frequency (MHz)												Frequency (GHz)	
	750		835		1750		1900		2450		2600		5GHz	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	39.28	51.30	41.45	52.40	54.50	40.20	54.90	40.40	62.70	73.20	60.30	71.40	65.5	78.6
Salt (NaCl)	1.47	1.42	1.45	1.50	0.17	0.49	0.18	0.50	0.50	0.10	0.60	0.20	0.00	0.00
Sugar	58.15	46.18	56.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEC	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bactericide	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.2	10.7
DGBE	0.00	0.00	0.00	0.00	45.33	59.31	44.92	59.10	36.80	26.70	39.10	28.40	0.00	0.00
Dielectric Constant	41.88	54.60	42.54	56.10	40.10	53.60	39.90	54.00	39.80	52.50	39.80	52.50	0.00	0.00
Conductivity (S/m)	0.90	0.97	0.91	0.95	1.39	1.49	1.42	1.45	1.88	1.78	1.88	1.78	0.00	0.00
Diethylene Glycol Mono-hexlether	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.3	10.7

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized,  $16 \text{ M } \Omega$  resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

### 5.3 Liquid Depth

According to KDB865664 ,the depth of tissue-equivalent liquid in a phantom must be  $\geq 15.0$  cm with  $\leq \pm 0.5$  cm variation for SAR measurements  $\leq 3$  GHz and  $\geq 10.0$  cm with  $\leq \pm 0.5$  cm variation for measurements  $> 3$  GHz.

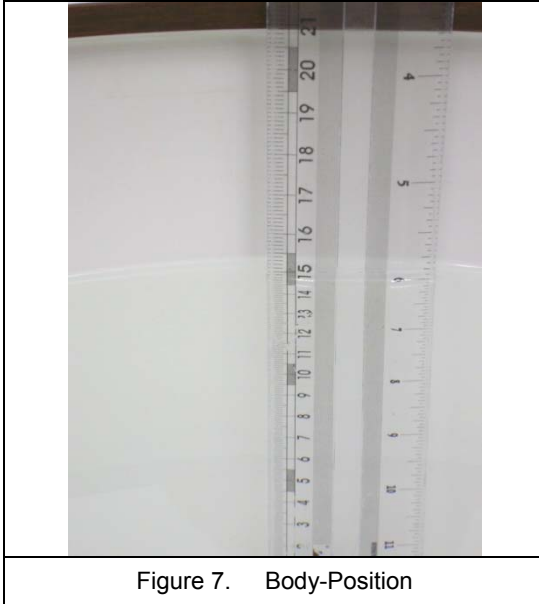


Figure 7. Body-Position



## 6. SAR Testing with RF Transmitters

### 6.1 SAR Testing with 802.11 Transmitters

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- $\leq 0.4$  W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- $> 0.4$  W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closest/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is  $\leq 0.8$  W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is  $> 0.8$  W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is  $\leq 1.2$  W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is  $\leq 1.2$  W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.



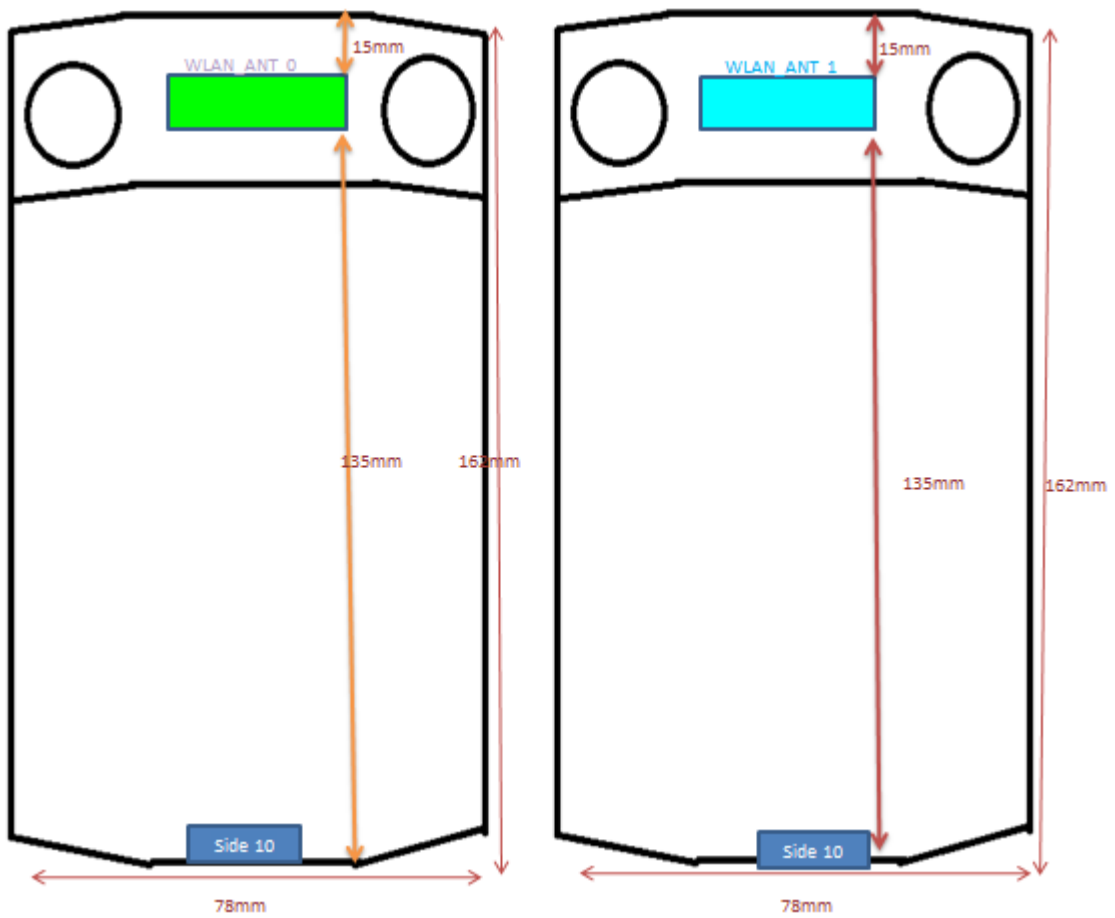


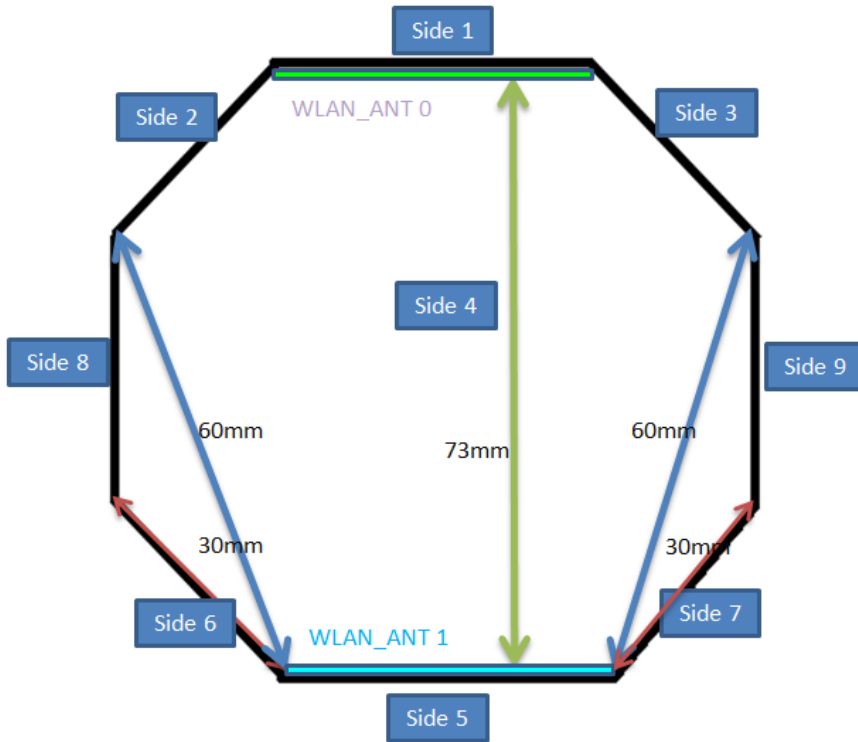
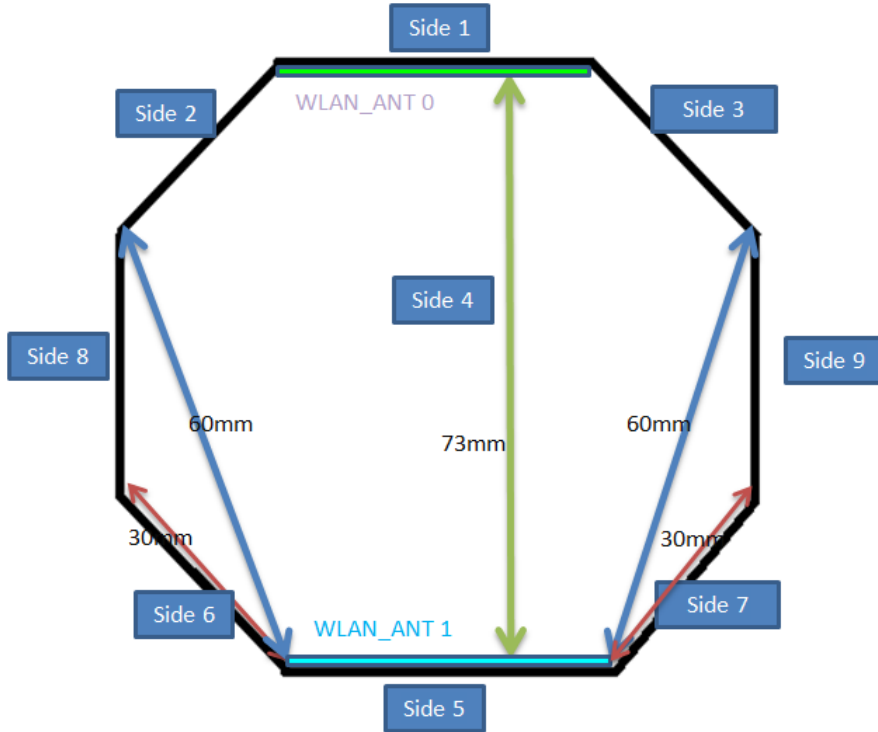
## 6.2 Conducted Power

Band	Data Rate	CH	Frequency (MHz)	Average Power (dBm)		
				ANT-0	ANT-1	ANT-0+1
IEEE 802.11a	6 M	36	5180.0	9.63	10.01	12.83
		40	5200.0	13.15	13.33	16.25
		44	5220.0	13.30	13.37	16.35
		48	5240.0	13.31	13.40	16.37
	54 M	36	5180.0	9.58	9.91	12.76
		40	5200.0	12.87	13.29	16.10
		44	5220.0	13.01	13.36	16.20
		48	5240.0	13.03	13.36	16.21
IEEE 802.11n 5GHz 20MHz	13 M	36	5180.0	9.50	9.79	12.66
		40	5200.0	12.32	12.78	15.57
		44	5220.0	12.04	12.87	15.49
		48	5240.0	12.13	12.70	15.43
	144.4 M	36	5180.0	4.13	4.28	7.22
		40	5200.0	12.10	12.55	15.34
		44	5220.0	11.82	12.66	15.27
		48	5240.0	11.91	12.46	15.20
IEEE 802.11n 5GHz 40MHz	27 M	38	5190.0	4.28	4.25	7.28
		46	5230.0	12.95	12.49	15.74
	300 M	38	5190.0	4.04	4.13	7.10
		46	5230.0	12.93	12.48	15.72
IEEE 802.11ac 80MHz	58.6 M	42	5210.0	2.03	2.46	5.26
	866.6 M	42	5210.0	1.94	2.32	5.14

### 6.3 Antenna location

Ant. Used	Band	Channel	Frequency (GHz)	Distance of Ant. To User (mm)									
				Side 1	Side 2	Side 3	Side 4	Side 5	Side 6	Side 7	Side 8	Side 9	Side 10
ANT-0	5GHz	48	5.24	5	5	5	15	73	60	60	30	30	135
ANT-1	5GHz	48	5.24	73	60	60	15	5	5	5	30	30	135







## 6.4 Stand-alone SAR Evaluate

Transmitter and antenna implementation as below:

Band	WLAN ANT
WLAN	V

Stand-alone transmission configurations as below:

Ant. Used	Band	Channel	Frequency	Tune-Power		Distance of Ant. To User (mm)									
			(GHz)	(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6	Side 7	Side 8	Side 9	Side 10
ANT-0	5GHz	48	5.24	13.5	22	5	5	5	15	73	60	60	30	30	135
ANT-1	5GHz	48	5.24	13.5	22	73	60	60	15	5	5	5	30	30	135

Ant. Used	Band	Channel	Frequency	Tune-Power		Calculated value and evaluated result									
			(GHz)	(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6	Side 7	Side 8	Side 9	Side 10
ANT-0	5GHz	48	5.24	13.5	22	YES	YES	YES	YES	NO	NO	NO	NO	NO	NO
ANT-1	5GHz	48	5.24	13.5	22	NO	NO	NO	YES	YES	YES	YES	NO	NO	NO

Note:

1. Calculated Value include string "mW", that is mean through compare output power with threshold, if the output power more than threshold value the SAR test should be perform. Otherwise, the SAR test could be exempt. (> 50mm).
2. Calculated Value only include number format, that is mean through compare output power with threshold, if the Calculated value more than 3, the SAR test should be perform. Otherwise, the SAR test could be exempt. (<50mm).
3. When an antenna qualifies for the standalone SAR test exclusion of KDB 447498 section 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to KDB 447498 section "4.3.2. Simultaneous transmission SAR test exclusion considerations b) ".
4. We used highest frequency and power, that result should be evaluated the worst case..
5. Power and distance are rounded to the nearest mW and mm before calculation..
6. The result is rounded to one decimal place for comparison.



## 6.5 Simultaneous Transmitting Evaluate

Simultaneous transmission configurations as below:

Condition	Side	Frequency Band	
		WLAN_ANT-0	WLAN_ANT-1
1	1	V	V
2	2	V	V
3	3	V	V
4	4	V	V
5	5	V	V
6	6	V	V
7	7	V	V
8	8	V	V
9	9	V	V
10	10	V	V

Note :

WLAN\_ANT-0 & WLAN\_ANT-1 simultaneous transmitting.

### Estimated SAR

Ant. Used	Band	Channel	Frequency (GHz)	Tune-Power		Distance of Ant. To User (mm)									
				(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6	Side 7	Side 8	Side 9	Side 10
WLAN_ANT-0	IEEE 802.11 a	48	5.240	13.5	22	---	---	---	---	0.092	0.112	0.112	0.224	0.224	0.05
WLAN_ANT-1	IEEE 802.11 a	48	5.240	13.5	22	0.092	0.112	0.112	---	---	---	---	0.224	0.224	0.05

Note:

1. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v06 based on the formula below.

i)  $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})^2 \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$

for *test separation distances* ≤ 50 mm; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.

ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.

iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.



### 6.5.1 Sum of 10-g SAR of all simultaneously transmitting

When the sum of 10-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of 10-g SAR of summary as below:

Phantom Position	Spacing (mm)	ASSY	WLAN ANT-0		WLAN ANT-1		$\Sigma$ SAR <sub>10g</sub> (W/Kg)	Event	
			Band	SAR <sub>10g</sub> (W/Kg)	Band	SAR <sub>10g</sub> (W/Kg)			
Flat	Side 1	0	N/A	IEEE 802.11a	3.3	IEEE 802.11a	0.092*	3.392	<4.0
	Side 2	0	N/A	IEEE 802.11a	0.64	IEEE 802.11a	0.112*	0.752	<4.0
	Side 3	0	N/A	IEEE 802.11a	0.53	IEEE 802.11a	0.112*	0.642	<4.0
	Side 4	0	N/A	IEEE 802.11a	0.13	IEEE 802.11a	0.01	0.14	<4.0
	Side 5	0	N/A	IEEE 802.11a	0.092*	IEEE 802.11a	0.87	0.962	<4.0
	Side 6	0	N/A	IEEE 802.11a	0.112*	IEEE 802.11a	0.12	0.232	<4.0
	Side 7	0	N/A	IEEE 802.11a	0.112*	IEEE 802.11a	0.12	0.232	<4.0
	Side 8	0	N/A	IEEE 802.11a	0.224*	IEEE 802.11a	0.224*	0.448	<4.0
	Side 9	0	N/A	IEEE 802.11a	0.224*	IEEE 802.11a	0.224*	0.448	<4.0
	Side 10	0	N/A	IEEE 802.11a	0.05*	IEEE 802.11a	0.05*	0.1	<4.0

Note:

1. \*=Estimated SAR
2. When the sum of 10-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.



## 6.6 SAR test reduction according to KDB

General:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC, Supplement C [June 2001], IEEE1528-2013.
- All modes of operation were investigated, and worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plots.
- Batteries are fully charged for all readings.
- When the Channel's SAR 1g of maximum conducted power is  $> 0.8$  mW/g, low, middle and high channel are supposed to be tested.

KDB 447498:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to IEEE1528-2013.

KDB 865664:

- Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg.
- When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg.
- Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
- if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

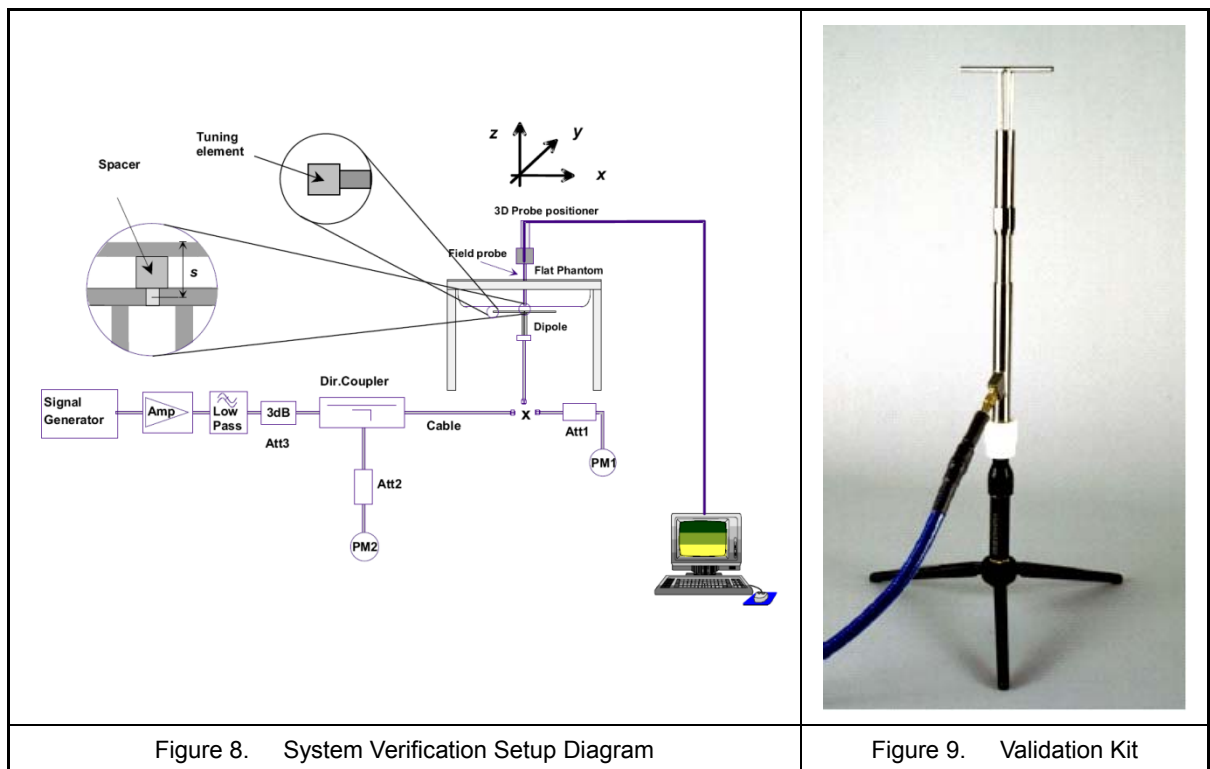
KDB 248227:

- Refer 6.1 SAR Testing with 802.11 Transmitters.

## 7. System Verification and Validation

### 7.1 Symmetric Dipoles for System Verification

Construction	Symmetrical dipole with 1/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	5250 MHz
Return Loss	> 20 dB at specified verification position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D5GHzV2: dipole length 20.6 mm; overall height 300 mm







## 7.2 Liquid Parameters

In order to comply with the target values of IEC 62209-2, we carry the same decimal place as the target value and provide it in the report. Because the gap between the values is very small, so it look same after the carry in some coefficients.

Liquid Verify								
Ambient Temperature : 22 ± 2 °C ; Relative Humidity : 40 -70%								
Liquid Type	Frequency	Temp (°C)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
5250MHz (Body)	5150MHz	22	$\epsilon_r$	49.08	50.69	3.26%	±5%	Apr. 25, 2018
			$\sigma$	5.241	5.122	-2.29%	±5%	
	5200MHz	22	$\epsilon_r$	49.01	50.58	3.27%	±5%	
			$\sigma$	5.299	5.202	-1.89%	±5%	
	5250MHz	22	$\epsilon_r$	48.95	50.46	3.27%	±5%	
			$\sigma$	5.358	5.281	-1.49%	±5%	
5250MHz (Body)	5150MHz	22	$\epsilon_r$	49.08	50.56	3.06%	±5%	Apr. 26, 2018
			$\sigma$	5.241	5.160	-1.53%	±5%	
	5200MHz	22	$\epsilon_r$	49.01	50.45	2.86%	±5%	
			$\sigma$	5.299	5.202	-1.89%	±5%	
	5250MHz	22	$\epsilon_r$	48.95	50.32	2.86%	±5%	
			$\sigma$	5.358	5.300	-1.12%	±5%	
5250MHz (Body)	5150MHz	22	$\epsilon_r$	49.08	50.44	2.65%	±5%	Apr. 27, 2018
			$\sigma$	5.241	5.148	-1.72%	±5%	
	5200MHz	22	$\epsilon_r$	49.01	50.33	2.65%	±5%	
			$\sigma$	5.299	5.189	-2.08%	±5%	
	5250MHz	22	$\epsilon_r$	48.95	50.20	2.66%	±5%	
			$\sigma$	5.358	5.287	-1.31%	±5%	

Table 3. Measured Tissue dielectric parameters for body phantoms -3



### 7.3 Verification Summary

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 10\%$ . The verification was performed at 5250MHz.

Mixture Type	Frequency (MHz)	Power	SAR <sub>1g</sub> (W/Kg)	SAR <sub>10g</sub> (W/Kg)	Drift (dB)	Difference percentage		Probe Model / Serial No.	Dipole Model / Serial No.	1W Target		Date
						1g	10g			SAR <sub>1g</sub> (W/Kg)	SAR <sub>10g</sub> (W/Kg)	
Body	5250 (Body)	100 mW	6.85	2.1	-0.15	-8.5%	0.5%	EX3DV4 7346	D5GHzV2 1244	74.9	20.9	Apr. 25, 2018
		Normalize to 1 Watt	68.5	21								
Body	5250 (Body)	100 mW	7.03	2.19	-0.12	-6.1%	4.8%	EX3DV4 7346	D5GHzV2 1244	74.9	20.9	Apr. 26, 2018
		Normalize to 1 Watt	70.3	21.9								
Body	5250 (Body)	100 mW	7.06	2.17	-0.14	-5.7%	3.8%	EX3DV4 7346	D5GHzV2 1244	74.9	20.9	Apr. 27, 2018
		Normalize to 1 Watt	70.6	21.7								



## 7.4 Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2013 and FCC KDB 865664 D01v01r04. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

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

Probe Type Model / Serial No.	Prob Cal. Point (MHz)	Head / Body	Cond.	Perm.	CW Validation			Mod. Validation			Date
			$\epsilon_r$	$\sigma$	Sensitivity	Probe	Probe	Mod. Type	Duty Factor	PAR	
						Linearity	Isotropy				
EX3DV4 SN:7346	5250	Body	50.456	5.281	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 25, 2018
EX3DV4 SN:7346	5180	Body	50.626	5.169	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 25, 2018
EX3DV4 SN:7346	5200	Body	50.581	5.202	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 25, 2018
EX3DV4 SN:7346	5220	Body	50.533	5.232	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 25, 2018
EX3DV4 SN:7346	5240	Body	50.483	5.264	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 25, 2018
EX3DV4 SN:7346	5250	Body	50.317	5.3	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 26, 2018
EX3DV4 SN:7346	5180	Body	50.494	5.175	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 26, 2018
EX3DV4 SN:7346	5200	Body	50.446	5.202	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 26, 2018
EX3DV4 SN:7346	5220	Body	50.355	5.242	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 26, 2018
EX3DV4 SN:7346	5240	Body	50.313	5.277	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 26, 2018
EX3DV4 SN:7346	5250	Body	50.197	5.287	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 27, 2018
EX3DV4 SN:7346	5180	Body	50.374	5.163	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 27, 2018
EX3DV4 SN:7346	5200	Body	50.325	5.189	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 27, 2018
EX3DV4 SN:7346	5220	Body	50.235	5.23	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 27, 2018
EX3DV4 SN:7346	5240	Body	50.193	5.265	Pass	Pass	Pass	QPSK	Pass	N/A	Apr. 27, 2018



## 8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Cal. Date	Cal.Period
SPEAG	5GHz System Validation Kit	D5GHzV2	1244	10/26/2017	1 year
SPEAG	Dosimetric E-Field Probe	EX3DV4	7346	02/28/2018	1 year
SPEAG	Data Acquisition Electronics	DAE4	916	12/14/2017	1 year
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	
SPEAG	Device Holder	N/A	N/A	NCR	
SPEAG	Phantom	ELI V4.0	1036	NCR	
SPEAG	Robot	Staubli TX90XL	F07/564ZA1/A/01	NCR	
SPEAG	Software	DASY52 V52.8 (8)	N/A	NCR	
SPEAG	Software	SEMCAD X V14.6.10(7331)	N/A	NCR	
R&S	Wireless Communication Test Set	CMU200	112387	03/08/2018	1 year
Anritsu	Radio Communication Analyzer	MT8820C	6201342039	12/10/2017	1 year
Agilent	ENA Series Network Analyzer	E5071B	MY42404655	04/13/2017	2 year
Agilent	Dielectric Probe Kit	85070C	US99360094	NCR	
HILA	Digital Thermometer	TM-906	GF-006	08/17/2017	1 year
Agilent	Power Sensor	8481H	3318A20779	06/07/2017	1 year
Agilent	Power Meter	EDM Series E4418B	GB40206143	06/07/2017	1 year
Agilent	Signal Generator	E8257D	MY53050382	03/08/2018	1 year
Agilent	Dual Directional Coupler	778D	50334	NCR	
Woken	Dual Directional Coupler	0100AZ20200801O	11012409517	NCR	
Mini-Circuits	Power Amplifier	ZHL-42W-SMA	D111103#5	NCR	
Mini-Circuits	Power Amplifier	ZVE-8G-SMA	D042005 671800514	NCR	
Aisi	Attenuator	IEAT 3dB	N/A	NCR	

Table 1. Test Equipment List



## 9. **Measurement Uncertainty**

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR<sub>10g</sub> to be less than  $\pm 21.31\%$  for 300MHz ~3GHz and 3GHz ~ 6GHz  $\pm 25.29\%$  [ 8 ] .

According to Std. C95.3 [ 9 ], the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of  $\pm 1$  to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least  $\pm 2$ dB can be expected.

Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	$c_i$ (1g)	$c_i$ (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	$v_i$ or $V_{eff}$
Measurement System									
u1	Probe Calibration ( $k=1$ )	±6.0%	Normal	1	1	1	±6.0%	±6.0%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.3%	Normal	1	1	1	±0.3%	±0.3%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±1.9%	Rectangular	$\sqrt{3}$	1	1	±1.1%	±1.1%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.4%	Rectangular	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
u13	Probe Positioning with respect to Phantom Shell	±2.9%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty ( shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±10.88%	±10.66%	313
Expanded uncertainty (95% CONFIDENCE LEVEL )			$k=2$				±21.76%	±21.31%	

Table 2. Uncertainty Budget for frequency range 300MHz to 3GHz



Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	$c_i$ (1g)	$c_i$ (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	$V_i$ or $V_{eff}$
Measurement System									
u1	Probe Calibration ( $k=1$ )	±6.5%	Normal	1	1	1	±6.5%	±6.5%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±2.0%	Rectangular	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.0%	Normal	1	1	1	±0.0%	±0.0%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±2.8%	Rectangular	$\sqrt{3}$	1	1	±2.8%	±2.8%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.7%	Rectangular	$\sqrt{3}$	1	1	±0.7%	±0.7%	∞
u13	Probe Positioning with respect to Phantom Shell	±9.9%	Rectangular	$\sqrt{3}$	1	1	±5.7%	±5.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty ( shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±12.84%	±12.65%	313
Expanded uncertainty (95% CONFIDENCE LEVEL )			$k=2$				±25.68%	±25.29%	

Table 3. Uncertainty Budget for frequency range 3GHz to 6GHz



## 10. Measurement Procedure

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

### 10.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages

1. Extraction of the measured data (grid and values) from the Zoom Scan
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. Generation of a high-resolution mesh within the measured volume
4. Interpolation of all measured values from the measurement grid to the high-resolution grid
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. Calculation of the averaged SAR within masses of 1g and 10g





## 10.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Grid Type	Frequency		Step size (mm)			X*Y*Z (Point)	Cube size			Step size		
			X	Y	Z		X	Y	Z	X	Y	Z
uniform grid	≤ 3GHz	≤ 2GHz	≤ 8	≤ 8	≤ 5	5*5*7	32	32	30	8	8	5
		2G - 3G	≤ 5	≤ 5	≤ 5	7*7*7	30	30	30	5	5	5
	3 - 6GHz	3 - 4GHz	≤ 5	≤ 5	≤ 4	7*7*8	30	30	28	5	5	4
		4 - 5GHz	≤ 4	≤ 4	≤ 3	8*8*10	28	28	27	4	4	3
		5 - 6GHz	≤ 4	≤ 4	≤ 2	8*8*12	28	28	22	4	4	2

(Our measure settings are refer KDB Publication 865664 D01v01r04)

## 10.3 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

## 10.4 SAR Averaged Methods

In DASYS, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

## 10.5 Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASYS measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.



## **11. SAR Test Results Summary**

1. A This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4.0 for limb-worn 10g SAR ) specified in FCC 47 CFR part 2(2.1093) and ANSI/IEEE C95.1-1992,and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 AND FCC KDB publications
2. The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band.
3. SAR for the initial test configuration is measured using the highest maximum output power channel.
4. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is not required when the measured SAR is < 0.8W/kg. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

### **11.1 Head SAR Measurement**

Evaluated head SAR is not available.

### **11.2 Body SAR Measurement**

Evaluated body SAR is not available.

### **11.3 Hot-spot mode SAR Measurement**

Hot-spot mode SAR is not available.



## 11.4 Extremity SAR Measurement

Index.	Band	Frequency		Data Rate	Test Position	Spacing (mm)	Remark	Accessory	SAR <sub>10g</sub> (W/kg)	Burst Avg Power	Max tune-up	Reported SAR <sub>10g</sub> (W/kg)
		Ch	MHz									
#2	IEEE 802.11a	36	5180.0	6M	Side1	0	ANT-0	---	1.17	9.693	10.5	1.41
#3	IEEE 802.11a	40	5200.0	6M	Side1	0	ANT-0	---	2.98	13.15	13.5	3.23
#4	IEEE 802.11a	44	5220.0	6M	Side1	0	ANT-0	---	3.15	13.3	13.5	3.30
#1	IEEE 802.11a	48	5240.0	6M	Side1	0	ANT-0	---	3.14	13.31	13.5	3.28
#9	IEEE 802.11a	48	5240.0	6M	Side2	0	ANT-0	---	0.612	13.31	13.5	0.64
#10	IEEE 802.11a	48	5240.0	6M	Side3	0	ANT-0	---	0.508	13.31	13.5	0.53
#11	IEEE 802.11a	48	5240.0	6M	Side4	0	ANT-0	---	0.124	13.31	13.5	0.13
#12	IEEE 802.11a	48	5240.0	6M	Side1	0	ANT-0	microphone	3.12	13.31	13.5	3.26
#13	IEEE 802.11a	48	5240.0	6M	Side1	0	ANT-0	base	2.85	13.31	13.5	2.98
#5	IEEE 802.11a	48	5240.0	6M	Side5	0	ANT-1	---	0.845	13.4	13.5	0.87
#6	IEEE 802.11a	48	5240.0	6M	Side6	0	ANT-1	---	0.118	13.4	13.5	0.12
#7	IEEE 802.11a	48	5240.0	6M	Side7	0	ANT-1	---	0.112	13.4	13.5	0.12
#8	IEEE 802.11a	48	5240.0	6M	Side4	0	ANT-1	---	0.012	13.4	13.5	0.01
#14	IEEE 802.11a	48	5240.0	6M	Side5	0	ANT-1	microphone	0.849	13.4	13.5	0.87
#15	IEEE 802.11a	48	5240.0	6M	Side5	0	ANT-1	base	0.728	13.4	13.5	0.75



## 11.5 SAR Variability Measurement

Detailed evaluations please refer KDB 865664 on "SAR test reduction according to KDB" section.

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1. The original highest measured Reported SAR 1g is  $\geq 0.80$  W/kg, repeat that measurement once.
2. Perform a second repeated measurement the ratio of largest to smallest SAR for the original and first repeated measurements is  $< 1.2$ , the original or repeated measurement is  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
3. Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .
4. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

Index	Band	Frequency		Test Mode	Test Position	Spacing (mm)	Remark	Note	First SAR <sub>10g</sub> (W/Kg)	Second SAR <sub>10g</sub> (W/Kg)	Third SAR <sub>10g</sub> (W/Kg)	Third Ratio
		Ch.	MHz									
#16	IEEE 802.11a	44	5220.0	6M	side1	0	ANT-0	original #4_once	3.08	2.22%	---	---
#17	IEEE 802.11a	44	5220.0	6M	side1	0	ANT-0	original #4_twice	3.12	0.95%	---	---

- Note: 1. According KDB 447498 D01 V06 section 4.1.4, the "Reported" explanation as below:  
 "When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported."  
 2. If actual power less than tune-up power that Scaling SAR is required.  
 3. The formula of Reported SAR, that represent as below:  

$$\text{Reported SAR} = \text{Original SAR} * 10^{[(\text{Tune-up power} - \text{Actual power})/10]}$$



## 11.6 Std. C95.1-1992 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure ( W/kg ) or ( mW/g)	Occupational Controlled Exposure ( W/kg ) or ( mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Partial-Body)	1.60	8.00
Spatial Peak SAR**** (Hands / Feet / Ankle / Wrist )	4.00	20.00

Table 4. Safety Limits for Partial Body Exposure

### Notes :

- \* 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.
- \*\* The Spatial Average value of the SAR averaged over the whole – body.
- \*\*\* The Spatial Average value of the SAR averaged over the partial – body.
- \*\*\*\* 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.

**Population / Uncontrolled Environments** : are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**Occupational / 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).

## 12. References

- [1] Std. C95.1-1999, "American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz", New York.
- [2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.
- [3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.
- [4] K. Pokovi<sup>c</sup>, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.
- [5] K. Pokovi<sup>c</sup>, T. Schmid, and N. Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.
- [6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.
- [7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.
- [8] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.
- [9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.
- [10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.
- [11] IEEE Std 1528™-2013 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques

## Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2018/4/25 AM 11:16:37

System Performance Check at 5250MHz\_20180425\_Body

**DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1244**

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.281$  S/m;  $\epsilon_r = 50.456$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS2, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**System Performance Check at 5250MHz/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 13.2 W/kg

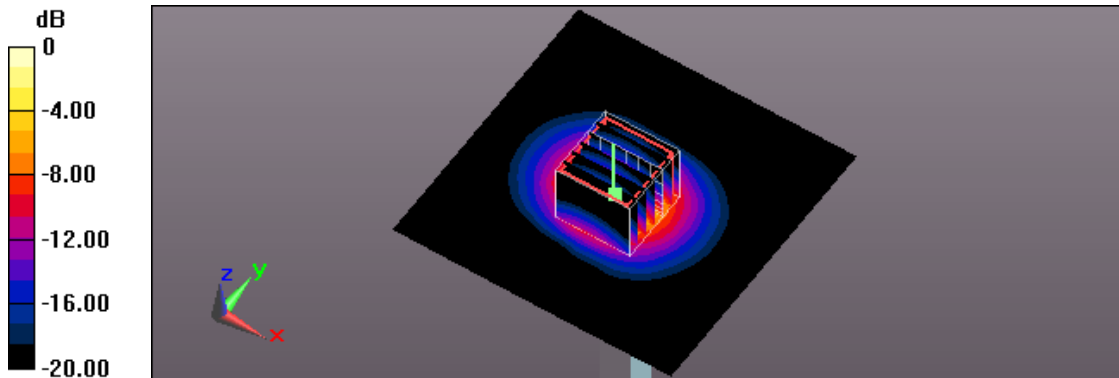
**System Performance Check at 5250MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 56.07 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 19.2 W/kg

**SAR(1 g) = 6.85 W/kg; SAR(10 g) = 2.1 W/kg**

Maximum value of SAR (measured) = 12.3 W/kg



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

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 AM 08:11:00  
 System Performance Check at 5250MHz\_20180426\_Body  
**DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1244**

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 5250 \text{ MHz}$ ;  $\sigma = 5.3 \text{ S/m}$ ;  $\epsilon_r = 50.317$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

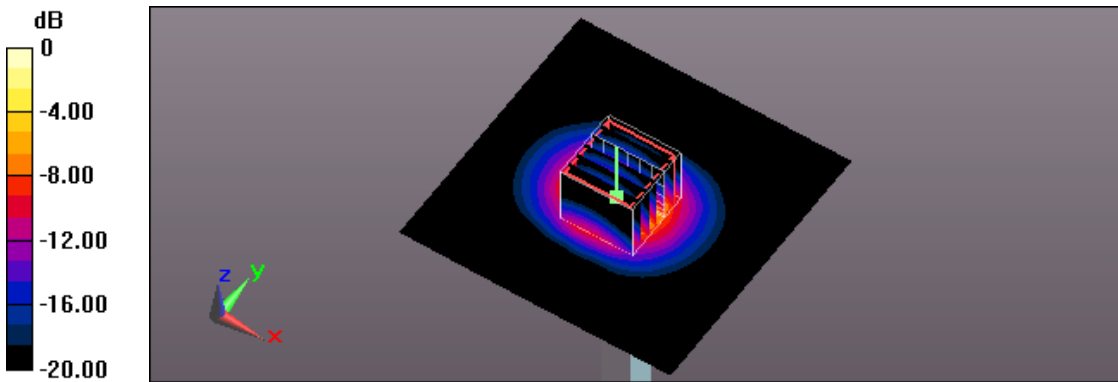
**System Performance Check at 5250MHz/Area Scan (91x91x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 12.0 W/kg

**System Performance Check at 5250MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 53.44 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 20.1 W/kg

**SAR(1 g) = 7.03 W/kg; SAR(10 g) = 2.19 W/kg**

Maximum value of SAR (measured) = 12.3 W/kg



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



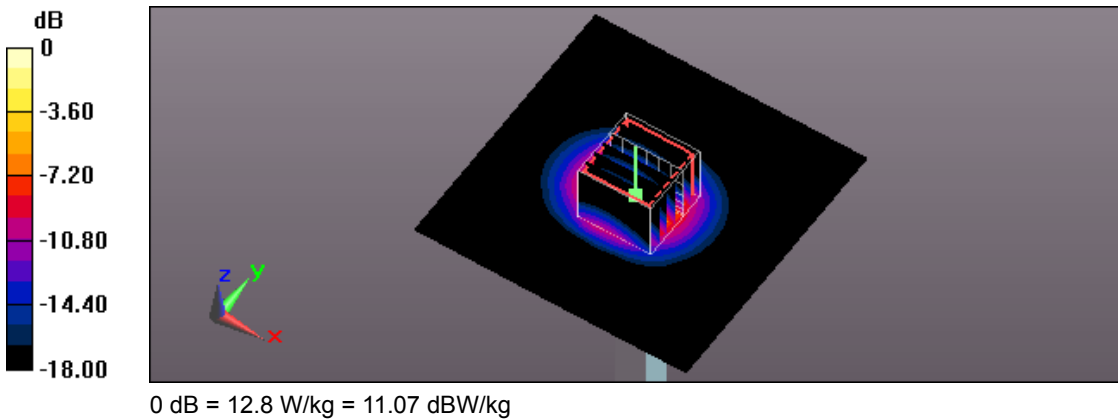
Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/27 AM 08:03:57  
 System Performance Check at 5250MHz\_20180427\_Body  
**DUT: Dipole 5GHzV2; Type: D5GHz; Serial: 1244**

Communication System: UID 0, CW (0); Frequency: 5250 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $f = 5250 \text{ MHz}$ ;  $\sigma = 5.287 \text{ S/m}$ ;  $\epsilon_r = 50.197$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**System Performance Check at 5250MHz/Area Scan (91x91x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 12.2 W/kg

**System Performance Check at 5250MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 53.74 V/m; Power Drift = -0.14 dB  
 Peak SAR (extrapolated) = 20.2 W/kg  
**SAR(1 g) = 7.06 W/kg; SAR(10 g) = 2.17 W/kg**  
 Maximum value of SAR (measured) = 12.8 W/kg



## Appendix B - SAR Measurement Data

Test Laboratory: A Test Lab Techno Corp.

Date/Time: 2018/4/26 AM 09:06:38

2\_ IEEE 802.11a CH36\_6M\_Side1\_0mm\_Ant 0

**DUT: Unicornis360; Type: Panoramic camera**

Communication System: UID 0, IEEE 802.11a (0); Frequency: 5180 MHz; Duty Cycle: 1:1.01042

Medium parameters used:  $f = 5180$  MHz;  $\sigma = 5.175$  S/m;  $\epsilon_r = 50.494$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS2, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000$  mm,  $dy=1.000$  mm

Maximum value of SAR (interpolated) = 7.13 W/kg

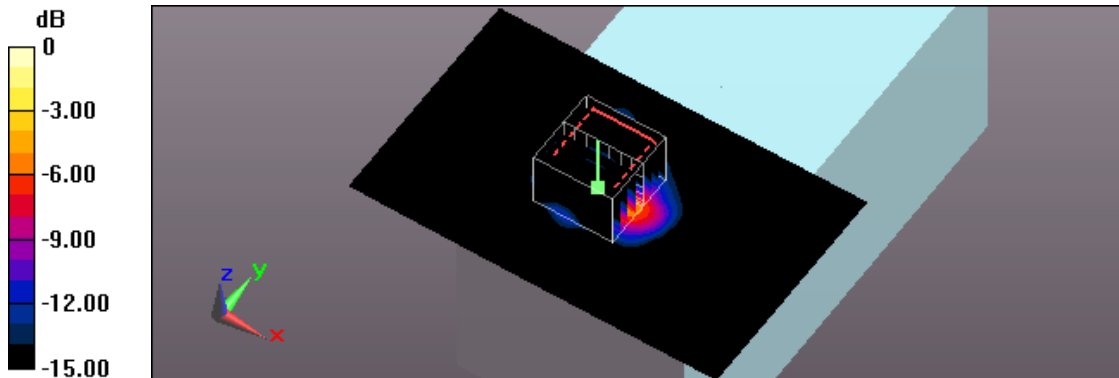
**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4$ mm,  $dy=4$ mm,  $dz=1.4$ mm

Reference Value = 24.07 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 11.8 W/kg

**SAR(1 g) = 3.91 W/kg; SAR(10 g) = 1.17 W/kg**

Maximum value of SAR (measured) = 6.83 W/kg



0 dB = 6.83 W/kg = 8.34 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 AM 09:41:28  
 3\_ IEEE 802.11a CH40\_6M\_Side1\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

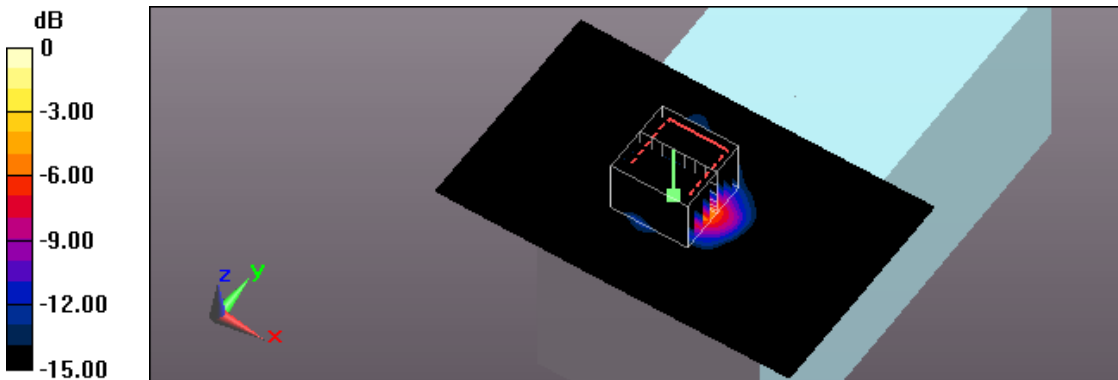
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5200 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 5.202 \text{ S/m}$ ;  $\epsilon_r = 50.446$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2007)  
 DASYS5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 18.3 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 39.14 V/m; Power Drift = -0.16 dB  
 Peak SAR (extrapolated) = 30.8 W/kg

**SAR(1 g) = 10 W/kg; SAR(10 g) = 2.98 W/kg**  
 Maximum value of SAR (measured) = 17.9 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 AM 10:16:29  
 4\_ IEEE 802.11a CH44\_6M\_Side1\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

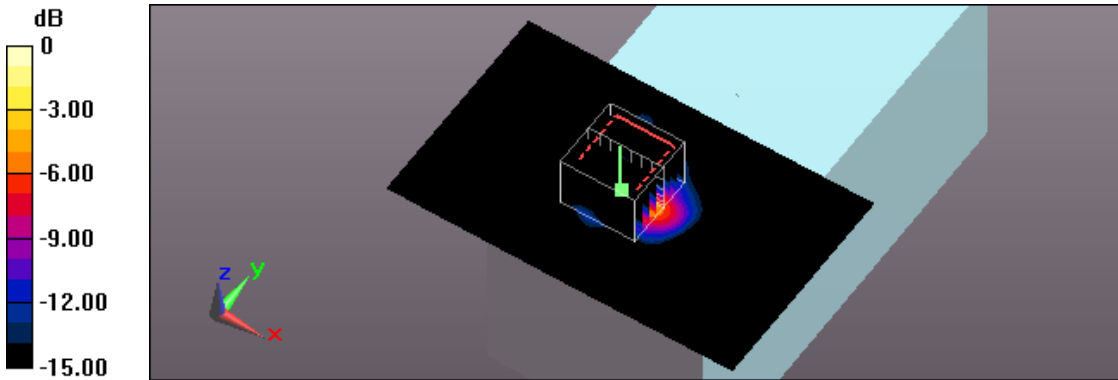
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5220 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used (interpolated):  $f = 5220 \text{ MHz}$ ;  $\sigma = 5.242 \text{ S/m}$ ;  $\epsilon_r = 50.355$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2007)  
 DASYS5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 19.7 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 38.76 V/m; Power Drift = -0.19 dB  
 Peak SAR (extrapolated) = 32.8 W/kg

**SAR(1 g) = 10.7 W/kg; SAR(10 g) = 3.15 W/kg**  
 Maximum value of SAR (measured) = 18.9 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/25 PM 04:51:39  
 1\_ IEEE 802.11a CH48\_6M\_Side1\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

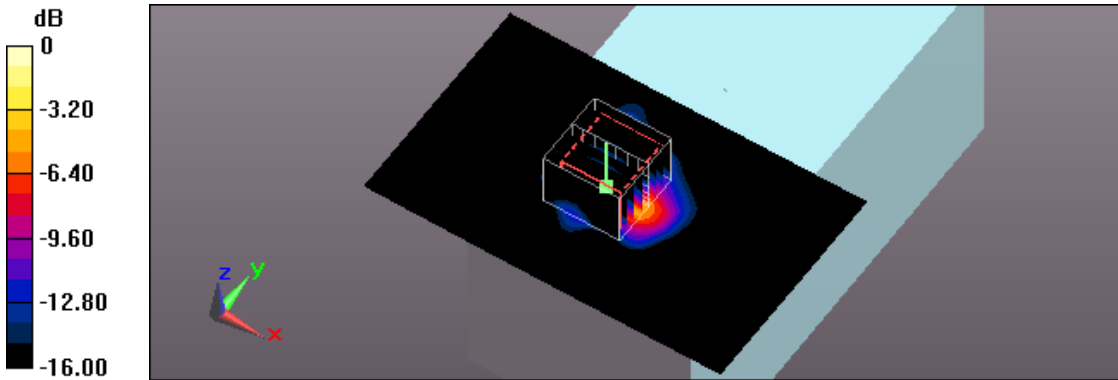
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.264 \text{ S/m}$ ;  $\epsilon_r = 50.483$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 20.2 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 40.83 V/m; Power Drift = -0.15 dB  
 Peak SAR (extrapolated) = 31.9 W/kg

**SAR(1 g) = 10.7 W/kg; SAR(10 g) = 3.14 W/kg**  
 Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 AM 10:56:20  
 9\_ IEEE 802.11a CH48\_6M\_Side2\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

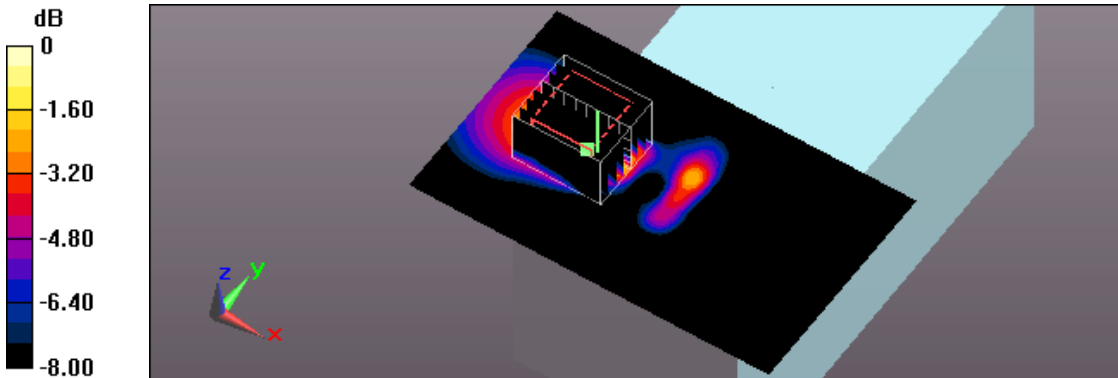
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 2.02 W/kg

**Flat/Zoom Scan (9x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 18.85 V/m; Power Drift = -0.09 dB  
 Peak SAR (extrapolated) = 2.82 W/kg

**SAR(1 g) = 1.33 W/kg; SAR(10 g) = 0.612 W/kg**  
 Maximum value of SAR (measured) = 1.87 W/kg



0 dB = 1.87 W/kg = 2.72 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 AM 11:35:10  
 10\_ IEEE 802.11a CH48\_6M\_Side3\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

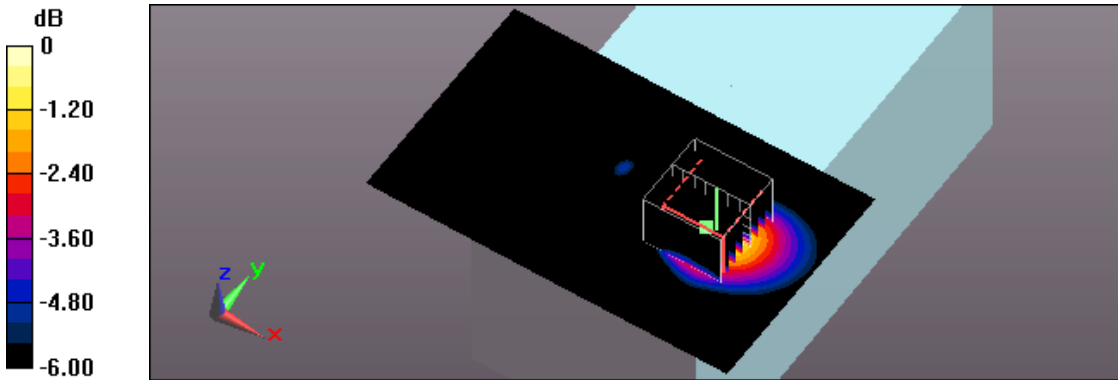
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 1.60 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 14.80 V/m; Power Drift = -0.06 dB  
 Peak SAR (extrapolated) = 2.33 W/kg

**SAR(1 g) = 1.07 W/kg; SAR(10 g) = 0.508 W/kg**  
 Maximum value of SAR (measured) = 1.49 W/kg



0 dB = 1.49 W/kg = 1.73 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 PM 01:16:11  
 11\_IEEE 802.11a CH48\_6M\_Side4\_0mm\_Ant 0  
**DUT: Unicornis360; Type: Panoramic camera**

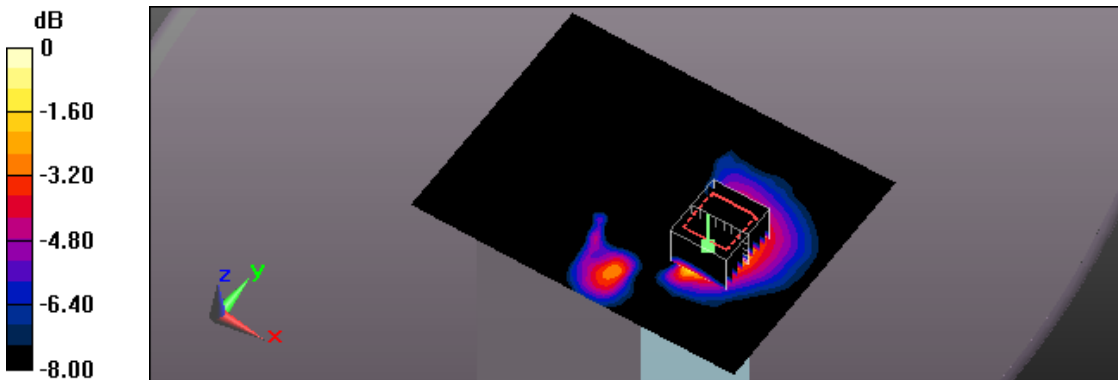
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (161x121x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.535 W/kg

**Flat/Zoom Scan (8x9x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 7.308 V/m; Power Drift = -0.02 dB  
 Peak SAR (extrapolated) = 0.620 W/kg

**SAR(1 g) = 0.280 W/kg; SAR(10 g) = 0.124 W/kg**  
 Maximum value of SAR (measured) = 0.404 W/kg



0 dB = 0.404 W/kg = -3.94 dBW/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 PM 02:40:54  
 12\_ IEEE 802.11a CH48\_6M\_Side1\_0mm\_Ant 0\_microphone  
**DUT: Unicornis360; Type: Panoramic camera**

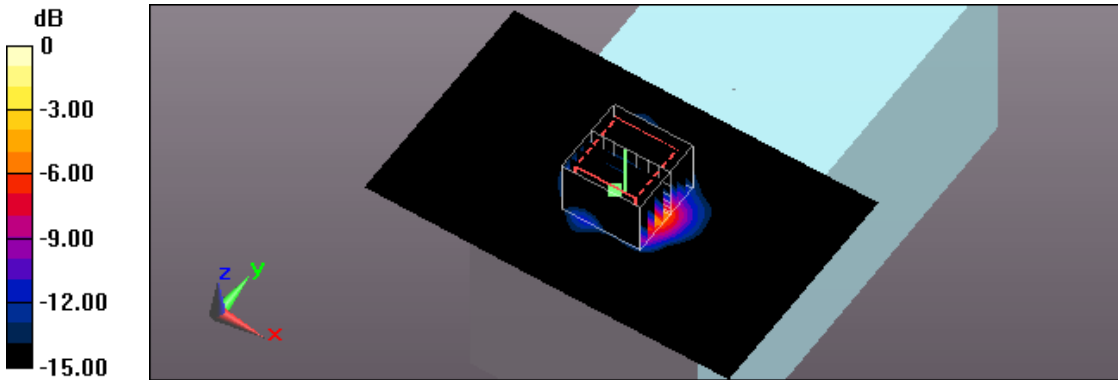
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2007)  
 DASYS5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 18.4 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 46.66 V/m; Power Drift = -0.12 dB  
 Peak SAR (extrapolated) = 31.8 W/kg

**SAR(1 g) = 10.5 W/kg; SAR(10 g) = 3.12 W/kg**  
 Maximum value of SAR (measured) = 17.2 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 PM 03:36:16  
 13\_IEEE 802.11a CH48\_6M\_Side1\_0mm\_Ant 0\_base  
**DUT: Unicornis360; Type: Panoramic camera**

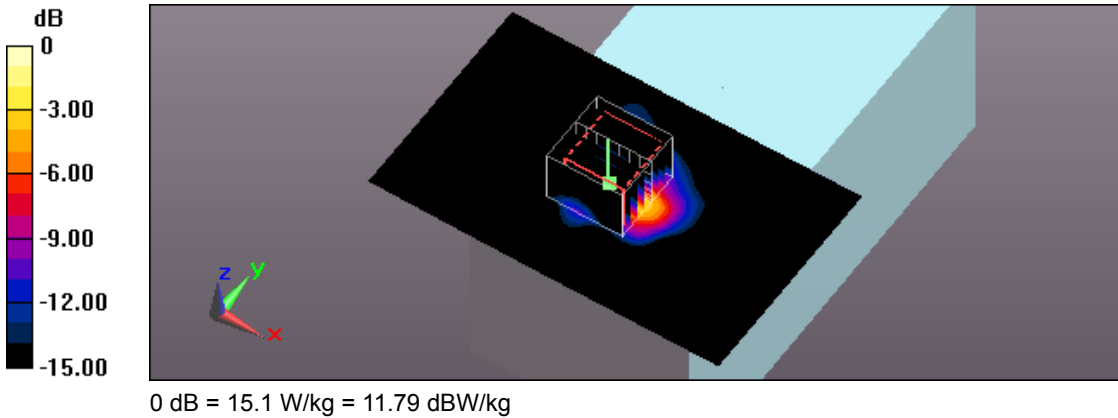
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 18.9 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 19.64 V/m; Power Drift = -0.08 dB  
 Peak SAR (extrapolated) = 27.2 W/kg

**SAR(1 g) = 9.26 W/kg; SAR(10 g) = 2.85 W/kg**  
 Maximum value of SAR (measured) = 15.1 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/25 PM 01:33:07  
 5\_ IEEE 802.11a CH48\_6M\_Side5\_0mm\_Ant 1  
**DUT: Unicornis360; Type: Panoramic camera**

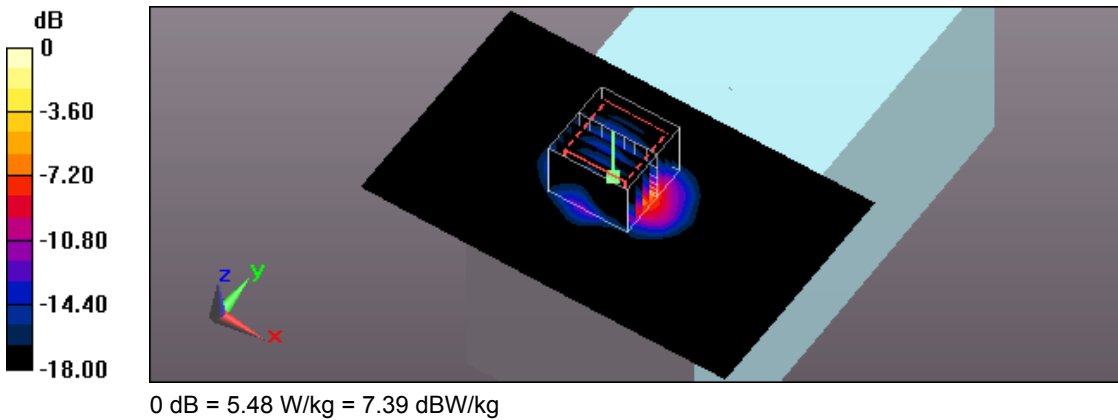
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.264 \text{ S/m}$ ;  $\epsilon_r = 50.483$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 4.44 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 16.16 V/m; Power Drift = -0.02 dB  
 Peak SAR (extrapolated) = 9.24 W/kg

**SAR(1 g) = 2.97 W/kg; SAR(10 g) = 0.845 W/kg**  
 Maximum value of SAR (measured) = 5.48 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/25 PM 02:08:37  
 6\_ IEEE 802.11a CH48\_6M\_Side6\_0mm\_Ant 1  
**DUT: Unicornis360; Type: Panoramic camera**

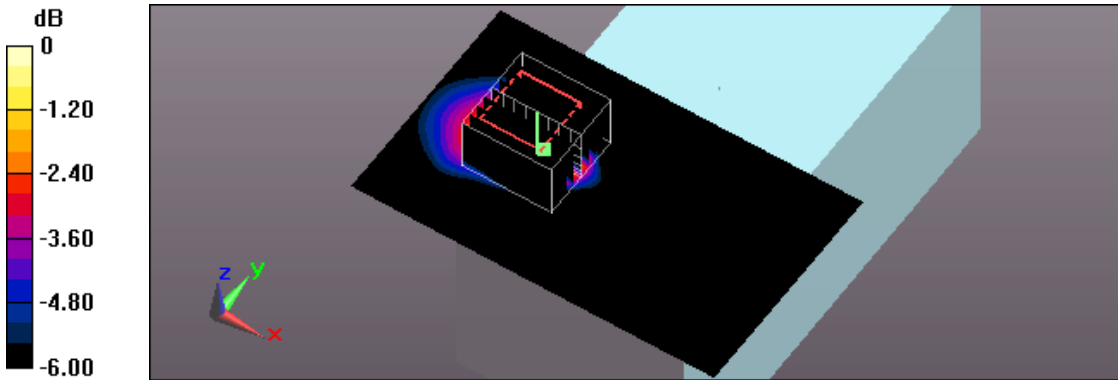
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.264 \text{ S/m}$ ;  $\epsilon_r = 50.483$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.352 W/kg

**Flat/Zoom Scan (9x9x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 6.722 V/m; Power Drift = -0.18 dB  
 Peak SAR (extrapolated) = 0.497 W/kg

**SAR(1 g) = 0.238 W/kg; SAR(10 g) = 0.118 W/kg**  
 Maximum value of SAR (measured) = 0.329 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/25 PM 02:45:44  
 7\_ IEEE 802.11a CH48\_6M\_Side7\_0mm\_Ant 1  
**DUT: Unicornis360; Type: Panoramic camera**

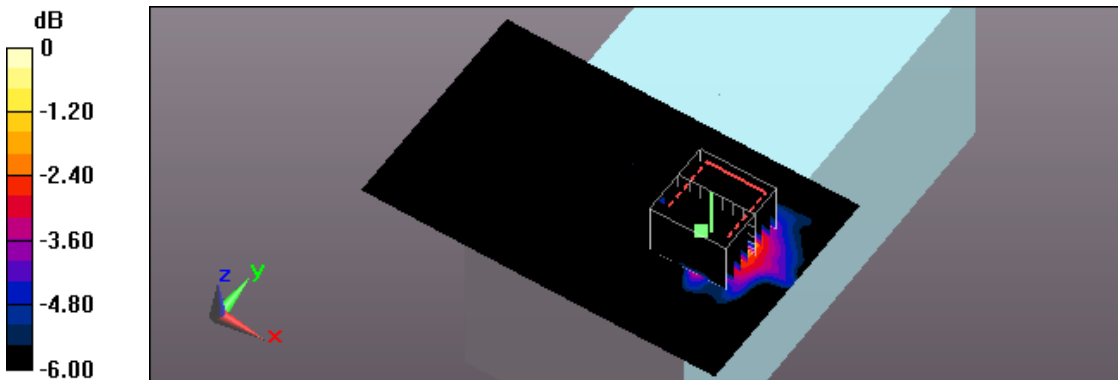
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.264 \text{ S/m}$ ;  $\epsilon_r = 50.483$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.394 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 7.462 V/m; Power Drift = -0.19 dB  
 Peak SAR (extrapolated) = 0.458 W/kg

**SAR(1 g) = 0.217 W/kg; SAR(10 g) = 0.112 W/kg**  
 Maximum value of SAR (measured) = 0.307 W/kg



0 dB = 0.307 W/kg = -5.13 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/25 PM 03:59:30  
 8\_ IEEE 802.11a CH48\_6M\_Side4\_0mm\_Ant 1  
**DUT: Unicornis360; Type: Panoramic camera**

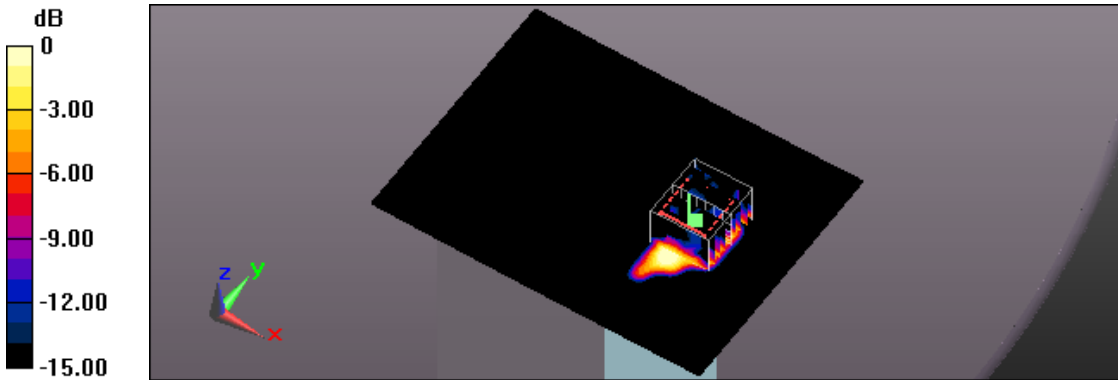
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.264 \text{ S/m}$ ;  $\epsilon_r = 50.483$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2007)  
 DASYS5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Flat/Area Scan (161x121x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 0.140 W/kg

**Flat/Zoom Scan (8x9x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 2.614 V/m; Power Drift = -0.11 dB  
 Peak SAR (extrapolated) = 0.0900 W/kg

**SAR(1 g) = 0.033 W/kg; SAR(10 g) = 0.012 W/kg**  
 Maximum value of SAR (measured) = 0.0494 W/kg



0 dB = 0.0494 W/kg = -13.06 dBW/kg

Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/26 PM 04:33:39  
 14\_ IEEE 802.11a CH48\_6M\_Side5\_0mm\_Ant 1\_microphone  
**DUT: Unicornis360; Type: Panoramic camera**

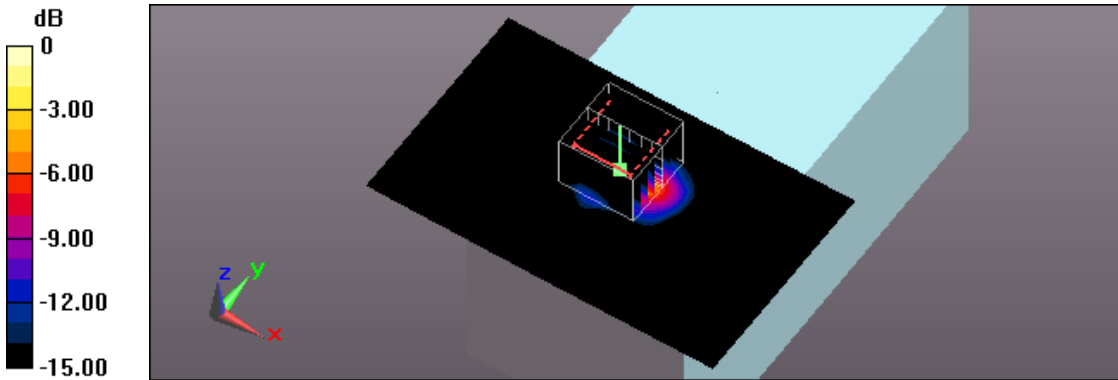
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.277 \text{ S/m}$ ;  $\epsilon_r = 50.313$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 5.37 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 13.39 V/m; Power Drift = 0.17 dB  
 Peak SAR (extrapolated) = 8.72 W/kg

**SAR(1 g) = 2.91 W/kg; SAR(10 g) = 0.849 W/kg**  
 Maximum value of SAR (measured) = 5.15 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/27 AM 08:46:15  
 15\_ IEEE 802.11a CH48\_6M\_Side5\_0mm\_Ant 1\_base  
**DUT: Unicornis360; Type: Panoramic camera**

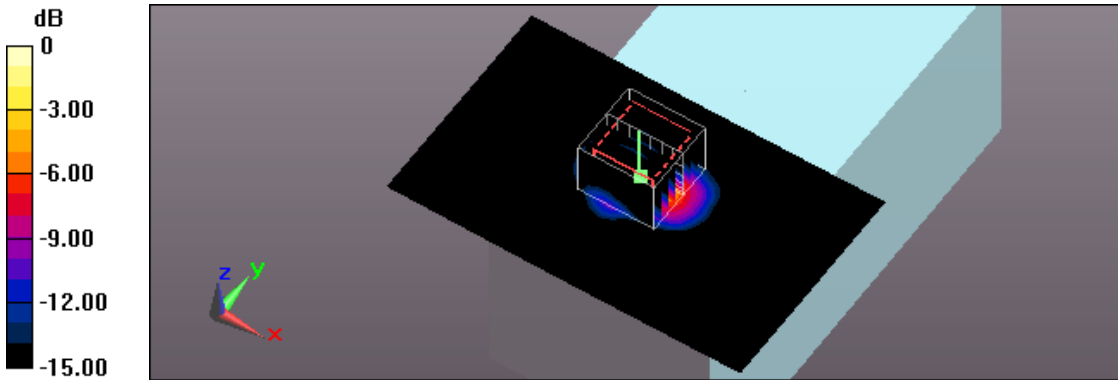
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5240 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used:  $f = 5240 \text{ MHz}$ ;  $\sigma = 5.265 \text{ S/m}$ ;  $\epsilon_r = 50.193$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASYS5 (IEEE/IEC/ANSI C63.19-2007)  
 DASYS5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASYS52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 3.71 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 11.03 V/m; Power Drift = 0.14 dB  
 Peak SAR (extrapolated) = 6.97 W/kg

**SAR(1 g) = 2.36 W/kg; SAR(10 g) = 0.728 W/kg**  
 Maximum value of SAR (measured) = 4.22 W/kg



0 dB = 4.22 W/kg = 6.25 dBW/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/27 AM 09:11:18  
 16\_IEEE 802.11a CH44\_6M\_Side1\_0mm\_Ant 0\_original #4\_once  
**DUT: Unicornis360; Type: Panoramic camera**

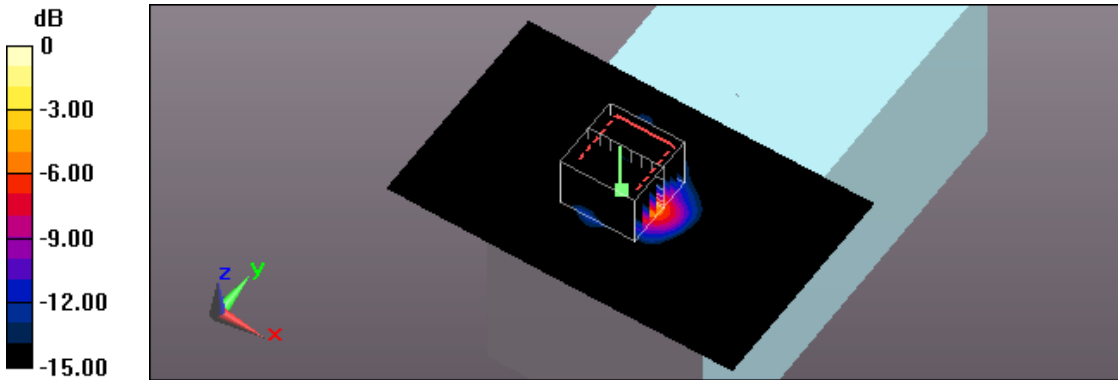
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5220 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used (interpolated):  $f = 5220 \text{ MHz}$ ;  $\sigma = 5.23 \text{ S/m}$ ;  $\epsilon_r = 50.235$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 15.2 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 38.74 V/m; Power Drift = 0.10 dB  
 Peak SAR (extrapolated) = 31.8 W/kg

**SAR(1 g) = 10.4 W/kg; SAR(10 g) = 3.08 W/kg**  
 Maximum value of SAR (measured) = 18.5 W/kg



Test Laboratory: A Test Lab Techno Corp.  
 Date/Time: 2018/4/27 AM 09:53:48  
 17\_IEEE 802.11a CH44\_6M\_Side1\_0mm\_Ant 0\_original #4\_twice  
**DUT: Unicornis360; Type: Panoramic camera**

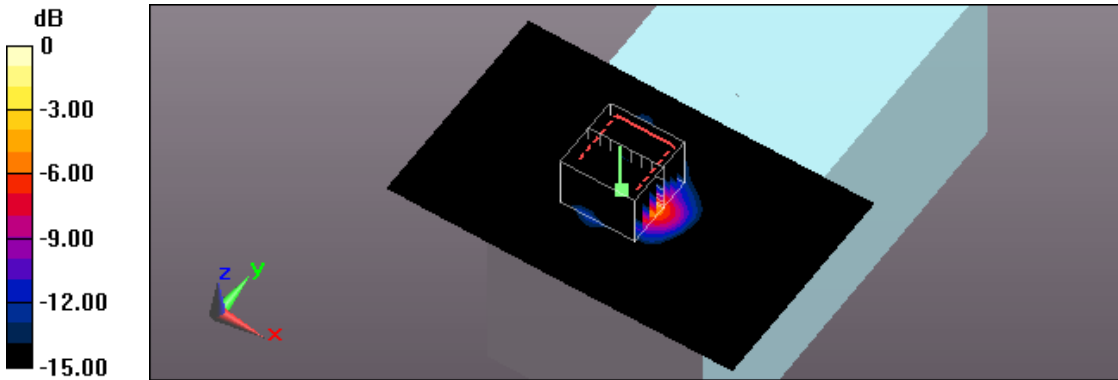
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5220 MHz; Duty Cycle: 1:1.01042  
 Medium parameters used (interpolated):  $f = 5220 \text{ MHz}$ ;  $\sigma = 5.23 \text{ S/m}$ ;  $\epsilon_r = 50.235$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN7346; ConvF(5.06, 5.06, 5.06); Calibrated: 2018/2/28;
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn916; Calibrated: 2017/12/14
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

**Flat/Area Scan (131x81x1):** Interpolated grid:  $dx=1.000 \text{ mm}$ ,  $dy=1.000 \text{ mm}$   
 Maximum value of SAR (interpolated) = 15.6 W/kg

**Flat/Zoom Scan (8x8x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$   
 Reference Value = 39.13 V/m; Power Drift = -0.14 dB  
 Peak SAR (extrapolated) = 31.6 W/kg

**SAR(1 g) = 10.5 W/kg; SAR(10 g) = 3.12 W/kg**  
 Maximum value of SAR (measured) = 18.7 W/kg



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



## **Appendix C - Calibration**

All of the instruments Calibration information are listed below.

- Dipole \_ D5GHzV2 SN:1244, Calibration No.D5GHzV2-1244\_Oct17
- Probe \_ EX3DV4 SN:7346, Calibration No.EX3-7346\_Feb18
- DAE \_ DAE4 SN:916, Calibration No. DAE4-916\_Dec17

**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  
**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 **UL-TW (Auden)**

Certificate No: **D5GHzV2-1244\_Oct17**

## CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1244**

Calibration procedure(s) **QA CAL-22.v2  
Calibration procedure for dipole validation kits between 3-6 GHz**

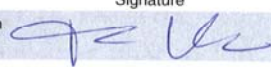

Calibration date: **October 26, 2017**

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-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 3503	31-Dec-16 (No. EX3-3503_Dec16)	Dec-17
DAE4	SN: 781	13-Jul-17 (No. DAE4-781_Jul17)	Jul-18
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: October 26, 2017

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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

**Additional Documentation:**

- e) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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



### Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

### Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL at 5250 MHz

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>79.6 W/kg ± 19.9 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>22.8 W/kg ± 19.5 % (k=2)</b>



**Head TSL parameters at 5300 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Head TSL at 5300 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>80.7 W / kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>23.2 W/kg ± 19.5 % (k=2)</b>

**Head TSL parameters at 5600 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Head TSL at 5600 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>82.1 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>23.5 W/kg ± 19.5 % (k=2)</b>



### Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>77.8 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>22.2 W/kg ± 19.5 % (k=2)</b>





**Body TSL parameters at 5250 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Body TSL at 5250 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>74.9 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.9 W/kg ± 19.5 % (k=2)</b>

**Body TSL parameters at 5300 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.57 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Body TSL at 5300 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>74.7 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.0 W/kg ± 19.5 % (k=2)</b>



### Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.97 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>78.2 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.9 W/kg ± 19.5 % (k=2)</b>

### Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>75.0 W/kg ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.7 W/kg ± 19.5 % (k=2)</b>



**Appendix (Additional assessments outside the scope of SCS 0108)**

**Antenna Parameters with Head TSL at 5250 MHz**

Impedance, transformed to feed point	48.9 $\Omega$ - 4.7 j $\Omega$
Return Loss	- 26.3 dB

**Antenna Parameters with Head TSL at 5300 MHz**

Impedance, transformed to feed point	48.3 $\Omega$ - 2.3 j $\Omega$
Return Loss	- 30.7 dB

**Antenna Parameters with Head TSL at 5600 MHz**

Impedance, transformed to feed point	50.3 $\Omega$ - 0.6 j $\Omega$
Return Loss	- 43.4 dB

**Antenna Parameters with Head TSL at 5800 MHz**

Impedance, transformed to feed point	53.4 $\Omega$ + 0.5 j $\Omega$
Return Loss	- 29.6 dB

**Antenna Parameters with Body TSL at 5250 MHz**

Impedance, transformed to feed point	48.5 $\Omega$ - 3.4 j $\Omega$
Return Loss	- 28.4 dB

**Antenna Parameters with Body TSL at 5300 MHz**

Impedance, transformed to feed point	49.4 $\Omega$ - 1.3 j $\Omega$
Return Loss	- 37.0 dB

**Antenna Parameters with Body TSL at 5600 MHz**

Impedance, transformed to feed point	52.5 $\Omega$ + 0.3 j $\Omega$
Return Loss	- 32.1 dB

**Antenna Parameters with Body TSL at 5800 MHz**

Impedance, transformed to feed point	54.1 $\Omega$ + 1.2 j $\Omega$
Return Loss	- 27.7 dB



### General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 22, 2016



## DASY5 Validation Report for Head TSL

Date: 26.10.2017

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1244

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.55$  S/m;  $\epsilon_r = 36$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 4.6$  S/m;  $\epsilon_r = 36$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 4.9$  S/m;  $\epsilon_r = 35.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 5.11$  S/m;  $\epsilon_r = 35.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

#### DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.58, 5.58, 5.58); Calibrated: 31.12.2016, ConvF(5.35, 5.35, 5.35); Calibrated: 31.12.2016, ConvF(5.09, 5.09, 5.09); Calibrated: 31.12.2016, ConvF(5.01, 5.01, 5.01); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn781; Calibrated: 13.07.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

#### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 69.86 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 28.6 W/kg

**SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 18.1 W/kg

#### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.79 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 28.1 W/kg

**SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.32 W/kg**

Maximum value of SAR (measured) = 18.3 W/kg

#### Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

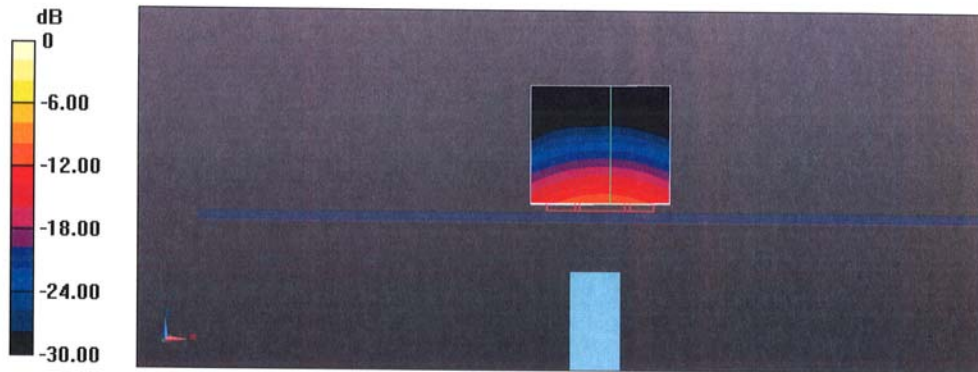
Reference Value = 69.55 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 31.4 W/kg

**SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.35 W/kg**

Maximum value of SAR (measured) = 19.3 W/kg

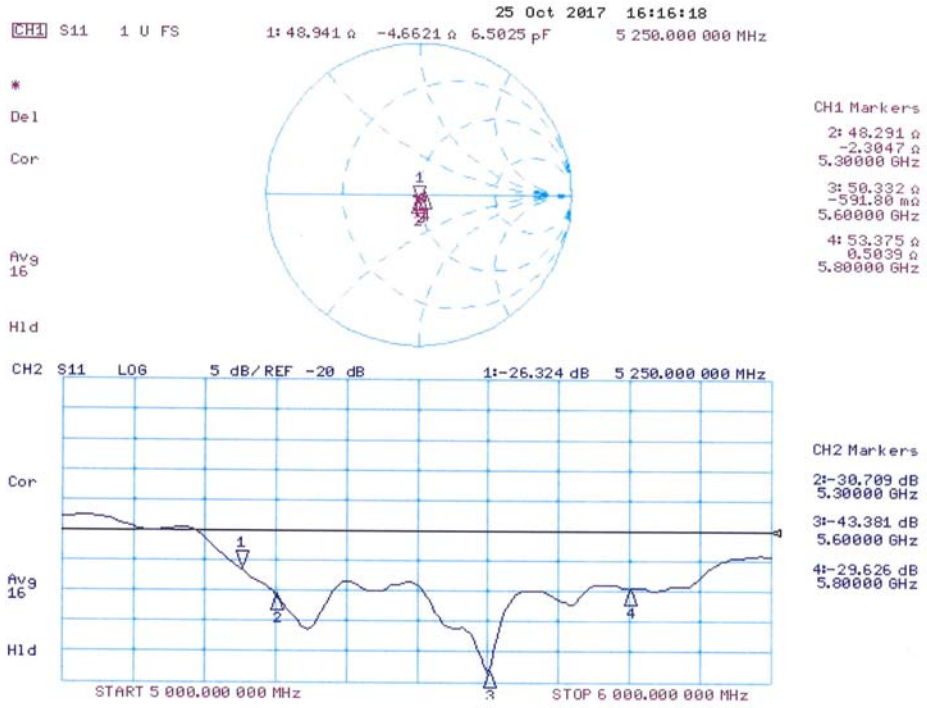
**Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 66.96 V/m; Power Drift = -0.09 dB  
Peak SAR (extrapolated) = 30.9 W/kg  
**SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.22 W/kg**  
Maximum value of SAR (measured) = 18.6 W/kg



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



### Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 26.10.2017

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1244**

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 5.5$  S/m;  $\epsilon_r = 47$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5300$  MHz;  $\sigma = 5.57$  S/m;  $\epsilon_r = 46.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5600$  MHz;  $\sigma = 5.97$  S/m;  $\epsilon_r = 46.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.25$  S/m;  $\epsilon_r = 46$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.14, 5.14, 5.14); Calibrated: 31.12.2016, ConvF(5.04, 5.04, 5.04); Calibrated: 31.12.2016, ConvF(4.57, 4.57, 4.57); Calibrated: 31.12.2016, ConvF(4.48, 4.48, 4.48); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn781; Calibrated: 13.07.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

### **Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,**

**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.12 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 28.8 W/kg

**SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.11 W/kg**

Maximum value of SAR (measured) = 17.7 W/kg

### **Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan,**

**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.61 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 29.0 W/kg

**SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.12 W/kg**

Maximum value of SAR (measured) = 17.6 W/kg

### **Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan,**

**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.01 V/m; Power Drift = -0.08 dB

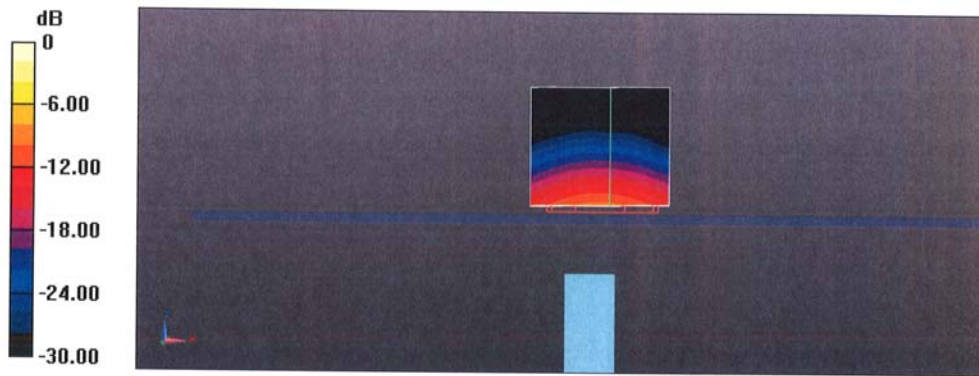
Peak SAR (extrapolated) = 32.6 W/kg

**SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.21 W/kg**

Maximum value of SAR (measured) = 19.0 W/kg



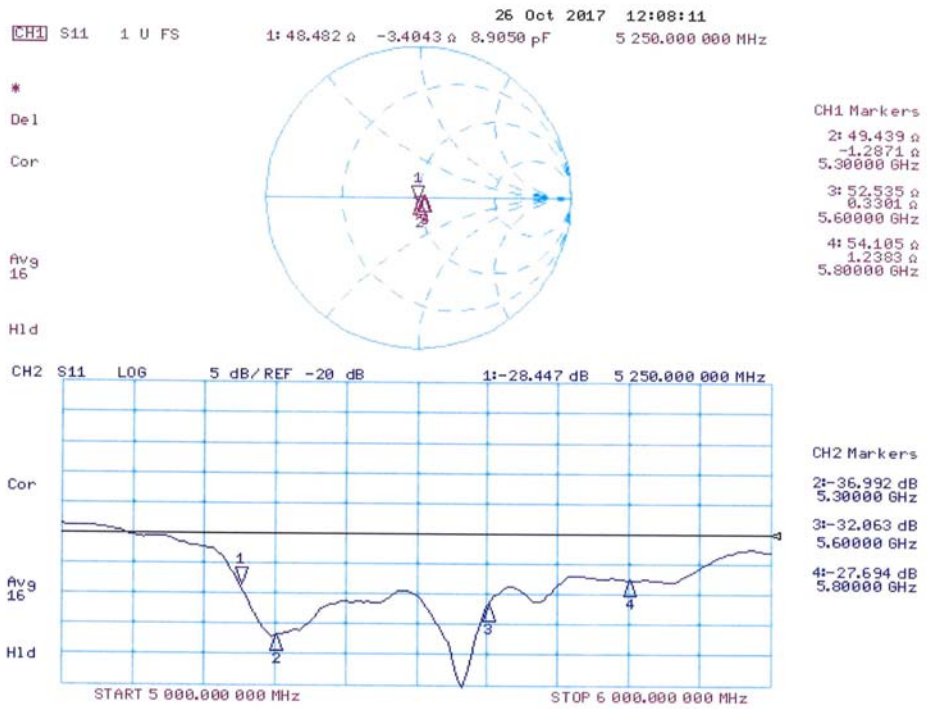
**Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 62.59 V/m; Power Drift = -0.06 dB  
Peak SAR (extrapolated) = 33.1 W/kg  
**SAR(1 g) = 7.56 W/kg; SAR(10 g) = 2.09 W/kg**  
Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 17.7 W/kg = 12.48 dBW/kg



### Impedance Measurement Plot for Body TSL





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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
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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 **Auden**

Certificate No: **EX3-7346\_Feb18**

**CALIBRATION CERTIFICATE**

Object: **EX3DV4 - SN:7346**

Calibration procedure(s): **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6  
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 28, 2018**

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-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

Calibrated by:	Name <b>Michael Weber</b>	Function Laboratory Technician	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Function Technical Manager	Signature 

Issued: March 1, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Accredited by the Swiss Accreditation Service (SAS)  
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**Glossary:**

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
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:**

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

**Methods Applied and Interpretation of Parameters:**

- NORM<sub>x,y,z</sub>:** Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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.
- DCP<sub>x,y,z</sub>:** DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>:** 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 NORM<sub>x,y,z</sub> \* 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  $\pm 50$  MHz to  $\pm 100$  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 NORM<sub>x</sub> (no uncertainty required).



EX3DV4 – SN:7346

February 28, 2018

# Probe EX3DV4

## SN:7346

Manufactured: October 13, 2014  
Repaired: February 19, 2018  
Calibrated: February 28, 2018

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



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.46	0.47	0.48	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	100.0	102.9	99.7	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	148.2	$\pm 3.0\%$
		Y	0.0	0.0	1.0		139.8	
		Z	0.0	0.0	1.0		139.3	

Note: For details on UID parameters see Appendix.

### Sensor Model Parameters

	C1 fF	C2 fF	$\alpha$ V <sup>-1</sup>	T1 ms.V <sup>-2</sup>	T2 ms.V <sup>-1</sup>	T3 ms	T4 V <sup>-2</sup>	T5 V <sup>-1</sup>	T6
X	35.30	261.2	35.06	7.248	0.016	5.034	1.798	0.079	1.006
Y	34.75	261.4	35.94	6.021	0.263	5.073	0.000	0.421	1.007
Z	48.88	364.7	35.56	12.29	0.261	5.100	0.367	0.451	1.005

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%.

<sup>A</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>3</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unc (k=2)
750	41.9	0.89	10.36	10.36	10.36	0.55	0.80	± 12.0 %
835	41.5	0.90	10.02	10.02	10.02	0.46	0.80	± 12.0 %
900	41.5	0.97	9.79	9.79	9.79	0.34	1.04	± 12.0 %
1450	40.5	1.20	8.83	8.83	8.83	0.33	0.80	± 12.0 %
1750	40.1	1.37	8.81	8.81	8.81	0.45	0.81	± 12.0 %
1900	40.0	1.40	8.46	8.46	8.46	0.38	0.85	± 12.0 %
2000	40.0	1.40	8.33	8.33	8.33	0.37	0.85	± 12.0 %
2300	39.5	1.67	7.87	7.87	7.87	0.30	0.89	± 12.0 %
2450	39.2	1.80	7.49	7.49	7.49	0.34	0.91	± 12.0 %
2600	39.0	1.96	7.35	7.35	7.35	0.42	0.87	± 12.0 %
3500	37.9	2.91	7.40	7.40	7.40	0.20	1.20	± 13.1 %
5250	35.9	4.71	5.49	5.49	5.49	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.97	4.97	4.97	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.12	5.12	5.12	0.40	1.80	± 13.1 %

<sup>C</sup> 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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



## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth (mm) <sup>G</sup>	Unc (k=2)
750	55.5	0.96	10.16	10.16	10.16	0.69	0.80	± 12.0 %
835	55.2	0.97	9.95	9.95	9.95	0.65	0.80	± 12.0 %
900	55.0	1.05	9.79	9.79	9.79	0.58	0.80	± 12.0 %
1450	54.0	1.30	8.95	8.95	8.95	0.30	0.80	± 12.0 %
1750	53.4	1.49	8.45	8.45	8.45	0.40	0.80	± 12.0 %
1900	53.3	1.52	8.04	8.04	8.04	0.40	0.85	± 12.0 %
2000	53.3	1.52	8.20	8.20	8.20	0.42	0.80	± 12.0 %
2300	52.9	1.81	7.89	7.89	7.89	0.36	0.88	± 12.0 %
2450	52.7	1.95	7.78	7.78	7.78	0.34	0.87	± 12.0 %
2600	52.5	2.16	7.44	7.44	7.44	0.24	0.99	± 12.0 %
3500	51.3	3.31	7.21	7.21	7.21	0.30	1.20	± 13.1 %
5250	48.9	5.36	5.06	5.06	5.06	0.50	1.90	± 13.1 %
5600	48.5	5.77	4.35	4.35	4.35	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.52	4.52	4.52	0.50	1.90	± 13.1 %

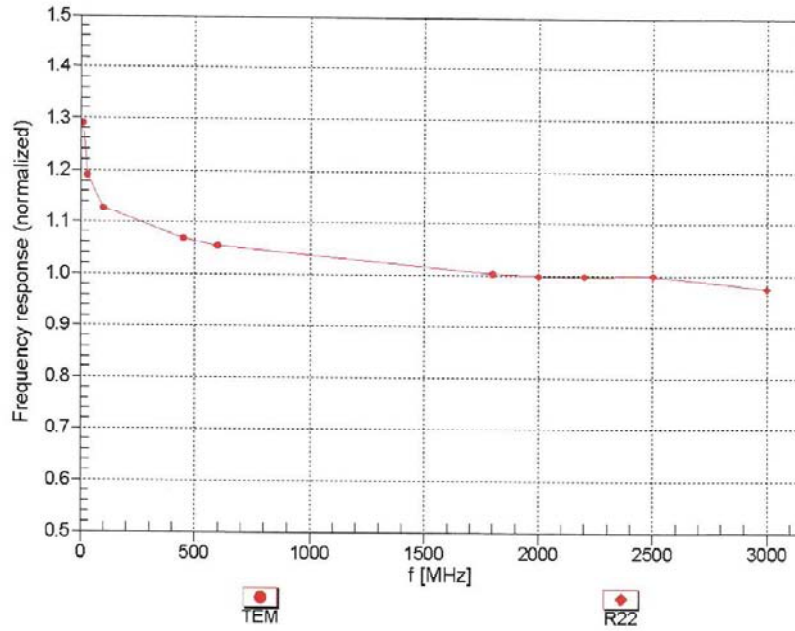
<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below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

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> 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.

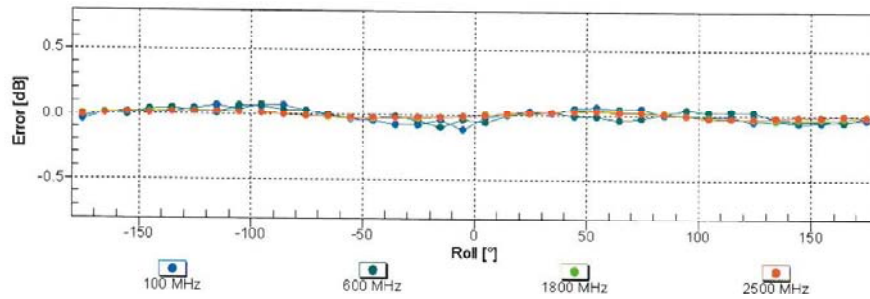
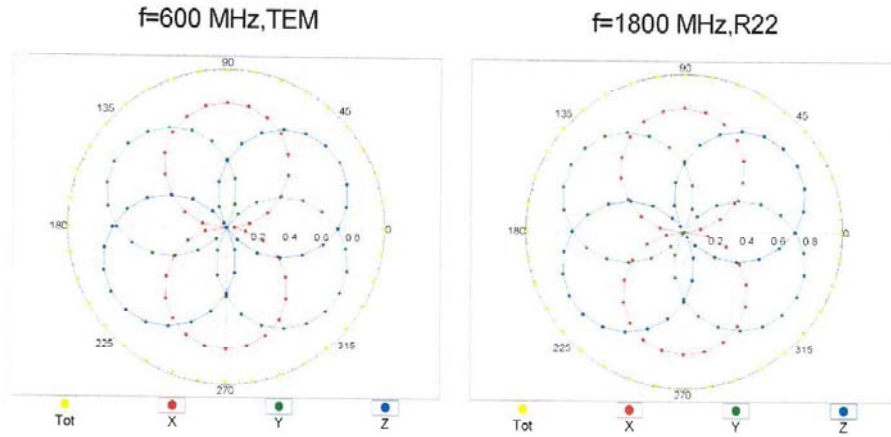


### Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



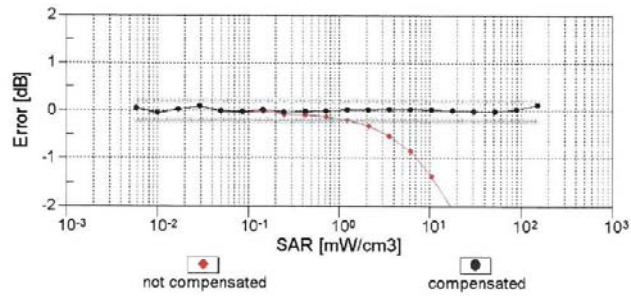
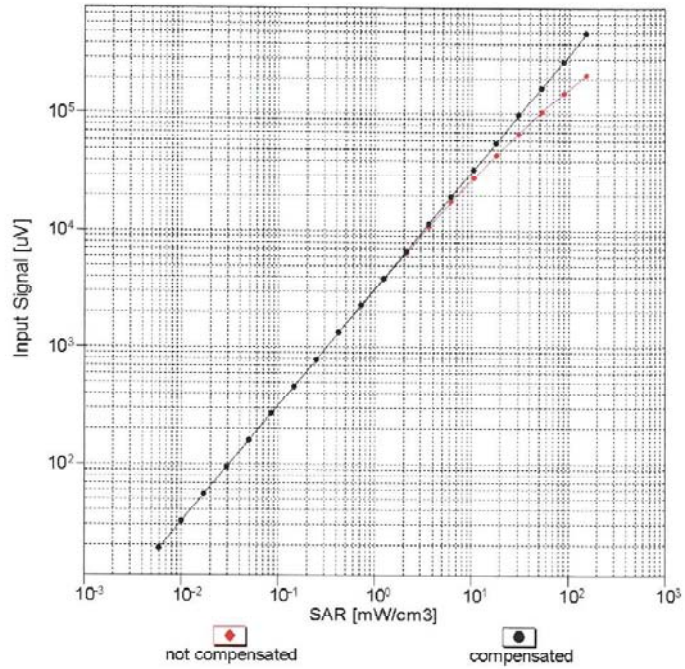
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



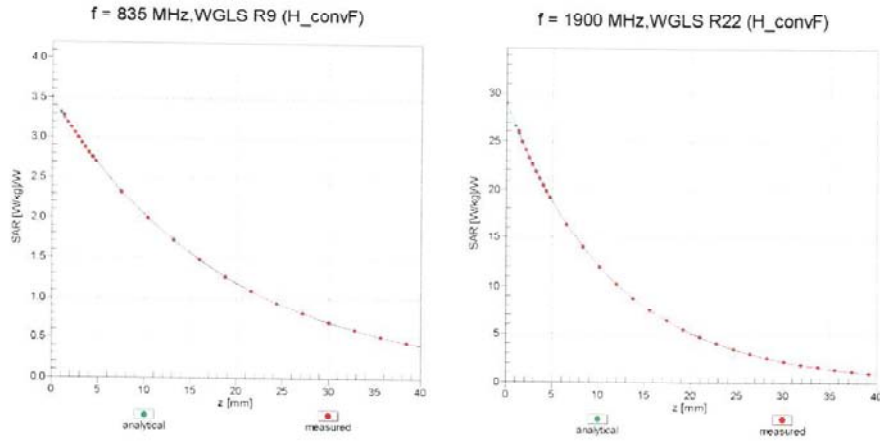
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f<sub>eval</sub>= 1900 MHz)

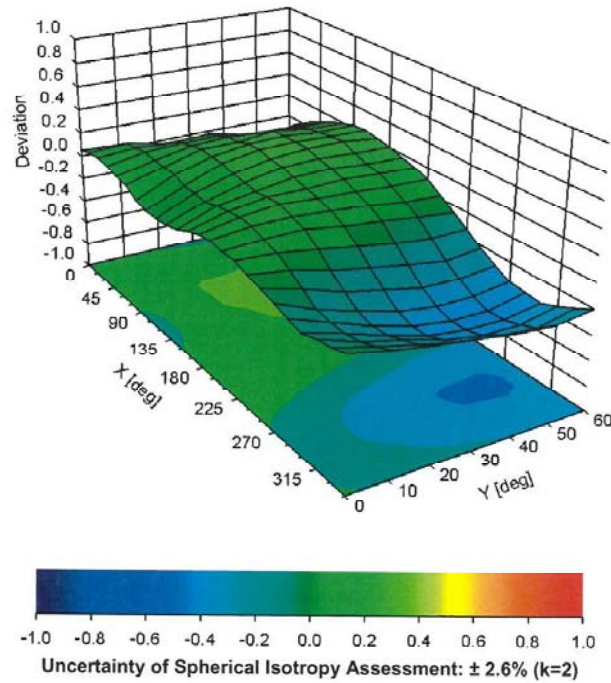


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

### Conversion Factor Assessment



### Deviation from Isotropy in Liquid Error ( $\phi, \theta$ ), f = 900 MHz





EX3DV4- SN:7346

February 28, 2018

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	94.5
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