

Prüfbericht-Nr.: <i>Test report No.:</i>	50052935 005	Auftrags-Nr.: <i>Order No.:</i>	164069063	Seite 1 von 29 <i>Page 1 of 29</i>
Kunden-Referenz-Nr.: <i>Client reference No.:</i>	N/A	Auftragsdatum: <i>Order date.:</i>	14.07.2016	
Auftraggeber: <i>Client:</i>	ContextMedia LLC 330 N. Wabash Ave STE 2500, Chicago, Illinois United States.			
Prüfgegenstand: <i>Test item:</i>	Wallboard 32" Tablet			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	P-WAL-106-ELC-XX (XX equals to 00, 01, 02, 03...99) (ContextMedia Health)			
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 2: Subpart J Section 2.1093 RSS-102 Issue 5 March 2015			
Wareneingangsdatum: <i>Date of receipt:</i>	21.07.2016	Please refer to photo documents		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000395547-003			
Prüfzeitraum: <i>Testing period:</i>	15.08.2016			
Ort der Prüfung: <i>Place of testing:</i>	Audix Technology (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:	kontrolliert von / reviewed by:			
08.09.2016	Andy Yan / Senior Project Engineer		08.09.2016	Owen Tian / Technical Certifier
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
<b>Sonstiges / Other:</b>				
FCC ID: 2AI6X-PWALELC IC: 21722-PWALELC HVIN: P-WAL-106-ELC-01, P-WAL-106-ELC-02, P-WAL-106-ELC-03 All the Identification no. are identical in the hardware and electronic aspects with each other. All the HVIN no. are identical in the hardware and electronic aspects with each other, the difference is only color apperance.				
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(pass) = entspricht o.g. Prüfgrundlage(n) F(fail) = entspricht nicht o.g. Prüfgrundlage(n) Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(pass) = passed a.m. test specifications(s) F(fail) = failed a.m. test specifications(s) N/A = nicht anwendbar N/T = nicht getestet N/A = not applicable N/T = not tested				
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzelchens.</b> <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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## **STATEMENT OF COMPLIANCE**

<b>TEST ITEM</b>	<b>SPECIFICATION</b>	<b>RESULT</b>
Specific Absorption Rate - Wi-Fi 802.11 b/g/n - 2.4GHz Band		PASS
Specific Absorption Rate - Wi-Fi 802.11 a/n/ac - 5GHz Band U-NII-1	Exposure Rules 47 C.F.R 2.1093; KDB 447498 D01 General RF Exposure Guidance v06; KDB 248227 D01 802.11 Wi-Fi SAR v02r02;	PASS
Specific Absorption Rate - Wi-Fi 802.11 a/n/ac - 5GHz Band U-NII-3	KDB 865664 D01 SAR Measurement 100 MHz to 6GHz v01r04; KDB 865664 D02 RF Exposure Reporting v01r02; KDB 616217 D04 SAR for laptop and tablets v01r02;	PASS
Specific Absorption Rate - Bluetooth BDR/EDR/LE	FCC Inquiry Tracking Number 351814	PASS

This device complies with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4W/kg) specified in CFR Title 47 Part 2 Subpart J Section 2.1093 and ANSI/IEEE C95.1-1992 for extremity SAR.

This device has been tested in accordance with the measurement methods and procedure specified in Published RF exposure KDB procedures

Refer to the maximum results of Specific Absorption Rate (SAR) during testing as below.

<b>FREQUENCY BAND</b>	<b>EXPOSURE POSITION</b>	<b>EQUIPMENT CLASS</b>	<b>HIGHEST REPORTED EXTREMITY 10G SAR VALUE (W/KG)</b>
802.11 b/g/n - 2.4GHz Band	Body	DTS	0.142
802.11 a/n/ac - 5GHz Band U-NII-1	Body	NII	0.232
802.11 a/n/ac - 5GHz Band U-NII-3	Body		0.234
Bluetooth (BDR)	Body	DSS	0.055

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## 1. General Remarks

### 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: System Performance Check and Test Plots

Appendix B: Calibration Certificate

## 2. Test Sites

### 2.1 Test Facilities

Audix Technology (Shenzhen) Co., Ltd.

No.6, Ke Feng Road, Block 52, Shenzhen Science & Industry Park,  
Nanshan, Shenzhen, Guangdong, China (518057)

The tests at the test site have been conducted under the supervision of a TÜV engineer.

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## 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

Equipment	Manufacturer	Model No.	Serial No.	Last Cal Date	Cal. Interval
DASY5 SAR Test System	Speag	TX60 L speag	F09/5B1H1/01	NCR	NCR
Power Meter	Anritsu	ML2487A	6K00002472	Oct.17,15	1 Year
Power Sensor	Anritsu	MA2491A	0033005	Oct.17,15	1 Year
Signal Generator	HP	83732B	VS34490501	Apr.23,16	1 Year
Amplifier	Milmega	ZHL-42W	C620601316	NCR	NCR
Dipole Validation Kits	Speag	D2450V2	862	May.29,14	3Year
Dipole Validation Kits	Speag	D5GHzV2	1102	Jun.16,14	3Year
Attenuator	Mini-Circuits	VAT-10+	NO.1	Apr.23,16	1Year
Data Acquisition Electronics	Speag	DAE4	889	Feb.02,16	2Year
E-Field Probe	Speag	EX3DV4	3767	Jan.30,15	3Year
Network Analyzer	Agilent	E5071B	MY42403549	Apr.24,16	1Year
Test Software	Schmid&Partner Englinnering AG	DASY5	52.8.7.1137	N/A	N/A

NCR means no calibration required (calibrated with system).

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### 3. General Product Information

#### 3.1 Product Function and Intended Use

The EUT is a Wallboard 32" Tablet which supports Bluetooth (dual mode) and Wi-Fi 802.11 a/b/g/n/ac wireless technology.

For details refer to the User Manual and Circuit Diagram.

#### 3.2 Ratings and System Details

**Table 2: Technical Specification of Wi-Fi**

Technical Specification	Value
Kind of Equipment	Wallboard 32" Tablet
Type Designation	P-WAL-106-ELC-XX (XX equals to 00, 01, 02, 03...99)
FCC ID	2AI6X-PWALELC
IC	21722-PWALELC
HVIN	P-WAL-106-ELC-01, P-WAL-106-ELC-02, P-WAL-106-ELC-03
Operating Frequency band	2400-2483.5MHz, 5150-5250MHz, 5725-5850MHz
Extreme Temperature Range	0~+40°C
Operation Voltage	DC 12 V from AC/DC Adapter
Antenna Type	Integral Antenna
Antenna Gain	2.0 dBi for 2.4GHz band and 4.5dBi for 5GHz Band
Hardware version:	R03-V3.1
Software version:	Android 4.4.4

**Table 3: Technical Specification of 2.4GHz, 802.11b/g/n**

Item	Description		
	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n (HT20)
Operating Frequency band (MHz)	2412 ~ 2462	2412 ~ 2462	2412 ~ 2462
Channel Number	11	11	11
Modulation	DSSS (DBPSK, DQPSK), CCK)	OFDM (DBPSK, DQPSK)	OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
Data Rate (Mbps)	1, 2, 5, 11	6, 9, 12, 18, 24, 36, 48, 54	MCS0 ~ MCS7
Maximum tune-up conducted average output power (dBm):	17.0	16.0	15.5
Maximum tested output power	16.61dBm	15.96dBm	14.21dBm

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**Table 4: List of WLAN Channel of 802.11b/g/n**

802.11b		802.11g		802.11n (HT20)	
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	2412	1	2412	1	2412
2	2417	2	2417	2	2417
3	2422	3	2422	3	2422
4	2427	4	2427	4	2427
5	2432	5	2432	5	2432
6	2437	6	2437	6	2437
7	2442	7	2442	7	2442
8	2447	8	2447	8	2447
9	2452	9	2452	9	2452
10	2457	10	2457	10	2457
11	2462	11	2462	11	2462

**Table 5: Technical Specification of 5GHz, 802.11a/n**

Operating mode(s) / WiFi:	IEEE 802.11a	IEEE 802.11n HT20	IEEE 802.11n HT40
Test modulation	OFDM (BPSK, QPSK, 16-QAM, 64-QAM)	OFDM (BPSK, QPSK, 16-QAM, 64-QAM)	OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
Transmit Frequency Range (MHz):	5180 - 5240 5845 - 5825	5180 - 5240 5845 - 5825	5180 - 5240 5845 - 5825
Channel Number	9	9	4
Data Rate (Mbps)	6, 9, 12, 18, 24, 36, 48, 54	MCS0 ~ MCS7	MCS0 ~ MCS7
Maximum tune-up conducted average output power (dBm):	15.5	15.0	15.0
Maximum tested output power	15.10 in band U-NII-1 15.06 in band U-NII-3	14.36	13.60

**Table 6: Technical Specification of 5GHz, 802.11ac**

Operating mode(s) / WiFi:	IEEE 802.11ac VHT20	IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
Test modulation	OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)	OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)	OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)
Transmit Frequency Range (MHz):	5180 - 5240 5845 - 5825	5180 - 5240 5845 - 5825	5180 - 5240 5845 - 5825
Channel Number	9	4	2
Data Rate (Mbps)	MCS0 ~ MCS8	MCS0 ~ MCS9	MCS0 ~ MCS9
Maximum tune-up conducted average output power (dBm):	15.0	15.0	15.0
Maximum tested output power	13.63	13.60	13.23

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**Table 7: List of WLAN Channel of 5GHz 802.11a/n**

802.11a		802.11n HT20		802.11n HT40	
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
36	5180	36	5180	38	5190
40	5200	40	5200	46	5230
44	5220	44	5220	151	5755
48	5240	48	5240	159	5795
149	5745	149	5745		
153	5765	153	5765		
157	5785	157	5785		
161	5805	161	5805		
165	5825	165	5825		

**Table 8: List of WLAN Channel of 5GHz 802.11ac**

802.11ac VHT20		802.11ac VHT40		802.11ac VHT80			
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)		
36	5180	38	5190	42	5210		
40	5200	46	5230	155	5775		
44	5220	151	5755				
48	5240	159	5795				
149	5745						
153	5765						
157	5785						
161	5805						
165	5825						

**Table 9: Technical Specification of Bluetooth (BDR & EDR mode)**

Technical Specification	Value
Operating Frequency band	2400 – 2483.5MHz
Channel separation	1MHz
Extreme Temperature Range	0~+40°C
Modulation	GFSK, 8DPSK, π/4DQPSK
Bluetooth version	4.0, Dual Mode
Antenna Type	Integral antenna
Antenna Gain	2.0dBi
Maximum tune-up conducted average output power (dBm)	8.5dBm
Maximum tested output power	8.25dBm

**Table 10: RF channel and frequency of Bluetooth (BDR & EDR mode)**

RF Channel	Frequency (MHz)						
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0	2402.00	21	2423.00	42	2444.00	63	2465.00
1	2403.00	22	2424.00	43	2445.00	64	2466.00
2	2404.00	23	2425.00	44	2446.00	65	2467.00
3	2405.00	24	2426.00	45	2447.00	66	2468.00
4	2406.00	25	2427.00	46	2448.00	67	2469.00
5	2407.00	26	2428.00	47	2449.00	68	2470.00
6	2408.00	27	2429.00	48	2450.00	69	2471.00
7	2409.00	28	2430.00	49	2451.00	70	2472.00
8	2410.00	29	2431.00	50	2452.00	71	2473.00
9	2411.00	30	2432.00	51	2453.00	72	2474.00
10	2412.00	31	2433.00	52	2454.00	73	2475.00
11	2413.00	32	2434.00	53	2455.00	74	2476.00
12	2414.00	33	2435.00	54	2456.00	75	2477.00
13	2415.00	34	2436.00	55	2457.00	76	2478.00
14	2416.00	35	2437.00	56	2458.00	77	2479.00
15	2417.00	36	2438.00	57	2459.00	78	2480.00
16	2418.00	37	2439.00	58	2460.00		
17	2419.00	38	2440.00	59	2461.00		
18	2420.00	39	2441.00	60	2462.00		
19	2421.00	40	2442.00	61	2463.00		
20	2422.00	41	2443.00	62	2464.00		

**Table 11: Technical Specification of Bluetooth (Low Energy mode)**

Technical Specification	Value
Operating Frequency band	2400 – 2483.5MHz
Channel separation	2MHz
Extreme Temperature Range	0~+40°C
Modulation	GFSK
Bluetooth version	4.0, Dual Mode
Antenna Type	Integral antenna
Antenna Gain	2.0dBi
Maximum tune-up conducted average output power (dBm)	2.5dBm
Maximum tested output power	2.3dBm

**Table 12: RF channel and frequency of Bluetooth (Low Energy mode)**

RF Channel	Frequency (MHz)						
0	2402.00	11	2424.00	22	2446.00	33	2468.00
1	2404.00	12	2426.00	23	2448.00	34	2470.00
2	2406.00	13	2428.00	24	2450.00	35	2472.00
3	2408.00	14	2430.00	25	2452.00	36	2474.00
4	2410.00	15	2432.00	26	2454.00	37	2476.00

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5	2412.00	16	2434.00	27	2456.00	38	2478.00
6	2414.00	17	2436.00	28	2458.00	39	2480.00
7	2416.00	18	2438.00	29	2460.00		
8	2418.00	19	2440.00	30	2462.00		
9	2420.00	20	2442.00	31	2464.00		
10	2422.00	21	2444.00	32	2466.00		

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### 3.3 Independent Operation Modes

The basic operation modes are:

- A. On, transmitting
  - 1. 802.11b
  - 2. 802.11g
  - 3. 802.11n (HT20)
  - 4. 802.11n (HT40)
  - 5. 802.11a
  - 6. 802.11ac (VHT20)
  - 7. 802.11ac (VHT40)
  - 8. 802.11ac (VHT80)
  - 9. Bluetooth BDR
  - 10. Bluetooth EDR
  - 11. Bluetooth Low Energy
- B. Off

### 3.4 Submitted Documents

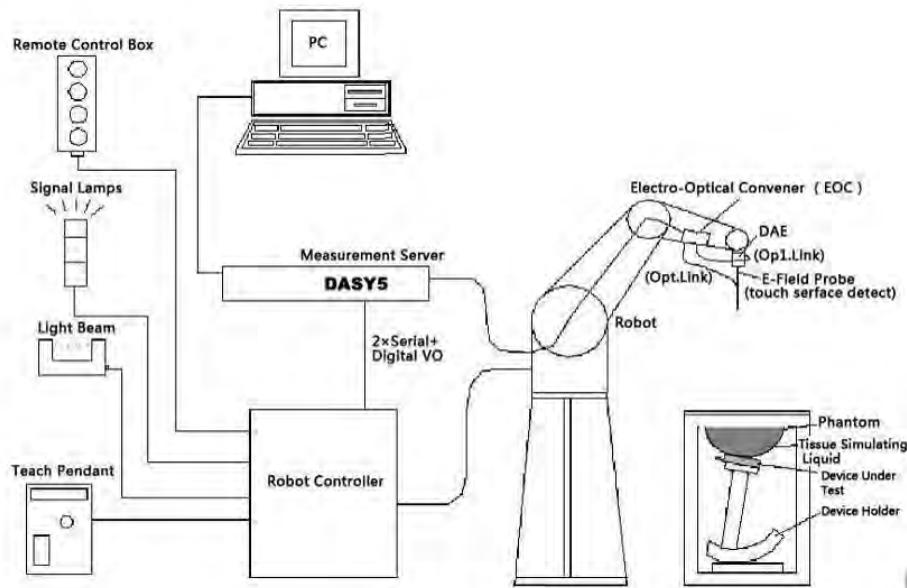
- Application Form
- Block Diagram
- Schematics
- Technical Description
- FCC/IC Label and Location Info
- Photo Document
- User Manual

## 4. SAR Measurements System Configuration

### 4.1 SAR Measurements Set-up

The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- 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.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- 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.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.



**Picture 1 SAR Lab Test Measurement Set-up**

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## 4.2 DASY5 E-Field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration 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 multifiber 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 DASY5 software reads the reflection turning a software approach and looks for the maximum using 2<sup>nd</sup> ord curve fitting. The approach is stopped at reaching the maximum.

**Probe Specifications:**

Model: EX3DV4

Frequency Range: 10MHz - 6.0GHz (EX3DV4)

Calibration: In head and body simulating tissue at Frequencies from 835 up to 5800MHz

Linearity: ± 0.2 dB (30 MHz to 6 GHz) for EX3DV4

Dynamic Range: 10 mW/kg - 100W/kg

Probe Length: 330 mm

Probe Tip Length: 20 mm

Body Diameter: 12 mm

Tip Diameter: 2.5 mm

Tip-Center: 1 mm

Application: SAR Dosimetry Testing  
Compliance tests of mobile phones  
Dosimetry in strong gradient fields**Picture 2 E-field Probe**

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### 4.3 E-Filed Probe Calibration

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.

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 inn 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 then rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mw/ cm<sup>2</sup>.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain 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.

$$SAR = C \frac{\Delta T}{\Delta t}$$

Where:

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

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

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

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

Where:

$\sigma$  = Simulated tissue conductivity,

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

### 4.4 Other Test Equipment

#### 4.4.1 Data Acquisition Electronics (DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200 MΩ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

#### 4.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

High precision (repeatability 0.02mm)

High reliability (industrial design)

Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)

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Jerk-free straight movements (brushless synchron motors; no stepper motors)  
 Low ELF interference (motor control fields shielded via the closed metallic construction shields)


**Picture 3 DASY 5**

#### **4.4.3 Measurement Server**

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5: 400 MHz, Intel Celeron), chip disk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.


**Picture 4 Server for DASY 5**

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

#### **4.4.4 Device Holder for Phantom**

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of  $\pm 0.5\text{mm}$  would produce a SAR uncertainty of  $\pm 20\%$ . Accurate device positioning is therefore crucial for accurate and

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repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

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.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.



Picture 5 Device Holder

#### 4.4.5 Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

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Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table


**Picture 8 ELI4 Phantom**

## 4.5 Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

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

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems

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and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

### Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing is set according to FCC KDB Publication 865664. During scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

### Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

### Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

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. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

### Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01

Frequency	Maximum Area Scan Resolution (mm) ( $\Delta x_{area}, \Delta y_{area}$ )	Maximum Zoom Scan Resolution (mm) ( $\Delta x_{zoom}, \Delta y_{zoom}$ )	Maximum Zoom Scan Spatial Resolution (mm) $\Delta z_{zoom}(n)$	Minimum Zoom Scan Volume (mm) (x,y,z)
≤2 GHz	≤15	≤8	≤5	≥ 30
2-3 GHz	≤12	≤5	≤5	≥30
3-4 GHz	≤12	≤5	≤4	≥28
4-5 GHz	≤10	≤4	≤3	≥25
5-6 GHz	≤10	≤4	≤2	≥22

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## 4.6 Data Storage and Evaluation

### 4.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DAE4". The 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 incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device set up, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a loss less media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### 4.6.2 Data Evaluation by SEMCAD

The SEMCAD software 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<sub>i</sub>, a<sub>i0</sub>, a<sub>i1</sub>, a<sub>i2</sub>

- Conversion factor      ConvF<sub>i</sub>

- Diode compression point      Dcp<sub>i</sub>

Device parameters: - Frequency      f

- Crest factor      cf

Media parameters: - Conductivity

- Density

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 DASY5 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:

$$V_i = U_i + U_i^2 \cdot c_f / dcp_i$$

With  $V_i$  = compensated signal of channel i ( i = x, y, z )

$U_i$  = input signal of channel i ( i = x, y, z )

$c_f$  = crest factor of exciting field (DASY parameter)

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**dcp<sub>i</sub>** = diode compression point (DASY parameter)

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

E-field probes:  $E_i = (V_i / \text{Norm}_i \cdot \text{ConvF})^{1/2}$

H-field probes:  $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

**Norm<sub>i</sub>** = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)<sup>2</sup>] for E-field Probes

**ConvF** = sensitivity enhancement in solution

**a<sub>ij</sub>** = sensor sensitivity factors for H-field probes

**f** = carrier frequency [GHz]

**E<sub>i</sub>** = electric field strength of channel i in V/m

**H<sub>i</sub>** = magnetic field strength of channel i in A/m

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

$$E_{\text{tot}} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$\text{SAR} = (E_{\text{tot}}) 2 \cdot \sigma / (\rho \cdot 1000)$$

with **SAR** = local specific absorption rate in mW/g

**E<sub>tot</sub>** = total field strength in V/m

= conductivity in [mho/m] or [Siemens/m]

= equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

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

with **P<sub>pwe</sub>** = equivalent power density of a plane wave in mW/cm<sup>2</sup>

**E<sub>tot</sub>** = total electric field strength in V/m; **H<sub>tot</sub>** = total magnetic field strength in A/m

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## 5. Test Set-up and Operation Modes

### 5.1 Principle of Configuration Selection

The EUT is commanded to operate at maximum transmitting power. The EUT shall use its internal transmitter. The antenna and accessories shall be those specified by the manufacturer. The EUT battery must be fully powered and checked periodically during the test to ascertain uniform power output.

**Table 13: Configuration of EUT**

Operation mode	Frequency Range (MHz)	Modulation	Default Test Channel			Power Control Level
			Low	Middle	High	
802.11b/g/n(HT20)	2412-2462	DSSS, OFDM	CH1	CH6	CH11	Test software was used to configure the EUT to transmit at maximum output power
802.11a/n(HT20)/ac(VHT20) (Band U-NII-1)	5180-5240	OFDM	CH36	CH40	CH48	
802.11a/n(HT20)/ac(VHT20) (Band U-NII-3)	5745-5825	OFDM	CH149	CH157	CH165	
802.11n(HT40)/ac(VHT40) (Band U-NII-1)	5180-5240	OFDM	CH38	---	CH46	
802.11n(HT40)/ac(VHT40) (Band U-NII-3)	5745-5825	OFDM	CH151	---	CH159	
802.11ac(VHT80) (Band U-NII-1)	5180-5240	OFDM	---	CH42	---	
802.11ac(VHT80) (Band U-NII-3)	5745-5825	OFDM	---	CH155	---	
Bluetooth (BDR & EDR)	2402-2480	FHSS	CH0	CH39	CH78	
Bluetooth (Low Energy)	2402-2480	GFSK	CH0	CH19	CH39	

### 5.2 Tissue Simulating Liquid Ingredients

The liquid is consisted of Water, Salt, Glycol and DGBE. The liquid has previously been proven to be suited for worst-case. The following table shows the detail solution.

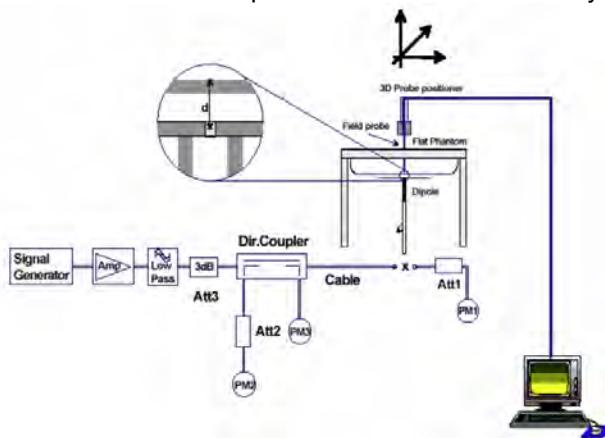
**Table 14: Composition of Tissue Simulating Liquid**

MIXTURE%(Weight)	FREQUENCY (Body) 2450MHz
Water	73.2
DGBE	26.7
Salt	0.04
MIXTURE%(Weight)	FREQUENCY (Body) 5GHz
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

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### 5.3 Specific Absorption Rate (SAR) System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in Appendix A. System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ). System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



**Picture 9 System Check Set-up**

**Table 15: System Check Results of Tissue Simulating Liquid**

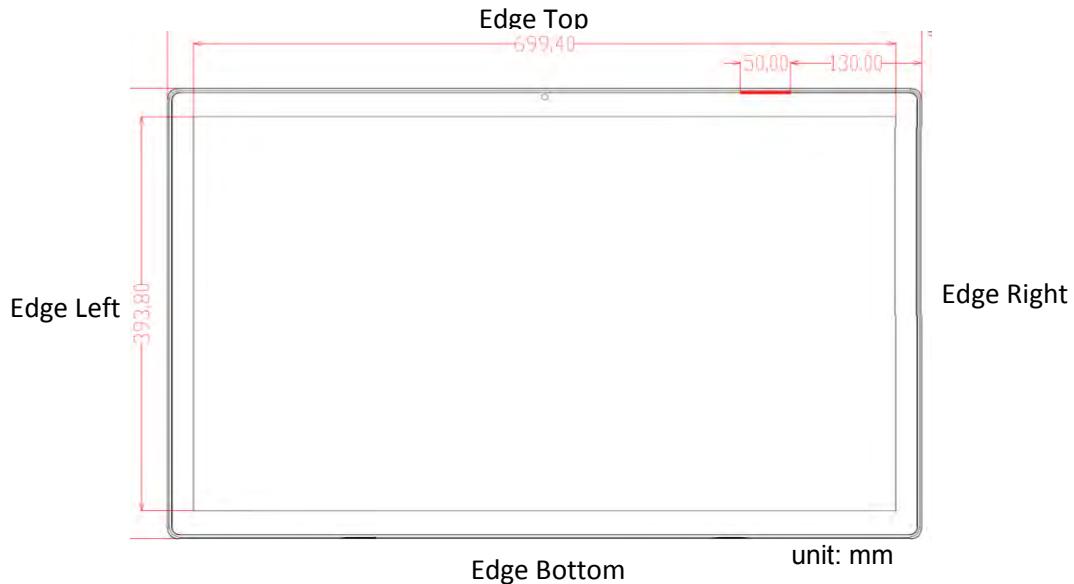
Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Target ( $\sigma$ )	Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
2450	Body	22.5	1.982	52.819	1.95	52.7	3.4	0.2	$\pm 5$	2016-08-15
5200	Body	22.5	5.254	50.131	5.30	49.0	-0.9	2.3	$\pm 5$	2016-08-15
5800	Body	22.5	5.871	48.50	6.00	48.2	-2.2	0.6	$\pm 5$	2016-08-15

(Liquid depth: 15cm)

**Table 16: System Validation**

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)	Limit (%)	Date
2450	Body	22.5	250	6.01	24.0	24.04	0.2	$\pm 10$	2016-08-15
5200	Body	22.5	250	5.39	21.7	21.56	-0.6	$\pm 10$	2016-08-15
5800	Body	22.5	250	5.46	20.4	21.84	7.0	$\pm 10$	2016-08-15

## 5.4 Exposure Positions Consideration



Front Screen and Top Edge were tested with small area near the antenna according to FCC inquiry with Tracking Number 351814

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## 5.5 Test Operation and Test Software

Test operation refers to test setup in chapter 5.

A communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode.

802.11 a/b/g/n/ac operating modes are tested independently according to the service requirements in each frequency band. 802.11a/b/g/n/ac modes are tested on channel low/middle/high. However, if output power reduction is necessary for channels lowest and/or highest to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 2.4GHz 802.11g/n when

- a) KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
- b) The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2 \text{ W/kg}$ .

Each channel should be tested at the lowest data rate, and repeated SAR measurement is required only when the measured SAR is  $\geq 0.8 \text{ W/kg}$ .

When the reported SAR is  $> 0.8 \text{ W/kg}$ , SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2 \text{ W/kg}$ , SAR is required for the third channel; i.e., all channels require testing.

## 5.6 Special Accessories and Auxiliary Equipment

None.

## 6. Test Results

### 6.1 Human Exposure to Radiofrequency Electromagnetic Fields

**RESULT:**
**Passed**

Date of testing	:	2016-08-15
Test standard	:	CFR Title 47 Part 2 Subpart J Section 2.1093 ANSI/IEEE C95.1-1992
FCC KDB Publication	:	KDB 248227 D01 v02r02 KDB 865664 D01 v01r04 KDB 616217 D04 v01r02
Limits	:	4W/kg for Extremity

Note: Wi-Fi antenna and Bluetooth cannot transmitter simultaneously.

According to the position of antenna and dimension of product, the test was carried out on front face /edge Top per FCC Inquiry with Tracking Number 351814.

The reported SAR of all initial test configurations are  $\leq$  1.2 W/kg. Adjusted SAR according to the ratio of the specified maximum output power of subsequent test configuration to initial test configuration will result in lower SAR; therefore, subsequent test configuration SAR is not required for this example.

Repeated SAR and other next highest channels are exempted to conduct with all the initial reported SAR  $\leq$  0.8 W/kg

**Table 17: Initial test configurations Test result of SAR Values**

Mode	Channel	Test Position	Output Power		Measured Results		Scaled-1		Scaled-Final		Power Drift (dBm)
			Max. Scaled AV Power (dBm)	Measured AV Power (dBm)	SAR1g (W/kg)	SAR10g (W/kg)	SAR1g (W/kg)	SAR10g (W/kg)	SAR1g (W/kg)	SAR10g (W/kg)	
802.11b	CH11	Top	17.00	16.61	0.197	0.129	0.216	0.141	0.217	0.142	-0.04
		Front			0.00782	0.00601	0.009	0.007	0.009	0.007	0.18
802.11a	CH48	Top	15.50	15.10	0.261	0.208	0.286	0.228	<b>0.291</b>	0.232	-0.18
		Front			0.051	0.044	0.056	0.048	0.057	0.049	-0.04
802.11a	CH165	Top	15.50	15.06	0.224	0.208	0.248	0.230	0.252	<b>0.234</b>	-0.05
		Front			0.058	0.051	0.064	0.056	0.065	0.057	-0.01
Bluetooth BDR	CH39	Top	8.5	8.25	0.019	0.016	0.020	0.017	0.020	0.017	0.13
		Front			0.059	0.052	0.062	0.055	0.062	0.055	0.16

Conclusion: PASS

Note :

Factor= Max. Scaled AV Power(W)/Measured Power(W)

Scaled SAR-1= Measured SAR\*Factor

Scaled-Final= Scaled SAR-1\*(1/Duty Cycle)

Duty Cycle for 802.11b: 99.29%; Duty Cycle for 802.11a: 98.33%; Duty Cycle for Bluetooth: 100%

The Max Reported SAR : **0.291 W/kg for 1g SAR and 0.234 for 10g extremity SAR**

Refer to attached Appendix B for details of test results.

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## 6.2 Measurement Uncertainty

### 6.2.1 Measurement uncertainty evaluation

The measured SAR were <1.5 W/kg for all frequency bands, therefore per KDB Publication 865664 D01, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports.

## 7. Photographs of the Test Set-Up

Photograph 1: Test Layout



Photograph 2: Set-up for Front Face



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**Photograph 3: Set-up for Edge Top**

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## **Appendix A**

### **System Performance Check**

Test Laboratory: Audix SAR Lab  
CW 2450

Date: 15/8/2016

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:862

Communication System: UID 0, CW, Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.982$  S/m;  $\epsilon_r = 52.819$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3767; ConvF(7.35, 7.35, 7.35); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/CW 2450/Area Scan (41x61x1):**

Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 15.21 W/kg

**Configuration/ CW 2450/Zoom Scan (7x7x7)/Cube 0:**

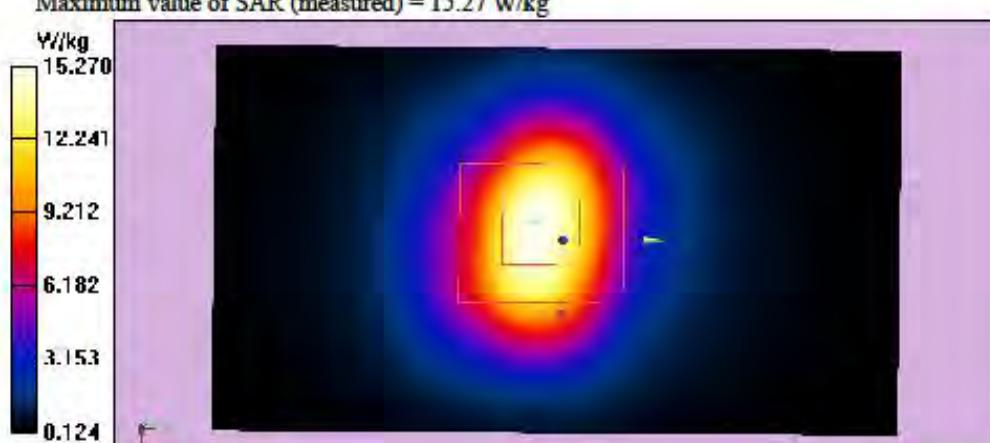
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.66 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 20.5 W/kg

SAR(1 g) = 13.11 W/kg; SAR(10 g) = 6.01 W/kg

Maximum value of SAR (measured) = 15.27 W/kg



Test Laboratory: Audix SAR Lab  
CW 5200

Date: 15/8/2016

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5200 MHz; Communication System PAR: 0 dB

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.254$  S/m;  $\epsilon_r = 50.131$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.98, 4.98, 4.98); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CW 5200/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 21.44 W/kg

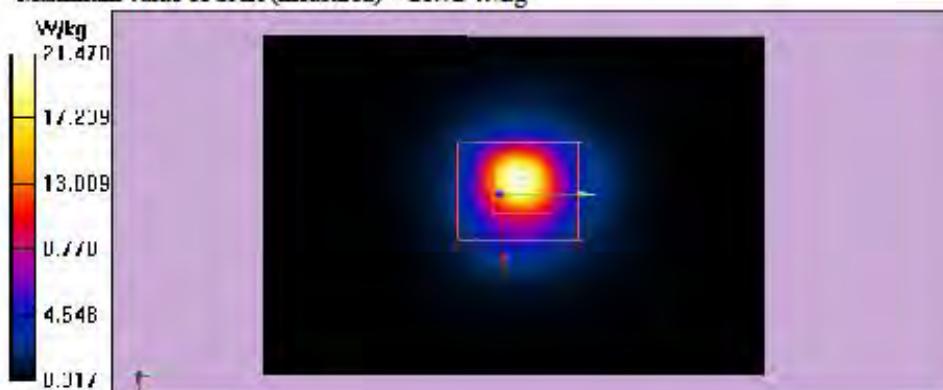
Configuration/CW 5200/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.19 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 45.60 W/kg

SAR(1 g) = 19.10 W/kg; SAR(10 g) = 5.39 W/kg

Maximum value of SAR (measured) = 21.72 W/kg



Test Laboratory: Audix SAR Lab  
CW 5800

Date: 15/8/2016

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5800 MHz; Communication System PAR: 0 dB

Medium parameters used:  $f = 5800 \text{ MHz}$ ;  $\sigma = 5.671 \text{ S/m}$ ;  $\epsilon_r = 48.50$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.33, 4.33, 4.33); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CW 5800/Area Scan (41x61x1): Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 22.84 W/kg

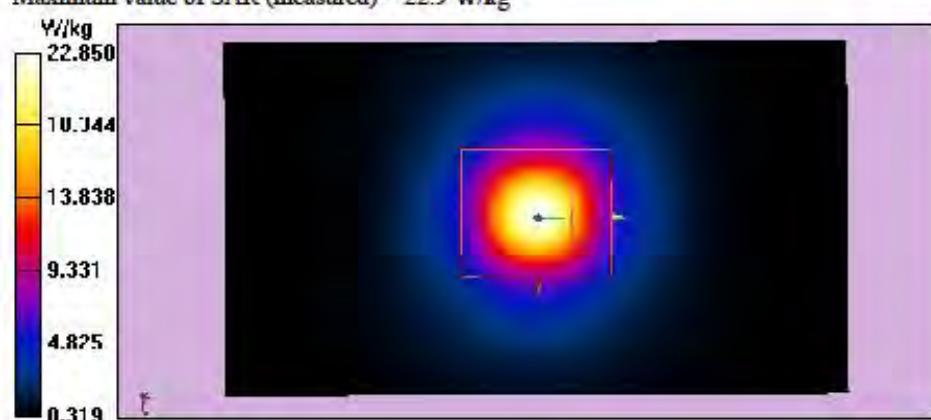
Configuration/CW 5800/Zoom Scan (7x7x7)/Cube 0: Measurement grid:  $dx=5 \text{ mm}$ ,  $dy=5 \text{ mm}$ ,  $dz=5 \text{ mm}$

Reference Value = 84.77 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 53.00 W/kg

SAR(1 g) = 19.50 W/kg; SAR(10 g) = 5.46 W/kg

Maximum value of SAR (measured) = 22.9 W/kg



## **Appendix A**

### **Test Plots of SAR Measurement**

**Test Laboratory: Audix SAR Lab  
11b CH11(2462MHz Front)**

Date: 15/8/2016

**DUT: Tablet PC; M/N: UIT232B-U03**

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);

Communication System Band: ISM 2.4GHz Band (2400.0-2483.5MHz); Frequency:  
2462 MHz; Communication System PAR: 0 dB. Medium parameters used:  $f = 2462$  MHz;  
 $\sigma = 1.983$  S/m;  $\epsilon_r = 54.141$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN3767; ConvF(7.35, 7.35, 7.35); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/CH11(2462MHz Front)/Area Scan (101x151x1):** Interpolated grid:  
 $dx=2.000$  mm,  $dy=2.000$  mm

Maximum value of SAR (interpolated) = 0.00977 W/kg

**Configuration/CH11(2462MHz Front)/Zoom Scan (7x7x7)/Cube 0:**

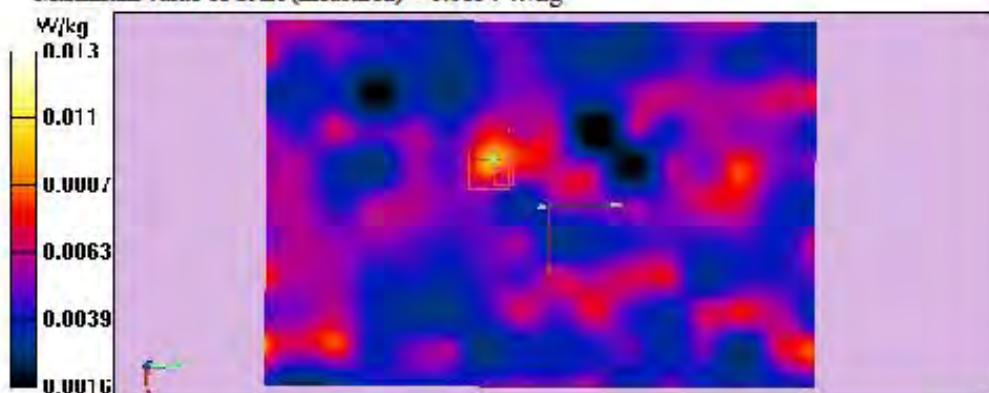
Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 1.598 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 0.0130 W/kg

SAR(1 g) = 0.00782 W/kg; SAR(10 g) = 0.00601 W/kg

Maximum value of SAR (measured) = 0.0134 W/kg



Test Laboratory: Audix SAR Lab  
**11a CH48(5240MHz Front)**

Date: 15/8/2016

DUT: Tablet PC; M/N: UIT232B-U03

Communication System: UID 0, IEEE 802.11a WiFi 5.2GHz (0); Communication System Band: IEEE 802.11a WiFi 5.2GHz; Frequency: 5240 MHz; Communication System PAR: 0 dB. Medium parameters used:  $f = 5240$  MHz;  $\sigma = 4.974$  S/m;  $\epsilon_r = 47.18$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.98, 4.98, 4.98); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CH48(5240MHz Front)/Area Scan (101x151x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 0.0565 W/kg

Configuration/CH48(5240MHz Front)/Zoom Scan (7x7x12)/Cube 0:

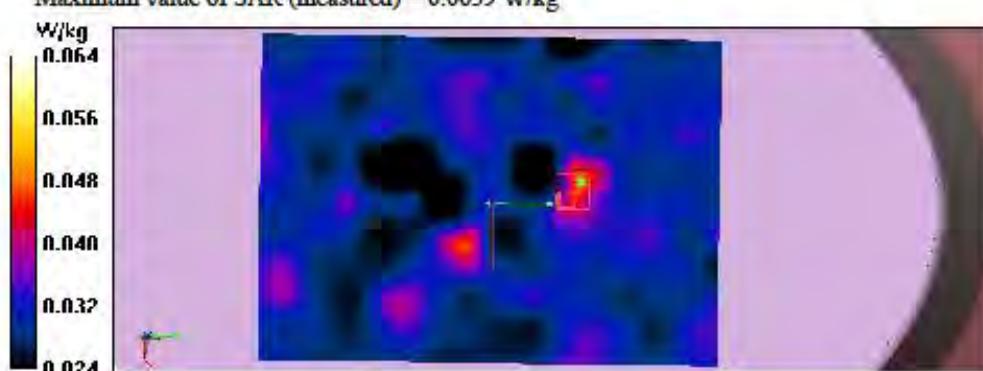
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 2.477 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.0780 W/kg

SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.044 W/kg

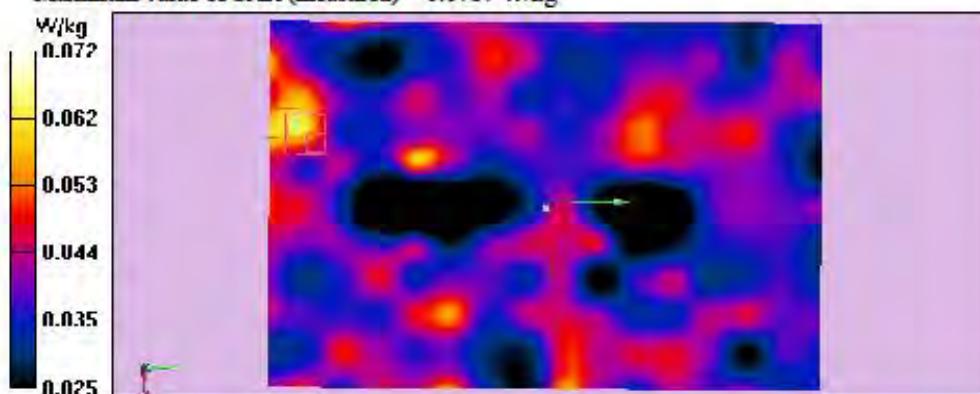
Maximum value of SAR (measured) = 0.0639 W/kg



**Test Laboratory: Audix SAR Lab** Date: 15/8/2016  
**11a CH165(5825MHz Front)**  
**DUT: Tablet PC; M/N: UIT232B-U03**  
Communication System: UID 0, IEEE 802.11a WiFi 5.8GHz (0); Communication System Band: IEEE 802.11a WiFi 5.8GHz ; Frequency: 5825 MHz; Communication System PAR: 0 dB.Medium parameters used:  $f = 5825$  MHz;  $\sigma = 6.009$  S/m;  $\epsilon_r = 47.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.33, 4.33, 4.33); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/CH165(5825MHz Front)/Area Scan (101x151x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm**  
Maximum value of SAR (interpolated) = 0.0640 W/kg  
**Configuration/CH165(5825MHz Front)/Zoom Scan (7x7x12)/Cube 0:**  
Measurement grid: dx=4mm, dy=4mm, dz=2mm  
Reference Value = 2.312 V/m; Power Drift = -0.01 dB  
Peak SAR (extrapolated) = 0.0720 W/kg  
SAR(1 g) = 0.058 W/kg; SAR(10 g) = 0.051 W/kg  
Maximum value of SAR (measured) = 0.0717 W/kg



Test Laboratory: Audix SAR Lab  
**11b CH11(2462MHz Top)**

Date: 15/8/2016

DUT: Tablet PC; M/N: UIT232B-U03

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);

Communication System Band: ISM 2.4GHz Band (2400.0-2483.5MHz); Frequency:

2462 MHz; Communication System PAR: 0 dB Medium parameters used:  $f = 2462$  MHz;  
 $\sigma = 1.981$  S/m;  $\epsilon_r = 54.144$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(7.35, 7.35, 7.35); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CH11(2462MHz Top)/Area Scan (51x151x1): Interpolated grid:  
 $dx=2.000$  mm,  $dy=2.000$  mm

Maximum value of SAR (interpolated) = 0.326 W/kg

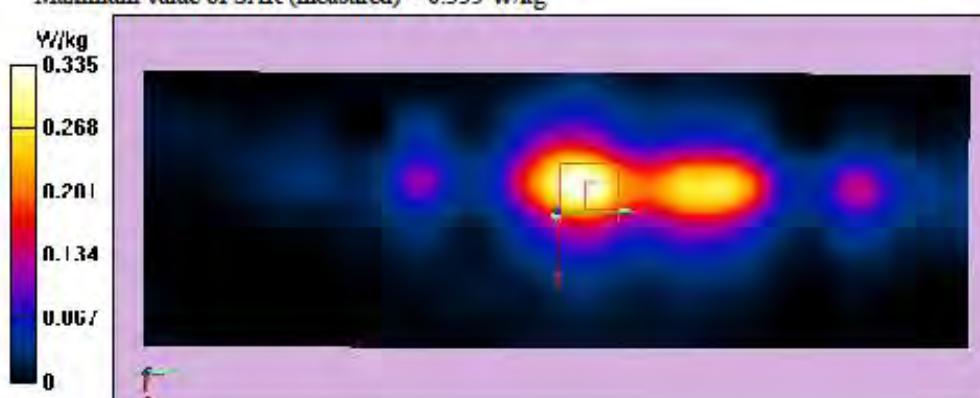
Configuration/CH11(2462MHz Top)/Zoom Scan (7x7x7)/Cube 0: Measurement  
grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 6.210 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.206 W/kg

SAR(1 g) = 0.197 W/kg; SAR(10 g) = 0.129 W/kg

Maximum value of SAR (measured) = 0.335 W/kg



**Test Laboratory: Audix SAR Lab  
11a CH48(5240MHz Top)**

Date: 15/8/2016

**DUT: Tablet PC; M/N: UIT232B-U03**

Communication System: UID 0, IEEE 802.11a WiFi 5.2GHz (0); Communication System Band: IEEE 802.11a WiFi 5.2GHz; Frequency: 5240 MHz; Communication System PAR: 0 dB. Medium parameters used:  $f = 5240$  MHz;  $\sigma = 4.977$  S/m;  $\epsilon_r = 47.19$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.98, 4.98, 4.98); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/CH48(5240MHz Top)/Area Scan (51x151x1): Interpolated grid:  
 $dx=2.000$  mm,  $dy=2.000$  mm**

Maximum value of SAR (interpolated) = 0.445 W/kg

**Configuration/CH48(5240MHz Top)/Zoom Scan (7x7x12)/Cube 0:**

Measurement grid:  $dx=4$  mm,  $dy=4$  mm,  $dz=2$  mm

Reference Value = 5.015 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 2.03 W/kg

SAR(1 g) = 0.261 W/kg; SAR(10 g) = 0.208 W/kg

Maximum value of SAR (measured) = 0.832 W/kg



Test Laboratory: Audix SAR Lab  
**11a CH165(5825MHz Top)**

Date: 15/8/2016

DUT: Tablet PC; M/N: UIT232B-U03

Communication System: UID 0, IEEE 802.11a WiFi 5.8GHz (0); Communication System Band: IEEE 802.11a WiFi 5.8GHz ; Frequency: 5825 MHz; Communication System PAR: 0 dB. Medium parameters used:  $f = 5825$  MHz;  $\sigma = 6.102$  S/m;  $\epsilon_r = 47.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(4.33, 4.33, 4.33); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Configuration/CH165(5825MHz Top)/Area Scan (51x151x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm**

Maximum value of SAR (interpolated) = 0.642 W/kg

**Configuration/CH165(5825MHz Top)/Zoom Scan (7x7x12)/Cube 0:**

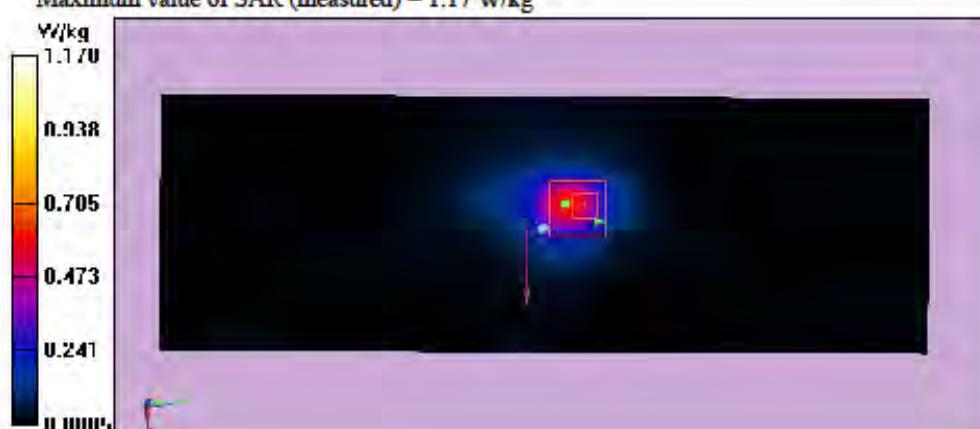
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 6.541 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.71 W/kg

SAR(1 g) = 0.224 W/kg; SAR(10 g) = 0.208 W/kg

Maximum value of SAR (measured) = 1.17 W/kg



Test Laboratory: Audix SAR Lab  
CH39(2441MHz Front)

Date: 15/8/2016

DUT: Tablet PC; M/N: UIT232B-U03

Communication System: UID 0, Blue Tooth (0); Communication System Band: Mid;  
Frequency: 2441 MHz; Communication System PAR: 0 dB. Medium parameters used  
(interpolated):  $f = 2441$  MHz;  $\sigma = 1.974$  S/m;  $\epsilon_r = 53.371$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(7.35, 7.35, 7.35); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CH2441(2441MHz Back)/Area Scan (51x71x1): Interpolated grid:  
 $dx=2.000$  mm,  $dy=2.000$  mm

Maximum value of SAR (interpolated) = 0.0447 W/kg

Configuration/CH2441(2441MHz Back)/Zoom Scan (7x7x7)/Cube 0:

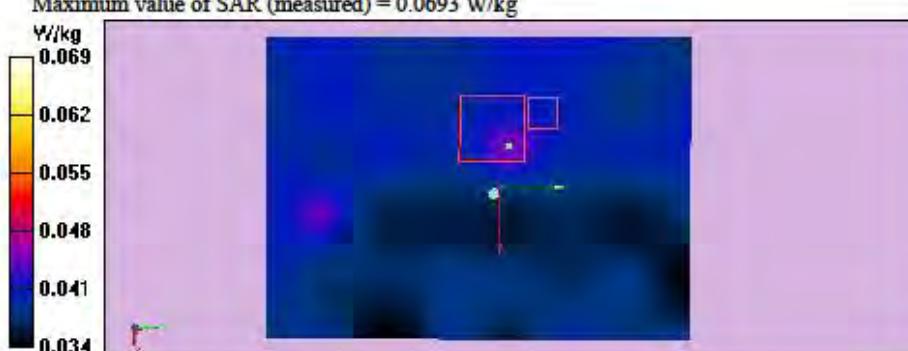
Measurement grid:  $dx=5$  mm,  $dy=5$  mm,  $dz=5$  mm

Reference Value = 4.323 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.0690 W/kg

SAR(1 g) = 0.059 W/kg; SAR(10 g) = 0.052 W/kg

Maximum value of SAR (measured) = 0.0693 W/kg



Test Laboratory: Audix SAR Lab  
CH39(2441MHz Top)

Date: 15/8/2016

DUT: Tablet PC; M/N: UIT232B-U03

Communication System: UID 0, Blue Tooth (0); Communication System Band: Mid;  
Frequency: 2441 MHz; Communication System PAR: 0 dB. Medium parameters used  
(interpolated):  $f = 2441 \text{ MHz}$ ;  $\sigma = 1.974 \text{ S/m}$ ;  $\epsilon_r = 53.371$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3767; ConvF(7.35, 7.35, 7.35); Calibrated: 30/01/2015;
- Modulation Compensation:
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn889; Calibrated: 02/02/2016
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1112
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/CH2441(2441MHz Top)/Area Scan (5lx7lx1): Interpolated grid:  
 $dx=2.000 \text{ mm}$ ,  $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.0153 W/kg

Configuration/CH2441(2441MHz Top)/Zoom Scan (7x7x7)/Cube 0:

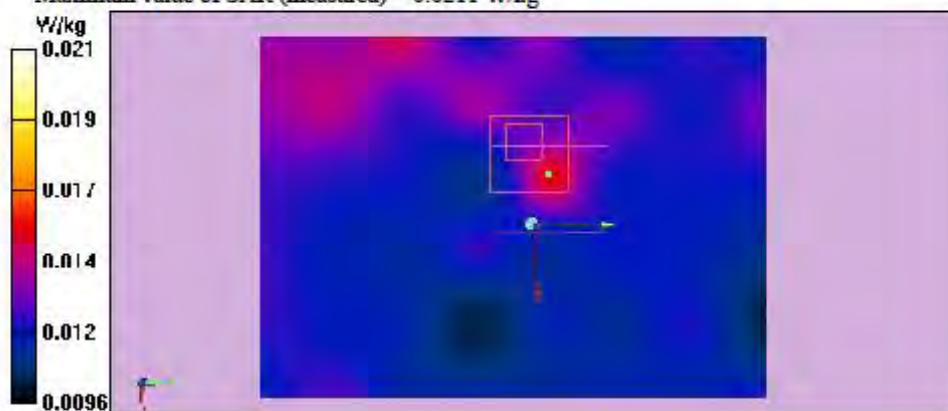
Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 2.457 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.0210 W/kg

SAR(1 g) = 0.019 W/kg; SAR(10 g) = 0.016 W/kg

Maximum value of SAR (measured) = 0.0211 W/kg



## **Appendix B**

### **Calibration Certificate**



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: ctll@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Client : **Audix**

Certificate No: Z16-97013

## CALIBRATION CERTIFICATE

Object DAE4 - SN: 899

Calibration Procedure(s) FD-Z11-2-002-01  
Calibration Procedure for the Data Acquisition Electronics  
(DAEx)

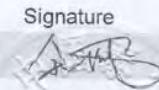
Calibration date: February 02, 2016

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.

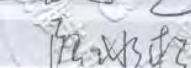
All calibrations have been conducted in the closed laboratory facility: environment temperature( $22\pm3$ )°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	06-July-15 (CTTL, No:J15X04257)	July-16

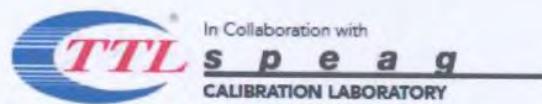
Calibrated by: Name **Yu Zongying** Function **SAR Test Engineer** Signature 

Reviewed by: Name **Qi Dianyuan** Function **SAR Project Leader** Signature 

Approved by: Name **Lu Bingsong** Function **Deputy Director of the laboratory** Signature 

Issued: February 03, 2016

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: ctll@chinattl.com Http://www.chinattl.cn

**Glossary:**

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

**Methods Applied and Interpretation of Parameters:**

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



In Collaboration with  
**TTL speag**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209  
E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) Http://www.chinattl.cn

#### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V , full range = -100...+300 mV  
Low Range: 1LSB = 61nV , full range = -1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	402.452 ± 0.15% (k=2)	403.036 ± 0.15% (k=2)	403.026 ± 0.15% (k=2)
Low Range	3.98069 ± 0.7% (k=2)	3.97751 ± 0.7% (k=2)	3.98419 ± 0.7% (k=2)

#### Connector Angle

Connector Angle to be used in DASY system	352.5° ± 1 °
---	--------------



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CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)



CALIBRATION  
No. L0570

Client

Audix

Certificate No: Z15-97001

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3767

Calibration Procedure(s) FD-Z11-2-004-01  
Calibration Procedures for Dosimetric E-field Probes

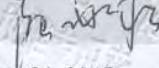
Calibration date: January 30, 2015

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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter	NRP2	101919	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor	NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor	NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Reference10dBAttenuator		18N50W-10dB	13-Mar-14(TMC, No.JZ14-1103)	Mar-16
Reference20dBAttenuator		18N50W-20dB	13-Mar-14(TMC, No.JZ14-1104)	Mar-16
Reference Probe	EX3DV4	SN 3617	28-Aug-14(SPEAG, No.EX3-3617_Aug14)	Aug-15
DAE4		SN 777	17-Sep-14 (SPEAG, DAE4-777_Sep14)	Sep-15
Secondary Standards		ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator	MG3700A	6201052605	01-Jul-14 (CTTL, No.J14X02145)	Jun-15
Network Analyzer	E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: January 31, 2015

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



In Collaboration with  
**s p e a g**  
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504  
E-mail: [ctl@chinattl.com](mailto:ctl@chinattl.com) Http://www.chinattl.cn

**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 $\Phi$	$\Phi$ rotation around probe axis
Polarization $\theta$	$\theta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), $\theta=0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

**Calibration is Performed According to the Following Standards:**

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

**Methods Applied and Interpretation of Parameters:**

- *NORM<sub>x,y,z</sub>*: Assessed for E-field polarization  $\theta=0$  ( $f \leq 900\text{MHz}$  in TEM-cell;  $f > 1800\text{MHz}$ : waveguide). *NORM<sub>x,y,z</sub>* are only intermediate values, i.e., the uncertainties of *NORM<sub>x,y,z</sub>* does not effect the  $E^2$ -field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = 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.
- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z; VRx,y,z; A,B,C* 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  $f \leq 800\text{MHz}$ ) and inside waveguide using analytical field distributions based on power measurements for  $f > 800\text{MHz}$ . The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued 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  $\pm 50\text{MHz}$  to  $\pm 100\text{MHz}$ .
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).



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# Probe EX3DV4

**SN: 3767**

Calibrated: January 30, 2015

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3767

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm( $\mu$ V/(V/m) <sup>A</sup> )	0.56	0.57	0.47	$\pm$ 10.8%
DCP(mV) <sup>B</sup>	102.2	97.8	103.3	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ $\mu$ V	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	202.6	$\pm$ 3.3%
		Y	0.0	0.0	1.0		204.8	
		Z	0.0	0.0	1.0		187.8	

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>2</sup>-field uncertainty inside TSL (see Page 5 and Page 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.



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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3767

### 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)	Unct. (k=2)
750	41.9	0.89	9.79	9.79	9.79	0.22	0.99	±12%
835	41.5	0.90	9.27	9.27	9.27	0.14	1.33	±12%
900	41.5	0.97	9.13	9.13	9.13	0.16	1.22	±12%
1450	40.5	1.20	8.77	8.77	8.77	0.58	0.70	±12%
1750	40.1	1.37	8.20	8.20	8.20	0.25	0.98	±12%
1900	40.0	1.40	7.91	7.91	7.91	0.17	1.30	±12%
2000	40.0	1.40	7.65	7.65	7.65	0.15	1.80	±12%
2450	39.2	1.80	7.18	7.18	7.18	0.53	0.71	±12%
2600	39.0	1.96	7.02	7.02	7.02	0.69	0.63	±12%
5200	36.0	4.66	5.44	5.44	5.44	0.50	1.00	±13%
5300	35.9	4.76	5.09	5.09	5.09	0.43	1.08	±13%
5500	35.6	4.96	4.83	4.83	4.83	0.55	1.03	±13%
5600	35.5	5.07	4.73	4.73	4.73	0.52	1.09	±13%
5800	35.3	5.27	4.65	4.65	4.65	0.50	1.15	±13%

<sup>C</sup> Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequency 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 the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3767

### 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 <sup>G</sup> (mm)	Unct. (k=2)
750	55.5	0.96	9.67	9.67	9.67	0.15	1.46	±12%
835	55.2	0.97	9.66	9.66	9.66	0.18	1.35	±12%
900	55.0	1.05	9.32	9.32	9.32	0.22	1.15	±12%
1450	54.0	1.30	8.22	8.22	8.22	0.11	1.61	±12%
1750	53.4	1.49	7.77	7.77	7.77	0.12	1.87	±12%
1900	53.3	1.52	7.58	7.58	7.58	0.17	1.39	±12%
2000	53.3	1.52	7.80	7.80	7.80	0.14	1.99	±12%
2450	52.7	1.95	7.35	7.35	7.35	0.31	1.19	±12%
2600	52.5	2.16	7.26	7.26	7.26	0.36	1.00	±12%
5200	49.0	5.30	4.98	4.98	4.98	0.52	1.08	±13%
5300	48.9	5.42	4.73	4.73	4.73	0.56	1.00	±13%
5500	48.6	5.65	4.35	4.35	4.35	0.52	1.26	±13%
5600	48.5	5.77	4.25	4.25	4.25	0.56	1.27	±13%
5800	48.2	6.00	4.33	4.33	4.33	0.44	1.28	±13%

<sup>C</sup> Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

<sup>F</sup> At frequency 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.

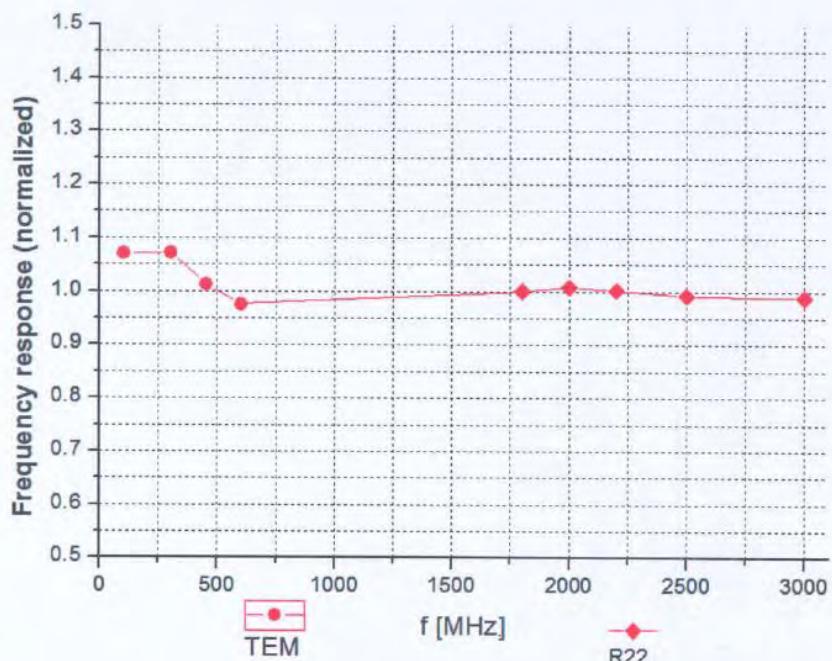
<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip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



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



Uncertainty of Frequency Response of E-field:  $\pm 7.5\%$  ( $k=2$ )

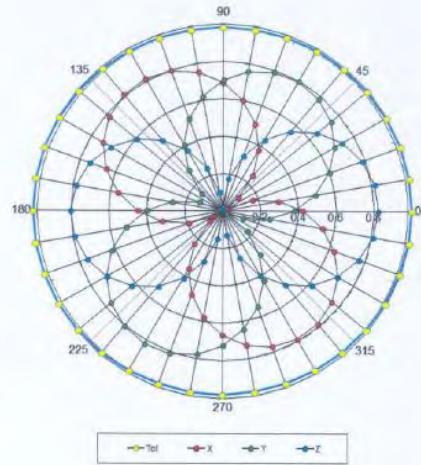


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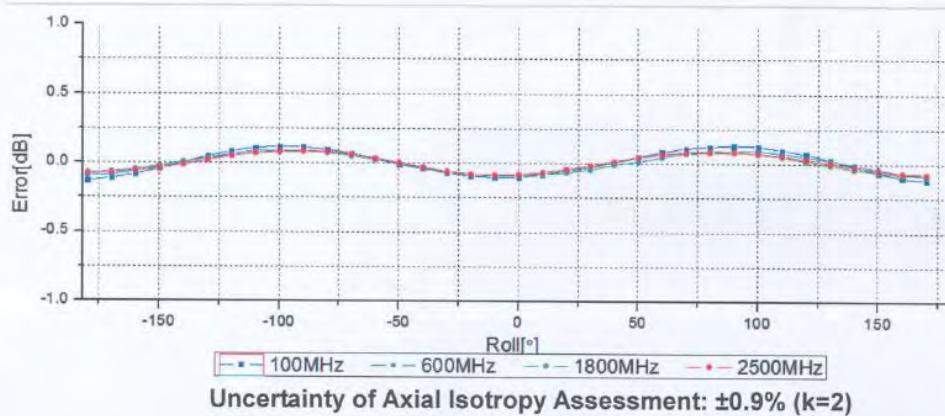
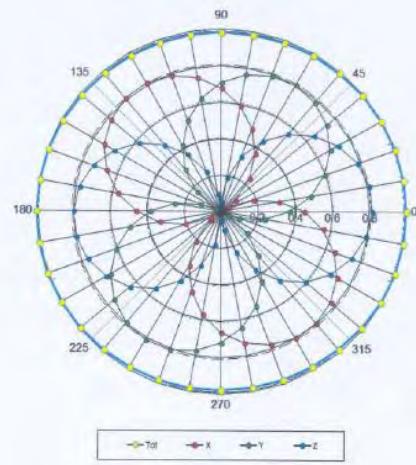
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### Receiving Pattern ( $\Phi$ ), $\theta=0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22

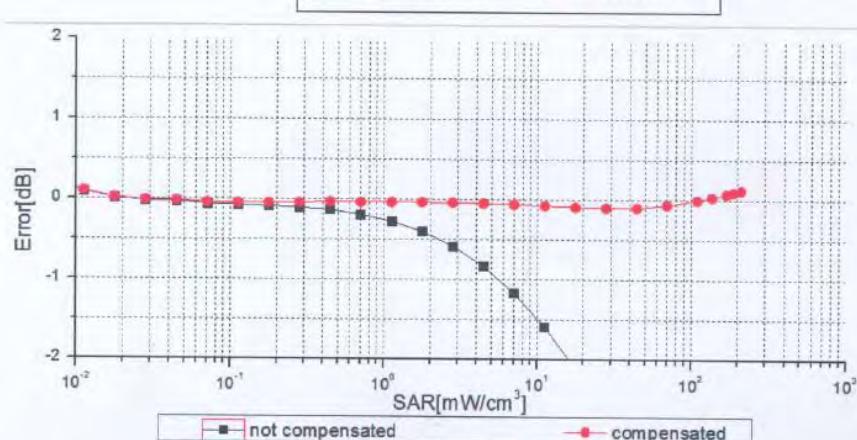
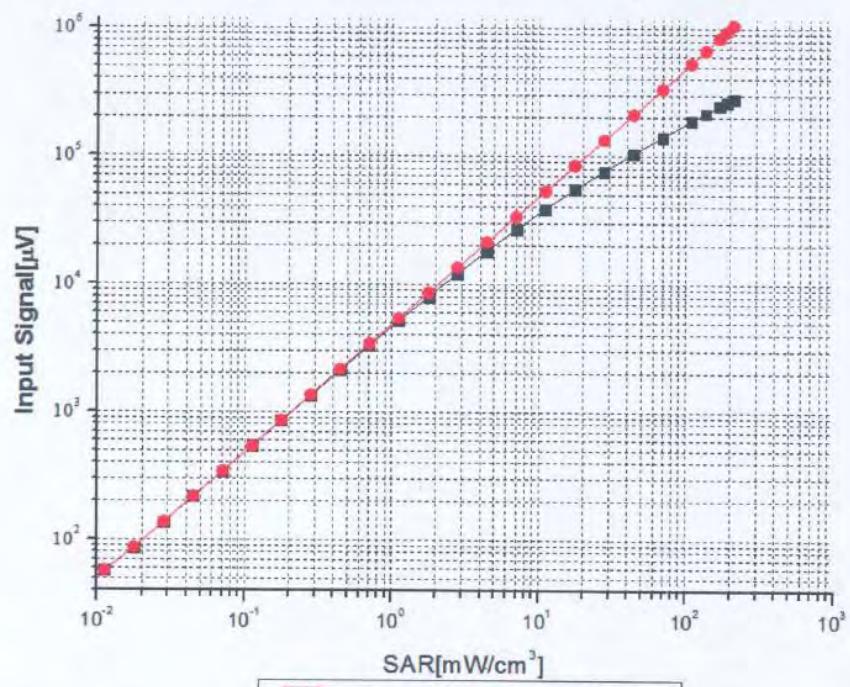




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### Dynamic Range f(SAR<sub>head</sub>) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)

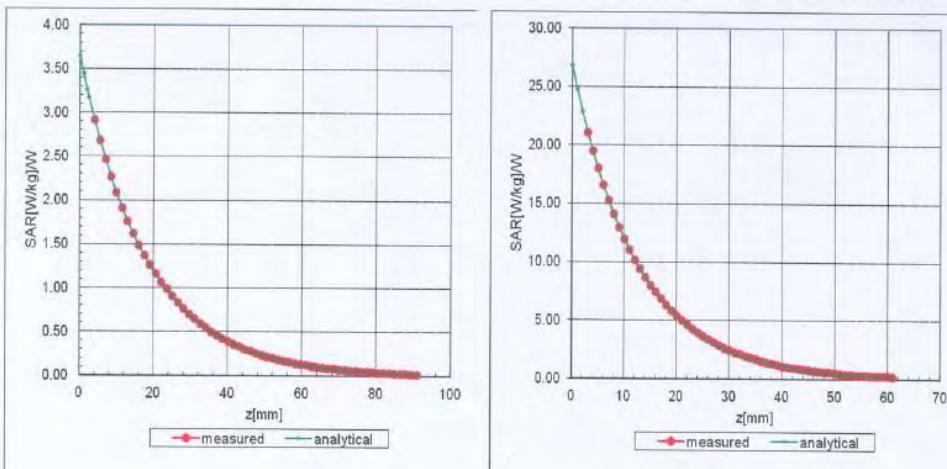


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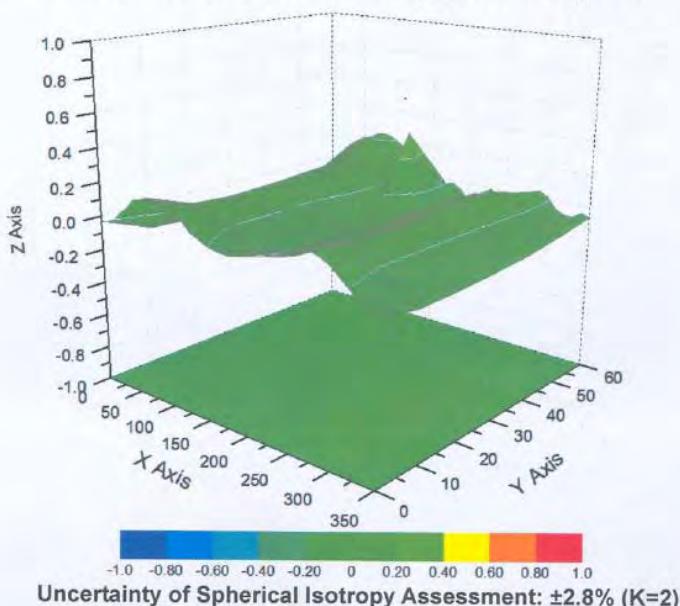
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## Conversion Factor Assessment

f=900 MHz, WGLS R9(H\_convF)      f=1750 MHz, WGLS R22(H\_convF)



## Deviation from Isotropy in Liquid





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## DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3767

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	145.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

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**CNAS** 

Client: Auden Certificate No: Z14-97048

**CALIBRATION CERTIFICATE**

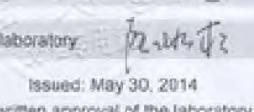
Object	D2450V2 - SN: 862
Calibration Procedure(s)	TMC-OS-E-02-194 Calibration procedure for dipole validation kits
Calibration date:	May 29, 2014

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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRV0	102063	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep-14
Reference Probe EX3DV4	SN 3848	3- Sep-13 (SPEAG, No.EX3-3848_Sep13)	Sep-14
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan-15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

Calibrated by:	Name	Function	Signature
	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: May 30, 2014

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



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**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) KDB865684, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- d) 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%.



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#### Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Twin Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	62.2	1.8 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	62.5 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	63.1 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.3 mW /g ± 20.4 % (k=2)

#### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	62.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	62.2 ± 6 %	1.94 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

#### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	50.4 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.0 mW /g ± 20.4 % (k=2)



#### Appendix

##### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.6Ω+6.07jΩ
Return Loss	-24.0dB

##### Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.1Ω+6.08jΩ
Return Loss	-24.0dB

##### General Antenna Parameters and Design

Electrical Delay (one direction)	1.346 ns
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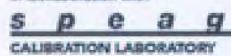
After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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
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DASY5 Validation Report for Head TSL Date: 27.05.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 862

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.819$  S/m;  $\epsilon_r = 38.51$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(6.78, 6.78, 6.78); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

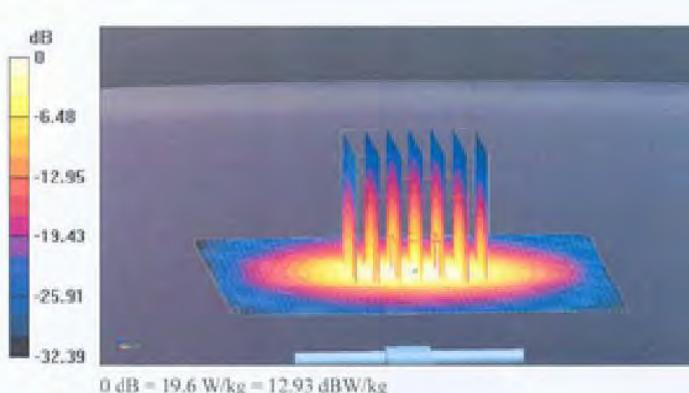
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 106.6 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.8 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.35 W/kg

Maximum value of SAR (measured) = 20.1 W/kg

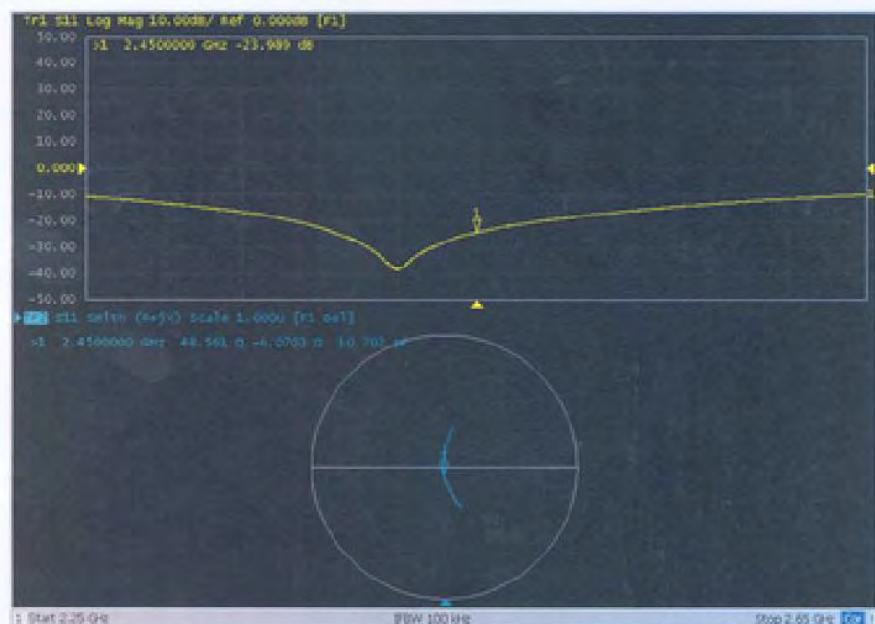




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Impedance Measurement Plot for Head TSL





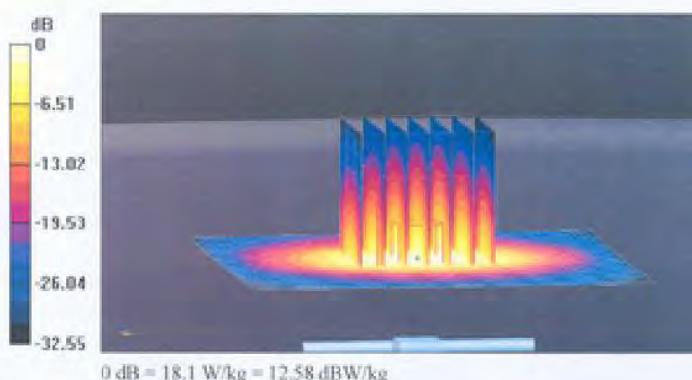
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DASY5 Validation Report for Body TSL  
Test Laboratory: TMC, Beijing, China  
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN: 862  
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.94$  S/m;  $c_0 = 52.5$ ;  $\rho = 1000$  kg/m $^3$   
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(6.73, 6.73, 6.73); Calibrated: 2013-09-03;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: xxxx
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW,  
dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid;  
dx=5mm, dy=5mm, dz=5mm  
Reference Value = 99.55 V/m; Power Drift = -0.00 dB  
Peak SAR (extrapolated) = 25.2 W/kg  
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.99 W/kg  
Maximum value of SAR (measured) = 19.0 W/kg

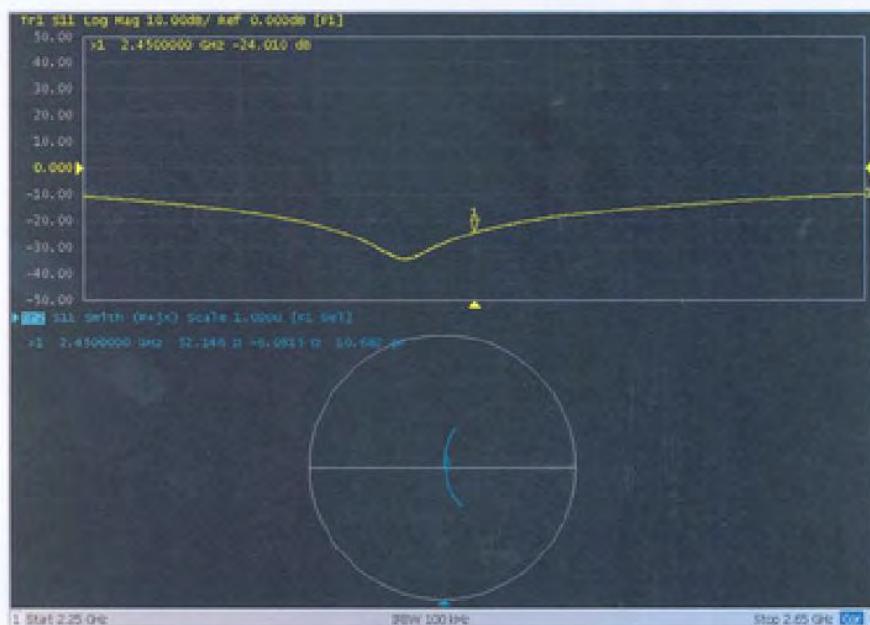




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Impedance Measurement Plot for Body TSL





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Client      Auden

Certificate No: Z14-97049

## CALIBRATION CERTIFICATE

Object      D5GHzV2 - SN:1102

Calibration Procedure(s)      TMC-OS-E-02-194  
Calibration procedure for dipole validation kits

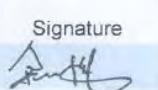
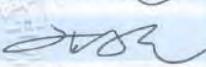
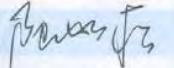
Calibration date:      June 16, 2014

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( $22\pm3^{\circ}\text{C}$ ) and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	11-Sep-13 (TMC, No.JZ13-443)	Sep-14
Power sensor NRV-Z5	100595	11-Sep-13 (TMC, No. JZ13-443)	Sep -14
Reference Probe EX3DV4	SN 3846	3- Sep-13 (SPEAG, No.EX3-3846_Sep13)	Sep-14
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Signal Generator E4438C	MY49070393	13-Nov-13 (TMC, No.JZ13-394)	Nov-14
Network Analyzer E8362B	MY43021135	19-Oct-13 (TMC, No.JZ13-278)	Oct-14

Calibrated by:	Name	Function	Signature
	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: June 17, 2014

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



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**Glossary:**

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- c) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

**Additional Documentation:**

- d) 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%.



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#### Measurement Conditions

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

DASY Version	DASY52	52.8.8.1222
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

#### Head TSL parameters at 5200MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.62 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

#### SAR result with Head TSL at 5200MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.04 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

#### SAR result with Head TSL at 5500MHz

	Condition	
SAR averaged over 1 cm³ (1 g) of Head TSL	250 mW input power	7.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	78.2 mW /g ± 23.0 % (k=2)
	Condition	
SAR averaged over 10 cm³ (10 g) of Head TSL	250 mW input power	2.23 mW / g
SAR measured	normalized to 1W	22.3 mW /g ± 22.2 % (k=2)



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#### Head TSL parameters at 5800MHz

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	34.9 ± 6 %	5.28 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

#### SAR result with Head TSL at 5800MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.57 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	75.5 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.4 mW /g ± 22.2 % (k=2)

#### Body TSL parameters at 5200MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.1 ± 6 %	5.32 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

#### SAR result with Body TSL at 5200MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	7.55 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	75.2 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.7 mW /g ± 22.2 % (k=2)



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#### Body TSL parameters at 5500MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.5 ± 6 %	5.62 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

#### SAR result with Body TSL at 5500MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	8.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	80.1 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.30 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.9 mW /g ± 22.2 % (k=2)

#### Body TSL parameters at 5800MHz

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	47.2 ± 6 %	6.05 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	---

#### SAR result with Body TSL at 5800MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	7.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	72.0 mW /g ± 23.0 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.4 mW /g ± 22.2 % (k=2)

## Appendix

#### Antenna Parameters with Head TSL at 5200MHz

Impedance, transformed to feed point	50.2Ω-8.19jΩ
Return Loss	-21.8dB



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**Antenna Parameters with Head TSL at 5500MHz**

Impedance, transformed to feed point	52.0Ω- 4.65jΩ
Return Loss	- 26.0dB

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

Impedance, transformed to feed point	54.7Ω- 1.58jΩ
Return Loss	- 26.5dB

**Antenna Parameters with Body TSL at 5200MHz**

Impedance, transformed to feed point	51.6Ω- 7.57jΩ
Return Loss	- 22.4dB

**Antenna Parameters with Body TSL at 5500MHz**

Impedance, transformed to feed point	51.1Ω- 5.61jΩ
Return Loss	- 25.0dB

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

Impedance, transformed to feed point	54.5Ω- 0.89jΩ
Return Loss	- 27.2dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.183 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
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**DASY5 Validation Report for Head TSL**

Date: 16.06.2014

Test Laboratory: TMC, Beijing, China

**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102**

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 4.62 \text{ S/m}$ ;  $\epsilon_r = 36.3$ ;  $\rho = 1000 \text{ kg/m}^3$

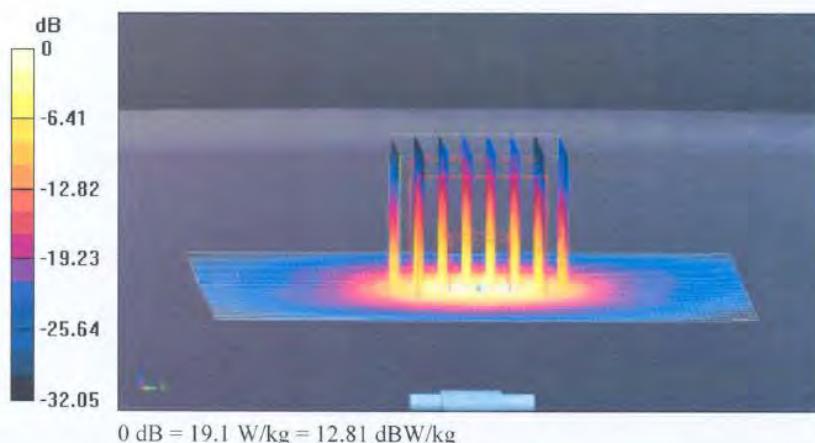
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(5.25, 5.25, 5.25); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,  
Pin=100mW, f=5200 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm  
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 69.42 V/m; Power Drift = 0.05 dB  
Peak SAR (extrapolated) = 36.0 W/kg  
SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.23 W/kg  
Maximum value of SAR (measured) = 18.5 W/kg





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DASY5 Validation Report for Head TSL  
Test Laboratory: TMC, Beijing, China

Date: 16.06.2014

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5500 \text{ MHz}$ ;  $\sigma = 5.04 \text{ S/m}$ ;  $\epsilon_r = 35.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(4.8, 4.8, 4.8); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,

Pin=100mW, f=5500 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm

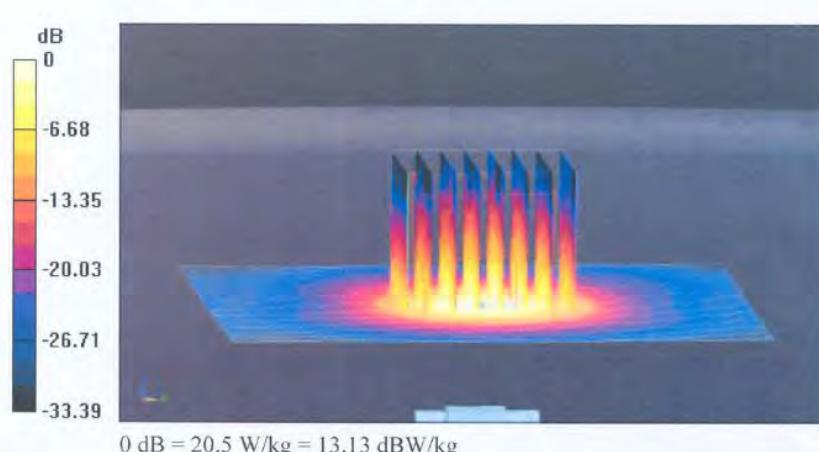
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 69.93 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 40.2 W/kg

SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.38 W/kg

Maximum value of SAR (measured) = 20.5 W/kg





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DASY5 Validation Report for Head TSL  
Test Laboratory: TMC, Beijing, China

Date: 16.06.2014

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 5800 \text{ MHz}$ ;  $\sigma = 5.28 \text{ S/m}$ ;  $\epsilon_r = 34.9$ ;  $\rho = 1000 \text{ kg/m}^3$

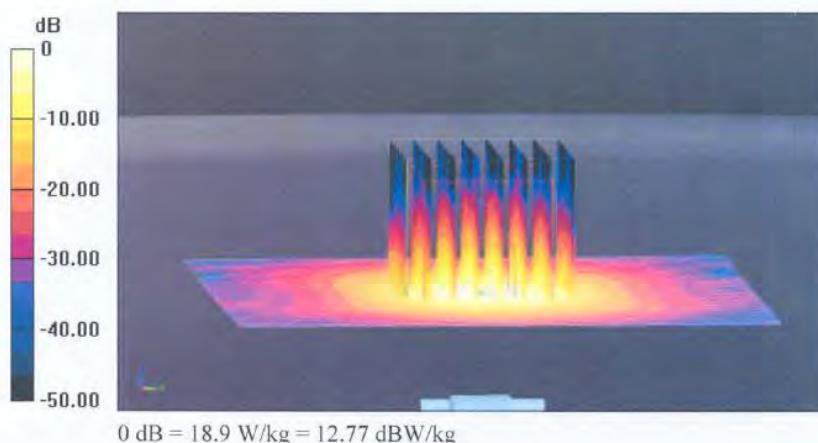
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(4.51, 4.51, 4.51); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,  
 $P_{in}=100\text{mW}$ ,  $f=5800 \text{ MHz}$ /Zoom Scan (4x4x1.4mm, graded), dist=1.4mm  
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 66.33 V/m; Power Drift = 0.08 dB  
Peak SAR (extrapolated) = 37.9 W/kg  
SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.15 W/kg  
Maximum value of SAR (measured) = 19.2 W/kg

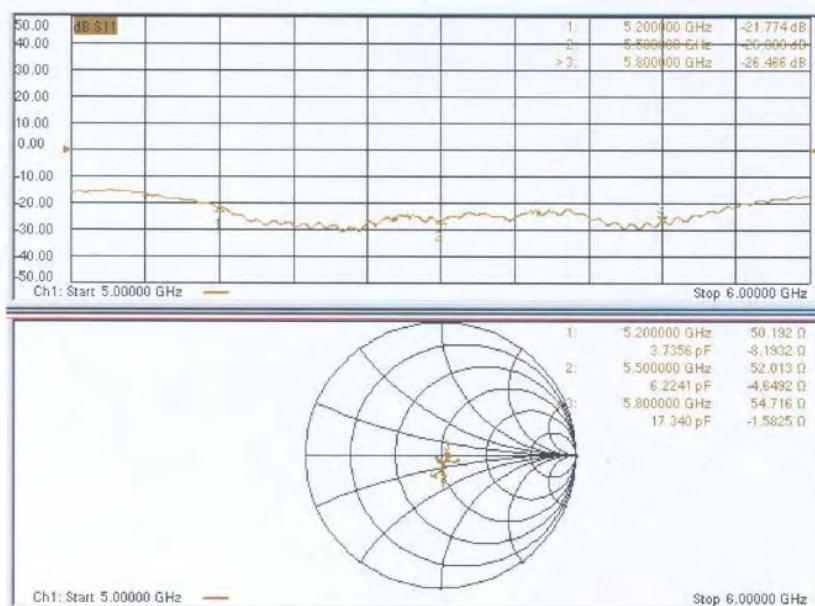




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL  
Test Laboratory: TMC, Beijing, China

Date: 13.06.2014

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5200 \text{ MHz}$ ;  $\sigma = 5.32 \text{ S/m}$ ;  $\epsilon_r = 48.1$ ;  $\rho = 1000 \text{ kg/m}^3$

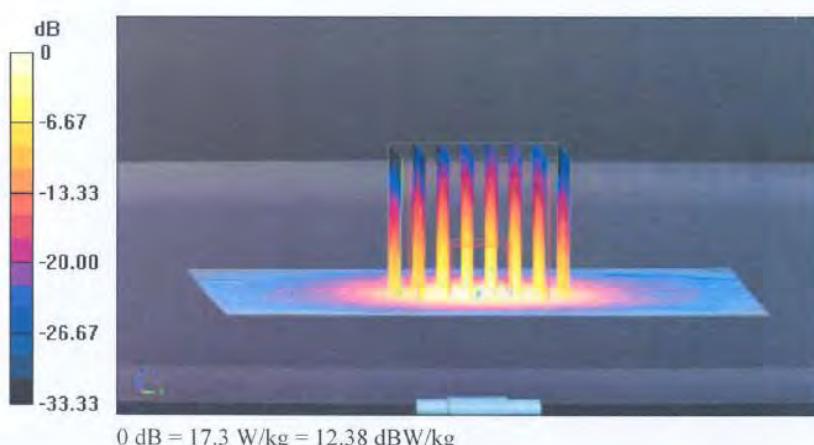
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(4.36, 4.36, 4.36); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,  
Pin=100mW, f=5200 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm  
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 65.52 V/m; Power Drift = 0.00 dB  
Peak SAR (extrapolated) = 29.4 W/kg  
SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.18 W/kg  
Maximum value of SAR (measured) = 17.2 W/kg





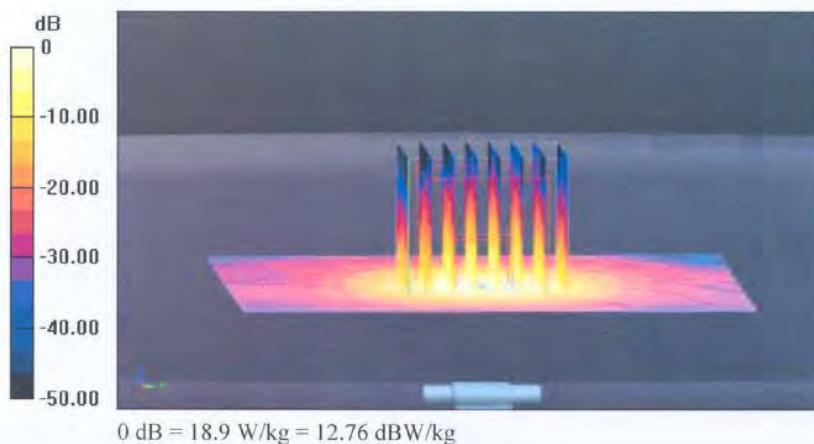
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**DASY5 Validation Report for Body TSL** Date: 13.06.2014  
Test Laboratory: TMC, Beijing, China  
**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102**  
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 5500 \text{ MHz}$ ;  $\sigma = 5.62 \text{ S/m}$ ;  $\epsilon_r = 47.5$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(3.81, 3.81, 3.81); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,  
Pin=100mW, f=5500 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm  
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 68.16 V/m; Power Drift = 0.03 dB  
Peak SAR (extrapolated) = 33.5 W/kg  
SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.3 W/kg  
Maximum value of SAR (measured) = 18.8 W/kg





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### DASY5 Validation Report for Body TSL

Date: 13.06.2014

Test Laboratory: TMC, Beijing, China

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1102

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.05$  S/m;  $\epsilon_r = 47.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

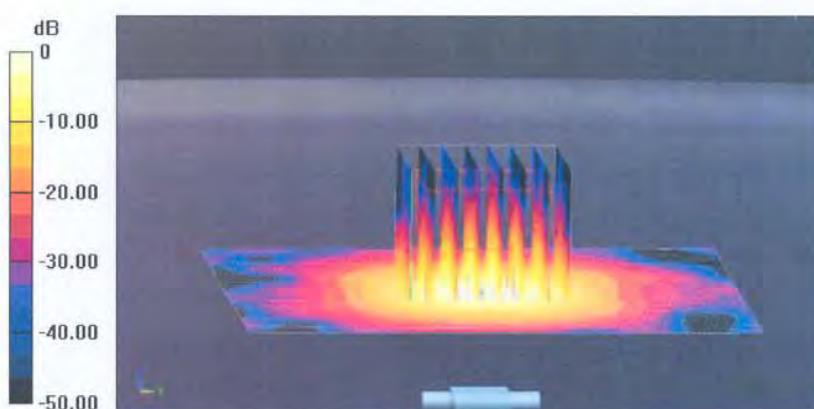
Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3846; ConvF(3.94, 3.94, 3.94); Calibrated: 2013-09-03;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2014-01-23
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm,  
Pin=100mW, f=5800 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm  
(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm  
Reference Value = 63.52 V/m; Power Drift = -0.02 dB  
Peak SAR (extrapolated) = 33.4 W/kg  
SAR(1 g) = 7.23 W/kg; SAR(10 g) = 2.05 W/kg  
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.6 W/kg = 12.45 dBW/kg



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Impedance Measurement Plot for Body TSL

