

Prüfbericht-Nr.: <i>Test Report No.:</i>	17040153 004	Auftrags-Nr.: <i>Order No.:</i>	164013996	Seite 1 von 19 <i>Page 1 of 19</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	07.05.2014		
Auftraggeber: <i>Client:</i>	KEEN HIGH TECHNOLOGIES LTD., Block A1 & A2, Ze Da Li Industrial Park, Tangwei Area, Fuyong, Bao'an, Shenzhen, Guangdong, China				
Prüfgegenstand: <i>Test item:</i>	Tablet				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	NS-15AT08	T8240RK-88T			
Auftrags-Inhalt: <i>Order content:</i>	FCC/IC Certification				
Prüfgrundlage: <i>Test specification:</i>	CFR Title 47 Part 2 Subpart J Section 2.1093 FCC OET Bulletin 65 Supplement C (Edition 01-01) IEEE 1528-2003 ANSI/IEEE C95.1-1992 RSS-102 Issue 4 March 2010				
Wareneingangsdatum: <i>Date of receipt:</i>	07.05.2014				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000070974 004				
Prüfzeitraum: <i>Testing period:</i>	14.05.2014				
Ort der Prüfung: <i>Place of testing:</i>	Shenzhen Academy of Metrology and Quality Inspection				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:	kontrolliert von / reviewed by:				
<i>Tom Wang</i>	<i>Sam Lin</i>				
06-06-2014 Tom Wang/Assistant Project Manager	06-06-2014	Sam Lin/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>	Unterschrift <i>Signature</i>
Sonstiges / Other:					
Zustand des Prüfgegenstandes bei Anlieferung: <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(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
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 Prüfzeichens. <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>					

STATEMENT OF COMPLIANCE

TEST ITEM	SPECIFICATION	RESULT
Specific Absorption Rate - Wi-Fi 802.11 b/g/n - 2.4GHz Band	OET Bulletin 65 Supplement C (Edition 01-01): Evaluating compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields	PASS

This device complies with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/kg) specified in CFR Title 47 Part 2 Subpart J Section 2.1093 and ANSI/IEEE C95.1-1992.

This device have been testd in accordance with the measurement methods and procedure specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement C (edition 01-01).

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

FREQUENCY BAND	EXPOSURE POSITION	EQUIPMENT CLASS	HIGHEST REPORTED SAR VALUE (W/KG)
802.11 b/g/n - 2.4GHz Band	Body	DTS	0.76

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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
- Appendix B: Test Plots of SAR Measurement
- Appendix C: Calibration Certificate

2. Test Sites

2.1 Test Facilities

Shenzhen Academy of Metrology and Quality Inspection
Bldg. Metrology and Quality Inspection, Longzhu Road, Shenzhen, Guangdong, China

The Laboratory is listed in the United States of American Federal Communications Commission (FCC), and the registration number are 446246 806614 994606 (semi anechoic chamber).

The Laboratory is registered to perform emission tests with Industry Canada (IC), and the registration number is IC4174.

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

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Type	Calibrated until
SAR test system	SPEAG	TX60L	---
SAR Probe	SPEAG	ES3DV3	2014.10.31
System Validation Dipole,835MHz	SPEAG	D835V2	2014.09.24
System Validation Dipole,1900MHz	SPEAG	D1900V2	2014.09.21
System Validation Dipole,2450MHz	SPEAG	D2450V2	2014.10.18
Dielectric Probe Kit	SPEAG	85070E	---
Dual-directional coupler,0.10-2.0GHz	Agilent	778D	---
Dual-directional coupler,2.00-18GHz	Agilent	772D	---
Coaxial attenuator	Agilent	8491A	---
Power Amplifier	Agilent	ZHL42W	---
Signal Generator	R&S	SMR20	2015.01.16
Power Meter	R&S	NRVD	2015.01.19
Call Tester	R&S	CMU 200	2015.03.30
Data Acquisition Electronics	SPEAG	DAE4	2015.10.30
Software	SPEAG	DASY52	--
Network Analyzer	Agilent	E5071C	2015.04.24

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a 8" tablet with Wi-Fi & Bluetooth function.
 For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification

Device type:	Portable device		
EUT Name:	Tablet		
Type Identification:	NS-15AT08 T8240RK-88T		
FCC ID:	XUZNS-15AT08		
IC number:	10558A-NS15AT08		
Operating mode(s) / WiFi:	802.11b	802.11g	802.11n
Test modulation	DSSS	OFDM	OFDM
Transmit Frequency Range (MHz):	2412-2462	2412-2462	2412-2462
Maximum tune-up average output power (dBm):	16	15	14
Operating mode(s) / Bluetooth:	Bluetooth 4.0		
Test modulation	GFSK, $\pi/4$ DQPSK, 8DPSK		
Transmit Frequency Range (MHz):	2402-2480		
Maximum tune-up average output power (dBm):	10		
Antenna type:	Integrated antenna		
Antenna Gain	2dBi		
Battery options:	DC 3.7V		

Table 3: List of WLAN Channel of 802.11b/g/n mode

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 4: List of Bluetooth Channel (BDR & EDR mode)

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

Table 5: List of Bluetooth Channel (LE mode)

Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
0	2402.00	10	2422.00	20	2442.00	30	2462.00
1	2404.00	11	2424.00	21	2444.00	31	2464.00
2	2406.00	12	2426.00	22	2446.00	32	2466.00
3	2408.00	13	2428.00	23	2448.00	33	2468.00
4	2410.00	14	2430.00	24	2450.00	34	2470.00
5	2412.00	15	2432.00	25	2452.00	35	2472.00
6	2414.00	16	2434.00	26	2454.00	36	2474.00
7	2416.00	17	2436.00	27	2456.00	37	2476.00
8	2418.00	18	2438.00	28	2458.00	38	2478.00
9	2420.00	19	2440.00	29	2460.00	39	2480.00

3.3 Independent Operation Modes

The basic operation modes are:

- A. WiFi transmitting
 - 1. 802.11b
 - i. CH1
 - ii. CH6
 - iii. CH11
 - 2. 802.11g
 - i. CH1
 - ii. CH6
 - iii. CH11
- B. Off

3.4 Submitted Documents

- Bill of Material
- Constructional Drawing
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

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

Table 6: Configuration of EUT

Operation mode	Frequency Range (MHz)	Modulation	Default Test Channel			Power Control Level
			Low	Middle	High	
802.11b/g/n	2412-2462	DSSS, OFDM	CH1	CH6	CH11	Test software was used to configure the EUT to transmit at maximum output power
Bluetooth (BDR & EDR mode)	2402-2480	FHSS	CH0	CH39	CH78	
Bluetooth (LE mode)	2402-2480	GFSK	CH0	CH19	CH39	

4.2 Specific Absorption Rate (SAR) System Check

Dielectric parameters of the tissue simulating liquid were verified prior to the SAR evaluation using the dielectric probe kit and the network analyzer.

A system check measurement was made following the determination of the dielectric parameters of the tissue simulating liquid, using the dipole validation kit. A power level of 250 mW for 2.4GHz band as 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 the following table.

Table 7: System Check Results of Dielectric Performance of Tissue Simulating Liquid

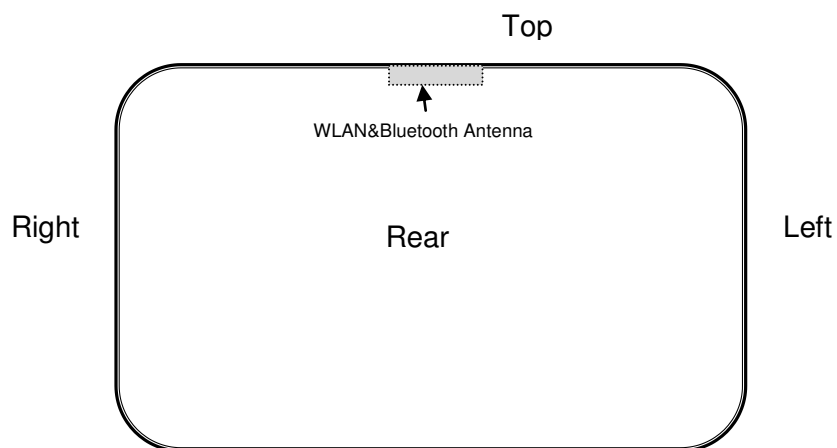
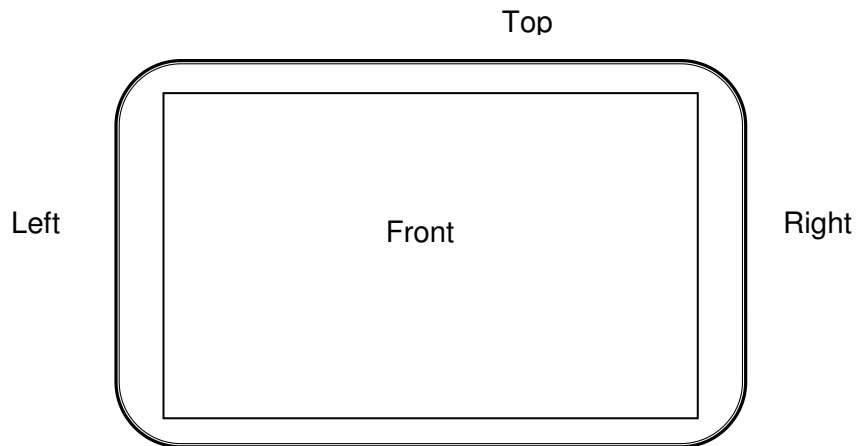
Used Target Frequency / Position	Target Tissue		Measured Tissue		Liquid Temp. (°C)
	ϵ_r (+/-5%)	σ (S/m) (+/-5%)	ϵ_r	σ (S/m)	
2450 MHz / Body	52.70	1.95	51.4	1.98	22

ϵ_r = Relative permittivity, σ = Conductivity

Table 8: System Check Results of System Verification

System Check	Target SAR Value (1W) (+/-5%)	Measured SAR Value (Normalized to 1W)
	1-g (W/kg)	1-g (W/kg)
2450 MHz / Body	50.8	48.8

4.3 Exposure Positions Consideration



Remark: the diagonal length of EUT is more than 20cm, hence the test was applied on the rear side & top side only.

4.4 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 b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on channel 1, 6, 11. However, if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11n when the maximum average output power is less than $\frac{1}{4}$ dB higher than that measured on the corresponding 802.11b channels.

Each channel should be tested at the lowest data rate, and repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg.

For each frequency band testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than $\frac{1}{4}$ dB higher than those measured at the lowest data rate.

4.5 Special Accessories and Auxiliary Equipment

None.

Table 11: Conducted Power of 802.11n

802.11n-HT20 Average Power (dBm)									
Channel	Frequency(M Hz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 01	2,412	10.52	10.63	10.71	11.26	11.42	11.45	11.50	11.54
CH 06	2,437	10.79	11.04	11.15	11.59	11.64	11.67	11.76	11.82
CH 11	2,462	10.92	11.19	11.24	11.79	11.82	11.85	11.89	11.91

Remark:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate. 2.4GHz WLAN SAR was tested on 802.11b 11Mbps.
3. Per KDB 248227 D01 v01r02, 11g, 11n-HT20 and 11n-HT40 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

Table 12: Test result of Peak Output Power of Buletooth (BDR mode)

Channel	Channel Frequency (MHz)	Peak Output Power	Limit
		(dBm)	(dBm)
Low Channel	2402	-4.32	21
Middle Channel	2441	-3.83	21
High Channel	2480	-3.80	21

Table 13: Test result of Peak Output Power of Bluetooth (EDR mode)

Channel	Channel Frequency (MHz)	Peak Output Power	Limit
		(dBm)	(dBm)
Low Channel	2402	-4.25	21
Middle Channel	2441	-3.76	21
High Channel	2480	-3.73	21

Table 14: Test result of Peak Output Power of Bluetooth (LE mode)

Channel	Channel Frequency (MHz)	Peak Output Power	Limit
		(dBm)	(dBm)
Low Channel	2402	5.61	30
Middle Channel	2440	5.97	30
High Channel	2480	5.88	30

According to KDB 447498 D01 v05r01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances $\leq 50\text{mm}$ are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min.test separation distance, mm})] \cdot [\sqrt{f_{\text{(GHz)}}}] \leq 3.0$$
 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

The maximum output power of Bluetooth is 5.97dBm (3.95mW), and the minimum separation distance is 5mm, hence the exclusion thresholds is $1.23 < 3.0$, therefore RF exposure evaluation is not required for Bluetooth.

Table 15: Test result of SAR Values

Band	Mode	Test Position	Channel	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
WIFI 2.4G	11b	Front	6	2437	14.53	15	1.114	0.682	0.760
WIFI 2.4G	11b	Front	1	2412	14.47	15	1.130	0.392	0.443
WIFI 2.4G	11b	Front	11	2462	14.67	15	1.079	0.621	0.670
WIFI 2.4G	11b	Back	6	2437	14.53	15	1.114	0.226	0.252
WIFI 2.4G	11b	Top	6	2437	14.53	15	1.114	0.501	0.558

Remark:

1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.

Reported SAR(W/kg)= Measured SAR(W/kg)* Scaling Factor

2. Per KDB 447498 D01v05, for each exposure position, if the mid channel or highest output channel reported SAR $\leq 0.8\text{W/kg}$, other channels SAR testing are not necessary

3. Per KDB 941225 D06v01r01, when the same wireless mode and device transmission configurations are required for testing body-worn accessories and hotspot mode, it is not necessary to test body-worn accessory SAR for the same device orientation if the test separation distance for hotspot mode is more conservative than that used for body-worn

4. According to KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8\text{W/kg}$. Measured SAR of all frequency band are lower than 0.8W/kg , repeated SAR is not required .

Refer to attached Appendix B for details of test results.

5.2 Measurement Uncertainty

5.2.1 Uncertainty for SAR Test

Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

Uncertainty Component	Tol. (%)	Prob Dist.	Div	ci (1g)	ci.ui(%) (1g)	vi
Measurement System						
Probe Calibration	±5.9	N	1	1	±5.9	∞
Axial Isotropy	±4.7	R	$\sqrt{3}$	0.7	±1.9	∞
Hemispherical Isotropy	±9.6	R	$\sqrt{3}$	0.7	±3.9	∞
Boundary Effect	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Linearity	±4.7	R	$\sqrt{3}$	1	±2.7	∞
System Detection Limits	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Readout Electronics	±0.3	N	1	1	±0.3	∞
Response Time	±0.8	R	$\sqrt{3}$	1	±0.5	∞
Integration Time	±2.6	R	$\sqrt{3}$	1	±1.5	∞
RF Ambient Conditions - Noise	±3.0	R	$\sqrt{3}$	1	±1.7	∞
RF Ambient Conditions - Reflections	±3.0	R	$\sqrt{3}$	1	±1.7	∞
Probe Positioner Mechanical Tolerance	±0.4	R	$\sqrt{3}$	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	±2.9	R	$\sqrt{3}$	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	±1.0	R	$\sqrt{3}$	1	±0.6	∞
Test Sample Related						
Test Sample Positioning	±2.9	N	1	1	±2.9	145
Device Holder Uncertainty	±3.6	N	1	1	±3.6	5
Output Power Variation - SAR drift measurement	±5.0	R	$\sqrt{3}$	1	±2.9	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	±4.0	R	$\sqrt{3}$	1	±2.3	∞
Conductivity Target - tolerance	±5.0	R	$\sqrt{3}$	0.43	±1.2	∞
Conductivity - measurement uncertainty	±2.5	N	1	0.43	±1.1	∞
Permittivity Target - tolerance	±5.0	R	$\sqrt{3}$	0.49	±1.4	∞
Permittivity - measurement uncertainty	±2.5	N	1	0.49	±1.2	5
Combined Standard Uncertainty					±10.7	387
Expanded STD Uncertainty					±21.4	

5.2.2 Uncertainty for System Validation

Uncertainty Component	Uncert. value	Prob. Dist.	Div.	(ci) (1g)	Std. Unc. (1g)	(vi) v _{eff}
Probe Calibration	±6.55 %	N	1	1	±6.55 %	1
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	1	±2.7 %	1
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0	±0 %	1
Boundary Effects	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Linearity	±4.7 %	R	$\sqrt{3}$	1	±2.7 %	1
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Modulation Response	±0 %	R	$\sqrt{3}$	1	±0 %	1
Readout Electronics	±0.3 %	N	1	1	±0.3 %	1
Response Time	±0 %	R	$\sqrt{3}$	1	±0 %	1
Integration Time	±0 %	R	$\sqrt{3}$	1	±0 %	1
RF Ambient Noise	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
RF Ambient Reflections	±1.0 %	R	$\sqrt{3}$	1	±0.6 %	1
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	±0.5 %	1
Probe Positioning	±6.7 %	R	$\sqrt{3}$	1	±3.9 %	1
Max. SAR Eval.	±2.0 %	R	$\sqrt{3}$	1	±1.2 %	1
Dipole Related						
Deviation of exp. dipole	±5.5 %	R	$\sqrt{3}$	1	±3.2 %	1
Dipole Axis to Liquid Dist.	±2.0 %	R	$\sqrt{3}$	1	±1.2 %	1
Input power & SAR drift	±3.4 %	R	$\sqrt{3}$	1	±2.0 %	1
Phantom and Setup						
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	±2.3 %	1
SAR correction	±1.9 %	R	$\sqrt{3}$	0.84	±0.9 %	1
Liquid Conductivity (meas.)	±2.5 %	N	1	0.71	±1.8 %	1
Liquid Permittivity (meas.)	±2.5 %	N	1	0.26	±0.7 %	1
Temp. unc. -Conductivity	±1.7 %	R	$\sqrt{3}$	0.71	±0.7 %	1
Temp. unc. -Permittivity	±0.3 %	R	$\sqrt{3}$	0.26	±0.0 %	∞
Combined Std. Uncertainty					±10.1 %	
Expanded STD Uncertainty					±20.1 %	

6. Photographs of the Test Set-Up

Photograph 1: Set-up for front side



Photograph 2: Set-up for rear side



Photograph 3: Set-up for top side



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SystemPerformanceCheck-D2450 Body

Date: 2014.5. 14.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:818

Communication System: CW; Communication System Band: Not Specified; Frequency: 2450 MHz; Communication System PAR: 0 dB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.98$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72,4.72); Calibrated: 2013.10.31.

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn876; Calibrated: 2013.10.31.

Phantom: SAM 1; Type: QD000P40CC; Serial: TP:1504

Measurement SW: DASYS2, Version 52.8 (0); SEMCAD X Version 14.6.4 (4989)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm

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

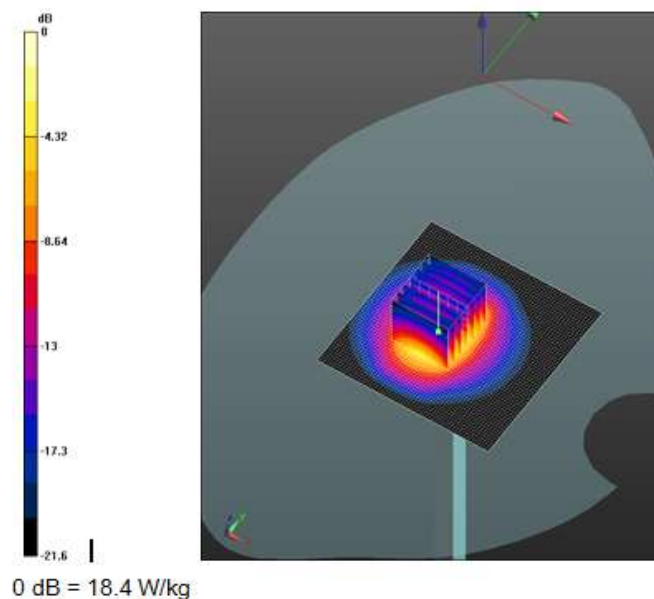
Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 82.205 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 24.691 mW/g

SAR(1 g) = 12.2 mW/g; SAR(10 g) = 5.72 mW/g

Maximum value of SAR (measured) = 18.4 W/kg



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Test Result of SAR Measurement

Date/Time: 2014.05.14.

Test Laboratory: SMQ SAR Test

1. NS-15AT08 WiFi 802.11b Body Faceup, Low channel

DUT: MID; Type: default; Serial: Not Specified

Communication System: 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System

Band: 802.11b; Frequency: 2412 MHz;Communication System PAR: 3.599 dB

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 2.00$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72, 4.72); Calibrated: 2013.10.31.;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 2014.03.03.
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- Measurement SW: DASYS2, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

802.11b-0mm/Faceup-Low/Area Scan (71x101x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Reference Value = 6.859 V/m; Power Drift = 0.25 dB

Fast SAR: SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.158 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.404 W/kg

802.11b-0mm/Faceup-Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

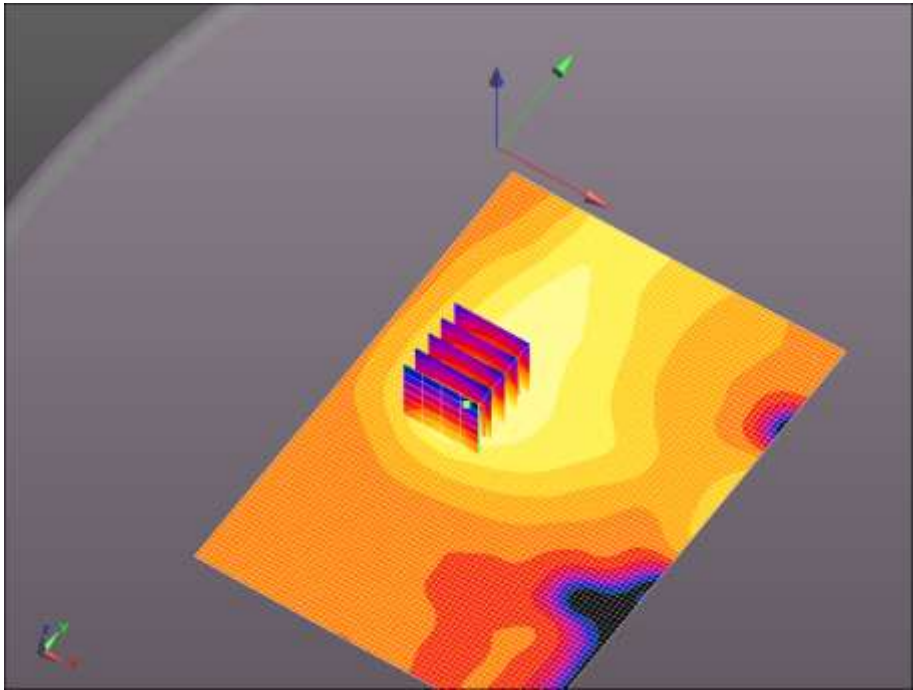
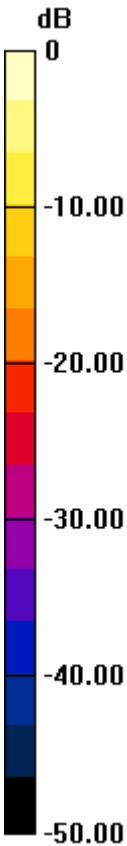
Reference Value = 6.859 V/m; Power Drift = 0.25 dB

Peak SAR (extrapolated) = 0.854 mW/g

SAR(1 g) = 0.392 mW/g; SAR(10 g) = 0.184 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.428 W/kg



$0 \text{ dB} = 0.404 \text{ W/kg} = -7.87 \text{ dB W/kg}$

2. NS-15AT08 WiFi 802.11b Body Faceup, Middel channel

DUT: MID; Type: default; Serial: Not Specified

Communication System: 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System Band: 802.11b; Frequency: 2437 MHz;Communication System PAR: 3.599 dB

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2.011$ mho/m; $\epsilon_r = 50.719$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72, 4.72); Calibrated: 2013.10.31.;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 2014.03.03.
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- Measurement SW: DASYS2, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

802.11b-0mm/Faceup-Mid/Area Scan (71x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 4.690 V/m; Power Drift = 0.04 dB

Fast SAR: SAR(1 g) = 0.265 mW/g; SAR(10 g) = 0.112 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.389 W/kg

802.11b-0mm/Faceup-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

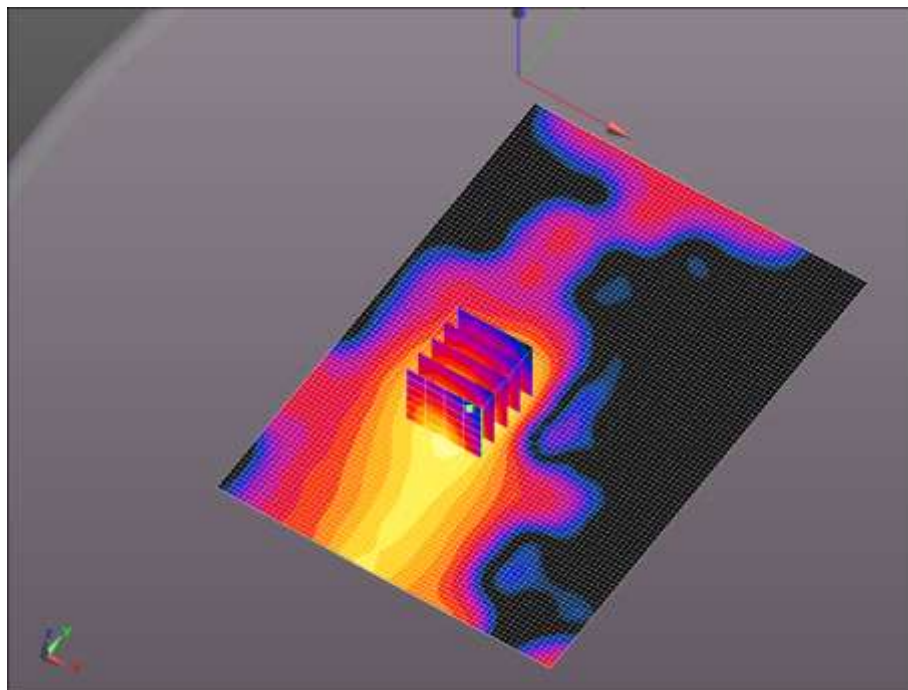
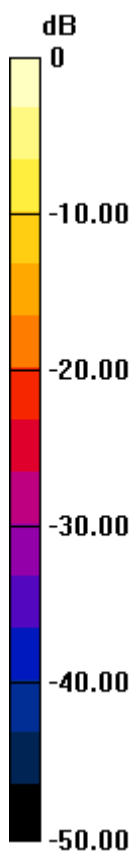
Reference Value = 4.690 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.848 mW/g

SAR(1 g) = 0.682 mW/g; SAR(10 g) = 0.237 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.845 W/kg



0 dB = 0.389 W/kg = -8.21 dB W/kg

3. NS-15AT08 WiFi 802.11b Body Faceup, High channel

DUT: MID; Type: default; Serial: Not Specified

Communication System: 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System Band: 802.11b; Frequency: 2462 MHz;Communication System PAR: 3.599 dB

Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 1.974$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72, 4.72); Calibrated: 2013.10.31.;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 2014.03.03.
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- Measurement SW: DASYS2, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

802.11b-0mm/Faceup-High/Area Scan (71x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 8.454 V/m; Power Drift = 0.07 dB

Fast SAR: SAR(1 g) = 0.480 mW/g; SAR(10 g) = 0.236 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.583 W/kg

802.11b-0mm/Faceup-High/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

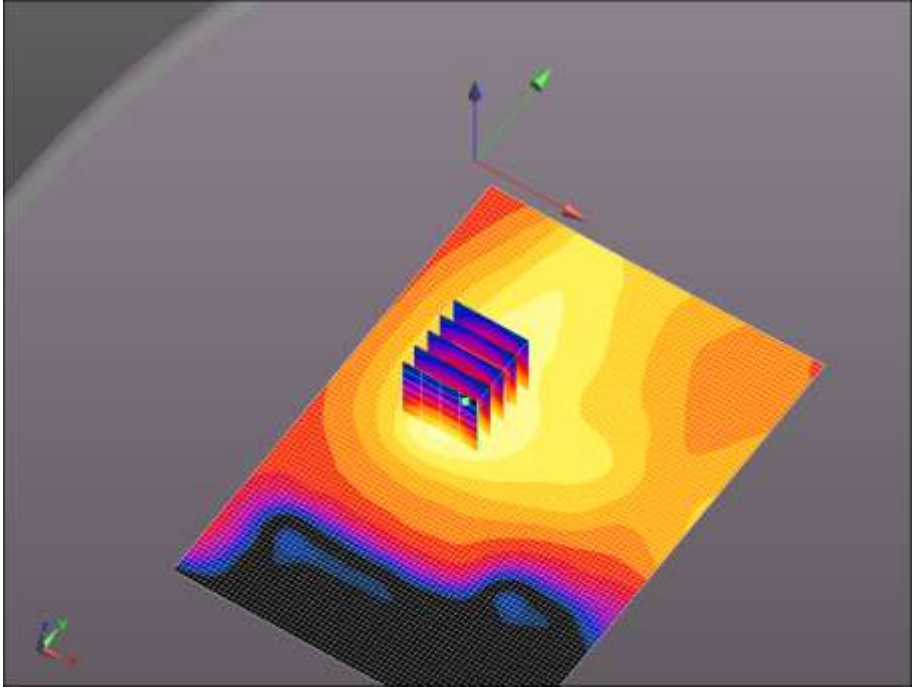
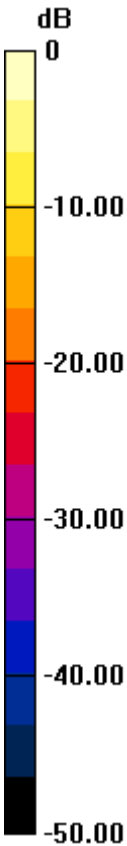
Reference Value = 8.454 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.417 mW/g

SAR(1 g) = 0.621 mW/g; SAR(10 g) = 0.283 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.657 W/kg



0 dB = 0.583 W/kg = -4.68 dB W/kg

4. NS-15AT08 WiFi 802.11b Body Facedwon, Middel channel

DUT: MID; Type: default; Serial: Not Specified

Communication System: 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System Band: 802.11b; Frequency: 2437 MHz;Communication System PAR: 3.599 dB

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2.011$ mho/m; $\epsilon_r = 50.719$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72, 4.72); Calibrated: 2013.10.31.;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 2014.03.03.
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- Measurement SW: DASYS2, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

802.11b-0mm/Facedown-Mid/Area Scan (71x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 2.671 V/m; Power Drift = 0.96 dB

Fast SAR: SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.066 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.229 W/kg

802.11b-0mm/Facedown-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

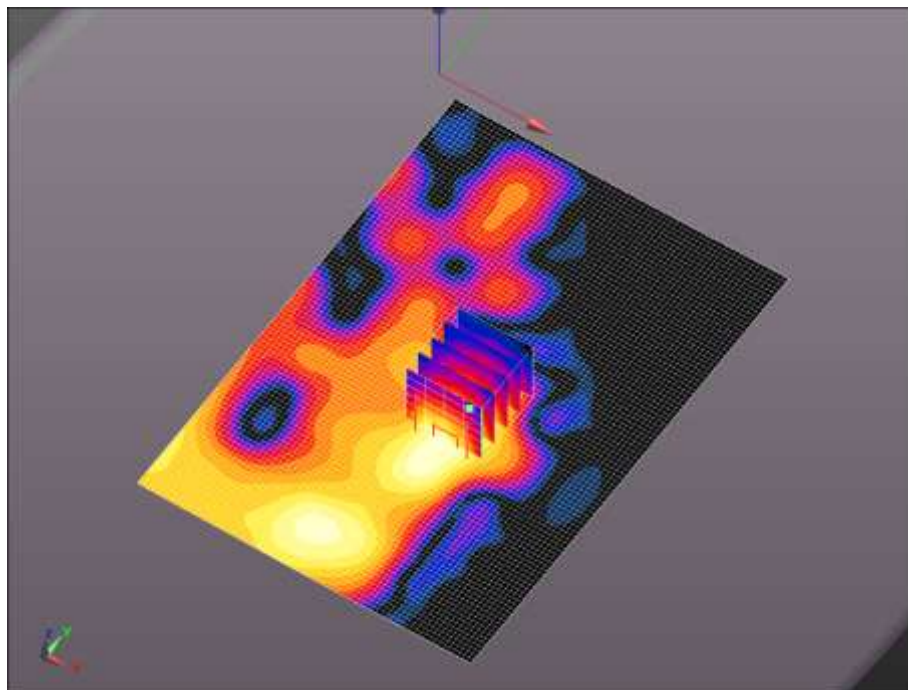
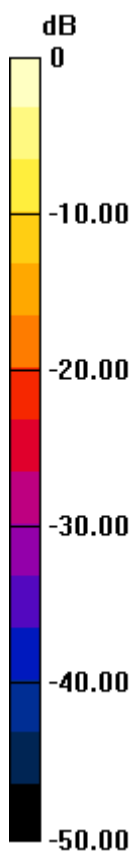
Reference Value = 2.671 V/m; Power Drift = 0.96 dB

Peak SAR (extrapolated) = 0.508 mW/g

SAR(1 g) = 0.226 mW/g; SAR(10 g) = 0.096 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.239 W/kg



0 dB = 0.229 W/kg = -12.79 dB W/kg

Date/Time: 2014.05.14

Test Laboratory: SMQ SAR Test

5. NS-15AT08 WiFi 802.11b Body Top, Middle Channel

DUT: MID; Type: default; Serial: Not Specified

Communication System: 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System Band: 802.11b; Frequency: 2437 MHz;Communication System PAR: 3.599 dB

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2.011$ mho/m; $\epsilon_r = 50.719$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3203; ConvF(4.72, 4.72, 4.72); Calibrated: 2013.10.31.;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn876; Calibrated: 2014.03.03.
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- Measurement SW: DASYS2, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

802.11b-0mm 2/top-Mid/Area Scan (71x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 6.932 V/m; Power Drift = 0.47 dB

Fast SAR: SAR(1 g) = 0.411 mW/g; SAR(10 g) = 0.146 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (interpolated) = 0.625 W/kg

802.11b-0mm 2/top-Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

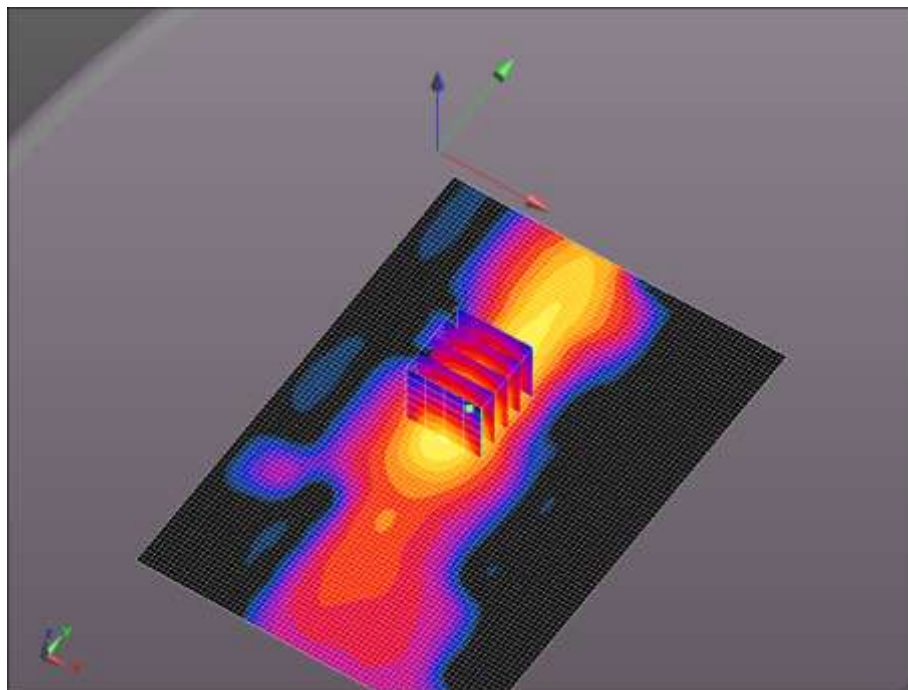
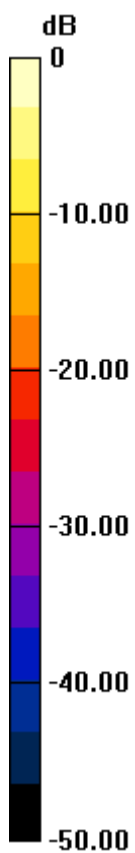
Reference Value = 6.932 V/m; Power Drift = 0.47 dB

Peak SAR (extrapolated) = 1.231 mW/g

SAR(1 g) = 0.501 mW/g; SAR(10 g) = 0.186 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.618 W/kg



0 dB = 0.625 W/kg = -4.09 dB W/kg

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Client **SMQ**

Certificate No: **J13-2-2921**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3203**

Calibration Procedure(s) **TMC-OS-E-02-195**
Calibration Procedures for Dosimetric E-field Probes

Calibration date: **October 31, 2013**


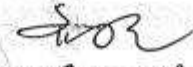
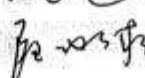
This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	03-Sep-13(SPEAG,No.EX3-3846_Sep13)	Sep-14
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-13 (TMC, No.JZ13-781)	Feb-14

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

Issued: November 4, 2013

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
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i $\theta=0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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_{x,y,z}:** Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z}* frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,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.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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_{x,y,z}* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from $\pm 50\text{MHz}$ 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 NORM_x (no uncertainty required).



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Probe ES3DV3

SN: 3203

Calibrated: October 31, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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DASY – Parameters of Probe: ES3DV3 - SN: 3203

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^A	1.30	1.26	1.11	$\pm 10.8\%$
DCP(mV) ^B	103.9	104.0	105.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	200.4	$\pm 3.5\%$
		Y	0.0	0.0	1.0		184.0	
		Z	0.0	0.0	1.0		184.4	

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

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).

^B Numerical linearization parameter: uncertainty not required.

^E 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 – Parameters of Probe: ES3DV3 - SN: 3203

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
900	41.5	0.97	6.55	6.55	6.55	0.39	1.77	±12%
1810	40.0	1.40	5.41	5.41	5.41	0.31	2.22	±12%
2450	39.2	1.80	5.07	5.07	5.07	0.54	1.66	±12%

^C 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.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.



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DASY – Parameters of Probe: ES3DV3 - SN: 3203

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
900	55.0	1.05	6.75	6.75	6.75	2.14	0.90	± 12%
1810	53.3	1.52	5.12	5.12	5.12	0.32	2.38	± 12%
2450	52.7	1.95	4.72	4.72	4.72	0.64	1.49	± 12%

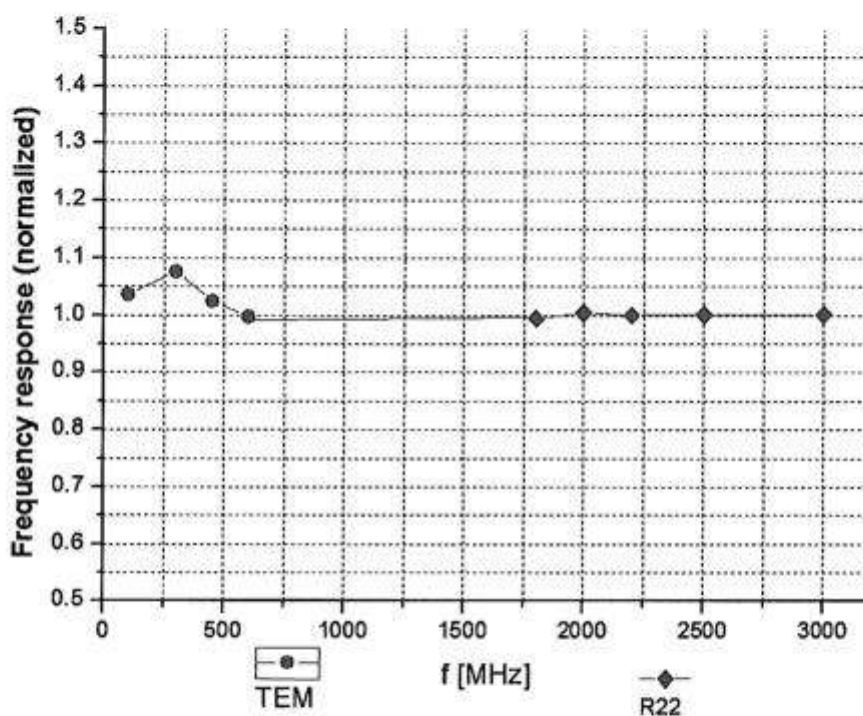
^C Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) 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 (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.



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



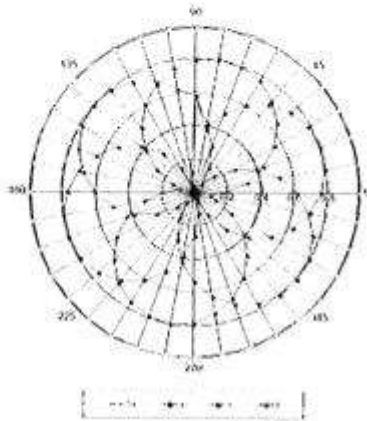
Uncertainty of Frequency Response of E-field: $\pm 7.5\%$ (k=2)



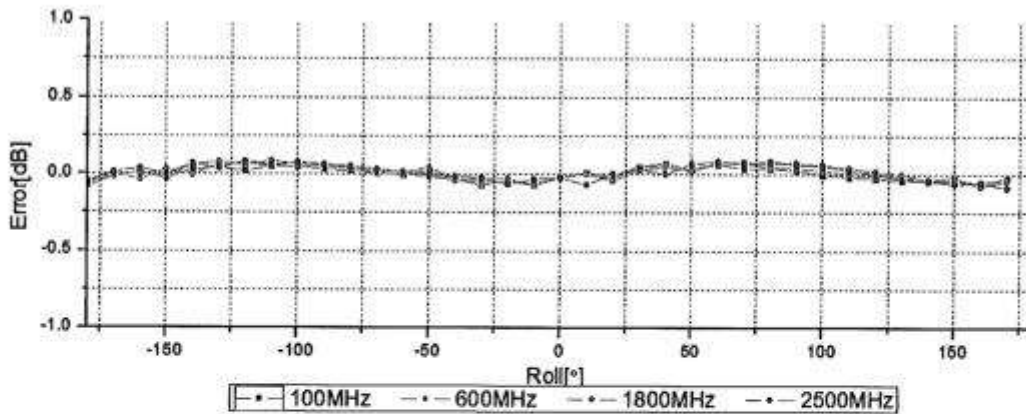
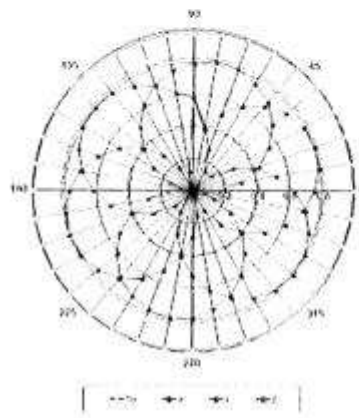
Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China
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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM



f=1800 MHz, R22

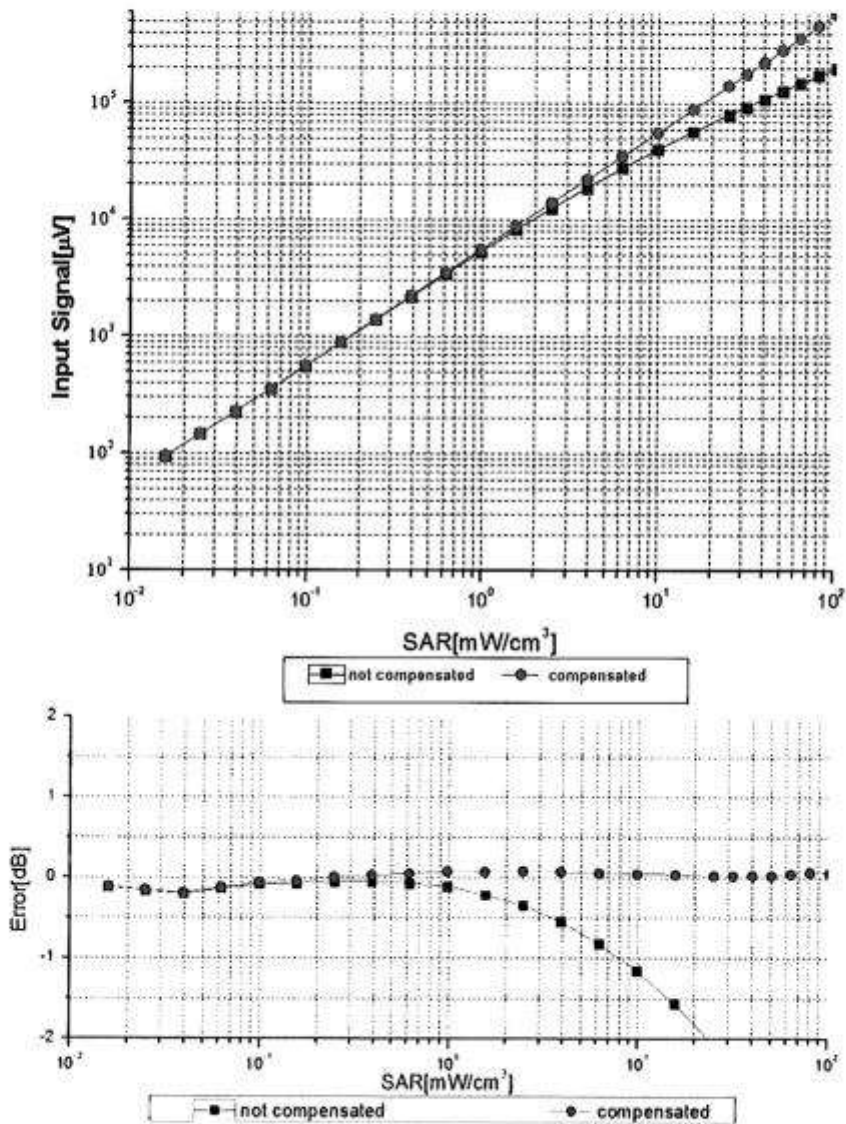


Uncertainty of Axial Isotropy Assessment: $\pm 0.9\%$ (k=2)



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**Dynamic Range f(SAR_{head})
 (TEM cell, f = 900 MHz)**



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

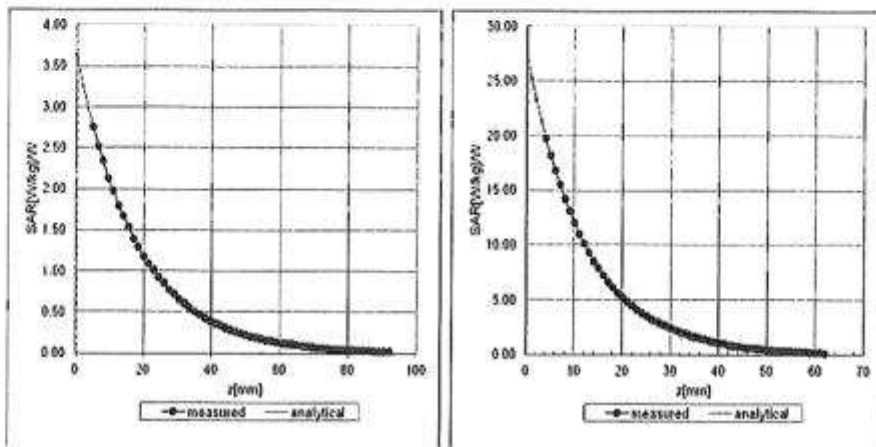


Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: info@emcite.com Http://www.emcite.com

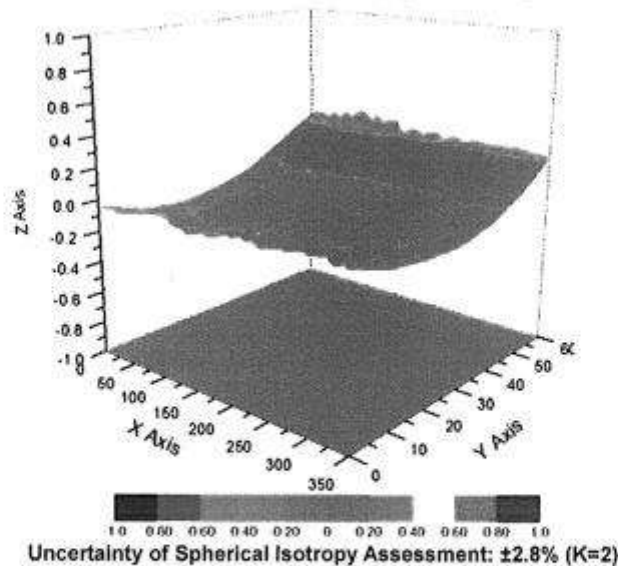
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF)

f=1810 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 2.8\%$ (K=2)



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DASY - Parameters of Probe: ES3DV3 - SN: 3203

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	175
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	4mm
Probe Tip to Sensor X Calibration Point	2mm
Probe Tip to Sensor Y Calibration Point	2mm
Probe Tip to Sensor Z Calibration Point	2mm
Recommended Measurement Distance from Surface	3mm

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



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

Accreditation No.: **SCS 108**

Client **SMQ (Auden)**

Certificate No: **D2450V2-818_Oct12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 818**

Calibration procedure(s) **QA CAL-05.v8**
 Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **October 18, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature



Issued: October 18, 2012

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

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



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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.3 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.8 W/kg ± 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω + 2.5 j Ω
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 4.4 j Ω
Return Loss	- 27.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.165 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 11, 2008

DASY5 Validation Report for Head TSL

Date: 18.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

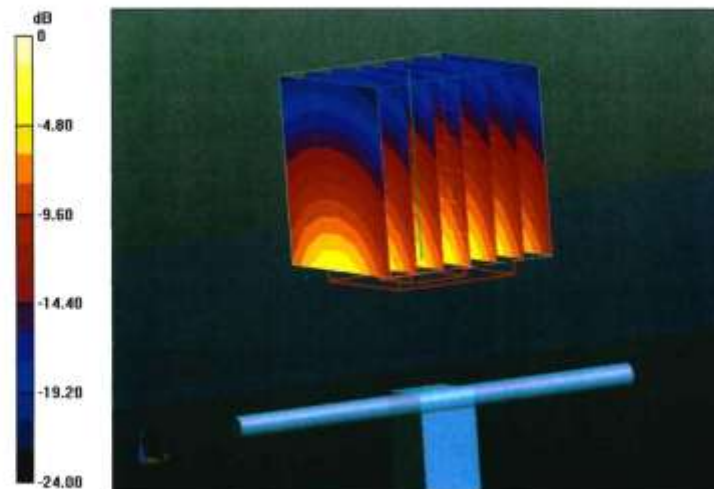
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.551 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 27.4 W/kg

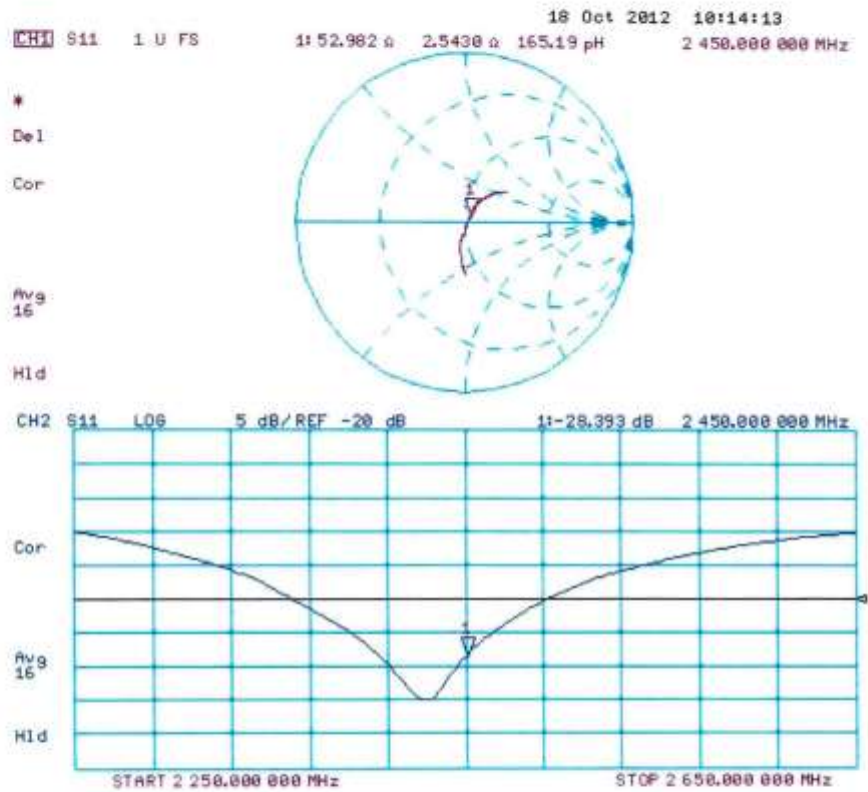
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg

Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 51$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm 2/Zoom Scan (7x7x7)/Cube 0:

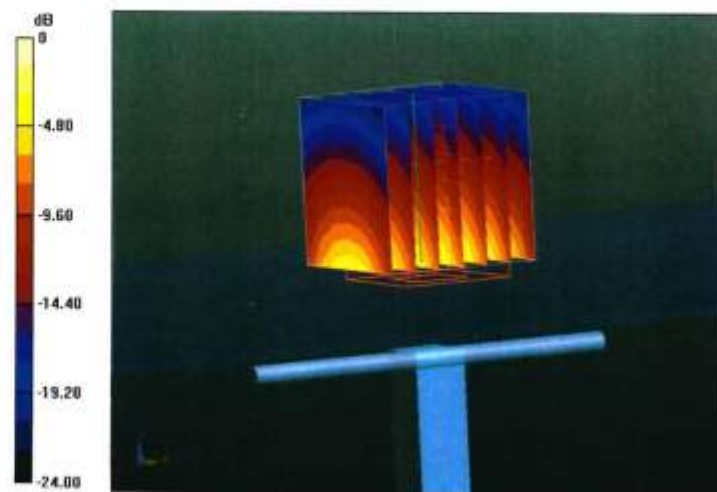
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.079 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.9 W/kg

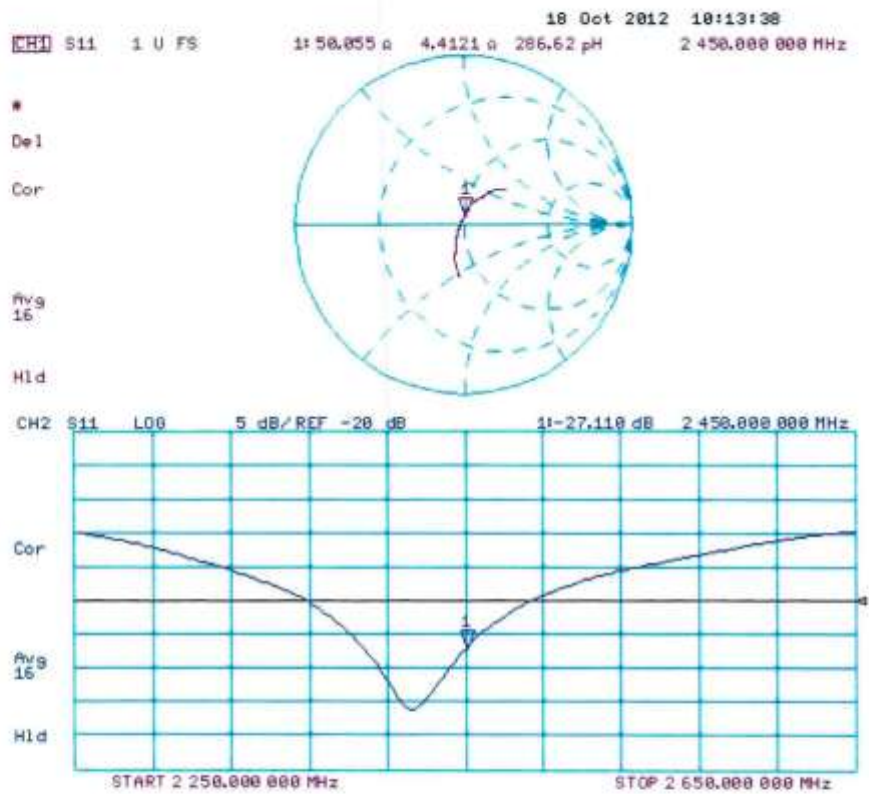
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.03 W/kg

Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Body TSL



Produkte
Products

Referring to KDB 865664, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Justification of the extended calibration

	2450 Body					
	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2013-10-18	-27.110		50.055		4.4121	
2013-10-17	-26.329	-2.88	51.434	1.38	5.9356	1.52

Produkte
Products

2450 Body

