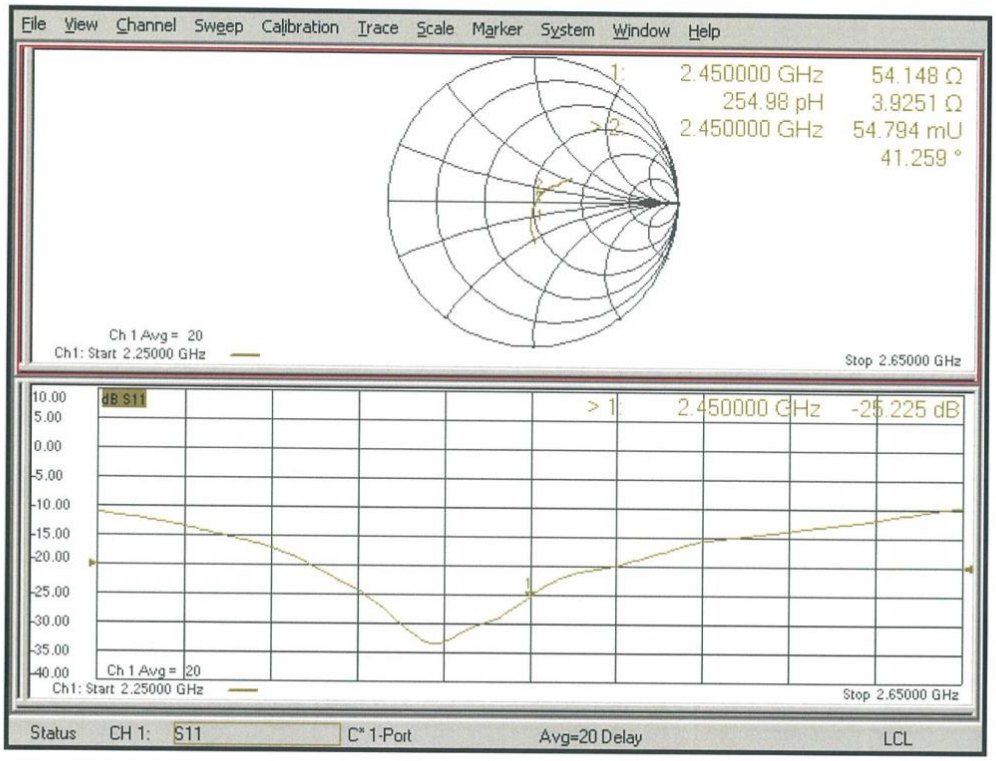
Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:853

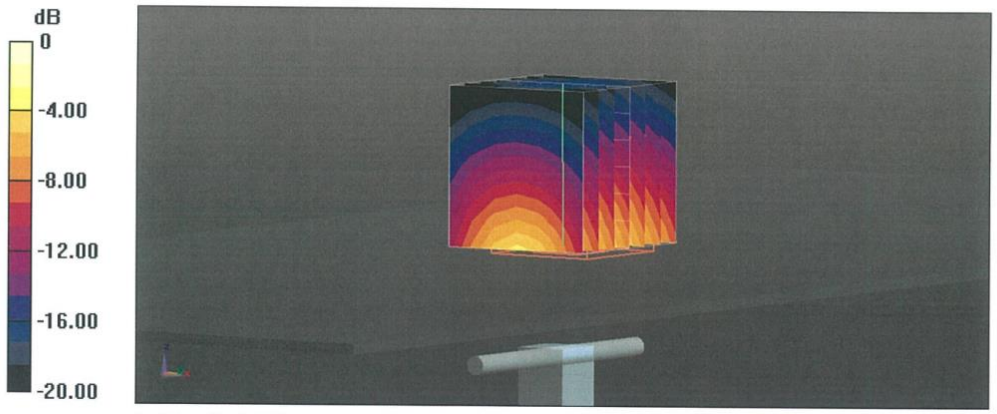
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.01, 8.01, 8.01) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

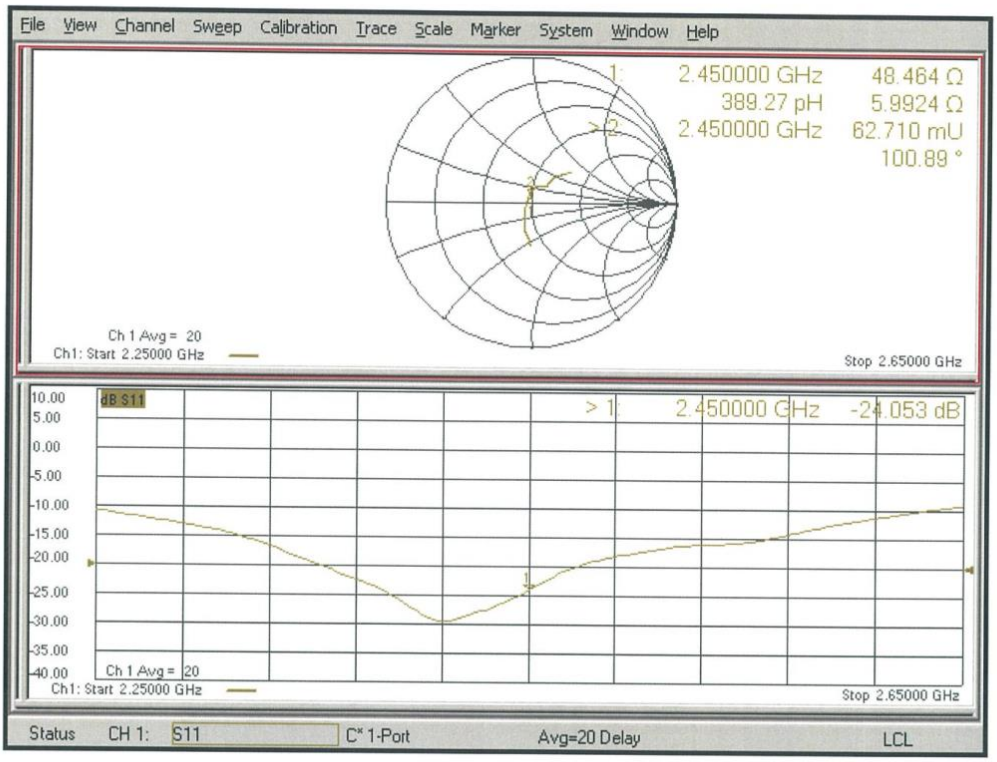
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 108.0 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 25.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 21.0 W/kg



0 dB = 21.0 W/kg = 13.22 dBW/kg

Impedance Measurement Plot for Body TSL



ANNEX I SPOT CHECK

I.1 Dielectric Performance

Table I.1-1: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2019-7-2	Head	2450 MHz	39.96	1.94	1.856	3.11
2019-7-2	Body	2300 MHz	52.72	-0.15	1.853	0.16

Note: The liquid temperature is 22.0℃

I.2 System Verification

Table I.2-1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2019-7-2	2450 MHz	24.2	51.7	24.6	52.6	1.65%	1.74%

Table I.2-2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2019-7-2	2300 MHz	22.7	47.0	23.0	47.5	1.32%	1.06%

I.3 Conducted power of selected case

Table I.3-1: The conducted Power for LTE

LTE Band30 10MHz	1RB-Middle (50)	2310 (27710)	22.60

Table I.3-2: The conducted Power for WLAN

Mode / data rate	Channel	Measured Power (dBm)
802.11b / 5.5Mbps	11	17.21
802.11b / 5.5Mbps	6	17.58
802.11b / 5.5Mbps	1	16.80

I.4 Measurement results for spot check

Table I.4-1: The spot check results

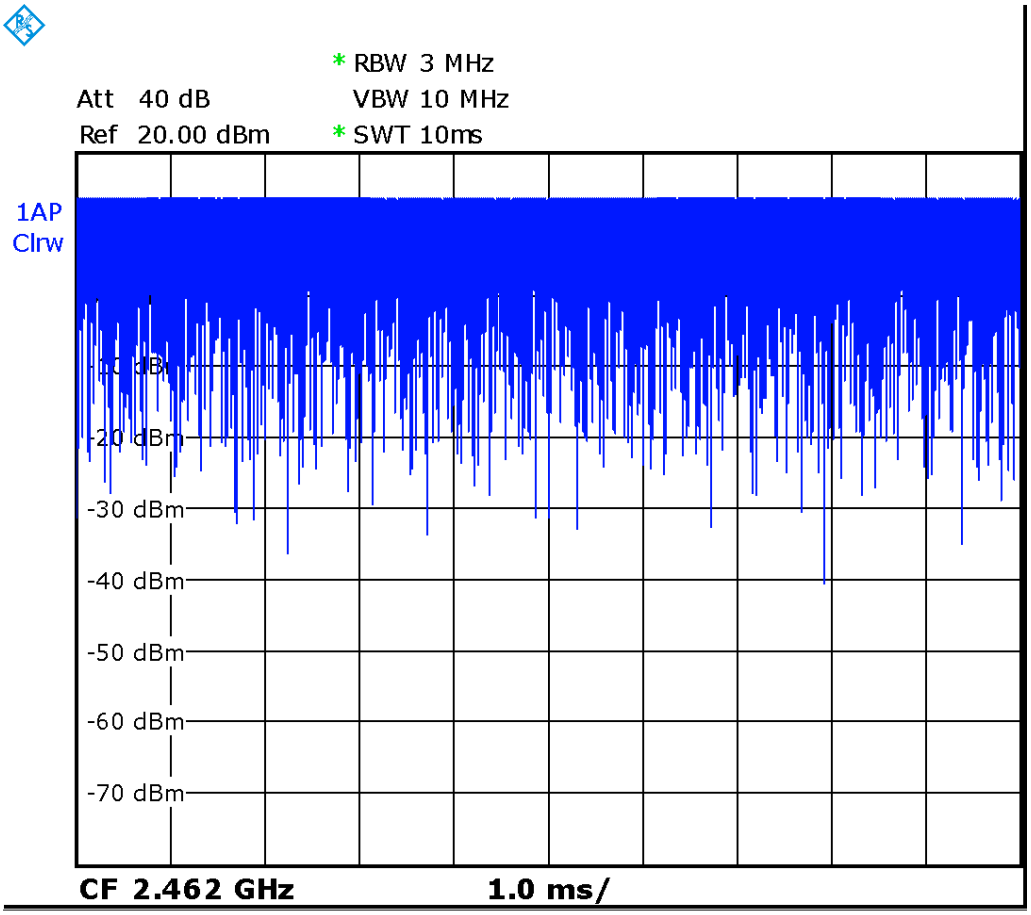
Test Band	Channel	Frequency	Test Position	Figure No.	Conducted Power (dBm)	Tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
LTE Band 30	27710	2310	Rear	Fig I.8-1	22.60	23.00	0.507	**0.56**	**0.961**	**1.05**	-0.13
WLAN	11	2462	Left	Fig I.8-2	17.21	18.00	0.454	**0.54**	**0.920**	**1.10**	-0.09
WLAN	6	2437	Left	/	17.58	18.00	0.431	**0.47**	0.799	**0.88**	0.09
WLAN	1	2412	Left	/	16.80	18.00	0.369	**0.49**	0.639	**0.84**	-0.02

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table I.4-2: SAR Values (WLAN - Head) – 802.11b (Scaled Reported SAR)

Ambient Temperature: 22.9 ºC Liquid Temperature: 22.5ºC							
Frequency		Side	Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.						
2462	11	Left	Touch	100%	100%	**1.10**	**1.10**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture I.4-1 Duty factor plot for head

I.5 Reported SAR Comparison

Table J.5-1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Reported SAR 10g (W/kg): spot check	Reported SAR 10g (W/kg): original
Head (Separation Distance 0mm)	GSM 850	/	0.30
	PCS 1900	/	0.12
	UMTS FDD 5	/	0.47
	UMTS FDD 4	/	0.26
	UMTS FDD 2	/	0.35
	LTE Band 2	/	0.35
	LTE Band 4	/	0.32
	LTE Band 5	/	0.48
	LTE Band 12	/	0.31
	LTE Band 14	/	0.35
	LTE Band 30	/	0.16
	WLAN 2.4 GHz	1.10	0.98
Hotspot (Separation Distance 10mm)	GSM 850	/	0.59
	PCS 1900	/	0.74
	UMTS FDD 5	/	0.83
	UMTS FDD 4	/	0.89
	UMTS FDD 2	/	0.86
	LTE Band 2	/	0.63
	LTE Band 4	/	0.64
	LTE Band 5	/	0.74
	LTE Band 12	/	0.49
	LTE Band 14	/	0.60
	LTE Band 30	/	0.84
	WLAN 2.4 GHz	/	0.13
Body-worn (Separation Distance 15mm)	UMTS FDD 2	/	0.98
	LTE Band 2	/	0.65
	LTE Band 4	/	0.37
	LTE Band 30	1.05	1.11

Note: All the spot check results marked blue are larger than the original results. So it replace the original results and others are shared.

I.6 Evaluation of Simultaneous

Table I.6-1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Left hand, Touch cheek	0.48	1.10	**1.58**
Highest reported SAR value for Body	Rear 10mm	0.84	0.13	**0.97**
	Bottom 10mm	0.89	/	**0.89**
	Rear 15mm	1.11	0.13[1]	**1.24**

Table I.6-2: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Left hand, Touch cheek	0.48	0.17[2]	**0.65**
Maximum reported SAR value for Body	Rear 10mm	0.84	0.08[2]	**0.92**
	Bottom 10mm	0.89	/	**0.89**
	Rear 15mm	1.11	0.06[2]	**1.17**

I.7 List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 24, 2019	One year
02	Power meter	NRVD	102083	October 24, 2018	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49070393	January 4, 2019	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	159890	January 3, 2019	One year
07	E-field Probe	SPEAG EX3DV4	7514	August 27, 2018	One year
08	DAE	SPEAG DAE4	1525	September 18, 2018	One year
09	Dipole Validation Kit	SPEAG D2300V2	1018	July 24, 2018	One year
10	Dipole Validation Kit	SPEAG D2450V2	853	July 24, 2018	One year

I.8 Graph Results

LTE Band30 Body Rear with QPSK_10M_1RB_Middle

Date: 2019-7-2
Electronics: DAE4 Sn1525
Medium: Body 2300 MHz
Medium parameters used: f = 2310 MHz; σ = 1.853 mho/m; εr = 52.72; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: LTE Band30 Frequency: 2310 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7514 ConvF(7.25, 7.25, 7.25)

Area Scan (161x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.46 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.493 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 1.70 W/kg
SAR(1 g) = 0.961 W/kg; SAR(10 g) = 0.507 W/kg
Maximum value of SAR (measured) = 1.44 W/kg

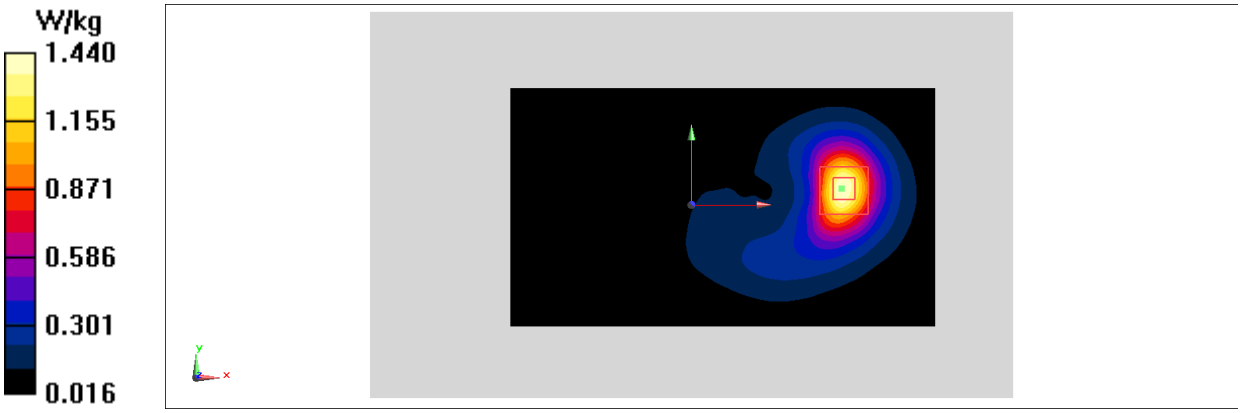


Fig I.8-1 LTE Band30

Wifi 802.11b Left Cheek Channel 11

Date: 2019-7-2
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.876 mho/m; ε_r = 39.06; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: WLan 2450 Frequency: 2462 MHz Duty Cycle: 1:1
Probe: EX3DV4– SN7514 ConvF(6.95, 6.95, 6.95)

Area Scan (81x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.52 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.69 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.99 W/kg
SAR(1 g) = 0.920 W/kg; SAR(10 g) = 0.454 W/kg
Maximum value of SAR (measured) = 1.46 W/kg

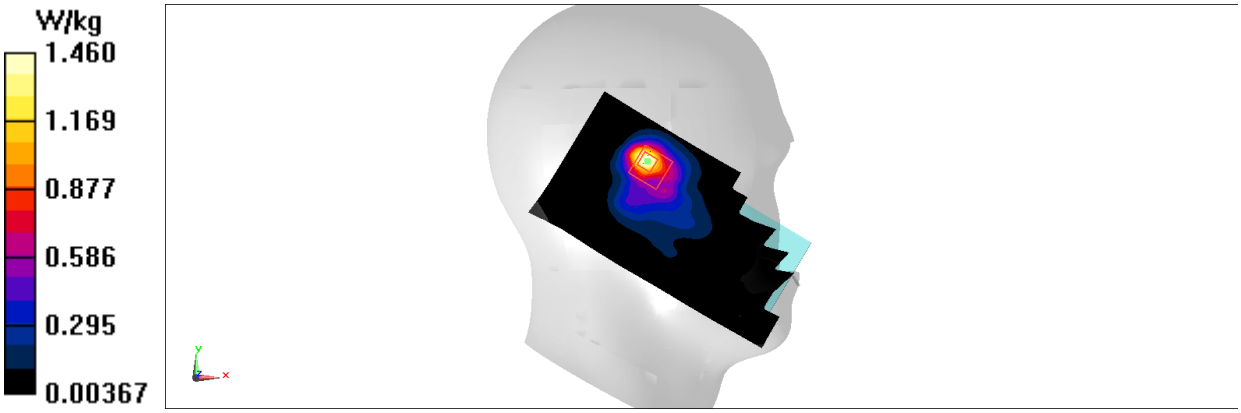


Fig I.8-2 2450 MHz

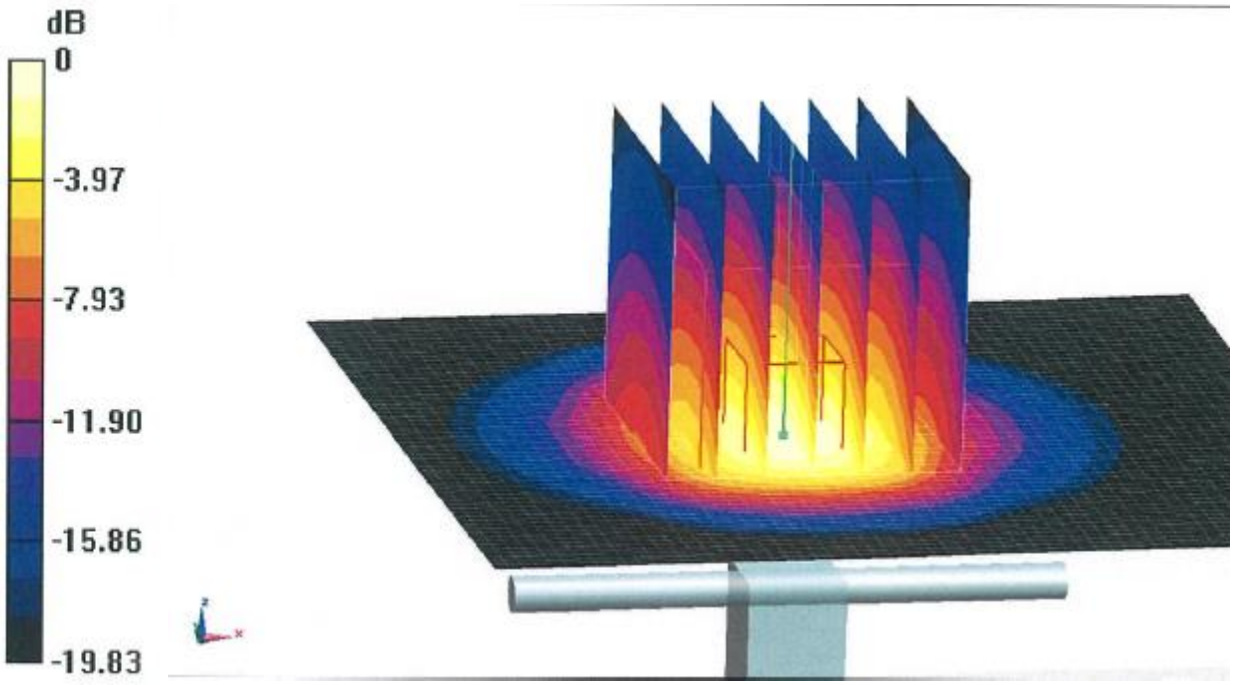
I.9 System Verification Results

2300MHz

Date: 2019-7-2
Electronics: DAE4 Sn1525
Medium: Body 2300 MHz
Medium parameters used: f = 2300 MHz; σ = 1.853 mho/m; ε_r = 52.72; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 2300 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(7.25, 7.25, 7.25)

System Validation /Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 105.2 V/m; Power Drift = 0.03 dB
SAR(1 g) = 11.96 W/kg; SAR(10 g) = 5.46 W/kg
Maximum value of SAR (interpolated) = 19.3 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.2 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 23.5 W/kg
SAR(1 g) = 11.5 W/kg; SAR(10 g) = 6.05 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

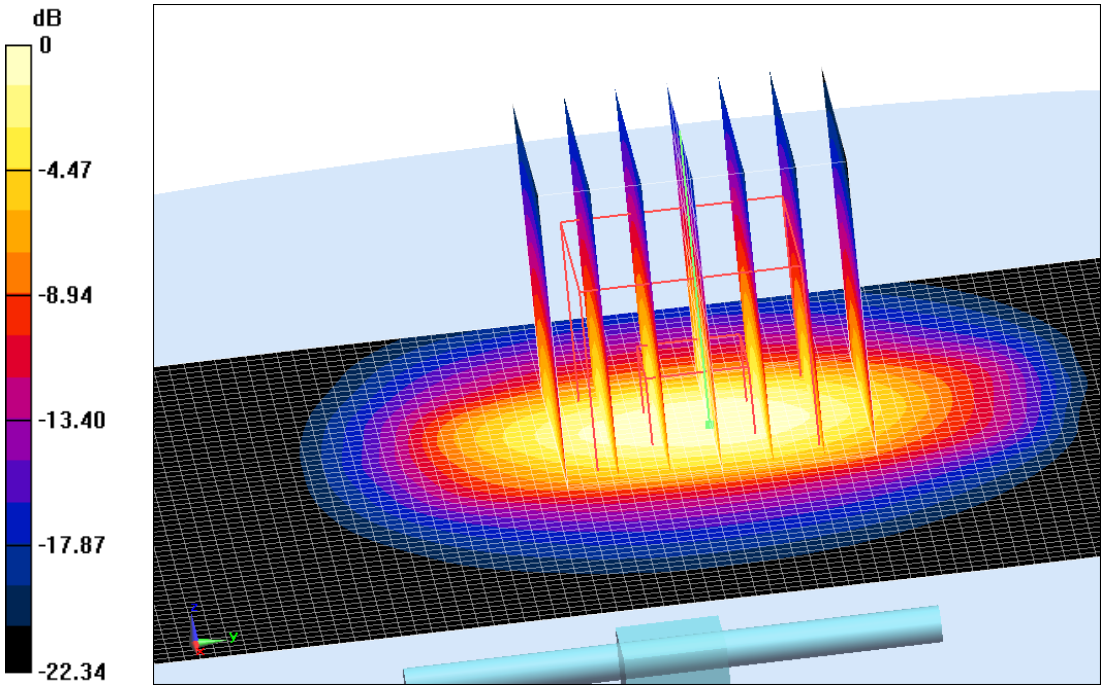
Fig I.9-1 validation 2300MHz 250mW

2450MHz

Date: 2019-7-2
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.856 mho/m; ε_r = 39.96; ρ = 1000 kg/m^3
Ambient Temperature: 22.9ºC Liquid Temperature: 22.5ºC
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(6.95, 6.95, 6.95)

System Validation /Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 96.36 V/m; Power Drift = -0.12 dB
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (interpolated) = 16.2 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.36 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 27.41 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.67 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



0 dB = 15.9 W/kg = 12.01 dBW/kg

Fig I.9-2 validation 2450MHz 250mW

ANNEX J Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2018-09-28 through 2019-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program