Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.4 Ω - 7.4 jΩ
Return Loss	- 21.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.1 Ω - 4.9 jΩ
Return Loss	- 21.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 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	October 30, 2007

DASY5 Validation Report for Head TSL

Date: 26.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012

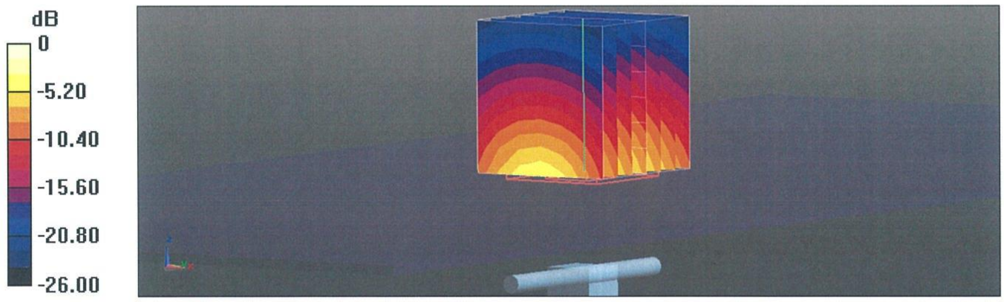
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.02 S/m; ε_r = 37.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.7, 7.7, 7.7) @ 2600 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

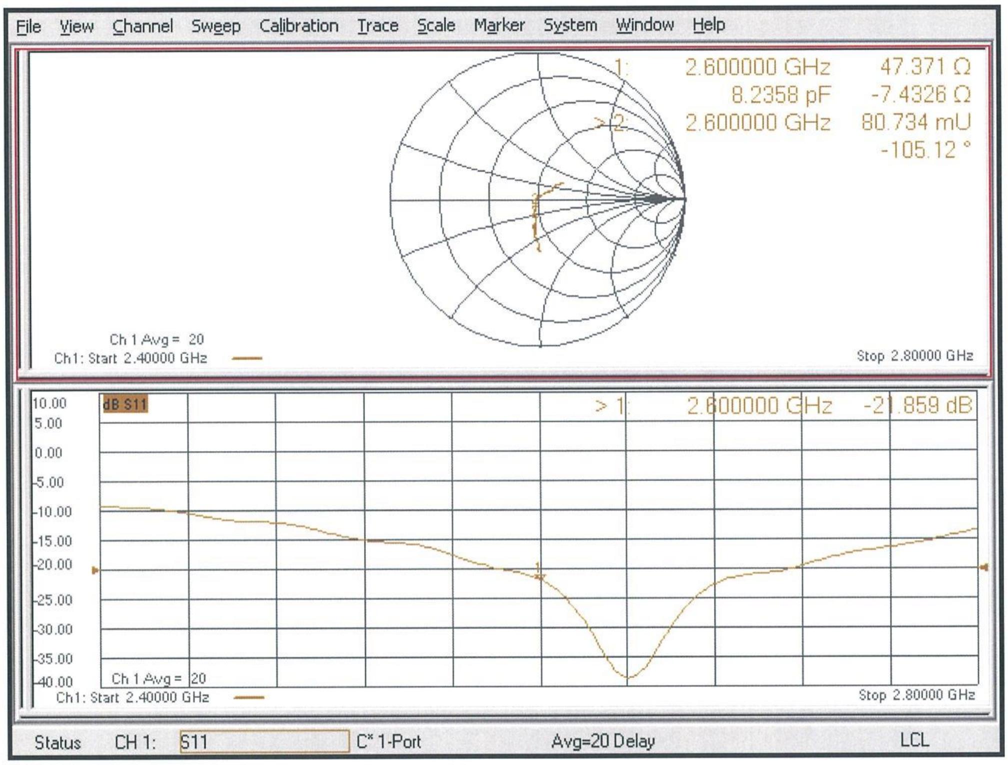
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 118.3 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.33 W/kg
Maximum value of SAR (measured) = 23.7 W/kg



0 dB = 23.7 W/kg = 13.75 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 26.07.2018

Test Laboratory: SPEAG, Zurich, Switzerland

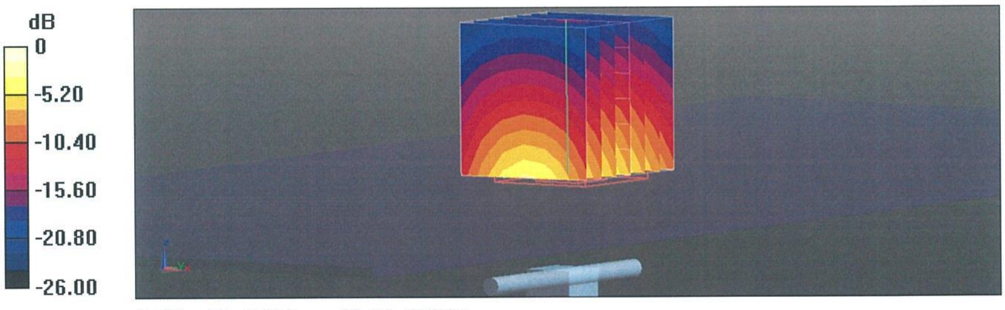
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.2 S/m; ε_r = 51.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

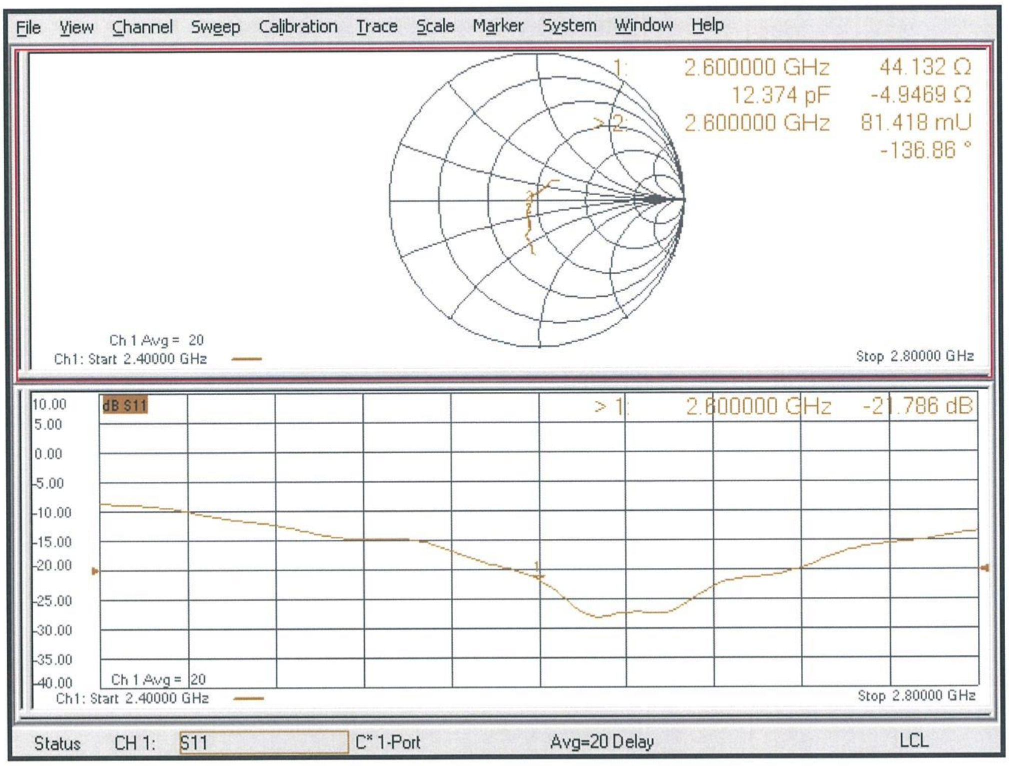
- Probe: EX3DV4 - SN7349; ConvF(7.81, 7.81, 7.81) @ 2600 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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 = 107.5 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.17 W/kg
Maximum value of SAR (measured) = 22.6 W/kg



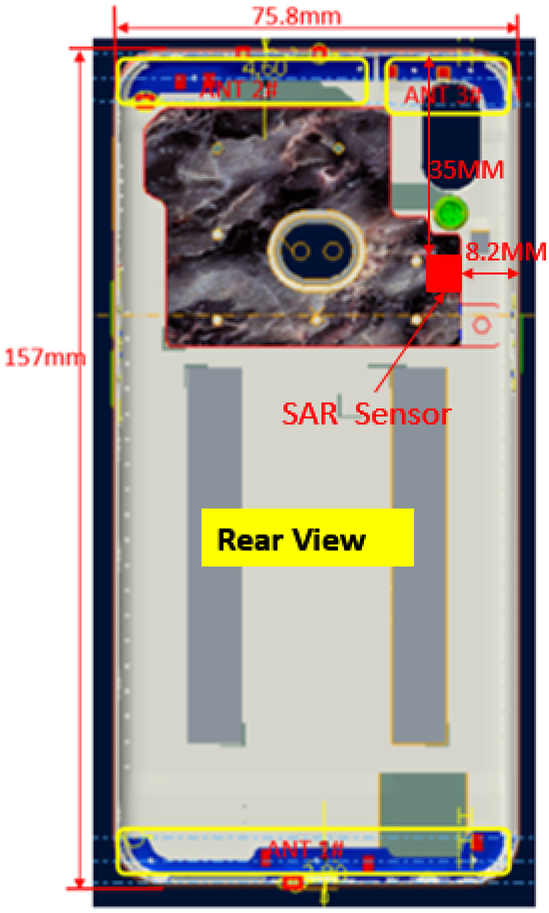
0 dB = 22.6 W/kg = 13.54 dBW/kg

Impedance Measurement Plot for Body TSL



ANNEX I Sensor Triggering Data Summary

SAR Sensor



Reduce Power for SAR sensor

LTE		
LTE Band	Power	Tolerance
1	22.5	+1dBm/ -1dBm
3	22	+1dBm/ -1dBm
7	21.5	+1dBm/ -1dBm
38	21.5	+1dBm/ -1dBm
40	21.5	+1dBm/ -1dBm
41	21.5	+1dBm/ -1dBm

GSM		
Mode/Band		Voice (dBm)
GSM/GPRS/EDGE 1800	Max Power	30
	Nom	29
GSM/GPRS/EDGE 1900	Max Power	29
	Nom	28

WCDMA		
Mode/Band		Modulated Average (dBm)
		WCDMA
UMTS 2100	Max	23.5
	Nom	22.5

Antenna	Band	Full Power Level (PRB dBm)	Reduced power Level (dBm)
3# Wifi Antenna	WIFI Head Sar	17	15

Antenna	Trigger Position	Trigger Distance(mm)
1# Main Antenna	Rear	15
	Bottom	15
	Front	10

According to the above description, this device was tested by the manufacturer to determine the SAR sensor triggering distances for the rear and bottom edge of the device. The measured power state within ±5mm of the triggering points (or until touching the phantom) is included for rear and each applicable edge.

To ensure all production units are compliant it is necessary to test SAR at a distance 1mm less than the smallest distance from the device and SAR phantom with the device at maximum output power without power reduction.

We tested the power and got the different proximity sensor triggering distances for rear and bottom edge. But the manufacturer has declared 15mm is the most conservative triggering distance for main antenna. So base on the most conservative triggering distance of 15mm, additional SAR measurements were required at 14mm from the highest SAR position between rear and bottom edge of main antenna.

Rear

Moving device toward the phantom:

The power state											
Distance [mm]	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**
Main antenna	Normal	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Main antenna	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal	Normal

Bottom Edge

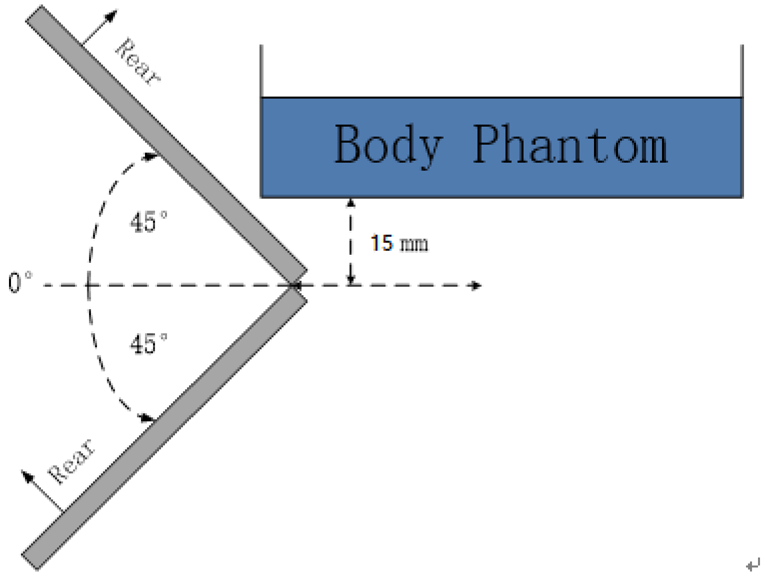
Moving device toward the phantom:

The power state											
Distance [mm]	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**
Main antenna	Normal	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low

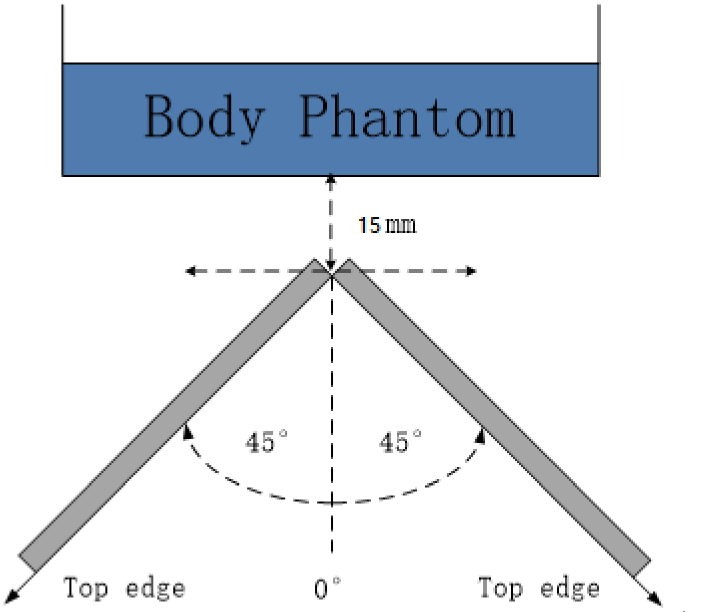
Moving device away from the phantom:

The power state											
Distance [mm]	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Main antenna	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal	Normal

The influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in ≤ 10° increments until the tablet is ±45° or more from the vertical position at 0°.



The rear evaluation for main antenna



The bottom edge evaluation for main antenna

Based on the above evaluation, we come to the conclusion that the sensor triggering is not released and normal maximum output power is not restored within the ±45° range at the smallest sensor triggering test distance declared by manufacturer.

ANNEX J SPOT CHECK

J.1 Dielectric Performance and System Validation

Table J.1-1: Targets for tissue simulating liquid

Frequency(MHz)	Liquid Type	Conductivity (σ)	± 5% Range	Permittivity(ε)	± 5% Range
1900	Body	1.52	1.44～1.60	53.3	50.6～56.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2

Table J.1-2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2019-7-13	Body	1900 MHz	54.1	1.50	1.525	0.33
2019-7-13	Head	2450 MHz	39.25	0.13	1.767	-1.83

Table J.1-3: System Validation 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
2019-7-13	2450 MHz	24.2	51.7	25	51.28	1.21%	-1.76%

Table J.1-4: 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
2019-7-13	1900 MHz	21.4	40.4	21.28	39.68	-0.56%	-1.78%

J.2 SAR test result for spot check

Table J.2-1: Spot Check of Head

Test Band	Channel	Frequency	Figure	Test Position	Tune-Up	Measured Power	Measured 10g SAR	Reported 10g SAR	Measured 1g SAR	Reported 1g SAR	Power Drift
WLAN2450	11	2462	Fig J.2	Left Check	16	15.94	0.281	0.28	0.526	0.53	-0.09

Table J.2-2: Spot Check of Body

Test Band	Channel	Frequency	Figure	Test Position	Tune-Up	Measured Power	Measured 10g SAR	Reported 10g SAR	Measured 1g SAR	Reported 1g SAR	Power Drift
PCS1900	661	1880	Fig J.1	Bottom Edge	25.5	24.49	0.263	0.33	0.423	0.53	-0.05

Note1: The distance between the EUT and the phantom bottom is 10mm.

J.3 Reported SAR Comparison

Table 3.1-1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g(W/kg) original	Highest Reported SAR 1g(W/kg) spot check	Equipment Class
Head (Separation Distance 0mm)	GSM 850	0.14	/	PCE
	PCS 1900	0.10	/	
	UMTS FDD	0.15	/	
	LTE Band 5	0.11	/	
	LTE Band 7	0.24	/	
	LTE Band 41	0.18	/	
	WLAN 2.4	0.25	0.53	DTS
Hotspot (Separation Distance 10mm)	GSM 850	0.33	/	PCE
	PCS 1900	0.66	0.53	
	UMTS FDD	0.27	/	
	LTE Band 5	0.16	/	
	LTE Band 7	0.43	/	
	LTE Band 41	0.23	/	
	WLAN 2.4	0.09	/	DTS

Note: The spot check results marked blue are larger than the original result.

J.4 MAIN TEST INSTRUMENTS

Table J.4-1: 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	E5515C	MY50263375	January 17, 2019	One year
07	BTS	CMW500	159890	January 3, 2019	One year
08	E-field Probe	SPEAG EX3DV4	7514	August 27, 2018	One year
09	DAE	SPEAG DAE4	1525	September 18, 2018	One year
10	Dipole Validation Kit	SPEAG D1900V2	5d101	July 24, 2018	One year
11	Dipole Validation Kit	SPEAG D2450V2	853	July 24, 2018	One year

END OF REPORT BODY

J.5 GRAPH RESULTS

PCS1900_CH661 Bottom Edge
Date: 7/13/2017
Electronics: DAE4 Sn1525
Medium: body 1900 MHz
Medium parameters used: f = 1880; σ = 1.506 mho/m; εr = 54.12; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C
Communication System: PCS1900 1880 Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(7.53,7.53,7.53)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.603 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.36 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.66 W/kg
SAR(1 g) = 0.423 W/kg; SAR(10 g) = 0.263 W/kg
Maximum value of SAR (measured) = 0.532 W/kg

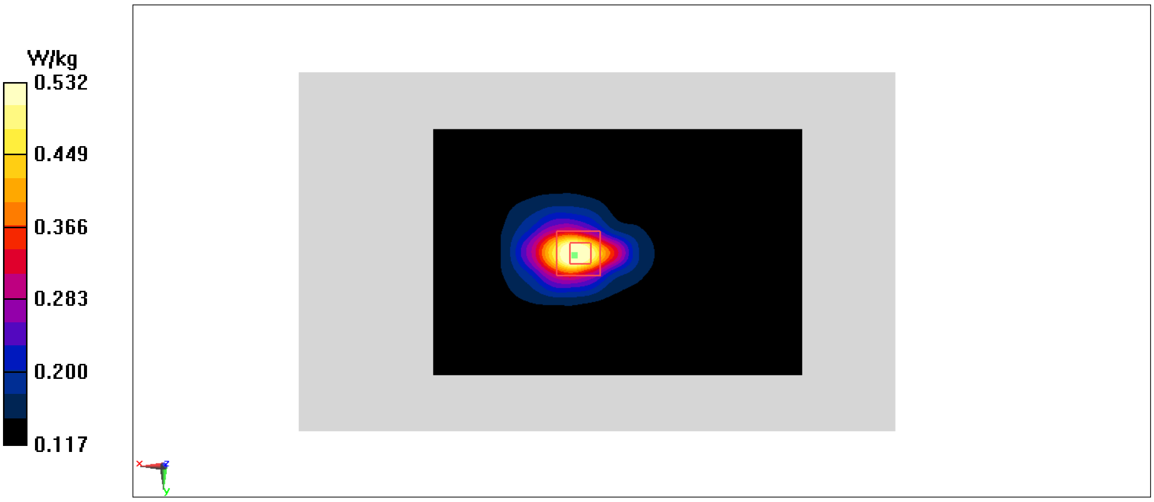


Fig J.1

WLAN2450_CH11 Left Cheek
Date: 7/13/2017
Electronics: DAE4 Sn1525
Medium: head 2450 MHz
Medium parameters used: f = 2462; σ = 1.778 mho/m; εr = 39.24; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C,   Liquid Temperature: 22.3°C
Communication System: WLAN2450 2462 Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(6.95,6.95,6.95)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.853 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.085 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.526 W/kg; SAR(10 g) = 0.281 W/kg
Maximum value of SAR (measured) = 0.804 W/kg

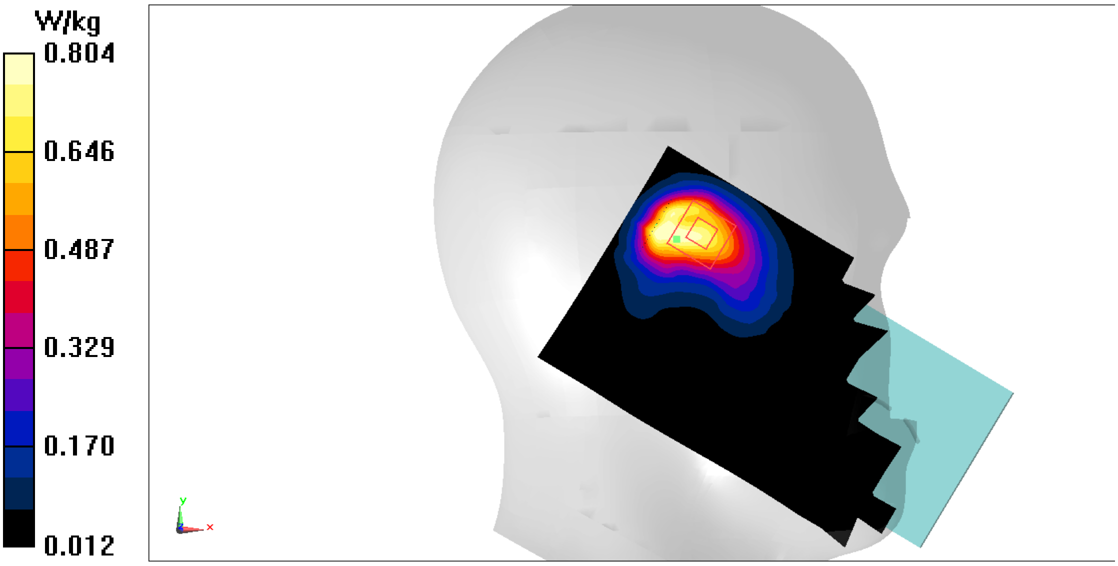


Fig J.2

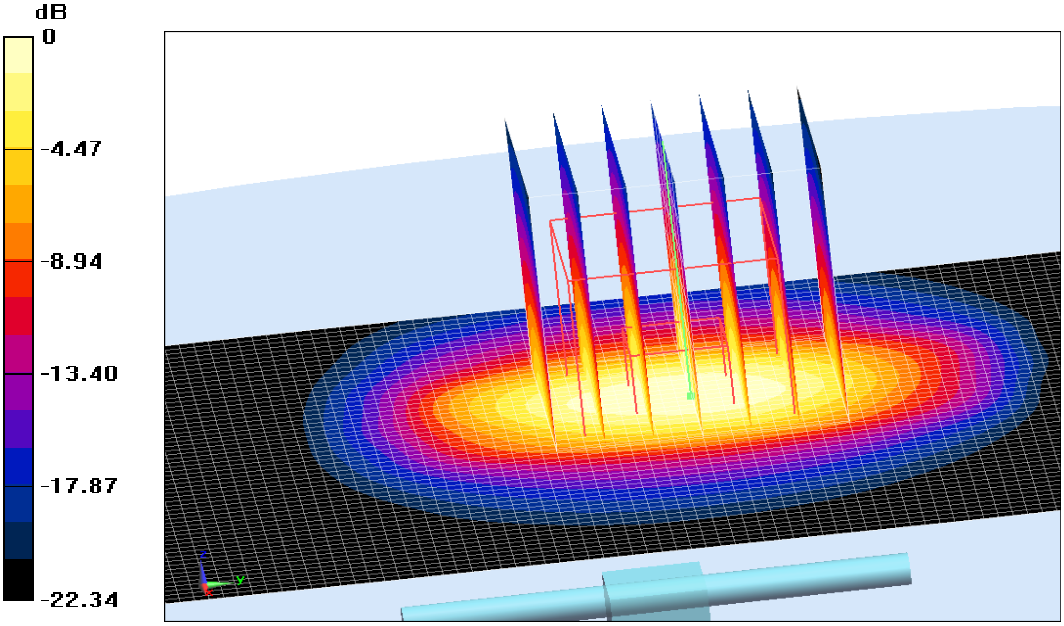
J.6 ANNEX SYSTEM VALIDATION RESULTS

2450 MHz

Date: 2019-7-13
Electronics: DAE4 Sn1525
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ =1.385 mho/m; ε_r = 39.78; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(6.95,6.95,6.95)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 112.6 V/m; Power Drift = 0.04
Fast SAR: SAR(1 g) = 12.87 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (interpolated) = 21.08 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =112.6 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 26.22 W/kg
SAR(1 g) = 12.82 W/kg; SAR(10 g) = 6.25 W/kg
Maximum value of SAR (measured) = 21.57 W/kg



0 dB = 21.57 W/kg = 13.34 dB W/kg

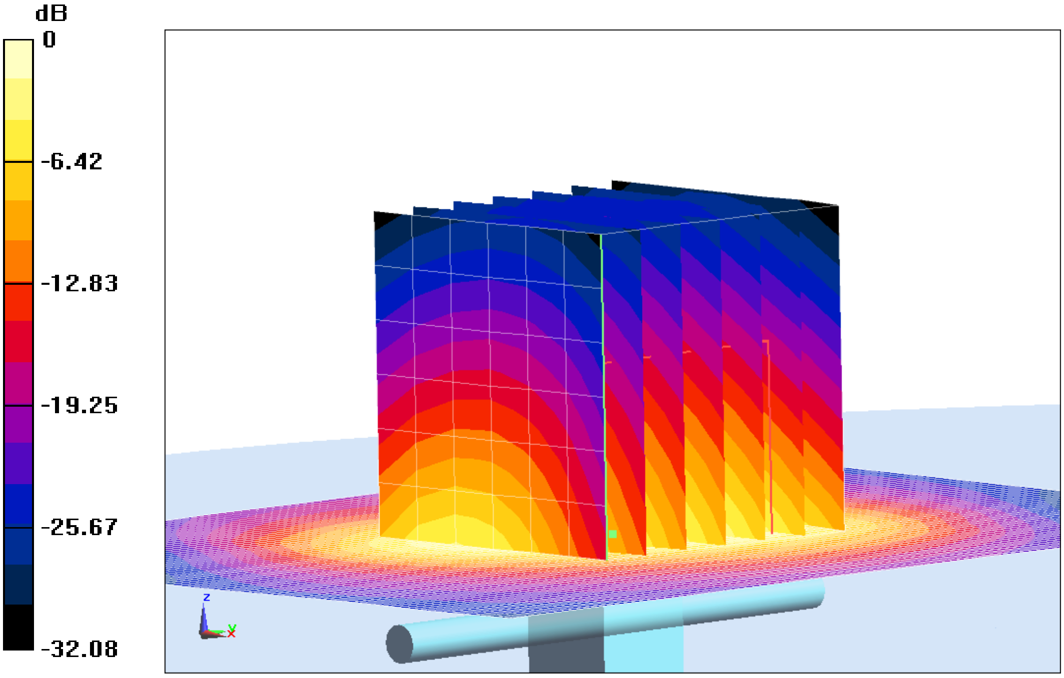
Fig.J.1 validation 2450 MHz 250mW

1900 MHz

Date: 2019-7-13
Electronics: DAE4 Sn1525
Medium: Body 1900 MHz
Medium parameters used: f = 1900 MHz; σ =1.525 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7514 ConvF(7.53,7.53,7.53)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 104 V/m; Power Drift = 0.05
Fast SAR: SAR(1 g) = 10.05 W/kg; SAR(10 g) = 5.45 W/kg
Maximum value of SAR (interpolated) = 16.92 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =104 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.39 W/kg
SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.32 W/kg
Maximum value of SAR (measured) = 14.57 W/kg



0 dB = 14.57 W/kg = 11.63 dB W/kg

Fig.J.2 validation 1900 MHz 250mW

The SAR system verification must be required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR.

Table B.1 Comparison between area scan and zoom scan for system verification

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2019-7-13	2450	Body	12.87	12.82	0.39
2019-7-13	1900	Head	10.05	9.92	1.31

ANNEX K 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