Measurement Conditions

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

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.7 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	5.06 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.43 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.3 W/kg ± 19.9 % (k=2)**

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

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.90 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.87 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	6.11 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.4 Ω - 5.2 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.0 Ω + 0.2 jΩ
Return Loss	- 34.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.2 Ω + 2.0 jΩ
Return Loss	- 28.8 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	47.9 Ω - 3.5 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω + 2.0 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	53.6 Ω + 3.7 jΩ
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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

DASY5 Validation Report for Head TSL

Date: 30.01.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1262

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.54 S/m; ε_r = 36.7; ρ = 1000 kg/m^3,
Medium parameters used: f = 5600 MHz; σ = 4.9 S/m; ε_r = 36.2; ρ = 1000 kg/m^3,
Medium parameters used: f = 5750 MHz; σ = 5.06 S/m; ε_r = 36; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

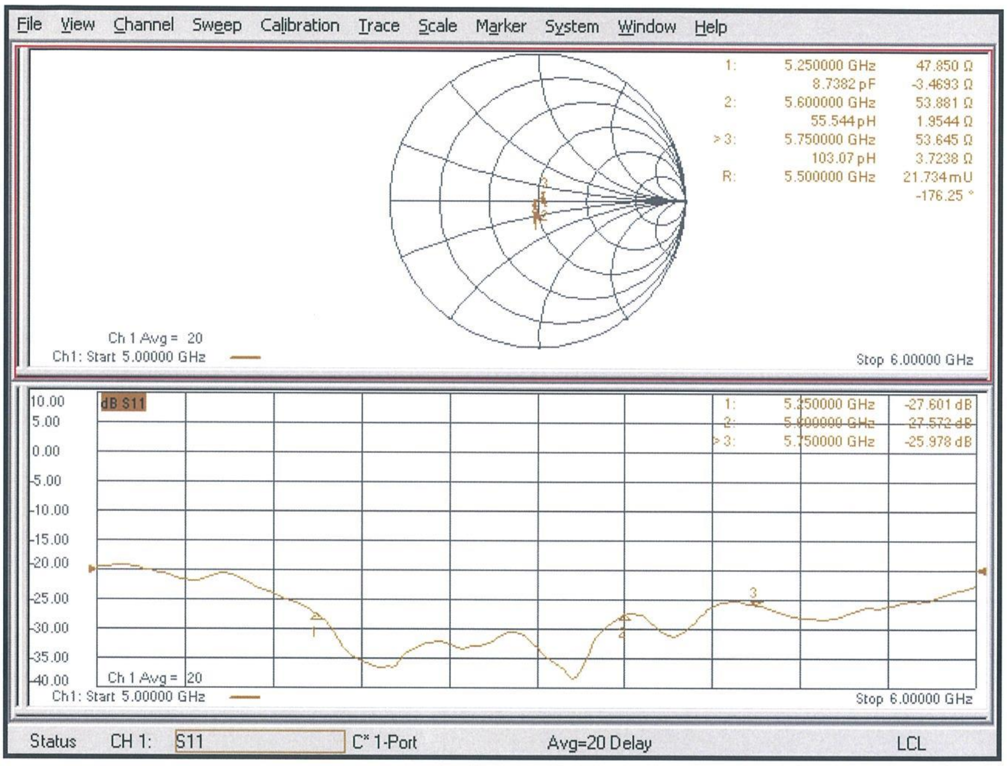
- Probe: EX3DV4 - SN3503; ConvF(5.45, 5.45, 5.45) @ 5250 MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 31.12.2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.10 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 18.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.81 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 31.7 W/kg
SAR(1 g) = 8.34 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.84 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 19.6 W/kg

Impedance Measurement Plot for Body TSL



ANNEX I Sensor Triggering Data Summary

The trigger distance of the SAR sensor is 9mm (read/bottom) and 4mm (Front), when the hotspot on and the sensor are triggered at the same time, the mobile phone will take the decrease of hotspot on as the priority one, the decrease of the sensor will not be actived, so that both normal body 1g SAR and extremtiy 10g SAR does not involve the problem of this sensor.

Trigger Position	Trigger Distance(mm)
Rear	9
Bottom	9
Front	4

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

Rear

Moving device toward the phantom:

The power state											
Distance [mm]	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Bottom Edge

Moving device toward the phantom:

The power state											
Distance [mm]	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Front Edge

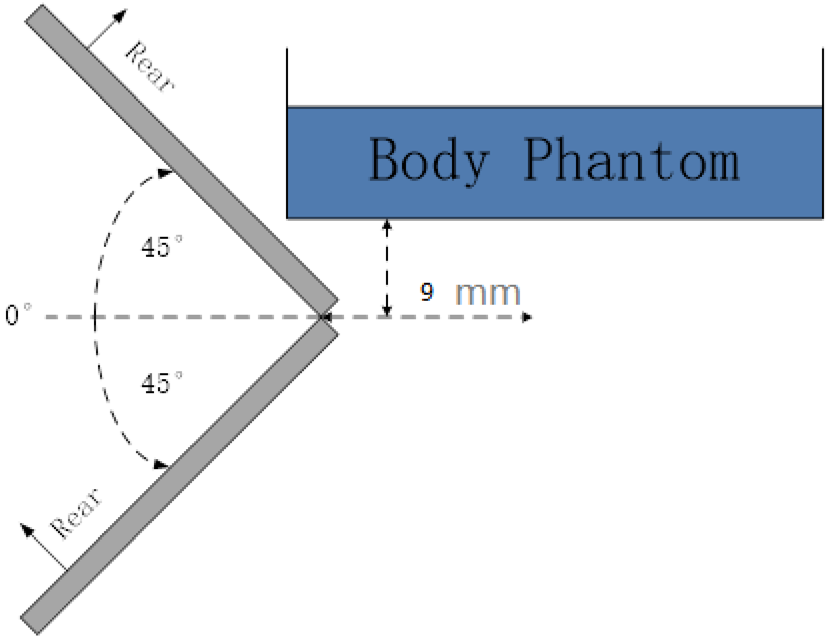
Moving device toward the phantom:

Distance [mm]	9	8	7	6	5	4	3	2	1
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low

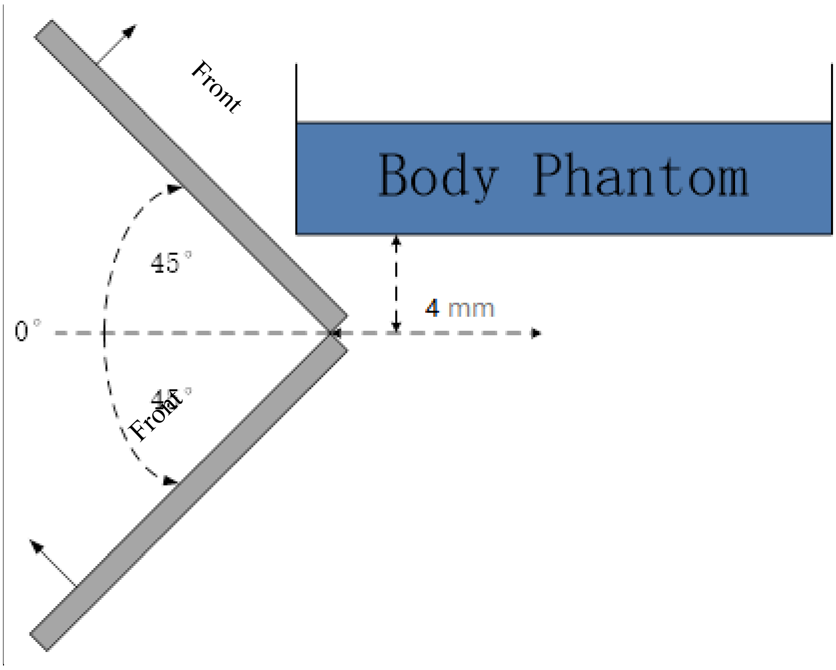
Moving device away from the phantom:

Distance [mm]	1	2	3	4	5	6	7	8	9
Main antenna	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

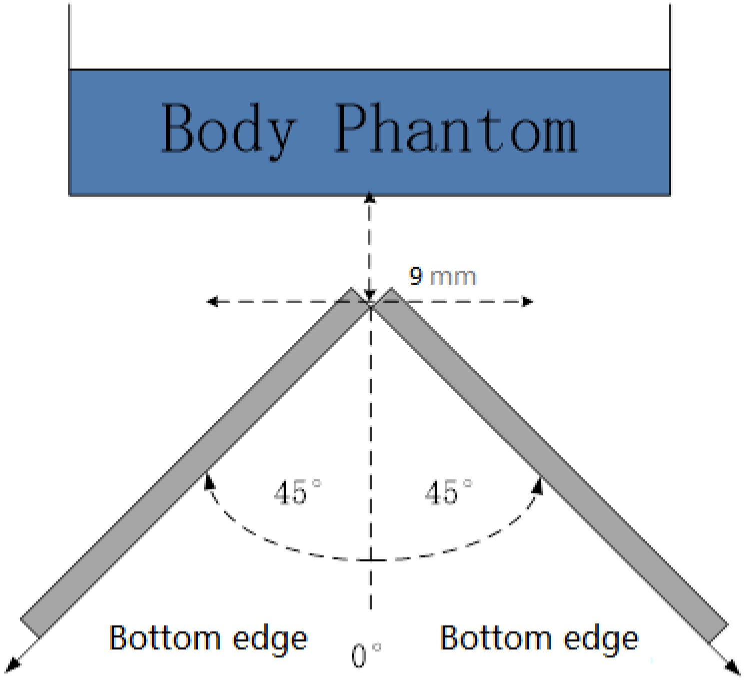
The influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in ≤ 10° increments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



The rear evaluation



The front edge evaluation



The bottom edge evaluation

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 SAR Test Result

J.1 Tissue and Verification

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

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2019-12-5	Head	2600 MHz	38.36	-1.67	1.935	-1.28
	Body	2600 MHz	52.41	-0.17	2.167	0.32

Table J.1-2: 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
2019-12-5	2600 MHz	25.1	55.8	25.52	55.92	1.67%	0.22%

Table J.1-3: System Validation 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
2019-12-5	2600 MHz	24.8	55	25.12	55.44	1.29%	0.80%

J.2 Measurement result for 5G NR

This device supports 5G NR (EN-DC) for LTE and n41. The technical specifications are as below:

Combination type: LTE B2-n41, LTE B25-n41, LTE B26-n41, LTE B66-n41

NR SCS: 30 kHz

NR modulation: CP – QPSK, 16QAM, 64QAM , 256QAM

DFT－QPSK, 16QAM, 64QAM, 256QAM

NR BW: 20/40/50/60/80/90/100MHz

The tune up of normal power is 20dBm / (256QAM CP-OFDM is 18dBm) and the tune up of low power is 18dBm .

There is power reduction for LTE in the mode of EN-DC and the tune up of LTE is 20dBm.

Head exposure conditions:

While the device is transmitting, and the audio is actively routed through the earpiece receiver, power reduction enabled for this band.

According to the requirements of 3GPP regulations and the above technical specifications, the conducted power of 5G NR is tested as follows:

Table J.2-1: The conducted power measurement results for n41-Normal Power

No.	Test Freq Description	5G-n41						Power Results (dBm)
		SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
1	High	30	20	DFT-s-OFDM QPSK	Edge_1RB_Right	2685	537000	19.34
2	Middle-1	30	20	DFT-s-OFDM QPSK	Inner_Full	2638.995	527799	19.61
3	Middle-2	30	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	19.81
4	Middle-3	30	20	DFT-s-OFDM QPSK	Inner_Full	2547	509400	19.89
5	Low	30	20	DFT-s-OFDM QPSK	Edge_1RB_Left	2501.01	500202	19.76
6	High	30	100	DFT-s-OFDM QPSK	Edge_1RB_Right	2640	528000	19.75
7	Middle-1	30	100	DFT-s-OFDM QPSK	Inner_Full	2616.495	523299	19.68
8	Middle-2	30	100	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	19.57
9	Middle-3	30	100	DFT-s-OFDM QPSK	Inner_Full	2569.5	513900	19.34
10	Low	30	100	DFT-s-OFDM QPSK	Edge_1RB_Left	2546.01	509202	19.38

Table J.2-2: The conducted power measurement results for n41 (other configuratios) - Normal Power

No.	Test Freq Description	5G-n41						Power Results (dBm)
		SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
1	default	30	20	DFT-s-OFDM 16QAM	Inner_Full	2549.505	509400	19.82
2	default	30	20	DFT-s-OFDM 64QAM	Inner_Full	2549.505	509400	19.76
3	default	30	20	DFT-s-OFDM 256QAM	Inner_Full	2549.505	509400	19.00
4	default	30	20	CP-OFDM QPSK	Inner_Full	2549.505	509400	19.80
5	default	30	20	CP-OFDM 16QAM	Inner_Full	2549.505	509400	19.81
6	default	30	20	CP-OFDM 64QAM	Inner_Full	2549.505	509400	19.48
7	default	30	20	CP-OFDM 256QAM	Inner_Full	2549.505	509400	17.26
8	default	30	20	DFT-s-OFDM QPSK	Edge_Full_Right	2549.505	509400	19.65
9	default	30	20	DFT-s-OFDM QPSK	Edge_Full_Left	2549.505	509400	19.27
10	default	30	20	DFT-s-OFDM QPSK	Inner_1RB_Right	2549.505	509400	19.05
11	default	30	20	DFT-s-OFDM QPSK	Inner_1RB_Left	2549.505	509400	19.36
12	default	30	20	DFT-s-OFDM QPSK	Outer_Full	2549.505	509400	19.00
14	default	30	40	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	19.85
15	default	30	50	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	19.48
16	default	30	60	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	19.56
16	default	30	80	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	19.19
17	default	30	90	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	19.25

According to the tables above, the following configuration of 5G NR is selected as the SAR test configuration:

Test Freq Description	5G-n41						Power Results (dBm)
	SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
Middle-2	30	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	19.89

Table J.2-3: The conducted power measurement results for n41-Low Power

No.	Test Freq Description	5G-n41						Power Results (dBm)
		SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
1	High	30	20	DFT-s-OFDM QPSK	Edge_1RB_Right	2679.99	535998	17.51
2	Middle-1	30	20	DFT-s-OFDM QPSK	Inner_Full	2636.49	527298	17.32
3	Middle-2	30	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.88
4	Middle-3	30	20	DFT-s-OFDM QPSK	Inner_Full	2549.505	509400	17.79
5	Low	30	20	DFT-s-OFDM QPSK	Edge_1RB_Left	2506.02	501204	17.50
6	High	30	100	DFT-s-OFDM QPSK	Edge_1RB_Right	2640	528000	17.63
7	Middle-1	30	100	DFT-s-OFDM QPSK	Inner_Full	2616.495	523299	17.53
8	Middle-2	30	100	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.25
9	Middle-3	30	100	DFT-s-OFDM QPSK	Inner_Full	2569.5	513900	17.30
10	Low	30	100	DFT-s-OFDM QPSK	Edge_1RB_Left	2546.01	509202	17.46

Table J.2-4: The conducted power measurement results for n41 (other configuratios) -Low Power

No.	Test Freq Description	5G-n41						Power Results (dBm)
		SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
1	Low	30	20	DFT-s-OFDM 16QAM	Inner_Full	2592.99	518598	17.85
2	Low	30	20	DFT-s-OFDM 64QAM	Inner_Full	2592.99	518598	17.83
3	Low	30	20	DFT-s-OFDM 256QAM	Inner_Full	2592.99	518598	17.86
5	Low	30	20	CP-OFDM QPSK	Inner_Full	2592.99	518598	17.78
6	Low	30	20	CP-OFDM 16QAM	Inner_Full	2592.99	518598	17.79
7	Low	30	20	CP-OFDM 64QAM	Inner_Full	2592.99	518598	16.99
8	Low	30	20	CP-OFDM 256QAM	Inner_Full	2592.99	518598	17.20
9	Low	30	20	DFT-s-OFDM QPSK	Edge_Full_Right	2592.99	518598	17.55
10	Low	30	20	DFT-s-OFDM QPSK	Edge_Full_Left	2592.99	518598	17.14
11	Low	30	20	DFT-s-OFDM QPSK	Inner_1RB_Right	2592.99	518598	17.65
12	Low	30	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.55
13	Low	30	20	DFT-s-OFDM QPSK	Outer_Full	2592.99	518598	17.63
16	Low	30	40	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.75
17	Low	30	50	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.36
18	Low	30	60	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.50
19	Low	30	80	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.62
20	Low	30	90	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.73
21	Low	15	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.75

According to the tables above, the following configuration of 5G NR is selected as the SAR test configuration:

Test Freq Description	5G-n41						Power Results (dBm)
	SCS (kHz)	NR BW (MHz)	Modulation	RB allocation	NR Test Freq. (MHz)	NR Test CH.	n41
Middle-2	30	20	DFT-s-OFDM QPSK	Inner_Full	2592.99	518598	17.88

J.3 NR EN-DC downlink

UAT

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_n41A_25A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	25	20	8365	17.88	17.79
DC_n41A_26A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	26	15	8865	17.88	17.8
DC_n41A_2A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	900	17.88	17.81
DC_n41A_66A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	66	20	66886	17.88	17.76

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz)	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_n41A_2C	n41	20	Edge_1RB_Left	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	700	2	20	898	17.88	17.66
DC_n41A_2A-66A	n41	20	Edge_1RB_Left	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	900	66	20	66886	17.88	17.72
DC_(n)71AA_2A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	898	19.98	19.76
DC_(n)71AA_2A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	898	19.98	19.82
DC_(n)71AA_66A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	66	20	66886	19.98	17.74

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz)	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_(n)71AA_66C	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	66	20	66536	66	20	66734	19.98	19.73
DC_(n)71AA_2A-66A_	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	900	66	20	66886	19.98	19.85

LAT

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_n41A_25A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	25	20	8365	17.88	17.82
DC_n41A_26A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	26	15	8865	17.88	17.83
DC_n41A_2A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	900	17.88	17.85
DC_n41A_66A	n41	20	Inner_Full	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	66	20	66886	17.88	17.8

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz)	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_n41A_2C	n41	20	Edge_1RB_Left	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	700	2	20	898	17.88	17.74
DC_n41A_2A-66A	n41	20	Edge_1RB_Left	DFT-s-OFDM QPSK	30	Middle-2	518598	2592.99	2	20	900	66	20	66886	17.88	17.76
DC_(n)71AA_2A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	898	19.98	19.82
DC_(n)71AA_2A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	898	19.98	19.87
DC_(n)71AA_66A	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	66	20	66886	19.98	19.77

DL CA Class	Band	Bandwidth (MHz)	UL RB size	Modulation	SCS (kHz)	Test Freq Description	UL Channel	Frequency	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Band	Bandwidth (MHz)	DL Channel	Power Rel 8 LTETx Power(dBm)	Power Rel 10 DL LTE CA Tx Power(dBm)
DC_(n)71AA_66C	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	66	20	67036	66	20	67180	19.98	19.78
DC_(n)71AA_2A-66A_	n71	20	Inner_Full	DFT-s-OFDM QPSK	15	Middle-1	137600	688	71	20	135476	2	20	900	66	20	66786	19.98	19.74

J.4 Measurement results

B2: Battery of BLP745 Sunwoda Electronic India Private Limited

Table J.4-1: SAR Values (n41- Head)

Phantom position L/R/F	Frequency Band	Channel Number	Frequency (MHz)	Test Position	Figure NO./Note	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Calculated SAR 10g (W/kg)	Power Drift
Left	n41	2592.99	518598	Cheek	/	17.88	18	0.127	**0.13**	0.073	**0.08**	-0.03
Left	n41	2592.99	518598	Tilt	/	17.88	18	0.118	**0.12**	0.058	**0.06**	0.09
Right	n41	2592.99	518598	Cheek	/	17.88	18	0.465	**0.48**	0.229	**0.24**	0.06
Right	n41	2592.99	518598	Tilt	Fig J.1	17.88	18	0.554	**0.57**	0.233	**0.24**	0.12
Right	n41	2592.99	518598	Tilt	B2	17.88	18	0.537	**0.55**	0.221	**0.23**	-0.05

Table J.4-2: SAR Values (n41- Body)

Frequency Band	Channel Number	Frequency (MHz)	Test Position	Figure NO./Note	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Calculated SAR 10g (W/kg)	Power Drift
n41	2592.99	518598	**Front**	/	**19.89**	**20**	**0.165**	**0.17**	**0.089**	**0.09**	-0.05
n41	2592.99	518598	**Rear**	/	**19.89**	**20**	**0.183**	**0.19**	**0.097**	**0.10**	-0.01
n41	2592.99	518598	**Left Edge**	Fig J.2	**19.89**	**20**	**0.262**	**0.27**	**0.132**	**0.14**	0.09
n41	2592.99	518598	**Right Edge**	/	**19.89**	**20**	**0.000**	**<0.01**	**0.000**	**<0.01**	-0.13
n41	2592.99	518598	**Bottom Edge**	/	**19.89**	**20**	**0.000**	**<0.01**	**0.000**	**<0.01**	-0.04
n41	2592.99	518598	**Top Edge**	/	**19.89**	**20**	**0.183**	**0.19**	**0.077**	**0.08**	0.06
n41	2592.99	518598	**Left Edge**	B2	**19.89**	**20**	**0.244**	**0.25**	**0.119**	**0.12**	-0.08

Note: The distance between the EUT and the phantom bottom is 10mm.SAR results for **Table**

J.4-2: SAR results for Standard procedure

Test Band	Channel	Frequency	Tune-Up	Measured Power	Test Position	Measured 10g SAR	Measured 1g SAR	Reported 10g SAR	Reported 1g SAR	Power Drift	Figure
NR n41	2592.99	518598	18	17.88	Right Tilt	0.233	0.554	0.24	0.57	0.12	Fig A.1
NR n41	2592.99	518598	20	19.89	Left Edge	0.132	0.262	0.14	0.27	0.09	Fig A.2

Table J.4-3: The sum of reported SAR values for LAT

	Position	n41	LTEB25	Sum
Highest reported SAR value for Head	Left head, Tilt	0.57	0.17	**0.74**
Highest reported SAR value for Body	Rear 10mm	/	0.74	**0.74**

	Position	n41	LTEB26	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.26	**0.65**
Highest reported SAR value for Body	Rear 10mm	0.19	0.2	**0.39**

	Position	n41	LTEB66	Sum
Highest reported SAR value for Head	Right head, Tilt	0.48	0.19	**0.67**
Highest reported SAR value for Body	Rear 10mm	/	0.99	**0.99**

	Position	n41	LTEB2	Sum
Highest reported SAR value for Head	Right head, Tilt	0.48	0.19	**0.67**
Highest reported SAR value for Body	Rear 10mm	/	0.99	**0.99**

	Position	n41	LTEB25	WIFI 5G	Sum
Highest reported SAR value for Head	Left head, Tilt	0.57	0.17	0.19	**0.93**
Highest reported SAR value for Body	Rear 10mm	0.19	0.46	0.4	**1.05**

	Position	n41	LTEB26	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.26	0.19	**0.84**
Highest reported SAR value for Body	Rear 10mm	0.19	0.2	0.4	**0.79**

	Position	n41	LTEB66	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Cheek	0.48	0.19	0.21	**0.88**
Highest reported SAR value for Body	Rear 10mm	0.19	0.48	0.4	**1.07**

	Position	n41	LTEB2	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.06	0.19	**0.82**
Highest reported SAR value for Body	Rear 10mm	0.19	0.27	0.4	**0.86**

	Position	n41	LTEB25	WIFI 2.4G	Sum
Highest reported SAR value for Head	Left head, Check	0.48	0.23	0.23	**0.94**
Highest reported SAR value for Body	Rear 10mm	0.19	0.46	0.47	**1.12**

	Position	n41	LTEB26	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.48	0.11	0.19	**0.82**
Highest reported SAR value for Body	Rear 10mm	0.19	0.2	0.47	**0.86**

	Position	n41	LTEB66	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Cheek	0.48	0.19	0.23	**0.90**
Highest reported SAR value for Body	Rear 10mm	0.19	0.48	0.4	**1.14**

	Position	n41	LTEB2	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.06	0.16	**0.79**
Highest reported SAR value for Body	Rear 10mm	0.19	0.27	0.47	**0.86**

Table J.4-4: The sum of reported SAR values for UAT

	Position	n41	LTEB25	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.62	**1.19**
Highest reported SAR value for Body	Top Edge 10mm	0.19	0.4	**0.59**

	Position	n41	LTEB26	Sum
Highest reported SAR value for Head	Left head, Check	0.57	0.24	**0.37**
Highest reported SAR value for Body	Rear 10mm	0.19	0.31	**0.50**

	Position	n41	LTEB66	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.49	**1.06**
Highest reported SAR value for Body	Top Edge 10mm	0.19	0.64	**0.83**

	Position	n41	LTEB2	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.31	**0.88**
Highest reported SAR value for Body	Top Edge 10mm	0.19	0.37	**0.56**

	Position	n41	LTEB25	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.19	0.62	0.19	**1.38**
Highest reported SAR value for Body	Rear 10mm	0.19	0.36	0.4	**0.95**

	Position	n41	LTEB26	WIFI 5G	Sum
Highest reported SAR value for Head	Left head, Check	0.13	0.24	0.42	**0.79**
Highest reported SAR value for Body	Rear 10mm	0.19	0.31	0.4	**0.90**

	Position	n41	LTEB66	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.49	0.19	**1.25**
Highest reported SAR value for Body	Top Edge 10mm	0.19	0.42	0.4	**1.01**

	Position	n41	LTEB2	WIFI 5G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.31	0.19	**1.07**
Highest reported SAR value for Body	Front 10mm	0.17	0.29	0.4	**0.88**

	Position	n41	LTEB25	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.19	0.62	0.19	**1.38**
Highest reported SAR value for Body	Rear 10mm	0.19	0.36	0.4	**0.95**

	Position	n41	LTEB26	WIFI 2.4G	Sum
Highest reported SAR value for Head	Left head, Check	0.13	0.24	0.42	**0.79**
Highest reported SAR value for Body	Rear 10mm	0.19	0.31	0.4	**0.90**

	Position	n41	LTEB66	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.49	0.16	**1.22**
Highest reported SAR value for Body	Top Edge 10mm	0.19	0.64	0.29	**1.12**

	Position	n41	LTEB2	WIFI 2.4G	Sum
Highest reported SAR value for Head	Right head, Tilt	0.57	0.31	0.19	**1.05**
Highest reported SAR value for Body	Front 10mm	0.19	0.29	0.47	**0.95**

J.5 List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5239A	MY46110673	January 24, 2019	One year
02	Power meter	NRP2	106277	September 4, 2019	One year
03	Power sensor	NRP8S	104291		
04	Signal Generator	E4438C	MY49070393	January 4, 2019	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	Directional Coupler	778D	MY48220584	No Calibration Requested	
07	Directional Coupler	772D	MY46151265	No Calibration Requested	
08	BTS	E5515C	MY50263375	January 17, 2019	One year
09	BTS	CMW500	159890	January 3, 2019	One year
10	E-field Probe	SPEAG EX3DV4	3617	January 31, 2019	One year
11	DAE	SPEAG DAE4	771	January 11, 2019	One year
12	Dipole Validation Kit	SPEAG D2600V2	1012	July 17, 2019	One year

J.6 Graph Results

NR n41_CH2592.99 Right Tilt

Date: 12/6/2019

Electronics: DAE4 Sn771

Medium: head 2600 MHz

Medium parameters used: f = 2592.99 MHz; σ = -1.416 mho/m; εr = 42.72; ρ = 1000 kg/m^3

Ambient Temperature: 22.5ºC, Liquid Temperature: 22.3ºC

Communication System: NR n41-2592.99 MHz Duty Cycle: 1：1

Probe: EX3DV4 – SN3617 ConvF(7.19,7.19,7.19)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.859 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.651 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 0.554 W/kg; SAR(10 g) = 0.233 W/kg
Maximum value of SAR (measured) = 1 W/kg

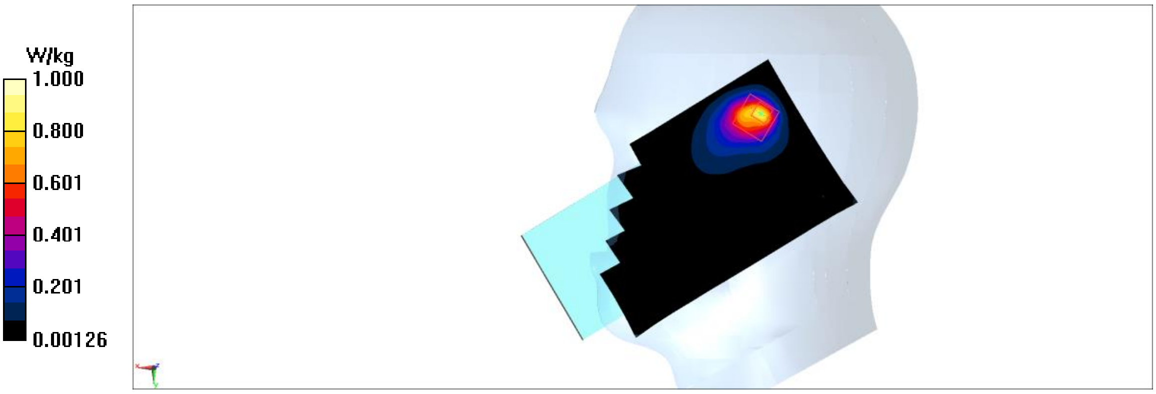


Fig J.1

NR n41_CH2592.99 Left Edge
Date: 12/6/2019
Electronics: DAE4 Sn771
Medium: body 2600 MHz
Medium parameters used: f = 2592.99 MHz; σ = -1.224 mho/m; εr = 57.19; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C
Communication System: NR n71-2592.99 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(7.49,7.49,7.49)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.385 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.083 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.497 W/kg
SAR(1 g) = 0.262 W/kg; SAR(10 g) = 0.132 W/kg
Maximum value of SAR (measured) = 0.379 W/kg

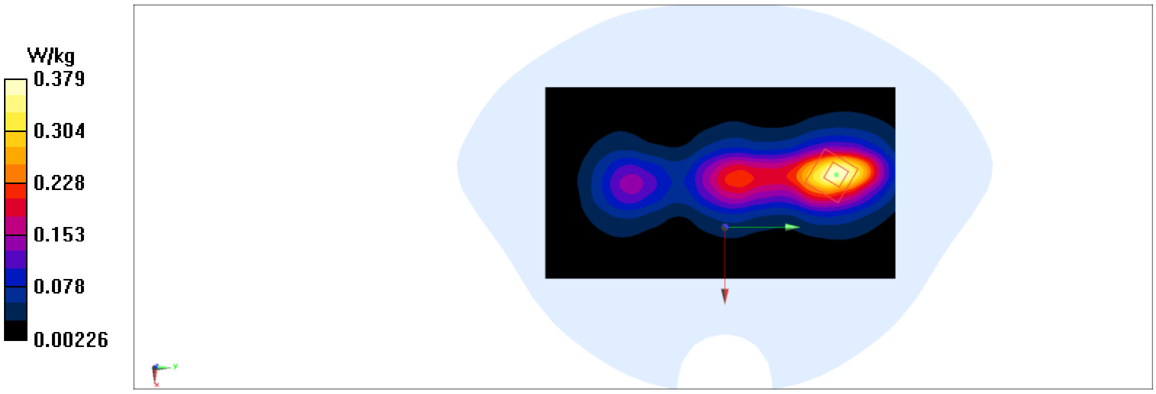


Fig J.2

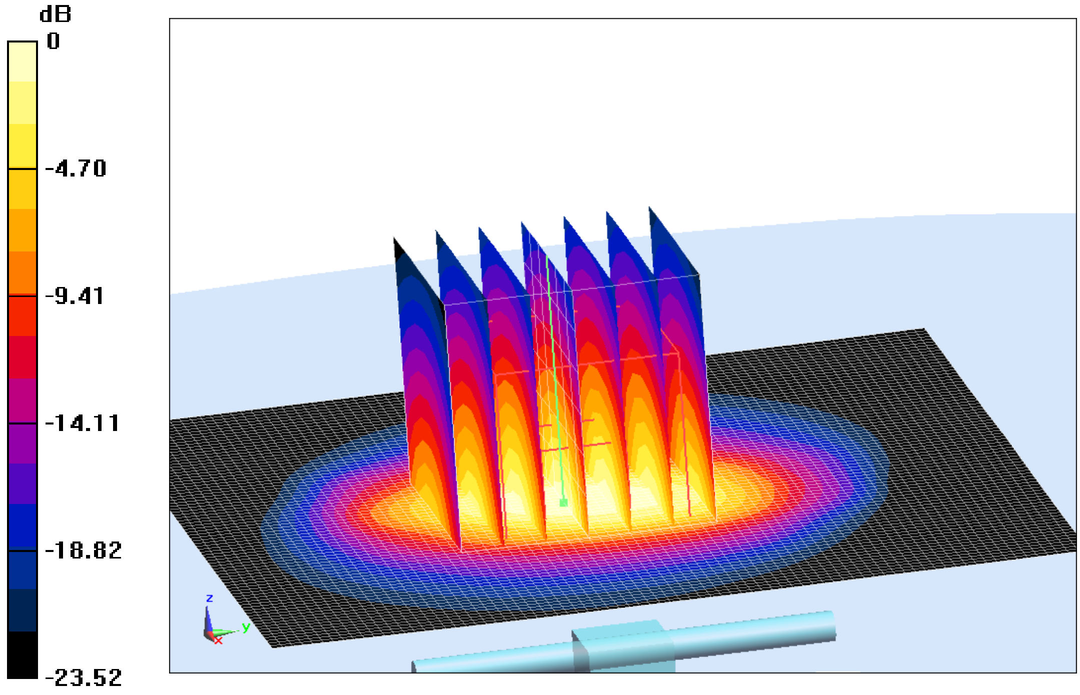
J.7 System Verification Results

2600 MHz

Date: 12/6/2019
Electronics: DAE4 Sn771
Medium: Head 2600 MHz
Medium parameters used: f = 2600 MHz; σ =1.935 mho/m; ε_r = 38.36; ρ = 1000 kg/m^3
Ambient Temperature: 22.5ºC Liquid Temperature: 22.3ºC
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(7.19,7.19,7.19)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 120.52 V/m; Power Drift = 0.06
Fast SAR: SAR(1 g) = 14.02 W/kg; SAR(10 g) = 6.26 W/kg
Maximum value of SAR (interpolated) = 25.21 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =120.52 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 28.56 W/kg
SAR(1 g) = 13.98 W/kg; SAR(10 g) = 6.38 W/kg
Maximum value of SAR (measured) = 23.54 W/kg



0 dB = 23.54 W/kg = 13.72 dB W/kg

Fig.J.3 validation 2600 MHz 250Mw

2600 MHz

Date: 12/6/2019
Electronics: DAE4 Sn771
Medium: Body 2600 MHz
Medium parameters used: f = 2600 MHz; σ =2.167 mho/m; ε_r = 52.41; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(7.49,7.49,7.49)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 109.05 V/m; Power Drift = -0.02

Fast SAR: SAR(1 g) = 13.82 W/kg; SAR(10 g) = 6.1 W/kg

Maximum value of SAR (interpolated) = 23.33 W/kg

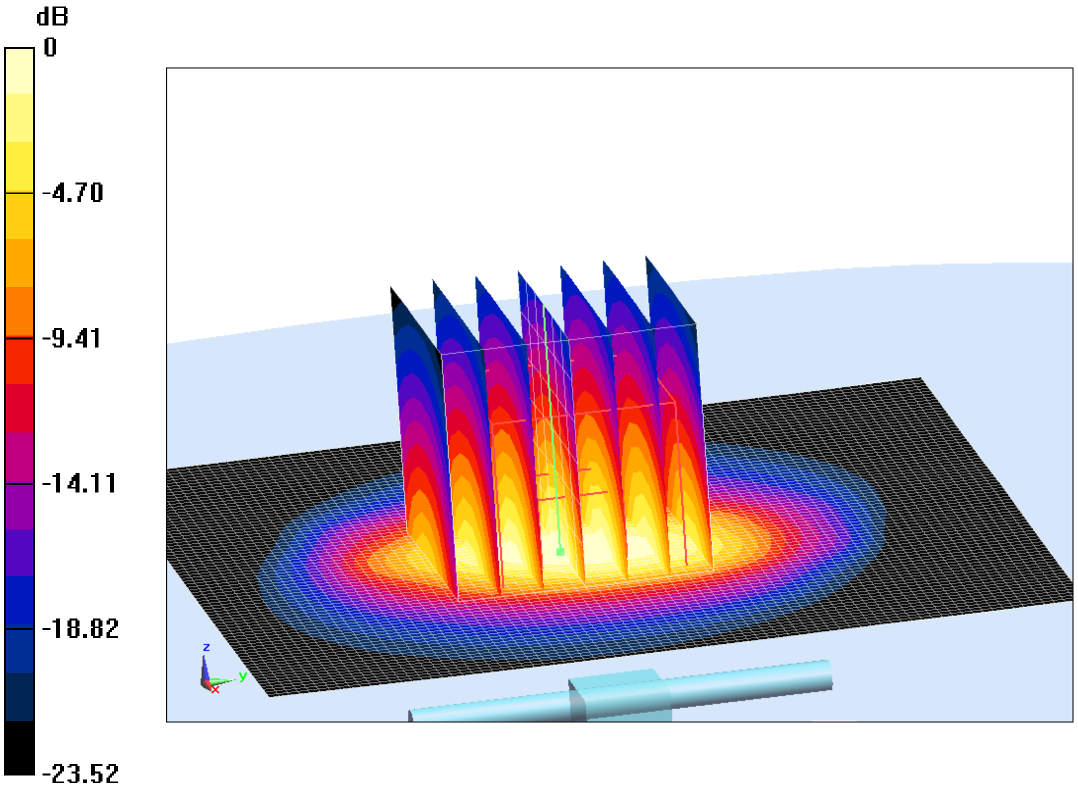
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =109.05 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 28.77 W/kg

SAR(1 g) = 13.86 W/kg; SAR(10 g) = 6.28 W/kg

Maximum value of SAR (measured) = 23.34 W/kg



0 dB = 23.34 W/kg = 13.68 dB W/kg

Fig.J.4 validation 2600 MHz 250mW

The SAR system verification must be required that the area scan estimated 10-g SAR is within 3% of the zoom scan 10-g SAR.

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

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2019-12-6	2600	Head	14.02	13.98	0.29
2019-12-6	2600	Body	13.82	13.86	-0.29

J.8 Probe Calibration Certificate

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **EX3-3617_Jan19**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3617
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	January 31, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
DAE4	SN: 660	19-Dec-18 (No. DAE4-660_Dec18)	Dec-19
Reference Probe ES3DV2	SN: 3013	31-Dec-18 (No. ES3-3013_Dec18)	Dec-19
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: February 2, 2019

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

Certificate No: EX3-3617_Jan19 Page 1 of 19

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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.e., ϑ = 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, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z*: *A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,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 ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3617

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.35	0.21	0.32	± 10.1 %
DCP (mV)[B]	102.9	95.7	101.9	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Max Unc[E] (k=2)
0	CW	X	0.00	0.00	1.00	0.00	151.4	± 3.0 %	± 4.7 %
		Y	0.00	0.00	1.00		154.7		
		Z	0.00	0.00	1.00		150.4		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	5.31	73.42	14.63	10.00	60.0	± 2.6 %	± 9.6 %
		Y	2.86	65.84	11.90		60.0		
		Z	15.00	87.67	20.10		60.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	10.57	81.97	16.23	6.99	80.0	± 1.7 %	± 9.6 %
		Y	2.03	65.40	10.27		80.0		
		Z	15.00	89.79	19.80		80.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	15.00	86.62	16.29	3.98	95.0	± 1.1 %	± 9.6 %
		Y	0.82	61.50	6.58		95.0		
		Z	15.00	97.47	22.01		95.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	15.00	89.99	16.64	2.22	120.0	± 1.2 %	± 9.6 %
		Y	0.40	60.00	3.98		120.0		
		Z	15.00	114.21	28.32		120.0		
10387-AAA	QPSK Waveform, 1 MHz	X	0.65	62.36	8.93	0.00	150.0	± 3.9 %	± 9.6 %
		Y	0.45	60.00	5.43		150.0		
		Z	0.90	65.62	10.92		150.0		
10388-AAA	QPSK Waveform, 10 MHz	X	2.42	70.53	17.16	0.00	150.0	± 1.8 %	± 9.6 %
		Y	1.99	67.57	15.24		150.0		
		Z	2.71	72.39	18.22		150.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	3.78	75.33	20.79	3.01	150.0	± 0.7 %	± 9.6 %
		Y	3.23	71.01	18.81		150.0		
		Z	3.71	74.94	20.97		150.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	3.58	68.11	16.37	0.00	150.0	± 4.0 %	± 9.6 %
		Y	3.32	66.75	15.59		150.0		
		Z	3.71	68.68	16.83		150.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.84	66.21	15.87	0.00	150.0	± 6.7 %	± 9.6 %
		Y	4.48	64.72	15.19		150.0		
		Z	4.93	66.43	16.14		150.0		

Note: For details on UID parameters see Appendix

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 E^2-field uncertainty inside TSL (see Pages 5 and 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3617

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	38.8	281.02	33.92	10.58	0.71	4.99	1.88	0.20	1.01
Y	39.2	310.65	39.54	8.92	1.27	5.05	0.00	0.75	1.01
Z	40.7	300.62	35.22	10.39	0.59	5.05	1.28	0.33	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	14.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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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 [G]	Depth [G] (mm)	Unc (k=2)
64	54.2	0.75	12.45	12.45	12.45	0.00	1.00	± 13.3 %
150	52.3	0.76	11.88	11.88	11.88	0.00	1.00	± 13.3 %
300	45.3	0.87	11.40	11.40	11.40	0.08	1.20	± 13.3 %
450	43.5	0.87	10.54	10.54	10.54	0.14	1.40	± 13.3 %
750	41.9	0.89	10.03	10.03	10.03	0.63	0.84	± 12.0 %
835	41.5	0.90	9.75	9.75	9.75	0.39	0.95	± 12.0 %
900	41.5	0.97	9.66	9.66	9.66	0.47	0.85	± 12.0 %
1450	40.5	1.20	8.68	8.68	8.68	0.37	0.80	± 12.0 %
1640	40.2	1.31	8.48	8.48	8.48	0.38	0.80	± 12.0 %
1750	40.1	1.37	8.38	8.38	8.38	0.36	0.82	± 12.0 %
1810	40.0	1.40	8.11	8.11	8.11	0.32	0.84	± 12.0 %
1900	40.0	1.40	8.14	8.14	8.14	0.32	0.85	± 12.0 %
2000	40.0	1.40	8.13	8.13	8.13	0.28	0.84	± 12.0 %
2100	39.8	1.49	8.30	8.30	8.30	0.37	0.85	± 12.0 %
2300	39.5	1.67	7.74	7.74	7.74	0.32	0.84	± 12.0 %
2450	39.2	1.80	7.62	7.62	7.62	0.31	0.95	± 12.0 %
2600	39.0	1.96	7.19	7.19	7.19	0.43	0.85	± 12.0 %
3300	38.2	2.71	6.98	6.98	6.98	0.25	1.20	± 13.1 %
3500	37.9	2.91	6.97	6.97	6.97	0.50	1.20	± 13.1 %
3700	37.7	3.12	6.89	6.89	6.89	0.20	1.20	± 13.1 %
3900	37.5	3.32	6.88	6.88	6.88	0.20	1.20	± 13.1 %
4600	36.7	4.04	6.84	6.84	6.84	0.20	1.50	± 13.1 %
4950	36.3	4.40	5.60	5.60	5.60	0.40	1.80	± 13.1 %
5200	36.0	4.66	5.50	5.50	5.50	0.40	1.80	± 13.1 %
5250	35.9	4.71	5.39	5.39	5.39	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.25	5.25	5.25	0.40	1.80	± 13.1 %
5500	35.6	4.96	5.18	5.18	5.18	0.40	1.80	± 13.1 %
5600	35.5	5.07	5.06	5.06	5.06	0.40	1.80	± 13.1 %
5750	35.4	5.22	5.07	5.07	5.07	0.40	1.80	± 13.1 %
5800	35.3	5.27	5.04	5.04	5.04	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies 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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

