Appendix B SAR Measurement data

B.1 Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and the horizontal grid spacing was 15 mm x 15 mm, 12 mm x 12 mm or 10 mm x 10 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point found in the Step 2 (area scan), a volume of 30 mm x 30 mm x 30 mm or more was assessed by measuring 7 x 7 x 7 points at least for below 3GHz and a volume of 28 mm x 28mm x 22.5mm or more was assessed by measuring 8 x 8 x 6(ratio step method (*1)) points at least for 5GHz band.

And for any secondary peaks found in the Step2 which are within 2dB of maximum peak and not with this Step3 (Zoom scan) is repeated.
On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

(1). The data at the surface were extrapolated, since the center of the dipoles is 1mm(EX3DV4) away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes.
This polynomial was then used to evaluate the points between the surface and the probe tip.

(2). The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot"-condition (in x, y and z-directions) [4], [5]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

(3). All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

*1. Ratio step method parameters used;
The first measurement point: 2mm from the phantom surface, the initial grid separation: 2mm, subsequent graded grid ratio: 1.5
These parameters comply with the requirement of the KDB 865664D01.

Step 4: Re-measurement of the E-field at the same location as in Step 1.
Confirmation after SAR testing
It was checked that the power drift [W] is within +/-5 %.The verification of power drift during the SAR test is that DASY5 system calculates the power drift by measuring the e-filed at the same location at beginning and the end of the scan measurement for each test position.

DASY5 system calculation Power drift value[dB] =20log(Ea)/(Eb)
Before SAR testing : Eb[V/m]
After SAR testing : Ea[V/m]

Limit of power drift[W] =+/-5 %
X[dB]=10log[P]=10log(1.05/1)=10log(1.05)-10log(1)=0.212dB

from E-filed relations with power.
p=E^2/η=E^2/
Therefore, The correlation of power and the E-filed
XdB=10log(P)=10log(E)^2=20log(E)

Therefore,
The calculated power drift of DASY5 System must be the less than +/-0.212 dB.

B.2 Plot No. N41.1 / NR Bn41 ch518600 2593MHz BPSK DFTsOFDM Bottom 0 mm 100 MHz RBn1 RBp1

Communication System: UID 0, #NR (0); Communication System Band: NR 41; ; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2593 MHz; σ = 1.896 S/m; ε_r = 38.422; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.2, 7.2, 7.2) @ 2593 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1369;
Phantom: ELI v4.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1045
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

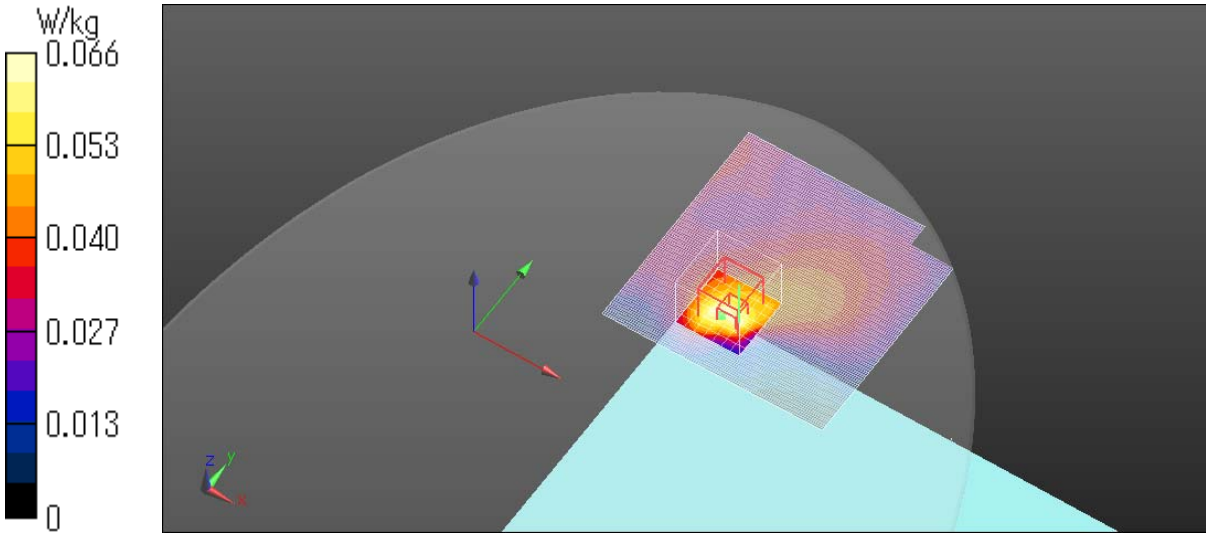
2.4 & 2.6 G/NR N41 ch518600 2593 MHz BPSK DFTsOFDM Bottom 0 mm 100 MHz 1-1/Area Scan (101x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.0661 W/kg

2.4 & 2.6 G/NR N41 ch518600 2593 MHz BPSK DFTsOFDM Bottom 0 mm 100 MHz 1-1/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5 mm, dy=5 mm, dz=5 mm
Reference Value = 6.097 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0850 W/kg
SAR(1 g) = 0.041 W/kg; SAR(10 g) = 0.022 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 17.5 mm)
Ratio of SAR at M2 to SAR at M1 = 47.9 %

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.0664 W/kg

Ambient Temp. : 23.0 degree.C. Liquid Temp.; 23.0 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/03/02



B.3 Plot No. N41.2 / NR Bn41 ch518600 2593MHz BPSK DFTsOFDM Keyboard Limbs 0 mm 100 MHz RBn1 RBp1

Communication System: UID 0, #Generic LTE (0); Communication System Band: Band 41, E-UTRA/TDD (2496.0 - 2690.0 MHz); ; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2593 MHz; σ = 1.874 S/m; ε_r = 39.069; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.2, 7.2, 7.2) @ 2593 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509;
Phantom: ELI v5.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1203
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

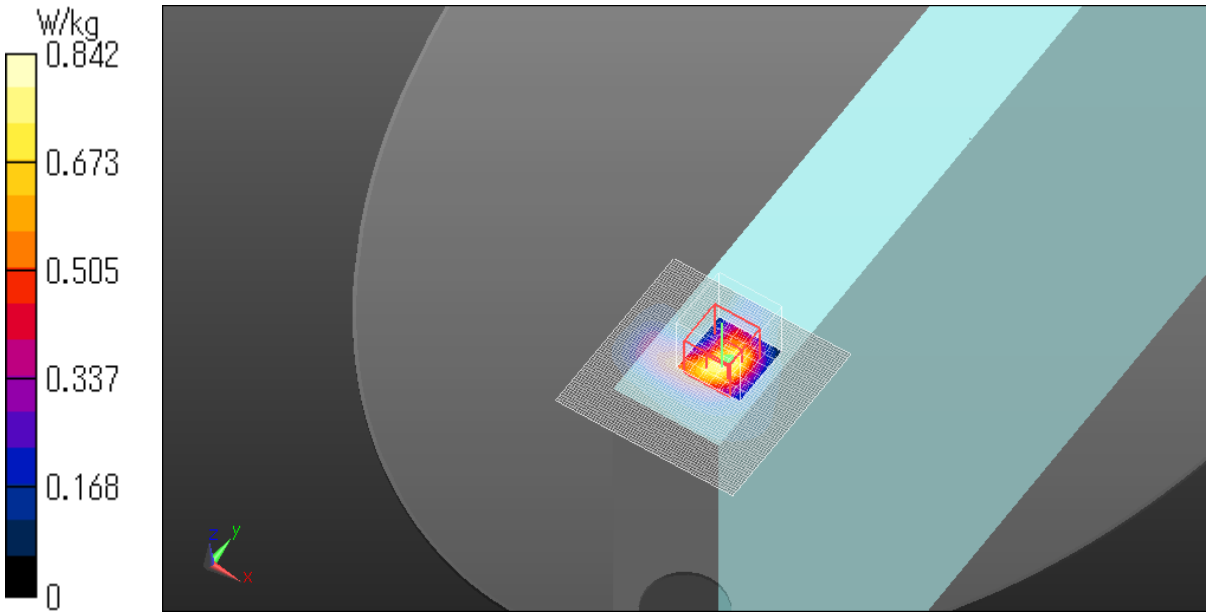
2.4 & 2.6 G/NR N41 ch518600 2593 MHz BPSK DFTsOFDM Keyboard 0 mm 100 MHz 1-1/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.842 W/kg

2.4 & 2.6 G/NR N41 ch518600 2593 MHz BPSK DFTsOFDM Keyboard 0 mm 100 MHz 1-1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5 mm, dy=5 mm, dz=5 mm
Reference Value = 21.43 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.00 W/kg
SAR(1 g) = 0.491 W/kg; SAR(10 g) = 0.234 W/kg
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 48.4 %

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.798 W/kg

Ambient Temp. : 20.0 degree.C. Liquid Temp.; 20 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/02/25



B.4 Plot No. W2.4 / WLAN 2.4 GHz / Main Ant Keyboard 0 mm 11b 2417 MHz

Communication System: UID 0, #WLAN 11a/b/g/n (0); Communication System Band: 11b/g/n (2.4 G); ; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2417 MHz; σ = 1.722 S/m; ε_r = 39.361; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3917; ConvF(7.42, 7.42, 7.42) @ 2417 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509;
Phantom: ELI v5.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1203
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

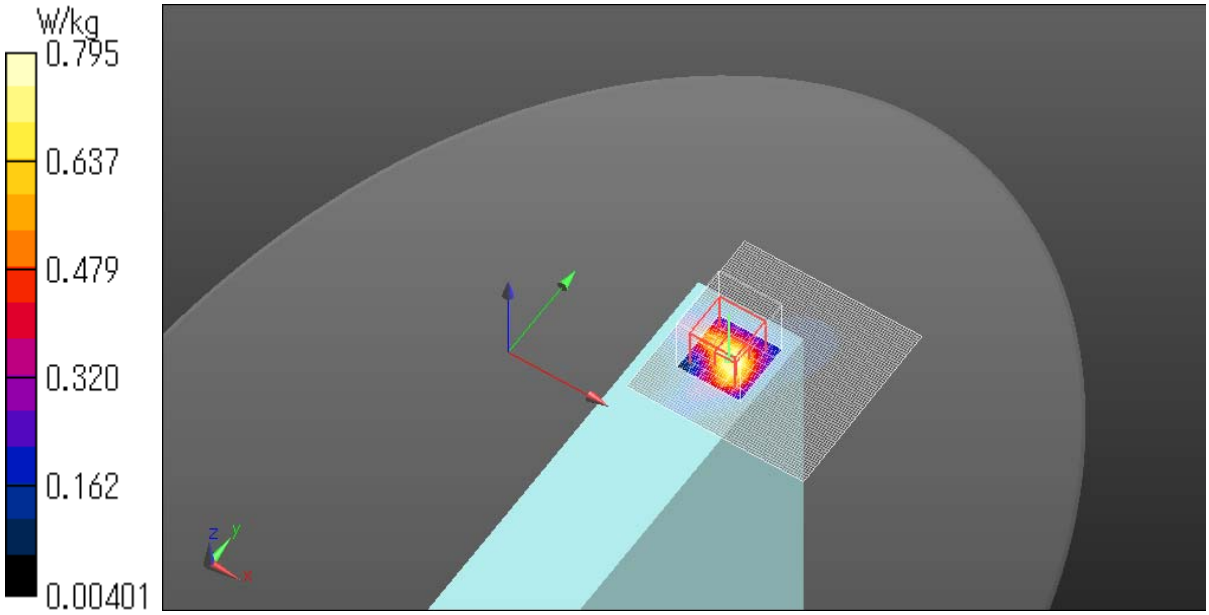
2.4 & 2.6 G/WLAN main Keyboard 11b 2417 MHz/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.777 W/kg

2.4 & 2.6 G/WLAN main Keyboard 11b 2417 MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5 mm, dy=5 mm, dz=5 mm
Reference Value = 22.42 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.00 W/kg
SAR(1 g) = 0.483 W/kg; SAR(10 g) = 0.226 W/kg
Smallest distance from peaks to all points 3 dB below = 9.2 mm
Ratio of SAR at M2 to SAR at M1 = 49.4 %

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.795 W/kg

Ambient Temp. : 20.0 degree.C. Liquid Temp.; 20.0 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/02/25



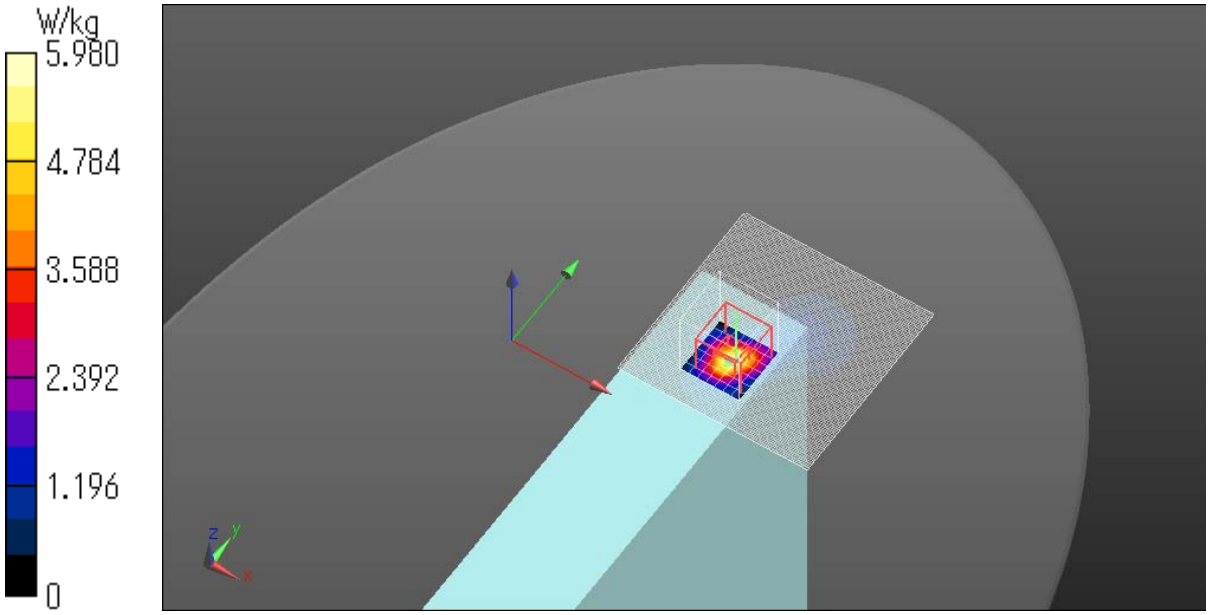
B.5 Plot No. W5.3 / WLAN 5.3 GHz / Main Ant Keyboard 0 mm 11a 5260 MHz

Communication System: UID 0, #WLAN 5 GHz (0); Communication System Band: WLAN 5 GHz Low; ; Duty Cycle: 1:1
Medium parameters used: f = 5260 MHz; σ = 4.537 S/m; ε_r = 35.594; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(5.12, 5.12, 5.12) @ 5260 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509;
Phantom: ELI v5.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1203
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

WLAN/WLAN main Keyboard 11a 5260 MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 6.03 W/kg

WLAN/WLAN main Keyboard 11a 5260 MHz/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4 mm, dy=4 mm, dz=1.4 mm
Reference Value = 40.03 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 9.54 W/kg
SAR(1 g) = 2.49 W/kg; SAR(10 g) = 0.803 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 64.7 %
Maximum value of SAR (measured) = 5.98 W/kg

Ambient Temp. : 20.0 degree.C. Liquid Temp.; 20.0 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/02/25



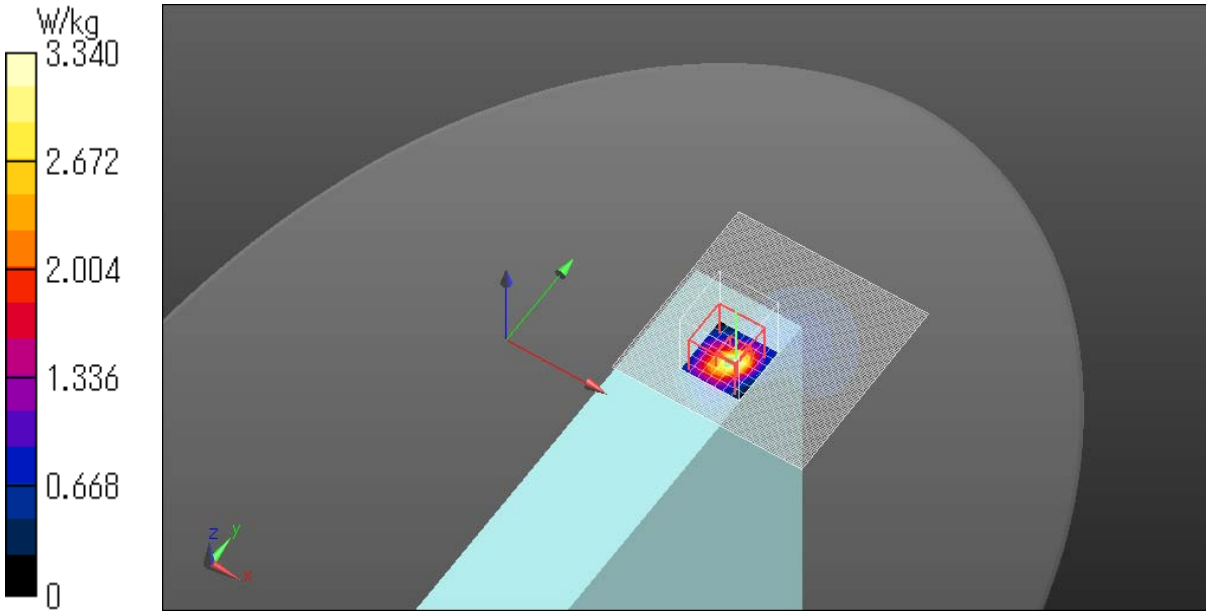
B.6 Plot No. W5.5 / WLAN5.5 GHz / Main Ant Keyboard 0 mm 11ac80 5690 MHz

Communication System: UID 0, #WLAN 5 GHz (0); Communication System Band: WLAN 5 GHz Mid; ; Duty Cycle: 1:1
Medium parameters used: f = 5690 MHz; σ = 5.055 S/m; ε_r = 34.969; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(4.66, 4.66, 4.66) @ 5690 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509;
Phantom: ELI v5.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1203
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

WLAN/WLAN main Keyboard 11ac80 5690 MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.52 W/kg

WLAN/WLAN main Keyboard 11ac80 5690 MHz/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4 mm, dy=4 mm, dz=1.4 mm
Reference Value = 28.10 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 5.74 W/kg
SAR(1 g) = 1.33 W/kg; SAR(10 g) = 0.419 W/kg
Smallest distance from peaks to all points 3 dB below = 6.9 mm
Ratio of SAR at M2 to SAR at M1 = 61 %
Maximum value of SAR (measured) = 3.34 W/kg

Ambient Temp. : 20.0 degree.C. Liquid Temp.; 20.0 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/02/25



B.7 Plot No. W5.8 / WLAN5.8 GHz / Main Ant Keyboard 0 mm 11n40 5795 MHz

Communication System: UID 0, #WLAN 5 GHz (0); Communication System Band: WLAN 5 GHz High; ; Duty Cycle: 1:1
Medium parameters used: f = 5795 MHz; σ = 5.18 S/m; ε_r = 34.847; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(4.68, 4.68, 4.68) @ 5795 MHz;
Sensor-Surface: 1.4 mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509;
Phantom: ELI v5.0 (20 deg probe tilt); Type: QDOVA001BB;Serial: TP:1203
Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7501)

WLAN/WLAN main Keyboard 11n40 5795MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.79 W/kg

WLAN/WLAN main Keyboard 11n40 5795MHz/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4 mm, dy=4 mm, dz=1.4 mm
Reference Value = 19.59 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 2.92 W/kg
SAR(1 g) = 0.665 W/kg; SAR(10 g) = 0.205 W/kg
Smallest distance from peaks to all points 3 dB below = 6.8 mm
Ratio of SAR at M2 to SAR at M1 = 60.1 %
Maximum value of SAR (measured) = 1.68 W/kg

Ambient Temp. : 20.0 degree.C. Liquid Temp.; 20.0 degree.C.
Liquid temp. is kept within the 2 degree.C. during the test.
Date: 2022/02/25