FCC SAR Test Report

Report No.	:	**SA181015C09**
Applicant	:	**NETGEAR INC.**
Address	:	**350 East Plumeria Drive, San Jose, CA 95134, USA**
Product	:	**5G MHS Travel Router**
FCC ID	:	**PY318300428**
Brand	:	**NETGEAR**
Model No.	:	**MR5000**
Standards	:	**FCC 47 CFR Part 2 (2.1093), IEEE C95.1:1992, IEEE Std 1528:2013 KDB 865664 D01 v01r04, KDB 865664 D02 v01r02, KDB 248227 D01 v02r02, KDB 447498 D01 v06, KDB 941225 D05 v02r05, KDB 941225 D05A v01r02, KDB 941225 D06 v02r01**
Sample Received Date	:	**Oct. 15, 2018**
Date of Testing	:	**Nov. 02, 2018 ~ Nov. 15, 2018**
Lab Address	:	**No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.**
Test Location	:	**No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil, Kwei Shan Dist., Taoyuan City 33383, Taiwan (R.O.C)**

CERTIFICATION: The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch – Lin Kou Laboratories**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

Prepared By : Rona Chen / Specialist

Approved By : Gordon Lin / Assistant Manager

Testing Laboratory 2021

FCC Accredited No.: TW0003

Table of Contents

Release Control Record

Report No.	Reason for Change	Date Issued
SA181015C09	Initial release	Nov. 19, 2018

1. Summary of Maximum SAR Value

Equipment Class	Mode	Highest SAR-1g Hotspot Tested at 10 mm (W/kg)
PCB	LTE 2	1.16
	LTE 4 / 66	1.00
	LTE 5	0.56
	LTE 12	0.59
	LTE 14	0.79
	LTE 30	1.09
DTS	2.4G WLAN	0.05
NII	5.2G WLAN	0.13
	5.8G WLAN	0.07

Highest Simultaneous Transmission SAR	Highest SAR-1g Hotspot Tested at 10 mm (W/kg)
	1.28

Note:

1. The SAR criteria **(Head & Body: SAR-1g 1.6 W/kg, and Extremity: SAR-10g 4.0 W/kg)** for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.
2. This device supports both LTE band 66 and band 4. The frequency span of LTE band 66 can completely cover LTE band 4, and they has the same tune-up power. SAR was tested for LTE band 66 only.

2. Description of Equipment Under Test

EUT Type	5G MHS Travel Router
FCC ID	PY318300428
Brand Name	NETGEAR
Model Name	MR5000
Tx Frequency Bands (Unit: MHz)	LTE Band 2 : 1850.7 ~ 1909.3 (BW: 1.4M, 3M, 5M, 10M, 15M, 20M) LTE Band 4 : 1710.7 ~ 1754.3 (BW: 1.4M, 3M, 5M, 10M, 15M, 20M) LTE Band 5 : 824.7 ~ 848.3 (BW: 1.4M, 3M, 5M, 10M) LTE Band 12 : 699.7 ~ 715.3 (BW: 1.4M, 3M, 5M, 10M) LTE Band 14 : 790.5 ~ 795.5 (BW: 5M, 10M) LTE Band 29 : 717 ~ 728 (Rx only) LTE Band 30 : 2307.5 ~ 2312.5 (BW: 5M, 10M) LTE Band 46 : 5150~5925 (Rx only) LTE Band 66 : 1710.7 ~ 1779.3 (BW: 1.4M, 3M, 5M, 10M, 15M, 20M) WLAN : 2412 ~ 2462, 5180 ~ 5240, 5745 ~ 5825
Uplink Modulations	LTE : QPSK, 16QAM, 64QAM 802.11b : DSSS 802.11a/g/n/ac : OFDM
Maximum Tune-up Conducted Power (Unit: dBm)	Please refer to section 4.6.1 of this report
Antenna Type	Internal IFA Antenna
EUT Stage	Engineering Sample

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.
2. For mmW5G please refer to power density report No. SP181015C09.

List of Accessory:

Battery	**Brand Name**	NETGEAR
	Model Name	W-10a
	Power Rating	3.85Vdc, 5040mAh
	Type	Li-ion

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\sigma|E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SPEAG DASY52 System

DASY52 system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY52 software defined. The DASY52 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

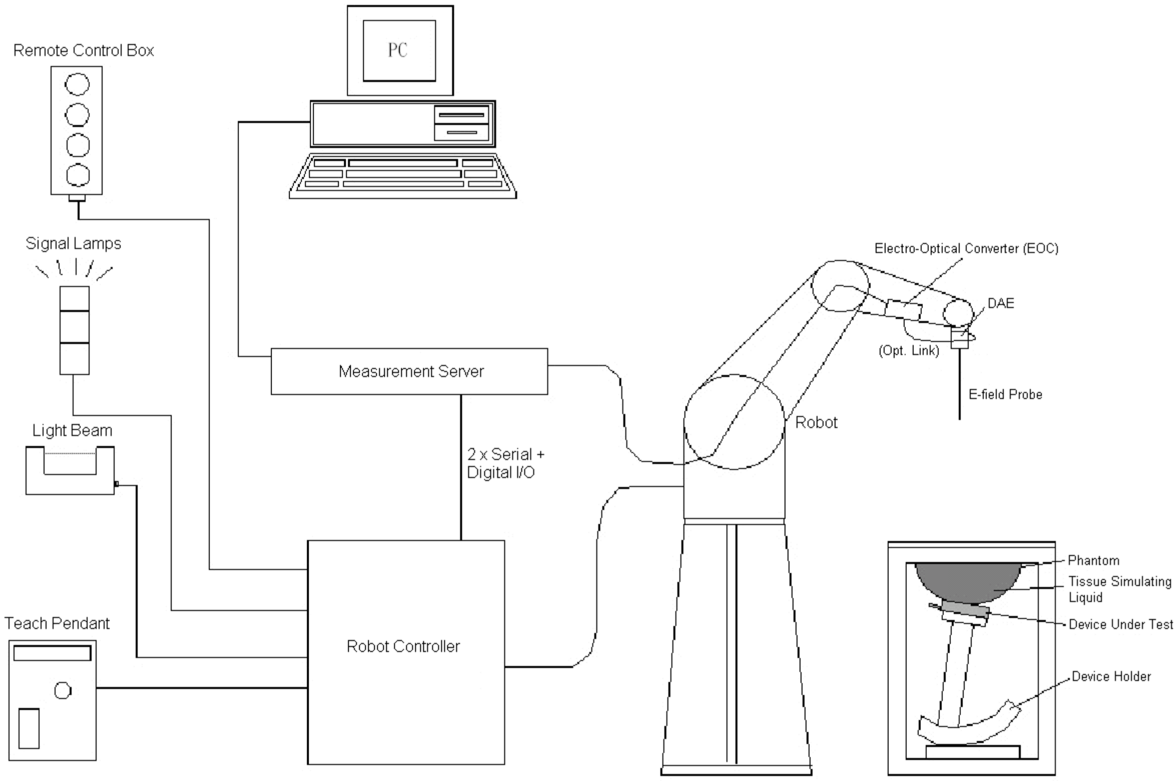


Fig-3.1 SPEAG DASY52 System Setup

3.2.1 Robot

The DASY52 systems use the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version of CS8c from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

Fig-3.2 SPEAG DASY52 System

3.2.2 Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Model	ES3DV3
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm

Model	ET3DV6
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 2.3 GHz; Linearity: ± 0.2 dB
Directivity	± 0.2 dB in TSL (rotation around probe axis) ± 0.4 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm

3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

3.2.4 Phantoms

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

3.2.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.2.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

3.2.7 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.

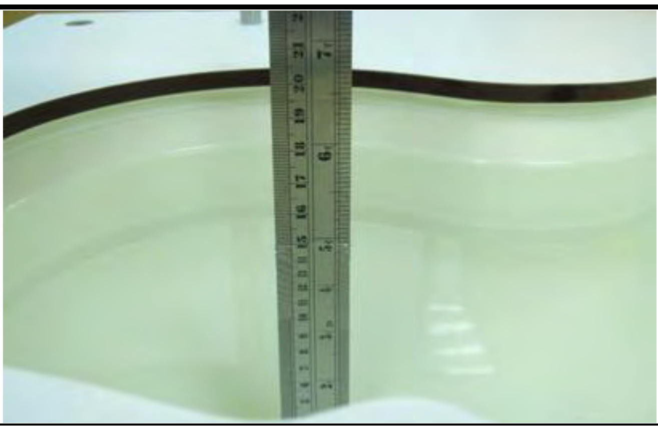
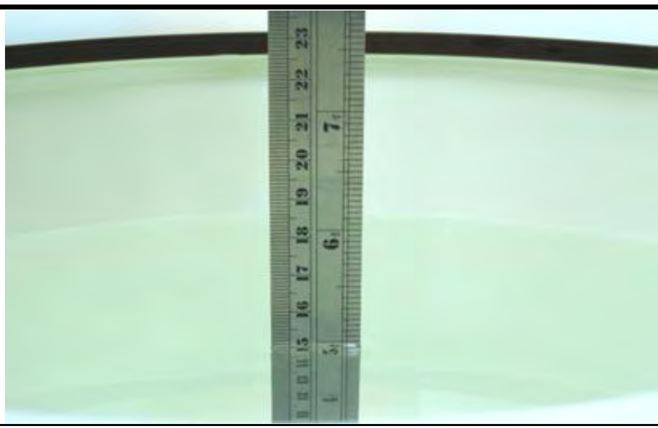
	

Photo of Liquid Height for Head Position	**Photo of Liquid Height for Body Position**

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528, and KDB 865664 D01 Appendix A. For the body tissue simulating liquids, the dielectric properties are defined in KDB 865664 D01 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit and a network analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of ±5%	Target Conductivity	Range of ±5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53
For Body				
750	55.5	52.7 ~ 58.3	0.96	0.91 ~ 1.01
835	55.2	52.4 ~ 58.0	0.97	0.92 ~ 1.02
900	55.0	52.3 ~ 57.8	1.05	1.00 ~ 1.10
1450	54.0	51.3 ~ 56.7	1.30	1.24 ~ 1.37
1640	53.8	51.1 ~ 56.5	1.40	1.33 ~ 1.47
1750	53.4	50.7 ~ 56.1	1.49	1.42 ~ 1.56
1800	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
1900	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2000	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2300	52.9	50.3 ~ 55.5	1.81	1.72 ~ 1.90
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05
2600	52.5	49.9 ~ 55.1	2.16	2.05 ~ 2.27
3500	51.3	48.7 ~ 53.9	3.31	3.14 ~ 3.48
5200	49.0	46.6 ~ 51.5	5.30	5.04 ~ 5.57
5300	48.9	46.5 ~ 51.3	5.42	5.15 ~ 5.69
5500	48.6	46.2 ~ 51.0	5.65	5.37 ~ 5.93
5600	48.5	46.1 ~ 50.9	5.77	5.48 ~ 6.06
5800	48.2	45.8 ~ 50.6	6.00	5.70 ~ 6.30

The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.5	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	31.0	-	0.2	-	-	68.8	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.

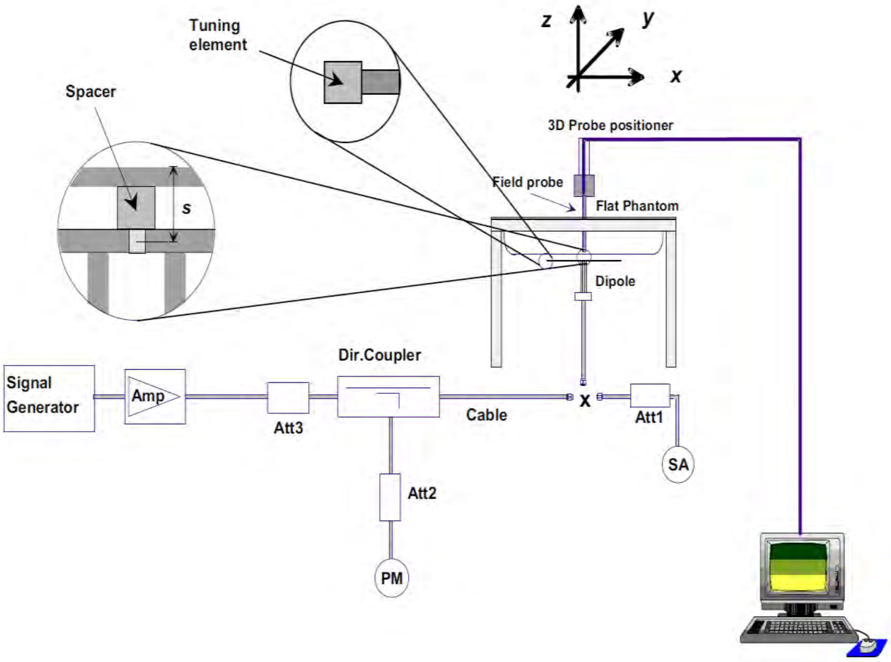


Fig-3.3 System Verification Setup

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

3.4 SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

3.4.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15 mm	<= 12 mm	<= 12 mm	<= 10 mm	<= 10 mm
Zoom Scan (Δx, Δy)	<= 8 mm	<= 5 mm	<= 5 mm	<= 4 mm	<= 4 mm
Zoom Scan (Δz)	<= 5 mm	<= 5 mm	<= 4 mm	<= 3 mm	<= 2 mm
Zoom Scan Volume	>= 30 mm	>= 30 mm	>= 28 mm	>= 25 mm	>= 22 mm

Note:

When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

3.4.2 Volume Scan Procedure

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

3.4.3 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

3.4.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

3.4.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

<Connections between EUT and System Simulator>

For WWAN SAR testing, the EUT was linked and controlled by base station emulator. Communication between the EUT and the emulator was established by air link. The distance between the EUT and the communicating antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during SAR testing.

<Considerations Related to LTE for Setup and Testing>

This device contains LTE transmitter which follows 3GPP standards, is category 3, supports both QPSK and QAM modulations, and supported LTE band and channel bandwidth is listed in below. The output power was tested per 3GPP TS 36.521-1 maximum transmit procedures for both QPSK and QAM modulation. The results please refer to section 4.6 of this report.

EUT Supported LTE Band and Channel Bandwidth						
LTE Band	BW 1.4 MHz	BW 3 MHz	BW 5 MHz	BW 10 MHz	BW 15 MHz	BW 20 MHz
2	V	V	V	V	V	V
4	V	V	V	V	V	V
5	V	V	V	V		
12	V	V	V	V		
14			V	V		
30			V	V		
66	V	V	V	V	V	V

The LTE maximum power reduction (MPR) in accordance with 3GPP TS 36.101 is active all times during LTE operation. The allowed MPR for the maximum output power is specified in below.

Modulation	Channel Bandwidth / RB Configurations						LTE MPR Setting (dB)
	BW 1.4 MHz	BW 3 MHz	BW 5 MHz	BW 10 MHz	BW 15 MHz	BW 20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16QAM	<= 5	<= 4	<= 8	<= 12	<= 16	<= 18	1
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	2
64QAM	<= 5	<= 4	<= 8	<= 12	<= 16	<= 18	2
64QAM	> 5	> 4	> 8	> 12	> 16	> 18	3

Note: MPR is according to the standard and implemented in the circuit (mandatory).

In addition, the device is compliant with additional maximum power reduction (A-MPR) requirements defined in 3GPP TS 36.101 section 6.2.4 that was disabled for all FCC compliance testing.

During LTE SAR testing, the related parameters of operating band, channel bandwidth, uplink channel number, modulation type, and RB was set in base station simulator. When the EUT has registered and communicated to base station simulator, the simulator set to make EUT transmitting the maximum radiated power.

LTE Downlink Carrier Aggregation (CA) Setup Configurations

LTE Carrier Aggregation (CA) was defined in 3GPP release 10 and higher. The LTE device in CA mode has one Primary Component Carrier (PCC) and one or more Secondary Component Carriers (SCC). PCC acts as the anchor carrier and can optionally cross-schedule data transmission on SCC. The RRC connection is only handled by one cell, the PCC for downlink and uplink communications. After making a data connection to the PCC, the LTE device adds the SCC on the downlink only. All uplink communications and acknowledgements remain identical to release 8 specifications on the PCC. The combinations of downlink carrier aggregation supported by this device are listed in below.

LTE CA Configurations and Bandwidth Combination Sets defined for Intra-Band Non-Contiguous CA

Downlink CA Configuration	Component Carriers in order of Increasing Carrier Frequency		Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
	Channel Bandwidths for Carrier-1 (MHz)	Channel Bandwidths for Carrier-2 (MHz)		
CA_2A-2A	5, 10, 15, 20	5, 10, 15, 20	40	0
CA_66A-66A	5, 10, 15, 20	5, 10, 15, 20	40	0

LTE CA Configurations and Bandwidth Combination Sets defined for Inter-Band CA (Two Bands)

Downlink CA Configuration	LTE Bands	Channel Bandwidths for Carrier (MHz)	Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
CA_2A-5A	2	5, 10, 15, 20	30	0
	5	5, 10		
	2	5, 10	20	1
	5	5, 10		
CA_2A-2A-5A	2	Refer to CA_2A-2A (BCS0)	50	0
	5	5, 10		
CA_2A-5B	2	5, 10, 15, 20	40	0
	5	Refer to CA_5B (BCS0)		
CA_2A-12A	2	5, 10, 15, 20	30	0
	12	5, 10		
	2	5, 10, 15, 20	30	1
	12	3, 5, 10		
	2	5, 10	20	2
	12	5, 10		
CA_2A-2A-12A	2	Refer to CA_2A-2A (BCS0)	50	0
	12	5, 10		
CA_2A-29A	2	5, 10	20	0
	29	3, 5, 10		
	2	5, 10	20	1
	29	5, 10		
	2	5, 10, 15, 20	30	2
	29	5, 10		
CA_2A-30A	2	5, 10, 15, 20	30	0
	30	5, 10		
CA_2A-2A-30A	2	Refer to CA_2A-2A (BCS0)	50	0
	30	5, 10		
CA_2A-46A	2	5, 10, 15, 20	40	0
	46	20		
CA_2A-46C	2	5, 10, 15, 20	60	0
	46	Refer to CA_46D (BCS0)		
CA_2A-46D	2	5, 10, 15, 20	80	0
	46	Refer to CA_46C (BCS0)		
CA_2A-66A	2	1.4, 3, 5, 10, 15, 20	40	0
	66	5, 10, 15, 20		
	2	5, 10	20	1
	66	5, 10		
	2	5, 10, 15, 20	40	2
	66	5, 10, 15, 20		
CA_2A-2A-66A	2	Refer to CA_2A-2A (BCS0)	60	0
	66	5, 10, 15, 20		
CA_2A-66A-66A	2	5, 10, 15, 20	60	0
	66	Refer to CA_66A-66A (BCS0)		
CA_5A-30A	5	5, 10	20	0
	30	5, 10		
CA_5B-30A	5	5, 10	20	0
	30	5, 10		
CA_5A-66A	5	5, 10	30	0
	66	5, 10, 15, 20		

Downlink CA Configuration	LTE Bands	Channel Bandwidths for Carrier (MHz)	Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
CA_5A-66A-66A	5	5, 10	50	0
	66	Refer to CA_66A-66A (BCS0)		
CA_5B-66A	5	Refer to CA_5B (BCS0)	40	0
	66	5, 10, 15, 20		
CA_12A-30A	12	5, 10	20	0
	30	5, 10		
CA_12A-66A	12	5, 10	20	0
	66	1.4, 3, 5,10		
	12	5, 10	30	1
	66	1.4, 3, 5, 10, 15, 20		
	12	3, 5, 10	30	2
	66	5, 10, 15, 20		
	12	5, 10	20	3
	66	5, 10		
	12	5, 10	30	4
	66	5, 10, 15, 20		
	12	5	20	5
	66	5, 10, 15		
CA_12A-66A-66A	12	5, 10	50	0
	66	Refer to CA_66A-66A (BCS0)		
CA_29A-30A	29	5, 10	20	0
	30	5, 10		
CA_30A-66A	30	5, 10	30	0
	66	5, 10, 15, 20		
CA_30A-66A-66A	30	5, 10	50	0
	66	Refer to CA_66A-66A (BCS0)		
CA_46C-66A	46	Refer to CA_46C (BCS0)	60	0
	66	5, 10, 15, 20		
CA_46A-66A	46	20	40	0
	66	5, 10, 15, 20		
CA_46D-66A	46	Refer to CA_46D (BCS0)	80	0
	66	5, 10, 15, 20		

LTE CA Configurations and Bandwidth Combination Sets defined for Inter-Band CA (Three Bands)

Downlink CA Configuration	LTE Bands	Channel Bandwidths for Carrier (MHz)	Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
CA_2A-2A-5A-66A	2	Refer to CA_2A-2A (BCS0)	70	0
	5	5, 10		
	66	5, 10, 15, 20		
CA_2A-2A-5A-66A-66A	2	Refer to CA_2A-2A (BCS0)	90	0
	5	5, 10		
	66	Refer to CA_66A-66A (BCS0)		
CA_2A-5A-30A	2	5, 10, 15, 20	40	0
	5	5, 10		
	30	5, 10		
CA_2A-2A-5A-30A	2	Refer to CA_2A-2A (BCS0)	60	0
	5	5, 10		
	30	5, 10		
CA_2A-5B-30A	2	5, 10, 15, 20	50	0
	5	Refer to CA_5B (BCS0)		
	30	5, 10		
CA_2A-5A-66A	2	5, 10, 15, 20	50	0
	5	5, 10		
	66	5, 10, 15, 20		
CA_2A-5A-66A-66A	2	5, 10, 15, 20	70	0
	5	5, 10		
	66	Refer to CA_66A-66A (BCS0)		
CA_2A-5B-66A	2	5, 10, 15, 20	60	0
	5	Refer to CA_5B (BCS0)		
	66	5, 10, 15, 20		
CA_2A-12A-30A	2	5, 10, 15, 20	40	0
	12	5, 10		
	30	5, 10		
CA_2A-2A-12A-30A	2	Refer to CA_2A-2A (BCS0)	60	0
	12	5, 10		
	30	5, 10		
CA_2A-12A-66A	2	5, 10, 15, 20	50	0
	12	5, 10		
	66	5, 10, 15, 20		
	2	5, 10	40	1
	12	5, 10		
	66	5, 10, 15, 20		
CA_2A-2A-12A-66A	2	Refer to CA_2A-2A (BCS0)	70	0
	12	5, 10		
	66	5, 10, 15, 20		
CA_2A-12A-66A-66A	2	5, 10,15, 20	70	0
	12	5, 10		
	66	Refer to 66A-66A (BCS0)		
CA_2A-29A-30A	2	5, 10, 15, 20	40	0
	29	5, 10		
	30	5, 10		
CA_2A-2A-30A-66A	2	Refer to CA_2A-2A (BCS0)	70	0
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-30A-66A-66A	2	5, 10, 15, 20	70	0
	30	5, 10		
	66	Refer to CA_66A-6A (BCS0)		
CA_2A-30A-66A	2	5, 10, 15, 20	50	0
	30	5, 10		
	66	5, 10, 15, 20		

Downlink CA Configuration	LTE Bands	Channel Bandwidths for Carrier (MHz)	Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
CA_2A-46A-66A	2	5, 10, 15, 20	60	0
	46	20		
	66	5, 10, 15, 20		
CA_2A-46C-66A	2	5, 10, 15, 20	80	0
	46	Refer to CA_46C (BCS0)		
	66	5, 10, 15, 20		
CA_2A-46D-66A	2	5, 10, 15, 20	100	0
	46	Refer to CA_46D (BCS0)		
	66	5, 10, 15, 20		
CA_5A-30A-66A	5	5, 10	40	0
	30	5, 10		
	66	5, 10, 15, 20		
CA_5A-30A-66A-66A	5	5, 10	60	0
	30	5, 10		
	66	Refer to CA_66A-66A (BCS0)		
CA_5B-30A-66A	5	Refer to CA_5B (BCS0)	50	0
	30	5, 10		
	66	5, 10, 15, 20		
CA_12A-30A-66A	12	5, 10	40	0
	30	5, 10		
	66	5, 10, 15, 20		
CA_12A-30A-66A-66A	12	5, 10	60	0
	30	5, 10		
	66	Refer to CA_66A-66A (BCS0)		

LTE CA Configurations and Bandwidth Combination Sets defined for Inter-Band CA (Four Bands)

Downlink CA Configuration	LTE Bands	Channel Bandwidths for Carrier (MHz)	Maximum Aggregated Bandwidth (MHz)	Bandwidth Combination Set
CA_2A-2A-5A-30A-66A	2	Refer to CA_2A-2A (BCS0)	80	0
	5	5, 10		
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-2A-12A-30A-66A	2	Refer to CA_2A-2A (BCS0)	80	0
	12	5, 10		
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-5A-30A-66A	2	5, 10, 15, 20	60	0
	5	5, 10		
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-5A-30A-66A-66A	2	5, 10, 15, 20	80	0
	5	5, 10		
	30	5, 10		
	66	Refer to CA_66A-66A (BCS3)		
CA_2A-5B-30A-66A	2	5, 10, 15, 20	70	0
	5	Refer to CA_5B (BCS0)		
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-12A-30A-66A	2	5, 10, 15, 20	60	0
	12	5, 10		
	30	5, 10		
	66	5, 10, 15, 20		
CA_2A-12A-30A-66A-66A	2	5, 10, 15, 20	80	0
	12	5, 10		
	30	5, 10		
	66	Refer to CA_66A-66A (BCS0)		

<SAR Test Exclusion Evaluations for LTE Downlink CA>

According to Nov 2017 TCB Workshop, SAR test exclusion for LTE downlink Carrier Aggregation is determined by power measurements according to the number of component carriers (CCs) supported by the product implementation. The downlink Carrier Aggregation configurations are tabulated in separate columns. DL CA would be listed in the columns corresponding to Intra Band contiguous, Intra Band Non-contiguous, 2bands/2CCs, 2bands/3CCs, 2bands/4CCs, 3bands/3CCs, 3bands/4CCs, 3bands/5CC, 4bands/4CCs and 4bands/5CC. The CA/CC combinations in each columns are sorted so that frequency bands listed in subsequent columns on each row are ascending subsets, as following LTE Downlink CA table and LTE Downlink CA (4*4 MIMO) table ; i.e., columns to the right correspond to increasing number of frequency bands and CCs.

	Intra Band	Inter Band							
	Non-Contiguous	2 Bands / 2CC	2 Bands / 3CC	2 Bands / 4CC	3 Bands / 3CC	3 Bands / 4CC	3 Bands / 5CC	4 Bands / 4CC	4 Bands / 5CC
LTE Downlink CA-Configure	CA_2A-2A	CA_2A-30A	CA_2A-2A-30A		CA_2A-12A-30A	CA_2A-2A-12A-30A		CA_2A-12A-30A-66A	CA_2A-2A-12A-30A-66A
		CA_2A-12A	CA_2A-2A-12A						
		CA_12A-30A							
	CA_66A-66A	CA_2A-66A	CA_2A-66A-66A		CA_12A-30A-66A				
			CA_2A-2A-66A		CA_2A-12A-66A	CA_2A-12A-66A-66A			
		CA_2A-5A	CA_2A-5B		CA_2A-5A-30A	CA_2A-2A-5A-30A			CA_2A-2A-5A-30A-66A
		CA_5A-30A	CA_5B-30A			CA_2A-5B-30A			
						CA_2A-2A-12A-66A			
		CA_5A-66A	CA_5A-66A-66A		CA_2A-5A-66A	CA_2A-2A-5A-66A			
			CA_2A-2A-5A			CA_2A-5B-66A			
			CA_5B-66A		CA_5A-30A-66A	CA_5B-30A-66A		CA_2A-5A-30A-66A	CA_2A-5A-30A-66A-66A
						CA_5A-30A-66A-66A			
		CA_30A-66A	CA_30A-66A-66A		CA_2A-30A-66A	CA_2A-30A-66A-66A			CA_2A-5B-30A-66A
						CA_2A-2A-30A-66A			
						CA_12A-30A-66A-66A			CA_2A-12A-30A-66A-66A
		CA_12A-66A	CA_12A-66A-66A			CA_2A-5A-66A-66A			
		CA_2A-46A	CA_2A-46C	CA_2A-46D	CA_2A-46A-66A	CA_2A-46C-66A	CA_2A-46D-66A		
		CA_2A-29A			CA_2A-29A-30A				
		CA_29A-30A							
		CA_46A-66A	CA_46C-66A	CA_46D-66A					

• Only yellow highlighted cells need power measurement.

<table>
<tr><th rowspan="2"></th><th colspan="5">Inter Band(4*4 MIMO)</th></tr>
<tr><th>2 Bands / 2CC</th><th>2 Bands / 3CC</th><th>2 Bands / 4CC</th><th>3 Bands / 3CC</th><th>4 Bands / 4CC</th></tr>
<tr><td rowspan="9">LTE Downlink CA (4*4 MIMO) Configure</td><td>CA_2A(4*4)-12A</td><td></td><td></td><td>CA_2A(4*4)-12A-66A</td><td rowspan="4">CA_2A-12A-12A-66A(4*4)</td></tr>
<tr><td>CA_2A(4*4)-66A</td><td></td><td></td><td></td></tr>
<tr><td>CA_2A-66A(4*4)</td><td></td><td></td><td></td></tr>
<tr><td>CA_2A(4*4)-66A(4*4)</td><td></td><td></td><td></td></tr>
<tr><td>CA_46A-66A(4*4)</td><td>CA_46C-66A(4*4)</td><td>CA_46D-66A(4*4)</td><td>CA_2A(4*4)-12A-30A</td><td></td></tr>
<tr><td>CA_2A(4*4)-46A</td><td>CA_2A(4*4)-46C</td><td>CA_2A(4*4)-46D</td><td>CA_2A-12A-66A(4*4)</td><td></td></tr>
<tr><td>CA_2A(4*4)-30A</td><td></td><td></td><td rowspan="3">CA_12A_30A_66A(4*4)</td><td></td></tr>
<tr><td>CA_12A-66A(4*4)</td><td></td><td></td><td></td></tr>
<tr><td>CA_30A-66A(4*4)</td><td></td><td></td><td></td></tr>
</table>

• Only yellow highlighted cells need power measurement.

<Considerations Related to WLAN for Setup and Testing>

In general, various vendor specific external test software and chipset based internal test modes are typically used for SAR measurement. These chipset based test mode utilities are generally hardware and manufacturer dependent, and often include substantial flexibility to reconfigure or reprogram a device. A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current generation SAR systems to measure SAR correctly. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

According to KDB 248227 D01, this device has installed WLAN engineering testing software which can provide continuous transmitting RF signal. During WLAN SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

Initial Test Configuration

An initial test configuration is determined for OFDM transmission modes in 2.4 GHz and 5 GHz bands according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.

Subsequent Test Configuration

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. When the highest reported SAR for the initial test configuration according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

SAR Test Configuration and Channel Selection

When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is using largest channel bandwidth, lowest order modulation, lowest data rate, and lowest order 802.11 mode (i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n). After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following.

1) The channel closest to mid-band frequency is selected for SAR measurement.

2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

Test Reduction for U-NII-1 (5.2 GHz) and U-NII-2A (5.3 GHz) Bands

For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following.

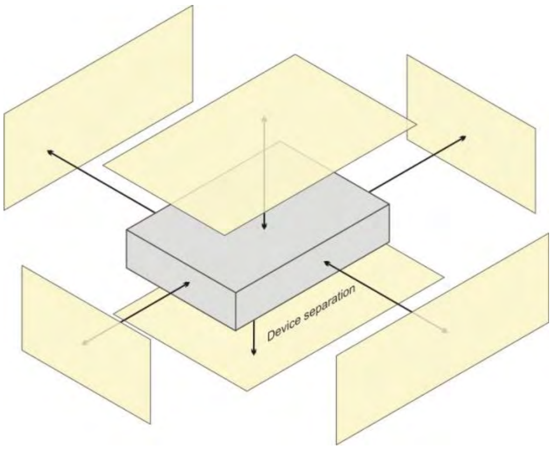
1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition).

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

4.2 EUT Testing Position

4.2.1 Hotspot Mode Exposure Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225 D06. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).



Based on the antenna location shown on appendix D of this report, the SAR testing required for hotspot mode is listed as below.

Antenna	Front Face	Rear Face	Left Side	Right Side	Top Side	Bottom Side
WWAN Ant (For LTE B2/4/5/12/14/29/66)	V	V	V		V	V
WWAN Ant (For LTE B30)	V	V	V			
WLAN Ant 0	V	V			V	
WLAN Ant 1	V	V		V	V	

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Nov. 05, 2018	Body	750	23.4	0.975	55.11	0.96	55.5	1.56	-0.70
Nov. 05, 2018	Body	750	23.4	0.938	57.378	0.96	55.5	-2.29	3.38
Nov. 06, 2018	Body	750	23.4	0.918	55.862	0.96	55.5	-4.37	0.65
Nov. 05, 2018	Body	835	23.4	1.012	56.703	0.97	55.2	4.12	2.72
Nov. 02, 2018	Body	1750	23.3	1.443	51.612	1.49	53.4	-3.15	-3.35
Nov. 02, 2018	Body	1900	23.3	1.586	51.293	1.52	53.3	4.34	-3.77
Nov. 05, 2018	Body	1900	23.5	1.574	52.296	1.52	53.3	3.55	-1.88
Nov. 06, 2018	Body	1900	23.4	1.581	51.599	1.52	53.3	4.01	-3.19
Nov. 02, 2018	Body	2300	23.3	1.849	51.991	1.81	52.9	2.15	-1.72
Nov. 15, 2018	Body	2450	23.3	2.017	51.297	1.95	52.7	3.44	-2.66
Nov. 15, 2018	Body	5250	23.3	5.262	49.557	5.36	48.9	-1.83	1.34
Nov. 15, 2018	Body	5750	23.3	5.918	48.809	5.94	48.3	-0.37	1.05

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2 ℃.

4.4 System Validation

The SAR measurement system was validated according to procedures in KDB 865664 D01. The validation status in tabulated summary is as below.

Test Date	Probe S/N	Calibration Point		Measured Conductivity (σ)	Measured Permittivity (ε_r)	Validation for CW			Validation for Modulation		
						Sensitivity Range	Probe Linearity	Probe Isotropy	Modulation Type	Duty Factor	PAR
Nov. 05, 2018	3898	Body	750	0.975	55.11	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 05, 2018	3898	Body	750	0.938	57.378	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 06, 2018	3650	Body	750	0.918	55.862	Pass	Pass	Pass	GMSK	Pass	N/A
Nov. 05, 2018	3898	Body	835	1.01	56.703	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 02, 2018	3650	Body	1750	1.443	51.612	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 02, 2018	3650	Body	1900	1.586	51.293	Pass	Pass	Pass	GMSK	Pass	N/A
Nov. 05, 2018	3898	Body	1900	1.574	52.296	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 06, 2018	3650	Body	1900	1.581	51.599	Pass	Pass	Pass	N/A	N/A	N/A
Nov. 02, 2018	3650	Body	2300	1.849	51.991	Pass	Pass	Pass	GMSK	Pass	N/A
Nov. 15, 2018	7472	Body	2450	2.017	51.297	Pass	Pass	Pass	OFDM	N/A	Pass
Nov. 15, 2018	7472	Body	5250	5.262	49.557	Pass	Pass	Pass	OFDM	N/A	Pass
Nov. 15, 2018	7472	Body	5750	5.918	48.809	Pass	Pass	Pass	OFDM	N/A	Pass

4.5 System Verification

The measuring result for system verification is tabulated as below.

Test Date	Mode	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Nov. 05, 2018	Body	750	8.62	2.2	8.80	2.09	1013	3898	1277
Nov. 05, 2018	Body	750	8.62	2.12	8.48	-1.62	1013	3898	1277
Nov. 06, 2018	Body	750	8.62	2.04	8.16	-5.34	1013	3650	579
Nov. 05, 2018	Body	835	9.64	2.51	10.04	4.15	4d121	3898	1277
Nov. 02, 2018	Body	1750	36.90	8.87	35.48	-3.85	1055	3650	579
Nov. 02, 2018	Body	1900	40.20	10.1	40.40	0.50	5d036	3650	579
Nov. 05, 2018	Body	1900	40.20	10.3	41.20	2.49	5d036	3898	1277
Nov. 06, 2018	Body	1900	40.20	9.84	39.36	-2.09	5d036	3650	579
Nov. 02, 2018	Body	2300	47.30	11.80	47.20	-0.21	1004	3650	579
Nov. 15, 2018	Body	2450	50.50	12.8	51.20	1.39	737	7472	861
Nov. 15, 2018	Body	5250	74.90	7.68	76.80	2.54	1019	7472	861
Nov. 15, 2018	Body	5750	74.50	6.99	69.90	-6.17	1019	7472	861

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.6 Maximum Output Power

4.6.1 Maximum Target Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Mode	LTE 2	LTE 4	LTE 5	LTE 12
Maximum Target Power	**24.0**	**24.0**	**24.0**	**24.0**

Mode	LTE 14	LTE 30	LTE 66
Maximum Target Power	**24.0**	**23.5**	**24.0**

Mode	2.4G WLAN	5.2G WLAN	5.8G WLAN
802.11b	**Ant 0: 10.0** **Ant 1: 10.0** **Ant 0+1: 13.0**	N/A	N/A
802.11g	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	N/A	N/A
802.11a	N/A	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0
802.11n HT20	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	N/A	N/A
802.11n HT40	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	N/A	N/A
802.11ac VHT20	N/A	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0
802.11ac VHT40	N/A	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0	Ant 0: 10.0 Ant 1: 10.0 Ant 0+1: 13.0
802.11ac VHT80	N/A	**Ant 0: 10.0** **Ant 1: 10.0** **Ant 0+1: 13.0**	**Ant 0: 10.0** **Ant 1: 10.0** **Ant 0+1: 13.0**

4.6.2 Measured Conducted Power Result

The measuring conducted average power (Unit: dBm) is shown as below.

LTE Band 2

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18700	18900	19100	
		Frequency (MHz)		1860.0	1880.0	1900.0	
20M	QPSK	1	0	23.74	**23.88**	23.68	0
		1	50	23.38	23.47	23.31	0
		1	99	23.62	23.71	23.57	0
		50	0	22.93	**22.99**	22.85	1
		50	25	22.92	22.96	22.82	1
		50	50	22.86	22.97	22.80	1
		100	0	22.91	**22.98**	22.81	1
	16QAM	1	0	22.64	22.83	22.58	1
		1	50	22.34	22.37	22.24	1
		1	99	22.57	22.68	22.51	1
		50	0	21.89	21.95	21.80	2
		50	25	21.82	21.93	21.76	2
		50	50	21.84	21.89	21.71	2
		100	0	21.87	21.96	21.74	2
	64QAM	1	0	21.64	21.83	21.60	2
		1	50	21.35	21.47	21.24	2
		1	99	21.58	21.65	21.53	2
		50	0	20.84	20.97	20.79	3
		50	25	20.87	20.97	20.74	3
		50	50	20.80	20.89	20.73	3
		100	0	20.91	20.91	20.71	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18675	18900	19125	
		Frequency (MHz)		1857.5	1880.0	1902.5	
15M	QPSK	1	0	23.65	23.82	23.64	0
		1	37	23.38	23.41	23.21	0
		1	74	23.61	23.69	23.56	0
		36	0	22.87	22.99	22.84	1
		36	19	22.84	22.93	22.79	1
		36	39	22.83	22.90	22.79	1
		75	0	22.87	22.90	22.72	1
	16QAM	1	0	22.59	22.74	22.60	1
		1	37	22.37	22.37	22.24	1
		1	74	22.62	22.60	22.44	1
		36	0	21.76	21.97	21.72	2
		36	19	21.82	21.94	21.70	2
		36	39	21.78	21.92	21.69	2
		75	0	21.89	21.86	21.71	2
	64QAM	1	0	21.63	21.74	21.53	2
		1	37	21.36	21.42	21.18	2
		1	74	21.49	21.66	21.47	2
		36	0	20.83	20.99	20.74	3
		36	19	20.80	20.92	20.65	3
		36	39	20.77	20.94	20.73	3
		75	0	20.77	20.91	20.71	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18650	18900	19150	
		Frequency (MHz)		1855.0	1880.0	1905.0	
10M	QPSK	1	0	23.64	23.70	23.60	0
		1	24	23.33	23.38	23.23	0
		1	49	23.52	23.68	23.48	0
		25	0	22.82	22.85	22.63	1
		25	12	22.75	22.90	22.71	1
		25	25	22.75	22.82	22.58	1
		50	0	22.79	22.84	22.64	1
	16QAM	1	0	22.59	22.73	22.57	1
		1	24	22.12	22.35	22.09	1
		1	49	22.42	22.58	22.43	1
		25	0	21.82	21.89	21.73	2
		25	12	21.71	21.90	21.58	2
		25	25	21.64	21.76	21.56	2
		50	0	21.71	21.67	21.58	2
	64QAM	1	0	21.59	21.84	21.48	2
		1	24	21.18	21.18	21.11	2
		1	49	21.42	21.60	21.37	2
		25	0	20.74	20.88	20.54	3
		25	12	20.73	20.97	20.53	3
		25	25	20.67	20.85	20.58	3
		50	0	20.67	20.86	20.59	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18625	18900	19175	
		Frequency (MHz)		1852.5	1880.0	1907.5	
5M	QPSK	1	0	23.68	23.71	23.58	0
		1	12	23.24	23.40	23.14	0
		1	24	23.50	23.68	23.25	0
		12	0	22.79	22.90	22.55	1
		12	6	22.76	22.98	22.57	1
		12	13	22.79	22.75	22.56	1
		25	0	22.81	22.81	22.56	1
	16QAM	1	0	22.54	22.64	22.42	1
		1	12	22.33	22.30	22.15	1
		1	24	22.43	22.53	22.54	1
		12	0	21.70	21.93	21.71	2
		12	6	21.66	21.77	21.59	2
		12	13	21.57	21.89	21.59	2
		25	0	21.68	21.91	21.66	2
	64QAM	1	0	21.53	21.64	21.48	2
		1	12	21.25	21.36	21.22	2
		1	24	21.41	21.59	21.46	2
		12	0	20.67	20.85	20.66	3
		12	6	20.68	20.85	20.72	3
		12	13	20.64	20.78	20.69	3
		25	0	20.81	20.82	20.71	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18615	18900	19185	
		Frequency (MHz)		1851.5	1880.0	1908.5	
3M	QPSK	1	0	23.59	23.83	23.60	0
		1	7	23.31	23.33	23.19	0
		1	14	23.48	23.61	23.54	0
		8	0	22.80	22.93	22.80	1
		8	3	22.78	23.00	22.74	1
		8	7	22.76	22.80	22.69	1
		15	0	22.72	22.87	22.61	1
	16QAM	1	0	22.61	22.68	22.43	1
		1	7	22.21	22.19	22.16	1
		1	14	22.52	22.51	22.48	1
		8	0	21.74	21.85	21.75	2
		8	3	21.75	21.85	21.60	2
		8	7	21.71	21.89	21.74	2
		15	0	21.76	21.86	21.67	2
	64QAM	1	0	21.63	21.65	21.51	2
		1	7	21.12	21.35	21.13	2
		1	14	21.37	21.59	21.41	2
		8	0	20.77	20.82	20.67	3
		8	3	20.75	20.97	20.63	3
		8	7	20.69	20.91	20.57	3
		15	0	20.75	20.79	20.63	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		18607	18900	19193	
		Frequency (MHz)		1850.7	1880.0	1909.3	
1.4M	QPSK	1	0	23.56	23.86	23.45	0
		1	2	23.26	23.38	23.14	0
		1	5	23.58	23.62	23.35	0
		3	0	23.80	23.87	23.74	0
		3	1	23.71	23.85	23.62	0
		3	3	23.73	23.81	23.66	0
		6	0	22.89	22.98	22.78	1
	16QAM	1	0	22.61	22.55	22.60	1
		1	2	22.10	22.20	22.13	1
		1	5	22.41	22.54	22.42	1
		3	0	22.75	22.88	22.59	1
		3	1	22.81	22.80	22.71	1
		3	3	22.67	22.88	22.65	1
		6	0	21.75	21.82	21.48	2
	64QAM	1	0	21.47	21.69	21.60	2
		1	2	21.15	21.42	21.12	2
		1	5	21.37	21.61	21.34	2
		3	0	21.80	21.98	21.74	2
		3	1	21.70	21.81	21.62	2
		3	3	21.54	21.89	21.64	2
		6	0	20.65	20.83	20.60	3

LTE Band 4															
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20050	20175	20300				Channel		20025	20175	20325	
		Frequency (MHz)		1720.0	1732.5	1745.0				Frequency (MHz)		1717.5	1732.5	1747.5	
20M	QPSK	1	0	23.60	23.83	23.96	0	15M	QPSK	1	0	23.55	23.74	23.89	0
		1	50	23.52	23.72	23.86	0			1	37	23.47	23.67	23.83	0
		1	99	23.56	23.76	23.89	0			1	74	23.53	23.72	23.79	0
		50	0	22.71	22.97	22.99	1			36	0	22.61	22.96	22.97	1
		50	25	22.69	22.95	22.97	1			36	19	22.61	22.91	23.00	1
		50	50	22.65	22.91	22.96	1			36	39	22.60	22.86	23.00	1
		100	0	22.67	22.95	22.98	1			75	0	22.62	22.94	22.98	1
	16QAM	1	0	22.55	22.82	22.88	1		16QAM	1	0	22.50	22.74	22.84	1
		1	50	22.42	22.64	22.82	1			1	37	22.42	22.61	22.84	1
		1	99	22.53	22.71	22.81	1			1	74	22.37	22.67	22.82	1
		50	0	21.67	21.92	21.95	2			36	0	21.58	21.82	21.94	2
		50	25	21.62	21.91	21.94	2			36	19	21.52	21.79	21.96	2
		50	50	21.63	21.91	21.95	2			36	39	21.47	21.80	21.89	2
		100	0	21.66	21.95	21.96	2			75	0	21.52	21.87	21.90	2
	64QAM	1	0	21.57	21.77	21.96	2		64QAM	1	0	21.54	21.64	21.89	2
		1	50	21.50	21.62	21.80	2			1	37	21.39	21.60	21.68	2
		1	99	21.48	21.67	21.85	2			1	74	21.49	21.72	21.77	2
		50	0	20.63	20.91	20.97	3			36	0	20.62	20.84	20.95	3
		50	25	20.66	20.85	20.92	3			36	19	20.54	20.86	20.98	3
		50	50	20.59	20.89	20.95	3			36	39	20.64	20.86	20.90	3
		100	0	20.62	20.86	20.99	3			75	0	20.52	20.86	20.94	3
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20000	20175	20350				Channel		19975	20175	20375	
		Frequency (MHz)		1715.0	1732.5	1750.0				Frequency (MHz)		1712.5	1732.5	1752.5	
10M	QPSK	1	0	23.53	23.67	23.75	0	5M	QPSK	1	0	23.45	23.78	23.78	0
		1	24	23.34	23.66	23.63	0			1	12	23.39	23.62	23.71	0
		1	49	23.46	23.66	23.67	0			1	24	23.52	23.58	23.85	0
		25	0	22.61	22.74	22.90	1			12	0	22.62	22.86	22.76	1
		25	12	22.44	22.78	22.90	1			12	6	22.69	22.76	22.82	1
		25	25	22.48	22.80	22.87	1			12	13	22.62	22.68	22.87	1
		50	0	22.51	22.81	22.93	1			25	0	22.57	22.70	22.88	1
	16QAM	1	0	22.47	22.66	22.75	1		16QAM	1	0	22.50	22.64	22.79	1
		1	24	22.47	22.46	22.66	1			1	12	22.40	22.46	22.61	1
		1	49	22.33	22.57	22.71	1			1	24	22.42	22.58	22.71	1
		25	0	21.51	21.76	21.97	2			12	0	21.61	21.87	21.84	2
		25	12	21.50	21.83	21.90	2			12	6	21.46	21.77	21.88	2
		25	25	21.54	21.75	21.84	2			12	13	21.50	21.72	21.79	2
		50	0	21.43	21.77	21.79	2			25	0	21.44	21.65	21.99	2
	64QAM	1	0	21.46	21.73	21.69	2		64QAM	1	0	21.48	21.60	21.81	2
		1	24	21.41	21.44	21.74	2			1	12	21.28	21.54	21.68	2
		1	49	21.35	21.50	21.69	2			1	24	21.41	21.60	21.85	2
		25	0	20.61	20.88	20.97	3			12	0	20.68	20.76	20.91	3
		25	12	20.53	20.78	20.82	3			12	6	20.54	20.73	20.87	3
		25	25	20.54	20.83	20.92	3			12	13	20.45	20.75	20.94	3
		50	0	20.46	20.73	20.86	3			25	0	20.56	20.82	20.83	3
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		19965	20175	20385				Channel		19957	20175	20393	
		Frequency (MHz)		1711.5	1732.5	1753.5				Frequency (MHz)		1710.7	1732.5	1754.3	
3M	QPSK	1	0	23.57	23.72	23.83	0	1.4M	QPSK	1	0	23.42	23.77	23.89	0
		1	7	23.42	23.64	23.74	0			1	2	23.38	23.53	23.81	0
		1	14	23.52	23.65	23.71	0			1	5	23.41	23.73	23.77	0
		8	0	22.57	22.89	22.96	1			3	0	23.56	23.81	23.95	0
		8	3	22.62	22.87	22.92	1			3	1	23.61	23.84	23.94	0
		8	7	22.53	22.68	22.94	1			3	3	23.59	23.81	23.87	0
		15	0	22.49	22.84	22.97	1			6	0	22.57	22.73	22.98	1
	16QAM	1	0	22.50	22.59	22.80	1		16QAM	1	0	22.44	22.60	22.70	1
		1	7	22.31	22.52	22.57	1			1	2	22.36	22.52	22.76	1
		1	14	22.37	22.58	22.62	1			1	5	22.36	22.67	22.84	1
		8	0	21.48	21.76	21.91	2			3	0	22.54	22.81	22.96	1
		8	3	21.66	21.88	21.83	2			3	1	22.43	22.76	22.99	1
		8	7	21.35	21.66	21.97	2			3	3	22.44	22.64	22.82	1
		15	0	21.55	21.85	21.84	2			6	0	21.49	21.77	21.95	2
	64QAM	1	0	21.43	21.69	21.76	2		64QAM	1	0	21.41	21.65	21.75	2
		1	7	21.38	21.53	21.67	2			1	2	21.39	21.41	21.58	2
		1	14	21.40	21.51	21.64	2			1	5	21.47	21.61	21.75	2
		8	0	20.42	20.69	20.92	3			3	0	21.60	21.89	21.97	2
		8	3	20.48	20.88	20.84	3			3	1	21.56	21.83	21.86	2
		8	7	20.47	20.75	20.89	3			3	3	21.47	21.68	21.95	2
		15	0	20.63	20.78	20.80	3			6	0	20.34	20.76	20.97	3

LTE Band 5

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20450	20525	20600				Channel		20425	20525	20625	
		Frequency (MHz)		829.0	836.5	844.0				Frequency (MHz)		826.5	836.5	846.5	
10M	QPSK	1	0	23.32	**23.43**	23.35	0	5M	QPSK	1	0	23.14	23.23	23.03	0
		1	24	22.95	23.05	23.00	0			1	12	22.81	22.97	22.77	0
		1	49	23.23	23.24	23.17	0			1	24	22.98	23.02	22.91	0
		25	0	22.40	**22.48**	22.43	1			12	0	22.28	22.35	22.21	1
		25	12	22.37	22.46	22.40	1			12	6	22.27	22.46	22.22	1
		25	25	22.33	22.41	22.36	1			12	13	22.12	22.22	22.18	1
		50	0	22.35	**22.46**	22.39	1			25	0	22.21	22.25	22.16	1
	16QAM	1	0	22.26	22.41	22.25	1		16QAM	1	0	22.10	22.20	22.28	1
		1	24	21.90	22.00	21.91	1			1	12	21.81	21.76	21.89	1
		1	49	22.05	22.20	22.10	1			1	24	21.93	22.01	21.84	1
		25	0	21.38	21.38	21.38	2			12	0	21.25	21.28	21.11	2
		25	12	21.29	21.40	21.32	2			12	6	21.20	21.30	21.10	2
		25	25	21.20	21.37	21.32	2			12	13	21.08	21.23	21.11	2
		50	0	21.25	21.43	21.28	2			25	0	21.31	21.38	21.18	2
	64QAM	1	0	21.28	21.40	21.34	2		64QAM	1	0	21.13	21.31	21.08	2
		1	24	20.84	21.04	20.90	2			1	12	20.78	20.85	20.71	2
		1	49	21.05	21.22	21.13	2			1	24	20.83	21.10	20.94	2
		25	0	20.36	20.39	20.42	3			12	0	20.18	20.31	20.30	3
		25	12	20.30	20.46	20.39	3			12	6	20.12	20.36	20.11	3
		25	25	20.24	20.31	20.32	3			12	13	20.20	20.27	20.15	3
		50	0	20.28	20.37	20.34	3			25	0	20.14	20.27	20.09	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		20415	20525	20635				Channel		20407	20525	20643	
		Frequency (MHz)		825.5	836.5	847.5				Frequency (MHz)		824.7	836.5	848.3	
3M	QPSK	1	0	23.10	23.37	23.23	0	1.4M	QPSK	1	0	23.11	23.35	23.12	0
		1	7	22.75	22.92	22.93	0			1	2	22.72	22.92	22.81	0
		1	14	22.99	23.14	23.01	0			1	5	23.08	23.09	22.92	0
		8	0	22.19	22.30	22.22	1			3	0	23.36	23.26	23.25	0
		8	3	22.27	22.40	22.30	1			3	1	23.36	23.38	23.27	0
		8	7	22.18	22.35	22.21	1			3	3	23.29	23.29	23.17	0
		15	0	22.21	22.38	22.22	1			6	0	22.16	22.31	22.31	1
	16QAM	1	0	22.14	22.19	22.17	1		16QAM	1	0	22.17	22.24	22.33	1
		1	7	21.80	21.97	21.81	1			1	2	21.72	21.86	21.79	1
		1	14	21.85	21.98	21.89	1			1	5	21.86	21.97	22.05	1
		8	0	21.24	21.26	21.23	2			3	0	22.32	22.21	22.18	1
		8	3	21.33	21.34	21.18	2			3	1	22.30	22.26	22.24	1
		8	7	21.13	21.24	21.23	2			3	3	22.08	22.12	22.21	1
		15	0	21.10	21.16	21.17	2			6	0	21.22	21.35	21.15	2
	64QAM	1	0	21.11	21.29	21.32	2		64QAM	1	0	21.15	21.30	21.15	2
		1	7	20.75	20.82	20.81	2			1	2	20.76	20.79	20.66	2
		1	14	20.98	21.10	21.07	2			1	5	20.89	21.07	21.06	2
		8	0	20.33	20.33	20.35	3			3	0	21.26	21.32	21.24	2
		8	3	20.17	20.25	20.23	3			3	1	21.27	21.22	21.23	2
		8	7	20.15	20.27	20.23	3			3	3	21.23	21.13	21.13	2
		15	0	20.24	20.26	20.13	3			6	0	20.22	20.24	20.22	3

LTE Band 12

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		23060	23095	23130	
		Frequency (MHz)		704.0	707.5	711.0	
10M	QPSK	1	0	23.18	**23.25**	23.19	0
		1	24	22.95	22.97	22.91	0
		1	49	23.05	23.12	23.06	0
		25	0	22.29	**22.34**	22.31	1
		25	12	22.24	22.28	22.25	1
		25	25	22.14	22.21	22.17	1
		50	0	22.26	**22.32**	22.28	1
	16QAM	1	0	22.08	22.23	22.19	1
		1	24	21.94	21.96	21.86	1
		1	49	21.97	22.06	22.04	1
		25	0	21.23	21.34	21.25	2
		25	12	21.14	21.19	21.20	2
		25	25	21.04	21.14	21.12	2
		50	0	21.19	21.28	21.23	2
	64QAM	1	0	21.14	21.16	21.19	2
		1	24	20.86	20.92	20.91	2
		1	49	20.96	21.07	21.02	2
		25	0	20.26	20.28	20.27	3
		25	12	20.18	20.21	20.16	3
		25	25	20.04	20.20	20.09	3
		50	0	20.23	20.26	20.25	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		23035	23095	23155	
		Frequency (MHz)		701.5	707.5	713.5	
5M	QPSK	1	0	23.06	23.18	22.95	0
		1	12	22.76	22.84	22.82	0
		1	24	22.85	22.99	22.92	0
		12	0	22.11	22.28	22.02	1
		12	6	22.11	22.17	21.88	1
		12	13	21.98	22.01	21.93	1
		25	0	22.15	22.18	22.12	1
	16QAM	1	0	22.01	22.09	21.89	1
		1	12	21.81	21.76	21.77	1
		1	24	21.98	21.91	21.93	1
		12	0	21.18	21.15	21.11	2
		12	6	21.11	21.06	21.11	2
		12	13	20.92	20.97	20.93	2
		25	0	21.00	21.03	21.11	2
	64QAM	1	0	21.09	21.23	21.02	2
		1	12	20.67	20.86	20.68	2
		1	24	20.80	20.81	21.05	2
		12	0	20.14	20.19	20.03	3
		12	6	19.99	20.18	20.16	3
		12	13	19.90	19.97	20.12	3
		25	0	20.05	20.18	20.02	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		23025	23095	23165	
		Frequency (MHz)		700.5	707.5	714.5	
3M	QPSK	1	0	23.08	23.05	22.96	0
		1	7	22.89	22.88	22.78	0
		1	14	22.91	23.01	23.00	0
		8	0	22.07	22.29	22.15	1
		8	3	22.01	22.21	22.07	1
		8	7	22.01	22.10	21.97	1
		15	0	22.09	22.14	22.22	1
	16QAM	1	0	21.90	22.00	22.03	1
		1	7	21.75	21.78	21.82	1
		1	14	21.71	22.03	21.92	1
		8	0	21.15	21.24	21.23	2
		8	3	21.11	21.05	21.10	2
		8	7	20.91	21.10	20.94	2
		15	0	21.08	21.06	21.09	2
	64QAM	1	0	20.93	21.09	21.05	2
		1	7	20.80	20.84	20.86	2
		1	14	20.87	20.82	20.94	2
		8	0	20.11	20.24	20.17	3
		8	3	20.05	20.13	20.04	3
		8	7	19.95	19.94	19.92	3
		15	0	20.07	20.02	20.11	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		23017	23095	23173	
		Frequency (MHz)		699.7	707.5	715.3	
1.4M	QPSK	1	0	23.07	23.04	23.14	0
		1	2	22.85	22.79	22.76	0
		1	5	22.97	23.06	22.98	0
		3	0	23.22	23.11	23.19	0
		3	1	23.21	23.08	23.04	0
		3	3	23.11	23.15	23.15	0
		6	0	22.13	22.14	22.16	1
	16QAM	1	0	22.04	22.20	22.03	1
		1	2	21.81	21.77	21.70	1
		1	5	21.85	21.97	21.96	1
		3	0	22.05	22.09	22.16	1
		3	1	22.06	22.13	22.08	1
		3	3	21.90	22.08	22.13	1
		6	0	21.14	21.28	21.19	2
	64QAM	1	0	20.86	21.05	21.03	2
		1	2	20.67	20.91	20.65	2
		1	5	20.85	20.93	20.79	2
		3	0	21.18	21.23	21.15	2
		3	1	21.06	21.06	21.09	2
		3	3	20.91	21.00	20.93	2
		6	0	20.08	20.09	20.13	3

LTE Band 14															
BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel			23330					Channel			23330		
		Frequency (MHz)			793.0					Frequency (MHz)			793.0		
10M	QPSK	1	0		**23.31**		0	5M	QPSK	1	0	22.95	23.04	22.87	0
		1	24		22.76		0			1	12	22.74	22.83	22.66	0
		1	49		23.09		0			1	24	22.72	22.81	22.64	0
		25	0		**22.36**		1			12	0	22.19	22.28	22.11	1
		25	12		22.32		1			12	6	22.16	22.25	22.08	1
		25	25		22.23		1			12	13	22.18	22.27	22.10	1
		50	0		**22.31**		1			25	0	22.27	22.36	22.19	1
	16QAM	1	0		22.30		1		16QAM	1	0	21.94	21.97	21.91	1
		1	24		21.71		1			1	12	22.18	21.81	22.33	1
		1	49		21.99		1			1	24	22.24	21.78	22.30	1
		25	0		21.35		2			12	0	21.15	21.21	21.32	2
		25	12		21.31		2			12	6	21.49	21.22	21.32	2
		25	25		21.23		2			12	13	21.47	21.18	21.46	2
		50	0		21.28		2			25	0	21.44	21.34	21.43	2
	64QAM	1	0		21.29		2		64QAM	1	0	20.95	21.03	20.90	2
		1	24		20.75		2			1	12	21.26	20.77	21.19	2
		1	49		21.05		2			1	24	21.41	20.73	21.24	2
		25	0		20.32		3			12	0	20.27	20.22	20.09	3
		25	12		20.28		3			12	6	20.48	20.22	20.49	3
		25	25		20.14		3			12	13	20.46	20.25	20.42	3
		50	0		20.29		3			25	0	20.49	20.30	20.48	3

LTE Band 30															
BW	MCS Index	RB Size	RB Offset		Mid		3GPP MPR (dB)	BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel			27710					Channel		27685	27710	27735	
		Frequency (MHz)			2310.0					Frequency (MHz)		2307.5	2310.0	2312.5	
10M	QPSK	1	0		22.82		0	5M	QPSK	1	0	22.71	22.69	22.65	0
		1	24		22.41		0			1	12	22.38	22.28	22.26	0
		1	49		**22.84**		0			1	24	22.73	22.71	22.61	0
		25	0		22.06		1			12	0	21.98	21.93	21.91	1
		25	12		21.96		1			12	6	21.86	21.83	21.80	1
		25	25		**22.09**		1			12	13	21.98	21.96	21.93	1
		50	0		**22.07**		1			25	0	21.96	21.94	21.90	1
	16QAM	1	0		21.80		1		16QAM	1	0	21.76	21.74	21.68	1
		1	24		21.39		1			1	12	21.36	21.31	21.27	1
		1	49		21.82		1			1	24	21.78	21.76	21.72	1
		25	0		21.04		2			12	0	20.98	20.89	20.86	2
		25	12		20.94		2			12	6	20.84	20.78	20.75	2
		25	25		21.07		2			12	13	20.98	20.96	20.92	2
		50	0		21.05		2			25	0	20.96	20.92	20.86	2
	64QAM	1	0		20.77		2		64QAM	1	0	20.65	20.63	20.57	2
		1	24		20.36		2			1	12	20.25	20.20	20.16	2
		1	49		20.79		2			1	24	20.67	20.65	20.61	2
		25	0		20.01		3			12	0	19.87	19.78	19.75	3
		25	12		19.91		3			12	6	19.73	19.67	19.64	3
		25	25		20.04		3			12	13	19.87	19.85	19.81	3
		50	0		20.02		3			25	0	19.85	19.81	19.75	3

LTE Band 66

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		132072	132322	132572	
		Frequency (MHz)		1720.0	1745.0	1770.0	
20M	QPSK	1	0	23.73	**23.99**	23.96	0
		1	50	23.55	23.80	23.79	0
		1	99	23.58	23.86	23.85	0
		50	0	22.89	**22.97**	22.94	1
		50	25	22.75	22.94	22.92	1
		50	50	22.80	22.96	22.89	1
		100	0	22.86	**22.95**	22.89	1
	16QAM	1	0	21.94	22.94	21.91	1
		1	50	22.18	22.74	22.33	1
		1	99	22.24	22.79	22.30	1
		50	0	21.15	21.97	21.32	2
		50	25	21.66	21.92	21.68	2
		50	50	21.93	21.94	21.74	2
		100	0	21.54	21.86	21.63	2
	64QAM	1	0	20.95	21.91	20.90	2
		1	50	21.26	21.78	21.19	2
		1	99	21.41	21.82	21.24	2
		50	0	20.27	20.92	20.09	3
		50	25	20.68	20.92	20.69	3
		50	50	20.83	20.88	20.92	3
		100	0	20.64	20.88	20.48	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		132047	132322	132597	
		Frequency (MHz)		1717.5	1745.0	1772.5	
15M	QPSK	1	0	23.71	23.94	23.90	0
		1	37	23.45	23.77	23.75	0
		1	74	23.56	23.77	23.82	0
		36	0	22.86	22.88	22.90	1
		36	19	22.73	22.88	22.85	1
		36	39	22.73	22.88	22.84	1
		75	0	22.82	22.87	22.80	1
	16QAM	1	0	21.88	22.93	21.84	1
		1	37	22.09	22.70	22.31	1
		1	74	22.17	22.78	22.21	1
		36	0	21.14	21.88	21.28	2
		36	19	21.63	21.80	21.67	2
		36	39	21.91	21.91	21.64	2
		75	0	21.53	21.90	21.57	2
	64QAM	1	0	20.88	21.96	20.88	2
		1	37	21.24	21.74	21.13	2
		1	74	21.34	21.77	21.17	2
		36	0	20.20	20.94	20.02	3
		36	19	20.58	20.80	20.59	3
		36	39	20.81	20.86	20.84	3
		75	0	20.62	20.82	20.42	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		132022	132322	132622	
		Frequency (MHz)		1715.0	1745.0	1775.0	
10M	QPSK	1	0	23.60	23.94	23.76	0
		1	24	23.51	23.68	23.69	0
		1	49	23.52	23.73	23.69	0
		25	0	22.76	22.89	22.91	1
		25	12	22.67	22.89	22.74	1
		25	25	22.67	22.79	22.80	1
		50	0	22.69	22.79	22.81	1
	16QAM	1	0	21.81	22.85	21.71	1
		1	24	22.02	22.57	22.09	1
		1	49	22.16	22.57	22.14	1
		25	0	21.13	21.76	21.21	2
		25	12	21.55	21.79	21.59	2
		25	25	21.74	21.83	21.50	2
		50	0	21.46	21.82	21.50	2
	64QAM	1	0	20.80	21.87	20.89	2
		1	24	21.06	21.59	20.98	2
		1	49	21.39	21.65	21.04	2
		25	0	20.16	20.75	19.86	3
		25	12	20.60	20.72	20.57	3
		25	25	20.67	20.76	20.67	3
		50	0	20.46	20.73	20.29	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		131997	132322	132647	
		Frequency (MHz)		1712.5	1745.0	1777.5	
5M	QPSK	1	0	23.63	23.86	23.84	0
		1	12	23.48	23.62	23.52	0
		1	24	23.36	23.64	23.62	0
		12	0	22.75	22.91	22.75	1
		12	6	22.65	22.73	22.72	1
		12	13	22.57	22.88	22.78	1
		25	0	22.67	22.79	22.71	1
	16QAM	1	0	21.82	22.86	21.78	1
		1	12	22.09	22.55	22.18	1
		1	24	22.11	22.72	22.21	1
		12	0	20.98	21.75	21.17	2
		12	6	21.58	21.83	21.51	2
		12	13	21.79	21.82	21.55	2
		25	0	21.33	21.66	21.53	2
	64QAM	1	0	20.82	21.81	20.71	2
		1	12	21.12	21.78	21.06	2
		1	24	21.37	21.74	21.14	2
		12	0	20.18	20.83	19.93	3
		12	6	20.56	20.80	20.44	3
		12	13	20.71	20.72	20.77	3
		25	0	20.55	20.88	20.34	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		131987	132322	132657	
		Frequency (MHz)		1711.5	1745.5	1778.5	
3M	QPSK	1	0	23.55	23.81	23.84	0
		1	7	23.39	23.65	23.66	0
		1	14	23.44	23.78	23.75	0
		8	0	22.77	22.83	22.85	1
		8	3	22.57	22.84	22.74	1
		8	7	22.66	22.94	22.79	1
		15	0	22.63	22.83	22.85	1
	16QAM	1	0	21.80	22.75	21.80	1
		1	7	22.14	22.61	22.23	1
		1	14	22.09	22.74	22.09	1
		8	0	21.03	21.78	21.28	2
		8	3	21.52	21.67	21.59	2
		8	7	21.77	21.72	21.62	2
		15	0	21.39	21.79	21.46	2
	64QAM	1	0	20.73	21.82	20.69	2
		1	7	21.08	21.54	21.16	2
		1	14	21.17	21.63	21.14	2
		8	0	20.19	20.74	19.99	3
		8	3	20.60	20.72	20.56	3
		8	7	20.71	20.71	20.81	3
		15	0	20.55	20.81	20.47	3

BW	MCS Index	RB Size	RB Offset	Low	Mid	High	3GPP MPR (dB)
		Channel		131979	132322	132665	
		Frequency (MHz)		1710.7	1745.0	1779.3	
1.4M	QPSK	1	0	23.62	23.78	23.89	0
		1	2	23.50	23.61	23.65	0
		1	5	23.39	23.69	23.64	0
		3	0	23.77	23.89	23.72	0
		3	1	23.63	23.84	23.71	0
		3	3	23.76	23.85	23.81	0
		6	0	22.71	22.87	22.74	1
	16QAM	1	0	21.81	22.83	21.81	1
		1	2	21.95	22.59	22.24	1
		1	5	22.18	22.70	22.10	1
		3	0	22.04	22.71	22.22	1
		3	1	22.49	22.65	22.52	1
		3	3	22.78	22.78	22.65	1
		6	0	21.50	21.72	21.57	2
	64QAM	1	0	20.75	21.89	20.86	2
		1	2	21.19	21.61	21.02	2
		1	5	21.24	21.71	21.11	2
		3	0	21.19	21.85	20.89	2
		3	1	21.64	21.79	21.59	2
		3	3	21.65	21.79	21.83	2
		6	0	20.46	20.73	20.27	3

<WLAN 2.4G>

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11b	1	2412	9.88	9.83	12.87
	6	2437	**9.91**	**9.92**	**12.93**
	11	2462	9.85	9.81	12.84

<WLAN 5.2G>

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11ac (VHT80)	42	5210	**9.87**	**9.89**	**12.89**

<WLAN 5.8G>

Mode	Channel	Frequency (MHz)	Average Power (Ant-0)	Average Power (Ant-1)	Average Power (Ant-0 + Ant-1)
802.11ac (VHT80)	155	5775	**9.87**	**9.89**	**12.89**

4.7 SAR Testing Results

4.7.1 SAR Test Reduction Considerations

<KDB 447498 D01, General RF Exposure Guidance>

Testing of other required channels within the operating mode of a frequency band is not required when the reported SAR for the mid-band or highest output power channel is:

(1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

(2) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz

(3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

When SAR is not measured at the maximum power level allowed for production units, the measured SAR will be scaled to the maximum tune-up tolerance limit to determine compliance. The scaling factor for the tune-up power is defined as maximum tune-up limit (mW) / measured conducted power (mW). The reported SAR would be calculated by measured SAR x tune-up power scaling factor.

The SAR has been measured with highest transmission duty factor supported by the test mode tools for WLAN and/or Bluetooth. When the transmission duty factor could not achieve 100%, the reported SAR will be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up power. The scaling factor for the duty factor is defined as 100% / transmission duty cycle (%). The reported SAR would be calculated by measured SAR x tune-up power scaling factor x duty cycle scaling factor.

<KDB 941225 D01, 3G SAR Measurement Procedures>

The mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ 1/4 dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

<KDB 941225 D05, SAR Evaluation Considerations for LTE Devices>

(1) QPSK with 1 RB and 50% RB allocation

Start with the largest channel bandwidth and measure SAR, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

(2) QPSK with 100% RB allocation

SAR is not required when the highest maximum output power for 100% RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

(3) Higher order modulations

SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 1/2 dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

(4) Other channel bandwidth

SAR is required when the highest maximum output power of the smaller channel bandwidth is > 1/2 dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

<Power Confirmation for SAR Test Exclusion for LTE Downlink CA>

According to KDB 941225 D05A, the uplink maximum output power below was measured with downlink CA active on the channel with highest measured maximum output power when downlink CA is inactive. The downlink SCC channel was paired with the uplink channel as normal operation. For intra-band contiguous CA, the downlink channel spacing between the component carriers was set to multiple of 300 kHz less than the nominal channel spacing per section 5.4.1A of 3GPP TS36.521. For intra-band non-contiguous CA, the downlink channel spacing between the component carriers was set to maximum separation from PCC and remain fully within the downlink transmission band. For Inter-band CA, the SCC downlink channel was set to near the middle of its transmission band.

Power Measurements for Inter-Band Downlink CA

CA Combination	PCC								SCC1				SCC2				SCC3				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-29A-30A	2	20	18900	1880	1	0	900	1960	29	10	9715	722.5	30	10	9820	2355	-	-	-	-	23.88	23.16
CA_66A-46D	66	20	132322	1745	1	0	66786	2145	46	20	50492	5520.2	46	20	50690	5540	46	20	50888	5559.8	23.99	23.07

CA Combination	PCC								SCC1				SCC2				SCC3				SCC4				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-46D-66A	2	20	18900	1880	1	0	900	1960	46	20	50492	5520.2	46	20	50690	5540	46	20	50888	5559.8	66	20	66886	2155	23.88	23.15

CA Combination	PCC								SCC1				SCC2				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-2A-12A-30A-66A	2	20	18900	1880	1	0	900	1960	2	20	1100	1980	12	10	5095	737.5	23.88	23.03
									SCC3				SCC4					
									LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)		
									30	10	9820	2355	66	20	66886	2155		

CA Combination	PCC								SCC1				SCC2				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-2A-5A-30A-66A	2	20	18900	1880	1	0	900	1960	2	20	1100	1980	5	10	2525	881.5	23.88	23.08
									SCC3				SCC4					
									LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)		
									30	10	9820	2355	66	20	66886	2155		

CA Combination	PCC								SCC1				SCC2				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-5A-30A-66A-66A	2	20	18900	1880	1	0	900	1960	5	10	2525	881.5	30	10	9820	2355	23.88	23.15
									SCC3				SCC4					
									LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)		
									66	20	66536	2120	66	20	67036	2170		

CA Combination	PCC								SCC1				SCC2				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-5B-30A-66A	2	20	18900	1880	1	0	900	1960	5	10	2476	876.6	5	10	2575	886.5	23.88	23.11
									SCC3				SCC4					
									LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)		
									30	10	9820	2355	66	20	66886	2155		

CA Combination	PCC								SCC1				SCC2				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-12A-30A-66A-66A	2	20	18900	1880	1	0	900	1960	12	10	5095	737.5	30	10	9820	2355	23.88	23.27
									SCC3				SCC4					
									LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)		
									66	20	66536	2120	66	20	67036	2170		

Power Measurements for Inter-Band Downlink CA (4*4 MIMO)

CA Combination	PCC								SCC1				SCC2				SCC3				Power	
	LTE Band	BW (MHz)	UL Channel	UL Freq. (MHz)	RB Size	RB Offset	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	LTE Band	BW (MHz)	DL Channel	DL Freq. (MHz)	Single Carrier Tx Power (dBm)	Tx Power with DL-CA Active (dBm)
CA_2A-12A-12A-66A(4*4)	2	20	18900	1880	1	0	900	1960	12	5	5035	731.5	12	5	5155	743.5	66	20	66886	2155	23.88	23.18
CA_2A(4*4)-12A-30A	2	20	18900	1880	1	0	900	1960	12	10	5095	737.5	30	10	9820	2355					23.88	23.13
CA_2A-12A-66A(4*4)	2	20	18900	1880	1	0	900	1960	12	10	5095	737.5	66	20	66886	2155					23.88	23.25
CA_12A_30A_66A(4*4)	12	10	23095	707.5	1	0	5095	737.5	30	10	9820	2355	66	20	66886	2155					23.25	23.20

Summary for SAR Test Exclusion for LTE Downlink CA

Per power confirmation results in above, the uplink maximum output power with downlink CA active remains within the specified tune-up tolerance and not more than 0.25 dB higher than the maximum output power with downlink CA inactive. According to KDB 941225 D05A, the SAR test exclusion applies to LTE downlink CA operation.

<KDB 248227 D01, SAR Guidance for Wi-Fi Transmitters>

(1) For handsets operating next to ear, hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is <= 0.4 W/kg, SAR testing for remaining test positions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is <= 0.8 W/kg or all test positions are measured.

(2) For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

(3) For WLAN 5 GHz, the initial test configuration was selected according to the transmission mode with the highest maximum output power. When the reported SAR of initial test configuration is > 0.8 W/kg, SAR is required for the subsequent highest measured output power channel until the reported SAR result is <= 1.2 W/kg or all required channels are measured. For other transmission modes, SAR is not required when the highest reported SAR for initial test configuration is adjusted by the ratio of subsequent test configuration to initial test configuration specified maximum output power and it is <= 1.2 W/kg.

(4) For WLAN MIMO mode, the power-based standalone SAR test exclusion or the sum of SAR provision in KDB 447498 to determine simultaneous transmission SAR test exclusion should be applied. Otherwise, SAR for MIMO mode will be measured with all applicable antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

4.7.2 SAR Results for Body Exposure Condition (Test Separation Distance is 10 mm)

Plot No.	Band	Mode	Test Position	Ch.	RB#	RB Offset	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
	LTE 2	QPSK20M	Front Face	18900	1	0	24.0	23.88	1.03	-0.08	1.08	1.11
	LTE 2	QPSK20M	Rear Face	18900	1	0	24.0	23.88	1.03	-0.07	0.742	0.76
	LTE 2	QPSK20M	Left Side	18900	1	0	24.0	23.88	1.03	-0.02	0.475	0.49
	LTE 2	QPSK20M	Top Side	18900	1	0	24.0	23.88	1.03	-0.01	0.037	0.04
	LTE 2	QPSK20M	Bottom Side	18900	1	0	24.0	23.88	1.03	-0.08	0.846	0.87
	LTE 2	QPSK20M	Front Face	18900	50	0	23.0	22.99	1.00	-0.09	0.883	0.88
	LTE 2	QPSK20M	Rear Face	18900	50	0	23.0	22.99	1.00	-0.19	0.75	0.75
	LTE 2	QPSK20M	Left Side	18900	50	0	23.0	22.99	1.00	-0.10	0.47	0.47
	LTE 2	QPSK20M	Top Side	18900	50	0	23.0	22.99	1.00	-0.04	0.042	0.04
	LTE 2	QPSK20M	Bottom Side	18900	50	0	23.0	22.99	1.00	-0.17	0.717	0.72
01	LTE 2	QPSK20M	Front Face	18700	1	0	24.0	23.74	1.06	-0.10	1.09	**1.16**
	LTE 2	QPSK20M	Front Face	19100	1	0	24.0	23.68	1.08	0.02	1.04	1.12
	LTE 2	QPSK20M	Bottom Side	18700	1	0	24.0	23.74	1.06	0.07	0.846	0.90
	LTE 2	QPSK20M	Bottom Side	19100	1	0	24.0	23.68	1.08	0.15	0.877	0.95
	LTE 2	QPSK20M	Front Face	18700	50	0	23.0	22.93	1.02	-0.16	0.933	0.95
	LTE 2	QPSK20M	Front Face	19100	50	0	23.0	22.85	1.04	-0.18	0.881	0.92
	LTE 2	QPSK20M	Front Face	18900	100	0	23.0	22.98	1.00	0.12	0.94	0.94
	LTE 2	QPSK20M	Bottom Side	18900	100	0	23.0	22.98	1.00	-0.05	0.88	0.88
	LTE 2	QPSK20M	Front Face	18700	1	0	24.0	23.74	1.06	-0.10	1.05	1.11
	LTE 5	QPSK10M	Front Face	20525	1	0	24.0	23.43	1.14	-0.01	0.399	0.45
02	LTE 5	QPSK10M	Rear Face	20525	1	0	24.0	23.43	1.14	-0.02	0.489	**0.56**
	LTE 5	QPSK10M	Left Side	20525	1	0	24.0	23.43	1.14	0.01	0.166	0.19
	LTE 5	QPSK10M	Top Side	20525	1	0	24.0	23.43	1.14	0.10	0.195	0.22
	LTE 5	QPSK10M	Bottom Side	20525	1	0	24.0	23.43	1.14	0.12	0.351	0.40
	LTE 5	QPSK10M	Front Face	20525	25	0	23.0	22.48	1.13	0.15	0.313	0.35
	LTE 5	QPSK10M	Rear Face	20525	25	0	23.0	22.48	1.13	0.15	0.334	0.38
	LTE 5	QPSK10M	Left Side	20525	25	0	23.0	22.48	1.13	0.01	0.146	0.16
	LTE 5	QPSK10M	Top Side	20525	25	0	23.0	22.48	1.13	0.17	0.168	0.19
	LTE 5	QPSK10M	Bottom Side	20525	25	0	23.0	22.48	1.13	-0.04	0.265	0.30
	LTE 12	QPSK10M	Front Face	23095	1	0	24.0	23.25	1.19	-0.04	0.388	0.46
03	LTE 12	QPSK10M	Rear Face	23095	1	0	24.0	23.25	1.19	0.02	0.497	**0.59**
	LTE 12	QPSK10M	Left Side	23095	1	0	24.0	23.25	1.19	0.01	0.075	0.09
	LTE 12	QPSK10M	Top Side	23095	1	0	24.0	23.25	1.19	0.19	0.083	0.10
	LTE 12	QPSK10M	Bottom Side	23095	1	0	24.0	23.25	1.19	0.19	0.236	0.28
	LTE 12	QPSK10M	Front Face	23095	25	0	23.0	22.34	1.16	0.12	0.335	0.39
	LTE 12	QPSK10M	Rear Face	23095	25	0	23.0	22.34	1.16	-0.16	0.394	0.46
	LTE 12	QPSK10M	Left Side	23095	25	0	23.0	22.34	1.16	-0.03	0.063	0.07
	LTE 12	QPSK10M	Top Side	23095	25	0	23.0	22.34	1.16	0.01	0.071	0.08
	LTE 12	QPSK10M	Bottom Side	23095	25	0	23.0	22.34	1.16	0.09	0.210	0.24

Plot No.	Band	Mode	Test Position	Ch.	RB#	RB Offset	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
	LTE 14	QPSK10M	Front Face	23330	1	0	24.0	23.31	1.17	0.02	0.654	0.77
04	LTE 14	QPSK10M	Rear Face	23330	1	0	24.0	23.31	1.17	0.07	0.674	0.79
	LTE 14	QPSK10M	Left Side	23330	1	0	24.0	23.31	1.17	-0.13	0.081	0.09
	LTE 14	QPSK10M	Top Side	23330	1	0	24.0	23.31	1.17	-0.14	0.148	0.17
	LTE 14	QPSK10M	Bottom Side	23330	1	0	24.0	23.31	1.17	0.11	0.486	0.57
	LTE 14	QPSK10M	Front Face	23330	25	0	23.0	22.36	1.16	0.13	0.52	0.60
	LTE 14	QPSK10M	Rear Face	23330	25	0	23.0	22.36	1.16	-0.03	0.552	0.64
	LTE 14	QPSK10M	Left Side	23330	25	0	23.0	22.36	1.16	-0.08	0.104	0.12
	LTE 14	QPSK10M	Top Side	23330	25	0	23.0	22.36	1.16	0.18	0.143	0.17
	LTE 14	QPSK10M	Bottom Side	23330	25	0	23.0	22.36	1.16	-0.13	0.335	0.39
05	LTE 30	QPSK10M	Front Face	27710	1	49	23.5	22.84	1.16	-0.03	0.938	1.09
	LTE 30	QPSK10M	Rear Face	27710	1	49	23.5	22.84	1.16	0.08	0.416	0.48
	LTE 30	QPSK10M	Left Side	27710	1	49	23.5	22.84	1.16	-0.09	0.907	1.05
	LTE 30	QPSK10M	Front Face	27710	25	25	22.5	22.09	1.10	-0.08	0.845	0.93
	LTE 30	QPSK10M	Rear Face	27710	25	25	22.5	22.09	1.10	-0.15	0.351	0.39
	LTE 30	QPSK10M	Left Side	27710	25	25	22.5	22.09	1.10	-0.01	0.756	0.83
	LTE 30	QPSK10M	Front Face	27710	50	0	22.5	22.07	1.10	0.11	0.822	0.90
	LTE 30	QPSK10M	Left Side	27710	50	0	22.5	22.07	1.10	-0.10	0.764	0.84
	LTE 30	QPSK10M	Front Face	27710	1	49	23.5	22.84	1.16	-0.03	0.821	0.95
06	LTE 66	QPSK20M	Front Face	132322	1	0	24.0	23.99	1.00	0.02	1	1.00
	LTE 66	QPSK20M	Rear Face	132322	1	0	24.0	23.99	1.00	0.09	0.800	0.80
	LTE 66	QPSK20M	Left Side	132322	1	0	24.0	23.99	1.00	-0.07	0.526	0.53
	LTE 66	QPSK20M	Top Side	132322	1	0	24.0	23.99	1.00	-0.10	0.084	0.08
	LTE 66	QPSK20M	Bottom Side	132322	1	0	24.0	23.99	1.00	0.05	0.884	0.88
	LTE 66	QPSK20M	Front Face	132322	50	0	23.0	22.97	1.01	-0.15	0.843	0.85
	LTE 66	QPSK20M	Rear Face	132322	50	0	23.0	22.97	1.01	-0.02	0.676	0.68
	LTE 66	QPSK20M	Left Side	132322	50	0	23.0	22.97	1.01	0.03	0.414	0.42
	LTE 66	QPSK20M	Top Side	132322	50	0	23.0	22.97	1.01	0.08	0.074	0.07
	LTE 66	QPSK20M	Bottom Side	132322	50	0	23.0	22.97	1.01	0.17	0.695	0.70
	LTE 66	QPSK20M	Front Face	132072	1	0	24.0	23.73	1.06	0.12	0.812	0.86
	LTE 66	QPSK20M	Front Face	132572	1	0	24.0	23.96	1.01	-0.06	0.983	0.99
	LTE 66	QPSK20M	Rear Face	132072	1	0	24.0	23.73	1.06	0.05	0.652	0.69
	LTE 66	QPSK20M	Rear Face	132572	1	0	24.0	23.96	1.01	-0.03	0.771	0.78
	LTE 66	QPSK20M	Bottom Side	132072	1	0	24.0	23.73	1.06	0.07	0.726	0.77
	LTE 66	QPSK20M	Bottom Side	132572	1	0	24.0	23.96	1.01	0.18	0.851	0.86
	LTE 66	QPSK20M	Front Face	132072	50	0	23.0	22.89	1.03	0.04	0.651	0.67
	LTE 66	QPSK20M	Front Face	132572	50	0	23.0	22.94	1.01	0.12	0.793	0.80
	LTE 66	QPSK20M	Front Face	132322	100	0	23.0	22.95	1.01	-0.08	0.822	0.83
	LTE 66	QPSK20M	Rear Face	132322	100	0	23.0	22.95	1.01	0.15	0.66	0.67
	LTE 66	QPSK20M	Bottom Side	132322	100	0	23.0	22.95	1.01	-0.05	0.736	0.74
	LTE 66	QPSK20M	Front Face	132322	1	0	24.0	23.99	1.00	0.01	0.987	0.99

Plot No.	Band	Mode	Test Position	Ch.	Tx Antenna	DutyCycle	Crest Factor	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
	WLAN2.4G	802.11b	Front Face	6	Ant 0	99.00	1.01	10.0	9.91	1.02	-0.14	0.037	0.04
	WLAN2.4G	802.11b	Rear Face	6	Ant 0	99.00	1.01	10.0	9.91	1.02	0.00	< 0.001	0.00
	WLAN2.4G	802.11b	Top Side	6	Ant 0	99.00	1.01	10.0	9.91	1.02	0.00	< 0.001	0.00
	WLAN2.4G	802.11b	Front Face	6	Ant 1	99.00	1.01	10.0	9.92	1.02	0.03	0.048	0.05
	WLAN2.4G	802.11b	Rear Face	6	Ant 1	99.00	1.01	10.0	9.92	1.02	0.00	< 0.001	0.00
07	WLAN2.4G	802.11b	Right Side	6	Ant 1	99.00	1.01	10.0	9.92	1.02	0.09	0.051	**0.05**
	WLAN2.4G	802.11b	Top Side	6	Ant 1	99.00	1.01	10.0	9.92	1.02	0.00	< 0.001	0.00
	WLAN2.4G	802.11b	Front Face	6	Ant 0+1	99.00	1.01	13.0	12.93	1.02	-0.11	0.04	0.04
	WLAN2.4G	802.11b	Rear Face	6	Ant 0+1	99.00	1.01	13.0	12.93	1.02	0.00	< 0.001	0.00
	WLAN2.4G	802.11b	Right Side	6	Ant 0+1	99.00	1.01	13.0	12.93	1.02	0.00	< 0.001	0.00
	WLAN2.4G	802.11b	Top Side	6	Ant 0+1	99.00	1.01	13.0	12.93	1.02	-0.17	0.032	0.03
	WLAN5.2G	802.11ac VHT80	Front Face	42	Ant 0	94.70	1.06	10.0	9.87	1.03	-0.16	0.106	0.12
	WLAN5.2G	802.11ac VHT80	Rear Face	42	Ant 0	94.70	1.06	10.0	9.87	1.03	0.00	< 0.001	0.00
08	WLAN5.2G	802.11ac VHT80	Top Side	42	Ant 0	94.70	1.06	10.0	9.87	1.03	0.11	0.119	**0.13**
	WLAN5.2G	802.11ac VHT80	Front Face	42	Ant 1	94.70	1.06	10.0	9.89	1.03	0.03	0.06	0.07
	WLAN5.2G	802.11ac VHT80	Rear Face	42	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.2G	802.11ac VHT80	Right Side	42	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.2G	802.11ac VHT80	Top Side	42	Ant 1	94.70	1.06	10.0	9.89	1.03	-0.03	0.062	0.07
	WLAN5.2G	802.11ac VHT80	Front Face	42	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.09	0.078	0.09
	WLAN5.2G	802.11ac VHT80	Rear Face	42	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.00	< 0.001	0.00
	WLAN5.2G	802.11ac VHT80	Right Side	42	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.00	< 0.001	0.00
	WLAN5.2G	802.11ac VHT80	Top Side	42	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.13	0.115	0.13
09	WLAN5.8G	802.11ac VHT80	Front Face	155	Ant 0	94.70	1.06	10.0	9.87	1.03	-0.01	0.063	**0.07**
	WLAN5.8G	802.11ac VHT80	Rear Face	155	Ant 0	94.70	1.06	10.0	9.87	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Top Side	155	Ant 0	94.70	1.06	10.0	9.87	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Front Face	155	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Rear Face	155	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Right Side	155	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Top Side	155	Ant 1	94.70	1.06	10.0	9.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Front Face	155	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.03	0.052	0.06
	WLAN5.8G	802.11ac VHT80	Rear Face	155	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Right Side	155	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.00	< 0.001	0.00
	WLAN5.8G	802.11ac VHT80	Top Side	155	Ant 0+1	94.70	1.06	13.0	12.89	1.03	0.00	< 0.001	0.00

Note: The “< 0.001” means there is no SAR value or the SAR is too low to be measured.

4.7.3 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. If the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20, or when the original or repeated measurement is >= 1.45 W/kg, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

Band	Mode	Test Position	Ch.	Original Measured SAR-1g (W/kg)	1st Repeated SAR-1g (W/kg)	L/S Ratio	2nd Repeated SAR-1g (W/kg)	L/S Ratio	3rd Repeated SAR-1g (W/kg)	L/S Ratio
LTE 2	QPSK20M	Front Face	18700	1.09	1.05	1.04	N/A	N/A	N/A	N/A
LTE 30	QPSK10M	Front Face	27710	0.938	0.821	1.14	N/A	N/A	N/A	N/A
LTE 66	QPSK20M	Front Face	132322	1.00	0.987	1.01	N/A	N/A	N/A	N/A

4.7.4 Simultaneous Multi-band Transmission Evaluation

<Possibilities of Simultaneous Transmission>

The simultaneous transmission possibilities for this device are listed as below.

Simultaneous TX Combination	Capable Transmit Configurations	Body Exposure Condition
1	LTE + WLAN 2.4G	Yes
2	LTE + WLAN 5G	Yes

Note :

1. The WLAN 2.4G and WLAN 5G cannot transmit simultaneously.
2. This device does not support voice transmission capability.

<SAR Summation Analysis>

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of SAR_{1g} of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR_{1g} 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR_{1g} is greater than the SAR limit (SAR_{1g} 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
1	**LTE 2 + WLAN (DTS)**	Hotspot	Front Face	1.16	0.05	1.21	Σ SAR < 1.6, Not required
			Rear Face	0.76	0.00	0.76	Σ SAR < 1.6, Not required
			Left Side	0.49	0.00	0.49	Σ SAR < 1.6, Not required
			Right Side	0.00	0.05	0.05	Σ SAR < 1.6, Not required
			Top Side	0.04	0.03	0.07	Σ SAR < 1.6, Not required
			Bottom Side	0.95	0.00	0.95	Σ SAR < 1.6, Not required
2	**LTE 2 + WLAN (NII)**	Hotspot	Front Face	1.16	0.12	**1.28**	Σ SAR < 1.6, Not required
			Rear Face	0.76	0.00	0.76	Σ SAR < 1.6, Not required
			Left Side	0.49	0.00	0.49	Σ SAR < 1.6, Not required
			Right Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
			Top Side	0.04	0.13	0.17	Σ SAR < 1.6, Not required
			Bottom Side	0.95	0.00	0.95	Σ SAR < 1.6, Not required

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
3	LTE 5 + WLAN (DTS)	Hotspot	Front Face	0.45	0.05	0.50	Σ SAR < 1.6, Not required
			Rear Face	0.56	0.00	0.56	Σ SAR < 1.6, Not required
			Left Side	0.19	0.00	0.19	Σ SAR < 1.6, Not required
			Right Side	0.00	0.05	0.05	Σ SAR < 1.6, Not required
			Top Side	0.22	0.03	0.25	Σ SAR < 1.6, Not required
			Bottom Side	0.40	0.00	0.40	Σ SAR < 1.6, Not required
4	LTE 5 + WLAN (NII)	Hotspot	Front Face	0.45	0.12	0.57	Σ SAR < 1.6, Not required
			Rear Face	0.56	0.00	0.56	Σ SAR < 1.6, Not required
			Left Side	0.19	0.00	0.19	Σ SAR < 1.6, Not required
			Right Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
			Top Side	0.22	0.13	0.35	Σ SAR < 1.6, Not required
			Bottom Side	0.40	0.00	0.40	Σ SAR < 1.6, Not required

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
5	LTE 12 + WLAN (DTS)	Hotspot	Front Face	0.46	0.05	0.51	Σ SAR < 1.6, Not required
			Rear Face	0.59	0.00	0.59	Σ SAR < 1.6, Not required
			Left Side	0.09	0.00	0.09	Σ SAR < 1.6, Not required
			Right Side	0.00	0.05	0.05	Σ SAR < 1.6, Not required
			Top Side	0.10	0.03	0.13	Σ SAR < 1.6, Not required
			Bottom Side	0.28	0.00	0.28	Σ SAR < 1.6, Not required
6	LTE 12 + WLAN (NII)	Hotspot	Front Face	0.46	0.12	0.58	Σ SAR < 1.6, Not required
			Rear Face	0.59	0.00	0.59	Σ SAR < 1.6, Not required
			Left Side	0.09	0.00	0.09	Σ SAR < 1.6, Not required
			Right Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
			Top Side	0.10	0.13	0.23	Σ SAR < 1.6, Not required
			Bottom Side	0.28	0.00	0.28	Σ SAR < 1.6, Not required

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
7	LTE 14 + WLAN (DTS)	Hotspot	Front Face	0.77	0.05	0.82	Σ SAR < 1.6, Not required
			Rear Face	0.79	0.00	0.79	Σ SAR < 1.6, Not required
			Left Side	0.12	0.00	0.12	Σ SAR < 1.6, Not required
			Right Side	0.00	0.05	0.05	Σ SAR < 1.6, Not required
			Top Side	0.17	0.03	0.20	Σ SAR < 1.6, Not required
			Bottom Side	0.57	0.00	0.57	Σ SAR < 1.6, Not required
8	LTE 14 + WLAN (NII)	Hotspot	Front Face	0.77	0.12	0.89	Σ SAR < 1.6, Not required
			Rear Face	0.79	0.00	0.79	Σ SAR < 1.6, Not required
			Left Side	0.12	0.00	0.12	Σ SAR < 1.6, Not required
			Right Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
			Top Side	0.17	0.13	0.30	Σ SAR < 1.6, Not required
			Bottom Side	0.57	0.00	0.57	Σ SAR < 1.6, Not required

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
9	LTE 30 + WLAN (DTS)	Hotspot	Front Face	1.09	0.05	1.14	Σ SAR < 1.6, Not required
			Rear Face	0.48	0.00	0.48	Σ SAR < 1.6, Not required
			Left Side	1.05	0.00	1.05	Σ SAR < 1.6, Not required
			Right Side	0.00	0.05	0.05	Σ SAR < 1.6, Not required
			Top Side	0.00	0.03	0.03	Σ SAR < 1.6, Not required
			Bottom Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
10	LTE 30 + WLAN (NII)	Hotspot	Front Face	1.09	0.12	1.21	Σ SAR < 1.6, Not required
			Rear Face	0.48	0.00	0.48	Σ SAR < 1.6, Not required
			Left Side	1.05	0.00	1.05	Σ SAR < 1.6, Not required
			Right Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required
			Top Side	0.00	0.13	0.13	Σ SAR < 1.6, Not required
			Bottom Side	0.00	0.00	0.00	Σ SAR < 1.6, Not required

No.	Conditions (SAR1 + SAR2)	Exposure Condition	Test Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR Analysis
11	LTE 66 + WLAN (DTS)	Hotspot	Front Face	1.00	0.05	1.05	Σ SAR < 1.6, Not required
			Rear Face	0.80	0.00	0.80	Σ SAR < 1.6, Not required
			Left Side	0.53	0.00	0.53	Σ SAR < 1.6, Not required
			Right Side	0.08	0.05	0.13	Σ SAR < 1.6, Not required
			Top Side	0.00	0.03	0.03	Σ SAR < 1.6, Not required
			Bottom Side	0.88	0.00	0.88	Σ SAR < 1.6, Not required
12	LTE 66 + WLAN (NII)	Hotspot	Front Face	1.00	0.12	1.12	Σ SAR < 1.6, Not required
			Rear Face	0.80	0.00	0.80	Σ SAR < 1.6, Not required
			Left Side	0.53	0.00	0.53	Σ SAR < 1.6, Not required
			Right Side	0.08	0.00	0.08	Σ SAR < 1.6, Not required
			Top Side	0.00	0.13	0.13	Σ SAR < 1.6, Not required
			Bottom Side	0.88	0.00	0.88	Σ SAR < 1.6, Not required

Test Engineer： Raymond Wu, and Hance Chang

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D750V3	1013	Aug. 23, 2018	1 Year
System Validation Dipole	SPEAG	D835V2	4d121	Aug. 23, 2018	1 Year
System Validation Dipole	SPEAG	D1750V2	1055	Aug. 27, 2018	1 Year
System Validation Dipole	SPEAG	D1900V2	5d036	Jan. 18, 2018	1 Year
System Validation Dipole	SPEAG	D2300V2	1004	Jan. 17, 2018	1 Year
System Validation Dipole	SPEAG	D2450V2	737	Aug. 24, 2018	1 Year
System Validation Dipole	SPEAG	D5GHzV2	1019	Mar. 22, 2018	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	3898	Jun. 26, 2018	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	3650	Jul. 27, 2018	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	7472	Aug. 29, 2018	1 Year
Data Acquisition Electronics	SPEAG	DAE3	579	Aug. 27, 2018	1 Year
Data Acquisition Electronics	SPEAG	DAE4	861	May. 30, 2018	1 Year
Data Acquisition Electronics	SPEAG	DAE4	1277	Jan. 18, 2018	1 Year
Radio Communication Analyzer	Anritsu	MT8820C	6201381727	May. 09, 2018	1 Year
Spectrum Analyzer	R&S	FSL6	102006	Mar. 23, 2018	1 Year
ENA Series Network Analyzer	Agilent	E5071C	MY46214281	Jun. 08, 2018	1 Year
MXG Analong Signal Generator	Agilent	N5181A	MY50143868	Jul. 03, 2018	1 Year
Vector Signal Generator	Anritsu	MG3710A	6201599977	Mar. 16, 2018	1 Year
Power Meter	Anritsu	ML2495A	1218009	Jul. 03, 2018	1 Year
Power Sensor	Anritsu	MA2411B	1207252	Jul. 03, 2018	1 Year
Thermometer	YFE	YF-160A	130504591	Mar. 23, 2018	1 Year

6. Measurement Uncertainty

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
Probe Calibration	6.0	Normal	1	1	1	6.0	6.0	∞
Axial Isotropy	4.7	Rectangular	√3	√0.5	√0.5	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	√3	√0.5	√0.5	3.9	3.9	∞
Boundary Effect	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Linearity	4.7	Rectangular	√3	1	1	2.7	2.7	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Probe Modulation Response	3.5	Rectangular	√3	1	1	2.0	2.0	∞
Readout Electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Integration Time	1.7	Rectangular	√3	1	1	1.0	1.0	∞
RF Ambient Conditions – Noise	3.0	Rectangular	√3	1	1	1.7	1.7	∞
RF Ambient Conditions – Reflections	3.0	Rectangular	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe Positioning with Respect to Phantom	2.9	Rectangular	√3	1	1	1.7	1.7	∞
Post-processing	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Test Sample Related								
Test Sample Positioning	3.9 / 2.06	Normal	1	1	1	3.9	2.1	35
Device Holder Uncertainty	2.9 / 4.1	Normal	1	1	1	2.9	4.1	11
Power Drift of Measurement	5.0	Rectangular	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty (Shape and Thickness Tolerances)	6.1	Rectangular	√3	1	1	3.5	3.5	∞
Liquid Conductivity (Temperature Uncertainty)	3.24	Rectangular	√3	0.78	0.71	1.5	1.3	∞
Liquid Conductivity (Measured)	2.88	Normal	1	0.78	0.71	2.2	2.0	43
Liquid Permittivity (Temperature Uncertainty)	1.13	Rectangular	√3	0.23	0.26	0.2	0.2	∞
Liquid Permittivity (Measured)	2.50	Normal	1	0.23	0.26	0.6	0.7	54
Combined Standard Uncertainty						± 11.4 %	± 11.2 %	
Expanded Uncertainty (K=2)						**± 22.8 %**	**± 22.4 %**	

Head SAR Uncertainty Budget for Frequency Range of 300 MHz to 3 GHz

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
Probe Calibration	6.55	Normal	1	1	1	6.55	6.55	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	3.9	3.9	∞
Boundary Effect	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Linearity	4.7	Rectangular	√3	1	1	2.7	2.7	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Probe Modulation Response	3.5	Rectangular	√3	1	1	2.0	2.0	∞
Readout Electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Integration Time	1.7	Rectangular	√3	1	1	1.0	1.0	∞
RF Ambient Conditions – Noise	3.0	Rectangular	√3	1	1	1.7	1.7	∞
RF Ambient Conditions – Reflections	3.0	Rectangular	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe Positioning with Respect to Phantom	6.7	Rectangular	√3	1	1	3.9	3.9	∞
Post-processing	4.0	Rectangular	√3	1	1	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	3.9 / 2.06	Normal	1	1	1	3.9	2.1	35
Device Holder Uncertainty	2.9 / 4.1	Normal	1	1	1	2.9	4.1	11
Power Drift of Measurement	5.0	Rectangular	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty (Shape and Thickness Tolerances)	6.6	Rectangular	√3	1	1	3.8	3.8	∞
Liquid Conductivity (Temperature Uncertainty)	3.24	Rectangular	√3	0.78	0.71	1.5	1.3	∞
Liquid Conductivity (Measured)	2.88	Normal	1	0.78	0.71	2.2	2.0	43
Liquid Permittivity (Temperature Uncertainty)	1.13	Rectangular	√3	0.23	0.26	0.2	0.2	∞
Liquid Permittivity (Measured)	2.50	Normal	1	0.23	0.26	0.6	0.7	54
Combined Standard Uncertainty						± 12.5 %	± 12.3 %	
Expanded Uncertainty (K=2)						**± 25.0 %**	**± 24.6 %**	

Head SAR Uncertainty Budget for Frequency Range of 3 GHz to 6 GHz

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
Probe Calibration	6.0	Normal	1	1	1	6.0	6.0	∞
Axial Isotropy	4.7	Rectangular	√3	√0.5	√0.5	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	√3	√0.5	√0.5	3.9	3.9	∞
Boundary Effect	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Linearity	4.7	Rectangular	√3	1	1	2.7	2.7	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Probe Modulation Response	3.5	Rectangular	√3	1	1	2.0	2.0	∞
Readout Electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Integration Time	1.7	Rectangular	√3	1	1	1.0	1.0	∞
RF Ambient Conditions – Noise	3.0	Rectangular	√3	1	1	1.7	1.7	∞
RF Ambient Conditions – Reflections	3.0	Rectangular	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe Positioning with Respect to Phantom	2.9	Rectangular	√3	1	1	1.7	1.7	∞
Post-processing	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Test Sample Related								
Test Sample Positioning	4.38 / 1.35	Normal	1	1	1	4.4	1.4	29
Device Holder Uncertainty	2.9 / 4.1	Normal	1	1	1	2.9	4.1	11
Power Drift of Measurement	5.0	Rectangular	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty (Shape and Thickness Tolerances)	7.2	Rectangular	√3	1	1	4.2	4.2	∞
Liquid Conductivity (Temperature Uncertainty)	3.24	Rectangular	√3	0.78	0.71	1.5	1.3	∞
Liquid Conductivity (Measured)	2.88	Normal	1	0.78	0.71	2.2	2.0	43
Liquid Permittivity (Temperature Uncertainty)	1.13	Rectangular	√3	0.23	0.26	0.2	0.2	∞
Liquid Permittivity (Measured)	2.50	Normal	1	0.23	0.26	0.6	0.7	54
Combined Standard Uncertainty						± 11.8 %	± 11.3 %	
Expanded Uncertainty (K=2)						**± 23.6 %**	**± 22.6 %**	

Body SAR Uncertainty Budget for Frequency Range of 300 MHz to 3 GHz

Source of Uncertainty	Uncertainty (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (± %, 1g)	Standard Uncertainty (± %, 10g)	Vi
Measurement System								
Probe Calibration	6.55	Normal	1	1	1	6.55	6.55	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	3.9	3.9	∞
Boundary Effect	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Linearity	4.7	Rectangular	√3	1	1	2.7	2.7	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Probe Modulation Response	3.5	Rectangular	√3	1	1	2.0	2.0	∞
Readout Electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Integration Time	1.7	Rectangular	√3	1	1	1.0	1.0	∞
RF Ambient Conditions – Noise	3.0	Rectangular	√3	1	1	1.7	1.7	∞
RF Ambient Conditions – Reflections	3.0	Rectangular	√3	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe Positioning with Respect to Phantom	6.7	Rectangular	√3	1	1	3.9	3.9	∞
Post-processing	4.0	Rectangular	√3	1	1	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	4.38 / 1.35	Normal	1	1	1	4.4	1.4	29
Device Holder Uncertainty	2.9 / 4.1	Normal	1	1	1	2.9	4.1	11
Power Drift of Measurement	5.0	Rectangular	√3	1	1	2.9	2.9	∞
Power Scaling	0.0	Rectangular	√3	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty (Shape and Thickness Tolerances)	7.6	Rectangular	√3	1	1	4.4	4.4	∞
Liquid Conductivity (Temperature Uncertainty)	3.24	Rectangular	√3	0.78	0.71	1.5	1.3	∞
Liquid Conductivity (Measured)	2.88	Normal	1	0.78	0.71	2.2	2.0	43
Liquid Permittivity (Temperature Uncertainty)	1.13	Rectangular	√3	0.23	0.26	0.2	0.2	∞
Liquid Permittivity (Measured)	2.50	Normal	1	0.23	0.26	0.6	0.7	54
Combined Standard Uncertainty						± 12.8 %	± 12.4 %	
Expanded Uncertainty (K=2)						**± 25.6 %**	**± 24.8 %**	

Body SAR Uncertainty Budget for Frequency Range of 3 GHz to 6 GHz

7. Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Taiwan HwaYa EMC/RF/Safety Lab:
Add: No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan, R.O.C.
Tel: 886-3-318-3232
Fax: 886-3-327-0892

Taiwan LinKo EMC/RF Lab:
Add: No. 47-2, 14th Ling, Chia Pau Vil., Linkou Dist., New Taipei City 244, Taiwan, R.O.C.
Tel: 886-2-2605-2180
Fax: 886-2-2605-1924

Taiwan HsinChu EMC/RF/Telecom Lab:
Add: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 30078, Taiwan, R.O.C.
Tel: 886-3-666-8565
Fax: 886-3-666-8323

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The road map of all our labs can be found in our web site also.

---END---

Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/06

System Check_B750_181106

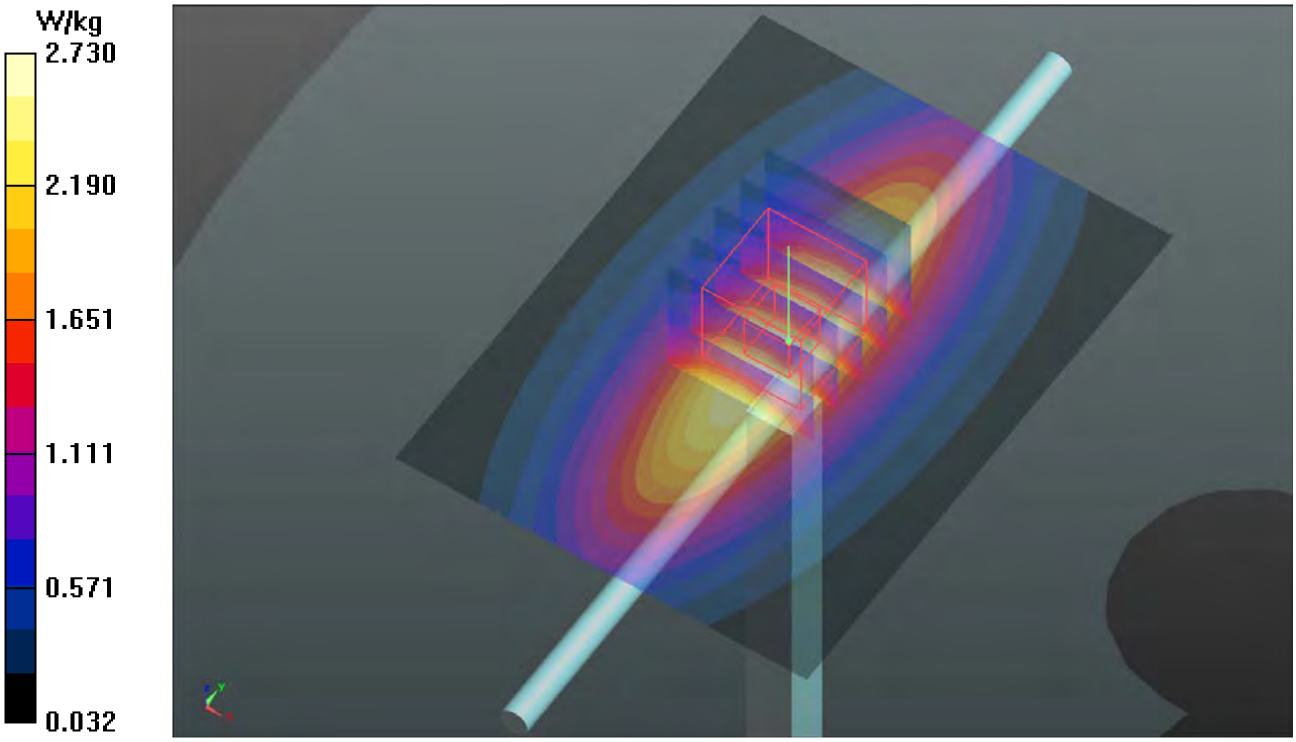
DUT: Dipole 750 MHz; Type: D750V3; SN: 1013

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: B07T10N1_1106 Medium parameters used: f = 750 MHz; σ = 0.918 S/m; ε_r = 55.862; ρ = 1000 kg/m^3
Ambient Temperature：23.9 ℃； Liquid Temperature：23.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(9.91, 9.91, 9.91); Calibrated: 2018/07/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2018/08/27
- Phantom: Twin SAM Phantom_1822; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.73 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 57.02 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.04 W/kg
SAR(1 g) = 2.04 W/kg; SAR(10 g) = 1.36 W/kg
Maximum value of SAR (measured) = 2.70 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/05

System Check_B835_181105

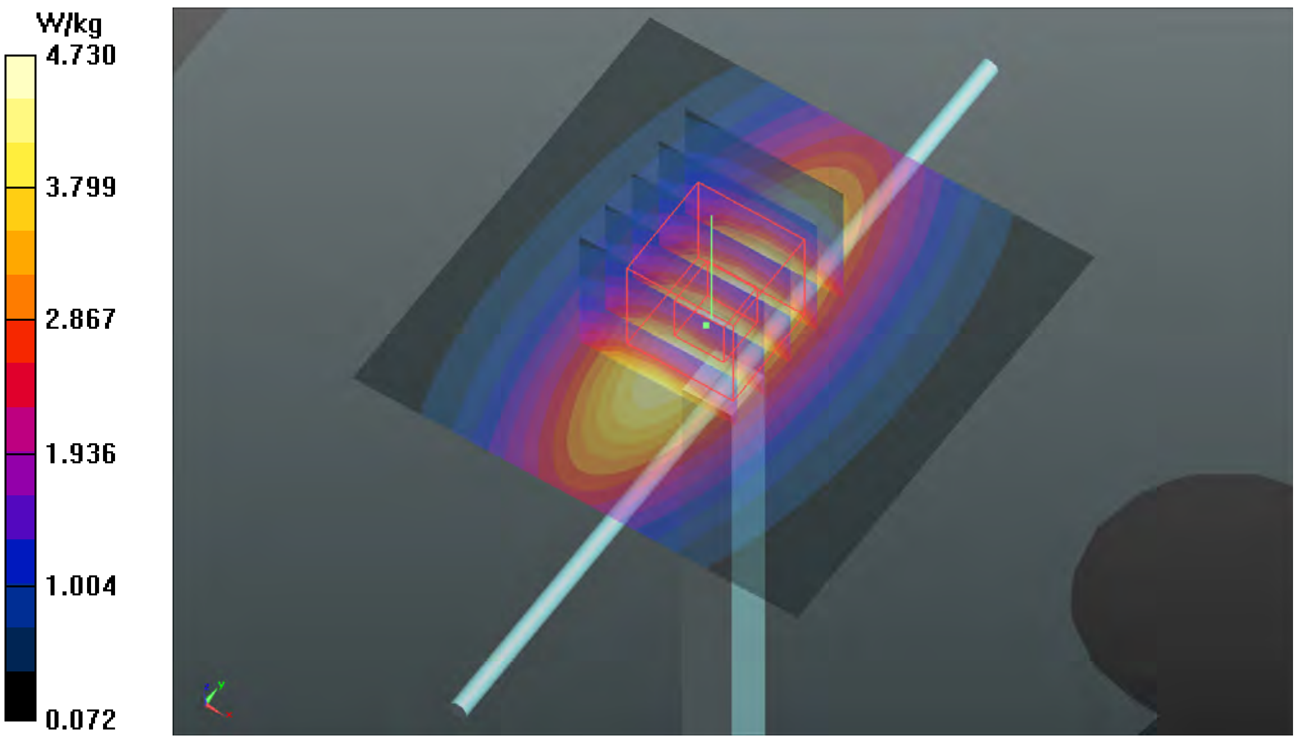
DUT: Dipole 835 MHz; Type: D835V2; SN: 4d121

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: B07T10N1_1105 Medium parameters used: f = 835 MHz; σ = 1.012 S/m; ε_r = 56.703; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(10.25, 10.25, 10.25); Calibrated: 2018/06/26
- Sensor-Surface: 1.4m (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 4.73 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 66.16 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 5.61 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 4.76 W/kg



System Check_B1750_181102

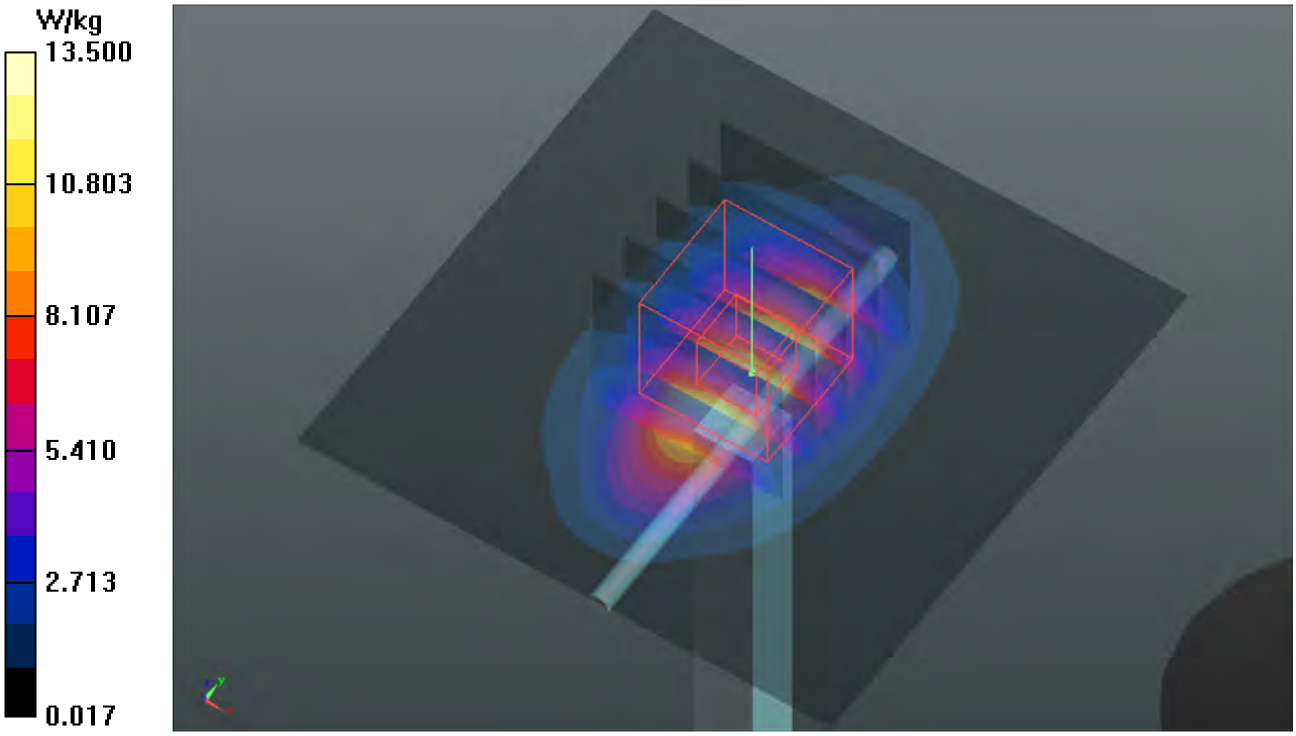
DUT: Dipole 1750 MHz; Type: D1750V2; SN: 1055

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: B16T20N1_1102 Medium parameters used: f = 1750 MHz; σ = 1.443 S/m; ε_r = 51.612; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(8.2, 8.2, 8.2); Calibrated: 2018/07/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2018/08/27
- Phantom: Twin SAM Phantom_1822; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.5 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 100.6 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 15.7 W/kg
SAR(1 g) = 8.87 W/kg; SAR(10 g) = 4.74 W/kg
Maximum value of SAR (measured) = 13.4 W/kg



System Check_B1900_181105

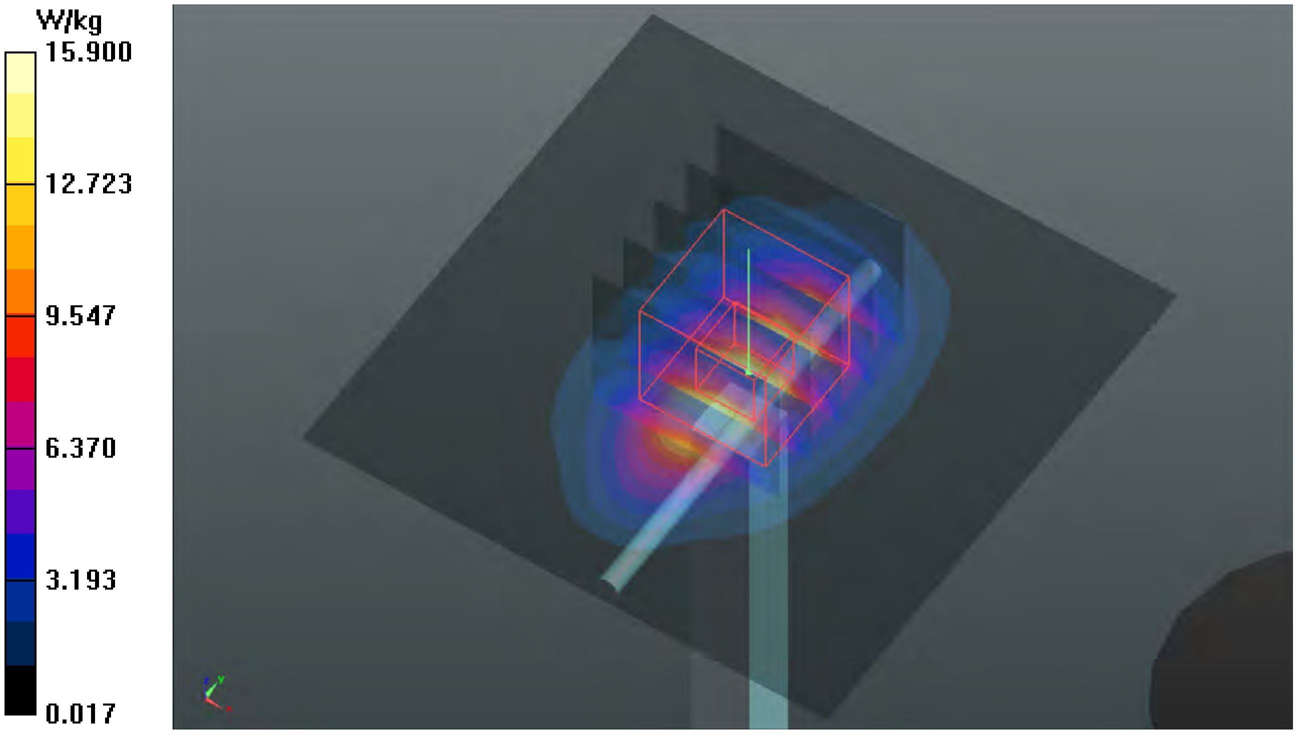
DUT: Dipole 1900 MHz; Type: D1900V2; SN: 5d036

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: B16T20N1_1105 Medium parameters used: f = 1900 MHz; σ = 1.574 S/m; ε_r = 52.296; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃；Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(7.97, 7.97, 7.97) ; Calibrated: 2018/06/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.9 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 102.6 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 19.0 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.35 W/kg
Maximum value of SAR (measured) = 16.1 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/02

System Check_B2300_181102

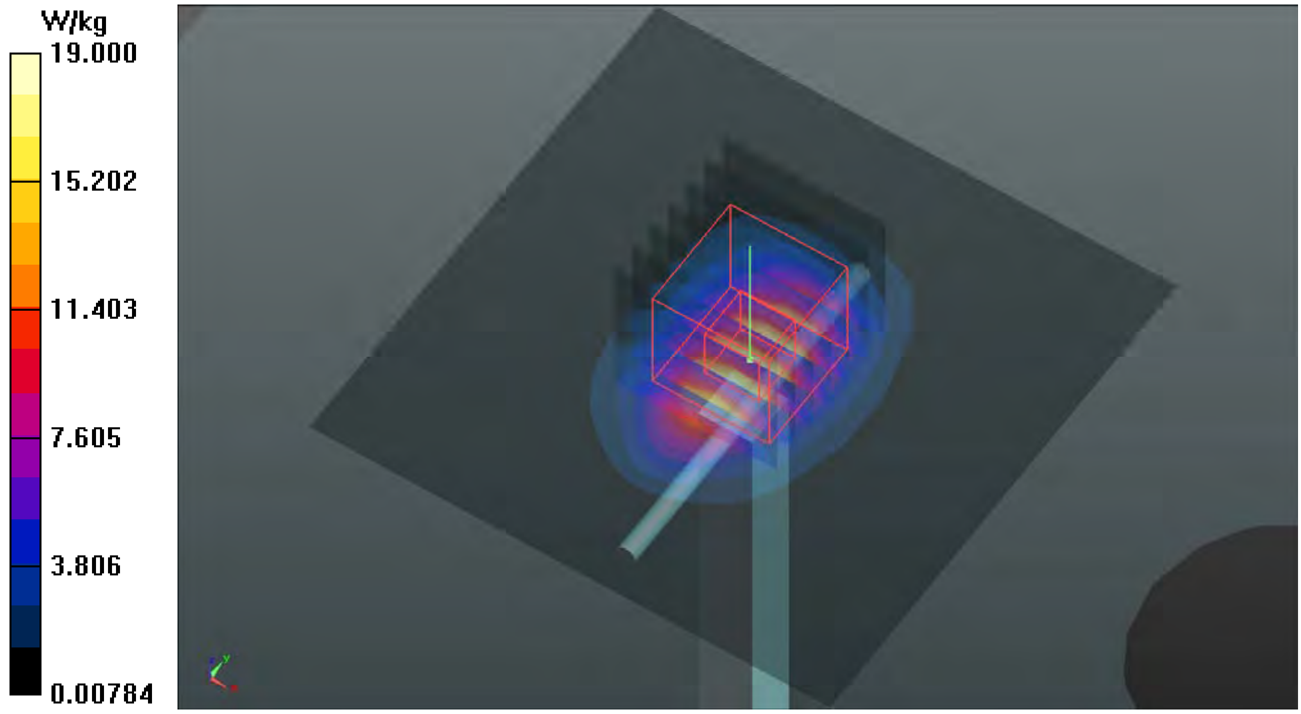
DUT: Dipole 2300 MHz; Type: D2300V2; SN:1004

Communication System: CW; Frequency: 2300 MHz;Duty Cycle: 1:1
Medium: B19T27N1_1102 Medium parameters used: f = 2300 MHz; σ = 1.849 S/m; ε_r = 51.991; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(7.77, 7.77, 7.77); Calibrated: 2018/07/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2018/08/27
- Phantom: Twin SAM Phantom_1822; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 19.0 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 22.8 W/kg
SAR(1 g) = 11.8 W/kg; SAR(10 g) = 5.68 W/kg
Maximum value of SAR (measured) = 19.0 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/15

System Check_B2450_181115

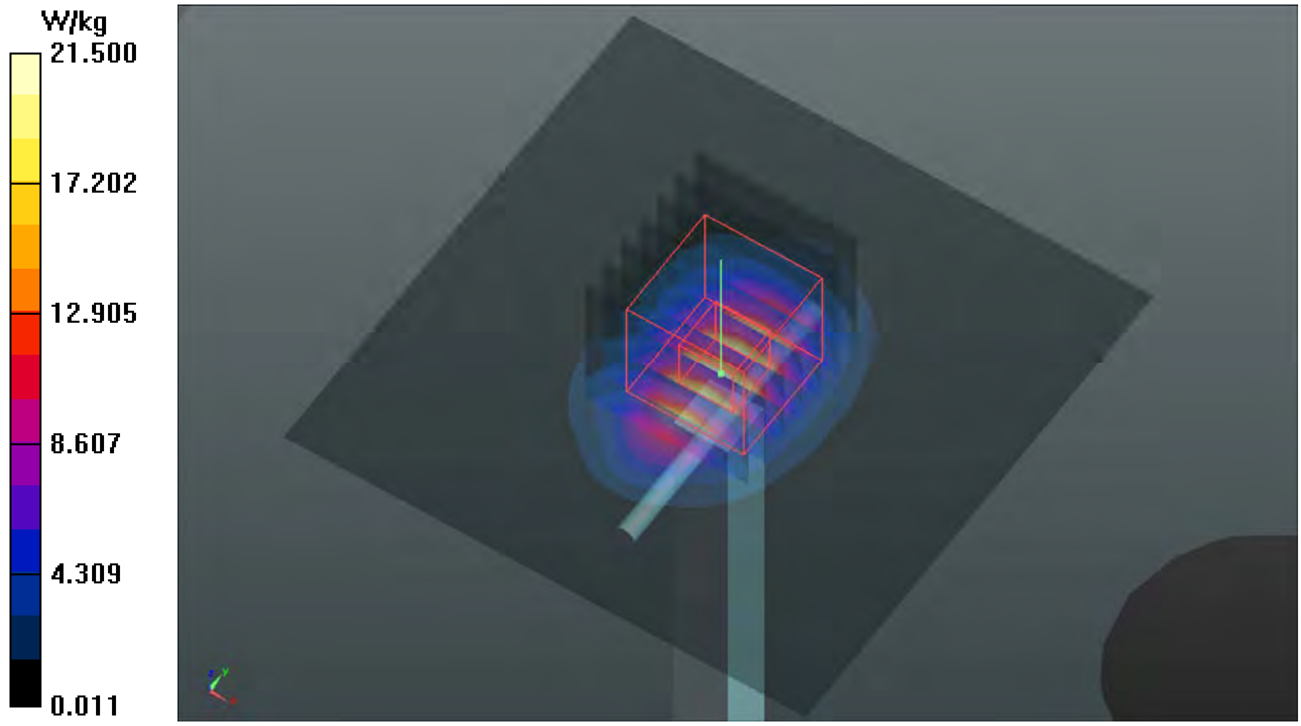
DUT: Dipole 2450 MHz; Type: D2450V2; SN: 737

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: B19T27N1_1115 Medium parameters used: f = 2450 MHz; σ = 2.017 S/m; ε_r = 51.297; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃；Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(7.84, 7.84, 7.84); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 21.5 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.3 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.82 W/kg
Maximum value of SAR (measured) = 21.7 W/kg



System Check_B5250_181115

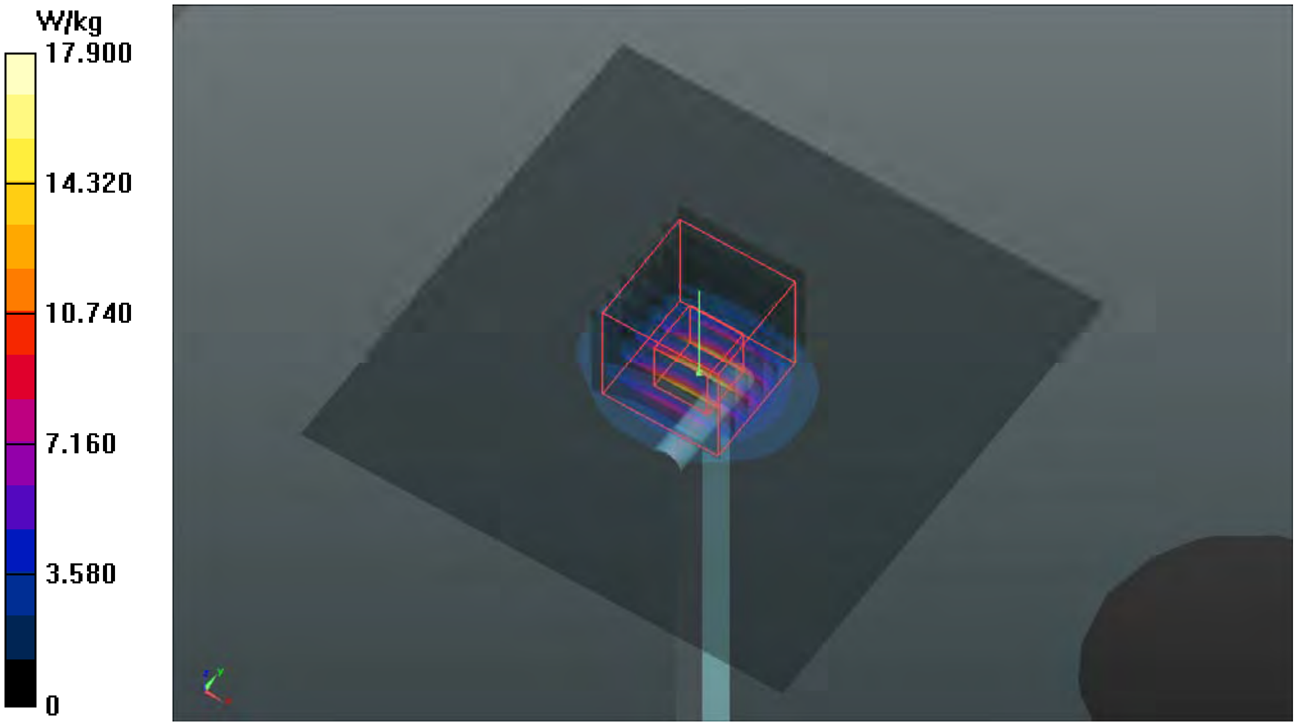
DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019

Communication System: CW; Frequency: 5250 MHz;Duty Cycle: 1:1
Medium: B34T60N2_1115 Medium parameters used: f = 5250 MHz; σ = 5.262 S/m; ε_r = 49.557; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃；Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(4.9, 4.9, 4.9); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=100mW/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.9 W/kg

Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 67.66 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.3 W/kg
SAR(1 g) = 7.68 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 19.7 W/kg



System Check_B5750_181115

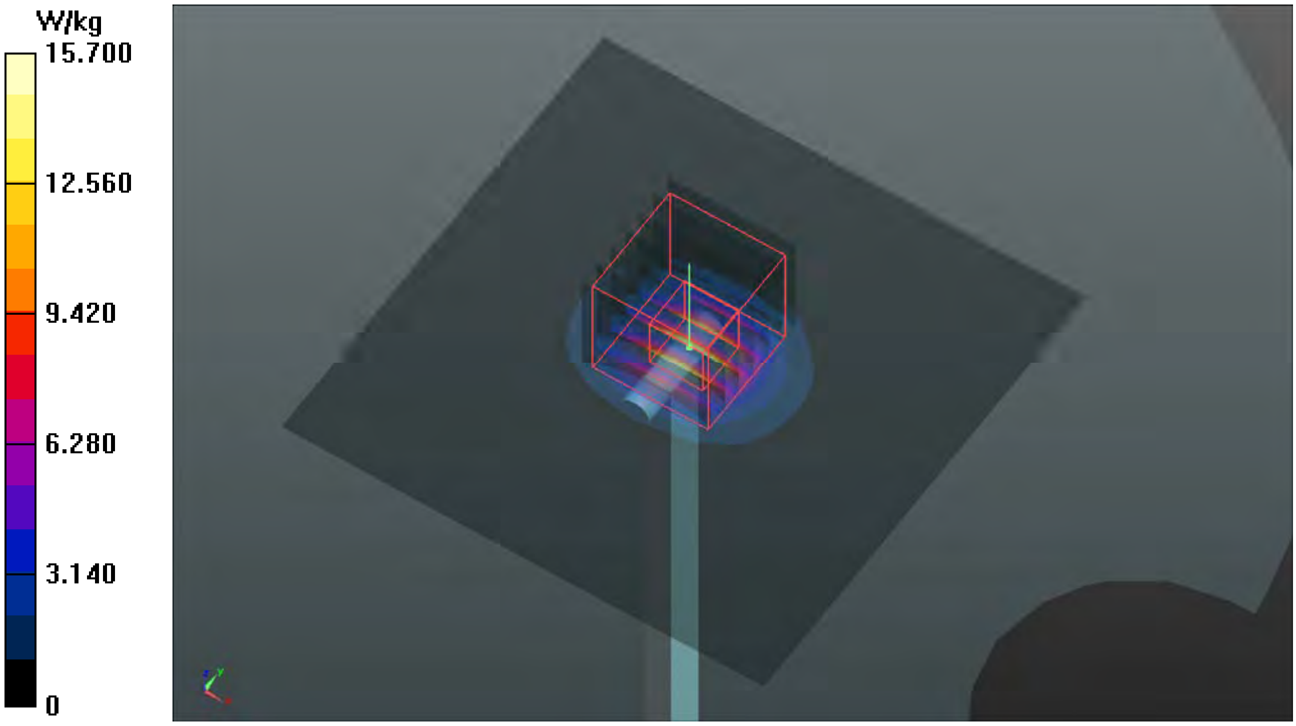
DUT: Dipole 5 GHz; Type: D5GHzV2; SN: 1019

Communication System: CW; Frequency: 5750 MHz;Duty Cycle: 1:1
Medium: B34T60N2_1115 Medium parameters used: f = 5750 MHz; σ = 5.918 S/m; ε_r = 48.809; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(4.56, 4.56, 4.56); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

Pin=100mW/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 15.7 W/kg

Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 51.55 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 6.99 W/kg; SAR(10 g) = 1.99 W/kg
Maximum value of SAR (measured) = 17.9 W/kg



Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/05

P01 LTE 2_QPSK20M_Front Face_10mm_Ch18700_1RB_OS0

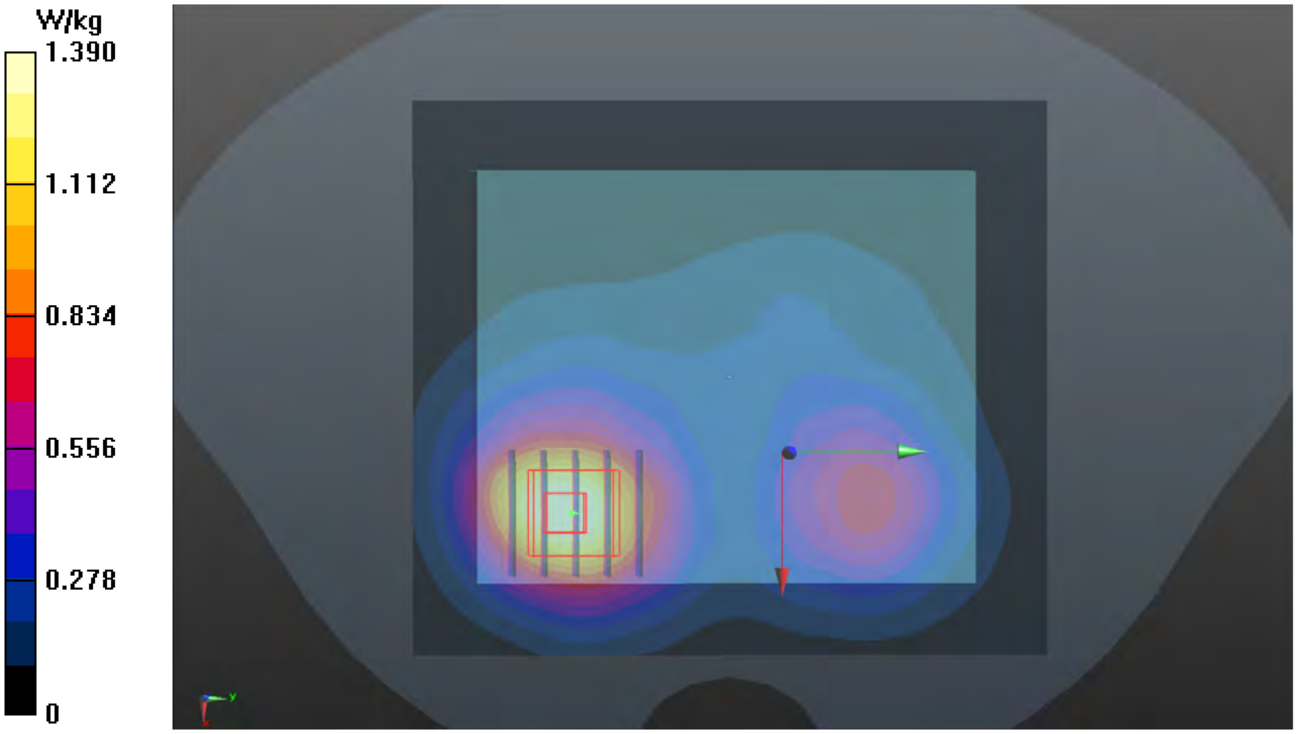
DUT: 181015C09

Communication System: LTE; Frequency: 1860 MHz;Duty Cycle: 1:1
Medium: B16T20N1_1105 Medium parameters used: f = 1860 MHz; σ = 1.54 S/m; ε_r = 52.418; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(7.97, 7.97, 7.97) ; Calibrated: 2018/06/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.39 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.03 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.73 W/kg
SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.660 W/kg
Maximum value of SAR (measured) = 1.49 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab   Date: 2018/11/05

P02 LTE 5_QPSK10M_Rear Face_10mm_Ch20525_1RB_OS0

DUT: 181015C09

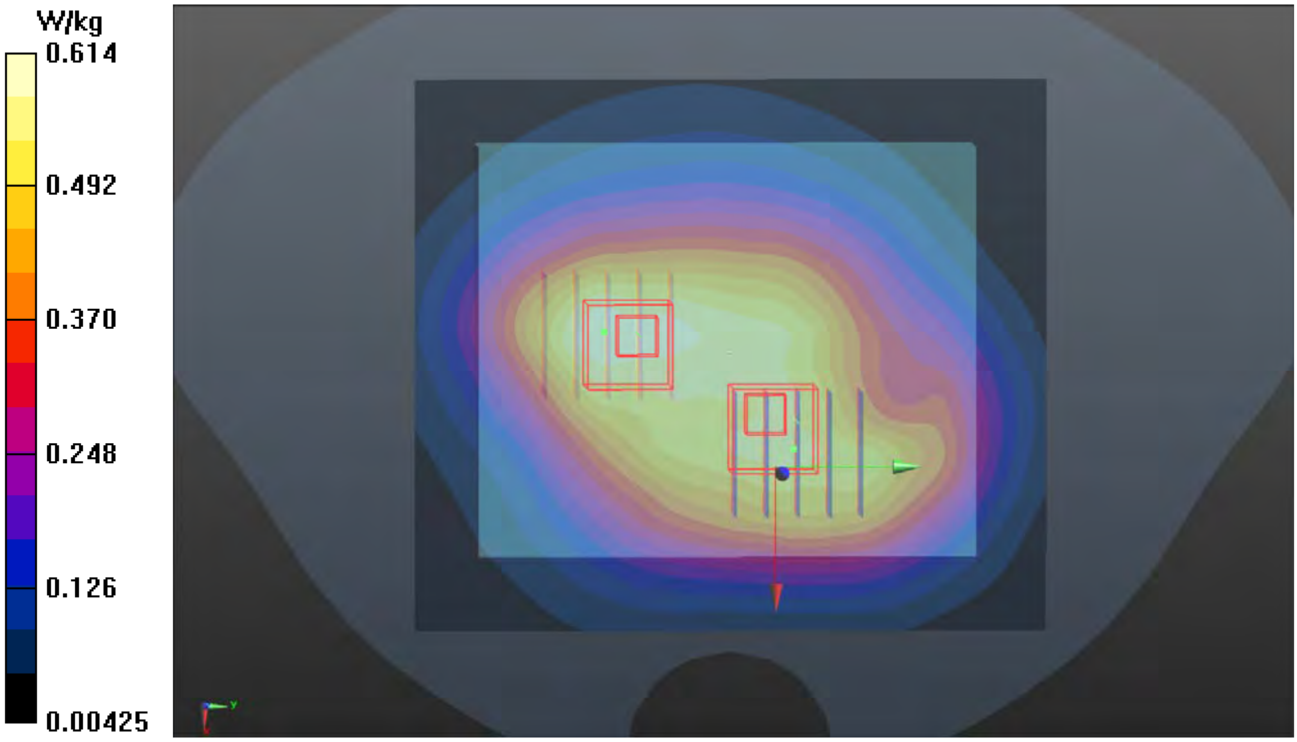
Communication System: LTE; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: B07T10N1_1105 Medium parameters used: f = 836.5 MHz; σ = 1.013 S/m; ε_r = 56.682; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(10.25, 10.25, 10.25); Calibrated: 2018/06/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.614 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.89 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.624 W/kg
SAR(1 g) = 0.489 W/kg; SAR(10 g) = 0.375 W/kg
Maximum value of SAR (measured) = 0.585 W/kg

- Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.89 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.594 W/kg
SAR(1 g) = 0.449 W/kg; SAR(10 g) = 0.340 W/kg
Maximum value of SAR (measured) = 0.545 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab   Date: 2018/11/05

P03 LTE 12_QPSK10M_Rear Face_10mm_Ch23095_1RB_OS0

DUT: 181015C09

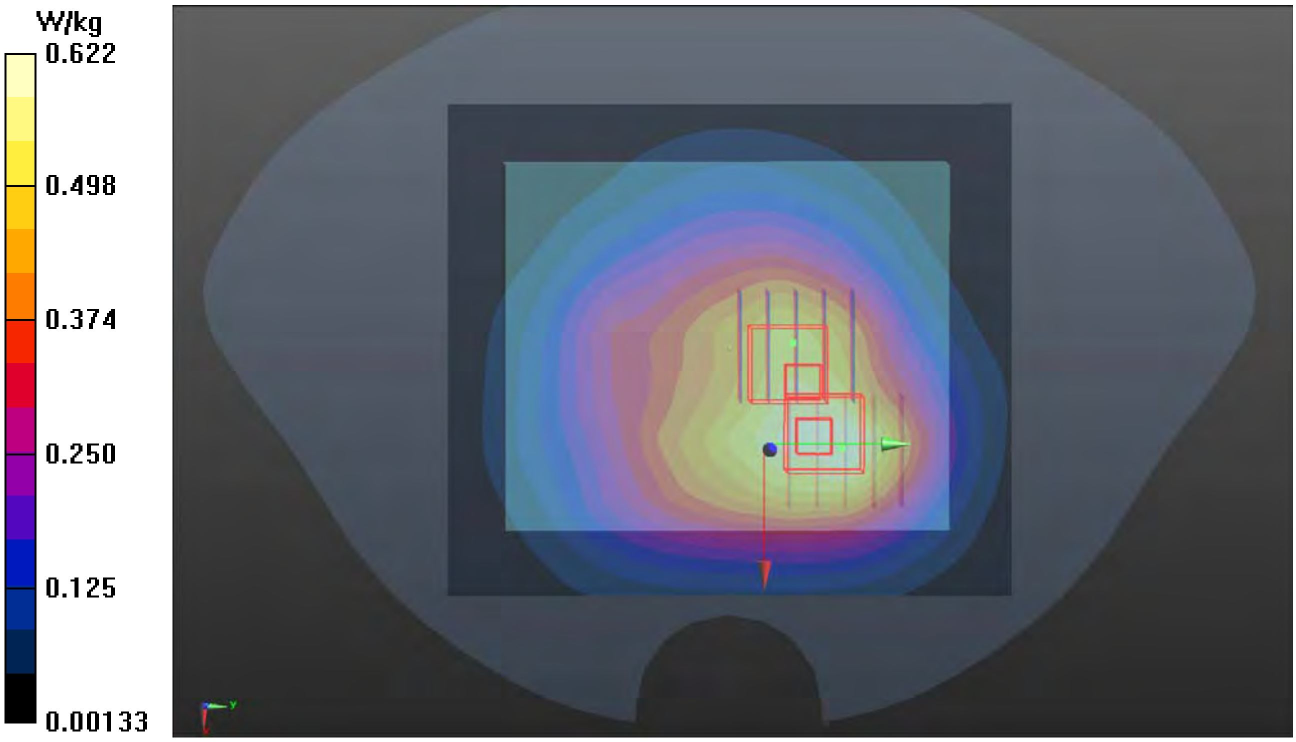
Communication System: LTE; Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium: B06T09N1_1105 Medium parameters used: f = 707.5 MHz; σ = 0.938 S/m; ε_r = 55.47; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(10.28, 10.28, 10.28); Calibrated: 2018/06/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.622 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.07 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.678 W/kg
SAR(1 g) = 0.497 W/kg; SAR(10 g) = 0.358 W/kg
Maximum value of SAR (measured) = 0.611 W/kg

- Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.07 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.615 W/kg
SAR(1 g) = 0.464 W/kg; SAR(10 g) = 0.353 W/kg
Maximum value of SAR (measured) = 0.567 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/05

P04 LTE 14_QPSK10M_Rear Face_10mm_Ch23330_1RB_OS0

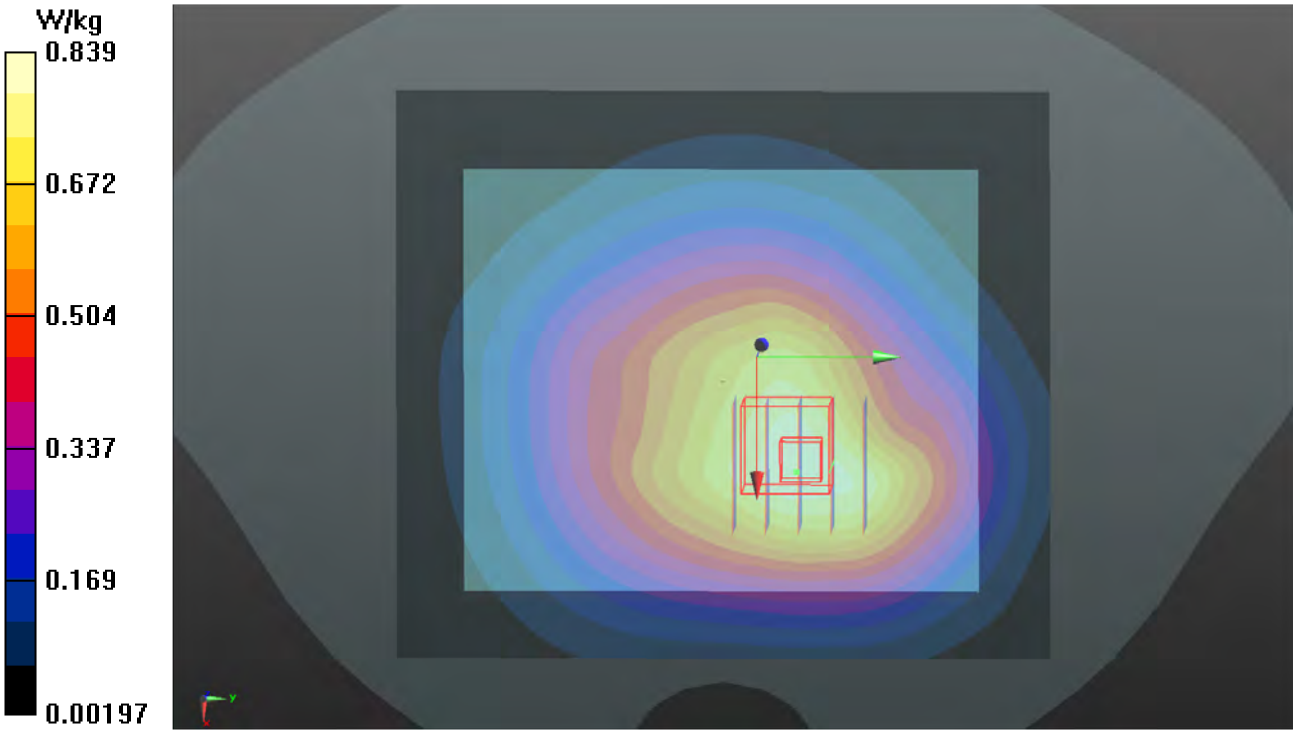
DUT: 181015C09

Communication System: LTE; Frequency: 793 MHz;Duty Cycle: 1:1
Medium: B07T10N1_1105 Medium parameters used: f = 793 MHz; $\sigma = 0.975$ S/m; $\varepsilon_r = 57.019$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3898; ConvF(10.28, 10.28, 10.28) ; Calibrated: 2018/06/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1277; Calibrated: 2018/01/18
- Phantom: Twin SAM Phantom_1496; Type: QD000P40CA;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.839 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.21 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.903 W/kg
SAR(1 g) = 0.674 W/kg; SAR(10 g) = 0.500 W/kg
Maximum value of SAR (measured) = 0.821 W/kg



P05 LTE 30_QPSK10M_Front Face_10mm_Ch27710_1RB_OS49

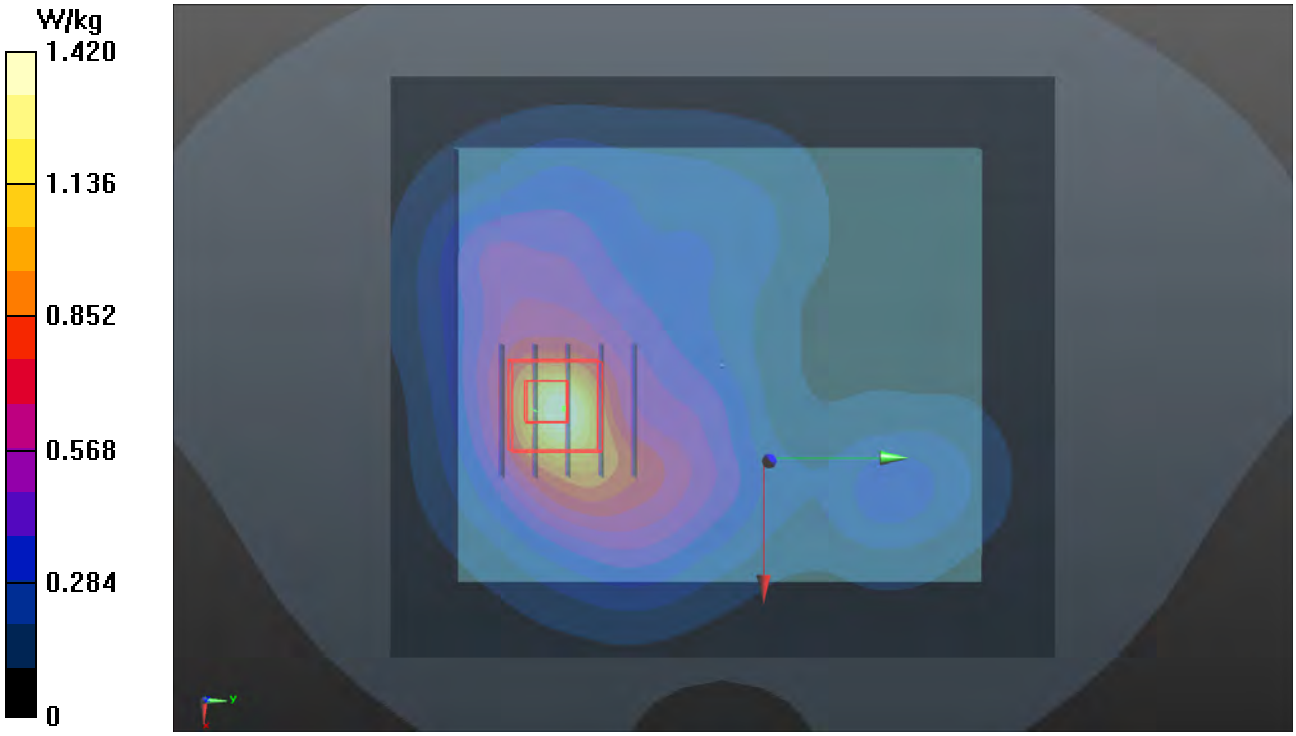
DUT: 181015C09

Communication System: LTE; Frequency: 2310 MHz;Duty Cycle: 1:1
Medium: B19T27N1_1102 Medium parameters used: f = 2310 MHz; σ = 1.859 S/m; ε_r = 51.962; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.1 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(7.77, 7.77, 7.77); Calibrated: 2018/07/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2018/08/27
- Phantom: Twin SAM Phantom_1822; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (121x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.42 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.95 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.70 W/kg
SAR(1 g) = 0.938 W/kg; SAR(10 g) = 0.486 W/kg
Maximum value of SAR (measured) = 1.40 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/02

P06 LTE 66_QPSK20M_Front Face_10mm_Ch132322_1RB_OS0

DUT: 181015C09

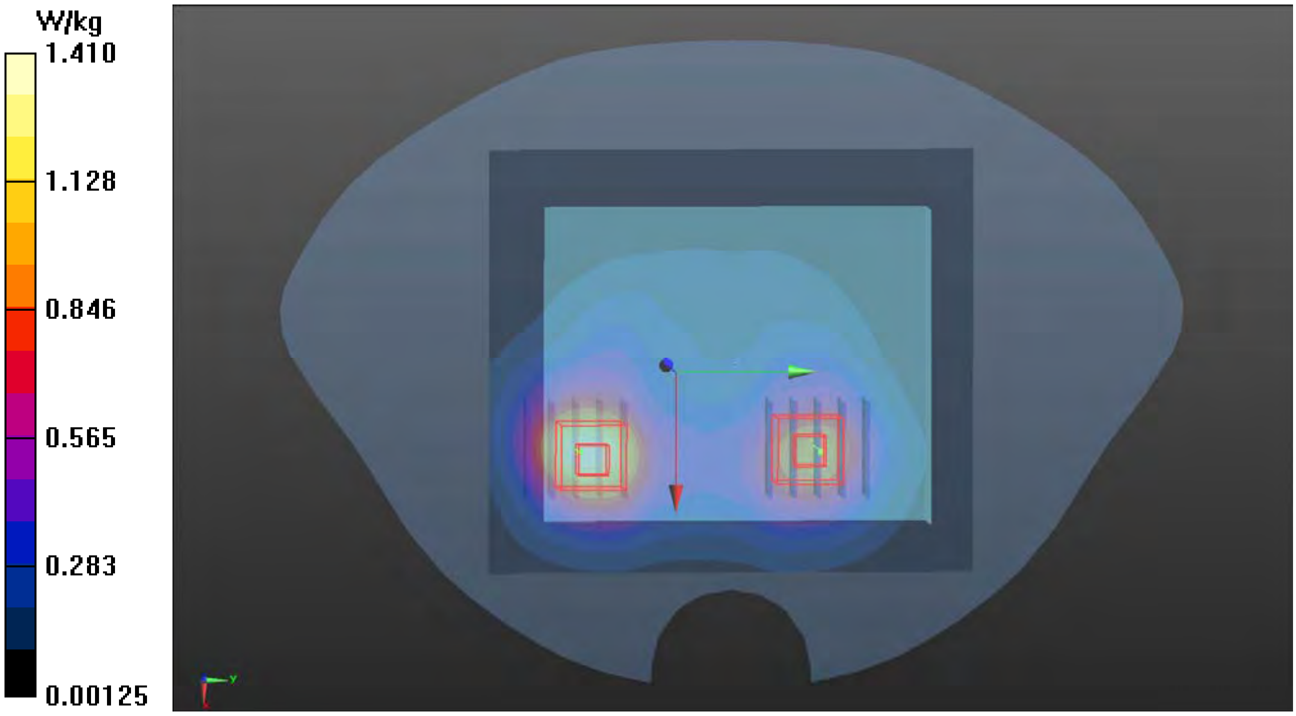
Communication System: LTE; Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: B16T20N1_1102 Medium parameters used: f = 1745 MHz; σ = 1.438 S/m; ε_r = 51.619; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3650; ConvF(8.2, 8.2, 8.2); Calibrated: 2018/07/27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2018/08/27
- Phantom: Twin SAM Phantom_1822; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.41 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.35 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.64 W/kg
SAR(1 g) = 1 W/kg; SAR(10 g) = 0.602 W/kg
Maximum value of SAR (measured) = 1.36 W/kg

- Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.35 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.708 W/kg; SAR(10 g) = 0.447 W/kg
Maximum value of SAR (measured) = 0.946 W/kg



P07 WLAN2.4G_802.11b_Right Side_10mm_Ch6_Ant1

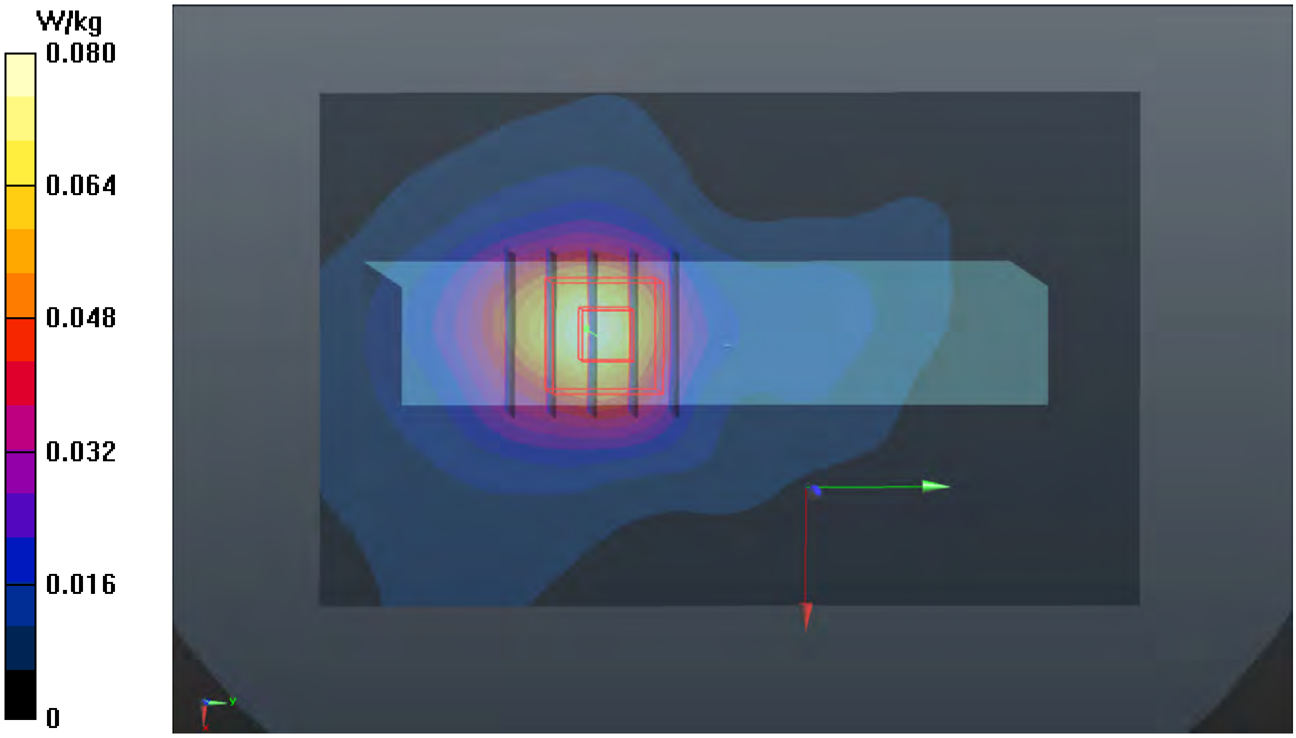
DUT: 181015C09

Communication System: WLAN_2.4G; Frequency: 2437 MHz;Duty Cycle: 1:1.01
Medium: B19T27N1_1115 Medium parameters used: f = 2437 MHz; σ = 2.003 S/m; ε_r = 51.331; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(7.84, 7.84, 7.84); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (91x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0798 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.262 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.104 W/kg
SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.028 W/kg
Maximum value of SAR (measured) = 0.0838 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/15

P08 WLAN5.2G_802.11ac VHT80_Top Side_10mm_Ch42_Ant0

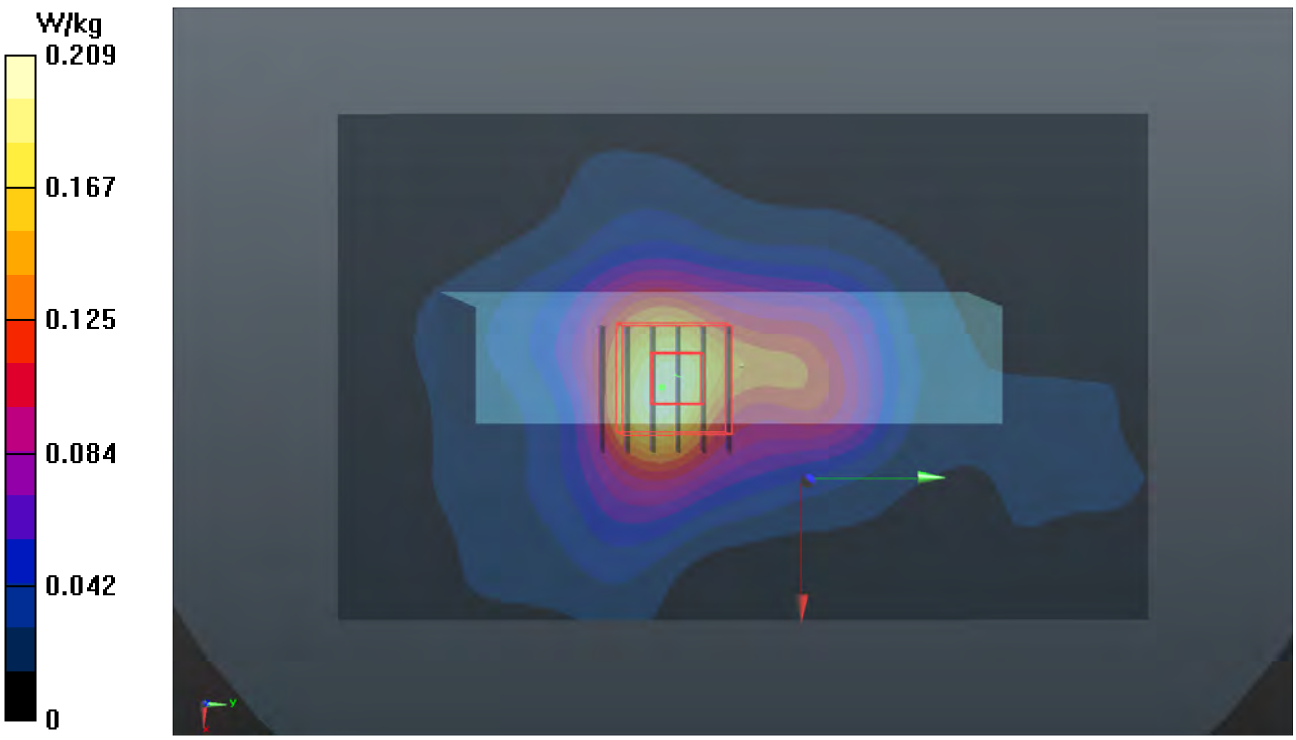
DUT: 181015C09

Communication System: WLAN_5G; Frequency: 5210 MHz;Duty Cycle: 1:1.06
Medium: B34T60N2_1115 Medium parameters used: f = 5210 MHz; σ = 5.21 S/m; ε_r = 49.619; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃； Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(4.9, 4.9, 4.9); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.209 W/kg

- Zoom Scan (6x6x12)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm
Reference Value = 6.810 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.388 W/kg
SAR(1 g) = 0.119 W/kg; SAR(10 g) = 0.048 W/kg
Maximum value of SAR (measured) = 0.241 W/kg



Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab Date: 2018/11/15

P09 WLAN5.8G_802.11ac VHT80_Front Face_10mm_Ch155_Ant0

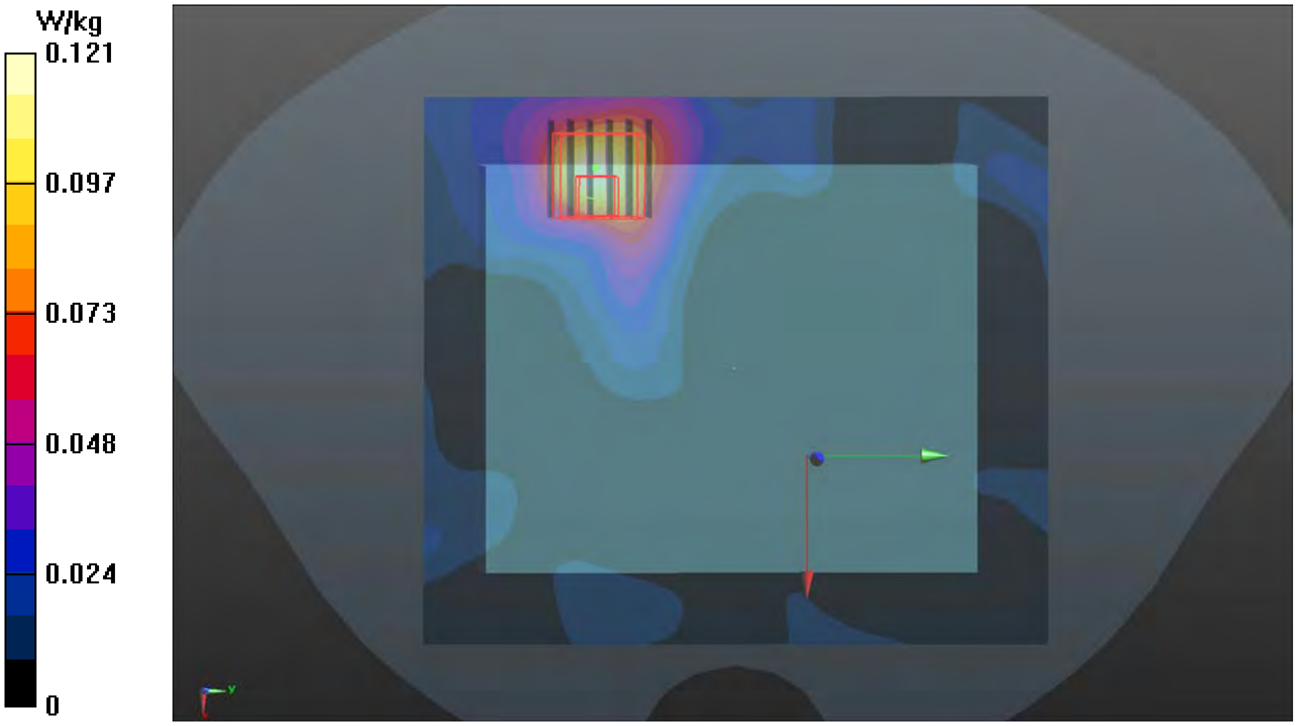
DUT: 181015C09

Communication System: WLAN_5G; Frequency: 5775 MHz;Duty Cycle: 1:1.06
Medium: B34T60N2_1115 Medium parameters used: f = 5775 MHz; σ = 5.954 S/m; ε_r = 48.775; ρ = 1000 kg/m^3
Ambient Temperature：23.7 ℃；Liquid Temperature：23.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7472; ConvF(4.56, 4.56, 4.56); Calibrated: 2018/08/29
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn861; Calibrated: 2018/05/30
- Phantom: Twin SAM Phantom_1823; Type: QD000P40CD;
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

- Area Scan (141x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.121 W/kg

- Zoom Scan (6x6x12)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm
Reference Value = 5.059 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.273 W/kg
SAR(1 g) = 0.063 W/kg; SAR(10 g) = 0.021 W/kg
Maximum value of SAR (measured) = 0.149 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.

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 **B.V.ADT (Auden)**

Certificate No: D750V3-1013_Aug18

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1013
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2018

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: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 24, 2018

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:

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"

Additional Documentation:

e) 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	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.89 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	2.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.15 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.30 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	0.96 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	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.62 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.71 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 0.1 jΩ
Return Loss	- 28.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.6 Ω - 3.1 jΩ
Return Loss	- 29.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.035 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	March 22, 2010

DASY5 Validation Report for Head TSL

Date: 22.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1013

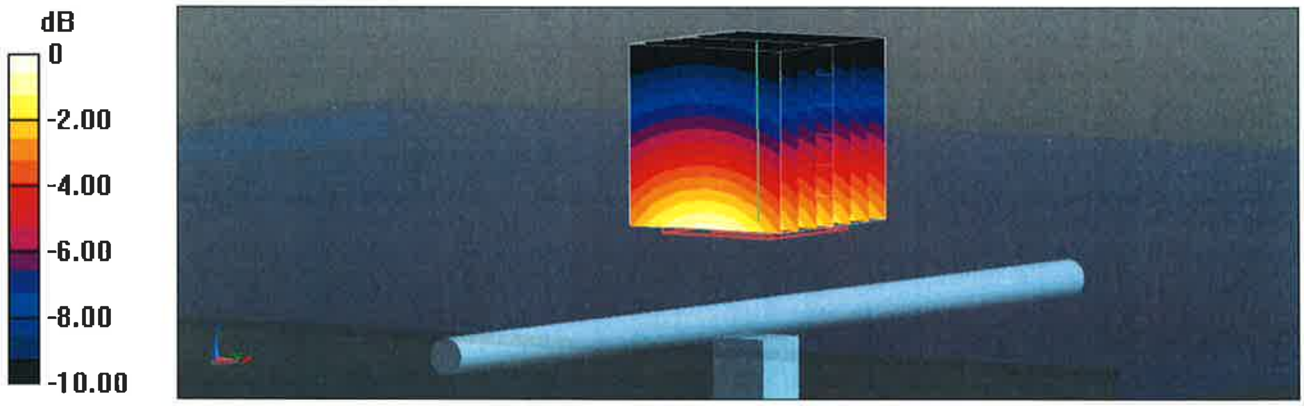
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.22, 10.22, 10.22) @ 750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

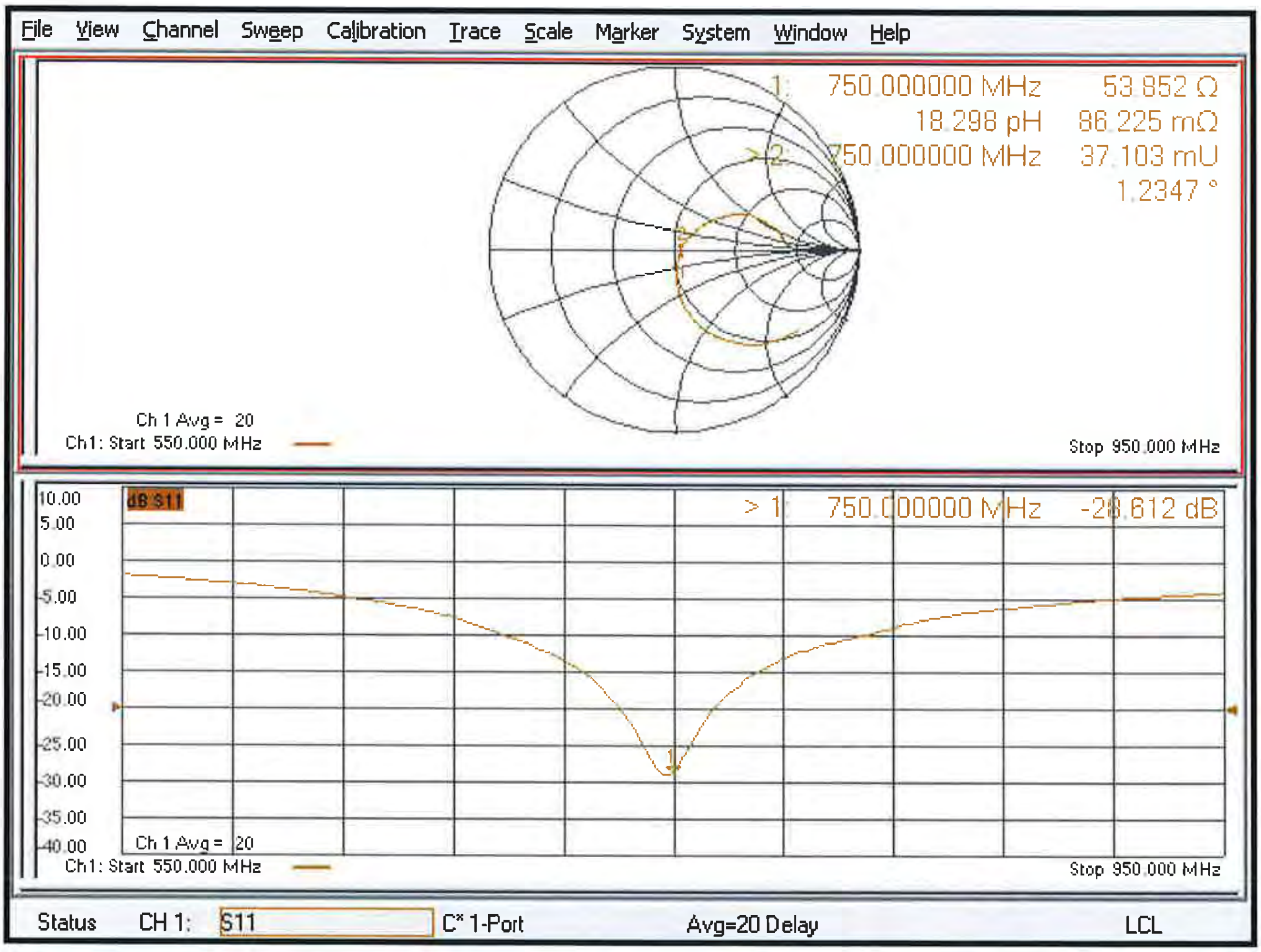
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.09 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.09 W/kg
SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.33 W/kg
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1013

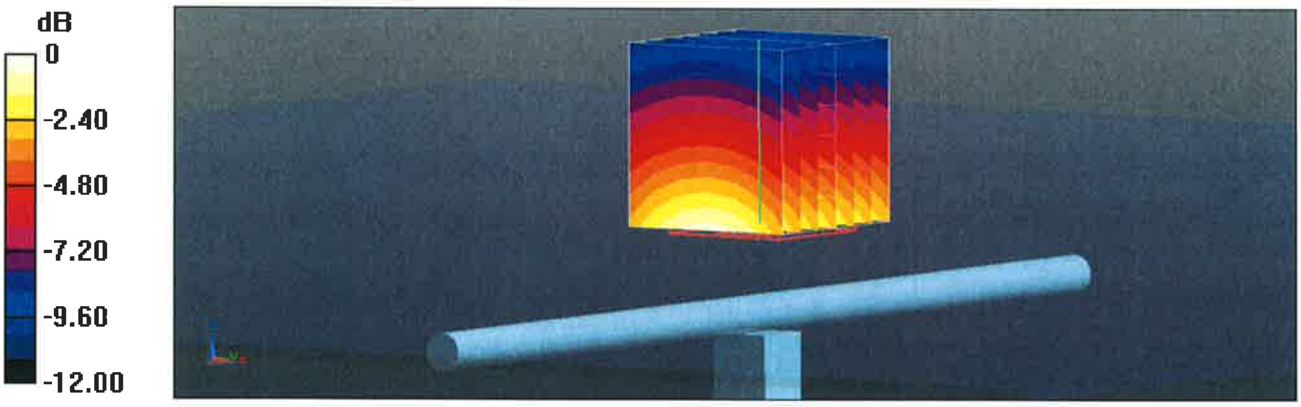
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.96 S/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.19, 10.19, 10.19) @ 750 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

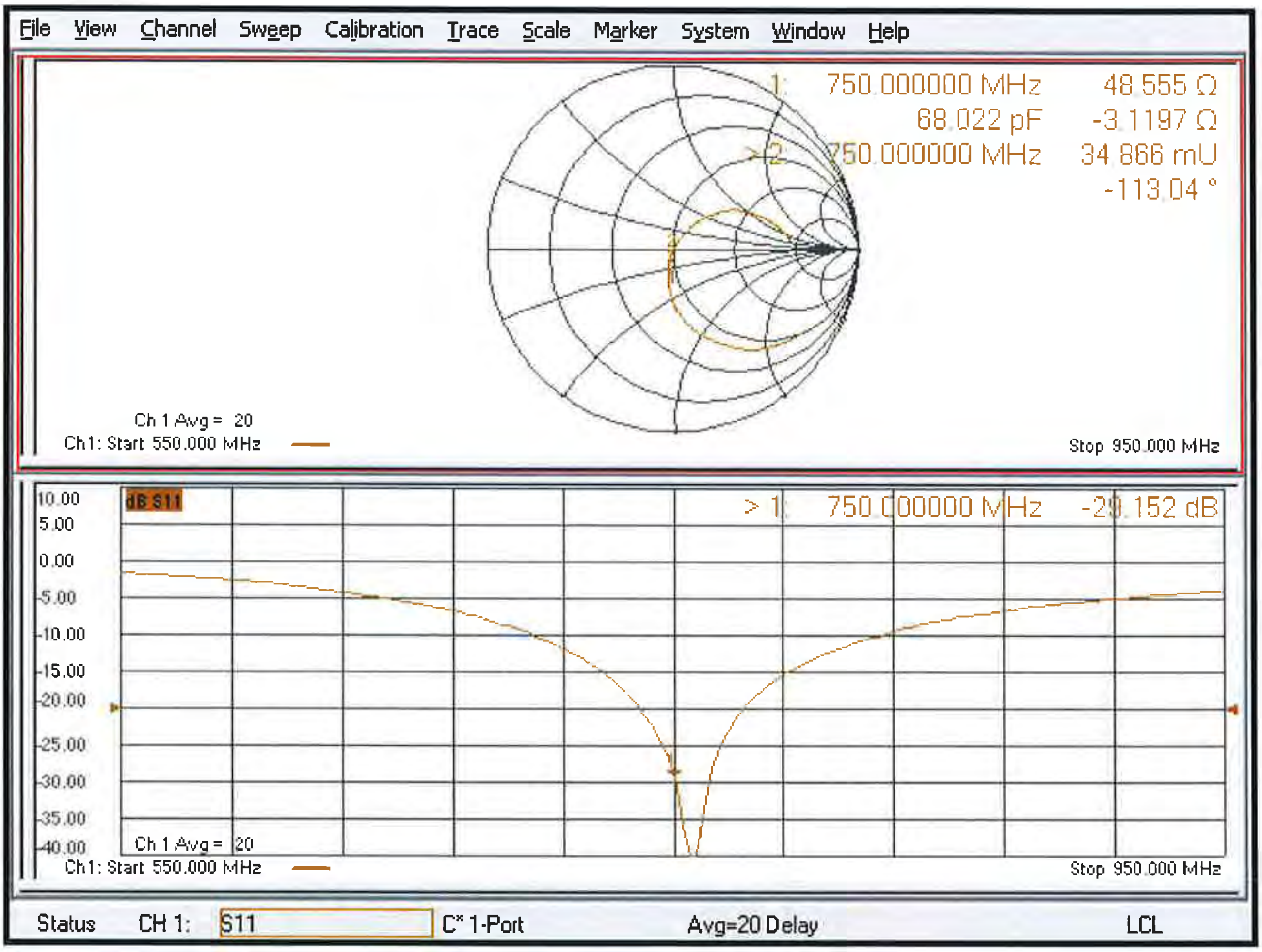
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.93 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.43 W/kg
Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

Impedance Measurement Plot for Body TSL



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 **B.V.ADT (Auden)**

Certificate No: D835V2-4d121_Aug18

CALIBRATION CERTIFICATE

Object	D835V2 - SN:4d121
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2018

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: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 24, 2018

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:

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"

Additional Documentation:

e) 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	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.7 ± 6 %	0.92 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	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.44 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.10 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.99 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	2.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.64 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.32 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.3 Ω - 2.3 jΩ
Return Loss	- 31.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω - 5.4 jΩ
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 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	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 22.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

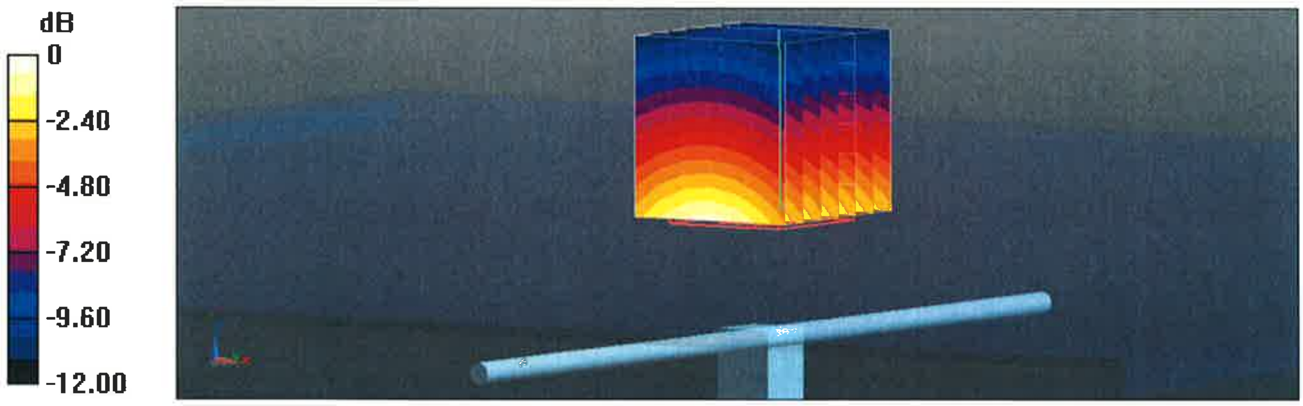
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d121

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.92$ S/m; $\varepsilon_r = 40.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

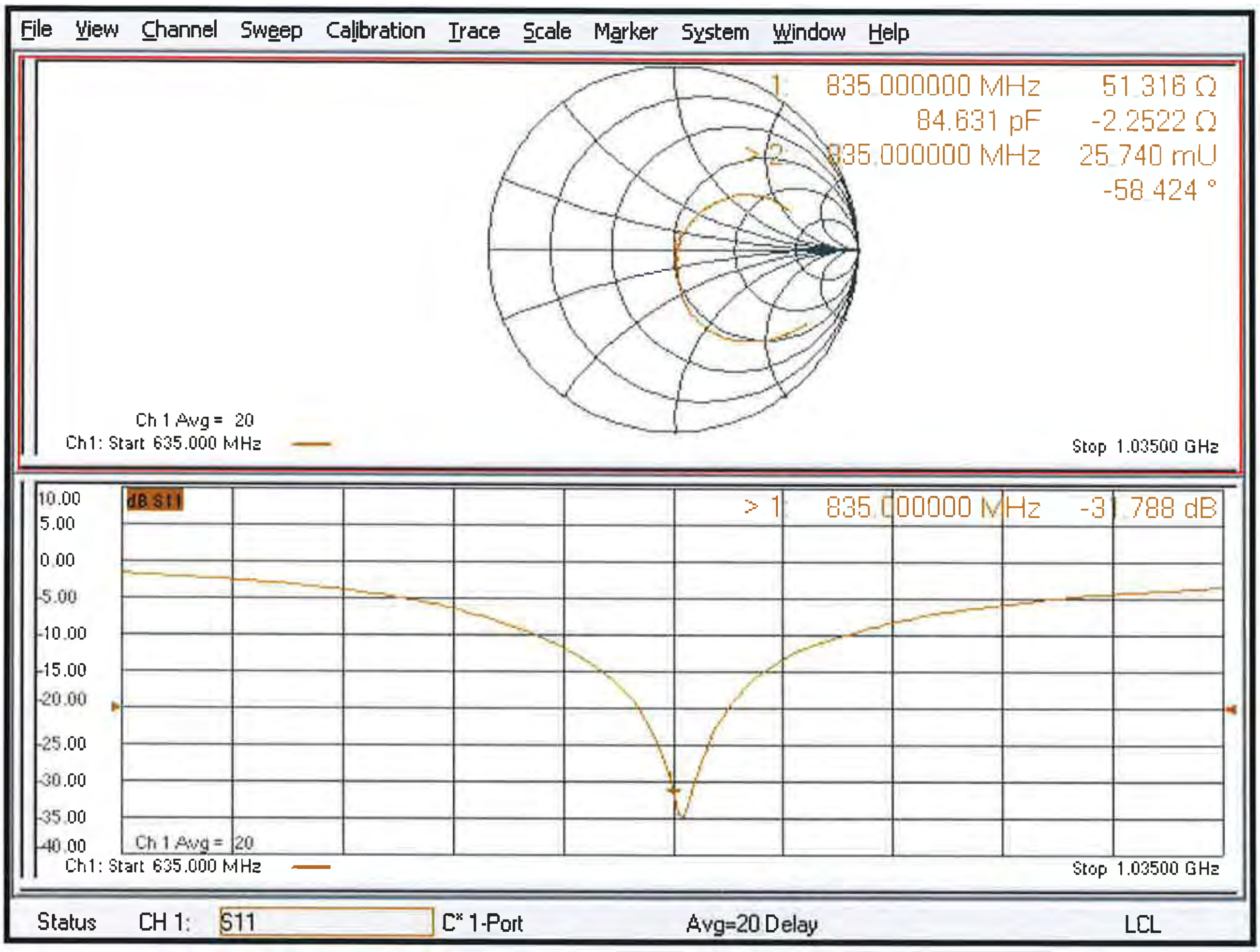
- Probe: EX3DV4 - SN7349; ConvF(9.9, 9.9, 9.9) @ 835 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.11 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 3.70 W/kg
SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d121

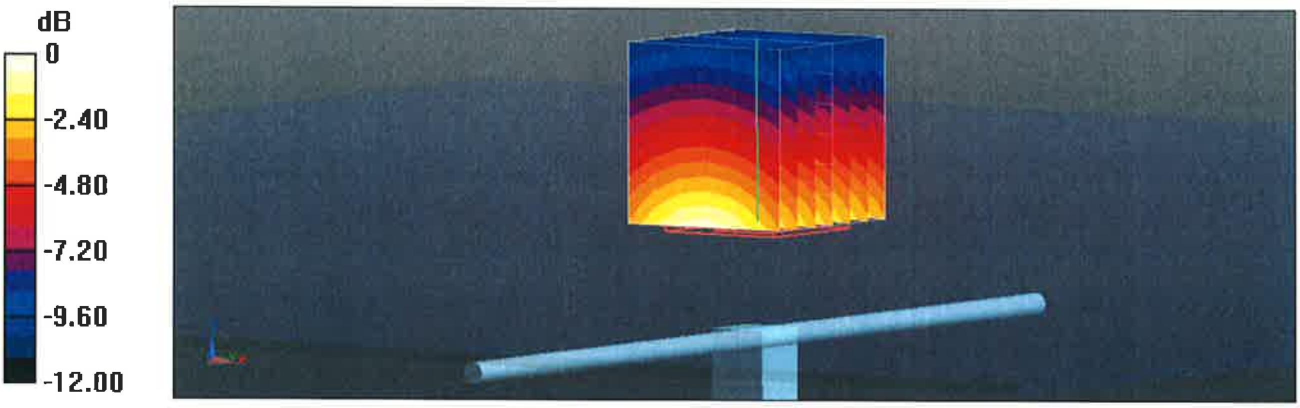
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.05, 10.05, 10.05) @ 835 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

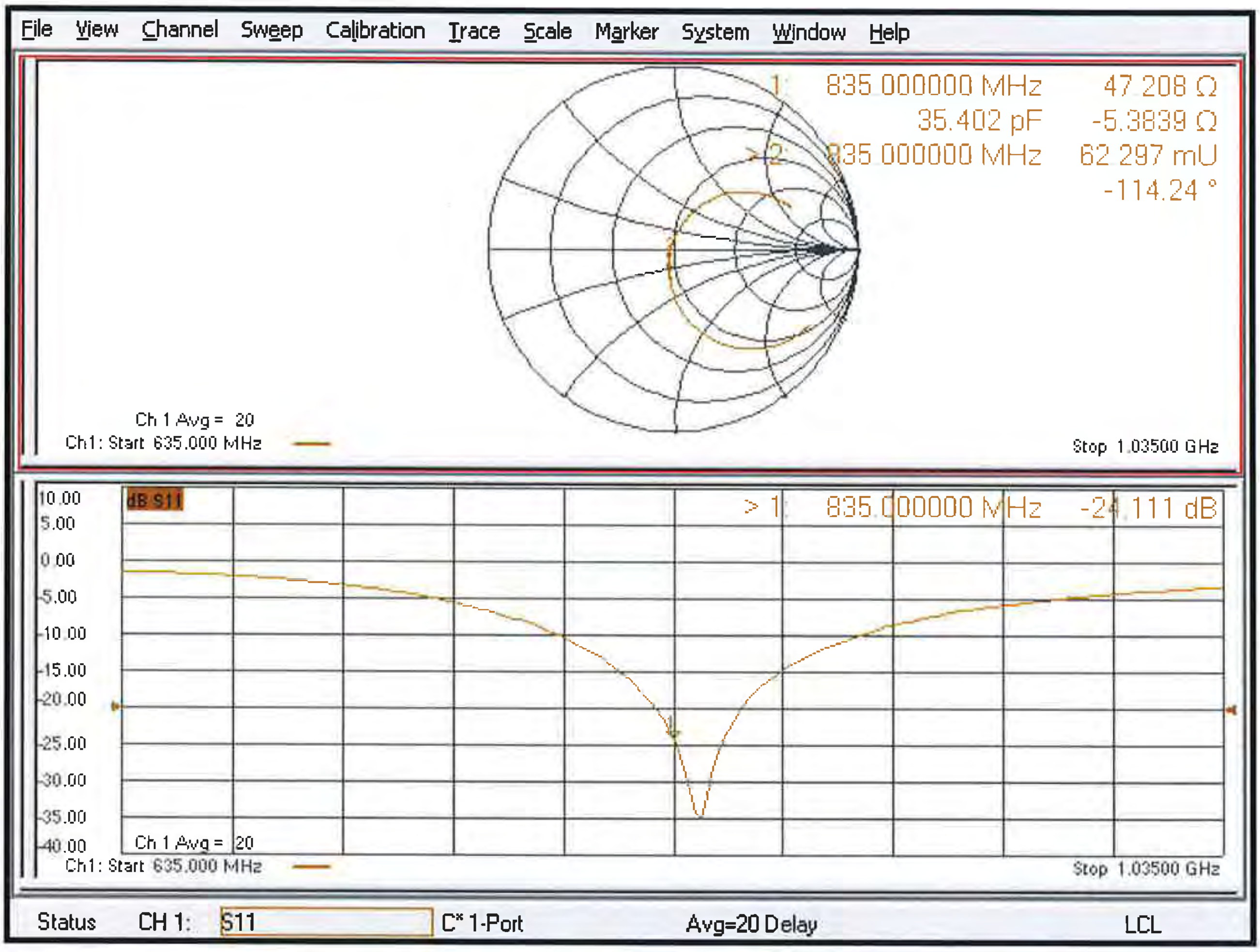
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 61.20 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.64 W/kg
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

Impedance Measurement Plot for Body TSL



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

Client **B.V. ADT (Auden)**

Certificate No: D1750V2-1055_Aug18

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1055
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 27, 2018

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: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 28, 2018

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:

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"

Additional Documentation:

e) 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	V52.10.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.34 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	9.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.3 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.47 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	9.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**36.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 Ω + 2.1 jΩ
Return Loss	- 29.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3 Ω + 0.5 jΩ
Return Loss	- 31.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.223 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	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 27.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1055

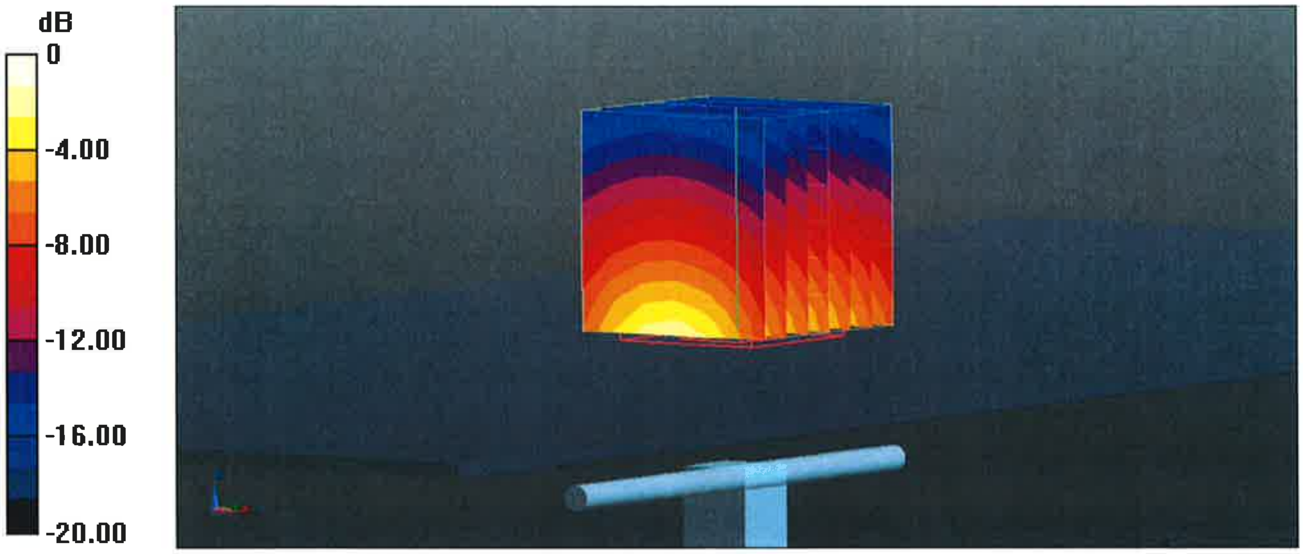
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; $\sigma = 1.34$ S/m; $\varepsilon_r = 38.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.5, 8.5, 8.5) @ 1750 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)

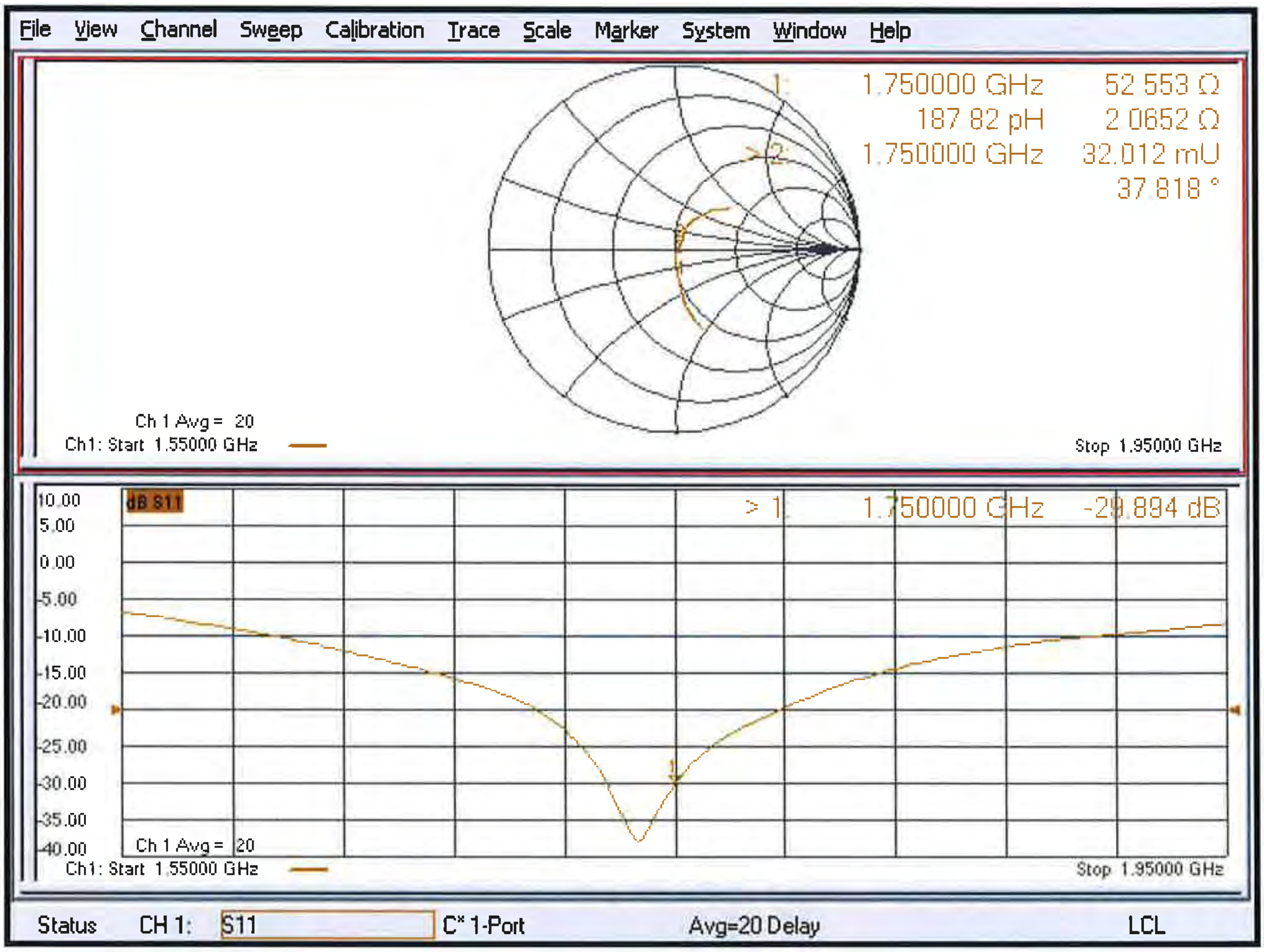
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.6 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 9.15 W/kg; SAR(10 g) = 4.81 W/kg
Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 27.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1055

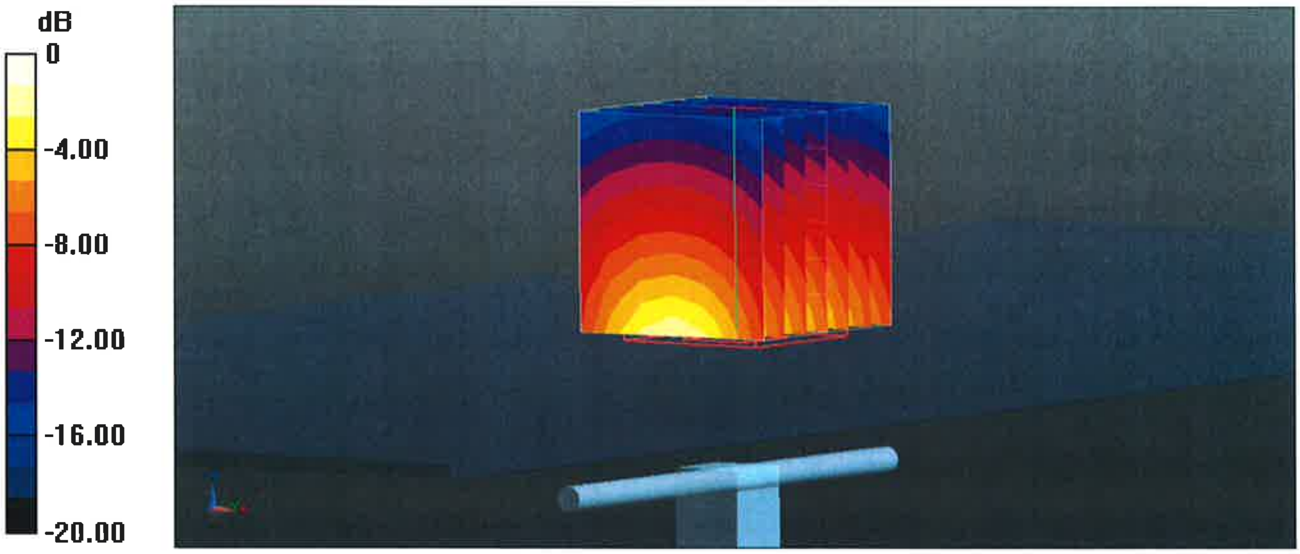
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.35, 8.35, 8.35) @ 1750 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)

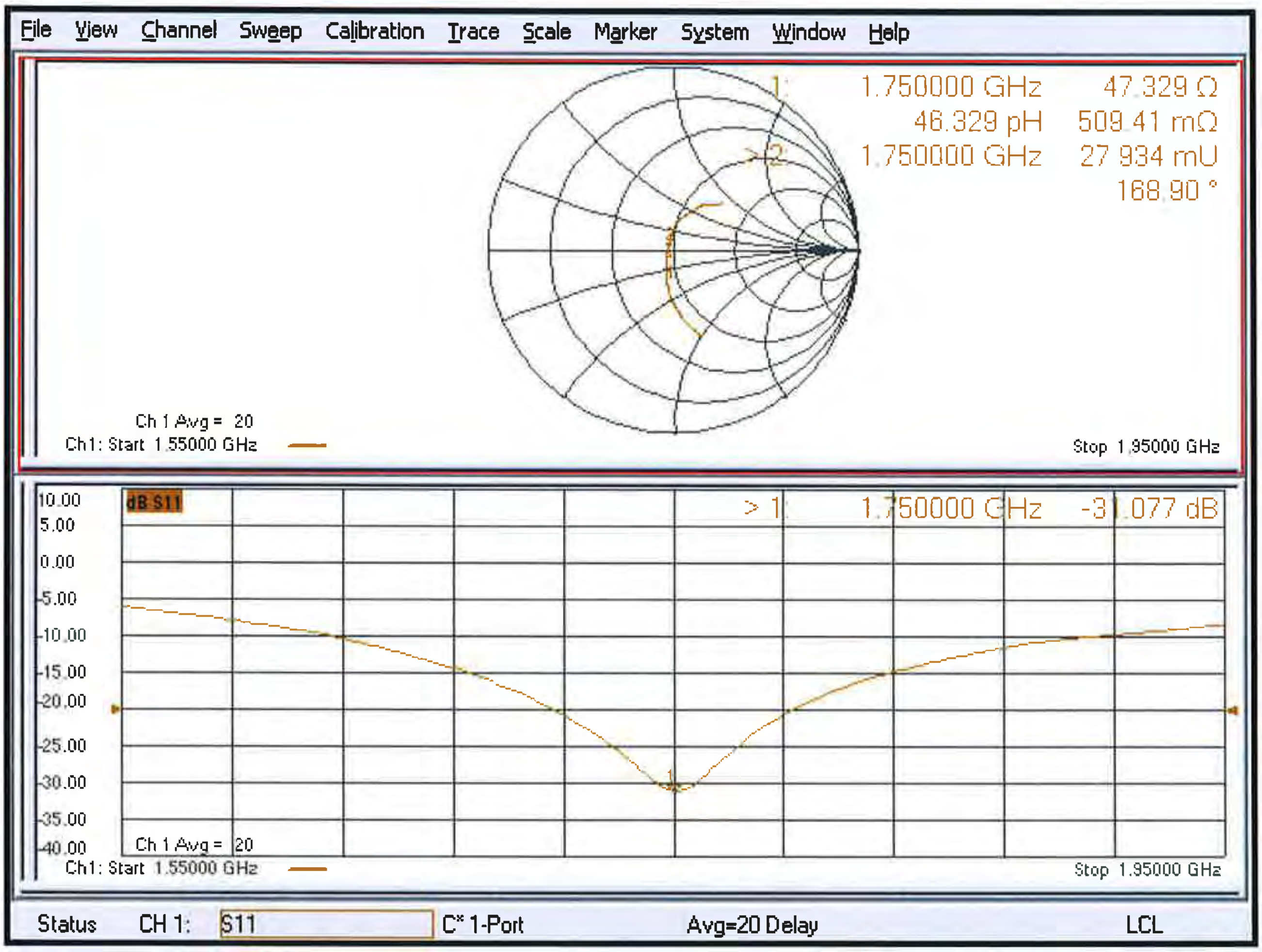
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.2 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.15 W/kg; SAR(10 g) = 4.89 W/kg
Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Impedance Measurement Plot for Body TSL



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 **B.V. ADT (Auden)**

Certificate No: D1900V2-5d036_Jan18

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d036
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 18, 2018

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-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: January 18, 2018

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

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:

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"

Additional Documentation:

e) 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	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.39 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.2 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	1.46 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	9.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.3 Ω + 5.2 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω + 5.9 jΩ
Return Loss	- 23.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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	May 08, 2003

DASY5 Validation Report for Head TSL

Date: 18.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d036

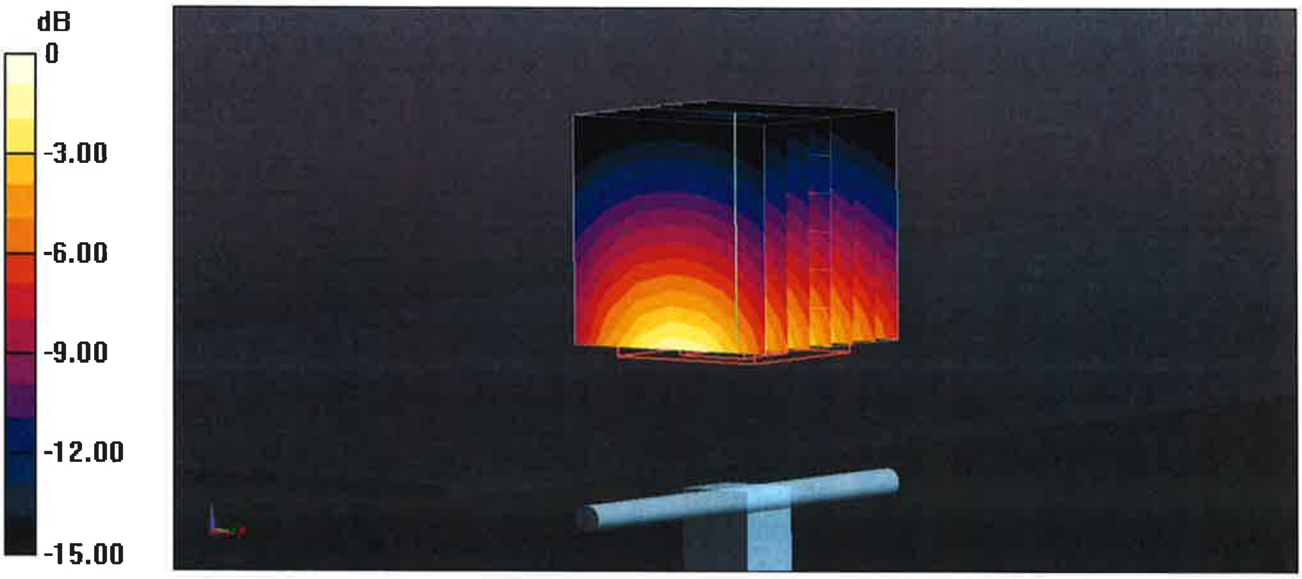
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.18, 8.18, 8.18); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

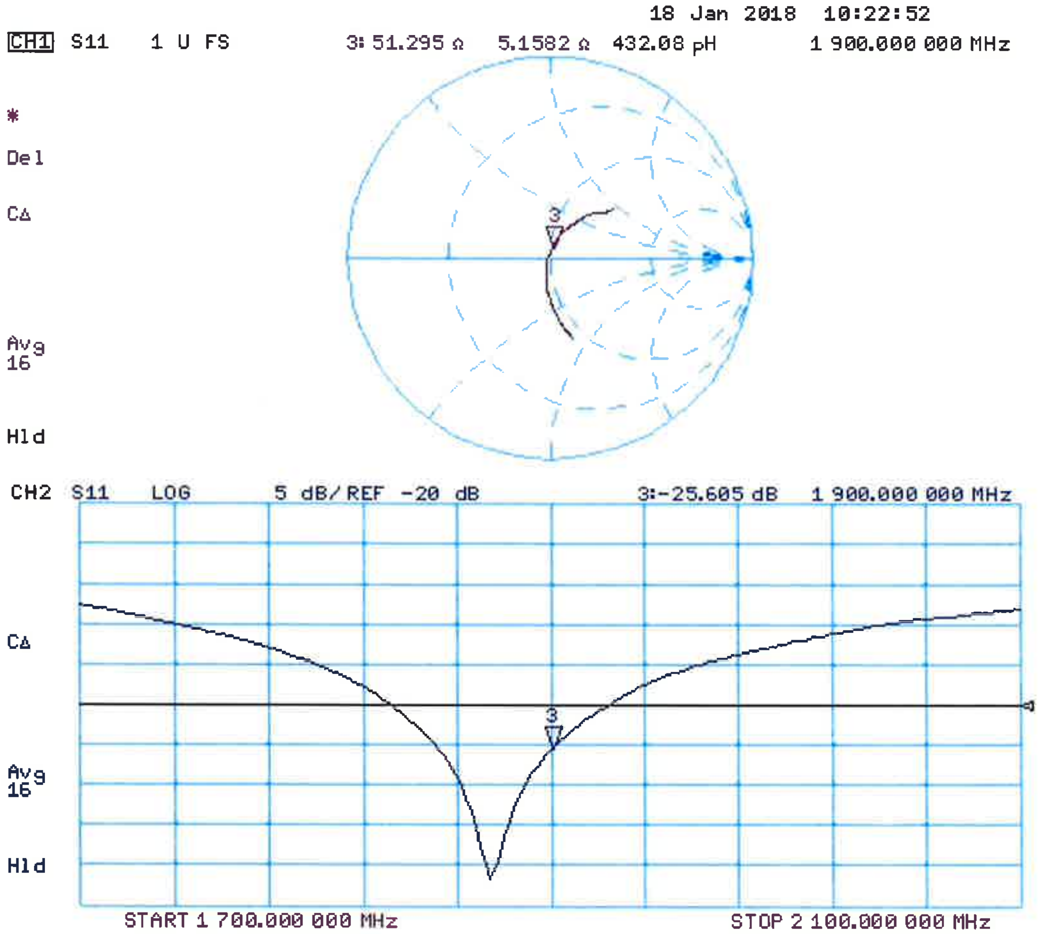
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 109.4 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg
Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.82 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d036

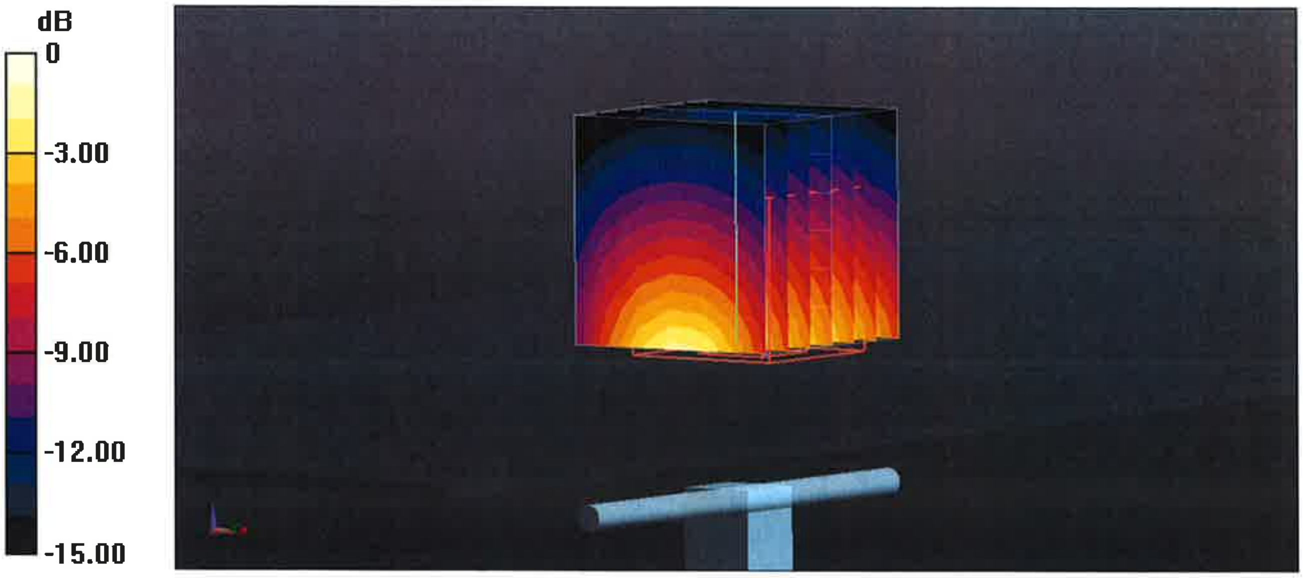
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.46 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.15, 8.15, 8.15); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

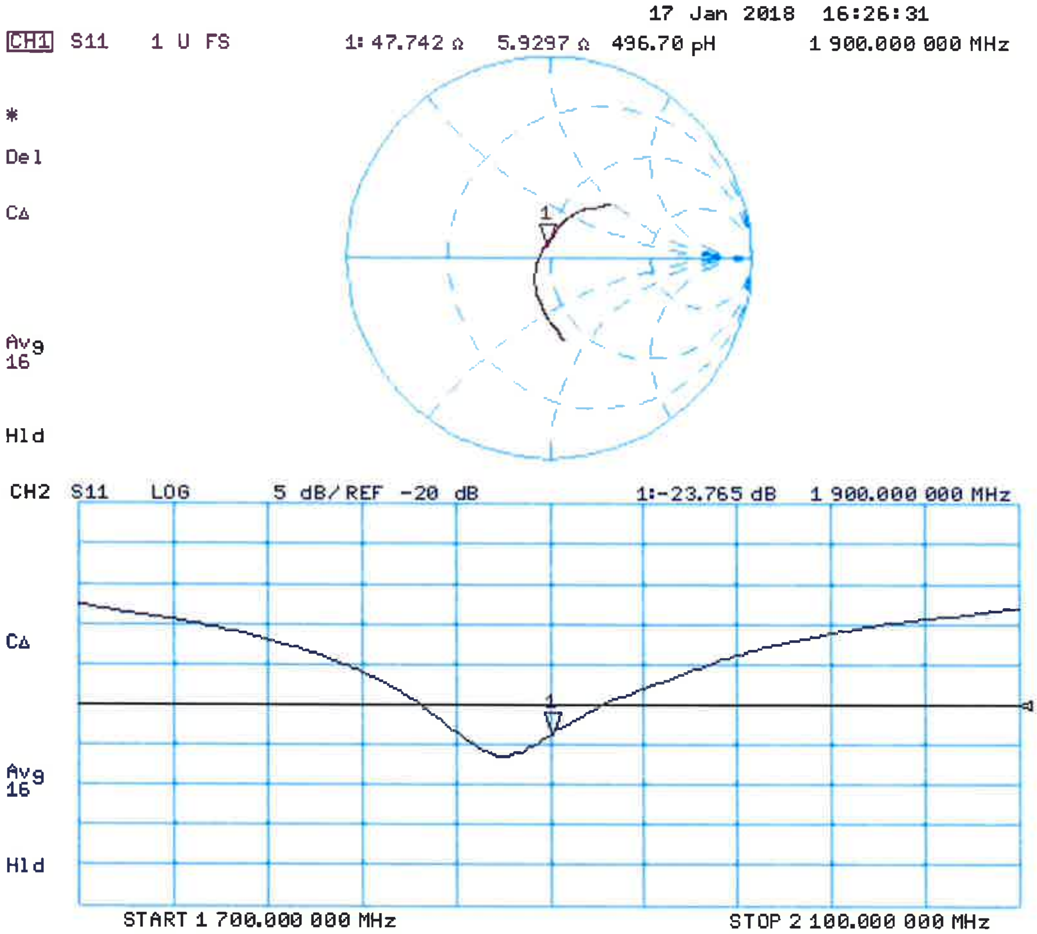
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.6 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.76 W/kg; SAR(10 g) = 5.21 W/kg
Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg

Impedance Measurement Plot for Body TSL



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 **B.V. ADT (Auden)**

Certificate No: D2300V2-1004_Jan18

CALIBRATION CERTIFICATE

Object	D2300V2 - SN:1004
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 17, 2018

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-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02522)	Apr-18
Reference 20 dB Attenuator	SN: 5058 (20k)	07-Apr-17 (No. 217-02528)	Apr-18
Type-N mismatch combination	SN: 5047.2 / 06327	07-Apr-17 (No. 217-02529)	Apr-18
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: January 17, 2018

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:

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"

Additional Documentation:

e) 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	V52.10.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.71 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	12.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**49.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.6 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	52.9	1.81 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.85 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	12.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**47.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.77 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.1 Ω - 3.0 jΩ
Return Loss	- 28.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.0 Ω - 1.9 jΩ
Return Loss	- 23.5 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 23, 2006

DASY5 Validation Report for Head TSL

Date: 17.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1004

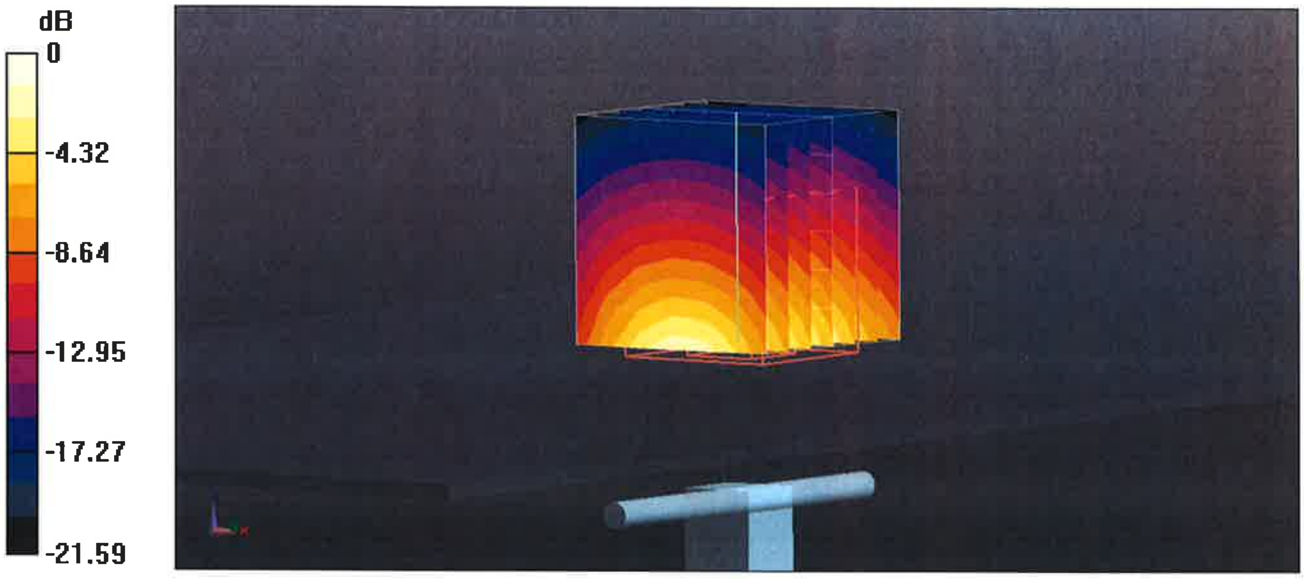
Communication System: UID 0 - CW; Frequency: 2300 MHz
Medium parameters used: f = 2300 MHz; σ = 1.71 S/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.08, 8.08, 8.08); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

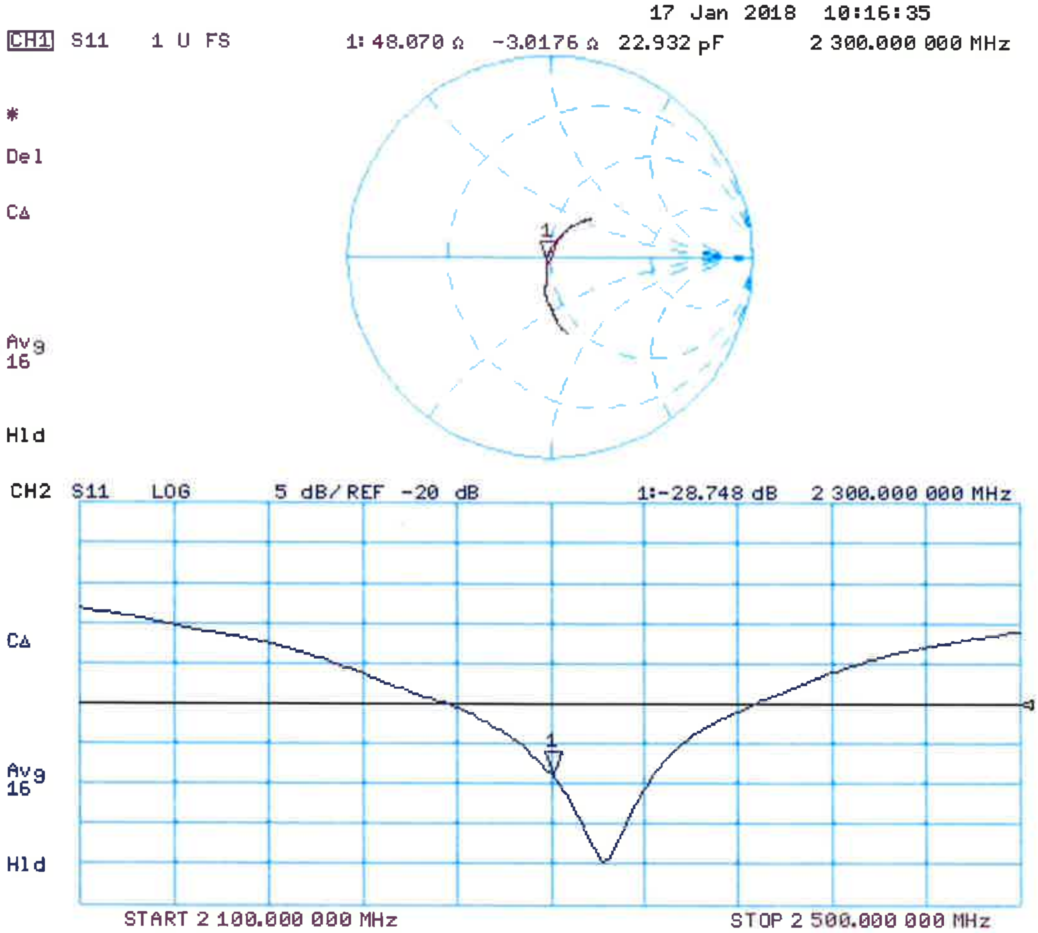
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.5 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 24.9 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.97 W/kg
Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.01.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN:1004

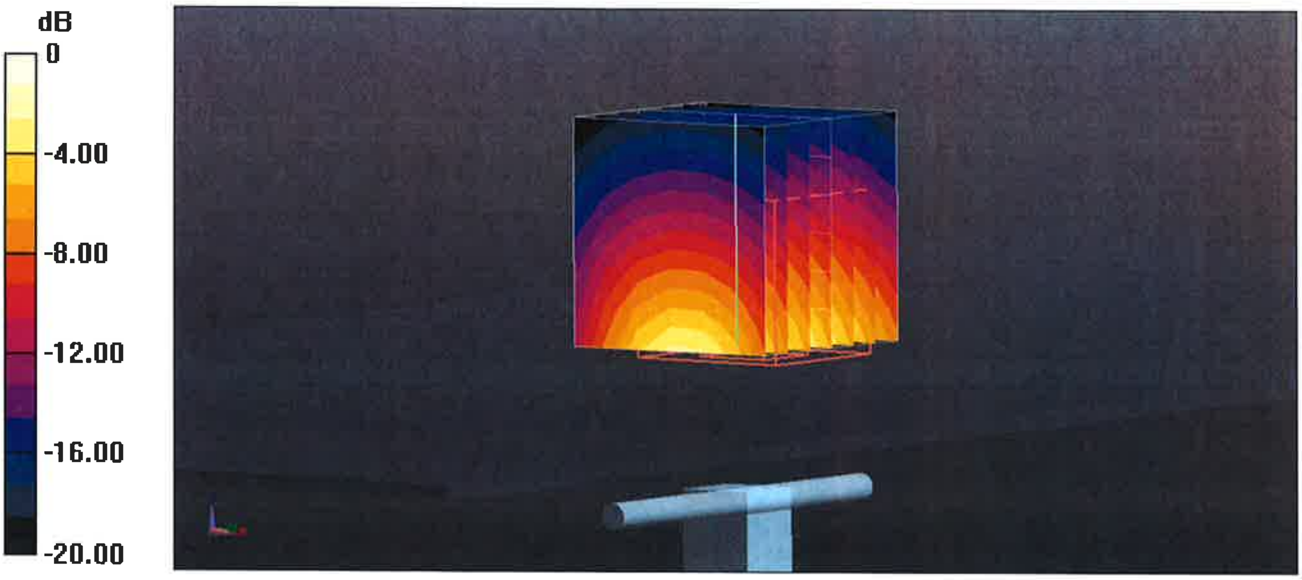
Communication System: UID 0 - CW; Frequency: 2300 MHz
Medium parameters used: f = 2300 MHz; σ = 1.85 S/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.08, 8.08, 8.08); 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 52.10.0(1446); SEMCAD X 14.6.10(7417)

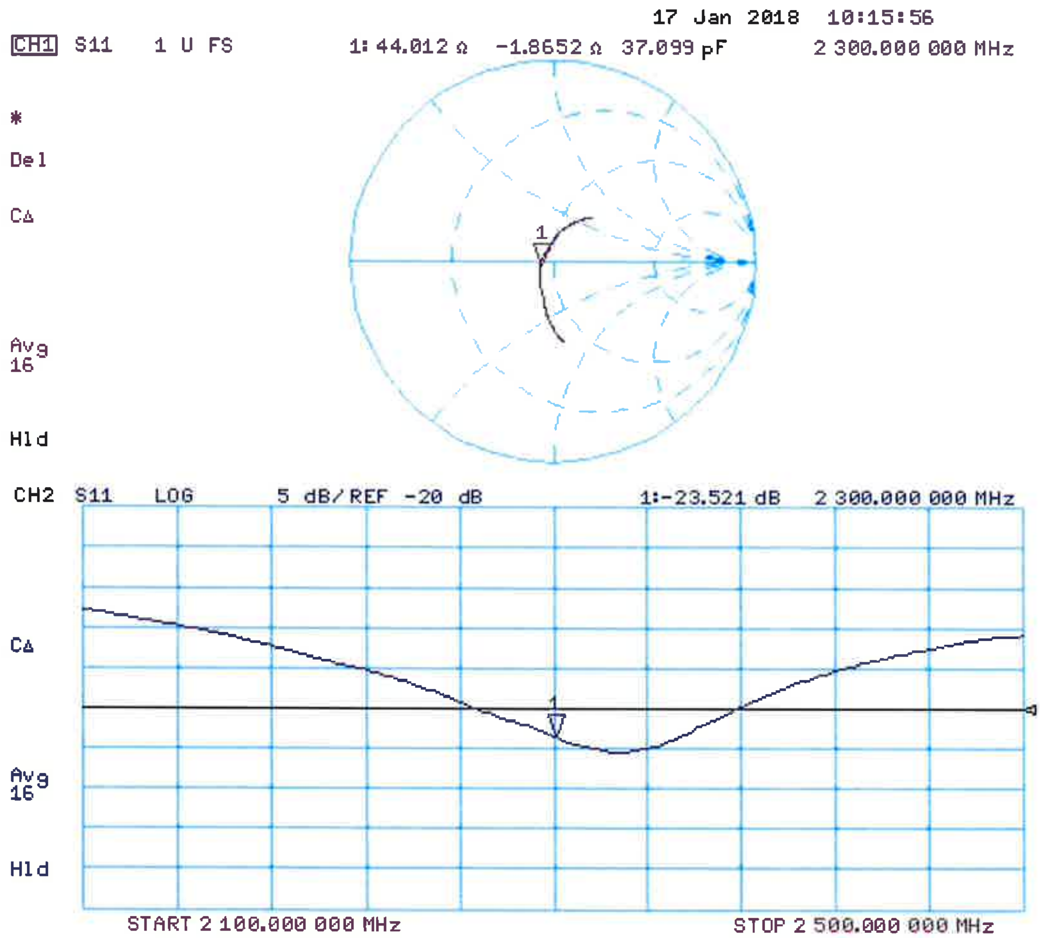
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.5 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 23.0 W/kg
SAR(1 g) = 12 W/kg; SAR(10 g) = 5.77 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Impedance Measurement Plot for Body TSL



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

Client **B.V. ADT (Auden)**

Certificate No: D2450V2-737_Aug18

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:737
Calibration procedure(s)	QA CAL-05.v10 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 24, 2018

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: 5058 (20k)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 7349	30-Dec-17 (No. EX3-7349_Dec17)	Dec-18
DAE4	SN: 601	26-Oct-17 (No. DAE4-601_Oct17)	Oct-18

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-16)	In house check: Oct-18
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-16)	In house check: Oct-18
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Manu Seitz	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 24, 2018

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:

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"

Additional Documentation:

e) 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	V52.10.1
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	37.7 ± 6 %	1.86 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 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	51.8 ± 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	12.9 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.6 Ω + 4.1 jΩ
Return Loss	- 23.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.4 Ω + 7.3 jΩ
Return Loss	- 22.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 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	August 26, 2003

DASY5 Validation Report for Head TSL

Date: 23.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:737

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

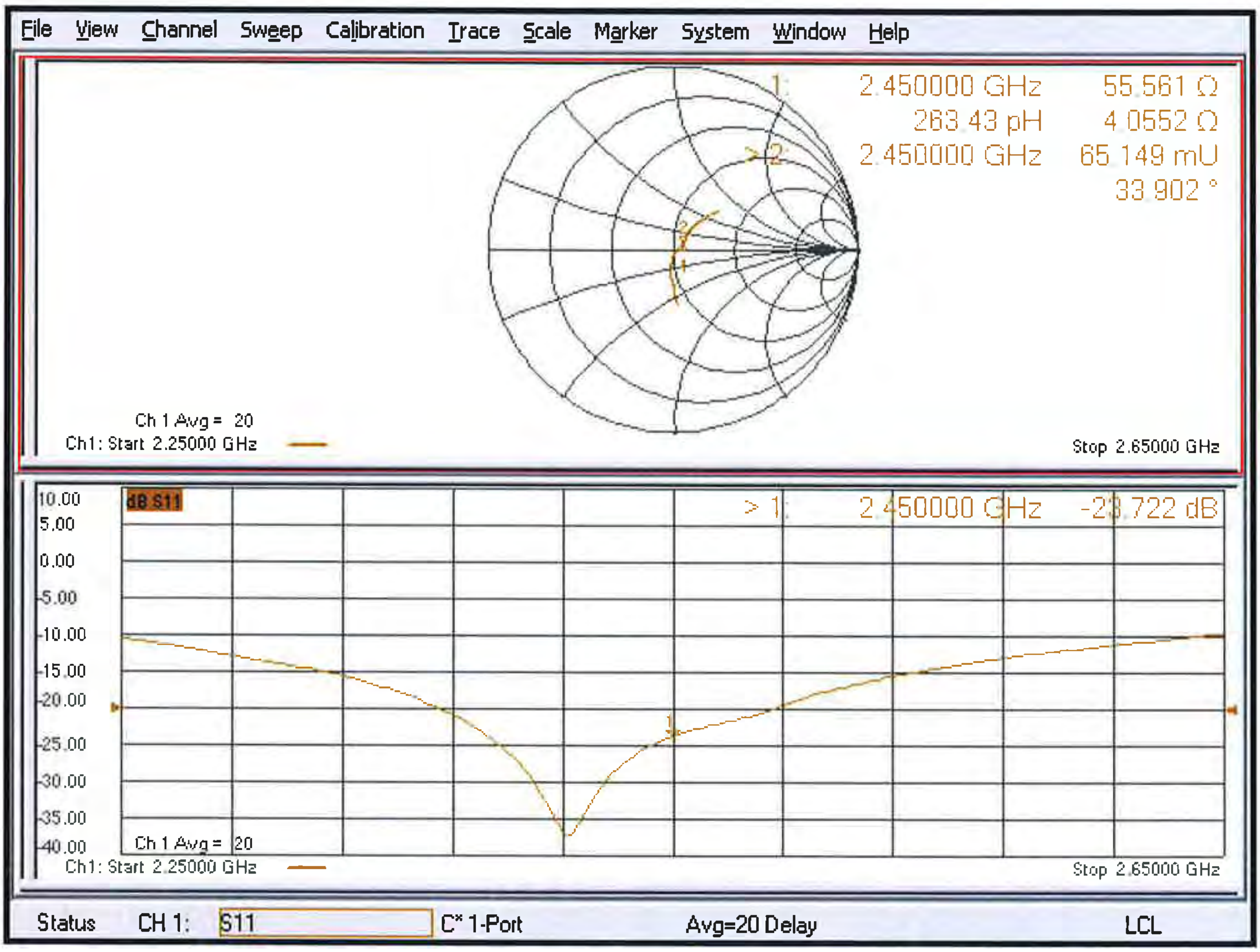
- Probe: EX3DV4 - SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 26.10.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

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 = 115.2 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 26.1 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 21.7 W/kg

0 dB = 21.7 W/kg = 13.36 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.08.2018

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:737

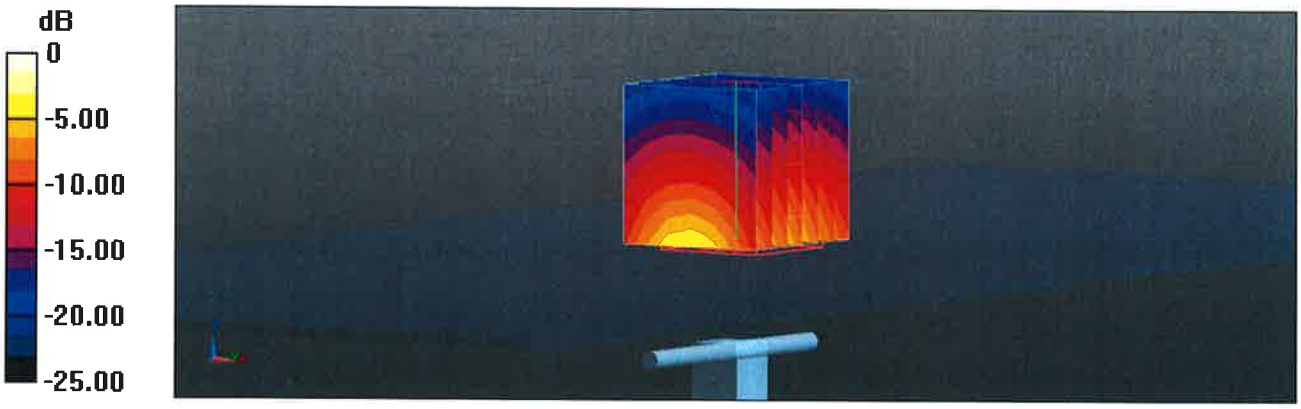
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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 = 107.8 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 25.5 W/kg
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 6.01 W/kg
Maximum value of SAR (measured) = 20.9 W/kg



0 dB = 20.9 W/kg = 13.20 dBW/kg

Impedance Measurement Plot for Body TSL