FCC SAR REPORT

Applicant:	Teladoc Health, Inc.
Address of Applicant:	150 W. Evelyn, Suite 150, Mountain View, CA 94041
Equipment Under Test (EUT)	
Product Name:	Livongo Blood Glucose Monitoring System
Model No.:	BG1000
Trade mark	Livongo
FCC ID:	2AA92LV02799
Applicable standards:	FCC 47 CFR Part 2.1093
Date of Test:	04 Nov., 2021 ~ 10 Nov., 2021
Test Result:	Maximum Reported 1-g SAR (W/kg) Body: 1.424

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*17 Dec., 2021*	*Original*
01	*13 Jan., 2022*	*Update Page 60*

Tested by: Vieta Zhang ***Date:*** *13 Jan., 2022*

Test Engineer

Reviewed by: Wiby Zhang ***Date:*** *13 Jan., 2022*

Project Engineer

3 Contents

4 SAR Results Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported 1-g SAR (W/kg)
Body (5 mm Gap)	GSM 850	0.618	PCB	1.424
	GSM 1900	1.066		
	WCDMA Band V	0.441		
	WCDMA Band IV	1.424		
	WCDMA Band II	1.410		
	LTE Band 2	1.297		
	LTE Band 5	1.394		
	LTE Band 12	0.361		
	LTE Band 66	1.417		
	LTE Band 71	0.280		

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.
2. For FDD-LTE Band 4 is full covered by FDD-LTE Band 66, so only FDD-LTE Band 66 was tested.

5 General Information

5.1 Client Information

Applicant:	Teladoc Health, Inc.
Address:	150 W. Evelyn, Suite 150, Mountain View, CA 94041
Manufacturer:	Teladoc Health, Inc.
Address:	150 W. Evelyn, Suite 150, Mountain View, CA 94041

5.2 General Description of EUT

Product Name:	Livongo Blood Glucose Monitoring System		
Model No.:	BG1000		
Category of device	Portable device		
Operation Frequency:	2G :	GSM850: 824.2~848.8 MHz	PCS 1900: 1850.2~1909.8 MHz
	3G :	Band II: 1852.4~1907.6 MHz	Band V: 826.4~846.6 MHz
		Band IV: 1712.4~1752.6 MHz	
	4G :	Band 2 :1850MHz~1910MHz	Band 4 :1710MHz~1755MHz
		Band 5 :824MHz~849MHz	Band 12: 698MHz~716MHz
		Band 66 :1710MHz~1780MHz	Band 71 :663MHz~698MHz

Modulation technology:	2G:	☐Voice(GMSK)	☒GPRS(GMSK)	☒EGPRS(GMSK, 8PSK)
	3G:	☒RCM(QPSK)	☒HSUPA(QPSK)	☒HSDPA(QPSK,16QAM)
	4G:	☒QPSK	☒16QAM	☒64QAM

Antenna Type:	Internal Antenna	
Antenna Gain:	GSM 850: -1.61 dBi; PCS 1900: 0.87 dBi WCDMA Band II: 0.87 dBi; WCDMA Band IV: -1.35 dBi; WCDMA Band V: -1.61 dBi LTE Band 2: 0.87 dBi; LTE Band 4: -1.35 dBi; LTE Band 5: -1.35 dBi;LTE Band 12: -3.49 dBi; LTE Band 66: -1.35 dBi; LTE Band 71: -5.49 dBi	
(E)GPRS Class:	(E)GPRS Class: 12	
Dimensions (L*W*H):	126 mm (L)× 67 mm (W)× 13 mm (H)	
Accessories information:	Adapter 1: Model: PSAA05E-050QL6W-R Input: AC100-240V, 50/60Hz, 0.2A Output: DC 5.0V, 1.0A Adapter 2: Model: PSAA05A-050QL6W-R Input: AC100-240V, 50/60Hz, 0.2A Output: DC 5.0V, 1.0A Adapter 3: Model: PSAA05K-050QL6W-R Input: AC100-240V, 50/60Hz, 0.2A Output: DC 5.0V, 1.0A Note: Only the pins are different between different models	Battery : Rechargeable Li-ion Polymer Battery DC 3.85V, 2400mAh Manufacturer: ShenZhen BYD Lithium Battery Company Limited

5.3 Maximum RF Output Power

Mode	Average Power (dBm)	
	GSM 850	GSM 1900
GPRS (1 TX Slot)	33.41	30.51
GPRS (2 TX Slots)	31.12	27.07
GPRS (3 TX Slots)	28.54	25.24
GPRS (4 TX Slots)	26.34	23.47
EGPRS (1 TX Slot)	26.79	25.39
EGPRS (2 TX Slots)	24.67	22.66
EGPRS (3 TX Slots)	22.67	21.00
EGPRS (4 TX Slots)	20.94	19.75

Mode	Average Power (dBm)		
	WCDMA Band V	WCDMA Band IV	WCDMA Band II
AMR 12.2 kbps	23.20	23.05	23.13
RMC 12.2 kbps	23.41	23.20	23.25
HSDPA Sub-test 1	22.18	21.94	22.46
HSDPA Sub-test 2	22.07	21.84	22.43
HSDPA Sub-test 3	21.72	21.38	21.98
HSDPA Sub-test 4	21.69	21.37	22.08
HSUPA Sub-test 1	21.86	21.42	22.05
HSUPA Sub-test 2	21.08	20.80	21.32
HSUPA Sub-test 3	20.88	20.44	21.14
HSUPA Sub-test 4	21.32	20.99	21.64
HSUPA Sub-test 5	22.15	21.77	22.59

Mode	Average Power (dBm)					
	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 12	LTE Band 66	LTE Band 17
BW/1.4 MHz	23.18	23.39	23.38	23.66	23.55	/
BW/3.0 MHz	23.21	23.44	23.51	23.79	23.37	/
BW/5.0 MHz	23.07	23.34	23.36	23.70	23.55	23.01
BW/10 MHz	22.85	23.35	23.41	23.56	23.41	23.11
BW/15 MHz	23.14	23.16	/	/	23.28	22.72
BW/20 MHz	23.22	23.69	/	/	23.32	23.26

5.4 Environment of Test Site

Temperature:	18°C ~25 °C
Humidity:	35%~75% RH
Atmospheric Pressure:	1010 mbar

5.5 Test Sample Plan

Sample Number	Used for Test Items
1#	SAR
***Remark**: JianYan Testing Group Shenzhen Co., Ltd. is only responsible for the test project data of the above samples, and will keep the above samples for a month.*	

5.6 Test Location

JianYan Testing Group Shenzhen Co., Ltd.
No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: http://www.ccis-cb.com

6 Introduction

6.1 Introduction

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.

6.2 SAR Definition

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:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = C\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 RF Exposure Limits

7.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

7.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

7.3 RF Exposure Limits

SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

Note:

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

8 SAR Measurement System

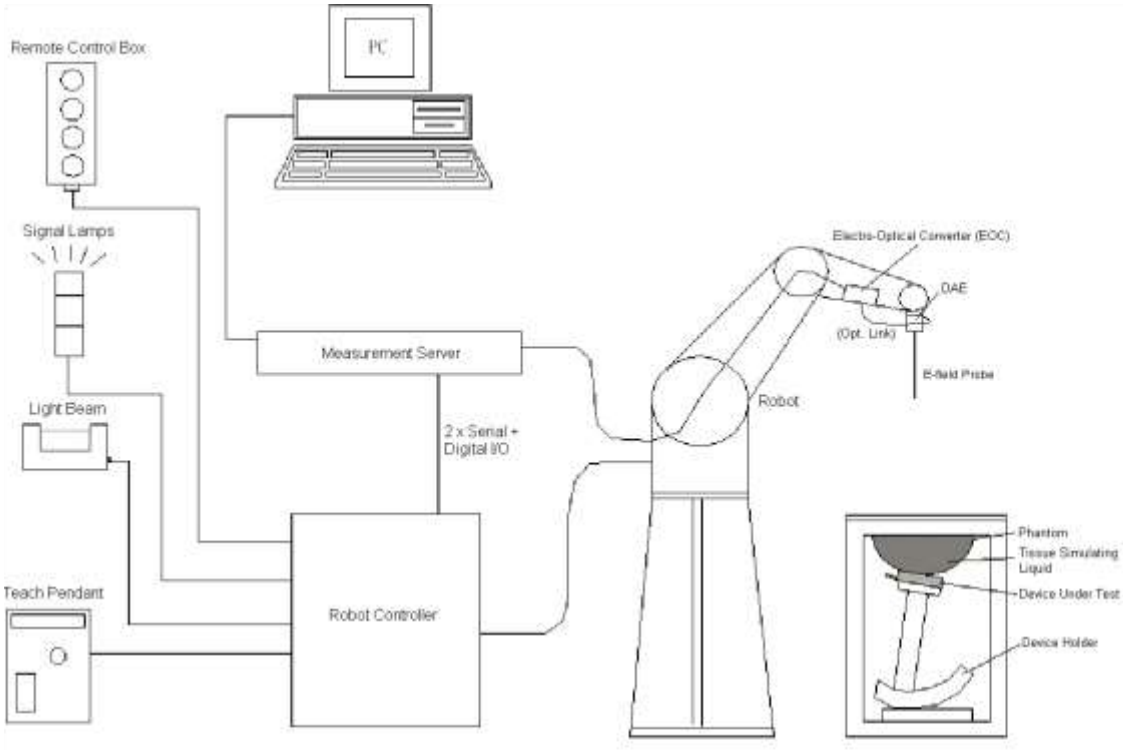


Fig. 8.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Component details are described in the following sub-sections.

8.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). 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. This probe has a built in optical surface detection system to prevent from collision with phantom.

- **E-Field Probe Specification**
  <EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency Directivity	10 MHz to 6 GHz; Linearity: ± 0.2 dB ± 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: 330 mm (Tip: 20mm) Tip diameter: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1 mm

Fig. 8.2 Photo of E-Field Probe

- **E-Field Probe Calibration**
  Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (Norm X, Norm Y and Norm Z), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix E of this report.

8.2 Data Acquisition Electronics (DAE)

The Data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig. 8.3 Photo of DAE

8.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; nobelt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

Fig. 8.4 Photo of Robot

8.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY 5: 400MHz, Intel Celeron), chip-disk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.
The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Fig. 8.5 Photo of Server for DASY5

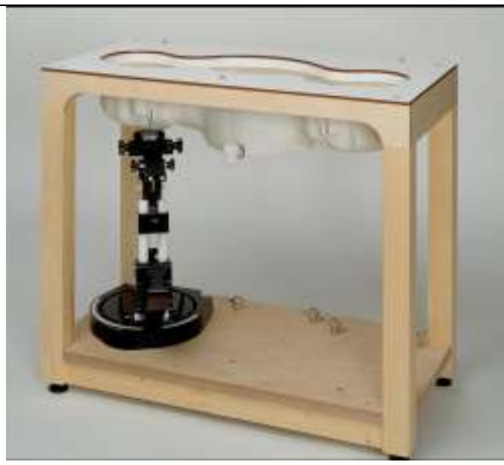
8.5 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Fig. 8.6 Photo of Light Beam

8.6 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 **Fig. 8.7 Photo of SAM Twin Phantom**
Filling Volume Dimensions	Approx. 25 liters Length: 1000mm; Width: 500mm; Height: adjustable feet	
Measurement Areas	Left Head, Right Head, Flat phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom >

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.
ELI4 has been optimized regarding its performance and can be integrated into a SPEAG standard phantom table. 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 can be used with the following tissue simulating liquids:

- Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not in use; otherwise the parameters will change due to water evaporation.
- DGBE based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not in use (desirable at least once a week).
- Do not use other organic solvents without previously testing the phantom resistiveness

Fig.8.8 Photo of ELI4 Phantom

8.7 Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.
The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP).
Thus the device needs no repositioning when changing the angles.
The DASY device holder is constructed of low-low POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Fig. 8.9 Photo of Device Holder

8.8 Data storage and Evaluation

- **Data Storage**

  The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verifications of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

  The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

- **Data Evaluation**

  The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion	$ConvF_i$
	- Diode compression point	dcp_i
Device Parameters:	- Frequency	f
	- Crest	cf
Media Parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With V_i = compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp^i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated:

E- Field Probes: $$E_i = \sqrt{\frac{V_i}{Norm_i ConvF}}$$

H-Field Probes: $$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = senor sensitivity of channel i, (i = x, y, z), μV/ $(V/m)^2$
ConvF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency (GHz)
E_i = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in (mho/m) or (Siemens/m)
ρ = equipment tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

8.9 Test Equipment List

Manufacturer	Equipment Description	Model	S/N	Cal. Information	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1118	05.28.2020	05.27.2023
SPEAG	835MHz System Validation Kit	D835V2	4d154	06.11.2019	06.10.2022
SPEAG	1750MHz System Validation Kit	D1750V2	1177	02.10.2021	02.09.2024
SPEAG	1900MHz System Validation Kit	D1900V2	5d175	06.11.2019	06.10.2022
SPEAG	Data Acquisition Electronics	DAE4	1452	05.26.2021	05.25.2022
SPEAG	Dosimetric E-Field Probe	EX3DV4	7515	11.30.2020	11.29.2021
SPEAG	DASY 52 Measurement Software	DASY 52	Version 52.10.4.1527	N.C.R	N.C.R
SPEAG	DASY 52 File Conversion Software	SEMCAD X	Version 14.6.14 (7483)	N.C.R	N.C.R
SPEAG	Phantom	Twin Phantom	1765	N.C.R	N.C.R
SPEAG	Phantom	ELI V5.0	1208	N.C.R	N.C.R
SPEAG	Phone Positioner	N/A	N/A	N.C.R	N.C.R
Stäubli	Robot	TX60L	F13/5P6VB1/A/01	N.C.R	N.C.R
Anritsu	Universal Radio Communication Analyzer	MT8820C	6201468866	03.03.2021	03.02.2022
R&S	Universal Radio Communication Tester	CMU200	109231	06.18.2020	06.17.2022
R&S	Universal Radio Communication Tester	CMW500	140486	07.16.2021	07.15.2022
HP	Network Analyzer	8753D	3410A06291	06.18.2020	06.17.2022
KEYSIGHT	EPM Series Power Meter	N1914A	MY60400002	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	MY60340002	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	MY60340003	08.29.2021	08.28.2022
KEYSIGHT	Signal Generator	N5173B	MY59100857	03.25.2021	03.24.2022
Huber Suhner	RF Cable	SUCOFLEX	12341	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	17268	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	2080	See Note 3	
Weinschel	Attenuator	23-3-34	BL5513	See Note 3	
Anritsu	Directional Coupler	MP654A	100217491	See Note 3	
SPEAG	Dielectric Assessment Kit	3.5 Probe	1119	See Note 4	
SPEAG	DAK Measurement Software	DAK	Version: DAK 3.5	N.C.R	
TXC	Broadband Amplifier	BBA018000	LNA-00500200-2515	See Note 5	

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1 W input power according to the ratio of 1 W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
6. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
7. N.C.R means No Calibration Requirement.

9 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to liquid top surface is larger than 15 cm, which is shown in Fig. 9.1.

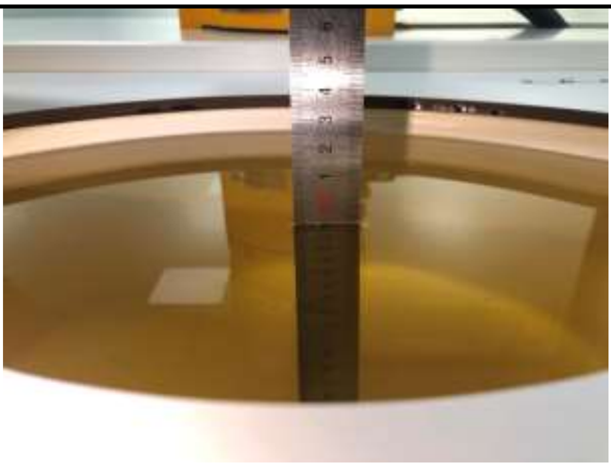


Fig. 9.2 Photo of Liquid Height for Body SAR (700MHz~1000MHz)(depth>15cm)

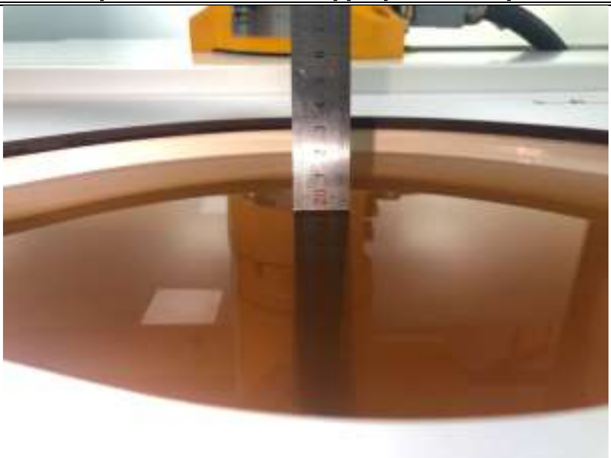


Fig. 9.4 Photo of Liquid Height for Body SAR (1700MHz~2000MHz) (depth>15cm)

The relative permittivity and conductivity of the tissue material should be within ±5% of the values given in the table below recommended by the FCC OET 65 supplement C and RSS 102 Issue 5.

Target Frequency (MHz)	εr	σ(S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800-2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5800	35.3	5.27

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

The dielectric parameters of liquids were verified prior to the SAR evaluation using a Speag Dielectric Probe Kit and an Agilent Network Analyzer.
The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target(σ)	Permittivity Target(εr)	Delta (σ)%	Delta (εr)%	Limit (%)	Date (mm/dd/yy)
750	22.5	0.90	40.90	0.89	41.90	1.12	-2.39	±5	11.04.2021
835	22.5	0.93	40.76	0.90	41.50	3.33	-1.78	±5	11.04.2021
1750	21.9	1.37	41.59	1.37	40.10	0.00	3.72	±5	11.10.2021
1900	21.9	1.45	41.37	1.40	40.00	3.57	3.42	±5	11.10.2021

10 SAR System Verification

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

- **Purpose of System Performance check**
  The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

- **System Setup**
  In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

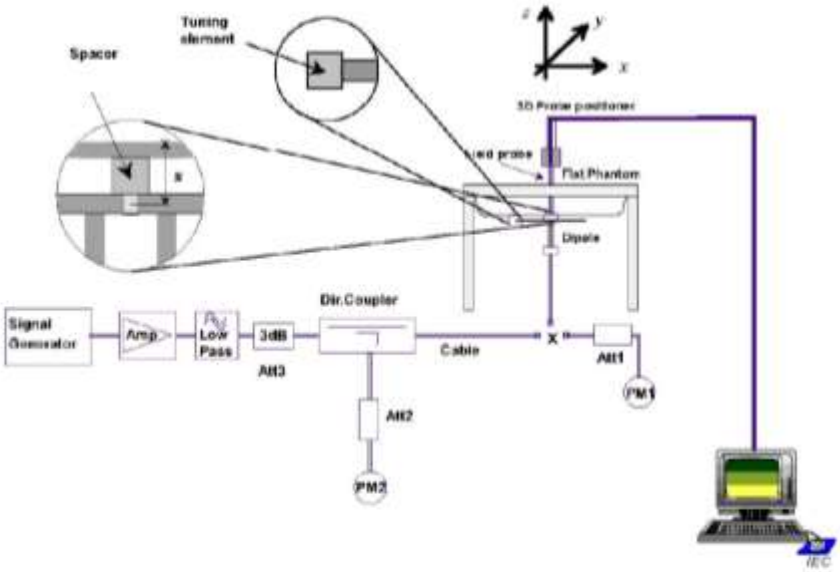


Fig.10.1 System Verification Setup Diagram

Fig.10.2 Photo of Dipole setup

- **System Verification Results**
  Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10%. The table as below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix C of this report.

Date (mm/dd/yy)	Frequency (MHz)	Power fed onto dipole (mW)	Measured 1g SAR (W/kg)	Normalized to 1W 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	Deviation (%)
11.04.2021	750	80	0.682	8.53	8.37	1.91
11.04.2021	835	80	0.788	9.85	9.49	3.79
11.10.2021	1750	40	1.470	36.75	36.4	0.96
11.10.2021	1900	40	1.540	38.50	39.4	-2.28

11 EUT Testing Position

This EUT was tested in five different positions. They are Front/Back/Left/Right Side /Bottom Side of the EUT with phantom 5mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

11.1 Body Configurations

- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 5 mm.

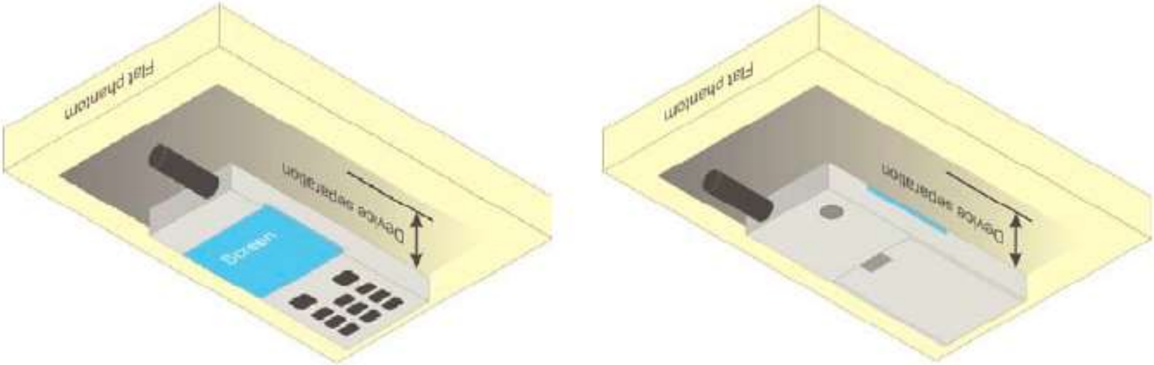


Fig.11.5 Illustration for Body Position

12 Measurement Procedures

The measurement procedures are as bellows:

<Conducted power measurement>

- For WWAN power measurement, use base station simulator to configure EUT WWAN transition in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- Read the WWAN RF power level from the base station simulator.
- For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- Connect EUT RF port through RF cable to the power meter or spectrum analyzer, and measure WLAN/BT output power.

<Conducted power measurement>

- Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- Place the EUT in positions as Appendix B demonstrates.
- Set scan area, grid size and other setting on the DASY software.
- Measure SAR results for the highest power channel on each testing position.
- Find out the largest SAR result on these testing positions of each band.
- Measure SAR results for other channels in worst SAR testing position if the Reported SAR or highest power channel is larger than 0.8 W/kg.

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

- Power reference measurement
- Area scan
- Zoom scan
- Power drift measurement

12.1 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 10 g 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 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

12.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

12.3 Area & Zoom Scan Procedures

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 10g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

12.4 Volume Scan Procedures

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 post-processor scan combine and subsequently superpose these measurement data to calculating the multiband SAR.

12.5 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 1g and 10g cubes, the extrapolation distance should not be larger than 5 mm.

12.6 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 drifts more than 5%, the SAR will be retested.

13 Conducted RF Output Power

13.1 GSM Conducted Power

Band: GSM 850	Burst Average Power (dBm)			Frame-Average Power(dBm)		
Channel	128	190	251	128	190	251
Frequency (MHz)	824.2	836.6	848.8	824.2	836.6	848.8
GPRS (GMSK, 1 TX slot)	33.17	33.41	33.39	24.14	24.38	24.36
GPRS (GMSK, 2 TX slots)	30.20	**31.12**	30.80	24.18	**25.10**	24.78
GPRS (GMSK, 3 TX slots)	27.88	28.40	28.54	23.62	24.14	24.28
GPRS (GMSK, 4 TX slots)	25.67	26.19	26.34	22.66	23.18	23.33
EGPRS (8PSK, 1 TX slot)	26.24	26.67	26.79	17.21	17.64	17.76
EGPRS (8PSK, 2 TX slots)	24.17	24.59	24.67	18.15	18.57	18.65
EGPRS (8PSK, 3 TX slots)	22.15	22.60	22.67	17.89	18.34	18.41
EGPRS (8PSK, 4 TX slots)	20.46	20.86	20.94	17.45	17.85	17.93

Remark:

1. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated method are shown as below:
   The duty cycle "x" of different time slots as below:
   1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
   Based on the calculation formula:
   Frame-averaged power = Burst averaged power + 10 1og (x)
   So,
   Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
   Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
   Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
   Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
2. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

Note:

1. For Body mode SAR testing, GPRS and EGPRS mode should be evaluated, therefore the EUT was set in GPRS 2 TX slots mode due to the highest frame-averaged power.
2. For GPRS multi time slots SAR measurement, when the measured maximum output power levels are within 0.25 dB of each other, test the configuration with the most number of time slots.
3. Per KDB447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
4. The EUT do not support DTM and VoIP function.

Band: PCS 1900	Burst Average Power (dBm)			Frame-Average Power(dBm)		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
GPRS (GMSK, 1 TX slot)	29.94	**30.51**	30.27	20.91	**21.48**	21.24
GPRS (GMSK, 2 TX slots)	26.93	27.07	26.87	20.91	21.05	20.85
GPRS (GMSK, 3 TX slots)	25.13	25.24	25.05	20.87	20.98	20.79
GPRS (GMSK, 4 TX slots)	23.43	23.47	23.19	20.42	20.46	20.18
EGPRS (8PSK, 1 TX slot)	25.39	25.27	25.09	16.36	16.24	16.06
EGPRS (8PSK, 2 TX slots)	22.66	22.62	22.44	16.64	16.60	16.42
EGPRS (8PSK, 3 TX slots)	21.00	20.90	20.75	16.74	16.64	16.49
EGPRS (8PSK, 4 TX slots)	19.75	19.61	19.41	16.74	16.60	16.40

Remark:

3. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated method are shown as below:
   The duty cycle "x" of different time slots as below:
   1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8
   Based on the calculation formula:
   Frame-averaged power = Burst averaged power + 10 1og (x)
   So,
   Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot)– 9.03
   Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots)– 6.02
   Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots)– 4.26
   Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
4. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

Note:

1. For Body mode SAR testing, GPRS and EGPRS mode should be evaluated, therefore the EUT was set in GPRS 1 TX slot mode due to the highest frame-averaged power.
2. Per KDB447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
3. The EUT do not support DTM and VoIP function.

13.2 WCDMA Conducted Power

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification. A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Rohde & Schwarz CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table 1

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15.
Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

HSDPA Sub-test setup configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Rohde & Schwarz CMU200 referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table 2

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ ⇔ $\beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

HSUPA Sub-test setup configuration

WCDMA Conducted Power:

WCDMA Average power (dBm)			
Band	WCDMA Band V		
Channel	4132	4183	4233
Frequency (MHz)	826.4	836.6	846.6
AMR 12.2 kbps	23.20	23.12	23.06
RMC 12.2 kbps	23.16	**23.41**	23.40
HSDPA Sub-test 1	22.12	22.06	22.18
HSDPA Sub-test 2	22.05	22.07	22.06
HSDPA Sub-test 3	21.72	21.62	21.58
HSDPA Sub-test 4	21.69	21.54	21.60
HSUPA Sub-test 1	21.37	21.27	21.86
HSUPA Sub-test 2	20.73	21.08	20.64
HSUPA Sub-test 3	20.71	20.88	20.36
HSUPA Sub-test 4	21.01	21.02	21.32
HSUPA Sub-test 5	21.99	22.07	22.15

WCDMA Average power (dBm)			
Band	WCDMA Band IV		
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
AMR 12.2 kbps	22.80	23.01	23.05
RMC 12.2 kbps	22.94	23.07	**23.20**
HSDPA Sub-test 1	21.77	21.94	21.75
HSDPA Sub-test 2	21.65	21.79	21.84
HSDPA Sub-test 3	21.38	21.14	21.33
HSDPA Sub-test 4	21.37	21.19	21.24
HSUPA Sub-test 1	21.16	21.02	21.42
HSUPA Sub-test 2	20.48	20.80	20.38
HSUPA Sub-test 3	20.44	20.39	20.12
HSUPA Sub-test 4	20.77	20.69	20.99
HSUPA Sub-test 5	21.61	21.71	21.77

WCDMA Average power (dBm)			
Band	WCDMA Band II		
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880.0	1907.6
AMR 12.2 kbps	23.13	23.04	23.07
RMC 12.2 kbps	22.84	23.01	**23.25**
HSDPA Sub-test 1	22.38	22.42	22.46
HSDPA Sub-test 2	22.28	22.39	22.43
HSDPA Sub-test 3	21.92	21.98	21.80
HSDPA Sub-test 4	22.08	21.81	22.00
HSUPA Sub-test 1	21.57	21.64	22.05
HSUPA Sub-test 2	21.21	21.32	20.94
HSUPA Sub-test 3	20.86	21.14	20.59
HSUPA Sub-test 4	21.28	21.30	21.64
HSUPA Sub-test 5	22.37	22.41	22.59

Note:

1. Applying the subtest setup in Table C.11.1.3 of 3GPP TS 34.121-1
2. Per KDB 941225 D01, RMC 12.2kbps mode is used to evaluate SAR due the highest output power. If AMR 12.2 kbps power is < 0.25dB higher than RMC 12.2kbps, SAR tests with AMR 12.2 kbps can be excluded.
3. AMR, HSDPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.

13.3 LTE Conducted Power

13.3.1 Largest channel bandwidth standalone SAR test requirements

QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, 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 for 1 RB allocation; 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.8 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.

QPSK with 50% RB allocation

The procedures required for 1 RB allocation in section 4.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.9

QPSK with 100% RB allocation

For 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 in sections 4.2.1 and 4.2.2 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.

Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in sections 4.2.1, 5.2.2 and 4.2.3 to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

13.3.2 Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section 4.2 to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ 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. The equivalent channel configuration for the RB allocation, RB offset and modulation etc. is determined for the smaller channel bandwidth according to the same number of RB allocated in the largest channel bandwidth. For example, 50 RB in 10 MHz channel bandwidth does not apply to 5 MHz channel bandwidth; therefore, this cannot be tested in the smaller channel bandwidth. However, 50% RB allocation in 10 MHz channel bandwidth is equivalent to 100% RB allocation in 5 MHz channel bandwidth; therefore, these are the equivalent configurations to be compared to determine the specific channel and configuration in the smaller channel bandwidth that need SAR testing.

13.3.3 TDD LTE configuration setup for SAR measurement

According to KDB 941225 D05v02r03 and April 2013 TCB workshop slides, SAR must be tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

- see 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
- “special subframe S” contains both uplink and downlink transmissions and must be taken into consideration to determine the transmission duty factor
  - according to the worst case uplink and downlink cyclic prefix requirements for UpPTS to determine the highest SAR test duty factor

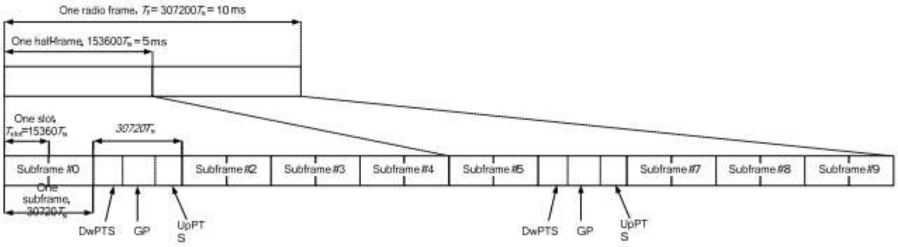


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity)

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Per 3GPP 36.211 section 4.2, each radio frame of length T_f=37200·*T*s = 10 ms consists of two half-frames of length 153600·Ts = 5ms each. Each half-frame consists of five subframes of length 30720 ·*T*s = 1ms. So, the uplink duty factor in special subframe as below:

Special Subframe configuration	Normal cyclic prefix in downlink		Extended cyclic prefix in downlink	
	Duty factor of Uplink		Duty factor of Uplink	
	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink	Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	7.14%	8.33%	7.14%	8.33%
1	7.14%	8.33%	7.14%	8.33%
2	7.14%	8.33%	7.14%	8.33%
3	7.14%	8.33%	7.14%	8.33%
4	7.14%	8.33%	14.27%	16.67%
5	14.27%	16.67%	14.27%	16.67%
6	14.27%	16.67%	14.27%	16.67%
7	14.27%	16.67%	14.27%	16.67%
8	14.27%	16.67%	/	/
9	14.27%	16.67%	/	/

Table 4.2-2: Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

According to above table:

1. The highest duty factor is configuration 0;
2. The duty factor of uplink in one half-frame with normal cyclic prefix is: (3ms + 0.143ms)/5ms=62.86%;
3. The duty factor of uplink in one half-frame with extended cyclic prefix is: (3ms + 0.167ms)/5ms=63.34%;
4. For purpose to get the worst case SAR test duty factor, the duty factor of normal cyclic prefix in uplink scaled-up to the extended cyclic prefix in uplink, the scaling factor is 63.34%/62.86%=1.008, and the scaling factor will be taken into the final measured SAR.

LTE Band 2 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18607	18900	19193
					1850.7MHz	1880.0MHz	1909.3MHz
Band 2	1.4	QPSK	1	0	22.96	22.94	23.00
			1	2	22.81	23.03	23.18
			1	5	22.84	22.80	22.88
			3	0	22.92	22.82	22.93
			3	1	23.02	22.88	22.91
			3	2	22.77	22.85	22.96
			6	0	21.80	21.84	21.73
		16QAM	1	0	21.99	21.78	21.84
			1	2	22.15	21.72	21.74
			1	5	21.94	21.79	21.81
			3	0	21.71	21.94	21.79
			3	1	21.80	21.92	21.96
			3	2	21.58	21.99	21.91
			6	0	21.10	20.81	20.68

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18615	18900	19185
					1851.5MHz	1880.0MHz	1908.5MHz
Band 2	3	QPSK	1	0	23.14	22.99	22.95
			1	7	22.71	22.77	23.21
			1	14	22.84	22.80	23.09
			8	0	22.13	21.86	22.07
			8	4	22.08	21.87	22.00
			8	7	21.96	21.84	22.02
			15	0	22.03	21.86	22.03
		16QAM	1	0	22.11	22.08	21.76
			1	7	22.55	21.79	21.74
			1	14	21.93	21.89	22.08
			8	0	20.84	21.02	21.07
			8	4	21.00	21.02	20.92
			8	7	20.64	20.95	21.01
			15	0	20.95	20.73	20.93

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18625	18900	19175
					1852.5MHz	1880.0MHz	1907.5MHz
Band 2	5	QPSK	1	0	23.07	22.96	22.90
			1	12	22.82	22.59	22.87
			1	24	22.97	22.85	22.71
			12	0	21.78	21.76	21.67
			12	6	21.78	21.67	21.60
			12	11	21.66	21.74	21.68
			25	0	21.68	21.75	21.63
		16QAM	1	0	21.91	21.80	21.57
			1	12	21.42	21.77	21.33
			1	24	22.01	21.66	21.55
			12	0	20.72	20.71	20.63
			12	6	20.71	20.65	20.45
			12	11	20.58	20.64	20.76
			25	0	20.62	20.71	20.81

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18650	18900	19150
					1855.0MHz	1880.0MHz	1905.0MHz
Band 2	10	QPSK	1	0	22.83	22.85	22.78
			1	24	22.75	22.58	22.61
			1	49	22.77	22.63	22.72
			25	0	21.73	21.71	21.63
			25	12	21.71	21.66	21.68
			25	24	21.81	21.64	21.65
			50	0	21.74	21.64	21.70
		16QAM	1	0	21.95	21.74	21.62
			1	24	21.64	21.91	21.71
			1	49	21.81	22.38	21.68
			25	0	20.70	20.64	20.61
			25	12	20.79	20.66	20.62
			25	24	20.81	20.74	20.70
			50	0	20.70	20.74	20.68

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18675	18900	19125
					1857.5MHz	1880.0MHz	1902.5MHz
Band 2	15	QPSK	1	0	22.57	23.14	22.97
			1	37	22.52	22.70	22.76
			1	74	22.94	23.07	23.04
			36	0	21.76	21.87	22.64
			36	16	21.77	21.63	21.47
			36	35	22.01	21.73	21.90
			75	0	22.01	21.86	21.93
		16QAM	1	0	21.92	22.23	21.98
			1	37	21.75	21.39	21.50
			1	74	22.69	22.62	22.04
			36	0	22.03	21.85	22.60
			36	16	21.93	21.27	22.44
			36	35	22.11	21.75	22.08
			75	0	20.93	20.82	20.89

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					18700	18900	19100
					1860.0MHz	1880.0MHz	1900.0MHz
Band 2	20	QPSK	1	0	22.87	23.09	23.05
			1	49	23.22	23.03	22.97
			1	99	23.08	22.94	23.05
			50	0	21.98	21.96	22.10
			50	24	21.86	22.06	22.06
			50	49	22.14	21.96	21.92
			100	0	21.91	21.96	21.96
		16QAM	1	0	22.28	21.66	22.39
			1	49	22.87	21.65	22.66
			1	99	21.80	21.76	22.29
			50	0	20.87	20.92	20.99
			50	24	20.80	20.91	21.09
			50	49	21.04	20.96	20.86
			100	0	20.84	20.83	20.88

LTE Band 4 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19957	20175	20393
					1710.7MHz	1732.5MHz	1754.3MHz
Band 4	1.4	QPSK	1	0	23.26	23.13	22.94
			1	2	23.39	23.38	23.12
			1	5	23.21	23.22	22.68
			3	0	23.25	23.26	22.97
			3	1	23.24	23.27	22.90
			3	2	23.24	23.27	22.85
			6	0	22.26	22.23	21.93
		16QAM	1	0	21.99	22.51	21.95
			1	2	22.08	22.41	22.26
			1	5	22.15	22.83	21.70
			3	0	22.06	22.03	21.69
			3	1	22.39	22.03	21.72
			3	2	22.19	21.99	21.65
			6	0	21.01	21.30	21.13

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19965	20175	20385
					1711.5MHz	1732.5MHz	1753.5MHz
Band 4	3	QPSK	1	0	23.21	23.03	23.26
			1	7	23.35	23.07	22.93
			1	14	23.36	23.44	23.14
			8	0	22.32	22.24	21.94
			8	4	22.36	22.24	21.90
			8	7	22.38	22.23	21.93
			15	0	22.37	22.19	21.96
		16QAM	1	0	22.29	22.10	22.12
			1	7	22.68	21.80	22.54
			1	14	22.56	22.14	21.82
			8	0	21.37	21.05	20.88
			8	4	21.22	21.03	20.71
			8	7	21.18	21.29	20.93
			15	0	21.05	21.08	20.69

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					19975	20175	20375
					1712.5MHz	1732.5MHz	1752.5MHz
Band 4	5	QPSK	1	0	23.24	23.34	22.99
			1	12	23.26	23.17	23.06
			1	24	23.17	23.12	23.11
			12	0	22.32	22.08	21.96
			12	6	22.31	22.17	21.93
			12	11	22.32	22.12	22.00
			25	0	22.33	22.17	21.94
		16QAM	1	0	22.09	22.14	22.07
			1	12	22.13	21.98	22.24
			1	24	21.86	22.25	22.17
			12	0	21.14	21.21	20.80
			12	6	21.22	21.01	20.92
			12	11	21.28	21.22	20.89
			25	0	21.15	21.08	20.97

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20000	20175	20350
					1715.0MHz	1732.5MHz	1750.0MHz
Band 4	10	QPSK	1	0	23.17	23.04	22.86
			1	24	23.35	23.29	23.17
			1	49	23.23	23.20	23.04
			25	0	22.31	22.19	22.04
			25	12	22.36	22.09	22.14
			25	24	22.25	22.18	22.05
			50	0	22.27	22.16	22.16
		16QAM	1	0	22.28	22.60	22.04
			1	24	22.25	22.89	22.42
			1	49	22.03	22.91	22.05
			25	0	21.17	21.21	21.08
			25	12	21.27	21.22	20.96
			25	24	21.21	21.31	21.00
			50	0	21.28	21.14	20.99

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20025	20175	20325
					1717.5MHz	1732.5MHz	1747.5MHz
Band 4	15	QPSK	1	0	23.06	22.92	23.16
			1	37	22.97	23.11	22.77
			1	74	23.00	23.09	22.68
			36	0	23.01	21.77	22.13
			36	16	22.28	21.78	22.12
			36	35	22.20	22.12	22.02
			75	0	22.32	22.04	21.93
		16QAM	1	0	22.17	21.96	21.74
			1	37	22.07	21.64	22.54
			1	74	22.92	22.02	21.81
			36	0	22.30	21.87	22.12
			36	16	22.26	21.65	22.09
			36	35	22.23	22.14	22.03
			75	0	22.17	22.01	20.92

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20050	20175	20300
					1720.0MHz	1732.5MHz	1745.0MHz
Band 4	20	QPSK	1	0	23.07	23.20	23.09
			1	49	23.69	23.07	23.16
			1	99	23.05	23.16	22.98
			50	0	22.07	22.05	22.18
			50	24	22.17	21.96	22.13
			50	49	22.12	22.03	21.86
			100	0	22.21	21.95	22.04
		16QAM	1	0	22.16	22.11	22.15
			1	49	22.69	22.27	21.72
			1	99	21.83	22.39	22.76
			50	0	21.13	21.00	22.13
			50	24	21.06	21.00	21.05
			50	49	21.19	21.00	20.90
			100	0	20.97	20.98	21.06

LTE Band 5 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20407	20525	20643
					824.7MHz	836.5MHz	848.3MHz
Band 5	1.4	QPSK	1	0	23.11	23.04	23.04
			1	2	23.15	23.26	23.30
			1	5	23.07	23.18	23.08
			3	0	23.27	23.30	23.17
			3	1	23.35	23.29	23.38
			3	2	23.08	23.26	23.35
			6	0	22.16	22.34	22.31
		16QAM	1	0	22.07	22.15	22.07
			1	2	22.04	22.34	22.54
			1	5	21.58	22.38	22.25
			3	0	22.08	22.11	22.41
			3	1	22.08	22.40	22.31
			3	2	22.34	22.14	22.05
			6	0	21.15	21.06	21.31

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20415	20525	20635
					825.5MHz	836.5MHz	847.5MHz
Band 5	3	QPSK	1	0	23.12	23.36	23.15
			1	7	23.02	23.38	23.14
			1	14	23.14	23.51	23.21
			8	0	22.01	22.18	22.09
			8	4	22.04	22.15	22.06
			8	7	22.17	22.49	22.16
			15	0	22.13	22.14	22.17
		16QAM	1	0	22.52	22.44	22.19
			1	7	21.88	22.06	21.80
			1	14	22.04	22.73	22.18
			8	0	21.16	20.99	21.06
			8	4	20.75	20.93	20.90
			8	7	21.26	21.51	21.19
			15	0	20.84	21.04	21.03

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20425	20525	20625
					826.5MHz	836.5MHz	846.5MHz
Band 5	5	QPSK	1	0	23.19	23.18	23.14
			1	12	23.11	23.12	23.05
			1	24	23.36	23.21	23.18
			12	0	22.18	22.30	22.17
			12	6	22.09	22.32	22.28
			12	11	22.29	22.11	22.34
			25	0	22.15	22.18	22.29
		16QAM	1	0	22.02	22.33	22.08
			1	12	22.08	22.24	22.12
			1	24	22.35	22.43	22.19
			12	0	21.08	21.04	20.98
			12	6	21.08	21.18	21.03
			12	11	21.38	21.09	21.14
			25	0	20.96	21.25	21.32

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					20450	20525	20600
					829MHz	836.5MHz	844MHz
Band 5	10	QPSK	1	0	22.99	23.16	23.09
			1	24	23.10	23.25	23.41
			1	49	23.20	23.17	23.16
			25	0	22.14	22.23	22.32
			25	12	22.23	22.24	22.34
			25	24	22.19	22.30	22.36
			50	0	22.34	22.27	22.26
		16QAM	1	0	22.26	22.12	22.15
			1	24	22.43	22.52	22.41
			1	49	21.98	22.18	22.29
			25	0	21.38	21.24	21.26
			25	12	21.27	21.31	21.27
			25	24	21.35	21.46	21.28
			50	0	21.20	21.23	21.20

LTE Band 12 part:

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23017	23095	23175
					699.7MHz	707.5MHz	715.3MHz
Band 12	1.4	QPSK	1	0	23.16	23.34	23.10
			1	2	23.32	23.42	23.05
			1	5	23.54	23.66	23.05
			3	0	23.30	23.52	23.16
			3	1	23.28	23.52	23.24
			3	2	23.28	23.44	23.21
			6	0	22.34	22.62	22.39
		16QAM	1	0	22.07	22.27	22.02
			1	2	22.57	22.29	22.10
			1	5	22.30	22.33	22.25
			3	0	22.16	22.30	21.97
			3	1	22.15	22.29	22.24
			3	2	22.65	22.62	22.35
			6	0	20.99	21.22	21.07

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23025	23095	23165
					700.5MHz	707.5MHz	714.5MHz
Band 12	3	QPSK	1	0	23.24	23.40	23.64
			1	7	23.78	23.20	23.18
			1	14	23.52	23.44	23.44
			8	0	22.33	22.57	22.47
			8	4	22.63	22.43	22.44
			8	7	22.39	22.46	22.29
			15	0	22.43	22.60	22.58
		16QAM	1	0	22.39	22.37	23.05
			1	7	22.70	22.22	21.88
			1	14	23.05	22.11	22.86
			8	0	21.28	21.38	21.50
			8	4	21.73	21.29	21.30
			8	7	21.29	21.31	21.31
			15	0	21.48	21.34	21.62

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23035	23095	23155
					701.5MHz	707.5MHz	713.5MHz
Band 12	5	QPSK	1	0	23.23	23.52	23.59
			1	12	23.64	23.47	23.70
			1	24	23.41	23.56	23.31
			12	0	22.45	22.36	22.45
			12	6	22.43	22.38	22.45
			12	11	22.41	22.44	22.40
			25	0	22.53	22.50	22.42
		16QAM	1	0	22.38	22.61	22.31
			1	12	22.62	22.17	22.37
			1	24	22.48	22.28	21.95
			12	0	21.48	21.10	21.45
			12	6	21.38	21.10	21.55
			12	11	21.49	21.36	21.38
			25	0	21.49	21.46	21.56

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					23060	23095	23130
					704MHz	707.5MHz	711MHz
Band 12	10	QPSK	1	0	23.27	23.56	23.22
			1	24	23.55	23.41	23.55
			1	49	23.40	23.42	23.07
			25	0	22.50	22.44	22.61
			25	12	22.39	22.46	22.68
			25	24	22.61	22.46	22.57
			50	0	22.61	22.44	22.50
		16QAM	1	0	22.86	22.71	22.42
			1	24	22.91	23.16	22.92
			1	49	22.54	23.08	22.11
			25	0	21.52	21.49	21.67
			25	12	21.59	21.50	21.66
			25	24	21.72	21.69	21.37
			50	0	21.48	21.58	21.50

LTE Band 66 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					131979	132322	132665
					1710.70MHz	1745.00MHz	1779.30MHz
Band 66	1.4	QPSK	1	0	23.21	22.93	23.06
			1	2	23.55	23.22	23.27
			1	5	23.31	23.18	23.00
			3	0	23.32	23.30	23.27
			3	1	23.27	23.29	23.26
			3	2	23.31	23.21	23.36
			6	0	22.35	22.14	22.26
		16QAM	1	0	22.09	22.69	22.23
			1	2	22.28	22.35	22.59
			1	5	22.29	22.72	22.28
			3	0	22.45	22.16	22.11
			3	1	22.13	22.00	22.00
			3	2	22.14	21.90	21.98
			6	0	21.27	21.14	21.47

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					131987	132322	132657
					1711.50MHz	1745.00MHz	1778.50MHz
Band 66	3	QPSK	1	0	22.08	23.30	23.31
			1	7	22.98	22.99	23.31
			1	14	23.37	22.96	23.05
			8	0	22.22	22.14	22.19
			8	4	22.20	22.11	22.14
			8	7	22.32	22.24	22.22
			15	0	22.19	22.11	22.21
		16QAM	1	0	21.77	22.08	22.15
			1	7	21.75	22.18	22.15
			1	14	22.03	22.09	21.95
			8	0	21.00	21.20	21.04
			8	4	21.09	21.00	21.28
			8	7	21.13	21.04	21.39
			15	0	20.99	20.94	20.96

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					131997	132322	132647
					1712.50MHz	1745.00MHz	1777.50MHz
Band 66	5	QPSK	1	0	23.35	23.18	23.30
			1	12	23.22	23.17	23.40
			1	24	23.34	23.24	23.55
			12	0	22.17	22.04	22.21
			12	6	22.19	22.15	22.33
			12	11	22.19	22.19	22.35
			25	0	22.29	22.15	22.35
		16QAM	1	0	22.18	22.03	22.28
			1	12	22.22	22.06	22.32
			1	24	22.13	22.13	22.46
			12	0	21.17	21.12	21.25
			12	6	20.85	21.13	21.36
			12	11	20.99	21.14	21.29
			25	0	21.08	21.05	21.30

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					132022	132322	132622
					1715.00MHz	1745.00MHz	1775.00MHz
Band 66	10	QPSK	1	0	23.10	23.00	23.18
			1	24	23.12	23.41	23.41
			1	49	23.34	23.30	23.32
			25	0	22.16	22.16	22.34
			25	12	22.26	22.17	22.24
			25	24	22.19	22.21	22.25
			50	0	22.24	22.24	22.22
		16QAM	1	0	22.20	22.00	22.01
			1	24	22.45	22.43	22.53
			1	49	22.15	22.12	22.97
			25	0	21.21	21.29	21.26
			25	12	20.98	21.28	21.27
			25	24	21.07	21.22	21.31
			50	0	21.19	21.14	21.23

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					132047	132322	132597
					1717.50MHz	1745.00MHz	1772.50MHz
Band 66	15	QPSK	1	0	23.13	22.96	23.04
			1	37	23.09	23.07	22.98
			1	74	23.02	23.10	23.28
			36	0	22.02	21.99	22.72
			36	16	21.99	22.51	21.95
			36	35	22.11	22.24	22.16
			75	0	22.15	22.07	22.13
		16QAM	1	0	22.23	22.72	21.90
			1	37	21.94	21.44	21.98
			1	74	22.10	22.30	21.98
			36	0	22.07	22.77	22.06
			36	16	22.75	22.68	21.73
			36	35	22.19	22.20	22.88
			75	0	21.00	20.99	21.05

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					132072	132322	132572
					1720.00MHz	1745.00MHz	1770.00MHz
Band 66	20	QPSK	1	0	23.07	23.01	23.19
			1	49	23.32	22.95	23.04
			1	99	23.03	23.28	23.12
			50	0	22.13	22.05	22.06
			50	24	22.09	22.14	22.02
			50	49	22.16	22.12	22.20
			100	0	22.04	22.09	22.02
		16QAM	1	0	22.25	22.01	22.98
			1	49	21.90	22.27	22.31
			1	99	22.01	22.54	22.54
			50	0	21.09	21.01	21.07
			50	24	21.03	21.13	21.05
			50	49	20.95	21.12	21.08
			100	0	21.04	21.06	20.94

LTE Band 71 part

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					133147	133297	133447
					665.5MHz	680.50MHz	695.50MHz
Band 71	5	QPSK	1	0	22.75	22.77	22.90
			1	12	23.01	22.81	22.68
			1	24	22.79	22.67	22.67
			12	0	21.84	21.73	21.71
			12	6	21.91	21.73	21.62
			12	11	21.84	21.71	21.74
			25	0	21.84	21.78	21.74
		16QAM	1	0	21.49	21.65	21.75
			1	12	21.46	21.89	21.77
			1	24	21.76	21.82	21.30
			12	0	20.69	20.68	20.66
			12	6	20.66	20.89	20.54
			12	11	20.82	20.78	20.55
			25	0	20.90	20.55	20.78

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					133172	133297	133422
					668.00MHz	680.50MHz	693.00MHz
Band 71	10	QPSK	1	0	22.68	22.83	22.64
			1	24	23.11	22.84	22.89
			1	49	22.65	22.68	22.59
			25	0	21.76	21.86	21.88
			25	12	21.86	21.77	21.88
			25	24	21.86	21.76	21.80
			50	0	21.78	21.68	21.76
		16QAM	1	0	21.67	21.96	21.69
			1	24	22.14	22.27	22.12
			1	49	21.51	21.72	21.91
			25	0	20.97	20.84	21.02
			25	12	20.96	20.75	20.58
			25	24	20.90	20.76	20.85
			50	0	20.75	20.86	20.67

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					133197	133297	133397
					670.50MHz	680.50MHz	690.50MHz
Band 71	15	QPSK	1	0	22.65	22.56	22.72
			1	37	22.62	22.69	22.62
			1	74	22.71	22.71	22.69
			36	0	21.78	21.80	21.96
			36	16	21.65	21.67	22.43
			36	35	21.91	21.61	22.45
			75	0	21.87	21.69	21.74
		16QAM	1	0	21.78	21.60	21.94
			1	37	21.63	21.80	21.55
			1	74	21.94	21.80	22.05
			36	0	21.86	21.80	22.36
			36	16	21.66	21.63	22.43
			36	35	21.83	21.69	22.04
			75	0	20.85	20.75	20.80

LTE Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Average Power (dBm)		
					133222	133322	133372
					673.00MHz	683.00MHz	688.00MHz
Band 71	20	QPSK	1	0	22.81	22.74	22.65
			1	49	22.88	23.26	22.76
			1	99	22.74	22.84	22.73
			50	0	21.73	21.71	21.62
			50	24	21.63	21.75	21.66
			50	49	21.85	21.66	21.71
			100	0	21.74	21.76	21.63
		16QAM	1	0	22.04	21.53	21.84
			1	49	22.77	21.70	22.22
			1	99	22.74	21.66	21.85
			50	0	20.76	20.82	20.66
			50	24	20.65	20.76	20.68
			50	49	20.78	20.71	20.94
			100	0	20.74	20.68	20.56

14 Exposure Positions Consideration

14.1 EUT Antenna Locations

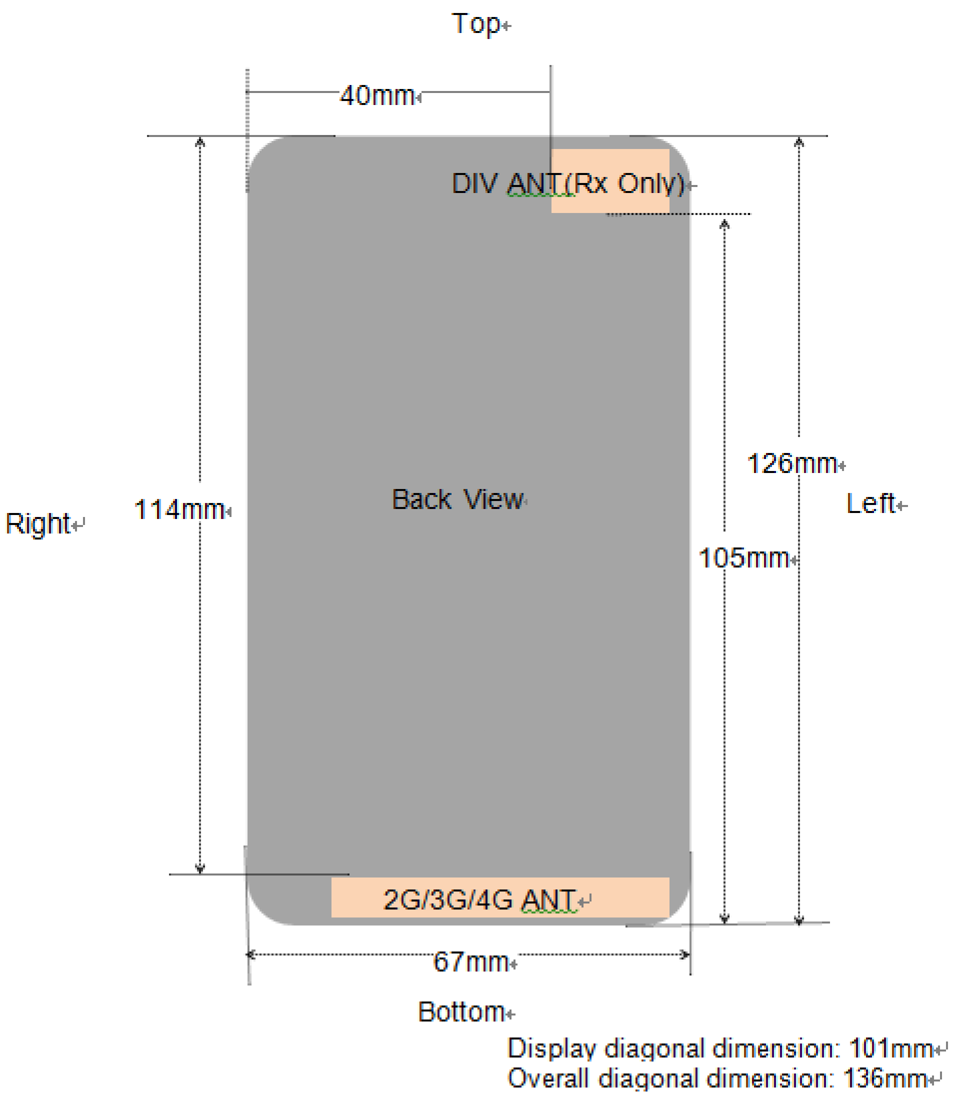


Fig.14.1 EUT Antenna Locations

Note: This antenna diagram is only used as a reference for the distance from the antenna to each edge. For the specific shape of the antenna, please refer to the physical photo.

14.2 Test Positions Consideration

Distance of Antennas to EUT edge/surface Test distance: 5mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G	<25mm	<25mm	114mm	<25mm	<25mm	<25mm

Test Positions Test distance: 5mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G	Yes	Yes	No	Yes	Yes	Yes

Note:

1. Body mode SAR assessments are required.
2. Referring to KDB 941225 D07 v01r02, UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge, at 5 mm separation from a flat phantom, for the data modes, wireless technologies and frequency bands supported by the device to determine SAR compliance..

15 SAR Test Results Summary

15.1 Standalone Body SAR

➢ GSM Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	GPRS850/2 slots	Front	190	836.6	31.12	0.07	31.5	0.231	1.091	0.252
1	GPRS850/2 slots	Back	190	836.6	31.12	0.17	31.5	**0.566**	1.091	0.618
	GPRS850/2 slots	Left	190	836.6	31.12	0.01	31.5	0.215	1.091	0.235
	GPRS850/2 slots	Right	190	836.6	31.12	0.14	31.5	0.186	1.091	0.203
	GPRS850/2 slots	Bottom	190	836.6	31.12	0.08	31.5	0.069	1.091	0.075
	GPRS1900/1 slot	Front	661	1880	30.51	0.04	31.0	0.356	1.119	0.398
	GPRS1900/1 slot	Back	661	1880	30.51	-0.03	31.0	0.710	1.119	0.794
	GPRS1900/1 slot	Left	661	1880	30.51	-0.09	31.0	0.311	1.119	0.348
	GPRS1900/1 slot	Right	661	1880	30.51	0.08	31.0	0.256	1.119	0.286
	GPRS1900/1 slot	Bottom	661	1880	30.51	-0.09	31.0	**0.953**	1.119	1.066
2	**GPRS1900/1 slot**	**Bottom**	**661**	**1880**	**30.51**	**-0.04**	**31.0**	**0.920**	**1.119**	**1.029**
	GPRS1900/1 slot	Bottom	512	1850.2	29.94	0.05	31.0	0.812	1.276	1.036
	GPRS1900/1 slot	Bottom	810	1909.8	30.27	-0.14	31.0	0.873	1.183	1.033
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ WCDMA Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band V/RMC	Front	4183	836.6	23.41	0.11	24.0	0.195	1.146	0.223
3	Band V/RMC	Back	4183	836.6	23.41	0.20	24.0	**0.385**	1.146	0.441
	Band V/RMC	Left	4183	836.6	23.41	0.05	24.0	0.123	1.146	0.141
	Band V/RMC	Right	4183	836.6	23.41	-0.06	24.0	0.102	1.146	0.117
	Band V/RMC	Bottom	4183	836.6	23.41	0.10	24.0	0.052	1.146	0.060
	Band IV/RMC	Front	1513	1752.6	23.20	0.05	23.5	0.736	1.072	0.789
4	Band IV/RMC	Back	1513	1752.6	23.20	0.05	23.5	**1.300**	1.072	1.394
	Band IV/RMC	**Back**	**1513**	**1752.6**	**23.20**	**0.01**	**23.5**	**1.250**	**1.072**	**1.340**
	Band IV/RMC	Back	1312	1712.4	22.94	-0.02	23.5	1.251	1.138	1.424
	Band IV/RMC	Back	1413	1732.6	22.07	-0.03	23.5	1.240	1.104	1.369
	Band IV/RMC	Left	1513	1752.6	23.20	-0.14	23.5	0.716	1.072	0.768
	Band IV/RMC	Right	1513	1752.6	23.20	-0.08	23.5	0.635	1.072	0.681
	Band IV/RMC	Bottom	1513	1752.6	23.20	0.18	23.5	1.260	1.072	1.351
	Band IV/RMC	Bottom	1312	1712.4	22.94	0.07	23.5	1.200	1.138	1.366
	Band IV/RMC	Bottom	1413	1732.6	23.07	0.04	23.5	1.210	1.104	1.336
	Band II/RMC	Front	9538	1907.6	23.25	0.06	23.5	0.643	1.059	0.681
	Band II/RMC	Back	9538	1907.6	23.25	-0.03	23.5	1.000	1.059	1.059
	Band II/RMC	Back	9262	1852.4	22.84	-0.03	23.5	1.050	1.164	1.222
	Band II/RMC	Back	9400	1880	23.01	-0.07	23.5	1.110	1.119	1.242
	Band II/RMC	Left	9538	1907.6	23.25	-0.18	23.5	0.456	1.059	0.483
	Band II/RMC	Right	9538	1907.6	23.25	0.15	23.5	0.588	1.059	0.623
	Band II/RMC	Bottom	9538	1907.6	23.25	0.07	23.5	1.170	1.059	1.239
	Band II/RMC	Bottom	9262	1852.4	22.84	0.06	23.5	1.180	1.164	1.374
5	Band II/RMC	Bottom	9400	1880	23.01	-0.16	23.5	**1.260**	1.119	1.410
	Band II/RMC	**Bottom**	**9400**	**1880**	**23.01**	**-0.10**	**23.5**	**1.220**	**1.119**	**1.365**
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 2(20MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band2/1RB#49	Front	18700	1860	23.22	0.03	23.5	0.741	1.067	0.791
	Band2/1RB#49	Back	18700	1860	23.22	0.13	23.5	1.120	1.067	1.195
	Band2/1RB#49	Back	18900	1880	23.09	0.01	23.5	1.050	1.099	1.154
	Band2/1RB#49	Back	19100	1900	23.05	-0.16	23.5	1.020	1.109	1.131
	Band2/1RB#49	Left	18700	1860	23.22	0.08	23.5	0.652	1.067	0.696
	Band2/1RB#49	Right	18700	1860	23.22	-0.17	23.5	0.668	1.067	0.713
	Band2/1RB#49	Bottom	18700	1860	23.22	-0.15	23.5	1.070	1.067	1.142
6	Band2/1RB#0	Bottom	18900	1880	23.09	0.17	23.5	**1.180**	1.099	1.297
	Band2/1RB#0	**Bottom**	**18900**	**1880**	**23.09**	**0.11**	**23.5**	**1.120**	**1.099**	**1.231**
	Band2/1RB#0	Bottom	19100	1900	23.05	0.19	23.5	1.080	1.109	1.198
	Band2/50%RB#49	Front	18700	1860	22.14	0.00	22.5	0.681	1.086	0.740
	Band2/50%RB#49	Back	18700	1860	22.14	0.07	22.5	1.020	1.086	1.108
	Band2/50%RB#49	Back	18900	1880	21.96	0.16	22.5	0.913	1.132	1.034
	Band2/50%RB#0	Back	19100	1900	22.10	-0.02	22.5	0.958	1.096	1.050
	Band2/50%RB#49	Left	18700	1860	22.14	-0.19	22.5	0.561	1.086	0.609
	Band2/50%RB#49	Right	18700	1860	22.14	0.05	22.5	0.528	1.086	0.573
	Band2/50%RB#49	Bottom	18700	1860	22.14	-0.01	22.5	1.070	1.086	1.162
	Band2/50%RB#49	Bottom	18900	1880	21.96	0.18	22.5	0.988	1.132	1.118
	Band2/50%RB#0	Bottom	19100	1900	22.10	-0.18	22.5	0.946	1.096	1.037
	Band2/100RB#0	Front	18900	1880	21.96	0.17	22.5	0.642	1.132	0.727
	Band2/100RB#0	Back	18900	1880	21.96	0.03	22.5	0.958	1.132	1.084
	Band2/100RB#0	Back	18700	1860	21.91	-0.14	22.5	0.921	1.146	1.055
	Band2/100RB#0	Back	19100	1900	21.96	-0.04	22.5	0.933	1.132	1.056
	Band2/100RB#0	Left	18900	1880	21.96	-0.03	22.5	0.498	1.132	0.564
	Band2/100RB#0	Right	18900	1880	21.96	0.01	22.5	0.426	1.132	0.482
	Band2/100RB#0	Bottom	18900	1880	21.96	-0.02	22.5	0.982	1.132	1.112
	Band2/100RB#0	Bottom	18700	1860	21.91	-0.09	22.5	0.964	1.146	1.105
	Band2/100RB#0	Bottom	19100	1900	21.96	0.06	22.5	0.945	1.132	1.070
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

➢ FDD-LTE Band 5(10MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band5/1RB#24	Front	20600	844	23.41	0.03	23.5	0.611	1.021	0.624
	Band5/1RB#24	Back	20600	844	23.41	-0.01	23.5	1.210	1.021	1.235
7	Band5/1RB#24	Back	20450	829	23.20	0.09	23.5	**1.300**	1.072	1.394
	Band5/1RB#24	**Back**	**20450**	**829**	**23.20**	**0.01**	**23.5**	**1.260**	**1.072**	**1.351**
	Band5/1RB#24	Back	20525	836.5	23.25	0.00	23.5	1.120	1.059	1.186
	Band5/1RB#24	Left	20600	844	23.41	-0.02	23.5	0.333	1.021	0.340
	Band5/1RB#24	Right	20600	844	23.41	0.06	23.5	0.390	1.021	0.398
	Band5/1RB#24	Bottom	20600	844	23.41	-0.31	23.5	0.180	1.021	0.184
	Band5/25RB#24	Front	20600	844	22.36	0.02	23.0	0.535	1.159	0.620
	Band5/25RB#24	Back	20600	844	22.36	-0.20	23.0	1.150	1.159	1.333
	Band5/25RB#12	Back	20450	829	22.23	0.10	23.0	1.055	1.194	1.260
	Band5/25RB#24	Back	20525	836.5	22.30	0.13	23.0	0.985	1.175	1.157
	Band5/25RB#24	Left	20600	844	22.36	0.16	23.0	0.354	1.159	0.410
	Band5/25RB#24	Right	20600	844	22.36	-0.01	23.0	0.331	1.159	0.384
	Band5/25RB#24	Bottom	20600	844	22.36	0.06	23.0	0.152	1.159	0.176
	Band5/50RB#0	Front	20450	829	22.34	0.09	23.0	0.511	1.164	0.595
	Band5/50RB#0	Back	20450	829	22.34	0.11	23.0	1.120	1.164	1.304
	Band5/50RB#0	Back	20525	836.5	22.27	-0.07	23.0	0.952	1.183	1.126
	Band5/50RB#0	Back	20600	844	22.26	0.07	23.0	0.943	1.186	1.118
	Band5/50RB#0	Left	20450	829	22.34	-0.03	23.0	0.321	1.164	0.374
	Band5/50RB#0	Right	20450	829	22.34	0.03	23.0	0.305	1.164	0.355
	Band5/50RB#0	Bottom	20450	829	22.34	-0.17	23.0	0.137	1.164	0.159

ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	1.6 W/kg (mW/g) Averaged over 1g

➢ FDD-LTE Band 12(10MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band12/1RB#0	Front	23095	707.5	23.56	0.13	24.0	0.214	1.107	0.237
8	Band12/1RB#0	Back	23095	707.5	23.56	-0.02	24.0	**0.326**	1.107	0.361
	Band12/1RB#0	Left	23095	707.5	23.56	0.08	24.0	0.136	1.107	0.151
	Band12/1RB#0	Right	23095	707.5	23.56	0.10	24.0	0.112	1.107	0.124
	Band12/1RB#0	Bottom	23095	707.5	23.56	-0.02	24.0	0.121	1.107	0.134
	Band12/25RB#12	Front	23130	711	22.68	0.11	23.0	0.201	1.076	0.216
	Band12/25RB#12	Back	23130	711	22.68	0.05	23.0	0.240	1.076	0.258
	Band12/25RB#12	Left	23130	711	22.68	-0.06	23.0	0.113	1.076	0.122
	Band12/25RB#12	Right	23130	711	22.68	-0.05	23.0	0.107	1.076	0.115
	Band12/25RB#12	Bottom	23130	711	22.68	-0.11	23.0	0.106	1.076	0.114
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**1.6 W/kg (mW/g) Averaged over 1g**				

➢ FDD-LTE Band 66(20MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band66/1RB#49	Front	132072	1720	23.32	-0.07	23.5	0.642	1.042	0.669
	Band66/1RB#49	Back	132072	1720	23.32	0.05	23.5	1.310	1.042	1.365
	Band66/1RB#99	Back	132322	1745	23.28	0.02	23.5	1.280	1.052	1.347
	Band66/1RB#0	Back	132572	1770	23.19	0.05	23.5	1.240	1.074	1.332
	Band66/1RB#49	Left	132072	1720	23.32	0.15	23.5	0.358	1.042	0.373
	Band66/1RB#49	Right	132072	1720	23.32	0.11	23.5	0.314	1.042	0.327
9	Band66/1RB#49	Bottom	132072	1720	23.32	-0.08	23.5	**1.360**	1.042	1.417
	Band66/1RB#49	**Bottom**	**132072**	**1720**	**23.32**	**-0.04**	**23.5**	**1.300**	**1.042**	**1.355**
	Band66/1RB#99	Bottom	132322	1745	23.28	0.05	23.5	1.050	1.052	1.105
	Band66/1RB#0	Bottom	132572	1770	23.19	0.12	23.5	1.150	1.074	1.235
	Band66/50RB#49	Front	132572	1770	22.20	0.09	22.5	0.602	1.072	0.645
	Band66/50RB#49	Back	132572	1770	22.20	0.04	22.5	1.050	1.072	1.126
	Band66/50RB#49	Back	132072	1720	22.16	0.15	22.5	0.857	1.081	0.926
	Band66/50RB#24	Back	132322	1745	22.14	-0.14	22.5	0.965	1.086	1.048
	Band66/50RB#49	Left	132572	1770	22.20	-0.07	22.5	0.225	1.072	0.241
	Band66/50RB#49	Right	132572	1770	22.20	0.08	22.5	0.261	1.072	0.280
	Band66/50RB#49	Bottom	132572	1770	22.20	0.12	22.5	1.150	1.072	1.233
	Band66/50RB#49	Bottom	132072	1720	22.16	0.20	22.5	1.040	1.081	1.124
	Band66/50RB#24	Bottom	132322	1745	22.14	0.04	22.5	0.955	1.086	1.037
	Band66/100RB#0	Front	132322	1745	22.09	0.09	22.5	0.521	1.099	0.573
	Band66/100RB#0	Back	132322	1745	22.09	0.04	22.5	0.856	1.099	0.941
	Band66/100RB#0	Back	132072	1720	22.04	0.15	22.5	0.751	1.112	0.835
	Band66/100RB#0	Back	132572	1770	22.02	-0.14	22.5	0.788	1.117	0.880
	Band66/100RB#0	Left	132322	1745	22.09	-0.07	22.5	0.214	1.099	0.235
	Band66/100RB#0	Right	132322	1745	22.09	0.08	22.5	0.223	1.099	0.245
	Band66/100RB#0	Bottom	132322	1745	22.09	0.12	22.5	1.050	1.099	1.154
	Band66/100RB#0	Bottom	132072	1720	22.04	0.20	22.5	0.976	1.112	1.085
	Band66/100RB#0	Bottom	132572	1770	22.02	0.04	22.5	0.931	1.117	1.040
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						**1.6 W/kg (mW/g) Averaged over 1g**				

➢ FDD-LTE Band 71(20MHz) QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	Reported SAR_{1g} (W/kg)
	Band71/1RB#49	Front	133322	683	23.26	0.01	24.0	0.156	1.186	0.185
10	Band71/1RB#49	Back	133322	683	23.26	0.02	24.0	**0.236**	1.186	0.280
	Band71/1RB#49	Left	133322	683	23.26	-0.05	24.0	0.128	1.186	0.152
	Band71/1RB#49	Right	133322	683	23.26	-0.09	24.0	0.121	1.186	0.144
	Band71/1RB#49	Bottom	133322	683	23.26	-0.10	24.0	0.082	1.186	0.097
	Band71/50RB#49	Front	133222	673	21.85	-0.11	22.5	0.143	1.161	0.166
	Band71/50RB#49	Back	133222	673	21.85	0.03	22.5	0.229	1.161	0.266
	Band71/50RB#49	Left	133222	673	21.85	-0.05	22.5	0.112	1.161	0.130
	Band71/50RB#49	Right	133222	673	21.85	0.14	22.5	0.105	1.161	0.122
	Band71/50RB#49	Bottom	133222	673	21.85	-0.05	22.5	0.056	1.161	0.065
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**					

Note:
1. According to KDB 941225 D07 v01r02, Body SAR testing was performed at 5mm separation.
2. Per KDB 447498 D01v06, for each exposure position, if the highest output channel Reported SAR ≤0.8W/kg, otherchannels SAR testing is not necessary.
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measuredSAR is ≥0.8W/kg.
4. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
5. Highlight part of test data means repeated test.

15.2 Repeated SAR measurement

Band/ Mode	Test Position	CH.	Freq. (MHz)	Measured SAR (W/kg)				
				Original	1st Repeated		2nd Repeated	
					Value	Ratio	Value	Ratio
GPRS1900/1 slot	Bottom	661	1880	0.953	0.920	1.04	/	/
Band IV/RMC	Bottom	1513	1752.6	1.300	1.250	1.04	/	/
Band II/RMC	Bottom	9400	1880	1.260	1.220	1.03	/	/
Band2/1RB#0	Bottom	18900	1880	1.180	1.120	1.05	/	/
Band5/1RB#24	Back	20450	829	1.300	1.260	1.03	/	/
Band66/1RB#49	Bottom	132072	1720	1.360	1.330	1.02	/	/
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**1.6 W/kg (mW/g) Averaged over 1g**				

Note:
1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r04, if the ratio of *original* and *repeated* is ≤ 1.2and the measured SAR <1.45W/kg,only one repeated measurement is required.

15.3 Measurement Uncertainty

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A Type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in below Table.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor	1/k(b)	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

Uncertainty Component	Section	Uncert. Value	Prob. Dist.	Div.	(C_i) (1 g)	(C_i) (10 g)	Std. Unc. (1 g)	Std. Unc. (10 g)	V_i
Measurement System									
Probe Calibration	E.2.1	±7.4%	N	1	1	1	±7.4%	±7.4%	∞
Axial Isotropy	E.2.2	±1.2%	R	$\sqrt{3}$	0.7	0.7	±0.49%	±0.49%	∞
Hemispherical Isotropy	E.2.2	±3.2%	R	$\sqrt{3}$	0.7	0.7	±1.29%	±1.29%	∞
Boundary Effects	E.2.3	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Linearity	E.2.4	±0.9%	R	$\sqrt{3}$	1	1	±0.52%	±0.52%	∞
System Detection Limits	E.2.5	±0.25%	R	$\sqrt{3}$	1	1	±0.14%	±0.14%	∞
Readout Electronics	E.2.6	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	E.2.7	±0.8%	R	$\sqrt{3}$	1	1	±0.46%	±0.46%	∞
Integration Time	E.2.8	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	E.6.1	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
RF Ambient Reflections	E.6.1	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
Probe positioner mechanical tolerances	E.6.2	±0.4%	R	$\sqrt{3}$	1	1	±0.23%	±0.23%	∞
Probe positioning tolerance with respect to the phantom shell surface	E.6.3	±2.9%	R	$\sqrt{3}$	1	1	±1.68%	±1.68%	∞
Interpolation, extrapolation, and integration algorithm For max. SAR Evaluation.	E.5	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Test Sample Related									
Device Positioning	E.4.2	±4.6%	N	1	1	1	±4.6%	±4.6%	M-1
Device Holder	E.4.1	±5.2%	N	1	1	1	±5.2%	±5.2%	M-1
Power Drift	6.6.2	±5.0%	R	$\sqrt{3}$	1	1	±2.89%	±2.89%	∞
Phantom and Setup									
Phantom Uncertainty	E.3.1	±4.0%	R	$\sqrt{3}$	1	1	±2.31%	±2.31%	∞
Liquid conductivity (measured value)	E.3.3	±2.97%	N	1	0.78	0.71	±2.32%	±2.11%	M
Liquid dielectric constant (measured value)	E.3.3	±3.08%	N	1	0.23	0.26	±0.71%	±0.8%	M
Liquid Conductivity - Temperature Uncertainty	E.3.4	±1.3%	R	$\sqrt{3}$	0.78	0.71	±0.59%	±0.53%	∞
Liquid Dielectric Constant - Temperature Uncertainty	E.3.4	±1.1%	R	$\sqrt{3}$	0.23	0.26	±0.15%	±0.17%	∞
Combined Standard Uncertainty (RSS)							±11.55%	±11.51%	
Expanded Uncertainty (95% Confidence Level, k = 2)							±23.11%	±23.01%	

Uncertainty Budget for frequency range 300 MHz to 3 GHz according to IEEE1528-2003

15.4 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested. Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

16 Reference

[1]. FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

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[3]. IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4]. SPEAG DASY52 System Handbook

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[6]. FCC KDB 616217 D04 v01r02, “SAR EVALUATION CONSIDERATIONS FOR LAPTOP, NOTEBOOK, NETBOOK AND TABLET COMPUTERS”, October 2015

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[9]. FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[10]. FCC KDB 941225 D05 v02r05, “SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES”, Dec 2015

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[12]. FCC KDB 941225 D06 v02r01, "SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES", October 2015

[13]. FCC KDB 865664 D01 v01r04, “SAR MEASUREMENT REQUIREMENTS FOR 100 MHz TO 6 GHz”, August 2015

[14]. FCC KDB 865664 D02 v01r02, ”RF EXPOSURE COMPLIANCE REPORTING AND DOCUMENTATION CONSIDERATIONS”, October , 2015

Appendix A: Plots of SAR System Check

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Dipole 750 MHz; Type: D750V3; Serial: SN:1118

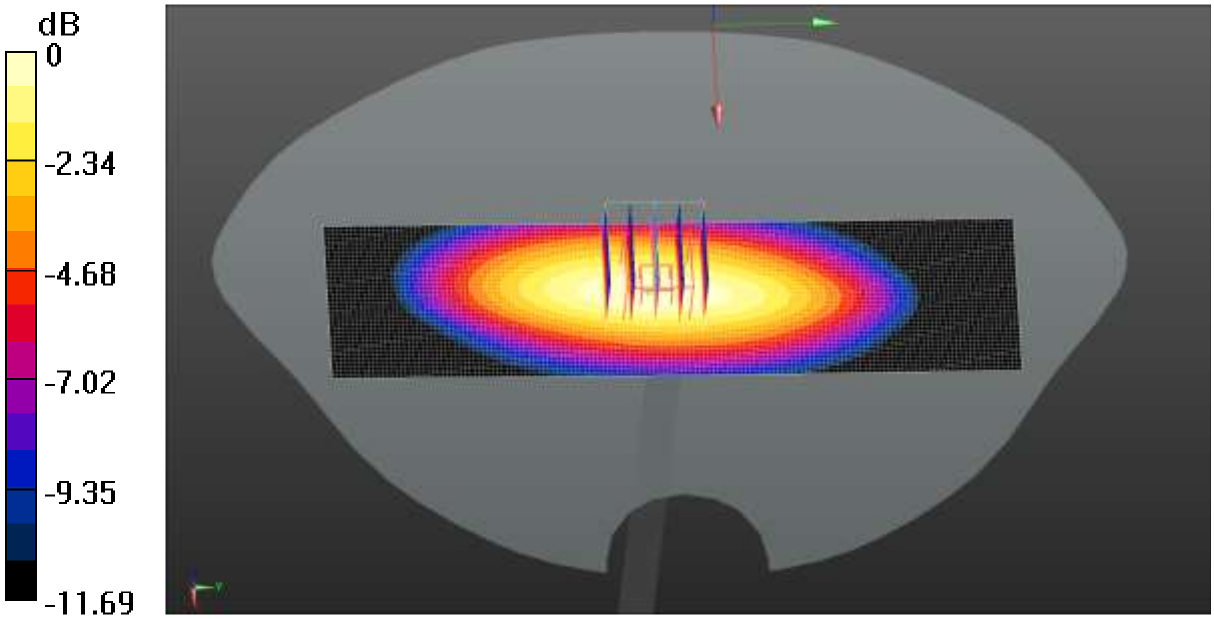
Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 750 MHz; σ = 0.891 S/m; ε_r = 40.901; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(10.09, 10.09, 10.09) @ 750 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency750 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Area Scan (41x151x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.947 W/kg

System Performance Check at Frequency750 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.11 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.682 W/kg; SAR(10 g) = 0.433 W/kg
Smallest distance from peaks to all points 3 dB below = 11 mm
Ratio of SAR at M2 to SAR at M1 = 60.5%
Maximum value of SAR (measured) = 0.955 W/kg



0 dB = 0.955 W/kg = -0.20 dBW/kg

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Dipole 835 MHz; Type: D835V2; Serial: SN:4D154

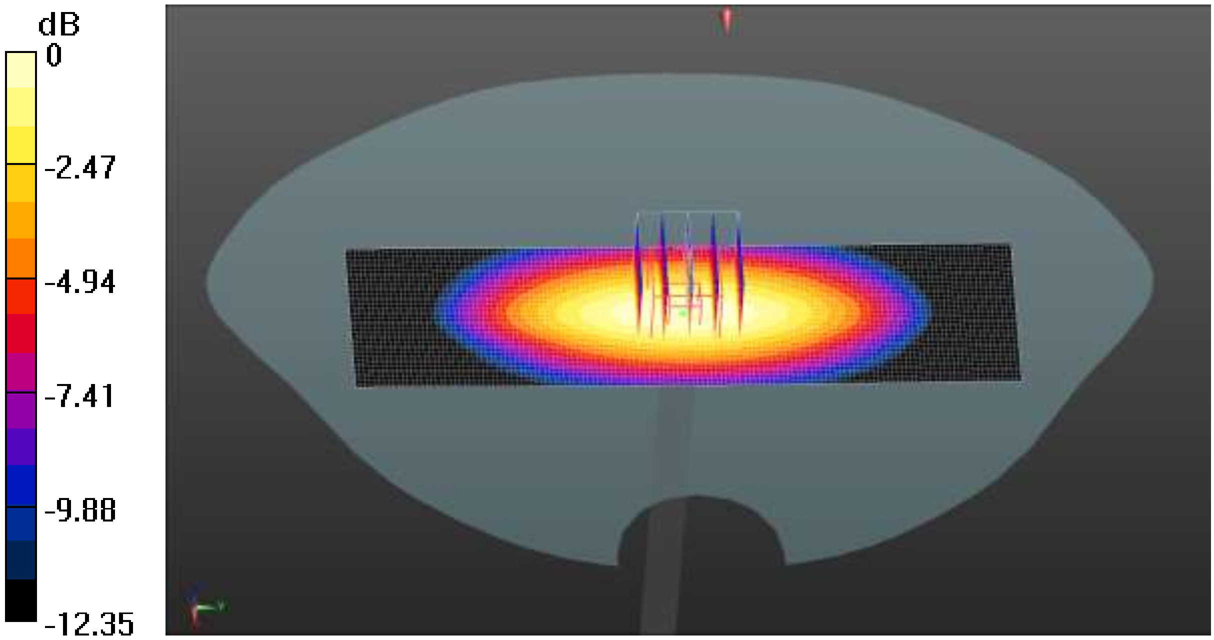
Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.929 S/m; ε_r = 40.763; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(9.73, 9.73, 9.73) @ 835 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Area Scan (41x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.02W/kg

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.53 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.788 W/kg; SAR(10 g) = 0.482 W/kg
Smallest distance from peaks to all points 3 dB below = 13.6 mm
Ratio of SAR at M2 to SAR at M1 = 52.2%
Maximum value of SAR (measured) = 1.03 W/kg



0 dB = 1.03 W/kg = 0.13 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: SN:1177

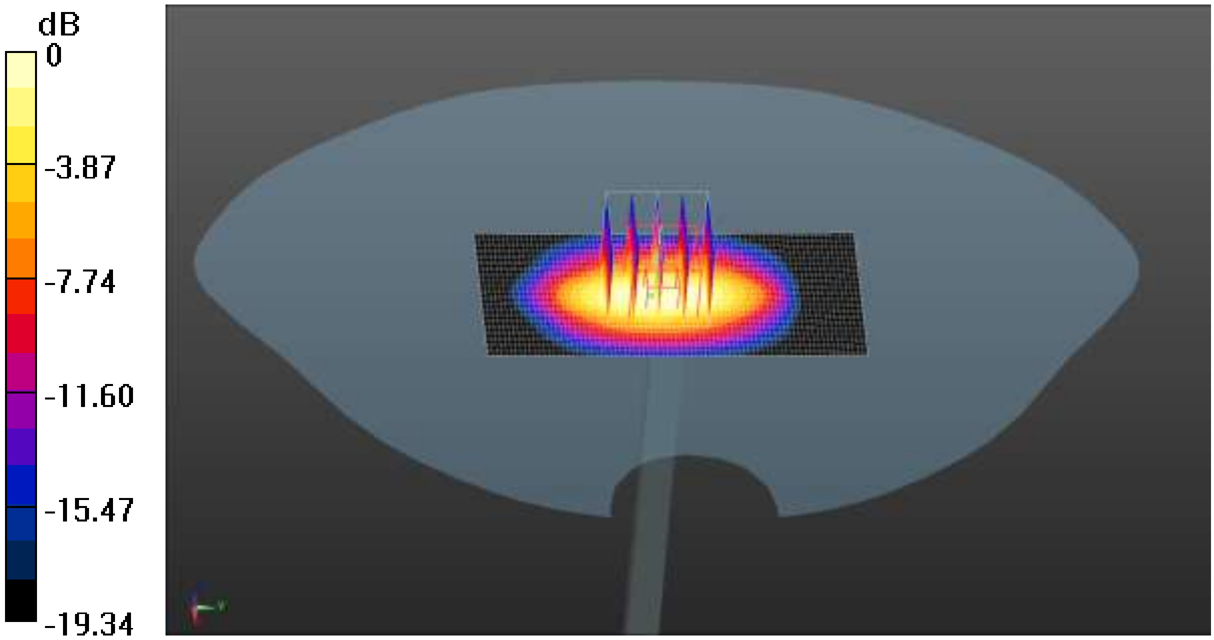
Communication System: UID 0, CW (0); Frequency: 1750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1750 MHz; σ = 1.366 S/m; ε_r = 41.594; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.53, 8.53, 8.53) @ 1750 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency 1750 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Area Scan (41x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.13 W/kg

System Performance Check at Frequency 1750 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 40.66 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.51 W/kg
SAR(1 g) = 1.47 W/kg; SAR(10 g) = 0.764 W/kg
Smallest distance from peaks to all points 3 dB below = 10.3 mm
Ratio of SAR at M2 to SAR at M1 = 51.8%
Maximum value of SAR (measured) = 2.18 W/kg



0 dB = 2.18 W/kg = 3.38 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN:5d175

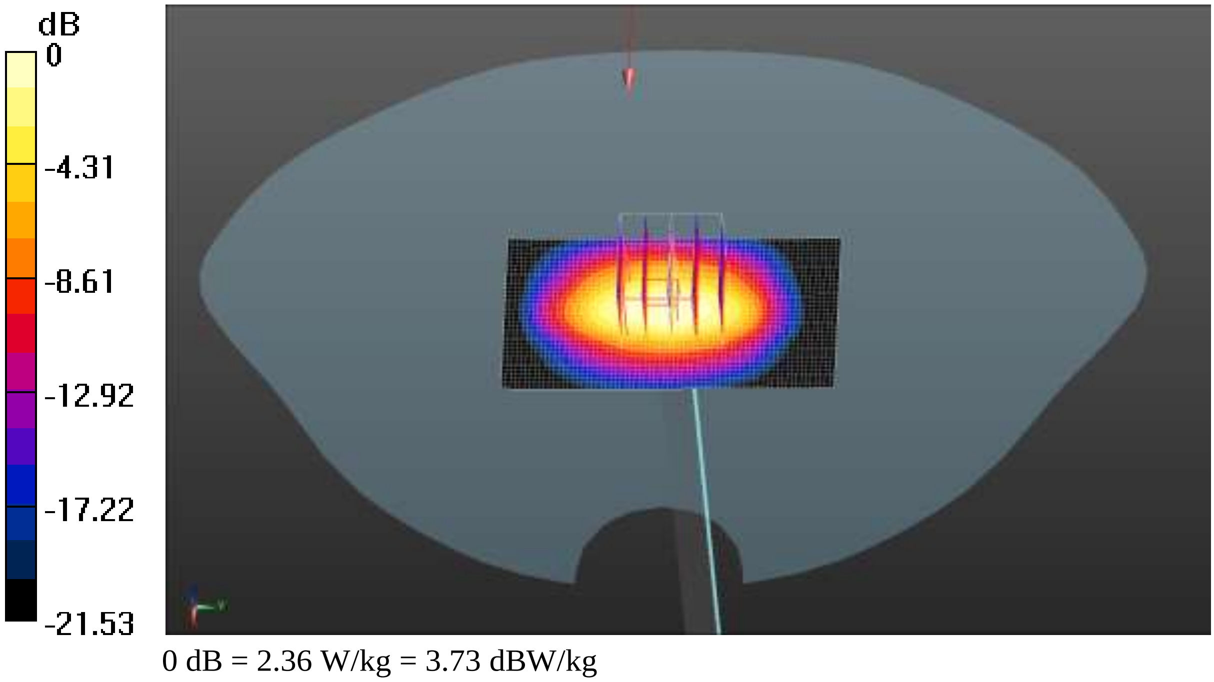
Communication System: UID 0, CW (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.451 S/m; ε_r = 41.369; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.13, 8.13, 8.13) @ 1900 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency 1900 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Area Scan (41x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.36 W/kg

System Performance Check at Frequency 1900 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 40.12 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.06 W/kg
SAR(1 g) = 1.54 W/kg; SAR(10 g) = 0.804 W/kg
Smallest distance from peaks to all points 3 dB below = 12.7 mm
Ratio of SAR at M2 to SAR at M1 = 60.6%
Maximum value of SAR (measured) = 2.36 W/kg



0 dB = 2.36 W/kg = 3.73 dBW/kg

Appendix B: Plots of SAR Test Data

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

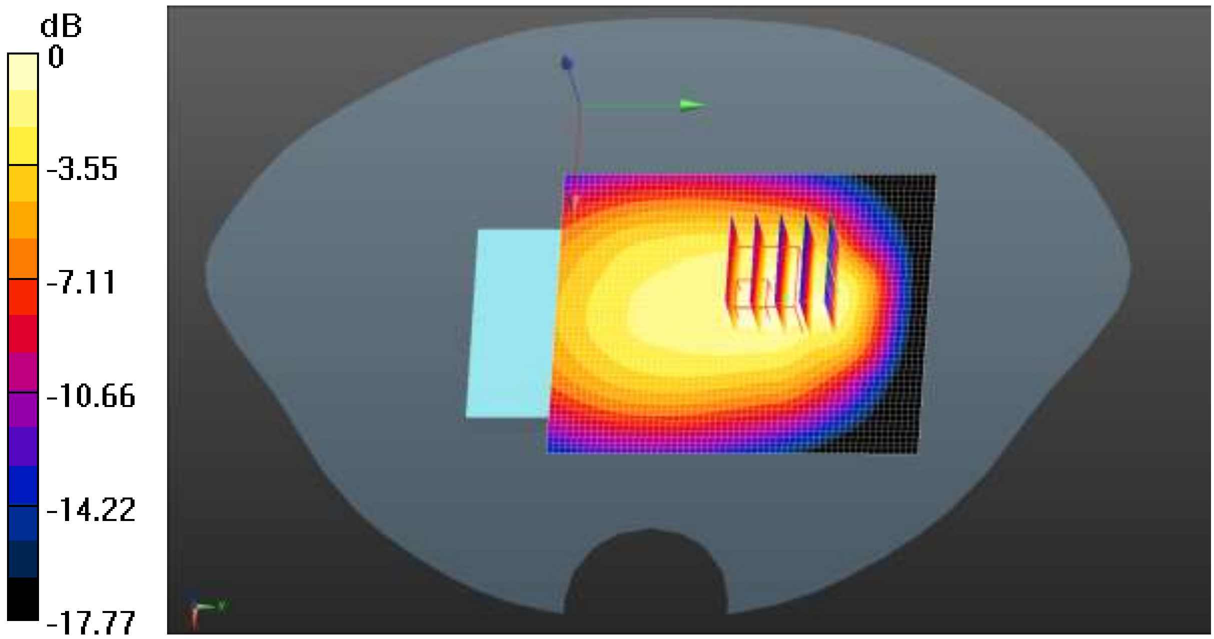
Communication System: UID 0, GPRS(2 Slots) (0); Frequency: 836.6 MHz;Duty Cycle: 1:4.10015
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.929 S/m; ε_r = 40.755; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(9.74, 9.74, 9.74) @ 836.6 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

GPRS 850 2Slots Body Back/Middle Channel/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.883 W/kg

GPRS 850 2Slots Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.80 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.566 W/kg; SAR(10 g) = 0.369 W/kg
Smallest distance from peaks to all points 3 dB below = 14.4 mm
Ratio of SAR at M2 to SAR at M1 = 36.7%
Maximum value of SAR (measured) = 0.913 W/kg



0 dB = 0.913 W/kg = -0.40 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

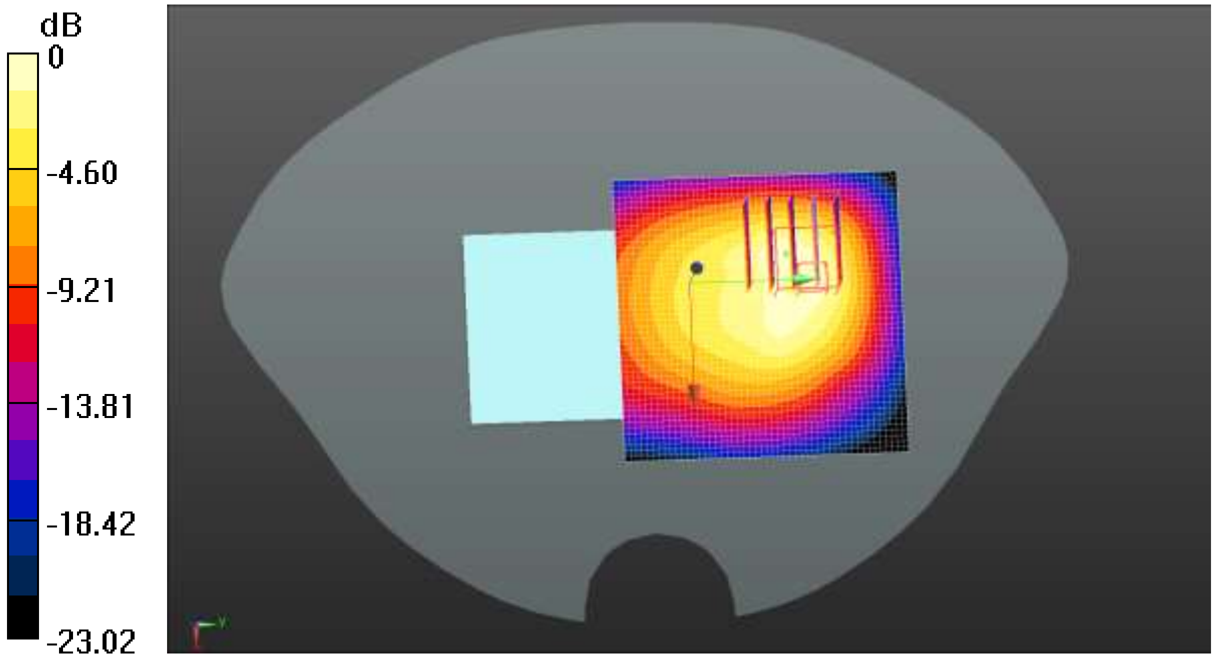
Communication System: UID 0, GPRS(1 Slots) (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.443 S/m; ε_r = 41.406; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.13, 8.13, 8.13) @ 1880 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

GPRS 1900 1Slot Body Back/Middle Channel/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.11 W/kg

GPRS 1900 1Slot Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.02 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.953 W/kg; SAR(10 g) = 0.577 W/kg
Smallest distance from peaks to all points 3 dB below = 13.6 mm
Ratio of SAR at M2 to SAR at M1 = 49.6%
Maximum value of SAR (measured) = 1.38 W/kg



0 dB = 1.38 W/kg = 1.40 dBW/kg

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

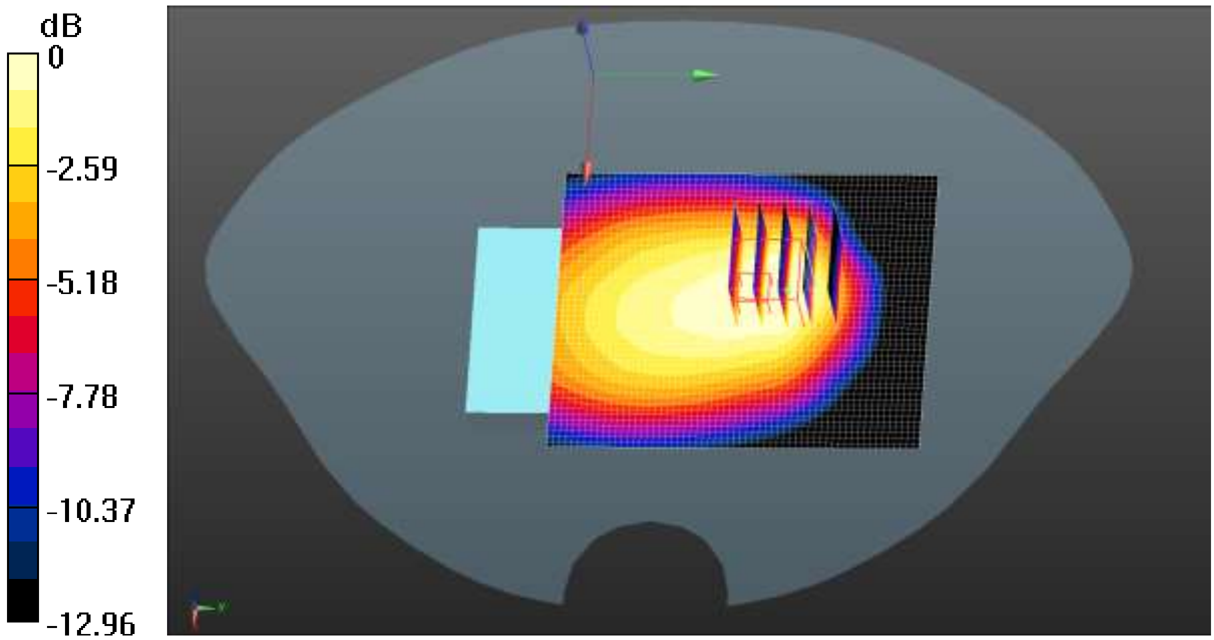
Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.929 S/m; ε_r = 40.755; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(9.74, 9.74, 9.74) @ 836.6 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

WCDMA 850 Body Back/Middle Channel/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.706 W/kg

WCDMA 850 Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.74 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.771 W/kg
SAR(1 g) = 0.385 W/kg; SAR(10 g) = 0.243 W/kg
Smallest distance from peaks to all points 3 dB below = 10.7 mm
Ratio of SAR at M2 to SAR at M1 = 42.7%
Maximum value of SAR (measured) = 0.547 W/kg



0 dB = 0.547 W/kg = -2.62 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

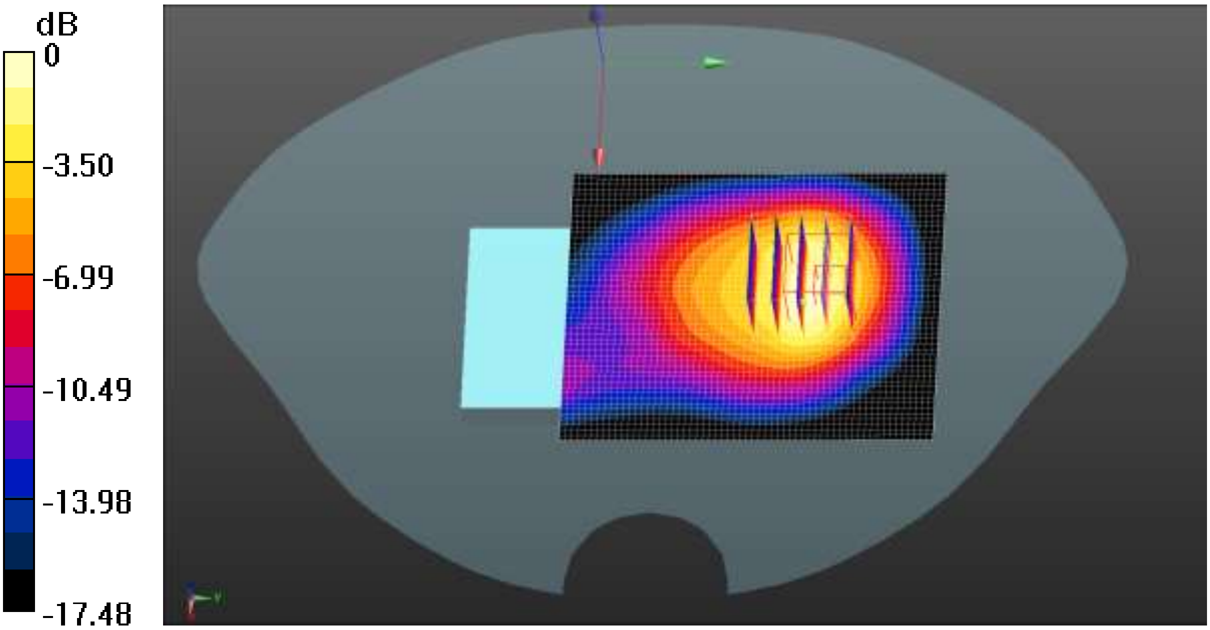
Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1752.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1752.6 MHz; σ = 1.373 S/m; ε_r = 41.587; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.53, 8.53, 8.53) @ 1752.6 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

WCDMA 1700 Body Back/High Channel/Area Scan (51x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.83 W/kg

WCDMA 1700 Body Back/High Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.82 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 2.80 W/kg
SAR(1 g) = 1.30 W/kg; SAR(10 g) = 0.707 W/kg
Smallest distance from peaks to all points 3 dB below = 11.3 mm
Ratio of SAR at M2 to SAR at M1 = 52.7%
Maximum value of SAR (measured) = 2.01 W/kg



0 dB = 2.01 W/kg = 3.03 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

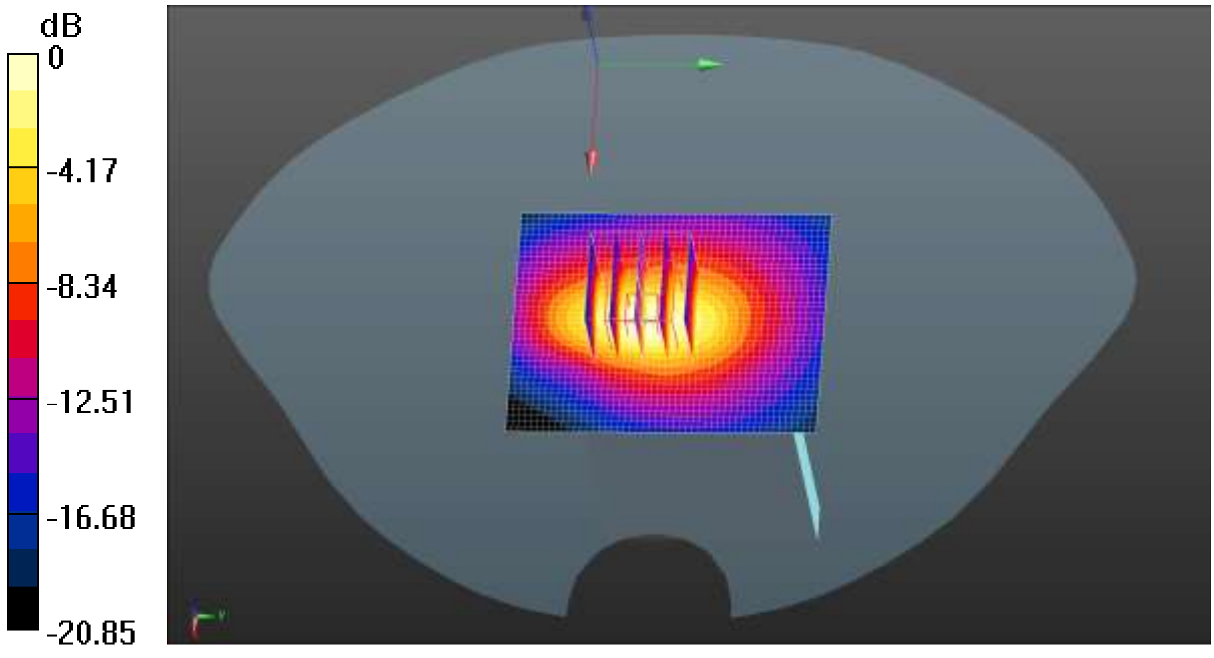
Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.443 S/m; ε_r = 41.406; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.13, 8.13, 8.13) @ 1880 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

WCDMA 1900 Body Bottom/Middle Channel/Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.88 W/kg

WCDMA 1900 Body Bottom/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.61 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 1.26 W/kg; SAR(10 g) = 0.592 W/kg
Smallest distance from peaks to all points 3 dB below = 9.3 mm
Ratio of SAR at M2 to SAR at M1 = 53.5%
Maximum value of SAR (measured) = 1.84 W/kg



0 dB = 1.84 W/kg = 2.65 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

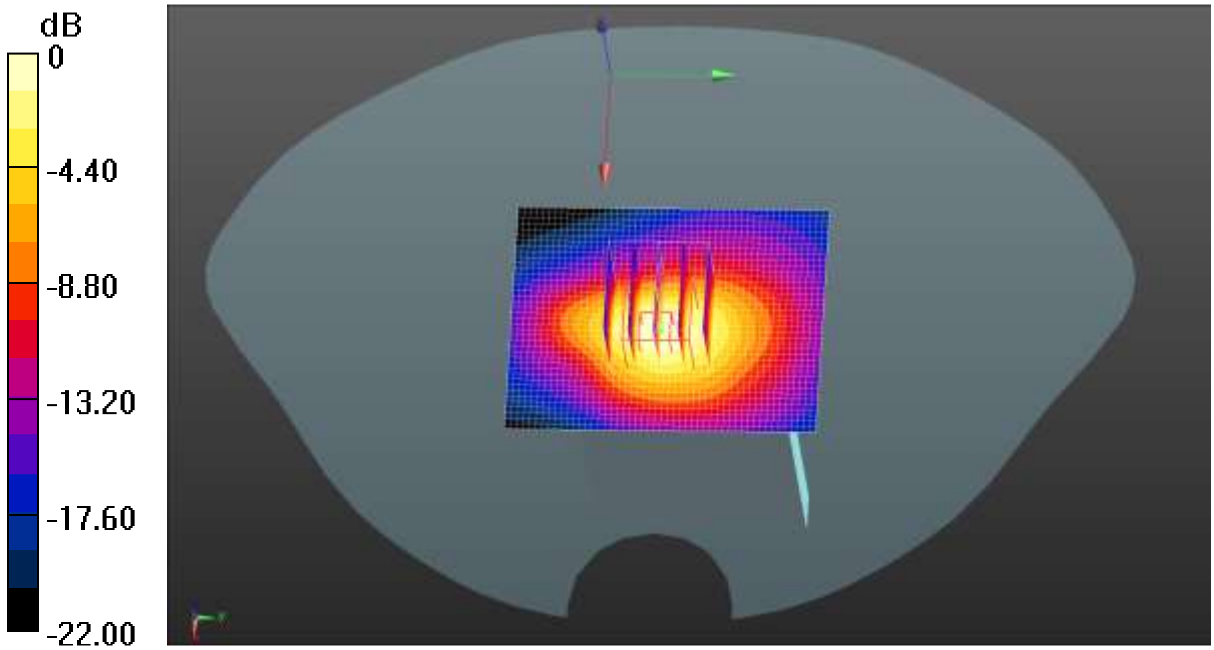
Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.443 S/m; ε_r = 41.406; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(8.13, 8.13, 8.13) @ 1880 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

LTE Band 2 1RB(20MHz) Body Bottom/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.38 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 2.58 W/kg
SAR(1 g) = 1.18 W/kg; SAR(10 g) = 0.643 W/kg
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 54.6%
Maximum value of SAR (measured) = 1.82 W/kg

LTE Band 2 1RB(20MHz) Body Bottom/Middle Channel/Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.82 W/kg



0 dB = 1.82 W/kg = 2.60 dBW/kg

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

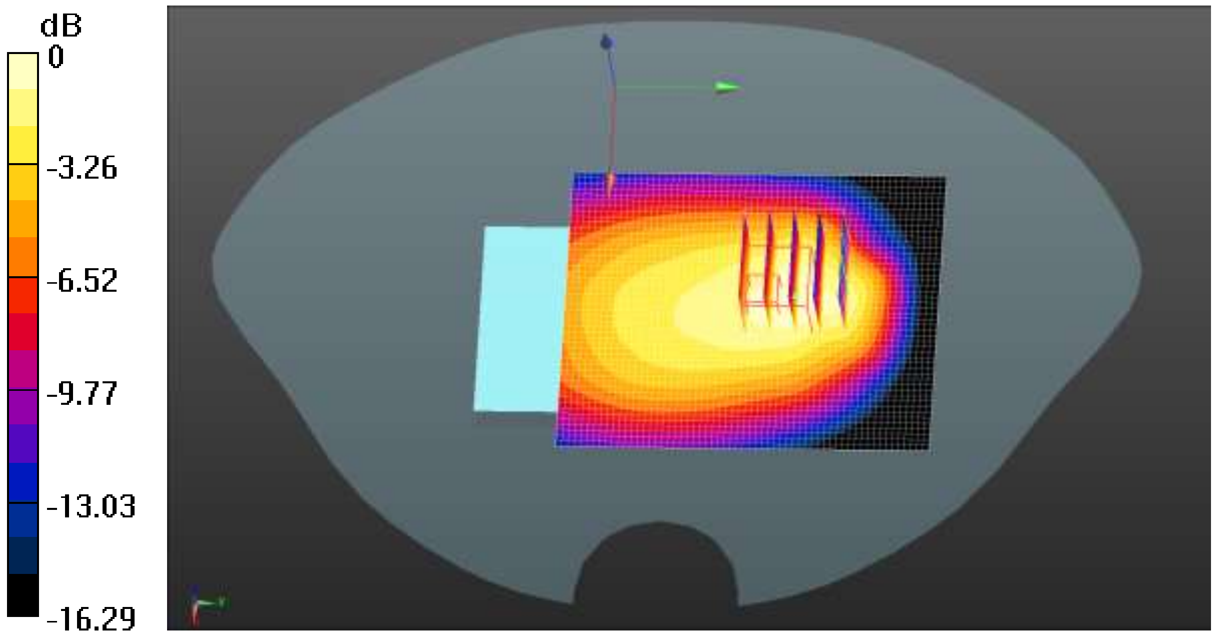
Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 829 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 829 MHz; σ = 0.925 S/m; ε_r = 40.77; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(9.74, 9.74, 9.74) @ 829 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

LTE Band 5 1RB(10MHz) Body Back/Low Channel/Area Scan (51x61x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.12 W/kg

LTE Band 5 1RB(10MHz) Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 35.98 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 3.09 W/kg
SAR(1 g) = 1.30 W/kg; SAR(10 g) = 0.875 W/kg
Smallest distance from peaks to all points 3 dB below = 11.3 mm
Ratio of SAR at M2 to SAR at M1 = 38.1%
Maximum value of SAR (measured) = 2.14 W/kg



0 dB = 2.14 W/kg = 3.30 dBW/kg

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

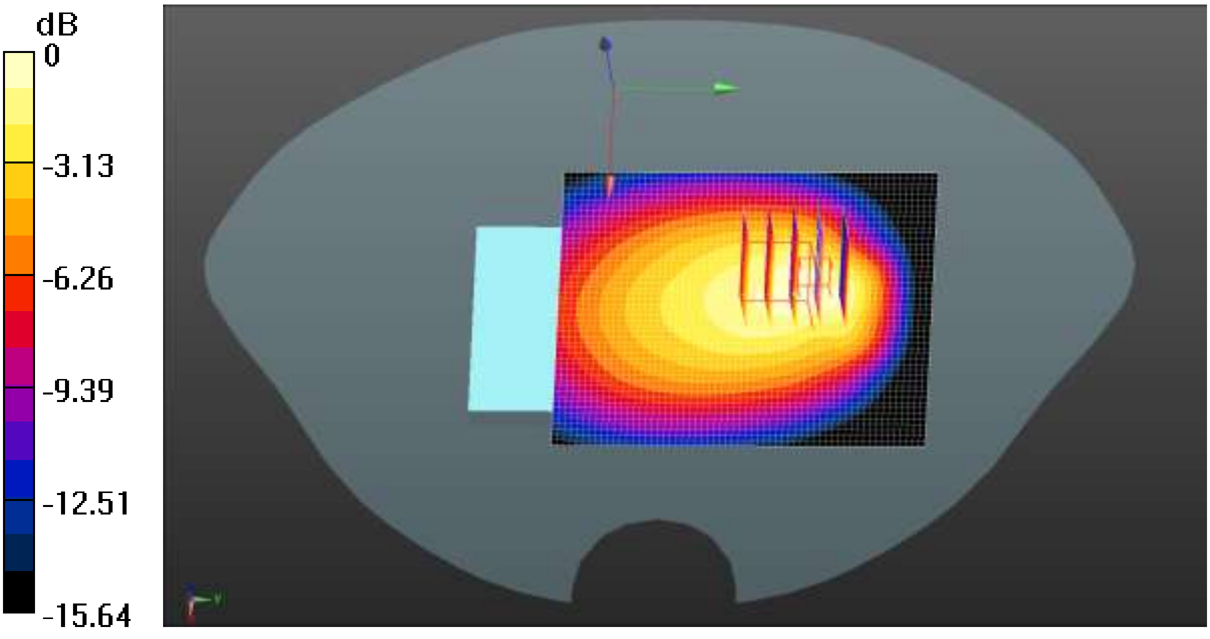
Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 707.5 MHz; σ = 0.899 S/m; ε_r = 41.073; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(10.04, 10.04, 10.04) @ 707.5 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

LTE Band 12 1RB(10MHz) Body Back/Middle Channel/Area Scan (51x61x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.496 W/kg

LTE Band 12 1RB(10MHz) Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.15 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.711 W/kg
SAR(1 g) = 0.326 W/kg; SAR(10 g) = 0.217 W/kg
Smallest distance from peaks to all points 3 dB below = 10.7 mm
Ratio of SAR at M2 to SAR at M1 = 48.5%
Maximum value of SAR (measured) = 0.508 W/kg



0 dB = 0.508 W/kg = -2.94 dBW/kg

Test Laboratory: JYTSZ Date: 11.10.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 1720 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1720 MHz; σ = 1.36 S/m; ε_r = 41.644; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

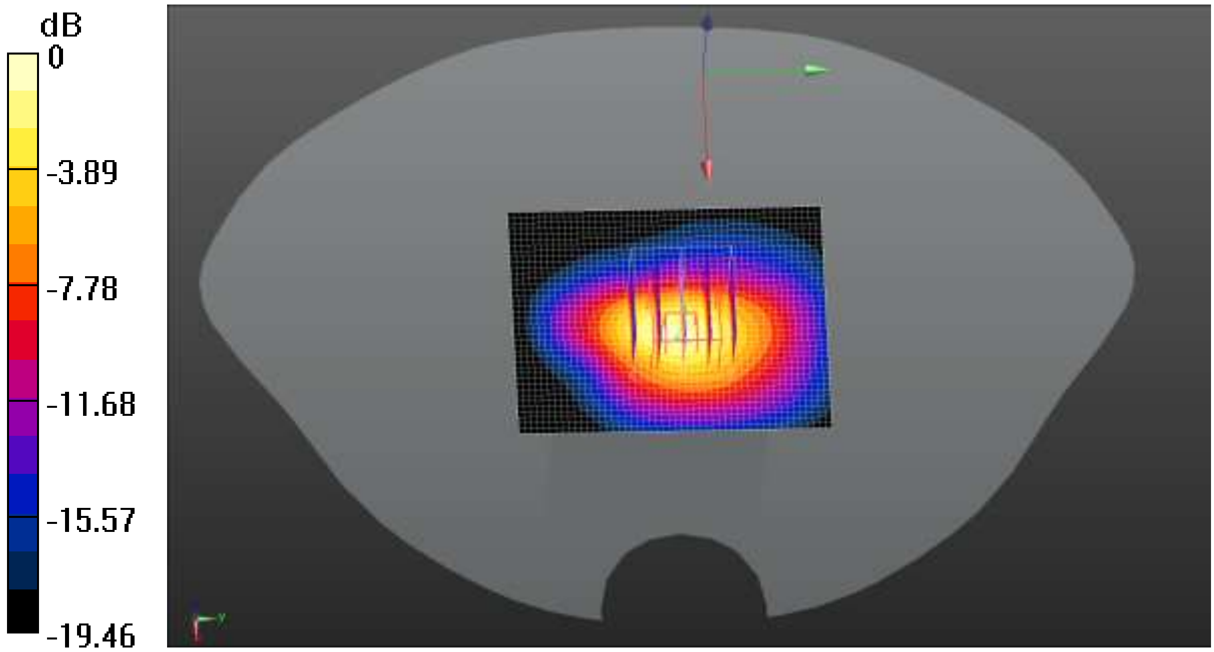
- Probe: EX3DV4 – SN7515; ConvF(8.53, 8.53, 8.53) @ 1720 MHz; Calibrated: 09.23.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

LTE Band 66 1RB(20MHz) Body Bottom/Low Channel/Area Scan (41x51x1):

Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.98 W/kg

LTE Band 66 1RB(20MHz) Body Bottom/Low Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.11 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 3.01 W/kg
SAR(1 g) = 1.36 W/kg; SAR(10 g) = 0.729 W/kg
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 54%
Maximum value of SAR (measured) = 2.21 W/kg



0 dB = 2.21 W/kg = 3.44 dBW/kg

Test Laboratory: JYTSZ Date: 11.04.2021

DUT: Livongo Blood Glucose Monitoring System; Type: BG1000; Serial: 1#

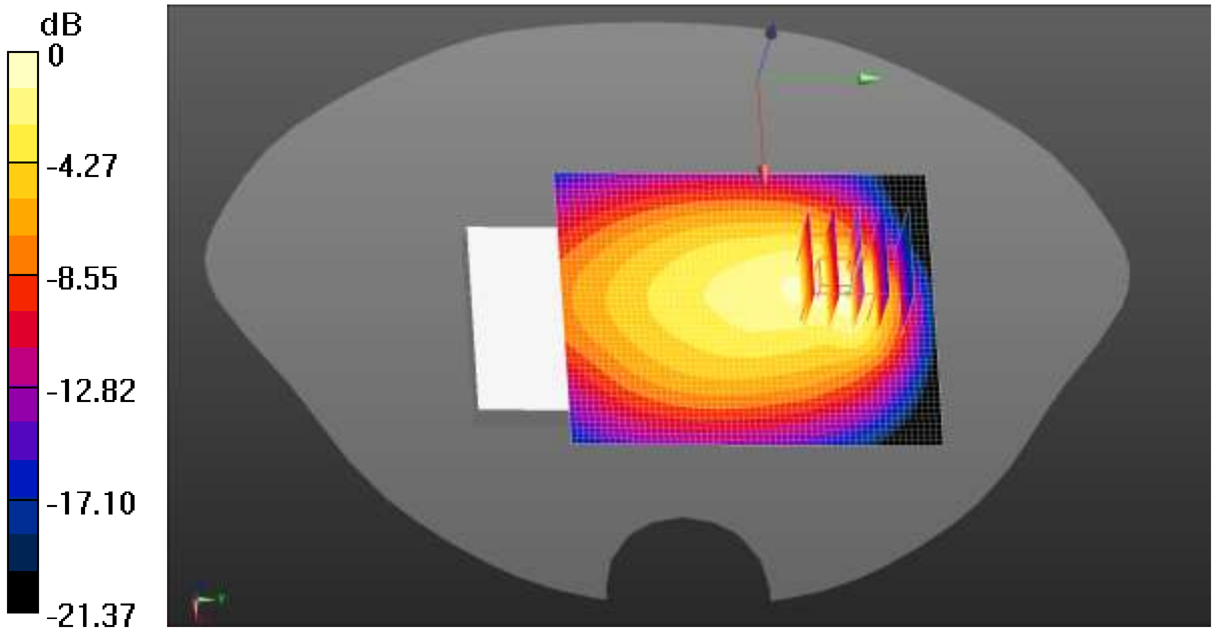
Communication System: UID 0, LTE-Fdd(USA) 1RB QPSK (0); Frequency: 680.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 680.5 MHz; σ = 0.894 S/m; ε_r = 41.421; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7515; ConvF(10.04, 10.04, 10.04) @ 680.5 MHz; Calibrated: 11.30.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

LTE Band 71 1RB(20MHz) Body Back/Middle Channel/Area Scan (51x61x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.363 W/kg

LTE Band 71 1RB(20MHz) Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.31 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.599 W/kg
SAR(1 g) = 0.236 W/kg; SAR(10 g) = 0.133 W/kg
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 37.1%
Maximum value of SAR (measured) = 0.416 W/kg



0 dB = 0.416 W/kg = -3.81 dBW/kg

Appendix E: System Calibration Certificate

Calibration information for E-field probes

CTTL In Collaboration with speag CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client **Auden** **Certificate No: Z20-60435**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 7515
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	November 30, 2020

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101547	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101548	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 7307	29-May-20(SPEAG, No.EX3-7307_May20)	May-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	23-Jun-20(CTTL, No.J20X04343)	Jun-21
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 02, 2020

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7515

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (*k*=2)
Norm(µV/(V/m)^2)[A]	0.44	0.49	0.47	±10.0%
DCP(mV)[B]	97.6	97.6	100.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (*k*=2)
0	CW	X	0.0	0.0	1.0	0.00	158.9	±2.5%
		Y	0.0	0.0	1.0		161.5	
		Z	0.0	0.0	1.0		158.2	

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor *k*=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7515

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.09	10.09	10.09	0.40	0.75	±12.1%
835	41.5	0.90	9.74	9.74	9.74	0.16	1.15	±12.1%
900	41.5	0.97	9.60	9.60	9.60	0.17	1.22	±12.1%
1750	40.1	1.37	8.53	8.53	8.53	0.26	1.01	±12.1%
1900	40.0	1.40	8.13	8.13	8.13	0.26	1.06	±12.1%
2000	40.0	1.40	8.18	8.18	8.18	0.23	1.12	±12.1%
2300	39.5	1.67	7.74	7.74	7.74	0.52	0.76	±12.1%
2450	39.2	1.80	7.34	7.34	7.34	0.38	0.98	±12.1%
2600	39.0	1.96	7.30	7.30	7.30	0.53	0.80	±12.1%
3300	38.2	2.71	7.12	7.12	7.12	0.41	1.02	±13.3%
3500	37.9	2.91	6.78	6.78	6.78	0.47	0.97	±13.3%
3700	37.7	3.12	6.45	6.45	6.45	0.40	1.15	±13.3%
3900	37.5	3.32	6.56	6.56	6.56	0.40	1.33	±13.3%
4100	37.2	3.53	6.54	6.54	6.54	0.40	1.15	±13.3%
4200	37.1	3.63	6.43	6.43	6.43	0.40	1.25	±13.3%
4400	36.9	3.84	6.34	6.34	6.34	0.35	1.35	±13.3%
4600	36.7	4.04	6.23	6.23	6.23	0.45	1.25	±13.3%
4800	36.4	4.25	6.20	6.20	6.20	0.40	1.41	±13.3%
4950	36.3	4.40	5.87	5.87	5.87	0.45	1.30	±13.3%
5250	35.9	4.71	5.54	5.54	5.54	0.50	1.25	±13.3%
5600	35.5	5.07	4.85	4.85	4.85	0.55	1.35	±13.3%
5750	35.4	5.22	4.86	4.86	4.86	0.55	1.42	±13.3%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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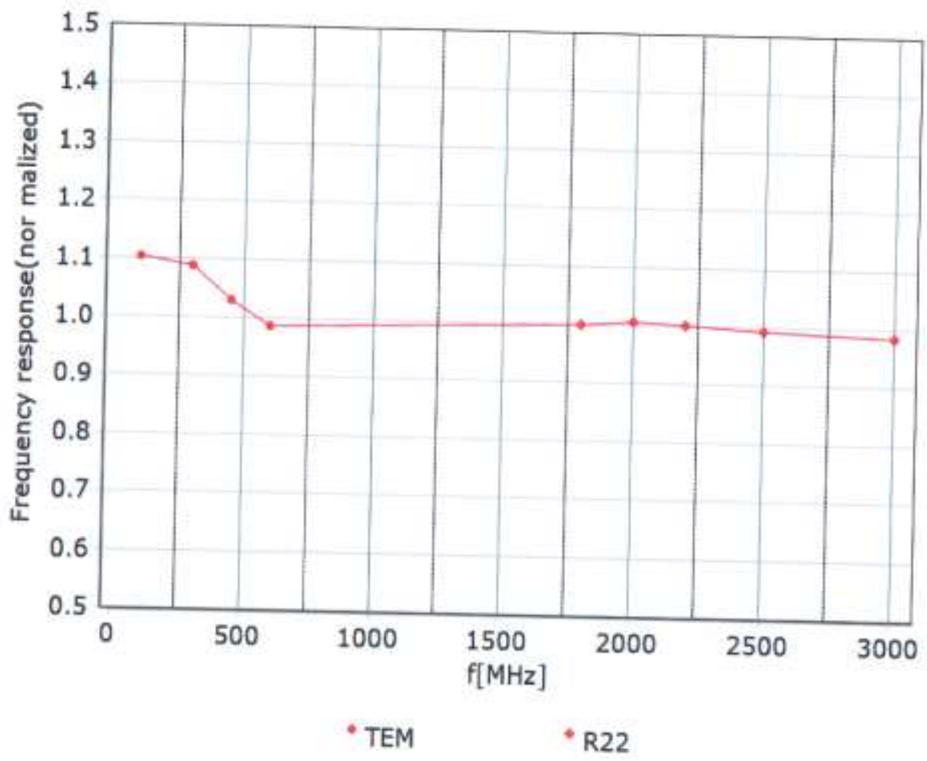
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)

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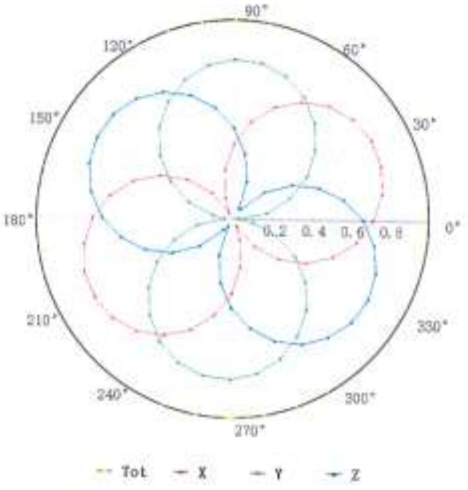
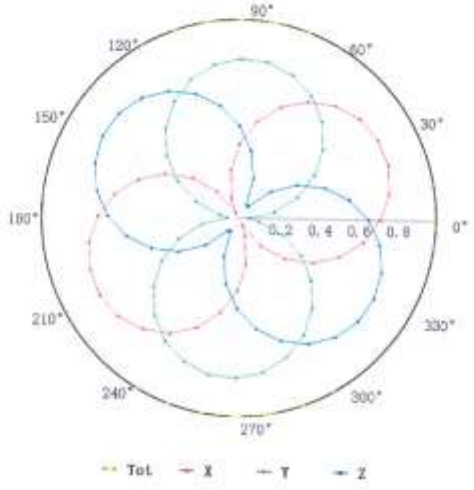
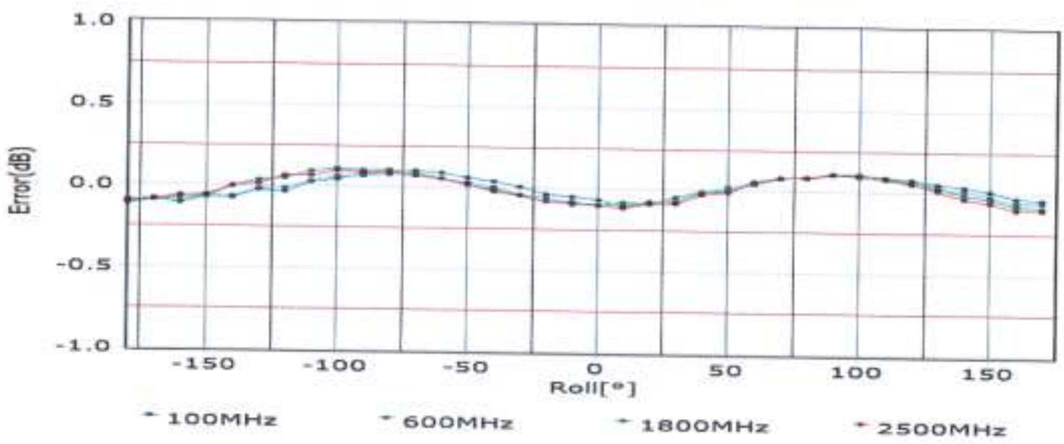
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM

f=1800 MHz, R22







Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

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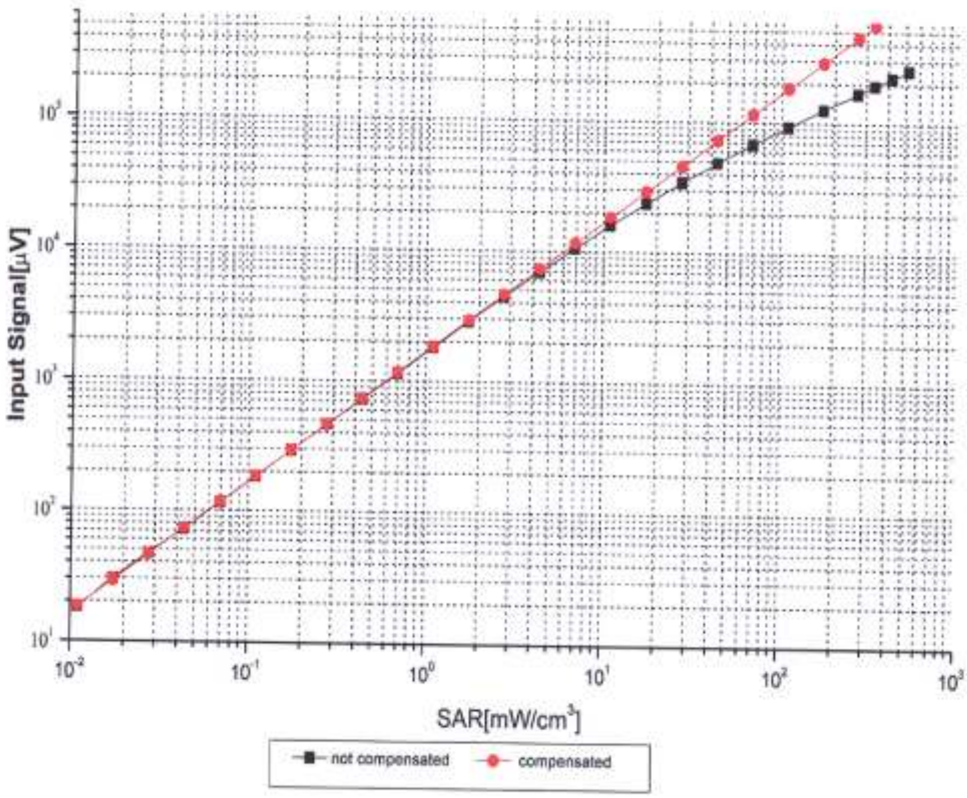
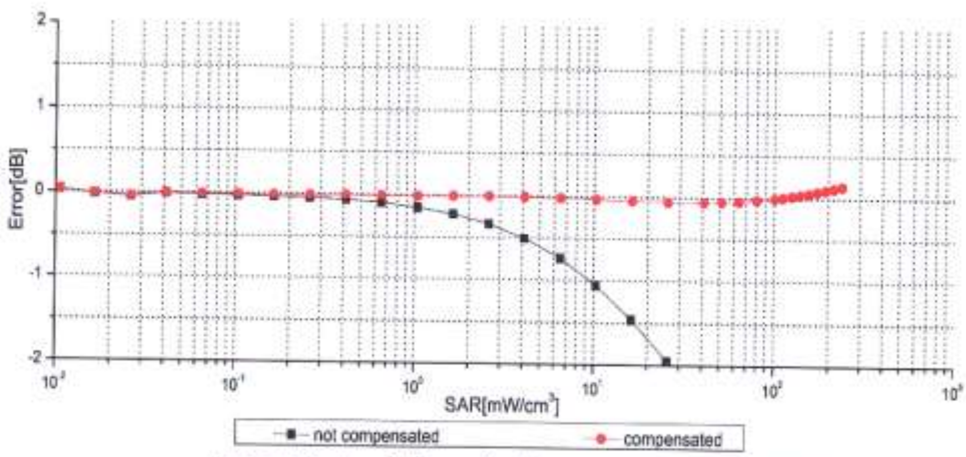
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (*k*=2)

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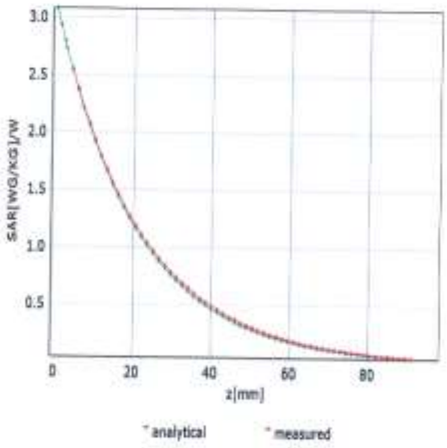
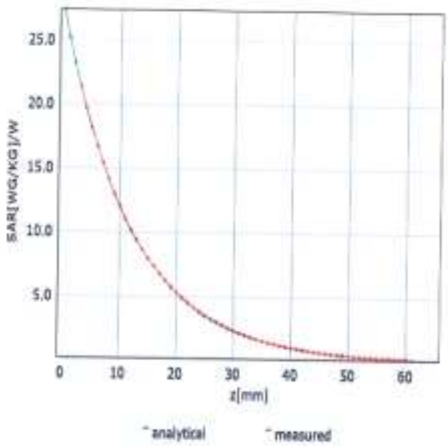
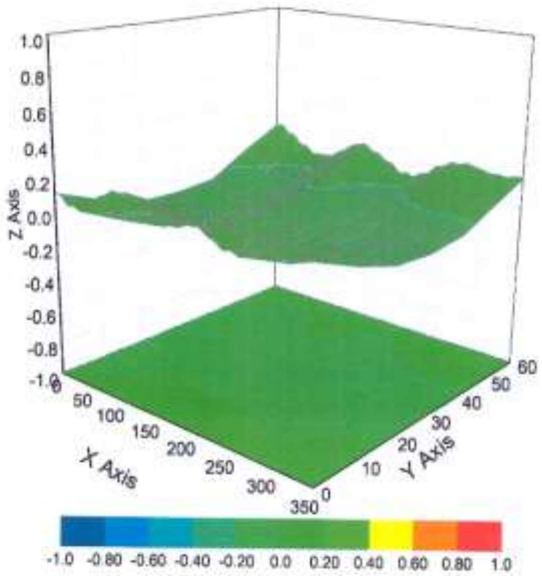
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF) **f=1750 MHz,WGLS R22(H_convF)**





Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7515

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	175.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Calibration information for Dipole

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Client CCIS Certificate No: Z20-60195

CALIBRATION CERTIFICATE

Object: D750V3 - SN: 1118

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: May 28, 2020

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP6A	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Reference Probe EX3DV4	SN 7514	27-Sep-19(CTTL-SPEAG,No.Z19-60306)	Sep-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	赵靖
Reviewed by:	Lin Hao	SAR Test Engineer	林浩
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 30, 2020

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
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	41.1 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.37 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.53 W/kg ± 18.7 % (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 %	0.94 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.61 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.67 W/kg ±18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4Ω- 4.05jΩ
Return Loss	- 24.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.0Ω- 6.05jΩ
Return Loss	- 24.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.900 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

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DASY5 Validation Report for Head TSL Date: 05.27.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1118

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 750 MHz; σ = 0.872 S/m; ε_r = 41.1; ρ = 1000 kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.7, 9.7, 9.7) @ 750 MHz; Calibrated: 2019-09-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 2019-08-22
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 53.61 V/m; Power Drift = -0.04 dB

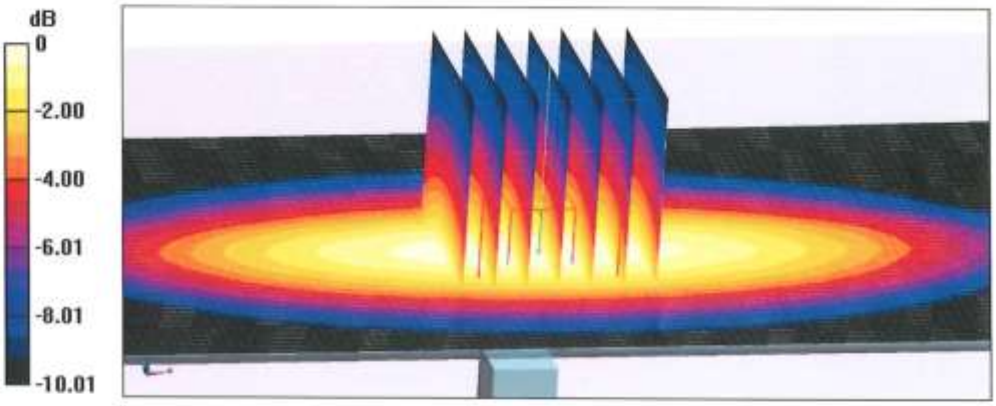
Peak SAR (extrapolated) = 3.21 W/kg

SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.37 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid

Ratio of SAR at M2 to SAR at M1 = 64.7%

Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

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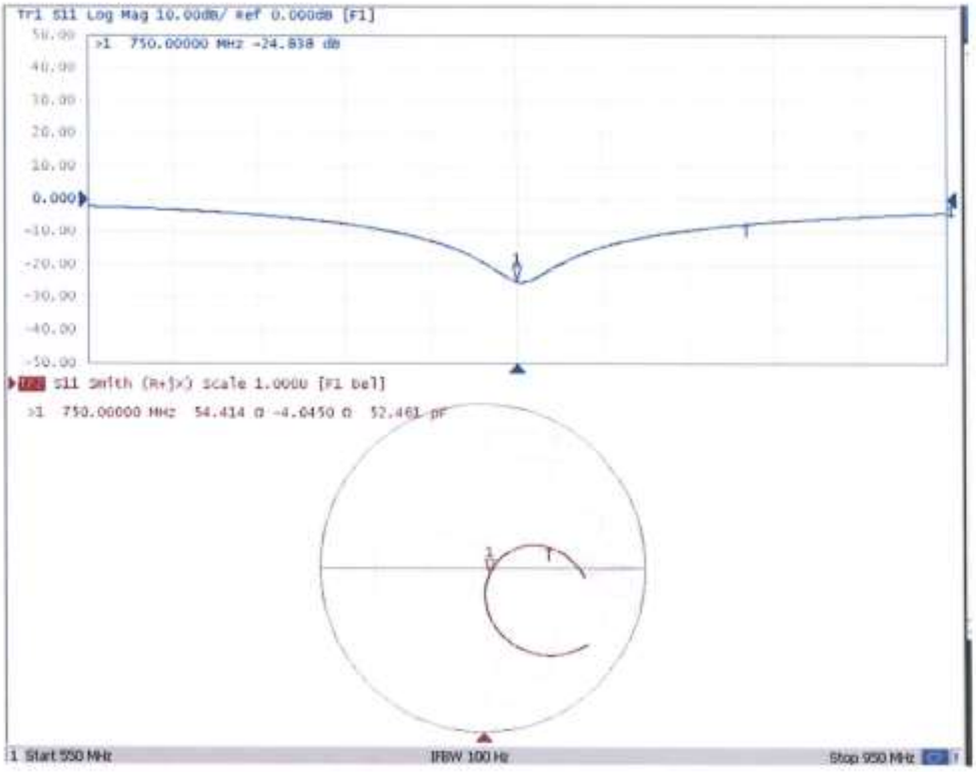
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 05.28.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1118

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 750 MHz; σ = 0.938 S/m; ε_r = 55.02; ρ = 1000 kg/m^3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.87, 9.87, 9.87) @ 750 MHz; Calibrated: 2019-09-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 2019-08-22
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 53.55 V/m; Power Drift = 0.01 dB

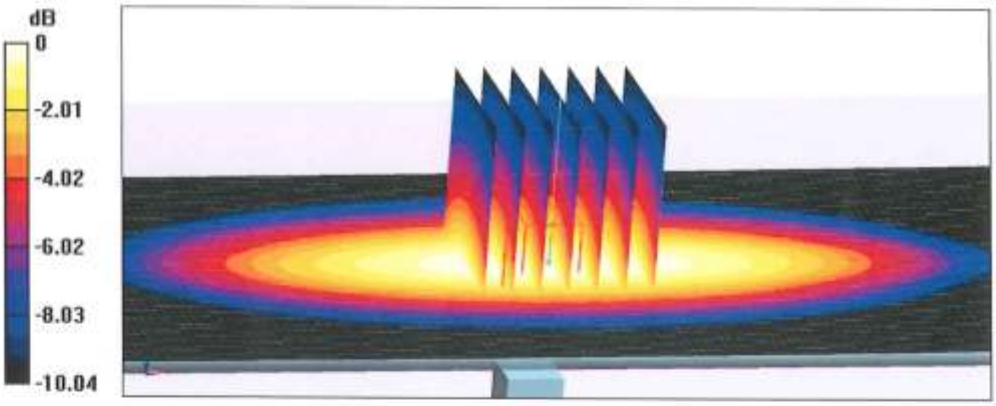
Peak SAR (extrapolated) = 3.31 W/kg

SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.4 W/kg

Smallest distance from peaks to all points 3 dB below = 19.2 mm

Ratio of SAR at M2 to SAR at M1 = 64.7%

Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

Certificate No: Z20-60195 Page 7 of 8

TTL In Collaboration with speag CALIBRATION LABORATORY

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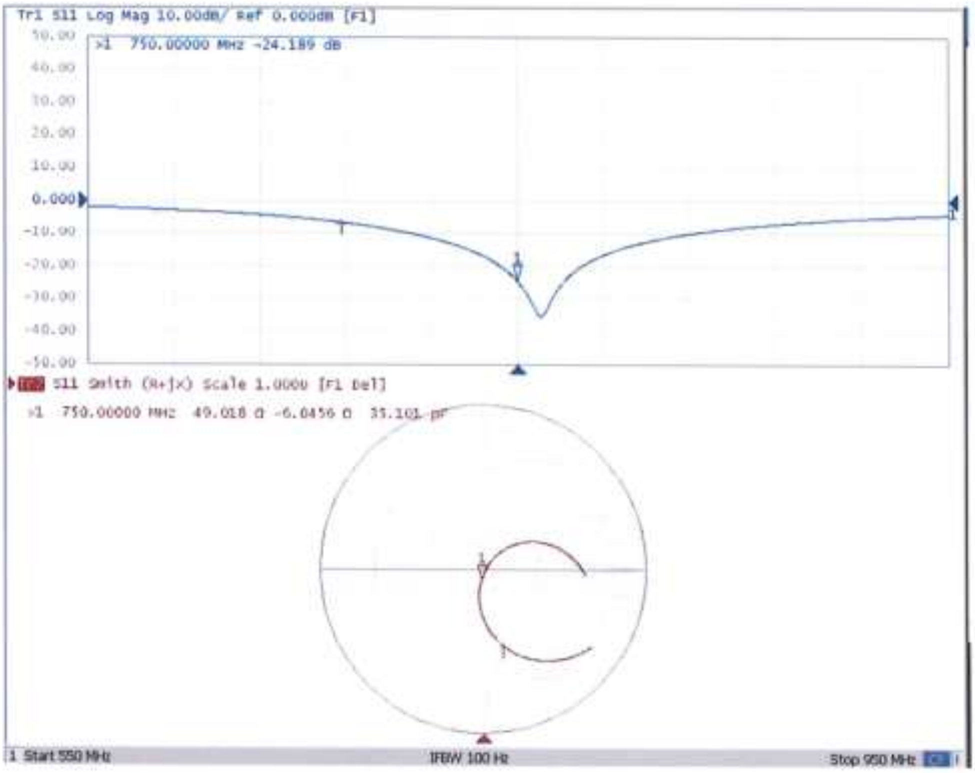
Impedance Measurement Plot for Body TSL



Dipole Impedance and Return Loss calibration Report

Object: D750V3 - SN: 1118

Calibration Date: June 1, 2021

Calibration reference: IEEE Std 1528:2013, IEC 62209-1:2006, FCC KDB 865664 D01

Calibrated By: (Janet Wei, SAR project engineer)

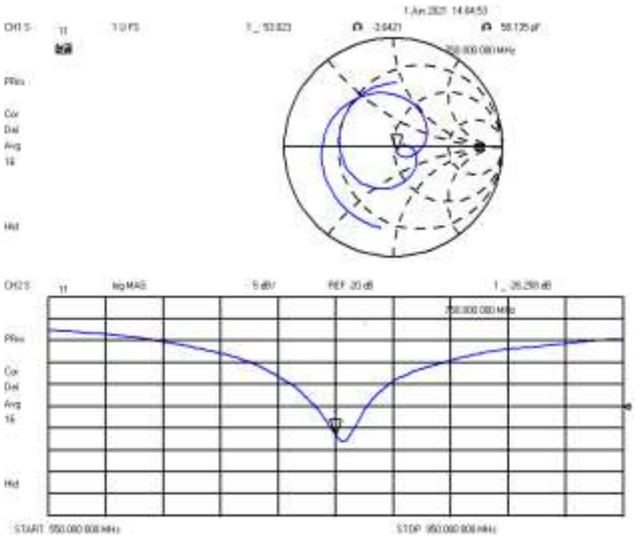
Reviewed By: (Winner Zhang, Technical manager)

Environment of Test Site

Temperature:	21 ~ 23°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

Test Data

Measurement Plot for Head TSL In 2021



Comparison with Original report

Items	Calibrated By CTTL	Calibrated By JYT In 2021	Deviation	Limit
Impendence for Head TSL	54.4Ω –4.05jΩ	53.02Ω –3.64jΩ	-1.38Ω +0.41jΩ	±5Ω
Return Loss for Head TSL	-24.8	-26.26	5.89%	±20%(No less than 20 dB)

Result

Compliance

TTL In Collaboration with speag CALIBRATION LABORATORY

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Client CCIS Certificate No: Z19-60175

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d154
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	June 11, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1556	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 14, 2019

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1504
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
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	41.1 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.49 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.33 W/kg ± 18.7 % (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	55.0 ± 6 %	0.97 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.57 W /kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.31 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9Ω- 3.09jΩ
Return Loss	- 29.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3Ω- 4.87jΩ
Return Loss	- 24.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.277 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

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DASY5 Validation Report for Head TSL Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.886 S/m; ε_r = 41.12; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.09, 9.09, 9.09) @ 835 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

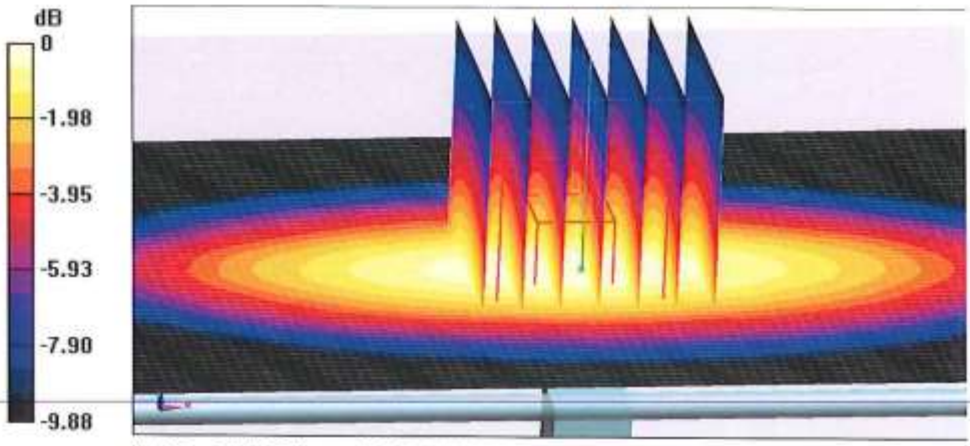
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.27 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.45 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.09 W/kg



0 dB = 3.09 W/kg = 4.90 dBW/kg

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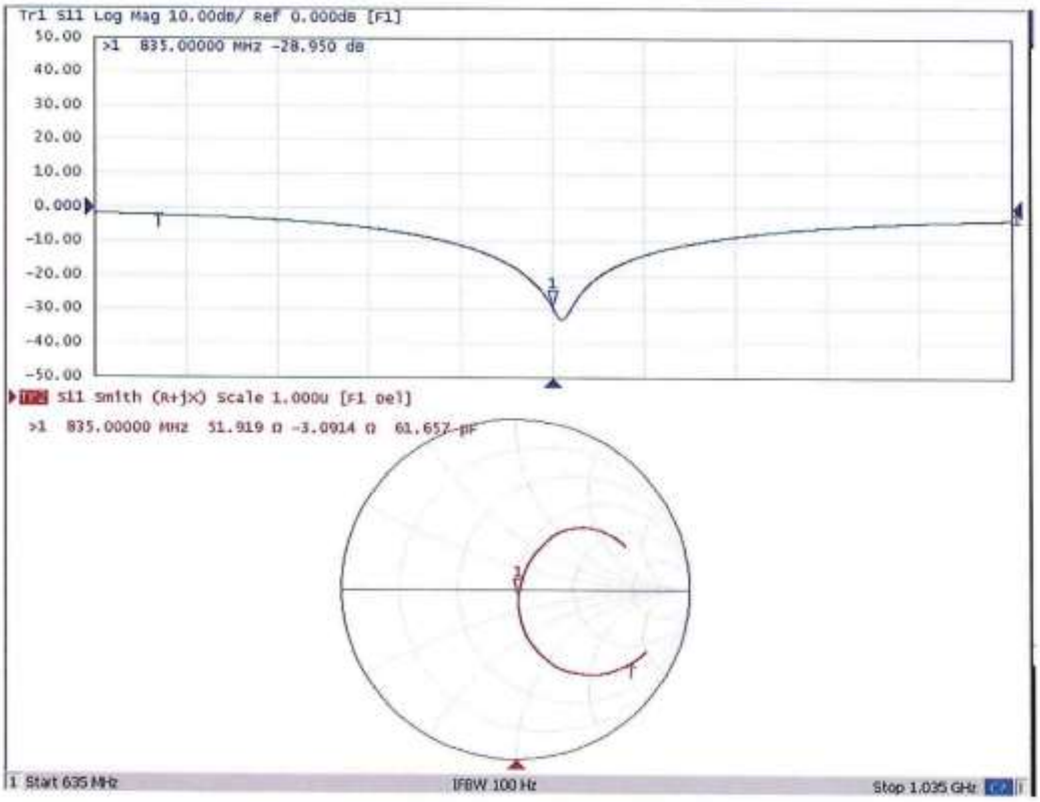
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.973 S/m; ε_r = 55; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.47, 9.47, 9.47) @ 835 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

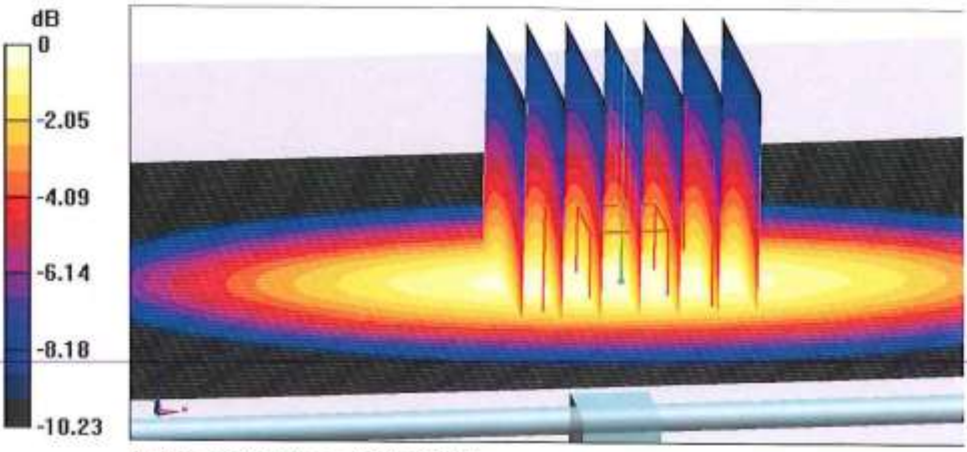
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.93 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.23 W/kg



0 dB = 3.23 W/kg = 5.09 dBW/kg

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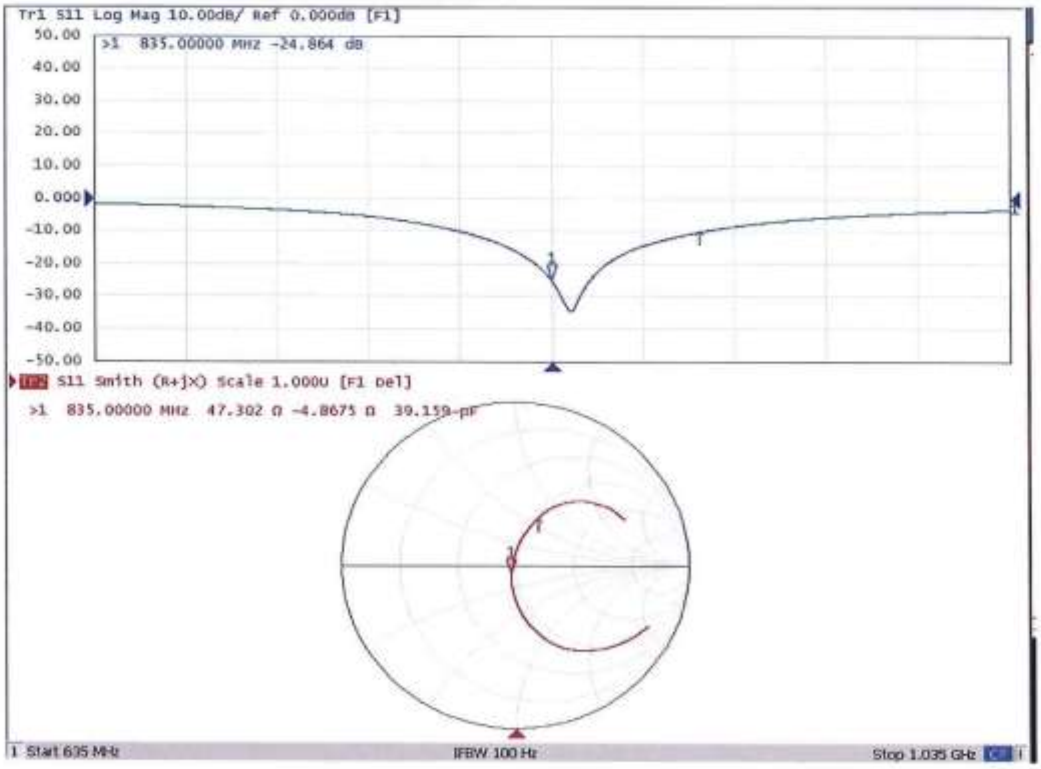
Impedance Measurement Plot for Body TSL



Dipole Impedance and Return Loss calibration Report

Object: D835V2 - SN: 4d154

Calibration Date: June 11, 2021

Calibration reference: IEEE Std 1528:2013, IEC 62209-1:2006, FCC KDB 865664 D01

Calibrated By: Janet Wei (Janet Wei, SAR project engineer)

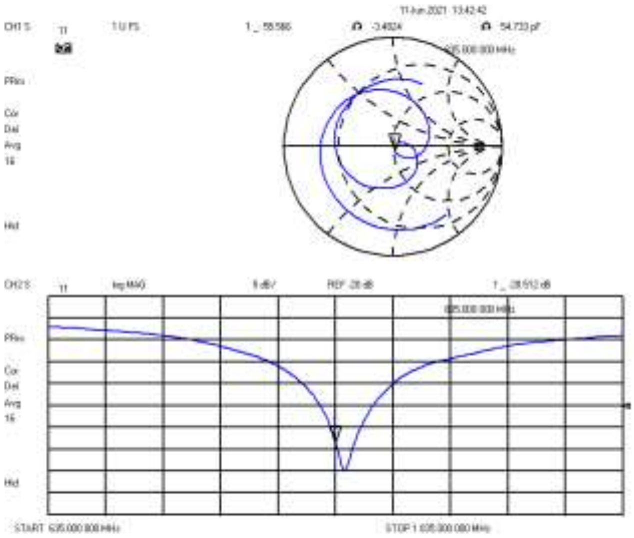
Reviewed By: Winner zhang (Winner Zhang, Technical manager)

Environment of Test Site

Temperature:	21 ~ 23°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

Test Data

Measurement Plot for Head TSL In 2021



Comparison with Original report

Items	Calibrated By CTTL	Calibrated By JYT In 2021	Deviation	Limit
Impendence for Head TSL	51.9Ω –3.09jΩ	55.57Ω –3.48jΩ	3.67Ω –0.39jΩ	±5Ω
Return Loss for Head TSL	-29.0	-28.51	-1.69%	±20%(No less than 20 dB)

Result

Compliance

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

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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 **JYT (Auden)**

Certificate No: D1750V2-1177_Feb21

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1177
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	February 10, 2021

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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 11, 2021

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

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S Swiss Calibration Service

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

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
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	V52.10.4
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	39.4 ± 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	9.00 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.0 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	49.5 Ω - 1.2 jΩ
Return Loss	- 37.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.218 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

JianYan Testing Group Shenzhen Co., Ltd. Project No.: JYTSZB-R14-2109027
No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street,
Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366, E-mail: info-JYTee@lets.com

DASY5 Validation Report for Head TSL

Date: 10.02.2021

Test Laboratory: SPEAG, Zurich, Switzerland

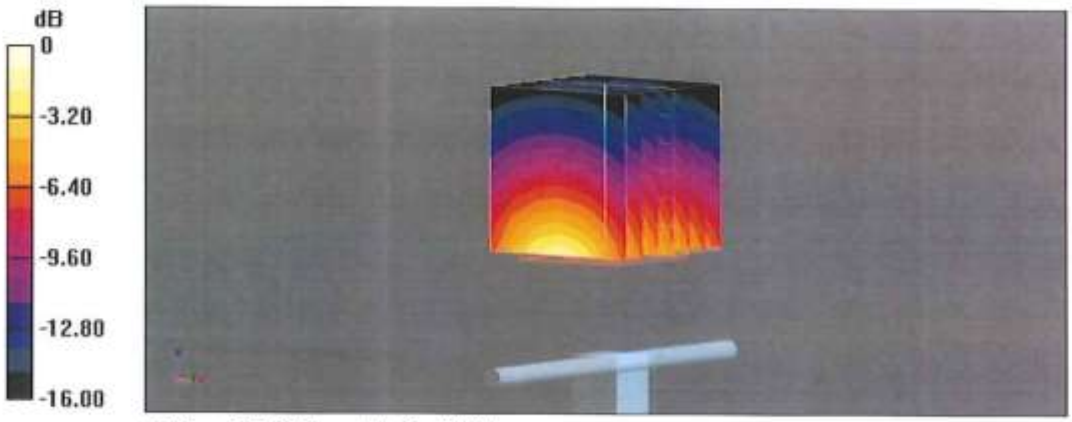
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1177

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 106.3 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9 W/kg; SAR(10 g) = 4.73 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 54.2%
Maximum value of SAR (measured) = 13.9 W/kg



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

JianYan Testing Group Shenzhen Co., Ltd. Project No.: JYTSZB-R14-2109027
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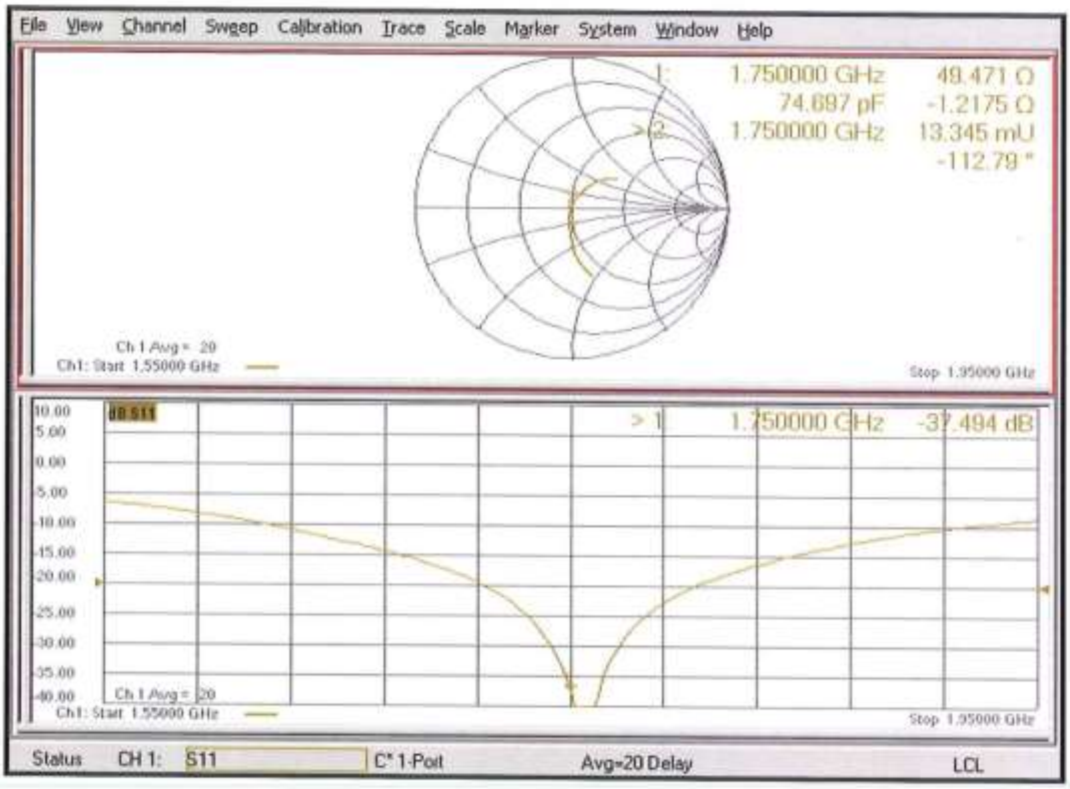
Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1177_Feb21 Page 6 of 6

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CALIBRATION LABORATORY
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CALIBRATION
CNAS L0570

Client CCIS

Certificate No: Z19-60176

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d175
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	June 11, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1556	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 14, 2019

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lossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1504
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
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	40.2 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.4 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.4 W/kg ± 18.7 % (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	52.2 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.5 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 5.93jΩ
Return Loss	- 24.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8Ω+ 5.24jΩ
Return Loss	- 24.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.064 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

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DASY5 Validation Report for Head TSL Date: 06.10.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.387 S/m; ε_r = 40.2; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.73, 7.73, 7.73) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

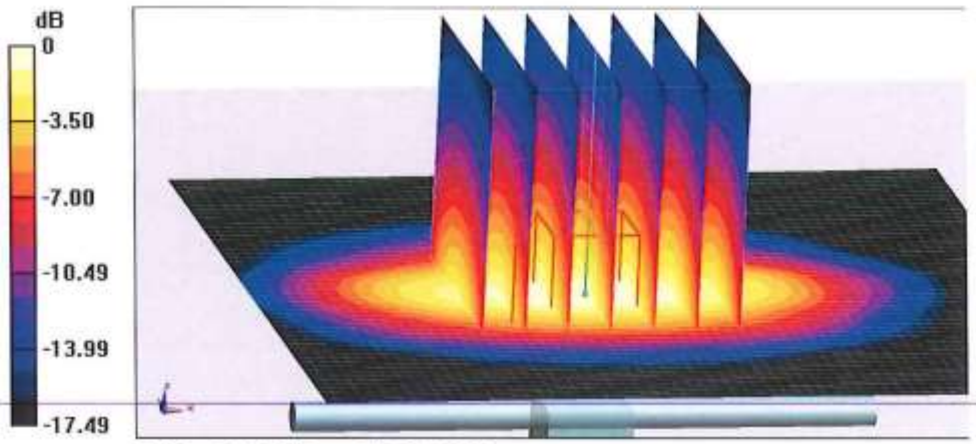
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.94 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 9.79 W/kg; SAR(10 g) = 5.07 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

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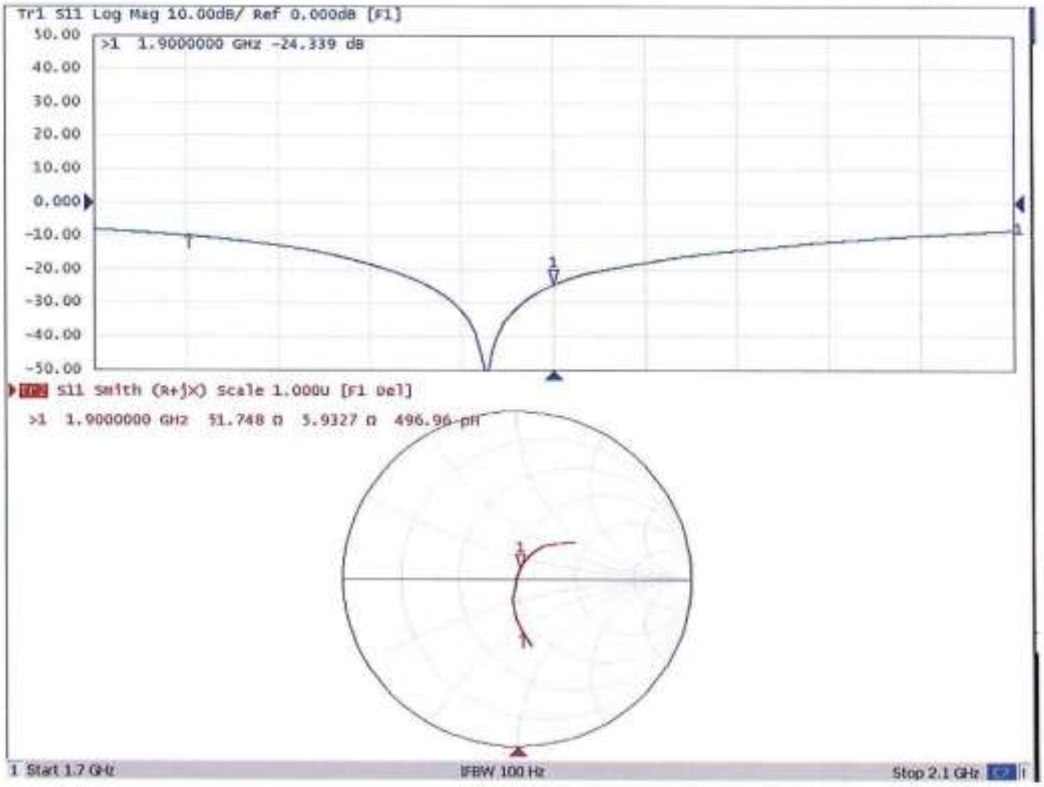
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.499 S/m; ε_r = 52.18; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.53, 7.53, 7.53) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

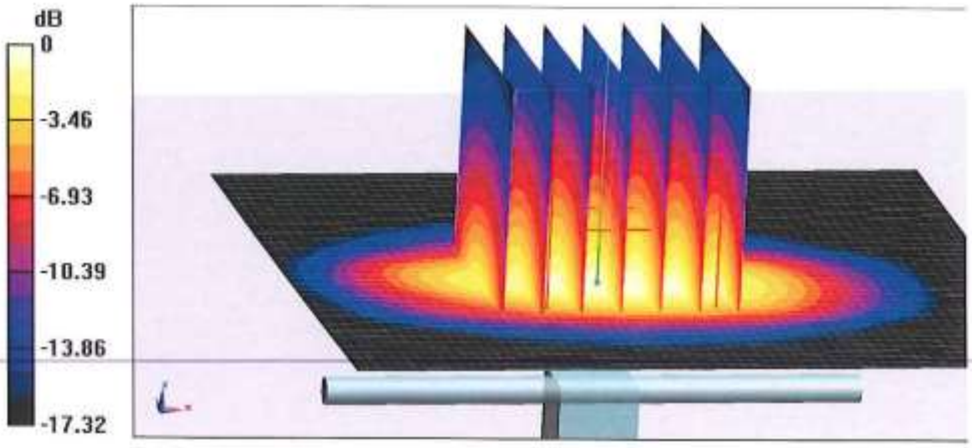
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.67 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

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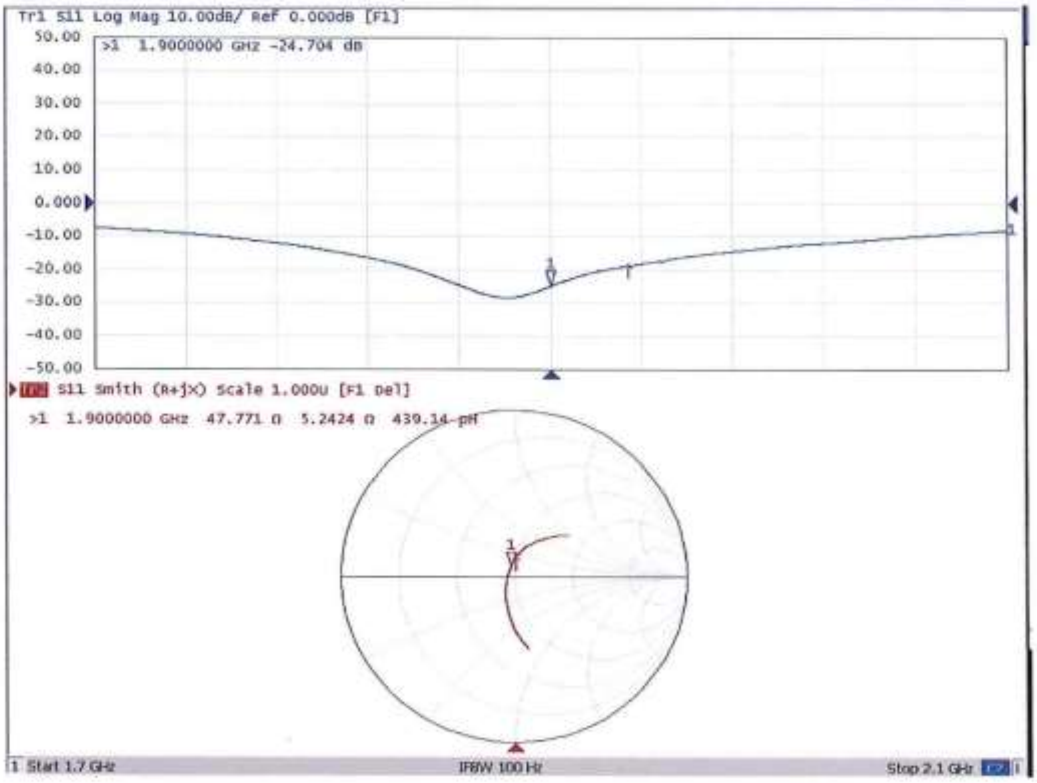
Impedance Measurement Plot for Body TSL



Dipole Impedance and Return Loss calibration Report

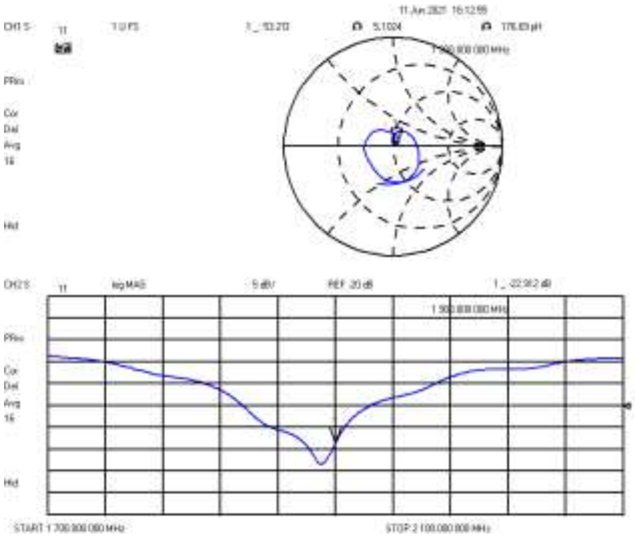
Object:	D1900V2 - SN: 5d175
Calibration Date:	June 11, 2021
Calibration reference:	IEEE Std 1528:2013, IEC 62209-1:2006, FCC KDB 865664 D01
Calibrated By:	Janet Wei (Janet Wei, SAR project engineer)
Reviewed By:	Winner Zhang (Winner Zhang, Technical manager)

Environment of Test Site

Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

Test Data

Measurement Plot for Head TSL In 2021



Comparison with Original report

Items	Calibrated By CTTL	Calibrated By JYT In 2021	Deviation	Limit
Impendence for Head TSL	51.7Ω+5.93 jΩ	53.21Ω+5.10 jΩ	1.51Ω-0.83jΩ	±5Ω
Return Loss for Head TSL	-24.3dB	-22.91dB	-5.72%	±20%(No less than 20 dB)

Result

Compliance

Calibration information for DAE

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1452
cc1

IMPORTANT NOTICE

USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

TN_EH190306AE DAE4.docx 07.03.2019

Calibration Laboratory of
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Engineering AG
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C Service suisse d'étalonnage
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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 **CCIS (Auden)**

Certificate No: **DAE4-1452_May21**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1452
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 26, 2021

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
Keithley Multimeter Type 2001	SN: 0810278	07-Sep-20 (No:28647)	Sep-21
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-21 (in house check)	In house check: Jan-22
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-21 (in house check)	In house check: Jan-22

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	[signature]
Approved by:	Sven Kühn	Deputy Manager	[signature]

Issued: May 26, 2021

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Accreditation No.: **SCS 0108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.348 ± 0.02% (k=2)	404.687 ± 0.02% (k=2)	405.256 ± 0.02% (k=2)
Low Range	3.99425 ± 1.50% (k=2)	3.99683 ± 1.50% (k=2)	4.01673 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	51.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200035.36	0.42	0.00
Channel X	+ Input	20006.81	0.84	0.00
Channel X	- Input	-20003.88	1.82	-0.01
Channel Y	+ Input	200037.10	2.34	0.00
Channel Y	+ Input	20004.84	-0.89	-0.00
Channel Y	- Input	-20007.39	-1.50	0.01
Channel Z	+ Input	200033.27	-1.83	-0.00
Channel Z	+ Input	20003.78	-1.97	-0.01
Channel Z	- Input	-20006.83	-0.82	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.37	0.05	0.00
Channel X	+ Input	200.96	-0.33	-0.16
Channel X	- Input	-199.17	-0.61	0.31
Channel Y	+ Input	2000.80	-0.39	-0.02
Channel Y	+ Input	200.07	-1.12	-0.56
Channel Y	- Input	-200.08	-1.28	0.65
Channel Z	+ Input	2001.07	-0.11	-0.01
Channel Z	+ Input	200.38	-0.77	-0.38
Channel Z	- Input	-199.93	-1.12	0.57

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	1.67	-0.11
	- 200	0.56	-1.39
Channel Y	200	-2.77	-3.79
	- 200	1.75	1.13
Channel Z	200	-22.37	-22.78
	- 200	21.31	21.31

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.56	-3.85
Channel Y	200	6.97	-	3.25
Channel Z	200	8.35	4.50	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16028	16039
Channel Y	15789	16121
Channel Z	15769	16454

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.79	-0.02	2.36	0.41
Channel Y	-0.13	-1.32	1.53	0.52
Channel Z	-0.36	-1.38	0.84	0.39

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

------End of Report------