FCC SAR Test Report

APPLICANT	:	**PAX Technology Limited**
EQUIPMENT	:	**Smart Mini Payment Terminal**
BRAND NAME	:	**PAX**
MODEL NAME	:	**A50**
FCC ID	:	**V5PA50**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

The product was received on Feb. 26, 2020 and testing was started from Mar. 25, 2020 and completed on Mar. 29, 2020. We, Sporton International (Shenzhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International (Shenzhen) Inc., the test report shall not be reproduced except in full.

Reviewed by: Long Liang / Supervisor

ilac-MRA ACCREDITED Cert #5145.01

Approved by: Johnny Chen / Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA022603	01	Initial issue of report	Apr. 26, 2020

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **PAX Technology Limited, Smart Mini Payment Terminal, A50,** are as follows.

Highest SAR Summary			
Equipment Class	Frequency Band		Highest SAR Summary Extremity (Separation 0mm) 10g SAR (W/kg)
Licensed	WCDMA	Band V	1.15
		Band II	2.62
		Band IV	2.42
	LTE	Band 12/Band 17	1.48
		Band 13	1.03
		Band 5	1.24
		Band 4	2.76
		Band 2	**3.10**
DTS	WLAN	2.4GHz	0.85
DSS	Bluetooth	2.4GHz Bluetooth	0.11
Date of Testing:		2020/3/25~2020/3/29	
Remark: This device supports LTE B12 and B17. Since the supported frequency span for LTE B17 falls completely within the supports frequency span for LTE B12, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B12.			

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4.0 W/kg for Extremity 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory		
Test Firm	Sporton International (Shenzhen) Inc.	
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595	
Test Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CN1256	421272

Applicant	
Company Name	PAX Technology Limited
Address	Room 2416, 24/F., Sun Hung Kai Centre, 30 Harbour Road, Wanchai, Hong Kong

Manufacturer	
Company Name	PAX Computer Technology (Shenzhen) Co., Ltd.
Address	4/F, No.3 Building, Software Park, Second Central Science-Tech Road, High-Tech industrial Park, Shenzhen, Guangdong, P.R.C.

3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	Smart Mini Payment Terminal
Brand Name	PAX
Model Name	A50
FCC ID	V5PA50
IMEI Code	357369100001340
Wireless Technology and Frequency Range	WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 12: 699.7 MHz ~ 715.3 MHz LTE Band 13: 779.5 MHz ~ 784.5 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink is not supported) LTE: QPSK, 16QAM WLAN 2.4GHz : 802.11b/g/n HT20 Bluetooth BR/EDR/LE NFC:ASK
HW Version	N/A
SW Version	N/A
EUT Stage	Production Unit

Remark:
1. This device does not support voice function.
2. 802.11n-HT40 is not supported in 2.4GHz WLAN.

4.2 General LTE SAR Test and Reporting Considerations

<table>
<tr><th colspan="2">Summarized necessary items addressed in KDB 941225 D05 v02r05</th></tr>
<tr><td>FCC ID</td><td>V5PA50</td></tr>
<tr><td>Equipment Name</td><td>Smart Mini Payment Terminal</td></tr>
<tr><td>Operating Frequency Range of each LTE transmission band</td><td>LTE Band 2: 1850.7 MHz ~ 1909.3 MHz
LTE Band 4: 1710.7 MHz ~ 1754.3 MHz
LTE Band 5: 824.7 MHz ~ 848.3 MHz
LTE Band 12: 699.7 MHz ~ 715.3 MHz
LTE Band 13: 779.5 MHz ~ 784.5 MHz
LTE Band 17: 706.5 MHz ~ 713.5 MHz</td></tr>
<tr><td>Channel Bandwidth</td><td>LTE Band 2:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 4:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 12:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 13: 5MHz, 10MHz
LTE Band 17: 5MHz, 10MHz</td></tr>
<tr><td>Uplink Modulations Used</td><td>QPSK / 16QAM</td></tr>
<tr><td>LTE Voice / Data requirements</td><td>Data only</td></tr>
<tr><td>LTE Category Version</td><td>R10 ,Cat 4</td></tr>
<tr><td>CA Support</td><td>Not Supported</td></tr>
<tr><td>LTE MPR permanently built-in by design</td><td>Table 6.2.3E-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (N_{RB})</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>>2</td><td>>2</td><td>>1</td><td>>4</td><td>-</td><td>-</td><td>≤ 1</td></tr>
<tr><td>QPSK</td><td>>5</td><td>>5</td><td>-</td><td>-</td><td>-</td><td>-</td><td>≤ 2</td></tr>
<tr><td>16 QAM</td><td>≤ 2</td><td>≤ 2</td><td>>1</td><td>>3</td><td>-</td><td>-</td><td>≤ 1</td></tr>
<tr><td>16QAM</td><td>>2</td><td>>2</td><td>>3</td><td>>5</td><td>-</td><td>-</td><td>≤ 2</td></tr>
</table></td></tr>
<tr><td>LTE A-MPR</td><td>In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)</td></tr>
<tr><td>Spectrum plots for RB configuration</td><td>A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.</td></tr>
</table>

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 2

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 12

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	23017	699.7	23025	700.5	23035	701.5	23060	704
M	23095	707.5	23095	707.5	23095	707.5	23095	707.5
H	23173	715.3	23165	714.5	23155	713.5	23130	711

LTE Band 13

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq.(MHz)
L	23205	779.5	23230	782
M	23230	782		
H	23255	784.5		

LTE Band 17

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq. (MHz)
L	23755	706.5	23780	709
M	23790	710	23790	710
H	23825	713.5	23800	711

5. RF Exposure Limits

5.1 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.

5.2 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. The 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.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

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:

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

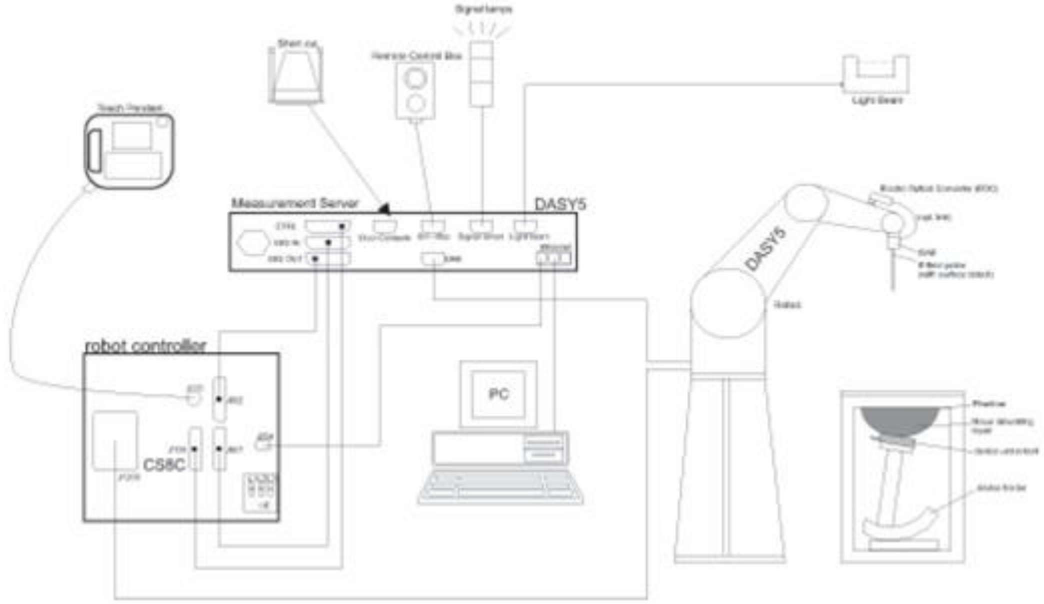
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

7.1 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.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

7.2 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.

Photo of DAE

7.3 Phantom

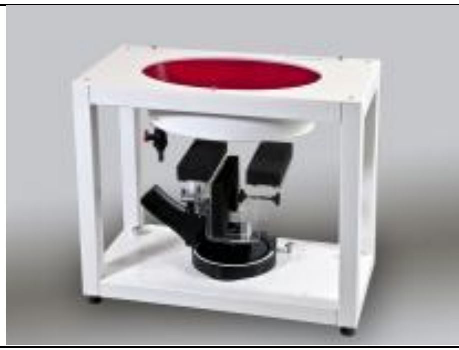
<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, 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.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm



The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) 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
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) 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.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of 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:

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

8.1 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 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

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

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

8.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements 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.

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm</td></tr>
<tr><td>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 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>
</table>

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 *reported* 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.

8.5 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 postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 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.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1099	Dec. 06, 2018	Dec. 05, 2021
SPEAG	835MHz System Validation Kit	D835V2	4d162	Dec. 05, 2018	Dec. 04, 2021
SPEAG	1750MHz System Validation Kit	D1750V2	1137	Jul. 30, 2018	Jul. 29, 2021
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Dec. 07, 2018	Dec. 06, 2021
SPEAG	2450MHz System Validation Kit	D2450V2	924	Apr. 15, 2019	Apr. 14, 2020
SPEAG	Data Acquisition Electronics	DAE4	1356	Oct. 16, 2019	Oct. 15, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	7577	Feb. 03, 2020	Feb. 02, 2021
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1670	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201300653	Jul. 22, 2019	Jul. 21, 2020
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 22, 2019	Jul. 21, 2020
Agilent	Network Analyzer	E5071C	MY46523671	Oct. 17, 2019	Oct. 16, 2020
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Oct. 28, 2019	Oct. 27, 2020
Agilent	Signal Generator	N5181A	MY50145381	Dec. 26, 2019	Dec. 25, 2020
Anritsu	Power Senor	MA2411B	1306099	Jul. 22, 2019	Jul. 21, 2020
Anritsu	Power Meter	ML2495A	1349001	Jul. 22, 2019	Jul. 21, 2020
Anritsu	Power Sensor	MA2411B	1207253	Dec. 26, 2019	Dec. 25, 2020
Anritsu	Power Meter	ML2495A	1218010	Dec. 26, 2019	Dec. 25, 2020
R&S	CBT BLUETOOTH TESTER	CBT	100963	Dec. 26, 2019	Dec. 25, 2020
R&S	Spectrum Analyzer	FSP7	100818	Jul. 22, 2019	Jul. 21, 2020
LKM electronic	Hygrometer	DTM3000	3241	Jul. 25, 2019	Jul. 24, 2020
Anymetre	Thermo-Hygrometer	JR593	2015102801	Dec. 30, 2019	Dec. 29, 2020
AR	Amplifier	5S1G4	0333096	Note 1	
mini-circuits	Amplifier	ZVE-3W-83+	599201528	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
PASTERNACK	Dual Directional Coupler	PE2214-10	N/A	Note 1	
Agilent	Dual Directional Coupler	778D	50422	Note 1	
MCL	Attenuation1	BW-S10W5	N/A	Note 1	
Weinschel	Attenuation2	3M-20	N/A	Note 1	
Zhongjilianhe	Attenuation3	MVE2214-03	N/A	Note 1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
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 justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

10. System Verification

10.1 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 the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1.

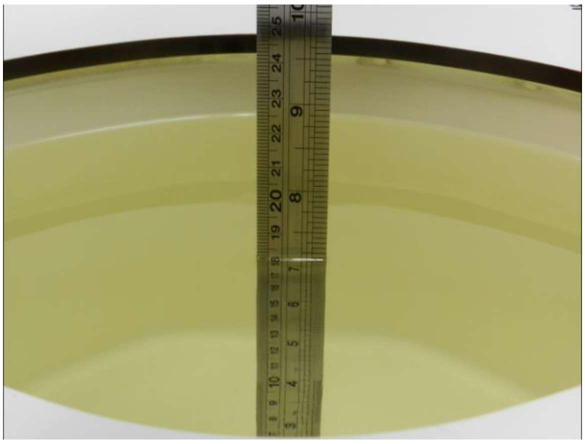


Fig 10.1 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
750	Head	22.5	0.896	42.398	0.89	41.90	0.67	1.19	±5	2020/3/25
835	Head	22.4	0.883	41.279	0.90	41.50	-1.89	-0.53	±5	2020/3/26
1750	Head	22.4	1.355	38.395	1.37	40.10	-1.09	-4.25	±5	2020/3/27
1900	Head	22.5	1.419	38.344	1.40	40.00	1.36	-4.14	±5	2020/3/28
2450	Head	22.7	1.754	40.370	1.80	39.20	-2.56	2.98	±5	2020/3/29

10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

<10g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2020/3/25	750	Head	250	1099	7577	1356	1.49	5.64	5.96	5.67
2020/3/26	835	Head	250	4d162	7577	1356	1.61	6.35	6.44	1.42
2020/3/27	1750	Head	250	1137	7577	1356	4.63	19.50	18.52	-5.03
2020/3/28	1900	Head	250	5d182	7577	1356	5.00	20.70	20	-3.38
2020/3/29	2450	Head	250	924	7577	1356	5.60	23.90	22.4	-6.28

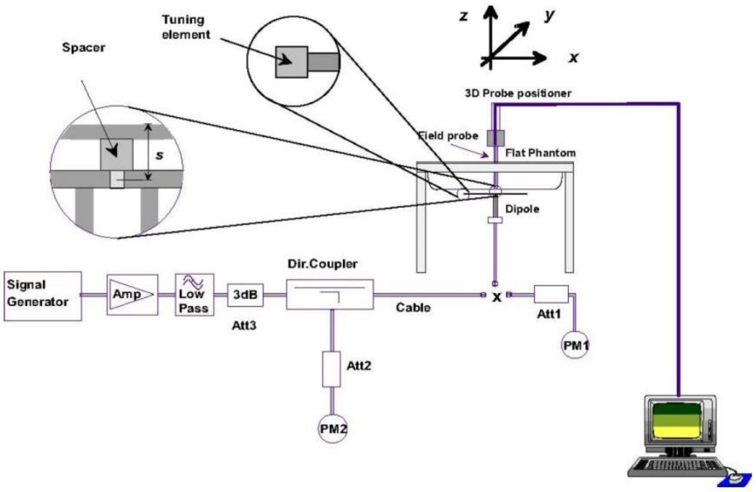


Fig 10.3.1 System Performance Check Setup

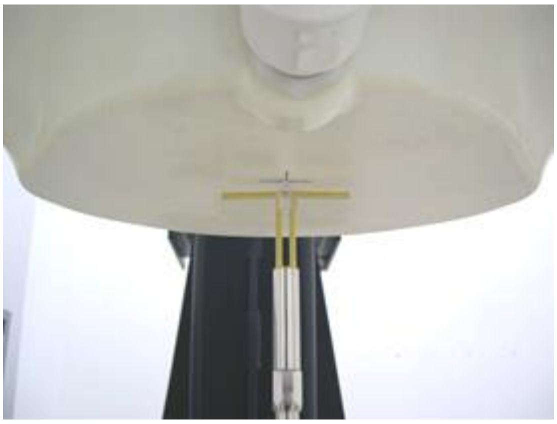


Fig 10.3.2 Setup Photo

11. RF Exposure Positions

11.1 SAR Testing for Device

(a) To position the device parallel to the phantom surface with all surfaces of the device.

(b) To adjust the device parallel to the flat phantom.

(c) To adjust the distance between the device surface and the flat phantom to 0 mm.

Please refer to Appendix D for the test setup photos.

12. UMTS/LTE Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix E.

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C 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 C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$, and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: 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 signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C 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 C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	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_{ed}1: 47/15 β_{ed}2: 47/15	4 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	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 5/15 with $\beta_{hs} = 5/15 * \beta_c$.

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 signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} can not be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
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 RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

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:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

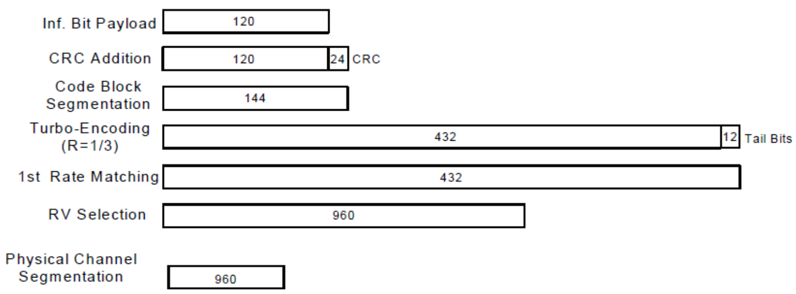


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r05, 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 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.
6. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
8. For LTE B4 / 5 / B12 /B17 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

13. WiFi/Bluetooth Output Power (Unit: dBm)

<WLAN Conducted Power>

General Note:

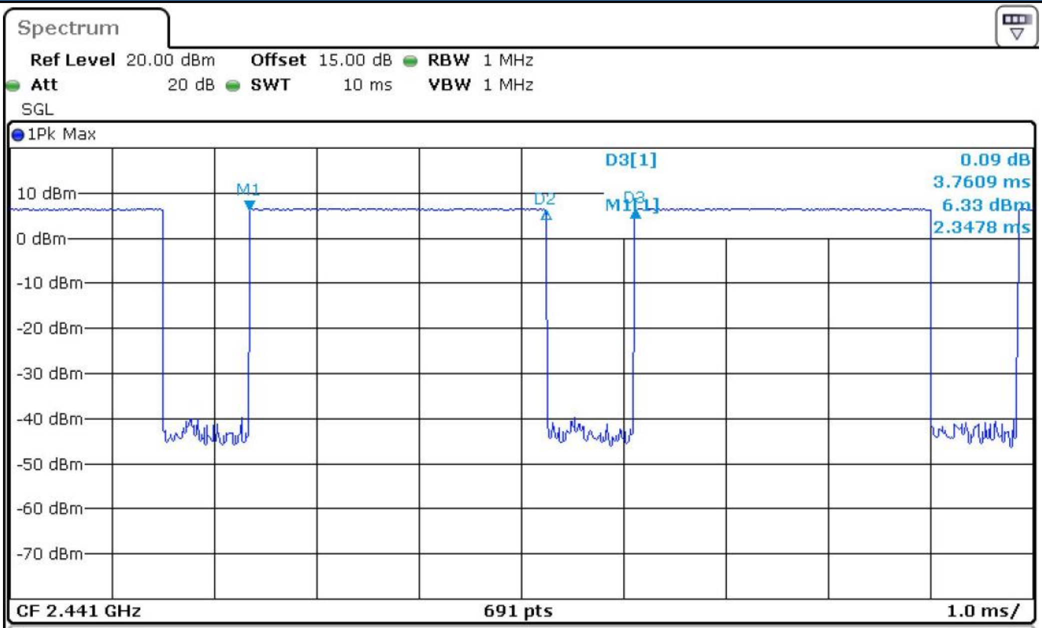
1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configurati on, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures. 18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

<u><2.4GHz Bluetooth></u>

General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 76.92 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation

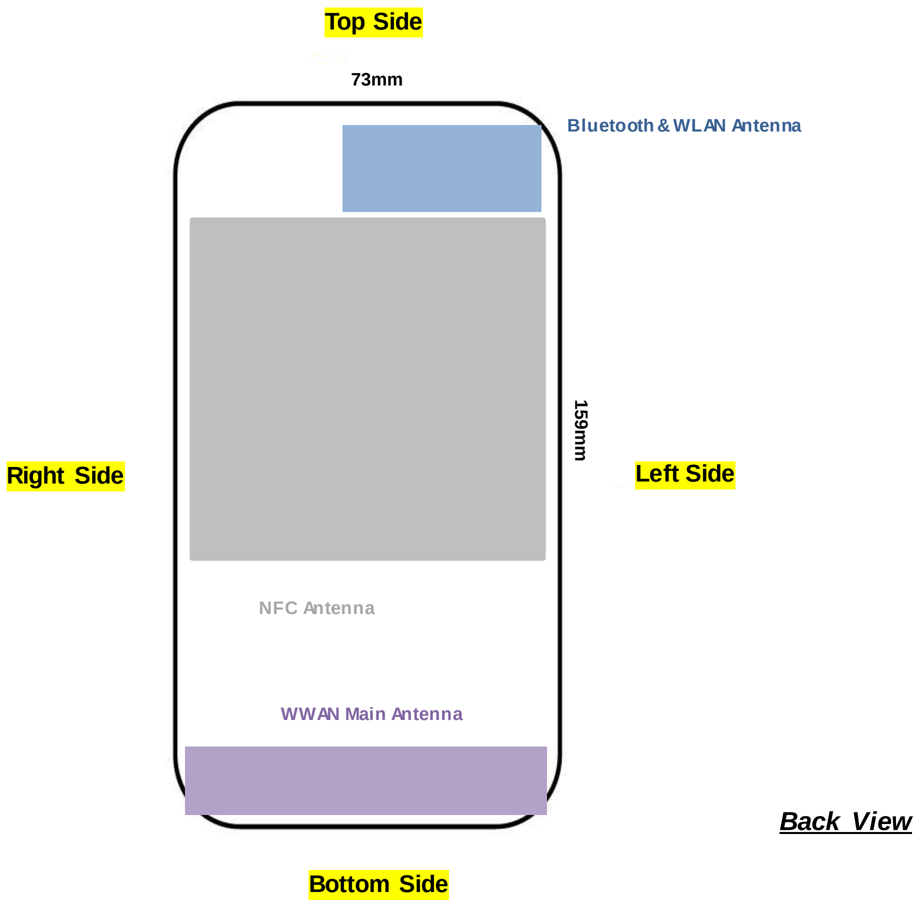
Bluetooth time-domain plot



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.3478 ms	6.33 dBm		
D2	M1	1	2.8928 ms	-0.21 dB		
D3	M1	1	3.7609 ms	0.09 dB		

14. Antenna Location



15. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 10-g SAR for the mid-band or highest output power channel is:
   - ≤2.0 W/kg for 10-g, when the transmission band is ≤ 100 MHz
   - ≤1.5 W/kg for 10-g, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 1.0 W/kg for 10-g, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥ 0.8W/kg. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

UMTS Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA, and according to the following RF output power, the output power results of the secondary modes (HSUPA, HSDPA, DC-HSDPA) are less than ¼ dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

LTE Note:

1. Per KDB 941225 D05v02r05, 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 for RB offsets at the upper edge, middle and lower edge of each required test channel.
2. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
3. Per KDB 941225 D05v02r05, 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 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.
4. Per KDB 941225 D05v02r05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, 16QAM SAR testing is not required.
5. Per KDB 941225 D05v02r05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
6. For LTE B4 / B5 / B12 /B17 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
7. LTE band 17 SAR test was covered by Band 12; according to TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. The maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion.
   b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

15.1 Extremity SAR

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	0mm	4233	846.6	22.29	23.00	1.178	-0.17	0.605	0.712
	WCDMA V	RMC 12.2Kbps	Back	0mm	4233	846.6	22.29	23.00	1.178	-0.07	0.759	0.894
	WCDMA V	RMC 12.2Kbps	Right Side	0mm	4233	846.6	22.29	23.00	1.178	-0.1	0.451	0.531
	WCDMA V	RMC 12.2Kbps	Left Side	0mm	4233	846.6	22.29	23.00	1.178	-0.09	0.564	0.664
	WCDMA V	RMC 12.2Kbps	Top Side	0mm	4233	846.6	22.29	23.00	1.178	-0.03	0.056	0.066
	WCDMA V	RMC 12.2Kbps	Bottom Side	0mm	4233	846.6	22.29	23.00	1.178	0.08	0.475	0.559
01	WCDMA V	RMC 12.2Kbps	Back	0mm	4132	826.4	22.25	23.00	1.189	0.16	0.964	**1.146**
	WCDMA V	RMC 12.2Kbps	Back	0mm	4182	836.4	22.27	23.00	1.183	0.06	0.870	1.029
	WCDMA II	RMC 12.2Kbps	Front	0mm	9262	1852.4	22.34	23.00	1.164	0.01	1.430	1.665
	WCDMA II	RMC 12.2Kbps	Back	0mm	9262	1852.4	22.34	23.00	1.164	0.02	2.110	2.456
	WCDMA II	RMC 12.2Kbps	Right Side	0mm	9262	1852.4	22.34	23.00	1.164	-0.01	0.818	0.952
	WCDMA II	RMC 12.2Kbps	Left Side	0mm	9262	1852.4	22.34	23.00	1.164	0.09	0.223	0.260
	WCDMA II	RMC 12.2Kbps	Top Side	0mm	9262	1852.4	22.34	23.00	1.164	-0.07	0.083	0.097
	WCDMA II	RMC 12.2Kbps	Bottom Side	0mm	9262	1852.4	22.34	23.00	1.164	0.13	0.876	1.020
	WCDMA II	RMC 12.2Kbps	Back	0mm	9400	1880	22.24	23.00	1.191	0.09	2.130	2.537
02	WCDMA II	RMC 12.2Kbps	Back	0mm	9538	1907.6	22.21	23.00	1.199	0.06	2.180	**2.615**
	WCDMA IV	RMC 12.2Kbps	Front	0mm	1513	1752.6	22.35	23.00	1.161	0.08	1.120	1.301
	WCDMA IV	RMC 12.2Kbps	Back	0mm	1513	1752.6	22.35	23.00	1.161	0.12	2.080	2.416
	WCDMA IV	RMC 12.2Kbps	Right Side	0mm	1513	1752.6	22.35	23.00	1.161	0.05	0.866	1.006
	WCDMA IV	RMC 12.2Kbps	Left Side	0mm	1513	1752.6	22.35	23.00	1.161	0.03	0.140	0.163
	WCDMA IV	RMC 12.2Kbps	Top Side	0mm	1513	1752.6	22.35	23.00	1.161	0.04	0.081	0.094
	WCDMA IV	RMC 12.2Kbps	Bottom Side	0mm	1513	1752.6	22.35	23.00	1.161	0.06	0.089	0.104
	WCDMA IV	RMC 12.2Kbps	Back	0mm	1312	1712.4	22.28	23.00	1.180	0.11	2.010	2.372
03	WCDMA IV	RMC 12.2Kbps	Back	0mm	1413	1732.6	22.34	23.00	1.164	0.01	2.080	**2.421**

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	LTE Band 12	10M	QPSK	1	49	Front	0mm	23095	707.5	22.66	24.00	1.361	-0.11	0.330	0.449
04	LTE Band 12	10M	QPSK	1	49	Back	0mm	23095	707.5	22.66	24.00	1.361	0.08	1.090	**1.484**
	LTE Band 12	10M	QPSK	1	49	Right Side	0mm	23095	707.5	22.66	24.00	1.361	0.06	0.378	0.515
	LTE Band 12	10M	QPSK	1	49	Left Side	0mm	23095	707.5	22.66	24.00	1.361	-0.01	0.384	0.523
	LTE Band 12	10M	QPSK	1	49	Top Side	0mm	23095	707.5	22.66	24.00	1.361	-0.07	0.535	0.728
	LTE Band 12	10M	QPSK	1	49	Bottom Side	0mm	23095	707.5	22.66	24.00	1.361	-0.14	0.075	0.102
	LTE Band 12	10M	QPSK	25	25	Front	0mm	23095	707.5	21.79	23.00	1.321	-0.07	0.302	0.399
	LTE Band 12	10M	QPSK	25	25	Back	0mm	23095	707.5	21.79	23.00	1.321	-0.05	0.920	1.216
	LTE Band 12	10M	QPSK	25	25	Right Side	0mm	23095	707.5	21.79	23.00	1.321	-0.03	0.317	0.419
	LTE Band 12	10M	QPSK	25	25	Left Side	0mm	23095	707.5	21.79	23.00	1.321	0.04	0.347	0.458
	LTE Band 12	10M	QPSK	25	25	Top Side	0mm	23095	707.5	21.79	23.00	1.321	0.04	0.044	0.058
	LTE Band 12	10M	QPSK	25	25	Bottom Side	0mm	23095	707.5	21.79	23.00	1.321	0.02	0.062	0.082
	LTE Band 13	10M	QPSK	1	25	Front	0mm	23230	782	22.78	24.00	1.324	0.06	0.428	0.567
05	LTE Band 13	10M	QPSK	1	25	Back	0mm	23230	782	22.78	24.00	1.324	0.05	0.775	**1.026**
	LTE Band 13	10M	QPSK	1	25	Right Side	0mm	23230	782	22.78	24.00	1.324	-0.03	0.392	0.519
	LTE Band 13	10M	QPSK	1	25	Left Side	0mm	23230	782	22.78	24.00	1.324	-0.1	0.499	0.661
	LTE Band 13	10M	QPSK	1	25	Top Side	0mm	23230	782	22.78	24.00	1.324	0.17	0.041	0.054
	LTE Band 13	10M	QPSK	1	25	Bottom Side	0mm	23230	782	22.78	24.00	1.324	-0.1	0.104	0.138
	LTE Band 13	10M	QPSK	25	12	Front	0mm	23230	782	21.85	23.00	1.303	0.02	0.342	0.446
	LTE Band 13	10M	QPSK	25	12	Back	0mm	23230	782	21.85	23.00	1.303	0.1	0.630	0.821
	LTE Band 13	10M	QPSK	25	12	Right Side	0mm	23230	782	21.85	23.00	1.303	-0.14	0.320	0.417
	LTE Band 13	10M	QPSK	25	12	Left Side	0mm	23230	782	21.85	23.00	1.303	-0.02	0.420	0.547
	LTE Band 13	10M	QPSK	25	12	Top Side	0mm	23230	782	21.85	23.00	1.303	0.05	0.032	0.042
	LTE Band 13	10M	QPSK	25	12	Bottom Side	0mm	23230	782	21.85	23.00	1.303	0.11	0.085	0.111
	LTE Band 5	10M	QPSK	1	25	Front	0mm	20525	836.5	22.67	24.00	1.358	0.03	0.703	0.955
06	LTE Band 5	10M	QPSK	1	25	Back	0mm	20525	836.5	22.67	24.00	1.358	0.15	0.909	**1.235**
	LTE Band 5	10M	QPSK	1	25	Right Side	0mm	20525	836.5	22.67	24.00	1.358	0.04	0.471	0.640
	LTE Band 5	10M	QPSK	1	25	Left Side	0mm	20525	836.5	22.67	24.00	1.358	-0.06	0.611	0.830
	LTE Band 5	10M	QPSK	1	25	Top Side	0mm	20525	836.5	22.67	24.00	1.358	-0.08	0.054	0.073
	LTE Band 5	10M	QPSK	1	25	Bottom Side	0mm	20525	836.5	22.67	24.00	1.358	0.08	0.133	0.181
	LTE Band 5	10M	QPSK	25	12	Front	0mm	20525	836.5	21.78	23.00	1.324	0.05	0.571	0.756
	LTE Band 5	10M	QPSK	25	12	Back	0mm	20525	836.5	21.78	23.00	1.324	0.08	0.761	1.008
	LTE Band 5	10M	QPSK	25	12	Right Side	0mm	20525	836.5	21.78	23.00	1.324	-0.05	0.380	0.503
	LTE Band 5	10M	QPSK	25	12	Left Side	0mm	20525	836.5	21.78	23.00	1.324	0.04	0.504	0.667
	LTE Band 5	10M	QPSK	25	12	Top Side	0mm	20525	836.5	21.78	23.00	1.324	0.04	0.043	0.057
	LTE Band 5	10M	QPSK	25	12	Bottom Side	0mm	20525	836.5	21.78	23.00	1.324	-0.18	0.108	0.143
	LTE Band 4	20M	QPSK	1	49	Front	0mm	20175	1732.5	23.19	24.00	1.205	0.13	1.100	1.326
07	LTE Band 4	20M	QPSK	1	49	Back	0mm	20175	1732.5	23.19	24.00	1.205	-0.16	2.290	**2.760**
	LTE Band 4	20M	QPSK	1	49	Right Side	0mm	20175	1732.5	23.19	24.00	1.205	-0.06	0.904	1.089
	LTE Band 4	20M	QPSK	1	49	Left Side	0mm	20175	1732.5	23.19	24.00	1.205	0.02	0.141	0.170
	LTE Band 4	20M	QPSK	1	49	Top Side	0mm	20175	1732.5	23.19	24.00	1.205	-0.04	0.086	0.104
	LTE Band 4	20M	QPSK	1	49	Bottom Side	0mm	20175	1732.5	23.19	24.00	1.205	-0.03	1.060	1.277
	LTE Band 4	20M	QPSK	50	0	Front	0mm	20175	1732.5	22.15	23.00	1.216	-0.03	0.988	1.202
	LTE Band 4	20M	QPSK	50	0	Back	0mm	20175	1732.5	22.15	23.00	1.216	0.08	1.930	2.347
	LTE Band 4	20M	QPSK	50	0	Right Side	0mm	20175	1732.5	22.15	23.00	1.216	-0.1	0.727	0.884
	LTE Band 4	20M	QPSK	50	0	Left Side	0mm	20175	1732.5	22.15	23.00	1.216	0.03	0.118	0.144
	LTE Band 4	20M	QPSK	50	0	Top Side	0mm	20175	1732.5	22.15	23.00	1.216	-0.08	0.068	0.083
	LTE Band 4	20M	QPSK	50	0	Bottom Side	0mm	20175	1732.5	22.15	23.00	1.216	-0.1	0.853	1.037
	LTE Band 4	20M	QPSK	100	0	Back	0mm	20175	1732.5	22.16	23.00	1.213	-0.02	1.950	2.366

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	LTE Band 2	20M	QPSK	1	0	Front	0mm	18900	1880	23.05	24.00	1.245	0.14	1.530	1.904
	LTE Band 2	20M	QPSK	1	0	Back	0mm	18900	1880	23.05	24.00	1.245	-0.01	2.280	2.837
	LTE Band 2	20M	QPSK	1	0	Right Side	0mm	18900	1880	23.05	24.00	1.245	-0.16	0.910	1.133
	LTE Band 2	20M	QPSK	1	0	Left Side	0mm	18900	1880	23.05	24.00	1.245	0.07	0.277	0.345
	LTE Band 2	20M	QPSK	1	0	Top Side	0mm	18900	1880	23.05	24.00	1.245	-0.06	0.102	0.127
	LTE Band 2	20M	QPSK	1	0	Bottom Side	0mm	18900	1880	23.05	24.00	1.245	0.02	1.170	1.456
	LTE Band 2	20M	QPSK	1	0	Back	0mm	18700	1860	23.04	24.00	1.247	0.01	2.360	2.944
08	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	23.00	24.00	1.259	0.18	2.460	**3.097**
	LTE Band 2	20M	QPSK	50	0	Front	0mm	18900	1880	22.02	23.00	1.253	0.06	1.220	1.529
	LTE Band 2	20M	QPSK	50	0	Back	0mm	18900	1880	22.02	23.00	1.253	-0.05	1.890	2.368
	LTE Band 2	20M	QPSK	50	0	Right Side	0mm	18900	1880	22.02	23.00	1.253	0.1	0.730	0.915
	LTE Band 2	20M	QPSK	50	0	Left Side	0mm	18900	1880	22.02	23.00	1.253	-0.14	0.248	0.311
	LTE Band 2	20M	QPSK	50	0	Top Side	0mm	18900	1880	22.02	23.00	1.253	0.02	0.082	0.103
	LTE Band 2	20M	QPSK	50	0	Bottom Side	0mm	18900	1880	22.02	23.00	1.253	-0.16	0.862	1.080
	LTE Band 2	20M	QPSK	50	0	Back	0mm	18700	1860	21.80	23.00	1.318	0.09	1.820	2.399
	LTE Band 2	20M	QPSK	50	0	Back	0mm	19100	1900	21.95	23.00	1.274	0.08	1.890	2.407
	LTE Band 2	20M	QPSK	100	0	Back	0mm	18900	1880	21.93	23.00	1.279	0.06	1.880	2.405

<WLAN 2.4GHz SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Front	0mm	1	2412	15.00	16.50	1.413	100	1.000	-0.08	0.140	0.198
	WLAN2.4GHz	802.11b 1Mbps	Back	0mm	1	2412	15.00	16.50	1.413	100	1.000	0.1	0.117	0.165
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	1	2412	15.00	16.50	1.413	100	1.000	0.09	0.043	0.061
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	1	2412	15.00	16.50	1.413	100	1.000	-0.19	0.001	0.001
	WLAN2.4GHz	802.11b 1Mbps	Top Side	0mm	1	2412	15.00	16.50	1.413	100	1.000	0.05	0.149	0.210
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	0mm	1	2412	15.00	16.50	1.413	100	1.000	0.09	0.001	0.001
	WLAN2.4GHz	802.11b 1Mbps	Top Side	0mm	6	2437	12.10	13.00	1.230	100	1.000	-0.03	0.472	0.581
09	WLAN2.4GHz	802.11b 1Mbps	Top Side	0mm	11	2462	10.10	11.00	1.230	100	1.000	0.06	0.692	**0.851**

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	Bluetooth	DH5 1Mbps	Front	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	-0.12	0.073	0.102
	Bluetooth	DH5 1Mbps	Back	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	0.06	0.066	0.093
	Bluetooth	DH5 1Mbps	Left Side	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	0.02	0.017	0.024
	Bluetooth	DH5 1Mbps	Right Side	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	0.07	0.005	0.007
10	Bluetooth	DH5 1Mbps	Top Side	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	0.18	0.075	**0.105**
	Bluetooth	DH5 1Mbps	Bottom Side	0mm	0	2402	7.40	8.50	1.288	76.92	1.083	0.13	<0.001	<0.001
	Bluetooth	DH5 1Mbps	Top Side	0mm	39	2441	6.20	7.50	1.349	76.92	1.083	0.09	0.054	0.079
	Bluetooth	DH5 1Mbps	Top Side	0mm	78	2480	4.50	5.50	1.259	76.92	1.083	-0.02	0.045	0.061

15.2 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Ratio	Reported 10g SAR (W/kg)
1st	LTE Band 4	20M	QPSK	1	49	Back	0mm	20175	1732.5	23.19	24.00	1.205	-0.16	2.290	1	2.760
2nd	LTE Band 4	20M	QPSK	1	49	Back	0mm	20175	1732.5	23.19	24.00	1.205	0.05	2.150	1.065	2.591
1st	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	23.00	24.00	1.259	0.18	2.460	1	3.097
2nd	LTE Band 2	20M	QPSK	1	0	Back	0mm	19100	1900	23.00	24.00	1.259	0.09	2.380	1.034	2.996

General Note:

1. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, the same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds .
2. The ratio is the difference in percentage between original and repeated *measured SAR*.
3. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations
1.	None

General Note:

1. EUT will choose each WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
2. WLAN 2.4GHz and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. According to the EUT character, WLAN and WWAN cannot transmit simultaneously.

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17. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

18. References

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

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[7] FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, Oct 2015

[8] FCC KDB 941225 D05 v02r05, “SAR Evaluation Considerations for LTE Devices”, Dec 2015

[9] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[10] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Head_750MHz

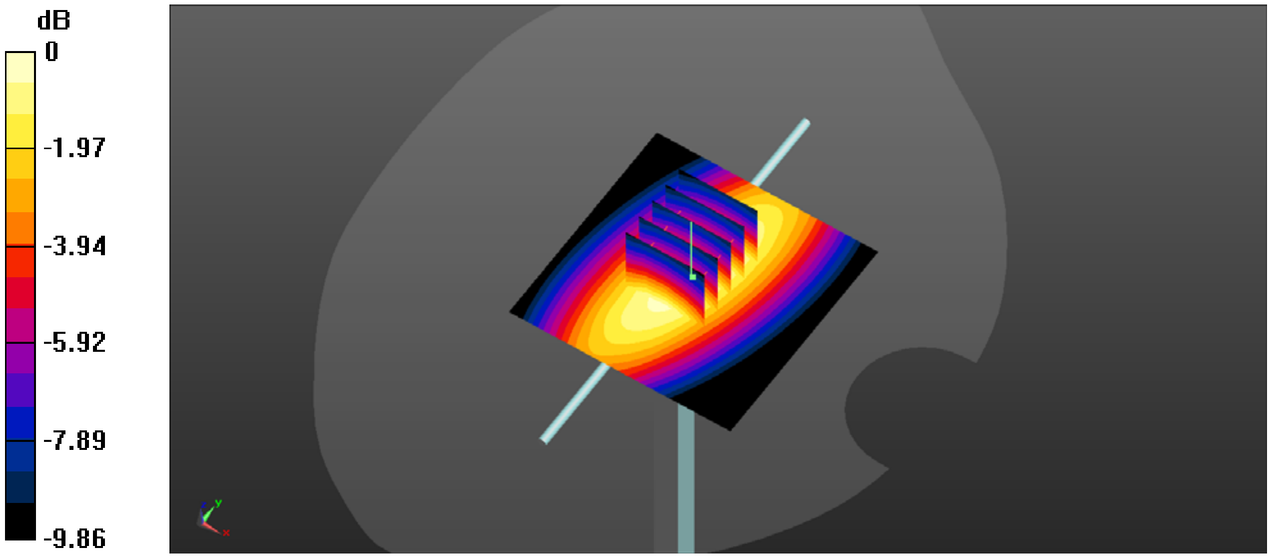
DUT: D750V3-SN:1099

Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1
Medium: HSL_750_200325 Medium parameters used: f = 750 MHz; σ = 0.896 S/m; ε_r = 42.398; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(10.1, 10.1, 10.1); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.76 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.82 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.20 W/kg
SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.76 W/kg



0 dB = 2.76 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020/3/26

System Check_Head_835MHz

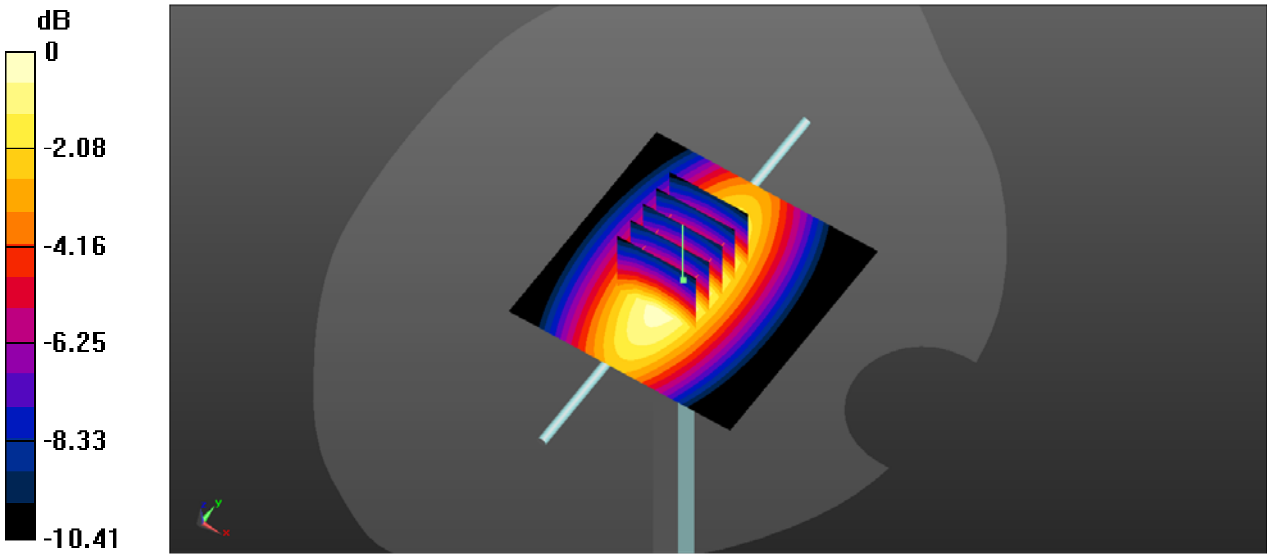
DUT: D835V2-SN:4d162

Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_200326 Medium parameters used: f = 835 MHz; $\sigma = 0.883$ S/m; $\varepsilon_r = 41.279$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(9.69, 9.69, 9.69); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.02 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.53 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.61 W/kg
Maximum value of SAR (measured) = 3.04 W/kg



0 dB = 3.04 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2020/3/27

System Check_Head_1750MHz

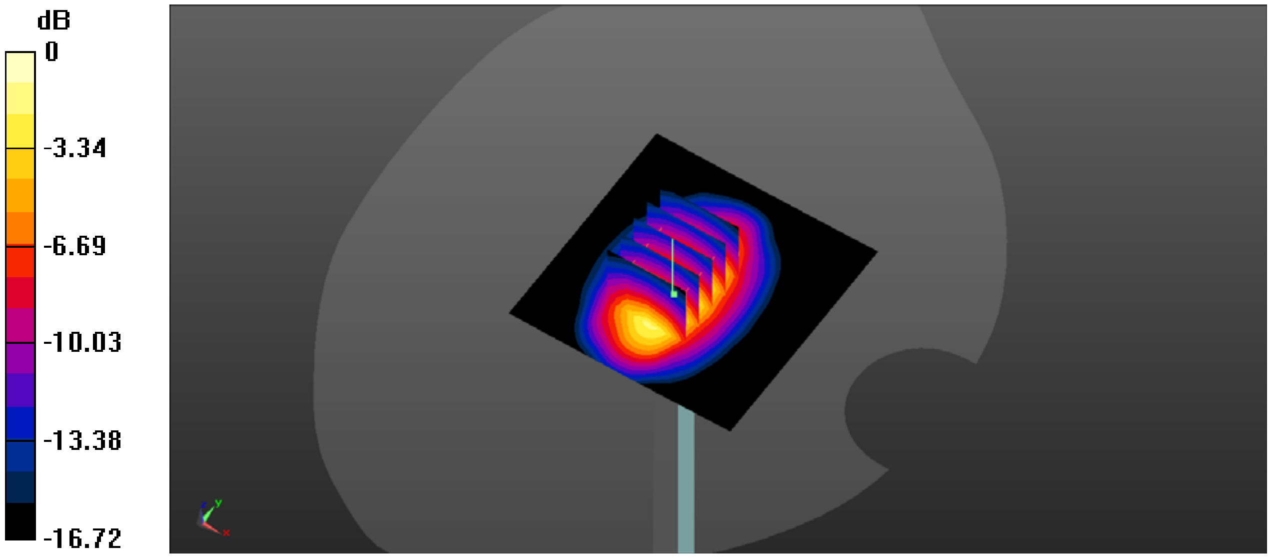
DUT: D1750V2-SN:1137

Communication System: UID 0, CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200327 Medium parameters used: f = 1750 MHz; σ = 1.355 S/m; ε_r = 38.395; ρ = 1000 kg/m^3
Ambient Temperature : 23.5 ℃; Liquid Temperature : 22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.62, 8.62, 8.62); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.3 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 89.46 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 15.3 W/kg
SAR(1 g) = 8.67 W/kg; SAR(10 g) = 4.63 W/kg
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020/3/28

System Check_Head_1900MHz

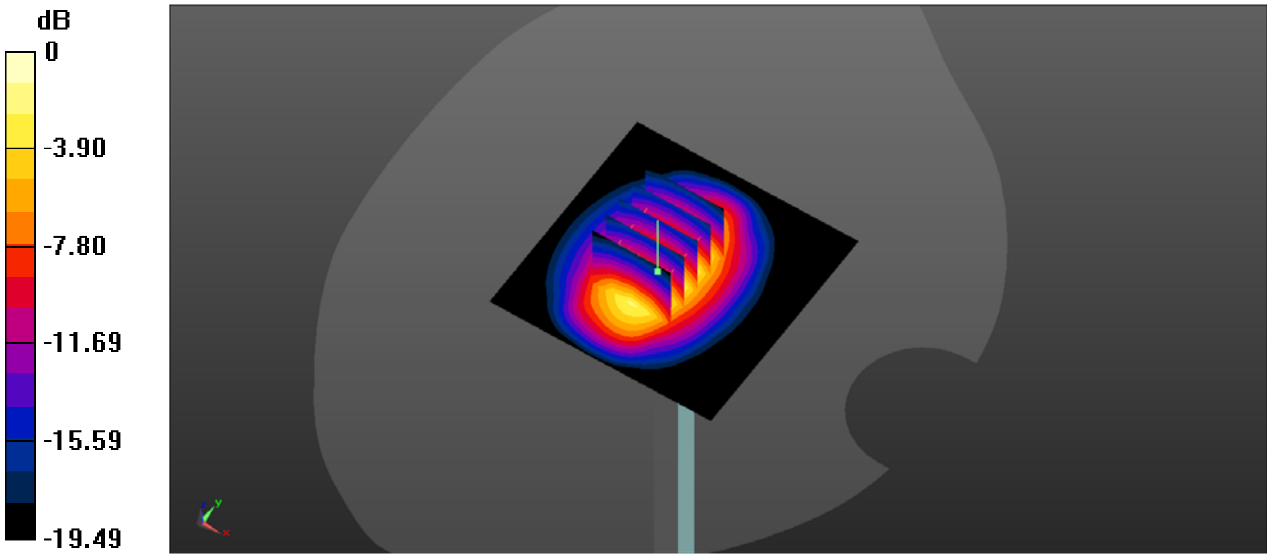
DUT: D1900V2-SN:5d182

Communication System: UID 0, CW (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200328 Medium parameters used: f = 1900 MHz; $\sigma = 1.419$ S/m; $\varepsilon_r = 38.344$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.34, 8.34, 8.34); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.6 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 97.69 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 19.1 W/kg
SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5 W/kg
Maximum value of SAR (measured) = 14.5 W/kg



0 dB = 14.5 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020/3/29

System Check_Head_2450MHz

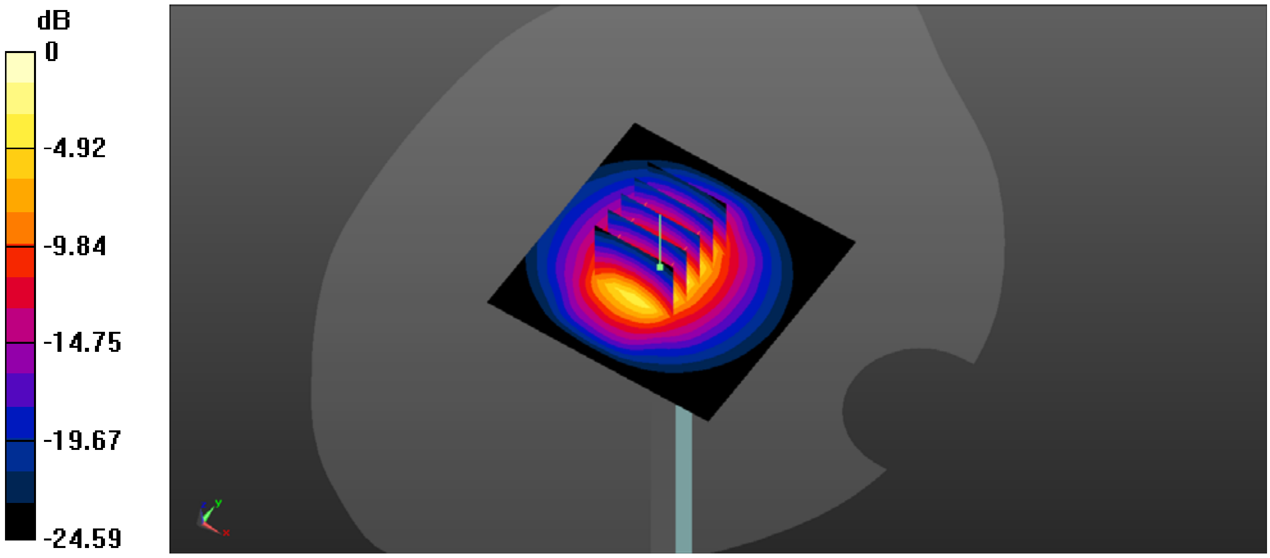
DUT: D2450V2-SN:924

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450_200329 Medium parameters used: f = 2450 MHz; σ = 1.754 S/m; ε_r = 40.37; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(7.8, 7.8, 7.8); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 18.5 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.77 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 26.4 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.6 W/kg
Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg

Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

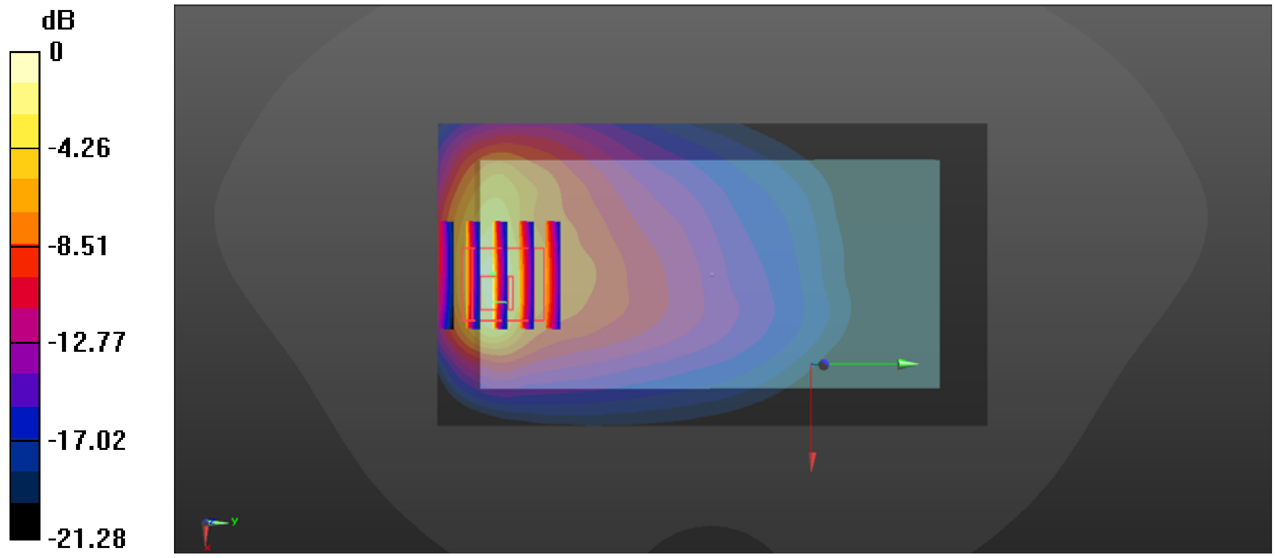
01_WCDMA V_RMC 12.2Kbps_Back_0mm_Ch4132

Communication System: UID 0, UMTS (0); Frequency: 826.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_200326 Medium parameters used: f = 826.4 MHz; σ = 0.875 S/m; ε_r = 41.384; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(9.69, 9.69, 9.69); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch4132/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.01 W/kg

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.828 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 7.69 W/kg
SAR(1 g) = 2.29 W/kg; SAR(10 g) = 0.964 W/kg
Maximum value of SAR (measured) = 4.74 W/kg



0 dB = 4.74 W/kg

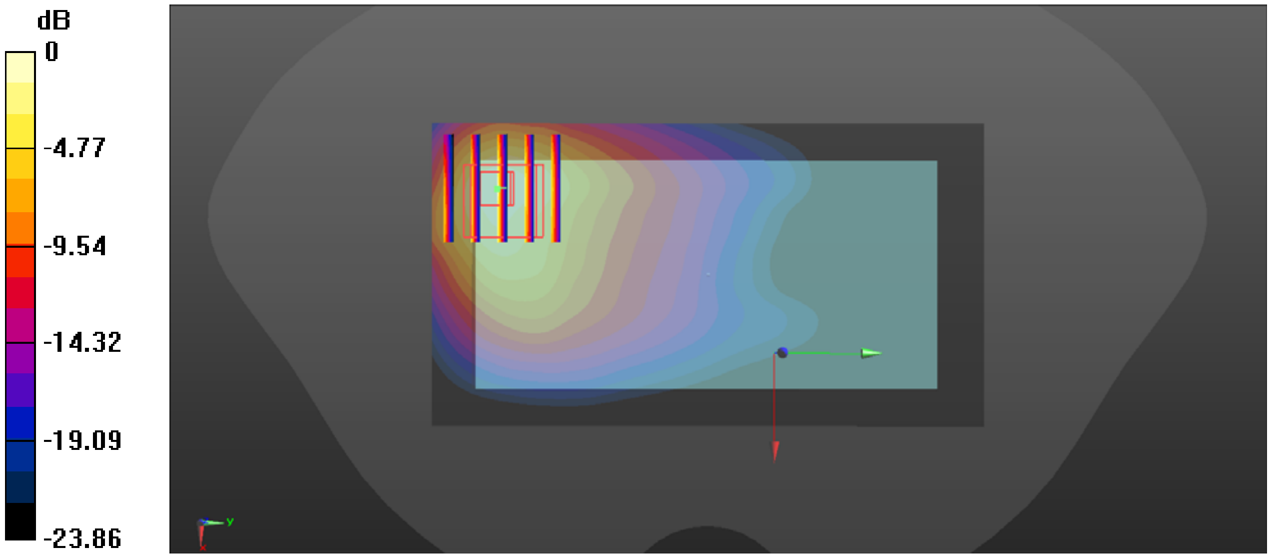
02_WCDMA II_RMC 12.2Kbps_Back_0mm_Ch9538

Communication System: UID 0, UMTS (0); Frequency: 1907.6 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200328 Medium parameters used: f = 1908 MHz; σ = 1.428 S/m; ε_r = 38.311; ρ = 1000 kg/m^3
Ambient Temperature : 23.6 ℃; Liquid Temperature : 22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.34, 8.34, 8.34); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch9538/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 8.05 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 12.7 W/kg
SAR(1 g) = 4.65 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 7.81 W/kg



0 dB = 7.81 W/kg

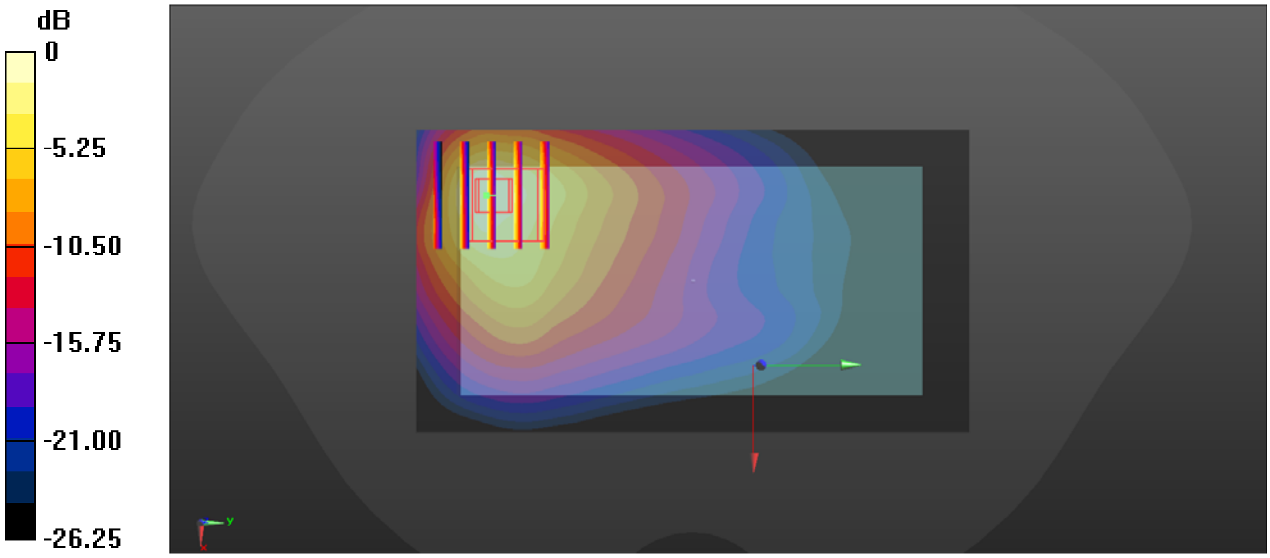
03_WCDMA IV_RMC 12.2Kbps_Back_0mm_Ch1413

Communication System: UID 0, UMTS (0); Frequency: 1732.6 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200327 Medium parameters used: f = 1733 MHz; σ = 1.339 S/m; ε_r = 38.475; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.62, 8.62, 8.62); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch1413/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 7.61 W/kg

Ch1413/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 10.3 W/kg
SAR(1 g) = 4.37 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 7.05 W/kg



0 dB = 7.05 W/kg

04_LTE Band 12_10M_QPSK_1RB_49Offset_Back_0mm_Ch23095

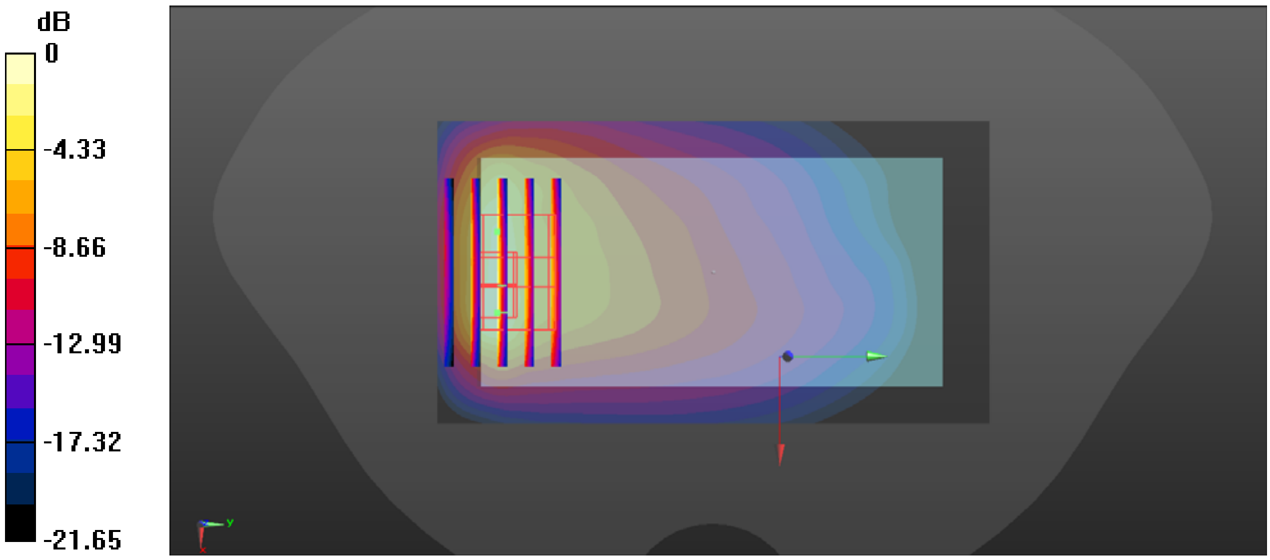
Communication System: UID 0, LTE (0); Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium: HSL_750_200325 Medium parameters used: f = 707.5 MHz; σ = 0.857 S/m; ε_r = 42.968; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(10.1, 10.1, 10.1); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23095/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.22 W/kg

Ch23095/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.9760 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 8.40 W/kg
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.09 W/kg
Maximum value of SAR (measured) = 4.80 W/kg

Ch23095/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.9760 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 6.70 W/kg
SAR(1 g) = 1.84 W/kg; SAR(10 g) = 0.929 W/kg
Maximum value of SAR (measured) = 4.35 W/kg



0 dB = 4.35 W/kg

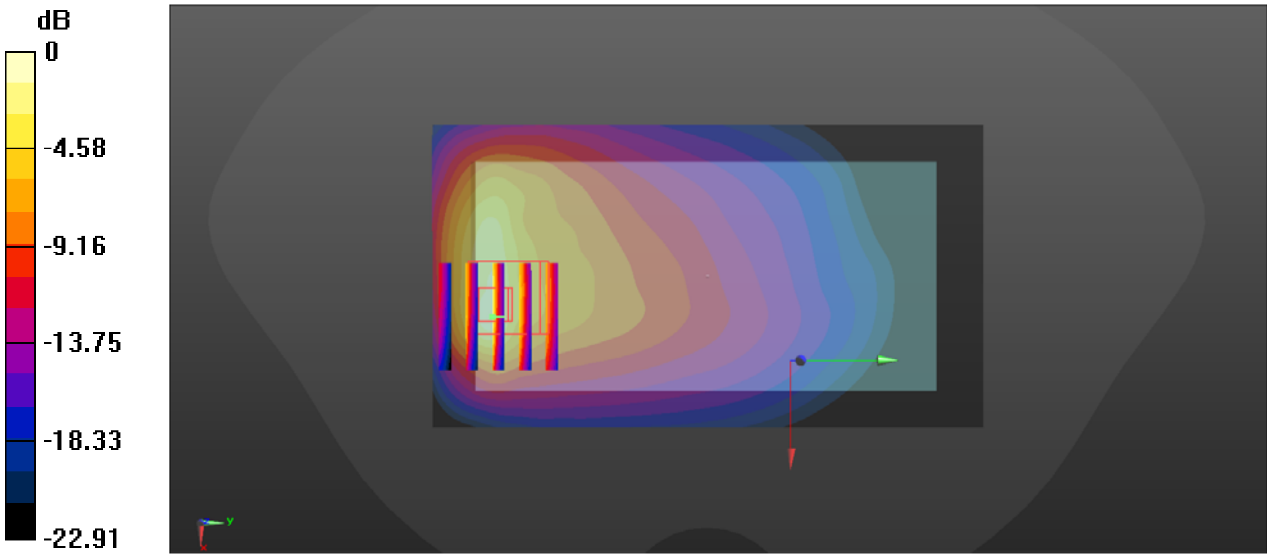
05_LTE Band 13_10M_QPSK_1RB_25Offset_Back_0mm_Ch23230

Communication System: UID 0, LTE (0); Frequency: 782 MHz;Duty Cycle: 1:1
Medium: HSL_750_200325 Medium parameters used: f = 782 MHz; σ = 0.923 S/m; ε_r = 41.978; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(10.1, 10.1, 10.1); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23230/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.08 W/kg

Ch23230/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.4880 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 6.08 W/kg
SAR(1 g) = 1.79 W/kg; SAR(10 g) = 0.775 W/kg
Maximum value of SAR (measured) = 3.53 W/kg



0 dB = 3.53 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2020/3/26

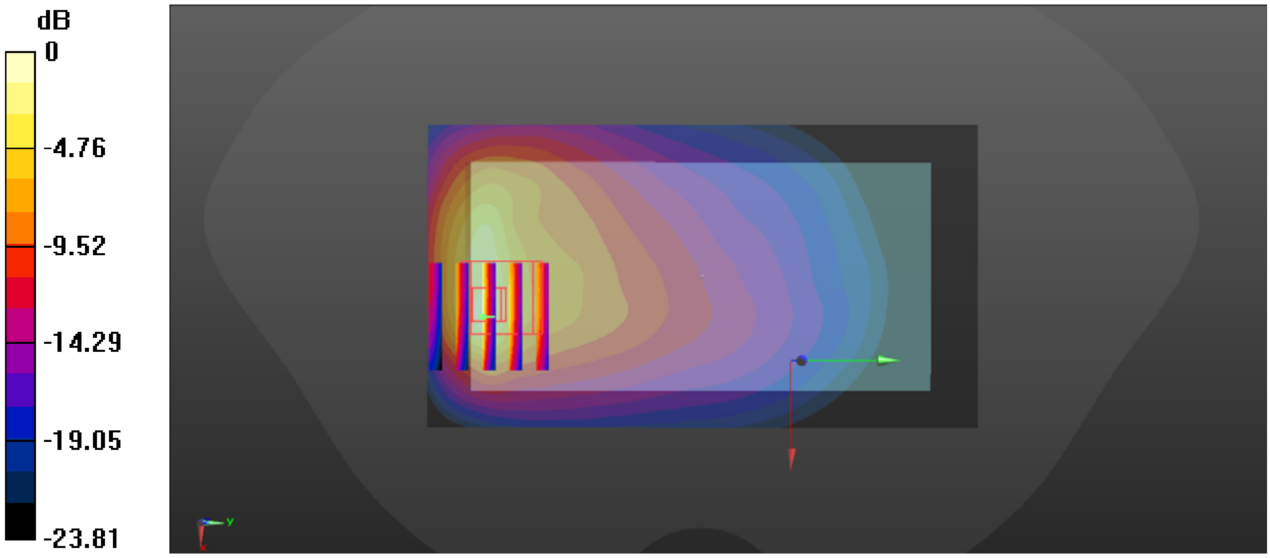
06_LTE Band 5_10M_QPSK_1RB_25Offset_Back_0mm_Ch20525

Communication System: UID 0, LTE (0); Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: HSL_835_200326 Medium parameters used: f = 836.5 MHz; σ = 0.884 S/m; ε_r = 41.261; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(9.69, 9.69, 9.69); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch20525/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.73 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.4890 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 7.43 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 0.909 W/kg
Maximum value of SAR (measured) = 4.32 W/kg



0 dB = 4.32 W/kg

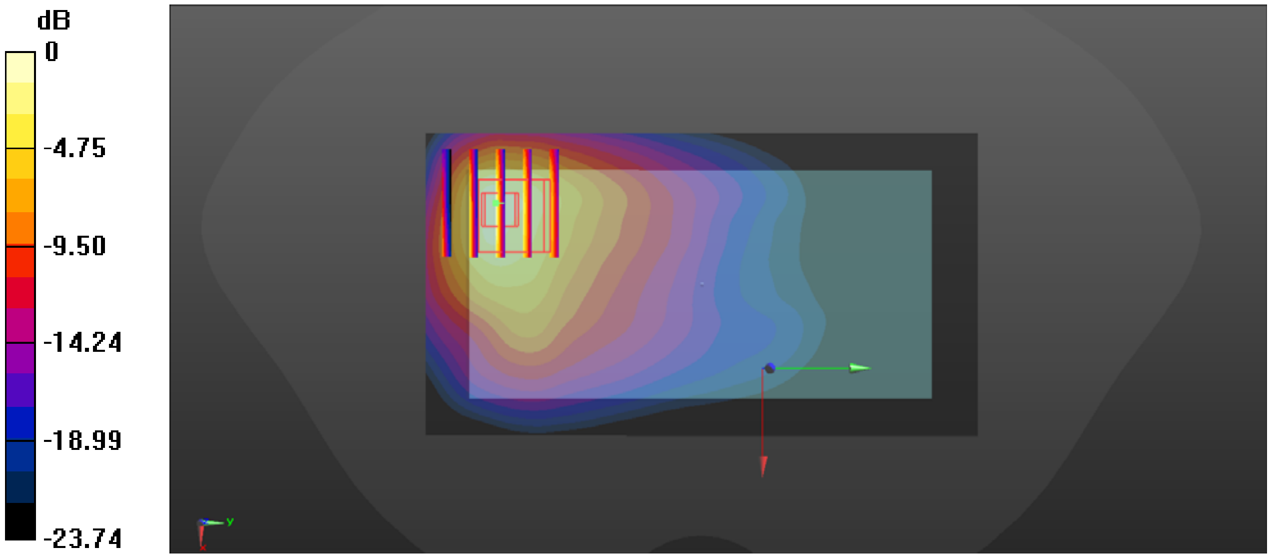
07_LTE Band 4_20M_QPSK_1RB_49Offset_Back_0mm_Ch20175

Communication System: UID 0, LTE (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: HSL_1750_200327 Medium parameters used: f = 1733 MHz; σ = 1.339 S/m; ε_r = 38.475; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.62, 8.62, 8.62); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch20175/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 6.98 W/kg

Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0.3950 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 10.9 W/kg
SAR(1 g) = 4.75 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 7.49 W/kg



0 dB = 7.49 W/kg

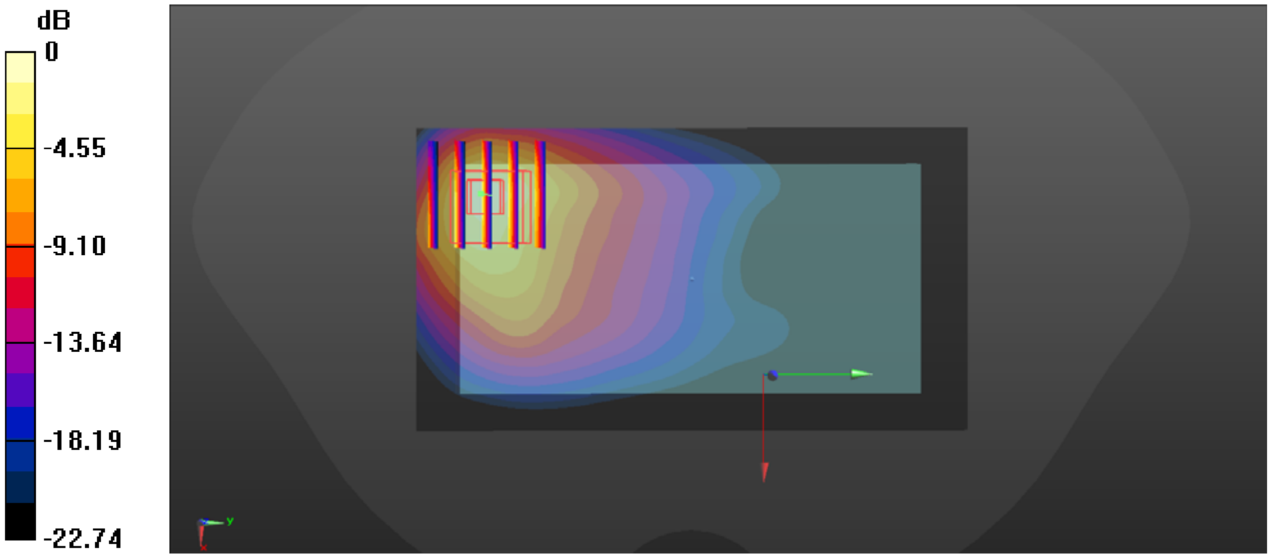
08_LTE Band 2_20M_QPSK_1RB_0Offset_Back_0mm_Ch19100

Communication System: UID 0, LTE (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_200328 Medium parameters used: f = 1900 MHz; $\sigma = 1.419$ S/m; $\varepsilon_r = 38.344$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(8.34, 8.34, 8.34); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch19100/Area Scan (61x111x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 8.15 W/kg

Ch19100/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 12.9 W/kg
SAR(1 g) = 5.25 W/kg; SAR(10 g) = 2.46 W/kg
Maximum value of SAR (measured) = 8.84 W/kg



0 dB = 8.84 W/kg

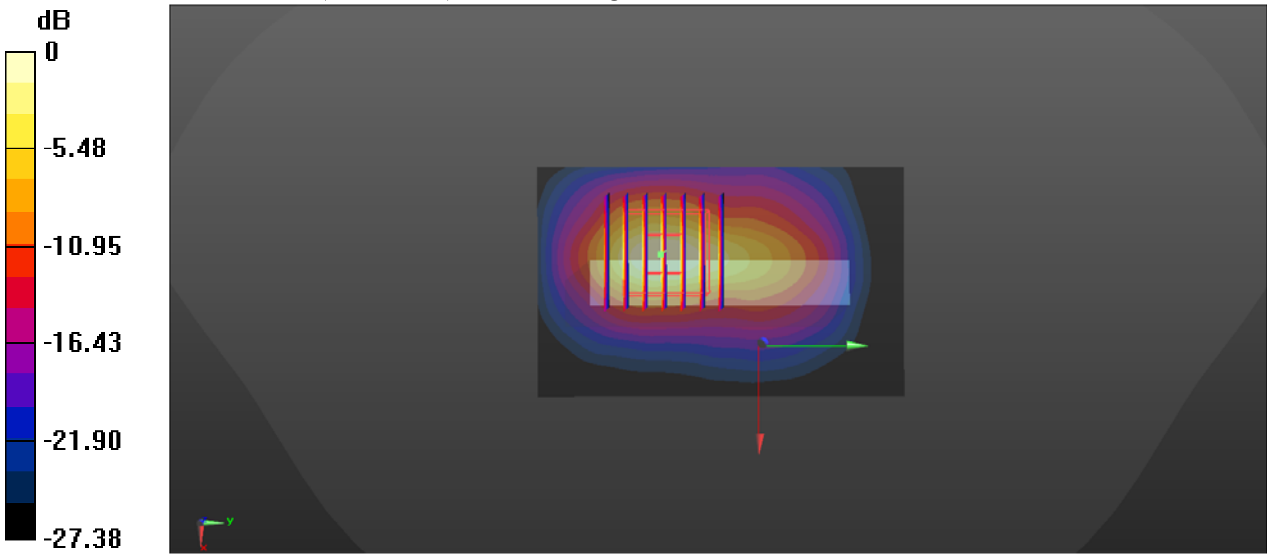
09_WLAN2.4GHz_802.11b 1Mbps_Top Side_0mm_Ch11

Communication System: UID 0, WIFI (0); Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: HSL_2450_200329 Medium parameters used: f = 2462 MHz; σ = 1.739 S/m; ε_r = 40.421; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(7.8, 7.8, 7.8); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch11/Area Scan (51x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 3.44 W/kg

Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.23 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 5.29 W/kg
SAR(1 g) = 1.9 W/kg; SAR(10 g) = 0.692 W/kg
Maximum value of SAR (measured) = 3.46 W/kg



0 dB = 3.44 W/kg

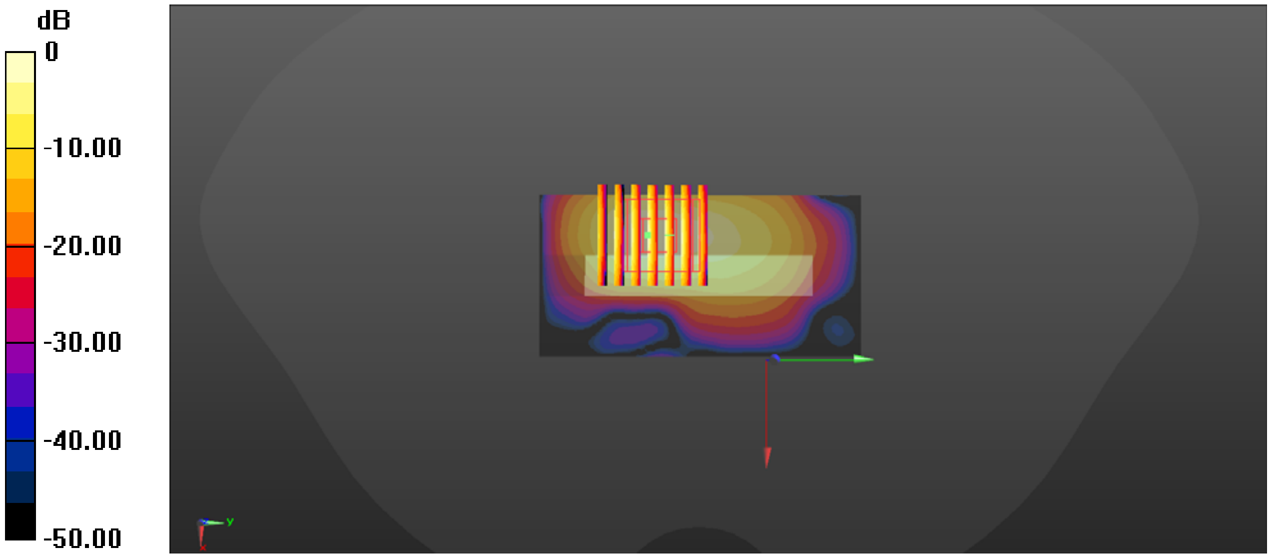
10_Bluetooth_DH5 1Mbpss_Top Side_0mm_Ch0

Communication System: UID 0, Bluetooth (0); Frequency: 2402 MHz;Duty Cycle: 1:1.3
Medium: HSL_2450_200329 Medium parameters used: f = 2402 MHz; $\sigma = 1.704$ S/m; $\varepsilon_r = 40.55$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7577; ConvF(7.8, 7.8, 7.8); Calibrated: 2020/2/3
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1356; Calibrated: 2019/10/16
- Phantom: Twin-SAM1(P1aP2a20); Type: QD 000 P40 CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch0/Area Scan (41x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.365 W/kg

Ch0/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.045 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.561 W/kg
SAR(1 g) = 0.204 W/kg; SAR(10 g) = 0.075 W/kg
Maximum value of SAR (measured) = 0.364 W/kg



0 dB = 0.364 W/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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CALIBRATION LABORATORY

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CNAS L0570

Client **Sporton** **Certificate No: Z18-60532**

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1099
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	December 6, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	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: December 9, 2018

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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	52.10.2.1495
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	43.1 ± 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 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**8.52 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.38 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**5.64 mW /g ± 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	54.0 ± 6 %	0.95 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	2.15 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**8.61 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.44 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**5.77 mW /g ±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	54.2Ω- 1.12jΩ
Return Loss	- 27.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8Ω- 3.37jΩ
Return Loss	- 29.4dB

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: 12.05.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

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

Medium parameters used: f = 750 MHz; σ = 0.865 S/m; ε_r = 43.13; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.47, 9.47, 9.47) @ 750 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; 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 (7450)

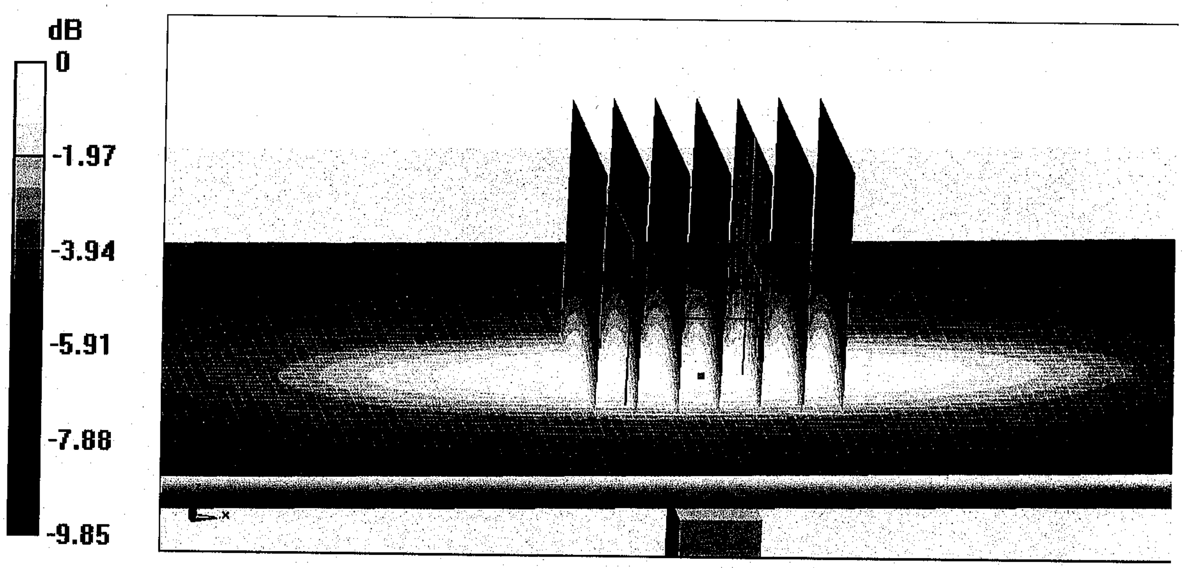
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.37 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.12 W/kg

SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (measured) = 2.75 W/kg



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

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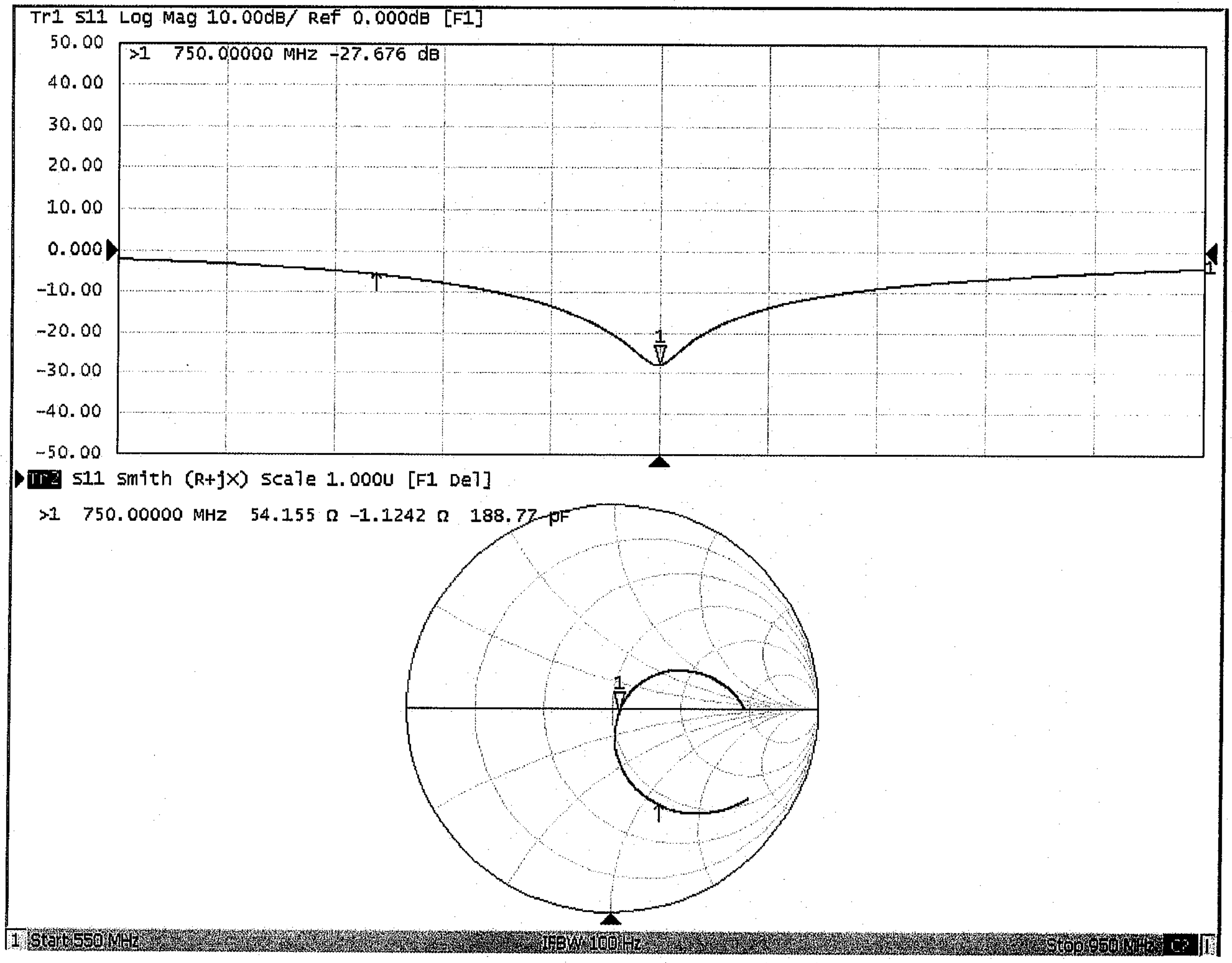
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 12.05.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

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

Medium parameters used: f = 750 MHz; σ = 0.951 S/m; ε_r = 54.02; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.68, 9.68, 9.68) @ 750 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; 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 (7450)

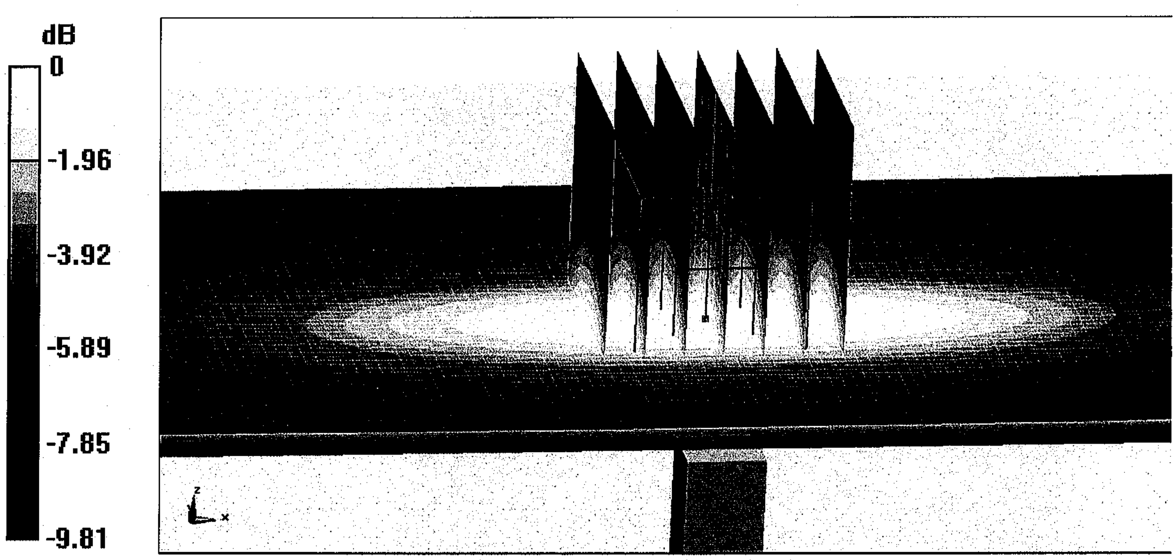
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 51.51 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 3.29 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.44 W/kg

Maximum value of SAR (measured) = 2.88 W/kg



0 dB = 2.88 W/kg = 4.59 dBW/kg

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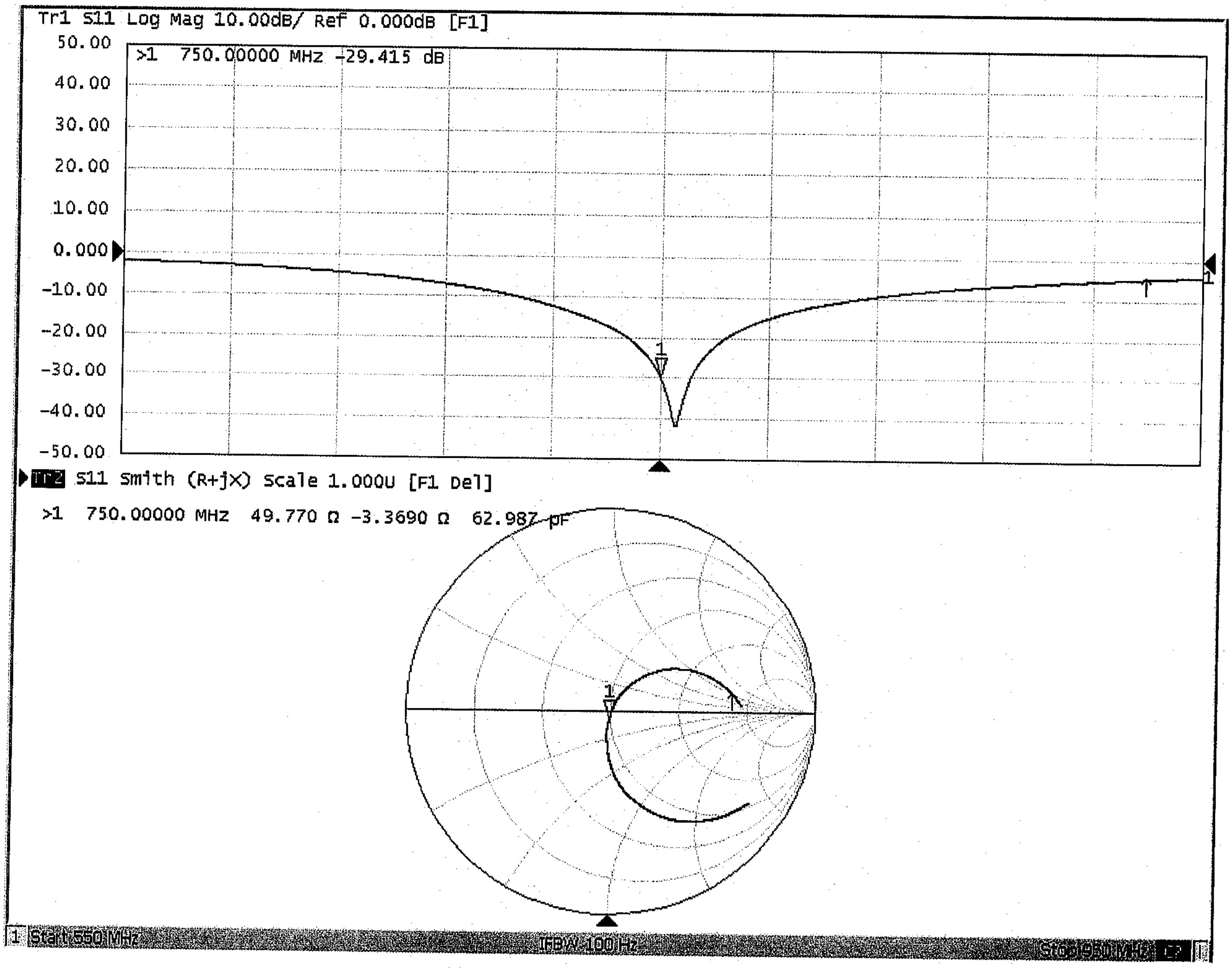
Impedance Measurement Plot for Body TSL



D750V3, Serial No. 1099 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

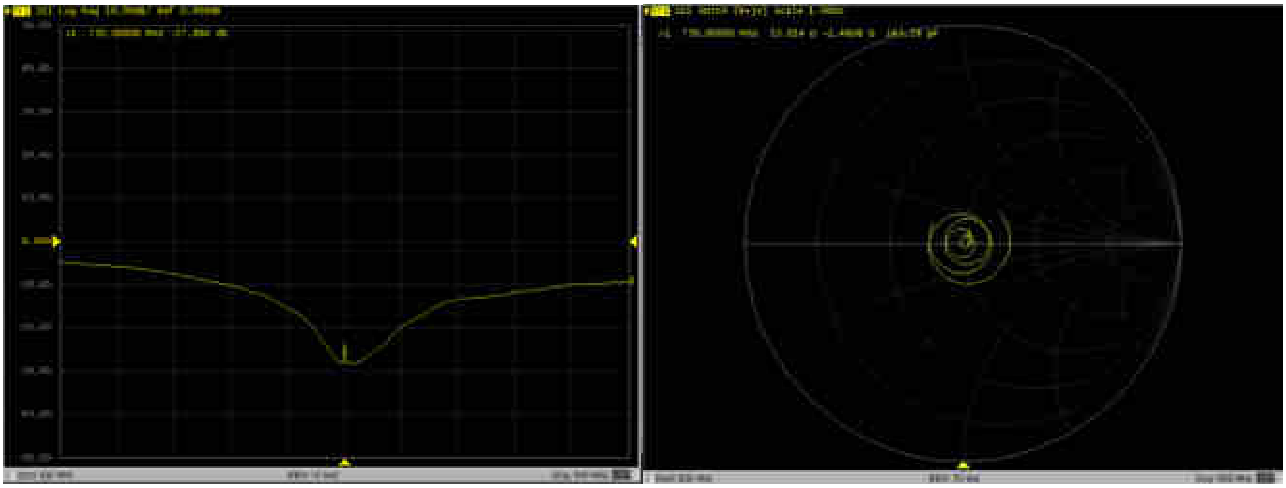
D750V3 – serial no. 1099												
	750 Head						750 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018.12.6	-27.7		54.2		-1.12		-29.4		49.8		-3.37	
2019.11.25	-27.9	-0.7	53.0	-1.2	-1.46	-0.34	-29.2	0.7	48.7	-1.1	-3.17	0.2

<Justification of the extended calibration>

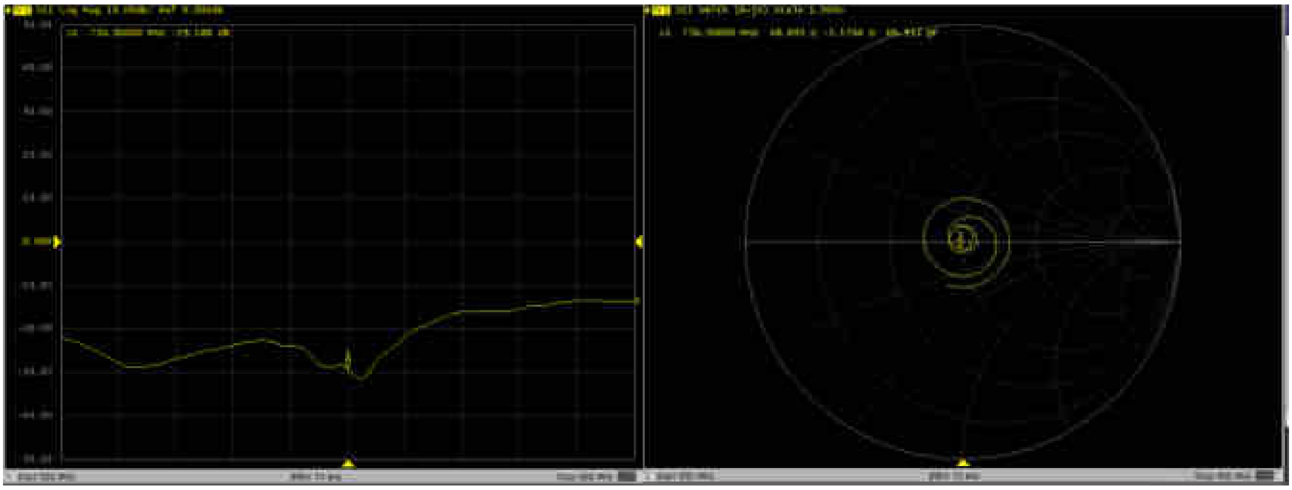
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D750V3, serial no. 1099

750MHz - Head



750MHz – Body



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CNAS L0570

Client **Sporton** **Certificate No: Z18-60533**

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d162

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

Calibration date: December 5, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	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: December 8, 2018

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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	52.10.2.1495
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	42.7 ± 6 %	0.88 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 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.61 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.35 mW /g ± 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	53.7 ± 6 %	0.99 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	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.70 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.64 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.47 mW /g ± 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	52.6Ω- 2.56jΩ
Return Loss	- 28.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2Ω- 6.92jΩ
Return Loss	- 22.3dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.306 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: 12.04.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

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

Medium parameters used: f = 835 MHz; σ = 0.881 S/m; ε_r = 42.71; 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 Sn1555; 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 (7450)

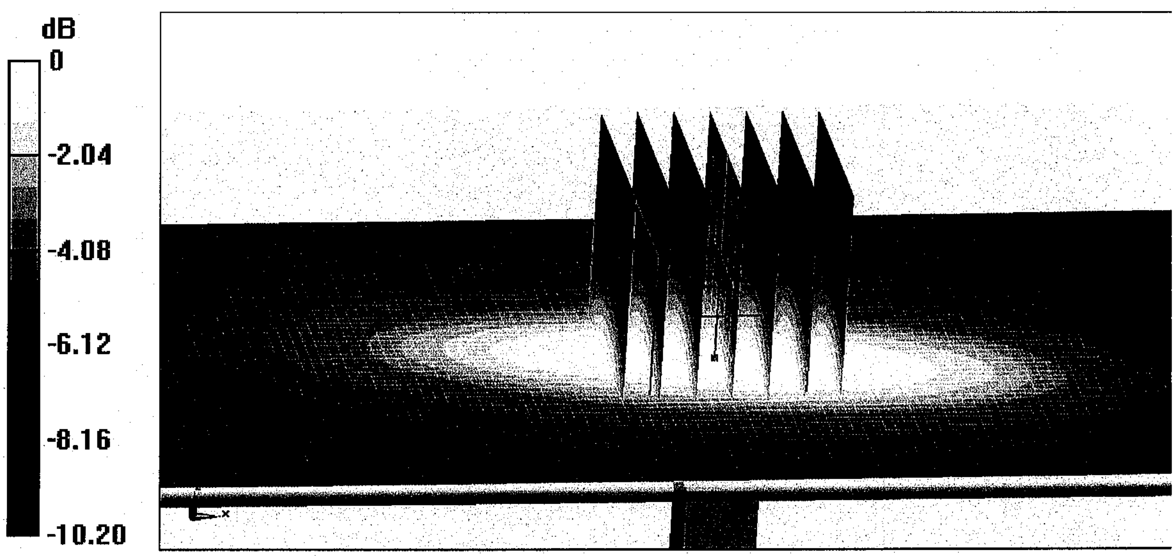
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.75 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.50 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 3.11 W/kg



0 dB = 3.11 W/kg = 4.93 dBW/kg

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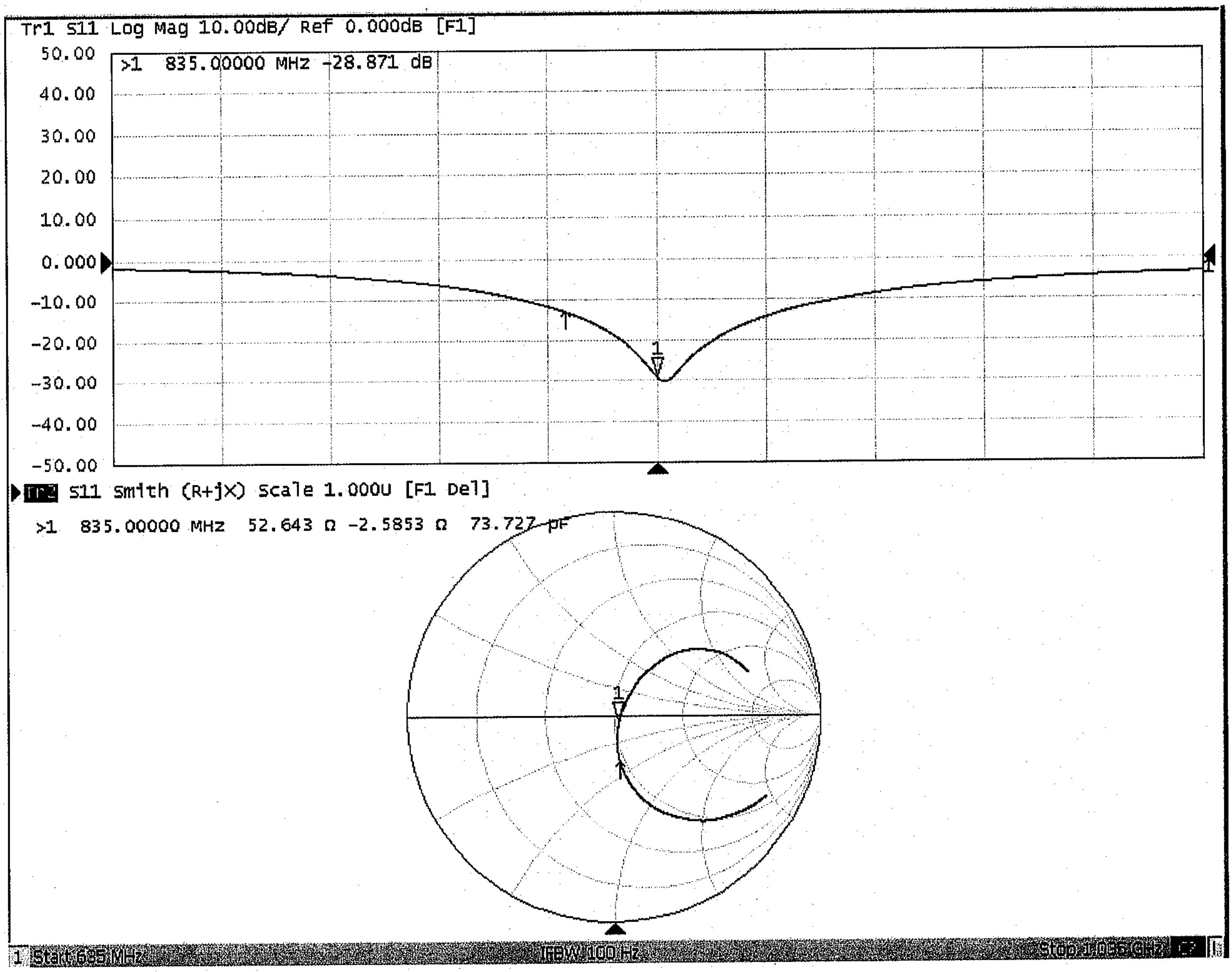
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 12.04.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

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

Medium parameters used: f = 835 MHz; σ = 0.986 S/m; ε_r = 53.72; 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 Sn1555; 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 (7450)

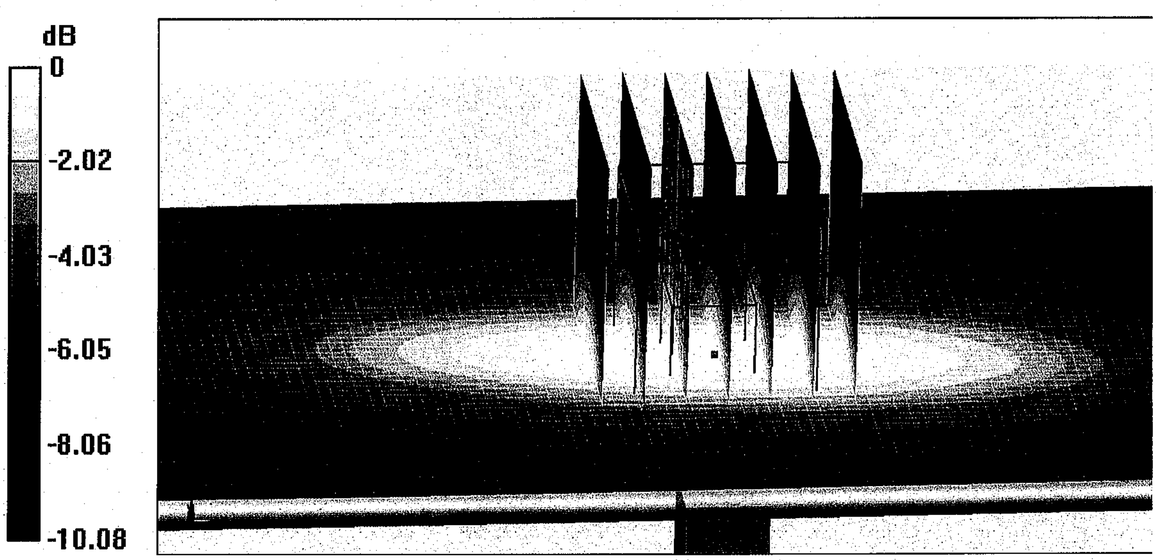
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.24 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.72 W/kg

SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.64 W/kg

Maximum value of SAR (measured) = 3.29 W/kg



0 dB = 3.29 W/kg = 5.17 dBW/kg

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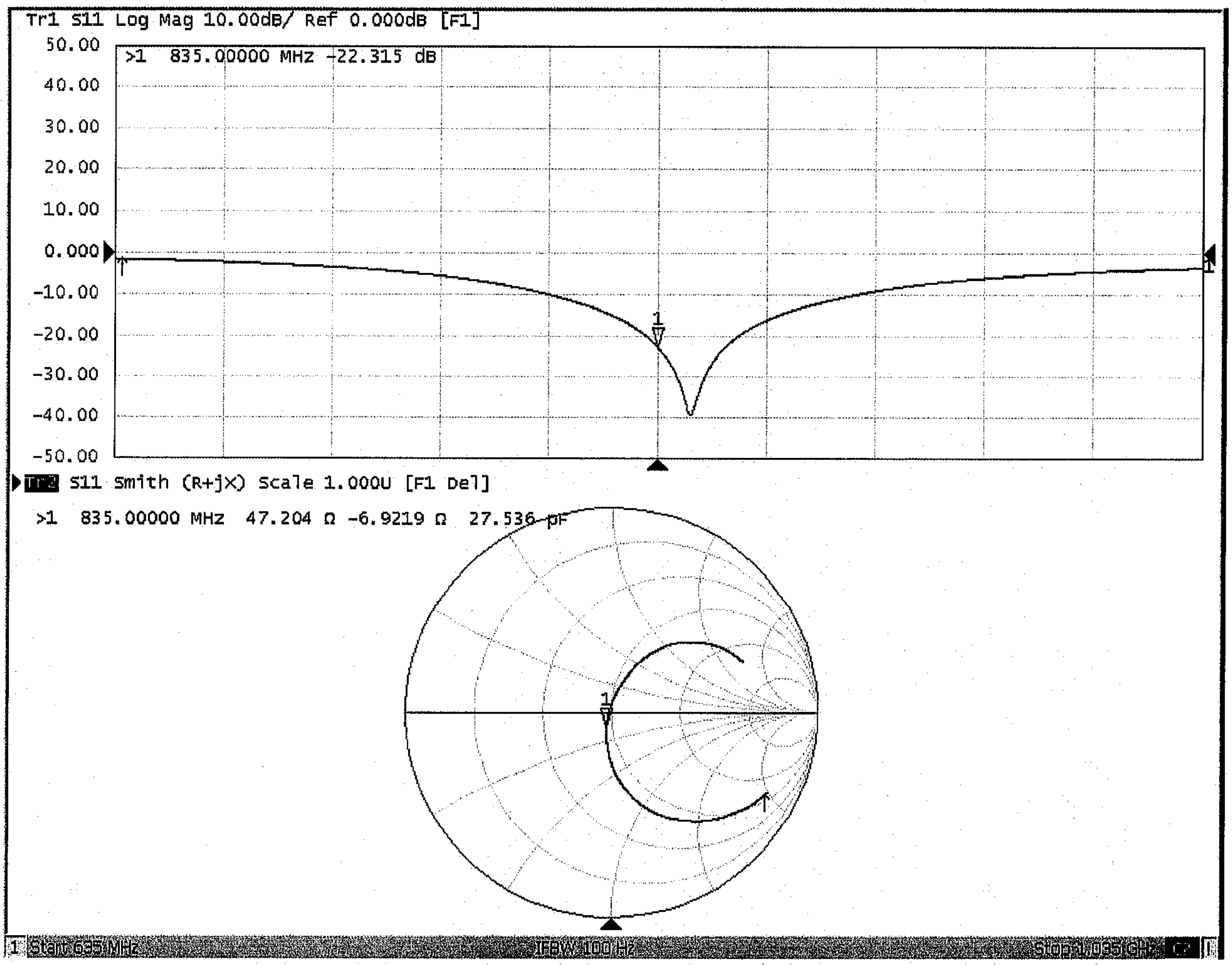
Impedance Measurement Plot for Body TSL



D835V2, Serial No. 4d162 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

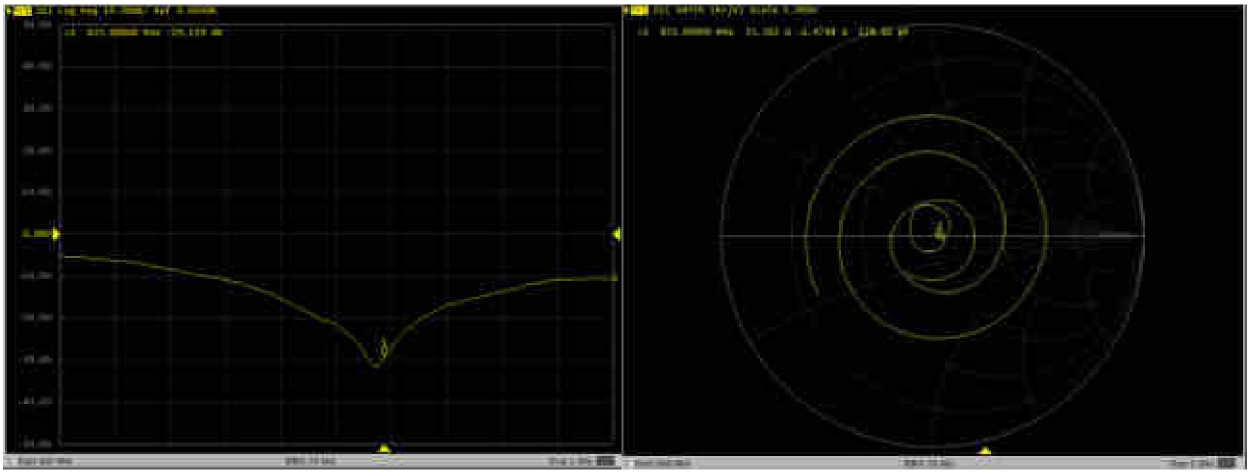
D835V2 – serial no. 4d162												
	835 Head						835 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018.12.5	-28.9		52.6		-2.56		-22.3		47.2		-6.92	
2019.11.25	-29.2	1.0	53.4	0.8	-1.48	1.08	-21.1	5.4	46.6	-0.6	-7.81	-0.89

<Justification of the extended calibration>

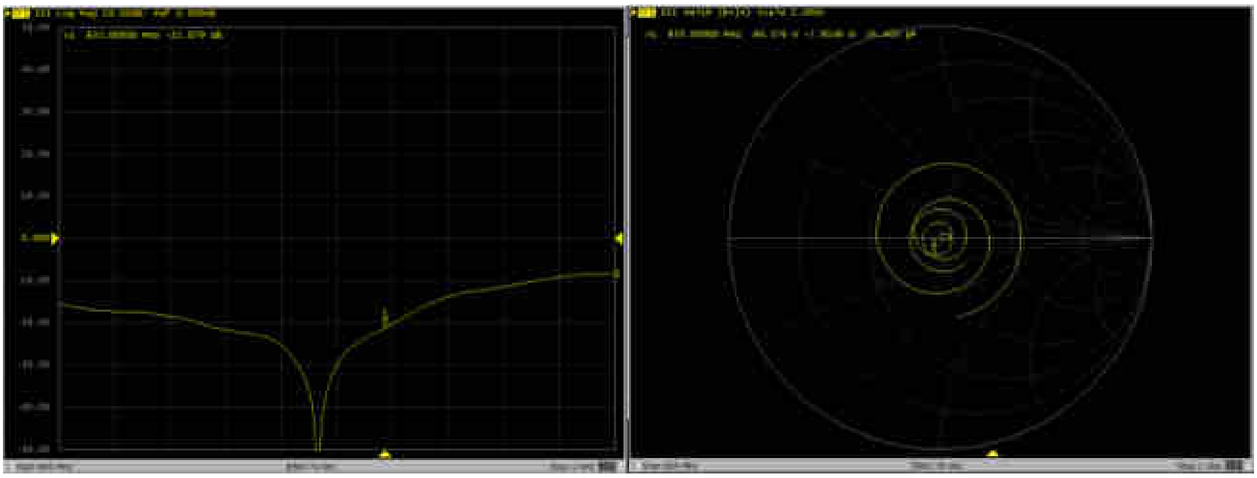
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> 835V2, serial no. 4d162

835MHz - Head



835MHz – Body



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CALIBRATION
CNAS L0570

Client **Sporton** **Certificate No: Z18-60258**

CALIBRATION CERTIFICATE

Object D1750V2 - SN: 1137

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

Calibration date: July 30, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	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: August 3, 2018

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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	52.10.1.1476
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	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	41.2 ± 6 %	1.33 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	8.91 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**19.5 mW /g ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	1.48 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	9.17 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**37.0 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.3 mW /g ± 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	50.3- 0.87 jΩ
Return Loss	- 40.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.8Ω- 2.59 jΩ
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.087 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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Date: 07.30.2018

DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.332 S/m; εr = 41.17; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.7, 8.7, 8.7) @ 1750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

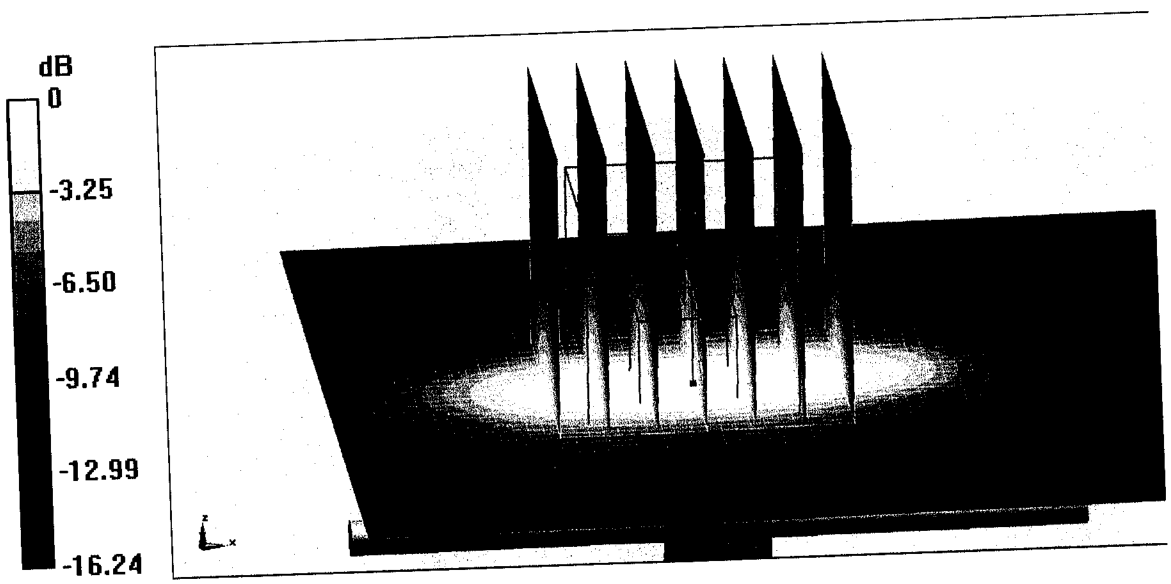
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 8.91 W/kg; SAR(10 g) = 4.81 W/kg

Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.5 W/kg = 11.30 dBW/kg

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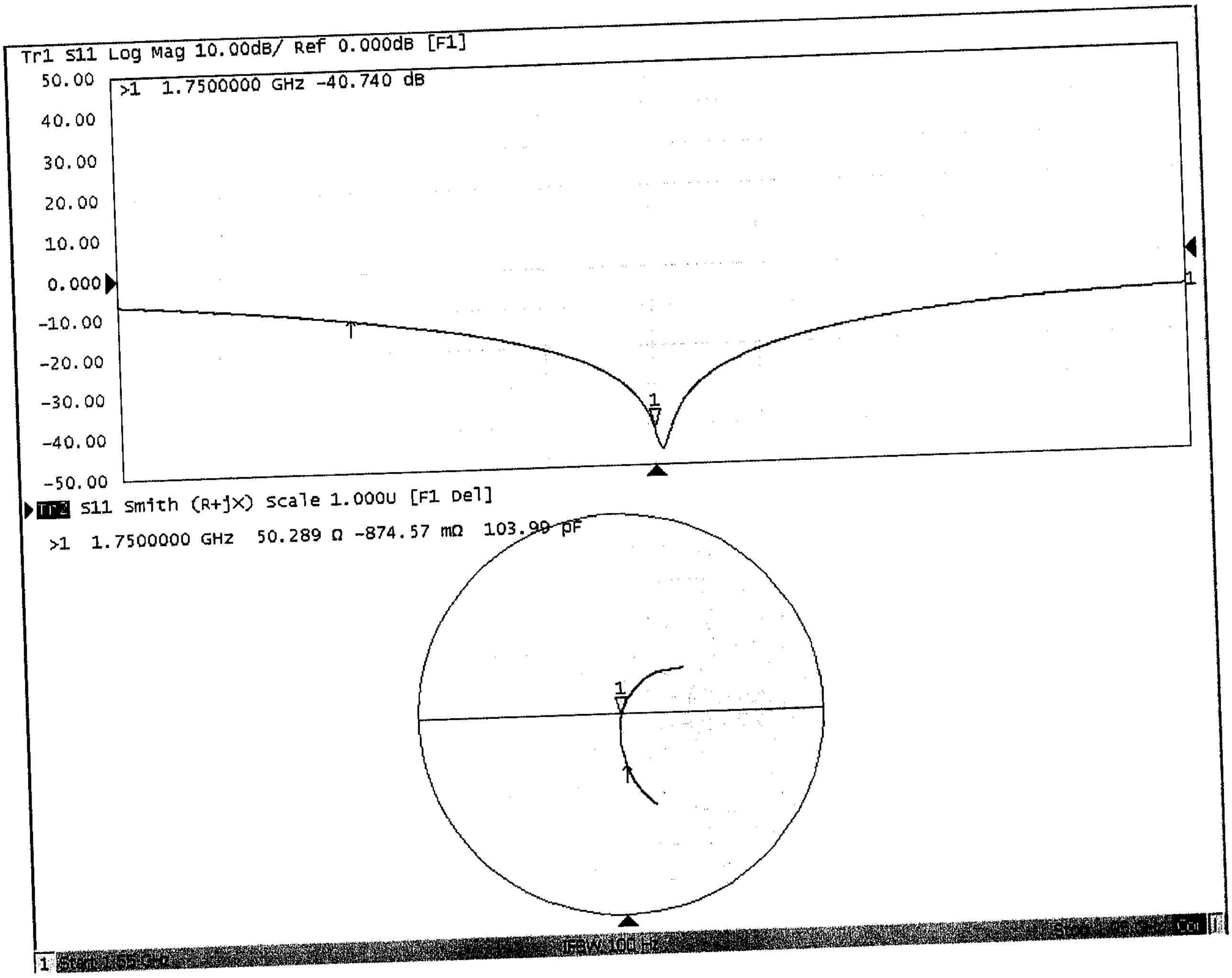
Impedance Measurement Plot for Head TSL



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Date: 07.30.2018

DASY5 Validation Report for Body TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.477 S/m; εr = 53.84; ρ = 1000 kg/m3

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.6, 8.6, 8.6) @ 1750 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

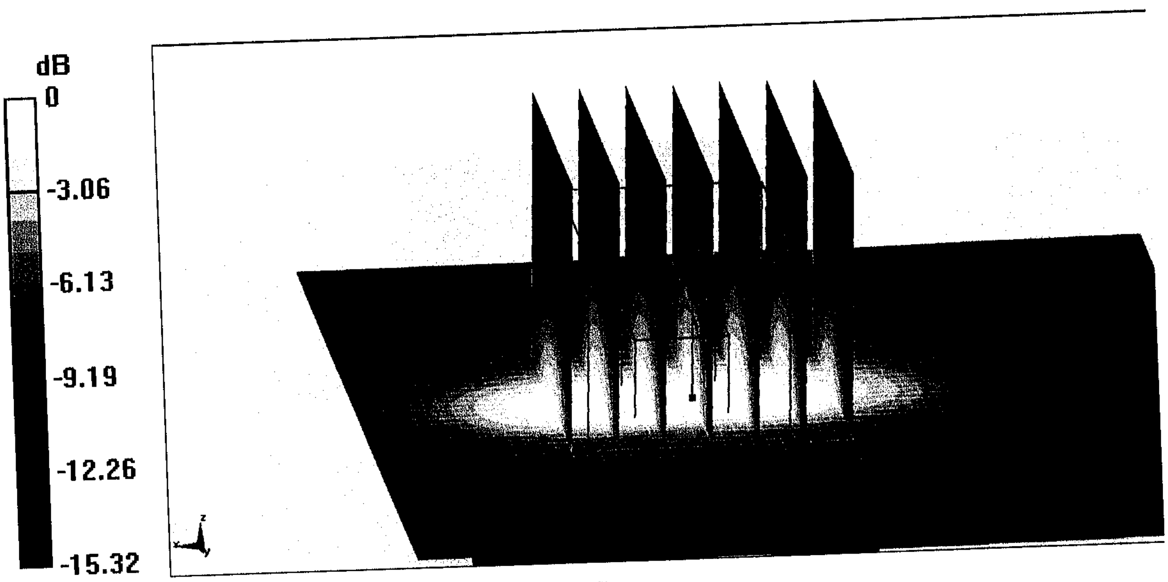
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 77.55 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.17 W/kg; SAR(10 g) = 5.05 W/kg

Maximum value of SAR (measured) = 13.7 W/kg



0 dB = 13.7 W/kg = 11.37 dBW/kg

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Impedance Measurement Plot for Body TSL