FCC SAR Test Report

APPLICANT	:	**HMD Global Oy**
EQUIPMENT	:	**4G feature phone**
BRAND NAME	:	**Nokia**
MODEL NAME	:	**TA-1155**
FCC ID	:	**2AJOTTA-1155**
STANDARD	:	**FCC 47 CFR PART 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2013**

The product was received on Oct. 31, 2019 and testing was started from Nov. 18, 2019 and completed on Nov. 20, 2019. We, Sporton International (Kunshan) 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 report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

Rose Wang

Reviewed by: Rose Wang / Supervisor

Kat Yin

Approved by: Kat Yin / Manager

ilac-MRA

ACCREDITED
Cert #5145.02

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People's Republic of China

Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA9O3108	Rev. 01	Initial issue of report	Nov. 29, 2019

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **HMD Global Oy, 4G feature phone, TA-1155**, are as follows.

Highest Standalone 1g SAR Summary					Highest Simultaneous Transmission 1g SAR (W/kg)
Equipment Class	Frequency Band		Head (Separation 0mm)	Body-worn (Separation 15mm)	
			1g SAR (W/kg)		
Licensed	GSM	GSM850	**1.42**	1.03	1.59
	LTE	LTE Band 5	1.37	**1.13**	
		LTE Band 7	1.33	0.46	
		LTE Band 38	0.61	0.30	
DSS	Bluetooth	Bluetooth	0.17	<0.10	1.59
Date of Testing			2019/11/18~2019/11/20		

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 (1.6 W/kg for Partial-Body 1g 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 (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory		
Test Firm	Sporton International (Kunshan) Inc.	
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958	
Test Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CN1257	314309

Applicant	
Company Name	HMD Global Oy
Address	Bertel Jungin aukio 9, 02600 Espoo, Finland

Manufacturer	
Company Name	HMD Global Oy
Address	Bertel Jungin aukio 9, 02600 Espoo, Finland

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 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r03
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
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-

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	4G feature phone
Brand Name	Nokia
Model Name	TA-1155
FCC ID	2AJOTTA-1155
IMEI Code	SIM1: 357686100001739 SIM2: 357686100016737
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS/EGPRS (Downlink only) LTE Cat 1bis: QPSK, 16QAM Bluetooth BR/EDR
HW Version	HW0301
SW Version	14.01.17.05
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network
EUT Stage	Identical Prototype

Remark:
1. This device supports VoIP in GPRS and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. This device does not support DTM operation and support GRPS mode up to multi-slot class 12, EGRPS only support Downlink.
3. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.

4.2 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	2AJOTTA-1155
Equipment Name	4G feature phone
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz
Channel Bandwidth	LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz
Uplink Modulations used	QPSK / 16QAM
LTE Voice / Data requirements	Voice and Data
LTE Release Version	R13, Cat1bis
CA Support	Not Supported
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3 (see below)
LTE A-MPR	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)
Spectrum plots for RB configuration	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.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1, 2 and 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3
256 QAM	≥ 1						≤ 5

Transmission (H, M, L) channel numbers and frequencies in each LTE band								
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 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560
LTE Band 38								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610

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:

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

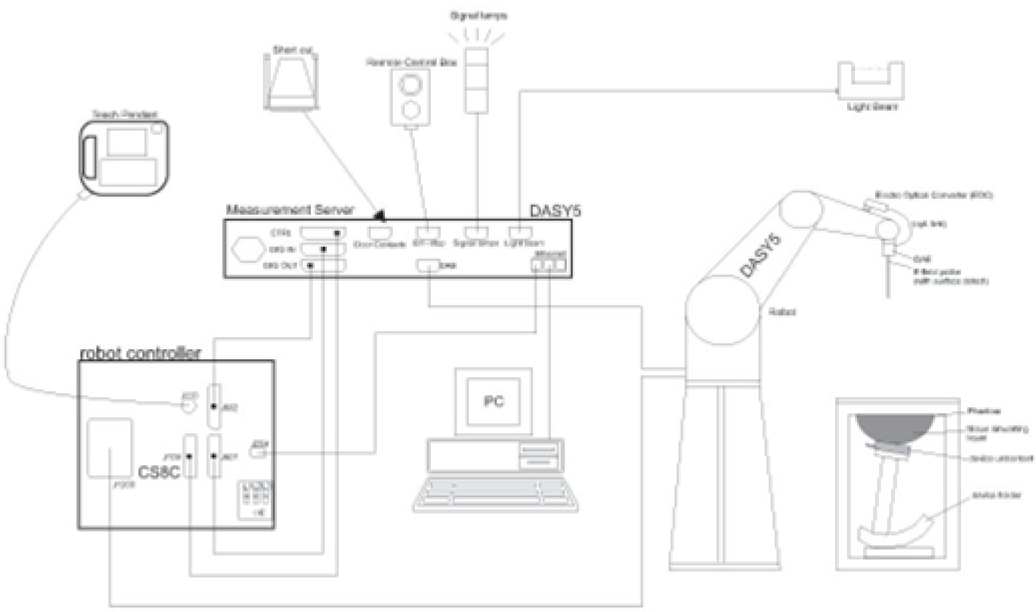
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

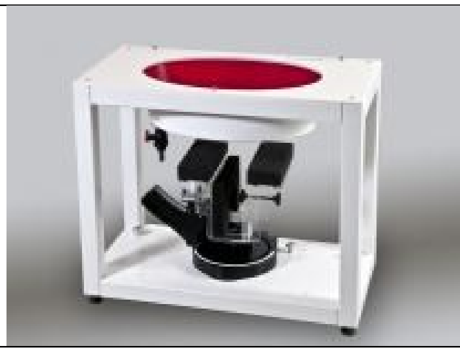
7.3 Phantom

<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	

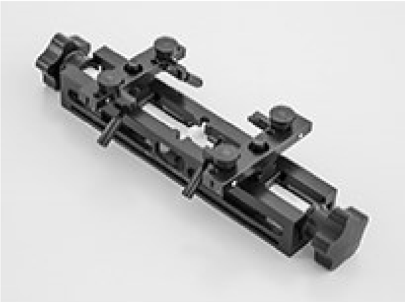
The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

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.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2}\cdot\delta\cdot\ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	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.	

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	835MHz System Validation Kit	D835V2	4d151	2019/3/27	2020/3/26
SPEAG	2450MHz System Validation Kit	D2450V2	908	2019/3/25	2020/3/24
SPEAG	2600MHz System Validation Kit	D2600V2	1061	2018/12/7	2019/12/6
SPEAG	Data Acquisition Electronics	DAE4	1210	2019/7/23	2020/7/22
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2019/5/27	2020/5/26
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1697	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio Communication Analyzer	MT8821C	6201432831	2019/4/17	2020/4/16
Agilent	Wireless Communication Test Set	E5515C	MY52102706	2019/4/17	2020/4/16
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	2019/4/17	2020/4/16
SPEAG	Dielectric Probe Kit	DAK-3.5	1071	2019/10/28	2020/10/27
Anritsu	Vector Signal Generator	MG3710A	6201682672	2019/1/14	2020/1/13
Rohde & Schwarz	Power Meter	NRVD	102081	2019/8/15	2020/8/14
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2019/8/14	2020/8/13
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2019/8/14	2020/8/13
Testo	Hygrometer	608-H1	1241332088	2019/1/11	2020/1/10
FLUKE	DIGITAC THERMOMETER	51II	97240029	2019/8/15	2020/8/14
ARRA	Power Divider	A3200-2	N/A	Note	
MCL	Attenuation1	BW-S10W5+	N/A	Note	
MCL	Attenuation2	BW-S10W5+	N/A	Note	
MCL	Attenuation3	BW-S10W5+	N/A	Note	
Agilent	Dual Directional Coupler	778D	20500	Note	
Agilent	Dual Directional Coupler	11691D	MY48151020	Note	
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note	

Note:
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.

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 head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. 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. 10.2.

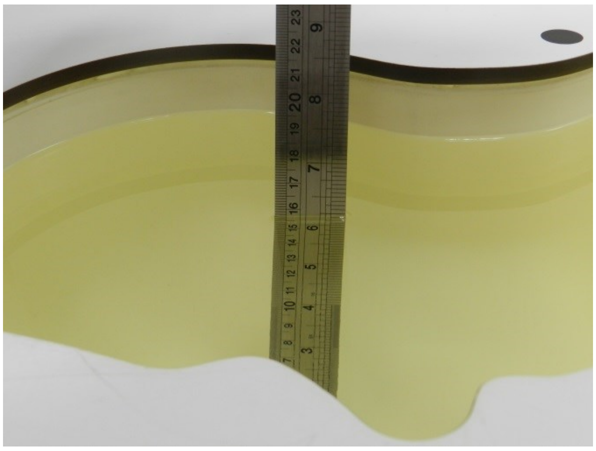


Fig 11.1.1Photo of Liquid Height for Head SAR

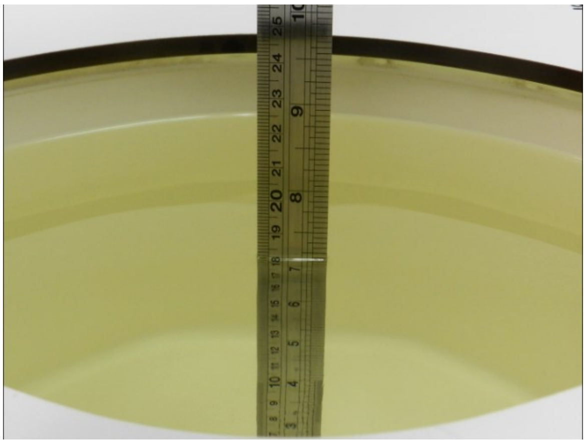


Fig 11.1.2 Photo of Liquid Height for Body SAR

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								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0

<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
835	Head	22.7	0.929	42.242	0.90	41.50	3.22	1.79	±5	2019/11/19
2450	Head	22.7	1.860	38.535	1.80	39.20	3.33	-1.70	±5	2019/11/20
2600	Head	22.8	2.032	37.935	1.96	39.00	3.67	-2.73	±5	2019/11/18

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.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2019/11/19	835	Head	250	4d151	3857	1210	2.43	9.30	9.72	4.52
2019/11/20	2450	Head	250	908	3857	1210	13.20	52.80	52.8	0.00
2019/11/18	2600	Head	250	1061	3857	1210	14.00	57.70	56	-2.95

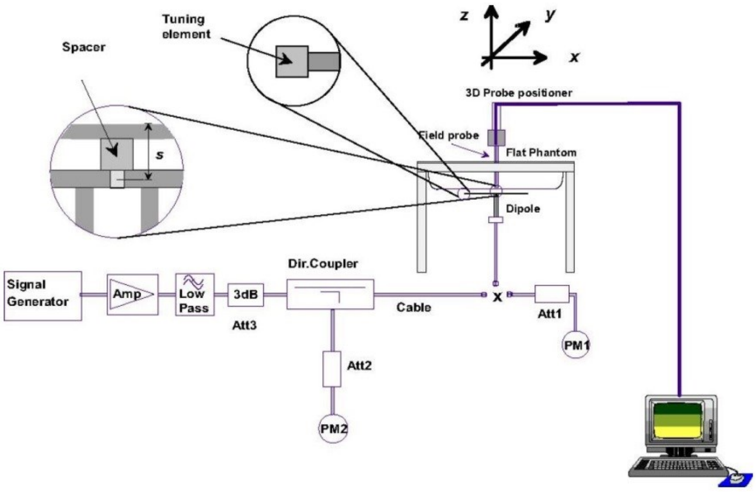


Fig 11.3.1 System Performance Check Setup

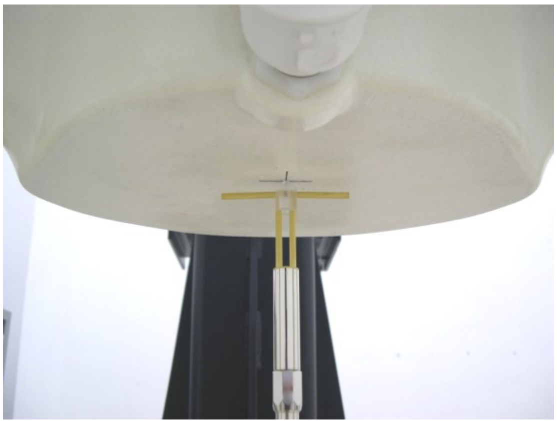


Fig 11.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 11.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 11.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 11.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 11.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

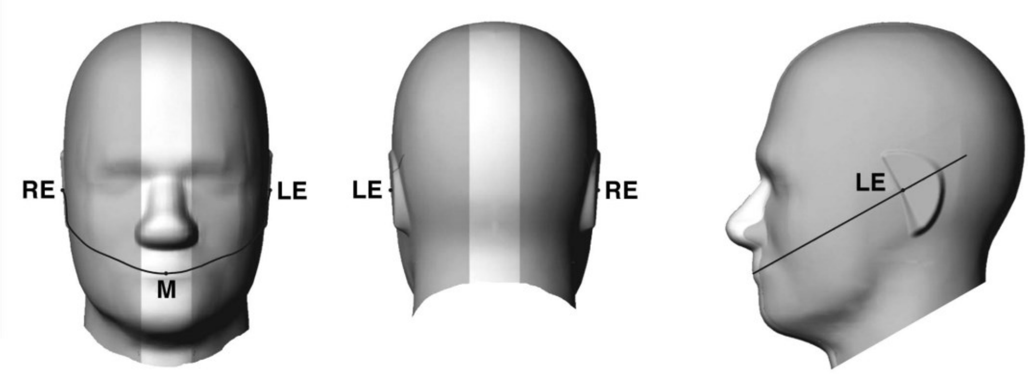


Fig 11.1.1 Front, back, and side views of SAM twin phantom

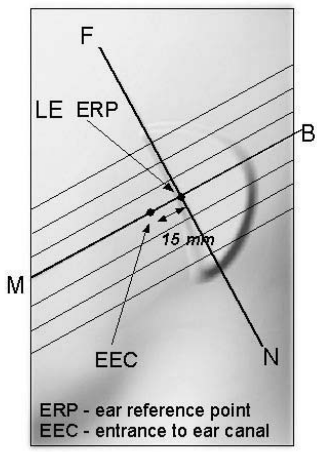


Fig 11.1.2 Close-up side view of phantom showing the ear region.

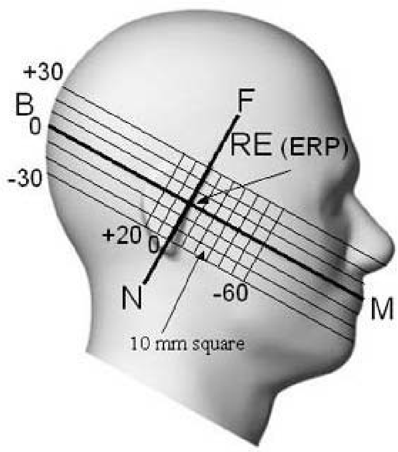


Fig 11.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 11.2.1 and Figure 11.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 11.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 11.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 11.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 11.2.3. The actual rotation angles should be documented in the test report.

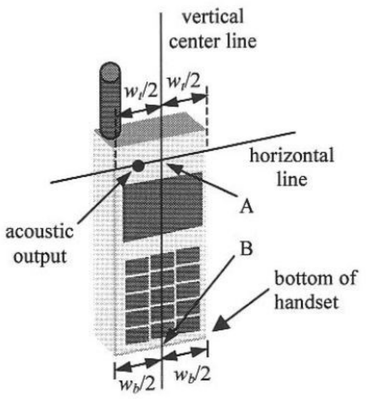


Fig 11.2.1 Handset vertical and horizontal reference lines—"fixed case

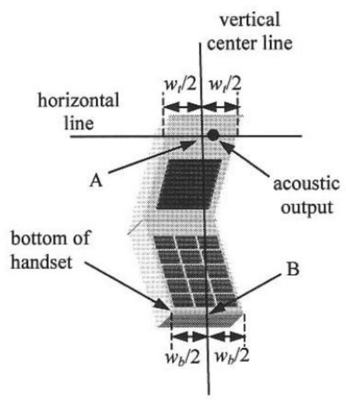


Fig 11.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

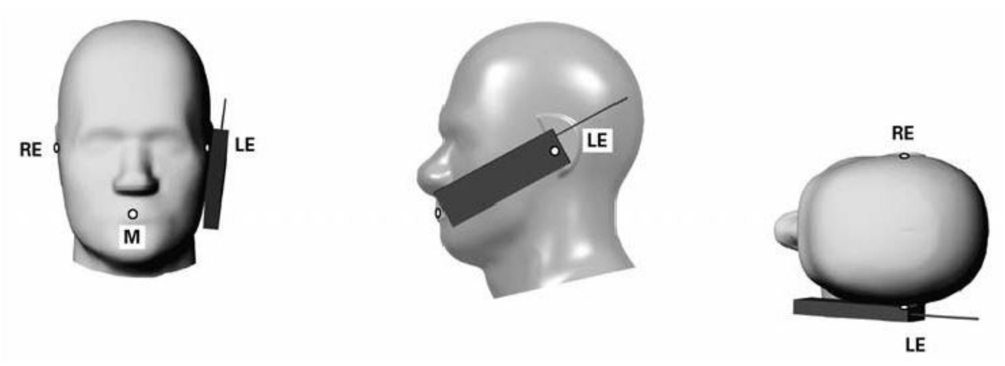


Fig 11.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 11.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

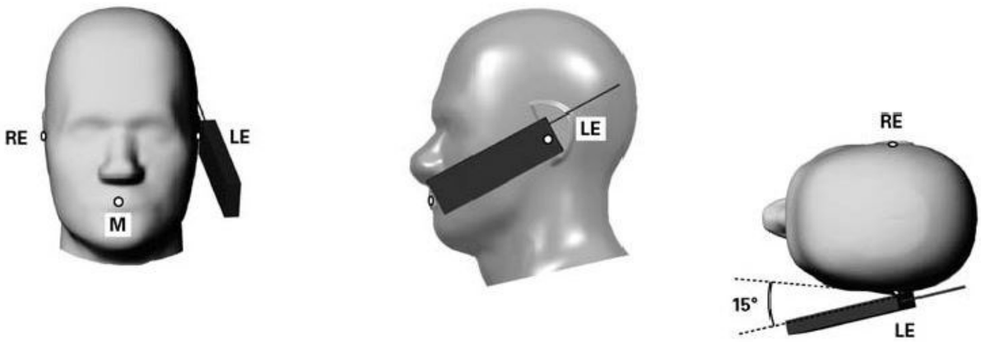


Fig 11.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 11.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

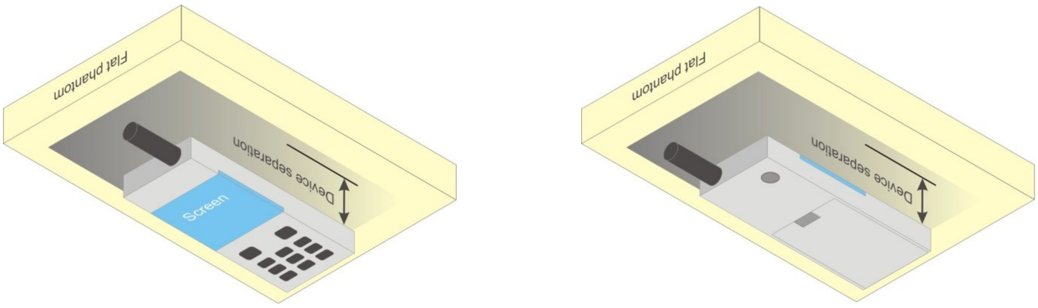


Fig 11.4 Body Worn Position

12. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS 4Tx slots for GSM850 are considered as the primary mode.
3. Other configurations of GSM / GPRS are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode, SAR measurement is not required for the secondary mode.

GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
Tx Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM 1 Tx slot	31.66	31.71	31.72	33.00	22.66	22.71	22.72	24.00
GPRS 1 Tx slot	31.65	31.70	31.71	33.00	22.65	22.70	22.71	24.00
GPRS 2 Tx slots	28.63	28.95	29.02	30.00	22.63	22.95	23.02	24.00
GPRS 3 Tx slots	27.23	27.32	27.58	28.50	22.97	23.06	23.32	24.24
GPRS 4 Tx slots	25.73	25.62	26.08	27.50	22.73	22.62	23.08	**24.50**

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

<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 B5 / B38 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.

<LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	23.33	22.95	22.90	24	0
10	QPSK	1	25	22.57	22.90	22.97		
10	QPSK	1	49	22.48	23.39	22.29		
10	QPSK	25	0	22.57	22.57	22.86	23.5	0.5
10	QPSK	25	12	22.34	22.78	22.71		
10	QPSK	25	25	22.43	23.20	22.84		
10	QPSK	50	0	21.70	22.01	21.84		
10	16QAM	1	0	22.65	22.19	22.31	23.5	0.5
10	16QAM	1	25	21.92	22.25	22.21		
10	16QAM	1	49	21.89	22.91	21.81		
10	16QAM	25	0	21.64	21.66	21.85	22.5	1.5
10	16QAM	25	12	21.41	21.77	21.74		
10	16QAM	25	25	21.49	21.91	21.88		
10	16QAM	50	0	20.78	21.02	20.98		
Channel				20425	20525	20625	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.78	22.46	22.64	24	0
5	QPSK	1	12	22.45	22.54	22.47		
5	QPSK	1	24	22.26	22.94	22.14		
5	QPSK	12	0	22.62	22.54	22.63	23.5	0.5
5	QPSK	12	7	22.45	22.58	22.47		
5	QPSK	12	13	22.43	22.82	22.65		
5	QPSK	25	0	21.60	21.69	21.60		
5	16QAM	1	0	22.12	21.76	22.14	23.5	0.5
5	16QAM	1	12	21.84	21.91	21.83		
5	16QAM	1	24	21.63	22.52	21.79		
5	16QAM	12	0	21.72	21.59	21.73	22.5	1.5
5	16QAM	12	7	21.53	21.64	21.56		
5	16QAM	12	13	21.51	21.89	21.75		
5	16QAM	25	0	20.67	20.76	20.68		

Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	23.12	22.75	22.67	24	0
3	QPSK	1	8	23.06	23.21	22.81		
3	QPSK	1	14	22.45	22.16	22.02		
3	QPSK	8	0	22.77	22.50	22.71	23.5	0.5
3	QPSK	8	4	22.83	22.62	22.46		
3	QPSK	8	7	22.83	23.18	22.72		
3	QPSK	15	0	21.74	21.75	21.57		
3	16QAM	1	0	22.43	22.15	22.08	23.5	0.5
3	16QAM	1	8	22.39	22.51	22.13		
3	16QAM	1	14	21.81	22.19	21.55		
3	16QAM	8	0	21.92	21.92	21.93	22.5	1.5
3	16QAM	8	4	21.95	21.91	21.66		
3	16QAM	8	7	21.97	21.98	21.95		
3	16QAM	15	0	20.84	20.84	20.67		
Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.82	22.63	22.27	24	0
1.4	QPSK	1	3	22.95	22.82	22.27		
1.4	QPSK	1	5	22.69	22.58	22.06		
1.4	QPSK	3	0	22.86	22.56	22.26		
1.4	QPSK	3	1	22.83	22.68	22.31		
1.4	QPSK	3	3	22.81	22.70	22.23		
1.4	QPSK	6	0	21.82	21.58	21.56	23.5	0.5
1.4	16QAM	1	0	22.16	21.91	21.59	23.5	0.5
1.4	16QAM	1	3	22.29	22.16	21.62		
1.4	16QAM	1	5	22.03	21.89	21.59		
1.4	16QAM	3	0	21.95	21.59	21.56		
1.4	16QAM	3	1	21.92	21.72	21.52		
1.4	16QAM	3	3	21.91	21.77	21.55		
1.4	16QAM	6	0	20.95	20.70	20.52	22.5	1.5

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	23.46	23.27	23.25	24	0
20	QPSK	1	49	23.20	23.12	23.26		
20	QPSK	1	99	23.00	23.03	23.05		
20	QPSK	50	0	23.10	23.04	23.00	23.5	0.5
20	QPSK	50	24	23.11	23.08	23.02		
20	QPSK	50	50	23.44	23.35	23.40		
20	QPSK	100	0	22.20	22.03	22.01		
20	16QAM	1	0	22.62	22.54	22.54	23.5	0.5
20	16QAM	1	49	22.47	22.49	22.55		
20	16QAM	1	99	22.68	22.18	22.48		
20	16QAM	50	0	22.46	22.24	22.30	22.5	1.5
20	16QAM	50	24	22.20	22.22	22.25		
20	16QAM	50	50	22.24	22.42	22.49		
20	16QAM	54	0	21.11	21.30	21.50		
Channel				20825	21100	21375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	22.78	23.01	22.96	24	0
15	QPSK	1	37	22.93	22.92	23.07		
15	QPSK	1	74	23.04	23.04	23.22		
15	QPSK	36	0	23.09	23.02	22.99	23.5	0.5
15	QPSK	36	20	23.08	23.05	23.10		
15	QPSK	36	39	23.19	23.28	23.33		
15	QPSK	75	0	22.19	22.08	22.19		
15	16QAM	1	0	22.02	22.24	22.21	23.5	0.5
15	16QAM	1	37	22.21	22.22	22.36		
15	16QAM	1	74	22.34	22.40	22.51		
15	16QAM	36	0	22.14	22.09	22.06	22.5	1.5
15	16QAM	36	20	22.13	22.13	22.27		
15	16QAM	36	39	22.29	22.40	22.46		
15	16QAM	54	0	21.30	21.25	21.36		

Channel				20800	21100	21400	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	22.86	23.04	22.98	24	0
10	QPSK	1	25	22.77	22.98	22.99		
10	QPSK	1	49	22.92	23.06	23.05		
10	QPSK	25	0	22.84	22.92	22.82	23.5	0.5
10	QPSK	25	12	22.81	22.95	22.97		
10	QPSK	25	25	22.95	23.17	23.19		
10	QPSK	50	0	21.87	22.06	22.13		
10	16QAM	1	0	22.15	22.36	22.35	23.5	0.5
10	16QAM	1	25	22.10	22.33	22.35		
10	16QAM	1	49	22.30	22.47	22.48		
10	16QAM	25	0	21.83	22.00	21.90	22.5	1.5
10	16QAM	25	12	21.79	22.02	22.09		
10	16QAM	25	25	22.03	22.27	22.24		
10	16QAM	50	0	20.93	21.16	21.24		
Channel				20775	21100	21425	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	22.59	22.82	22.88	24	0
5	QPSK	1	12	22.61	22.71	22.64		
5	QPSK	1	24	22.71	22.81	22.84		
5	QPSK	12	0	22.68	22.76	22.86	23.5	0.5
5	QPSK	12	7	22.75	22.86	22.76		
5	QPSK	12	13	22.71	22.80	23.12		
5	QPSK	25	0	21.83	21.87	21.85		
5	16QAM	1	0	21.91	22.11	22.14	23.5	0.5
5	16QAM	1	12	21.94	22.06	21.95		
5	16QAM	1	24	22.06	22.15	22.19		
5	16QAM	12	0	21.73	21.81	21.96	22.5	1.5
5	16QAM	12	7	22.14	21.91	21.87		
5	16QAM	12	13	21.87	21.85	22.17		
5	16QAM	25	0	20.89	20.91	20.94		

<TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

SAR was tested with a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by 3GPP.

a. 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations
b. “special subframe S” contains both uplink and downlink transmissions, it has been taken into consideration to determine the transmission duty factor according to the worst case uplink and downlink cyclic prefix requirements for UpPTS
c. Establishing connections with base station simulators ensure a consistent means for testing SAR and recommended for evaluating SAR. The Anritsu MT8820C (firmware: #22.52#004) was used for LTE output power measurements and SAR testing.

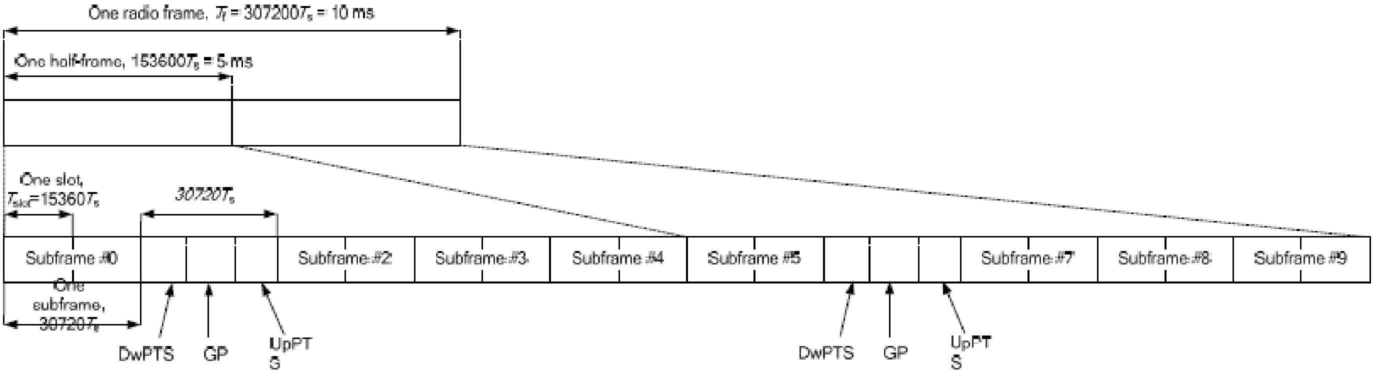


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

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

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

<table>
<tr><th rowspan="3">Special subframe configuration</th><th colspan="3">Normal cyclic prefix in downlink</th><th colspan="3">Extended cyclic prefix in downlink</th></tr>
<tr><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th><th rowspan="2">DwPTS</th><th colspan="2">UpPTS</th></tr>
<tr><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th><th>Normal cyclic prefix in uplink</th><th>Extended cyclic prefix in uplink</th></tr>
<tr><td>0</td><td>$6592 \cdot T_s$</td><td rowspan="5">$2192 \cdot T_s$</td><td rowspan="5">$2560 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="4">$2192 \cdot T_s$</td><td rowspan="4">$2560 \cdot T_s$</td></tr>
<tr><td>1</td><td>$19760 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>2</td><td>$21952 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>3</td><td>$24144 \cdot T_s$</td><td>$25600 \cdot T_s$</td></tr>
<tr><td>4</td><td>$26336 \cdot T_s$</td><td>$7680 \cdot T_s$</td><td rowspan="4">$4384 \cdot T_s$</td><td rowspan="4">$5120 \cdot T_s$</td></tr>
<tr><td>5</td><td>$6592 \cdot T_s$</td><td rowspan="5">$4384 \cdot T_s$</td><td rowspan="5">$5120 \cdot T_s$</td><td>$20480 \cdot T_s$</td></tr>
<tr><td>6</td><td>$19760 \cdot T_s$</td><td>$23040 \cdot T_s$</td></tr>
<tr><td>7</td><td>$21952 \cdot T_s$</td><td>$12800 \cdot T_s$</td></tr>
<tr><td>8</td><td>$24144 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>9</td><td>$13168 \cdot T_s$</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Special subframe (30720·T_s): Normal cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
Uplink duty factor in one special subframe	**0~4**	7.13%	8.33%
	5~9	14.3%	16.7%

Special subframe(30720·T_s): Extended cyclic prefix in downlink (UpPTS)			
	Special subframe configuration	**Normal cyclic prefix in uplink**	**Extended cyclic prefix in uplink**
Uplink duty factor in one special subframe	**0~3**	7.13%	8.33%
	4~7	14.3%	16.7%

The highest duty factor is resulted from:

i. Uplink-downlink configuration: 0. In a half-frame consisted of 5 subfames, uplink operation is in 3 uplink subframes and 1 special subframe.

ii. special subframe configuration: 5-9 for normal cyclic prefix in downlink, 4-7 for extended cyclic prefix in downlink

iii. for special subframe with extended cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.167)/5 = 63.3%

iv. for special subframe with normal cyclic prefix in uplink, the total uplink duty factor in one half-frame is: (3+0.143)/5 = 62.9%

v. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The scaled TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.

<LTE Band 38>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				37850	38000	38150		
Frequency (MHz)				2580	2595	2610		
20	QPSK	1	0	23.82	23.61	23.52	24	0
20	QPSK	1	49	23.52	23.32	23.35		
20	QPSK	1	99	23.76	23.75	23.69		
20	QPSK	50	0	23.27	23.20	22.98	23.5	0.5
20	QPSK	50	24	23.25	23.15	23.05		
20	QPSK	50	50	23.47	23.46	23.40		
20	QPSK	100	0	22.24	22.10	22.11		
20	16QAM	1	0	22.91	22.72	22.65	23.5	0.5
20	16QAM	1	49	22.63	22.44	22.50		
20	16QAM	1	99	22.88	22.93	22.88		
20	16QAM	50	0	22.33	22.18	22.02	22.5	1.5
20	16QAM	50	24	22.32	22.14	22.07		
20	16QAM	50	50	22.50	22.49	22.45		
20	16QAM	54	0	21.50	21.41	21.62		
Channel				37825	38000	38175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2577.5	2595	2612.5		
15	QPSK	1	0	23.44	23.26	23.26	24	0
15	QPSK	1	37	23.26	23.19	23.24		
15	QPSK	1	74	23.35	23.25	23.43		
15	QPSK	36	0	23.14	23.16	23.25	23.5	0.5
15	QPSK	36	20	23.17	23.17	23.19		
15	QPSK	36	39	23.12	23.08	23.31		
15	QPSK	75	0	22.41	22.31	22.36		
15	16QAM	1	0	22.52	22.44	22.34	23.5	0.5
15	16QAM	1	37	22.37	22.30	22.34		
15	16QAM	1	74	22.46	22.39	22.51		
15	16QAM	36	0	22.12	22.19	22.14	22.5	1.5
15	16QAM	36	20	22.15	22.22	22.11		
15	16QAM	36	39	22.15	22.14	22.47		
15	16QAM	54	0	21.30	21.22	21.37		

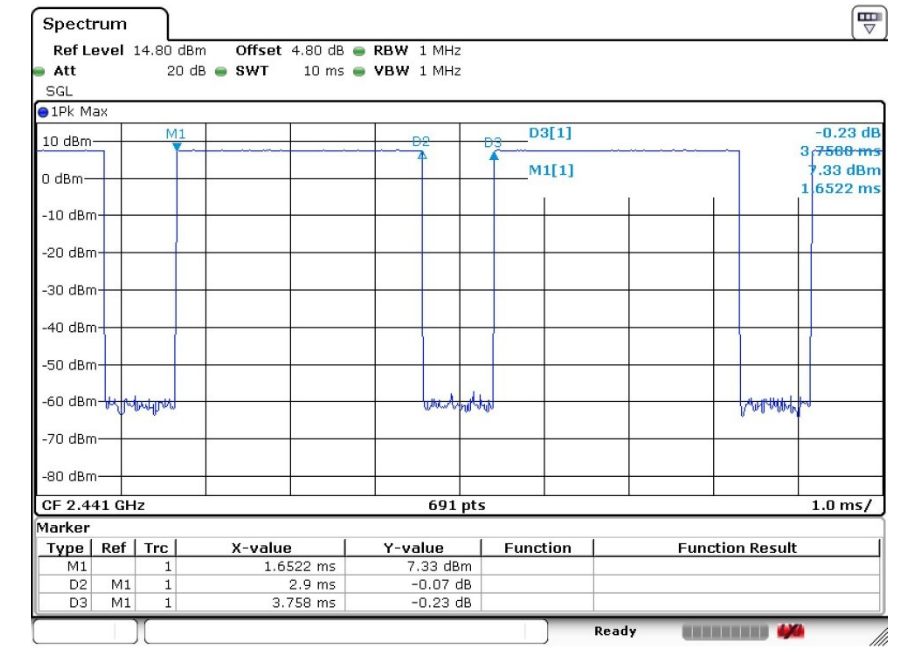
Channel				37800	38000	38200	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2575	2595	2615		
10	QPSK	1	0	23.63	23.49	23.43	24	0
10	QPSK	1	25	23.33	23.25	23.29		
10	QPSK	1	49	23.42	23.43	23.50		
10	QPSK	25	0	23.21	23.19	23.22	23.5	0.5
10	QPSK	25	12	23.18	23.17	23.16		
10	QPSK	25	25	23.23	23.10	23.14		
10	QPSK	50	0	22.37	22.20	22.30		
10	16QAM	1	0	22.64	22.60	22.54	23.5	0.5
10	16QAM	1	25	22.43	22.41	22.37		
10	16QAM	1	49	22.53	22.61	22.58		
10	16QAM	25	0	22.23	22.29	22.19	22.5	1.5
10	16QAM	25	12	22.22	22.27	22.15		
10	16QAM	25	25	22.29	22.21	22.14		
10	16QAM	50	0	21.41	21.34	21.32		
Channel				37775	38000	38225	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2572.5	2595	2617.5		
5	QPSK	1	0	23.49	23.17	23.33	24	0
5	QPSK	1	12	23.23	23.00	23.23		
5	QPSK	1	24	23.36	23.00	23.44		
5	QPSK	12	0	23.25	23.34	23.27	23.5	0.5
5	QPSK	12	7	23.36	23.25	23.21		
5	QPSK	12	13	23.39	23.15	23.33		
5	QPSK	25	0	22.35	22.18	22.27		
5	16QAM	1	0	22.51	22.29	22.45	23.5	0.5
5	16QAM	1	12	22.34	22.10	22.24		
5	16QAM	1	24	22.50	22.45	22.50		
5	16QAM	12	0	22.24	22.25	22.26	22.5	1.5
5	16QAM	12	7	22.35	22.22	22.23		
5	16QAM	12	13	22.37	22.11	22.38		
5	16QAM	25	0	21.39	21.25	21.39		

<2.4GHz Bluetooth>

General Note:

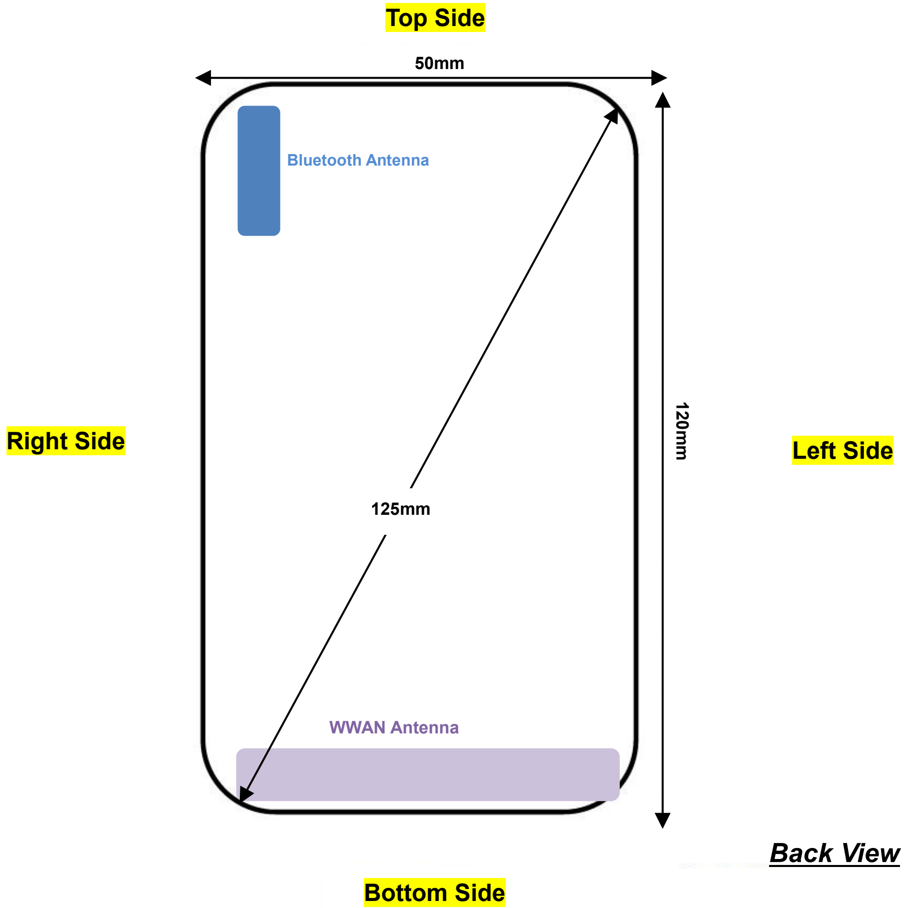
1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 77.17 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation

Bluetooth time-domain plot



Mode	Channel	Frequency (MHz)	Data Rate
			1Mbps
BR/EDR	CH 00	2402	7.36
	CH 39	2441	8.08
	CH 78	2480	6.06
Tune-up Limit			9.00

13. Antenna Location



14. 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 WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   c. For 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* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

GSM Note:

1. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS (4Tx slots) for GSM850 are considered as the primary mode.
2. Other configurations of GSM / GPRS are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode, SAR measurement is not required for the secondary mode.

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 B5 / B38 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.

14.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS 4 Tx slots	Right Cheek	251	848.8	26.08	27.50	1.387	0.01	0.891	1.236
	GSM850	GPRS 4 Tx slots	Right Cheek	128	824.2	25.73	27.50	1.503	0.03	0.918	1.380
	GSM850	GPRS 4 Tx slots	Right Cheek	189	836.4	25.62	27.50	1.542	0.01	0.869	1.340
	GSM850	GPRS 4 Tx slots	Right Tilted	251	824.2	26.08	27.50	1.387	-0.03	0.576	0.799
	GSM850	GPRS 4 Tx slots	Left Cheek	251	824.2	26.08	27.50	1.387	0.01	0.927	1.286
01	GSM850	GPRS 4 Tx slots	Left Cheek	128	824.2	25.73	27.50	1.503	0.07	0.947	1.423
	GSM850	GPRS 4 Tx slots	Left Cheek	189	836.4	25.62	27.50	1.542	0.06	0.889	1.371
	GSM850	GPRS 4 Tx slots	Left Tilted	251	824.2	26.08	27.50	1.387	0.04	0.620	0.860
	GSM850	GPRS 4 Tx slots	Left Tilted	128	824.2	25.73	27.50	1.503	-0.03	0.590	0.887
	GSM850	GPRS 4 Tx slots	Left Tilted	189	836.4	25.62	27.50	1.542	0.08	0.572	0.882

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1	49	Right Cheek	20525	836.5	23.39	24.00	1.151	0.01	1.030	1.185
	LTE Band 5	10M	QPSK	25	25	Right Cheek	20525	836.5	23.20	23.50	1.072	0.03	0.833	0.893
	LTE Band 5	10M	QPSK	50	0	Right Cheek	20525	836.5	22.01	23.50	1.409	0.04	0.588	0.829
	LTE Band 5	10M	QPSK	1	49	Right Tilted	20525	836.5	23.39	24.00	1.151	0.03	0.772	0.888
	LTE Band 5	10M	QPSK	25	25	Right Tilted	20525	836.5	23.20	23.50	1.072	0.06	0.666	0.714
	LTE Band 5	10M	QPSK	50	0	Right Tilted	20525	836.5	22.01	23.50	1.409	0.03	0.449	0.633
02	LTE Band 5	10M	QPSK	1	49	Left Cheek	20525	836.5	23.39	24.00	1.151	-0.18	1.190	1.369
	LTE Band 5	10M	QPSK	25	25	Left Cheek	20525	836.5	23.20	23.50	1.072	0.03	0.959	1.028
	LTE Band 5	10M	QPSK	50	0	Left Cheek	20525	836.5	22.01	23.50	1.409	-0.03	0.681	0.960
	LTE Band 5	10M	QPSK	1	49	Left Tilted	20525	836.5	23.39	24.00	1.151	0.01	0.740	0.852
	LTE Band 5	10M	QPSK	25	25	Left Tilted	20525	836.5	23.20	23.50	1.072	0.03	0.592	0.634
	LTE Band 5	10M	QPSK	50	0	Left Tilted	20525	836.5	22.01	23.50	1.409	-0.02	0.456	0.643
	LTE Band 7	20M	QPSK	1	0	Right Cheek	20850	2510	23.46	24.00	1.132	0.01	0.999	1.131
	LTE Band 7	20M	QPSK	1	0	Right Cheek	21100	2535	23.27	24.00	1.183	-0.02	0.890	1.053
	LTE Band 7	20M	QPSK	1	0	Right Cheek	21350	2560	23.25	24.00	1.189	0.03	0.685	0.814
	LTE Band 7	20M	QPSK	50	50	Right Cheek	20850	2510	23.44	23.50	1.014	0.09	0.872	0.884
	LTE Band 7	20M	QPSK	50	50	Right Cheek	21100	2535	23.35	23.50	1.035	0.04	0.810	0.838
	LTE Band 7	20M	QPSK	50	50	Right Cheek	21350	2560	23.40	23.50	1.023	0.01	0.721	0.738
	LTE Band 7	20M	QPSK	100	0	Right Cheek	20850	2510	22.20	23.50	1.349	0.03	0.847	1.143
	LTE Band 7	20M	QPSK	1	0	Right Tilted	20850	2510	23.46	24.00	1.132	0.01	0.608	0.688
	LTE Band 7	20M	QPSK	50	50	Right Tilted	20850	2510	23.44	23.50	1.014	0.02	0.603	0.611
	LTE Band 7	20M	QPSK	1	0	Left Cheek	20850	2510	23.46	24.00	1.132	0.01	1.110	1.257
03	LTE Band 7	20M	QPSK	1	0	Left Cheek	21100	2535	23.27	24.00	1.183	0.03	1.120	1.325
	LTE Band 7	20M	QPSK	1	0	Left Cheek	21350	2560	23.25	24.00	1.189	0.03	0.868	1.032
	LTE Band 7	20M	QPSK	50	50	Left Cheek	20850	2510	23.44	23.50	1.014	-0.03	0.949	0.962
	LTE Band 7	20M	QPSK	50	50	Left Cheek	21100	2535	23.35	23.50	1.035	0.03	0.898	0.930
	LTE Band 7	20M	QPSK	50	50	Left Cheek	21350	2560	23.40	23.50	1.023	0.09	0.980	1.003
	LTE Band 7	20M	QPSK	100	0	Left Cheek	20850	2510	22.20	23.50	1.349	0.03	0.820	1.106
	LTE Band 7	20M	QPSK	1	0	Left Tilted	20850	2510	23.46	24.00	1.132	0.06	0.463	0.524
	LTE Band 7	20M	QPSK	50	50	Left Tilted	20850	2510	23.44	23.50	1.014	0.04	0.467	0.473

<TDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 38	20M	QPSK	1	0	Right Cheek	38000	2595	23.61	24.00	1.094	62.9	1.006	0.1	0.467	0.514
	LTE Band 38	20M	QPSK	50	50	Right Cheek	38000	2595	23.46	23.50	1.009	62.9	1.006	0.03	0.410	0.416
	LTE Band 38	20M	QPSK	1	0	Right Tilted	38000	2595	23.61	24.00	1.094	62.9	1.006	0.01	0.323	0.355
	LTE Band 38	20M	QPSK	50	50	Right Tilted	38000	2595	23.46	23.50	1.009	62.9	1.006	0.03	0.271	0.275
04	LTE Band 38	20M	QPSK	1	0	Left Cheek	38000	2595	23.61	24.00	1.094	62.9	1.006	-0.07	0.553	**0.609**
	LTE Band 38	20M	QPSK	50	50	Left Cheek	38000	2595	23.46	23.50	1.009	62.9	1.006	0.01	0.396	0.402
	LTE Band 38	20M	QPSK	1	0	Left Tilted	38000	2595	23.61	24.00	1.094	62.9	1.006	0.03	0.252	0.277
	LTE Band 38	20M	QPSK	50	50	Left Tilted	38000	2595	23.46	23.50	1.009	62.9	1.006	0.06	0.208	0.211

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps	Right Cheek	39	2441	8.08	9.00	1.236	77.17	1.079	-0.02	0.070	0.093
	Bluetooth	1Mbps	Right Tilted	39	2441	8.08	9.00	1.236	77.17	1.079	0.02	0.027	0.036
05	Bluetooth	1Mbps	Left Cheek	39	2441	8.08	9.00	1.236	77.17	1.079	-0.03	0.128	**0.171**
	Bluetooth	1Mbps	Left Tilted	39	2441	8.08	9.00	1.236	77.17	1.079	-0.04	0.028	0.037

14.2 Body Worn Accessory SAR

<GSM 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 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS 4 Tx slots	Front	15	251	848.8	26.08	27.50	1.387	0.03	0.649	0.900
	GSM850	GPRS 4 Tx slots	Front	15	128	824.2	25.73	27.50	1.503	0.03	0.636	0.956
	GSM850	GPRS 4 Tx slots	Front	15	189	836.4	25.62	27.50	1.542	0.04	0.605	0.933
	GSM850	GPRS 4 Tx slots	Back	15	251	824.2	26.08	27.50	1.387	-0.08	0.654	0.907
	GSM850	GPRS 4 Tx slots	Back	15	128	824.2	25.73	27.50	1.503	-0.02	0.671	1.009
06	GSM850	GPRS 4 Tx slots	Back	15	189	836.4	25.62	27.50	1.542	-0.08	0.666	1.027

<FDD 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 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1	49	Front	15	20525	836.5	23.39	24.00	1.151	0.03	0.901	1.037
	LTE Band 5	10M	QPSK	25	25	Front	15	20525	836.5	23.20	23.50	1.072	0.03	0.711	0.762
	LTE Band 5	10M	QPSK	50	0	Front	15	20525	836.5	22.01	23.50	1.409	-0.07	0.516	0.727
07	LTE Band 5	10M	QPSK	1	49	Back	15	20525	836.5	23.39	24.00	1.151	-0.1	0.985	1.134
	LTE Band 5	10M	QPSK	25	25	Back	15	20525	836.5	23.20	23.50	1.072	0.03	0.828	0.887
	LTE Band 5	10M	QPSK	50	0	Back	15	20525	836.5	22.01	23.50	1.409	-0.03	0.582	0.820
	LTE Band 7	20M	QPSK	1	0	Front	15	20850	2510	23.46	24.00	1.132	-0.08	0.343	0.388
	LTE Band 7	20M	QPSK	50	50	Front	15	20850	2510	23.44	23.50	1.014	0.02	0.350	0.355
08	LTE Band 7	20M	QPSK	1	0	Back	15	20850	2510	23.46	24.00	1.132	-0.02	0.405	0.459
	LTE Band 7	20M	QPSK	50	50	Back	15	20850	2510	23.44	23.50	1.014	0.02	0.389	0.394

<TDD 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	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 38	20M	QPSK	1	0	Front	15	38000	2595	23.61	24.00	1.094	62.9	1.006	0.01	0.181	0.199
	LTE Band 38	20M	QPSK	50	50	Front	15	38000	2595	23.46	23.50	1.009	62.9	1.006	0.03	0.146	0.148
09	LTE Band 38	20M	QPSK	1	0	Back	15	38000	2595	23.61	24.00	1.094	62.9	1.006	-0.1	0.276	0.304
	LTE Band 38	20M	QPSK	50	50	Back	15	38000	2595	23.46	23.50	1.009	62.9	1.006	-0.01	0.236	0.240

<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 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps	Front	15	39	2441	8.08	9.00	1.236	77.17	1.079	0.03	0.008	0.011
10	Bluetooth	1Mbps	Back	15	39	2441	8.08	9.00	1.236	77.17	1.079	-0.07	0.010	0.014

14.3 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	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 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 5	10M	QPSK	1	49	-	Left Cheek	0	20525	836.5	23.39	24.00	1.151		1.000	-0.18	1.190	1	1.369
2nd	LTE Band 5	10M	QPSK	1	49	-	Left Cheek	0	20525	836.5	23.39	24.00	1.151		1.000	0.03	1.170	1.017	1.346
1st	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0	21100	2535	23.27	24.00	1.183		1.000	0.03	1.120	1	1.325
2nd	LTE Band 7	20M	QPSK	1	0	-	Left Cheek	0	21100	2535	23.27	24.00	1.183		1.000	-0.02	1.110	1.009	1.313

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

15. Simultaneous Transmission Analysis

No.	Simultaneous Transmission Configurations	Portable Handset	
		Head	Body-worn
1.	GSM Voice + Bluetooth	Yes	Yes
2.	GPRS + Bluetooth	Yes	Yes
3.	LTE + Bluetooth	Yes	Yes

General Note:

1. This device supports VoIP in GPRS and LTE (e.g. for 3rd-party VoIP), and LTE supports VoLTE function.
2. EUT will choose each GSM and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. All licensed modes share the same antenna part and cannot transmit simultaneously.
4. The reported SAR summation is calculated based on the same configuration and test position
5. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

15.1 Head Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2
			WWAN	Bluetooth	Summed 1g SAR (W/kg)
			1g SAR (W/kg)	1g SAR (W/kg)	
GSM	GSM850	Right Cheek	1.380	0.093	1.47
		Right Tilted	0.799	0.036	0.84
		Left Cheek	1.423	0.171	**1.59**
		Left Tilted	0.887	0.037	0.92
LTE	Band 5	Right Cheek	1.185	0.093	1.28
		Right Tilted	0.888	0.036	0.92
		Left Cheek	1.369	0.171	1.54
		Left Tilted	0.852	0.037	0.89
	Band 7	Right Cheek	1.143	0.093	1.24
		Right Tilted	0.688	0.036	0.72
		Left Cheek	1.325	0.171	1.50
		Left Tilted	0.524	0.037	0.56
	Band 38	Right Cheek	0.514	0.093	0.61
		Right Tilted	0.355	0.036	0.39
		Left Cheek	0.609	0.171	0.78
		Left Tilted	0.277	0.037	0.31

15.2 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2
			WWAN	Bluetooth	Summed 1g SAR (W/kg)
			1g SAR (W/kg)	1g SAR (W/kg)	
GSM	GSM850	Front	0.956	0.011	0.97
		Back	1.027	0.014	1.04
LTE	Band 5	Front	1.037	0.011	1.05
		Back	1.134	0.014	1.15
	Band 7	Front	0.388	0.011	0.40
		Back	0.459	0.014	0.47
	Band 38	Front	0.199	0.011	0.21
		Back	0.304	0.014	0.32

Test Engineer： Nick Hu, Yuan Zhao, Jiaxing Chang, Yuankai Kong

16. 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. Therefore, the measurement uncertainty table is not required in this report.

17. 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 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

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

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

[8] FCC KDB 648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 2015.

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

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

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2019.11.19

System Check_Head_850MHz

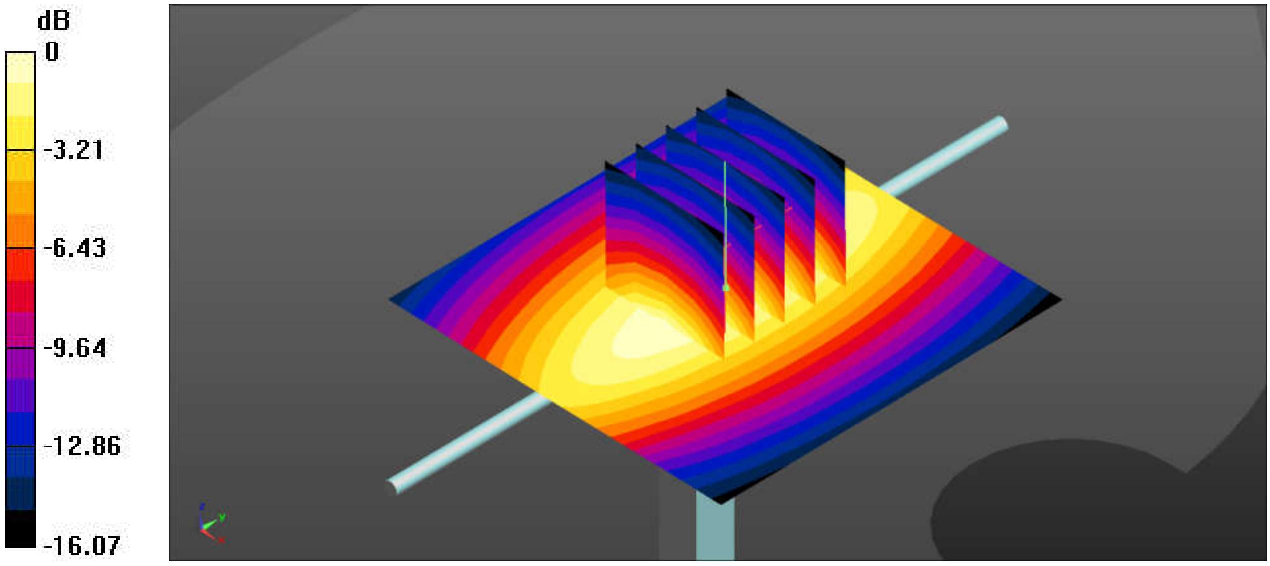
DUT: D835V2 - SN:4d151

Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_850 Medium parameters used: f = 835 MHz; σ = 0.929 S/m; ε_r = 42.242; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(9.48, 9.48, 9.48); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 4.03 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 67.31 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 4.57 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 4.06 W/kg



0 dB = 4.03 W/kg = 6.05 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2019.11.20

System Check_Head_2450MHz

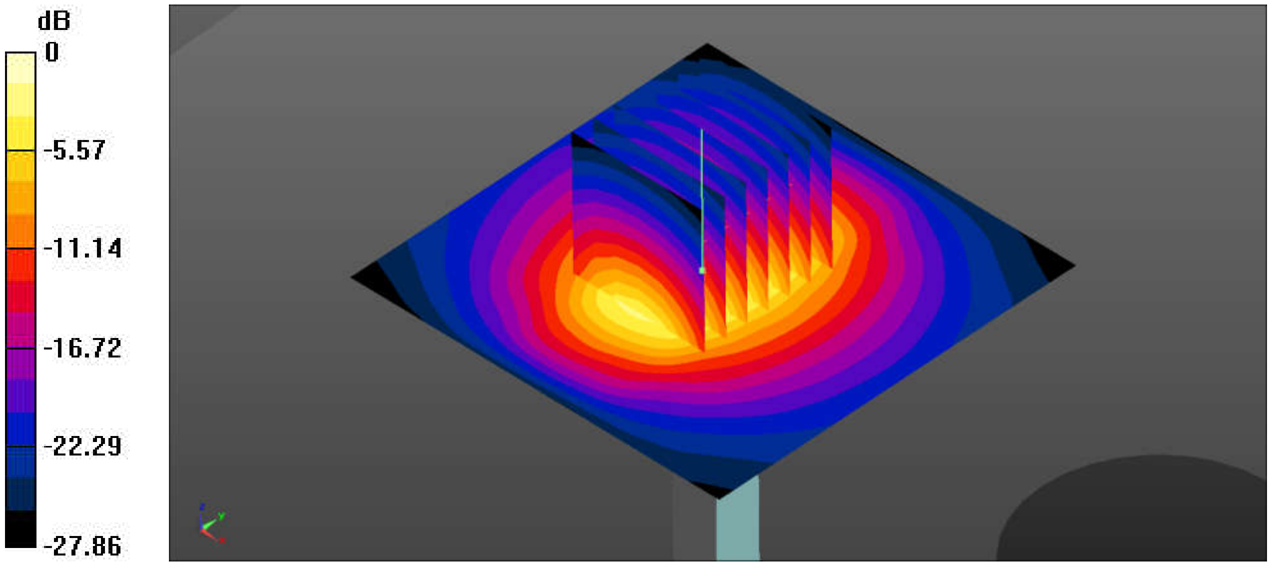
DUT: D2450V2 - SN:908

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450 Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38.535; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.5, 7.5, 7.5); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Pin=250mW/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 18.5 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.88 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.25 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2019.11.18

System Check_Head_2600MHz

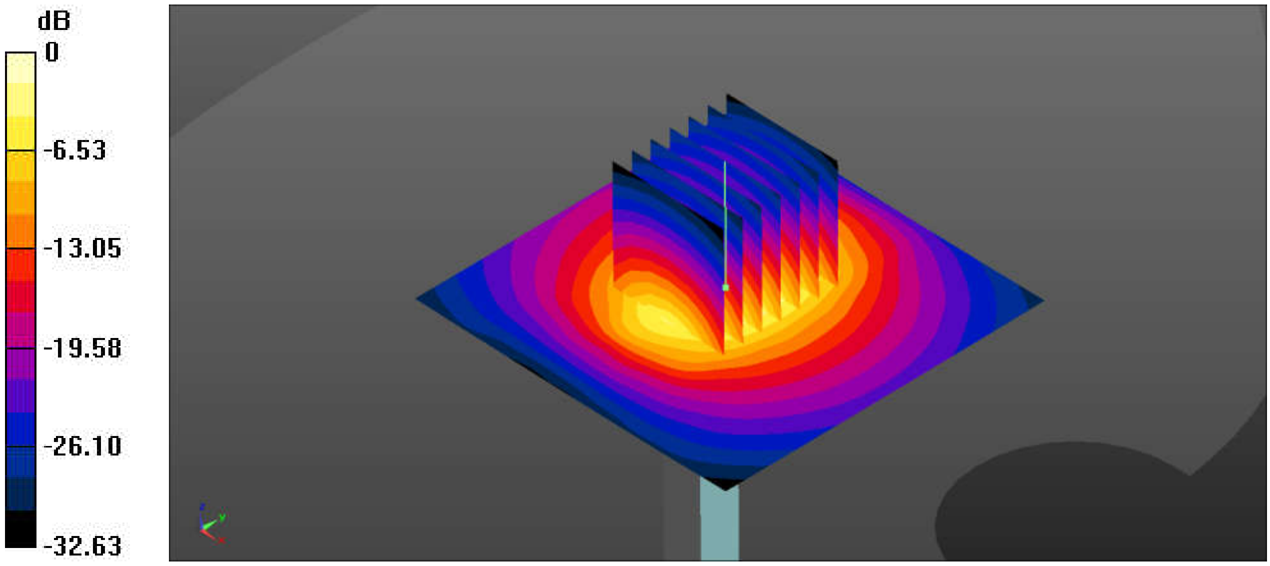
DUT: D2600V2 - SN:1061

Communication System: UID 0, CW (0); Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: HSL_2600 Medium parameters used: f = 2600 MHz; σ = 2.032 S/m; ε_r = 37.935; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.31, 7.31, 7.31); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Pin=250mW/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 22.9 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.30 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.32 W/kg
Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.9 W/kg = 13.60 dBW/kg

Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

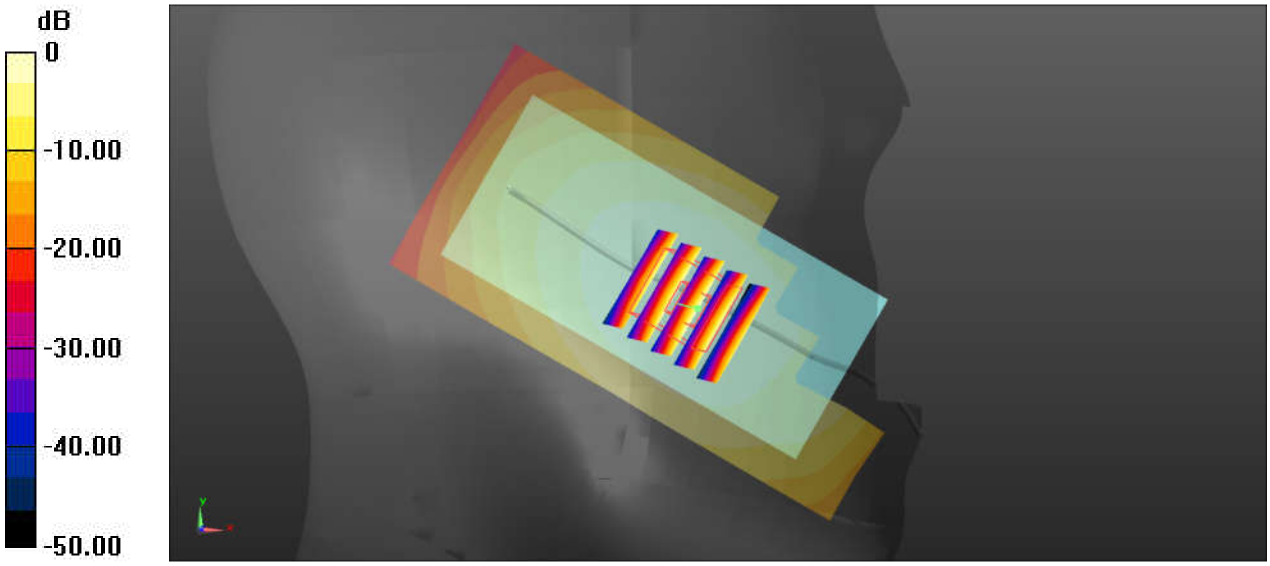
01_GSM850_GPRS 4 Tx slots_Left Cheek_0mm_Ch128

Communication System: UID 0, GSM850 (0); Frequency: 824.2 MHz;Duty Cycle: 1:2.08
Medium: HSL_850 Medium parameters used: f = 824.2 MHz; σ = 0.918 S/m; ε_r = 42.362; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(9.48, 9.48, 9.48); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch128/Area Scan (51x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.03 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.947 W/kg; SAR(10 g) = 0.684 W/kg
Maximum value of SAR (measured) = 1.15 W/kg



0 dB = 1.13 W/kg = 0.53 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2019.11.19

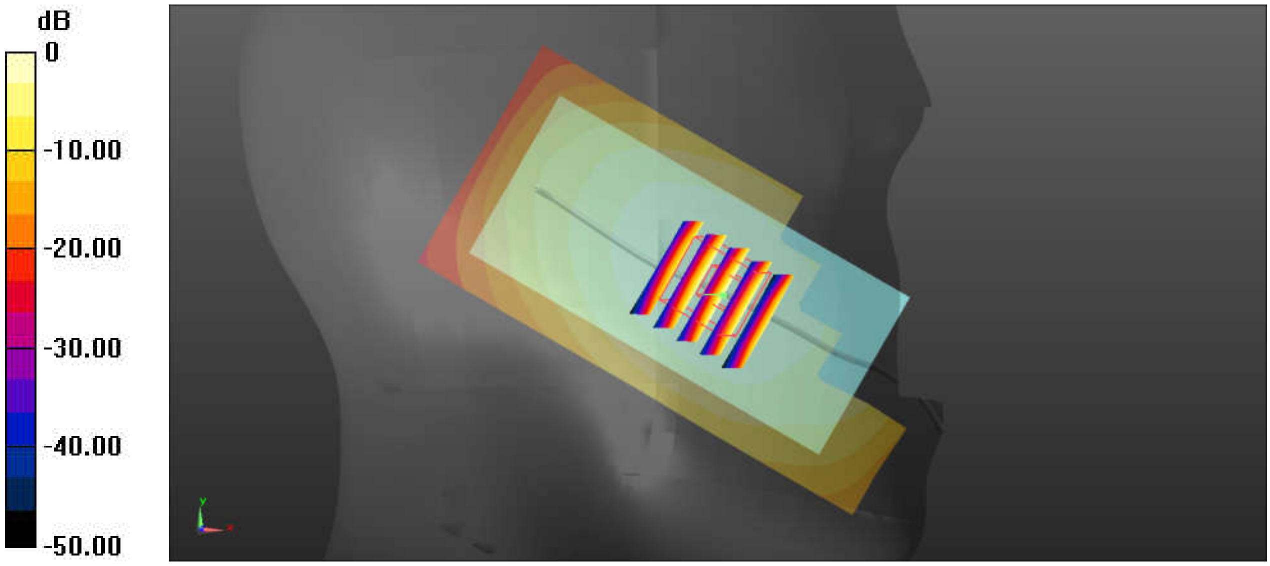
02_LTE Band 5_10M_QPSK_1RB_49offset_Left Cheek_0mm_Ch20525

Communication System: UID 0, LTE-FDD (0); Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: HSL_850 Medium parameters used: f = 836.5 MHz; σ = 0.931 S/m; ε_r = 42.228; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(9.48, 9.48, 9.48); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch20525/Area Scan (51x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.40 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.03 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 1.19 W/kg; SAR(10 g) = 0.864 W/kg
Maximum value of SAR (measured) = 1.45 W/kg



0 dB = 1.40 W/kg = 1.46 dBW/kg

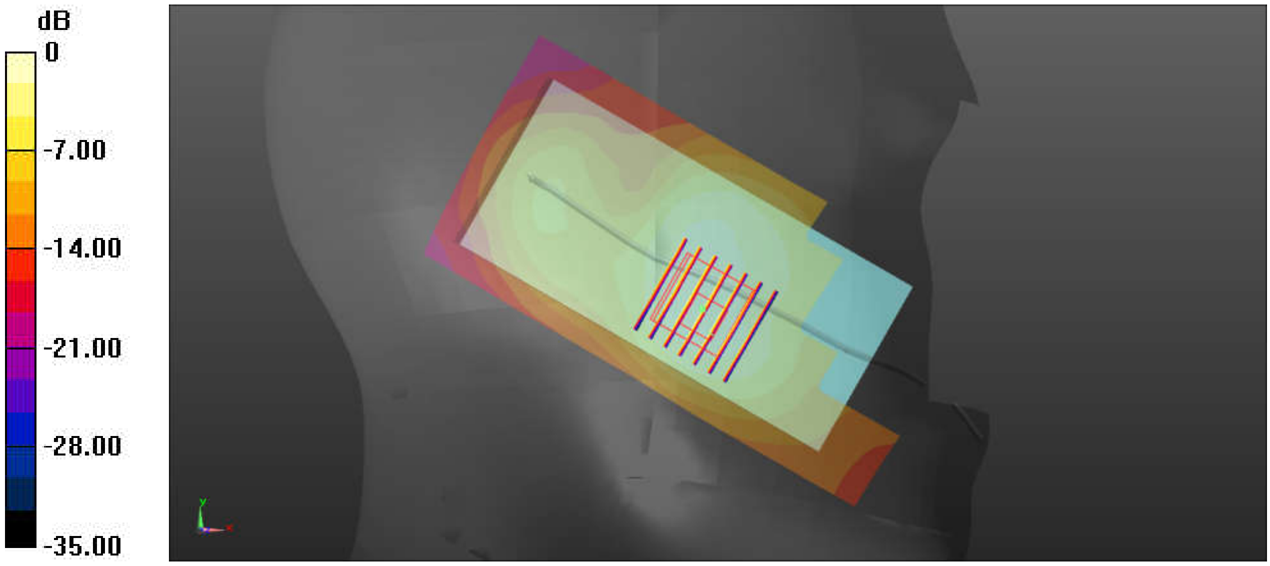
03_LTE Band 7_20M_QPSK_1RB_0offset_Left Cheek_0mm_Ch21100

Communication System: UID 0, LTE-FDD (0); Frequency: 2535 MHz;Duty Cycle: 1:1
Medium: HSL_2600 Medium parameters used: f = 2535 MHz; σ = 1.955 S/m; ε_r = 38.185; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.31, 7.31, 7.31); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch21100/Area Scan (61x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.71 W/kg

Ch21100/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.33 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.89 W/kg
SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.615 W/kg
Maximum value of SAR (measured) = 1.58 W/kg



0 dB = 1.71 W/kg = 2.33 dBW/kg

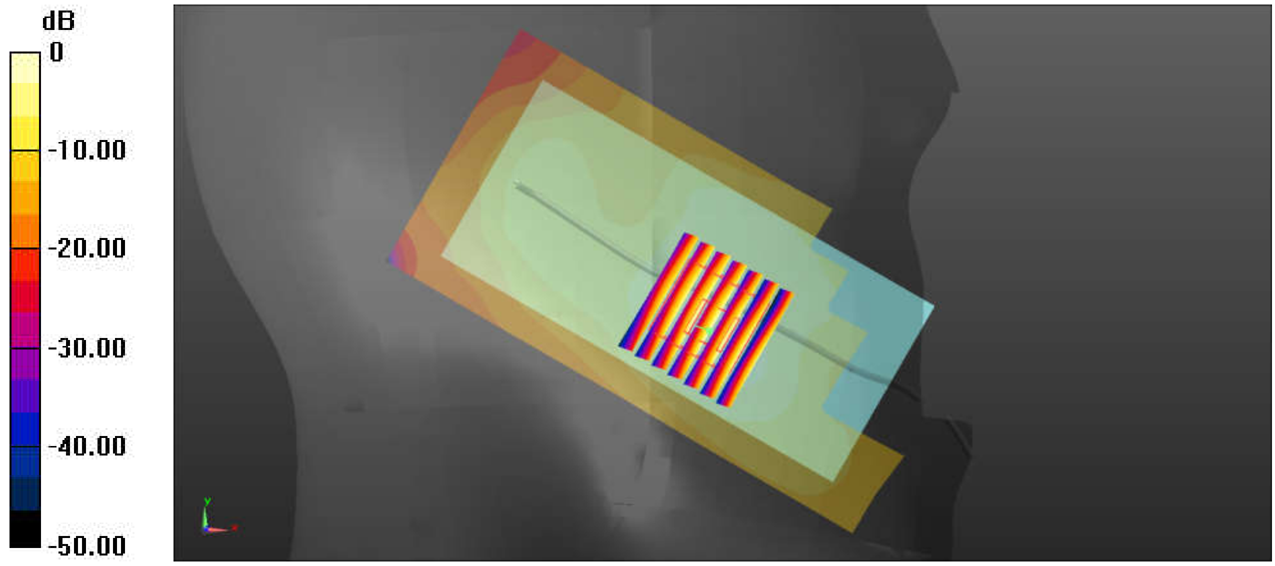
04_LTE Band 38_20M_QPSK_1RB_0offset_Left Cheek_0mm_Ch38000

Communication System: UID 0, LTE-TDD (0); Frequency: 2595 MHz;Duty Cycle: 1:1.59
Medium: HSL_2600 Medium parameters used: f = 2595 MHz; σ = 2.026 S/m; ε_r = 37.955; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.31, 7.31, 7.31); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch38000/Area Scan (61x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.861 W/kg

Ch38000/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.389 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.985 W/kg
SAR(1 g) = 0.553 W/kg; SAR(10 g) = 0.292 W/kg
Maximum value of SAR (measured) = 0.828 W/kg



0 dB = 0.861 W/kg = -0.65 dBW/kg

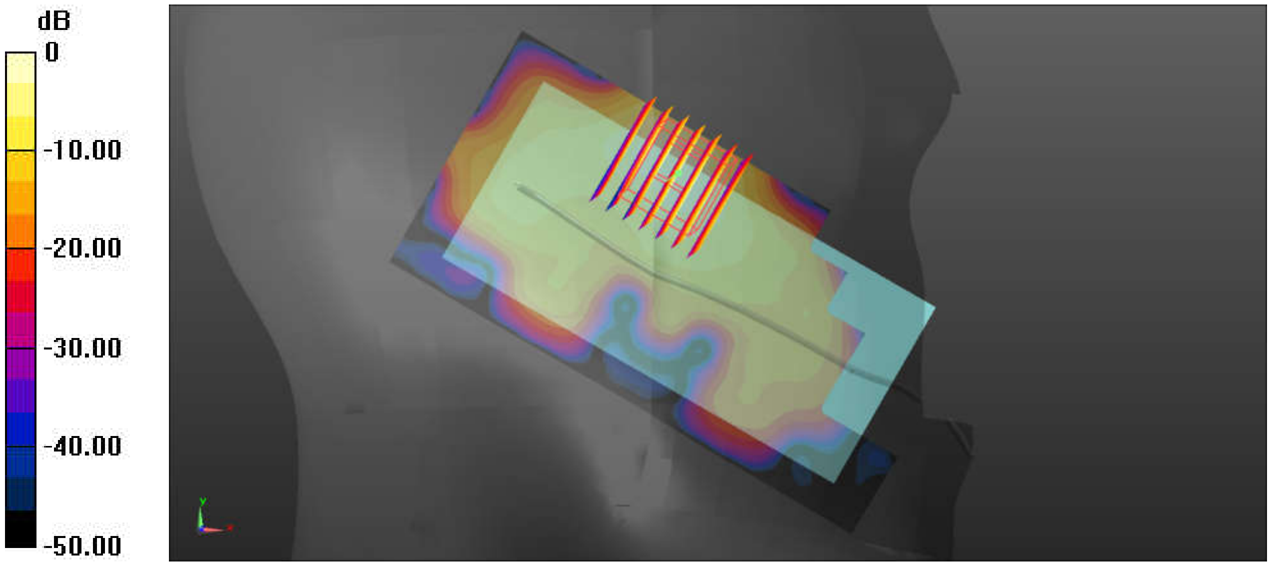
05_Bluetooth_1Mbps_Left Cheek_0mm_Ch39

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1.296
Medium: HSL_2450 Medium parameters used: f = 2441 MHz; σ = 1.848 S/m; ε_r = 38.573; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.5, 7.5, 7.5); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch39/Area Scan (61x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.266 W/kg

Ch39/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.402 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.367 W/kg
SAR(1 g) = 0.128 W/kg; SAR(10 g) = 0.054 W/kg
Maximum value of SAR (measured) = 0.271 W/kg



0 dB = 0.266 W/kg = -5.75 dBW/kg

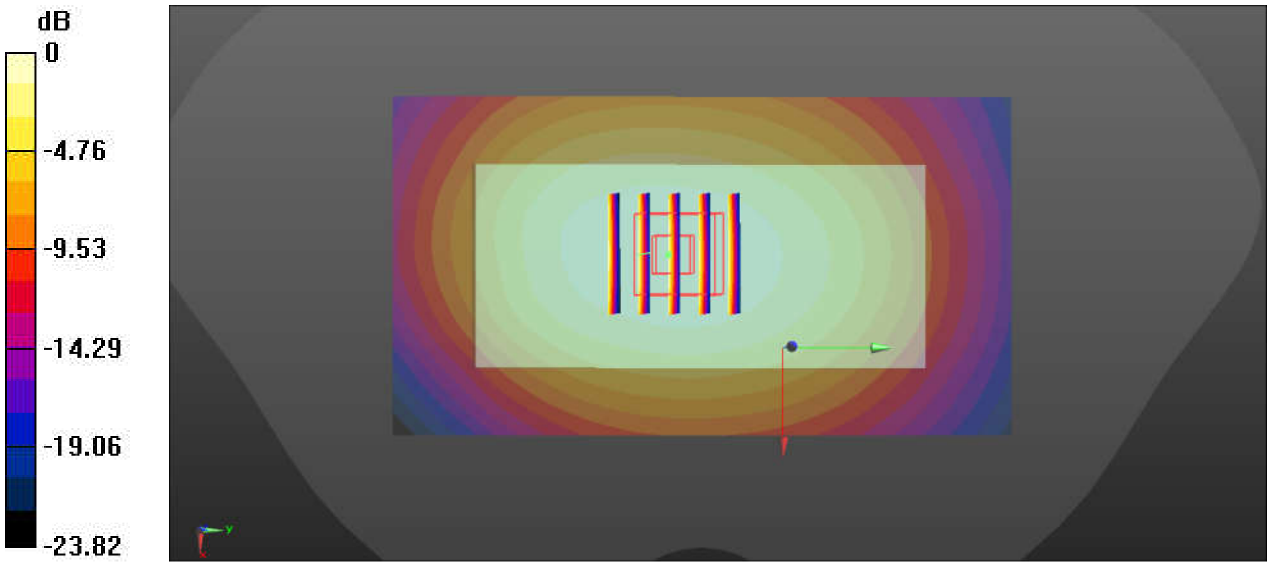
06_GSM850_GPRS 4 Tx slots_Back_15mm_Ch189

Communication System: UID 0, GSM850 (0); Frequency: 836.4 MHz;Duty Cycle: 1:2.08
Medium: HSL_850 Medium parameters used: f = 836.4 MHz; σ = 0.931 S/m; ε_r = 42.229; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(9.48, 9.48, 9.48); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch189/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.854 W/kg

Ch189/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm,dz=5mm
Reference Value = 30.71 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.934 W/kg
SAR(1 g) = 0.666 W/kg; SAR(10 g) = 0.486 W/kg
Maximum value of SAR (measured) = 0.825 W/kg



0 dB = 0.854 W/kg = -0.69 dBW/kg

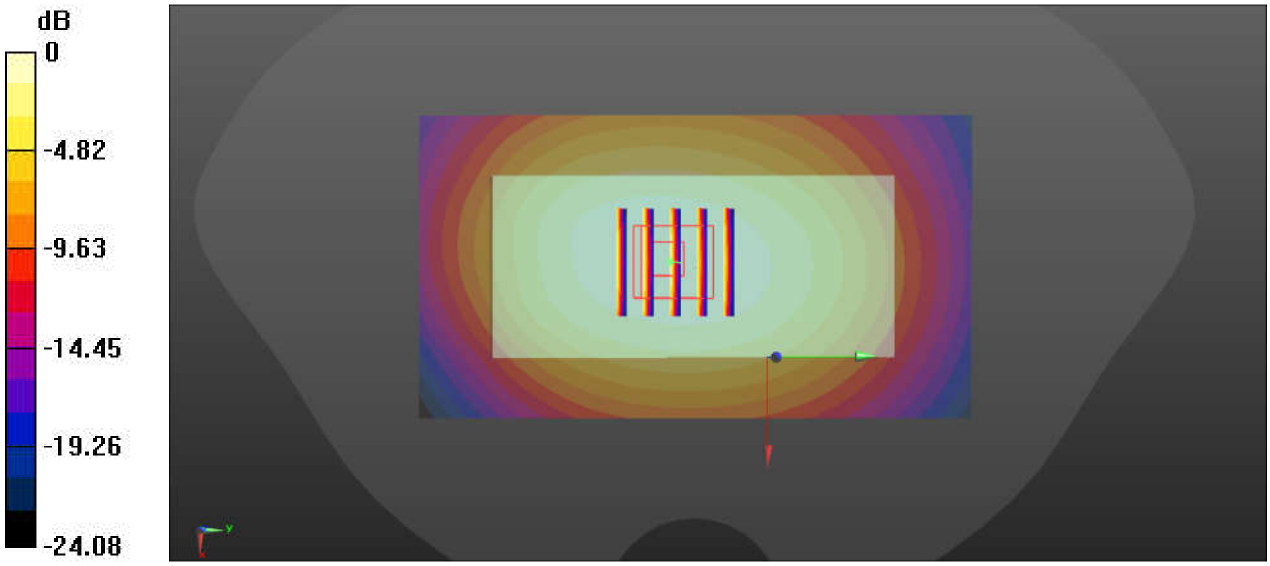
07_LTE Band 5_10M_QPSK_1RB_49Offset_Back_15mm_Ch20525

Communication System: UID 0, LTE-FDD (0); Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: HSL_850 Medium parameters used: f = 836.5 MHz; σ = 0.931 S/m; ε_r = 42.228; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(9.48, 9.48, 9.48); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch20525/Area Scan (61x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.24 W/kg

Ch20525/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.74 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.985 W/kg; SAR(10 g) = 0.699 W/kg
Maximum value of SAR (measured) = 1.26 W/kg



0 dB = 1.24 W/kg = 0.93 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2019.11.18

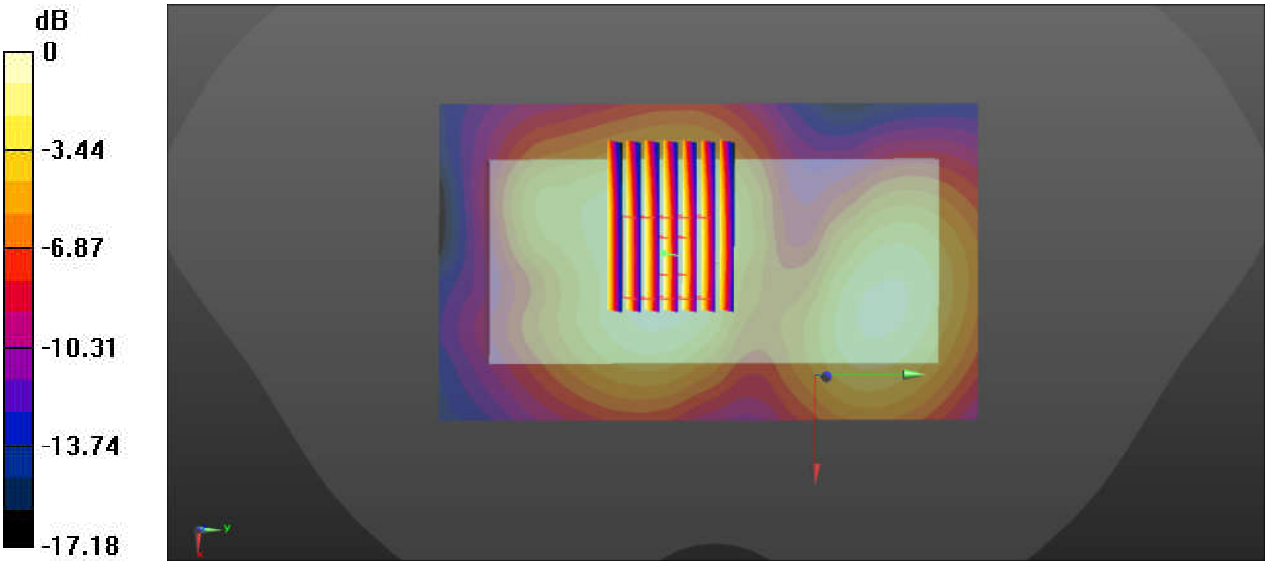
08_LTE Band 7_20M_QPSK_1RB_0Offset_Back_15mm_Ch20850

Communication System: UID 0, LTE-FDD (0); Frequency: 2510 MHz;Duty Cycle: 1:1
Medium: HSL_2600 Medium parameters used: f = 2510 MHz; σ = 1.926 S/m; ε_r = 38.298; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.31, 7.31, 7.31); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch20850/Area Scan (71x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.616 W/kg

Ch20850/Zoom Scan (10x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.79 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.718 W/kg
SAR(1 g) = 0.405 W/kg; SAR(10 g) = 0.239 W/kg
Maximum value of SAR (measured) = 0.597 W/kg



0 dB = 0.616 W/kg = -2.10 dBW/kg

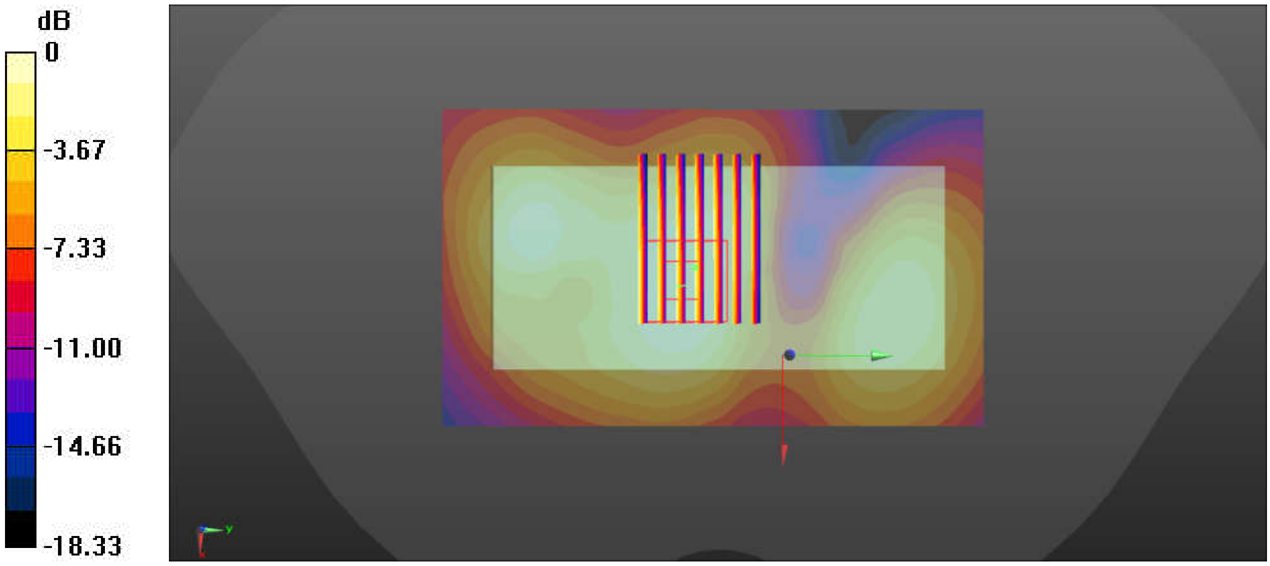
09_LTE Band 38_20M_QPSK_1RB_0Offset_Back_15mm_Ch38000

Communication System: UID 0, LTE-TDD (0); Frequency: 2595 MHz;Duty Cycle: 1:1.59
Medium: HSL_2600 Medium parameters used: f = 2595 MHz; σ = 2.026 S/m; ε_r = 37.955; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.31, 7.31, 7.31); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch38000/Area Scan (71x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.404 W/kg

Ch38000/Zoom Scan (10x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.14 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 0.494 W/kg
SAR(1 g) = 0.276 W/kg; SAR(10 g) = 0.158 W/kg
Maximum value of SAR (measured) = 0.405 W/kg



0 dB = 0.404 W/kg = -3.94 dBW/kg

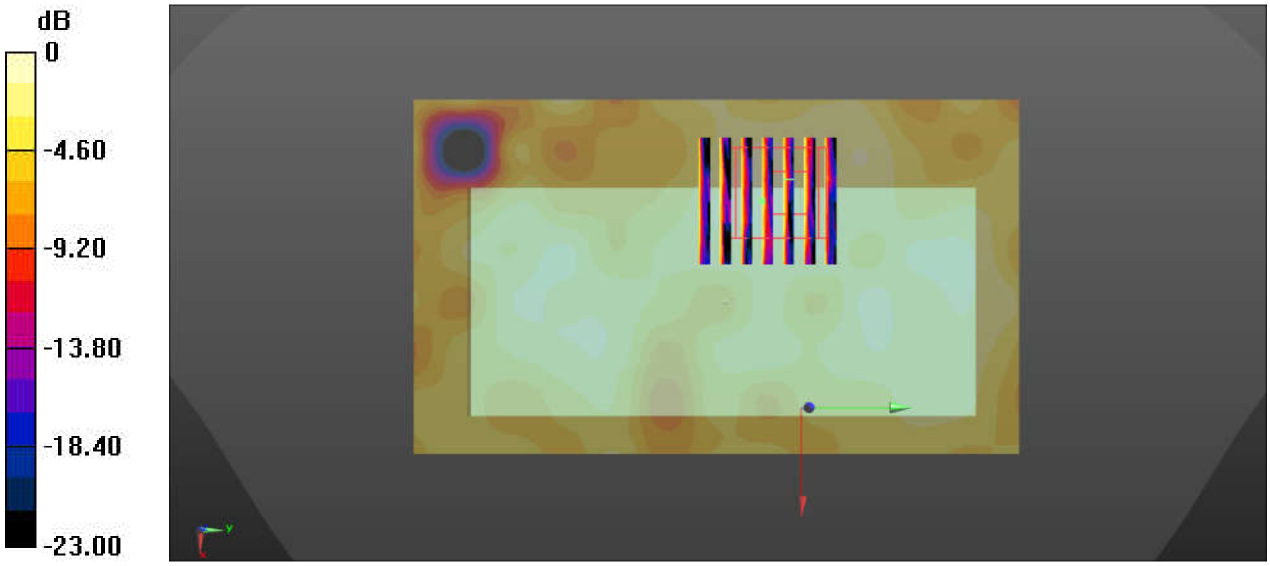
10_Bluetooth_1Mbps_Back_15mm_Ch39

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1.296
Medium: HSL_2450 Medium parameters used: f = 2441 MHz; σ = 1.848 S/m; ε_r = 38.573; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.5, 7.5, 7.5); Calibrated: 2019.5.27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2019.7.23
- Phantom: SAM1; Type: SAM; Serial: TP-1697
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Ch39/Area Scan (71x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0204 W/kg

Ch39/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.499 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.0370 W/kg
SAR(1 g) = 0.010 W/kg; SAR(10 g) = 0.00467 W/kg
Maximum value of SAR (measured) = 0.0194 W/kg



0 dB = 0.0204 W/kg = -16.90 dBW/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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中国认可
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CALIBRATION
CNAS L0570

Client **Sporton** **Certificate No: Z19-60082**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d151
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 27, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

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

Issued: March 30, 2019

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E-mail: cttl@chinattl.com http://www.chinattl.cn

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 %	0.93 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	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.30 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.16 W/kg ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	56.7 ± 6 %	0.94 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.53 W /kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.20 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8Ω- 3.28jΩ
Return Loss	- 29.5dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7Ω- 3.98jΩ
Return Loss	- 25.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.253 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: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: f = 835 MHz; σ = 0.925 S/m; ε_r = 42.68; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.75, 9.75, 9.75) @ 835 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

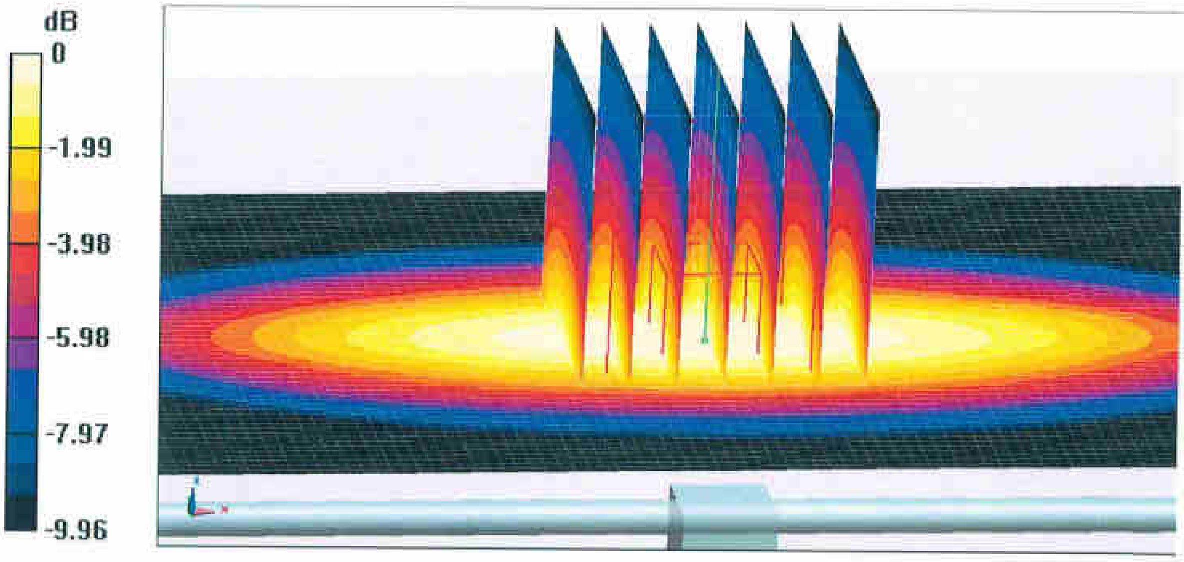
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.34 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 3.14 W/kg



0 dB = 3.14 W/kg = 4.97 dBW/kg

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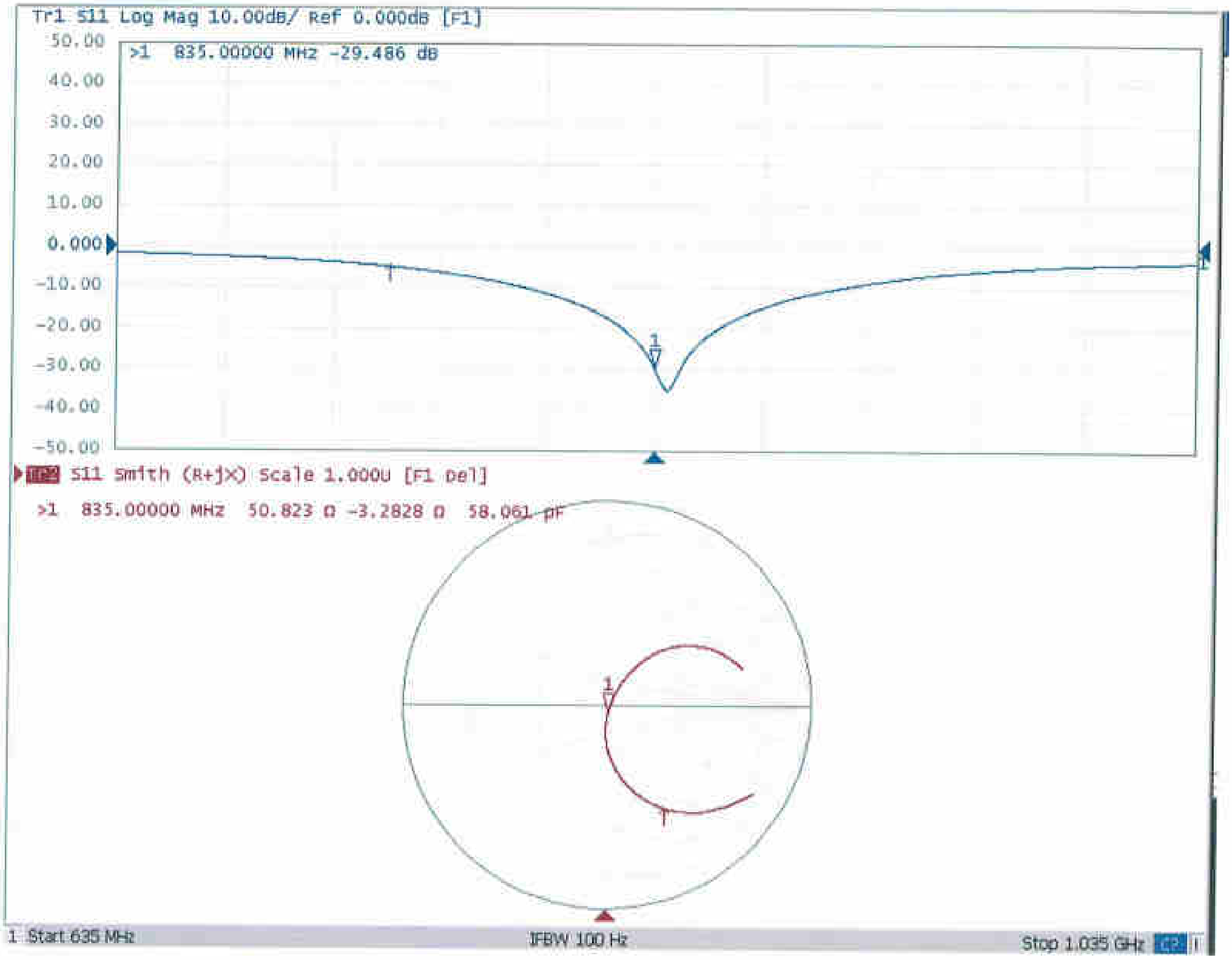
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d151

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

Medium parameters used: f = 835 MHz; σ = 0.944 S/m; ε_r = 56.66; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.61, 9.61, 9.61) @ 835 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

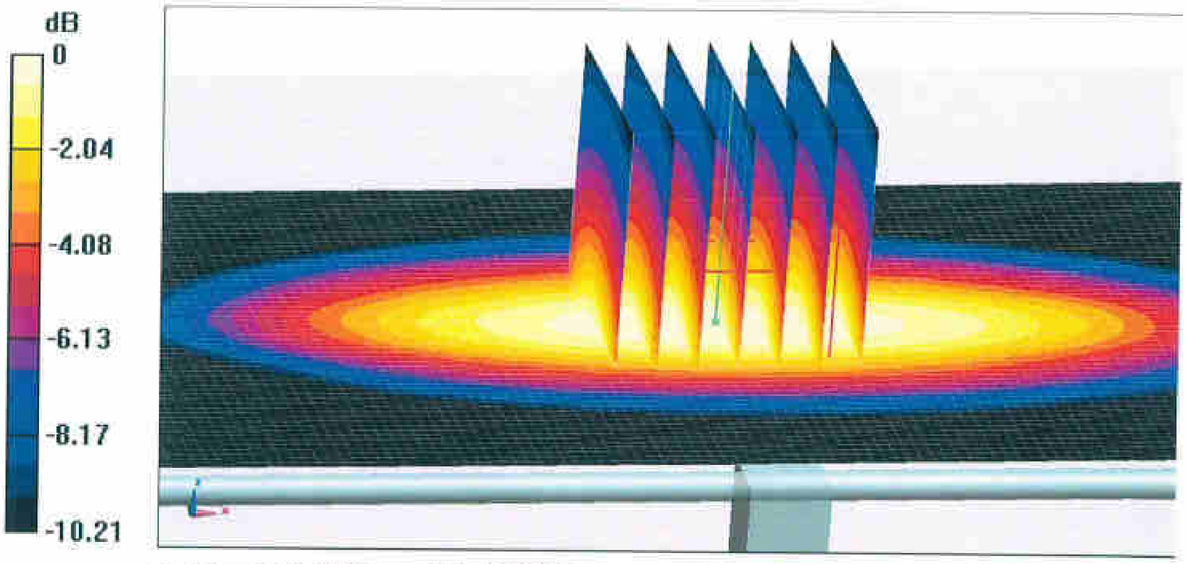
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.03 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.52 W/kg

Maximum value of SAR (measured) = 3.12 W/kg



0 dB = 3.12 W/kg = 4.94 dBW/kg

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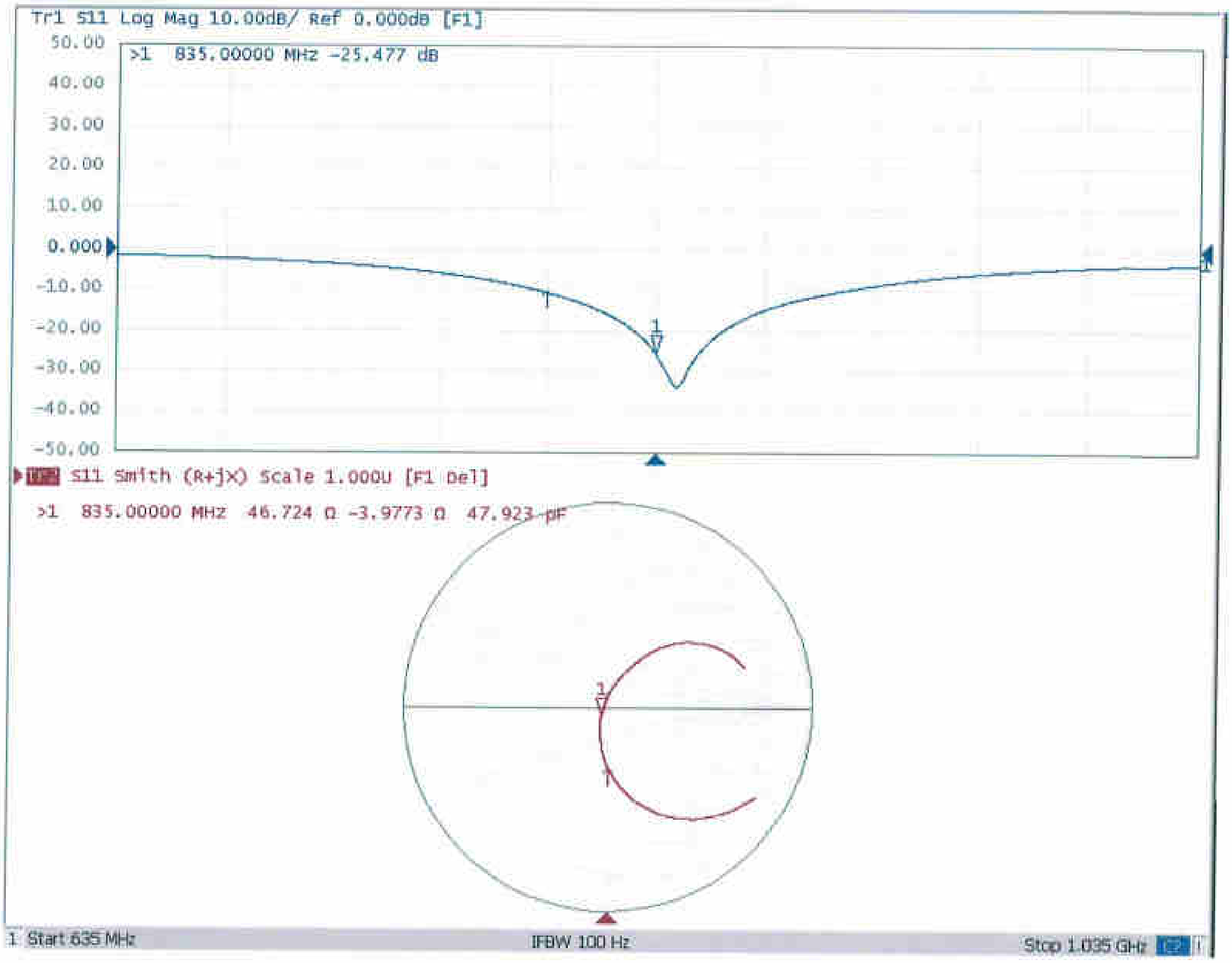
Impedance Measurement Plot for Body TSL



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CALIBRATION
CNAS L0570

Client **Sporton** **Certificate No: Z19-60087**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 908
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 25, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

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

Issued: March 28, 2019

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

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Measurement Conditions

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

DASY Version	DASY52	52.10.2.1495
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	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.6 ± 6 %	1.84 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	2.00 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	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.8 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.6 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.3Ω+ 5.18 jΩ
Return Loss	- 21.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.6Ω+ 5.81 jΩ
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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DASY5 Validation Report for Head TSL

Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.841 S/m; ε_r = 39.63; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.62, 7.62, 7.62) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

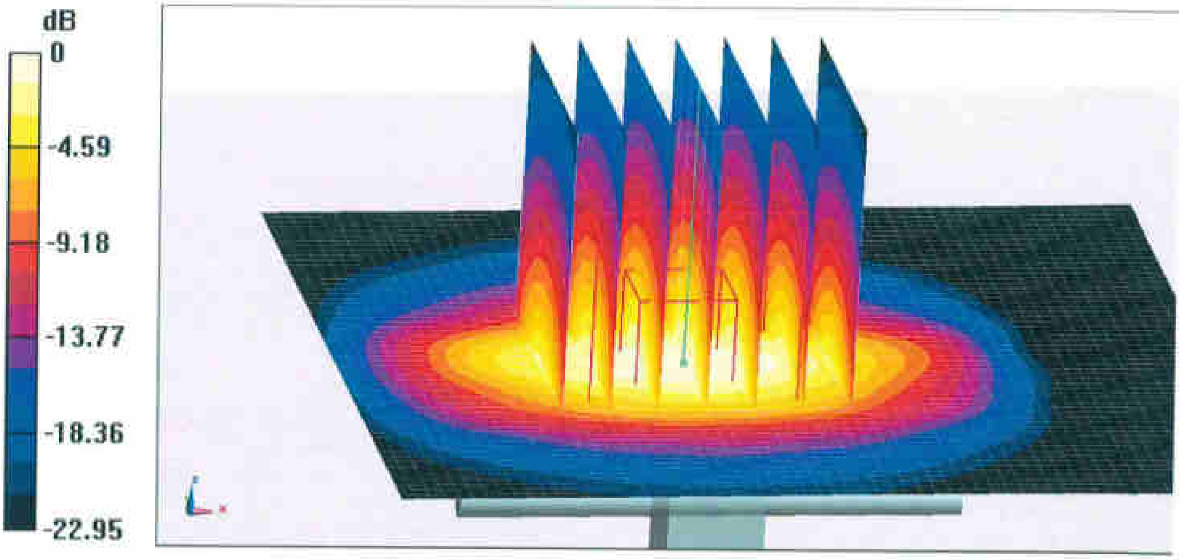
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.04 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 22.4 W/kg



0 dB = 22.4 W/kg = 13.50 dBW/kg

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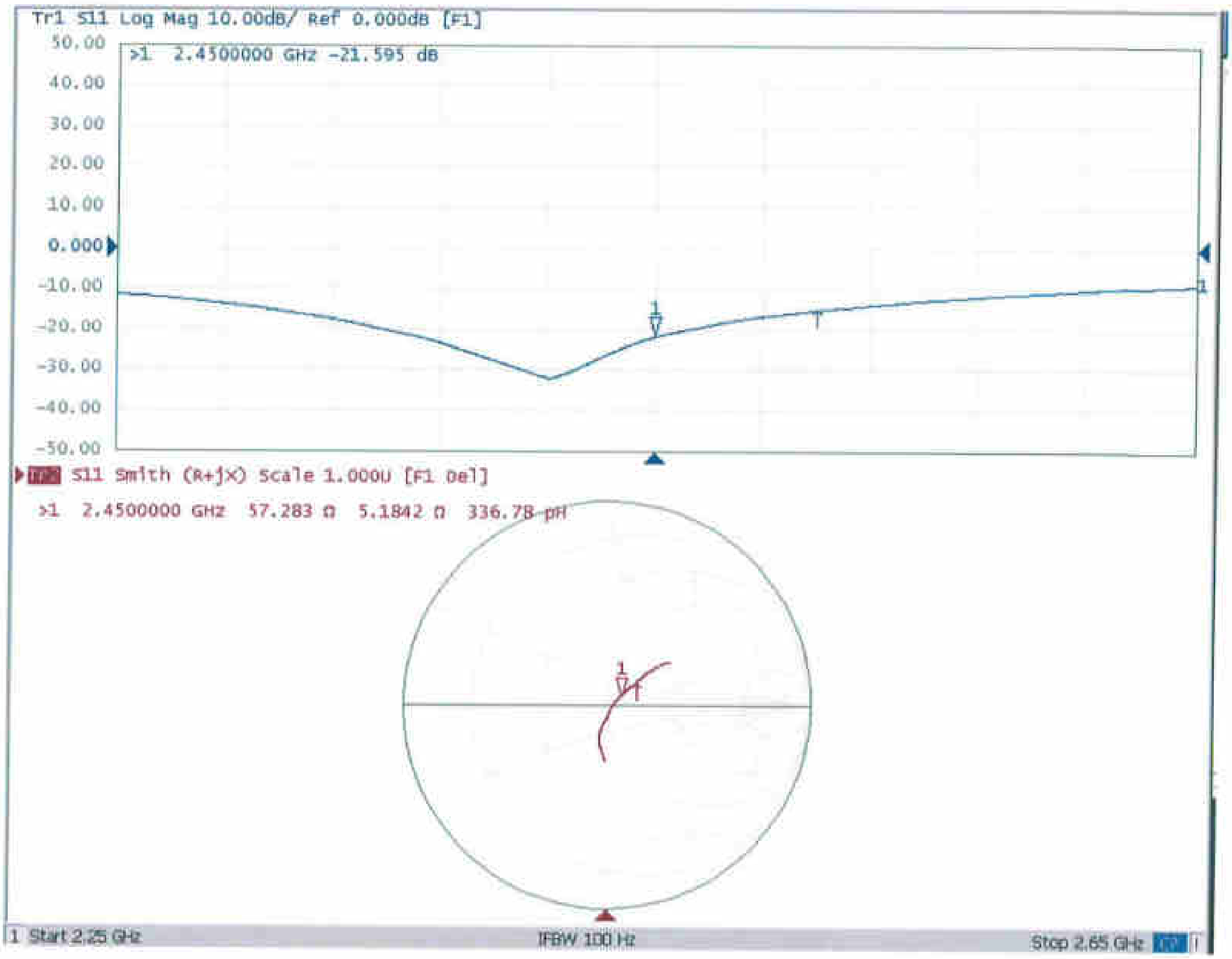
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 2.003 S/m; ε_r = 53.78; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.79, 7.79, 7.79) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

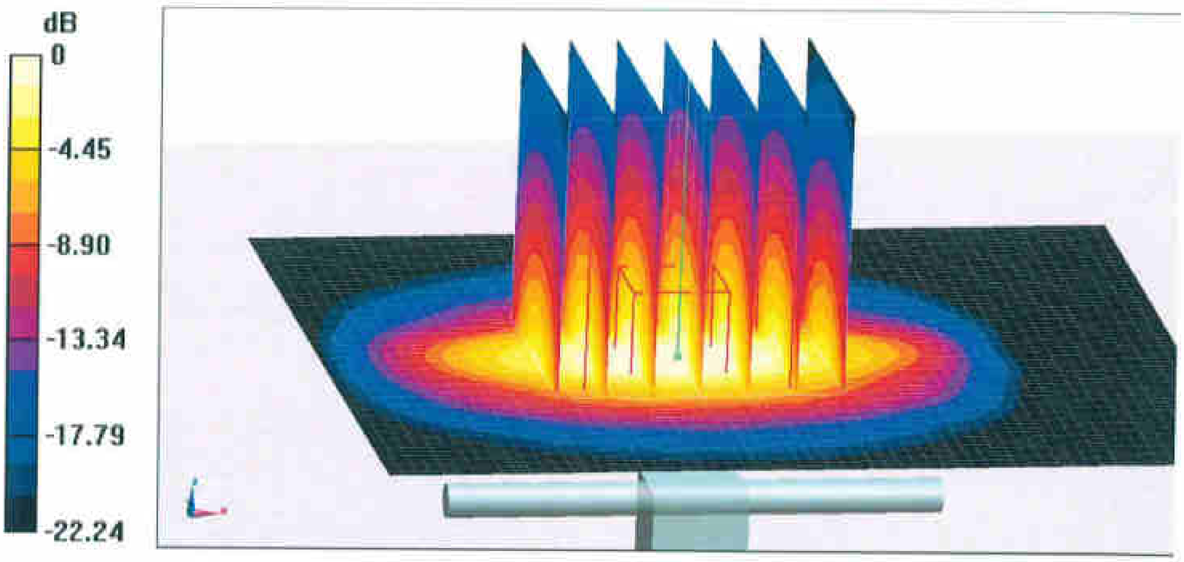
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.91 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

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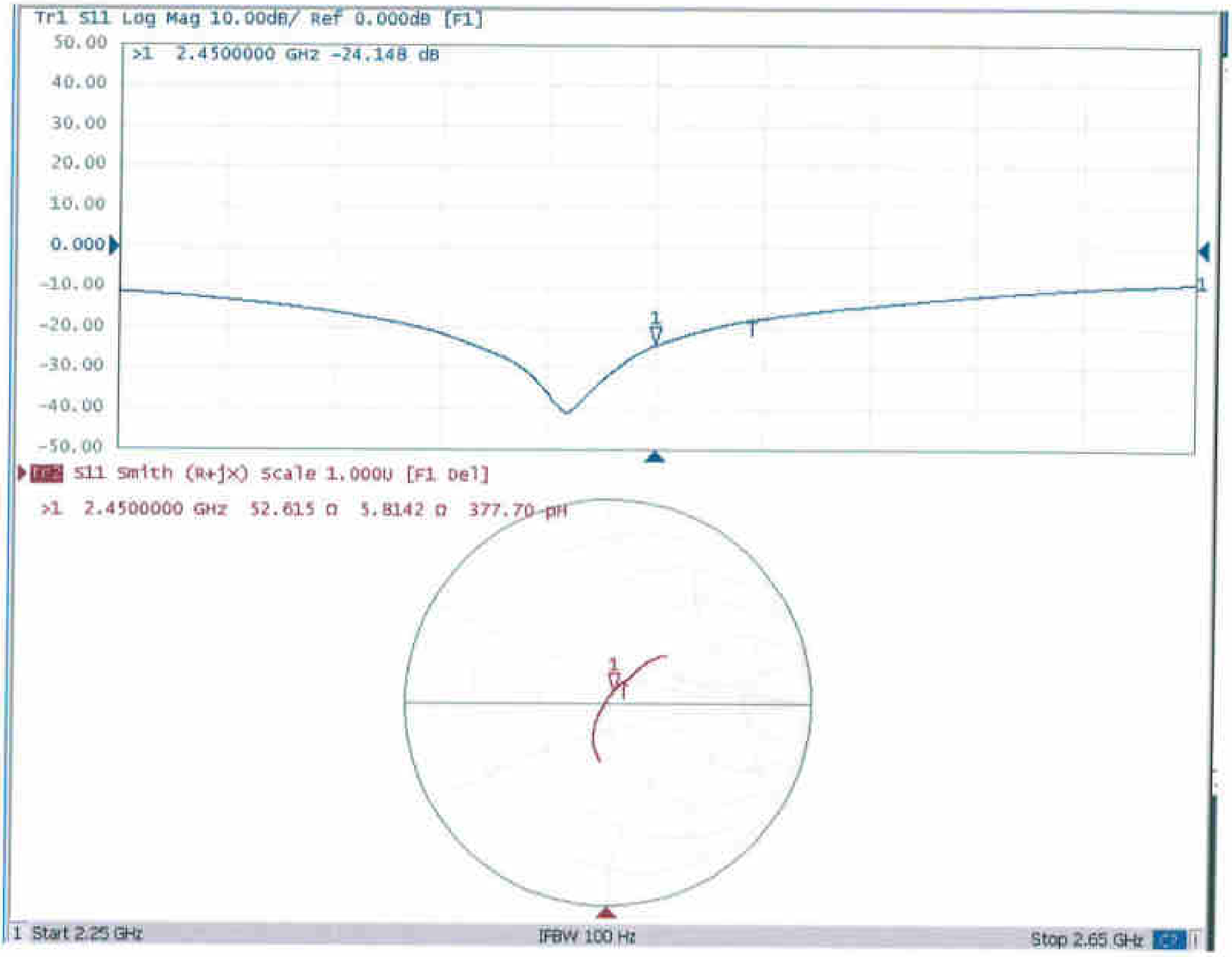
Impedance Measurement Plot for Body TSL



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Client **Sporton** **Certificate No: Z18-60490**

CALIBRATION CERTIFICATE

Object: D2600V2 - SN: 1061

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

Calibration date: December 7, 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
Network Analyzer 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 10, 2018