FCC SAR Test Report

APPLICANT	:	**LG Electronics Mobile Comm USA**
EQUIPMENT	:	**Smart phone**
BRAND NAME	:	**LG**
MODEL NAME	:	**LG-X240YK**
FCC ID	:	**ZNFX240YK**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had 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 INC., the test report shall not be reproduced except in full.

Eric Huang

Reviewed by: Eric Huang / Manager

JonesTsai

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA6D1013	Rev. 01	Initial issue of report	Mar. 10, 2017
FA6D1013	Rev. 02	1. Revised typo in section 4.2.2 2. Updated section 13 3. Added Appendix F	Mar. 15, 2017

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for LG Electronics Mobile Comm USA, Smart phone, LG-X240YK, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
		Head (Separation 0mm)	Body-worn (Separation 15mm)	Hotspot (Separation 10mm)	
		1g SAR (W/kg)			
Licensed	GSM850	0.61	0.63	0.83	1.59
	GSM1900	0.14	0.18	0.32	
	WCDMA V	0.46	0.54	0.64	
	LTE Band 5	0.32	0.40	0.49	
	LTE Band 7	0.59	1.13	0.57	
DTS	2.4GHz WLAN	0.98	0.05	0.12	
Date of Testing:		2017/1/26 ~ 2017/2/6			

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications

2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	LG Electronics Mobile Comm USA
Address	LG Twin Towers 20, Yeouido-Dong Youngdeungpo-Gu, Seoul 150-721, Republic Of Korea

Manufacturer	
Company Name	Arima Communications Corp.
Address	6F,No.866,Jhongjheng Rd., Jhonghe Dist., New Taipei City 23586, Taiwan

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 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01
- FCC KDB 941225 D05 SAR for LTE Devices v02r05
- FCC KDB 941225 D06 Hotspot Mode SAR v02r01

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	Smart phone
Brand Name	LG
Model Name	LG-X240YK
FCC ID	ZNFX240YK
IMEI Code	355463080005706
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM 802.11b/g/n HT20/HT40 Bluetooth BR/EDR/LE
HW Version	Rev. 1.0
SW Version	LGX240YKAT-00-V08a-CIS-XX-NOV-17-2016+0
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	Production Unit

Remark:

1. This device 2.4GHz WLAN supports Hotspot operation.
2. In this report, WLAN / BT SAR test results are referred to LG-X240H (FCC ID : ZNFX240H), Sporton Report No: FA6O1802 or Appendix D and spot checks were performed on to LG-X240YK to ensure that the SAR measurements for both devices are the same.
3. When hotspot mode is enabled, power reduction will be activated to limit the maximum power of LTE band 7.

4.2 Spot Check Evaluation

1. Introduction Section

The original model (FCC ID: ZNFX240H) and the variant model (FCC ID: ZNFX240YK) has identical PCB layout, antenna, SW implementation for Bluetooth/Wi-Fi/GPS. Based on their similarity, the FCC SAR (equipment class: DTS, DSS, NII) test data of ZNFX240YK references the test data of ZNFX240H.

The applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID (FCC ID: ZNFX240YK).

2. Difference Section

The original model (FCC ID: ZNFX240H) and the variant model (FCC ID: ZNFX240YK) has identical PCB layout, antenna, SW implementation for Bluetooth/Wi-Fi/GPS. The details of similarity and difference can be found in the OpDes_Data Reuse.

Cellular transmitter RF components are different in ZNFX240YK, to support capability for different cellular bands.

The product specification is outlined in the following table:

FCC ID			ZNFX240H	ZNFX240YK
Wireless Tech	**Mode**		**Frequency (MHz)**	
GSM	GSM Voice GPRS (GMSK) EDGE (8PSK)	Multi-Slot Class 12 DTM: No	850/1900	850/1900
UMTS	AMR/RCM12.2Kbps HSDPA/HSUPA/DC-HSDPA		B2/B4/B5	B5
LTE (FDD)	QPSK 16QAM		B2/B4/B5/B7/B13/B17	B5/B7
Wi-Fi	11b/11g/11n(HT20/HT40)		2412-2462 MHz	
Bluetooth	BR/EDR/LE		2402-2480 MHz	

3. Spot Check Verification Data Section

<Head SAR>

Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Original Model (FCC ID: ZNFX240H)					Spot Check Mode (FCC ID: ZNFX240YK)					Deviation
						Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	
WLAN2.4GHz	802.11b 1Mbps	Right Cheek	0mm	6	2437	16.97	17.00	100	0.970	0.977	16.97	17.00	100	0.960	0.967	-1.0%

<Hotspot SAR>

Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Original Model (FCC ID: ZNFX240H)					Spot Check Mode (FCC ID: ZNFX240YK)					Deviation
						Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	
WLAN2.4GHz	802.11b 1Mbps	Front	10mm	6	2437	16.97	17.00	100	0.123	0.124	16.97	17.00	100	0.132	0.133	7.3%

<Body-Worn SAR>

Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Original Model (FCC ID: ZNFX240H)					Spot Check Mode (FCC ID: ZNFX240YK)					Deviation
						Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Average Power (dBm)	Tune-Up Limit (dBm)	Duty Cycle %	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	
WLAN2.4GHz	802.11b 1Mbps	Back	15mm	6	2437	16.97	17.00	100	0.051	0.051	16.97	17.00	100	0.056	0.056	9.8%

Note: The spot check verification shows the WLAN SAR performance of ZNFX240H represents the performance of ZNFX240YK.

4. Reference detail Section

Rule Part	Frequency Band (MHz)	Wireless Technology	Reference FCC ID	Reference Report Title	Reference Report No.	Reference Report Sections
15C	2402~2480	Bluetooth	ZNFX240H	FCC SAR Test Report	FA6O1802	Sections related to Bluetooth test data
15C	2412~2462	Wi-Fi	ZNFX240H	FCC SAR Test Report	FA6O1802	Sections related to WiFi test data

4.3 General LTE SAR Test and Reporting Considerations

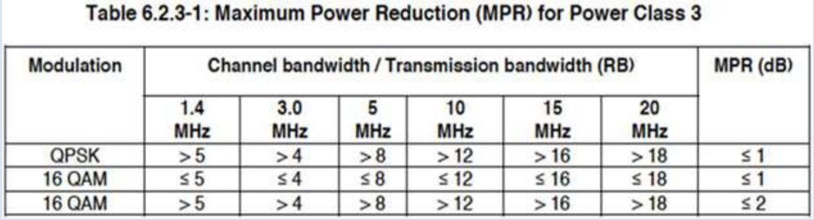
Summarized necessary items addressed in KDB 941225 D05 v02r05	
FCC ID	ZNFX240YK
Equipment Name	Smart phone
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz
Channel Bandwidth	LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK, and 16QAM
LTE Voice / Data requirements	1. Data only
LTE MPR permanently built-in by design	
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.
Power reduction applied to satisfy SAR compliance	1. Yes, when operating in hotspot mode that LTE B7 power reduction applied to satisfy SAR compliance.

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

Modulation	Channel bandwidth / Transmission bandwidth (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

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

5. RF Exposure Limits

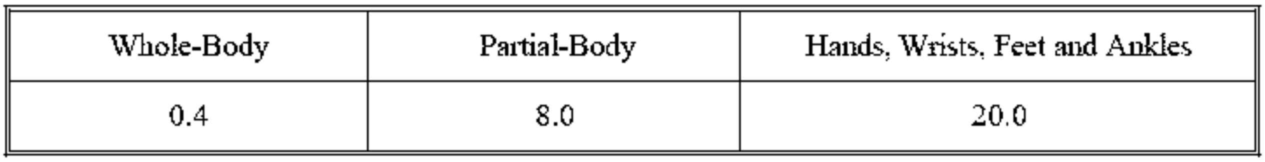
5.1 Uncontrolled Environment

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

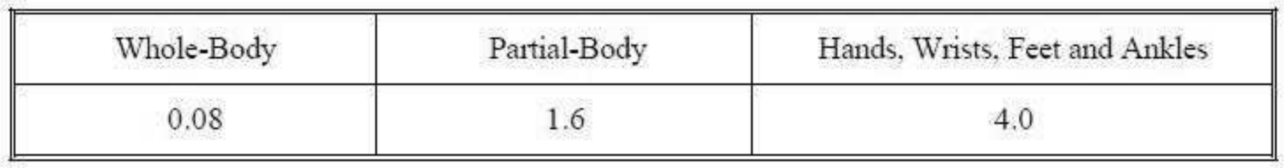
Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed 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

1. 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:

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

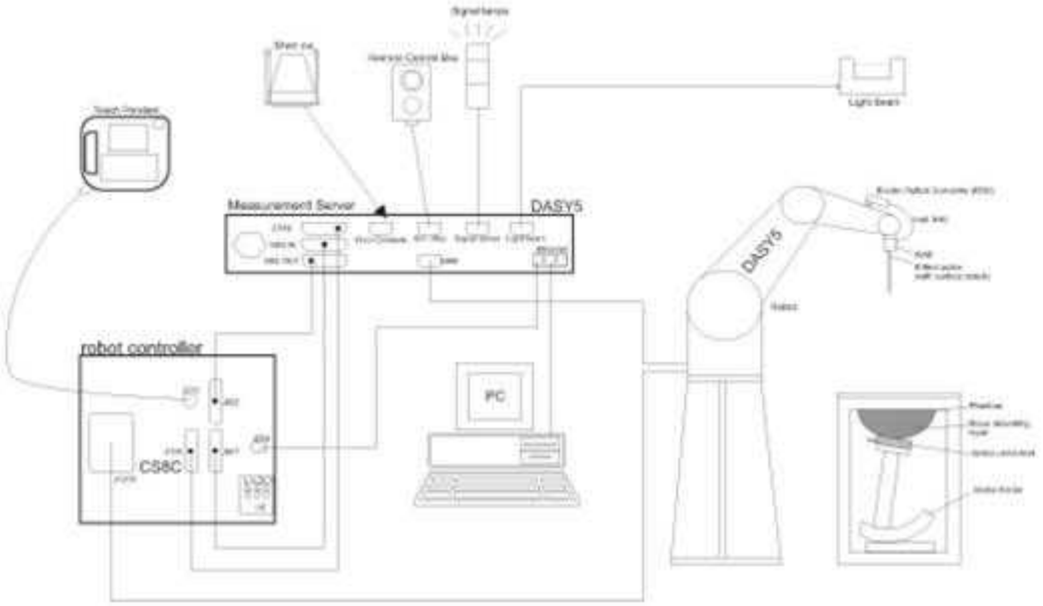
SAR is expressed in units of Watts per kilogram (W/kg)

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

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.

<ES3DV3 Probe>

Construction	Symmetric design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – 4 GHz; Linearity: ±0.2 dB (30 MHz – 4 GHz)	
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)	
Dynamic Range	5 µW/g – >100 mW/g; Linearity: ±0.2 dB	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 3.0 mm	

<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.

Fig 5.1 Photo of DAE

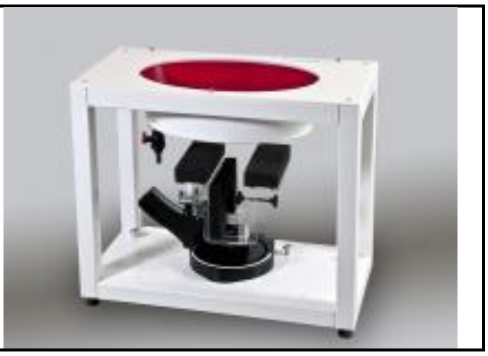
7.3 Phantom

<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

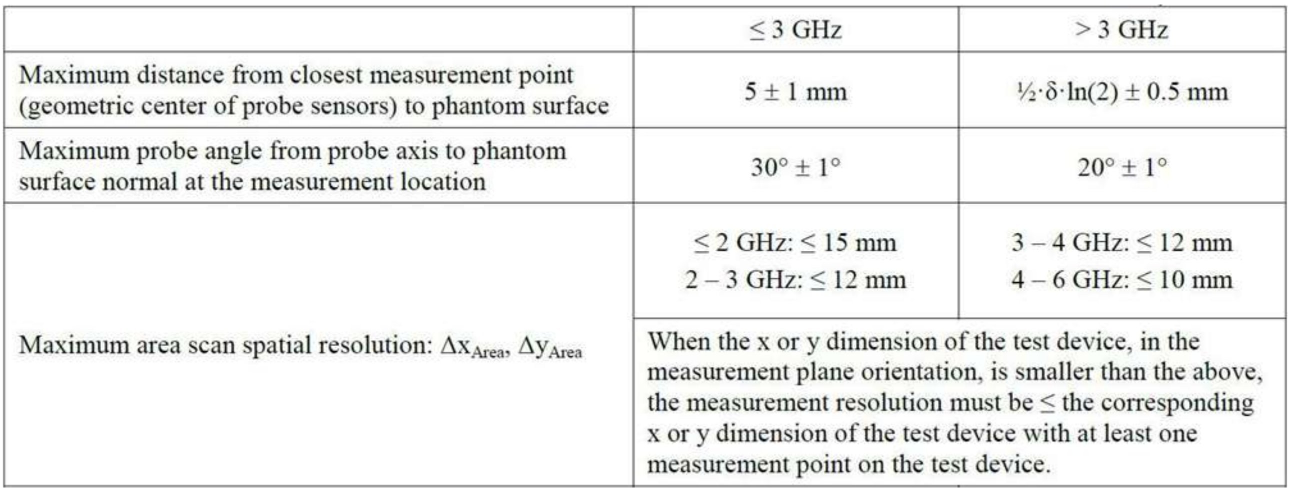
8.2 Power Reference Measurement

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.

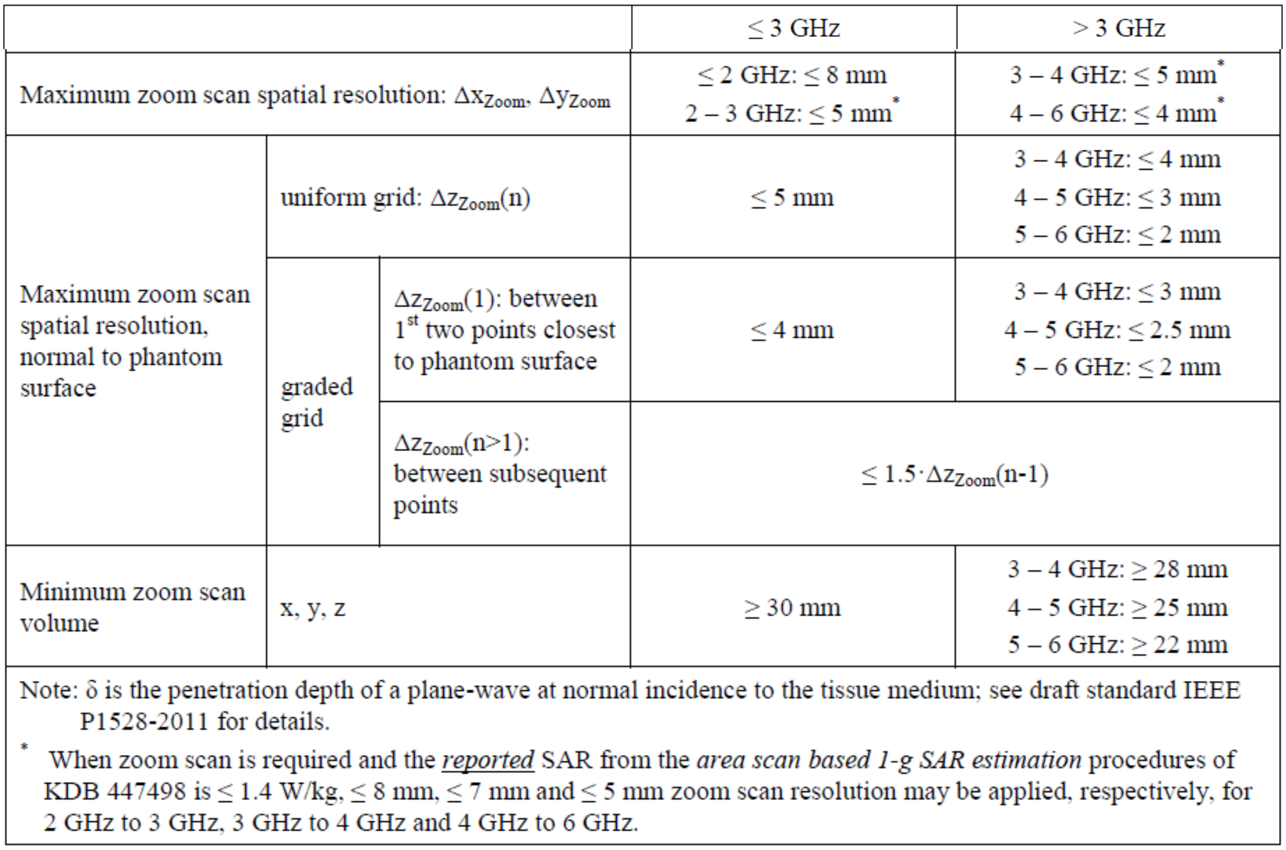


	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan 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.



			$\leq$ 3 GHz	$>$ 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 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		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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	499	Mar. 21, 2016	Mar. 20, 2017
SPEAG	835MHz System Validation Kit	D835V2	4d200	Aug. 23, 2016	Aug. 22, 2017
SPEAG	1900MHz System Validation Kit	D1900V2	5d210	Aug. 25, 2016	Aug. 24, 2017
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Aug. 30, 2016	Aug. 29, 2017
SPEAG	Data Acquisition Electronics	DAE3	495	May. 27, 2016	May. 26, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 26, 2016	May. 25, 2017
WonDer	Thermometer	WD-5015	TM642	Oct. 12, 2016	Oct. 11, 2017
Anritsu	Radio Communication Analyzer	MT8820C	6201381760	May. 10, 2016	May. 09, 2017
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 17, 2016	May. 16, 2017
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Dec. 09, 2016	Dec. 08, 2017
Agilent	ENA Network Analyzer	E5071C	MY46316648	Jan. 04, 2017	Jan. 03, 2018
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 19, 2016	Jul. 18, 2017
LINE SEIKI	Digital Thermometer	LKMelectronic	DTM3000SPEZIAL	Sep. 05, 2016	Sep. 04, 2017
Anritsu	Power Meter	ML2495A	1419002	May. 10, 2016	May. 09, 2017
Anritsu	Power Sensor	MA2411B	1339124	May. 10, 2016	May. 09, 2017
Agilent	Spectrum Analyzer	E4408B	MY44211028	Aug. 22, 2016	Aug. 21, 2017
Mini-Circuits	Power Amplifier	ZVE-8G+	D120604	Mar. 16, 2016	Mar. 15, 2017
Mini-Circuits	Power Amplifier	ZHL-42W+	QA1344002	Mar. 16, 2016	Mar. 15, 2017
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

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.

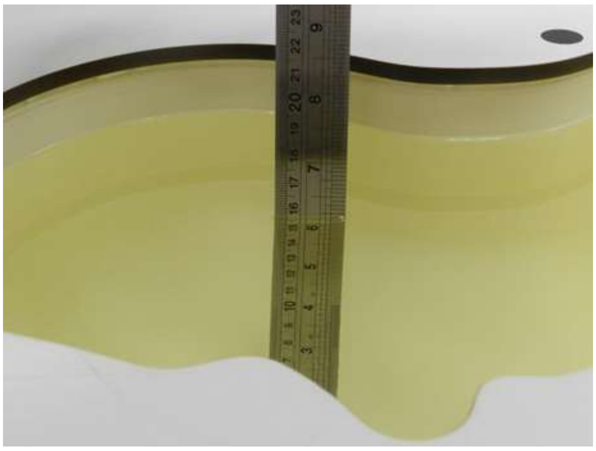


Fig 10.1Photo of Liquid Height for Head SAR

Fig 10.2 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								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<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	HSL	22.6	0.887	43.400	0.90	41.50	-1.44	4.58	±5	2017/2/3
835	MSL	22.2	0.933	53.800	0.97	55.20	-3.81	-2.54	±5	2017/2/3
1900	HSL	22.2	1.430	41.300	1.40	40.00	2.14	3.25	±5	2017/2/6
1900	MSL	22.2	1.530	54.300	1.52	53.30	0.66	1.88	±5	2017/2/4
2600	HSL	22.6	1.982	39.622	1.96	39.00	1.12	1.59	±5	2017/2/2
2600	MSL	22.6	2.188	52.530	2.16	52.50	1.30	0.06	±5	2017/1/26

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 (%)
2017/2/3	835	HSL	250	D835V2-499	EX3DV4 - SN3925	DAE3 Sn495	2.37	9.14	9.48	3.72
2017/2/3	835	MSL	250	D835V2-4d200	EX3DV4 - SN3925	DAE3 Sn495	2.33	9.65	9.32	-3.42
2017/2/6	1900	HSL	250	D1900V2-5d210	EX3DV4 - SN3925	DAE3 Sn495	9.93	39.90	39.72	-0.45
2017/2/4	1900	MSL	250	D1900V2-5d210	EX3DV4 - SN3925	DAE3 Sn495	10.20	40.30	40.80	1.24
2017/2/2	2600	HSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	14.40	56.80	57.60	1.41
2017/1/26	2600	MSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	13.60	55.20	54.40	-1.45

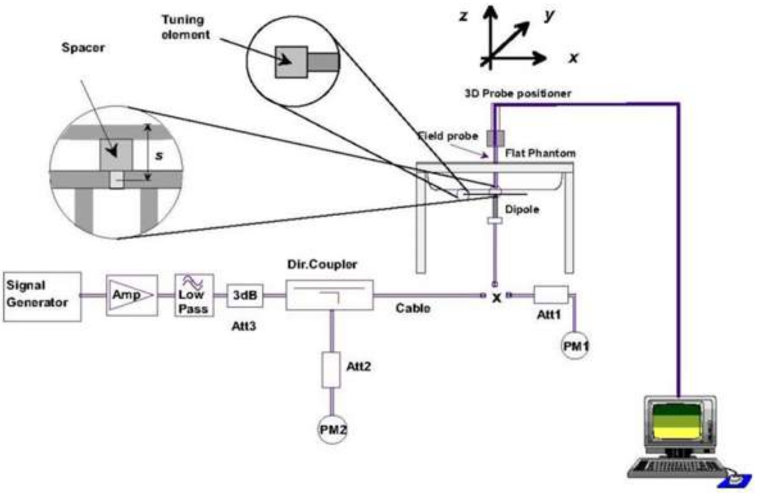


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 9.1.1 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 9.1.2 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 9.1.3). 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 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

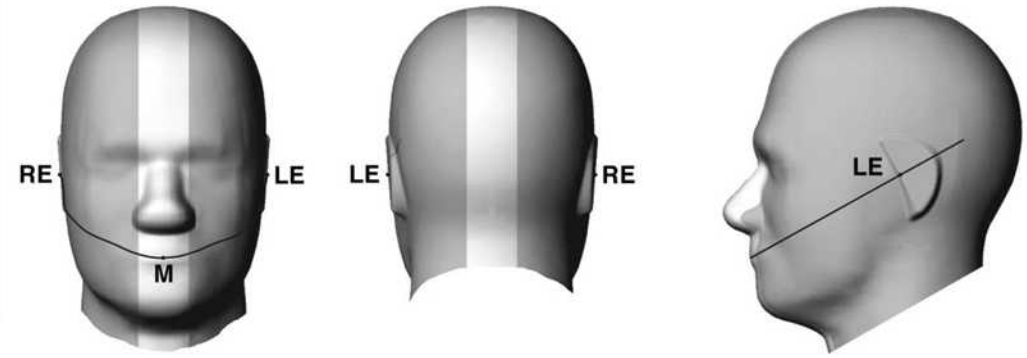


Fig 9.1.1 Front, back, and side views of SAM twin phantom

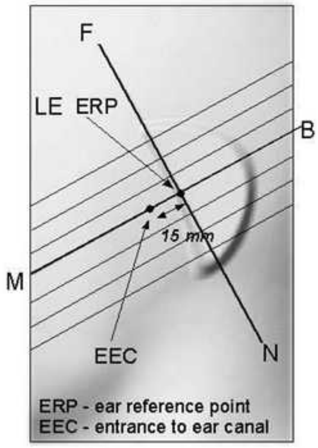


Fig 9.1.2 Close-up side view of phantom showing the ear region.

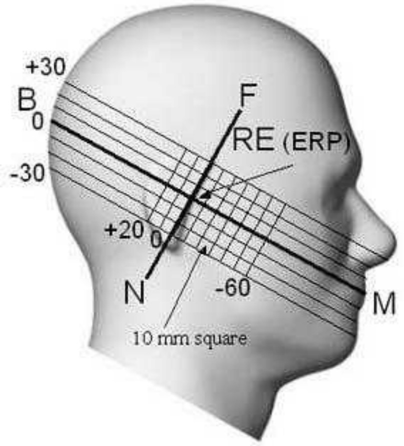


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

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 9.2.1 and Figure 9.2.2), 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 9.2.1). 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 9.2.2), 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 9.2.3), 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 9.2.3. The actual rotation angles should be documented in the test report.

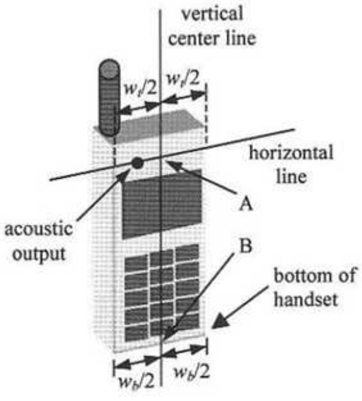


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

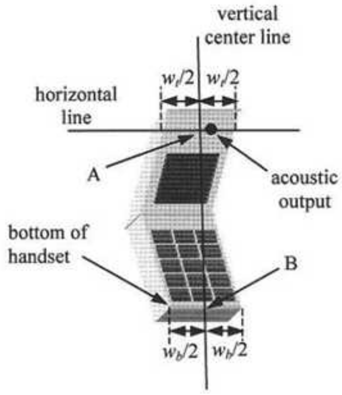


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

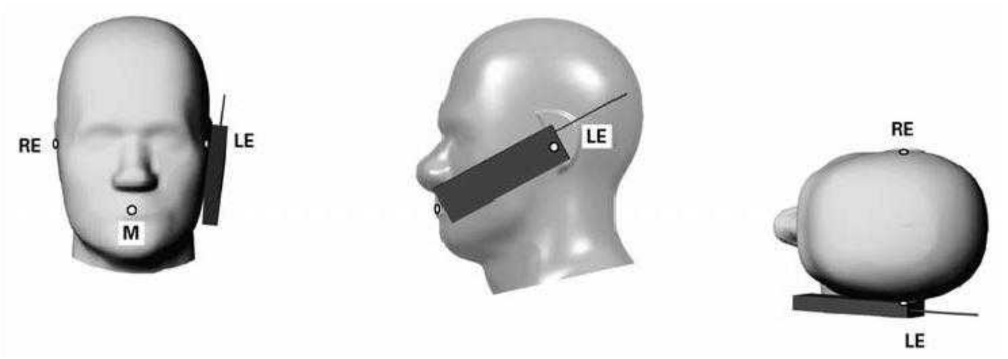


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

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 9.3.1. 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

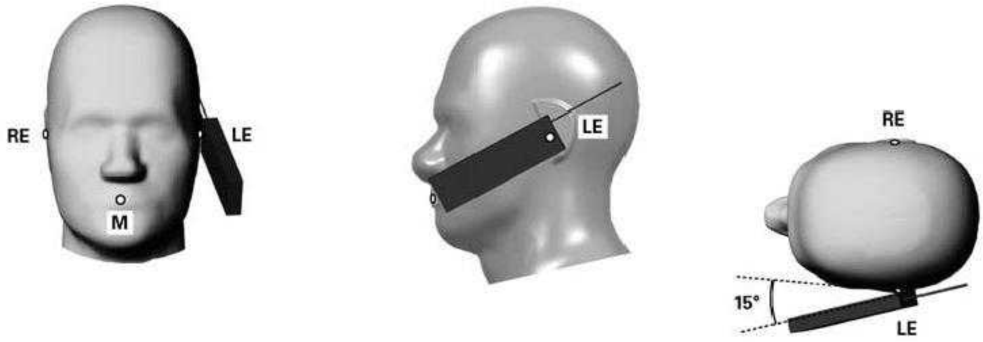


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

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 9.4). 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.

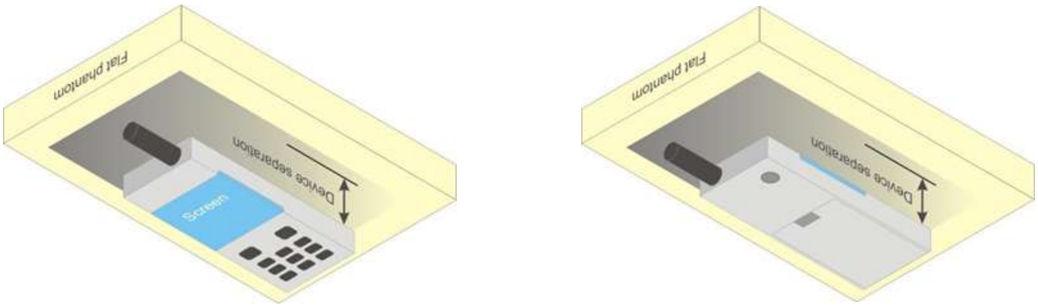


Fig 9.4 Body Worn Position

11.5 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

12. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

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 / EDGE 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/GSM1900 is considered as the primary mode.
3. Other configurations of GSM / GPRS / EDGE 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	33.73	33.80	33.81	34.00	24.73	24.80	24.81	25.00
GPRS 1 Tx slot	33.87	33.83	33.86	34.00	24.87	24.83	24.86	25.00
GPRS 2 Tx slots	30.32	30.13	30.10	30.50	24.32	24.13	24.10	24.50
GPRS 3 Tx slots	28.48	28.47	28.48	29.00	24.22	24.21	24.22	24.74
GPRS 4 Tx slots	27.91	27.92	27.93	28.00	24.91	24.92	24.93	25.00
EDGE 1 Tx slot	26.92	26.83	26.80	27.00	17.92	17.83	17.80	18.00
EDGE 2 Tx slots	24.79	24.81	24.77	25.00	18.79	18.81	18.77	19.00
EDGE 3 Tx slots	23.17	23.11	23.04	23.50	18.91	18.85	18.78	19.24
EDGE 4 Tx slots	21.99	21.93	21.84	22.50	18.99	18.93	18.84	19.50

GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM 1 Tx slot	29.90	29.84	29.80	30.00	20.90	20.84	20.80	21.00
GPRS 1 Tx slot	29.83	29.87	29.92	30.00	20.83	20.87	20.92	21.00
GPRS 2 Tx slots	27.17	27.23	27.26	27.50	21.17	21.23	21.26	21.50
GPRS 3 Tx slots	25.37	25.47	25.56	26.00	21.11	21.21	21.30	21.74
GPRS 4 Tx slots	24.71	24.81	24.92	25.00	21.71	21.81	21.92	22.00
EDGE 1 Tx slot	25.78	25.84	25.90	26.00	16.78	16.84	16.90	17.00
EDGE 2 Tx slots	23.57	23.78	23.78	24.00	17.57	17.78	17.78	18.00
EDGE 3 Tx slots	21.83	21.98	21.95	22.00	17.57	17.72	17.69	17.74
EDGE 4 Tx slots	20.66	20.87	20.90	21.00	17.66	17.87	17.90	18.00

<WCDMA Conducted Power>

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

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
    i. Set Gain Factors (β_c and β_d) and parameters were set according to each
    ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
    iii. Set RMC 12.2Kbps + HSDPA mode.
    iv. Set Cell Power = -86 dBm
    v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
    vi. Select HSDPA Uplink Parameters
    vii. Set Delta ACK, Delta NACK and Delta CQI = 8
    viii. Set Ack-Nack Repetition Factor to 3
    ix. Set CQI Feedback Cycle (k) to 4 ms
    x. Set CQI Repetition Factor to 2
    xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

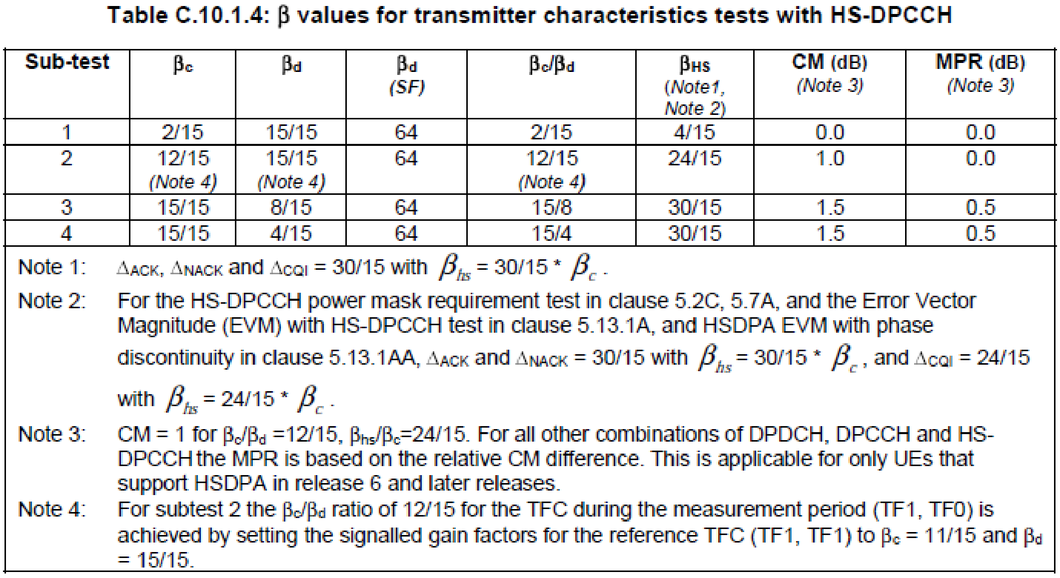


Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

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

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

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

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

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

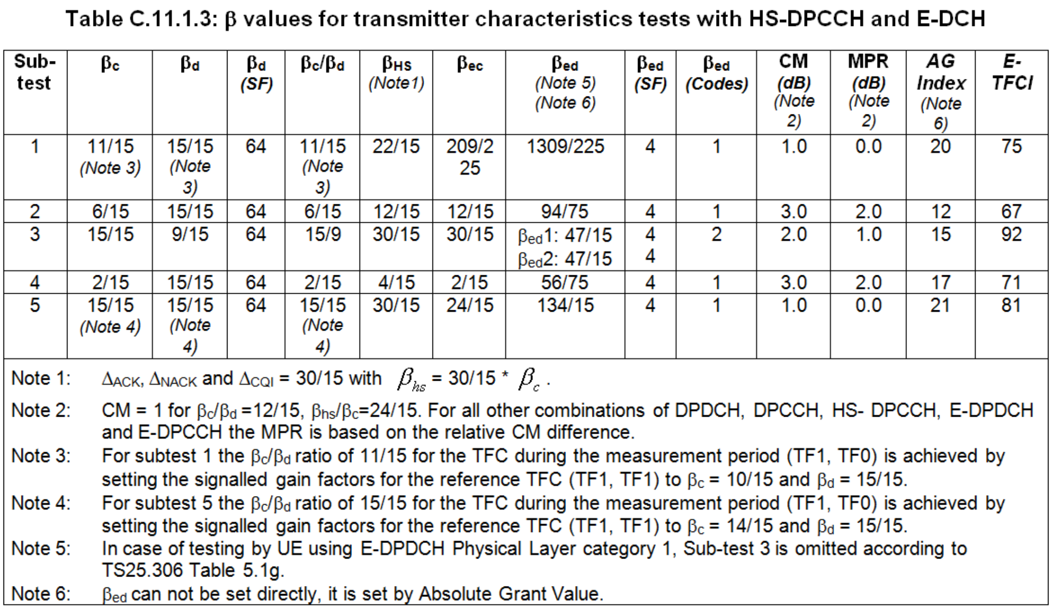


Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 5) (Note 6)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM *(dB) (Note 2)*	MPR *(dB) (Note 2)*	*AG Index (Note 6)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 *(Note 4)*	15/15 *(Note 4)*	64	15/15 *(Note 4)*	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

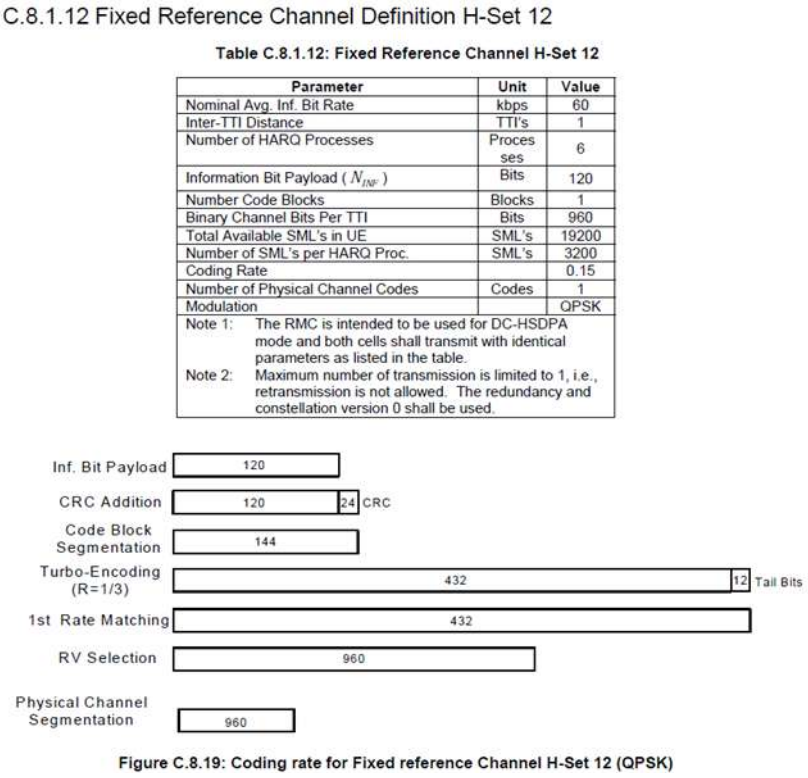
Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

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

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



C.8.1.12 Fixed Reference Channel Definition H-Set 12

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

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

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

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

Band		WCDMA V			Tune-up Limit (dBm)
TX Channel		4132	4182	4233	
Rx Channel		4357	4407	4458	
Frequency (MHz)		826.4	836.4	846.6	
3GPP Rel 99	AMR 12.2Kbps	24.87	24.80	24.91	25.00
3GPP Rel 99	RMC 12.2Kbps	24.89	24.86	24.98	25.00
3GPP Rel 6	HSDPA Subtest-1	23.94	23.83	23.87	24.00
3GPP Rel 6	HSDPA Subtest-2	23.93	23.85	23.91	24.00
3GPP Rel 6	HSDPA Subtest-3	23.50	23.44	23.45	23.50
3GPP Rel 6	HSDPA Subtest-4	23.41	23.38	23.47	23.50
3GPP Rel 8	DC-HSDPA Subtest-1	23.76	23.71	23.74	24.00
3GPP Rel 8	DC-HSDPA Subtest-2	23.75	23.70	23.72	24.00
3GPP Rel 8	DC-HSDPA Subtest-3	23.35	23.26	23.30	23.50
3GPP Rel 8	DC-HSDPA Subtest-4	23.25	23.27	23.31	23.50
3GPP Rel 6	HSUPA Subtest-1	21.89	21.86	21.97	24.00
3GPP Rel 6	HSUPA Subtest-2	21.93	21.90	21.91	22.00
3GPP Rel 6	HSUPA Subtest-3	22.92	22.89	22.88	23.00
3GPP Rel 6	HSUPA Subtest-4	21.41	21.37	21.47	22.00
3GPP Rel 6	HSUPA Subtest-5	23.90	23.80	23.90	24.00

<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 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.

Default Power Mode

<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	24.42	24.42	24.36	24.5	0
10	QPSK	1	25	24.41	24.35	24.34		
10	QPSK	1	49	24.35	24.36	24.33		
10	QPSK	25	0	23.38	23.44	23.11	23.5	1
10	QPSK	25	12	23.40	23.36	23.12		
10	QPSK	25	25	23.40	23.32	23.10		
10	QPSK	50	0	23.45	23.42	23.15		
10	16QAM	1	0	23.38	23.49	23.15	23.5	1
10	16QAM	1	25	23.47	23.40	23.16		
10	16QAM	1	49	23.40	23.31	23.01		
10	16QAM	25	0	22.40	22.36	22.09	22.5	2
10	16QAM	25	12	22.40	22.37	22.10		
10	16QAM	25	25	22.39	22.33	22.10		
10	16QAM	50	0	22.42	22.40	22.12		
Channel				20425	20525	20625	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	24.01	23.95	24.01	24.5	0
5	QPSK	1	12	24.04	24.03	24.04		
5	QPSK	1	24	24.02	23.95	24.02		
5	QPSK	12	0	23.09	23.04	23.09	23.5	1
5	QPSK	12	7	22.99	23.07	22.99		
5	QPSK	12	13	23.08	23.00	23.08		
5	QPSK	25	0	23.00	23.02	23.00		
5	16QAM	1	0	23.10	23.28	23.10	23.5	1
5	16QAM	1	12	23.08	23.24	23.08		
5	16QAM	1	24	23.11	23.02	23.11		
5	16QAM	12	0	22.14	22.50	22.14	22.5	2
5	16QAM	12	7	22.36	22.43	22.36		
5	16QAM	12	13	22.41	22.41	22.41		
5	16QAM	25	0	22.37	22.38	22.37		
Channel				20415	20525	20635	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	23.97	24.02	24.07	24.5	0
3	QPSK	1	8	24.12	24.08	24.01		
3	QPSK	1	14	23.96	23.99	24.04		
3	QPSK	8	0	23.06	23.09	23.17	23.5	1
3	QPSK	8	4	23.03	23.08	23.13		
3	QPSK	8	7	23.01	23.05	23.12		
3	QPSK	15	0	23.07	23.08	23.18		
3	16QAM	1	0	23.02	23.06	23.11	23.5	1
3	16QAM	1	8	23.09	23.14	23.10		
3	16QAM	1	14	23.04	22.98	23.03		
3	16QAM	8	0	22.12	22.46	22.20	22.5	2
3	16QAM	8	4	22.04	22.38	22.16		
3	16QAM	8	7	22.08	22.36	22.15		
3	16QAM	15	0	22.23	22.35	22.17		

Channel				20407	20525	20643	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	24.01	24.05	24.09	24.5	0
1.4	QPSK	1	3	24.03	24.08	24.11		
1.4	QPSK	1	5	24.01	24.04	24.08		
1.4	QPSK	3	0	24.14	24.19	24.17		
1.4	QPSK	3	1	24.09	24.12	24.14		
1.4	QPSK	3	3	24.12	24.15	24.18		
1.4	QPSK	6	0	23.04	23.09	23.14	23.5	1
1.4	16QAM	1	0	23.07	23.11	23.07	23.5	1
1.4	16QAM	1	3	23.11	23.14	23.09		
1.4	16QAM	1	5	23.09	23.10	23.03		
1.4	16QAM	3	0	23.00	23.02	23.01		
1.4	16QAM	3	1	22.96	22.98	22.96		
1.4	16QAM	3	3	22.97	22.95	22.98		
1.4	16QAM	6	0	22.09	22.43	22.17	22.5	2

<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	20850	21100	21350	
Frequency (MHz)				2510	2535	2560	2510	2535	2560	
20	QPSK	1	0	23.24	22.79	21.92	23.3	22.8	22.0	0
20	QPSK	1	49	23.23	22.70	21.55				
20	QPSK	1	99	23.10	22.58	21.57				
20	QPSK	50	0	22.30	21.77	20.77	22.3	21.8	21.0	1
20	QPSK	50	24	22.29	21.71	20.71				
20	QPSK	50	50	22.27	21.80	20.75				
20	QPSK	100	0	22.26	21.78	20.70				
20	16QAM	1	0	22.29	21.76	20.97	22.3	21.8	21.0	1
20	16QAM	1	49	22.27	21.73	20.75				
20	16QAM	1	99	22.26	21.77	20.79				
20	16QAM	50	0	21.25	20.79	19.71	21.3	20.8	20.0	2
20	16QAM	50	24	21.23	20.75	19.56				
20	16QAM	50	50	21.22	20.75	19.60				
20	16QAM	100	0	21.21	20.63	19.62				
Channel				20825	21100	21375	20825	21100	21375	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5	2507.5	2535	2562.5	
15	QPSK	1	0	22.83	22.38	21.72	23.3	22.8	22.0	0
15	QPSK	1	37	22.85	22.31	21.72				
15	QPSK	1	74	22.78	22.12	21.71				
15	QPSK	36	0	21.89	21.42	20.75	22.3	21.8	21.0	1
15	QPSK	36	20	21.87	21.36	20.78				
15	QPSK	36	39	21.86	21.28	20.76				
15	QPSK	75	0	21.87	21.36	20.80				
15	16QAM	1	0	21.94	21.59	20.92	22.3	21.8	21.0	1
15	16QAM	1	37	21.99	21.51	20.89				
15	16QAM	1	74	21.94	21.34	20.91				
15	16QAM	36	0	20.84	20.37	19.68	21.3	20.8	20.0	2
15	16QAM	36	20	20.81	20.31	19.72				
15	16QAM	36	39	20.81	20.22	19.70				
15	16QAM	75	0	20.80	20.30	19.73				
Channel				20800	21100	21400	20800	21100	21400	MPR (dB)
Frequency (MHz)				2505	2535	2565	2505	2535	2565	
10	QPSK	1	0	22.83	22.35	21.69	23.3	22.8	22.0	0
10	QPSK	1	25	22.81	22.26	21.69				
10	QPSK	1	49	22.80	22.16	21.69				
10	QPSK	25	0	21.84	21.38	20.72	22.3	21.8	21.0	1
10	QPSK	25	12	21.85	21.34	20.72				
10	QPSK	25	25	21.83	21.27	20.75				
10	QPSK	50	0	21.87	21.37	20.75				
10	16QAM	1	0	22.00	21.55	20.89	22.3	21.8	21.0	1
10	16QAM	1	25	21.96	21.46	20.89				
10	16QAM	1	49	21.97	21.37	20.87				
10	16QAM	25	0	20.78	20.32	19.66	21.3	20.8	20.0	2
10	16QAM	25	12	20.79	20.26	19.65				
10	16QAM	25	25	20.77	20.21	19.69				
10	16QAM	50	0	20.81	20.30	19.68				

Channel				20775	21100	21425	20775	21100	21425	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5	2502.5	2535	2567.5	
5	QPSK	1	0	22.84	22.30	21.66	23.3	22.8	22.0	0
5	QPSK	1	12	22.85	22.29	21.71				
5	QPSK	1	24	22.78	22.16	21.60				
5	QPSK	12	0	21.88	21.36	20.73	22.3	21.8	21.0	1
5	QPSK	12	7	21.88	21.35	20.73				
5	QPSK	12	13	21.85	21.31	20.73				
5	QPSK	25	0	21.85	21.33	20.71				
5	16QAM	1	0	21.94	21.49	20.84	22.3	21.8	21.0	1
5	16QAM	1	12	21.97	21.48	20.88				
5	16QAM	1	24	21.90	21.35	20.78				
5	16QAM	12	0	20.81	20.31	19.67	21.3	20.8	20.0	2
5	16QAM	12	7	20.81	20.29	19.66				
5	16QAM	12	13	20.79	20.25	19.66				
5	16QAM	25	0	20.79	20.26	19.65				

Reduced Power Mode

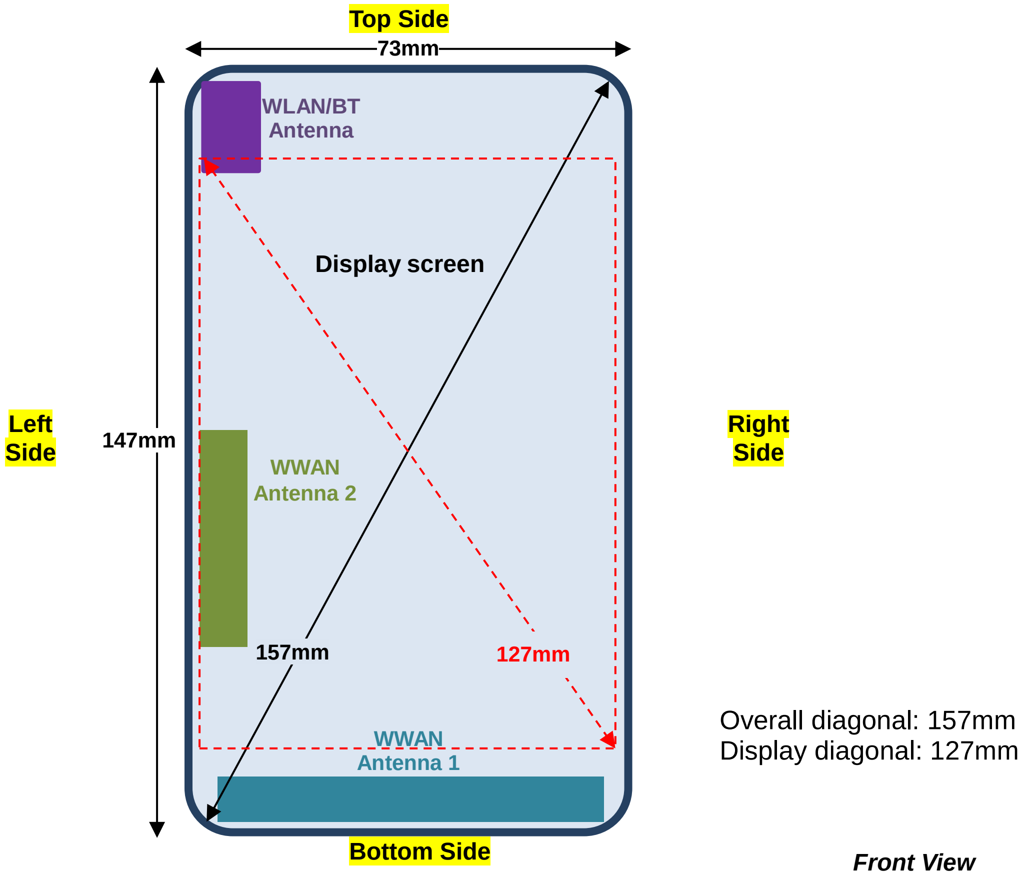
<LTE Band 7>

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	20850	21100	21350	
Frequency (MHz)				2510	2535	2560	2510	2535	2560	
20	QPSK	1	0	18.28	17.80	16.97	18.3	17.8	17.0	0
20	QPSK	1	49	18.21	17.76	16.50				
20	QPSK	1	99	18.14	17.56	16.61				
20	QPSK	50	0	18.27	17.79	16.67	18.3	17.8	17.0	0
20	QPSK	50	24	18.26	17.77	16.54				
20	QPSK	50	50	18.26	17.71	16.61				
20	QPSK	100	0	18.22	17.77	16.60				
20	16QAM	1	0	18.21	17.70	17.00	18.3	17.8	17.0	0
20	16QAM	1	49	18.22	17.71	16.76				
20	16QAM	1	99	18.25	17.79	16.88				
20	16QAM	50	0	18.27	17.75	16.65	18.3	17.8	17.0	0
20	16QAM	50	24	18.22	17.78	16.51				
20	16QAM	50	50	18.24	17.69	16.57				
20	16QAM	100	0	18.20	17.74	16.57				
Channel				20825	21100	21375	20825	21100	21375	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5	2507.5	2535	2562.5	
15	QPSK	1	0	18.24	17.70	16.52	18.3	17.8	17.0	0
15	QPSK	1	37	18.25	17.77	16.52				
15	QPSK	1	74	18.23	17.40	16.59				
15	QPSK	36	0	18.21	17.80	16.54	18.3	17.8	17.0	0
15	QPSK	36	20	18.22	17.77	16.59				
15	QPSK	36	39	18.04	17.75	16.59				
15	QPSK	75	0	17.72	17.75	16.60				
15	16QAM	1	0	17.80	17.71	16.79	18.3	17.8	17.0	0
15	16QAM	1	37	17.86	17.77	16.79				
15	16QAM	1	74	17.96	17.75	16.85				
15	16QAM	36	0	17.62	17.77	16.52	18.3	17.8	17.0	0
15	16QAM	36	20	17.53	17.59	16.56				
15	16QAM	36	39	17.74	17.56	16.59				
15	16QAM	75	0	17.56	17.39	16.61				
Channel				20800	21100	21400	20800	21100	21400	MPR (dB)
Frequency (MHz)				2505	2535	2565	2505	2535	2565	
10	QPSK	1	0	17.70	17.26	16.51	18.3	17.8	17.0	0
10	QPSK	1	25	17.70	17.07	16.58				
10	QPSK	1	49	17.69	17.03	16.60				
10	QPSK	25	0	17.74	17.07	16.58	18.3	17.8	17.0	0
10	QPSK	25	12	17.75	17.04	16.57				
10	QPSK	25	25	17.73	16.82	16.67				
10	QPSK	50	0	17.76	17.00	16.63				
10	16QAM	1	0	18.01	17.35	16.88	18.3	17.8	17.0	0
10	16QAM	1	25	17.99	17.20	16.82				
10	16QAM	1	49	18.01	17.05	16.88				
10	16QAM	25	0	17.73	17.02	16.59	18.3	17.8	17.0	0
10	16QAM	25	12	17.73	16.94	16.58				
10	16QAM	25	25	17.72	16.67	16.59				
10	16QAM	50	0	17.74	16.89	16.58				

Channel				20775	21100	21425	20775	21100	21425	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5	2502.5	2535	2567.5	
5	QPSK	1	0	17.69	17.18	16.50	18.3	17.8	17.0	0
5	QPSK	1	12	17.73	17.10	16.54				
5	QPSK	1	24	17.66	16.92	16.51				
5	QPSK	12	0	17.79	17.27	16.55	18.3	17.8	17.0	0
5	QPSK	12	7	17.78	17.12	16.57				
5	QPSK	12	13	17.76	17.08	16.56				
5	QPSK	25	0	17.75	16.93	16.55				
5	16QAM	1	0	18.00	17.26	16.74	18.3	17.8	17.0	0
5	16QAM	1	12	18.01	17.16	16.84				
5	16QAM	1	24	17.94	17.15	16.76				
5	16QAM	12	0	17.78	16.94	16.54	18.3	17.8	17.0	0
5	16QAM	12	7	17.77	16.96	16.56				
5	16QAM	12	13	17.75	17.03	16.62				
5	16QAM	25	0	17.73	17.03	16.58				

13. Antenna Location

<Mobile Phone>



Front View

WWAN Antenna	Support Band
WWAN Antenna 1	GSM 850 / 1900, WCDMA B5 LTE B5
WWAN Antenna 2	LTE B7

Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Antenna 1	≤ 25mm	≤ 25mm	138 mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Antenna 2	≤ 25mm	≤ 25mm	75 mm	35 mm	66 mm	≤ 25mm
BT / WLAN	≤ 25mm	≤ 25mm	≤ 25mm	130 mm	64 mm	≤ 25mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Antenna 1	Yes	Yes	No	Yes	Yes	Yes
WWAN Antenna 2	Yes	Yes	No	No	No	Yes
BT / WLAN	Yes	Yes	Yes	No	No	Yes

General Note:

1. Referring to KDB 941225 D06 v02r01, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge

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 SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
    c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
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. When hotspot mode is enabled, power reduction will be activated to limit the maximum power of LTE band 7.
5. 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 / EDGE 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/GSM1900 is considered as the primary mode.
2. Other configurations of GSM / GPRS / EDGE 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.

UMTS Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”.
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

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 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	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)
01	GSM850	GPRS (4 Tx slots)	Right Cheek	0mm	251	848.8	27.93	28.00	1.016	0.042	0.603	0.613
	GSM850	GPRS (4 Tx slots)	Right Tilted	0mm	251	848.8	27.93	28.00	1.016	-0.015	0.297	0.302
	GSM850	GPRS (4 Tx slots)	Left Cheek	0mm	251	848.8	27.93	28.00	1.016	-0.038	0.513	0.521
	GSM850	GPRS (4 Tx slots)	Left Tilted	0mm	251	848.8	27.93	28.00	1.016	0.037	0.272	0.276
	GSM1900	GPRS (4 Tx slots)	Right Cheek	0mm	810	1909.8	24.92	25.00	1.019	-0.053	0.136	0.139
	GSM1900	GPRS (4 Tx slots)	Right Tilted	0mm	810	1909.8	24.92	25.00	1.019	-0.15	0.045	0.046
02	GSM1900	GPRS (4 Tx slots)	Left Cheek	0mm	810	1909.8	24.92	25.00	1.019	-0.028	0.138	0.141
	GSM1900	GPRS (4 Tx slots)	Left Tilted	0mm	810	1909.8	24.92	25.00	1.019	0.034	0.044	0.045

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA V	RMC 12.2Kbps	Right Cheek	0mm	4233	846.6	24.98	25.00	1.005	-0.065	0.459	0.461
	WCDMA V	RMC 12.2Kbps	Right Tilted	0mm	4233	846.6	24.98	25.00	1.005	0.166	0.251	0.252
	WCDMA V	RMC 12.2Kbps	Left Cheek	0mm	4233	846.6	24.98	25.00	1.005	-0.113	0.380	0.382
	WCDMA V	RMC 12.2Kbps	Left Tilted	0mm	4233	846.6	24.98	25.00	1.005	-0.041	0.218	0.219

<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)
04	LTE Band 5	10M	QPSK	1	0	Right Cheek	0mm	20525	836.5	24.42	24.50	1.019	-0.02	0.317	0.323
	LTE Band 5	10M	QPSK	25	0	Right Cheek	0mm	20525	836.5	23.44	23.50	1.014	-0.108	0.264	0.268
	LTE Band 5	10M	QPSK	1	0	Right Tilted	0mm	20525	836.5	24.42	24.50	1.019	0.012	0.179	0.182
	LTE Band 5	10M	QPSK	25	0	Right Tilted	0mm	20525	836.5	23.44	23.50	1.014	0.024	0.148	0.150
	LTE Band 5	10M	QPSK	1	0	Left Cheek	0mm	20525	836.5	24.42	24.50	1.019	-0.058	0.287	0.292
	LTE Band 5	10M	QPSK	25	0	Left Cheek	0mm	20525	836.5	23.44	23.50	1.014	0.031	0.235	0.238
	LTE Band 5	10M	QPSK	1	0	Left Tilted	0mm	20525	836.5	24.42	24.50	1.019	-0.036	0.161	0.164
	LTE Band 5	10M	QPSK	25	0	Left Tilted	0mm	20525	836.5	23.44	23.50	1.014	0.086	0.134	0.136
	LTE Band 7	20M	QPSK	1	0	Right Cheek	0mm	20850	2510	23.24	23.30	1.014	0.04	0.162	0.164
	LTE Band 7	20M	QPSK	50	0	Right Cheek	0mm	20850	2510	22.30	22.30	1.000	-0.05	0.135	0.135
	LTE Band 7	20M	QPSK	1	0	Right Tilted	0mm	20850	2510	23.24	23.30	1.014	0.1	0.159	0.161
	LTE Band 7	20M	QPSK	50	0	Right Tilted	0mm	20850	2510	22.30	22.30	1.000	0.06	0.138	0.138
05	LTE Band 7	20M	QPSK	1	0	Left Cheek	0mm	20850	2510	23.24	23.30	1.014	0.12	0.579	0.587
	LTE Band 7	20M	QPSK	50	0	Left Cheek	0mm	20850	2510	22.30	22.30	1.000	0	0.491	0.491
	LTE Band 7	20M	QPSK	1	0	Left Tilted	0mm	20850	2510	23.24	23.30	1.014	0	0.089	0.090
	LTE Band 7	20M	QPSK	50	0	Left Tilted	0mm	20850	2510	22.30	22.30	1.000	-0.07	0.074	0.074

14.2 Hotspot SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	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	10mm	OFF	251	848.8	27.93	28.00	1.016	0.006	0.609	0.619
06	GSM850	GPRS (4 Tx slots)	Back	10mm	OFF	251	848.8	27.93	28.00	1.016	0.02	0.819	0.832
	GSM850	GPRS (4 Tx slots)	Back	10mm	OFF	128	824.2	27.91	28.00	1.021	-0.016	0.361	0.369
	GSM850	GPRS (4 Tx slots)	Back	10mm	OFF	189	836.4	27.92	28.00	1.019	-0.02	0.547	0.557
	GSM850	GPRS (4 Tx slots)	Left Side	10mm	OFF	251	848.8	27.93	28.00	1.016	-0.015	0.320	0.325
	GSM850	GPRS (4 Tx slots)	Right Side	10mm	OFF	251	848.8	27.93	28.00	1.016	0.062	0.478	0.486
	GSM850	GPRS (4 Tx slots)	Bottom Side	10mm	OFF	251	848.8	27.93	28.00	1.016	0.042	0.116	0.118
07	GSM1900	GPRS (4 Tx slots)	Front	10mm	OFF	810	1909.8	24.92	25.00	1.019	-0.055	0.315	0.321
	GSM1900	GPRS (4 Tx slots)	Back	10mm	OFF	810	1909.8	24.92	25.00	1.019	-0.031	0.246	0.251
	GSM1900	GPRS (4 Tx slots)	Left Side	10mm	OFF	810	1909.8	24.92	25.00	1.019	0.05	0.124	0.126
	GSM1900	GPRS (4 Tx slots)	Right Side	10mm	OFF	810	1909.8	24.92	25.00	1.019	-0.054	0.076	0.077
	GSM1900	GPRS (4 Tx slots)	Bottom Side	10mm	OFF	810	1909.8	24.92	25.00	1.019	0.056	0.184	0.187

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Power Reduction	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)
	WCDMA V	RMC 12.2Kbps	Front	10mm	OFF	4233	846.6	24.98	25.00	1.005	-0.039	0.459	0.461
08	WCDMA V	RMC 12.2Kbps	Back	10mm	OFF	4233	846.6	24.98	25.00	1.005	-0.031	0.638	0.641
	WCDMA V	RMC 12.2Kbps	Left Side	10mm	OFF	4233	846.6	24.98	25.00	1.005	-0.098	0.367	0.369
	WCDMA V	RMC 12.2Kbps	Right Side	10mm	OFF	4233	846.6	24.98	25.00	1.005	0.005	0.504	0.506
	WCDMA V	RMC 12.2Kbps	Bottom Side	10mm	OFF	4233	846.6	24.98	25.00	1.005	-0.172	0.079	0.079

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	Power Reduction	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	0	Front	10mm	OFF	20525	836.5	24.42	24.50	1.019	-0.126	0.350	0.357
	LTE Band 5	10M	QPSK	25	0	Front	10mm	OFF	20525	836.5	23.44	23.50	1.014	-0.14	0.290	0.294
09	LTE Band 5	10M	QPSK	1	0	Back	10mm	OFF	20525	836.5	24.42	24.50	1.019	0.026	0.482	0.491
	LTE Band 5	10M	QPSK	25	0	Back	10mm	OFF	20525	836.5	23.44	23.50	1.014	0.019	0.396	0.402
	LTE Band 5	10M	QPSK	1	0	Left Side	10mm	OFF	20525	836.5	24.42	24.50	1.019	0.027	0.101	0.103
	LTE Band 5	10M	QPSK	25	0	Left Side	10mm	OFF	20525	836.5	23.44	23.50	1.014	-0.061	0.082	0.083
	LTE Band 5	10M	QPSK	1	0	Right Side	10mm	OFF	20525	836.5	24.42	24.50	1.019	-0.012	0.257	0.262
	LTE Band 5	10M	QPSK	25	0	Right Side	10mm	OFF	20525	836.5	23.44	23.50	1.014	-0.02	0.212	0.215
	LTE Band 5	10M	QPSK	1	0	Bottom Side	10mm	OFF	20525	836.5	24.42	24.50	1.019	-0.091	0.058	0.059
	LTE Band 5	10M	QPSK	25	0	Bottom Side	10mm	OFF	20525	836.5	23.44	23.50	1.014	0.054	0.050	0.051
	LTE Band 7	20M	QPSK	1	0	Front	10mm	ON	20850	2510	18.28	18.30	1.005	0.1	0.095	0.095
	LTE Band 7	20M	QPSK	50	0	Front	10mm	ON	20850	2510	18.27	18.30	1.007	-0.12	0.100	0.101
	LTE Band 7	20M	QPSK	1	0	Back	10mm	ON	20850	2510	18.28	18.30	1.005	-0.18	0.527	0.529
10	LTE Band 7	20M	QPSK	50	0	Back	10mm	ON	20850	2510	18.27	18.30	1.007	-0.1	0.565	0.569
	LTE Band 7	20M	QPSK	1	0	Left Side	10mm	ON	20850	2510	18.28	18.30	1.005	-0.05	0.302	0.303
	LTE Band 7	20M	QPSK	50	0	Left Side	10mm	ON	20850	2510	18.27	18.30	1.007	0.06	0.385	0.388

14.3 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	15mm	251	848.8	27.93	28.00	1.016	0.105	0.533	0.542
11	GSM850	GPRS (4 Tx slots)	Back	15mm	251	848.8	27.93	28.00	1.016	0.003	0.619	0.629
12	GSM1900	GPRS (4 Tx slots)	Front	15mm	810	1909.8	24.92	25.00	1.019	-0.004	0.177	0.180
	GSM1900	GPRS (4 Tx slots)	Back	15mm	810	1909.8	24.92	25.00	1.019	-0.016	0.153	0.156

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	15mm	4233	846.6	24.98	25.00	1.005	-0.029	0.429	0.431
13	WCDMA V	RMC 12.2Kbps	Back	15mm	4233	846.6	24.98	25.00	1.005	-0.123	0.540	0.542

<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	0	Front	15mm	20525	836.5	24.42	24.50	1.019	-0.128	0.337	0.343
	LTE Band 5	10M	QPSK	25	0	Front	15mm	20525	836.5	23.44	23.50	1.014	-0.196	0.289	0.293
14	LTE Band 5	10M	QPSK	1	0	Back	15mm	20525	836.5	24.42	24.50	1.019	0	0.396	0.403
	LTE Band 5	10M	QPSK	25	0	Back	15mm	20525	836.5	23.44	23.50	1.014	-0.1	0.337	0.342
	LTE Band 7	20M	QPSK	1	0	Front	15mm	20850	2510	23.24	23.30	1.014	-0.06	0.146	0.148
	LTE Band 7	20M	QPSK	50	0	Front	15mm	20850	2510	22.30	22.30	1.000	0.01	0.122	0.122
	LTE Band 7	20M	QPSK	1	0	Back	15mm	20850	2510	23.24	23.30	1.014	-0.08	0.801	0.812
	LTE Band 7	20M	QPSK	1	0	Back	15mm	21100	2535	22.79	22.80	1.002	-0.07	1.060	1.062
15	LTE Band 7	20M	QPSK	1	0	Back	15mm	21350	2560	21.92	22.00	1.019	0	1.110	1.131
	LTE Band 7	20M	QPSK	50	0	Back	15mm	20850	2510	22.30	22.30	1.000	-0.03	0.683	0.683
	LTE Band 7	20M	QPSK	100	0	Back	15mm	20850	2510	22.26	22.30	1.009	-0.07	0.715	0.722

14.4 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	GSM850					GPRS (4 Tx slots)	Back	10mm	OFF	251	848.8	27.93	28.00	1.016	0.02	0.819		0.832
2nd	GSM850					GPRS (4 Tx slots)	Back	10mm	OFF	251	848.8	27.93	28.00	1.016	-0.012	0.801	1.02	0.814
1st	LTE Band 7	20M	QPSK	1	0		Back	15mm	-	21350	2560	21.92	22.00	1.019	0	1.110		1.131
2nd	LTE Band 7	20M	QPSK	1	0		Back	15mm	-	21350	2560	21.92	22.00	1.019	-0.07	1.080	1.03	1.100

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	Hotspot
1.	GSM Voice + WLAN2.4GHz	Yes	Yes	
2.	GPRS/EDGE + WLAN2.4GHz	Yes	Yes	Yes
3.	WCDMA + WLAN2.4GHz	Yes	Yes	Yes
4.	LTE + WLAN2.4GHz	Yes	Yes	Yes
5.	GSM Voice + Bluetooth		Yes	
6.	GPRS/EDGE + Bluetooth		Yes	
7.	WCDMA+ Bluetooth		Yes	
8.	LTE + Bluetooth		Yes	

General Note:

1. In this report, WLAN / BT SAR test results are referred to LG-X240H (FCC ID : ZNFX240H), Sporton Report No: FA6O1802 or Appendix D and used to perform transmission simultaneous analysis.
2. This device 2.4GHz WLAN supports Hotspot operation.
3. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
4. The Scaled 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.
6. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v06 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[√f(GHz)/*x*] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.

Bluetooth Max Power	Exposure Position	Body worn
	Test separation	15 mm
8dBm	Estimated SAR (W/kg)	0.084W/kg

15.1 Head Exposure Conditions

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	2 2.4GHz WLAN 1g SAR (W/kg)	**1+2 Summed 1g SAR (W/kg)**
GSM	GSM850	Right Cheek	0.613	0.977	**1.590**
		Right Tilted	0.302	0.600	**0.902**
		Left Cheek	0.521	0.427	**0.948**
		Left Tilted	0.276	0.485	**0.761**
	GSM1900	Right Cheek	0.139	0.977	**1.116**
		Right Tilted	0.046	0.600	**0.646**
		Left Cheek	0.141	0.427	**0.568**
		Left Tilted	0.045	0.485	**0.530**
WCDMA	WCDMA V	Right Cheek	0.461	0.977	**1.438**
		Right Tilted	0.252	0.600	**0.852**
		Left Cheek	0.382	0.427	**0.809**
		Left Tilted	0.219	0.485	**0.704**
LTE	LTE Band 5	Right Cheek	0.323	0.977	**1.300**
		Right Tilted	0.182	0.600	**0.782**
		Left Cheek	0.292	0.427	**0.719**
		Left Tilted	0.164	0.485	**0.649**
	LTE Band 7	Right Cheek	0.164	0.977	**1.141**
		Right Tilted	0.161	0.600	**0.761**
		Left Cheek	0.587	0.427	**1.014**
		Left Tilted	0.090	0.485	**0.575**

15.2 Hotspot Exposure Conditions

WWAN Band		Exposure Position	1	2	1+2 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	
			1g SAR (W/kg)	1g SAR (W/kg)	
GSM	GSM850	Front	0.619	0.124	**0.743**
		Back	0.832	0.106	**0.938**
		Left side	0.325	0.055	**0.380**
		Right side	0.486		**0.486**
		Top side		0.077	**0.077**
		Bottom side	0.118		**0.118**
	GSM1900	Front	0.321	0.124	**0.445**
		Back	0.251	0.106	**0.357**
		Left side	0.126	0.055	**0.181**
		Right side	0.077		**0.077**
		Top side		0.077	**0.077**
		Bottom side	0.187		**0.187**
WCDMA	WCDMA V	Front	0.461	0.124	**0.585**
		Back	0.641	0.106	**0.747**
		Left side	0.369	0.055	**0.424**
		Right side	0.506		**0.506**
		Top side		0.077	**0.077**
		Bottom side	0.079		**0.079**
LTE	LTE Band 5	Front	0.357	0.124	**0.481**
		Back	0.491	0.106	**0.597**
		Left side	0.103	0.055	**0.158**
		Right side	0.262		**0.262**
		Top side		0.077	**0.077**
		Bottom side	0.059		**0.059**
	LTE Band 7	Front	0.101	0.124	**0.225**
		Back	0.569	0.106	**0.675**
		Left side	0.388	0.055	**0.443**
		Right side			**0.000**
		Top side		0.077	**0.077**
		Bottom side			**0.000**

15.3 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	Estimated 1g SAR (W/kg)		
GSM	GSM850	Front	0.542	0.045	0.084	**0.587**	**0.626**
		Back	0.629	0.051	0.084	**0.680**	**0.713**
	GSM1900	Front	0.180	0.045	0.084	**0.225**	**0.264**
		Back	0.156	0.051	0.084	**0.207**	**0.240**
WCDMA	WCDMA V	Front	0.431	0.045	0.084	**0.476**	**0.515**
		Back	0.542	0.051	0.084	**0.593**	**0.626**
LTE	LTE Band 5	Front	0.343	0.045	0.084	**0.388**	**0.427**
		Back	0.403	0.051	0.084	**0.454**	**0.487**
	LTE Band 7	Front	0.148	0.045	0.084	**0.193**	**0.232**
		Back	1.131	0.051	0.084	**1.182**	**1.215**

Test Engineer： San Lin Thomas Wang Steven Chang Tommy Chen Kurt Liu Iran Wang and Ken Li

16. Uncertainty Assessment

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

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

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

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

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 16.1. Standard Uncertainty for Assumed Distribution

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

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

Error Description	**Uncertainty Value (±%)**	**Probability**	**Divisor**	**(Ci) 1g**	**(Ci) 10g**	**Standard Uncertainty (1g) (±%)**	**Standard Uncertainty (10g) (±%)**
Measurement System							
Probe Calibration	6.00	N	1	1	1	6.0	6.0
Axial Isotropy	4.70	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.60	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.00	R	1.732	1	1	0.6	0.6
Linearity	4.70	R	1.732	1	1	2.7	2.7
System Detection Limits	1.00	R	1.732	1	1	0.6	0.6
Modulation Response	4.68	R	1.732	1	1	2.7	2.7
Readout Electronics	0.30	N	1	1	1	0.3	0.3
Response Time	0.00	R	1.732	1	1	0.0	0.0
Integration Time	2.60	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.00	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.00	R	1.732	1	1	1.7	1.7
Probe Positioner	0.40	R	1.732	1	1	0.2	0.2
Probe Positioning	2.90	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.00	R	1.732	1	1	1.2	1.2
Test Sample Related							
Device Positioning	3.03	N	1	1	1	3.0	3.0
Device Holder	3.60	N	1	1	1	3.6	3.6
Power Drift	5.00	R	1.732	1	1	2.9	2.9
Power Scaling	0.00	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.10	R	1.732	1	1	3.5	3.5
SAR correction	0.00	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.03	N	1	0.78	0.71	0.0	0.0
Liquid Conductivity (target)	5.00	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.50	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.68	R	1.732	0.78	0.71	1.7	1.5
Liquid Permittivity Repeatability	0.02	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.00	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.50	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.84	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						11.6%	11.6%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						23.2%	23.1%

Table 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

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 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

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

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

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

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

[10] FCC KDB 941225 D06 v02r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2015.

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

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

Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Head_835MHz

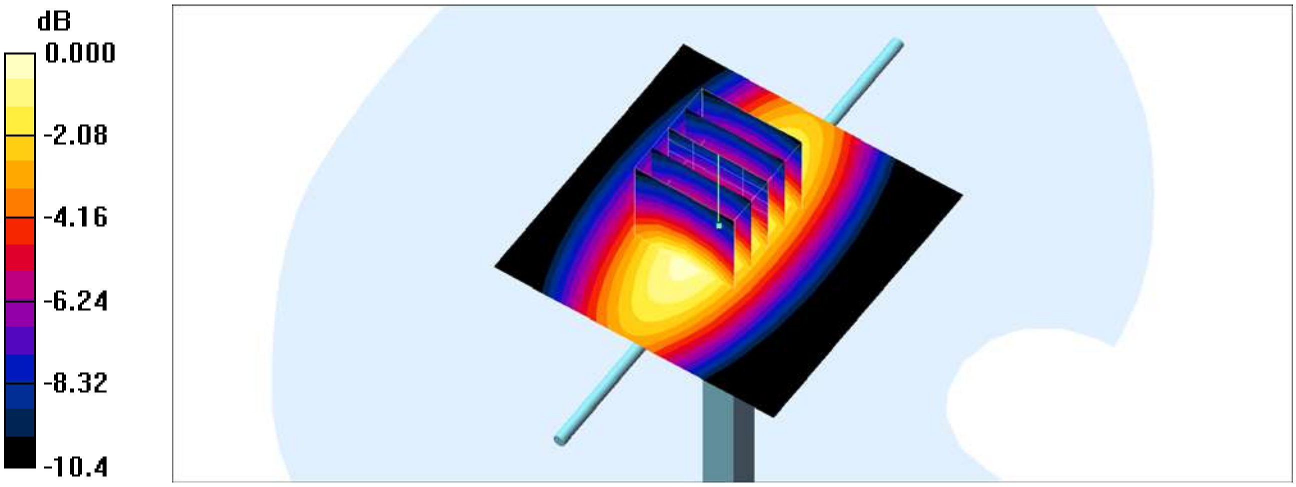
DUT: D835V2-499

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_850_170203 Medium parameters used: f = 835 MHz; σ = 0.887 mho/m; ε_r = 43.4; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.08 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 60.3 V/m; Power Drift = 0.022 dB
Peak SAR (extrapolated) = 3.45 W/kg
SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.57 mW/g
Maximum value of SAR (measured) = 3.11 mW/g



0 dB = 3.11mW/g

System Check_Body_835MHz

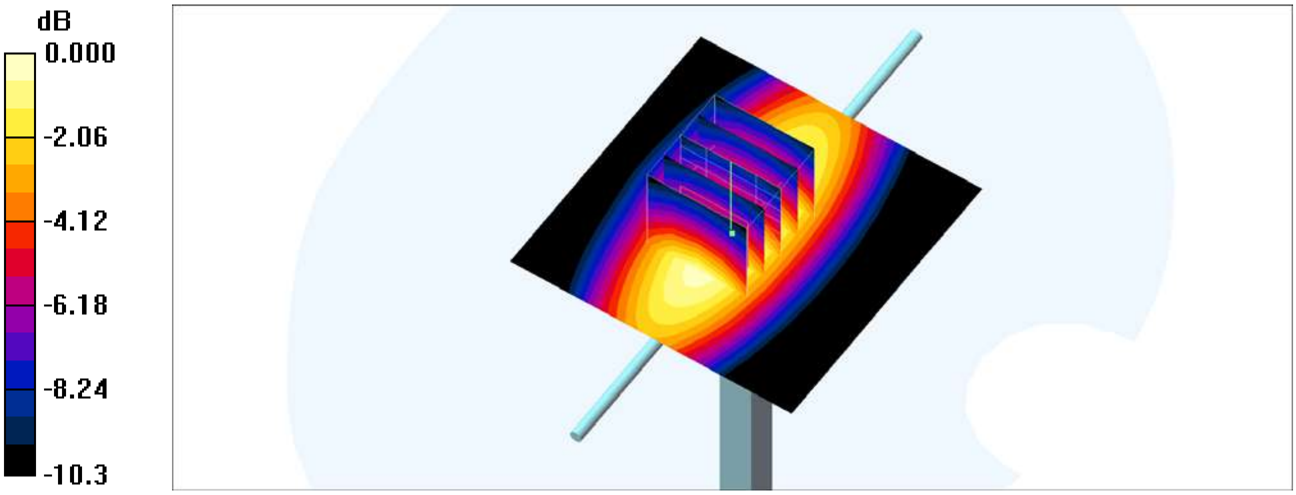
DUT: D835V2-4d200

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_850_170203 Medium parameters used: f = 835 MHz; $\sigma = 0.933$ mho/m; $\varepsilon_r = 53.8$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.06 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 59.8 V/m; Power Drift = -0.095 dB
Peak SAR (extrapolated) = 3.38 W/kg
SAR(1 g) = 2.33 mW/g; SAR(10 g) = 1.55 mW/g
Maximum value of SAR (measured) = 3.05 mW/g



0 dB = 3.05mW/g

System Check_Head_1900MHz

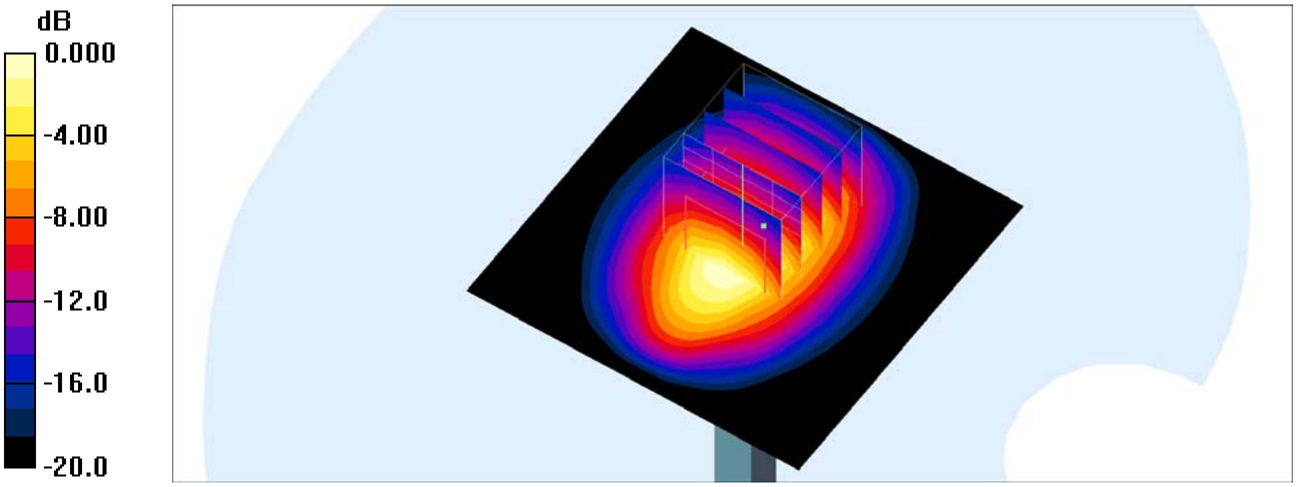
DUT: D1900V2-5d210

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170206 Medium parameters used: f = 1900 MHz; $\sigma = 1.43$ mho/m; $\varepsilon_r = 41.3$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8.3, 8.3, 8.3); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.5 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 105.2 V/m; Power Drift = 0.100 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 9.93 mW/g; SAR(10 g) = 5.16 mW/g
Maximum value of SAR (measured) = 15.5 mW/g



0 dB = 15.5mW/g

System Check_Body_1900MHz

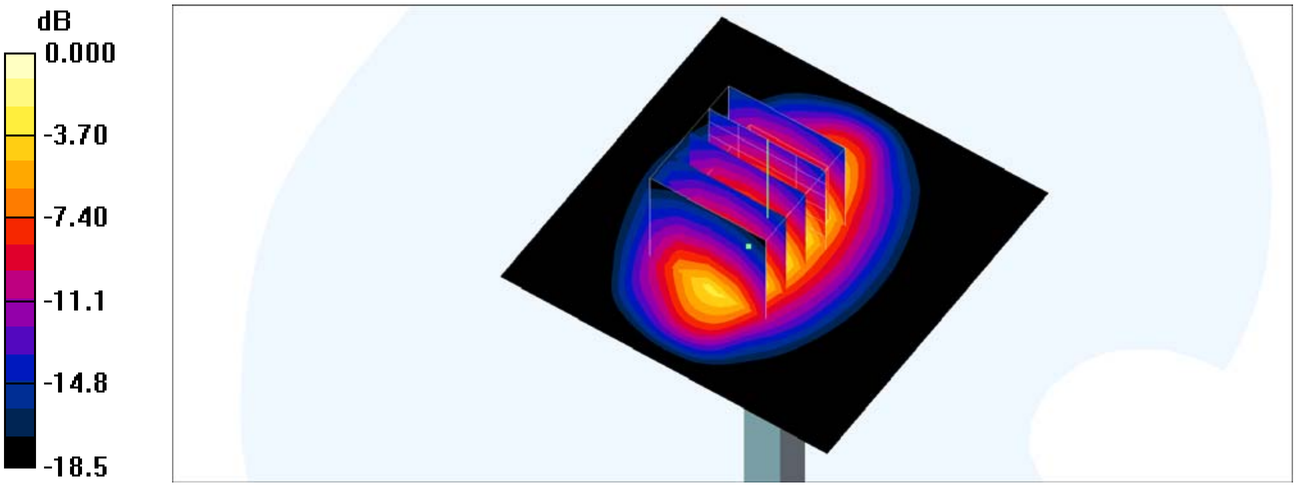
DUT: D1900V2-5d210

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_170204 Medium parameters used: f = 1900 MHz; $\sigma = 1.53$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 15.4 mW/g

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 99.9 V/m; Power Drift = 0.124 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.35 mW/g
Maximum value of SAR (measured) = 15.1 mW/g



0 dB = 15.1mW/g

System Check_Head_2600MHz

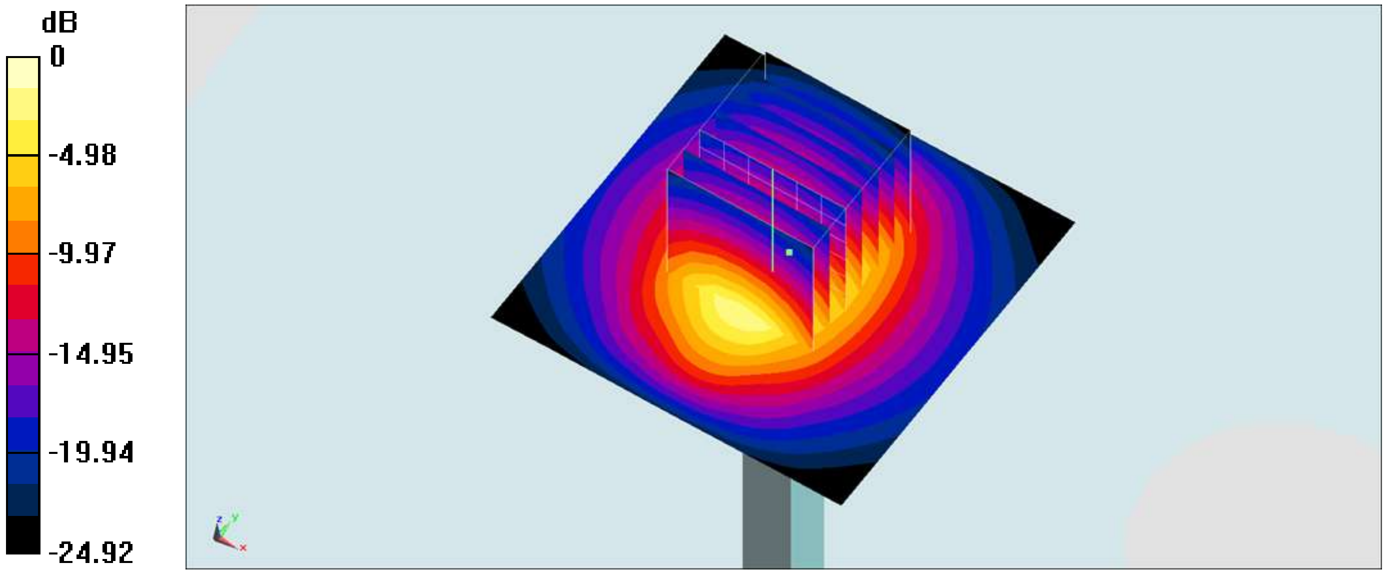
DUT: D2600V2-1008

Communication System: CW ; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: HSL_2600_170202 Medium parameters used: f = 2600 MHz; σ = 1.982 S/m; ε_r = 39.622; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Left; Type: QD000P40CD; Serial: TP:1644
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 22.1 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.7 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.39 W/kg
Maximum value of SAR (measured) = 22.4 W/kg



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

System Check_Body_2600MHz

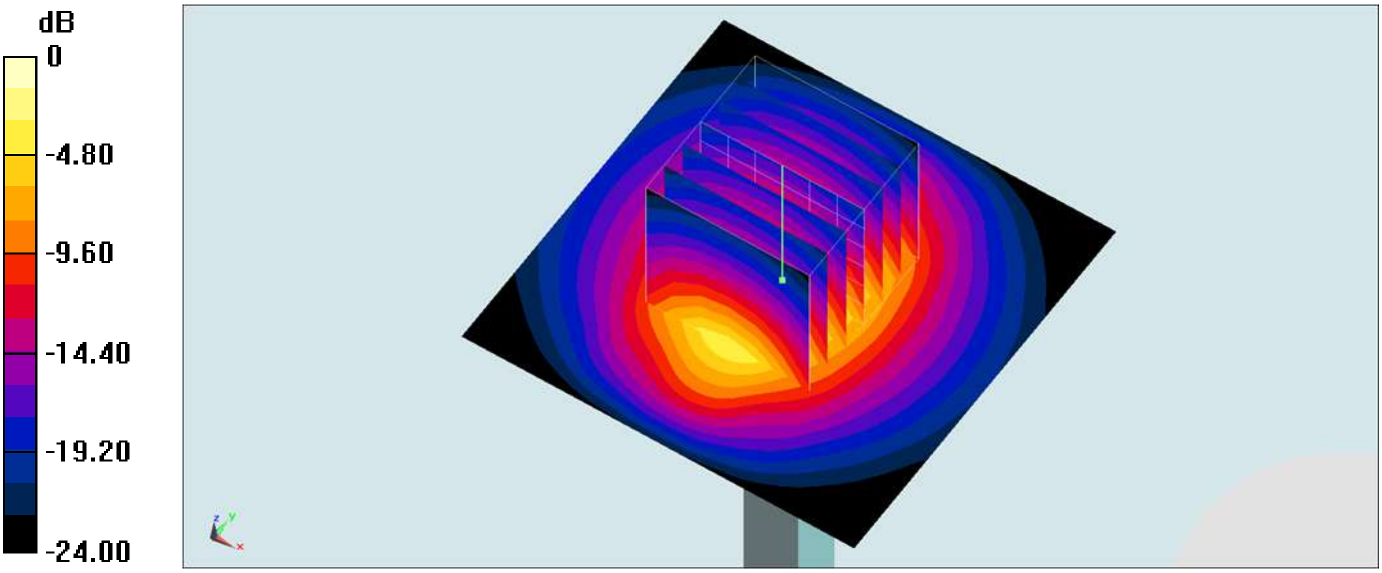
DUT: D2600V2-1008

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL_2600_170126 Medium parameters used: f = 2600 MHz; $\sigma = 2.188$ S/m; $\varepsilon_r = 52.53$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM-Right; Type: SAM; Serial: 1795
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 23.2 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.7 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.03 W/kg
Maximum value of SAR (measured) = 23.5 W/kg



0 dB = 23.5 W/kg = 13.71 dBW/kg

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

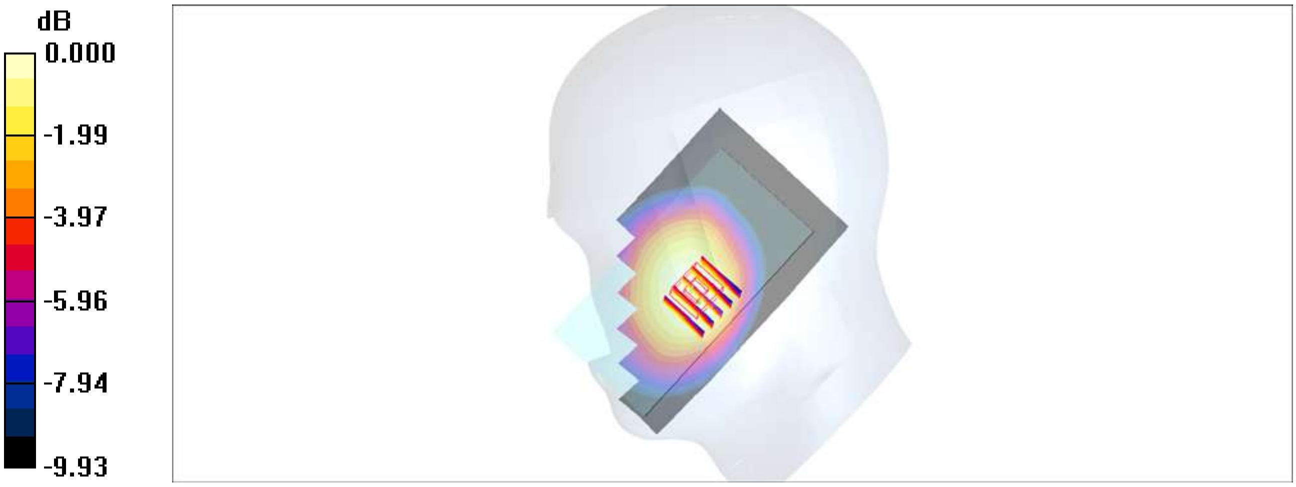
#01_GSM850_GPRS (4 Tx slots)_Right Cheek_Ch251

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:2.08
Medium: HSL_850_170203 Medium parameters used: f = 849 MHz; σ = 0.901 mho/m; ε_r = 43.2; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.744 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.0 V/m; Power Drift = 0.042 dB
Peak SAR (extrapolated) = 0.764 W/kg
SAR(1 g) = 0.603 mW/g; SAR(10 g) = 0.463 mW/g
Maximum value of SAR (measured) = 0.703 mW/g



0 dB = 0.703mW/g

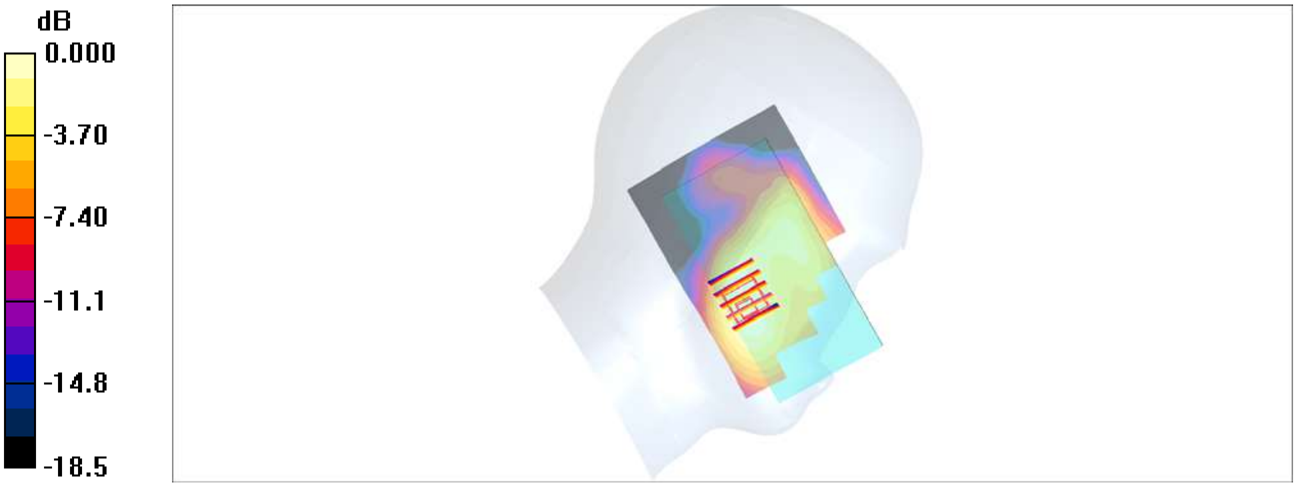
#02_GSM1900_GPRS (4 Tx slots)_Left Cheek_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:2.08
Medium: HSL_1900_170206 Medium parameters used: f = 1910 MHz; $\sigma = 1.44$ mho/m; $\varepsilon_r = 41.2$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8.3, 8.3, 8.3); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.185 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.56 V/m; Power Drift = -0.028 dB
Peak SAR (extrapolated) = 0.226 W/kg
SAR(1 g) = 0.138 mW/g; SAR(10 g) = 0.086 mW/g
Maximum value of SAR (measured) = 0.187 mW/g



0 dB = 0.187mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date/Time: 2017/2/3

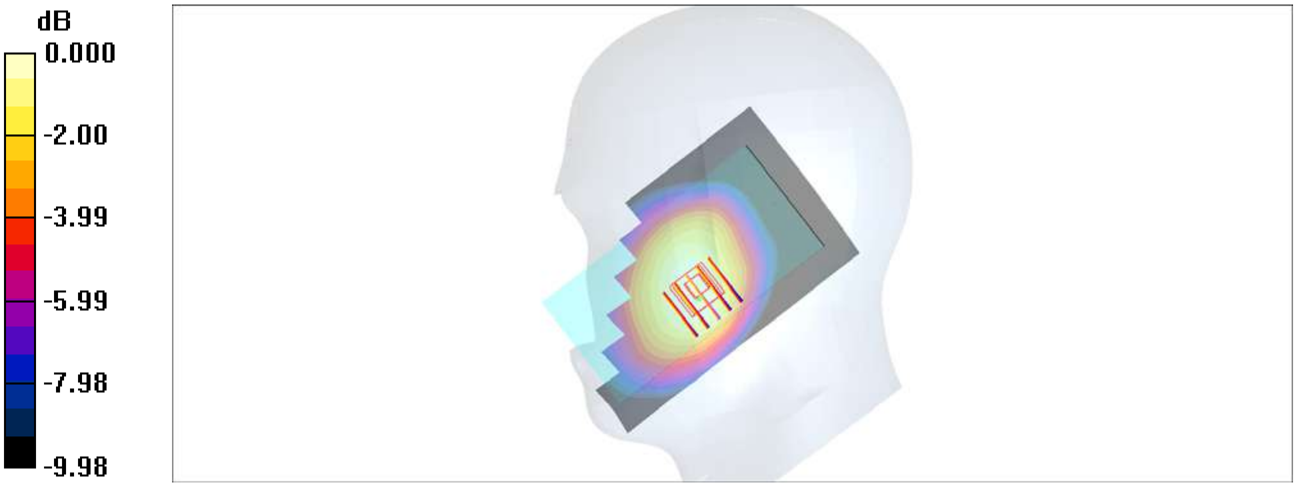
#03_WCDMA V_RMC 12.2Kbps_Right Cheek_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: HSL_850_170203 Medium parameters used: f = 847 MHz; $\sigma = 0.899$ mho/m; $\varepsilon_r = 43.3$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.556 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.4 V/m; Power Drift = -0.065 dB
Peak SAR (extrapolated) = 0.562 W/kg
SAR(1 g) = 0.459 mW/g; SAR(10 g) = 0.354 mW/g
Maximum value of SAR (measured) = 0.525 mW/g



0 dB = 0.525mW/g

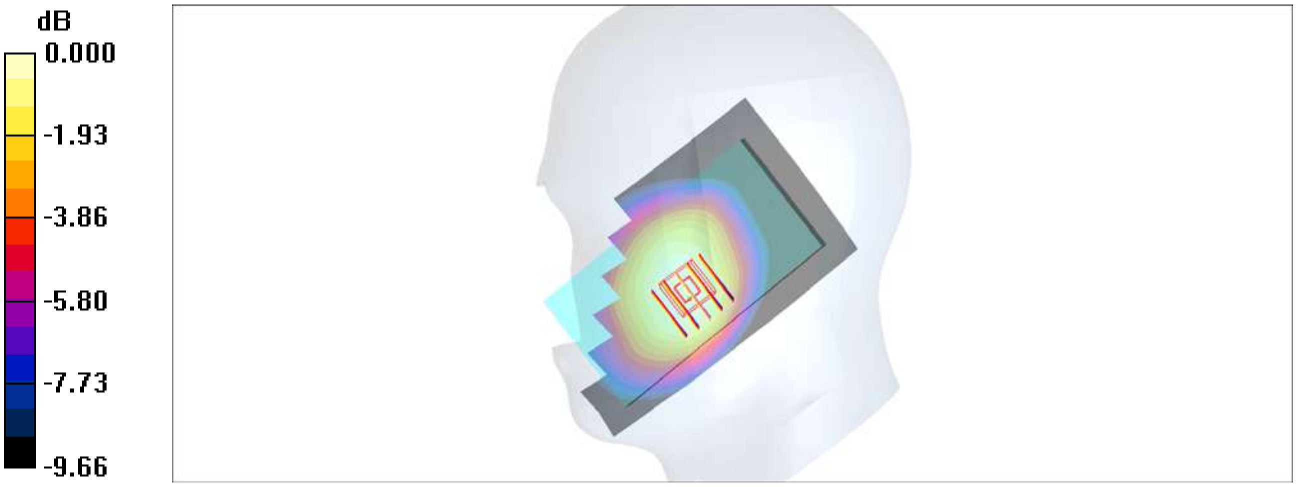
#04_LTE Band 5_10M_QPSK_1_0_Right Cheek_Ch20525

Communication System: LTE; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: HSL_850_170203 Medium parameters used: f = 836.5 MHz; $\sigma = 0.888$ mho/m; $\varepsilon_r = 43.4$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.92, 9.92, 9.92); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.387 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.2 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 0.389 W/kg
SAR(1 g) = 0.317 mW/g; SAR(10 g) = 0.246 mW/g
Maximum value of SAR (measured) = 0.367 mW/g



0 dB = 0.367mW/g

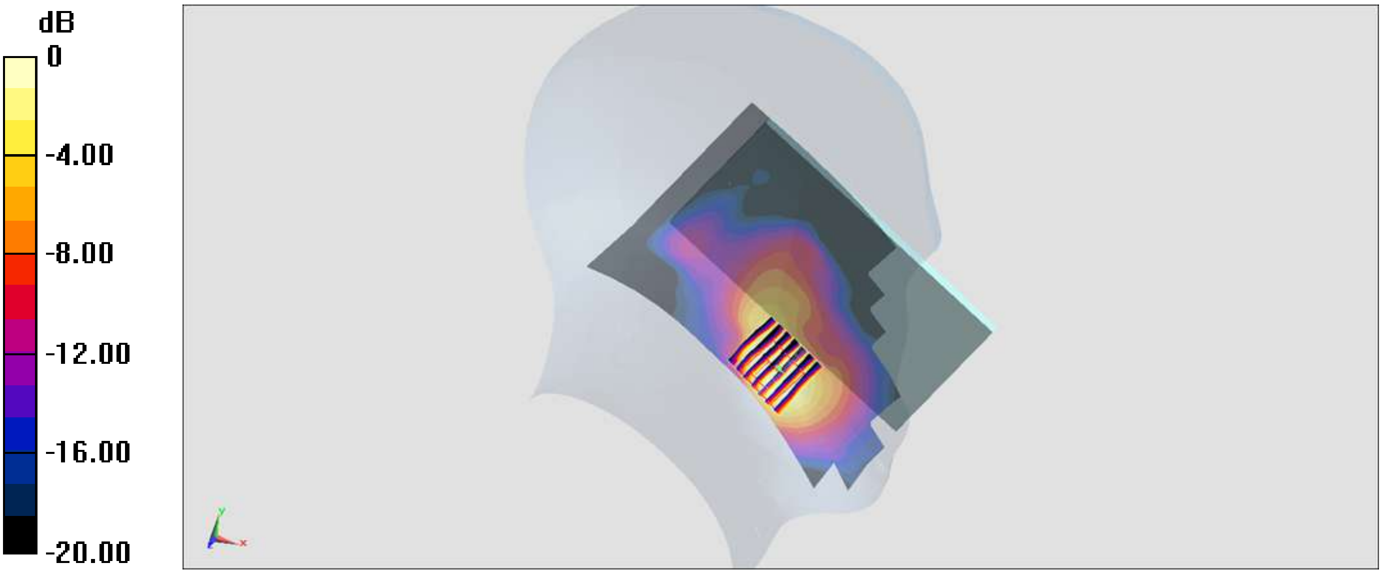
#05_LTE Band 7_20M_QPSK_1_0_Left Cheek_Ch20850

Communication System: LTE; Frequency: 2510 MHz;Duty Cycle: 1:1
Medium: HSL_2600_170202 Medium parameters used: f = 2510 MHz; $\sigma = 1.875$ S/m; $\varepsilon_r = 39.951$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.28, 7.28, 7.28); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Left; Type: QD000P40CD; Serial: TP:1644
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Area Scan (91x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.15 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.08 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.579 W/kg; SAR(10 g) = 0.291 W/kg
Maximum value of SAR (measured) = 0.888 W/kg



0 dB = 0.888 W/kg = -0.52 dBW/kg

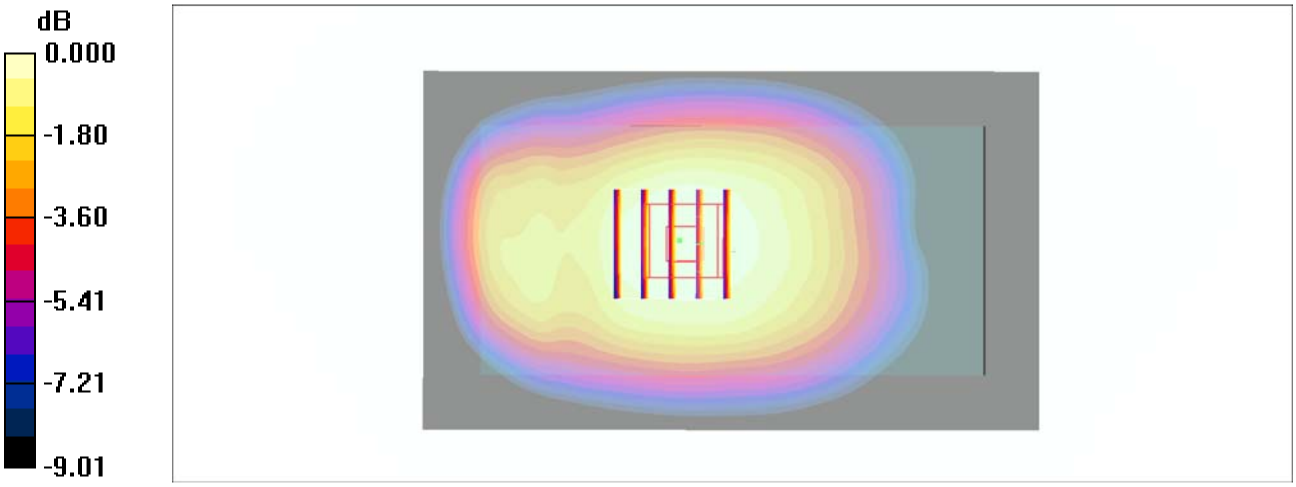
#06_GSM850_GPRS (4 Tx slots)_Back_10mm_Ch251

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:2.08
Medium: MSL_850_170203 Medium parameters used: f = 849 MHz; σ = 0.946 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.981 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.7 V/m; Power Drift = 0.020 dB
Peak SAR (extrapolated) = 1.07 W/kg
SAR(1 g) = 0.819 mW/g; SAR(10 g) = 0.633 mW/g
Maximum value of SAR (measured) = 0.982 mW/g



0 dB = 0.982mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/2/4

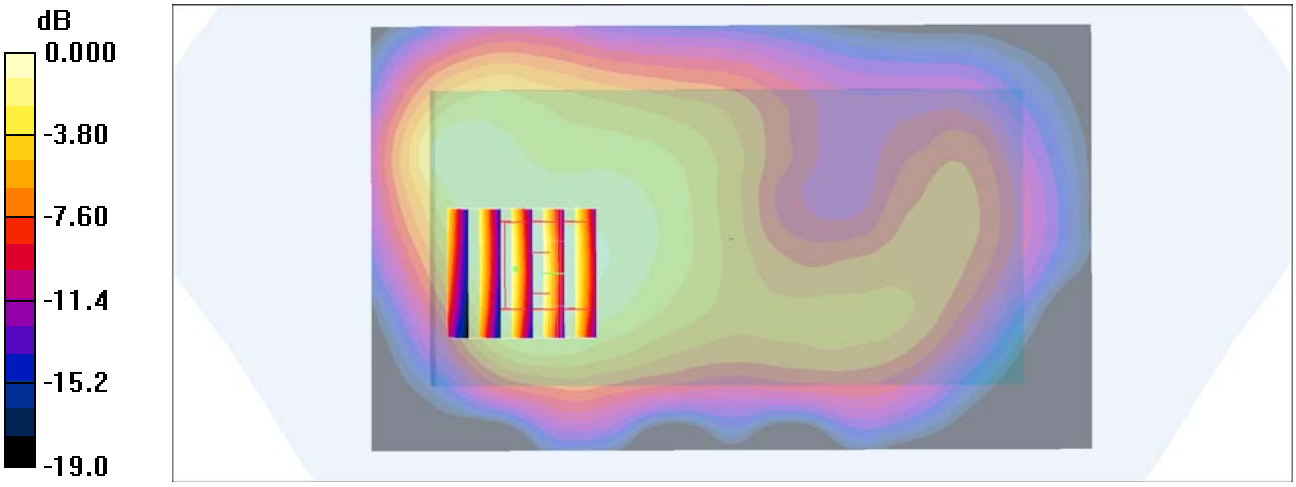
#07_GSM1900_GPRS (4 Tx slots)_Front_10mm_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:2.08
Medium: MSL_1900_170204 Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.427 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.2 V/m; Power Drift = -0.055 dB
Peak SAR (extrapolated) = 0.495 W/kg
SAR(1 g) = 0.315 mW/g; SAR(10 g) = 0.196 mW/g
Maximum value of SAR (measured) = 0.421 mW/g



0 dB = 0.421mW/g

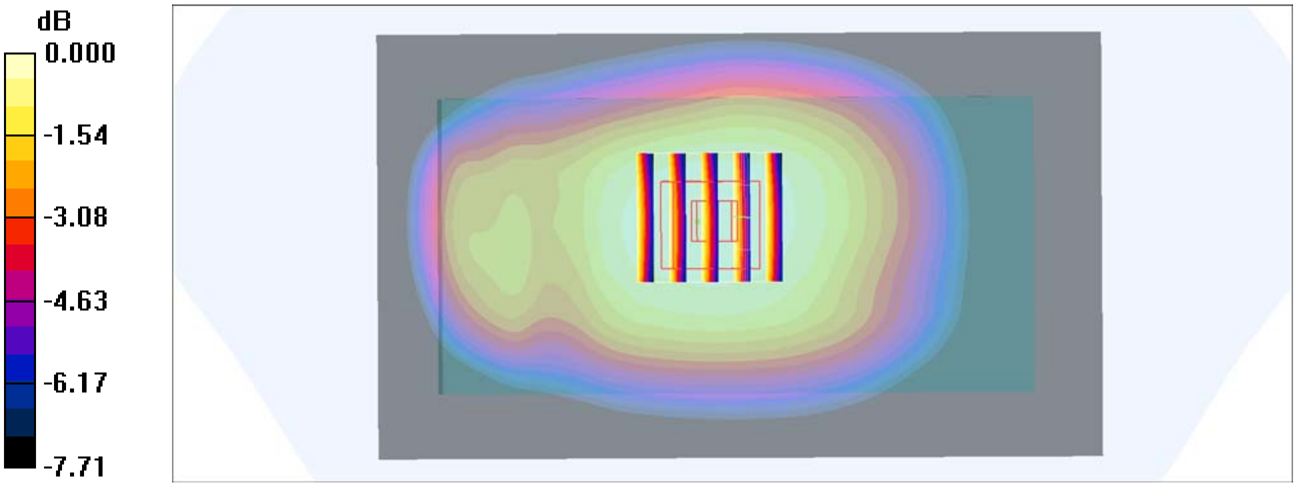
#08_WCDMA V_RMC 12.2Kbps_Back_10mm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_170203 Medium parameters used: f = 847 MHz; σ = 0.944 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.759 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.5 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 0.810 W/kg
SAR(1 g) = 0.638 mW/g; SAR(10 g) = 0.495 mW/g
Maximum value of SAR (measured) = 0.754 mW/g



0 dB = 0.754mW/g

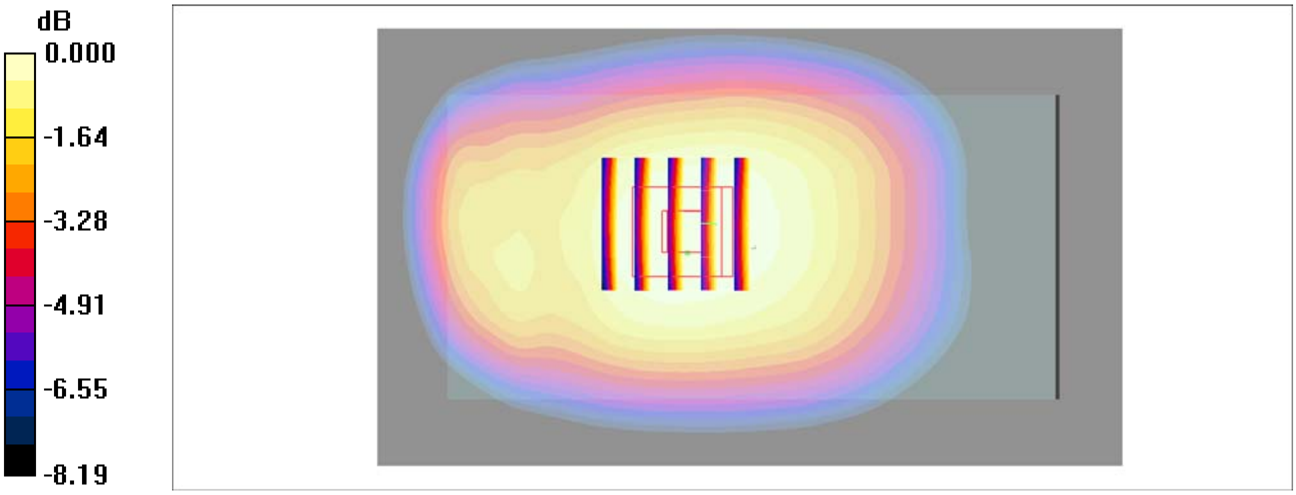
#09_LTE Band 5_10M_QPSK_1_0_Back_10mm_Ch20525

Communication System: LTE; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: MSL_850_170203 Medium parameters used : f = 836.5 MHz; σ = 0.935 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.568 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.5 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 0.614 W/kg
SAR(1 g) = 0.482 mW/g; SAR(10 g) = 0.374 mW/g
Maximum value of SAR (measured) = 0.570 mW/g



0 dB = 0.570mW/g

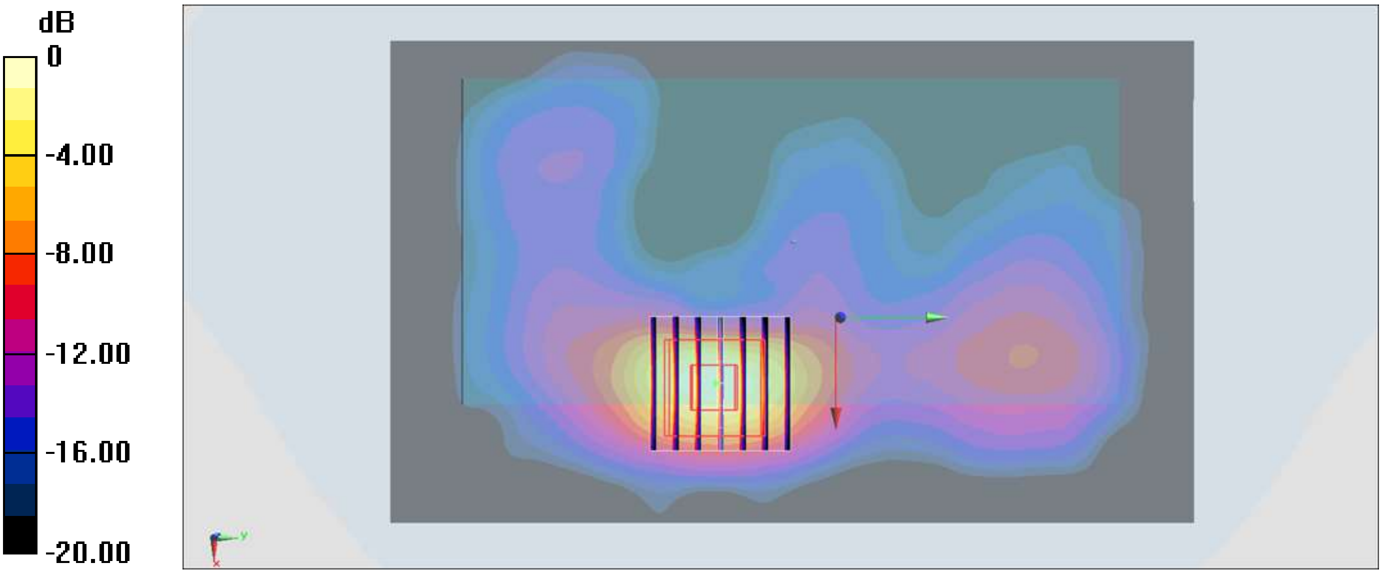
#10_LTE Band 7_20M_QPSK_50_0_Back_10mm_Ch20850

Communication System: LTE; Frequency: 2510 MHz;Duty Cycle: 1:1
Medium: MSL_2600_170126 Medium parameters used: f = 2510 MHz; σ = 2.064 S/m; ε_r = 52.847; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM-Right; Type: SAM; Serial: 1795
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Area Scan (91x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.979 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.08 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.565 W/kg; SAR(10 g) = 0.235 W/kg
Maximum value of SAR (measured) = 0.974 W/kg



0 dB = 0.974 W/kg = -0.11 dBW/kg

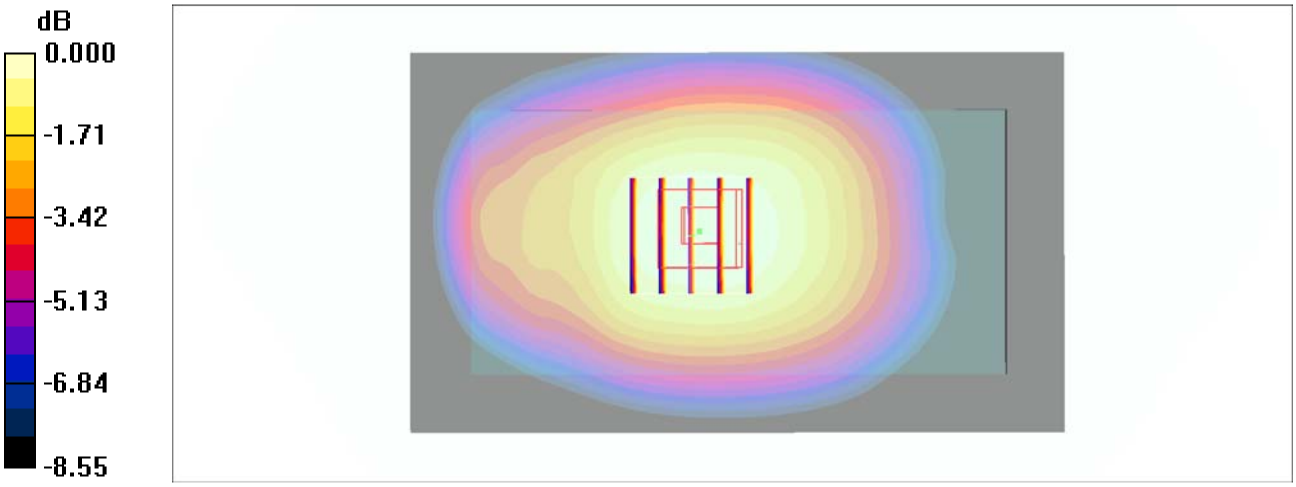
#11_GSM850_GPRS (4 Tx slots)_Back_15mm_Ch251

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:2.08
Medium: MSL_850_170203 Medium parameters used: f = 849 MHz; σ = 0.946 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.757 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.1 V/m; Power Drift = 0.003 dB
Peak SAR (extrapolated) = 0.797 W/kg
SAR(1 g) = 0.619 mW/g; SAR(10 g) = 0.478 mW/g
Maximum value of SAR (measured) = 0.740 mW/g



0 dB = 0.740mW/g

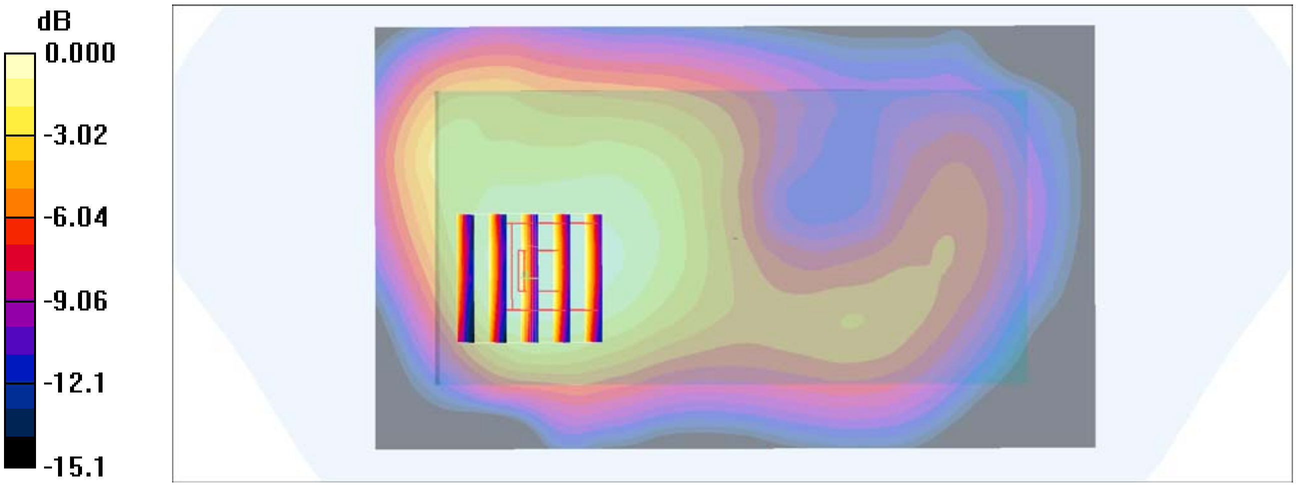
#12_GSM1900_GPRS (4 Tx slots)_Front_15mm_Ch810

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:2.08
Medium: MSL_1900_170204 Medium parameters used: f = 1910 MHz; σ = 1.54 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(8, 8, 8); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.241 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.6 V/m; Power Drift = -0.004 dB
Peak SAR (extrapolated) = 0.276 W/kg
SAR(1 g) = 0.177 mW/g; SAR(10 g) = 0.113 mW/g
Maximum value of SAR (measured) = 0.238 mW/g



0 dB = 0.238mW/g

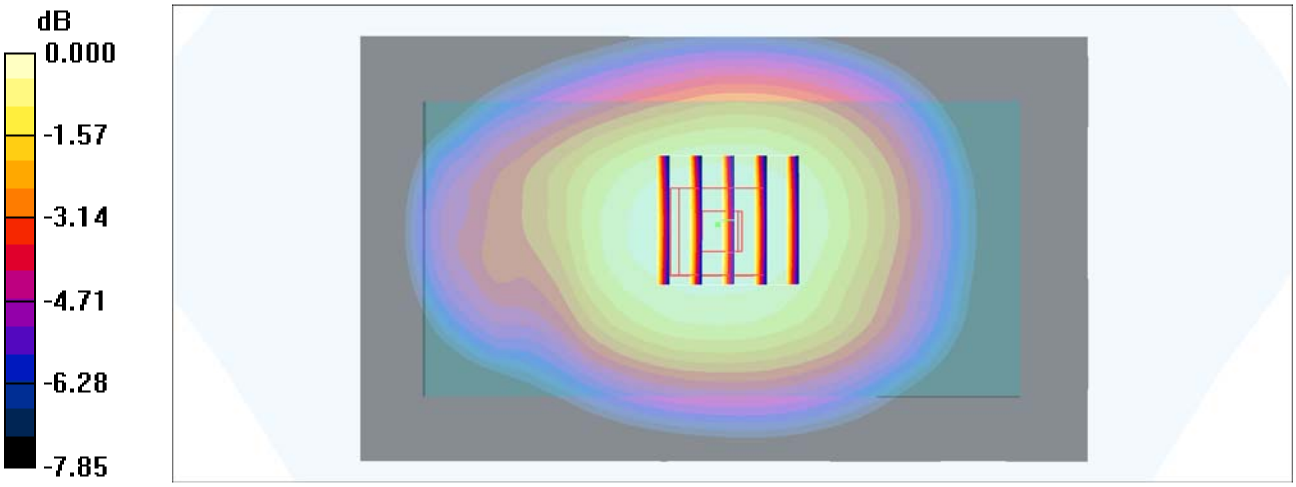
#13_WCDMA V_RMC 12.2Kbps_Back_15mm_Ch4233

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: MSL_850_170203 Medium parameters used: f = 847 MHz; σ = 0.944 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.654 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.4 V/m; Power Drift = -0.123 dB
Peak SAR (extrapolated) = 0.695 W/kg
SAR(1 g) = 0.540 mW/g; SAR(10 g) = 0.414 mW/g
Maximum value of SAR (measured) = 0.641 mW/g



0 dB = 0.641mW/g

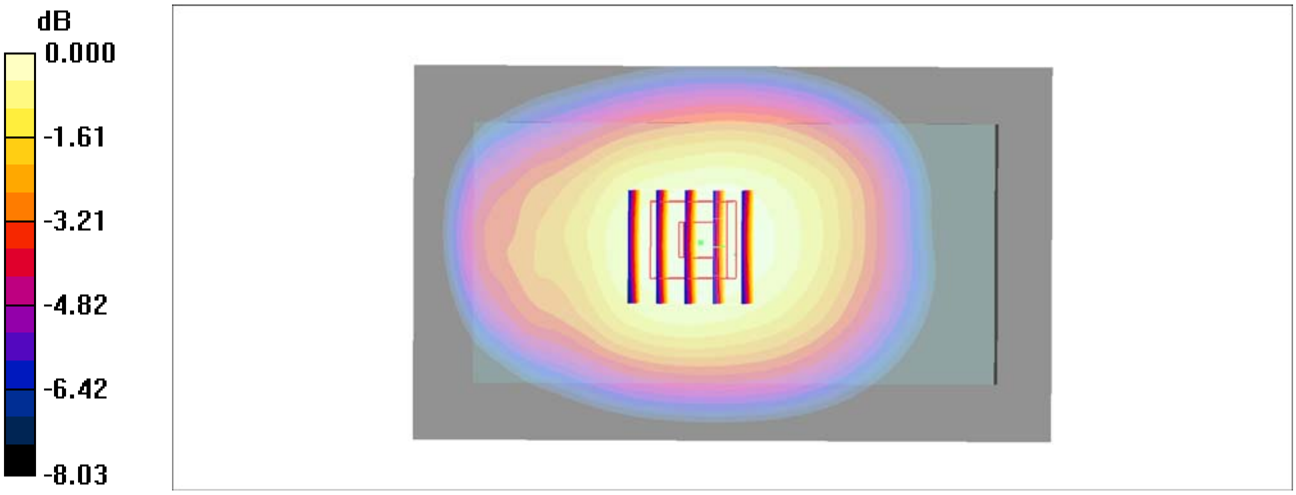
#14_LTE Band 5_10M_QPSK_1_0_Back_15mm_Ch20525

Communication System: LTE; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: MSL_850_170203 Medium parameters used: f = 836.5 MHz; $\sigma = 0.935$ mho/m; $\varepsilon_r = 53.8$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.2 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(9.91, 9.91, 9.91); Calibrated: 2016/5/26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM_Right; Type: QD000P40CD; Serial: TP:1383
- ;Postprocessing SW: SEMCAD, V1.8 Build 159

Area Scan (71x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.476 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.4 V/m; Power Drift = 0.000 dB
Peak SAR (extrapolated) = 0.507 W/kg
SAR(1 g) = 0.396 mW/g; SAR(10 g) = 0.306 mW/g
Maximum value of SAR (measured) = 0.468 mW/g



0 dB = 0.468mW/g

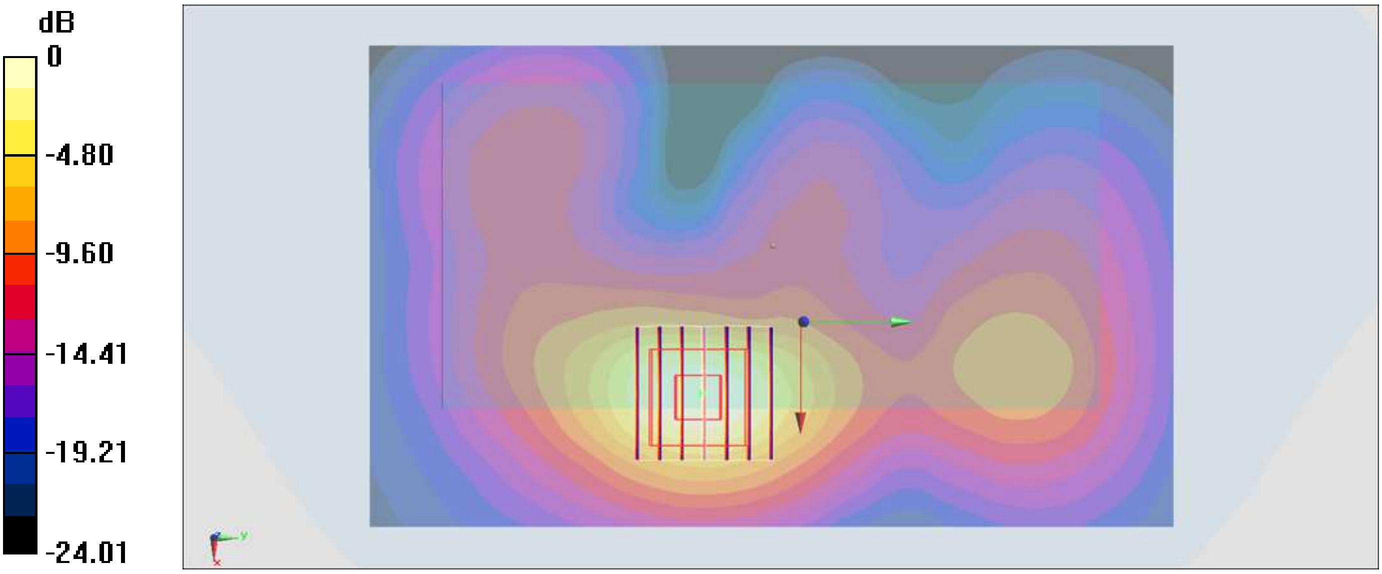
#15_LTE Band 7_20M_QPSK_1_0_Back_15mm_Ch21350

Communication System: LTE; Frequency: 2560 MHz;Duty Cycle: 1:1
Medium: MSL_2600_170126 Medium parameters used: f = 2560 MHz; $\sigma = 2.132$ S/m; $\varepsilon_r = 52.669$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3925; ConvF(7.38, 7.38, 7.38); Calibrated: 2016/5/26;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2016/5/27
- Phantom: SAM-Right; Type: SAM; Serial: 1795
- Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Area Scan (91x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.84 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.11 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 2.22 W/kg
SAR(1 g) = 1.11 W/kg; SAR(10 g) = 0.521 W/kg
Maximum value of SAR (measured) = 1.79 W/kg



0 dB = 1.79 W/kg = 2.53 dBW/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
S **Servizio svizzero di taratura**
Swiss Calibration Service

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

Accreditation No.: SCS 0108

Client **Sporton-TW (Auden)**

Certificate No: D835V2-499_Mar16

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 499
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 21, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: March 21, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, “SAR Measurement Requirements for 100 MHz to 6 GHz”

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.7 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.14 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.97 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.5 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.52 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.28 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω - 3.2 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.0 Ω - 5.3 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.390 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 10, 2003

DASY5 Validation Report for Head TSL

Date: 21.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

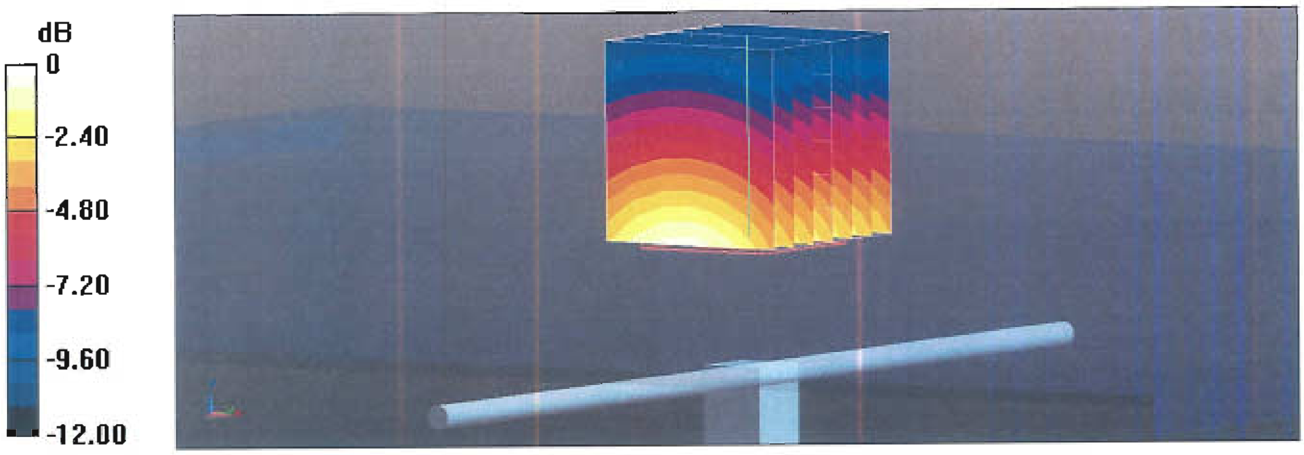
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.93 S/m; ε_r = 41.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

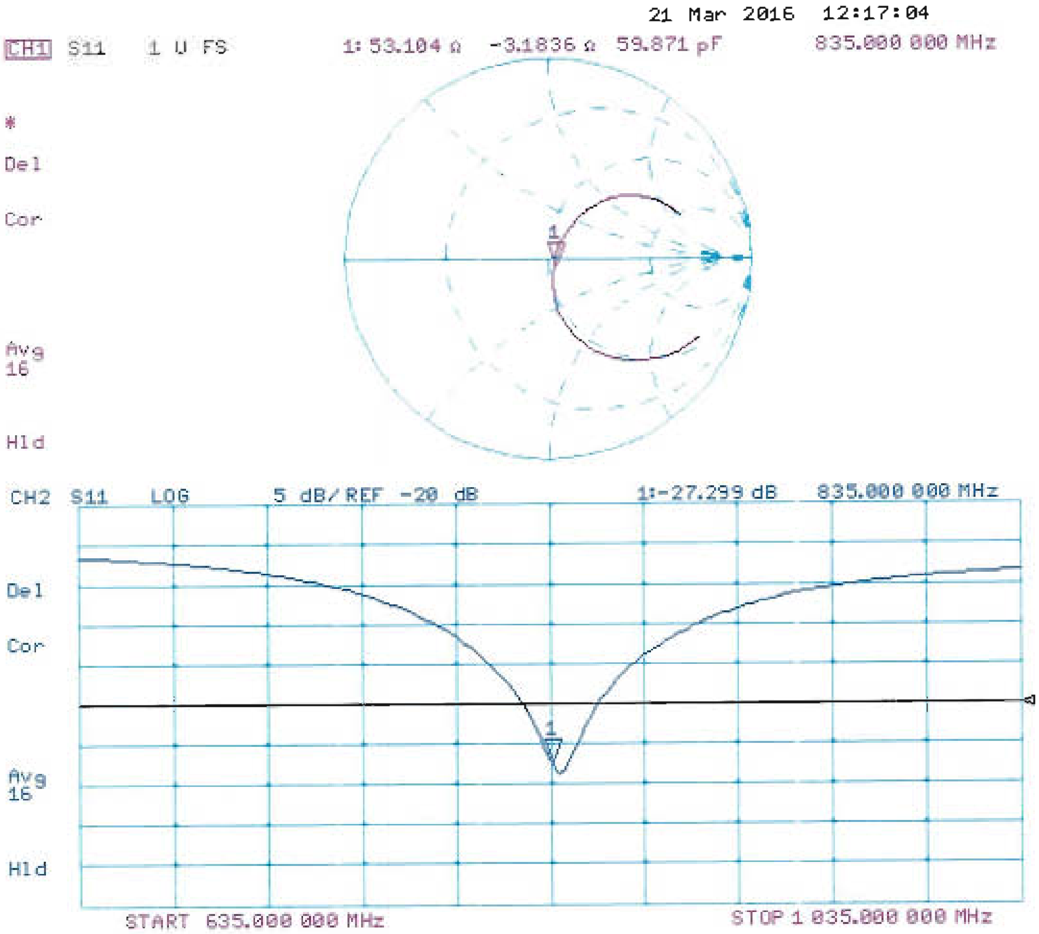
- Probe: EX3DV4 - SN7349; ConvF(9.83, 9.83, 9.83); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue EX-Probe/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.98 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg
Maximum value of SAR (measured) = 3.09 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.03.2016

Test Laboratory: SPEAG, Zurich, Switzerland

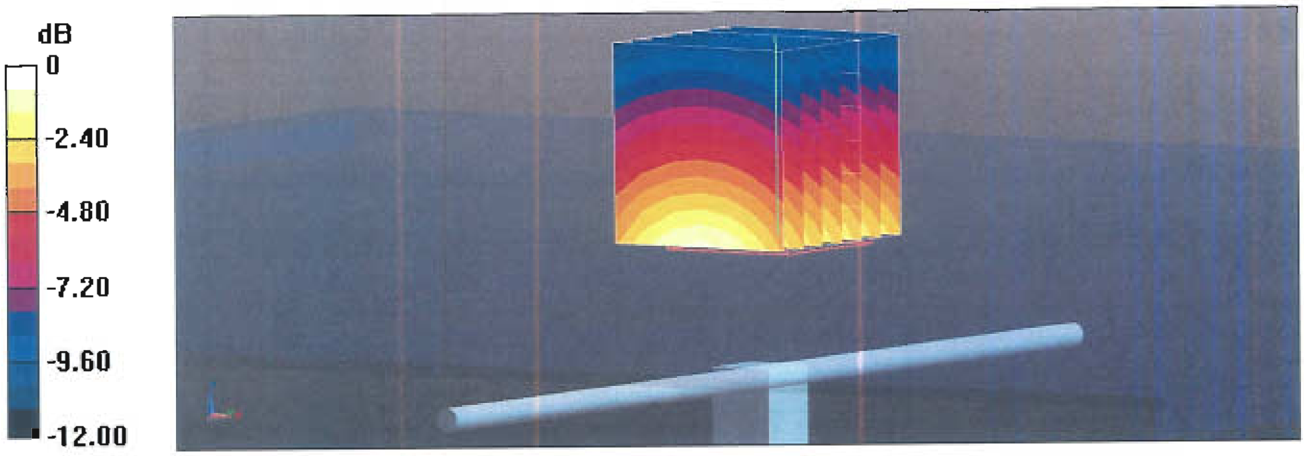
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 1.01$ S/m; $\varepsilon_r = 54.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

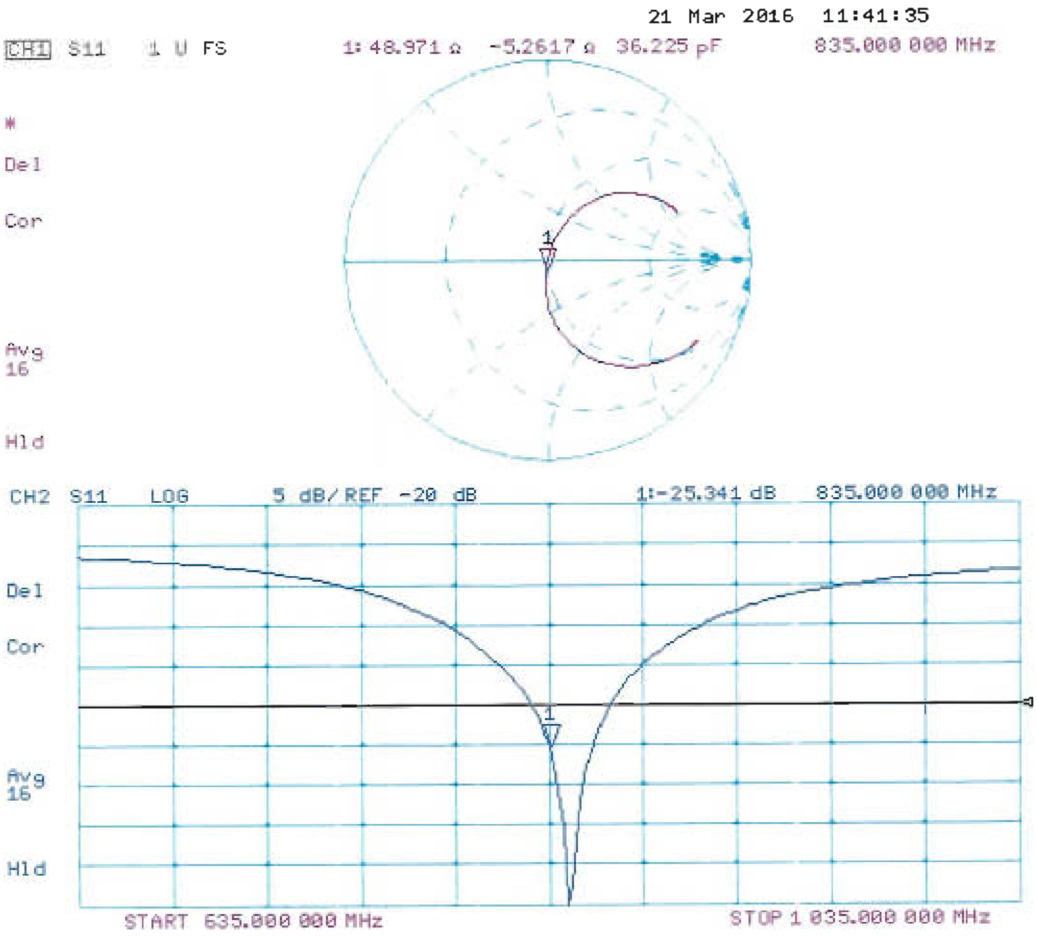
- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue EX-Probe/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.24 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.63 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.61 W/kg
Maximum value of SAR (measured) = 3.26 W/kg



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

Impedance Measurement Plot for Body TSL



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Client **Sporton_TW** **Certificate No: Z16-97124**

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d200

Calibration Procedure(s) FD-Z11-2-003-01
Calibration Procedures for dipole validation kits

Calibration date: August 23, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 3617	26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Aug-16
DAE4	SN 777	26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Aug-16
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: August 26, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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%.

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
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	42.0 ± 6 %	0.92 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	2.37 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.39 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.19 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.98 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	2.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.65 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.44 mW /g ± 20.4 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.0Ω- 3.39jΩ
Return Loss	- 29.4dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1Ω- 5.27jΩ
Return Loss	- 23.3dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.499 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

DASY5 Validation Report for Head TSL Date: 08.23.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d200

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

Medium parameters used: f = 835 MHz; $\sigma = 0.915$ S/m; $\varepsilon_r = 41.98$; $\rho = 1000$ kg/m^3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.56, 9.56,9.56); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 2015-08-26
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

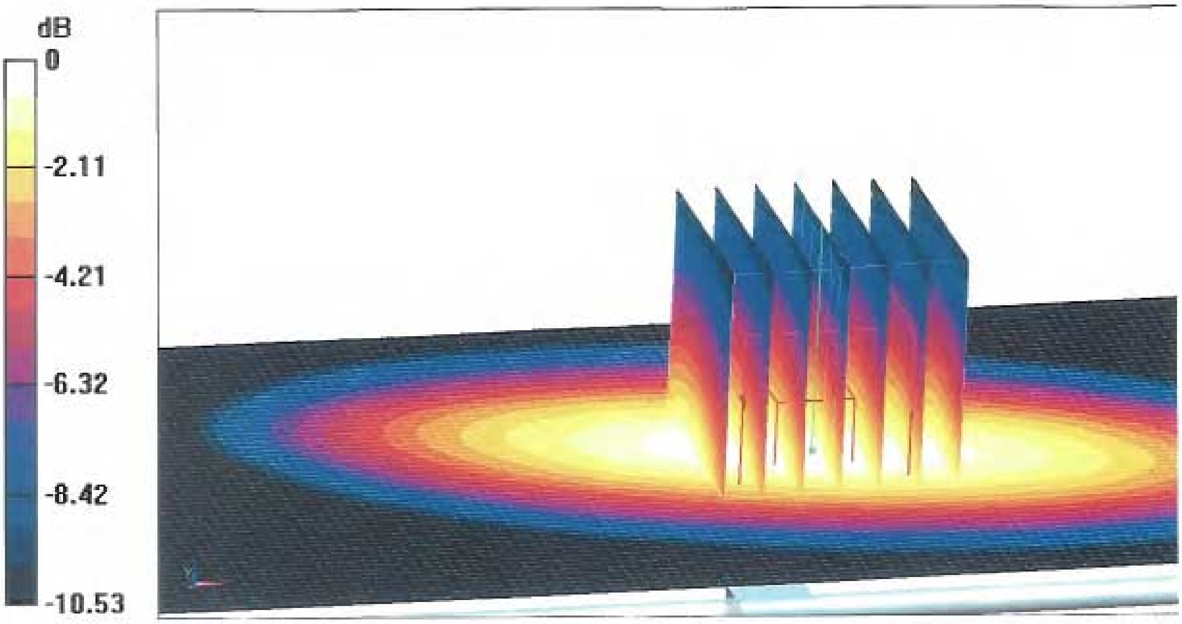
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.36V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.53 W/kg

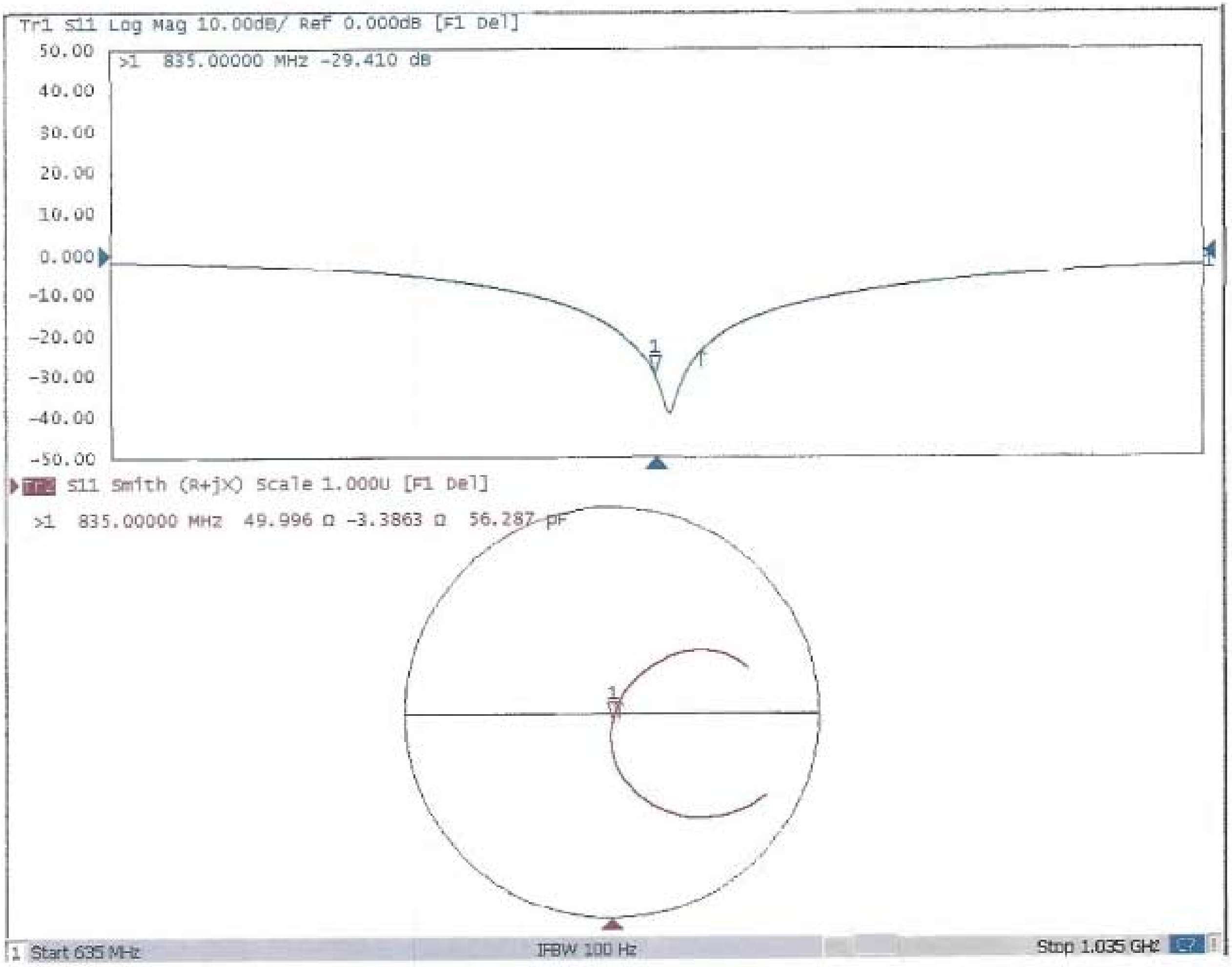
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 3.00 W/kg



0 dB = 3.00 W/kg = 4.77 dBW/kg

Impedance Measurement Plot for Head TSL



```
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1 Del]
>1  835.00000 MHz -29.410 dB
Tr2 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1  835.00000 MHz  49.996 Ω -3.3863 Ω  56.287 pF
1 Start 635 MHz                IFBW 100 Hz                Stop 1.035 GHz
```

DASY5 Validation Report for Body TSL Date: 08.23.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d200

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

Medium parameters used: f = 835 MHz; $\sigma = 0.978$ S/m; $\varepsilon_r = 54.86$; $\rho = 1000$ kg/m^3

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.71,9.71, 9.71); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 2015-08-26
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

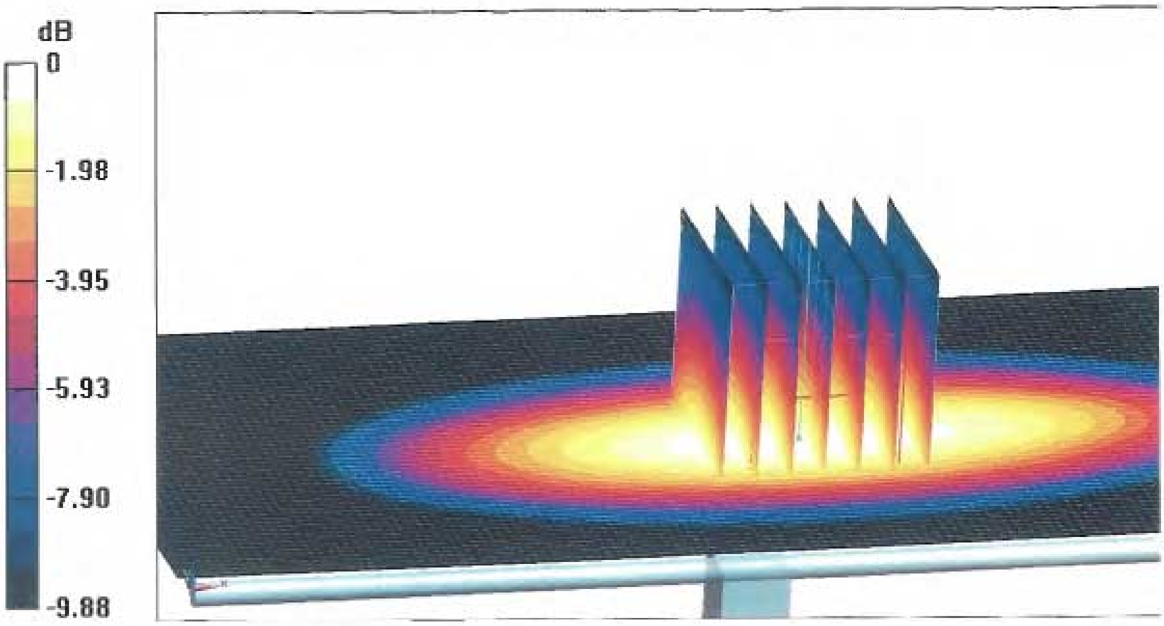
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.53 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.54 W/kg

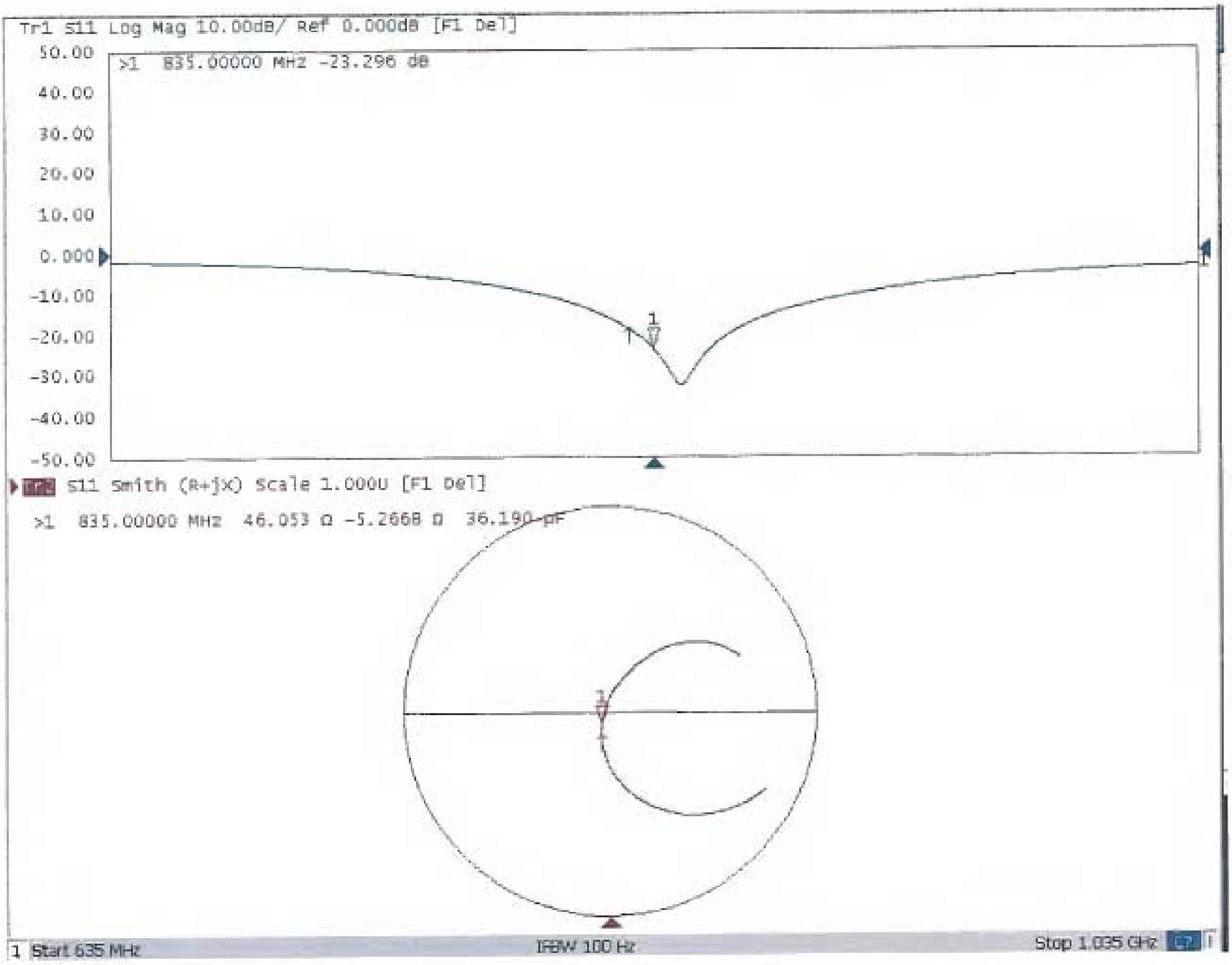
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.62 W/kg

Maximum value of SAR (measured) = 3.04 W/kg



0 dB = 3.04 W/kg = 4.83 dBW/kg

Impedance Measurement Plot for Body TSL



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Client **Sporton_TW** **Certificate No: Z16-97128**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d210
Calibration Procedure(s)	FD-Z11-2-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 25, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 3617	26-Aug-15(SPEAG,No.EX3-3617_Aug15)	Aug-16
DAE4	SN 777	26-Aug-15(SPEAG,No.DAE4-777_Aug15)	Aug-16
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: Agust 27, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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%.

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.91 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.9 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.20 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.9 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.9 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**40.3 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.32 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 mW /g ± 20.4 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8Ω+ 4.37jΩ
Return Loss	- 26.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1Ω+ 3.94jΩ
Return Loss	- 25.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.311 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

DASY5 Validation Report for Head TSL Date: 08.25.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d210

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

Medium parameters used: f = 1900 MHz; σ = 1.379 S/m; εr = 39.42; ρ = 1000 kg/m3

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.07, 8.07, 8.07); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/26/2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

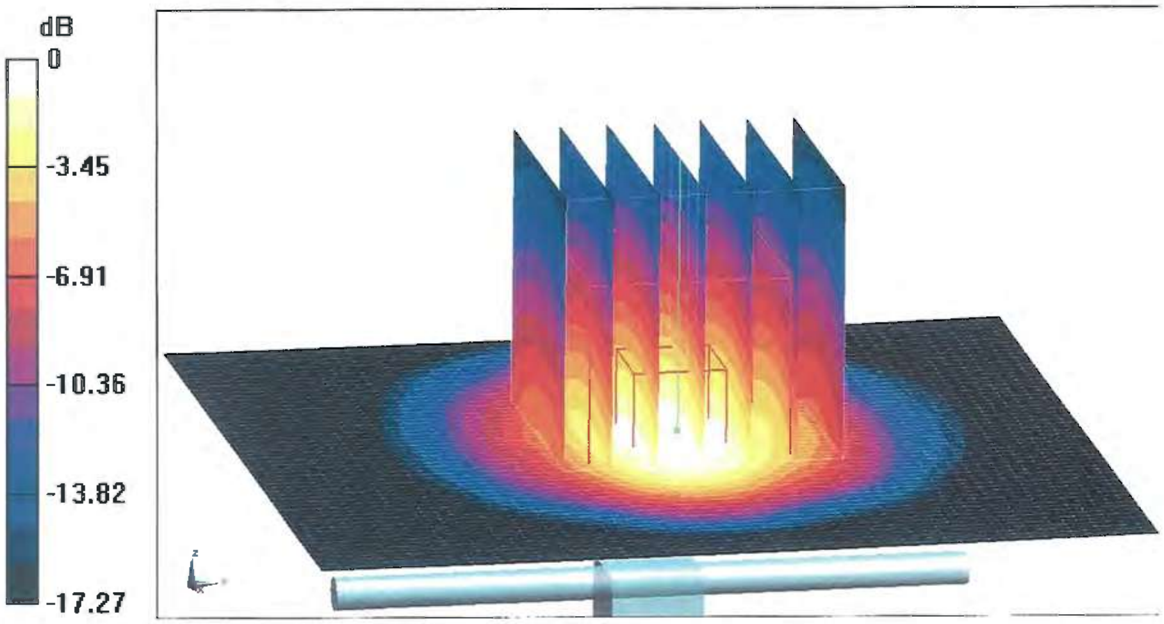
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.2V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 18.3W/kg

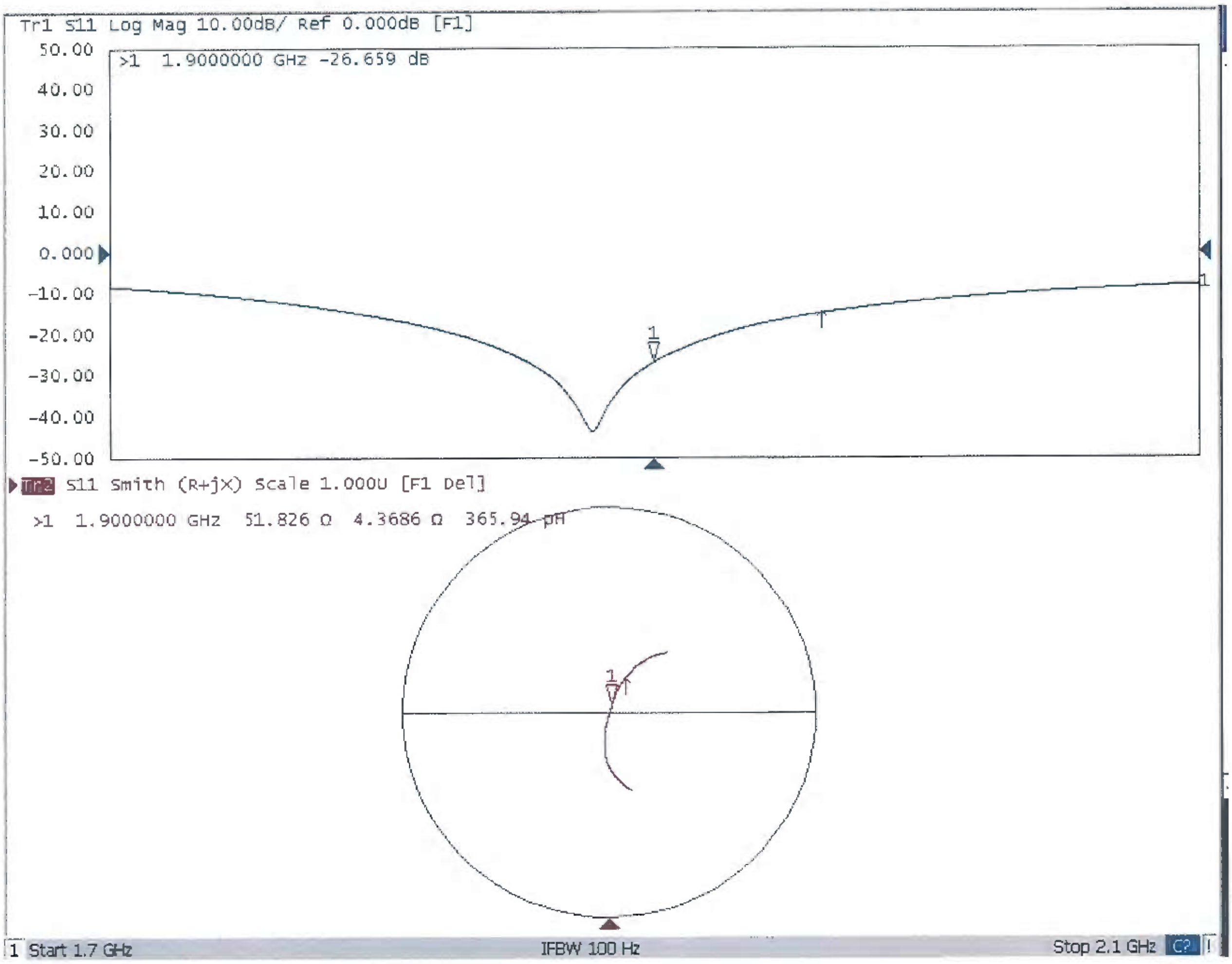
SAR(1 g) = 9.91 W/kg; SAR(10 g) = 5.2 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



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

Impedance Measurement Plot for Head TSL



```
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1  1.9000000 GHz -26.659 dB
Tr2 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1  1.9000000 GHz  51.826 Ω  4.3686 Ω  365.94 pH
1 Start 1.7 GHz          IFBW 100 Hz          Stop 2.1 GHz
```

DASY5 Validation Report for Body TSL Date: 08.25.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d210

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

Medium parameters used: f = 1900 MHz; $\sigma = 1.508$ S/m; $\varepsilon_r = 53.92$; $\rho = 1000$ kg/m^3

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.74, 7.74, 7.74); Calibrated: 8/26/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/26/2015
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

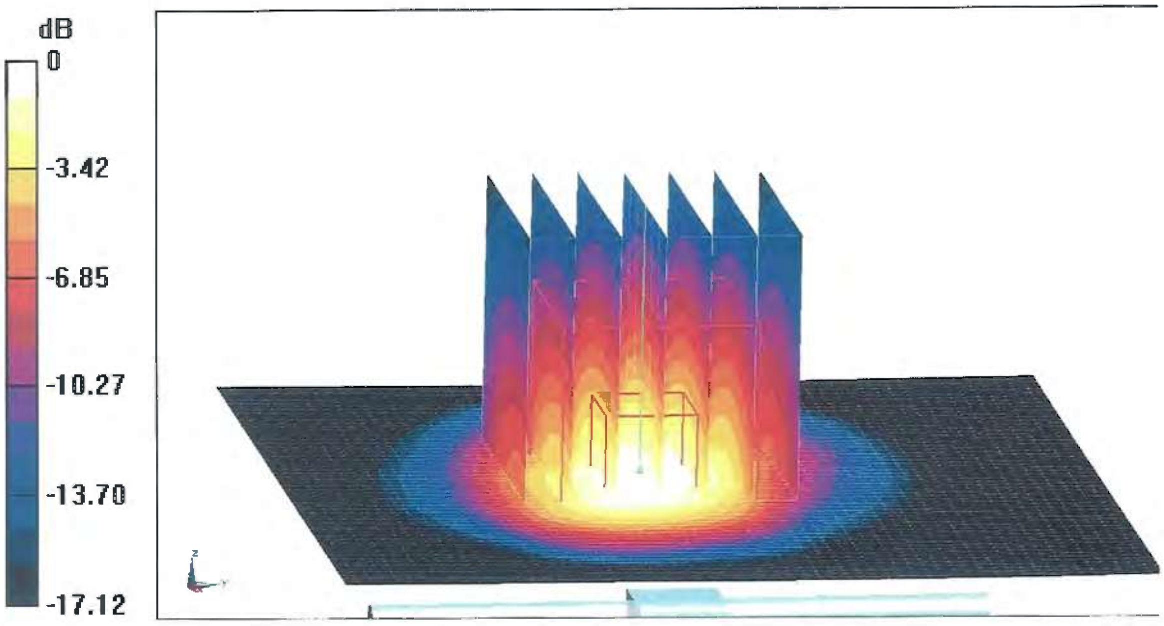
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.92 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 17.8 W/kg

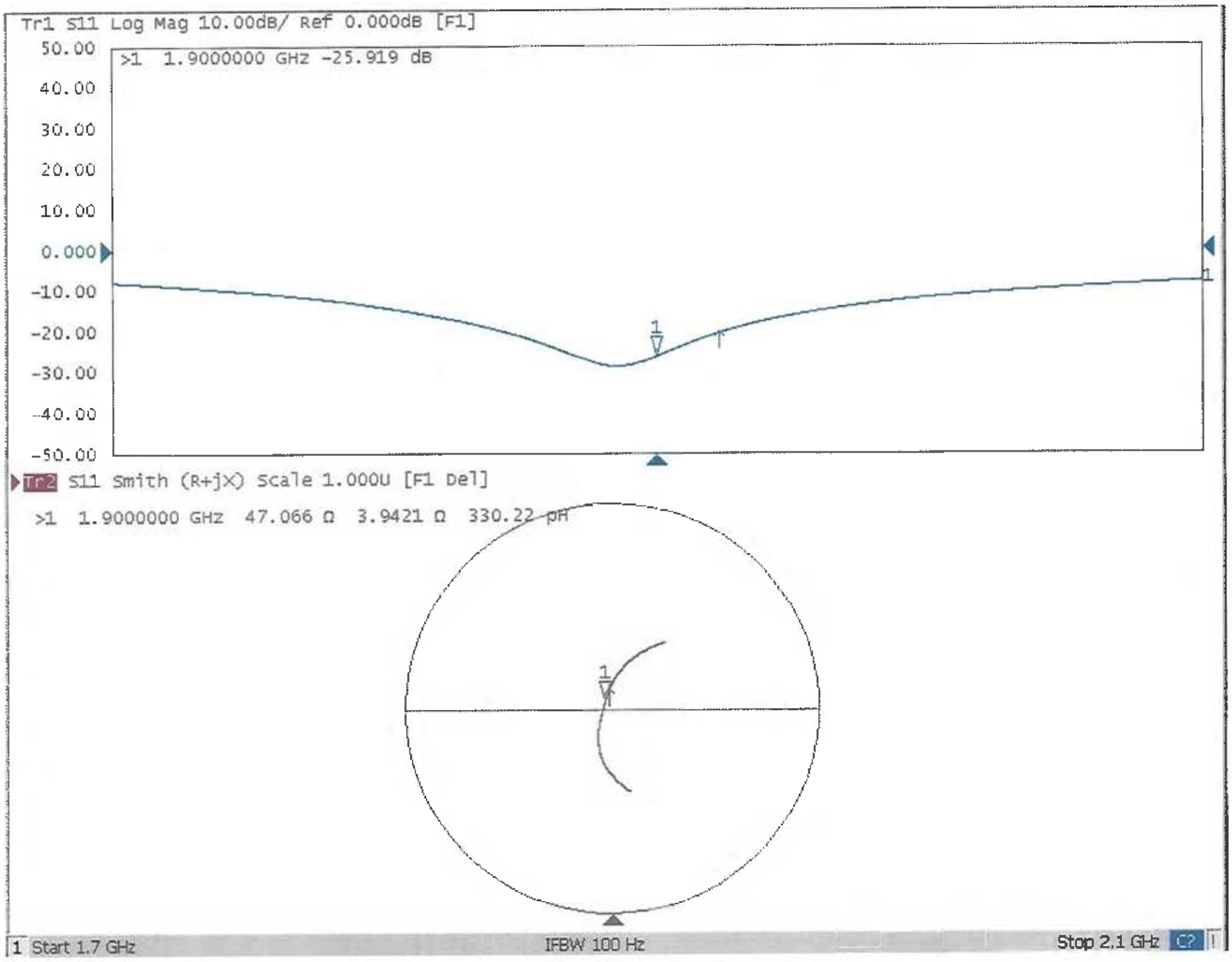
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.32 W/kg

Maximum value of SAR (measured) = 14.1 W/kg



0 dB = 14.1 W/kg = 11.49 dBW/kg

Impedance Measurement Plot for Body TSL



Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]

>1 1.9000000 GHz -25.919 dB

Tr2 S11 Smith (R+jX) Scale 1.000U [F1 Del]

>1 1.9000000 GHz 47.066 Ω 3.9421 Ω 330.22 pH

1 Start 1.7 GHz IFBW 100 Hz Stop 2.1 GHz

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

Client **Sporton_TW** **Certificate No: Z16-97132**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1008
Calibration Procedure(s)	FD-Z11-2-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 30, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Power sensor NRP-Z91	101547	01-Jul-15 (CTTL, No.J15X04256)	Jun-16
Reference Probe EX3DV4	SN 3801	29-Jun-16(SPEAG,No.EX3-3801_Jun16)	Jun-17
DAE4	SN 777	22-Aug-16(CTTL-SPEAG,No.Z16-97138)	Aug-17

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: September 1, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
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%.

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
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	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.97 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	14.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**56.8 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.40 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.6 mW /g ± 20.4 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	2.18 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	13.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**55.2 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.28 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**25.0 mW /g ± 20.4 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3Ω- 1.82jΩ
Return Loss	- 31.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8Ω- 1.91jΩ
Return Loss	- 26.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.046 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

DASY5 Validation Report for Head TSL Date: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1008

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2600 MHz; σ = 1.974 S/m; εr = 39.43; ρ = 1000 kg/m3

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(6.64, 6.64, 6.64); Calibrated: 6/29/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

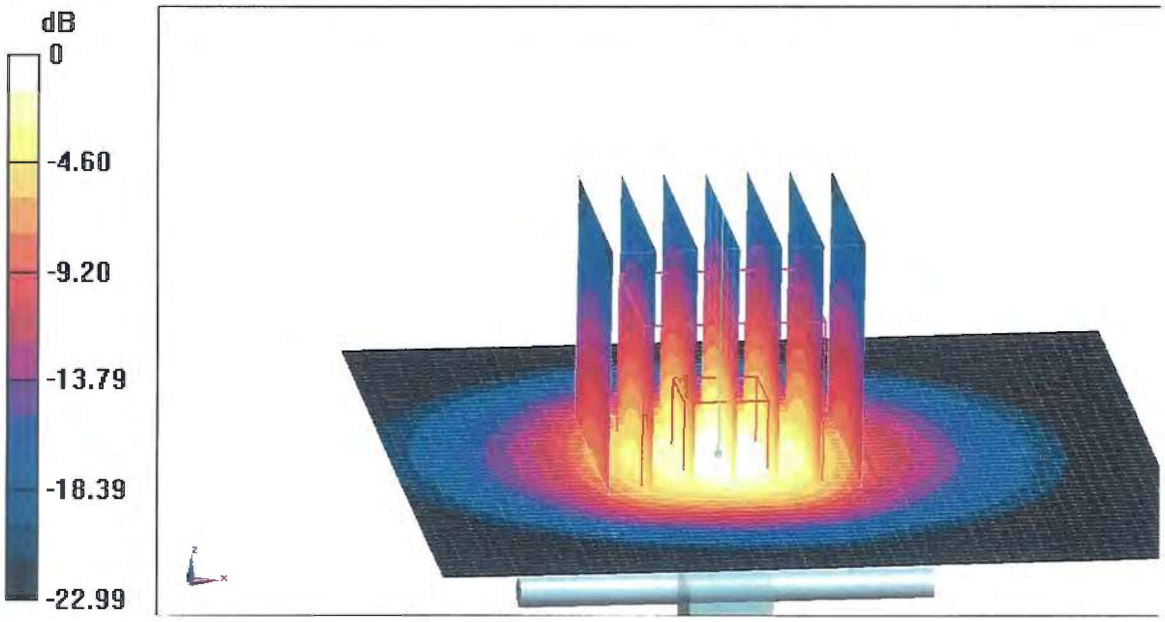
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.4 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 30.0 W/kg

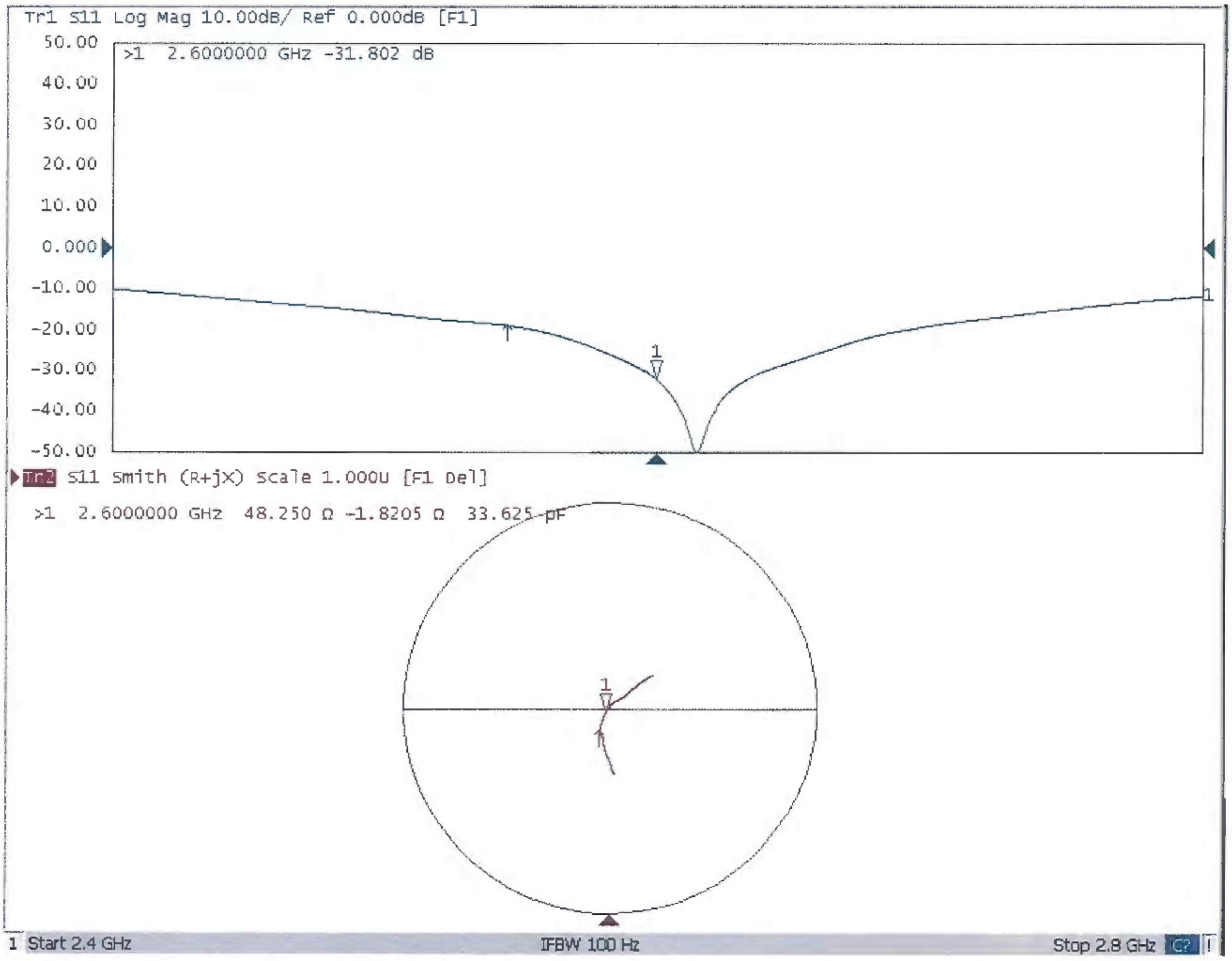
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.4 W/kg

Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg = 13.44 dBW/kg

Impedance Measurement Plot for Head TSL



Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]

>1 2.6000000 GHz -31.802 dB

Tr2 S11 Smith (R+jX) Scale 1.000U [F1 Del]

>1 2.6000000 GHz 48.250 Ω -1.8205 Ω 33.625 pF

DASY5 Validation Report for Body TSL Date: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1008

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2600 MHz; σ = 2.184 S/m; ε_r = 52.15; ρ = 1000 kg/m^3

Phantom section: Left Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(6.7, 6.7,6.7); Calibrated: 6/29/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 8/22/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

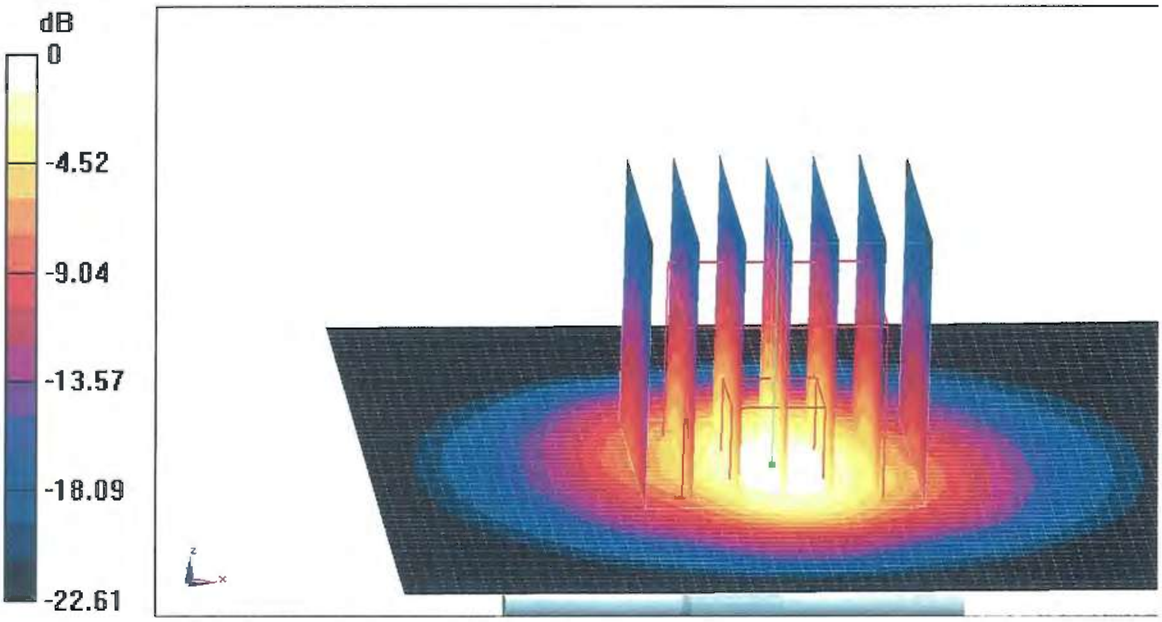
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.70 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 28.8 W/kg

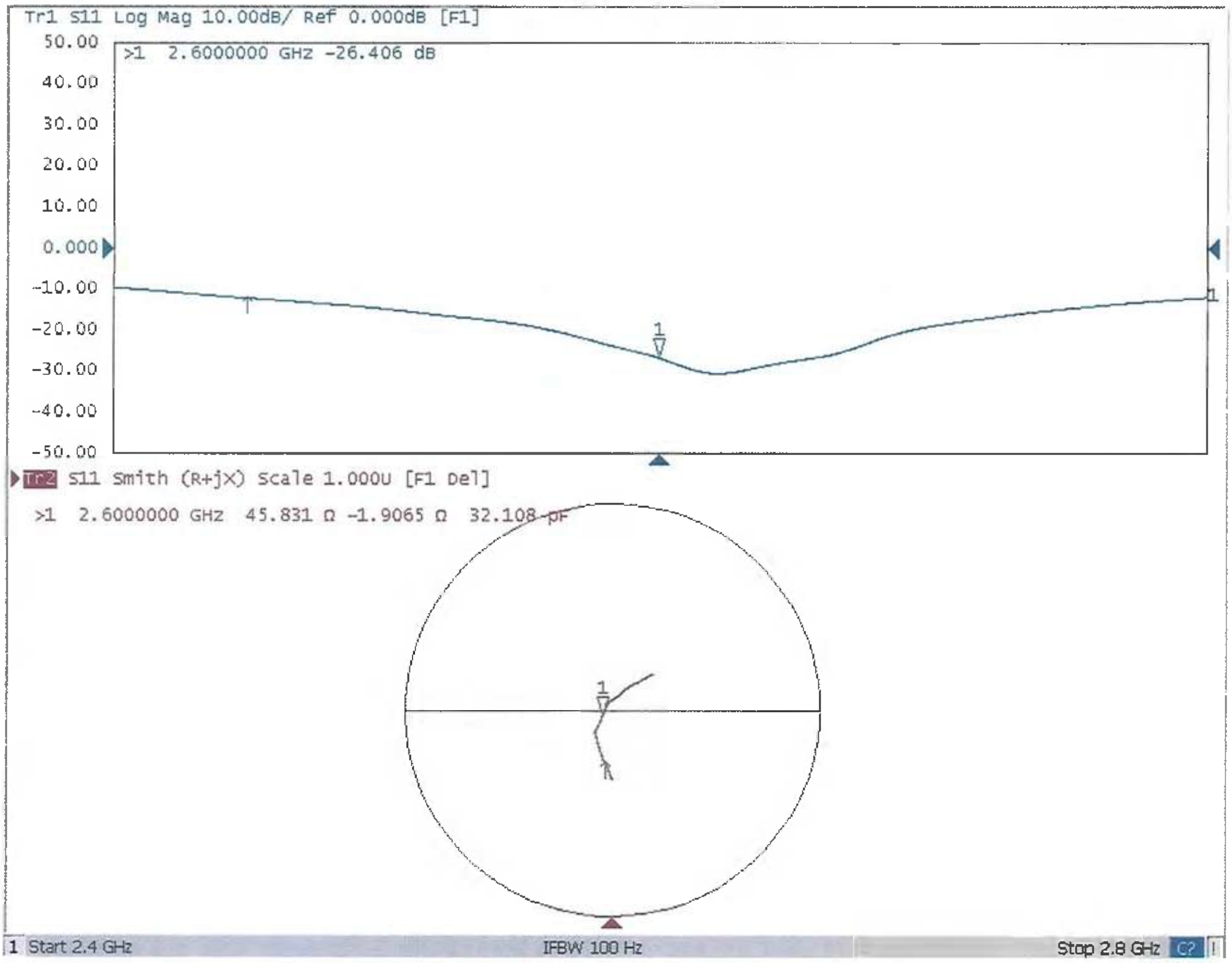
SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.28 W/kg

Maximum value of SAR (measured) = 21.3 W/kg



0 dB = 21.3 W/kg = 13.28 dBW/kg

Impedance Measurement Plot for Body TSL



```
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1  2.6000000 GHz -26.406 dB
Tr2 S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1  2.6000000 GHz  45.831 Ω -1.9065 Ω  32.108 pF
1 Start 2.4 GHz                IFBW 100 Hz                Stop 2.8 GHz
```

Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton - TW (Auden)**

Certificate No: **DAE3-495_May16**

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AD - SN: 495
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 27, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	09-Sep-15 (No:17153)	Sep-16
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-16 (in house check)	In house check: Jan-17
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-16 (in house check)	In house check: Jan-17

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: May 27, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.......+3mV

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

Calibration Factors	**X**	**Y**	**Z**
High Range	404.392 ± 0.02% (k=2)	405.369 ± 0.02% (k=2)	405.725 ± 0.02% (k=2)
Low Range	3.95295 ± 1.50% (k=2)	3.99096 ± 1.50% (k=2)	3.96580 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	78.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199996.62	1.58	0.00
Channel X	+ Input	20000.74	-0.12	-0.00
Channel X	- Input	-19996.44	4.68	-0.02
Channel Y	+ Input	199995.94	1.53	0.00
Channel Y	+ Input	20002.54	1.56	0.01
Channel Y	- Input	-19999.75	1.29	-0.01
Channel Z	+ Input	199992.83	-1.82	-0.00
Channel Z	+ Input	20002.61	1.74	0.01
Channel Z	- Input	-19998.46	2.69	-0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2001.48	0.75	0.04
Channel X	+ Input	201.55	0.46	0.23
Channel X	- Input	-198.32	0.30	-0.15
Channel Y	+ Input	2000.13	-0.57	-0.03
Channel Y	+ Input	200.91	-0.45	-0.22
Channel Y	- Input	-199.30	-0.77	0.39
Channel Z	+ Input	1999.63	-0.96	-0.05
Channel Z	+ Input	200.82	-0.44	-0.22
Channel Z	- Input	-199.88	-1.27	0.64

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	3.18	2.27
	- 200	-2.19	-3.80
Channel Y	200	0.69	0.05
	- 200	-0.39	-0.92
Channel Z	200	2.28	2.22
	- 200	-4.44	-4.68

3. Channel separation

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

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-0.76	-2.16
Channel Y	200	7.44	-	-0.52
Channel Z	200	5.77	5.68	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15817	17431
Channel Y	15765	17509
Channel Z	15903	17029

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.15	-1.92	1.72	0.56
Channel Y	0.33	-0.86	2.13	0.60
Channel Z	-1.62	-2.91	-0.07	0.62

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

Client **Sporton-TW (Auden)**

Certificate No: EX3-3925_May16

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3925
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	May 26, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-16
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-16
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284)	In house check: Jun-16
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Apr-13)	In house check: Jun-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 31, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

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

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3925

Manufactured:	March 8, 2013
Calibrated:	May 26, 2016

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.59	0.52	0.50	± 10.1 %
DCP (mV)[B]	96.5	97.9	98.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	152.6	±2.7 %
		Y	0.0	0.0	1.0		143.7	
		Z	0.0	0.0	1.0		138.9	

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

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.37	10.37	10.37	0.48	0.80	± 12.0 %
835	41.5	0.90	9.92	9.92	9.92	0.47	0.81	± 12.0 %
900	41.5	0.97	9.72	9.72	9.72	0.41	0.80	± 12.0 %
1750	40.1	1.37	8.57	8.57	8.57	0.29	0.80	± 12.0 %
1900	40.0	1.40	8.30	8.30	8.30	0.30	0.80	± 12.0 %
2000	40.0	1.40	8.26	8.26	8.26	0.30	0.80	± 12.0 %
2450	39.2	1.80	7.47	7.47	7.47	0.35	0.80	± 12.0 %
2600	39.0	1.96	7.28	7.28	7.28	0.36	0.86	± 12.0 %
3500	37.9	2.91	7.14	7.14	7.14	0.29	1.30	± 13.1 %
5200	36.0	4.66	5.31	5.31	5.31	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.15	5.15	5.15	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.66	4.66	4.66	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.47	4.47	4.47	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.51	4.51	4.51	0.50	1.80	± 13.1 %

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

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	10.18	10.18	10.18	0.49	0.80	± 12.0 %
835	55.2	0.97	9.91	9.91	9.91	0.44	0.88	± 12.0 %
900	55.0	1.05	9.96	9.96	9.96	0.47	0.80	± 12.0 %
1750	53.4	1.49	8.30	8.30	8.30	0.34	0.80	± 12.0 %
1900	53.3	1.52	8.00	8.00	8.00	0.38	0.80	± 12.0 %
2000	53.3	1.52	8.18	8.18	8.18	0.37	0.80	± 12.0 %
2450	52.7	1.95	7.64	7.64	7.64	0.36	0.80	± 12.0 %
2600	52.5	2.16	7.38	7.38	7.38	0.26	0.80	± 12.0 %
3500	51.3	3.31	6.73	6.73	6.73	0.29	1.30	± 13.1 %
5200	49.0	5.30	4.39	4.39	4.39	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.22	4.22	4.22	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.02	4.02	4.02	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.85	3.85	3.85	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.85	3.85	3.85	0.60	1.90	± 13.1 %

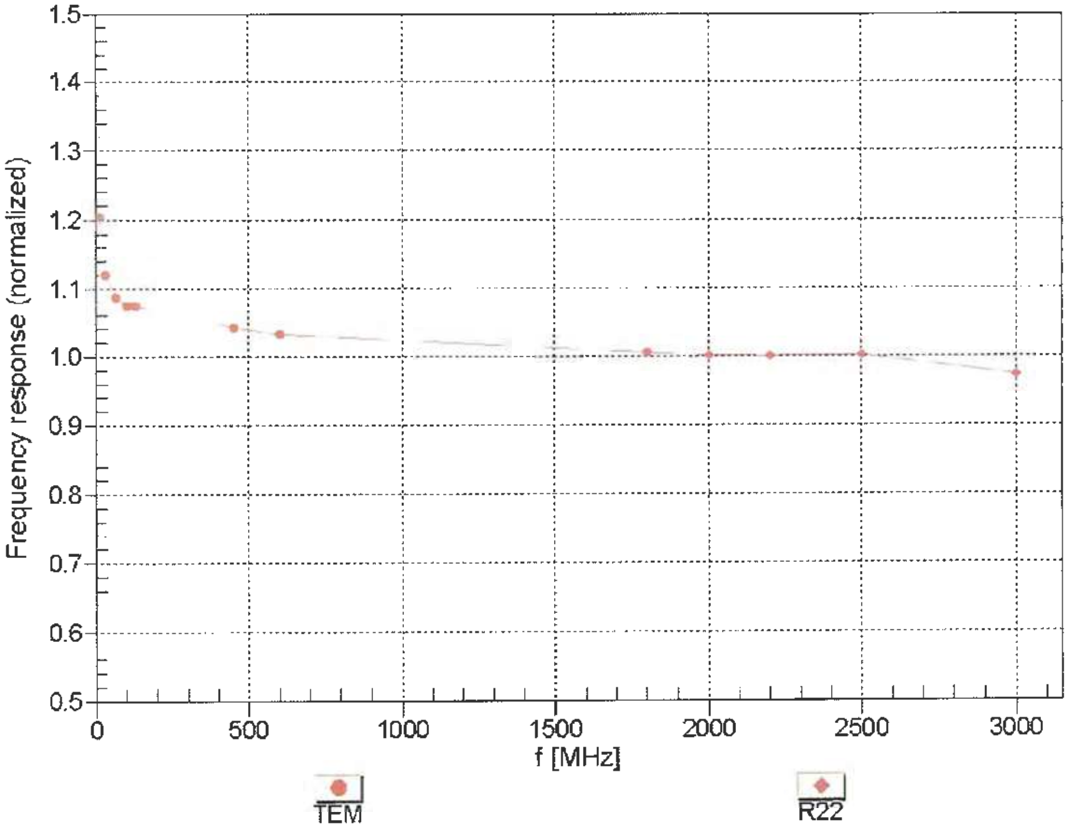
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz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

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

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

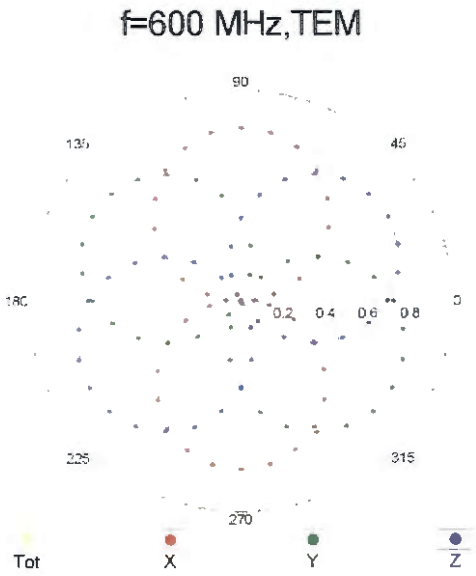
Frequency Response of E-Field

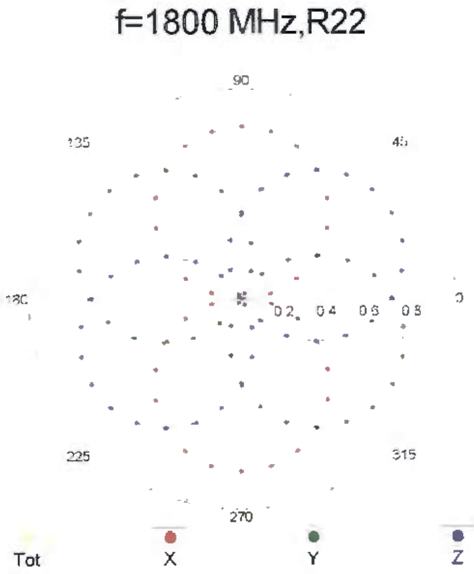
(TEM-Cell:ifi110 EXX, Waveguide: R22)

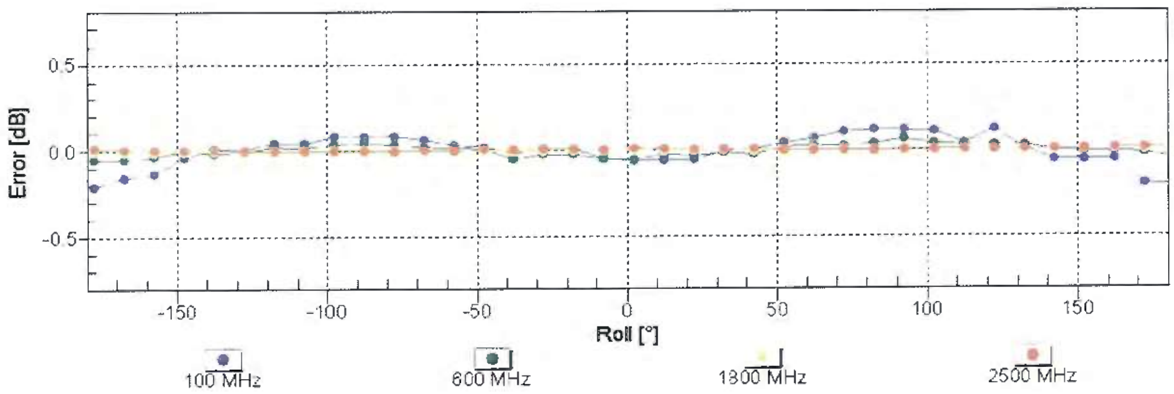


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

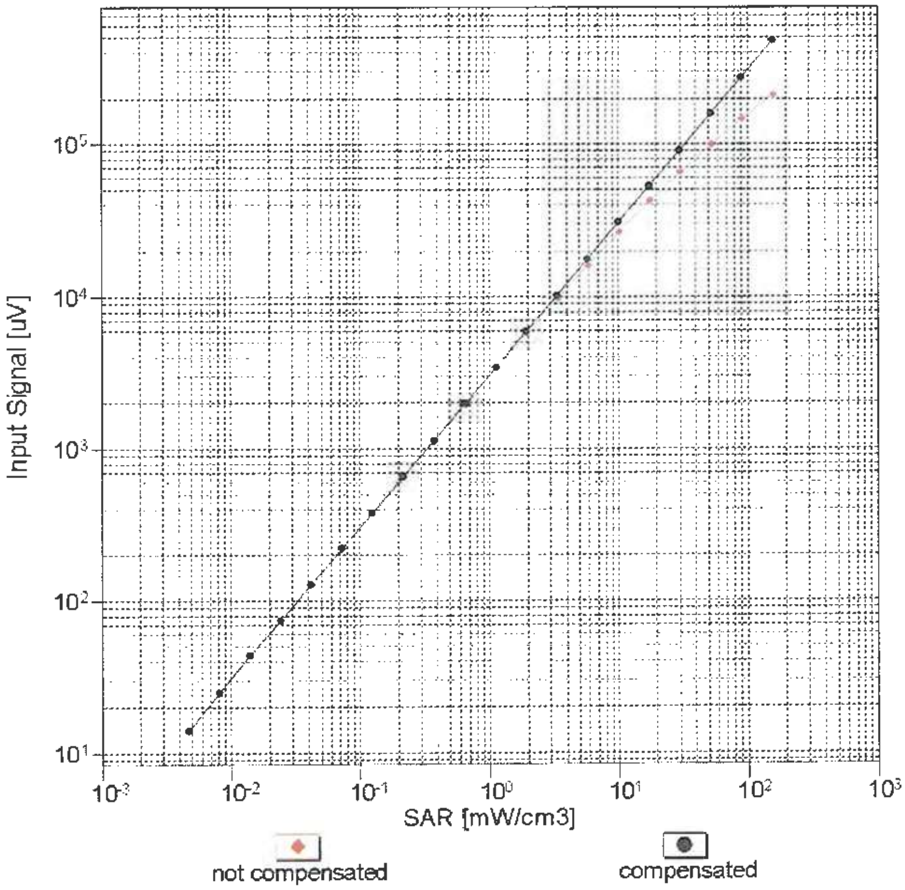


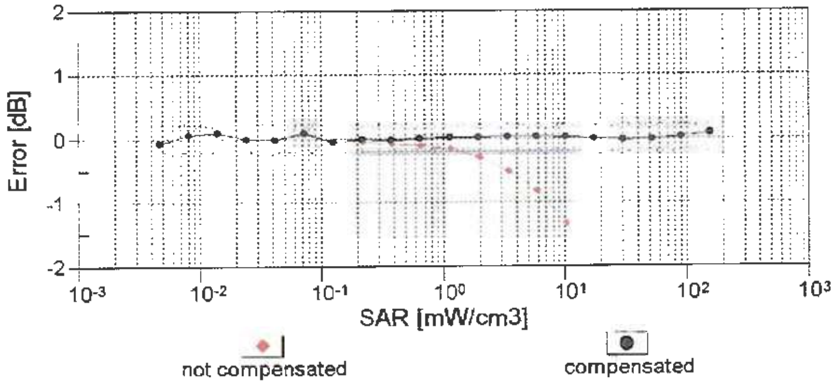




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

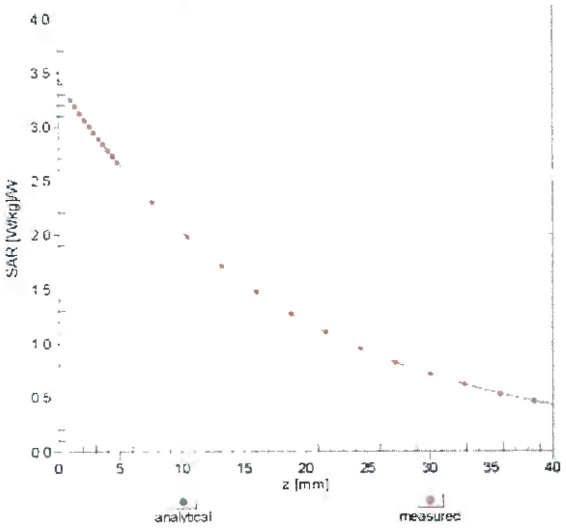




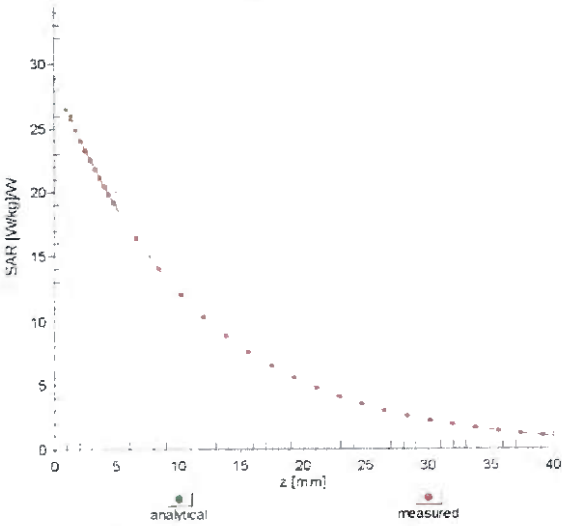
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

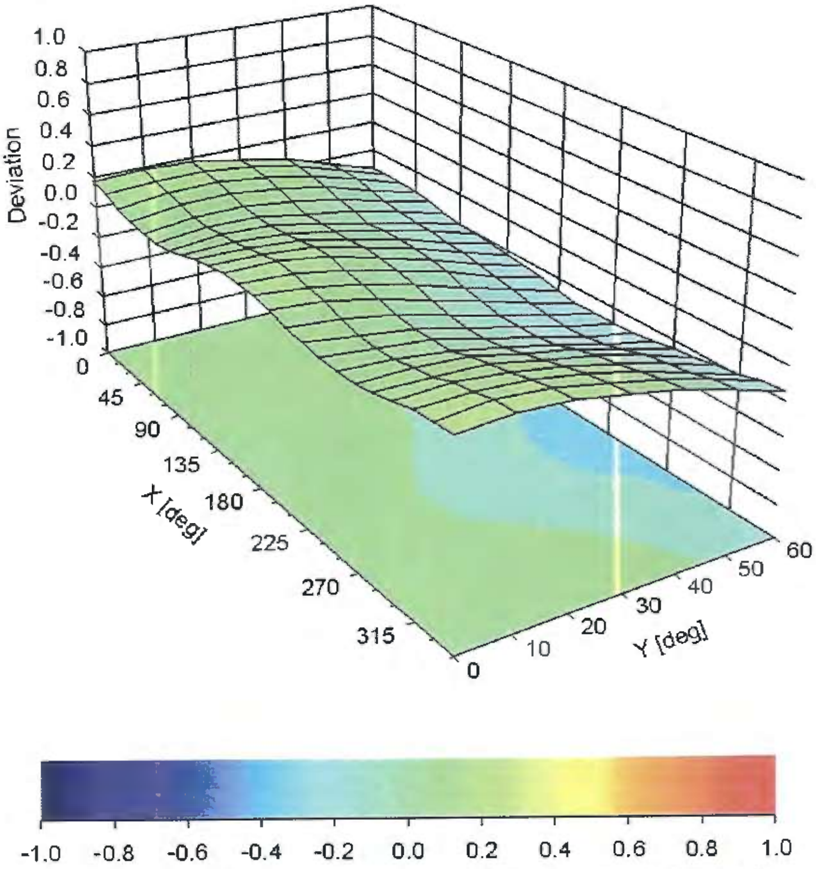


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	92.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm