FCC SAR Test Report

APPLICANT	:	Motorola Mobility LLC
EQUIPMENT	:	Mobile Cellular Phone
BRAND NAME	:	Motorola
MODEL NAME	:	10808
FCC ID	:	IHDT56WJ2
STANDARD	:	FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2013

We, SPORTON INTERNATIONAL (XI'AN) 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 (XI'AN) INC., the test report shall not be reproduced except in full.

Prepared by: Mark Qu / Manager

Approved by: Jones Tsai / Manager

Testing Laboratory 2804

SPORTON INTERNATIONAL (XI'AN) INC.

No. 39 Building A3, Entrepreneurship Avenue, New industrial park, High-tech district, Xi'an City, Shaanxi Province, P. R. China

Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA730825-01	Rev. 01	Initial issue of report	May 23, 2017

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Mobility LLC, Mobile Cellular Phone, 10808** are as follows.

Equipment Class	Frequency Band		Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
			Head (Separation 0mm)	Body-worn (Separation 10mm)	Hotspot (Separation 10mm)	
			1g SAR (W/kg)			
Licensed	GSM	GSM850	0.40	0.53	0.68	1.46
		GSM1900	0.14	0.54	1.07	
	WCDMA	Band V	0.58	**0.83**	1.18	
		Band II	0.27	0.80	1.16	
	LTE	Band 5	0.47	0.65	0.96	
		Band 7	**1.07**	0.80	**1.18**	
		Band 26	0.57	0.73	0.97	
		Band 41	0.38	0.57	0.78	
DTS	WLAN	2.4GHz WLAN	0.79	0.15	0.15	1.38
NII		5GHz WLAN	0.84	0.15	0.28	1.46
DSS	2.4GHz Band	Bluetooth				1.20
Date of Testing:			2017/03/15 ~ 2017/03/29			

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 (XI'AN) INC.
Test Site Location	No. 39 Building A3, Entrepreneurship Avenue, New industrial park, High-tech district, Xi'an City, Shaanxi Province, P. R. China TEL: +86-029-8860-8767 FAX: +86-029-8860-8791

Applicant	
Company Name	Motorola Mobility LLC
Address	222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

Manufacturer	
Company Name	Motorola Mobility LLC
Address	222 W, Merchandise Mart Plaza, Chicago IL 60654 USA

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	Mobile Cellular Phone
Brand Name	Motorola
Model Name	10808
FCC ID	IHDT56WJ2
IMEI Code	SIM1: 355661080019995 SIM2: 355661080020001
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 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 LTE Band 26: 814.7 MHz ~ 848.3 MHz LTE Band 38: 2572.5 MHz ~ 2617.5 MHz LTE Band 41: 2547.5 MHz ~ 2652.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is not supported) LTE 802.11b/g/n HT20 802.11a/n HT20/HT40 Bluetooth v3.0 + EDR, Bluetooth v4.0 LE, Bluetooth v4.1 LE, Bluetooth v4.2 LE NFC
HW Version	DVT1-B
SW Version	montana_n-userdebug 7.11 NPP26.56 1473 intcfg,test-keys
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype

Remark:
1. 802.11n-HT40 is not supported in 2.4GHz WLAN.
2. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
3. This device 2.4GHz WLAN/5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
4. This device does not support DTM operation and support GRPS/EGRPS mode up to multi-slot class 12.
5. For dual SIM card mobile has two SIM slots and supports dual SIM dual standby. The WWAN radio transmission will be enabled by either one SIM at a time (single active). After pre-scan two SIM cards power, we found test result of the SIM1 was the worse, so we chose SIM1 slot to perform all tests.
6. When the phone is in talking mode and receiver worked, then power reduction will be implemented immediately in WLAN 5GHz, all WWAN bands and WLAN2.4GHz are full powers.
7. The device employs proximity sensors that detect the presence of the user's body at the front or back faces of the device. When front or back body worn condition is detected, GSM1900, WCDMA Band II, and LTE B7 reduced power will be active. (P-sensor can't work at detecting presence of the user's body at the four edges of the device.)
8. When operating in hotspot mode, GSM1900, WCDMA Band II, and LTE B7 reduced power will be active.
9. This device hotspot reduced power and P-sensor reduced power level are the same. So only show one reduced power level for hotspot reduced power and P-sensor reduced power for this application.

4.2 Component List

Note: There are two types of EUT, the sample 1 and the sample 2, the difference between them can refer the following table. So we choose sample 1 to perform SAR full test, sample 2 verified the worst case of sample 1 for the same frequency band across head /hotspot /body-worn position.

Component	Sample 1	Sample 2
CPU	Qualcomm MSM-8937-4-727NSP-TR-00-1-AA	Qualcomm MSM-8937-4-727NSP-TR-00-1-AA
TLCM	Tianma TL052VVMP09-00/TL052VVMP13-00	Mutto 1010-0502-00009/1010-0502-00010
Memory	Samsung KMRX1000BM-B614	Hynix H9TQ26ACLTMCUR-KUM
Front Camera	sunny D5V16C-0JG	O-film L5695F70
Back Camera	sunny AL6S05S-0JG	Q-tech F3P3MBK
Battery	ATL SB18C15119	Sunwoda SB18C15118

4.3 Specification of Accessory

Note: There are two option batteries for the device, for the capacity of battery and electrical specifications are all the same, so we only chose battery 1 to do SAR testing.

Specification of Accessory				
AC Adapter 1	**Brand Name**	Motorola(Salom)	**Model Name**	SC-22
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5Vdc or 9Vdc or 12Vdc, 3000mA or 1600mA or 1200mA		
AC Adapter 2	**Brand Name**	Motorola(chenyang)	**Model Name**	SC-22
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5Vdc or 9Vdc or 12Vdc, 3000mA or 1600mA or 1200mA		
AC Adapter 3	**Brand Name**	Motorola(LiteOn)	**Model Name**	SC-22
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5Vdc or 9Vdc or 12Vdc, 3000mA or 1600mA or 1200mA		
Battery 1	**Brand Name**	Motorola (ATL)	**Model Name**	SB18C15119
	Power Rating	3.8Vdc,3000mAh	**Type**	Li-ion
Battery 2	**Brand Name**	Motorola (sunwoda)	**Model Name**	SB18C15118
	Power Rating	3.8Vdc,3000mAh	**Type**	Li-ion
Earphone 1	**Brand Name**	Motorola(Lian chuang)	**Model Name**	SJYN1181B
	Signal Line Type	1.2 meter, non-shielded cable, without ferrite core		
Earphone 2	**Brand Name**	Motorola(Lianyun)	**Model Name**	TS500-03AMS01WHR-M
	Signal Line Type	1.2 meter, non-shielded cable, without ferrite core		
Earphone 3	**Brand Name**	Motorola(Tianzhi)	**Model Name**	TJ101817
	Signal Line Type	1.2 meter, non-shielded cable, without ferrite core		
USB Cable 1	**Brand Name**	Motorola(Liqi)	**Model Name**	L25W-051000100AL
	Signal Line Type	1.0 meter, shielded cable, without core		
USB Cable 2	**Brand Name**	Motorola(Fukangyuan)	**Model Name**	F25W-051000100A
	Signal Line Type	1.0 meter, shielded cable, without core		

4.4 General LTE SAR Test and Reporting Considerations

<table>
<tr><th colspan="2">Summarized necessary items addressed in KDB 941225 D05 v02r05</th></tr>
<tr><td>FCC ID</td><td>IHDT56WJ2</td></tr>
<tr><td>Equipment Name</td><td>Mobile Cellular Phone</td></tr>
<tr><td>Operating Frequency Range of each LTE transmission band</td><td>LTE Band 5: 824.7 MHz ~ 848.3 MHz
LTE Band 7: 2502.5 MHz ~ 2567.5 MHz
LTE Band 26: 814.7 MHz ~ 848.3 MHz
LTE Band 38: 2572.5 MHz ~ 2617.5 MHz
LTE Band 41: 2547.5 MHz ~ 2652.5 MHz</td></tr>
<tr><td>Channel Bandwidth</td><td>LTE Band 5:1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 26:1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz
LTE Band 38: 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 41: 5MHz, 10MHz, 15MHz, 20MHz</td></tr>
<tr><td>uplink modulations used</td><td>QPSK, and 16QAM</td></tr>
<tr><td>LTE Voice / Data requirements</td><td>Voice and Data</td></tr>
<tr><td>LTE MPR permanently built-in by design</td><td>Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3
<table>
<tr><th rowspan="2">Modulation</th><th colspan="6">Channel bandwidth / Transmission bandwidth (RB)</th><th rowspan="2">MPR (dB)</th></tr>
<tr><th>1.4 MHz</th><th>3.0 MHz</th><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th></tr>
<tr><td>QPSK</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>≤ 5</td><td>≤ 4</td><td>≤ 8</td><td>≤ 12</td><td>≤ 16</td><td>≤ 18</td><td>≤ 1</td></tr>
<tr><td>16 QAM</td><td>> 5</td><td>> 4</td><td>> 8</td><td>> 12</td><td>> 16</td><td>> 18</td><td>≤ 2</td></tr>
</table></td></tr>
<tr><td>LTE A-MPR</td><td>In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)</td></tr>
<tr><td>Spectrum plots for RB configuration</td><td>A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.</td></tr>
<tr><td>Power reduction applied to satisfy SAR compliance</td><td>Yes,
1. When the phone is in talking mode and receiver worked, then power reduction will be implemented immediately in WLAN 5GHz, all WWAN bands and WLAN2.4GHz are full powers.
2. The device employs proximity sensors that detect the presence of the user's body at the front or back faces of the device. When front or back body worn condition is detected, GSM1900, WCDMA Band II, and LTE B7 reduced power will be active. (P-sensor can't work at detecting presence of the user's body at the four edges of the device.)
3. When operating in hotspot mode, GSM1900, WCDMA Band II, and LTE B7 reduced power will be active.</td></tr>
<tr><td>LTE Release Version</td><td>R8, Cat 4</td></tr>
<tr><td>CA Support</td><td>Not Supported</td></tr>
</table>

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

LTE Band 5

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

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

LTE Band 26

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	26697	814.7	26705	815.5	26715	816.5	26740	819	26765	821.5
M	26865	831.5	26865	831.5	26865	831.5	26865	831.5	26865	831.5
H	27033	848.3	27025	847.5	27015	846.5	26990	844	26965	841.5

LTE Band 38

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	37775	2572.5	37800	2575	37825	2577.5	37850	2580
M	38000	2595	38000	2595	38000	2595	38000	2595
H	38225	2617.5	38200	2615	38175	2612.5	38150	2610

LTE Band 41

	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	40165	2547.5	40190	2550	40215	2552.5	40240	2555
LM	40515	2582.5	40520	2583	40535	2584.5	40540	2585
HM	40865	2617.5	40850	2616	40855	2616.5	40840	2615
H	41215	2652.5	41190	2650	41165	2647.5	41140	2645

4.5 Re-use of Measured Data

4.5.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: 10646, FCC ID: IHDT56WJ2) is electrically identical to the reference device (Model: 10808, 10807, FCC ID: IHDT56WJ4) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 178919 D01.

4.5.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration "PED" file.

The re-used RF data includes the following bands provided in Appendix E (Sporton SAR Report No. FA730825-02 for the reference device Model: 10808, 10807, FCC ID: IHDT56WJ4):

- GSM850/1900
- WCDMA Band II/V
- LTE Band 5/7
- 2.4GHz WLAN
- 5GHz WLAN
- 2.4GHz Bluetooth

LTE Band 26/38/41 full SAR test. Spot check for WWAN (except for LTE Band 26/38/41) and WLAN are performed for ensure that SAR measurement for both device are the same. So, the original SAR value can represent this application.

4.5.3 Spot Check Verification Data Section

Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (mm)	Power Reduction	Ch.	Freq. (MHz)	Original model (FCC ID: IHDT56WJ4)				Spot check model (FCC ID: IHDT56WJ2)				Deviation
											Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	Average Power (dBm)	Tune-Up Limit (dBm)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)	
WLAN 2.4GHz	-	-	-	-	802.11b 1Mbps	Right Cheek	0	OFF	1	2412	16.61	17	0.706	0.792	16.61	17	0.634	0.711	-10.23%
WLAN 5.3GHz	-	-	-	-	802.11a 6Mbps	Right Cheek	0	ON	52	5260	11.41	12	0.578	0.758	11.41	12	0.524	0.687	-9.37%
WLAN 5.5GHz	-	-	-	-	802.11a 6Mbps	Right Cheek	0	ON	116	5580	14.55	15	0.663	0.842	14.55	15	0.655	0.832	-1.19%
WLAN 5.8GHz	-	-	-	-	802.11a 6Mbps	Right Cheek	0	ON	149	5745	13.53	14	0.573	0.731	13.53	14	0.502	0.640	-12.45%
GSM 850	-	-	-	-	GPRS 4 Tx slots	Left Side	10	OFF	251	848.8	27.37	28	0.586	0.677	27.37	28	0.532	0.615	-9.16%
GSM1900	-	-	-	-	GPRS 1 Tx slots	Bottom Side	10	ON	661	1880	26.21	26.5	1.000	1.069	26.21	26.5	0.945	1.010	-5.52%
WCDMA Band V	-	-	-	-	RMC 12.2Kbps	Left Side	10	OFF	4132	826.4	22.9	24	0.912	1.175	22.9	24	0.776	1.000	-14.89%
WCDMA Band II	-	-	-	-	RMC 12.2Kbps	Bottom Side	10	ON	9400	1880	16.36	17.5	0.893	1.161	16.36	17.5	0.832	1.082	-6.80%
LTE Band 5	10M	QPSK	1RB	25offset	-	Left Side	10	OFF	20525	836.5	23.2	24	0.797	0.958	23.2	24	0.733	0.881	-8.04%
LTE Band 7	20M	QPSK	1RB	49offset	-	Bottom Side	10	ON	21100	2535	20.78	21.5	0.996	1.176	20.78	21.5	0.883	1.042	-11.39%
WLAN 5.2GHz	-	-	-	-	802.11a 6Mbps	Left Side	10	OFF	40	5200	14.96	16	0.195	0.284	14.96	16	0.181	0.263	-7.39%

Note: In the table above, all the deviation of SAR test results are compliant with uncertainty budget.

4.5.4 Reference detail Section

Equipment Class	Reference FCC ID	Folder Test/RF Exposure	Report Title/Section
PCE (2G/3G/4G)	IHDT56WJ4	RF Exposure(FA730825-02)	All sections applicable
DTS (BLE)	IHDT56WJ4	RF Exposure(FA730825-02)	All sections applicable
DSS(BER)	IHDT56WJ4	RF Exposure(FA730825-02)	All sections applicable
DTS (WLAN)	IHDT56WJ4	RF Exposure(FA730825-02)	All sections applicable
NII (WLAN)	IHDT56WJ4	RF Exposure(FA730825-02)	All sections applicable

5. RF Exposure Limits

5.1 Uncontrolled Environment

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

5.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

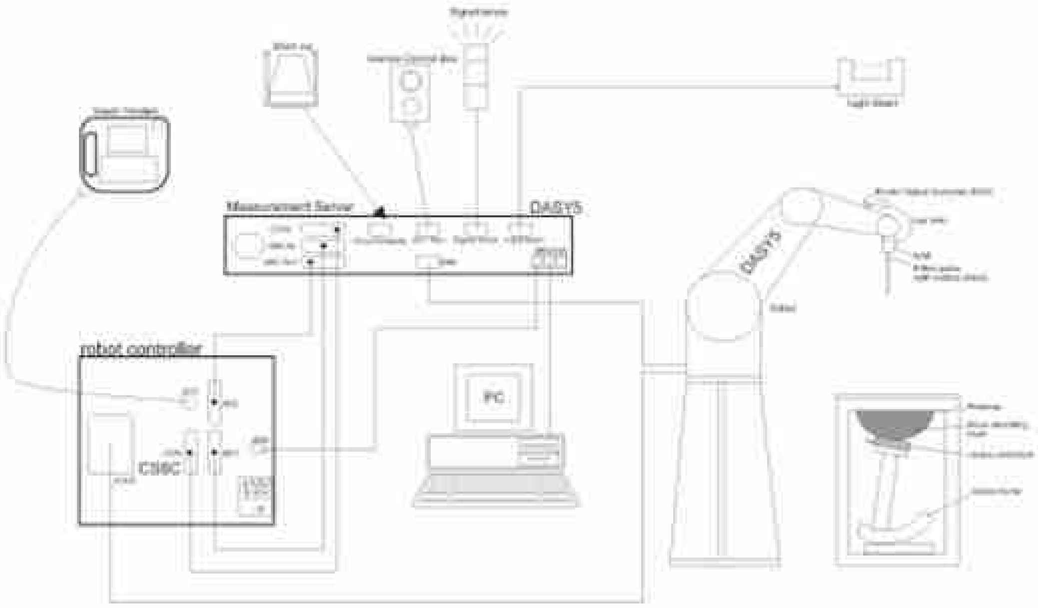
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

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



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

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

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

7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

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>

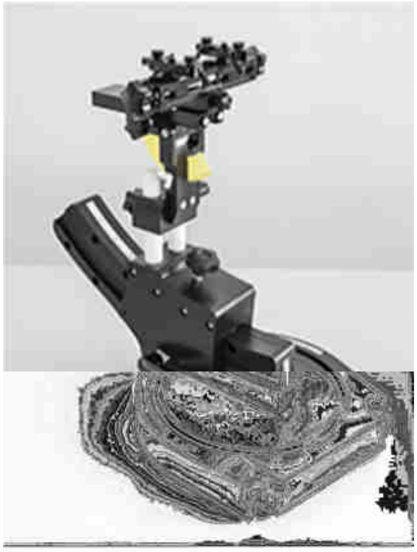
Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm

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	½·δ·ln(2) ± 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.

			$\le$ 3 GHz	$>$ 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\le$ 2 GHz: $\le$ 8 mm 2 – 3 GHz: $\le$ 5 mm*	3 – 4 GHz: $\le$ 5 mm* 4 – 6 GHz: $\le$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\le$ 5 mm	3 – 4 GHz: $\le$ 4 mm 4 – 5 GHz: $\le$ 3 mm 5 – 6 GHz: $\le$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\le$ 4 mm	3 – 4 GHz: $\le$ 3 mm 4 – 5 GHz: $\le$ 2.5 mm 5 – 6 GHz: $\le$ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\le 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\ge$ 30 mm	3 – 4 GHz: $\ge$ 28 mm 4 – 5 GHz: $\ge$ 25 mm 5 – 6 GHz: $\ge$ 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 $\le$ 1.4 W/kg, $\le$ 8 mm, $\le$ 7 mm and $\le$ 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	4d120	2016/6/22	2017/6/21
SPEAG	2600MHz System Validation Kit	D2600V2	1112	2016/8/30	2017/8/29
SPEAG	Data Acquisition Electronics	DAE4	1358	2016/9/5	2017/9/4
SPEAG	Dosimetric E-Field Probe	EX3DV4	3935	2016/11/28	2017/11/27
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1753	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1754	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY52102600	2016/12/5	2017/12/4
Anritus	Radio communication analyzer	MT8820C	6201074235	2016/12/5	2017/12/4
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	2016/12/5	2017/12/4
Agilent	Dielectric Probe Kit	85070E	MY44300751	NCR	NCR
Anritsu	Power Senor	MA2411B	1644003	2016/12/23	2017/12/22
Anritsu	Power Meter	ML2495A	1531197	2016/12/23	2017/12/22
Anritsu	Power Sensor	MA2411B	1644004	2016/12/23	2017/12/22
Anritsu	Power Meter	ML2495A	1531198	2016/12/23	2017/12/22
R&S	Signal Generator	N5181A	MY50145381	2017/1/3	2018/1/2
R&S	Spectrum Analyzer	FSV 7	101632	2016/12/5	2017/12/4
ARRA	Power Divider	A3200-2	NA	Note 1	
Agilent	Dual Directional Coupler	778D	50422	Note 1	
PASTERNACK	Dual Directional Coupler	PE2214-10	N/A	Note1	
Woken	Attenuation1	WK0602-XX	N/A	Note 1	
PE	Attenuation2	PE7005-10	N/A	Note 1	
PE	Attenuation3	PE7005-3	N/A	Note 1	
AR	Amplifier	5S1G4	342137	Note 1	
mini-circuits	Amplifier	ZVE-3W-83+	162601250	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

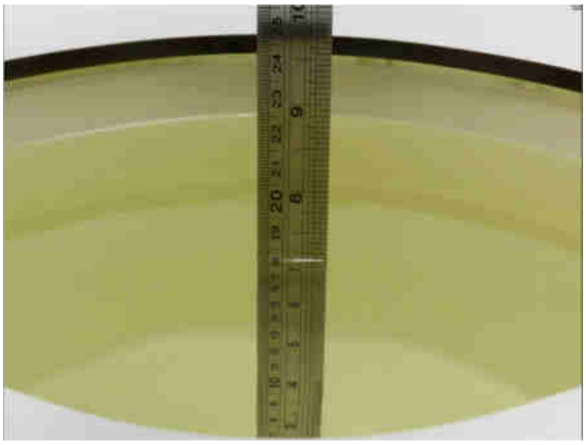


Fig 10.2 Photo of Liquid Height for Body SAR

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								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Head	22.5	0.91	42.91	0.9	41.5	1.11	3.40	±5	2017/3/17
2600	Head	22.3	2.056	37.587	1.96	39	4.90	-3.62	±5	2017/3/29
835	Body	22.4	0.983	56.56	0.97	55.2	1.34	2.46	±5	2017/3/15
2600	Body	22.8	2.22	53.297	2.16	52.5	2.78	1.52	±5	2017/3/27

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 (%)
2017/3/17	835	Head	250	4d120	3935	1358	2.38	9.42	9.52	1.06
2017/3/29	2600	Head	250	1112	3935	1358	14.9	56.4	59.6	5.67
2017/3/15	835	Body	250	4d120	3935	1358	2.44	9.52	9.76	2.52
2017/3/27	2600	Body	250	1112	3935	1358	14.7	54.9	58.8	7.10

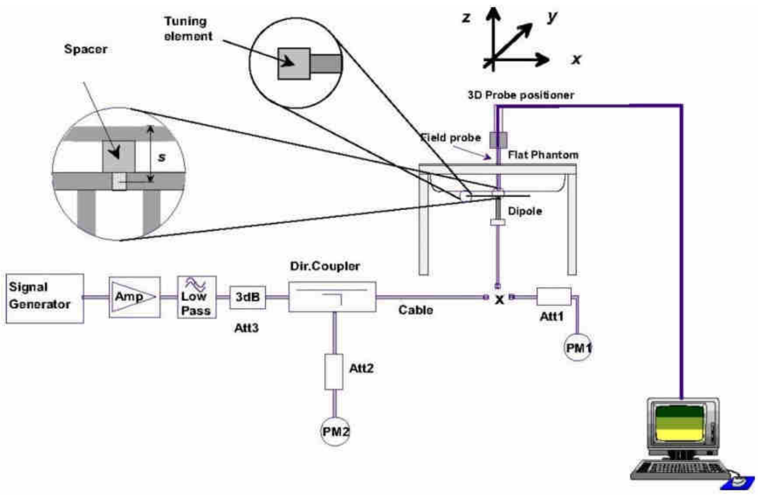


Fig 8.3.1 System Performance Check Setup

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

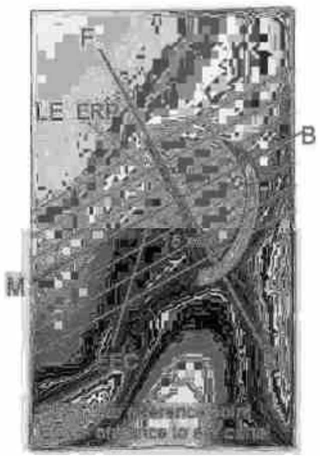


Fig 9.1.2 Close-up side view of phantom showing the ear region.

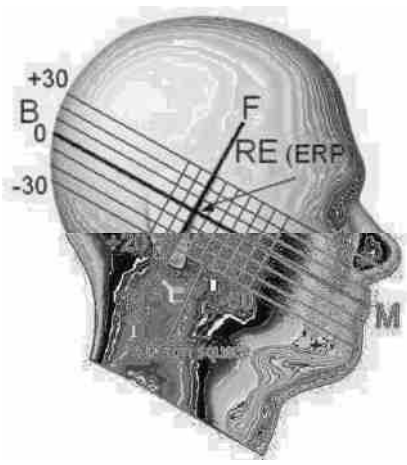


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

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.

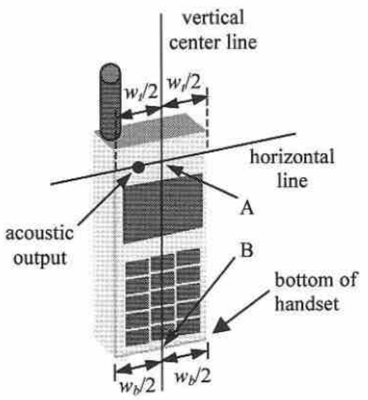


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

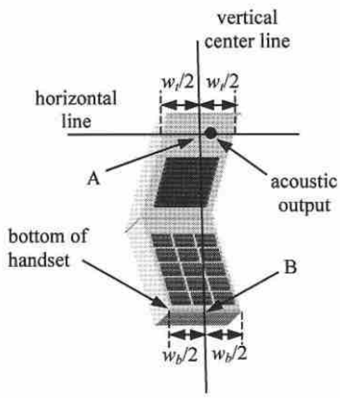


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

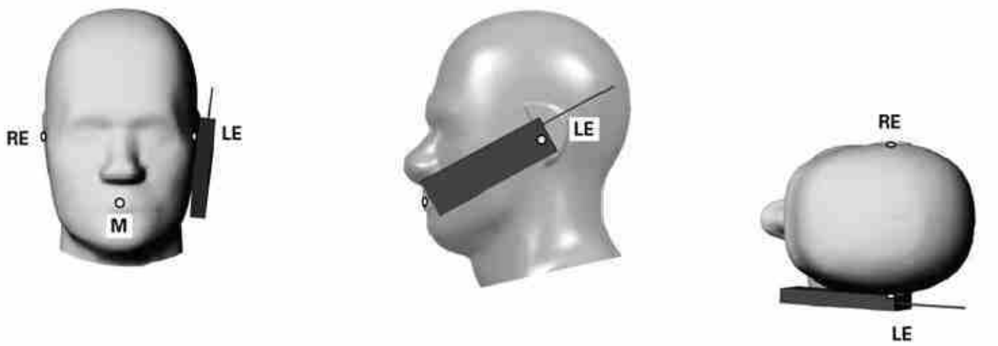


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

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.

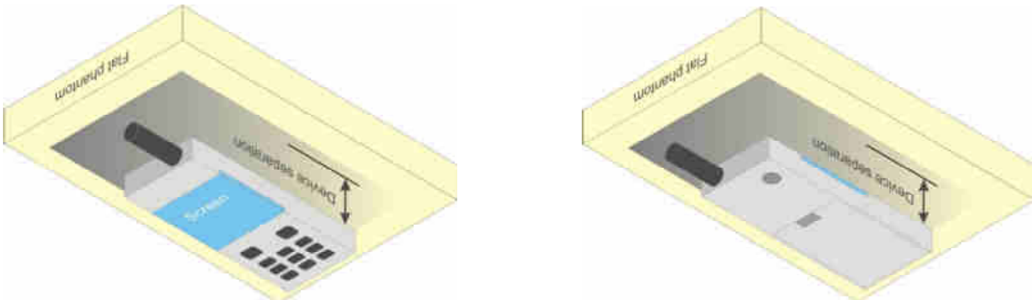


Fig 9.4 Body Worn Position

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)

<FDD 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 B26 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.
9. LTE band 38 SAR test was covered by Band 41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band

<Full Power Mode>

<LTE Band 26>

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				26765	26865	26965		
Frequency (MHz)				821.5	831.5	841.5		
15	QPSK	1	0	23.12	23.22	23.06	24	0
15	QPSK	1	37	23.36	23.35	23.25		
15	QPSK	1	74	23.13	23.02	23.06		
15	QPSK	36	0	22.34	22.20	22.17	23	1
15	QPSK	36	20	22.33	22.18	22.19		
15	QPSK	36	39	22.27	22.12	22.18		
15	QPSK	75	0	22.32	22.19	22.20		
15	16QAM	1	0	21.71	21.82	21.72	23	1
15	16QAM	1	37	22.63	22.56	22.24		
15	16QAM	1	74	21.95	21.95	21.69		
15	16QAM	36	0	21.13	21.13	21.15	22	2
15	16QAM	36	20	21.20	21.21	21.19		
15	16QAM	36	39	21.32	21.09	21.17		
15	16QAM	75	0	21.24	21.11	21.15		
Channel				26740	26865	26990	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				819	831.5	844		
10	QPSK	1	0	23.21	22.99	22.99	24	0
10	QPSK	1	25	23.31	23.19	23.26		
10	QPSK	1	49	23.14	23.01	22.95		
10	QPSK	25	0	22.35	22.27	22.18	23	1
10	QPSK	25	12	22.30	22.23	22.21		
10	QPSK	25	25	22.23	22.07	22.12		
10	QPSK	50	0	22.29	22.18	22.20		
10	16QAM	1	0	21.94	22.04	21.75	23	1
10	16QAM	1	25	22.41	22.43	22.22		
10	16QAM	1	49	21.87	21.73	21.81		
10	16QAM	25	0	21.23	21.15	21.18	22	2
10	16QAM	25	12	21.27	21.14	21.10		
10	16QAM	25	25	21.17	21.13	21.10		
10	16QAM	50	0	21.37	21.16	21.13		

Channel				26715	26865	27015	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				816.5	831.5	846.5		
5	QPSK	1	0	23.09	23.00	22.90	24	0
5	QPSK	1	12	23.29	23.32	23.27		
5	QPSK	1	24	22.91	23.03	22.83		
5	QPSK	12	0	22.30	22.24	22.13	23	1
5	QPSK	12	7	22.27	22.26	22.08		
5	QPSK	12	13	22.19	22.06	22.19		
5	QPSK	25	0	22.29	22.19	22.12		
5	16QAM	1	0	21.63	21.63	21.66	23	1
5	16QAM	1	12	22.42	22.25	22.32		
5	16QAM	1	24	21.76	22.09	21.65		
5	16QAM	12	0	21.07	21.16	21.08	22	2
5	16QAM	12	7	21.03	21.18	21.18		
5	16QAM	12	13	20.96	20.93	21.09		
5	16QAM	25	0	21.20	21.11	21.10		
Channel				26705	26865	27025	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				815.5	831.5	847.5		
3	QPSK	1	0	23.08	23.17	22.83	24	0
3	QPSK	1	8	23.12	22.93	23.04		
3	QPSK	1	14	23.07	23.12	22.88		
3	QPSK	8	0	22.23	22.24	22.21	23	1
3	QPSK	8	4	22.35	22.25	22.12		
3	QPSK	8	7	22.11	22.18	22.13		
3	QPSK	15	0	22.28	22.21	22.13		
3	16QAM	1	0	22.27	21.65	22.00	23	1
3	16QAM	1	8	22.28	21.61	21.66		
3	16QAM	1	14	21.70	21.63	21.62		
3	16QAM	8	0	21.31	21.19	21.17	22	2
3	16QAM	8	4	21.11	21.29	21.09		
3	16QAM	8	7	21.23	21.17	21.16		
3	16QAM	15	0	21.36	21.19	21.22		

Channel				26697	26865	27033	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				814.7	831.5	848.3		
1.4	QPSK	1	0	22.87	23.20	23.15	24	0
1.4	QPSK	1	3	23.04	23.18	23.00		
1.4	QPSK	1	5	23.01	23.12	23.01		
1.4	QPSK	3	0	23.22	23.26	23.28		
1.4	QPSK	3	1	23.22	23.34	23.30		
1.4	QPSK	3	3	23.18	23.29	23.21		
1.4	QPSK	6	0	22.13	22.20	22.19	23	1
1.4	16QAM	1	0	21.82	21.82	21.71	23	1
1.4	16QAM	1	3	22.11	22.09	21.92		
1.4	16QAM	1	5	21.91	21.73	22.03		
1.4	16QAM	3	0	22.05	22.05	22.04		
1.4	16QAM	3	1	22.34	22.03	21.95		
1.4	16QAM	3	3	22.17	22.01	21.94		
1.4	16QAM	6	0	21.01	21.19	20.91	22	2

<TDD LTE SAR Measurement>

TDD LTE configuration setup for SAR measurement

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

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

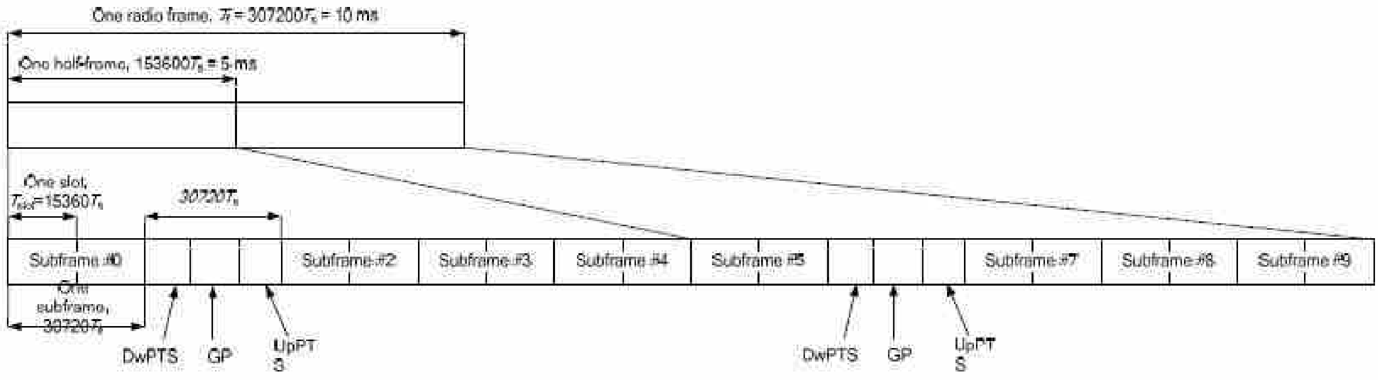


Figure 4.2-1: Frame structure type 2 (for 5 ms switch-point periodicity).

Table 4.2-2: Uplink-downlink configurations.

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

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

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

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

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

The highest duty factor is resulted from:

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

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

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

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

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

<Full Power Mode>

<LTE Band 38>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				37850	38000	38150		
Frequency (MHz)				2580	2595	2610		
20	QPSK	1	0	23.40	23.09	23.26	24	0
20	QPSK	1	49	23.16	23.17	23.34		
20	QPSK	1	99	23.08	23.02	22.95		
20	QPSK	50	0	22.52	22.47	22.46	23	1
20	QPSK	50	24	22.48	22.46	22.42		
20	QPSK	50	50	22.30	22.42	22.38		
20	QPSK	100	0	22.36	22.41	22.35		
20	16QAM	1	0	22.11	22.09	22.14	23	1
20	16QAM	1	49	22.23	22.22	22.16		
20	16QAM	1	99	22.02	22.06	21.76		
20	16QAM	50	0	21.35	21.43	21.33	22	2
20	16QAM	50	24	21.43	21.45	21.18		
20	16QAM	50	50	21.25	21.30	21.25		
20	16QAM	100	0	21.32	21.39	21.36		
Channel				37825	38000	38175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2577.5	2595	2612.5		
15	QPSK	1	0	23.35	23.41	23.40	24	0
15	QPSK	1	37	23.65	23.60	23.20		
15	QPSK	1	74	23.30	23.23	23.15		
15	QPSK	36	0	22.55	22.45	22.38	23	1
15	QPSK	36	20	22.39	22.51	22.39		
15	QPSK	36	39	22.32	22.42	22.27		
15	QPSK	75	0	22.38	22.43	22.37		
15	16QAM	1	0	22.08	22.16	22.11	23	1
15	16QAM	1	37	22.25	22.38	21.99		
15	16QAM	1	74	21.98	22.12	22.02		
15	16QAM	36	0	21.34	21.47	21.38	22	2
15	16QAM	36	20	21.30	21.45	21.31		
15	16QAM	36	39	21.34	21.38	21.22		
15	16QAM	75	0	21.32	21.48	21.38		

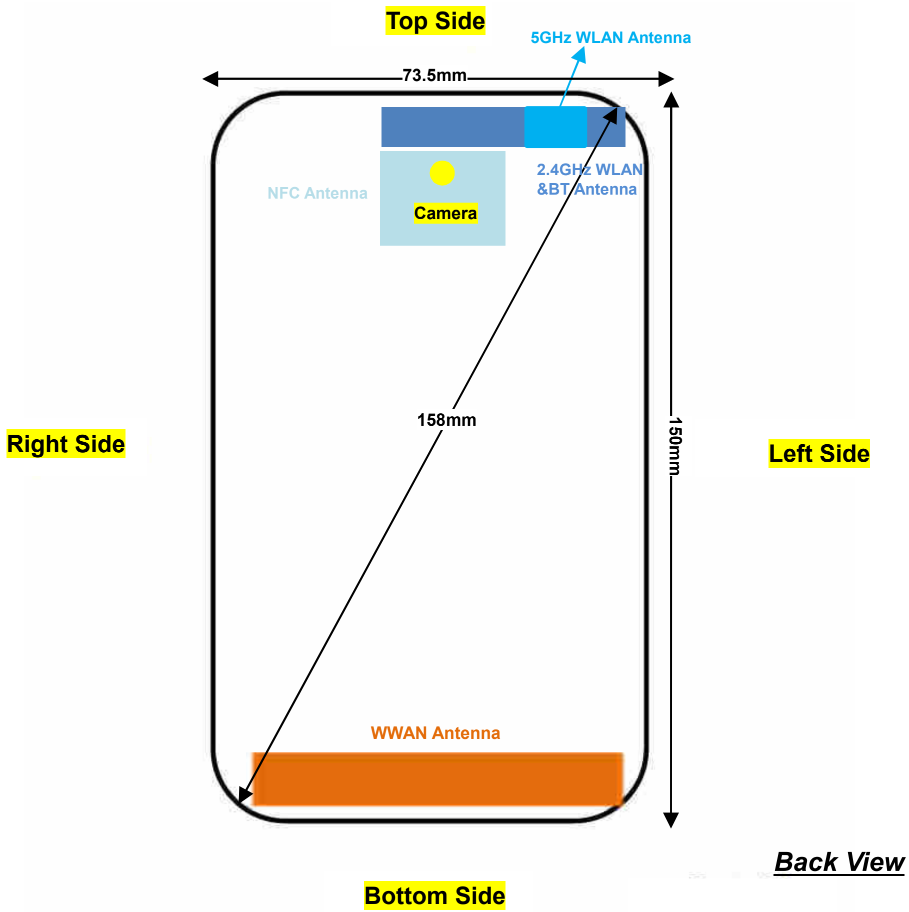
Channel				37800	38000	38200	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2575	2595	2615		
10	QPSK	1	0	23.50	23.17	23.08	24	0
10	QPSK	1	25	23.48	23.30	23.24		
10	QPSK	1	49	23.31	23.14	23.00		
10	QPSK	25	0	22.46	22.43	22.34	23	1
10	QPSK	25	12	22.46	22.39	22.42		
10	QPSK	25	25	22.39	22.28	22.31		
10	QPSK	50	0	22.34	22.38	22.43		
10	16QAM	1	0	22.22	22.12	22.11	23	1
10	16QAM	1	25	22.42	22.18	21.96		
10	16QAM	1	49	21.99	22.17	21.78		
10	16QAM	25	0	21.64	21.70	21.42	22	2
10	16QAM	25	12	21.63	21.68	21.55		
10	16QAM	25	25	21.52	21.66	21.56		
10	16QAM	50	0	21.40	21.55	21.37		
Channel				37775	38000	38225	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2572.5	2595	2617.5		
5	QPSK	1	0	23.30	23.11	23.23	24	0
5	QPSK	1	12	23.44	23.28	23.14		
5	QPSK	1	24	23.18	23.11	22.89		
5	QPSK	12	0	22.45	22.39	22.18	23	1
5	QPSK	12	7	22.50	22.40	22.23		
5	QPSK	12	13	22.34	22.40	22.15		
5	QPSK	25	0	22.40	22.39	22.18		
5	16QAM	1	0	22.25	21.92	21.72	23	1
5	16QAM	1	12	22.24	22.02	22.14		
5	16QAM	1	24	21.90	21.97	21.60		
5	16QAM	12	0	21.42	21.27	21.15	22	2
5	16QAM	12	7	21.45	21.47	21.31		
5	16QAM	12	13	21.40	21.38	21.14		
5	16QAM	25	0	21.56	21.53	21.06		

<u><LTE Band 41></u>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Low Ch. / Freq.	Power Middle High Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				40240	40540	40840	41140		
Frequency (MHz)				2555	2585	2615	2645		
20	QPSK	1	0	23.41	23.33	23.01	23.13	24	0
20	QPSK	1	49	23.69	23.24	23.33	23.17		
20	QPSK	1	99	23.44	22.93	23.12	22.80		
20	QPSK	50	0	22.58	22.50	22.37	22.13	23	1
20	QPSK	50	24	22.57	22.44	22.45	22.15		
20	QPSK	50	50	22.56	22.44	22.37	22.04		
20	QPSK	100	0	22.59	22.53	22.56	22.11		
20	16QAM	1	0	22.34	22.11	22.13	21.92	23	1
20	16QAM	1	49	22.41	22.23	22.10	21.92		
20	16QAM	1	99	21.96	22.00	21.70	21.51		
20	16QAM	50	0	21.50	21.47	21.41	20.99	22	2
20	16QAM	50	24	21.60	21.50	21.30	21.14		
20	16QAM	50	50	21.52	21.26	21.53	21.04		
20	16QAM	100	0	21.54	21.48	21.54	20.98		
Channel				40215	40535	40855	41165	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2552.5	2584.5	2616.5	2647.5		
15	QPSK	1	0	23.57	23.34	23.16	23.06	24	0
15	QPSK	1	37	23.68	23.57	23.31	23.30		
15	QPSK	1	74	23.67	23.29	23.07	22.92		
15	QPSK	36	0	22.64	22.53	22.38	22.10	23	1
15	QPSK	36	20	22.70	22.47	22.38	22.29		
15	QPSK	36	39	22.58	22.47	22.26	22.03		
15	QPSK	75	0	22.58	22.61	22.56	22.06		
15	16QAM	1	0	22.20	22.15	22.03	21.89	23	1
15	16QAM	1	37	22.18	22.00	21.92	21.72		
15	16QAM	1	74	22.42	22.18	21.96	21.48		
15	16QAM	36	0	21.50	21.45	21.32	21.01	22	2
15	16QAM	36	20	21.60	21.51	21.40	21.05		
15	16QAM	36	39	21.59	21.51	21.45	21.01		
15	16QAM	75	0	21.53	21.68	21.27	21.04		

Channel				40190	40520	40850	41190	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2550	2583	2616	2650		
10	QPSK	1	0	23.44	23.34	23.16	22.88	24	0
10	QPSK	1	25	23.61	23.25	23.30	22.96		
10	QPSK	1	49	23.62	23.12	23.26	22.85		
10	QPSK	25	0	22.55	22.47	22.44	22.19	23	1
10	QPSK	25	12	22.66	22.47	22.31	22.16		
10	QPSK	25	25	22.59	22.50	22.29	21.91		
10	QPSK	50	0	22.60	22.46	22.47	22.13		
10	16QAM	1	0	22.28	22.23	22.12	21.83	23	1
10	16QAM	1	25	22.42	22.14	22.17	21.72		
10	16QAM	1	49	22.23	22.21	21.96	21.66		
10	16QAM	25	0	21.55	21.73	21.23	21.33	22	2
10	16QAM	25	12	21.82	21.65	21.27	21.36		
10	16QAM	25	25	21.74	21.60	21.60	21.00		
10	16QAM	50	0	21.59	21.52	21.19	21.05		
Channel				40165	40515	40865	41215	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				2547.5	2582.5	2617.5	2652.5		
5	QPSK	1	0	23.38	23.23	23.13	22.89	24	0
5	QPSK	1	12	23.59	23.50	23.37	23.02		
5	QPSK	1	24	23.42	23.22	23.16	22.86		
5	QPSK	12	0	22.54	22.58	22.30	22.10	23	1
5	QPSK	12	7	22.62	22.56	22.37	22.09		
5	QPSK	12	13	22.54	22.45	22.27	21.98		
5	QPSK	25	0	22.50	22.46	22.26	22.07		
5	16QAM	1	0	22.04	22.11	21.85	21.70	23	1
5	16QAM	1	12	22.25	22.17	21.94	22.10		
5	16QAM	1	24	22.03	22.00	21.81	21.63		
5	16QAM	12	0	21.29	21.55	21.23	21.18	22	2
5	16QAM	12	7	21.48	21.55	21.43	21.16		
5	16QAM	12	13	21.38	21.52	21.19	20.96		
5	16QAM	25	0	21.50	21.61	21.44	21.19		

13. Antenna Location



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	≤ 25mm	≤ 25mm	140mm	≤ 25mm	≤ 25mm	≤ 25mm
BT&2.4GWLAN	≤ 25mm	≤ 25mm	≤ 25mm	140mm	40.5mm	≤ 25mm
5GWLAN	≤ 25mm	≤ 25mm	≤ 25mm	140mm	61mm	≤ 25mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	Yes	Yes	No	Yes	Yes	Yes
BT&2.4GWLAN	Yes	Yes	Yes	No	No	Yes
5GWLAN	Yes	Yes	Yes	No	No	Yes

General Note:
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. Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   c. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix 63.3%/62.9% = 1.006 is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)* Tune-up Scaling Factor* scaling factor for extended cyclic prefix.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

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 B26 the maximum bandwidth does not support three non-overlapping channels, per KDB 941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
7. LTE band 38 SAR test was covered by Band 41; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
   a. the maximum output power, including tolerance, for the smaller band is ≤ the larger band to qualify for the SAR test exclusion
   b. the channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band

14.1 Head SAR

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 26	15M	QPSK	1RB	37offset	Right Cheek	OFF	26865	831.5	23.35	24	1.161	0.16	#1	0.415	0.482
	LTE Band 26	15M	QPSK	1RB	37offset	Right Tilted	OFF	26865	831.5	23.35	24	1.161	-0.03	#1	0.263	0.305
01	LTE Band 26	15M	QPSK	1RB	37offset	Left Cheek	OFF	26865	831.5	23.35	24	1.161	0.07	#1	0.490	**0.569**
	LTE Band 26	15M	QPSK	1RB	37offset	Left Tilted	OFF	26865	831.5	23.35	24	1.161	-0.14	#1	0.310	0.360
	LTE Band 26	15M	QPSK	36RB	0offset	Right Cheek	OFF	26865	831.5	22.2	23	1.202	0.04	#1	0.245	0.295
	LTE Band 26	15M	QPSK	36RB	0offset	Right Tilted	OFF	26865	831.5	22.2	23	1.202	0.02	#1	0.146	0.176
	LTE Band 26	15M	QPSK	36RB	0offset	Left Cheek	OFF	26865	831.5	22.2	23	1.202	0.02	#1	0.290	0.349
	LTE Band 26	15M	QPSK	36RB	0offset	Left Tilted	OFF	26865	831.5	22.2	23	1.202	0.07	#1	0.183	0.220

<TDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
02	LTE Band 41	20M	QPSK	1RB	49offset	Right Cheek	OFF	40240	2555	23.69	24	1.074	62.9	1.006	0.12	#1	0.351	**0.379**
	LTE Band 41	20M	QPSK	1RB	49offset	Right Tilted	OFF	40240	2555	23.69	24	1.074	62.9	1.006	0.02	#1	0.089	0.096
	LTE Band 41	20M	QPSK	1RB	49offset	Left Cheek	OFF	40240	2555	23.69	24	1.074	62.9	1.006	0	#1	0.150	0.162
	LTE Band 41	20M	QPSK	1RB	49offset	Left Tilted	OFF	40240	2555	23.69	24	1.074	62.9	1.006	0.1	#1	0.104	0.112
	LTE Band 41	20M	QPSK	50RB	0offset	Right Cheek	OFF	40240	2555	22.58	23	1.102	62.9	1.006	0.04	#1	0.235	0.260
	LTE Band 41	20M	QPSK	50RB	0offset	Right Tilted	OFF	40240	2555	22.58	23	1.102	62.9	1.006	0.09	#1	0.060	0.066
	LTE Band 41	20M	QPSK	50RB	0offset	Left Cheek	OFF	40240	2555	22.58	23	1.102	62.9	1.006	0.14	#1	0.104	0.115
	LTE Band 41	20M	QPSK	50RB	0offset	Left Tilted	OFF	40240	2555	22.58	23	1.102	62.9	1.006	-0.13	#1	0.074	0.082

14.2 Hotspot SAR

<FDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Gap (mm)	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 26	15M	QPSK	1RB	37offset	10	Front	OFF	26865	831.5	23.35	24	1.16	0.02	#1	0.534	0.620
	LTE Band 26	15M	QPSK	1RB	37offset	10	Back	OFF	26865	831.5	23.35	24	1.16	0.03	#1	0.630	0.732
03	LTE Band 26	15M	QPSK	1RB	37offset	10	Left side	OFF	26865	831.5	23.35	24	1.16	0.04	#1	0.839	0.974
	LTE Band 26	15M	QPSK	1RB	37offset	10	Right side	OFF	26865	831.5	23.35	24	1.16	-0.08	#1	0.512	0.595
	LTE Band 26	15M	QPSK	1RB	37offset	10	Bottom side	OFF	26865	831.5	23.35	24	1.16	0.07	#1	0.140	0.163
	LTE Band 26	15M	QPSK	36RB	0offset	10	Front	OFF	26865	831.5	22.2	23	1.20	0.02	#1	0.325	0.391
	LTE Band 26	15M	QPSK	36RB	0offset	10	Back	OFF	26865	831.5	22.2	23	1.20	0.01	#1	0.384	0.462
	LTE Band 26	15M	QPSK	36RB	0offset	10	Left side	OFF	26865	831.5	22.2	23	1.20	0.04	#1	0.520	0.625
	LTE Band 26	15M	QPSK	36RB	0offset	10	Right side	OFF	26865	831.5	22.2	23	1.20	0.02	#1	0.323	0.388
	LTE Band 26	15M	QPSK	36RB	0offset	10	Bottom side	OFF	26865	831.5	22.2	23	1.20	0.08	#1	0.079	0.095
	LTE Band 26	15M	QPSK	75RB	0offset	10	Left side	OFF	26865	831.5	22.19	23	1.21	0.01	#1	0.505	0.609
	LTE Band 26	15M	QPSK	1RB	37offset	10	Left side	OFF	26865	831.5	23.35	24	1.16	0.06	#2	0.736	0.855

<TDD LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Gap (mm)	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 41	20M	QPSK	1RB	49offset	10	Front	OFF	40240	2555	23.69	24	1.07	62.9	1.006	0.01	#1	0.395	0.427
	LTE Band 41	20M	QPSK	1RB	49offset	10	Back	OFF	40240	2555	23.69	24	1.07	62.9	1.006	-0.01	#1	0.529	0.572
	LTE Band 41	20M	QPSK	1RB	49offset	10	Left side	OFF	40240	2555	23.69	24	1.07	62.9	1.006	0.05	#1	0.054	0.058
	LTE Band 41	20M	QPSK	1RB	49offset	10	Right side	OFF	40240	2555	23.69	24	1.07	62.9	1.006	0.11	#1	0.381	0.412
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40240	2555	23.69	24	1.07	62.9	1.006	-0.03	#1	0.705	0.762
04	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40540	2585	23.24	24	1.19	62.9	1.006	-0.07	#1	0.650	0.779
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40840	2615	23.33	24	1.17	62.9	1.006	-0.02	#1	0.641	0.752
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	41140	2645	23.17	24	1.21	62.9	1.006	-0.01	#1	0.524	0.638
	LTE Band 41	20M	QPSK	50RB	0offset	10	Front	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.02	#1	0.267	0.296
	LTE Band 41	20M	QPSK	50RB	0offset	10	Back	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.02	#1	0.359	0.398
	LTE Band 41	20M	QPSK	50RB	0offset	10	Left side	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.09	#1	0.032	0.035
	LTE Band 41	20M	QPSK	50RB	0offset	10	Right side	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.07	#1	0.270	0.299
	LTE Band 41	20M	QPSK	50RB	0offset	10	Bottom side	OFF	40240	2555	22.58	23	1.10	62.9	1.006	-0.1	#1	0.490	0.543
	LTE Band 41	20M	QPSK	100RB	0offset	10	Bottom side	OFF	40240	2555	22.59	23	1.10	62.9	1.006	-0.02	#1	0.496	0.548
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40540	2585	23.24	24	1.19	62.9	1.006	0.12	#2	0.622	0.745
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40240	2555	23.69	24	1.07	62.9	1.006	0.04	#2	0.611	0.660
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	40840	2615	23.33	24	1.17	62.9	1.006	0.07	#2	0.589	0.691
	LTE Band 41	20M	QPSK	1RB	49offset	10	Bottom side	OFF	41140	2645	23.17	24	1.21	62.9	1.006	-0.13	#2	0.507	0.617

14.3 Body Worn Accessory SAR

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Gap (mm)	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 26	15M	QPSK	1RB	37offset	10	Front	OFF	26865	831.5	23.35	24	1.16	0.02	#1	0.534	0.620
05	LTE Band 26	15M	QPSK	1RB	37offset	10	Back	OFF	26865	831.5	23.35	24	1.16	0.03	#1	0.630	0.732
	LTE Band 26	15M	QPSK	36RB	0offset	10	Front	OFF	26865	831.5	22.2	23	1.20	0.02	#1	0.325	0.391
	LTE Band 26	15M	QPSK	36RB	0offset	10	Back	OFF	26865	831.5	22.2	23	1.20	0.01	#1	0.384	0.462

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Gap (mm)	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 41	20M	QPSK	1RB	49offset	10	Front	OFF	40240	2555	23.69	24	1.07	62.9	1.006	0.01	#1	0.395	0.427
06	LTE Band 41	20M	QPSK	1RB	49offset	10	Back	OFF	40240	2555	23.69	24	1.07	62.9	1.006	-0.01	#1	0.529	0.572
	LTE Band 41	20M	QPSK	50RB	0offset	10	Front	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.02	#1	0.267	0.296
	LTE Band 41	20M	QPSK	50RB	0offset	10	Back	OFF	40240	2555	22.58	23	1.10	62.9	1.006	0.02	#1	0.359	0.398

14.4 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB Offset	Gap (mm)	Test Position	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Sample	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	LTE Band 26	15M	QPSK	1RB	37offset	10	Left side	OFF	26865	831.5	23.35	24	1.16	0.04	#1	0.839	1	0.974
2nd	LTE Band 26	15M	QPSK	1RB	37offset	10	Left side	OFF	26865	831.5	23.35	24	1.16	0.16	#1	0.772	1.087	0.897

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			Note
		Head	Body-worn	Hotspot	
1.	GSM Voice + WLAN2.4GHz	Yes	Yes		
2.	GPRS/EDGE + WLAN2.4GHz	Yes	Yes	Yes	WWAN VoIP
3.	WCDMA + WLAN2.4GHz	Yes	Yes	Yes	WWAN VoIP
4.	LTE + WLAN2.4GHz	Yes	Yes	Yes	WWAN VoIP
5.	GSM Voice + WLAN5.3/5.5GHz	Yes	Yes		
6.	GPRS/EDGE + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
7.	WCDMA + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
8.	LTE + WLAN5.3/5.5GHz	Yes	Yes		WWAN VoIP
9.	GSM Voice + WLAN5.2/5.8GHz	Yes	Yes	Yes	
10.	GPRS/EDGE + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
11.	WCDMA + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
12.	LTE + WLAN5.2/5.8GHz	Yes	Yes	Yes	WWAN VoIP
13.	GSM Voice + Bluetooth		Yes		
14.	GPRS/EDGE + Bluetooth		Yes		WWAN VoIP
15.	WCDMA + Bluetooth		Yes		WWAN VoIP
16.	LTE + Bluetooth		Yes		WWAN VoIP

General Note:

1. This device supports VoIP in GPRS, EGPRS, WCDMA and LTE (e.g. for 3rd-party VoIP), LTE supports VoLTE operation.
2. EUT will choose each GSM, WCDMA and LTE according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. This device 2.4GHz WLAN/ 5.2GHz WLAN/5.8GHz WLAN support hotspot operation, and 5.2GHz WLAN/5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
4. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment though they have independent antenna.
5. WLAN 2.4GHz and Bluetooth share the same antenna so can't transmit simultaneously.
6. According to the EUT character, WLAN 5GHz and Bluetooth can't transmit simultaneously.
7. Chose the worst zoom scan SAR of WLAN2.4GHz correspondingly for co-located with WWAN analysis.
8. The reported SAR summation is calculated based on the same configuration and test position.
9. 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.
10. 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 (dBm)	Exposure Position	Body worn
	Test separation	10 mm
12.50	Estimated SAR (W/kg)	0.378

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)	SPLSR	Case No
GSM	GSM850	Right Cheek	0.338	0.792	1.13		
		Right Tilted	0.247	0.542	0.79		
		Left Cheek	0.401	0.792	1.19		
		Left Tilted	0.230	0.792	1.02		
	GSM1900	Right Cheek	0.136	0.792	0.93		
		Right Tilted	0.042	0.542	0.58		
		Left Cheek	0.053	0.792	0.85		
		Left Tilted	0.043	0.792	0.84		
WCDMA	Band V	Right Cheek	0.419	0.792	1.21		
		Right Tilted	0.327	0.542	0.87		
		Left Cheek	0.584	0.792	**1.38**		
		Left Tilted	0.368	0.792	1.16		
	Band II	Right Cheek	0.274	0.792	1.07		
		Right Tilted	0.085	0.542	0.63		
		Left Cheek	0.120	0.792	0.91		
		Left Tilted	0.072	0.792	0.86		
LTE	Band 5	Right Cheek	0.399	0.792	1.19		
		Right Tilted	0.279	0.542	0.82		
		Left Cheek	0.469	0.792	1.26		
		Left Tilted	0.302	0.792	1.09		
	Band 7	Right Cheek	1.070	0.792	**1.86**	**0.03**	**#1**
		Right Tilted	0.226	0.542	0.77		
		Left Cheek	0.396	0.792	1.19		
		Left Tilted	0.284	0.792	1.08		
	Band 26	Right Cheek	0.482	0.792	1.27		
		Right Tilted	0.305	0.542	0.85		
		Left Cheek	0.569	0.792	1.36		
		Left Tilted	0.360	0.792	1.15		
	Band 41	Right Cheek	0.379	0.792	1.17		
		Right Tilted	0.096	0.542	0.64		
		Left Cheek	0.162	0.792	0.95		
		Left Tilted	0.112	0.792	0.90		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	3 5.3GHz WLAN 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Right Cheek	0.338	0.758	1.10		
		Right Tilted	0.247	0.589	0.84		
		Left Cheek	0.401	0.233	0.63		
		Left Tilted	0.230	0.194	0.42		
	GSM1900	Right Cheek	0.136	0.758	0.89		
		Right Tilted	0.042	0.589	0.63		
		Left Cheek	0.053	0.233	0.29		
		Left Tilted	0.043	0.194	0.24		
WCDMA	Band V	Right Cheek	0.419	0.758	1.18		
		Right Tilted	0.327	0.589	0.92		
		Left Cheek	0.584	0.233	0.82		
		Left Tilted	0.368	0.194	0.56		
	Band II	Right Cheek	0.274	0.758	1.03		
		Right Tilted	0.085	0.589	0.67		
		Left Cheek	0.120	0.233	0.35		
		Left Tilted	0.072	0.194	0.27		

WWAN Band		Exposure Position	1	3	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN	5.3GHz WLAN			
			1g SAR (W/kg)	1g SAR (W/kg)			
LTE	Band 5	Right Cheek	0.399	0.758	1.16		
		Right Tilted	0.279	0.589	0.87		
		Left Cheek	0.469	0.233	0.70		
		Left Tilted	0.302	0.194	0.50		
	Band 7	Right Cheek	1.070	0.758	**1.83**	**0.03**	**#2**
		Right Tilted	0.226	0.589	0.82		
		Left Cheek	0.396	0.233	0.63		
		Left Tilted	0.284	0.194	0.48		
	Band 26	Right Cheek	0.482	0.758	1.24		
		Right Tilted	0.305	0.589	0.89		
		Left Cheek	0.569	0.233	0.80		
		Left Tilted	0.360	0.194	0.55		
	Band 41	Right Cheek	0.379	0.758	1.14		
		Right Tilted	0.096	0.589	0.69		
		Left Cheek	0.162	0.233	0.40		
		Left Tilted	0.112	0.194	0.31		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	4 5.5GHz WLAN 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Right Cheek	0.338	0.842	1.18		
		Right Tilted	0.247	0.381	0.63		
		Left Cheek	0.401	0.250	0.65		
		Left Tilted	0.230	0.196	0.43		
	GSM1900	Right Cheek	0.136	0.842	0.98		
		Right Tilted	0.042	0.381	0.42		
		Left Cheek	0.053	0.250	0.30		
		Left Tilted	0.043	0.196	0.24		
WCDMA	Band V	Right Cheek	0.419	0.842	1.26		
		Right Tilted	0.327	0.381	0.71		
		Left Cheek	0.584	0.250	0.83		
		Left Tilted	0.368	0.196	0.56		
	Band II	Right Cheek	0.274	0.842	1.12		
		Right Tilted	0.085	0.381	0.47		
		Left Cheek	0.120	0.250	0.37		
		Left Tilted	0.072	0.196	0.27		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	4 5.5GHz WLAN 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
LTE	Band 5	Right Cheek	0.399	0.842	1.24		
		Right Tilted	0.279	0.381	0.66		
		Left Cheek	0.469	0.250	0.72		
		Left Tilted	0.302	0.196	0.50		
	Band 7	Right Cheek	1.070	0.842	**1.91**	**0.03**	**#3**
		Right Tilted	0.226	0.381	0.61		
		Left Cheek	0.396	0.250	0.65		
		Left Tilted	0.284	0.196	0.48		
	Band 26	Right Cheek	0.482	0.842	1.32		
		Right Tilted	0.305	0.381	0.69		
		Left Cheek	0.569	0.250	0.82		
		Left Tilted	0.360	0.196	0.56		
	Band 41	Right Cheek	0.379	0.842	1.22		
		Right Tilted	0.096	0.381	0.48		
		Left Cheek	0.162	0.250	0.41		
		Left Tilted	0.112	0.196	0.31		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	5 5.8GHz WLAN 1g SAR (W/kg)	1+5 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Right Cheek	0.338	0.731	1.07		
		Right Tilted	0.247	0.583	0.83		
		Left Cheek	0.401	0.254	0.66		
		Left Tilted	0.230	0.216	0.45		
	GSM1900	Right Cheek	0.136	0.731	0.87		
		Right Tilted	0.042	0.583	0.63		
		Left Cheek	0.053	0.254	0.31		
		Left Tilted	0.043	0.216	0.26		
WCDMA	Band V	Right Cheek	0.419	0.731	1.15		
		Right Tilted	0.327	0.583	0.91		
		Left Cheek	0.584	0.254	0.84		
		Left Tilted	0.368	0.216	0.58		
	Band II	Right Cheek	0.274	0.731	1.01		
		Right Tilted	0.085	0.583	0.67		
		Left Cheek	0.120	0.254	0.37		
		Left Tilted	0.072	0.216	0.29		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	5 5.8GHz WLAN 1g SAR (W/kg)	1+5 Summed 1g SAR (W/kg)	SPLSR	Case No
LTE	Band 5	Right Cheek	0.399	0.731	1.13		
		Right Tilted	0.279	0.583	0.86		
		Left Cheek	0.469	0.254	0.72		
		Left Tilted	0.302	0.216	0.52		
	Band 7	Right Cheek	1.070	0.731	**1.80**	**0.03**	**#4**
		Right Tilted	0.226	0.583	0.81		
		Left Cheek	0.396	0.254	0.65		
		Left Tilted	0.284	0.216	0.50		
	Band 26	Right Cheek	0.482	0.731	1.21		
		Right Tilted	0.305	0.583	0.89		
		Left Cheek	0.569	0.254	0.82		
		Left Tilted	0.360	0.216	0.58		
	Band 41	Right Cheek	0.379	0.731	1.11		
		Right Tilted	0.096	0.583	0.68		
		Left Cheek	0.162	0.254	0.42		
		Left Tilted	0.112	0.216	0.33		

15.2 Hotspot 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)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.145	0.61		
		Back	0.528	0.145	0.67		
		Left side	0.677	0.145	0.82		
		Right side	0.414		0.41		
		Top side		0.145	0.15		
		Bottom side	0.126		0.13		
	GSM1900	Front	0.447	0.145	0.59		
		Back	0.543	0.145	0.69		
		Left side	0.029	0.145	0.17		
		Right side	0.039		0.04		
		Top side		0.145	0.15		
		Bottom side	1.069		1.07		
WCDMA	Band V	Front	0.692	0.145	0.84		
		Back	0.826	0.145	0.97		
		Left side	1.175	0.145	1.32		
		Right side	0.712		0.71		
		Top side		0.145	0.15		
		Bottom side	0.174		0.17		
	Band II	Front	0.667	0.145	0.81		
		Back	0.802	0.145	0.95		
		Left side	0.038	0.145	0.18		
		Right side	0.054		0.05		
		Top side		0.145	0.15		
		Bottom side	1.161		1.16		

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)	SPLSR	Case No
LTE	Band 5	Front	0.541	0.145	0.69		
		Back	0.652	0.145	0.80		
		Left side	0.958	0.145	1.10		
		Right side	0.485		0.49		
		Top side		0.145	0.15		
		Bottom side	0.150		0.15		
	Band 7	Front	0.582	0.145	0.73		
		Back	0.798	0.145	0.94		
		Left side	0.090	0.145	0.24		
		Right side	0.371		0.37		
		Top side		0.145	0.15		
		Bottom side	1.176		1.18		
	Band 26	Front	0.620	0.145	0.77		
		Back	0.732	0.145	0.88		
		Left side	0.974	0.145	1.12		
		Right side	0.595		0.60		
		Top side		0.145	0.15		
		Bottom side	0.163		0.16		
	Band 41	Front	0.427	0.145	0.57		
		Back	0.572	0.145	0.72		
		Left side	0.058	0.145	0.20		
		Right side	0.412		0.41		
		Top side		0.145	0.15		
		Bottom side	0.779		0.78		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	3 5.2GHz WLAN 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.109	0.58		
		Back	0.528	0.074	0.60		
		Left side	0.677	0.284	0.96		
		Right side	0.414		0.41		
		Top side		0.102	0.10		
		Bottom side	0.126		0.13		
	GSM1900	Front	0.447	0.109	0.56		
		Back	0.543	0.074	0.62		
		Left side	0.029	0.284	0.31		
		Right side	0.039		0.04		
		Top side		0.102	0.10		
		Bottom side	1.069		1.07		
WCDMA	Band V	Front	0.692	0.109	0.80		
		Back	0.826	0.074	0.90		
		Left side	1.175	0.284	**1.46**		
		Right side	0.712		0.71		
		Top side		0.102	0.10		
		Bottom side	0.174		0.17		
	Band II	Front	0.667	0.109	0.78		
		Back	0.802	0.074	0.88		
		Left side	0.038	0.284	0.32		
		Right side	0.054		0.05		
		Top side		0.102	0.10		
		Bottom side	1.161		1.16		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	3 5.2GHz WLAN 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
LTE	Band 5	Front	0.541	0.109	0.65		
		Back	0.652	0.074	0.73		
		Left side	0.958	0.284	1.24		
		Right side	0.485		0.49		
		Top side		0.102	0.10		
		Bottom side	0.150		0.15		
	Band 7	Front	0.582	0.109	0.69		
		Back	0.798	0.074	0.87		
		Left side	0.090	0.284	0.37		
		Right side	0.371		0.37		
		Top side		0.102	0.10		
		Bottom side	1.176		1.18		
	Band 26	Front	0.620	0.109	0.73		
		Back	0.732	0.074	0.81		
		Left side	0.974	0.284	1.26		
		Right side	0.595		0.60		
		Top side		0.102	0.10		
		Bottom side	0.163		0.16		
	Band 41	Front	0.427	0.109	0.54		
		Back	0.572	0.074	0.65		
		Left side	0.058	0.284	0.34		
		Right side	0.412		0.41		
		Top side		0.102	0.10		
		Bottom side	0.779		0.78		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	4 5.8GHz WLAN 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.101	0.57		
		Back	0.528	0.039	0.57		
		Left side	0.677	0.140	0.82		
		Right side	0.414		0.41		
		Top side		0.054	0.05		
		Bottom side	0.126		0.13		
	GSM1900	Front	0.447	0.101	0.55		
		Back	0.543	0.039	0.58		
		Left side	0.029	0.140	0.17		
		Right side	0.039		0.04		
		Top side		0.054	0.05		
		Bottom side	1.069		1.07		
WCDMA	Band V	Front	0.692	0.101	0.79		
		Back	0.826	0.039	0.87		
		Left side	1.175	0.140	1.32		
		Right side	0.712		0.71		
		Top side		0.054	0.05		
		Bottom side	0.174		0.17		
	Band II	Front	0.667	0.101	0.77		
		Back	0.802	0.039	0.84		
		Left side	0.038	0.140	0.18		
		Right side	0.054		0.05		
		Top side		0.054	0.05		
		Bottom side	1.161		1.16		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	4 5.8GHz WLAN 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
LTE	Band 5	Front	0.541	0.101	0.64		
		Back	0.652	0.039	0.69		
		Left side	0.958	0.140	1.10		
		Right side	0.485		0.49		
		Top side		0.054	0.05		
		Bottom side	0.150		0.15		
	Band 7	Front	0.582	0.101	0.68		
		Back	0.798	0.039	0.84		
		Left side	0.090	0.140	0.23		
		Right side	0.371		0.37		
		Top side		0.054	0.05		
		Bottom side	1.176		1.18		
	Band 26	Front	0.620	0.101	0.72		
		Back	0.732	0.039	0.77		
		Left side	0.974	0.140	1.11		
		Right side	0.595		0.60		
		Top side		0.054	0.05		
		Bottom side	0.163		0.16		
	Band 41	Front	0.427	0.101	0.53		
		Back	0.572	0.039	0.61		
		Left side	0.058	0.140	0.20		
		Right side	0.412		0.41		
		Top side		0.054	0.05		
		Bottom side	0.779		0.78		

15.3 Body-Worn Accessory 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)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.145	0.61		
		Back	0.528	0.145	0.67		
	GSM1900	Front	0.447	0.145	0.59		
		Back	0.543	0.145	0.69		
WCDMA	Band V	Front	0.692	0.145	0.84		
		Back	0.826	0.145	0.97		
	Band II	Front	0.667	0.145	0.81		
		Back	0.802	0.145	0.95		
LTE	Band 5	Front	0.541	0.145	0.69		
		Back	0.652	0.145	0.80		
	Band 7	Front	0.582	0.145	0.73		
		Back	0.798	0.145	0.94		
	Band 26	Front	0.620	0.145	0.77		
		Back	0.732	0.145	0.88		
	Band 41	Front	0.427	0.145	0.57		
		Back	0.572	0.145	0.72		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	3 5.3GHz WLAN 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.152	0.62		
		Back	0.528	0.087	0.62		
	GSM1900	Front	0.447	0.152	0.60		
		Back	0.543	0.087	0.63		
WCDMA	Band V	Front	0.692	0.152	0.84		
		Back	0.826	0.087	0.91		
	Band II	Front	0.667	0.152	0.82		
		Back	0.802	0.087	0.89		
LTE	Band 5	Front	0.541	0.152	0.69		
		Back	0.652	0.087	0.74		
	Band 7	Front	0.582	0.152	0.73		
		Back	0.798	0.087	0.89		
	Band 26	Front	0.620	0.152	0.77		
		Back	0.732	0.087	0.82		
	Band 41	Front	0.427	0.152	0.58		
		Back	0.572	0.087	0.66		

WWAN Band		Exposure Position	1	4	1+4 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN	5.5GHz WLAN			
			1g SAR (W/kg)	1g SAR (W/kg)			
GSM	GSM850	Front	0.468	0.107	0.58		
		Back	0.528	0.051	0.58		
	GSM1900	Front	0.447	0.107	0.55		
		Back	0.543	0.051	0.59		
WCDMA	Band V	Front	0.692	0.107	0.80		
		Back	0.826	0.051	0.88		
	Band II	Front	0.667	0.107	0.77		
		Back	0.802	0.051	0.85		
LTE	Band 5	Front	0.541	0.107	0.65		
		Back	0.652	0.051	0.70		
	Band 7	Front	0.582	0.107	0.69		
		Back	0.798	0.051	0.85		
	Band 26	Front	0.620	0.107	0.73		
		Back	0.732	0.051	0.78		
	Band 41	Front	0.427	0.107	0.53		
		Back	0.572	0.051	0.62		

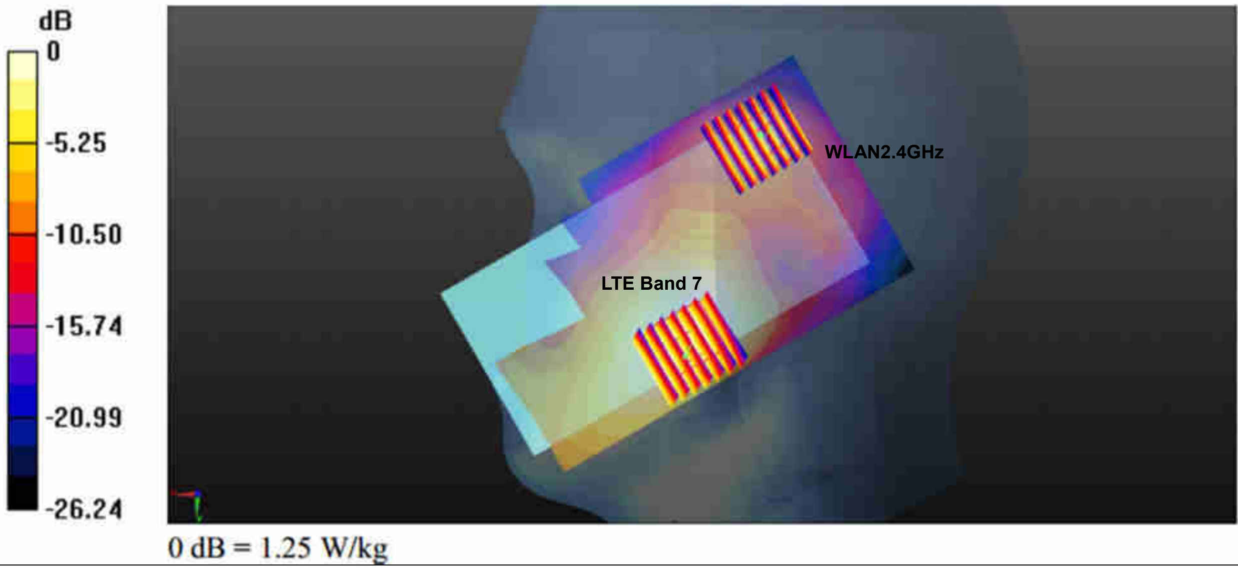
WWAN Band		Exposure Position	1	5	1+5 Summed 1g SAR (W/kg)	SPLSR	Case No
			WWAN	5.8GHz WLAN			
			1g SAR (W/kg)	1g SAR (W/kg)			
GSM	GSM850	Front	0.468	0.101	0.57		
		Back	0.528	0.039	0.57		
	GSM1900	Front	0.447	0.101	0.55		
		Back	0.543	0.039	0.58		
WCDMA	Band V	Front	0.692	0.101	0.79		
		Back	0.826	0.039	0.87		
	Band II	Front	0.667	0.101	0.77		
		Back	0.802	0.039	0.84		
LTE	Band 5	Front	0.541	0.101	0.64		
		Back	0.652	0.039	0.69		
	Band 7	Front	0.582	0.101	0.68		
		Back	0.798	0.039	0.84		
	Band 26	Front	0.620	0.101	0.72		
		Back	0.732	0.039	0.77		
	Band 41	Front	0.427	0.101	0.53		
		Back	0.572	0.039	0.61		

WWAN Band		Exposure Position	1 WWAN 1g SAR (W/kg)	6 Bluetooth Estimated 1g SAR (W/kg)	1+6 Summed 1g SAR (W/kg)	SPLSR	Case No
GSM	GSM850	Front	0.468	0.378	0.85		
		Back	0.528	0.378	0.91		
	GSM1900	Front	0.447	0.378	0.83		
		Back	0.543	0.378	0.92		
WCDMA	Band V	Front	0.692	0.378	1.07		
		Back	0.826	0.378	1.20		
	Band II	Front	0.667	0.378	1.05		
		Back	0.802	0.378	1.18		
LTE	Band 5	Front	0.541	0.378	0.92		
		Back	0.652	0.378	1.03		
	Band 7	Front	0.582	0.378	0.96		
		Back	0.798	0.378	1.18		
	Band 26	Front	0.620	0.378	1.00		
		Back	0.732	0.378	1.11		
	Band 41	Front	0.427	0.378	0.81		
		Back	0.572	0.378	0.95		

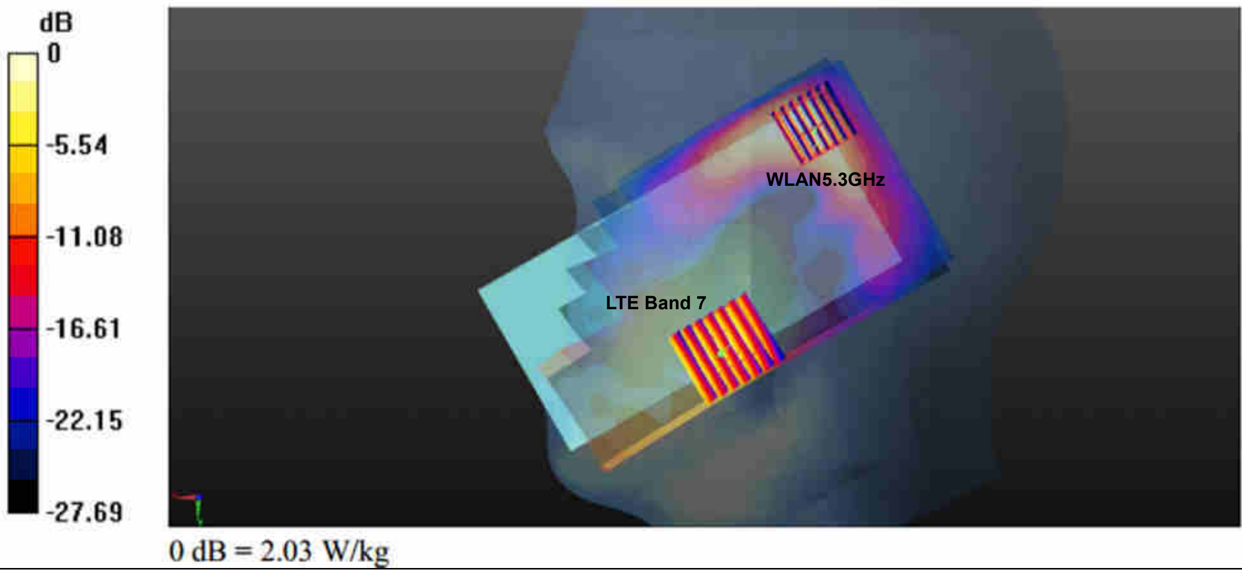
15.4 SPLSR Evaluation and Analysis

General Note:
SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*). If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

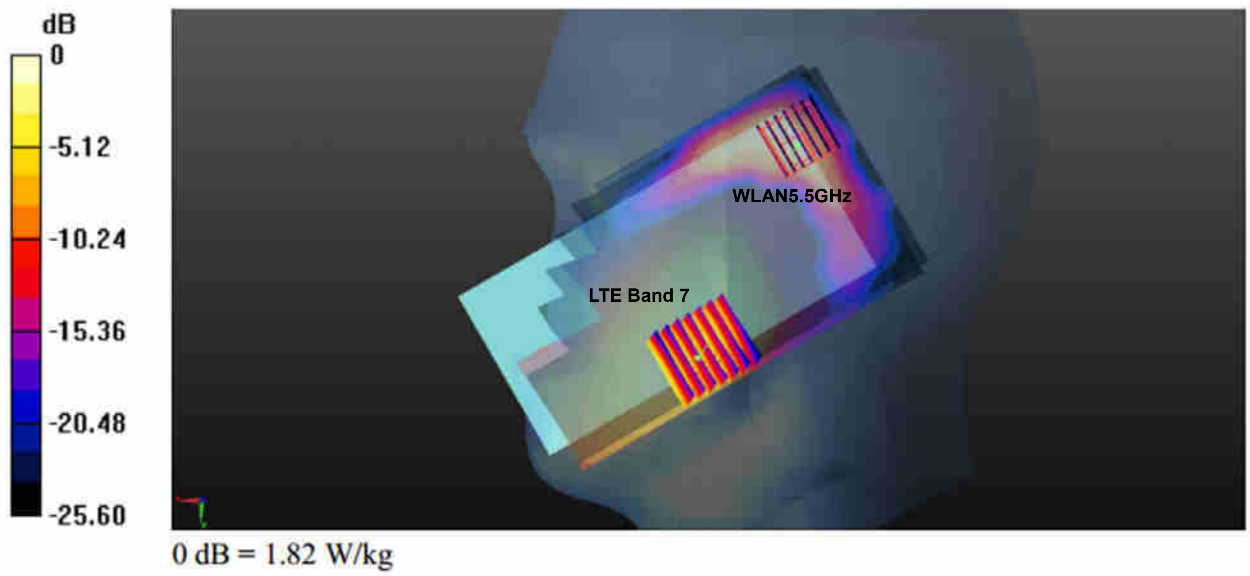
Case 1	Band	Position	SAR (W/kg)	Gap	SAR peak location (cm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	LTE Band 7	Right Cheek	1.070	0	4.33	6.5	-0.21	93.55	1.86	0.03	Not required
	WLAN2.4GHz		0.792	0	1.27	-2.34	-0.23				



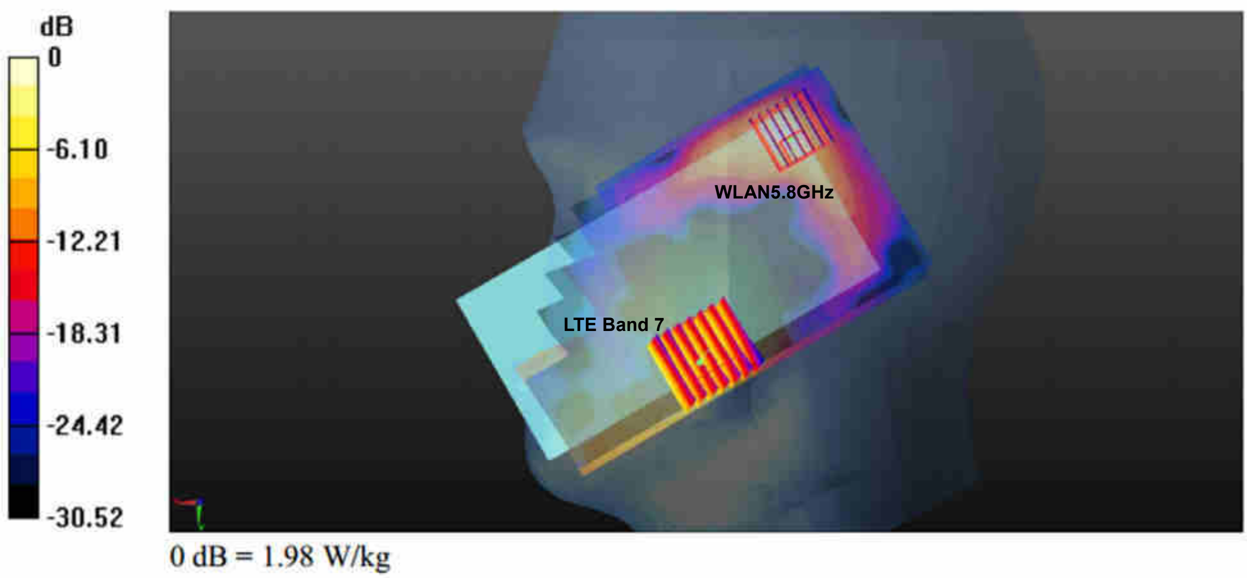
Case 2	Band	Position	SAR (W/kg)	Gap	SAR peak location (cm)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	LTE Band 7	Right Cheek	1.070	0	4.33	6.5	-0.21	92.17	1.83	0.03	Not required
	WLAN5.3GHz		0.758	0	0.84	-2.03	-0.15				



Case 3	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (cm) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
	LTE Band 7	Right Cheek	1.070	0	4.33	6.5	-0.21	90.17	1.91	0.03	Not required
	WLAN5.5GHz		0.842	0	0.76	-1.78	-0.15				



Case 4	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (cm) X	Y	Z	3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
	LTE Band 7	Right Cheek	1.070	0	4.33	6.5	-0.21	91.40	1.80	0.03	Not required
	WLAN5.8GHz		0.731	0	0.92	-1.98	-0.17				



Test Engineer： Kat Yin

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	6.0	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						11.4%	11.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						22.9%	22.7%

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

Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.6	R	1.732	1	1	3.8	3.8
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						12.5%	12.5%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						25.1%	25.0%

Table 16.3. Uncertainty Budget for frequency range 3 GHz to 6 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_20170317

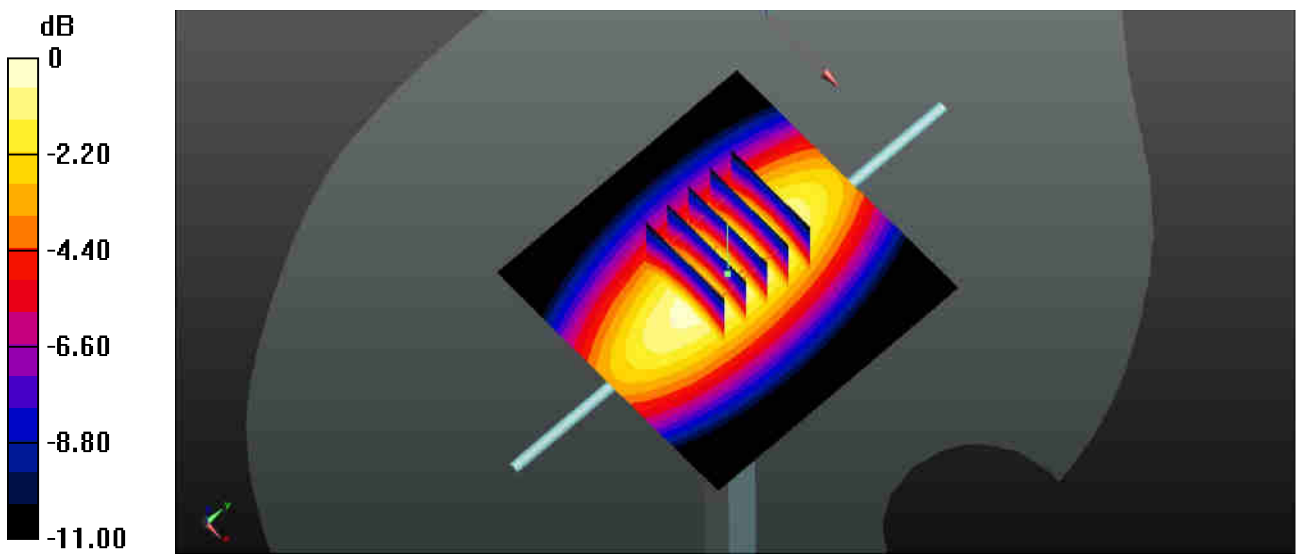
DUT: D835V2-SN:4d120

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_2017/03/17 Medium parameters used: f = 835 MHz; σ = 0.91 S/m; ε_r = 42.91; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.61, 10.61, 10.61); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.19 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.41 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.64 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 3.22 W/kg



0 dB = 3.22 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2017/3/29

System Check_Head_2600MHz_20170329

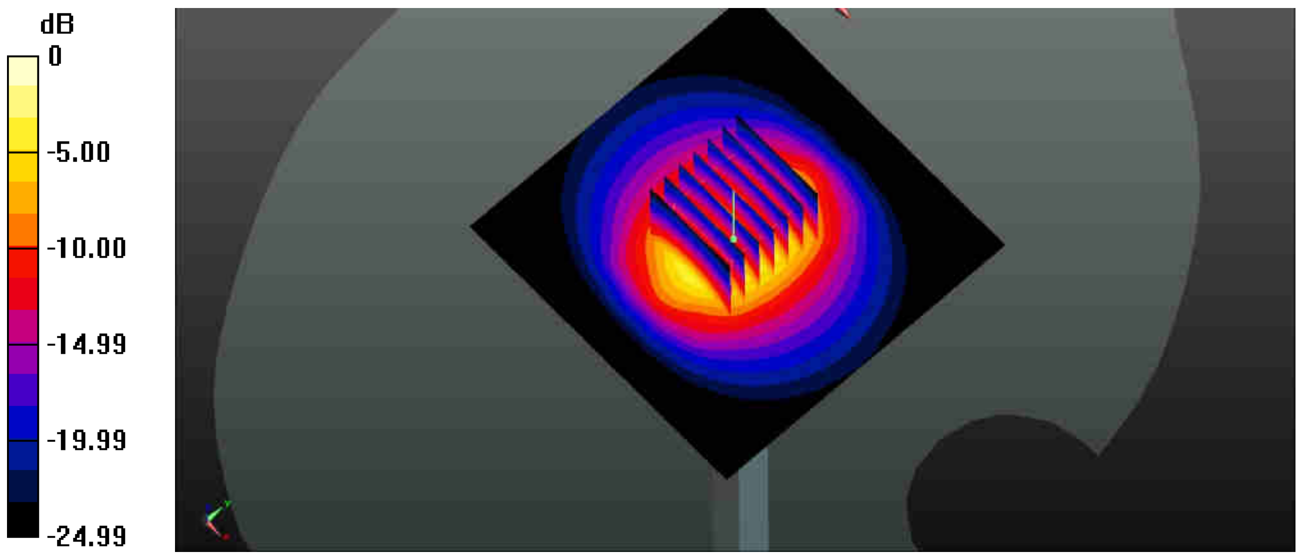
DUT: D2600V2 -SN:1112

Communication System: UID 0, CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: HSL_2600_2017/03/29 Medium parameters used: f = 2600 MHz; σ = 2.056 S/m; ε_r = 37.587; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature ：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.6, 7.6, 7.6); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 23.9 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.56 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 14.9 W/kg; SAR(10 g) = 6.46 W/kg
Maximum value of SAR (measured) = 24.0 W/kg



0 dB = 24.0 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/3/15

System Check_Body_835MHz_20170315

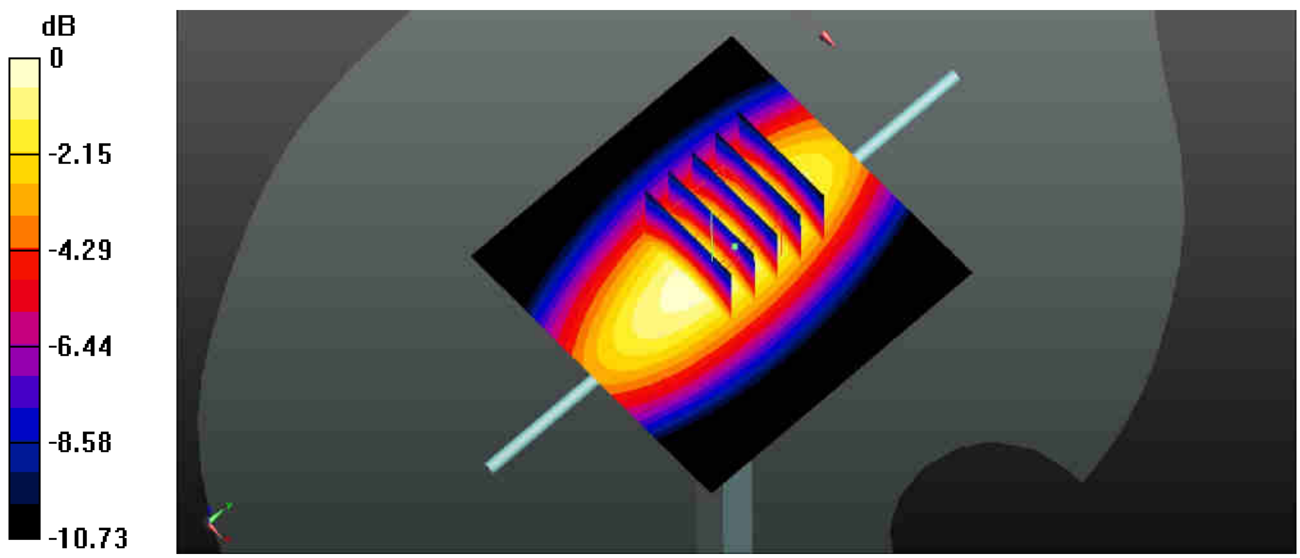
DUT: D835V2-SN:4d120

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_835_2017/03/15 Medium parameters used: f = 835 MHz; σ = 0.983 S/m; ε_r = 56.56; ρ = 1000 kg/m^3
Ambient Temperature：23.8 ℃; Liquid Temperature ：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.27 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 50.98 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.76 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 3.28 W/kg



0 dB = 3.28 W/kg

System Check_Body_2600MHz_20170327

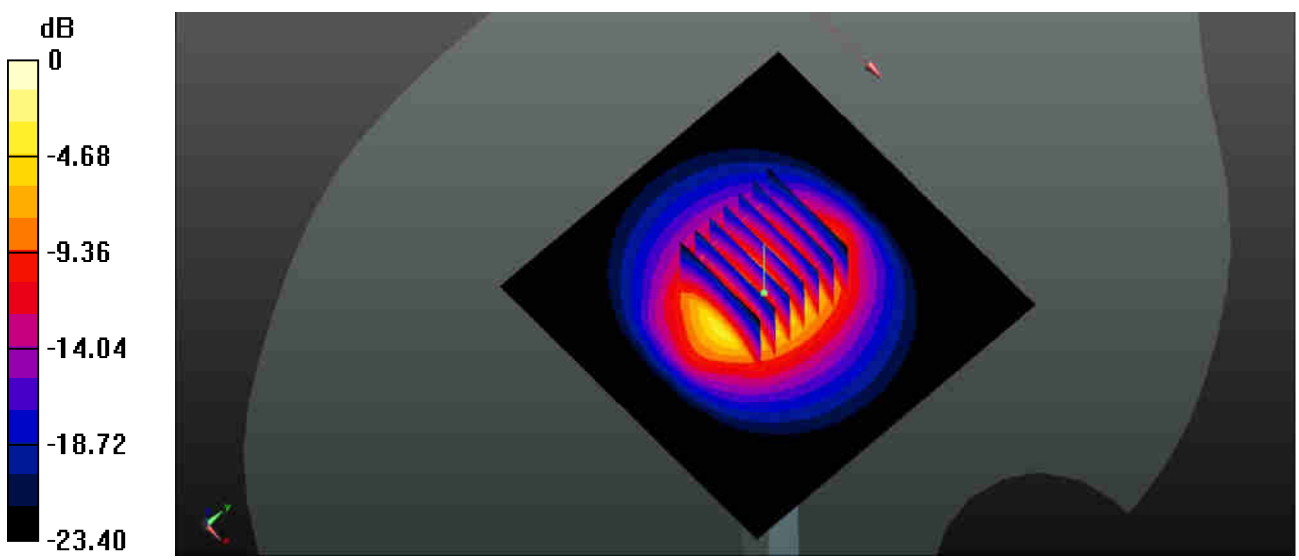
DUT: D2600V2 -SN:1112

Communication System: UID 0, CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL_2600_2017/03/27 Medium parameters used: f = 2600 MHz; σ = 2.22 S/m; ε_r = 53.297; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.67, 7.67, 7.67); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 25.2 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.49 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.49 W/kg
Maximum value of SAR (measured) = 25.5 W/kg



0 dB = 25.5 W/kg

Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

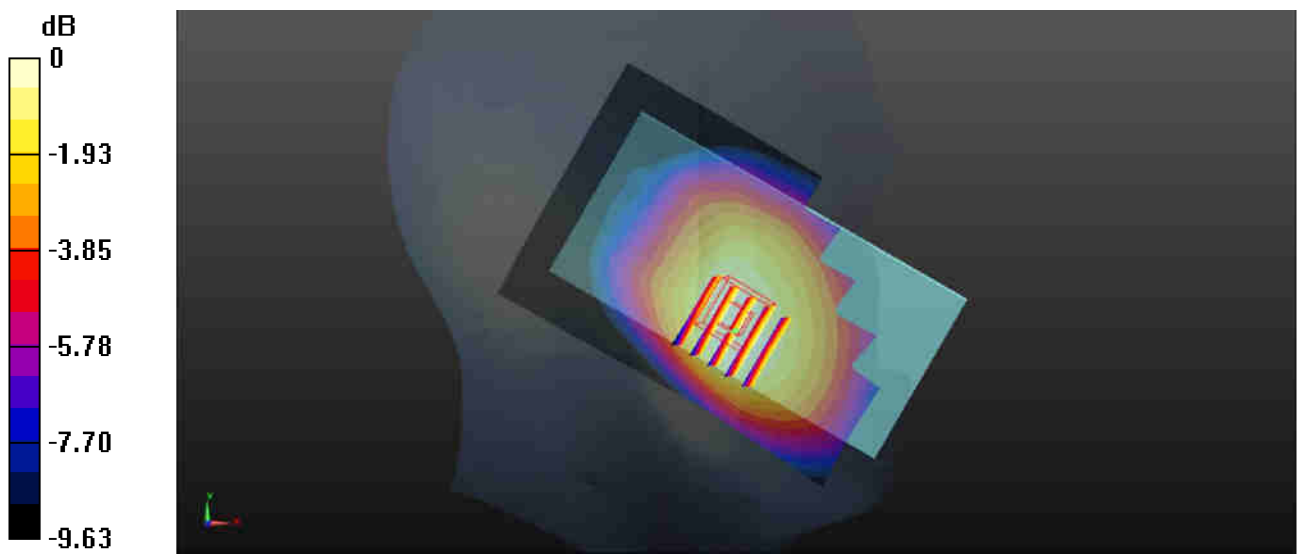
01_LTE Band 26_15M_QPSK_1RB_37offset_Left Cheek_0mm_Ch26865_#1

Communication System: UID 0, FDD-LTE (0); Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: HSL_835_2017/03/17 Medium parameters used: f = 831.5 MHz; σ = 0.906 S/m; ε_r = 42.952; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.61, 10.61, 10.61); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch26865/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.582 W/kg

Ch26865/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.346 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.617 W/kg
SAR(1 g) = 0.490 W/kg; SAR(10 g) = 0.378 W/kg
Maximum value of SAR (measured) = 0.573 W/kg



0 dB = 0.573 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017/3/29

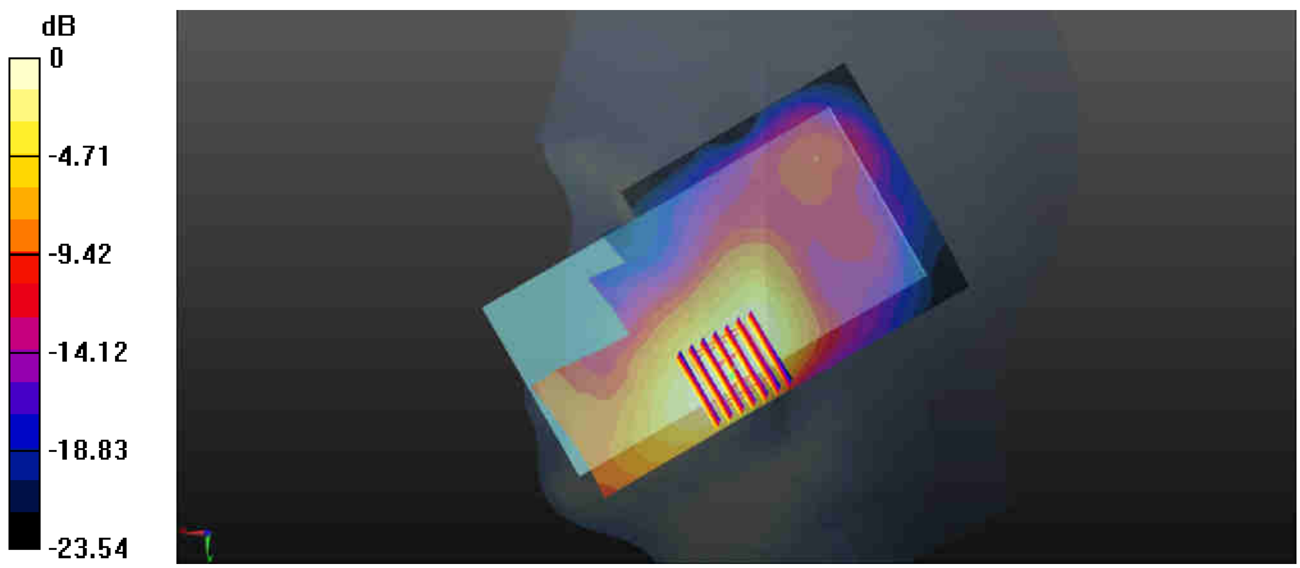
02_LTE Band 41_20M_QPSK_1RB_49offset_Right Cheek_0mm_Ch40240_#1

Communication System: UID 0, TDD-LTE (0); Frequency: 2555 MHz;Duty Cycle: 1:1.59
Medium: HSL_2600_2017/03/29 Medium parameters used: f = 2555 MHz; σ = 2.003 S/m; ε_r = 37.808; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature ：22.3 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.6, 7.6, 7.6); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch40240/Area Scan (81x151x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.574 W/kg

Ch40240/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.243 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.683 W/kg
SAR(1 g) = 0.351 W/kg; SAR(10 g) = 0.187 W/kg
Maximum value of SAR (measured) = 0.550 W/kg



0 dB = 0.550 W/kg

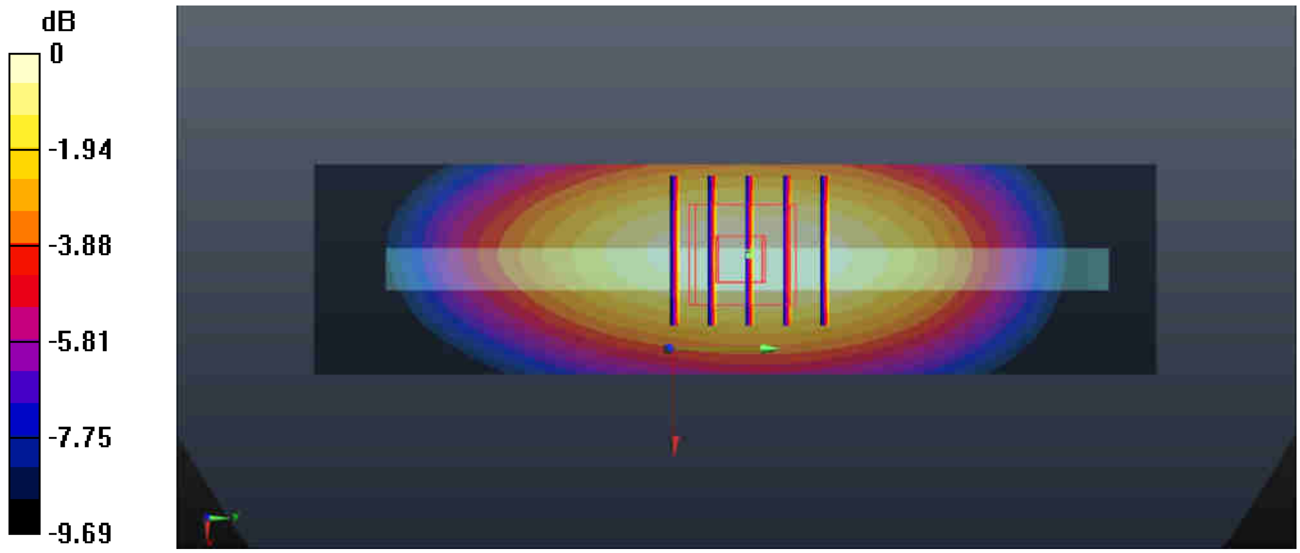
03_LTE Band 26_15M_QPSK_1RB_37offset_Left side_10mm_Ch26865_#1

Communication System: UID 0, FDD-LTE (0); Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: MSL_835_2017/03/15 Medium parameters used: f = 831.5 MHz; σ = 0.979 S/m; ε_r = 56.582; ρ = 1000 kg/m^3
Ambient Temperature：23.8 ℃; Liquid Temperature ：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch26865/Area Scan (31x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.12 W/kg

Ch26865/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.52 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.839 W/kg; SAR(10 g) = 0.571 W/kg
Maximum value of SAR (measured) = 1.11 W/kg



0 dB = 1.11 W/kg

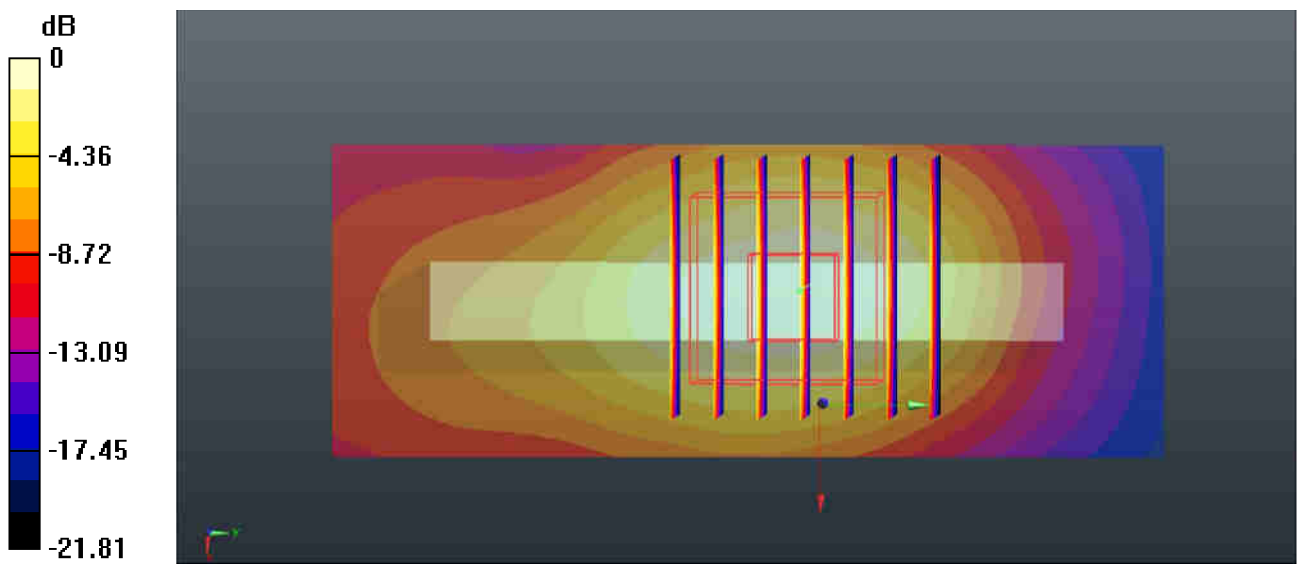
04_LTE Band 41_20M_QPSK_1RB_49offset_Bottom side_10mm_Ch40540_#1

Communication System: UID 0, TDD-LTE (0); Frequency: 2585 MHz;Duty Cycle: 1:1.59
Medium: MSL_2600_2017/03/27 Medium parameters used: f = 2585 MHz; σ = 2.199 S/m; ε_r = 53.335; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.67, 7.67, 7.67); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch40540/Area Scan (31x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 1.15 W/kg

Ch40540/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.71 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.37 W/kg
SAR(1 g) = 0.650 W/kg; SAR(10 g) = 0.311 W/kg
Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg

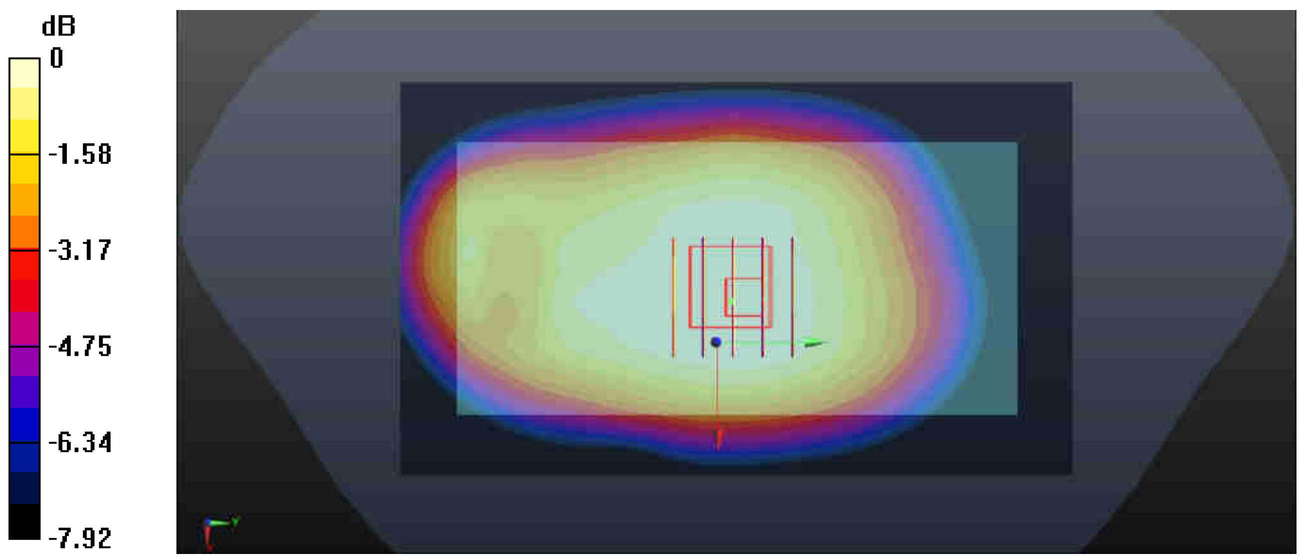
05_LTE Band 26_15M_QPSK_1RB_37offset_Back_10mm_Ch26865_#1

Communication System: UID 0, FDD-LTE (0); Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: MSL_835_2017/03/15 Medium parameters used: f = 831.5 MHz; σ = 0.979 S/m; ε_r = 56.582; ρ = 1000 kg/m^3
Ambient Temperature：23.8 ℃; Liquid Temperature ：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch26865/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.805 W/kg

Ch26865/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.70 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.841 W/kg
SAR(1 g) = 0.630 W/kg; SAR(10 g) = 0.486 W/kg
Maximum value of SAR (measured) = 0.765 W/kg



0 dB = 0.765 W/kg

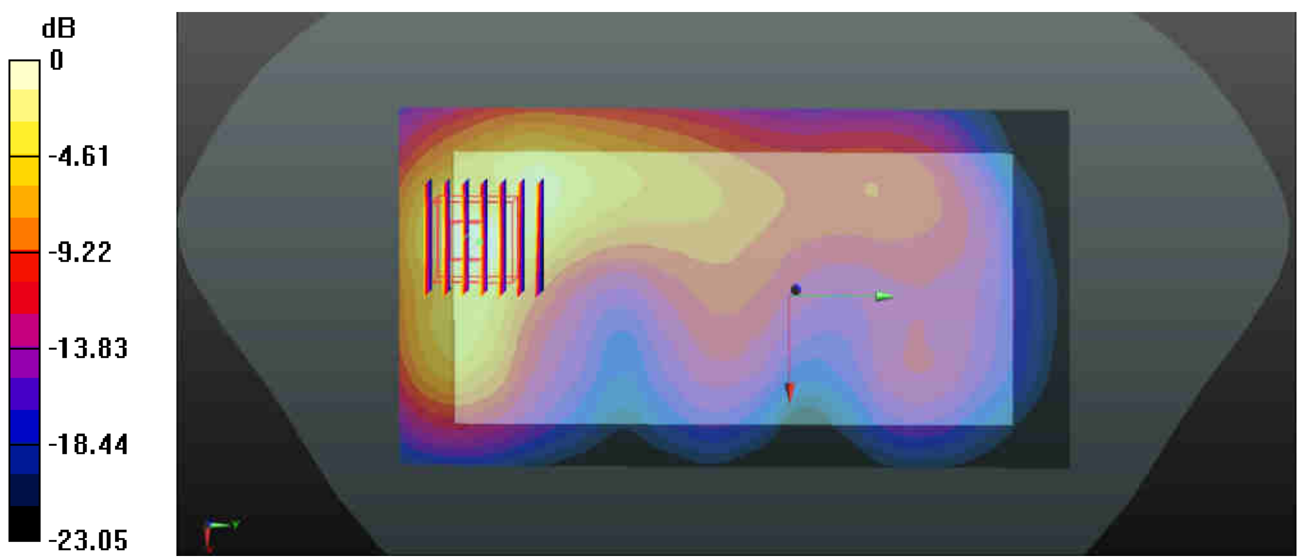
06_LTE Band 41_20M_QPSK_1RB_49offset_Back_10mm_Ch40240_#1

Communication System: UID 0, TDD-LTE (0); Frequency: 2555 MHz;Duty Cycle: 1:1.59
Medium: MSL_2600_2017/03/27 Medium parameters used: f = 2555 MHz; σ = 2.152 S/m; ε_r = 53.437; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature ：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3935; ConvF(7.67, 7.67, 7.67); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Ch40240/Area Scan (81x151x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.862 W/kg

Ch40240/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.459 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.529 W/kg; SAR(10 g) = 0.233 W/kg
Maximum value of SAR (measured) = 0.928 W/kg



0 dB = 0.928 W/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 **Auden**

Certificate No: **D835V2-4d120_Jun16**

CALIBRATION CERTIFICATE

Object: D835V2 - SN:4d120

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: June 22, 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: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-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:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 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 / 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	41.0 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.42 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.11 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	54.4 ± 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	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.23 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 4.1 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 6.5 jΩ
Return Loss	- 22.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.397 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 22.06.2016

Test Laboratory: SPEAG, Zurich, Switzerland

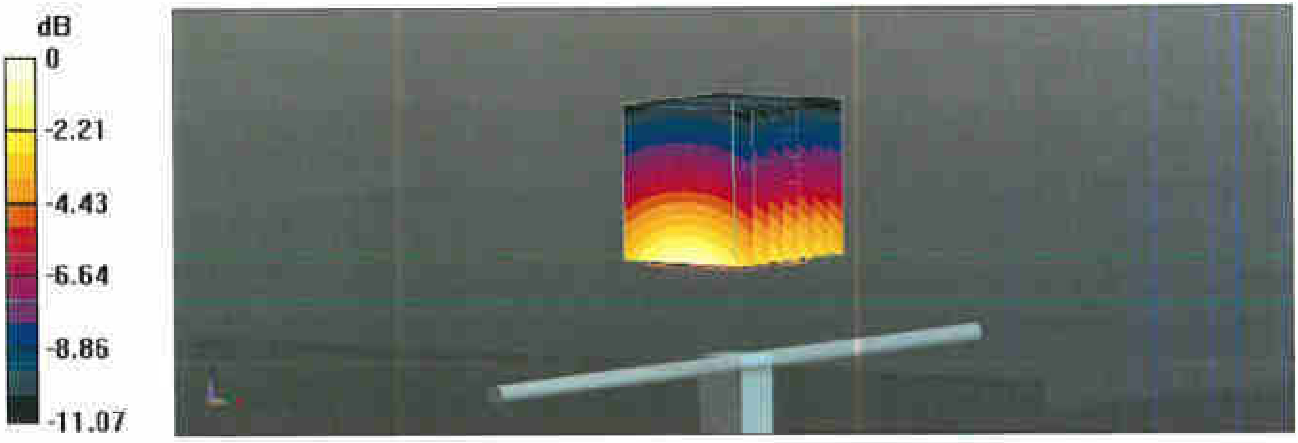
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d120

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

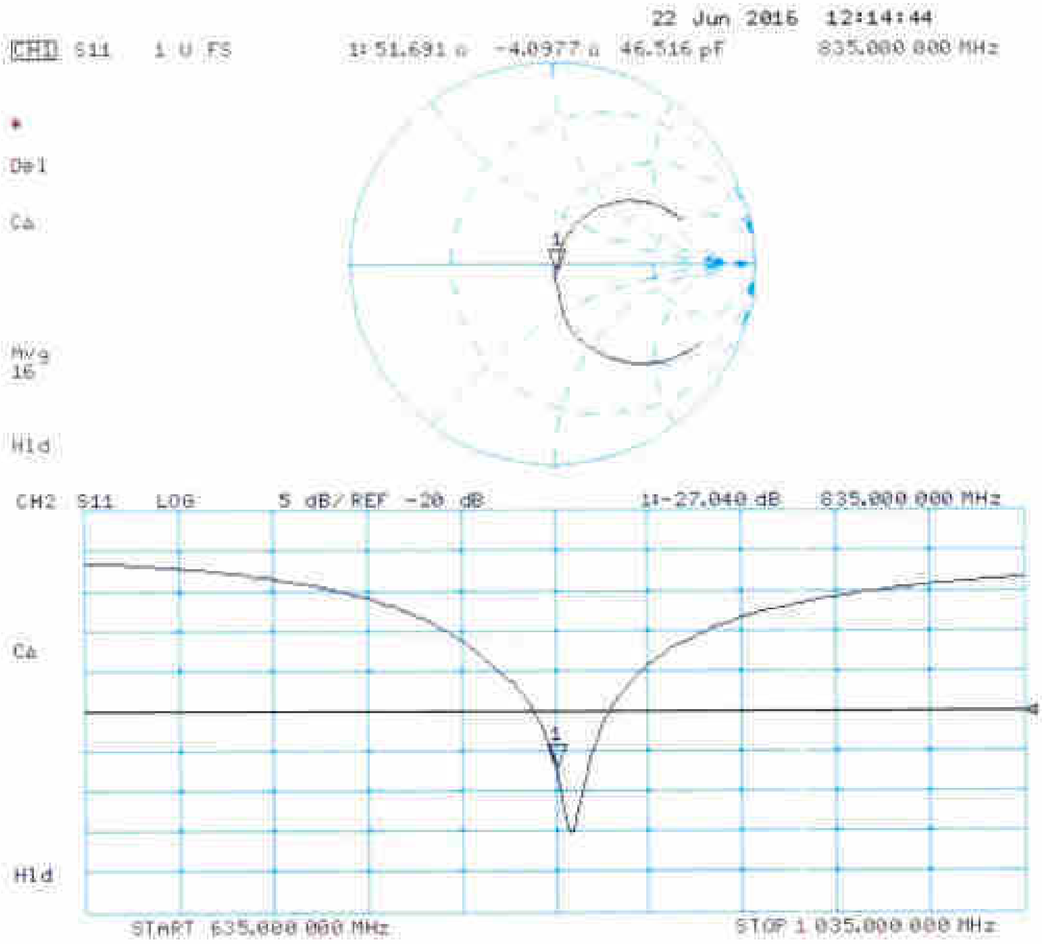
- Probe: EX3DV4 - SN7349; ConvF(9.72, 9.72, 9.72); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 61.88 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 3.21 W/kg



0 dB = 3.21 W/kg = 5.07 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.06.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d120

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

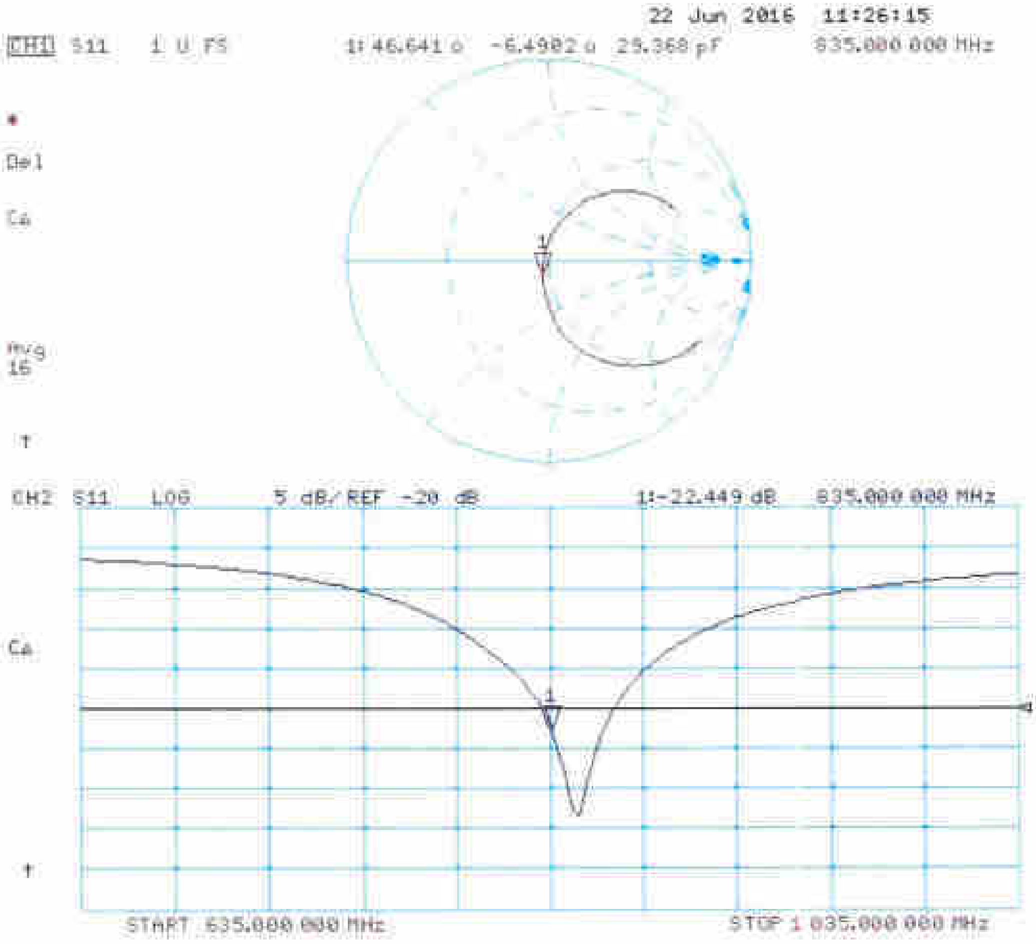
- Probe: EX3DV4 - SN7349; ConvF(9.73, 9.73, 9.73); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.94 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.62 W/kg
SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.6 W/kg
Maximum value of SAR (measured) = 3.25 W/kg

0 dB = 3.25 W/kg = 5.12 dBW/kg

Impedance Measurement Plot for Body TSL



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Client Sporton_KS Certificate No: Z16-97147

CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1112

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

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Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "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%.

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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	14.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**56.4 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.37 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.5 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	13.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**54.9 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.25 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.9 mW /g ± 20.4 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.4Ω- 5.90jΩ
Return Loss	- 24.2dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1Ω- 4.51jΩ
Return Loss	- 24.1dB

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

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DASY5 Validation Report for Head TSL Date: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1112

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)

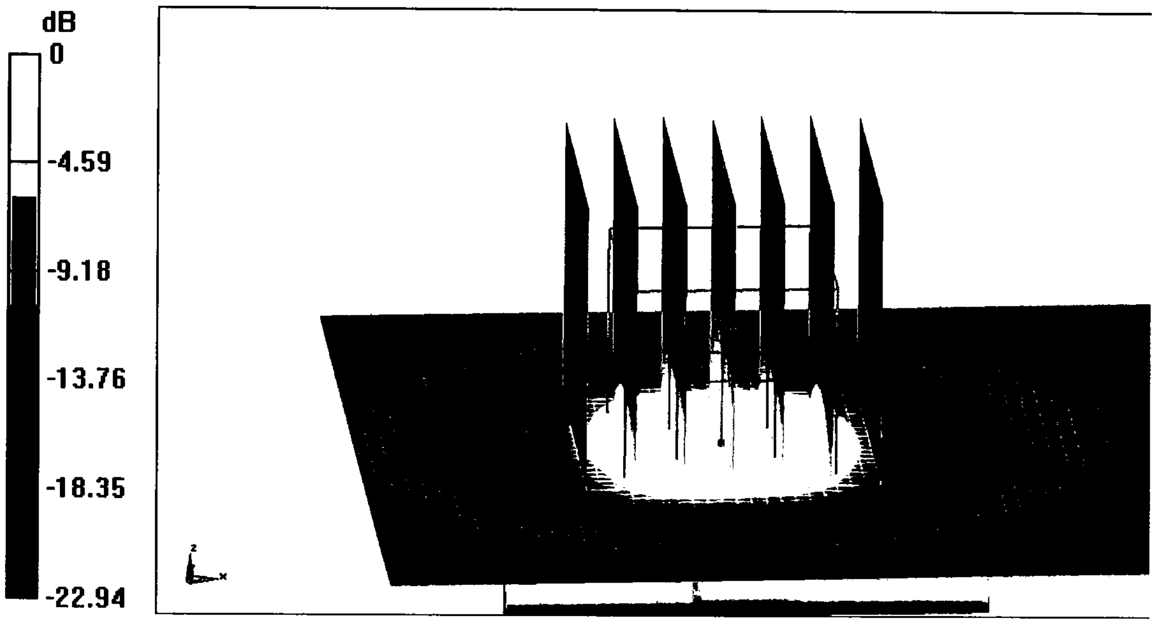
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.8 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.37 W/kg

Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

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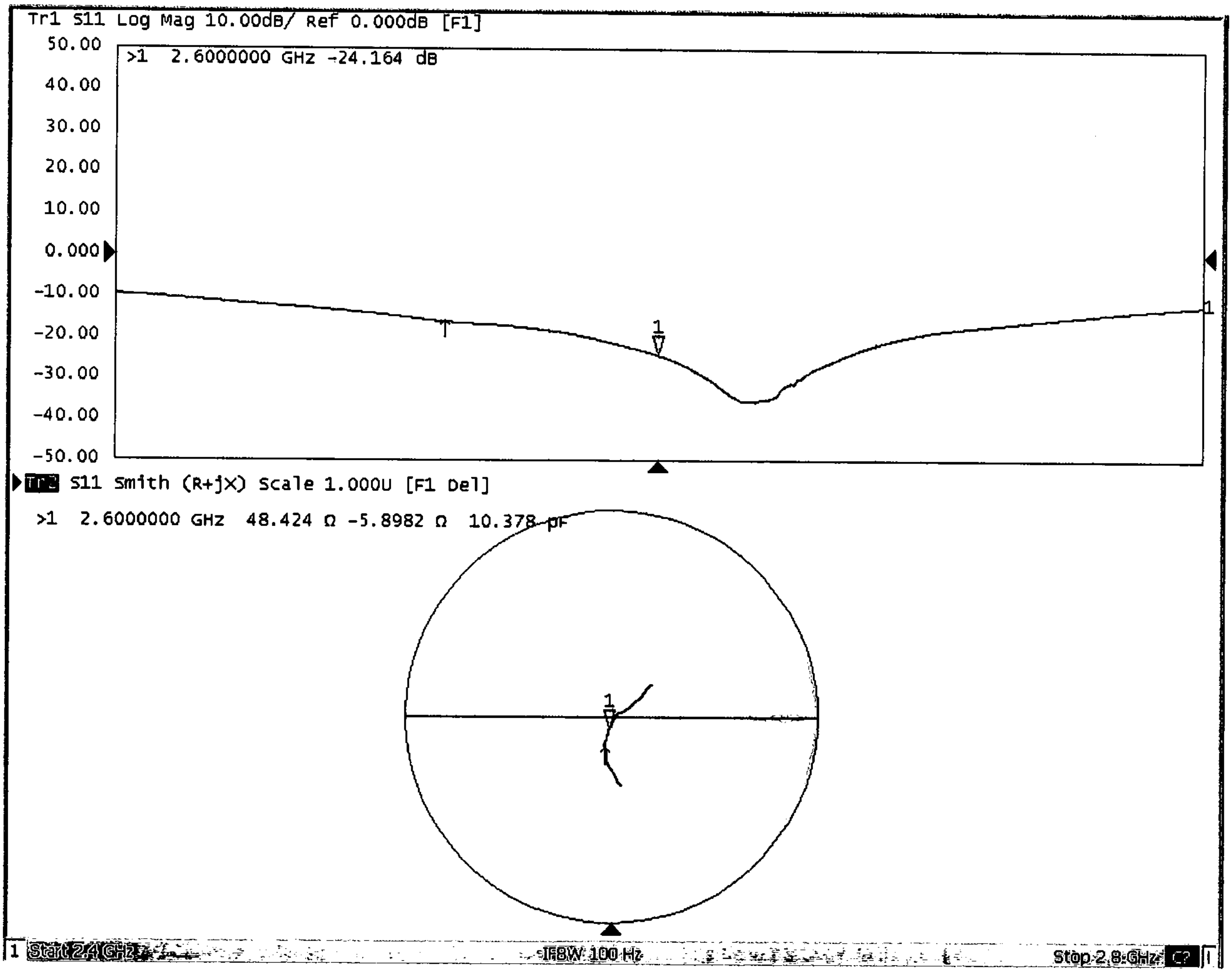
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 08.30.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1112

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: Center 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)

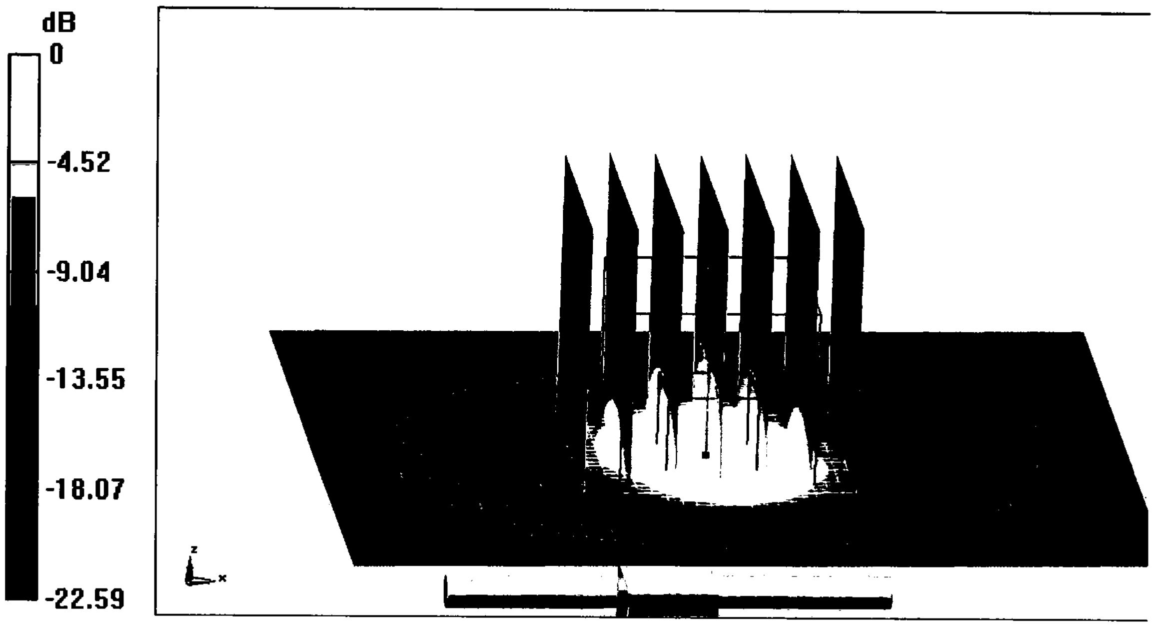
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.10 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 28.7 W/kg

SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.25 W/kg

Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

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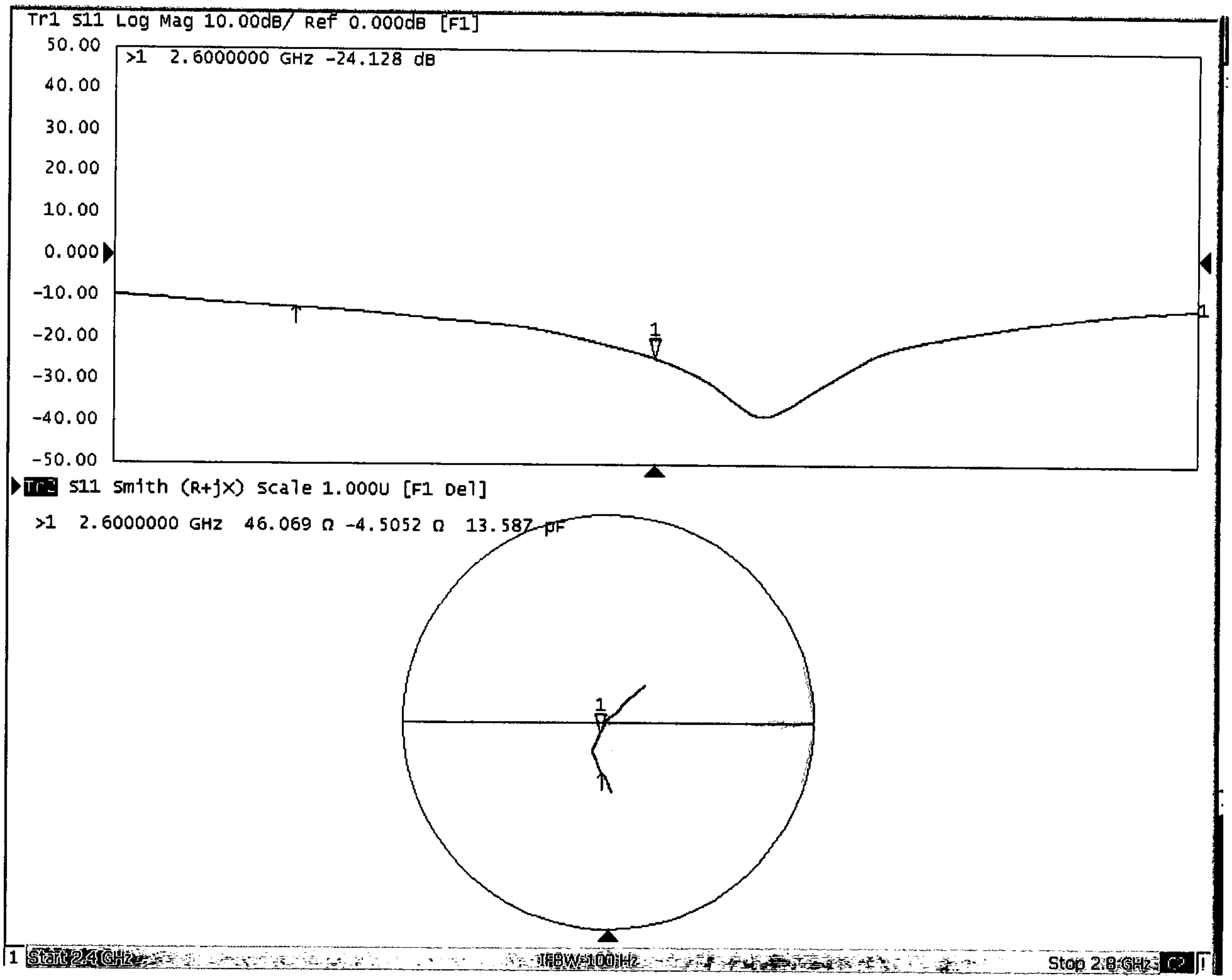
Impedance Measurement Plot for Body TSL



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CNAS L0570

Client : Sporton_XA

Certificate No: Z16-97144

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1358
Calibration Procedure(s)	FD-Z11-2-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	September 05, 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
Process Calibrator 753	1971018	27-June-16 (CTTL, No:J16X04778)	June-17

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

Issued: September 06, 2016

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
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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 report provide only calibration results for DAE, it does not contain other performance test results.

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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	403.508 ± 0.15% (k=2)	403.540 ± 0.15% (k=2)	403.540 ± 0.15% (k=2)
Low Range	3.96197 ± 0.7% (k=2)	3.98804 ± 0.7% (k=2)	3.99223 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	134° ± 1 °

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-XA (Auden)**

Certificate No: EX3-3935_Nov16

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3935
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:	November 28, 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 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

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

Issued: November 28, 2016

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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 ϑ = 0 (f ≤ 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 ≤ 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:3935

Manufactured: July 24, 2013
Calibrated: November 28, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3935

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (μV/(V/m)²)[A]	0.48	0.52	0.47	± 10.1 %
DCP (mV)[B]	103.3	100.8	106.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.4	±3.5 %
		Y	0.0	0.0	1.0		144.8	
		Z	0.0	0.0	1.0		133.6	

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:3935

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	10.92	10.92	10.92	0.41	1.07	± 12.0 %
835	41.5	0.90	10.61	10.61	10.61	0.24	1.49	± 12.0 %
900	41.5	0.97	10.52	10.52	10.52	0.23	1.56	± 12.0 %
1750	40.1	1.37	9.03	9.03	9.03	0.38	0.80	± 12.0 %
1900	40.0	1.40	8.64	8.64	8.64	0.38	0.80	± 12.0 %
2000	40.0	1.40	8.48	8.48	8.48	0.37	0.80	± 12.0 %
2300	39.5	1.67	8.18	8.18	8.18	0.38	0.81	± 12.0 %
2450	39.2	1.80	7.81	7.81	7.81	0.28	1.00	± 12.0 %
2600	39.0	1.96	7.60	7.60	7.60	0.36	0.80	± 12.0 %
3500	37.9	2.91	7.37	7.37	7.37	0.26	1.20	± 13.1 %
5250	35.9	4.71	5.32	5.32	5.32	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.84	4.84	4.84	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.78	4.78	4.78	0.40	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.

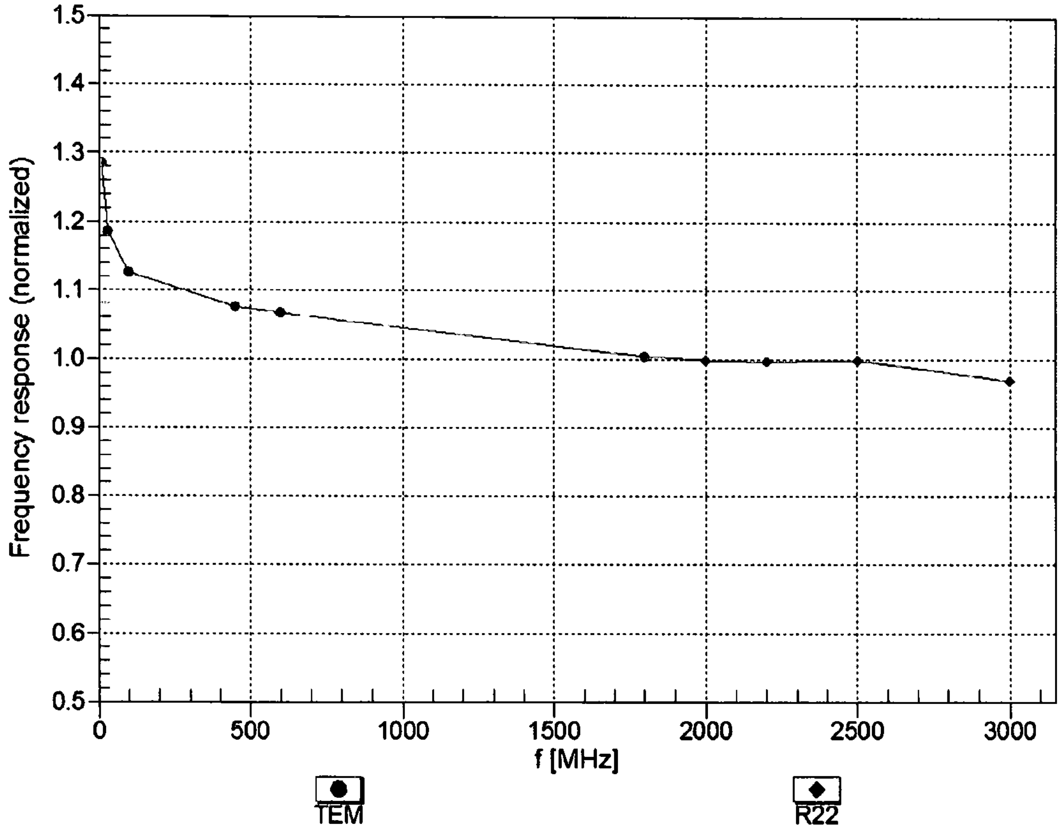
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3935

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	10.68	10.68	10.68	0.44	0.85	± 12.0 %
835	55.2	0.97	10.48	10.48	10.48	0.41	0.80	± 12.0 %
1750	53.4	1.49	8.46	8.46	8.46	0.45	0.80	± 12.0 %
1900	53.3	1.52	8.18	8.18	8.18	0.45	0.80	± 12.0 %
2300	52.9	1.81	7.99	7.99	7.99	0.41	0.80	± 12.0 %
2450	52.7	1.95	7.89	7.89	7.89	0.39	0.80	± 12.0 %
2600	52.5	2.16	7.67	7.67	7.67	0.36	0.80	± 12.0 %
3500	51.3	3.31	7.13	7.13	7.13	0.26	1.20	± 13.1 %
5250	48.9	5.36	4.84	4.84	4.84	0.35	1.90	± 13.1 %
5600	48.5	5.77	4.00	4.00	4.00	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.23	4.23	4.23	0.50	1.90	± 13.1 %

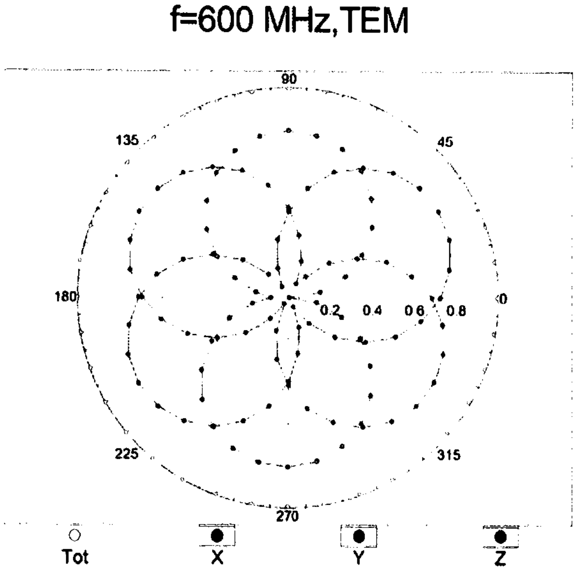
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz 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.

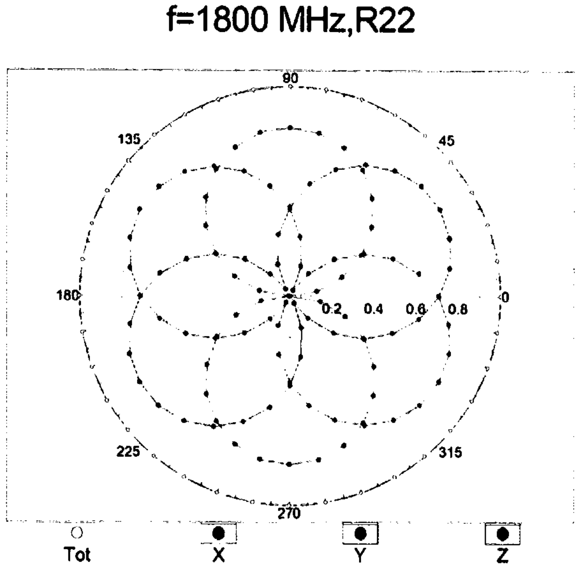
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

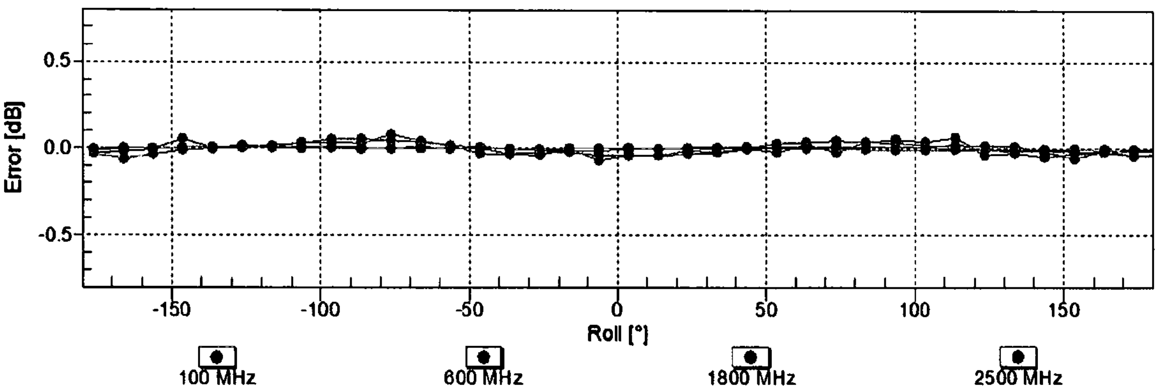


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$



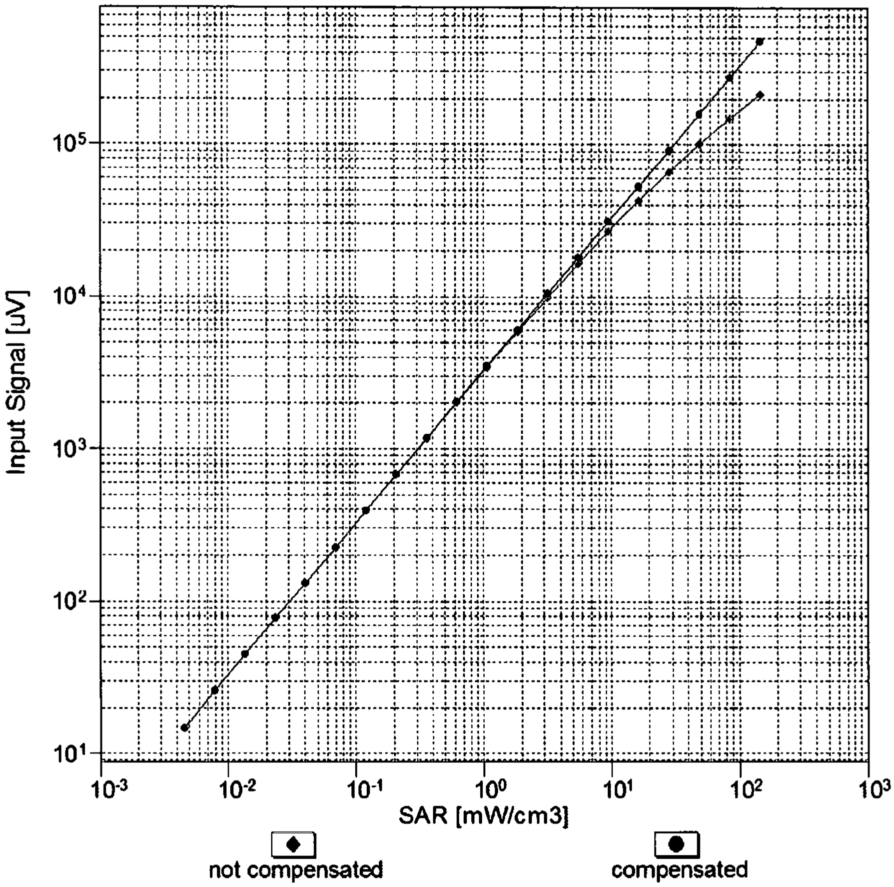


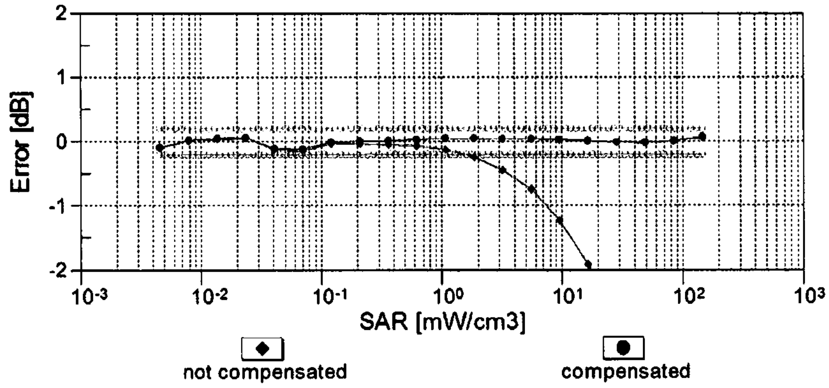


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

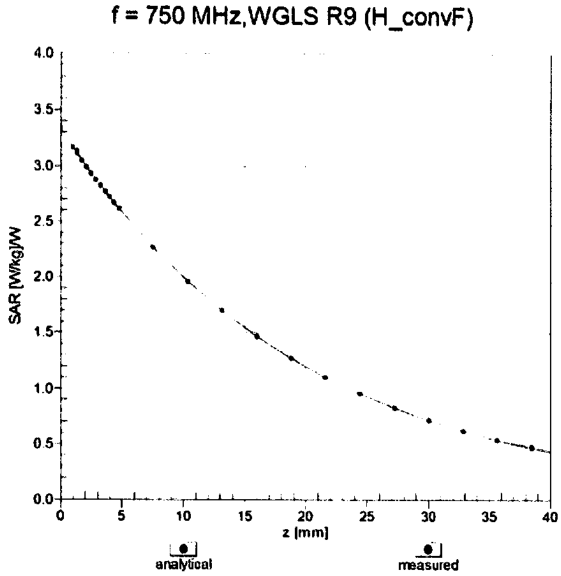
(TEM cell , f_{eval}= 1900 MHz)

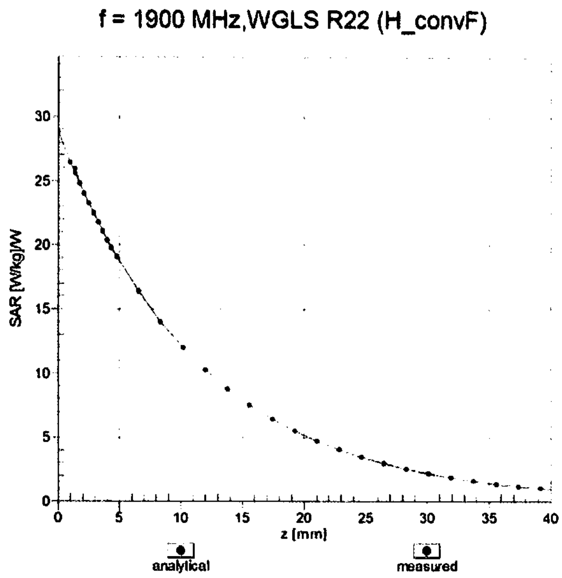




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

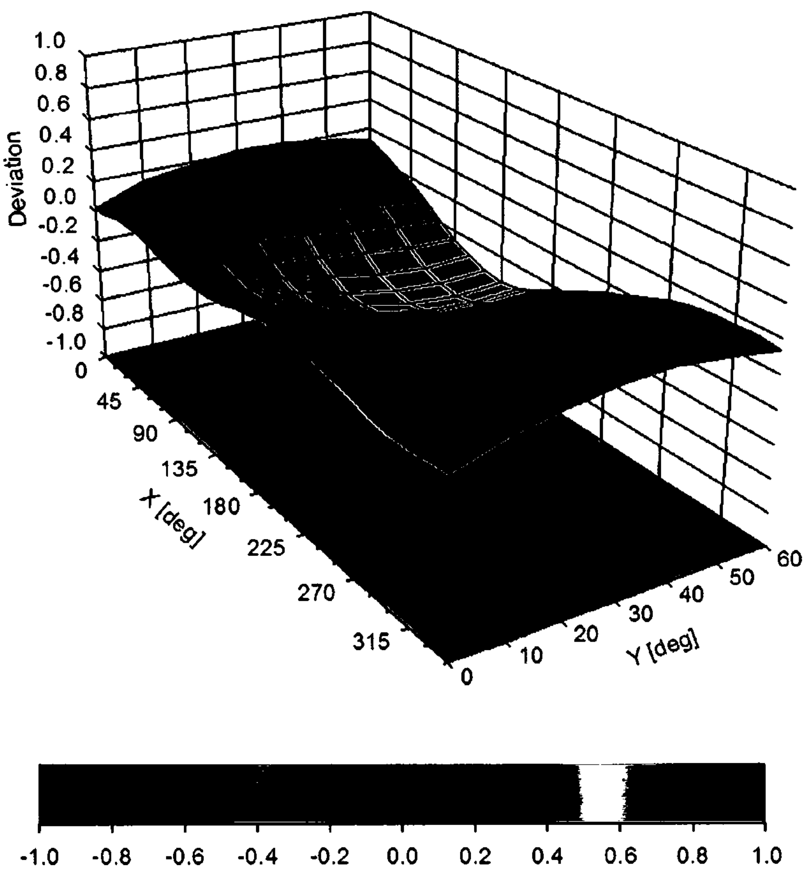
Conversion Factor Assessment





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:3935

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	43.7
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

Appendix E. Reference Report

Please refer to Sporton report number FA730825-02 which is issued separately.