SAR TEST REPORT

Report No. 2015SAR270

FCC ID:	SRQ-MF900
Applicant:	ZTE Corporation
Product:	TE/WCDMA /GSM Multi-Mode Ufi
Model:	MF900
HW Version:	H02
SW Version:	BD_UROSMF900V1.0.0B04
Issue Date:	2015-07-18

Prepared by: Chen Qiang **Reviewed by:** Yin Xiaoming **Approved by:** Wang Jianrong (General Manager)

报告专用章

Remark: This report details the results of the testing carried out on the samples specified in this report, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. The report shall not be reproduced except in full, without written approval of the Company.

Standards

Applicable Limit Regulations	**ANSI/IEEE C95.1-2005** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields. 3 kHz to 300 GHz
	ANSI/IEEE C95.3-2002 Recommended Practice For Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to such Fields. 100 kHz-300 GHz
Applicable Standards	**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
	KDB865664 D01v01r03: SAR Measurement Requirements for 100 MHz to 6 GHz
	KDB447498 D01v05r02: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Polices
	KDB248227 D01v02r01: SAR Measurement Procedures for IEEE 802.11 Wi-Fi Transmitters
	KDB941225 D01v03: SAR Measurement Procedures for 3G Devices
	KDB941225 D05v02r03: SAR Test Consideration for LTE Handsets and Data Modems
	KDB941225 D06v02: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities.

Conclusion

Localized Specific Absorption Rate (SAR) of this equipment has been measured in all cases requested by the relevant standards above. Maximum localized SAR is below exposure limits as well.

Change History

Version	Change Contents	Author	Date
V1.0	First edition	Chen Qiang	2015-06-30
V2.0	Add two channel testing of LTE band 41, retest wifi for MIMO mode	Chen Qiang	2015-07-14
V3.0	Add evaluation for wifi with ducy cycle factor	Chen Qiang	2015-07-16
V4.0	Add evaluation for LTE 50%RB worst position	Chen Qiang	2015-07-17
V5.0	Update evaluation of wifi	Chen Qiang	2015-07-18

Note: The last version will be invalid automatically while the new version is issued.

CONTENTS:

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION LTE/WCDMA /GSM Multi-Mode Ufi MF900** are as follows.

Highest standalone SAR Summary:

Exposure Position	Frequency Band	Maximum reported 1g SAR (W/kg)	Highest reported 1g SAR (W/kg)
Body-worn (10mm)	GSM850	1.177	1.228
	GSM1900	0.990	
	WCDMA BAND II	1.228	
	WCDMA BAND V	1.005	
	LTE BAND 2	1.223	
	LTE BAND 4	1.228	
	LTE BAND 5	0.890	
	LTE BAND 7	1.187	
	LTE BAND 41	0.411	
	Wi-Fi（2.45G）	0.368	0.368
	Wi-Fi（5.2G）	0.365	
	Wi-Fi（5.8G）	0.333	

Evaluation for Simultaneous SAR					
Summation BAND	**Exposure Position**	**Maximum reported 1g SAR (W/kg)**	**Summation SAR(1g) (W/kg)**	**SAR –to-peak-location Separation Ratio**	**Simultaneous Measurement Required?**
WWAN +WiFi 2.4G	Body-worn (10mm)	1.228+0.369=1.597	＜1.6	/	No

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

2. Administrative Information

2.1 Project Information

Date of start test	2015-05-13
Date of end test:	2015-07-17

2.2 Test Laboratory Information

Company:	Shanghai Tejet Communications Technology Co., Ltd Testing Center
Address:	Room 6205-6208, Building 6, No.399 Cailun Rd. Zhangjiang Hi-Tech Park, Shanghai, China
Post Code:	210203
Tel:	+86-21-61650880
Fax:	+86-21-61650881
Website:	www.tejet.cn

2.3 Test Environment

Temperature:	20℃～25 ℃
Relative Humidity:	20%～70%

3. Client Information

3.1 Applicant information

Company Name:	ZTE Corporation
Address:	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China
City:	Shenzhen
Postal Code:	518057
Country:	China
Telephone:	+86-755-86360200
Fax:	+86-755-86360298

3.2 Manufacturer Information

Company Name:	ZTE Corporation
Address:	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China
City:	Shenzhen
Postal Code:	518057
Country:	China
Telephone:	+86-755-86360200
Fax:	+86-755-86360298

4. Equipment Under Test (EUT) and Accessory Equipment (AE)

4.1 Information of EUT

Device Type	Portable device
Product	LTE/WCDMA /GSM Multi-Mode Ufi
Model	MF900
Type	Identical Prototype
Exposure Category	Uncontrolled environment / general population
Device operation configuration:	
Operating Mode(s):	GSM850
	PCS1900
	WCDMA BAND II/V
	LTE BAND 2/4/5/7/41
	802.11a/b/g/n（20M/40M）
Test Modulation	(GSM)GMSK，（WCDMA）QPSK,(LTE)QPSK/16QAM
GPRS Operation Class	B
GPRS Multislot Class	10
EDGE Class	12
DTM Support	N/A
AP Support	Yes
Rated Output Power	GSM 850:31dBm (2Txsolts)
	PCS1900: 29dBm (2Txsolts)
	WCDMA BAND II: 23.5dBm
	WCDMA BAND V: 23.5dBm
	LTE BAND 2/4/5/7/41: 22.5dBm
	802.11b：17dBm 802.11g：16dBm 802.11a：14dBm 802.11n(20M)2.4G：18dBm 802.11n(40M)2.4G：17dBm 802.11n(20M/40M) 5.2G&5.8G：13.5dBm
Band Width	LTE BAND 2: 1.4,3,5,10,15,20
	LTE BAND 4: 1.4,3,5,10,15,20
	LTE BAND 5: 1.4,3,5,10
	LTE BAND 7: 5,10,15,20
	LTE BAND 41: 5,10,15,20
WCDMA category	6（uplink），24（downlink）

Antenna Type:	Internal antenna	
Operating Frequency Range(s):	Band	Tx(MHz)
	GSM850	824.2～848.8
	PCS1900	1850.2～1909.8
	WCDMA BAND II	1852.4～1907.6
	WCDMA BAND V	826.4～846.6
	LTE BAND 2	1850～1910
	LTE BAND 4	1710～1755
	LTE BAND 5	824～849
	LTE BAND 7	2500～2570
	LTE BAND 41	2496～2690
Power Class	GSM850: 4,test with power level 5	
	PCS1900: 1,test with power level 0	
	WCDMA BAND II/V：3，test with maximum output power	
	LTE BAND 2/4/5/7/41： test with maximum output power	

4.2 Identification of EUT

EUT ID	SN or IMEI	HW Version	SW Version	Received Date
TN26	866883021502887	H02	BD_UROSMF900V1.0.0B04	2015-05-12

*EUT ID: identify the test sample in the lab internally.

4.3 Identification of AE

AE ID*	Description
AE1	Battery
AE2	Travel Adaptor

AE1

Model	Li3832T43P3h455290-H
Manufacturer	ZTE CORPORATION
Capacitance	3200mAh
Nominal Voltage	3.8V

AE2

Model	STC-A515A-Z
Manufacturer	DOKOCOM
Length of DC line	0cm with USB connector

*AE ID: identify the test sample in the lab internally.

5. Operational Conditions during Test

5.1 General description of test procedures

A communication link is set up with a system simulator by air link， and a call is established. The absolute radio frequency channel is allocated to low, middle and high respectively in the case of each band. The EUT is commanded to operate at maximum transmitting power.

Connection to the EUT is established via air interface with CMU200, and the EUT is set to maximum output power by CMU200. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30dB.

The AP is supported，
According to KDB941225 D06,

1. The device size is 12.3 cm x 6.1 cm > 9 cm x 5 cm, so test separation distance was 10mm. The test separation distance is given by user manual
2. SAR must be tested for all surfaces and edges with a transmit antenna within 2.5cm, at a test separation distance of 10mm. And also the worst position of head are tested with Wi-Fi keep transmitting.

5.2 GSM Test Configuration

SAR test for GSM 850/1900, a communication link is set up with a system simulator by air link. Using CMU200 the power level is set to “5” in SAR of GSM850，set to “0” in SAR of GSM 1900， The tests in the band of GSM850/1900 are performed in the mode of voice and data transfer function.

For Class A devices, the SAR evaluation must take into account the maximum CS and PS time slots defined by the DTM multislot class for the device, with respect to head body-worn accessory and other near body operating configurations and exposure conditions. SAR may be evaluated for DTM with the device operating in DTM using one CS plus the number of PS time-slots that result in the highest source-based time-averaged maximum output or by summing the single time-slot CS and highest maximum output multislot PS SAR.38 A communication test set with DTM support is necessary to configure the test device for SAR measurement in DTM mode. Alternatively, the single slot CS GSM/GMSK voice mode SAR for each applicable exposure condition can be added respectively to the PS (E)GPRS multislot data-mode SAR to demonstrate SAR compliance for DTM.

5.3 WCDMA Test Configuration

SAR test for WCDMA BANDII/V, a communication link is set up with a system simulator by air link. Using CMU200 the power level is set to “3” in SAR of WCDMA BAND II/V. The tests in the band of WCDMA BAND II/V are performed in the mode of RMC 12.2kbps transfer function.

SAR for body exposure configurations in voice and data modes is measured using 12.2kbps RMC with TPC bits configured to all “1’s”. SAR for other spreading codes and multiple DPDCHn , when supported by the DYT, are not required when the maximum average output of each RF channel, for each spreading code and DPDCHn configuration, are lessthan 1/4 dB higher than those measured in 12.2 kbps RMC. Otherwise , SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or DPDCHn using the exposure configuration that results in the highest SAR with 12.2 kbps RMC. When more than 2 DPDCHn are supported by the DUT, it may be necessary to configure additional DPDCHn for a DUT using FTM(Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384kbps and 968 kbps RMC.

HSDPA Test Configuration

Body SAR is also measured for HSDPA when the maximum average output of each RF channel with HSDPA active is at least 1/4 dB higher than that measured without HSDPA using 12.2 kbps RMC or the maximum SAR 12.2 kbps RMC is above75% of the SAR limit. Body SAR is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1 , using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.
HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes , minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set f. To maintain a consistent test configuration and stable transmission condition, QPSK is user in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DODCH gain factors(β c,β d), and HS_DPCCH power offset parameters(△ACK, △NACK, △CQI) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS_PDSCHs and modulation used in the H-set.

Table 1:Subtest for UMTS Release 5 HSDPA

Sub-set	β c	β d	B d（SF）	B c/β d	β hs	CM(dB)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5
Note 1: △ACK, △NACK, △CQI=8⇔Ahs=β hs/β c=30/15⇔β hs=30/15c Note 2: CM=1 forβ c/β d=12/15, β hs/β c=24/15 Note 3: For subset 2 theβ cβ d ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factor for the reference TFC						

(TFC1,TF1) toβ c=11/15 andβ d=15/15.

Table 2:Settings of required H-set 1 QPSK in HSDPA mode

Parameter	Unit	Value
Nominal Avg.Inf.Bit Rate	Kbps	534
Inter-TTI Distance	TTI's	3
Number of HARQ Processes	Processes	2
Information Bit Payload	Bitw	3202
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bots	4800
Total Avaliable SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	9600
Coding Rate	/	0.67
Number of Physical Channel Codes	Codes	5
Modulation	/	QPSK

Table 3：HSDPA UE category

HS-DSCH Category	Maximum HS_DSCH Codes Received	Minimum Inter-TTI Interval	Maximum Transport Bits/HS-DSCH	Total Channel
１	5	3	7298	19200
２	5	3	7298	28800
３	5	2	7298	28800
４	5	2	7298	38400
５	5	1	7298	57600
６	5	1	7298	67200
７	10	1	14411	115200
８	10	1	14411	134400
９	15	1	25251	172800
１２	15	1	27952	172800
１１	5	2	3630	14400
１２	5	1	3630	28800
１３	15	1	34800	259200
１４	15	1	42196	259200
１５	15	1	23370	345600
１６	15	1	27952	345600

HSUPA Test Configuration

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

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

applicable only if Maximum Power Reduction (MPR) is implemented according to Cubic Metric (CM) requirements.[37]

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

5.4 LTE Test Configuration

SAR tests for LTE are performed with a base station simulator, Anritsu MT8820C.
Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the MT8820C.

Maximum power reduction (MPR)
It must be clearly identified if Maximum Power Reduction (MPR) is implemented and whether it is an optional or permanent feature, i.e., built-in by design. MPR may be considered during SAR testing only when the maximum output power is permanently limited by the MPR implemented within the device, according to the RB (resource block) configurations specified in 3GPP/LTE standards. Regardless of network requirements, only those RB configurations allowed by 3GPP for the channel bandwidth and modulation combinations may be tested with MPR active. Configurations with RB allocations less than the RB thresholds required by 3GPP must be tested without MPR. A-MPR (additional MPR) must be disabled during SAR testing.

The maximum average conducted output power measurd
according to the following configurations, for the required test channels, channel bandwidths and uplink modulations, in each frequency band, are used to support the SAR test reduction and exclusion.

• 100% RB allocation

• 1 RB and also 50% RB allocation, offset to the upper edge, middle and lower edge of the channel bandwidth of each required test channel

Higher order modulations

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

TDD Test

TDD testing is performed using guidance from FCC KDB 941225 D05v02r03 and the SAR test guidance provided in April 2013 TCB works hop notes. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05v02r03. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211.

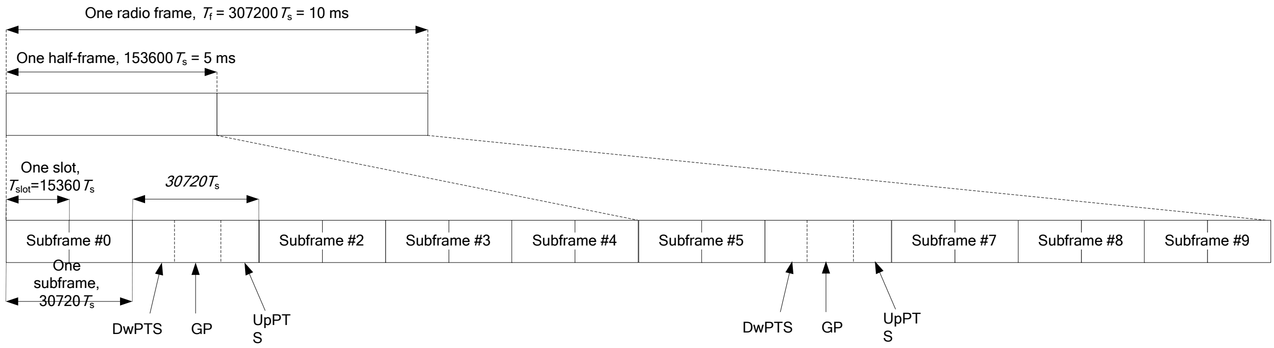


Figure 5.4-1: Frame structure type 2 (for 5 ms switch-point periodicity)

Table 5.4-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

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

Table 5.4-2: 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

Duty factor is calculated by:

Duty factor = uplink frame*6+UpPTS*2/one frame length

= (30720.T_s * 6+5120. T_s*2)/307200.T_s

= 0.633

According to the KDB 447498 D01, SAR should be evaluated at more than 3 frequencies for devices supporting transmit bands wider than 100MHz. Oct.2014 FCC-TCB conference notes (Dec. 2014 rev.) specifies the 5 test channels to use for 3GPP band 41 SAR evaluation.

5.6 Wi-Fi Test Configuration

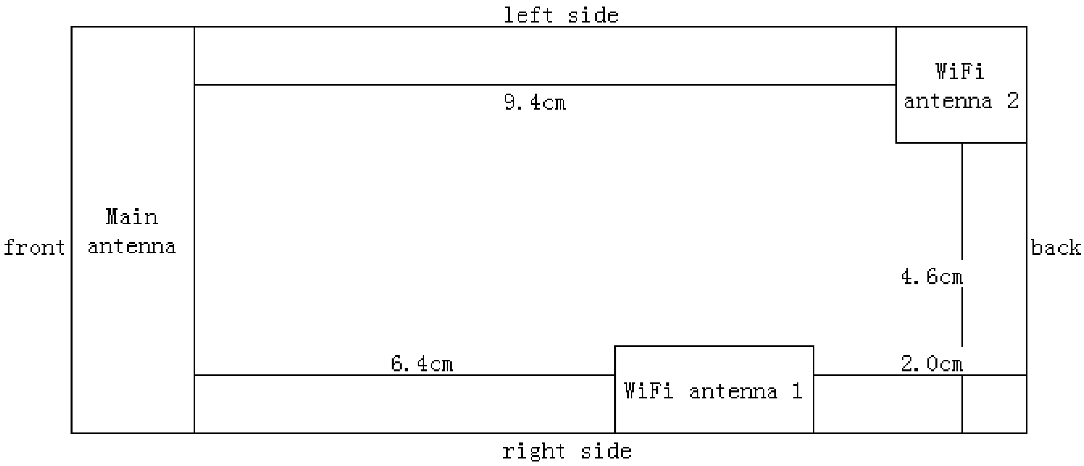
The Wi-Fi is set to different data rate and channels by the software.
According to KDB648474:

1. The separation between the Wi-Fi antenna and the main antenna is 6.4cm>5cm
2.The maximum conducted output power of Wi-Fi is 16.46dBm=44.3mW＞P（max）=19mW

So stand along SAR is needed。

According to KDB248227

SAR is not required for 802.11g channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.



Picture of antennas

According to KDB941225 D06

SAR must be tested for all surfaces and edges with a transmit antenna within 2.5cm, at a test separation distance of 10mm

Band	Position for test (yes or n/a)					
	Top	Bottom	Leftside	Rightside	Front	Back
WWAN	yes	yes	yes	yes	yes	n/a 9.4cm>2.5cm
WLAN1	yes	yes	n/a 4.6cm>2.5cm	yes	n/a 6.4cm>2.5cm	yes
WLAN2	yes	yes	yes	n/a 4.6cm>2.5cm	n/a 9.4cm>2.5cm	yes

.

Top—toward phantom

Bottom---towards ground

6. SAR Measurements system configuration

6.1 SAR Measurement set-up

The DASY5 system for performing compliance tests consists of the following items:

·A standard high precision 6-axis robot (Staubli TX=RX family) 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 and the DASY5 software.
·Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
·The generic twin phantom enabling the testing of left-hand and right-hand usage.
·The device holder for handheld mobile phones.
·Tissue simulating liquid mixed according to the given recipes.
·System validation dipoles allowing to validate the proper functioning of the system.

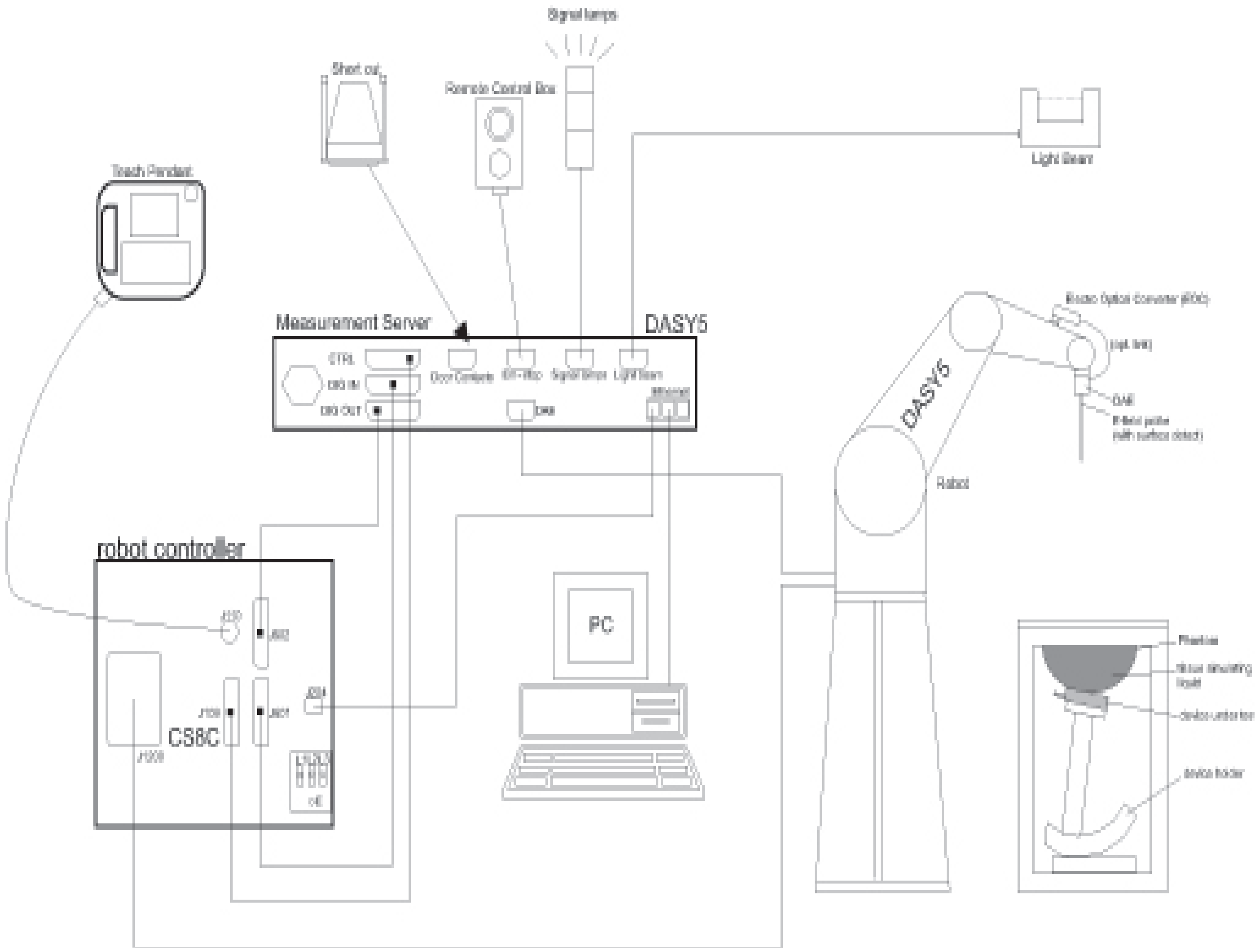


Figure 5-1 SAR Lab Test Measurement Set-up

6.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

6.2.1 Es3DV3 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 850 and HSL 1750 Additional CF for other liquids and frequencies upon request
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 μW/g to > 100 mW/g Linearity: ± 0.2dB (noise: typically < 1 μW/g)

Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

Figure 5-2.ES3DV3 E-field Probe

Figure 5-3. ES3DV3 E-field probe

6.2.2 E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\mathrm{SAR} = C\frac{\Delta T}{\Delta t}$$

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

Or

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

Where:
σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

6.3 Other Test Equipment

6.3.1 Device Holder for Transmitters

The DASY5 device holder is designed to cope with the die rent positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the inference of the clamp on the test results could thus be lowered.

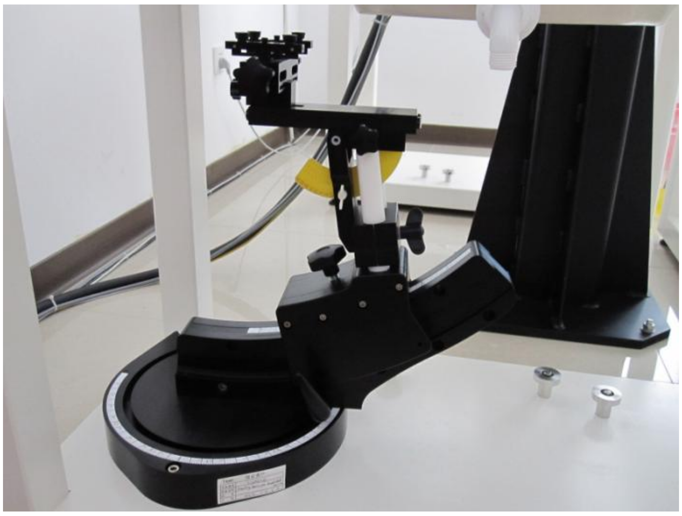


Figure 5-4.Device Holder

6.3.2 Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden Figure. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness 2±0.1 mm
Filling Volume Approx. 20 liters
Dimensions 810 x l000 x 500 mm (H x L x W)

Aailable Special

Figure 5-5.Generic Twin Phantom

6.4 Scanning procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

• The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ±5%.

• The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

• Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

• Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

• Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard ‘s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

• A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

6.5 Data Storage and Evaluation

6.5.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated. The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

6.5.2 Data Evaluation by SEMCAD

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

Probe parameters:	- Sensitivity	Normi, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	
	- Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.
The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With V_i = compensated signal of channel i (i = x, y, z)

U_i = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

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

E-field probes: $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

With V_i = compensated signal of channel i (i = x, y, z)

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)²] for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot}^2 \cdot \quad) / (\quad \cdot 1000)$$

with **SAR** = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

= conductivity in [mho/m] or [Siemens/m]

= equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$P_{pwe} = E_{tot}^2 / 3770$ or $P_{pwe} = H_{tot}^2 \cdot 37.7$

with P_{pwe} = equivalent power density of a plane wave in mW/cm²

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

6.6 System check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulates, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.1 and6.2.2

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).
System check is performed regularly on all frequency bands where tests are performed with the DASY 5 system.

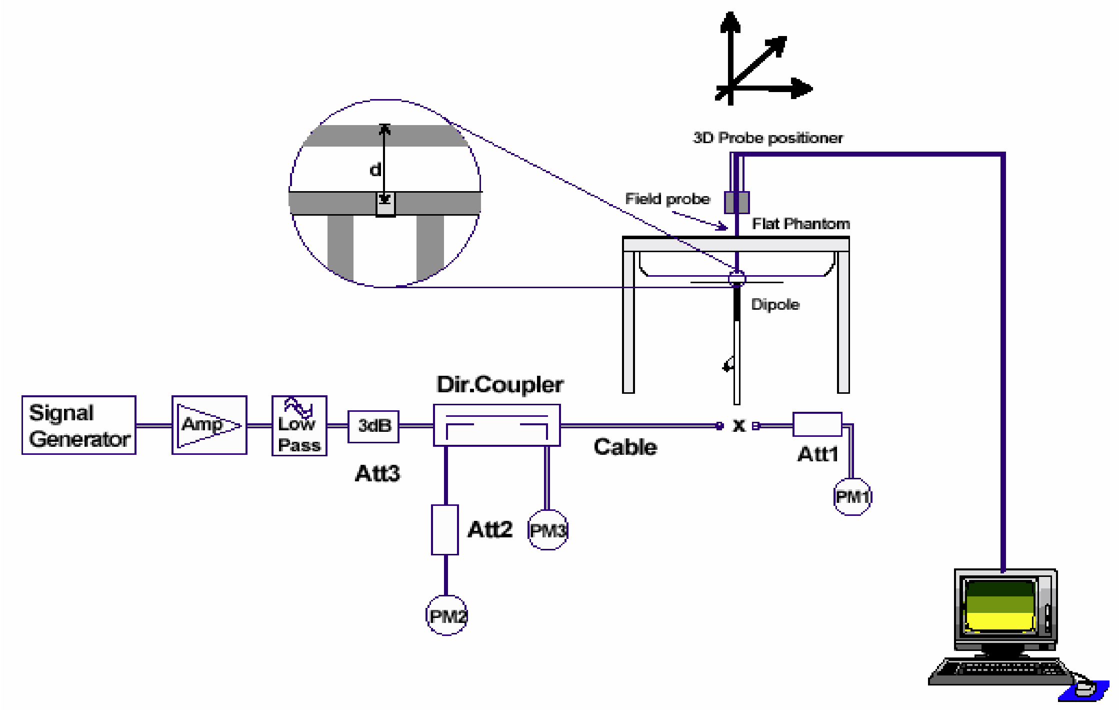


Figure 5-6. System Check Set-up

6.7 Equivalent Tissues

The liquid is consisted of water, salt, Glycol, Sugar, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The Table show the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the OET 65.

MIXTURE%	FREQUENCY(body) 835MHz
Water	52.5
Sugar	45
Salt	1.4
Preventol	0.1
Cellulose	1.0
Dielectric Parameters Target Value	f=835MHz ε=55.2 σ=0.97
MIXTURE%	FREQUENCY(body)1900MHz
Water	69.91
Glycol monobutyl	29.96
Salt	0.13
Dielectric Parameters Target Value	f=1900MHz ε=53.3 σ=1.52
MIXTURE%	FREQUENCY(body)2450MHz
Water	70
Glycol monobutyl	30
Salt	0
Dielectric Parameters Target Value	f=2450MHz ε=52.7 σ=1.95
MIXTURE%	FREQUENCY(body)1750MHz
Water	69.91
Glycol monobutyl	29.96
Salt	0.13
Dielectric Parameters Target Value	f=1750MHz ε=53.3 σ=1.52
MIXTURE%	FREQUENCY(Body)2600MHz
Water	69.5
Glycol monobutyl	30.4

Salt	**0**
Dielectric Parameters Target Value	**f=2600MHz ε=52.5 σ=2.16**
MIXTURE%	**FREQUENCY(body)5200/5800MHz**
Water	**75.48**
Triton X-100	**12.26**
Diethylenglycol monohexylether	**12.26**
Dielectric Parameters Target Value	**f=5200MHz ε=49.0 σ=5.30 f=5800MHz ε=48.2 σ=6.00**

7. Summary of Test Results

7.1 Conducted Output Power Measurement

7.1.1 Summary

The DUT is tested using CMU200 or MT8820C communications tester as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted power.

Conducted output power was measured using an integrated RF connector and attached RF cable.

This result contains conducted output power for the EUT.

7.1.2 Conducted Power Results

GSM850		Conducted output power(dBm)						
		low	middle	high				
		CH128	CH189	CH251				
		824.2MHz	836.6MHz	848.8MHz				
GSM		/	/	/	(dB)	CH128	CH189	CH251
GPRS	1 TX-slot result	32.4	32.4	32.3	-9.03	23.38	23.34	23.27
	2 TX-slot result	30.9	30.9	31.0	-6.02	**24.85**	**24.85**	**24.99**
EDGE (GMSK)	1 TX-slot result	32.4	32.4	32.3	-9.03	23.38	23.34	23.27
	2 TX-slot result	30.9	30.9	31.0	-6.02	**24.85**	**24.85**	**24.99**
	3 TX-slot result	29.1	29.1	29.0	-4.26	24.84	24.83	24.76
	4 TX-slot result	27.5	27.5	27.4	-3.01	24.49	24.46	24.35

GSM1900		Conducted output power(dBm)						
		low	middle	high				
		CH512	CH661	CH810				
		1850.2MHz	1880MHz	1909.8MHz				
GSM		/	/	/	(dB)	CH512	CH661	CH810
GPRS	1 TX-slot result	29.4	29.6	29.4	-9.03	20.36	20.59	20.37
	2 TX-slot result	27.2	27.5	27.6	-6.02	**21.22**	**21.47**	**21.59**
EDGE (GMSK)	1 TX-slot result	29.4	29.6	29.4	-9.03	20.36	20.59	20.37
	2 TX-slot result	27.2	27.5	27.6	-6.02	**21.22**	**21.47**	**21.59**
	3 TX-slot result	25.2	25.5	25.5	-4.26	20.97	21.23	21.25
	4 TX-slot result	23.9	24.1	24.1	-3.01	20.9	21.11	21.07

Note: To average the power, the division factor is as follows:

1 TX-slot =1 transmit time slot of 8 time slots
=>conducted power divided by (8/1) =>-9.03dB
2 TX-slot =2 transmit time slot of 8 time slots
=>conducted power divided by (8/2) =>-6.02dB
3 TX-slot =3 transmit time slot of 8 time slots
=>conducted power divided by (8/3) =>-4.26dB
4 TX-slot =4 transmit time slot of 8 time slots
=>conducted power divided by (8/4) =>-3.01dB

Body-worn of GSM850/1900 are tested with GPRS 4 timeslots

WCDMA BAND II		Conducted Output power (dBm)		
		low	middle	high
		CH9262	CH9400	CH9538
		1852.4MHz	1800MHz	1907.6MHz
12.2kbps RMC		23.0	22.9	23.1
HSDPA	SUB-TEST 1	22.1	22.0	22.2
	SUB-TEST 2	21.8	21.8	21.9
	SUB-TEST 3	20.3	20.4	20.6
	SUB-TEST 4	20.1	20.3	20.3
HSUPA	SUB-TEST 1	22.1	22.0	22.2
	SUB-TEST 2	21.3	21.2	21.2
	SUB-TEST 3	21.4	21.4	21.3
	SUB-TEST 4	21.0	20.9	21.1
	SUB-TEST 5	21.7	21.8	21.9

WCDMA BAND V		Conducted Output power (dBm)		
		low	middle	high
		CH4132	CH4183	CH4233
		826.4 MHz	836.6MHz	846.6MHz
12.2kbps RMC		23.4	23.2	23.3
HSDPA	SUB-TEST 1	22.4	22.3	22.2
	SUB-TEST 2	22.4	22.2	22.1
	SUB-TEST 3	20.9	20.7	20.7
	SUB-TEST 4	20.9	20.5	20.6
HSUPA	SUB-TEST 1	22.4	22.3	22.3
	SUB-TEST 2	21.7	21.5	21.3
	SUB-TEST 3	21.8	21.6	21.5
	SUB-TEST 4	21.3	21.1	21.2

	SUB-TEST 5	22.2	22.0	22.0

Body-worn of WCDMA BAND II/V are tested with 12.2kbps RMC.

LTE Band 2				
Bandwidth	RB	Frequency(MHz)	Actual output power(dBm)	
			QPSK	16QAM
1.4MHz	1RB_low	1909.3	22.04	21.06
		1880	21.93	21.22
		1850.7	21.73	20.38
	1RB_high	1909.3	22.04	21.09
		1880	22.02	20.72
		1850.7	21.83	20.6
	50%RB	1909.3	22.19	21.06
		1880	21.96	20.94
		1850.7	21.78	20.64
	100%RB	1909.3	21.12	20.12
		1880	21.01	19.93
		1850.7	20.7	19.78
3MHz	1RB_low	1851.5	22.05	20.83
		1880	21.97	20.67
		1908.5	21.81	20.41
	1RB_high	1851.5	22.07	20.9
		1880	21.94	21.1
		1908.5	21.8	20.78
	50%RB	1851.5	22.12	20.95
		1880	21.96	20.89
		1908.5	21.74	20.66
	100%RB	1851.5	21.1	20.21
		1880	20.93	19.89
		1908.5	20.73	19.72
5MHz	1RB_low	1852.5	22	21.21
		1880	21.86	20.79
		1907.5	21.7	20.3
	1RB_high	1852.5	22.15	20.96
		1880	21.85	20.98
		1907.5	21.88	20.65
	50%RB	1852.5	21.06	20.22
		1880	20.94	20.09
		1907.5	20.74	19.85

	100%RB	1852.5	21.13	20.17
		1880	20.99	20.05
		1907.5	20.73	19.87
10MHz	1RB_low	1905	21.98	20.63
		1880	22.06	21.07
		1855	21.79	20.65
	1RB_high	1905	22.17	21.17
		1880	21.89	20.79
		1855	21.86	20.49
	50%RB	1905	21.16	20.19
		1880	20.94	19.97
		1855	20.78	19.93
	100%RB	1905	21.13	20.12
		1880	20.99	20.04
		1855	20.9	19.9
15MHz	1RB_low	1902.5	21.95	20.72
		1880	21.96	21.17
		1857.5	21.75	20.64
	1RB_high	1902.5	22.25	21.25
		1880	21.89	20.56
		1857.5	21.94	20.53
	50%RB	1902.5	22.05	21
		1880	21.97	20.95
		1857.5	21.81	20.74
	100%RB	1902.5	21.17	20.15
		1880	21.01	20
		1857.5	20.87	20.04
20MHz	100%RB	1900	22.06	20.96
		1880	21.85	20.85
		1860	21.77	20.77
	50%RB	1900	21.02	19.98
		1880	20.99	19.99
		1860	20.95	19.94
	1RB-low	1900	**22.05**	21.35
		1880	**22.07**	20.86
		1860	**22.04**	21.15
	1RB-mid	1900	21.75	20.77
		1880	21.87	21.37
		1860	21.7	20.55

	1RB-high	1900	22.01	21.26
		1880	21.93	21
		1860	22.07	21.03

LTE Band 4				
Bandwidth	RB	Frequency(MHz)	Actual output power(dBm)	
			QPSK	16QAM
1.4MHz	1RB_low	1710.7	21.97	21.12
		1732.5	22.04	20.52
		1754.3	22.03	20.92
	1RB_high	1710.7	22.05	20.76
		1732.5	22.06	20.59
		1754.3	22.05	21.21
	50%RB	1710.7	22.09	20.92
		1732.5	22	20.93
		1754.3	22.02	20.93
	100%RB	1710.7	21.01	19.81
		1732.5	20.97	19.87
		1754.3	21.02	19.84
3MHz	1RB_low	1711.5	21.95	21.1
		1732.5	21.95	20.58
		1753.5	21.93	20.64
	1RB_high	1711.5	21.95	21.17
		1732.5	21.87	20.99
		1753.5	21.95	21.07
	50%RB	1711.5	21.95	20.83
		1732.5	21.98	20.8
		1753.5	21.99	20.93
	100%RB	1711.5	20.98	19.81
		1732.5	20.9	19.95
		1753.5	21.03	19.91
5MHz	1RB_low	1712.5	21.87	20.76
		1732.5	21.96	20.75
		1752.5	21.91	20.78
	1RB_high	1712.5	21.93	21.1
		1732.5	21.94	20.57
		1752.5	21.97	21.02

	50%RB	1712.5	20.9	19.92
		1732.5	20.96	19.98
		1752.5	20.98	20.01
	100%RB	1712.5	20.99	19.94
		1732.5	20.98	19.97
		1752.5	20.94	20.1
10MHz	1RB_low	1715	21.91	20.79
		1732.5	21.96	20.85
		1750	21.95	21.15
	1RB_high	1715	21.94	20.68
		1732.5	21.92	20.79
		1750	21.91	20.49
	50%RB	1715	20.9	19.89
		1732.5	20.96	19.92
		1750	20.96	20.02
	100%RB	1715	21	19.89
		1732.5	20.95	19.9
		1750	20.93	20.09
15MHz	1RB_low	1717.5	22.01	20.83
		1732.5	21.98	21.08
		1747.5	21.99	21.13
	1RB_high	1717.5	22.02	20.59
		1732.5	21.98	21.05
		1747.5	21.87	20.75
	50%RB	1717.5	22.1	21.00
		1732.5	22.01	20.92
		1747.5	22.2	20.98
	100%RB	1717.5	21	20.06
		1732.5	20.91	20.07
		1747.5	20.89	19.88
20MHz	100%RB	1720	21.85	21.00
		1732.5	21.82	20.96
		1745	21.97	21.03
	50%RB	1720	21.06	20.1
		1732.5	20.92	19.95
		1745	20.97	19.94
	1RB-low	1720	**22.13**	20.72
		1732.5	**22.29**	21.19
		1745	**22.19**	20.9

	1RB-mid	1720	21.89	20.72
		1732.5	21.85	21.08
		1745	21.91	20.7
	1RB-high	1720	21.87	20.87
		1732.5	22.29	21.01
		1745	21.97	20.85

LTE Band 5				
Bandwidth	RB	Frequency(MHz)	Actual output power(dBm)	
			QPSK	16QAM
1.4MHz	1RB_low	824.7	21.93	21.04
		836.6	22.01	20.81
		848.3	22.1	20.99
	1RB_high	824.7	22.07	21.15
		836.6	22.03	20.81
		848.3	22.08	21.32
	50%RB	824.7	22.01	20.94
		836.6	22.01	20.95
		848.3	22.06	21.07
	100%RB	824.7	21.02	19.88
		836.6	20.98	19.97
		848.3	21.14	19.98
3MHz	1RB_low	825.5	21.98	20.84
		836.6	21.99	20.74
		847.5	22.13	21.15
	1RB_high	825.5	21.99	20.73
		836.6	22.02	20.83
		847.5	22.12	21.27
	50%RB	825.5	22.02	20.94
		836.6	21.93	20.86
		847.5	22.01	21.05
	100%RB	825.5	20.94	19.91
		836.6	20.96	19.96
		847.5	21.08	20.03
5MHz	1RB_low	826.5	21.7	21.05
		836.5	21.87	20.69
		846.5	22.01	20.68

	1RB_high	826.5	21.9	21.12
		836.5	21.93	21.19
		846.5	22.09	20.67
	50%RB	826.5	20.96	20.02
		836.5	21	19.99
		846.5	21.06	20.13
	100%RB	826.5	20.89	19.96
		836.5	20.97	20.1
		846.5	20.97	20.12
10MHz	1RB_low	829	**22.09**	20.72
		836.5	**22.16**	20.78
		844	**22.20**	20.86
	1RB_mid	829	21.92	21.87
		836.5	22.02	21.81
		844	22.06	21.95
	1RB_high	829	21.91	20.74
		836.5	21.9	20.71
		844	22.05	20.93
	50%RB	829	20.88	19.96
		836.5	20.9	20.08
		844	21.0	20.12
	100%RB	829	21.0	19.96
		836.5	20.94	19.93
		844	21.04	20.1

LTE Band 7				
Bandwidth	RB	Frequency(MHz)	Actual output power(dBm)	
			QPSK	16QAM
5MHz	1RB_low	2502.5	21.65	20.9
		2535	21.55	20.34
		2567.5	21.88	20.8
	1RB_high	2502.5	21.84	20.61
		2535	21.57	20.83
		2567.5	21.93	21.02
	50%RB	2502.5	20.74	19.71
		2535	20.58	19.6
		2567.5	20.82	19.92

	100%RB	2502.5	20.74	19.74
		2535	20.54	19.53
		2567.5	20.91	19.72
10MHz	1RB_low	2505	21.78	20.74
		2535	21.58	20.74
		2565	21.88	20.97
	1RB_high	2505	21.81	20.9
		2535	21.72	20.31
		2565	21.61	20.63
	50%RB	2505	20.9	19.99
		2535	20.55	19.62
		2565	20.67	19.65
	100%RB	2505	20.79	19.86
		2535	20.53	19.55
		2565	20.81	19.82
15MHz	1RB_low	2507.5	21.78	20.8
		2535	21.51	20.31
		2562.5	21.77	20.69
	1RB_high	2507.5	21.7	20.91
		2535	21.6	20.48
		2562.5	21.88	20.79
	50%RB	2507.5	21.91	20.89
		2535	21.59	20.52
		2562.5	21.65	20.57
	100%RB	2507.5	20.88	19.84
		2535	20.56	19.6
		2562.5	20.82	19.75
20MHz	100%RB	2510	21.87	20.75
		2535	21.60	21.66
		2560	21.8	20.73
	50%RB	2510	20.88	19.92
		2535	20.66	19.68
		2560	20.86	19.85
	1RB-low	2510	**21.90**	21.01
		2535	**21.77**	20.33
		2560	**21.73**	20.83
	1RB-mid	2510	21.79	20.6
		2535	21.52	20.25
		2560	21.84	20.98

	1RB-high	2510	21.68	21.05
		2535	21.55	20.53
		2560	21.56	20.73

LTE Band 41				
Bandwidth	RB	Frequency(MHz)	Actual output power(dBm)	
			QPSK	16QAM
5MHz	1RB_low	2498.5	21.76	20.70
		2545.8	21.82	20.75
		2593	21.88	20.84
		2640.3	21.97	20.86
		2687.5	22.03	20.88
	1RB_high	2498.5	21.79	20.87
		2545.8	21.84	20.88
		2593	21.89	20.89
		2640.3	21.92	20.87
		2687.5	21.93	20.85
	50%RB	2498.5	20.86	19.77
		2545.8	20.87	19.81
		2593	20.86	19.86
		2640.3	20.88	19.90
		2687.5	20.89	19.92
	100%RB	2498.5	20.88	19.80
		2545.8	20.89	19.92
		2593	20.91	20.01
		2640.3	20.89	19.98
		2687.5	20.91	19.96
10MHz	1RB_low	2501	21.76	20.75
		2547	21.81	20.81
		2593	21.85	20.85
		2639	21.91	20.97
		2685	21.99	21.04
	1RB_high	2501	21.84	20.87
		2547	21.89	20.82
		2593	21.95	20.76
		2639	21.93	20.86
		2685	21.94	20.92

	50%RB	2501	20.9	19.82
		2547	20.91	19.94
		2593	20.89	19.99
		2639	20.94	19.98
		2685	20.99	20.03
	100%RB	2501	20.95	19.85
		2547	20.93	19.88
		2593	20.94	19.96
		2639	20.93	19.97
		2685	20.94	19.97
15MHz	1RB_low	2503.5	21.83	20.82
		2547	21.86	20.89
		2593	21.93	20.94
		2639	21.91	21.03
		2862.5	21.92	21.10
	1RB_high	2503.5	21.89	20.78
		2547	21.92	20.81
		2593	21.90	20.82
		2639	21.96	20.87
		2862.5	22.10	20.90
	50%RB	2503.5	21.89	20.88
		2547	21.89	20.91
		2593	21.90	20.93
		2639	21.98	21.02
		2862.5	22.03	21.08
	100%RB	2503.5	20.86	19.77
		2547	20.88	19.81
		2593	20.97	19.97
		2639	20.99	20.01
		2862.5	21.04	20.04
20MHz	100%RB	2506	21.90	20.87
		2565	21.88	20.85
		2593	21.91	20.87
		2645	21.86	20.86
		2680	22.18	21.03
	50%RB	2506	20.87	19.76
		2565	20.85	19.75
		2593	20.88	19.76
		2645	20.98	19.76

		2680	21.08	20.08
	1RB-low	2506	**21.92**	20.79
		2565	**21.92**	20.81
		2593	**21.94**	20.80
		2645	**21.96**	20.82
		2680	**22.13**	21.03
	1RB-mid	2506	21.85	20.81
		2565	21.84	20.83
		2593	21.85	20.81
		2645	21.86	20.85
		2680	22.12	21.09
	1RB-high	2506	21.86	20.74
		2565	21.87	20.76
		2593	21.86	20.73
		2645	21.85	20.75
		2680	21.87	20.76

LTE BAND 2/4/7/41 are tested with QPSK 20MHz 1RB low and check for QPAK 20MHz 1RB mid and high, LTE BAND 5 are tested with QPAK 10MHz 1RB low and check for QPSK 20MHz 1RB mid and high.

Maximum Power Reduction (MPR) for Power Class 3

BAND	1.4 MHz (RB)	3 MHz (RB)	5 MHz (RB)	10 MHz (RB)	15 MHz (RB)	20MHz (RB)	MPR（dB）	
							QPSK	16QAM
LTE Band 2	> 5	> 4	> 8	> 12	> 16	> 18	≤1	≤2
LTE Band 4	> 5	> 4	> 8	> 12	> 16	> 18	≤1	≤2
LTE Band 5	> 5	> 4	> 8	> 12	/	/	≤1	≤2
LTE Band 7	/	/	> 8	> 12	> 16	> 18	≤1	≤2
LTE Band 41	/	/	> 8	> 12	> 16	> 18	≤1	≤2

Wi-Fi Average Conducted Power

802.11b(dBm)

Channel\data rate			1Mbps	2Mbps	5.5Mbps	11Mbps
low	2412MHz	1	16.16	16.08	15.70	15.44
middle	2437MHz	6	16.46	/	/	15.86
high	2462MHz	11	15.36	/	/	14.47

802.11g(dBm)

Channel\data rate			6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
low	2412MHz	1	15.63	15.58	15.48	15.34	14.97	14.17	13.28	12.45
middle	2437MHz	6	15.83	/	15.70	/	/	/	/	/
high	2462MHz	11	14.92	/	14.71	/	/	/	/	/

802.11n(20M)(dBm) 2×2 MIMO

Channel\data rate			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
low	2412MHz	1	17.35	/	/	/	/	/	/	/
middle	2437MHz	6	17.90	/	/	/	/	/	/	/
high	2462MHz	11	17.20	/	/	/	/	/	/	/

802.11n(40M)(dBm) 2×2 MIMO

Channel\data rate			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
low	2422MHz	3	16.73	/	/	/	/	/	/	/
middle	2437MHz	6	16.36	/	/	/	/	/	/	/
high	2452MHz	9	16.33	/	/	/	/	/	/	/

802.11a(dBm)								
Channel\data rate	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
36(5180MHz)	13.71	13.69	13.65	13.64	13.47	10.93	10.94	8.17
40(5200MHz)	13.67	/	/	/	/	/	/	/
48(5240MHz)	13.76	/	/	/	/	/	/	/
149(5745MHz)	13.97	13.90	13.83	13.86	13.67	11.37	11.36	11.28
157(5785MHz)	13.80	/	/	/	/	/	/	/
165(5825MHz)	13.94	/	/	/	/	/	/	/
802.11n(dBm)-20MHz 2×2 MIMO								
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
36(5180MHz)	12.48	/	/	/	/	/	/	/
40(5200MHz)	12.69	/	/	/	/	/	/	/
48(5240MHz)	12.81	/	/	/	/	/	/	/
149(5745MHz)	12.98	/	/	/	/	/	/	/
157(5785MHz)	13.48	/	/	/	/	/	/	/
165(5825MHz)	13.27	/	/	/	/	/	/	/

802.11n(dBm)-40MHz 2×2 MIMO								
Channel\data rate	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
38(5190MHz)	12.34	/	/	/	/	/	/	/
46(5230MHz)	12.65	/	/	/	/	/	/	/
151(5755MHz)	13.06	/	/	/	/	/	/	/
159(5795MHz)	13.43	/	/	/	/	/	/	/

The maximum conducted output power of Wi-Fi is 16.46dBm=44.3mW>P(max)=19mW..
So stand alone SAR is required.
SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

SAR of WLAN(2.4G) should be tested on 802.11b 1Mbps. Check for 80211n(20M/40M).
SAR of WLAN(5.2G) should be tested on 802.11a 6Mbps
SAR of WLAN(5.8G) should be tested on 802.11a 6Mbps

band	Fre’	Duty cycle	Scaled factor
802.11b 11Mbps.	2412 MHz	99.8%	1.002
	2437 MHz	99.8%	1.002
	2462 MHz	99.8%	1.002
802.11a 5.2G 6Mbps	5180 MHz	97.87%	1.021
	5200 MHz	97.87%	1.021
	5240 MHz	97.87%	1.021
802.11a 5.8G 6Mbps	5745 MHz	97.87%	1.021
	5785 MHz	97.87%	1.021
	5825 MHz	97.87%	1.021

7.2 Test Results

7.2.1. Dielectric Performance

Dielectric Performance of Tissue Simulating Liquid

Frequency	Description	Dielectric Parameters εr	σ(s/m)	temp ℃
835MHz (body)	Target value 5% window	55.2 52.44-57.96	0.97 0.92-1.02	/
	Measurement value 2015-05-25	54.82	0.96	21.7
	Measurement value 2015-05-26	54.35	0.94	21.9
	Measurement value 2015-06-04	54.54	0.95	21.8
1750MHz (body)	Target value 5% window	53.3 50.63-55.96	1.52 1.44 -1.60	/
	Measurement value 2015-05-27	52.45	1.5	21.8
1900MHz (body)	Target value 5% window	53.3 50.63-55.96	1.52 1.44 -1.60	/
	Measurement value 2015-05-13	52.49	1.49	21.8
	Measurement value 2015-05-22	52.63	1.50	21.9
2450MHz (body)	Target value 5% window	52.7 50.06-55.33	1.95 1.85 -2.05	/
	Measurement value 2015-07-13	52.13	1.93	21.8
2600MHz (body)	Target value 5% window	52.5 49.88-55.13	2.16 2.05 -2.27	
	Measurement value 2015-05-21	51.98	2.12	21.9
5200MHz (body)	Target value 5% window	49 46.55-51.45	5.3 5.04-5.57	/
	Measurement value 2015-07-13	47.94	5.18	21.9
5800MHz (body)	Target value 5% window	48.2 45.79-50.61	6 5.7-6.3	/
	Measurement value 2015-07-13	47.66	6.06	21.9

7.2.2. System Check Results

System Check for tissue simulation liquid

Frequency	Description	SAR(W/kg)		Targeted SAR1g (W/kg)	Normalized SAR1g (W/kg)	Deviation (%)
		10g	1g			
835MHz (body)	Recommended result ±10% window	1.6 1.44-1.76	2.41 2.17-2.65	/	/	/
	Measurement value 2015-05-25	1.58	2.42	9.52	9.68	1.68
	Measurement value 2015-05-26	1.56	2.39	9.52	9.56	0.42
	Measurement value 2015-06-04	1.53	2.35	9.52	9.4	-1.26
1750MHz (body)	Recommended result ±10% window	5.08 4.57-5.59	9.35 8.42-10.29	/	/	/
	Measurement value 2015-05-27	4.88	9.44	37.9	37.76	-0.37
1900MHz (body)	Recommended result ±10% window	5.28 4.75-5.81	10.1 9.09-11.11	/	/	/
	Measurement value 2015-05-13	5.09	9.77	39.6	39.08	-1.31
	Measurement value 2015-05-22	5.11	9.84	39.6	39.36	-0.61
2450MHz (body)	Recommended result ±10% window	5.95 5.36-6.55	12.7 11.43-13.97	/	/	/
	Measurement value 2015-07-13	5.87	12.9	50.3	51.6	2.58
2600MHz (body)	Recommended result ±10% window	6.63 5.88-7.18	14.5 13.05-15.95	/	/	/
	Measurement value 2015-05-21	6.42	14.1	58.1	56.4	-2.93
5200MHz (body)	Recommended result ±10% window	2.12 1.91-2.33	7.61 6.85-8.37	/	/	/
	Measurement value 2015-07-13	2.15	7.72	75.5	77.2	2.25
5800MHz (body)	Recommended result ±10% window	2.08 1.87-2.29	7.55 6.8-8.31	/	/	/
	Measurement value 2015-07-13	2.06	7.69	74.8	76.9	2.81

Note: 1. the graph results see ANNEX B.1.

2 .Recommended Values used derive from the calibration certificate and 250 mW is used as feeding power to the calibrated dipole.

7.2.3 Test Results

7.2.3.1 Summary of Measurement Results (GSM850)

SAR Values (GSM850)

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
Test position of Body with GPRS(2UP) (Distance 10mm)				
Towards phantom	middle	**1.15**	-0.00	**max**
Towards Ground	middle	1.11	-0.07	
Front	middle	0.0617	-0.03	
back	middle	0.0316	-0.05	
Left side	middle	0.682	0.04	
Right side	middle	0.828	0.18	
Towards phantom	low	1.14	-0.16	
	high	1.06	-0.06	
Towards Ground	low	1.14	0.11	
	high	1.04	0.07	
Right side	low	0.800	0.54	
	high	0.810	0.18	
Towards phantom	middle	1.15	-0.03	repeat
Towards phantom	middle	1.12	-0.05	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is lower than the SAR limit (< 0.4W/kg), testing at the high and low channels is optional.
4.Per KDB 865664 d01v01, for each frequency band ,repeated SAR measurement is required only when the measured SAR is ≥0.8(W/kg).

7.2.3.2 Summary of Measurement Results (PCS1900)

SAR Values (PCS1900)

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
Test position of Body with GPRS(2UP) (Distance 10mm)				
Towards phantom	middle	0.605	-0.14	
Towards Ground	middle	**0.701**	0.05	**max**
Front	middle	0.230	-0.01	
back	middle	0.0758	-0.06	
Left side	middle	0.214	0.03	
Right side	middle	0.485	-0.03	
Towards Ground	low	0.670	0.06	
	high	0.689	-0.12	
Towards Ground	middle	0.682	0.03	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.
2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is lower than the SAR limit (< 0.4W/kg), testing at the high and low channels is optional.
4.Per KDB 865664 d01v01, for each frequency band ,repeated SAR measurement is required only when the measured SAR is ≥0.8(W/kg).

7.2.3.3 Summary of Measurement Results (WCDMA BAND II)

SAR Values (WCDMA BANDII)

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
Test position of Body (Distance 10mm)				
Towards phantom	middle	1	-0.11	
Towards Ground	middle	0.908	-0.10	
Front	middle	0.383	0.05	
back	middle	0.152	0.12	
Left side	middle	0.337	0.11	
Right side	middle	0.555	0.14	
Towards phantom	low	1.08	0.02	
	high	1.1	-0.13	
Towards Ground	low	1.07	-0.05	
	high	1.07	-0.10	
Towards phantom	high	**1.12**	-0.10	Repeat **max**
Towards phantom	high	1.10	-0.05	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is lower than the SAR limit (< 0.4W/kg), testing at the high and low channels is optional.
4. Per KDB 865664 d01v01, for each frequency band ,repeated SAR measurement is required only when the measured SAR is ≥0.8(W/kg).

7.2.3.4 Summary of Measurement Results (WCDMA BAND V)

SAR Values (WCDMA BAND V)

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
Test position of Body (Distance 10mm)				
Towards phantom	middle	0.850	-0.03	
Towards Ground	middle	0.866	0.03	
Front	middle	0.050	0.03	
back	middle	0.0267	0.01	
Left side	middle	0.530	0.03	
Right side	middle	0.666	-0.07	
Towards phantom	low	0.953	-0.06	
	high	0.933	0.03	
Towards Ground	low	0.838	-0.07	
	high	0.797	-0.03	
Towards phantom	low	0.956	-0.07	repeat
Towards phantom	low	**0.982**	-0.11	Addition card **max**

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is lower than the SAR limit (< 0.4W/kg), testing at the high and low channels is optional.
4. Per KDB 865664 d01v01, for each frequency band ,repeated SAR measurement is required only when the measured SAR is ≥0.8(W/kg).

7.2.3.5 Summary of Measurement Results (LTE BAND 2)

SAR Values (LTE BAND 2)

Test Case			Measurement Result(W/kg) 1 g Average	Power Drift(dB)	Note
Different Test Position		Channel			
Worst case position of Body with (Distance 10mm)					
QPSK_20M_1RB_low	Towards phantom	middle	0.807	-0.15	
	Towards Ground	middle	0.940	-0.05	
	front	middle	0.265	0.13	
	back	middle	0.0774	0.12	
	left side	middle	0.326	0.17	
	right side	middle	0.395	0.20	
	Towards phantom	low	1.04	-0.04	
		high	1.1	-0.04	
	Towards Ground	low	1.05	-0.03	
		high	**1.1**	-0.06	**max**
QPSK_20M_1RB_mid	Towards Ground	high	1.09	0.01	
QPSK_20M_1RB_high	Towards Ground	high	1.1	-0.06	
QPSK_20M_50%RB	Towards Ground	high	0.946	0.12	
QPSK_20M_1RB_low	Towards Ground	high	1.08	0.05	repeat
QPSK_20M_1RB_low	Towards Ground	high	1.07	-0.05	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test

configuration is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the high and low channels is optional.

4. 16QAM SAR for body was not required since the average output power of the 16QAM was not more than 0.25dB higher than the QPSK level and the maximum SAR for QPSK_20M_1RB was less than 75% SAR limit

7.2.3.6 Summary of Measurement Results (LTE BAND4)

SAR Values (LTE BAND 4)

Test Case			Measurement Result(W/kg) 1 g Average	Power Drift(dB)	Note
Different Test Position		Channel			
Worst case position of Body with (Distance 10mm)					
QPSK_20M_1RB_ low	Towards phantom	middle	0.925	0.00	
	Towards Ground	middle	1.17	0.00	
	front	middle	0.0550	0.16	
	back	middle	0.304	0.16	
	left side	middle	0.462	0.17	
	right side	middle	0.186	0.18	
	Towards phantom	low	0.943	0.01	
		high	0.983	0.04	
	Towards Ground	low	1.16	0.01	
		high	1.16	0.06	
QPSK_20M_1RB_ mid	Towards Ground	middle	1.16	0.10	
QPSK_20M_1RB_high	Towards Ground	middle	1.17	0.07	**max**
QPSK_20M_50%RB	Towards Ground	middle	0.991	-0.11	
QPSK_20M_1RB_high	Towards Ground	middle	1.16	-0.05	Addition card
QPSK_20M_1RB_high	Towards Ground	middle	1.15	0.02	repeat

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the high and low channels is optional.
4. 16QAM SAR for body was not required since the average output power of the 16QAM was not more than 0.25dB higher than the QPSK level and the maximum SAR for QPSK_20M_1RB was less than 75% SAR limit

7.2.3.7 Summary of Measurement Results (LTE BAND 5)

SAR Values (LTE BAND 5)

Test Case			Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position		Channel	1 g Average		
Worst case position of Body with (Distance 10mm)					
QPSK_10M_1RB_low	Towards phantom	middle	0.763	-0.05	
	Towards Ground	middle	0.692	0.00	
	front	middle	0.0399	0.13	
	back	middle	0.0236	0.12	
	left side	middle	0.466	0.08	
	right side	middle	0.566	0.07	
	Towards Towards	low	0.618	0.03	
		high	0.666	0.02	
QPSK_10M_1RB_mid	Towards	middle	0.766	0.02	
QPSK_10M_1RB_high	Towards	middle	0.774	0.00	
QPSK_10M_1RB_high	Towards	middle	**0.775**	-0.01	Repeat **max**
QPSK_10M_1RB_high	Towards	middle	0.765	0.05	addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the high and low channels is optional.
4. 16QAM SAR for body was not required since the average output power of the 16QAM was not more than 0.25dB higher than the QPSK level and the maximum SAR for QPSK_20M_1RB was less than 75% SAR limit

7.2.3.8 Summary of Measurement Results (LTE BAND 7)

SAR Values (LTE BAND 7)

Test Case			Measurement Result(W/kg) 1 g Average	Power Drift(dB)	Note
Different Test Position		Channel			
Worst case position of Body with (Distance 10mm)					
QPSK_20M_1RB_low	Towards phantom	middle	0.735	0.01	
	Towards Ground	middle	0.488	0.02	
	front	middle	0.469	-0.03	
	back	middle	0.0204	0.14	
	left side	middle	0.117	-0.19	
	right side	middle	0.695	0.18	
	Towards phantom	low	0.605	-0.12	
		high	0.964	-0.06	
QPSK_20M_1RB_mid	Towards phantom	high	**1.02**	-0.01	**max**
QPSK_20M_1RB_high	Towards phantom	high	0.92	0.01	
QPSK_20M_50%RB	Towards phantom	high	0.857	0.04	
QPSK_20M_1RB_mid	Towards phantom	high	0.985	0.03	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the high and low channels is optional.
4. 16QAM SAR for body was not required since the average output power of the 16QAM was not more than 0.25dB higher than the QPSK level and the maximum SAR for QPSK_20M_1RB was less than 75% SAR limit

7.2.3.9 Summary of Measurement Results (LTE BAND 41)

SAR Values (LTE BAND 41)

Test Case			Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position		Channel	1 g Average		
Worst case position of Body with (Distance 10mm)					
QPSK_20M_1RB_low	Towards phantom	40620	**0.361**	-0.03	**max**
	Towards Ground	40620	0261	-0.04	
	front	40620	0.221	-0.03	
	Back	40620	0.0117	-0.12	
	left side	40620	0.036	-0.15	
	right side	40620	0.237	0.01	
	Towards phantom	39750	0.256	-0.14	
		40340	0.335	-0.05	
		41040	0.312	-0.02	
		41490	0.308	-0.13	
QPSK_20M_1RB_mid	Towards phantom	40620	0.353	-0.07	
QPSK_20M_1RB_high	Towards phantom	40620	0.353	-0.03	
QPSK_20M_1RB_low	Towards phantom	40620	0.354	0.07	Addition card

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB lower than the SAR limit (< 0.8W/kg), testing at the high and low channels is optional.
4. 16QAM SAR for body was not required since the average output power of the 16QAM was not more than 0.25dB higher than the QPSK level and the maximum SAR for QPSK_20M_1RB was less than 75% SAR limit

7.2.3.10 Summary of Measurement Results (Wi-Fi)

SAR Value: WLAN 2.4G

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
802.11b antenna 1 Test position of Body (Distance 10mm)				
Towards phantom	middle	0.102	0.08	
Towards Ground	middle	**0.138**	0.11	
Back	middle	0.078	-0.16	
Left side	middle	0.052	-0.13	
right side	middle	0.122	-0.12	
Towards Ground	low	0.119	-0.18	
	high	0.101	-0.19	
802.11b antenna 2 Test position of Body (Distance 10mm)				
Towards phantom	middle	0.28	0.11	
Towards Ground	middle	**0.325**	0.16	**max**
Back	middle	0.0825	-0.07	
Left side	middle	0.071	0.23	
right side	middle	0.224	0.10	
Towards Ground	low	0.243	-0.33	
	high	0.230	-0.34	

802.11 n 2×2 MIMO Worst position of Body (Distance 10mm)				
Towards Ground	middle	0.216	-0.13	802.11n（20M）
Towards Ground	middle	0.218	-0.24	802.11n（40M）

SAR Value: WLAN 5.2G

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
802.11a antenna 1 Test position of Body (Distance 10mm)				
Towards phantom	middle	**0.331**	-0.16	**max**
Towards Ground	middle	0.244	0.22	
Back	middle	0.0945	0.16	
Left side	middle	0.076	-0.26	
right side	middle	0.201	-0.34	
Towards phantom	low	0.257	-0.14	
	high	0.264	-0.17	
802.11a antenna 2 Test position of Body (Distance 10mm)				
Towards phantom	middle	**0.131**	0.12	
Towards Ground	middle	0.098	0.21	
Back	middle	0.062	-0.23	
Left side	middle	0.034	0.31	
right side	middle	0.052	-0.24	
Towards phantom	low	0.077	-0.31	
	high	0.094	0.22	
802.11 n 2×2 MIMO Worst position of Body (Distance 10mm)				
Towards Ground	middle	**0.207**	0.17	802.11n（20M）
Towards Ground	middle	0.202	-0.31	802.11n（40M）

SAR Value: WLAN 5.8G

Test Case		Measurement Result(W/kg)	Power Drift(dB)	Note
Different Test Position	Channel	1 g Average		
802.11a antenna 1 Test position of Body (Distance 10mm)				
Towards phantom	middle	0.312	0.12	
Towards Ground	middle	0.218	0.21	
Back	middle	0.101	-0.17	
Left side	middle	0.086	-0.23	
right side	middle	0.206	-0.14	
Towards phantom	low	0.314	0.32	
	high	**0.328**	-0.08	**max**
802.11a antenna 2 Test position of Body (Distance 10mm)				
Towards phantom	middle	0.116	-0.28	
Towards Ground	middle	0.103	-0.14	
Back	middle	0.028	-0.36	
Left side	middle	0.058	-0.34	
right side	middle	0.033	-0.25	
Towards phantom	low	0.114	-0.31	
	high	**0.185**	-0.26	
802.11 n 2×2 MIMO Worst position of Body (Distance 10mm)				
Towards Ground	high	0.265	-0.26	802.11n（20M）
Towards Ground	high	**0.274**	0.21	802.11n（40M）

Note: 1.The value with blue color is the maximum SAR Value of test case of head and body in each test band.

2. Upper and lower frequencies were measured at the worst position.
3. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is lower than the SAR limit (< 0.4W/kg), testing at the high and low channels is optional.
4.Per KDB 865664 d01v01, for each frequency band ,repeated SAR measurement is

required only when the measured SAR is ≥0.8(W/kg).

7.2.4 Maximum SAR

Test Case				Measurement Result (W/kg)	conducted power (dBm)	maximum power (dBm)	Maximum reported 1g SAR (W/kg)	Limit 1g SAR (W/kg)
band	Different Test Position		Ch	1g Average				
GSM850	body	Towards phantom with GPRS(2up)	middle	1.15	30.9	31	1.177	1.6
GSM1900	body	Towards Ground with GPRS(2up)	middle	0.701	27.5	29	0.990	1.6
WCDMA BAND II	body	Towards phantom	high	1.12	23.1	23.5	1.228	1.6
WCDMA BAND V	body	Towards phantom addition card	low	0.982	23.4	23.5	1.005	1.6
LTE BAND 2	body	QPSK_20M_1RB_low Towards Ground	high	1.1	22.04	22.5	1.223	1.6
LTE BAND 4	body	QPSK_20M_1RB_high Towards Ground	middle	1.17	22.29	22.5	1.228	1.6
LTE BAND 5	body	QPSK_10M_1RB_high Towards phantom	middle	0.775	21.9	22.5	0.890	1.6
LTE BAND 7	body	QPSK_20M_1RB_mid Towards phantom	high	1.02	21.84	22.5	1.187	1.6
LTE BAND 41	body	QPSK_20M_1RB_low Towards phantom	middle	0.361	21.94	22.5	0.411	1.6
802.11b	body	Towards Ground	middle	0.325	16.46	17	0.368	1.6
802.11n 2.4G/40M 2×2MIMO	body	Towards Ground	middle	0.218	16.36	17	0.253	1.6
802.11a 5.2G	body	Towards phantom	middle	0.331	13.67	14	0.357	1.6
802.11n 5.2G/20M 2×2MIMO	body	Towards phantom	middle	0.207	12.69	13.5	0.249	1.6
802.11a 5.8G	body	Towards phantom	high	0.328	13.94	14	0.333	1.6

802.11n 5.8G/40M 2×2MIMO	body	Towards phantom	high	0.274	13.43	13.5	0.278	1.6

Wifi duty cycle scaled

Band	Repored SAR	Duty cycle factor	Scaled SAR
802.11b	0.368	1.002	0.369
802.11n 2.4G (40M) 2×2 MIMO	0.253	1.002	0.253
802.11a 5.2G	0.357	1.021	0.365
802.11n 5.2G (20M) 2×2 MIMO	0.249	1.021	0.255
802.11a 5.8G	0.333	1.021	0.340
802.11n 5.8G (40M) 2×2 MIMO	0.278	1.021	0.284

Evaluation for Simultaneous SAR

Summation BAND	Exposure Position	Maximum reported 1g SAR (W/kg)	Summation SAR(1g) (W/kg)	SAR –to-peak-location Separation Ratio	Simultaneous Measurement Required?
WWAN +WiFi 2.4G	Body-worn (10mm)	1.228+0.369=1.597	＜1.6	/	No
WWAN +WiFi 5.2G	Body-worn (10mm)	1.228+0.365=1.593	＜1.6	/	No
WWAN +WiFi 5.8G	Body-worn (10mm)	1.228+0.340=1.568	＜1.6	/	No

General Judgment： PASS

8. Test Equipments Utilized

No.	Name	Type	S/N	Calibration Date	Valid Period
01	Network analyzer	Agilent E5071E	MY46109425	Oct 30th，2014	One year
02	Dielectric Probe Kit	Agilent 85070E	MY44300524	No Calibration Requested	
03	Power meter	Agilent E4418B	MY50000852	Oct 30th，2014	One year
04	Power sensor	Agilent E9200B	MY50300011	Oct 30th，2014	One year
05	Power sensor	Agilent E8482a	MY41091903	Dec 12th，2014	One year
06	Signal Generator	Agilent N5182A	MY49071248	Oct 30th，2014	One year
07	Amplifier	ZHL-42W	QA1020005	No Calibration Requested	
08	BTS	CMU200	121464	Oct 30th，2014	One year
09	BTS	MT8820C	6201107310	Apr 07th，2015	One year
10	E-field Probe	ES3DV3	3241	Sep 29th，2014	One year
11	E-field Probe	EX3DV4	3717	Sep 02th，2014	One year
12	DAE	DAE4	1226	Sep 15th，2014	One year
13	DAE	DAE4	1327	Apr 21th，2015	One year
14	Validation Kit 835MHz	D835V2	4d100	Sep 23th，2014	One year
15	Validation Kit 1900MHz	D1900V2	5d155	Apr 21th，2015	One year
16	Validation Kit 2450MHz	D2450V2	845	Sep 17th，2014	One year
17	Validation Kit 1750MHz	D1750V2	1034	Sep 19th，2014	One year
18	Validation Kit 2600MHz	D2600V2	1059	Apr 27th，2015	One year
19	Validation Kit 5GHz	D5GHzV2	1180	Aug 08th，2014	One year

9. Measurement Uncertainty

No	Source of Uncertainty	Type	Uncertainty value ± %	Probability Distribution	Div.	c_i (1 g)	c_i (10 g)	Standard Unc ± %, (1 g)	Standard Unc ± %, (10 g)	v_i or v_{eff}
1	System repetivity	A	2.7	N	1	1	1	2.7	2.7	9
Measurement System										
2	Probe Calibration	B	5.9	N	1	1	1	5.9	5.9	∞
3	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
4	Boundary Effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
5	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
6	Detection Limits	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Readout Electronics	B	0.3	N	1	1	1	0.3	0.3	∞
8	Response Time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
9	Integration Time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
10	RF ambient conditions – noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	RF ambient conditions – reflections	B	0	R	$\sqrt{3}$	1	1	0	0	∞
12	Probe Positioner Mech. Restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
13	Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
14	Post-Processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test Sample Related										

15	Test Sample Positioning	A	3.3	N	1	1	1	3.3	3.3	*71*
16	Device Holder Uncertainty	A	4.1	N	1	1	1	4.1	4.1	*5*
17	Drift of Output Power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and Set-up										
18	Phantom Uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid Conductivity (target.)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid Conductivity (meas.)	A	2.06	N	1	0,64	0,43	1.7	1.4	*43*
21	Liquid Permittivity (target.)	B	5.0	R	$\sqrt{3}$	0,6	0,49	1.7	1.4	∞
22	Liquid Permittivity (meas.)	A	1.6	N	1	0,6	0,49	1.0	0.8	521
Combined standard uncertainty		$u'_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.54	10.34	
Expanded uncertainty (95 % confidence interval)		k=2						21.08	20.68	

ANNEX A: Detailed Test Results

Annex A.1 System Check Results

System check 835body

Date/Time: 25/05/2015 08:48:00

Communication System: UID 10000, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 835 MHz; σ = 0.963 S/m; ε_r = 54.822; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

835body/d=15mm, Pin=250 mW/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.39 W/kg

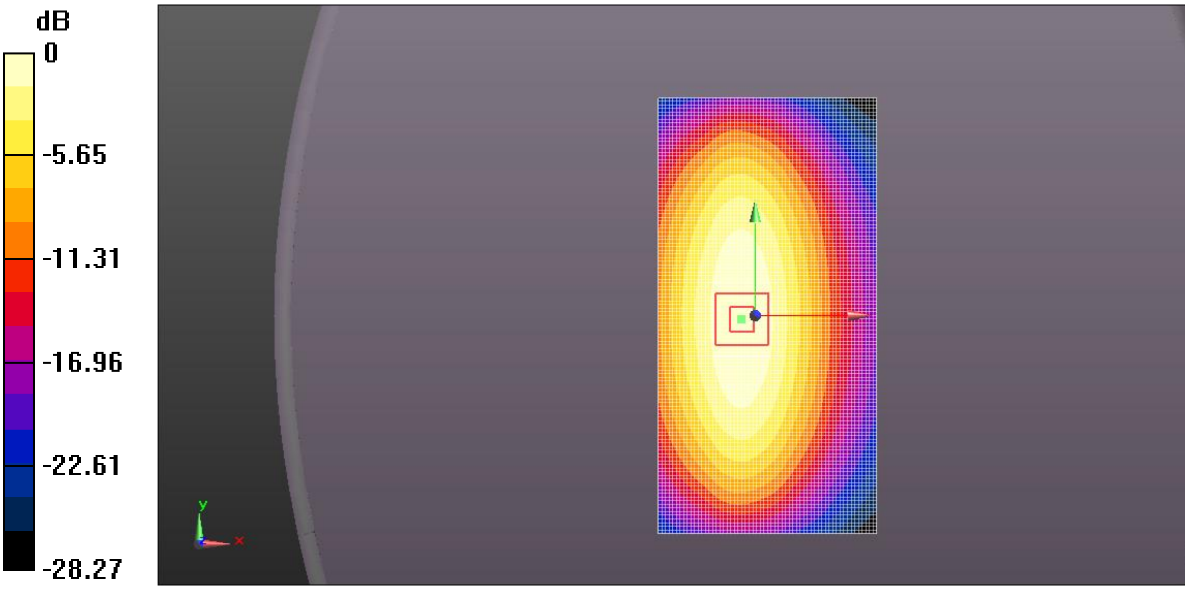
835body/d=15mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 51.344 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 3.19 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 2.38 W/kg



0 dB = 2.39 W/kg = 3.78 dBW/kg

System check 835body

Date/Time: 26/05/2015 09:23:13

Communication System: UID 10000, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 835 MHz; σ = 0.936 S/m; ε_r = 54.345; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

835body/d=15mm, Pin=250 mW/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.78 W/kg

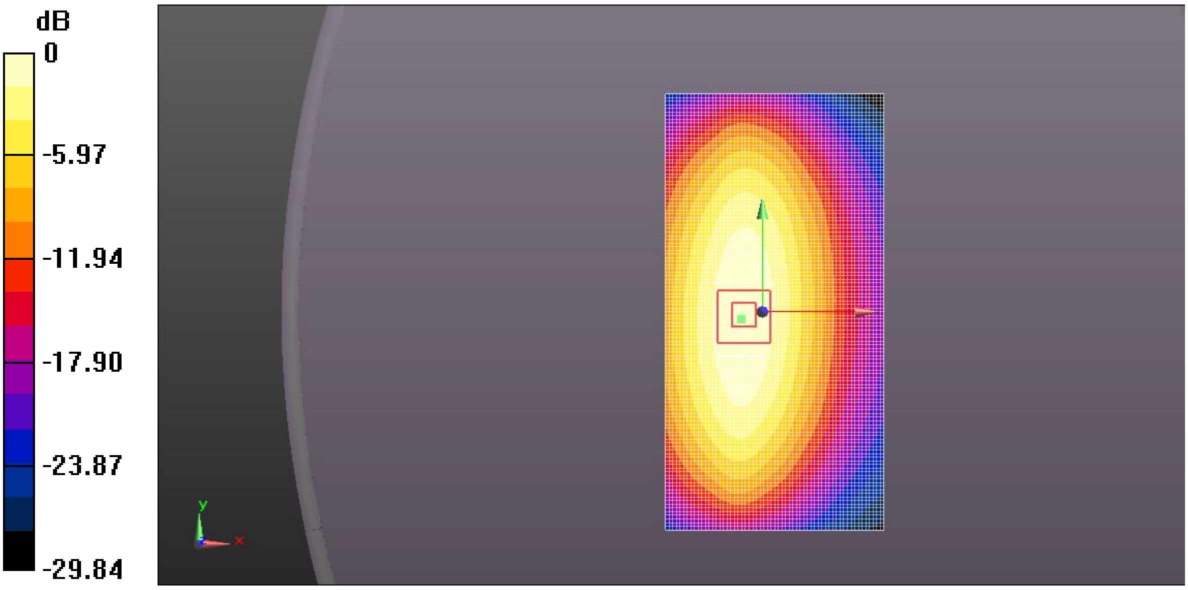
835body/d=15mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.978 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.46 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.78 W/kg = 4.43 dBW/kg

System check 835body

Date/Time: 04/06/2015 07:23:13

Communication System: UID 10000, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 835 MHz; σ = 0.953 S/m; ε_r = 54.542; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

835body/d=15mm, Pin=250 mW/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.65 W/kg

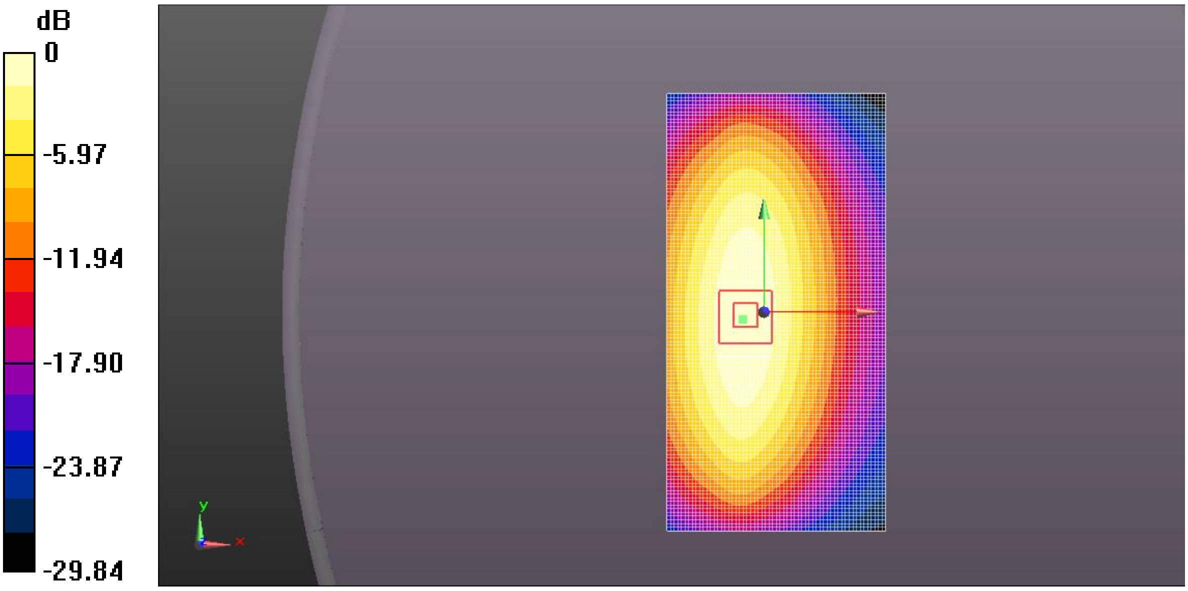
835body/d=15mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.978 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.46 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.53 W/kg

Maximum value of SAR (measured) = 2.62 W/kg



0 dB = 2.65 W/kg = 4.23 dBW/kg

System check 1750body

Date/Time: 27/05/2015 08:21:41

Communication System: UID 10000, CW; Communication System Band: D1750 (17500.0 MHz); Frequency: 1750 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1750 MHz; σ = 1.503 S/m; ε_r = 52.447; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(5.01, 5.01, 5.01); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: SAM 1; Type: SAM; Serial: TP:1702
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1750 body/d=10mm, Pin=250 mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 10.5 W/kg

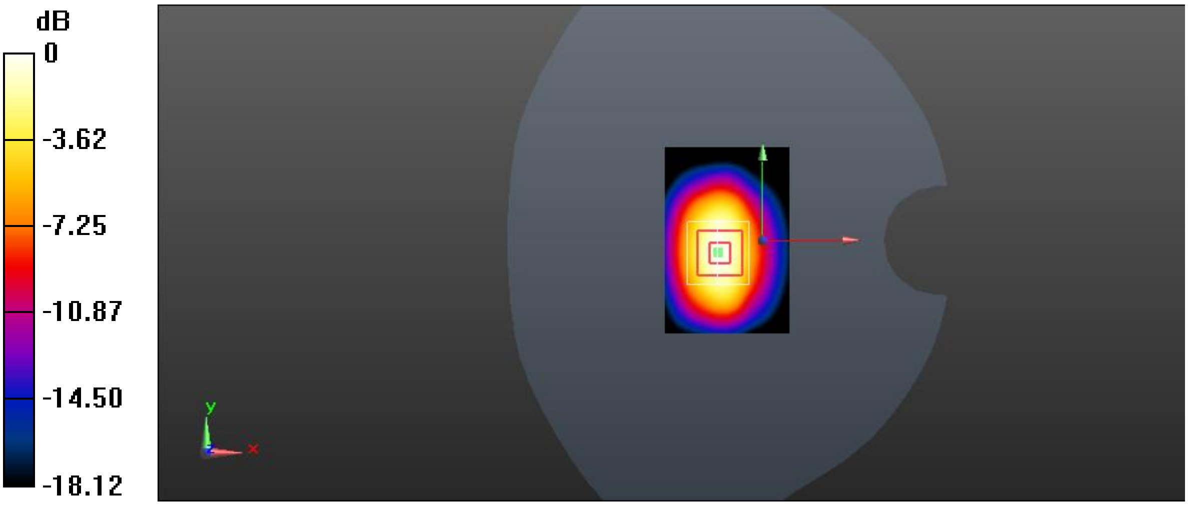
1750 body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.887 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 18.1 W/kg

SAR(1 g) = 9.44 W/kg; SAR(10 g) = 4.88 W/kg

Maximum value of SAR (measured) = 10.3 W/kg



0 dB = 10.5 W/kg = 10.21 dBW/kg

System check 1900body

Date/Time: 13/05/2015 07:37:35

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1900 MHz; σ = 1.492 S/m; ε_r = 52.486; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(4.85, 4.85, 4.85); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1900body/d=10mm, Pin=250 mW/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 12.6 W/kg

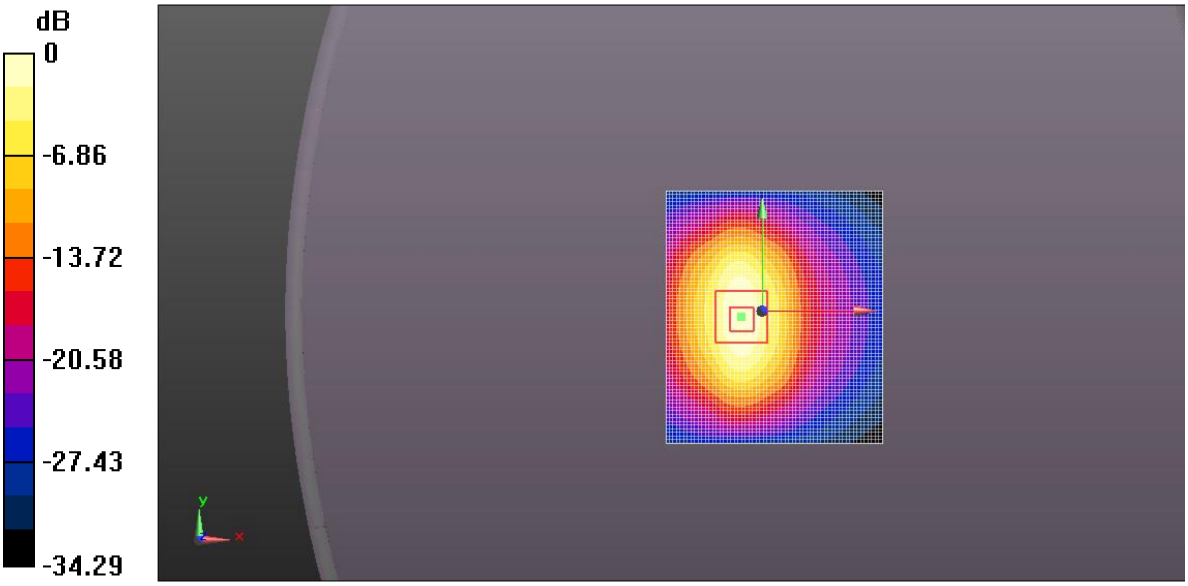
1900body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 70.500 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.77 W/kg; SAR(10 g) = 5.09 W/kg

Maximum value of SAR (measured) = 11.7 W/kg



0 dB = 12.6 W/kg = 11.01 dBW/kg

System check 1900body

Date/Time: 22/05/2015 09:08:41

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1900 MHz; σ = 1.503 S/m; ε_r = 52.634; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(4.85, 4.85, 4.85); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: SAM 1; Type: SAM; Serial: TP:1702
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1900body/d=10mm, Pin=250 mW/Area Scan (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 11.5 W/kg

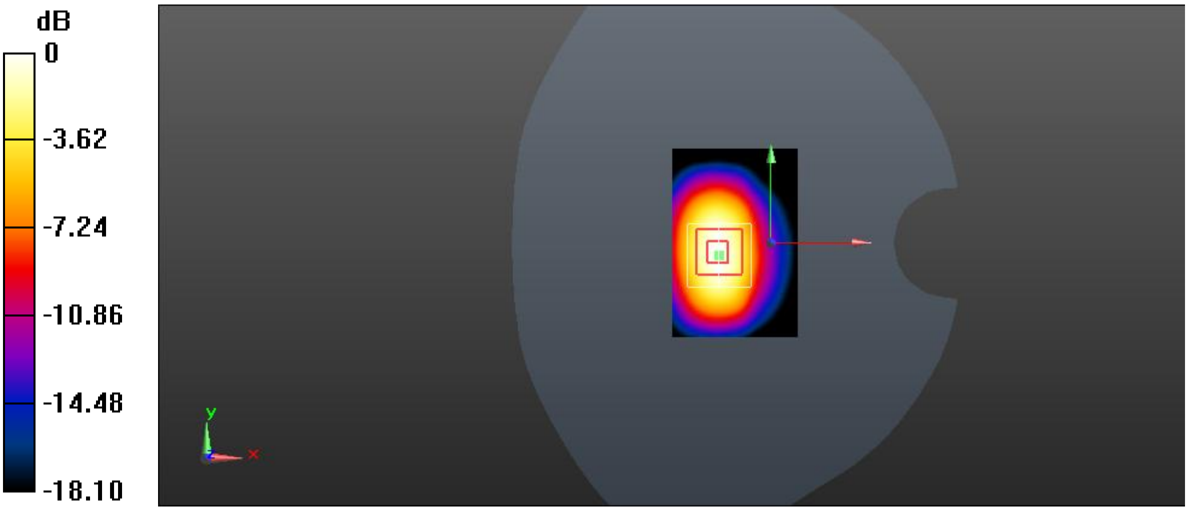
1900body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 80.747 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 16.3 W/kg

SAR(1 g) = 9.84 W/kg; SAR(10 g) = 5.11 W/kg

Maximum value of SAR (measured) = 11.2 W/kg



0 dB = 11.5 W/kg = 10.61 dBW/kg

System check 2450body

Date/Time: 13/07/2015 16:20:12

Communication System: UID 10000, CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2450 MHz; σ = 1.931 S/m; ε_r = 52.132; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(7.11, 7.11, 7.11); Calibrated: 02/09/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

2450body/d=10mm, Pin=250 mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 17.6 W/kg

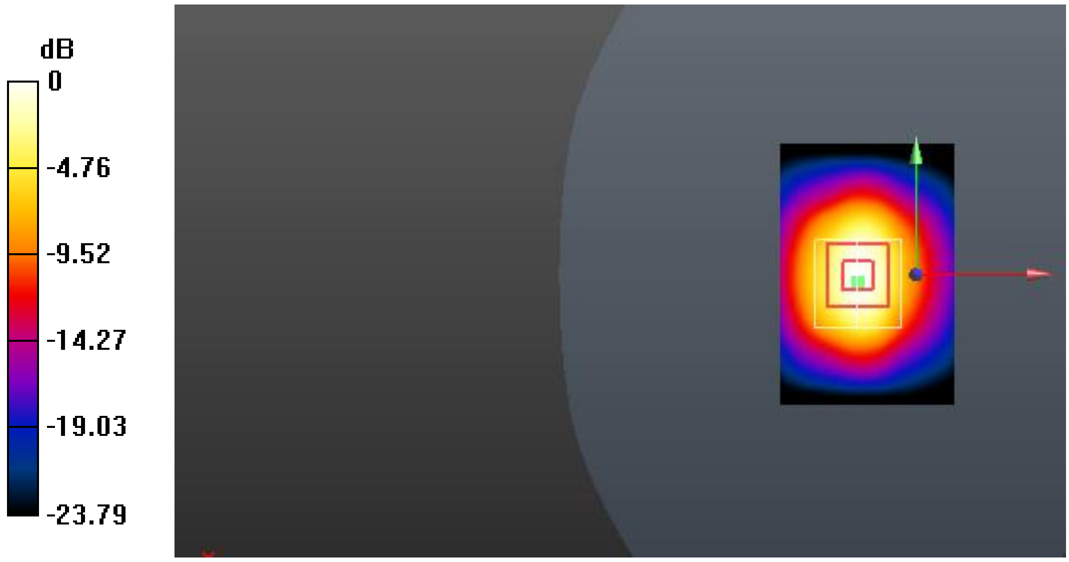
2450body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 71.463 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 26.2 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.87 W/kg

Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 17.6 W/kg = 12.46 dBW/kg

System check 2600body

Date/Time: 21/05/2015 07:20:12

Communication System: UID 10000, CW; Communication System Band: D2600 (2600.0 MHz); Frequency: 2600 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2600 MHz; σ = 2.122S/m; ε_r = 51.982; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(6.99, 6.99, 6.99); Calibrated: 02/09/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

2600body/d=10mm, Pin=250 mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 17.6 W/kg

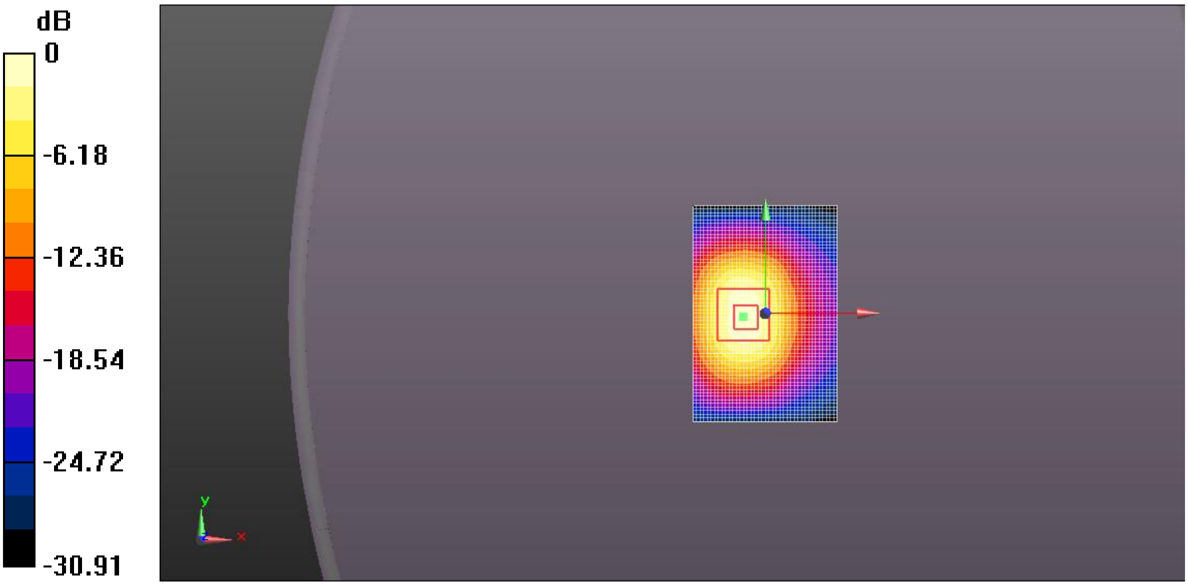
2600body/d=10mm, Pin=250 mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 71.463 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.2 W/kg

SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.42 W/kg

Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 17.6 W/kg = 12.46 dBW/kg

System check 5200body

Date/Time: 13/07/2015 20:15:40

Communication System: CW; Communication System Band: 5.2G; Frequency: 5200 MHz;Communication System PAR: 0 dB

Medium parameters used (interpolated): f = 5200 MHz; σ = 5.183 S/m; ε_r = 47.944; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(4.49, 4.49, 4.49); Calibrated: 02/09/2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5200body/d=10mm, Pin=100 mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 18.1 W/kg

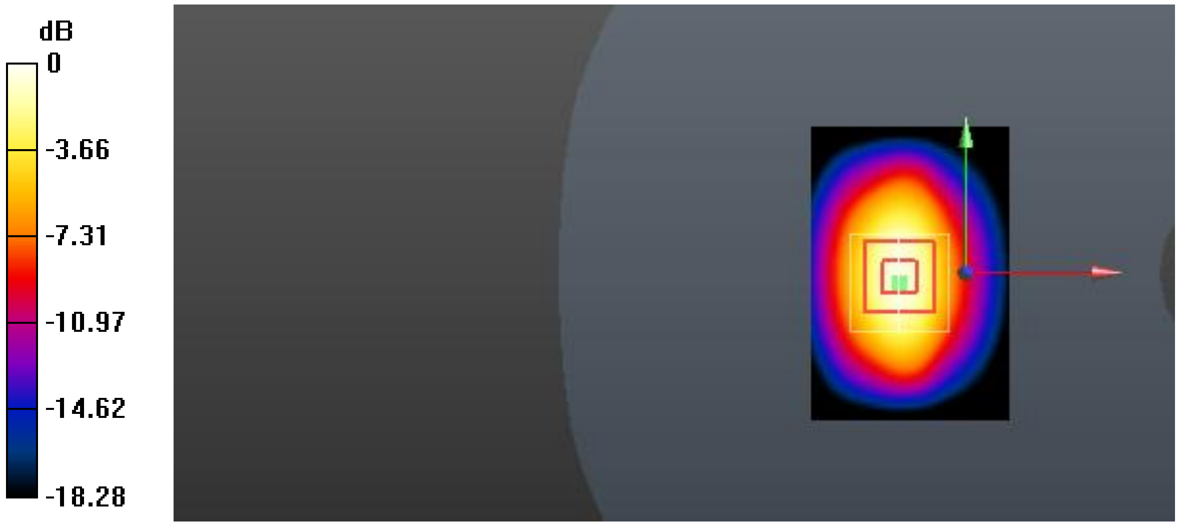
5200body/d=10mm, Pin=100 mW/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.914 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 29.5 W/kg

SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.15 W/kg

Maximum value of SAR (measured) = 18.0 W/kg



0 dB = 18.0 W/kg = 12.55 dBW/kg

System check 5800body

Date/Time: 13/07/2015 20:48:31

Communication System: CW; Communication System Band: 5.8G; Frequency: 5800 MHz;Communication System PAR: 0 dB

Medium parameters used (interpolated): f = 5800 MHz; σ = 6.063 S/m; ε_r = 47.663; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(4.05, 4.05, 4.05); Calibrated: 02/09/2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5800body/d=10mm, Pin=100 mW/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 19.3 W/kg

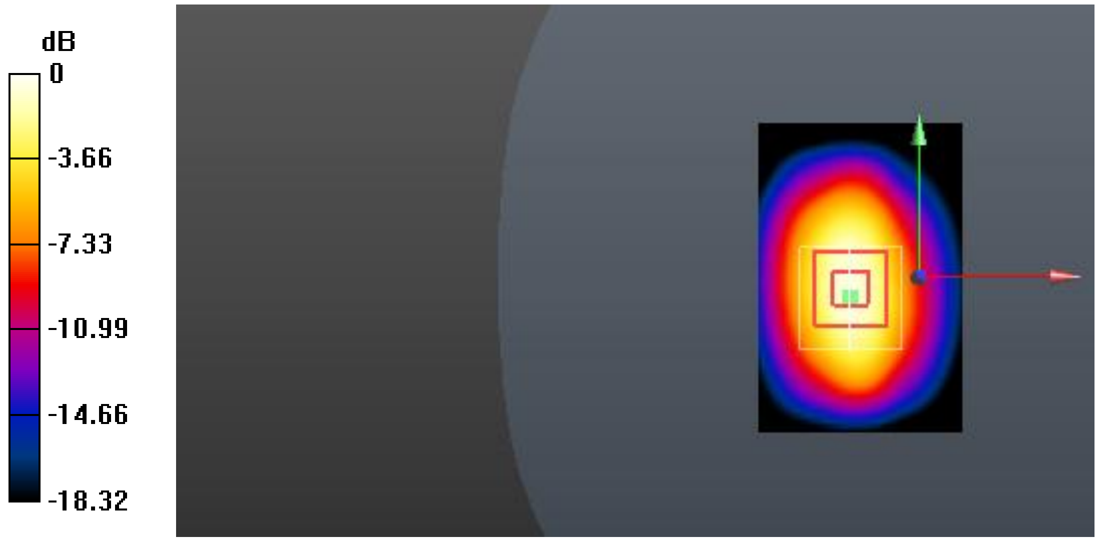
5800body/d=10mm, Pin=100 mW/Zoom Scan (8x8x10) /Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 53.028 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.06 W/kg

Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Annex A.2 Graph Result

GSM850 towards phantom mid

Date/Time: 25/05/2015 16:12:38

Communication System: UID 0, GPRS/EGPRS(2UP) (0); Communication System Band: GSM850; Frequency: 836.6 MHz;Communication System PAR: 6.19 dB

Medium parameters used: f = 837 MHz; σ = 0.951 S/m; ε_r = 54.241; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards phantom mid/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.27 W/kg

Configuration/towards phantom mid/Zoom Scan (5x5x7)/Cube 0:

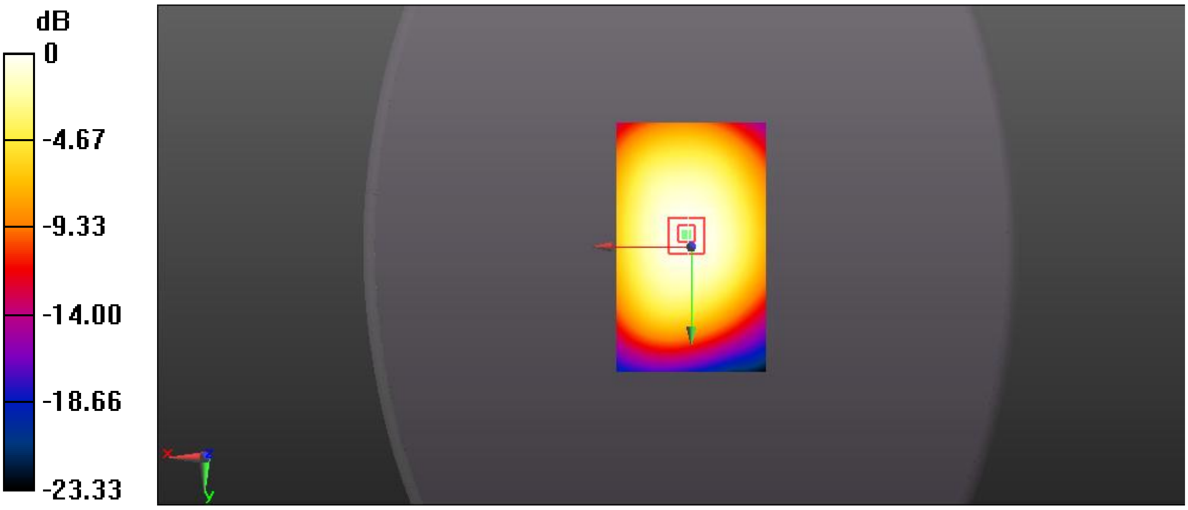
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 37.429 V/m; Power Drift = -0.00 dB

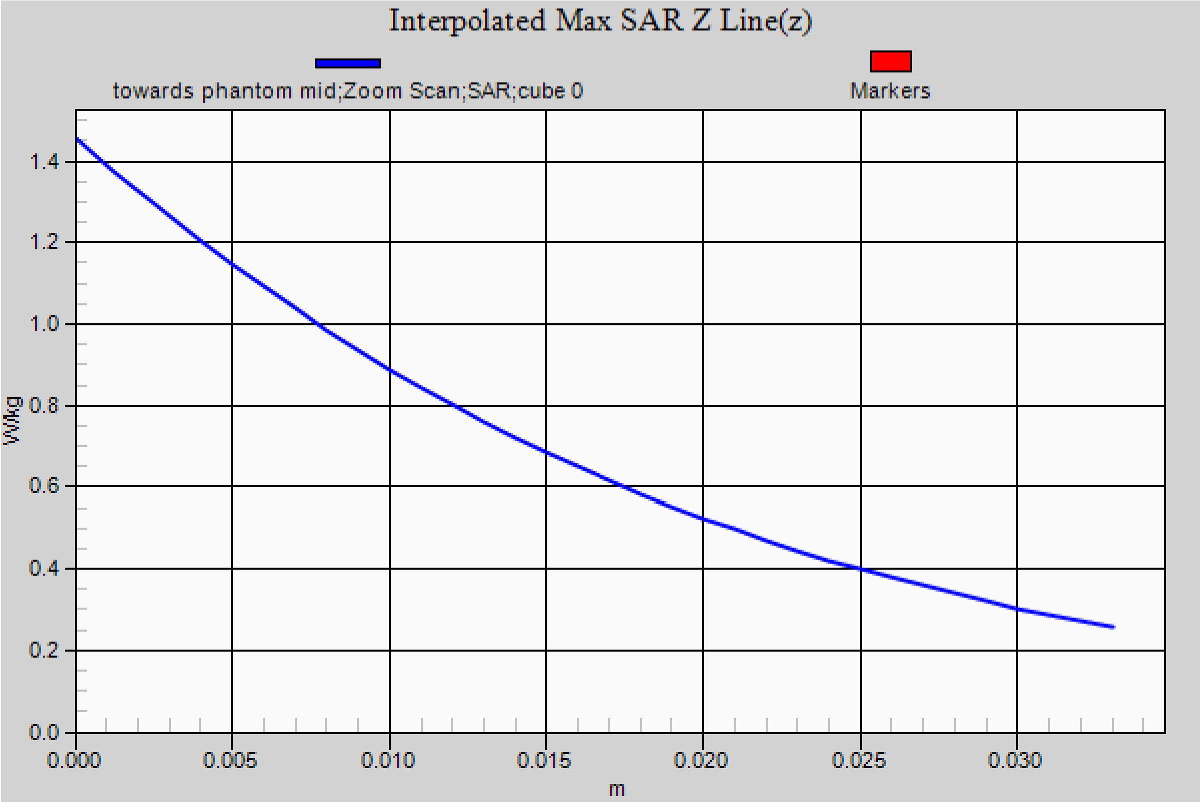
Peak SAR (extrapolated) = 1.46 W/kg

SAR(1 g) = 1.15 W/kg; SAR(10 g) = 0.858 W/kg

Maximum value of SAR (measured) = 1.26 W/kg



0 dB = 1.27 W/kg = 1.04 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom mid;Zoom Scan;SAR;cube 0
Markers
W/kg
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

GSM1900 towards ground mid

Date/Time: 13/05/2015 09:44:47

Communication System: UID 0, GPRS/EGPRS(2UP) (0); Communication System Band: PCS1900; Frequency: 1880 MHz;Communication System PAR: 6.19 dB

Medium parameters used: f = 1880 MHz; σ = 1.477 S/m; ε_r = 52.425; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(4.85, 4.85, 4.85); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards ground mid/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.851 W/kg

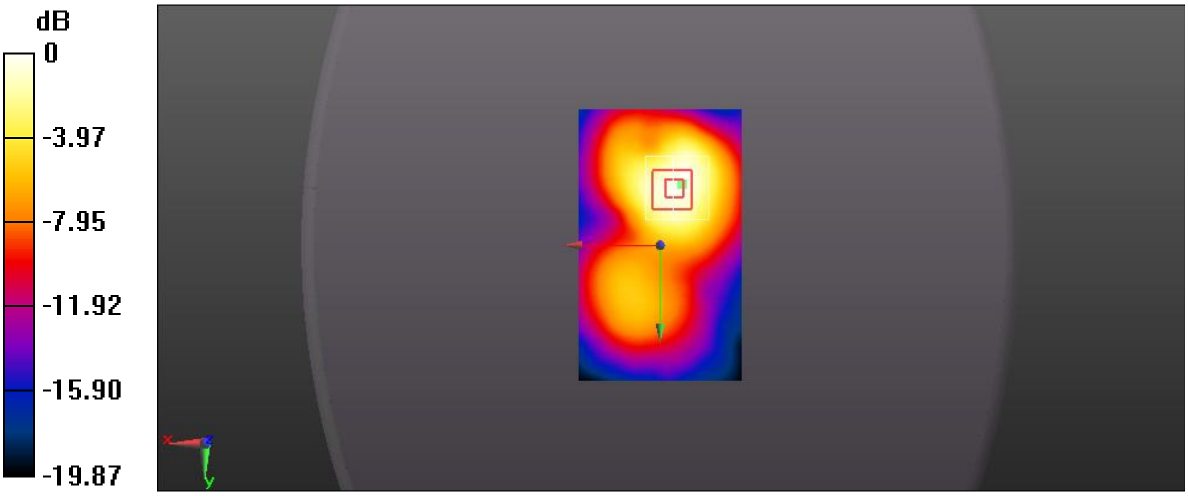
Configuration/towards ground mid/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.002 V/m; Power Drift = 0.05 dB

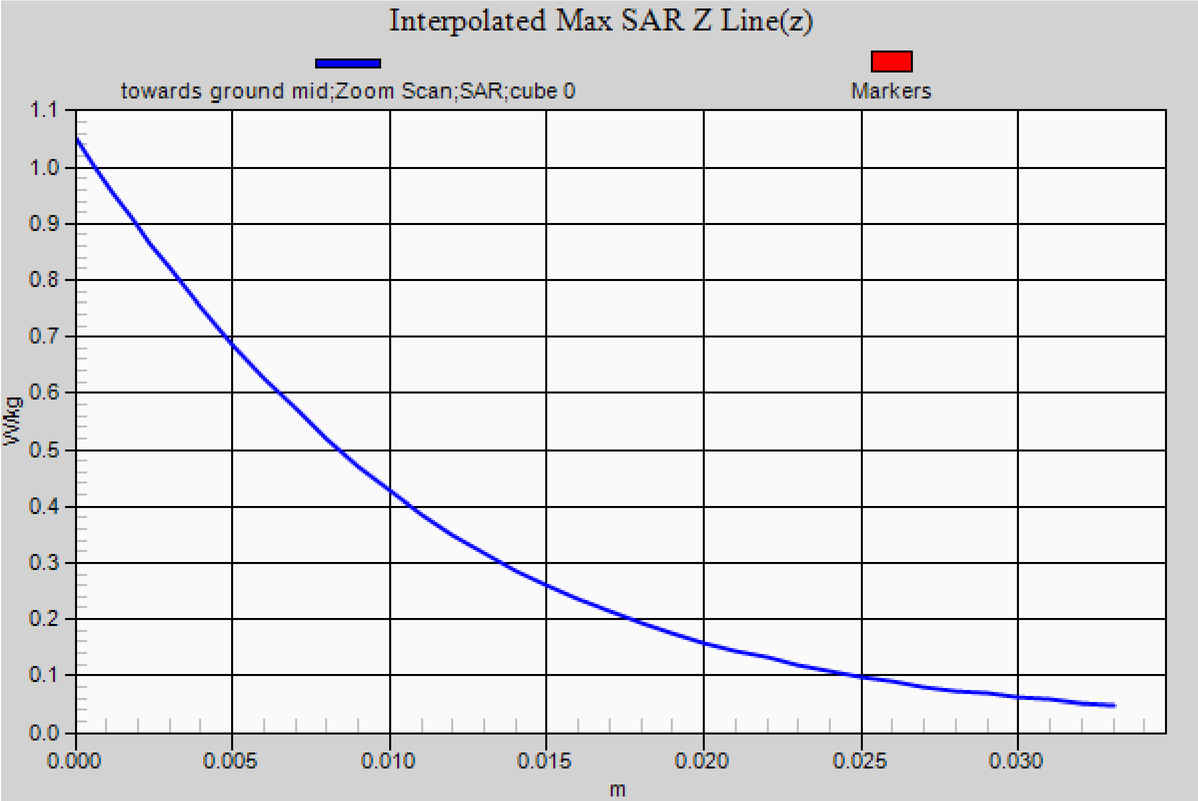
Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.701 W/kg; SAR(10 g) = 0.433 W/kg

Maximum value of SAR (measured) = 0.821 W/kg



0 dB = 0.851 W/kg = -0.70 dBW/kg


Interpolated Max SAR Z Line(z)
towards ground mid;Zoom Scan;SAR;cube 0
Markers
W/kg
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

WCDMA BAND II towards phantom high repeat

Date/Time: 22/05/2015 23:09:52

Communication System: UID 0, WCDMA (0); Communication System Band: BAND 2; Frequency: 1907.6 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1908 MHz; σ = 1.502 S/m; ε_r = 52.332; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(4.85, 4.85, 4.85); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: SAM 1; Type: SAM; Serial: TP:1702
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration 2/towards phantom high repeat/Area Scan (91x151x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.38 W/kg

Configuration 2/towards phantom high repeat/Zoom Scan (7x7x7)/Cube 0:

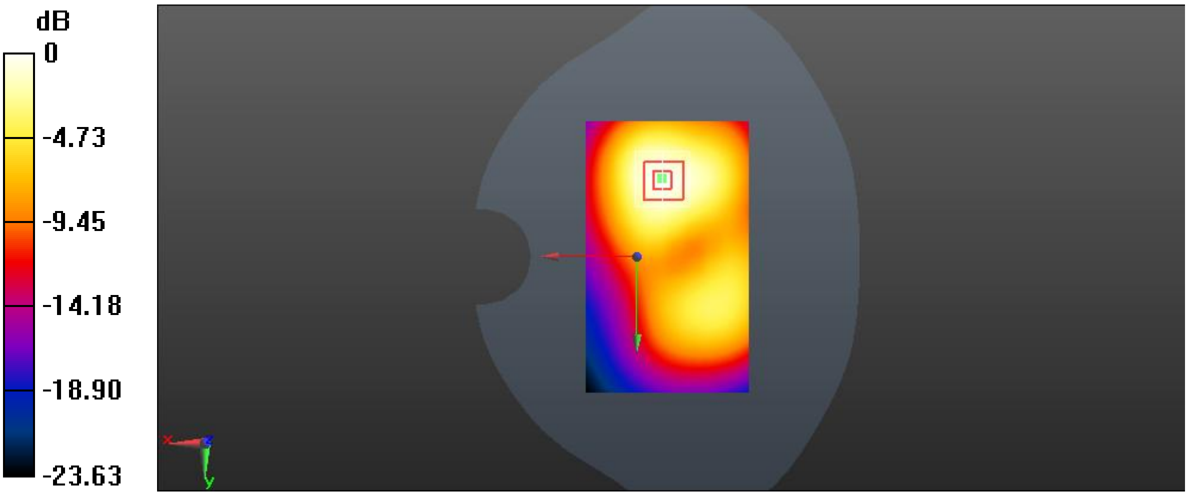
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.026 V/m; Power Drift = -0.10 dB

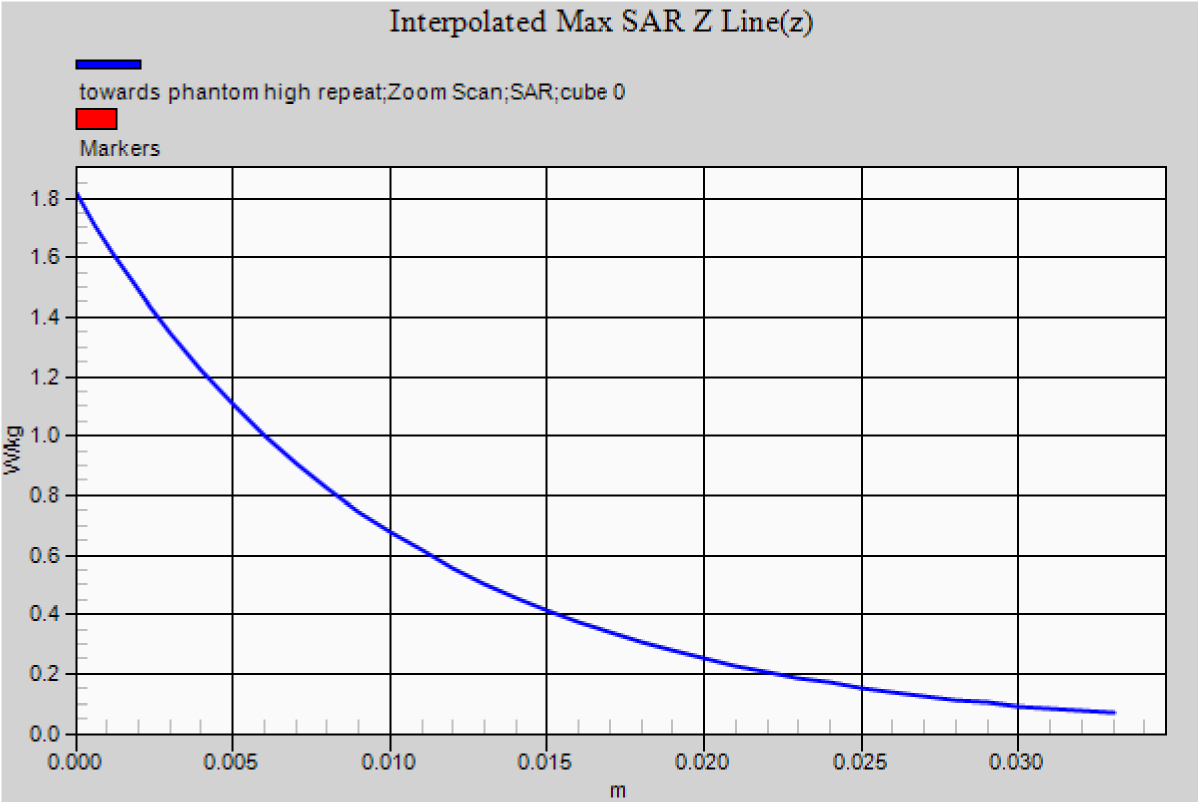
Peak SAR (extrapolated) = 1.82 W/kg

SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.673 W/kg

Maximum value of SAR (measured) = 1.35 W/kg



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


Interpolated Max SAR Z Line(z)
towards phantom high repeat;Zoom Scan;SAR;cube 0
Markers
W/kg
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

WCDMA BAND V towards phantom low addition card

Date/Time: 04/06/2015 09:13:40

Communication System: UID 0, WCDMA (0); Communication System Band: BAND 5; Frequency: 826.4 MHz;Communication System PAR: 0 dB

Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.936 S/m; ε_r = 54.3; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards phantom low addition card/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.09 W/kg

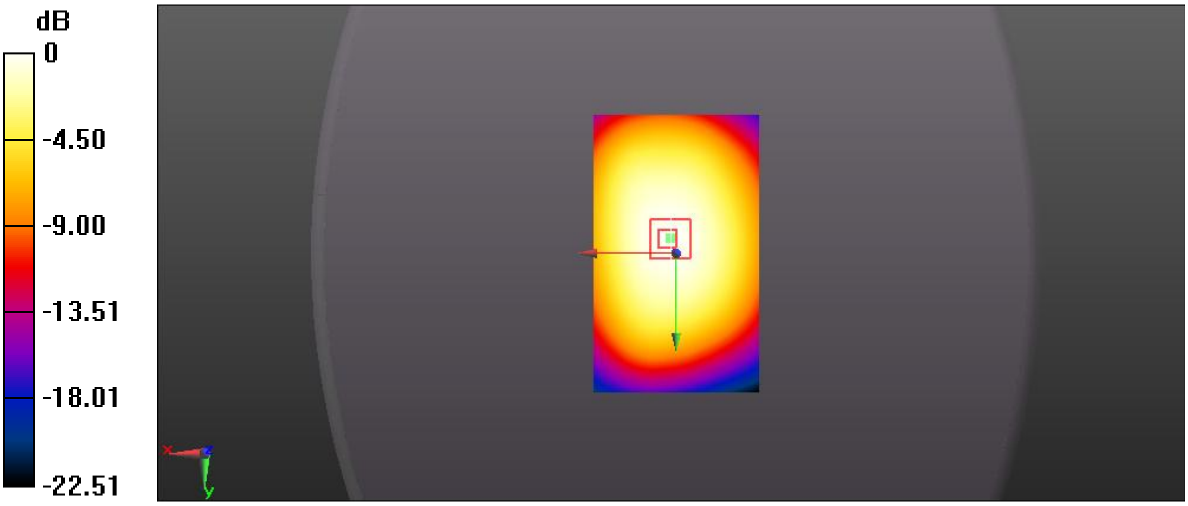
Configuration/towards phantom low addition card/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 34.997 V/m; Power Drift = -0.12 dB

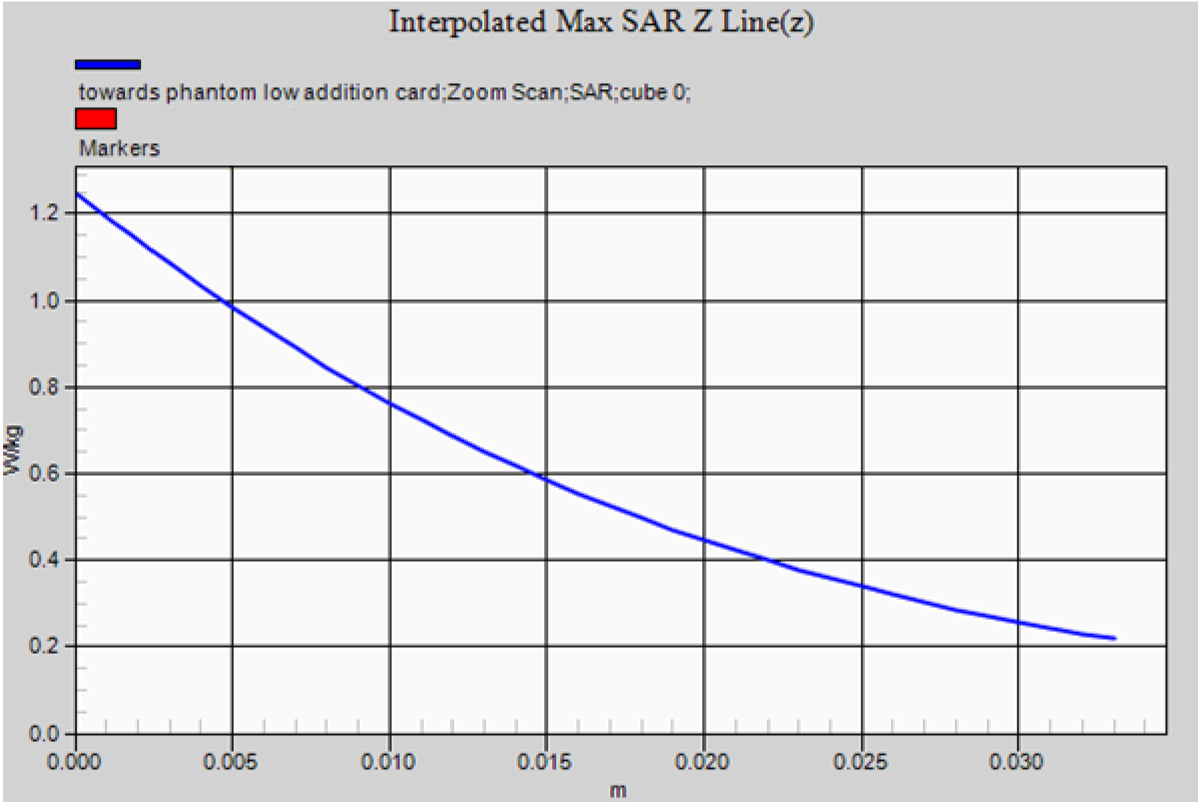
Peak SAR (extrapolated) = 1.25 W/kg

SAR(1 g) = 0.982 W/kg; SAR(10 g) = 0.733 W/kg

Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.37 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom low addition card;Zoom Scan;SAR;cube 0;
Markers
W/kg
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

LTE 2 towards ground high QPSK_20M_1RB low

Date/Time: 22/05/2015 16:00:34

Communication System: UID 0, FDD-LTE(QPSK_20M_1RB) (0); Communication System Band: BAND 2; Frequency: 1900 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1900 MHz; σ = 1.495 S/m; ε_r = 52.357; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(4.85, 4.85, 4.85); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: SAM 1; Type: SAM; Serial: TP:1702
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards ground high/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.33 W/kg

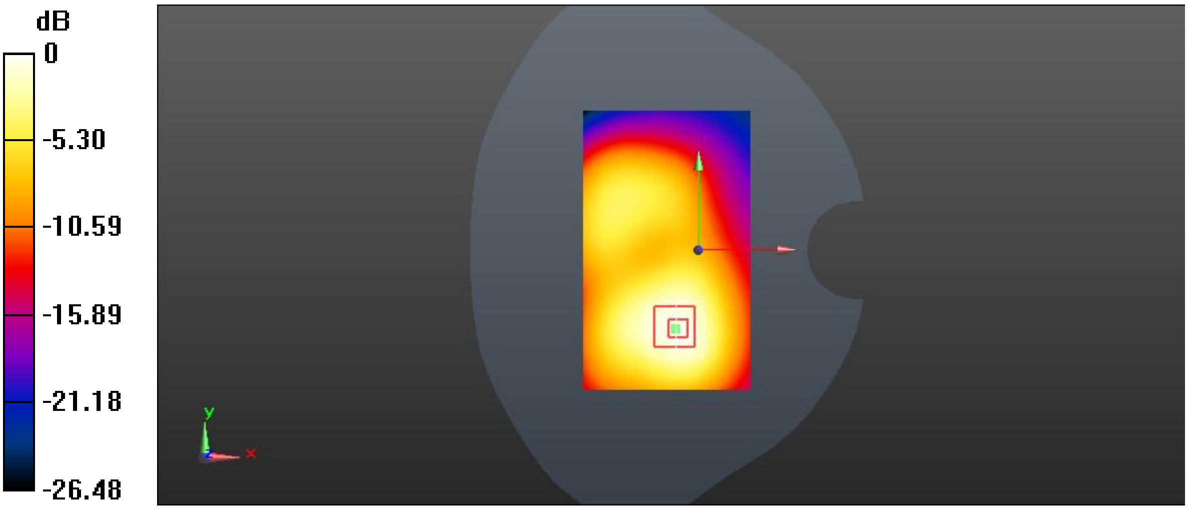
Configuration/towards ground high/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.773 V/m; Power Drift = -0.06 dB

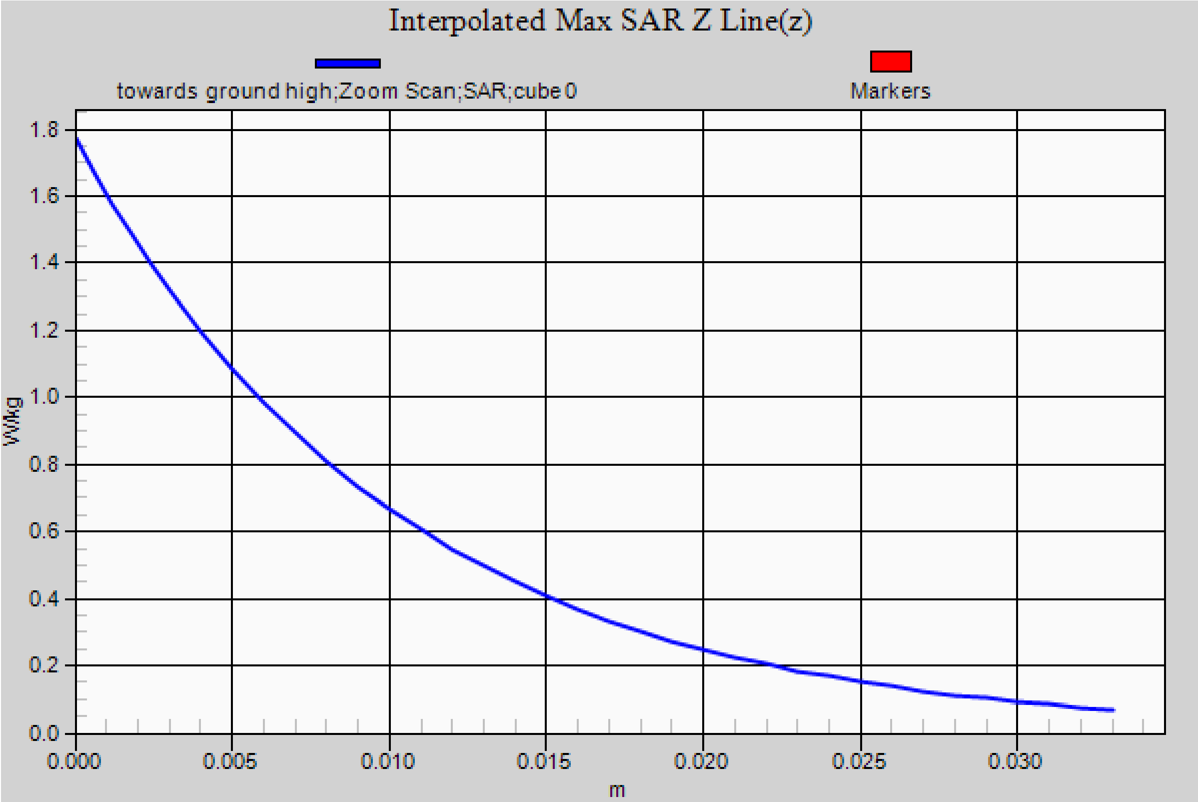
Peak SAR (extrapolated) = 1.77 W/kg

SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.659 W/kg

Maximum value of SAR (measured) = 1.32 W/kg



0 dB = 1.33 W/kg = 1.24 dBW/kg


Interpolated Max SAR Z Line(z)
towards ground high;Zoom Scan;SAR;cube 0
Markers
W/kg
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

LTE 4 towards ground mid QPSK_20M_1RB_high

Date/Time: 27/05/2015 09:29:20

Communication System: UID 0, FDD-LTE(QPSK_20M_1RB) (0); Communication System Band: BAND 4; Frequency: 1732.5 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 1800 MHz; σ = 1.397 S/m; ε_r = 52.54; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(5.01, 5.01, 5.01); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: SAM 1; Type: SAM; Serial: TP:1702
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards ground mid QPSK_20M_1RB_high /Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.41 W/kg

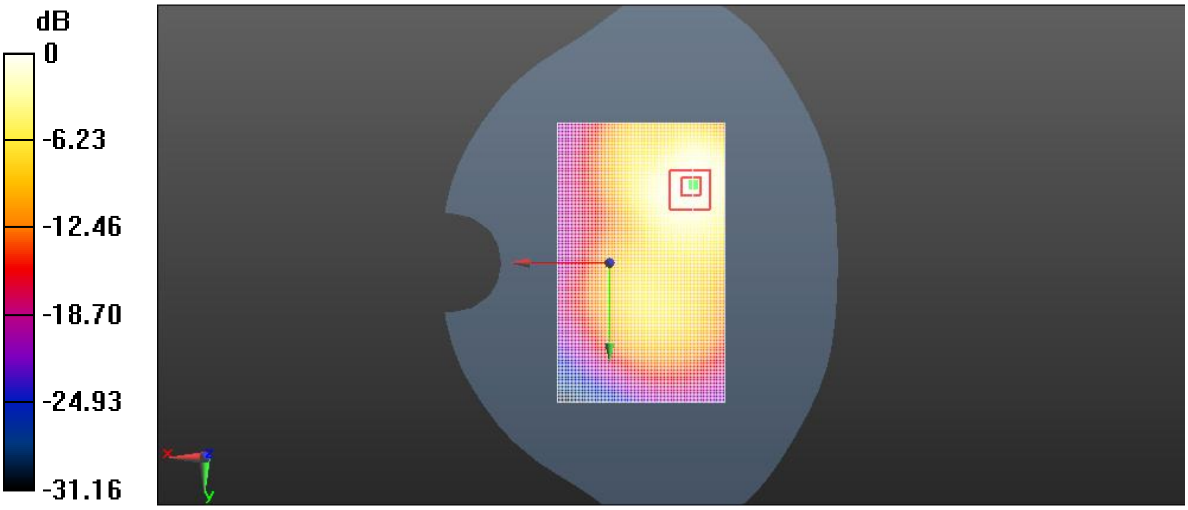
Configuration/towards ground mid QPSK_20M_1RB_high /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.349 V/m; Power Drift = 0.07 dB

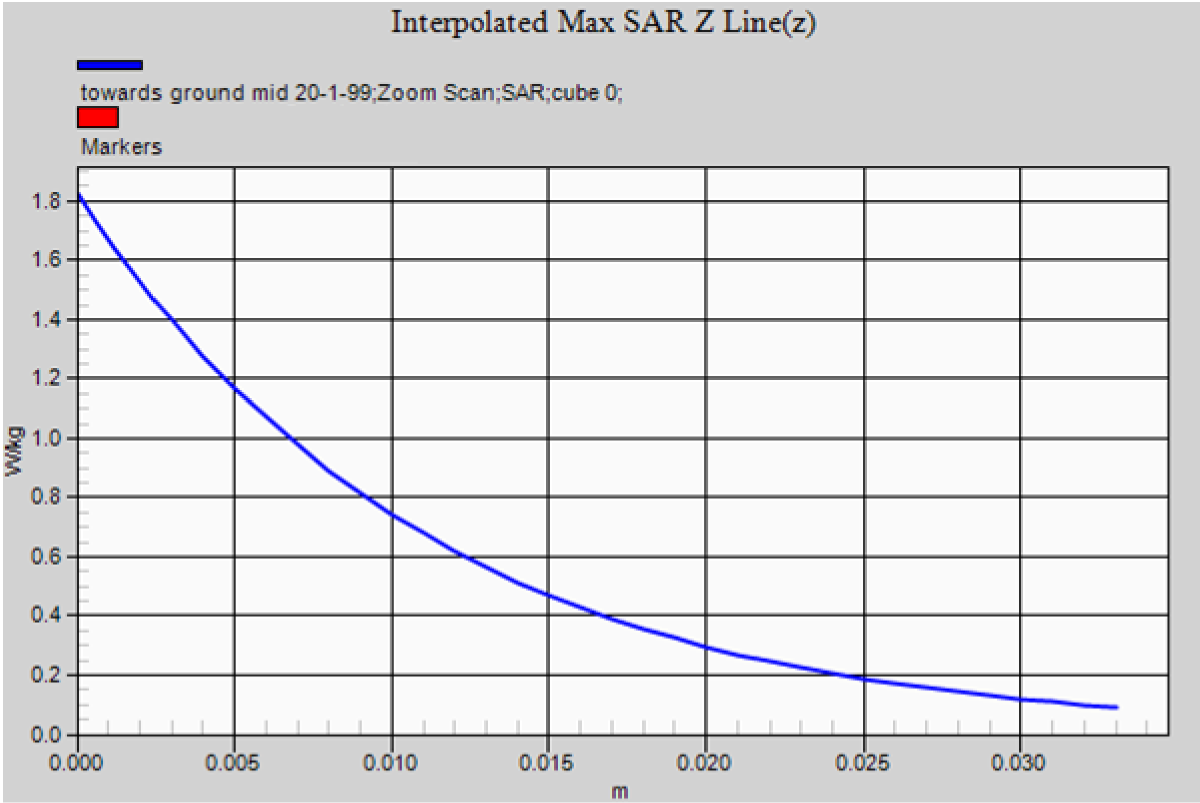
Peak SAR (extrapolated) = 1.83 W/kg

SAR(1 g) = 1.17 W/kg; SAR(10 g) = 0.722 W/kg

Maximum value of SAR (measured) = 1.40 W/kg



0 dB = 1.41 W/kg = 1.49 dBW/kg


Interpolated Max SAR Z Line(z)
towards ground mid 20-1-99;Zoom Scan;SAR;cube 0;
Markers
W/kg
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

LTE 5 towards phantom mid QPSK_10M_1RB high repeat

Date/Time: 26/05/2015 06:19:10

Communication System: UID 0, FDD-LTE(QPSK_10M_1RB) (0); Communication System Band: BAND 5; Frequency: 836.5 MHz;Communication System PAR: 0 dB

Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.95 S/m; ε_r = 54.245; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: ES3DV3 - SN3241; ConvF(6.37, 6.37, 6.37); Calibrated: 29/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1226; Calibrated: 15/09/2014
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards phantom mid QPSK_10M_1RB high repeat/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.850 W/kg

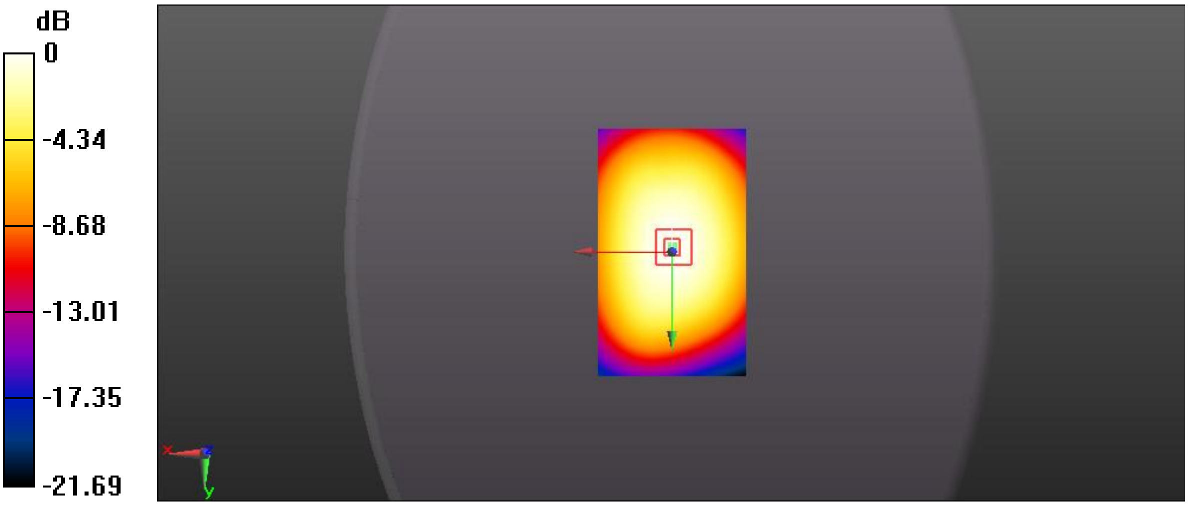
Configuration/towards phantom mid QPSK_10M_1RB high repeat/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 30.995 V/m; Power Drift = -0.01 dB

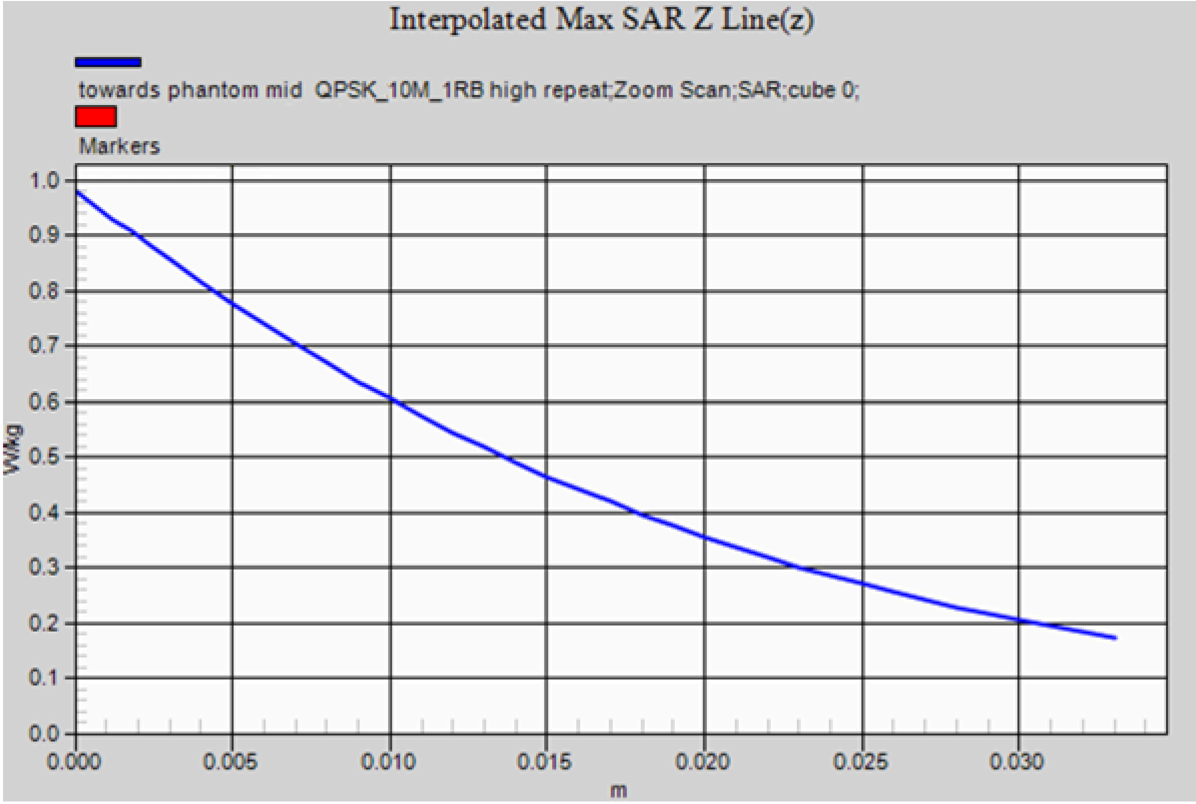
Peak SAR (extrapolated) = 0.980 W/kg

SAR(1 g) = 0.775 W/kg; SAR(10 g) = 0.579 W/kg

Maximum value of SAR (measured) = 0.857 W/kg



0 dB = 0.850 W/kg = -0.71 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom mid QPSK_10M_1RB high repeat;Zoom Scan;SAR;cube 0;
Markers
W/kg
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

LTE 7 towards phantom high QPSK_20M_1RB mid

Date/Time: 21/05/2015 18:20:45

Communication System: UID 0, FDD-LTE(QPSK_20M_1RB) (0); Communication System Band: BAND 7; Frequency: 2560 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2560 MHz; σ = 2.142 S/m; ε_r = 51.52; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(6.99, 6.99, 6.99); Calibrated: 02/09/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards phantom high QPSK_20M_1RB mid/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.28 W/kg

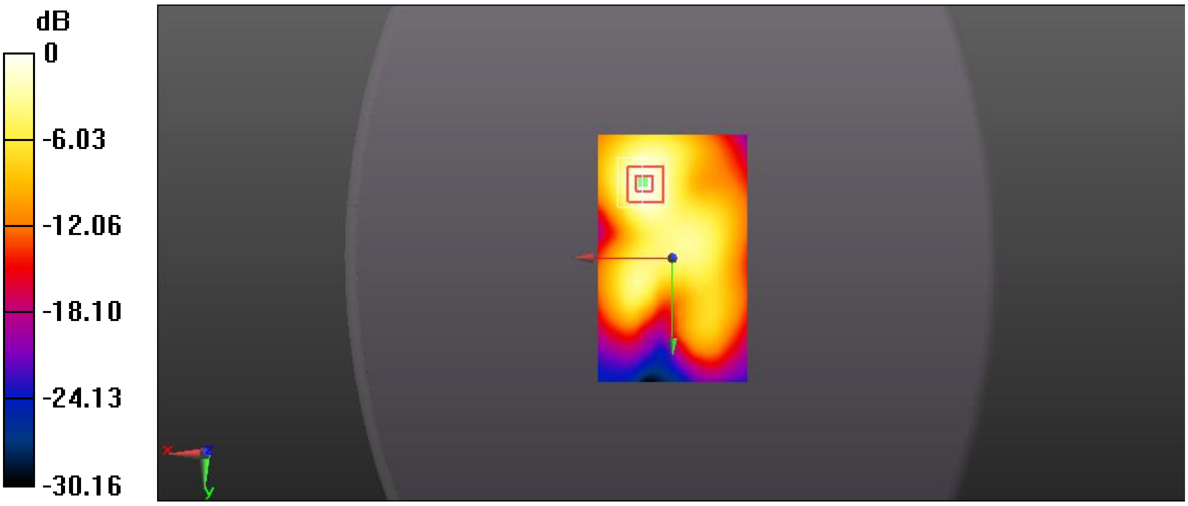
Configuration/towards phantom high QPSK_20M_1RB mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.521 V/m; Power Drift = -0.01 dB

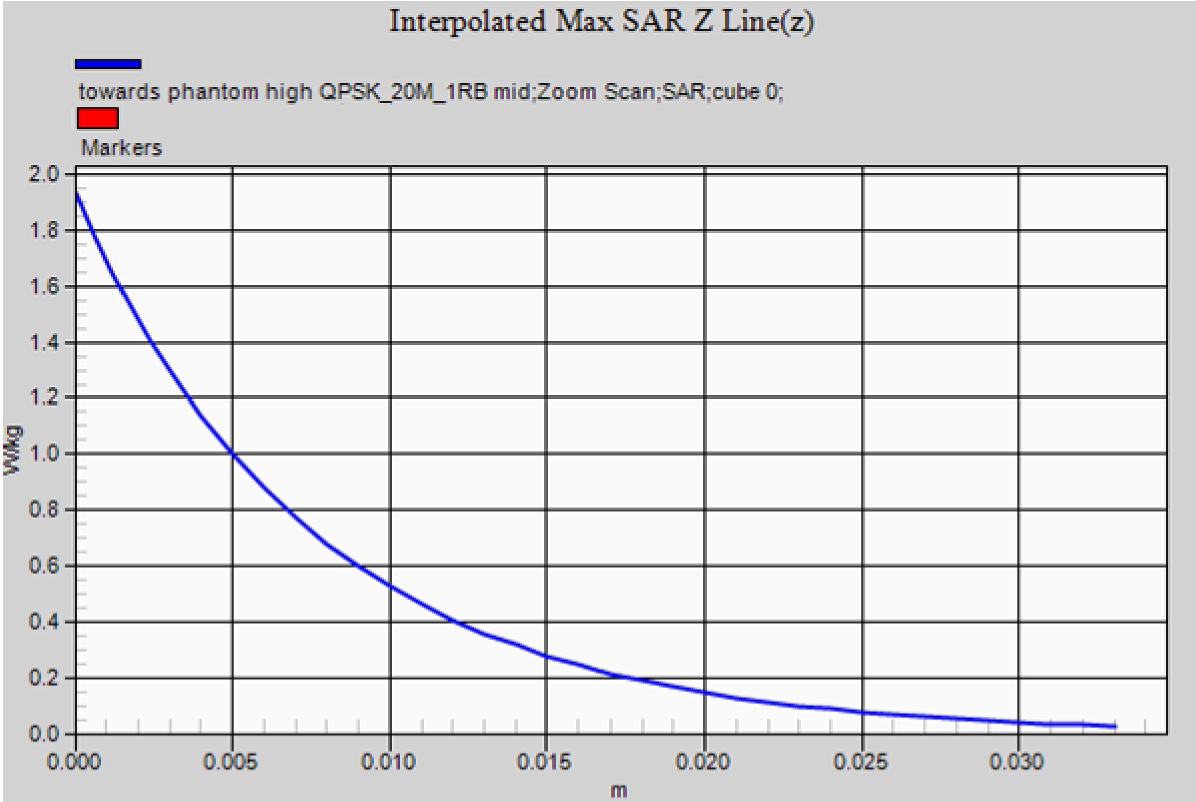
Peak SAR (extrapolated) = 1.94 W/kg

SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.516 W/kg

Maximum value of SAR (measured) = 1.29 W/kg



0 dB = 1.28 W/kg = 1.07 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom high QPSK_20M_1RB mid;Zoom Scan;SAR;cube 0;
Markers
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
W/kg
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

LTE 41 towards phantom mid QPSK_20M_1RB low

Date/Time: 21/05/2015 08:37:04

Communication System: UID 0, TDD-LTE(QPSK_20M_1RB) (0); Communication System Band: BAND41; Frequency: 2593 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2593 MHz; σ = 2.177 S/m; ε_r = 51.224; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(6.99, 6.99, 6.99); Calibrated: 02/09/2014;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards phantom mid/Area Scan (91x151x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.447 W/kg

Configuration/towards phantom mid/Zoom Scan (7x7x7)/Cube 0:

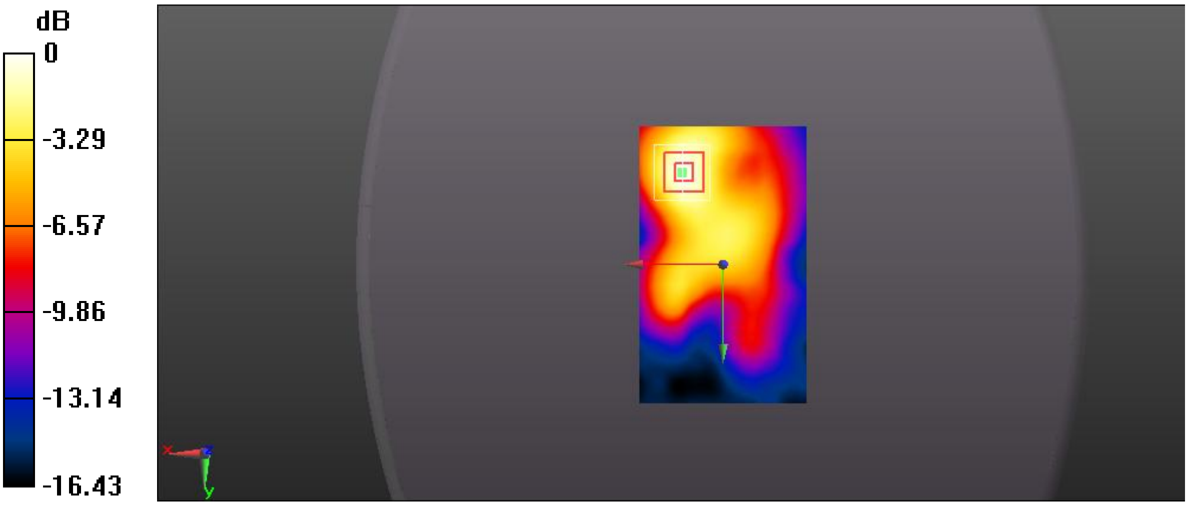
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.236 V/m; Power Drift = -0.04 dB

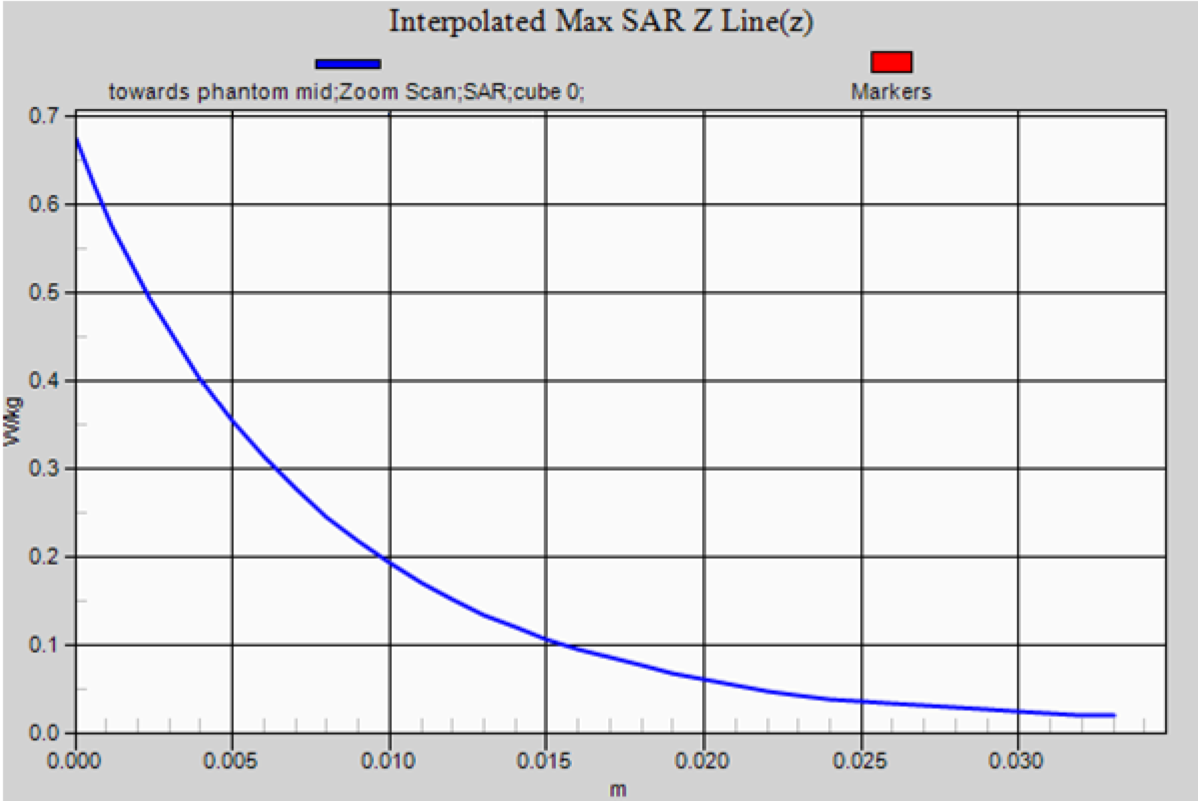
Peak SAR (extrapolated) = 0.675 W/kg

SAR(1 g) = 0.361 W/kg; SAR(10 g) = 0.192 W/kg

Maximum value of SAR (measured) = 0.457 W/kg



0 dB = 0.447 W/kg = -3.50 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom mid;Zoom Scan;SAR;cube 0;
Markers
W/kg
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11b antenna 2 Data Rate: 1 Mbps towards ground mid

Date/Time: 13/07/2015 19:59:32

Communication System: UID 0, 802.11b/g/n 2.45GHz (0); Communication System Band: 2400-2483.5; Frequency: 2437 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2437 MHz; σ = 1.906 S/m; ε_r = 51.957; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(7.11, 7.11, 7.11); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards ground mid/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.297 W/kg

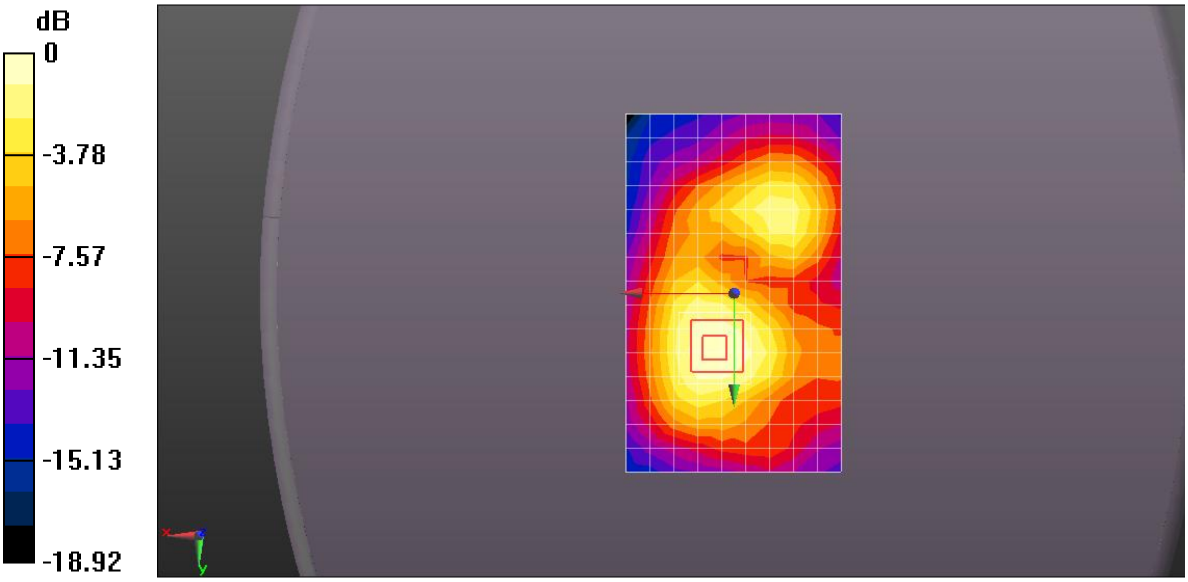
Configuration/towards ground mid/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.168 V/m; Power Drift = 0.16dB

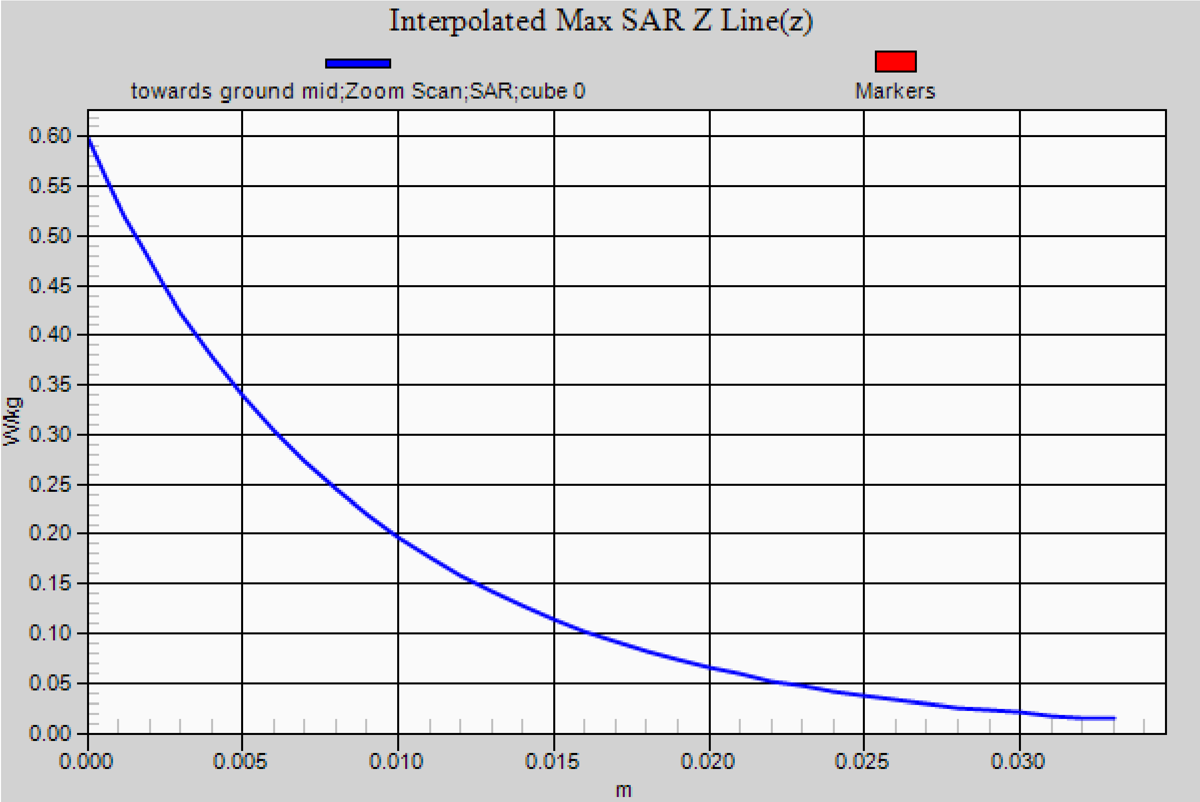
Peak SAR (extrapolated) = 0.598 W/kg

SAR(1 g) = 0.325 W/kg; SAR(10 g) = 0.183 W/kg

Maximum value of SAR (measured) = 0.424 W/kg



0 dB = 0.297 W/kg = -5.27 dBW/kg



Interpolated Max SAR Z Line(z)
towards ground mid;Zoom Scan;SAR;cube 0
Markers
W/kg
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11n(40M) MIMO mcs0 towards ground mid

Date/Time: 13/07/2015 21:01:59

Communication System: UID 0, 802.11b/g/n 2.45GHz (0); Communication System Band: 2.4G; Frequency: 2422 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 2422 MHz; σ = 1.887 S/m; ε_r = 51.964; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(7.11, 7.11, 7.11); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/towards ground mid with n 40Mhz/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.258 W/kg

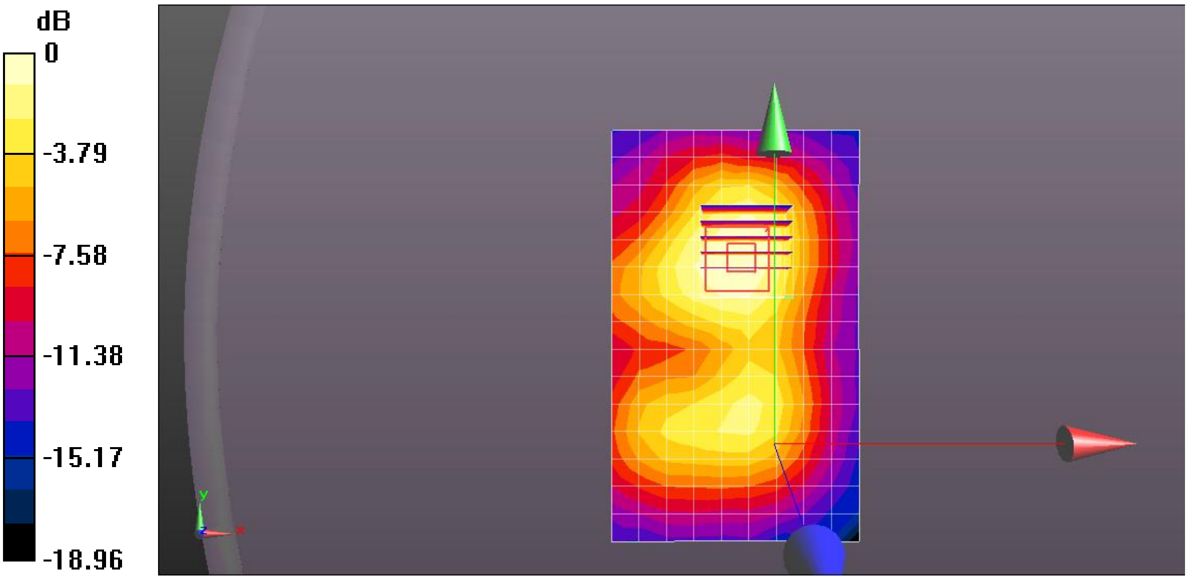
Configuration/towards ground mid with n 40Mhz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.277 V/m; Power Drift = -0.24 dB

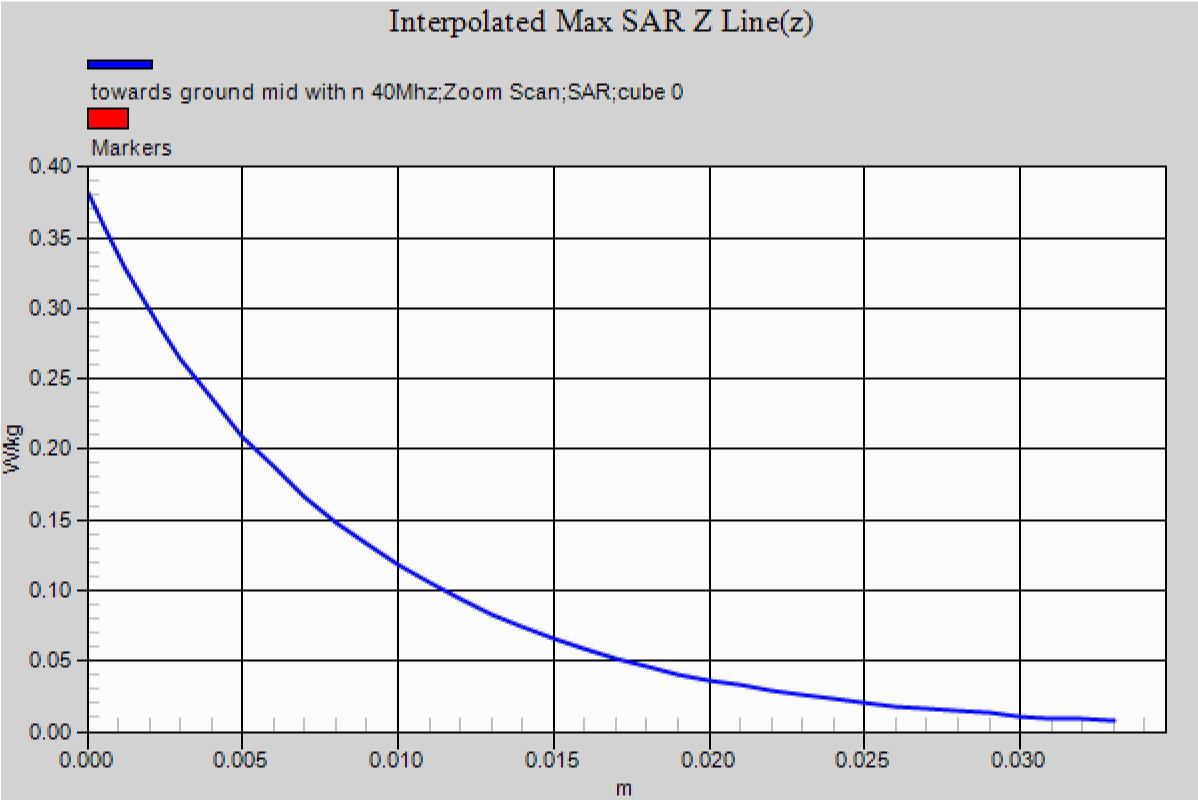
Peak SAR (extrapolated) = 0.382 W/kg

SAR(1 g) = 0.218 W/kg; SAR(10 g) = 0.123 W/kg

Maximum value of SAR (measured) = 0.265 W/kg



0 dB = 0.258 W/kg = -5.88 dBW/kg


Interpolated Max SAR Z Line(z)
towards ground mid with n 40Mhz;Zoom Scan;SAR;cube 0
Markers
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
W/kg
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11a 5.2G antenna 1 Data Rate: 6 Mbps towards phantom mid

Date/Time: 13/07/2015 21:40:31

Communication System: UID 0, 802.11a/n 5G (0); Communication System Band: 5.2G; Frequency: 5200 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 5200 MHz; $\sigma = 5.303$ S/m; $\varepsilon_r = 47.836$; $\rho = 1000$ kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(4.49, 4.49, 4.49); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration 2/towards phantom mid 2/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.481 W/kg

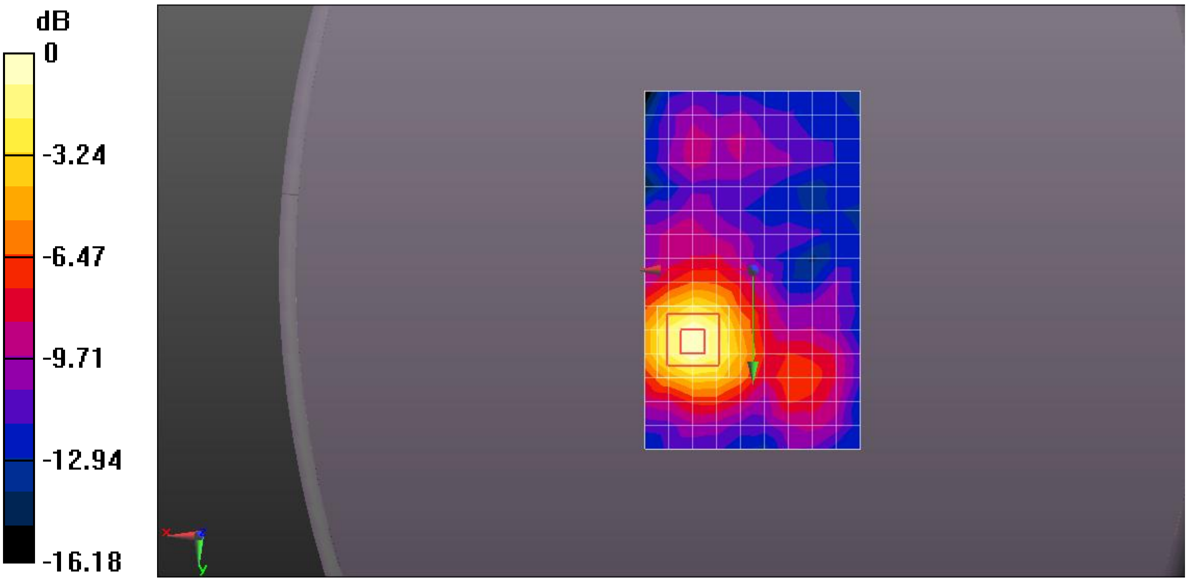
Configuration 2/towards phantom mid 2/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.706 V/m; Power Drift = -0.16 dB

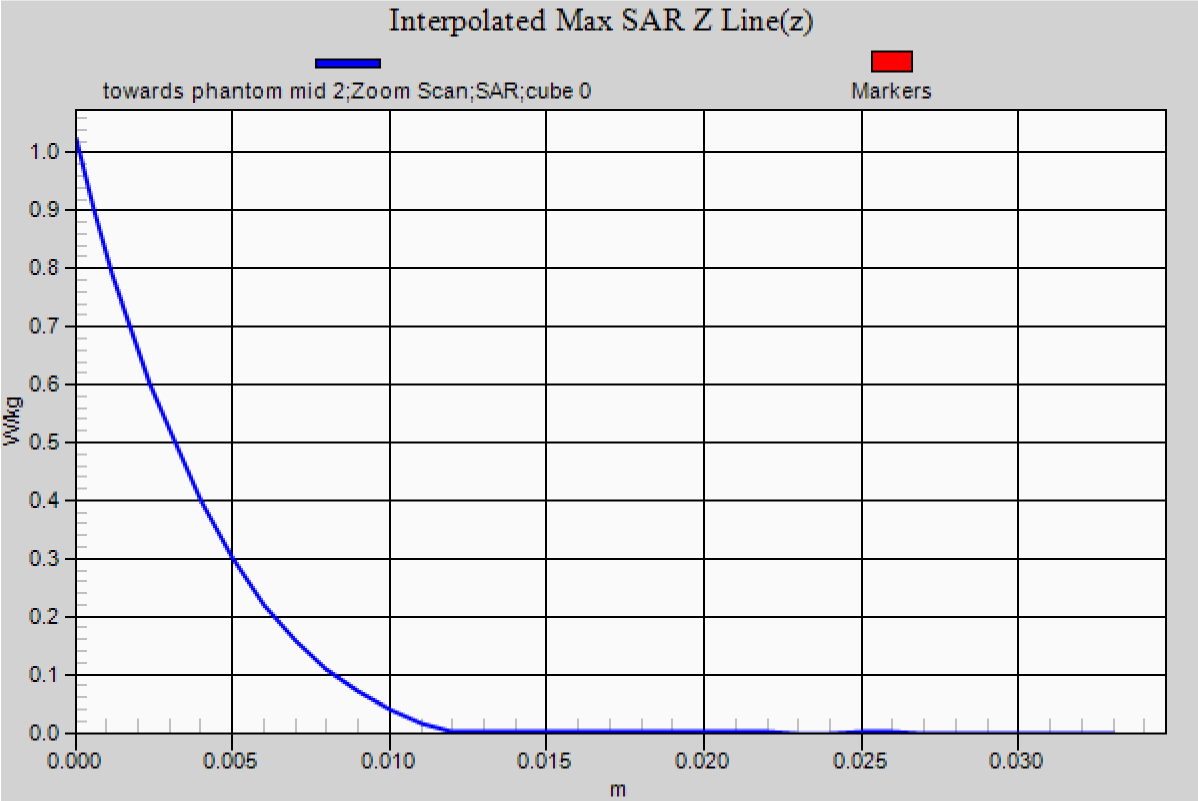
Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.331 W/kg; SAR(10 g) = 0.121 W/kg

Maximum value of SAR (measured) = 0.519 W/kg



0 dB = 0.481 W/kg = -3.18 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom mid 2;Zoom Scan;SAR;cube 0
Markers
W/kg
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11n(20**M)** 5.2G **MIMO mcs0 towards phantom mid**

Date/Time: 13/07/2015 22:27:22

Communication System: UID 0, 802.11a/n 5G (0); Communication System Band: 5.2G; Frequency: 5200 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 5200 MHz; σ = 5.303 S/m; ε_r = 47.836; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528-2013)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(4.49, 4.49, 4.49); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/ towards phantom mid with n 20Mhz/Area Scan (10x16x1):
Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.252 W/kg

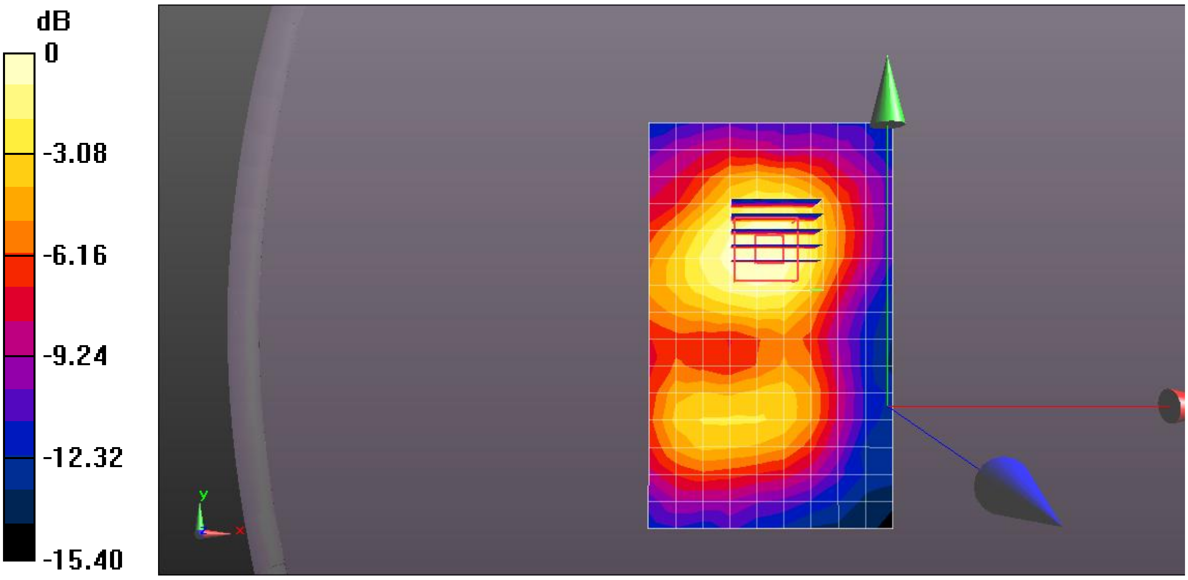
Configuration/ towards phantom mid with n 20Mhz /Zoom Scan (8x8x10)/ Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 6.906 V/m; Power Drift = 0.17 dB

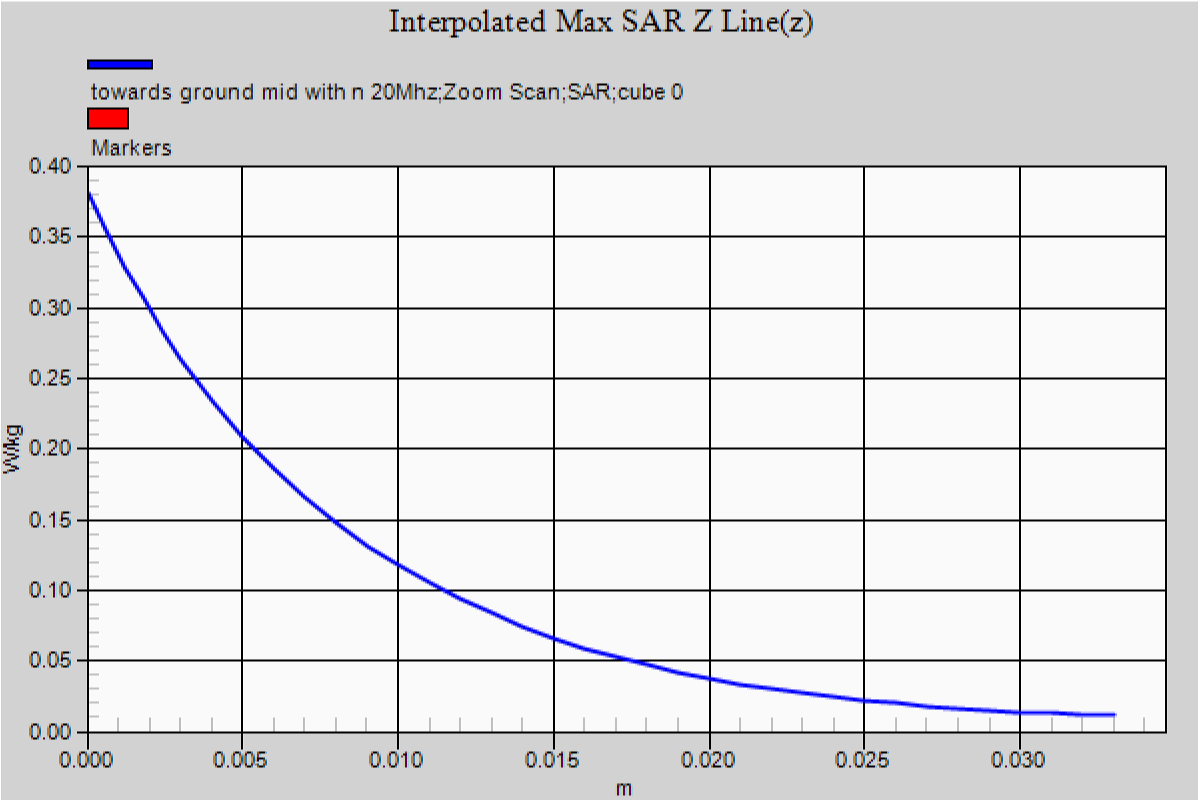
Peak SAR (extrapolated) = 0.382 W/kg

SAR(1 g) = 0.207 W/kg; SAR(10 g) = 0.121 W/kg

Maximum value of SAR (measured) = 0.265 W/kg



0 dB = 0.252 W/kg = -5.98 dBW/kg


Interpolated Max SAR Z Line(z)
towards ground mid with n 20Mhz;Zoom Scan;SAR;cube 0
Markers
W/kg
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11a 5.8G antenna 1 Data Rate: 6 Mbps towards phantom high

Date/Time: 13/07/2015 23:23:53

Communication System: UID 0, 802.11a/n 5G (0); Communication System Band: 5.8G; Frequency: 5825 MHz;Communication System PAR: 0 dB

Medium parameters used: f = 5825 MHz; σ = 6.198 S/m; ε_r = 46.29; ρ = 1000 kg/m^3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE1528)

DASY5 Configuration:

- Probe: EX3DV4 - SN3717; ConvF(4.05, 4.05, 4.05); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration 3/towards phantom high/Area Scan (10x16x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.435 W/kg

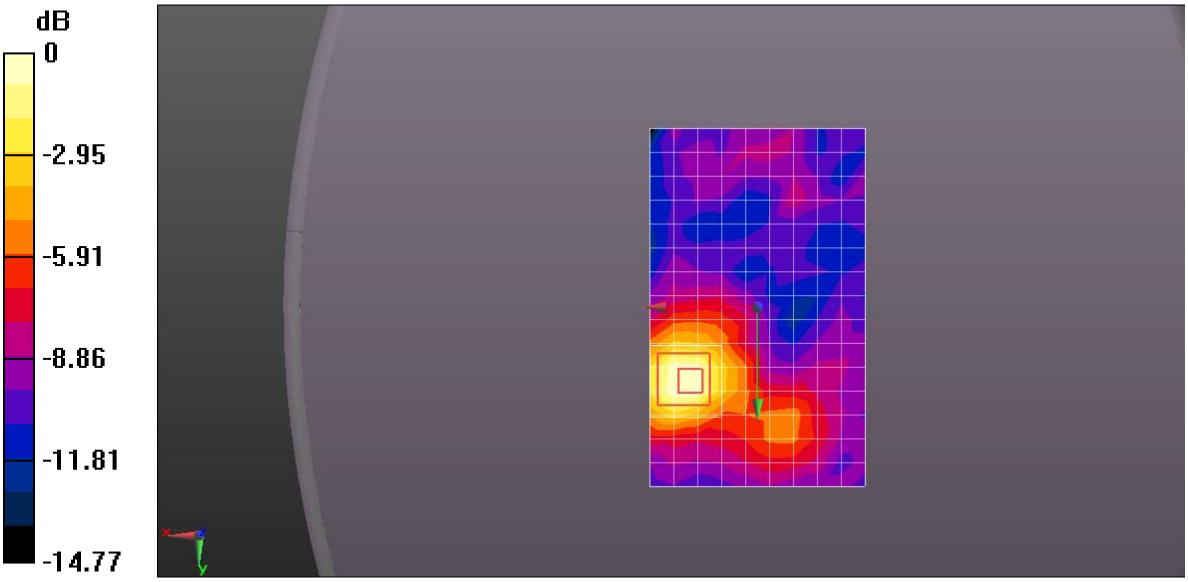
Configuration 3/towards phantom high/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 2.736 V/m; Power Drift = -0.08 dB

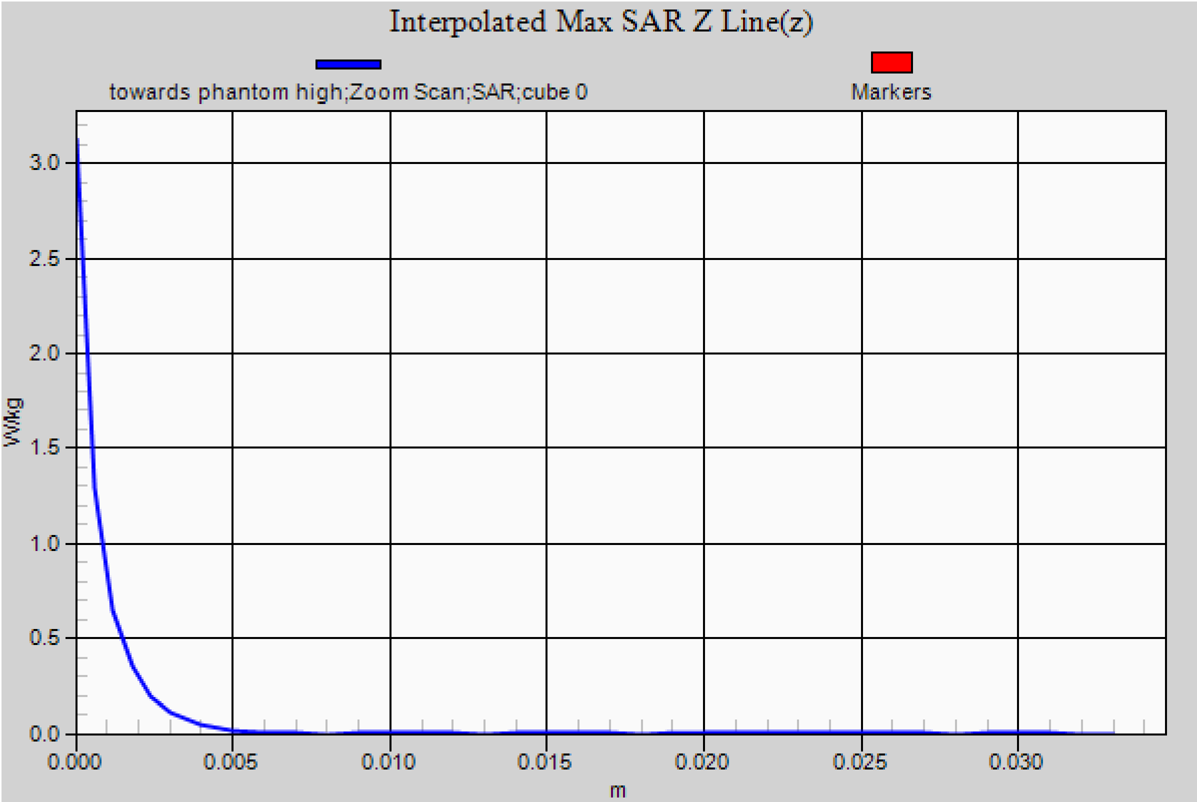
Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 0.328 W/kg; SAR(10 g) = 0.123W/kg

Maximum value of SAR (measured) = 0.498 W/kg



0 dB = 0.435 W/kg = -3.62 dBW/kg


Interpolated Max SAR Z Line(z)
towards phantom high;Zoom Scan;SAR;cube 0
Markers
W/kg
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

802.11n(40M) 5.8 G MIMO mcs0 towards phantom high

Date/Time: 13/07/2015 23:57:24

Communication System: UID 0, 802.11a/n 5G (0); Communication System Band: 5.8G; Frequency: 5795 MHz; Communication System PAR: 0 dB

Medium parameters used: f = 5795 MHz; σ = 6.191 S/m; ε_r = 46.52; ρ = 1000 kg/m^3

Phantom section: Flat Section

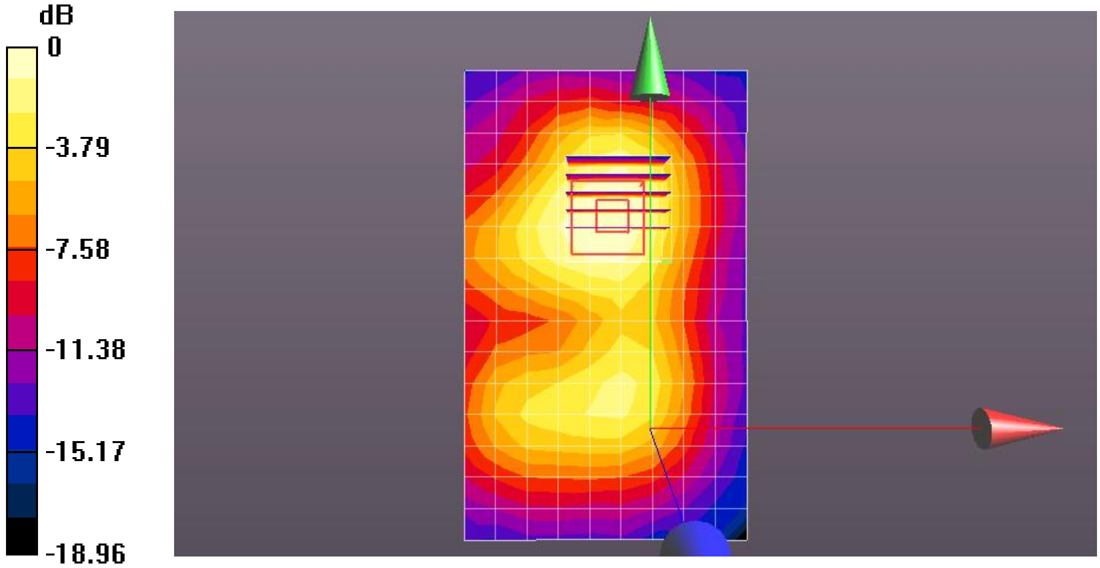
Measurement Standard: DASY5 (IEEE1528)

DASY5 Configuration:

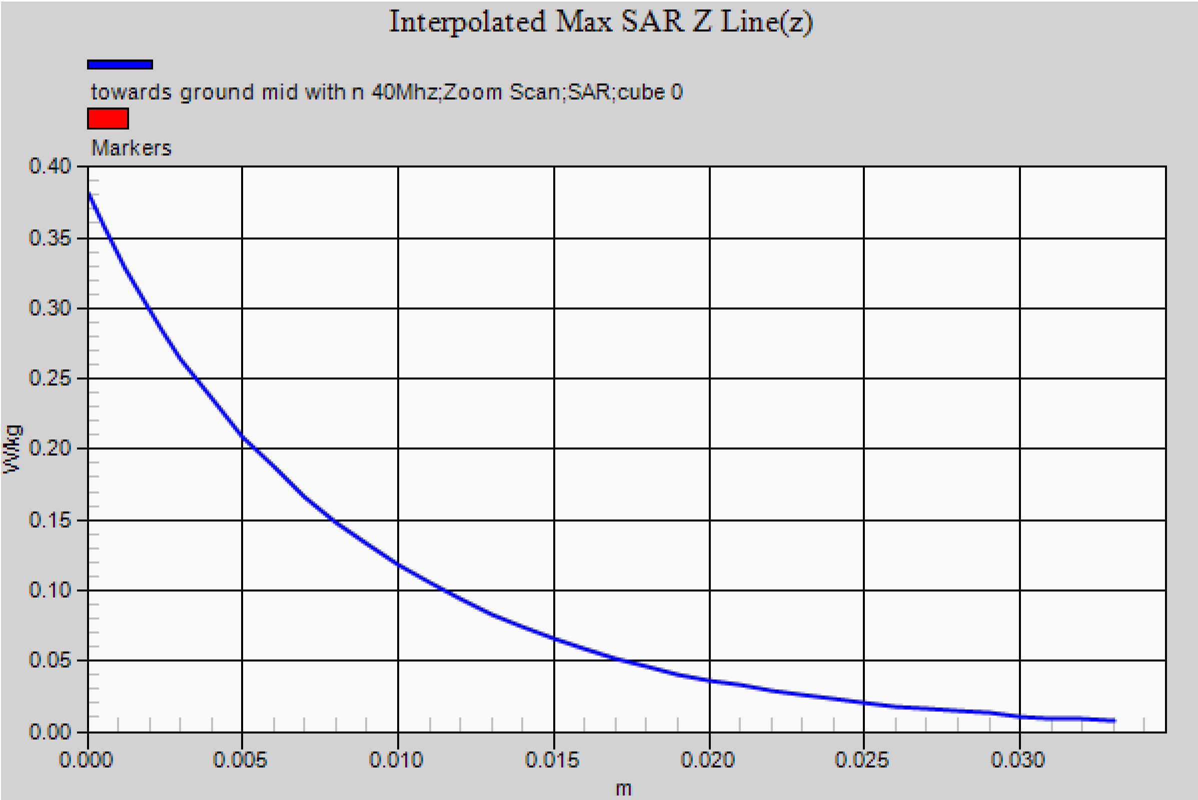
- Probe: EX3DV4 - SN3717; ConvF(4.05, 4.05, 4.05); Calibrated: 02/09/2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1327; Calibrated: 21/04/2015
- Phantom: ELI v4.0; Type: ELI4; Serial: TP:1086
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/ towards phantom high with n 40Mhz/Area Scan (10x16x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.262 W/kg

Configuration/ towards phantom high with n 40Mhz /Zoom Scan (8x8x10)/ Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 7.315 V/m; Power Drift = 0.21 dB
Peak SAR (extrapolated) = 0.391 W/kg
SAR(1 g) = 0.274 W/kg; SAR(10 g) = 0.131 W/kg
Maximum value of SAR (measured) = 0.269 W/kg



0 dB = 0.258 W/kg = -6.01 dBW/kg



Interpolated Max SAR Z Line(z)
towards ground mid with n 40Mhz;Zoom Scan;SAR;cube 0
Markers
W/kg
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.000
0.005
0.010
0.015
0.020
0.025
0.030
m

ANNEX B: Calibration Certificate

Annex B.1 Probe Calibration Certificate

TTL In Collaboration with s p e a g CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

ilac-MRA CNAS CALIBRATION No. L0570

Client Tejet Certificate No: Z14-97105

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3241

Calibration Procedure(s): TMC-OS-E-02-195
Calibration Procedures for Dosimetric E-field Probes

Calibration date: September 29, 2014

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-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101547	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Power sensor NRP-Z91	101548	01-Jul-14 (CTTL, No.J14X02146)	Jun-15
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3617	28-Aug-14(SPEAG,No.EX3-3617_Aug14)	Aug-15
DAE4	SN 1331	23-Jan-14 (SPEAG, DAE4-1331_Jan14)	Jan -15
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-14 (CTTL, No.J14X02145)	Jun-15
Network Analyzer E5071C	MY46110673	15-Feb-14 (TMC, No.JZ14-781)	Feb-15

	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: October 10, 2014

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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 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 300MHz to 3GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

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Probe ES3DV3

SN: 3241

Calibrated: September 29, 2014

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY – Parameters of Probe: ES3DV3 - SN: 3241

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	1.12	0.83	1.00	±10.8%
DCP(mV)[B]	105.8	106.3	106.4	

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	294.1	±2.3%
		Y	0.0	0.0	1.0		250.2	
		Z	0.0	0.0	1.0		276.2	

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

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5 and Page 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY – Parameters of Probe: ES3DV3 - SN: 3241

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	6.90	6.90	6.90	0.59	1.23	±12%
835	41.5	0.90	6.41	6.41	6.41	0.43	1.46	±12%
900	41.5	0.97	6.35	6.35	6.35	0.46	1.44	±12%
1750	40.1	1.37	5.48	5.48	5.48	0.47	1.50	±12%
1900	40.0	1.40	5.12	5.12	5.12	0.73	1.24	±12%
2000	40.0	1.40	5.10	5.10	5.10	0.52	1.48	±12%
2450	39.2	1.80	4.64	4.64	4.64	0.89	1.13	±12%

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

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

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

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DASY – Parameters of Probe: ES3DV3 - SN: 3241

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)	Unct. (k=2)
750	55.2	0.97	6.44	6.44	6.44	0.38	1.64	±12%
835	55.2	0.99	6.37	6.37	6.37	0.48	1.48	±12%
900	55.0	1.05	6.24	6.24	6.24	0.40	1.62	±12%
1750	53.4	1.49	5.01	5.01	5.01	0.52	1.53	±12%
1900	53.3	1.52	4.85	4.85	4.85	0.48	1.64	±12%
2000	53.3	1.52	4.92	4.92	4.92	0.52	1.58	±12%
2450	52.7	1.95	4.46	4.46	4.46	0.86	1.18	±12%

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

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

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

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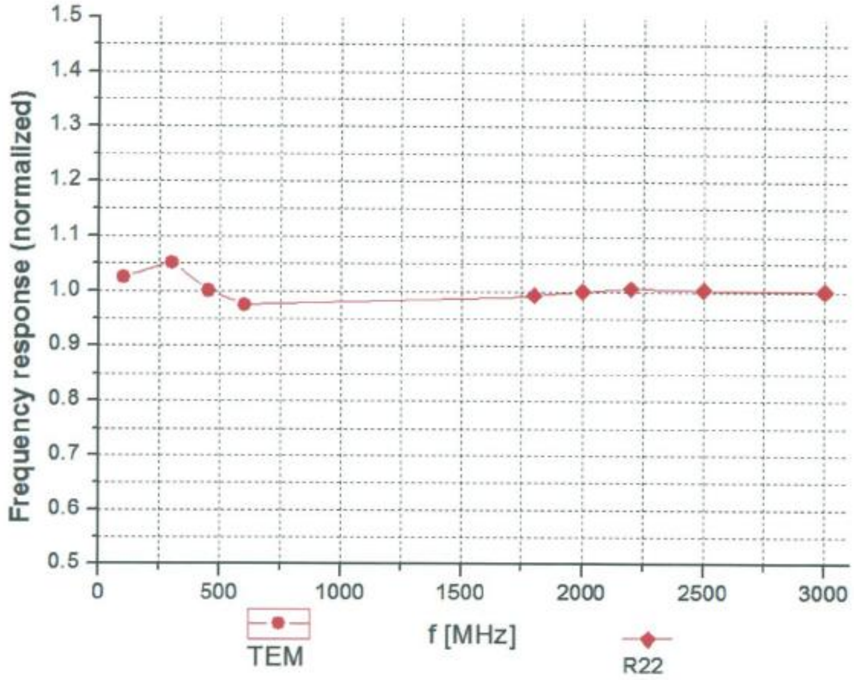
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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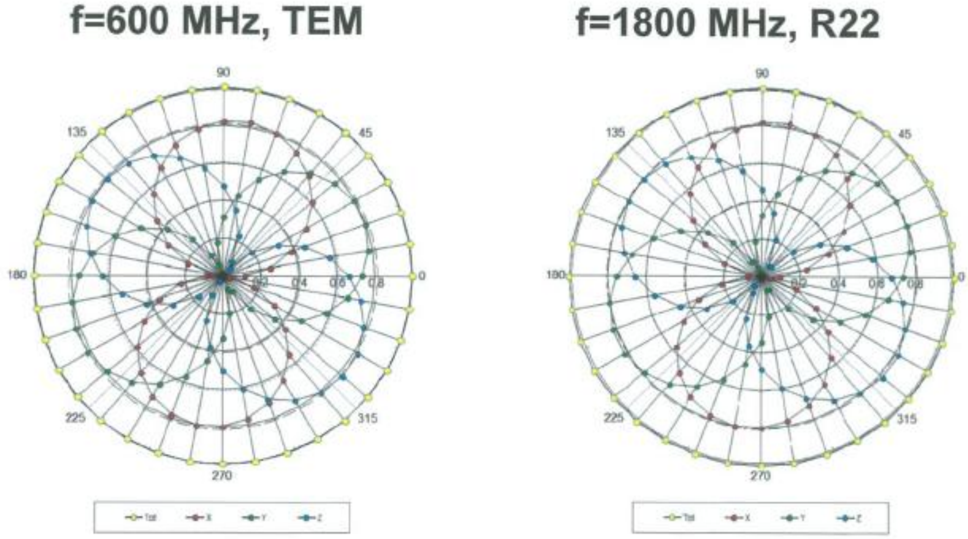
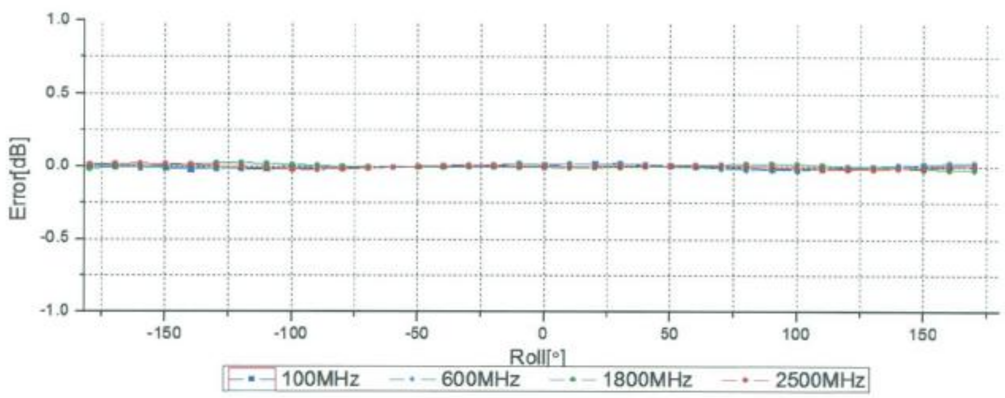
Receiving Pattern (Φ), θ=0°





Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)