



SAR TEST REPORT

Applicant Doro AB
FCC ID WS5DFC0270
Product 4G Clamshell Smart Feature Phone
Brand Doro
Model DFC-0270
Report No. R2103A0299-S1
Issue Date June 22, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **IEEE 1528- 2013, ANSI C95.1: 1992, IEEE C95.1: 1991**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Yurui Zhao

Prepared by: Yurui Zhao

Guangchang Fan

Approved by: Guangchang Fan

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

Table of Contents

1	Test Laboratory.....	4
1.1	Notes of the Test Report	4
1.2	Test facility	4
1.3	Testing Location.....	4
1.4	Laboratory Environment.....	5
2	Statement of Compliance	6
3	Description of Equipment under Test.....	8
4	Test Specification, Methods and Procedures	11
5	Operational Conditions during Test	12
5.1	Test Positions.....	12
5.1.1	Against Phantom Head	12
5.1.2	Body Worn Configuration.....	12
5.2	Measurement Variability	13
5.3	Test Configuration	14
5.3.1	GSM Test Configuration	14
5.3.2	UMTS Test Configuration.....	14
5.3.3	LTE Test Configuration	18
5.3.4	Wi-Fi Test Configuration.....	20
6	SAR Measurements System Configuration	21
6.1	SAR Measurement Set-up	21
6.2	DASY5 E-field Probe System.....	22
6.3	SAR Measurement Procedure	23
7	Main Test Equipment.....	25
8	Tissue Dielectric Parameter Measurements & System Verification	26
8.1	Tissue Verification	26
8.2	System Performance Check.....	27
8.3	SAR System Validation	29
9	Normal and Maximum Output Power	30
9.1	GSM Mode	30
9.2	WCDMA Mode	31
9.3	LTE Mode.....	32
9.4	WLAN Mode.....	34
9.5	Bluetooth Mode	35
10	Measured and Reported (Scaled) SAR Results	36
10.1	EUT Antenna Locations	36
10.2	Standalone SAR test exclusion considerations	37
10.3	Measured SAR Results	38
10.4	Simultaneous Transmission Analysis	48
11	Measurement Uncertainty	51
	ANNEX A: Test Layout.....	52
	ANNEX B: System Check Results.....	54
	ANNEX C: Highest Graph Results.....	60
	ANNEX D: Probe Calibration Certificate.....	72



ANNEX E: D1900V2 Dipole Calibration Certificate.....	81
ANNEX F: D2450V2 Dipole Calibration Certificate.....	89
ANNEX G: D2600V2 Dipole Calibration Certificate (May 2, 2018)	97
ANNEX H: D2600V2 Dipole Calibration Certificate (April 23, 2021)	105
ANNEX I: DAE4 Calibration Certificate (October 23, 2019).....	111
ANNEX L:DAE4 Calibration Certificate (February 23, 2021)	116
ANNEXJ: The EUT Appearance	119
ANNEX K: Test Setup Photos.....	120
ANNEX L: Product Change Description	121

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City:	Shanghai
Post code:	201201
Country:	P. R. China
Contact:	Fan Guangchang
Telephone:	+86-021-50791141/2/3
Fax:	+86-021-50791141/2/3-8000
Website:	http://www.ta-shanghai.com
E-mail:	fanguangchang@ta-shanghai.com



1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Table 1: Highest Reported SAR

Mode	Highest Reported SAR (W/kg)		
	1g SAR Head	1g SAR Body-worn (Separation 15mm)	1g SAR Hotspot (Separation 10mm)
GSM 1900	0.552	0.675	1.473
WCDMA Band II	0.780	0.992	1.295
LTE FDD 7	0.604	0.479	0.791
Wi-Fi (2.4G)	0.599	0.120	0.302
BT	/	/	/
Date of Testing:	September 11, 2020 and May 13, 2021		

Table 2: Highest Simultaneous Transmission SAR

Exposure Configuration	1g SAR Head	1g SAR Body-worn (Separation 15mm)	1g SAR Hotspot (Separation 10mm)
Highest Simultaneous Transmission SAR (W/kg)	1.339	1.112	1.775
Note: 1. The detail for simultaneous transmission consideration is described in chapter 10.4.			

DFC-0270 (Report No.: R2103A0299-S1) is a variant model of DFC-0270 (Report No.: R2008A0539-S1). Test items tested see the table below. The detailed product change description please refers to the *Product Change Description_Variant--Doro7030*.

Band	Variant 1 (R2008A0539-S1)	Variant 2 (R2103A0299-S1)
GSM 1900	Pass	Only tested the worst case of Original
WCDMA Band II	Pass	Only tested the worst case of Original
LTE FDD 7	Pass	Refer to the Original
Wi-Fi (2.4G)	Pass	Refer to the Original

DFC-0270 (Report No.: R2008A0539-S1) is a variant model of DFC-0270 (Report No.: R1905A0242-S1). Test items tested see the table below. The detailed product change description please refers to the *Product Change Description_Variant*.

Band	Original (R1905A0242-S1)	Variant 1 (R2008A0539-S1)
GSM 1900	Pass	Only tested the worst case of Original
WCDMA Band II	Pass	Only tested the worst case of Original
LTE FDD 7	Pass	Only tested the worst case of Original
Wi-Fi (2.4G)	Pass	Only tested the worst case of Original

3 Description of Equipment under Test

Client Information

Applicant	Doro AB
Applicant address	Jörgen Kocksgatan 1B, SE 211 20 MALMÖ, SWEDEN
Manufacturer	Doro AB
Manufacturer address	Jörgen Kocksgatan 1B, SE 211 20 MALMÖ, SWEDEN

General Technologies

EUT Stage:	Identical Prototype	
Model:	DFC-0270	
IMEI:	Configuration 3	IMEI 1: 356755101511466 IMEI 2: 356755101511474
	Configuration 4	IMEI 1: 356755101510468 IMEI 2: 356755101510476
	Configuration 5	IMEI 1: 356755101510245 IMEI 2: 356755101510252
	Configuration 6	IMEI 1: 356755101510542 IMEI 2: 356755101510559
	HW code 5061	IMEI 1: 356755102717666 IMEI 2: 356755102717674
	HW code 5071	IMEI 1: 356755102717302 IMEI 2: 356755102717310
	HW code 5081	IMEI 1: 356755102759726 IMEI 2: 356755102759734
	HW code 5091	IMEI 1: 356755102760245 IMEI 2: 356755102760252
	HW code 5101	IMEI 1: 356755102760740 IMEI 2: 356755102760757
Hardware Version:	V01C(HW code: 5011/5061/5071/5081/5091/5101)	
Software Version:	DFC0270_VF292_N_S01A_V18_M210325_CE	
Antenna Type:	Internal Antenna	
Device Class:	B	
Wi-Fi Hotspot:	Wi-Fi 2.4G	
Power Class:	GSM 1900:1 UMTS Band II:3 LTE FDD 7:3	
Power Level:	GSM 1900:level 0 UMTS Band II:all up bits	



	LTE FDD 7:max power
EUT Accessory	
Adapter 1	Manufacturer: TEN PAO INDUSTRIAL CO.,LTD Model: S003ATB0500055 (Halogen free)
Adapter 2	Manufacturer: Dongguan Aohai Power Technology CO.,LTD Model: A31A-050055U-EU1(Halogen free)
Adapter 3	Manufacturer: Dongguan Aohai Power Technology CO.,LTD Model: A806A-050100U-UK1(Halogen free)
Adapter 4	Manufacturer: Dongguan Aohai Power Technology CO.,LTD Model: A2-501000(Halogen free)
Adapter 5	Manufacturer: Shenzhen BaiJunDa ELECTRONIC CO.,Ltd Model: UT-133E-5100
Adapter 6	Manufacturer: Mobewire Mobiles (Ningbo) Co.,Ltd Model: DFC-0240/0270 (Halogen free)
Battery 1	Manufacturer: NINGBO VEKEN BATTERY CO., LTD Model: DBX-1350A
Battery 2	Manufacturer: ZhongshanTianmao Battery Co., Ltd Model: DBX-1350B
Earphone 1	Manufacturer: Shenzhen Juwei Electronics Co.,Ltd Model: JWEP0944-M01R (Halogen free)
Earphone 2	Manufacturer: Shenzhen Juwei Electronics Co.,Ltd Model: JWEP0782-M01 (Halogen free)
USB Cable	Manufacturer: SHENZHEN FKY-QY HARDWARE ELECTRONIC CO.,LTD Model: M039B0800150 (Halogen free)
Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.	

HW code	Chipset	2.8 LCD	Flash	Rear CAM
5011	MT6731	Sanlong IC7789V2	Nanya (NE1484KALAXA7-MD)	GC2385
5061	MT8765B	Sanlong IC7789V2	Nanya (NE1484KALAXA7-MD)	02M2
5071	MT6731	Sanlong IC7789V2	Nanya (NE1484KALAXA7-MD)	02M2
5081	MT8765B	Sanlong IC7789V3	Nanya (NE1484KALAXA7-MD)	02M2
5091	MT6731	Sanlong IC7789V3	Nanya (NE1484KALAXA7-MD)	02M2
5101	MT8765B	Digital IC GC9306	Nanya (NE1484KALAXA7-MD)	02M2

Wireless Technology and Frequency Range

Wireless Technology		Modulation	Operating mode	Tx (MHz)
GSM	1900	Voice(GMSK) GPRS(GMSK) EGPRS(GMSK,8PSK)	☐ Multi-slot Class:8-1UP ☐ Multi-slot Class:10-2UP ☒ Multi-slot Class:12-4UP ☐ Multi-slot Class:33-4UP	1850 ~ 1910
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
UMTS	Band II	QPSK	HSDPA UE Category:14 HSUPA UE Category:7 DC-HSDPA UE Category:24	1850 ~ 1910
LTE	FDD 7	QPSK, 16QAM	Rel.9	2500 ~ 2570
	Does this device support Carrier Aggregation (CA) ☐ Yes ☒ No			
	Does this device support SV-LTE (1xRTT-LTE)? ☐ Yes ☒ No			
BT	2.4G	Version 4.2 LE		2402 ~ 2480
Wi-Fi	2.4G	DSSS,OFDM	802.11b/g/n HT20	2412 ~ 2462
		OFDM	802.11n HT40	2422 ~ 2452
	Does this device support MIMO ☐ Yes ☒ No			



4 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE 1528- 2013, ANSI C95.1: 1992/IEEE C95.1: 1991, the following FCC Published RF exposure KDB procedures:

IEC 62209-1

Reference Standards

KDB 248227 D01 802.11Wi-Fi SAR v02r02

KDB 447498 D01 General RF Exposure Guidance v06

KDB 648474 D04 Handset SAR v01r03

KDB 690783 D01 SAR Listings on Grants v01r03

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04

KDB 865664 D02 RF Exposure Reporting v01r02

KDB 941225 D01 3G SAR Procedures v03r01

KDB 941225 D05 SAR for LTE Devices v02r05

KDB 941225 D06 Hotspot Mode v02r01

5 Operational Conditions during Test

5.1 Test Positions

5.1.1 Against Phantom Head

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.

The positions used in the measurements were according to IEEE 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".

5.1.2 Body Worn Configuration

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Per FCC KDB Publication 648474 D04, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is $> 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

5.2 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

- 1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
- 2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
- 4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

5.3 Test Configuration

5.3.1 GSM Test Configuration

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:

Output power of reductions:

Table 3: The allowed power reduction in the multi-slot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power,(dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. GSM voice and GPRS data use GMSK, which is a constant amplitude modulation with minimal peak to average power difference within the time-slot burst. For EDGE, GMSK is used for MCS 1 – MCS 4 and 8-PSK is used for MCS 5 – MCS 9; where 8-PSK has an inherently higher peak-to-average power ratio. The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance. The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

5.3.2 UMTS Test Configuration

5.3.2.1 3G SAR Test Reduction Procedure

The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2 kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations modes according to output power, exposure conditions and device operating capabilities. Maximum output power is verified by applying the applicable versions of 3GPP TS 34.121.

5.3.2.2 Head SAR

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest SAR configuration in 12.2 kbps RMC for head exposure.

5.3.2.3 Body-worn accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits

configured to all "1's". The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the EUT with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the EUT, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC

5.3.2.4 Release 5 HSDPA Test Configuration

The 3G SAR test reduction procedure is applied to HSDPA body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures in the "Release 5 HSDPA Data Devices" section of this document, for the highest SAR body-worn accessory exposure configuration in 12.2 kbps RMC. EUT with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

HSDPA should be configured according to the UE category of a test device. The number of HSDSCH/ HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used 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 DPDCH gain factors (β_c , β_d), and HS-DPCCH power offset parameters (Δ_{ACK} , Δ_{NACK} , Δ_{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 4: Subtests for UMTS Release 5 HSDPA

Sub-set	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (note 1, note 2)	CM(dB) (note 3)	MPR(dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (note 4)	15/15 (note 4)	64	12/15 (note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5
Note1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ Note2: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. Note3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period(TF1,TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1,TF1) to $\beta_c=11/15$ and $\beta_d=15/15$.							

5.3.2.5 Release 6 HSUPA Test Configuration

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body-worn accessory configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures in the "Release 6 HSPA Data Devices" section of this document, for the highest body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When VOIP is applicable for next to the ear head exposure in HSPA, the 3G SAR test reduction procedure is

applied to HSPA with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body-worn accessory measurements is tested for next to the ear head exposure.

Due to inner loop power control requirements in HSPA, a communication test set is required for output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA are configured according to the β values indicated in Table 2 and other applicable procedures described in the 'WCDMA EUT and 'Release 5 HSDPA Data Devices' sections of this document

Table 5: Sub-Test 5 Setup for Release 6 HSUPA

Sub-set	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	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 $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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 $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Figure 5.1g.

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

Table 6: HSUPA UE category

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI (ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	11484	5.76
	4	4	10		20000	2.00



7 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	22996	?
	4	4	10		20000	?
NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE Categories 1 to 6 supports QPSK only. UE Category 7 supports QPSK and 16QAM. (TS25.306-7.3.0)						

5.3.2.6 HSPA and DC-HSDPA Test Configuration

SAR test exclusion may apply to 3GPP Rel. 6 HSPA and Rel. 8 DC-HSDPA. When SAR measurement is required for HSPA or DC-HSDPA, a KDB inquiry is required to confirm that the wireless mode configurations in the test setup have remained stable throughout the SAR measurements. Without prior KDB confirmation to determine the SAR results are acceptable, a PAG is required for equipment approval.

SAR test exclusion for HSPA and DC-HSDPA is determined according to the following:

- 1) The HSPA procedures are applied to configure 3GPP Rel. 6 HSPA devices in the required sub-test mode(s) to determine SAR test exclusion.
- 2) 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.
- 3) Regardless of whether a PBA is required, the following information must be verified and included in the SAR report for devices supporting HSPA or DC-HSDPA:
 - a) The output power measurement results and applicable release version(s) of 3GPP TS 34.121.
 - i) Power measurement difficulties due to test equipment setup or availability must be resolved between the grantee and its test lab.
 - b) The power measurement results are in agreement with the individual device implementation and specifications. When Enhanced MPR (E-MPR) applies, the normal MPR targets may be modified according to the Cubic Metric (CM) measured by the device, which must be taken into consideration.
 - c) The UE category, operating parameters, such as the β and Δ values used to configure the device for testing, power setback procedures described in 3GPP TS 34.121 for the power measurements, and HSPA channel conditions (active and stable) for the entire duration of the measurement according to the required E-TFCI and AG index values.
- 5) When SAR measurement is required, the test configurations, procedures and power measurement results must be clearly described to confirm that the required test parameters are used, including E-TFCI and AG index stability and output power conditions.

Table 7: HS-DSCH UE category

Table 5.1a: FDD HS-DSCH physical layer categories

HS-DSCH category	Maximum number of HS-DSCH codes received	Minimum inter-TTI interval	Maximum number of bits of an HS-DSCH transport block received within an HS-DSCH TTI NOTE 1	Total number of soft channel bits	Supported modulations without MIMO operation or dual cell operation	Supported modulations with MIMO operation and without dual cell operation	Supported modulations with dual cell operation
Category 1	5	3	7298	19200	QPSK, 16QAM	Not applicable (MIMO not supported)	Not applicable (dual cell operation not supported)
Category 2	5	3	7298	28800			
Category 3	5	2	7298	28800			
Category 4	5	2	7298	38400			
Category 5	5	1	7298	57600			
Category 6	5	1	7298	67200			
Category 7	10	1	14411	115200			
Category 8	10	1	14411	134400			
Category 9	15	1	20251	172800			
Category 10	15	1	27952	172800			
Category 11	5	2	3630	14400	QPSK		
Category 12	5	1	3630	28800	QPSK, 16QAM, 64QAM		
Category 13	15	1	35280	259200			
Category 14	15	1	42192	259200			
Category 15	15	1	23370	345600	QPSK, 16QAM		
Category 16	15	1	27952	345600	QPSK, 16QAM		
Category 17 NOTE 2	15	1	35280	259200	QPSK, 16QAM, 64QAM	—	
			23370	345600	—	QPSK, 16QAM	
Category 18 NOTE 3	15	1	42192	259200	QPSK, 16QAM, 64QAM	—	
			27952	345600	—	QPSK, 16QAM	
Category 19	15	1	35280	518400	QPSK, 16QAM, 64QAM		
Category 20	15	1	42192	518400	QPSK, 16QAM, 64QAM		
Category 21	15	1	23370	345600	-	-	QPSK, 16QAM
Category 22	15	1	27952	345600			QPSK, 16QAM, 64QAM
Category 23	15	1	35280	518400			
Category 24	15	1	42192	518400			

5.3.3 LTE Test Configuration

LTE modes were tested according to FCC KDB 941225 D05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

A) Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

B) MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP

TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

C)A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

D) Largest channel bandwidth standalone SAR test requirements

1) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

2) QPSK with 50% RB allocation

The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.

3) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 1) and 2) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

4) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections 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 $> \frac{1}{2}$ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

E) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is $> \frac{1}{2}$ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the *reported* SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

5.3.4 Wi-Fi Test Configuration

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported SAR* for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported SAR* is ≤ 0.8 W/kg or all required test positions are tested.
 - ✧ For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - ✧ When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported SAR* is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported SAR* is ≤ 1.2 W/kg or all required test channels are considered.
 - ✧ The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

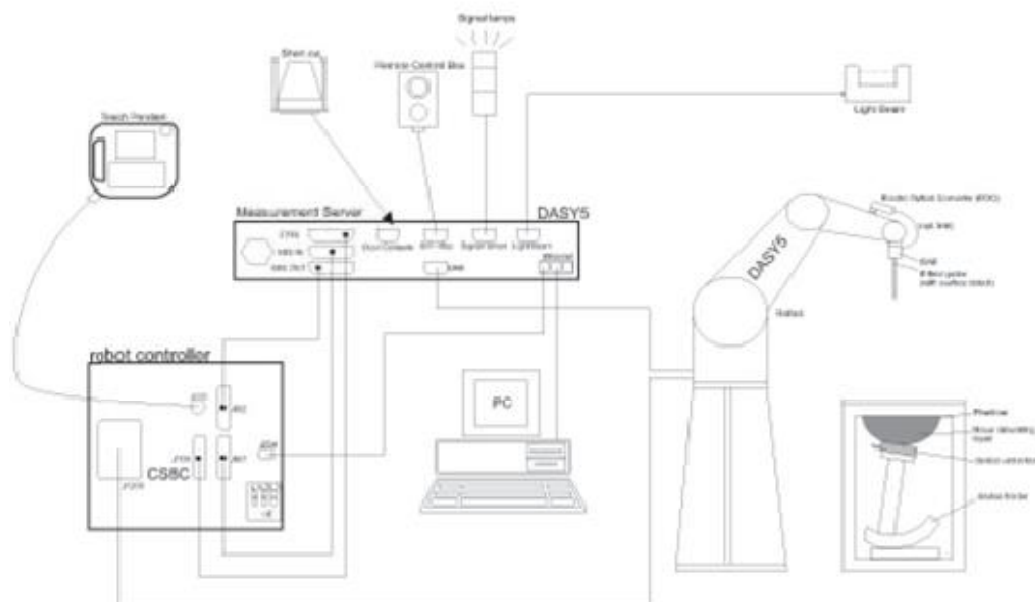
To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.

A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement.

6 SAR Measurements System Configuration

6.1 SAR Measurement Set-up

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



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

6.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

EX3DV4 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	ISO/IEC 17025 calibration service available
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 μ W/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/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%.



E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy was evaluated and found to be better than ± 0.25 dB. 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 below 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.



$$SAR = C \Delta T / \Delta t$$

Where: Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

Or

$$SAR = |E|^2 \sigma / \rho$$

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

6.3 SAR Measurement Procedure

Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Area Scan

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

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm	$3 - 4$ GHz: ≤ 12 mm $4 - 6$ GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Zoom Scan

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

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			≤3GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{zoom}} \Delta y_{\text{zoom}}$			≤2GHz: ≤8mm 2 – 3GHz: ≤5mm*	3 – 4GHz: ≤5mm* 4 – 6GHz: ≤4mm*
Maximum zoom scan spatial resolution, normal to phantom surface	Uniform grid: $\Delta z_{\text{zoom}}(n)$		≤5mm	3 – 4GHz: ≤4mm 4 – 5GHz: ≤3mm 5 – 6GHz: ≤2mm
	Graded grid	$\Delta z_{\text{zoom}}(1)$: between 1 st two points closest to phantom surface	≤4mm	3 – 4GHz: ≤3mm 4 – 5GHz: ≤2.5mm 5 – 6GHz: ≤2mm
		$\Delta z_{\text{zoom}}(n>1)$: between subsequent points	≤1.5• $\Delta z_{\text{zoom}}(n-1)$	
Minimum zoom scan volume	X, y, z		≥30mm	3 – 4GHz: ≥28mm 4 – 5GHz: ≥25mm 5 – 6GHz: ≥22mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4W/kg, ≤8mm, ≤7mm and ≤5mm zoom scan resolution may be applied, respectively, for 2GHz to 3GHz, 3GHz to 4GHz and 4GHz to 6GHz.				

Volume Scan Procedures

The volume scan is used to assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

7 Main Test Equipment

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Cal.	Cal. Due Date
Network analyzer	Agilent	E5071B	MY42404014	2020-05-17	2021-05-16
Dielectric Probe Kit	HP	85070E	US44020115	2020-05-17	2021-05-16
Power meter	Agilent	E4417A	GB41291714	2020-05-17	2021-05-16
Power sensor	Agilent	N8481H	MY50350004	2020-05-17	2021-05-16
Power sensor	Agilent	E9327A	US40441622	2020-05-17	2021-05-16
Dual directional coupler	Agilent	778D-012	50519	/	/
Dual directional coupler	Agilent	777D	50146	/	/
Amplifier	INDEXSAR	IXA-020	0401	2020-05-17	2021-05-16
Wireless communication tester	Anritsu	MT8820C	6201342015	2020-05-17	2021-05-16
Wireless communication tester	Key sight	E5515C	MY48360988	2019-12-15	2020-12-14
				2020-12-13	2021-12-12
Wideband radio communication tester	R&S	CMW 500	113645	2020-05-17	2021-05-16
E-field Probe	SPEAG	EX3DV4	3677	2020-07-06	2021-07-05
DAE	SPEAG	DAE4	1317	2019-10-23	2020-10-22
				2021-02-23	2022-02-22
Validation Kit 1900MHz	SPEAG	D1900V2	5d060	2020-08-27	2023-08-26
Validation Kit 2450MHz	SPEAG	D2450V2	786	2020-08-27	2023-08-26
Validation Kit 2600MHz	SPEAG	D2600V2	1025	2018-05-02	2021-05-01
Validation Kit 2600MHz	SPEAG	D2600V2	1025	2021-04-23	2024-04-22
Temperature Probe	Tianjin jinming	JM222	381	2020-05-25	2021-05-24
Hygrothermograph	Anymetr	NT-311	20150731	2020-05-17	2021-05-16
Twin SAM Phantom	Speag	SAM1	TP-1534	/	/
Software for Test	Speag	DASY52	/	/	/
Softwarefor Tissue	Agilent	85070	/	/	/

8 Tissue Dielectric Parameter Measurements & System Verification

8.1 Tissue Verification

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 24 hours of use; or earlier if the dielectric parameters can become out of tolerance.

Target values

Frequency (MHz)	Water (%)	Salt (%)	Sugar (%)	Glycol (%)	Preventol (%)	Cellulose (%)	ϵ_r	$\sigma(\text{s/m})$
1900	55.242	0.306	0	44.452	0	0	40.0	1.40
2450	62.7	0.5	0	36.8	0	0	39.2	1.80
2600	55.242	0.306	0	44.452	0	0	39.0	1.96

Measurements results

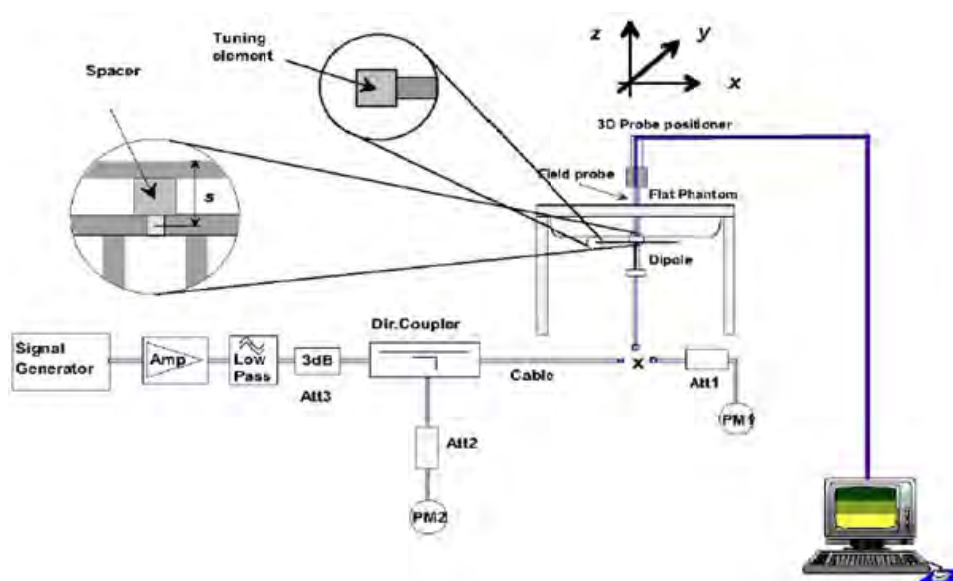
Frequency (MHz)	Test Date	Temp $^\circ\text{C}$	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within $\pm 5\%$)	
			ϵ_r	$\sigma(\text{s/m})$	ϵ_r	$\sigma(\text{s/m})$	Dev $\epsilon_r(\%)$	Dev $\sigma(\%)$
1900	9/11/2020	21.5	40.1	1.41	40.0	1.40	0.25	0.71
	5/13/2021	21.5	40.0	1.40	40.0	1.40	0.00	0.00
2450	9/11/2020	21.5	38.6	1.81	39.2	1.80	-1.53	0.56
	5/13/2021	21.5	38.6	1.81	39.2	1.80	-1.53	0.56
2600	9/11/2020	21.5	38.2	2.01	39.0	1.96	-2.05	2.55
	5/13/2021	21.5	38.2	1.96	39.0	1.96	-2.05	0.00

Note: The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.

8.2 System Performance Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured using the dielectric probe kit and the network analyzer. A system check measurement for every day was made following the determination of the dielectric parameters of the Tissue simulates, using the dipole validation kit. The dipole antenna was placed under the flat section of the twin SAM phantom.

System check is performed regularly on all frequency bands where tests are performed with the DASY system.



Picture 1 System Performance Check setup



Picture 2 Setup Photo

Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< -20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

Dipole		Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	$\Delta\Omega$
Dipole D1900V2 SN: 5d060	Head Liquid	8/26/2017	-23.4	/	52.0	/
		8/25/2018	-24.7	-5.3	54.4	-2.4
		8/24/2019	-24.9	-0.8	56.2	-1.8
Dipole D2450V2 SN: 786	Head Liquid	8/29/2017	-25.5	/	53.4	/
		8/28/2018	-23.0	10.9	57.2	-3.8
		8/27/2019	-22.2	3.6	56.4	0.8

System Check results

Frequency (MHz)	Test Date	Temp $^{\circ}\text{C}$	250mW Measured SAR_{1g} (W/kg)	1W Normalized SAR_{1g} (W/kg)	1W Target SAR_{1g} (W/kg)	Δ % (Limit $\pm 10\%$)	Plot No.
1900	9/11/2020	21.5	9.88	39.52	39.50	0.05	1
	5/13/2021	21.5	10.55	42.20	39.50	6.84	2
2450	9/11/2020	21.5	13.70	54.80	52.30	4.78	3
	5/13/2021	21.5	13.70	54.80	52.30	4.78	4
2600	9/11/2020	21.5	13.90	55.60	54.10	2.77	5
	5/13/2021	21.5	13.90	55.60	56.10	-0.89	6

Note: Target Values used derive from the calibration certificate Data Storage and Evaluation.

8.3 SAR System Validation

Per FCC KDB 865664 D02v01, SAR system verification is required to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles are used with the required tissue-equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point must be validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media. a tabulated summary of the system validation status, measurement frequencies, SAR probes, calibrated signal type(s) and tissue dielectric parameters has been included.

Frequency [MHz]	Date	Probe SN	Probe Type	Probe Cal Point		PERM (Er)	COND (Σ)	CW Validation			Mod. Validation		
								Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR
1900	8/27/2020	5d060	EX3DV4	1900	Head	39.43	1.42	PASS	PASS	PASS	GMSK	PASS	N/A
2450	8/27/2020	786	EX3DV4	2450	Head	38.19	1.83	PASS	PASS	PASS	OFDM	PASS	PASS
2600	5/02/2020	1025	EX3DV4	2600	Head	37.60	1.99	PASS	PASS	PASS	TDD	PASS	N/A
1900	8/27/2020	5d060	EX3DV4	1900	Body	50.98	1.56	PASS	PASS	PASS	GMSK	PASS	N/A
2450	8/27/2020	786	EX3DV4	2450	Body	50.59	1.95	PASS	PASS	PASS	OFDM	PASS	PASS
2600	5/02/2020	1025	EX3DV4	2600	Body	50.14	2.13	PASS	PASS	PASS	TDD	PASS	N/A

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5dB), such as OFDM according to KDB 865664.

9 Normal and Maximum Output Power

KDB 447498 D01 at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

9.1 GSM Mode

GSM 1900		Burst-Averaged output power(dBm)				Division Factors	Frame-Averaged output power(dBm)			
		Tune-up	Channel/Frenqucy(MHz)				Tune-up	Channel/Frenqucy(MHz)		
		MAX	512 /1850.2	661 /1880	810 /1909.8		MAX	512 /1850.2	661 /1880	810 /1909.8
GSM	CS	28.00	27.86	27.35	27.31	9.03	18.97	18.83	18.32	18.28
GPRS/ EGPRS (GMSK)	1 Tx Slot	28.50	27.82	27.34	27.29	9.03	19.47	18.79	18.31	18.26
	2 Tx Slots	27.00	26.43	25.91	25.92	6.02	20.98	20.41	19.89	19.90
	3 Tx Slots	25.00	24.52	23.97	24.01	4.26	20.74	20.26	19.71	19.75
	4 Tx Slots	24.00	23.63	23.11	23.09	3.01	20.99	20.62	20.10	20.08
EGPRS (8PSK)	1 Tx Slot	25.50	24.75	24.86	25.03	9.03	16.47	15.72	15.83	16.00
	2 Tx Slots	24.50	23.52	23.58	23.65	6.02	18.48	17.50	17.56	17.63
	3 Tx Slots	22.50	21.49	21.45	21.62	4.26	18.24	17.23	17.19	17.36
	4 Tx Slots	21.50	20.63	20.58	20.52	3.01	18.49	17.62	17.57	17.51
Notes: The worst-case configuration and mode for SAR testing is determined to be as follows:										
1. Standalone: GSM 1900 GMSK (GPRS) mode with 4 time slots for Max power, based on the output power measurements above.										

9.2 WCDMA Mode

The following tests were completed according to the test requirements outlined in the 3GPP TS34.121 specification.

WCDMA		Band II(dBm)			
Tx Channel		9262	9400	9538	Tune-up Limit
Frequency(MHz)		1852.4	1880	1907.6	
RMC	12.2kbps	20.73	20.63	20.46	21.50
AMR	12.2kbps	20.57	20.46	20.31	21.50
HSDPA	Sub 1	20.15	20.05	19.88	21.00
	Sub 2	20.14	20.04	19.87	21.00
	Sub 3	19.63	19.53	19.36	20.50
	Sub 4	19.62	19.52	19.35	20.50
HSUPA	Sub 1	20.11	20.01	19.84	21.00
	Sub 2	19.10	19.00	18.83	20.00
	Sub 3	19.58	19.49	19.32	20.50
	Sub 4	19.07	18.98	18.81	20.00
	Sub 5	20.06	19.97	19.80	21.00
DC-HSDPA	Sub 1	20.07	19.99	19.80	21.00
	Sub 2	20.06	19.98	19.79	21.00
	Sub 3	19.64	19.47	19.30	20.50
	Sub 4	19.63	19.46	19.29	20.50

Note: 1.Per KDB 941225 D01, SAR for each exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".

9.3 LTE Mode

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1 of the 3GPP TS36.101.

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

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

LTE FDD Band 7				Conducted Power(dBm)			Tune-up Limit
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			
				20775/2502.5	21100/2535	21425/2567.5	
5MHz	QPSK	1	0	21.25	21.49	21.16	22.50
		1	13	21.76	21.85	21.56	22.50
		1	24	21.38	21.62	21.18	22.50
		12	0	20.54	21.04	20.58	21.50
		12	6	20.75	21.10	20.66	21.50
		12	13	20.83	21.03	20.53	21.50
		25	0	20.63	21.05	20.57	21.50
	16QAM	1	0	20.93	21.01	20.70	21.50
		1	13	20.91	21.17	20.92	21.50
		1	24	20.71	20.83	20.62	21.50
		12	0	19.48	19.71	19.45	20.50
		12	6	19.67	19.59	19.56	20.50
		12	13	19.68	19.56	19.52	20.50
		25	0	19.56	19.54	19.43	20.50
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20800/2505	21100/2535	21400/2565	
10MHz	QPSK	1	0	21.23	21.44	21.13	22.50
		1	25	21.75	21.85	21.54	22.50
		1	49	21.34	21.56	21.13	22.50
		25	0	20.52	21.00	20.55	21.50
		25	13	20.73	21.06	20.61	21.50
		25	25	20.80	21.02	20.50	21.50
		50	0	20.65	21.02	20.54	21.50
	16QAM	1	0	20.87	20.98	20.67	21.50
		1	25	20.89	21.16	20.90	21.50
		1	49	20.68	20.79	20.58	21.50
		25	0	19.46	19.70	19.43	20.50



		25	13	19.63	19.53	19.51	20.50
		25	25	19.66	19.52	19.49	20.50
		50	0	19.54	19.50	19.38	20.50
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20825/2507.5	21100/2535	21375/2562.5	
15MHz	QPSK	1	0	21.22	21.47	21.12	22.50
		1	38	21.74	21.81	21.53	22.50
		1	74	21.35	21.57	21.14	22.50
		36	0	20.51	20.99	20.54	21.50
		36	18	20.73	21.06	20.61	21.50
		36	39	20.81	21.01	20.49	21.50
		75	0	20.63	21.04	20.55	21.50
	16QAM	1	0	20.90	20.97	20.67	21.50
		1	38	20.88	21.15	20.89	21.50
		1	74	20.68	20.81	20.58	21.50
		36	0	19.46	19.67	19.42	20.50
		36	18	19.64	19.54	19.52	20.50
		36	39	19.65	19.51	19.48	20.50
		75	0	19.54	19.50	19.38	20.50
Bandwidth	Modulation	RB size	RB offset	Channel/Frequency (MHz)			Tune-up Limit
				20850/2510	21100/2535	21350/2560	
20MHz	QPSK	1	0	21.20	21.40	21.10	22.50
		1	50	21.74	21.81	21.52	22.50
		1	99	21.32	21.55	21.10	22.50
		50	0	20.49	20.95	20.51	21.50
		50	25	20.71	21.02	20.58	21.50
		50	50	20.77	20.97	20.46	21.50
		100	0	20.62	20.97	20.50	21.50
	16QAM	1	0	20.70	20.94	20.62	21.50
		1	50	20.85	21.14	20.86	21.50
		1	99	20.66	20.76	20.56	21.50
		50	0	19.43	19.66	19.40	20.50
		50	25	19.60	19.51	19.48	20.50
		50	50	19.63	19.47	19.45	20.50
		100	0	19.52	19.46	19.35	20.50

9.4 WLAN Mode

Wi-Fi 2.4G Mode	Channel /Frequency(MHz)	Maximum Output Power (dBm)		
		Tune-up	Meas.	TP Set Level
802.11b (1M)	1/2412	17.00	15.92	19
	6/2437	17.00	16.55	19
	11/2462	17.00	16.36	19
802.11g (6M)	1/2412	13.00	11.91	17
	6/2437	15.00	14.38	17
	11/2462	13.00	12.51	17
802.11n-HT20 (MCS0)	1/2412	13.00	11.85	17
	6/2437	15.00	14.36	17
	11/2462	13.00	12.52	17
802.11n-HT40 (MCS0)	3/2422	11.00	9.97	16.5
	6/2437	15.00	14.04	16.5
	9/2452	12.00	10.76	16.5

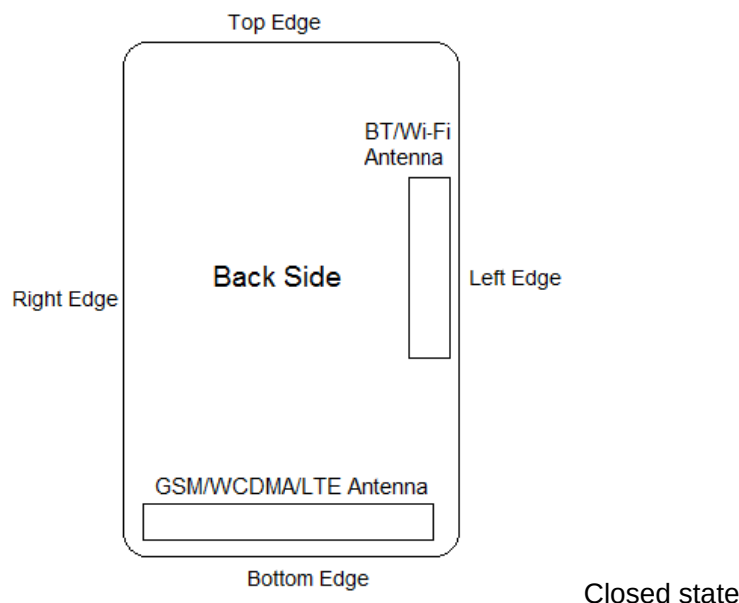
Note: Initial test configuration is 802.11b mode.

9.5 Bluetooth Mode

BT	Conducted Power(dBm)			Tune-up Limit (dBm)
	Channel/Frequency(MHz)			
	Ch 0/2402 MHz	Ch 39/2441 MHz	Ch 78/2480 MHz	
GFSK	4.97	5.65	5.38	6.00
$\pi/4$ DQPSK	1.29	2.19	1.87	2.50
8DPSK	1.23	2.23	1.89	2.50
BLE	Ch 0/2402 MHz	Ch 19/2440 MHz	Ch 39/2480 MHz	Tune-up Limit (dBm)
GFSK	0.80	1.03	0.65	2.00

10 Measured and Reported (Scaled) SAR Results

10.1 EUT Antenna Locations



Overall (Length x Width): 108mm x 57 mm						
Overall Diagonal: 115 mm/Display Diagonal:73mm						
Distance of the Antenna to the EUT surface/edge						
Antenna	Back Side	Front side	Left Edge	Right Edge	Top Edge	Bottom Edge
GSM/WCDMA/LTE Antenna	<25mm	<25mm	<25mm	<25mm	>25mm	<25mm
BT/Wi-Fi Antenna	<25mm	<25mm	<25mm	>25mm	>25mm	>25mm
Hotspot mode, Positions for SAR tests						
Mode	Back Side	Front side	Left Edge	Right Edge	Top Edge	Bottom Edge
GSM/WCDMA/LTE Antenna	Yes	Yes	Yes	Yes	N/A	Yes
BT/Wi-Fi Antenna	Yes	Yes	Yes	N/A	N/A	N/A

Note: 1. Per KDB 941225 D06, when the overall device length and width are $\geq 9\text{cm} \times 5\text{cm}$, the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.

2. Per FCC KDB 447498 D01,

for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

a) $\leq 0.8 \text{ W/kg}$ or 2.0 W/kg , for 1-g or 10-g respectively, when the transmission band is $\leq 100\text{MHz}$

b) $\leq 0.6 \text{ W/kg}$ or 1.5 W/kg , for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.

c) $\leq 0.4 \text{ W/kg}$ or 1.0 W/kg , for 1-g or 10-g respectively, when the transmission band is $\geq 200 \text{ MHz}$.

3. When the original highest measured SAR is $\geq 0.80 \text{ W/kg}$, the measurement was repeated once.

4. Per FCC KDB Publication 648474 D04, SAR was evaluated without a headset connected to the device. Since the reported SAR was $\leq 1.2 \text{ W/kg}$, no additional SAR evaluations using a headset cable were required.

5. When the flip is closed, there is no voice function.

10.2 Standalone SAR test exclusion considerations

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for product specific 10-g SAR

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

Per KDB 447498 D01, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Bluetooth	Distance (mm)	MAXPower (dBm)	Frequency (MHz)	Ratio	Evaluation
Head	5	6.00	2480	1.25	No
Body-worn	15	6.00	2480	0.42	No
Hotspot SAR	10	6.00	2480	0.63	No



10.3 Measured SAR Results

Table 8: GSM 1900

Original

Test Position	Cover Type	Time slot	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measure dSAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR											
Left Cheek	Open	GSM	1:8.3	661/1880	28.00	27.35	0.441	0.090	1.16	0.512	/
Left Tilt	Open	GSM	1:8.3	661/1880	28.00	27.35	0.083	0.100	1.16	0.096	/
Right Cheek	Open	GSM	1:8.3	661/1880	28.00	27.35	0.475	0.025	1.16	0.552	/
Right Tilt	Open	GSM	1:8.3	661/1880	28.00	27.35	0.106	0.010	1.16	0.123	/
Right Cheek	SIM 2 Open	GSM	1:8.3	661/1880	28.00	27.35	0.377	-0.160	1.16	0.438	/
Body-worn SAR (Distance 15mm)											
Back Side	Open	GSM	1:8.3	661/1880	28.00	27.35	0.463	0.100	1.16	0.538	/
Back Side	Close	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front Side	Close	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Back Side	SIM2 Open	GSM	1:8.3	661/1880	28.00	27.35	0.428	0.160	1.16	0.497	/
Hotspot SARSAR (Distance 10mm)											
Back Side	Open	4Txslots	1:8.3	512/1850.2	24.00	23.63	1.070	0.025	1.09	1.165	/
		4Txslots	1:8.3	661/1880	24.00	23.11	1.200	0.180	1.23	1.473	/
		4Txslots	1:8.3	810/1909.8	24.00	23.09	1.130	0.020	1.23	1.393	/
Back Side	Close	4Txslots	1:8.3	512/1850.2	24.00	23.63	0.838	0.024	1.09	0.913	/
		4Txslots	1:8.3	661/1880	24.00	23.11	0.785	0.140	1.23	0.964	/
		4Txslots	1:8.3	810/1909.8	24.00	23.09	0.710	0.130	1.23	0.876	/
Front Side	Close	4Txslots	1:8.3	661/1880	24.00	23.11	0.164	-0.040	1.23	0.201	/
Left Edge	Close	4Txslots	1:8.3	661/1880	24.00	23.11	0.064	0.090	1.23	0.078	/
Right Edge	Close	4Txslots	1:8.3	661/1880	24.00	23.11	0.300	0.023	1.23	0.368	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Close	4Txslots	1:8.3	661/1880	24.00	23.11	0.171	0.038	1.23	0.210	/
Back Side	SIM2 Open	4Txslots	1:8.3	661/1880	24.00	23.11	1.020	0.024	1.23	1.252	/
Back Side	Earphone1 Open	4Txslots	1:8.3	661/1880	24.00	23.11	0.990	0.022	1.23	1.215	/
Back Side	Earphone2 Open	4Txslots	1:8.3	661/1880	24.00	23.11	1.110	0.021	1.23	1.362	/
Back Side	Repeated Open	4Txslots	1:8.3	661/1880	24.00	23.11	1.180	0.023	1.23	1.448	/

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.

3. Accessories that do not contain RF transmitters and have been proven to increase the peak SAR by less than 5 %, such as hands-free kits, do not need SAR tests separate from the SAR tests attached to a main EUT configuration.



Measurement Variability				
Test Position	Channel/ Frequency(MHz)	MAX Measured SAR _{1g} (W/kg)	1 st Repeated SAR _{1g} (W/kg)	Ratio
Back Side	661/1880	1.200	1.180	1.02
Note: 1) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit). 2) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.				

Variant 1

Test Position	Cover Type	Config uration	Time slot	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
								Measure dSAR1g	Power Drift (dB)	Scalin g Factor	Report SAR1g	
Head SAR												
Right Cheek	Open	Conf.5	GSM	1:8.3	661/1880	28.00	27.35	0.430	0.154	1.16	0.499	7
Body-worn SAR (Distance 15mm)												
Back Side	Open	Conf.5	GSM	1:8.3	661/1880	28.00	27.35	0.581	0.140	1.16	0.675	8
Hotspot SARSAR (Distance 10mm)												
Back Side	Open	Conf.3	4Txslots	1:8.3	661/1880	24.00	23.11	0.934	0.110	1.23	1.146	/
Back Side	Open	Conf.4	4Txslots	1:8.3	661/1880	24.00	23.11	1.000	0.140	1.23	1.227	/
Back Side	Open	Conf.5	4Txslots	1:8.3	661/1880	24.00	23.11	1.120	0.130	1.23	1.375	9
Back Side	Open	Conf.6	4Txslots	1:8.3	661/1880	24.00	23.11	1.020	0.090	1.23	1.252	/
Note: 1.The value with blue color is the maximum SAR Value of each test band.												
2.When multiple slots are used, SAR should be tested to account for the maximum source-based time-averaged output power.												

Variant 2

Test Position	Cover Type	HW code	Time slot	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
								Measure dSAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Hotspot SARSAR (Distance 10mm)												
Back Side	Open	5061	4Txslots	1:8.3	661/1880	24.00	23.11	0.580	0.110	1.23	0.712	/
Back Side	Open	5071	4Txslots	1:8.3	661/1880	24.00	23.11	0.834	0.130	1.23	1.024	/
Back Side	Open	5081	4Txslots	1:8.3	661/1880	24.00	23.11	0.835	-0.020	1.23	1.025	/
Back Side	Open	5091	4Txslots	1:8.3	661/1880	24.00	23.11	0.813	-0.020	1.23	0.998	/
Back Side	Open	5101	4Txslots	1:8.3	661/1880	24.00	23.11	0.853	0.040	1.23	1.047	/
Note: 1.The value with blue color is the maximum SAR Value of each test band.												



Table 9: UMTS Band II

Original

Test Position	Cover Type	Channel Type	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
							Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR											
Left Cheek	Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.606	-0.170	1.22	0.740	/
Left Tilt	Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.110	-0.034	1.22	0.134	/
Right Cheek	Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.638	-0.028	1.22	0.780	/
Right Tilt	Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.110	0.000	1.22	0.134	/
Right Cheek	SIM2 Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.505	0.040	1.22	0.617	/
Right Cheek	Conf. 2 Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.556	0.024	1.22	0.679	/
Body-worn SAR (Distance 15mm)											
Back Side	Open	RMC 12.2K	1:1	9262/1852.4	21.50	20.73	0.737	0.028	1.19	0.880	/
		RMC 12.2K	1:1	9400/1880	21.50	20.63	0.770	0.110	1.22	0.941	/
		RMC 12.2K	1:1	9538/1907.6	21.50	20.46	0.417	0.100	1.27	0.530	/
Back Side	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.610	0.010	1.22	0.745	/
Front Side	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.127	0.180	1.22	0.155	/
Back Side	SIM2 Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.527	0.160	1.22	0.644	/
Hotspot SAR(Distance 10mm)											
Back Side	Open	RMC 12.2K	1:1	9262/1852.4	21.50	20.73	0.908	0.021	1.19	1.084	/
		RMC 12.2K	1:1	9400/1880	21.50	20.63	0.917	0.160	1.22	1.120	/
		RMC 12.2K	1:1	9538/1907.6	21.50	20.46	0.768	0.160	1.27	0.976	/
Back Side	Close	RMC 12.2K	1:1	9262/1852.4	21.50	20.73	0.873	0.070	1.19	1.042	/
		RMC 12.2K	1:1	9400/1880	21.50	20.63	0.862	-0.130	1.22	1.053	/
		RMC 12.2K	1:1	9538/1907.6	21.50	20.46	0.751	0.021	1.27	0.954	/
Front Side	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.116	0.100	1.22	0.142	/
Left Edge	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.044	0.022	1.22	0.054	/
Right Edge	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.268	0.029	1.22	0.327	/
Top Edge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bottom Edge	Close	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.130	0.020	1.22	0.159	/
Back Side	SIM2 Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.900	0.020	1.22	1.100	/
Back Side	Repeated Open	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.911	0.023	1.22	1.113	/

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.
3. Accessories that do not contain RF transmitters and have been proven to increase the peak SAR by less than 5 %, such as hands-free kits, do not need SAR tests separate from the SAR tests attached to a main EUT configuration.



Measurement Variability				
Test Position	Channel/ Frequency(MHz)	MAX Measured SAR _{1g} (W/kg)	1 st Repeated SAR _{1g} (W/kg)	Ratio
Back Side	9400/1880	0.917	0.911	1.01
Note: 1) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit). 2) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.				

Variant 1

Test Position	Cover Type	Confi gurati on	Channel Type	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
								Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR												
Right Cheek	Open	Conf.4	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.514	-0.190	1.22	0.628	/
Right Cheek	Open	Conf.3	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.546	-0.160	1.22	0.667	10
Right Cheek	Open	Conf.5	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.529	-0.021	1.22	0.646	/
Right Cheek	Open	Conf.4	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.519	-0.180	1.22	0.634	/
Body-worn SAR (Distance 15mm)												
Back Side	Open	Conf.4	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.693	0.020	1.22	0.847	/
Back Side	Open	Conf.3	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.772	0.040	1.22	0.943	/
Back Side	Open	Conf.5	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.718	0.020	1.22	0.877	/
Back Side	Open	Conf.6	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.812	-0.020	1.22	0.992	11
Hotspot SAR(Distance 10mm)												
Back Side	Open	Conf.5	RMC 12.2K	1:1	9400/1880	21.50	20.63	1.060	0.130	1.22	1.295	12
Note: 1.The value with blue color is the maximum SAR Value of each test band.												
2. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.												



Variant 2

Test Position	Cover Type	HW code	Channel Type	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
								Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR												
Right Cheek	Open	5061	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.468	-0.029	1.22	0.572	/
Right Cheek	Open	5071	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.497	0.056	1.22	0.607	/
Right Cheek	Open	5081	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.541	-0.023	1.22	0.661	/
Right Cheek	Open	5091	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.598	-0.110	1.22	0.731	/
Right Cheek	Open	5101	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.594	0.190	1.22	0.726	/
Body-worn SAR (Distance 15mm)												
Back Side	Open	5061	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.714	0.130	1.22	0.872	/
Back Side	Open	5071	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.455	0.120	1.22	0.556	/
Back Side	Open	5081	RMC 12.2K		9400/1880	21.50	20.63	0.712	0.010	1.22	0.870	/
Back Side	Open	5091	RMC 12.2K	1:1	9400/1880	21.50	20.63	0.743	0.024	1.22	0.908	/
Back Side	Open	5101	RMC 12.2K		9400/1880	21.50	20.63	0.569	-0.060	1.22	0.695	/
Note: 1.The value with blue color is the maximum SAR Value of each test band.												



Table 10: LTE Band 7

Original

Test Position	Cover Type	Duty Cycle	RB alloc ation	RB offset	Channel/ Frequency (MHz)	Tune- up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
								Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR (QPSK)												
Left Cheek	Open	1:1	1	50	21100/2535	22.50	21.81	0.288	0.078	1.17	0.338	/
Left Tilt	Open	1:1	1	50	21100/2535	22.50	21.81	0.061	0.160	1.17	0.071	/
Right Cheek	Open	1:1	1	50	21100/2535	22.50	21.81	0.515	0.040	1.17	0.604	/
Right Tilt	Open	1:1	1	50	21100/2535	22.50	21.81	0.115	0.023	1.17	0.135	/
Left Cheek	Open	1:1	50%	25	21100/2535	21.50	21.02	0.277	0.075	1.12	0.309	/
Left Tilt	Open	1:1	50%	25	21100/2535	21.50	21.02	0.065	0.083	1.12	0.073	/
Right Cheek	Open	1:1	50%	25	21100/2535	21.50	21.02	0.419	0.031	1.12	0.468	/
Right Tilt	Open	1:1	50%	25	21100/2535	21.50	21.02	0.094	0.027	1.12	0.105	/
Right Cheek	SIM2 Open	1:1	1	50	21100/2535	22.50	21.81	0.411	-0.032	1.17	0.482	/
Body-worn SAR (QPSK, Distance 15mm)												
Back Side	Open	1:1	1	50	21100/2535	22.50	21.81	0.363	0.170	1.17	0.426	/
Back Side	Close	1:1	1	50	21100/2535	22.50	21.81	0.309	-0.030	1.17	0.362	/
Front Side	Close	1:1	1	50	21100/2535	22.50	21.81	0.053	0.082	1.17	0.062	/
Back Side	Open	1:1	50%	25	21100/2535	21.50	21.02	0.298	0.043	1.12	0.333	/
Back Side	Close	1:1	50%	25	21100/2535	21.50	21.02	0.259	0.045	1.12	0.289	/
Front Side	Close	1:1	50%	25	21100/2535	21.50	21.02	0.042	0.149	1.12	0.047	/
Back Side	SIM2 Open	1:1	1	50	21100/2535	22.50	21.81	0.305	-0.190	1.17	0.358	/
Hotspot SAR(QPSK, Distance 10mm)												
Back Side	Open	1:1	1	50	21100/2535	22.50	21.81	0.542	-0.162	1.17	0.635	/
Back Side	Close	1:1	1	50	21100/2535	22.50	21.81	0.591	-0.036	1.17	0.693	/
Front Side	Close	1:1	1	50	21100/2535	22.50	21.81	0.106	0.043	1.17	0.124	/
Left Edge	Close	1:1	1	50	21100/2535	22.50	21.81	0.091	0.036	1.17	0.107	/
Right Edge	Close	1:1	1	50	21100/2535	22.50	21.81	0.431	-0.024	1.17	0.505	/
Top Edge	Close	1:1	1	50	21100/2535	22.50	21.81	0.140	0.033	1.17	0.164	/
Bottom Edge	Close	1:1	1	50	21100/2535	22.50	21.81	0.135	0.055	1.17	0.158	/
Back Side	Open	1:1	50%	25	21100/2535	21.50	21.02	0.437	0.027	1.12	0.488	/
Back Side	Close	1:1	50%	25	21100/2535	21.50	21.02	0.441	-0.024	1.12	0.493	/
Front Side	Close	1:1	50%	25	21100/2535	21.50	21.02	0.081	-0.024	1.12	0.091	/
Left Edge	Close	1:1	50%	25	21100/2535	21.50	21.02	0.076	0.042	1.12	0.085	/
Right Edge	Close	1:1	50%	25	21100/2535	21.50	21.02	0.322	-0.025	1.12	0.360	/
Top Edge	Close	1:1	50%	25	21100/2535	21.50	21.02	0.115	0.042	1.12	0.128	/
Bottom Edge	Close	1:1	50%	25	21100/2535	21.50	21.02	0.107	0.037	1.12	0.120	/



Back Side	SIM2 Close	1:1	1	50	21100/2535	22.50	21.81	0.564	0.023	1.17	0.661	/
-----------	------------	-----	---	----	------------	-------	-------	-------	-------	------	-------	---

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. For QPSK with 100% RB allocation, SAR is required when and the highest reported SAR for 1 RB and 50% RB allocation in are $\geq 50\%$ limit(1g).

3. Accessories that do not contain RF transmitters and have been proven to increase the peak SAR by less than 5 %, such as hands-free kits, do not need SAR tests separate from the SAR tests attached to a main EUT configuration.

Variant 1

Test Position	Cover Type	Configuration	Duty Cycle	RB allocation	RB offset	Channel/Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)				Plot No.
									Measured SAR1g	Power Drift (dB)	Scaling Factor	Report SAR1g	
Head SAR (QPSK)													
Right Cheek	Open	Conf.5	1:1	1	50	21100/2535	22.50	21.81	0.505	0.150	1.17	0.592	13
Body-worn SAR (QPSK, Distance 15mm)													
Back Side	Open	Conf.5	1:1	1	50	21100/2535	22.50	21.81	0.409	0.040	1.17	0.479	14
Hotspot SAR(QPSK, Distance 10mm)													
Back Side	Close	Conf.5	1:1	1	50	21100/2535	22.50	21.81	0.675	0.046	1.17	0.791	15
Note: 1. The value with blue color is the maximum SAR Value of each test band.													
2.For QPSK with 100% RB allocation, SAR is required when and the highest reported SAR for 1 RB and 50% RB allocation in are ≥ 50% limit(1g).													

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. For QPSK with 100% RB allocation, SAR is required when and the highest reported SAR for 1 RB and 50% RB allocation in are $\geq 50\%$ limit(1g).



Table 11: Wi-Fi (2.4G)

Original

Test Position	Cover Type	Mode 802.11b	Duty Cycle	Channel/ Frequency (MHz)	Tune-up (dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)					Plot No.
							Area Scan SAR 1g	Zoom Scan SAR 1g	Power Drift (dB)	Scaling Factor	Report SAR 1g	
Head SAR												
Left Cheek	Open	DSSS	100.0%	6/2437	17.00	16.55	0.389	0.461	0.095	1.11	0.511	/
Left Tilt	Open	DSSS	100.0%	6/2437	17.00	16.55	0.098	0.135	0.114	1.11	0.150	/
Right Cheek	Open	DSSS	100.0%	6/2437	17.00	16.55	0.197	0.196	0.160	1.11	0.217	/
Right Tilt	Open	DSSS	100.0%	6/2437	17.00	16.55	0.080	0.072	-0.100	1.11	0.080	/
Body-worn SAR (Distance 15mm)												
Back Side	Open	DSSS	100.0%	6/2437	17.00	16.55	0.071	0.071	-0.120	1.11	0.079	/
Back Side	Close	DSSS	100.0%	6/2437	17.00	16.55	0.111	0.108	0.070	1.11	0.120	/
Front Side	Close	DSSS	100.0%	6/2437	17.00	16.55	0.047	0.047	0.170	1.11	0.052	/
Hotspot SAR(Distance 10mm)												
Back Side	Open	DSSS	100.0%	6/2437	17.00	16.55	0.121	0.135	-0.030	1.11	0.150	/
Back Side	Close	DSSS	100.0%	6/2437	17.00	16.55	0.117	0.116	-0.070	1.11	0.129	/
Front Side	Close	DSSS	100.0%	6/2437	17.00	16.55	0.049	0.047	0.107	1.11	0.052	/
Left Edge	Close	DSSS	100.0%	6/2437	17.00	16.55	0.134	0.134	0.028	1.11	0.149	/
Right Edge	Close	DSSS	100.0%	6/2437	17.00	16.55	0.029	0.029	0.036	1.11	0.032	/
Top Edge	Close	DSSS	100.0%	6/2437	17.00	16.55	0.050	0.053	0.084	1.11	0.058	/
Bottom Edge	Close	DSSS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Note: 1. The value with blue color is the maximum SAR Value of each test band.												

Note: 1. The value with blue color is the maximum SAR Value of each test band.

MAX Adjusted SAR							
Mode	Test Position	Channel/ Frequency (MHz)	MAX Reported SAR _{1g} (W/kg)	802.11b Tune-up limit (dBm)	Tune-up limit (dBm)	Scaling Factor	Adjusted SAR _{1g} (W/kg)
802.11g	Left Cheek	6/2437	0.511	17.00	15.00	0.63	0.322
802.11n HT20	Left Cheek	6/2437	0.511	17.00	15.00	0.63	0.322
802.11n HT40	Left Cheek	6/2437	0.511	17.00	15.00	0.63	0.322

Note: SAR is not required for OFDM when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.



Variant 1

Test Position	Cover Type	Configuration	Mode 802.11b	Duty Cycle	Channel/Frequency (MHz)	Tune-up dBm)	Measured power (dBm)	Limit of SAR 1.6 W/kg (mW/g)					Plot No.
								Area Scan SAR 1g	Zoom Scan SAR 1g	Power Drift (dB)	Scaling Factor	Report SAR 1g	
Head SAR													
Left Cheek	Open	Conf.5	DSSS	100.0%	6/2437	17.00	16.55	0.382	0.540	-0.063	1.11	0.599	16
Body-worn SAR (Distance 15mm)													
Back Side	Close	Conf.5	DSSS	100.0%	6/2437	17.00	16.55	0.053	0.093	-0.048	1.11	0.103	17
Hotspot SAR(Distance 10mm)													
Back Side	Open	Conf.5	DSSS	100.0%	6/2437	17.00	16.55	0.270	0.272	-0.040	1.11	0.302	18
Note: 1. The value with blue color is the maximum SAR Value of each test band.													

MAX Adjusted SAR							
Mode	Test Position	Channel/Frequency (MHz)	MAX Reported SAR _{1g} (W/kg)	802.11b Tune-up limit (dBm)	Tune-up limit (dBm)	Scaling Factor	Adjusted SAR _{1g} (W/kg)
802.11g	Left Cheek	6/2437	0.599	17.00	15.00	0.63	0.378
802.11n HT20	Left Cheek	6/2437	0.599	17.00	15.00	0.63	0.378
802.11n HT40	Left Cheek	6/2437	0.599	17.00	15.00	0.63	0.378

Note: SAR is not required for OFDM when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Table 12: BT

Original

Band	Configuration	Frequency (MHz)	Maximum Power (dBm)	Separation Distance (mm)	Estimated SAR (W/kg)
Bluetooth	Head	2480	6.00	5	0.167
	Body-worn	2480	6.00	15	0.056
	Hotspot SAR	2480	6.00	10	0.084

For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below.

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm) · [$\sqrt{f(\text{GHz})}$]/x W/kg for test separation distances ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

10.4 Simultaneous Transmission Analysis

Simultaneous Transmission Configurations	Head	Body-worn	Hotspot
GSM + Bluetooth	Yes	Yes	Yes
WCDMA + Bluetooth	Yes	Yes	Yes
LTE + Bluetooth	Yes	Yes	Yes
GSM + Wi-Fi-2.4GHz	Yes	Yes	Yes
WCDMA + Wi-Fi-2.4GHz	Yes	Yes	Yes
LTE + Wi-Fi-2.4GHz	Yes	Yes	Yes
Wi-Fi-2.4GHz + Bluetooth	N/A	N/A	N/A

General Note:

- The Scaled SAR summation is calculated based on the same configuration and test position.
- Per KDB 447498 D01, simultaneous transmission SAR is compliant if,
 - Scalar SAR summation $< 1.6\text{W/kg}$, simultaneously transmission SAR measurement is not necessary.
 - $\text{SPLSR} = (\text{SAR1} + \text{SAR2})^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where $(x1, y1, z1)$ and $(x2, y2, z2)$ are the coordinates of the extrapolated peak SAR locations in the zoom scan.
 - If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.

The maximum SAR_{1g} Value for GSM/WCDMA/LTE Antenna

SAR _{1g} (W/kg)		GSM 1900	WCDMA Band II	LTE FDD 7	MAX. SAR _{1g}
Test Position					
Left Cheek		0.512	0.740	0.338	0.740
Left Tilt		0.096	0.134	0.073	0.134
Right Cheek		0.552	0.780	0.604	0.780
Right Tilt		0.123	0.134	0.135	0.135
Body worn	Back Side	0.675	0.992	0.479	0.992
	Front Side	N/A	0.155	0.062	0.155
Hotspot	Back Side	1.473	1.295	0.791	1.473
	Front Side	0.201	0.142	0.124	0.201
	Left Edge	0.078	0.054	0.107	0.107
	Right Edge	0.368	0.327	0.505	0.505
	Top Edge	N/A	N/A	0.164	0.164
	Bottom Edge	0.210	0.159	0.158	0.210

About BT and GSM/WCDMA/LTE Antenna

SAR _{1g} (W/kg)		GSM/WCDMA/LTE Antenna	BT	MAX. ΣSAR _{1g}
Test Position				
Left Cheek		0.740	0.167	0.907
Left Tilt		0.134	0.167	0.301
Right Cheek		0.780	0.167	0.947
Right Tilt		0.135	0.167	0.302
Body worn 1g	Back Side	0.992	0.056	1.048
	Front Side	0.155	0.056	0.211
Hotspot 1g	Back Side	1.473	0.084	1.557
	Front Side	0.201	0.084	0.285
	Left Edge	0.107	0.084	0.191
	Right Edge	0.505	0.084	0.589
	Top Edge	0.164	0.084	0.248
	Bottom Edge	0.210	0.084	0.294

Note: 1.The value with blue color is the maximum ΣSAR_{1g} Value.
2.MAX. ΣSAR_{1g} =Unlicensed SAR_{MAX} +Licensed SAR_{MAX}

MAX. ΣSAR_{1g} =1.557W/kg<1.6W/kg, so the Simultaneous transimition SAR with volum scan are not required for BT and GSM/WCDMA/LTE Antenna.

About Wi-Fi and GSM/WCDMA/LTE Antenna

SAR _{1g} (W/kg)		GSM/WCDMA/LTE Antenna	Wi-Fi 2.4G	MAX. Σ SAR _{1g}
Test Position				
Left Cheek		0.740	0.599	1.339
Left Tilt		0.134	0.150	0.284
Right Cheek		0.780	0.217	0.997
Right Tilt		0.135	0.080	0.215
Body worn 1g	Back Side	0.992	0.120	1.112
	Front Side	0.155	0.052	0.207
Hotspot 1g	Back Side	1.473	0.302	1.775
	Front Side	0.201	0.052	0.253
	Left Edge	0.107	0.149	0.256
	Right Edge	0.505	0.032	0.537
	Top Edge	0.164	0.058	0.222
	Bottom Edge	0.210	N/A	0.210
Note: 1.The value with blue color is the maximum Σ SAR _{1g} Value.				
2.MAX. Σ SAR _{1g} =Unlicensed SAR _{MAX} +Licensed SAR _{MAX}				

MAX. Σ SAR_{1g} = 1.775W/kg>1.6W/kg, so the SAR to peak location separation ratio should be considered

Reported SAR _{10g} (W/kg)	GSM 1900	WCDMA Band II	LTE FDD 7	Wi-Fi 2.4G	MAX. Σ SAR _{10g}
Test Position					
Back Side	1.473	/	/	0.302	1.775
	/	1.295	/	0.302	1.597
	/	/	0.791	0.302	1.093
Note: 1.The value with blue color is the SAR _{1g} >1.6W/kg.					
2. When the MAX. Σ SAR _{1g} >1.6 W/kg in a position, Ratio need consideration in this position.					

(SAR_{Max} =1.775W/Kg)

The position SAR_{GSM 1900} is (x₁= -20, y₁= -49.5, z₁= -205.8),

The position SAR_{WIFI 2.4G} is (x₂= 5.5, y₂=15, z₂= -204.5)

so the distance is 69.370mm.

PSLS=Peak SAR Location Separation

Ratio =[(Reported SAR_{Max.GSM/UMTS/LTE}) 1.473W/kg +(Reported SAR_{Max.WIFI}) 0.302W/kg]^{3/2} /PSLS
=0.034 <0.04

so the Simultaneous transimition SAR with volum scan are not required for Wi-Fi and GSM/WCDMA/LTE Antenna.



11 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528- 2013 is not required in SAR reports submitted for equipment approval.

ANNEX A: Test Layout

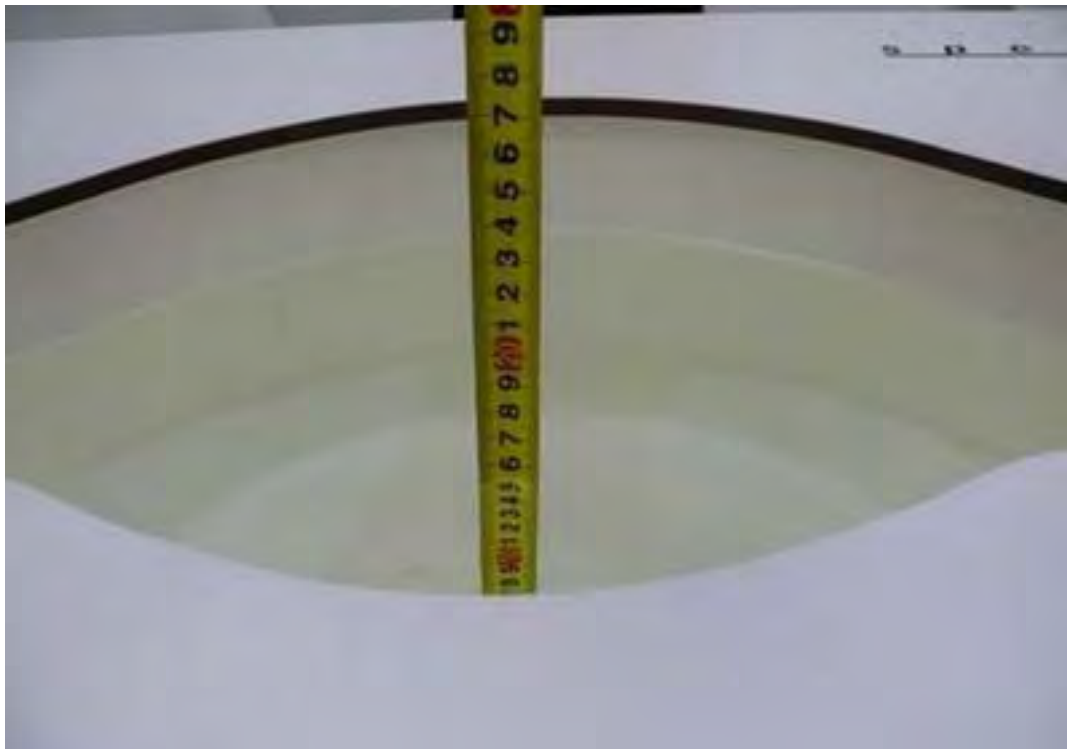


Tissue Simulating Liquids

For the measurement of the field distribution inside the flat phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For Head and Body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Picture 3 and Picture 4.



Picture 3: liquid depth in the head Phantom



Picture 4: Liquid depth in the flat Phantom

ANNEX B: System Check Results

Plot 1 System Performance Check at 1900 MHz TSL

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2

Date: 9/11/2020

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.41 \text{ S/m}$; $\epsilon_r = 40.1$; $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 22.3°C Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 11.3 mW/g

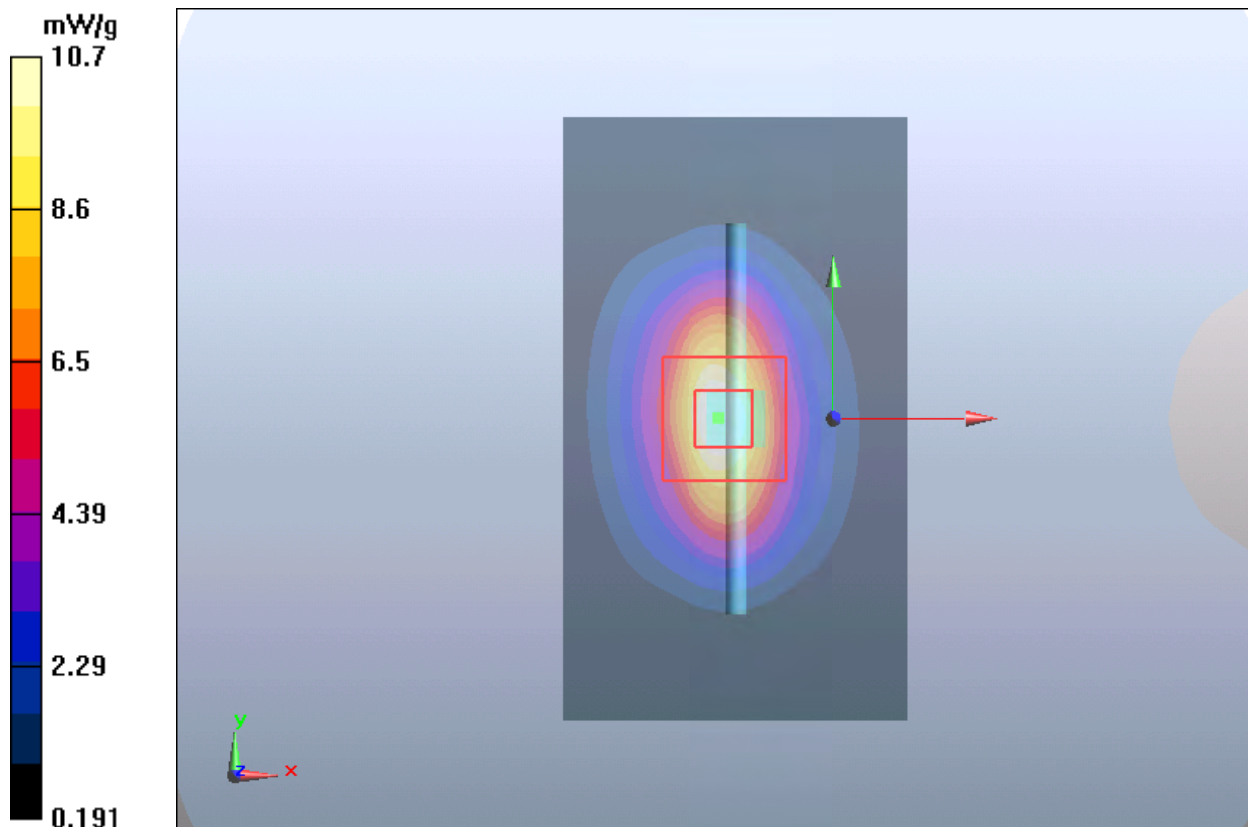
d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 85.5 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 9.88 mW/g; SAR(10 g) = 4.9 mW/g

Maximum value of SAR (measured) = 10.7 mW/g



Plot 2 System Performance Check at 1900 MHz

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2

Date: 5/13/2021

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.40$ mho/m; $\epsilon_r = 40.0$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/6/2020;

Electronics: DAE4 SN1317; Calibrated: 2/23/2021

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 12.9 mW/g

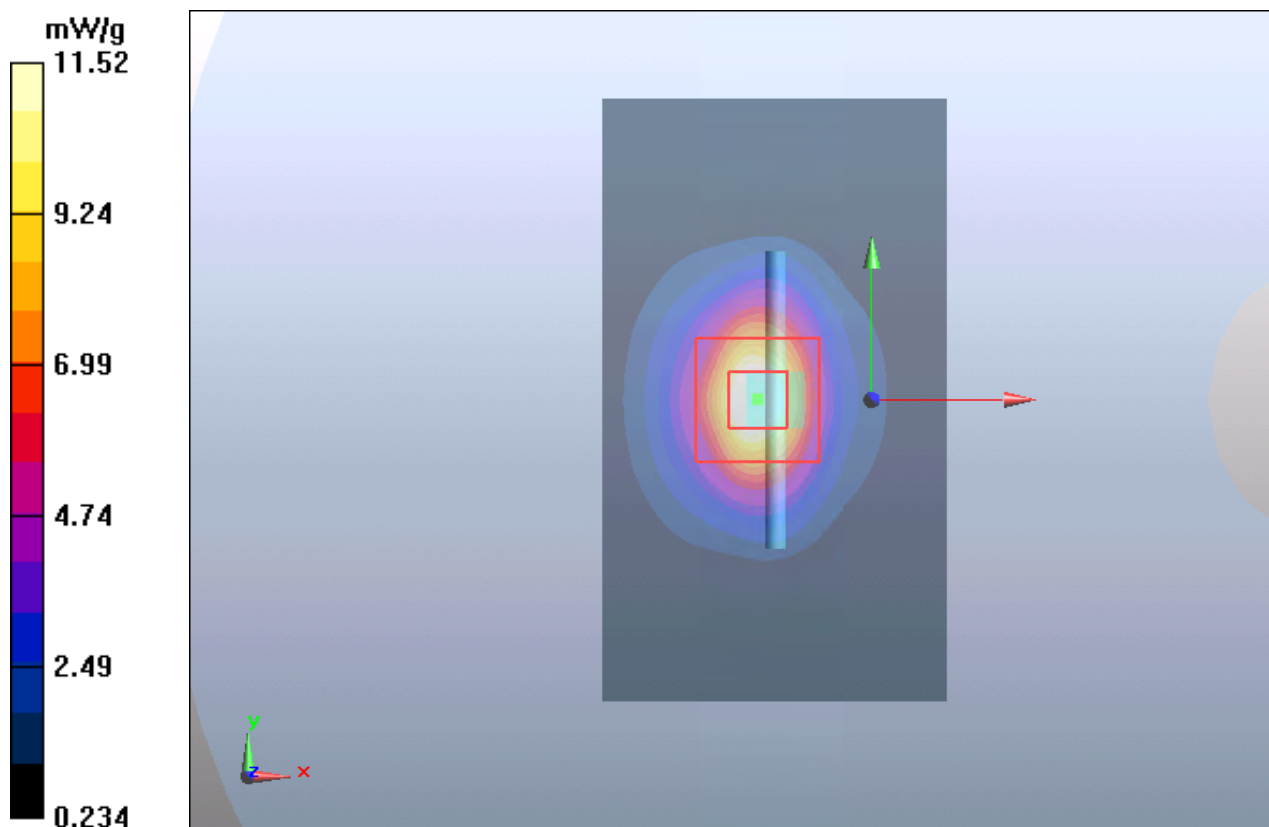
d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 87.8 V/m; Power Drift = 0.030 dB

Peak SAR (extrapolated) = 20.1 W/kg

SAR(1 g) = 10.55 mW/g; SAR(10 g) = 5.39 mW/g

Maximum value of SAR (measured) = 11.52 mW/g



Plot 3 System Performance Check at 2450 MHz TSL

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2

Date: 9/11/2020

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ S/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C

Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.54, 7.54, 7.54); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 18.2 mW/g

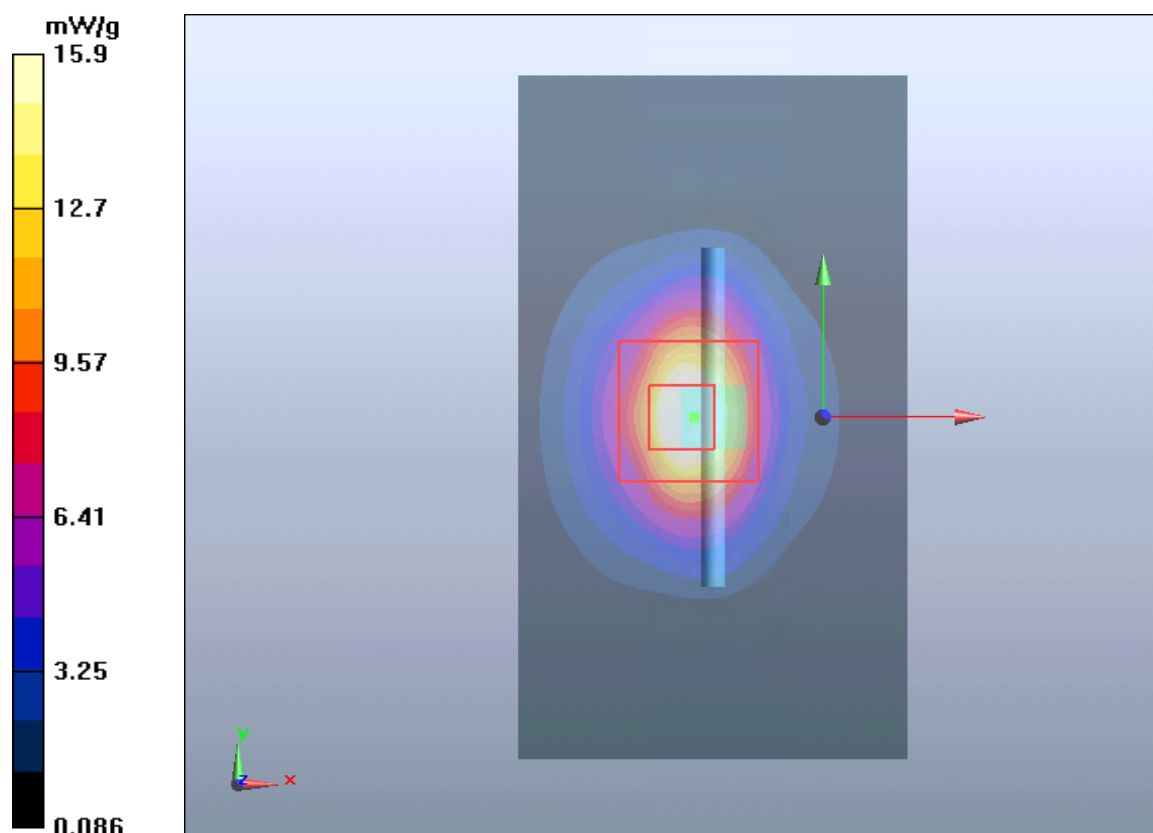
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.8 V/m; Power Drift = 0.075 dB

Peak SAR (extrapolated) = 30 W/kg

SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.22 mW/g

Maximum value of SAR (measured) = 15.9 mW/g



Plot4 System Performance Check at 2450 MHz TSL

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2

Date: 5/13/2021

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ S/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C

Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.54, 7.54, 7.54); Calibrated: 7/6/2020;

Electronics: DAE4 SN1317; Calibrated: 2/23/2021

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 18.2 mW/g

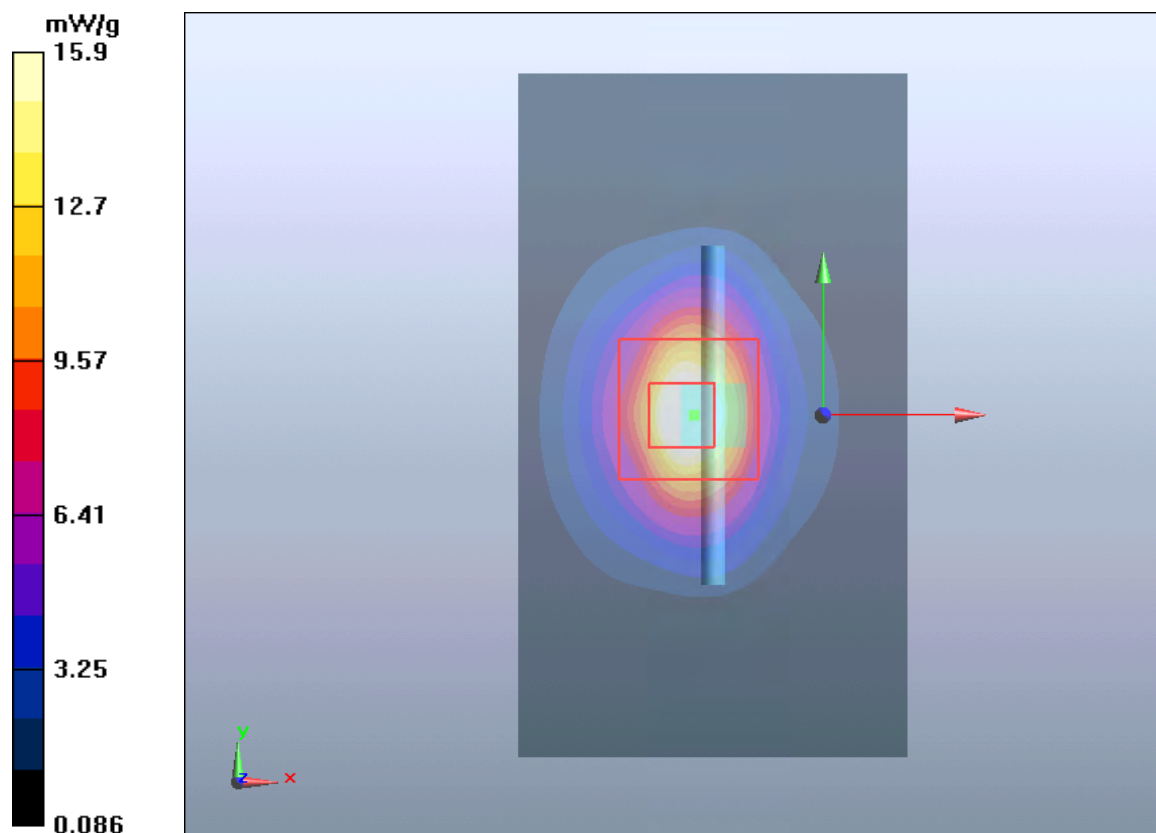
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.8 V/m; Power Drift = 0.075 dB

Peak SAR (extrapolated) = 30 W/kg

SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.22 mW/g

Maximum value of SAR (measured) = 15.9 mW/g



Plot 5 System Performance Check at 2600 MHz TSL

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2

Date: 9/11/2020

Communication System: CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.01$ S/m; $\epsilon_r = 38.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.26, 7.26, 7.26); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid:dx=12mm, dy=12mm

Maximum value of SAR (measured) = 17.439 mW/g

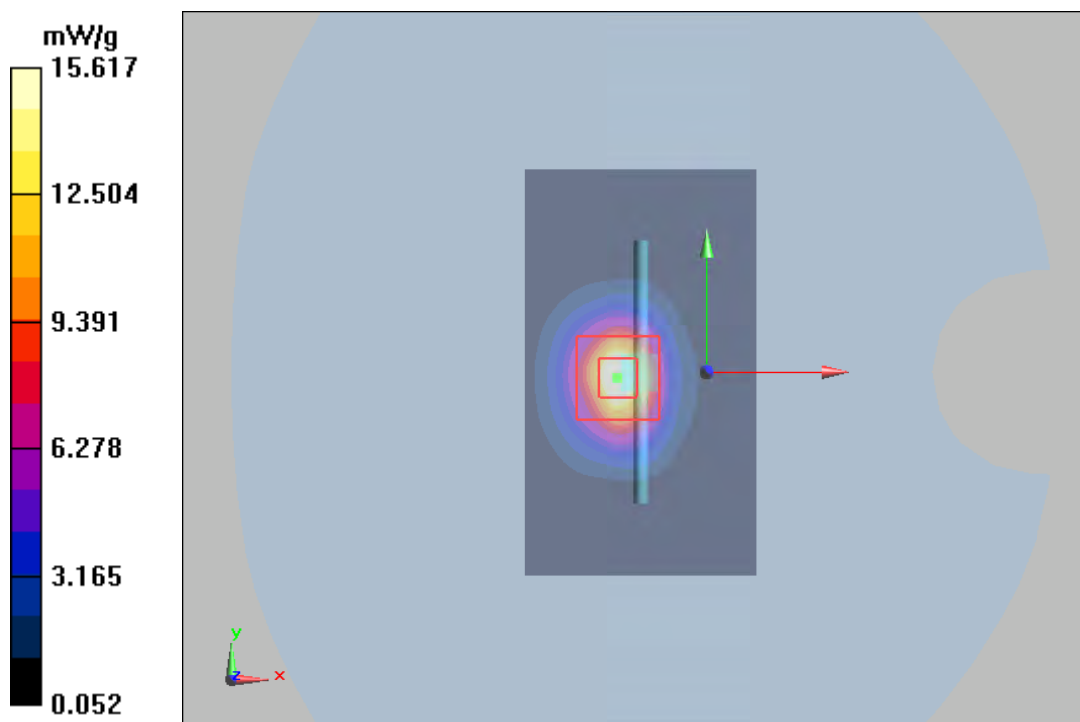
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.998 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.858 W/kg

SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.07 mW/g

Maximum value of SAR (measured) = 15.617 mW/g



Plot 6 System Performance Check at 2600 MHz TSL

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2

Date: 5/13/2021

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 38.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.26, 7.26, 7.26); Calibrated: 7/6/2020;

Electronics: DAE4 SN1317; Calibrated: 2/23/2021

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

d=10mm, Pin=250mW/Area Scan (6x10x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 17.439 mW/g

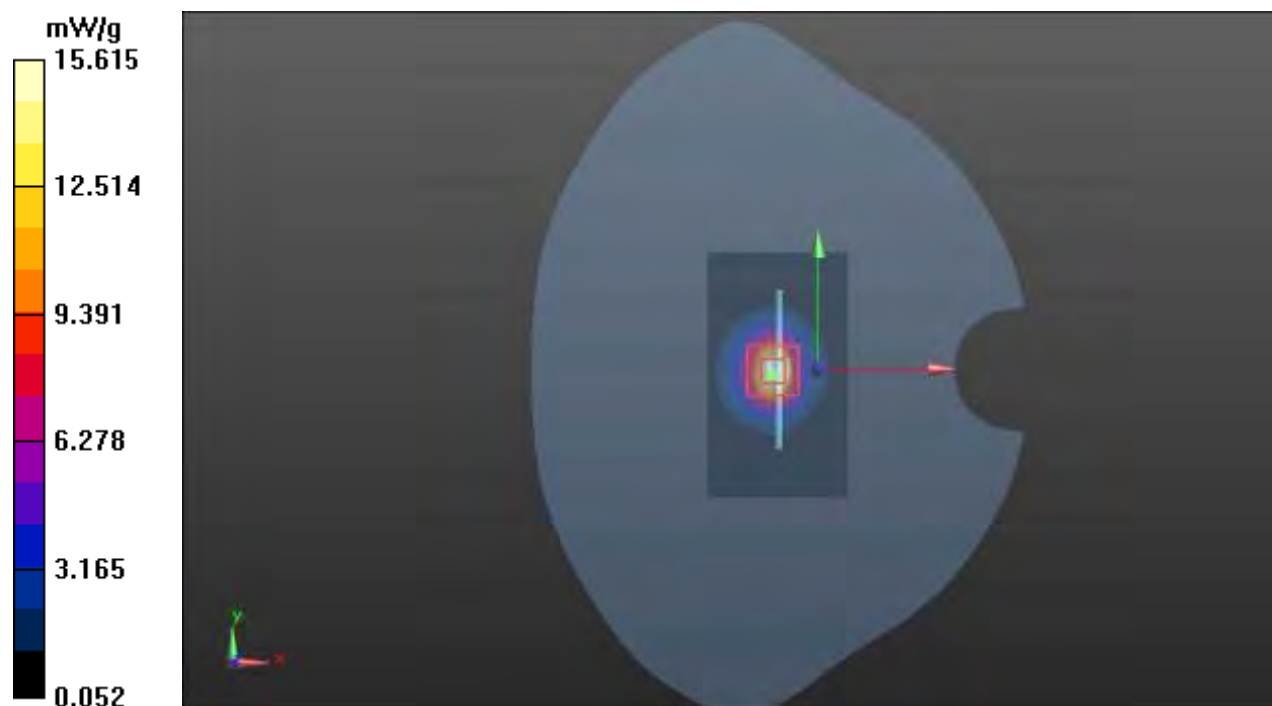
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.998 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.858 W/kg

SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.08 mW/g

Maximum value of SAR (measured) = 15.615 mW/g



ANNEX C: Highest Graph Results

Plot 7 GSM 1900 Right Cheek Middle

Date: 9/11/2020

Communication System: UID 0, GSM (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Right Cheek Middle/Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.390 W/kg

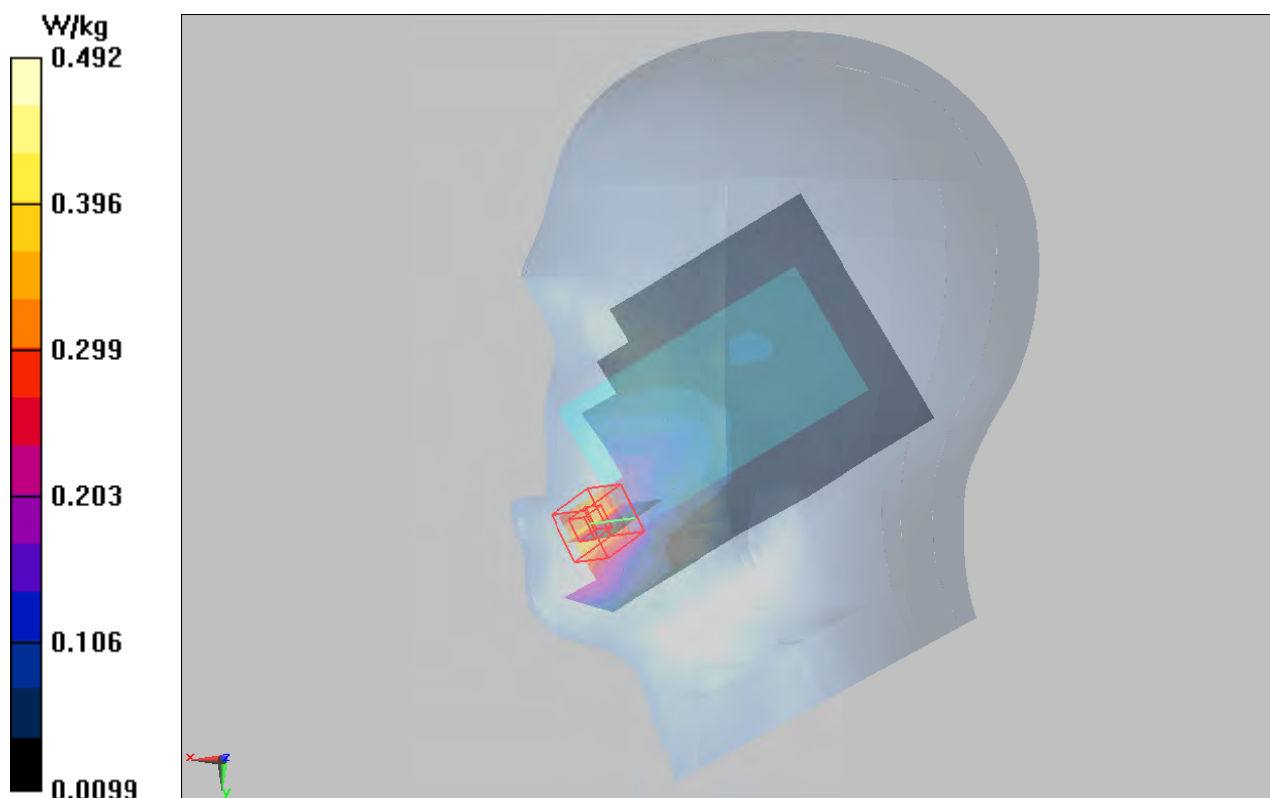
Right Cheek Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.121 V/m; Power Drift = 0.154 dB

Peak SAR (extrapolated) = 0.707 W/kg

SAR(1 g) = 0.430 W/kg; SAR(10 g) = 0.255 W/kg

Maximum value of SAR (measured) = 0.492 W/kg



Plot 8 GSM 1900 Back Side Middle (Distance 15mm, Open)

Date: 9/11/2020

Communication System: UID 0, GSM (0); Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.599 W/kg

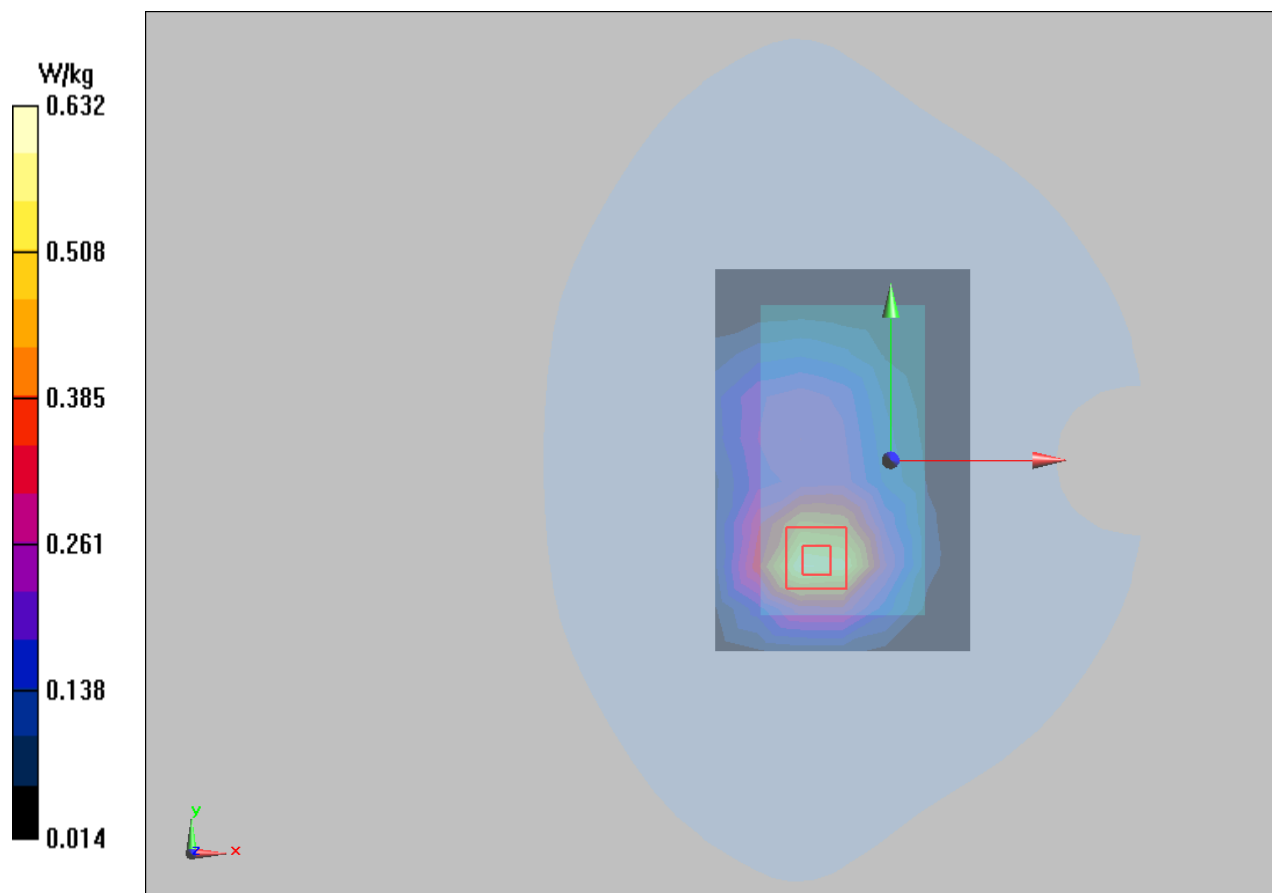
Back Side Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.74 V/m; Power Drift = 0.140 dB

Peak SAR (extrapolated) = 0.960 W/kg

SAR(1 g) = 0.581 W/kg; SAR(10 g) = 0.339 W/kg

Maximum value of SAR (measured) = 0.632 W/kg



Plot 9 GSM 1900 GPRS (4Txslots) Back Side Middle (Distance 10mm, Open)

Date: 9/11/2020

Communication System: UID 0, GPRS 4TX (0); Frequency: 1880 MHz; Duty Cycle: 1:2.07491

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.21 W/kg

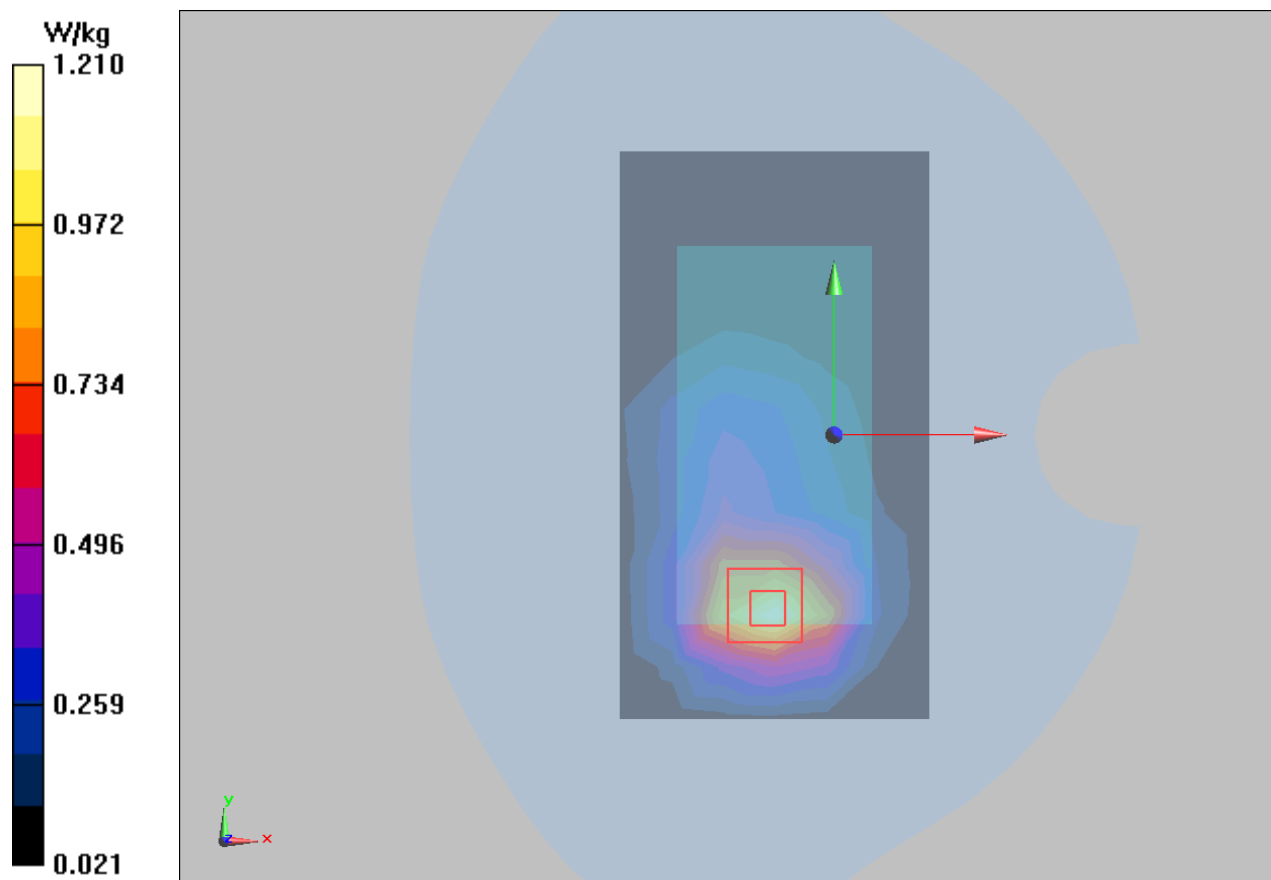
Back Side Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.88 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.96 W/kg

SAR(1 g) = 1.120 W/kg; SAR(10 g) = 0.637 W/kg

Maximum value of SAR (measured) = 1.210 W/kg



Plot 10 UMTS Band II Right Cheek Middle

Date: 9/11/2020

Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Right Cheek Middle/Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.543 W/kg

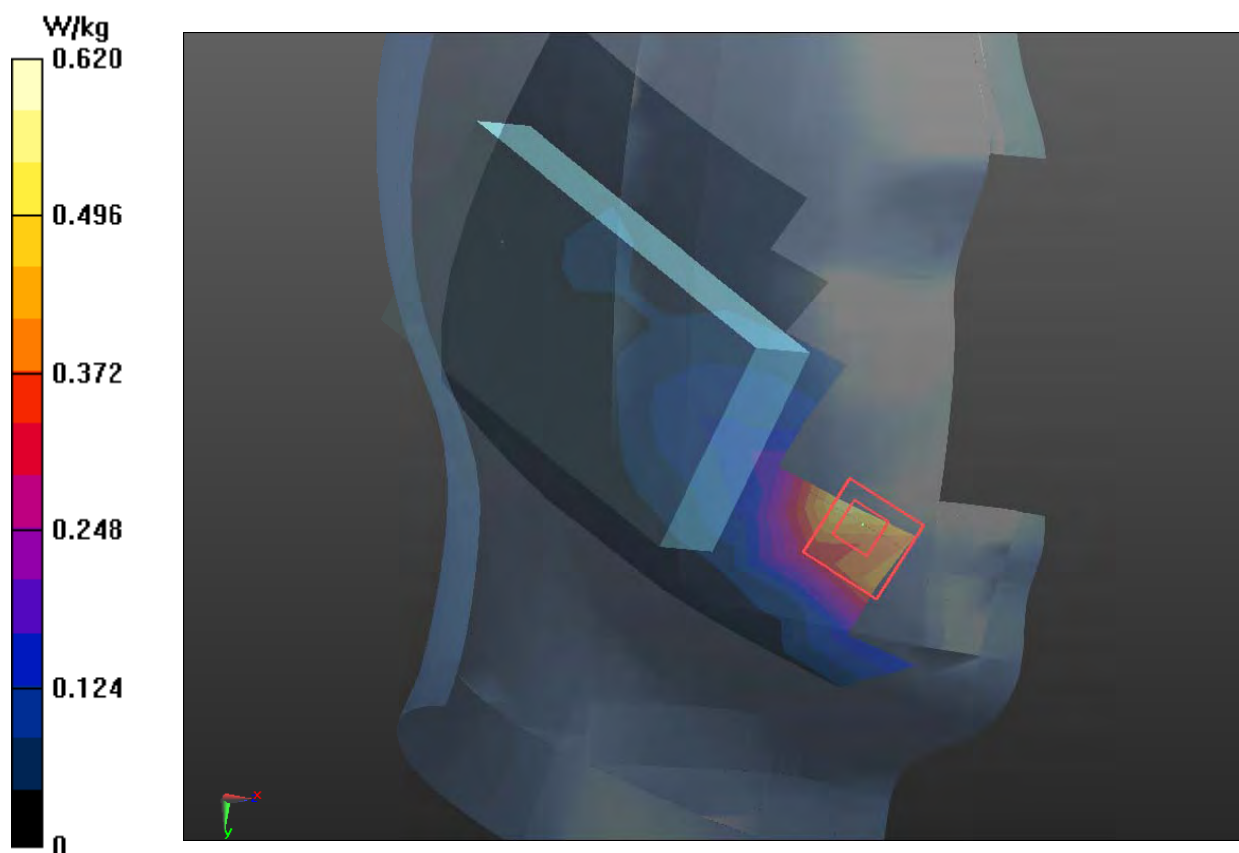
Right Cheek Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.213 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.901 W/kg

SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.312 W/kg

Maximum value of SAR (measured) = 0.620 W/kg



Plot 11 UMTS Band II Back Side Middle (Distance 15mm, Open)

Date: 9/11/2020

Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.886 W/kg

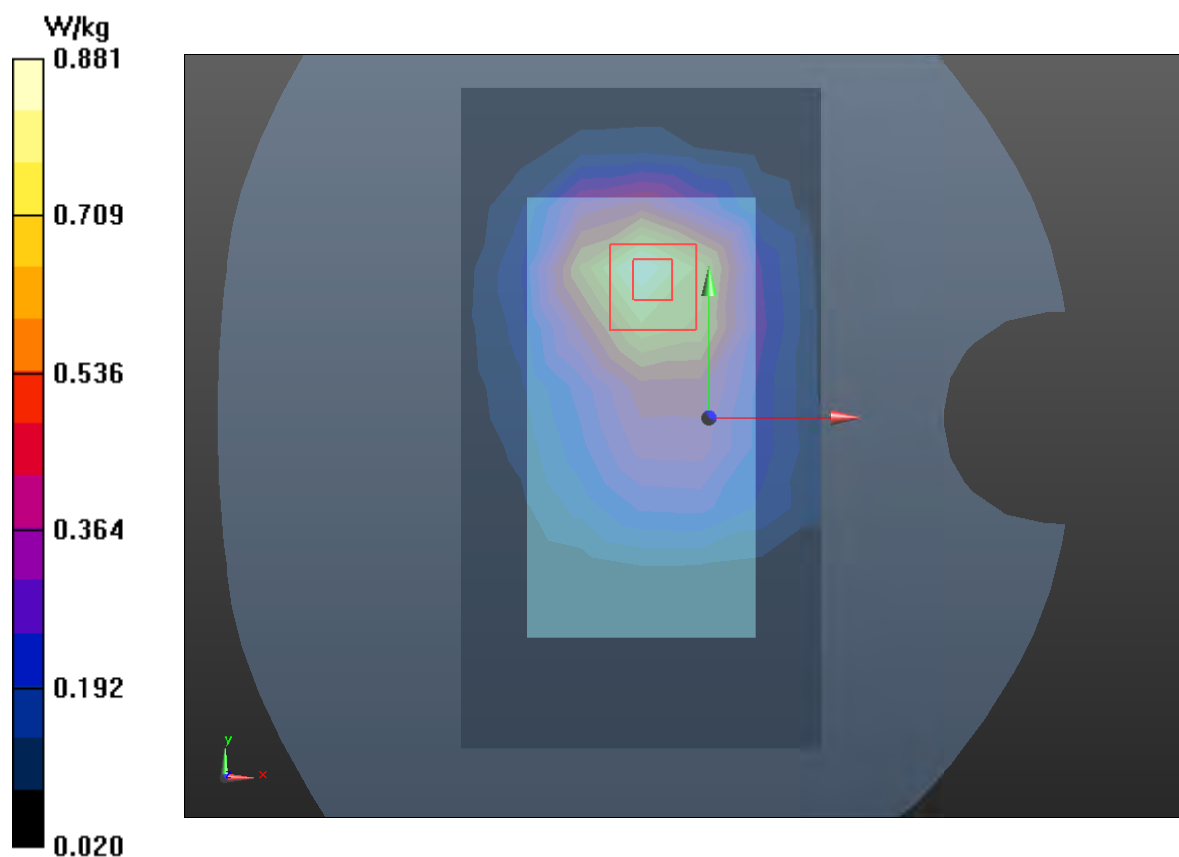
Back Side Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.11 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR(1 g) = 0.812 W/kg; SAR(10 g) = 0.480 W/kg

Maximum value of SAR (measured) = 0.881 W/kg



Plot 12 UMTS Band II Back Side Middle (Distance 10mm, Open)

Date: 9/11/2020

Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 38.948$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.90, 7.90, 7.90); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.31 W/kg

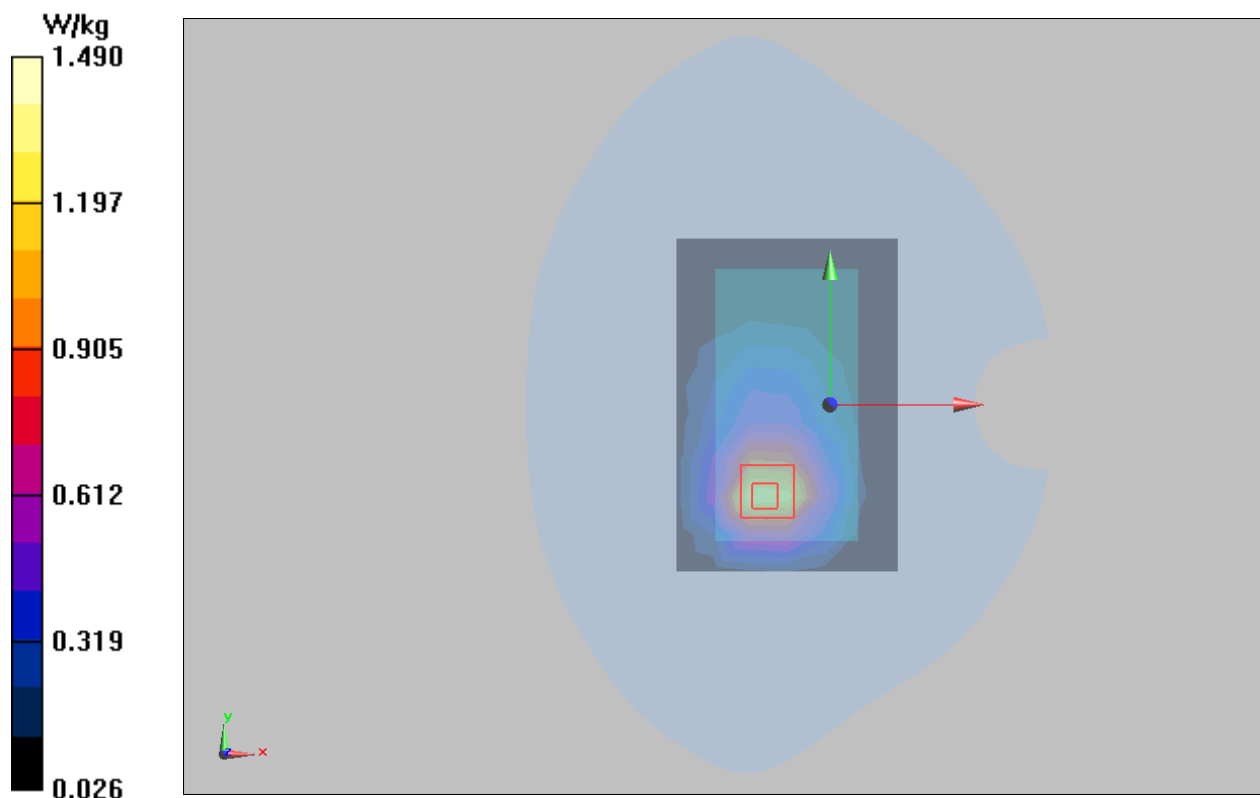
Back Side Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.98 V/m; Power Drift = 0.130 dB

Peak SAR (extrapolated) = 2.33 W/kg

SAR(1 g) = 1.060 W/kg; SAR(10 g) = 0.601 W/kg

Maximum value of SAR (measured) = 1.490 W/kg



Plot 13 LTE Band 7 1RB Right Cheek Middle

Date: 9/11/2020

Communication System: UID 0, LTE (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2535$ MHz; $\sigma = 1.905$ S/m; $\epsilon_r = 38.267$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Right Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.26, 7.26, 7.26); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Right Cheek Middle /Area Scan (10x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.549 W/kg

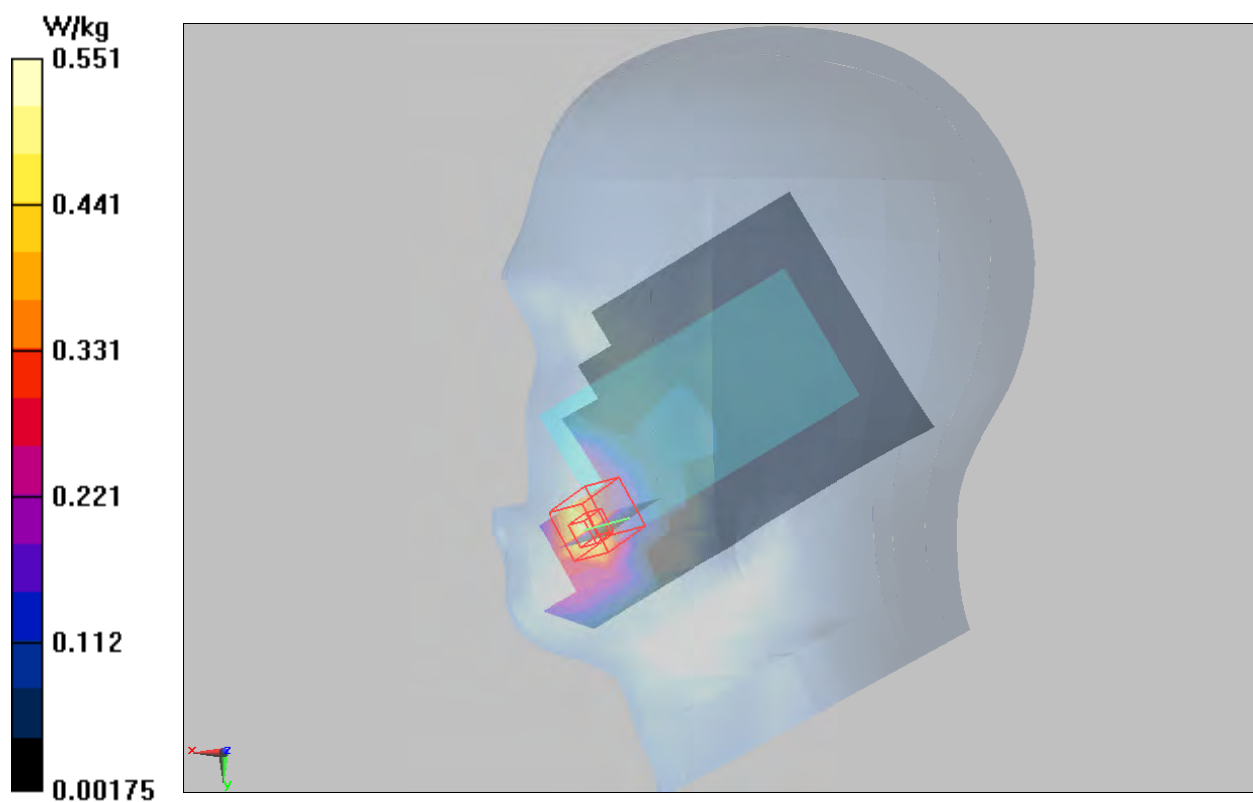
Right Cheek Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.734 V/m; Power Drift = 0.150 dB

Peak SAR (extrapolated) = 0.959 W/kg

SAR(1 g) = 0.505 W/kg; SAR(10 g) = 0.262 W/kg

Maximum value of SAR (measured) = 0.551 W/kg



Plot 14 LTE Band 7 1RB Back Side Middle (Distance 15mm, Open)

Date: 9/11/2020

Communication System: UID 0, LTE (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2535$ MHz; $\sigma = 1.905$ S/m; $\epsilon_r = 38.267$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.26, 7.26, 7.26); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.418 W/kg

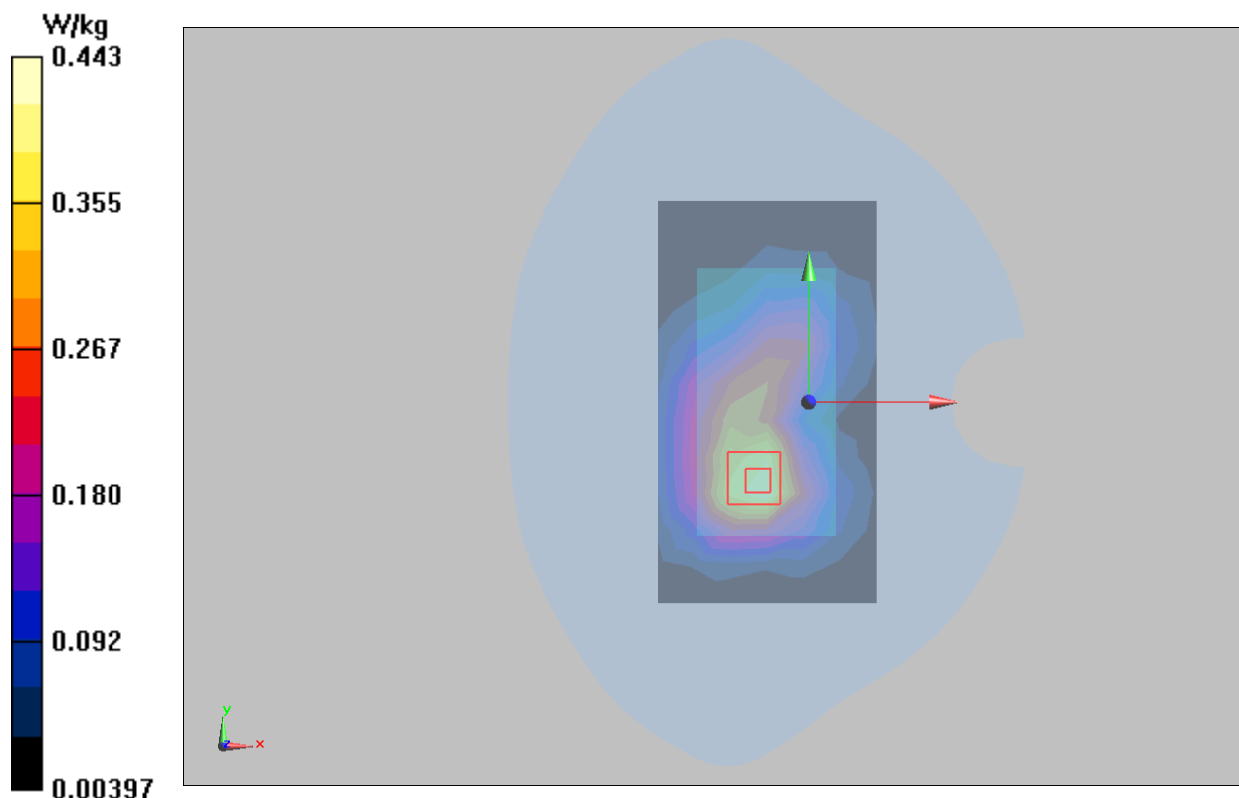
Back Side Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.62 V/m; Power Drift = 0.040 dB

Peak SAR (extrapolated) = 0.781 W/kg

SAR(1 g) = 0.409 W/kg; SAR(10 g) = 0.221 W/kg

Maximum value of SAR (measured) = 0.443 W/kg



Plot 15 LTE Band 7 1RB Back Side Middle (Distance 10mm, Close)

Date: 9/11/2020

Communication System: UID 0, LTE (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2535$ MHz; $\sigma = 1.905$ S/m; $\epsilon_r = 38.267$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.26, 7.26, 7.26); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.673 W/kg

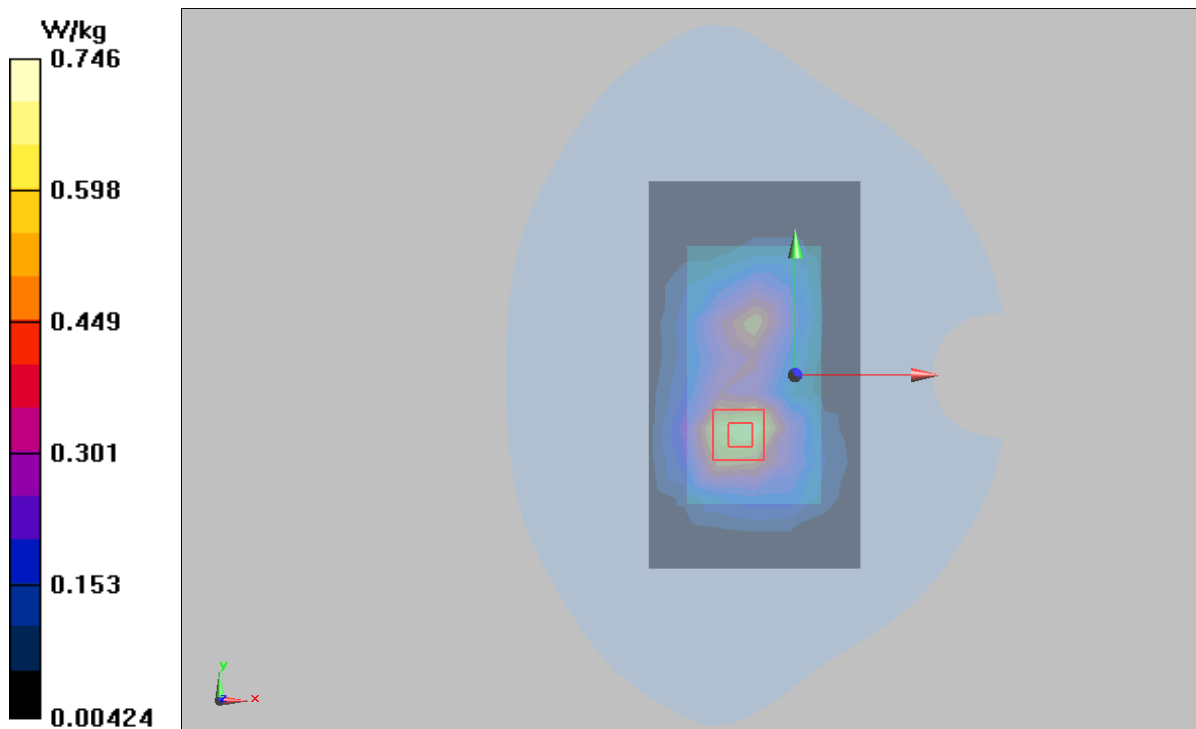
Back Side Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.01 V/m; Power Drift = 0.046 dB

Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 0.675 W/kg; SAR(10 g) = 0.353 W/kg

Maximum value of SAR (measured) = 0.746 W/kg



Plot 16 802.11b Left Cheek Middle

Date: 9/11/2020

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.797$ S/m; $\epsilon_r = 38.629$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Left Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.54, 7.54, 7.54); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Left Cheek Middle /Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.532 W/kg

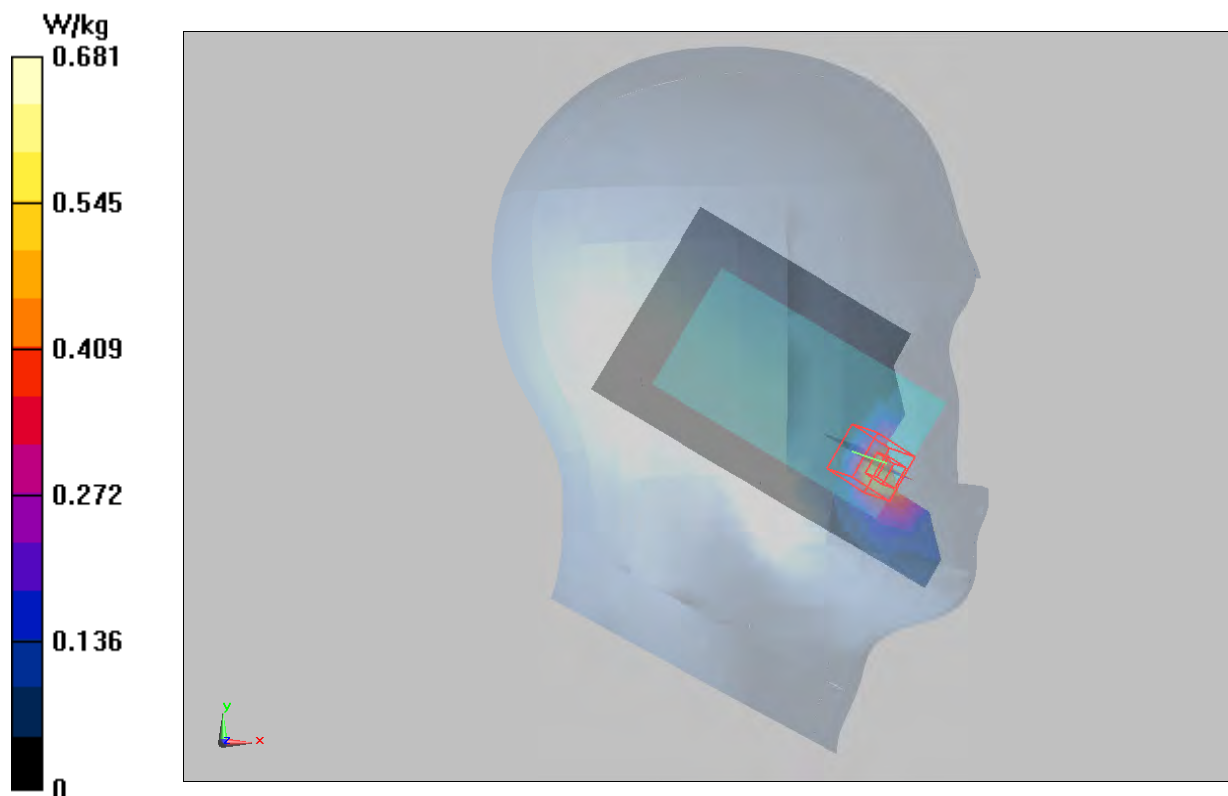
Left Cheek Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.423 V/m; Power Drift = -0.063 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.540 W/kg; SAR(10 g) = 0.255 W/kg

Maximum value of SAR (measured) = 0.681 W/kg



Plot 17 802.11b Back Side Middle (Distance 15mm, Close)

Date: 9/11/2020

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.797$ S/m; $\epsilon_r = 38.629$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.54, 7.54, 7.54); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle /Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.101 W/kg

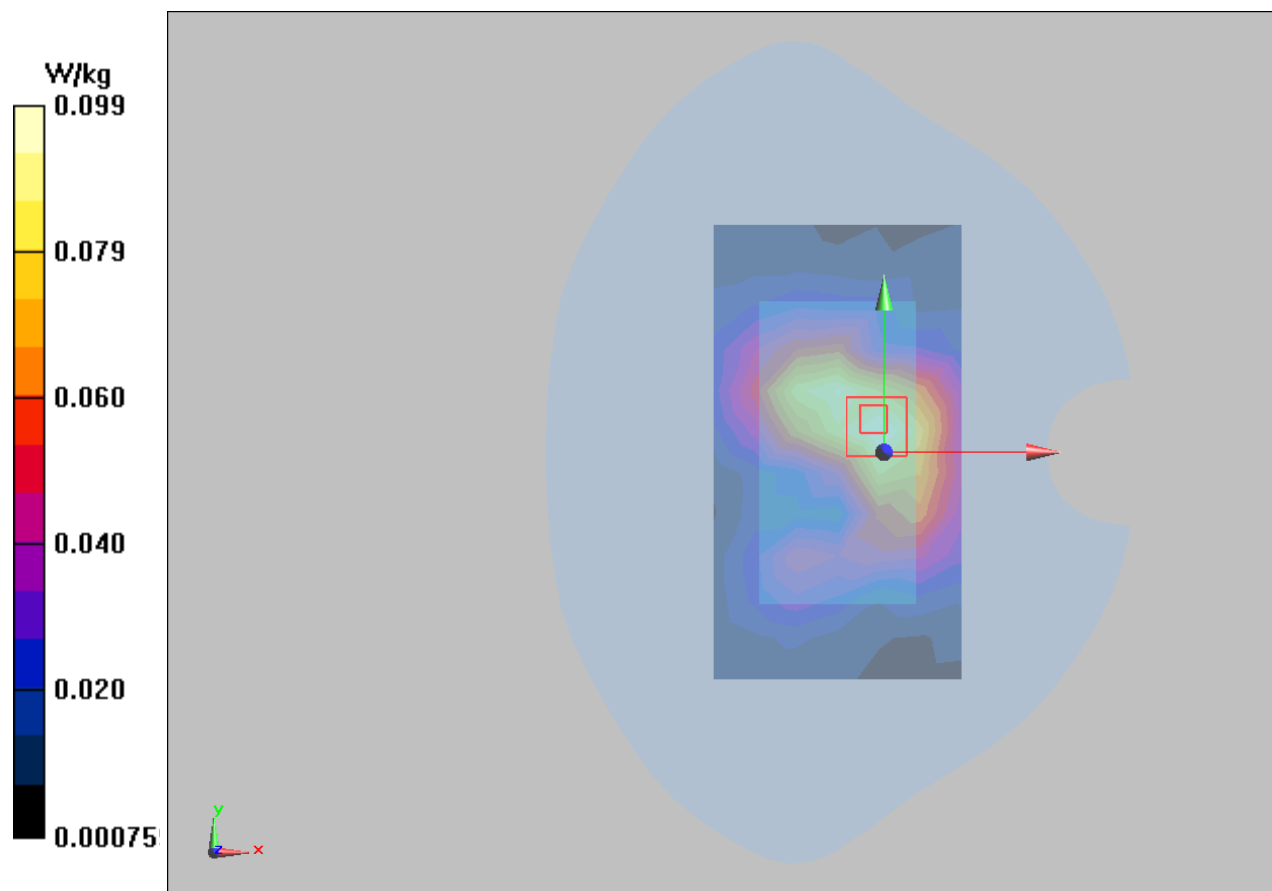
Back Side Middle /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.133 V/m; Power Drift = -0.048 dB

Peak SAR (extrapolated) = 0.169 W/kg

SAR(1 g) = 0.093 W/kg; SAR(10 g) = 0.053 W/kg

Maximum value of SAR (measured) = 0.099 W/kg



Plot 18 802.11b 802.11b Back Side Middle (Distance 10mm, Open)

Date: 9/11/2020

Communication System: UID 0, 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2437$ MHz; $\sigma = 1.797$ S/m; $\epsilon_r = 38.629$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.3 °C Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN3677; ConvF(7.54, 7.54, 7.54); Calibrated: 7/06/2020;

Electronics: DAE4 SN1317; Calibrated: 10/23/2019

Phantom: SAM1; Type: SAM; Serial: TP-1534

Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Back Side Middle/Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.280 W/kg

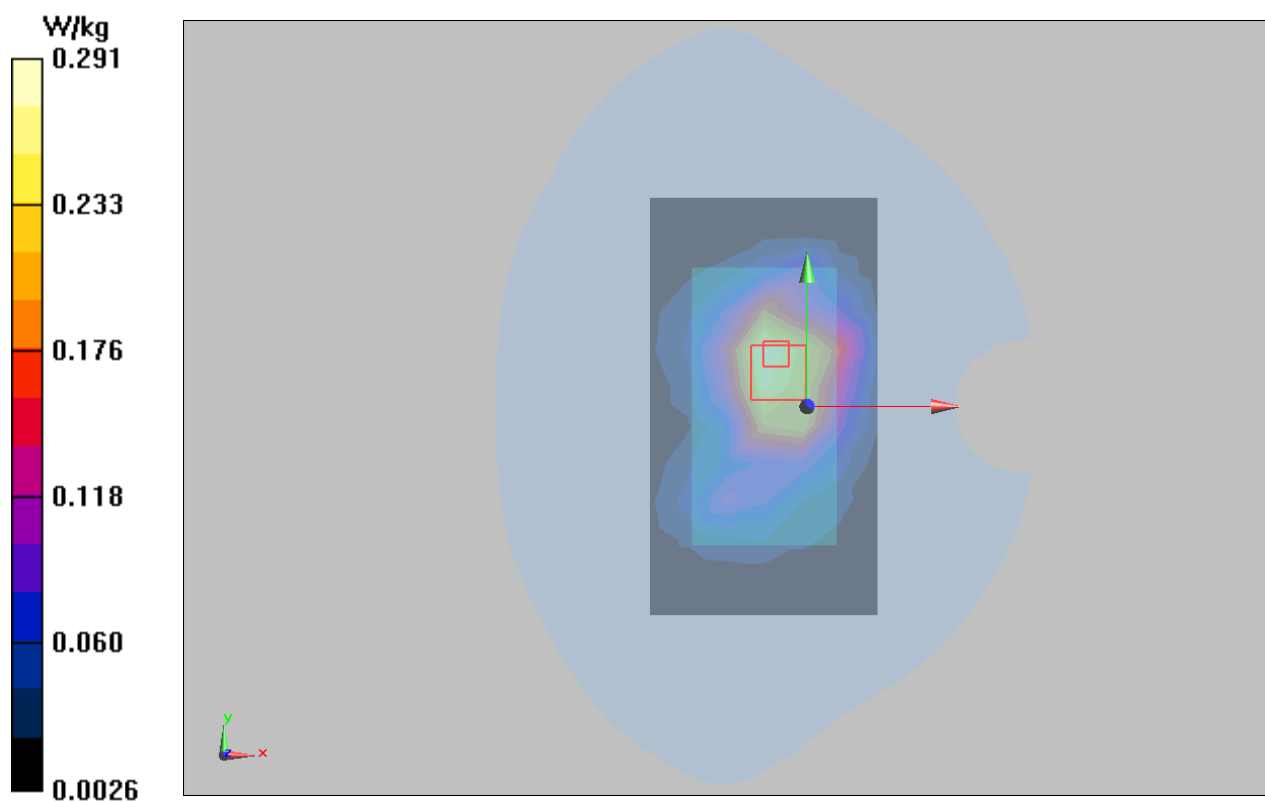
Back Side Middle/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.69 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.538 W/kg

SAR(1 g) = 0.272 W/kg; SAR(10 g) = 0.154 W/kg

Maximum value of SAR (measured) = 0.291 W/kg





ANNEX D: Probe Calibration Certificate



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

Client **TA(Shanghai)**Certificate No: **Z20-60218****CALIBRATION CERTIFICATE**Object **EX3DV4 - SN : 3677**

Calibration Procedure(s) **FF-Z11-004-01**
Calibration Procedures for Dosimetric E-field Probes

Calibration date: **July 06, 2020**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101547	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101548	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG, No.EX3-3617_Jan20/2)	Jan-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	23-Jun-20(CTTL, No.J20X04343)	Jun-21
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: July 08, 2020

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

Certificate No: Z20-60218

Page 1 of 9



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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 $\theta=0$ 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:

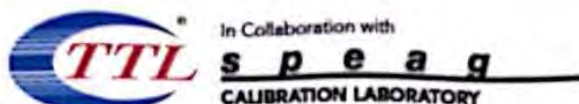
- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. 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 NORM_{x,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 $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Certificate No: Z20-60218

Page 2 of 9



Add: No 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

DASY/EASY – Parameters of Probe: EX3DV4 – SN:3677

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^A	0.41	0.46	0.40	±10.0%
DCP(mV) ^B	100.7	102.6	102.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB· μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	174.8	±2.0%
		Y	0.0	0.0	1.0		186.9	
		Z	0.0	0.0	1.0		173.5	

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 E²-field uncertainty inside TSL (see Page 4).

^B Numerical linearization parameter: uncertainty not required.

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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY/EASY – Parameters of Probe: EX3DV4 – SN:3677

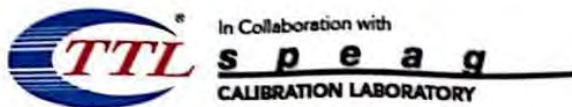
Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^E	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc. (k=2)
750	41.9	0.89	9.78	9.78	9.78	0.40	0.75	±12.1%
835	41.5	0.90	9.38	9.38	9.38	0.21	1.11	±12.1%
1750	40.1	1.37	8.25	8.25	8.25	0.26	1.05	±12.1%
1900	40.0	1.40	7.90	7.90	7.90	0.28	1.06	±12.1%
2000	40.0	1.40	7.97	7.97	7.97	0.23	1.17	±12.1%
2300	39.5	1.67	7.69	7.69	7.69	0.66	0.68	±12.1%
2450	39.2	1.80	7.54	7.54	7.54	0.66	0.70	±12.1%
2600	39.0	1.96	7.26	7.26	7.26	0.74	0.67	±12.1%
3300	38.2	2.71	7.07	7.07	7.07	0.48	0.97	±13.3%
3500	37.9	2.91	7.03	7.03	7.03	0.49	0.93	±13.3%
3700	37.7	3.12	6.83	6.83	6.83	0.49	0.97	±13.3%
3900	37.5	3.32	6.76	6.76	6.76	0.40	1.20	±13.3%
4100	37.2	3.53	6.78	6.78	6.78	0.40	1.15	±13.3%
4400	36.9	3.84	6.47	6.47	6.47	0.40	1.20	±13.3%
4600	36.7	4.04	6.42	6.42	6.42	0.50	1.13	±13.3%
4800	36.4	4.25	6.35	6.35	6.35	0.45	1.25	±13.3%
4950	36.3	4.40	6.22	6.22	6.22	0.45	1.25	±13.3%
5250	35.9	4.71	5.55	5.55	5.55	0.50	1.15	±13.3%
5600	35.5	5.07	4.97	4.97	4.97	0.55	1.22	±13.3%
5750	35.4	5.22	5.00	5.00	5.00	0.55	1.27	±13.3%

^E Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 60 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

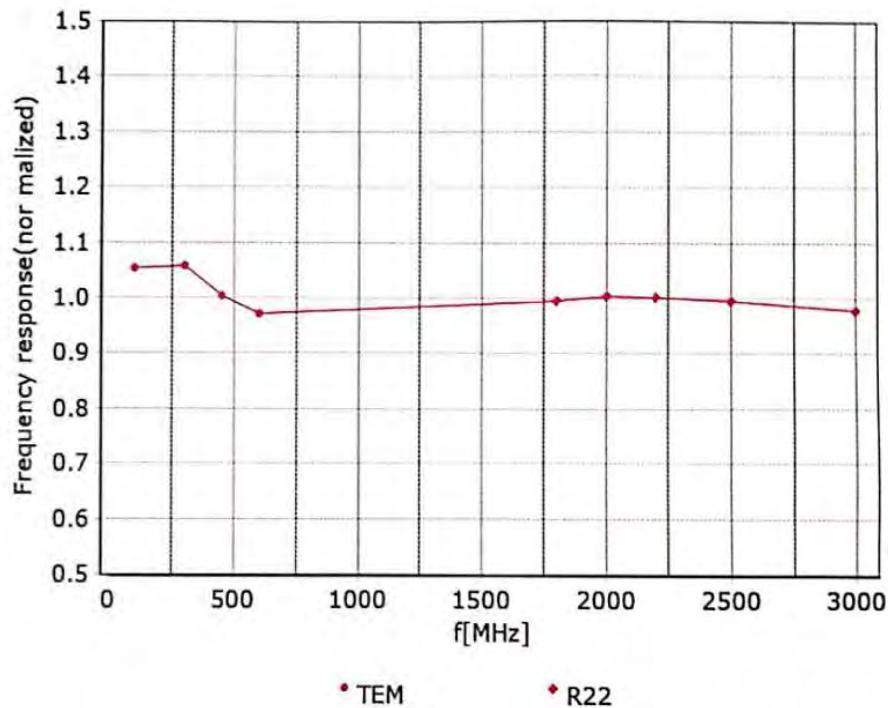
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty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



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

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



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)



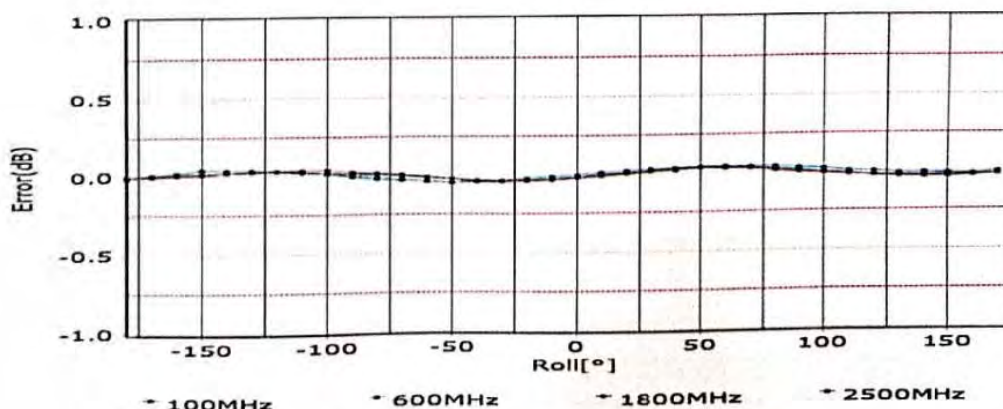
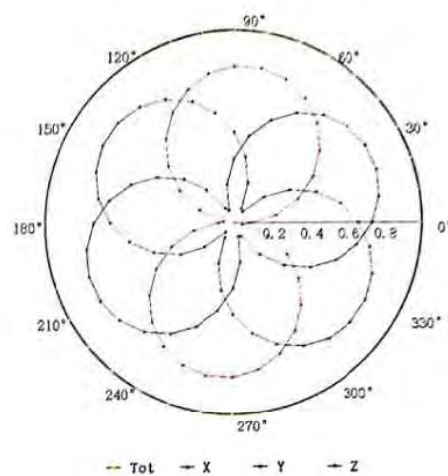
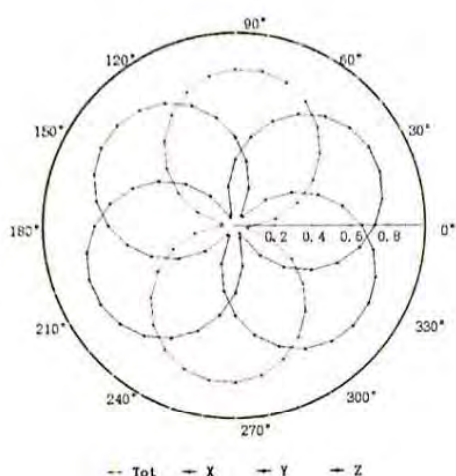
In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

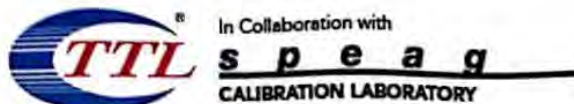
f=1800 MHz, R22



Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)

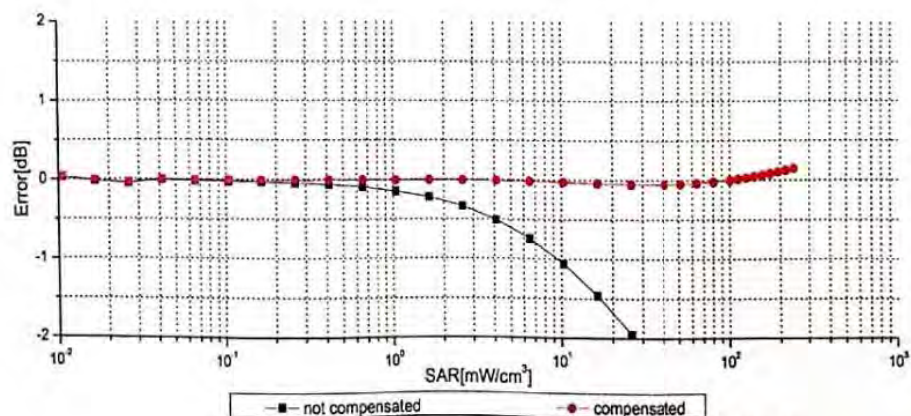
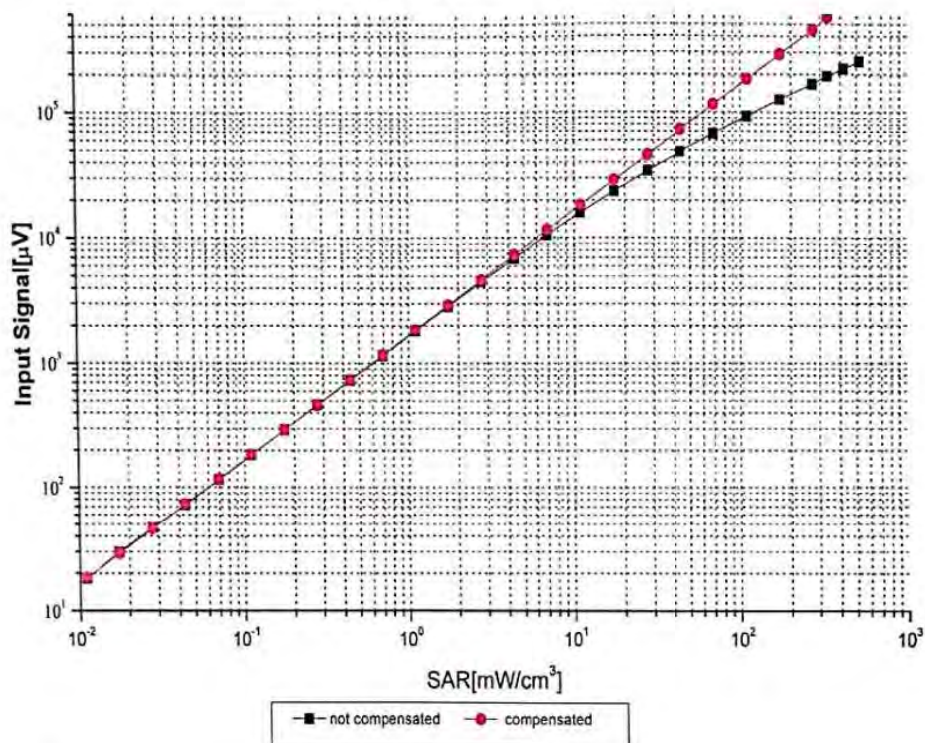
Certificate No:Z20-60218

Page 6 of 9



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: $\pm 0.9\%$ ($k=2$)



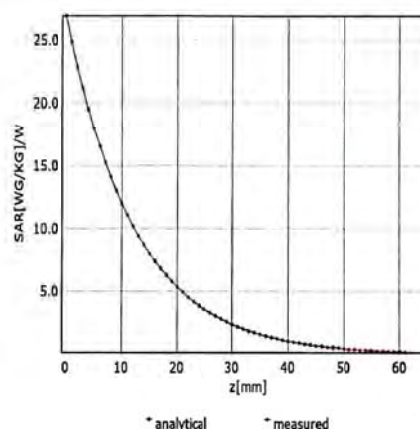
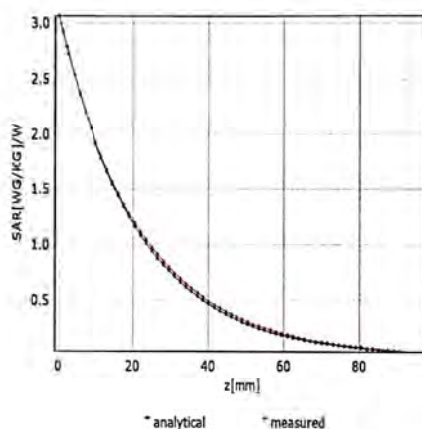
In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

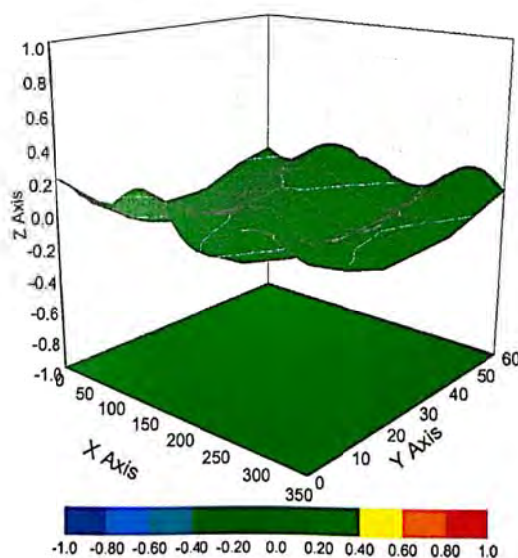
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF)

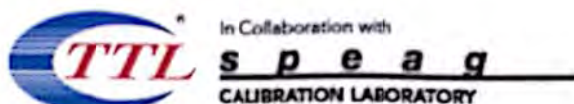
f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 3.2\%$ ($k=2$)



Add: No 51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

DASY/EASY – Parameters of Probe: EX3DV4 – SN:3677

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	115.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm



ANNEX E: D1900V2 Dipole Calibration Certificate



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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

Client **TA(Shanghai)**Certificate No: **Z20-60297****CALIBRATION CERTIFICATE**Object **D1900V2 - SN: 5d060**

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

Calibration date: **August 27, 2020**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG, No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG, No.Z20-60017)	Feb-21
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00516)	Feb-21

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

Issued: September 3, 2020

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

Certificate No: Z20-60297

Page 1 of 8



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

lossary:

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

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.1 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.5 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.2 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.5 $\pm$ 6 %	1.51 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.89 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.8 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg $\pm$ 18.7 % (k=2)

Certificate No: Z20-60297

Page 3 of 8



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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5Ω+ 6.58jΩ
Return Loss	- 23.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0Ω+ 6.72jΩ
Return Loss	- 22.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.061 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



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

DASY5 Validation Report for Head TSL

Date: 08.27.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060

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

Medium parameters used; $f = 1900$ MHz; $\sigma = 1.404$ S/m; $\epsilon_r = 41.12$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.14, 8.14, 8.14) @ 1900 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.3 V/m; Power Drift = -0.03 dB

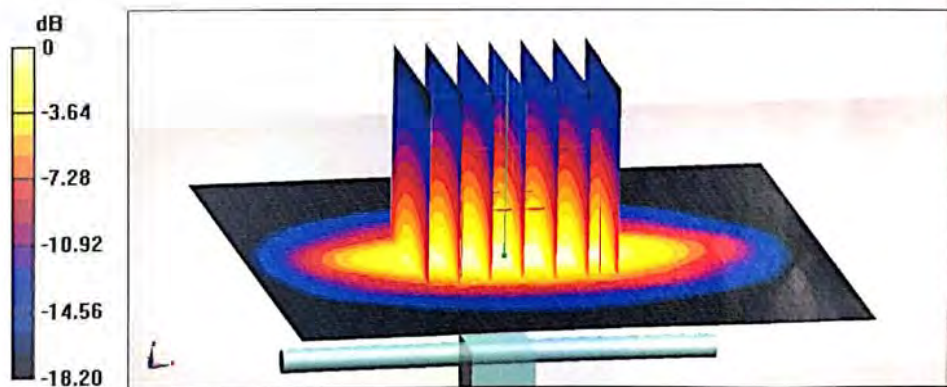
Peak SAR (extrapolated) = 19.0 W/kg

SAR(1 g) = 9.82 W/kg; SAR(10 g) = 5.04 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 51.9%

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Certificate No: Z20-60297

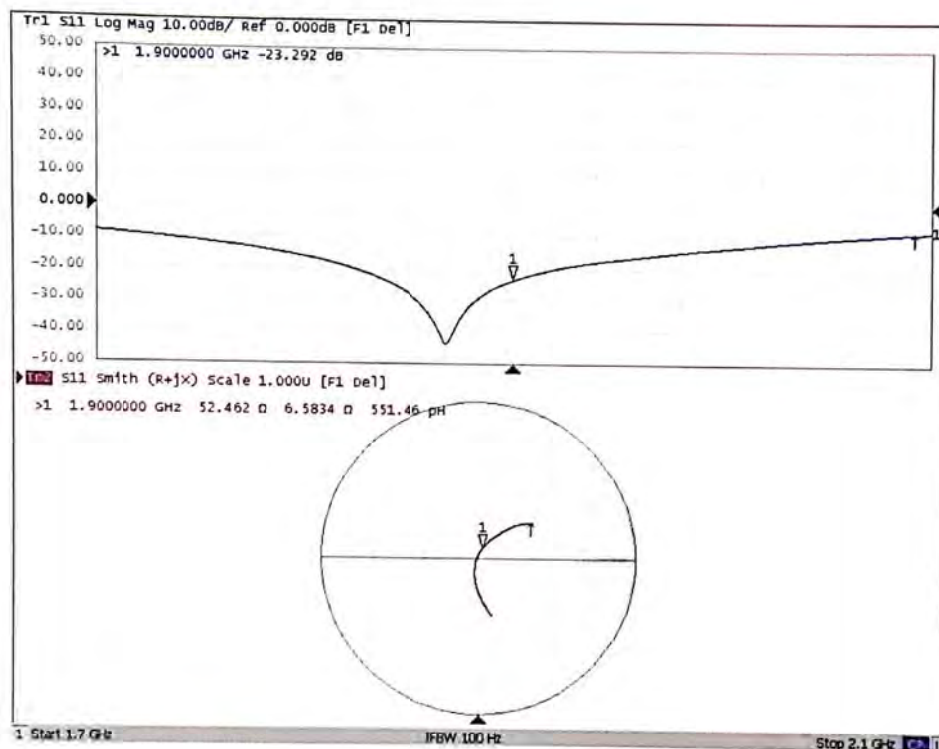
Page 5 of 8



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

Impedance Measurement Plot for Head TSL





In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyun 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

DASY5 Validation Report for Body TSL

Date: 08.27.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d060

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

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.508$ S/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.94, 7.94, 7.94) @ 1900 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.34 V/m; Power Drift = -0.03 dB

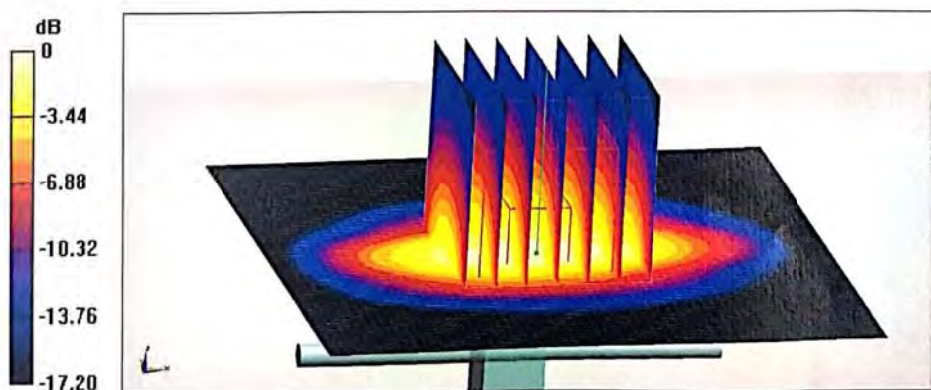
Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.89 W/kg; SAR(10 g) = 5.13 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 55.4%

Maximum value of SAR (measured) = 15.3 W/kg



0 dB = 15.3 W/kg = 11.85 dBW/kg

Certificate No: Z20-60297

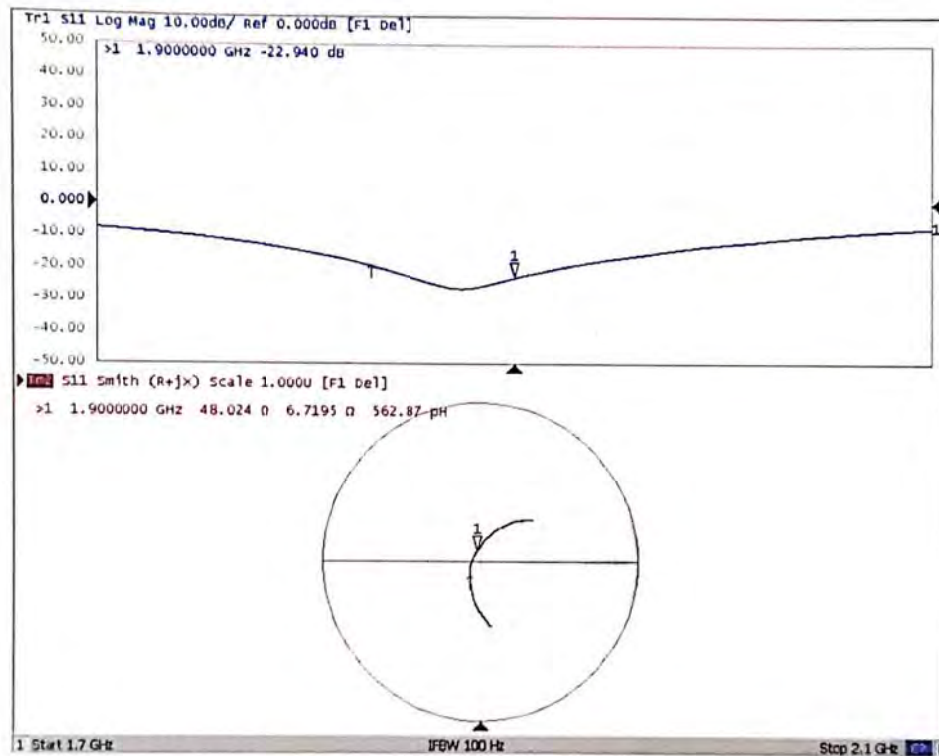
Page 7 of 8



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@chinantl.com http://www.chinantl.cn

Impedance Measurement Plot for Body TSL





ANNEX F: D2450V2 Dipole Calibration Certificate



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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

Client

TA(Shanghai)

Certificate No: Z20-60298

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 786

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

Calibration date: August 27, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG, No. EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG, No. Z20-60017)	Feb-21
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No. J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46107873	10-Feb-20 (CTTL, No. J20X00515)	Feb-21

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

Issued: September 2, 2020

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

Certificate No: Z20-60298

Page 1 of 8



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: ctt@chinattl.com http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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", September 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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.chirattl.cn

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.79 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.3 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.1 $\pm$ 6 %	1.94 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	52.4 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.3 W/kg $\pm$ 18.7 % (k=2)



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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5Ω+ 1.44 jΩ
Return Loss	- 26.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9Ω+ 5.09 jΩ
Return Loss	- 25.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.018 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



In Collaboration with
s p e a k
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

DASY5 Validation Report for Head TSL

Date: 08.27.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.787$ S/m; $v_a = 39.53$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.65, 7.65, 7.65) @ 2450 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P5I Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 102.7 V/m; Power Drift = -0.04 dB

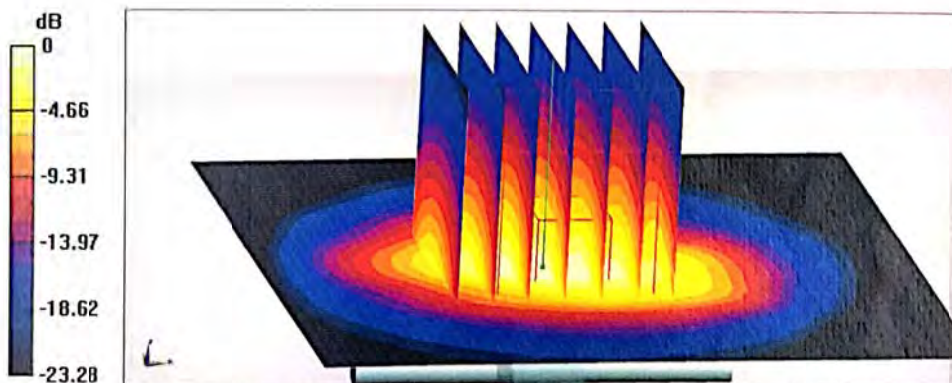
Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 5.99 W/kg

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 47%

Maximum value of SAR (measured) = 22.0 W/kg



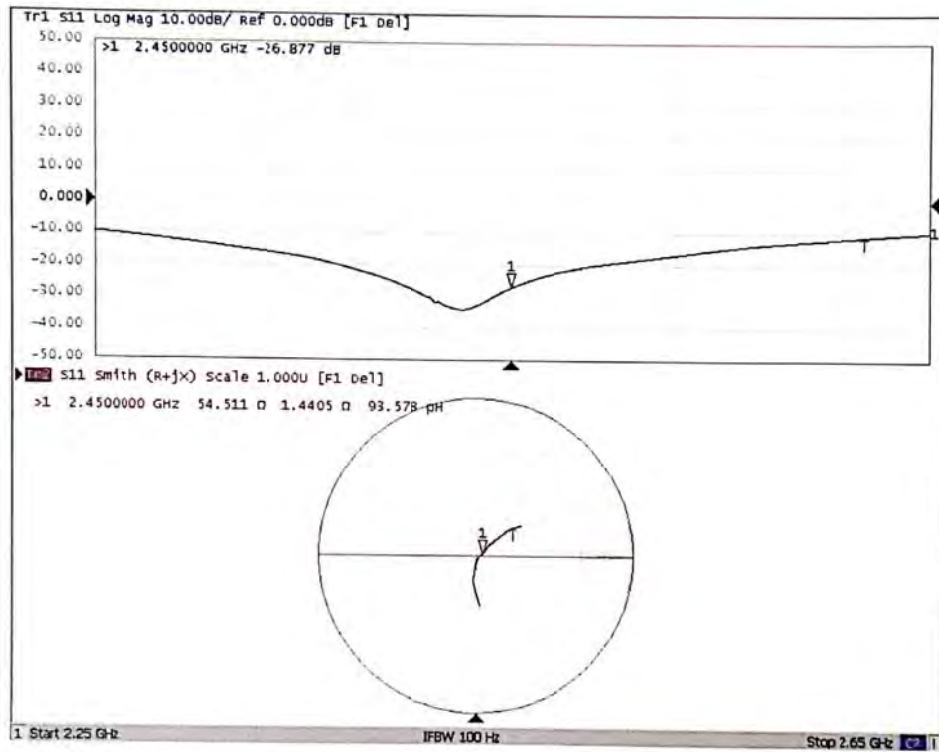
0 dB = 22.0 W/kg = 13.42 dBW/kg



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: ctt@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL





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: ttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Body TSL

Date: 08.27.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 786

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.938$ S/m; $\epsilon_r = 52.06$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.76, 7.76, 7.76) @ 2450 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 102.9 V/m; Power Drift = -0.03 dB

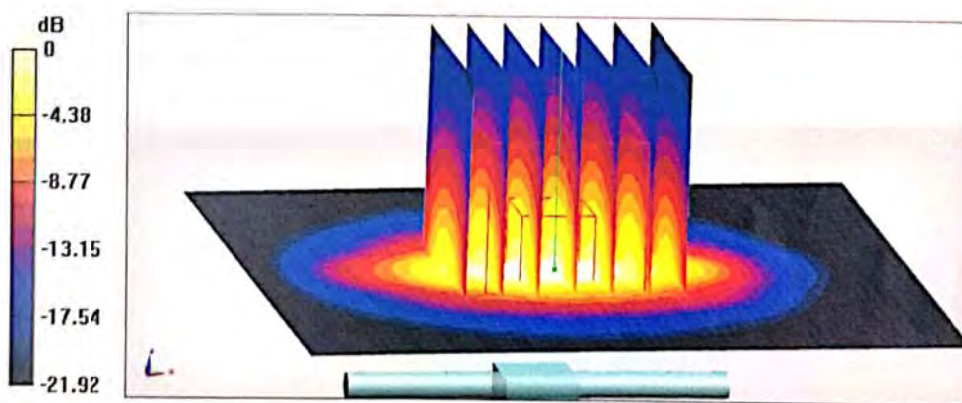
Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.08 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 49.9%

Maximum value of SAR (measured) = 21.8 W/kg



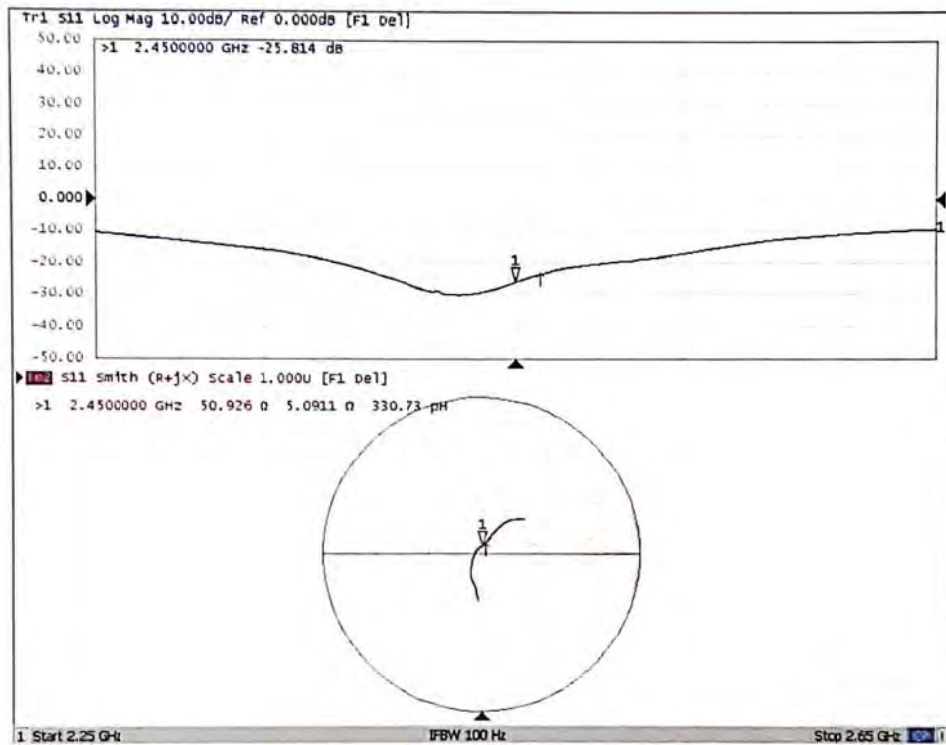
0 dB = 21.8 W/kg = 13.38 dBW/kg



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

Impedance Measurement Plot for Body TSL





ANNEX G: D2600V2 Dipole Calibration Certificate (May 2, 2018)



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

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

Client **TA(Shanghai)**Certificate No: **Z18-60094****CALIBRATION CERTIFICATE**Object **D2600V2 - SN: 1025**

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

Calibration date: **May 2, 2018**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG, No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1525	02-Oct-17(SPEAG, No.DAE4-1525_Oct17)	Oct-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Signature

Issued: May 5, 2018

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

Certificate No: Z18-60094

Page 1 of 8



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: +86-10-62304633-2304
E-mail: csl@chinattl.com http://www.chinattl.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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: ttl@chinattl.com http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	52.10.0.1446
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.1 $\pm$ 6 %	2.01 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.1 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.03 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.1 mW / g $\pm$ 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.1 $\pm$ 6 %	2.15 mho/m $\pm$ 6 %
Body TSL temperature change during test	<1.0 °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.6 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	54.5 mW / g $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.06 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.3 mW / g $\pm$ 18.7 % (k=2)



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

Appendix(Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.1Ω- 7.55jΩ
Return Loss	- 22.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6Ω- 7.06jΩ
Return Loss	- 21.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.014 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



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

DASY5 Validation Report for Head TSL

Date: 05.02.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025

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

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.014$ S/m; $\epsilon_r = 40.09$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.76, 7.76, 7.76); Calibrated: 9/12/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

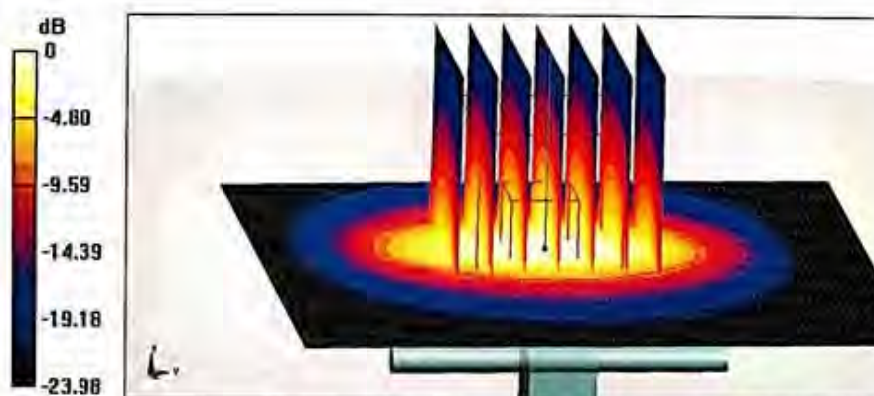
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.50 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 29.6 W/kg

SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.03 W/kg

Maximum value of SAR (measured) = 23.5 W/kg



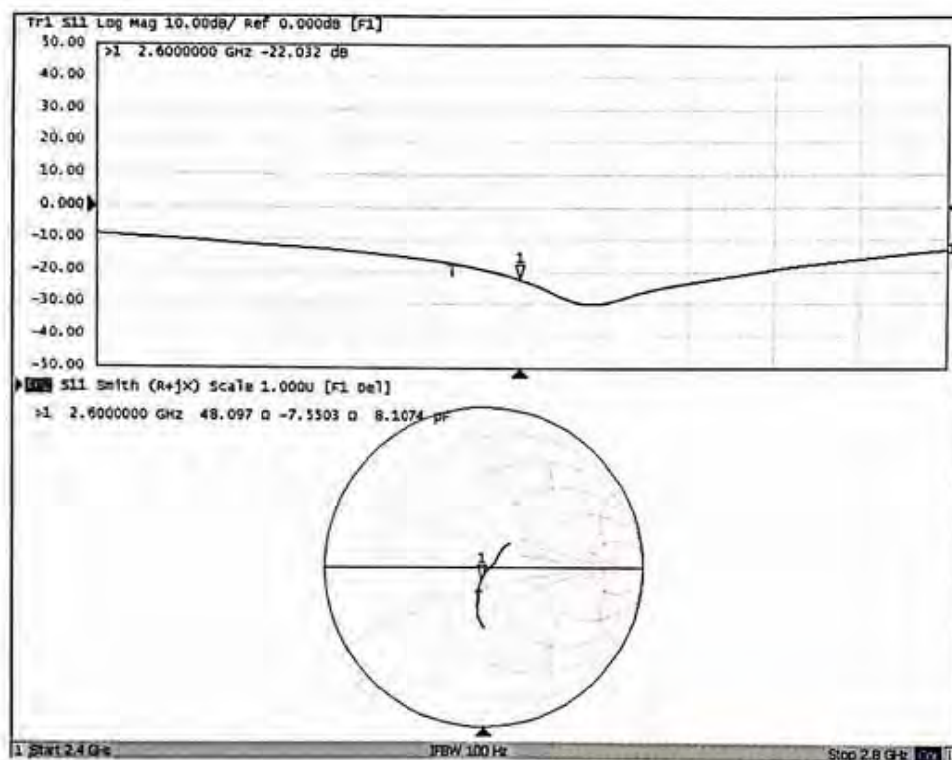
0 dB = 23.5 W/kg = 13.71 dBW/kg



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

Impedance Measurement Plot for Head TSL





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

DASY5 Validation Report for Body TSL

Date: 05.02.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025

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

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.146$ S/m; $\epsilon_r = 52.09$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.84, 7.84, 7.84); Calibrated: 9/12/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1525; Calibrated: 10/2/2017
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.10 (0); SEMCAD X Version 14.6.10 (7417)

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

Reference Value = 83.79 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 29.7 W/kg

SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.06 W/kg

Maximum value of SAR (measured) = 23.6 W/kg



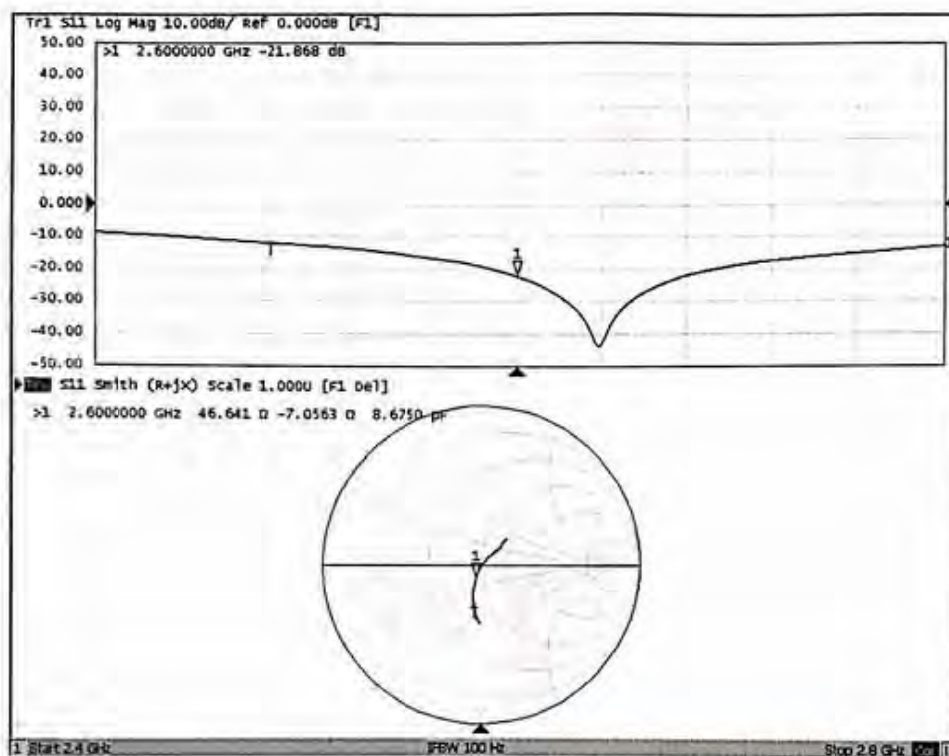
0 dB = 23.6 W/kg = 13.73 dBW/kg



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

Impedance Measurement Plot for Body TSL

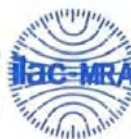




ANNEX H: D2600V2 Dipole Calibration Certificate (April 23, 2021)



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, Chi
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttf@chinattl.com http://www.chinattl.cn

Client TA(Shanghai)

Certificate No: Z21-60156

CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1025

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

Calibration date: April 23, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No J20X02965)	May-21
Reference Probe EX3DV4	SN 3517	27-Jan-21(SPEAG, No EX3-3617_Jan21)	Jan-22
DAE4	SN 777	06-Jan-21(CTTL-SPEAG, No Z21-60003)	Jan-22
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No J21X00593)	Jan-22
Network Analyzer E5071C	MY46110673	14-Jan-21 (CTTL, No J21X00232)	Jan-22

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

Issued: April 29, 2021

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

Certificate No: Z21-60156

Page 1 of 6



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinatll.com http://www.chinatll.cn

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cml@chinattl.com http://www.chinattl.cn

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.9 $\pm$ 6 %	1.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.1 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg $\pm$ 18.7 % (k=2)



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei 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

Appendix(Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.1Q- 7.19iQ
Return Loss	- 22.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.055 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei 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

DASY5 Validation Report for Head TSL

Date: 04.23.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025

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

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.944$ S/m; $\epsilon_r = 39.94$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.55, 7.55, 7.55) @ 2600 MHz; Calibrated: 2021-01-27
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn777; Calibrated: 2021-01-08
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 101.1 V/m; Power Drift = -0.09 dB

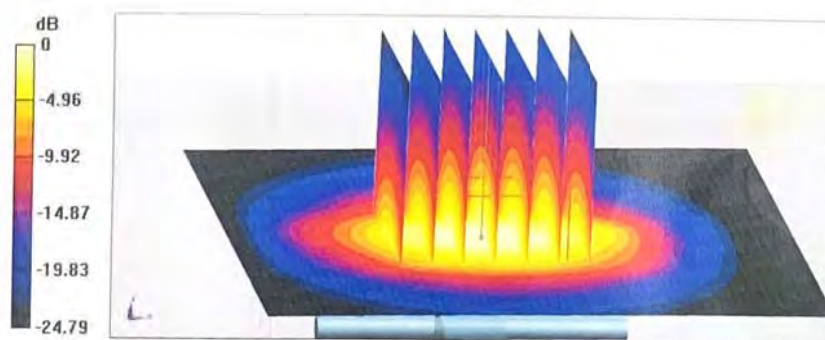
Peak SAR (extrapolated) = 31.5 W/kg

SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.1 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 44%

Maximum value of SAR (measured) = 24.4 W/kg



0 dB = 24.4 W/kg = 13.87 dBW/kg

Certificate No: Z21-60156

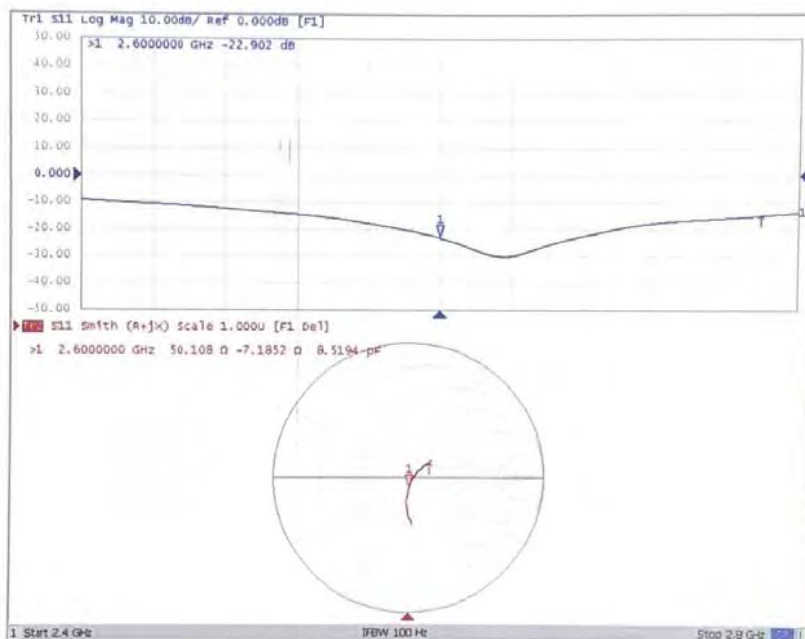
Page 5 of 6



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei 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

Impedance Measurement Plot for Head TSL



ANNEX I: DAE4 Calibration Certificate (October 23, 2019)

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



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

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

Accreditation No.: SCS 0108

Client **TA-SH (Auden)**

Certificate No: **DAE4-1317_Oct19**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1317**

Calibration procedure(s) **QA CAL-06.v29**
 Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **October 23, 2019**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25949)	Sep-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-19 (in house check)	In house check: Jan-20
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-19 (in house check)	In house check: Jan-20

Calibrated by:	Name Dominique Steffen	Function Laboratory Technician	Signature 
Approved by:	Sven Kühn	Deputy Manager	

Issued: October 23, 2019

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

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



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

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

Accreditation No.: **SCS 0108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

**DC Voltage Measurement**

A/D - Converter Resolution nominal

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

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

Calibration Factors	X	Y	Z
High Range	403.804 $\pm$ 0.02% (k=2)	404.568 $\pm$ 0.02% (k=2)	403.927 $\pm$ 0.02% (k=2)
Low Range	3.97954 $\pm$ 1.50% (k=2)	3.99058 $\pm$ 1.50% (k=2)	3.96919 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	332.5 ° $\pm$ 1 °
---	-------------------

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	199993.97	-1.61	-0.00
Channel X + Input	20003.68	1.67	0.01
Channel X - Input	-19999.35	1.95	-0.01
Channel Y + Input	199994.72	-0.94	-0.00
Channel Y + Input	20001.93	-0.03	-0.00
Channel Y - Input	-19999.69	1.70	-0.01
Channel Z + Input	199995.14	-0.83	-0.00
Channel Z + Input	20001.23	-0.62	-0.00
Channel Z - Input	-20001.59	-0.08	0.00

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.92	-0.47	-0.02
Channel X + Input	202.45	0.76	0.37
Channel X - Input	-197.45	0.81	-0.41
Channel Y + Input	2000.30	-0.94	-0.05
Channel Y + Input	201.24	-0.37	-0.18
Channel Y - Input	-198.12	0.14	-0.07
Channel Z + Input	2000.71	-0.42	-0.02
Channel Z + Input	200.46	-1.06	-0.53
Channel Z - Input	-198.55	-0.18	0.09

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	12.11	9.92
	- 200	-9.05	-11.12
Channel Y	200	11.30	11.37
	- 200	-12.29	-12.77
Channel Z	200	1.70	1.84
	- 200	-3.81	-3.72

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.67	-4.44
Channel Y	200	8.45	-	3.12
Channel Z	200	10.32	5.39	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15754	15950
Channel Y	16502	16801
Channel Z	16087	13971

5. Input Offset Measurement

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

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.94	-0.24	2.94	0.49
Channel Y	0.26	-1.03	1.33	0.51
Channel Z	-1.40	-2.82	0.02	0.54

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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



ANNEX L:DAE4 Calibration Certificate (February 23, 2021)

In Collaboration with
s p e a g
CALIBRATION LABORATORY中国认可
国际互认
校准
CALIBRATION
CNAS L0570Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)Client : **TA(Shanghai)**Certificate No: **Z21-60041****CALIBRATION CERTIFICATE**Object **DAE4 - SN: 1317**Calibration Procedure(s) **FF-Z11-002-01**
Calibration Procedure for the Data Acquisition Electronics (DAEx)Calibration date: **February 23, 2021**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
-------------------	------	--	-----------------------

Process Calibrator 753	1971018	16-Jun-20 (CTTL, No.J20X04342)	Jun-21
------------------------	---------	--------------------------------	--------

	Name	Function
Calibrated by:	Yu Zongying	SAR Test Engineer
Reviewed by:	Lin Hao	SAR Test Engineer
Approved by:	Qi Dianyuan	SAR Project Leader

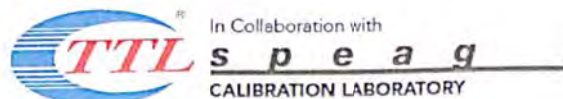
Signature

Issued: February 25, 2021

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

Certificate No: Z21-60041

Page 1 of 3



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

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

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.



In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

Calibration Factors	X	Y	Z
High Range	403.746 $\pm$ 0.15% (k=2)	404.512 $\pm$ 0.15% (k=2)	403.872 $\pm$ 0.15% (k=2)
Low Range	3.97990 $\pm$ 0.7% (k=2)	3.99299 $\pm$ 0.7% (k=2)	3.96969 $\pm$ 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	333° $\pm$ 1 °
---	----------------



ANNEXJ: The EUT Appearance

The EUT Appearance are submitted separately.



ANNEX K: Test Setup Photos

The Test Setup Photos are submitted separately.



ANNEX L: Product Change Description

The Product Change Description are submitted separately.