SAR TEST REPORT

No. I15N01043-SAR

For

Tinitell AB

GSM Wristphone

Model Name: TT1

Marketing Name: Tinitell TT1

With

Hardware Version: LM03_MBV20

Software Version: MAUI.11C.W14.18.SP4.V16.F4

FCC ID: 2AFVQ-TT1A

Issued Date: 2015-11-9

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

Test Laboratory:

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I15N01043-SAR	Rev.0	2015-11-9	Initial creation of test report

TABLE OF CONTENT

1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shenzhen)
Address:	TCL International E City No.1001 Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province P.R.China

1.2 Testing Environment

Temperature:	18°C~25 °C,
Relative humidity:	30%~ 70%
Ground system resistance:	< 0.5 Ω
Ambient noise & Reflection:	< 0.012 W/kg

1.3 Project Data

Project Leader:	Cao Junfei
Test Engineer:	He Guanyi
Testing Start Date:	October 28, 2015
Testing End Date:	October 29, 2015

1.4 Signature

He Guanyi

(Prepared this test report)

Cao Junfei

(Reviewed this test report)

Zhang Bojun

Director of the laboratory

(Approved this test report)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Tinitell AB GSM wrist phoneTT1 are as follows:

Table 2.1:Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g (W/Kg)	Equipment Class
Front to face (Separation Distance 10mm)	GSM 850	0.08	PCE
	PCS 1900	0.28	

Table 2.2:Highest Reported SAR (10g)

Exposure Configuration	Technology Band	Highest Reported SAR 10g (W/Kg)	Equipment Class
Body (Separation Distance 0mm)	GSM 850	1.16	PCE
	PCS 1900	1.52	

The SAR values found for the Wrist Phone are below the maximum recommended levels of 1.6 W/kg in Head and trunk over any 1 gram of tissue and 4.0 W/kg in Limbs over any 10 gram of tissue according to the ANSI C95.1-1999.

For body worn operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 10 mm for held to head and 0 mm to wrist. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output.

The measurement together with the test system set-up is described in annex C of this test report. A detailed description of the equipment under test can be found in chapter 4 of this test report.

The highest reported SAR value is obtained at the case of **(Table 2.1),** and the values are**: 0.28 W/kg (1g).** The highest reported SAR value is obtained at the case of **(Table 2.2),** and the values are**: 1.52 W/kg (10g).**

Table 2.3: The sum of reported SAR values for main antenna and Bluetooth(1 g)

	Position	**Main antenna(1 g)**	**BT*(1 g)**	**Sum(1 g)**
Highest reported SAR value for Front to face	**Front**	0.28	0.02	0.30

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 2.4: The sum of reported SAR values for main antenna and Bluetooth(10 g)

	Position	**Main antenna(10 g)**	**BT*(10 g)**	**Sum(10 g)**
Highest reported SAR value for Body	**Rear**	1.52	0.02	1.54

BT* - Estimated SAR for Bluetooth (see the table 13.3)

According to the above tables, the highest sum of reported SAR values are **0.30 W/kg (1g)** and. **1.54 W/kg (10g)**The detail for simultaneous transmission consideration is described in chapter 13.

3 Client Information

3.1 Applicant Information

Company Name:	Tinitell AB
Address /Post:	Hollandarsgatan 20, 11160 Stockholm, Sweden
Contact:	Mario Sanchez
Email:	mario@tinitell.com
Telephone:	+46762319766
Fax:	/

3.2 Manufacturer Information

Company Name:	Tinitell AB
Address /Post:	Hollandarsgatan 20, 11160 Stockholm, Sweden
Contact:	Mario Sanchez
Email:	mario@tinitell.com
Telephone:	+46762319766
Fax:	/

4 Equipment Under Test (EUT) and Ancillary Equipment (AE)

4.1 About EUT

Description:	GSM wrist phone
Model Name:	TT1
Marketing Name:	Tinitell TT1
Operating mode(s):	GSM 850/900/1800/1900
Tested Tx Frequency:	825 – 848.8 MHz (GSM 850)
	1850.2 – 1910 MHz (GSM 1900)
GPRS&EGPRS Multislot Class:	12
Release Version:	GSM: R4
	GPRS: R99
Test device Production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna

4.2 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	354244070000001	LM03_MBV20	MAUI.11C.W14.18.SP4.V16.F4

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

Note: It is performed to test SAR with the EUT1 and conducted power with the EUT 2

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
/	/	/	/	/

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

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

ANSI C95.1–1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

It specifies the maximum exposure limit of **1.6 W/kg** in Head and trunk over any 1 gram of tissue and **4.0 W/kg** in Limbs over any 10 gram of tissue the appropriate averaging time. portable devices being used within 20 cm of the user in the uncontrolled environment.

5.2 Applicable Measurement Standards

IEEE 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Experimental Techniques.

KDB 447498 D01: General RF Exposure Guidance v05r02: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB 648474 D04 Handset SAR v01r02: SAR Evaluation Considerations for Wireless Handsets.

KDB 248227 D01 802.11 Wi-Fi SAR v02r01: SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters.

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB 865664 D02 RF Exposure Reporting v01r01: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 Tissue Simulating Liquids

7.1 Targets for tissue simulating liquid

Table 7.1: Targets for tissue simulating liquid

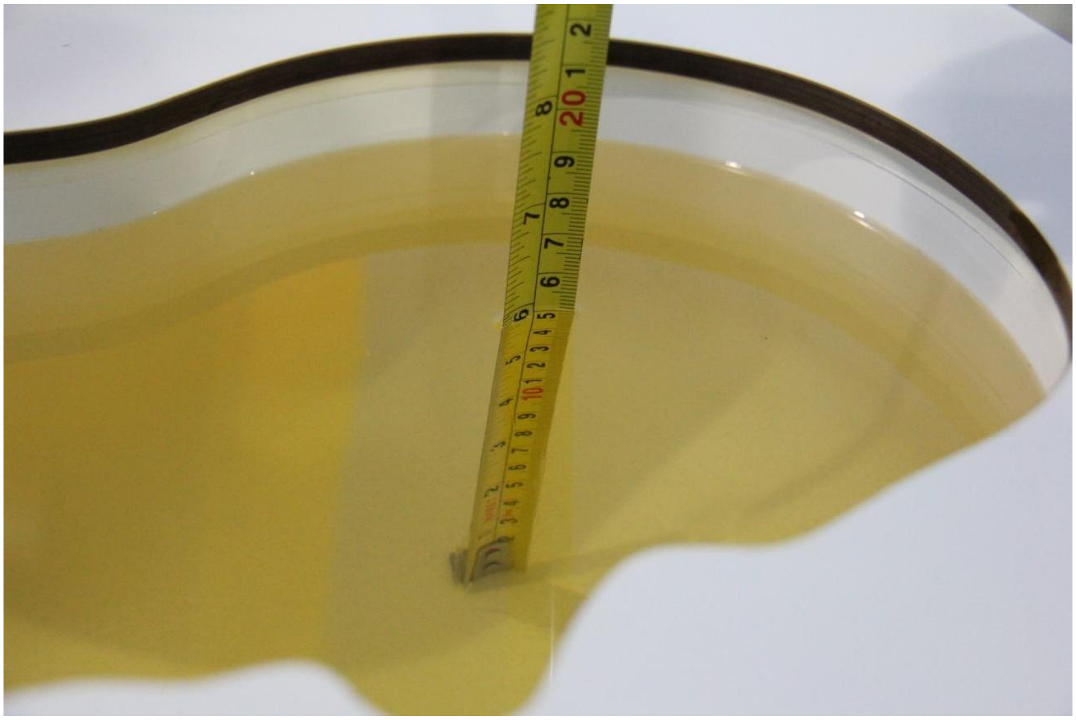
Frequency (MHz)	Liquid Type	Permittivity (ε)	± 5% Range	Conductivity (σ)	± 5% Range
835	Head	41.5	39.4～43.6	0.90	0.86～0.95
835	Body	55.2	52.4～58.0	0.97	0.92～1.02
1900	Head	40.0	38.0～42.0	1.40	1.33～1.47
1900	Body	53.3	50.6～56.0	1.52	1.44～1.60

7.2 Dielectric Performance

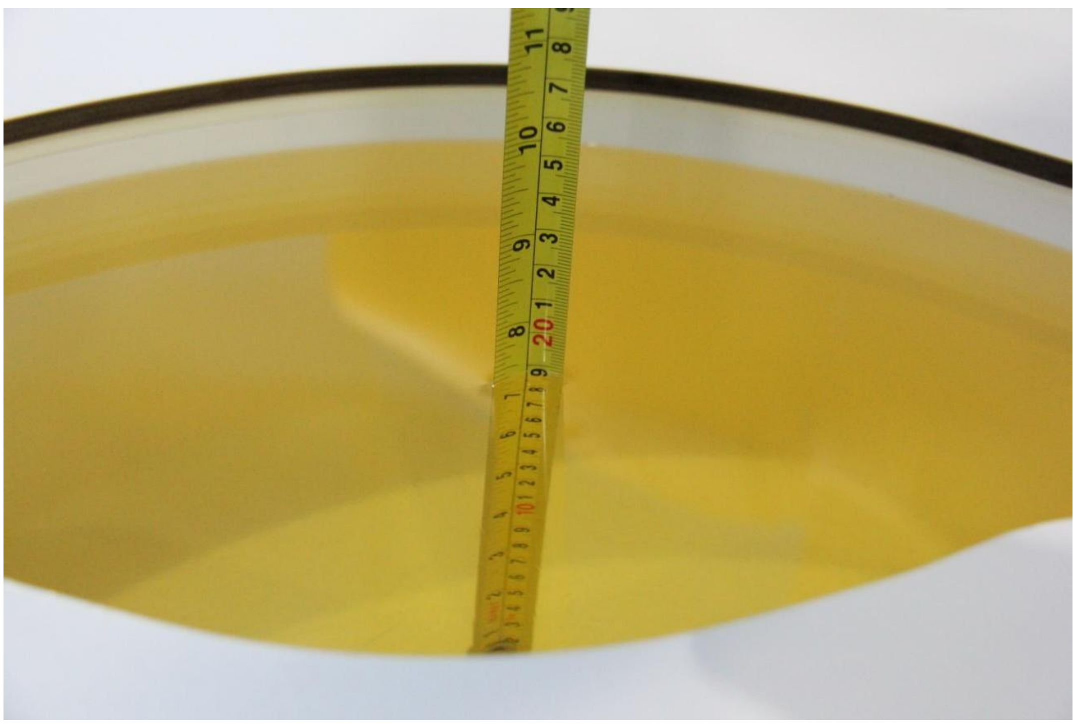
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	**Type**	**Frequency**	**Permittivity ε**	**Drift (%)**	**Conductivity σ (S/m)**	**Drift (%)**
2015-10-29	Head	835 MHz	41.32	-0.43	0.93	3.33
2015-10-29	Body	835 MHz	53.50	-3.08	0.97	0.00
2015-10-28	Head	1900 MHz	38.84	-2.90	1.42	1.43
2015-10-28	Body	1900 MHz	50.79	-4.71	1.54	1.32

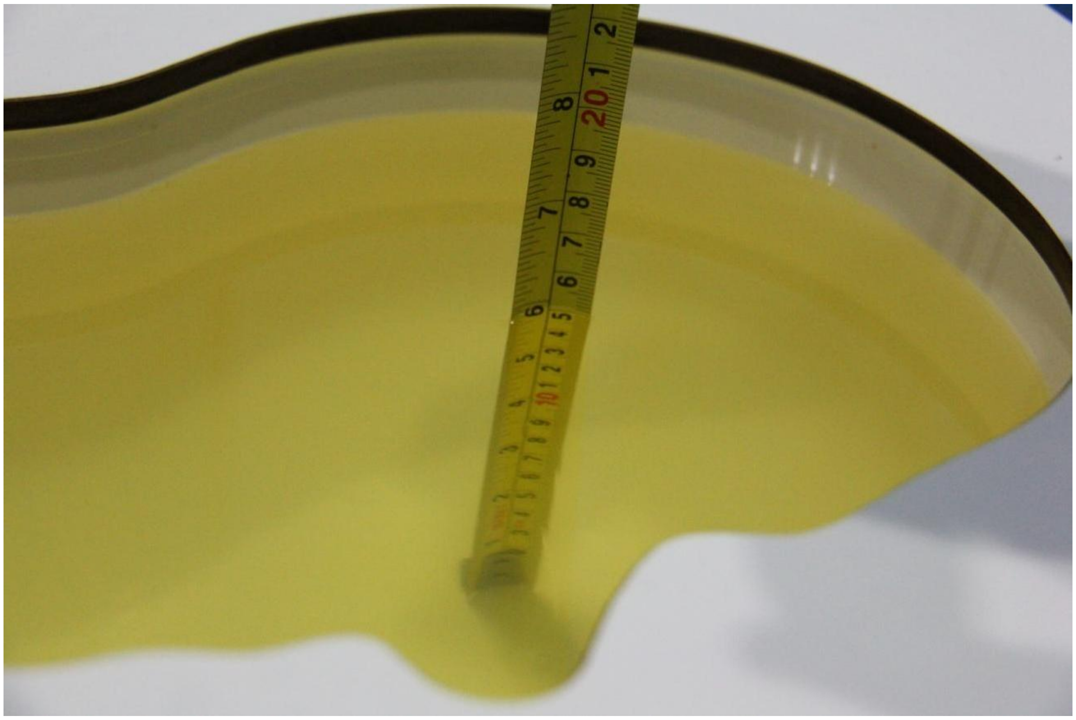
Note: The liquid temperature is 22.0 ^{o}C



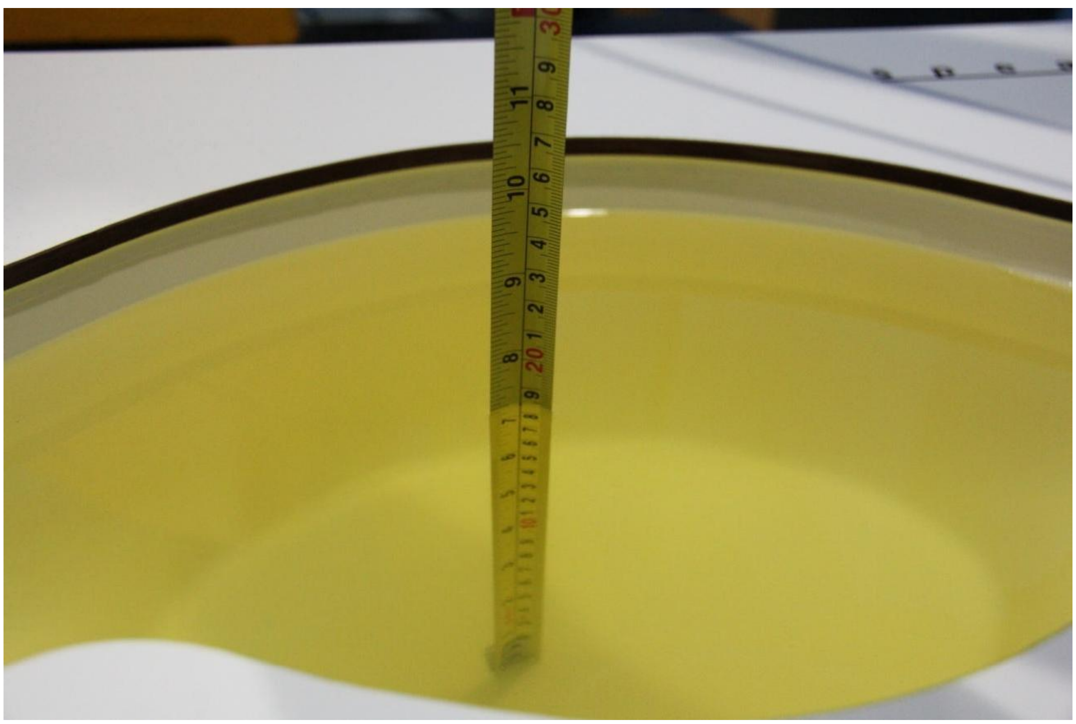
Picture 7-1: Liquid depth in the Head Phantom (835 MHz)



Picture 7-2: Liquid depth in the Flat Phantom (835 MHz)



Picture 7-3: Liquid depth in the Head Phantom (1900 MHz)

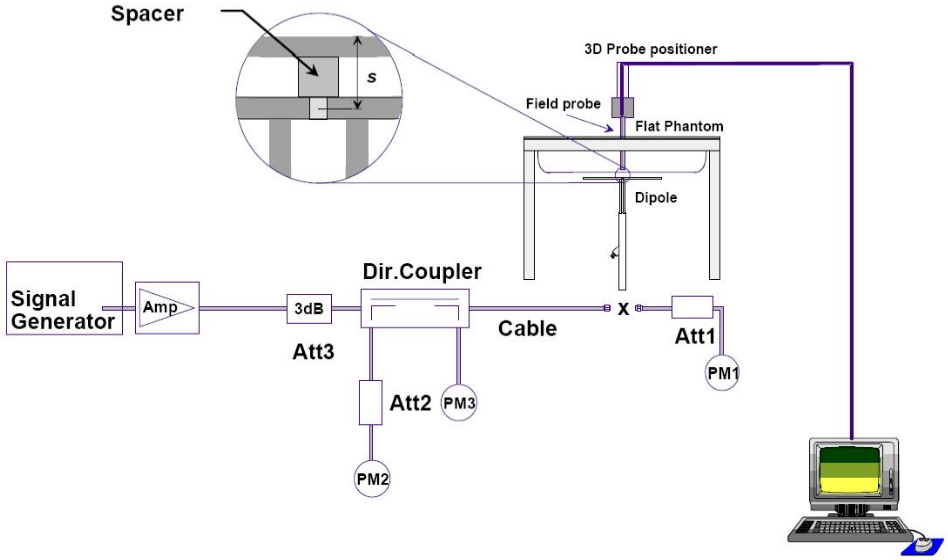


Picture 7-4 Liquid depth in the Flat Phantom (1900MHz)

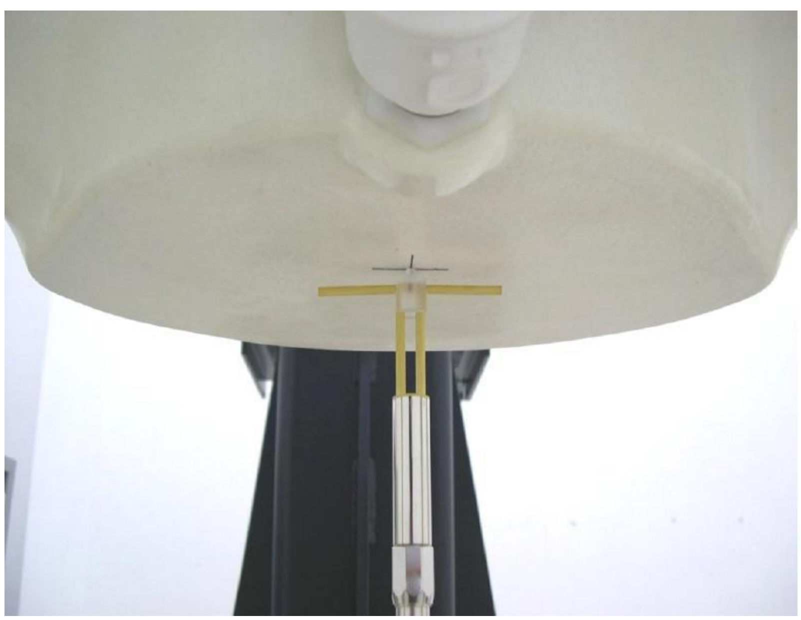
8 System verification

8.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device.

The system verification results are required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR. The details are presented in annex B.

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2015-10-29	835 MHz	6.2	9.48	6.2	9.76	0.00%	2.95%
2015-10-28	1900 MHz	20.9	40.5	20.52	39.72	-1.82%	-1.93%

Table 8.2: System Verification of Body

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value (W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2015-10-29	835 MHz	6.36	9.53	6.40	9.80	0.63%	2.83%
2015-10-28	1900 MHz	21.5	41.1	21.08	40.40	-1.95%	-1.70%

9 Measurement Procedures

9.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in picture 9.1.

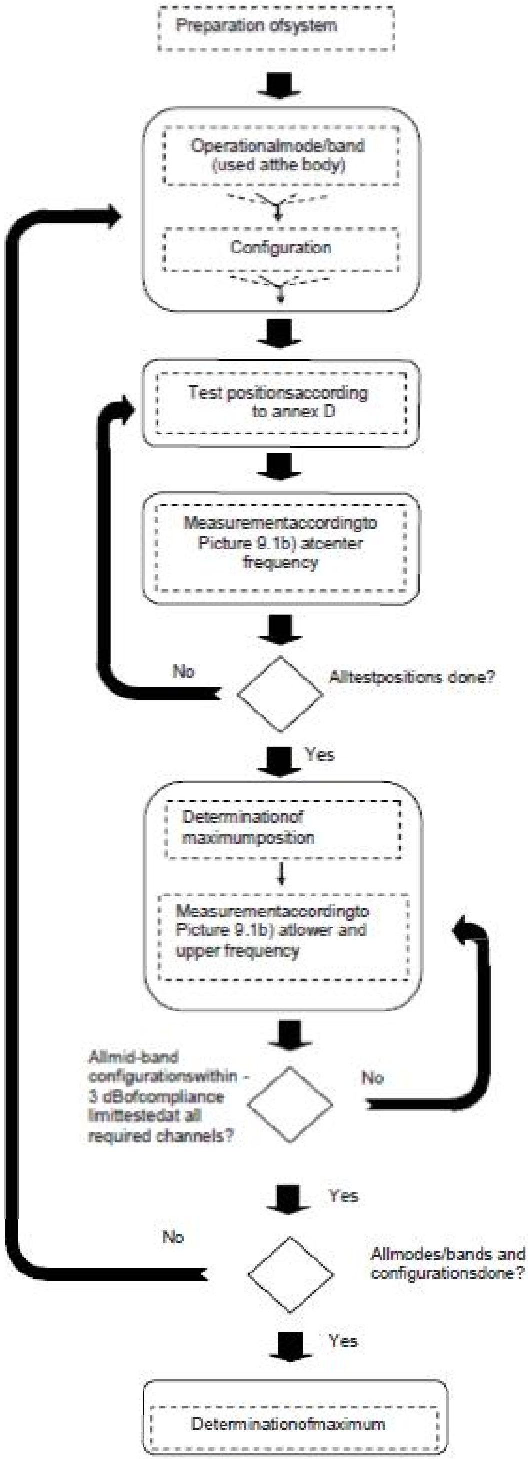
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

a) all device positions (as described in annex D),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

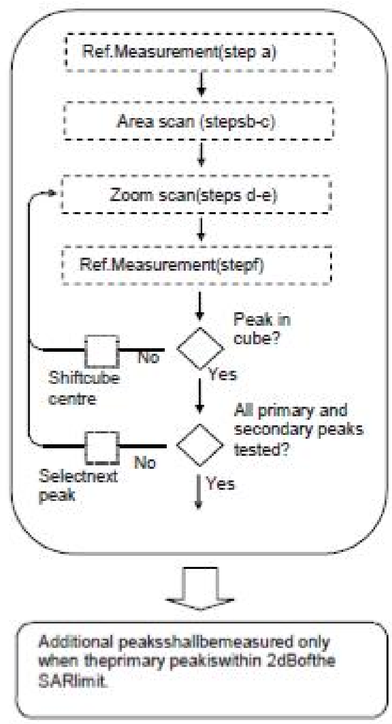
If more than three frequencies need to be tested according to 11.1 (i.e., N_c > 3), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

Step 3: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.



Picture 9.1a–Teststobeperformed



Picture 9.1b–Generalprocedure

Picture 9.1 Block diagram of the tests to be performed

9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2013. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the <u>*reported*</u> SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

9.3 Bluetooth Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of BT transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

9.4 Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 14.2 to Table 14.25 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01 v05, when the implementation is based the specific polynomial fit algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

10.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz) and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.

Both algorithms are implemented in DASY software.

11 Conducted Output Power

11.1 Manufacturing tolerance

Table 11.1: GSM Speech

GSM 850			
Channel	Channel 251	Channel 190	Channel 128
Target (dBm)	32	32	32
Tolerance ±(dB)	1	1	1
GSM 1900			
Channel	Channel 810	Channel 661	Channel 512
Target (dBm)	30	30	30
Tolerance ±(dB)	1	1	1

Table 11.2: GPRS and EGPRS

GSM 850 GPRS (GMSK)				
Channel		**251**	**190**	**128**
1 Txslot	Target (dBm)	32	32	32
	Tolerance ±(dB)	1	1	1
2 Txslots	Target (dBm)	31	31	31
	Tolerance ±(dB)	1	1	1
3Txslots	Target (dBm)	30	30	30
	Tolerance ±(dB)	1	1	1
4 Txslots	Target (dBm)	29	29	29
	Tolerance ±(dB)	1	1	1
GSM 1900 GPRS (GMSK)				
Channel		**810**	**661**	**512**
1 Txslot	Target (dBm)	30	30	30
	Tolerance ±(dB)	1	1	1
2 Txslots	Target (dBm)	29	29	29
	Tolerance ±(dB)	1	1	1
3Txslots	Target (dBm)	27	27	27
	Tolerance ±(dB)	1	1	1
4 Txslots	Target (dBm)	26	26	26
	Tolerance ±(dB)	1	1	1

Table 11.3: Bluetooth

Mode	Frequency	Target (dBm)	Tolerance ±(dB)
2.4G	2402	-0.5	0.5
	2441	-3	0.5
	2472	-2	0.5
2.4G BLE	2402	-1	0.5
	2441	-3	0.5
	2472	-2	0.5

Remark: 2.4G WiFi only receive the SSID signal, no transmit and no communication with AP.

11.2 GSM Measurement result

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (E5515C) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Table 11.4: The conducted power measurement results for GSM850/1900

GSM 850MHz	Conducted Power (dBm)		
	Channel 251(848.8MHz)	Channel 190(836.6MHz)	Channel 128(824.2MHz)
	32.81	32.83	32.85
GSM 1900MHz	Conducted Power (dBm)		
	Channel 810(1909.8MHz)	Channel 661(1880MHz)	Channel 512(1850.2MHz)
	30.21	30.2	30.19

Table 11.5: The conducted power measurement results for GPRS

GSM850		MeasuredPower(dBm)			calculation	AveragedPower(dBm)		
		251	**190**	**128**		**251**	**190**	**128**
GPRS (GMSK)	1Txslot	32.63	32.69	32.74	-9.03dB	23.60	23.66	23.71
	2Txslots	31.93	31.95	31.93	-6.02dB	25.91	25.93	25.91
	3Txslots	30.32	30.26	30.19	-4.26dB	26.06	26.00	25.93
	4Txslots	29.55	29.49	29.41	-3.01dB	**26.54**	**26.48**	**26.40**
PCS1900		MeasuredPower(dBm)			calculation	AveragedPower(dBm)		
		810	**661**	**512**		**810**	**661**	**512**
GPRS (GMSK)	1Txslot	29.53	29.51	29.51	-9.03dB	20.50	20.48	20.48
	2Txslots	28.92	29.01	29.06	-6.02dB	22.90	22.99	23.04
	3Txslots	27.45	27.80	27.63	-4.26dB	23.19	23.54	23.37
	4Txslots	26.67	26.92	26.83	-3.01dB	**23.66**	**23.91**	**23.82**

NOTES:

1) To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 4Txslots for GSM 850 and GSM 1900.

Table 11.6: The average conducted power for BT is as following:

	Power (dBm)		
	2402MHz	2441MHz	2480MHz
DH1	-0.91	-3.04	-2.05
2DH1	-2.27	-4.41	-3.41
3DH1	-1.90	-4.07	-3.11

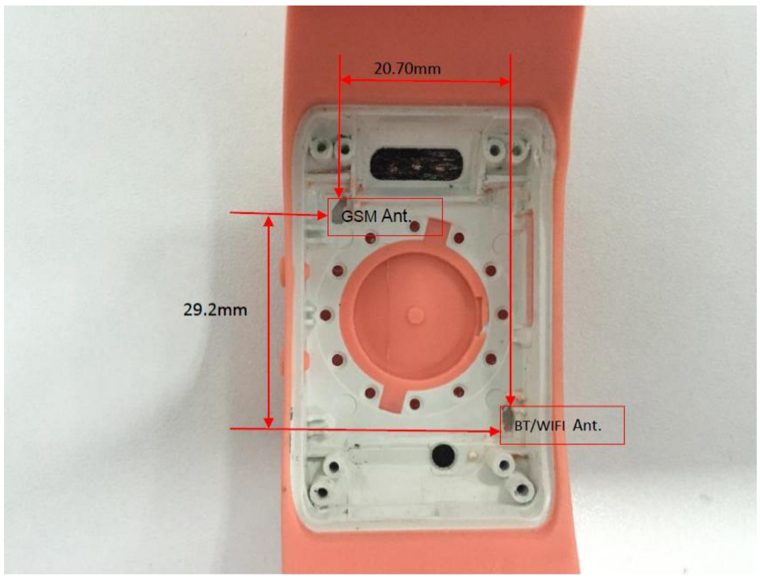
12 Simultaneous TX SAR Considerations

12.1 Introduction

The following procedures adopted from "FCC SAR Considerations for Cell Phones with Multiple Transmitters" are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

12.2 Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3 Standalone SAR Test Exclusion Considerations

Standalone 1-g or body and 10-g extremity SAR head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

The 1-g SAR and 10-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(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

Table 12.1: Standalone SAR test exclusion considerations(1-g SAR)

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Front to face	19.2	0	1.00	Yes

Table 12.2:Standalone SAR test exclusion considerations(10-g SAR)

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Body	24	0	1.00	Yes

Remark: 2.4G WiFi only receive the SSID signal, no transmit and no communication with AP.

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and Bluetooth(1 g)

	Position	Main antenna(1 g)	BT*(1 g)	Sum(1 g)
Highest reported SAR value for Front to face	**Front**	0.28	0.02	0.30

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.2:The sum of reported SAR values for main antenna and Bluetooth(10 g)

	Position	Main antenna(10 g)	BT*(10 g)	Sum(10 g)
Highest reported SAR value for Body	**Rear**	1.52	0.02	1.54

BT* - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Position	F (GHz)	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
			dBm	mW	
Front to face	2.402	10	0.00	1.00	0.02 (1 g)
Body	2.402	5	0.00	1.00	0.02 (10 g)

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR and 18.75 for 10-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:
According to the above tables, the sum of reported SAR values is < 1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 10mm and just applied to the condition of body worn accessory.
It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or > 1.2W/kg.
The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target} - P_{Measured})/10}$$

Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	Duty Cycle
Speech for GSM850/1900	1:8.3
GPRS&EGPRS for GSM850	1:2
GPRS&EGPRS for GSM1900	1:2

14.1 SAR results for Fast SAR

Table 14.2: SAR Values (GSM 850 MHz Band - Front to face)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
848.8	251	Speech	Front	10	/	32.81	33	0.043	**0.04**	0.074	**0.08**	-0.03
836.6	190	Speech	Front	10	/	32.83	33	0.037	**0.04**	0.057	**0.06**	0.02
824.2	128	Speech	Front	10	/	32.85	33	0.034	**0.04**	0.051	**0.05**	0.05

Table 14.3: SAR Values (GSM 850 MHz Band-Body)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
848.8	251	GPRS	Rear	0	/	29.55	30	1.05	**1.16**	1.67	**1.85**	-0.02
836.6	190	GPRS	Rear	0	/	29.49	30	0.805	**0.91**	1.28	**1.44**	-0.13
824.2	128	GPRS	Rear	0	/	29.41	30	0.651	**0.75**	1.03	**1.18**	0.08

Table 14.4: SAR Values (GSM 1900 MHz Band - Front to face)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
1909.8	810	Speech	Front	10	/	30.21	31	0.107	**0.13**	0.185	**0.22**	0.03
1880	661	Speech	Front	10	/	30.20	31	0.137	**0.16**	0.237	**0.28**	0.05
1850.2	512	Speech	Front	10	/	30.19	31	0.127	**0.15**	0.221	**0.27**	0.10

Table 14.5: SAR Values (GSM 1900 MHz Band-Body)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
1909.8	810	GPRS	Rear	0	/	26.67	27	0.982	**1.06**	1.84	**1.99**	-0.01
1880	661	GPRS	Rear	0	/	26.92	27	1.34	**1.36**	2.52	**2.57**	0.07
1850.2	512	GPRS	Rear	0	/	26.83	27	1.46	**1.52**	2.72	**2.83**	-0.03

14.2 SAR results for Standard procedure

There is zoom scan measurement to be added for the highest measured SAR in each exposure configuration/band.

Table 14.6: SAR Values (GSM 850 MHz Band - Front to face)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
848.8	251	Speech	Front	10	Fig.1	32.81	33	0.043	**0.04**	0.074	**0.08**	-0.03

Table 14.7: SAR Values (GSM 850 MHz Band-Body)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
848.8	251	GPRS	Rear	0	Fig.2	29.55	30	1.05	**1.16**	1.67	**1.85**	-0.02
836.6	190	GPRS	Rear	0	Fig.3	29.49	30	0.805	**0.91**	1.28	**1.44**	-0.13
824.2	128	GPRS	Rear	0	Fig.4	29.41	30	0.651	**0.75**	1.03	**1.18**	0.08

Table 14.8: SAR Values (GSM 1900 MHz Band - Front to face)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
1880	661	Speech	Front	10	Fig.5	30.20	31	0.137	**0.16**	0.237	**0.28**	0.05

Table 14.9: SAR Values (GSM 1900 MHz Band-Body)

Frequency		Mode /Band	Test Position	Spacing	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
MHz	Ch.											
1909.8	810	GPRS	Rear	0	Fig.6	26.67	27	0.982	**1.06**	1.84	**1.99**	-0.01
1880	661	GPRS	Rear	0	Fig.7	26.92	27	1.34	**1.36**	2.52	**2.57**	0.07
1850.2	512	GPRS	Rear	0	Fig.8	26.83	27	1.46	**1.52**	2.72	**2.83**	-0.03

15 Measurement Uncertainty

15.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

2No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	5.5	N	1	1	1	5.4	5.4	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	1	1	1.6	1.6	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	6.4	6.4	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	0.5	0.5	∞
5	Detection limit	B	1.0	N	1	1	1	1	1	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.6	0.6	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.0	0.0	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.0	1.0	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
10	RF ambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	5
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1	0.28	9
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	0.31	0.25	9
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						11.1	11.0	95.5
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						22.3	22.1	

15.2 Measurement Uncertainty for Fast SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	10.8	N	1	1	5.4	5.4	1	∞
2	Isotropy	B	2.8	R	1	1	1.6	1.6	1	∞
3	Boundary effect	B	1.0	R	1	1	0.6	0.6	1	∞
4	Linearity	B	4.7	R	1	1	2.7	2.7	1	∞
5	Detection limit	B	1.0	R	1	1	0.6	0.6	1	∞
6	Readout electronics	B	0.3	R	1	1	0.3	0.3	1	∞
7	Response time	B	0.8	R	1	1	0.5	0.5	1	∞
8	Integration time	B	2.6	R	1	1	1.5	1.5	1	∞
9	RF ambient conditions-noise	B	0	R	1	1	0	0	1	∞
10	RF ambient conditions-reflection	B	0	R	1	1	0	0	1	∞
11	Probe positioned mech. Restrictions	B	0.4	R	1	1	0.2	0.2	1	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	1	1	1.7	1.7	1	∞
13	Post-processing	B	1.0	R	1	1	0.6	0.6	1	∞
14	Fast SAR z-Approximation	B	7.0	R	1	1	4.0	4.0	1	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.1	12.4 5	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						26.2	25.9	

16 MAIN TEST INSTRUMENTS

Table 16.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent E5071C	MY46103759	December 17,2014	One year
02	Dielectric probe	85070E	MY44300317	No Calibration Requested	
03	Power meter	NRVD	101253	March 5,2015	One year
04	Power sensor	NRV-Z5	100333		
05	Signal Generator	E4438C	MY45095825	January 13, 2015	One year
06	Amplifier	VTL5400	0404	No Calibration Requested	
07	Directional coupler	Agilent 778D	20414	No Calibration Requested	
08	BTS	E5515C	GB46110723	May 20, 2015	One year
09	E-field Probe	SPEAG EX3DV4	3633	September 9, 2015	One year
11	DAE	SPEAG DAE4	786	November 20, 2014	One year
12	Dipole Validation Kit	SPEAG D835V2	4d057	November 4, 2014	One year
13	Dipole Validation Kit	SPEAG D1900V2	873	November 5, 2014	One year

END OF REPORT BODY

ANNEX A Graph Results

GSM 850 Front side High

Date/Time: 2015/10/29

Electronics: DAE4 Sn786

Medium: Head 900 MHz

Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.94 S/m; ε_r = 41.17; ρ = 1000 kg/m^3

Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C

Communication System: UID 0, GSM (0) Frequency: 848.8 MHz Duty Cycle: 1:8.3

Probe: EX3DV4 - SN3633 ConvF(9.31, 9.31, 9.31);

Front side High/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.0890 W/kg

Front side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.313 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.133 W/kg

SAR(1 g) = 0.074 W/kg; SAR(10 g) = 0.043 W/kg

Maximum value of SAR (measured) = 0.0810 W/kg

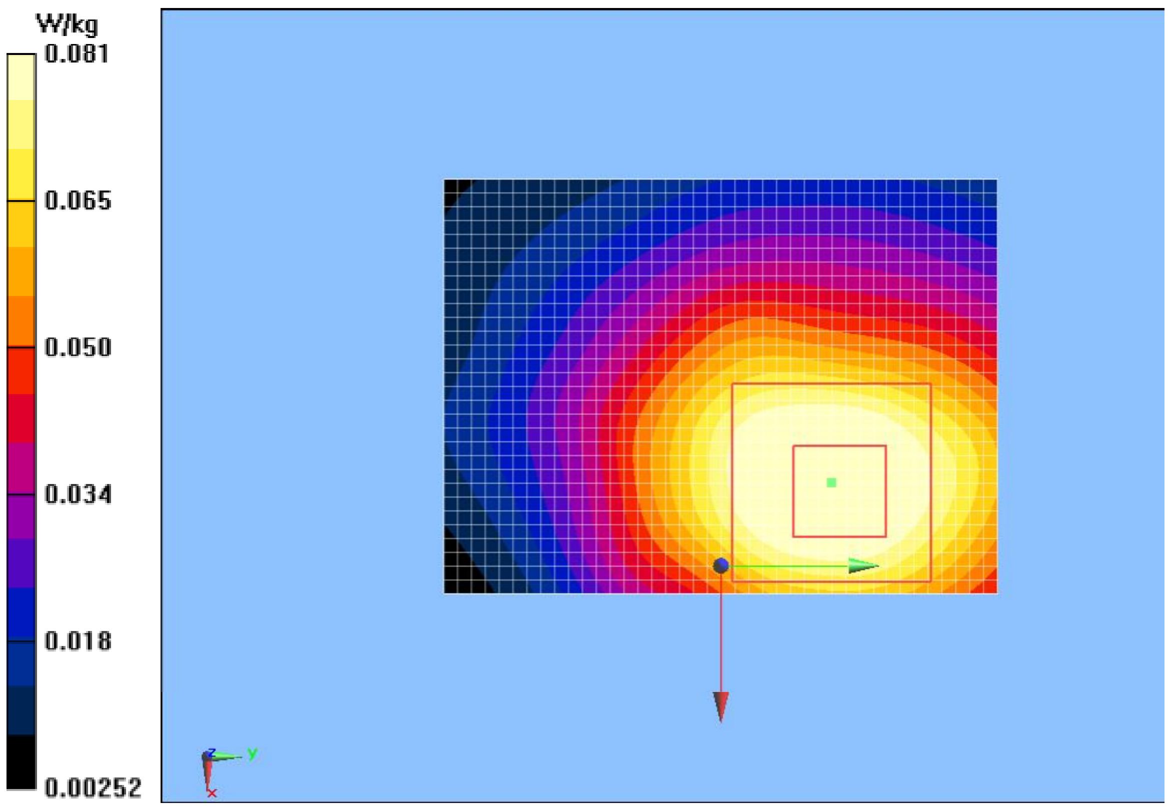


Fig.1 850 MHz CH251

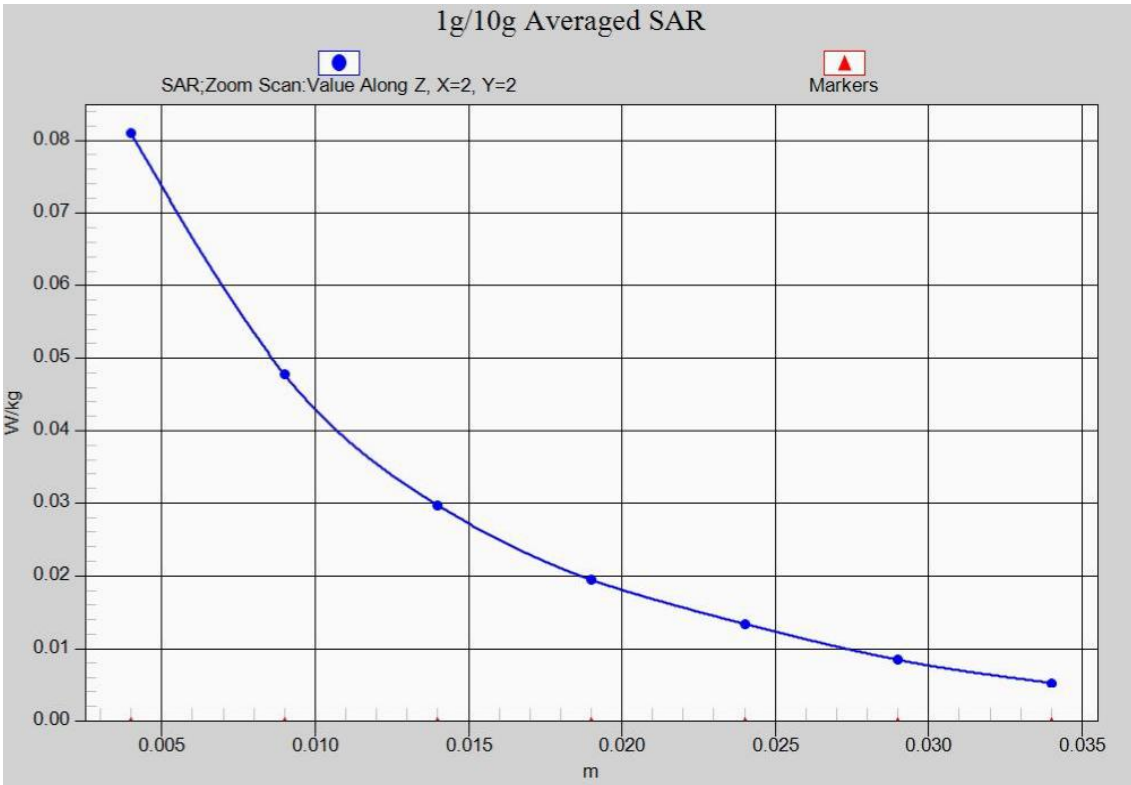


Fig.1-1 Z-Scan at power reference point (850 MHz CH251)

GSM 850 Body Rear

Date/Time: 2015/10/29
Electronics: DAE4 Sn786
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 848.8 MHz; σ = 0.984 S/m; ε_r = 53.419; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, 4 slot GPRS (0) Frequency: 848.8 MHz Duty Cycle: 1:2.08018
Probe: EX3DV4 - SN3633 ConvF(9.29, 9.29, 9.29); Calibrated: 2015/9/9

Rear side High/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.89 W/kg

Rear side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 38.92 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.06 W/kg
SAR(1 g) = 1.67 W/kg; SAR(10 g) = 1.05 W/kg
Maximum value of SAR (measured) = 1.76 W/kg

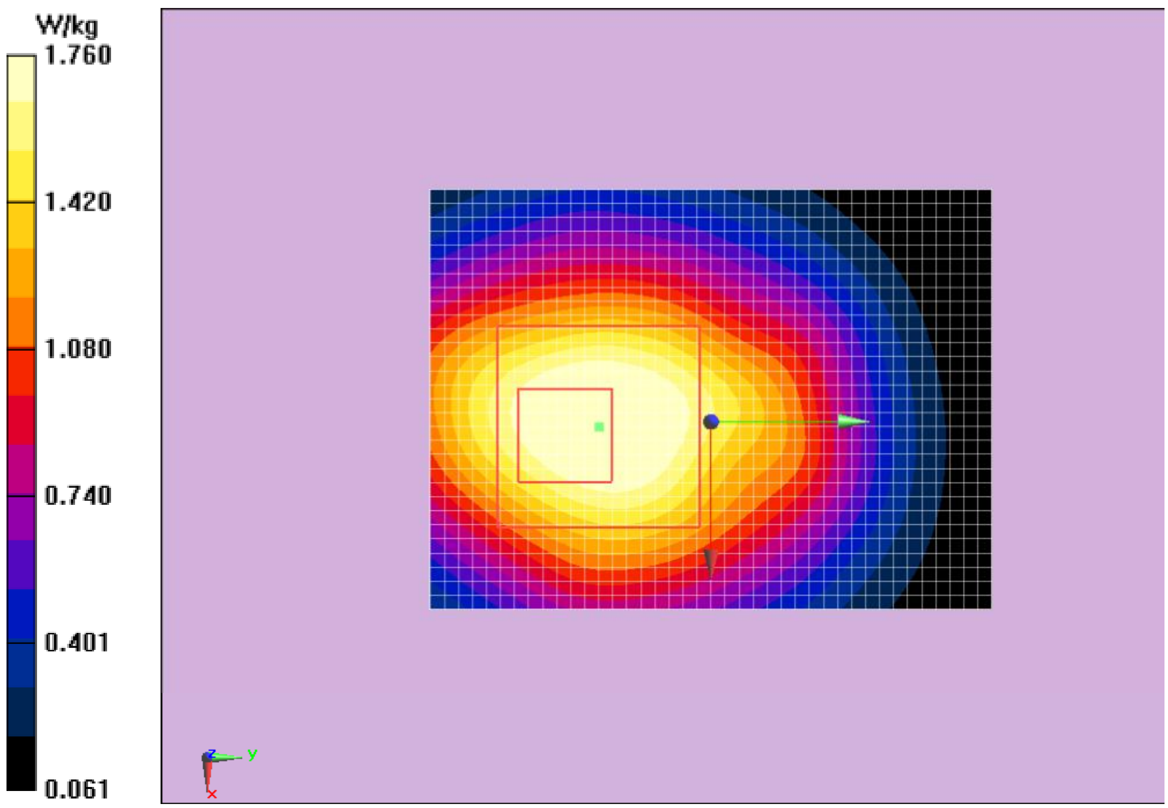


Fig.2 850 MHz CH251

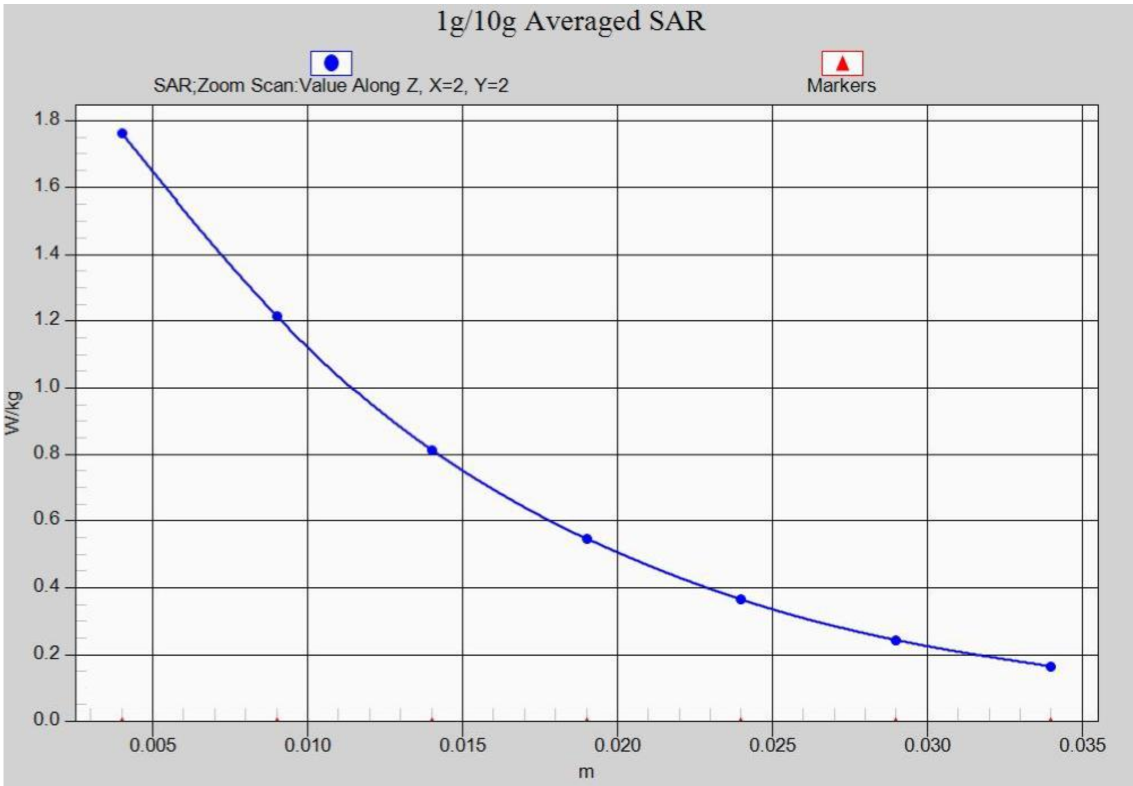


Fig.2-1 Z-Scan at power reference point (850 MHz CH251)

GSM 850 Body Rear

Date/Time: 2015/10/29
Electronics: DAE4 Sn786
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.971 S/m; ε_r = 53.489; ρ = 1000 kg/m^3
Ambient Temperature:22.0°C Liquid Temperature:21.5°C
Communication System: UID 0, 4 slot GPRS (0) Frequency: 836.6 MHz Duty Cycle: 1:2.0
Probe: EX3DV4 - SN3633 ConvF(9.29, 9.29, 9.29);

Rear side Middle/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.40 W/kg

Rear side Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.20 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 2.41 W/kg
SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.805 W/kg
Maximum value of SAR (measured) = 1.35 W/kg

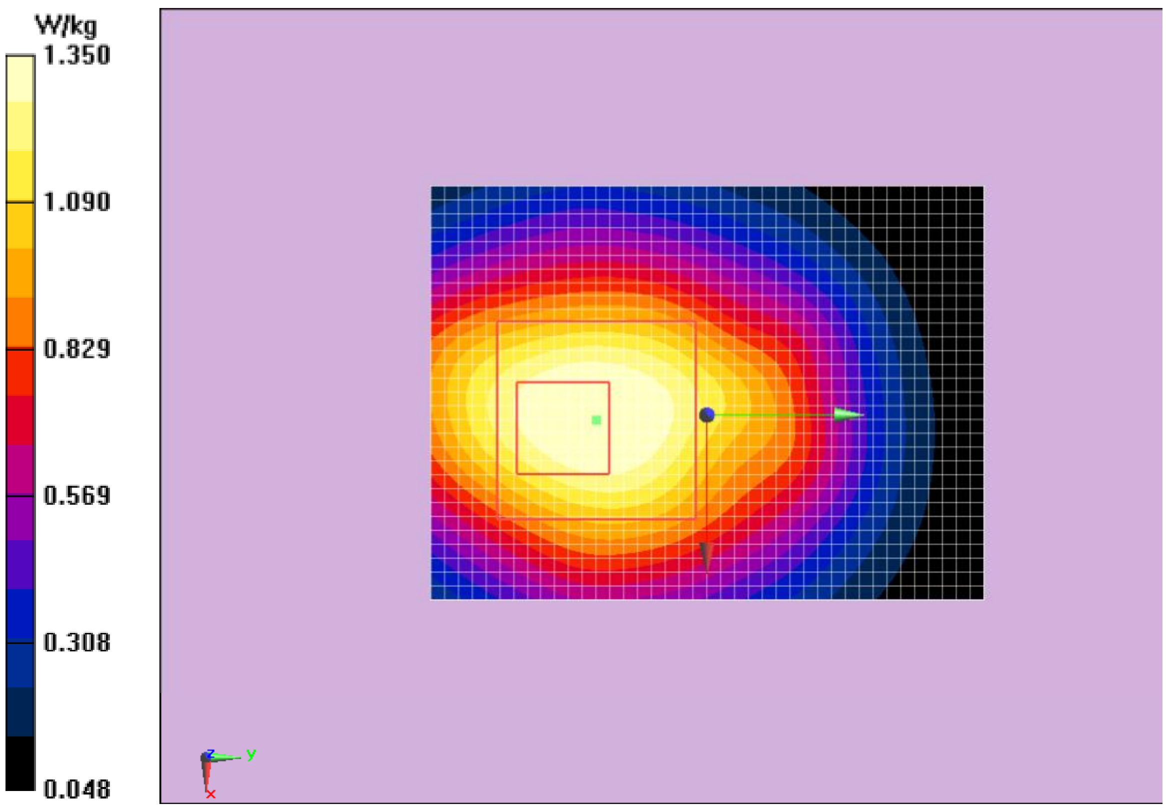


Fig.3 850 MHz CH661

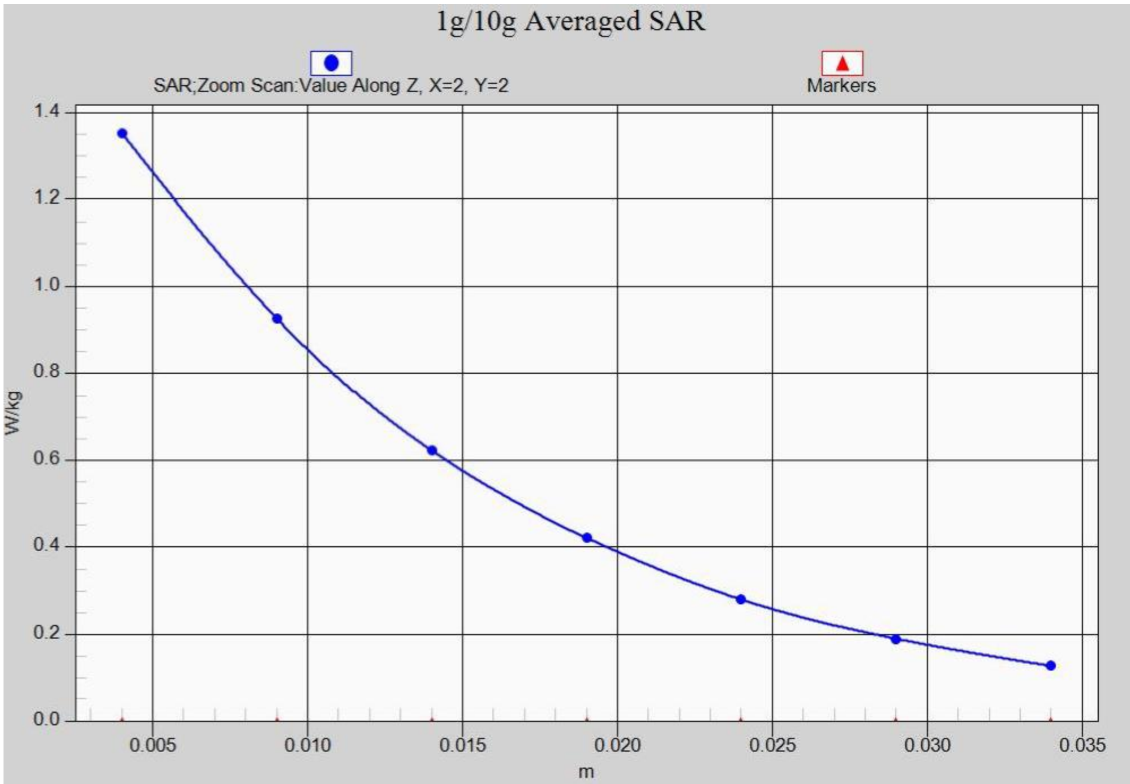


Fig.3-1 Z-Scan at power reference point (850 MHz CH661)

GSM 850 Body Rear

Date/Time: 2015/10/29
Electronics: DAE4 Sn786
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.959 S/m; ε_r = 53.571; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, 4 slot GPRS (0) Frequency: 824.2 MHz Duty Cycle: 1:2.0
Probe: EX3DV4 - SN3633 ConvF(9.29, 9.29, 9.29); Calibrated: 2015/9/9

Rear side Low/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.15 W/kg

Rear side Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.59 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 2.02 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.651 W/kg
Maximum value of SAR (measured) = 1.08 W/kg

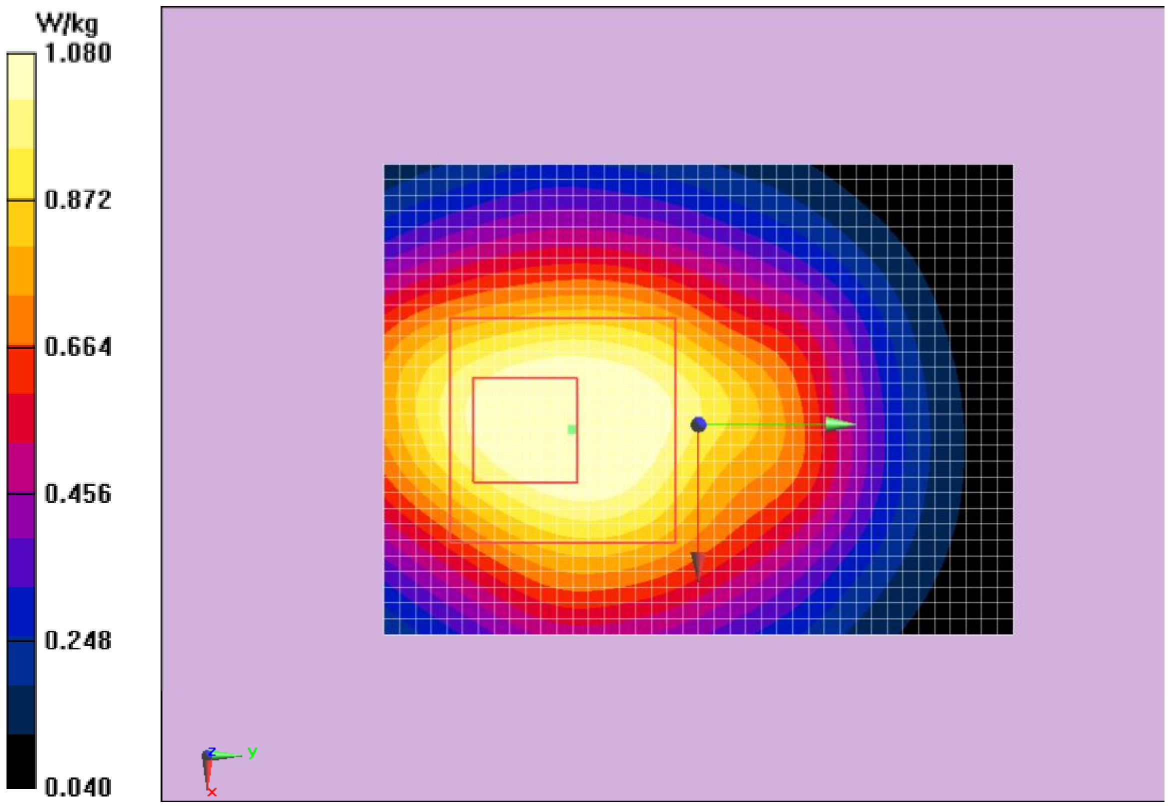


Fig.4 850 MHz CH128

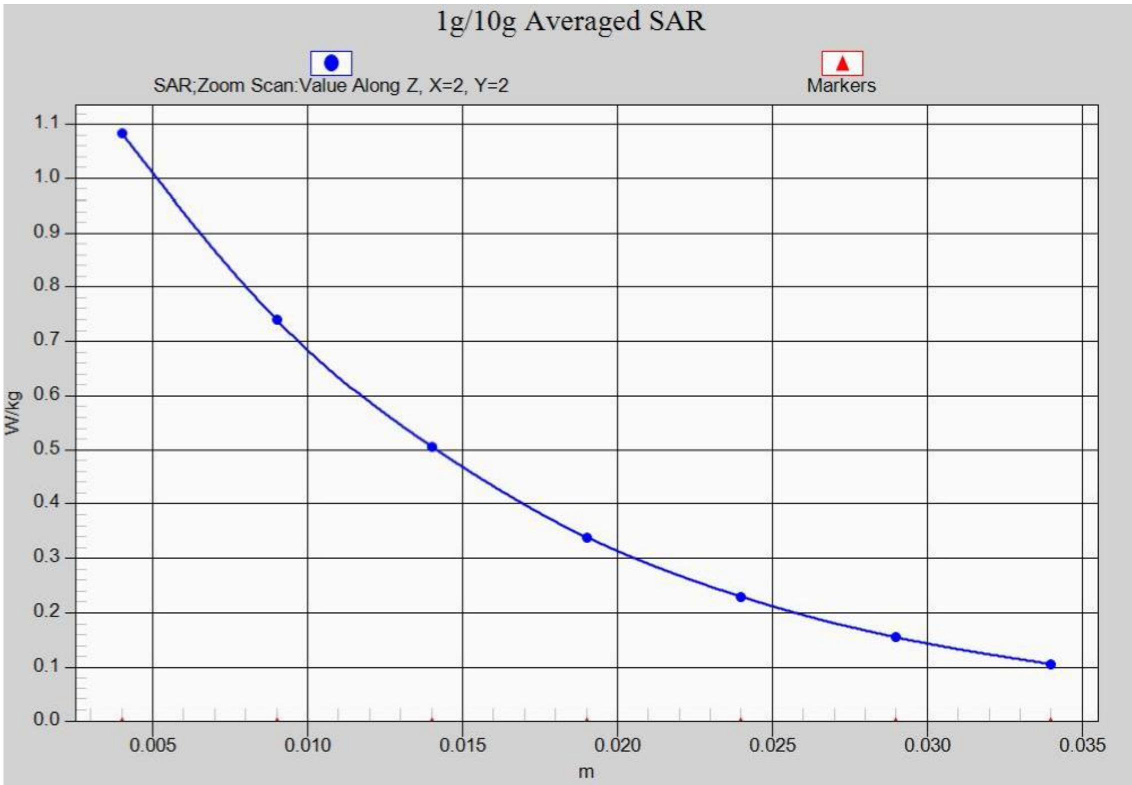


Fig.4-1 Z-Scan at power reference point (850 MHz CH128)

GSM 1900 Front side

Date/Time: 2015/10/28
Electronics: DAE4 Sn786
Medium: Head 1900 MHz
Medium parameters used: f = 1880 MHz; σ = 1.4 S/m; ε_r = 38.224; ρ = 1000 kg/m^3
Ambient Temperature:22.0°C Liquid Temperature:21.5°C
Communication System: UID 0, GSM (0) Frequency: 1880 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3633 ConvF(7.55, 7.55, 7.55);

Front side Mid/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.262 W/kg

Front side Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.08 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.393 W/kg
SAR(1 g) = 0.237 W/kg; SAR(10 g) = 0.137 W/kg
Maximum value of SAR (measured) = 0.257 W/kg

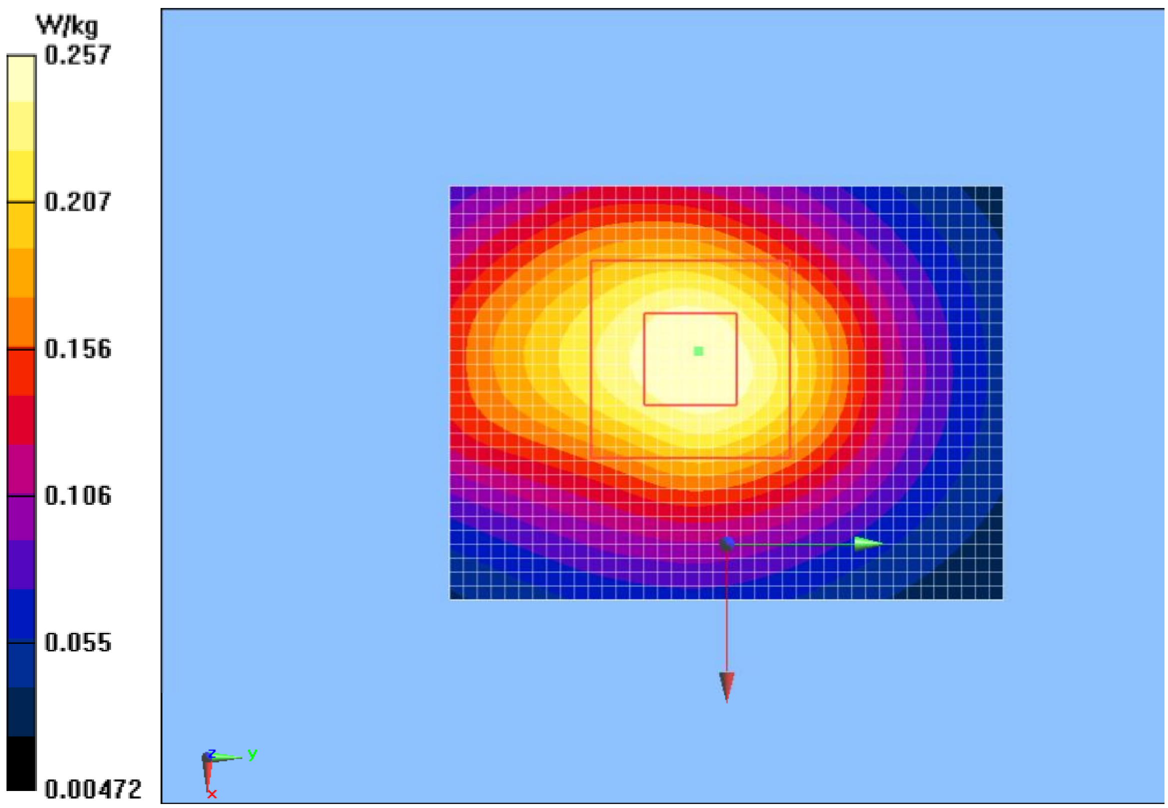


Fig.5 1900 MHz CH661

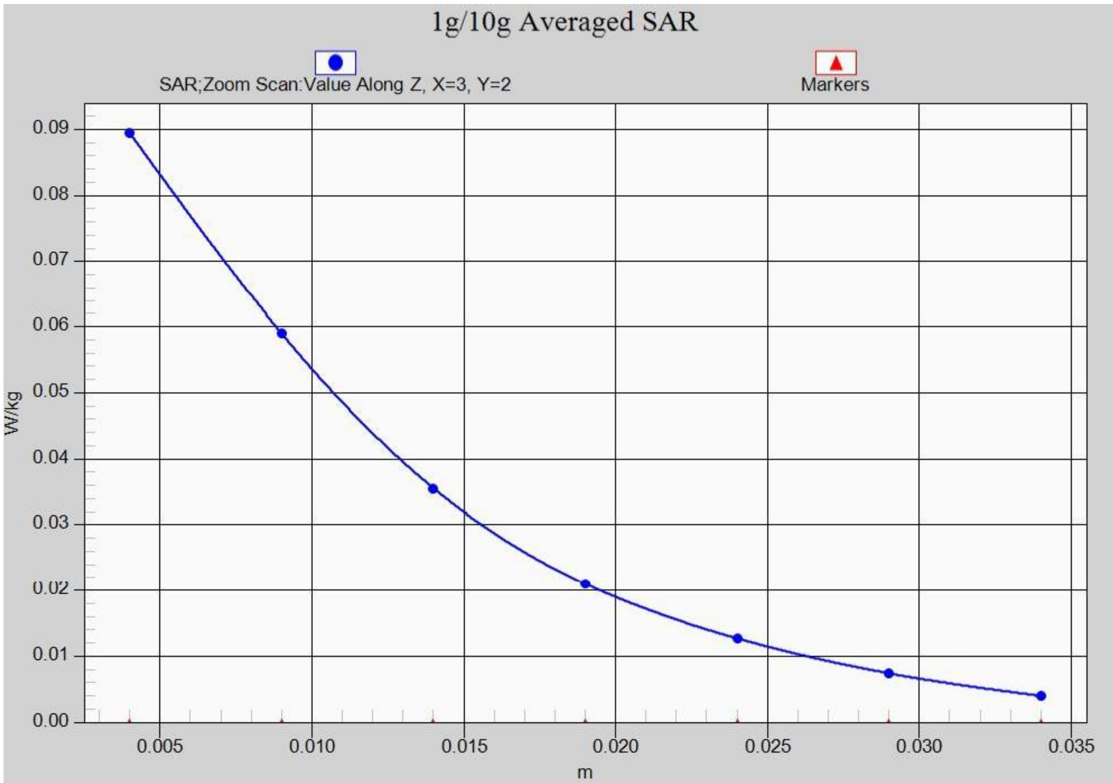


Fig.5-1 Z-Scan at power reference point (1900 MHz CH661)

GSM 1900 Body Rear

Date/Time: 2015/10/28
Electronics: DAE4 Sn786
Medium: Body1900 MHz
Medium parameters used: f = 1910 MHz; σ = 1.58 S/m; ε_r = 53.422; ρ = 1000 kg/m^3
Ambient Temperature:22.0^{o}C Liquid Temperature:21.5^{o}C
Communication System: UID 0, 4 slot GPRS (0) Frequency: 1909.8 MHz Duty Cycle: 1:2.0
Probe: EX3DV4 - SN3633 ConvF(7.18, 7.18, 7.18);

Rear side High/Area Scan (31x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.13 W/kg

Rear side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.04 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 4.36 W/kg
SAR(1 g) = 1.84 W/kg; SAR(10 g) = 0.982 W/kg
Maximum value of SAR (measured) = 2.01 W/kg

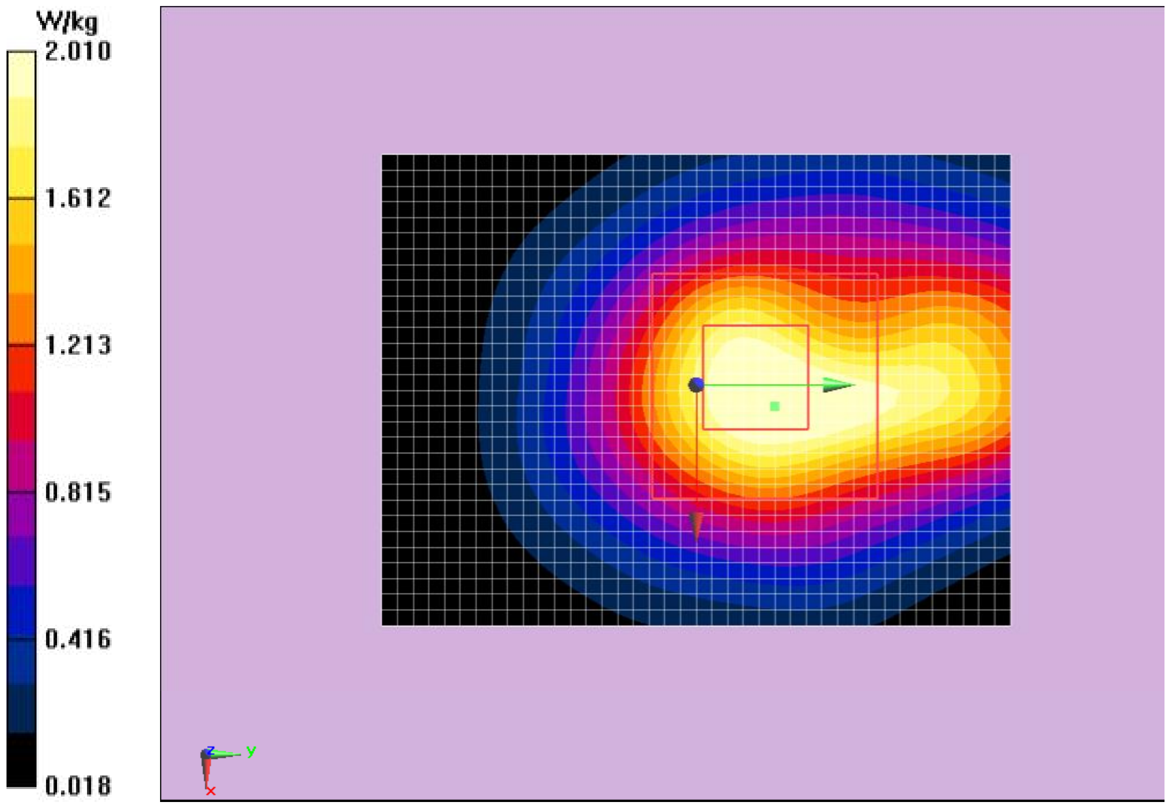


Fig.6 1900 MHz CH810