SAR TEST REPORT

No. I21Z61038-SEM01

For

Gabb Wireless Inc.

Watch Lite

Model Name: UT310AG

with

Hardware Version: V0.30

Software Version: V1.3

FCC ID: 2AZDOUT310AG

Issued Date: 2021-7-26

Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT

No. 51, Xueyuan Road, Haidian District, Beijing, P. R. China 100191.

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I21Z61038-SEM01	Rev.0	2021-7-12	Initial creation of test report
I21Z61038-SEM01	Rev.1	2021-7-26	Update conducted power on section10.1 Update SAR test result on section12.1

TABLE OF CONTENT

1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shouxiang)
Address:	No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191

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:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	June 6, 2021
Testing End Date:	July 9, 2021

1.4 Signature

Lin Xiaojun

(Prepared this test report)
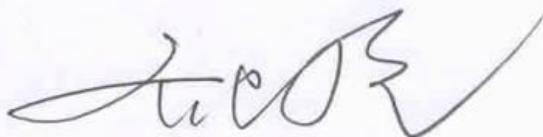
Qi Dianyuan

(Reviewed this test report)
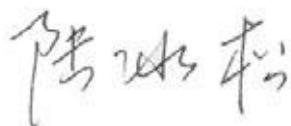
Lu Bingsong

Deputy Director of the laboratory

(Approved this test report)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Gabb Wireless Inc. Watch Lite UT310AG are as follows:

Table 2.1: Highest Reported SAR (10g)

Exposure Configuration	Technology Band	Highest Reported SAR (W/kg)	Limited (W/kg)	Equipment Class
Limb-worn (Separation Distance 0mm)	NB-IOT Band13	0.13(10g)	4.0(10g)	TNT

The SAR values found for the Mobile Phone are below the maximum recommended levels of 4.0 W/kg as averaged over any 10g tissue according to the ANSI C95.1-1992.

For body 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 0 mm between this device and the body of the user. 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: **0.13** W/kg(10g) for limb-worn.

3 Client Information

3.1 Applicant Information

Company Name:	Gabb Wireless Inc.
Address/Post:	4101 N Thanksgiving Way , Unit 300 , Lehi , UTAH , 84043
Contact Person:	Colin Cole
E-mail:	colin.cole@gabbwireless.com
Telephone:	385 248 7798
Fax:	\

3.2 Manufacturer Information

Company Name:	Shenzhen Tinno Mobile Technology Corp.
Address/Post:	Building, No.33, Xiandong Rd, Xili, Nanshan District, Shenzhen, PRC
Contact Person:	xiaoping.li
E-mail:	xiaoping.li@tinno.com
Telephone:	0755-86095550
Fax:	\

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

4.1 About EUT

Description:	Watch Lite
Model name:	UT310AG
Operating mode(s):	NB-IoT Band13
Tested Tx Frequency:	777 –787 MHz (Band 13)
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*	IMEI	HW Version	SW Version
EUT1	866368050000706	V0.30	V1.3
EUT2	866368050000128	V0.30	V1.3

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

Note: It is performed to test SAR with the EUT2 and conducted power with the EUT1.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	ZWD382026V	/	ZHONGSHAN ZHONGWANGDE NEW ENERGY TECHNOLOGY Co.,LTD

*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** as averaged over any 1 gram of tissue for 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: Measurement Techniques.

KDB447498 D01: General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB941225 D05 SAR for LTE Devices v02r05: SAR Evaluation Considerations for LTE Devices

KDB865664 D01SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB865664 D02RF Exposure Reporting v01r02: 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:

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

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

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

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

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	Conductivity(σ)	± 5% Range	Permittivity(ε)	± 5% Range
750	Head	0.89	0.85～0.93	41.94	39.8～44.0

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 (%)
2021-7-9	Head	750 MHz	44.37	5.79	0.869	-2.36

Note: The liquid temperature is 22.0ºC

Picture 7-1 Liquid depth in the Head Phantom (750MHz)

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:
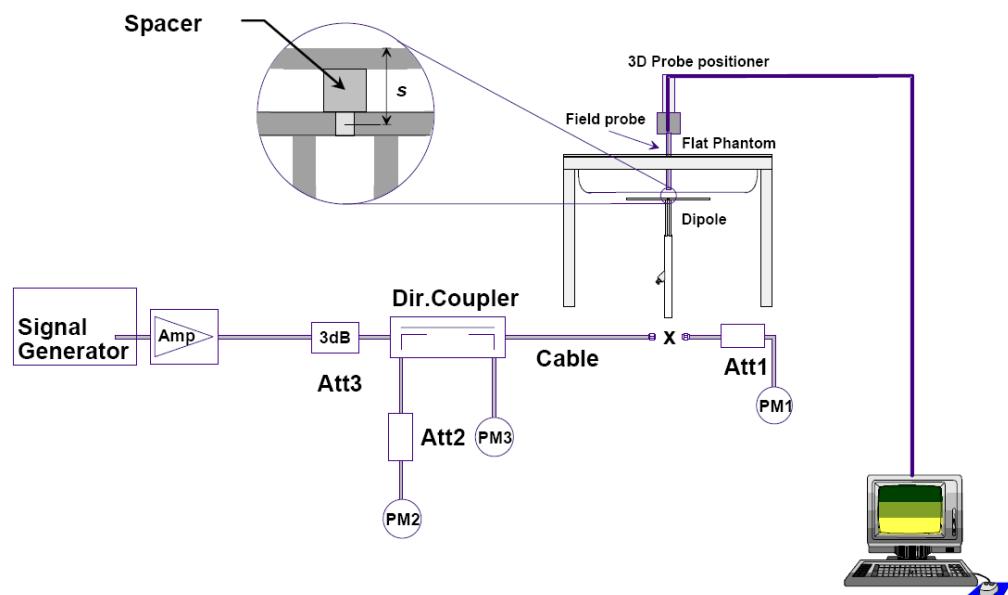
Picture 8.1 System Setup for System Evaluation

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.

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
2021-7-9	750 MHz	5.84	8.85	5.60	8.44	-4.11%	-4.63%

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 (cheek and tilt, for both left and right sides of the SAM phantom, 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 within3 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 a – Tests to be performed

Picture b – General procedure
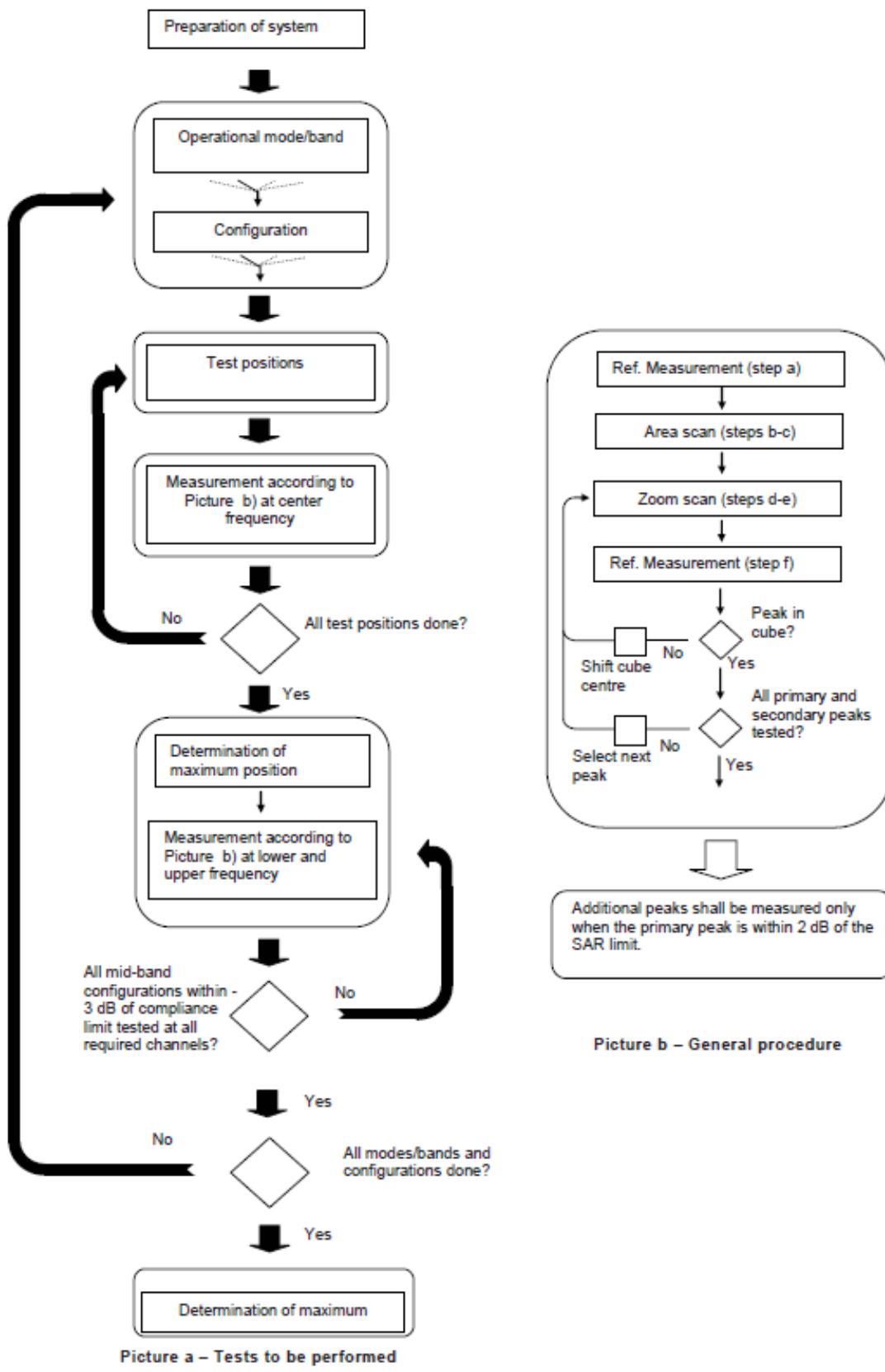
Picture 9.1Block diagram of the tests to be performed

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 1528-2003. 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.

			$\leq$ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 $\pm$ 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° $\pm$ 1°	20° $\pm$ 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			$\leq$ 2 GHz: $\leq$ 15 mm 2 – 3 GHz: $\leq$ 12 mm	3 – 4 GHz: $\leq$ 12 mm 4 – 6 GHz: $\leq$ 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.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5\cdot\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 22 mm

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

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

9.3 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Rohde & Rchwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the CMW 500.

It is performed for conducted power and SAR based on the KDB941225 D05.

SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The procedures in the following subsections are applied separately to test each LTE frequency band.

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 among 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.

9.4 Power Drift

To control the output power stability during the SAR test, DASY5 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 section14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Conducted Output Power

10.1 LTE Measurement result

Table 10.1-1: The tune up for NB IOT

Band	Tune up
Band 13	25

NB-IoT band 13(777MHz~787MHz) standalone

Subcarrier Spacing	Subcarrier number/offset	Frequency (MHz)	Power(dBm)	
			BPSK	QPSK
3.75kHz	1@47	786.90	23.71	23.41
		782.00	23.68	23.67
		777.10	23.63	23.36
	1@0	786.90	23.73	23.48
		782.00	23.68	23.69
		777.10	23.60	23.39
15kHz	1@11	786.90	23.86	23.87
		782.00	23.87	23.85
		777.10	23.84	23.78
	1@0	786.90	23.87	23.88
		782.00	23.80	23.79
		777.10	23.85	23.79
	12@0	786.90	-	22.25
		782.00	-	22.11
		777.10	-	22.04

NB-IoT band 13(777MHz~787MHz) guard-band

Subcarrier Spacing	LTE Bandwidth	Subcarrier number/offset	Frequency (MHz)	Power(dBm)	
				BPSK	QPSK
3.75kHz	5MHz	1@47	786.885	23.48	23.46
			779.615	23.39	23.37
			777.115	23.35	23.33
		1@0	786.885	23.46	23.44
			779.615	23.34	23.31
			777.115	23.41	23.38
	10MHz	1@47	786.885	23.44	23.41
			786.615	23.46	23.44
			777.115	23.42	23.39
		1@0	786.885	23.47	23.43
			786.615	23.44	23.41
			777.115	23.42	23.35

15kHz	5MHz	1@11	786.885	23.82	23.83
			779.615	23.74	23.73
			777.115	23.79	23.80
		1@0	786.885	23.83	23.81
			779.615	23.75	23.76
			777.115	23.81	23.79
		12@0	786.885	-	22.13
			779.615	-	22.06
			777.115	-	22.15
	10MHz	1@11	786.885	23.81	23.80
			786.615	23.81	23.82
			777.115	23.76	23.75
		1@0	786.885	23.82	23.81
			786.615	23.84	23.82
			777.115	23.77	23.78
		12@0	786.885	-	22.14
			786.615	-	22.08
			777.115	-	22.01

NB-IoT band 13(777MHz~787MHz) in-band-same PCI

Subcarrier Spacing	LTE Bandwidth	Subcarrier number/offset	Frequency (MHz)	Power(dBm)	
				BPSK	QPSK
3.75kHz	5MHz	1@47	786.30	23.52	23.49
			781.10	23.47	23.41
			777.70	23.39	23.37
		1@0	786.30	23.57	23.53
			781.10	23.45	23.37
			777.70	23.36	23.35
	10MHz (PRB 30)	1@47	782.99	23.54	23.51
		1@0	782.99	23.48	23.44
	10 MHz (PRB 35)	1@47	783.89	23.57	23.52
		1@0	783.89	23.56	23.53
15kHz	5MHz	1@11	786.30	23.80	23.81
			781.10	23.78	23.76
			777.70	23.72	23.71
		1@0	786.30	23.85	23.81
			781.10	23.79	23.76
			777.70	23.74	23.72
		12@0	786.30	-	22.16
			781.10	-	22.08
			777.70	-	22.04

	10MHz (PRB 30)	1@11	782.99	23.85	23.84
		1@0	782.99	23.84	23.81
		12@0	782.99	-	22.14
	10 MHz (PRB 35)	1@11	783.89	23.84	23.84
		1@0	783.89	23.86	23.85
		12@0	783.89	-	22.21

NB-IoT band 13(777MHz~787MHz) in-band-different PCI

Subcarrier Spacing	LTE Bandwidth	Subcarrier number/offset	Frequency (MHz)	Power(dBm)	
				BPSK	QPSK
3.75kHz	5MHz	1@47	786.30	23.48	23.44
			781.10	23.43	23.40
			777.70	23.38	23.33
		1@0	786.30	23.50	23.48
			781.10	23.44	23.39
			777.70	23.37	23.31
	10MHz (PRB 30)	1@47	782.99	23.51	23.47
		1@0	782.99	23.46	23.43
	10 MHz (PRB 35)	1@47	783.89	23.51	23.48
		1@0	783.89	23.50	23.46
15kHz	5MHz	1@11	786.30	23.84	23.82
			781.10	23.78	23.79
			777.70	23.73	23.72
		1@0	786.30	23.87	23.84
			781.10	23.79	23.77
			777.70	23.74	23.72
		12@0	786.30	-	22.16
			781.10	-	22.09
			777.70	-	22.03
	10MHz (PRB 30)	1@11	782.99	23.85	23.84
		1@0	782.99	23.87	23.81
		12@0	782.99	-	22.13
	10 MHz (PRB 35)	1@11	783.89	23.85	23.84
		1@0	783.89	23.87	23.85
		12@0	783.89	-	22.16

11 Transmit Antenna Separation Distances
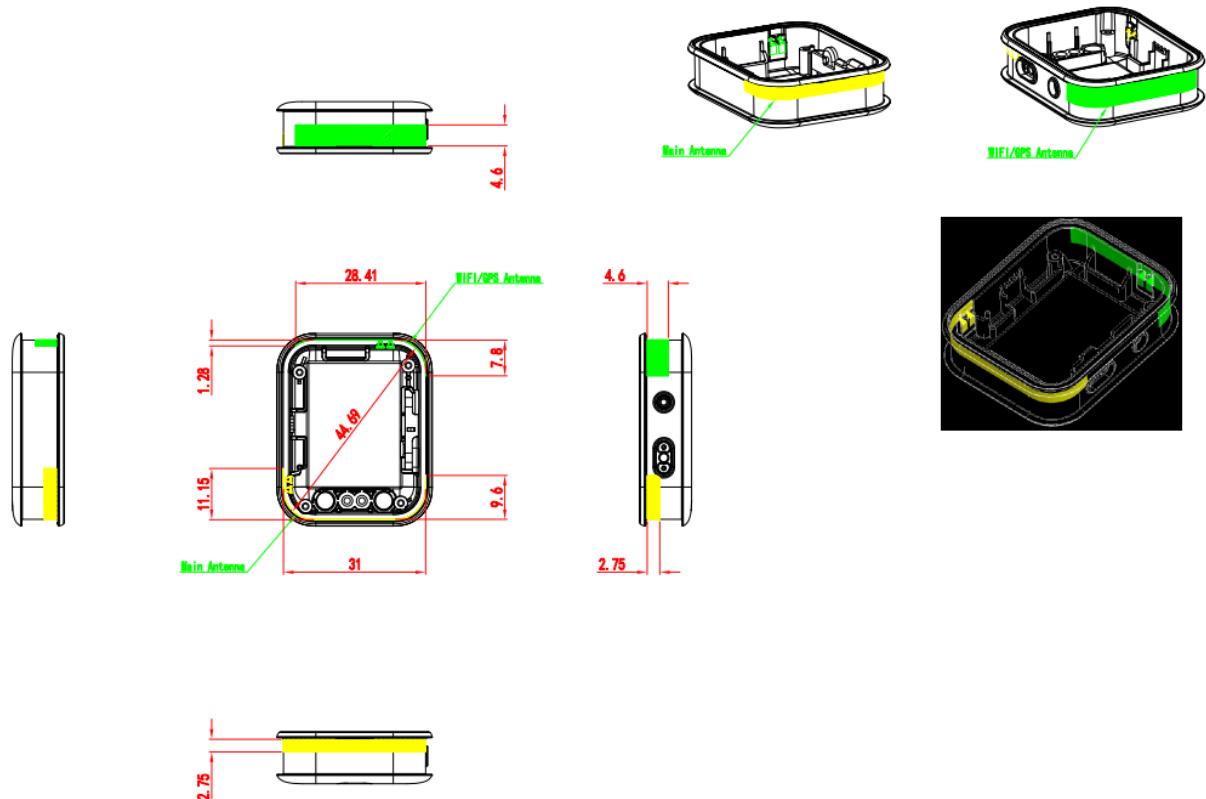
Picture 11.1 Antenna Locations

12 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 0 mm and just applied to the condition of body worn accessory.

The calculated SAR is obtained by the following formula:

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

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

12.1 SAR results for Limb-worn

Ambient Temperature: 22.9 °C						Liquid Temperature: 22.5°C						
Frequency		Mode	Side	Distance	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)
Ch.	MHz											
23279	786.9	1RB-0	Rear	0mm	/	23.88	25.00	0.090	0.12	0.154	0.20	0.03
23230	782	1RB-11	Rear	0mm	/	23.85	25.00	0.089	0.12	0.153	0.20	0.01
23181	777.1	1RB-0	Rear	0mm	Fig.1	23.88	25.00	0.098	0.13	0.168	0.22	0.08

Note: There is no usage scenarios for the tracker to next-to-mouth

13 SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

14 Measurement Uncertainty

14.1 Measurement Uncertainty for Normal 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	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	N	1	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
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	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
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	1.32	0.89	43
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	1.0	0.8	521

								9.55	9.43	257
Combined standard uncertainty	$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$							9.55	9.43	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$							19.1	18.9	

15 MAIN TEST INSTRUMENTS

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 14, 2021	One year
02	Power meter	NRP2	106277	September 23, 2020	One year
03	Power sensor	NRP8S	104291		
04	Signal Generator	E4438C	MY49071430	February 01, 2021	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	129942	February 2, 2021	One year
07	E-field Probe	SPEAG EX3DV4	7464	December 18, 2020	One year
08	DAE	SPEAG DAE4	1588	September 02, 2020	One year
09	Dipole Validation Kit	SPEAG D750V3	1017	July 24,,2020	One year

END OF REPORT BODY

ANNEX A   Graph Results

NB-IoT Band13 Rear 0mm

Date/Time: 7/9/2021

Electronics: DAE4 Sn1588

Medium: H700-6000(All1-1) 2021-Jun-11

Medium parameters used (interpolated): f = 777.14 MHz; σ = 0.88 S/m; ε_r = 44.183; ρ = 1000 kg/m^3

Ambient Temperature:23.3ºC   Liquid Temperature: 22.5ºC

Communication System: UID 0, LTE Band13 (0) Frequency: 777.14 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7464 ConvF(10.43, 10.43, 10.43) @ 777.14 MHz

Area Scan (41x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.304 W/kg

Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.62 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.329 W/kg
SAR(1 g) = 0.168 W/kg; SAR(10 g) = 0.098 W/kg
Maximum value of SAR (measured) = 0.244 W/kg
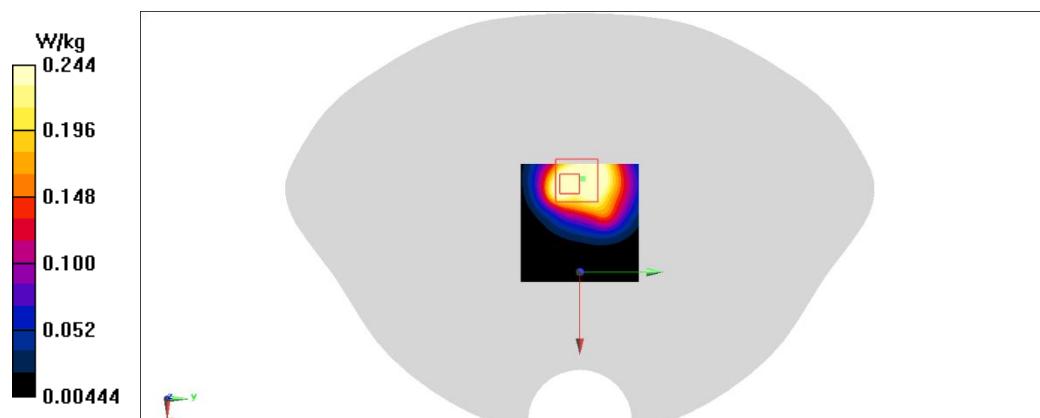
Fig A.1
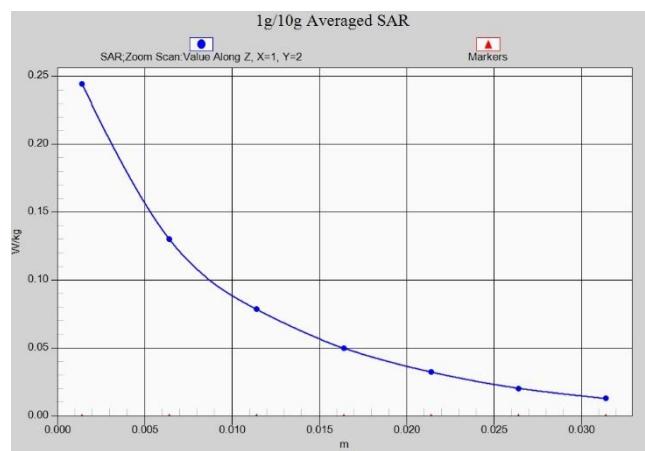
Z-Scan at power reference point (NB-IOT Band13)

ANNEX B   System Verification Results

750 MHz

Date/Time: 7/9/2021

Electronics: DAE4 Sn1588

Medium: H700-6000

Medium parameters used: f = 750 MHz; σ = 0.869 S/m; ε_r = 44.368; ρ = 1000 kg/m³

Ambient Temperature:23.3ºC   Liquid Temperature: 22.5ºC

Communication System: UID 0, CW (0) Frequency: 750 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7464 ConvF(10.43, 10.43, 10.43) @ 750 MHz
System Performance Check /d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Area Scan (61x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.64 W/kg

System Performance Check /d=15mm, Pin=250 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.56 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.11 W/kg; SAR(10 g) = 1.4 W/kg
Maximum value of SAR (measured) = 2.67 W/kg
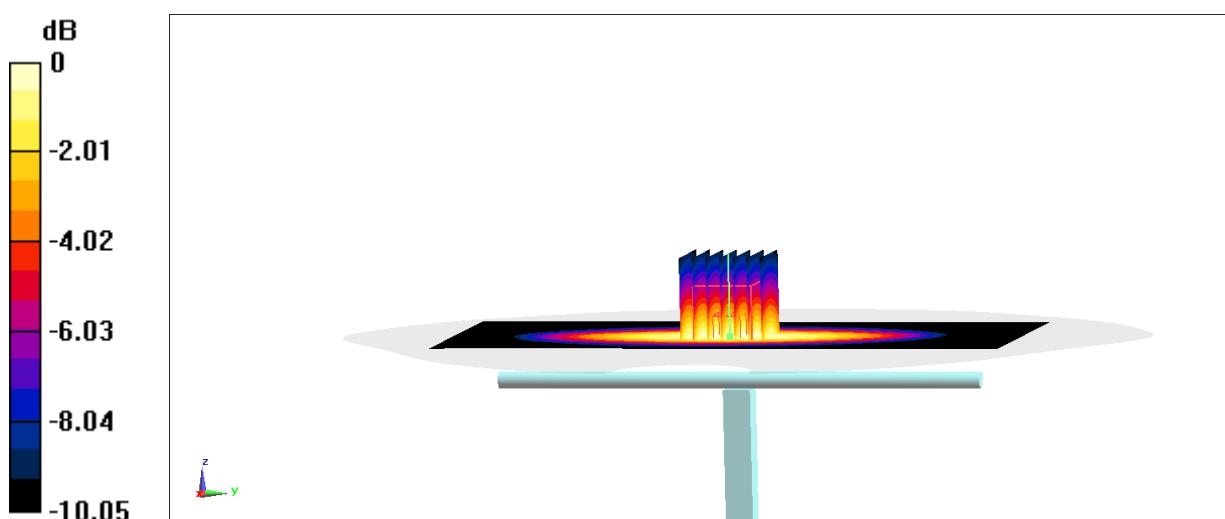
0 dB = 2.67 W/kg = 4.27 dBW/kg
Fig.B.1 validation 750 MHz 250mW

ANNEX C   SAR Measurement Setup

C.1 Measurement Set-up

The Dasy4 or DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:
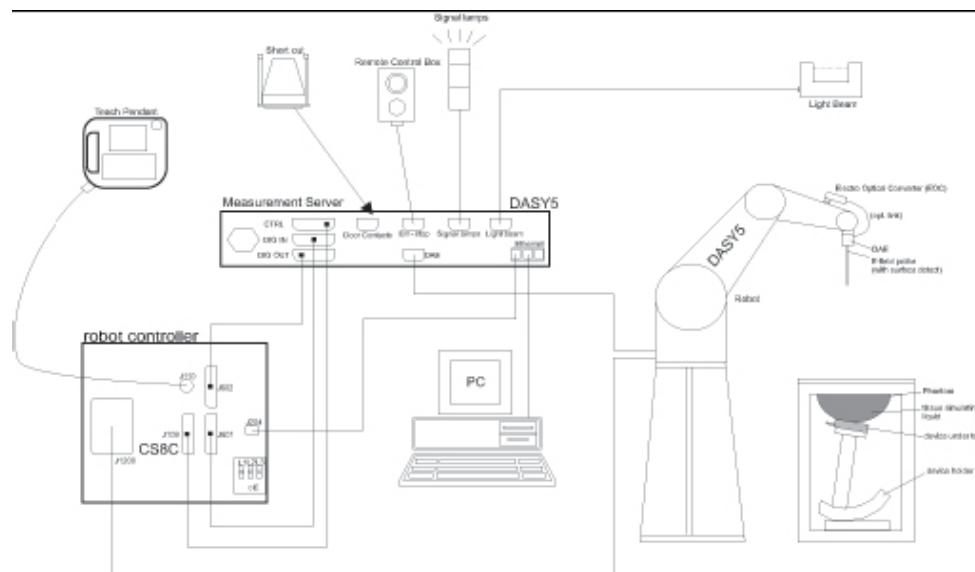
Picture C.1SAR Lab Test Measurement Set-up

- A standard high precision 6-axis robot (StäubliTX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY4 or DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

C.2 Dasy4 or DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 or DASY5 software reads the reflection durning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model:	**ES3DV3, EX3DV4**
Frequency	**10MHz — 6.0GHz(EX3DV4)**
Range:	**10MHz — 4GHz(ES3DV3)**
Calibration:	**In head and body simulating tissue at Frequencies from 835 up to 5800MHz**

Linearity: **± 0.2 dB(30 MHz to 6 GHz) for EX3DV4**
± 0.2 dB(30 MHz to 4 GHz) for ES3DV3

Picture C.2Near-field Probe

DynamicRange: 10 mW/kg — 100W/kg
Probe Length: 330 mm
Probe Tip
Length: 20 mm
Body Diameter: 12 mm
Tip Diameter: 2.5 mm (3.9 mm for ES3DV3)
Tip-Center: 1 mm (2.0mm for ES3DV3)
Application:SAR Dosimetry Testing
Compliance tests ofmobile phones
Dosimetry in strong gradient fields

Picture C.3E-field Probe

C.3 E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

The free space E-field from amplified probe outputs is determined in a test chamber. This

calibration can be performed in a TEM cell if the frequency is below 1 GHz and inn a waveguide or other methodologies 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 until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2..

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

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

Where:

Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

C.4 Other Test Equipment

C.4.1 Data Acquisition Electronics(DAE)

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

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

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

PictureC.4: DAE

C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90XL; DASY5: RX160L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

➢ High precision (repeatability 0.02mm)
➢ High reliability (industrial design)
➢ Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
➢ Jerk-free straight movements (brushless synchron motors; no stepper motors)
➢ Low ELF interference (motor control fields shielded via the closed metallic construction shields)

Picture C.5DASY 4

Picture C.6DASY 5

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (dasy4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128MB), RAM (DASY4: 64 MB, DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

Picture C.7 Server for DASY 4   **Picture C.8 Server for DASY 5**

C.4.4 Device Holder for Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε =3 and loss tangent δ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

Picture C.9-1: Device Holder   **Picture C.9-2: Laptop Extension Kit**
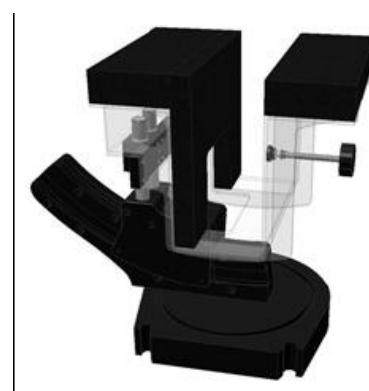
C.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to

Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation

of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2±0. 2 mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x l000 x 500 mm (H x L x W)

Available: Special

Picture C.10: SAM Twin Phantom

ANNEX D   Position of the wireless device in relation to the phantom

D.1 Limb-worn device

SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled. The wrist bands should be unstrapped and touching the phantom. The space introduced between the transmitter and the flat phantom must be representative of actual use conditions.
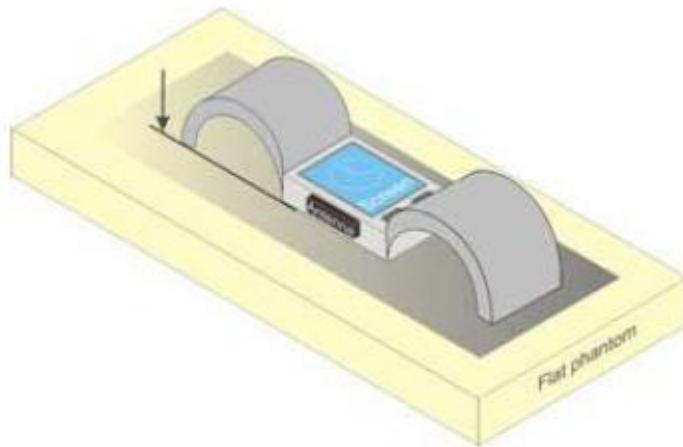
Picture D.1 Test positions for Limb-worn devices

D.2 DUT Setup Photos

Picture D.2

ANNEX E   Equivalent Media Recipes

The liquid used for the frequency range of 800-3000 MHz consisted of water, sugar, salt, preventol, glycol monobutyl and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table E.1 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

TableE.1: Composition of the Tissue Equivalent Matter

Frequency (MHz)	835Head	835Body	1900 Head	1900 Body	2450 Head	2450 Body	5800 Head	5800 Body
Ingredients (% by weight)								
Water	41.45	52.5	55.242	69.91	58.79	72.60	65.53	65.53
Sugar	56.0	45.0	\	\	\	\	\	\
Salt	1.45	1.4	0.306	0.13	0.06	0.18	\	\
Preventol	0.1	0.1	\	\	\	\	\	\
Cellulose	1.0	1.0	\	\	\	\	\	\
Glycol Monobutyl	\	\	44.452	29.96	41.15	27.22	\	\
Diethylenglycol monohexylether	\	\	\	\	\	\	17.24	17.24
Triton X-100	\	\	\	\	\	\	17.24	17.24
Dielectric Parameters Target Value	ε=41.5 σ=0.90	ε=55.2 σ=0.97	ε=40.0 σ=1.40	ε=53.3 σ=1.52	ε=39.2 σ=1.80	ε=52.7 σ=1.95	ε=35.3 σ=5.27	ε=48.2 σ=6.00

Note: There are a little adjustment respectively for 750, 1750, 2600, 5200, 5300 and 5600 based on the recipe of closest frequency in table E.1.

ANNEX F   System Validation

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

Table F.1: System Validation for 7464

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
7464	Head 750MHz	January 03,2021	750 MHz	OK
7464	Head 900MHz	January 03,2021	900 MHz	OK
7464	Head 1450MHz	January 03,2021	1450 MHz	OK
7464	Head 1750MHz	January 03,2021	1750 MHz	OK
7464	Head 1900MHz	January 03,2021	1900 MHz	OK
7464	Head 2100MHz	January 03,2021	2100 MHz	OK
7464	Head 2300MHz	January 03,2021	2300 MHz	OK
7464	Head 2450MHz	January 03,2021	2450 MHz	OK
7464	Head 2600MHz	January 03,2021	2600 MHz	OK
7464	Head 3500MHz	January 03,2021	3500 MHz	OK
7464	Head 3700MHz	January 03,2021	3700 MHz	OK
7464	Head 3900MHz	January 03,2021	3900 MHz	OK
7464	Head 4100MHz	January 03,2021	4100 MHz	OK
7464	Head 4200MHz	January 03,2021	4200 MHz	OK
7464	Head 4400MHz	January 03,2021	4400 MHz	OK
7464	Head 4600MHz	January 03,2021	4600 MHz	OK
7464	Head 4800MHz	January 03,2021	4800 MHz	OK
7464	Head 4950MHz	January 03,2021	4950 MHz	OK
7464	Head 5250MHz	January 03,2021	5250 MHz	OK
7464	Head 5600MHz	January 03,2021	5600 MHz	OK
7464	Head 5750MHz	January 03,2021	5750 MHz	OK

ANNEX G   Probe Calibration Certificate

Probe 7464 Calibration Certificate

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中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client   **CTTL**   **Certificate No: Z20-60472**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 7464
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	December 18, 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)℃ 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 7307	29-May-20(SPEAG, No.EX3-7307_May20)	May-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	
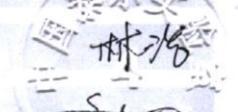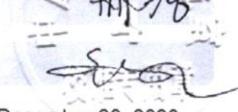
Issued: December 20, 2020

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "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

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

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f＞1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConvF).

- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.

- *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.

- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.

- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z*:A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.

- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.

- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.

- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7464

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^{A}	0.47	0.44	0.46	±10.0%
DCP(mV)^B	100.2	103.5	100.6	

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	164.9	±3.3%
		Y	0.0	0.0	1.0		154.1	
		Z	0.0	0.0	1.0		156.0	

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

^{A} The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 4).
^{B} Numerical linearization parameter: uncertainty not required.
^{E} Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7464

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.43	10.43	10.43	0.40	0.75	±12.1%
900	41.5	0.97	9.79	9.79	9.79	0.17	1.28	±12.1%
1450	40.5	1.20	8.81	8.81	8.81	0.10	1.38	±12.1%
1640	40.3	1.29	8.70	8.70	8.70	0.31	0.88	±12.1%
1750	40.1	1.37	8.60	8.60	8.60	0.27	0.98	±12.1%
1900	40.0	1.40	8.15	8.15	8.15	0.23	1.12	±12.1%
2100	39.8	1.49	8.23	8.23	8.23	0.23	1.11	±12.1%
2300	39.5	1.67	8.12	8.12	8.12	0.61	0.68	±12.1%
2450	39.2	1.80	7.75	7.75	7.75	0.63	0.67	±12.1%
2600	39.0	1.96	7.47	7.47	7.47	0.44	0.89	±12.1%
3300	38.2	2.71	7.25	7.25	7.25	0.38	1.02	±13.3%
3500	37.9	2.91	7.02	7.02	7.02	0.47	0.90	±13.3%
3700	37.7	3.12	6.68	6.68	6.68	0.38	1.07	±13.3%
3900	37.5	3.32	6.68	6.68	6.68	0.35	1.42	±13.3%
4100	37.2	3.53	6.65	6.65	6.65	0.40	1.15	±13.3%
4200	37.1	3.63	6.52	6.52	6.52	0.35	1.35	±13.3%
4400	36.9	3.84	6.41	6.41	6.41	0.30	1.50	±13.3%
4600	36.7	4.04	6.24	6.24	6.24	0.40	1.35	±13.3%
4800	36.4	4.25	6.15	6.15	6.15	0.40	1.45	±13.3%
4950	36.3	4.40	5.85	5.85	5.85	0.40	1.42	±13.3%
5250	35.9	4.71	5.55	5.55	5.55	0.40	1.40	±13.3%
5600	35.5	5.07	4.89	4.89	4.89	0.55	1.22	±13.3%
5750	35.4	5.22	4.99	4.99	4.99	0.55	1.21	±13.3%

[C] 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, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

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In Collaboration with
**s p e a g**
CALIBRATION LABORATORY

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Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)
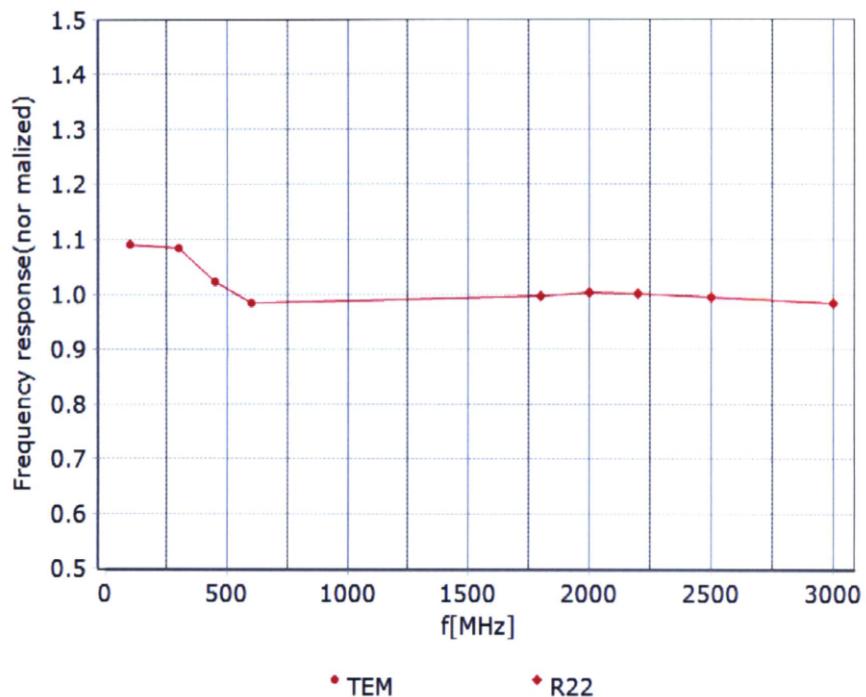
Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)

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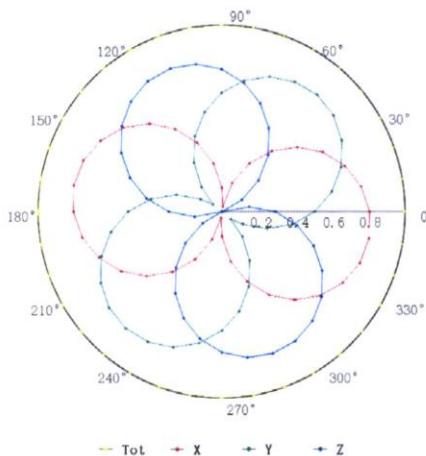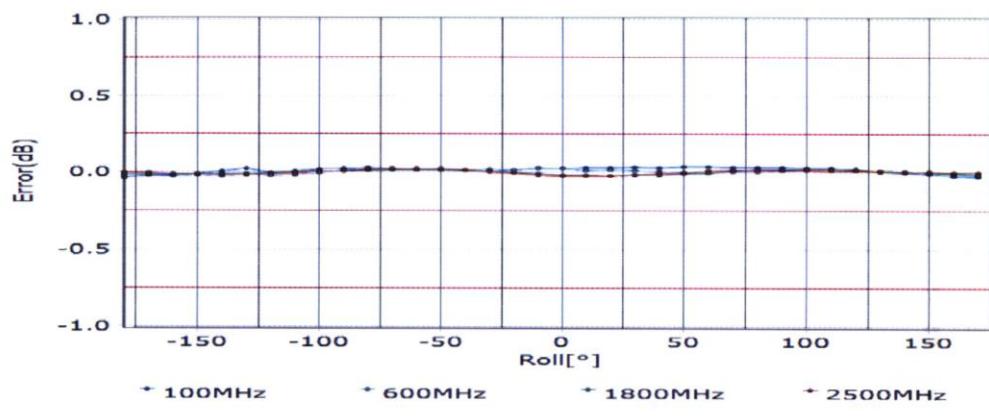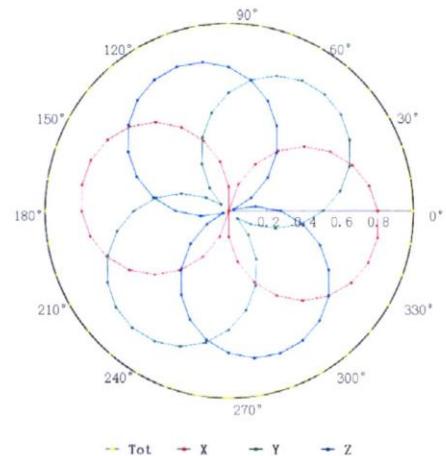
Dynamic Range f(SAR_head)
(TEM cell, f = 900 MHz)

- not compensated - compensated

- not compensated - compensated
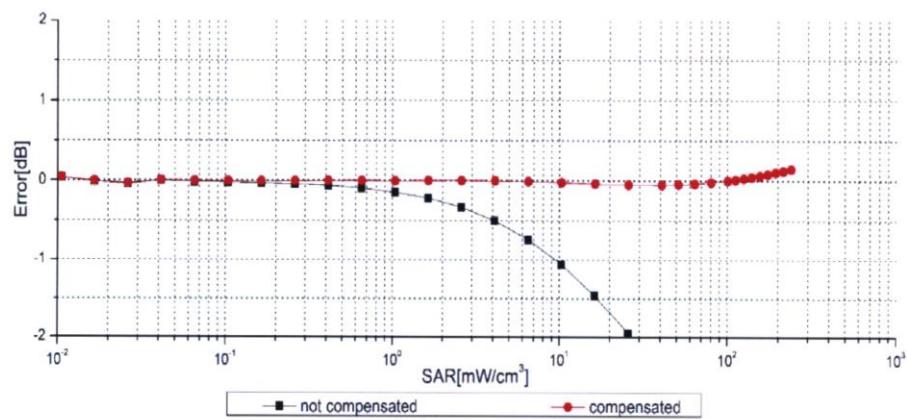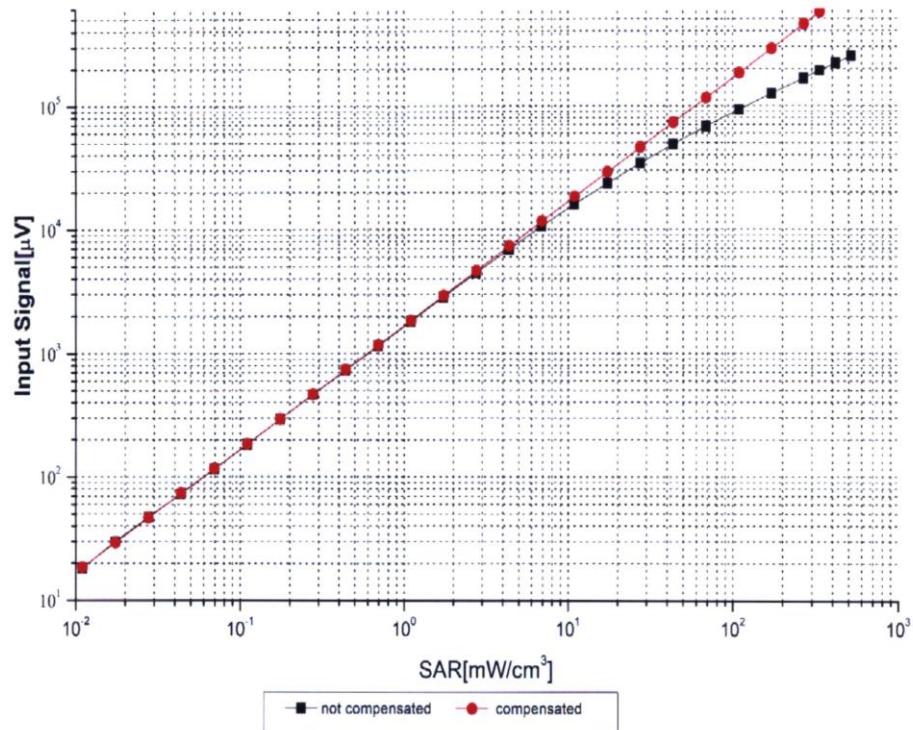
Uncertainty of Linearity Assessment: ±0.9% (*k*=2)

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Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF)   f=1750 MHz,WGLS R22(H_convF)
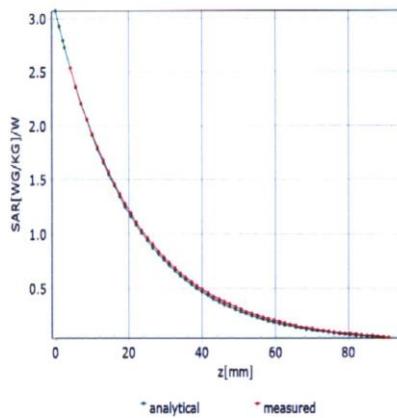
* analytical   * measured   * analytical   * measured
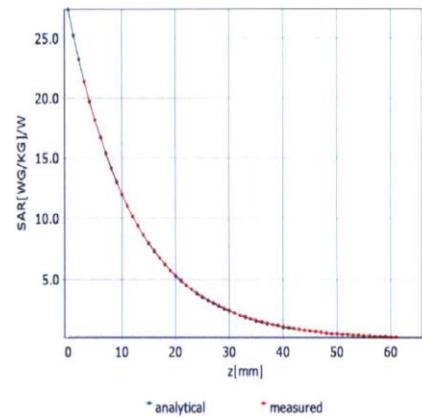
Deviation from Isotropy in Liquid
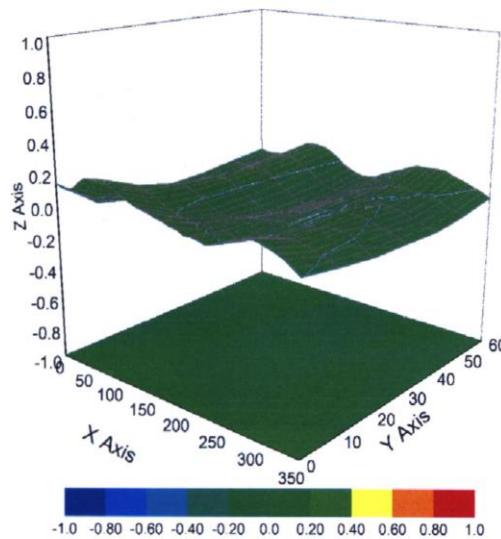
Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)

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