SAR TEST REPORT

No. 25T04Z200152-002

For

Samsung Electronics Co., Ltd.

Tablet with Bluetooth, WLAN

Model Name: SM-X133

FCC ID: ZCASMX133

with

Hardware Version: REV1.0

Software Version: X133.001

Issued Date: 2025-07-25

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:

CTTL, Telecommunication Technology Labs, CAICT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512,Fax:+86(0)10-62304633-2504

Email:cttl_terminals@caict.ac.cn, website:www.chinattl.com

REPORT HISTORY

Report Number	Revision	Issue Date	Description
25T04Z200152-002	Rev.0	2025-7-20	Initial creation of test report
25T04Z200152-002	Rev.1	2025-7-25	Update information for the section5.3; Update the tune up power of WLAN 2.4G 802.11g/n sensor off on page 29;
25T04Z200152-002	Rev.2	2025-7-25	Update information for the section5.3;

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1 Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA website.

1.2. Testing Location

Location 1: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,
P. R. China 100191

1.3. Testing Environment

Normal Temperature:	18-25℃
Relative Humidity:	30-70%

1.4. Project data

Testing Start Date:	2025-07-07
Testing End Date:	2025-07-10

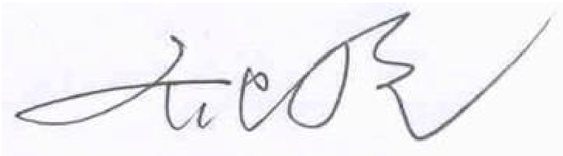
1.5. Signature

Zhang Xin

(Prepared this test report)

Lin Jun

(Reviewed this test report)



Qi Dianyuan

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 Samsung Electronics Co., Ltd. Tablet with Bluetooth, WLAN SM-X133 are as follows:

Table 2.1: Highest Reported SAR (1g)

Technology Band	1g SAR Hotspot	1g SAR Body-worn
WLAN 2.4GHz	**0.99**	**0.41**
WLAN 5GHz	**0.71**	**0.71**
BT	**0.10**	**0.10**

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/kg as averaged over any 1g 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**:**

Hotspot: 0.99 W/kg(1g)

Body-worn: 0.71 W/kg(1g)

Table 2.2: Simultaneous Transmission-Body

	Position	**WiFi**	**BT**	**Sum**
Highest SAR value for Body	Front 8mm	0.71 (WiFi5G)	0.06	**0.77**

Note1: the test positions of above tables are for the worse case that have been evaluated.

According to the above tables, the highest sum of reported SAR values is **0.77W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

Conclusion:

According to the above tables, the sum of reported SAR values is<1.6W/kg for 1g SAR. So the simultaneous transmission SAR with volume scans is not required.

3 Client Information

3.1 Applicant Information

Company Name:	Samsung Electronics Co., Ltd.
Address/Post:	19 Chapin Rd.,Building D Pine Brook, NJ 07058
Contact Person:	Jenni Chun
Contact Email:	j1.chun@samsung.com
Telephone:	+1-201-937-4203
Fax	/

3.2 Manufacturer Information

Company Name:	Samsung Electronics Co., Ltd.
Address/Post:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea
Contact Person:	Kobe Cho
Contact Email:	ggobi.cho@samsung.com
Telephone:	+82 - 10 - 2722 - 4159
Fax	/

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

4.1 About EUT

Description:	Tablet with Bluetooth, WLAN
Model name:	SM-X133
Operating mode(s):	Wi-Fi(2.4G&5G),BT
Tested Tx Frequency:	2412 – 2462 MHz (Wi-Fi 2.4G)
	5180 – 5240 MHz (Wi-Fi 5.2G)
	5260 – 5320 MHz (Wi-Fi 5.3G)
	5500 – 5720 MHz (Wi-Fi 5.5G)
	5745 – 5825 MHz (Wi-Fi 5.8G)
	2400 – 2483.5 MHz (Bluetooth)
Test device production information:	Production unit
Device type:	Portable device
Antenna type:	Integrated antenna
Hotspot mode:	Support

4.2 Internal Identification of EUT used during the test

EUT ID*	SN	HW Version	SW Version
EUT1	25T04Z200152-13a	REV1.0	X133.001
EUT2	25T04Z200152-14a	REV1.0	X133.001
EUT3	25T04Z200152-08a	REV1.0	X133.001

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

Note: It is performed to test SAR with the EUT1-2 and conducted power with the EUT3.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	HQ-3565S	\	Secondary Li-ion Battery
AE2	Battery	HQ-6739SDS	\	Secondary Li-ion Battery

*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.

It specifies the maximum exposure limit of **4.0** W/kg as averaged over any 10 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

5.2 Applicable Measurement Standards

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

EN IEC/IEEE 62209-1528:2021 Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from head-held and body-mounted wireless communication devices (Frequency range of 4 MHz to 10 GHz)

5.3 KDB and Workshop Procedures

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

KDB941225 D06 Hotspot Mode SAR v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

KDB248227 D01 802.11 Wi-Fi SAR v02r02: Sar Guidance For IEEE 802.11 (Wi-Fi) Transmitters

KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB616217 D04 SAR for laptop and tablets v01r02：SAR Evaluation Considerations
For Laptop, Notebook, Netbook and Tablet Computers.

KDB865664 D02 RF 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:

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

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 <3GHz)

Frequency(MHz)	Liquid Type	Conductivity(σ)	±10% Range	Permittivity(ε)	± 10% Range
750	Head	0.89	0.80～0.98	41.94	37.75～46.13
900	Head	0.97	0.87～1.07	41.5	37.35～45.65
1800	Head	1.40	1.26～1.54	40.0	36～44
1900	Head	1.40	1.26～1.54	40.0	36～44
2000	Head	1.40	1.26～1.54	40.0	36～44
2300	Head	1.67	1.50～1.84	39.47	37.5～41.4
2450	Head	1.80	1.62～1.98	39.2	35.28～43.12
2600	Head	1.96	1.76～2.16	39.01	35.11～42.91

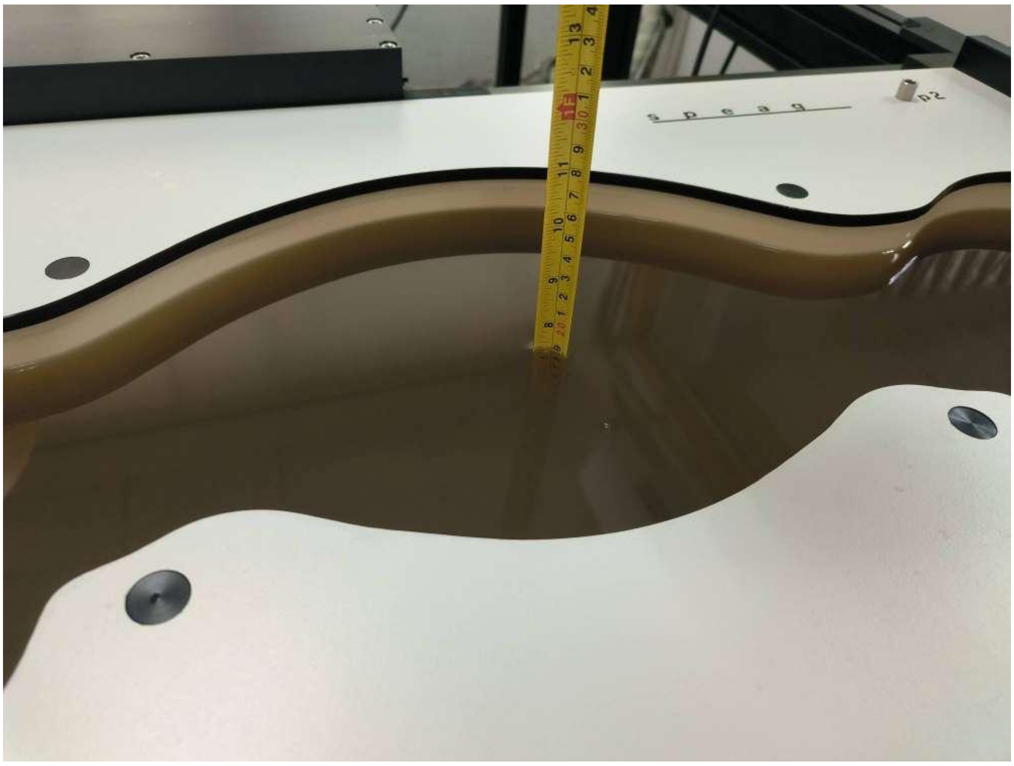
Table 7.2: Targets for tissue simulating liquid(frequency >3GHz)

Frequency(MHz)	Liquid Type	Conductivity(σ)	± 5% Range	Permittivity(ε)	± 5% Range
3300	Head	2.71	2.57～2.85	38.2	36.29～40.11
3500	Head	2.91	2.76～3.06	37.93	36.03～39.83
3700	Head	3.22	3.06~3.38	37.6	35.72~39.48
3900	Head	3.32	3.15~3.49	37.5	35.63~39.38
4200	Head	3.63	3.45~3.81	37.1	35.25~38.96
5250	Head	4.71	4.47～4.95	35.93	34.13～37.73
5600	Head	5.07	4.82～5.32	35.53	33.8～37.3
5750	Head	5.22	4.96～5.48	35.36	33.59～37.13

7.2 Dielectric Performance

Table 7.3: Dielectric Performance of Head Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2025/7/7	Head	2450 MHz	40.86	4.23	1.884	4.67
2025/7/10	Head	5250 MHz	36.91	2.73	4.511	-4.23
2025/7/10	Head	5600 MHz	36.31	2.20	4.885	-3.65
2025/7/10	Head	5750 MHz	36.07	2.01	5.05	-3.26

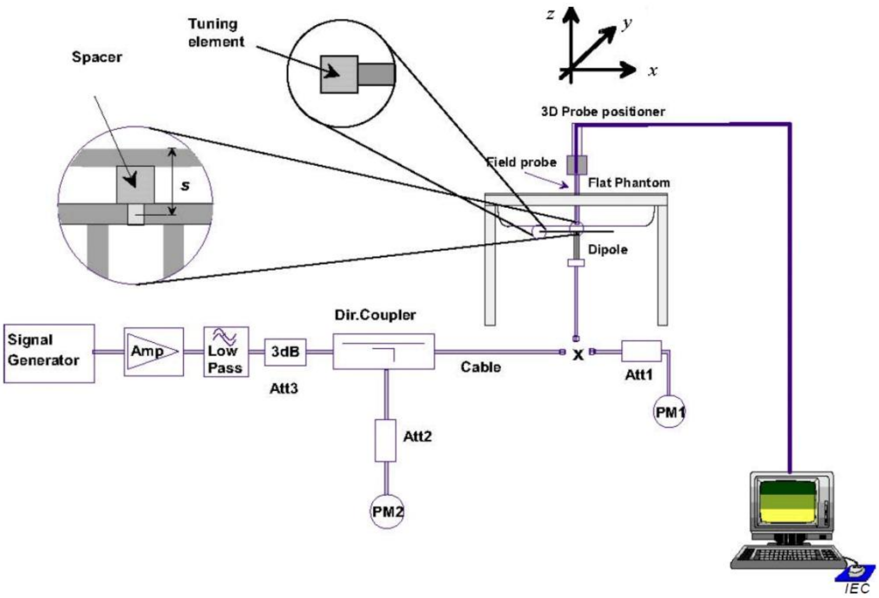


Picture 1 Liquid depth in the Flat Phantom

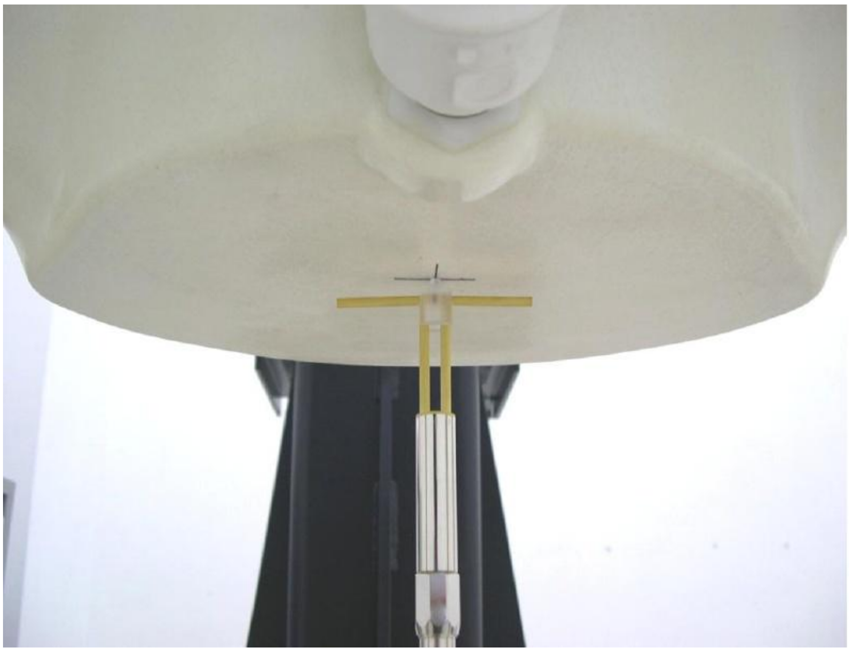
8 System verification

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 3 System Setup for System Evaluation



Picture 4 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 Validation 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
2025/7/7	2450 MHz	24.5	52.2	24.7	50.4	0.73%	-3.45%
2025/7/10	5250 MHz	22.3	77.8	21.7	78.3	-2.69%	0.64%
2025/7/10	5600 MHz	23.4	81.2	23.2	82.7	-0.85%	1.85%
2025/7/10	5750 MHz	21.7	76.1	22.2	78.1	2.30%	2.63%

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 5.

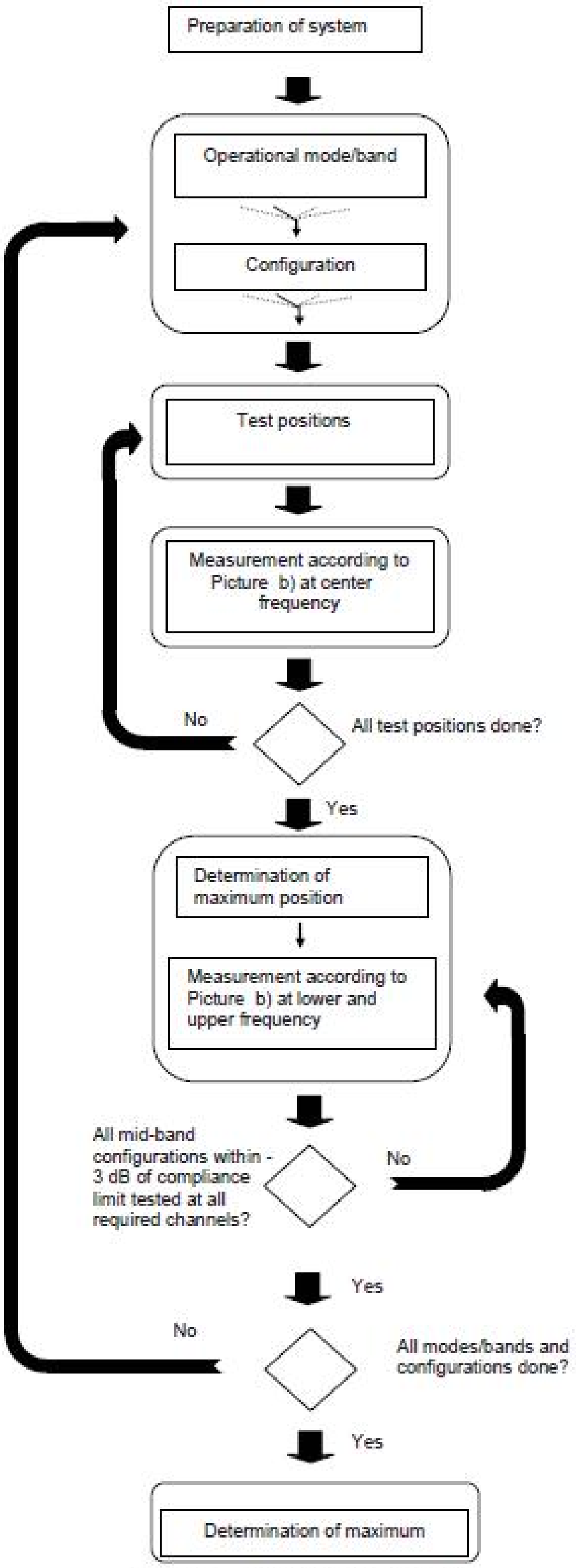
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

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.

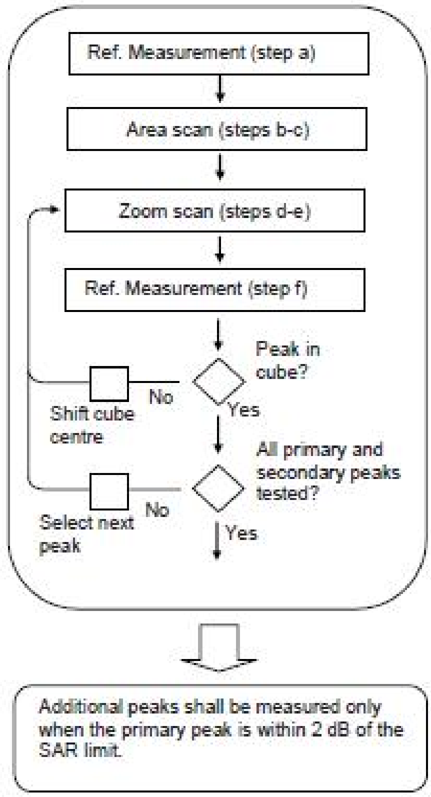
If more than three frequencies need to be tested according to 11.1 (i.e., N_c > 3), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1,perform all tests described in 10.2 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 5 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 1528-2003. 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.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">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 $\leq$ 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.</td></tr>
</table>

9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.5	1.5	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	1.5	1.5	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	1.5	1.5	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	1.5	1.5	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.5	1.5	21	81

Rel.8 DC-HSDPA (Cat 24)

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

9.4 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.

TDD test:

TDD testing is performed using guidance from FCC KDB 941225 D05 and the SAR test guidance provided in April 2013 TCB works hop notes. TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225 D05. SAR testing is performed using the extended cyclic prefix listed in 3GPP TS 36.211.

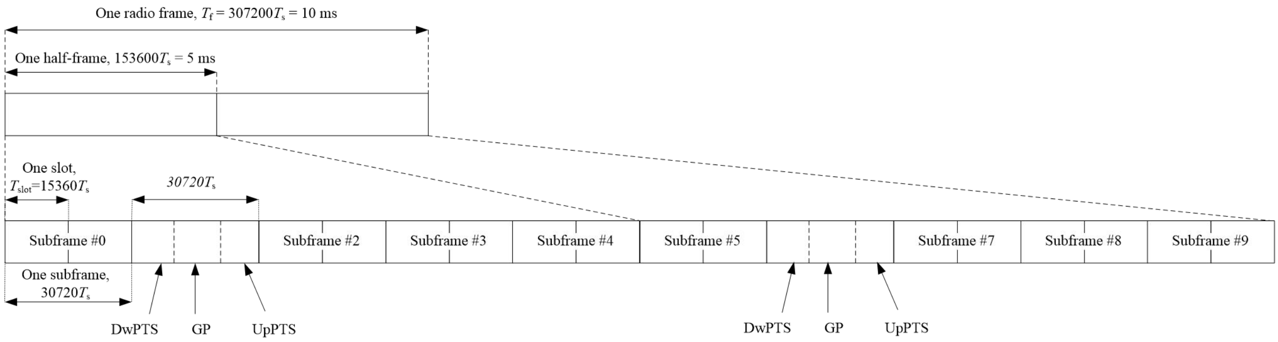


Figure 6: Frame structure type 2 (for 5 ms switch-point periodicity)

Table 9.1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

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

Table 9.2: Uplink-downlink configurations

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

Duty factor is calculated by:

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

$= (30720.T_s * 6+5120. T_s*2)/307200.T_s$
$= 0.633$

9.5 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 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.

9.6 NR Measurement Procedures for SAR

Due to test setup limitations, SAR testing for NR was performed using Factory Test Mode software to establish the connection and perform SAR with 100% transmission.

9.7 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 Wi-Fi and BT Measurement result

The maximum output power of BT antenna is 6.31dBm.
The maximum tune up of BT antenna is 7dBm.

WIFI2.4G power sensor on

FCC			Tune up
802.11b	Channel\data	1Mbps	
WLAN2450	11(2462MHz)	10.66	12.00
	6(2437(MHz)	10.84	12.00
	1(2412MHz)	10.62	12.00
802.11g	Channel\data	6Mbps	
WLAN2450	11(2462MHz)	10.61	12.00
	6(2437(MHz)	10.63	12.00
	1(2412MHz)	10.58	12.00
802.11n-20MHz	Channel\data	MCS0	
WLAN2450	11(2462MHz)	10.41	12.00
	6(2437(MHz)	10.63	12.00
	1(2412MHz)	10.37	12.00

WIFI2.4G power sensor off

FCC			Tune up
802.11b	Channel\data	1Mbps	
WLAN2450	11(2462MHz)	17.03	18.00
	6(2437(MHz)	17.17	18.00
	1(2412MHz)	16.98	18.00
802.11g	Channel\data	6Mbps	
WLAN2450	11(2462MHz)	13.31	14.50
	6(2437(MHz)	16.61	17.50
	1(2412MHz)	15.56	16.50
802.11n-20MHz	Channel\data	MCS0	
WLAN2450	11(2462MHz)	13.28	14.50
	6(2437(MHz)	16.38	17.50
	1(2412MHz)	15.41	16.50

WIFI5G power sensor on

5GHz		Tune up
802.11ac(dBm)-80MHz		
Channel\data rate	MCS0	
42(5210 MHz)	6.11	8
58(5290 MHz)	6.04	8
106(5530 MHz)	6.23	8
122(5610 MHz)	6.31	8
138(5690 MHz)	6.16	8
155(5775 MHz)	6.03	8

WIFI5G power sensor off

5GHz		Tune up
802.11a(dBm)		
Channel\data rate	6Mbps	
36(5180 MHz)	15.51	16.50
40(5200 MHz)	15.54	16.50
44(5220 MHz)	15.56	16.50
48(5240 MHz)	15.63	16.50
52(5260 MHz)	15.69	16.50
56(5280 MHz)	15.66	16.50
60(5300 MHz)	15.65	16.50
64(5320 MHz)	15.61	16.50
149(5745 MHz)	16.74	17.50
153(5765 MHz)	16.62	17.50
157(5785 MHz)	16.65	17.50
161(5805 MHz)	16.81	17.50
165(5825 MHz)	16.79	17.50
802.11n(dBm)-40MHz		
Channel\data rate	MCS0	
102(5510 MHz)	12.19	13.50
110(5550 MHz)	12.24	13.50
118(5590 MHz)	12.77	13.50
126(5630 MHz)	12.79	13.50
134(5670 MHz)	12.56	13.50
142(5710 MHz)	12.38	13.50

11 SAR Test Result

Note:

KDB 447498 D01 General RF Exposure Guidance:

For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor

For BT/WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor

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

≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz

≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

KDB 941225 D05 SAR for LTE Devices:

SAR test reduction is applied using the following criteria:

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% 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 for other Channels is performed at the highest output power level for 1RB, and 50% RB configuration for that channel.

Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low,Mid and High Channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg. Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg.

Testing for 16-QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/Kg and its output power is not more than 0.5 dB higher than that of QPSK.

Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is <1.45 W/Kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

For LTE bands that do not support at least three non-overlapping channels in certain channel bandwidths, test the available non-overlapping channels instead. When a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing; therefore, the requirement for H, M and L channels may not fully apply.

KDB 248227 D01 SAR meas for 802.11:

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

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

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

≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.

> 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

• For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.

• When it is unclear, all equivalent conditions must be tested.

For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.

•The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

Table 15.1: Duty Cycle

Mode	Duty Cycle
Speech for GSM	1:8.3
GPRS&EGPRS 1 Slot	1:8.3
GPRS&EGPRS 2 Slot	1:4
GPRS&EGPRS 3 Slot	1:2.67
GPRS&EGPRS 4 Slot	1:2
WCDMA&LTE FDD	1:1
TDD PC3	1:1.58
TDD PC2	1:2.31

11.1 SAR results for WLAN

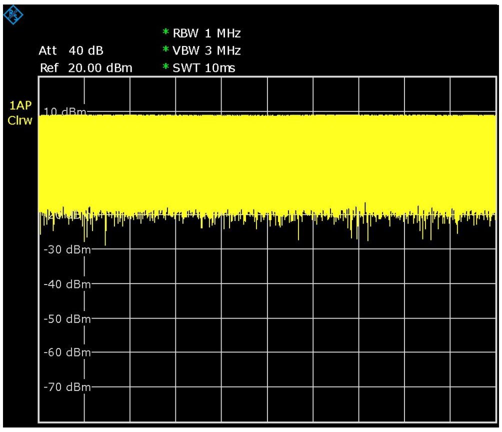
The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac/ax modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n ac then ax) is selected.

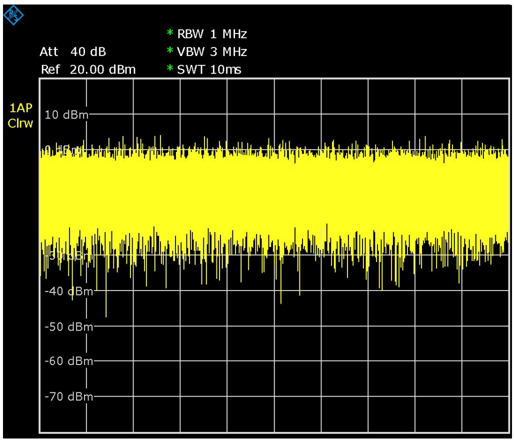
SAR Test reduction was applied from KDB 248227 guidance, when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

Duty factor plot

WIFI 2.4G



WIFI5G



WIFI2.4G

ANT	RF Exposure Conditions	Frequency Band	Channel Number	Frequency (MHz)	RB/TX slot	Mode	Test Position	Distance	Figure No./Note	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Reported SAR 10g (W/kg)	Power Drift
3	sensor off	WLAN 2.4G	11	2462	1M	802.11b	Front	8mm	\	17.03	18.00	0.244	0.31	0.119	0.15	-0.1
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Front	8mm	\	17.17	18.00	0.264	0.32	0.126	0.15	0.05
3	sensor off	WLAN 2.4G	1	2412	1M	802.11b	Front	8mm	\	16.98	18.00	0.321	0.41	0.153	0.19	0.14
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Rear	12mm	\	17.17	18.00	0.238	0.29	0.115	0.14	0
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Left	0mm	\	17.17	18.00	0.094	0.11	0.033	0.04	0.07
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Right	0mm	\	17.17	18.00	0.13	0.16	0.051	0.06	0.15
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Bottom	0mm	\	17.17	18.00	<0.01	0.00	<0.01	0.00	\
3	sensor off	WLAN 2.4G	6	2437	1M	802.11b	Top	17mm	\	17.17	18.00	0.117	0.14	0.06	0.07	-0.05
3	Body	WLAN 2.4G	6	2437	1M	802.11b	Front	0mm	\	10.84	12.00	0.334	0.44	0.127	0.17	-0.08
3	Body	WLAN 2.4G	1	2412	1M	802.11b	Rear	0mm	\	10.66	12.00	0.603	0.82	0.22	0.30	-0.08
3	Body	WLAN 2.4G	6	2437	1M	802.11b	Rear	0mm	\	10.84	12.00	0.543	0.71	0.211	0.28	-0.13
3	Body	WLAN 2.4G	11	2462	1M	802.11b	Rear	0mm	F.1	10.62	12.00	0.717	0.99	0.274	0.38	0.11
3	Body	WLAN 2.4G	11	2462	1M	802.11b	Rear	0mm	B2	10.62	12.00	0.704	0.97	0.268	0.37	0.04
3	Body	WLAN 2.4G	6	2437	1M	802.11b	Top	0mm	\	10.84	12.00	0.326	0.43	0.116	0.15	0.01

WIFI5G

ANT	RF Exposure Conditions	Frequency Band	Channel Number	Frequency (MHz)	RB/TX slot	Mode	Test Position	Distance	Figure No./Note	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Reported SAR 10g (W/kg)	Power Drift
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Front	8mm	\	15.63	16.50	0.333	0.41	0.09	0.11	-0.11
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Rear	12mm	\	15.63	16.50	0.264	0.32	0.07	0.09	0.03
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Left	0mm	\	15.63	16.50	0.043	0.05	0.01	0.01	-0.05
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Right	0mm	\	15.63	16.50	0.049	0.06	0.013	0.02	0.14
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Bottom	0mm	\	15.63	16.50	<0.01	0.00	<0.01	0.00	\
3	sensor off	WLAN 5G	48	5240	MCS0	802.11a	Top	17mm	\	15.63	16.50	0.334	0.41	0.096	0.12	-0.01
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Front	8mm	\	15.69	16.50	0.367	0.44	0.095	0.11	-0.12
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Rear	12mm	\	15.69	16.50	0.305	0.37	0.08	0.10	0.07
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Left	0mm	\	15.69	16.50	0.044	0.05	0.013	0.02	0.09
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Right	0mm	\	15.69	16.50	0.072	0.09	0.017	0.02	0.04
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Bottom	0mm	\	15.69	16.50	<0.01	0.00	<0.01	0.00	\
3	sensor off	WLAN 5G	52	5260	MCS0	802.11a	Top	17mm	\	15.69	16.50	0.323	0.39	0.095	0.11	0.11
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Front	8mm	\	12.79	13.50	0.273	0.32	0.072	0.08	-0.13
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Rear	12mm	\	12.79	13.50	0.174	0.20	0.045	0.05	0.12
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Left	0mm	\	12.79	13.50	0.061	0.07	0.016	0.02	-0.11
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Right	0mm	\	12.79	13.50	0.059	0.07	0.015	0.02	0.17
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Bottom	0mm	\	12.79	13.50	0.044	0.05	0.007	0.01	-0.16
3	sensor off	WLAN 5G	126	5630	MCS0	802.11n-40M	Top	17mm	\	12.79	13.50	0.282	0.33	0.079	0.09	-0.17
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Front	8mm	F.2	16.81	17.50	0.606	0.71	0.155	0.18	0.19
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Rear	12mm	\	16.81	17.50	0.338	0.40	0.086	0.10	0.11
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Left	0mm	\	16.81	17.50	0.104	0.12	0.027	0.03	-0.05
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Right	0mm	\	16.81	17.50	0.089	0.10	0.026	0.03	-0.01
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Bottom	0mm	\	16.81	17.50	<0.01	0.00	<0.01	0.00	\
3	sensor off	WLAN 5G	161	5805	MCS0	802.11a	Top	17mm	\	16.81	17.50	0.428	0.50	0.126	0.15	-0.14
3	Body	WLAN 5G	42	5210	MCS0	802.11ac-80M	Front	0mm	\	6.11	8.00	0.063	0.10	0.013	0.02	-0.15
3	Body	WLAN 5G	42	5210	MCS0	802.11ac-80M	Rear	0mm	\	6.11	8.00	0.062	0.10	0.013	0.02	-0.12
3	Body	WLAN 5G	42	5210	MCS0	802.11ac-80M	Top	0mm	\	6.11	8.00	0.292	0.45	0.04	0.06	0
3	Body	WLAN 5G	58	5290	MCS0	802.11ac-80M	Front	0mm	\	6.04	8.00	0.181	0.28	0.033	0.05	-0.17
3	Body	WLAN 5G	58	5290	MCS0	802.11ac-80M	Rear	0mm	\	6.04	8.00	0.196	0.31	0.037	0.06	0.08
3	Body	WLAN 5G	58	5290	MCS0	802.11ac-80M	Top	0mm	\	6.04	8.00	0.384	0.60	0.059	0.09	0.01
3	Body	WLAN 5G	122	5610	MCS0	802.11ac-80M	Front	0mm	\	6.31	8.00	0.308	0.45	0.05	0.07	0.02
3	Body	WLAN 5G	122	5610	MCS0	802.11ac-80M	Rear	0mm	\	6.31	8.00	0.361	0.53	0.06	0.09	-0.11
3	Body	WLAN 5G	122	5610	MCS0	802.11ac-80M	Top	0mm	\	6.31	8.00	0.421	0.62	0.062	0.09	-0.01
3	Body	WLAN 5G	155	5775	MCS0	802.11ac-80M	Front	0mm	\	6.03	8.00	0.195	0.31	0.04	0.06	0.09
3	Body	WLAN 5G	155	5775	MCS0	802.11ac-80M	Rear	0mm	\	6.03	8.00	0.2	0.31	0.037	0.06	0.1
3	Body	WLAN 5G	155	5775	MCS0	802.11ac-80M	Top	0mm	\	6.03	8.00	0.231	0.36	0.038	0.06	-0.04

11.2 SAR results for BT

ANT	RF Exposure Conditions	Frequency Band	Channel Number	Frequency (MHz)	RB/TX slot	Mode	Test Position	Distance	Figure No./Note	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Reported SAR 10g (W/kg)	Power Drift
3	Body	BT	0	2402	DH5	GFSK	Front	0mm	\	6.31	7.00	0.054	0.06	0.019	0.02	-0.11
3	Body	BT	0	2402	DH5	GFSK	Rear	0mm	F.3	6.31	7.00	0.084	0.10	0.027	0.03	0
3	Body	BT	0	2402	DH5	GFSK	Left	0mm	\	6.31	7.00	<0.01	<0.01	<0.01	<0.01	\
3	Body	BT	0	2402	DH5	GFSK	Right	0mm	\	6.31	7.00	<0.01	<0.01	<0.01	<0.01	\
3	Body	BT	0	2402	DH5	GFSK	Top	0mm	\	6.31	7.00	0.057	0.07	0.017	0.02	-0.09
3	Body	BT	0	2402	DH5	GFSK	Bottom	0mm	\	6.31	7.00	<0.01	<0.01	<0.01	<0.01	\

11.3 SAR results for Phablet

According to the KDB648474 D04, for smart phones, with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, that can provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets and support voice calls next to the ear, unless it is confirmed otherwise through KDB inquiries, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance.

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.
2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB Publication 865664 D01 to address interactive hand use exposure conditions. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg; however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold. The normal tablet procedures in KDB Publication 616217 are required when the overall diagonal dimension of the device is > 20.0 cm. Hotspot mode SAR is not required when normal tablet procedures are applied. Extremity 10-g SAR is also not required for the front (top) surface of larger form factor full size tablets. The more conservative normal tablet SAR results can be used to support phablet mode 10-g extremity SAR.
3. The simultaneous transmission operating configurations applicable to voice and data transmissions for both phone and mini-tablet modes must be taken into consideration separately for 1-g and 10-g SAR to determine the simultaneous transmission SAR test exclusion and measurement requirements for the relevant wireless modes and exposure conditions

The 10g extremity SAR is not required for this DUT, because all the hotspot mode 1g reported SAR is less than 1.2 W/kg.

11.4 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

12 Simultaneous TX SAR Considerations

12.1 Transmit Antenna Separation Distances

The detail for transmit antenna separation distances is described in the additional document:

Appendix to test report No.25T04Z200152-002

The photos of SAR test

12.2 Simultaneous Transmission

12.2.1 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 WLAN and Bluetooth devices which may simultaneously transmit with the licensed transmitter. KDB 447498 D01 provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

12.2.2 Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

12.2.3 SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$SPLSR = (SAR1 + SAR2)^{1.5} / Ri$

Where:

SAR1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition.

SAR2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first .

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of

$[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$(SAR1 + SAR2)^{1.5} / Ri \leqslant 0.04$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest reported SAR for the frequency bands should be used to determine SAR1 or SAR2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

12.2.4 Evaluation of Simultaneous

Sensor off		BT	WIFI5G	SUM
Front	8mm	0.06	0.71	0.77
Rear	12mm	0.10	0.4	0.50
Top	17mm	0.07	0.5	0.57

Sensor on		BT	WIFI5G	SUM
Front	0mm	0.06	0.45	0.51
Rear	0mm	0.10	0.53	0.63
Left	0mm	0.00	0.12	0.12
Right	0mm	0.00	0.1	0.10
Bottom	0mm	0.00	0	0.00
Top	0mm	0.07	0.62	0.69

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.

13 Measurement Uncertainty

13.1 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	A	1.6	N	1	0.6	0.49	1.0	0.8	521

	(meas.)									
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	

13.2 Measurement Uncertainty for Normal SAR Tests (3~6GHz)

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	6.55	N	1	1	1	6.55	6.55	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	$\sqrt{3}$	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	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	$\sqrt{3}$	1	1	3.9	3.9	∞
13	Post-processing	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
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	A	2.06	N	1	0.64	0.43	1.32	0.89	43

	(meas.)									
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
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$						10.7	10.6	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						21.4	21.1	

14 MAIN TEST INSTRUMENTS

Table 14.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	December 18, 2024	One year
02	Power sensor	NRP50S	101488	May 30, 2025	One year
03	Power sensor	NRP50S	101489		
04	Signal Generator	E4438C	MY49071430	December 19 2024	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	DAE	DAE4	1588	September 13,2024	One year
07	E-field Probe	EX3DV4	3846	May 28,2025	One year
08	Dipole Validation Kit	D2450V2	853	July 10,2024	One year
09	Dipole Validation Kit	D5GHzV2	1262	January 17,2025	One year

END OF REPORT BODY

ANNEX A GRAPH RESULTS

WIFI2.4G BODY

Date/Time: 2025-07-07

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used (interpolated): f = 2462 MHz; σ = 1.835 S/m; ε_r = 39.59; ρ = 1000 kg/m^3

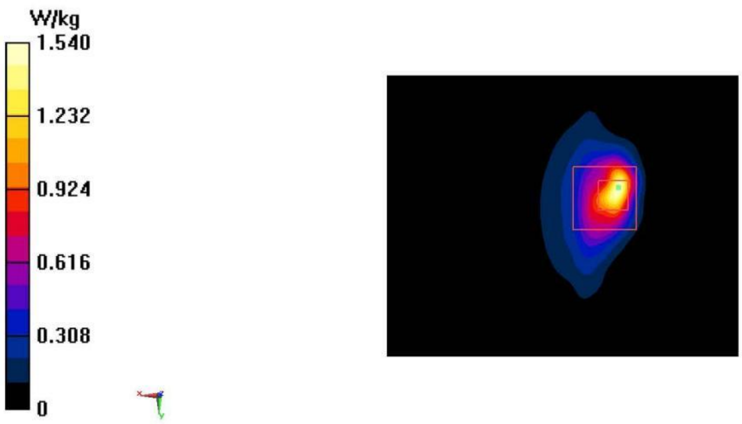
Ambient Temperature:23.3°C Liquid Temperature: 22.5°C

Communication System: UID 0, WLan 2450 (0) Frequency: 2462 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(7.43, 7.43, 7.43) @ 2462 MHz

Area Scan (101x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.01 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 2.22 W/kg
SAR(1 g) = 0.717 W/kg; SAR(10 g) = 0.274 W/kg
Maximum value of SAR (measured) = 1.54 W/kg



F. 1

WIFI5G BODY

Date/Time: 2025-07-10

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 5805 MHz; σ = 5.157 S/m; ε_r = 34.131; ρ = 1000 kg/m^3

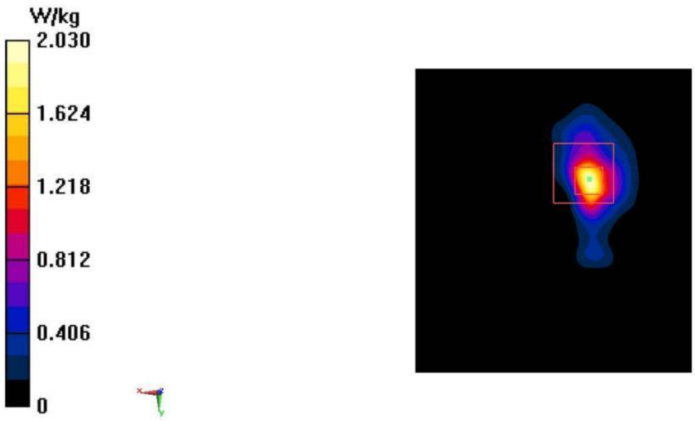
Ambient Temperature:23.3°C   Liquid Temperature: 22.5°C

Communication System: UID 0, WLan 11a (0) Frequency: 5805 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(4.92, 4.92, 4.92) @ 5805 MHz

Area Scan (101x111x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.03 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 3.10 W/kg
SAR(1 g) = 0.606 W/kg; SAR(10 g) = 0.155 W/kg
Maximum value of SAR (measured) = 1.73 W/kg



F. 2

BT BODY

Date/Time: 2025-07-07

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 2402 MHz; σ = 1.852 S/m; ε_r = 39.556; ρ = 1000 kg/m^3

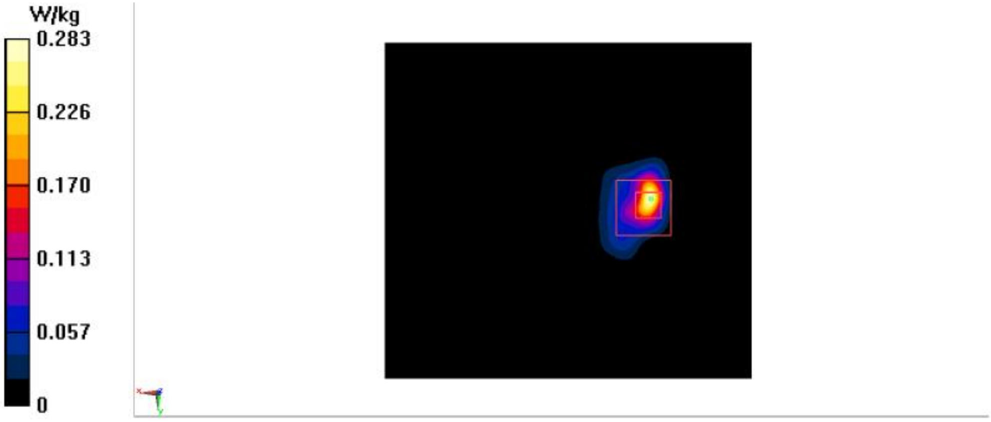
Ambient Temperature:23.3°C Liquid Temperature: 22.5°C

Communication System: UID 0, Bluetooth (0) Frequency: 2402 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN3846 ConvF(7.43, 7.43, 7.43) @ 2402 MHz

Area Scan (121x111x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.283 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.420 W/kg
SAR(1 g) = 0.084 W/kg; SAR(10 g) = 0.027 W/kg
Maximum value of SAR (measured) = 0.188 W/kg



F. 3

ANNEX B   SYSTEM VALIDATION RESULTS

2450 MHz

Date: 2025/7/7

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 2450 MHz; σ =1.884mho/m; εr = 40.86; ρ = 1000 kg/m3

Ambient Temperature: 22.5oC Liquid Temperature: 22.3oC

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

Probe: EX3DV4 –SN3846 ConvF(7.43, 7.43, 7.43)

Area Scan (81x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 21.4 W/kg

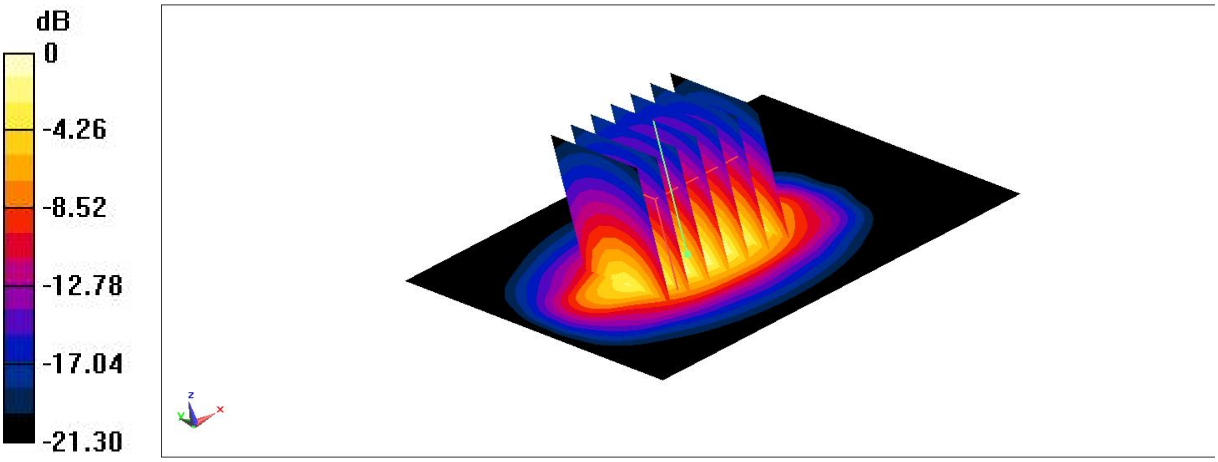
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =103.3 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 28.5 W/kg

SAR(1 g) = 12.6 W/kg; SAR(10 g) = 6.17 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

5250 MHz

Date: 2025/7/10

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 5250 MHz; σ =4.511 S/m; εr = 36.91; ρ = 1000 kg/m3

Ambient Temperature: 22.5oC Liquid Temperature: 22.3oC

Communication System: CW Frequency: 5250 MHz Duty Cycle: 1:1

Probe: EX3DV4 –SN3846 ConvF(5.40, 5.40, 5.40)

Area Scan (51x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.8 W/kg

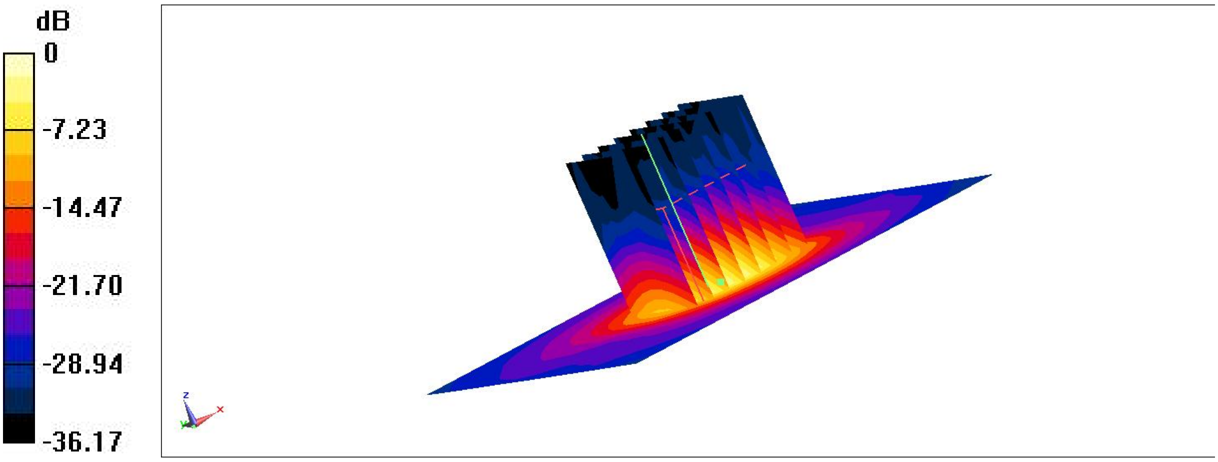
Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value =66.54 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 32.1 W/kg

SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

5600 MHz

Date: 2025/7/10

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 5600 MHz; σ =4.885 S/m; εr = 36.31; ρ = 1000 kg/m3

Ambient Temperature: 22.5oC Liquid Temperature: 22.3oC

Communication System: CW Frequency: 5600 MHz Duty Cycle: 1:1

Probe: EX3DV4 –SN3846 ConvF(4.80, 4.80, 4.80)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 19.5 W/kg

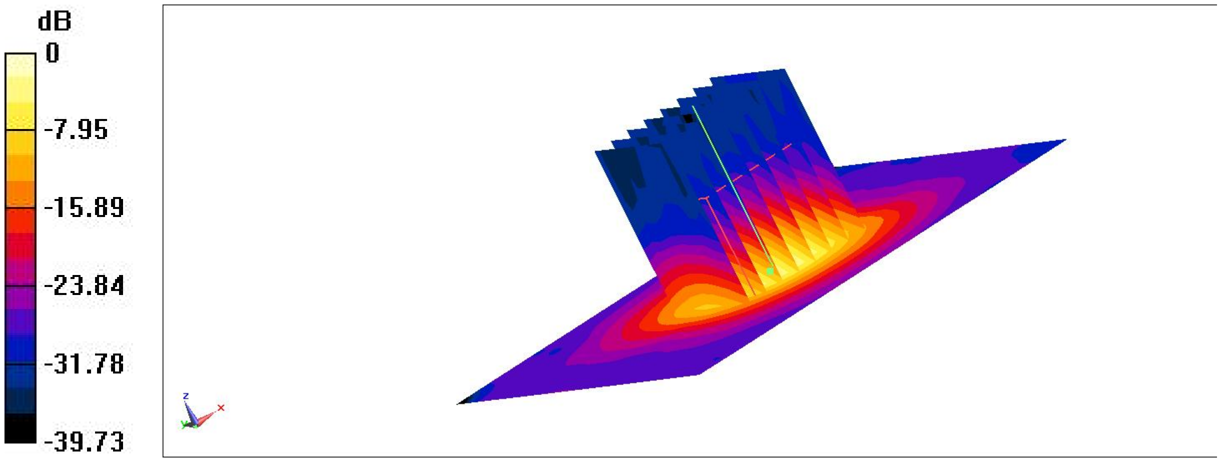
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value =67.71 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 35.0 W/kg

SAR(1 g) = 8.27 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

5750 MHz

Date: 2025/7/10

Electronics: DAE4 Sn1588

Medium: H700-6000M

Medium parameters used: f = 5750 MHz; σ =5.05 S/m; εr = 36.07; ρ = 1000 kg/m3

Ambient Temperature: 22.5oC Liquid Temperature: 22.3oC

Communication System: CW Frequency: 5750 MHz Duty Cycle: 1:1

Probe: EX3DV4 –SN3846 ConvF(4.92, 4.92, 4.92)

System Validation /Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.7 W/kg

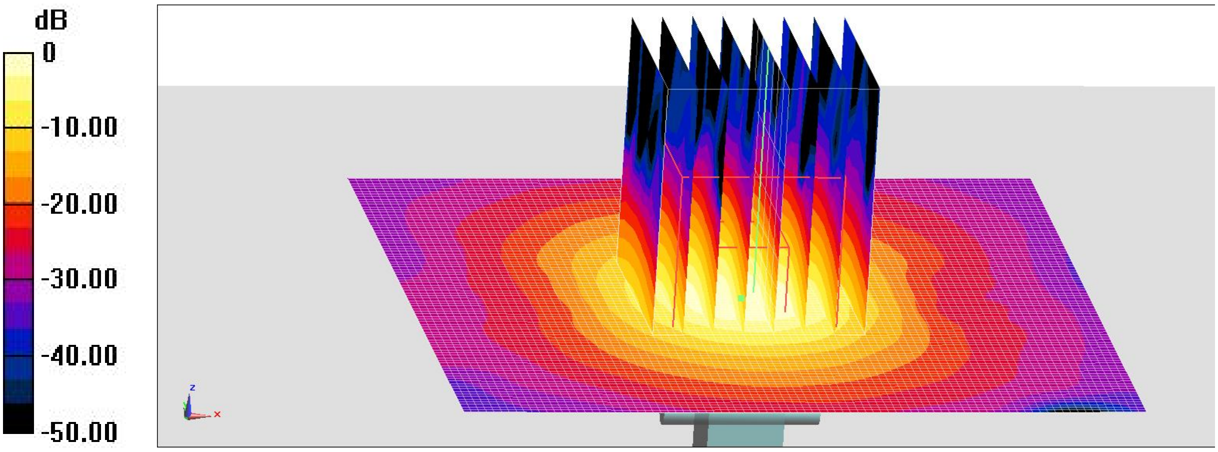
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value =68.78 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 34.7 W/kg

SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 18.9 W/kg

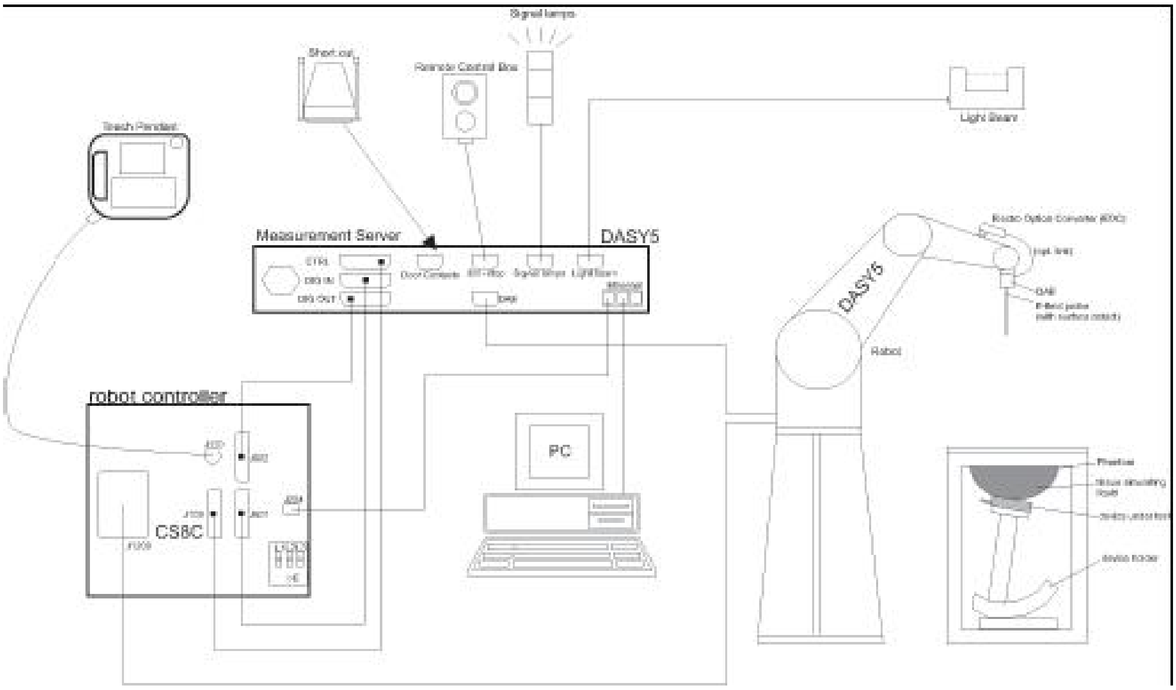


0 dB = 18.9 W/kg = 12.76 dBW/kg

ANNEX C SAR Measurement Setup

C.1 Measurement Set-up

The Dasy5 or DASY8 system for performing compliance tests is illustrated above graphically. This system consists of the following items:



Picture C.1 SAR Lab Test Measurement Set-up

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win10 and the DASY5 or DASY8 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 DASY5 or DASY8 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 DASY5 or DASY8 software reads the reflection during a software approach and looks for the maximum using 2^{nd} curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: EX3DV4

Frequency Range: 10MHz — 6.0GHz(EX3DV4)

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

Picture C.2 Near-field Probe

Dynamic Range: 10 mW/kg — 100W/kg

Probe Length: 330 mm

Probe Tip Length: 20 mm

Body Diameter: 12 mm

Tip Diameter: 2.5 mm

Tip-Center: 1 mm

Application: SAR Dosimetry Testing
Compliance tests of mobile phones
Dosimetry in strong gradient fields

Picture C.3 E-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.

Picture C.4: DAE

C.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: RX160L; DASY8: TX2-90XL spe) 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:

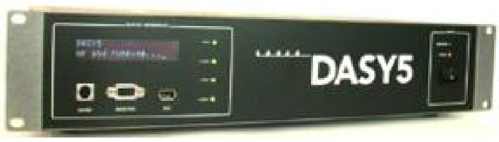
- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded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

Picture C.5 DASY 5 **Picture C.6 DASY 8**

C.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5/DASY8: 400 MHz, Intel Celeron), chipdisk (DASY5/DASY8: 128MB), RAM (DASY5/DASY8: 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 5 **Picture C.8 Server for DASY 8**

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.

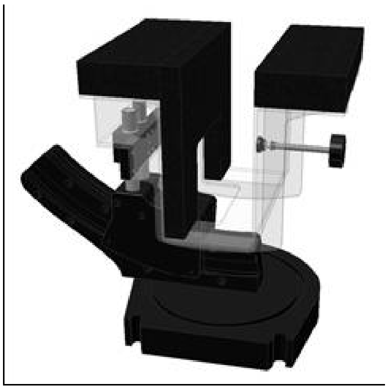
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference 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: Device Holder

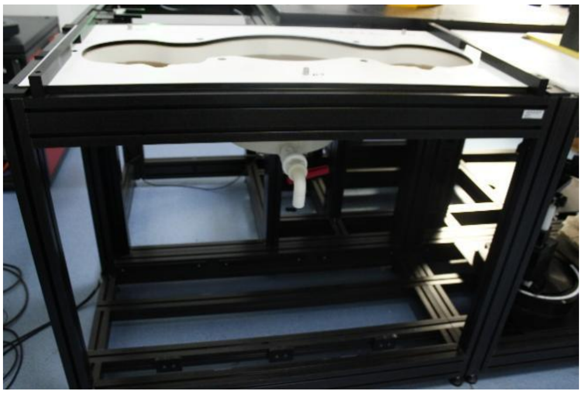


Picture C.10: Laptop Extension Kit

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

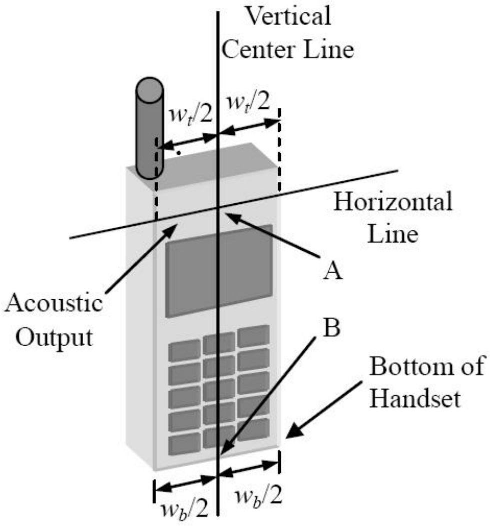


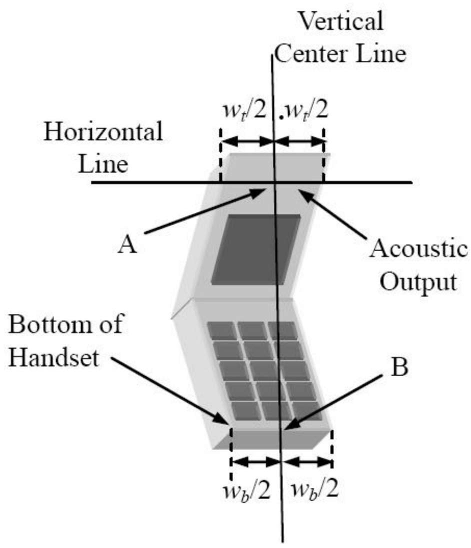
Picture C.11 SAM Twin Phantom

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

D.1 General considerations

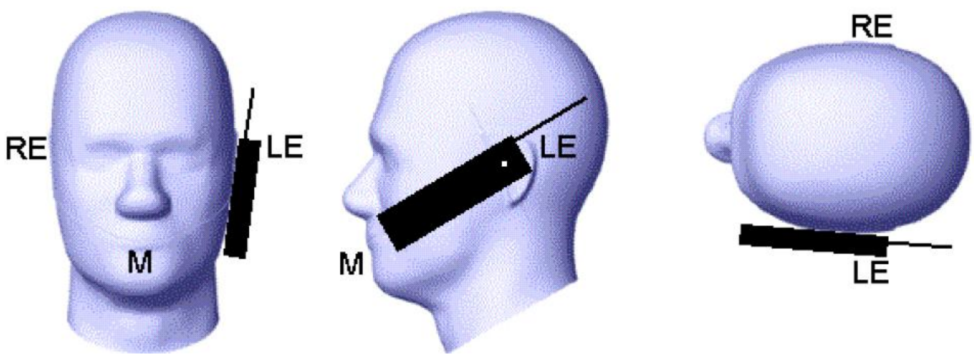
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



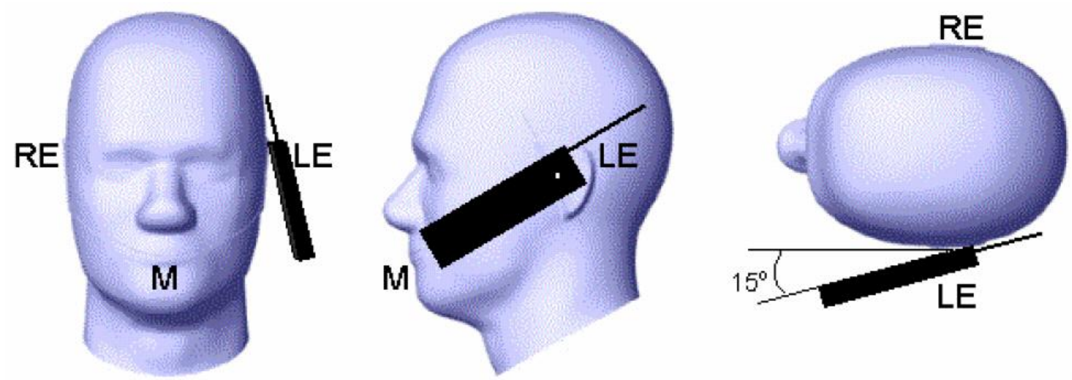


w_t	Width of the handset at the level of the acoustic
w_b	Width of the bottom of the handset
A	Midpoint of the width w_t of the handset at the level of the acoustic output
B	Midpoint of the width w_b of the bottom of the handset

Picture D.1 Typical “fixed” case headset **Picture D.2 Typical “clam-shell” case headset**



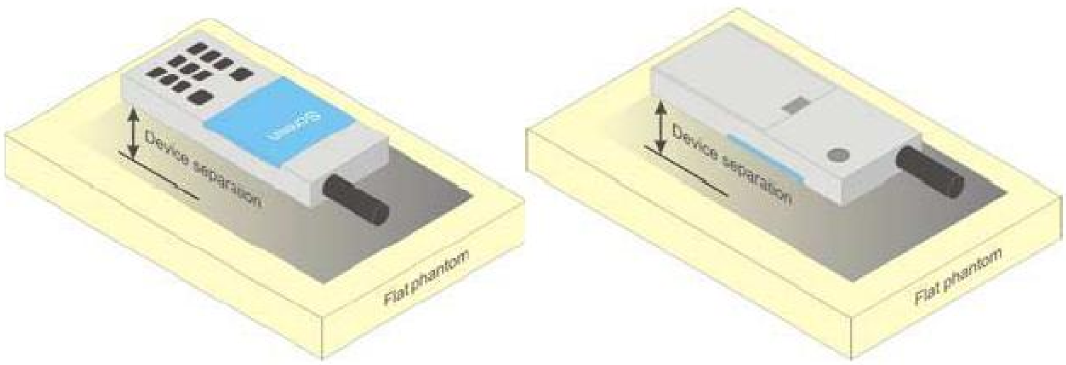
Picture D.3 Cheek position of the wireless device on the left side of SAM



Picture D.4 Tilt position of the wireless device on the left side of SAM

D.2 Body-worn device

A typical example of a body-worn device is a mobile phone, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.

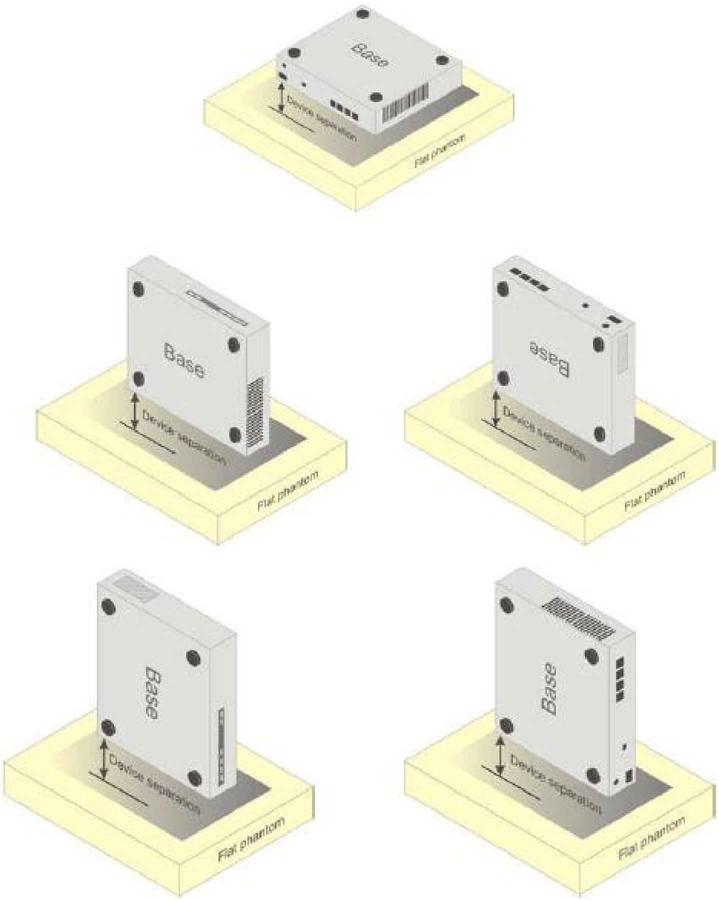


Picture D.5 Test positions for body-worn devices

D.3 Desktop device

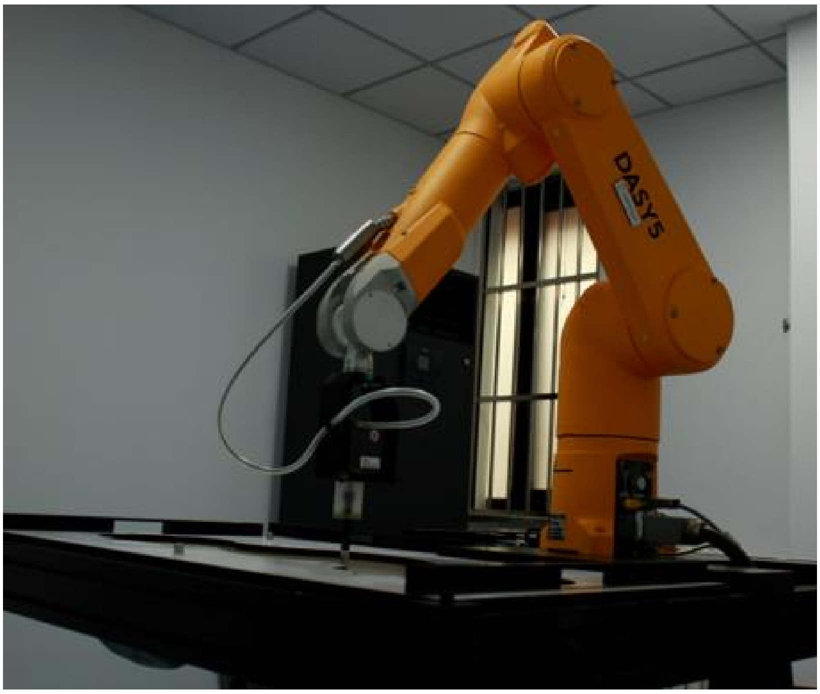
A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.

The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture8.5 show positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



Picture D.6 Test positions for desktop devices

D.4 DUT Setup Photos



Picture D.7

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 Std 1528 and BS EN IEC/IEEE 62209-1528:2021.

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 3846

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
3846	Head 750MHz	June 1,2025	750MHz	OK
3846	Head 900MHz	June 1,2025	900MHz	OK
3846	Head 1450MHz	June 2,2025	1450MHz	OK
3846	Head 1750MHz	June 2,2025	1750MHz	OK
3846	Head 1900MHz	June 4,2025	1900MHz	OK
3846	Head 2100MHz	June 4,2025	2000MHz	OK
3846	Head 2300MHz	June 4,2025	2300MHz	OK
3846	Head 2450MHz	June 6,2025	2450MHz	OK
3846	Head 2600MHz	June 6,2025	2600MHz	OK
3846	Head 3300MHz	June 7,2025	3300MHz	OK
3846	Head 3500MHz	June 7,2025	3500MHz	OK
3846	Head 3700MHz	June 7,2025	3700MHz	OK
3846	Head 3900MHz	June 7,2025	3900MHz	OK
3846	Head 4100MHz	June 8,2025	4100MHz	OK
3846	Head 4400MHz	June 8,2025	4400MHz	OK
3846	Head 4600MHz	June 8,2025	4600MHz	OK
3846	Head 4800MHz	June 8,2025	4800MHz	OK
3846	Head 4950MHz	June 9,2025	4950MHz	OK
3846	Head 5250MHz	June 9,2025	5250MHz	OK
3846	Head 5600MHz	June 9,2025	5600MHz	OK
3846	Head 5750MHz	June 9,2025	5750MHz	OK

ANNEX G PROBE CALIBRATION CERTIFICATE

Probe 3846 Calibration Certificate

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Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
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中国认可 国际互认 校准
CALIBRATION
CNAS L0570

Client: CTTL Beijing

Certificate No: 25J02Z000277

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN : 3846

Calibration Procedure(s): FF-Z11-004-02
Calibration Procedures for Dosimetric E-field Probes

Calibration date: May 28, 2025

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	106277	18-Oct-24(CTTL, No.24J02X101459)	Oct-25
Power sensor NRP8S	104291	18-Oct-24(CTTL, No.24J02X101459)	Oct-25
Power sensor NRP8S	104292	18-Oct-24(CTTL, No.24J02X101459)	Oct-25
Reference 10dBAttenuator	18N50W-10dB	22-Jan-25(CTTL, No.25J02X000465)	Jan-27
Reference 20dBAttenuator	18N50W-20dB	22-Jan-25(CTTL, No.25J02X000466)	Jan-27
Reference Probe EX3DV4	SN 7464	28-Jan-25(SPEAG, No.EX-7464_Jan25)	Jan-26
DAE4	SN 1555	16-Aug-24(SPEAG, No.DAE4-1555_Aug24)	Aug-25
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	12-Jun-24(CTTL, No.24J02X005419)	Jun-25
SignalGenerator APSIN26G	181-33A6D0700-1959	27-Mar-25(CTTL, No.25J02X001962)	Mar-26
Network Analyzer E5071C	MY46110673	18-Dec-24(CTTL, No.24J02X103932)	Dec-25
Reference 10dBAttenuator	BT0520	15-May-25(CTTL, No.25J02X003069)	May-27
Reference 20dBAttenuator	BT0267	15-May-25(CTTL, No. 25J02X003070)	May-27
OCP DAKS	SN 0015	09-Oct-24(SPEAG, No. OCP-DAKS-0015_Oct24)	Oct-25

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

Issued: June 03, 2025

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Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
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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:3846

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (*k*=2)
Norm(μV/(V/m)²) [A]	0.39	0.47	0.47	±10.0%
DCP(mV) [B]	99.7	100.4	101.3	

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	146.6	±2.6%
		Y	0.0	0.0	1.0		165.5	
		Z	0.0	0.0	1.0		166.1	

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:3846

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	9.93	9.93	9.93	0.15	1.27	±13%
900	41.5	0.97	9.47	9.47	9.47	0.15	1.44	±13%
1450	40.5	1.20	8.60	8.60	8.60	0.15	1.15	±13%
1750	40.1	1.37	8.26	8.26	8.26	0.27	1.01	±13%
1900	40.0	1.40	7.92	7.92	7.92	0.33	0.90	±13%
2100	39.8	1.49	7.87	7.87	7.87	0.23	1.15	±13%
2300	39.5	1.67	7.70	7.70	7.70	0.64	0.68	±13%
2450	39.2	1.80	7.43	7.43	7.43	0.63	0.69	±13%
2600	39.0	1.96	7.27	7.27	7.27	0.64	0.69	±13%
3300	38.2	2.71	6.91	6.91	6.91	0.45	0.90	±14%
3500	37.9	2.91	6.80	6.80	6.80	0.47	1.01	±14%
3700	37.7	3.12	6.65	6.65	6.65	0.45	1.09	±14%
3900	37.5	3.32	6.55	6.55	6.55	0.40	1.25	±14%
4100	37.2	3.53	6.52	6.52	6.52	0.35	1.25	±14%
4400	36.9	3.84	6.40	6.40	6.40	0.30	1.52	±14%
4600	36.7	4.04	6.30	6.30	6.30	0.45	1.23	±14%
4800	36.4	4.25	6.22	6.22	6.22	0.50	1.20	±14%
4950	36.3	4.40	6.03	6.03	6.03	0.50	1.22	±14%
5250	35.9	4.71	5.40	5.40	5.40	0.45	1.40	±14%
5600	35.5	5.07	4.80	4.80	4.80	0.55	1.20	±14%
5750	35.4	5.22	4.92	4.92	4.92	0.55	1.22	±14%

[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 up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

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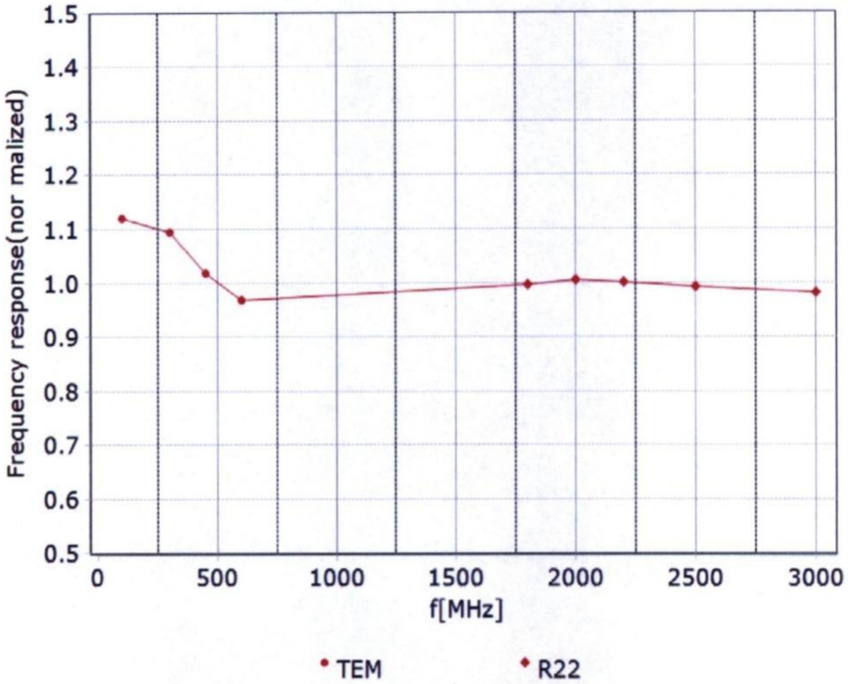
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)

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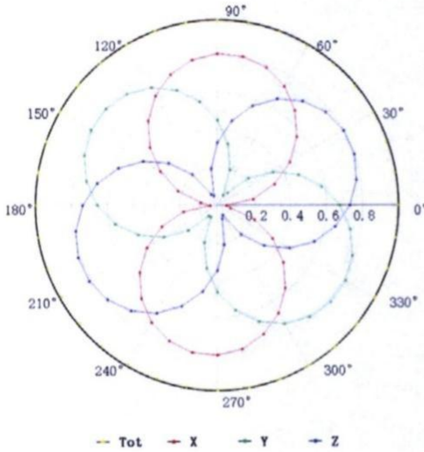
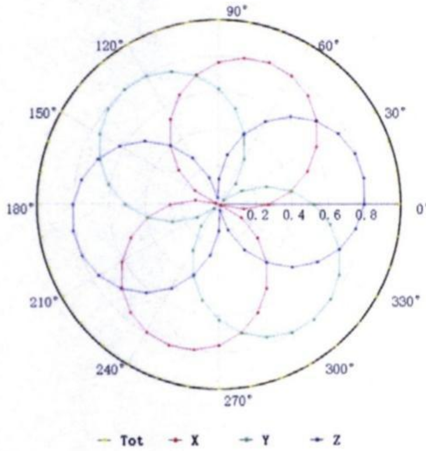
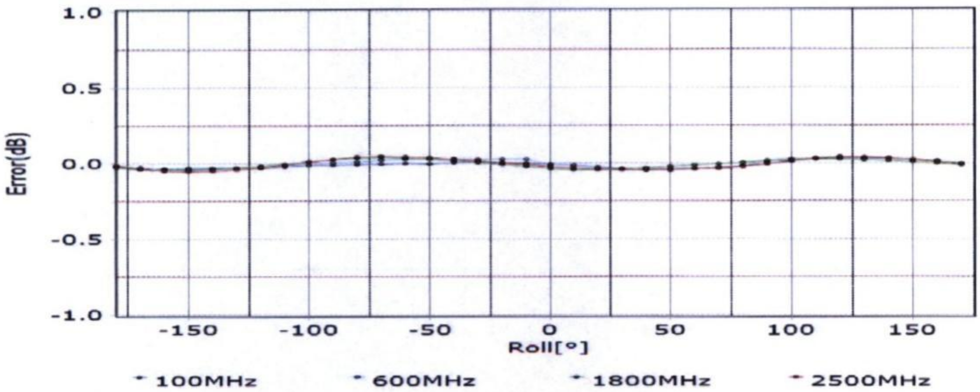
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





Uncertainty of Axial Isotropy Assessment: ±1.2% (*k*=2)

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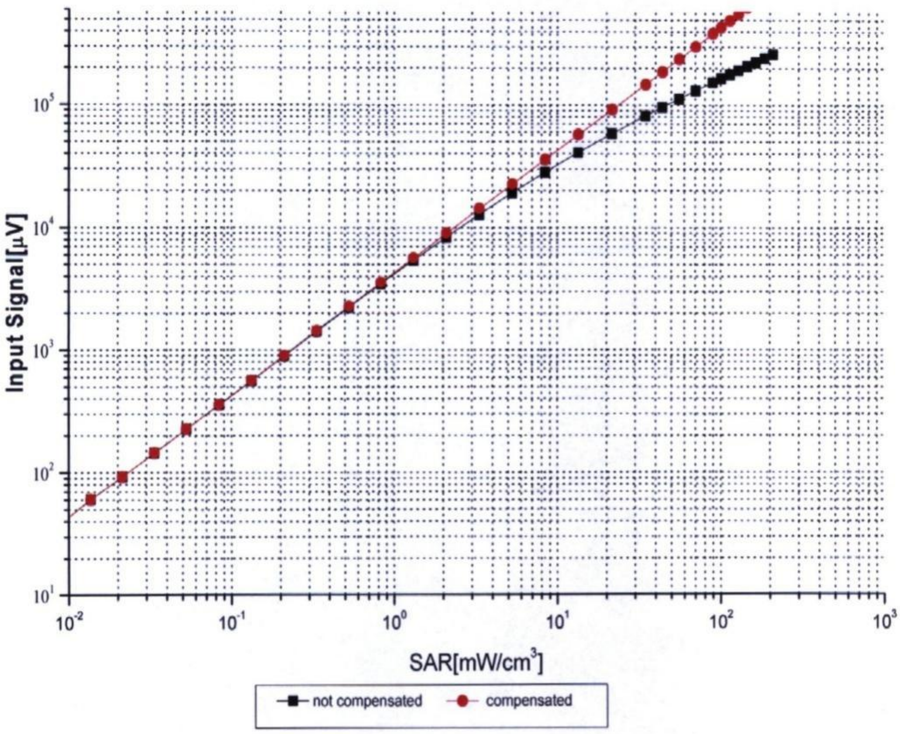
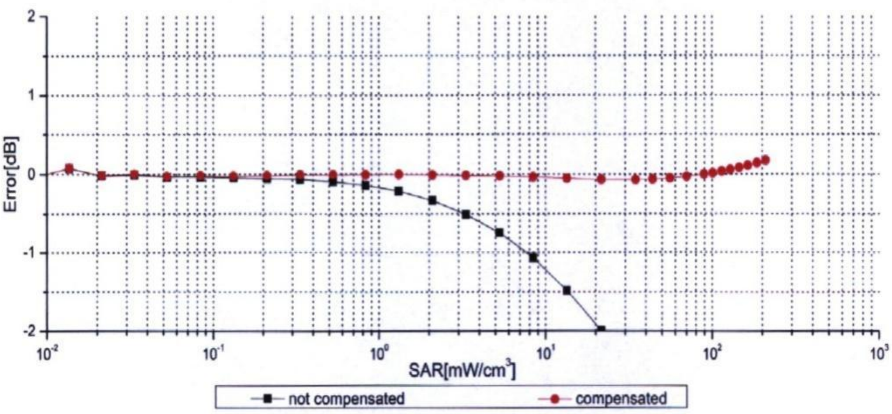
Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (*k*=2)

