SAR TEST REPORT

No. I21Z62857-SEM02

For

TCL Communication Ltd.

Tablet PC

Model Name: 9160G

with

Hardware Version: 05

Software Version: DT1A

FCC ID: 2ACCJB174

Issued Date: 2022-03-15

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.

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
I21Z62857-SEM02	Rev.0	2022-03-15	Initial creation of test report

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1 Test Laboratory

1.1 Testing Location

Company Name:	CTTL(Shouxiang)
Address:	No. 51, Xueyuan Road, Haidian District, Beijing, P. R. China 100191.

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

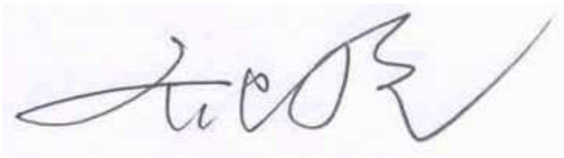
1.3 Project Data

Project Leader:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	February 20, 2022
Testing End Date:	February 28, 2022

1.4 Signature

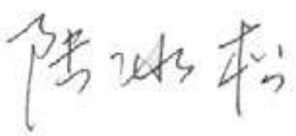
Yao Juming

(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 TCL Communication Ltd. Tablet PC 9160G are as follows:

Table 2.1: Highest Reported SAR (1g)

Technology Band	Body SAR 1g (W/kg)	Equipment Class
GSM850	**0.62**	PCE
GSM1900	**1.30**	
WCDMA1900	**1.11**	
WCDMA1700	**1.36**	
WCDMA 850	**1.19**	
LTE Band2	**1.31**	
LTE Band5	**1.14**	
LTE Band7	**1.27**	
LTE Band12	**1.01**	
LTE Band13	**0.90**	
LTE Band41	**1.17**	
LTE Band66	**1.24**	
WLAN 2.4GHz	**0.74**	DTS
WLAN 5GHz	**0.69**	NII
Bluetooth	**0.04**	DSS

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 0mm/8mm/16mm/17mm 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**:**
Body: 1.36 W/kg(1g)

Remark：
This device supports both LTE B4/B17/B38 and LTE B66/B12/B41. Since the supported frequency span for LTE B4/B17/B38 falls completely within the supports frequency span for LTE B66/B12/B41, both LTE bands have the same target power, and both LTE bands share the same transmission path; therefore, SAR was only assessed for LTE B66/B12/B41.

Table 2.2: The sum of SAR values for Main antenna + WiFi-2.4G

	Position	Main antenna	WiFi-2.4G	Sum
Highest SAR value for Body	Rear 0mm (GSM1900)	0.74	0.74	**1.48**

Table 2.3: The sum of SAR values for Main antenna + WiFi-5G

	Position	Main antenna	WiFi-5G	Sum
Highest SAR value for Body	Top 0mm (LTE B5)	1.14	0.39	**1.53**

Table 2.4: The sum of SAR values for Main antenna + WiFi-5G + BT

	Position	Main antenna	WiFi-5G	BT	Sum
Highest SAR value for Body	Top 0mm (LTE B5)	1.14	0.39	0.04	**1.57**

According to the above tables, the highest sum of reported SAR values is **1.57 W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 15.

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.

3 Client Information

3.1 Applicant Information

Company Name:	TCL Communication Ltd.
Address/Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person:	Peter yang
E-mail:	peter.yang@tcl.com
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3.2 Manufacturer Information

Company Name:	TCL Communication Ltd.
Address/Post:	5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person:	Peter yang
E-mail:	peter.yang@tcl.com
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Fax:	+86 755 3661 2000-81722

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

4.1 About EUT

Description:	Tablet PC
Model name:	9160G
Operating mode(s):	GSM850/900/1800/1900, WCDMA850/900/1700/1900/2100 LTEBand1/2/3/4/5/7/8/12/13/17/20/28/38/40/41/66, BT, Wi-Fi(2.4G&5G)
Tested Tx Frequency:	824 – 849 MHz (GSM 850)
	1850 – 1910 MHz (GSM 1900)
	824 – 849 MHz (WCDMA 850 Band V)
	1850 – 1910 MHz (WCDMA1900 Band IV)
	1710-1755 MHz (WCDMA1700 Band II)
	1850.7 – 1909.3 MHz (LTE Band 2)
	824.7 – 848.3 MHz (LTE Band 5)
	2500 – 2570 MHz (LTE Band 7)
	699.7 – 715.3 MHz (LTE Band 12)
	777 – 787 MHz (LTE Band 13)
	2498.5 – 2687.5 MHz (LTE Band41)
	1710.7 –1779.3 MHz (LTE Band 66)
	2412 – 2462 MHz (Wi-Fi 2.4G)
	2400 – 2483.5 MHz (Bluetooth)
	5150 – 5250 MHz (U-NII-1)
	5250 – 5350 MHz (U-NII-2A)
	5725 – 5850 MHz (U-NII-3)
GPRS/EGPRS Multislot Class:	12
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*	IMEI/SN	HW Version	SW Version
EUT1	358946220000592	05	DT1A
EUT2	358946220000568	05	DT1A
EUT3	358946220000535	05	DT1A
EUT4	358946220000543	05	DT1A
EUT5	358946220001004	05	DT1A
EUT6	358946220000881	05	DT1A
EUT7	358946220001012	05	DT1A

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

Note: It is performed to test SAR with the EUT1-5 and conducted power with the EUT6/7.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	TLp053C1	/	BYD

*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.

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

KDB648474 D04 Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets.

KDB941225 D01 SAR test for 3G devices v03r01: SAR Measurement Procedures for 3G Devices

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

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.

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

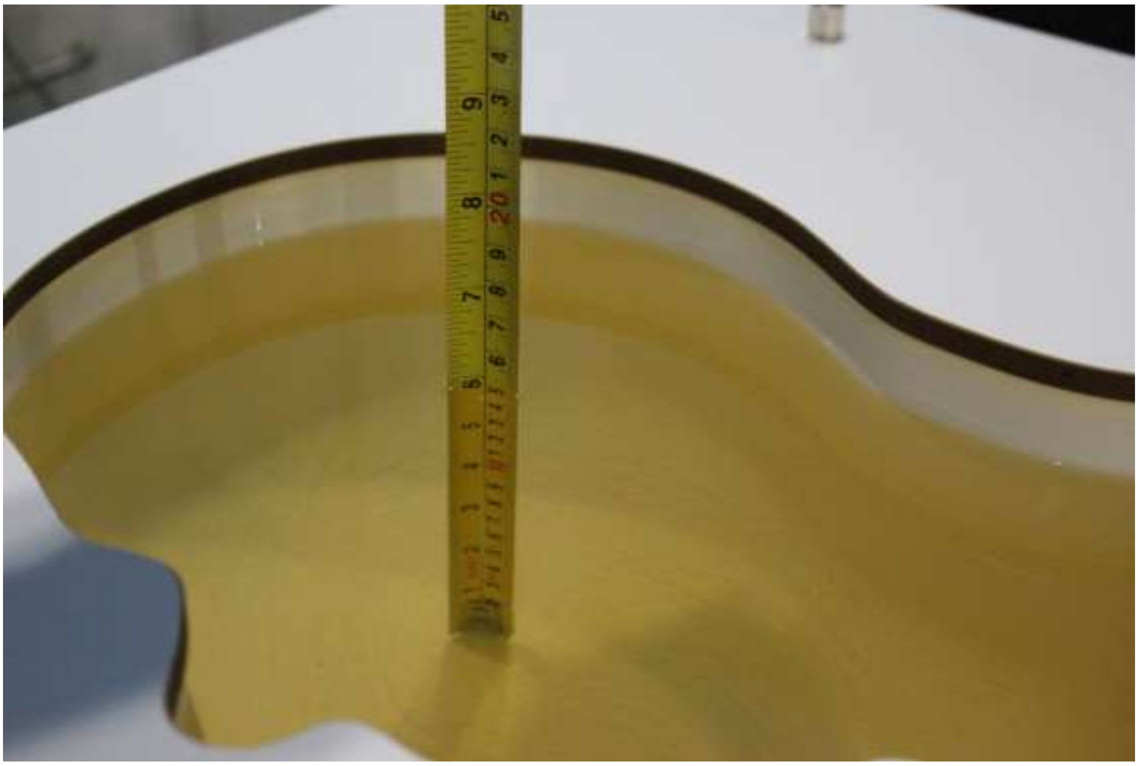
Frequency(MHz)	Liquid Type	Conductivity(σ)	± 5% Range	Permittivity(ε)	± 5% Range
750	Head	0.89	0.85～0.93	41.94	39.8～44.0
835	Head	0.90	0.86～0.95	41.5	39.4～43.6
1750	Head	1.37	1.30～1.44	40.08	38.1～42.1
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
2450	Head	1.67	1.59～1.75	39.47	37.5～41.4
2600	Head	1.96	1.86～2.06	39.01	37.1～41.0
5250	Head	4.71	4.47～4.95	35.93	34.13～37.73
5750	Head	5.22	4.96～5.48	35.36	33.59～37.13

7.2 Dielectric Performance

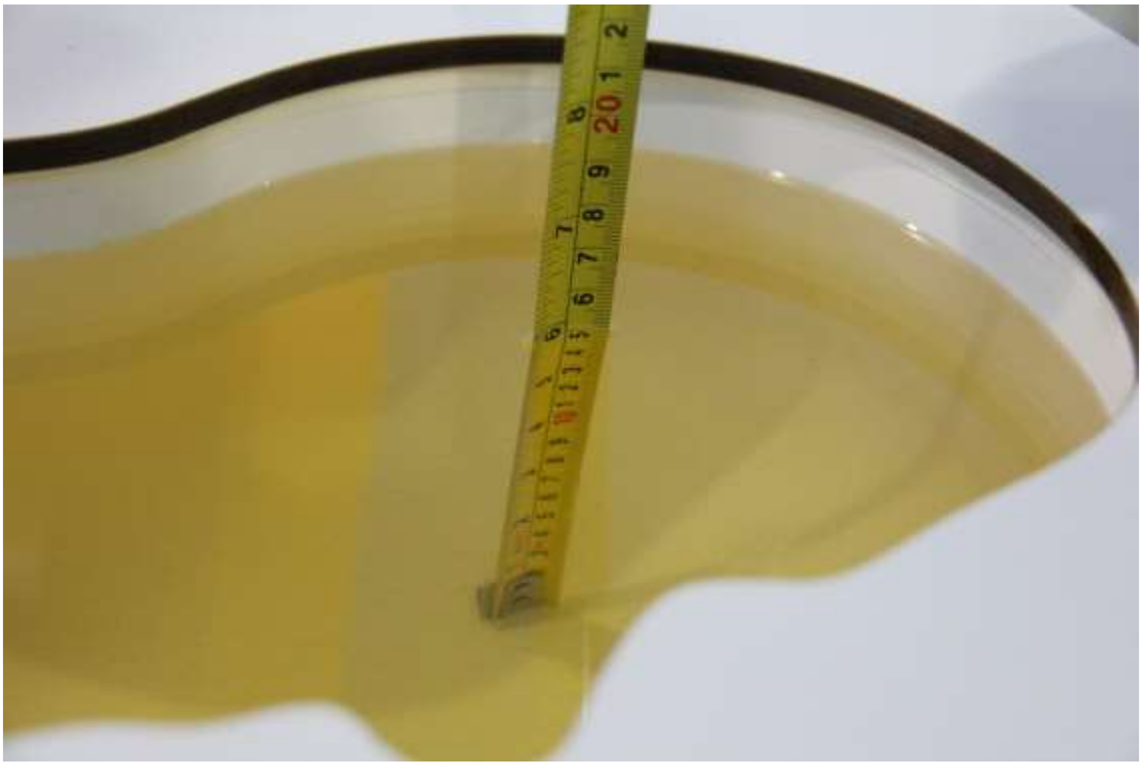
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2022-2-20	Head	750 MHz	44.4	5.87	0.921	3.48
2022-2-21	Head	835 MHz	44.37	6.92	0.861	-4.33
2022-2-28	Head	1750 MHz	41.86	4.44	1.404	2.48
2022-2-24	Head	1900 MHz	40.98	2.45	1.386	-1.00
2022-2-25	Head	2450 MHz	39.27	0.18	1.821	1.17
2022-2-27	Head	2600 MHz	40.17	2.97	1.951	-0.46
2022-2-26	Head	5250 MHz	35.07	-2.39	4.789	1.68
2022-2-26	Head	5750 MHz	34.06	-3.68	5.315	1.82

Note: The liquid temperature is 22.0℃

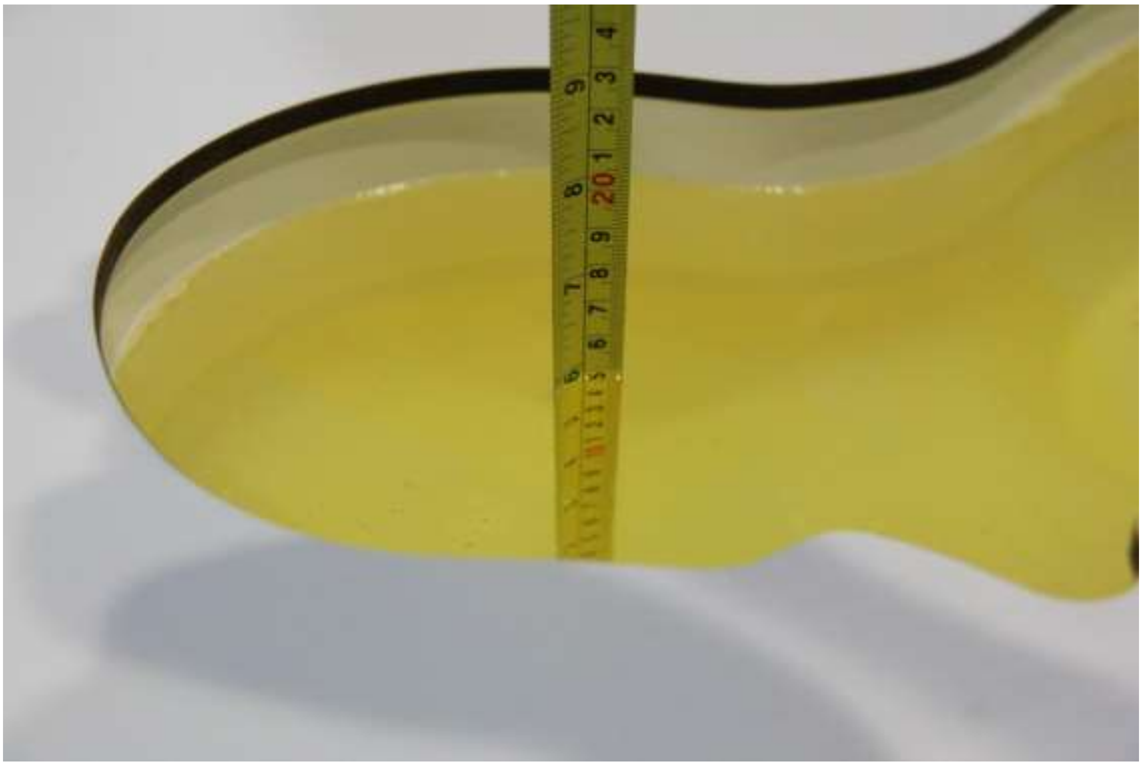


Picture 7-1 Liquid depth in the Head Phantom (750MHz)

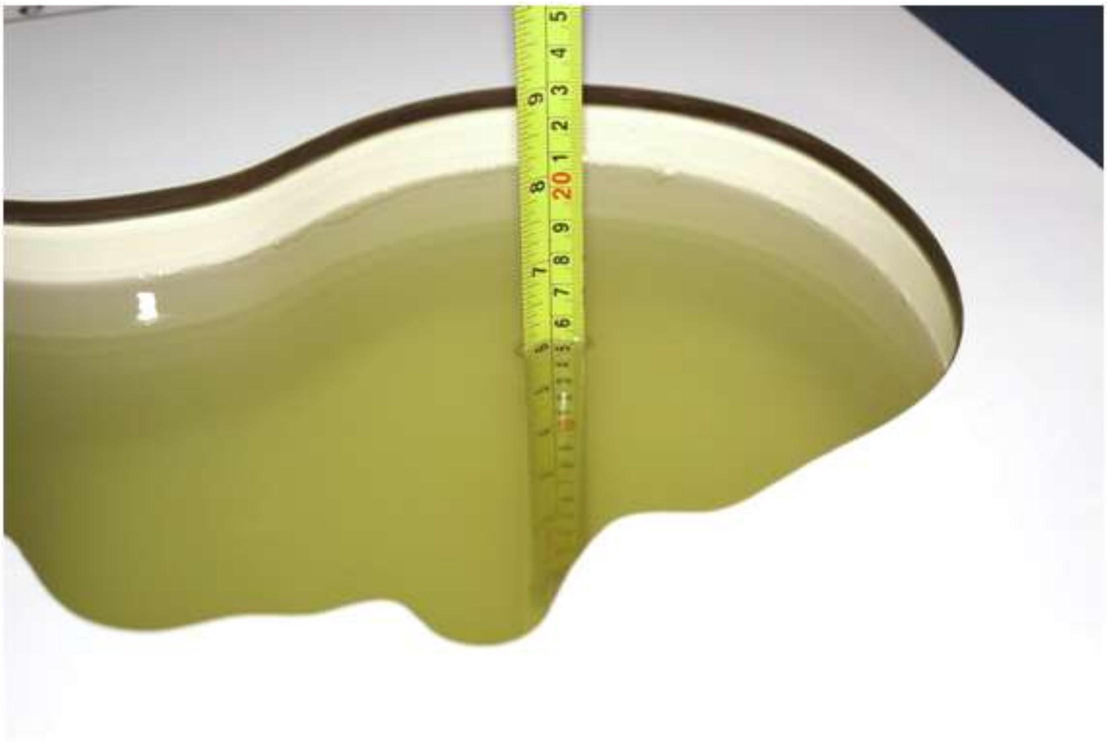


Picture 7-2 Liquid depth in the Head Phantom (835 MHz)

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



Picture 7-4 Liquid depth in the Head Phantom (2450MHz)



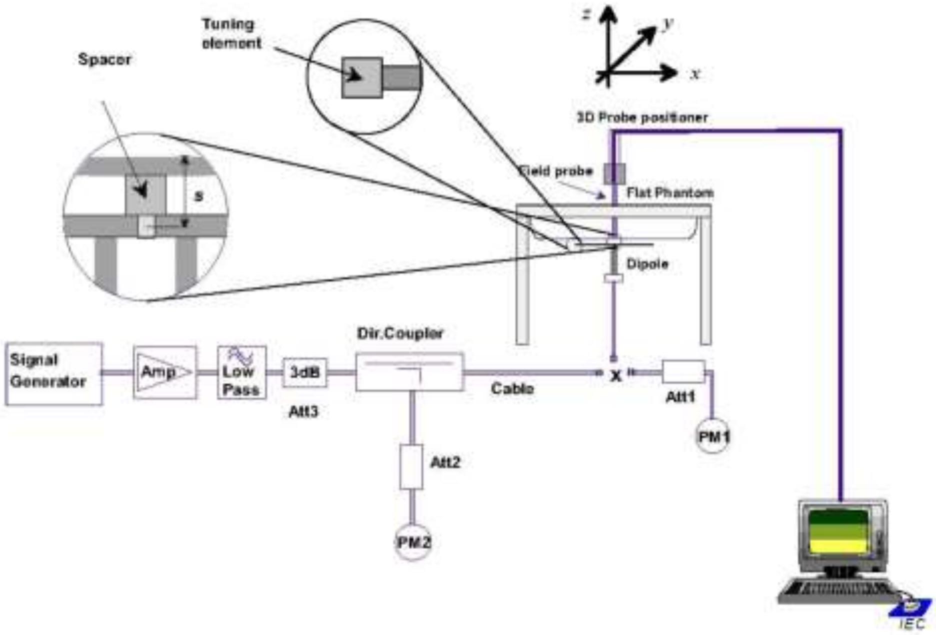
Picture 7-5 Liquid depth in the Head Phantom (2600 MHz)

Picture 7-6 Liquid depth in the Head Phantom (5GHz)

8 System verification

8.1 System Setup

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



Picture 8.1 System Setup for System Evaluation

Picture 8.2 Photo of Dipole Setup

8.2 System Verification

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

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

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2022-2-20	750 MHz	5.65	8.68	5.68	8.52	0.53%	-1.84%
2022-2-21	835 MHz	6.24	9.63	6.24	9.52	0.00%	-1.14%
2022-2-28	1750 MHz	19.4	36.9	19.88	36.92	2.47%	0.05%
2022-2-24	1900 MHz	20.9	40.1	21.08	40.80	0.86%	1.75%
2022-2-25	2450 MHz	24.9	53.3	24.96	53.20	0.24%	-0.19%
2022-2-27	2600 MHz	25.5	57.1	25.00	56.40	-1.96%	-1.23%
2022-2-26	5250 MHz	22.7	79.5	22.10	77.50	-2.64%	-2.52%
2022-2-26	5750 MHz	22.7	81.0	22.50	79.40	-0.88%	-1.98%

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.

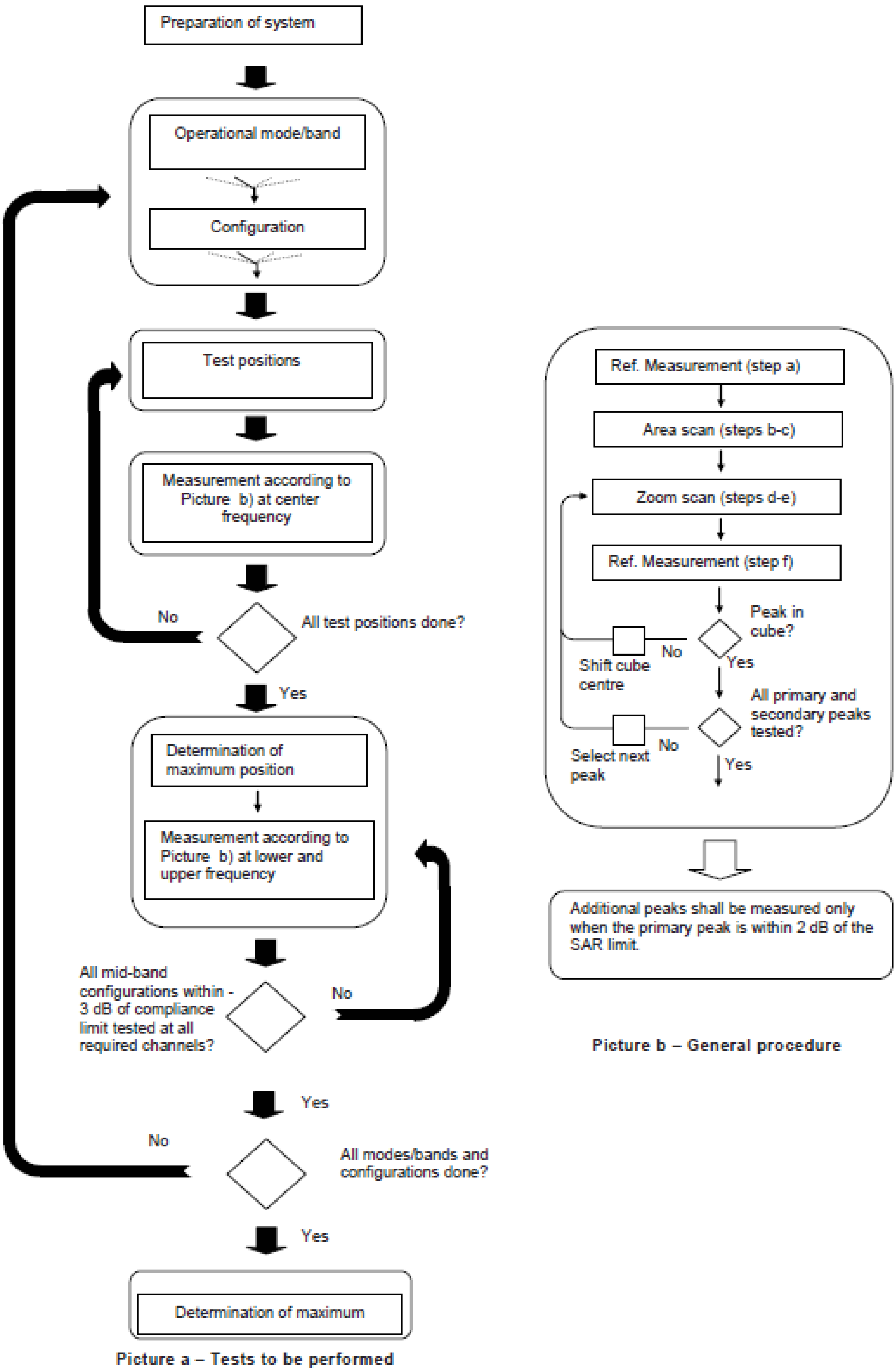
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

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 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.

<table>
<tr><th colspan="3"></th><th>≤ 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>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 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 ≤ 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>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 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>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 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>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 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 ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</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.

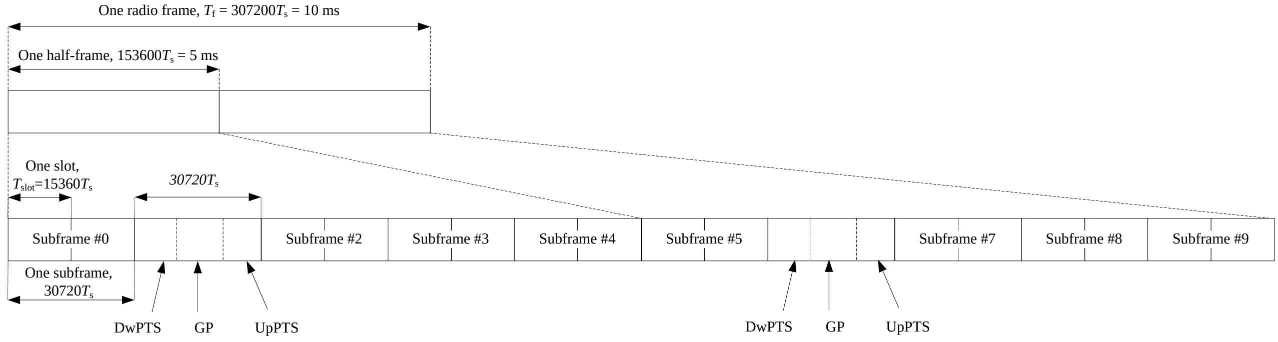


Figure 9.2: Frame structure type 2 (for 5 ms switch-point periodicity)

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

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

Table 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 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 Area Scan Based 1-g SAR

10.1 Requirement of KDB

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

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

10.2 Fast SAR Algorithms

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

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

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

Both algorithms are implemented in DASY software.

11 Conducted Output Power

There are two sets of tune-up power, Normal power and Low power, for all bands by proximity sensor. The detail of proximity sensor is presented in Annex I.

11.1 GSM Measurement result

Table 11.1-1: The conducted power for GSM – Normal power

GSM 850 GPRS (GMSK)	Measured Power (dBm)			**Tune up**	calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	31.75	31.73	31.62	**33.5**	-9.03	22.72	22.70	22.59
2 Txslots	**30.89**	**30.86**	**30.73**	**32**	-6.02	**24.87**	**24.84**	**24.71**
3 Txslots	28.98	28.93	28.85	**30**	-4.26	24.72	24.67	24.59
4 Txslots	27.77	27.71	27.57	**28.5**	-3.01	24.76	24.70	24.56
GSM 850 EGPRS (GMSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	31.79	31.77	31.65	**33.5**	-9.03	22.76	22.74	22.62
2 Txslots	**30.93**	**30.90**	**30.77**	**32**	-6.02	**24.91**	**24.88**	**24.75**
3 Txslots	29.02	28.97	28.89	**30**	-4.26	24.76	24.71	24.63
4 Txslots	27.80	27.75	27.62	**28.5**	-3.01	24.79	24.74	24.61
GSM 850 EGPRS (8PSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	251	190	128			251	190	128
1 Txslot	25.56	25.50	25.60	**27**	-9.03	16.53	16.47	16.57
2 Txslots	24.44	24.47	24.23	**26**	-6.02	18.42	18.45	18.21
3Txslots	21.99	21.92	21.87	**23**	-4.26	17.73	17.66	17.61
4 Txslots	20.56	20.47	20.46	**22**	-3.01	17.55	17.46	17.45
PCS1900 GPRS (GMSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	28.51	28.55	28.64	**30.5**	-9.03	19.48	19.52	19.61
2 Txslots	**27.45**	**27.71**	**27.85**	**29**	-6.02	**21.43**	**21.69**	**21.83**
3 Txslots	25.47	25.88	26.07	**27**	-4.26	21.21	21.62	21.81
4 Txslots	24.18	24.63	24.79	**25.5**	-3.01	21.17	21.62	21.78
PCS1900 EGPRS (GMSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	28.50	28.57	28.66	**30.5**	-9.03	19.47	19.54	19.63
2 Txslots	**27.45**	**27.72**	**27.87**	**29**	-6.02	**21.43**	**21.70**	**21.85**
3Txslots	25.48	25.89	26.09	**27**	-4.26	21.22	21.63	21.83
4 Txslots	24.18	24.65	24.78	**25.5**	-3.01	21.17	21.64	21.77
PCS1900 EGPRS (8PSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	24.25	24.93	25.04	**25.5**	-9.03	15.22	15.90	16.01
2 Txslots	23.46	23.56	23.71	**24.5**	-6.02	17.44	17.54	17.69

3Txslots	20.78	21.16	21.36	**22.5**	-4.26	16.52	16.90	17.10
4 Txslots	19.35	19.83	20.15	**20.5**	-3.01	16.34	16.82	17.14

NOTES:

1) Division Factors

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

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

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

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

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

According to the conducted power as above, the body measurements are performed with 2Txslots for GSM850/1900.

Table 11.1-2: The conducted power for GSM – Low power

GSM 850	Measured Power (dBm)			**Tune up**	calculation	Averaged Power (dBm)		
GPRS (GMSK)	251	190	128			251	190	128
1 Txslot	**26.46**	**26.40**	**26.25**	**27.5**	-9.03	**17.43**	**17.37**	**17.22**
2 Txslots	23.41	23.35	23.17	**24.5**	-6.02	17.39	17.33	17.15
3 Txslots	21.58	21.50	21.31	**22.5**	-4.26	17.32	17.24	17.05
4 Txslots	20.16	20.09	19.87	**21**	-3.01	17.15	17.08	16.86
GSM 850	Measured Power (dBm)				calculation	Averaged Power (dBm)		
EGPRS (GMSK)	251	190	128			251	190	128
1 Txslot	**26.45**	**26.39**	**26.23**	**27.5**	-9.03	**17.42**	**17.36**	**17.20**
2 Txslots	23.41	23.33	23.15	**24.5**	-6.02	17.39	17.31	17.13
3 Txslots	21.57	21.49	21.29	**22.5**	-4.26	17.31	17.23	17.03
4 Txslots	20.15	20.07	19.85	**21**	-3.01	17.14	17.06	16.84
GSM 850	Measured Power (dBm)				calculation	Averaged Power (dBm)		
EGPRS (8PSK)	251	190	128			251	190	128
1 Txslot	19.13	19.02	19.24	**20**	-9.03	10.10	9.99	10.21
2 Txslots	15.91	15.85	15.91	**17**	-6.02	9.89	9.83	9.89
3Txslots	14.06	14.01	13.93	**15**	-4.26	9.80	9.75	9.67
4 Txslots	12.47	12.42	12.40	**13.5**	-3.01	9.46	9.41	9.39
PCS1900	Measured Power (dBm)				calculation	Averaged Power (dBm)		
GPRS (GMSK)	810	661	512			810	661	512
1 Txslot	**20.95**	**21.45**	**21.84**	**22.5**	-9.03	**11.92**	**12.42**	**12.81**
2 Txslots	17.89	18.43	18.82	**19.5**	-6.02	11.87	12.41	12.80
3 Txslots	16.03	16.66	16.98	**17.5**	-4.26	11.77	12.40	12.72
4 Txslots	14.54	15.25	15.73	**16**	-3.01	11.53	12.24	12.72

PCS1900 EGPRS (GMSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	**20.88**	**21.41**	**21.79**	**22.5**	-9.03	**11.85**	**12.38**	**12.76**
2 Txslots	17.83	18.39	18.75	**19.5**	-6.02	11.81	12.37	12.73
3Txslots	15.97	16.63	17.01	**17.5**	-4.26	11.71	12.37	12.75
4 Txslots	14.48	15.23	15.67	**16**	-3.01	11.47	12.22	12.66
PCS1900 EGPRS (8PSK)	Measured Power (dBm)				calculation	Averaged Power (dBm)		
	810	661	512			810	661	512
1 Txslot	15.69	16.16	16.79	**17**	-9.03	6.66	7.13	7.76
2 Txslots	12.59	13.81	13.34	**14.5**	-6.02	6.57	7.79	7.32
3Txslots	11.35	11.32	11.28	**12.5**	-4.26	7.09	7.06	7.02
4 Txslots	17.27	17.79	17.97	**18.5**	-3.01	14.26	14.78	14.96

NOTES:

1) Division Factors

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

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

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

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

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

According to the conducted power as above, the body measurements are performed with 1Txslot for GSM850/1900.

11.2 WCDMA Measurement result

Table 11.2-1: The conducted Power for WCDMA – Normal power

WCDMA850	FDDV result (dBm)			Tune up
	4233/4458	4183/4408	4132/4357	
	(846.6MHz)	(836.6MHz)	(826.4MHz)	
	22.40	22.44	22.35	23.5
HSUPA	19.46	19.47	19.50	20.5
	19.45	19.49	19.47	20.5
	20.56	20.57	20.58	21.5
	19.01	19.03	18.57	20
	20.46	20.47	20.49	21.5
HSPA+	21.08	21.06	21.10	22
DC-HSDPA	20.49	20.56	20.53	21.5
	20.36	20.45	20.42	21.5
	19.97	20.07	19.99	21
	19.98	20.02	19.97	21
WCDMA1700	FDDIV result (dBm)			Tune up
	1513/1738	1412/1637	1312/1537	
	(1752.6MHz)	(1732.4MHz)	(1712.4MHz)	
	22.83	22.74	22.70	23.2
HSUPA	18.93	18.87	18.82	20
	18.96	18.89	18.86	20
	20.01	19.94	19.89	21
	18.5	18.40	18.36	19.5
	19.97	19.89	19.88	21
HSPA+	20.28	20.49	20.36	21.5
DC-HSDPA	20.06	19.98	19.96	21
	19.87	19.89	19.92	21
	19.51	19.49	19.46	20.5
	19.62	19.50	19.44	20.5
WCDMA1900	FDDII result (dBm)			Tune up
	9538/9938	9400/9800	9262/9662	
	(1907.6MHz)	(1880MHz)	(1852.4MHz)	
	22.24	22.44	22.48	23.5
HSUPA	19.18	19.37	19.58	20.5
	19.21	19.39	19.59	20.5
	20.3	20.49	20.67	21.5
	18.74	18.93	19.14	20
	20.18	20.38	20.64	21.5
HSPA+	20.83	21.04	21.05	22

DC-HSDPA	20.22	20.50	20.73	**21.5**
	20.11	20.31	20.60	**21.5**
	19.69	19.97	20.25	**21**
	19.68	19.91	20.26	**21**

Table 11.2-2: The conducted Power for WCDMA – Low power

WCDMA850	**FDDV result (dBm)**			**Tune up**
	4233/4458	**4183/4408**	**4132/4357**	
	(846.6MHz)	**(836.6MHz)**	**(826.4MHz)**	
	20.57	20.64	20.59	**21.5**
HSUPA	19.05	19.08	19.06	**20**
	19.03	19.07	19.05	**20**
	20.09	20.80	20.04	**21**
	18.61	18.60	18.56	**19.5**
	20.2	20.05	20.20	**21**
HSPA+	20.12	19.98	20.03	**21**
DC-HSDPA	20.49	20.52	20.54	**21**
	20.71	20.72	20.73	**21.5**
	19.95	19.97	19.93	**21**
	19.93	19.89	19.92	**21**
WCDMA1700	**FDDIV result (dBm)**			**Tune up**
	1513/1738	**1412/1637**	**1312/1537**	
	(1752.6MHz)	**(1732.4MHz)**	**(1712.4MHz)**	
	11.84	11.74	11.51	**12.5**
HSUPA	9.71	9.63	9.57	**10.5**
	9.73	9.68	9.56	**10.5**
	10.7	10.63	10.54	**11.5**
	9.19	9.14	9.07	**10**
	10.67	10.61	10.52	**11.5**
HSPA+	10.67	10.58	10.55	**11.5**
DC-HSDPA	10.99	10.96	10.91	**12**
	10.91	10.86	10.87	**12**
	10.38	10.45	10.37	**11.5**
	10.43	10.41	10.35	**11.5**
WCDMA1900	**FDDII result (dBm)**			**Tune up**
	9538/9938	**9400/9800**	**9262/9662**	
	(1907.6MHz)	**(1880MHz)**	**(1852.4MHz)**	
	13.26	13.40	13.49	**14**
HSUPA	11.01	11.18	11.49	**12.5**
	11.03	11.22	11.50	**12.5**
	11.89	12.16	12.49	**13**

	10.43	10.68	10.97	**12**
	11.86	12.11	12.42	**13**
HSPA+	11.94	12.12	12.24	**13**
DC-HSDPA	12.25	12.52	12.71	**13.5**
	12.22	12.45	12.62	**13.5**
	11.67	11.97	12.12	**13**
	11.61	11.90	12.13	**13**

11.3 LTE Measurement result

Table 11.3-1: Maximum Power Reduction (MPR) for LTE

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

Table 11.3-2: The tune up for LTE

Band	**Tune up**	
	Normal power	**Low power**
LTE Band 2	24	15
LTE Band 5	24	21
LTE Band 7	23	13.5
LTE Band 12	24	22
LTE Band 13	24	22
LTE Band 41	24	14.5
LTE Band 66	22.5	13.5

Band 2 – Normal power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	1909.3	22.85	22.17
		1880	22.93	22.21
		1850.7	23.22	22.58
	1RB_Middle	1909.3	23.01	22.20
		1880	23.04	22.38
		1850.7	23.17	22.70
	1RB_Low	1909.3	22.84	22.04
		1880	22.94	22.21
		1850.7	23.20	22.55
	3RB_High	1909.3	22.95	21.87
		1880	23.05	22.10
		1850.7	23.15	22.30
	3RB_Middle	1909.3	23.02	21.97
		1880	23.11	22.15
		1850.7	23.20	22.43
	3RB_Low	1909.3	22.97	21.93
		1880	23.04	22.00
		1850.7	23.12	22.34
	6RB	1909.3	21.95	21.11
		1880	22.03	21.19
		1850.7	22.33	21.38
3 MHz	1RB_High	1908.5	22.84	22.08
		1880	22.90	22.29
		1851.5	23.18	22.49
	1RB_Middle	1908.5	22.97	22.24
		1880	23.07	22.45
		1851.5	23.17	22.61
	1RB_Low	1908.5	22.83	22.04
		1880	22.91	22.19
		1851.5	23.16	22.47
	8RB_High	1908.5	21.87	20.95
		1880	21.95	21.10
		1851.5	22.26	21.35
	8RB_Middle	1908.5	21.91	21.02
		1880	22.01	21.10
		1851.5	22.30	21.42
	8RB_Low	1908.5	21.89	21.03
		1880	21.97	21.08
		1851.5	22.27	21.37
	15RB	1908.5	21.87	20.93
		1880	21.94	21.02
		1851.5	22.25	21.34

5 MHz	1RB_High	1907.5	22.74	22.12
		1880	22.78	22.10
		1852.5	23.06	22.35
	1RB_Middle	1907.5	23.02	22.28
		1880	23.13	22.53
		1852.5	23.19	22.59
	1RB_Low	1907.5	22.75	22.06
		1880	22.82	22.08
		1852.5	23.11	22.45
	12RB_High	1907.5	21.75	20.80
		1880	21.86	20.90
		1852.5	22.22	21.24
	12RB_Middle	1907.5	21.93	20.95
		1880	22.03	21.09
		1852.5	22.27	21.34
	12RB_Low	1907.5	21.91	20.97
		1880	21.95	20.99
		1852.5	22.23	21.31
	25RB	1907.5	21.82	20.90
		1880	21.90	20.97
		1852.5	22.25	21.32
10MHz	1RB_High	1905	22.87	22.21
		1880	22.95	22.26
		1855	23.12	22.37
	1RB_Middle	1905	22.90	22.15
		1880	23.00	22.41
		1855	23.16	22.49
	1RB_Low	1905	22.85	22.06
		1880	23.02	22.31
		1855	23.23	22.55
	25RB_High	1905	21.69	20.76
		1880	21.87	20.94
		1855	22.24	21.27
	25RB_Middle	1905	21.91	20.96
		1880	22.00	21.07
		1855	22.21	21.32
	25RB_Low	1905	21.91	20.97
		1880	22.05	21.10
		1855	22.18	21.23
	50RB	1905	21.83	20.88
		1880	21.97	21.02
		1855	22.21	21.26
15MHz	1RB_High	1902.5	22.81	22.18
		1880	22.87	22.22
		1857.5	23.03	22.28
	1RB_Middle	1902.5	22.94	22.21
		1880	23.03	22.36
		1857.5	23.22	22.44

	1RB_Low	1902.5	22.83	22.15
		1880	22.94	22.32
		1857.5	23.23	22.50
	36RB_High	1902.5	21.82	20.83
		1880	21.95	20.97
		1857.5	22.22	21.24
	36RB_Middle	1902.5	21.93	20.94
		1880	22.06	21.07
		1857.5	22.29	21.30
	36RB_Low	1902.5	21.93	20.90
		1880	22.08	21.10
		1857.5	22.26	21.25
	75RB	1902.5	21.85	20.89
		1880	22.01	21.05
		1857.5	22.22	21.26
20MHz	1RB_High	1900	22.43	21.78
		1880	22.50	21.85
		1860	22.61	21.84
	1RB_Middle	1900	22.81	22.08
		1880	22.91	22.14
		1860	23.05	22.41
	1RB_Low	1900	22.50	21.79
		1880	22.61	21.84
		1860	22.90	22.21
	50RB_High	1900	21.55	20.62
		1880	21.66	20.75
		1860	22.02	21.08
	50RB_Middle	1900	21.77	20.82
		1880	21.88	20.93
		1860	22.07	21.14
	50RB_Low	1900	21.76	20.80
		1880	21.97	21.03
		1860	22.06	21.11
	100RB	1900	21.65	20.68
		1880	21.82	20.88
		1860	22.02	21.09

Band 2 – Low power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	1909.3	13.93	14.28
		1880	14.00	14.30
		1850.7	14.31	14.41
	1RB_Middle	1909.3	14.08	14.35
		1880	14.13	14.44
		1850.7	14.46	14.59
	1RB_Low	1909.3	13.93	14.27
		1880	14.00	14.24
		1850.7	14.31	14.47
	3RB_High	1909.3	14.05	14.04
		1880	14.11	14.09
		1850.7	14.48	14.37
	3RB_Middle	1909.3	14.12	14.10
		1880	14.16	14.18
		1850.7	14.50	14.51
	3RB_Low	1909.3	14.05	14.07
		1880	14.15	14.13
		1850.7	14.42	14.43
	6RB	1909.3	14.06	14.15
		1880	14.09	14.22
		1850.7	14.40	14.53
3 MHz	1RB_High	1908.5	13.94	14.26
		1880	14.01	14.22
		1851.5	14.30	14.58
	1RB_Middle	1908.5	14.13	14.36
		1880	14.18	14.46
		1851.5	14.50	14.54
	1RB_Low	1908.5	13.92	14.25
		1880	13.99	14.20
		1851.5	14.28	14.42
	8RB_High	1908.5	13.97	13.98
		1880	14.06	14.09
		1851.5	14.31	14.41
	8RB_Middle	1908.5	14.01	14.07
		1880	14.10	14.13
		1851.5	14.40	14.45
	8RB_Low	1908.5	13.99	14.02
		1880	14.07	14.10
		1851.5	14.36	14.45
	15RB	1908.5	13.93	13.99
		1880	14.04	14.06
		1851.5	14.34	14.35

5 MHz	1RB_High	1907.5	13.82	14.04
		1880	13.88	14.12
		1852.5	14.13	14.37
	1RB_Middle	1907.5	14.08	14.46
		1880	14.15	14.54
		1852.5	14.48	14.56
	1RB_Low	1907.5	13.80	14.05
		1880	13.91	14.12
		1852.5	14.20	14.49
	12RB_High	1907.5	13.88	13.86
		1880	13.97	13.93
		1852.5	14.35	14.35
	12RB_Middle	1907.5	14.01	13.99
		1880	14.12	14.05
		1852.5	14.37	14.36
	12RB_Low	1907.5	14.04	14.03
		1880	14.04	14.02
		1852.5	14.33	14.31
	25RB	1907.5	13.98	13.95
		1880	14.00	14.01
		1852.5	14.34	14.36
10MHz	1RB_High	1905	13.94	14.28
		1880	14.00	14.34
		1855	14.22	14.38
	1RB_Middle	1905	14.05	14.34
		1880	14.13	14.33
		1855	14.34	14.49
	1RB_Low	1905	13.94	14.23
		1880	14.03	14.36
		1855	14.33	14.43
	25RB_High	1905	13.81	13.82
		1880	14.00	13.97
		1855	14.35	14.33
	25RB_Middle	1905	13.99	13.98
		1880	14.10	14.05
		1855	14.31	14.30
	25RB_Low	1905	14.03	14.02
		1880	14.17	14.15
		1855	14.30	14.32
	50RB	1905	13.92	13.93
		1880	14.08	14.06
		1855	14.33	14.32
15MHz	1RB_High	1902.5	13.86	14.15
		1880	13.87	14.09
		1857.5	14.04	14.31
	1RB_Middle	1902.5	13.96	14.23
		1880	14.02	14.29
		1857.5	14.22	14.53

	1RB_Low	1902.5	13.90	14.08
		1880	14.00	14.30
		1857.5	14.25	14.51
	36RB_High	1902.5	13.84	13.81
		1880	13.99	13.94
		1857.5	14.25	14.23
	36RB_Middle	1902.5	13.98	13.93
		1880	14.08	14.02
		1857.5	14.30	14.29
	36RB_Low	1902.5	13.95	13.90
		1880	14.13	14.07
		1857.5	14.31	14.28
	75RB	1902.5	13.89	13.87
		1880	14.06	14.03
		1857.5	14.27	14.27
20MHz	1RB_High	1900	13.63	13.93
		1880	13.69	14.00
		1860	13.78	13.96
	1RB_Middle	1900	13.94	14.14
		1880	14.02	14.36
		1860	14.24	14.44
	1RB_Low	1900	13.68	13.92
		1880	13.79	13.97
		1860	14.05	14.41
	50RB_High	1900	13.76	13.74
		1880	13.87	13.86
		1860	14.21	14.22
	50RB_Middle	1900	13.96	13.93
		1880	14.05	14.03
		1860	14.20	14.19
	50RB_Low	1900	13.97	13.94
		1880	14.17	14.14
		1860	14.22	14.23
	100RB	1900	13.87	13.81
		1880	14.05	14.00
		1860	14.20	14.18

Band 5 – Normal power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	848.3	23.02	22.26
		836.5	22.96	22.10
		824.7	22.94	22.16
	1RB_Middle	848.3	23.17	22.43
		836.5	23.09	22.27
		824.7	23.05	22.34
	1RB_Low	848.3	22.99	22.27
		836.5	22.96	22.27
		824.7	22.90	22.16
	3RB_High	848.3	23.18	22.09
		836.5	23.04	21.99
		824.7	23.02	21.99
	3RB_Middle	848.3	23.20	22.21
		836.5	23.14	22.13
		824.7	23.07	22.09
	3RB_Low	848.3	23.13	22.16
		836.5	23.08	21.97
		824.7	23.02	22.01
	6RB	848.3	22.13	21.25
		836.5	22.08	21.17
		824.7	22.01	21.13
3 MHz	1RB_High	847.5	23.13	22.39
		836.5	23.00	22.25
		825.5	23.00	22.29
	1RB_Middle	847.5	23.24	22.59
		836.5	23.14	22.41
		825.5	23.18	22.50
	1RB_Low	847.5	23.08	22.34
		836.5	23.00	22.26
		825.5	22.98	22.20
	8RB_High	847.5	22.12	21.20
		836.5	22.07	21.10
		825.5	22.02	21.10
	8RB_Middle	847.5	22.17	21.22
		836.5	22.08	21.16
		825.5	22.04	21.15
	8RB_Low	847.5	22.09	21.20
		836.5	22.00	21.09
		825.5	22.00	21.08
	15RB	847.5	22.09	21.13
		836.5	22.07	21.07
		825.5	21.98	21.02

5 MHz	1RB_High	846.5	23.01	22.33
		836.5	22.89	22.09
		826.5	22.92	22.31
	1RB_Middle	846.5	23.24	22.46
		836.5	23.16	22.42
		826.5	23.15	22.43
	1RB_Low	846.5	22.96	22.27
		836.5	22.90	22.25
		826.5	22.88	22.26
	12RB_High	846.5	22.09	21.10
		836.5	22.10	21.08
		826.5	22.01	21.02
	12RB_Middle	846.5	22.14	21.20
		836.5	22.10	21.10
		826.5	22.09	21.10
	12RB_Low	846.5	22.13	21.14
		836.5	22.01	21.00
		826.5	22.02	21.01
	25RB	846.5	22.12	21.13
		836.5	22.08	21.07
		826.5	22.03	21.06
10MHz	1RB_High	844	23.01	22.36
		836.5	22.96	22.20
		829	22.91	22.26
	1RB_Middle	844	23.13	22.49
		836.5	23.09	22.41
		829	23.09	22.45
	1RB_Low	844	23.00	22.30
		836.5	22.95	22.22
		829	22.90	22.20
	25RB_High	844	22.04	21.04
		836.5	22.12	21.14
		829	22.04	21.05
	25RB_Middle	844	22.05	21.07
		836.5	22.05	21.06
		829	21.99	21.00
	25RB_Low	844	22.15	21.16
		836.5	22.04	21.02
		829	22.02	21.06
	50RB	844	22.13	21.13
		836.5	22.08	21.05
		829	22.03	21.03

Band 5 – Low power				
Bandwidth (MHz)	RB allocation / RB offset	Frequency (MHz)	Actual output power (dBm)	
			QPSK	16QAM
1.4 MHz	1RB_High	848.3	20.03	20.32
		836.5	20.01	20.30
		824.7	19.95	20.24
	1RB_Middle	848.3	20.19	20.38
		836.5	20.13	20.41
		824.7	20.09	20.47
	1RB_Low	848.3	20.01	20.39
		836.5	19.98	20.27
		824.7	19.92	20.18
	3RB_High	848.3	20.17	20.18
		836.5	20.13	20.09
		824.7	20.04	20.04
	3RB_Middle	848.3	20.21	20.16
		836.5	20.15	20.17
		824.7	20.10	20.03
	3RB_Low	848.3	20.15	20.19
		836.5	20.09	20.05
		824.7	20.03	20.07
	6RB	848.3	20.15	20.25
		836.5	20.06	20.19
		824.7	20.03	20.12
3 MHz	1RB_High	847.5	20.08	20.35
		836.5	20.03	20.34
		825.5	19.99	20.38
	1RB_Middle	847.5	20.18	20.41
		836.5	20.20	20.41
		825.5	20.17	20.33
	1RB_Low	847.5	20.07	20.49
		836.5	20.02	20.37
		825.5	20.00	20.38
	8RB_High	847.5	20.12	20.25
		836.5	20.08	20.14
		825.5	20.02	20.13
	8RB_Middle	847.5	20.16	20.27
		836.5	20.11	20.19
		825.5	20.06	20.14
	8RB_Low	847.5	20.14	20.21
		836.5	20.05	20.11
		825.5	20.02	20.11
	15RB	847.5	20.11	20.15
		836.5	20.05	20.08
		825.5	19.99	20.05

5 MHz	1RB_High	846.5	19.98	20.28
		836.5	19.95	20.29
		826.5	19.92	20.33
	1RB_Middle	846.5	20.22	20.37
		836.5	20.23	20.30
		826.5	20.20	20.28
	1RB_Low	846.5	19.97	20.33
		836.5	19.92	20.33
		826.5	19.89	20.17
	12RB_High	846.5	20.10	20.13
		836.5	20.09	20.16
		826.5	20.01	20.06
	12RB_Middle	846.5	20.18	20.20
		836.5	20.12	20.12
		826.5	20.08	20.12
	12RB_Low	846.5	20.16	20.19
		836.5	20.04	20.03
		826.5	20.00	20.04
	25RB	846.5	20.11	20.16
		836.5	20.08	20.12
		826.5	20.02	20.07
10MHz	1RB_High	844	20.07	20.45
		836.5	20.02	20.25
		829	19.96	20.37
	1RB_Middle	844	20.16	20.45
		836.5	20.15	20.43
		829	20.13	20.40
	1RB_Low	844	20.05	20.42
		836.5	20.03	20.28
		829	19.96	20.36
	25RB_High	844	20.06	20.12
		836.5	20.05	20.14
		829	20.05	20.11
	25RB_Middle	844	20.12	20.15
		836.5	20.11	20.10
		829	20.03	20.06
	25RB_Low	844	20.17	20.19
		836.5	20.15	20.08
		829	20.09	20.13
	50RB	844	20.14	20.17
		836.5	20.10	20.15
		829	20.05	20.10

Band 7 – Normal power				
Bandwidth (MHz)	RB allocation / RB offset	Frequency (MHz)	Actual output power (dBm)	
			QPSK	16QAM
5 MHz	1RB_High	2567.5	22.00	21.35
		2535	22.28	21.66
		2502.5	22.02	21.40
	1RB_Middle	2567.5	22.36	21.68
		2535	22.59	21.86
		2502.5	22.26	21.44
	1RB_Low	2567.5	22.06	21.38
		2535	22.28	21.63
		2502.5	21.94	21.33
	12RB_High	2567.5	21.14	20.19
		2535	21.40	20.47
		2502.5	21.13	20.20
	12RB_Middle	2567.5	21.18	20.26
		2535	21.46	20.53
		2502.5	21.14	20.22
	12RB_Low	2567.5	21.15	20.25
		2535	21.42	20.51
		2502.5	21.06	20.13
	25RB	2567.5	21.13	20.25
		2535	21.43	20.50
		2502.5	21.07	20.18
10MHz	1RB_High	2565	22.09	21.46
		2535	22.41	21.71
		2505	22.19	21.54
	1RB_Middle	2565	22.25	21.61
		2535	22.49	21.79
		2505	22.21	21.56
	1RB_Low	2565	22.26	21.58
		2535	22.39	21.70
		2505	22.04	21.37
	25RB_High	2565	21.16	20.26
		2535	21.42	20.54
		2505	21.26	20.34
	25RB_Middle	2565	21.22	20.31
		2535	21.48	20.57
		2505	21.16	20.25
	25RB_Low	2565	21.22	20.32
		2535	21.51	20.60
		2505	21.14	20.23
	50RB	2565	21.21	20.30
		2535	21.50	20.55
		2505	21.23	20.33

15MHz	1RB_High	2562.5	21.98	21.31
		2535	22.27	21.66
		2507.5	22.05	21.48
	1RB_Middle	2562.5	22.18	21.44
		2535	22.40	21.66
		2507.5	22.14	21.37
	1RB_Low	2562.5	22.25	21.68
		2535	22.26	21.51
		2507.5	21.92	21.25
	36RB_High	2562.5	21.17	20.24
		2535	21.41	20.48
		2507.5	21.29	20.33
	36RB_Middle	2562.5	21.22	20.26
		2535	21.44	20.50
		2507.5	21.18	20.27
	36RB_Low	2562.5	21.21	20.28
		2535	21.46	20.52
		2507.5	21.10	20.18
	75RB	2562.5	21.20	20.28
		2535	21.44	20.49
		2507.5	21.21	20.31
20MHz	1RB_High	2560	22.07	21.40
		2535	22.29	21.59
		2510	22.20	21.53
	1RB_Middle	2560	22.55	21.96
		2535	22.69	21.99
		2510	22.47	21.90
	1RB_Low	2560	22.42	21.77
		2535	22.33	21.64
		2510	22.03	21.49
	50RB_High	2560	21.48	20.49
		2535	21.68	20.67
		2510	21.59	20.68
	50RB_Middle	2560	21.52	20.58
		2535	21.72	20.77
		2510	21.48	20.55
	50RB_Low	2560	21.49	20.52
		2535	21.74	20.77
		2510	21.34	20.44
	100RB	2560	21.51	20.52
		2535	21.70	20.72
		2510	21.47	20.56

Band 7 – Low power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
5 MHz	1RB_High	2567.5	12.11	12.35
		2535	12.55	12.90
		2502.5	12.33	12.53
	1RB_Middle	2567.5	12.43	12.59
		2535	12.84	13.09
		2502.5	12.58	12.93
	1RB_Low	2567.5	12.22	12.51
		2535	12.57	12.88
		2502.5	12.24	12.55
	12RB_High	2567.5	12.25	12.22
		2535	12.69	12.69
		2502.5	12.49	12.41
	12RB_Middle	2567.5	12.33	12.35
		2535	12.77	12.74
		2502.5	12.48	12.47
	12RB_Low	2567.5	12.32	12.31
		2535	12.73	12.72
		2502.5	12.38	12.38
	25RB	2567.5	12.30	12.30
		2535	12.73	12.74
		2502.5	12.42	12.42
10MHz	1RB_High	2565	12.21	12.46
		2535	12.62	12.84
		2505	12.45	12.77
	1RB_Middle	2565	12.42	12.61
		2535	12.77	13.15
		2505	12.48	12.86
	1RB_Low	2565	12.41	12.72
		2535	12.70	12.93
		2505	12.37	12.62
	25RB_High	2565	12.36	12.33
		2535	12.70	12.73
		2505	12.58	12.58
	25RB_Middle	2565	12.41	12.40
		2535	12.75	12.78
		2505	12.49	12.49
	25RB_Low	2565	12.43	12.44
		2535	12.84	12.83
		2505	12.45	12.45
	50RB	2565	12.38	12.40
		2535	12.76	12.78
		2505	12.51	12.50

15MHz	1RB_High	2562.5	12.11	12.41
		2535	12.57	12.77
		2507.5	12.42	12.80
	1RB_Middle	2562.5	12.36	12.70
		2535	12.69	13.02
		2507.5	12.43	12.81
	1RB_Low	2562.5	12.45	12.68
		2535	12.61	12.86
		2507.5	12.29	12.61
	36RB_High	2562.5	12.29	12.26
		2535	12.67	12.66
		2507.5	12.56	12.53
	36RB_Middle	2562.5	12.38	12.35
		2535	12.74	12.71
		2507.5	12.49	12.47
	36RB_Low	2562.5	12.43	12.41
		2535	12.79	12.77
		2507.5	12.43	12.41
	75RB	2562.5	12.35	12.34
		2535	12.71	12.73
		2507.5	12.52	12.50
20MHz	1RB_High	2560	12.25	12.52
		2535	12.76	13.06
		2510	12.67	13.01
	1RB_Middle	2560	12.98	13.02
		2535	13.09	13.28
		2510	12.98	13.18
	1RB_Low	2560	12.69	12.95
		2535	12.79	13.07
		2510	12.45	12.83
	50RB_High	2560	12.66	12.72
		2535	12.96	12.98
		2510	12.91	13.03
	50RB_Middle	2560	12.75	12.78
		2535	13.06	13.08
		2510	12.84	12.88
	50RB_Low	2560	12.98	12.79
		2535	13.18	13.19
		2510	13.01	12.83
	100RB	2560	12.74	12.75
		2535	13.09	13.05
		2510	12.90	12.92

Band 12 – Normal power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	715.3	23.05	22.23
		707.5	23.01	22.25
		699.7	23.01	22.29
	1RB_Middle	715.3	23.18	22.41
		707.5	23.08	22.48
		699.7	23.09	22.47
	1RB_Low	715.3	23.02	22.31
		707.5	23.00	22.26
		699.7	23.01	22.28
	3RB_High	715.3	23.15	22.12
		707.5	23.08	22.06
		699.7	23.10	22.11
	3RB_Middle	715.3	23.20	22.24
		707.5	23.18	22.09
		699.7	23.18	22.23
	3RB_Low	715.3	23.16	22.14
		707.5	23.12	22.06
		699.7	23.12	22.05
	6RB	715.3	22.16	21.28
		707.5	22.12	21.24
		699.7	22.14	21.19
3 MHz	1RB_High	714.5	23.04	22.27
		707.5	23.02	22.43
		700.5	23.00	22.25
	1RB_Middle	714.5	23.24	22.53
		707.5	23.20	22.42
		700.5	23.22	22.53
	1RB_Low	714.5	23.09	22.26
		707.5	23.06	22.42
		700.5	23.08	22.35
	8RB_High	714.5	22.13	21.20
		707.5	22.10	21.17
		700.5	22.11	21.16
	8RB_Middle	714.5	22.19	21.20
		707.5	22.15	21.20
		700.5	22.15	21.19
	8RB_Low	714.5	22.13	21.21
		707.5	22.10	21.19
		700.5	22.11	21.18
	15RB	714.5	22.11	21.12
		707.5	22.13	21.13
		700.5	22.11	21.11

5 MHz	1RB_High	713.5	22.98	22.24
		707.5	22.97	22.23
		701.5	22.97	22.31
	1RB_Middle	713.5	23.16	22.52
		707.5	23.17	22.49
		701.5	23.18	22.49
	1RB_Low	713.5	23.03	22.30
		707.5	22.97	22.29
		701.5	23.01	22.30
	12RB_High	713.5	22.10	21.08
		707.5	22.11	21.11
		701.5	22.13	21.10
	12RB_Middle	713.5	22.17	21.12
		707.5	22.15	21.15
		701.5	22.12	21.12
	12RB_Low	713.5	22.15	21.13
		707.5	22.16	21.15
		701.5	22.09	21.07
	25RB	713.5	22.18	21.15
		707.5	22.13	21.16
		701.5	22.10	21.13
10MHz	1RB_High	711	22.93	22.21
		707.5	22.91	22.28
		704	22.87	22.14
	1RB_Middle	711	23.02	22.32
		707.5	23.01	22.27
		704	23.07	22.40
	1RB_Low	711	22.97	22.24
		707.5	22.91	22.30
		704	22.93	22.32
	25RB_High	711	22.01	20.99
		707.5	21.98	21.01
		704	21.97	20.96
	25RB_Middle	711	22.05	21.04
		707.5	22.03	21.03
		704	22.01	21.02
	25RB_Low	711	22.11	21.10
		707.5	22.07	21.08
		704	21.99	21.00
	50RB	711	22.04	21.05
		707.5	22.04	21.06
		704	22.00	20.99

Band 12 – Low power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	715.3	21.09	21.36
		707.5	21.01	21.26
		699.7	21.06	21.38
	1RB_Middle	715.3	21.20	21.45
		707.5	21.16	21.34
		699.7	21.15	21.48
	1RB_Low	715.3	21.06	21.34
		707.5	21.05	21.31
		699.7	21.06	21.26
	3RB_High	715.3	21.21	21.19
		707.5	21.17	21.07
		699.7	21.11	21.18
	3RB_Middle	715.3	21.22	21.26
		707.5	21.19	21.11
		699.7	21.21	21.17
	3RB_Low	715.3	21.17	21.16
		707.5	21.16	21.13
		699.7	21.15	21.11
	6RB	715.3	21.18	21.24
		707.5	21.11	21.17
		699.7	21.13	21.23
3 MHz	1RB_High	714.5	21.11	21.29
		707.5	21.08	21.29
		700.5	21.09	21.35
	1RB_Middle	714.5	21.23	21.44
		707.5	21.25	21.41
		700.5	21.26	21.46
	1RB_Low	714.5	21.09	21.36
		707.5	21.10	21.45
		700.5	21.10	21.37
	8RB_High	714.5	21.14	21.16
		707.5	21.09	21.17
		700.5	21.14	21.19
	8RB_Middle	714.5	21.18	21.26
		707.5	21.15	21.19
		700.5	21.13	21.23
	8RB_Low	714.5	21.15	21.21
		707.5	21.15	21.20
		700.5	21.13	21.18
	15RB	714.5	21.12	21.13
		707.5	21.09	21.15
		700.5	21.10	21.11

5 MHz	1RB_High	713.5	21.04	21.32
		707.5	20.99	21.34
		701.5	20.99	21.35
	1RB_Middle	713.5	21.25	21.37
		707.5	21.27	21.38
		701.5	21.20	21.31
	1RB_Low	713.5	21.05	21.34
		707.5	21.02	21.28
		701.5	21.02	21.31
	12RB_High	713.5	21.11	21.09
		707.5	21.11	21.13
		701.5	21.13	21.12
	12RB_Middle	713.5	21.18	21.15
		707.5	21.19	21.16
		701.5	21.16	21.13
	12RB_Low	713.5	21.17	21.14
		707.5	21.16	21.16
		701.5	21.11	21.10
	25RB	713.5	21.15	21.15
		707.5	21.15	21.14
		701.5	21.11	21.12
10MHz	1RB_High	711	21.02	21.34
		707.5	21.02	21.32
		704	20.98	21.23
	1RB_Middle	711	21.11	21.43
		707.5	21.08	21.40
		704	21.13	21.41
	1RB_Low	711	21.08	21.41
		707.5	21.01	21.33
		704	21.02	21.29
	25RB_High	711	21.07	21.08
		707.5	21.07	21.08
		704	21.00	21.04
	25RB_Middle	711	21.10	21.13
		707.5	21.08	21.09
		704	21.03	21.07
	25RB_Low	711	21.14	21.19
		707.5	21.11	21.14
		704	21.07	21.12
	50RB	711	21.13	21.14
		707.5	21.08	21.10
		704	21.02	21.08

Band 13 – Normal power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
5 MHz	1RB_High	784.5	22.81	22.08
		782	22.85	22.19
		779.5	22.86	22.18
	1RB_Middle	784.5	23.07	22.33
		782	23.05	22.36
		779.5	23.15	22.36
	1RB_Low	784.5	22.87	22.07
		782	22.91	22.20
		779.5	22.86	22.13
	12RB_High	784.5	21.90	20.92
		782	22.01	21.02
		779.5	21.99	21.03
	12RB_Middle	784.5	22.02	21.03
		782	22.03	21.01
		779.5	22.03	21.05
	12RB_Low	784.5	21.95	20.99
		782	21.96	20.97
		779.5	21.99	20.99
	25RB	784.5	21.92	20.95
		782	21.99	21.02
		779.5	21.98	21.03
10MHz	1RB_High	782	22.89	22.08
	1RB_Middle	782	23.05	22.35
	1RB_Low	782	23.01	22.27
	25RB_High	782	22.04	21.10
	25RB_Middle	782	22.03	21.07
	25RB_Low	782	22.05	21.08
	50RB	782	22.05	21.09

Band 13 – Low power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
5 MHz	1RB_High	784.5	20.92	21.27
		782	21.17	21.22
		779.5	21.16	21.19
	1RB_Middle	784.5	21.17	21.30
		782	20.93	21.30
		779.5	20.98	21.21
	1RB_Low	784.5	20.93	21.12
		782	20.96	20.97
		779.5	21.08	21.05
	12RB_High	784.5	21.06	21.03
		782	21.06	21.09
		779.5	21.07	21.04
	12RB_Middle	784.5	21.08	21.05
		782	21.03	21.02
		779.5	21.06	21.02
	12RB_Low	784.5	21.06	21.08
		782	20.99	20.98
		779.5	21.04	21.06
	25RB	784.5	21.03	21.04
		782	20.96	21.31
		779.5	21.13	21.46
10MHz	1RB_High	782	21.08	21.41
	1RB_Middle	782	21.13	21.14
	1RB_Low	782	21.12	21.12
	25RB_High	782	21.10	21.13
	25RB_Middle	782	21.11	21.16
	25RB_Low	782	20.92	21.27
	50RB	782	21.17	21.22

Band 41 – Normal power				
Bandwidth (MHz)	RB allocation / RB offset	Frequency (MHz)	Actual output power (dBm)	
			QPSK	16QAM
5 MHz	1RB_High	2687.5	22.73	21.80
		2640.3	22.92	21.99
		2593	23.11	22.16
		2545.8	23.83	22.81
		2498.5	23.69	22.74
	1RB_Middle	2687.5	22.90	21.97
		2640.3	23.09	22.21
		2593	23.34	22.42
		2545.8	23.93	22.91
		2498.5	23.84	22.85
	1RB_Low	2687.5	22.74	21.78
		2640.3	22.95	22.00
		2593	23.18	22.26
		2545.8	23.92	22.92
		2498.5	23.66	22.69
	12RB_High	2687.5	21.80	20.80
		2640.3	22.00	21.05
		2593	22.21	21.10
		2545.8	22.91	21.90
		2498.5	22.81	21.71
	12RB_Middle	2687.5	21.83	20.83
		2640.3	22.03	21.06
		2593	22.25	21.24
		2545.8	22.97	21.96
		2498.5	22.81	21.69
	12RB_Low	2687.5	21.84	20.74
		2640.3	21.99	20.98
		2593	22.27	21.20
		2545.8	22.94	21.93
		2498.5	22.77	21.65
	25RB	2687.5	21.80	20.86
		2640.3	22.05	21.08
		2593	22.25	21.23
		2545.8	22.93	21.98
		2498.5	22.71	21.75
10MHz	1RB_High	2685	22.78	21.85
		2639	22.99	22.05
		2593	23.18	22.27
		2547	23.88	22.85
		2501	23.81	22.82
	1RB_Middle	2685	22.90	21.96
		2639	23.14	22.23
		2593	23.33	22.39
		2547	23.91	22.91
		2501	23.91	22.92

	1RB_Low	2685	22.77	21.86
		2639	23.06	22.13
		2593	23.31	22.33
		2547	23.94	22.99
		2501	23.75	22.73
	25RB_High	2685	21.87	20.86
		2639	22.11	21.11
		2593	22.23	21.24
		2547	22.99	21.98
		2501	22.86	21.86
	25RB_Middle	2685	21.80	20.88
		2639	22.07	21.12
		2593	22.25	21.25
		2547	22.99	21.94
		2501	22.78	21.80
	25RB_Low	2685	21.85	20.90
		2639	22.07	21.16
		2593	22.31	21.33
		2547	22.99	21.95
		2501	22.80	21.79
	50RB	2685	21.79	20.86
		2639	22.01	21.16
		2593	22.22	21.33
		2547	22.88	21.94
		2501	22.73	21.78
15MHz	1RB_High	2682.5	22.70	21.77
		2637.8	22.90	21.97
		2593	23.03	22.13
		2548.3	23.75	22.79
		2503.5	23.79	22.80
	1RB_Middle	2682.5	22.84	21.86
		2637.8	23.13	22.19
		2593	23.29	22.34
		2548.3	23.96	22.98
		2503.5	23.81	22.82
	1RB_Low	2682.5	22.67	21.77
		2637.8	23.06	22.12
		2593	23.24	22.33
		2548.3	23.90	22.95
		2503.5	23.64	22.67
	36RB_High	2682.5	21.83	20.80
		2637.8	21.98	21.03
		2593	22.19	21.16
		2548.3	22.94	21.85
		2503.5	22.86	21.77
	36RB_Middle	2682.5	21.84	20.80
		2637.8	22.04	21.05
		2593	22.22	21.24

		2548.3	23.00	21.91
		2503.5	22.82	21.73
	36RB_Low	2682.5	21.80	20.82
		2637.8	22.05	21.09
		2593	22.31	21.27
		2548.3	22.93	21.96
		2503.5	22.77	21.72
	75RB	2682.5	21.74	20.91
		2637.8	22.08	21.13
		2593	22.28	21.31
		2548.3	22.91	21.93
		2503.5	22.73	21.78
20MHz	1RB_High	2680	22.42	21.41
		2636.5	22.54	21.63
		2593	22.75	21.82
		2549.5	23.40	22.34
		2506	23.58	22.62
	1RB_Middle	2680	22.73	21.80
		2636.5	23.03	22.12
		2593	23.25	22.26
		2549.5	23.90	22.94
		2506	23.79	22.86
	1RB_Low	2680	22.47	21.53
		2636.5	22.84	21.88
		2593	23.05	22.08
		2549.5	23.76	22.73
		2506	23.44	22.43
	50RB_High	2680	21.54	20.69
		2636.5	21.93	21.02
		2593	22.07	21.09
		2549.5	22.74	21.78
		2506	22.70	21.77
	50RB_Middle	2680	21.59	20.68
		2636.5	21.86	21.07
		2593	22.09	21.22
		2549.5	22.75	21.83
		2506	22.68	21.83
	50RB_Low	2680	21.65	20.75
		2636.5	22.02	21.14
		2593	22.21	21.30
		2549.5	22.76	21.84
		2506	22.71	21.65
	100RB	2680	21.64	20.68
		2636.5	22.01	21.08
		2593	22.16	21.19
		2549.5	22.79	21.77
		2506	22.70	21.81

Band 41 – Low power				
Bandwidth (MHz)	RB allocation / RB offset	Frequency (MHz)	Actual output power (dBm)	
			QPSK	16QAM
5 MHz	1RB_High	2687.5	12.72	12.79
		2640.3	12.89	12.97
		2593	13.06	13.19
		2545.8	13.80	13.85
		2498.5	13.65	13.72
	1RB_Middle	2687.5	12.82	12.89
		2640.3	13.08	13.17
		2593	13.39	13.45
		2545.8	14.05	14.11
		2498.5	13.85	13.97
	1RB_Low	2687.5	12.73	12.80
		2640.3	12.93	12.99
		2593	13.17	13.29
		2545.8	13.89	13.98
		2498.5	13.60	13.72
	12RB_High	2687.5	12.79	12.67
		2640.3	12.94	12.92
		2593	13.15	13.07
		2545.8	13.93	13.85
		2498.5	13.73	13.67
	12RB_Middle	2687.5	12.83	12.75
		2640.3	13.05	12.98
		2593	13.16	13.13
		2545.8	13.98	13.93
		2498.5	13.70	13.72
	12RB_Low	2687.5	12.79	12.66
		2640.3	12.96	12.90
		2593	13.21	13.14
		2545.8	13.97	13.90
		2498.5	13.70	13.62
	25RB	2687.5	12.80	12.78
		2640.3	13.01	13.05
		2593	13.20	13.25
		2545.8	13.93	13.92
		2498.5	13.71	13.71
10MHz	1RB_High	2685	12.82	12.88
		2639	12.96	13.06
		2593	13.11	13.25
		2547	13.84	13.93
		2501	13.74	13.84
	1RB_Middle	2685	12.88	12.92
		2639	13.14	13.23
		2593	13.34	13.45
		2547	14.08	14.14
		2501	13.83	13.96

	1RB_Low	2685	12.79	12.84
		2639	13.08	13.13
		2593	13.32	13.40
		2547	13.98	14.08
		2501	13.70	13.79
	25RB_High	2685	12.77	12.79
		2639	13.03	13.08
		2593	13.21	13.21
		2547	14.01	14.01
		2501	13.76	13.82
	25RB_Middle	2685	12.80	12.83
		2639	13.02	13.06
		2593	13.23	13.27
		2547	13.98	14.00
		2501	13.77	13.77
	25RB_Low	2685	12.79	12.82
		2639	13.03	13.06
		2593	13.28	13.31
		2547	14.04	14.02
		2501	13.74	13.74
	50RB	2685	12.77	12.80
		2639	12.99	13.03
		2593	13.20	13.25
		2547	13.94	14.01
		2501	13.82	13.83
15MHz	1RB_High	2682.5	12.72	12.75
		2637.8	12.87	12.97
		2593	13.00	13.13
		2548.3	13.69	13.82
		2503.5	13.70	13.78
	1RB_Middle	2682.5	12.81	12.86
		2637.8	13.05	13.17
		2593	13.22	13.31
		2548.3	13.95	13.99
		2503.5	13.72	13.82
	1RB_Low	2682.5	12.73	12.80
		2637.8	13.03	13.11
		2593	13.22	13.36
		2548.3	13.94	14.02
		2503.5	13.62	13.66
	36RB_High	2682.5	12.82	12.74
		2637.8	13.00	12.96
		2593	13.17	13.14
		2548.3	13.93	13.88
		2503.5	13.81	13.75
	36RB_Middle	2682.5	12.83	12.71
		2637.8	13.03	12.97
		2593	13.27	13.24

		2548.3	13.98	13.94
		2503.5	13.82	13.76
	36RB_Low	2682.5	12.82	12.68
		2637.8	13.06	13.00
		2593	13.28	13.22
		2548.3	14.00	13.93
		2503.5	13.76	13.69
	75RB	2682.5	12.72	12.68
		2637.8	13.01	12.97
		2593	13.19	13.25
		2548.3	13.95	13.89
		2503.5	13.78	13.79
20MHz	1RB_High	2680	12.50	12.59
		2636.5	12.65	12.73
		2593	12.83	12.90
		2549.5	13.45	13.55
		2506	13.64	13.69
	1RB_Middle	2680	12.84	12.91
		2636.5	13.14	13.23
		2593	13.41	13.40
		2549.5	13.95	14.07
		2506	13.89	13.92
	1RB_Low	2680	12.58	12.68
		2636.5	12.93	13.00
		2593	13.13	13.21
		2549.5	13.77	13.86
		2506	13.45	13.52
	50RB_High	2680	12.75	12.75
		2636.5	13.04	13.06
		2593	13.15	13.22
		2549.5	13.80	13.81
		2506	13.71	13.95
	50RB_Middle	2680	12.74	12.65
		2636.5	13.03	13.02
		2593	13.23	13.28
		2549.5	13.95	13.93
		2506	13.76	13.85
	50RB_Low	2680	12.79	12.77
		2636.5	13.09	13.18
		2593	13.34	13.41
		2549.5	14.00	14.03
		2506	13.78	13.76
	100RB	2680	12.85	12.85
		2636.5	13.18	13.21
		2593	13.31	13.38
		2549.5	14.01	13.99
		2506	13.93	13.94

Band 66 – Normal power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	1779.3	21.85	21.09
		1745	21.71	20.99
		1710.7	21.63	20.98
	1RB_Middle	1779.3	21.94	21.25
		1745	21.81	21.22
		1710.7	21.78	21.14
	1RB_Low	1779.3	21.86	21.23
		1745	21.71	20.98
		1710.7	21.67	20.90
	3RB_High	1779.3	21.96	20.96
		1745	21.84	20.77
		1710.7	21.74	20.79
	3RB_Middle	1779.3	21.98	21.05
		1745	21.87	20.87
		1710.7	21.79	20.82
	3RB_Low	1779.3	21.95	21.02
		1745	21.80	20.89
		1710.7	21.74	20.78
	6RB	1779.3	21.00	20.07
		1745	20.82	19.97
		1710.7	20.79	19.84
3 MHz	1RB_High	1778.5	21.91	21.14
		1745	21.79	21.24
		1711.5	21.72	21.08
	1RB_Middle	1778.5	22.03	21.47
		1745	21.91	21.23
		1711.5	21.84	21.19
	1RB_Low	1778.5	21.92	21.26
		1745	21.76	21.09
		1711.5	21.71	21.09
	8RB_High	1778.5	21.00	20.02
		1745	20.82	19.90
		1711.5	20.77	19.82
	8RB_Middle	1778.5	21.00	20.05
		1745	20.83	19.92
		1711.5	20.82	19.86
	8RB_Low	1778.5	20.97	20.01
		1745	20.83	19.92
		1711.5	20.78	19.83
	15RB	1778.5	20.95	19.98
		1745	20.81	19.83
		1711.5	20.77	19.78

5 MHz	1RB_High	1777.5	21.85	21.25
		1745	21.73	21.08
		1712.5	21.65	20.94
	1RB_Middle	1777.5	22.06	21.48
		1745	21.90	21.24
		1712.5	21.92	21.25
	1RB_Low	1777.5	21.85	21.23
		1745	21.73	21.08
		1712.5	21.64	21.01
	12RB_High	1777.5	20.96	19.92
		1745	20.82	19.80
		1712.5	20.77	19.73
	12RB_Middle	1777.5	21.03	20.02
		1745	20.88	19.88
		1712.5	20.83	19.82
	12RB_Low	1777.5	20.95	19.95
		1745	20.83	19.84
		1712.5	20.76	19.76
	25RB	1777.5	20.95	19.94
		1745	20.83	19.82
		1712.5	20.75	19.77
10MHz	1RB_High	1775	21.92	21.30
		1745	21.84	21.28
		1715	21.80	21.07
	1RB_Middle	1775	22.05	21.33
		1745	21.92	21.17
		1715	21.85	21.23
	1RB_Low	1775	21.98	21.39
		1745	21.78	21.14
		1715	21.76	21.05
	25RB_High	1775	21.03	20.02
		1745	20.85	19.89
		1715	20.81	19.83
	25RB_Middle	1775	21.05	20.07
		1745	20.91	19.90
		1715	20.87	19.87
	25RB_Low	1775	21.01	20.03
		1745	20.87	19.86
		1715	20.83	19.82
	50RB	1775	21.04	20.05
		1745	20.84	19.84
		1715	20.85	19.86
15MHz	1RB_High	1772.5	21.87	21.16
		1745	21.76	21.16
		1717.5	21.73	21.06
	1RB_Middle	1772.5	22.00	21.41
		1745	21.88	21.19
		1717.5	21.82	21.22

	1RB_Low	1772.5	21.90	21.27
		1745	21.70	21.12
		1717.5	21.70	21.02
	36RB_High	1772.5	21.07	20.02
		1745	20.95	19.88
		1717.5	20.90	19.86
	36RB_Middle	1772.5	21.07	20.05
		1745	20.91	19.90
		1717.5	20.90	19.85
	36RB_Low	1772.5	21.12	20.06
		1745	20.90	19.86
		1717.5	20.87	19.85
	75RB	1772.5	21.05	20.07
		1745	20.91	19.91
		1717.5	20.87	19.86
20MHz	1RB_High	1770	21.68	21.03
		1745	21.57	20.84
		1720	21.45	20.80
	1RB_Middle	1770	22.09	21.32
		1745	21.93	21.31
		1720	21.82	21.20
	1RB_Low	1770	21.69	21.02
		1745	21.53	20.96
		1720	21.46	20.75
	50RB_High	1770	21.07	20.09
		1745	20.92	19.89
		1720	20.84	19.86
	50RB_Middle	1770	21.04	20.02
		1745	20.89	19.88
		1720	20.82	19.84
	50RB_Low	1770	21.03	20.10
		1745	20.89	19.90
		1720	20.83	19.84
	100RB	1770	21.07	20.06
		1745	20.89	19.86
		1720	20.83	19.84

Band 66 – Low power				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	Actual output power (dBm)	
	RB offset		QPSK	16QAM
1.4 MHz	1RB_High	1779.3	12.88	13.08
		1745	12.74	12.95
		1710.7	12.69	12.94
	1RB_Middle	1779.3	13.00	13.06
		1745	12.89	13.09
		1710.7	12.83	13.07
	1RB_Low	1779.3	12.89	13.13
		1745	12.73	12.96
		1710.7	12.70	12.90
	3RB_High	1779.3	12.98	12.98
		1745	12.86	12.83
		1710.7	12.78	12.73
	3RB_Middle	1779.3	13.03	13.02
		1745	12.88	12.92
		1710.7	12.84	12.84
	3RB_Low	1779.3	12.98	12.98
		1745	12.83	12.84
		1710.7	12.79	12.77
	6RB	1779.3	12.99	13.07
		1745	12.82	12.87
		1710.7	12.76	12.86
3 MHz	1RB_High	1778.5	12.98	13.09
		1745	12.80	13.10
		1711.5	12.77	13.08
	1RB_Middle	1778.5	13.11	13.18
		1745	12.89	13.06
		1711.5	12.91	13.09
	1RB_Low	1778.5	12.93	13.06
		1745	12.79	13.03
		1711.5	12.73	12.92
	8RB_High	1778.5	12.97	13.03
		1745	12.82	12.87
		1711.5	12.78	12.83
	8RB_Middle	1778.5	12.99	13.03
		1745	12.83	12.87
		1711.5	12.79	12.83
	8RB_Low	1778.5	12.95	13.03
		1745	12.79	12.87
		1711.5	12.75	12.78
	15RB	1778.5	12.93	12.96
		1745	12.81	12.81
		1711.5	12.75	12.75

5 MHz	1RB_High	1777.5	12.89	13.07
		1745	12.74	12.97
		1712.5	12.66	12.88
	1RB_Middle	1777.5	13.07	13.10
		1745	12.92	13.07
		1712.5	12.89	13.07
	1RB_Low	1777.5	12.88	13.19
		1745	12.72	12.91
		1712.5	12.67	12.94
	12RB_High	1777.5	12.94	12.91
		1745	12.79	12.80
		1712.5	12.78	12.76
	12RB_Middle	1777.5	13.01	12.97
		1745	12.84	12.85
		1712.5	12.82	12.78
	12RB_Low	1777.5	12.93	12.92
		1745	12.82	12.76
		1712.5	12.77	12.69
	25RB	1777.5	12.95	12.95
		1745	12.80	12.85
		1712.5	12.76	12.75
10MHz	1RB_High	1775	12.93	13.13
		1745	12.85	13.09
		1715	12.78	13.07
	1RB_Middle	1775	13.01	13.15
		1745	12.88	13.02
		1715	12.87	13.07
	1RB_Low	1775	12.99	13.21
		1745	12.76	13.05
		1715	12.81	13.06
	25RB_High	1775	13.03	13.02
		1745	12.87	12.87
		1715	12.83	12.82
	25RB_Middle	1775	13.04	13.03
		1745	12.87	12.89
		1715	12.84	12.82
	25RB_Low	1775	13.03	13.03
		1745	12.88	12.86
		1715	12.84	12.79
	50RB	1775	13.07	13.04
		1745	12.84	12.87
		1715	12.86	12.85
15MHz	1RB_High	1772.5	12.89	13.08
		1745	12.79	13.06
		1717.5	12.71	13.03
	1RB_Middle	1772.5	13.01	13.18
		1745	12.87	13.09
		1717.5	12.82	12.98

	1RB_Low	1772.5	12.92	13.07
		1745	12.73	13.05
		1717.5	12.71	13.03
	36RB_High	1772.5	13.04	12.99
		1745	12.91	12.86
		1717.5	12.88	12.81
	36RB_Middle	1772.5	13.06	13.02
		1745	12.88	12.86
		1717.5	12.85	12.79
	36RB_Low	1772.5	13.08	13.03
		1745	12.86	12.84
		1717.5	12.84	12.79
	75RB	1772.5	13.07	13.04
		1745	12.90	12.87
		1717.5	12.84	12.82
20MHz	1RB_High	1770	12.65	12.93
		1745	12.53	12.74
		1720	12.47	12.79
	1RB_Middle	1770	12.99	12.98
		1745	12.84	12.91
		1720	12.83	12.95
	1RB_Low	1770	12.63	12.89
		1745	12.52	12.89
		1720	12.50	12.70
	50RB_High	1770	12.92	12.95
		1745	12.86	12.90
		1720	12.84	12.86
	50RB_Middle	1770	12.96	12.97
		1745	12.83	12.82
		1720	12.80	12.78
	50RB_Low	1770	12.97	12.96
		1745	12.89	12.84
		1720	12.86	12.82
	100RB	1770	12.92	12.91
		1745	12.82	12.81
		1720	12.81	12.79

11.4 Wi-Fi and BT Measurement result

Mode	GFSK		
Channel	0	39	78
The conducted power (dBm)	1.70	2.80	1.28
Tune up	3	3.5	2.5

The average conducted power of Wi-Fi for normal power is as following:

802.11b(dBm)		
Channel\data rate	1Mbps	**Tune up**
11(2462MHz)	17.09	**18**
6(2437MHz)	17.48	**18**
1(2412MHz)	17.35	**18**
802.11g(dBm)		
Channel\data rate	6Mbps	**Tune up**
11(2462MHz)	16.55	**17.5**
6(2437MHz)	17.22	**18**
1(2412MHz)	16.97	**18**
802.11n(dBm)-20MHz		
Channel\data rate	MCS0	**Tune up**
11(2462MHz)	16.39	**17.5**
6(2437MHz)	17.12	**18**
1(2412MHz)	16.84	**18**
802.11n(dBm)-40MHz		
Channel\data rate	MCS0	**Tune up**
9(2452MHz)	16.86	**18**
6(2437MHz)	17.11	**18**
3(2422MHz)	17.13	**18**
802.11a(dBm)		
Channel\data rate	6Mbps	**Tune up**
36(5180 MHz)	16.68	**18**
40(5200 MHz)	16.77	**18**
44(5220 MHz)	16.76	**18**
48(5240 MHz)	16.69	**18**
52(5260 MHz)	16.75	**18**
56(5280 MHz)	16.81	**18**
60(5300 MHz)	16.70	**18**
64(5320 MHz)	16.77	**18**
149(5745 MHz)	16.55	**18**
153(5765 MHz)	16.79	**18**
157(5785 MHz)	16.53	**18**
161(5805 MHz)	16.80	**18**
165(5825 MHz)	16.51	**18**

The average conducted power of Wi-Fi for Low power is as following:

802.11b(dBm)		
Channel\data rate	1Mbps	**Tune up**
11(2462MHz)	15.58	**16**
6(2437MHz)	16.37	**16.5**
1(2412MHz)	16.24	**16.5**
802.11g(dBm)		
Channel\data rate	6Mbps	**Tune up**
11(2462MHz)	13.37	**14.5**
6(2437MHz)	13.68	**14.5**
1(2412MHz)	13.57	**14.5**
802.11n(dBm)-20MHz		
Channel\data rate	MCS0	**Tune up**
11(2462MHz)	12.70	**14**
6(2437MHz)	13.57	**14.5**
1(2412MHz)	13.73	**14.5**
802.11n(dBm)-40MHz		
Channel\data rate	MCS0	**Tune up**
9(2452MHz)	13.57	**14.5**
6(2437MHz)	13.67	**14.5**
3(2422MHz)	13.98	**14.5**
802.11a(dBm)		
Channel\data rate	6Mbps	**Tune up**
36(5180 MHz)	10.55	**12.5**
40(5200 MHz)	11.03	**12.5**
44(5220 MHz)	10.94	**12.5**
48(5240 MHz)	10.77	**12.5**
52(5260 MHz)	10.90	**12.5**
56(5280 MHz)	11.11	**12.5**
60(5300 MHz)	11.26	**12.5**
64(5320 MHz)	11.55	**12.5**
149(5745 MHz)	12.12	**12.5**
153(5765 MHz)	11.79	**12.5**
157(5785 MHz)	11.44	**12.5**
161(5805 MHz)	11.27	**12.5**
165(5825 MHz)	11.59	**12.5**

12 Antenna Location

12.1 Transmit Antenna Separation Distances

The detail for transmit antenna separation distance is described in the additional document:
Appendix to test report No.I21Z62857-SEM02
The photos of SAR test

12.2 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR v01, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

SAR measurement positions						
Mode	Front	Rear	Left edge	Right edge	Top edge	Bottom edge
Main antenna	No	Yes	Yes	No	Yes	No
BT/WiFi antenna	No	Yes	No	No	Yes	No

13 SAR Test Result

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

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

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

Table 13.1: Duty Cycle

Mode	Duty Cycle
GPRS/EGPRS 850/1900	1:8.3 or 1:4
WCDMA&LTE FDD	1:1
LTE TDD	1:1.58

13.1 SAR results for 2G/3G/4G

Note: The distance between the EUT and the phantom bottom is 8mm/16mm/17mm by sensor, the distance for other results is 0mm.

Table 13.1-1: SAR Values (GSM 850 MHz Band-Body)

Ambient Temperature: 23.1 °C Liquid Temperature: 22.6 °C											
Frequency		Mode	Test Position	Figure No./ Note	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										
251	848.8	GPRS(1)	Rear	/	26.46	27.5	0.242	**0.31**	0.414	**0.53**	0.10
190	836.6	GPRS(1)	Rear	Fig.1	26.40	27.5	0.282	**0.36**	0.483	**0.62**	0.19
128	824.2	GPRS(1)	Rear	/	26.25	27.5	0.250	**0.33**	0.427	**0.57**	0.09
190	836.6	GPRS(1)	Left	/	26.40	27.5	0.177	**0.23**	0.303	**0.39**	0.15
190	836.6	GPRS(1)	Top	/	26.40	27.5	0.171	**0.22**	0.292	**0.38**	0.09
190	836.6	GPRS(2)	Rear	16mm	30.86	32	0.190	**0.25**	0.325	**0.42**	0.08
190	836.6	GPRS(2)	Left	17mm	30.86	32	0.061	**0.08**	0.104	**0.14**	0.05
190	836.6	GPRS(2)	Top	8mm	30.86	32	0.189	**0.25**	0.323	**0.42**	-0.06
190	836.6	EGPRS(1)	Rear	/	26.39	27.5	0.205	**0.26**	0.350	**0.45**	0.11

Table 13.1-2: SAR Values (GSM 1900 MHz Band - Body)

Ambient Temperature: 23.1 °C Liquid Temperature: 22.6 °C											
Frequency		Mode	Test Position	Figure No./ Note	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										
661	1880	GPRS(1)	Rear	/	21.84	22.5	0.290	**0.34**	0.633	**0.74**	0.06
810	1909.8	GPRS(1)	Left	/	20.95	22.5	0.231	**0.33**	0.545	**0.78**	0.06
661	1880	GPRS(1)	Left	/	21.45	22.5	0.381	**0.49**	0.899	**1.14**	0.04
512	1850.2	GPRS(1)	Left	Fig.2	21.84	22.5	0.475	**0.55**	1.12	**1.30**	0.07
661	1880	GPRS(1)	Top	/	21.84	22.5	0.027	**0.03**	0.064	**0.07**	0.12
661	1880	GPRS(2)	Rear	16mm	27.71	29	0.233	**0.31**	0.406	**0.55**	-0.08
661	1880	GPRS(2)	Left	17mm	27.71	29	<0.01	**<0.01**	<0.01	**<0.01**	/
661	1880	GPRS(2)	Top	8mm	27.71	29	0.072	**0.10**	0.126	**0.17**	-0.15
512	1850.2	EGPRS(1)	Left	/	21.79	22.5	0.401	**0.47**	0.945	**1.11**	0.08

Table 13.1-3: SAR Values (WCDMA 1900 MHz Band - Body)

Ambient Temperature: 23.1 ºC   Liquid Temperature: 22.6 ºC

Frequency		Mode	Test Position	Figure No./ Note	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										
9400	1880	RMC	Rear	/	13.40	14	0.240	**0.28**	0.572	**0.66**	0.11
9538	1907.6	RMC	Left	/	13.26	14	0.327	**0.39**	0.780	**0.93**	0.09
9400	1880	RMC	Left	/	13.40	14	0.358	**0.41**	0.853	**0.98**	-0.08
9262	1852.4	RMC	Left	Fig.3	13.49	14	0.414	**0.47**	0.987	**1.11**	0.17
9400	1880	RMC	Top	/	13.40	14	0.024	**0.03**	0.056	**0.06**	0.13
9400	1880	RMC	Rear	16mm	22.24	23.5	0.270	**0.36**	0.645	**0.86**	0.07
9400	1880	RMC	Left	17mm	22.44	23.5	0.240	**0.31**	0.408	**0.52**	-0.06
9400	1880	RMC	Top	8mm	22.48	23.5	0.066	**0.08**	0.156	**0.20**	0.08

Table 13.1-4: SAR Values (WCDMA 1700 MHz Band - Body)

Ambient Temperature: 23.1 ºC   Liquid Temperature: 22.6 ºC

Frequency		Mode	Test Position	Figure No./ Note	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										
1412	1732.4	RMC	Rear	/	11.74	12.5	0.414	**0.49**	0.905	**1.08**	0.09
1412	1732.4	RMC	Left	/	11.74	12.5	0.605	**0.72**	1.06	**1.26**	0.08
1412	1732.4	RMC	Top	/	11.74	12.5	0.068	**0.08**	0.119	**0.14**	0.15
1412	1732.4	RMC	Rear	16mm	22.74	23.2	0.655	**0.73**	1.15	**1.28**	0.08
1513	1752.6	RMC	Left	17mm	22.83	23.2	0.675	**0.74**	1.18	**1.28**	0.08
1412	1732.4	RMC	Left	Fig.4/ 17mm	22.74	23.2	0.697	**0.77**	1.22	**1.36**	0.07
1312	1712.4	RMC	Left	17mm	22.70	23.2	0.692	**0.78**	1.20	**1.35**	-0.05
1412	1732.4	RMC	Top	8mm	22.74	23.2	0.317	**0.35**	0.556	**0.62**	-0.09

Table 13.1-5: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 23.1 ºC   Liquid Temperature: 22.6 ºC

Frequency		Mode	Test Position	Figure No./ Note	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										
4233	846.6	RMC	Rear	/	20.57	21.5	0.561	**0.69**	0.956	**1.18**	0.05
4183	836.6	RMC	Rear	Fig.5	20.64	21.5	0.574	**0.70**	0.975	**1.19**	0.19
4132	826.4	RMC	Rear	/	20.59	21.5	0.519	**0.64**	0.882	**1.09**	0.06
4183	836.6	RMC	Left	/	20.64	21.5	0.346	**0.42**	0.588	**0.72**	0.09
4183	836.6	RMC	Top	/	20.64	21.5	0.467	**0.57**	0.794	**0.97**	-0.05
4183	836.6	RMC	Rear	16mm	22.44	23.5	0.193	**0.25**	0.328	**0.42**	0.08
4183	836.6	RMC	Left	17mm	22.44	23.5	0.089	**0.11**	0.152	**0.19**	0.10
4183	836.6	RMC	Top	8mm	22.44	23.5	0.149	**0.19**	0.253	**0.32**	0.11

Table 13.1-6: SAR Values (LTE Band2 - Body)

Ambient Temperature: 23.1 °C Liquid Temperature: 22.6 °C											
Frequency		Mode	Test Position	Figure No./ Note	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										
19100	1900	1RB_Mid	Rear	/	13.94	15	0.227	**0.29**	0.538	**0.69**	0.09
18900	1880	1RB_Mid	Rear	/	14.02	15	0.248	**0.31**	0.587	**0.74**	0.08
18700	1860	1RB_Mid	Rear	/	14.24	15	0.331	**0.39**	0.717	**0.85**	0.11
19100	1900	1RB_Mid	Left	/	13.94	15	0.323	**0.41**	0.764	**0.97**	-0.05
18900	1880	1RB_Mid	Left	/	14.02	15	0.346	**0.43**	0.818	**1.02**	0.06
18700	1860	1RB_Mid	Left	Fig.6	14.24	15	0.465	**0.55**	1.10	**1.31**	0.19
18700	1860	1RB_Mid	Top	/	14.24	15	0.039	**0.05**	0.093	**0.11**	0.15
19100	1900	50RB_Low	Rear	/	13.97	15	0.232	**0.29**	0.548	**0.69**	0.07
18900	1880	50RB_Low	Rear	/	14.17	15	0.246	**0.30**	0.582	**0.70**	0.05
18700	1860	50RB_Low	Rear	/	14.22	15	0.339	**0.41**	0.734	**0.88**	0.02
19100	1900	50RB_Low	Left	/	13.97	15	0.323	**0.41**	0.765	**0.97**	0.06
18900	1880	50RB_Low	Left	/	14.17	15	0.335	**0.40**	0.791	**0.96**	-0.04
18700	1860	50RB_Low	Left	/	14.22	15	0.392	**0.47**	0.928	**1.11**	0.08
18700	1860	50RB_Low	Top	/	14.22	15	0.038	**0.05**	0.089	**0.11**	0.12
18700	1860	100RB	Rear	/	14.20	15	0.281	**0.34**	0.666	**0.80**	0.09
18700	1860	100RB	Left	/	14.20	15	0.381	**0.46**	0.901	**1.08**	0.11
18700	1860	1RB_Mid	Rear	16mm	23.05	24	0.237	**0.29**	0.560	**0.70**	0.08
18700	1860	1RB_Mid	Left	17mm	23.05	24	0.273	**0.34**	0.645	**0.80**	0.09
18700	1860	1RB_Mid	Top	8mm	23.05	24	0.068	**0.08**	0.161	**0.20**	0.13
18700	1860	50RB_Mid	Rear	16mm	22.07	23	0.184	**0.23**	0.434	**0.54**	0.07
18700	1860	50RB_Mid	Left	17mm	22.07	23	0.212	**0.26**	0.502	**0.62**	-0.08
18700	1860	50RB_Mid	Top	8mm	22.07	23	0.054	**0.07**	0.128	**0.16**	0.11

Note: The LTE mode is QPSK_20MHz.

Table 13.1-7: SAR Values (LTE Band5 - Body)

Ambient Temperature: 23.1 °C Liquid Temperature: 22.6 °C											
Frequency		Mode	Test Position	Figure No./ Note	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										
20600	844	1RB_Mid	Rear	/	20.16	21	0.395	**0.48**	0.669	**0.81**	-0.03
20525	836.5	1RB_Mid	Rear	/	20.15	21	0.439	**0.53**	0.743	**0.90**	0.05
20450	829	1RB_Mid	Rear	/	20.13	21	0.460	**0.56**	0.778	**0.95**	0.08
20600	844	1RB_Mid	Left	/	20.16	21	0.269	**0.33**	0.517	**0.63**	0.05
20600	844	1RB_Mid	Top	Fig.7	20.16	21	0.488	**0.59**	0.939	**1.14**	-0.19
20525	836.5	1RB_Mid	Top	/	20.15	21	0.376	**0.46**	0.723	**0.88**	0.08
20450	829	1RB_Mid	Top	/	20.13	21	0.410	**0.50**	0.789	**0.96**	0.09
20600	844	25RB_Low	Rear	/	20.17	21	0.397	**0.48**	0.672	**0.81**	-0.05
20525	836.5	25RB_Low	Rear	/	20.15	21	0.434	**0.53**	0.735	**0.89**	0.06
20450	829	25RB_Low	Rear	/	20.09	21	0.463	**0.57**	0.783	**0.97**	0.01
20600	844	25RB_Low	Left	/	20.17	21	0.203	**0.25**	0.391	**0.47**	0.07
20600	844	25RB_Low	Top	/	20.17	21	0.472	**0.57**	0.908	**1.10**	0.06
20525	836.5	25RB_Low	Top	/	20.15	21	0.382	**0.46**	0.735	**0.89**	-0.04
20450	829	25RB_Low	Top	/	20.09	21	0.401	**0.49**	0.772	**0.95**	0.06
20600	844	50RB	Rear	/	20.14	21	0.399	**0.49**	0.767	**0.94**	0.08
20600	844	50RB	Top	/	20.14	21	0.302	**0.37**	0.581	**0.71**	0.04
20600	844	1RB_Mid	Rear	16mm	23.13	24	0.219	**0.27**	0.422	**0.52**	-0.05
20600	844	1RB_Mid	Left	17mm	23.13	24	0.087	**0.11**	0.168	**0.21**	0.09
20600	844	1RB_Mid	Top	8mm	23.13	24	0.066	**0.08**	0.128	**0.16**	0.08
20600	844	25RB_Low	Rear	16mm	22.15	23	0.171	**0.21**	0.328	**0.40**	0.06
20600	844	25RB_Low	Left	17mm	22.15	23	0.068	**0.08**	0.131	**0.16**	0.11
20600	844	25RB_Low	Top	8mm	22.15	23	0.051	**0.06**	0.098	**0.12**	0.07

Note: The LTE mode is QPSK_10MHz.

Table 13.1-8: SAR Values (LTE Band7 - Body)

Ambient Temperature: 23.1 ºC Liquid Temperature: 22.6 ºC											
Frequency		Mode	Test Position	Figure No./ Note	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										
21350	2560	1RB_Mid	Rear	/	12.98	13.5	0.358	**0.40**	1.05	**1.18**	0.07
21100	2535	1RB_Mid	Rear	/	13.09	13.5	0.368	**0.40**	1.07	**1.18**	0.08
20850	2510	1RB_Mid	Rear	/	12.98	13.5	0.371	**0.42**	1.08	**1.22**	0.05
21350	2560	1RB_Mid	Left	/	12.98	13.5	0.342	**0.39**	1.00	**1.13**	-0.03
21100	2535	1RB_Mid	Left	/	13.09	13.5	0.390	**0.43**	1.14	**1.25**	0.06
20850	2510	1RB_Mid	Left	/	12.98	13.5	0.377	**0.42**	1.12	**1.26**	0.05
21100	2535	1RB_Mid	Top	/	13.09	13.5	0.064	**0.07**	0.188	**0.21**	0.13
21350	2560	50RB_Low	Rear	/	12.98	13.5	0.398	**0.45**	1.08	**1.22**	0.02
21100	2535	50RB_Low	Rear	Fig.8	13.18	13.5	0.441	**0.47**	1.18	**1.27**	0.08
20850	2510	50RB_Low	Rear	/	13.01	13.5	0.413	**0.46**	1.10	**1.23**	0.03
21350	2560	50RB_Low	Left	/	12.98	13.5	0.332	**0.37**	0.972	**1.10**	0.05
21100	2535	50RB_Low	Left	/	13.18	13.5	0.380	**0.41**	1.11	**1.19**	-0.07
20850	2510	50RB_Low	Left	/	13.01	13.5	0.371	**0.42**	1.08	**1.21**	0.02
21100	2535	50RB_Low	Top	/	13.18	13.5	0.066	**0.07**	0.192	**0.21**	0.15
21100	2535	100RB	Rear	/	13.09	13.5	0.332	**0.37**	0.972	**1.07**	-0.05
21100	2535	100RB	Left	/	13.09	13.5	0.371	**0.41**	1.08	**1.19**	0.04
21350	2560	1RB_Mid	Rear	16mm	22.55	23	0.312	**0.35**	0.707	**0.78**	0.03
21100	2535	1RB_Mid	Rear	16mm	22.69	23	0.349	**0.37**	0.791	**0.85**	0.05
20850	2510	1RB_Mid	Rear	16mm	22.47	23	0.392	**0.44**	0.888	**1.00**	0.07
21350	2560	1RB_Mid	Left	17mm	22.55	23	0.364	**0.40**	0.825	**0.91**	0.08
21100	2535	1RB_Mid	Left	17mm	22.69	23	0.399	**0.43**	0.904	**0.97**	0.14
20850	2510	1RB_Mid	Left	17mm	22.47	23	0.396	**0.45**	0.896	**1.01**	0.06
21100	2535	1RB_Mid	Top	8mm	22.69	23	0.319	**0.34**	0.723	**0.78**	0.06
21100	2535	50RB_Low	Rear	16mm	21.74	22	0.280	**0.30**	0.635	**0.67**	0.04
21100	2535	50RB_Low	Left	17mm	21.74	22	0.253	**0.27**	0.573	**0.61**	-0.08
21100	2535	50RB_Low	Top	8mm	21.74	22	0.247	**0.26**	0.559	**0.59**	0.09
21100	2535	100RB	Rear	16mm	21.70	22	0.279	**0.30**	0.632	**0.68**	-0.09
21100	2535	100RB	Left	17mm	21.70	22	0.307	**0.33**	0.695	**0.75**	0.11

Note: The LTE mode is QPSK_20MHz.

Table 13.1-9: SAR Values (LTE Band12 - Body)

Ambient Temperature: 23.1 ºC Liquid Temperature: 22.6 ºC											
Frequency		Mode	Test Position	Figure No./ Note	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										
23130	711	1RB_Mid	Rear	/	21.11	22	0.447	**0.55**	0.798	**0.98**	0.05
23095	707.5	1RB_Mid	Rear	/	21.08	22	0.454	**0.56**	0.811	**1.00**	0.06
23060	704	1RB_Mid	Rear	Fig.9	21.13	22	0.462	**0.56**	0.825	**1.01**	-0.12
23060	704	1RB_Mid	Left	/	21.13	22	0.295	**0.36**	0.526	**0.64**	0.09
23060	704	1RB_Mid	Top	/	21.13	22	0.344	**0.42**	0.614	**0.75**	0.08
23130	711	25RB_Low	Rear	/	21.14	22	0.447	**0.54**	0.798	**0.97**	-0.05
23095	707.5	25RB_Low	Rear	/	21.11	22	0.447	**0.55**	0.798	**0.98**	0.07
23060	704	25RB_Low	Rear	/	21.07	22	0.447	**0.55**	0.798	**0.99**	0.06
23130	711	25RB_Low	Left	/	21.14	22	0.233	**0.28**	0.416	**0.51**	0.07
23130	711	25RB_Low	Top	/	21.14	22	0.289	**0.35**	0.516	**0.63**	0.04
23130	711	50RB	Rear	/	21.13	22	0.443	**0.54**	0.791	**0.97**	-0.08
23060	704	1RB_Mid	Rear	16mm	23.07	24	0.064	**0.08**	0.114	**0.14**	0.08
23060	704	1RB_Mid	Left	17mm	23.07	24	0.070	**0.09**	0.125	**0.16**	0.09
23060	704	1RB_Mid	Top	8mm	23.07	24	0.047	**0.06**	0.084	**0.10**	0.11
23130	711	25RB_Low	Rear	16mm	22.11	23	0.052	**0.06**	0.093	**0.11**	0.05
23130	711	25RB_Low	Left	17mm	22.11	23	0.054	**0.07**	0.097	**0.12**	0.13
23130	711	25RB_Low	Top	8mm	22.11	23	0.039	**0.05**	0.070	**0.09**	0.09

Note: The LTE mode is QPSK_10MHz.

Table 13.1-10: SAR Values (LTE Band13 - Body)

Ambient Temperature: 23.1 ºC Liquid Temperature: 22.6 ºC											
Frequency		Mode	Test Position	Figure No./ Note	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										
23230	782	1RB_Mid	Rear	Fig.10	21.13	22	0.408	**0.50**	0.737	**0.90**	-0.08
23230	782	1RB_Mid	Left	/	21.13	22	0.264	**0.32**	0.477	**0.58**	0.06
23230	782	1RB_Mid	Top	/	21.13	22	0.273	**0.33**	0.492	**0.60**	0.05
23230	782	25RB_High	Rear	/	21.13	22	0.372	**0.45**	0.671	**0.82**	0.03
23230	782	25RB_High	Left	/	21.13	22	0.273	**0.33**	0.492	**0.60**	-0.05
23230	782	25RB_High	Top	/	21.13	22	0.265	**0.32**	0.478	**0.58**	0.04
23230	782	1RB_Mid	Rear	16mm	23.05	24	0.157	**0.20**	0.284	**0.35**	0.07
23230	782	1RB_Mid	Left	17mm	23.05	24	0.083	**0.10**	0.150	**0.19**	0.10
23230	782	1RB_Mid	Top	8mm	23.05	24	0.090	**0.11**	0.162	**0.20**	0.09
23230	782	25RB_Low	Rear	16mm	22.05	23	0.121	**0.15**	0.219	**0.27**	-0.08
23230	782	25RB_Low	Left	17mm	22.05	23	0.066	**0.08**	0.119	**0.15**	0.12
23230	782	25RB_Low	Top	8mm	22.05	23	0.066	**0.08**	0.119	**0.15**	0.07

Note: The LTE mode is QPSK_10MHz.

Table 13.1-11: SAR Values (LTE Band41 - Body)

Frequency		Mode	Test Position	Figure No./ Note	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)
Ambient Temperature: 23.1 ºC Liquid Temperature: 22.6 ºC											
Ch.	MHz										
41490	2680	1RB_Mid	Rear	/	12.84	14.5	0.187	**0.27**	0.496	**0.73**	0.09
41055	2636.5	1RB_Mid	Rear	/	13.14	14.5	0.232	**0.32**	0.617	**0.84**	0.08
40620	2593	1RB_Mid	Rear	/	13.41	14.5	0.276	**0.36**	0.733	**0.94**	0.05
40185	2549.5	1RB_Mid	Rear	/	13.95	14.5	0.314	**0.36**	0.843	**0.96**	0.04
39750	2506	1RB_Mid	Rear	/	13.89	14.5	0.312	**0.36**	0.828	**0.95**	0.08
41490	2680	1RB_Mid	Left	/	12.84	14.5	0.192	**0.28**	0.569	**0.83**	0.04
41055	2636.5	1RB_Mid	Left	/	13.14	14.5	0.216	**0.30**	0.640	**0.88**	0.07
40620	2593	1RB_Mid	Left	/	13.31	14.5	0.241	**0.32**	0.715	**0.94**	0.10
40185	2549.5	1RB_Mid	Left	/	13.95	14.5	0.315	**0.36**	0.942	**1.07**	-0.04
39750	2506	1RB_Mid	Left	Fig.11	13.89	14.5	0.344	**0.40**	1.02	**1.17**	0.06
40185	2549.5	1RB_Mid	Top	/	13.95	14.5	0.058	**0.07**	0.172	**0.20**	0.14
41490	2680	50RB_Low	Rear	/	12.79	14.5	0.195	**0.29**	0.517	**0.77**	0.11
41055	2636.5	50RB_Low	Rear	/	13.09	14.5	0.228	**0.32**	0.605	**0.84**	0.09
40620	2593	50RB_Low	Rear	/	13.34	14.5	0.271	**0.35**	0.720	**0.94**	-0.08
40185	2549.5	50RB_Low	Rear	/	14.00	14.5	0.280	**0.31**	0.744	**0.83**	0.06
39750	2506	50RB_Low	Rear	/	13.78	14.5	0.298	**0.35**	0.790	**0.93**	0.04
41490	2680	50RB_Low	Left	/	12.79	14.5	0.184	**0.27**	0.546	**0.81**	0.05
41055	2636.5	50RB_Low	Left	/	13.09	14.5	0.202	**0.28**	0.599	**0.83**	0.03
40620	2593	50RB_Low	Left	/	13.34	14.5	0.242	**0.32**	0.717	**0.94**	-0.06
40185	2549.5	50RB_Low	Left	/	14.00	14.5	0.279	**0.31**	0.826	**0.93**	0.05
39750	2506	50RB_Low	Left	/	13.78	14.5	0.314	**0.37**	0.930	**1.10**	0.07
40185	2549.5	50RB_Low	Top	/	14.00	14.5	0.052	**0.06**	0.155	**0.17**	0.03
40185	2549.5	100RB	Rear	/	14.01	14.5	0.292	**0.33**	0.867	**0.97**	0.08
40185	2549.5	100RB	Left	/	14.01	14.5	0.283	**0.32**	0.838	**0.94**	0.09
40185	2549.5	1RB_Mid	Rear	16mm	23.90	24	0.221	**0.23**	0.655	**0.67**	0.10
40185	2549.5	1RB_Mid	Left	17mm	23.90	24	0.208	**0.21**	0.616	**0.63**	0.08
40185	2549.5	1RB_Mid	Top	8mm	23.90	24	0.200	**0.20**	0.593	**0.61**	-0.06
40185	2549.5	50RB_Low	Rear	16mm	22.76	23	0.169	**0.18**	0.500	**0.53**	0.04
40185	2549.5	50RB_Low	Left	17mm	22.76	23	0.156	**0.16**	0.462	**0.49**	0.07
40185	2549.5	50RB_Low	Top	8mm	22.76	23	0.156	**0.16**	0.462	**0.49**	0.08

Note: The LTE mode is QPSK_20MHz.

Table 13.1-12: SAR Values (LTE Band66 - Body)

Ambient Temperature: 23.1 °C Liquid Temperature: 22.6 °C											
Frequency		Mode	Test Position	Figure No./ Note	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										
132572	1770	1RB_Mid	Rear	/	12.99	13.5	0.406	**0.46**	0.887	**1.00**	0.05
132322	1745	1RB_Mid	Rear	/	12.84	13.5	0.444	**0.52**	0.969	**1.13**	0.08
132072	1720	1RB_Mid	Rear	/	12.83	13.5	0.439	**0.51**	0.957	**1.12**	0.06
132572	1770	1RB_Mid	Left	/	12.99	13.5	0.455	**0.51**	1.050	**1.18**	0.01
132322	1745	1RB_Mid	Left	/	12.84	13.5	0.437	**0.51**	0.998	**1.16**	0.01
132072	1720	1RB_Mid	Left	/	12.83	13.5	0.391	**0.46**	0.889	**1.04**	0.09
132572	1770	1RB_Mid	Top	/	12.99	13.5	0.048	**0.05**	0.110	**0.12**	0.15
132572	1770	50RB_Low	Rear	/	12.97	13.5	0.335	**0.38**	0.764	**0.86**	0.07
132322	1745	50RB_Low	Rear	/	12.89	13.5	0.339	**0.39**	0.775	**0.89**	0.05
132072	1720	50RB_Low	Rear	/	12.86	13.5	0.337	**0.39**	0.770	**0.89**	-0.08
132572	1770	50RB_Low	Left	/	12.97	13.5	0.453	**0.51**	1.04	**1.17**	0.07
132322	1745	50RB_Low	Left	/	12.89	13.5	0.420	**0.48**	0.964	**1.11**	-0.09
132072	1720	50RB_Low	Left	/	12.86	13.5	0.382	**0.44**	0.868	**1.01**	0.03
132572	1770	50RB_Low	Top	/	12.97	13.5	0.048	**0.05**	0.109	**0.12**	-0.14
132572	1770	100RB	Rear	/	12.92	13.5	0.338	**0.39**	0.772	**0.88**	0.09
132572	1770	100RB	Left	/	12.92	13.5	0.406	**0.46**	0.926	**1.06**	0.08
132572	1770	1RB_Mid	Rear	16mm	22.09	22.5	0.569	**0.63**	1.00	**1.10**	0.13
132322	1745	1RB_Mid	Rear	16mm	21.93	22.5	0.481	**0.55**	0.844	**0.96**	0.06
132072	1720	1RB_Mid	Rear	Fig.12/ 16mm	21.82	22.5	0.604	**0.71**	1.06	**1.24**	-0.06
132572	1770	1RB_Mid	Left	17mm	22.09	22.5	0.522	**0.57**	0.911	**1.00**	-0.02
132322	1745	1RB_Mid	Left	17mm	21.93	22.5	0.590	**0.67**	1.02	**1.16**	0.04
132072	1720	1RB_Mid	Left	17mm	21.82	22.5	0.486	**0.57**	0.848	**0.99**	0.08
132572	1770	1RB_Mid	Top	8mm	22.09	22.5	0.098	**0.11**	0.173	**0.19**	0.12
132572	1770	50RB_High	Rear	16mm	21.07	21.5	0.487	**0.54**	0.854	**0.94**	-0.05
132322	1745	50RB_High	Rear	16mm	20.92	21.5	0.426	**0.49**	0.748	**0.86**	0.06
132072	1720	50RB_High	Rear	16mm	20.84	21.5	0.341	**0.40**	0.599	**0.70**	0.08
132572	1770	50RB_High	Left	17mm	21.07	21.5	0.404	**0.45**	0.708	**0.78**	0.04
132572	1770	50RB_High	Top	8mm	21.07	21.5	0.073	**0.08**	0.127	**0.14**	0.13
132572	1770	100RB	Rear	16mm	21.07	21.5	0.418	**0.46**	0.733	**0.81**	-0.07
132572	1770	100RB	Left	17mm	21.07	21.5	0.412	**0.45**	0.722	**0.80**	0.06

Note: The LTE mode is QPSK_20MHz.

13.2 SAR results for WLAN

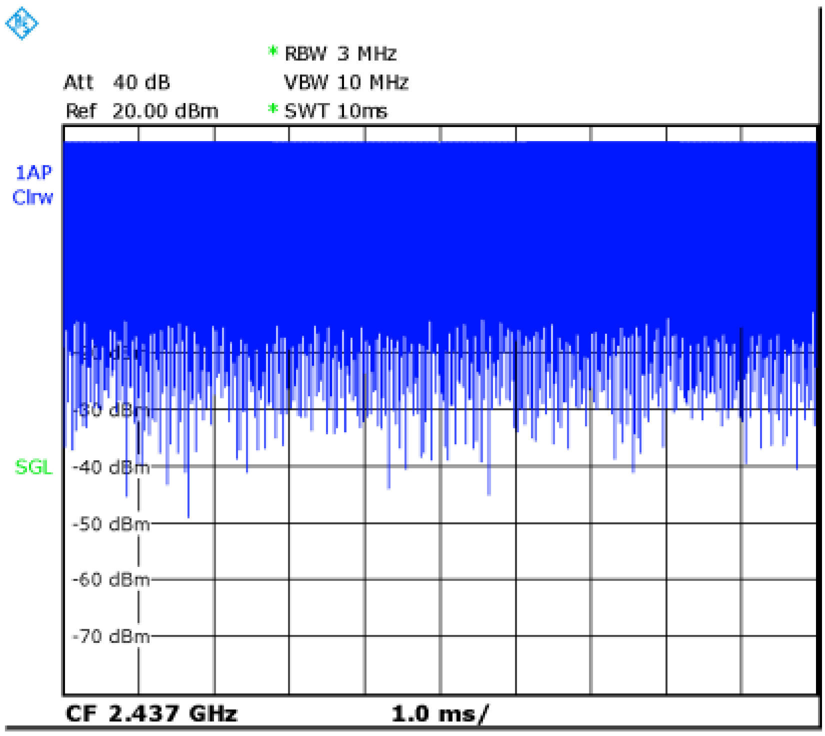
The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default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

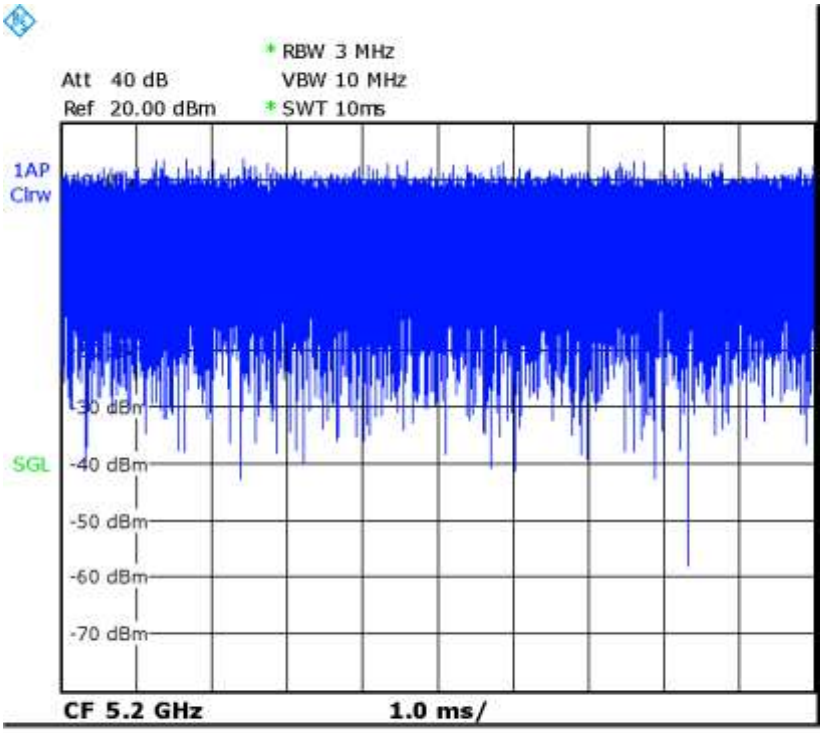
SAR Test reduction was applied from KDB 248227 guidance, when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest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

Duty factor plot

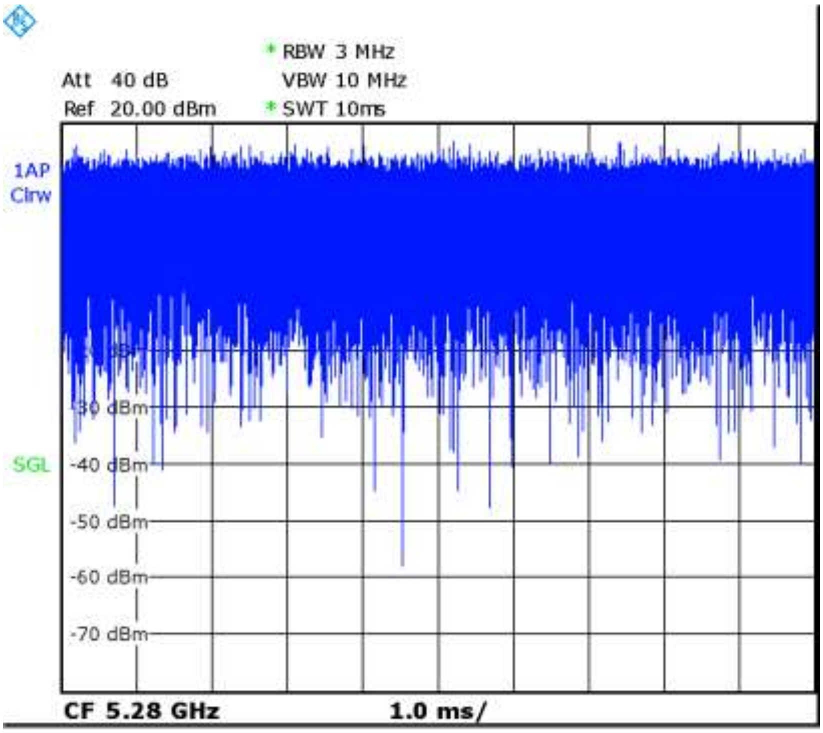
CH6



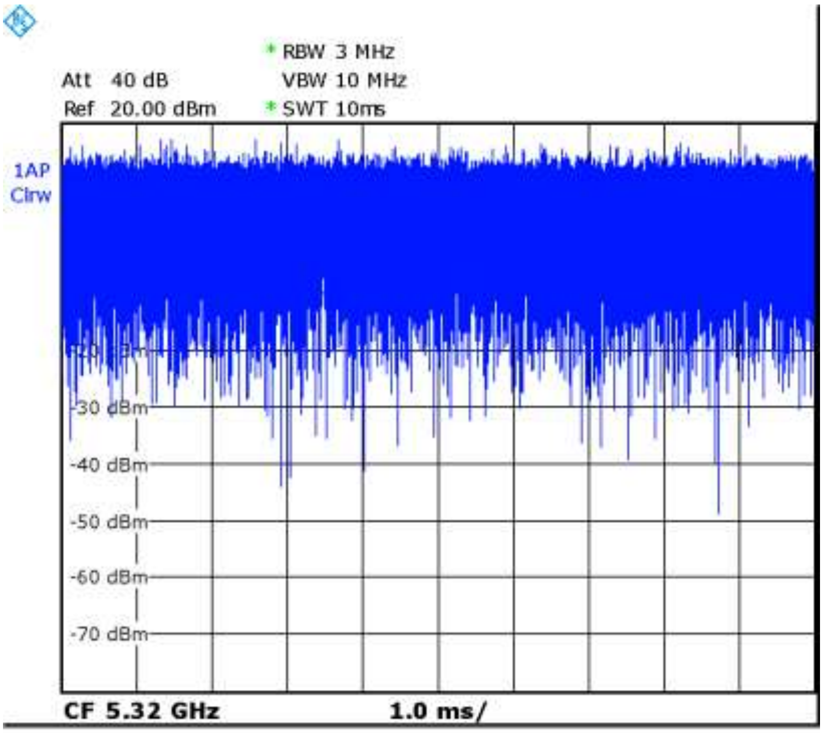
CH40


RBW 3 MHz
Att 40 dB
VBW 10 MHz
Ref 20.00 dBm
SWT 10ms
1AP
Clrw
-30 dBm
SGL
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.2 GHz
1.0 ms/

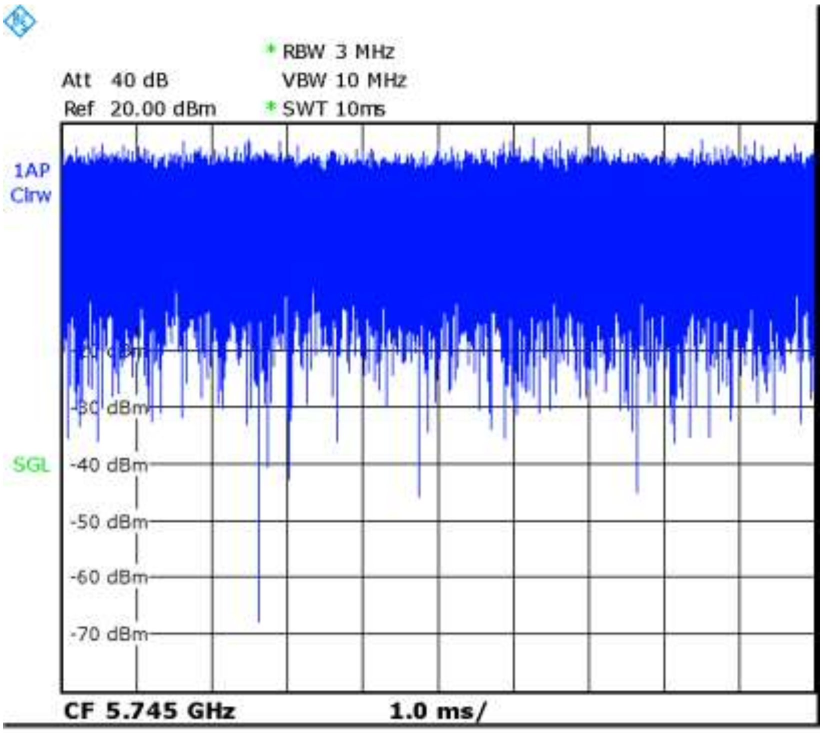
CH56


RBW 3 MHz
Att 40 dB
VBW 10 MHz
Ref 20.00 dBm
SWT 10ms
1AP
Clrw
-30 dBm
SGL
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.28 GHz
1.0 ms/

CH64


* RBW 3 MHz
Att 40 dB
VBW 10 MHz
Ref 20.00 dBm
* SWT 10ms
1AP
Clrw
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.32 GHz
1.0 ms/

CH149


* RBW 3 MHz
Att 40 dB
VBW 10 MHz
Ref 20.00 dBm
* SWT 10ms
1AP
Clrw
SGL
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.745 GHz
1.0 ms/

CH161

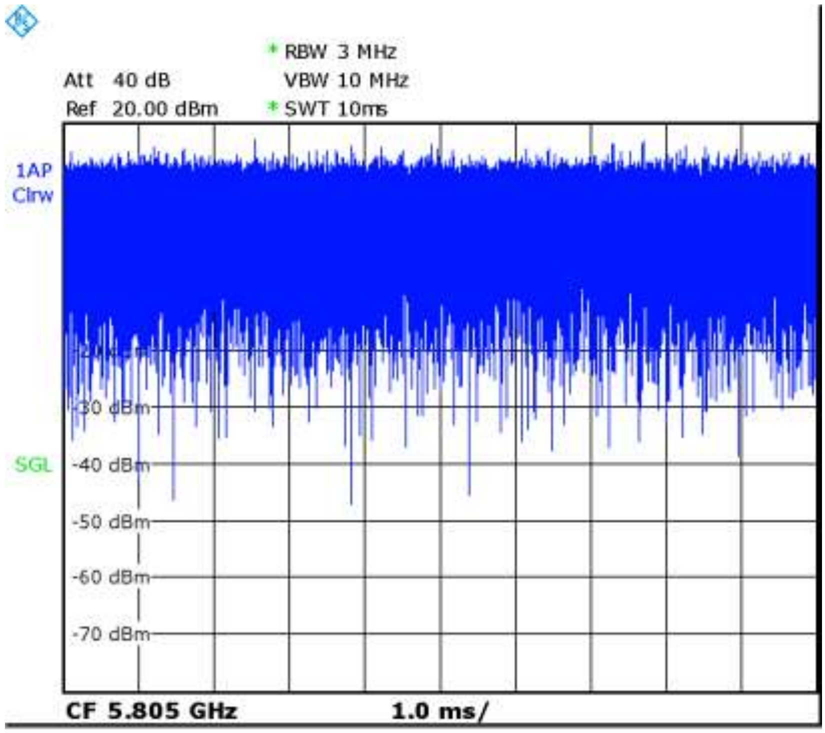


Table 13.2-1: SAR Values (WiFi 2.4G – Body)

Frequency		Test Position	Figure No./ Note	Duty Cycle	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										
6	2437	Rear	Fig.13/ Note1	100%	16.37	16.5	0.292	**0.30**	0.720	**0.74**	0.05
6	2437	Top	Note1	100%	16.37	16.5	0.122	**0.13**	0.262	**0.27**	-0.09
6	2437	Rear	Note2	100%	17.48	18	0.044	**0.05**	0.108	**0.12**	0.13
6	2437	Top	Note2	100%	17.48	18	0.034	**0.04**	0.084	**0.09**	-0.11

Note1: The distance between the EUT and the phantom bottom is 0mm.

Note2: The distance between the EUT and the phantom bottom is 13mm.

Table 13.2-2: SAR Values (WiFi 2.4G – Body)

Frequency		Test Position	Figure No./ Note	Duty Cycle	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										
40	5200	Rear	Note1	100%	11.03	12.5	0.096	**0.13**	0.391	**0.55**	0.06
40	5200	Top	Note1	100%	11.03	12.5	0.050	**0.07**	0.204	**0.29**	0.09
40	5200	Rear	Note2	100%	16.77	18	0.033	**0.04**	0.137	**0.18**	0.08
40	5200	Top	Note2	100%	16.77	18	0.040	**0.05**	0.165	**0.22**	0.10
64	5320	Rear	Fig.14/ Note1	100%	11.55	12.5	0.136	**0.17**	0.556	**0.69**	0.01
64	5320	Top	Note1	100%	11.55	12.5	0.076	**0.09**	0.310	**0.39**	0.07
56	5280	Rear	Note2	100%	16.81	18	0.051	**0.07**	0.210	**0.28**	0.08
56	5280	Top	Note2	100%	16.81	18	0.055	**0.07**	0.226	**0.30**	0.06
149	5745	Rear	Note1	100%	12.12	12.5	0.141	**0.15**	0.545	**0.59**	-0.07
149	5745	Top	Note1	100%	12.12	12.5	0.087	**0.10**	0.357	**0.39**	0.05
161	5805	Rear	Note2	100%	16.80	18	0.075	**0.10**	0.307	**0.40**	0.04
161	5805	Top	Note2	100%	16.80	18	0.116	**0.15**	0.473	**0.62**	-0.06
161	5805	Rear	Note3	100%	16.80	18	0.0628	**0.08**	0.167	**0.22**	0.01

Note1: The distance between the EUT and the phantom bottom is 0mm.
Note2: The distance between the EUT and the phantom bottom is 13mm.
Note3: The distance between the EUT and the phantom bottom is 16mm for simultaneous transmission.

13.3 SAR results for BT

Table 13.3-1: SAR Values (BT - Body)

Frequency		Test Position	Figure No./ Note	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									
0	2402	Rear	/	1.70	3	＜0.01	**＜0.01**	＜0.01	**＜0.01**	/
39	2441	Rear	Fig.15	2.80	3.5	0.012	**0.01**	0.035	**0.04**	0.03
78	2480	Rear		1.28	2.5	＜0.01	**＜0.01**	＜0.01	**＜0.01**	/
39	2441	Top	/	2.80	3.5	0.010	**0.01**	0.031	**0.04**	0.05

Note: The distance between the EUT and the phantom bottom is 0mm.

14 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

Table 14.1: SAR Measurement Variability for Body (1g)

Band	Frequency		Mode	Test Position	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
	Ch.	MHz							
GSM1900	512	1850.2	GPRS(1)	Left	0	1.12	1.10	1.02	/
WCDMA850	4183	836.6	RMC	Rear	0	0.975	0.968	1.01	/
WCDMA1700	1412	1732.5	RMC	Left	17	1.22	1.21	1.01	/
WCDMA1900	9262	1852.4	RMC	Left	0	0.987	0.981	1.01	/
LTE B2	18700	1860	1RB-Mid	Left	0	1.1	1.05	1.05	/
LTE B5	20600	844	1RB-Mid	Top	0	0.939	0.926	1.01	/
LTE B7	21100	2535	50RB-Low	Rear	0	1.18	1.15	1.03	/
LTE B12	23060	704	1RB-Mid	Rear	0	0.825	0.809	1.02	/
LTE B41	39750	2506	1RB-Mid	Left	0	1.02	0.992	1.03	/
LTE B66	132072	1720	1RB-Mid	Rear	16	1.06	1.04	1.02	/

15 Evaluation of Simultaneous

15.1 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)

15.1.1 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.

15.1.2 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.

15.2 Simultaneous Transmission Capabilities

The simultaneous transmission possibilities for this device are listed as below:

NO	If support: WWAN*1TX and WLAN*1TX	Y or N
1	WWAN + WLAN 2.4GHz	Y
2	WWAN + WLAN 2.4GHz +BT	N
3	WWAN + WLAN 5GHz	Y
4	WWAN + WLAN 5GHz +BT	Y

Note:

1. The reported SAR summation is calculated based on the same configuration and test position.
2. For the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR, we determined the SAR of this edges were less than 0.01. For the convenience of simultaneous transmission calculation, all SAR values less than or equal to 0.01 are uniformly written as 0.00

15.3 SAR Simultaneous Transmission Analysis

reported SAR 1g (W/kg)																			
Body		GSM850	GSM1900	WCDMA 850	WCDMA 1700	WCDMA 1900	LTE Band2	LTE Band5	LTE Band7	LTE Band12	LTE Band13	LTE Band41	LTE Band66	2.4G	5G	BT	Cellular+WiFi2.4G	Cellular+WiFi5G	Cellular+WIFI5G+BT
Rear	0mm	0.62	0.74	1.19	1.08	0.66	0.88	0.97	1.27	1.01	0.90	0.96	1.13	0.74	0.69	0.04	2.01	1.96	2.00
Left	0mm	0.39	1.30	0.72	1.26	1.11	1.31	0.63	1.26	0.64	0.60	1.17	1.18	0.00	0.00	0.00	1.31	1.31	1.31
Top	0mm	0.38	0.07	0.97	0.14	0.06	0.11	1.14	0.21	0.75	0.60	0.20	0.12	0.27	0.39	0.04	1.41	1.53	1.57
Rear	16mm	0.42	0.55	0.42	1.28	0.86	0.70	0.52	1.00	0.14	0.35	0.67	1.24	0.12	0.22	0.00	1.40	1.50	1.50
Left	17mm	0.14	0.00	0.19	1.36	0.52	0.80	0.21	1.01	0.16	0.19	0.63	1.16	0.00	0.00	0.00	1.36	1.36	1.36
Top	8mm	0.42	0.17	0.32	0.62	0.20	0.20	0.16	0.78	0.10	0.20	0.61	0.19	0.27	0.39	0.00	1.05	1.17	1.17
Top	13mm	0.42	0.17	0.32	0.62	0.20	0.20	0.16	0.78	0.10	0.20	0.61	0.19	0.09	0.62	0.00	0.87	1.40	1.40

Note: To be more conservative, the value of top 13mm is replaced by 8mm for cellular, the value of rear 16mm is replaced by 13mm for WLAN 2.4G/5G and the value of top 8mm is replaced by 0mm for WLAN 2.4G/5G.

The sum of 1-g SAR for rear 0mm is large than 1.6 W/kg. The SPLSR is calculated as follows.

Table 15.3-1: The sum of reported SAR values for main antenna and WiFi2.4G (SPLSR)

	Position	Band	Main antenna	WiFi 2.4G	Sum (1g)	Distance (mm)	Ratio
Highest reported SAR value for Body	Rear 0mm	LTE B7	1.27	0.74	2.01	85.47	0.033
		W850	1.19		1.93	98.71	0.027
		W1700	1.08		1.82	99.1	0.025
		LTE B12	1.01		1.75	65.16	0.036
		LTE B5	0.97		1.71	99.19	0.023
		LTE B41	0.96		1.70	118.22	0.019
		LTE B66	1.13		1.87	90.13	0.028
		LTE B13	0.90		1.64	65.42	0.032
		LTE B2	0.88		1.62	99.41	0.021

Table 15.3-2: The sum of reported SAR values for main antenna and WiFi5G (SPLSR)

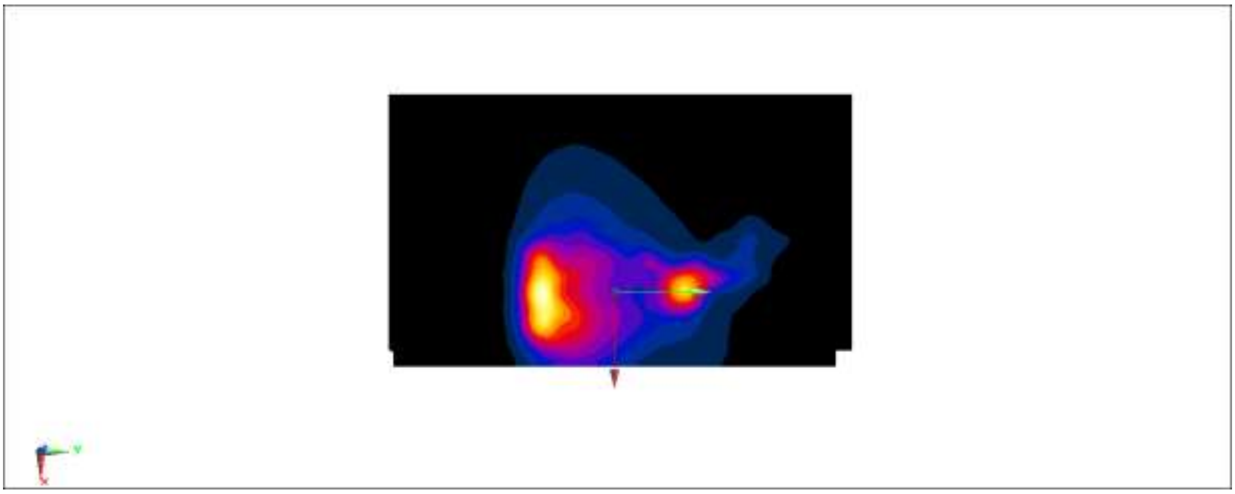
	Position	Band	Main antenna	WiFi 5G	Sum (1g)	Distance (mm)	Ratio
Highest reported SAR value for Body	Rear 0mm	LTE B7	1.27	0.69	1.96	80.97	0.034
		W850	1.19		1.88	94.41	0.027
		W1700	1.08		1.77	94.45	0.025
		LTE B12	1.01		1.70	60.47	0.037
		LTE B5	0.97		1.66	94.67	0.023
		LTE B41	0.96		1.65	113.51	0.019
		LTE B66	1.13		1.82	85.5	0.029
		LTE B13	0.90		1.59	60.63	0.033
		LTE B2	0.88		1.57	94.69	0.021

Table 15.3-3: The sum of reported SAR values for main antenna and BT (SPLSR)

	Position	Band	Main antenna	BT	Sum (1g)	Distance (mm)	Ratio
Highest reported SAR value for Body	Rear 0mm	LTE B7	1.27	0.04	1.31	90.41	0.017
		W850	1.19		1.23	102.21	0.013
		W1700	1.08		1.12	105.18	0.011
		LTE B12	1.01		1.05	76.03	0.014
		LTE B5	0.97		1.01	104.07	0.010
		LTE B41	0.96		1.00	124.76	0.008
		LTE B66	1.13		1.17	96.13	0.013
		LTE B13	0.90		0.94	73.84	0.012
		LTE B2	0.88		0.92	106.22	0.008

Table 15.3-3: The sum of reported SAR values for BT and WiFi5G (SPLSR)

	Position	BT	WiFi 5G	Sum (1g)	Distance (mm)	Ratio
Highest reported SAR value for Body	Rear 0mm	0.04	0.69	0.73	17.03	0.037



Find distance of maxima

Maxima and position w.r.t. Grid Reference Point	associated 1g averages
Zoom Scan (D:\2021\I21Z62857(CE+FCC)\FCC\LTE Band12 Body SWL.da53:0/Rear 0mm 1RB-M -2dB)	
Max. 1 at (38.30, -29.50, 2.15) mm	0.82 W/kg
Zoom Scan (D:\2021\I21Z62857(CE+FCC)\FCC\WLAN5G Body 11dB SWL zuizhongjieguo.da53:0/Rear 0mm 1...	
Max. 2 at (24.60, 29.40, 1.72) mm	0.56 W/kg
Distances and Separation Ratios	
Max. 1 - Max. 2	Distance [mm]: 60.47 / Separation ratio [W/kg/mm]: 0.03

Picture 15.3-1 Distance evaluation for LTE B12 and WiFi 5G

15.4 Conclusion

According to the above tables, the highest simultaneous transmission reported SAR values is **1.57W/kg (10g).** The sum of reported SAR values is < 1.6W/kg.

16 Measurement Uncertainty

16.1 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

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	

16.2 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 (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
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	

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

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	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	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	0.4	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	∞
14	Fast SAR z-Approximation	B	7.0	R	$\sqrt{3}$	1	1	4.0	4.0	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞

20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						10.4	10.3	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						20.8	20.6	

16.4 Measurement Uncertainty for Fast 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	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	14.0	R	$\sqrt{3}$	1	1	8.1	8.1	∞
Test sample related										
15	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
16	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5

17	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
18	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
19	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
20	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
21	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
22	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521
Combined standard uncertainty		$u_c^{'} = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$						13.5	13.4	257
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$						27.0	26.8	

17 MAIN TEST INSTRUMENTS

Table 17.1: List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 14, 2022	One year
02	Power meter	NRP2	106277	September 24, 2021	One year
03	Power sensor	NRP6A	104291		
04	Signal Generator	E4438C	MY49071430	January 13, 2022	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	166370	June 25 2021	One year
07	E-field Probe	SPEAG EX3DV4	7517	January 19, 2022	One year
08	DAE	SPEAG DAE4	1525	September 1, 2021	One year
09	Dipole Validation Kit	SPEAG D750V3	1017	July 12,,2021	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	July 21,,2021	One year
11	Dipole Validation Kit	SPEAG D1750V2	1003	July 12,,2021	One year
12	Dipole Validation Kit	SPEAG D1900V2	5d101	July 15,2021	One year
13	Dipole Validation Kit	SPEAG D2450V2	853	July 26,2021	One year
14	Dipole Validation Kit	SPEAG D2600V2	1012	July 26,2021	One year
15	Dipole Validation Kit	SPEAG D5GHzV2	1060	June 22,2021	One year

END OF REPORT BODY

ANNEX A Graph Results

GSM850 Rear 0mm
Date: 2/21/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.865 S/m; ε_r = 44.284;ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: GSM850 836.6 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 – SN7517 ConvF(9.3,9.3,9.3)

Area Scan (81x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.914 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.30 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.955 W/kg
SAR(1 g) = 0.483 W/kg; SAR(10 g) = 0.282 W/kg
Maximum value of SAR (measured) = 0.761 W/kg

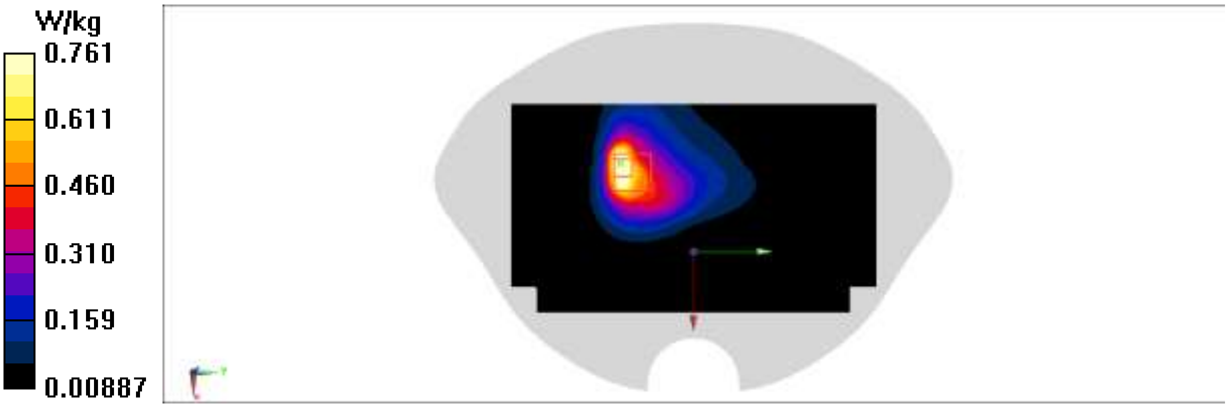


Fig A.1

PCS1900 Left 0mm
Date: 2/24/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.308 S/m; ε_r = 39.409; ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: PCS1900 1850.2 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 – SN7517 ConvF(7.74,7.74,7.74)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.98 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.23 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 2.47 W/kg
SAR(1 g) = 1.12 W/kg; SAR(10 g) = 0.475 W/kg
Maximum value of SAR (measured) = 1.86 W/kg

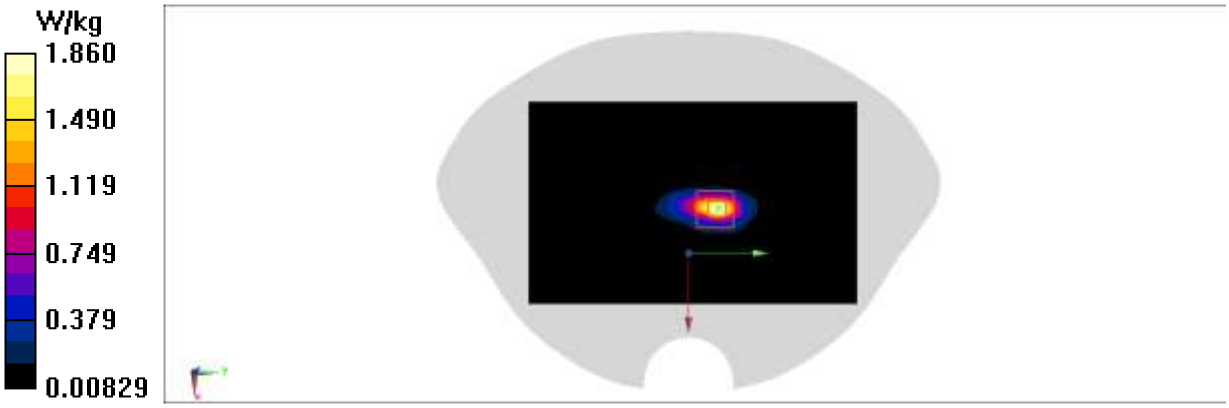


Fig A.2

WCDMA1900 Left 0mm
Date: 2/24/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.301 S/m; ε_r = 39.62; ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: WCDMA1900 1852.4 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(7.74,7.74,7.74)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.65 W/kg

Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.99 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 2.22 W/kg
SAR(1 g) = 0.987 W/kg; SAR(10 g) = 0.414 W/kg
Maximum value of SAR (measured) = 1.72 W/kg

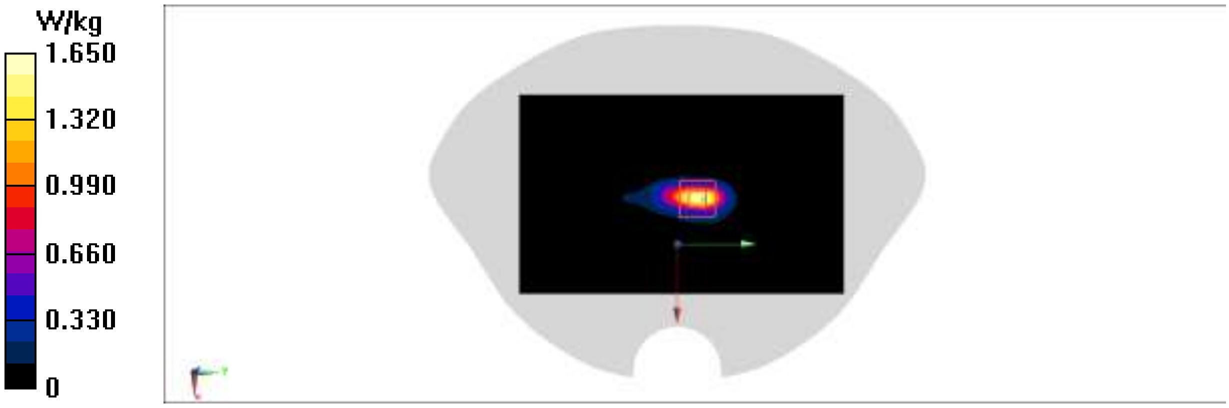


Fig A.3

WCDMA1700 Left 17mm

Date: 2/28/2022

Electronics: DAE4 Sn1525

Medium: H700-6000

Medium parameters used (interpolated): f = 1732.4 MHz; σ = 1.359 S/m; ε_r = 40.708;ρ = 1000 kg/m^3

Ambient Temperature: 23.1°C, Liquid Temperature: 22.6°C

Communication System: WCDMA1700 1732.4 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN7517 ConvF(8.1,8.1,8.1)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.88 W/kg

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

Reference Value = 16.63 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 2.11 W/kg

SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.697 W/kg

Maximum value of SAR (measured) = 1.79 W/kg

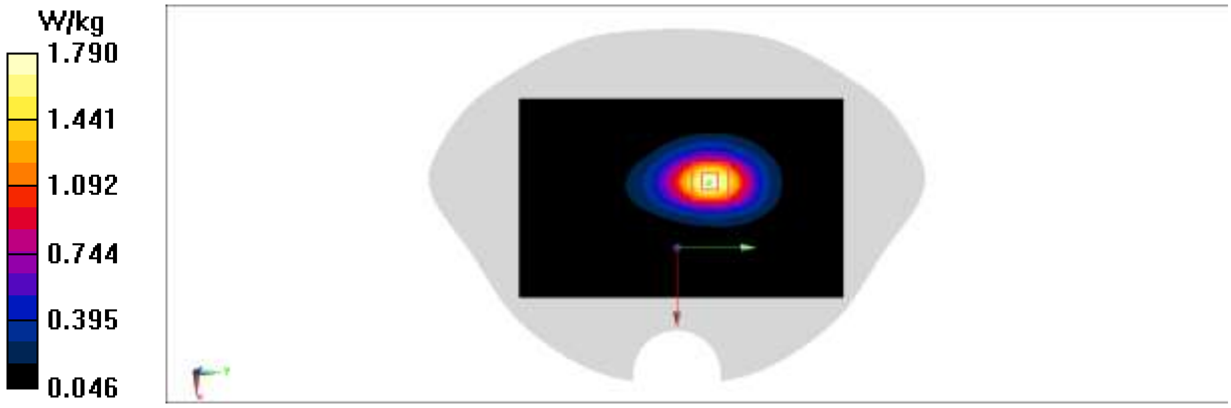


Fig A.4

WCDMA850 Rear 0mm
Date: 2/21/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.866 S/m; ε_r = 44.281; ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: WCDMA850 836.6 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(9.3,9.3,9.3)

Area Scan (81x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.46 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.89 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 2.01 W/kg
SAR(1 g) = 0.975 W/kg; SAR(10 g) = 0.574 W/kg
Maximum value of SAR (measured) = 1.47 W/kg

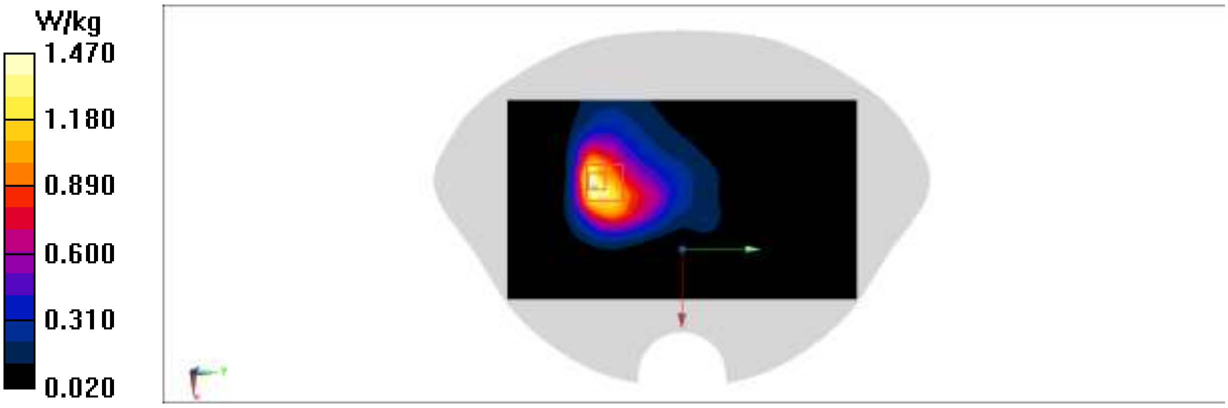


Fig A.5

LTE B2 Left 0mm
Date: 2/24/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 1860 MHz; σ = 1.29 S/m; ε_r = 39.539; ρ = 1000 kg/m^3
Ambient Temperature: 23.1ºC, Liquid Temperature: 22.6ºC
Communication System: LTE B2 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(7.74, 7.74, 7.74)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.85 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.51 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 2.43 W/kg
SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.465 W/kg
Maximum value of SAR (measured) = 1.91 W/kg

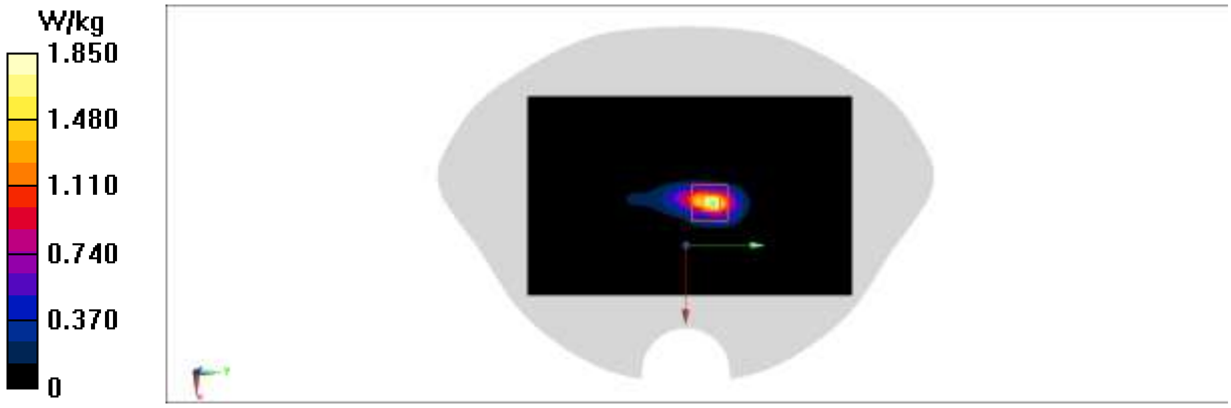


Fig A.6

LTE B5 Top 0mm
Date: 2/21/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 844 MHz; σ = 0.893 S/m; ε_r = 43.138;ρ = 1000 kg/m^3
Ambient Temperature: 22.2°C, Liquid Temperature: 22°C
Communication System: LTE B5 844 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(9.3,9.3,9.3)

Area Scan (81x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.60 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.82 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 0.939 W/kg; SAR(10 g) = 0.488 W/kg
Maximum value of SAR (measured) = 1.94 W/kg

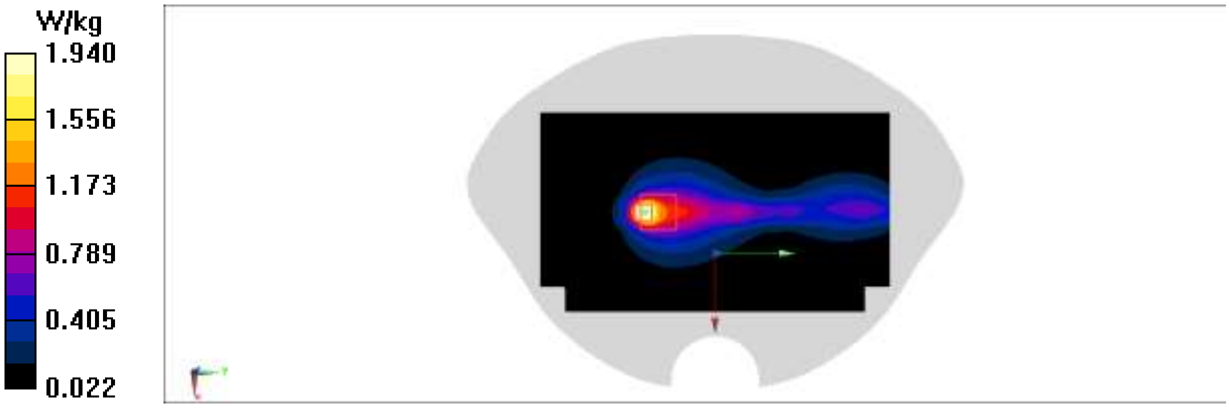


Fig A.7

LTE B7 Rear 0mm
Date: 2/27/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 2535 MHz; σ = 1.939 S/m; εr = 40.538; ρ = 1000 kg/m3
Ambient Temperature: 22.2ºC, Liquid Temperature: 22ºC
Communication System: LTE B7 2535 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(6.97,6.97,6.97)

Area Scan (101x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 2.34 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.157 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 3.05 W/kg
SAR(1 g) = 1.18 W/kg; SAR(10 g) = 0.441 W/kg
Maximum value of SAR (measured) = 2.33 W/kg

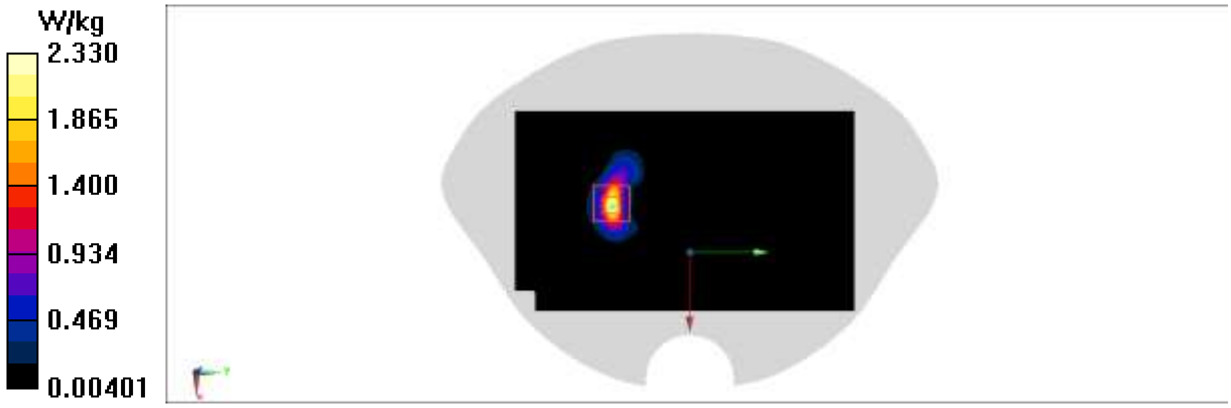


Fig A.8

LTE B12 Rear 0mm
Date: 2/20/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 704 MHz; σ = 0.897 S/m; ε_r = 44.652; ρ = 1000 kg/m^3
Ambient Temperature: 23.1°C, Liquid Temperature: 22.6°C
Communication System: LTE B12 704 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(9.7,9.7,9.7)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.22 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.98 W/kg
SAR(1 g) = 0.825 W/kg; SAR(10 g) = 0.462 W/kg
Maximum value of SAR (measured) = 1.44 W/kg

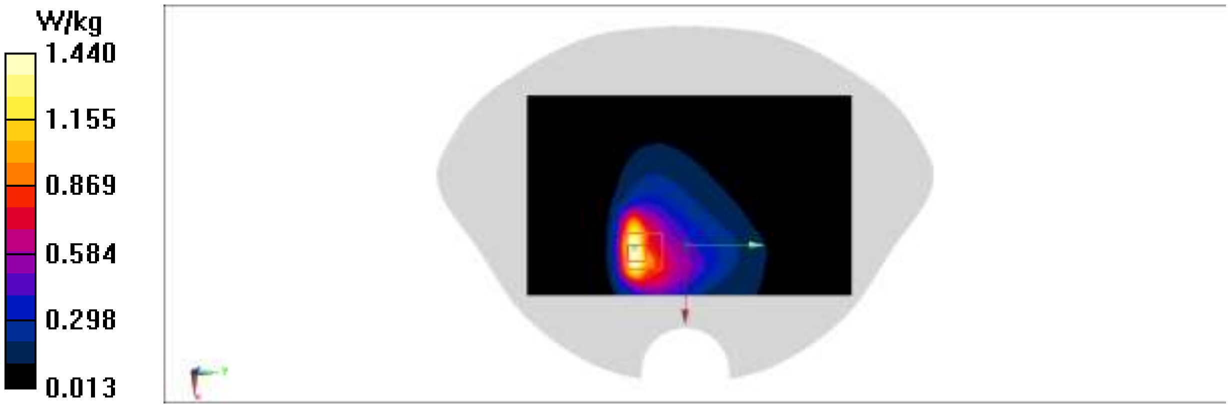


Fig A.9

LTE B13 Rear 0mm
Date: 2/20/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 782 MHz; σ = 0.935 S/m; ε_r = 44.27;ρ = 1000 kg/m^3
Ambient Temperature: 23.1°C, Liquid Temperature: 22.6°C
Communication System: LTE B13 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(9.7,9.7,9.7)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.38 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.59 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.74 W/kg
SAR(1 g) = 0.737 W/kg; SAR(10 g) = 0.408 W/kg
Maximum value of SAR (measured) = 1.26 W/kg

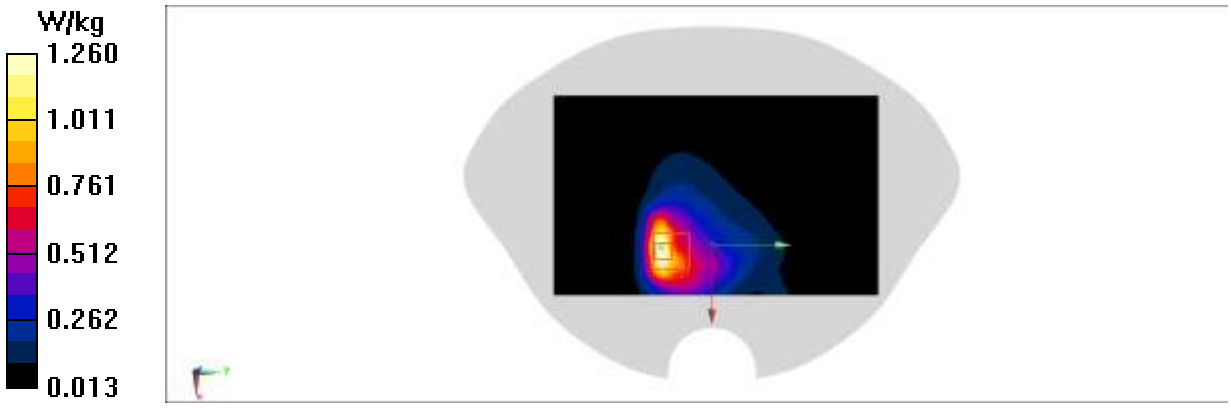


Fig A.10

LTE B41 Left 0mm
Date: 2/27/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 2506 MHz; σ = 1.865 S/m; ε_r = 40.236; ρ = 1000 kg/m^3
Ambient Temperature: 23.1ºC,   Liquid Temperature: 22.6ºC
Communication System: LTE B41 2506 MHz Duty Cycle: 1:1.58
Probe: EX3DV4 – SN7517 ConvF(6.97, 6.97, 6.97)

Area Scan (101x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.70 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.19 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 3.03 W/kg
SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.344 W/kg
Maximum value of SAR (measured) = 2.11 W/kg

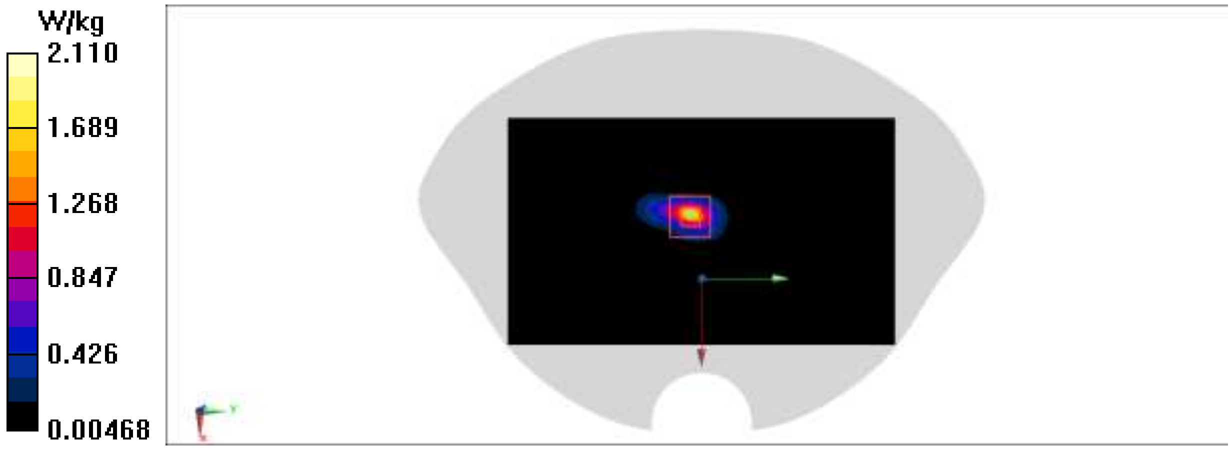


Fig A.11

LTE B66 Rear 16mm
Date: 2/28/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 1720 MHz; σ = 1.383 S/m; ε_r = 41.92;ρ = 1000 kg/m^3
Ambient Temperature: 23.1°C, Liquid Temperature: 22.6°C
Communication System: LTE B66 1720 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(8.1,8.1,8.1)

Area Scan (81x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.61 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.473 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.82 W/kg
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.604 W/kg
Maximum value of SAR (measured) = 1.55 W/kg

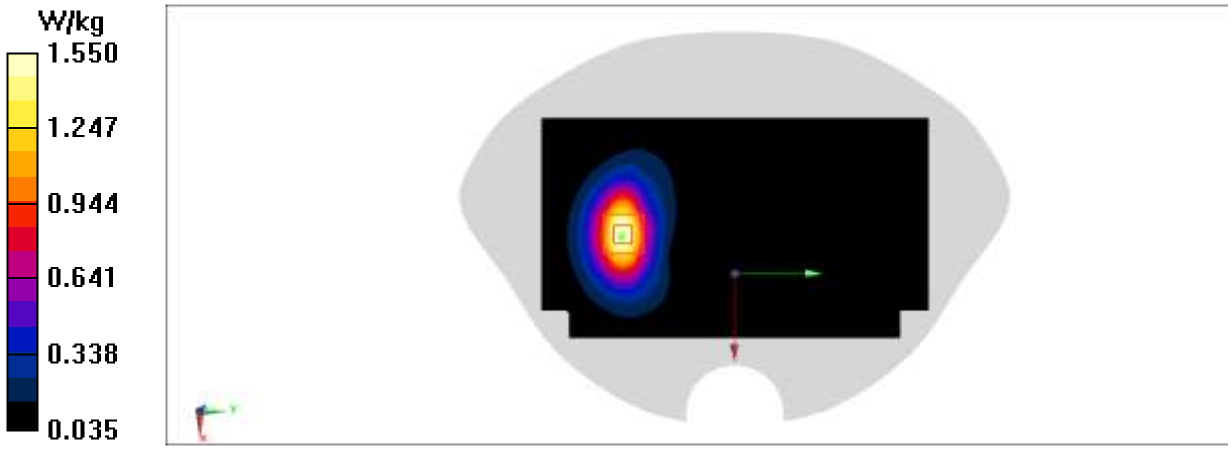


Fig A.12

WLAN2450 Rear 0mm
Date: 2/25/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.81 S/m; ε_r = 39.307; ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: WLAN2450 2437 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(7.16,7.16,7.16)

Area Scan (101x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.77 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.834 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 2.17 W/kg
SAR(1 g) = 0.720 W/kg; SAR(10 g) = 0.292 W/kg
Maximum value of SAR (measured) = 1.29 W/kg

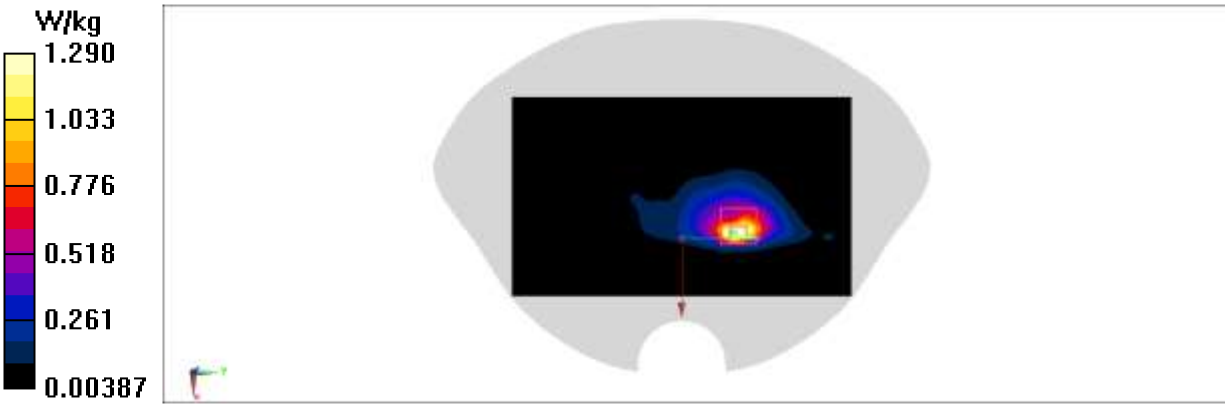


Fig A.13

WLAN5G Rear 0mm
Date: 2/26/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 5320 MHz; σ = 4.904 S/m; ε_r = 34.871; ρ = 1000 kg/m^3
Ambient Temperature: 23.1ºC, Liquid Temperature: 22.6ºC
Communication System: WLAN5G 5320 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(5.3, 5.3, 5.3)

Area Scan (121x211x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.11 W/kg

Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.36 W/kg
SAR(1 g) = 0.556 W/kg; SAR(10 g) = 0.136 W/kg
Maximum value of SAR (measured) = 1.66 W/kg

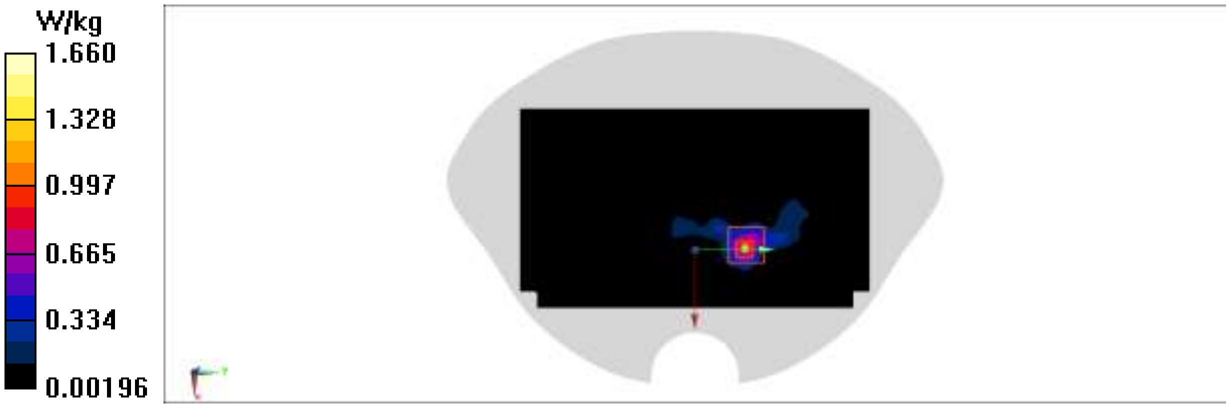


Fig A.14

BT Rear 0mm
Date: 2/25/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used (interpolated): f = 2441 MHz; σ = 1.815 S/m; ε_r = 39.283; ρ = 1000 kg/m^3
Ambient Temperature: 23.1^{o}C, Liquid Temperature: 22.6^{o}C
Communication System: BT 2441 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN7517 ConvF(7.16,7.16,7.16)

Area Scan (101x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.103 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.5100 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.127 W/kg
SAR(1 g) = 0.035 W/kg; SAR(10 g) = 0.012 W/kg
Maximum value of SAR (measured) = 0.0833 W/kg

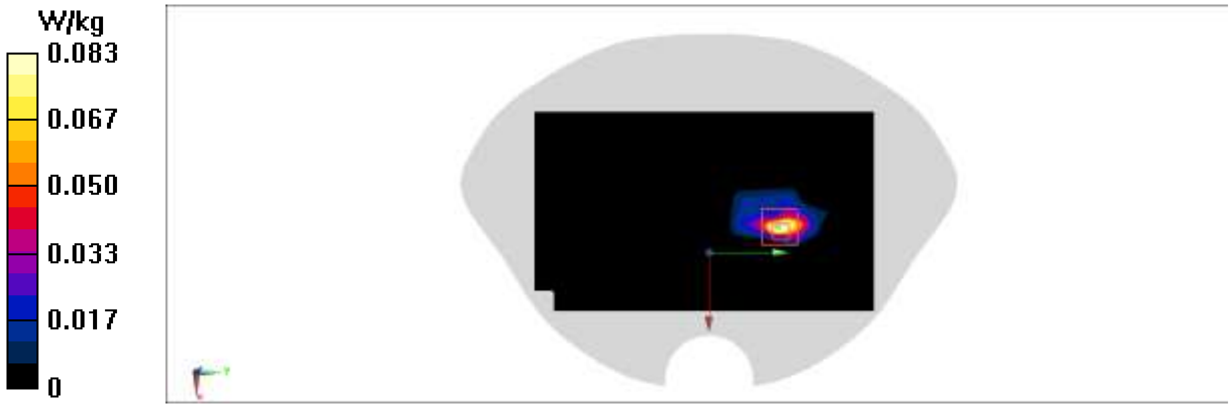
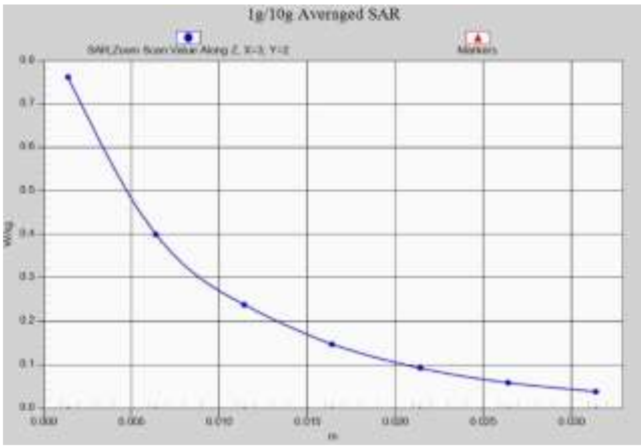
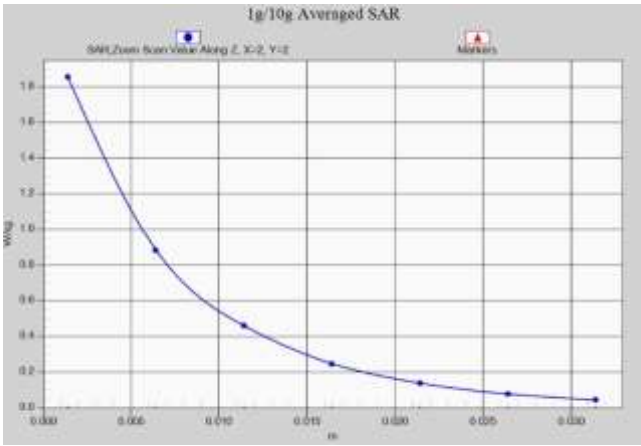


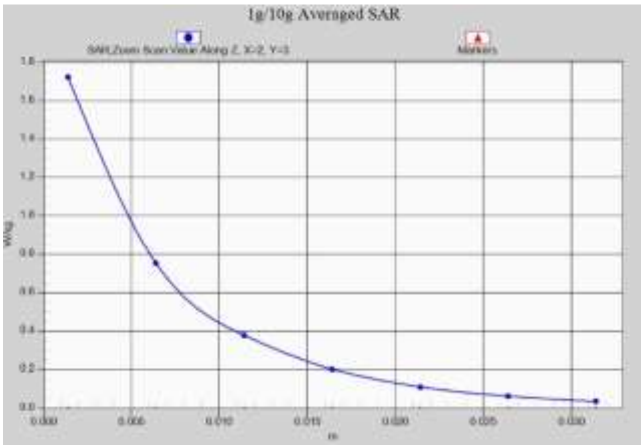
Fig A.15



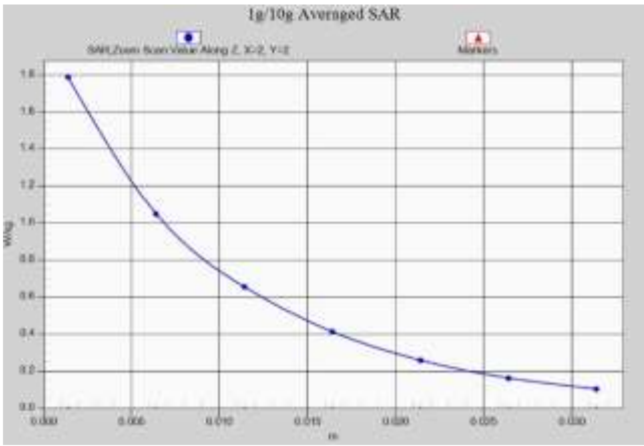
Z-Scan at power reference point (GSM850)



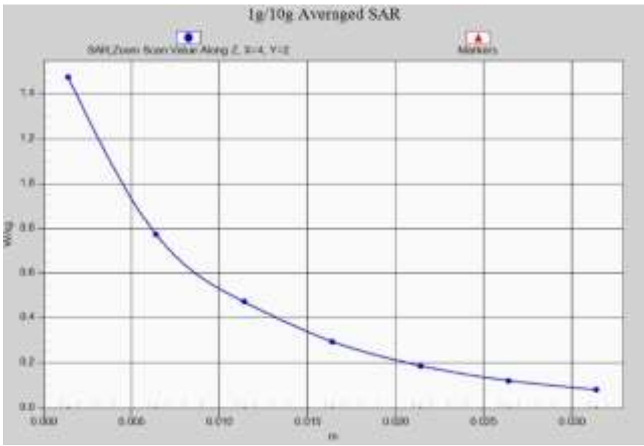
Z-Scan at power reference point (GSM1900)



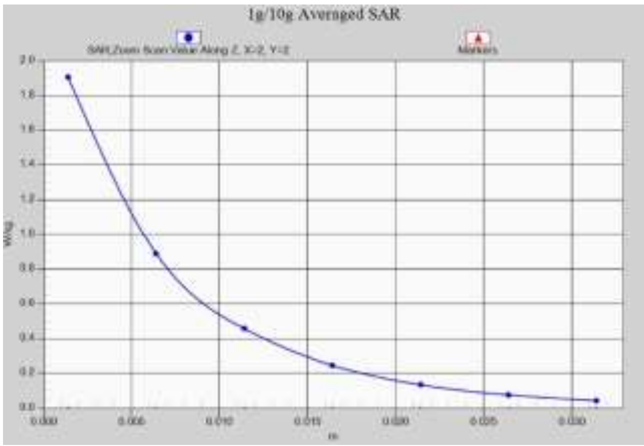
Z-Scan at power reference point (WCDMA1900)



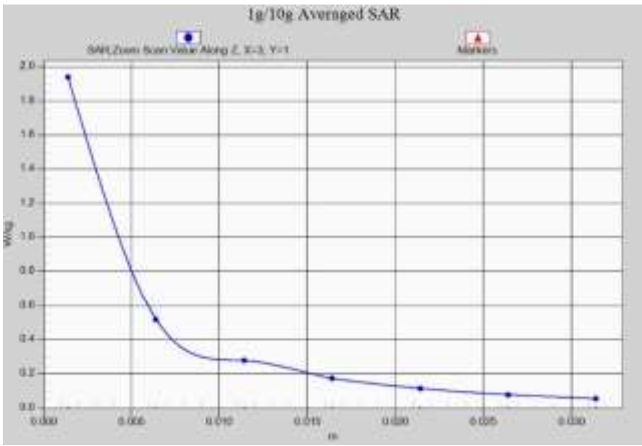
Z-Scan at power reference point (WCDMA1700)



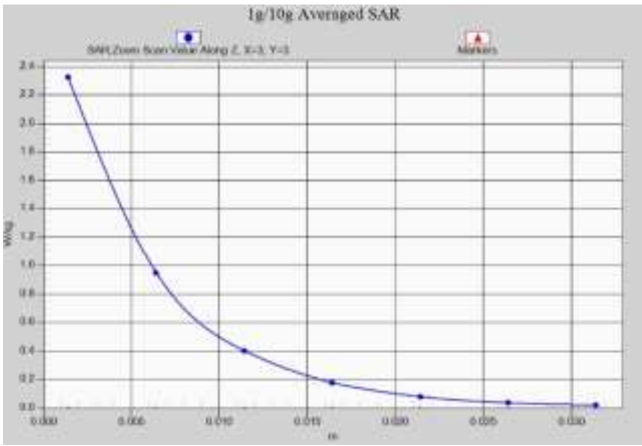
Z-Scan at power reference point (WCDMA850)



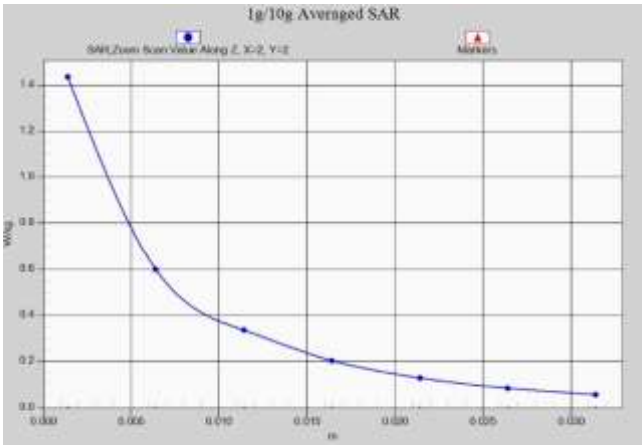
Z-Scan at power reference point (LTEB2)



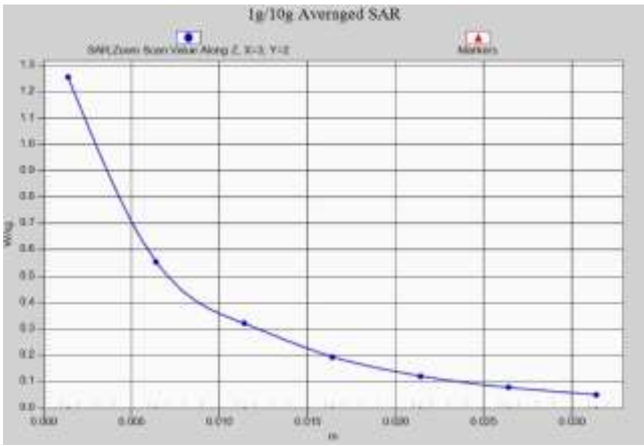
Z-Scan at power reference point (LTEB5)



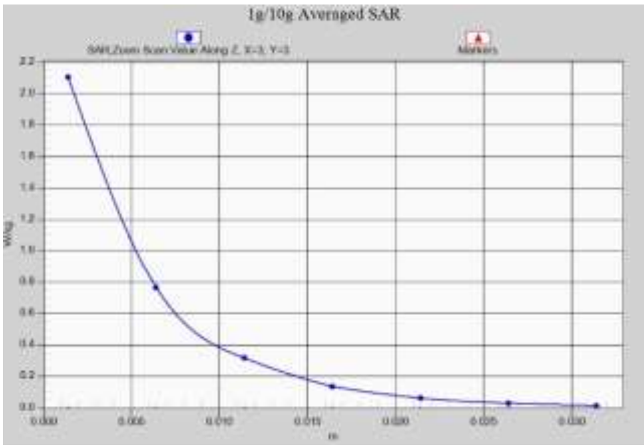
Z-Scan at power reference point (LTEB7)



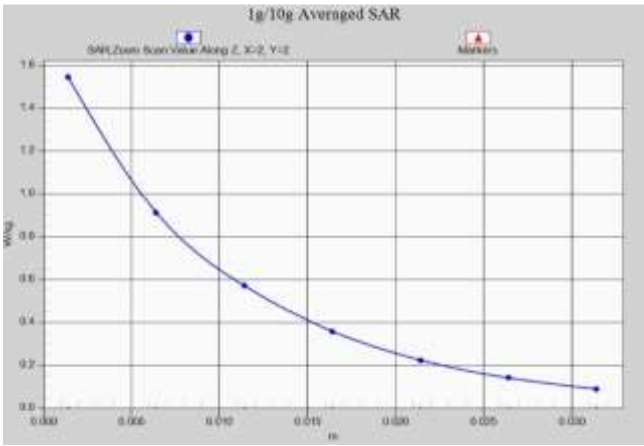
Z-Scan at power reference point (LTEB12)



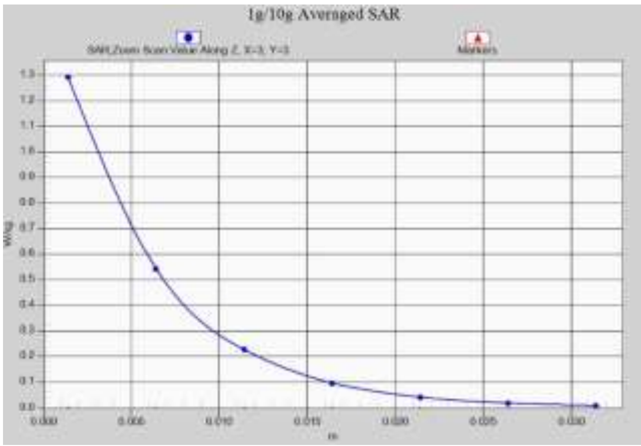
Z-Scan at power reference point (LTEB13)



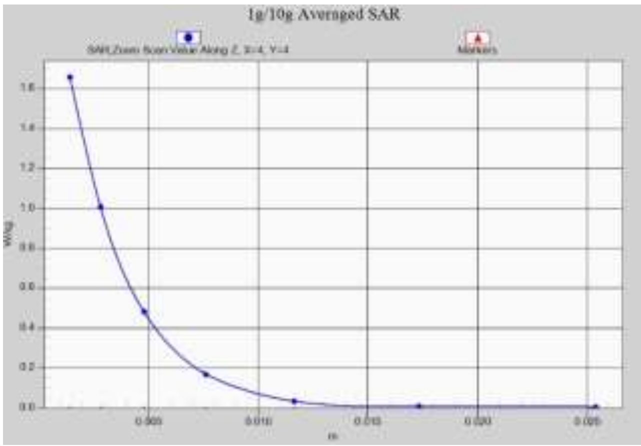
Z-Scan at power reference point (LTEB41)



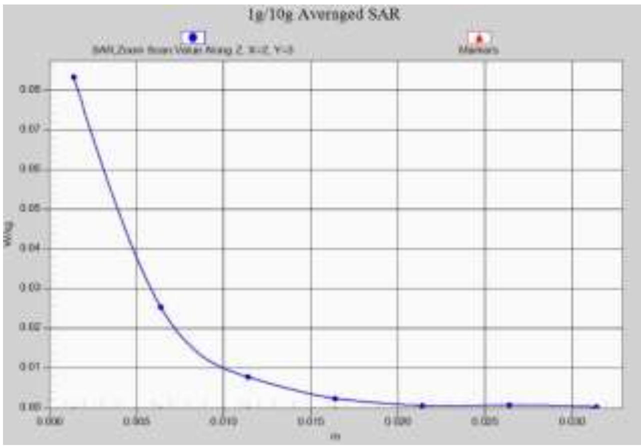
Z-Scan at power reference point (LTEB66)



Z-Scan at power reference point (WIFI2.4G)



Z-Scan at power reference point (WIFI5G)



Z-Scan at power reference point (BT)

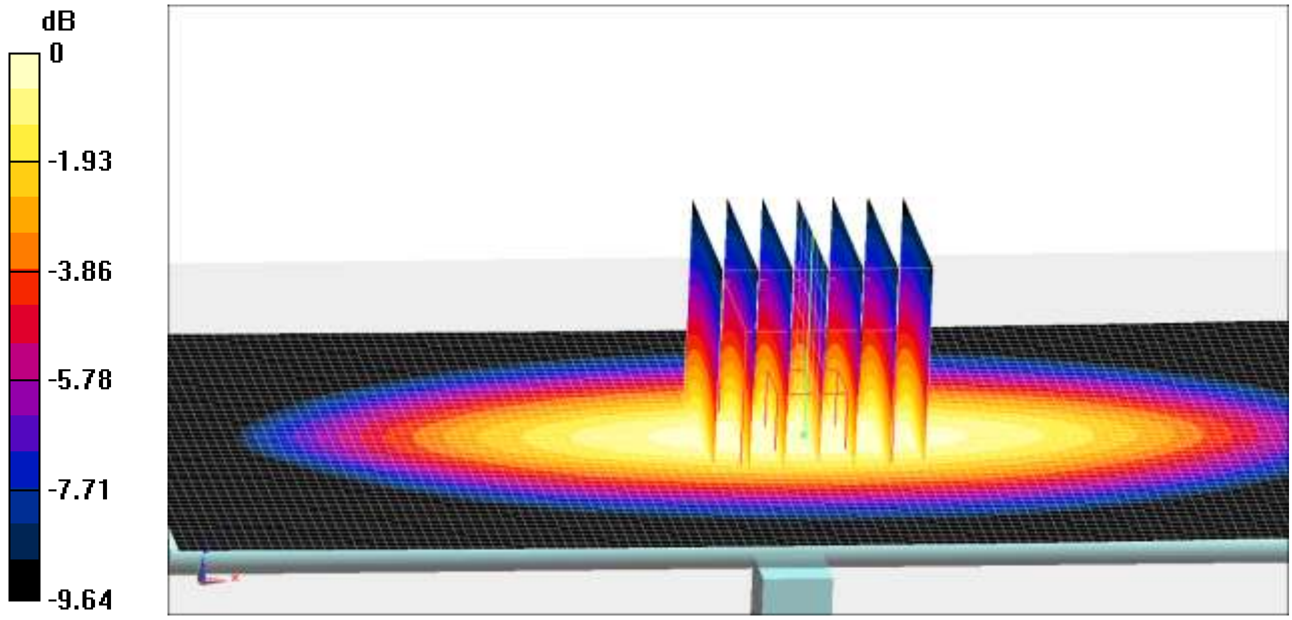
ANNEX B System Verification Results

750MHz

Date: 2/20/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 750 MHz; σ = 0.921 S/m; εr = 44.4; ρ = 1000 kg/m3
Ambient Temperature: 23.1℃ Liquid Temperature: 22.6℃
Communication System: CW Frequency: 750 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(9.7, 9.7, 9.7)

Area Scan (51x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 55.48 V/m; Power Drift = 0.01 dB
Fast SAR: SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.44 W/kg
Maximum value of SAR (interpolated) = 2.68 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.48 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.08 W/kg
SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.42 W/kg
Maximum value of SAR (measured) = 2.65 W/kg



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

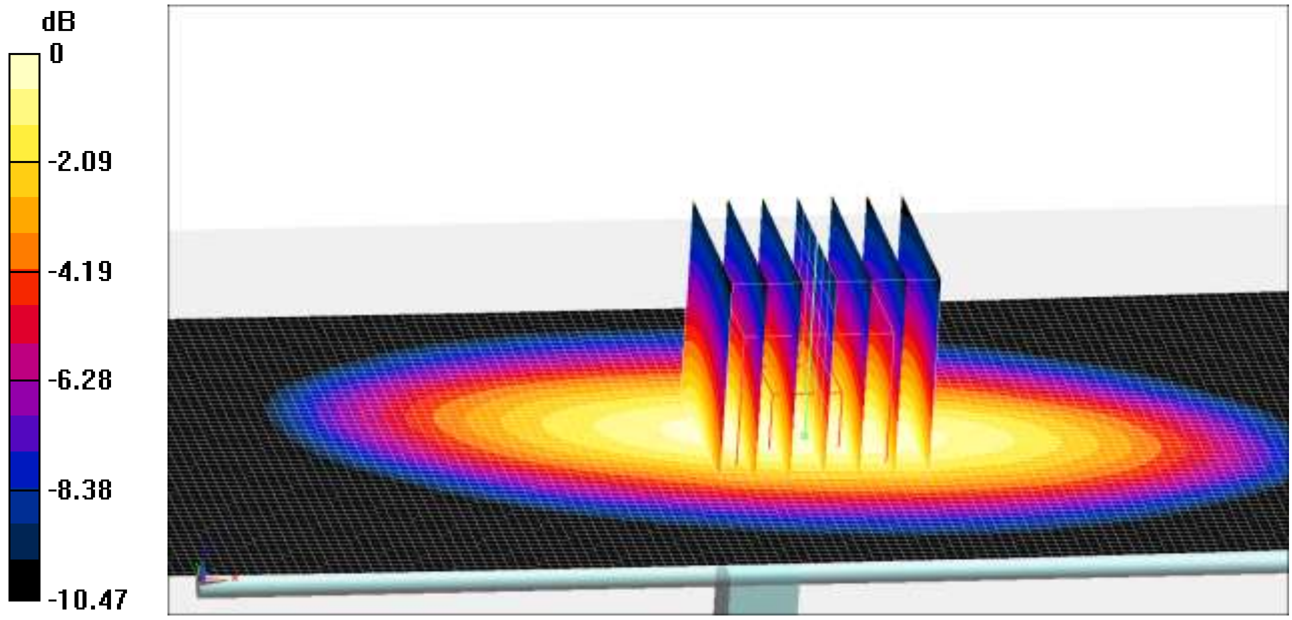
Fig.B.1 validation 750MHz 250mW

835 MHz

Date: 2/21/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 835 MHz; σ = 0.861 S/m; εr = 44.37; ρ = 1000 kg/m3
Ambient Temperature: 23.1℃ Liquid Temperature: 22.6℃
Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(9.3, 9.3, 9.3)

Area Scan (51x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 58.25 V/m; Power Drift = -0.02 dB
Fast SAR: SAR(1 g) = 2.41 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (interpolated) = 3.05 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.25 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.55 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 3.02 W/kg



0 dB = 3.02 W/kg = 4.80 dBW/kg

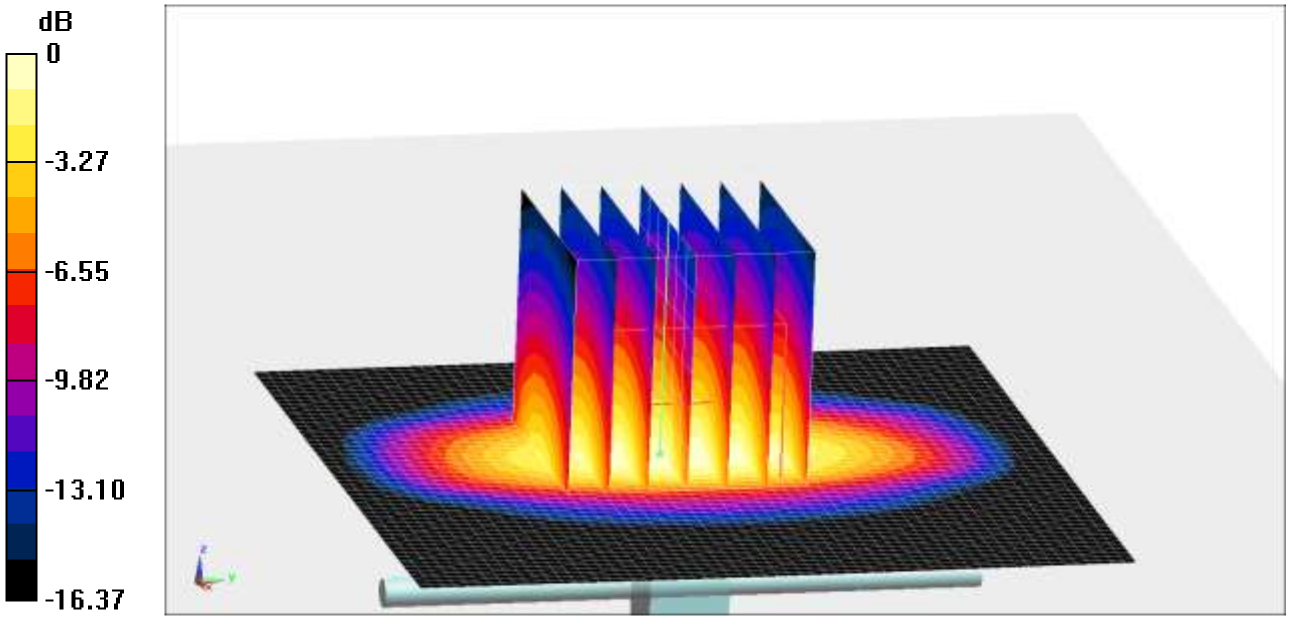
Fig.B.2 validation 835 MHz 250mW

1750 MHz

Date: 2/28/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 1750 MHz; σ = 1.404 S/m; εr = 41.86; ρ = 1000 kg/m3
Ambient Temperature: 23.1℃ Liquid Temperature: 22.6℃
Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(8.1, 8.1, 8.1)

Area Scan (51x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 99.29 V/m; Power Drift = 0.03 dB
Fast SAR: SAR(1 g) = 9.32 W/kg; SAR(10 g) = 5.03 W/kg
Maximum value of SAR (interpolated) = 13.1 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.29 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.23 W/kg; SAR(10 g) = 4.97 W/kg
Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.14 dBW/kg

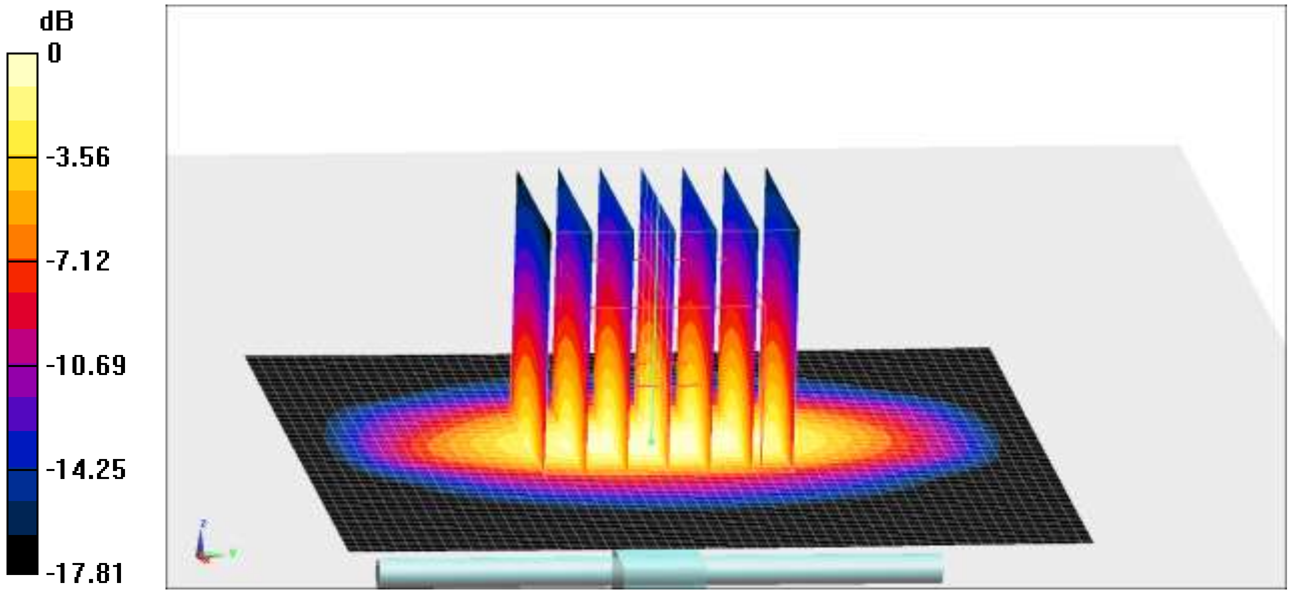
Fig.B.3 validation 1750 MHz 250mW

1900MHz

Date: 2/24/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 1900 MHz; σ = 1.386 S/m; εr = 40.98; ρ = 1000 kg/m3
Ambient Temperature: 23.1°C Liquid Temperature: 22.6°C
Communication System: CW Frequency: 1900 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(7.74, 7.74, 7.74)

Area Scan (51x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 102.6 V/m; Power Drift = 0.03 dB
Fast SAR: SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.33 W/kg
Maximum value of SAR (interpolated) = 14.8 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.6 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.27 W/kg
Maximum value of SAR (measured) = 14.7 W/kg



0 dB = 14.7 W/kg = 11.67 dBW/kg

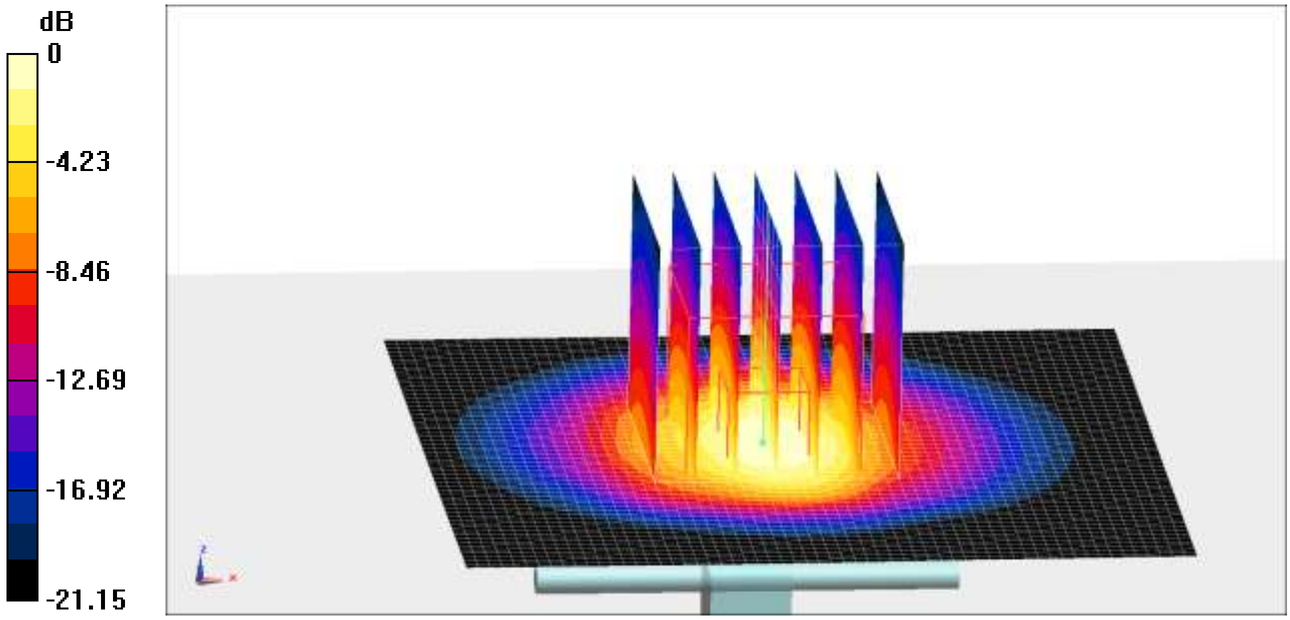
Fig.B.4 validation 1900MHz 250mW

2450MHz

Date: 2/25/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 2450 MHz; σ = 1.821 S/m; εr = 39.27; ρ = 1000 kg/m3
Ambient Temperature: 23.1℃ Liquid Temperature: 22.6℃
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(7.16, 7.16, 7.16)

Area Scan (61x171x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 103.9 V/m; Power Drift = -0.03 dB
Fast SAR: SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.31 W/kg
Maximum value of SAR (interpolated) = 20.4 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.24 W/kg
Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

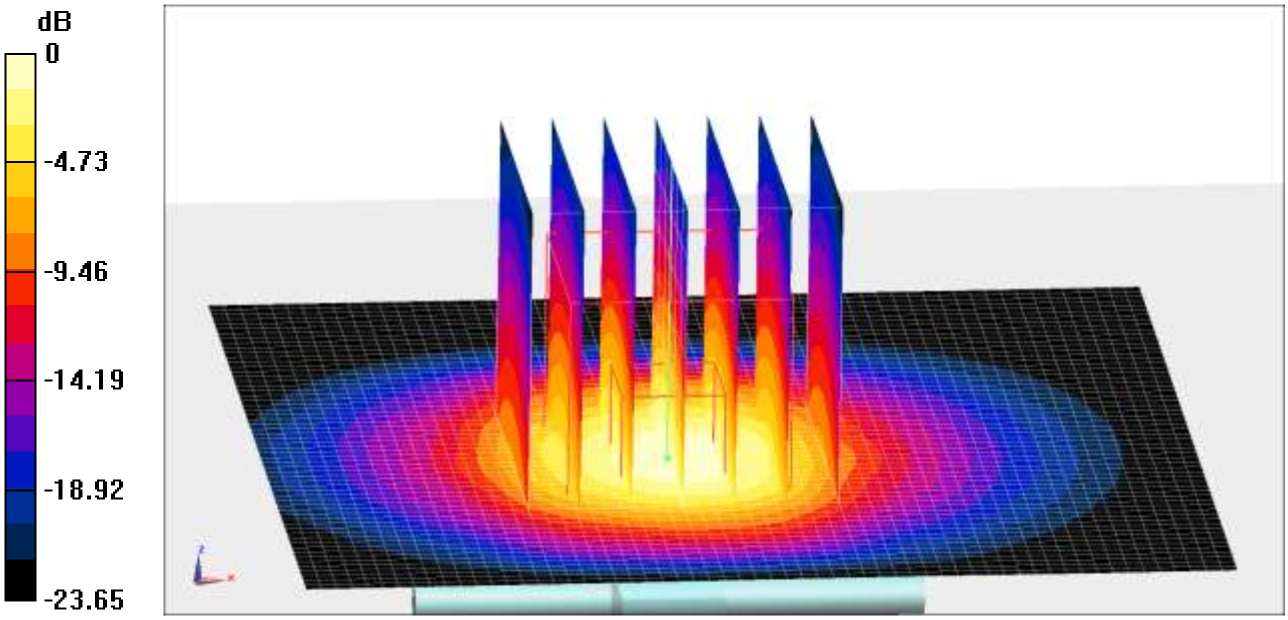
Fig.B.5 validation 2450MHz 250mW

2600MHz

Date: 2/27/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 2600 MHz; σ = 1.951 S/m; εr = 40.17; ρ = 1000 kg/m3
Ambient Temperature:23.1°C Liquid Temperature: 22.6°C
Communication System: CW Frequency: 2600 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(6.97, 6.97, 6.97)

Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 102.3 V/m; Power Drift = 0.05 dB
Fast SAR: SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.34 W/kg
Maximum value of SAR (interpolated) = 21.9 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.3 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.25 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



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

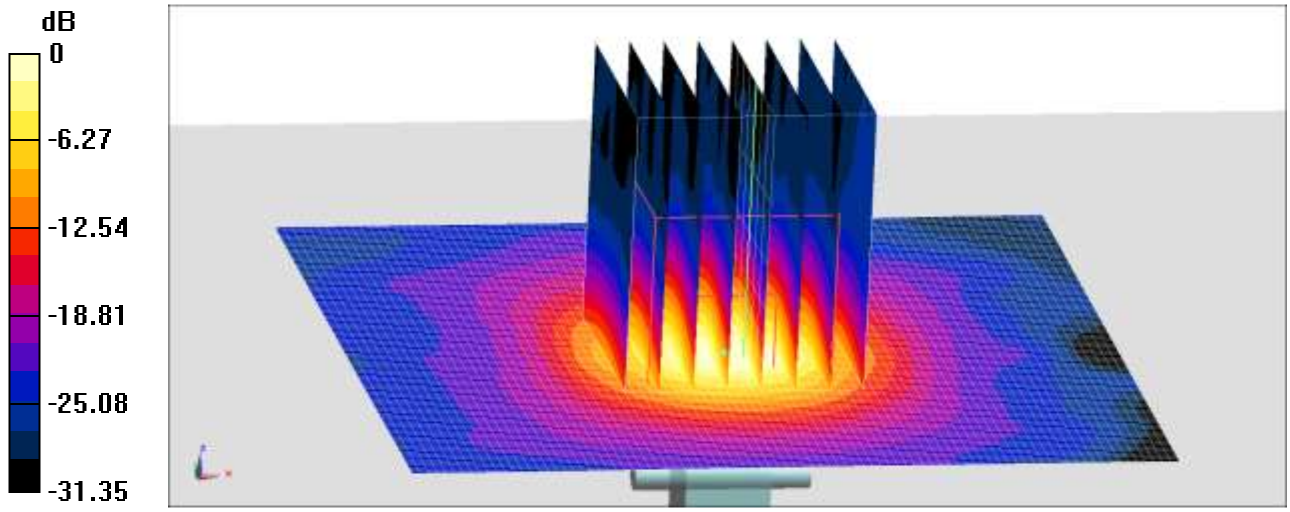
Fig.B.6 validation 2600MHz 250mW

5250 MHz

Date: 2/26/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 5250 MHz; σ = 4.789 S/m; εr = 35.07; ρ = 1000 kg/m3
Ambient Temperature: 23.1°C Liquid Temperature: 22.6°C
Communication System: CW Frequency: 5250 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(5.3, 5.3, 5.3)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.6 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.11 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 18.5 W/kg



0 dB = 18.5 W/kg = 12.67 dBW/kg

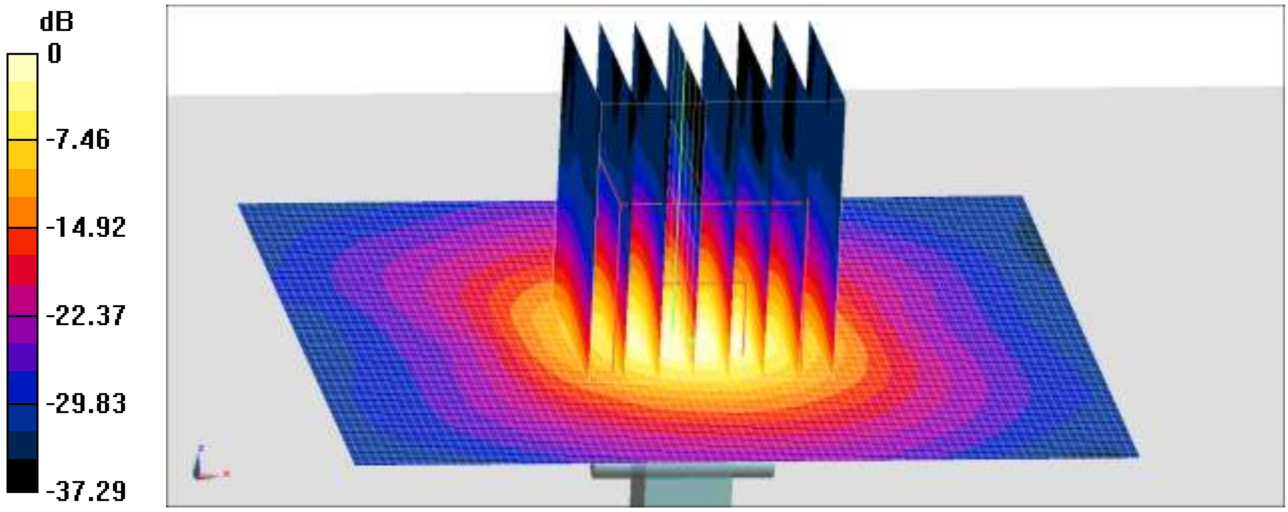
Fig.B.7 validation 5250 MHz 100mW

5750 MHz

Date: 2/26/2022
Electronics: DAE4 Sn1525
Medium: H700-6000
Medium parameters used: f = 5750 MHz; σ = 5.315 S/m; εr = 34.06; ρ = 1000 kg/m3
Ambient Temperature: 23.1°C Liquid Temperature: 22.6°C
Communication System: CW Frequency: 5750 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7517 ConvF(4.75, 4.75, 4.75)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.6 W/kg

Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.61 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 19.7 W/kg



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

Fig.B.8 validation 5750 MHz 100mW

The SAR system verification must be required that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR.

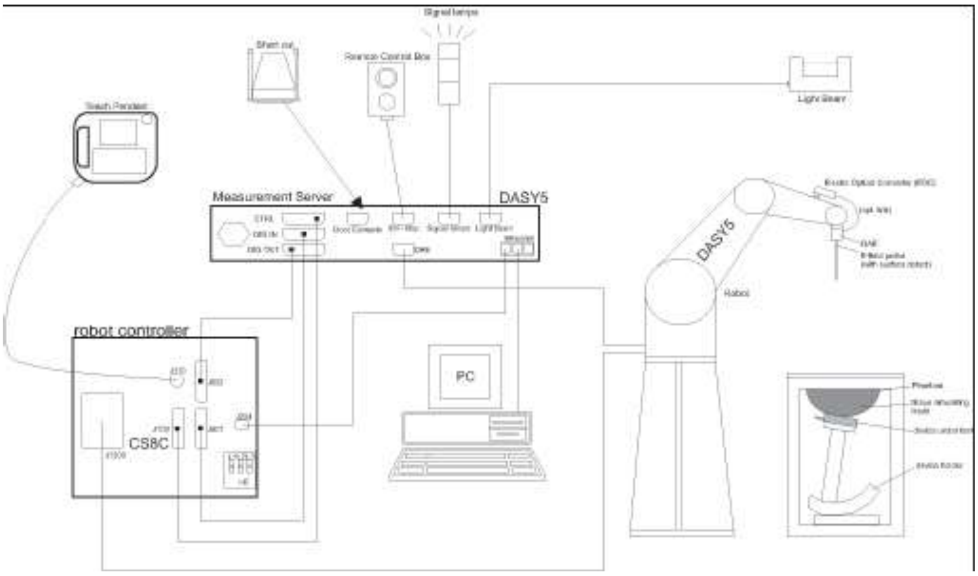
Table B.1 Comparison between area scan and zoom scan for system verification

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2022-02-20	750 MHz	Head	2.15	2.13	0.94
2022-02-21	835 MHz	Head	2.41	2.38	1.26
2022-02-28	1750 MHz	Head	9.32	9.23	0.98
2022-02-24	1900 MHz	Head	10.3	10.2	0.98
2022-02-25	2450 MHz	Head	13.4	13.3	0.75
2022-02-27	2600 MHz	Head	14.2	14.1	0.71

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.

Picture C.2Near-field Probe

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

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.

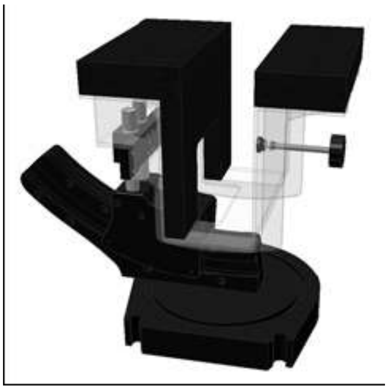
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference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

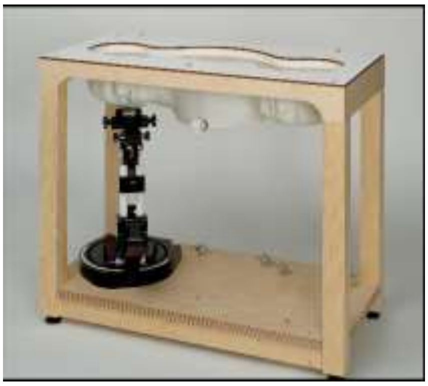


Picture C.9-2: Laptop Extension Kit

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

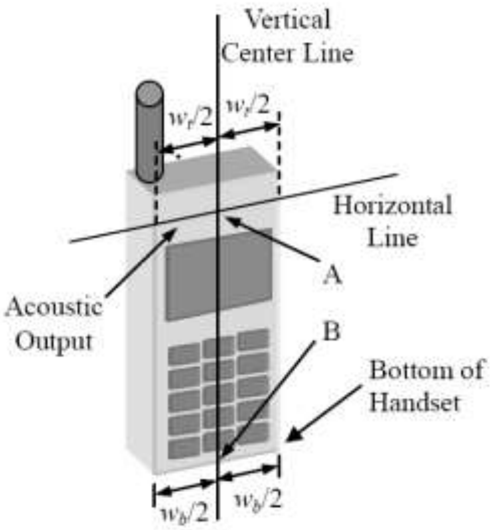


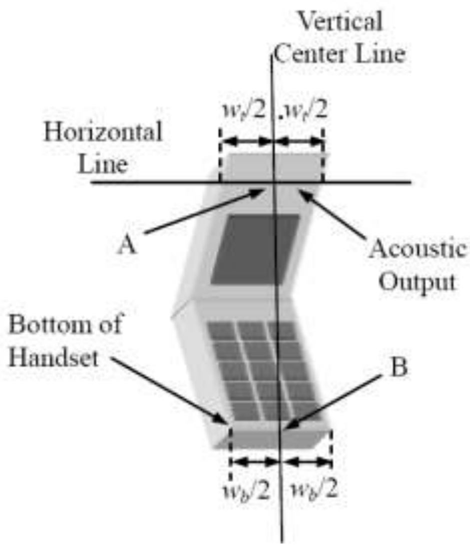
Picture C.10: SAM Twin Phantom

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

D.1 General considerations

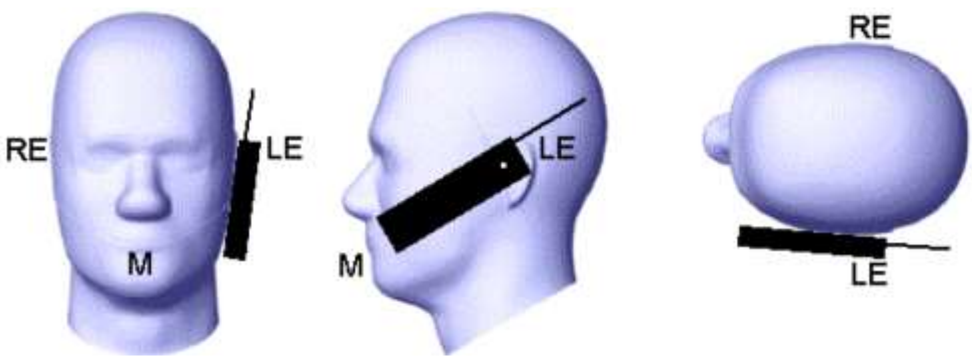
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



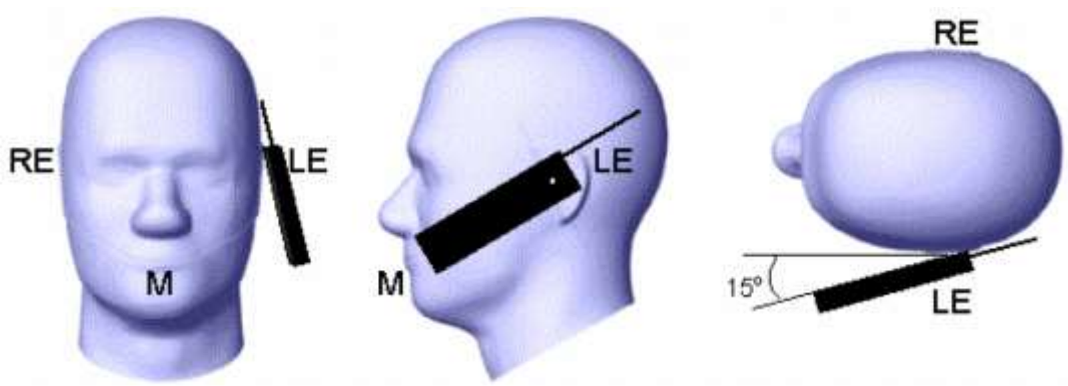


w_t	Width of the handset at the level of the acoustic
w_b	Width of the bottom of the handset
A	Midpoint of the width w_t of the handset at the level of the acoustic output
B	Midpoint of the width w_b of the bottom of the handset

Picture D.1-a Typical “fixed” case handset Picture D.1-b Typical “clam-shell” case handset



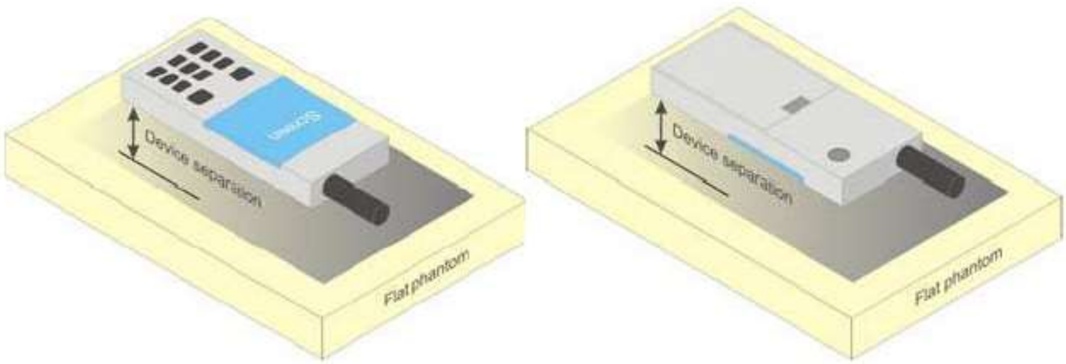
Picture D.2 Cheek position of the wireless device on the left side of SAM



Picture D.3 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.

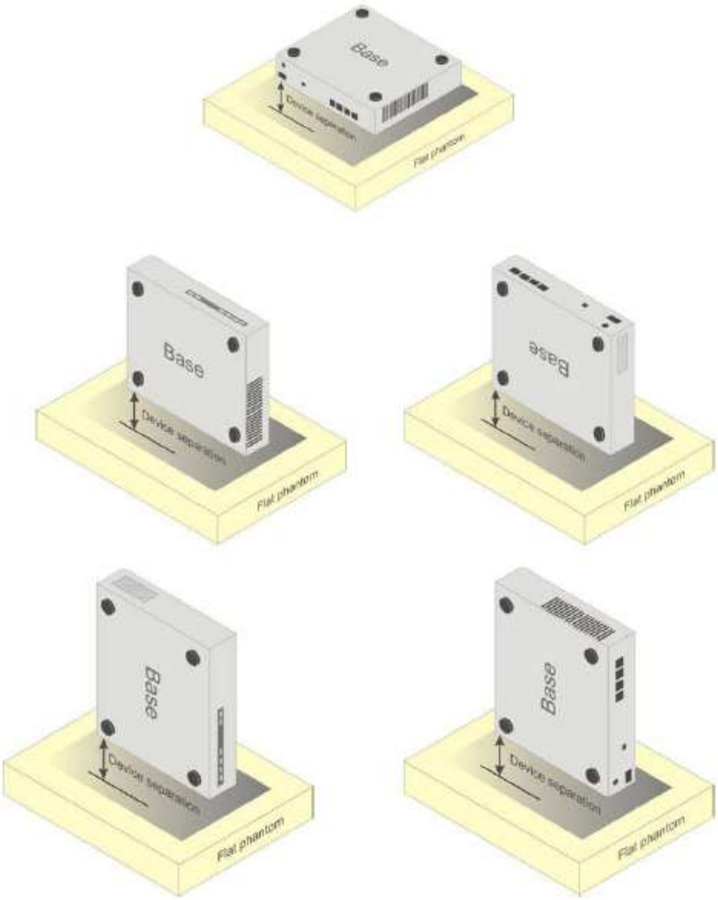


Picture D.4Test positions for body-worn devices

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.5 Test positions for desktop devices

D.4 DUT Setup Photos

Picture D.6

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 7517

Probe SN.	Liquid name	Validation date	Frequency point	Status (OK or Not)
7517	Head 750MHz	February.7,2022	750 MHz	OK
7517	Head 900MHz	February.7,2022	900 MHz	OK
7517	Head 1750MHz	February.7,2022	1750 MHz	OK
7517	Head 1900MHz	February.8,2022	1900 MHz	OK
7517	Head 2300MHz	February.8,2022	2300 MHz	OK
7517	Head 2450MHz	February.8,2022	2450 MHz	OK
7517	Head 2600MHz	February.8,2022	2600 MHz	OK
7517	Head 3300MHz	February.9,2022	3300 MHz	OK
7517	Head 3500MHz	February.9,2022	3500 MHz	OK
7517	Head 3700MHz	February.9,2022	3700 MHz	OK
7517	Head 5250MHz	February.10,2022	5250 MHz	OK
7517	Head 5600MHz	February.10,2022	5600 MHz	OK
7517	Head 5750MHz	February.10,2022	5750 MHz	OK

ANNEX G Probe Calibration Certificate

Probe 7517 Calibration Certificate

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中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client **CTTL** **Certificate No: Z21-60558**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 7517
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	January 19, 2022

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	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101547	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101548	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	27-Jan-21(SPEAG, No.EX3-3617_Jan21)	Jan-22
DAE4	SN 1555	20-Aug-21(SPEAG, No.DAE4-1555_Aug21/2)	Aug-22

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	16-Jun-21(CTTL, No.J21X04467)	Jun-22
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL, No.J22X00406)	Jan -23

	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: January 21, 2022

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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).

Certificate No:Z21-60558 Page 2 of 10

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.49	0.51	0.55	±10.0%
DCP(mV)[B]	101.9	101.5	100.9	

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	168.0	±3.0%
		Y	0.0	0.0	1.0		172.3	
		Z	0.0	0.0	1.0		178.0	

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 and Page 5).
[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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E-mail: cttl@chinattl.com Http://www.chinattl.cn

DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

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	9.70	9.70	9.70	0.15	1.32	±12.1%
900	41.5	0.97	9.30	9.30	9.30	0.21	1.19	±12.1%
1450	40.5	1.20	8.40	8.40	8.40	0.18	1.06	±12.1%
1640	40.3	1.29	8.20	8.20	8.20	0.30	0.90	±12.1%
1750	40.1	1.37	8.10	8.10	8.10	0.25	0.93	±12.1%
1900	40.0	1.40	7.74	7.74	7.74	0.30	0.90	±12.1%
2100	39.8	1.49	7.64	7.64	7.64	0.24	1.09	±12.1%
2300	39.5	1.67	7.44	7.44	7.44	0.64	0.68	±12.1%
2450	39.2	1.80	7.16	7.16	7.16	0.43	0.91	±12.1%
2600	39.0	1.96	6.97	6.97	6.97	0.57	0.77	±12.1%
3300	38.2	2.71	6.85	6.85	6.85	0.45	0.92	±13.3%
3500	37.9	2.91	6.60	6.60	6.60	0.40	1.03	±13.3%
3700	37.7	3.12	6.34	6.34	6.34	0.41	1.03	±13.3%
3900	37.5	3.32	6.25	6.25	6.25	0.35	1.35	±13.3%
4100	37.2	3.53	6.34	6.34	6.34	0.40	1.15	±13.3%
4200	37.1	3.63	6.26	6.26	6.26	0.35	1.35	±13.3%
4400	36.9	3.84	6.15	6.15	6.15	0.35	1.35	±13.3%
4600	36.7	4.04	6.05	6.05	6.05	0.50	1.13	±13.3%
4800	36.4	4.25	6.01	6.01	6.01	0.50	1.13	±13.3%
4950	36.3	4.40	5.74	5.74	5.74	0.45	1.25	±13.3%
5250	35.9	4.71	5.30	5.30	5.30	0.50	1.25	±13.3%
5600	35.5	5.07	4.70	4.70	4.70	0.55	1.20	±13.3%
5750	35.4	5.22	4.75	4.75	4.75	0.55	1.20	±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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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	55.5	0.96	9.65	9.65	9.65	0.40	0.85	±12.1%
900	55.0	1.05	9.20	9.20	9.20	0.24	1.18	±12.1%
1450	54.0	1.30	8.20	8.20	8.20	0.14	1.34	±12.1%
1640	53.8	1.40	8.05	8.05	8.05	0.25	1.08	±12.1%
1750	53.4	1.49	7.85	7.85	7.85	0.32	0.98	±12.1%
1900	53.3	1.52	7.58	7.58	7.58	0.24	1.13	±12.1%
2100	53.2	1.62	7.47	7.47	7.47	0.25	1.19	±12.1%
2300	52.9	1.81	7.35	7.35	7.35	0.44	0.93	±12.1%
2450	52.7	1.95	7.21	7.21	7.21	0.50	0.84	±12.1%
2600	52.5	2.16	7.02	7.02	7.02	0.68	0.70	±12.1%
3300	51.6	3.08	6.25	6.25	6.25	0.43	1.11	±13.3%
3500	51.3	3.31	6.06	6.06	6.06	0.40	1.25	±13.3%
3700	51.0	3.55	5.99	5.99	5.99	0.40	1.25	±13.3%
3900	51.2	3.78	5.95	5.95	5.95	0.40	1.30	±13.3%
4100	50.5	4.01	5.90	5.90	5.90	0.40	1.30	±13.3%
4200	50.4	4.13	5.80	5.80	5.80	0.45	1.30	±13.3%
4400	50.1	4.37	5.70	5.70	5.70	0.45	1.30	±13.3%
4600	49.8	4.60	5.58	5.58	5.58	0.50	1.25	±13.3%
4800	49.6	4.83	5.41	5.41	5.41	0.50	1.45	±13.3%
4950	49.4	5.01	5.12	5.12	5.12	0.50	1.55	±13.3%
5250	48.9	5.36	4.70	4.70	4.70	0.50	1.55	±13.3%
5600	48.5	5.77	4.10	4.10	4.10	0.55	1.50	±13.3%
5750	48.3	5.94	4.15	4.15	4.15	0.50	1.60	±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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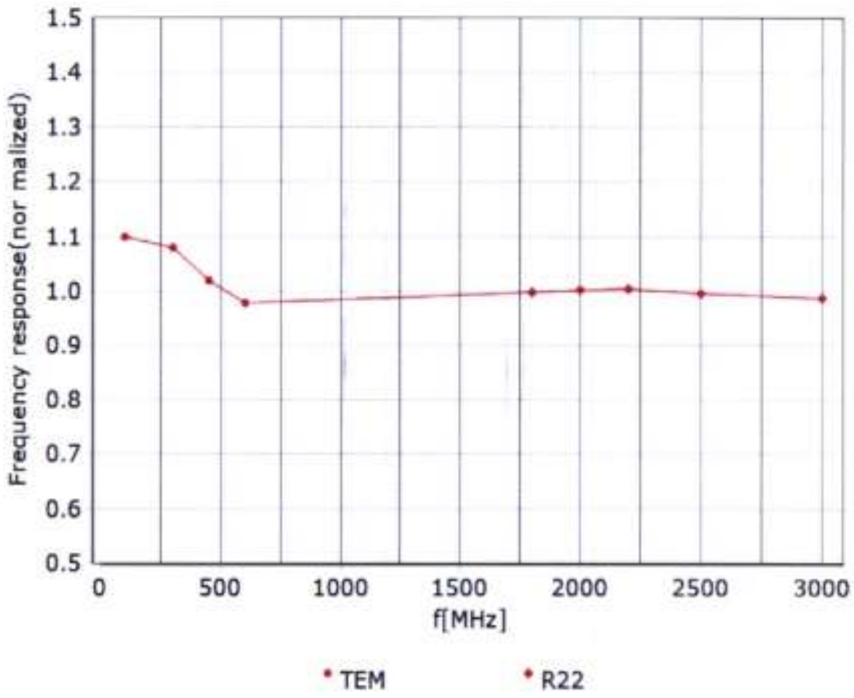
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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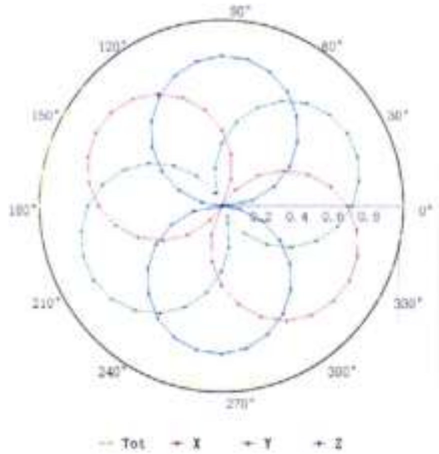
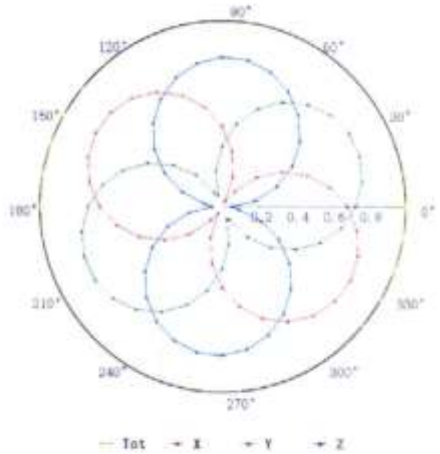
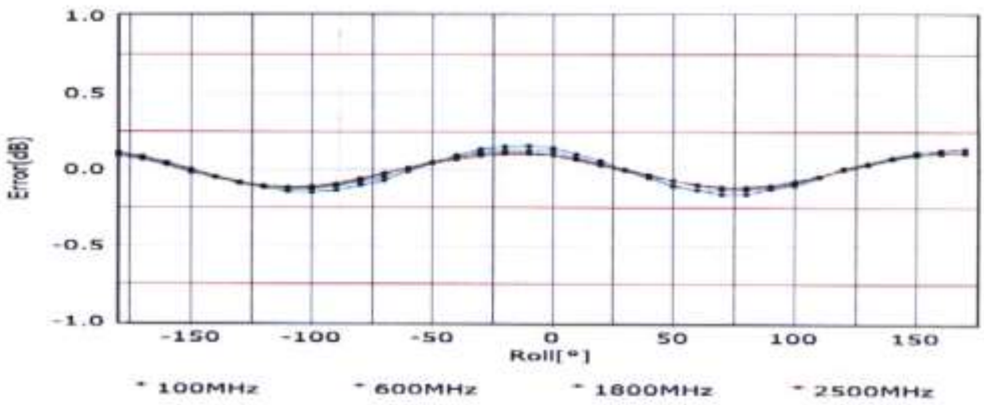
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

Certificate No:Z21-60558 Page 7 of 10

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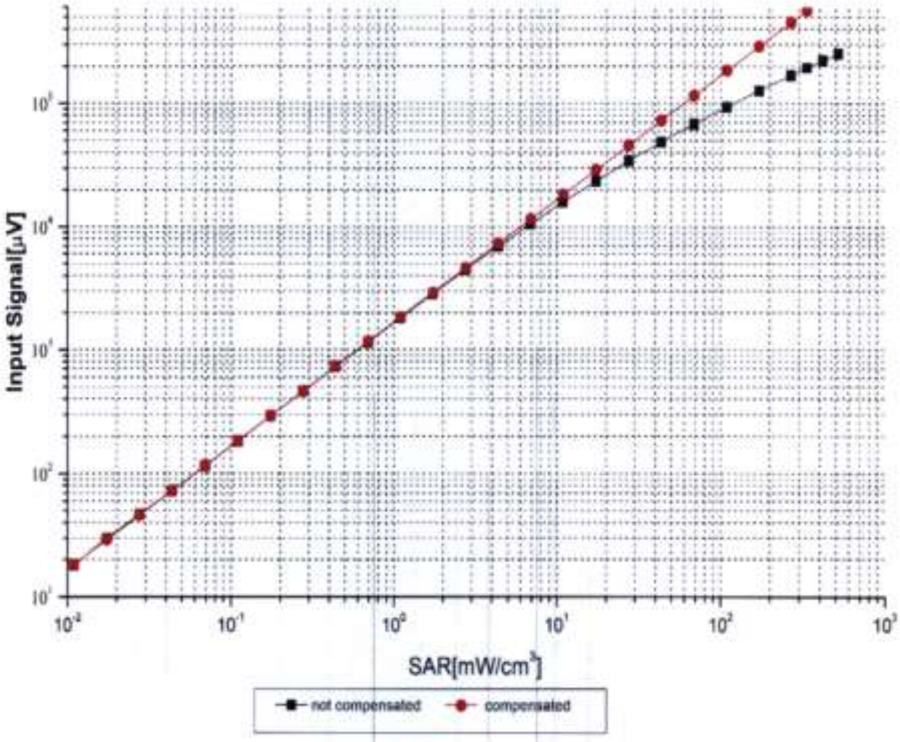
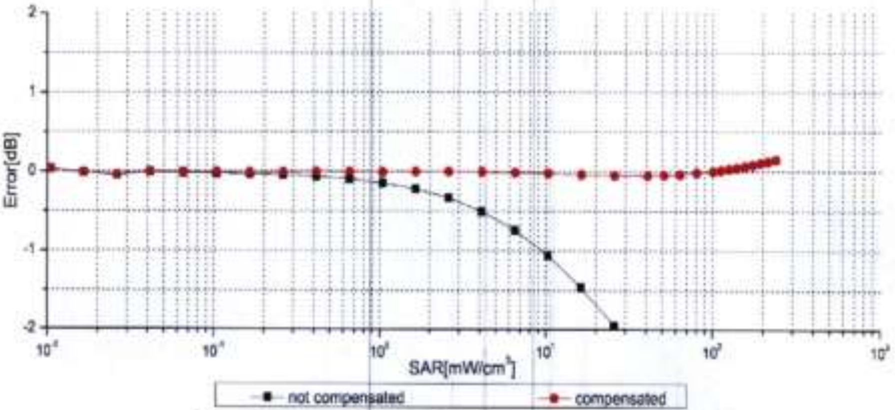
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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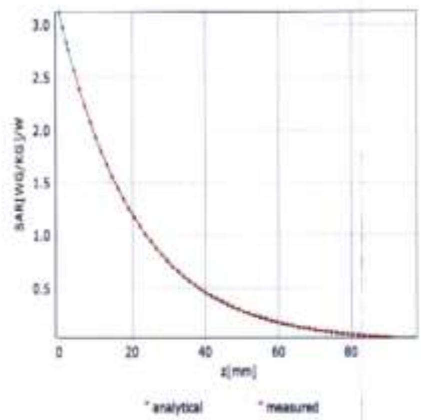
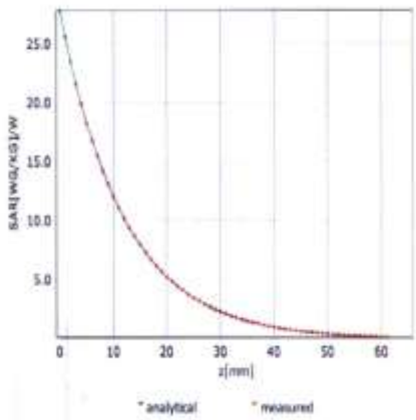
Conversion Factor Assessment

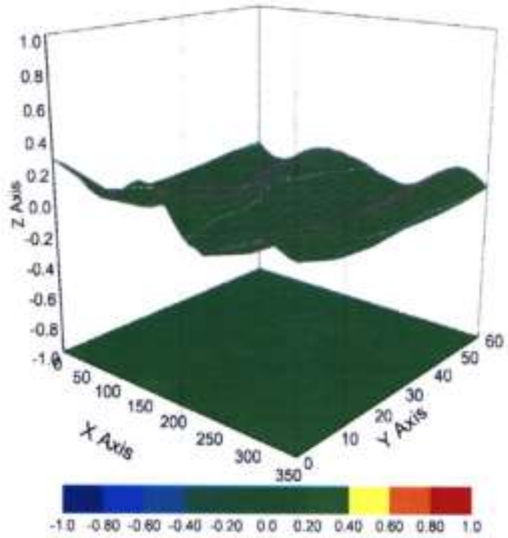
f=750 MHz,WGLS R9(H_convF)



f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	15.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

ANNEX H Dipole Calibration Certificate

750 MHz Dipole Calibration Certificate

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Servizio svizzero di taratura
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Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **D750V3-1017_Jul21**

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1017
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 12, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 15, 2021

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

Certificate No: D750V3-1017_Jul21 Page 1 of 6

Calibration Laboratory of
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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.4 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.68 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.65 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.8 Ω - 0.2 jΩ
Return Loss	- 28.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.036 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 12.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

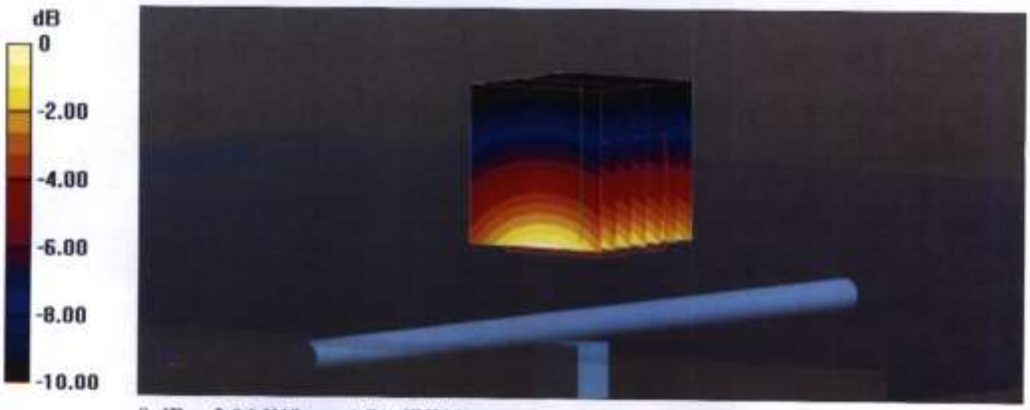
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1017

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 42.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

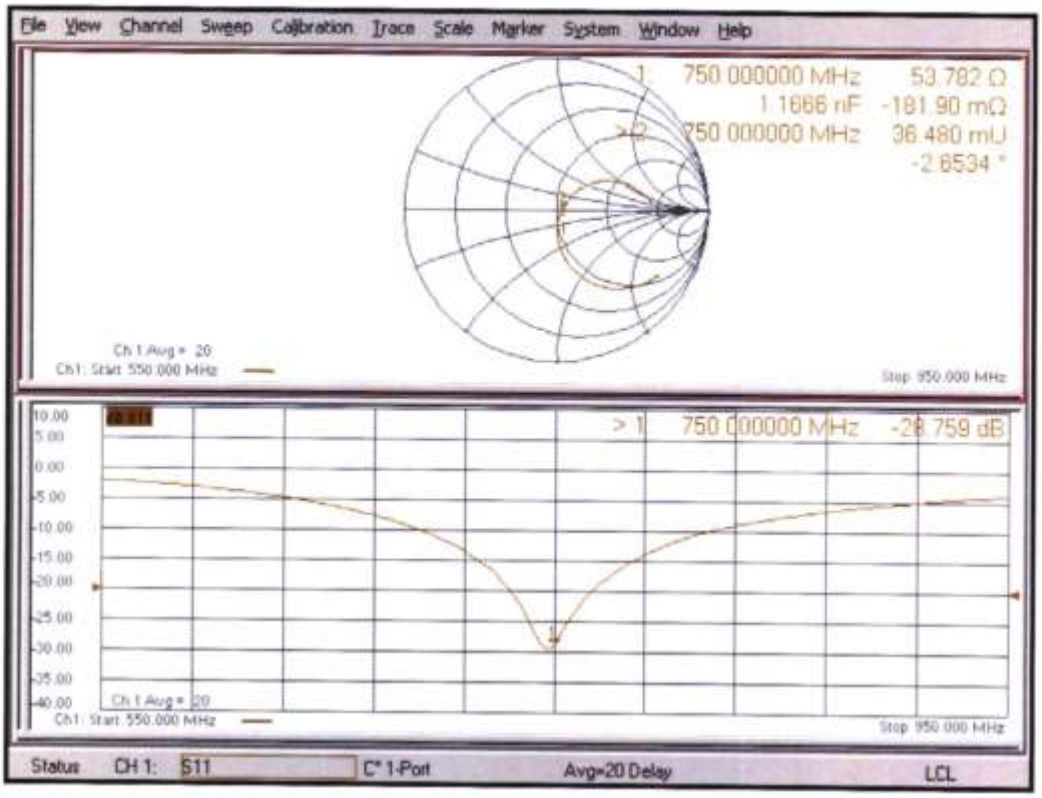
- Probe: EX3DV4 - SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.01 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.39 W/kg
SAR(1 g) = 2.20 W/kg; SAR(10 g) = 1.43 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 64.8%
Maximum value of SAR (measured) = 2.96 W/kg



0 dB = 2.96 W/kg = 4.71 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1017_Jul21 Page 6 of 6

835 MHz Dipole Calibration Certificate

Calibration Laboratory of
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S Swiss Calibration Service

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Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **D835V2-4d069_Jul21**

CALIBRATION CERTIFICATE

Object	D835V2 - SN:4d069
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 12, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: July 15, 2021

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Certificate No: D835V2-4d069_Jul21 Page 1 of 6

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.2 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.63 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.24 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω - 2.3 jΩ
Return Loss	- 31.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 12.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

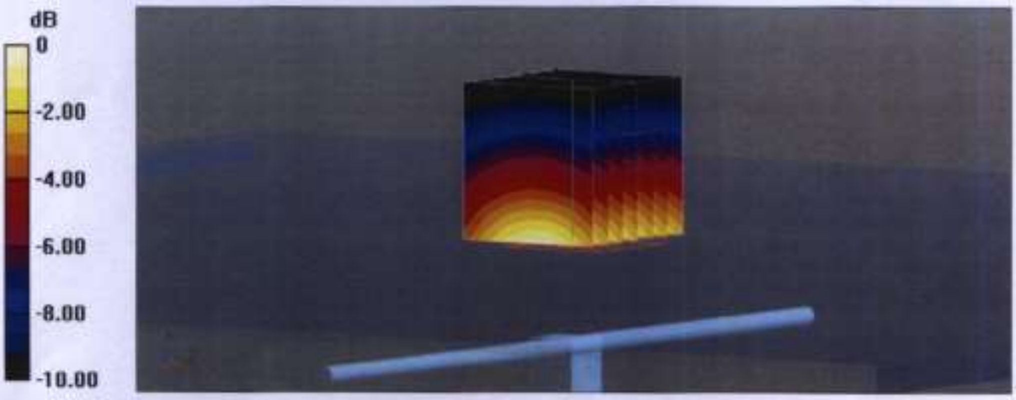
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 42.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

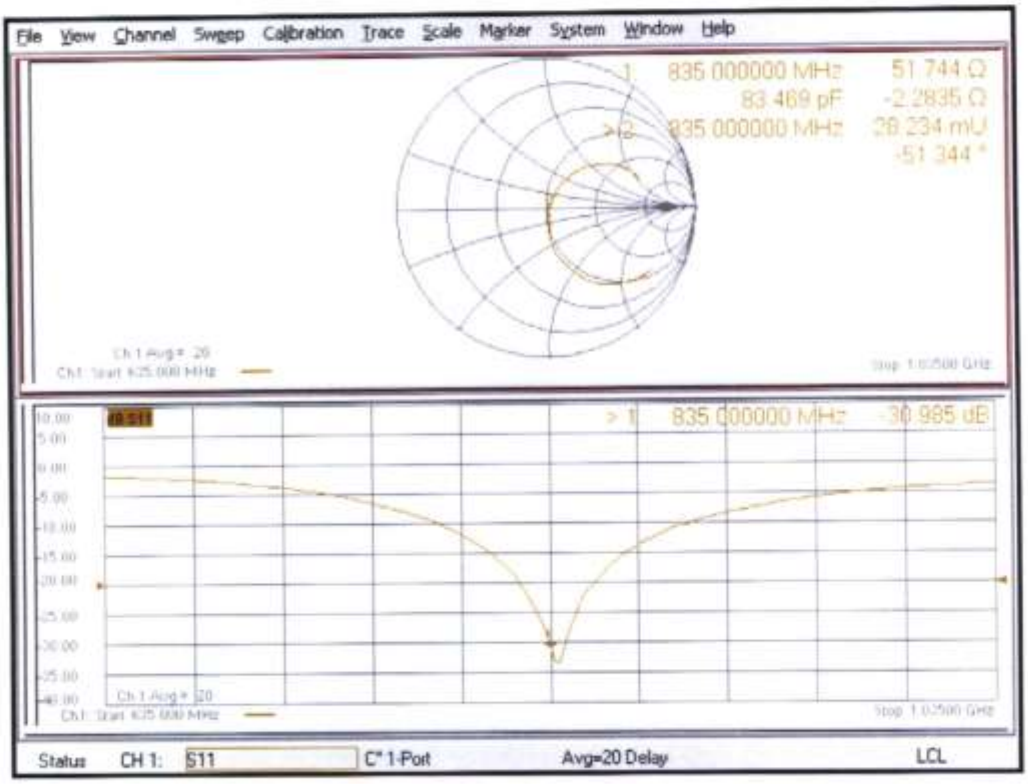
- Probe: EX3DV4 - SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.94 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.76 W/kg
SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.60 W/kg
Smallest distance from peaks to all points 3 dB below = 16.3 mm
Ratio of SAR at M2 to SAR at M1 = 66.1%
Maximum value of SAR (measured) = 3.29 W/kg



0 dB = 3.29 W/kg = 5.18 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d069_Jul21 Page 6 of 6

1750 MHz Dipole Calibration Certificate

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Accreditation No.: SCS 0108

Client **CTTL (Auden)**

Certificate No: D1750V2-1003_Jul21

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1003
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 12, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 15, 2021

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.4 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω + 0.3 jΩ
Return Loss	- 47.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.215 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 12.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

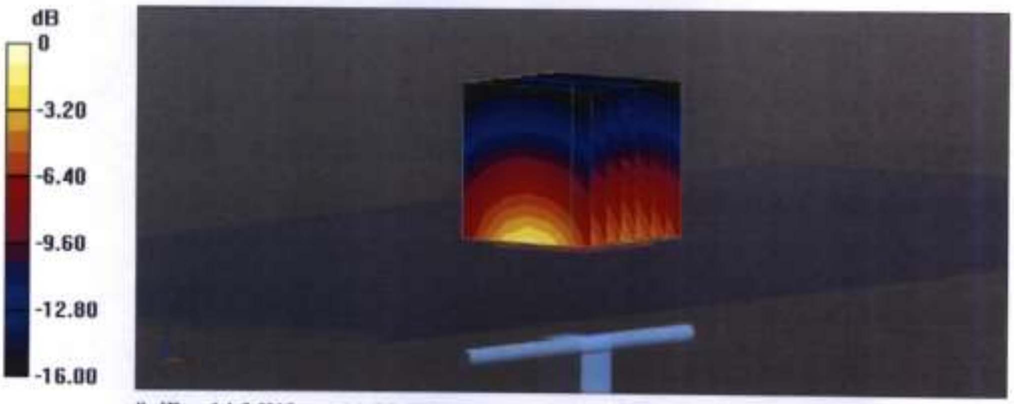
DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1003

Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.36 S/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.67, 8.67, 8.67) @ 1750 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

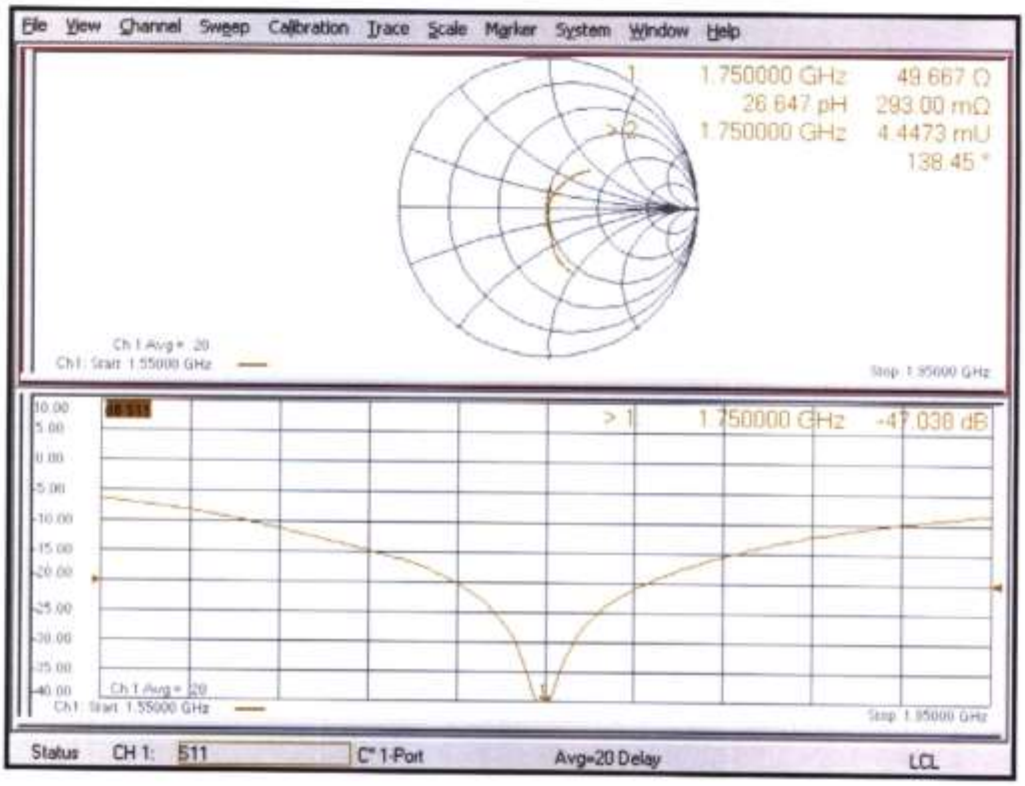
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 106.5 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.17 W/kg; SAR(10 g) = 4.82 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 54%
Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg = 11.55 dBW/kg

Certificate No: D1750V2-1003_Jul21 Page 5 of 6

Impedance Measurement Plot for Head TSL



1900 MHz Dipole Calibration Certificate

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Accreditation No.: SCS 0108

Client **CTTL (Auden)**

Certificate No: D1900V2-5d101_Jul21

CALIBRATION CERTIFICATE

Object: D1900V2 - SN:5d101

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: July 15, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: July 19, 2021

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Certificate No: D1900V2-5d101_Jul21 Page 1 of 6

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.9 Ω + 4.8 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 15.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

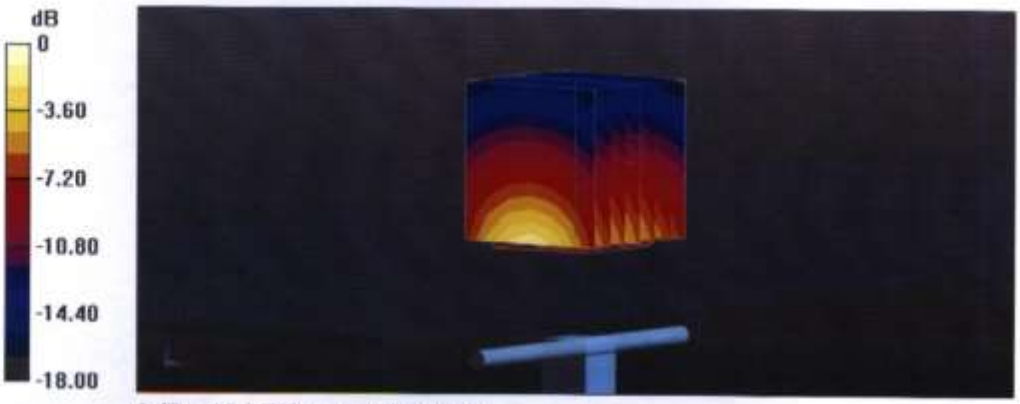
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d101

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.4 S/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

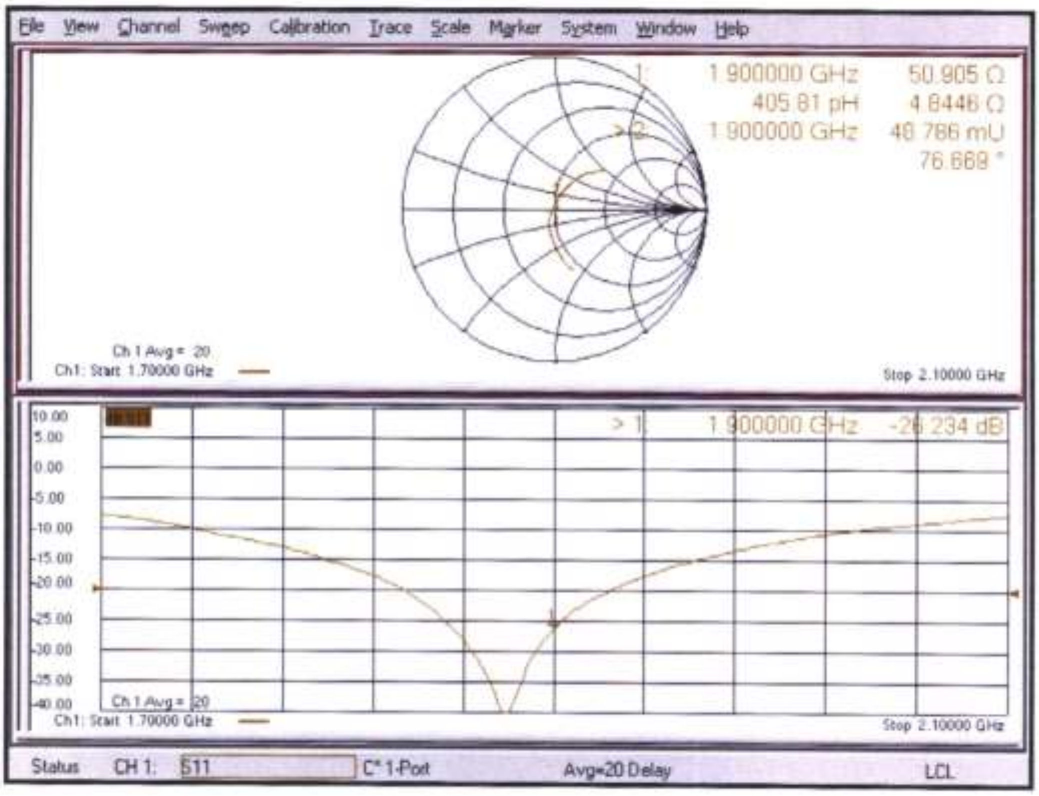
- Probe: EX3DV4 - SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 110.1 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 18.4 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.22 W/kg
Smallest distance from peaks to all points 3 dB below = 9.8 mm
Ratio of SAR at M2 to SAR at M1 = 54.9%
Maximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg = 11.90 dBW/kg

Impedance Measurement Plot for Head TSL



2450 MHz Dipole Calibration Certificate

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Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **D2450V2-853_Jul21**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:853
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 26, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 26, 2021

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Certificate No: D2450V2-853_Jul21 Page 1 of 6

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	1.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.6 Ω + 3.8 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.164 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 26.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

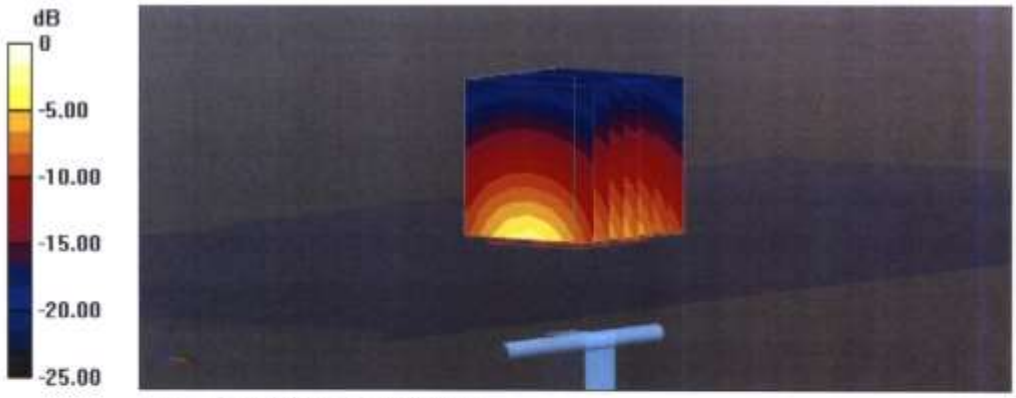
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 853

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

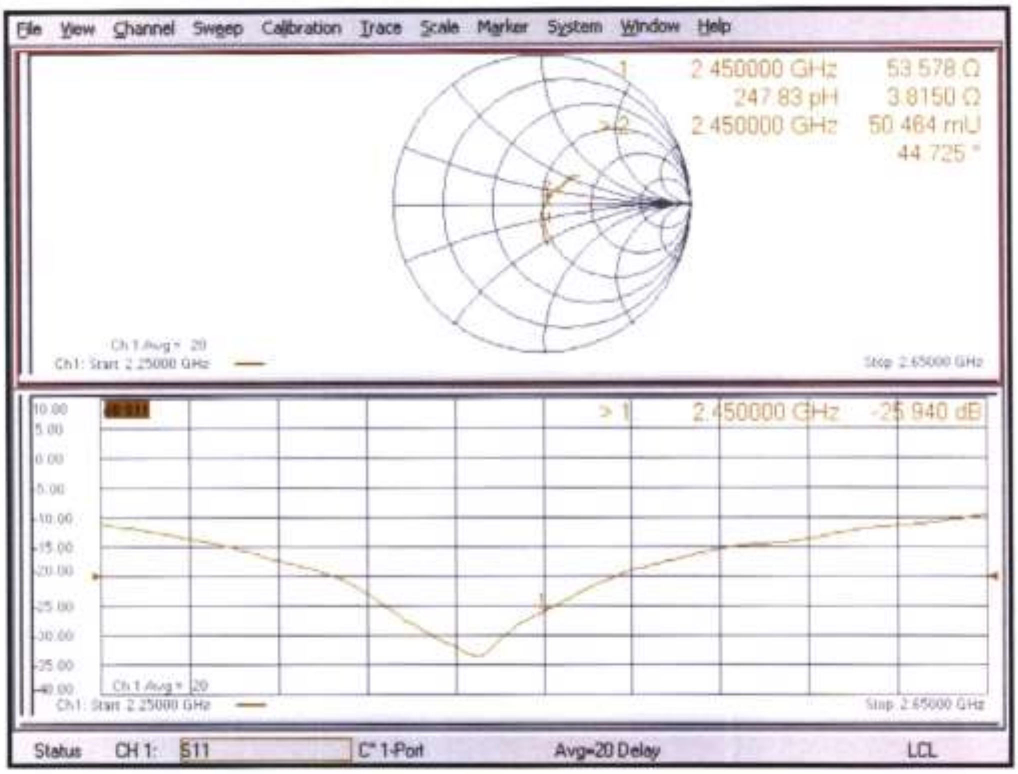
- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 116.2 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.33 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50%
Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg = 13.56 dBW/kg

Impedance Measurement Plot for Head TSL



2600 MHz Dipole Calibration Certificate

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Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **D2600V2-1012_Jul21**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN:1012
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 26, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 26, 2021

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**57.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.8 Ω - 5.7 jΩ
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 26.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

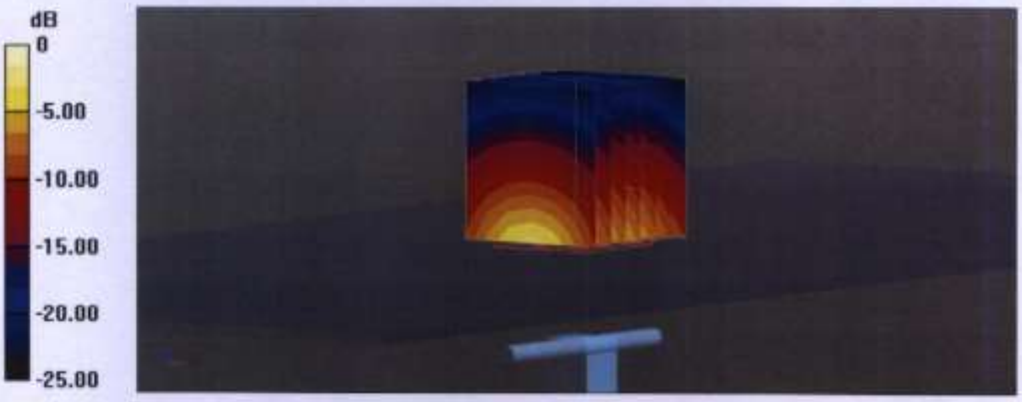
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1012

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.05 S/m; ε_r = 37.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

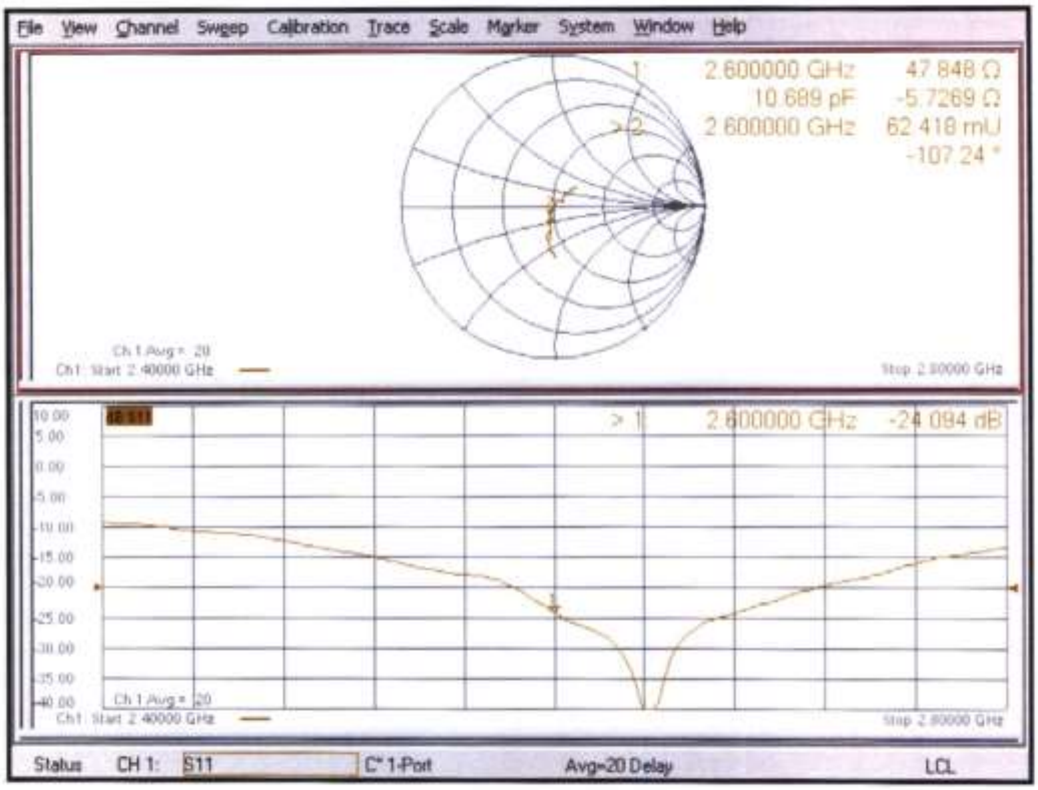
- Probe: EX3DV4 - SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 118.6 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.48 W/kg
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 49.6%
Maximum value of SAR (measured) = 24.4 W/kg



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

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1012_Jul21 Page 6 of 6

5G Dipole Calibration Certificate

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Accreditation No.: **SCS 0108**

Client **CTTL (Auden)**

Certificate No: **D5GHzV2-1060_Jun21**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1060
Calibration procedure(s)	QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz
Calibration date:	June 22, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 3503	30-Dec-20 (No. EX3-3503_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 22, 2021

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Certificate No: D5GHzV2-1060_Jun21 Page 1 of 13

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5250 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**87.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	4.95 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.8 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	47.6 Ω - 6.2 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	46.9 Ω - 4.8 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	46.2 Ω - 3.3 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.1 Ω - 4.2 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω + 0.4 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.8 Ω - 0.8 jΩ
Return Loss	- 34.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	50.9 Ω - 2.7 jΩ
Return Loss	- 31.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 22.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1060

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.54 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5250 MHz; σ = 4.59 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 4.64 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.85 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.95 S/m; ε_r = 34.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.1 S/m; ε_r = 33.9; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.15 S/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.25, 5.25, 5.25) @ 5500 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.84 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.1%
Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.04 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70.3%
Maximum value of SAR (measured) = 18.2 W/kg

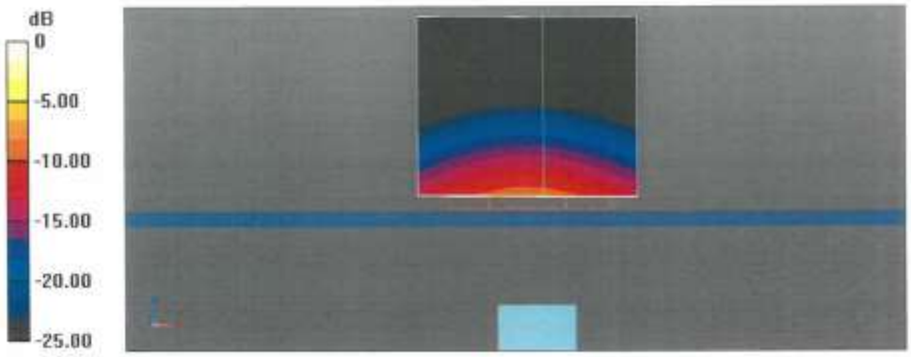
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.15 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.9 W/kg
SAR(1 g) = 8.25 W/kg; SAR(10 g) = 2.35 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.1%
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.07 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.80 W/kg; SAR(10 g) = 2.47 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.4%
Maximum value of SAR (measured) = 20.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.82 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.40 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.5%
Maximum value of SAR (measured) = 19.9 W/kg

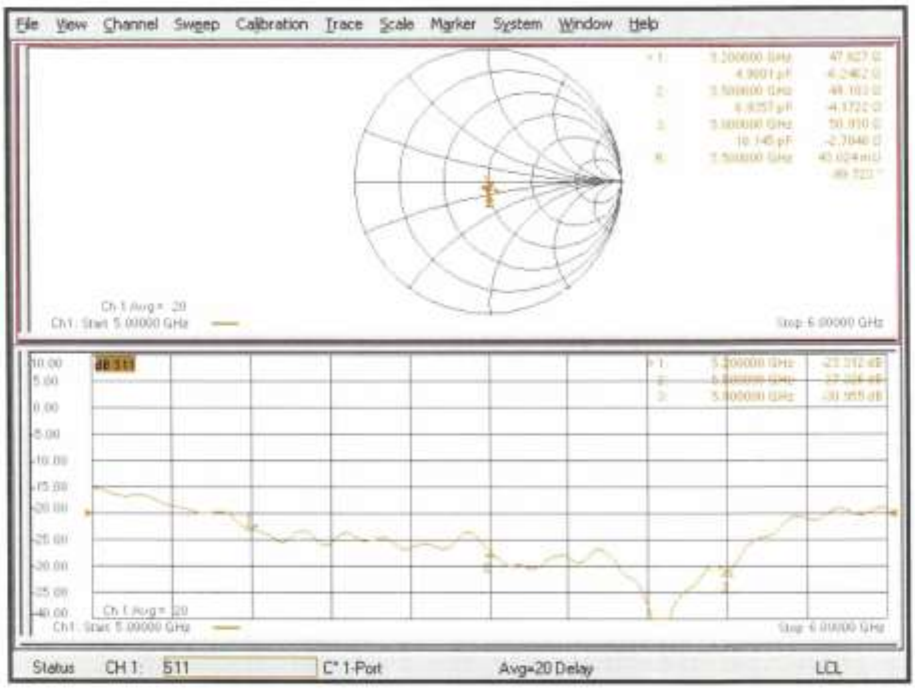
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.22 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 8.18 W/kg; SAR(10 g) = 2.30 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.8%
Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.53 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.31 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 20.9 W/kg = 13.20 dBW/kg

Impedance Measurement Plot for Head TSL (5200, 5500, 5800 MHz)



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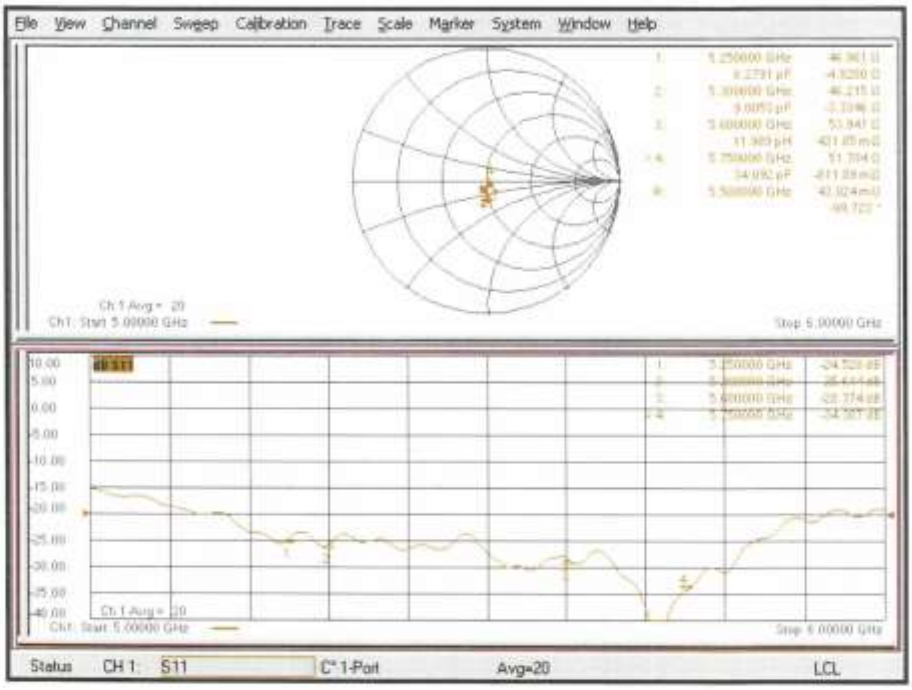
Impedance Measurement Plot for Head TSL (5250, 5300, 5600, 5750 MHz)



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ANNEX E Sensor Triggering Data Summary

ANT	P-Sensor Detect	Triggering distances
Main ANT	Front	9 mm
	Rear	17 mm
	Left	18 mm
	Top	9 mm
WIFI ANT	Front	7 mm
	Rear	14 mm
	Top	14 mm

According to the above description, this device was tested to check the SAR sensor triggering distances for the front, rear, left edge and top edge of the device. The measured power state within ±5mm of the triggering points (or until touching the phantom) is included for front, rear and each applicable edge.

To ensure all production units are compliant it is necessary to test SAR at a distance 1mm less than the smallest distance from the device and SAR phantom with the device at maximum output power without power reduction.

We monitor power changes with software built in the EUT and got the different proximity sensor triggering distances for front, rear, left edge and top edge. But the manufacturer has declared 9mm (front), 17mm (rear), 18mm (left edge) and 9mm (top edge) for main antenna. Therefore, base on the most conservative triggering distances as above, additional SAR measurements were required at 8mm (front), 16mm (rear), 17mm (left edge) and 8mm (top edge) for main antenna.

We monitor power changes with software built in the EUT and got the different proximity sensor triggering distances for front, rear and left edge. But the manufacturer has declared 7mm (front), 14mm (rear) and 14mm (top edge) for WIFI antenna. Therefore, base on the most conservative triggering distances as above, additional SAR measurements were required at 6mm (front), 13mm (rear) and 13mm (top edge) for WIFI antenna.

Main antenna

Front of main antenna

Moving device toward the phantom:

The power state											
Distance [mm]	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Rear of main antenna

Moving device toward the phantom:

The power state											
Distance [mm]	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Left of main antenna

Moving device toward the phantom:

The power state											
Distance [mm]	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Top of main antenna

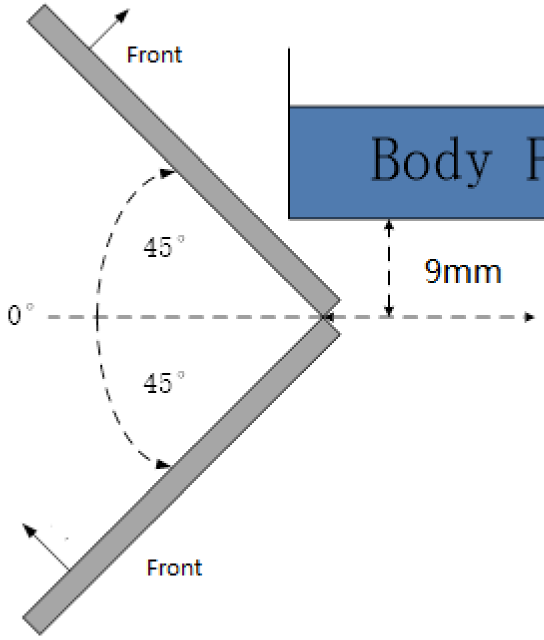
Moving device toward the phantom:

The power state											
Distance [mm]	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

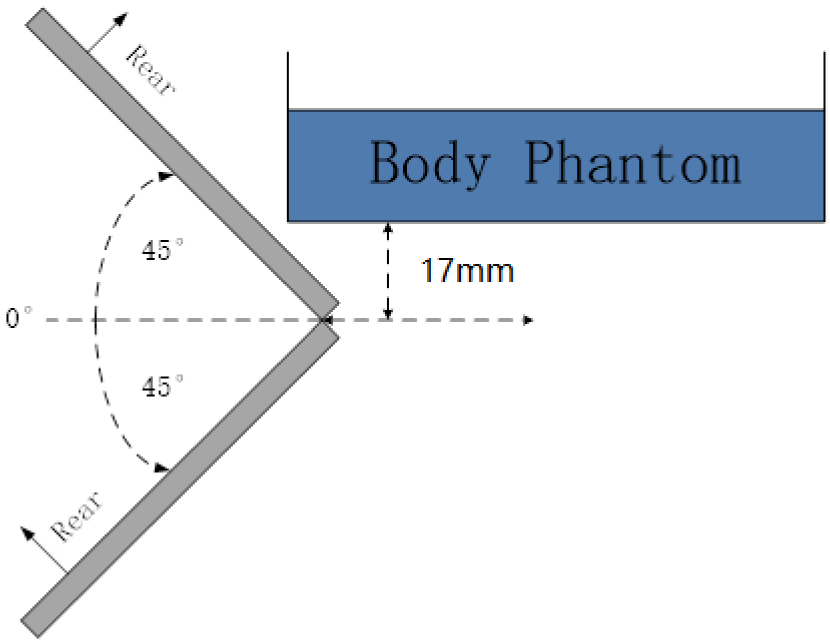
Moving device away from the phantom:

The power state											
Distance [mm]	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

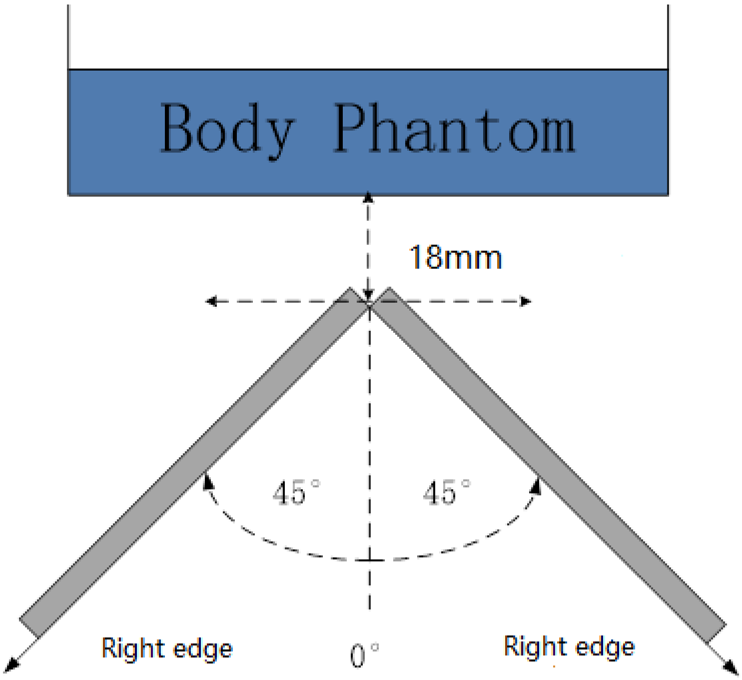
The influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in ≤ 10° increments until the tablet is ±45° or more from the vertical position at 0°.



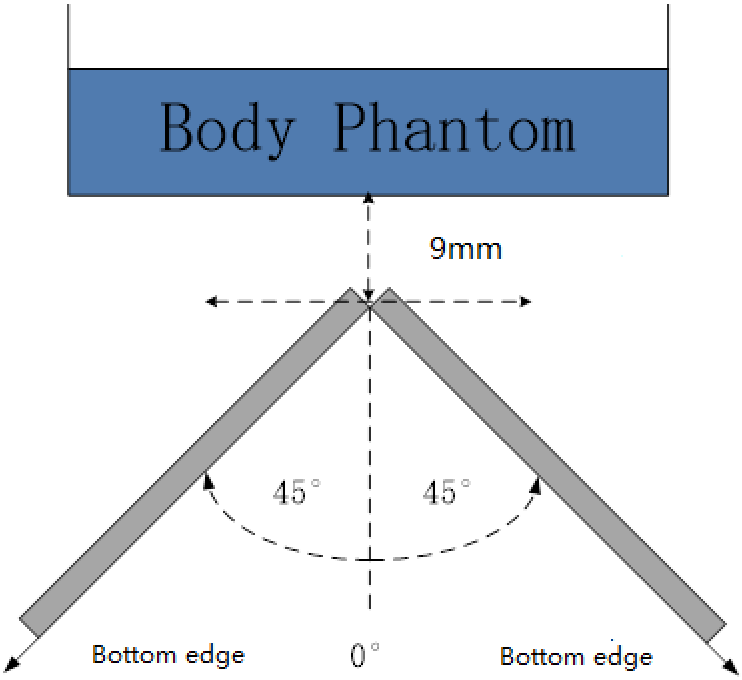
The Front evaluation



The Rear evaluation



The Left edge evaluation



The Top edge evaluation

Front of main antenna

Moving device toward the phantom:

The power state											
Distance [mm]	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Rear of main antenna

Moving device toward the phantom:

The power state											
Distance [mm]	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Top of main antenna

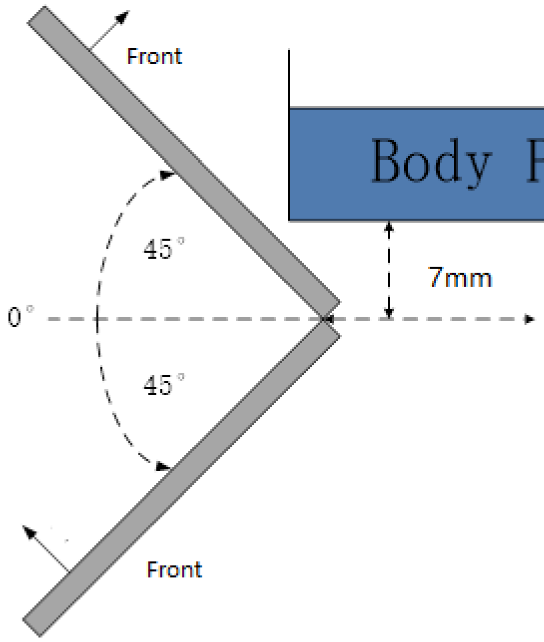
Moving device toward the phantom:

The power state											
Distance [mm]	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

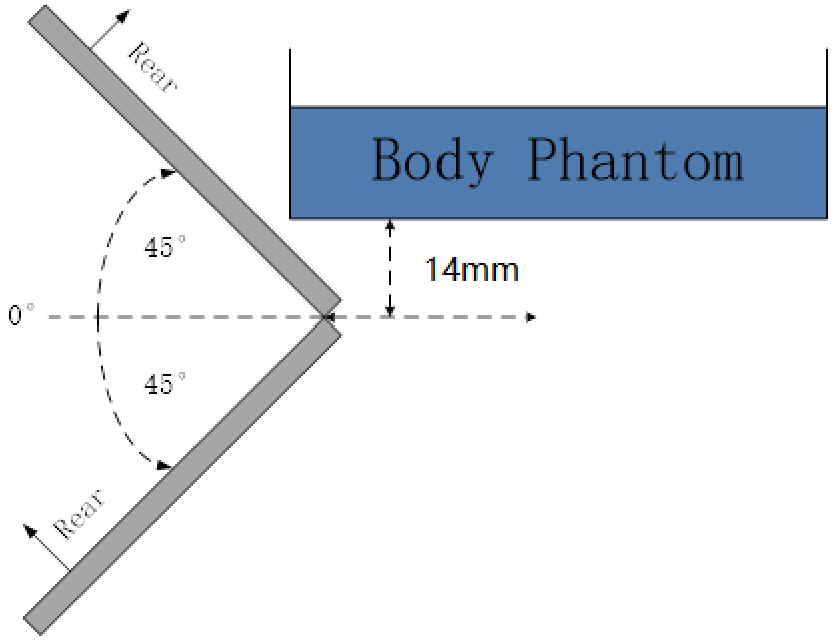
Moving device away from the phantom:

The power state											
Distance [mm]	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

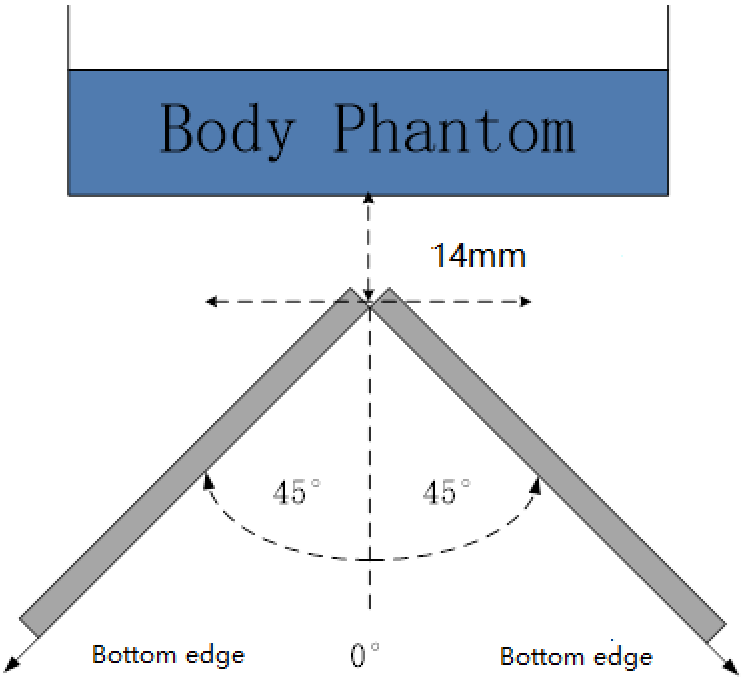
The influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in ≤ 10° increments until the tablet is ±45° or more from the vertical position at 0°.



The Front evaluation



The Rear evaluation



The Top edge evaluation

Based on the above evaluation, we come to the conclusion that the sensor triggering is not released and normal maximum output power is not restored within the ±45° range at the smallest sensor triggering test distance declared by manufacturer.

ANNEX J Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP® ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2021-09-29 through 2022-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program