SAR TEST REPORT

No. I20Z60996-SEM01

For

TCL Communication Ltd.

Mobile WiFi

Model Name: MW45AN

With

Hardware Version: V2.0

Software Version: MW45A_ZZ_02.00_01

FCC ID: 2ACCJB132

Issued Date: 2020-7-15

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.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT
No. 51, Xueyuan Road, Haidian District, Beijing, P. R. China 100191.
Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504
Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Issue Date	Description
I20Z60996-SEM01	Rev.0	2020-7-15	Initial creation of test report

TABLE OF CONTENT

1 Test Laboratory

1.1 Testing Location

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

1.2 Testing Environment

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

1.3 Project Data

Project Leader:	Qi Dianyuan
Test Engineer:	Lin Xiaojun
Testing Start Date:	July 2, 2020
Testing End Date:	July 7, 2020

1.4 Signature

Lin Xiaojun

(Prepared this test report)

Qi Dianyuan

(Reviewed this test report)

Lu Bingsong

Deputy Director of the laboratory

(Approved this test report)

2 Statement of Compliance

The maximum results of SAR found during testing for TCL Communication Ltd. Mobile WiFi MW45AN are as follows:

Table 2.1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Highest Reported SAR 1g(W/kg)-Body	Equipment Class
Hotspot (Separation Distance 10mm)	WCDMA1900	**1.26**	PCE
	WCDMA1700	1.22	
	WCDMA850	0.96	
	LTE Band 2	1.21	
	LTE Band 4	0.90	
	LTE Band 5	1.02	
	LTE Band 7	1.24	
	LTE Band 13	1.21	
	LTE Band 17	0.82	
	WLAN 2.4 GHz Ant0	0.19	DTS
	WLAN 2.4 GHz Ant1	0.31	

NOTE: This device does not support next to the ear voice operations, so the head SAR does not need to be tested.

The SAR values found for the MW45AN are below the maximum recommended levels of 1.6 W/kg as averaged over any 1g tissue according to the ANSI C95.1-1992.

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**: 1.26 W/kg(1g).**

Table 2.2: The sum of reported SAR values for main antenna and WiFi2.4G

	Position	Main antenna	WiFi Ant1	Sum
Highest reported SAR value for Body	Front 10mm	1.26 (WCDMA1900)	0.31	**1.57**

According to the above tables, the highest sum of reported SAR values is **1.57W/kg (1g)**. The detail for simultaneous transmission consideration is described in chapter 13.

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:	Gong Zhizhou
Contact Email:	zhizhou.gong@tcl.com
Telephone:	0086-755-36611722
Fax:	0086-755-36612000-81722

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:	Gong Zhizhou
Contact Email:	zhizhou.gong@tcl.com
Telephone:	0086-755-36611722
Fax:	0086-755-36612000-81722

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

4.1 About EUT

Description:	Mobile WiFi
Model name:	MW45AN
Operating mode(s):	UMTS FDD 2/4/5/, Wi-Fi(2.4G) LTE Band 2/3/4/5/7/13/17/28
Tested Tx Frequency:	824–849 MHz (WCDMA 850 Band V)
	1710 – 1755 MHz (WCDMA 1700 Band IV)
	1850–1910 MHz (WCDMA1900 Band II)
	1860 – 1900 MHz (LTE Band 2)
	1720 – 1745 MHz (LTE Band 4)
	824-849 MHz (LTE Band 5)
	2502.5 – 2567.5 MHz(LTE Band 7)
	779.5 –784.5 MHz (LTE Band 13)
	706.5 – 713.5MHz(LTE Band 17)
	2412 – 2462 MHz (Wi-Fi 2.4G)
Test device Production information:	Production unit
Device type:	MiFi
Antenna type:	Embedded
Hotspot mode:	Support

4.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW	SW Version
EUT1	350426930000057	V2.0	MW45A_ZZ_02.00_01
EUT2	350426930000453	V2.0	MW45A_ZZ_02.00_01
EUT3	350426930000099	V2.0	MW45A_ZZ_02.00_01

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

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

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	LI-ION Battery	CAB2150015C7	VEKEN

*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.

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

KDB865664 D02RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

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

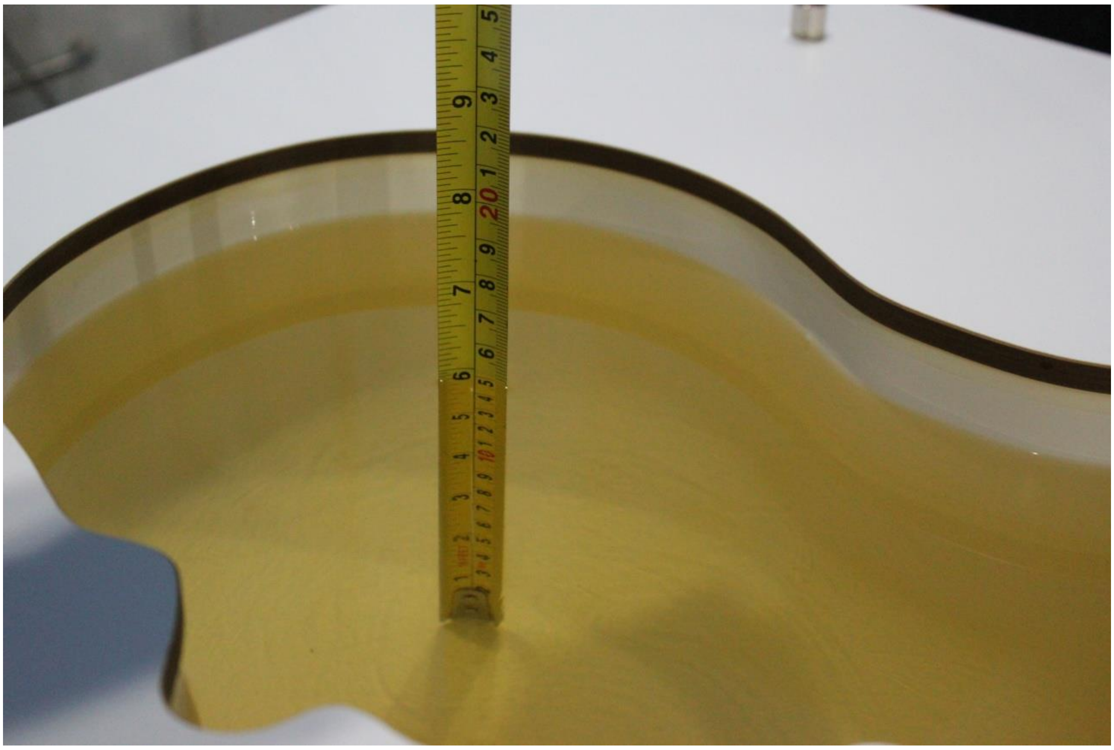
Frequency(MHz)	Liquid Type	Conductivity(σ)	± 5% Range	Permittivity(ε)	± 5% Range
750	Head	0.89	0.85～0.93	41.94	39.8～44.0
835	Head	0.90	0.86～0.95	41.5	39.4～43.6
1750	Head	1.37	1.30～1.44	40.08	38.1～42.1
1900	Head	1.40	1.33～1.47	40.0	38.0～42.0
2450	Head	1.80	1.71～1.89	39.2	37.2～41.2
2600	Head	1.96	1.86～2.06	39.01	37.1～41.0

7.2 Dielectric Performance

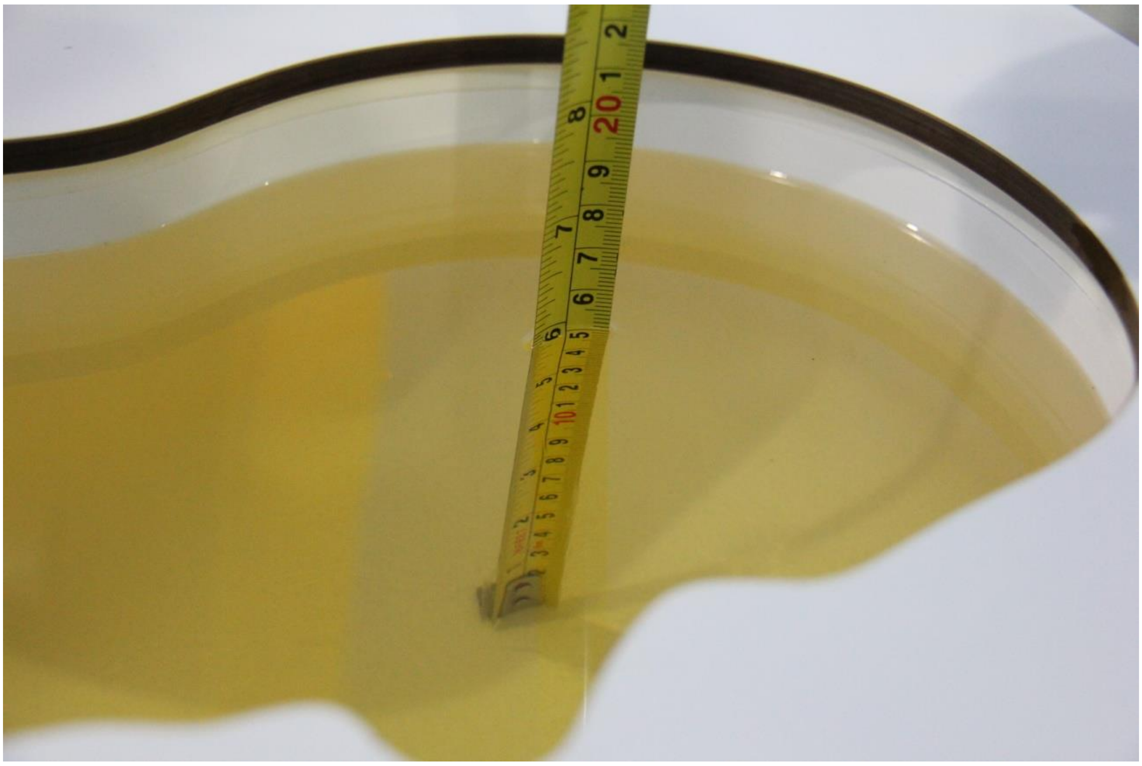
Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date yyyy/mm/dd	Frequency	Type	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2020/7/2	750 MHz	Head	41.35	-1.41	0.888	-0.22
2020/7/3	835 MHz	Head	41.1	-0.96	0.892	-0.89
2020/7/4	1750 MHz	Head	40.82	1.85	1.377	0.51
2020/7/5	1900 MHz	Head	39.99	-0.02	1.428	2.00
2020/7/6	2450 MHz	Head	38.99	-0.54	1.78	-1.11
2020/7/7	2600 MHz	Head	39.06	0.13	1.925	-1.79

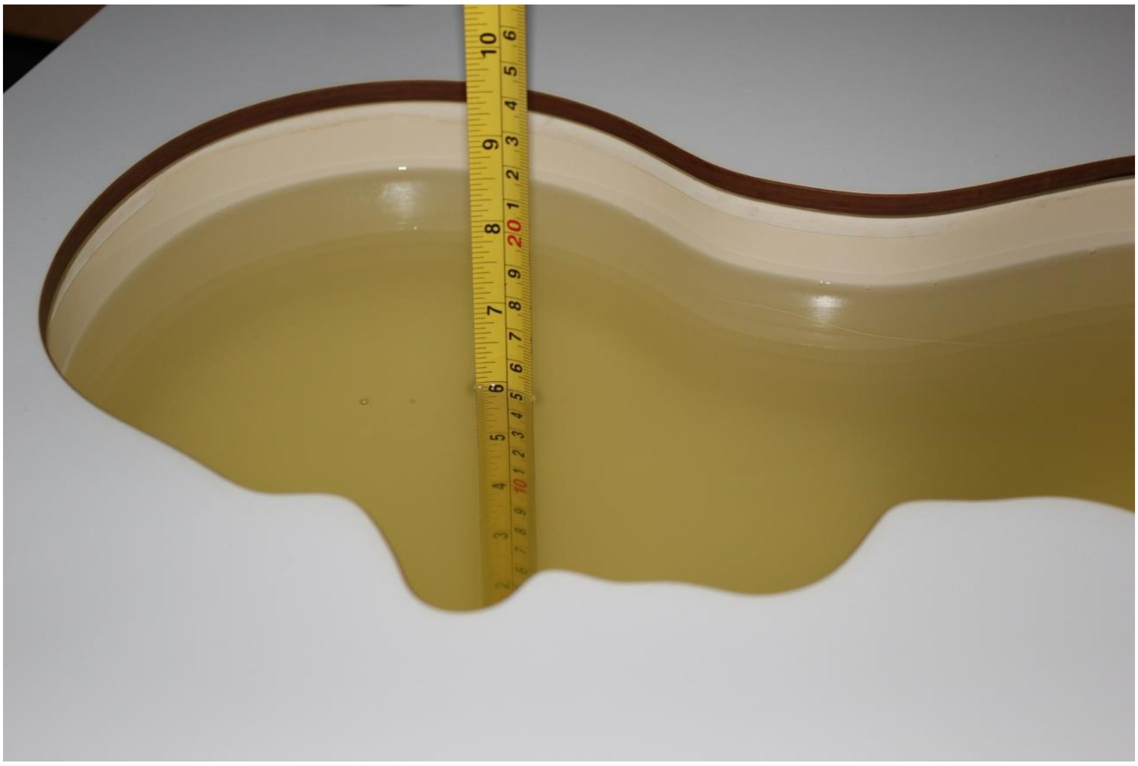
Note: The liquid temperature is 22.0℃



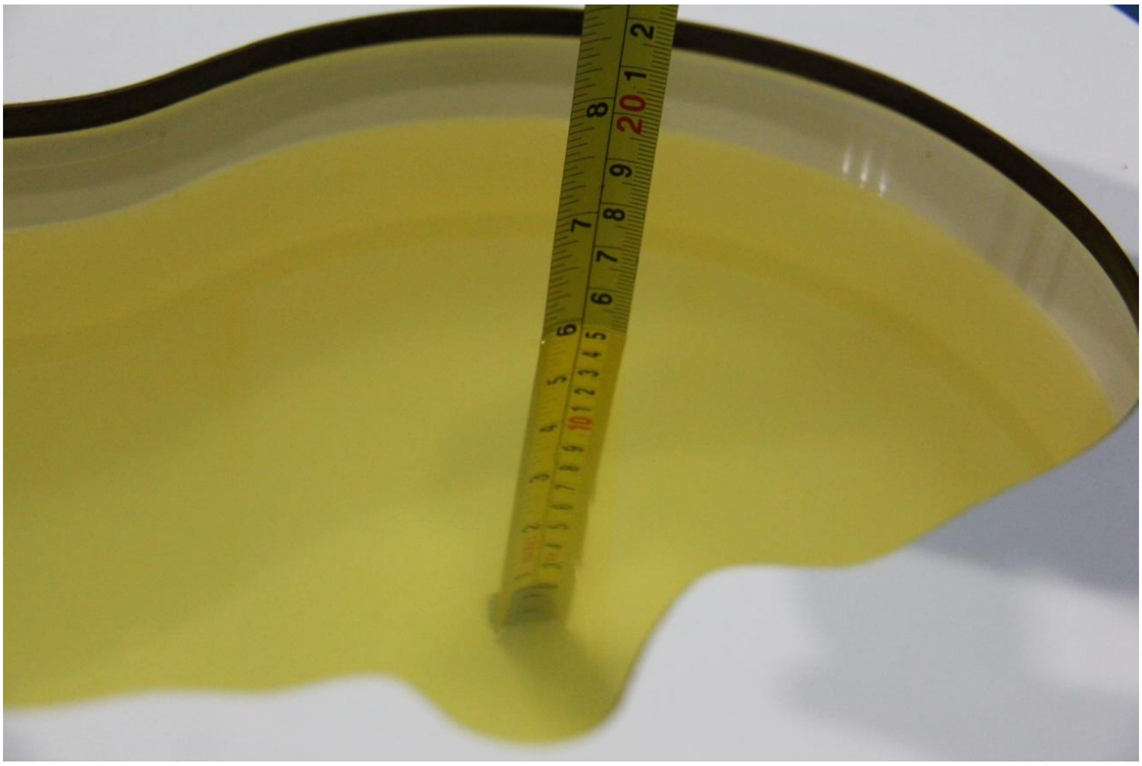
Picture 7-1 Liquid depth in the Head Phantom (750MHz)



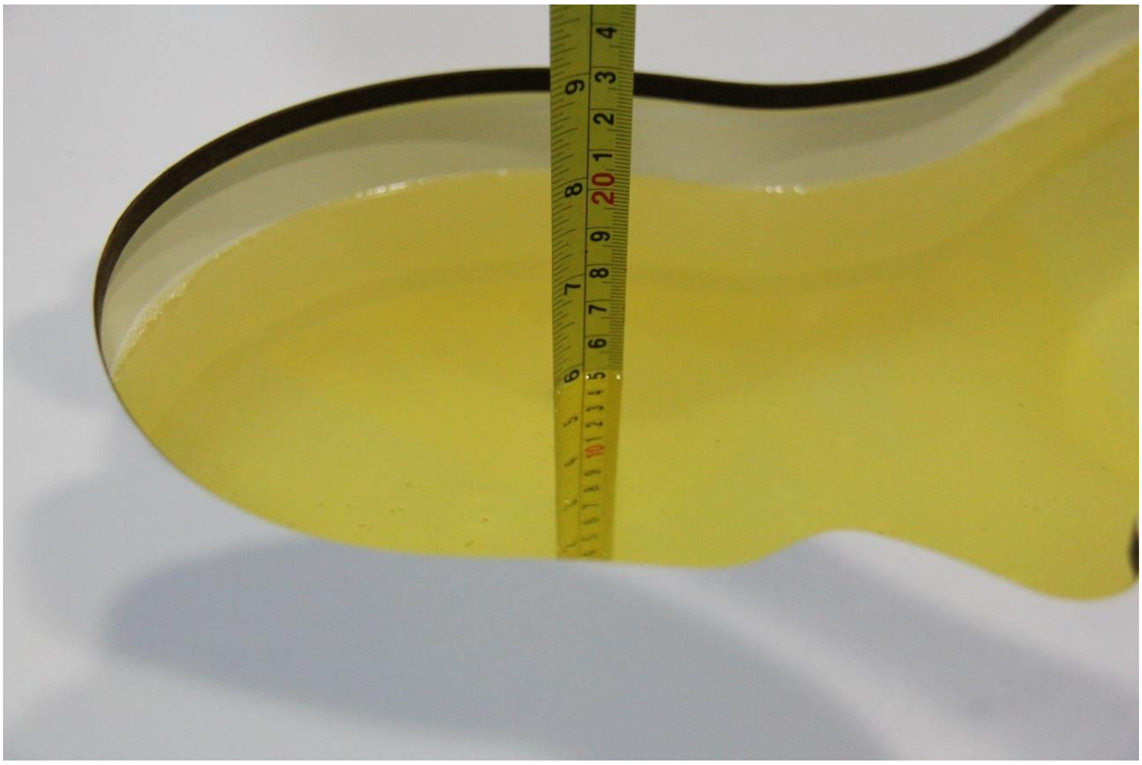
Picture 7-2 Liquid depth in the Head Phantom (835 MHz)



Picture 7-3 Liquid depth in the Head Phantom (1750 MHz)



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



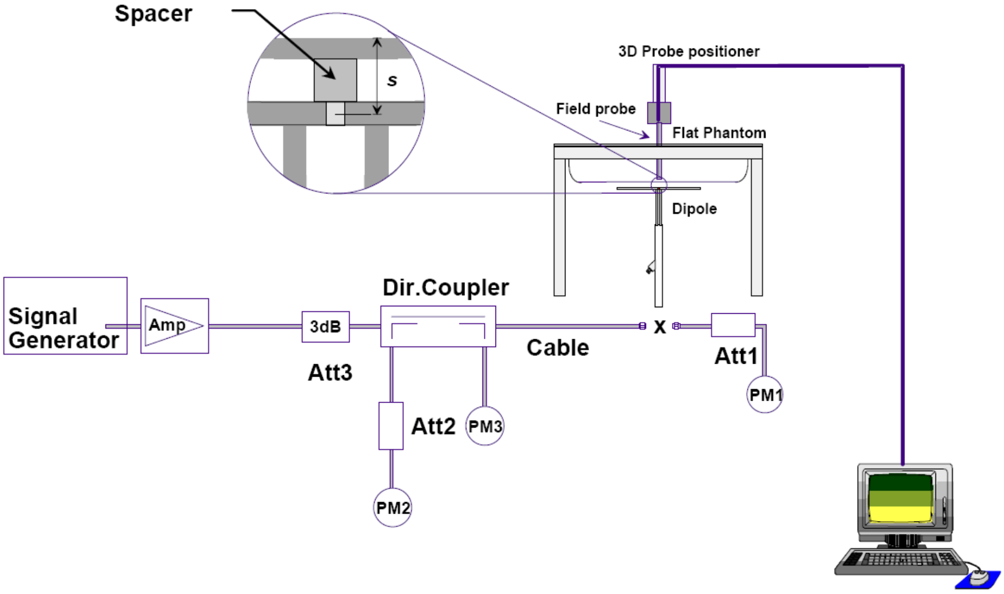
Picture 7-5 Liquid depth in the Head Phantom (2450MHz)

Picture 7-6 Liquid depth in the Head Phantom (2600 MHz)

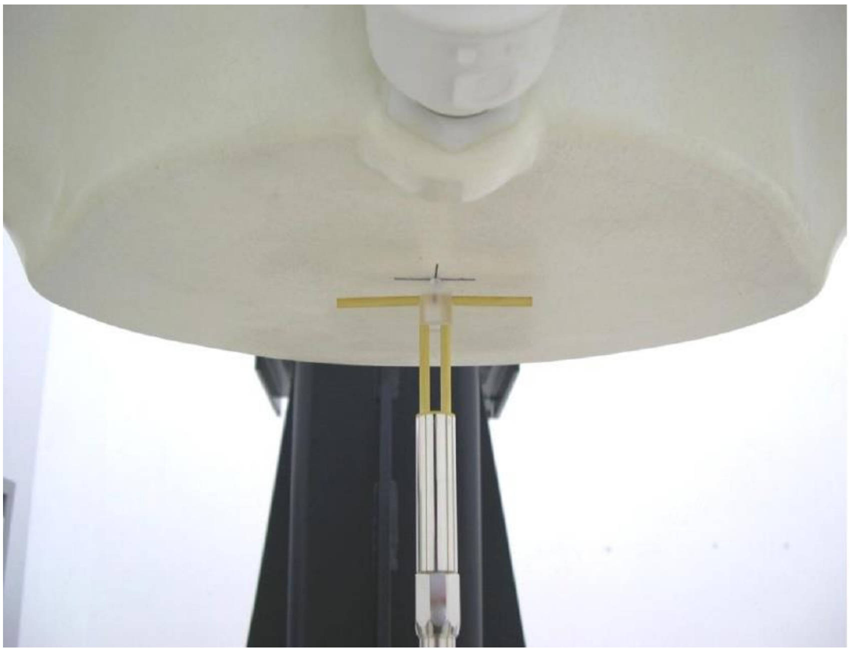
8 System verification

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
2020/7/2	750 MHz	5.57	8.57	5.68	8.60	1.97%	0.35%
2020/7/3	835 MHz	6.29	9.70	6.32	9.60	0.48%	-1.03%
2020/7/4	1750 MHz	19.30	36.60	19.32	36.68	0.10%	0.22%
2020/7/5	1900 MHz	20.80	39.70	21.12	39.68	1.54%	-0.05%
2020/7/6	2450 MHz	24.20	51.60	24.48	50.72	1.16%	-1.71%
2020/7/7	2600 MHz	25.10	55.80	25.00	54.72	-0.40%	-1.94%

9 Measurement Procedures

9.1 Tests to be performed

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

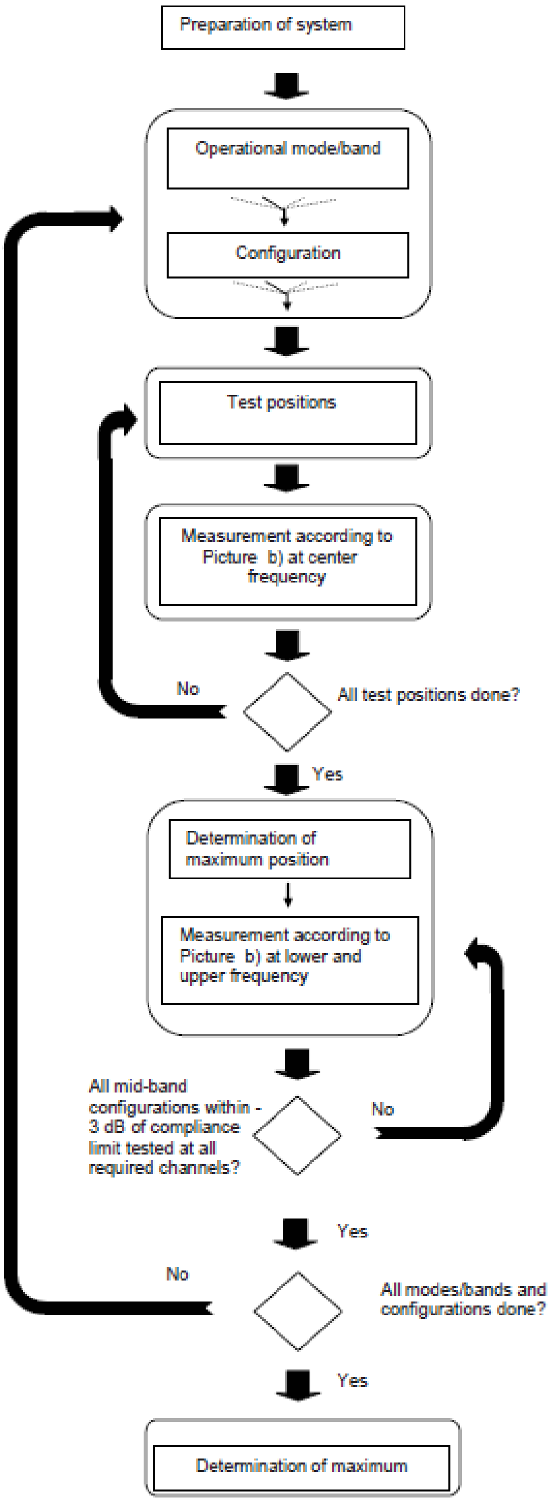
Step 1: The tests described in 9.2 shall be performed at the channel that is closest to the centre of the transmit frequency band (f_c) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in annex D),
b) all configurations for each device position in a), e.g., antenna extended and retracted, and
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

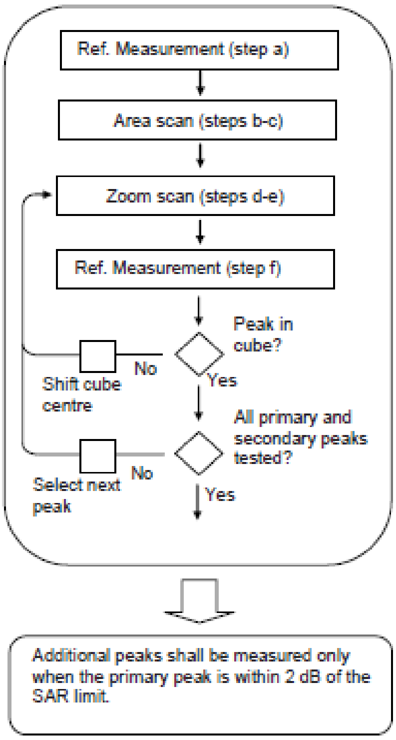
If more than three frequencies need to be tested according to 11.1 (i.e., $N_c > 3$), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

Step 2: For the condition providing highest peak spatial-average SAR determined in Step 1,perform all tests described in 9.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

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



Picture a – Tests to be performed



Picture b – General procedure

Picture 9.1Block diagram of the tests to be performed

9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

9.3 WCDMA Measurement Procedures for SAR

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

For Release 5 HSDPA Data Devices:

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

For Release 6 HSPA Data Devices

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

Rel.8 DC-HSDPA (Cat 24)

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

9.4 SAR Measurement for LTE

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

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

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

1) QPSK with 1 RB allocation

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

2) QPSK with 50% RB allocation

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

3) QPSK with 100% RB allocation

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

9.5 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, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in 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 v05, 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

11.1 WCDMA Measurement result

Table 11.1-1: The conducted Power for WCDMA

Item	band	FDDV result			
Item	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)	Tune up
WCDMA	\	21.02	21.00	21.01	22.00
HSUPA	1	19.79	19.67	19.96	21.50
	2	19.07	19.01	19.00	21.00
	3	18.77	19.51	18.79	20.50
	4	19.52	19.68	19.83	21.50
	5	20.51	20.63	20.51	21.50
HSPA+		19.71	19.70	19.72	21.50
DC-HSDPA	1	20.21	20.19	20.18	21.50
	2	20.26	20.29	20.31	21.50
	3	19.78	19.74	19.81	21.50
	4	19.85	19.80	19.77	21.50
Item	band	FDDIV result			
	ARFCN	1513 (1752.6MHz)	1412 (1732.4MHz)	1312 (1712.4MHz)	Tune up
WCDMA	\	20.54	20.55	20.63	21.70
HSUPA	1	19.59	19.84	19.53	21.50
	2	19.01	19.00	19.01	21.00
	3	19.13	18.50	18.51	20.50
	4	19.22	19.75	19.15	21.50
	5	20.46	20.30	20.25	21.50
HSPA+		19.42	19.45	19.37	21.50
DC-HSDPA	1	19.83	19.89	19.82	21.50
	2	19.96	19.84	19.81	21.50
	3	19.43	19.42	19.29	21.50
	4	19.47	19.40	19.36	21.50
Item	band	FDDII result			
	ARFCN	9538 (1907.6MHz)	9400 (1880MHz)	9262 (1852.4MHz)	Tune up
WCDMA	\	21.00	21.08	21.03	21.50
HSUPA	1	19.81	19.61	19.67	21.50
	2	19.43	19.10	19.07	21.00
	3	19.49	19.42	18.73	20.50
	4	19.50	19.52	19.79	21.50
	5	20.97	20.98	20.99	21.50
HSPA+		19.60	19.75	19.73	21.50
DC-HSDPA	1	20.05	20.09	20.16	21.50

	2	20.07	20.18	20.19	21.50
	3	19.66	19.74	19.82	21.50
	4	19.63	19.73	19.80	21.50

11.2 LTE Measurement result

Table 11.2-1: 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 11.2-2: The tune up for LTE

Band	Tune up
LTE Band 2	21.7
LTE Band 4	21.9
LTE Band 5	22.5
LTE Band 7	21.7
LTE Band 13	22.5
LTE Band 17	22.5

Table 11.2-3: The conducted Power for LTE

Band 2				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	QPSK	16QAM
	RB offset (Start RB)		Actual output power (dBm)	Actual output power (dBm)
1.4 MHz	1RB High (5)	1909.3	20.66	20.07
		1880	20.95	19.96
		1850.7	21.03	20.08
	1RB Middle (3)	1909.3	21.04	20.03
		1880	21.15	19.97
		1850.7	21.20	20.08
	1RB Low (0)	1909.3	20.90	20.05
		1880	21.16	19.98
		1850.7	21.04	20.01
	3RB High (3)	1909.3	20.94	20.15
		1880	21.03	19.62
		1850.7	21.33	20.02
	3RB Middle (1)	1909.3	21.06	20.33
		1880	21.18	19.70
		1850.7	21.42	20.06
	3RB Low (0)	1909.3	21.05	20.32
		1880	21.14	19.68
		1850.7	21.42	20.02

	6RB (0)	1909.3	20.21	19.27
		1880	20.07	18.82
		1850.7	20.40	18.93
3 MHz	1RB High (14)	1908.5	20.91	19.92
		1880	20.87	20.05
		1851.5	21.21	20.07
	1RB Middle (7)	1908.5	20.95	20.07
		1880	20.89	20.11
		1851.5	21.11	20.39
	1RB Low (0)	1908.5	21.04	20.00
		1880	21.04	19.98
		1851.5	21.12	20.23
	8RB High (7)	1908.5	19.98	18.85
		1880	20.00	18.71
		1851.5	20.30	19.10
	8RB Middle (4)	1908.5	20.09	18.99
		1880	20.04	18.74
		1851.5	20.32	19.05
	8RB Low (0)	1908.5	20.03	19.04
		1880	20.07	19.09
		1851.5	20.28	19.21
	15RB (0)	1908.5	20.09	18.73
		1880	20.09	19.04
		1851.5	20.29	19.25
5 MHz	1RB High (24)	1907.5	20.55	19.05
		1880	21.08	19.62
		1852.5	21.02	20.20
	1RB Middle (12)	1907.5	21.12	19.68
		1880	21.07	19.92
		1852.5	20.95	20.27
	1RB Low (0)	1907.5	20.98	19.70
		1880	20.97	19.50
		1852.5	20.96	20.09
	12RB High (13)	1907.5	19.84	18.72
		1880	19.91	18.89
		1852.5	20.15	18.99
	12RB Middle (6)	1907.5	19.91	19.04
		1880	19.96	18.93
		1852.5	20.14	19.08
	12RB Low (0)	1907.5	19.95	18.86
		1880	19.92	18.86
		1852.5	20.17	19.01
	25RB (0)	1907.5	19.86	18.79
		1880	19.95	18.95
		1852.5	20.17	19.02
10 MHz	1RB High (49)	1905	20.83	19.83
		1880	20.92	19.80
		1855	21.04	19.96

	1RB Middle (24)	1905	20.92	19.72
		1880	20.92	19.82
		1855	21.18	20.05
	1RB Low (0)	1905	20.84	19.48
		1880	21.04	19.67
		1855	20.92	19.81
	25RB High (25)	1905	19.83	18.99
		1880	19.95	18.79
		1855	20.07	19.01
	25RB Middle (12)	1905	19.87	18.88
		1880	20.00	18.79
		1855	20.11	19.04
	25RB Low (0)	1905	19.76	18.82
		1880	19.91	18.68
		1855	20.11	19.05
	50RB (0)	1905	19.78	18.76
		1880	19.91	18.82
		1855	20.08	18.90
15 MHz	1RB High (74)	1902.5	20.88	19.18
		1880	20.78	20.37
		1857.5	20.77	19.78
	1RB Middle (37)	1902.5	20.69	19.75
		1880	20.89	20.46
		1857.5	21.30	20.01
	1RB Low (0)	1902.5	20.74	19.59
		1880	20.66	19.92
		1857.5	21.26	20.02
	36RB High (38)	1902.5	19.90	18.75
		1880	19.92	18.78
		1857.5	20.04	18.88
	36RB Middle (19)	1902.5	19.82	18.82
		1880	19.87	18.79
		1857.5	20.09	18.94
	36RB Low (0)	1902.5	19.84	18.87
		1880	19.88	18.71
		1857.5	19.98	18.93
	75RB (0)	1902.5	19.78	18.78
		1880	19.87	18.81
		1857.5	19.98	18.94
20 MHz	1RB High (99)	1900	20.50	19.31
		1880	20.53	19.46
		1860	20.50	19.51
	1RB Middle (50)	1900	20.93	19.50
		1880	20.74	19.48
		1860	20.91	20.30
	1RB Low (0)	1900	20.90	19.53
		1880	20.51	19.27
		1860	20.64	19.99

	50RB High (50)	1900	19.54	18.58
		1880	19.63	18.66
		1860	19.64	18.74
	50RB Middle (25)	1900	19.51	18.67
		1880	19.73	18.65
		1860	19.84	18.94
	50RB Low (0)	1900	19.61	18.67
		1880	19.59	18.64
		1860	19.79	18.90
	100RB (0)	1900	19.63	18.57
		1880	19.65	18.71
		1860	19.78	18.80

Band 4				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	QPSK	16QAM
	RB offset (Start RB)		Actual output power (dBm)	Actual output power (dBm)
1.4MHz	1RB-High (5)	1754.3 (20393)	21.00	19.90
		1732.5 (20175)	20.86	19.86
		1710.7 (19957)	20.63	19.64
	1RB-Middle (3)	1754.3 (20393)	21.30	20.03
		1732.5 (20175)	21.02	19.87
		1710.7 (19957)	20.91	19.84
	1RB-Low (0)	1754.3 (20393)	20.85	19.87
		1732.5 (20175)	21.01	19.84
		1710.7 (19957)	20.72	19.48
	3RB-High (3)	1754.3 (20393)	20.95	19.98
		1732.5 (20175)	21.08	19.78
		1710.7 (19957)	21.00	19.62
	3RB-Middle (1)	1754.3 (20393)	20.97	19.87
		1732.5 (20175)	21.14	19.84
		1710.7 (19957)	20.96	19.67
	3RB-Low (0)	1754.3 (20393)	20.79	19.72
		1732.5 (20175)	21.06	20.08
		1710.7 (19957)	21.00	19.72
	6RB (0)	1754.3 (20393)	19.96	19.05
		1732.5 (20175)	20.06	19.22
		1710.7 (19957)	19.88	18.54
3MHz	1RB-High (14)	1753.5 (20385)	20.90	20.07
		1732.5 (20175)	21.18	19.66
		1711.5 (19965)	20.74	20.32
	1RB-Middle (7)	1753.5 (20385)	20.79	19.85
		1732.5 (20175)	21.07	19.94
		1711.5 (19965)	20.69	19.86
	1RB-Low (0)	1753.5 (20385)	20.78	19.80
		1732.5 (20175)	21.16	20.31
		1711.5 (19965)	20.77	19.53

	8RB-High (7)	1753.5 (20385)	19.79	18.51
		1732.5 (20175)	19.99	19.15
		1711.5 (19965)	19.76	18.60
	8RB-Middle (4)	1753.5 (20385)	19.86	18.60
		1732.5 (20175)	19.98	19.03
		1711.5 (19965)	19.69	18.76
	8RB-Low (0)	1753.5 (20385)	19.80	18.55
		1732.5 (20175)	19.94	19.02
		1711.5 (19965)	19.81	18.90
	15RB (0)	1753.5 (20385)	19.84	18.70
		1732.5 (20175)	20.03	18.93
		1711.5 (19965)	19.76	18.87
5MHz	1RB-High (24)	1752.5 (20375)	20.76	19.78
		1732.5 (20175)	21.05	19.53
		1712.5 (19975)	20.47	19.52
	1RB-Middle (12)	1752.5 (20375)	20.71	19.56
		1732.5 (20175)	21.07	19.48
		1712.5 (19975)	20.60	19.47
	1RB-Low (0)	1752.5 (20375)	20.88	19.75
		1732.5 (20175)	21.16	19.54
		1712.5 (19975)	20.52	19.57
	12RB-High (13)	1752.5 (20375)	19.90	18.80
		1732.5 (20175)	19.99	18.90
		1712.5 (19975)	19.69	18.57
	12RB-Middle (6)	1752.5 (20375)	19.86	18.80
		1732.5 (20175)	19.87	18.68
		1712.5 (19975)	19.75	18.67
	12RB-Low (0)	1752.5 (20375)	19.89	18.83
		1732.5 (20175)	19.88	18.71
		1712.5 (19975)	19.72	18.79
	25RB (0)	1752.5 (20375)	19.82	18.67
		1732.5 (20175)	19.95	18.90
		1712.5 (19975)	19.74	18.71
10MHz	1RB-High (49)	1750 (20350)	20.84	20.00
		1732.5 (20175)	21.08	19.69
		1715 (20000)	20.68	19.34
	1RB-Middle (24)	1750 (20350)	21.01	20.15
		1732.5 (20175)	21.14	19.69
		1715 (20000)	20.86	19.68
	1RB-Low (0)	1750 (20350)	21.06	19.76
		1732.5 (20175)	20.99	19.56
		1715 (20000)	20.78	19.55
	25RB-High (25)	1750 (20350)	19.75	18.80
		1732.5 (20175)	19.97	18.95
		1715 (20000)	19.70	18.73
	25RB-Middle (12)	1750 (20350)	19.83	18.95
		1732.5 (20175)	19.89	18.89
		1715 (20000)	19.80	18.84

	25RB-Low (0)	1750 (20350)	19.91	19.09
		1732.5 (20175)	19.93	18.82
		1715 (20000)	19.82	18.74
	50RB (0)	1750 (20350)	19.81	18.84
		1732.5 (20175)	20.00	18.88
		1715 (20000)	19.71	18.61
15MHz	1RB-High (74)	1747.5 (20325)	20.69	20.61
		1732.5 (20175)	21.14	20.24
		1717.5 (20025)	20.83	19.78
	1RB-Middle (37)	1747.5 (20325)	20.77	21.05
		1732.5 (20175)	21.07	19.82
		1717.5 (20025)	20.66	19.57
	1RB-Low (0)	1747.5 (20325)	20.84	20.53
		1732.5 (20175)	21.11	19.87
		1717.5 (20025)	20.79	19.80
	36RB-High (38)	1747.5 (20325)	19.79	18.71
		1732.5 (20175)	20.01	18.98
		1717.5 (20025)	19.82	18.77
	36RB-Middle (19)	1747.5 (20325)	19.85	18.80
		1732.5 (20175)	19.88	18.90
		1717.5 (20025)	19.70	18.81
	36RB-Low (0)	1747.5 (20325)	19.77	18.70
		1732.5 (20175)	19.87	18.88
		1717.5 (20025)	19.83	18.89
	75RB (0)	1747.5 (20325)	19.76	18.80
		1732.5 (20175)	19.98	19.00
		1717.5 (20025)	19.76	18.78
20MHz	1RB-High (99)	1745 (20300)	20.59	19.61
		1732.5 (20175)	20.49	19.23
		1720 (20050)	19.99	19.13
	1RB-Middle (50)	1745 (20300)	20.60	20.04
		1732.5 (20175)	20.11	19.47
		1720 (20050)	20.54	19.81
	1RB-Low (0)	1745 (20300)	20.42	19.03
		1732.5 (20175)	20.35	19.46
		1720 (20050)	20.02	19.58
	50RB-High (50)	1745 (20300)	19.48	18.44
		1732.5 (20175)	19.72	18.59
		1720 (20050)	19.67	18.76
	50RB-Middle (25)	1745 (20300)	19.49	18.54
		1732.5 (20175)	19.61	18.47
		1720 (20050)	19.51	18.57
	50RB-Low (0)	1745 (20300)	19.51	18.41
		1732.5 (20175)	19.59	18.57
		1720 (20050)	19.38	18.58
	100RB (0)	1745 (20300)	19.52	18.48
		1732.5 (20175)	19.75	18.62
		1720 (20050)	19.49	18.50

Band 5				
Bandwidth (MHz)	RB allocation RB offset (Start RB)	Frequency (MHz)	QPSK Actual output power (dBm)	16QAM Actual output power (dBm)
1.4 MHz	1RB High (5)	848.3	20.90	19.81
		836.5	21.22	20.01
		824.7	20.99	20.34
	1RB Middle (3)	848.3	21.26	19.71
		836.5	21.30	19.99
		824.7	21.51	20.56
	1RB Low (0)	848.3	21.25	19.64
		836.5	21.12	19.93
		824.7	21.13	20.49
	3RB High (3)	848.3	21.21	19.87
		836.5	21.36	19.74
		824.7	21.27	20.33
	3RB Middle (1)	848.3	21.27	19.88
		836.5	21.32	19.73
		824.7	21.19	20.36
	3RB Low (0)	848.3	21.25	19.86
		836.5	21.26	20.24
		824.7	21.15	20.28
	6RB (0)	848.3	20.27	19.19
		836.5	20.33	19.29
		824.7	20.31	18.99
3 MHz	1RB High (14)	847.5	20.93	19.76
		836.5	21.35	20.29
		825.5	21.30	20.20
	1RB Middle (7)	847.5	21.23	19.88
		836.5	21.44	19.70
		825.5	21.63	20.49
	1RB Low (0)	847.5	21.17	20.30
		836.5	21.52	19.75
		825.5	21.28	20.31
	8RB High (7)	847.5	20.21	19.16
		836.5	20.27	19.01
		825.5	20.41	19.23
	8RB Middle (4)	847.5	20.35	19.24
		836.5	20.27	19.09
		825.5	20.45	19.30
	8RB Low (0)	847.5	20.29	19.26
		836.5	20.25	18.99
		825.5	20.42	19.25
	15RB (0)	847.5	20.25	19.05
		836.5	20.33	19.24
		825.5	20.40	19.36
5 MHz	1RB	846.5	20.91	20.02

	High (24)	836.5	21.04	20.04
		826.5	20.84	20.25
	1RB Middle (12)	846.5	21.40	20.19
		836.5	21.11	19.85
		826.5	21.35	20.10
	1RB Low (0)	846.5	21.31	20.20
		836.5	21.13	19.76
		826.5	21.12	20.24
	12RB High (13)	846.5	20.10	19.02
		836.5	20.27	19.28
		826.5	20.33	19.17
	12RB Middle (6)	846.5	20.17	19.28
		836.5	20.22	19.33
		826.5	20.30	19.45
	12RB Low (0)	846.5	20.19	19.29
		836.5	20.20	19.18
		826.5	20.40	19.24
	25RB (0)	846.5	20.11	19.12
		836.5	20.32	19.38
		826.5	20.38	19.32
10 MHz	1RB High (49)	844	20.59	19.59
		836.5	20.91	19.73
		829	20.74	19.74
	1RB Middle (24)	844	21.06	19.71
		836.5	20.84	20.11
		829	21.26	20.28
	1RB Low (0)	844	20.57	19.58
		836.5	20.76	19.86
		829	21.14	20.38
	25RB High (25)	844	19.90	18.89
		836.5	19.94	19.02
		829	19.91	18.91
	25RB Middle (12)	844	19.92	18.96
		836.5	19.88	18.97
		829	20.02	19.03
	25RB Low (0)	844	19.85	18.86
		836.5	19.88	18.96
		829	20.07	19.07
	50RB (0)	844	19.82	18.81
		836.5	19.99	18.94
		829	19.99	18.93

Band 7				
Bandwidth (MHz)	RB allocation RB offset (Start RB)	Frequency (MHz)	QPSK Actual output power (dBm)	16QAM Actual output power (dBm)
5 MHz	1RB High (24)	2567.5	20.77	19.54
		2535	20.99	19.67
		2502.5	20.87	19.85
	1RB Middle (12)	2567.5	21.09	19.83
		2535	21.17	19.75
		2502.5	20.88	19.76
	1RB Low (0)	2567.5	20.97	19.82
		2535	21.14	19.48
		2502.5	21.18	19.62
	12RB High (13)	2567.5	19.92	18.84
		2535	20.16	19.02
		2502.5	20.04	18.79
	12RB Middle (6)	2567.5	20.04	19.15
		2535	20.14	18.84
		2502.5	20.11	18.86
	12RB Low (0)	2567.5	20.03	18.87
		2535	20.13	18.85
		2502.5	20.03	19.07
	25RB (0)	2567.5	19.94	18.85
		2535	20.14	19.00
		2502.5	20.14	19.27
10 MHz	1RB High (49)	2565	21.02	19.84
		2535	20.97	19.94
		2505	21.14	19.77
	1RB Middle (24)	2565	21.35	19.84
		2535	21.14	20.17
		2505	21.45	20.39
	1RB Low (0)	2565	21.14	19.88
		2535	21.25	20.15
		2505	21.13	20.38
	25RB High (25)	2565	20.27	19.01
		2535	20.37	19.32
		2505	20.38	19.04
	25RB Middle (12)	2565	20.21	19.04
		2535	20.31	19.12
		2505	20.30	19.15
	25RB Low (0)	2565	20.15	19.07
		2535	20.22	19.14
		2505	20.30	19.13
	50RB (0)	2565	20.22	19.03
		2535	20.26	19.08
		2505	20.27	18.99

15 MHz	1RB High (74)	2562.5	20.96	20.61
		2535	20.92	20.03
		2507.5	21.05	20.26
	1RB Middle (37)	2562.5	21.13	20.72
		2535	20.97	20.00
		2507.5	21.15	20.28
	1RB Low (0)	2562.5	21.12	20.66
		2535	20.93	19.93
		2507.5	21.29	20.35
	36RB High (38)	2562.5	20.07	19.03
		2535	20.19	19.11
		2507.5	20.15	19.01
	36RB Middle (19)	2562.5	19.95	19.06
		2535	20.14	19.09
		2507.5	20.17	19.04
	36RB Low (0)	2562.5	19.91	19.07
		2535	20.08	19.05
		2507.5	20.17	19.06
	75RB (0)	2562.5	19.95	19.10
		2535	20.11	18.97
		2507.5	20.10	19.02
20 MHz	1RB High (99)	2560	20.81	19.92
		2535	21.26	20.33
		2510	20.88	19.79
	1RB Middle (50)	2560	21.18	20.20
		2535	21.32	20.38
		2510	21.44	20.56
	1RB Low (0)	2560	20.89	20.00
		2535	20.94	20.12
		2510	21.11	20.42
	50RB High (50)	2560	20.26	19.16
		2535	20.31	19.34
		2510	20.06	19.12
	50RB Middle (25)	2560	20.17	19.12
		2535	20.28	19.31
		2510	20.21	19.19
	50RB Low (0)	2560	20.13	19.05
		2535	20.21	19.25
		2510	20.16	19.15
	100RB (0)	2560	20.19	19.15
		2535	20.24	19.21
		2510	20.15	19.13

Band 13				
Bandwidth (MHz)	RB allocation RB offset (Start RB)	Frequency (MHz)	QPSK Actual output power (dBm)	16QAM Actual output power (dBm)
5 MHz	1RB High (24)	784.4	20.81	19.88
		782	21.31	19.73
		799.5	20.92	20.01
	1RB Middle (12)	784.4	21.40	19.83
		782	21.22	19.62
		799.5	21.24	19.78
	1RB Low (0)	784.4	21.20	19.93
		782	21.34	19.54
		799.5	20.93	19.65
	12RB High (13)	784.4	19.99	18.82
		782	20.12	19.00
		799.5	20.17	18.94
	12RB Middle (6)	784.4	20.05	18.88
		782	20.10	18.90
		799.5	20.06	19.09
	12RB Low (0)	784.4	20.12	18.99
		782	20.10	19.00
		799.5	20.07	19.35
	25RB (0)	784.4	19.94	18.92
		782	20.08	19.00
		799.5	20.19	19.16
10 MHz	1RB High (49)	782	20.87	19.78
	1RB Middle (24)	782	21.13	20.43
	1RB Low (0)	782	20.94	20.16
	25RB High (25)	782	20.01	19.29
	25RB Middle (12)	782	20.08	19.27
	25RB Low (0)	782	20.06	19.26
	50RB (0)	782	20.04	19.09

Band 17				
Bandwidth (MHz)	RB allocation RB offset (Start RB)	Frequency (MHz)	QPSK Actual output power (dBm)	16QAM Actual output power (dBm)
5MHz	1RB-High (24)	713.5 (23825)	20.98	19.97
		710 (23790)	20.89	20.09
		706.5 (23755)	20.81	20.12
	1RB-Middle (12)	713.5 (23825)	21.09	19.98
		710 (23790)	21.04	20.20
		706.5 (23755)	21.06	20.05
	1RB-Low (0)	713.5 (23825)	21.05	19.93

		710 (23790)	21.07	20.15
		706.5 (23755)	21.12	19.82
	12RB-High (13)	713.5 (23825)	20.02	18.93
		710 (23790)	20.01	19.09
		706.5 (23755)	20.10	19.03
	12RB-Middle (6)	713.5 (23825)	20.04	19.07
		710 (23790)	20.07	19.14
		706.5 (23755)	20.18	19.08
	12RB-Low (0)	713.5 (23825)	20.05	19.09
		710 (23790)	20.00	19.06
		706.5 (23755)	20.07	19.12
	25RB (0)	713.5 (23825)	20.03	19.08
		710 (23790)	20.02	19.07
		706.5 (23755)	20.14	19.10
10MHz	1RB-High (49)	711 (23800)	20.85	19.82
		710 (23790)	21.01	19.83
		709 (23780)	20.91	19.83
	1RB-Middle (24)	711 (23800)	21.08	19.77
		710 (23790)	21.11	20.29
		709 (23780)	21.11	19.99
	1RB-Low (0)	711 (23800)	20.85	19.74
		710 (23790)	21.07	19.90
		709 (23780)	21.13	19.57
	25RB-High (25)	711 (23800)	20.06	19.02
		710 (23790)	20.12	18.97
		709 (23780)	20.18	19.04
	25RB-Middle (12)	711 (23800)	20.14	19.10
		710 (23790)	20.17	19.00
		709 (23780)	20.15	19.07
	25RB-Low (0)	711 (23800)	20.13	19.00
		710 (23790)	20.06	18.92
		709 (23780)	20.18	19.08
	50RB (0)	711 (23800)	20.08	18.94
		710 (23790)	20.09	18.98
		709 (23780)	20.27	19.06

11.4 Wi-Fi Measurement result

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

2.4GHz ANT1		
802.11b	Channel\data	1Mbps
WLAN2450	11(2462MHz)	16.62
	6(2437(MHz)	16.98
	1(2412MHz)	16.59
	Tune up	17.00
802.11g	Channel\data	6Mbps
WLAN2450	11(2462MHz)	14.46
	6(2437(MHz)	14.76
	1(2412MHz)	14.88
	Tune up	15.00
802.11n-20MHz	Channel\data	MCS0
WLAN2450	11(2462MHz)	12.78
	6(2437(MHz)	12.56
	1(2412MHz)	12.74
	Tune up	13.00
802.11n-40MHz	Channel\data	MCS0
WLAN2450	9(2452MHz)	12.75
	6(2437MHz)	12.77
	3(2422MHz)	12.56
	Tune up	13.00

2.4GHz ANT0		
802.11b	Channel\data	1Mbps
WLAN2450	11(2462MHz)	16.65
	6(2437(MHz)	16.67
	1(2412MHz)	16.50
	Tune up	17.00
802.11g	Channel\data	6Mbps
WLAN2450	11(2462MHz)	14.54
	6(2437(MHz)	14.71
	1(2412MHz)	14.56
	Tune up	15.00
802.11n-20MHz	Channel\data	MCS0
WLAN2450	11(2462MHz)	12.76
	6(2437(MHz)	12.44
	1(2412MHz)	12.65
	Tune up	13.00
802.11n-40MHz	Channel\data	MCS0
WLAN2450	9(2452MHz)	12.44
	6(2437MHz)	12.66
	3(2422MHz)	12.79
	Tune up	13.00

2.4G MIMO(ANT0+ANT1)		
802.11n-20MHz	Channel\data rate	MCS0
WLAN2450	11(2462MHz)	15.67
	6(2437(MHz)	15.87
	1(2412MHz)	15.75
	Tune up	16.00
802.11n-40MHz	Channel\data rate	MCS0
WLAN2450	9(2452MHz)	15.70
	6(2437MHz)	15.79
	3(2422MHz)	15.75
	Tune up	16.00

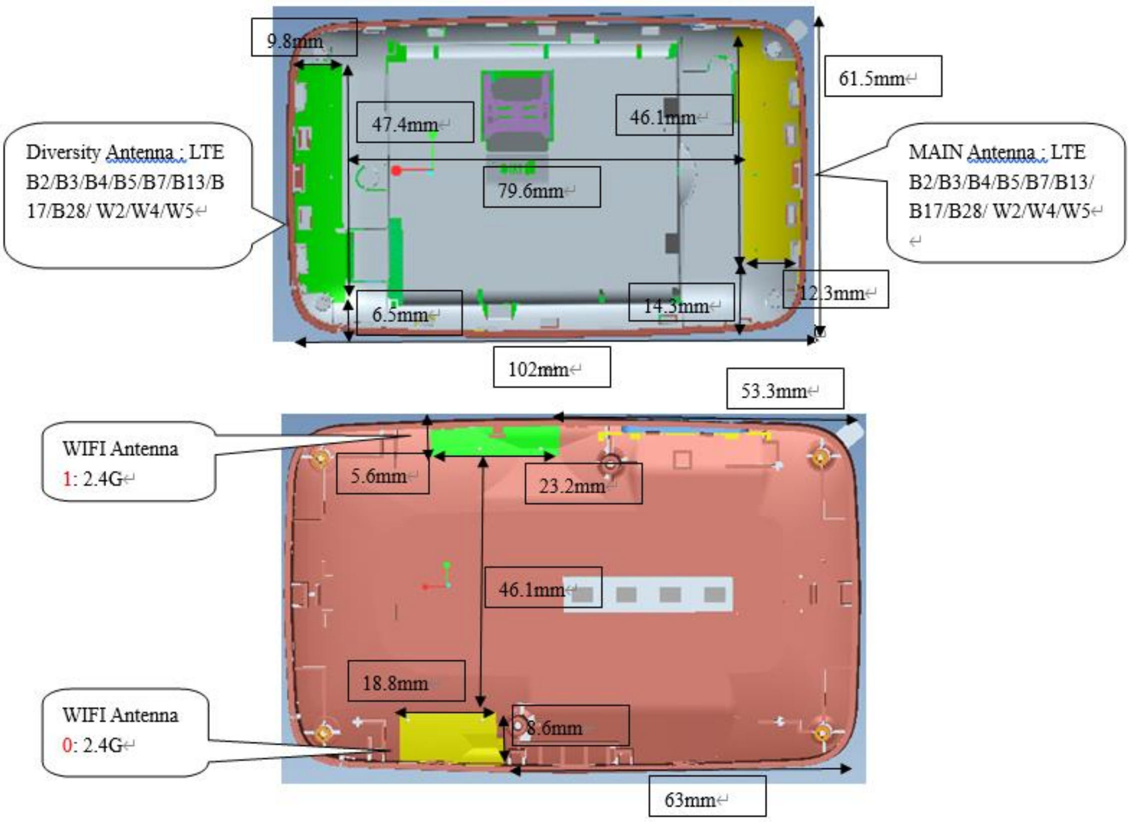
12 Simultaneous TX SAR Considerations

12.1 Introduction

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

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

12.2 Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3 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	Yes	Yes	Yes	No	Yes	Yes
WLAN Ant1	Yes	Yes	Yes	No	Yes	No
WLAN Ant0	Yes	Yes	Yes	No	No	Yes

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:

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

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

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	**F(GHz)**	**Position**	**SAR test exclusion threshold(mW)**	**RF output power**		**SAR test exclusion**
				dBm	**mW**	
2.4GHz WLAN	2.45	Body	19.17	17	50.12	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WiFi2.4G-Ant0

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Body	Front 10mm	1.26 (WCDMA1900)	0.19	**1.45**

Table 13.2: The sum of reported SAR values for main antenna and WiFi2.4G-Ant1

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Body	Front 10mm	1.26 (WCDMA1900)	0.31	**1.57**

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom. The distance is 10 mm applied to the condition of body test.

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-gSAR 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:

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

Where P_{Target} is the power of manufacturing upper limit;

$P_{Measured}$ is the measured power in chapter 11.

Table 14.1: Duty Cycle

Mode	**Duty Cycle**
WCDMA&LTE FDD	1:1

14.1 SAR results for Fast SAR

Table 14.1-1: SAR Values (WCDMA1900 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
9538	1907.6	Front	/	21.00	21.5	0.589	**0.66**	1.05	**1.18**	0.05
9400	1880	Front	Fig.1	21.08	21.5	0.718	**0.79**	1.14	1.26	0.718
9262	1852.4	Front	/	21.03	21.5	0.709	**0.79**	1.12	**1.25**	-0.11
9538	1907.6	Rear	/	21	21.5	0.547	**0.61**	0.899	**1.01**	-0.12
9400	1880	Rear	/	21.08	21.5	0.585	**0.64**	0.945	**1.04**	-0.07
9262	1852.4	Rear	/	21.03	21.5	0.546	**0.61**	0.843	**0.94**	0.05
9400	1880	Left	/	21.08	21.5	0.345	**0.38**	0.614	**0.68**	0.01
9400	1880	Bottom	/	21.08	21.5	0.424	**0.47**	0.722	**0.80**	0.06
9400	1880	Top	/	21.08	21.5	0.362	**0.40**	0.576	**0.63**	0.01

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.1-2: SAR Values (WCDMA1700 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
1513	1752.6	Front	Fig.2	20.54	21.7	0.555	**0.72**	0.934	1.22	0.01
1412	1732.5	Front	/	20.55	21.7	0.536	**0.70**	0.898	**1.17**	0.07
1312	1712.4	Front	/	20.63	21.7	0.513	**0.66**	0.865	**1.11**	-0.15
1513	1752.6	Rear	/	20.54	21.7	0.412	**0.54**	0.672	**0.88**	-0.13
1412	1732.5	Rear	/	20.55	21.7	0.449	**0.59**	0.703	**0.92**	-0.04
1312	1712.4	Rear	/	20.63	21.7	0.436	**0.56**	0.672	**0.86**	-0.09
1513	1752.6	Left	/	20.54	21.7	0.432	**0.56**	0.778	**1.02**	-0.08
1412	1732.5	Left	/	20.55	21.7	0.413	**0.54**	0.745	**0.97**	-0.03
1312	1712.4	Left	/	20.63	21.7	0.428	**0.55**	0.768	**0.98**	-0.05
1412	1732.5	Bottom	/	20.55	21.7	0.118	**0.15**	0.193	**0.25**	-0.16
1412	1732.5	Top	/	20.55	21.7	0.322	**0.42**	0.532	**0.69**	0.17

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.1-3: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
4183	836.6	Front	/	21.00	22	0.454	**0.57**	0.609	**0.77**	-0.06
4233	846.6	Rear	/	21.02	22	0.507	**0.64**	0.685	**0.86**	-0.12
4183	836.6	Rear	/	21.00	22	0.469	**0.59**	0.639	**0.80**	-0.18
4132	826.4	Rear	Fig.3	21.01	22	0.55	**0.69**	0.763	0.96	0.55

4183	836.6	Left	/	21.00	22	0.065	**0.08**	0.118	**0.15**	0.09
4183	836.6	Bottom	/	21.00	22	0.231	**0.29**	0.32	**0.40**	0.02
4183	836.6	Top	/	21.00	22	0.261	**0.33**	0.374	**0.47**	0.15

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.1-4: SAR Values (LTE Band2 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
19100	1900	1RB-Mid	Front	/	20.93	21.7	0.561	**0.67**	0.866	**1.03**	0.01
18900	1880	1RB-Mid	Front	/	20.74	21.7	0.574	**0.72**	0.966	**1.20**	-0.02
18700	1860	1RB-Mid	Front	Fig.4	20.91	21.7	0.592	**0.71**	1.01	**1.21**	0.12
19100	1900	1RB-Mid	Rear	/	20.93	21.7	0.389	**0.46**	0.631	**0.75**	0.15
18900	1880	1RB-Mid	Rear	/	20.74	21.7	0.411	**0.51**	0.688	**0.86**	-0.05
18700	1860	1RB-Mid	Rear	/	20.91	21.7	0.467	**0.56**	0.794	**0.95**	-0.14
19100	1900	1RB-Mid	Left	/	20.93	21.7	0.185	**0.22**	0.334	**0.40**	-0.07
19100	1900	1RB-Mid	Bottom	/	20.93	21.7	0.171	**0.20**	0.294	**0.35**	-0.15
19100	1900	1RB-Mid	Top	/	20.93	21.7	0.332	**0.40**	0.554	**0.66**	0.04
19100	1900	50RB-Mid	Front	/	19.51	20.7	0.353	**0.46**	0.593	**0.78**	-0.07
18900	1880	50RB-Mid	Front	/	19.73	20.7	0.419	**0.52**	0.703	**0.88**	-0.17
18700	1860	50RB-Mid	Front	/	19.84	20.7	0.411	**0.50**	0.696	**0.85**	-0.05
18700	1860	50RB-Mid	Rear	/	19.84	20.7	0.336	**0.41**	0.569	**0.69**	0
18700	1860	50RB-Mid	Left	/	19.84	20.7	0.196	**0.24**	0.354	**0.43**	-0.05
18700	1860	50RB-Mid	Bottom	/	19.84	20.7	0.091	**0.11**	0.156	**0.19**	0.15
18700	1860	50RB-Mid	Top	/	19.84	20.7	0.26	**0.32**	0.434	**0.53**	-0.09
18700	1860	100RB	Front	/	19.78	20.7	0.351	**0.43**	0.597	**0.74**	-0.01
18700	1860	100RB	Rear	/	19.78	20.7	0.31	**0.38**	0.517	**0.64**	0.1

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.1-5: SAR Values (LTE Band4 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20300	1745	1RB-Mid	Front	/	20.6	21.9	0.413	**0.56**	0.64	**0.86**	0.01
20175	1732.5	1RB-High	Front	/	20.11	21.9	0.369	**0.56**	0.591	**0.89**	0.01
20050	1720	1RB-Mid	Front	/	20.54	21.9	0.416	**0.57**	0.654	**0.89**	0.12
20300	1745	1RB-Mid	Rear	/	20.6	21.9	0.36	**0.49**	0.585	**0.79**	-0.1
20300	1745	1RB-Mid	Left	Fig.5	20.6	21.9	0.372	**0.50**	0.669	**0.90**	0.372
20175	1732.5	1RB-High	Left	/	20.11	21.9	0.349	**0.53**	0.591	**0.89**	0.02
20050	1720	1RB-Mid	Left	/	20.54	21.9	0.353	**0.48**	0.634	**0.87**	-0.02
20300	1745	1RB-Mid	Bottom	/	20.6	21.9	0.177	**0.24**	0.301	**0.41**	-0.04
20300	1745	1RB-Mid	Top	/	20.6	21.9	0.256	**0.35**	0.422	**0.57**	-0.17
20175	1732.5	50RB-High	Front	/	19.72	20.9	0.256	**0.34**	0.408	**0.54**	0.12
20175	1732.5	50RB-High	Rear	/	19.72	20.9	0.335	**0.44**	0.559	**0.73**	-0.14
20175	1732.5	50RB-High	Left	/	19.72	20.9	0.329	**0.43**	0.608	**0.80**	-0.01
20175	1732.5	50RB-High	Bottom	/	19.72	20.9	0.153	**0.20**	0.258	**0.34**	-0.01
20175	1732.5	50RB-High	Top	/	19.72	20.9	0.197	**0.26**	0.324	**0.43**	0.12
20175	1732.5	100RB	Front	/	19.75	20.9	0.378	**0.49**	0.651	**0.85**	-0.15
20175	1732.5	100RB	Left	/	19.75	20.9	0.314	**0.41**	0.558	**0.73**	-0.18

Table 14.1-6: SAR Values (LTE Band5- Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20450	829	1RB-Middle	Front	/	21.26	22.5	0.458	**0.61**	0.677	**0.90**	0.15
20600	844	1RB-Middle	Rear	Fig.6	21.06	22.5	0.493	**0.69**	0.731	**1.02**	-0.08
20525	836.5	1RB-Middle	Rear	/	20.84	22.5	0.474	**0.69**	0.658	**0.96**	-0.08
20450	829	1RB-Middle	Rear	/	21.26	22.5	0.486	**0.65**	0.725	**0.96**	-0.08
20450	829	1RB-Middle	Left	/	21.26	22.5	0.089	**0.12**	0.18	**0.24**	-0.08
20450	829	1RB-Middle	Bottom	/	21.26	22.5	0.209	**0.28**	0.323	**0.43**	0.14
20450	829	1RB-Middle	Top	/	21.26	22.5	0.2	**0.27**	0.299	**0.40**	0.02
20450	829	25RB-Low	Front	/	20.07	21.5	0.373	**0.52**	0.545	**0.76**	0.08
20600	844	25RB-Low	Front	/	19.85	21.5	0.39	**0.57**	0.565	**0.83**	0.08
20525	836.5	25RB-Low	Front	/	19.88	21.5	0.409	**0.59**	0.6	**0.87**	0.08
20450	829	25RB-Low	Rear	/	20.07	21.5	0.365	**0.51**	0.541	**0.75**	-0.18
20450	829	25RB-Low	Left	/	20.07	21.5	0.058	**0.08**	0.109	**0.15**	-0.03
20450	829	25RB-Low	Bottom	/	20.07	21.5	0.162	**0.23**	0.242	**0.34**	-0.13
20450	829	25RB-Low	Top	/	20.07	21.5	0.151	**0.21**	0.225	**0.31**	0.1

20450	829	50RB	Rear	/	20.07	21.5	0.397	**0.55**	0.588	**0.82**	-0.18
20600	844	50RB	Front	/	19.85	21.5	0.392	**0.57**	0.575	**0.84**	0.08

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.1-7: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
21350	2560	1RB-Mid	Front	Fig.7	21.18	21.7	0.588	**0.66**	1.1	**1.24**	0.07
21100	2535	1RB-Mid	Front	/	21.32	21.7	0.578	**0.63**	1.05	**1.15**	-0.17
20850	2510	1RB-Mid	Front	/	21.44	21.7	0.565	**0.60**	1.03	**1.09**	-0.13
21350	2560	1RB-Mid	Rear	/	21.18	21.7	0.494	**0.56**	0.997	**1.12**	-0.13
21100	2535	1RB-Mid	Rear	/	21.32	21.7	0.494	**0.54**	0.969	**1.06**	0.1
20850	2510	1RB-Mid	Rear	/	21.44	21.7	0.457	**0.49**	0.908	**0.96**	0.16
20850	2510	1RB-Mid	Left	/	21.44	21.7	0.191	**0.20**	0.332	**0.35**	-0.14
20850	2510	1RB-Mid	Bottom	/	21.44	21.7	0.106	**0.11**	0.192	**0.20**	-0.17
20850	2510	1RB-Mid	Top	/	21.44	21.7	0.129	**0.14**	0.244	**0.26**	0.02
21350	2560	50RB-High	Front	/	20.26	20.7	0.493	**0.55**	0.917	**1.01**	0.13
21100	2535	50RB-High	Front	/	20.31	20.7	0.461	**0.50**	0.852	**0.93**	0.09
20850	2510	50RB-Mid	Front	/	20.06	20.7	0.41	**0.48**	0.742	**0.86**	-0.13
21350	2560	50RB-High	Rear	/	20.26	20.7	0.402	**0.44**	0.807	**0.89**	-0.18
21100	2535	50RB-High	Rear	/	20.31	20.7	0.399	**0.44**	0.799	**0.87**	0.11
20850	2510	50RB-Mid	Rear	/	20.06	20.7	0.362	**0.42**	0.728	**0.84**	-0.04
21100	2535	50RB-High	Left	/	20.31	20.7	0.146	**0.16**	0.255	**0.28**	0.16
21100	2535	50RB-High	Bottom	/	20.31	20.7	0.084	**0.09**	0.152	**0.17**	-0.04
21100	2535	50RB-High	Top	/	20.31	20.7	0.108	**0.12**	0.204	**0.22**	-0.17
21100	2535	100RB	Front	/	20.24	20.7	0.451	**0.50**	0.842	**0.94**	0.07
21100	2535	100RB	Rear	/	20.24	21	0.4	**0.48**	0.802	**0.96**	0.11

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.1-8: SAR Values (LTE Band13 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
23230	782	1RB-Mid	Front	/	21.13	22.5	0.535	**0.73**	0.751	**1.03**	-0.17
23230	782	1RB-Mid	Rear	Fig.8	21.13	22.5	0.623	**0.85**	0.881	**1.21**	0.623
23230	782	1RB-Mid	Left	/	21.13	22.5	0.061	**0.08**	0.104	**0.14**	-0.17
23230	782	1RB-Mid	Bottom	/	21.13	22.5	0.277	**0.38**	0.394	**0.54**	0.18
23230	782	1RB-Mid	Top	/	21.13	22.5	0.307	**0.42**	0.441	**0.60**	-0.02
23230	782	25RB-Mid	Front	/	20.08	21.5	0.409	**0.57**	0.574	**0.80**	-0.01
23230	782	25RB-Mid	Rear	/	20.08	21.5	0.464	**0.64**	0.657	**0.91**	-0.12
23230	782	25RB-Mid	Left	/	20.08	21.5	0.046	**0.06**	0.077	**0.11**	0.12
23230	782	25RB-Mid	Bottom	/	20.08	21.5	0.217	**0.30**	0.309	**0.43**	0.14
23230	782	25RB-Mid	Top	/	20.08	21.5	0.231	**0.32**	0.329	**0.46**	-0.14
23230	782	50RB	Front	/	20.04	21.5	0.469	**0.66**	0.657	**0.92**	0.16
23230	782	50RB	Rear	/	20.04	21.5	0.447	**0.63**	0.625	**0.87**	0.01

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_10MHz.

Table 14.1-9: SAR Values (LTE Band17 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
23780	709	1RB-Low	Front	/	21.13	22.5	0.4	**0.55**	0.576	**0.79**	-0.05
23780	709	1RB-Low	Rear	Fig.9	21.13	22.5	0.417	**0.57**	0.596	**0.82**	0.417
23780	709	1RB-Low	Left	/	21.13	22.5	0.053	**0.07**	0.09	**0.12**	0.02
23780	709	1RB-Low	Bottom	/	21.13	22.5	0.206	**0.28**	0.292	**0.40**	0.12
23780	709	1RB-Low	Top	/	21.13	22.5	0.147	**0.20**	0.215	**0.29**	0.02
23780	709	25RB-Low	Front	/	20.18	21.5	0.312	**0.42**	0.448	**0.61**	-0.06
23780	709	25RB-Low	Rear	/	20.18	21.5	0.304	**0.41**	0.434	**0.59**	0.14
23780	709	25RB-Low	Left	/	20.18	21.5	0.039	**0.05**	0.068	**0.09**	0.09
23780	709	25RB-Low	Bottom	/	20.18	21.5	0.169	**0.23**	0.243	**0.33**	0.15
23780	709	25RB-Low	Top	/	20.18	21.5	0.123	**0.17**	0.178	**0.24**	-0.05

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_10MHz.

14.2 SAR results for Standard procedure

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

Table 14.2-1: SAR Values (WCDMA1900 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
9400	1880	Front	Fig.1	21.08	21.5	0.718	**0.79**	1.14	1.26	0.718

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.2-2: SAR Values (WCDMA1700 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
1513	1752.6	Front	Fig.2	20.54	21.7	0.555	**0.72**	0.934	1.22	0.01

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.2-3: SAR Values (WCDMA 850 MHz Band - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g)(W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz									
4132	826.4	Rear	Fig.3	21.01	22	0.55	**0.69**	0.763	0.96	0.55

Note1: The distance between the EUT and the phantom bottom is 10mm

Table 14.2-4: SAR Values (LTE Band2 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
18700	1860	1RB-Mid	Front	Fig.4	20.91	21.7	0.592	**0.71**	1.01	1.21	0.12

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.2-5: SAR Values (LTE Band4 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20300	1745	1RB-Mid	Left	Fig.5	20.6	21.9	0.372	**0.50**	0.669	0.90	0.372

Table 14.2-6: SAR Values (LTE Band5- Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
20600	844	1RB-Middle	Rear	Fig.6	21.06	22.5	0.493	**0.69**	0.731	**1.02**	-0.08

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.2-7: SAR Values (LTE Band7 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
21350	2560	1RB-Mid	Front	Fig.7	21.18	21.7	0.588	**0.66**	1.1	**1.24**	0.07

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_20MHz.

Table 14.2-8: SAR Values (LTE Band13 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
23230	782	1RB-Mid	Rear	Fig.8	21.13	22.5	0.623	**0.85**	0.881	**1.21**	0.623

Note1: The distance between the EUT and the phantom bottom is 10mm.

Note2: The LTE mode is QPSK_10MHz.

Table 14.2-9: SAR Values (LTE Band17 - Body)

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C											
Frequency		Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
Ch.	MHz										
23780	709	1RB-Low	Rear	Fig.9	21.13	22.5	0.417	**0.57**	0.596	**0.82**	0.417

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK_10MHz.

14.3 WLAN Evaluation for 2.4G

According to the KDB248227 D01, SAR is measured for 2.4GHz 802.11b DSSS using the initial test position procedure.

Body Evaluation

Table 14.3-1: SAR Values (WLAN - Body)– 802.11b (Fast SAR)-Ant0

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2437	6	Front	/	16.67	17	0.089	**0.10**	0.158	**0.17**	-0.15
2437	6	Rear	/	16.67	17	0.065	**0.07**	0.121	**0.13**	0.03
2437	6	Left	/	16.67	17	0.011	**0.01**	0.02	**0.02**	-0.17
2437	6	Bottom	/	16.67	17	0.059	**0.06**	0.109	**0.12**	0.11

As shown above table, the initial test position for body is "Front". So the body SAR of WLAN is presented as below:

Table 14.3-2: SAR Values (WLAN - Body)– 802.11b (Full SAR)-Ant0

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2437	6	Front	Fig.10	16.67	17	0.096	**0.10**	0.172	**0.19**	-0.12

Note1: When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest estimated 1-g SAR conditions determined by area scans, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg.

Note2: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

Table 14.3-3: SAR Values (WLAN - Body) – 802.11b (Scaled Reported SAR)-Ant0

Ambient Temperature: 22.9 °C Liquid Temperature: 22.5°C						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2437	6	Front	100%	100%	**0.19**	**0.19**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.

Table 14.3-4: SAR Values (WLAN - Body)– 802.11b (Fast SAR)-Ant1

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2437	6	Front	/	16.98	17	0.152	**0.15**	0.309	**0.31**	-0.19
2437	6	Rear	/	16.98	17	0.041	**0.04**	0.077	**0.08**	-0.04
2437	6	Left	/	16.98	17	0.014	**0.01**	0.024	**0.02**	-0.15
2437	6	Top	/	16.98	17	0.057	**0.06**	0.107	**0.11**	-0.03

As shown above table, the initial test position for body is "Front". So the body SAR of WLAN is presented as below:

Table 14.3-5: SAR Values (WLAN - Body)– 802.11b (Full SAR)-Ant1

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃										
Frequency		Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g)(W/kg)	Power Drift (dB)
MHz	Ch.									
2437	6	Front	Fig.11	16.98	17	0.148	**0.15**	0.31	**0.31**	-0.19

Note1: When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest estimated 1-g SAR conditions determined by area scans, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg.

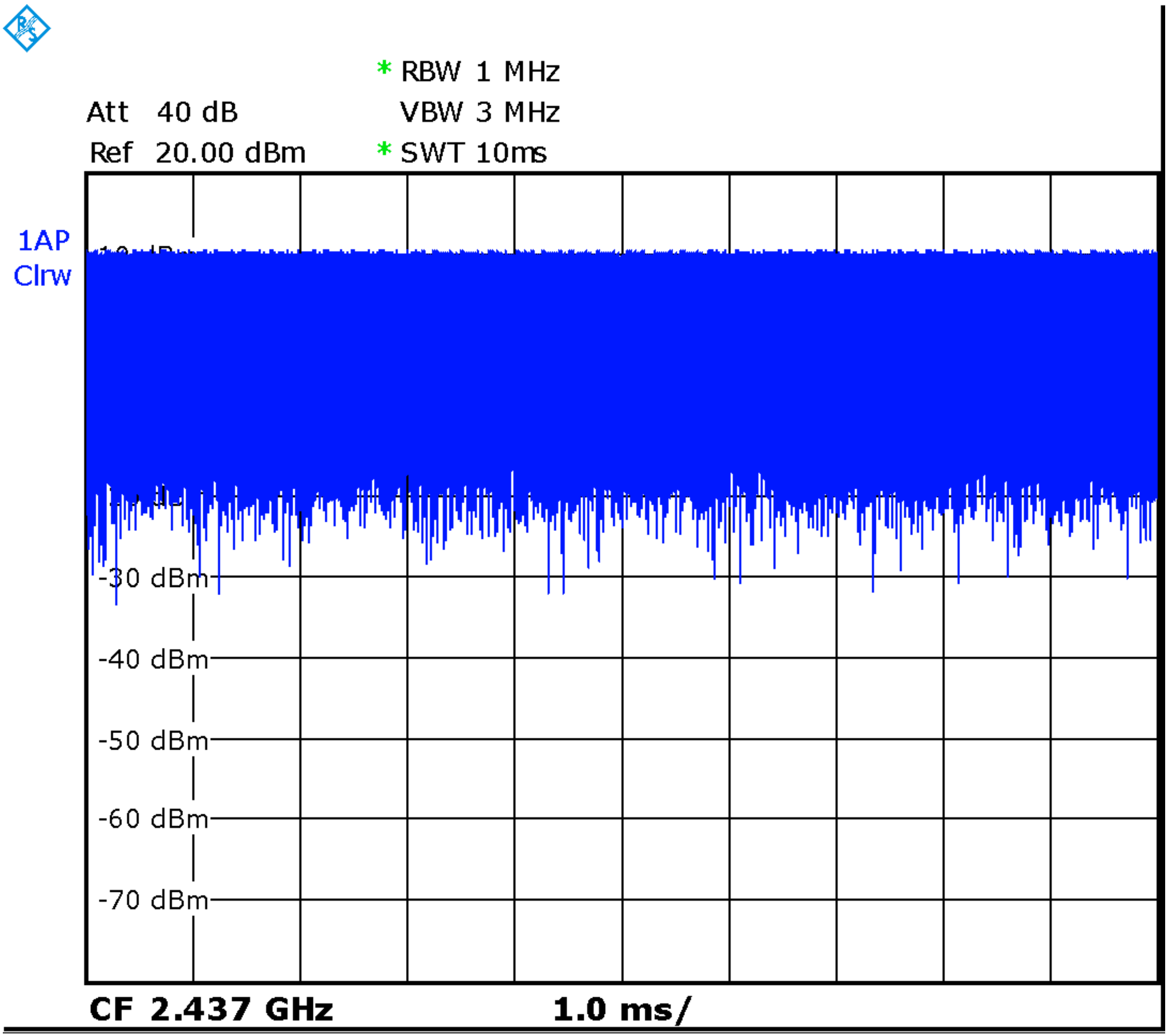
Note2: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

According to the KDB248227 D01, The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. The scaled reported SAR is presented as below.

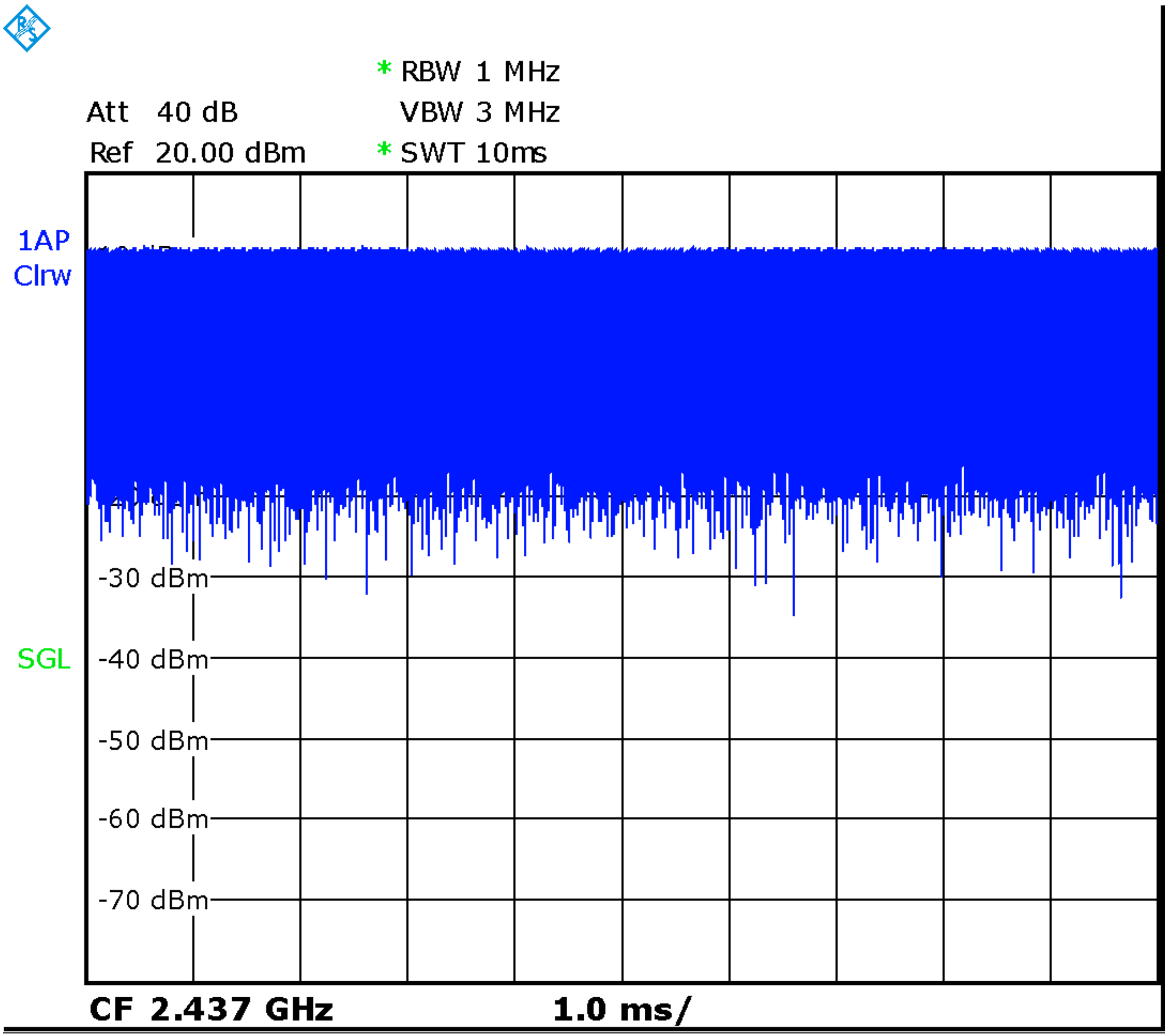
Table 14.3-6: SAR Values (WLAN - Body) – 802.11b (Scaled Reported SAR)-Ant1

Ambient Temperature: 22.9 ℃ Liquid Temperature: 22.5℃						
Frequency		Test Position	Actual duty factor	maximum duty factor	Reported SAR (1g)(W/kg)	Scaled reported SAR (1g)(W/kg)
MHz	Ch.					
2437	6	Front	100%	100%	**0.31**	**0.31**

SAR is not required for OFDM because the 802.11b adjusted SAR ≤ 1.2 W/kg.



Picture 14.1 Duty factor plot Ant0



Picture 14.2 Duty factor plot Ant1

15 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.

Mode	CH	Freq	Test Poisition	Original SAR (W/kg)	First Repeated SAR(W/kg)	The Ratio
WCDMA1700	1513	1752.6MHz	Front 10mm	0.934	0.929	1.01
WCDMA1900	9400	1880 MHz	Front 10mm	1.14	1.09	1.05
LTE Band2	18700	1860 MHz	Front 10mm	1.01	0.98	1.03
LTE Band7	21350	2560 MHz	Front 10mm	1.10	1.07	1.03
LTE Band13	23230	782 MHz	Front 10mm	0.881	0.863	1.02

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	√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	√3	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	2.0	R	√3	1	1	1.2	1.2	∞
4	Linearity	B	4.7	R	√3	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	R	√3	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	√3	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	√3	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	√3	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	√3	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	√3	1	1	0	0	∞
11	Probe positioned mech. Restrictions	B	0.8	R	√3	1	1	0.5	0.5	∞
12	Probe positioning with respect to phantom shell	B	6.7	R	√3	1	1	3.9	3.9	∞
13	Post-processing	B	1.0	R	√3	1	1	0.6	0.6	∞
14	Fast SAR z-Approximation	B	14.0	R	√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	N5239A	MY46110673	January 24, 2020	One year
02	Power meter	NRP2	106277	September 4, 2019	One year
03	Power sensor	NRP8S	104291		
04	Signal Generator	E4438C	MY49070393	January 4, 2020	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	129942	February 10, 2020	One year
07	E-field Probe	SPEAG EX3DV4	3617	Jan 30, 2020	One year
08	DAE	SPEAG DAE4	777	Jan 8, 2020	One year
09	Dipole Validation Kit	SPEAG D750V3	1017	July 18,2019	One year
10	Dipole Validation Kit	SPEAG D835V2	4d069	July 18,2019	One year
11	Dipole Validation Kit	SPEAG D1750V2	1003	July 16,2019	One year
12	Dipole Validation Kit	SPEAG D1900V2	5d101	July 17,2019	One year
13	Dipole Validation Kit	SPEAG D2450V2	853	July 17,2019	One year
14	Dipole Validation Kit	SPEAG D2600V2	1012	July 17,2019	One year

END OF REPORT BODY

ANNEX A Graph Results

WCDMA1900 CH9400 Front

Date: 7/5/2020

Electronics: DAE4 Sn777

Medium: body 1900 MHz

Medium parameters used: f = 1880MHz; σ = 1.363 mho/m; εr = 39.35; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA1900-BII 1880 Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(8.14,8.14,8.14)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.63 W/kg

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

Reference Value = 29.26 V/m; Power Drift = 0.718 dB

Peak SAR (extrapolated) = 1.83 W/kg

SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.718 W/kg

Maximum value of SAR (measured) = 1.53 W/kg

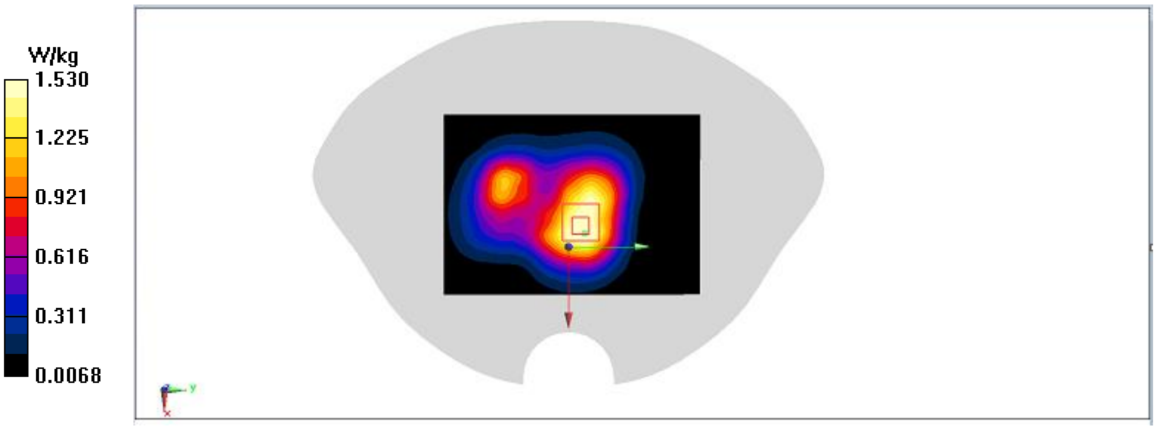


Fig.1

WCDMA1700 CH1513 Front

Date: 7/4/2020

Electronics: DAE4 Sn777

Medium: body 1750 MHz

Medium parameters used: f = 1752.6MHz; σ = 1.377 mho/m; εr = 39.44; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WCDMA1700-BIV 1752.6 Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(8.41,8.41,8.41)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.37 W/kg

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

Reference Value = 22.28 V/m; Power Drift = 0.555 dB

Peak SAR (extrapolated) = 1.64 W/kg

SAR(1 g) = 0.934 W/kg; SAR(10 g) = 0.555 W/kg

Maximum value of SAR (measured) = 1.37W/kg

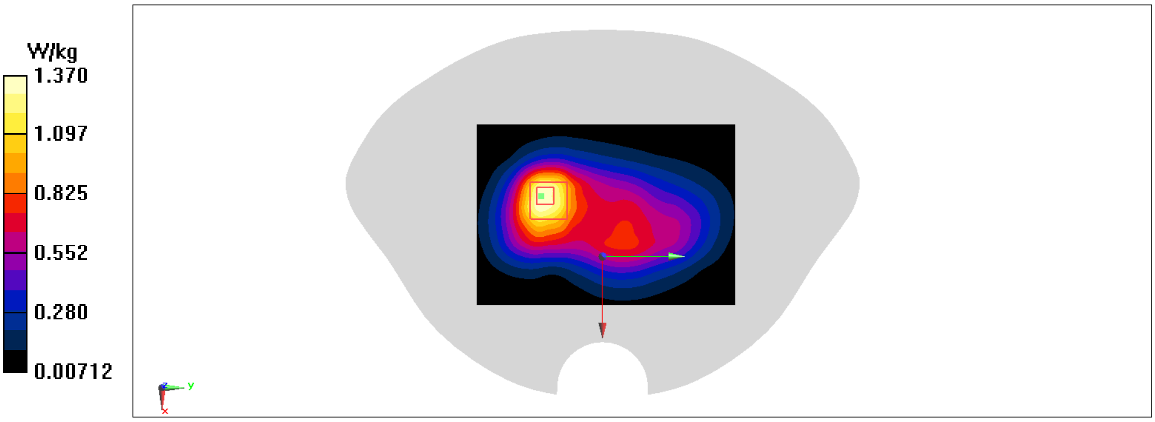


Fig.2

WCDMA850 CH4132 Rear

Date: 7/3/2020

Electronics: DAE4 Sn777

Medium: body 835 MHz

Medium parameters used: f = 826.4MHz; σ = 0.875 mho/m; εr = 41.46; ρ = 1000 kg/m^3

Ambient Temperature: 22.5ºC, Liquid Temperature: 22.3ºC

Communication System: WCDMA850-BV 826.4 Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(9.66,9.66,9.66)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.974 W/kg

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

Reference Value = 33.16 V/m; Power Drift = 0.55 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.763 W/kg; SAR(10 g) = 0.55 W/kg

Maximum value of SAR (measured) = 0.978 W/kg

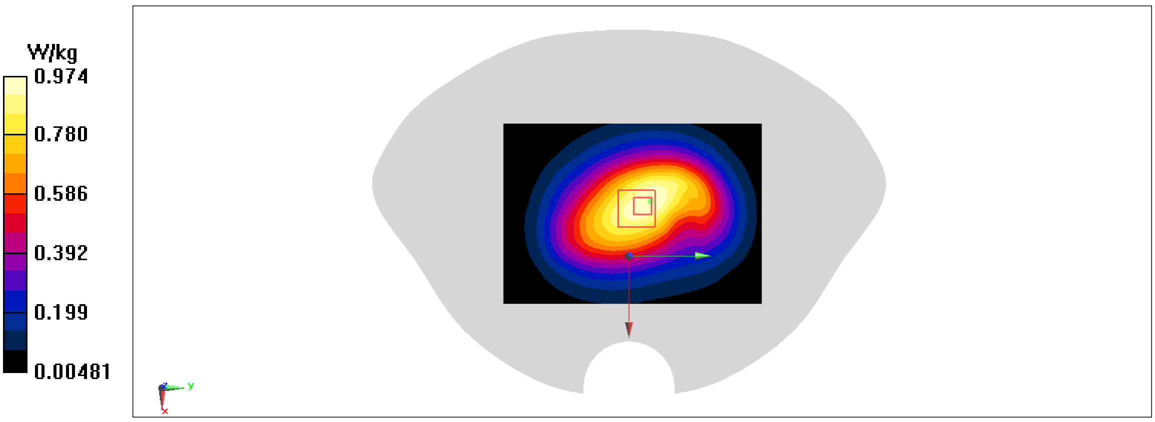


Fig.3

LTE1900-FDD2_CH18700 1RB-Middle Front

Date: 7/5/2020

Electronics: DAE4 Sn777

Medium: body 1900 MHz

Medium parameters used: f = 1860 MHz; σ = 1.344 mho/m; εr = 39.38; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE1900-FDD2 1860 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(8.14,8.14,8.14)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.57 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.35 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.76 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.592 W/kg
Maximum value of SAR (measured) = 1.46 W/kg

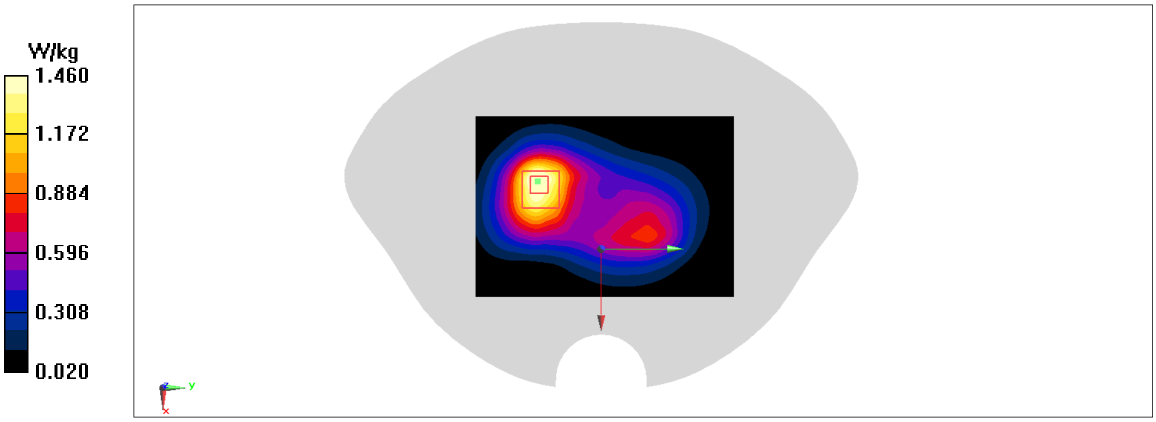


Fig.4

LTE1700-FDD4_CH20300 1RB-Middle Left Edge

Date: 7/4/2020
Electronics: DAE4 Sn777
Medium: body 1750 MHz
Medium parameters used: f = 1745 MHz; σ = 1.369 mho/m; εr = 39.45; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C
Communication System: LTE1700-FDD4 1745 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(8.41,8.41,8.41)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.04 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.69 V/m; Power Drift = 0.372 dB
Peak SAR (extrapolated) = 1.2 W/kg
SAR(1 g) = 0.669 W/kg; SAR(10 g) = 0.372 W/kg
Maximum value of SAR (measured) = 0.989 W/kg

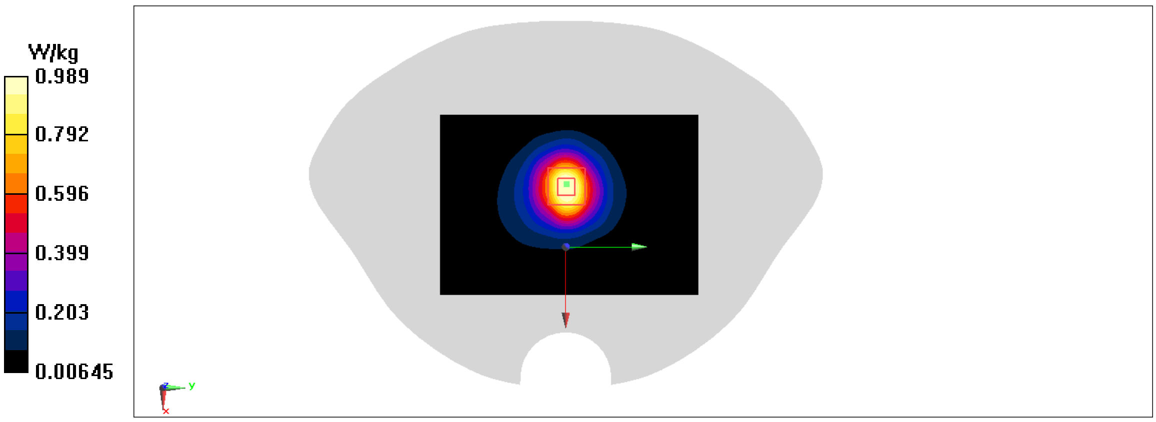


Fig.5

LTE850-FDD5_CH20600 1RB-Middle Rear

Date: 7/3/2020

Electronics: DAE4 Sn777

Medium: body 835 MHz

Medium parameters used: f = 844 MHz; σ = 0.893 mho/m; εr = 41.44; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE850-FDD5 844 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(9.66,9.66,9.66)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.973 W/kg

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

Reference Value = 27.32 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 1.16 W/kg

SAR(1 g) = 0.731 W/kg; SAR(10 g) = 0.493 W/kg

Maximum value of SAR (measured) = 0.995 W/kg

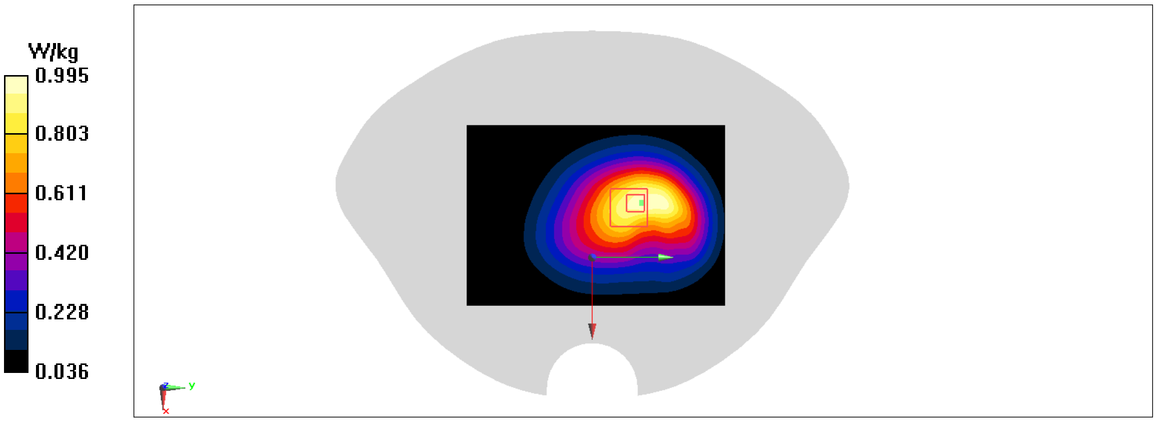


Fig.6

LTE2500-FDD7_CH21350 1RB-Middle Front

Date: 7/7/2020

Electronics: DAE4 Sn777

Medium: body 2600 MHz

Medium parameters used: f = 2560 MHz; σ = 1.918 mho/m; εr = 38.51; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE2500-FDD7 2560 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(7.65,7.65,7.65)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.78 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 19.82 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 2.22 W/kg
SAR(1 g) = 1.1 W/kg; SAR(10 g) = 0.588 W/kg
Maximum value of SAR (measured) =1.78 W/kg

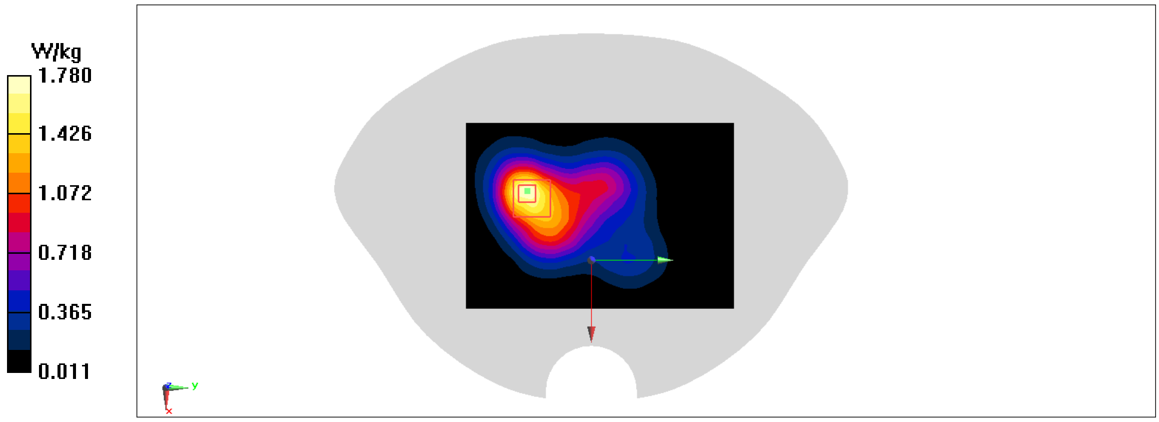


Fig.7

LTE750-FDD13_CH23230 1RB-Middle Rear
Date: 7/2/2020
Electronics: DAE4 Sn777
Medium: body 750 MHz
Medium parameters used: f = 782 MHz; σ = 0.927 mho/m; εr = 42.03; ρ = 1000 kg/m^3
Ambient Temperature: 22.5ºC, Liquid Temperature: 22.3ºC
Communication System: LTE750-FDD13 782 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(10.07,10.07,10.07)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.21 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.86 V/m; Power Drift = 0.623 dB
Peak SAR (extrapolated) = 1.3 W/kg
SAR(1 g) = 0.881 W/kg; SAR(10 g) = 0.623 W/kg
Maximum value of SAR (measured) = 1.14 W/kg

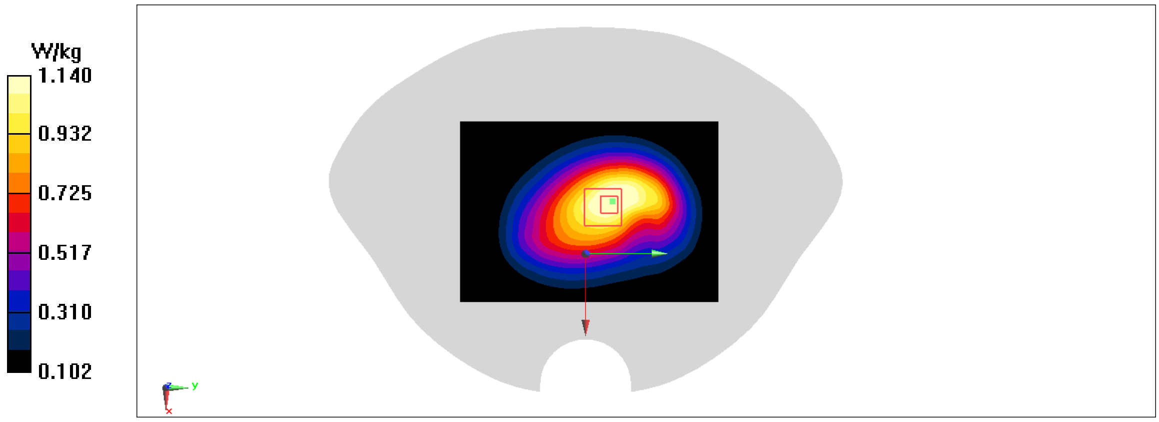


Fig.8

LTE700-FDD17_CH23780 1RB-Low Rear

Date: 7/2/2020

Electronics: DAE4 Sn777

Medium: body 750 MHz

Medium parameters used: f = 709 MHz; σ = 0.858 mho/m; εr = 42.12; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: LTE700-FDD17 709 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(10.07,10.07,10.07)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.782 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.94 V/m; Power Drift = 0.417 dB
Peak SAR (extrapolated) = 0.888 W/kg
SAR(1 g) = 0.596 W/kg; SAR(10 g) = 0.417 W/kg
Maximum value of SAR (measured) = 0.770W/kg

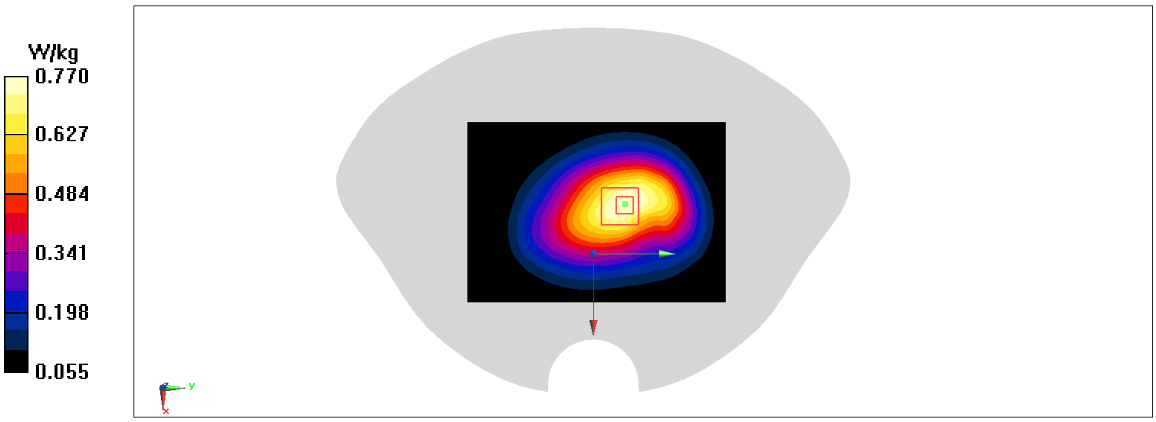


Fig.9

WLAN2450_CH6 Ant0 Front

Date: 7/6/2020

Electronics: DAE4 Sn777

Medium: body 2450 MHz

Medium parameters used: f = 2437MHz; σ = 1.788 mho/m; εr = 38.6; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WLAN2450 2437 Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(7.65,7.65,7.65)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.259 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.526 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.319 W/kg
SAR(1 g) = 0.172 W/kg; SAR(10 g) = 0.096 W/kg
Maximum value of SAR (measured) = 0.257 W/kg

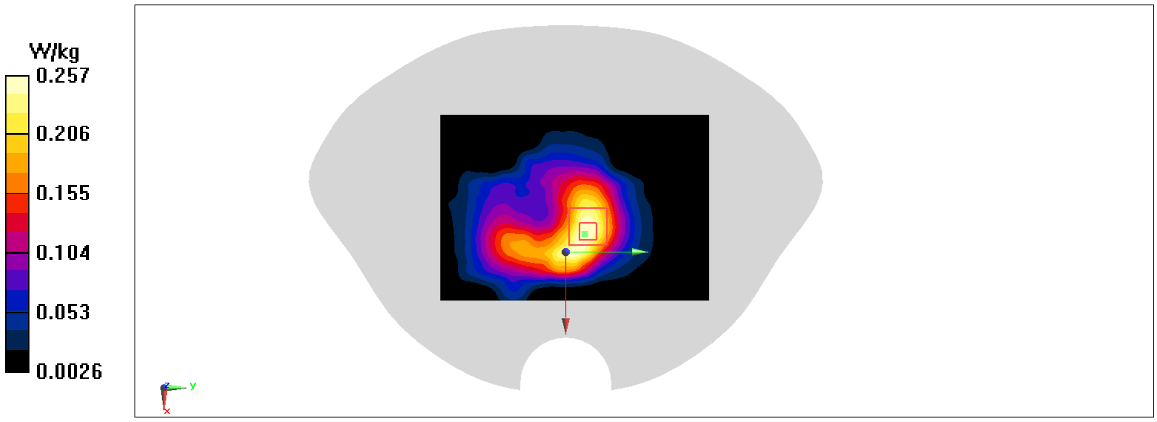


Fig.10

WLAN2450_CH6 Ant1 Front

Date: 7/6/2020

Electronics: DAE4 Sn777

Medium: body 2450 MHz

Medium parameters used: f = 2437MHz; σ = 1.788 mho/m; εr = 38.6; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C, Liquid Temperature: 22.3°C

Communication System: WLAN2450 2437 Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(7.65,7.65,7.65)

Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.52 W/kg

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

Reference Value = 6.29 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 0.639 W/kg

SAR(1 g) = 0.31 W/kg; SAR(10 g) = 0.148 W/kg

Maximum value of SAR (measured) =0.512 W/kg

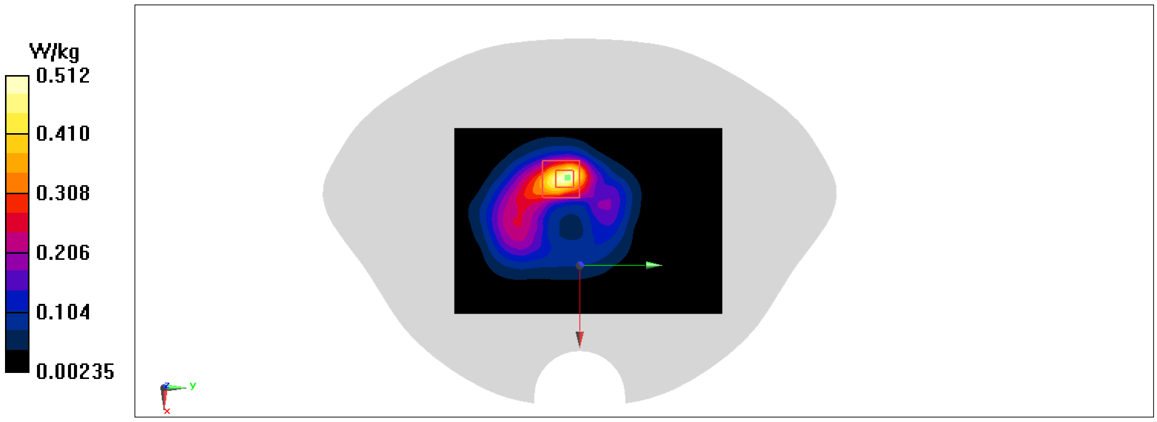


Fig.11

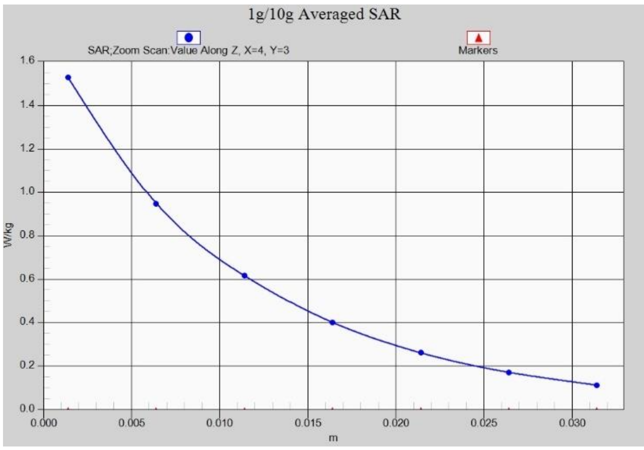


Fig. 1-1 Z-Scan at power reference point (WCDMA1900)

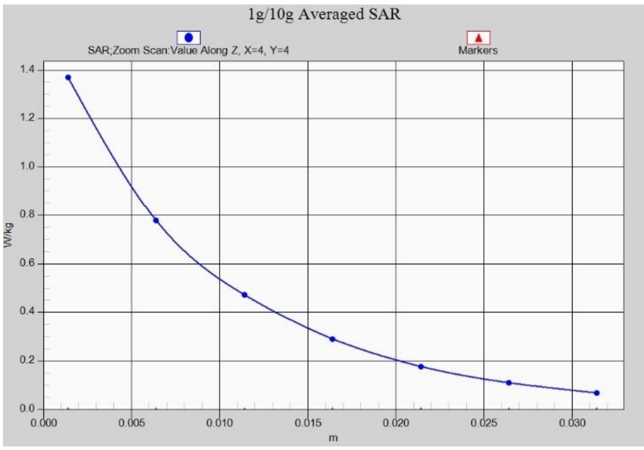


Fig. 1-2 Z-Scan at power reference point (WCDMA1700)

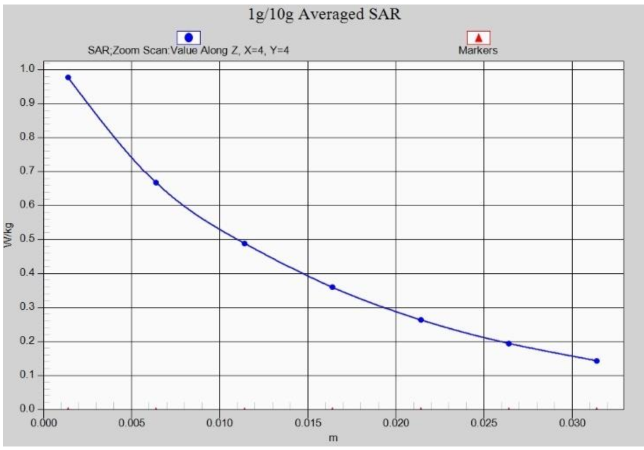


Fig. 1-3 Z-Scan at power reference point (WCDMA850)

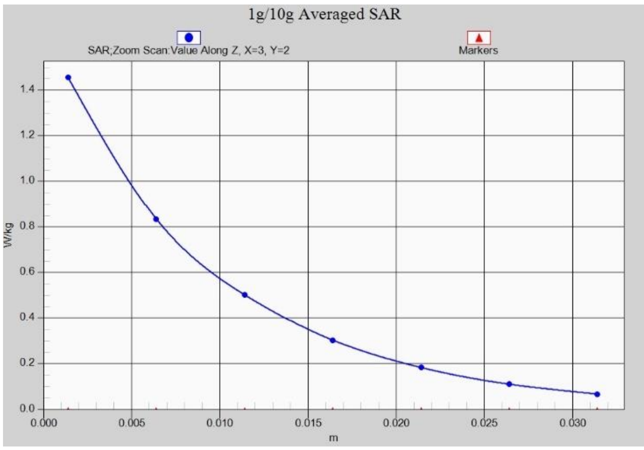


Fig. 1-4 Z-Scan at power reference point (LTE Band 2)

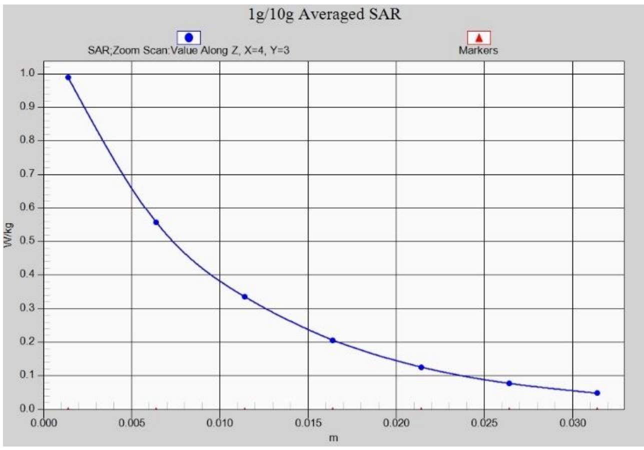


Fig. 1-5 Z-Scan at power reference point (LTE Band 4)

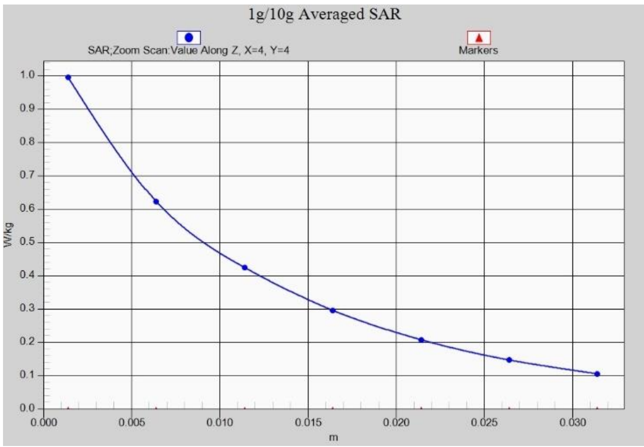


Fig. 1-6 Z-Scan at power reference point (LTE Band 5)

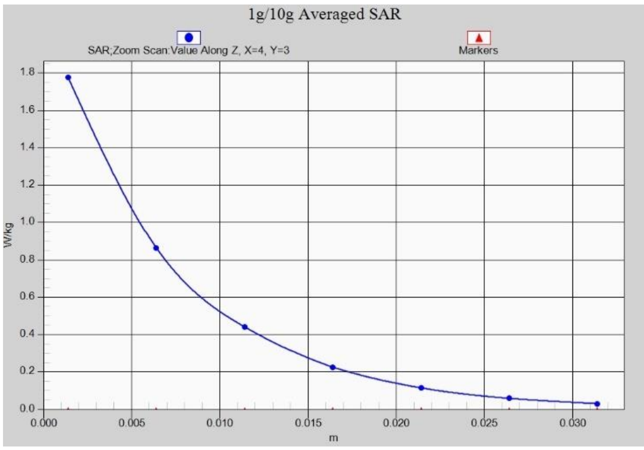


Fig. 1-7 Z-Scan at power reference point (LTE Band 7)

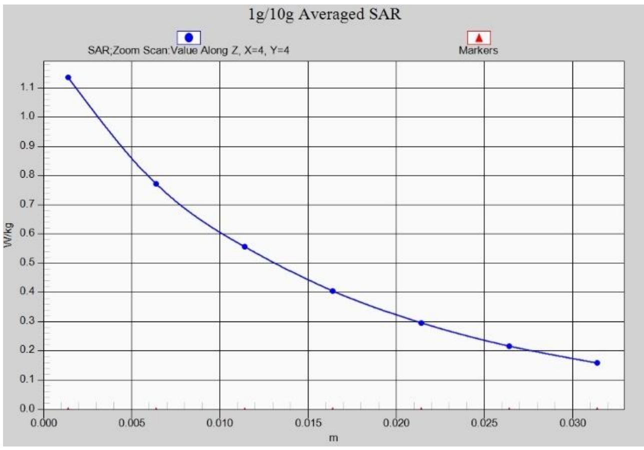


Fig. 1-8 Z-Scan at power reference point (LTE Band 13)

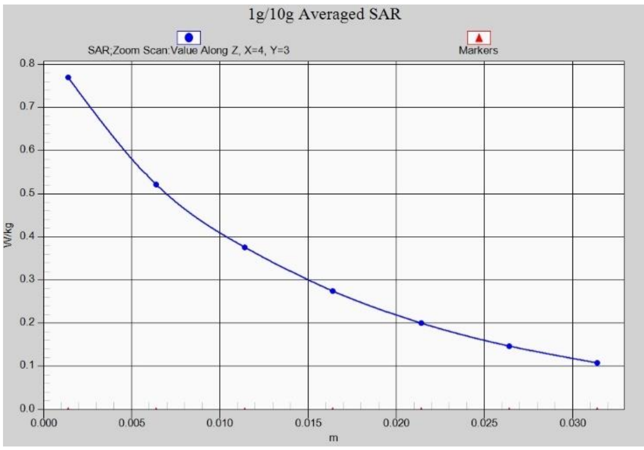


Fig. 1-9 Z-Scan at power reference point (LTE Band 17)

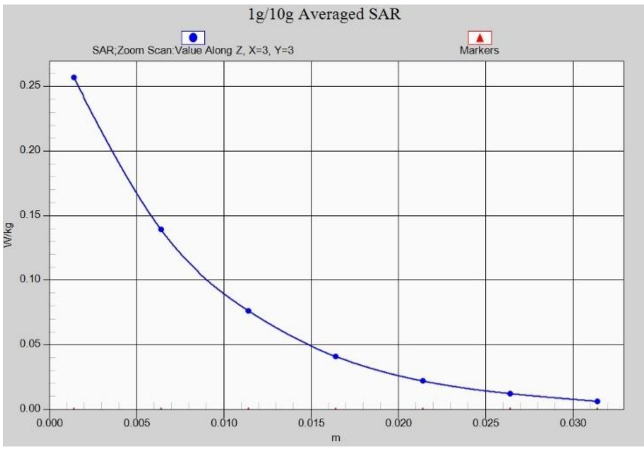


Fig. 1-10 Z-Scan at power reference point (2450 MHz)-Ant0

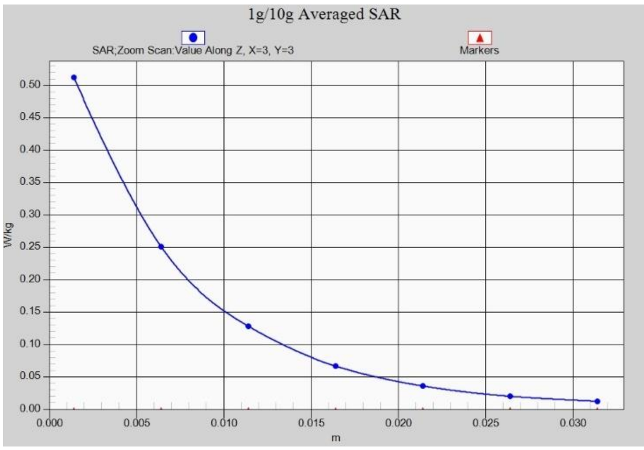


Fig. 1-11 Z-Scan at power reference point (2450 MHz)- Ant1

ANNEX B System Verification Results

750 MHz

Date: 7/2/2020

Electronics: DAE4 Sn777

Medium: Head 750 MHz

Medium parameters used: f = 750 MHz; σ =0.888 mho/m; ε_r = 41.35; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C

Communication System: CW Frequency: 750 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(10.07,10.07,10.07)

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

Reference Value = 60.74 V/m; Power Drift = -0.08

Fast SAR: SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.38 W/kg

Maximum value of SAR (interpolated) = 2.82 W/kg

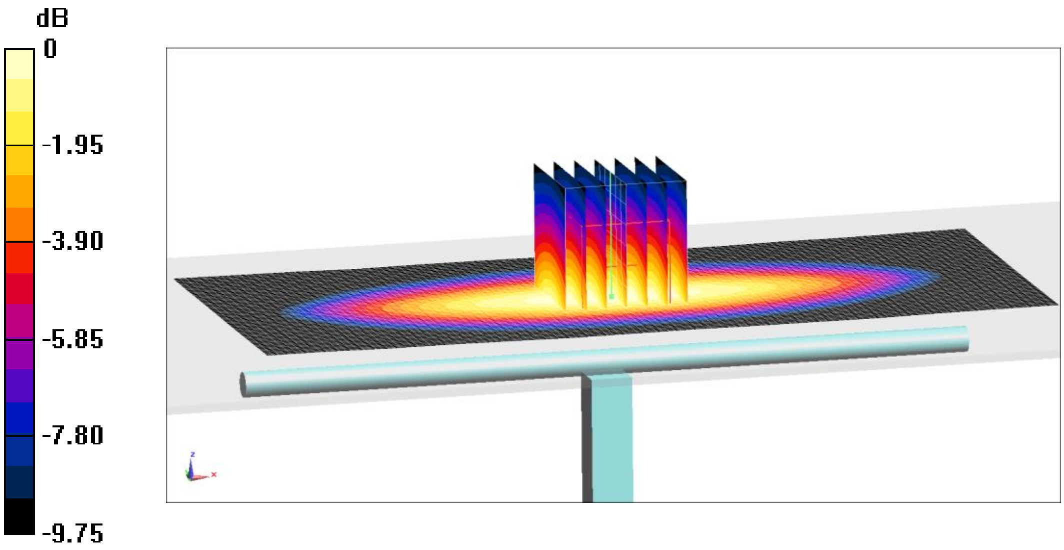
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =60.74 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 3.2 W/kg

SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.42 W/kg

Maximum value of SAR (measured) = 2.83 W/kg



0 dB = 2.83 W/kg = 4.52 dB W/kg

Fig.B.1 validation 750 MHz 250mW

835 MHz

Date: 7/3/2020

Electronics: DAE4 Sn777

Medium: Head 835 MHz

Medium parameters used: f = 835 MHz; σ =0.892 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Probe: EX3DV4 – SN3617 ConvF(9.66,9.66,9.66)

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

Reference Value = 62.29 V/m; Power Drift = 0.06

Fast SAR: SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.54 W/kg

Maximum value of SAR (interpolated) = 3.11 W/kg

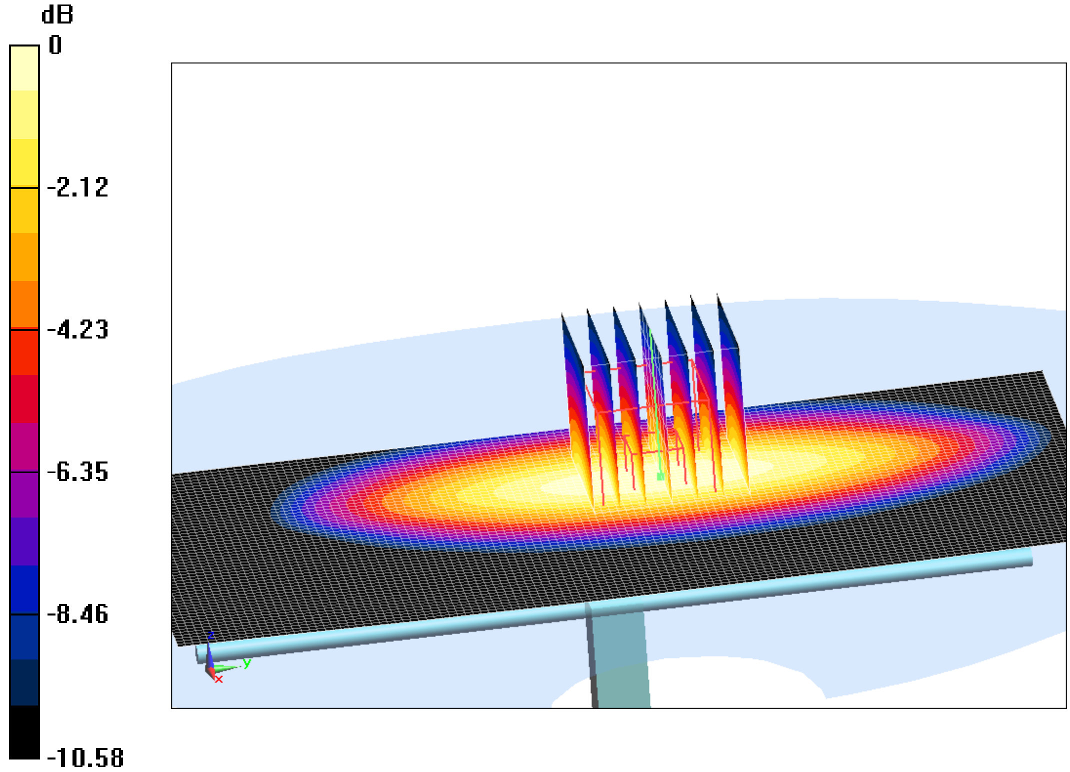
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =62.29 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.54 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.28 W/kg



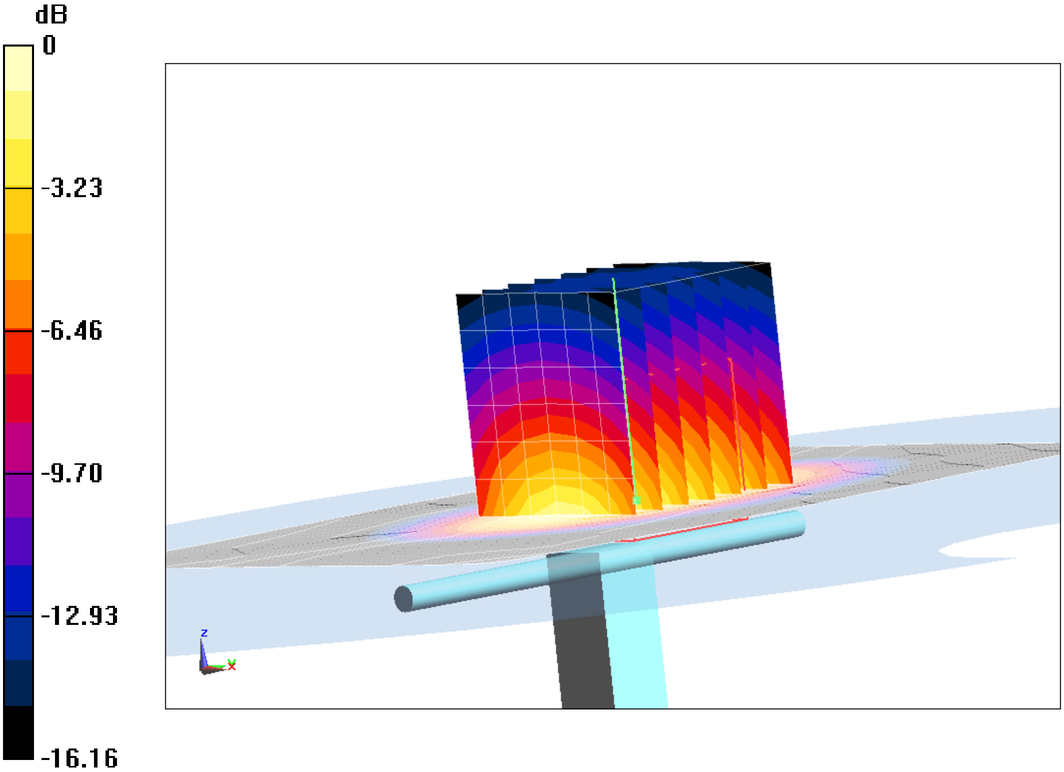
0 dB = 3.28 W/kg = 5.16 dB W/kg

Fig.B.2 validation 835 MHz 250mW

1750 MHz
Date: 7/4/2020
Electronics: DAE4 Sn777
Medium: Head 1750 MHz
Medium parameters used: f = 1750 MHz; σ =1.377 mho/m; ε_r = 40.82; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 1750 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(8.41,8.41,8.41)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 107.9 V/m; Power Drift = -0.03
Fast SAR: SAR(1 g) = 9.33 W/kg; SAR(10 g) = 4.73 W/kg
Maximum value of SAR (interpolated) = 14.19 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =107.9 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 16.59 W/kg
SAR(1 g) = 9.17 W/kg; SAR(10 g) = 4.83 W/kg
Maximum value of SAR (measured) = 14.09 W/kg



0 dB = 14.09 W/kg = 11.49 dB W/kg

Fig.B.3validation 1750 MHz 250mW

1900 MHz

Date: 7/5/2020

Electronics: DAE4 Sn777

Medium: Head 1900 MHz

Medium parameters used: f = 1900 MHz; σ =1.428 mho/m; ε_r = 39.99; ρ = 1000 kg/m^3

Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C

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

Probe: EX3DV4 – SN3617 ConvF(8.14,8.14,8.14)

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

Reference Value = 109.25 V/m; Power Drift = -0.02

Fast SAR: SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.14 W/kg

Maximum value of SAR (interpolated) = 14.98 W/kg

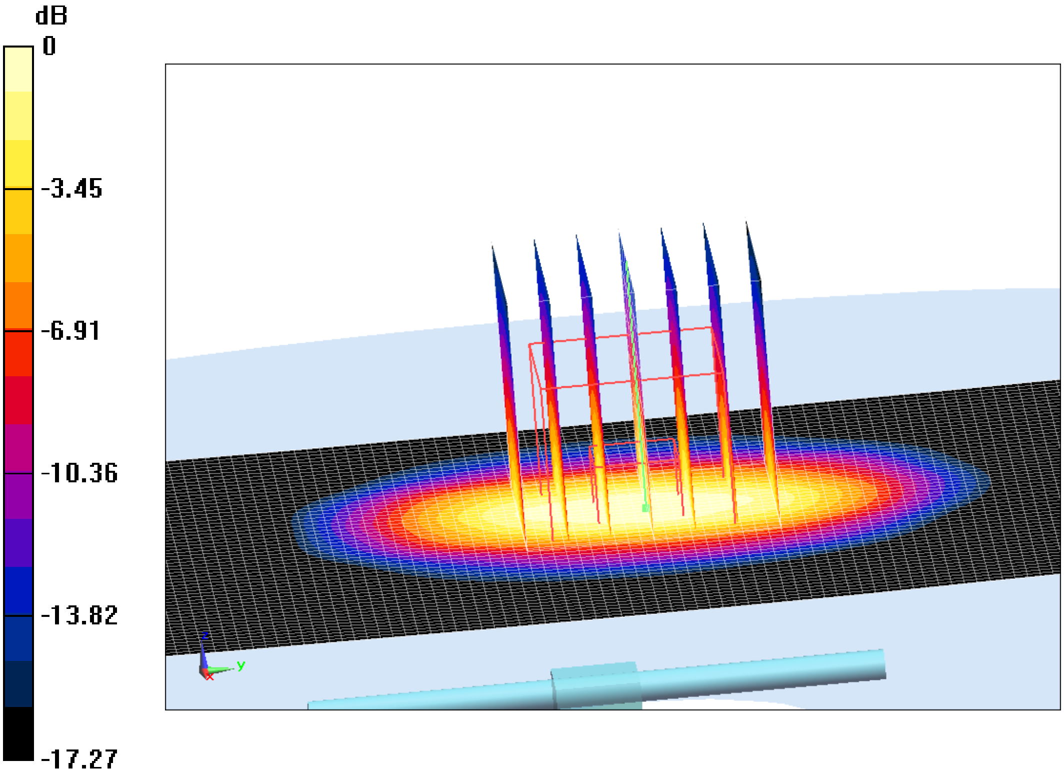
System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =109.25 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.82 W/kg

SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 14.78 W/kg



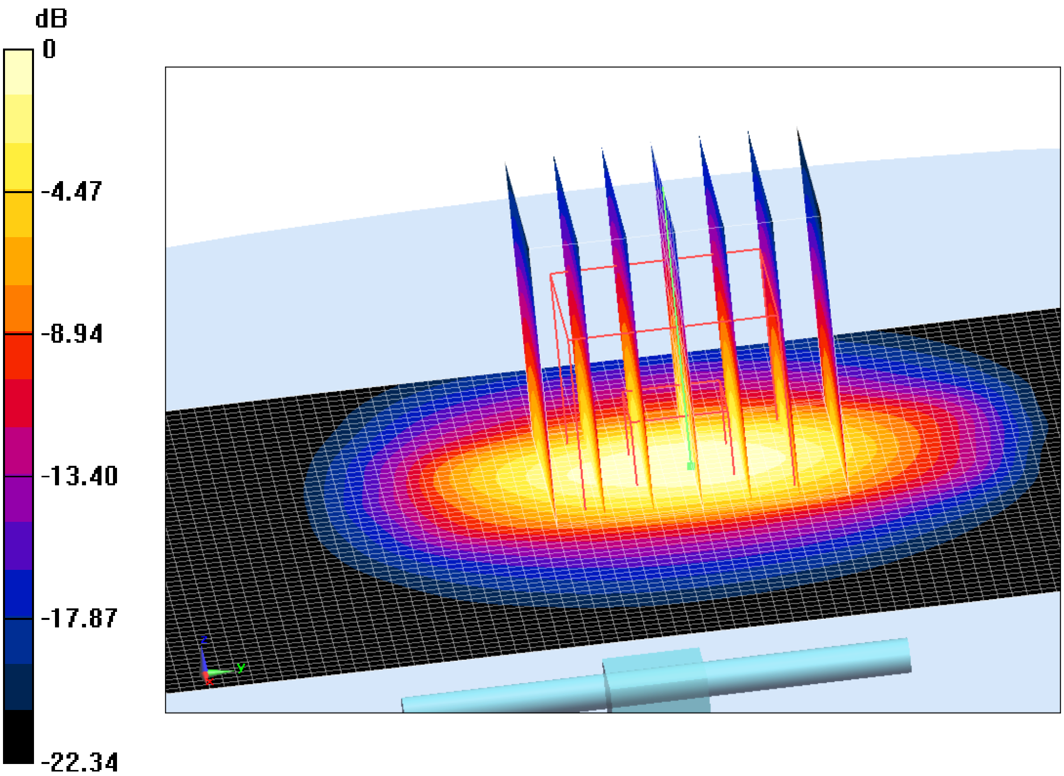
0 dB = 14.78 W/kg = 11.7 dB W/kg

Fig.B.4 validation 1900 MHz 250mW

2450 MHz
Date: 7/6/2020
Electronics: DAE4 Sn777
Medium: Head 2450 MHz
Medium parameters used: f = 2450 MHz; σ =1.78 mho/m; ε_r = 38.99; ρ = 1000 kg/m^3
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C
Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1
Probe: EX3DV4 – SN3617 ConvF(7.65,7.65,7.65)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 115.5 V/m; Power Drift = 0.04
Fast SAR: SAR(1 g) = 12.73 W/kg; SAR(10 g) = 5.98 W/kg
Maximum value of SAR (interpolated) = 21.56 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =115.5 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 25.82 W/kg
SAR(1 g) = 12.68 W/kg; SAR(10 g) = 6.12 W/kg
Maximum value of SAR (measured) = 21.47 W/kg



0 dB = 21.47 W/kg = 13.32 dB W/kg

Fig.B.5 validation 2450 MHz 250mW

2600 MHz

Date: 7/7/2020

Electronics: DAE4 Sn777

Medium: Head 2600 MHz

Medium parameters used: f = 2600 MHz; σ =1.925 mho/m; ε_r = 39.06; ρ = 1000 kg/m^3

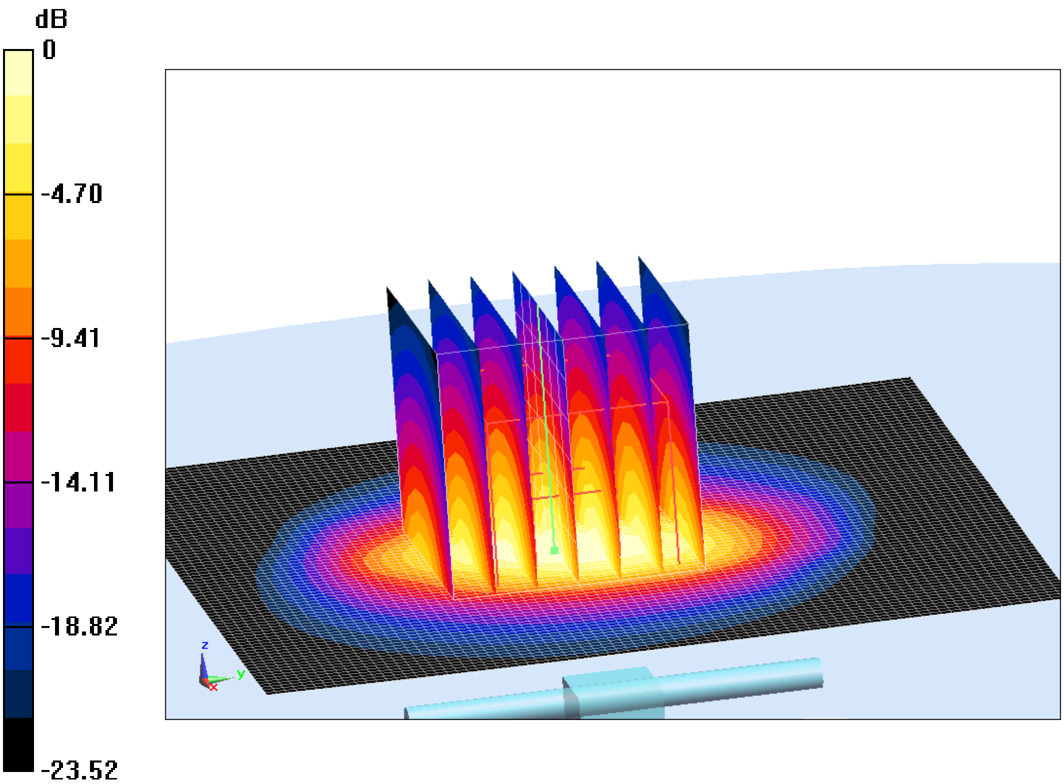
Ambient Temperature: 22.5°C Liquid Temperature: 22.3°C

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

Probe: EX3DV4 – SN3617 ConvF(7.52,7.52,7.52)

System Validation /Area Scan (81x191x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 117.26 V/m; Power Drift = 0.05
Fast SAR: SAR(1 g) = 13.89 W/kg; SAR(10 g) = 6.31 W/kg
Maximum value of SAR (interpolated) = 24.99 W/kg

System Validation /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value =117.26 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.68 W/kg
SAR(1 g) = 13.68 W/kg; SAR(10 g) = 6.25 W/kg
Maximum value of SAR (measured) = 24.47 W/kg



0 dB = 24.47 W/kg = 13.89 dB W/kg

Fig.B.6 validation 2600 MHz 250mW

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.

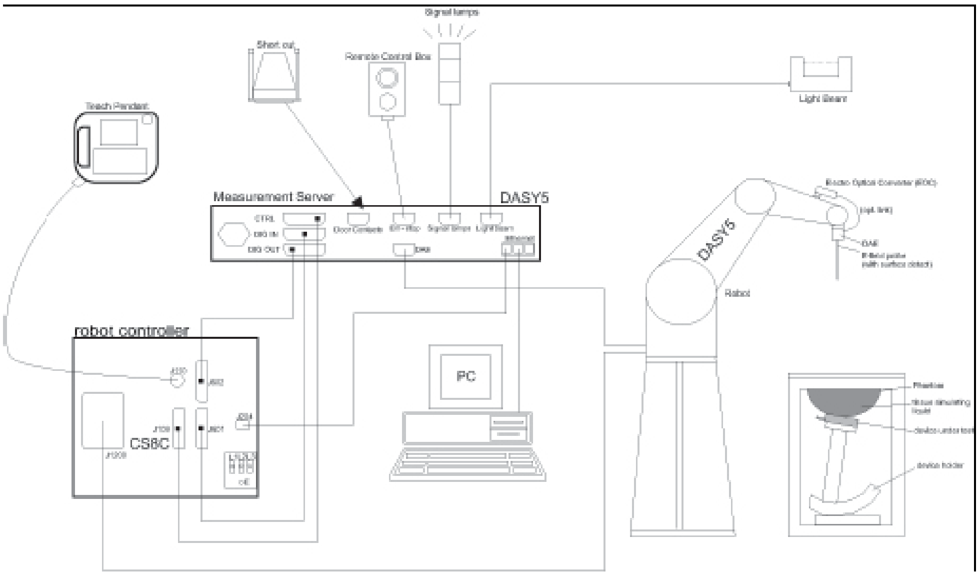
Table B.1 Comparison between area scan and zoom scan for system verification

Date	Band	Position	Area scan (1g)	Zoom scan (1g)	Drift (%)
2020/7/2	750	Head	2.14	2.15	-0.47
2020/7/3	835	Head	2.40	2.40	0.00
2020/7/4	1750	Head	9.33	9.17	1.74
2020/7/5	1900	Head	9.90	9.92	-0.20
2020/7/6	2450	Head	12.73	12.68	0.39
2020/7/7	2600	Head	13.89	13.68	1.54

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.

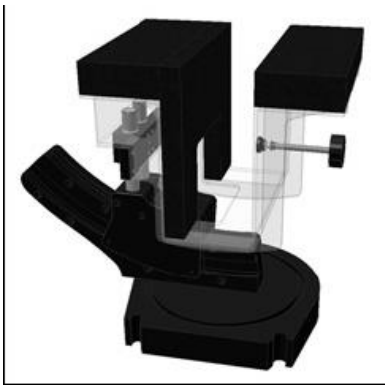
The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales are the ear reference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

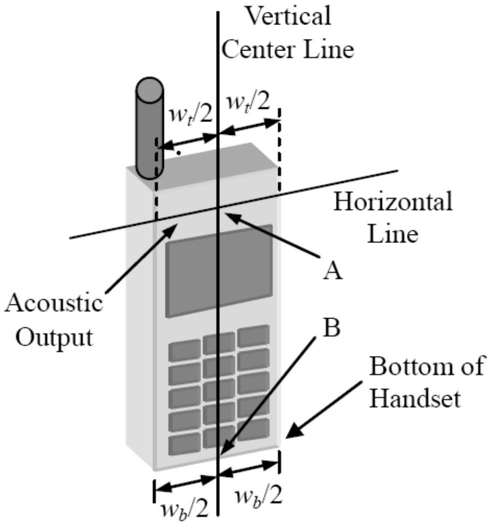
Available: Special

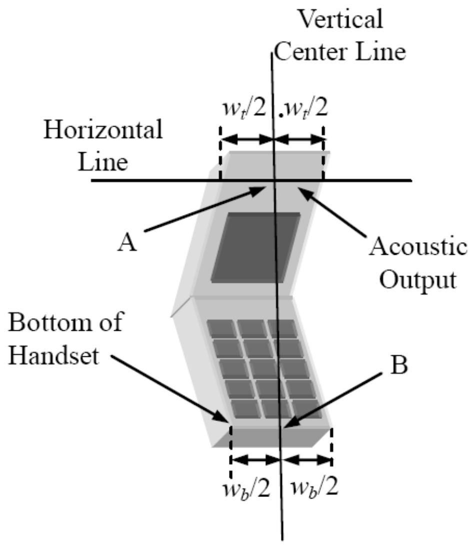
Picture C.10: SAM Twin Phantom

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

D.1 General considerations

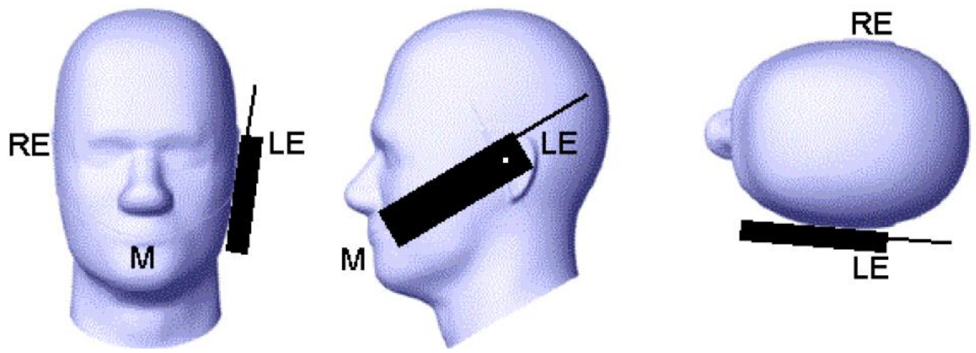
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



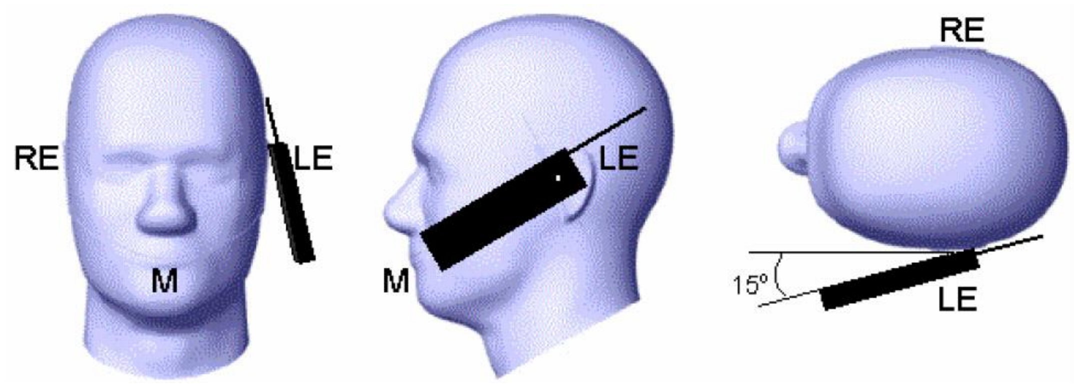


W_t	Width of the handset at the level of the acoustic
W_b	Width of the bottom of the handset
A	Midpoint of the width W_t of the handset at the level of the acoustic output
B	Midpoint of the width W_b of the bottom of the handset

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



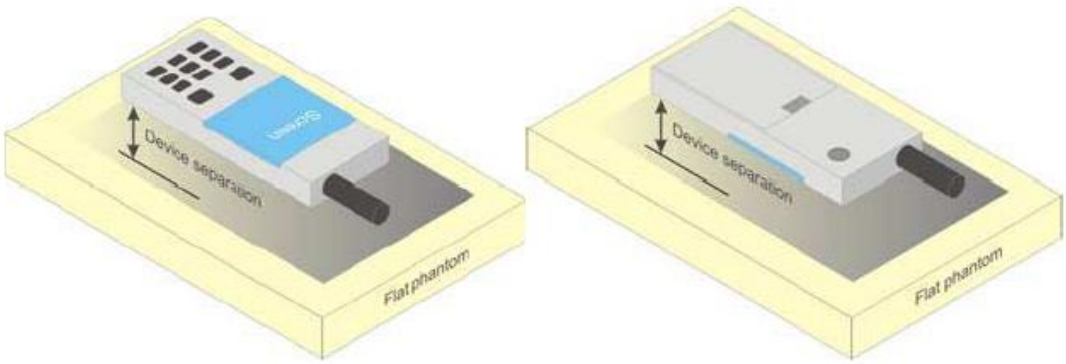
Picture D.2 Cheek position of the wireless device on the left side of SAM



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.

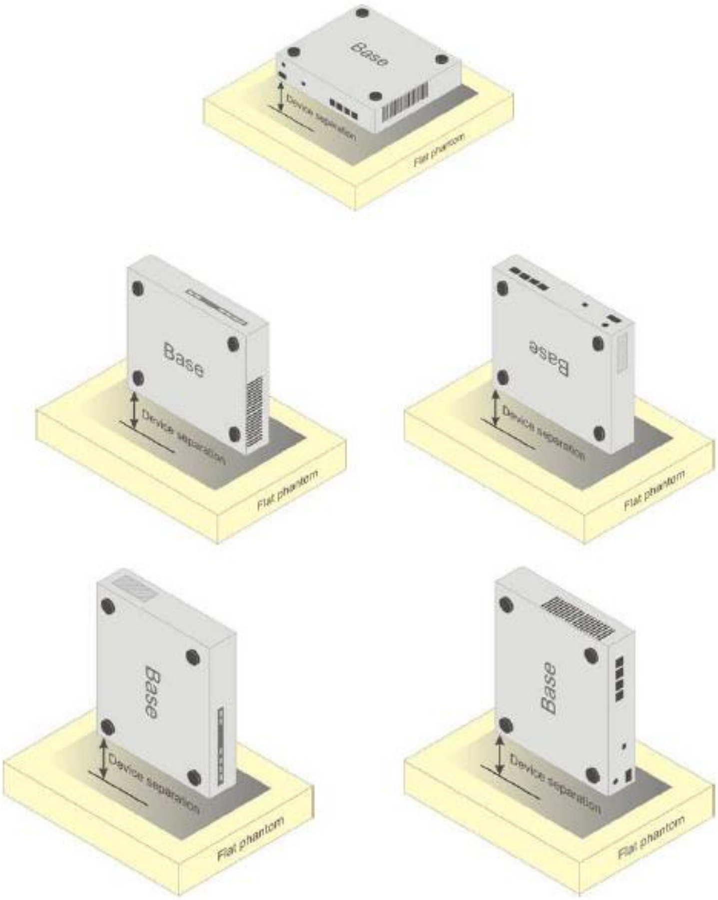


Picture D.4Test positions for body-worn devices

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.