



SAR TEST REPORT

For

Shenzhen Huafurui Technology Co., Ltd.

Smartphone

Test Model: KINGKONG ES PRO

Prepared for : Shenzhen Huafurui Technology Co., Ltd.
Address : Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.
Address : Room 101/201, Building A, and Room 101/301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Tel : (+86)755-82591330
Fax : (+86)755-82591332
Web : www.LCS-cert.com
Mail : webmaster@LCS-cert.com

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Number of tested samples : 1
Sample No. : A240520136-1
Serial number : Prototype
Date of Test : May 21, 2024 ~ June 07, 2024
July 27, 2026 ~ July 31, 2026
Date of Report : August 03, 2026



SAR TEST REPORT	
Report Reference No.	LCSA07276088EB
Date Of Issue	August 03, 2026
Testing Laboratory Name	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	Room 101/201, Building A, and Room 101/301, Building C, Juji Industrial Park, Yabianxueziwei, Shajing Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	Shenzhen Huafurui Technology Co., Ltd.
Address	Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China
Test Specification:	
Standard	EN 50360:2017/A1:2023 EN 50663:2017 EN 50566:2017/A2:2025 EN IEC/IEEE 62209-1528:2021 EN 62479:2010
Test Report Form No.	LCSEMC-1.0
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Test Item Description.	Smartphone
Trade Mark	CUBOT
Model/Type Reference	KINGKONG ES PRO
Ratings	Please Refer to Page 7
Result	Positive

Compiled by:

Jay zhan

Jay Zhan/ Administrator

Supervised by:

Jack Liu

Jack Liu/ Technique principal

Approved by:



Gavin Liang/ Manager



SAR -- TEST REPORT

Test Report No. : LCSA07276088EBAugust 03, 2026
Date of issue

Type / Model..... : KINGKONG ES PRO

EUT..... : Smartphone

Applicant..... : Shenzhen Huafurui Technology Co., Ltd.

Address..... : Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China

Telephone..... : /

Fax..... : /

Manufacturer..... : Shenzhen Huafurui Technology Co., Ltd.

Address..... : Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China

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Telephone..... : /

Fax..... : /

Test Result**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.



Revision History

Revision	Issue Date	Revision Content	Revised By
000	August 03, 2026	Initial Issue	---
Note : This test report is Updated test standard EN IEC/IEEE 62209-1528:2021 and EN 50566:2017/A2:2025 based on original test report“LCSA05204088EB”. And the LTE Band 41 test has been added. all test data is based on the raw-data of test original report. Test Model: KINGKONG ES Software Version: CUBOT_KINGKONG ES PRO_E081_V01 Change to Test Model: KINGKONG ES PRO Software Version: CUBOT_KINGKONG ES PRO_E083_V01			



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1. TEST STANDARDS AND TEST DESCRIPTION

1.1. Test Standards

The tests were performed according to following standards:

EN 50360:2017/A1:2023: Product standard to demonstrate the compliance of wireless communication devices, with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 300 MHz to 6 GHz: devices used next to the ear

EN 50663:2017: Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)

EN 50566:2017/A2:2025: Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body

EN 62479:2010: Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)

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

1.2. Test Description

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



1.3. Product Description

EUT	: Smartphone
Test Model	: KINGKONG ES PRO
Ratings	: Input: DC 5V, 2000mA Adapter1 Model: HJ-0502000W2-EU For AC Adapter Input: 100-240V~, 50/60Hz, 0.3A Adapter Output: 5.0V---2.0A Output Power: 10W DC 3.87V by Rechargeable Li-ion Battery, 5100mAh
Hardware Version	: Q16-MB-V2.0
Software Version	: CUBOT_KINGKONG ES PRO_E083_V01
Bluetooth	:
Frequency Range	: 2402MHz~2480MHz
Channel Number	: 79 channels for Bluetooth V5.0 (BDR/EDR) 40 channels for Bluetooth V5.0 (BT LE/ BT 2LE)
Channel Spacing	: 1MHz for Bluetooth V5.0 (BDR/EDR) 2MHz for Bluetooth V5.0 (BT LE/ BT 2LE)
Modulation Type	: GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0 (BDR/EDR) GFSK for Bluetooth V5.0 (BT LE/ BT 2LE)
Bluetooth Version	: V5.0
Antenna Description	: PIFA Antenna, 2.64dBi(Max.)
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz~2472MHz
Channel Spacing	: 5MHz
Channel Number	: 13 Channel for 20MHz bandwidth(2412~2472MHz) 9 channels for 40MHz bandwidth(2422~2462MHz)
Modulation Type	: 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: PIFA Antenna, 2.64dBi(Max.)
WIFI(5.2G Band)	:
Frequency Range	: 5180MHz~5240MHz
Channel Number	: 4 channels for 20MHz bandwidth(5180~5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Modulation Type	: 802.11a/n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: PIFA Antenna, 5.40dBi(Max.)
WIFI(5.8G Band)	:
Frequency Range	: 5745MHz~5825MHz
Channel Number	: 5 channels for 20MHz bandwidth(5745~5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	: 802.11a/n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: PIFA Antenna, 5.40dBi(Max.)



2G :

Support Band : ☒ GSM 900 (EU-Band) ☒ DCS 1800 (EU-Band)
☒ GSM 850 (U.S.-Band) ☒ PCS 1900 (U.S.-Band)

Release Version : R99

GPRS Class : Class 12

EGPRS Class : Class 12

Uplink : GSM 900: 880MHz~915MHz
DCS 1800: 1710MHz~1785MHz

Downlink : GSM 900: 925MHz~960MHz
DCS 1800: 1805MHz~1880MHz

Type Of Modulation : GMSK for GSM/GPRS; GMSK/8PSK for EGPRS

Antenna Description : PIFA Antenna
0.03dBi (max.) For GSM 900
-2.58dBi (max.) For DCS 1800

Power Class : GSM 900: Level 5, DCS 1800: Level 0
EGPRS 900: Level 8, EGPRS 1800: Level 2

3G :

Support Band : ☒ WCDMA Band I (EU-Band)
☒ WCDMA Band VIII (EU-Band)

Release Version : R9

Uplink : WCDMA Band I: 1920MHz~1980MHz
WCDMA Band VIII: 880MHz~915MHz

Downlink : WCDMA Band I: 2110MHz~2170MHz
WCDMA Band VIII: 925MHz~960MHz

Type Of Modulation : QPSK/16QAM

Antenna Description : PIFA Antenna
-2.31dBi (max.) For WCDMA Band I
0.03dBi (max.) For WCDMA Band VIII

Power Class : Level 3

LTE :

Support Band : ☒ E-UTRA Band 1(EU-Band)
☒ E-UTRA Band 3(EU-Band)
☒ E-UTRA Band 7(EU-Band)
☒ E-UTRA Band 8(EU-Band)
☒ E-UTRA Band 20(EU-Band)
☒ E-UTRA Band 28(EU-Band)
☒ E-UTRA Band 41(EU-Band)

LTE Release Version : R9

FDD Band : Uplink: E-UTRA Band 1: 1920MHz~1980MHz
E-UTRA Band 3: 1710MHz~1785MHz
E-UTRA Band 7: 2500MHz~2570MHz
E-UTRA Band 8: 880MHz~915MHz
E-UTRA Band 20: 832MHz~862MHz
E-UTRA Band 28: 703MHz~748MHz
Downlink: E-UTRA Band 1: 2110MHz~2170MHz
E-UTRA Band 3: 1805MHz~1880MHz
E-UTRA Band 7: 2620MHz~2690MHz
E-UTRA Band 8: 925MHz~960MHz
E-UTRA Band 20: 791MHz~821MHz
E-UTRA Band 28: 758MHz~803MHz



TDD Band : E-UTRA Band 41: 2500MHz~2690MHz
Type Of Modulation : QPSK/16QAM
Antenna Description : PIFA Antenna
-2.31dBi (max.) For E-UTRA Band 1
2.93dBi (max.) For E-UTRA Band 3
-1.67dBi (max.) For E-UTRA Band 7
0.03dBi (max.) For E-UTRA Band 8
-6.25dBi (max.) For E-UTRA Band 20
0.03dBi (max.) For E-UTRA Band 28
-1.67dBi (max.) For E-UTRA Band 41
Power Class : Class 3

GPS Receiver

Receive Frequency : 1575.42MHz
Channel Number : 1

Antenna Description : PIFA Antenna, 0dBi(Max.)

GLONASS Receiver

Receive Frequency : 1602.5625MHz
Channel Number : 1

Antenna Description : PIFA Antenna, 0dBi(Max.)

Galileo Receiver

Receive Frequency : 1589.74MHz
Channel Number : 1

Antenna Description : PIFA Antenna, 0dBi(Max.)



1.4. Summary SAR Results

Table 1:Max. SAR Measured(10g)

Exposure Configuration	Technolohy Band	Highest Measured SAR 10g(W/kg)	Reported SAR 10g(W/kg)
Head	GSM900	0.081	0.093
	DCS1800	0.052	0.056
	WCDMA Band VIII	0.079	0.088
	WCDMA Band I	0.056	0.062
	WLAN2450	0.232	0.233
	WLAN5200	0.154	0.161
	WLAN5800	0.079	0.083
	E-UTRA Band 1	0.106	0.116
	E-UTRA Band 3	0.306	0.330
	E-UTRA Band 7	0.107	0.114
	E-UTRA Band 8	0.101	0.102
	E-UTRA Band 20	0.089	0.095
	E-UTRA Band 28	0.025	0.027
	E-UTRA Band 41	0.102	0.105
Body-worn	GSM900	0.133	0.145
	DCS1800	0.130	0.137
	WCDMA Band VIII	0.109	0.122
	WCDMA Band I	0.249	0.274
	WLAN2450	0.159	0.159
	WLAN5200	0.119	0.124
	WLAN5800	0.051	0.054
	E-UTRA Band 1	0.188	0.206
	E-UTRA Band 3	0.206	0.222
	E-UTRA Band 7	0.405	0.431
	E-UTRA Band 8	0.483	0.487
	E-UTRA Band 20	0.080	0.086
	E-UTRA Band 28	0.124	0.132
	E-UTRA Band 41	0.388	0.399
Limb-worn (Separation Distance 0mm)	GSM900	0.533	0.583
	DCS1800	0.458	0.482
	WCDMA Band VIII	0.500	0.560
	WCDMA Band I	0.773	0.851
	WLAN2450	0.341	0.342
	WLAN5200	0.235	0.245
	WLAN5800	0.127	0.133
	E-UTRA Band 1	0.671	0.734
	E-UTRA Band 3	0.798	0.861
	E-UTRA Band 7	0.809	0.861
	E-UTRA Band 8	0.483	0.487
	E-UTRA Band 20	0.478	0.511
	E-UTRA Band 28	0.160	0.170
	E-UTRA Band 41	0.775	0.797

Note:

- 1.The SAR values found for the EUT below the maximum recommended levels of 2.0W/Kg as averaged over for 10g tissue according to EN IEC/IEEE 62209-1528:2021. Wrist worn of EUT below the maximum recommended levels of 4.0W/Kg as averaged over for 10g
2. All test modes were tested, but we only recorded the worst case in this report.



1.5. EUT operation mode

The EUT has been tested under typical operating condition and The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

1.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

○	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/
○	Multimeter	Manufacturer :	/
		Model No. :	/



2. TEST ENVIRONMENT

2.1. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Site Description

Sar Lab.

: NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.

2.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	18-25 ° C
Humidity:	40-65 %
Atmospheric pressure:	950-1050mbar

2.3. SAR Limits

EXPOSURE LIMITS	CE Limit (10g Tissue)	
	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average(averaged over the whole body)	0.08	0.4
Spatial Peak(averaged over any 10 g of tissue)	2.0	10
Spatial Peak(hands/wrists/ feet/anklesaveraged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).



2.4. Equipments Used during the Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	PC	Lenovo	G5005	MY42081102	N/A	N/A
2	SAR Measurement system	SATIMO	4014_01	SAR_4014_01	N/A	N/A
3	Signal Generator	Agilent	E4438C	MY49072627	2023-06-09	2024-06-08
4	S-parameter Network Analyzer	Agilent	8753ES	US38432944	2023-06-09	2024-06-08
5	Wideband Radio Communication Tester	R&S	CMW500	103818-1	2023-10-25	2024-10-24
6	E-Field PROBE	MVG	SSE2	SN 25/22 EPGO376	2023-06-22	2024-06-21
7	DIPOLE 750	SATIMO	SID 750	SN 07/14 DIP 0G750-302	2021-09-29	2024-09-28
8	DIPOLE 900	SATIMO	SID 900	SN 07/14 DIP 0G900-300	2021-09-29	2024-09-28
9	DIPOLE 1800	SATIMO	SID 1800	SN 07/14 DIP 1G800-301	2021-09-29	2024-09-28
10	DIPOLE 2000	SATIMO	SID 2000	SN 07/14 DIP 2G000-305	2021-09-29	2024-09-28
11	DIPOLE 2450	SATIMO	SID 2450	SN 07/14 DIP 2G450-306	2021-09-29	2024-09-28
12	DIPOLE 2600	SATIMO	SID 2600	SN 38/18 DIP 2G600-468	2021-09-22	2024-09-21
13	DIPOLE 5000-6000	SATIMO	SWG5500	SN 49/16 WGA 43	2021-09-22	2024-09-21
14	COMOSAR OPENCoaxial Probe	SATIMO	OCPG 68	SN 40/14 OCPG68	2023-10-25	2024-10-24
15	Communication Antenna	SATIMO	ANTA57	SN 39/14 ANTA57	2023-10-25	2024-10-24
16	FEATURE PHONEPOSITIONING DEVICE	SATIMO	MSH98	SN 40/14 MSH98	N/A	N/A
17	DUMMY PROBE	SATIMO	DP60	SN 03/14 DP60	N/A	N/A
18	SAM PHANTOM	SATIMO	SAM117	SN 40/14 SAM117	N/A	N/A
19	Liquid measurement Kit	HP	85033D	3423A03482	N/A	N/A
20	Power meter	Agilent	E4419B	MY45104493	2023-10-25	2024-10-24
21	Power meter	Agilent	E4419B	MY45100308	2023-10-25	2024-10-24
22	Power sensor	Agilent	E9301H	MY41495616	2023-10-25	2024-10-24
23	Power sensor	Agilent	E9301H	MY41495234	2023-10-25	2024-10-24
8	Directional Coupler	MCLI/USA	4426-20	03746	2023-06-09	2024-06-08



Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	PC	Lenovo	G5005	MY42081102	N/A	N/A
2	SAR Measurement system	SATIMO	4014_01	SAR_4014_01	N/A	N/A
3	Signal Generator	Agilent	E4438C	MY49072627	2025-09-27	2026-09-26
4	S-parameter Network Analyzer	Agilent	8753ES	US38432944	2026-04-21	2027-04-20
5	Wideband Radio Communication Tester	R&S	CMW500	103818-1	2025-09-27	2026-09-26
6	E-Field PROBE	MVG	SSE2	SN 08/21 EPGO352	2025-09-15	2026-09-14
7	DIPOLE 2600	SPEAG	D2600V2	1231	2025-07-15	2028-07-14
8	COMOSAR OPENCoaxial Probe	SATIMO	OCPG 68	SN 40/14 OCPG68	2025-09-27	2026-09-26
9	Communication Antenna	SATIMO	ANTA57	SN 39/14 ANTA57	2025-09-27	2026-09-26
10	FEATURE PHONEPOSITIONING DEVICE	SATIMO	MSH98	SN 40/14 MSH98	N/A	N/A
11	DUMMY PROBE	SATIMO	DP60	SN 03/14 DP60	N/A	N/A
12	SAM PHANTOM	SATIMO	SAM117	SN 40/14 SAM117	N/A	N/A
13	Liquid measurement Kit	HP	85033D	3423A03482	2025-09-27	2026-09-26
14	Power meter	Agilent	E4419B	MY45104493	2025-09-27	2026-09-26
15	Power meter	Agilent	E4419B	MY45100308	2025-09-27	2026-09-26
16	Power sensor	Agilent	E9301H	MY41495616	2025-09-27	2026-09-26
17	Power sensor	Agilent	E9301H	MY41495234	2025-09-27	2026-09-26
18	3dB Attenuator	NA	2N-3dB	NA	2025-09-27	2026-09-26
19	3dB Attenuator	NA	2N-3dB	NA	2025-09-27	2026-09-26
20	3dB Attenuator	NA	2N-3dB	NA	2025-09-27	2026-09-26
21	Directional Coupler	MCLI/USA	4426-20	03746	2025-09-27	2026-09-26

3.SAR MEASUREMENTS SYSTEM CONFIGURATION

3.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System(VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch,It sends an "Emergency signal" to the robot controller that to stop robot's moves

A computer operating Windows XP.

OPENSAR software

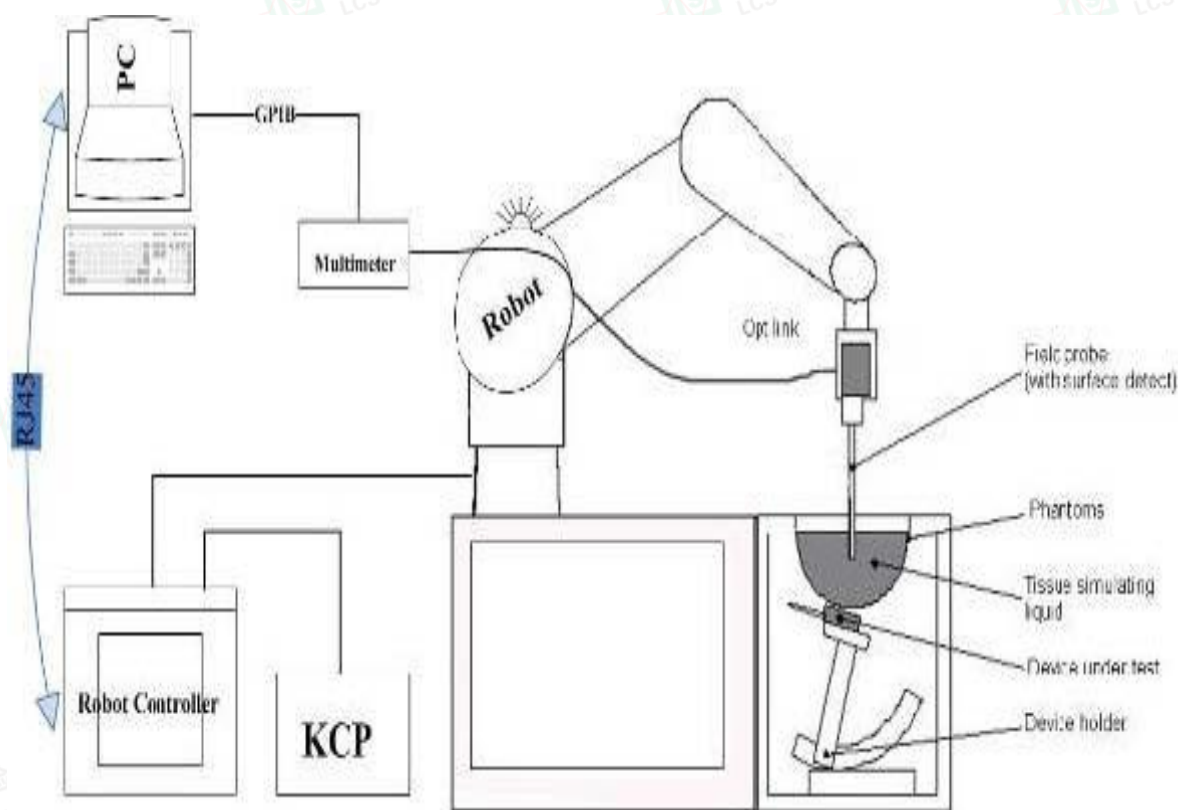
Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes .

System validation dipoles to validate the proper functioning of the system.





3.2. OPENSAR E-field Probe System

The SAR measurements were conducted with the dosimetric probe EPGO376 (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

Probe Specification

Construction Symmetrical design with triangular core

Interleaved sensors

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

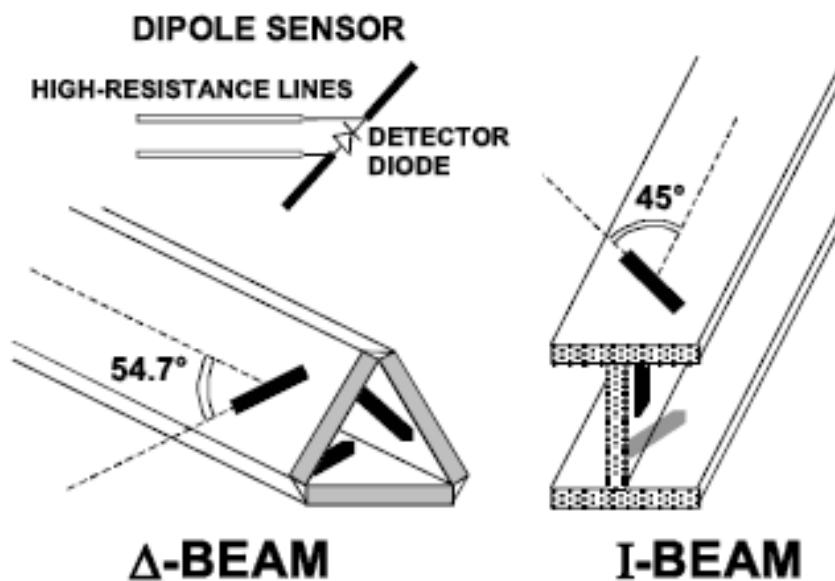
Calibration ISO/IEC 17025 calibration service available.

Frequency	450 MHz to 6 GHz; Linearity: 0.25dB(450 MHz to 6 GHz)
Directivity	0.25 dB in HSL (rotation around probe axis) 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	0.01W/kg to > 100 W/kg; Linearity: 0.25 dB
Dimensions	Overall length: 330 mm (Tip: 16mm) Tip diameter: 5 mm (Body: 8 mm) Distance from probe tip to sensor centers: 2.5 mm
Application	General dosimetry up to 6 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

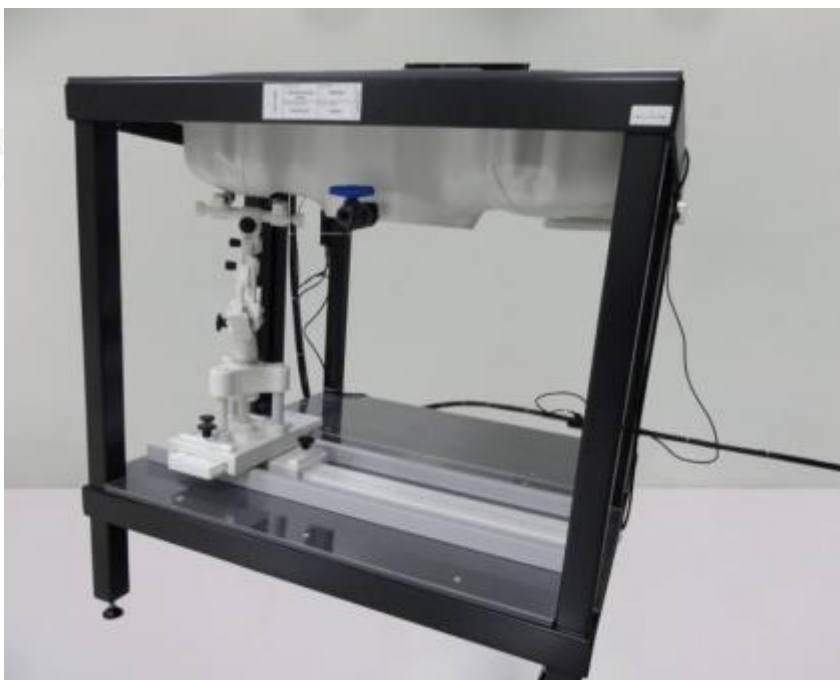
The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



3.3. Phantoms

The SAM Phantom SAM117 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN62209-1, EN62209-2:2010. The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. 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.

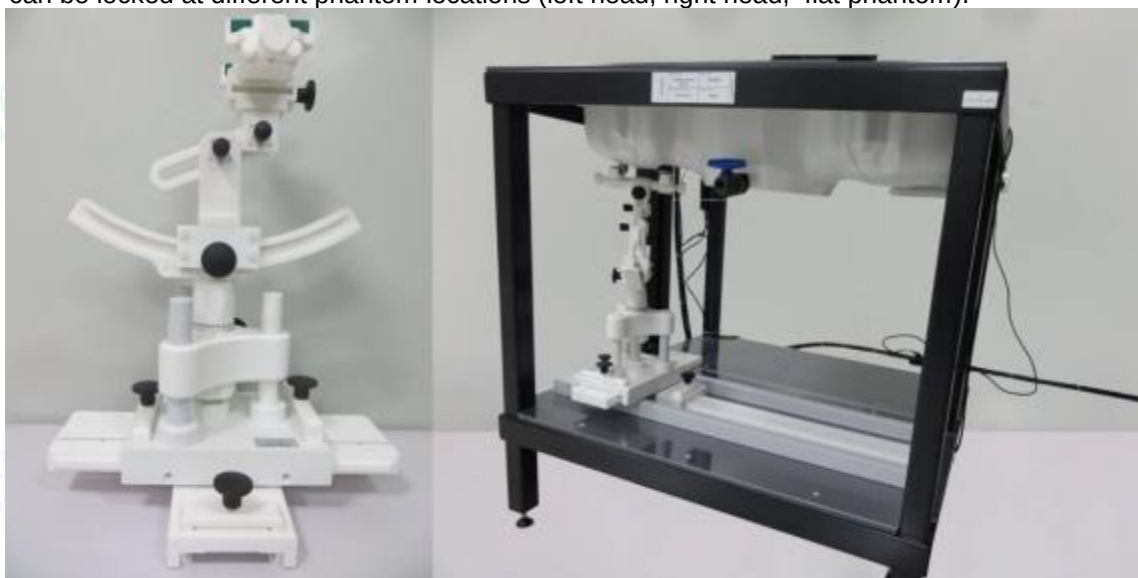
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.



SAM Twin Phantom

3.4. Device Holder

In combination with the Generic Twin Phantom SAM117, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).



Device holder supplied by SATIMO



3.5. Scanning Procedure

The procedure for assessing the peak spatial-average SAR value consists of the following steps

Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in OPENSAR software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 4 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more than one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have OPENSAR software stop the measurements if this limit is exceeded.

3.6. Data Storage and Evaluation

Data Storage

The OPENSAR software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The OPENSAR software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ



These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the OPENSAR components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcpi}$$

With V_i = compensated signal of channel i ($i = x, y, z$)

U_i = input signal of channel i ($i = x, y, z$)

cf = crest factor of exciting field

$dcpi$ = diode compression point

From the compensated input signals the primary field data for each channel can be evaluated:

$$E - \text{fieldprobes} : E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H - \text{fieldprobes} : H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

With V_i = compensated signal of channel i ($i = x, y, z$)

$Norm_i$ = sensor sensitivity of channel i ($i = x, y, z$)

[mV/(V/m)²] for E-field Probes

$ConvF$ = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

3.7. Position of the wireless device in relation to the phantom

General considerations

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

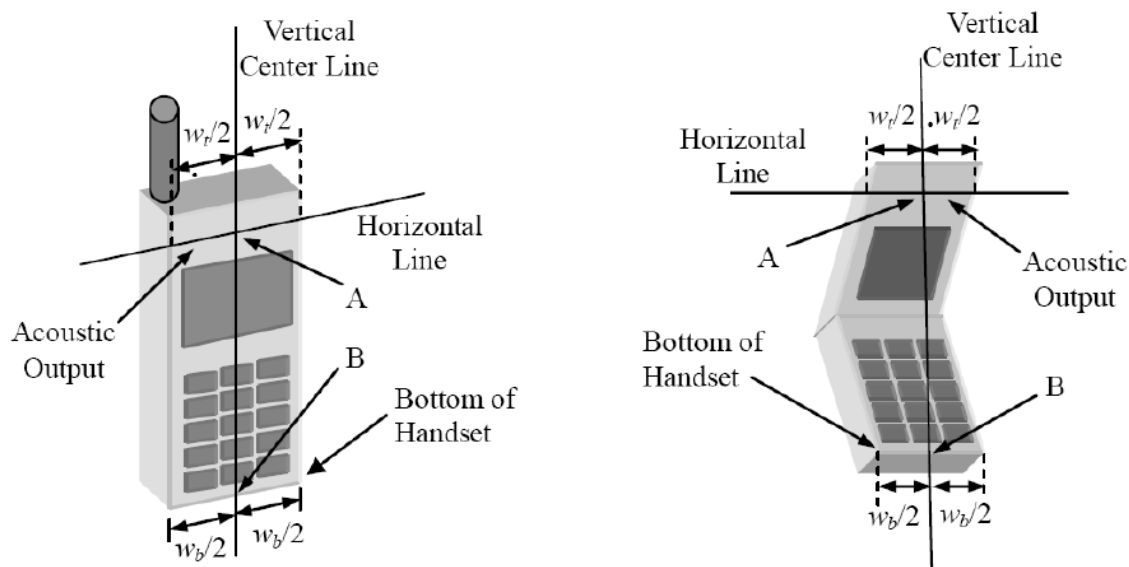
The power flow density is calculated assuming the excitation field as a free space field

$$P_{(pwe)} = \frac{E_{tot}^2}{3770} \text{ or } P_{(pwe)} = H_{tot}^2 \cdot 37.7$$

Where P_{pwe} = Equivalent power density of a plane wave in mW/cm²

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m



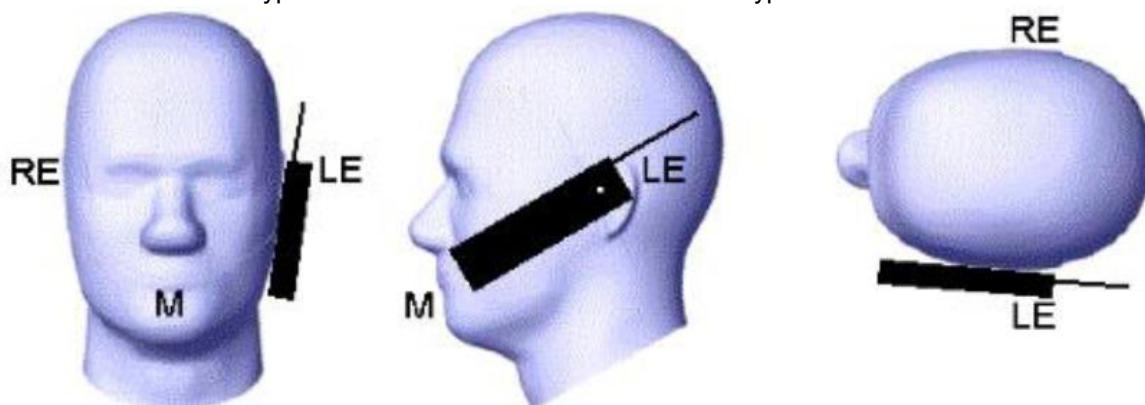
W_t Width of the handset at the level of the acoustic

W_b Width of the bottom of the handset

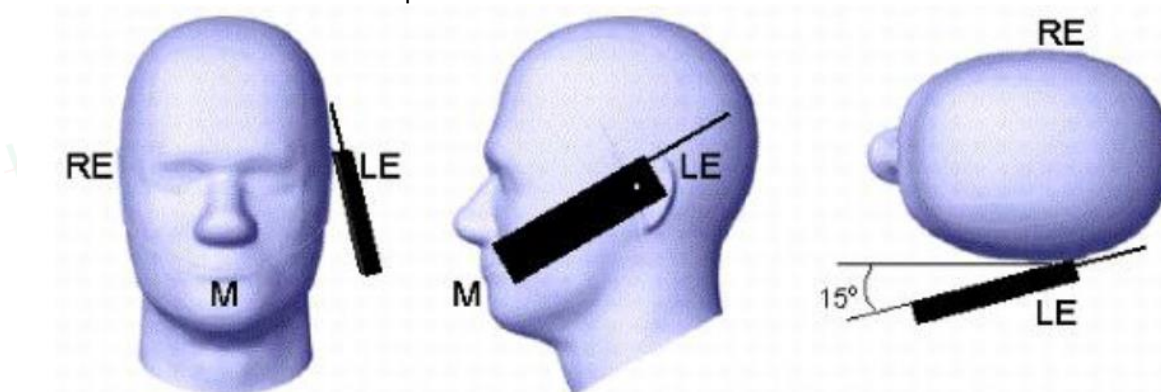
A Midpoint of the width w_t of the handset at the level of the acoustic output

B Midpoint of the width w_b of the bottom of the handset

Picture 1-a Typical "fixed" case handset Picture 1-b Typical "clam-shell" case handset



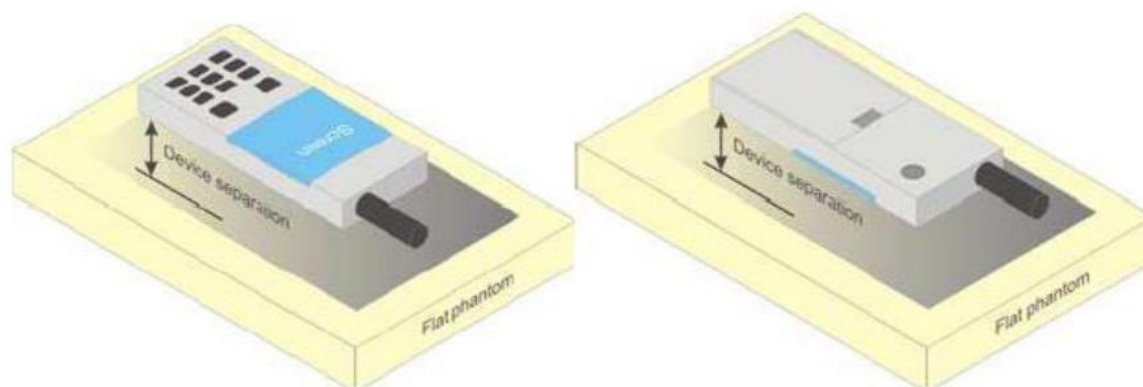
Picture 2 Cheek position of the wireless device on the left side of SAM



Picture 3 Tilt position of the wireless device on the left side of SAM

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 4 Test positions for body-worn devices

Devices with hinged or swivel antenna(s)

For devices that employ one or more external antennas with variable positions (e.g. antenna extended, retracted, rotated), these shall be positioned in accordance with the user instructions provided by the manufacturer. For a device with only one antenna, if no intended antenna position is specified, tests shall be performed if applicable in both the horizontal and vertical positions relative to the phantom, and with the antenna oriented away from the body of the DUT (Figure 5) and/or with the antenna extended and retracted such as to obtain the highest exposure condition. For antennas that may be rotated through one or two planes, an evaluation should be made and documented in the measurement report to the highest exposure scenario and only that position(s) need(s) to be tested. For devices with multiple detachable antennas see provisions of 6.2.2.

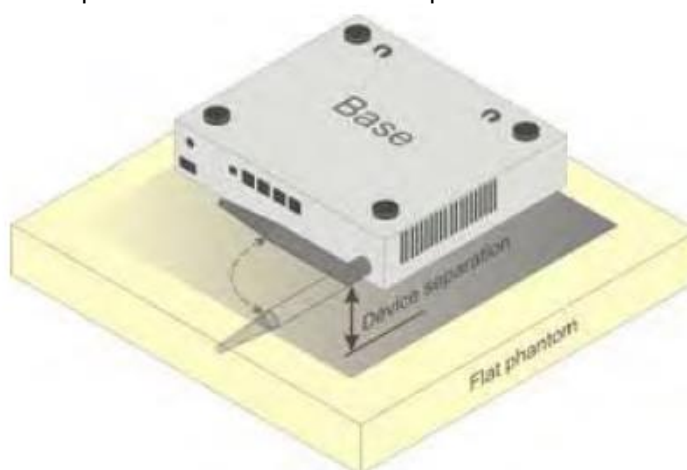


Figure 5— Device with swivel antenna (example of desktop device)

Body-supported device

A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting user. To represent this orientation, the device shall be positioned with its base against the flat phantom. Other orientations may be specified by the manufacturer in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations.

The screen portion of the device shall be in an open position at a 90° angle as seen in Figure 6a (left side), or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation, then the screen-side will not need to be tested if the antenna(s) integrated in it ordinarily remain(s) 200 mm from the body. Where a screen mounted antenna is present, the measurement shall be performed with the screen against the flat phantom as shown in Figure 6a) (right side), if operating the screen against the body is consistent with the intended use.

Other devices that fall into this category include tablet type portable computers and credit card transaction authorisation terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied.

The example in Figure 6b) shows a tablet form factor portable computer for which SAR should be separately assessed with

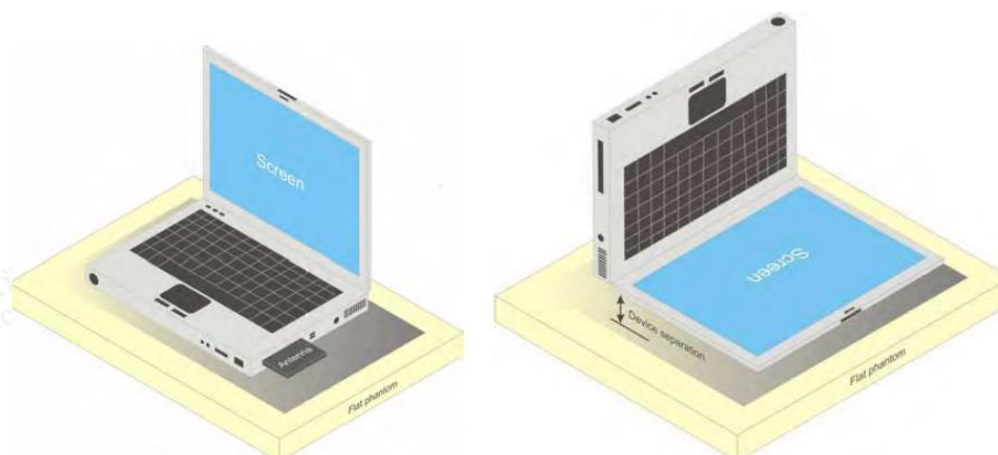
c). each surface and

d). the separation distances

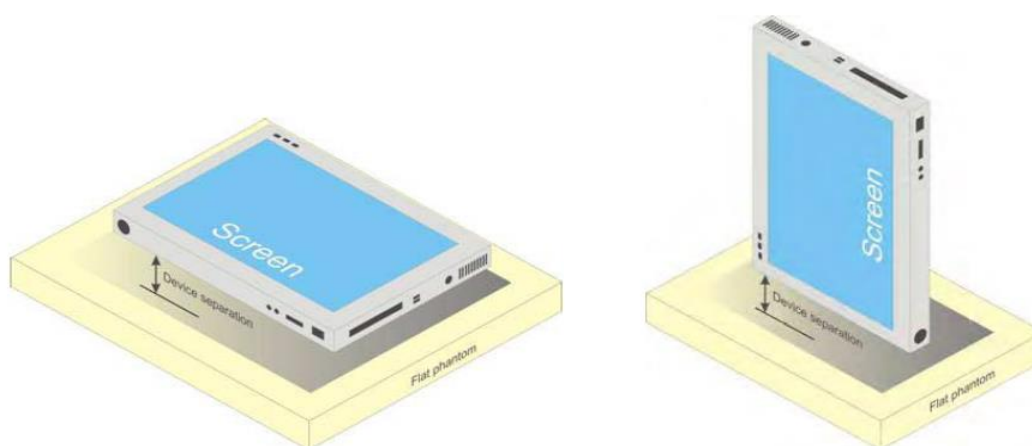
positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations.

Some body-supported devices may allow testing with an external power supply (e.g. a.c. adapter) supplemental to the battery, but it shall be verified and documented in the measurement report that SAR is still conservative.

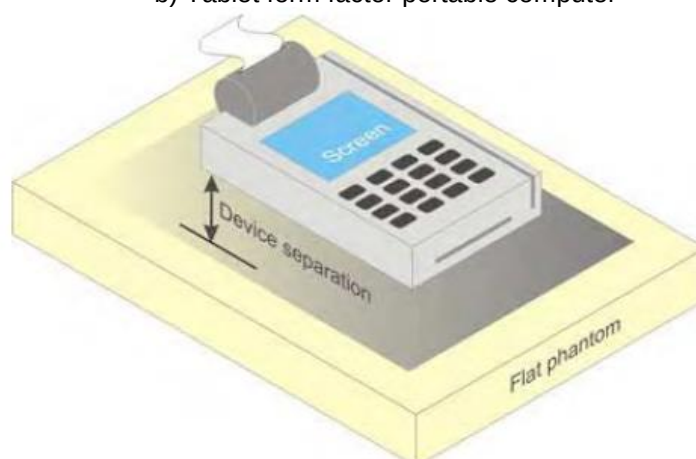
For devices that employ an external antenna with variable positions (e.g. swivel antenna), see 6.1.4.5 and Figure 5.



a) Portable computer with external antenna plug-in-radio-card (left side) or with internal antenna located in screen section (right side)



b) Tablet form factor portable computer



c) Wireless credit card transaction authorisation terminal
Figure 6 – Test positions for body supported devices

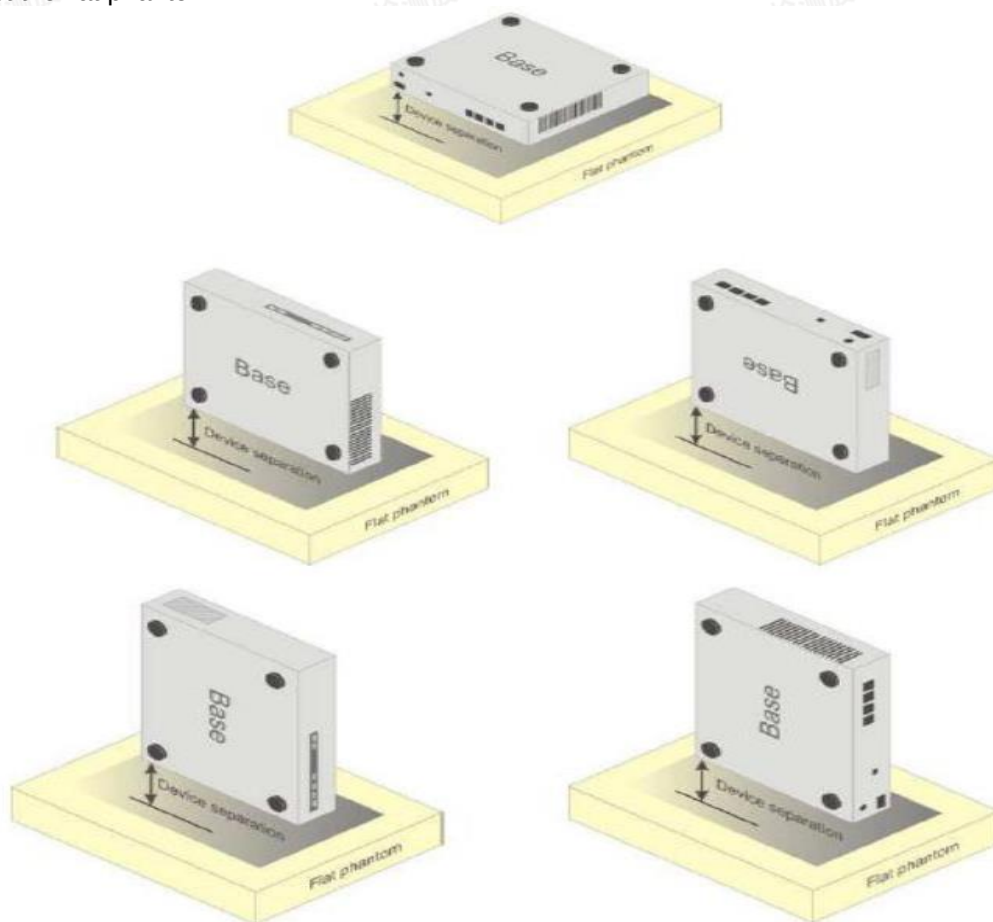
Desktop device

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



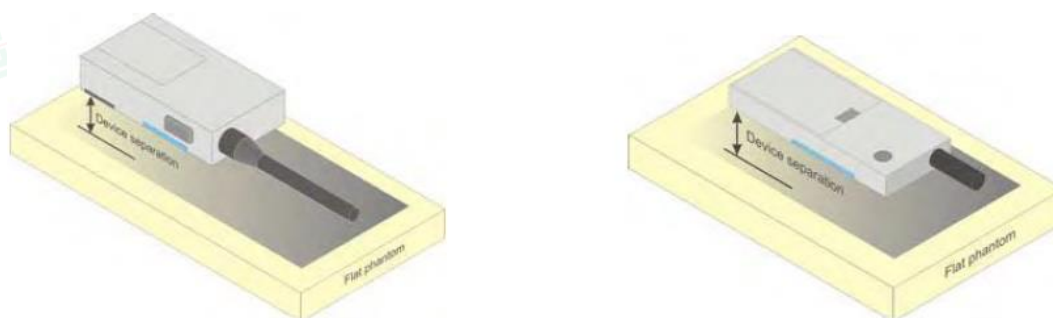
antenna with variable positions, tests shall be performed for all antenna positions specified. Picture 14 shows positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.



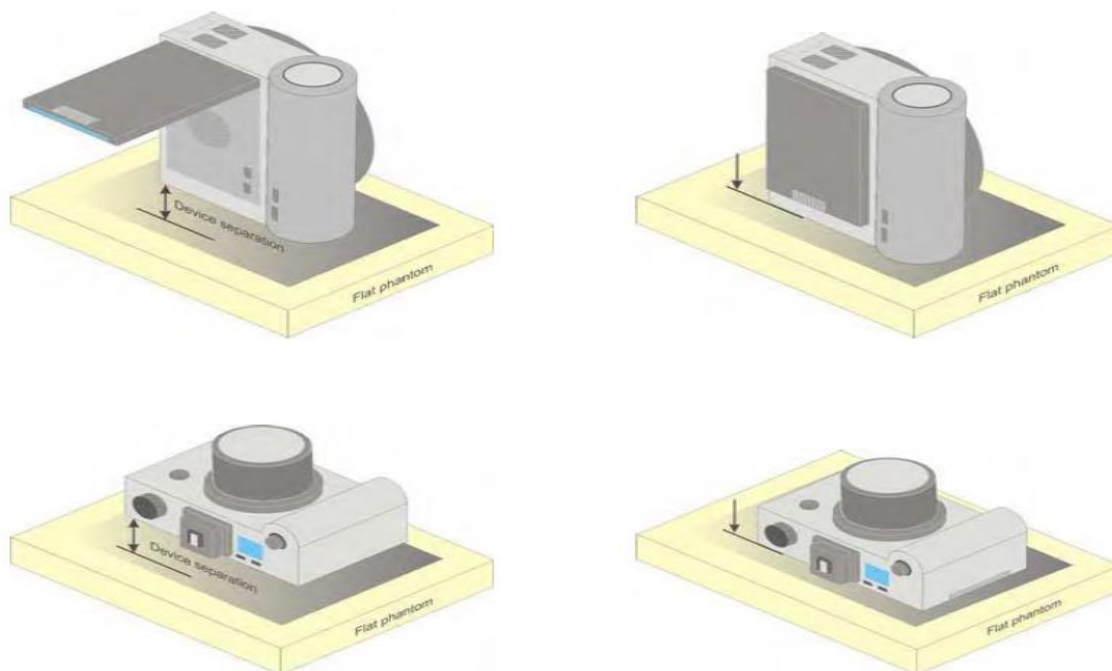
Picture 7 Test positions for desktop devices

Front-of-face device

A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions (Figure 8a). If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.



a) Two-way radios



b) Still cameras and video cameras

Figure 8 – Test positions for front-of-face devices

Other devices that fall into this category include wireless-enabled still cameras and video cameras that can send data to a network or other device (Figure 8b). In the case of a device whose intended use requires a separation distance from the user (e.g., device with a viewing screen), this shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions (Figure 8b, left side). If the intended use is not specified, a separation distance of 25 mm between the phantom surface and the device shall be used.

For a device whose intended use requires the user's face to be in contact with the device (e.g., device with an optical viewfinder), this shall be placed directly against the phantom (Figure 8b, right side).

Hand-held usage of the device, not at the head or torso

Additional studies remain needed for devising a representative method for evaluating SAR in the hand of hand-held devices. Future versions of this standard are intended to contain a test method based on scientific data and rationale. Annex J presents the currently available test procedure.

Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 9. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

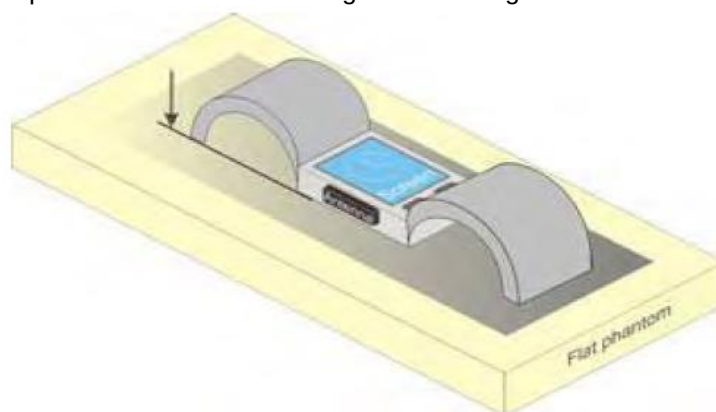


Figure 9 – Test position for limb-worn devices

Clothing-integrated device



A typical example of a clothing-integrated device is a wireless device (Mobile Phone) integrated into a jacket to provide voice communications through an embedded speaker and microphone. This category also includes headgear with integrated wireless devices.

All wireless or RF transmitting components shall be placed in the orientation and at the separation distance to the phantom surface that correspond to intended use of the device when it is integrated into the clothing (Figure 10).

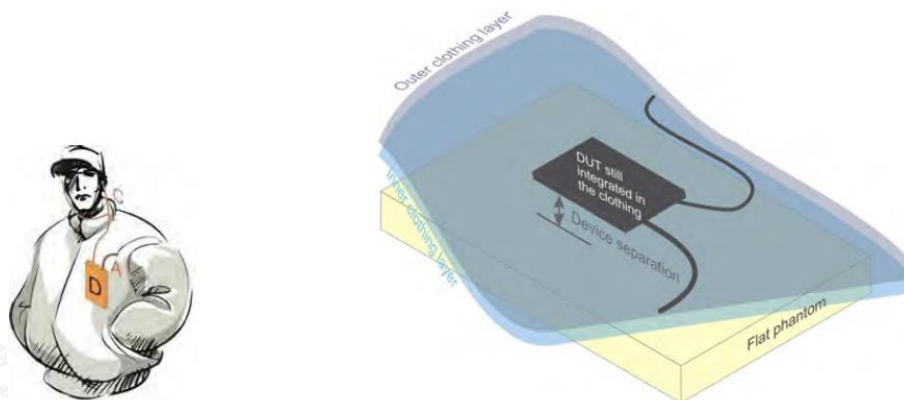


Figure 10– Test position for clothing-integrated wireless devices



3.8. Tissue Dielectric Parameters for Head and Body Phantoms

The liquid used for the frequency range of 700-3000 MHz consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 3 and 4 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.

Table 2. Composition of the Head Tissue Equivalent Matter

Frequency (MHz)	Bactericide	DGBE	HEC	NaCl	Sucrose	1,2-Propanediol	X100	Water	Conductivity	Permittivity
	%	%	%	%	%	%	%	%	σ	ϵ_r
750	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
835	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
900	/	/	/	0.79	/	64.81	/	34.40	0.97	41.8
1800	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
1900	/	13.84	/	0.35	/	/	30.45	55.36	1.38	41.0
2000	/	7.99	/	0.16	/	/	19.97	71.88	1.55	41.1
2450	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3
2600	/	7.99	/	0.16	/	/	19.97	71.88	1.88	40.3

Table 3. Targets for tissue simulating liquid

Frequency (MHz)	Liquid Type	Liquid Type (σ)	$\pm 5\%$ Range	Permittivity (ϵ)	$\pm 5\%$ Range
300	Head	0.87	0.83~0.91	45.30	43.04~47.57
450	Head	0.87	0.83~0.91	43.50	41.33~45.68
835	Head	0.90	0.86~0.95	41.50	39.43~43.58
900	Head	0.97	0.92~1.02	41.50	39.43~43.58
1450	Head	1.20	1.14~1.26	40.50	38.48~42.53
1800	Head	1.40	1.33~1.47	40.00	38.00~42.00
1900	Head	1.40	1.33~1.47	40.00	38.00~42.00
1950	Head	1.40	1.33~1.47	40.00	38.00~42.00
2000	Head	1.40	1.33~1.47	40.00	38.00~42.00
2450	Head	1.80	1.71~1.89	39.20	37.24~41.16
3000	Head	2.40	2.28~2.52	38.50	36.58~40.43
300	Body	0.87	0.83~0.91	45.30	43.04~47.57
450	Body	0.87	0.83~0.91	43.50	41.33~45.68
835	Body	0.90	0.86~0.95	41.50	39.43~43.58
900	Body	0.97	0.92~1.02	41.50	39.43~43.58
1450	Body	1.20	1.14~1.26	40.50	38.48~42.53
1800	Body	1.40	1.33~1.47	40.00	38.00~42.00
1900	Body	1.40	1.33~1.47	40.00	38.00~42.00
1950	Body	1.40	1.33~1.47	40.00	38.00~42.00
2000	Body	1.40	1.33~1.47	40.00	38.00~42.00
2100	Body	1.49	1.42~1.56	39.80	37.81~41.79
2450	Body	1.80	1.71~1.89	39.20	37.24~41.16
2600	Body	1.96	1.86~2.06	39.00	37.05~40.95
3000	Body	2.40	2.28~2.52	38.50	36.58~40.43
3500	Body	2.91	2.77~3.06	37.90	36.01~39.80
4000	Body	3.43	3.26~3.61	37.40	35.53~39.27
4500	Body	3.94	3.74~4.14	36.80	34.96~38.64
5000	Body	4.45	4.23~4.67	36.20	34.39~38.01
5200	Body	4.66	4.43~4.89	36.00	34.20~37.80
5400	Body	4.86	4.62~5.10	35.80	34.01~37.59
5600	Body	5.07	4.82~5.32	35.50	33.73~37.28
5800	Body	5.27	5.01~5.53	35.30	33.54~37.07
6000	Body	5.48	5.21~5.75	35.10	33.35~36.86

3.9. Test Condition and Dielectric Performance

Test Condition and Test Date

Test Engineer: bob.yang			
LiquidFrequency	Measurement temperature	Measurement humidity	Measurement Date
750 MHz	23.3°C	53.1%	May 21, 2024
900 MHz	23.3°C	53.1%	May 23, 2024
1800 MHz	24.1°C	52.8%	May 24, 2024
2000 MHz	23.9°C	53.4%	May 28, 2024
2450 MHz	23.6°C	54.2%	June 01, 2024
2600 MHz	21.9°C	53.4%	June 05, 2024
5200 MHz	22.2°C	52.6%	June 07, 2024
5800 MHz	22.2°C	52.6%	June 07, 2024
2600 MHz	20.3°C	55.2%	July 30, 2026

Dielectric Performance of Head Tissue Simulating Liquid

Measured Frequency (MHz)	Target Tissue		Measured Tissue			
	σ	ϵ_r	σ	Dev.	ϵ_r	Dev.
750	0.89	42.06	0.88	-1.12%	41.90	-0.38%
900	0.97	41.5	0.94	-3.09%	42.58	2.60%
1800	1.40	40.0	1.43	2.14%	40.64	1.60%
2000	1.40	40.0	1.42	1.43%	39.17	-2.08%
2450	1.80	39.2	1.78	-1.11%	38.35	-2.17%
2600	1.96	39.0	1.90	-3.06%	40.35	3.46%
5200	4.66	36.0	4.69	0.64%	35.85	-0.42%
5800	5.27	35.30	5.31	0.76%	34.77	-1.50%
2600	1.96	39.0	2.03	3.57%	38.59	-1.05%

3.10. System Check

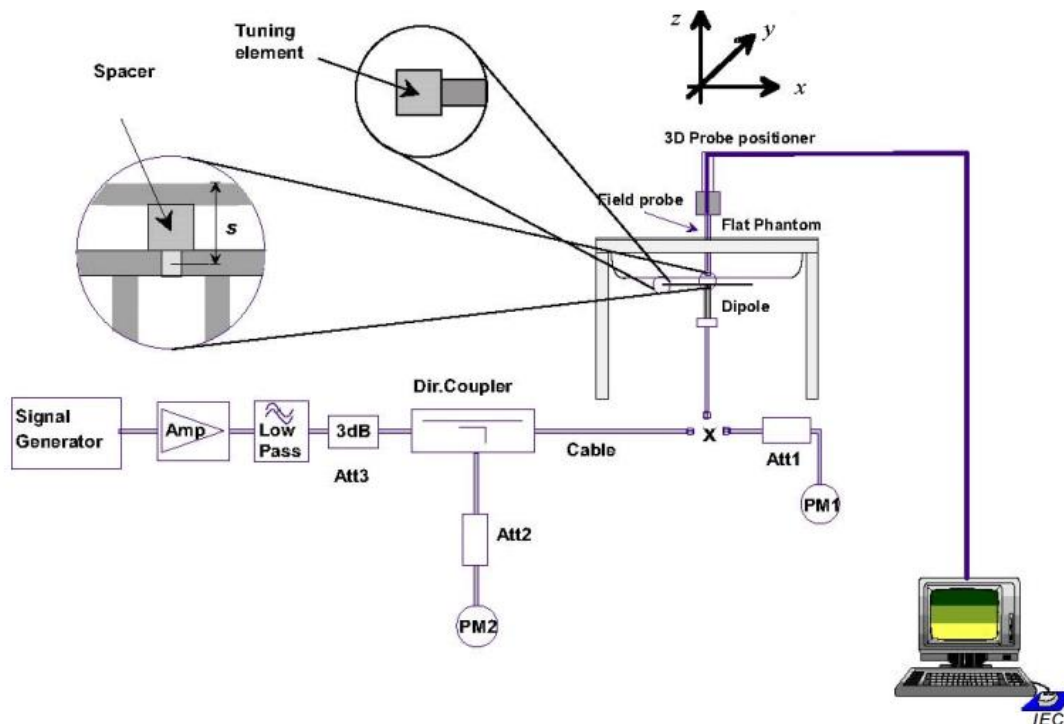


Figure D.1 - Test set-up for the system check

The system performance check verifies that the system operates within its specifications. System and operator errors



can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

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:

- 1 Signal Generator
- 2 Amplifier
- 3 Directional Coupler
- 4 Power Meter
- 5 Calibrated Dipole

The output power on dipole port must be calibrated to 20 dBm (100 mW) before dipole is connected.



Photo of Dipole Setup

System Validation of Head

Verification results	Frequency (MHz)	Target value (W/kg)		Measured value (W/kg)		Deviation	
		1 g	10 g	1 g	10 g	1 g	10 g
		Average	Average	Average	Average	Average	Average
	750	8.49	5.55	8.71	5.53	2.59%	-0.36%
	900	10.9	6.99	11.4	7.21	4.59%	3.15%
	1800	38.4	20.1	40.1	18.9	4.43%	-5.97%
	2000	41.1	21.1	40.5	19.6	-1.46%	-7.11%
	2450	52.4	24.0	49.8	23.4	-4.96%	-2.50%
	2600	55.3	24.6	56.1	24.5	1.45%	-0.41%
	5200	165.77	57.20	178.32	54.32	7.57%	-5.03%
	5800	186.77	62.84	175.25	65.98	-6.17%	5.00%
	2600	54.9	24.6	55.3	24.1	0.73%	-2.03%



3.11. Measurement Procedures

The measurement procedures are as follows:

1.1. GSM Test Configuration

SAR tests for GSM 900 and GSM 1800, a communication link is set up with a base station by air link. Using CMU200 the power level is set to "5" and "0" in SAR of GSM 900 and GSM 1800. The tests in the band of GSM 900 and GSM 1800 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 33 for this EUT, it has at most 4 timeslots in uplink and at most 5 timeslots in downlink, the maximum total timeslot is 6. The EGPRS class is 33 for this EUT, it has at most 4 timeslots in uplink, and at most 5 timeslots in downlink, the maximum total timeslot is 6.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power, the higher number time-slot configuration should be tested.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode

1.2. UMTS Test Configuration

1) . Output Power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1's" for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are required in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

2) . Head SAR

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure

3) . Body SAR

SAR for body configurations is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

4) . HSDPA / HSUPA / DC-HSDPA

RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power for production units in HSDPA / HSUPA / DC-HSDPA is $\leq \frac{1}{4}$ dB higher than RMC 12.2Kbps or when the highest measured SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power of HSDPA / HSUPA / DC-HSDPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.5 W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA.

a) HSDPA



HSDPA is configured according to the applicable UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4 ms and a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors(β_c , β_d), and HS-DPCCH power offset parameters (Δ_{ACK} , Δ_{NACK} , Δ_{CQI}) are set according to values indicated in the following table. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

Sub-test	β_c	Bd	β_d (SF)	β_c/β_d	β_{hs}	CM(dB)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 8$ Ahs = $\beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$
Note2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude(EVM) with HS-DPCCH test in clause 5.13.1.A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 8$ (Ahs=30/15) with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta_{CQI} = 7$ (Ahs=24/15) with $\beta_{hs} = 24/15 * \beta_c$.
Note3: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI"s
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

Table 1: settings of required H-Set 1 QPSK acc. to 3GPP 34.121

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum H S-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
------------------	--------------------------------	----------------------------	---	-------------------------



1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

Table 2: HSDPA UE category

b) HSUPA

Due to inner loop power control requirements in HSUPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSUPA should be configured according to the values indicated below as well as other applicable procedures described in the „WCDMA Handset“ and „Release 5 HSUPA Data Device“ sections of 3G device.



Sub-test ^a	$\beta_{e^{(1)}}$	$\beta_{d^{(1)}}$	β_d (SF)) ^a	$\beta_e/\beta_d^{(1)}$	$\beta_{hs}^{(1)}$) ^a	$\beta_{e^{(2)}}$	$\beta_{d^{(2)}}$	β_e (SF)) ^a	$\beta_{d^{(2)}}$ (code)) ^a	CM ⁽²⁾ (dB)) ^a	MP R ⁽¹⁾ (dB) ^a	AG ⁽⁴⁾) ^a Inde x ^a	E- TFC I ^a
1 ^a	11/15 ⁽³⁾ ^a	15/15 ⁽³⁾ ^a	64 ^a	11/15 ⁽³⁾ ^a	22/15 ^a	209/22 5 ^a	1039/225 ^a	4 ^a	1 ^a	1.0 ^a	0.0 ^a	20 ^a	75 ^a
2 ^a	6/15 ^a	15/15 ^a	64 ^a	6/15 ^a	12/15 ^a	12/15 ^a	94/75 ^a	4 ^a	1 ^a	3.0 ^a	2.0 ^a	12 ^a	67 ^a
3 ^a	15/15 ^a	9/15 ^a	64 ^a	15/9 ^a	30/15 ^a	30/15 ^a	$\beta_{ad1}:47/1$ 5 ^a $\beta_{ad2}:47/1$ 5 ^a	4 ^a	2 ^a	2.0 ^a	1.0 ^a	15 ^a	92 ^a
4 ^a	2/15 ^a	15/15 ^a	64 ^a	2/15 ^a	4/15 ^a	2/15 ^a	56/75 ^a	4 ^a	1 ^a	3.0 ^a	2.0 ^a	17 ^a	71 ^a
5 ^a	15/15 ⁽⁴⁾ ^a	15/15 ⁽⁴⁾ ^a	64 ^a	15/15 ⁽⁴⁾ ^a	30/15 ^a	24/15 ^a	134/15 ^a	4 ^a	1 ^a	1.0 ^a	0.0 ^a	21 ^a	81 ^a

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI=8$ $A_{hs} = \beta_{hs}/\beta_e = 30/15$ $\beta_{hs} = 30/15 * \beta_{e^{(1)}}$

Note 2: CM = 1 for $\beta_e/\beta_d = 12/15$, $\beta_{hs}/\beta_e = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference^a

Note 3 : For subtest 1 the β_e/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_e = 10/15$ and $\beta_d = 15/15$ ^a

Note 4 : For subtest 5 the β_e/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_e = 14/15$ and $\beta_d = 15/15$ ^a

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g^a

Note 6: β_{ad} can not be set directly; it is set by Absolute Grant Value.^a

Table 3: Subtests for UMTS Release 6 HSUPA

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF	11484	5.76
	4	4	2	4	20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF	22996	?
	4	4	10	4	20000	?

NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM. (TS25.306-7.3.0).

Table 4: HSUPA UE category

**c) DC-HSDPA**

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a Second serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS 34.108 v9.5.0.

A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH_Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13.

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

The measurements were performed with a Fixed Reference Channel (FRC) H-Set 12 with QPSK.

Parameter	Value
Nominal average inf. bit rate	60 kbit/s
Inter-TTI Distance	1 TTI's
Number of HARQ Processes	6 Processes
Information Bit Payload	120 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	960 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	3200 SMLs
Coding Rate	0.15
Number of Physical Channel Codes	1

Table 5: settings of required H-Set 12 QPSK acc. to 3GPP 34.121

Note:

1. The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table above.
2. Maximum number of transmission is limited to 1,i.e.,retransmission is not allowed. The redundancy and constellation version 0 shall be used.

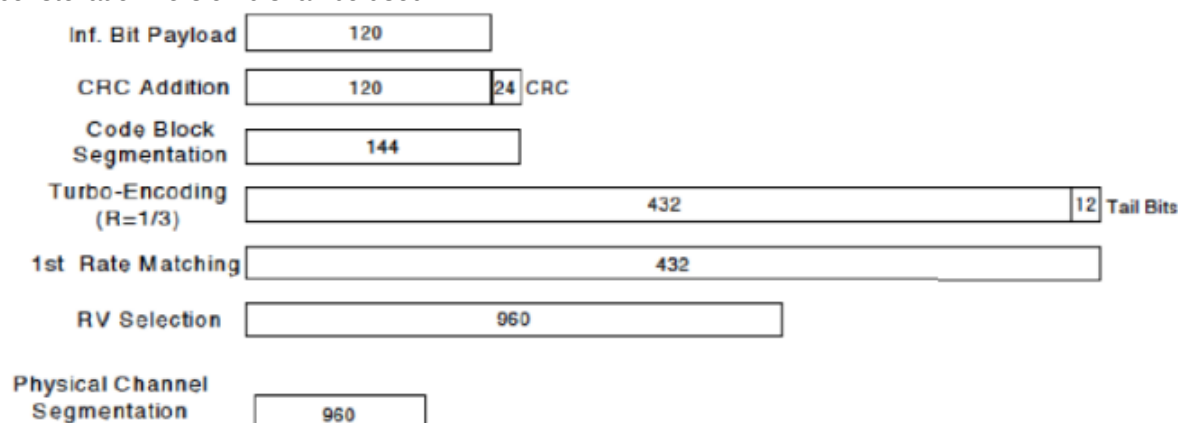


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 5 procedures. A summary of subtest settings are illustrated below:



Sub-test ^o	β_c ^o	β_d ^o	β_d (SF) ^o	β_c/β_d ^o	$\beta_{hs}(1)$ ^o	CM(dB)(2) ^o	MPR (dB) ^o
1 ^o	2/15 ^o	15/15 ^o	64 ^o	2/15 ^o	4/15 ^o	0.0 ^o	0 ^o
2 ^o	12/15(3) ^o	15/15(3) ^o	64 ^o	12/15(3) ^o	24/15 ^o	1.0 ^o	0 ^o
3 ^o	15/15 ^o	8/15 ^o	64 ^o	15/8 ^o	30/15 ^o	1.5 ^o	0.5 ^o
4 ^o	15/15 ^o	4/15 ^o	64 ^o	15/4 ^o	30/15 ^o	1.5 ^o	0.5 ^o

Note 1: Δ ACK, Δ NACK and Δ CQI=8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM=1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$

Up commands are set continuously to set the UE to Max power.

Note:

1. The Dual Carriers transmission only applies to HSDPA physical channels
2. The Dual Carriers belong to the same Node and are on adjacent carriers.
3. The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation
4. The Dual Carriers operate in the same frequency band.
5. The device doesn't support the modulation of 16QAM in uplink but 64QAM in downlink for DC-HSDPA mode.
6. The device doesn't support carrier aggregation for it just can operate in Release 8.

d) DC-HSDPA

SAR is required for Rel. 7 HSPA+ when SAR is required for Rel. 6 HSPA; otherwise, the 3G SAR test reduction procedure is applied to (uplink) HSPA+ with 12.2 kbps RMC as the primary mode. Power is measured for HSPA+ that supports uplink 16 QAM according to configurations in Table C.11.1.4 of 3GPP TS 34.121-1 to determine SAR test reduction.

Table C.11.1.4: β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM

Sub-test	β_{C} (Note 3)	β_{d}	β_{HS} (Note 1)	β_{EC}	β_{ed1} (2xSF2) (Note 4)	β_{ed2} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed1} : 30/15 β_{ed2} : 30/15	β_{ed3} : 24/15 β_{ed4} : 24/15	3.5	2.5	14	105	105
Note 1: $\Delta_{\text{ACK}}, \Delta_{\text{NACK}}$ and $\Delta_{\text{CQI}} = 30/15$ with $\beta_{\text{HS}} = 30/15 * \beta_{\text{C}}$. Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0). Note 3: DPDCH is not configured, therefore the β_{C} is set to 1 and $\beta_{\text{d}} = 0$ by default. Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value. Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signalled to use the extrapolation algorithm.											

1.3. LTE Test Configuration

Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The Anritsu MT8821C was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

TDD LTE test consideration

For Time-Division Duplex (TDD) systems, SAR must be tested using a fixed periodic duty factor according to the highest transmission duty factor implemented for the device and supported by the defined 3GPP LTE TDD configurations.

SAR was tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special subframe configuration 7.

LTE TDD Band support 3GPP TS 36.211 section 4.2 for Type 2 Frame Structure and Table 4.2-2 for uplink-downlink configurations and Table 4.2-1 for Special subframe configurations.

Frame structure type 2:

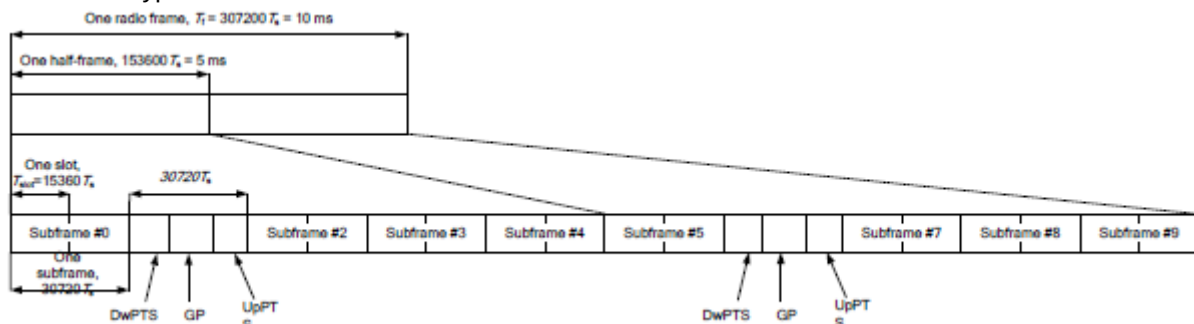


Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	6592.Ts	2192.Ts	2560.Ts	7680.Ts	2192.Ts	2560.Ts
1	19760.Ts			20480.Ts		



2	21952.Ts	4384.Ts	5120.Ts	23040.Ts	4384.Ts	5120.Ts
3	24144.Ts			25600.Ts		
4	26336.Ts			7680.Ts		
5	6592.Ts			20480.Ts		
6	19760.Ts			23040.Ts		
7	21952.Ts			25600.Ts		
8	24144.Ts			-	-	-
9	13168.Ts			-	-	-

Table 4.2-2: Uplink-downlink configurations.

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

Calculated Duty Cycle=[Extended cyclic prefix in uplink x (Ts) x # of S + # of U]/10ms

Uplink-Downlink Configuration	Downlink-to-Uplink Switch-point Periodicity	Subframe Number										Calculated Duty Cycle (%)
		0	1	2	3	4	5	6	7	8	9	
0	5 ms	D	S	U	U	U	D	S	U	U	U	63.33
1	5 ms	D	S	U	U	D	D	S	U	U	D	43.33
2	5 ms	D	S	U	D	D	D	S	U	D	D	23.33
3	10 ms	D	S	U	U	U	D	D	D	D	D	31.67
4	10 ms	D	S	U	U	D	D	D	D	D	D	21.67
5	10 ms	D	S	U	D	D	D	D	D	D	D	11.67
6	5 ms	D	S	U	U	U	D	S	U	U	D	53.33

A) Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

B) MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

Modulation	Channel bandwidth / Transmission bandwidth (N _{RB})						MPR (dB)
	1.4 MHz	3.0 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

C) A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

D) Largest channel bandwidth standalone SAR test requirements

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 for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 1.0 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 $> 1.80 \text{ W/kg}$, SAR is required for all three RB offset configurations for that required test channel.

2) QPSK with 50% RB allocation

For QPSK with 50% RB allocation, SAR is only required measure for the worst case of 1RB allocation used the highest maximum output power. SAR is also required for test when the highest reported SAR for 1 RB allocation in 1 at that position is $\geq 1.0 \text{ W/kg}$.

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 $\leq 1.0 \text{ W/kg}$. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is $> 1.80 \text{ W/kg}$, the remaining required test channels must also be tested.

4) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is $> \frac{1}{2} \text{ dB}$ higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is $> 1.80 \text{ W/kg}$.

E) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is $> \frac{1}{2} \text{ dB}$ higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is $> 1.80 \text{ W/kg}$.

1.4. WIFI Test Configuration

For the 802.11b/g/n SAR tests, a communication link is set up with the test mode software for Wi-Fi mode test. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 1, 7 and 13 respectively in the case of 2450 MHz during the test at the each test frequency channel, the EUT is operated at the RF continuous emission mode. Each channel should be tested at the lowest rate. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on channel 1, 7, 13; however if output power reduction is necessary for channels 1 and/or 13 to meet restricted band requirements the highest output channel closest to each of these channels must be tested instead.

SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25dB higher than that measured on the corresponding 802.11b channels.

WLAN Conducted Power

1. For 2.4GHz WLAN, choose the mode with highest output power, at middle channel to test SAR and determine the worst configuration for further high/low channel testing.
2. For 5.2&5.3&5.5GHz WLAN, choose the mode with highest output power, at middle channel to test SAR and determine the worst configuration for further high/low channel testing.
3. 802.11ax supports full tone size and partial tone size, for full tone size with higher power level, so only chose full tone size to perform SAR testing.

1.5. Power Reduction

The product without any power reduction.

1.6. Power Drift

To control the output power stability during the SAR test, SAR 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. This ensures that the power drift during one measurement is within 5%.



4. TEST CONDITIONS AND RESULTS

4.1. Conducted Power Results

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

The conducted power measurement results for GSM900/DCS1800

GSM900	Conducted Power (dBm)			Tune up (dBm)
	Channel 124 (914.80MHz)	Channel 63 (902.60MHz)	Channel 975 (880.20MHz)	
	32.52	32.42	32.44	
DCS1800	Conducted Power (dBm)			Tune up (dBm)
	Channel 885 (1784.80MHz)	Channel 698 (1747.40MHz)	Channel 512 (1710.20MHz)	
	29.63	29.67	29.57	

The conducted power measurement results for GPRS

GPRS 900 (GMSK)	Measured Power (dBm)			Tune up (dBm)	Calculation (dB)	Averaged Power (dBm)			Tune up (dBm)
	880.2 MHz	902.6 MHz	914.8 MHz			880.2 MHz	902.6 MHz	914.8 MHz	
1 Txslot	30.09	30.06	29.94	30.50	-9.03	21.06	21.03	20.91	21.50
2 Txslot	28.53	28.61	28.52	29.00	-6.02	22.51	22.59	22.50	23.00
3 Txslot	26.21	26.22	26.26	26.50	-4.26	21.95	21.96	22.00	22.50
4 Txslot	25.46	25.47	25.42	25.50	-3.01	22.45	22.46	22.41	22.50
GPRS 1800 (GMSK)	Measured Power (dBm)			Tune up (dBm)	Calculation (dB)	Averaged Power (dBm)			Tune up (dBm)
	1710.2 MHz	1747.4 MHz	1784.8 MHz			1710.2 MHz	1747.4 MHz	1784.8 MHz	
1 Txslot	28.22	28.25	28.29	28.50	-9.03	19.19	19.22	19.26	19.50
2 Txslot	26.36	26.28	26.29	26.50	-6.02	20.34	20.26	20.27	20.50
3 Txslot	23.62	23.53	23.57	24.00	-4.26	19.36	19.27	19.31	19.50
4 Txslot	20.94	21.02	21.00	21.50	-3.01	17.93	18.01	17.99	18.50

The conducted power measurement results for EGPRS

EGPRS 900 (GMSK)	Measured Power (dBm)			Tune up (dBm)	Calculation (dB)	Averaged Power (dBm)			Tune up (dBm)
	880.2 MHz	902.6 MHz	914.8 MHz			880.2 MHz	902.6 MHz	914.8 MHz	
1 Txslot	26.22	26.15	26.12	26.50	-9.03	17.19	17.12	17.09	17.50
2 Txslot	25.41	25.42	25.52	26.00	-6.02	19.39	19.40	19.50	20.00
3 Txslot	22.39	22.37	22.56	23.00	-4.26	18.13	18.11	18.30	18.50
4 Txslot	20.71	20.84	20.90	21.00	-3.01	17.70	17.83	17.89	18.00
EGPRS 1800 (GMSK)	Measured Power (dBm)			Tune up (dBm)	Calculation (dB)	Averaged Power (dBm)			Tune up (dBm)
	1710.2 MHz	1747.4 MHz	1784.8 MHz			1710.2 MHz	1747.4 MHz	1784.8 MHz	
1 Txslot	26.29	26.34	26.24	26.50	-9.03	17.26	17.31	17.21	17.50
2 Txslot	23.71	23.55	23.58	24.00	-6.02	17.69	17.53	17.56	18.00
3 Txslot	21.02	21.04	21.08	21.50	-4.26	16.76	16.78	16.82	17.00
4 Txslot	20.51	20.59	20.46	21.00	-3.01	17.50	17.58	17.45	18.00

Note:

1. Division Factors

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

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

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

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

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

2. According to the conducted power as above, the body measurements are performed with 2Txslots for 900MHz and 2Txslots for 1800MHz for GPRS.

The conducted power measurement results for WCDMA

Item	band	FDD Band VIII result (dBm)	Tune up	FDD Band I result (dBm)	Tune up
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	sub-test	Test Channel			(dBm)	Test Channel			(dBm)
		2712	2788	2863		9612	9750	9888	
5.2(WCDMA)	\	23.56	23.51	23.48	24.00	23.51	23.58	23.54	24.00
5.2AA (HSDPA)	1	22.10	22.04	22.00	22.50	22.67	22.70	22.66	23.00
	2	22.01	22.02	21.81	22.50	22.29	22.42	22.49	23.00
	3	21.83	21.86	21.43	22.00	22.01	22.38	22.30	22.50
	4	21.70	21.85	21.14	22.00	21.68	22.04	22.14	22.50
5.2B (HSUPA)	1	21.98	21.96	21.95	22.00	22.31	22.34	22.29	22.50
	2	21.78	21.73	21.69	22.00	22.26	22.33	22.36	22.50
	3	21.73	21.62	21.48	22.00	22.09	22.05	22.24	22.50
	4	21.47	21.70	21.51	22.00	21.96	21.76	21.98	22.00
	5	21.55	21.41	21.57	22.00	21.68	21.59	21.80	22.00

The conducted power measurement results for WLAN 2.4G

Mode	Channel	Frequency (MHz)	Conducted Output Power	Tune up (dBm)	Test Rate Data
			(dBm)		
802.11b	1	2412	11.77	12.00	1 Mbps
	7	2442	10.99	11.00	1 Mbps
	13	2472	10.55	11.00	1 Mbps
802.11g	1	2412	10.55	11.00	6 Mbps
	7	2442	9.99	10.00	6 Mbps
	13	2472	10.00	10.50	6 Mbps
802.11n(20MHz)	1	2412	10.01	10.50	6.5 Mbps
	7	2442	9.94	10.00	6.5 Mbps
	13	2472	10.01	10.50	6.5 Mbps
802.11n(40MHz)	3	2422	8.61	9.00	13 Mbps
	7	2442	8.16	8.50	13 Mbps
	11	2462	7.94	8.00	13 Mbps

The conducted power measurement results for WLAN 5.2G

Mode	Channel	Frequency (MHz)	Conducted Output Power(dBm)	Tune up (dBm)
802.11a	36	5180	6.66	7.00
	40	5200	6.65	7.00
	48	5240	6.63	7.00
802.11n(20MHz)	36	5180	6.92	7.00
	40	5200	6.90	7.00
	48	5240	6.89	7.00
802.11ac(20MHz)	36	5180	6.88	7.00
	40	5200	6.85	7.00
	48	5240	6.83	7.00
802.11n(40MHz)	38	5190	7.30	7.50
	46	5230	7.26	7.50
802.11ac(40MHz)	38	5190	6.94	7.00
	46	5230	6.91	7.00
802.11ac(80MHz)	42	5210	7.32	7.50

**The conducted power measurement results for WLAN 5.8G**

Mode	Channel	Frequency (MHz)	Conducted Output Power(dBm)	Tune up (dBm)
802.11a	149	5745	6.16	6.50
	157	5785	6.12	6.50
	165	5825	6.10	6.50
802.11n(20MHz)	149	5745	6.03	6.50
	157	5785	6.01	6.50
	165	5825	6.00	6.50
802.11ac(20MHz)	149	5745	5.98	6.00
	157	5785	5.95	6.00
	165	5825	5.92	6.00
802.11n(40MHz)	151	5755	6.46	6.50
	159	5795	6.41	6.50
802.11ac(40MHz)	151	5755	6.43	6.50
	159	5795	6.39	6.50
802.11ac(80MHz)	155	5775	6.79	7.00

The conducted power measurement results for Bluetooth

Mode	Channel	Frequency (MHz)	Conducted Output Power	Tune up (dBm)
			(dBm)	
BLE_1M	00	2402	-1.02	-1.00
	19	2440	-2.00	-1.50
	39	2480	-1.72	-1.50
BLE_2M	00	2402	-1.78	-1.50
	19	2440	-2.78	-2.50
	39	2480	-2.52	-2.50
GFSK	00	2402	0.49	0.50
	78	2480	0.57	1.00
$\pi/4$ -DQPSK	00	2402	-1.42	-1.00
	78	2480	-0.88	-0.50
8DPSK	00	2402	0.14	0.50
	78	2480	-0.08	0.00

Note: 1. because the output power(eirp) of Bluetooth of the EUT is less than 20mW(13dBm), so standalone SAR are exempt according EN50663.

**The conducted power measurement results for LTE****LTE-BAND1**

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band1	5MHz	QPSK	18025	1RB#0	20.73	21.00
NTNV	Band1	5MHz	QPSK	18025	8RB#0	20.62	21.00
NTNV	Band1	5MHz	QPSK	18300	1RB#0	21.15	22.00
NTNV	Band1	5MHz	QPSK	18300	8RB#0	21.34	22.00
NTNV	Band1	5MHz	QPSK	18575	1RB#24	20.43	21.00
NTNV	Band1	5MHz	QPSK	18575	8RB#17	20.34	21.00
NTNV	Band1	20MHz	QPSK	18100	1RB#0	20.53	21.00
NTNV	Band1	20MHz	QPSK	18100	18RB#0	20.41	21.00
NTNV	Band1	20MHz	QPSK	18300	1RB#0	20.42	21.00
NTNV	Band1	20MHz	QPSK	18300	18RB#0	20.61	21.00
NTNV	Band1	20MHz	QPSK	18500	1RB#99	21.30	22.00
NTNV	Band1	20MHz	QPSK	18500	18RB#82	21.45	22.00

LTE-BAND3

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band3	1.4MHz	QPSK	19207	1RB#0	20.32	21.00
NTNV	Band3	1.4MHz	QPSK	19943	1RB#0	20.09	21.00
NTNV	Band3	1.4MHz	QPSK	19575	1RB#0	20.86	21.00
NTNV	Band3	1.4MHz	QPSK	19575	5RB#0	20.96	21.00
NTNV	Band3	5MHz	QPSK	19225	1RB#0	20.36	21.00
NTNV	Band3	5MHz	QPSK	19225	1RB#24	20.52	21.00
NTNV	Band3	5MHz	QPSK	19925	1RB#0	20.45	21.00
NTNV	Band3	5MHz	QPSK	19925	1RB#24	20.01	21.00
NTNV	Band3	5MHz	QPSK	19575	1RB#0	21.01	22.00
NTNV	Band3	5MHz	QPSK	19575	1RB#24	20.78	21.00
NTNV	Band3	5MHz	QPSK	19575	8RB#0	20.99	21.00
NTNV	Band3	20MHz	QPSK	19300	1RB#0	20.33	21.00
NTNV	Band3	20MHz	QPSK	19300	1RB#99	21.28	22.00
NTNV	Band3	20MHz	QPSK	19850	1RB#0	20.65	21.00
NTNV	Band3	20MHz	QPSK	19850	1RB#99	20.10	21.00
NTNV	Band3	20MHz	QPSK	19575	1RB#0	21.67	22.00
NTNV	Band3	20MHz	QPSK	19575	1RB#99	20.79	21.00
NTNV	Band3	20MHz	QPSK	19575	18RB#0	21.43	22.00

**LTE-BAND7**

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band7	5MHz	QPSK	20775	1RB#0	20.09	21.00
NTNV	Band7	5MHz	QPSK	20775	1RB#24	19.70	20.00
NTNV	Band7	5MHz	QPSK	21425	1RB#0	20.19	21.00
NTNV	Band7	5MHz	QPSK	21425	1RB#24	20.81	21.00
NTNV	Band7	5MHz	QPSK	21100	1RB#0	21.14	22.00
NTNV	Band7	5MHz	QPSK	21100	1RB#24	21.01	22.00
NTNV	Band7	5MHz	QPSK	21100	8RB#0	21.13	22.00
NTNV	Band7	20MHz	QPSK	20850	1RB#0	19.96	20.00
NTNV	Band7	20MHz	QPSK	20850	1RB#99	19.71	20.00
NTNV	Band7	20MHz	QPSK	21350	1RB#0	19.55	20.00
NTNV	Band7	20MHz	QPSK	21350	1RB#99	20.54	21.00
NTNV	Band7	20MHz	QPSK	21100	1RB#0	21.58	22.00
NTNV	Band7	20MHz	QPSK	21100	1RB#99	21.06	22.00
NTNV	Band7	20MHz	QPSK	21100	18RB#0	21.73	22.00

LTE-BAND8

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band8	1.4MHz	QPSK	21457	1RB#0	23.93	24.00
NTNV	Band8	1.4MHz	QPSK	21793	1RB#0	23.45	24.00
NTNV	Band8	1.4MHz	QPSK	21625	1RB#0	23.90	24.00
NTNV	Band8	1.4MHz	QPSK	21625	5RB#0	23.96	24.00
NTNV	Band8	5MHz	QPSK	21475	1RB#0	23.89	24.00
NTNV	Band8	5MHz	QPSK	21475	1RB#24	23.90	24.00
NTNV	Band8	5MHz	QPSK	21775	1RB#0	23.40	24.00
NTNV	Band8	5MHz	QPSK	21775	1RB#24	23.30	24.00
NTNV	Band8	5MHz	QPSK	21625	1RB#0	23.90	24.00
NTNV	Band8	5MHz	QPSK	21625	1RB#24	23.77	24.00
NTNV	Band8	5MHz	QPSK	21625	8RB#0	23.85	24.00
NTNV	Band8	10MHz	QPSK	21500	1RB#0	23.89	24.00
NTNV	Band8	10MHz	QPSK	21500	1RB#49	23.90	24.00
NTNV	Band8	10MHz	QPSK	21750	1RB#0	23.68	24.00
NTNV	Band8	10MHz	QPSK	21750	1RB#49	23.38	24.00
NTNV	Band8	10MHz	QPSK	21625	1RB#0	23.93	24.00
NTNV	Band8	10MHz	QPSK	21625	1RB#49	23.71	24.00
NTNV	Band8	10MHz	QPSK	21625	12RB#0	23.93	24.00

**LTE-BAND20**

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band20	5MHz	QPSK	24175	1RB#0	24.03	24.50
NTNV	Band20	5MHz	QPSK	24175	1RB#24	24.08	24.50
NTNV	Band20	5MHz	QPSK	24425	1RB#0	24.25	24.50
NTNV	Band20	5MHz	QPSK	24425	1RB#24	24.20	24.50
NTNV	Band20	5MHz	QPSK	24300	1RB#0	24.18	24.50
NTNV	Band20	5MHz	QPSK	24300	1RB#24	24.21	24.50
NTNV	Band20	5MHz	QPSK	24300	8RB#0	24.12	24.50
NTNV	Band20	20MHz	QPSK	24250	1RB#0	24.00	24.50
NTNV	Band20	20MHz	QPSK	24250	1RB#99	24.20	24.50
NTNV	Band20	20MHz	QPSK	24350	1RB#0	24.07	24.50
NTNV	Band20	20MHz	QPSK	24350	1RB#99	24.15	24.50
NTNV	Band20	20MHz	QPSK	24300	1RB#0	23.92	24.50
NTNV	Band20	20MHz	QPSK	24300	1RB#99	24.18	24.50
NTNV	Band20	20MHz	QPSK	24300	18RB#0	23.99	24.50

LTE-BAND28-1

Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Tune up (dBm)
NTNV	Band28(703-733)	3MHz	QPSK	27225	1RB#0	23.60	24.00
NTNV	Band28(703-733)	3MHz	QPSK	27225	4RB#0	23.65	24.00
NTNV	Band28(703-733)	3MHz	QPSK	27360	1RB#0	23.73	24.00
NTNV	Band28(703-733)	3MHz	QPSK	27360	4RB#0	23.60	24.00
NTNV	Band28(703-733)	3MHz	QPSK	27495	1RB#14	23.54	24.00
NTNV	Band28(703-733)	3MHz	QPSK	27495	4RB#11	23.54	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27235	1RB#0	23.49	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27235	8RB#0	23.49	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27360	1RB#0	23.60	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27360	8RB#0	23.52	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27485	1RB#24	23.52	24.00
NTNV	Band28(703-733)	5MHz	QPSK	27485	8RB#17	23.59	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27310	1RB#0	23.58	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27310	18RB#0	23.51	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27360	1RB#0	23.61	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27360	18RB#0	23.61	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27410	1RB#99	23.42	24.00
NTNV	Band28(703-733)	20MHz	QPSK	27410	18RB#82	23.39	24.00



LTE-BAND28-2

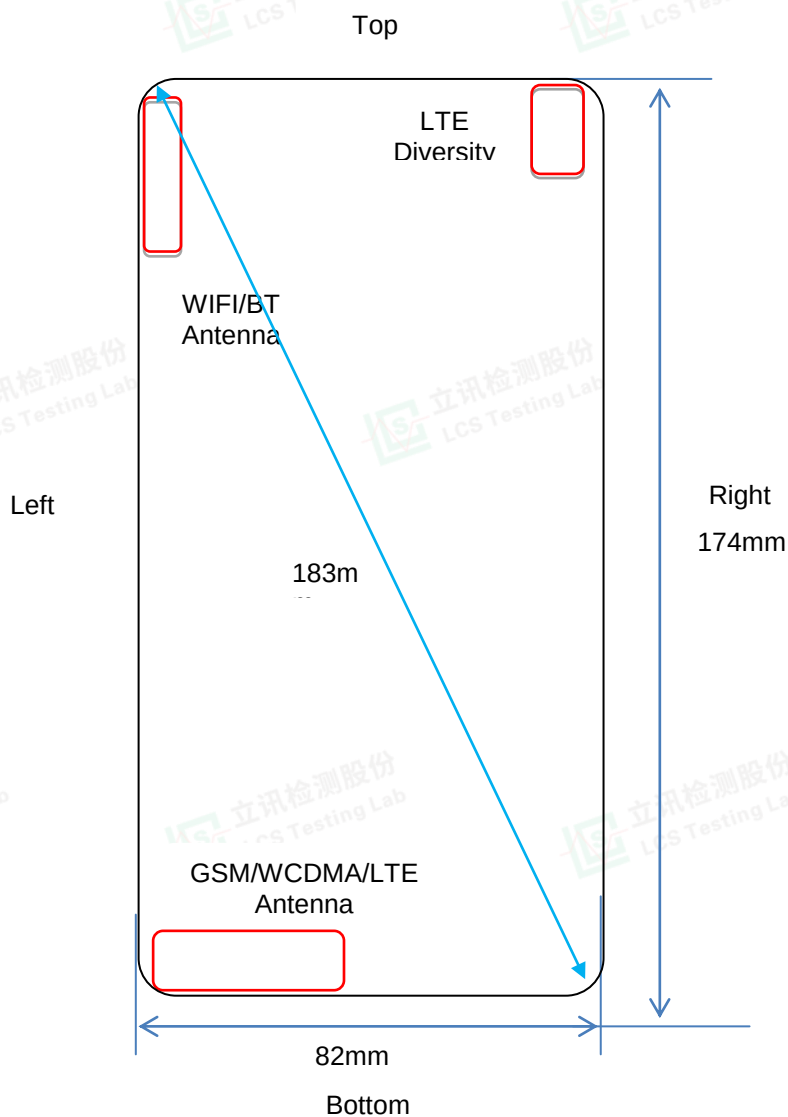
Condition	Band	Channel Bandwidth	Modulation	Channel	RB Configure	Result (dBm)	Limit (dBm)
NTNV	Band28(718-748)	3MHz	QPSK	27375	1RB#0	23.71	24.00
NTNV	Band28(718-748)	3MHz	QPSK	27375	4RB#0	23.59	24.00
NTNV	Band28(718-748)	3MHz	QPSK	27510	1RB#0	23.57	24.00
NTNV	Band28(718-748)	3MHz	QPSK	27510	4RB#0	23.55	24.00
NTNV	Band28(718-748)	3MHz	QPSK	27645	1RB#14	23.54	24.00
NTNV	Band28(718-748)	3MHz	QPSK	27645	4RB#11	23.61	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27385	1RB#0	23.62	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27385	8RB#0	23.53	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27510	1RB#0	23.47	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27510	8RB#0	23.60	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27635	1RB#24	23.56	24.00
NTNV	Band28(718-748)	5MHz	QPSK	27635	8RB#17	23.45	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27460	1RB#0	23.65	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27460	18RB#0	23.60	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27510	1RB#0	23.46	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27510	18RB#0	23.59	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27560	1RB#99	23.48	24.00
NTNV	Band28(718-748)	20MHz	QPSK	27560	18RB#82	23.36	24.00

LTE-BAND41

The Conducted Power Measurement Result for LTE Band					
Test Result for LTE Band 41					
Channel Bandwidth	Channel	RB Allocation		Average Power (dBm, QPSK)	Limit (dBm)
		RB Size	RB Offset		
5MHz	Low Range	1	1RB#0	23.44	18.8~25.7
			1RB#24	23.47	18.8~25.7
	Mid Range	1	1RB#0	23.88	20.3~25.7
			1RB#24	23.77	20.3~25.7
	High Range	1	1RB#0	23.87	18.8~25.7
			1RB#24	23.37	18.8~25.7
20MHz	Low Range	1	1RB#0	23.46	18.8~25.7
			1RB#99	23.47	18.8~25.7
	Mid Range	1	1RB#0	23.82	20.3~25.7
			1RB#99	23.55	20.3~25.7
	High Range	1	1RB#0	23.85	18.8~25.7
			1RB#99	23.36	18.8~25.7
			18RB#0	23.00	18.8~25.7



4.2. DUT Antenna Locations(Rear View)



Rear View



4.3. SAR Measurement Results

SAR Values [GSM 900]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
63	902.6	Voice	Left Cheek	32.42	33.00	2.41	1.143	0.081	0.093	Plot 1
124	914.8	Voice	Left Cheek	32.52	33.00	0.08	1.117	0.070	0.078	
975	880.2	Voice	Left Cheek	32.44	33.00	-4.12	1.138	0.067	0.076	
63	902.6	Voice	Left Tilt	32.42	33.00	2.13	1.143	0.043	0.049	
63	902.6	Voice	Right Cheek	32.42	33.00	0.64	1.143	0.077	0.088	
63	902.6	Voice	Right Tilt	32.42	33.00	-1.87	1.143	0.040	0.046	
measured / reported SAR numbers - Body (5mm)										
63	902.6	2Txslots	Front	28.61	29.00	-1.21	1.094	0.061	0.067	Plot 2
63	902.6	2Txslots	Rear	28.61	29.00	0.18	1.094	0.133	0.145	
975	880.2	2Txslots	Rear	28.53	29.00	-3.32	1.114	0.115	0.128	
124	914.8	2Txslots	Rear	28.52	29.00	0.09	1.117	0.110	0.123	
63	902.6	2Txslots	Left	28.61	29.00	0.74	1.094	0.053	0.058	
63	902.6	2Txslots	Right	28.61	29.00	-2.54	1.094	0.036	0.039	
63	902.6	2Txslots	Top	28.61	29.00	4.77	1.094	0.017	0.019	
63	902.6	2Txslots	Bottom	28.61	29.00	-0.36	1.094	0.059	0.065	

Note:

- 1.The EUT is a Class B Mobile Phone which can be attached to both GPRS and GSM services,using one service at a time
- 2.The Multi-slot Classes of EUT is Class12 which has maximum 1 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+2UL is the worse case.

SAR Values [GSM 1800]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
698	1747.4	Voice	Left Cheek	29.67	30.00	1.83	1.079	0.052	0.056	Plot 3
885	1784.8	Voice	Left Cheek	29.63	30.00	-1.17	1.089	0.046	0.050	
512	1710.2	Voice	Left Cheek	29.57	30.00	0.15	1.104	0.035	0.039	
698	1747.4	Voice	Left Tilt	29.67	30.00	-3.12	1.079	0.029	0.031	
698	1747.4	Voice	Right Cheek	29.67	30.00	2.85	1.079	0.05	0.054	
698	1747.4	Voice	Right Tilt	29.67	30.00	4.10	1.079	0.027	0.029	
measured / reported SAR numbers - Body (5mm)										
698	1747.4	2Txslots	Front	26.28	26.50	-1.12	1.052	0.072	0.076	Plot 4
698	1747.4	2Txslots	Rear	26.28	26.50	0.60	1.052	0.130	0.137	
885	1784.8	2Txslots	Rear	26.29	26.50	0.02	1.050	0.122	0.128	
512	1710.2	2Txslots	Rear	26.36	26.50	-0.41	1.033	0.119	0.123	
698	1747.4	2Txslots	Left	26.28	26.50	0.94	1.052	0.056	0.059	
698	1747.4	2Txslots	Right	26.28	26.50	-2.91	1.052	0.028	0.029	
698	1747.4	2Txslots	Top	26.28	26.50	0.56	1.052	0.011	0.012	
698	1747.4	2Txslots	Bottom	26.28	26.50	-1.04	1.052	0.069	0.073	

Note:

- 1.The EUT is a Class B Mobile Phone which can be attached to both GPRS and GSM services,using one service at a time
- 2.The Multi-slot Classes of EUT is Class12 which has maximum 1 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+2UL is the worse case.

**SAR Values [WCDMA Band VIII]**

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
2788	897.6	RMC	Left Cheek	23.51	24.00	3.66	1.119	0.079	0.088	Plot 5
2712	882.4	RMC	Left Cheek	23.56	24.00	0.03	1.107	0.072	0.080	
2863	912.6	RMC	Left Cheek	23.48	24.00	-0.19	1.127	0.065	0.073	
2788	897.6	RMC	Left Tilt	23.51	24.00	3.45	1.119	0.044	0.049	
2788	897.6	RMC	Right Cheek	23.51	24.00	-2.06	1.119	0.075	0.084	
2788	897.6	RMC	Right Tilt	23.51	24.00	1.87	1.119	0.039	0.044	
measured / reported SAR numbers - Body (5mm)										
2788	897.6	RMC	Front	23.51	24.00	-0.54	1.119	0.055	0.062	Plot 6
2788	897.6	RMC	Rear	23.51	24.00	-0.24	1.119	0.109	0.122	
2712	882.4	RMC	Rear	23.56	24.00	1.36	1.107	0.096	0.106	
2863	912.6	RMC	Rear	23.48	24.00	-0.28	1.127	0.088	0.099	
2788	897.6	RMC	Left	23.51	24.00	0.04	1.119	0.042	0.047	
2788	897.6	RMC	Right	23.51	24.00	-3.33	1.119	0.024	0.027	
2788	897.6	RMC	Top	23.51	24.00	0.78	1.119	0.009	0.010	
2788	897.6	RMC	Bottom	23.51	24.00	-1.25	1.119	0.051	0.057	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode

SAR Values [WCDMA Band I]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
9750	1950.0	RMC	Left Cheek	23.58	24.00	0.02	1.102	0.056	0.062	Plot 7
9612	1922.4	RMC	Left Cheek	23.51	24.00	-3.65	1.119	0.042	0.047	
9888	1977.6	RMC	Left Cheek	23.54	24.00	0.08	1.112	0.046	0.051	
9750	1950.0	RMC	Left Tilt	23.58	24.00	-4.78	1.102	0.033	0.036	
9750	1950.0	RMC	Right Cheek	23.58	24.00	2.94	1.102	0.051	0.056	
9750	1950.0	RMC	Right Tilt	23.58	24.00	3.64	1.102	0.03	0.033	
measured / reported SAR numbers - Body (5mm)										
9750	1950.0	RMC	Front	23.58	24.00	-0.92	1.102	0.172	0.189	Plot 8
9750	1950.0	RMC	Rear	23.58	24.00	-1.02	1.102	0.249	0.274	
9612	1922.4	RMC	Rear	23.51	24.00	-3.33	1.119	0.215	0.241	
9888	1977.6	RMC	Rear	23.54	24.00	-0.18	1.112	0.226	0.251	
9750	1950.0	RMC	Left	23.58	24.00	-0.50	1.102	0.116	0.128	
9750	1950.0	RMC	Right	23.58	24.00	-1.17	1.102	0.088	0.097	
9750	1950.0	RMC	Top	23.58	24.00	0.85	1.102	0.031	0.034	
9750	1950.0	RMC	Bottom	23.58	24.00	3.98	1.102	0.159	0.175	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**SAR Values [WLAN2450]**

Ch.	Freq. (MHz)	Time slots	Test Position	Conducte d Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
7	2442	802.11b	Left Cheek	10.99	11.00	-3.75	1.002	0.232	0.233	Plot 9
1	2412	802.11b	Left Cheek	11.77	12.00	-0.65	1.054	0.215	0.227	
13	2472	802.11b	Left Cheek	10.55	11.00	2.98	1.109	0.206	0.228	
7	2442	802.11b	Left Tilt	10.99	11.00	3.45	1.002	0.119	0.119	
7	2442	802.11b	Right Cheek	10.99	11.00	0.62	1.002	0.225	0.226	
7	2442	802.11b	Right Tilt	10.99	11.00	-4.21	1.002	0.108	0.108	
measured / reported SAR numbers - Body (5mm)										
7	2442	802.11b	Front	10.99	11.00	0.32	1.002	0.095	0.095	Plot10
7	2442	802.11b	Rear	10.99	11.00	-0.53	1.002	0.159	0.159	
1	2412	802.11b	Rear	11.77	12.00	-3.98	1.054	0.144	0.152	
13	2472	802.11b	Rear	10.55	11.00	0.05	1.109	0.120	0.133	
7	2442	802.11b	Left	10.99	11.00	1.05	1.002	0.072	0.072	
7	2442	802.11b	Right	10.99	11.00	-4.56	1.002	0.034	0.034	
7	2442	802.11b	Top	10.99	11.00	3.69	1.002	0.018	0.018	
7	2442	802.11b	Bottom	10.99	11.00	-0.08	1.002	0.089	0.089	

Note:

- The result was tested under the lowest data rate 1Mbps for 802.11b.

SAR Values [WLAN5200]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
42	5210	802.11ac(80MHz)	Left Cheek	7.32	7.50	-2.62	1.042	0.154	0.161	Plot 11
42	5210	802.11ac(80MHz)	Left Tilt	7.32	7.50	0.22	1.042	0.082	0.085	
42	5210	802.11ac(80MHz)	Right Cheek	7.32	7.50	3.45	1.042	0.149	0.155	
42	5210	802.11ac(80MHz)	Right Tilt	7.32	7.50	-2.08	1.042	0.079	0.082	
measured / reported SAR numbers - Body (5mm)										
42	5210	802.11ac(80MHz)	Front	7.32	7.50	1.36	1.042	0.067	0.070	Plot 12
42	5210	802.11ac(80MHz)	Rear	7.32	7.50	-1.11	1.042	0.119	0.124	
42	5210	802.11ac(80MHz)	Left	7.32	7.50	-3.85	1.042	0.042	0.044	
42	5210	802.11ac(80MHz)	Right	7.32	7.50	4.78	1.042	0.023	0.024	
42	5210	802.11ac(80MHz)	Top	7.32	7.50	1.19	1.042	0.062	0.065	
42	5210	802.11ac(80MHz)	Bottom	7.32	7.50	3.65	1.042	0.011	0.011	

Note:

- The result was tested under the lowest data rate 6Mbps for 802.11ac(80MHz).

SAR Values [WLAN5800]

Ch.	Freq. (MHz)	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
								Measured	Reported	
measured / reported SAR numbers – Head										
155	5775	802.11ac(80MHz)	Left Cheek	6.79	7.00	-1.30	1.050	0.079	0.083	Plot 13
155	5775	802.11ac(80MHz)	Left Tilt	6.79	7.00	3.45	1.050	0.043	0.045	
155	5775	802.11ac(80MHz)	Right Cheek	6.79	7.00	0.56	1.050	0.076	0.080	
155	5775	802.11ac(80MHz)	Right Tilt	6.79	7.00	-2.11	1.050	0.041	0.043	
measured / reported SAR numbers - Body (5mm)										
155	5775	802.11ac(80MHz)	Front	6.79	7.00	0.13	1.050	0.038	0.040	
155	5775	802.11ac(80MHz)	Rear	6.79	7.00	-0.29	1.050	0.051	0.054	Plot14
155	5775	802.11ac(80MHz)	Left	6.79	7.00	-3.85	1.050	0.029	0.030	
155	5775	802.11ac(80MHz)	Right	6.79	7.00	4.78	1.050	0.022	0.023	
155	5775	802.11ac(80MHz)	Top	6.79	7.00	1.19	1.050	0.035	0.037	
155	5775	802.11ac(80MHz)	Bottom	6.79	7.00	3.65	1.050	0.004	0.004	

Note:

- The result was tested under the lowest data rate 6Mbps for 802.11ac(80MHz).

**SAR Values [E-UTRA Band 1]**

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
18300	1950.0	20MHz	18RB#0	Left Cheek	20.61	21.00	1.23	1.094	0.106	0.116	Plot15
18100	1920.0	20MHz	1RB#0	Left Cheek	20.53	21.00	0.06	1.114	0.085	0.095	
18500	1979.9	20MHz	18RB#82	Left Cheek	21.45	22.00	-3.25	1.135	0.096	0.109	
18300	1950.0	20MHz	18RB#0	Left Tilt	20.61	21.00	3.45	1.094	0.063	0.069	
18300	1950.0	20MHz	18RB#0	Right Cheek	20.61	21.00	2.87	1.094	0.097	0.106	
18300	1950.0	20MHz	18RB#0	Right Tilt	20.61	21.00	-4.44	1.094	0.060	0.066	
measured / reported SAR numbers - Body (5mm)											
18300	1950.0	20MHz	18RB#0	Front	20.61	21.00	-0.19	1.094	0.102	0.112	
18300	1950.0	20MHz	18RB#0	Rear	20.61	21.00	1.16	1.094	0.188	0.206	Plot16
18100	1920.0	20MHz	1RB#0	Rear	20.53	21.00	4.87	1.114	0.162	0.181	
18500	1979.9	20MHz	18RB#82	Rear	21.45	22.00	0.02	1.135	0.179	0.203	
18300	1950.0	20MHz	18RB#0	Left	20.61	21.00	0.89	1.094	0.073	0.080	
18300	1950.0	20MHz	18RB#0	Right	20.61	21.00	-4.17	1.094	0.052	0.057	
18300	1950.0	20MHz	18RB#0	Top	20.61	21.00	-1.20	1.094	0.012	0.013	
18300	1950.0	20MHz	18RB#0	Bottom	20.61	21.00	-0.98	1.094	0.097	0.106	

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

SAR Values [E-UTRA Band 3]

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
19575	1747.5	20MHz	1RB#0	Left Cheek	21.67	22.00	-0.69	1.079	0.306	0.330	Plot17
19300	1720.0	20MHz	1RB#99	Left Cheek	21.28	22.00	-2.21	1.180	0.278	0.328	
19850	1775.0	20MHz	1RB#0	Left Cheek	20.65	21.00	3.65	1.084	0.232	0.251	
19575	1747.5	20MHz	1RB#0	Left Tilt	21.67	22.00	2.03	1.079	0.162	0.175	
19575	1747.5	20MHz	1RB#0	Right Cheek	21.67	22.00	-4.63	1.079	0.299	0.323	
19575	1747.5	20MHz	1RB#0	Right Tilt	21.67	22.00	-1.08	1.079	0.154	0.166	
measured / reported SAR numbers - Body (5mm)											
19575	1747.5	20MHz	1RB#0	Front	21.67	22.00	-0.19	1.079	0.125	0.135	
19575	1747.5	20MHz	1RB#0	Rear	21.67	22.00	-4.65	1.079	0.206	0.222	Plot18
19300	1720.0	20MHz	1RB#99	Rear	21.28	22.00	-4.17	1.180	0.178	0.210	
19850	1775.0	20MHz	1RB#0	Rear	20.65	21.00	2.98	1.084	0.136	0.147	
19575	1747.5	20MHz	1RB#0	Left	21.67	22.00	-1.77	1.079	0.097	0.105	
19575	1747.5	20MHz	1RB#0	Right	21.67	22.00	3.65	1.079	0.061	0.066	
19575	1747.5	20MHz	1RB#0	Top	21.67	22.00	0.96	1.079	0.024	0.026	
19575	1747.5	20MHz	1RB#0	Bottom	21.67	22.00	2.52	1.079	0.121	0.131	

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**SAR Values [E-UTRA Band 7]**

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
21100	2535.0	20MHz	18RB#0	Left Cheek	21.73	22.00	-3.99	1.064	0.107	0.114	Plot19
20850	2510.0	20MHz	1RB#0	Left Cheek	19.96	20.00	-4.11	1.009	0.072	0.073	
21350	2560.0	20MHz	1RB#99	Left Cheek	20.54	21.00	-3.12	1.112	0.087	0.097	
21100	2535.0	20MHz	18RB#0	Left Tilt	21.73	22.00	4.12	1.064	0.063	0.067	
21100	2535.0	20MHz	18RB#0	Right Cheek	21.73	22.00	3.05	1.064	0.101	0.107	
21100	2535.0	20MHz	18RB#0	Right Tilt	21.73	22.00	2.33	1.064	0.056	0.060	
measured / reported SAR numbers - Body (5mm)											
21100	2535.0	20MHz	18RB#0	Front	21.73	22.00	0.09	1.064	0.234	0.249	
21100	2535.0	20MHz	18RB#0	Rear	21.73	22.00	-0.45	1.064	0.405	0.431	Plot20
20850	2510.0	20MHz	1RB#0	Rear	19.96	20.00	-4.17	1.009	0.342	0.345	
21350	2560.0	20MHz	1RB#99	Rear	20.54	21.00	0.02	1.112	0.384	0.427	
21100	2535.0	20MHz	18RB#0	Left	21.73	22.00	-2.22	1.064	0.216	0.230	
21100	2535.0	20MHz	18RB#0	Right	21.73	22.00	3.52	1.064	0.115	0.122	
21100	2535.0	20MHz	18RB#0	Top	21.73	22.00	-4.78	1.064	0.048	0.051	
21100	2535.0	20MHz	18RB#0	Bottom	21.73	22.00	0.06	1.064	0.181	0.193	

Note:

- 1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

SAR Values [E-UTRA Band 8]

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
21625	897.5	1.4MHz	5RB#0	Left Cheek	23.96	24.00	4.21	1.009	0.101	0.102	Plot21
21457	880.7	1.4MHz	1RB#0	Left Cheek	23.93	24.00	0.09	1.016	0.096	0.098	
21793	914.3	1.4MHz	1RB#0	Left Cheek	23.45	24.00	-2.06	1.135	0.065	0.074	
21625	897.5	1.4MHz	5RB#0	Left Tilt	23.96	24.00	3.45	1.009	0.055	0.056	
21625	897.5	1.4MHz	5RB#0	Right Cheek	23.96	24.00	2.06	1.009	0.097	0.098	
21625	897.5	1.4MHz	5RB#0	Right Tilt	23.96	24.00	-3.96	1.009	0.051	0.051	
measured / reported SAR numbers - Body (5mm)											
21625	897.5	1.4MHz	5RB#0	Front	23.96	24.00	-0.24	1.009	0.263	0.265	Plot22
21625	897.5	1.4MHz	5RB#0	Rear	23.96	24.00	-0.24	1.009	0.483	0.487	
21457	880.7	1.4MHz	1RB#0	Rear	23.93	24.00	-4.12	1.016	0.472	0.480	
21793	914.3	1.4MHz	1RB#0	Rear	23.45	24.00	0.08	1.135	0.426	0.484	
21625	897.5	1.4MHz	5RB#0	Left	23.96	24.00	3.65	1.009	0.197	0.199	
21625	897.5	1.4MHz	5RB#0	Right	23.96	24.00	0.85	1.009	0.131	0.132	
21625	897.5	1.4MHz	5RB#0	Top	23.96	24.00	4.96	1.009	0.082	0.083	
21625	897.5	1.4MHz	5RB#0	Bottom	23.96	24.00	-3.35	1.009	0.238	0.240	

Note:

- 1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**SAR Values [E-UTRA Band 20]**

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
24300	847.0	5MHz	1RB#24	Left Cheek	24.21	24.50	-0.85	1.069	0.089	0.095	Plot23
24175	834.5	5MHz	1RB#24	Left Cheek	24.08	24.50	-2.02	1.102	0.069	0.076	
24425	859.5	5MHz	1RB#0	Left Cheek	24.25	24.50	1.44	1.059	0.080	0.085	
24300	847.0	5MHz	1RB#24	Left Tilt	24.21	24.50	3.45	1.069	0.051	0.055	
24300	847.0	5MHz	1RB#24	Right Cheek	24.21	24.50	2.05	1.069	0.083	0.089	
24300	847.0	5MHz	1RB#24	Right Tilt	24.21	24.50	-3.74	1.069	0.044	0.047	
measured / reported SAR numbers - Body (5mm)											
24300	847.0	5MHz	1RB#24	Front	24.21	24.50	-0.33	1.069	0.044	0.047	
24300	847.0	5MHz	1RB#24	Rear	24.21	24.50	-0.47	1.069	0.080	0.086	Plot24
24175	834.5	5MHz	1RB#24	Rear	24.08	24.50	0.08	1.102	0.052	0.057	
24425	859.5	5MHz	1RB#0	Rear	24.25	24.50	-4.12	1.059	0.072	0.076	
24300	847.0	5MHz	1RB#24	Left	24.21	24.50	-1.65	1.069	0.028	0.030	
24300	847.0	5MHz	1RB#24	Right	24.21	24.50	3.89	1.069	0.019	0.020	
24300	847.0	5MHz	1RB#24	Top	24.21	24.50	0.01	1.069	0.005	0.005	
24300	847.0	5MHz	1RB#24	Bottom	24.21	24.50	-4.52	1.069	0.041	0.044	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

SAR Values [E-UTRA Band 28(703-733)]

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
27360	718.0	3MHz	1RB#0	Left Cheek	23.73	24.00	-0.55	1.064	0.025	0.027	Plot25
27225	704.5	3MHz	4RB#0	Left Cheek	23.65	24.00	-0.03	1.084	0.018	0.020	
27495	731.5	3MHz	4RB#11	Left Cheek	23.54	24.00	1.41	1.112	0.014	0.016	
27360	718.0	3MHz	1RB#0	Left Tilt	23.73	24.00	0.82	1.064	0.014	0.015	
27360	718.0	3MHz	1RB#0	Right Cheek	23.73	24.00	0.71	1.064	0.023	0.024	
27360	718.0	3MHz	1RB#0	Right Tilt	23.73	24.00	-2.25	1.064	0.012	0.013	
measured / reported SAR numbers - Body (5mm)											
27360	718.0	3MHz	1RB#0	Front	23.73	24.00	1.24	1.064	0.064	0.068	
27360	718.0	3MHz	1RB#0	Rear	23.73	24.00	0.82	1.064	0.124	0.132	Plot26
27225	704.5	3MHz	4RB#0	Rear	23.65	24.00	-1.21	1.084	0.110	0.119	
27495	731.5	3MHz	4RB#11	Rear	23.54	24.00	0.03	1.112	0.085	0.094	
27360	718.0	3MHz	1RB#0	Left	23.73	24.00	-3.62	1.064	0.036	0.038	
27360	718.0	3MHz	1RB#0	Right	23.73	24.00	0.31	1.064	0.027	0.029	
27360	718.0	3MHz	1RB#0	Top	23.73	24.00	1.07	1.064	0.006	0.006	
27360	718.0	3MHz	1RB#0	Bottom	23.73	24.00	0.3	1.064	0.059	0.063	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**SAR Values [E-UTRA Band 28(718-748)]**

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
27510	733.0	3MHz	1RB#0	Left Cheek	23.57	24.00	-4.12	1.104	0.018	0.020	
27375	719.5	3MHz	1RB#0	Left Cheek	23.71	24.00	0.05	1.069	0.012	0.013	
27645	746.5	3MHz	4RB#11	Left Cheek	23.61	24.00	-1.97	1.094	0.009	0.010	
27510	733.0	3MHz	1RB#0	Left Tilt	23.57	24.00	3.25	1.104	0.006	0.007	
27510	733.0	3MHz	1RB#0	Right Cheek	23.57	24.00	4.10	1.104	0.015	0.017	
27510	733.0	3MHz	1RB#0	Right Tilt	23.57	24.00	2.22	1.104	0.003	0.003	
measured / reported SAR numbers - Body (5mm)											
27510	733.0	3MHz	1RB#0	Front	23.57	24.00	-1.74	1.104	0.052	0.057	
27510	733.0	3MHz	1RB#0	Rear	23.57	24.00	0.02	1.104	0.106	0.117	
27375	719.5	3MHz	1RB#0	Rear	23.71	24.00	3.65	1.069	0.096	0.103	
27645	746.5	3MHz	4RB#11	Rear	23.61	24.00	4.12	1.094	0.075	0.082	
27510	733.0	3MHz	1RB#0	Left	23.57	24.00	0.08	1.104	0.049	0.054	
27510	733.0	3MHz	1RB#0	Right	23.57	24.00	-1.11	1.104	0.038	0.042	
27510	733.0	3MHz	1RB#0	Top	23.57	24.00	-3.21	1.104	0.002	0.002	
27510	733.0	3MHz	1RB#0	Bottom	23.57	24.00	0.02	1.104	0.066	0.073	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

SAR Values [E-UTRA Band 41]

Ch.	Freq. (MHz)	Channel Bandwidth	Time slots	Test Position	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (%)	Scaling Factor	SAR _{10-g} results(W/kg)		Graph Results
									Measured	Reported	
measured / reported SAR numbers – Head											
40620	2593	5MHz	1RB#0	Left Cheek	23.88	24.00	-1.15	1.028	0.102	0.105	Plot27
39675	2498.5	5MHz	1RB#24	Left Cheek	23.47	24.00	0.06	1.130	0.086	0.097	
41565	2687.5	5MHz	1RB#0	Left Cheek	23.87	24.00	-1.74	1.030	0.100	0.103	
40620	2593	5MHz	1RB#0	Left Tilt	23.88	24.00	3.12	1.028	0.058	0.060	
40620	2593	5MHz	1RB#0	Right Cheek	23.88	24.00	-0.19	1.028	0.096	0.099	
40620	2593	5MHz	1RB#0	Right Tilt	23.88	24.00	-0.03	1.028	0.044	0.045	
measured / reported SAR numbers - Body (5mm)											
40620	2593	5MHz	1RB#0	Front	23.88	24.00	-1.14	1.028	0.325	0.334	
40620	2593	5MHz	1RB#0	Rear	23.88	24.00	-2.74	1.028	0.388	0.399	Plot28
39675	2498.5	5MHz	1RB#24	Rear	23.47	24.00	-1.49	1.130	0.335	0.378	
41565	2687.5	5MHz	1RB#0	Rear	23.87	24.00	-3.45	1.030	0.382	0.394	
40620	2593	5MHz	1RB#0	Left	23.88	24.00	-0.06	1.028	0.289	0.297	
40620	2593	5MHz	1RB#0	Right	23.88	24.00	2.98	1.028	0.015	0.015	
40620	2593	5MHz	1RB#0	Top	23.88	24.00	-4.18	1.028	0.001	0.001	
40620	2593	5MHz	1RB#0	Bottom	23.88	24.00	3.32	1.028	0.358	0.368	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for GSM900 Band**

Frequency		Service/Headset	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel										
902.6	63	GPRS 2TS	Front	0	28.61	29.00	1.094	0.264	0.289	-1.21	
902.6	63	GPRS 2TS	Rear	0	28.61	29.00	1.094	0.533	0.583	0.87	Plot29
880.2	975	GPRS 2TS	Rear	0	28.53	29.00	1.114	0.524	0.584	3.21	
914.8	124	GPRS 2TS	Rear	0	28.52	29.00	1.117	0.511	0.571	0.02	
902.6	63	GPRS 2TS	Left	0	28.61	29.00	1.094	0.157	0.172	0.74	
902.6	63	GPRS 2TS	Right	0	28.61	29.00	1.094	0.152	0.166	-2.54	
902.6	63	GPRS 2TS	Top	0	28.61	29.00	1.094	0.032	0.035	4.77	
902.6	63	GPRS 2TS	Bottom	0	28.61	29.00	1.094	0.251	0.275	-0.36	

Note:

- 1.The EUT is a Class B Mobile Phone which can be attached to both GPRS and GSM services,using one service at a time
- 2.The Multi-slot Classes of EUT is Class12 which has maximum 1 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+2UL is the worse case.

Limb-worn SAR Data for DCS1800 Band

Frequency		Service/Headset	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel										
1747.4	698	GPRS 2TS	Front	0	26.28	26.50	1.052	0.239	0.251	0.92	
1747.4	698	GPRS 2TS	Rear	0	26.28	26.50	1.052	0.458	0.482	-0.71	Plot30
1784.8	885	GPRS 2TS	Rear	0	26.29	26.50	1.050	0.421	0.442	3.65	
1710.2	512	GPRS 2TS	Rear	0	26.36	26.50	1.033	0.441	0.455	0.02	
1747.4	698	GPRS 2TS	Left	0	26.28	26.50	1.052	0.114	0.120	0.21	
1747.4	698	GPRS 2TS	Right	0	26.28	26.50	1.052	0.109	0.115	-1.15	
1747.4	698	GPRS 2TS	Top	0	26.28	26.50	1.052	0.025	0.026	0.02	
1747.4	698	GPRS 2TS	Bottom	0	26.28	26.50	1.052	0.211	0.222	-1.73	

Note:

- 1.The EUT is a Class B Mobile Phone which can be attached to both GPRS and GSM services,using one service at a time
- 2.The Multi-slot Classes of EUT is Class12 which has maximum 1 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+2UL is the worse case.

**Limb-worn SAR Data for WCDMA Band VIII**

Frequency		Mode/Band	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel										
897.6	2788	RMC	Front	0	23.51	24.00	1.119	0.301	0.337	-0.54	
897.6	2788	RMC	Rear	0	23.51	24.00	1.119	0.500	0.560	-1.04	Plot31
882.4	2712	RMC	Rear	0	23.56	24.00	1.107	0.482	0.533	3.32	
912.6	2863	RMC	Rear	0	23.48	24.00	1.127	0.423	0.477	0.12	
897.6	2788	RMC	Left	0	23.51	24.00	1.119	0.173	0.194	0.04	
897.6	2788	RMC	Right	0	23.51	24.00	1.119	0.166	0.186	-3.33	
897.6	2788	RMC	Top	0	23.51	24.00	1.119	0.047	0.053	0.78	
897.6	2788	RMC	Bottom	0	23.51	24.00	1.119	0.292	0.327	-1.25	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode

Limb-worn SAR Data for WCDMA Band I

Frequency		Mode/Band	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel										
1950.0	9750	RMC	Front	0	23.58	24.00	1.102	0.402	0.443	-0.92	
1950.0	9750	RMC	Rear	0	23.58	24.00	1.102	0.773	0.851	-0.70	Plot32
1922.4	9612	RMC	Rear	0	23.51	24.00	1.119	0.722	0.808	-0.20	
1977.6	9888	RMC	Rear	0	23.54	24.00	1.112	0.751	0.835	0.06	
1950.0	9750	RMC	Left	0	23.58	24.00	1.102	0.226	0.249	-0.50	
1950.0	9750	RMC	Right	0	23.58	24.00	1.102	0.218	0.240	-1.17	
1950.0	9750	RMC	Top	0	23.58	24.00	1.102	0.081	0.089	0.85	
1950.0	9750	RMC	Bottom	0	23.58	24.00	1.102	0.389	0.428	3.98	

Note:

1. When the 10-g SAR is ≤ 2.0 W/kg, testing for low and high channel is optional.
2. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for WLAN2450 Band**

Frequency		Mode/Band	Test Position	Spacing(m m)	Conducte d Power (dBm)	Maximu m Allowed Power (dBm)	Scalin g Factor	SAR(10g) (W/kg)	Reporte d SAR	Power Drift(%)	Ref.Plo t #
MHz	Channe l										
2442. 0	7	802.11b	Front	0	10.99	11.00	1.002	0.205	0.205	3.65	
2442. 0	7	802.11b	Rear	0	10.99	11.00	1.002	0.341	0.342	-0.15	Plot33
2412	1	802.11b	Rear	0	11.77	12.00	1.054	0.322	0.340	4.24	
2472	13	802.11b	Rear	0	10.55	11.00	1.109	0.306	0.339	0.08	
2442. 0	7	802.11b	Left	0	10.99	11.00	1.002	0.182	0.182	-4.12	
2442. 0	7	802.11b	Right	0	10.99	11.00	1.002	0.094	0.094	0.98	
2442. 0	7	802.11b	Top	0	10.99	11.00	1.002	0.199	0.199	0.52	
2442. 0	7	802.11b	Bottom	0	10.99	11.00	1.002	0.031	0.031	-4.44	

Note:

1. The result was tested under the lowest data rate 1Mbps for 802.11b.

Limb-worn SAR Data for WLAN5200 Band

Frequency		Mode/Band	Test Position	Spacing(m m)	Conduct ed Power (dBm)	Maximu m Allowed Power (dBm)	Scalin g Factor	SAR(10 g) (W/kg)	Reporte d SAR	Power Drift(%)	Ref.PI ot #
MHz	Chann el										
5210. 0	42	802.11ac(80M Hz)	Front	0	7.32	7.50	1.042	0.127	0.132	-1.11	
5210. 0	42	802.11ac(80M Hz)	Rear	0	7.32	7.50	1.042	0.235	0.245	0.13	Plot34
5210. 0	42	802.11ac(80M Hz)	Left	0	7.32	7.50	1.042	0.102	0.106	3.52	
5210. 0	42	802.11ac(80M Hz)	Right	0	7.32	7.50	1.042	0.063	0.066	0.98	
5210. 0	42	802.11ac(80M Hz)	Top	0	7.32	7.50	1.042	0.117	0.122	4.52	
5210. 0	42	802.11ac(80M Hz)	Bottom	0	7.32	7.50	1.042	0.019	0.020	-3.52	

Note:

1. The result was tested under the lowest data rate 6Mbps for 802.11ac(80MHz).

**Limb-worn SAR Data for WLAN5800 Band**

Frequency		Mode/Band	Test Position	Spacing(m m)	Conduct ed Power (dBm)	Maximu m Allowed Power (dBm)	Scalin g Factor	SAR(10 g) (W/kg)	Reporte d SAR	Power Drift(%)	Ref.PI ot #
MHz	Chann el										
5775.0	155	802.11ac(80M Hz)	Front	0	6.79	7.00	1.050	0.068	0.071	-3.65	
5775.0	155	802.11ac(80M Hz)	Rear	0	6.79	7.00	1.050	0.127	0.133	-2.38	Plot35
5775.0	155	802.11ac(80M Hz)	Left	0	6.79	7.00	1.050	0.059	0.062	0.98	
5775.0	155	802.11ac(80M Hz)	Right	0	6.79	7.00	1.050	0.032	0.034	4.17	
5775.0	155	802.11ac(80M Hz)	Top	0	6.79	7.00	1.050	0.065	0.068	-2.54	
5775.0	155	802.11ac(80M Hz)	Bottom	0	6.79	7.00	1.050	0.012	0.013	-3.65	

Note:

1. The result was tested under the lowest data rate 6Mbps for 802.11ac(80MHz).

Limb-worn SAR Data for E-UTRA Band 1

Frequency		Channel Bandwid th	Time slots	Test Position	Spacing(m m)	Conduct ed Power (dBm)	Maximu m Allowe d Power (dBm)	Scalin g Facto r	SAR(10 g) (W/kg)	Report ed SAR	Power Drift(%)	Ref.PI ot #
MHz	Chann el											
1950.0	18300	20MHz	18RB# 0	Front	0	20.61	21.00	1.094	0.402	0.440	-2.65	
1950.0	18300	20MHz	18RB# 0	Rear	0	20.61	21.00	1.094	0.671	0.734	1.69	Plot36
1920.0	18100	20MHz	1RB#0	Rear	0	20.53	21.00	1.114	0.654	0.729	3.25	
1979.9	18500	20MHz	18RB# 82	Rear	0	21.45	22.00	1.135	0.628	0.713	0.02	
1950.0	18300	20MHz	18RB# 0	Left	0	20.61	21.00	1.094	0.223	0.244	4.74	
1950.0	18300	20MHz	18RB# 0	Right	0	20.61	21.00	1.094	0.202	0.221	2.69	
1950.0	18300	20MHz	18RB# 0	Top	0	20.61	21.00	1.094	0.032	0.035	-0.08	
1950.0	18300	20MHz	18RB# 0	Bottom	0	20.61	21.00	1.094	0.351	0.384	-3.33	

Note:

1. The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for E-UTRA Band 3**

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel											
1747.5	19575	20MHz	1RB#0	Front	0	21.67	22.00	1.079	0.425	0.459	-3.65	
1747.5	19575	20MHz	1RB#0	Rear	0	21.67	22.00	1.079	0.798	0.861	-0.06	Plot37
1720.0	19300	20MHz	1RB#9	Rear	0	21.28	22.00	1.180	0.722	0.852	0.02	
1775.0	19850	20MHz	1RB#0	Rear	0	20.65	21.00	1.084	0.786	0.852	1.33	
1747.5	19575	20MHz	1RB#0	Left	0	21.67	22.00	1.079	0.283	0.305	0.08	
1747.5	19575	20MHz	1RB#0	Right	0	21.67	22.00	1.079	0.147	0.159	-4.44	
1747.5	19575	20MHz	1RB#0	Top	0	21.67	22.00	1.079	0.094	0.101	-1.78	
1747.5	19575	20MHz	1RB#0	Bottom	0	21.67	22.00	1.079	0.403	0.435	-2.05	

Note:

- 1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

Limb-worn SAR Data for E-UTRA Band 7

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel											
2535.0	21100	20MHz	18RB#0	Front	0	21.73	22.00	1.064	0.431	0.459	3.98	
2535.0	21100	20MHz	18RB#0	Rear	0	21.73	22.00	1.064	0.809	0.861	-1.34	Plot38
2510.0	20850	20MHz	1RB#0	Rear	0	19.96	20.00	1.009	0.754	0.761	-3.22	
2560.0	21350	20MHz	1RB#9	Rear	0	20.54	21.00	1.112	0.769	0.855	0.02	
2535.0	21100	20MHz	18RB#0	Left	0	21.73	22.00	1.064	0.294	0.313	0.78	
2535.0	21100	20MHz	18RB#0	Right	0	21.73	22.00	1.064	0.166	0.177	-4.21	
2535.0	21100	20MHz	18RB#0	Top	0	21.73	22.00	1.064	0.102	0.109	-2.22	
2535.0	21100	20MHz	18RB#0	Bottom	0	21.73	22.00	1.064	0.414	0.441	3.78	

Note:

- 1.When the 10-g SAR is $\leq 2.0W/kg$, testing for low and high channel is optional.
- 2.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for E-UTRA Band 8**

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel											
897.5	21625	1.4MHz	5RB#0	Front	0	23.96	24.00	1.009	0.294	0.297	-3.66	
897.5	21625	1.4MHz	5RB#0	Rear	0	23.96	24.00	1.009	0.483	0.487	-1.14	Plot39
880.7	21457	1.4MHz	1RB#0	Rear	0	23.93	24.00	1.016	0.466	0.474	0.87	
914.3	21793	1.4MHz	1RB#0	Rear	0	23.45	24.00	1.135	0.426	0.484	1.14	
897.5	21625	1.4MHz	5RB#0	Left	0	23.96	24.00	1.009	0.216	0.218	-4.98	
897.5	21625	1.4MHz	5RB#0	Right	0	23.96	24.00	1.009	0.115	0.116	-1.78	
897.5	21625	1.4MHz	5RB#0	Top	0	23.96	24.00	1.009	0.048	0.048	-2.08	
897.5	21625	1.4MHz	5RB#0	Bottom	0	23.96	24.00	1.009	0.281	0.284	-3.66	

Note:

- 1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

Limb-worn SAR Data for E-UTRA Band 20

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel											
847.0	24300	5MHz	1RB#24	Front	0	24.21	24.50	1.069	0.281	0.300	-2.33	
847.0	24300	5MHz	1RB#24	Rear	0	24.21	24.50	1.069	0.478	0.511	-1.06	Plot40
834.5	24175	5MHz	1RB#24	Rear	0	24.08	24.50	1.102	0.419	0.462	0.02	
859.5	24425	5MHz	1RB#0	Rear	0	24.25	24.50	1.059	0.470	0.498	-1.41	
847.0	24300	5MHz	1RB#24	Left	0	24.21	24.50	1.069	0.204	0.218	4.17	
847.0	24300	5MHz	1RB#24	Right	0	24.21	24.50	1.069	0.107	0.114	-0.55	
847.0	24300	5MHz	1RB#24	Top	0	24.21	24.50	1.069	0.042	0.045	-4.74	
847.0	24300	5MHz	1RB#24	Bottom	0	24.21	24.50	1.069	0.269	0.288	-2.82	

Note:

- 1.When the 10-g SAR is ≤ 2.0 W/kg, testing for low and high channel is optional.
- 2.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for E-UTRA Band 28(703-733)**

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref.PI ot #
MHz	Channel											
718.0	27360	3MHz	1RB#0	Front	0	23.73	24.00	1.064	0.093	0.099	-4.74	
718.0	27360	3MHz	1RB#0	Rear	0	23.73	24.00	1.064	0.160	0.170	-0.51	Plot41
704.5	27225	3MHz	4RB#0	Rear	0	23.65	24.00	1.084	0.143	0.155	-3.32	
731.5	27495	3MHz	4RB#11	Rear	0	23.54	24.00	1.112	0.122	0.136	0.21	
718.0	27360	3MHz	1RB#0	Left	0	23.73	24.00	1.064	0.081	0.086	-2.64	
718.0	27360	3MHz	1RB#0	Right	0	23.73	24.00	1.064	0.053	0.056	-3.98	
718.0	27360	3MHz	1RB#0	Top	0	23.73	24.00	1.064	0.011	0.012	-2.85	
718.0	27360	3MHz	1RB#0	Bottom	0	23.73	24.00	1.064	0.086	0.092	0.78	

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

Limb-worn SAR Data for E-UTRA Band 28(718-748)

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref.PI ot #
MHz	Channel											
733.0	27510	3MHz	1RB#0	Front	0	23.57	24.00	1.104	0.082	0.091	3.65	
733.0	27510	3MHz	1RB#0	Rear	0	23.57	24.00	1.104	0.143	0.158	-0.19	
719.5	27375	3MHz	1RB#0	Rear	0	23.71	24.00	1.069	0.123	0.131	0.47	
746.5	27645	3MHz	4RB#11	Rear	0	23.61	24.00	1.094	0.114	0.125	2.21	
718.0	27360	3MHz	1RB#0	Left	0	23.57	24.00	1.104	0.066	0.073	3.45	
718.0	27360	3MHz	1RB#0	Right	0	23.57	24.00	1.104	0.036	0.040	0.01	
718.0	27360	3MHz	1RB#0	Top	0	23.57	24.00	1.104	0.007	0.008	-4.74	
718.0	27360	3MHz	1RB#0	Bottom	0	23.57	24.00	1.104	0.064	0.071	3.21	

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.

**Limb-worn SAR Data for E-UTRA Band 41**

Frequency		Channel Bandwidth	Time slots	Test Position	Spacing(m)	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Scaling Factor	SAR(10g) (W/kg)	Reported SAR	Power Drift(%)	Ref. Plot #
MHz	Channel											
2593	40620	5MHz	1RB#0	Front	0	23.88	24.00	1.028	0.596	0.613	-3.36	
2593	40620	5MHz	1RB#0	Rear	0	23.88	24.00	1.028	0.775	0.797	0.01	Plot42
2498.5	39675	5MHz	1RB#24	Rear	0	23.47	24.00	1.130	0.700	0.791	-1.74	
2687.5	41565	5MHz	1RB#0	Rear	0	23.87	24.00	1.030	0.771	0.794	2.32	
2593	40620	5MHz	1RB#0	Left	0	23.88	24.00	1.028	0.685	0.704	-0.06	
2593	40620	5MHz	1RB#0	Right	0	23.88	24.00	1.028	0.015	0.015	-0.17	
2593	40620	5MHz	1RB#0	Top	0	23.88	24.00	1.028	0.002	0.002	3.32	
2593	40620	5MHz	1RB#0	Bottom	0	23.88	24.00	1.028	0.754	0.775	-0.16	

Note:

1.The default test configuration is to measure SAR with an established radio link between the EUT and a communication test set using a 12.2kbps RMC(reference measurement channel) configuration in test loop mode.



4.4. Test reduction procedure

Maximum power level

The maximum power level, $P_{\max,m}$, that can be transmitted by a device before the SAR averaged over a mass, m , exceeds a given limit, $SAR_{\lim}$, can be defined. Any device transmitting at power levels below $P_{\max,m}$ can then be excluded from SAR testing. The lowest possible value for $P_{\max,m}$ is: $P_{\max,m} = SAR_{\lim} \cdot m$.

When working alone, the averages transmit power of BT module should be less than 20mW. According to the test results, when working alone, the testing of BT module is not necessary.

Simultaneous Multi-band Transmission SAR Analysis List of Mode for Simultaneous Multi-band

Transmission

No.	Configurations	Head SAR	Body SAR
1	GSM + 2.4G WLAN	Yes	Yes
2	WCDMA +2.4G WLAN	Yes	Yes
3	LTE +2.4G WLAN	Yes	Yes
4	GSM + 5.2G WLAN	Yes	Yes
5	WCDMA +5.2G WLAN	Yes	Yes
6	LTE +5.2G WLAN	Yes	Yes
7	GSM + 5.8G WLAN	Yes	Yes
8	WCDMA +5.8G WLAN	Yes	Yes
9	LTE +5.8G WLAN	Yes	Yes
10	GSM + Bluetooth	Yes	Yes
11	WCDMA + Bluetooth	Yes	Yes
12	LTE + Bluetooth	Yes	Yes

Remark:

One way of determining the threshold power level available to the secondary transmitter ($P_{\text{available}}$) is to calculate it from the measured peak spatial-average SAR of the primary transmitter (SAR_1) according to the equation:

$$P_{\text{available}} = P_{\text{th},m} \times (SAR_{\lim} - SAR_1) / SAR_{\lim}$$

where $P_{\text{th},m}$ is the threshold exclusion power level taken from Annex B of EN 50663 for the frequency of the secondary transmitter at the separation distance used in the testing.

For simultaneous transmission analysis, Bluetooth SAR is below:

Bluetooth:

	Average Power (dBm)	Output Power (mW)	$P_{\text{th},m}$ (mW)	$SAR_{\lim}$ (W/kg)	SAR_1 (W/kg)	$P_{\text{available}}$ (mW)
Head	1.00	1.259	20	2.0	0.330	16.70
Body	1.00	1.259	20	2.0	0.487	15.13
Limb-worn	1.00	1.259	20	4.0	0.861	15.695

The Bluetooth output power of the secondary transmitter is less than $P_{\text{available}}$, So SAR measurement for the secondary transmitter is not necessary.

Maximum SAR 1.0 value and the sum of the 10-g SAR for WWAN & WLAN – Head



WWAN Band	WWAN Max SAR (W/kg)	2.4GWLAN Max SAR (W/kg)	5.2GWLAN Max SAR (W/kg)	5.8GWLAN Max SAR (W/kg)	Max SAR Sum (W/kg)	Limit (W/kg)
GSM900	0.093	0.233	0.161	0.083	0.326	2.0
DCS1800	0.056	0.233	0.161	0.083	0.289	
WCDMA900	0.088	0.233	0.161	0.083	0.321	
WCDMA2100	0.062	0.233	0.161	0.083	0.295	
LTE Band 1	0.116	0.233	0.161	0.083	0.349	
LTE Band 3	0.330	0.233	0.161	0.083	0.563	
LTE Band 7	0.114	0.233	0.161	0.083	0.347	
LTE Band 8	0.102	0.233	0.161	0.083	0.335	
LTE Band 20	0.095	0.233	0.161	0.083	0.328	
LTE Band 28	0.027	0.233	0.161	0.083	0.260	
LTE Band 41	0.105	0.233	0.161	0.083	0.338	

Maximum SAR value and the sum of the 10-g SAR for WWAN & WLAN - Body

WWAN Band	WWAN Max SAR (W/kg)	2.4GWLAN Max SAR (W/kg)	5.2GWLAN Max SAR (W/kg)	5.8GWLAN Max SAR (W/kg)	Max SAR Sum (W/kg)	Limit (W/kg)
GSM900	0.145	0.159	0.124	0.054	0.304	2.0
DCS1800	0.137	0.159	0.124	0.054	0.296	
WCDMA900	0.122	0.159	0.124	0.054	0.281	
WCDMA2100	0.274	0.159	0.124	0.054	0.433	
LTE Band 1	0.206	0.159	0.124	0.054	0.365	
LTE Band 3	0.222	0.159	0.124	0.054	0.381	
LTE Band 7	0.431	0.159	0.124	0.054	0.590	
LTE Band 8	0.487	0.159	0.124	0.054	0.646	
LTE Band 20	0.086	0.159	0.124	0.054	0.245	
LTE Band 28	0.132	0.159	0.124	0.054	0.291	
LTE Band 41	0.399	0.159	0.124	0.054	0.558	

Maximum SAR value and the sum of the 10-g SAR for WWAN & WLAN - Limb-worn

WWAN Band	WWAN Max SAR (W/kg)	2.4GWLAN Max SAR (W/kg)	5.2GWLAN Max SAR (W/kg)	5.8GWLAN Max SAR (W/kg)	Max SAR Sum (W/kg)	Limit (W/kg)
GSM900	0.583	0.342	0.245	0.133	0.925	4.0
DCS1800	0.482	0.342	0.245	0.133	0.824	
WCDMA900	0.560	0.342	0.245	0.133	0.902	
WCDMA2100	0.851	0.342	0.245	0.133	1.193	
LTE Band 1	0.734	0.342	0.245	0.133	1.076	
LTE Band 3	0.861	0.342	0.245	0.133	1.203	
LTE Band 7	0.861	0.342	0.245	0.133	1.203	
LTE Band 8	0.487	0.342	0.245	0.133	0.829	
LTE Band 20	0.511	0.342	0.245	0.133	0.853	
LTE Band 28	0.170	0.342	0.245	0.133	0.512	
LTE Band 41	0.797	0.342	0.245	0.133	1.139	

Remark:

- 1 WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
- 2 GSM, WCDMA and LTE share the same antenna, and cannot transmit simultaneously.
- 3 The maximum SAR summation is calculated based on the same configuration and test position.
If 10g-SAR summation < 2.0W/kg, simultaneous SAR measurement is not necessary.
- 4 When the maximum SAR summation ≥ 1.0 W/kg on Body, WWAN, WLAN2.4G, WLAN5.2G, WLAN5.8G for low and high Channels are necessary to be tested and the test results please refer to the SAR Measurement Results.



4.5. Measurement Uncertainty (450MHz-6GHz)

Measurement uncertainty evaluation for SAR test and System check

Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Veff
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	$\sqrt{1 - C_p}$	$\sqrt{1 - C_p}$	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	$\sqrt{C_p}$	$\sqrt{C_p}$	2.41	2.41	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0.0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Max. SAR Evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample Related								
Device positioning	2.6	N	1	1	1	2.6	2.6	11
Device holder	3.0	N	1	1	1	3.0	3.0	7
Drift of output power	5.0	N	$\sqrt{3}$	1	1	2.89	2.89	∞
System check source(dipole)								
Deviation between experimental dipoles	2.0	N	1	1	1	2.0	2.0	∞
Input power and SAR drift measurement	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
Dipole axis to liquid distance	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
System check source								
Deviation between experimental source	—	N	1	0	0	—	—	7
Input power and SAR drift measurement	—	R	$\sqrt{3}$	1	1	—	—	∞
Other source contributions	—	R	$\sqrt{3}$	1	1	—	—	∞
Phantom and Tissue Parameters								
Phantom uncertainty	4.00	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	5
Liquid conductivity (meas)	4.00	N	1	0.23	0.26	0.92	1.04	5
Liquid Permittivity (target)	2.50	N	1	0.78	0.71	1.95	1.78	∞
Liquid Permittivity (meas)	5.00	N	1	0.23	0.26	1.15	1.30	∞



Combined Standard		RSS	$U_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$	10.63%	10.54%	
Expanded Uncertainty (95% Confidence interval)	U = k U _C , k=2			21.26%	21.08%	



4.6. System Check Results

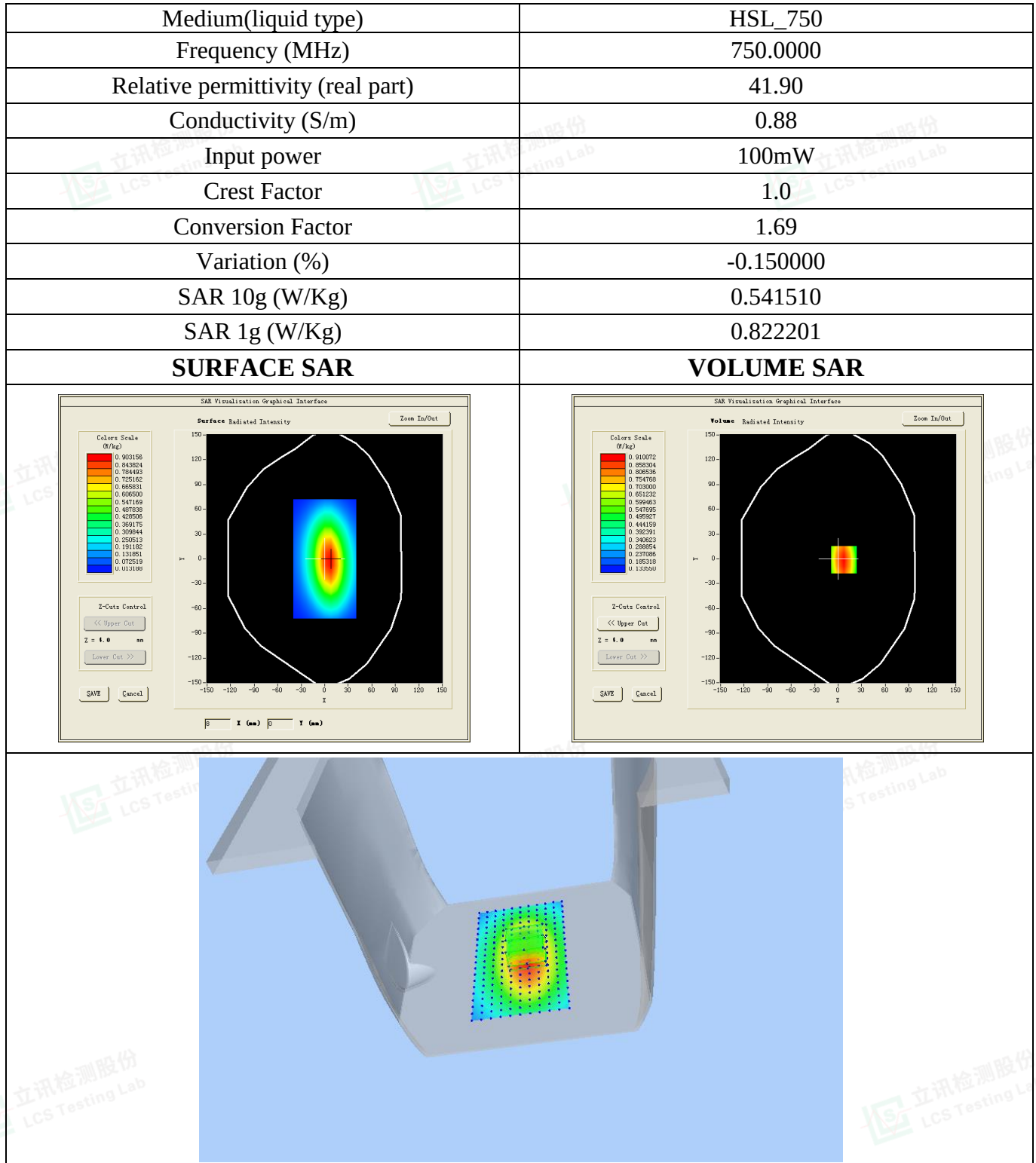
Test mode:750MHz

Product Description:Validation

Model:Dipole SID750

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: May 21, 2024





Test mode:900MHz

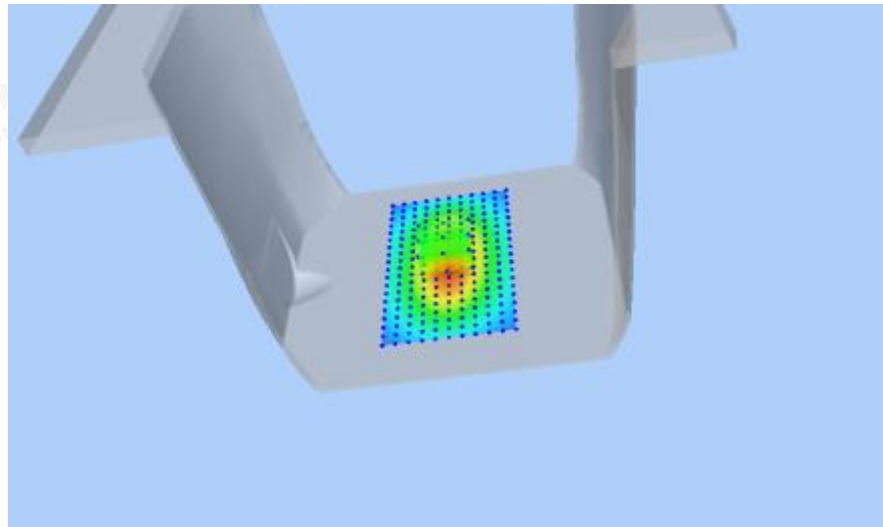
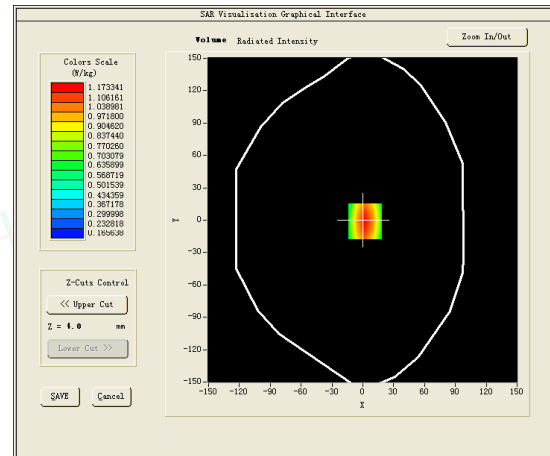
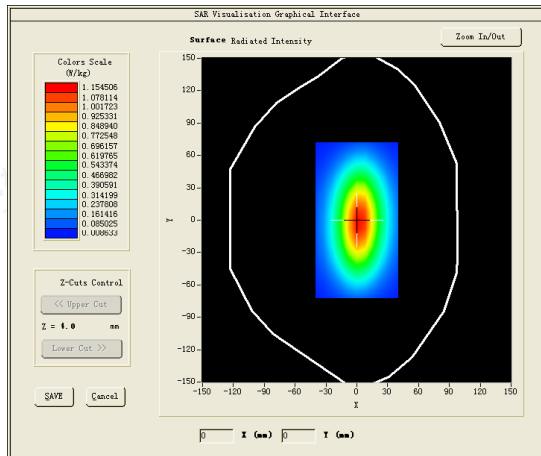
Product Description:Validation

Model:Dipole SID900

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	900.0000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.94
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.87
Variation (%)	-1.400000
SAR 10g (W/Kg)	0.701230
SAR 1g (W/Kg)	1.122250
SURFACE SAR	VOLUME SAR





Test mode:1800MHz

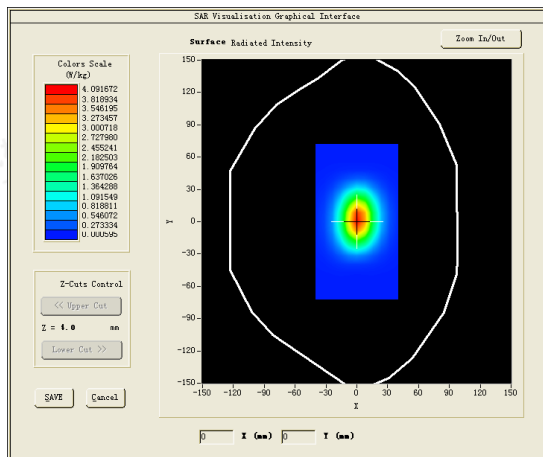
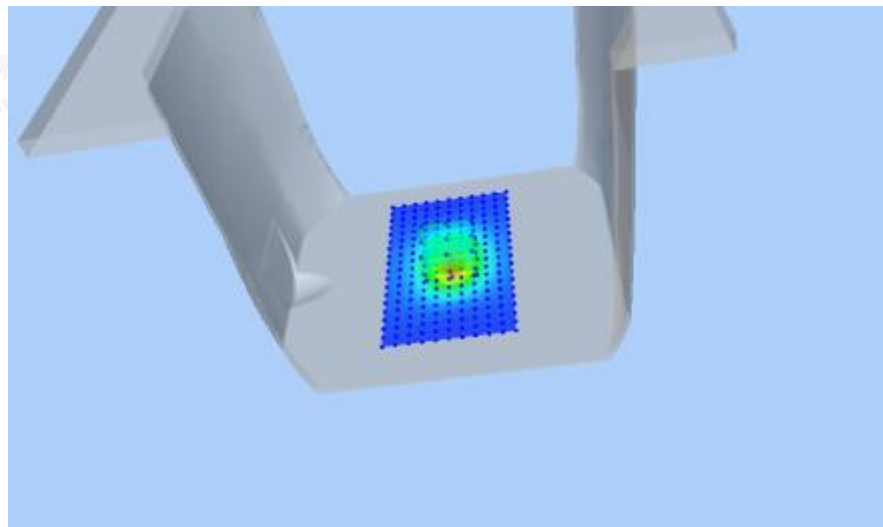
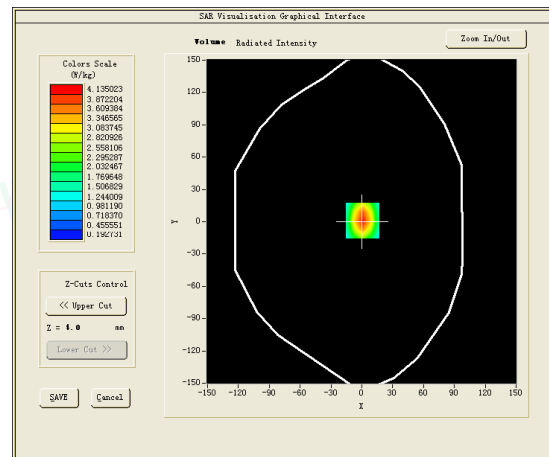
Product Description:Validation

Model:Dipole SID1800

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1800.0000
Relative permittivity (real part)	40.64
Conductivity (S/m)	1.43
Input power	100mW
Crest Factor	1.0
Conversion Factor	2.09
Variation (%)	-3.120000
SAR 10g (W/Kg)	1.863690
SAR 1g (W/Kg)	4.001231

SURFACE SAR**VOLUME SAR**



Test mode:2000MHz

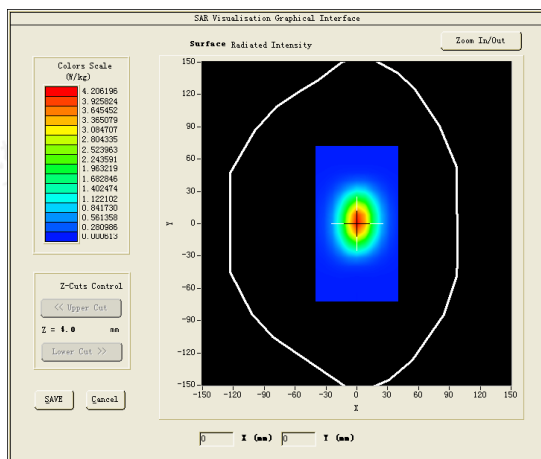
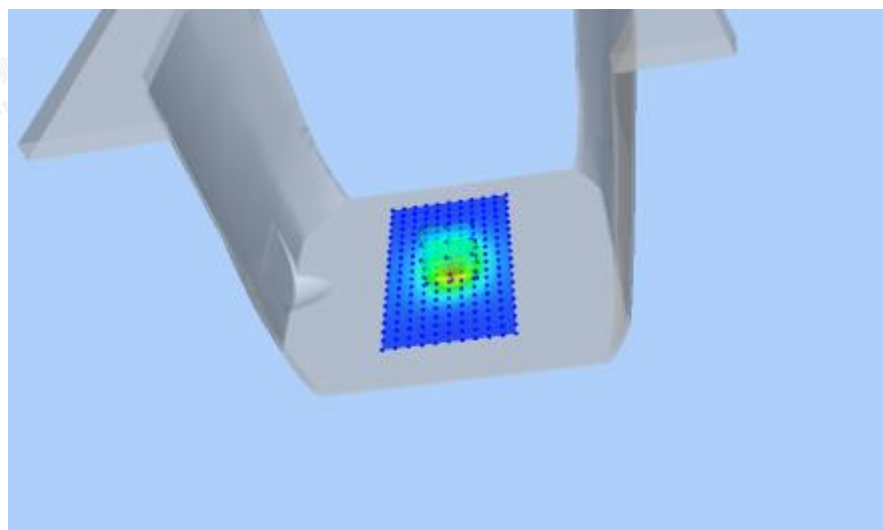
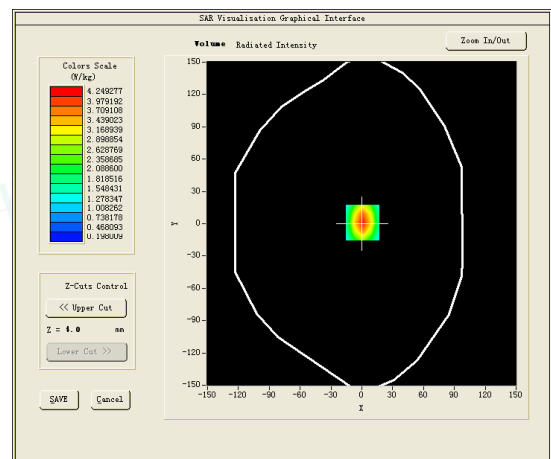
Product Description:Validation

Model:Dipole SID2000

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	2000.0000
Relative permittivity (real part)	39.17
Conductivity (S/m)	1.42
Input power	100mW
Crest Factor	1.0
Conversion Factor	2.31
Variation (%)	-3.420000
SAR 10g (W/Kg)	1.933212
SAR 1g (W/Kg)	4.012030

SURFACE SAR**VOLUME SAR**



Test mode:2450MHz

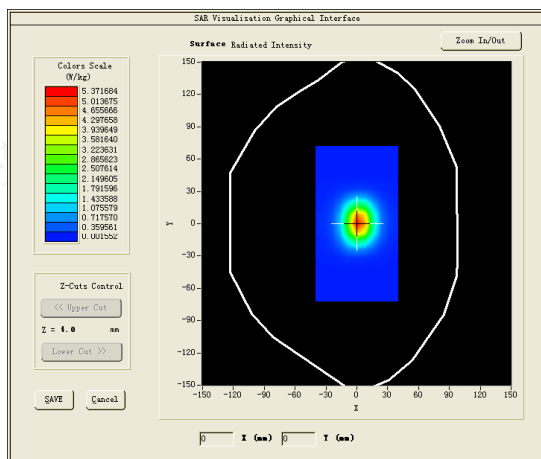
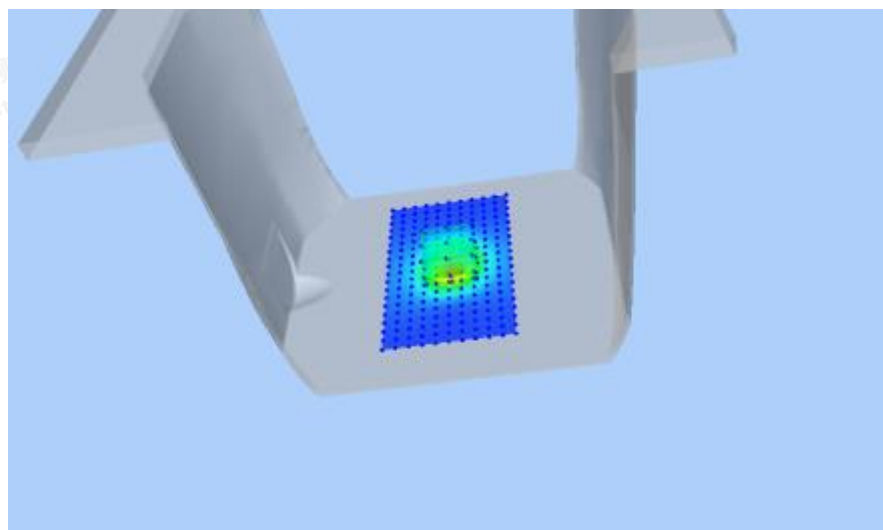
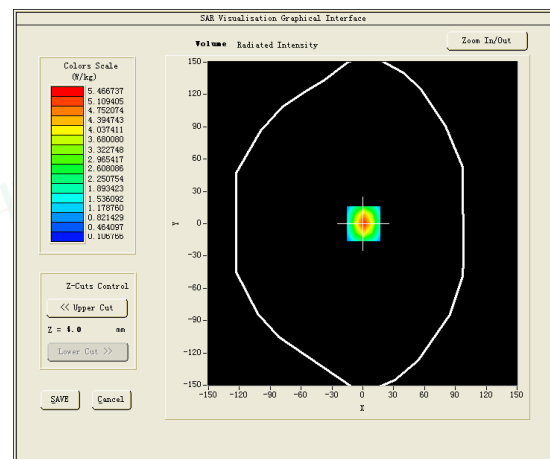
Product Description:Validation

Model:Dipole SID2450

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: June 01, 2024

Medium(liquid type)	HSL_2450
Frequency (MHz)	2450.0000
Relative permittivity (real part)	38.35
Conductivity (S/m)	1.78
Input power	100mW
Crest Factor	1.0
Conversion Factor	2.60
Variation (%)	-1.520000
SAR 10g (W/Kg)	2.339721
SAR 1g (W/Kg)	4.923420

SURFACE SAR**VOLUME SAR**



Test mode:2600MHz

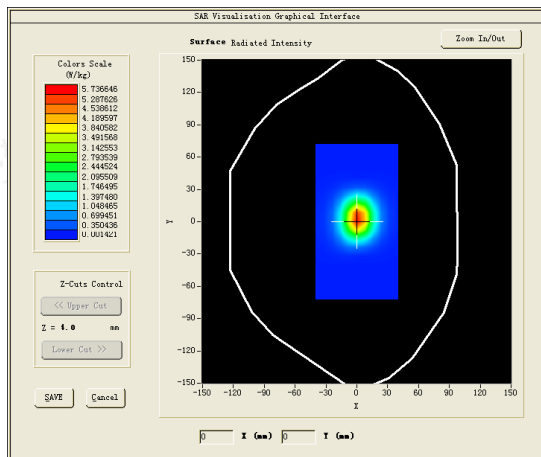
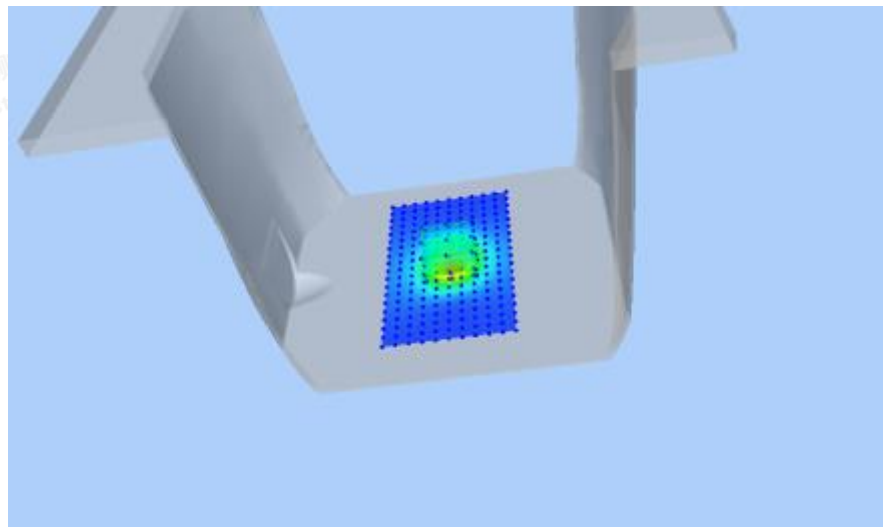
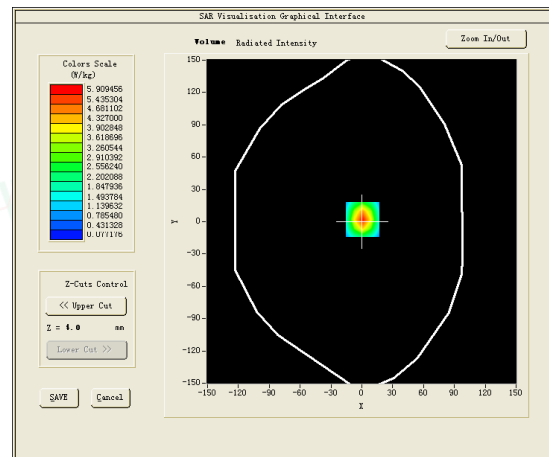
Product Description:Validation

Model:Dipole SID2600

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: June 05, 2024

Medium(liquid type)	HSL_2600
Frequency (MHz)	2600.0000
Relative permittivity (real part)	40.35
Conductivity (S/m)	1.90
Input power	100mW
Crest Factor	1.0
Conversion Factor	2.39
Variation (%)	-1.200000
SAR 10g (W/Kg)	2.453607
SAR 1g (W/Kg)	5.600611

SURFACE SAR**VOLUME SAR**



Test mode:5200MHz

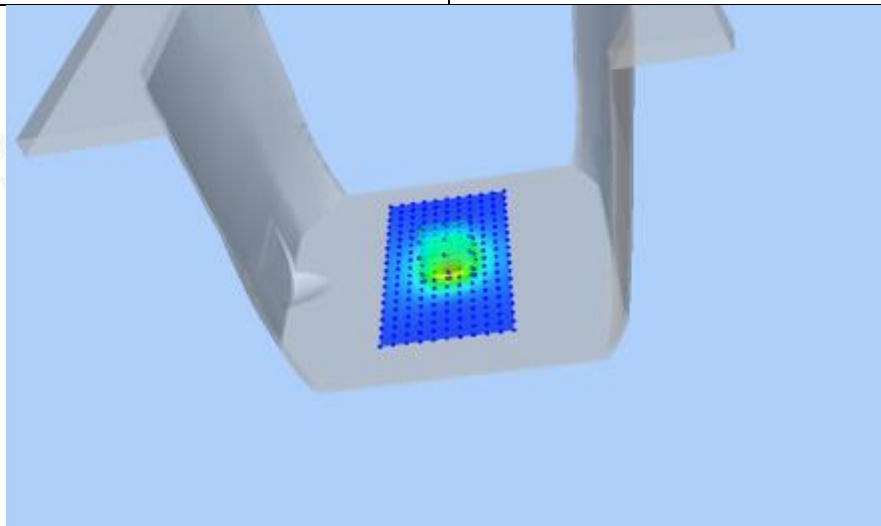
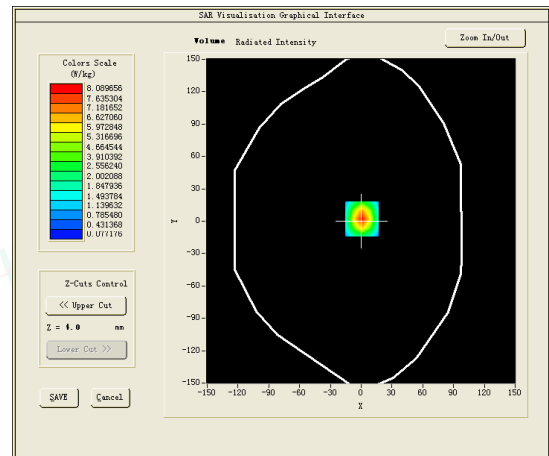
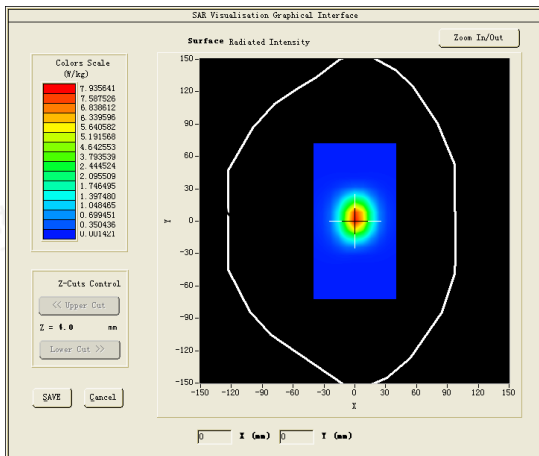
Product Description:Validation

Model:Dipole SWG5500

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: June 07, 2024

Medium(liquid type)	HSL_5000
Frequency (MHz)	5000.0000
Relative permittivity (real part)	35.81
Conductivity (S/m)	4.59
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.85
Variation (%)	2.410000
SAR 10g (W/Kg)	2.112010
SAR 1g (W/Kg)	7.542101
SURFACE SAR	VOLUME SAR





Test mode:5800MHz

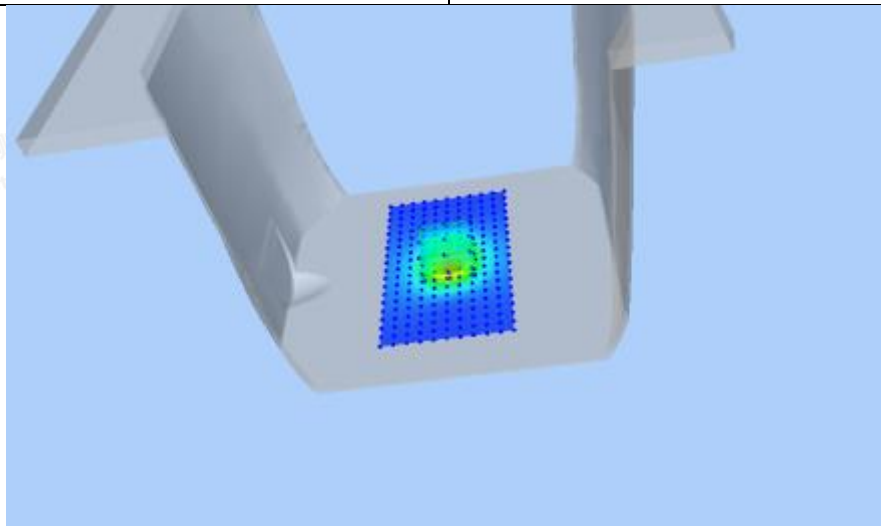
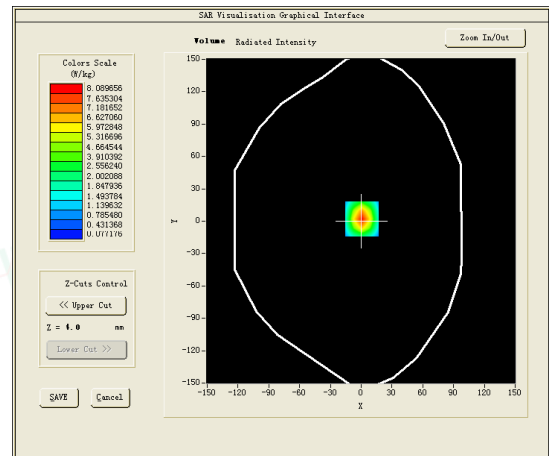
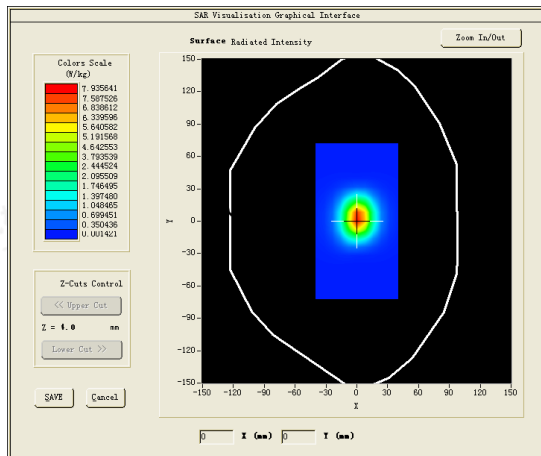
Product Description:Validation

Model:Dipole SWG5500

E-Field Probe: SSE2(SN 25/22 EPGO376)

Test Date: June 07, 2024

Medium(liquid type)	HSL_5800
Frequency (MHz)	5800.0000
Relative permittivity (real part)	34.77
Conductivity (S/m)	5.31
Input power	100mW
Crest Factor	1.0
Conversion Factor	2.01
Variation (%)	3.660000
SAR 10g (W/Kg)	6.598008
SAR 1g (W/Kg)	17.525436
SURFACE SAR	VOLUME SAR





Test mode:2600MHz

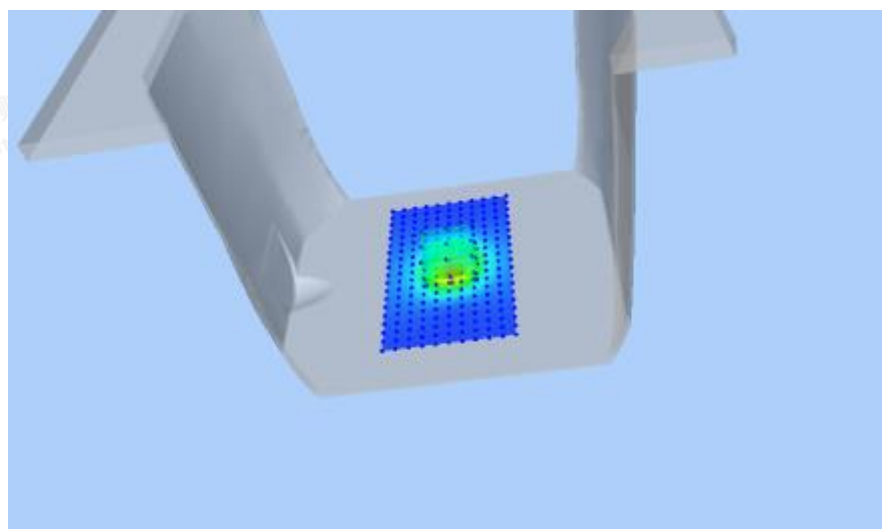
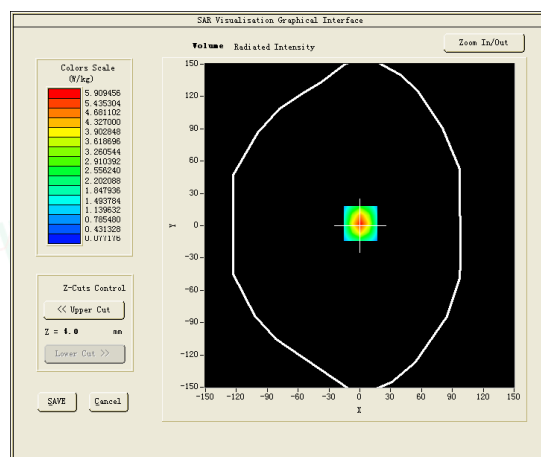
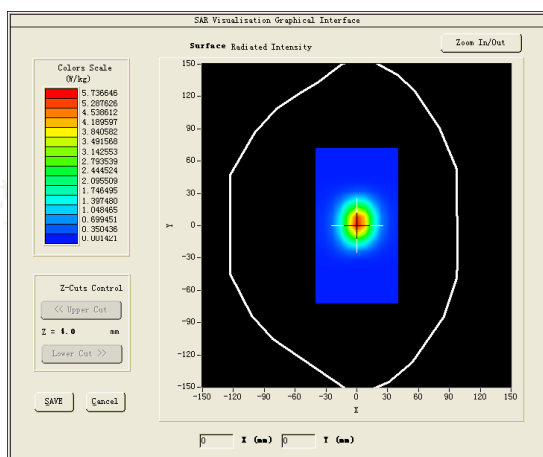
Product Description:Validation

Model:Dipole D2600V2

E-Field Probe: SSE2(SN 08/21 EPG0352)

Test Date: July 30, 2026

Medium(liquid type)	HSL_2600
Frequency (MHz)	2600.0000
Relative permittivity (real part)	38.59
Conductivity (S/m)	2.03
Input power	100mW
Crest Factor	1.0
Conversion Factor	1.70
Variation (%)	0.250000
SAR 10g (W/Kg)	2.410587
SAR 1g (W/Kg)	5.532418
SURFACE SAR	VOLUME SAR





4.7. SAR Test Graph Results

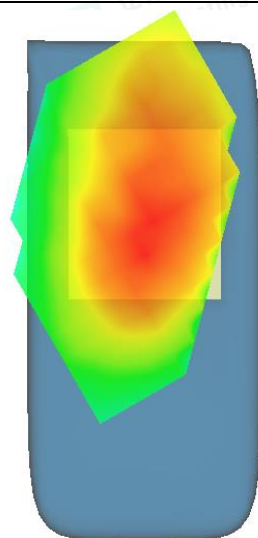
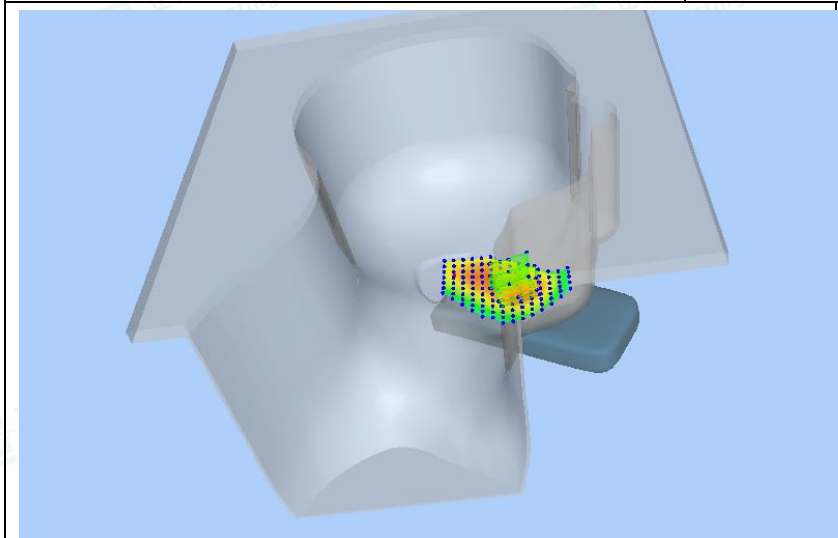
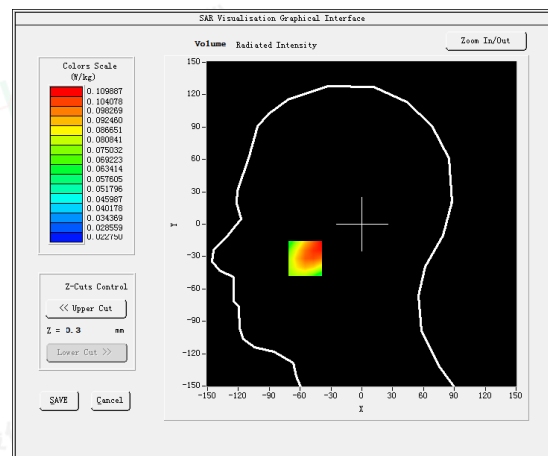
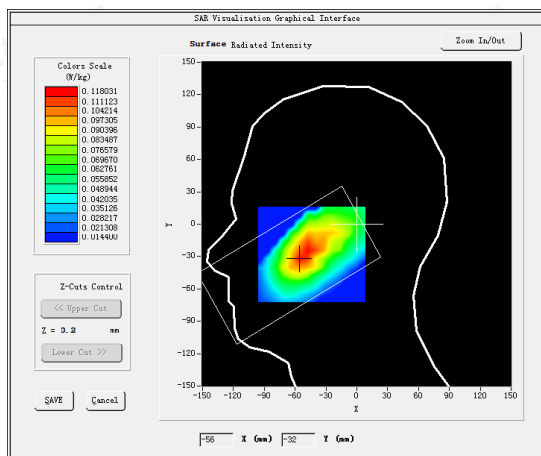
#1 Test Mode: GSM900MHz, Middle channel (Left head cheek)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 23, 2024

Medium (liquid type)	HSL_900
Frequency (MHz)	902.6000
Relative permittivity (real part)	42.59
Conductivity (S/m)	0.96
E-Field Probe	SN 25/22 EPGO376
Crest Factor	8.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm
Variation (%)	2.410000
SAR 10g (W/Kg)	0.080664
SAR 1g (W/Kg)	0.106111
SURFACE SAR	VOLUME SAR





#2

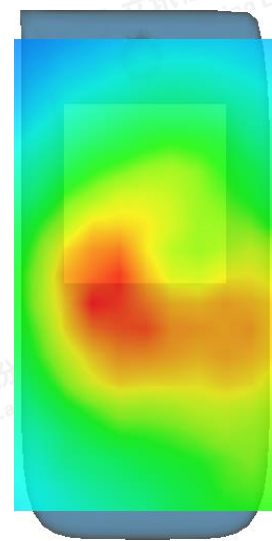
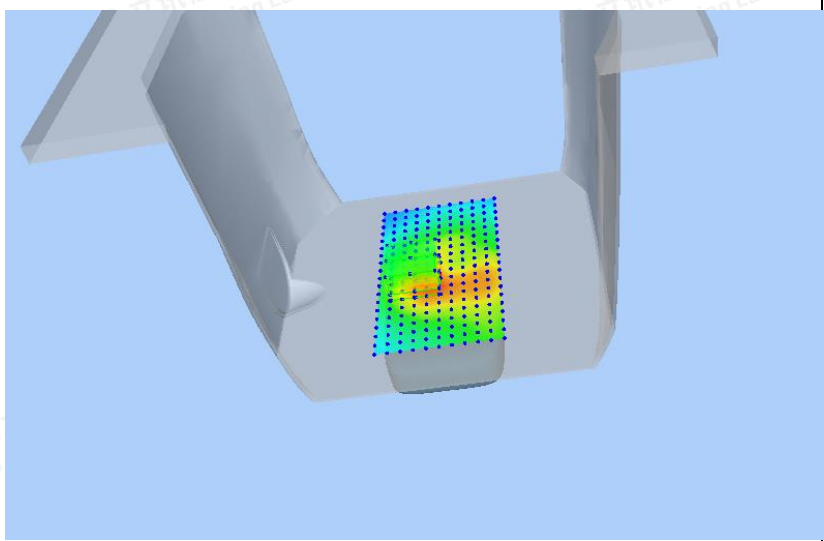
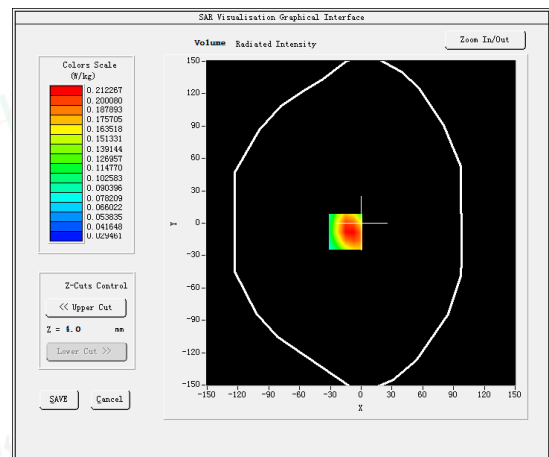
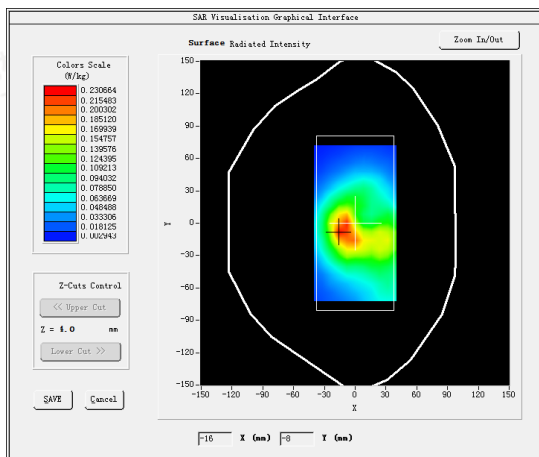
Test Mode:GPRS900MHz,Middle channel(Rear Side 5mm)

Product Description:Smartphone

Model:KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	902.6000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.95
E-Field Probe	SN 25/22 EPGO376
Crest Factor	4.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.180000
SAR 10g (W/Kg)	0.132751
SAR 1g (W/Kg)	0.207591
SURFACE SAR	VOLUME SAR





#3

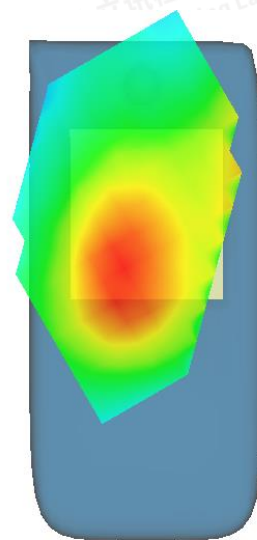
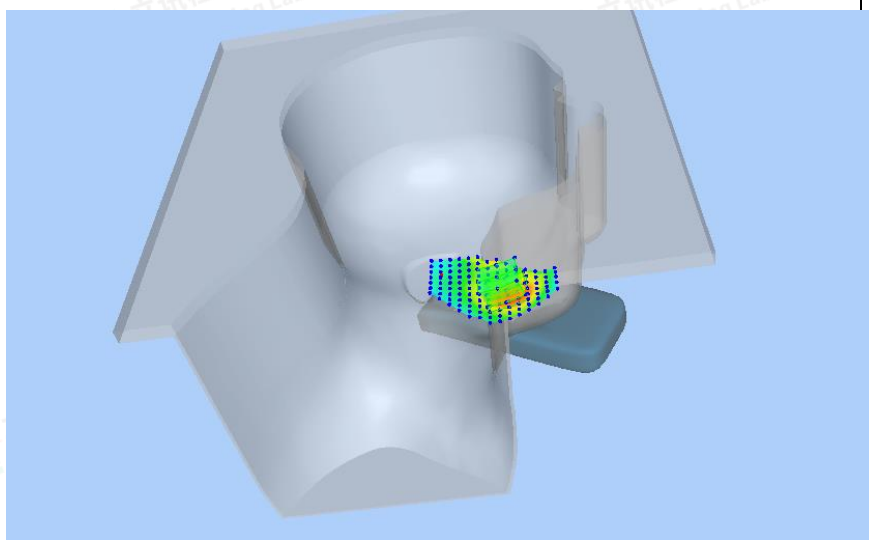
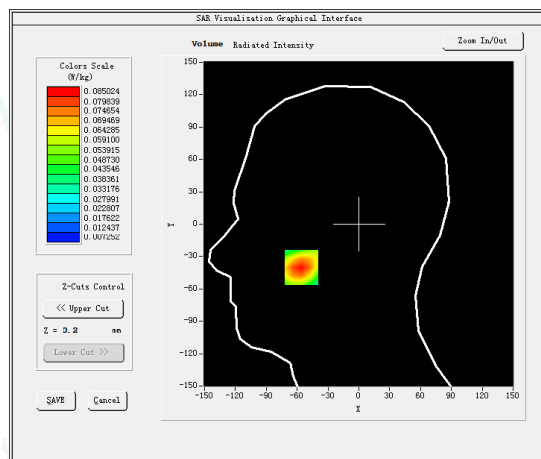
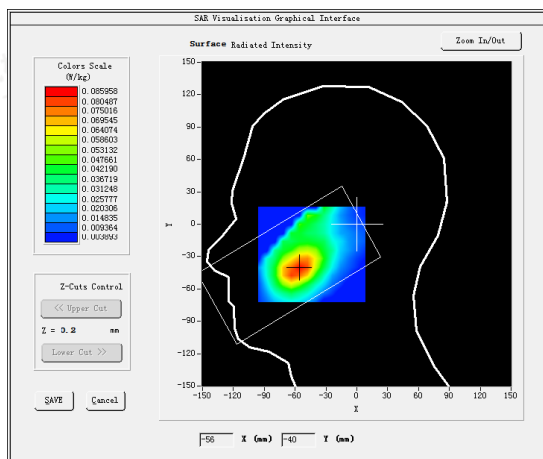
Test Mode: GSM1800MHz, Middle channel (Left head cheek)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 24, 2024

Medium (liquid type)	HSL_1800
Frequency (MHz)	1747.4000
Relative permittivity (real part)	40.65
Conductivity (S/m)	1.42
E-Field Probe	SN 25/22 EPGO376
Crest Factor	8.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm
Variation (%)	1.830000
SAR 10g (W/Kg)	0.051778
SAR 1g (W/Kg)	0.084324
SURFACE SAR	VOLUME SAR





#4

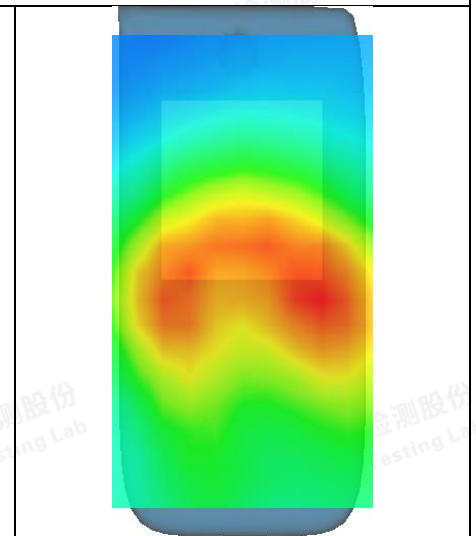
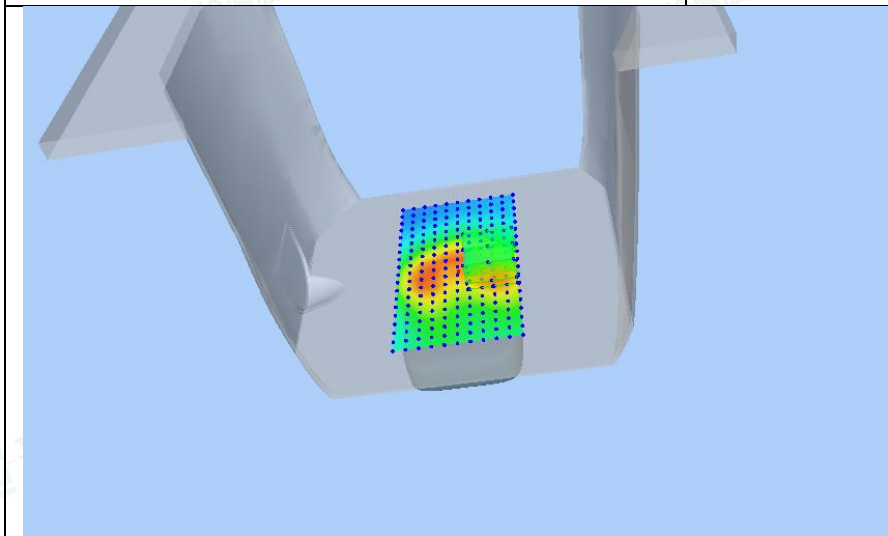
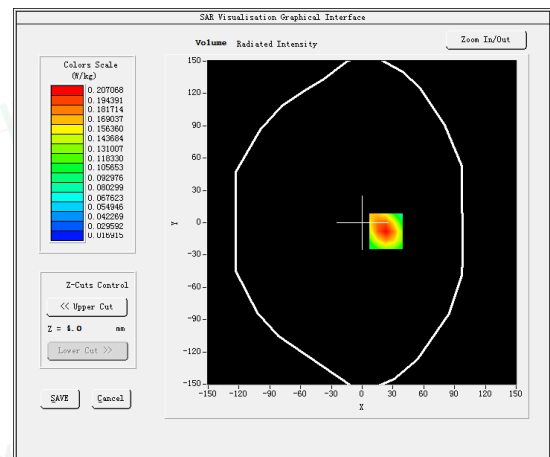
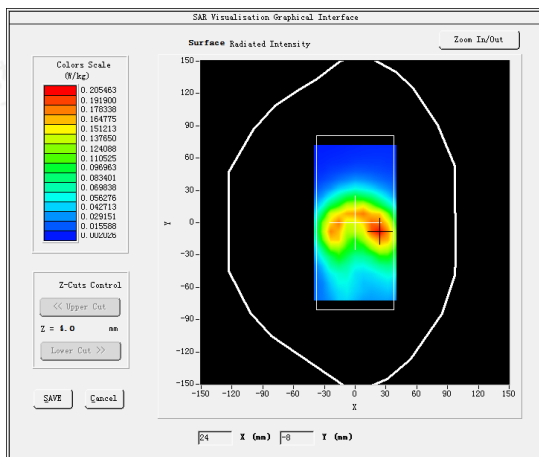
Test Mode:GPRS1800MHz,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.4000
Relative permittivity (real part)	40.66
Conductivity (S/m)	1.42
E-Field Probe	SN 25/22 EPGO376
Crest Factor	4.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.600000
SAR 10g (W/Kg)	0.130230
SAR 1g (W/Kg)	0.232791
SURFACE SAR	VOLUME SAR





#5

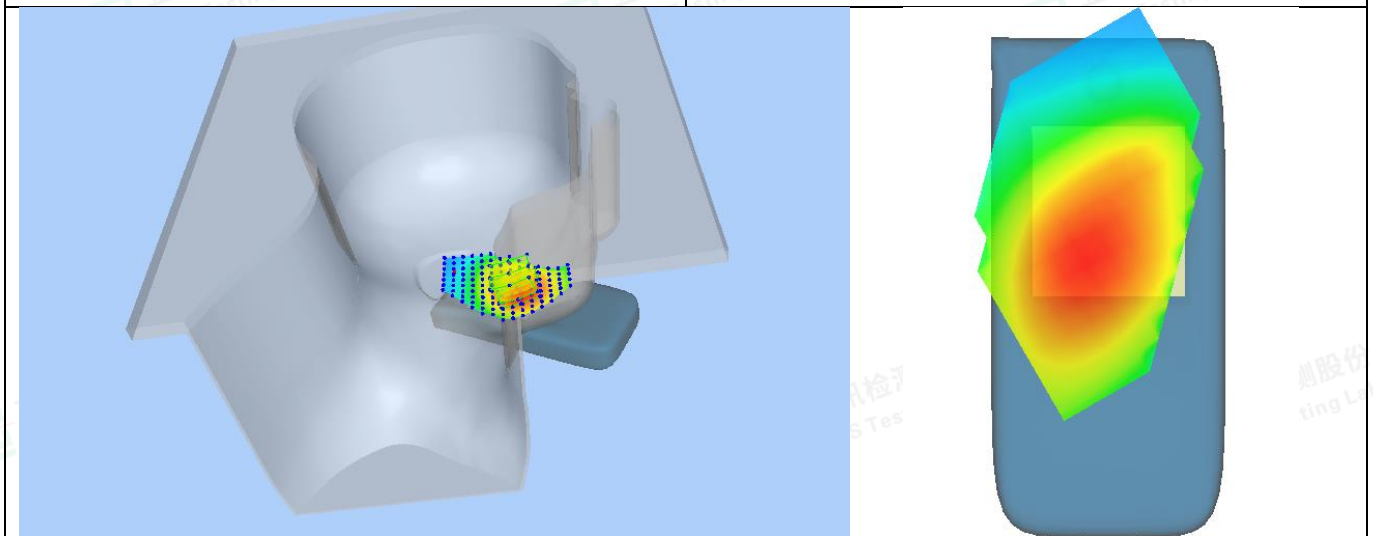
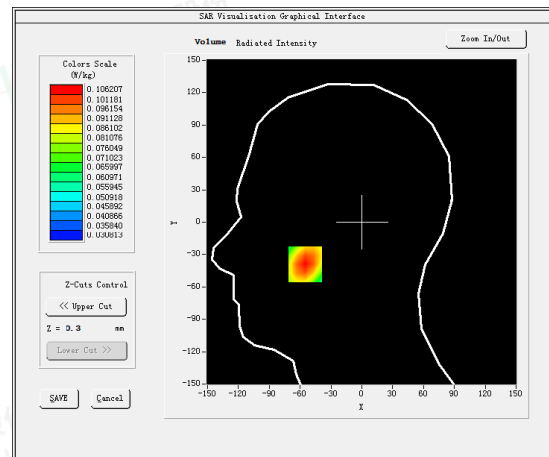
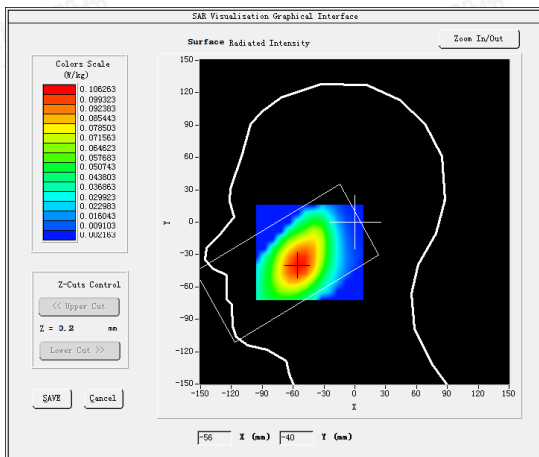
Test Mode:WCDMA 900MHz,Middle channel(Left Head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.6000
Relative permittivity (real part)	42.55
Conductivity (S/m)	0.93
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	3.660000
SAR 10g (W/Kg)	0.079216
SAR 1g (W/Kg)	0.105216
SURFACE SAR	VOLUME SAR





#6

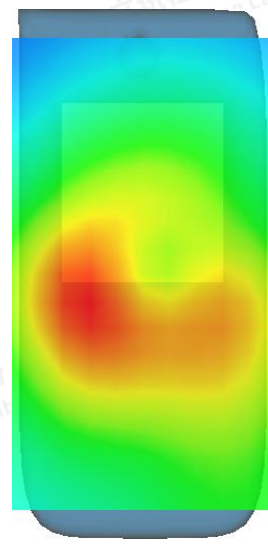
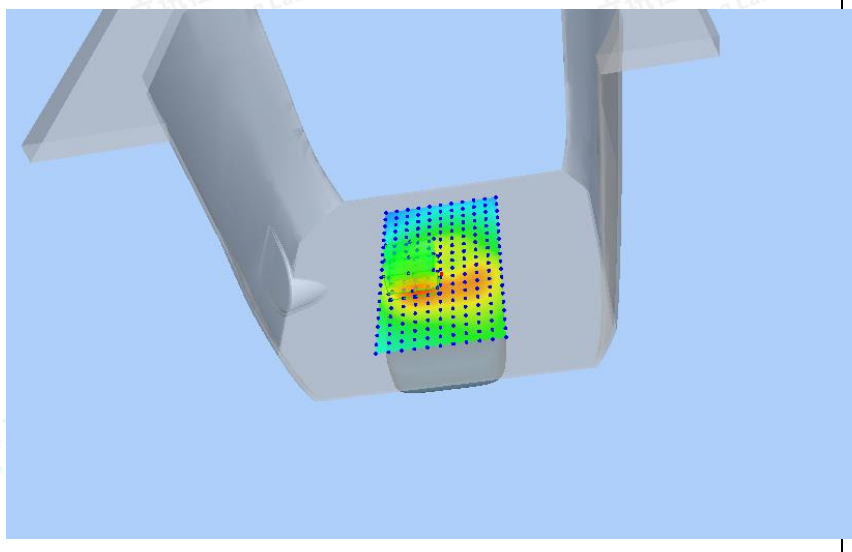
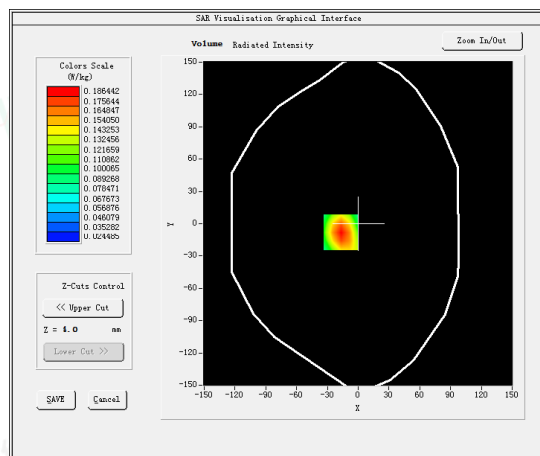
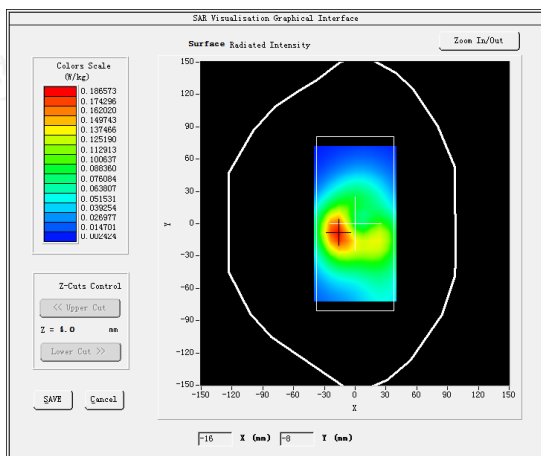
Test Mode:WCDMA 900MHz,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.6000
Relative permittivity (real part)	42.57
Conductivity (S/m)	0.93
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.240000
SAR 10g (W/Kg)	0.109222
SAR 1g (W/Kg)	0.177407
SURFACE SAR	VOLUME SAR





#7

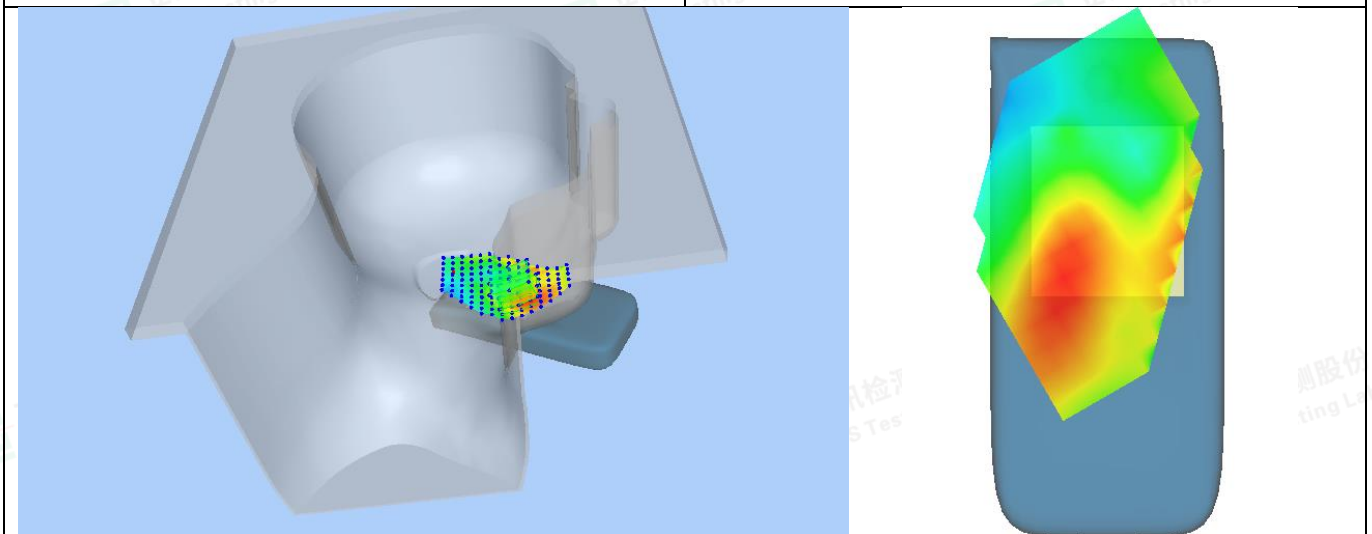
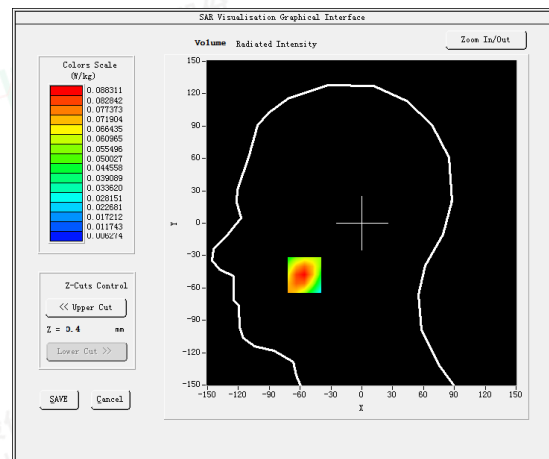
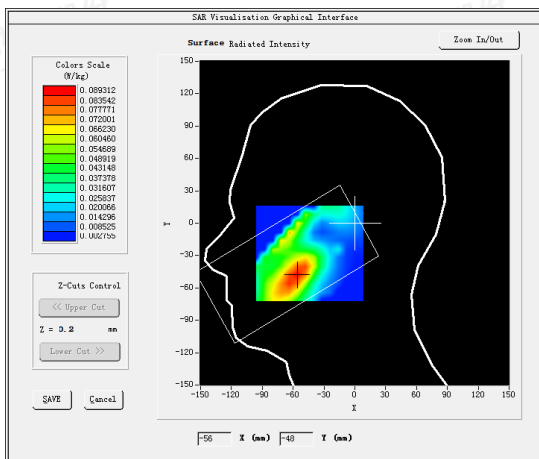
Test Mode:WCDMA2100MHz,Middle channel(Left Head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.20
Conductivity (S/m)	1.44
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.020000
SAR 10g (W/Kg)	0.056402
SAR 1g (W/Kg)	0.099140
SURFACE SAR	VOLUME SAR





#8

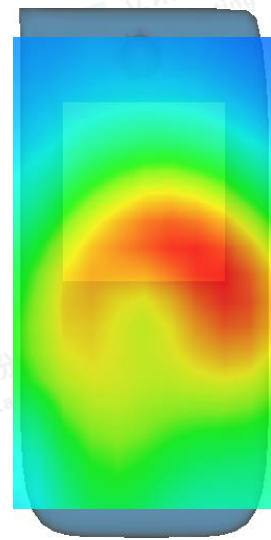
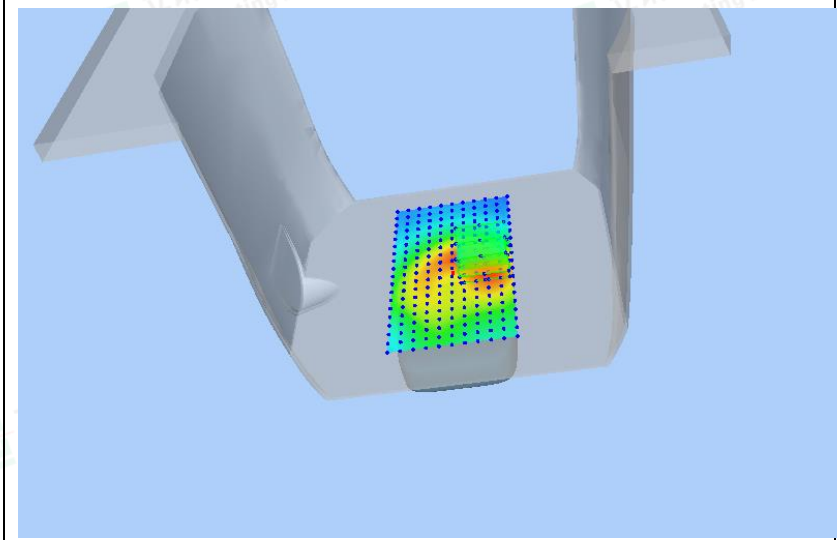
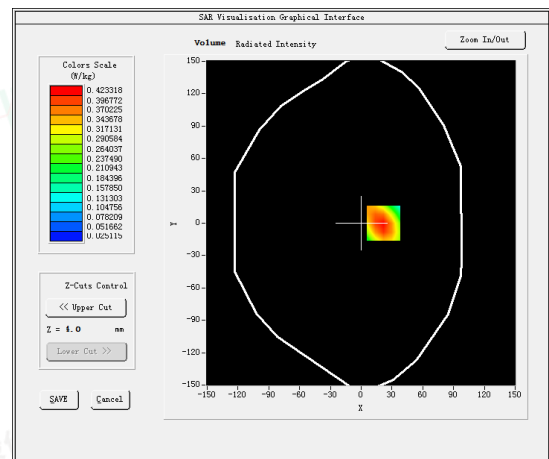
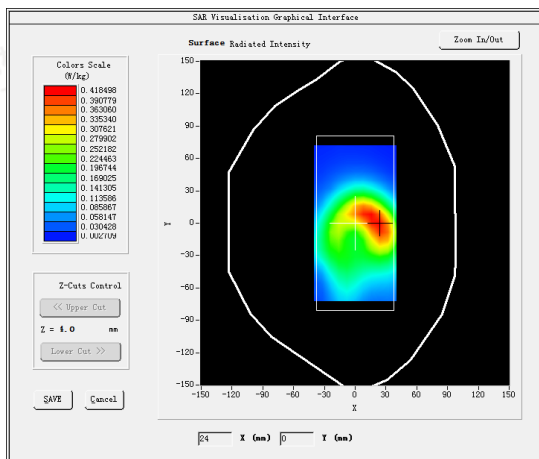
Test Mode:WCDMA2100MHz,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.18
Conductivity (S/m)	1.43
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.020000
SAR 10g (W/Kg)	0.249025
SAR 1g (W/Kg)	0.435220
SURFACE SAR	VOLUME SAR





#9

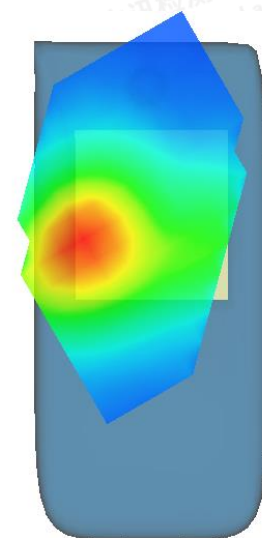
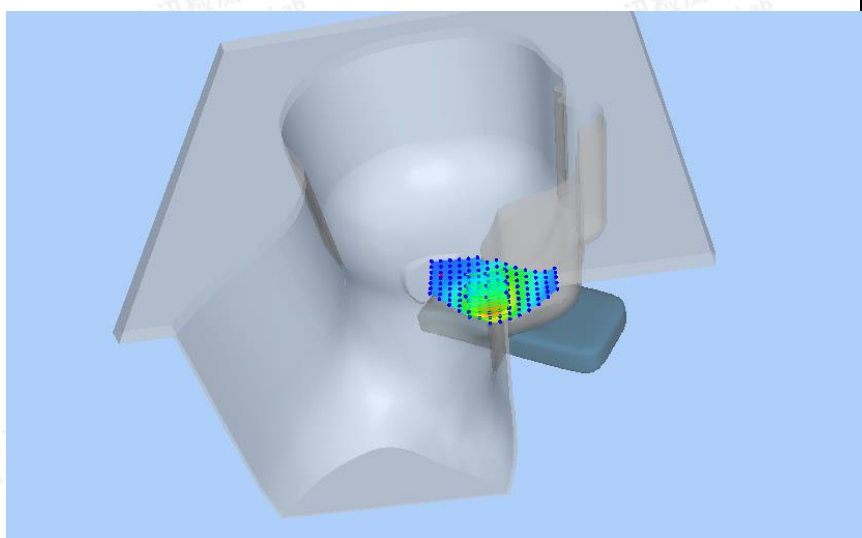
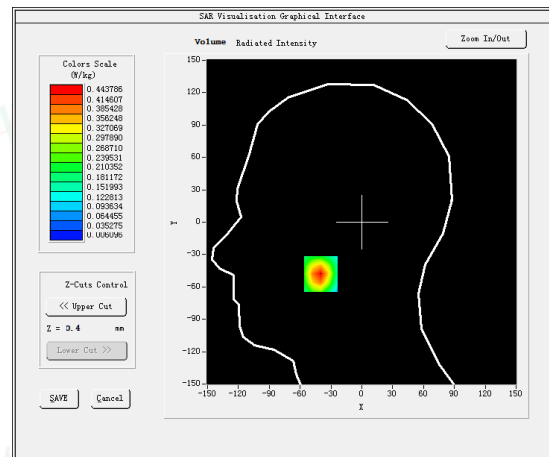
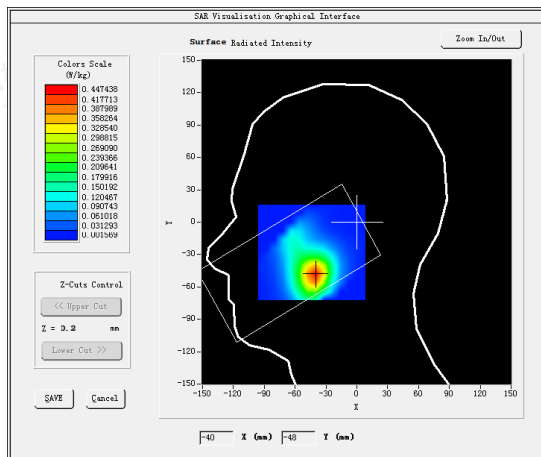
Test Mode:802.11b,Middle channel(Left Head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: June 01, 2024

Medium(liquid type)	HSL_2450
Frequency (MHz)	2442.0000
Relative permittivity (real part)	38.38
Conductivity (S/m)	1.79
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.60
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-3.750000
SAR 10g (W/Kg)	0.232418
SAR 1g (W/Kg)	0.496599
SURFACE SAR	VOLUME SAR





#10

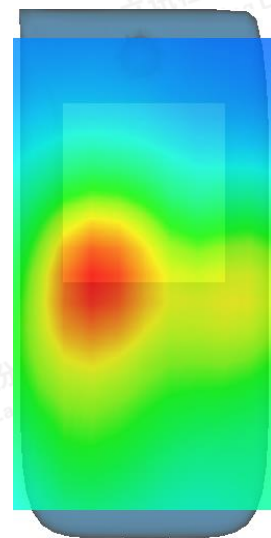
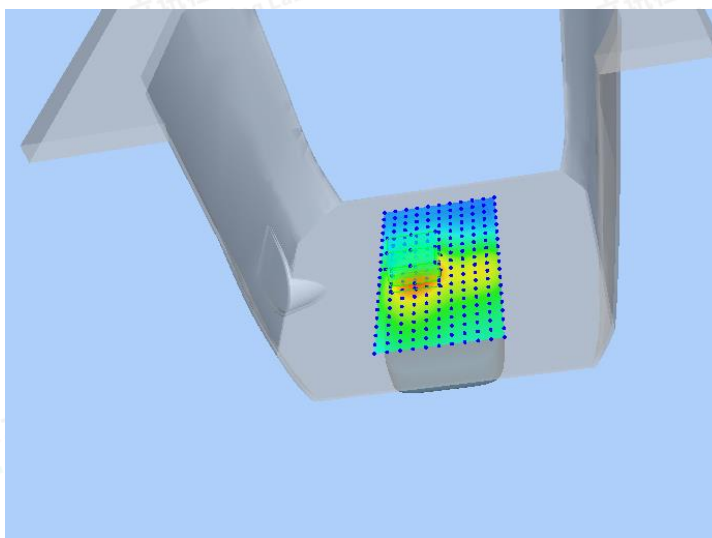
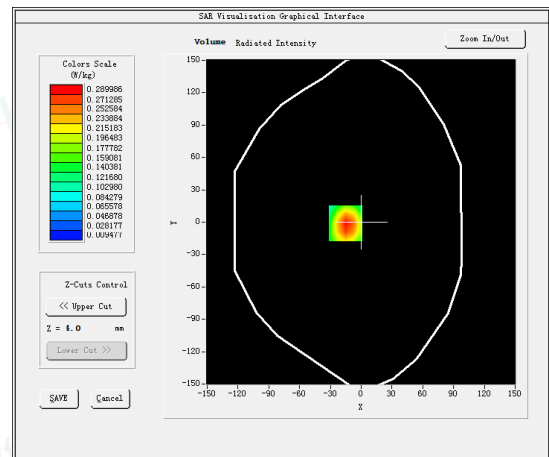
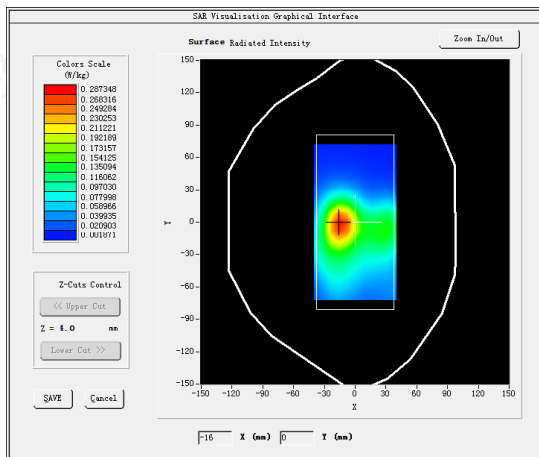
Test Mode:802.11b,Middle channel(Rear Side 5mm)

Product Description:Smartphone

Model:KINGKONG ES PRO

Test Date: June 01, 2024

Medium(liquid type)	HSL_2450
Frequency (MHz)	2442.0000
Relative permittivity (real part)	38.33
Conductivity (S/m)	1.76
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.60
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.530000
SAR 10g (W/Kg)	0.158800
SAR 1g (W/Kg)	0.330146
SURFACE SAR	VOLUME SAR





#11

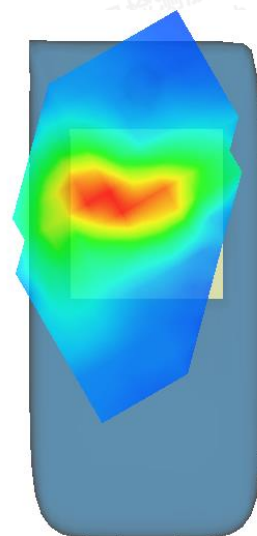
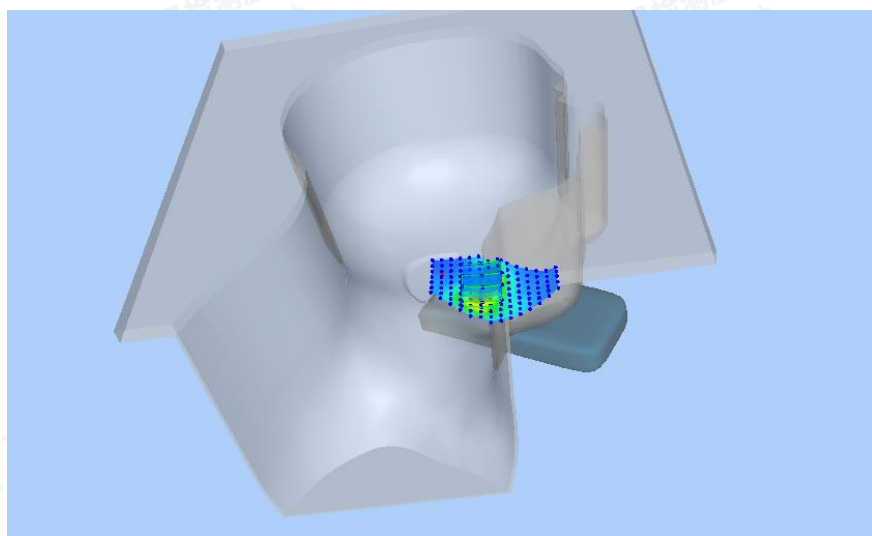
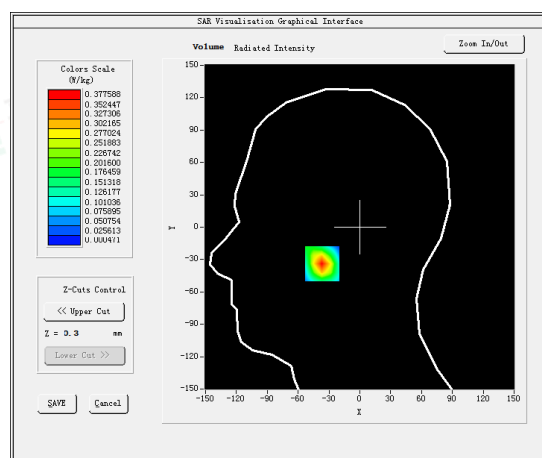
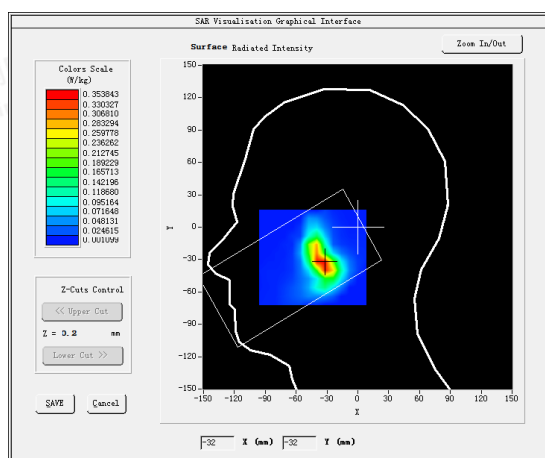
Test Mode: 802.11ac(80MHz)(WiFi5.2G),Middle channel(Left Head cheek)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024

Medium(liquid type)	HSL _5200
Frequency (MHz)	5210.0000
Relative permittivity (real part)	35.80
Conductivity (S/m)	4.57
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.85
Sensor	4mm
Area Scan	dx=10mm dy=10mm
Zoom Scan	7x7x7,dx=4mm dy=4mm dz=1.4mm
Variation (%)	-2.620000
SAR 10g (W/Kg)	0.153897
SAR 1g (W/Kg)	0.432866
SURFACE SAR	VOLUME SAR





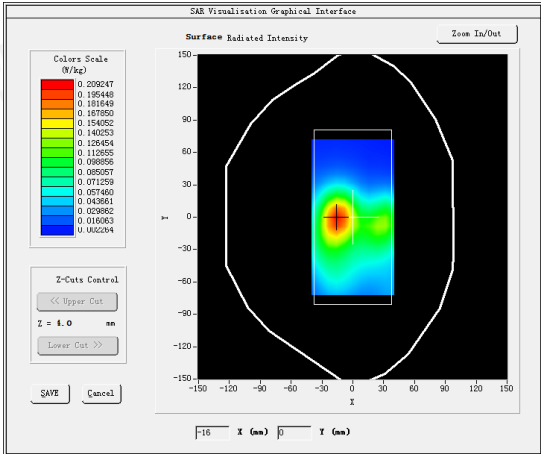
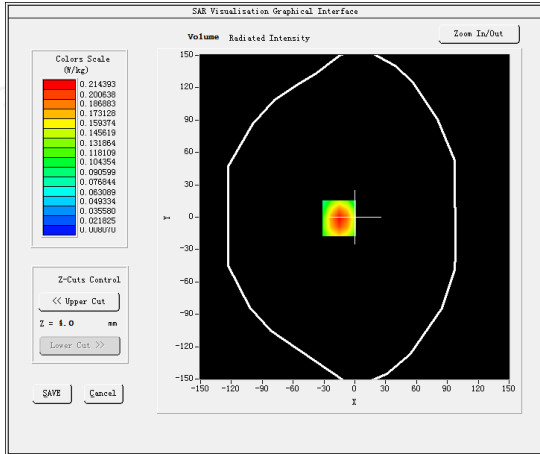
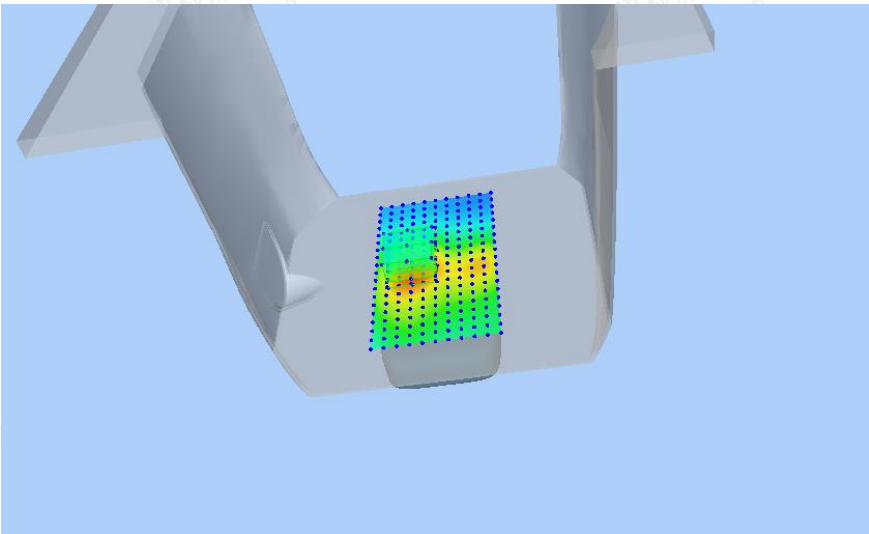
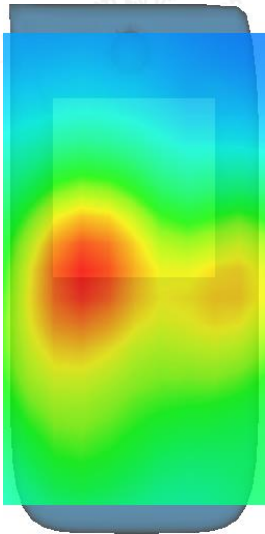
#12

Test Mode: 802.11ac(80MHz)(WiFi5.2G),Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024

Medium(liquid type)	HSL _5200
Frequency (MHz)	5210.0000
Relative permittivity (real part)	35.80
Conductivity (S/m)	4.57
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.85
Sensor	4mm
Area Scan	dx=10mm dy=10mm
Zoom Scan	7x7x7,dx=4mm dy=4mm dz=1.4mm
Variation (%)	-1.110000
SAR 10g (W/Kg)	0.118993
SAR 1g (W/Kg)	0.243387
SURFACE SAR	VOLUME SAR
	
	



#13

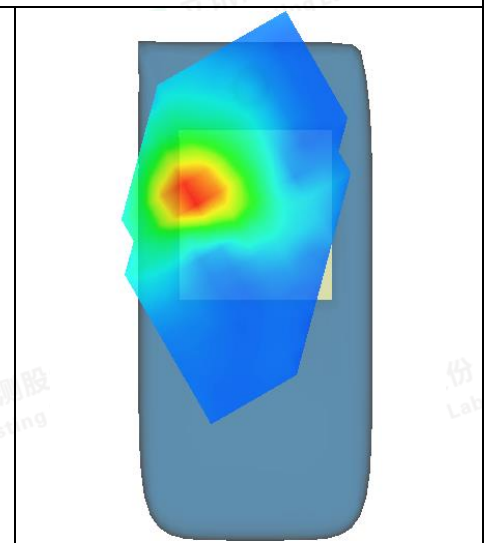
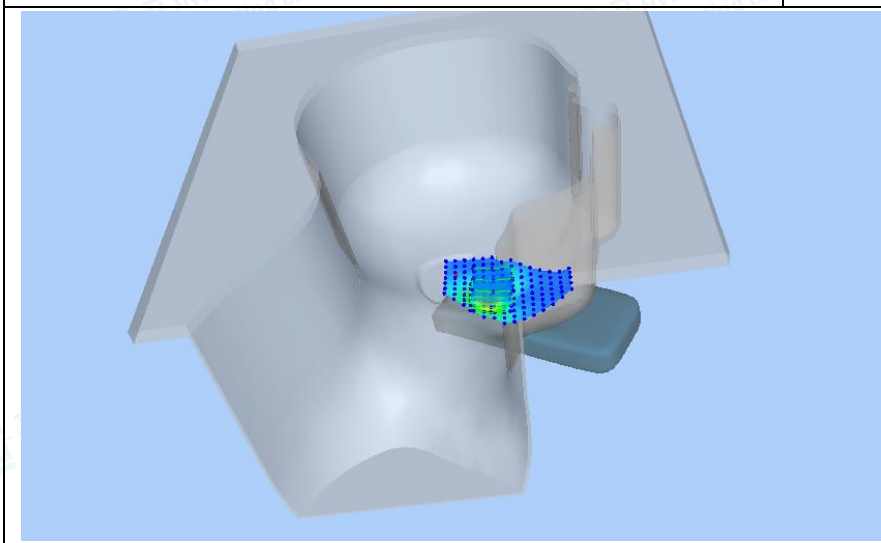
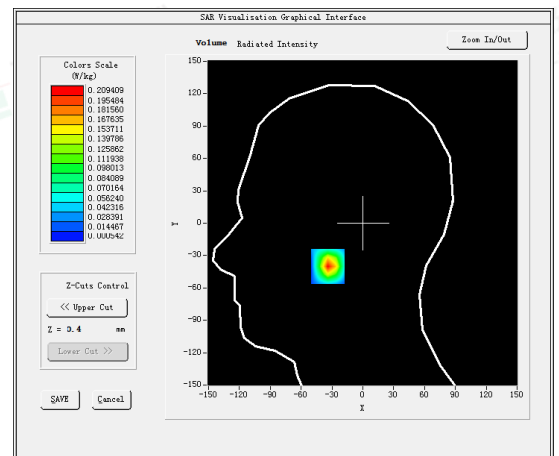
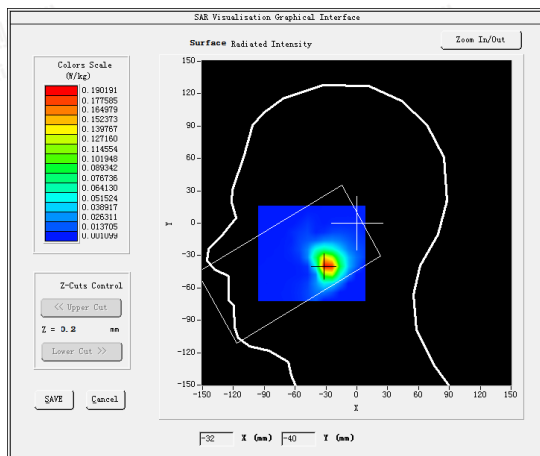
Test Mode: 802.11ac(80MHz)(WiFi5.8G), Middle channel (Left Head cheek)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024

Medium(liquid type)	HSL_5800
Frequency (MHz)	5775.0000
Relative permittivity (real part)	35.83
Conductivity (S/m)	4.61
E-Field Probe	SN 25/22 EPG0376
Crest Factor	1.0
Conversion Factor	2.01
Sensor	4mm
Area Scan	dx=10mm dy=10mm
Zoom Scan	7x7x7,dx=4mm dy=4mm dz=1.4mm
Variation (%)	-1.300000
SAR 10g (W/Kg)	0.078802
SAR 1g (W/Kg)	0.239311
SURFACE SAR	VOLUME SAR





#14

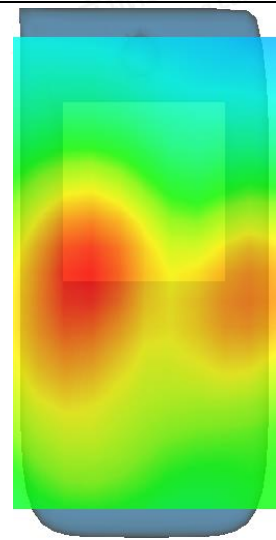
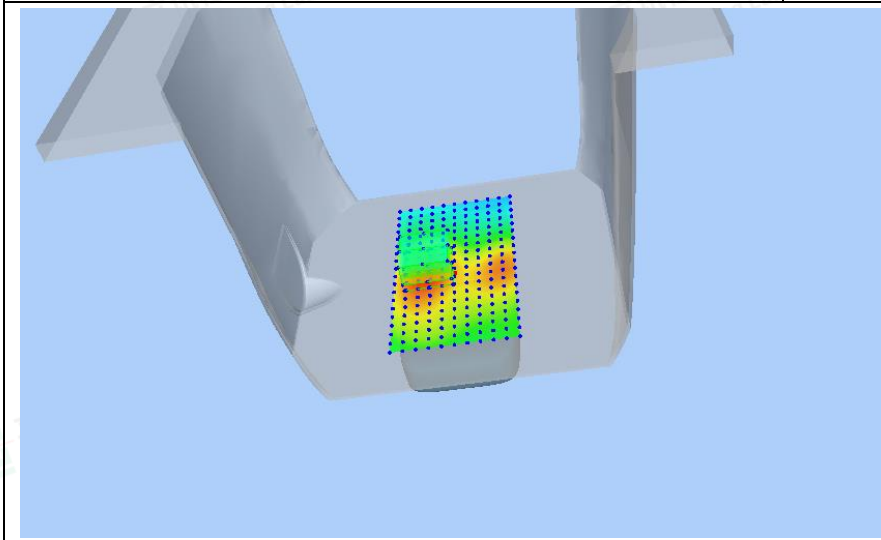
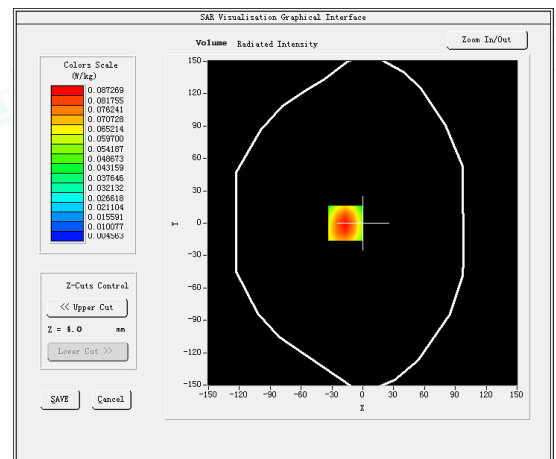
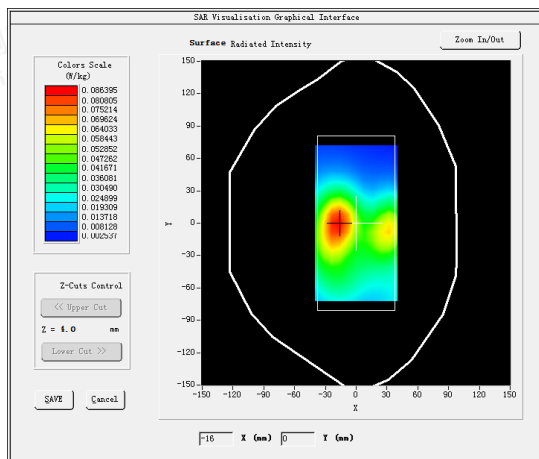
Test Mode: 802.11ac(80MHz)(WiFi5.8G), Middle channel (Rear Side 5mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024

Medium(liquid type)	HSL_5800
Frequency (MHz)	5775.0000
Relative permittivity (real part)	35.83
Conductivity (S/m)	4.61
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.01
Sensor	4mm
Area Scan	dx=10mm dy=10mm
Zoom Scan	7x7x7,dx=4mm dy=4mm dz=1.4mm
Variation (%)	-0.290000
SAR 10g (W/Kg)	0.051080
SAR 1g (W/Kg)	0.099867
SURFACE SAR	VOLUME SAR





#15

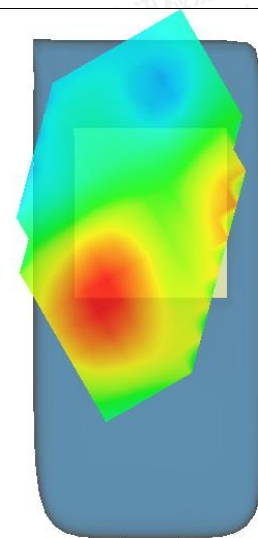
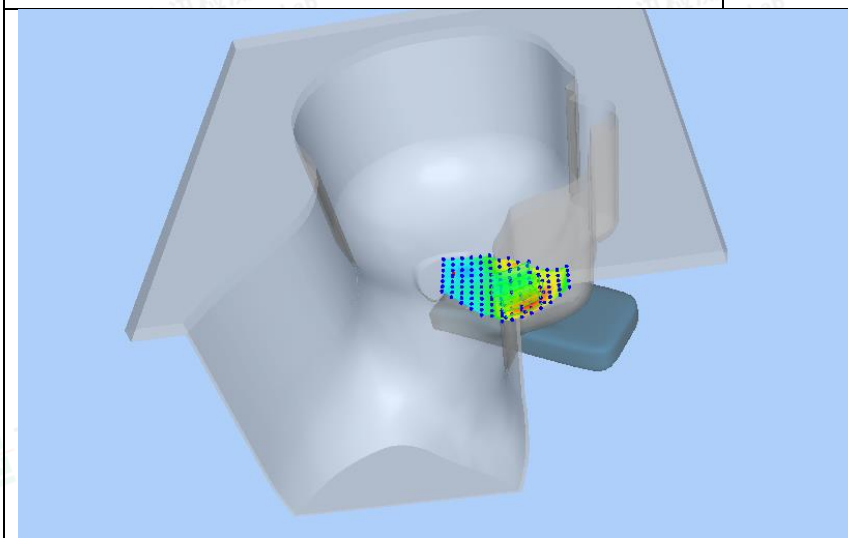
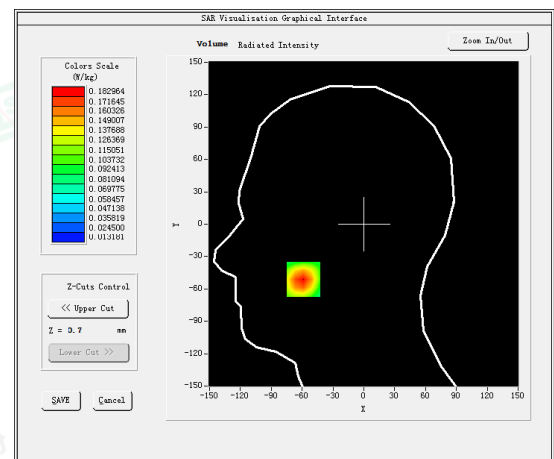
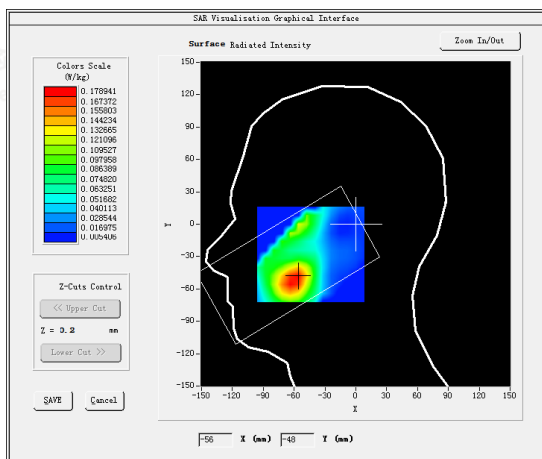
Test Mode:E-UTRA Band1,Middle channel(Left Head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.18
Conductivity (S/m)	1.43
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.230000
SAR 10g (W/Kg)	0.105808
SAR 1g (W/Kg)	0.186933
SURFACE SAR	VOLUME SAR





#16

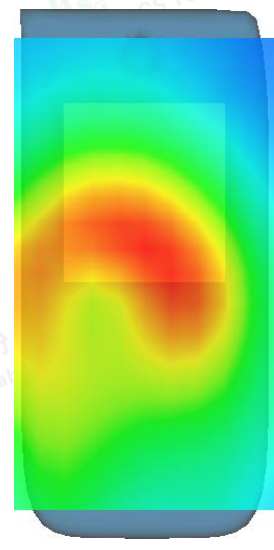
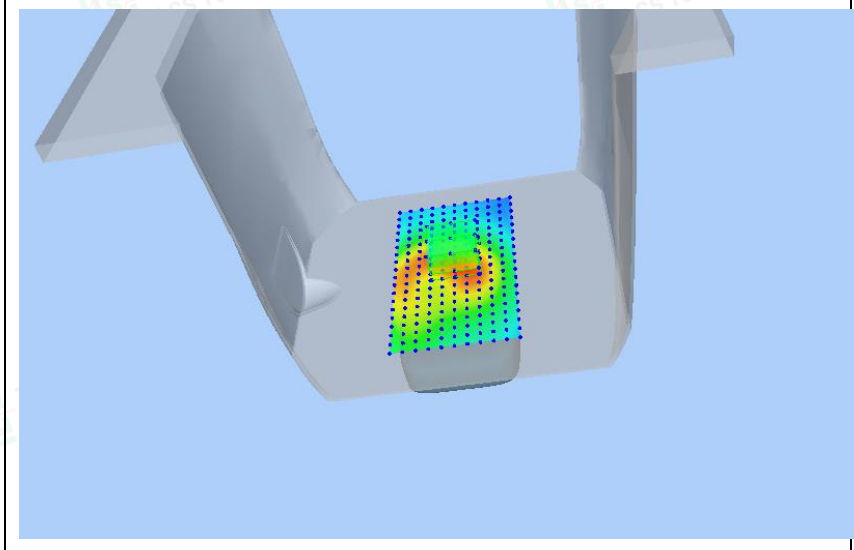
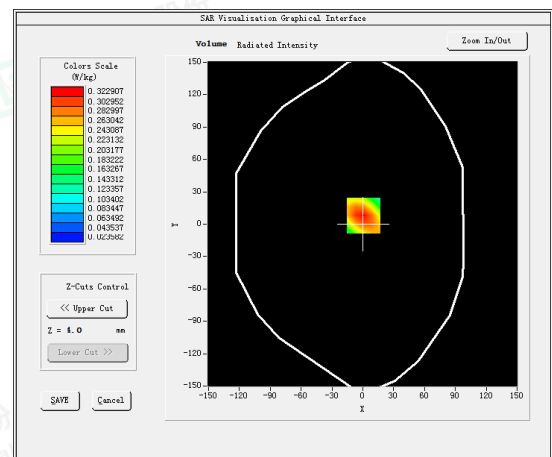
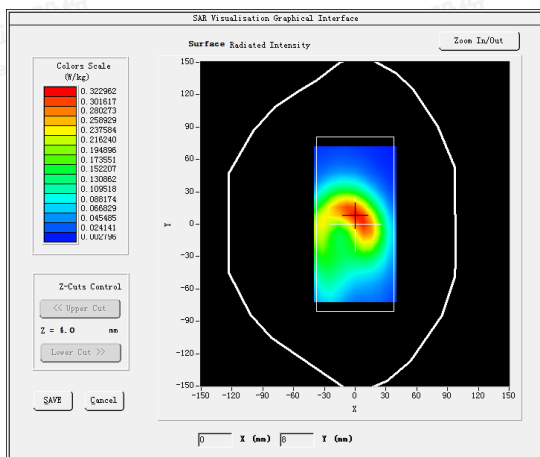
Test Mode: E-UTRA Band1,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.19
Conductivity (S/m)	1.40
E-Field Probe	SN 25/22 EPG0376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.160000
SAR 10g (W/Kg)	0.188455
SAR 1g (W/Kg)	0.331340
SURFACE SAR	VOLUME SAR





#17

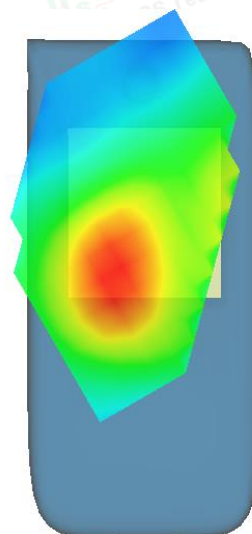
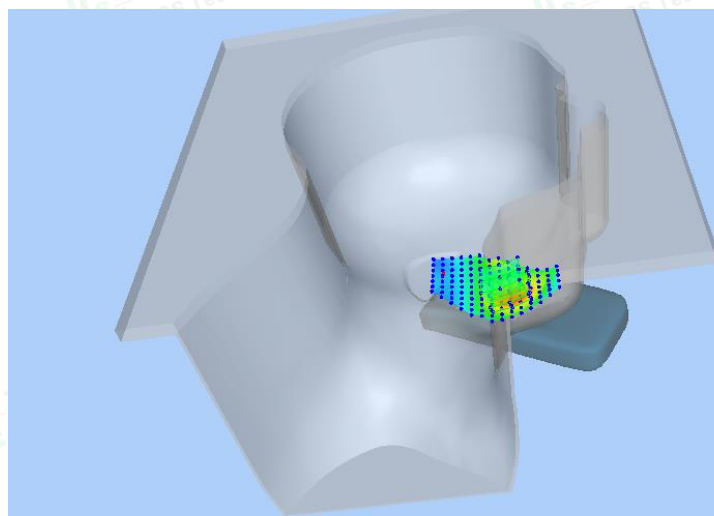
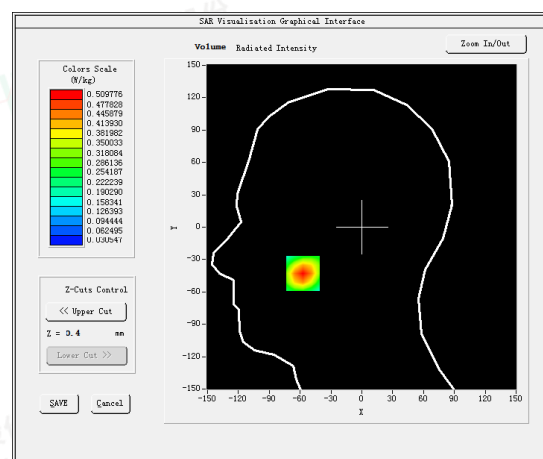
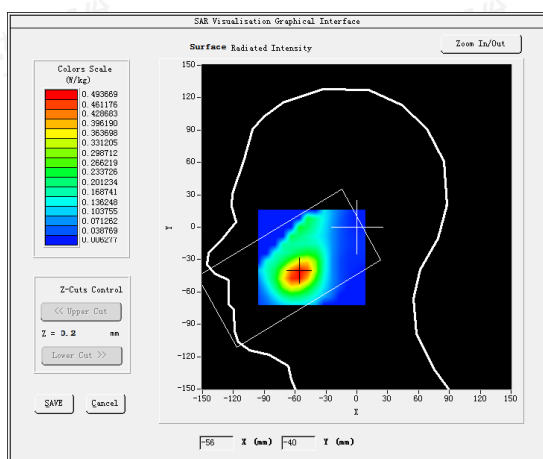
Test Mode:E-UTRA3,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.5000
Relative permittivity (real part)	40.65
Conductivity (S/m)	1.42
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.690000
SAR 10g (W/Kg)	0.306179
SAR 1g (W/Kg)	0.565607
SURFACE SAR	VOLUME SAR





#18

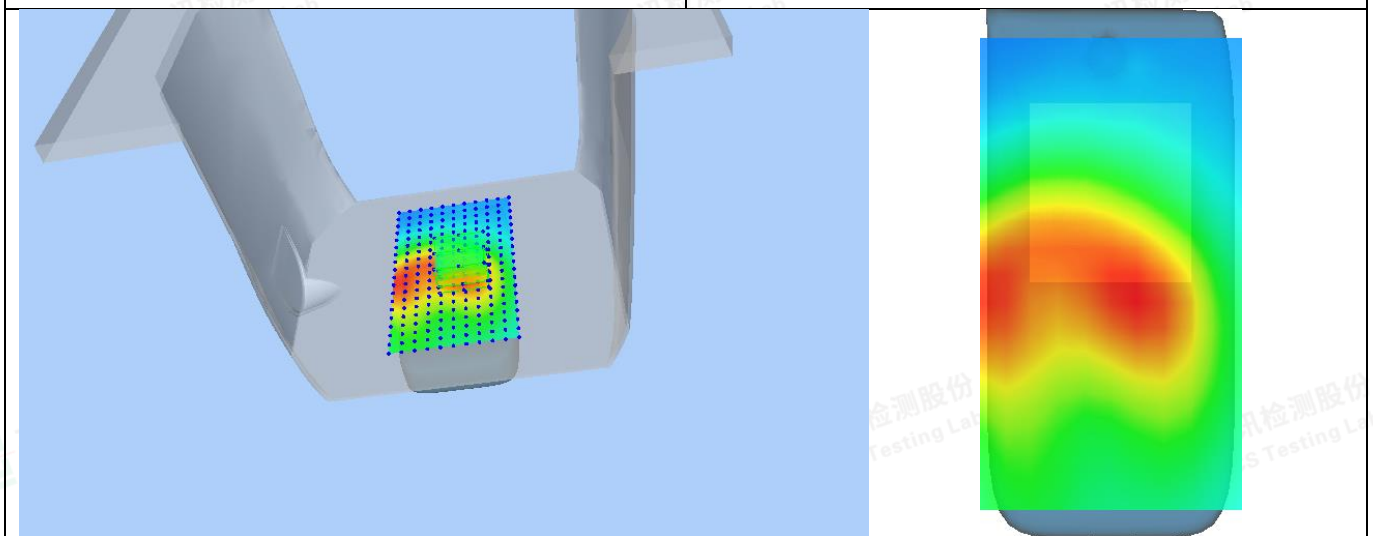
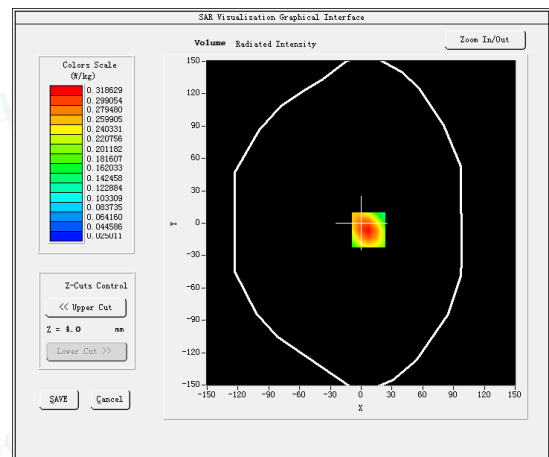
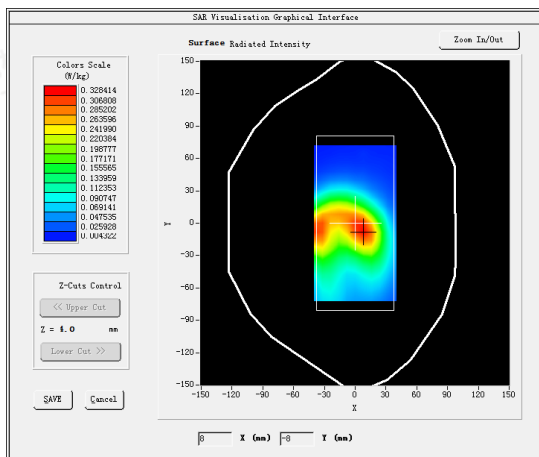
Test Mode: E-UTRA3,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.5000
Relative permittivity (real part)	40.67
Conductivity (S/m)	1.45
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-4.650000
SAR 10g (W/Kg)	0.205502
SAR 1g (W/Kg)	0.359324
SURFACE SAR	VOLUME SAR





#19

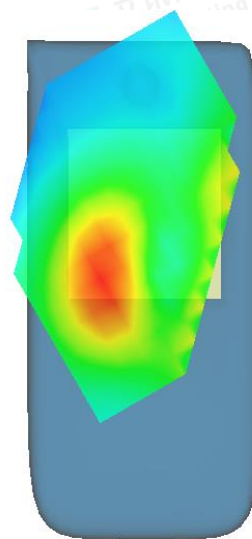
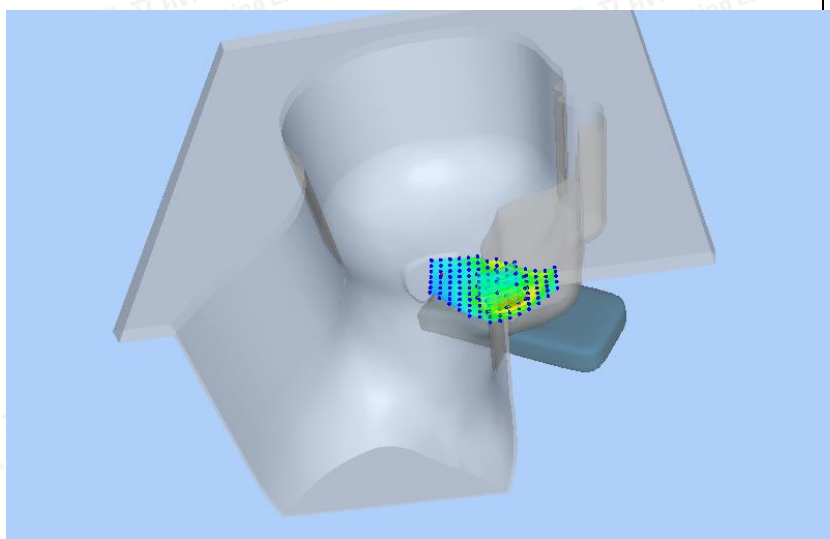
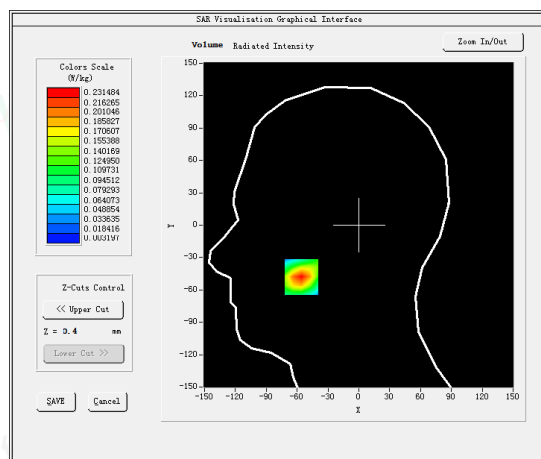
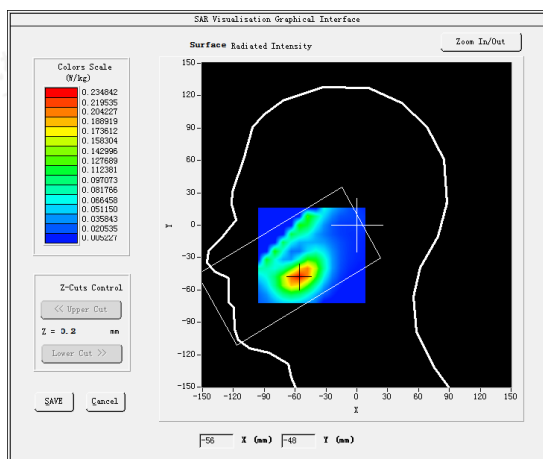
Test Mode: E-UTRA7,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: June 05, 2024

Medium(liquid type)	HSL_2600
Frequency (MHz)	2535.0000
Relative permittivity (real part)	40.37
Conductivity (S/m)	1.91
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.39
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-3.990000
SAR 10g (W/Kg)	0.107384
SAR 1g (W/Kg)	0.213947
SURFACE SAR	VOLUME SAR





#20

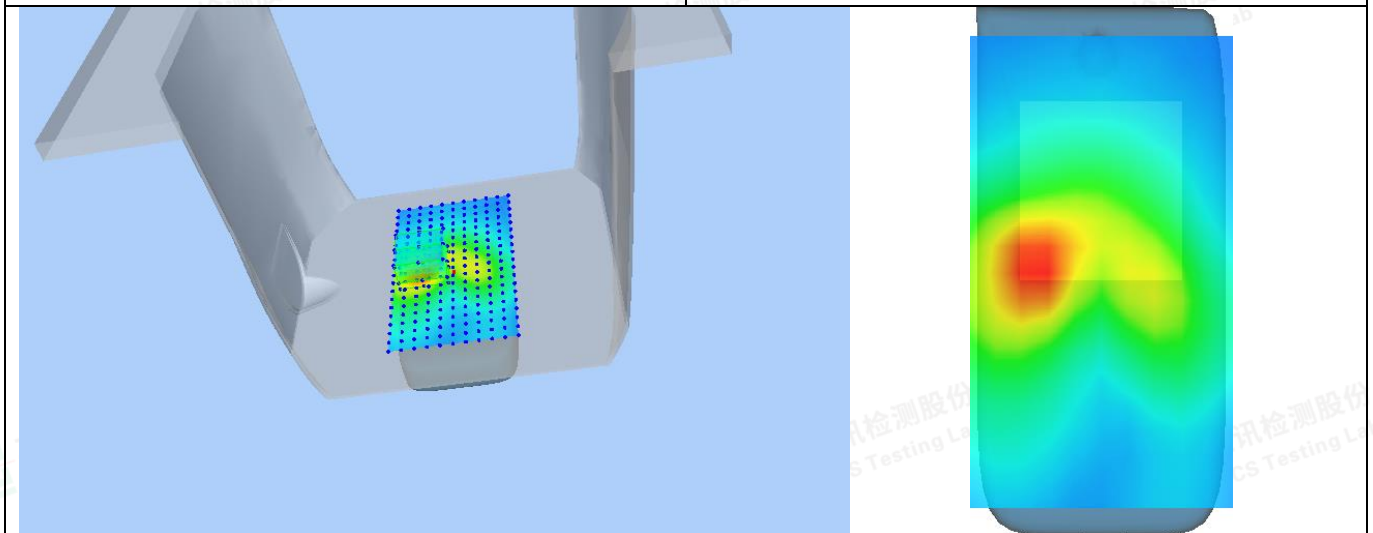
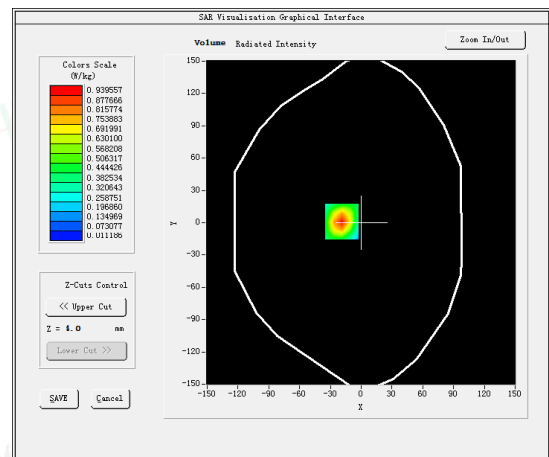
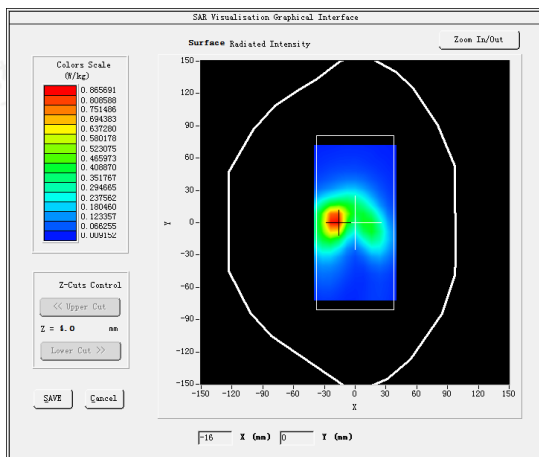
Test Mode: E-UTRA7,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: June 05, 2024

Medium(liquid type)	HSL_2600
Frequency (MHz)	2535.0000
Relative permittivity (real part)	40.38
Conductivity (S/m)	1.92
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.39
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.450000
SAR 10g (W/Kg)	0.404720
SAR 1g (W/Kg)	0.872381
SURFACE SAR	VOLUME SAR





#21

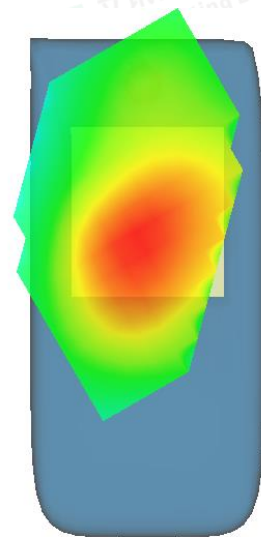
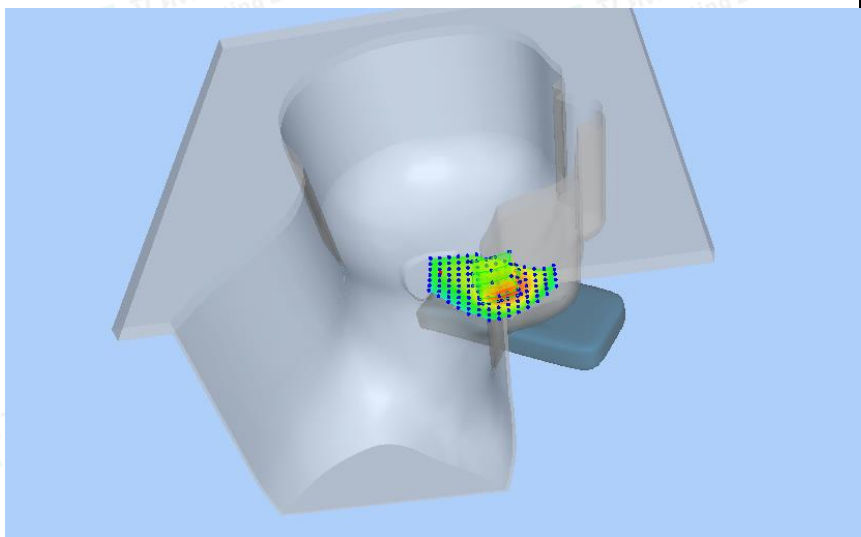
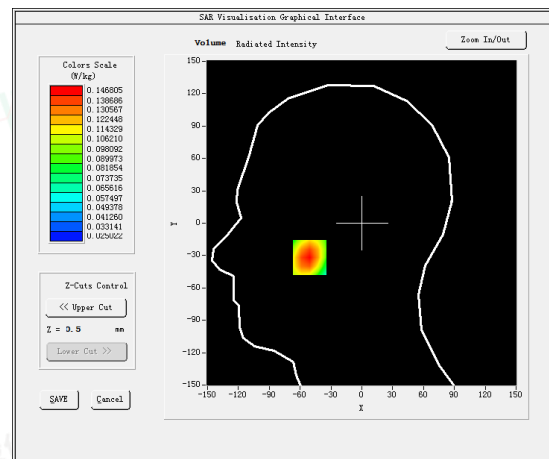
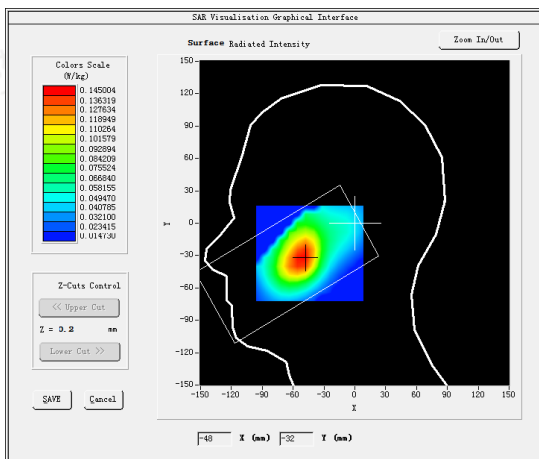
Test Mode: E-UTRA8,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.5000
Relative permittivity (real part)	42.52
Conductivity (S/m)	0.93
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	4.210000
SAR 10g (W/Kg)	0.101207
SAR 1g (W/Kg)	0.141632
SURFACE SAR	VOLUME SAR





#22

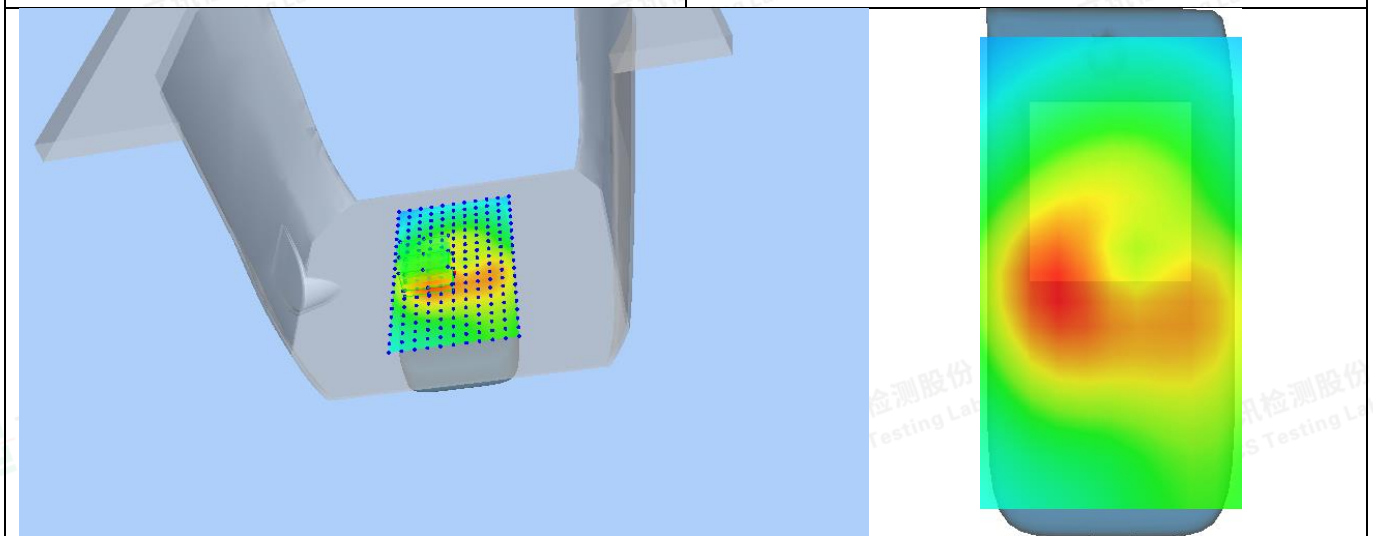
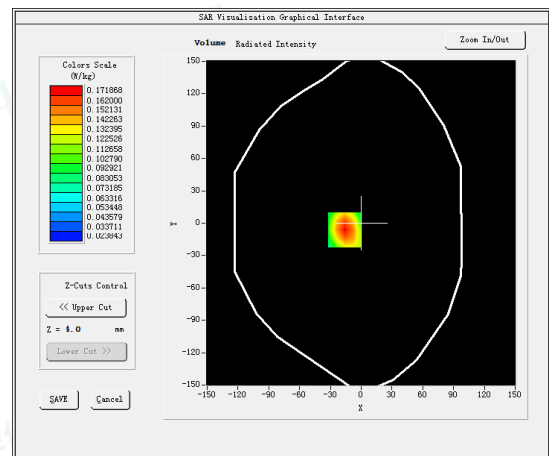
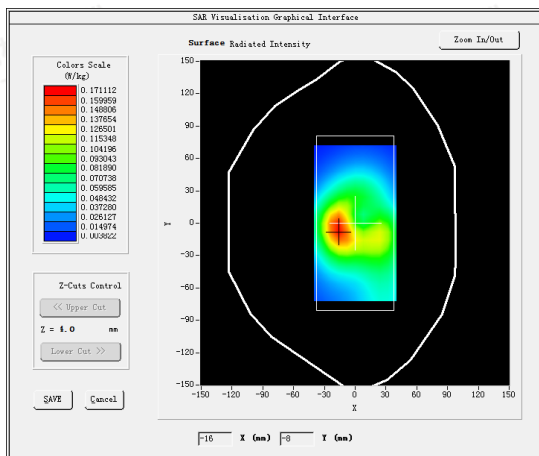
Test Mode: E-UTRA8,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.5000
Relative permittivity (real part)	42.52
Conductivity (S/m)	0.95
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.240000
SAR 10g (W/Kg)	0.101036
SAR 1g (W/Kg)	0.163674
SURFACE SAR	VOLUME SAR





#23

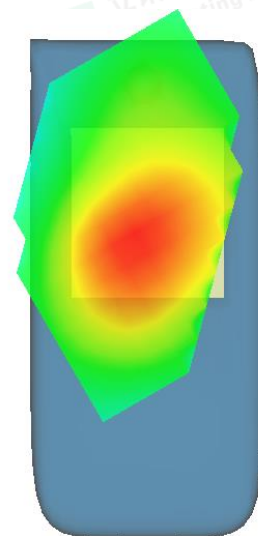
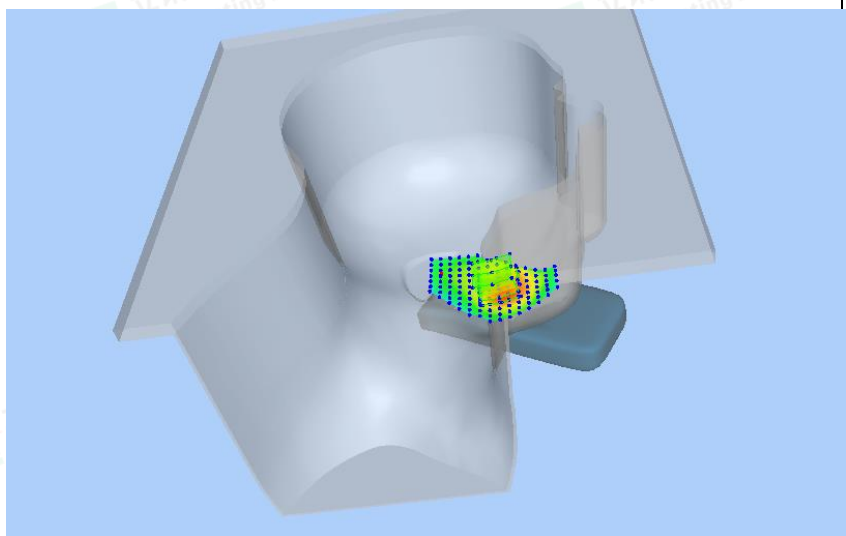
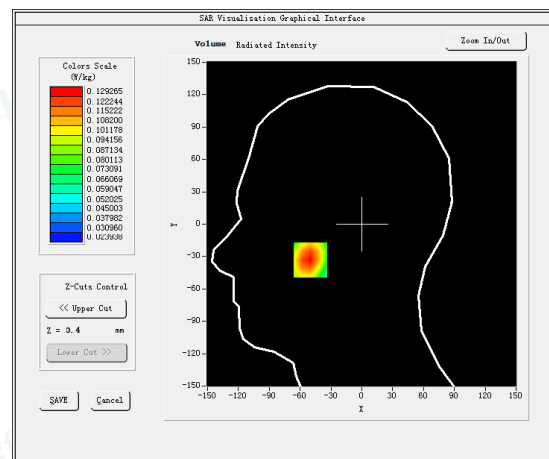
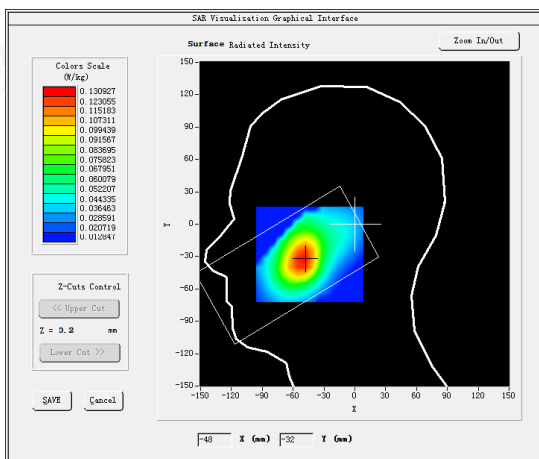
Test Mode: E-UTRA20,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	847.0000
Relative permittivity (real part)	41.90
Conductivity (S/m)	0.88
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.850000
SAR 10g (W/Kg)	0.089008
SAR 1g (W/Kg)	0.124708
SURFACE SAR	VOLUME SAR





#24

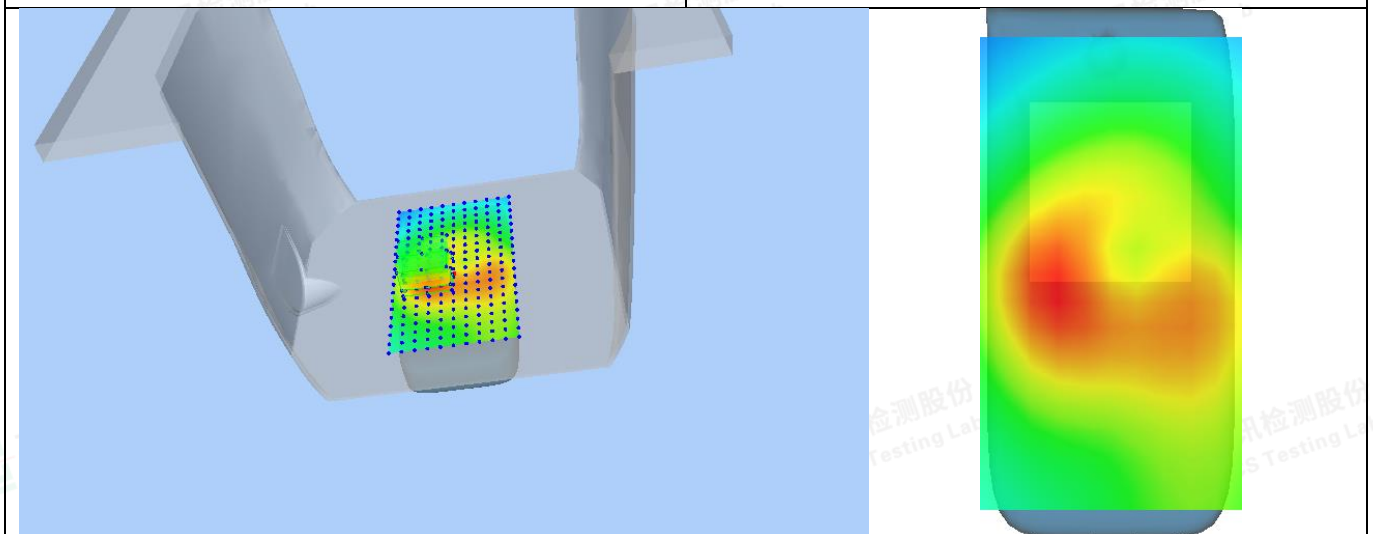
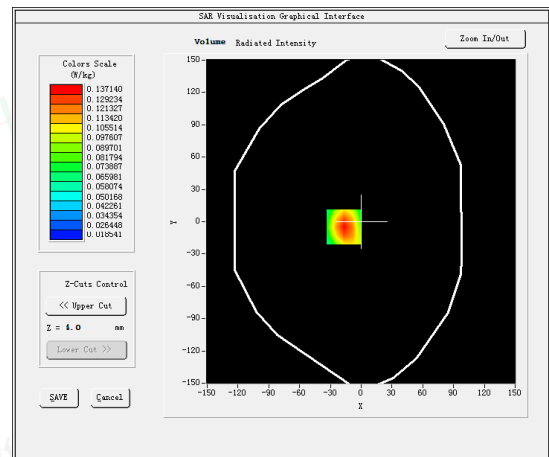
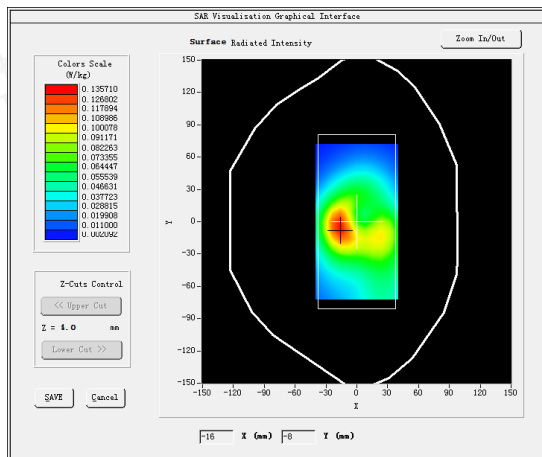
Test Mode: E-UTRA20,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	847.0000
Relative permittivity (real part)	41.90
Conductivity (S/m)	0.88
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.470000
SAR 10g (W/Kg)	0.080159
SAR 1g (W/Kg)	0.130400
SURFACE SAR	VOLUME SAR





#25

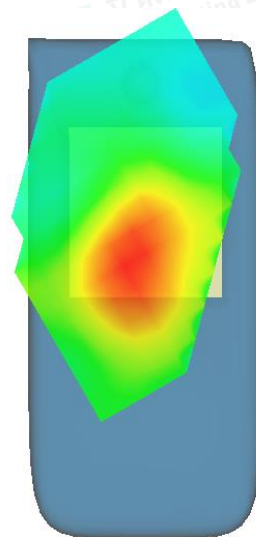
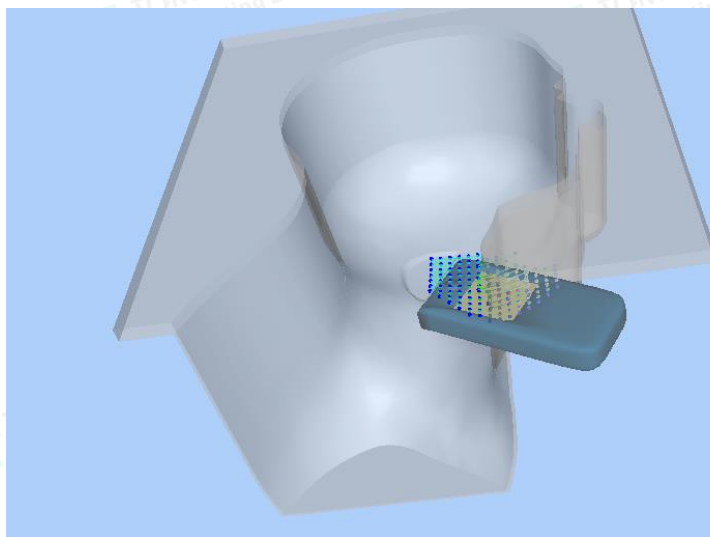
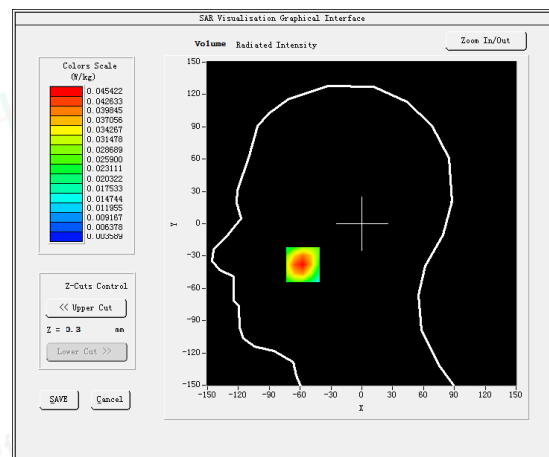
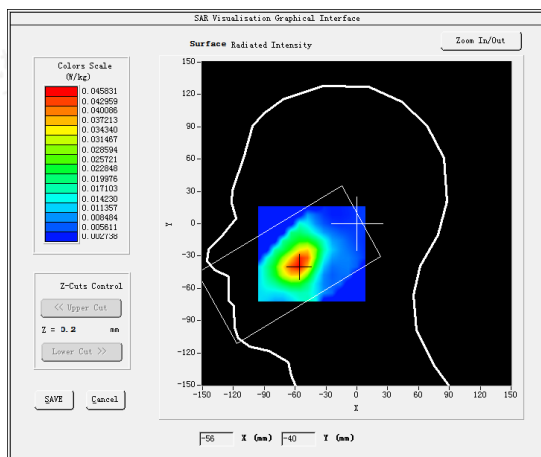
Test Mode: E-UTRA28,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	718.0000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.90
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.550000
SAR 10g (W/Kg)	0.024889
SAR 1g (W/Kg)	0.042790
SURFACE SAR	VOLUME SAR





#26

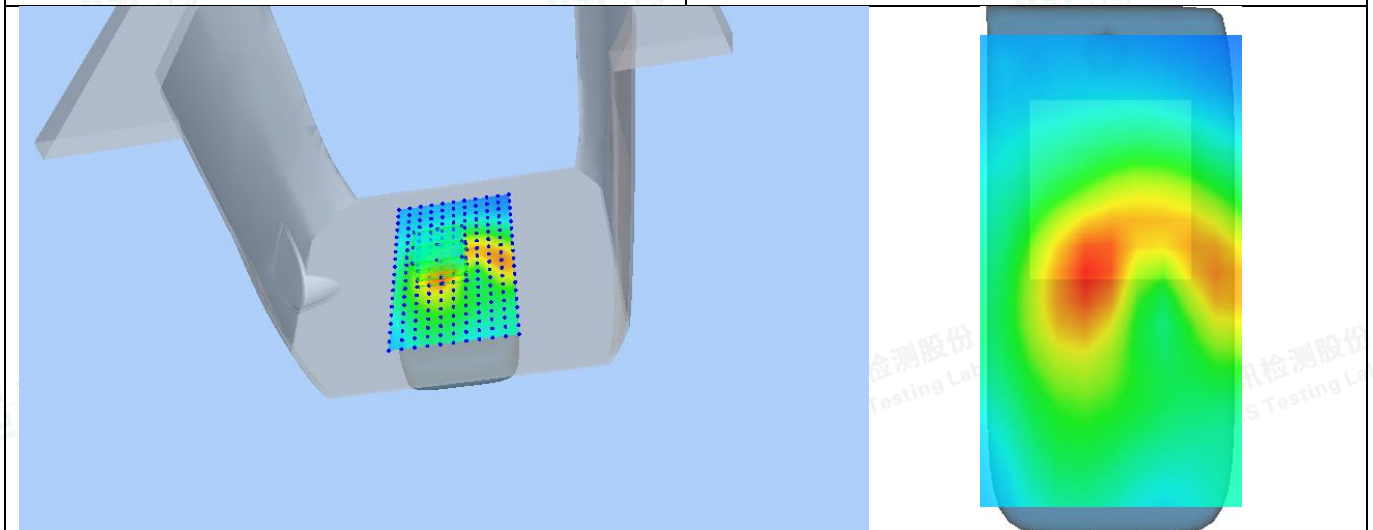
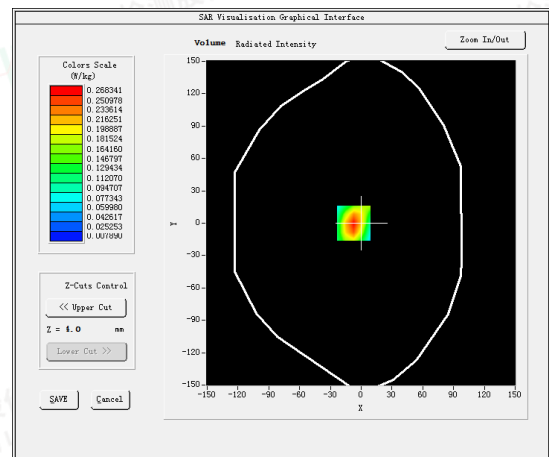
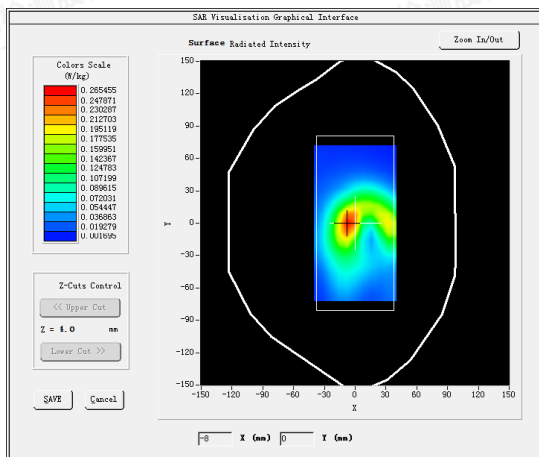
Test Mode: E-UTRA28,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	718.0000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.90
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.820000
SAR 10g (W/Kg)	0.124833
SAR 1g (W/Kg)	0.249873
SURFACE SAR	VOLUME SAR





#27

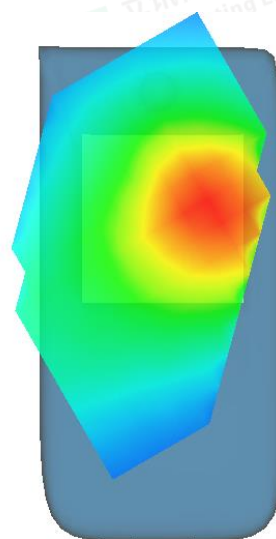
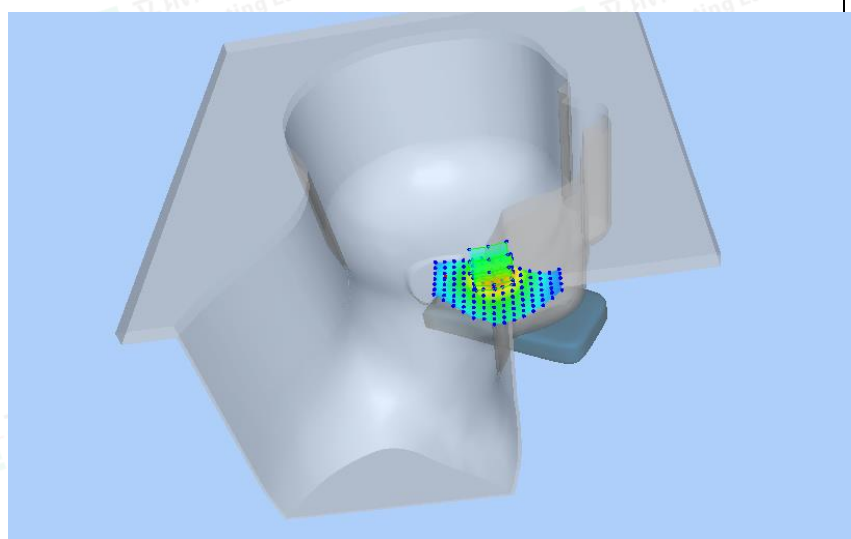
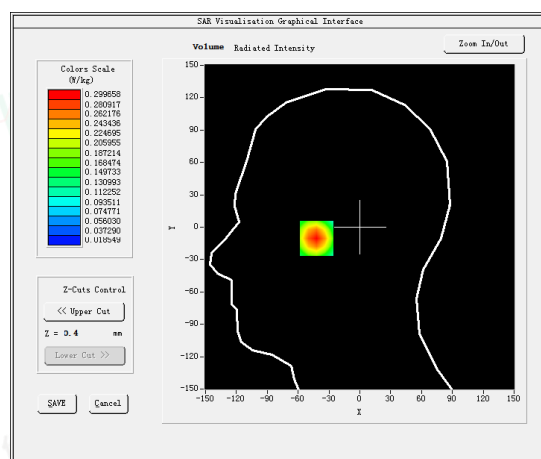
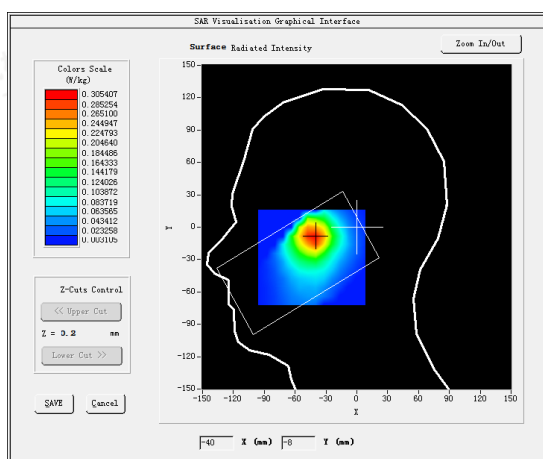
Test Mode: E-UTRA41,Middle channel(Left head cheek)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: July 30, 2026

Medium(liquid type)	HSL_2600
Frequency (MHz)	2593.0000
Relative permittivity (real part)	38.59
Conductivity (S/m)	2.03
E-Field Probe	SN 08/21 EPGO352
Crest Factor	1.0
Conversion Factor	1.70
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.150000
SAR 10g (W/Kg)	0.102368
SAR 1g (W/Kg)	0.238597
SURFACE SAR	VOLUME SAR





#28

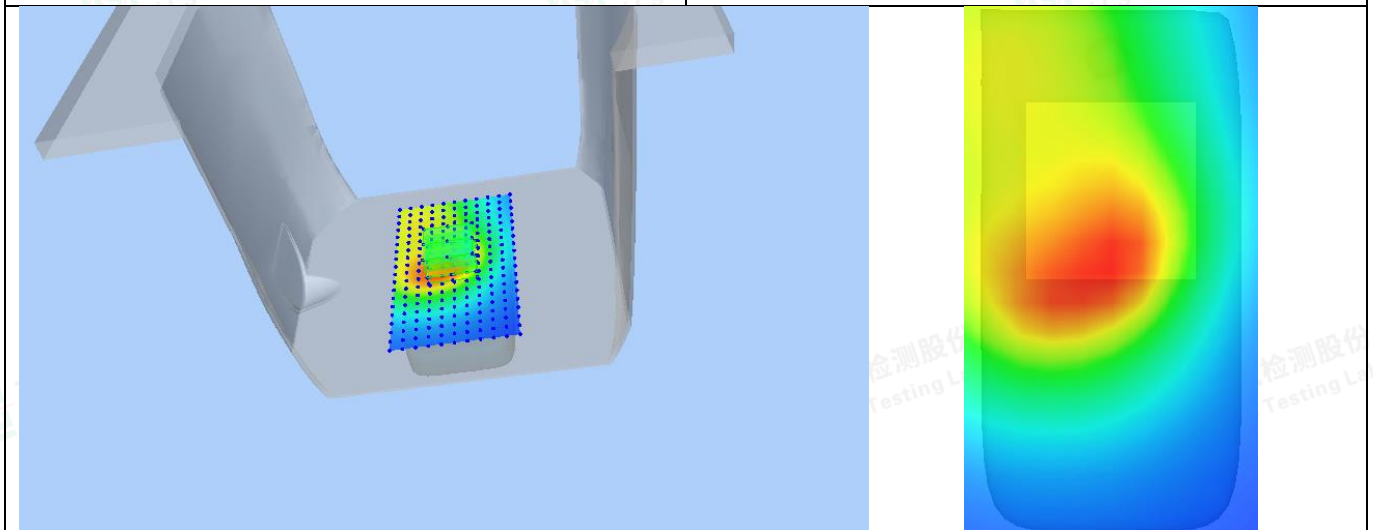
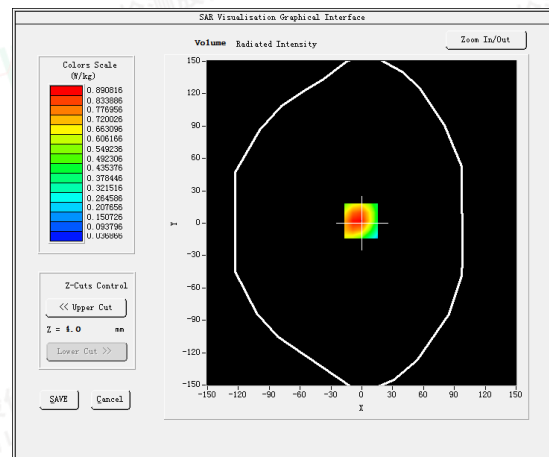
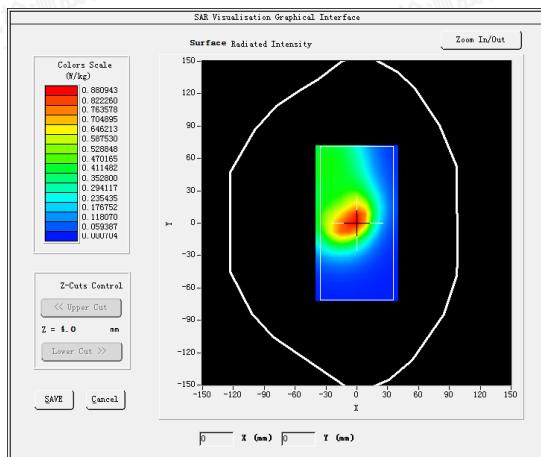
Test Mode: E-UTRA41,Middle channel(Rear Side 5mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: July 30, 2026

Medium(liquid type)	HSL_2600
Frequency (MHz)	2593.0000
Relative permittivity (real part)	38.59
Conductivity (S/m)	2.03
E-Field Probe	SN 08/21 EPGO352
Crest Factor	1.0
Conversion Factor	1.70
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-2.740000
SAR 10g (W/Kg)	0.387844
SAR 1g (W/Kg)	0.584788
SURFACE SAR	VOLUME SAR





#29

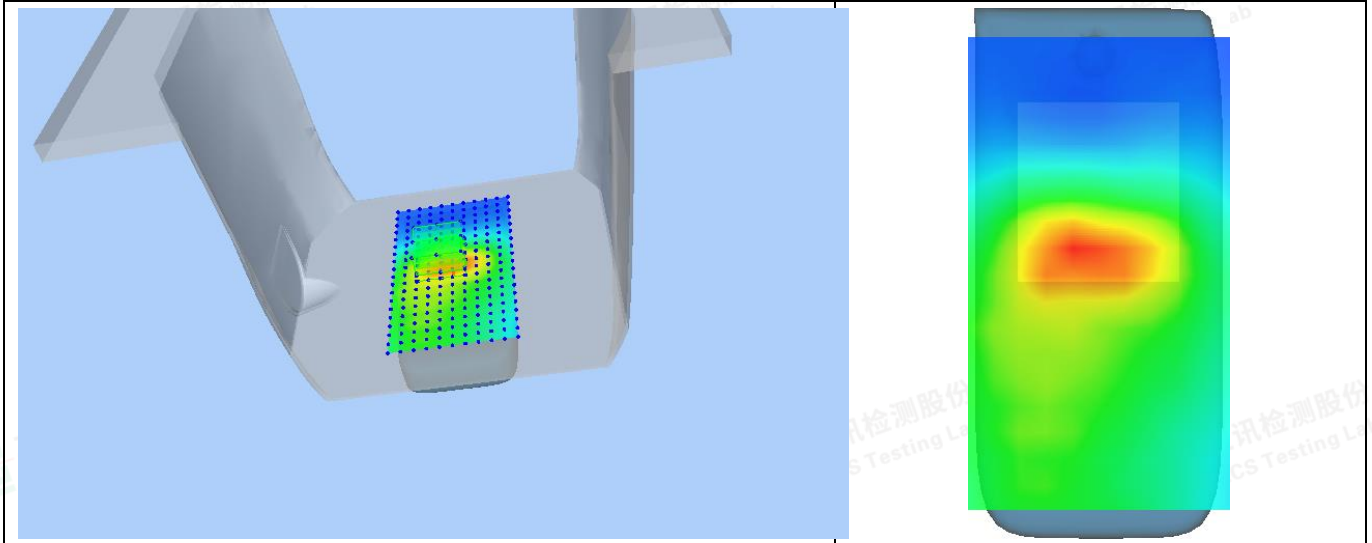
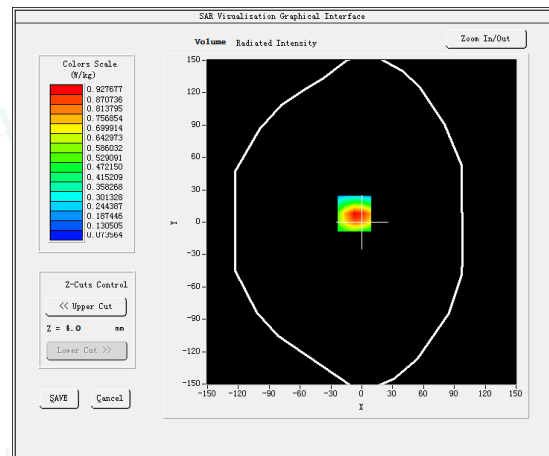
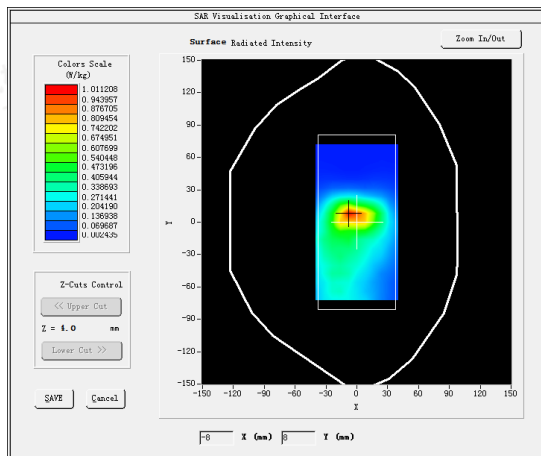
Test Mode:GPRS900MHz,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	902.6000
Relative permittivity (real part)	42.58
Conductivity (S/m)	0.95
E-Field Probe	SN 25/22 EPGO376
Crest Factor	4.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.870000
SAR 10g (W/Kg)	0.532849
SAR 1g (W/Kg)	0.892738
SURFACE SAR	VOLUME SAR





#30

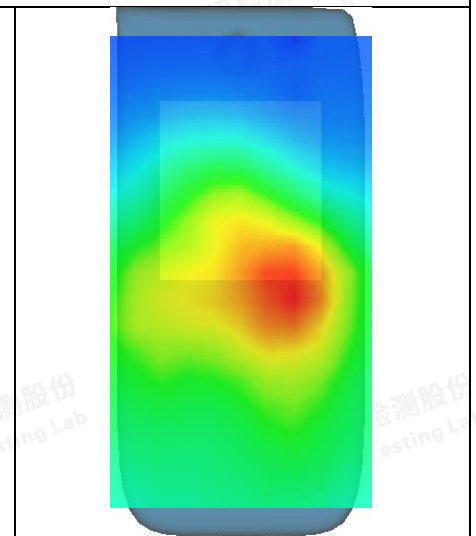
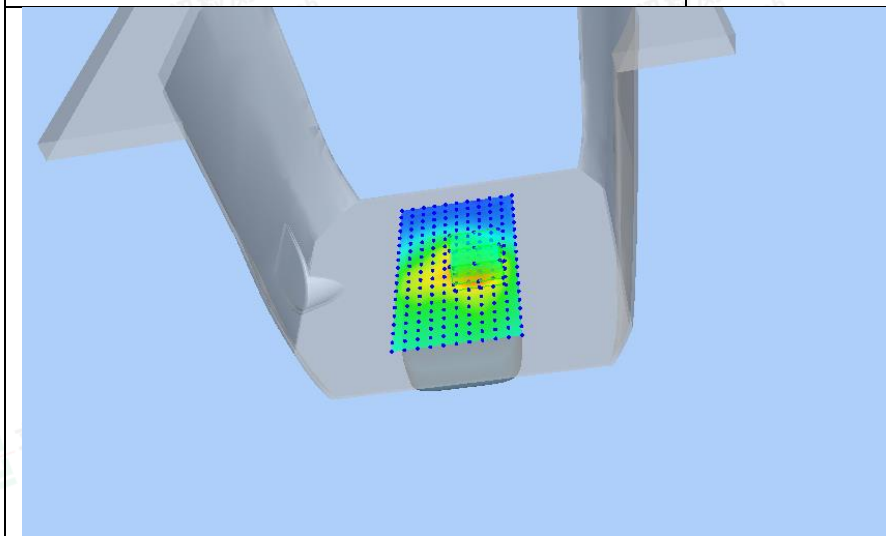
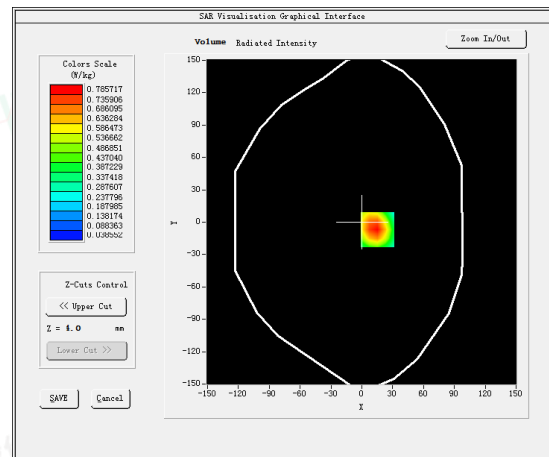
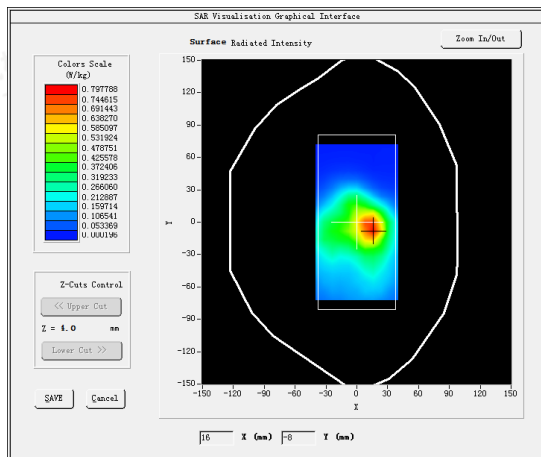
Test Mode:GPRS1800MHz,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.4000
Relative permittivity (real part)	40.66
Conductivity (S/m)	1.42
E-Field Probe	SN 25/22 EPGO376
Crest Factor	4.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.710000
SAR 10g (W/Kg)	0.458032
SAR 1g (W/Kg)	0.889475
SURFACE SAR	VOLUME SAR





#31

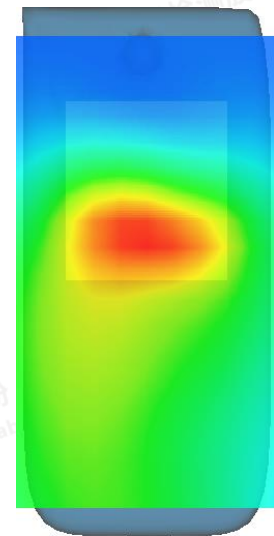
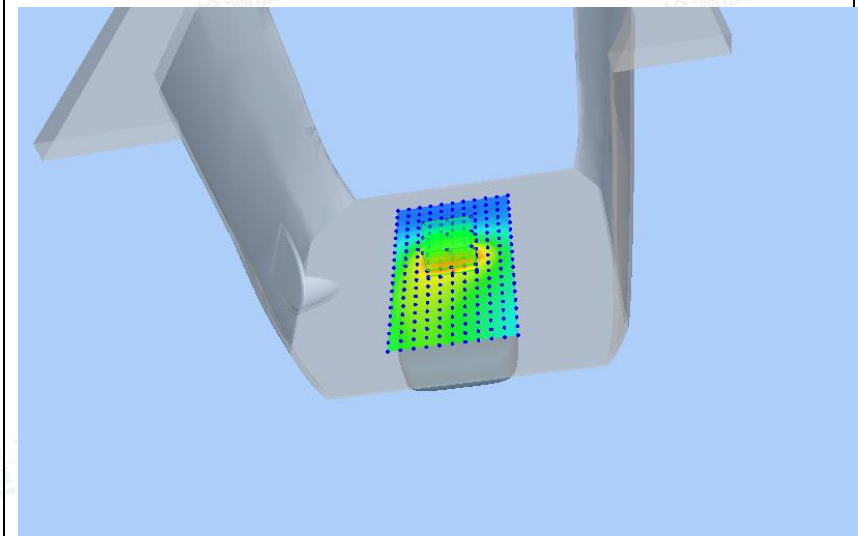
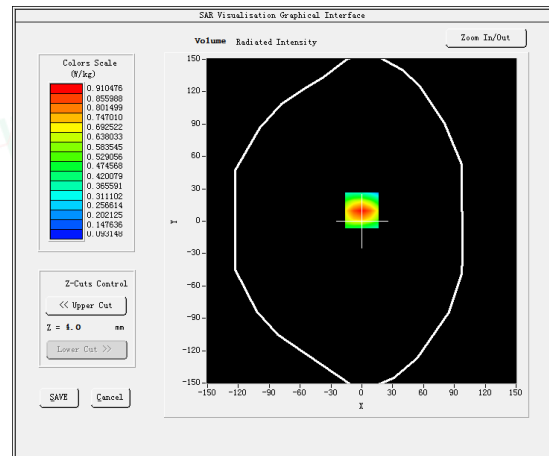
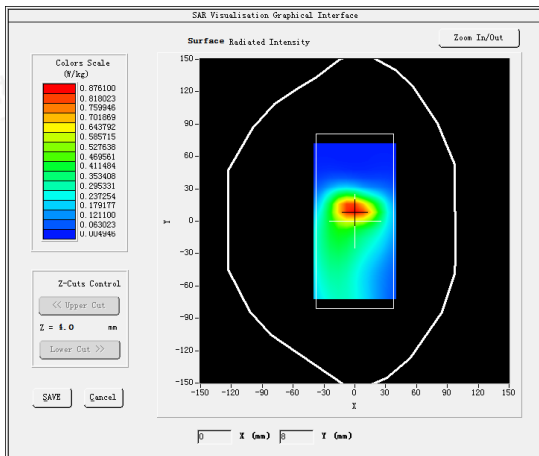
Test Mode:WCDMA 900MHz,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.6000
Relative permittivity (real part)	42.57
Conductivity (S/m)	0.93
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.040000
SAR 10g (W/Kg)	0.499842
SAR 1g (W/Kg)	0.859716
SURFACE SAR	VOLUME SAR





#32

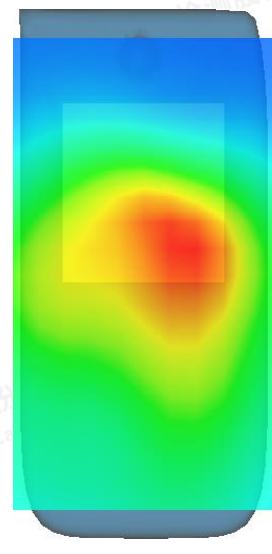
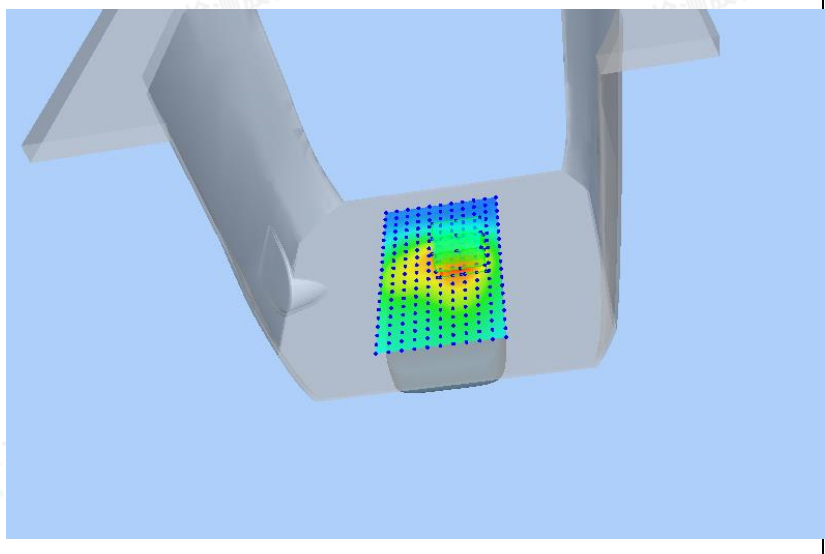
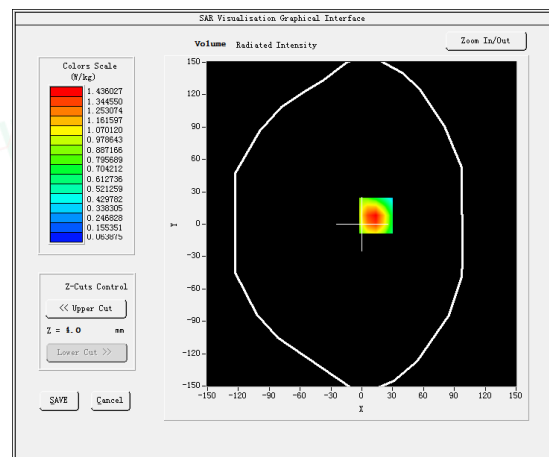
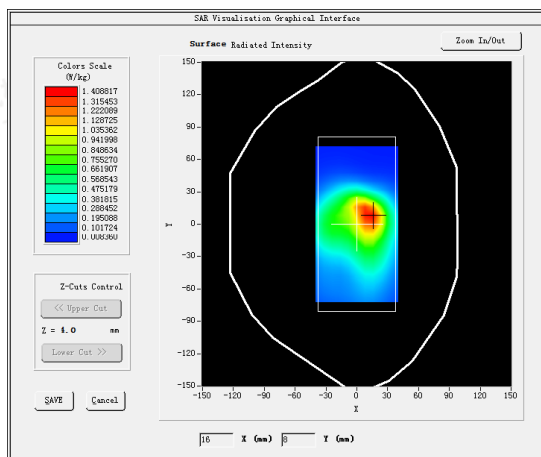
Test Mode:WCDMA2100MHz,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.18
Conductivity (S/m)	1.43
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.700000
SAR 10g (W/Kg)	0.772532
SAR 1g (W/Kg)	1.482484
SURFACE SAR	VOLUME SAR





#33

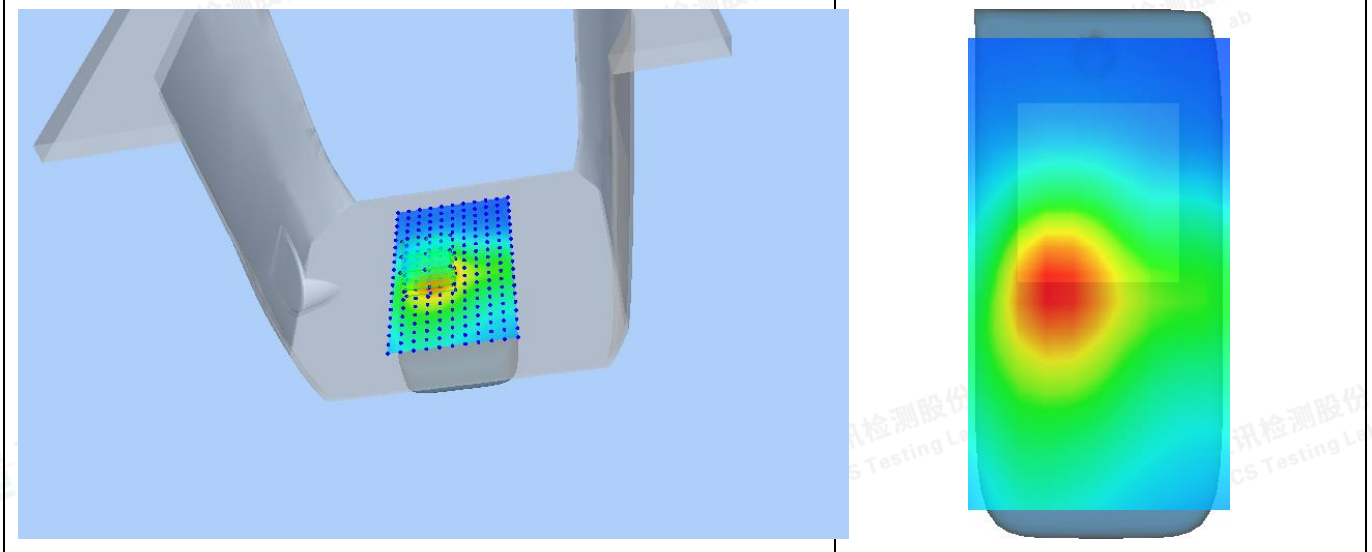
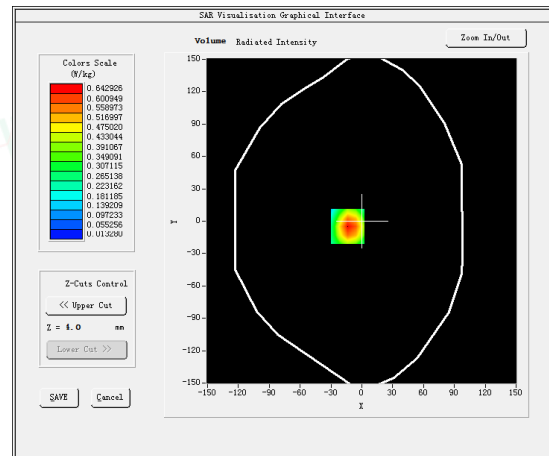
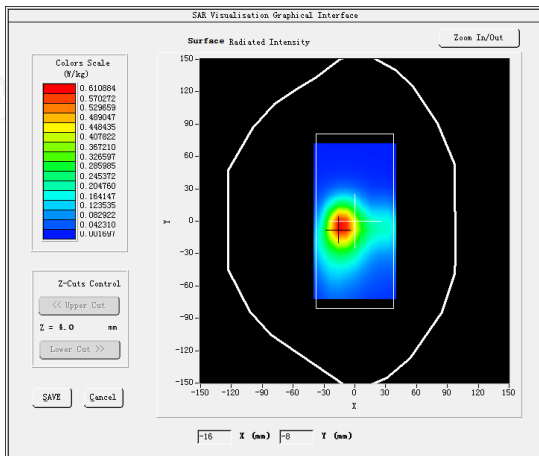
Test Mode:802.11b,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 01, 2024

Medium(liquid type)	HSL_2450
Frequency (MHz)	2442.0000
Relative permittivity (real part)	38.33
Conductivity (S/m)	1.76
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.60
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.150000
SAR 10g (W/Kg)	0.341223
SAR 1g (W/Kg)	0.729172
SURFACE SAR	VOLUME SAR





#34

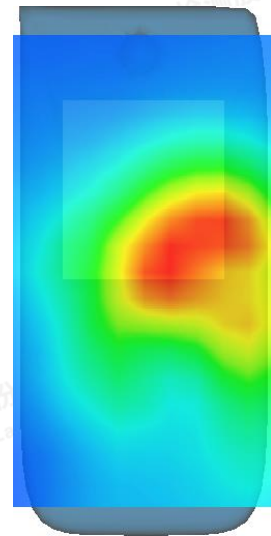
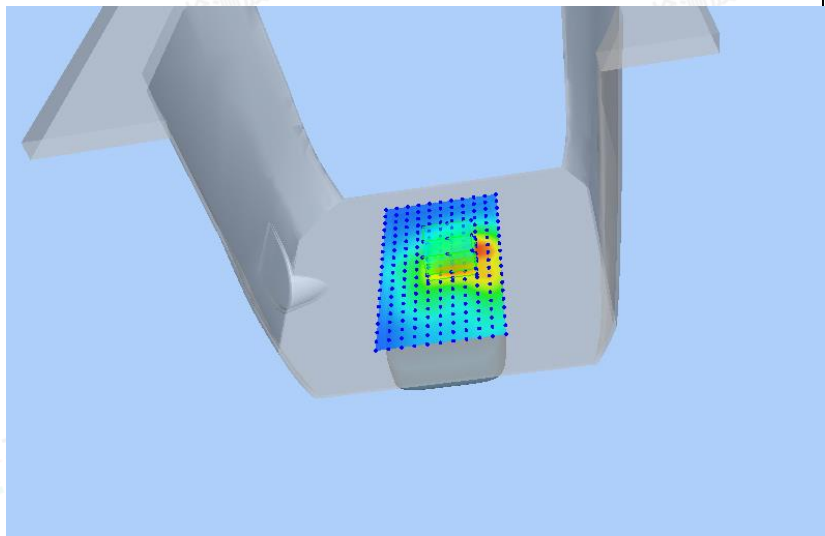
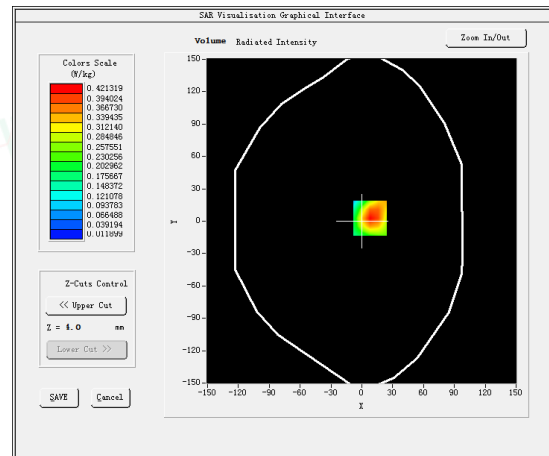
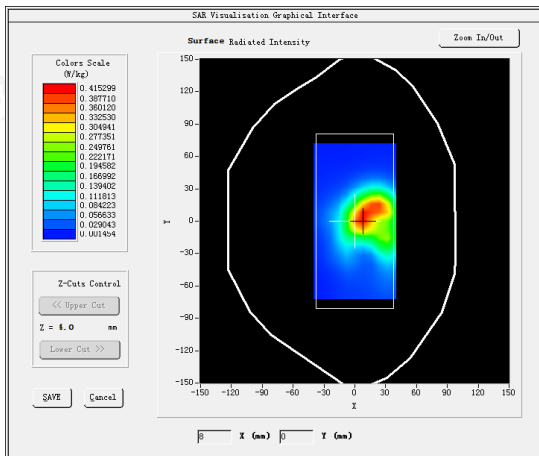
Test Mode: 802.11ac(80MHz)(WiFi5.2G),Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024

Medium(liquid type)	HSL _5200
Frequency (MHz)	5210.0000
Relative permittivity (real part)	35.80
Conductivity (S/m)	4.57
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.85
Sensor	4mm
Area Scan	dx=10mm dy=10mm
Zoom Scan	7x7x7,dx=4mm dy=4mm dz=1.4mm
Variation (%)	0.130000
SAR 10g (W/Kg)	0.235391
SAR 1g (W/Kg)	0.480488
SURFACE SAR	VOLUME SAR





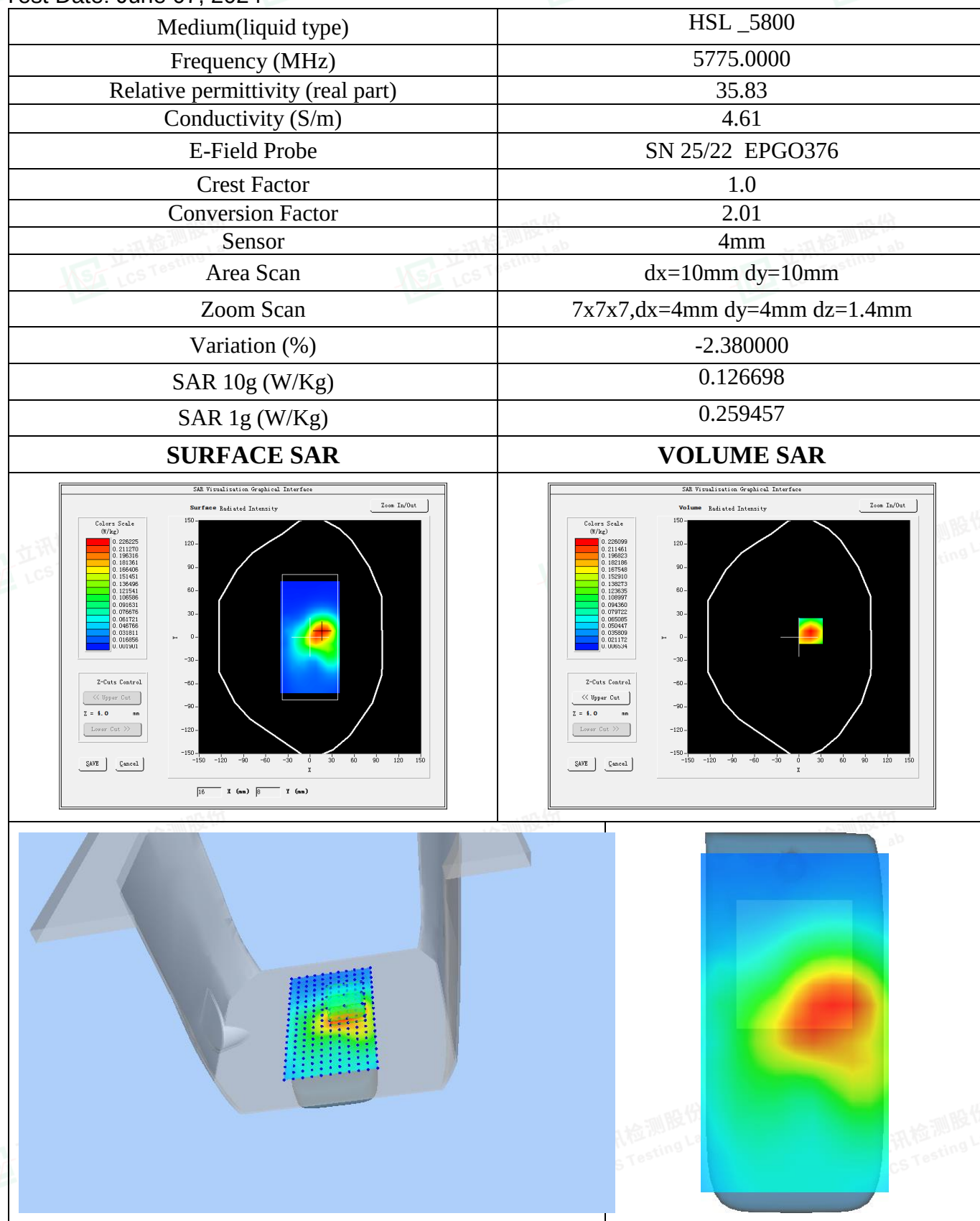
#35

Test Mode: 802.11ac(80MHz)(WiFi5.8G),Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 07, 2024





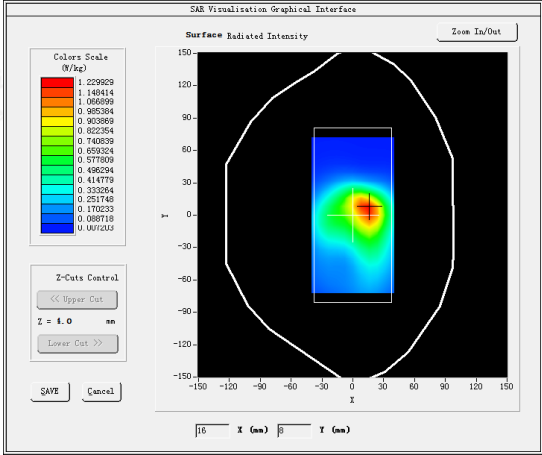
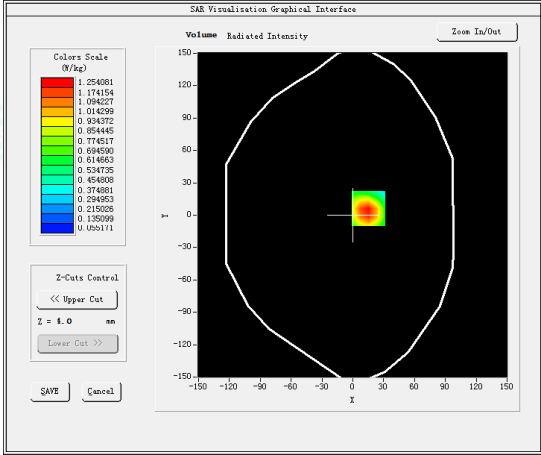
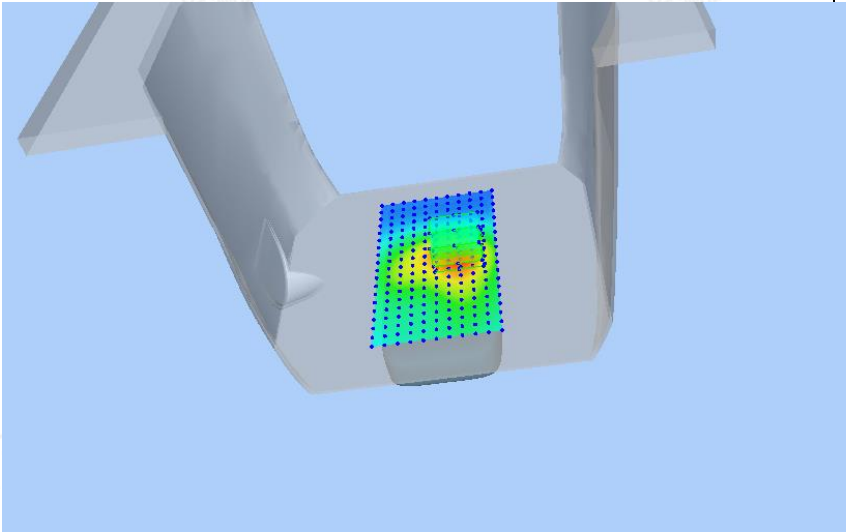
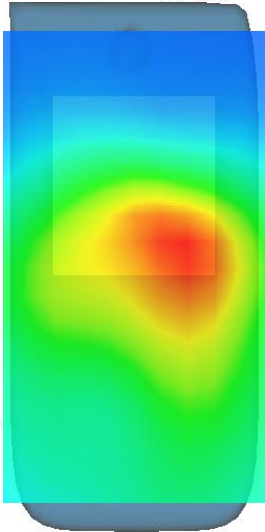
#36

Test Mode: E-UTRA Band1,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 28, 2024

Medium(liquid type)	HSL_2000
Frequency (MHz)	1950.0000
Relative permittivity (real part)	39.18
Conductivity (S/m)	1.43
E-Field Probe	SN 25/22 EPG0376
Crest Factor	1.0
Conversion Factor	2.31
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	1.690000
SAR 10g (W/Kg)	0.670693
SAR 1g (W/Kg)	1.294536
SURFACE SAR	VOLUME SAR
	
	



#37

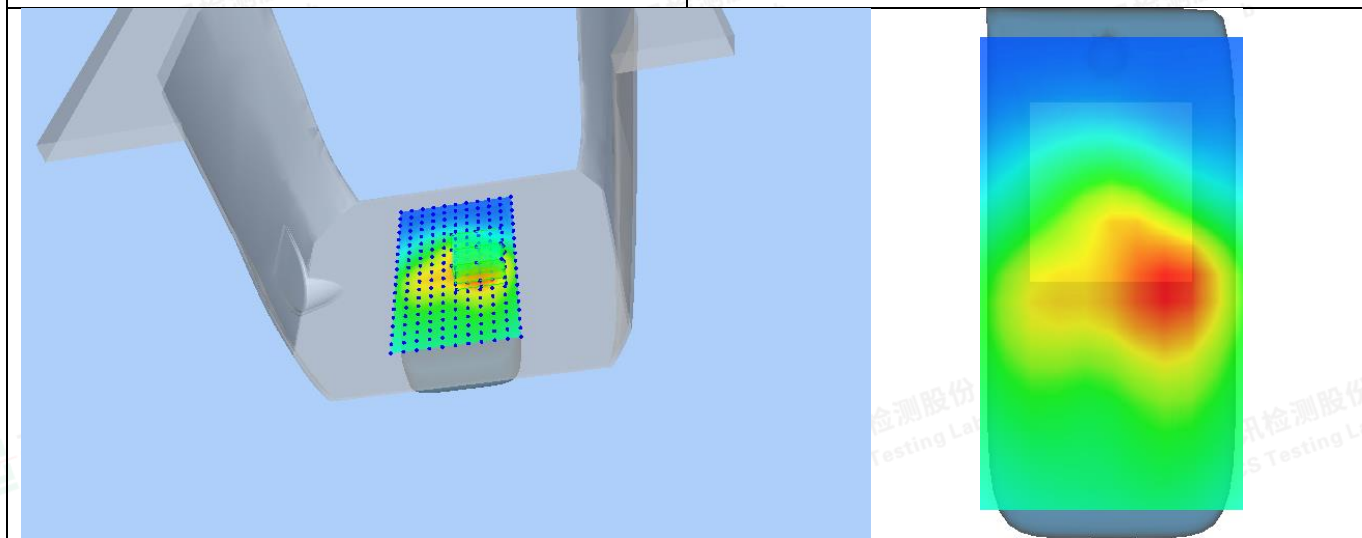
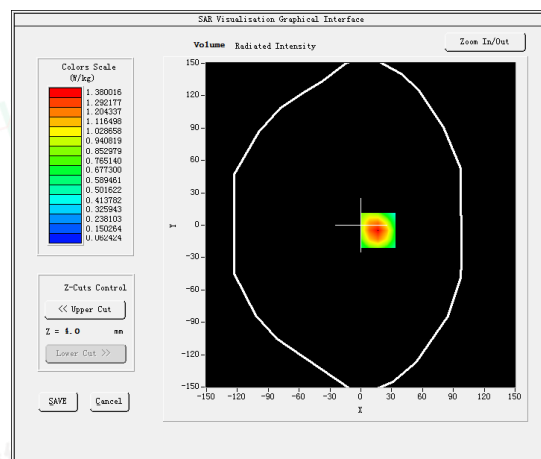
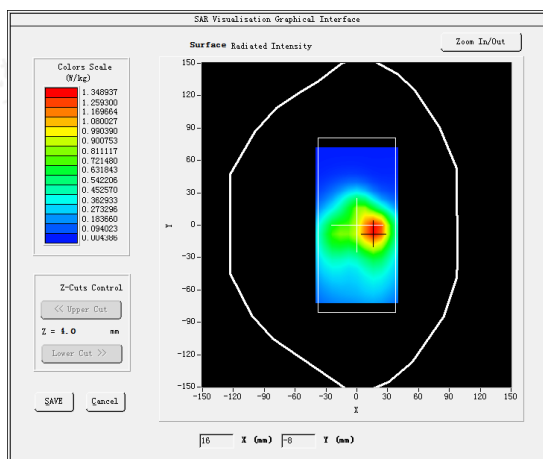
Test Mode: E-UTRA3,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 24, 2024

Medium(liquid type)	HSL_1800
Frequency (MHz)	1747.5000
Relative permittivity (real part)	40.67
Conductivity (S/m)	1.45
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.09
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.060000
SAR 10g (W/Kg)	0.798040
SAR 1g (W/Kg)	1.544079
SURFACE SAR	VOLUME SAR





#38

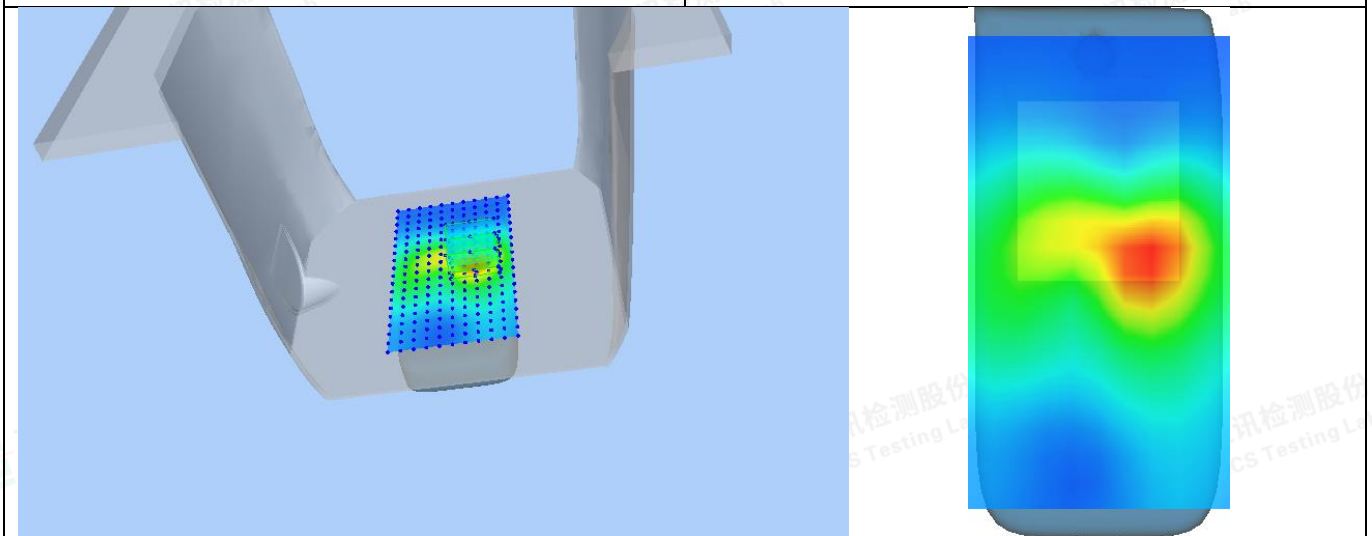
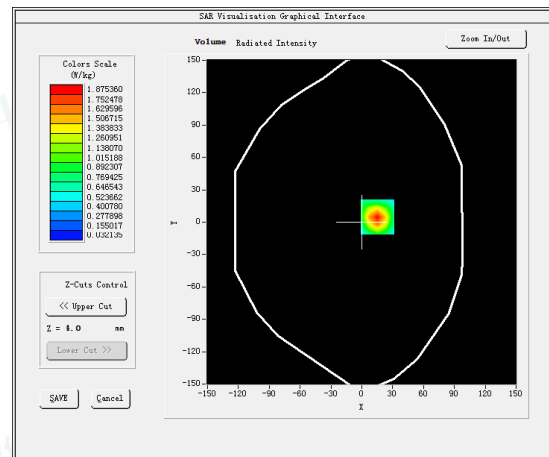
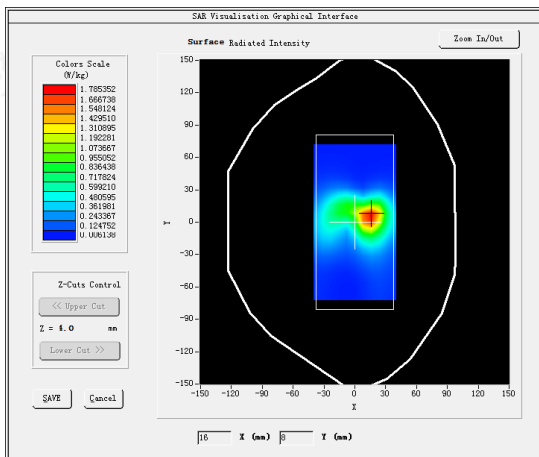
Test Mode: E-UTRA7,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: June 05, 2024

Medium(liquid type)	HSL_2600
Frequency (MHz)	2535.0000
Relative permittivity (real part)	40.38
Conductivity (S/m)	1.92
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	2.39
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.340000
SAR 10g (W/Kg)	0.808564
SAR 1g (W/Kg)	1.741264
SURFACE SAR	VOLUME SAR





#39

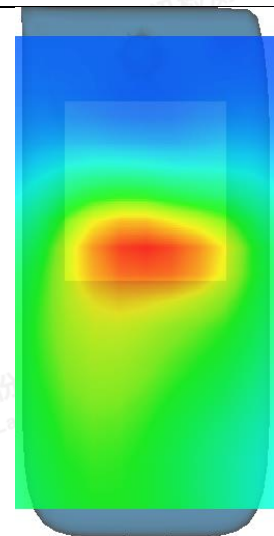
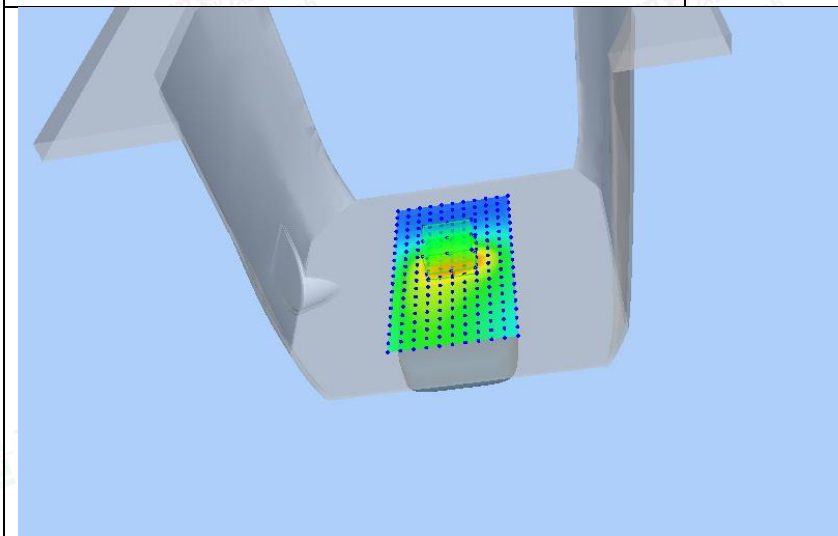
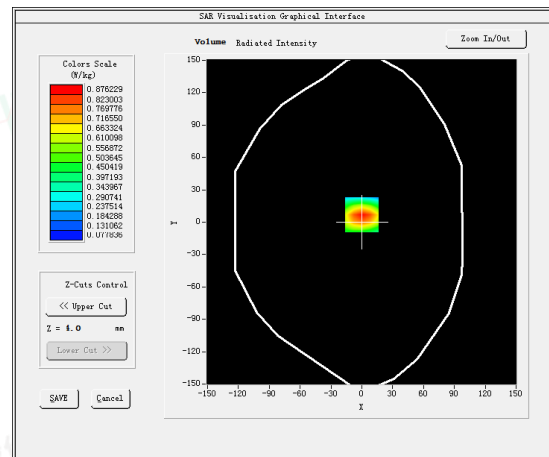
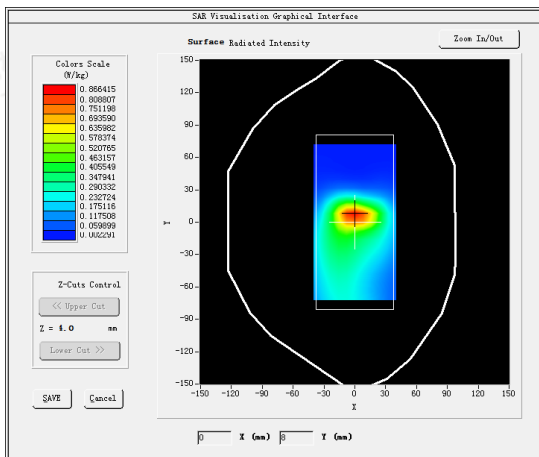
Test Mode: E-UTRA8,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 23, 2024

Medium(liquid type)	HSL_900
Frequency (MHz)	897.5000
Relative permittivity (real part)	42.52
Conductivity (S/m)	0.95
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.87
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.140000
SAR 10g (W/Kg)	0.483028
SAR 1g (W/Kg)	0.832946
SURFACE SAR	VOLUME SAR





#40

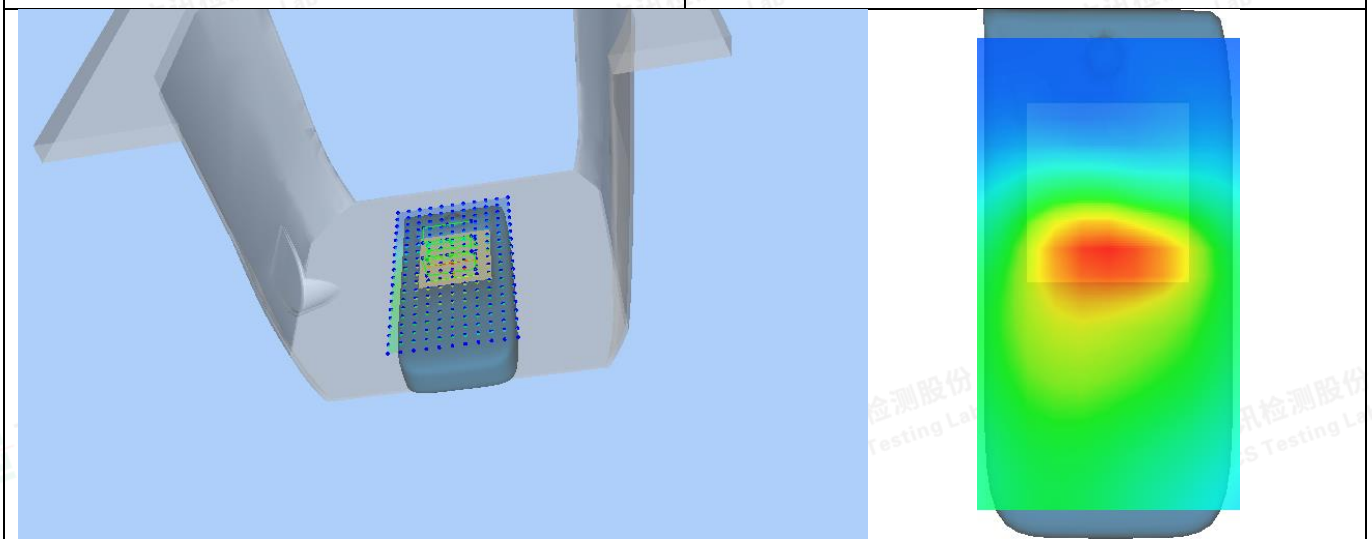
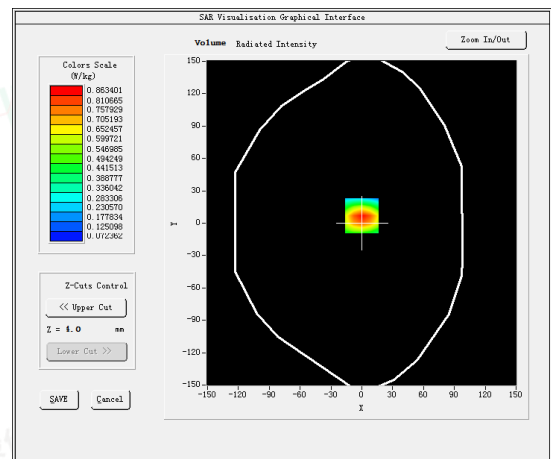
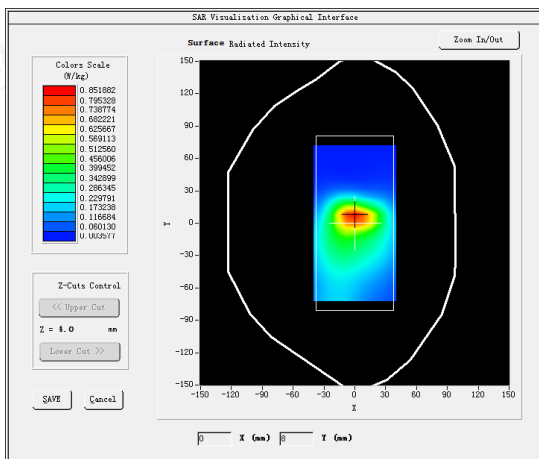
Test Mode: E-UTRA20,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	847.0000
Relative permittivity (real part)	41.90
Conductivity (S/m)	0.88
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-1.060000
SAR 10g (W/Kg)	0.477816
SAR 1g (W/Kg)	0.823625
SURFACE SAR	VOLUME SAR





#41

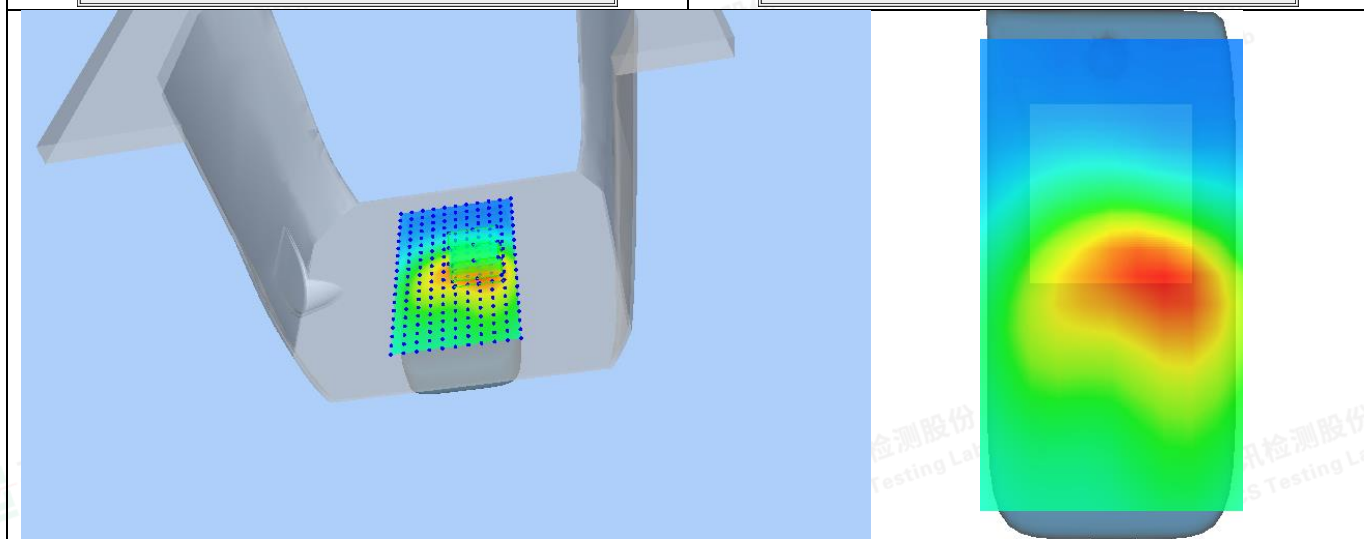
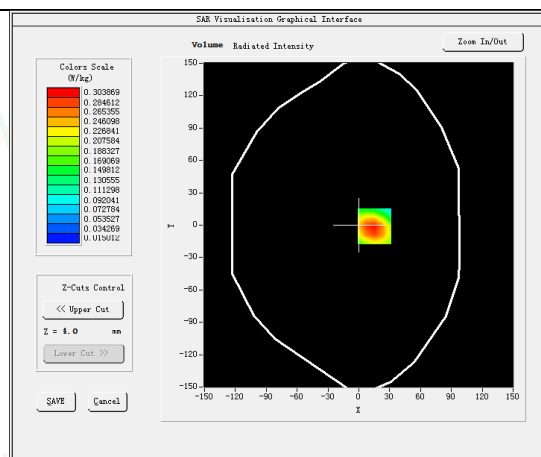
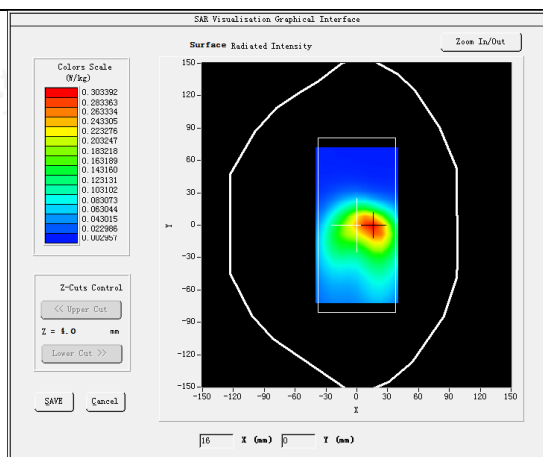
Test Mode: E-UTRA28,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model: KINGKONG ES PRO

Test Date: May 21, 2024

Medium(liquid type)	HSL_750
Frequency (MHz)	718.0000
Relative permittivity (real part)	41.95
Conductivity (S/m)	0.90
E-Field Probe	SN 25/22 EPGO376
Crest Factor	1.0
Conversion Factor	1.69
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	-0.510000
SAR 10g (W/Kg)	0.160003
SAR 1g (W/Kg)	0.289283
SURFACE SAR	VOLUME SAR





#42

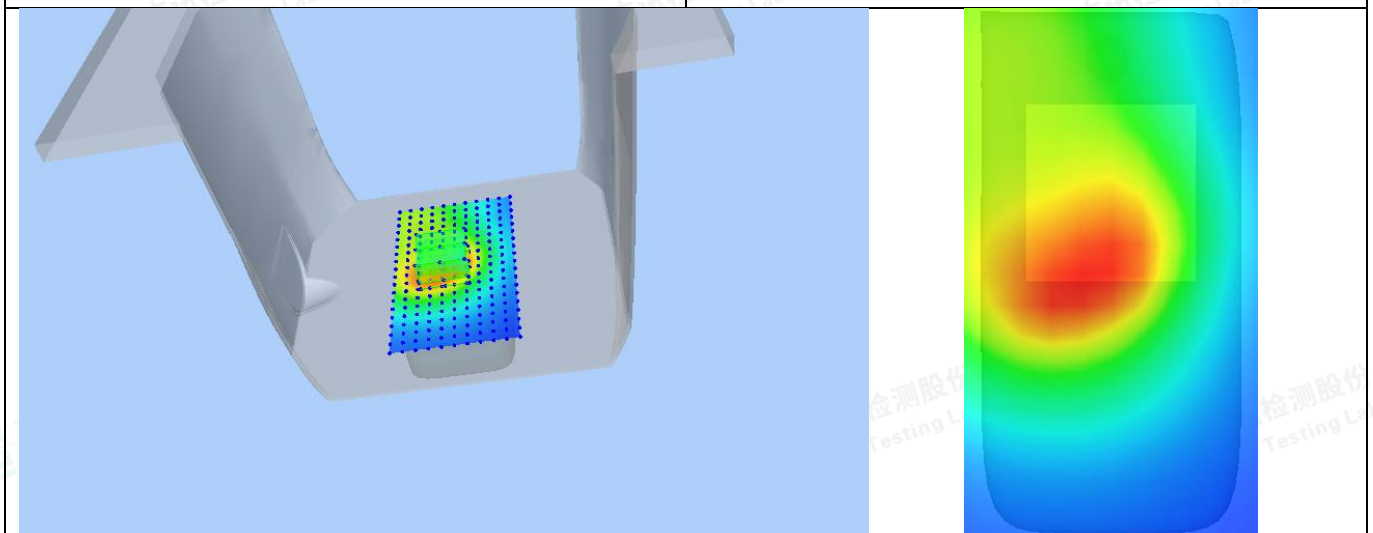
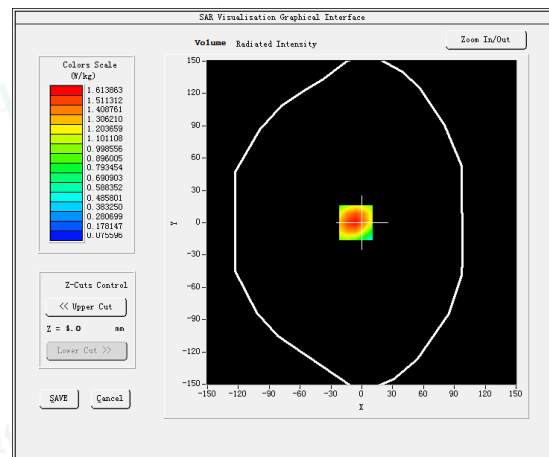
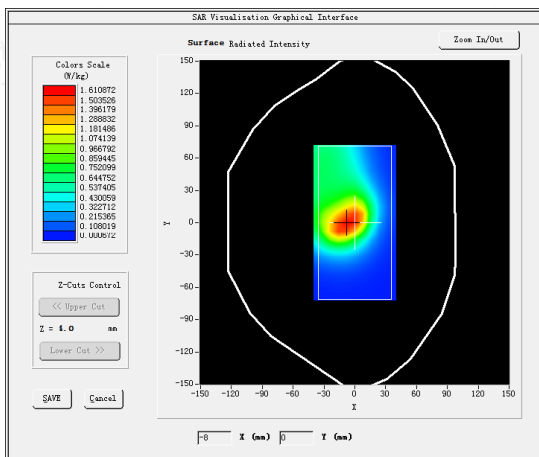
Test Mode: E-UTRA41,Middle channel(Limb-Rear side 0mm)

Product Description: Smartphone

Model:KINGKONG ES PRO

Test Date: July 30, 2026

Medium(liquid type)	HSL_2600
Frequency (MHz)	2593.0000
Relative permittivity (real part)	38.59
Conductivity (S/m)	2.03
E-Field Probe	SN 08/21 EPGO352
Crest Factor	1.0
Conversion Factor	1.70
Sensor	4mm
Area Scan	dx=8mm dy=8mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Variation (%)	0.010000
SAR 10g (W/Kg)	0.775481
SAR 1g (W/Kg)	1.125415
SURFACE SAR	VOLUME SAR





5. CALIBRATION CERTIFICATE

SARTIMO Calibration Certificate-Extended Dipole Calibrations

According to KDB 450824 D02, Dipoles must be recalibrated at least once every three years; however, immediate re-calibration is required for following conditions. The test laboratory must ensure that the required supporting information and documentation have been included in the SAR report to qualify for extended 3-year calibration interval.

- 1) When the most recent return-loss, measured at least annually, deviates by more than 20% from the previous measurement (i.e. 0.2 of the dB value) or not meeting the required -20 dB return-loss specification
- 2) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, deviates by more than 5Ω from the previous measurement

Summary Result:

SID750 SN 07/14 DIP 0G750-302 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-29	-34.80		50.7		1.6	
2022-09-29	-34.35	-1.29	51.2	0.5	1.5	-0.1
2023-09-29	-34.42	-1.09	51.3	0.4	1.5	-0.1

SID900 SN 07/14 DIP 0G900-300 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-29	-23.55		52.8		5.4	
2022-09-29	-23.49	-0.26	52.5	-0.3	5.3	-0.1
2023-09-29	-23.51	-0.17	52.6	-0.2	5.2	-0.2

SID1800 SN 30/14 DIP 1G800-301 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-29	-20.26		43.1		6.9	
2022-09-29	-20.13	-0.64	42.9	-0.2	6.7	-0.2
2023-09-29	-20.20	-0.30	43.0	-0.1	6.6	-0.3

SID2000 SN 07/14 DIP 2G000-305 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-29	-23.67		50.8		6.2	
2022-09-29	-23.46	-0.89	51.0	0.2	6.5	0.3
2023-09-29	-23.50	-0.72	51.2	0.4	6.3	0.1

SID2450 SN 07/14 DIP 2G450-306 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-29	-25.59		44.7		-1.1	
2022-09-29	-25.68	0.35	44.8	0.1	-1.0	0.1
2023-09-29	-25.70	0.43	44.5	-0.2	-1.1	0.0

SID2600 SN 38/18 DIP 2G600-468 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-22	-29.14		49.2		3.4	
2022-09-22	-29.12	-0.07	49.1	-0.1	3.2	-0.2
2023-09-29	-29.10	-0.07	49.2	0.0	3.3	-0.1



SID5200 SN 49/16 DIP WGA43 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-22	-8.59		19.38		13.50	
2022-09-22	-8.62	0.35	19.25	-0.13	13.47	-0.03
2023-09-22	-8.63	0.47	19.26	-0.12	13.45	-0.05

SWG5800 SN 49/16 DIP WGA43 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021-09-22	-11.37		54.79		25.47	
2022-09-22	-11.42	0.44	54.68	-0.11	25.26	-0.21
2022-09-22	-11.44	0.62	54.80	0.10	25.28	-0.19



5.1 Probe-EPGO376 Calibration Certificate

**COMOSAR E-Field Probe Calibration Report**

Ref : ACR.180.4.42.BES.A

**SHENZHEN LCS COMPLIANCE TESTING
LABORATORY LTD.****1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD, BAO'AN
BLVD****BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA****MVG COMOSAR DOSIMETRIC E-FIELD PROBE****SERIAL NO.: SN 25/22 EPGO376****Calibrated at MVG****Z.I. de la pointe du diable****Technopôle Brest Iroise – 295 avenue Alexis de Rochon****29280 PLOUZANE - FRANCE****Calibration date: 06/22/2023**Accreditations #2-6792
Scope available on www.cofrac.fr**The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.****Summary:**

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.4.42.BES.A

	Name	Function	Date	Signature
Prepared by :	Jérôme Le Gall	Measurement Responsible	6/23/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	6/23/2023	
Authorized by:	Yann Toutain	Laboratory Director	6/23/2023	

2023.06.23
13:37:50 +02'03'

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Name	Date	Modifications
A	Jérôme Le Gall	6/23/2023	Initial release

Page: 2/11

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.442.BES.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.4.42.BES.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 25/22 EPGO376
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.193 MΩ Dipole 2: R2=0.188 MΩ Dipole 3: R3=0.198 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their affect. All calibrations / measurements performed meet the fore mentioned standards.

3.1 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.2 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards.

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3.3 LOWER DETECTION LIMIT

The lower detection limit was assessed using the same measurement set up as used for the linearity measurement. The required lower detection limit is 10 mW/kg.

3.4 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.1 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = \Delta SAR_{be} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta/2})}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest zoom-scan measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect SAR uncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).



4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with an E-field probe calibration using the waveguide technique. All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

Uncertainty analysis of the probe calibration in waveguide					
ERROR SOURCES	Uncertainty value (%)	Probability Distribution	Divisor	ci	Standard Uncertainty (%)
Expanded uncertainty 95 % confidence level $k = 2$					14 %

5 CALIBRATION MEASUREMENT RESULTS

Calibration Parameters	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 SENSITIVITY IN AIR

Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
0.76	0.78	0.76

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
106	107	108

Calibration curves $e_i=f(V)$ ($i=1,2,3$) allow to obtain E-field value using the formula:

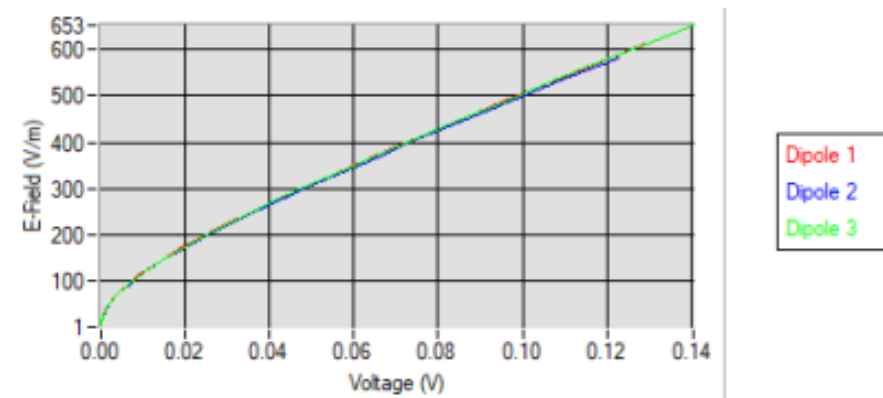
$$E = \sqrt{E_1^2 + E_2^2 + E_3^2}$$



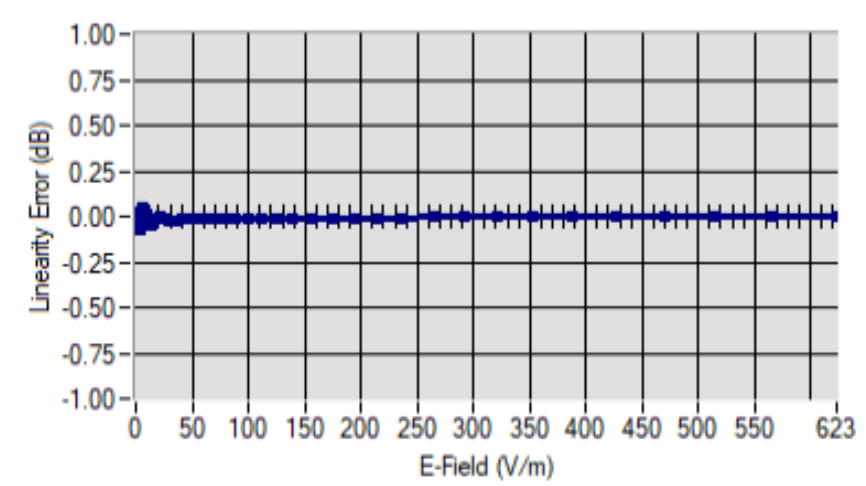
COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.180.4.42.BES.A

Calibration curves

5.2 LINEARITY

Linearity

Linearity: $\pm 1.81\%$ ($\pm 0.08\text{dB}$)



COMOSAR E-FIELD PROBE CALIBRATION REPORT

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5.3 SENSITIVITY IN LIQUID

Liquid	Frequency (MHz +/- 100MHz)	ConvF
HL450*	450*	1.74*
BL450*	450*	1.67*
HL750	750	1.69
BL750	750	1.73
HL850	835	1.75
BL850	835	1.80
HL900	900	1.87
BL900	900	1.85
HL1800	1800	2.09
BL1800	1800	2.15
HL1900	1900	2.14
BL1900	1900	2.27
HL2000	2000	2.31
BL2000	2000	2.34
HL2300	2300	2.46
BL2300	2300	2.51
HL2450	2450	2.60
BL2450	2450	2.70
HL2600	2600	2.39
BL2600	2600	2.50
HL5200	5200	1.85
BL5200	5200	1.81
HL5400	5400	2.07
BL5400	5400	2.00
HL5600	5600	2.19
BL5600	5600	2.11
HL5800	5800	2.01
BL5800	5800	1.97

* Frequency not cover by COFRAC scope, calibration not accredited

LOWER DETECTION LIMIT: 7mW/kg

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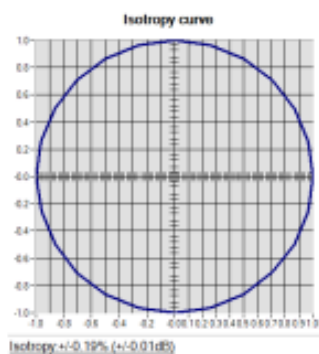
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5.4 ISOTROPY

HL1800 MHz

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6 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer	Agilent 8753ES	MY40003210	10/2022	10/2025
Network Analyzer – Calibration kit	HP 85033D	3423A08186	06/2021	06/2027
Multimeter	Keithley 2000	1160271	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Rohde & Schwarz NRVD	832839-056	11/2022	11/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.

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Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024

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5.1 Probe-EPGO352 Calibration Certificate

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COMOSAR E-Field Probe Calibration Report

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SHENZHEN STS TEST SERVICES CO., LTD.**1/F, BUILDING 2, ZHUOKE SCIENCE PARK, 190
CHONGQING ROAD****FUYONG, BAO' AN DISTRICT, SHENZHEN, CHINA****MVG COMOSAR DOSIMETRIC E-FIELD PROBE****SERIAL NO.: SN 08/21 EPGO352****Calibrated at MVG****Z.I. de la pointe du diable****Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE****Calibration date: 09/15/2025**Accreditations #2-6789
Scope available on www.cofrac.fr**The use of the Cofrac brand and the accreditation references is prohibited from any reproduction.****Summary:**

This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.95.19.25.BES.A

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	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Measurement Responsible	9/16/2025	
Checked & approved by:	Jérôme Luc	Technical Manager	9/16/2025	
Authorized by:	Geraldine Toutain	Laboratory Director	9/16/2025	

Digitized by
Geraldine TOUTAIN
A1C9AC91CB5441A份
Lab

	Customer Name
Distribution :	Shenzhen STS Test Services Co., Ltd.

Issue	Name	Date	Modifications
A	Pedro Ruiz	9/16/2025	Initial release

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Lab



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立讯检测股份
LCS Testing Lab

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.95.19.25.BES.A

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1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 08/21 EPG0352
Product Condition (new / used)	Used
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.222 MΩ Dipole 2: R2=0.198 MΩ Dipole 3: R3=0.191 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.



3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty} [\%] = SAR_{the} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(e^{-d_{be}/\delta})}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest zoom-scan measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).



COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.95.19.25.BES.A

3.5 PROBE MODULATION RESPONSE

MVG's probe were evaluated experimentally with various modulated signal and the deviation from CW response were found neglectable in the used power range of the probe. So the correction to taking into account the linearization parameters for different modulation is null, therefore the CW factor given in this report can be used whatever the measured modulation

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.

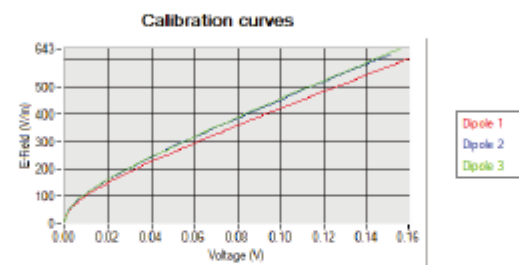
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^3 \frac{V_i (1 + V_i / DCP_i)}{Norm_i}$$

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where

V_i =voltage readings on the 3 channels of the probe

DCPi=diode compression point given below for the 3 channels of the probe

Normi=dipole sensitivity given below for the 3 channels of the probe

Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
1.09	0.94	0.94

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
106	107	103

5.2 CALIBRATION IN LIQUID

The calorimeter cell or the waveguide is used to determine the calibration in liquid using the formula below.

$$\text{ConvF} = \frac{E_{\text{liquid}}^2}{E_{\text{air}}^2}$$

The E-field in the liquid is determined from the SAR measurement according to the below formula.

$$E_{\text{liquid}}^2 = \frac{\rho \text{ SAR}}{\sigma}$$

where

σ =the conductivity of the liquid

ρ =the volumetric density of the liquid

SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

For the calorimeter cell (150-450 MHz), the formula is:

$$\text{SAR} = c \frac{dT}{dt}$$

where

c =the specific heat for the liquid

dT/dt =the temperature rises over the time

For the waveguide setup (600-75000 MHz), the formula is:

$$\text{SAR} = \frac{4P W}{ab\delta} e^{-\frac{az}{\delta}}$$

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where

a=the larger cross-sectional of the waveguide

b=the smaller cross-sectional of the waveguide

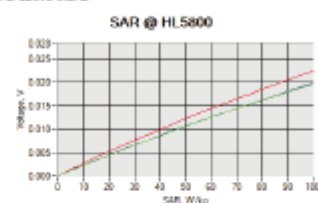
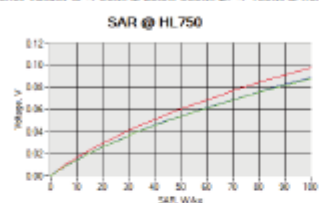
δ =the skin depth for the liquid in the waveguide

Pw=the power delivered to the liquid

The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

Liquid	Frequency (MHz*)	ConvF
HL750	750	1.51
HL850	835	1.49
HL900	900	1.36
HL1800	1800	1.54
HL1900	1900	1.73
HL2000	2000	1.34
HL2100	2100	1.39
HL2300	2300	1.74
HL2450	2450	1.82
HL2600	2600	1.70
HL3500	3500	1.42
HL3700	3700	1.33
HL3900	3900	1.12
HL4200	4200	1.24
HL4600	4600	1.25
HL4900	4900	1.19
HL5200	5200	1.37
HL5400	5400	1.26
HL5600	5600	1.21
HL5800	5800	1.32

(*) Frequency validity is +/-50MHz below 600MHz, +/-100MHz from 600MHz to 6GHz and +/-700MHz above 6GHz



6 VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is +/-0.2 dB for linearity and +/-0.15 dB for axial isotropy.

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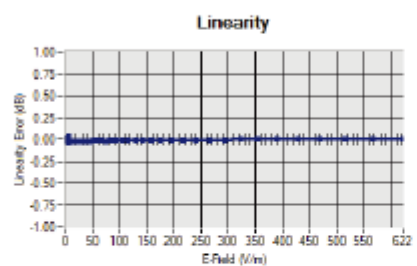
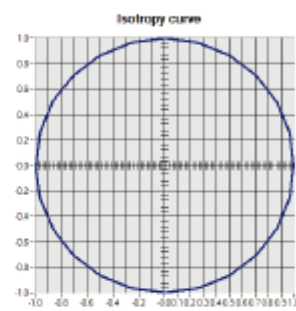


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LCS Testing LabLinearity $\pm 0.91\%$ ($\pm 0.04\text{dB}$)Isotropy $\pm 0.10\%$ ($\pm 0.01\text{dB}$)份
Lab立讯检测股份
LCS Testing Lab份
Lab

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7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2026
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2025	07/2028
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2025	03/2028
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2026
USB Sensor	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	08/2024	08/2027
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G600_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.95.19.25.BES.A

Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44235403	02/2024	02/2027

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5.2 SID750 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.287.3.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
SATIMO COMOSAR REFERENCE DIPOLE**

**FREQUENCY: 750 MHZ
SERIAL NO.: SN 07/14 DIP 0G750-302**

**Calibrated at SATIMO US
2105 Barrett Park Dr. - Kennesaw, GA 30144**



09/29/2021

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.3.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/12/2021	
Checked by :	Jérôme LUC	Product Manager	10/12/2021	
Approved by :	Kim RUTKOWSKI	Quality Manager	10/12/2021	

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/12/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 750 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID750
Serial Number	SN 07/14 DIP 0G750-302
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

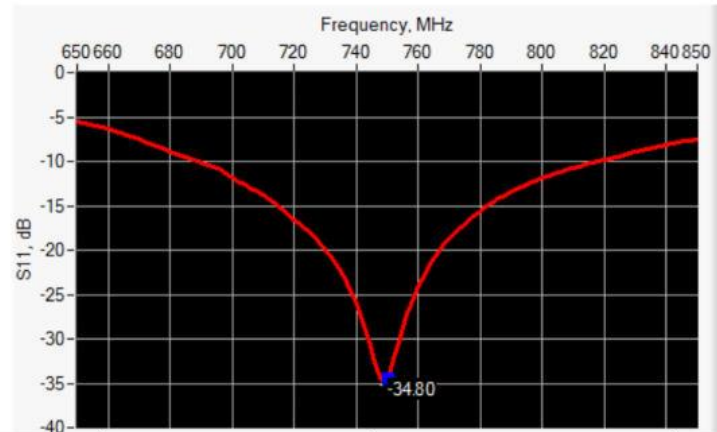
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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
750	-34.80	-20	$50.7 \Omega + 1.6 j\Omega$

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 ±1 %.		250.0 ±1 %.		6.35 ±1 %.	
450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.	PASS	100.0 ±1 %.	PASS	6.35 ±1 %.	PASS
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

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7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %	PASS	0.89 $\pm$ 5 %	PASS
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %		0.97 $\pm$ 5 %	
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_r' : 42.1 sigma : 0.89
Distance between dipole center and liquid	15.0 mm
Area scan resolution	$\Delta x=8\text{mm}/\Delta y=8\text{mm}$

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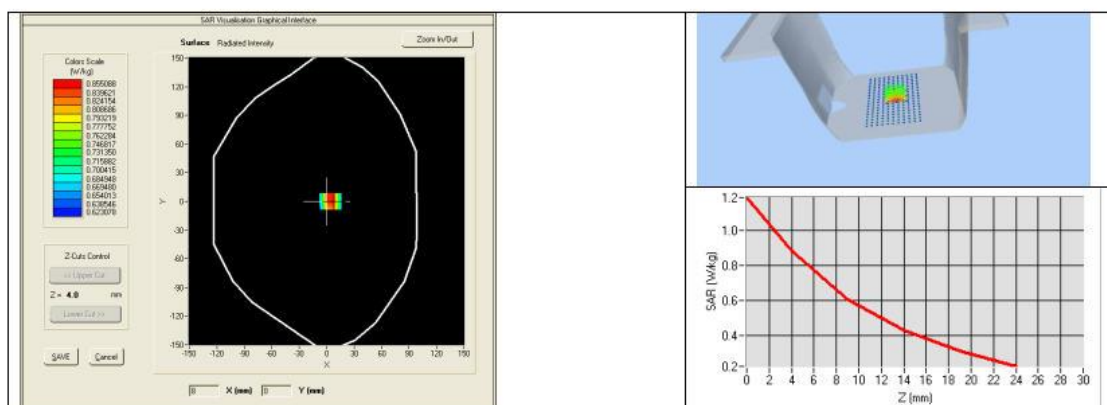


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.3.14.SATIM.A

Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49	8.38 (0.84)	5.55	5.53 (0.55)
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.3.14.SATU.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %	PASS	0.96 $\pm$ 5 %	PASS
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	
2450	52.7 $\pm$ 5 %		1.95 $\pm$ 5 %	
2600	52.5 $\pm$ 5 %		2.16 $\pm$ 5 %	
3000	52.0 $\pm$ 5 %		2.73 $\pm$ 5 %	
3500	51.3 $\pm$ 5 %		3.31 $\pm$ 5 %	
5200	49.0 $\pm$ 10 %		5.30 $\pm$ 10 %	
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %		5.53 $\pm$ 10 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: ϵ_r' : 56.6 sigma : 0.99
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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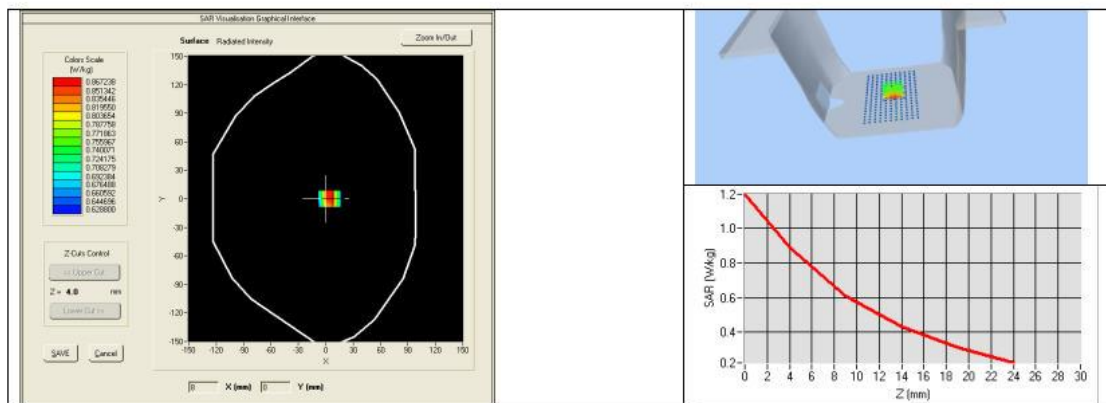
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.3.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
750	8.77 (0.88)	5.78 (0.58)





8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2024	02/2027
Calipers	Carrera	CALIPER-01	12/2021	12/2024
Reference Probe	Satimo	EPG122 SN 18/11	10/2022	10/2025
Multimeter	Keithley 2000	1188656	12/2021	12/2024
Signal Generator	Agilent E4438C	MY49070581	12/2018	12/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2021	12/2024
Power Sensor	HP ECP-E26A	US37181460	12/2021	12/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2021	8/2024

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5.3 SID900 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.287.5.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD**

BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 900 MHZ

SERIAL NO.: SN 07/14 DIP 0G900-300

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



09/29/2021

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU..A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	10/12/2021	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/12/2021	Initial release

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5.3	Validation Measurement	5
6	Calibration Measurement Results	6
6.1	Return Loss and Impedance	6
6.2	Mechanical Dimensions	6
7	Validation measurement	7
7.1	Head Liquid Measurement	7
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8	List of Equipment	11

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 900 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID900
Serial Number	SN 07/14 DIP 0G900-300
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

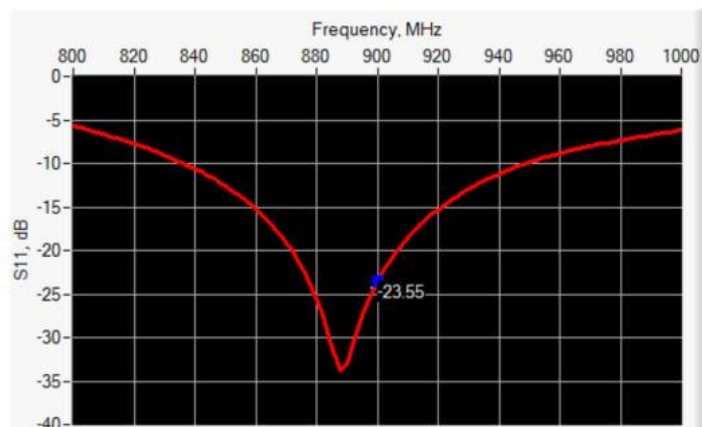
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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
900	-23.55	-20	52.8 Ω - 5.4 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
900	149.0 $\pm$ 1 %.	PASS	83.3 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.		41.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.		37.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.		30.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2600	48.5 $\pm$ 1 %.		28.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3000	41.5 $\pm$ 1 %.		25.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3500	37.0 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3700	34.7 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

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7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %		0.89 $\pm$ 5 %	
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %	PASS	0.97 $\pm$ 5 %	PASS
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps} : 42.5 sigma : 0.96
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm

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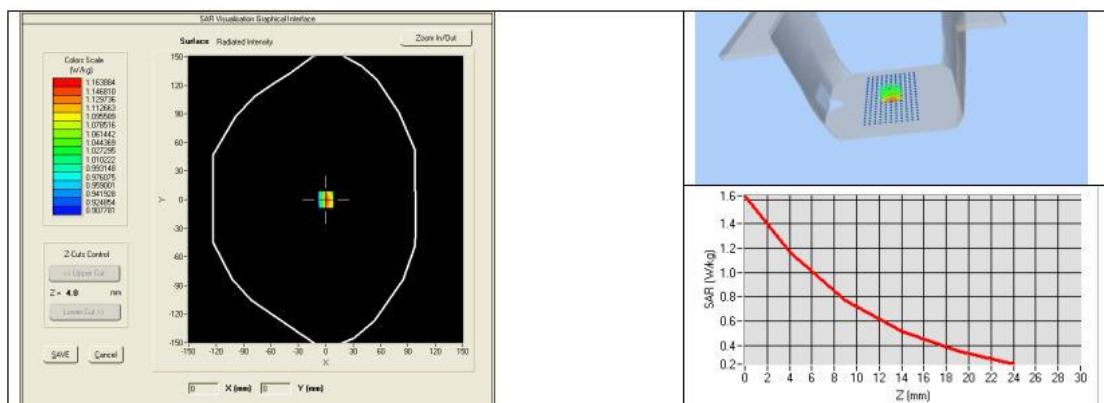


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9	11.12 {1.11}	6.99	7.01 {0.70}
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %	PASS	1.05 $\pm$ 5 %	PASS
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	
2450	52.7 $\pm$ 5 %		1.95 $\pm$ 5 %	
2600	52.5 $\pm$ 5 %		2.16 $\pm$ 5 %	
3000	52.0 $\pm$ 5 %		2.73 $\pm$ 5 %	
3500	51.3 $\pm$ 5 %		3.31 $\pm$ 5 %	
5200	49.0 $\pm$ 10 %		5.30 $\pm$ 10 %	
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %		5.53 $\pm$ 10 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: ϵ_r' : 56.7 sigma: 1.08
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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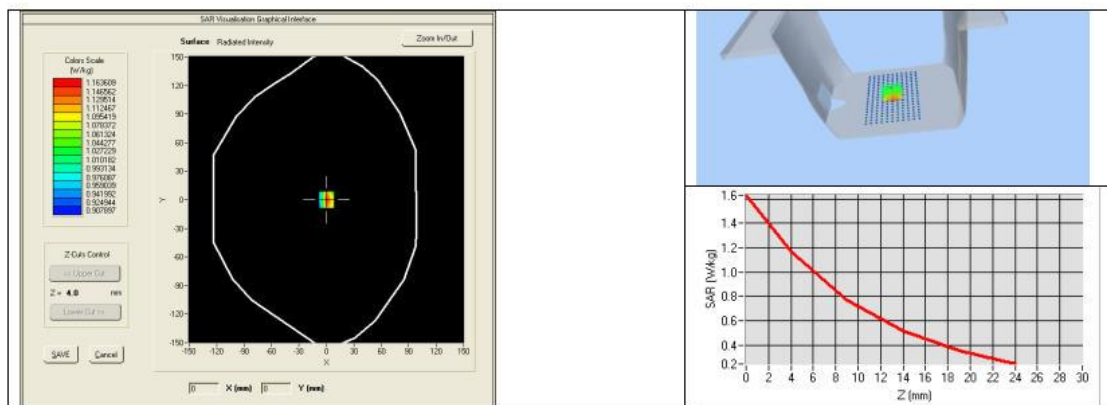
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
900	11.34 (1.13)	7.15 (0.72)



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.5.14.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2022	02/2025
Calipers	Carrera	CALIPER-01	12/2022	12/2025
Reference Probe	Satimo	EPG122 SN 18/11	10/2023	10/2024
Multimeter	Keithley 2000	1188656	12/2022	12/2025
Signal Generator	Agilent E4438C	MY49070581	12/2022	12/2025
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2022	12/2025
Power Sensor	HP ECP-E26A	US37181460	12/2022	12/2025
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2016	8/2025

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**5.4 SID1800 Dipole Calibration Certificate****SAR Reference Dipole Calibration Report**

Ref : ACR.287.6.14.SATU.A

**SHENZHEN LCS COMPLIANCE TESTING
LABORATORY LTD.****1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD****BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA****SATIMO COMOSAR REFERENCE DIPOLE****FREQUENCY: 1800 MHZ****SERIAL NO.: SN 07/14 DIP 1G800-301****Calibrated at SATIMO US****2105 Barrett Park Dr. - Kennesaw, GA 30144****09/29/2021***Summary:*

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	10/12/2021	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen LCS Compliance Testing Laboratory Ltd.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	10/12/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID1800
Serial Number	SN 07/14 DIP 1G800-301
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

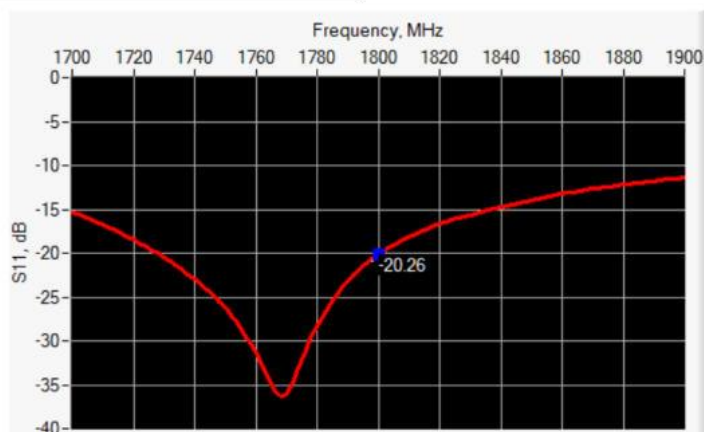
Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-20.26	-20	43.1 Ω + 6.9 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
900	149.0 $\pm$ 1 %.		83.3 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.	PASS	41.7 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.		37.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.		30.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2600	48.5 $\pm$ 1 %.		28.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3000	41.5 $\pm$ 1 %.		25.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3500	37.0 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3700	34.7 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

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7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEM/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %		0.89 $\pm$ 5 %	
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %		0.97 $\pm$ 5 %	
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %	PASS	1.40 $\pm$ 5 %	PASS
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEM/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: ϵ_{ps}' : 41.3 sigma : 1.38
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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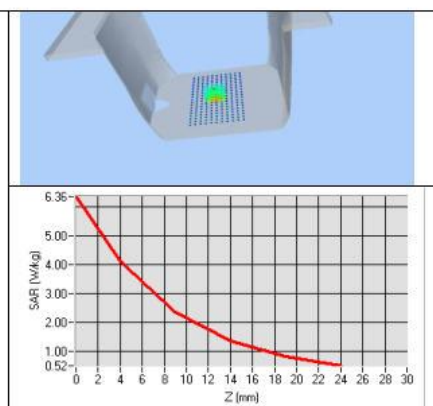
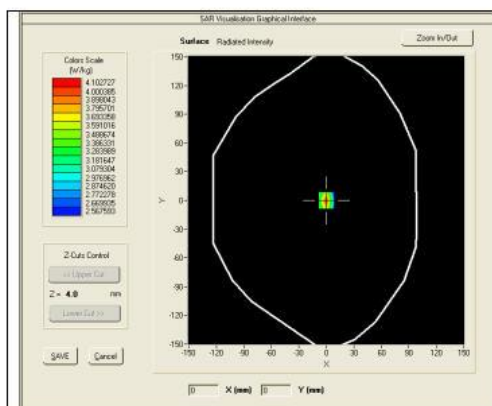


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	38.13 (3.81)	20.1	20.20 (2.02)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



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7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %	PASS	1.52 $\pm$ 5 %	PASS
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	
2450	52.7 $\pm$ 5 %		1.95 $\pm$ 5 %	
2600	52.5 $\pm$ 5 %		2.16 $\pm$ 5 %	
3000	52.0 $\pm$ 5 %		2.73 $\pm$ 5 %	
3500	51.3 $\pm$ 5 %		3.31 $\pm$ 5 %	
5200	49.0 $\pm$ 10 %		5.30 $\pm$ 10 %	
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %		5.53 $\pm$ 10 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: ϵ_r : 53.3 sigma: 1.51
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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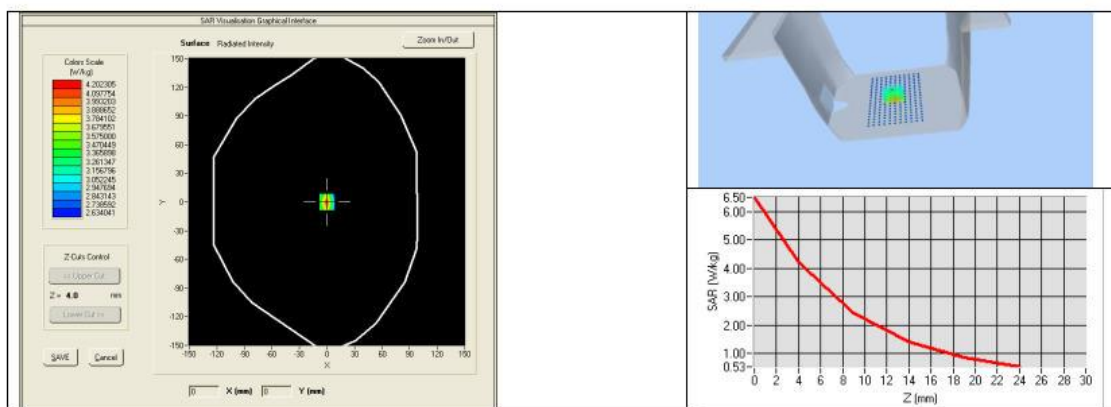
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.6.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	39.03 (3.90)	20.65 (2.07)





8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2024	02/2027
Calipers	Carrera	CALIPER-01	12/2021	12/2024
Reference Probe	Satimo	EPG122 SN 18/11	10/2023	10/2024
Multimeter	Keithley 2000	1188656	12/2021	12/2024
Signal Generator	Agilent E4438C	MY49070581	12/2021	12/2024
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2021	12/2024
Power Sensor	HP ECP-E26A	US37181460	12/2021	12/2024
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2021	8/2024

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5.5 SID2000 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.287.7.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD**

BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2000 MHZ

SERIAL NO.: SN 07/14 DIP 2G000-305

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



09/29/2021

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	10/12/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	10/12/2021	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen LCS Compliance Testing Laboratory Ltd.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	10/12/2021	Initial release

Page: 2/11

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2000 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2000
Serial Number	SN 07/14 DIP 2G000-305
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole



4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

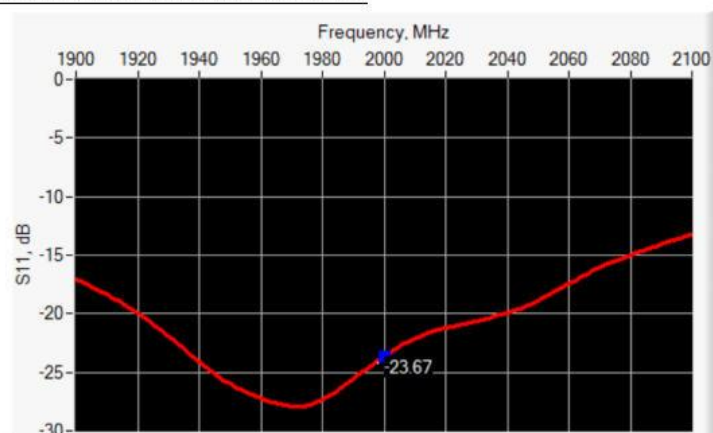
Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2000	-23.67	-20	50.8 Ω - 6.2 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
900	149.0 $\pm$ 1 %.		83.3 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.		41.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.	PASS	37.5 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.		30.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2600	48.5 $\pm$ 1 %.		28.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3000	41.5 $\pm$ 1 %.		25.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3500	37.0 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3700	34.7 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

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7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %		0.89 $\pm$ 5 %	
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %		0.97 $\pm$ 5 %	
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %	PASS	1.40 $\pm$ 5 %	PASS
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %		1.80 $\pm$ 5 %	
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: cps' : 39.7 sigma : 1.43
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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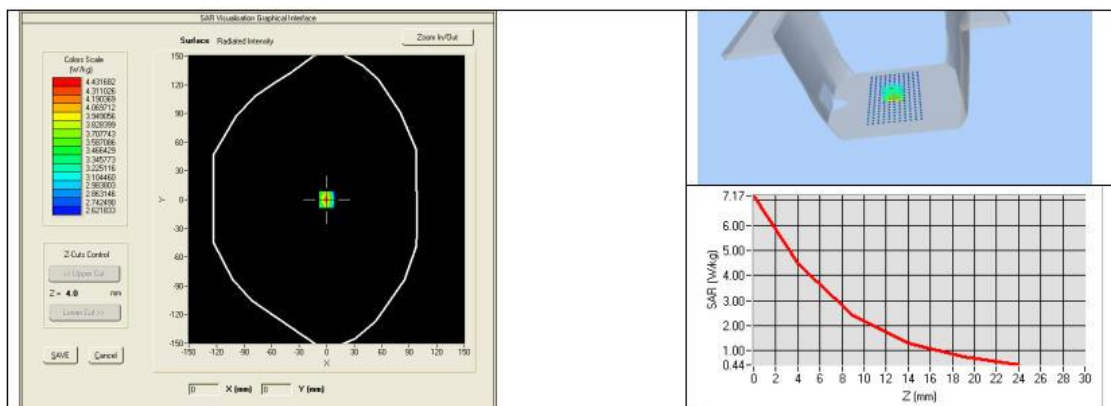


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATIM0.A

Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1	43.00 (4.30)	21.1	21.20 (2.12)
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %	PASS	1.52 $\pm$ 5 %	PASS
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	
2450	52.7 $\pm$ 5 %		1.95 $\pm$ 5 %	
2600	52.5 $\pm$ 5 %		2.16 $\pm$ 5 %	
3000	52.0 $\pm$ 5 %		2.73 $\pm$ 5 %	
3500	51.3 $\pm$ 5 %		3.31 $\pm$ 5 %	
5200	49.0 $\pm$ 10 %		5.30 $\pm$ 10 %	
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %		5.53 $\pm$ 10 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 10 %	

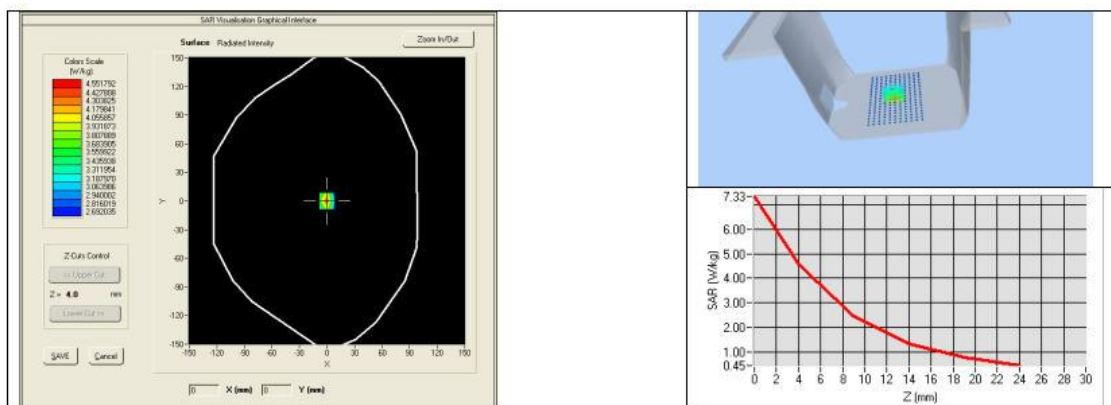
7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: cps' : 53.9 sigma : 1.53
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	2000 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2000	45.84 (4.58)	22.30 (2.23)





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.7.14.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2022	02/2025
Calipers	Carrera	CALIPER-01	12/2022	12/2025
Reference Probe	Satimo	EPG122 SN 18/11	10/2023	10/2024
Multimeter	Keithley 2000	1188656	12/2022	12/2025
Signal Generator	Agilent E4438C	MY49070581	12/2022	12/2025
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2022	12/2025
Power Sensor	HP ECP-E26A	US37181460	12/2022	12/2025
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2022	8/2025

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5.6 SID2450 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.287.8.14.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD**

BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA

SATIMO COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 07/14 DIP 2G450-306

Calibrated at SATIMO US

2105 Barrett Park Dr. - Kennesaw, GA 30144



09/29/2021

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	10/12/2021	
Checked by :	Jérôme LUC	Product Manager	10/12/2021	
Approved by :	Kim RUTKOWSKI	Quality Manager	10/12/2021	

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	10/12/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	Satimo
Model	SID2450
Serial Number	SN 07/14 DIP 2G450-306
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

Satimo's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – Satimo COMOSAR Validation Dipole



4 MEASUREMENT METHOD

The IEEE 1528, OET 65 Bulletin C and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, OET 65 Bulletin C, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

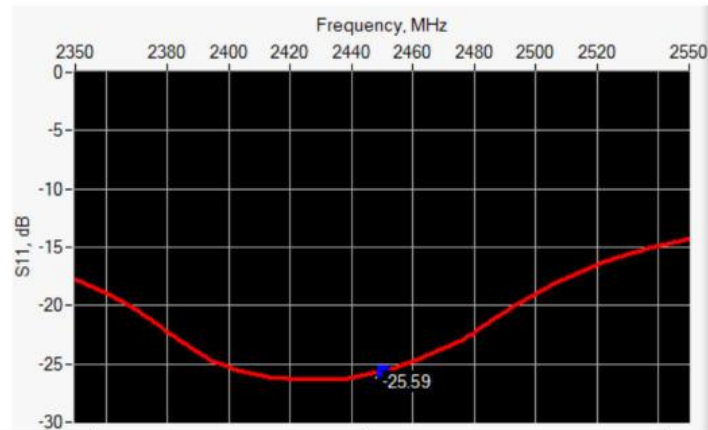
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6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-25.59	-20	44.7 Ω - 1.1 j Ω

6.2 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %.		250.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
450	290.0 $\pm$ 1 %.		166.7 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
750	176.0 $\pm$ 1 %.		100.0 $\pm$ 1 %.		6.35 $\pm$ 1 %.	
835	161.0 $\pm$ 1 %.		89.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
900	149.0 $\pm$ 1 %.		83.3 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1450	89.1 $\pm$ 1 %.		51.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1500	80.5 $\pm$ 1 %.		50.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1640	79.0 $\pm$ 1 %.		45.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1750	75.2 $\pm$ 1 %.		42.9 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1800	72.0 $\pm$ 1 %.		41.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1900	68.0 $\pm$ 1 %.		39.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
1950	66.3 $\pm$ 1 %.		38.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2000	64.5 $\pm$ 1 %.		37.5 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2100	61.0 $\pm$ 1 %.		35.7 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2300	55.5 $\pm$ 1 %.		32.6 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
2450	51.5 $\pm$ 1 %.	PASS	30.4 $\pm$ 1 %.	PASS	3.6 $\pm$ 1 %.	PASS
2600	48.5 $\pm$ 1 %.		28.8 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3000	41.5 $\pm$ 1 %.		25.0 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3500	37.0 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	
3700	34.7 $\pm$ 1 %.		26.4 $\pm$ 1 %.		3.6 $\pm$ 1 %.	

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7 VALIDATION MEASUREMENT

The IEEE Std. 1528, OET 65 Bulletin C and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 $\pm$ 5 %		0.87 $\pm$ 5 %	
450	43.5 $\pm$ 5 %		0.87 $\pm$ 5 %	
750	41.9 $\pm$ 5 %		0.89 $\pm$ 5 %	
835	41.5 $\pm$ 5 %		0.90 $\pm$ 5 %	
900	41.5 $\pm$ 5 %		0.97 $\pm$ 5 %	
1450	40.5 $\pm$ 5 %		1.20 $\pm$ 5 %	
1500	40.4 $\pm$ 5 %		1.23 $\pm$ 5 %	
1640	40.2 $\pm$ 5 %		1.31 $\pm$ 5 %	
1750	40.1 $\pm$ 5 %		1.37 $\pm$ 5 %	
1800	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1900	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
1950	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2000	40.0 $\pm$ 5 %		1.40 $\pm$ 5 %	
2100	39.8 $\pm$ 5 %		1.49 $\pm$ 5 %	
2300	39.5 $\pm$ 5 %		1.67 $\pm$ 5 %	
2450	39.2 $\pm$ 5 %	PASS	1.80 $\pm$ 5 %	PASS
2600	39.0 $\pm$ 5 %		1.96 $\pm$ 5 %	
3000	38.5 $\pm$ 5 %		2.40 $\pm$ 5 %	
3500	37.9 $\pm$ 5 %		2.91 $\pm$ 5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: cps' : 39.0 sigma : 1.77
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm

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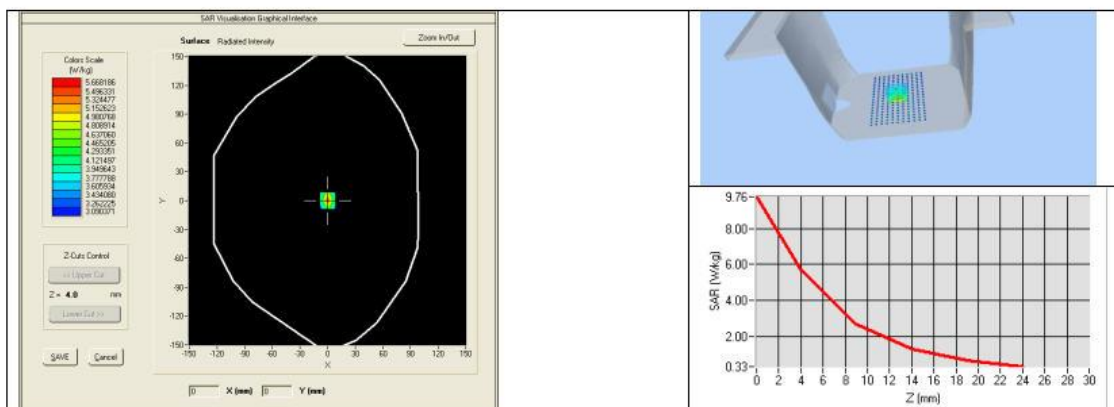


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATU.A

Zoon Scan Resolution	$dx=8mm/dy=8mm/dz=5mm$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	53.89 (5.39)	24	24.15 (2.42)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.287.8.14.SATIM0.A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	
2450	52.7 $\pm$ 5 %	PASS	1.95 $\pm$ 5 %	PASS
2600	52.5 $\pm$ 5 %		2.16 $\pm$ 5 %	
3000	52.0 $\pm$ 5 %		2.73 $\pm$ 5 %	
3500	51.3 $\pm$ 5 %		3.31 $\pm$ 5 %	
5200	49.0 $\pm$ 10 %		5.30 $\pm$ 10 %	
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %		5.53 $\pm$ 10 %	
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %		5.77 $\pm$ 10 %	
5800	48.2 $\pm$ 10 %		6.00 $\pm$ 10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: ϵ_{ps}' : 53.0 sigma : 1.93
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Sean Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

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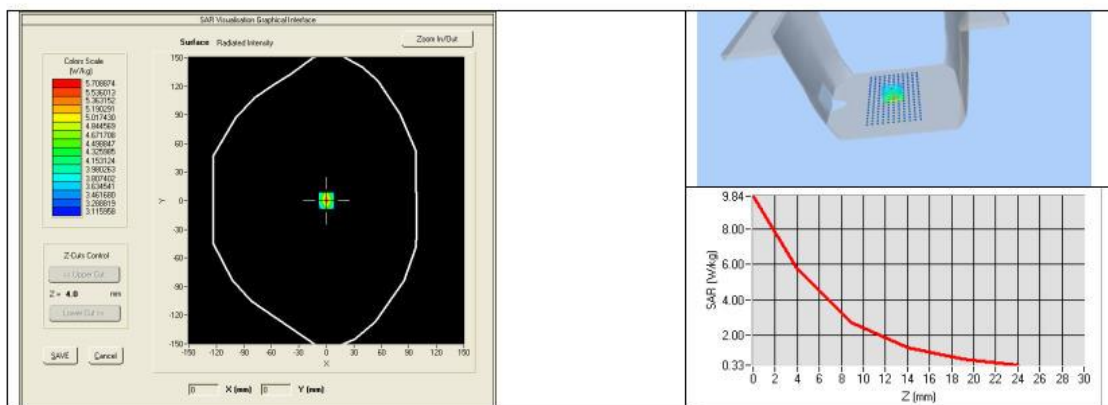
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Ref: ACR.287.8.14.SATU.A

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2450	54.65 (5.46)	24.58 (2.46)



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8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	Satimo	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2024	02/2027
Calipers	Carrera	CALIPER-01	12/2023	12/2026
Reference Probe	Satimo	EPG122 SN 18/11	10/2023	10/2024
Multimeter	Keithley 2000	1188656	12/2023	12/2026
Signal Generator	Agilent E4438C	MY49070581	12/2023	12/2026
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	12/2023	12/2026
Power Sensor	HP ECP-E26A	US37181460	12/2023	12/2026
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	11-661-9	8/2021	8/2024

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5.7 SID2600 Dipole Calibration Certificate



SAR Reference Dipole Calibration Report

Ref : ACR.273.4.18.SATU.A

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.

**1F., XINGYUAN INDUSTRIAL PARK, TONGDA ROAD,
BAO'AN BLVD
BAO'AN DISTRICT, SHENZHEN, GUANGDONG, CHINA
MVG COMOSAR REFERENCE DIPOLE**

FREQUENCY: 2600 MHZ

SERIAL NO.: SN 38/18 DIP 2G600-468

Calibrated at MVG US

2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 09/22/2021

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	09/28/2021	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	09/28/2021	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	09/28/2021	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Shenzhen LCS Compliance Testing Laboratory Ltd.

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	09/28/2021	Initial release

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATC..A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.273.4.18.SATU.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2600 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2600
Serial Number	SN 38/18 DIP 2G600-468
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEEE 1528, FCC KDBs and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

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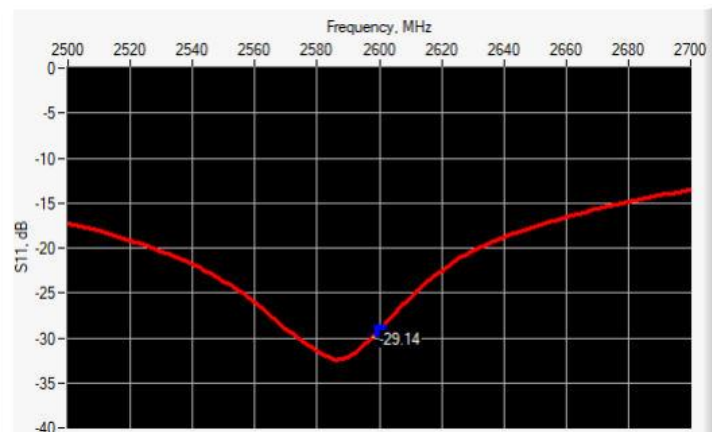
Ref: ACR.273.4.18.SATU.A

10 g

20.1 %

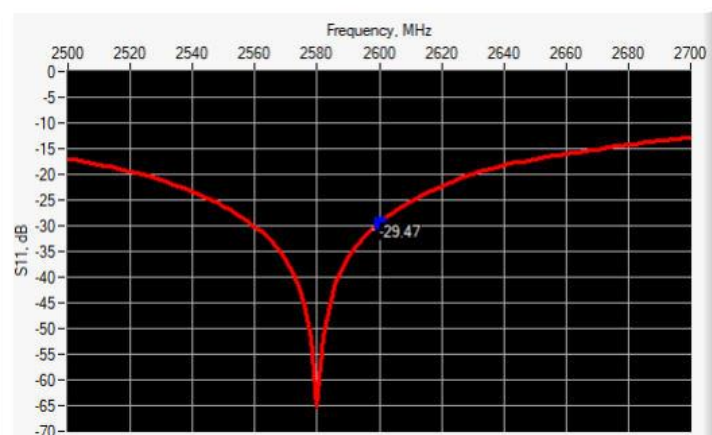
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-29.14	-20	49.2 Ω + 3.4 j Ω

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2600	-29.47	-20	47.5 Ω + 2.2 j Ω

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	420.0 $\pm$ 1 %		250.0 $\pm$ 1 %		6.35 $\pm$ 1 %	

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450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.		41.7 ±1 %.		3.6 ±1 %.	
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.	PASS	28.8 ±1 %.	PASS	3.6 ±1 %.	PASS
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEM/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r)		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

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1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %	PASS	1.96 ±5 %	PASS
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: cps' : 39.8 sigma : 1.99
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	

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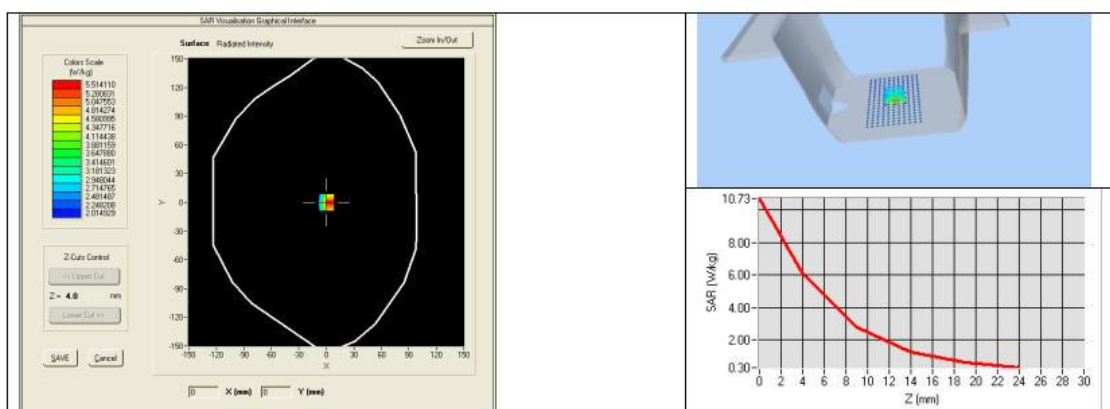
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1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3	56.91 (5.69)	24.6	24.69 (2.47)
3000	63.8		25.7	
3500	67.1		25	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 $\pm$ 5 %		0.80 $\pm$ 5 %	
300	58.2 $\pm$ 5 %		0.92 $\pm$ 5 %	
450	56.7 $\pm$ 5 %		0.94 $\pm$ 5 %	
750	55.5 $\pm$ 5 %		0.96 $\pm$ 5 %	
835	55.2 $\pm$ 5 %		0.97 $\pm$ 5 %	
900	55.0 $\pm$ 5 %		1.05 $\pm$ 5 %	
915	55.0 $\pm$ 5 %		1.06 $\pm$ 5 %	
1450	54.0 $\pm$ 5 %		1.30 $\pm$ 5 %	
1610	53.8 $\pm$ 5 %		1.40 $\pm$ 5 %	
1800	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
1900	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2000	53.3 $\pm$ 5 %		1.52 $\pm$ 5 %	
2100	53.2 $\pm$ 5 %		1.62 $\pm$ 5 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

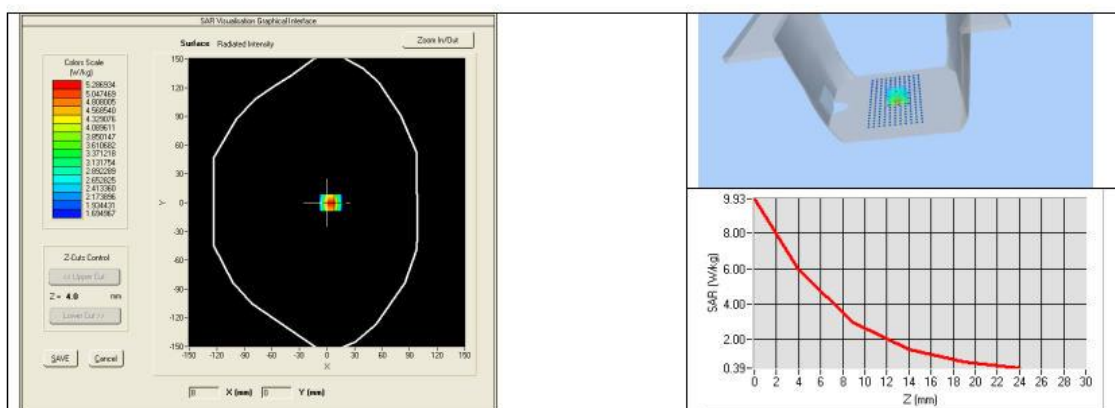
Ref: ACR.273.4.18.SATU.A

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %	PASS	2.16 ±5 %	PASS
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: ϵ_{ps}' : 52.5 sigma : 2.23
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2600 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
2600	54.14 (5.41)	24.13 (2.41)



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.2734.18.SATU..A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	06/2021	06/2024
Calipers	Carrera	CALIPER-01	01/2023	01/2026
Reference Probe	MVG	EPG122 SN 18/11	08/2023	08/2024
Multimeter	Keithley 2000	1188656	01/2023	01/2026
Signal Generator	Agilent E4438C	MY49070581	01/2023	01/2026
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2023	11/2026
Power Sensor	HP ECP-E26A	US37181460	01/2023	01/2026
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	11/2023	11/2026

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Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client
LCS
Shenzhen

Certificate No. **D2600V2-1231_Jul25/2**

CALIBRATION CERTIFICATE (Replacement of No: D2600V2-1231_Jul25)

Object **D2600V2 - SN: 1231**

Calibration procedure(s) **QA CAL-05.v12**
Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

Calibration date **July 15, 2025**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.
All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.
Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	30-Apr-25 (No. 1020-300791789)	Apr-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4lp	SN: 1836	17-Apr-25 (No. DAE4lp-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182061	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Krešimir Franjić	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			Issued: September 1, 2025

Certificate No: D2600V2-1231_Jul25/2

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**Calibration Laboratory of**Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland

**S** Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Glossary

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

Calibration is Performed According to the Following Standards

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

Additional Documentation

- DASY System Handbook

Methods Applied and Interpretation of Parameters

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

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

Certificate No: D2600V2-1231_Jul25/2

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D2600V2 - SN: 1231

July 15, 2025

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz ±1MHz	

HSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.0	1.96 mho/m
Measured HSL parameters	(22.0 ±0.2)°C	37.6 ±6%	2.00 mho/m ±6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2600 MHz

SAR averaged over 1 cm³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	13.8 W/kg
SAR for nominal HSL parameters	normalized to 1W	54.9 W/kg ±17.0% (k = 2)

SAR averaged over 10 cm³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.17 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.6 W/kg ±16.5% (k = 2)



D2600V2 - SN: 1231

July 15, 2025

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 2600 MHz**

Impedance	48.5 Ω + 1.3 j Ω
Return Loss	-34.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.15 ns
----------------------------------	---------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



D2600V2 - SN: 1231

July 15, 2025

System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D2600V2 - SN1231	2600	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0--		2600, 0	7.26	2.00	12.6

Hardware Setup

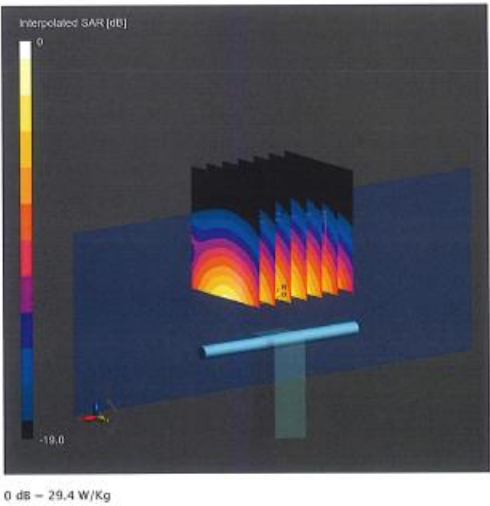
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V6.0 Center	HSL, 2025-07-15	EX3DV4 - SM7349, 2025-01-10	DAE4ip Sn1816, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2025-07-15
psSAR1g [W/Kg]	13.8
psSAR10g [W/Kg]	6.17
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



Certificate No: D2600V2-1231_Jul25/2

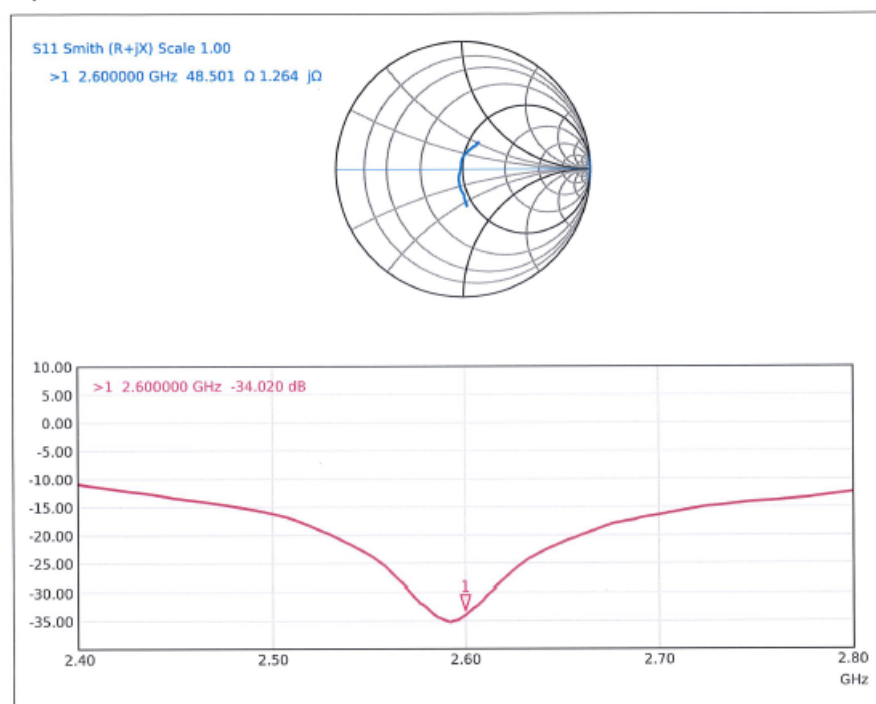
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D2600V2 - SN: 1231

July 15, 2025

Impedance Measurement Plot for HSL



Certificate No: D2600V2-1231_Jul25/2

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**5.8 SID5G-6G Dipole Calibration Certificate****SAR Reference Waveguide Calibration Report**

Ref : ACR.273.5.18.SATU.A

**SHENZHEN LCS COMPLIANCE TESTING
LABORATORY LTD.****1F., XINGYUAN INDUSTRIAL PARK, TONGDA
ROAD, BAO'AN BLVDBAO'AN DISTRICT,
SHENZHEN, GUANGDONG, CHINAMVG COMOSAR
REFERENCE WAVEGUIDE****FREQUENCY: 5000-6000 MHZ****SERIAL NO.: SN 49/16 WGA 43****Calibrated at MVG US****2105 Barrett Park Dr. - Kennesaw, GA 30144****Calibration Date: 09/22/2021***Summary:*

This document presents the method and results from an accredited SAR reference waveguide calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	09/28/2021	<i>JS</i>
Checked by :	Jérôme LUC	Product Manager	09/28/2021	<i>JS</i>
Approved by :	Kim RUTKOWSKI	Quality Manager	09/28/2021	<i>Kim Rutkowski</i>

	Customer Name
Distribution :	Shenzhen LCS Compliance Testing Laboratory Ltd.

Issue	Date	Modifications
A	09/28/2021	Initial release

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1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528 and CEI/IEC 62209 standards for reference waveguides used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 5000-6000 MHz REFERENCE WAVEGUIDE
Manufacturer	MVG
Model	SWG5500
Serial Number	SN 49/16 WGA 43
Product Condition (new / used)	Used

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Waveguides are built in accordance to the IEEE 1528 and CEI/IEC 62209 standards.

4 MEASUREMENT METHOD

The IEEE 1528 and CEI/IEC 62209 standards provide requirements for reference waveguides used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The waveguide used for SAR system validation measurements and checks must have a return loss of -8 dB or better. The return loss measurement shall be performed with matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE 1528 and CEI/IEC 62209 standards specify the mechanical dimensions of the validation waveguide, the specified dimensions are as shown in Section 6.2. Figure 1 shows how the dimensions relate to the physical construction of the waveguide.

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5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

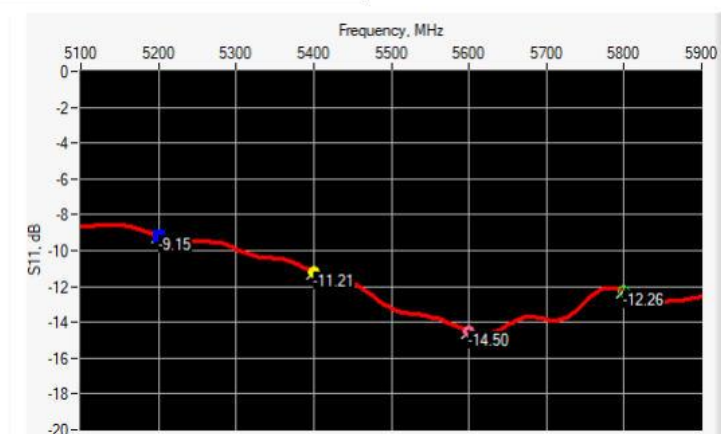
5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %
10 g	20.1 %

6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS IN HEAD LIQUID



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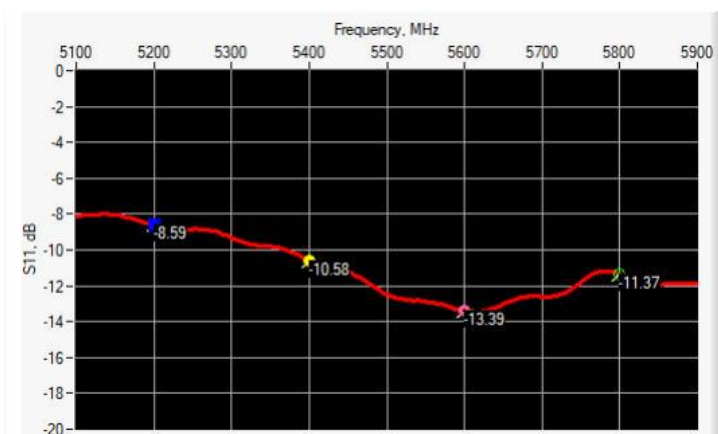


SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU.A

Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-9.15	-8	$20.57 \Omega + 11.55 j\Omega$
5400	-11.21	-8	$75.27 \Omega + 4.08 j\Omega$
5600	-14.50	-8	$33.91 \Omega - 8.72 j\Omega$
5800	-12.26	-8	$53.07 \Omega + 23.41 j\Omega$

6.2 RETURN LOSS IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-8.59	-8	$19.38 \Omega + 13.50 j\Omega$
5400	-10.58	-8	$77.13 \Omega + 1.81 j\Omega$
5600	-13.39	-8	$30.95 \Omega - 7.75 j\Omega$
5800	-11.37	-8	$54.79 \Omega + 25.47 j\Omega$

6.3 MECHANICAL DIMENSIONS

Frequency (MHz)	L (mm)		W (mm)		L _r (mm)		W _r (mm)		T (mm)	
	Requirement	Measurement	Requirement	Measurement	Requirement	Measurement	Requirement	Measurement	Requirement	Measurement
5200	40.39 – 0.13	PASS	20.19 – 0.13	PASS	81.03 – 0.13	PASS	61.98 – 0.13	PASS	5.3*	PASS
5800	40.39 – 0.13	PASS	20.19 – 0.13	PASS	81.03 – 0.13	PASS	61.98 – 0.13	PASS	4.3*	PASS

* The tolerance for the matching layer is included in the return loss measurement.

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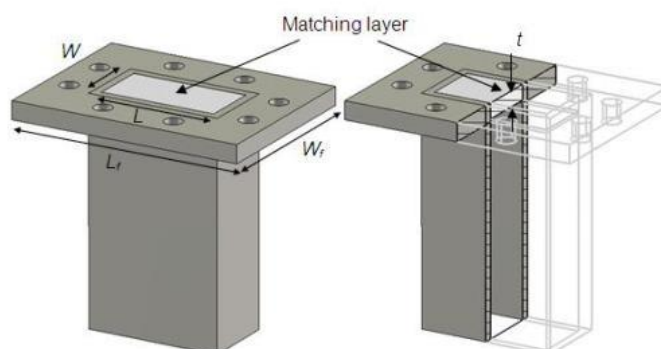


Figure 1: Validation Waveguide Dimensions

7 VALIDATION MEASUREMENT

The IEEE Std. 1528 and CIE/IEC 62209 standards state that the system validation measurements must be performed using a reference waveguide meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed with the matching layer placed in the open end of the waveguide, with the waveguide and matching layer in direct contact with the phantom shell.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
5000	36.2 $\pm$ 10 %		4.45 $\pm$ 10 %	
5100	36.1 $\pm$ 10 %		4.56 $\pm$ 10 %	
5200	36.0 $\pm$ 10 %	PASS	4.66 $\pm$ 10 %	PASS
5300	35.9 $\pm$ 10 %		4.76 $\pm$ 10 %	
5400	35.8 $\pm$ 10 %	PASS	4.86 $\pm$ 10 %	PASS
5500	35.6 $\pm$ 10 %		4.97 $\pm$ 10 %	
5600	35.5 $\pm$ 10 %	PASS	5.07 $\pm$ 10 %	PASS
5700	35.4 $\pm$ 10 %		5.17 $\pm$ 10 %	
5800	35.3 $\pm$ 10 %	PASS	5.27 $\pm$ 10 %	PASS
5900	35.2 $\pm$ 10 %		5.38 $\pm$ 10 %	
6000	35.1 $\pm$ 10 %		5.48 $\pm$ 10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

At those frequencies, the target SAR value can not be generic. Hereunder is the target SAR value defined by MVG, within the uncertainty for the system validation. All SAR values are normalized to 1 W net power. In bracket, the measured SAR is given with the used input power.

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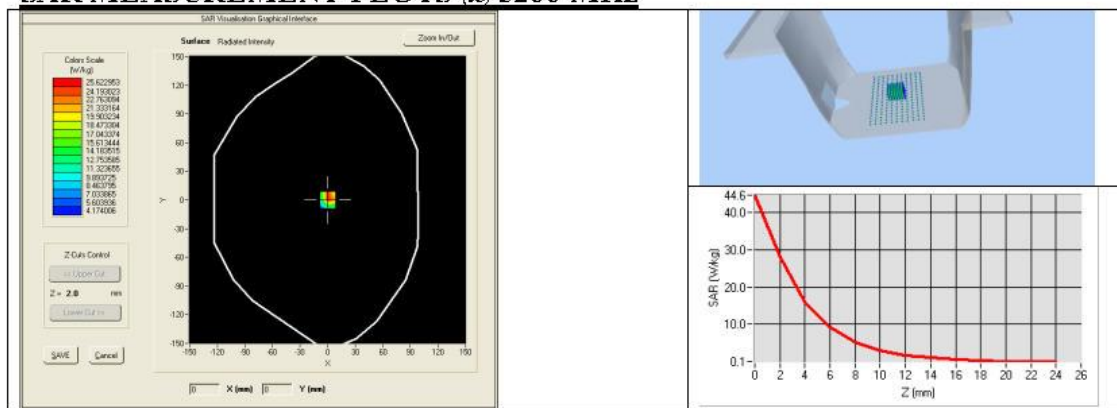
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU.A

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5200 MHz: ϵ_p ' :35.64 sigma : 4.67 Head Liquid Values 5400 MHz: ϵ_p ' :36.44 sigma : 4.87 Head Liquid Values 5600 MHz: ϵ_p ' :36.66 sigma : 5.17 Head Liquid Values 5800 MHz: ϵ_p ' :35.31 sigma : 5.31
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4mm/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency (MHz)	1 g SAR (W/kg)		10 g SAR (W/kg)	
	required	measured	required	measured
5200	159.00	165.77 (16.58)	56.90	57.20 (5.72)
5400	166.40	173.20 (17.32)	58.43	59.22 (5.92)
5600	173.80	179.61 (17.96)	59.97	60.98 (6.10)
5800	181.20	186.77 (18.68)	61.50	62.84 (6.28)

SAR MEASUREMENT PLOTS @ 5200 MHz



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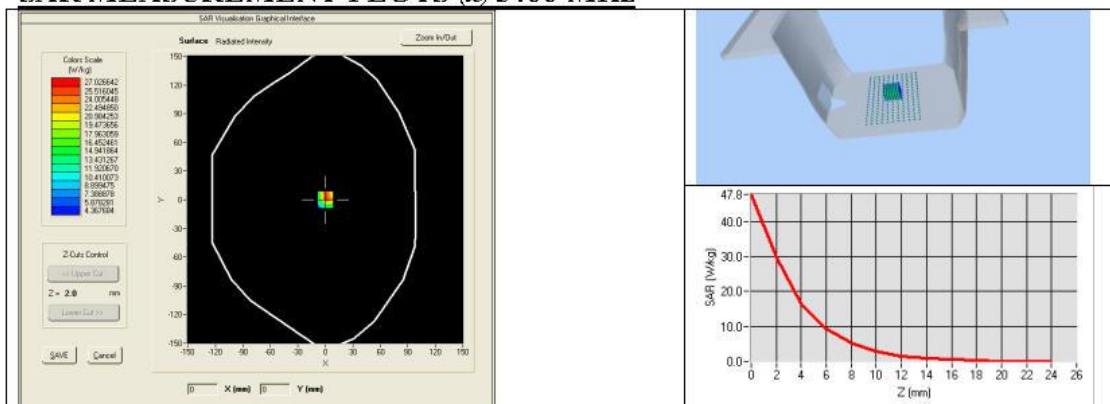
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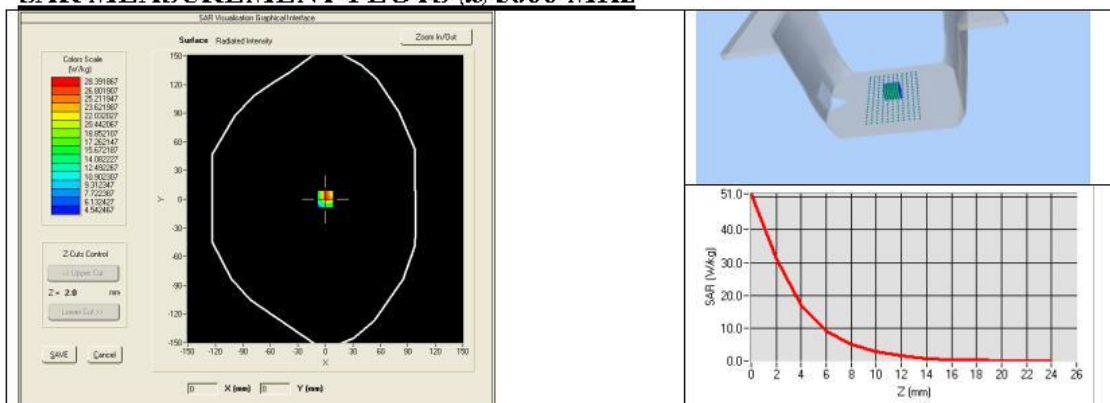
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Ref: ACR.273.5.18.SATC.A

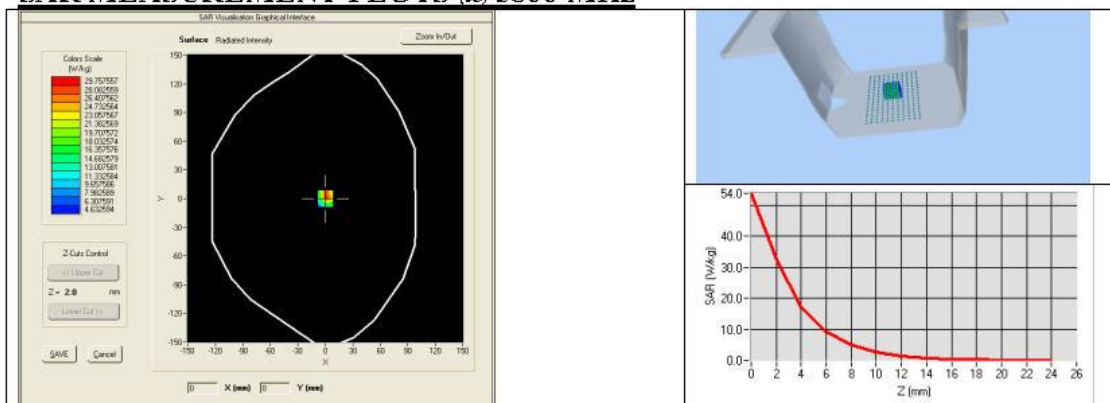
SAR MEASUREMENT PLOTS @ 5400 MHz



SAR MEASUREMENT PLOTS @ 5600 MHz



SAR MEASUREMENT PLOTS @ 5800 MHz



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SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU..A

7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
5200	49.0 $\pm$ 10 %	PASS	5.30 $\pm$ 10 %	PASS
5300	48.9 $\pm$ 10 %		5.42 $\pm$ 10 %	
5400	48.7 $\pm$ 10 %	PASS	5.53 $\pm$ 10 %	PASS
5500	48.6 $\pm$ 10 %		5.65 $\pm$ 10 %	
5600	48.5 $\pm$ 10 %	PASS	5.77 $\pm$ 10 %	PASS
5800	48.2 $\pm$ 10 %	PASS	6.00 $\pm$ 10 %	PASS

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values 5200 MHz: ϵ_r' :48.64 sigma : 5.51 Body Liquid Values 5400 MHz: ϵ_r' :46.52 sigma : 5.77 Body Liquid Values 5600 MHz: ϵ_r' :46.79 sigma : 5.77 Body Liquid Values 5800 MHz: ϵ_r' :47.04 sigma : 6.10
Distance between dipole waveguide and liquid	0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4m/dz=2mm
Frequency	5200 MHz 5400 MHz 5600 MHz 5800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency (MHz)	1 g SAR (W/kg)	10 g SAR (W/kg)
	measured	measured
5200	159.09 (15.91)	56.13 (5.61)
5400	164.56 (16.46)	57.31 (5.73)
5600	172.25 (17.23)	59.72 (5.97)
5800	177.77 (17.78)	61.06 (6.11)

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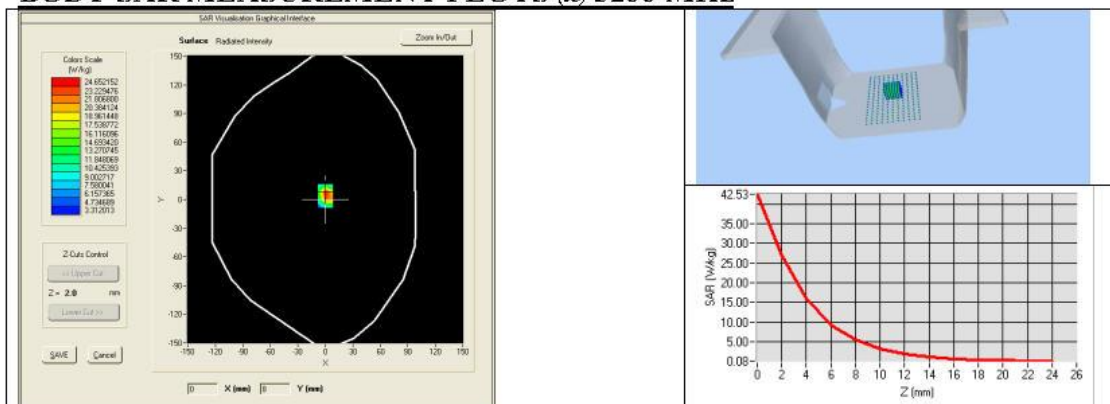
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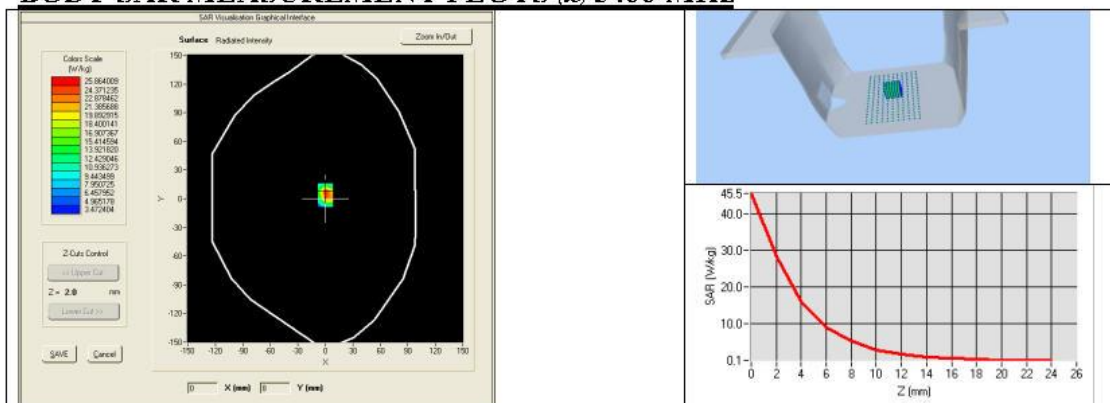
SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATC.A

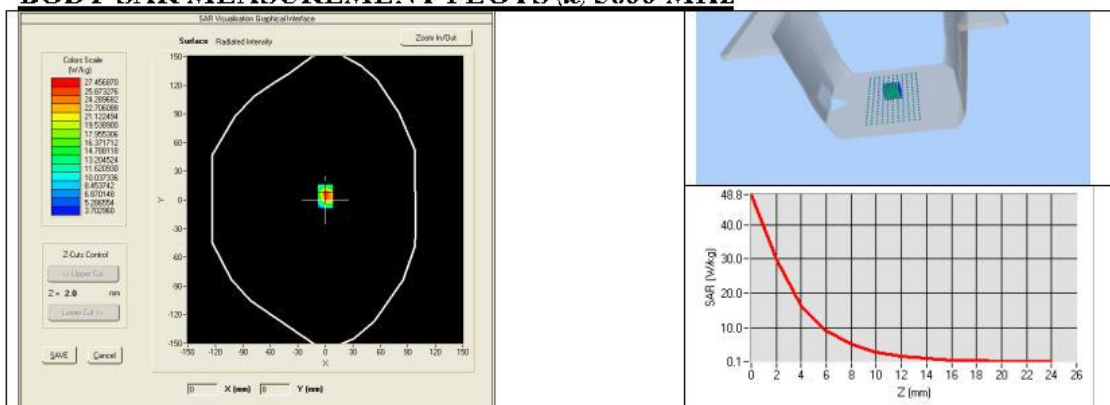
BODY SAR MEASUREMENT PLOTS @ 5200 MHz



BODY SAR MEASUREMENT PLOTS @ 5400 MHz



BODY SAR MEASUREMENT PLOTS @ 5600 MHz

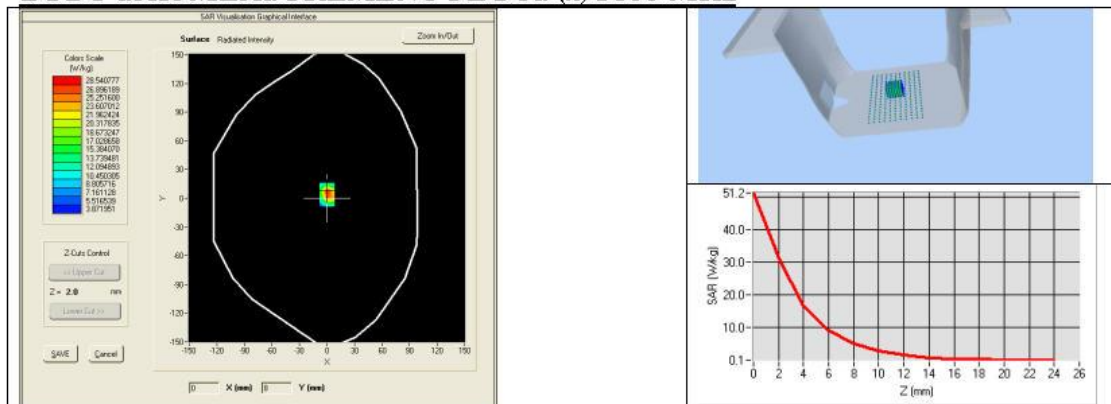




SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU.A

BODY SAR MEASUREMENT PLOTS @ 5800 MHz





SAR REFERENCE WAVEGUIDE CALIBRATION REPORT

Ref: ACR.273.5.18.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
Flat Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	06/2021	06/2024
Calipers	Carrera	CALIPER-01	01/2023	01/2026
Reference Probe	MVG	EPG122 SN 18/11	08/2023	08/2024
Multimeter	Keithley 2000	1188656	01/2023	01/2026
Signal Generator	Agilent E4438C	MY49070581	01/2023	01/2026
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	11/2023	11/2026
Power Sensor	HP ECP-E26A	US37181460	01/2023	01/2026
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	11/2023	11/2026

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6.SAR System PHOTOGRAPHS

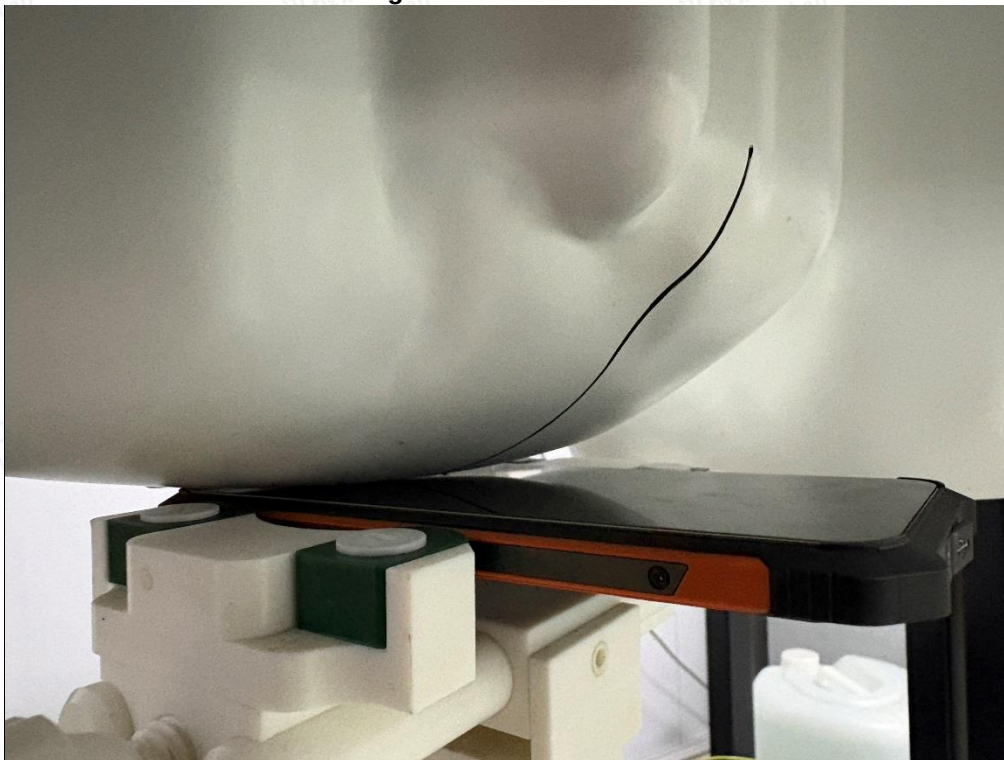


Liquid depth $\geq 15\text{cm}$

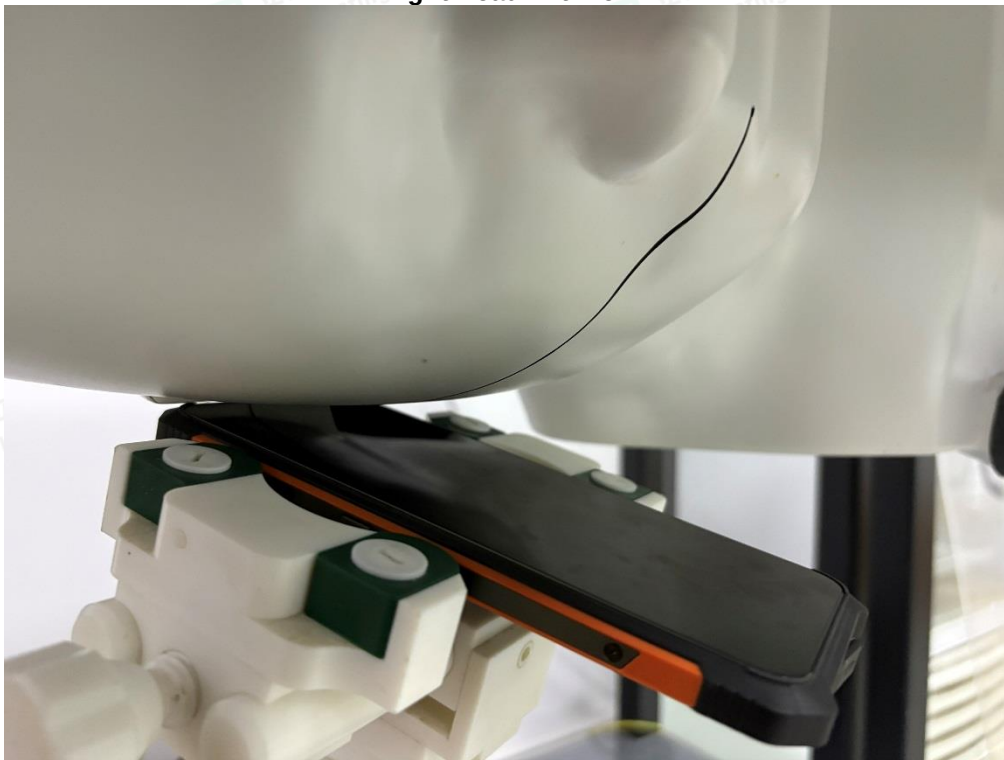


7.SETUP PHOTOGRAPHS

Right Head Touch View

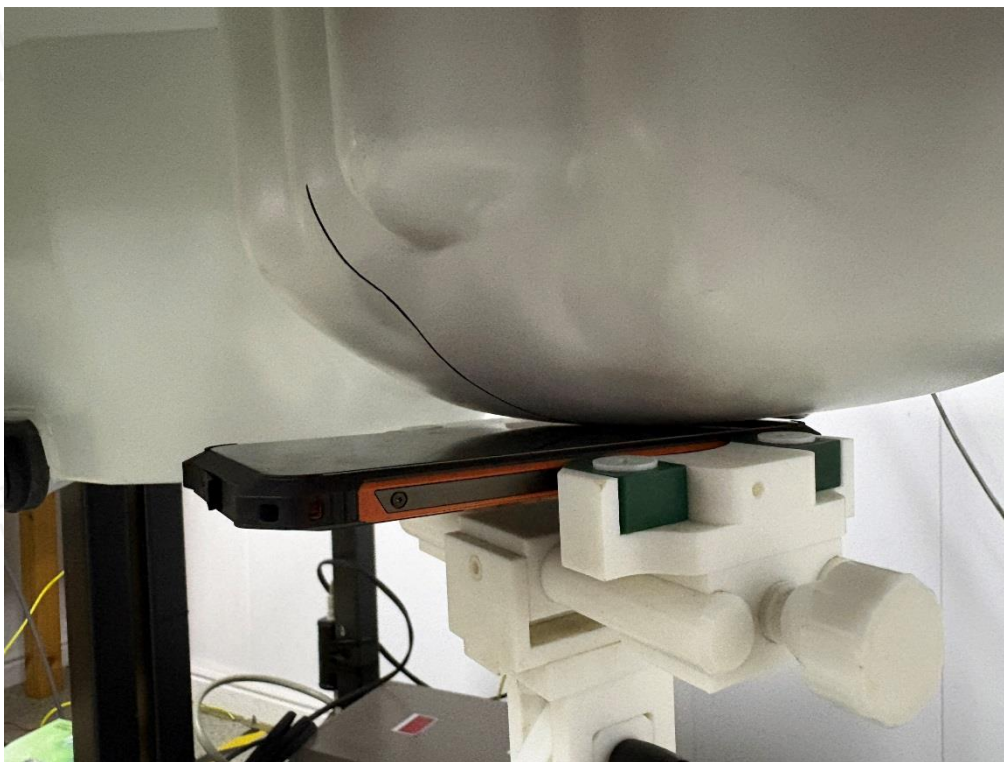


Right Head Tilt View





Left Head Touch View

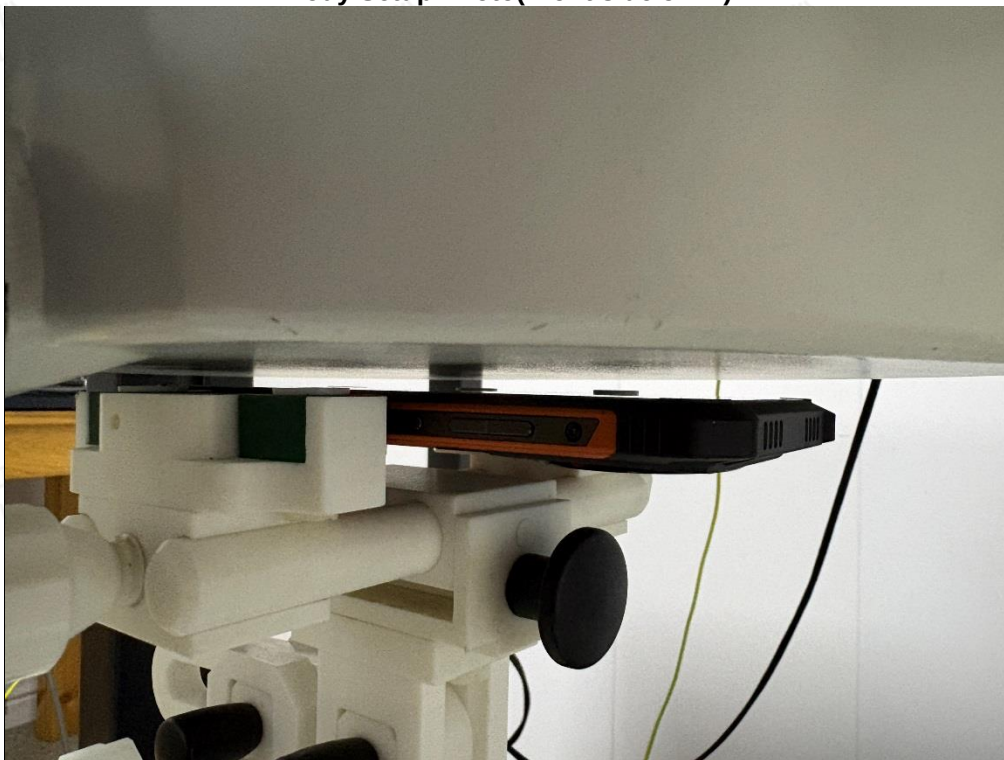


Left Head Tilt View

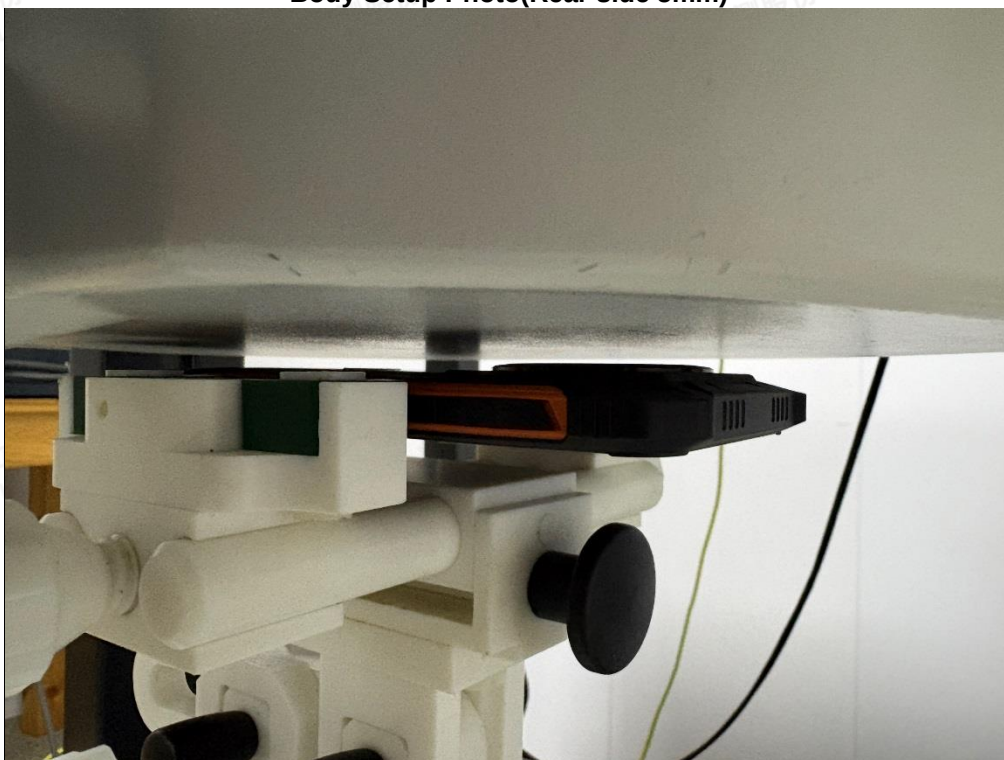




Body Setup Photo(Front side 5mm)



Body Setup Photo(Rear side 5mm)





Body Setup Photo(Left side 5mm)



Body Setup Photo(Right side 5mm)





Body Setup Photo(Top side 5mm)



Body Setup Photo(Bottom side 5mm)

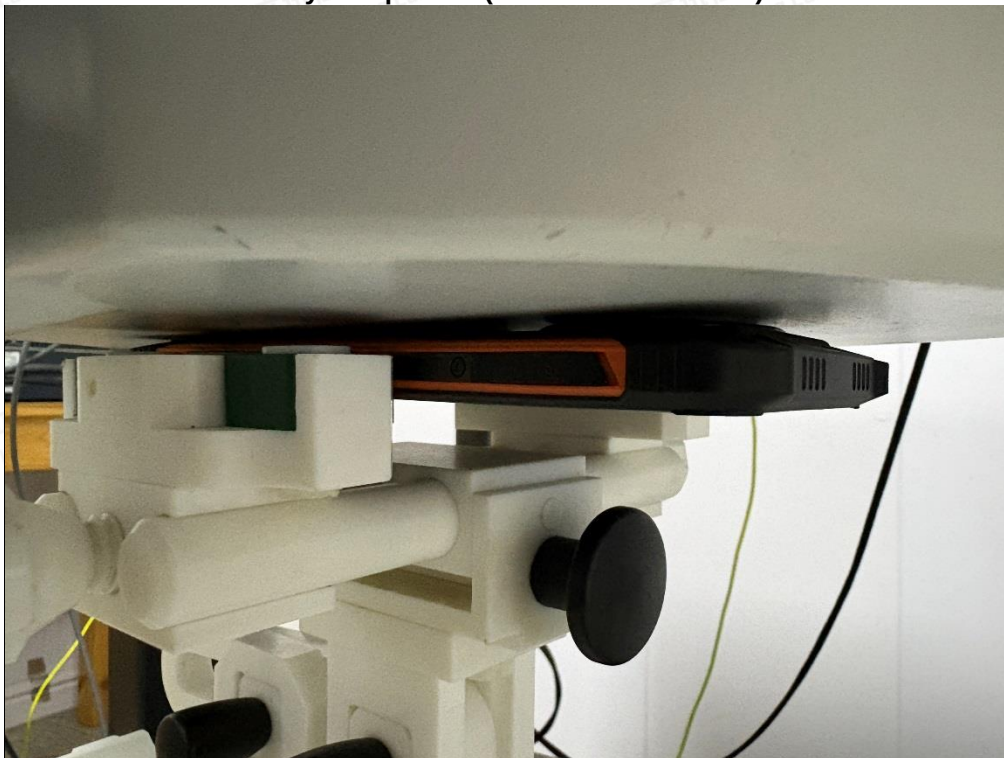




Body Setup Photo(Limb-Front side 0mm)



Body Setup Photo(Limb-Rear side 0mm)





Body Setup Photo(Limb-Left side 0mm)

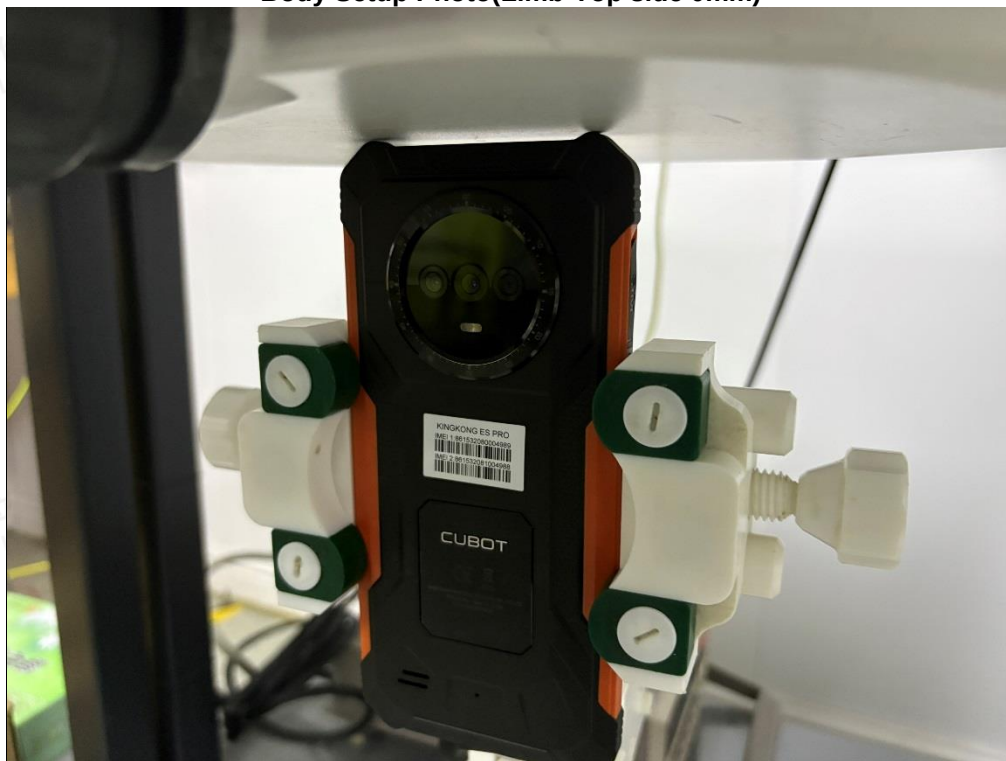


Body Setup Photo(Limb-Right side 0mm)

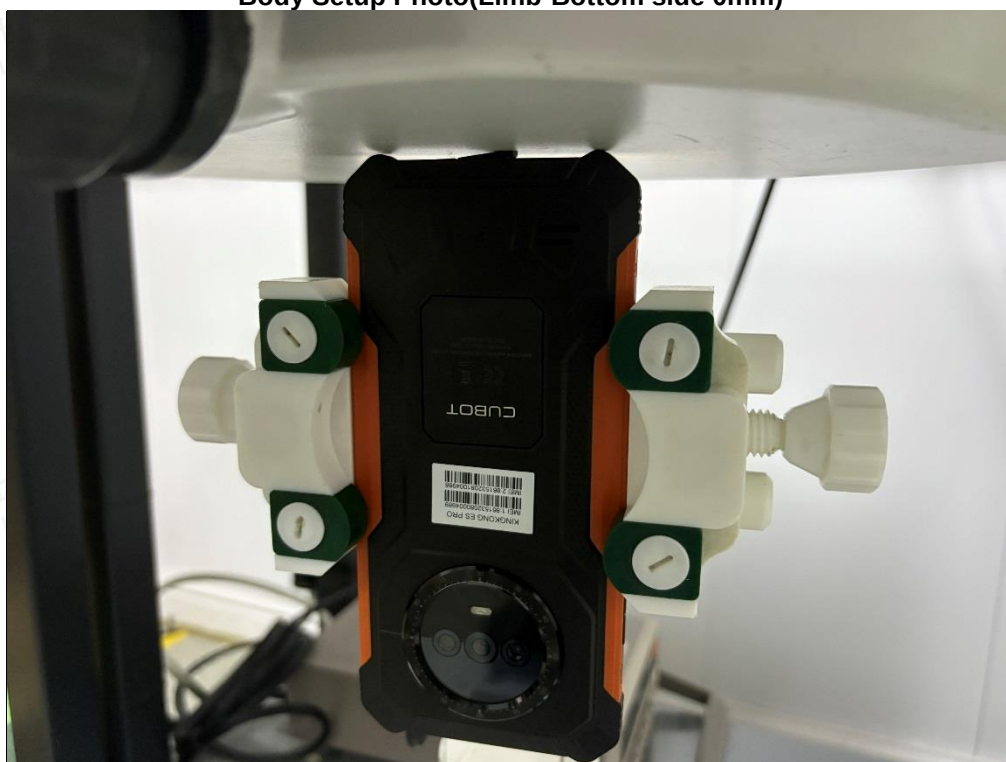




Body Setup Photo(Limb-Top side 0mm)



Body Setup Photo(Limb-Bottom side 0mm)



8.EUT PHOTOGRAPHS



Fig.1



Fig.2

.....The End of Test Report.....