SAR Report

Applicant	:	台灣三星電子股份有限公司
Product Type	:	NR 手持式行動電話機
Trade Name	:	SAMSUNG
Model Number	:	SM-G9960
Applicable Standard	:	CNS 14959 / CNS 14958-1
Received Date	:	Oct. 30, 2020
Test Period	:	Oct. 31 ~ Nov. 04, 2020
Issued Date	:	Nov. 25, 2020

Issued by

Tested By : Kris Pan

(Kris Pan)

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C.)
Tel：+886-3-2710188 / Fax：+886-3-2710190

Taiwan Accreditation Foundation accreditation number: 1330

Note:

1. The test results are valid only for samples provided by customers and under the test conditions described in this report.
2. This report shall not be reproduced except in full, without the written approval of A Test Lab Technology Corporation.
3. The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Nov. 13, 2020	Initial Issue	Nicole Chu
01	Nov. 25, 2020	P6 Revised TX Frequency P7 Revised Conducted Power P7 & P10 Revised PLMN10 to PLMN ALL	Nicole Chu

Contents

1. General Information 4
1.1 Reference Applicable Standard 4
1.2 Test Site Environment 4
1.3 Laboratory Information 4
2. Summary of Maximum Reported SAR Value 5
3. Description of Equipment under Test (EUT) 6
4. Introduction 10
5. SAR Definition 10
6. SAR Measurement Setup 11
7. System Components 12
7.1 DASY E-Field Probe System 12
7.1.1 E-Field Probe Specification 12
7.2 Data Acquisition Electronic (DAE) System 13
7.3 Robot 13
7.4 Measurement Server 13
7.5 Device Holder 14
7.6 Phantom - SAM v4.0 14
8. Test Equipment List 15
9. Tissue Simulating Liquids 16
10. Measurement Process 17
10.1 Device and Test Conditions 17
10.2 System Performance Check 18
10.2.1 Symmetric Dipoles for System Validation 18
10.2.2 Validation 19
10.3 Dosimetric Assessment Setup 20
10.3.1 Handset Test Position - Head Position 20
10.3.2 Measurement Procedures 22
10.4 Spatial Peak SAR Evaluation 23
11. Measurement Uncertainty 24
12. SAR Test Results Summary 27
12.1 Test Results 27
12.2 European Council Recommendation 1999 519 EC 32
13. Conclusion 33
14. References 33
Appendix A - System Performance Check 34
Appendix B - SAR Measurement Data 41
Appendix C - Calibration 54

1. General Information

1.1 Reference Applicable Standard

Standard	Description	Version
ANSI/IEEE C95.1	American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 KHz to 100 GHz, New York.	2005
IEEE 1528	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques.	2013
IEC 62209-1	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 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz)	2016
CNS 14959	Limit for exposuring to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)	2005-12
CNS 14958-1	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)	2005-12

1.2 Test Site Environment

Items	Required (IEEE 1528-2013)	Actual
Temperature (°C)	18-25	21-23

1.3 Laboratory Information

Issue Location

Site Name: A Test Lab Techno Corp.

http://www.atl-lab.com.tw/e-index.htm

Site Address: No. 140-1, Changan Street, Bade District, Taoyuan City 33465, Taiwan (R.O.C.)

Tel：+886-3-2710188

Fax：+886-3-2710190

2. Summary of Maximum Reported SAR Value

Equipment Class	Mode	Highest Reported 10g SAR (W/Kg)
		Head standalone SAR $_{10\,g}$(W/kg)
Licensed	GSM900	0.058
	WCDMA Band I	0.048
	WCDMA Band VIII	0.089
	LTE Band 1	0.056
	LTE Band 3	0.117
	LTE Band 7	0.029
	LTE Band 8	0.084
	LTE Band 28	**0.150**
	LTE Band 38	0.013
	LTE Band 41	0.015
	5G NR n1	0.019
	5G NR n28	0.053
	5G NR n78	0.077

3. Description of Equipment under Test (EUT)

Applicant	台灣三星電子股份有限公司 臺北市內湖區瑞光路 399 號 10 樓之 1
Manufacturer(1)	Samsung Electronics Co., Ltd. 302,3Gongdan 3-Ro,Gumi-Si,Gyeongsangbuk-Do 730-722 Korea
Manufacturer(2)	Tianjin Samsung Telecom.Technology Co.,Ltd. No.9 WeiWu Road, Micro-Electronics Industrial Park, XiQing District., Tianjin City 300385,P.R. China
Manufacturer(3)	HUIZHOU SAMSUNG ELECTRONICS CO.,LTD 256, ZHONGKAI 6TH ROAD, CHENJIANG TOWN,HUIZHOU CITY, GUANGDONG PROVINCE,CHINA
Manufacturer(4)	Shenzhen Samsung Kejian Mobile Telecommunication Technology Co.,Ltd. Samsung Kejian Plant,No.2 Songping St., North Area of Hi-tech Park,Nanshan District,Shenzhen City,Guangdong
Manufacturer(5)	SAMSUNG ELECTRONICS VIETNAM CO., LTD Yen Phong 1 Industrial Zone,Yen Trung Commune,Yen Phong District,Bac Ninh Province, Vietnam
Manufacturer(6)	SAMSUNG ELECTRONICS VIETNAM THAI NGUYEN CO.,LTD Yen Binh IP,Dong Tien WARD Pho Yen,Thai Nguyen PROVINCE VIETNAM
Product Type	NR 手持式行動電話機
Trade Name	SAMSUNG
Model Number	SM-G9960
IMEI No.	IMEI 1: 352733380012435, IMEI 2: 358293220012438
Test Device	Production Unit
TX Frequency	890.2 - 914.8 MHz (PGSM 900) 1920 - 1980 MHz (WCDMA Band 1) 885 - 915 MHz (WCDMA Band 8) 1920 - 1980 MHz LTE Band 1 (BW 5, 10, 15, 20 MHz) 1710 - 1785 MHz LTE Band 3 (BW 1.4, 3, 5, 10, 15, 20 MHz) 2500 - 2570 MHz LTE Band 7 (BW 5, 10, 15, 20 MHz) 885 - 915 MHz LTE Band 8 (BW 1.4, 3, 5, 10 MHz) 703 - 748 MHz LTE Band 28 (BW 3, 5, 10, 15, 20 MHz) 2570 - 2620 MHz LTE Band 38 (BW 5, 10, 15, 20 MHz) 2500 - 2690 MHz LTE Band 41 (BW 5, 10, 15, 20 MHz) 1920 - 1980 MHz 5G NR n1 (BW 5, 10, 15, 20 MHz) 703 - 748 MHz 5G NR n28 (BW 5, 10, 15, 20 MHz) 3300 - 3570 MHz 5G NR n78 (BW 20, 40, 50, 60, 80, 90, 100 MHz)
5G NR FR1 SCS	5G NR n1: SCS 15 kHz 5G NR n28: SCS 15 kHz 5G NR n78: SCS 30 kHz
EN-DC Uplink Combinations	3A+n1,7A+n1,8A+n1,1A+n28,3A+n28,7A+n28,1A+n78,3A+n78, 7A+n78,8A+n78

Max. Avg. Conducted Power	2.023	W /	33.06	dBm	PGSM 900
	0.210	W /	23.23	dBm	WCDMA Band 1
	0.264	W /	24.21	dBm	WCDMA Band 8
	0.199	W /	22.99	dBm	LTE Band 1
	0.219	W /	23.40	dBm	LTE Band 3
	0.169	W /	22.27	dBm	LTE Band 7
	0.311	W /	24.93	dBm	LTE Band 8
	0.295	W /	24.70	dBm	LTE Band 28
	0.197	W /	22.94	dBm	LTE Band 38
	0.221	W /	23.44	dBm	LTE Band 41
	0.227	W /	23.56	dBm	5G NR n1
	0.294	W /	24.68	dBm	5G NR n28
	0.225	W /	23.52	dBm	5G NR n78
Max. SAR Measurement	0.150 W/kg Head SAR				
Device Category	Portable				
RF Exposure Environment	General Population / Uncontrolled				
Battery Option	Standard				
Application Type	Certification				

Note:

1. This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment / general population exposure limits specified in Std. C95.1-2005 & CNS14959 & PLMN ALL and had been tested in accordance with the measurement procedures specified in IEEE Std. 1528-2013 and IEC 62209-1.
2. 5G NR power is maximum when the E-UTRAN target level is setup to 0.

Antenna list:

Antenna	Brand	Model Number	Type	Frequency	Max. Gain (dBi)
GSM 900/ WCDMA	GALTRONICS	SM-G996U	LDS Antenna	GSM 900	-7.58
				WCDMA (Band I)	-7.46
				WCDMA (Band 8)	-7.58
LTE	GALTRONICS	SM-G996U	LDS Antenna	LTE 2100 (Band 1)	-7.46
				LTE 1800 (Band 3)	-5.30
				LTE 900 (Band 8)	-7.58
				LTE 700 (Band 28)	-8.12
				LTE 2600 (Band 7)	-3.64
				LTE 2600 (Band 38)	-3.64
				LTE 2500 (Band 41)	-3.64
FR1	GALTRONICS	SM-G996U	LDS Antenna	n1	-7.46
				n28	-8.12
	GALTRONICS	SM-G996U SUB	LDS Antenna	n78	-4.06
Bluetooth / WLAN 2.4 G / 5 G	GALTRONICS	SM-G996U SUB	LDS Antenna	Bluetooth	-1.04
				WLAN 2.4 G ANT-0	-1.04
				WLAN 2.4 G ANT-1	-1.78
				5 G ANT-0	-1.08
				5 G ANT-1	-2.25
UWB	GALTRONICS	SM-G996U SUB	LDS Antenna	UWB ANT-0	-2.11
	Ethertronics	FP80229	Patch Antenna	UWB ANT-1	-1.26
Antenna	Brand	Model Number	Type	Frequency	Modulation
NFC	SAMSUNG	SM-G9960	Loop Antenna	13.56MHz (TXRX)	ASK
WPC	SAMSUNG	SM-G9960	Loop Antenna	110KHz-205KHz (TXRX)	ASK

附屬裝置表:

裝置名稱	廠牌	型　號	備註
內建固定式電池	SAMSUNG	EB-BG996ABY (本型式係指 PCB 版號 R07H)	3.88 VDC, 4660 mAh 製造商(1): Dongguan Amperex Technology Limited 製造商(2): Ningde Amperex Technology Limited
電源供應器(1)	SAMSUNG	EP-TA800	INPUT　：100-240 VAC, 50-60 Hz, 0.7 A OUTPUT： (PDO) 5.0 VDC, 3.0 A or 9.0 VDC, 2.77 A (PPS) 5.9 VDC, 3.0 A or 11.0 VDC, 2.25 A 製造商(1): DONGYANG INSTRUMENT QINGDAO Inc. 製造商(2): DONGYANG ELECTRIC AND POWER INDIA PRIVATE LIMITED 製造商(3): DONGYANG E&P VIETNAM CO., LTD. 製造商(4): DONG YANG E&P HCM VINA CO. , LTD 製造商(5): Huizhou Dongyang E&P Electronics Co., Ltd. 製造商(6): DONGYANG E&P Inc. 證書號碼：CI33806475I622 黑色/白色
電源供應器(2)	SAMSUNG	EP-TA800 (本型式係使用變壓器型號為 EP-TA800)	INPUT　：100-240 VAC, 50-60 Hz, 0.7 A OUTPUT： (PDO) 5.0 VDC, 3.0 A or 9.0 VDC, 2.77 A (PPS) 5.9 VDC, 3.0 A or 11.0 VDC, 2.25 A 製造商(1): Dongguan Dongwon Electronics Co., Ltd. 製造商(2): HAEM VINA Co., Ltd. 證書號碼：CI33806475J192 黑色/白色
電源供應器(3)	SAMSUNG	EP-TA800 (本型式係 PCB 版型號: EP-TA800 REV1.0)	INPUT　：100-240 VAC, 50-60 Hz, 0.7 A OUTPUT： (PDO) 5.0 VDC, 3.0 A or 9.0 VDC, 2.77 A (PPS) 5.9 VDC, 3.0 A or 11.0 VDC, 2.25 A 製造商(1): RFTECH THAI NGUYEN CO., LTD 製造商(2): R. F. Tech Electronics (HuiZhou) Co., Ltd. 製造商(3): RFTech Bac Ninh Co., Ltd. 製造商(4): XIN XIN ELECTRONICS Co., Ltd. 製造商(5): RFTECH(TIANJIN) ELECTRONICS Co., Ltd. 製造商(6): RFTECH Co., Ltd. 證書號碼：CI33806475J283 黑色/白色
電源供應器(4)	SAMSUNG	EP-TA800 (本型式係使用變壓器型號為 A800)	INPUT　：100-240 VAC, 50-60 Hz, 0.7 A OUTPUT： (PDO) 5.0 VDC, 3.0 A or 9.0 VDC, 2.77 A (PPS) 5.9 VDC, 3.0 A or 11.0 VDC, 2.25 A 製造商(1): Dongguan Yingju Power Co., Ltd. 製造商(2): Dongguan Solum Electronics Co., Ltd. 製造商(3): Dongguan City Yingju Electronics Co. Ltd. 製造商(4): SOLUM VINA COMPANY LIMITED 證書號碼：CI33806475J791 黑色/白色
USB Cable(1)	SAMSUNG	EP-DG980BBE	Type-C → Type-C Shielded, 1.0 m
USB Cable(2)	SAMSUNG	EP-DN980BBE	Type-C → Type-C Shielded, 1.0 m
USB Cable(3)	SAMSUNG	EP-DG980BWE	Type-C → Type-C Shielded, 1.0 m
USB Cable(4)	SAMSUNG	EP-DN980BWE	Type-C → Type-C Shielded, 1.0 m
耳機麥克風	SAMSUNG	EO-IG955	Non-Shielded, 1.2 m 黑色/白色

4. Introduction

The A Test Lab Techno Corp. has performed measurements of the maximum potential exposure to the user. The test procedures, as described in IEC 62209-1 / CNS14959 / PLMN ALL were employed and they specify the maximum exposure limit of 2.0W/kg as averaged over any 10 gram of tissue. A description of the product and operating configuration, detailed summary of the test results, methodology and procedures used in the equipment are included within this test report.

5. SAR Definition

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

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

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

SAR measurement can be related to the electrical field in the tissue by

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

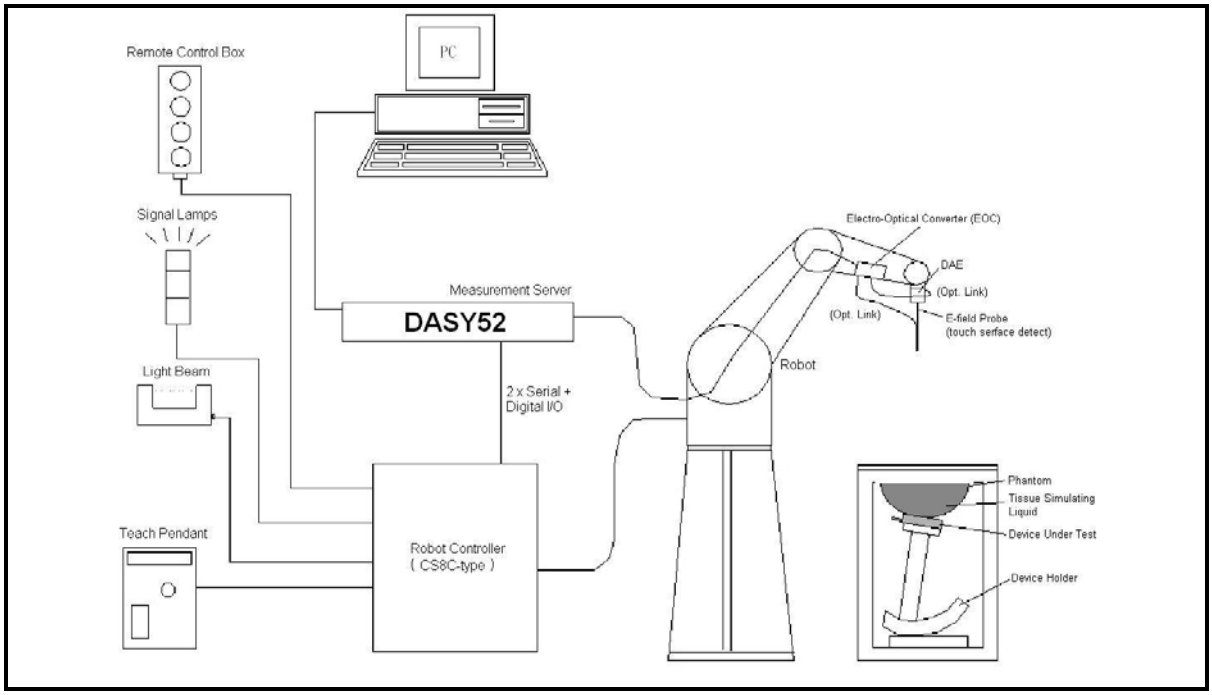
Where：

σ = conductivity of the tissue (S/m)

ρ = mass density of the tissue (kg/m3)

E = RMS electric field strength (V/m)

6. SAR Measurement Setup



The DASY52 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli TX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
6. A computer operating Windows 7 or Windows 8.
7. DASY52 software.
8. Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
9. The SAM twin phantom enabling testing left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. Validation dipole kits allowing validating the proper functioning of the system.

7. System Components

7.1 DASY E-Field Probe System

The SAR measurements were conducted with the dosimetric probe (manufactured by SPEAG), designed in the classical triangular configuration〔3〕and optimized for dosimetric evaluation. The probes is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.

7.1.1 E-Field Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	±0.3 dB in brain tissue (rotation around probe axis) ±0.5 dB in brain tissue (rotation normal probe axis)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Calibration	ISO/IEC 17025 calibration service available

EX3DV4 E-Field Probe

Probe setup on robot

7.2 Data Acquisition Electronic (DAE) System

Model	DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4 mV, 400 mV)	
Input Offset Voltage	< 5 µV (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

7.3 Robot

Positioner	Stäubli Unimation Corp.	
Robot Model	TX90XL	
Number of Axes	6	
Norminal Load	5 kg	
Reach	1450 mm	
Repeatability	± 0.035 mm	

7.4 Measurement Server

Processor	Stäubli Unimation Corp.	
I/O-board	TX90XL	
Number of Axes	Link to DAE4 16-bit A/D converter for surface detection system Digital I/O interface Serial link to robot Direct emergency stop output for robot	

7.5 Device Holder

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

Device Holder 1	Device Holder 2

7.6 Phantom - SAM v4.0

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It 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 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 with the robot.

Shell Thickness	2 ±0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	1000×500 mm (L×W)

Table 1. Specification of SAM v4.0

8. Test Equipment List

Testing Engineer: Jason Tsao

Brand	Name of Equipment	Type/Model	Serial Number	Calibration	
				Cal. Date	Cal.Period
SPEAG	750MHz System Validation Kit	D750V3	1004	2020/09/17	1 year
SPEAG	900MHz System Validation Kit	D900V2	073	2020/05/08	1 year
SPEAG	1800MHz System Validation Kit	D1800V2	265	2020/04/28	1 year
SPEAG	1950MHz System Validation Kit	D1950V3	1117	2020/04/28	1 year
SPEAG	2600MHz System Validation Kit	D2600V2	1007	2020/09/29	1 year
SPEAG	3300MHz System Validation Kit	D3300V2	1004	2020/04/30	1 year
SPEAG	3500MHz System Validation Kit	D3500V2	1013	2020/04/24	1 year
SPEAG	Dosimetric E-Field Probe	EX3DV4	3847	2020/05/20	1 year
SPEAG	Data Acquisition Electronics	DAE4	541	2020/03/18	1 year
SPEAG	Measurement Server	SE UMS 011 AA	1025	NCR	
SPEAG	Device Holder	N/A	N/A	NCR	
SPEAG	Phantom	SAM V4.0	TP-1009	NCR	
SPEAG	Robot	Staubli TX90XL	F16/54FTA1/A/01	NCR	
SPEAG	Software	DASY52 V52.10 (3)	N/A	NCR	
SPEAG	Software	SEMCAD X V14.6.10(7331)	N/A	NCR	
R&S	Wireless Communication Test Set	CMU200	112387	2020/05/15	1 year
Anritsu	Radio Communication Analyzer	MT8820C	6201342039	2019/12/11	1 year
Keysight	UXM 5G Wireless Test Platform	E7515B	MY59321574	2019/12/04	1 year
R&S	Wideband Radio Communication Tester	CMW500	103168	2019/11/13	1 year
SPEAG	Network Analyzer	DAKS_VNA R140	0010318	2020/05/26	1 year
SPEAG	Dielectric Probe Kit	DAKS-3.5	1101	2020/05/26	1 year
HILA	Digital Thermometer	TM-906A	1500033	2020/10/28	1 year
Agilent	Power Sensor	8481H	3318A20779	2020/06/09	1 year
Agilent	Power Meter	EDM Series E4418B	GB40206143	2020/06/09	1 year
Agilent	Signal Generator	E8257D	MY44320425	2020/03/04	1 year
Agilent	Dual Directional Coupler	778D	50334	NCR	
Woken	Dual Directional Coupler	0100AZ20200801O	11012409517	NCR	
Mini-Circuits	Power Amplifier	EMC014225P	980292	NCR	
Mini-Circuits	Power Amplifier	EMC2830P	980293	NCR	
Aisi	Attenuator	IEAT 3dB	N/A	NCR	

Table 2. Test Equipment List

9. *Tissue Simulating Liquids*

The Head and Muscle mixtures consist of a viscous gel using hydroxethylcellullouse (HEC) gelling agent and saline solution. Preservation with a bacteriacide is added and visual inspection is made to ensure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an 85070C Dielectric Probe Kit and an E5071B Network Analyzer.

Ingredient	Frequency					
	HSL750 - Head	HSL900 - Head	HSL1800 - Head	HSL1950 - Head	HSL2600 - Head	HSL3500 - Head
Water	49.23 %	51.07 %	54.88 %	55.27 %	55.67 %	71.8 %
HEC	0.27 %	0.23 %	0 %	0 %	0 %	0 %
Sugar	48.93 %	47.31 %	0 %	0 %	0 %	0 %
Preventol	0.29 %	0.24 %	0 %	0 %	0 %	0 %
Salt	1.28 %	1.15 %	0.21 %	0.26 %	0.29 %	0 %
Glycol monobutyl	0 %	0 %	44.91 %	44.47 %	44.04 %	44.04 %
Triton X-100	0 %	0 %	0 %	0 %	0 %	20.0 %
DGBE	0 %	0 %	44.50 %	44.50 %	45.10 %	8.0 %

Table 3. Recipes for Head Tissue Simulating Liquids

Target Frequency	Head	
(MHz)	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 - 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5800	35.3	5.27
(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)		

Table 4. Tissue dielectric parameters for head phantoms

10. Measurement Process

10.1 Device and Test Conditions

The device was put in operation using the **R&S CMU200 or Agilent E5515C (8960) wireless Communication Test Set**. Communication between device and tester was established by air-link in order to simulate the actual usage as close as possible. The spatial peak SAR values were assessed for the lowest, middle and highest channels defined by **PGSM 900** (#01=890.2 MHz, #62=902.4 MHz, #124=914.8 MHz) and **WCDMA BAND 1** (#9612=1922.4 MHz, #9750=1950.0 MHz, #9888=1977.6 MHz) and **WCDMA BAND 8** (#2737= 887.4 MHz, #2800= 900.0 MHz, #2863= 912.6 MHz)systems. Power level was set to its maximum, i.e., **PGSM 900** nominal maximum output power class 4 (PCL 5, 33 dBm) and **WCDMA BAND 1** nominal maximum output power class 3 and **WCDMA BAND 8** nominal maximum output power class 3 . These parameters will need to be replaced for the individual phone tested. All SAR measurements for LTE were performed using the **Anritsu MT8820C**. A closed loop power control setting allowed the UE to transmit at the maximum output power during the SAR measurements. Configure the base station to support LTE tests, and set channel, RB allocation number, RB allocation offset, and send continuously up power control commands to the device. MPR was enabled for this device. A-MPR was disabled for all SAR test measurements.

All SAR measurements 5G NR were performed using the **UXM**. A closed loop power control setting allowed the UE to transmit at the maximum output power during the SAR measurements. Configure the base station to support LTE tests, and set channel, RB allocation number, RB allocation offset, and send continuously up power control commands to the device. MPR was enabled for this device. A-MPR was disabled for all SAR test measurements**.**

10.2 System Performance Check

10.2.1 Symmetric Dipoles for System Validation

Construction	Symmetrical dipole with l/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Return Loss	> 20 dB at specified verification position
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request

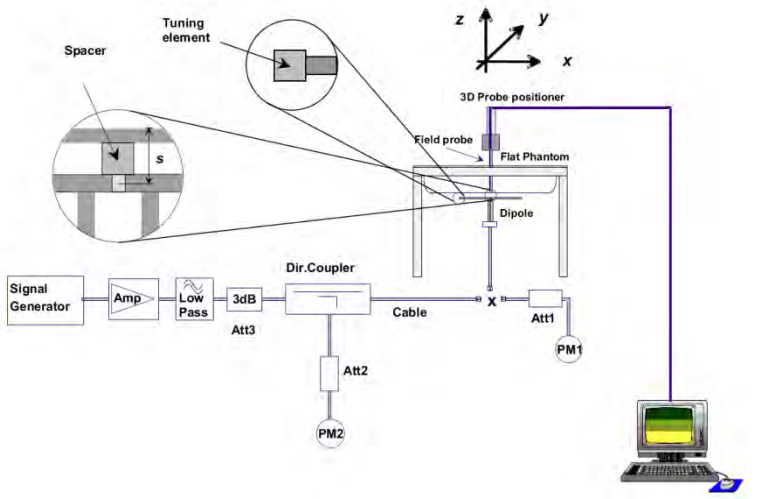


Figure 1. System Verification Setup Diagram

Figure 2. Validation Kit

10.2.2 Validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ± 10 %.

Mixture Type	Frequency (MHz)	Power	Probe	Dipole	SAR_{1g} (W/Kg)	Normalize to 1 Watt 1 g (W/Kg)	1 W Target SAR_{1g} (W/Kg)	SAR_{10g} (W/Kg)	Normalize to 1 Watt 10 g (W/Kg)	1 W Target SAR_{10g} (W/Kg)	Difference percentage 1 g	Difference percentage 10 g	Date
			Model / Serial No.	Model / Serial No.									
Head	750	250 mW	EX3DV4-SN3847	D750V3 – SN1004	2.16	8.64	8.37	1.38	5.52	5.48	3.2%	0.7%	Nov. 02, 2020
Head	900	250 mW	EX3DV4-SN3847	D900V2 – SN073	2.65	10.6	11.20	1.69	6.76	7.33	-5.4%	-7.8%	Nov. 01, 2020
Head	1800	250 mW	EX3DV4-SN3847	D1800V2 – SN265	9.46	37.84	38.80	5.02	20.08	20.20	-2.5%	-0.6%	Oct. 31, 2020
Head	1950	250 mW	EX3DV4-SN3847	D1950V3 – SN1117	9.33	37.32	40.00	4.79	19.16	20.30	-6.7%	-5.6%	Oct. 31, 2020
Head	2600	250 mW	EX3DV4-SN3847	D2600V2 – SN1007	14.1	56	57.30	6.22	24.88	25.90	-1.6%	-3.9%	Nov. 03, 2020
Head	3300	100 mW	EX3DV4-SN3847	D3300V2 – SN1004	6.44	64.4	66.40	2.39	23.9	25.60	-3.0%	-6.6%	Nov. 04, 2020
Head	3500	100 mW	EX3DV4-SN3847	D3500V2 – SN1013	6.31	63.1	66.70	2.29	22.9	25.10	-5.4%	-8.8%	Nov. 04, 2020

10.3 Dosimetric Assessment Setup

10.3.1 Handset Test Position - Head Position

1. Specifies two handset test positions against the head phantom – the "Cheek" position and the "Tilt" position. The DUT shall be tested in both of these positions on the left and right sides of the SAM phantom. In some cases (e.g. asymmetric handsets) the DUT positioning procedures representing intended use conditions cannot be used.
2. The cheek position is established as follows:
   (a) Configure the DUT for talk operation, if necessary. For example, for a DUT with a flip, swivel or slide cover piece, open the cover if this is consistent with talk operation. If the DUT can also be used with the cover closed, both configurations shall be tested.
   (b) Define two imaginary lines on the DUT, the vertical centreline and the horizontal line, for the DUT in vertical orientation as shown in figure as below. The vertical centreline passes through two points on the front side of the DUT: the midpoint of the width wt of the handset at the level of the acoustic output (Point A), and the midpoint of the width wb at the bottom of the handset (Point B). The horizontal line is perpendicular to the vertical centreline and passes through the centre of the acoustic output. The two lines intersect at Point A.
   (c) Position the DUT close to the surface of the phantom such that Point A is on the (virtual) extension of the line passing through Points RE (right ear) and LE (left ear) on the phantom. The plane defined by the vertical centreline and the horizontal line of the DUT shall be parallel to the sagittal plane of the phantom.
   (d) Translate the DUT towards the phantom along the line passing through RE and LE until the handset touches the ear.
   (e) Rotate the DUT around its vertical centreline until the plane defined by the DUT vertical centreline and horizontal line is parallel to the N-F line, and then translate the DUT towards the phantom along the LE-RE line until DUT Point A touches the ear at the ERP (ear reference point).
   (f) While keeping Point A on the line passing through RE and LE and maintaining the DUT in contact with the pinna, rotate the handset about the line N-F until any point on the DUT is in contact with a phantom point below the pinna (cheek). The physical angles of rotation shall be documented.
   (g) While keeping DUT Point A in contact with the ERP, rotate the handset around a line perpendicular to the plane defined by the DUT vertical centreline and horizontal line and passing through DUT Point A, until the DUT vertical centreline is in the reference plane.

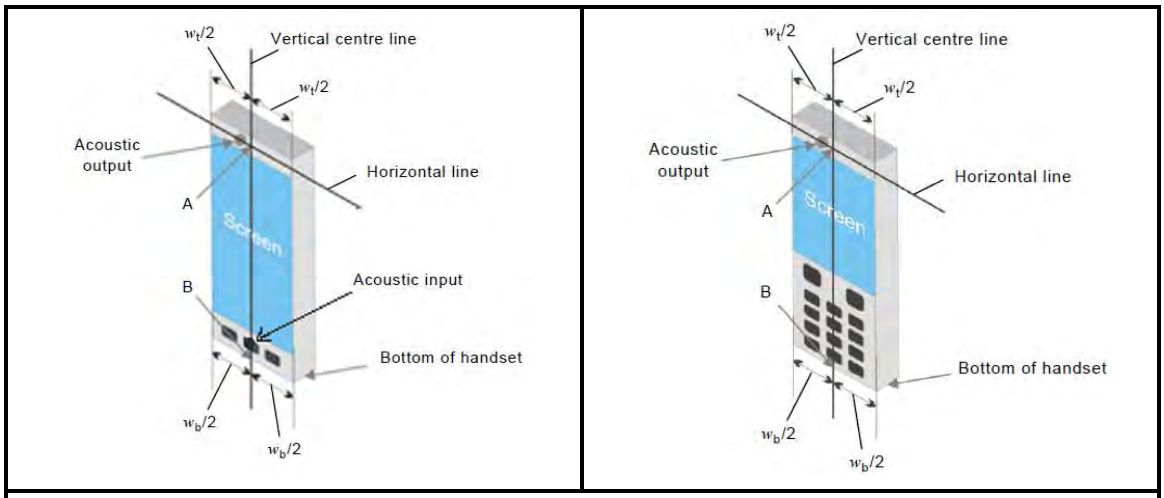


Figure - Vertical and horizontal reference lines and reference Points A, B on two example device types: a full touch screen smart phone (top) and a keyboard handset (bottom).

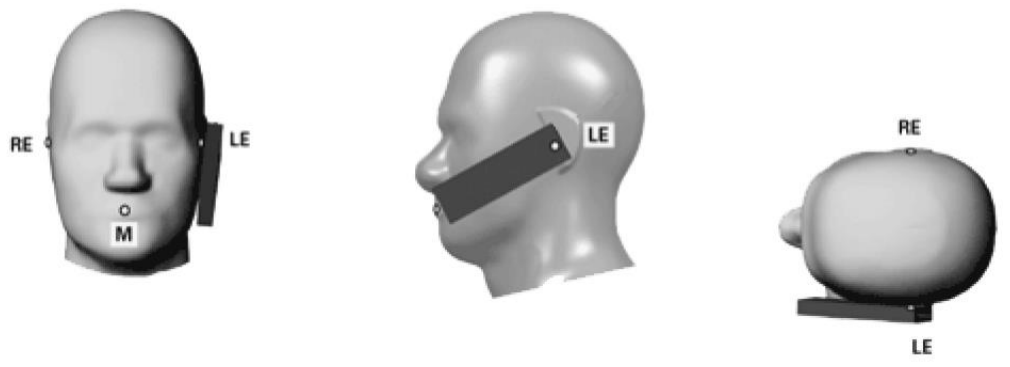


Figure - The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

3. The Tilt position is established as follows:
   (a) Repeat Steps (a) to (g) of cheek procedure to place the DUT in the cheek position.
   (b) While maintaining the orientation of the DUT, move the DUT away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
   (c) Rotate the DUT around the horizontal line by 15°.
   (d) While maintaining the orientation of the DUT, move the DUT towards the phantom on a line passing through RE and LE until any part of the DUT touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g. extended antenna on the back of the phantom head, the angle of the DUT shall be reduced. In this case, the tilt position is obtained if any part of the DUT is in contact with the pinna and a second part of the DUT is in contact with the phantom, e.g. the antenna with the back of the head.

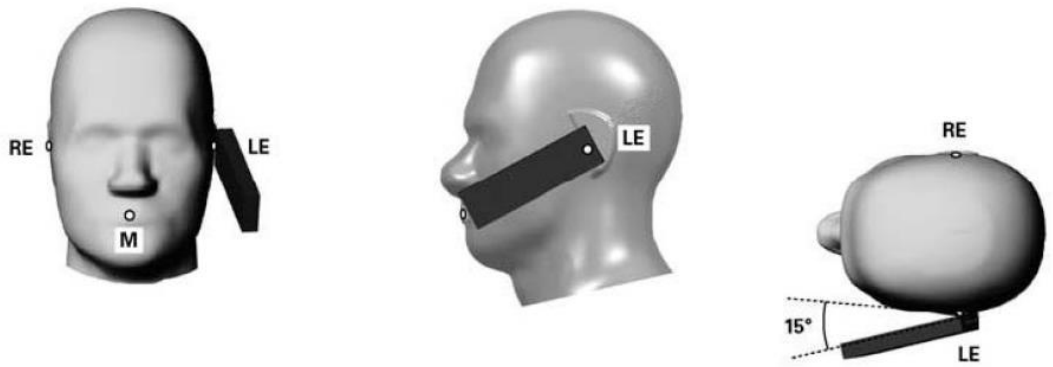


Figure - Tilt position of the wireless device on the left side of SAM.

10.3.2 Measurement Procedures

The evaluation was performed with the following procedures：

Surface Check：

A surface checks job gathers data used with optical surface detection. It determines the distance from the phantom surface where the reflection from the optical detector has its peak. Any following measurement jobs using optical surface detection will then rely on this value. The surface check performs its search a specified number of times, so that the repeatability can be verified.

Reference：

The reference job measures the field at a specified reference position, at 2 mm from the selected section's grid reference point.

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 can find the maximum locations even in relatively coarse grids. When an area scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. Any following zoom scan within the same procedure will then perform fine scans around these maxima. The area covered the entire dimension of the EUT and the horizontal grid spacing was 15 mm × 15 mm.

Zoom Scan：

Zoom scans are used to assess the highest averaged SAR for cubic averaging volumes with 1 g and 10 g of simulated tissue. The zoom scan measures 5 x 5 x 7 points in a 32 x 32 x 30 mm cube whose base faces are centered around the maxima returned from a preceding area scan within the same procedure.

Drift：

The drift job measures the field at the same location as the most recent reference job within the same procedure, with the same settings. The drift measurement gives the field difference in dB from the last reference measurement. Several drift measurements are possible for each reference measurement. This allows monitoring of the power drift of the device in the batch process.If the value changed by more than 5 %, the evaluation was repeated.

10.4 Spatial Peak SAR Evaluation

The DASY52 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the Draft: SCC-34, SC-2, WG-2 - Computational Dosimetry, IEEE P1529/D0.0 (Draft Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) Associated with the Use of Wireless Handsets - Computational Techniques), a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.

The base for the evaluation is a ”cube” measurement in a volume of (32x32x30) mm3 (5x5x7 points). The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10 g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location.

The entire evaluation of the spatial peak values is performed within the Postprocessing engine (SEMCAD). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into three stages:

Interpolation and Extrapolation

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7 mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.

In DASY52, the choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and SAR extrapolation routines. The interpolation, Maxima Search and extrapolation routines are all based on the modified Quadratic Shepard’s method [7].

11. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR to be less than ± 30 %〔8〕.

According to Std. C95.3〔9〕, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ±1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ±2 dB can be expected.

According to CENELEC〔10〕, typical worst-case uncertainty of field measurements is ±5 dB. For well-defined modulation characteristics the uncertainty can be reduced to ±3 dB.

Decision Rule

■ Uncertainty is not included.

□ Uncertainty is included.

IEEE 1528-2013 & IEC 62209-1 Measurement uncertainty evaluation template for handset SAR test (300 MHz~3 GHz)								
Uncertainty component	**Tol.**	**Prob. Dist.**	**Div.**	**C_i - 1g**	**C_i - 10g**	**u_i - 1g (± %)**	**u_i - 10g (± %)**	**v_i**
Measurement system								
Probe calibration	6.1	N	1	1	1	6.1	6.1	∞
Axial isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9	∞
Hemispherical isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9	∞
Boundary effect	1.0	R	1.732	1	1	0.6	0.6	∞
Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
System detection limits	0.25	R	1.732	1	1	0.1	0.1	∞
Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
Response time	0.0	R	1.732	1	1	0.0	0.0	∞
Integration time	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Positioner	0.02	R	1.732	1	1	0.01	0.01	∞
Probe Positioning	0.4	R	1.732	1	1	0.2	0.2	∞
Max. SAR evaluation	2.0	R	1.732	1	1	1.2	1.2	∞
Test sample related								
Test sample positioning	2.9	N	1	1	1	2.9	2.9	145
Device holder uncertainty	3.6	N	1	1	1	3.6	3.6	7
SAR drift measurement	5.0	R	1.732	1	1	2.9	2.9	∞
Phantom and tissue parameters								
Phantom shell uncertainty	6.1	R	1.732	1	1	3.5	3.5	∞
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0	∞
Liquid Conductivity (measurement)	4.8	R	1.732	0.78	0.71	2.2	2.0	∞
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8	∞
Liquid Permittivity (measurement)	4.8	R	1.732	0.23	0.26	0.6	0.7	∞
Combined standard uncertainty								
-	-	RSS	-	-	-	11.2	11.2	642
Expanded uncertainty (95% confidence interval)								
-	-	k =2	-	-	-	22.4	22.3	-

IEEE 1528-2013 & IEC 62209-1 Measurement uncertainty evaluation template for SAR test (3 GHz~6 GHz)								
Uncertainty component	**Tol.**	**Prob. Dist.**	**Div.**	**C_i - 1g**	**C_i - 10g**	**u_i - 1g (± %)**	**u_i - 10g (± %)**	**v_i**
Measurement system								
Probe calibration	6.7	N	1	1	1	6.7	6.7	∞
Axial isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9	∞
Hemispherical isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9	∞
Boundary effect	2.0	R	1.732	1	1	1.2	1.2	∞
Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
System detection limits	0.25	R	1.732	1	1	0.1	0.1	∞
Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
Response time	0.0	R	1.732	1	1	0.0	0.0	∞
Integration time	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Positioner	0.04	R	1.732	1	1	0.02	0.02	∞
Probe Positioning	0.8	R	1.732	1	1	0.5	0.5	∞
Max. SAR evaluation	4.0	R	1.732	1	1	2.3	2.3	∞
Test sample related								
Test sample positioning	2.9	N	1	1	1	2.9	2.9	145
Device holder uncertainty	3.6	N	1	1	1	3.6	3.6	7
SAR drift measurement	5.0	R	1.732	1	1	2.9	2.9	∞
Phantom and tissue parameters								
Phantom shell uncertainty	6.6	R	1.732	1	1	3.8	3.8	∞
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0	∞
Liquid Conductivity (measurement)	4.8	R	1.732	0.78	0.71	2.2	2.0	∞
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8	∞
Liquid Permittivity (measurement)	4.8	R	1.732	0.23	0.26	0.6	0.7	∞
Combined standard uncertainty								
-	-	RSS	-	-	-	11.9	11.8	804
Expanded uncertainty (95% confidence interval)								
-	-	k =2	-	-	-	23.7	23.6	-

12. SAR Test Results Summary

12.1 Test Results

PGSM 900 MHz SAR Test Results - Head							
Frequency		Test Mode	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz						
62	902.4	Voice	Right-Cheek	0	0.042	0.042	---
1	890.2	Voice	Right-Cheek	0	0.058	0.058	---
124	914.8	Voice	Right-Cheek	0	0.052	0.052	
62	902.4	Voice	Right-Tilted	0	0.017	0.017	
62	902.4	Voice	Left-Cheek	0	0.028	0.028	
62	902.4	Voice	Left-Tilted	0	0.018	0.018	
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959				Head 2.0 W/kg Averaged over 10 gram			

WCDMA Band 1 SAR Test Results - Head							
Frequency		Modulation or Sub-Test	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz						
9750	1950	RMC12.2K	Right-Cheek	0	0.041	0.041	---
9750	1950	RMC12.2K	Right-Tilted	0	0.019	0.019	---
9750	1950	RMC12.2K	Left-Cheek	0	0.046	0.046	---
9612	1922.4	RMC12.2K	Left-Cheek	0	0.045	0.045	---
9888	1977.6	RMC12.2K	Left-Cheek	0	0.048	0.048	---
9750	1950	RMC12.2K	Left-Tilted	0	0.025	0.025	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959				Head 2.0 W/kg Averaged over 10 gram			

WCDMA Band 8 SAR Test Results - Head							
Frequency		Modulation or Sub-Test	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz						
2800	900.0	RMC12.2K	Right-Cheek	0	0.076	0.076	---
2737	887.4	RMC12.2K	Right-Cheek	0	0.089	0.089	---
2863	912.6	RMC12.2K	Right-Cheek	0	0.082	0.082	---
2800	900.0	RMC12.2K	Right-Tilted	0	0.031	0.031	---
2800	900.0	RMC12.2K	Left-Cheek	0	0.051	0.051	---
2800	900.0	RMC12.2K	Left-Tilted	0	0.033	0.033	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959				Head 2.0 W/kg Averaged over 10 gram			

LTE Band 1 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
18300	1950.0	5M	QPSK	8	17	Right-Cheek	0	0.038	0.038	---
18300	1950.0	5M	QPSK	8	17	Right-Tilted	0	0.026	0.026	---
18300	1950.0	5M	QPSK	8	17	Left-Cheek	0	0.056	0.056	---
18025	1922.5	5M	QPSK	8	17	Left-Cheek	0	0.049	0.049	---
18575	1977.5	5M	QPSK	8	17	Left-Cheek	0	0.051	0.051	---
18300	1950.0	5M	QPSK	8	17	Left-Tilted	0	0.021	0.021	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 3 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
19575	1747.5	20M	QPSK	18	0	Right-Cheek	0	0.071	0.071	---
19575	1747.5	20M	QPSK	18	0	Right-Tilted	0	0.052	0.052	---
19575	1747.5	20M	QPSK	18	0	Left-Cheek	0	0.117	0.117	---
19300	1720.0	20M	QPSK	18	0	Left-Cheek	0	0.106	0.106	---
19850	1775.0	20M	QPSK	18	0	Left-Cheek	0	0.098	0.098	---
19575	1747.5	20M	QPSK	18	0	Left-Tilted	0	0.044	0.044	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 7 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
21100	2535.0	20M	QPSK	18	82	Right-Cheek	0	0.027	0.027	---
21100	2535.0	20M	QPSK	18	82	Right-Tilted	0	0.025	0.025	---
21100	2535.0	20M	QPSK	18	82	Left-Cheek	0	0.028	0.028	---
20850	2510.0	20M	QPSK	18	82	Left-Cheek	0	0.029	0.029	---
21350	2560.0	20M	QPSK	18	82	Left-Cheek	0	0.027	0.027	---
21100	2535.0	20M	QPSK	18	82	Left-Tilted	0	0.015	0.015	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 8 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
21650	900.0	5M	QPSK	1	24	Right-Cheek	0	0.072	0.072	---
21525	887.5	5M	QPSK	1	24	Right-Cheek	0	0.084	0.084	---
21775	912.5	5M	QPSK	1	24	Right-Cheek	0	0.077	0.077	---
21650	900.0	5M	QPSK	1	24	Right-Tilted	0	0.029	0.029	---
21650	900.0	5M	QPSK	1	24	Left-Cheek	0	0.048	0.048	---
21650	900.0	5M	QPSK	1	24	Left-Tilted	0	0.031	0.031	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 28 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
27510	733.0	20M	QPSK	18	82	Right-Cheek	0	0.150	0.150	---
27460	728.0	20M	QPSK	18	82	Right-Cheek	0	0.128	0.128	---
27560	738.0	20M	QPSK	18	82	Right-Cheek	0	0.138	0.138	---
27510	733.0	20M	QPSK	18	82	Right-Tilted	0	0.052	0.052	---
27510	733.0	20M	QPSK	18	82	Left-Cheek	0	0.086	0.086	---
27510	733.0	20M	QPSK	18	82	Left-Tilted	0	0.056	0.056	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 38 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
38000	2595.0	20M	QPSK	1	99	Right-Cheek	0	0.012	0.012	---
38000	2595.0	20M	QPSK	1	99	Right-Tilted	0	0.011	0.011	---
38000	2595.0	20M	QPSK	1	99	Left-Cheek	0	0.013	0.013	---
37850	2580.0	20M	QPSK	1	99	Left-Cheek	0	0.0119	0.012	---
38150	2610.0	20M	QPSK	1	99	Left-Cheek	0	0.008	0.008	---
38000	2595.0	20M	QPSK	1	99	Left-Tilted	0	0.012	0.012	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE Band 41 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
40640	2595.0	20M	QPSK	1	99	Right-Cheek	0	0.013	0.013	---
40640	2595.0	20M	QPSK	1	99	Right-Tilted	0	0.012	0.012	---
40640	2595.0	20M	QPSK	1	99	Left-Cheek	0	0.012	0.012	---
39790	2510.0	20M	QPSK	1	99	Left-Cheek	0	0.015	0.015	---
41490	2680.0	20M	QPSK	1	99	Left-Cheek	0	0.014	0.014	---
40640	2595.0	20M	QPSK	1	99	Left-Tilted	0	0.012	0.012	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE 5G NR n1 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
390000	1950	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.008	0.008	---
390000	1950	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Tilted	0	0.006	0.006	---
390000	1950	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Cheek	0	0.01	0.010	---
385500	1927.5	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Cheek	0	0.013	0.013	---
394500	1972.5	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Cheek	0	0.019	0.019	---
390000	1950	15M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Tilted	0	0.004	0.004	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959						Head 2.0 W/kg Averaged over 10 gram				

LTE 5G NR n28 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
145100	725.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.047	0.047	---
141100	705.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.049	0.049	---
149100	745.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.053	0.053	---
145100	725.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Tilted	0	0.018	0.018	---
145100	725.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Cheek	0	0.043	0.043	---
145100	725.5	5M	15K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Tilted	0	0.028	0.028	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959					Head 2.0 W/kg Averaged over 10 gram					

LTE 5G NR n78 SAR Test Results - Head										
Frequency		Bandwidth (MHz)	Modulation	RB Size	RB Offset	Test Position	Spacing (mm)	SAR_{10g} (W/kg)	Reported SAR_{10g}	Note
Ch.	MHz									
629000	3435	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.077	0.077	---
621668	3325.02	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.062	0.062	---
636332	3544.98	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Cheek	0	0.069	0.069	---
629000	3435	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Right-Tilted	0	0.015	0.015	---
629000	3435	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Cheek	0	0.051	0.051	---
629000	3435	50M	30K-DFT-s-OFDM-PI/2B PSK	1	1	Left-Tilted	0	0.011	0.011	---
Safety Limit / Spatial Peak European Council Recommendation 1999 519 EC NCC CNS14959					Head 2.0 W/kg Averaged over 10 gram					

12.2 European Council Recommendation 1999 519 EC

Depending on frequency, the following physical quantities (dosimetric / exposimetric quantities) are used to specify the basic restrictions on electromagnetic fields：

∗ between 0 and 1 Hz basic restrictions are provided for magnetic flux density for static magnetic fields (0 Hz) and current density for time-varying fields up to 1 Hz, in order to prevent effects on the cardiovascular and central nervous system,

∗ between 1Hz and 10 MHz basic restrictions are provided for current density to prevent effects on nervous system functions,

∗ Between 100 kHz and 10 GHz basic restrictions on SAR are provided to prevent whole-body heat stress and excessive localized heating of tissues. In the range 100 kHz to 10 MHz, restrictions on both current density and SAR are provided,

∗ Between 10 GHz and 300 GHz basic restrictions on power density are provided to prevent heating in tissue at or near the body surface.

Frequency Range	Magnetic flux density (mT)	Current density (mA/m^2) (rms)	Whole body average SAR (W/kg)	Localized SAR (head and trunk) (W/kg)	Localized SAR (limbs) (W/kg)	Power density, S (W/m^2)
0	40	-----	-----	-----	-----	-----
> 0 - 1 Hz	-----	8	-----	-----	-----	-----
1 - 4 Hz	-----	8/f	-----	-----	-----	-----
4 - 1000 Hz	-----	2	-----	-----	-----	-----
1000 Hz -100 kHz	-----	f/500	-----	-----	-----	-----
100 kHz - 10 MHz	-----	f/500	0.08	2	4	-----
10 MHz - 10 GHz	-----	-----	0.08	2	4	-----
10 - 300 GHz	-----	-----	-----	-----	-----	10

Table 5. Reference levels for electric, magnetic and electromagnetic fields
(0Hz to 300GHz, unperturbed RMS values)

13. Conclusion

The SAR test values found for the portable mobile phone are below the maximum recommended level of 2.0 W/kg (W/kg).

14. References

[1] Std. C95.1-2005, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz",* New York: IEEE, Aug. 1992.

[2] NCRP, National Council on Radiation Protection and Measurements, "*Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields"*, NCRP report NO. 86, 1986.

[3] T. Schmid, O. Egger, and N. Kuster, "*Automatic E-field scanning system for dosimetric assessments*", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.

[4] K. Pokovi ć, T. Schmid, and N. Kuster, "*Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency*", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.

[5] K. Pokovi ć, T. Schmid, and N. Kuster, "*E-field probe with improved isotropy in brain simulating liquids*", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.

[6] N. Kuster, and Q. Balzano, "*Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz"*, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[7] Robert J. Renka, "*Multivariate Interpolation Of Large Sets Of Scattered Data*", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.

[8] N. Kuster, R. Kastle, T. Schmid, *Dosimetric evaluation of mobile communications equipment with known precision*, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[9] Std. C95.3-1991, "*IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave,* New York: IEEE, Aug. 1992.

[10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), *Human Exposure to Electromagnetic Fields High-frequency*: 10 KHz-300GHz, Jan. 1995.

Appendix A - System Performance Check

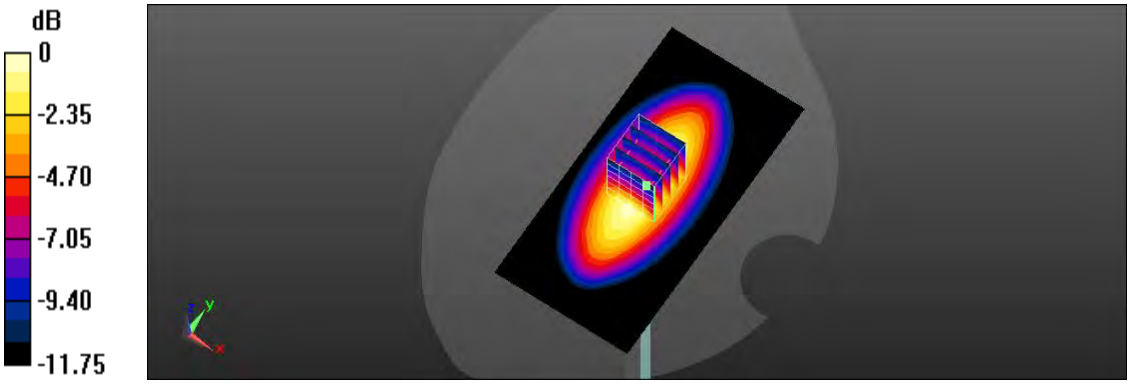
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/2
System Performance Check at 750MHz_Head
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1004

Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.899 S/m; ε_r = 42.674; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.54, 9.54, 9.54) @ 750 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 750MHz/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.94 W/kg

System Performance Check at 750MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 58.28 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 3.41 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.38 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 63.1%
Maximum value of SAR (measured) = 2.97 W/kg



0 dB = 2.97 W/kg = 4.73 dBW/kg

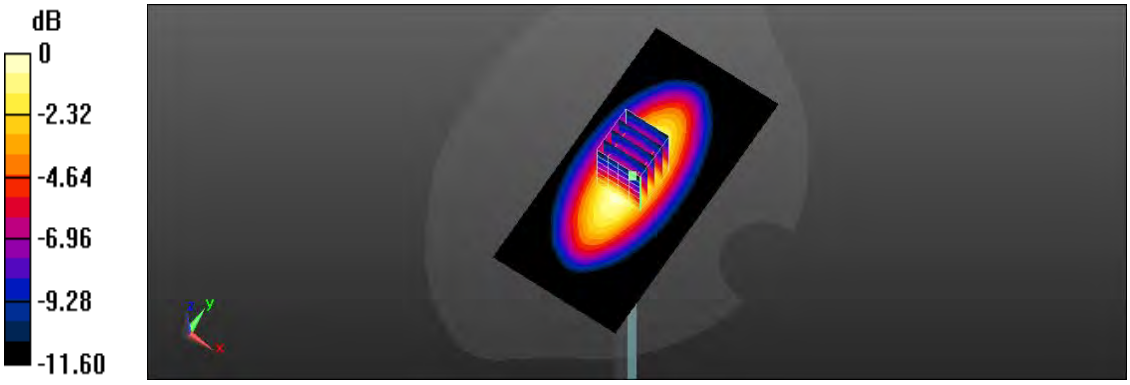
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/1
System Performance Check at 900MHz_Head
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:073

Communication System: UID 0, CW (0); Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 0.97 S/m; ε_r = 41.626; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.3, 9.3, 9.3) @ 900 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 900MHz/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.63 W/kg

System Performance Check at 900MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 62.08 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 4.21 W/kg
SAR(1 g) = 2.65 W/kg; SAR(10 g) = 1.69 W/kg
Smallest distance from peaks to all points 3 dB below = 17.6 mm
Ratio of SAR at M2 to SAR at M1 = 62.7%
Maximum value of SAR (measured) = 3.65 W/kg



0 dB = 3.65 W/kg = 5.62 dBW/kg

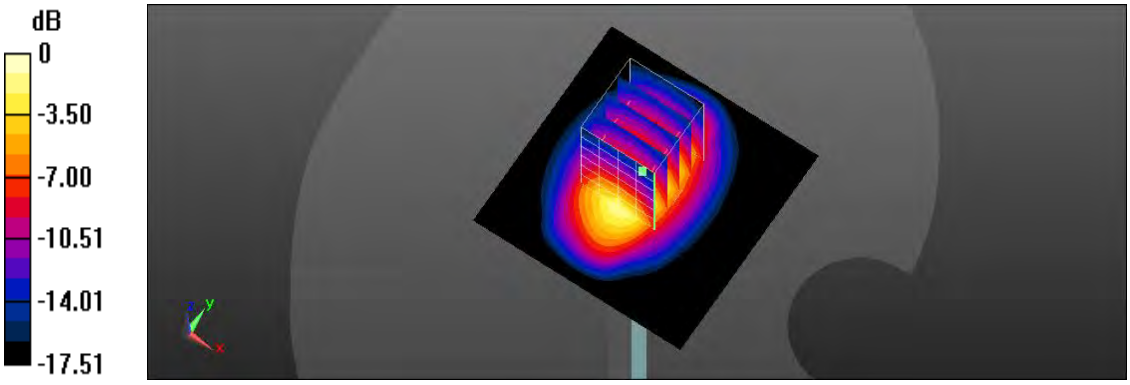
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
System Performance Check at 1800MHz_Head
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:265

Communication System: UID 0, CW (0); Frequency: 1800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1800 MHz; σ = 1.422 S/m; ε_r = 40.456; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(8.14, 8.14, 8.14) @ 1800 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 1800MHz/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.4 W/kg

System Performance Check at 1800MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 97.07 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.46 W/kg; SAR(10 g) = 5.02 W/kg
Smallest distance from peaks to all points 3 dB below = 10.7 mm
Ratio of SAR at M2 to SAR at M1 = 54.3%
Maximum value of SAR (measured) = 14.5 W/kg



0 dB = 14.5 W/kg = 11.61 dBW/kg

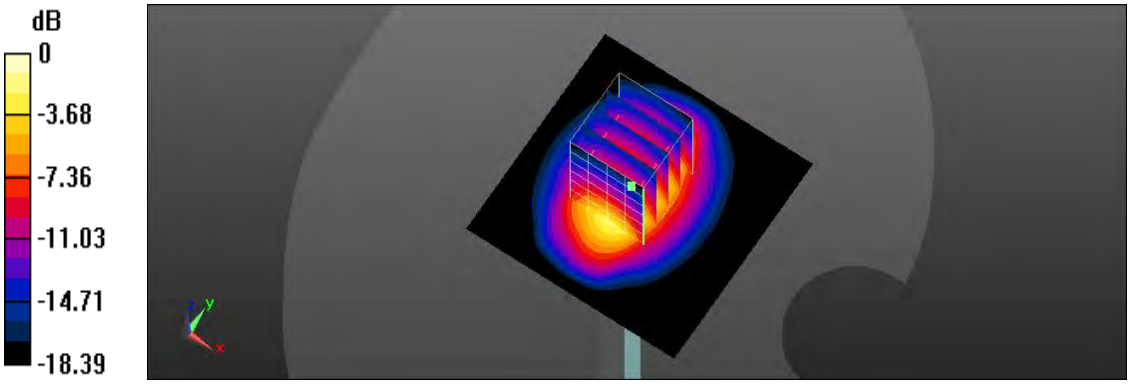
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
System Performance Check at 1950MHz_Head
DUT: Dipole 1950 MHz; Type: D1950V3; Serial: D1950V3 - SN:1117

Communication System: UID 0, CW (0); Frequency: 1950 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1950 MHz; σ = 1.39 S/m; ε_r = 39.837; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.78, 7.78, 7.78) @ 1950 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 1950MHz/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.5 W/kg

System Performance Check at 1950MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.25 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 9.33 W/kg; SAR(10 g) = 4.79 W/kg
Smallest distance from peaks to all points 3 dB below = 9.7 mm
Ratio of SAR at M2 to SAR at M1 = 52.3%
Maximum value of SAR (measured) = 14.8 W/kg



0 dB = 14.8 W/kg = 11.70 dBW/kg

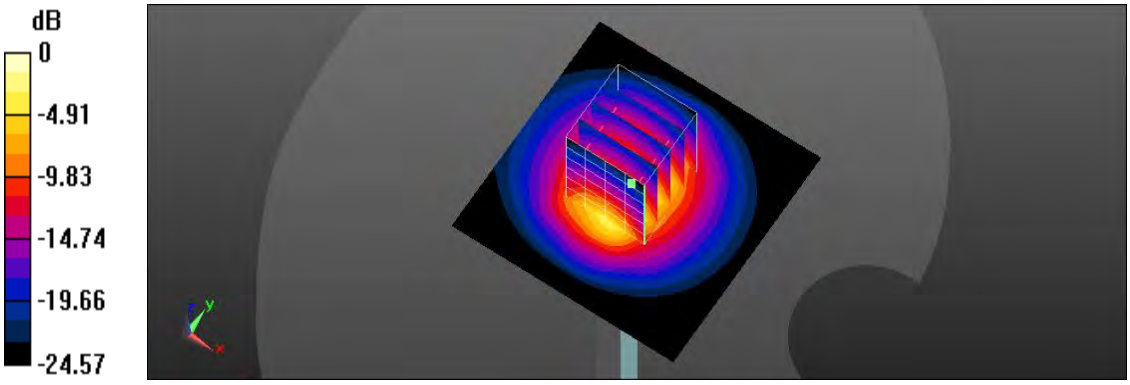
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/3
System Performance Check at 2600MHz_Head
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1007

Communication System: UID 0, CW (0); Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 1.982 S/m; ε_r = 39.599; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.2, 7.2, 7.2) @ 2600 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 2600MHz/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 23.4 W/kg

System Performance Check at 2600MHz/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 108.1 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.22 W/kg
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 46.1%
Maximum value of SAR (measured) = 24.3 W/kg



0 dB = 24.3 W/kg = 13.86 dBW/kg

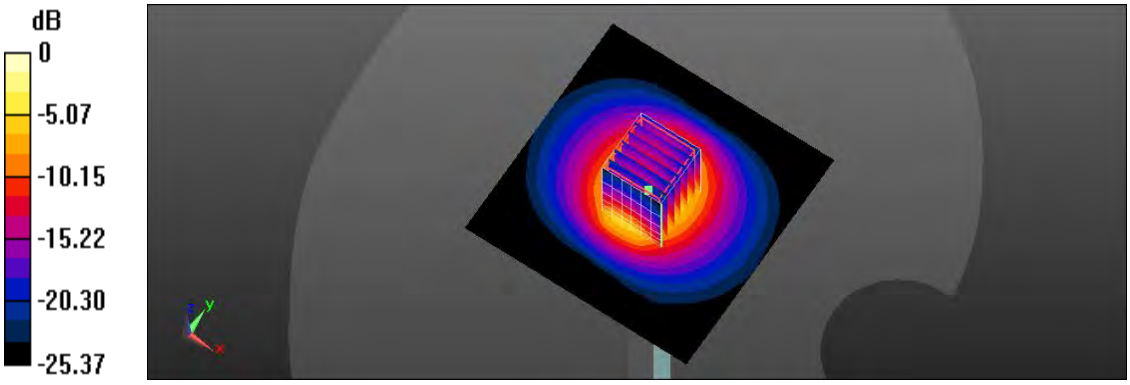
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/4
System Performance Check at 3300MHz_Head
DUT: Dipole D3300 MHz; Type: D3300V2; Serial: D3300V2 - SN1004

Communication System: UID 0, CW (0); Frequency: 3300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 3300 MHz; σ = 2.693 S/m; ε_r = 39.013; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(6.79, 6.79, 6.79) @ 3300 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 3300MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 12.7 W/kg

System Performance Check at 3300MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.21 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 6.44 W/kg; SAR(10 g) = 2.39 W/kg
Smallest distance from peaks to all points 3 dB below = 8.4 mm
Ratio of SAR at M2 to SAR at M1 = 76.3%
Maximum value of SAR (measured) = 12.2 W/kg



0 dB = 12.2 W/kg = 10.86 dBW/kg

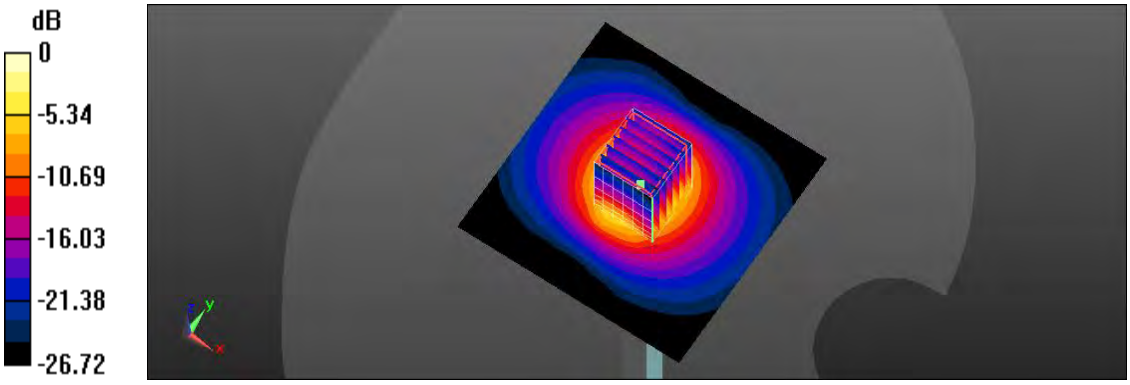
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/4
System Performance Check at 3500MHz_Head
DUT: Dipole D3500 MHz; Type: D3500V2; Serial: D3500V2 - SN1013

Communication System: UID 0, CW (0); Frequency: 3500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 3500 MHz; σ = 2.929 S/m; ε_r = 38.351; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(6.74, 6.74, 6.74) @ 3500 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 3500MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 12.3 W/kg

System Performance Check at 3500MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.46 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 6.31 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 8.2 mm
Ratio of SAR at M2 to SAR at M1 = 74.8%
Maximum value of SAR (measured) = 12.3 W/kg



0 dB = 12.3 W/kg = 10.90 dBW/kg

Appendix B - SAR Measurement Data

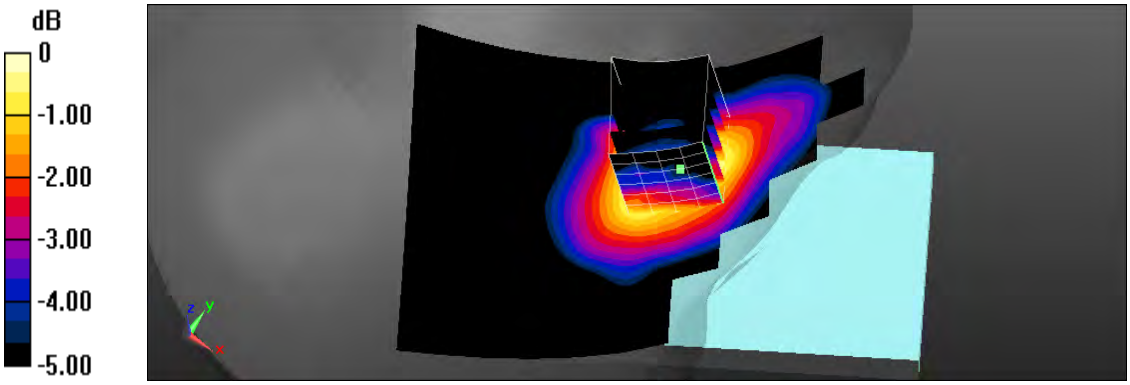
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/1
25_GSM900 CH 1_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, GSM900 (0); Frequency: 890.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 890.2 MHz; σ = 0.96 S/m; ε_r = 41.737; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.3, 9.3, 9.3) @ 890.2 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.102 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.04 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.108 W/kg
SAR(1 g) = 0.078 W/kg; SAR(10 g) = 0.058 W/kg
Ratio of SAR at M2 to SAR at M1 = 69.4%
Maximum value of SAR (measured) = 0.0959 W/kg



0 dB = 0.0959 W/kg = -10.18 dBW/kg

Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
06_WCDMA Band I CH 9888_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, WCDMA Band I (0); Frequency: 1977.6 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1978 MHz; σ = 1.417 S/m; ε_r = 39.707; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.86, 7.86, 7.86) @ 1977.6 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.109 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.352 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.112 W/kg
SAR(1 g) = 0.074 W/kg; SAR(10 g) = 0.048 W/kg
Ratio of SAR at M2 to SAR at M1 = 70.3%
Maximum value of SAR (measured) = 0.0947 W/kg

0 dB = 0.0947 W/kg = -10.24 dBW/kg

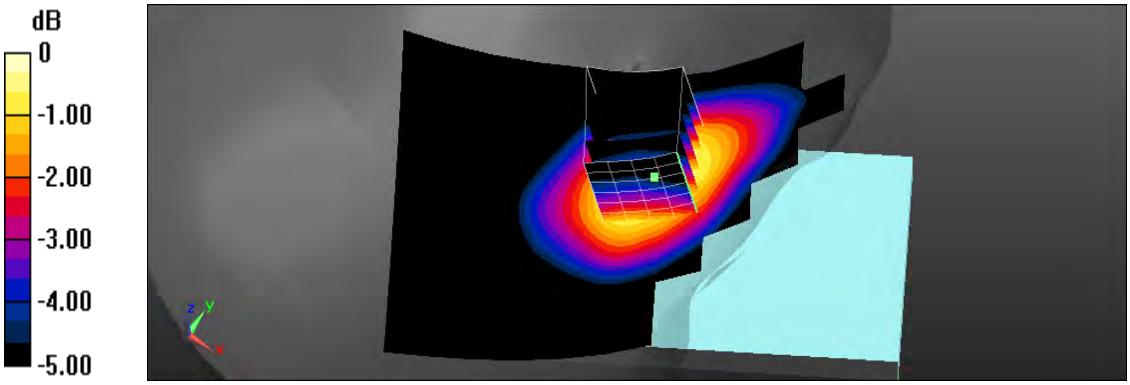
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/1
31_WCDMA Band VIII CH 2737_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, WCDMA Band VIII (0); Frequency: 887.4 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 887.4 MHz; σ = 0.957 S/m; ε_r = 41.775; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.3, 9.3, 9.3) @ 887.4 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.146 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.41 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.161 W/kg
SAR(1 g) = 0.118 W/kg; SAR(10 g) = 0.089 W/kg
Smallest distance from peaks to all points 3 dB below = 20.8 mm
Ratio of SAR at M2 to SAR at M1 = 74.3%
Maximum value of SAR (measured) = 0.145 W/kg



0 dB = 0.145 W/kg = -8.39 dBW/kg

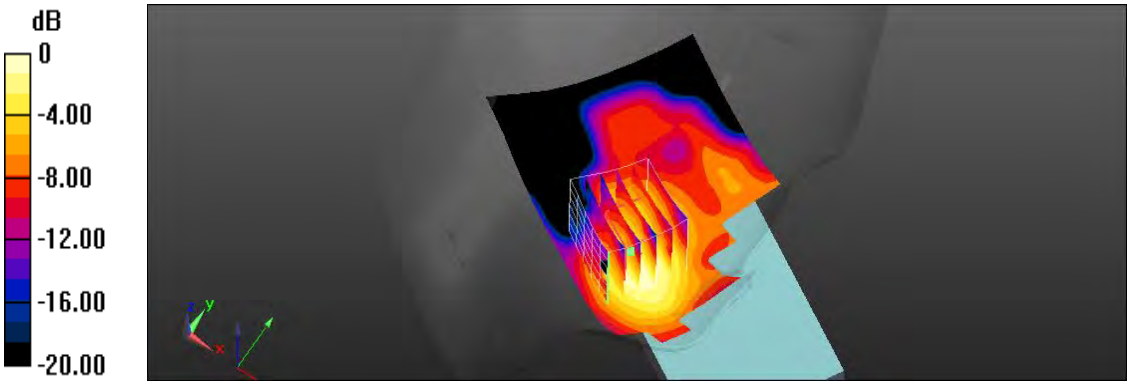
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
10_LTE Band 1 CH 18300_QPSK_BW 5M_8RB Size 17RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 1950 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1950 MHz; σ = 1.39 S/m; ε_r = 39.837; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.78, 7.78, 7.78) @ 1950 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.137 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.791 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.125 W/kg
SAR(1 g) = 0.085 W/kg; SAR(10 g) = 0.056 W/kg
Smallest distance from peaks to all points 3 dB below = 14.7 mm
Ratio of SAR at M2 to SAR at M1 = 67.5%
Maximum value of SAR (measured) = 0.111 W/kg



0 dB = 0.111 W/kg = -9.55 dBW/kg

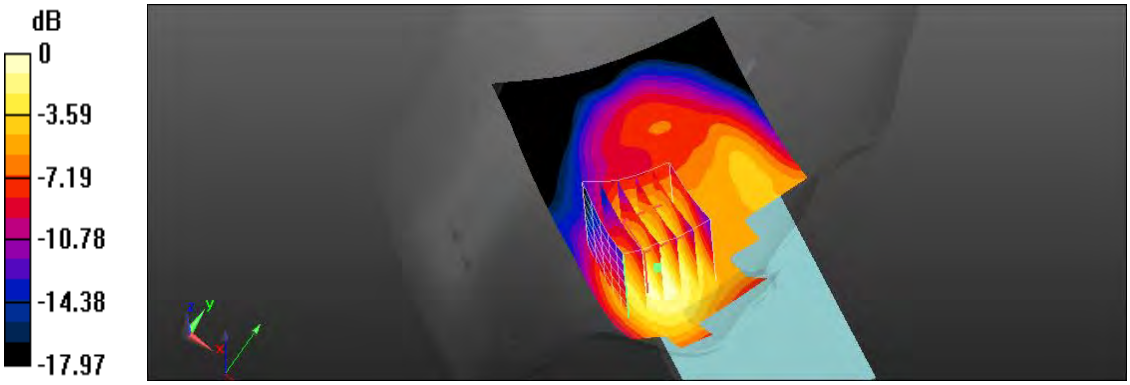
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
17_LTE Band 3 CH 19575_QPSK_BW 20M_18RB Size 0RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 1747.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1747.5 MHz; σ = 1.375 S/m; ε_r = 40.59; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(8.14, 8.14, 8.14) @ 1747.5 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.229 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.98 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.250 W/kg
SAR(1 g) = 0.173 W/kg; SAR(10 g) = 0.117 W/kg
Smallest distance from peaks to all points 3 dB below = 11.5 mm
Ratio of SAR at M2 to SAR at M1 = 73.8%
Maximum value of SAR (measured) = 0.217 W/kg



0 dB = 0.217 W/kg = -6.64 dBW/kg

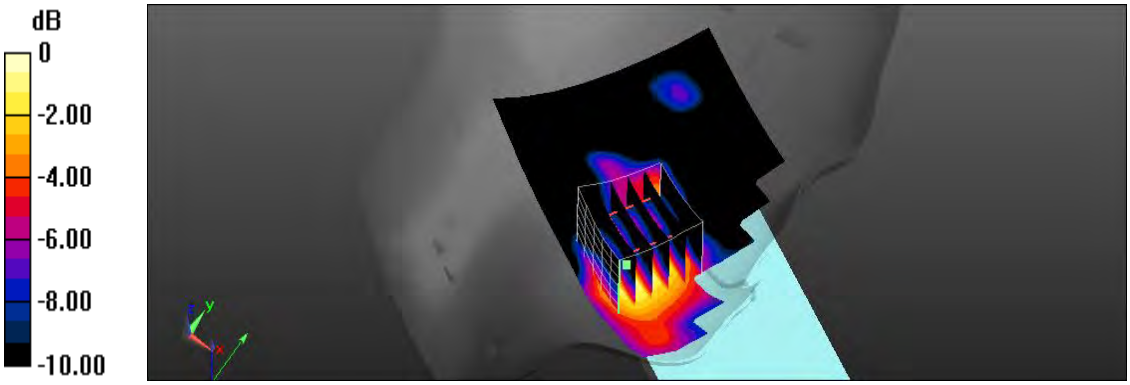
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/3
50_LTE Band 7 CH 20850_QPSK_BW 20M_18RB Size 82RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 2510 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2510 MHz; σ = 1.888 S/m; ε_r = 39.895; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.38, 7.38, 7.38) @ 2510 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0735 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.908 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.0880 W/kg
SAR(1 g) = 0.049 W/kg; SAR(10 g) = 0.029 W/kg
Ratio of SAR at M2 to SAR at M1 = 55.9%
Maximum value of SAR (measured) = 0.0725 W/kg



0 dB = 0.0725 W/kg = -11.40 dBW/kg

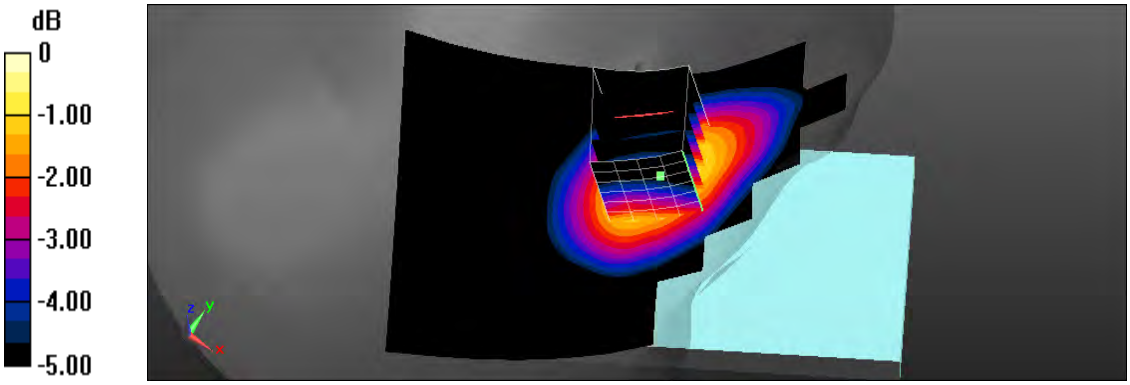
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/1
37_LTE Band 8 CH 21525_QPSK_BW 5M_1RB Size 24RB Offset_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 887.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 887.5 MHz; σ = 0.957 S/m; ε_r = 41.774; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.3, 9.3, 9.3) @ 887.5 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.129 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.13 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.155 W/kg
SAR(1 g) = 0.113 W/kg; SAR(10 g) = 0.084 W/kg
Smallest distance from peaks to all points 3 dB below = 22 mm
Ratio of SAR at M2 to SAR at M1 = 74.8%
Maximum value of SAR (measured) = 0.140 W/kg



0 dB = 0.140 W/kg = -8.54 dBW/kg

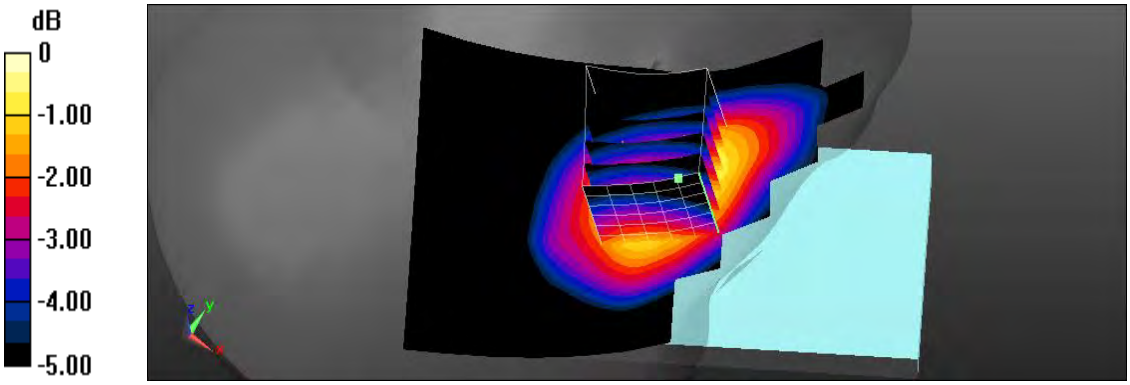
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/2
40_LTE Band 28 CH 27510_QPSK_BW 20M_18RB Size 82RB Offset_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 733 MHz;Duty Cycle: 1:1
Medium parameters used: f = 733 MHz; σ = 0.893 S/m; ε_r = 42.918; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.54, 9.54, 9.54) @ 733 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.214 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.87 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.236 W/kg
SAR(1 g) = 0.187 W/kg; SAR(10 g) = 0.150 W/kg
Smallest distance from peaks to all points 3 dB below = 23.2 mm
Ratio of SAR at M2 to SAR at M1 = 78.7%
Maximum value of SAR (measured) = 0.216 W/kg



0 dB = 0.216 W/kg = -6.66 dBW/kg

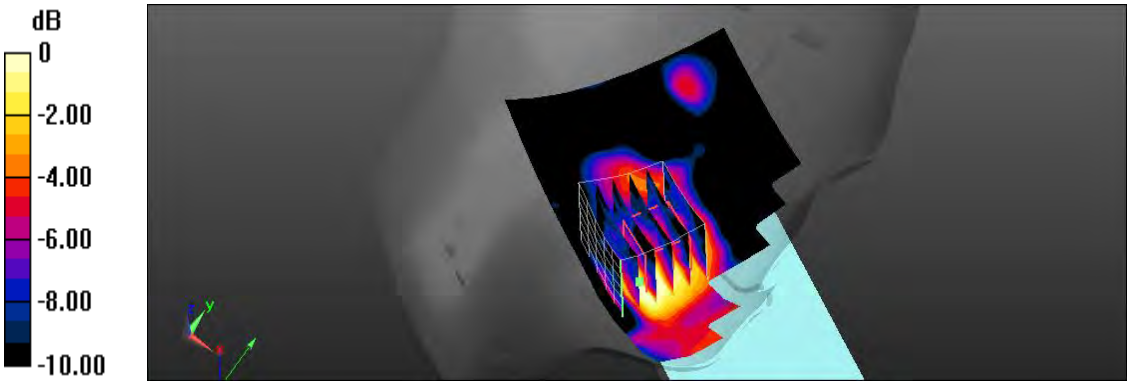
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/3
54_LTE Band 38 CH 38000_QPSK_BW 20M_1RB Size 99RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 2595 MHz;Duty Cycle: 1:1.59
Medium parameters used (interpolated): f = 2595 MHz; σ = 1.976 S/m; ε_r = 39.616; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.2, 7.2, 7.2) @ 2595 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0472 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.830 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.0360 W/kg
SAR(1 g) = 0.021 W/kg; SAR(10 g) = 0.013 W/kg
Ratio of SAR at M2 to SAR at M1 = 61.4%
Maximum value of SAR (measured) = 0.0287 W/kg



0 dB = 0.0287 W/kg = -15.42 dBW/kg

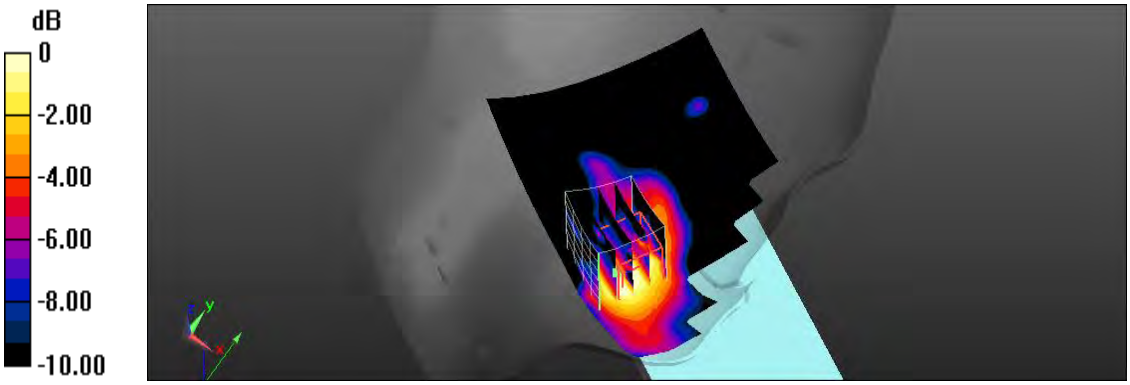
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/3
63_LTE Band 41 CH 39790_QPSK_BW 20M_1RB Size 99RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, Generic LTE (0); Frequency: 2510 MHz;Duty Cycle: 1:1.59
Medium parameters used: f = 2510 MHz; σ = 1.888 S/m; ε_r = 39.895; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.38, 7.38, 7.38) @ 2510 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0740 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.971 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.0780 W/kg
SAR(1 g) = 0.037 W/kg; SAR(10 g) = 0.015 W/kg
Ratio of SAR at M2 to SAR at M1 = 58.1%
Maximum value of SAR (measured) = 0.0583 W/kg



0 dB = 0.0583 W/kg = -12.34 dBW/kg

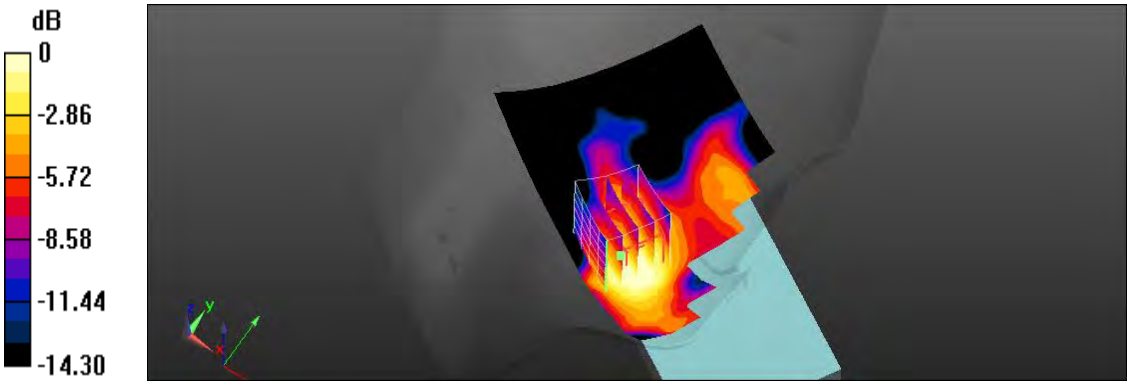
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/10/31
71_5G NR n1 CH 394500_15K-DFT-s-OFDM-PI2BPSK_BW 15M_1RB Size 1RB Offset_Left-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, 5G NR (0); Frequency: 1972.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1972.5 MHz; σ = 1.411 S/m; ε_r = 39.73; ρ = 1000 kg/m^3
Phantom section: Left Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(7.86, 7.86, 7.86) @ 1972.5 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0466 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.589 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.0430 W/kg
SAR(1 g) = 0.028 W/kg; SAR(10 g) = 0.019 W/kg
Ratio of SAR at M2 to SAR at M1 = 71.3%
Maximum value of SAR (measured) = 0.0369 W/kg



0 dB = 0.0369 W/kg = -14.33 dBW/kg

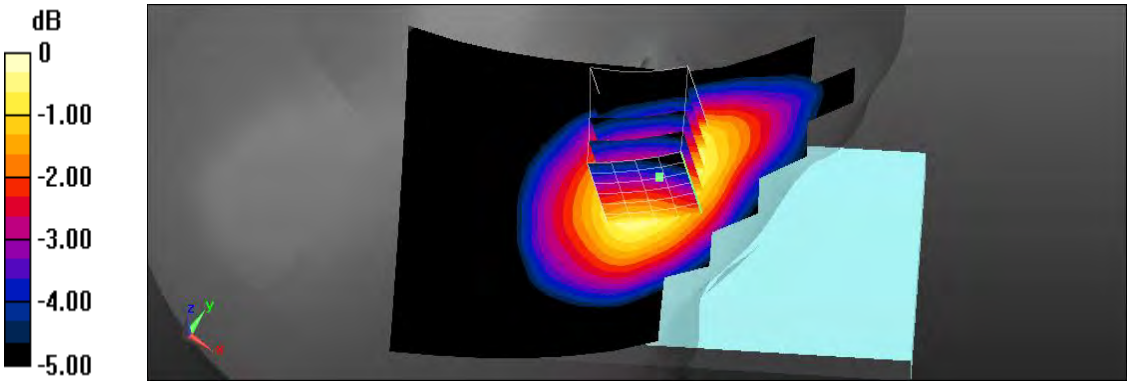
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/2
78_5G NR n28 CH 149100_15K-DFT-s-OFDM-PI2BPSK_BW 5M_1RB Size 1RB Offset_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, 5G NR (0); Frequency: 745.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 745.5 MHz; σ = 0.895 S/m; ε_r = 42.734; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(9.54, 9.54, 9.54) @ 745.5 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (71x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0751 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.278 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.0820 W/kg
SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.053 W/kg
Ratio of SAR at M2 to SAR at M1 = 78.4%
Maximum value of SAR (measured) = 0.0744 W/kg



0 dB = 0.0744 W/kg = -11.28 dBW/kg

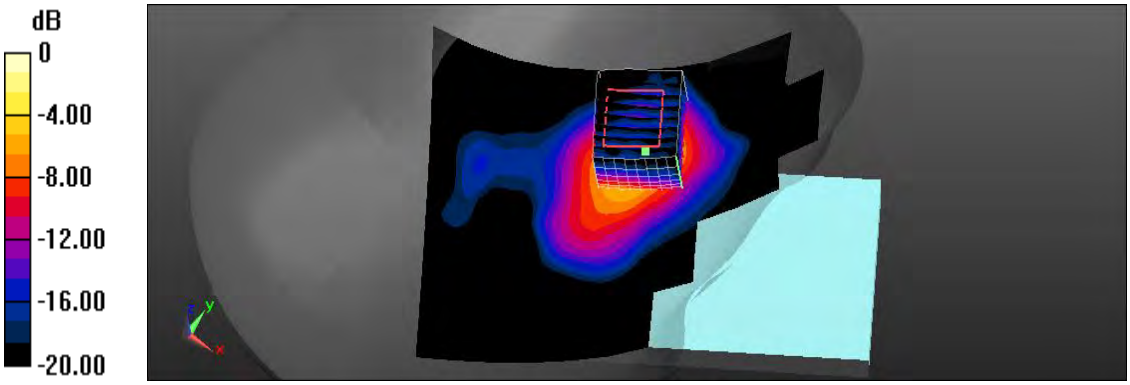
Test Laboratory: A Test Lab Techno Corp.
Date: 2020/11/4
80_5G NR n78 CH 629000_30K-DFT-s-OFDM-PI2BPSK_BW 50M_1RB Size 1RB Offset_Right-Cheek
DUT: SM-G9960; Type: NR 手持式行動電話機

Communication System: UID 0, 5G NR (0); Frequency: 3435 MHz;Duty Cycle: 1:1
Medium parameters used: f = 3435 MHz; σ = 2.86 S/m; ε_r = 38.605; ρ = 1000 kg/m^3
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3847; ConvF(6.74, 6.74, 6.74) @ 3435 MHz; Calibrated: 2020/5/20
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn541; Calibrated: 2020/3/18
- Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CD; Serial: TP-1009
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.10 (7331)

Area Scan (121x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.272 W/kg

Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 7.937 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 2.93 W/kg
SAR(1 g) = 0.222 W/kg; SAR(10 g) = 0.077 W/kg
Smallest distance from peaks to all points 3 dB below = 5.1 mm
Ratio of SAR at M2 to SAR at M1 = 66.9%
Maximum value of SAR (measured) = 0.516 W/kg



0 dB = 0.516 W/kg = -2.87 dBW/kg

Appendix C - Calibration

All of the instruments Calibration information are listed below.

- Dipole _ D750V3 SN:1004
- Dipole _ D900V2 SN:073
- Dipole _ D1800V2 SN:265
- Dipole _ D1950V3 SN:1117
- Dipole _ D2600V2 SN:1007
- Dipole _ D3300V2 SN:1004
- Dipole _ D3500V2 SN:1013
- Probe _ EX3DV4 SN:3847
- DAE _ DAE4 SN:541

In Collaboration with
s p e a g
CALIBRATION LABORATORY
ST-044_20-185
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client ATL Certificate No: Z20-60365

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1004
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	September 17, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
ReferenceProbe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: September 22, 2020

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
ST-004_20-073
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client ATL Certificate No: Z20-60158

CALIBRATION CERTIFICATE

Object	D900V2 - SN:073
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	May 8, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP8S	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Reference Probe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 10, 2020

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

ST-001_20-069

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client ATL Certificate No: Z20-60159

CALIBRATION CERTIFICATE

Object	D1800V2 - SN: 265
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	April 28, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP8S	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Reference Probe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 5, 2020

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
ST-005_20-070
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client ATL Certificate No: Z20-60161

CALIBRATION CERTIFICATE

Object	D1950V3 - SN: 1117
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	April 28, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP8S	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
ReferenceProbe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 5, 2020

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY

ST-021-20-186

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client ATL Certificate No: Z20-60374

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1007
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	September 29, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
Network Analyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: October 4, 2020

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

ST-052_20-064

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client **AUDEN** **Certificate No: Z20-60171**

CALIBRATION CERTIFICATE

Object	D3300V2 - SN: 1004
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	April 30 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP8S	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
ReferenceProbe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzerE5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: May 5, 2020

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

Certificate No: Z20-60171 Page 1 of 6

In Collaboration with
TTL speag CALIBRATION LABORATORY
EX-022-20-068
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client ATL Certificate No: Z20-60160

CALIBRATION CERTIFICATE

Object	D3500V2 - SN: 1013
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	April 24 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
Power sensor NRP8S	104291	04-Sep-19 (CTTL, No.J19X07825)	Sep-20
ReferenceProbe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzerE5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: April 30, 2020

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

EX-042_20-109

Client ATL Certificate No: Z20-60165

CALIBRATION CERTIFICAT

Object: EX3DV4 - SN : 3847

Calibration Procedure(s): FF-Z11-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: May 20, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101547	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101548	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG, No.EX3-3617_Jan20/2)	Jan-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	18-Jun-19(CTTL, No.J19X05127)	Jun-20
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21

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

Issued: May 22, 2020

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

MR-008_20-041

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client : ATL Certificate No: Z20-60115

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 541
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	March 18, 2020

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	24-Jun-19 (CTTL, No.J19X05126)	Jun-20

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

Issued: March 20, 2020

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

---END---