SAR EVALUATION REPORT

For

IEI Integration Corp

No. 29, ZhongXing Rd, Xizhi Dist.,New Taipei City 221, Taiwan(R.O.C.)

FCC ID: RFHMODAT-550A

Report Type:	**Product Type:**
Original Report	PDA

Report Number: RLK181207001-23A

Report Date: 2019-01-02

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Attestation of Test Results			
EUT Information	**EUT Description**	PDA	
	Model Name	MODAT-550A-OA53	
	Adding Model	MODAT-550A-OA53-ET	
	FCC ID	RFHMODAT-550A	
	Serial Number	SA18B12925	
	Test Date	2018-12-5 /2018-12-12/2018-12-17/2018-12-20/2018-12-21	
MODE		**Max. SAR Level(s) Reported(W/kg)**	**Limit**
WLAN 2.4GHz	**1g Head SAR**	**0.052**	**1.6**
	1g Body SAR	**0.033**	
WLAN 5GHz	**1g Head SAR**	**0.144**	
	1g Body SAR	**0.302**	
Simultaneous	**1g Head SAR**	**0.314**	
	1g Body SAR	**0.472**	
Applicable Standards	**FCC 47 CFR part 2.1093** Radiofrequency radiation exposure evaluation: portable devices		
	IEEE1528:2013 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques		
	IEC 62209-2:2010 Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices-Human models, instrumentation, and procedures-Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)		
	KDB procedures KDB 447498 D01 General RF Exposure Guidance v06 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 KDB 865664 D02 RF Exposure Reporting v01r02 KDB 941225 D06 Hotspot Mode v02r01 KDB 248227 D01 802 11 Wi-Fi SAR v02r02		

Note: This wireless device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in **FCC 47 CFR part 2.1093** and has been tested in accordance with the measurement procedures specified in IEEE 1528-2013 and RF exposure KDB procedures.

The results and statements contained in this report pertain only to the device(s) evaluated.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	RLK181207001-23	Original Report	2019-01-02

EUT DESCRIPTION

This report has been prepared on behalf of ***IEI Integration Corp*** and their product PDA , Model: ***MODAT-550A-OA53***, FCC ID: ***RFHMODAT-550A*** or the EUT (Equipment under Test) as referred to in the rest of this report.

All measurement and test data in this report was gathered from production sample serial number:* ***SA18B12925* *(Assigned by BACL, Taiwan).The EUT supplied by the applicant was received on* ***2018-12-3***.

Technical Specification

Device Type:	Portable
Exposure Category:	Population / Uncontrolled
Antenna Type(s):	Internal Antenna
Body-Worn Accessories:	None
Face-Head Accessories:	None
Operation Mode :	WLAN, Bluetooth
Frequency Band:	WLAN 2.4G (802.11b/g/n20): 2412-2462MHz WLAN 5G Band 1 (802.11a/n): 5150-5250MHz WLAN 5G Band 2 (802.11a/n): 5250-5350MHz WLAN 5G Band 3 (802.11a/n): 5470-5725MHz WLAN 5G Band 4 (802.11a/n): 5725-5850MHz Bluetooth:2402-2480MHz
Conducted RF Power:	WLAN 2.4G: **17.52** dBm
	WLAN 5G: **14.49** dBm
	Bluetooth BDR/EDR: **5.89** dBm
	Bluetooth LE: **-0.86** dBm
Dimensions (L*W*H):	Length (160 mm)*Width (85 mm)*High (30 mm)
Power Source:	3.7 VDC Rechargeable Battery
Normal Operation:	Head and Body Worn

REFERENCE, STANDARDS, AND GUIDELINES

FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by EN62209-1 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

SAR Limits

FCC Limit

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	**1.60**	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit

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

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

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

General Population/Uncontrolled environments Spatial Peak limit 1.6W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

FACILITIES

The test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on
☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

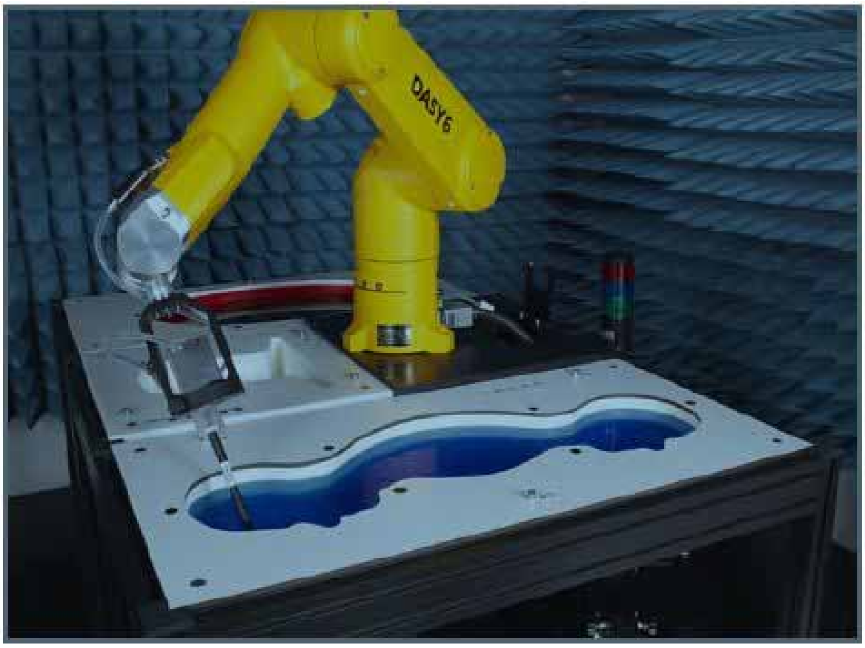
Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 22, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180), Please refer Exhibit E “Certificate and Scope of Accreditation of ISO/IEC 17025:2005 TAF Certificate”

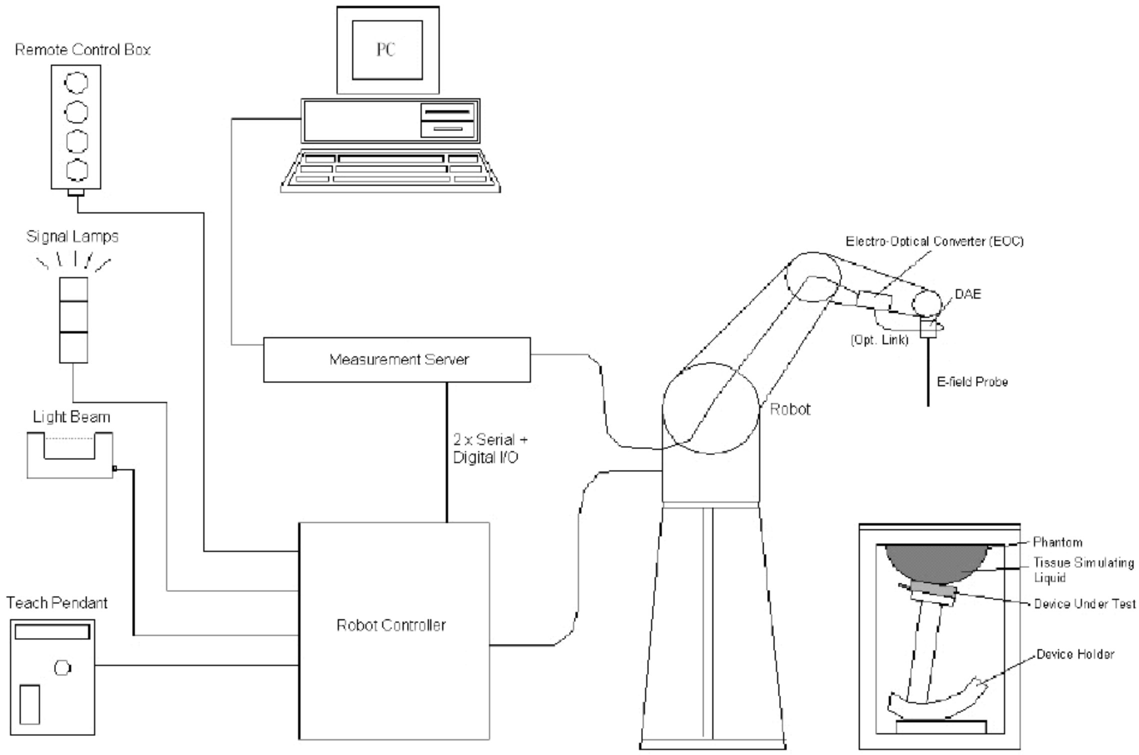
DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY6 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:



DASY6 System Description

The DASY6 system for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Staubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal application, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 professional operating system and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

DASY6 Measurement Server

The DASY6 measurement server is based on a PC/104 CPU board with a 400 MHz intel ULV Celeron, 128 MB chip-disk and 128 MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16-bit AD converter system for optical detection and digital I/O interface are contained on the DASY6 I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluations of field measurements and surface detection, controls robot movements, and handles safety operations. The PC operating system cannot interfere with these time-critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port, which is reserved for future applications. Please note that this expansion port does not have a standard- ized pinout, and therefore only devices provided by SPEAG can be connected. Connection of devices from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of both the DAE4 as well as of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 E-Field Probes

Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
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
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

SAM Twin Phantom

The SAM Twin Phantom (shown in front of DASY6) is a fiberglass shell phantom with shell thickness 2 mm, except in the ear region where the thickness is increased to 6 mm. The phantom has three mea- surement areas: 1) Left Head, 2) Right Head, and 3) Flat Section. For larger de- vices, the use of the ELI-Phantom (shown behind DASY6) is required. For devices such as glasses with a wireless link, the Face Down Phantom is the most suitable (between the SAM Twin and ELI phan- toms).

When the phantom is mounted inside allocated slot of the DASY6 platform, phanotm reference points can be taught directly in the DASY5 V5.2software. When the DASY6 platform is used to mount the

phantom, some of the phantom teaching points cannot be reached by the robot in DASY5 V5.2. A special tool called P1a-P2aX-Former is provided to transform two of the three points, P1 and P2, to reachable locations. To use these new teaching points, a revised phantom configuration file is required.
In addition to our standard broadband liquids, the phantom can be used with the following tissue simu- lating liquids:

Sugar-water-based liquids can be left permanently in the phantom. Always cover the liquid when the system is not in use to prevent changes in liquid parameters due to water evaporation.
DGBE-based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom, and the phantom should be dried when the system is not in use (desirable at least once a week).

•Do not use other organic solvents without previously testing the solvent resistivity of the phantom.
Approximately 25 liters of liquid is required to fill the SAM Twin phantom.

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Robots

The DASY6 system uses the high-precision industrial robots TX60L, TX90XL, and RX160L from St aubli SA (France). The TX robot family - the successor of the well-known RX robot family - continues to offer the features important for DASY6 applications:

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

The robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is provided

Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 15mm 2 step integral, with 1.5mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the DASY4 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm,with the side length of the 10g cube is 21.5mm.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 7 x7 x 7 (5mmx5mmx5mm) providing a volume of 30 mm in the X & Y & Z axis.

Recommended Tissue Dielectric Parameters for Head and Body

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	σ (S/m)	εr	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

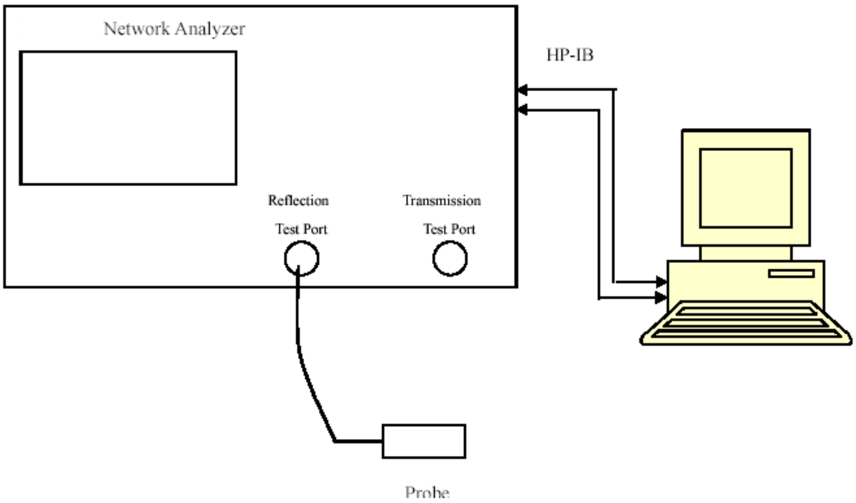
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Robot	TX90	5N26A1	NCR	NCR
DASY5 Test Software	DASY5.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY 6	1588	N/A	N/A
Data Acquisition Electronics	DAE4	1561	2018/11/7	2019/11/6
E-Field Probe	EX3DV4	7520	2018/11/5	2019/11/4
Dipole,2450MHz	D2450V2	969	2018/5/30	2021/5/29
Dipole,5GHz	D5GHzV2	1225	2018/5/25	2021/5/24
Spectrum Analyzer	FSU26	200268	2018/5/4	2019/5/3
Mounting Device	N/A	SD 000 H01 KA	N/A	N/A
Twin SAM	Twin SAM V5.0	1368	N/A	N/A
Twin SAM	Twin SAM V8.0	1953	N/A	N/A
Simulated Tissue 2450 MHz Head	TS-2450-H	/	Each Time	/
Simulated Tissue 2450 MHz Body	TS-2450-B	/	Each Time	/
Simulated Tissue 5 GHz Head	TS-5000-H	/	Each Time	/
Simulated Tissue 5 GHz Body	TS-5000-B	/	Each Time	/
Network Analyzer	8753D	3410A05361	2018/3/22	2019/3/21
Spectrum Analyzer	FSEK30	825084/006	2018/12/13	2019/12/12
Signal Generator	8648C	3623A02870	2018/5/18	2019/5/17
Power Meter	E4418B	US39402167	2018/5/17	2019/5/16
Power Sensor	E9300A	US39210953	2018/5/17	2019/5/16
Power Amplifier	ZHL-42W+	329401642	2018/1/11	2019/1/10
Directional Coupler	488Z	000810	NCR	NCR
Attenuator	20dB, 100W	1453	NCR	NCR

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		Ơ (S/m)	εr	Ơ (S/m)	εr	Ơ (S/m)	Δεr	
2450	Body Tissue	2.015	52.705	1.95	52.70	3.33	0.01	±5
2412	Body Tissue	1.977	52.755	1.91	52.75	3.51	0.01	±5
2437	Body Tissue	2.002	52.705	1.94	52.72	3.20	-0.03	±5
2462	Body Tissue	2.026	52.671	1.97	52.68	2.84	-0.02	±5

Liquid Verification above was performed on **2018-12-05*

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		Ơ (S/m)	εr	Ơ (S/m)	εr	Ơ (S/m)	Δεr	
2450	Head Tissue	1.818	40.810	1.80	39.20	1.00	4.11	±5
2412	Head Tissue	1.788	40.861	1.77	39.27	1.02	4.05	±5
2437	Head Tissue	1.806	40.813	1.79	39.22	0.89	4.06	±5
2462	Head Tissue	1.827	40.782	1.81	39.18	0.94	4.09	±5

Liquid Verification above was performed on **2018-12-12*

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		Ơ (S/m)	εr	Ơ (S/m)	εr	Ơ (S/m)	Δεr	
5260	Body Tissue	5.299	47.994	5.37	48.94	-1.32	-1.93	±5
5300	Body Tissue	5.362	47.883	5.42	48.9	-1.07	-2.08	±5
5320	Body Tissue	5.389	47.823	5.44	48.67	-0.94	-1.74	±5
5500	Body Tissue	5.651	47.484	5.65	48.6	0.02	-2.30	±5
5580	Body Tissue	5.768	47.335	5.74	48.52	0.49	-2.44	±5
5600	Body Tissue	5.798	47.298	5.77	48.50	0.49	-2.48	±5
5700	Body Tissue	5.942	47.108	5.88	48.35	1.05	-2.57	±5
5745	Body Tissue	6.018	46.99	5.94	48.28	1.31	-2.67	±5
5785	Body Tissue	6.074	46.916	5.98	48.22	1.57	-2.70	±5
5800	Body Tissue	6.100	46.907	6.00	48.20	1.67	-2.68	±5
5825	Body Tissue	6.132	46.845	6	48.2	2.20	-2.81	±5

*Liquid Verification above was performed on **2018-12-17***

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		Ơ (S/m)	εr	Ơ (S/m)	εr	Ơ (S/m)	Δεr	
5260	Head Tissue	4.809	36.296	4.72	35.94	1.89	0.99	±5
5300	Head Tissue	4.863	36.2	4.76	35.9	2.16	0.84	±5
5320	Head Tissue	4.893	36.16	4.78	35.87	2.36	0.81	±5
5500	Head Tissue	5.12	35.789	4.97	35.63	3.02	0.45	±5
5580	Head Tissue	5.218	35.625	5.05	35.53	3.33	0.27	±5
5600	Head Tissue	5.247	35.568	5.07	35.50	3.49	0.19	±5
5700	Head Tissue	5.368	35.367	5.17	35.4	3.83	-0.09	±5

*Liquid Verification above was performed on **2018-12-20***

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		Ơ (S/m)	εr	Ơ (S/m)	εr	Ơ (S/m)	Δεr	
5745	Head Tissue	5.424	35.265	5.22	35.36	3.91	-0.27	±5
5785	Head Tissue	5.477	35.206	5.26	35.32	4.13	-0.32	±5
5800	Head Tissue	5.492	35.174	5.27	35.30	4.21	-0.36	±5
5825	Head Tissue	5.521	35.112	5.3	35.28	4.17	-0.48	±5

*Liquid Verification above was performed on **2018-12-21***

System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

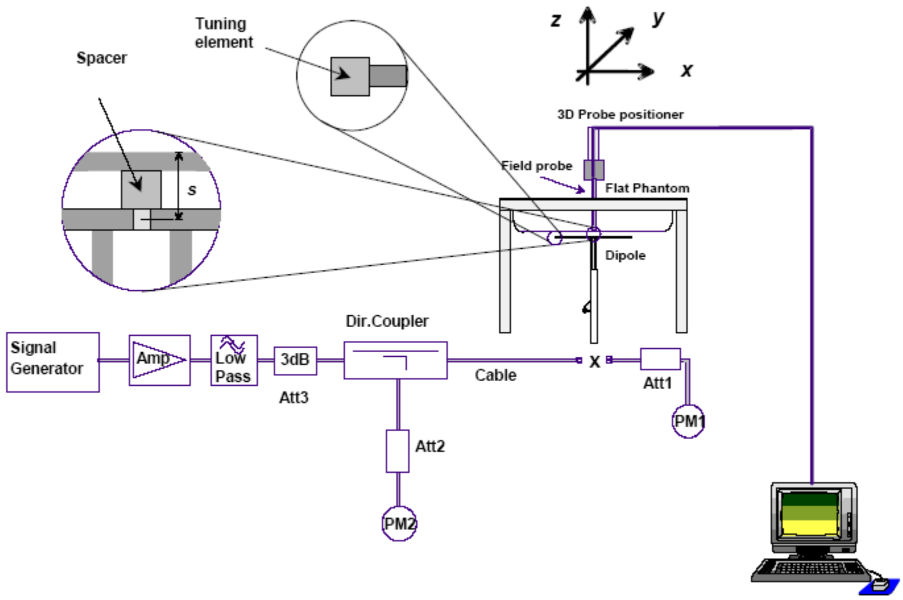
The spacing distances in the **System Verification Setup Block Diagram** is given by the following:

a) s = 15 mm ± 0,2 mm for 300 MHz ≤ f ≤ 1 000 MHz;

b) s = 10 mm ± 0,2 mm for 1 000 MHz < f ≤ 3 000 MHz;

c) s = 10 mm ± 0,2 mm for 3 000 MHz < f ≤ 6 000 MHz.

System Verification Setup Block Diagram



System Accuracy Check Results

Date	Frequency Band	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value(W/kg)	Delta (%)	Tolerance (%)
2018/12/5	2450 MHz	Body	250	1g	12.10	48.40	49.80	-2.81	±10
2018/12/12	2450 MHz	Head	250	1g	13.20	52.80	52.60	0.38	±10
2018/12/17	5300 MHz	Body	100	1g	8.14	81.4	81.00	0.49	±10
2018/12/17	5600 MHz	Body	100	1g	7.96	79.60	77.10	3.24	±10
2018/12/17	5800 MHz	Body	100	1g	7.24	72.40	74.50	-2.82	±10
2018/12/20	5300 MHz	Head	100	1g	8.01	80.1	74.90	6.94	±10
2018/12/20	5600 MHz	Head	100	1g	7.98	79.8	78.20	2.05	±10
2018/12/21	5800 MHz	Head	100	1g	8.53	85.3	80.50	5.96	±10

*The SAR values above are normalized to 1 Watt forward power.

SAR SYSTEM VALIDATION DATA

System Check_Head_2450MHz

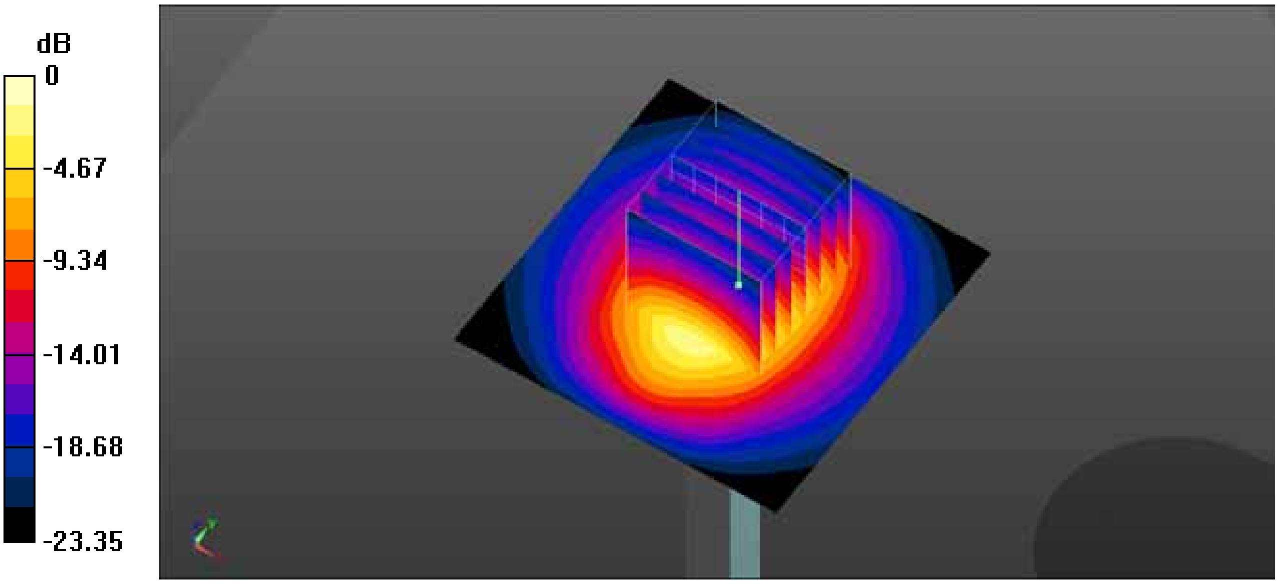
DUT: D2450V2-969

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2450 MHz; σ = 1.818 S/m; ε_r = 40.81; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(7.33, 7.33, 7.33); Calibrated: 11/5/2018
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (20deg probe tilt)-Right; Type: QD 000 P40 CB; Serial: 1368
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 17.9 W/kg

250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.90 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

System Check_Head_5300MHz

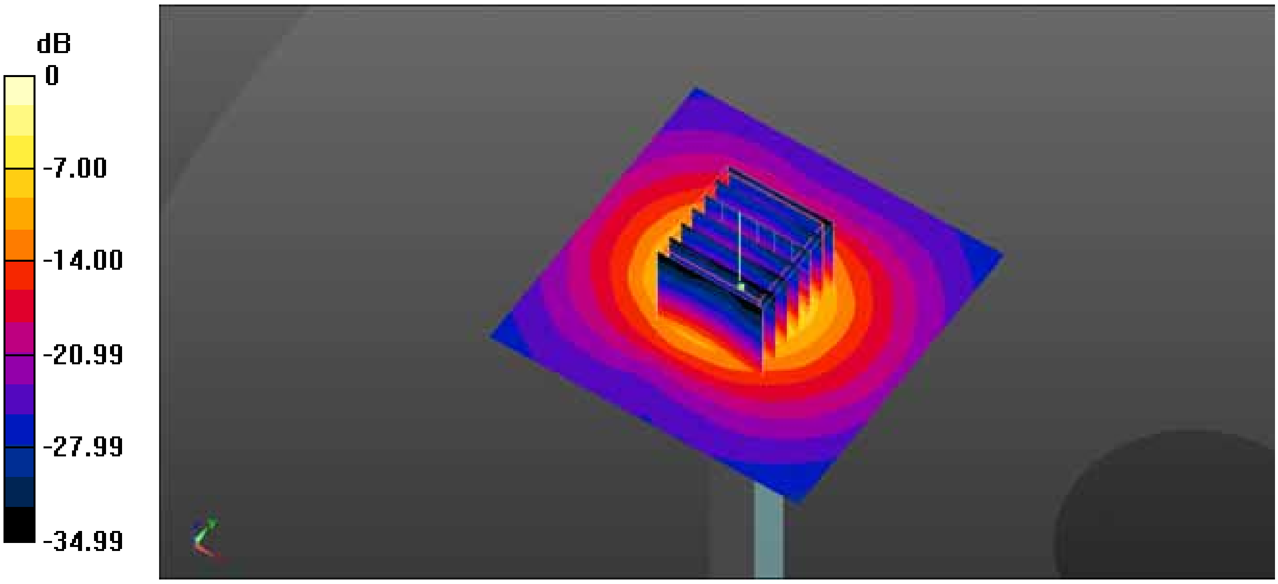
DUT: D5GHzV2-1225-5300

Communication System: CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: HSL_5G Medium parameters used: f = 5300 MHz; σ = 4.863 S/m; ε_r = 36.2; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(5.55, 5.55, 5.55); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (20deg probe tilt)-Right; Type: QD 000 P40 CB; Serial: 1368
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.9 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.09 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

System Check_Head_5600MHz

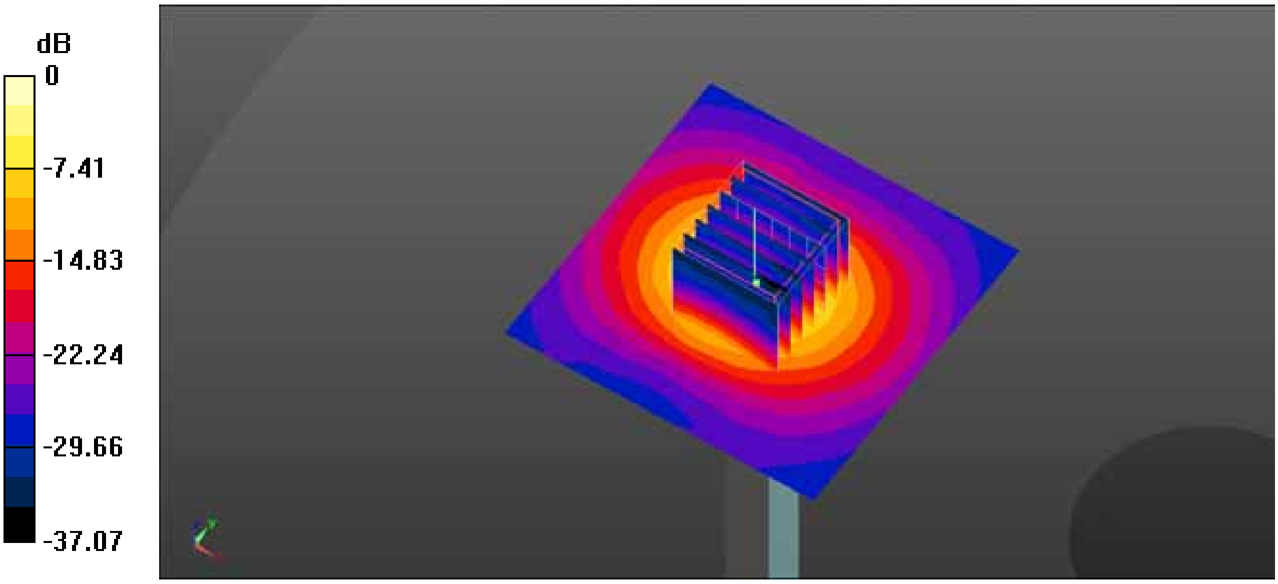
DUT: D5GHzV2-1225-5600

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: HSL_5G Medium parameters used: f = 5600 MHz; σ = 5.247 S/m; ε_r = 35.568; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(4.9, 4.9, 4.9); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (20deg probe tilt)-Right; Type: QD 000 P40 CB; Serial: 1368
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.6 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.31 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 36.2 W/kg
SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

System Check_Head_5800MHz

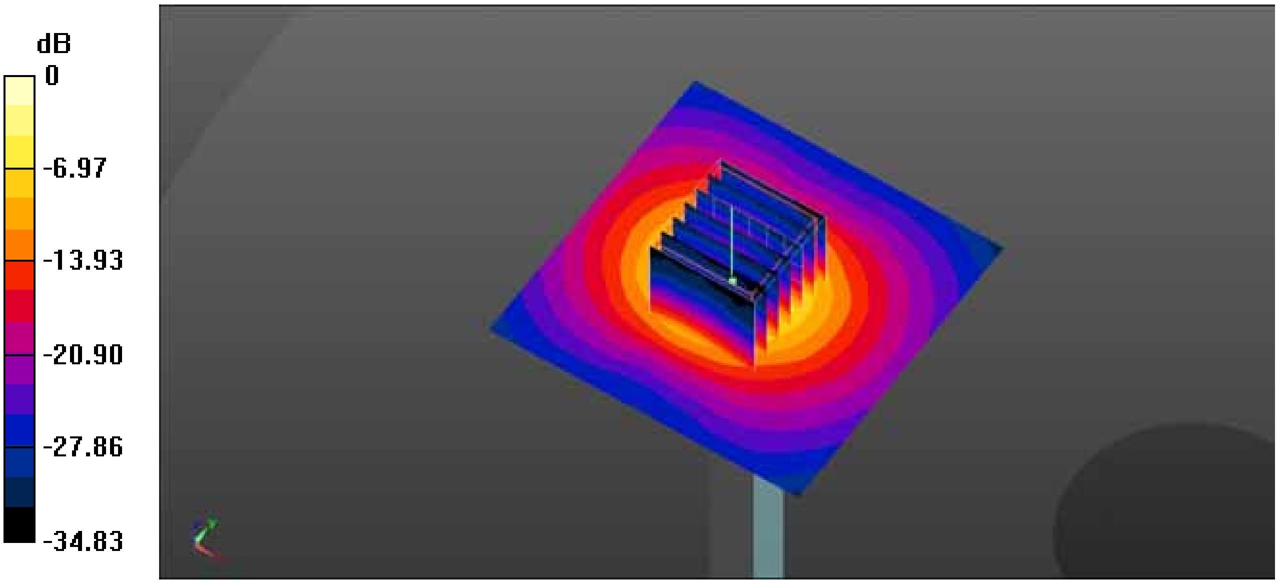
DUT: D5GHzV2-1225-5800

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: HSL_5G Medium parameters used: f = 5800 MHz; σ = 5.492 S/m; ε_r = 35.174; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(5.1, 5.1, 5.1); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (20deg probe tilt)-Right; Type: QD 000 P40 CB; Serial: 1368
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 21.9 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.98 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 39.4 W/kg
SAR(1 g) = 8.53 W/kg; SAR(10 g) = 2.35 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



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

System Check_Body_2450MHz

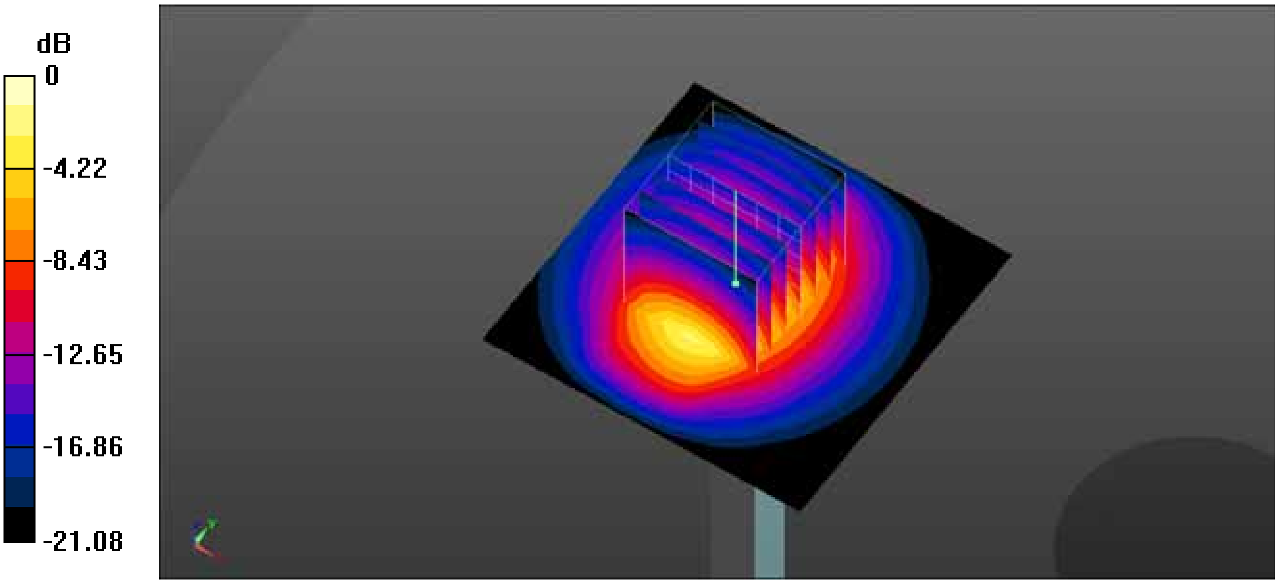
DUT: D2450V2-969

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL2450 Medium parameters used: f = 2450 MHz; σ = 2.015 S/m; ε_r = 52.705; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(7.48, 7.48, 7.48); Calibrated: 11/5/2018
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Type: QD 000 P41 Ax; Serial: 1953
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 16.1 W/kg

250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.51 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 24.5 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.62 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



0 dB = 15.9 W/kg = 12.01 dBW/kg

System Check_Body_5300MHz

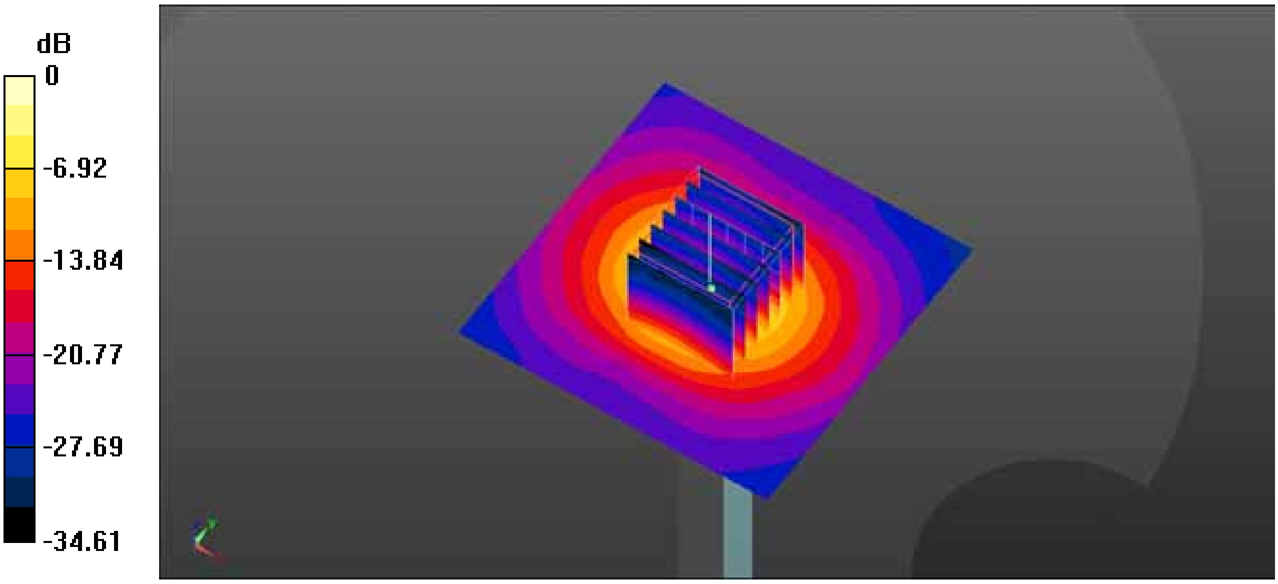
DUT: D5GHzV2-1225-5300

Communication System: CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: MSL5G Medium parameters used: f = 5300 MHz; σ = 5.362 S/m; ε_r = 47.883; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(4.94, 4.94, 4.94); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Type: QD 000 P41 Ax; Serial: 1953
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.7 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.62 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

System Check_Body_5600MHz

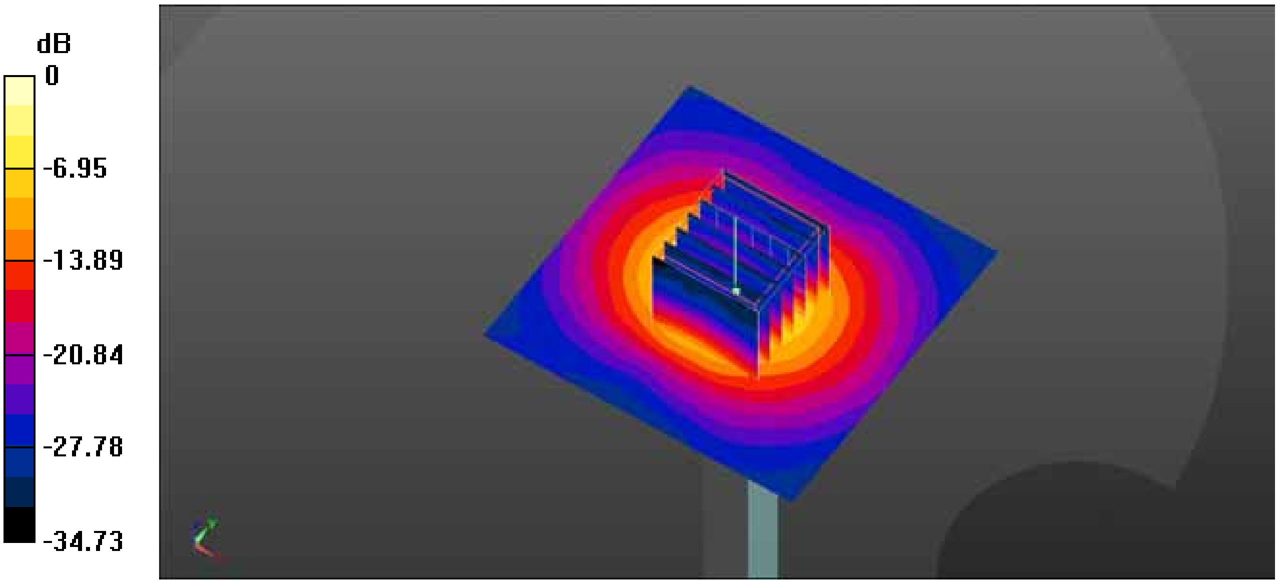
DUT: D5GHzV2-1225-5600

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: MSL5G Medium parameters used: f = 5600 MHz; σ = 5.798 S/m; ε_r = 47.298; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(4.51, 4.51, 4.51); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Type: QD 000 P41 Ax; Serial: 1953
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.9 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.88 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

System Check_Body_5800MHz

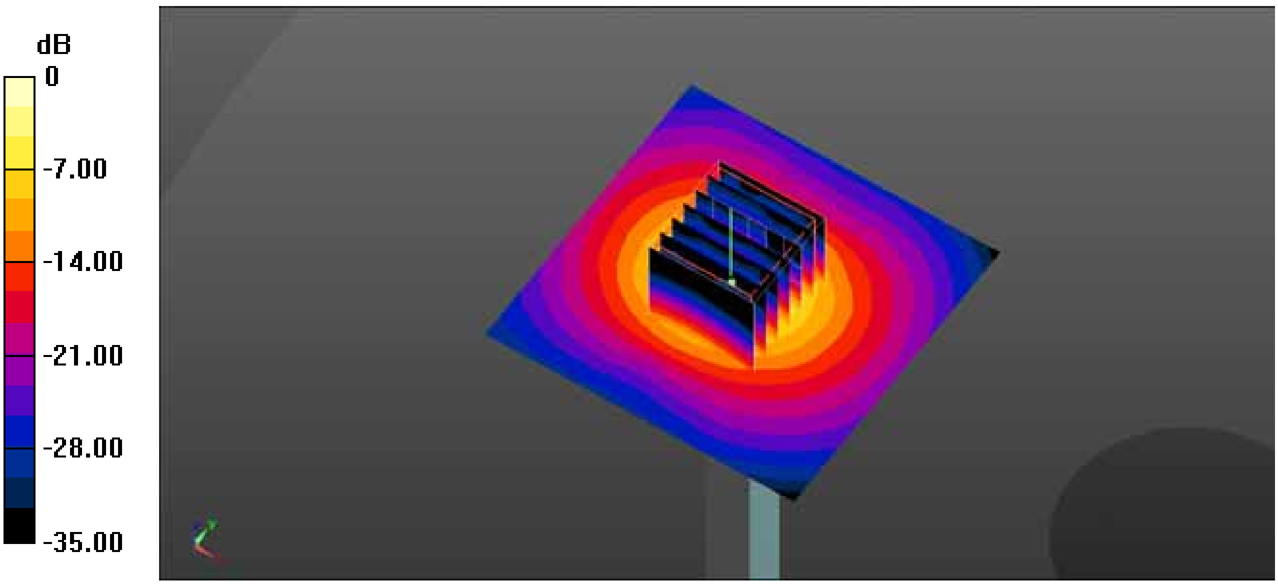
DUT: D5GHzV2-1225-5800

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: MSL5G Medium parameters used: f = 5800 MHz; σ = 6.1 S/m; ε_r = 46.907; ρ = 1000 kg/m^3

DASY5 Configuration:
- Probe: EX3DV4 - SN7520; ConvF(4.46, 4.46, 4.46); Calibrated: 11/5/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1561; Calibrated: 11/7/2018
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Type: QD 000 P41 Ax; Serial: 1953
- Measurement SW: DASY52, Version 52.10 (1);SEMCAD X Version 14.6.11 (7437)

100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.3 W/kg

100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.10 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 7.24 W/kg; SAR(10 g) = 1.99 W/kg
Maximum value of SAR (measured) = 18.5 W/kg



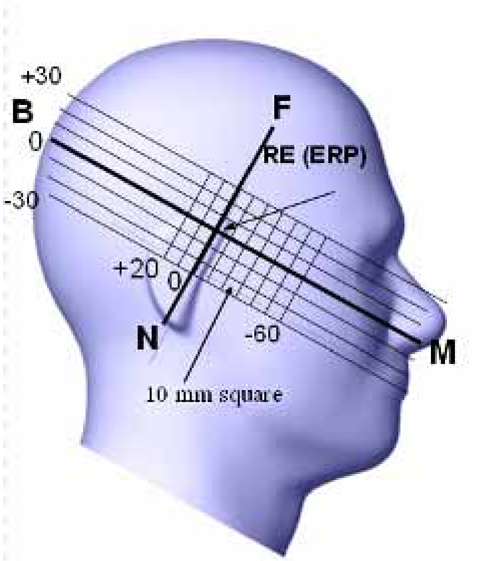
0 dB = 18.5 W/kg = 12.67 dBW/kg

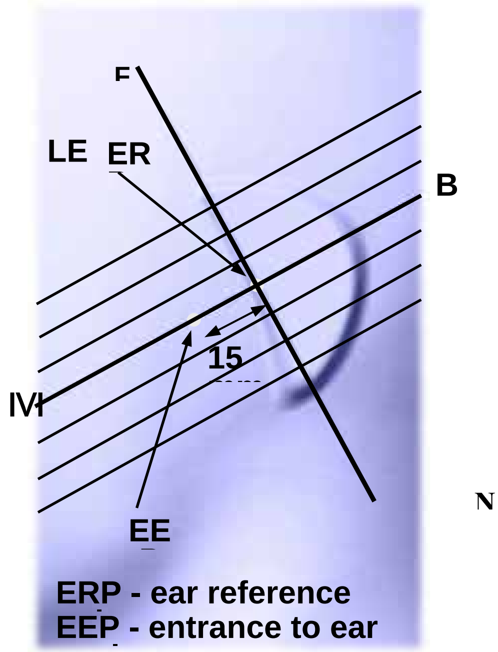
EUT TEST STRATEGY AND METHODOLOGY

Test Positions for Device Operating Next to a Person's Ear

This category includes most wireless handsets with fixed, retractable or internal antennas located toward the top half of the device, with or without a foldout, sliding or similar keypad cover. The handset should have its earpiece located within the upper ¼ of the device, either along the centerline or off-centered, as perceived by its users. This type of handset should be positioned in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point". The "test device reference point" should be located at the same level as the center of the earpiece region. The "vertical centerline" should bisect the front surface of the handset at its top and bottom edges. A "ear reference point" is located on the outer surface of the head phantom on each ear spacer. It is located 1.5 cm above the center of the ear canal entrance in the "phantom reference plane" defined by the three lines joining the center of each "ear reference point" (left and right) and the tip of the mouth.

A handset should be initially positioned with the earpiece region pressed against the ear spacer of a head phantom. For the SCC-34/SC-2 head phantom, the device should be positioned parallel to the "N-F" line defined along the base of the ear spacer that contains the "ear reference point". For interim head phantoms, the device should be positioned parallel to the cheek for maximum RF energy coupling. The "test device reference point" is aligned to the "ear reference point" on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane". This is called the "initial ear position". While maintaining these three alignments, the body of the handset is gradually adjusted to each of the following positions for evaluating SAR:





Cheek/Touch Position

The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line for the SCC-34/SC-2 head phantom.

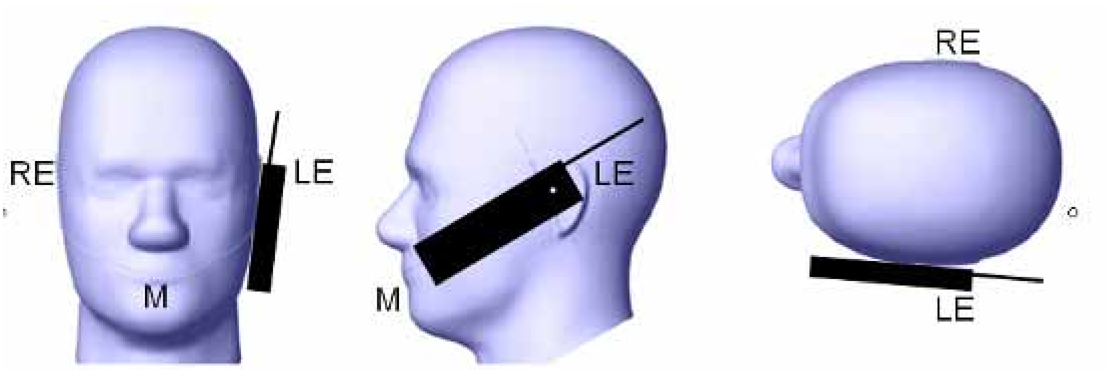
This test position is established:

When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.

(or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.

For existing head phantoms – when the handset loses contact with the phantom at the pivoting point, rotation should continue until the device touches the cheek of the phantom or breaks its last contact from the ear spacer.

Cheek /Touch Position



Ear/Tilt Position

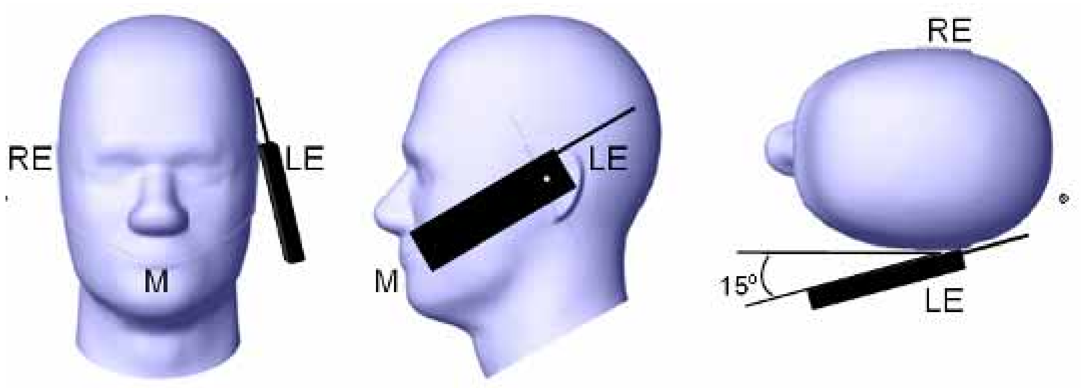
With the handset aligned in the "Cheek/Touch Position":

1) If the earpiece of the handset is not in full contact with the phantom's ear spacer (in the "Cheek/Touch position") and the peak SAR location for the "Cheek/Touch" position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.

2) (otherwise) The handset should be moved (translated) away from the cheek perpendicular to the line passes through both "ear reference points" (note: one of these ear reference points may not physically exist on a split head model) for approximate 2-3 cm. While it is in this position, the device handset is tilted away from the mouth with respect to the "test device reference point" until the inside angle between the vertical centerline on the front surface of the phone and the horizontal line passing through the ear reference point is by 15 80°. After the tilt, it is then moved (translated) back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously. This test position may require a device holder or positioner to achieve the translation and tilting with acceptable positioning repeatability.

If a device is also designed to transmit with its keypad cover closed for operating in the head position, such positions should also be considered in the SAR evaluation. The device should be tested on the left and right side of the head phantom in the "Cheek/Touch" and "Ear/Tilt" positions. When applicable, each configuration should be tested with the antenna in its fully extended and fully retracted positions. These test configurations should be tested at the high, middle and low frequency channels of each operating mode; for example, AMPS, CDMA, and TDMA. If the SAR measured at the middle channel for each test configuration (left, right, Cheek/Touch, Tilt/Ear, extended and retracted) is at least 2.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s). If the transmission band of the test device is less than 10 MHz, testing at the high and low frequency channels is optional.

Ear /Tilt 15º Position



Test positions for body-worn and other configurations

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.

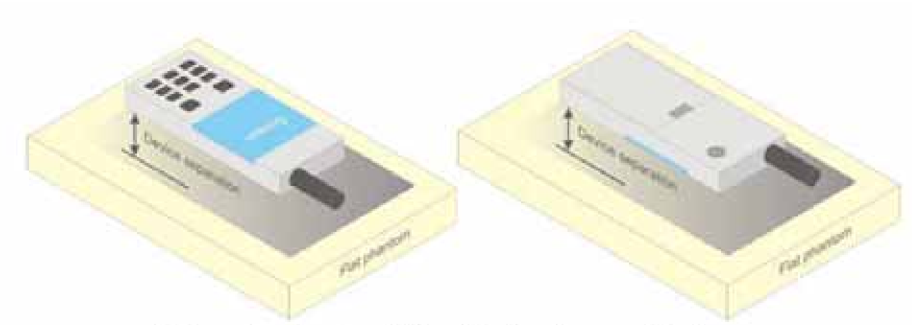


Figure 5 – Test positions for body-worn devices

Test Distance for SAR Evaluation

For this case the EUT(Equipment Under Test) is set 10mm away from the phantom, the test distance is 10mm.

SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or radiating structures of the EUT, the horizontal grid spacing was 15 mm x 15 mm, and the SAR distribution was determined by integrated grid of 1.5mm x 1.5mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

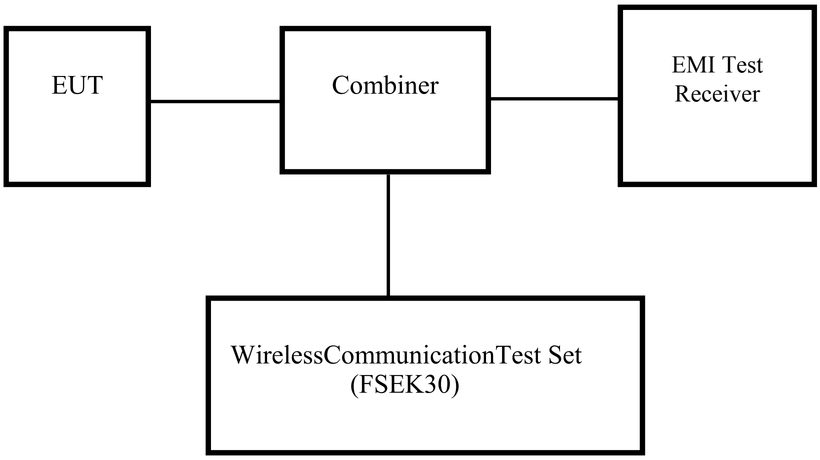
CONDUCTED OUTPUT POWER MEASUREMENT

Provision Applicable

The measured peak output power should be greater and within 5% than EMI measurement.

Test Procedure

The RF output of the transmitter was connected to the input of the EMI Test Receiver through sufficient attenuation.



WLAN

Radio Configuration

The power measurement was configured by the Wireless Communication Test Set.

Maximum Target Output Power

Max Target Power(dBm)			
Mode/Band	Channel		
	Low	Middle	High
WLAN 2.4G(802.11b)	17.5	18.0	17.5
WLAN 2.4G(802.11g)	14.0	14.0	14.5
WLAN 2.4G(802.11n HT20)	13.5	14.5	14.5
WLAN 2.4G(802.11n HT40)	14.0	14.0	14.0
WLAN 5G(802.11a)	14.5	14.5	14.5
WLAN 5G(802.11n HT20)	14.0	14.0	14.0
WLAN 5G(802.11n HT40)	14.0	14.0	14.0
Bluetooth(BDR/EDR)	5.5	6	5.5
Bluetooth BLE	-1	0	-1

Test Results:

WLAN 2.4G

Band	Frequency (MHz)	Average Conducted Output Power (dBm)	Peak Conducted Output Power (dBm)
802.11b	2412	17.23	20.24
	2437	**17.52**	20.39
	2462	17.33	20.37
802.11g	2412	13.73	23.07
	2437	13.97	22.91
	2462	13.90	23.06
802.11n HT20	2412	13.21	22.46
	2437	13.87	22.51
	2462	14.12	22.99
802.11n HT40	2422	13.34	21.87
	2437	13.72	22.86
	2452	13.52	22.61

Note:

1. The output power was tested under data rate 1Mbps for 802.11b, 6Mbps for 802.11g, MCS0 for 802.11n HT20, MCS0 for 802.11n HT40。

WLAN 5G(5150-5250 MHz):

Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5180	14.24
	5200	14.15
	5240	14.01
802.11ac20	5180	13.45
	5200	13.59
	5240	13.37
802.11ac40	5190	11.67
	5230	11.85

WLAN 5G(5250-5300 MHz):

Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5260	14.27
	5300	14.41
	5320	14.09
802.11ac20	5260	13.47
	5300	13.29
	5320	13.31
802.11ac40	5270	13.62
	5310	12.32

WLAN 5G(5740-5725 MHz):

Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5500	14.04
	5580	14.19
	5700	14.07
802.11ac20	5500	13.66
	5580	13.60
	5700	13.80
802.11ac40	5510	13.34
	5550	13.27
	5670	13.40

WLAN 5G(5725-5850 MHz):

Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5745	14.34
	5785	**14.49**
	5825	14.39
802.11ac20	5745	13.34
	5785	13.28
	5825	13.35
802.11ac40	5755	13.47
	5795	13.55

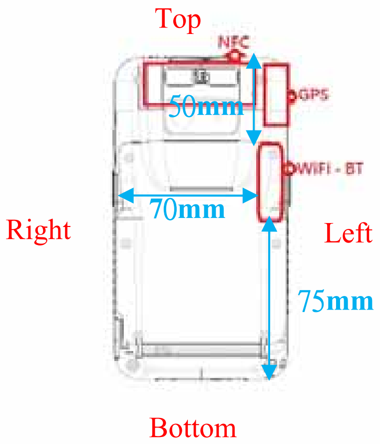
Note:
The output power was tested under data rate 54 for 802.11a, MCS7 for 802.11n-ht20 and 802.11n-ht40.

Bluetooth:

Mode	Channel frequency (MHz)	Average Conducted Output Power	Peak Conducted Output Power
		(dBm)	(dBm)
BDR(GFSK)	2402	5.21	5.84
	2441	5.89	6.48
	2480	5.14	5.85
EDR(4-DQPSK)	2402	2.46	5.01
	2441	3.27	5.72
	2480	2.58	5.08
EDR(8-DPSK)	2402	2.36	5.06
	2441	2.95	5.84
	2480	2.27	4.99
Bluetooth LE	2402	-1.74	0.29
	2440	-0.86	0.62
	2480	-1.45	0.38

Standalone SAR test exclusion considerations

Antennas Location:



Antenna Distance To Edge

Antenna Distance To Edge(mm)						
Antenna	Front	Back	Left	Right	Top	Bottom
WLAN	< 5	< 5	< 5	70	50	75

Standalone SAR test exclusion considerations

Mode	Frequency (MHz)	Pavg (dBm)	Pavg (mW)	Min. Test Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
WLAN 2.4G	2437	18	63	0	19.84	3	No
WLAN 5G	5785	14.5	28	0	8.82	3	No
Bluetooth	2480	6	4	0	2.48	3	YES

NOTE:
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Standalone SAR estimation:

Mode	Frequency (MHz)	Pavg (dBm)	Pavg (mW)	Distance (mm)	Estimated 1-g (W/kg)
BT Head	2480	6	4	0	0.17
BT Body	2480	6	4	10	0.09

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
[(max. power of channel, including tune-up tolerance , mW)/(min. test separation distance,mm)] · [√f(GHz)/x]
W/kg for test separation distances ≤50 mm;
where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion

SAR test exclusion for the EUT edge considerations Result

Antenna Distance To Edge(mm)						
Mode	**Front**	**Back**	**Left Side**	**Right Side**	**Top Side**	**Bottom Side**
WLAN	**Required**	**Required**	**Required**	**Exclusion**	**Exclusion**	**Exclusion**

Note:
Required：The distance to Edge is less than 25mm, testing is required.
Exclusion*：SAR test exclusion evaluation has been done above.
Exclusion：The distance to Edge is more than 25 mm, testing is not required.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

Temperature:	22.3-22.5 ℃	22.8-22.9 ℃	22.1-22.3 ℃	22.3-22.5 ℃	22.0-22.2 ℃
Relative Humidity:	57 %	55 %	57 %	55 %	53 %
Test Date:	2018/12/05	2018/12/12	2018/12/17	2018/12/20	2018/12/21

Testing was performed by Angelo Chang

WLAN 2.4G:

Plot No.	Band	Mode	Test Position	Gap (mm)	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
1	WLAN2.4G	802.11b 1Mbps	Right Cheek	-	2437	17.52	18.00	-0.12	0.045	0.050
2	WLAN2.4G	802.11b 1Mbps	Right Tilted	-	2437	17.52	18.00	0.13	0.011	0.012
3	WLAN2.4G	802.11b 1Mbps	Left Cheek	-	2437	17.52	18.00	0.15	0.047	**0.052**
4	WLAN2.4G	802.11b 1Mbps	Left Tilted	-	2437	17.52	18.00	-0.1	0.015	0.017
5	WLAN2.4G	802.11b 1Mbps	Left Cheek	-	2412	17.23	17.50	-0.11	0.044	0.047
6	WLAN2.4G	802.11b 1Mbps	Left Cheek	-	2462	17.33	17.50	0.06	0.044	0.046
7	WLAN2.4G	802.11b 1Mbps	Front	10	2437	17.52	18.00	-0.06	0.015	0.016
8	WLAN2.4G	802.11b 1Mbps	Back	10	2437	17.52	18.00	-0.15	0.021	0.023
9	WLAN2.4G	802.11b 1Mbps	Left Side	10	2437	17.52	18.00	-0.12	0.030	**0.033**
10	WLAN2.4G	802.11b 1Mbps	Left Side	10	2412	17.23	17.50	-0.19	0.029	0.030
11	WLAN2.4G	802.11b 1Mbps	Left Side	10	2462	17.33	17.50	-0.12	0.031	0.033

WLAN 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Consideration:

Modulation Mode	Pavg (dBm)	Pavg (mW)	Reported SAR(W/kg)	Adjusted SAR(W/kg)	Limit(W/kg)	SAR Test Exclusion
802.11b(DSSS)	18.0	63	0.052	/	/	/
802.11g(OFDM)	14.5	28	/	0.021	1.2	Yes
802.11n HT20(OFDM)	14.5	28	/	0.021	1.2	Yes
802.11n HT40(OFDM)	14.0	25	/	0.019	1.2	Yes

WLAN 5G:

Plot No.	Band	Mode	Test Position	Gap (mm)	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
12	WLAN5G	802.11a 6Mbps	Right Cheek	-	5300	14.41	14.50	0.14	0.054	0.055
13	WLAN5G	802.11a 6Mbps	Right Tilted	-	5300	14.41	14.50	0.17	0.014	0.014
14	WLAN5G	802.11a 6Mbps	Left Cheek	-	5300	14.41	14.50	-0.07	0.048	0.049
15	WLAN5G	802.11a 6Mbps	Left Tilted	-	5300	14.41	14.50	0.16	0.012	0.012
16	WLAN5G	802.11a 6Mbps	Right Cheek	-	5260	14.27	14.50	0.1	0.053	0.056
17	WLAN5G	802.11a 6Mbps	Right Cheek	-	5320	14.09	14.50	0.19	0.057	**0.063**
				-						
18	WLAN5G	802.11a 6Mbps	Right Cheek	-	5580	14.19	14.50	0.1	0.097	0.104
19	WLAN5G	802.11a 6Mbps	Right Tilted	-	5580	14.19	14.50	0.1	0.025	0.027
20	WLAN5G	802.11a 6Mbps	Left Cheek	-	5580	14.19	14.50	-0.01	0.121	0.130
21	WLAN5G	802.11a 6Mbps	Left Tilted	-	5580	14.19	14.50	-0.1	0.015	0.016
22	WLAN5G	802.11a 6Mbps	Left Cheek	-	5500	14.04	14.50	-0.12	0.074	0.082
23	WLAN5G	802.11a 6Mbps	Left Cheek	-	5700	14.07	14.50	0.01	0.114	**0.126**
				-						
24	WLAN5G	802.11a 6Mbps	Right Cheek	-	5785	14.49	14.50	0.07	0.091	0.091
25	WLAN5G	802.11a 6Mbps	Right Tilted	-	5785	14.49	14.50	-0.1	0.036	0.036
26	WLAN5G	802.11a 6Mbps	Left Cheek	-	5785	14.49	14.50	0.05	0.120	0.120
27	WLAN5G	802.11a 6Mbps	Left Tilted	-	5785	14.49	14.50	0.12	0.019	0.019
28	WLAN5G	802.11a 6Mbps	Left Cheek	-	5745	14.34	14.50	-0.15	0.139	**0.144**
29	WLAN5G	802.11a 6Mbps	Left Cheek	-	5825	14.39	14.50	0.11	0.119	0.122
30	WLAN5G	802.11a 6Mbps	Front	10	5300	14.41	14.50	-0.17	0.011	0.011
31	WLAN5G	802.11a 6Mbps	Back	10	5300	14.41	14.50	0.15	0.217	0.224
32	WLAN5G	802.11a 6Mbps	Left Side	10	5300	14.41	14.50	-0.17	0.078	0.081
33	WLAN5G	802.11a 6Mbps	Back	10	5260	14.27	14.50	-0.05	0.222	**0.241**
34	WLAN5G	802.11a 6Mbps	Back	10	5320	14.09	14.50	-0.08	0.224	0.237
35	WLAN5G	802.11a 6Mbps	Front	10	5580	14.19	14.50	-0.13	0.030	0.031
36	WLAN5G	802.11a 6Mbps	Back	10	5580	14.19	14.50	0.14	0.279	0.286
37	WLAN5G	802.11a 6Mbps	Left Side	10	5580	14.19	14.50	-0.11	0.121	0.124
38	WLAN5G	802.11a 6Mbps	Back	10	5500	14.04	14.50	0.02	0.261	0.286
39	WLAN5G	802.11a 6Mbps	Back	10	5700	14.07	14.50	-0.15	0.300	**0.302**
40	WLAN5G	802.11a 6Mbps	Front	10	5785	14.49	14.50	0.13	0.026	0.026
41	WLAN5G	802.11a 6Mbps	Back	10	5785	14.49	14.50	-0.1	0.274	**0.275**
42	WLAN5G	802.11a 6Mbps	Left Side	10	5785	14.49	14.50	-0.06	0.066	0.066
43	WLAN5G	802.11a 6Mbps	Back	10	5745	14.34	14.50	0.02	0.259	0.269
44	WLAN5G	802.11a 6Mbps	Back	10	5825	14.39	14.50	-0.11	0.264	0.271

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Per KDB 248227 D01v02r02, for U-NII-1 Head and Body-worn SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. For WLAN SAR testing was performed on single antenna RF power in SISO mode is larger or equal to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission exclusion analysis was performed with SAR test results of each antenna in SISO mode.
6. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6W/kg and SAR peak to location ratio < 0.04, no additional SAR measurements for MIMO.
7. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Note: The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The Highest Measured SAR Configuration in Each Frequency Band

Head

SAR probe calibration point	Frequency Band	Freq.(MHz)	EUT Position	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio
				Original	Repeated	
/	/	/	/	/	/	/

Body

SAR probe calibration point	Frequency Band	Freq.(MHz)	EUT Position	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio
				Original	Repeated	
/	/	/	/	/	/	/

Note:

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. The measured SAR results **do not** have to be scaled to the maximum tune-up tolerance to determine if repeated measurements are required.
3. SAR measurement variability must be assessed for each frequency band, which is determined by the **SAR probe calibration point and tissue-equivalent medium** used for the device measurements..

SAR SIMULTANEOUS TRANSMISSION DESCRIPTION

Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities		
Transmitter Combination	**Simultaneous?**	**Hotspot?**
WLAN+Bluetooth	√	x

Note:

1. The 2 WLAN antennas can transmit simultaneously.

Simultaneous and test exclusion considerations:

Mode(SAR1+SAR2)	Position	Reported SAR(W/kg)		ΣSAR < 1.6W/kg
		SAR1	SAR2	
WLAN2.4G+Bluetooth	Right Cheek	0.049	0.17	0.219
	Right Tilted	0.012	0.17	0.182
	Left Cheek	0.052	0.17	0.222
	Left Tilted	0.016	0.17	0.186
WLAN2.4G+Bluetooth	Front	0.016	0.09	0.186
	Back	0.023	0.09	0.193
	Left Side	0.033	0.09	0.203
WLAN5G+Bluetooth	Right Cheek	0.104	0.17	0.274
	Right Tilted	0.036	0.17	0.206
	Left Cheek	0.144	0.17	**0.314**
	Left Tilted	0.019	0.17	0.189
WLAN5G+Bluetooth	Front	0.031	0.09	0.201
	Back	0.302	0.09	**0.472**
	Left Side	0.124	0.09	0.294

Conclusion:

Sum of SAR: **ΣSAR ≤ 1.6 W/kg** therefore simultaneous transmission SAR with Volume Scans is **not required**.

APPENDIX A MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the measurement system and is given in the following Table.

Measurement uncertainty evaluation for IEEE1528-2013 SAR test

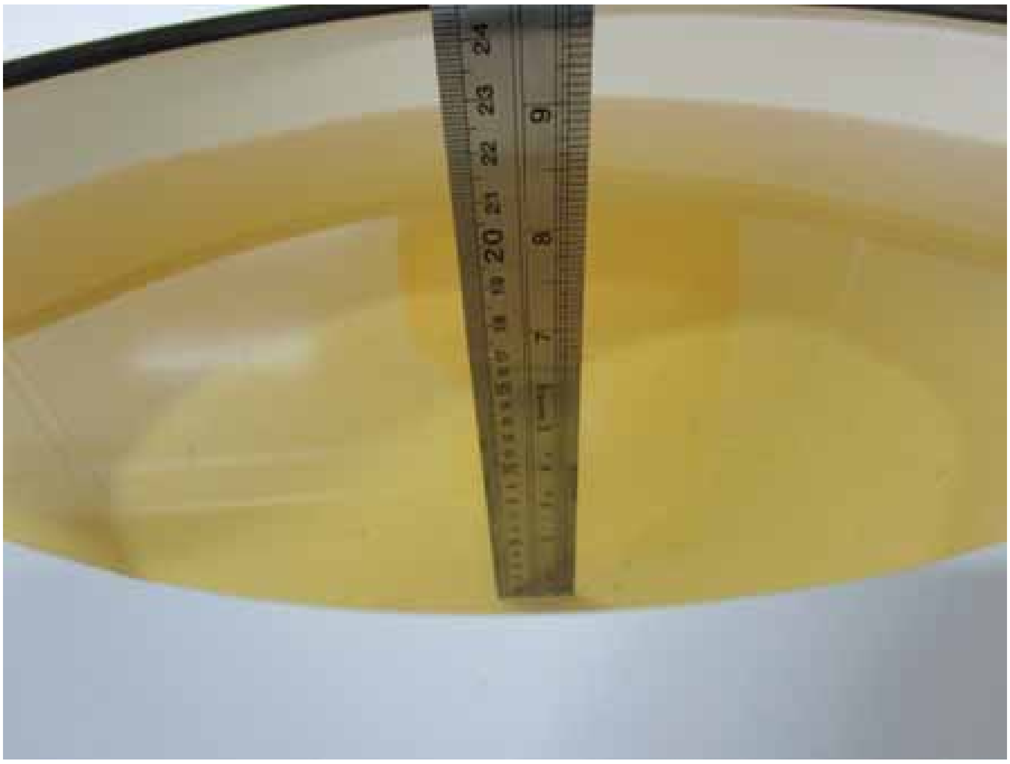
Source of uncertainty	Tolerance/ uncertainty ± %	Probability distribution	Divisor	ci (1 g)	ci (10 g)	Standard uncertainty ± %, (1 g)	Standard uncertainty ± %, (10 g)
Measurement system							
Probe calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	√3	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	√3	0	0	0.0	0.0
Boundary effect	1.0	R	√3	1	1	0.6	0.6
Linearity	4.7	R	√3	1	1	2.7	2.7
Detection limits	1.0	R	√3	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	√3	1	1	0.0	0.0
Integration time	0.0	R	√3	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	√3	1	1	0.6	0.6
RF ambient conditions–reflections	1.0	R	√3	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	√3	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	√3	1	1	3.9	3.9
Post-processing	2.0	R	√3	1	1	1.2	1.2
Test sample related							
Test sample positioning	2.8	N	1	1	1	2.8	2.8
Device holder uncertainty	6.3	N	1	1	1	6.3	6.3
Drift of output power	5.0	R	√3	1	1	2.9	2.9
Phantom and set-up							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	√3	1	1	2.3	2.3
Liquid conductivity target)	5.0	R	√3	0.64	0.43	1.8	1.2
Liquid conductivity meas.)	2.5	N	1	0.64	0.43	1.6	1.1
Liquid permittivity target)	5.0	R	√3	0.6	0.49	1.7	1.4
Liquid permittivity meas.)	2.5	N	1	0.6	0.49	1.5	1.2
Combined standard uncertainty		RSS				12.2	12.0
Expanded uncertainty 95 % confidence interval)						24.3	23.9

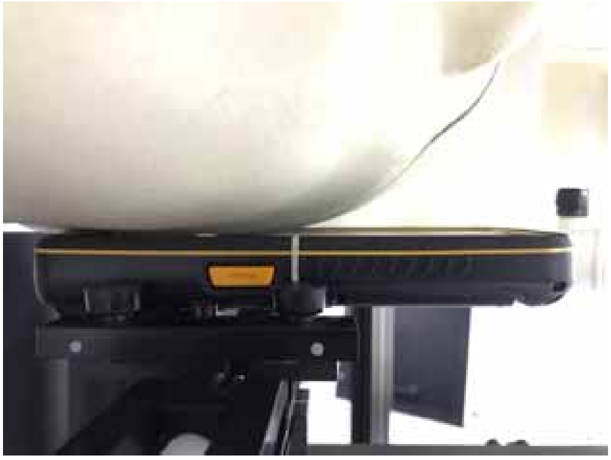
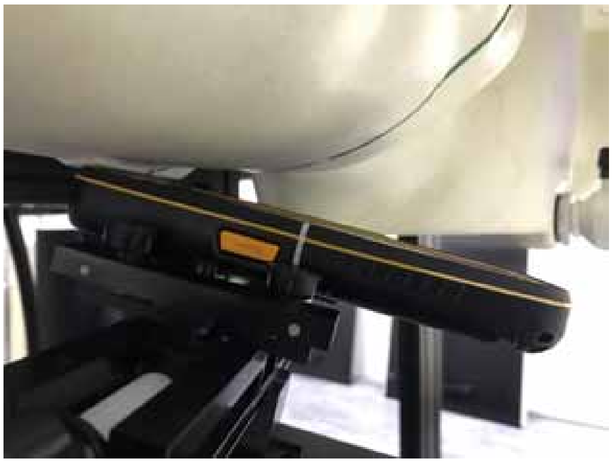
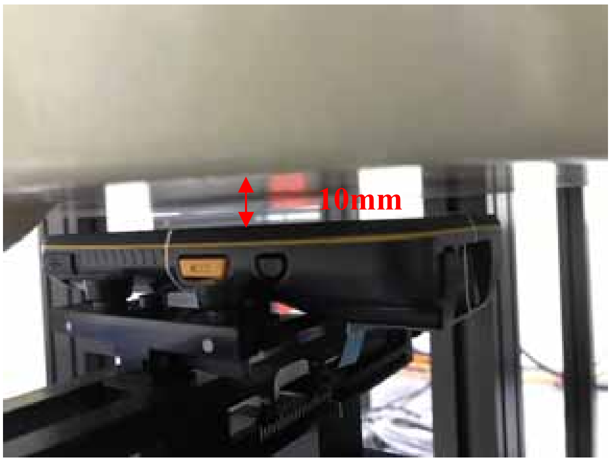
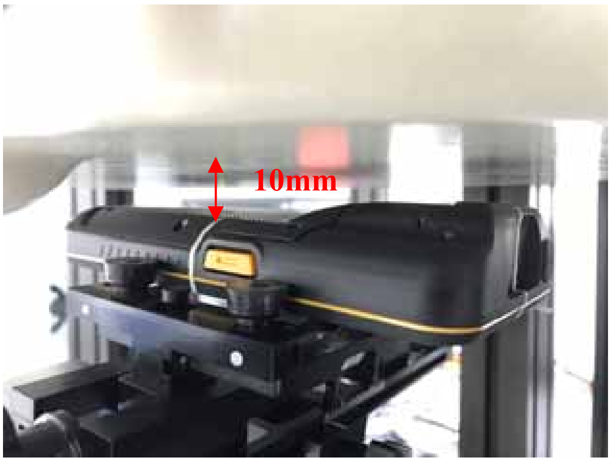
Measurement uncertainty evaluation for IEC62209-2 SAR test

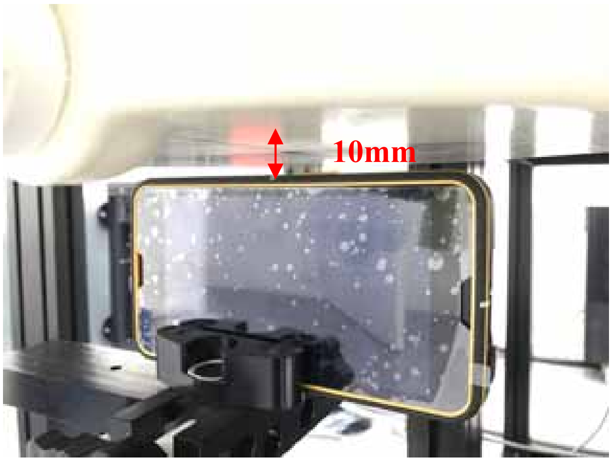
Source of uncertainty	Tolerance/ uncertainty ± %	Probability distribution	Divisor	ci (1 g)	ci (10 g)	Standard uncertainty ± %, (1 g)	Standard uncertainty ± %, (10 g)
Measurement system							
Probe calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	√3	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	√3	0	0	0.0	0.0
Linearity	4.7	R	√3	1	1	2.7	2.7
Modulation Response	0.0	R	√3	1	1	0.0	0.0
Detection limits	1.0	R	√3	1	1	0.6	0.6
Boundary effect	1.0	R	√3	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	√3	1	1	0.0	0.0
Integration time	0.0	R	√3	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	√3	1	1	0.6	0.6
RF ambient conditions–reflections	1.0	R	√3	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	√3	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	√3	1	1	3.9	3.9
Post-processing	2.0	R	√3	1	1	1.2	1.2
Test sample related							
Device holder Uncertainty	6.3	N	1	1	1	6.3	6.3
Test sample positioning	2.8	N	1	1	1	2.8	2.8
Power scaling	4.5	R	√3	1	1	2.6	2.6
Drift of output power	5.0	R	√3	1	1	2.9	2.9
Phantom and set-up							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	√3	1	1	2.3	2.3
Algorithm for correcting SAR for deviations in permittivity and conductivity	1.9	N	1	1	0.84	1.1	0.9
Liquid conductivity (meas.)	2.5	N	1	0.64	0.43	1.6	1.1
Liquid permittivity (meas.)	2.5	N	1	0.6	0.49	1.5	1.2
Temp. unc. - Conductivity	1.7	R	√3	0.78	0.71	0.8	0.7
Temp. unc. - Permittivity	0.3	R	√3	0.23	0.26	0.0	0.0
Combined standard uncertainty		RSS				12.2	12.1
Expanded uncertainty 95 % confidence interval)						24.5	24.2

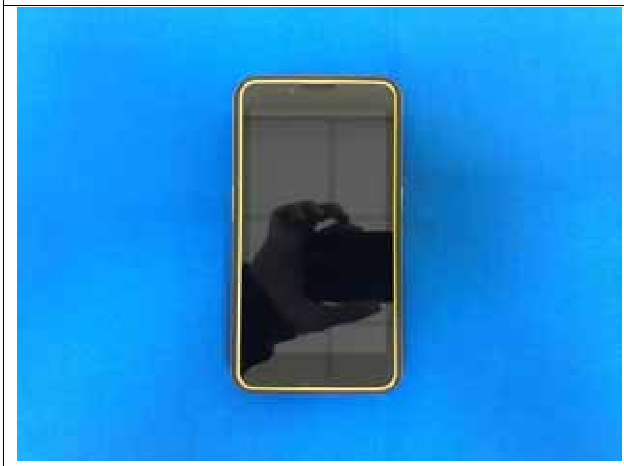
APPENDIX B EUT TEST POSITION PHOTOS

Liquid depth ≥ 15cm



Right Cheek	Right Tilted
	
Left Cheek	**Left Tilted**
	
Front	**Back**
	

Left Side	
	

EUT-Front View	EUT-Back View
	

APPENDIX C SAR PLOTS OF SAR MEASUREMENT

Please refer to the file document of RLK181207001-23A

APPENDIX C SAR PLOTS OF SAR MEASUREMENT.

APPENDIX D CALIBRATION CERTIFICATES

Please refer to the file document of RLK181207001-23A

APPENDIX D CALIBRATION CERTIFICATES.

******* END OF REPORT *******