

SAR EVALUATION REPORT

For

Autel Robotics Co., Ltd.

9th Floor, Building B1, Zhiyuan, Xueyuan Road, Xili, Nanshan, Shenzhen, China

FCC ID: 2AGNTEF8RC2409A

IC: 20910-EF8RC2409A

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Attestation of Test Results			
EUT Information	EUT Description	EF8	
	Tested Model	EF8	
	FCC ID	2AGNTEF8RC2409A	
	IC	20910-EF8RC2409A	
	Serial Number	19082800409	
	Test Date	2019/10/24 to 2019/10/26	
MODE		Max. SAR Level(s) Reported(W/kg)	Limit (W/kg)
SDR 2.4G	10g Extremity SAR	2.28	4.0
SDR 2.4G	1g Body SAR	1.16	1.6
SDR 900M	10g Extremity SAR	0.43	4.0
SDR 900M	1g Body SAR	0.27	1.6
Applicable Standards	FCC 47 CFR part 2.1093 Radiofrequency radiation exposure evaluation: portable devices		
	RSS-102 Issue 5 March 2015 Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands).		
	IEC 62209-1:2016 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)		
	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 D07 UMPC Mini Tablet v01r02		
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	RSZ190828004-SA	Original Report	2019-11-08

EUT DESCRIPTION

This report has been prepared on behalf of **Autel Robotics Co., Ltd.** and their product **EF8**, Model: **EF8**, **FCC ID: 2AGNTEF8RC2409A**, **IC: 20910-EF8RC2409A** 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: 19082800409 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2019-09-05.*

Technical Specification

Device Type:	Portable
Exposure Category:	Population / Uncontrolled
Antenna Type(s):	External Antenna
Accessories:	None
Operation Mode:	SDR 2.4G/900M
Frequency Band:	900MHz Band: 906~924 MHz@1.4MHz Mode 908~921 MHz@10MHz Mode 2.4GHz Band: 2403.5~2475.5MHz@1.4MHz Mode 2407.5~2471.5MHz@10MHz Mode
Conducted RF Power:	SDR 2.4G: 24.56 dBm SDR 900M: 24.35 dBm
Power Source:	Rechargeable Battery
Normal Operation:	Handheld and Close to Body (Body for short)

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.

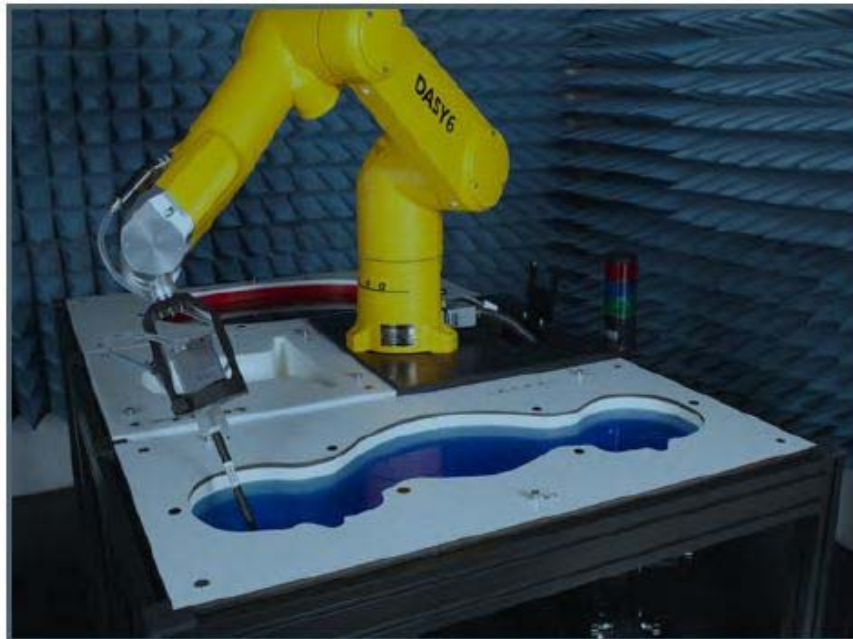
FACILITIES

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect data is located at 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

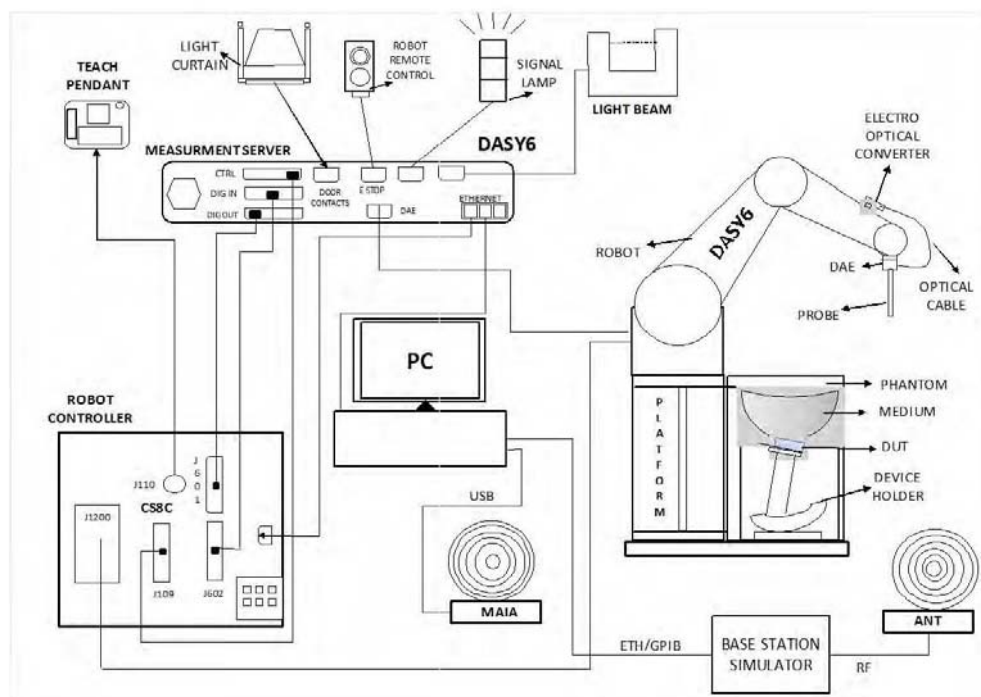
The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

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:



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 standardized 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 200M Ω ; 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 μ W/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/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 measurement areas: 1) Left Head, 2) Right Head, and 3) Flat Section. For larger devices, 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 phantoms).

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

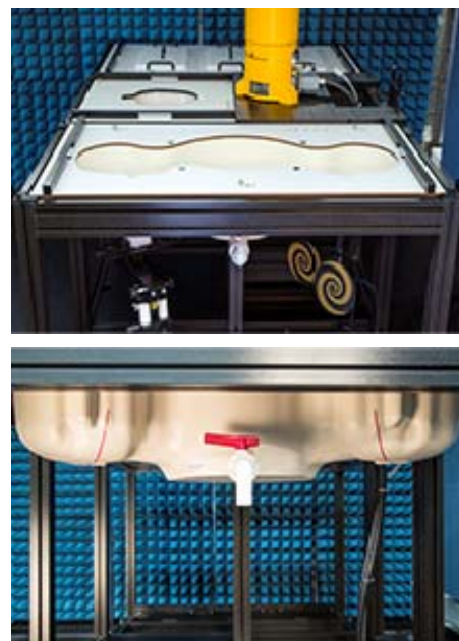
Phantom, some of the phantom teaching points cannot be reached by the robot in DASY5 V5.2. A special tool called P1a-P2aX-Former is provided to transform two of the three points, P1 and P2, to reachable locations. To use these new teaching points, a revised phantom configuration file is required.

In addition to our standard broadband liquids, the phantom can be used with the following tissue simulating 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.



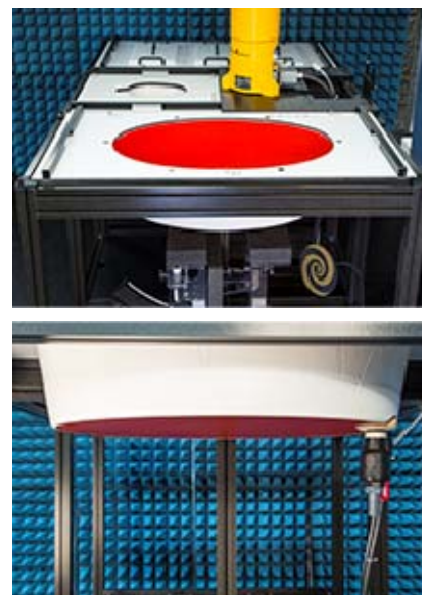
ELI Phantom

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI is fully compatible with the latest draft of the standard IEC 62209-2 and the use of all known tissue simulating liquids. ELI has been optimized for performance and can be integrated into a SPEAG standard phantom table. A cover is provided to prevent evaporation of water and changes in liquid parameters. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points.

The phantom can be used with the following tissue simulating 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 ELI phantom.



Robots

The DASY6 system uses the high-precision industrial robots TX60L, TX90XL, and RX160L from Staubli 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

Calibration Frequency Points for EX3DV4 E-Field Probes SN: 7522 Calibrated: 2018/11/02

Calibration Frequency Point(MHz)	Frequency Range(MHz)		Conversion Factor		
	From	To	X	Y	Z
750 Head	650	800	9.78	9.78	9.78
750 Body	650	800	9.8	9.8	9.8
850 Head	800	950	9.46	9.46	9.46
850 Body	800	950	9.54	9.54	9.54
1750 Head	1650	1810	8.2	8.2	8.2
1750 Body	1650	1810	7.88	7.88	7.88
1900 Head	1810	1920	7.91	7.91	7.91
1900 Body	1810	1920	7.48	7.48	7.48
2000 Head	1920	2100	7.78	7.78	7.78
2000 Body	1920	2100	7.36	7.36	7.36
2300 Head	2200	2399	7.35	7.35	7.35
2300 Body	2200	2399	7.27	7.27	7.27
2450 Head	2399	2500	6.97	6.97	6.97
2450 Body	2399	2500	7.05	7.05	7.05
2600 Head	2500	2700	6.79	6.79	6.79
2600 Body	2500	2700	6.95	6.95	6.95
5250 Head	5140	5360	5.05	5.05	5.05
5250 Body	5140	5360	4.77	4.77	4.77
5600 Head	5490	5700	4.48	4.48	4.48
5600 Body	5490	5700	4.27	4.27	4.27
5800 Head	5700	5910	4.76	4.76	4.76
5800 Body	5700	5910	4.31	4.31	4.31

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 DASY5 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/m³ 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 x 7 x 7 (5mmx5mmx5mm) providing a volume of 30 mm in the X & Y & Z axis.

Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1:2016

Recommended Tissue Dielectric properties for Head liquid

Table A.3 – Dielectric properties of the head tissue-equivalent liquid

Frequency MHz	Relative permittivity ϵ_r	Conductivity (σ) S/m
300	45,3	0,87
450	43,5	0,87
750	41,9	0,89
835	41,5	0,90
900	41,5	0,97
1 450	40,5	1,20
1 500	40,4	1,23
1 640	40,2	1,31
1 750	40,1	1,37
1 800	40,0	1,40
1 900	40,0	1,40
2 000	40,0	1,40
2 100	39,8	1,49
2 300	39,5	1,67
2 450	39,2	1,80
2 600	39,0	1,96
3 000	38,5	2,40
3 500	37,9	2,91
4 000	37,4	3,43
4 500	36,8	3,94
5 000	36,2	4,45
5 200	36,0	4,66
5 400	35,8	4,86
5 600	35,5	5,07
5 800	35,3	5,27
6 000	35,1	5,48

NOTE For convenience, permittivity and conductivity values at those frequencies which are not part of the original data provided by Drossos et al. [33] or the extension to 5 800 MHz are provided (i.e. the values shown *in italics*). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6 000 MHz that were linearly extrapolated from the values at 3 000 MHz and 5 800 MHz.

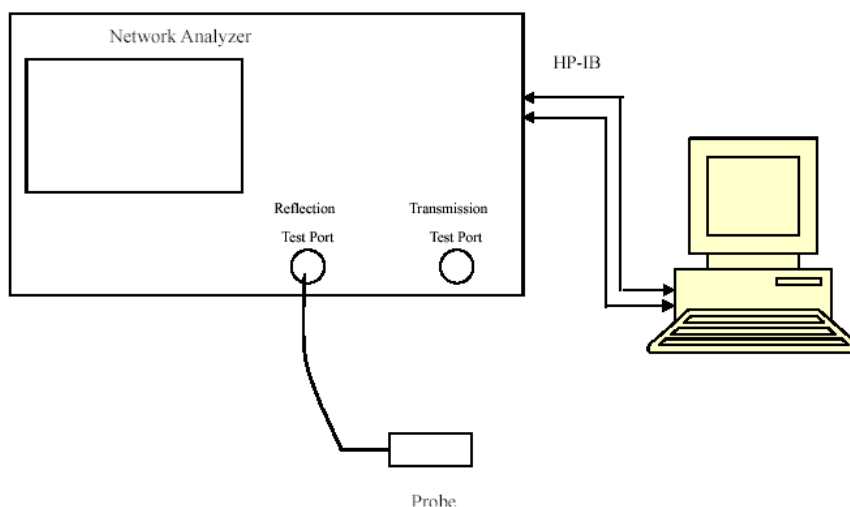
EQUIPMENT LIST AND CALIBRATION

Equipments List & Calibration Information

Equipment	Model	S/N	Calibration Date	Calibration Due Date
DASY5 Test Software	DASY52 52.10.2	N/A	NCR	NCR
DASY6 Measurement Server	DASY6 6.0.31	N/A	NCR	NCR
Data Acquisition Electronics	DAE4	1562	2018/11/6	2019/11/6
E-Field Probe	EX3DV4	7522	2018/11/2	2019/11/2
Mounting Device	MD4HHTV5	SD 000 H01 KA	NCR	NCR
SAM Twin Phantom	SAM-Twin V8.0	1962	NCR	NCR
Dipole, 900MHz	D900V2	132	2017/10/10	2020/10/10
Dipole, 2450MHz	D2450V2	751	2017/10/12	2020/10/12
Simulated Tissue Liquid Head	HBBL600-10000V6	180622-2	Each Time	
Network Analyzer	8753D	3410A08288	2019/04/25	2020/04/25
Dielectric Assessment Kit	DAK-3.5	1248	NCR	NCR
Anritsu Signal Generator	68369B	4114	2018/12/24	2019/12/24
Power Meter	E4419B	GB39511341	2019/06/23	2020/06/23
Power Amplifier	5S1G4	71377	NCR	NCR
Directional Coupler	4242-10	3307	NCR	NCR
Attenuator	3dB	5402	NCR	NCR
Attenuator	10dB	AU 3842	NCR	NCR
R&S, universal Radio Communication Tester	CMU200	115500	2019/06/23	2020/06/23
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	1201.002K50-146520-wh	2019/04/24	2020/04/24

SAR MEASUREMENT SYSTEM VERIFICATION

Liquid Verification



Liquid Verification Setup Block Diagram

Liquid Verification Results

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$	
2403.5	Head	37.835	1.747	39.29	1.76	-3.7	-0.74	± 5
2407.5	Head	37.961	1.749	39.29	1.76	-3.38	-0.62	± 5
2439.5	Head	38.245	1.771	39.22	1.79	-2.49	-1.06	± 5
2450	Head	38.014	1.815	39.20	1.80	-3.03	0.83	± 5
2471.5	Head	38.316	1.824	39.17	1.82	-2.18	0.22	± 5
2475.5	Head	38.344	1.829	39.17	1.83	-2.11	-0.05	± 5

*Liquid Verification above was performed on 2019/10/24.

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$	
2403.5	Head	37.898	1.746	39.29	1.76	-3.54	-0.8	± 5
2407.5	Head	37.912	1.749	39.29	1.76	-3.51	-0.62	± 5
2439.5	Head	38.328	1.767	39.22	1.79	-2.27	-1.28	± 5
2450	Head	37.907	1.816	39.20	1.80	-3.3	0.89	± 5
2471.5	Head	38.275	1.824	39.17	1.82	-2.28	0.22	± 5
2475.5	Head	38.48	1.826	39.17	1.83	-1.76	-0.22	± 5

*Liquid Verification above was performed on 2019/10/25.

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$	
900	Head	42.335	0.969	41.50	0.97	2.01	-0.1	± 5
906	Head	42.177	0.973	41.49	0.97	1.66	0.31	± 5
909	Head	42.063	0.977	41.48	0.97	1.41	0.72	± 5
915	Head	41.709	0.989	41.47	0.98	0.58	0.92	± 5
916	Head	41.637	0.989	41.47	0.98	0.4	0.92	± 5
921	Head	41.698	0.992	41.46	0.98	0.57	1.22	± 5
924	Head	41.487	0.994	41.46	0.98	0.07	1.43	± 5

*Liquid Verification above was performed on 2019/10/24.

Frequency (MHz)	Liquid Type	Liquid Parameter		Target Value		Delta (%)		Tolerance (%)
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	$\Delta\epsilon_r$	$\Delta\sigma$	
900	Head	42.54	0.973	41.50	0.97	2.51	0.31	± 5
906	Head	42.176	0.974	41.49	0.97	1.65	0.41	± 5
909	Head	42.039	0.974	41.48	0.97	1.35	0.41	± 5
915	Head	41.488	0.99	41.47	0.98	0.04	1.02	± 5
916	Head	41.655	0.994	41.47	0.98	0.45	1.43	± 5
921	Head	41.724	0.995	41.46	0.98	0.64	1.53	± 5
924	Head	41.6	0.995	41.46	0.98	0.34	1.53	± 5

*Liquid Verification above was performed on 2019/10/26.

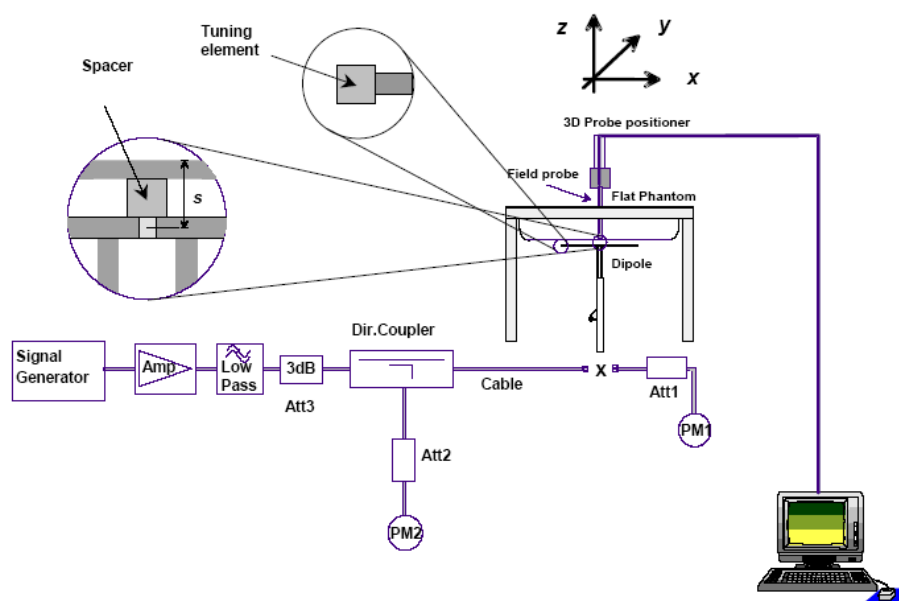
System Accuracy Verification

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

- $s = 15 \text{ mm} \pm 0,2 \text{ mm}$ for $300 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$ for $1\,000 \text{ MHz} < f \leq 3\,000 \text{ MHz}$;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$ for $3\,000 \text{ MHz} < f \leq 6\,000 \text{ MHz}$.

System Verification Setup Block Diagram



System Accuracy Check Results

Date	Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
2019/10/24	2450	Head	100	1g	5.29	52.9	52.5	0.762	±10
				10g	2.49	24.9	24.6	1.220	±10
2019/10/25	2450	Head	100	1g	5.34	53.4	52.5	1.714	±10
				10g	2.52	25.2	24.6	2.439	±10

Date	Frequency Band (MHz)	Liquid Type	Input Power (mW)	Measured SAR (W/kg)		Normalized to 1W (W/kg)	Target Value (W/Kg)	Delta (%)	Tolerance (%)
2019/10/24	900	Head	100	1g	1.03	10.3	10.9	-5.505	±10
				10g	0.66	6.6	7	-5.714	±10
2019/10/26	900	Head	100	1g	1.04	10.4	10.9	-4.587	±10
				10g	0.687	6.87	7	-1.857	±10

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

SAR SYSTEM VALIDATION DATA

System Performance 2450 MHz Head (Date:2019/10/24)

DUT: Dipole 2450MHz; Type: D2450V2; Serial: 751

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.815$ S/m; $\epsilon_r = 38.014$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7522; ConvF(6.97, 6.97, 6.97) @ 2450 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 11/6/2018
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Head 2450MHz Pin=100mW/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 5.89 W/kg

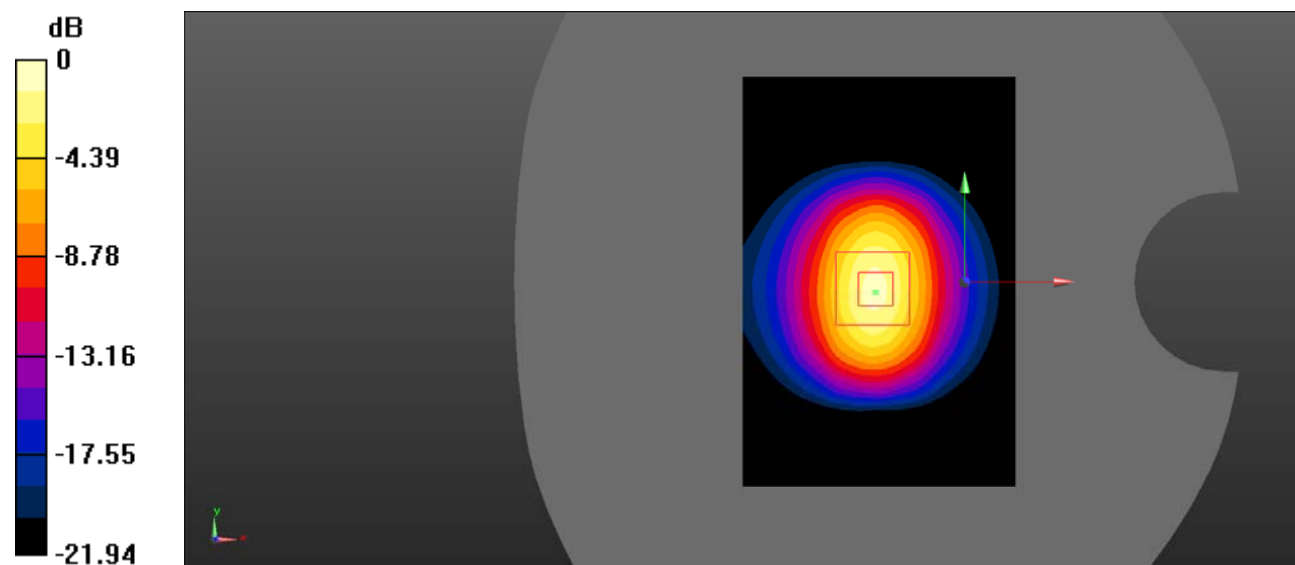
Head 2450MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.57 V/m; Power Drift = 0.041 dB

Peak SAR (extrapolated) = 10.6 W/kg

SAR(1 g) = 5.29 W/kg; SAR(10 g) = 2.49 W/kg

Maximum value of SAR (measured) = 6.24 W/kg



0 dB = 6.24 W/kg = 7.95 dBW/kg

System Performance 2450 MHz Head (Date:2019/10/25)**DUT: Dipole 2450MHz; Type: D2450V2; Serial: 751**

Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.816$ S/m; $\epsilon_r = 37.907$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7522; ConvF(6.97, 6.97, 6.97) @ 2450 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 11/6/2018
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Head 2450MHz Pin=100mW/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 5.92 W/kg

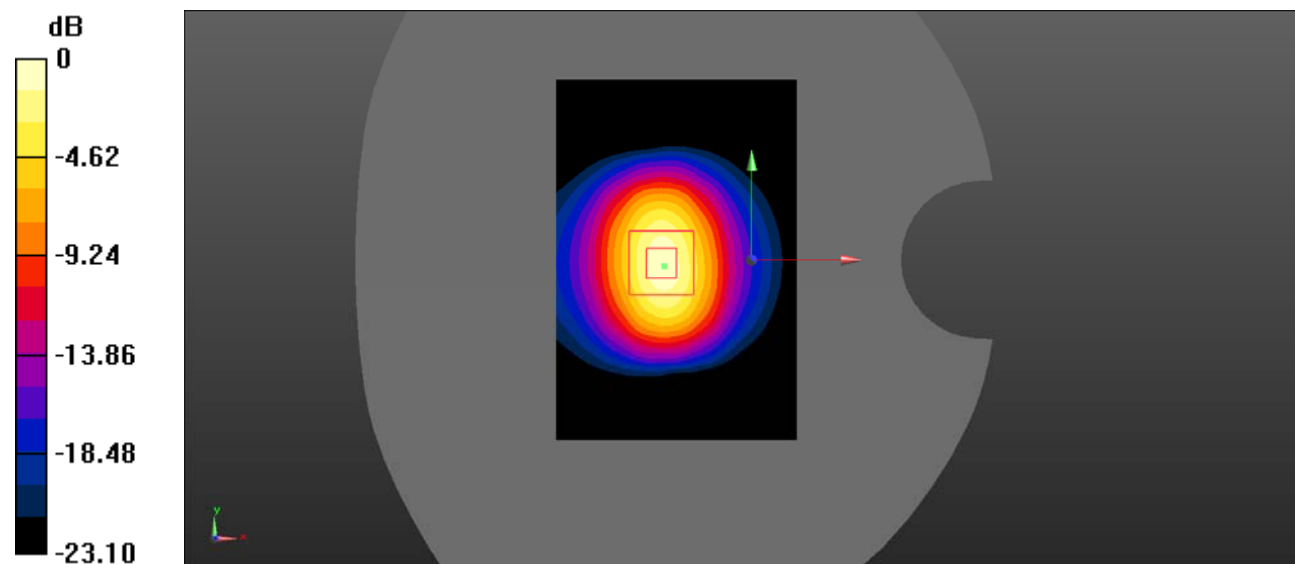
Head 2450MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.18V/m; Power Drift = 0.045 dB

Peak SAR (extrapolated) = 10.9 W/kg

SAR(1 g) = 5.34 W/kg; SAR(10 g) = 2.52 W/kg

Maximum value of SAR (measured) = 6.37 W/kg



0 dB = 6.37 W/kg = 8.04 dBW/kg

System Performance 900 MHz Head (Date:2019/10/24)**DUT: Dipole 900 MHz; Type: D900V2; Serial: 132**

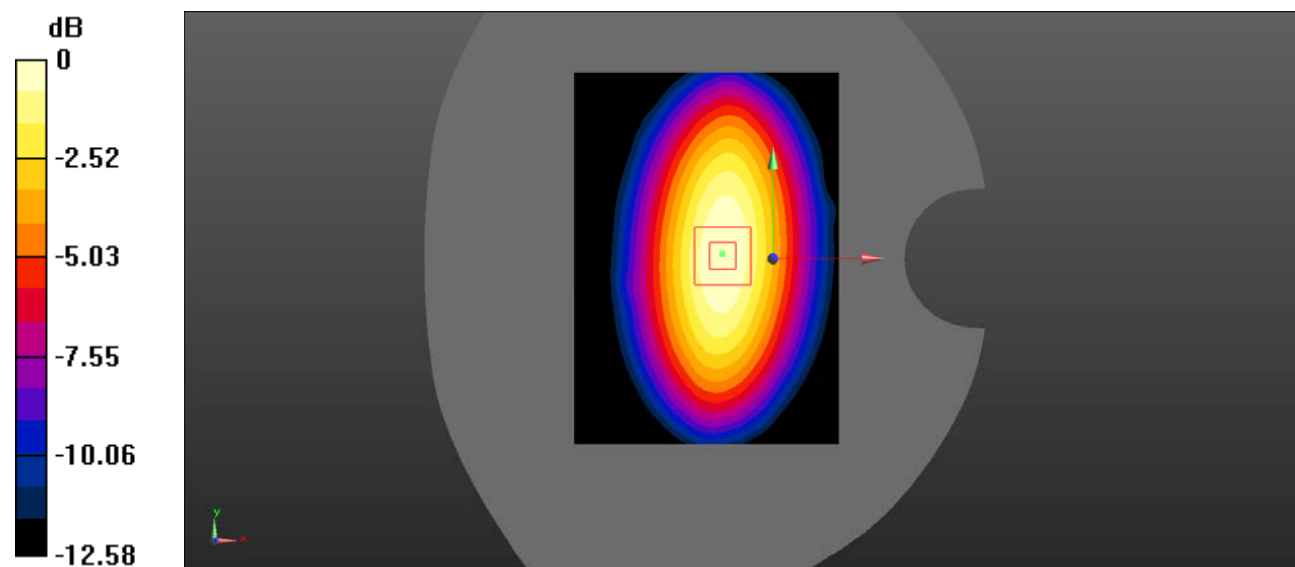
Communication System: UID 0, CW (0); Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.969 \text{ S/m}$; $\epsilon_r = 42.335$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7522; ConvF(9.46, 9.46, 9.46) @ 900 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 11/6/2018
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Head 900MHz Pin=100mW/Area Scan (101x141x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$ Maximum value of SAR (interpolated) = 1.08 W/kg **Head 900MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$ Reference Value = 33.73 V/m ; Power Drift = 0.012 dB Peak SAR (extrapolated) = 1.68 W/kg **SAR(1 g) = 1.03 W/kg ; SAR(10 g) = 0.66 W/kg** Maximum value of SAR (measured) = 1.18 W/kg  $0 \text{ dB} = 1.18 \text{ W/kg} = 0.72 \text{ dBW/kg}$

System Performance 900 MHz Head (Date:2019/10/26)**DUT: Dipole 900 MHz; Type: D900V2; Serial: 132**

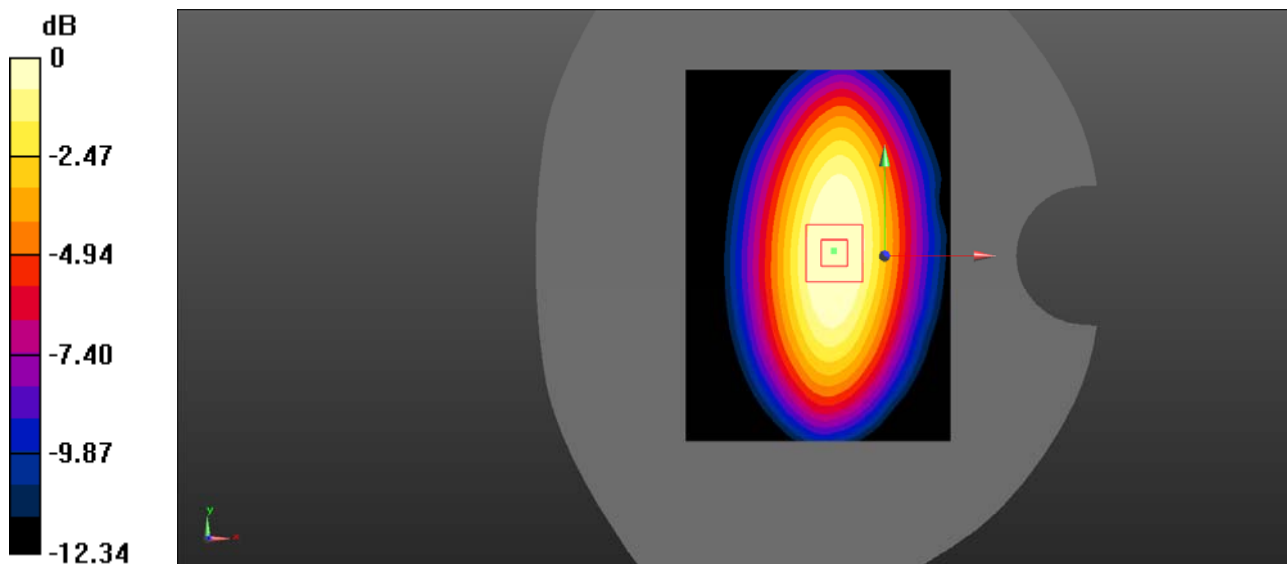
Communication System: UID 0, CW (0); Frequency: 900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 0.973 \text{ S/m}$; $\epsilon_r = 42.54$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7522; ConvF(9.46, 9.46, 9.46) @ 900 MHz;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1562; Calibrated: 11/6/2018
- Phantom: SAM-Twin V8.0 P1aP2a; Type: QD 000 P41 AA ; Serial: 1962
- Measurement SW: DASY52, Version 52.10 (2);

Head 900MHz Pin=100mW/Area Scan (101x141x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$ Maximum value of SAR (interpolated) = 1.12 W/kg **Head 900MHz Pin=100mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$ Reference Value = 33.97 V/m ; Power Drift = 0.012 dB Peak SAR (extrapolated) = 1.73 W/kg **SAR(1 g) = 1.04 W/kg ; SAR(10 g) = 0.687 W/kg** Maximum value of SAR (measured) = 1.23 W/kg  $0 \text{ dB} = 1.23 \text{ W/kg} = 0.90 \text{ dBW/kg}$

EUT TEST STRATEGY AND METHODOLOGY

Test positions for Hand-held device

Hand-held device means a portable device which is located in a user's hand during its intended use. Hand-held usage of the device, not at the head or torso. The device shall be placed directly against the flat phantom as shown in Figure J.1, for those sides of the device that are in contact with the hand during intended use.

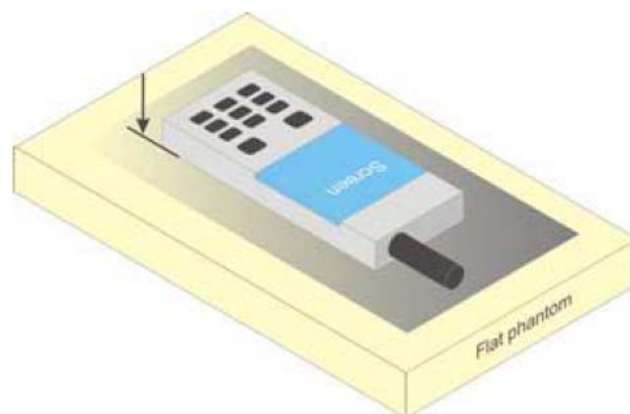


Figure J.1 – Test position for hand-held devices, not used at the head or torso

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.

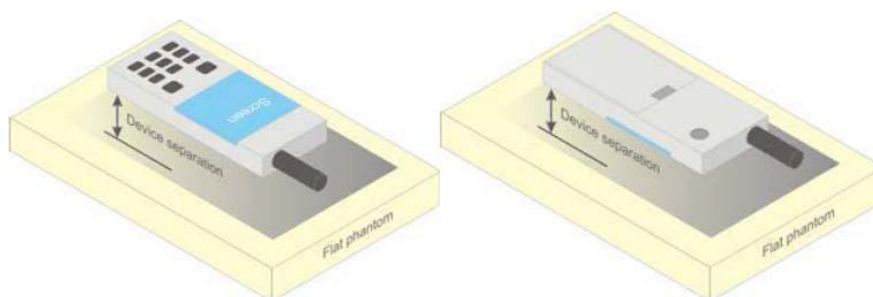


Figure 5 – Test positions for body-worn devices

Test Distance for SAR Evaluation

For Handheld mode (10g Extremity SAR) the EUT is set directly against the phantom, the distance is 0mm; For Close to Body mode (1g Body SAR) the EUT 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.

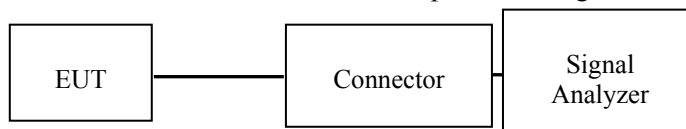
CONDUCTED OUTPUT POWER MEASUREMENT

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 Signal Analyzer through Connector.



SDR 2.4G/900M

Maximum Target Output Power

Max Target AV Power(dBm)					
Mode/Band		Bandwidth	Channel		
			Low	Middle	High
SDR 2.4G	Chain0	1.4MHz	24.2	24.2	24.2
		10MHz	20.6	20.6	20.6
	Chain1	1.4MHz	25.0	25.0	25.0
		10MHz	19.9	19.9	19.9
SDR 900M	Chain0	1.4MHz	23.5	23.5	23.5
		10MHz	20.0	20.0	20.0
	Chain1	1.4MHz	24.8	24.8	24.8
		10MHz	19.9	19.9	19.9

Test Results:

SDR 2.4G:

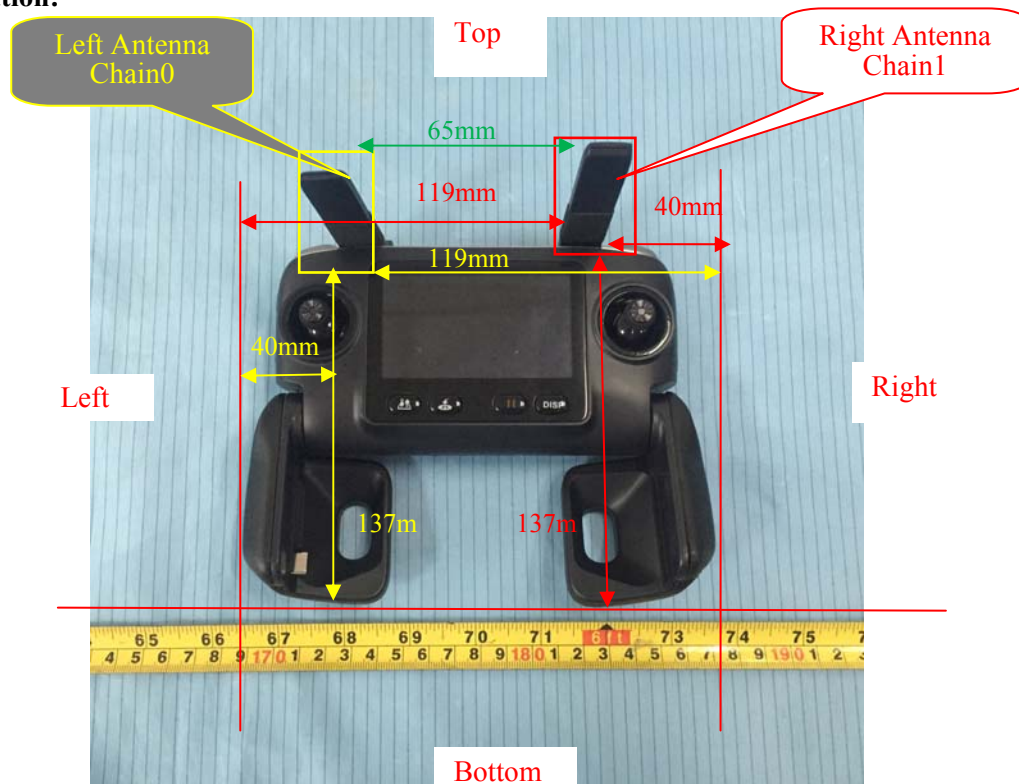
Frequency Band	Bandwidth	Channel	Frequency (MHz)	Max Conducted AV Output Power		Max Conducted AV Output Power	
				Chain0 (dBm)	Duty Cycle (%)	Chain1 (dBm)	Duty Cycle (%)
SDR 2.4G	1.4MHz	Low	2403.5	23.73	80.49	24.19	80.35
		Middle	2439.5	23.32		24.29	
		High	2475.5	23.37		24.56	
	10MHz	Low	2407.5	20.12	79.44	18.96	79.39
		Middle	2439.5	20.08		19.37	
		High	2471.5	19.87		19.47	

SDR 900M:

Frequency Band	Bandwidth	Channel	Frequency (MHz)	Max Conducted AV Output Power		Max Conducted AV Output Power	
				Chain0 (dBm)	Duty Cycle (%)	Chain1	Duty Cycle (%)
SDR 900M	1.4MHz	Low	906	23.03	80.47	24.35	80.22
		Middle	916	22.65		23.98	
		High	924	22.78		23.92	
	10MHz	Low	909	19.50	80.06	19.43	79.73
		Middle	915	19.26		18.97	
		High	921	19.51		19.11	

Standalone SAR test exclusion considerations

Antennas Location:



Antenna Distance To Edge

Antenna Distance To Edge(mm)						
Antenna	Left	Right	Front	Back	Top	Bottom
SDR 2.4G Chain0	40	119	<5	<5	<5	137
SDR 2.4G Chain1	119	40	<5	<5	<5	137
SDR 900M Chain0	40	119	<5	<5	<5	137
SDR 900M Chain1	119	40	<5	<5	<5	137

Standalone SAR test exclusion for the EUT Edge considerations (KDB)

Test exclusion result						
Antenna	Left	Right	Front	Back	Top	Bottom
SDR 2.4G/900M Chain0	Exclusion	Exclusion	Required	Required	Required	Exclusion
SDR 2.4G/900M Chain1	Exclusion	Exclusion	Required	Required	Required	Exclusion

Note:

Required: Per KDB 941225 D07: The distance to Edge is less than 25mm, test is required.

Exclusion: Per KDB 941225 D07: The distance to Edge is more than 25mm, test is not required.

Standalone SAR test exclusion for the EUT Edge considerations (RSS-102 issue 5)

Antenna	Frequency (MHz)	Conducted P_{avg} (dBm)	Gain (dBi)	EIRP P_{avg} (dBm)	EIRP P_{avg} (mW)	Test Exclusion Distance(mm)
SDR 2.4G Chain0	2475.5	24.2	0	24.2	263	46.9
SDR 2.4G Chain1	2475.5	25	0	25	316	51.2
SDR 900M Chain0	916	23.5	0	23.5	224	73.3
SDR 900M Chain1	916	24.8	0	24.8	302	98.8

Note:

1. When the operating frequency of the device is between two frequencies located in Table 1 of RSS-102 issue 5, linear interpolation shall be applied for the applicable separation distance.
2. When the Test Exclusion Distance is farther than 50mm and less than 200mm, testing for each edge is required.

Test exclusion result						
Antenna	Left	Right	Front	Back	Top	Bottom
SDR 2.4G Chain0	Required	Exclusion	Required	Required	Required	Exclusion
SDR 2.4G Chain1	Exclusion	Required	Required	Required	Required	Exclusion
SDR 900M Chain0	Required	Exclusion	Required	Required	Required	Exclusion
SDR 900M Chain1	Exclusion	Required	Required	Required	Required	Exclusion

Note:

Required: Per RSS-102 issue 5: The distance to Edge is less than **Test Exclusion Distance**, test is required.

Exclusion: Per RSS-102 issue 5: The distance to Edge is more than **Test Exclusion Distance**, test is not required.

SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

SAR Test Data

Environmental Conditions

Temperature:	21.6-22.8 °C	21.6-22.6 °C	21.5-22.3 °C
Relative Humidity:	52-63 %	49- 60%	48-62 %
ATM Pressure:	101.4 kPa	101.4 kPa	101.4 kPa
Test Date:	2019/10/24	2019/10/25	2019/10/26

* Testing was performed by Seven Liang, Ricardo Lan, Yates Li.

SDR 2.4G Mode:

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	10g SAR (W/Kg), Limited=4.0W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain0	Handheld Left (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.110	0.13	0.13	1#
			2475.5	/	/	/	/	/	/	/
	Handheld Front (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.136	0.17	0.17	2#
			2475.5	/	/	/	/	/	/	/
	Handheld Back (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.618	0.76	0.76	3#
			2475.5	/	/	/	/	/	/	/
	Handheld Back Antenna Fold (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.012	0.01	0.01	4#
			2475.5	/	/	/	/	/	/	/
	Handheld Top (0mm)	1.4	2403.5	23.73	24.2	1.114	1.08	1.20	1.20	5#
			2439.5	23.32	24.2	1.225	0.916	1.12	1.12	6#
			2475.5	23.37	24.2	1.211	0.692	0.84	0.84	7#
		10	2407.5	20.12	20.6	1.117	1.2	1.34	1.34	8#
			2439.5	20.08	20.6	1.127	0.880	0.99	0.99	9#
			2471.5	19.87	20.6	1.183	0.861	1.02	1.02	10#

Test on 2019/10/24

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg), Limited=1.6W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain0	Body Left (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.129	0.16	0.16	11#
			2475.5	/	/	/	/	/	/	/
	Body Front (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.116	0.14	0.14	12#
			2475.5	/	/	/	/	/	/	/
	Body Back (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	0.431	0.53	0.53	13#
			2475.5	/	/	/	/	/	/	/
	Body Back Antenna Fold (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	23.32	24.2	1.225	<0.01	0.01	0.01	/
			2475.5	/	/	/	/	/	/	/
	Body Top (10mm)	1.4	2403.5	23.73	24.2	1.114	0.536	0.60	0.60	14#
			2439.5	23.32	24.2	1.225	0.572	0.70	0.70	15#
			2475.5	23.37	24.2	1.211	0.384	0.46	0.46	16#
		10	2407.5	20.12	20.6	1.117	0.562	0.63	0.63	17#
			2439.5	20.08	20.6	1.127	0.427	0.48	0.49	18#
			2471.5	19.87	20.6	1.183	0.437	0.52	0.52	19#

Test on 2019/10/25

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	10g SAR (W/Kg), Limited=4.0W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain1	Handheld Right (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	0.134	0.16	0.16	20#
			2475.5	/	/	/	/	/	/	/
	Handheld Front (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	0.069	0.14	0.14	21#
			2475.5	/	/	/	/	/	/	/
	Handheld Back (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	1.01	1.19	1.19	22#
			2475.5	/	/	/	/	/	/	/
	Handheld Back Antenna Fold (0mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	<0.01	0.01	0.01	/
			2475.5	/	/	/	/	/	/	/
	Handheld Top (0mm)	1.4	2403.5	24.19	25.0	1.205	1.69	2.04	2.04	23#
			2439.5	24.29	25.0	1.178	1.94	2.28	2.28	24#
			2475.5	24.56	25.0	1.107	1.51	1.67	1.67	25#
		10	2407.5	18.96	19.9	1.242	1.82	2.26	2.26	26#
			2439.5	19.37	19.9	1.130	1.4	1.58	1.58	27#
			2471.5	19.47	19.9	1.104	1.21	1.34	1.34	28#

Test on 2019/10/25

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg), Limited=1.6W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain1	Body Right (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	0.069	0.08	0.08	29#
			2475.5	/	/	/	/	/	/	/
	Body Front (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	0.062	0.07	0.07	30#
			2475.5	/	/	/	/	/	/	/
	Body Back (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	0.279	0.33	0.33	31#
			2475.5	/	/	/	/	/	/	/
	Body Back Antenna Fold (10mm)	1.4	2403.5	/	/	/	/	/	/	/
			2439.5	24.29	25.0	1.178	<0.01	0.01	0.01	/
			2475.5	/	/	/	/	/	/	/
	Body Top (10mm)	1.4	2403.5	24.19	25.0	1.205	0.961	1.16	1.16	32#
			2439.5	24.29	25.0	1.178	0.419	0.49	0.49	33#
			2475.5	24.56	25.0	1.107	0.611	0.68	0.68	34#
		10	2407.5	18.96	19.9	1.242	0.726	0.90	0.90	35#
			2439.5	19.37	19.9	1.130	0.440	0.50	0.50	36#
			2471.5	19.47	19.9	1.104	0.582	0.64	0.64	37#

Test on 2019/10/25

SDR 900M Mode:

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	10g SAR (W/Kg), Limited=4.0W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain0	Handheld Left (0mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.031	0.04	0.04	38#
			924	/	/	/	/	/	/	/
	Handheld Front (0mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.024	0.03	0.03	39#
			924	/	/	/	/	/	/	/
	Handheld Back (0mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.299	0.36	0.36	40#
			924	/	/	/	/	/	/	/
	Handheld Back Antenna Fold (0mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.054	0.07	0.07	41#
			924	/	/	/	/	/	/	/
	Handheld Top (0mm)	1.4	906	23.03	23.5	1.114	0.163	0.18	0.18	42#
			916	22.65	23.5	1.216	0.357	0.43	0.43	43#
			924	22.78	23.5	1.180	0.36	0.42	0.42	44#
		10	909	19.50	20.0	1.122	0.172	0.19	0.19	45#
			915	19.26	20.0	1.186	0.321	0.38	0.38	46#
			921	19.51	20.0	1.119	0.114	0.13	0.13	47#

Test on 2019/10/24

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg), Limited=1.6W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain0	Body Left (10mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.029	0.04	0.04	48#
			924	/	/	/	/	/	/	/
	Body Front (10mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.022	0.03	0.03	49#
			924	/	/	/	/	/	/	/
	Body Back (10mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.212	0.26	0.26	50#
			924	/	/	/	/	/	/	/
	Body Back Antenna Fold (10mm)	1.4	906	/	/	/	/	/	/	/
			916	22.65	23.5	1.216	0.047	0.06	0.06	51#
			924	/	/	/	/	/	/	/
	Body Top (10mm)	1.4	906	23.03	23.5	1.114	0.135	0.15	0.15	52#
			916	22.65	23.5	1.216	0.219	0.27	0.27	53#
			924	22.78	23.5	1.180	0.232	0.27	0.27	54#
		10	909	19.50	20.0	1.122	0.151	0.17	0.17	55#
			915	19.26	20.0	1.186	0.203	0.24	0.24	56#
			921	19.51	20.0	1.119	0.096	0.11	0.11	57#

Test on 2019/10/26

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	10g SAR (W/Kg), Limited=4.0W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain1	Handheld Right (0mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.030	0.04	0.04	58#
			924	/	/	/	/	/	/	/
	Handheld Front (0mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.032	0.04	0.04	59#
			924	/	/	/	/	/	/	/
	Handheld Back (0mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.205	0.25	0.25	60#
			924	/	/	/	/	/	/	/
	Handheld Back Antenna Fold (0mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.061	0.07	0.07	61#
			924	/	/	/	/	/	/	/
	Handheld Top (0mm)	1.4	906	24.35	24.8	1.109	0.228	0.25	0.25	62#
			916	23.98	24.8	1.208	0.329	0.40	0.40	63#
			924	23.92	24.8	1.225	0.199	0.24	0.24	64#
		10	909	19.43	19.9	1.114	0.205	0.23	0.23	65#
			915	18.97	19.9	1.239	0.194	0.24	0.24	66#
			921	19.11	19.9	1.199	0.219	0.26	0.26	67#

Test on 2019/10/26

Antenna	EUT Position	Bandwidth (MHz)	Frequency (MHz)	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg), Limited=1.6W/kg				
						Scaled Factor	Meas.	Scaled SAR	Correct SAR	Plot
Chain1	Body Right (10mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.032	0.04	0.04	68#
			924	/	/	/	/	/	/	/
	Body Front (10mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.023	0.03	0.03	69#
			924	/	/	/	/	/	/	/
	Body Back (10mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.171	0.21	0.21	70#
			924	/	/	/	/	/	/	/
	Body Back Antenna Fold (10mm)	1.4	906	/	/	/	/	/	/	/
			916	23.98	24.8	1.208	0.061	0.07	0.07	71#
			924	/	/	/	/	/	/	/
	Body Top (10mm)	1.4	906	24.35	24.8	1.109	0.161	0.18	0.18	72#
			916	23.98	24.8	1.208	0.174	0.21	0.21	73#
			924	23.92	24.8	1.225	0.132	0.16	0.16	74#
		10	909	19.43	19.9	1.114	0.160	0.18	0.18	75#
			915	18.97	19.9	1.239	0.149	0.18	0.18	76#
			921	19.11	19.9	1.199	0.135	0.16	0.16	77#

Test on 2019/10/26

Note:

1. When the SAR value is less than half of the limit, testing for other channels are optional.
2. When SAR or MPE is not measured at the maximum power level allowed for production to the individual channels tested to determine compliance.
3. For modes that peak SAR is too low to evaluate, a SAR value 0.01 W/kg is considered as their Scaled SAR.
4. According to Notice 2016-DRS001: Based on the IEEE 1528 and IEC 62209 requirements, the high, mid and low channels for the configuration with the highest SAR value must be tested regardless of the SAR value measured
5. According to Notice 2012-DRS0529, if the correction Δ SAR has a negative sign, the measured SAR result should be corrected, and has a positive sign, the measured SAR result shall not be corrected.

Corrected SAR Evaluation

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Annex F
(normative)**SAR correction for deviations of complex permittivity from targets****F.2 SAR correction formula**

From [13] and [14], a linear relationship was found between the percent change in SAR (denoted ΔSAR) and the percent change in the permittivity and conductivity from the target values in Table 1 (denoted $\Delta \epsilon_r$ and $\Delta \sigma$, respectively). This linear relationship agrees with the results of Kuster and Balzano [48] and Bit-Babik et al. [2]. The relationship is given by:

$$\Delta SAR = c_\epsilon \Delta \epsilon_r + c_\sigma \Delta \sigma \quad (F.1)$$

where

$c_\epsilon = \partial(\Delta SAR)/\partial(\Delta \epsilon)$ is the coefficients representing the sensitivity of SAR to permittivity where SAR is normalized to output power;

$c_\sigma = \partial(\Delta SAR)/\partial(\Delta \sigma)$ is the coefficients representing the sensitivity of SAR to conductivity, where SAR is normalized to output power.

The values of c_ϵ and c_σ have a simple relationship with frequency that can be described using polynomial equations. For the 1 g averaged SAR c_ϵ and c_σ are given by

$$c_\epsilon = -7,854 \times 10^{-4} f^3 + 9,402 \times 10^{-3} f^2 - 2,742 \times 10^{-2} f - 0,202 \ 6 \quad (F.2)$$

$$c_\sigma = 9,804 \times 10^{-3} f^3 - 8,661 \times 10^{-2} f^2 + 2,981 \times 10^{-2} f + 0,782 \ 9 \quad (F.3)$$

where

f is the frequency in GHz.

For the 10 g averaged SAR, the variables c_ϵ and c_σ are given by:

$$c_\epsilon = 3,456 \times 10^{-3} f^3 - 3,531 \times 10^{-2} f^2 + 7,675 \times 10^{-2} f - 0,186 \ 0 \quad (F.4)$$

$$c_\sigma = 4,479 \times 10^{-3} f^3 - 1,586 \times 10^{-2} f^2 - 0,197 \ 2 f + 0,771 \ 7 \quad (F.5)$$

Calibrate Date	Type	Frequency (MHz)	C_ϵ	$\Delta\epsilon_r$	C_δ	$\Delta\delta$	ΔSAR
2019/10/24	10g SAR	2403.5	-0.158	-3.7	0.269	-0.74	0.386
		2407.5	-0.158	-3.38	0.269	-0.62	0.367
		2439.5	-0.159	-2.49	0.262	-1.06	0.118
		2450	-0.159	-3.03	0.260	0.83	0.698
		2471.5	-0.160	-2.18	0.256	0.22	0.405
		2475.5	-0.160	-2.11	0.256	-0.05	0.325
	1g SAR	2403.5	-0.225	-3.7	0.490	-0.74	0.47
		2407.5	-0.225	-3.38	0.489	-0.62	0.457
		2439.5	-0.225	-2.49	0.483	-1.06	0.048
		2450	-0.225	-3.03	0.480	0.83	1.08
		2471.5	-0.225	-2.18	0.476	0.22	0.595
		2475.5	-0.225	-2.11	0.475	-0.05	0.451

Calibrate Date	Type	Frequency (MHz)	C_ϵ	$\Delta\epsilon_r$	C_δ	$\Delta\delta$	ΔSAR
2019/10/25	10g SAR	2403.5	-0.158	-3.54	0.269	-0.8	0.344
		2407.5	-0.158	-3.51	0.269	-0.62	0.388
		2439.5	-0.159	-2.27	0.262	-1.28	0.026
		2450	-0.159	-3.3	0.260	0.89	0.756
		2471.5	-0.160	-2.28	0.256	0.22	0.421
		2475.5	-0.160	-1.76	0.256	-0.22	0.225
	1g SAR	2403.5	-0.225	-3.54	0.490	-0.8	0.405
		2407.5	-0.225	-3.51	0.489	-0.62	0.487
		2439.5	-0.225	-2.27	0.483	-1.28	-0.107
		2450	-0.225	-3.3	0.480	0.89	1.17
		2471.5	-0.225	-2.28	0.476	0.22	0.618
		2475.5	-0.225	-1.76	0.475	-0.22	0.292

Calibrate Date	Type	Frequency (MHz)	C_{ϵ}	$\Delta\epsilon_r$	C_{δ}	$\Delta\delta$	ΔSAR
2019/10/24	10g SAR	900	-0.143	2.01	0.585	-0.1	-0.346
		906	-0.143	1.66	0.583	0.31	-0.057
		909	-0.143	1.41	0.583	0.72	0.218
		915	-0.143	0.58	0.582	0.92	0.453
		916	-0.143	0.4	0.581	0.92	0.477
		921	-0.143	0.57	0.580	1.22	0.626
		924	-0.143	0.07	0.580	1.43	0.819
	1g SAR	900	-0.220	2.01	0.747	-0.1	-0.517
		906	-0.220	1.66	0.746	0.31	-0.134
		909	-0.220	1.41	0.746	0.72	0.227
		915	-0.220	0.58	0.745	0.92	0.558
		916	-0.220	0.4	0.745	0.92	0.597
		921	-0.220	0.57	0.745	1.22	0.784
		924	-0.221	0.07	0.744	1.43	1.048

Calibrate Date	Type	Frequency (MHz)	C_{ϵ}	$\Delta\epsilon_r$	C_{δ}	$\Delta\delta$	ΔSAR
2019/10/26	10g SAR	900	-0.143	2.51	0.585	0.31	-0.178
		906	-0.143	1.65	0.583	0.41	0.003
		909	-0.143	1.35	0.583	0.41	0.046
		915	-0.143	0.04	0.582	1.02	0.588
		916	-0.143	0.45	0.581	1.43	0.766
		921	-0.143	0.64	0.580	1.53	0.796
		924	-0.143	0.34	0.580	1.53	0.839
	1g SAR	900	-0.220	2.51	0.747	0.31	-0.321
		906	-0.220	1.65	0.746	0.41	-0.057
		909	-0.220	1.35	0.746	0.41	0.009
		915	-0.220	0.04	0.745	1.02	0.751
		916	-0.220	0.45	0.745	1.43	0.966
		921	-0.220	0.64	0.745	1.53	0.999
		924	-0.221	0.34	0.744	1.53	1.063

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 ($\sim 10\%$ 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?
Chain0 + Chain1	×	×

Note:

1. Chain0 and Chain1 cannot transmit simultaneously but can receive simultaneously.

SAR Plots

Please Refer to the Attachment.

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	$\sqrt{3}$	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0	0	0.0	0.0
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Integration time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
RF ambient conditions–reflections	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	$\sqrt{3}$	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	$\sqrt{3}$	1	1	3.9	3.9
Post-processing	2.0	R	$\sqrt{3}$	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	$\sqrt{3}$	1	1	2.9	2.9
Phantom and set-up							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.3	2.3
Liquid conductivity target)	5.0	R	$\sqrt{3}$	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	$\sqrt{3}$	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	$\sqrt{3}$	1	1	2.7	2.7
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0	0	0.0	0.0
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7
Modulation Response	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
Integration time	0.0	R	$\sqrt{3}$	1	1	0.0	0.0
RF ambient conditions – noise	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
RF ambient conditions–reflections	1.0	R	$\sqrt{3}$	1	1	0.6	0.6
Probe positioner mech. Restrictions	0.8	R	$\sqrt{3}$	1	1	0.5	0.5
Probe positioning with respect to phantom shell	6.7	R	$\sqrt{3}$	1	1	3.9	3.9
Post-processing	2.0	R	$\sqrt{3}$	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	$\sqrt{3}$	1	1	2.6	2.6
Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9
Phantom and set-up							
Phantom uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	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	$\sqrt{3}$	0.78	0.71	0.8	0.7
Temp. unc. - Permittivity	0.3	R	$\sqrt{3}$	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

Please Refer to the Attachment.

APPENDIX C PROBE CALIBRATION CERTIFICATES

Please Refer to the Attachment.

APPENDIX D DIPOLE CALIBRATION CERTIFICATES

Please Refer to the Attachment.

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